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Annotated Bibliography on High-Intensity Linear Accelerators

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ANNOTATED BIBLIOGRAPHY ON HIGH-INTENSITY LINEAR ACCELERATORS

by

R. A. Jameson and E. U. Roybal

ABSTRACT

A technical bibliography covering subjects important to the design of high-intensity beam transport systems and linear accelerators is presented. Space charge and emittance growth are stressed. Subject and author concordances provide cross-reference to detailed citations, which include an abstract and notes on the material. The bibliography resides in a computer database that can be searched for key words and phrases.

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I. INTRODUCTION

This bibliography brings together, from a variety of sources, reference material pertinent to understanding technical details of high-current, high-intensity beam transport systems and linear accelerators. The influence of space charge is stressed, and material was sought that dealt with phenomena causing emittance growth in these systems.

The literature search has been very useful in establishing directions for the high-intensity accelerator development activities of the Accelerator Technology and Medium-Energy Physics Divisions of the Los Alamos Scientific Laboratory; it may also serve as a useful general reference for the accelerator community.

The bibliography is stored in a computer database, using the Lawrence Livermore Laboratory Master Control Program. The program can perform searches on words or phrases, and can produce output in a variety of formats that can easily be tailored to the needs of the user. This report contains three examples of the output capability.

The first section is a subject concordance - a dictionary of key words or phrases in alphabetical order. Each entry is followed by a string of numbers that refer to the record number of detailed citations in the third section.

The second section is an author concordance, again in alphabetical order. The record numbers and titles of articles written by each author are listed under his name.

The third section includes a detailed citation for each record in the bibliography, including an abstract. Often other notes or comments have been added. An effort was made to stress results, remaining problems, correlations with other material, and other points of interest where possible above and beyond the formal abstract. It is hoped that this will result in somewhat more interesting and informative reading than might ordinarily be found in a bibliography.

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BEAM DYNAMICS CODES

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BEAM LOADING

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100	105	108	126	128	129	130	137	147	157
164	167	168	169	171	174	215	219	223	226
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1 TITLE....: OPTIMUM GEOMETRIES AND FIELD STRENGTHS FOR ALVAREZ LINAC

AUTHOR....: SWENSON, D.A.

AFFILIAT.: LASL-MP-14

DOC-TYPE.: INFORMAL REPORT

REP-NUM.: LA-3567

PAGES....: 18

DATE-PUBL: 670120

ABSTRACT.: A PROCEDURE IS DESCRIBED FOR SELECTING THE GEOMETRIES AND FIELD STRENGTHS FOR AN ALVAREZ LINAC WHICH WILL PRODUCE A LINAC OF A GIVEN PERFORMANCE FOR THE LEAST COST. THE GEOMETRIES CONSIDERED IN THIS STUDY ARE RESTRICTED TO CYLINDRICAL CAVITIES, LOADED WITH CYLINDRICAL DRIFT TUBES HAVING A CYLINDRICAL HOLE FOR PASSAGE OF BEAM, AND ROUNDED CORNERS (OUTER CORNER AND HOLE CORNER) TO REDUCE THE HIGH ELECTRIC FIELDS THAT WOULD OTHERWISE APPEAR ON THE SHARP CORNER. SEVERAL THOUSAND CAVITIES OF THIS TYPE HAVE BEEN EVALUATED BY THE MURA GROUP WITH THEIR LINAC FIELD COMPUTATIONAL PROCESS, MESSYMESH. THE ANALYSIS DESCRIBED HERE IS BASED ON THESE COMPUTATIONS. IT IS POSSIBLE TO DISPLAY DATA FROM HUNDREDS OF MESSYMESH COMPUTATIONS ON A PAIR OF GRAPHS IN SUCH A WAY AS TO FACILITATE THE EVALUATION OF THE ECONOMICS. THE DATA ON THESE GRAPHS ARE INDEPENDENT OF THE VARIOUS COST COEFFICIENTS WHICH ENTER INTO THE COST FORMULA AND ARE SUBJECT TO CHANGE. GIVEN THESE COST COEFFICIENTS, IT IS A SIMPLE MATTER TO SELECT THE OPTIMUM FIELD STRENGTH AND THE OPTIMUM GEOMETRY WITH THE AID OF THE GRAPHS.

SUBJECTS.: LINAC DESIGN, DRIFT TUBE LINAC,

REFERENCE: 7

CATEGORY.: SPACE CHARGE, ANALYSIS, THEORY,

CAT-SOURCE: HADLEY DATE-ENT.: 770810

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

2 TITLE....: STEM PERTURBATIONS IN ALVAREZ LINACS

AUTHOR...: SWENSON, D.A.

AFFILIAT.: LASL-MP-14

DOC-TYPE.: INTERNAL REPORT

PAGES.....: 6

REP-NUM...: MP-4/DAS-3

DATE-PUBL.: 670303

ABSTRACT.: FREQUENCY PERTURBATIONS DUE TO STEMS IN ALVAREZ LINACS, SOLUTIONS FOR ELECTRIC FIELD,
MAGNETIC FIELD, POWER DISSIPATED ON STEMS, AND NUMERICAL EVALUATION OF PERTURBATIONS.

SUBJECTS.: LINAC DESIGN; DRIFT TUBE LINAC; STEM PERTURBATION;

REFERENCE: SLATER, MICROWAVE ELECTRONICS; PANOFKY AND PHILLIPS, CLASSICAL ELECTRICITY AND MAGNETISM;

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY DATE-ENT.: 770810

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

1
3 TITLE....: FACTORS AFFECTING HIGH-CURRENT, BRIGHT LINAC BEAMS

AUTHOR...: JAMESON, R.A.; MILLS, R.S.;
AFFILIAT.: LASL-MP-9

DOC-TYPE.: MEMO
PAGES....: 18

DATE-PUBL: 770400

ABSTRACT.: PARAMETRIC LINAC DESIGN STUDY OF ALVAREZ TYPE LINACS FOR ACCELERATING HIGH BEAM CURRENTS WITH SMALL TRANSVERSE EMITTANCE. RESULTS SUGGEST 1) THE CENTRAL CORE OF THE BEAM CONTAINING 50 PERCENT OF THE PARTICLES SHOULD BE USED, SCRAPING OFF THE REST, 2) MORE CURRENT CAN BE ACCELERATED IF A LARGE LONGITUDINAL EMITTANCE CAN BE TOLERATED, 3) OUTPUT EMITTANCE, AS A FUNCTION OF INPUT EMITTANCE, CANNOT BE DECREASED BELOW SOME VALUE, WHICH DEPENDS ON CURRENT, AS THE INPUT EMITTANCE GOES TO ZERO, SOME RELIEF CAN BE OBTAINED WHEN CHOOSING PARAMETERS, 4) RAISING INJECTION ENERGY DOES NOT APPEAR TO REDUCE THE ATTAINABLE OUTPUT EMITTANCE, 5) DECREASING THE INPUT SYNCHRONOUS PHASE, REDUCING THE ACCELERATING GRADIENT, AND INCREASING THE OPERATING FREQUENCY HELP REDUCE THE OUTPUT EMITTANCE IN THE CASES STUDIED, INCREASING THE OPERATING FREQUENCY HELPS SIGNIFICANTLY; THE OTHER PARAMETERS CAUSE SLOW CHANGES, THIS RATHER SURPRISING RESULT HAS BEEN INDEPENDENTLY VERIFIED FROM ANALYSIS OF EQUILIBRIUM SOLUTIONS OF THE VLASOV EQUATION - SEE IDN 19 (WALTER'S RECOMMENDATIONS FOR FURTHER PARAMETER EXPLORATION AND CODE DEVELOPMENT ARE GIVEN).

SUBJECTS.: SPACE CHARGE; EMITTANCE; BRIGHTNESS; PARAMETER SEARCH; LINAC DESIGN;

DATA-RECD: 12 FIGURES;

CROSS-REF: IDN 19, SPCRG;

CATEGORY.: SPACE CHARGE; NUMERICAL COMPUTATION;

CAT-SOURC: JAMESON DATE-ENT.: 771000

MICROFILM;

STOR-LOC.: MP-9 SPCRG FILE;

4 TITLE..... SPACE CHARGE EFFECTS - COLLECTION OF MEMOS
SUBTITLE.: REVIEW OF GLUCKSTERN WEEK (SPACE CHARGE EFFECTS) 760802; SPACE CHARGE EFFECTS 761112; SPACE
CHARGE EFFECTS STUDY 761115; PRELIMINARY RESULTS ON RZFD PROBLEM (SPACE CHARGE) 761124; SPACE
CHARGE EFFECTS, PROGRESS REPORT NOV*76-JAN*77 770209;

AUTHOR...: LYSENKO, W.P.
AFFILIAT.: LASI-MP-9

DOC-TYPE.: MEMO
PAGES.....: 24

DATE-PUBL: 760802; 761112; 761115; 761124; 770209;

ABSTRACT.: A COLLECTION OF MEMOS COMMENTING ON COLLISION EFFECTS IN PARTICLE TRACING CODES,
POSSIBILITIES FOR CALCULATING BEAM HALO EFFECTS, THREE-DIMENSIONAL SOLUTIONS OF EQUILIBRIUM
DISTRIBUTION FUNCTIONS IN THE VLASOV EQUATION, PRELIMINARY RESULTS OF NUMERICAL CALCULATIONS ON
EQUILIBRIUM DISTRIBUTIONS IN RZ COORDINATES.

SUBJECTS.: SPACE CHARGE; EQUILIBRIUM DISTRIBUTIONS;

COMMENTS.: SEE IDN 19 FOR FULL REPORT;

CATEGORY.: SPACE CHARGE; ANALYSTS; NUMERICAL CALCULATION;

CAT-SOURC: JAMESON DATE-ENT.: 771006

MICROFILM:

STOR-LOC.: MP-9 SPACE FILE;

5 TITLE....: SELECTION OF QUADRUPOLE STRENGTHS FOR DRIFT TUBE LINAC

AUTHOR...: STOVALL, J.E.
AFFILIAT.: LASL-MP-3

DOC-TYPE.: INTERNAL REPORT
PAGES....: 24

REP-NUM...: MP-3-38
DATE-PUBL: 680703

ABSTRACT.: DEVELOPMENT OF BEAM DYNAMICS TRANSFORMATIONS THROUGH QUADRUPOLE, DRIFT, RF DEFOCUSING MATRICES AND QUADRUPOLE STABILITY DIAGRAM. CHOICE OF QUADRUPOLE STRENGTHS IN TYPICAL MACHINE RELATION FOR QUAD STRENGTH FOR GIVEN LENGTH TO MAINTAIN CONSTANT $\cos \mu$ AND β/γ CONSTANT. RATIO OF ACCEPTANCE AND EMITTANCE ELLIPSES AT A PLANE EXPRESSED AS MISMATCH FACTOR. APPENDIX A COMPARING MATRIX FORMULATIONS OF COURANT AND SNYDER, SMITH AND GLUCKSTERN, AND A METHOD USED IN PARMILA BASED ON THE COORDINATES x AND $\beta/\gamma - x'$ WHICH ARE ALWAYS CANONICALLY CONJUGATE. APPENDIX B COMPARES TWO-DIMENSIONAL PHASE-SPACE ELLIPSE FORMULATIONS OF COURANT AND SNYDER AND THE TRANSPORT PROGRAM.

SUBJECTS.: LINAC DESIGN; DRIFT TUBE LINAC; QUADRUPOLE FOCUSING; STABILITY DIAGRAM; ELLIPSE FORMULATION; MATRIX FORMULATIONS;

REFERENCE: 12

DATA-RECD: PLUS-MINUS QUAD STABILITY DIAGRAM; PLUS-ZERO-MINUS-ZERO QUAD STABILITY DIAGRAM; MATCHED AND UNMATCHED BEAM PROFILES;

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY DATE-ENT.: 770810

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1
6 TITLE....: NOTES ON ELLIPSES, ELLIPSE NOTATION, AND IMPLICATIONS FOR BEAM DYNAMICS

AUTHOR....: JHLL, W.F.

AFFILIAT.: LASL-MP-9

DOC-TYPE.: INFORMAL REPORT

PAGES....: 12

DATE-PUBL: 760000

ABSTRACT.: SEE TITLE

SUBJECTS.: ELLIPSE FORMULATION;

REFERENCE: 5

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURC: BRADLEY

DATE-ENT.: 770010

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

7 TITLE....: SOLENOID FOCUSING IN LOW BETA STRUCTURES

AUTHOR....: CLAUS, J.
AFFILIAT.: RNL

DOC-TYPE.: RNL MEMO
PAGES....: 2

DATE-PUBL: 770627

ABSTRACT.: SOLENOID NUMBERS AND LIMITING BEAM CURRENT DENSITY FOR XENON ADVANTAGES INCLUDE TRANSPORT OF SPILLED PARTICLES OUT OF MACHINE. AXIAL MOVEMENT OF CHARGED PARTICLES PRODUCED BY RESIDUAL GAS SCATTERING PRESERVES PLASMA NEUTRALITY. ELECTRONS COULD BE INTRODUCED TO PROVIDE NEUTRALIZATION.

SUBJECTS.: SOLENOIDAL FOCUSING; ACCELERATOR STRUCTURE; LINAC DESIGN; SPACE CHARGE; NEUTRALIZATION;

COMMENTS.: MEMO TO A. MASCHKE, RNL;

CATEGORY.: SPACE CHARGE; ANALYSIS;

CAT-SOURC: BRADLEY

DATE-ENT.: 770810

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

1
TITLE,...: ACCEPTANCE OF BEAM TRANSPORT SOLENOID

AUTHOR...: CLAUS, J.

AFFILIAT.: RNL

DOC-TYPE.: RNL TECHNICAL NOTE

PAGES....: 7

REF-NUM...: 3A

DATE-PUBL: 770315

ABSTRACT.: CONSIDERATION OF FOUR-DIMENSIONAL TRANSVERSE PHASE-SPACE; ACCEPTANCES ARE FUNCTIONS OF LONGITUDINAL MOMENTUM. ROTATIONALLY SYMMETRIC BEAM WITH STATIONARY DISTRIBUTION. CONSIDERATION OF END EFFECTS, NUMBERS FOR 20 KEV DEUTERON BEAM.

SUBJECTS.: SOLENOIDAL FOCUSING; BEAM TRANSPORT; ACCEPTANCE;

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770810

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

1
9 TITLE....: TRANSPORT OF ION BEAMS OF HIGH INTENSITY WITH SOLENOIDS

AUTHOR....: CLAUS, J.
AFFILIAT.: RNL

DOC-TYPE.: RNL TECHNICAL NOTE
PAGES.....: 11

REP=NUM.: 37
DATE=PUBL: 770303

ABSTRACT.: SIMPLE MODEL NEGLECTING MAGNETIC PART OF BEAM SELF-FIELD, ASSUME UNIFORM CURRENT DISTRIBUTION, ROTATIONAL SYMMETRY AND MAGNETIC FIELD UNIFORMITY. FOR 120 KEV H- WITH $J = 10$ MA/CM², NEED B .GT. 7 KG, H .GT. 0.55 MA/M; AND FOR $J = 14$ /CM², NEED B .GT. 22 KG, H .GT. 1.76 MA/M; IMPLYING SUPERCONDUCTING TECHNIQUES. INTRODUCTION OF MORE COMPLICATED MODEL ALLOWING FOR NON-UNIFORM CURRENT DISTRIBUTION LEADS TO DEVELOPMENT OF STABILITY REGIONS IN R, R-PRIME SPACE. DESIGN APPENDIX FOR 10A AND 100 MA/CM² 120 KEV H- BEAM INDICATES B GT 10 KG, INNER RADIUS = 6.5 CM, POWER REQUIREMENT OF 93 KW/M TIMES PACKING FACTOR RESULTS IN 100 KW/M. COMMENTS ON CONDUCTOR SIZE, VACUUM, AND PULSE LENGTH EFFECTS.

SUBJECTS.: SOLENOIDAL FOCUSING; SPACE CHARGE; BEAM TRANSPORT;

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT=SOURCE: BRADLEY DATE=ENT.: 770810

MICROFILM:

STOR=LOC.: MP-9 SPORG FILE;

10 TITLE....: REDUCTION OF LOSSES IN LINACS FOR PROTONS OR HEAVY IONS

AUTHOR....: CLAUS, J.
AFFILIAT.: RNL

DOC-TYPE.: TALK; PUBLICATION;
PAGES....: 3

REP-NUM...: RNL-22511
DATE-PURL: 772316

CONFERENCE: 1977 PARTICLE ACCEL CONF, CHICAGO, ILLINOIS, MARCH 14-18, 1977;

ABSTRACT.: IT IS NECESSARY TO MINIMIZE THE BEAM LOSSES IN LINACS FOR HIGH AVERAGE CURRENTS IN ORDER TO AVOID SERIOUS PROBLEMS DUE TO RADIATION DAMAGE, DISSIPATION AND RADIO ACTIVATION OF THE ACCELERATORS STRUCTURE. A LARGE PART OF THE LOSSES IN EXISTING LINACS IS DUE TO INCOMPLETE BUNCHING OF THE INJECTED BEAM. PROPOSED IMPROVEMENTS GENERALLY APPEAR TO BE DEFICIENT IN ONE OR MORE RESPECTS IF APPLIED TO LINACS WITH CONVENTIONAL FREQUENCIES, INJECTION ENERGIES AND CURRENT DENSITIES. BY PRECEDING THE LINAC PROPER WITH AN ACCELERATING STRUCTURE AND AN ENERGY ANALYZER, IT BECOMES POSSIBLE TO SEPARATE THE PARTICLES THAT REMAINED OUTSIDE THE BUCKETS FROM THOSE THAT ARE INSIDE SO THAT THEY CAN BE DUMPED IN A CONTROLLED MANNER.

SUBJECTS.: BUNCHER; PHASE SPACE MATCHING; LINAC DESIGN; SPACE CHARGE; SOLENOIDAL FOCUSING; QUADRUPOLE FOCUSING; DEFLECTING BUNCHER;

NOTES....: DISCUSSES BETTER BUNCHING SYSTEMS. DIFFICULT TO REALIZE TRUE SAWTOOTH BECAUSE TRANSIT TIME FACTORS DECREASE WITH INCREASING FREQUENCY IN CAVITIES WITH FIXED BORE, SO EFFECTIVENESS OF HIGHER HARMONICS IS LIMITED. ARGUES THAT TRANSVERSE DEFLECTOR SYSTEMS RAISE MORE PROBLEMS THAN THEY SOLVE FOR HIGH CURRENT LINACS. SOLENOIDS HAVE ADVANTAGE IN CONDUCTING OFF-MOMENTUM PARTICLES OUT OF THE MACHINE. CONSIDERS CONCEPT OF INJECTION LINAC (LINAC BUNCHER) WHICH COULD USE INCREASING GRADIENT, SOLENOID FOCUSING, INDEPENDENT CAVITIES, OR OTHER MEANS. GIVES FORMULA FOR PHASE ADVANCE PER CELL OF MAGNETIC PLUS-MINUS FOCUSING STRUCTURE WITH SPACE-CHARGE $\sin(\Delta\phi/2) \approx Q \cdot \sinh(\alpha \cdot L) / \alpha \cdot \sqrt{1 - (\alpha/R)^2}$ WHERE $\alpha = \sqrt{1/2 \cdot (\mu_0 \cdot S \cdot R - ZEROC / \text{REST ENERGY}) \cdot (\text{CURRENT DENSITY} / \beta \cdot \gamma - \text{GAMMA-CURD})}$. DISCUSSED POSSIBILITY OF N INJECTORS AT 1/N OF MAIN LINAC FREQUENCY, COMBINING BUNCHES IN MAIN LINAC TO FILL ALL BUCKETS.

REFERENCE: 11

CATEGORY.: SPACE CHARGE; SYSTEM DESCRIPTION; ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770810

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

11 TITLE....: NUMERICAL CALCULATIONS OF THE EFFECTS OF SPACE CHARGE ON SIX DIMENSIONAL BEAM DYNAMICS IN PROTON LINEAR ACCELERATORS

AUTHOR....: CHASMAN, P.W.
AFFILIAT.: RNL

DOC-TYPE.: TALK; PUBLICATION;
PAGES.....: 17

DATE-PUBL: 680520

CONFERENCE: PROC 1968 PROTON LINEAR ACCEL CONF, RNL, RNL 58120 (C-54) PART 1, P. 372-388, MAY 20-24, 1968;

ABSTRACT.: SIX DIMENSIONAL LINAC ORBIT CALCULATIONS, PERFORMED WITH A COMPUTER PROGRAM WHICH WAS DESIGNED TO INCLUDE SPACE CHARGE FORCES IN A PERFECT LINAC, HAVE SUGGESTED THE FOLLOWING CONCLUSIONS:

A. A SIMPLE RELIABLE PRESCRIPTION HAS BEEN FOUND TO MATCH THE BEAM TO BOTH THE LONGITUDINAL AND TRANSVERSE ADMITTANCES OF THE LINAC. THE RESULTANT BEAM ENVELOPE OSCILLATIONS REMAIN BUTTE SMALL DURING THE ACCELERATION.

B. MATCHED BEAMS WITH CURRENTS UP TO SEVERAL HUNDRED MILLIAMPERES CAN BE ACCELERATED THROUGH THE LINAC USING MEASURED CHARACTERISTICS OF RECENTLY DEVELOPED PREINJECTORS AND HIGH INITIAL QUADRUPOLE GRADIENTS.

C. THERE IS CONSIDERABLE TRANSVERSE EMITTANCE GROWTH IN BEAMS WITH A BRIGHTNESS (DEFINED IN SECTION 4C) OF 10^{11} AND HIGHER. THIS APPEARS TO BE CAUSED BY NON-LINEAR SPACE CHARGE FORCES.

SUBJECTS.: SPACE CHARGE; BEAM DYNAMICS; COUPLING;

NOTES....: SPACE CHARGE FORCES INCORPORATED ASSUMING EACH PARTICLE IS A SMALL, UNIFORMLY CHARGED SPHERE WHOSE RADIUS IS DETERMINED BY NEARBY PARTICLE DENSITY, VOLUMES AND CHARGES SUM TO THOSE OF BEAM BUNCH. NEGLECT NEIGHBORING BUNCHES, TOTAL SPACE CHARGE AT A POINT IS SUM OF FORCES FROM ALL SPHERES. IMAGE FORCES, MISALIGNMENTS, ABERRATIONS AND BEAM LOADING EFFECTS NEGLECTED. 4-DIMENSIONAL TRANSVERSE HYPERELLIPTICOID AND PHASE-ENERGY ELLIPSE RANDOMLY POPULATED. NO CORRELATIONS BETWEEN TRANSVERSE AND LONGITUDINAL, 500 PARTICLES. ATTENTION - ALL RESULTS ARE IN TERMS OF RMS EMITTANCE. LONGITUDINAL-TRANSVERSE COUPLING DUE TO THE ACCELERATING FIELD SHOWN TO BE SMALL. EMITTANCE GROWTH DUE TO NONLINEAR SPACE CHARGE SHOWS LOWER LIMIT TO OUTPUT EMITTANCE AT 10 MEV AS INPUT EMITTANCE IS DECREASED. GROWTH IS MONOTONICALLY INCREASING WITH BRIGHTNESS, AND IS WORSE IF BEAM IS NOT MATCHED. PHASE DAMPING GOES LIKE $(\Delta E/\Delta t)^{1/4}$ EVEN WITH STRONG SPACE CHARGE. BACKGROUND FOR 1976 BATCHELOR PAPER, CHALK RIVER CONFERENCE.

R. CHASMAN'S 1966 CONF. PAPER (IDN 25) CONSIDERED TOTAL EMITTANCE GROWTH, RATHER THAN THE RMS EMITTANCE CALCULATED HERE. IN THAT PAPER, IT WAS SHOWN THAT TOTAL EMITTANCE DOES GROW CONSIDERABLY DUE TO LONGITUDINAL-TRANSVERSE COUPLING THROUGH THE RF FIELD IN THE GAP. HERE SHE SHOWS RMS EMITTANCE IS NOT AFFECTED VERY MUCH, THIS ILLUSTRATES THE IMPORTANCE OF CONSIDERING TOTAL EMITTANCE IN HIGH CURRENT, LOW LOSS MACHINES, SEE ALSO GLUCKSTERN, 1969 CONF. (IDN 2A).

REFERENCE: 22

DATA-RECD: FIGURES ARE VERY VALUABLE. ONE SHOWS NORMALIZED 10 MEV OUTPUT EMITTANCE VS 0.750 MEV INPUT EMITTANCE FOR 100 MA BEAM; ANOTHER SHOWS EMITTANCE INCREASE AS FUNCTION OF BRIGHTNESS;

CATEGORY.: SPACE CHARGE; NUMERICAL;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770810

1
MICROFILM;

STOR=LOC.1 MP-9 SPORG FILE;

12 TITLE....: NOTES ON ELLIPSES AND TRANSFORMATIONS OF ELLIPSES

AUTHOR....: CRANDALL, K.R.
AFFILIAT.: LASL-MP-9

DOC-TYPE.: TECHNICAL NOTES
PAGES....: 17

DATE-PUBL: 760000

ABSTRACT.: EXPLAINS THE ELLIPSE NOTATION AND ELLIPSE TRANSFORMATIONS THROUGH BEAM TRANSPORT SYSTEMS. ALPHA, BETA, GAMMA NOTATION DEVELOPED FOR TWO DIMENSIONS, SECOND MOMENTS EXPRESSED IN TERMS OF ALPHA, BETA, GAMMA, AND VICE-VERSA, RELATED TO TRANSPORT CODE SIGMA NOTATION, AND MEANING OF SIGMA MATRIX ELEMENTS IN TERMS OF MAXIMUM EXTENT OF ELLIPSOID IN COORDINATE DIRECTIONS, VOLUME OF N-DIMENSIONAL ELLIPSOID.

SUBJECTS.: ELLIPSE FORMULATION; PHASE SPACE DISTRIBUTION;

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770810

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

13 TITLE....: EXPERIMENTS WITH A DIDNIKOV-TYPE H- ION SOURCE

AUTHOR...: ALLISON, P.W.

AFFILIAT.: LASL-P-5

DOC-TYPE.: PAPER

PAGES....: 7

DATE-PURL: 770906

ABSTRACT.: OPERATING CHARACTERISTICS ARE 2 MA CW OR OVER 100 MA PULSED. BEAM NOISE STUDIES AND
EMITTANCE MEASUREMENTS ARE EMPHASIZED IN THIS PAPER. FOR A DC BEAM OF 1 MA, IN THE X-PLANE A
GAUSSIAN WITH NORMALIZED EMITTANCE $\approx 0.02 \pi$ CM-MRAD REASONABLY REPRESENTS THE DATA. OTHER
FIGURES ARE GIVEN. REDUCTIONS CAN PROBABLY BE ACHIEVED BY IMPROVING THE FOCUSING MAGNET AND
REDUCING BEAM NOISE.

SUBJECTS.: H- ION SOURCE;

REFERENCE: 5

CATEGORY.: EQUIPMENT PERFORMANCE; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: JAMESON

DATE-ENT.: 771006

MICROFILM:

STOR-LOC.: MP-9 SPRG FILE;

14 TITLE.....: THE ABEL-TYPE INTEGRAL TRANSFORMATION WITH THE KERNEL $(T^{*2} X^{*2})^{*-1/2}$ AND ITS APPLICATION TO DENSITY DISTRIBUTIONS OF PARTICLE BEAMS

AUTHOR.....: KREMPL, P.W.

AFFILIAT.: EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

DOC-TYPE.: INTERNAL REPORT

REP-NUM.: MPS/INT.BR/74-1

PAGES.....: 32

DATE-PUBL: 740300

ABSTRACT.: THE INVERSION AND SOME PROPERTIES OF THE ABEL-TYPE INTEGRAL TRANSFORMATION WITH THE KERNEL $(T^{*2} X^{*2})^{*-1/2}$ ARE DEMONSTRATED. THE APPLICATION OF THIS TRANSFORMATION TO THE DIFFERENT PHASE-SPACE PROJECTIONS OF A COASTING BEAM, WHOSE PARTICLES PERFORM TWO-DIMENSIONAL PSEUDO-HARMONIC OSCILLATIONS IS SHOWN AND SOME FREQUENTLY USED DISTRIBUTIONS AND PROJECTIONS TABULATED. IN A SIMILAR WAY, THE CORRELATION BETWEEN SURFACE DENSITIES AND PROJECTED DENSITIES FOR ROTATIONAL SYMMETRIC SYSTEMS IS GIVEN, WITH EXAMPLES FOR THE MOST IMPORTANT CASES. SOME USEFUL TRANSFORMATION PAT'S ARE TABULATED IN THE APPENDIX.

SUBJECTS.: PHASE SPACE DISTRIBUTION; ABEL INTEGRALS;

NOTES.....: USEFUL RELATIONS BETWEEN MULTI-DIMENSIONAL PARTICLE POPULATIONS AND THE PROJECTIONS OF THE MULTI-DIMENSIONAL SPACE ONTO FEWER DIMENSIONS, EXAMPLES WORKED OUT FOR SOME USEFUL SIMPLE CASES E.G. GAUSSIAN, CONSTANT, PARABOLIC, CONICAL, CONSTANT PROJECTED DENSITY. SEE ALSO IDN 15, "MARSICANIN, THE PARTICLE BEAM EXTRACTION AND FORMATION OF THE INITIAL ENTRANCE.

REFERENCE: 12

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

1 15 TITLE,....: THE PARTICLE BEAM EXTRACTION AND FORMATION OF THE INITIAL EMITTANCE

AUTHOR...: MARSICANIN, R.
AFFILIAT.: CERN; INSTITUTE BORIS KIDRIC;

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 30

REP-NUM...: MPS/LIN NOTE 75-15
DATE-PUBL: 750714

ABSTRACT.: EXPLANATIONS OF EMITTANCE MEASUREMENTS VS CALCULATIONS ARE MADE IN TERMS OF: 1) EXTRACTION SURFACE, 2) COLUMN OPTICAL PROPERTIES, 3) SPACE CHARGE CONDITIONS. CONTINUES ANALYSIS OF RESULTS REPORTED IN MPS/LIN NOTE 71-5 (RUSSIAN) INFLUENCE OF EXTRACTION CONDITIONS OF THE ION SOURCE ON THE PHASE DENSITY DISTRIBUTION.

SUBJECTS.: PHASE SPACE DISTRIBUTION; EXTRACTED BEAM EMITTANCE; EMITTANCE MEASUREMENT;

NOTES.....: THERMAL COMPONENT OF EMITTANCE ONLY ABOUT ONE PERCENT EVEN WITH LIBERAL ESTIMATE OF ION TEMPERATURE. REST OF EMITTANCE NOT UNDERSTOOD - MAY BE FROM CURVED EXTRACTION SURFACE AND BEAM DENSITY DISTRIBUTION WHICH FOLLOWS, OR CONSEQUENCE OF UNSTABLE POSITION AND SHAPE OF EXTRACTION SURFACE WHICH VARIES WITH FREQUENCY OF SOURCE PLASMA OSCILLATION. A SPACE CHARGE PARAMETER IS DEFINED AS SPACE CHARGE TERM DIVIDED BY EMITTANCE TERM. SUGGESTS GRID IN EXTRACTION CUP TO PREVENT HOLLOW BEAMS AT CURRENTS GREATER THAN 150 MA. INCOMPLETE EVIDENCE SUGGESTS BEAM CURRENT DISTRIBUTION CLOSER TO UNIFORM RATHER THAN ONE WITH STRONG RADIAL DEPENDENCE (USES ABEL-TYPE INTEGRAL TRANSFORMATIONS). CONCLUDES PLASMA GRID IS EFFECTIVE IN CONTROLLING EMITTANCE AT EXPENSE OF SOME CURRENT. AT CURRENTS GREATER THAN 150 MA, ACCELERATING COLUMN PRODUCES LARGE ABERRATIONS DUE TO WEAK E-FIELD NEAR SOURCE; MAY BE REDUCED BY USING GRID AND/OR DECREASING DISTANCE BETWEEN EXTRACTION SURFACE AND END OF HIGH-VOLTAGE SCREEN. SAYS HOLLOW BEAMS DUE TO LARGE SPACE CHARGE HAS RARELY BEEN OBSERVED, PARTLY DUE TO INADEQUATE MEASUREMENTS, AND PARTLY BECAUSE COVERED BY OTHER EFFECTS.

REFERENCE: 10

CATEGORY.: SPACE CHARGE; EXPERIMENTAL ANALYSIS; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770811

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

16 TITLE....: A NORMAL BEAM WITH LINEAR FOCUSING AND SPACE-CHARGE FORCES

AUTHOR...: WALSH, T.R.

AFFILIAT.: RUTHERFORD LABORATORY

DOC-TYPE.: JOURNAL PUBLICATION;

PAGES....: 8

DATE-PUBL: 630000

JOURNAL...: PLASMA PHYSICS, JOURNAL OF NUCLEAR ENERGY, PART C, VOL. 5, 17-22 (1963); SEE ALSO VOL. 4, 53-54 (1962);

ABSTRACT.: A DIFFERENTIAL EQUATION IS OBTAINED FOR THE PROFILE OF A BEAM WITH FINITE EMITTANCE AND SPACE CHARGE. VARIOUS SPECIAL CASES ARE CONSIDERED AND PROFILES FOR A NON-ACCELERATED BEAM ARE GIVEN. A PHASE-SPACE DISTRIBUTION CONSISTENT WITH THE NON-ACCELERATED CASE IS DETERMINED EXPLICITLY AS FAR AS ITS FOURIER TRANSFORM.

SUBJECTS.: SPACE CHARGE;

REFERENCE: WALSH, T.R., THE OPTICAL DESIGN OF BEAM MATCHING SYSTEMS, A.E.R.E. A/R 2711, 1958;

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770811

MICROFILM;

STOR-LOC.: MP-9 SPORG FILE;

17 TITLE....: NUMERICAL CALCULATIONS OF TRANSVERSE EMITTANCE GROWTH IN BRIGHT LINAC BEAMS

AUTHOR...: CHASMAN, R.W.
AFFILIAT.: RNL

DOC-TYPE.: TALK; PUBLICATION;
PAGES....: 5

DATE-PURL: 690800

CONFERENCE: 1969 PARTICLE ACCEL CONF, ACCEL ENGINEERING AND TECH., WASHINGTON, D.C., MARCH 5-7, 1969;

JOURNAL...: IEEE TRANS NUCL SCI, VOL. NS-16, NO. 3, 202-206 (AUGUST 1969);

ABSTRACT.: RESULTS FROM NUMERICAL CALCULATIONS, DESCRIBED IN THIS PROGRAM, INDICATE THAT THE TRANSVERSE EMITTANCE OF BRIGHT LINAC BEAM GROWS PRIMARILY THROUGH SPACE CHARGE INDUCED LONGITUDINAL-TRANSVERSE COUPLING.

COMPUTATIONS ALSO SHOW THAT EXCESSIVE TRANSVERSE PHASE SPACE DILUTION CAN BE PREVENTED IF THE RATIO OF LONGITUDINAL TO TRANSVERSE EMITTANCE IS SMALLER THAN OR, AT THE MOST, EQUAL TO ONE AT THE BEGINNING OF THE LINAC. THIS WOULD REQUIRE AN INPUT ENERGY SPREAD OF ONLY A FEW KEV, ASSUMING CURRENTLY CONVENTIONAL VALUES FOR OTHER BEAM AND MACHINE PARAMETERS.

COMPARISON OF RESULTS REGARDING TRANSVERSE EMITTANCE GROWTH, WHICH WERE OBTAINED WITH +--+ AND +--+ FOCUSING SYSTEMS, SUGGEST THAT THE +--+ SYSTEM IS BY FAR PREFERABLE IF BAD DEGRADATION OF TRANSVERSE BEAM QUALITY IS TO BE AVOIDED.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH; BEAM BRIGHTNESS;

NOTES....: NONLINEAR TRANSVERSE SPACE CHARGE FORCES ARE SHOWN NOT TO BE A MAJOR CAUSE OF EMITTANCE GROWTH; THIS LONGITUDINAL TRANSVERSE COUPLING THROUGH SPACE CHARGE SEEMS TO BE THE MAJOR FACTOR. ARGUES FOR INPUT ENERGY SPREAD OF ONLY A FEW KEV, INSTEAD OF MORE SPREAD AS PRESENTLY BEING CONSIDERED AT CERN AND WHAT MIGHT SEEM APPROPRIATE FOR LOW CURRENT CASE, BECAUSE THIS KEEPS RATIO OF LONGITUDINAL TO TRANSVERSE EMITTANCE LESS THAN OR EQUAL TO ONE AT LINAC ENTRANCE.

REFERENCE: 5

DATA-RECD: VALUABLE FIGURES; NOTE - RESULTS GIVEN IN TERMS OF RMS EMITTANCE;

CATEGORY.: SPACE CHARGE; NUMERICAL; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

1A TITLE....: DESIGN OF THE LOW ENERGY BEAM TRANSPORT SYSTEM FOR THE NEW 50 MEV LINAC

AUTHOR....: BRU, R., WEISS, M.,

AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT

REP-NUM.: CERN/MPS/LIN 74-1

PAGES....: 64

DATE-PUBL: 740609

ABSTRACT.: THE DESIGN OF THE LOW ENERGY BEAM TRANSPORT SYSTEM (LEBT) FOR THE NEW 50 MEV LINAC IS ANALYZED IN PARTICULAR FROM THE BEAM OPTICAL POINT OF VIEW. PRINCIPLES AND METHODS ON WHICH THE DESIGN HAS BEEN BASED ARE REPORTED. SIX-DIMENSIONAL MATCHING TO 250 MA. COMBINATION OF LINEAR OPTIMIZATION PROGRAMS CHECKED BY MULTIPARTICLE PROGRAMS. DESIGN CRITERIA INCLUDE OPERATION OVER WIDE RANGE OF CURRENTS.

SUBJECTS.: BEAM TRANSPORT; SPACE CHARGE; CERN LEBT; MATCHING;

REFERENCE: 11

DATA-RECD: APPENDIX I - USEFUL FORMULAE CONCERNING RMS VALUES OF VARIOUS DENSITY DISTRIBUTIONS; APPENDIX II - MULTI-RING METHOD APPLIED TO OPTIMISE THE BUNCHING EFFICIENCY. TREATS CONTINUOUS BEAMS WITH TRANSVERSE UNIFORM, PARABOLIC OR GAUSSIAN DISTRIBUTIONS; MANY FIGURES;

CATEGORY.: SPACE CHARGE; SYSTEM DESIGN; SYSTEM OPERATION;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

19 TITLE....: EQUILIBRIUM PHASE SPACE DISTRIBUTIONS AND SPACE CHARGE LIMITS IN LINACS

AUTHOR....: LYSFENKO, W.P.

AFFILIAT.: LASLAMP-9

DOC-TYPE.: LA-MS

PAGES.....: 32

REP-NUM...: LA-7010-MS

DATE-PUBL: 771000

ABSTRACT.: LIMITS ON BEAM CURRENT AND EMITTANCE IN PROTON AND HEAVY ION LINEAR ACCELERATORS RESULTING FROM SPACE CHARGE FORCES ARE CALCULATED. THE METHOD INVOLVES DETERMINING EQUILIBRIUM DISTRIBUTIONS IN PHASE SPACE USING A CONTINUOUS FOCUSING, NO ACCELERATION, MODEL IN TWO DEGREES OF FREEDOM USING THE COORDINATES R AND Z . A NONLINEAR POISSON EQUATION MUST BE SOLVED NUMERICALLY. THIS PROCEDURE IS A MATCHING BETWEEN THE LONGITUDINAL AND TRANSVERSE DIRECTIONS TO MINIMIZE THE EFFECT OF LONGITUDINAL-TRANSVERSE COUPLING WHICH IS BELIEVED TO BE THE MAIN PROBLEM IN EMITTANCE GROWTH DUE TO SPACE CHARGE IN LINACS. LIMITS ON THE CLINTON P. ANDERSON MESON PHYSICS FACILITY (LAMPF) ACCELERATOR PERFORMANCE ARE CALCULATED AS AN EXAMPLE. THE BEAM PHYSICS IS DESCRIBED BY A FEW SPACE CHARGE PARAMETERS SO THAT ACCELERATORS WITH DIFFERENT PHYSICAL PARAMETERS CAN BE COMPARED IN A NATURAL WAY. THE MAIN RESULT OF THIS PARAMETER STUDY IS THAT THE REQUIREMENT OF A HIGH INTENSITY BEAM IS BEST FULFILLED WITH A LOW FREQUENCY ACCELERATOR WHEREAS THE REQUIREMENT OF A HIGH BRIGHTNESS BEAM IS BEST FULFILLED WITH A HIGH FREQUENCY ACCELERATOR.

SUBJECTS.: SPACE CHARGE; EQUILIBRIUM DISTRIBUTIONS; PARAMETER SEARCH;

COMMENTS.: DRAFT - IN PREPARATION FOR LA-MS;

NOTES....: FOR AVERAGE CURRENT OF 1 MA AT 4 PERCENT DUTY FACTOR (LAMPF), A UNIFORMLY CHARGED SPHERE OF RADIUS 2.5 MM CONTAINS 5.2×10^{11} PARTICLES. THE DEBYE SHIELDING DISTANCE, WHICH CHARACTERIZES THE CUTOFF DISTANCE BEYOND WHICH STATISTICAL FLUCTUATIONS IN THE PARTICLE DENSITY DISAPPEAR, IS 0.41 MM FOR LAMPF PARAMETERS. THE PLASMA PERIOD IS 53.7 NS, SELF COLLISION TIME 12.6 NS, TIME-OF-FLIGHT THRU THE ACCELERATOR 4.4 US, AND INTERPARTICLE SPACING 5.3 UM. THE SYSTEM IS ESSENTIALLY COLLISIONLESS.

THREE PARAMETERS ARE NEEDED TO DESCRIBE THE PHYSICS OF THE BEAM BUNCH. THE NUMBER OF PARTICLES IN THE BUNCH AND THE OSCILLATION WAVELENGTH MUST ALSO BE SPECIFIED TO RELATE TO A REAL BEAM.

FOR LAMPF PARAMETERS, THE MODEL SHOWS EMITTANCE VARIES AS $(\text{BEAM CURRENT})^{2/3}$. MEASURED VALUES, UNDER CERTAIN ASSUMPTIONS, AGREE WELL WITH AN $N \approx 2$ DISTRIBUTION AT A SPACE CHARGE MODEL PARAMETER VALUE OF 0.4.

ON ACCELERATOR DESIGN AT HIGH CURRENTS, IT IS SHOWN THAT IF EMITTANCE IS NOT AN IMPORTANT CRITERION, MORE CURRENT CAN BE ACHIEVED USING HIGHER INJECTION ENERGY AND LOWER FREQUENCY. LIMITS ON MAXIMUM CURRENT TRANSMISSION CAN BE CALCULATED; ILLUSTRATIVE EXAMPLES ARE GIVEN FOR LAMPF PARAMETERS. IF EMITTANCE IS ALSO IMPORTANT, A DIFFERENT RESULT IS OBTAINED; HIGHER FREQUENCIES WILL PRODUCE MORE CURRENT FOR A FIXED TRANSVERSE EMITTANCE. LIMITS CAN BE CALCULATED.

REFERENCE: 14

CATEGORY.: SPACE CHARGE; ANALYSIS; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON

DATE-ENT.: 771006

1
MICROFILM:

STOR=LOC.; MP=0 SPERG FILE:

1 24 TITLE....: CHOICE OF INITIAL OPERATING PARAMETERS FOR HIGH AVERAGE CURRENT LINEAR ACCELERATORS

AUTHOR....: RATCHFORD, K.
AFFILIAT.: RNL

DOC-TYPE.: TALK; PUBLICATION;
PAGES....: 13

REP-NUM.: RNL 21799
DATE-PUBL: 760914

CONFERENCE: 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976;

ABSTRACT.: RECENT EMPHASIS ON ALTERNATIVE ENERGY SOURCES TOGETHER WITH THE NEED FOR INTENSE NEUTRON SOURCES FOR TESTING OF MATERIALS FOR CTR HAS RESULTED IN RENEWED INTEREST IN HIGH CURRENT (APPROX 100 MA) C.W. PROTON AND DEUTERON LINEAR ACCELERATORS. IN DESIGNING AN ACCELERATOR FOR SUCH HIGH CURRENTS IT IS EVIDENT THAT BEAM LOSSES IN THE MACHINE MUST BE MINIMIZED, WHICH IMPLIES WELL MATCHED BEAMS, AND THAT ADEQUATE ACCEPTANCE UNDER SEVERE SPACE CHARGE CONDITIONS MUST BE MET. THIS PAPER INVESTIGATES THE INPUT PARAMETERS TO AN ALVAREZ TYPE DRIFT-TUBE ACCELERATOR RESULTING FROM SUCH FACTORS. USES UNIFORMLY CHARGED ELLIPSOIDAL MODEL, WHICH GIVES PESSIMISTIC RESULTS, WITH NON-RELATIVISTIC BEAM ENVELOPE EQUATIONS WITH SMOOTH APPROXIMATION FOR TRANSVERSE MOTION.

THE ANALYSIS INDICATES THAT AN ACCELERATOR OPERATING AT A FREQUENCY OF 50 MHZ IS CAPABLE OF ACCEPTING DEUTERON CURRENTS OF ABOUT 0.4 AMPERES AND PROTON CURRENTS OF ABOUT 1.2 AMPERES. THESE VALUES DEPEND CRITICALLY ON THE ASSUMED VALUES OF BEAM EMITTANCE AND ON THE ABILITY TO PROPERLY "MATCH" THIS TO THE LINAC ACCEPTANCE.

THE ANALYSIS DOES NOT CONCERN ITSELF WITH ACCELERATION SO NONE OF THE GROWTH EFFECTS ARISING THEREFROM ARE CONSIDERED. THESE EFFECTS AND THE EFFECTS OF MISALIGNMENTS AND QUADRUPOLE AND ELECTRIC FIELD GRADIENT ERRORS MAY FURTHER LIMIT THE ACCEPTABLE BEAM CURRENT. A DETAILED COMPUTER STUDY WILL BE NECESSARY TO DETERMINE THE FULL VALIDITY OF THE ABOVE.

SUBJECTS.: LINAC DESIGN; SPACE CHARGE; INITIAL ACCELERATION;

REFERENCE: 1A

CATEGORY.: SPACE CHARGE; ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770811

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

21 TITLE....: BEAM LOSSES IN THE 200 MEV INJECTOR

AUTHOR....: BATCHELOR, K.
AFFILIAT.: RNL

DOC-TYPE.: INFORMAL REPORT
PAGES.....: 21

RFP-NUM...: RNL 21295
DATE-PUBL: 7/20/12

ABSTRACT.: DURING THE PAST SEVERAL YEARS THE 200 MEV LINAC HAS BEEN OPERATING WITH A 5-10 MA PFAM CURRENT LOSS SOMEWHERE BETWEEN TANK NO. 2 OUTPUT ENERGY (37 MEV) AND TANK NO. 3 (66 MEV). THIS TECHNICAL NOTE DISCUSSES SOME OF THE POTENTIAL REASONS FOR THIS LOSS AND PROPOSES POSSIBLE SOLUTIONS. ACCEPTANCE DEFINED FROM UNIFORMLY CHARGED ELLIPSOIDAL MODEL, NON-RELATIVISTIC, BEAM ENVELOPE EQUATIONS WITH SMOOTH FOCUSING APPROXIMATION, VARIATION OF SPACE CHARGE MU WITH BETA IS DEVELOPED FOR DIFFERENT ASSUMPTIONS ABOUT THE WAY THE SYNCHRONOUS PHASE, ACCELERATING FIELD AND MAGNETIC FOCUSING LAW ARE ALLOWED TO VARY ALONG THE LINAC. (THIS DEVELOPMENT MAKES THIS A KEY PAPER FOR GUIDANCE IN FUTURE ACCELERATOR DESIGNS.).

THE ANALYSIS PRESENTED GIVES A POSSIBLE EXPLANATION FOR BEAM LOSS IN THE RNL 200 MEV LINAC AND GIVES A WAY OF TRYING TO AVOID THAT LOSS. IT SHOULD BE REMEMBERED THAT LINEAR THEORY HAS BEEN USED THROUGHOUT AND THAT THE BEAM BUNCH HAS BEEN ASSUMED ELLIPSOIDAL AND OF UNIFORM CHARGE DENSITY. THE RESULTS DEPEND HEAVILY ON THESE ASSUMPTIONS. THE EFFECT OF NON-LINEARITIES AND RF FIELD ERRORS HAS NOT BEEN CONSIDERED, NEITHER HAS THE BEAM DE-BUNCHING WHICH OCCURS BETWEEN ACCELERATING CAVITIES, PARTICULARLY AT THE LOWER ENERGIES. IN PRACTICE THE BEAM DOES NOT BEHAVE AS A UNIFORMLY CHARGED ELLIPSOID DURING ACCELERATION DUE TO VARIOUS NON-LINEAR EFFECTS SO THE FOREGOING RESULTS ARE ONLY APPROXIMATE. HOWEVER, THE POTENTIAL FOR LONGITUDINAL BEAM LOSS REMAINS VIABLE AND PERHAPS EVEN INCREASES IN THE PRESENCE OF THESE NON-LINEARITIES. IN REGARD TO RADIAL MOTION, IT IS CLEAR THAT LOSSES ONLY OCCUR DUE TO RADIAL INSTABILITY OF PARTICLES, THOUGH THIS MOST LIKELY OCCURS DUE TO LONGITUDINAL LOSS GIVING RISE TO A LARGE MAGNETIC FIELD GRADIENT ERROR FOR THOSE PARTICLES.

SUBJECTS.: SPACE CHARGE; BEAM LOSS; LINAC DESIGN; SYNCHRONOUS PHASE LAW; QUADRUPOLE LAW; ELECTRIC FIELD LAW;

COMMENTS.: LETTER DTD 770206 FROM K. BATCHELOR TO R.A. JAMESON ATTACHED;

NOTES....: THIS PAPER IS IMPORTANT IN CONSIDERING NEW ACCELERATOR DESIGNS. AT HIGH CURRENTS, IT WILL BE ADVANTAGEOUS TO VARY ACCELERATOR PARAMETERS SUCH AS SYNCHRONOUS PHASE, FIELD AMPLITUDE, FOCUSING LAW, ETC. TO MINIMIZE SPACE CHARGE EFFECTS. TRADITIONAL ACCELERATORS HAVE TENDED TO HOLD THESE MORE CONSTANT. THE EQUATIONS DEVELOPED HERE SHOULD BE DEVELOPED FURTHER AND PERHAPS PROGRAMMED TO FACILITATE PARAMETER SEARCHES.

REFERENCE: A

CATEGORY.: SPACE CHARGE; ERROR ANALYSIS; SYSTEM PERFORMANCE;

CAT-SOURCE: BRADLEY DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: MP-9 SPFRG FILE;

22 TITLE..... OPTIMIZATION OF THE INPUT BEAM PARAMETERS FOR A HIGH CURRENT C.W. DEUTERON LINEAR ACCELERATOR

AUTHOR...: HATCHER, K.
AFFILIAT.: RNL

DOC-TYPE.: INFORMAL REPORT
PAGES.....: 24

REP-NUM...: RNL 50515
DATE-PHRI: 760407

ABSTRACT.: A NUMBER OF PROPOSALS HAVE BEEN WRITTEN FOR A 35 MEV DEUTERON LINEAR ACCELERATOR WITH A CONTINUOUS OUTPUT CURRENT IN EXCESS OF 100 MA. THIS PAPER CONSIDERS THOSE FACTORS INFLUENCING THE CHOICE OF INJECTION ENERGY, OPERATING FREQUENCY AND INITIAL ELECTRIC FIELD GRADIENT, AND QUADRUPOLE MAGNETIC FIELD GRADIENT FOR THE MACHINE. MATCHED INPUT BEAM PARAMETERS UNDER SPACE CHARGE FORCES ARE CALCULATED AS A FUNCTION OF BEAM CURRENT AND RADIAL AND LONGITUDINAL EMITTANCE. THE ELLIPSOIDAL MODEL IS USED TO ESTIMATE OPTIMUM INPUT PARAMETERS FOR BEAMS MATCHED IN SIX DIMENSIONS, NEGLECTING ACCELERATION EFFECTS.

SUBJECTS.: LINAC DESIGN; SPACE CHARGE; INITIAL ACCELERATION;

REFERENCE: 10

CATEGORY.: SPACE CHARGE; ANALYSIS; SYSTEM DESIGN;

CAT-SOURC: BRANLEY DATE-FNI.: 770811

MICROFILM:

STOR-LOC.: MP-9 SPDCG FILE:

23 TITLE.....: SPACE CHARGE EFFECTS IN PROTON LINEAR ACCELERATORS

AUTHOR...: GLUCKSTERN, R.L.
AFFILIAT.: UNIV OF MASSACHUSETTS

DOC-TYPE.: TALK; PUBLICATION;
PAGES.....: 6

REP-NUM...: LA-3609
DATE-PUBL: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, LA-3609, P. 237-242, OCTOBER 3-7, 1966;

ABSTRACT.: DESCRIPTION OF SPACE CHARGE EFFECTS ON PROTON BEAM DYNAMICS, USING A NON RELATIVISTIC, ELLIPSOIDAL BEAM HUNCH OF UNIFORM CHARGE DENSITY. STABILITY LIMITS AND DAMPING OF THE LONGITUDINAL OSCILLATION ARE DERIVED AS FUNCTION OF BEAM CURRENT FOR BEAM OF CONSTANT TRANSVERSE CROSS-SECTION, SHOWING INCREASING SPACE CHARGE MU WITH BETA, AND IMPLYING BEAM LOSS WHEN THE PHASE STABLE REGION BECOMES SMALLER THAN THE DAMPED BEAM. NUMERICAL ESTIMATES ARE GIVEN FOR EXISTING AND PLANNED LINACS. METHODS TO REDUCE THE EFFECT OF SPACE CHARGE ON LONGITUDINAL MOTION INCLUDE LETTING THE TRANSVERSE BEAM SIZE GROW OR TILTING THE ACCELERATING FIELD GRADIENT. THE EFFECTS ON TRANSVERSE MOTION ARE DISCUSSED IN TERMS OF THE BEST VARIATION OF SPACE CHARGE MU AS A FUNCTION OF BETA.

SUBJECTS.: SPACE CHARGE; LINAC DESIGN; BEAM DYNAMICS; SYNCHRONOUS PHASE LAW; QUADRUPOLE LAW; ELECTRIC FIELD LAW;

REFERENCE: 0

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

24 TITLE.....: TRANSVERSE BEAM GROWTH DUE TO LONGITUDINAL COUPLING IN LINEAR ACCELERATORS

AUTHOR....: GLUCKSTERN, R.L.
AFFILIAT.: UNIV OF MASSACHUSETTS

DOC-TYPE.: TALK; PUBLICATION;
PAGES.....: 7

REP-NUM...: LA-3609
DATE-PUBL: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, LA-3609, P. 207-213, OCTOBER 3-7, 1966;

ABSTRACT.: ANALYSIS OF RF DEFOCUSING TERM IN THE TRANSVERSE MOTION ON THE LONGITUDINAL PHASE AND THE DEPENDENCE OF THE TRANSIT TIME FACTOR IN THE LONGITUDINAL MOTION ON THE TRANSVERSE POSITION; CARRIED TO A SECOND ORDER TERM WHICH TAKES INTO ACCOUNT HIGHER ORDER TERMS IN THE FIRST COUPLING TERM. LAGRANGIAN INCLUDES TERMS UP TO Y^2 , Y^3 , $X^2 + Y^2$, AND THE FOCUSING SYSTEM IS SMOOTHED. YIELDS CONSISTENT RESULTS FOR BEAMS NOT EXTENDING CLEAR TO THE BORE. RF COMPONENT IS THAT TRAVELING WITH THE BEAM. THE COUPLING FORCES DECREASE RAPIDLY WITH INCREASING BETA. AN EQUATION IS GIVEN FOR THE GROWTH IN TRANSVERSE DIMENSION AT THE END OF ACCELERATION (FIRST 10 MEV); THE GROWTH WILL BE ABOUT TWICE AS LARGE IN THE COURSE OF REACHING THE FINAL VALUE. FOR COMPARABLE $K_{SUB=L}$ AND $K_{SUB=T}$ AT THE START OF ACCELERATION, THE PREDICTION AT THE END OF ACCELERATION IS FOR A 15-20 PERCENT TRANSVERSE AMPLITUDE INCREASE AND A 30-45 PERCENT INCREASE IN TRANSVERSE EMITTANCE. THE EFFECT INCREASES FOR LOWER $K_{SUB=T}$ (WEAKER TRANSVERSE FOCUSING) AND SUGGESTS TRANSVERSE FOCUSING DESIGNS WHICH MAKE $K_{SUB=T}$ AS LARGE AS POSSIBLE AT INJECTION. EFFECT CAN BE SEVERE IF $K_{SUB=T} = K_{SUB=L}$ AT AN EARLY POINT IN THE ACCELERATION. FOR SMALL ($2 \times K_{SUB=T} = 2 \times K_{SUB=L}$), A RESONANT TREATMENT SHOULD BE USED INSTEAD, LEADING TO A FINITE RESULT AT $K_{SUB=T} = K_{SUB=L}$. SOME UNCERTAINTIES IN THE PREDICTIONS ARE POINTED OUT.

SUBJECTS.: SPACE CHARGE; LINAC DESIGN; RF COUPLING;

REFERENCE: 12; SEE R. CHASMAN, 1966 LINAC CONFERENCE (IDN 25);

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770811

MICROFILM;

STOR-LOC.: MF-9 SPERG FILE;

25 TITLE....: NUMERICAL CALCULATIONS OF COUPLING EFFECTS IN A LOW ENERGY PROTON LINAC

AUTHOR....: CHASMAN, R.W.
AFFILIAT.: RNL

DOC-TYPE.: TALK, PUBLICATION;
PAGES....: 5

REP-NUM...: LA-3609
DATE-PUBL: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, LA-3609, P. 224-228, OCTOBER 3-7, 1966;

ABSTRACT.: NUMERICAL CALCULATIONS IN CONJUNCTION WITH GLUCKSTERN 1966 CONF. PAPER ON LONGITUDINAL COUPLING DUE TO RF FIELDS, AND ALSO ON COUPLING BETWEEN TWO TRANSVERSE MOTIONS DUE TO QUADRUPOLE FRINGING FIELDS. IMPULSE APPROXIMATION MODEL WITH NO SPACE CHARGE. GROWTH DECREASES WITH BETA, AND IS STRONGLY AFFECTED BY THE MAGNETIC FIELD GRADIENTS, FOR CONSTANT θ^{**2} , (DECREASING GRADIENT), THE GROWTH PEAKS AT ABOUT TWICE THE VALUE IT FINALLY SETTLES TO AFTER ABOUT 10 MEV OF ACCELERATION. GROWTH DOES NOT DEPEND ON INITIAL TRANSVERSE AMPLITUDE. THE TRANSVERSE EMITTANCE GROWTH IN A $++-$ SYSTEM WITH OTHER PARAMETERS OF THE RNL LINAC WAS 30-40 PERCENT FOR $\theta^{**2} = 0.50$ (INITIAL GRADIENT = 7000 GAUSS/CM), AND 100-120 PERCENT FOR $\theta^{**2} = 0.40$ (INITIAL GRADIENT = 5600 GAUSS/CM). AN INTERESTING EFFECT WAS NOTICED THAT SHOULD BE KEPT IN MIND WHEN MAKING COMPUTATIONS. IF PARTICLES ARE STARTED WITH A FINITE TRANSVERSE EMITTANCE BUT ALL AT THE SAME ENERGY AND PHASE (SINGLE POINT IN LONGITUDINAL PHASE SPACE), THE TRANSVERSE AREA WILL DECREASE LOCALLY AND ASYMPTOTICALLY, BY SEVERAL TENS OF PERCENT DEPENDING ON PARAMETERS. WHILE THE LONGITUDINAL AREA GROWS, IN AGREEMENT WITH POINCARÉ'S THEOREM, THE SUM OF TRANSVERSE AND LONGITUDINAL PHASE SPACE AREA REMAINS CONSTANT. GENERALIZING MUST BE DONE CAREFULLY BECAUSE OF STRONG DEPENDENCE ON θ^{**2} . COMPUTATIONS ON OLD BNL 50-MEV LINAC INDICATED EMITTANCE GROWTH OF FACTOR 2, CORRESPONDING TO ABOUT 2.7 MEASURED. CERN LINAC PARAMETERS GAVE ABOUT FACTOR 3 WHICH AGREES WELL WITH MEASURED. TRANSVERSE MISALIGNMENTS MAY ADD 20 PERCENT MORE GROWTH. X-Y COUPLING DUE TO QUADRUPOLE FRINGING FIELDS MAY CAUSE FRACTIONAL CHANGES IN TRANSVERSE AMPLITUDE OF SEVERAL TENS OF PERCENT TO BE OBSERVED, BUT TO FIRST ORDER THERE IS NO CHANGE IN RADIAL AMPLITUDE. HIGHER ORDER TERMS MAY CAUSE GROWTH OF A FEW PERCENT. THE FRINGING FIELD EFFECT MAY ALSO BE MORE IMPORTANT IN BEAM TRANSPORT SYSTEMS THAN IN LINACS DUE TO THE DIFFERENT RELATIVE DIMENSIONS OF THE EMITTANCE.

SUBJECTS.: SPACE CHARGE; COUPLING;

NOTES....: NOTE: R. CHASMAN'S 1968 CONF. PAPER (IDN 11) SHOWS THAT RMS (UNDERLINED) EMITTANCE IS HARDLY AFFECTED BY LONGITUDINAL-TRANSVERSE COUPLING THROUGH THE RF FIELD IN THE GAP. SHE POINTS OUT THAT THE RESULTS IN THIS PAPER ARE FOR BORDER PARTICLES AND DO INDICATE RESULTS REPRESENTATIVE OF BEAM GROWTH OF ALL THE PARTICLES, INCLUDING THE WORST. THUS THIS PAPER IS IMPORTANT IN TERMS OF VERY HIGH CURRENT MACHINES WHERE LOW LOSSES ARE IMPORTANT.

REFERENCE: 3

DATA-RECD: MAX FRACTIONAL INCREASE IN TRANSVERSE AMPLITUDE = AS FUNCTION OF DRIFT TUBE NUMBER FOR DIFFERENT θ^{**2} ; AS FUNCTION OF θ^{**2} FOR DIFFERENT INITIAL LONGITUDINAL AMPLITUDE; AS FUNCTION OF INITIAL LONGITUDINAL PHASE FOR DIFFERENT θ^{**2} , AND OTHER VALUABLE FIGURES;

CATEGORY.: SPACE CHARGE; NUMERICAL; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 772811

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

26 TITLE....: BEAM DYNAMICS IN PROTON LINEAR ACCELERATORS

AUTHOR....: GLUCKSTERN, R.L.

AFFILIAT.: UNIV OF MASSACHUSETTS/LASL CONSULTANT MP-DO;

DOC-TYPE.: TALK; JOURNAL PUBLICATION;

PAGES....: 8

DATE-PUBL: 690600

CONFERENCE: 1969 PARTICLE ACCEL CONF, ACCEL ENGR AND TECH, WASHINGTON, D.C., MARCH 5-7, 1969;

JOURNAL...: IEEE TRANS NUCL SCI, VOL. NS-16, NO. 3, 194-201, JUNE 1969;

ABSTRACT.: THE UNCOUPLED EQUATIONS OF MOTION OF CHARGED PARTICLES IN THE LONGITUDINAL AND TRANSVERSE DIRECTIONS IN A LINEAR ACCELERATOR IN THE ABSENCE OF SPACE CHARGE FORCES ARE REVIEWED. THE EFFECT OF COUPLING ON THE DYNAMICS IS INTRODUCED AND RESULTS ARE OBTAINED FOR THE APPARENT INCREASE OF THE PROJECTED PHASE SPACE AREAS. QUESTIONS OF NON-LINEARITIES AND FRINGING FIELD COUPLINGS ARE DISCUSSED. IN THE PRESENCE OF SPACE CHARGE FORCES, OSCILLATION FREQUENCIES ARE DECREASED, ADMITTANCES ARE CHANGED, AND ADDITIONAL COUPLINGS AND NON-LINEARITIES ARE INTRODUCED. THESE CAUSE FURTHER DETEIORATION IN BEAM QUALITY. AN EFFORT HAS BEEN MADE TO IDENTIFY THOSE PARTICULAR EFFECTS WHICH PLAY THE MAJOR ROLE IN INCREASING PHASE SPACE AREAS. COMPARISONS ARE MADE WITH DETAILED THREE DIMENSIONAL ORBIT COMPUTATIONS IN AN EFFORT TO SORT OUT THE VARIOUS EFFECTS.

SUBJECTS.: SPACE CHARGE; BEAM DYNAMICS;

NOTES....: THIS IS PROBABLY STILL THE BEST SINGLE PAPER ON THE SUBJECT, ASSUMPTIONS AND LIMITATIONS OF THE ANALYTICAL APPROACH, AND COMPARISON WITH NUMERICAL RESULTS, ARE CAREFULLY POINTED OUT AS THE ARGUMENTS UNFOLD. THE SECTION ON LONGITUDINAL-TRANSVERSE COUPLING SUMMARIZES THE 1966-1968 WORK OF GLUCKSTERN AND CHASHAN (TNS 11 AND 25). DAMPING PREDICTIONS FROM THE THEORY ARE NOT CONFIRMED BY NUMERICAL CALCULATIONS, REQUIRING COUPLINGS AND NON-LINEARITIES TO BE EVALUATED PRIMARILY THRU NUMERICAL METHODS. GAUSSIAN CHARGE DISTRIBUTIONS ARE DISCUSSED IN TERMS OF THE TENDENCY FOR PROJECTED PHASE SPACE AREAS TO GROW UNTIL ALL ARE NEARLY THE SIZE OF THE ONE THAT WAS LARGEST TO START WITH. THE DIFFERENCE BETWEEN WEAK FOCUSING MODELS (SMOOTHED FOCUSING) AND STRONG FOCUSING ARE SAID NOT TO APPEAR TO CHANGE THE RESULTS APPRECIABLY. THE GAUSSIAN MODEL FOR TRANSVERSE-TRANSVERSE COUPLING SUGGESTS THE COUPLING IS A COLLECTIVE ACTION OF ALL PARTICLES WITH AN EXCHANGE RATE WHICH CAN ACCOUNT FOR A SIGNIFICANT GROWTH IN PHASE SPACE AREA - IN A SINGLE TRANSVERSE OSCILLATION - AS SEEN IN NUMERICAL COMPUTATIONS. CURRENTS ON THE ORDER OF 100 MA WILL DEFINITELY EVIDENCE THESE EFFECTS.

REFERENCE: 23

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770411

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1
27 TITLE....: PRESERVATION OF BEAM QUALITY IN HIGH-ENERGY ACCELERATORS

AUTHOR....: DOWELL, J.T.

AFFILIAT.: CONSULTANT TO PHYSICAL DYNAMICS INC. FROM IRT CORP.

DOC-TYPE.: INTERNAL REPORT

REP-NUM.: PDLJ-76-125

PAGES....: 13

DATE-PRIN.: 760800

ABSTRACT.: THE FOLLOWING IS AN ASSESSMENT OF THE PRESENT LEVEL OF UNDERSTANDING OF THE FACTORS GOVERNING THE QUALITY OF HIGH CURRENT BEAMS IN PARTICLE ACCELERATORS. (A HIGH QUALITY BEAM IS CONSIDERED TO BE ONE OF SMALL RADIUS AND VERY LOW DIVERGENCE.) SINCE LINEAR ACCELERATORS PRODUCE THE MOST INTENSE BEAMS AND THOSE OF THE BEST QUALITY, MOST RELEVANT EXPERIMENTAL STUDIES HAVE INVOLVED THE DIAGNOSIS OF BEAMS FROM THOSE DEVICES. LIKEWISE, MUCH OF THE RELEVANT THEORY HAS BEEN CONCERNED WITH THIS TYPE OF ACCELERATOR. MUCH OF THE PRESENT REVIEW IS CONSEQUENTLY ORIENTED TOWARD BEAMS IN LINEAR ACCELERATORS, ALTHOUGH MANY OF THE CONSIDERATIONS ARE APPLICABLE TO OTHER DEVICES.

SUBJECTS.: SPACE CHARGE; EMITTANCE;

NOTES....: SUMMARIZES EMITTANCE GROWTH DATA FROM BNL, CERN, FNAL, RTI LINACS (ALL FROM 1972 LINAC CONF). SIGNIFICANT GROWTH STILL SEEN FROM 10-200 MEV WITH 80 MA AT FNAL. GOOD SIMPLIFIED DISCUSSION OF EMITTANCE GROWTH MECHANISMS, AND CONJECTURES ABOUT COLLECTIVE PHENOMENA.

REFERENCE: 17

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: HP-9 SPRNG FILE;

1 28 TITLE.....: EMITTANCE OF HIGH-CURRENT PROTON BEAMS

AUTHOR....: KEEFE, D.
AFFILIAT.: LAWRENCE BERKELEY LAB

DOC-TYPE.: LETTER
PAGES.....: 3

DATE-PUBL: 761006

ABSTRACT.: OUTLINES DIRECTIONS THAT SHOULD BE TAKEN TOWARD DEVELOPING A COMPREHENSIVE REVIEW AND A PROGRAM TO TACKLE THE PROBLEMS. SUGGESTS CAREFUL REVIEW OF EXPERIMENTAL RESULTS AND MEASURING TECHNIQUES. POINTS OUT OTHER LIMITS WHICH MIGHT BE A CONCERN, SUCH AS SPACE CHARGE DEPRESSION WITHIN THE BEAM, THE LIMITING POWER A TRANSPORT SYSTEM CAN HANDLE AT HIGH POWER (HAS $\beta \approx 11/3$ DEPENDENCE AND INDICATES PROBLEMS AT LOW VELOCITY), AND REFLECTION OF LOW-SPEED IONS FROM VERY HIGH MAGNETIC FIELDS. SUGGESTS ACCELERATION OF SEVERAL BEAMS AND COMBINING AT HIGH VELOCITY, NON-LIOUVILLEAN METHODS (ELECTRON COOLING, STOCHASTIC COOLING, CHARGE-EXCHANGE INJECTION), NEUTRALIZATION (VERY COMPLICATED, BUT MAYBE ONLY WAY OF HANDLING LOW VELOCITY HIGH CURRENT BEAMS). USE OF ELECTRON MODEL TO TEST EFFECTS (SEE ION 32). EXISTING COMPUTER CODES SHOULD BE REVIEWED.

SUBJECTS.: SPACE CHARGE; EMITTANCE;

NOTES....: LETTER TO DR. ADOLF HOCHSTIM, PRESIDENT, LA JOLLA INSTITUTE;

REFERENCE: POLJ-76-125;

CATEGORY.: SPACE CHARGE; ANALYSIS;

CAT-SOURC: BRADLEY DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: WP-9 SPERG FILE;

1 29 TITLE.....: ON FREQUENCY SHIFT OF AXIAL OSCILLATIONS UNDER THE EFFECT OF THE BEAM SPACE CHARGE

AUTHOR....: GLAZOV, A.A.; DZHELEPOV, V.P.; DMITRIEVSKY, V.P.; ZAMOLODCHIKOV, B.I.; KOLGA, V.V.; NOVIKOV, D.
L.; ONISCHENKO, I.M.

AFFILIAT.: JOINT INSTITUTE OF NUCLEAR RESEARCH, DUBNA, USSR

DOC-TYPE.: JOURNAL PUBLICATION;

PAGES.....: 4 DATE-PUBL: 720000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 3, 231-234 (1972);

ABSTRACT.: EXPERIMENTAL STUDIES OF THE FREQUENCY SHIFT OF INCOHERENT AXIAL OSCILLATIONS UNDER THE
EFFECT OF THE BEAM SPACE CHARGE IN THE ELECTRON MODEL OF THE CIRCULAR CYCLOTRON ARE DESCRIBED.
THE RESULTS OF THE STUDIES ARE SATISFACTORY AGREEMENT WITH THE EXISTING PRESENTATION ON THE
MECHANISM OF THIS SHIFT.

SUBJECTS.: SPACE CHARGE; CYCLOTRON;

REFERENCE: 8

CATEGORY.: SPACE CHARGE; EXPERIMENTAL ANALYSIS; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770811

MICROFILM;

STOR-LOC.: MP-9 SPORG FILE;

30 TITLE....: DERIVATION AND SOLUTION OF THE SYSTEM OF EQUATIONS DESCRIBING INTENSE BEAMS, FOR NONSTATIONARY
DISTRIBUTION OF TRANSVERSE PHASE-SPACE DENSITY

AUTHOR....: KUZNETSOV, V.S.

AFFILIAT.: EREMOV RESEARCH INST OF ELECTROPHYSICAL INSTR, Leningrad, USSR

DOC-TYPE.: JOURNAL PUBLICATION

PAGES....: 8

DATE-PUBL: 710000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 2, 261-268 (1971);

ABSTRACT.: A SYSTEM OF EQUATIONS IS DERIVED FOR THE DEPENDENCE OF THE FOUR-DIMENSIONAL PARTICLE-
DENSITY DISTRIBUTION FUNCTION IN TRANSVERSE COORDINATES AND VELOCITIES ON THE LONGITUDINAL
COORDINATE OF THE BEAM. A NUMERICAL SOLUTION METHOD IS INTRODUCED AND JUSTIFIED FOR THESE
EQUATIONS.

SUBJECTS.: SPACE CHARGE; NONSTATIONARY DISTRIBUTION;

NOTES....: SEE COMPANION PAPER GIVING NUMERICAL METHODS AND RESULTS, SAME ISSUE (IDN 31);

REFERENCE: 15

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

31 TITLE....: INVESTIGATION OF THE DYNAMICS OF CHARGED PARTICLES IN INTENSE BEAMS WITH NONSTATIONARY
DISTRIBUTION OF TRANSVERSE PHASE-SPACE DENSITY, BY NUMERICAL EXPERIMENTS

AUTHOR....: KUZNETSOV, V.S.; KUZNETSOVA, N.P.; FIDELSKAYA, R.P.; SOLNYSHKOV, A.I.;
AFFILIAT.: EFREMOV RESEARCH INST OF ELECTROPHYSICAL INSTR, LENINGRAD, USSR

DOC-TYPE.: JOURNAL PUBLICATION;
PAGES....: 10

DATE-PUBL: 710000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 2, 269-278 (1971);

ABSTRACT.: AN ALGORITHM AND SCHEME ARE CONSIDERED FOR CALCULATIONS OF TRANSVERSE PHASE-SPACE DENSITY
REDISTRIBUTION, APPLIED TO AN AXIALLY SYMMETRIC BEAM FOR ARBITRARY PARTICLE-DENSITY
DISTRIBUTION FUNCTION IN TRANSVERSE COORDINATES AND VELOCITIES. RESULTS OF ACTUAL CALCULATIONS
ARE GIVEN OF THE VARIATION IN TRANSVERSE PHASE-SPACE DENSITY DISTRIBUTION FOR MOTION OF
PARTICLES OF AN INTENSE PROTON BEAM IN A LINEAR ACCELERATOR AND FOR MOTION OF THE FLUX OF
CHARGED PARTICLES IN A UNIFORM MAGNETIC FIELD. SOME CHARACTERISTICS OF INTENSE-BEAM DYNAMICS
ARE EXPLAINED FOR NONSTATIONARY TRANSVERSE PHASE-SPACE DENSITY DISTRIBUTIONS AND NONLINEAR
DISTRIBUTIONS OF COULOMB FORCES.

SUBJECTS.: SPACE CHARGE; NONSTATIONARY DISTRIBUTION;

NOTES....: SHOULD STUDY THIS PAPER MORE CLOSELY. USES DISTRIBUTION FUNCTION APPROACH GIVEN IN
COMPANION PAPER (IDN 30). COMPARISONS WITH UNIFORM CHARGE DENSITY DISTRIBUTION, LINEAR COULOMB
FORCE, ENVELOPE MODEL. RESULTS SHOWN FOR ION SOURCE TO 600 KV. ENVELOPE MODEL AND DISTRIBUTION
FUNCTION MODEL AGREE PRETTY WELL; EXPLAINED BY IDEA THAT FOR ANY NONLINEAR DISTRIBUTION OF
COULOMB FORCES, THE FORCE ACTING ON PARTICLES SITUATED AT THE BORDER OF THE FLUX IS INDEPENDENT
OF THE DISTRIBUTION OF SUCH FORCES INSIDE THE BEAM, HENCE THE MOTION OF PERIPHERAL PARTICLES
DEPENDS WEAKLY ON THE FORM OF THE DISTRIBUTION. FOR STRONGER NONLINEARITIES, MORE DISTORTION
AND INCREASES IN THE TWO-DIMENSIONAL PROJECTIONS OF TRANSVERSE PHASE SPACE VOLUME ARE OBSERVED.

REFERENCE: 17

CATEGORY.: SPACE CHARGE; NUMERICAL; THEORY;

CAT-SOURCE: BRADLEY DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

32 TITLE.....: EXPERIMENTAL STUDY ON THE SPACE-CHARGE EFFECT IN PROTON LINACS BY AN ELECTRON MODEL

AUTHOR....: OKUMURA, S.; NISHIKAWA, T.; YOSHIKAWA, H.;
AFFILIAT.: UNIV OF TOKYO

DOC-TYPE.: JOURNAL PUBLICATION;
PAGES.....: 4

DATE-PUBL: 710000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 2, 279-282, (1971);

ABSTRACT.: THE SPACE-CHARGE EFFECT IN PROTON LINACS IS EXPERIMENTALLY STUDIED BY AN ELECTRON MODEL. ELECTRONS ARE ACCELERATED IN THE FIRST 24 CELLS OF THE MODEL CAVITY WHICH HAS HALF-SIZE DIMENSIONS OF THE DESIGNED PROTON LINAC. THE OUTPUT ENERGY IS 1.6 KEV WHICH CORRESPONDS TO 2.8 MEV FOR PROTONS. THE OUTPUT CURRENTS AS A FUNCTION OF INPUT CURRENTS ARE MEASURED WITHOUT CHANGING THE OTHER ACCELERATING CONDITIONS. A MAXIMUM CURRENT OF 160 MICROAMPERES WHICH IS EQUIVALENT TO A PROTON CURRENT OF 300 MA IN THE SPACE-CHARGE EFFECT IS OBTAINED. THE OUTPUT CURRENTS SHOW A SATURATION AROUND THIS VALUE. THESE RESULTS ARE EXPLAINED IN TERMS OF THE LONGITUDINAL SPACE-CHARGE EFFECT.

SUBJECTS.: SPACE CHARGE; ELECTRON MODEL;

REFERENCE: 5

CATEGORY.: SPACE CHARGE; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 77MAR1

MICROFILM;

STORE-LOC.: MP-9 SPACE FILE;

33 TITLE.....: COMPUTED STUDIES OF BEAM DYNAMICS IN A PROTON LINEAR ACCELERATOR WITH SPACE CHARGE

AUTHOR....: MARTINI, M.; PRONE, M.;
AFFILIAT.: C. OLIVETTI S.P.A.; SACLAY;

DOC-TYPE.: JOURNAL PUBLICATION;
PAGES.....: 11

DATE-PUBL: 710000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 2, 289-299 (1971);

ABSTRACT.: TWO COMPUTER PROGRAMS WRITTEN FOR INVESTIGATING SPACE-CHARGE EFFECTS IN PROTON LINEAR ACCELERATORS ARE PRESENTED. BOTH USE THE DYNAMICS EQUATIONS DERIVED BY DRS. P. LAPOSTOLLE AND R. SCHNITZER; THE WAY THESE EQUATIONS HAVE BEEN PRACTICALLY TREATED IS EXPLAINED. DETAILS ARE GIVEN ON THE TWO PROGRAMS; THE FIRST ONE (MAPRO1) IS BASED ON A PARTICLE TO PARTICLE INTERACTION, WHILE THE SECOND ONE (MAPRO2) BENEFITS FROM A CONTINUOUS EQUIVALENT DISTRIBUTION. RESULTS GIVEN BY BOTH PROGRAMS ARE COMPARED AND CONTRASTED TO DR. P. CHASMAN'S PREVIOUS RESULTS. AS AN APPLICATION, THE PROBLEM OF THE INFLUENCE OF INJECTION ENERGY ON LINAC PERFORMANCE IS PARTIALLY TREATED.

SUBJECTS.: SPACE CHARGE; QUADRUPOLE FIELD ABERRATIONS; MAPRO1 CODE; MAPRO2 CODE;

NOTES.....: MAPRO1 IS A PARTICLE IN CELL METHOD. MAPRO2 USES ANALYTIC DISTRIBUTION FUNCTION WHERE THE DENSITY SURFACES ARE ELLIPSOIDS; THE DISTRIBUTION HAS NO DISCONTINUITIES AND THE CHARGE DENSITY TENDS TO ZERO FAR FROM THE ORIGIN; IT CANNOT REPRESENT HOLLOW BUNCHES BUT THIS SHOULD NOT BE SERIOUS IN PRACTICE. IN BOTH CODES, 4 QUADRANT SYMMETRY IS IMPOSED. FIGURE 3 GIVES NORMALIZED OUTPUT VS INPUT EMITTANCE OVER A RANGE OF CURRENTS, SHOWING LIMITING VALUE AS INPUT EMITTANCE APPROACHES ZERO, IN AGREEMENT WITH CHASMAN'S RESULTS. MAPRO2 GIVES EMITTANCE GROWTHS ABOUT 20 PERCENT LARGER THAN MAPRO1, WHICH UNDERESTIMATES EFFECT. INFLUENCE OF SIZE OF LONGITUDINAL EMITTANCE ALSO SHOWN. STUDIED EFFECT OF INJECTION ENERGY ON ACHIEVABLE CURRENT; SATURATION EFFECT AS FUNCTION OF INPUT CURRENT OCCURS; INFLUENCE OF INCREASING INJECTION ENERGY ON OUTPUT CURRENT DEPENDS STRONGLY ON INPUT CURRENT LEVEL. TABLE OF INJECTION ENERGY, INPUT AND OUTPUT CURRENT, AND TRANSVERSE AND LONGITUDINAL OUTPUT EMITTANCES IS GIVEN. THESE CALCULATIONS SEEM TO SHOW (FOR THIS CONFIGURATION, +++) THAT AN INCREASE IN INJECTION ENERGY IS VERY DESIRABLE TO GET BOTH MORE OUTPUT CURRENT AND A BETTER QUALITY BEAM. THEY SUGGEST TRYING A +++ STRUCTURE - WILL PROBABLY BE DIFFERENT.

REFERENCE: 15 (SEVERAL SHOULD BE STUDIED FURTHER - PARTICULARLY R ON QUAD FIELD ABERRATIONS, 14, AND OTHERS);

CATEGORY.: SPACE CHARGE; SOFTWARE DOCUMENTATION; NUMERICAL;

CAT-SOURC: BRANLEY DATE-ENT.: 770111

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

34 TITLE....: A SIMPLE DERIVATION OF PROTON LINAC BEAM DYNAMICS EQUATIONS

AUTHOR....: SCHNITZER, R.

AFFILIAT.: CERN

DOC-TYPE.: JOURNAL PUBLICATION

PAGES....: 7

DATE-PUBL: 710000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 2, 141-147 (1971);

ABSTRACT.: THE NON-RELATIVISTIC DIFFERENCE EQUATIONS DESCRIBING THE MOTION OF A SINGLE PROTON THROUGH AN ALVAREZ STRUCTURE LINAC GAP GIVEN BY P. LAPOSTOLLE AT THE FRASCATI CONFERENCE (1965) ARE DERIVED IN A VERY SIMPLE WAY. BEAM DYNAMICS COEFFICIENTS (T AND S TRANSIT TIME COEFFICIENTS) ARE DEFINED AS FOURIER TRANSFORMS OF THE RF FIELD IN THE GAP. THE EQUATIONS OF MOTION AND THE DIFFERENCE EQUATIONS ARE TRANSFORMED BY THE INTRODUCTION OF THIN LENS (REDUCED) VARIABLES. THE EQUATIONS OF MOTION ARE SOLVED BY ITERATION STARTING FROM FREE PARTICLE MOTION. FIRST ORDER RESULTS CAN BE FOUND BY IDENTIFYING THE INTEGRALS OF THE TRANSFORMED EQUATIONS OF MOTION WITH THOSE OF THE BEAM DYNAMICS COEFFICIENTS.

SUBJECTS.: SINGLE PARTICLE DYNAMICS; MAPRO1 CODE; MAPRO2 CODE;

NOTES....: USED IN MAPRO1 AND MAPRO2 CODES;

REFERENCE: 16

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: NR-9 SPORG FILE;

1
35 TITLE....: THE OPERATION OF THE FIRST SECTION OF THE NAL LINEAR ACCELERATOR

AUTHOR...: CURTIS, C.O.; GOODWIN, R.W.; GRAY, E.R.; LIVDAHL, P.V.; OWEN, C.W.; SHEA, M.F.; YOUNG, D.E.;
AFFILIAT.: NATIONAL ACCELERATOR LAB.

DOC-TYPE.: JOURNAL PUBLICATION;

PAGES.....: 17

DATE-PUBL: 700000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 1, 93-109 (1970);

ABSTRACT.: THE INITIAL PERFORMANCE OF THE 10-MEV SECTION OF THE NAL 200-MEV LINEAR ACCELERATOR IS PRESENTED. THE PRE-ACCELERATOR, MECHANICAL AND RF SYSTEMS OF THE LINAC, BEAM TRANSPORT LINES, DIAGNOSTIC EQUIPMENT AND COMPUTER-CONTROL SYSTEM ARE DESCRIBED BRIEFLY. BEAM EMITTANCE, PROFILES, MOMENTUM SPREAD AND OPERATING LINAC PARAMETERS PROCESSED THROUGH THE COMPUTER ARE DISPLAYED. THE MAXIMUM BEAM CURRENT ACCELERATED TO 10.0 MEV WAS 160 MA WITH A CAVITY TRANSMISSION OF 72 PERCENT. THE PHASE-SPACE DENSITY WAS SIGNIFICANTLY HIGHER IN THE CORE OF THE BEAM THAN NEAR THE PERIPHERY. FOR A 150-MA BEAM THE MEASURED EMITTANCE AREAS INCLUDING 80 PERCENT OF THE BEAM CURRENT WERE 10 AND 15 MILLIRADIAN-CM IN THE X AND Y PLANES RESPECTIVELY. THE BEAM-EMITTANCE GROWTH THROUGH THE LINAC WAS MEASURED AND A GRAPH SHOWING VARIATIONS OCCURRING UNDER DIFFERENT OPERATING CONDITIONS IS PRESENTED. THE TOTAL MOMENTUM SPREAD OF THE 10-MEV BEAM, INDEPENDENT OF BEAM CURRENT, WAS 1.0 PERCENT FOR APPROXIMATELY 90 PERCENT OF THE BEAM. FURTHER IMPROVEMENTS IN BEAM QUALITY CAN BE EXPECTED FROM OPTIMIZATION OF LINAC PARAMETERS.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH; OPERATING EXPERIENCE;

REFERENCE: 15

CATEGORY.: SPACE CHARGE; SYSTEM DESCRIPTION; SYSTEM PERFORMANCE;

CAT-SOURCE: BRADLEY DATE-ENT.: 770011

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1
36 TITLE....: HIGH GRADIENT PRECISION QUADRUPOLE MAGNETS FOR KEK LINEAR ACCELERATOR

AUTHOR...: KOBAYASHI, M.; TANAKA, J.; RABA, H.; INAGAKI, S.; OHMURA, S.; YAMASHITA, S.;
AFFILIAT.: DEPT OF PHYSICS/NARA WOMENS UNIV; NATL LAB FOR HIGH ENERGY PHYSICS, JAPAN;

DOC-TYPE.: JOURNAL PUBLICATION;

PAGES.....: 13

DATE-PUBL: 720000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 4, 87-99 (1972);

ABSTRACT.: NEW MANUFACTURING PROCESSES OF DRIFT TUBE QUADRUPOLE MAGNETS WERE DEVELOPED TO OBTAIN A
HIGH FIELD GRADIENT OF 11 KG/CM AND A HIGH MECHANICAL PRECISION. A TOTAL OF 90 MAGNETS FOR THE
KEK LINAC WERE CONSTRUCTED FOR THE DIFFERENCE BETWEEN THE MECHANICAL HOLE CENTRES AND THE
MAGNETIC CENTRES. THE FIELD CHARACTERISTICS, I.E., CORE SATURATION, FRINGING FIELD DISTRIBUTION,
EFFECTIVE LENGTH OF MAGNET, HARMONIC CONTENTS AND EDDY CURRENT EFFECTS, WERE MEASURED IN
PULSED EXCITATION WITH A NEW MEASURING SYSTEM USING A PEAK-TO-DC COMPARISON METHOD AND A
STEPPING SEARCH COIL.

SUBJECTS.: QUADRUPOLE DESIGN; QUADRUPOLE FIELD ABERRATIONS;

REFERENCE: 9

CATEGORY.: SPACE CHARGE; EQUIPMENT DESIGN;

CAT-SOURCE: BRADLEY DATE-ENT.: 770811

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

37 TITLE....: GENERAL ENVELOPE EQUATION FOR CYLINDRICALLY SYMMETRIC CHARGED-PARTICLE BEAMS

AUTHOR....: LEF, F.D., CONDER, R.K.;
AFFILIAT.: LAWRENCE LIVERMORE LAB

DOC-TYPE.: JOURNAL PUBLICATION;
PAGES....: 13

DATE-PUBL: 760000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 7, 83-95 (1976);

ABSTRACT.: AN ENVELOPE EQUATION, WHICH INCLUDES THE EFFECTS OF A SOLENOIDAL FIELD, ACCELERATION, SELF-INDUCED FORCES, AND SCATTERING BY A BACKGROUND MEDIUM, IS DERIVED FOR THE RMS RADIUS OF A RELATIVISTIC BEAM.

THE SYSTEM IS ASSUMED TO BE CYLINDRICALLY SYMMETRIC WITH HIGH ENOUGH ENERGY THAT THE PARAXIAL APPROXIMATION IS APPLICABLE. THE SOLENOIDAL FIELD IS TAKEN TO BE UNIFORM NORMAL TO THE DIRECTION OF PROPAGATION BUT THE BEAM CURRENT PROFILE IS ARBITRARY.

THE WELL-KNOWN EQUATIONS OF PROPAGATION ARE RECOVERED IN THEIR RESPECTIVE DOMAINS OF APPLICABILITY (I.E., VACUUM TRANSPORT IN A SOLENOID, EQUILIBRIUM CONDITIONS, THE NORDSTROM EQUATION, FREE EXPANSION, AND THE SAUSAGE-MODE EQUATION). A TREATMENT IS ALSO GIVEN OF THE MATCHING CONDITIONS FOR A BEAM INJECTED INTO GAS THROUGH A FOIL IN THE PRESENCE OF A SOLENOIDAL FIELD.

THE DERIVATION OF THE ENVELOPE EQUATION DIFFERS FROM PREVIOUS WORK IN MAKING USE OF THE SCALAR VIRTUAL MOMENT OF THE SINGLE-PARTICLE EQUATION OF MOTION. THE BEAM EMITTANCE APPEARS IN A NATURAL WAY AS A CONSTANT OF INTEGRATION AND IS SHOWN TO BE PROPORTIONAL TO THE EFFECTIVE PHASE AREA OCCUPIED BY THE PARTICLES. NO DISTRIBUTION FUNCTION IS SPECIFIED FOR THE TRANSVERSE VELOCITIES, BUT THE BEAM IS ASSUMED TO PULSATE IN A SELF-SIMILAR FASHION.

SUBJECTS.: SPACE CHARGE; ENVELOPE EQUATIONS;

REFERENCE: 12

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURCE: BRADLEY DATE-ENT.: 770811

MICROFILM;

STOR-LOC.: MP-9 SPRNG FILE;

3A TITLE....: ROUND TABLE DISCUSSION ON SPACE CHARGE AND RELATED EFFECTS

AUTHOR...: SMITH, I.; CHASMAN, R.W.; CRANDALL, K.R.; GLUCKSTERN, R.L.; NISHIKAWA, T.; HAINSON, J.;
LAPOSTOLLE, P.M.;

AFFILIAT.: PAL; RNL; IAS; UNIV OF MASSACHUSETTS/LASL CONSULTANT MP-DO; UNIV OF TOKYO; MIT; CERN;

DOC-TYPE.: DISCUSSION NOTES; CONF PAPER;

PAGES....: 12

DATE-PUBL: 6A0520

CONFERENCE: PROC 1968 PROTON LINEAR ACCEL CONF, RNL 50120 (C-54) PART 1, 433-444, MAY 20-24, 1968;

ABSTRACT.: MEASUREMENTS INDICATE OUTPUT EMITTANCE LIMIT VARIES AS INTENSITY TO THE 1/2 TO 1/2 POWER. DEVELOPMENT OF PROHABE SPHEROID MODEL WITH NON-UNIFORM CHARGE DENSITY. DIFFERENCES BETWEEN RMS AND TOTAL MEASUREMENTS ARE DISCUSSED. THE SUCCESS OF APPROXIMATE MATCHING PROCEDURES DERIVED FROM THE K-V FORMALISM IS CONSIDERED REMARKABLE. IN VIEW OF THE INHERENT ASSUMPTIONS, AGREEMENT BETWEEN NUMERICAL CALCULATIONS AT DIFFERENT LABS IS PRETTY GOOD. THREE-DIMENSIONAL MODELS USED FOR ELECTRON CALCULATIONS ALLOW FOR DISHING OR OIL-CANNING OF THE RISKS. BUNCHING SYSTEMS ARE DISCUSSED BRIEFLY. LAPOSTOLLE EXPLAINS HIS THERMODYNAMIC ARGUMENT. ESSENTIAL CYLINDRICAL SYMMETRY FORCED ON NUMERICAL CALCULATIONS OF VARIOUS KINDS IS POINTED OUT.

SUBJECTS.: SPACE CHARGE; BUNCHER; NUMERICAL COMPUTATION; SYMMETRY; MATCHING;

NOTES....: COMMENTS ON DIFFERENCES BETWEEN RMS AND BORDER (OR BOUNDARY, MARGINAL, TOTAL) EMITTANCE POINTS OF VIEW. REMARKABLY GOOD MATCHING RESULTS FROM THE SIMPLIFIED THEORY WHICH MAKES THE SECOND DERIVATIVE OF TRANSVERSE AND LONGITUDINAL BEAM SIZE EQUAL TO ZERO. GENERAL AGREEMENT BETWEEN METHODS AND RESULTS OF DIFFERENT GROUPS. COMMENTS ON THE ADEQUACY OF NUMERICAL COMPUTATION - NOT CLEAR, DEPENDS ON SPECS FOR PARTICULAR LINAC, PROBABLY ADEQUATE TO COMPARE LINACS BUT NEED GUIDE LINES FOR OPTIMIZATION. MUCH DISCUSSION OF BUNCHING; ONE REASON FOR DISCRETE BUNCHERS IS REQUIREMENT TO OPERATE OVER WIDE CURRENT RANGE; DIFFICULT TO OPTIMIZE A CONTINUOUS OR TAPERED BUNCHER OVER A WIDE RANGE. THE IMPLICIT SYMMETRY IMPOSED ON MANY-PARTICLE COMPUTATIONS BY INTRODUCING IMAGED CHARGES TO GET EFFECTIVELY FOUR TIMES AS MANY PARTICLES IS POINTED OUT - THIS MAY BE AN IMPORTANT DRAWBACK IN ANALYZING HIGH-CURRENT, LOW-LOSS LINACS.

REFERENCE: 7

CATEGORY.: SPACE CHARGE; THEORY; SYSTEM DESIGN; NUMERICAL COMPUTATION;

CAT-SOURCE: BRADLEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

1

39 TITLE....: GENERATION OF GEOMETRICAL DIMENSIONS FOR DRIFT TUBE LINACS

AUTHOR....: SWENSON, D.A.

AFFILIAT.: LASL-MP-3

DOC-TYPE.: INTERNAL REPORT

REP-NUM..: MP-3/DAS-1

PAGES....: 17

DATE-PUBL: 670629

ABSTRACT.: THIS REPORT DESCRIBES A PROCEDURE FOR USING THE MESSYMESH RESULTS TOGETHER WITH THE CONCEPT OF A SYNCHRONOUS PARTICLE TO GENERATE THE GEOMETRICAL DIMENSIONS OF A DRIFT TUBE LINAC. POLYNOMIAL FITS TO T , TP , S , SP AND G/I AS FUNCTIONS OF $BETA-SUR-G$ ARE USED AS INPUT TO THE PARMILA CODE.

SUBJECTS.: ACCELERATOR STRUCTURE; DRIFT TUBE LINAC; PARMILA CODE;

REFERENCE: 5

CATEGORY.: SPACE CHARGE; ANALYSIS; SYSTEM DESIGN;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE

1 40 TITLE.....: PARMILA

AUTHOR.....: SWENSON, D.A.; STOVALL, J.F.;
AFFILIAT.: LASI-MD-9

DOC-TYPE.: TECH REPORT
PAGES.....: 51

DATE-PUBL: 690000

ABSTRACT.: A COMPUTER PROGRAM ENTITLED PARMILA HAS BEEN PREPARED TO AID IN THE STUDY OF PARTICLE DYNAMICS IN PHOTON LINEAR ACCELERATORS. THE NAME IS DERIVED FROM THE PHRASE - PHASE AND RADIAL MOTION IN LINEAR ACCELERATORS. PARMILA IS A VERSATILE MULTI-PARTICLE CODE IN WHICH THE BEAM, REPRESENTED BY A COLLECTION OF PARTICLES, MAY BE TRANSFORMED THROUGH ANY LINAC SPECIFIED BY THE USER. USEFUL INFORMATION ABOUT THE BEAM INCLUDING THE SIX PHASE SPACE COORDINATES OF EACH PARTICLE, IS AVAILABLE AT FREQUENT INTERVALS ALONG THE ACCELERATOR AND CAN BE PROCESSED AND PRESENTED IN MANY WAYS.

SUBJECTS.: PARMILA CODE; NUMERICAL COMPUTATION; BEAM DYNAMICS;

NOTES.....: PLUS INFORMAL NOTES AND STOVALL MEMO ON MODIFICATIONS 28 FEB 77;

REFERENCE: I. SMITH AND R. GLUCKSTEIN, PSI-28-2, FEB. 1955;

CATEGORY.: SPACE CHARGE; SOFTWARE DOCUMENTATION;

CAT-SOURCE: BRADLEY DATE-ENT.: 772812

MICROFILM:

STOR-LOC.: MD-9 SPRNG FILE;

41 TITLE....: SIMULTANEOUS STEERING OF H+ AND H- BEAMS AT LAMPF

AUTHOR....: CRANDALL, K.R.; JULE, M.E.;

AFFILIAT.: LASL-PP-9

DOC-TYPE.: TALK; JOURNAL PUBLICATION;

PAGES.....: 2

DATE-PUBL: 740502

CONFERENCE: PROC IX INTL CONF ON HIGH ENERGY ACCELERATORS, SLAC, STANFORD, CA, 529-530, MAY 2-7, 1974;

ABSTRACT.: BASED ON ANALYSIS AND COMPUTER SIMULATIONS, IT HAS BECOME APPARENT THAT TWO KINDS OF DOUBLET STEERING ARE NECESSARY FOR LINEAR ACCELERATION OF H+ AND H- BEAMS SIMULTANEOUSLY. THE RESPECTIVE ADVANTAGES OF STEERING BY ELECTRICALLY TILTING AND DISPLACING A SYSTEM OF DOUBLETS ARE DESCRIBED. SINGLE DIPOLE STEERING FOR SIMULTANEOUS BEAMS AND THE EFFECT OF THE EARTH'S MAGNETIC FIELD ON OPPOSITELY CHARGED BEAMS IS ALSO CONSIDERED. FINALLY, THE IMPLEMENTATION OF THIS KIND OF STEERING AT LAMPF IS DISCUSSED.

SUBJECTS.: SIMULTANEOUS BEAMS; STEERING;

REFERENCE: D.A. SWENSON AND K.R. CRANDALL, LASL, PRIVATE COMMUNICATION, JULY 1968; D.A. SWENSON, LASL, PRIVATE COMMUNICATION, AUGUST 1968;

CATEGORY.: SPACE CHARGE; SYSTEM DESCRIPTION; SYSTEM OPERATION;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPONG FILE;

47 TITLE.....: RMS ENVELOPE EQUATIONS WITH SPACE CHARGE - 70111A

AUTHOR....: SACHERER, F.J.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 19

REF-NUM.: CERN/SI/INT. PL/70-12
DATE-PUBL: 70111C

CONFERENCE: SEE ALSO 1971 PARTICLE ACCEL CONF

ABSTRACT.: THE ENVELOPE EQUATIONS FOR A CONTINUOUS BEAM WITH CIRCULAR SYMMETRY BUT OTHERWISE ARBITRARY CHARGE DISTRIBUTION HAVE BEEN DERIVED BY LAPOSTOLLE AND GLUCKSTERN. THEIR RESULTS ARE EXTENDED IN THIS REPORT TO CONTINUOUS BEAMS WITH ELLIPTICAL SYMMETRY AND TO BUNCHED BEAMS WITH ELLIPSOIDAL FORM.

A RATHER SURPRISING AND USEFUL RESULT HAS BEEN FOUND FOR BEAMS IN FREE SPACE, NAMELY THAT THE RMS LINEAR PART OF THE SELF-FIELD DEPENDS MAINLY ON THE RMS SIZE OF THE DISTRIBUTION AND ONLY VERY WEAKLY ON ITS EXACT FORM. USING THIS RESULT, ENVELOPE EQUATIONS FOR THE RMS BEAM SIZE HAVE BEEN DERIVED THAT ARE EXACT FOR CONTINUOUS BEAMS OF ELLIPTICAL SYMMETRY, AND IN PRACTICE ALSO VALID FOR BUNCHED BEAMS OF ELLIPSOIDAL FORM. THE MAIN RESTRICTION IN APPLYING THESE EQUATIONS IS THAT THE TIME DEPENDENCE OF THE RMS EMITTANCE MUST BE KNOWN A PRIORI.

POSSIBLE USES OF THE EQUATIONS INCLUDE THE SPECIFICATION OF STATIONARY OR MATCHED STATES IN THE PRESENCE OF SPACE-CHARGE. FOR EXAMPLE, THE PERIODIC SOLUTION OF (47) FOR ALTERNATING GRADIENT STRUCTURES, INCLUDING RADIO FREQUENCY CAVITIES, SPECIFIES THE MATCHED BEAM SIZE (BOTH LONGITUDINAL AND TRANSVERSE) AS A FUNCTION OF RMS EMITTANCES AND INTENSITY. THE LARGEST MATCHED SIZE ATTAINABLE WITHOUT EXCEEDING APERTURE LIMITS OR BUCKET SIZE DETERMINES A SPACE-CHARGE LIMIT. FOR A BEAM MATCHED IN THIS WAY, ENVELOPE OSCILLATIONS ABOUT THE PERIODIC SOLUTION ARE SUPPRESSED, ALTHOUGH HIGHER MODES OF OSCILLATION (SEXTUPOLE, OCTUPOLE, ETC.) MAY OCCUR. SUPPRESSION OF THE HIGHER MODES WILL REQUIRE CONSTRAINTS, AS YET UNDETERMINED, ON THE HIGHER MOMENTS OF THE DISTRIBUTION. ANOTHER USE, ALREADY MENTIONED, IS THE DESIGN OF LOW-ENERGY BEAM TRANSFER LINES.

SUBJECTS.: SPACE CHARGE; RMS EMITTANCE; RMS ENVELOPE EQUATIONS; MULTIDIMENSIONAL MOMENT EQUATIONS;

NOTES.....: VERY IMPORTANT PAPER;

CROSS-REF: IDN 184. SPERG;

CATEGORY.: THEORY;

EXT-SOURCE: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MR-9 SPERG FILE;

1 45 TITLE.....: BEAM QUALITY IN THE DRIFT-TUBE LINAC

AUTHOR....: STOVALL, J.E.
AFFILIAT.: LASL-MP-3

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 18

REP-NUM.: MP-3-105
DATE-PUBL: 700526

ABSTRACT.: STUDY OF BEAM DYNAMICS FROM INJECTOR OUTPUT THRU TRANSPORT, BUNCHERS, AND DRIFT TUBE LINAC. INJECTED BEAM CONTINUOUS AND MONOENERGETIC WITH UNIFORM RANDOM DISTRIBUTION IN FOUR-DIMENSIONAL TRANSVERSE ELIPSOID. 0 MA AND 16 MA COMPUTATIONS COMPARED. A METHOD FOR SCRAPING IS DEVELOPED. AND THE RESULTS OF SCRAPING AT 40, 70, AND 100 MEV, IN CONJUNCTION WITH A REDUCED TANK 1 AMPLITUDE, ARE SHOWN. OPTIMIZING THE VALUE OF THE QUADRUPOLE FOCUSING IS REQUIRED. BY ELIMINATING 10-12 PERCENT OF THE BEAM, EMITTANCE GROWTH FOR 90 PERCENT OF THE BEAM WAS HELD TO A FACTOR OF TWO, AND EMITTANCE GROWTH FOR 100 PERCENT OF THE BEAM WAS HELD TO A FACTOR OF FOUR.

SUBJECTS.: SPACE CHARGE; BEAM TRANSPORT; BUNCHER; SCRAPING; EMITTANCE, TOTAL;

CATEGORY.: SPACE CHARGE; ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770812

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

1
#4 TITLE....: TRANSPORT TIME MEASUREMENTS

AUTHOR...: NILES, P.S.
AFFILIAT...: LASI-MP-0

DOC-TYPE...: MEMO
PAGES.....: 3

DATE-PUBL: 770706

ABSTRACT...: MEASURED PARAMETER VALUES FOR LAMP TRANSPORT SYSTEM FROM TUNNELS TO THE RE CURTAIN AT THE
ENTRANCE OF TANK 3 (BUTT LINE ZERO).

SUBJECTS...: BEAM TRANSPORT; LAMP SIMULATION; TRACE CODE; PARAMILA CODE;

CATEGORY...: MEASUREMENTS; LAMP;

CAT-SOURCE: HRALEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC...: MP-9 SPRG FILE;

45 TITLE.....: BEAM DYNAMICS IN DRIFT-TUBE LINACS

AUTHOR....: STOVALL, J.E.
AFFILIAT.: LASL-MP-3

DOC-TYPE.: THESIS
PAGES.....: 46

DATE-PUBL: 720600

ABSTRACT.: PARTICLES IN A LINEAR ACCELERATOR EXPERIENCE STRONG FORCES OF MANY TYPES. AS A RESULT, STABLE MOTION OCCURS ONLY WHEN A DELICATE BALANCE BETWEEN ALL OF THE FORCES IS ACHIEVED. THE CRITERIA OF STABLE MOTION IN LINACS IS DISCUSSED IN THE FIRST PART OF THE REPORT. THE SECOND PART DESCRIBES AN APPROACH FOR STUDYING THE DYNAMICS OF A LINEAR ACCELERATOR BEAM NUMERICALLY AND PRESENTS SOME TYPICAL CALCULATIONS. THE LAST PORTION OF THE REPORT PRESENTS FOUR DIAGNOSTIC TECHNIQUES WHICH WERE DEVELOPED TO ANALYZE CERTAIN PROPERTIES OF THE LINAC AND THE ACCELERATED BEAM. ALL OF THIS WORK WAS PERFORMED AT THE LOS ALAMOS MESON PHYSICS FACILITY (LAMPF).

SUBJECTS.: BEAM DYNAMICS;

NOTES.....: SECTIONS ON LONGITUDINAL AND TRANSVERSE MOTION, PARMILA, ACCEPTANCE, BEAM QUALITY, EXPERIMENTAL TECHNIQUES FOR MEASURING LONGITUDINAL AND TRANSVERSE ACCEPTANCE, EMITTANCE AND ENERGY SPECTRUM. APPENDICES ON RELATIVITY AND MAXWELL'S EQUATIONS.

REFERENCE: 18

CATEGORY.: SPACE CHARGE; LINAC PERFORMANCE; ANALYSIS;

CAT-SOURC: BRADLEY DATE-ENT.: 770612

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE:

44 TITLE....: BEAM STEERING USING UNBALANCED EXCITATION OF QUADRUPOLE MAGNETS

AUTHOR....: STEVENS, R.R., JR.

AFFILIAT.: LASL-MP-4

DOC-TYPE.: INTERNAL REPORT

PAGES....: 21

REF-NUM...: MP-4/RRS-2

DATE-PUBL: 670301

ABSTRACT.: ANALYSIS OF STEERING PRODUCED BY INTRODUCING IMBALANCE IN QUADRUPOLE WINDING EXCITATION. EFFECTIVE EMITTANCE ADDED PER DEGREE OF DEFLECTION FOR DIFFERENT POSITIONS OF THE BEAM IS GIVEN. DEFORMATION OF X-Y PROFILES SHOWN FOR A SINGLE DEFLECTION WITH A LONG DRIFT.

SUBJECTS.: STEERING; QUADRUPOLE FIELD ABERRATIONS;

REFERENCE: P.W. KEATON, LASL, PRIVATE COMMUNICATION; J.G. CRAMER AND F.W. SCHMIDT, NUCL INSTR AND METH, VOL. 45, 325-327 (1966); M.S. LIVINGSTON AND J.P. BLEWETT, PARTICLE ACCELERATORS, MCGRAW HILL, P. 112 (1962);

CATEGORY.: SYSTEM DESCRIPTION; THEORY;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

47 TITLE....: BERKELEY PROTON LINEAR ACCELERATOR

AUTHOR....: ALVAREZ, L.W.; BRADNER, H.; FRANCK, J.V.; GORDON, H.; GOW, J.D.; MARSHALL, L.C.; OPPENHEIMER, F.
; PANDOSKY, W.K.H.; RICHMAN, C.; WOODYARD, J.R.;

AFFILIAT.: UNIV OF CALIF, BERKELEY

DOC-TYPE.: JOURNAL PUBLICATION;

PAGES....: 23

DATE-PUBL: 550200

JOURNAL..: REV SCI INSTR, VOL. 26, NO. 2, 111-133 (FEBRUARY 1955);

ABSTRACT.: A LINEAR ACCELERATOR IS NOW IN USE WHICH INCREASES THE ENERGY OF PROTONS FROM A 4-MEV VAN DE GRAFF INJECTOR TO A FINAL ENERGY OF 31.5 MEV. THE ACCELERATOR CONSISTS OF A CAVITY 40 FEET LONG AND 39 INCHES IN DIAMETER, EXCITED AT RESONANCE IN A LONGITUDINAL ELECTRIC MODE WITH A RADIO-FREQUENCY POWER OF ABOUT $2.1 \times 10^{+6}$ WATTS PEAK AT 202.5 MC. ACCELERATION IS MADE POSSIBLE BY THE INTRODUCTION OF 46 AXIAL DRIFT TUBES INTO THE CAVITY, WHICH IS DESIGNED SO THAT THE PARTICLES TRAVERSE THE DISTANCE BETWEEN THE CENTERS OF SUCCESSIVE TUBES IN ONE CYCLE OF THE RF POWER. THE PROTON BUNCHES ARE LONGITUDINALLY STABLE AS IN THE SYNCHROTRON, AND ARE STABILIZED TRANSVERSELY BY THE ACTION OF CONVERGING FIELDS PRODUCED BY FOCUSING GRIDS. THE ELECTRICAL CAVITY IS CONSTRUCTED LIKE AN INVERTED AIRPLANE FUSELAGE AND IS SUPPORTED IN A VACUUM TANK. POWER IS SUPPLIED BY 9 HIGH-POWERED OSCILLATORS FED FROM A PULSE GENERATOR OF THE ARTIFICIAL TRANSMISSION LINE TYPE. OUTPUT CURRENTS ARE $3 \times 10^{+7}$ AMPERE, AVERAGE, AND 60 MICROAMPERE, PEAK. THE BEAM HAS A DIAMETER OF 1 CM AND AN ANGULAR DIVERGENCE OF 10^{+3} RADIANS.

SUBJECTS.: LINAC DESIGN; ACCELERATOR STRUCTURE; BEAM DYNAMICS; STABILITY;

REFERENCE: 29

CATEGORY.: FACILITY DESCRIPTION; FACILITY DEVELOPMENT;

CAT-SOURCE: BRADLEY DATE-ENT.: 770412

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

4A TITLE....: STANFORD HIGH-ENERGY LINEAR ELECTRON ACCELERATOR (MARK III)

AUTHOR....: CHODOROW, M.; GINZTON, E.L.; HANSEN, W.W.; KYHL, R.L.; NEAL, R.H.; PANOFKY, W.K.H.;
AFFILIAT.: STANFORD UNIV

DOC-TYPE.: JOURNAL PUBLICATION;

PAGES.....: 71

DATE-PUBL: 550200

JOURNAL...: REV SCI INSTR, VOL. 26, NO. 2, 134-204 (FEBRUARY 1955);

ABSTRACT.: THIS PAPER DESCRIBES THE DESIGN, CONSTRUCTION, AND EARLY TESTS OF THE HIGH-ENERGY LINEAR
ELECTRON ACCELERATOR WHICH HAS BEEN CONSTRUCTED AT STANFORD UNIVERSITY.

SUBJECTS.: LINAC DESIGN;

REFERENCE: 66

CATEGORY.: SYSTEM DESCRIPTION; SYSTEM PERFORMANCE;

CAT-SOURC: BRADLEY

DATE-ENT.: 770812

MICROFILM;

STOR-LOC.: HP-9 SPERG FILE;

49 TITLE....: THE STANFORD MARK II LINEAR ACCELERATOR

AUTHOR....: POST, R.F.; SHIREN, N.S.;
AFFILIAT.: STANFORD UNIV

DOC-TYPE.: JOURNAL PUBLICATION;
PAGES.....: 5

DATE-PUBL: 550200

JOURNAL...: REV SCI INSTR, VOL. 26, NO. 2, 204-209 (FEBRUARY 1955);

ABSTRACT.: THE DEVELOPMENT OF THE MARK II ELECTRON LINEAR ACCELERATOR, THE SECOND LINEAR ACCELERATOR CONSTRUCTED AT STANFORD UNIVERSITY, IS DESCRIBED. PRIMARILY INTENDED TO PROVIDE AN INTERMEDIATE MILEPOST ON THE WAY TOWARD THE EVENTUAL CONSTRUCTION OF A 1-REV MACHINE, IT WAS DESIGNED TO BE A PROTOTYPE OF ONE OF THE MANY SECTIONS OF THE LARGER ACCELERATOR. ELECTRON ENERGIES UP TO NEARLY 40 MEV HAVE BEEN OBTAINED, AND PEAK BEAM CURRENTS OF ABOUT 10 MA IN 1-MICROSEC PULSES. THE THEORETICAL DESIGN AND EXPERIMENTAL TESTING PROCEDURES DEVELOPED IN CONSTRUCTING THE LOADED WAVE GUIDE ARE OUTLINED. A BRIEF DESCRIPTION OF THE AUXILIARY EQUIPMENT, INCLUDING A MULTI-MEGAWATT KLYSTRON AMPLIFIER, IS GIVEN. OPERATING CHARACTERISTICS OF THE ACCELERATOR ARE SUMMARIZED. THE MACHINE HAS BEEN IN USE SINCE 1950 FOR EXPERIMENTATION IN ELECTRON PHYSICS.

SUBJECTS.: LINAC DESIGN;

REFERENCE: 6

CATEGORY.: SPACE CHARGE; SYSTEM DESCRIPTION; SYSTEM PERFORMANCE;

CAT-SOURCE: RKADLEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

1
50 TITLE.....: PROTON LINEAR-ACCELERATOR INJECTOR FOR THE BEVATRON

AUTHOR...: CORK, R.
AFFILIAT.: UNIV OF CALIF, BERKELEY

DOC-TYPE.: JOURNAL PUBLICATION;
PAGES.....: 8

DATE-PUBL: 550200

JOURNAL...: REV SCI INSTR, VOL. 26, NO. 2, 210-217 (FEBRUARY 1955);

ABSTRACT.: THE BEVATRON REQUIRES AN INTENSE SOURCE OF HIGH-ENERGY PROTONS. THE MACHINE SHOULD ACCEPT MONO-ENERGETIC PROTONS FOR A DURATION OF APPROX 500 MICROSECONDS ONCE EVERY 1/6 SECONDS, TO SATISFY THE REQUIREMENTS OF SMALL LOSS DUE TO SCATTERING BY THE GAS IN THE ACCELERATING CHAMBER. A 9.9-MEV LINEAR ACCELERATOR HAS BEEN BUILT AND OPERATED.

A 500-KILOVOLT COCKCROFT-WALTON GENERATOR IS USED TO INJECT 4-MA PEAK PROTON CURRENT INTO THE LINEAR ACCELERATOR. FOCUSING GRIDS INTERCEPT APPROX HALF OF THE INJECTED BEAM. ADDITIONAL LOSSES, INCLUDING RADIAL DEFOCUSING AND ACCEPTANCE PHASE ANGLE, RESULT IN A PEAK ACCELERATED BEAM OF 225 MICROAMPERES. THE ENERGY SPREAD OF THE ACCELERATED PROTONS HAS NOT BEEN MEASURED, BUT AN UPPER LIMIT IS LESS THAN 400- 30 KEV.

SUBJECTS.: LINAC DESIGN;

REFERENCE: 7

CATEGORY.: SYSTEM DESCRIPTION; SYSTEM PERFORMANCE;

CAT-SOURCE: 40VPA1 DATE-ENT.: 770921

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

51 TITLE....: FOCUSING IN LINEAR ION ACCELERATORS

AUTHOR....: SMITH, I.; GLUCKSTERN, R.L.;

AFFILIAT.: UNIV OF CALIF, BERKELEY; UNIV OF MASSACHUSETTS/LASL CONSULTANT MP=DD;

DOC-TYPE.: JOURNAL PUBLICATION;

PAGES....: 9

DATE=PURL: 550200

JOURNAL...: REV SCI INSTR, VOL. 26, NO. 2, 220-228 (FEBRUARY 1955);

ABSTRACT.: THE RESULTS OF THE INVESTIGATION OF THREE METHODS OF OBTAINING TRANSVERSE STABILITY IN LINEAR ACCELERATORS FOR IONS ARE PRESENTED AND DISCUSSED. FOR ELECTRIC OR MAGNETIC QUADRUPOLE FOCUSING THE RANGE OF STABLE OPERATION, OSCILLATION AMPLITUDES, AND THE EFFECT OF PERTURBING ERRORS ARE TREATED. FOR GRID FOCUSING, THE OPERATION OF AN ACTUAL GRID IS ANALYZED FROM MEASUREMENTS OF THE FIELD DISTRIBUTION. FINALLY, THE FORMULAS APPLICABLE TO FOCUSING BY AXIAL MAGNETIC LENSES ARE PRESENTED.

SUBJECTS.: BEAM TRANSPORT; BEAM DYNAMICS; QUADRUPOLE FOCUSING; ALIGNMENT; GRID FOCUSING; SOLENOIDAL FOCUSING;

REFERENCE: 16

CATEGORY.: ANALYSIS; THEORY;

CAT-SOURC: BRADLEY

DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

52 TITLE.....: A NONSATURABLE HIGH-ENERGY BEAM MONITOR

AUTHOR....: TAUTFEST, G.W.; FECHTER, H.R.;
AFFILIAT.: STANFORD UNIV

DOC-TYPE.: JOURNAL PUBLICATION;
PAGES.....: 3

DATE-PUBL: 550200

JOURNAL...: REV SCI INSTR, VOL. 26, NO. 2, 229-231 (FEBRUARY 1955);

ABSTRACT.: A MONITOR FOR HIGH-ENERGY BEAMS OF CHARGED PARTICLES UTILIZING THE PHENOMENON OF SECONDARY EMISSION IS DESCRIBED. THE PRIMARY BEAM TO BE MONITORED PASSES THROUGH A SET OF FOILS ALTERNATELY PHASED IN VOLTAGE. THE CURRENT PRODUCED BY SECONDARY ELECTRONS EJECTED BY THE BEAM PASSAGE IS COLLECTED ONTO THE ONE SET OF FOILS AND MEASURED. RESULTS OF TESTS WITH HIGH-ENERGY ELECTRONS ARE GIVEN. THE MONITOR GIVES NO INDICATION OF SATURATION UP TO PEAK CURRENT DENSITIES OF 16 MA/CM^2 , AND IS INDEPENDENT OF THE PRIMARY BEAM ENERGY IN THE RANGE OVER WHICH THE MONITOR WAS TESTED (111-235 MEV).

SUBJECTS.: INSTRUMENTATION; SECONDARY EMISSION;

REFERENCE: 5

CATEGORY.: SPACE CHARGE; EQUIPMENT DESCRIPTION;

CAT-SOURCE: WRADLEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-3 SPERG FILE:

53 TITLE.....: EMITTANCE GROWTH IN A 20 MA PROTON BEAM

AUTHOR....: STOVALL, J.E.

AFFILIAT.: LASI-MP-3

DOC-TYPE.: INTERNAL REPORT

PAGES.....: 9

REP-NUM..: MP-3-52

DATE-PUBL: 680926

ABSTRACT.: 500 PARTICLES RANDOMLY DISTRIBUTED WITH UNIFORM DENSITY IN APPROXIMATELY MATCHED SIX DIMENSIONAL ELLIPSOID; GIVES TWO-DIMENSIONAL PROJECTION MORE DENSELY POPULATED IN CENTRAL REGION. FIGURE-OF-MERIT DEFINED AS ELLIPSE FITTED AROUND PARTICLE DISTRIBUTION, USING MOMENT METHOD, DIVIDED BY THEORETICAL ADIABATICALLY DAMPED EMITTANCE. LAMPF LINAC PARAMETERS. THE INPUT BEAM IS ABOUT 7.5 PI CM.MRAD. IN TRANSVERSE AND PLUS-MINUS 0.22 MEV AND 5 DEGREES IN LONGITUDINAL. THE GROWTH OF THE INNER 96 PERCENT CORE OF THE BEAM STAYS NEAR ONE IN TRANSVERSE, AND RISES TO THREE FOR ENERGY-PHASE. THE 100 PERCENT AREA GROWTH RISES TO ABOUT 2.5 FOR TRANSVERSE AND 8 (EIGHT) FOR LONGITUDINAL. FIGURES 0-6 SHOW FIGURE-OF-MERIT FOR THE 50 OUTERMOST PARTICLES. ABOUT TWO PERCENT OF THE 500 PARTICLES HAVE FOM GREATER THAN ONE IN TRANSVERSE, AND ABOUT 10 PERCENT HAVE FOM GREATER THAN ONE IN LONGITUDINAL.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH;

REFERENCE: CROSS-REFERENCE IDN 326 MPLTB;

CATEGORY.: SPACE CHARGE; ANALYSIS;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

54 TITLE.....: COLLECTION OF NOTES ON HYPERELLIPSOID FITTING
SUBTITLE.: A GENERAL HYPERELLIPSOID LEAST-SQUARES FITTING ROUTINE 770608; NON-SINGULARITY OF THE GRAM
MATRIX FOR HYPERELLIPSOID (LEAST-SQUARES) FITTING 770609; COMPUTING THE VOLUME OF A GIVEN
HYPERELLIPSOID 770701; 770412 MEMO NO SUBJECT;

AUTHOR....: LAW, A.G.
AFFILIAT.: LASI-MP-9

DOC-TYPE.: MEMO
PAGES.....: 17

DATE-PUBL: 770608; 770609; 770701; 770412;

ABSTRACT.: MATHEMATICAL PROCEDURES RELATED TO THE GENERAL PROBLEM OF CHARACTERIZING AN ARBITRARY SET
OF POINTS IN HYPERSPACE.

SUBJECTS.: PHASE SPACE DISTRIBUTION; FITTING;

CATEGORY.: MATHEMATICS;

CAT-SOURC: JAMESON DATE-ENT.: 771006

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

55 TITLE....: DOUBLE CAVITY BUNCHER SYSTEMS

AUTHOR....: SWENSON, D.A.

AFFILIAT.: LASL-MP-3

DOC-TYPE.: INTERNAL REPORT

REP-NUM...: MP-3-86

PAGES....: 9

DATE-PUBL: 690516

ABSTRACT.: PARAMETER SEARCH OF DOUBLE CAVITY BUNCHER SYSTEMS WHICH PRODUCE BUNCHES SYMMETRICAL ABOUT THE CENTER OF THE BUNCH, WITH PERFORMANCE BASED ON FRACTION OF BEAM PLACED WITHIN PLUS-MINUS 25 DEGREES OF THE BUNCH CENTER. SIX PARAMETERS ARE HARMONIC NUMBERS AND ENERGY GAIN OF CAVITIES, DISTANCE BETWEEN FIRST AND SECOND CAVITIES, DISTANCE FROM SECOND CAVITY TO LINAC, THESE ARE COMBINED INTO FIVE OTHER PARAMETERS.

SUBJECTS.: BUNCHER, LONGITUDINAL BUNCHING;

NOTES....: CRITERION WAS TO MAXIMIZE FRACTION OF BEAM WITHIN PLUS-MINUS 25 DEGREES. PARAMETERS WERE RATIO OF DRIFT FROM FIRST TO SECOND BUNCHER TO SUM OF THAT DRIFT PLUS DRIFT TO LINAC, AND VOLTAGE ON EACH BUNCHER.

DATA-RECD: VALUABLE FIGURES;

CROSS-REF: IDN 383. MPLTR;

CATEGORY.: SYSTEM DESCRIPTION; SYSTEM OPERATION; NUMERICAL COMPUTATION; OPTIMIZATION; PARAMETER SEARCH;

CAT-SOURC: BRADLEY DATE-ENT.: 770812

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

56 TITLE.....: SOME FACTORS INFLUENCING THE SELECTION OF THE RUNCHER

AUTHOR.....: CHANDALL, K.P.; STOVALL, J.F.; SWENSON, D.A.;
AFFILIAT.....: LASL-MP-3

DOC-TYPE.....: INTERNAL REPORT
REP-NUM.....: MP-3-A1
DATE-PUBL.....: 690325

ABSTRACT.....: COMPARISON OF DOUBLE-DRIFT DOUBLE-FREQUENCY, DOUBLE-DRIFT SINGLE-FREQUENCY, AND SINGLE
CAVITY RUNCHERS; CRITERIA ARE CAPTURE EFFICIENCY, BEAM LOSS AT 100 MEV, AND FINAL BEAM QUALITY.
ESTIMATES OF TIME AVERAGE BEAM LOSS AT 100 MEV ARE GIVEN AS LESS THAN 1.0 MICRONS FOR THE
SINGLE-CAVITY, 0.7 MICRON FOR THE DOUBLE-DRIFT SINGLE-FREQUENCY, AND 0.4 MICRONS FOR THE
DOUBLE-DRIFT DOUBLE-FREQUENCY RUNCHER. THE LONGITUDINAL PHASE SPACE OF THE BEAM EMERGING FROM
THE LINAC IS INFLUENCED MORE BY RF FIELD PHASE AND AMPLITUDE ERRORS THAN BY RUNCHER SELECTION.
SUBJECTS.....: RUNCHER; LONGITUDINAL RUNCHING;

CATEGORY.....: ANALYSTS;

CAT-SOURCE.....: BRADLEY
DATE-FIN.....: 770812

MICROFILM:

STOR-LOC.....: MP-9 SPRNG FILE;

1
57 TITLE....: LINEAR AND NON-LINEAR COMPUTATION: AN ANALYSIS OF LINAC BEAM TRAJECTORY SIMULATION PROGRAMS

AUTHOR....: MANDERS, K.L.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 34

REP-NUM.: MPS/LIN/72-3
DATE-PUBL: 720823

ABSTRACT.: THIS REPORT IS A PRELIMINARY ATTEMPT TO GIVE A SYSTEMATIC TREATMENT OF THE VARIOUS APPROACHES AND SIMULATION PROGRAMS IN COMMON USE, ARGUES FOR DEVELOPMENT OF METHODS TO STUDY BASIC PHENOMENA (F.G. SPACE CHARGE) INDEPENDENT OF MACHINE DETAILS, THE RADIAL SYMMETRY IMPOSED IN MOST PROGRAMS IS DISCUSSED, COMMONLY USED TRAJECTORY INTEGRATION PROCEDURES ARE EXPLAINED, COMPARING DIFFERENCE EQUATIONS VERSUS DIRECT INTEGRATION, DISTANCE AND TIME AS INDEPENDENT VARIABLES, AND SPACE CHARGE FORCE CALCULATIONS, ANOTHER METHOD IS PROPOSED WHICH SHOULD REQUIRE CALCULATION TIME LINEARLY DEPENDENT ON THE NUMBER OF PARTICLES WITH ALL CALCULATIONS CONSISTING OF SUMS AND PRODUCTS, LINEAR PROGRAM (OR RMS) METHODS ARE DISCUSSED, THE STRUCTURAL ORGANIZATION OF MULTIPARTICLE SIMULATION PROGRAMS IS OUTLINED.

EMITTANCE CHANGE IS CONSIDERED USING THE FIRST AND SECOND TIME DERIVATIVES OF EMITTANCE IN AN ARBITRARY TWO-DIMENSIONAL PHASE PLANE, THE EFFECTS OF LINAC STRUCTURE, TIME VARYING FORCES, AND COUPLING ARE INCLUDED ON MOMENTARY CHANGES IN EMITTANCE, THE IMPORTANT CONCLUSION IS THAT THE THEORY SEEMS TO INDICATE THAT THERE IS A POSITIVE TERM IN THE SECOND DERIVATIVE OF EMITTANCE WHICH IMPLIES A CUMULATIVE EFFECT AND MAY POINT TO FUNDAMENTAL LIMITATIONS TO EMITTANCE CONTROL. DIRECTIONS FOR FURTHER WORK ARE INDICATED.

SUBJECTS.: SPACE CHARGE; BEAM DYNAMICS; NUMERICAL COMPUTATION; FUNDAMENTAL LIMITS;

REFERENCE: 9

DATA-RECD: APPENDIX ON METHOD FOR SPACE CHARGE FORCE CALCULATIONS WITH COMPUTATIONAL EFFORT LINEAR IN THE NUMBER OF PARTICLES;

CATEGORY.: SPACE CHARGE; ANALYSIS; NUMERICAL COMPUTATION;

CAT-SOURC: BRADLEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1
SR TITLE....: REVIEW OF RESULTS FROM THE 500 KEV MEASURING PROGRAMME

AUTHOR....: KNOTT, J., WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 31

REP-NUM.: MPS/LIN/NOTE 75-14
DATE-PUBL: 750616

ABSTRACT.: MEASUREMENTS ON BEAMS TO 200 MA. INEFFICIENCY OF COMPUTED MATCHING DISCUSSED (I.E. RESULTS DON'T AGREE WITH CALCULATIONS). AGREEMENT AT LOW INTENSITY ACHIEVED THROUGH PROPER ACCOUNT OF SLIT WIDTH IN THE EMITTANCE MEASURING APPARATUS. RESULTS AT HIGHER INTENSITIES ARE SHOWN. SPACE CHARGE EFFECTS IN THE EMITTANCE MEASUREMENTS ARE DISCUSSED. INPUT EMITTANCE FOR UNBUNCHED BEAMS FOUND NOT TO EXCEED 10 CM MRAD, THE DESIGN VALUE FOR 200 MA. BUNCHER CONTRIBUTIONS WERE SIGNIFICANT. PRELIMINARY ANALYSIS OF BUNCHING.

SUBJECTS.: BUNCHER; BEAM TRANSPORT; MATCHING;

REFERENCE: (MISSING);

DATA-RECD: MANY FIGURES AND DETAILS;

CATEGORY.: SPACE CHARGE; EXPERIMENTAL REPORT;

CAT-SOURC: BRADLEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE

59 TITLE....: PROJECT STUDY FOR A NEW 50 MEV LINEAR ACCELERATOR FOR THE C.P.S.

AUTHOR...: WARNER, D.J.
AFFILIAT.: CERN

DOC-TYPE.: PROJECT STUDY
PAGES.....: 42

REP-NUM...: CERN/MPS/LINP 73-1
DATE-PUBL: 731004

ABSTRACT.: SEE TITLE

SUBJECTS.: CERN LINAC DESIGN;

REFERENCE: 55

CATEGORY.: SPACE CHARGE; SYSTEM DESIGN; ACCELERATOR DESIGN; FACILITY DESIGN;

CAT-SOURC: BRADLEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPCRG FILE;

60 TITLE....: USE OF BEAM EMITTANCE MEASUREMENTS IN MATCHING PROBLEMS

AUTHOR...: GUYARD, J.; WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER; INTERNAL REPORT;
PAGES....: 5

REP-NUM...: AFCL-5677; CERN/PS/LIN 76-3;
DATE-PUBL: 761100; 76121P;

CONFERENCE: PROC 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AFCL-5677, P. 254;

ABSTRACT.: THE CERN NEW 50 MEV LINAC SHOULD OPERATE WITH A COMPUTER-AIDED BEAM MATCHING IN WHICH THE
TRANSVERSE CRITERIA ARE BASED ON MEASURED R.M.S. VALUES OF BEAM CO-ORDINATES IN PHASE SPACE.

THE COLLECTED DATA, HOWEVER, NEED TO UNDERGO AN INTERMEDIATE TREATMENT BEFORE SIGNIFICANT
RESULTS CAN BE OBTAINED AND THEN USED IN COMPUTATIONS. SOME EXAMPLES FROM THE EXPERIMENTAL
STUDY PROGRAMME ARE GIVEN AND THE ROLE OF AUTOMATED BEAM EMITTANCE MEASUREMENTS IN MATCHING
PROBLEMS DISCUSSED. EXTRAPOLATION OF SLIT WIDTH TO ZERO IS NECESSARY TO GET GOOD MEASURES OF
ALPHA AND BETA. SPACE CHARGE EFFECTS AND THE NUMBER OF MESH POINTS IN THE SAMPLE ARE ALSO
IMPORTANT.

SUBJECTS.: EMITTANCE MEASUREMENT; MATCHING; MEASUREMENT ERROR; SPACE CHARGE;

NOTES....: COMPARISON BETWEEN EXPERIMENTAL RESULTS AND THEORY IN EMITTANCE MEASUREMENTS, RMS METHOD
EMPHASIZED. SLIT WIDTH ERRORS ACCOUNTED FOR. DISCUSSION OF THE MEASUREMENT ACCURACY SUFFICIENT
FOR MATCHING, AND PRECISION WHICH CAN BE EXPECTED FROM MEASUREMENTS. OPTIMUM SLIT-COLLECTOR
DISTANCE TO MINIMIZE SPACE CHARGE EFFECTS. EFFECT OF COLLECTOR WIRE SPACING IS CALCULATED.

REFERENCE: 4

CATEGORY.: SPACE CHARGE; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

61 TITLE....: R.L. GLUCKSTERN'S COMMENTS ON 4-D ELLIPSOID

AUTHOR....: JULE, W.F.
AFFILIAT.: LASL-MP-9

DOC-TYPE.: MEMO
PAGES....: 1

DATE-PUBL.: 770425

ABSTRACT.: NOTES ON THE PROBLEM OF CHARACTERIZING A MULTIDIMENSIONAL PARTICLE DISTRIBUTION BY FITTING SURFACES TO IT.

SUBJECTS.: PHASE SPACE DISTRIBUTION; FITTING;

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURCE: BRADLEY DATE-ENT.: 770412

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

AUTHOR.....: WINFREY, G.W.; SANBROSON, J.G.;

AFFILIAT.: LAST-10-9

DOC-TYPE.: INFORMAL REPORT

PAGES.....: 41

REF-NUM.: LA-6747-MS
DATE-PUBL: 77W300

ABSTRACT.:

THIS STUDY WAS UNDERTAKEN TO DETERMINE HOW WELL A TWO-DIMENSIONAL SOURCE CAN BE RECONSTRUCTED FROM PROJECTION DATA WHEN ONLY TWO OR THREE VIEWS ARE AVAILABLE. FOR THE TWO-VIEW PROBLEM, ANALYTIC SOLUTIONS ARE OBTAINED CORRESPONDING TO SEVERAL OPTIMIZATION CRITERIA. THESE PROVIDE USEFUL INSIGHT ABOUT RECONSTRUCTION TECHNIQUES, BUT IN PRACTICE THEY DO NOT PRODUCE RELIABLE RECONSTRUCTIONS, EVEN FOR SIMPLE SHAPES. FOR THE THREE-VIEW PROBLEM, WE PRESENT NUMERICAL TESTS WITH ALGORITHMS BASED ON THE ALGEBRAIC RECONSTRUCTION TECHNIQUE (ART). A HEXAGONAL RASTER IS USED TO REPRESENT THE SOURCE; THIS SIMPLIFIES THE APPLICATION OF ART AND HELPS TO PRODUCE ARTIFACTS. A REFINEMENT OF ONE OF THE ART ALGORITHMS IS DESCRIBED, AND NUMERICAL CONVERGENCE CRITERIA ARE OBTAINED. WE PRESENT A COMPARISON AMONG FOUR ALGORITHMS FOR A VARIETY OF TEST PATTERNS. EXAMPLES ARE CONSIDERED WHICH SHOW THE EFFECT OF NOISE ON SYSTEMATIC ERRORS IN THE DATA. THE RESULTS INDICATE THAT, WITH THREE VIEWS, RELIABLE RECONSTRUCTIONS CAN BE OBTAINED, PROVIDED THAT THE SOURCE HAS A LITTLE AMOUNT OF STRUCTURE, OR IS CLOSE TO CIRCULAR SYMMETRY IN SHAPE.

SUBJECTS.: RECONSTRUCTION TECHNIQUE; EMITTANCE; BEAM PROFILE; HALOS;

NOTES.....:

NO A PRIORI ASSUMPTION ON FUNCTIONAL FORM IS MADE. MANY INVERSE TRANSFORMS (HERE THE INVERSE RADON TRANSFORM) HAVE PROPERTIES SIMILAR TO A DIFFERENTIATION OPERATOR AND SOME NOISE AMPLIFICATION RESULTS. (DATA PROCESSING TO INSURE CONSISTENCY AND POSSIBLY TO SMOOTH OUT NOISE IS PROBABLY RECOMMENDED BEFORE APPLYING THE RECONSTRUCTION.) ON CONVERGENCE CRITERIA; TWO TESTS ARE CONSIDERED IN THE LITERATURE - THOSE BASED ON PROPERTIES OF THE SOURCE FUNCTION SUCH AS VARIANCE OR ENTROPY, AND THOSE BASED ON RESIDUAL ERRORS IN THE PROJECTION DATA. NUMERICAL TESTS IN THIS PAPER SHOW THE LATTER TYPE IS MORE RELIABLE FOR THEIR THREE-VIEW SYSTEM.

REFERENCE: 15

CATEGORY.: SPACE CHARGE; ANALYSIS;

CAT-SOURCE: RADIALLY DATE-FMT.: 77W412

MICROFILM:

STOR-LOC.: WP-9 SPRNG FILE

63 TITLE.....: GYROTRON ANALYSIS

AUTHOR.....: TALLERICO, P.J.
AFFILIAT.: LASI-MP-8

DOC-TYPE.: MEMO
PAGES.....: 2

DATE-PUBL: 770406

ABSTRACT.: ANALYSIS OF THE GYROCON POWER EXTRACTION REGION SHOWS STRONG SIMILARITY TO THE ANALYSIS OF
THE MULTIPACTOR PROBLEM.

SUBJECTS.: RF SYSTEM; GYROCON;

CATEGORY.: ANALYSIS; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770812

MICROFILM;

SYNR-1,DC.: MP-9 SPORG FILE:

64 TITLE.....: H.F. MEASUREMENTS FOR THE DETERMINATION OF THRESHOLD LEVELS IN TANKS AND PHASE SHIFTS BETWEEN THEM

AUTHOR.....: WEISS, M.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 20

REP-NUM.: MPS/LIN - NOTE 72-6
DATE-PUBL: 720504

ABSTRACT.: THE LONGITUDINAL ACCEPTANCE OF THE CERN LINAC IS PROBED USING THE BEAM ITSELF AND THE RESULTS USED TO DEFINE INDIRECTLY THE TANK LEVELS AND PHASES. IN THE FIRST TANK, A DC BEAM IS USED; A RELATION IS DEFINED FOR THE RATIO OF THRESHOLD TO ACCELERATING FIELD AND A FITTING METHOD SHOWN. A REGRESSION METHOD FOR DETERMINING THE PHASE SHIFT BETWEEN TANKS IS ALSO GIVEN. LARGE DISCREPANCIES WERE NOTED BETWEEN PREDICTED AND ACTUAL EXPERIMENTAL RESULTS, ESPECIALLY IN THE PHASE SETTINGS.

SUBJECTS.: LONGITUDINAL TUNING; RF SYSTEM; PHASE SCAN; RF AMPLITUDE SCAN;

REFERENCE: K. RATCHELER, J.M. DICKSON AND S. NORCLIFFE: SOME CALIBRATION MEASUREMENTS ON THE PLA, RHFL/R112, 1967; R.P. FEATHERSTONE: STUDY OF TANK 3 ACCEPTANCE PHASE, MD OF AUGUST 19, 1967;

CROSS-REF: R.A. JAMESON AND W.E. JULE, "LONGITUDINAL TUNING OF THE LAMPF 201.25 MHZ LINAC - ZERO SPACE CHARGE", LA-6063, LASL (IN PREPARATION);

CATEGORY.: EXPERIMENTAL DATA; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770812

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

65 TITLE....: BEAM CAVITY INTERACTION - I
SUBTITLE.: BASIC CONSIDERATIONS

AUTHOR....: SANDS, M.
AFFILIAT.: ORSAY/UNIV OF CALIF, SANTA CRUZ

DOC-TYPE.: TECH REPORT
PAGES....: 42

REP-NUM..: LAL-2-76 C.1
DATE-PURL: 760500

ABSTRACT.: IN AN ELECTRON STORAGE RING WITH A HIGH-IMPEDANCE ACCELERATING CAVITY THE BEAM MAY BECOME UNSTABLE AT A STORED CURRENT WELL BELOW THE MAXIMUM SET BY THE POWER AVAILABLE FOR THE BEAM. THIS STABILITY LIMIT IS STUDIED IN A NEW WAY. FOR A SIMPLE RESONANT CAVITY THE NEW METHOD GIVES THE SAME RESULTS AS THOSE OBTAINED BY ROBINSON. THE NEW METHOD IS, HOWEVER, MUCH MORE EASILY EXTENDED TO MORE COMPLEX ACCELERATING SYSTEMS. IT IS APPLIED HERE TO BOTH ONE-CAVITY AND TWO-CAVITY SYSTEMS.

SUBJECTS.: ELECTRON STORAGE RING; RF SYSTEM; BEAM-CAVITY-AMPLIFIER INTERACTION;

REFERENCE: 7

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE:

66 TITLE...: BEAM CAVITY INTERACTION - II
SUBTITLE.: MAXIMUM BEAM CURRENT

AUTHOR...: SANDS, M.
AFFILIAT.: ORSAY/UNIV OF CALIF, SANTA CRUZ

DOC-TYPE.: TECH REPORT
PAGES....: 46

REP-NUM...: LAL-3-76 C.T
DATE-PUBL: 760720

ABSTRACT.: IN A STORAGE RING WITH A HIGH-IMPEDANCE R.F. SYSTEM THE STORED CURRENT MAY BE LIMITED BY EITHER THE ROBINSON INSTABILITY OR BY THE POWER LIMITATION OF THE TRANSMITTER WORKING INTO A REACTIVE LOAD. IT IS SHOWN THAT WITH AN OPTIMUM CHOICE OF THE TUNING ANGLE Φ SUB Y THESE TWO LIMITATIONS ARE EQUAL AND THE HIGHEST POSSIBLE LIMIT OF THE BEAM CURRENT IS OBTAINED. THE OPTIMUM CONDITIONS AND RESULTING MAXIMUM CURRENTS ARE CALCULATED FOR A SIMPLIFIED MODEL OF THE D.C.I. = 100 KILOWATT R.F. SYSTEM.

SUBJECTS.: ELECTRON STORAGE RING; RF SYSTEM; BEAM-CAVITY-AMPLIFIER INTERACTION;

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURC: BRADLEY DATE-ENT.: 770012

MICROFILM:

STOR-LOC.: MP-9 SPECIF FILE;

67 TITLE....: BEAM CAVITY INTERACTION - III
SUBTITLE.: DOUBLE CAVITY SYSTEM

AUTHOR...: SANDS, M.
AFFILIAT.: ORSAY/UNIV OF CALIF, SANTA CRUZ

DOC-TYPE.: TECH REPORT
PAGES....: 50

REP-NUM...: LAL-4-76 C.1
DATE-PUBL: 761015

ABSTRACT.: THE D.C.I. GROUP HAS PROPOSED THAT A DOUBLE-CAVITY SYSTEM BE USED TO OVERCOME THE CURRENT LIMIT IN A SINGLE HIGH-IMPEDANCE CAVITY SYSTEM DUE TO THE SO-CALLED ROBINSON INSTABILITY. THE PROPOSED DOUBLE-CAVITY SYSTEM HAS BEEN ANALYZED BY THE METHOD OF A PREVIOUS REPORT. THE CONDITIONS REQUIRED FOR STORING LARGE CURRENTS ARE FOUND. IT IS SHOWN THAT FOR LARGE CURRENTS A PASSIVE SECOND CAVITY IS AS GOOD AS AN ACTIVE ONE, AND THAT THE SECOND CAVITY IS REALLY USEFUL ONLY AT THE HIGH-ENERGY LIMIT OF THE SINGLE CAVITY.

SUBJECTS.: ELECTRON STORAGE RING; RF SYSTEM; BEAM-CAVITY-AMPLIFIER INTERACTION;

REFERENCE: 8

CATEGORY.: SPACE CHARGE; SYSTEM DESCRIPTION; ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770812

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

OR TITLE...: ION SOURCE AND INJECTOR DEVELOPMENT

AUTHOR...: CURTIS, C.D.

AFFILIAT...: FERMI NATL ACCEL LAB

DOC-TYPE...: CONF PAPER

REP-NUM...: AECL-5677

PAGES...: 10

DATE-PUBL: 761100

CONFERENCE: PROC 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AECL-5677, P. 179;

ABSTRACT: THIS IS A SURVEY OF LOW-ENERGY ACCELERATORS WHICH INJECT INTO PROTON LINACS. LABORATORIES
COVERED INCLUDE ARGONNE, BROOKHAVEN, CERN, CHALK RIVER, FERMI, ITP, KEK, RUTHERFORD, AND
SACLAY.

THIS PAPER EMPHASIZES COMPLETE INJECTOR SYSTEMS, COMPARING SIGNIFICANT HARDWARE FEATURES
AND BEAM PERFORMANCE DATA, INCLUDING RECENT ADDITIONS.

THERE IS INCREASED ACTIVITY NOW IN THE ACCELERATION OF POLARIZED PROTONS, H^+ AND H^- , AND
OF UNPOLARIZED H^- .

NEW SOURCE DEVELOPMENT AND PROGRAMS FOR THESE ION BEAMS IS OUTLINED AT THE END OF THE
REPORT. HEAVY-ION SOURCES ARE NOT INCLUDED.

SUBJECTS: ION SOURCE; INJECTOR; EMITTANCE; BRIGHTNESS; ACCELERATING COLUMN; BEAM TRANSPORT; OPERATING
EXPERIENCE; SPACE CHARGE;

REFERENCE: 22

DATA-REQD: EXTENSIVE TABLES COMPARING SYSTEMS. FIGURES: BEAM EMITTANCE AT LINAC ENTRANCE AND EXIT VS.
CURRENT; RATIOS OF OUTPUT TO INPUT EMITTANCE AND BRIGHTNESS VS. LINAC INPUT BRIGHTNESS;
INJECTOR BRIGHTNESS AND CURRENT-BRIGHTNESS PRODUCT AS FUNCTION OF CURRENT; LINAC BRIGHTNESS AND
CURRENT-BRIGHTNESS PRODUCT AS FUNCTION OF CURRENT; LINAC CURRENT-BRIGHTNESS PRODUCT VS.
INJECTOR CURRENT-BRIGHTNESS PRODUCT;

CATEGORY: SPACE CHARGE; SYSTEM DESIGN; OPERATING EXPERIENCE; EXPERIMENTAL DATA;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

1
69 TITLE....: THE INFLUENCE OF EXTRACTION CONDITIONS OF THE ION SOURCE ON THE PHASE DENSITY DISTRIBUTION IN
INTENSE ION BEAMS

AUTHOR...: ABROYAN, M.A.; KUZNETSOV, V.S.; KUZNETSOVA, N.P.; FIDELSKAYA, R.P.;
AFFILIAT...: STATE ATOMIC ENERGY COMMITTEE OF THE USSR

DOC-TYPE...: PUBLICATION
PAGES.....: 9

REP-NUM...: FPS/LIN - NOTE 71-5
DATE-PUBL: 710605

ABSTRACT...: PHASE DENSITY DISTRIBUTION FOR THE BEAM SECTION CLOSE TO A SOURCE WAS FOUND BY MEASURED
DISTRIBUTION OF PHASE DENSITY FOR SOME MORE DISTANCE BEAM SECTION WITH THE HELP OF NUMERICAL
SOLUTION OF EQUATION SYSTEM FOR A SELF-CONSISTENT FIELD. ION BEAMS OBTAINED FROM A
DUPPLASMATRON WERE STUDIED AT DIFFERENT OPERATION REGIMES OF THE SOURCE, I.E. AT VARIATION OF
EXTRACTION CONDITIONS.

THE CALCULATED DISTRIBUTION OF PHASE DENSITY NEAR THE SOURCE MAKES IT POSSIBLE TO JUDGE
ABOUT THE SHAPE OF THE PLASMA BOUNDARY, DIMENSIONS OF THE RADIATING SURFACE AND THEIR VARIATION
WITH VARIATION OF EXTRACTION CONDITIONS. THE RESULTS ON THE BEAM VELOCITY STRUCTURE NEAR THE
SOURCE OF DIFFERENT EXTRACTION CONDITIONS ARE GIVEN.

SUBJECTS...: ION SOURCE; PHASE SPACE DISTRIBUTION; EXTRACTION;

COMMENTS...: TRANSLATED AT CERN BY E. OZIURA, VISITOR FROM THE INST OF NUCL RESEARCH, SWIERK, POLAND;

NOTES....: THE BEAM CURRENT DENSITY DISTRIBUTIONS AND PHASE SPACE PROJECTIONS FOR SEVERAL SIMPLIFIED
PLASMA SURFACE SHAPES ARE SHOWN. THE DISTRIBUTIONS CHANGE WITH DISTANCE FROM THE SOURCE IN
PRACTICE. THE DEPENDENCE OF BEAM CURRENT ON THE FOUR-DIMENSIONAL PHASE SPACE VOLUME APPEARS TO
BE THE INVARIANT OF THAT MOTION; THIS ALSO DEFINES THE BRIGHTNESS. FIGURE 3 SHOWS I VS V_{SUR-4}
DEPENDENCE AS DISCHARGE CURRENT, EXTRACTION VOLTAGE, AND SOURCE MAGNETIC FIELD ARE VARIED. FOR
DISCHARGE CURRENT, BOTH PLASMA DENSITY AND SURFACE SHAPE ARE AFFECTED; BRIGHTNESS GROWS DUE TO
INCREASE IN PLASMA DENSITY BUT THE EFFECTIVE PHASE SPACE VOLUME GROWS DUE TO DISTORTION OF THE
PLASMA SURFACE. WITH EXTRACTION VOLTAGE VARIATION, THE PLASMA SURFACE SHAPE IS AFFECTED AND THE
BRIGHTNESS WILL FALL WHEN THE SURFACE DISTORTS. WITH MAGNETIC FIELD, THE INCREASE IN BRIGHTNESS
IS LESS PRONOUNCED THAN FOR DISCHARGE CURRENT INCREASE BECAUSE THERE IS NO MAGNETIC FIELD IN
THE EXTRACTION REGION.

REFERENCE: 5

CATEGORY...: SPACE CHARGE; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

70 TITLE....: TRANSVERSE BUNCHED-BEAM INSTABILITIES

AUTHOR....: SACHERER, F.J.
AFFILIAT.: CERN

DOC-TYPE.: TALK; PUBLICATION;
PAGES.....: 22

REP-NUM...: CERN/PS/BR 76-21
DATE-PUBL: 761110

CONFERENCE: INTL SCHOOL OF PARTICLE ACCEL, ERICE, SICILY, NOVEMBER 10-22, 1976;

ABSTRACT.: COLLECTIVE PHENOMENA IN CIRCULAR MACHINES. TRANSVERSE COUPLING ESTIMATION FROM WALL
CURRENTS AND FIELD LINES.

SUBJECTS.: COLLECTIVE EFFECTS; WALL IMAGES; TRANSVERSE COUPLING; CIRCULAR MACHINES;

COMMENTS.: THIS IS PART 2 OF A TWO-PART LECTURE ON SINGLE-BEAM COLLECTIVE PHENOMENA-TRANSVERSE AT
ABOVE CONFERENCE;

REFERENCE: 5

CATEGORY.: SPACE CHARGE; ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

71 TITLE....: SINGLE-BUNCH LONGITUDINAL INSTABILITY

AUTHOR...: SACHERER, F.J.
AFFILIAT.: CERN

DOC-TYPE.: TECH REPORT
PAGES....: 6

DATE-PUBL: 760000

ABSTRACT.: BUNCH DENSITY VIEWED AS A STATIONARY DISTRIBUTION PLUS AN OSCILLATING PERTURBATION
CHARACTERIZED AS AN N-POLE, APPLIED TO CIRCULAR MACHINES.

SUBJECTS.: CIRCULAR MACHINES; LONGITUDINAL INSTABILITY;

REFERENCE: H. HEReward, COASTING BEAM THEORY APPLIED TO BUNCHES, PROC 1975 ISABELLE SUMMER STUDY, VOL. 2,
P. 555, F. SACHERER, CERN/PS/BR 76-20;

CATEGORY.: SPACE CHARGE; ANALYSIS;

CAT-SOURC: BRADLEY DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

72 TITLE.....: OSCILLATION MODES IN TWO DIMENSIONAL BEAMS

AUTHOR.....: GLUCKSTERN, R.L.

AFFILIAT.: UNIV OF MASSACHUSETTS/LASL CONSULTANT MP-DO;

DOC-TYPE.: TALK; PUBLICATION;

REP-NUM.: LCO-262

PAGES.....: 12

DATE-PUBL: 7/29/92R

CONFERENCE: PROC 1970 PROTON LINEAR ACCEL CONF, BATAVIA, ILLINOIS, VOL. 2, 811-822, SEPT. 28 - OCT. 2, 1970;

ABSTRACT.: THE MODES OF OSCILLATION OF A UNIFORM ONE-DIMENSIONAL BEAM HAVE BEEN DERIVED AND STUDIED BY SACHSEPER AND SMITH. THE PRESENT WORK IS AN EXTENSION OF THEIR WORK TO TWO DIMENSIONS, USING A MATCHED KAPCHINSKY VLADIMIRSKY BEAM AS THE UNPERTURBED CONFIGURATION. THE METHOD CONSISTS OF OBTAINING TWO COUPLED INTEGRAL EQUATIONS IN THE PERTURBED PHASE SPACE DISTRIBUTION AND IN THE ELECTRIC FIELD. SOLUTIONS OF THESE EQUATIONS FOR DIFFERENT MODES OF OSCILLATION ARE OBTAINED, AND THE FREQUENCY SPECTRUM OF THESE MODES IS PRESENTED AS A FUNCTION OF SPACE CHARGE INTENSITY. IT IS SHOWN THAT THESE MODES CORRESPOND TO SURFACE DISTORTIONS OF THE KV ELLIPSOIDAL SURFACE IN 4-DIMENSIONAL PHASE SPACE. THE BEARING OF THESE RESULTS ON SPACE CHARGE LIMITS IN LINEAR AND CIRCULAR ACCELERATORS IS DISCUSSED.

SUBJECTS.: TWO-DIMENSIONAL BEAM OSCILLATIONS; SPACE CHARGE; KV DISTRIBUTION;

NOTES.....: FROM THE DERIVATION OF THE EIGEN-FREQUENCIES AND EIGEN-MODES FOR A 2-D KV BEAM, THE SPACE CHARGE LIMIT IN BOTH CIRCULAR AND LINEAR ACCELERATORS APPEARS TO BE CONNECTED WITH THE SECOND AZIMUTHALLY SYMMETRIC MODE OF BEAM OSCILLATION, AND IS MORE RESTRICTIVE THAN THE USUAL SPACE CHARGE LIMIT CONSIDERATIONS. AGREEMENT WITH NUMERICAL ORBIT CALCULATIONS IS GOOD.

REFERENCE: 6

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

73 TITLE....: SOME ASPECTS OF SIMULTANEOUS ACCELERATION OF PROTON AND H- BEAMS IN A LINAC

AUTHOR....: MURIN, R.P.; RONDAREV, R.Y.; DURKIN, A.P.; LOMIZE, L.G.; SOLOVIEV, L.YU.; FEDOTOV, A.P.;
AFFILIAT.: RADIOTECHNICAL INSTITUTE, MOSCOW, USSR

DOC-TYPE.: JOURNAL PUBLICATION;

PAGES.....: 7

DATE-PUBL: 750000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 6, 133-139 (1975);

ABSTRACT.: WHEN BOTH PROTONS AND NEGATIVE IONS ARE ACCELERATED IN THE SAME LINAC, AT THE SAME TIME, PROBLEMS ARISE CONCERNING SUPPRESSION OF BEAM COHERENT AND INCOHERENT OSCILLATIONS CAUSED BY ERRORS IN DOUBLET ADJUSTMENT. ALTHOUGH THE MAIN PARAMETERS OF THE FOCUSING CHANNEL DO NOT VARY IF THE SIGN OF PARTICLE CHARGE IS REVERSED, THE INDIVIDUAL BEAM TRAJECTORIES OF PROTONS AND NEGATIVE IONS ARE DIFFERENT. NEW TECHNIQUES FOR BEAM POSITION CONTROL ARE SUGGESTED AND THEIR EFFICIENCY IS EVALUATED BY COMPUTER MODELING. IT IS SHOWN THAT A TRANSVERSE ARTIFICIAL DISPLACEMENT OF DOUBLET AXIS CAN BE USED AS A RATHER EFFICIENT MEANS TO SHIFT THE POSITIVE AND THE NEGATIVE BEAM IN THE SAME DIRECTION. SUCH AXIS DISPLACEMENTS OF TWO SUCCESSIVE DOUBLETS COMBINED WITH AXIS DISPLACEMENT OF INDIVIDUAL LENSES IN EACH OF THESE DOUBLETS, ALL PRODUCED ELECTRICALLY, MAKE IT POSSIBLE TO PLACE THE POSITIVE AND NEGATIVE BEAMS AT ANY REQUIRED POINT IN THE TRANSVERSE PHASE-SPACE PLANE. BEAM AXIAL ALIGNMENT APPEARED MUCH LESS EFFICIENT THAN MIGHT BE DESIRABLE IN ORDER TO SUPPRESS BEAM OSCILLATIONS. PRODUCTION OF NEW BEAM OSCILLATIONS WITH THE PHASES AND AMPLITUDES PROPERLY CHOSEN IS SHOWN TO BE MORE EFFICIENT THAN BEAM ALIGNMENT ALONG THE LINAC AXIS.

A GLOBAL CONTROL OF FOCUSING FIELD THROUGHOUT THE LINAC IS BRIEFLY DISCUSSED AS A POSSIBLE METHOD TO REDUCE OSCILLATIONS THROUGH OFF-RESONANCE TUNING.

SUBJECTS.: SIMULTANEOUS BEAMS; STEERING; ALIGNMENT;

NOTES....: SOME EQUATIONS ARE GIVEN. RESULTS SHOW TOLERANCES ARE MUCH MORE STRINGENT THAN PREDICTED FROM EARLIER WORK; SAID IN ANOTHER WAY, BEAM RADII INCREASES ALONG A LINAC MORE RAPIDLY THAN EXPECTED FROM PREVIOUS THEORIES. THE GLOBAL CONTROL METHOD REFERS TO PREVENTING MISALIGNMENTS ALONG THE LINAC AS A FOURIER EXPANSION IN THE BEAM RESONANT FREQUENCY AND MAKING CHANGES TO MINIMIZE THE MAGNITUDE OF ANY SUCH RESONANCES OBSERVED.

REFERENCE: 4

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY DATE-ENT.: 770615

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

74 TITLE....: RANDOM PERTURBATIONS OF THE TRANSVERSE MOTION OF PROTONS IN A LINEAR ACCELERATOR AND THEIR CORRECTION

AUTHOR....: MURIN, R.P.; BONDAREV, B.I.; DURKIN, A.P.; SOLOVIEV, L.YU.;
AFFILIAT.: RADIO TECHNICAL INSTITUTE, MOSCOW, USSR

DOC-TYPE.: JOURNAL PUBLICATION
PAGES.....: 14

DATE-PUBL.: 740000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 6, 27-40 (1974);

ABSTRACT.: THE INFLUENCE OF RANDOM PERTURBATIONS OF FOCUSING CHANNEL PARAMETERS ON THE TRANSVERSE DIMENSIONS OF A BEAM IN A LINEAR PROTON ACCELERATOR IS CALCULATED BY A NEW METHOD. THE AUTHORS DID NOT INVESTIGATE THE ISOLATED PARTICLE BEHAVIOUR BUT INVESTIGATED THE FOUR-DIMENSIONAL PHASE VOLUME. THIS ALLOWED ESTIMATION OF THE INCREASE OF THE BEAM RADII AND OF THE EMITTANCE WITHOUT ANY ESSENTIAL LIMITATIONS OF THE SIZE OF THE RANDOM PERTURBATIONS. SIMULATION BY MEANS OF COMPUTERS IS USED IN PARALLEL WITH ANALYTICAL METHODS. THE POSSIBILITY OF CORRECTING THE CENTRE OF GRAVITY OF THE TRANSVERSE POSITION OF THE BEAM AND ITS PHASE VOLUME TRANSFORMATION IS BRIEFLY DISCUSSED.

SUBJECTS.: QUADRUPOLE FOCUSING; EMITTANCE GROWTH; QUADRUPOLE ERRORS;

COMMENTS.: A MAJOR POINT AGAIN TURNS OUT TO BE THAT THE PROBLEMS EVIDENCED IN DESIGN USING RANDOM ERRORS ARE NOT NECESSARILY THE SAME AS OPERATIONAL PROBLEMS IN A GIVEN LINAC ONCE THE ACTUAL ERRORS HAVE BEEN MEASURED, AT WHICH POINT CORRECTIONS CAN BE APPLIED.

NOTES..... SUGGESTS THAT ORIGINAL SMITH AND GLUCKSTERN ANALYSIS (IDN 51) ASSUMED A SMALL INCREASE IN BEAM RADII, AND ARE SERIOUSLY INACCURATE AND DO NOT CHARACTERIZE THE FLUCTUATION OF BEAM PARAMETERS IF THE TOLERANCES AND NUMBER OF FOCUSING PERIODS ARE LARGE OR IF FOCUSING IS DONE WITH QUADRUPOLE LENSES WHICH ARE SHORT IN COMPARISON WITH THE PERIOD LENGTH. SPACE CHARGE IS NEGLECTED. FOR INSTABILITIES IN MAGNETIC QUADRUPOLE FIELD GRADIENTS, FIGURE 1 GIVES THE DEPENDENCE OF THE INCREASE IN BEAM DIMENSION ON THE NUMBER OF FOCUSING PERIODS. FOR RMS ERRORS OF 1.2 PERCENT, THE CURVE HAS DECREASING SLOPE AND INDICATES AN INCREASE IN BEAM RADIUS OF ABOUT 1.6 TIMES AFTER 200 FOCUSING PERIODS. FOR 4 PERCENT RMS ERRORS, THE CURVE HAS INCREASING SLOPE AND SHOWS AN INCREASE OF ABOUT 70 TIMES AFTER 200 PERIODS. (THE ESTIMATES FROM THE EARLIER ANALYSIS ARE SHOWN AS 1.3 AND 3-4 RESPECTIVELY.) AGREEMENT WITH NUMERICAL CALCULATIONS IS GOOD. PROBABILITY INTEGRALS ARE GIVEN FOR THE PROBABILITY THAT THE GROWTH WILL NOT EXCEED SOME VALUE TO A CONFIDENCE ESTIMATE. FIGURES 3 AND 4 GIVE SIMILAR RESULTS FOR QUAD ROTATION ERRORS OF 1 DEGREE AND 2.5 DEGREES ABOUT THE LONGITUDINAL AXIS. FOR 2.5 DEGREES, CHANGE IN EMITTANCE IS GIVEN IN FIGURE 5.

COMPARING RESULTS WITH THE EARLIER ANALYSIS, IT IS NOTED THAT BEAM RADIUS IS ESTIMATED DIFFERENTLY HERE; THE AVERAGE RADIUS OF THE ENVELOPE OF TRAJECTORIES OF PARTICLES LOCATED ON THE SURFACE OF THE PHASE VOLUME OF THE BEAM CAN BE CALCULATED CONSISTENT WITH THE CHANNEL. THE EARLIER REFERENCES CONCENTRATED ON MEAN SQUARE VALUES, WHEREAS RADIUS CONFIDENCE ESTIMATES ARE CONSIDERED HERE. RANDOM SIMULATIONS WERE DONE TO CLARIFY THE RELATION BETWEEN THE AVERAGE VALUE OF BEAM RADIUS AND THE MEAN SQUARE VALUE OF AN ISOLATED PARTICLE'S OSCILLATION AMPLITUDE FOR ERRORS IN FIELD GRADIENT. THE ASSUMPTION THAT THE AVERAGE VALUE OF THE CHANGE IN OSCILLATION AMPLITUDE OF EACH PARTICLE IS ZERO (MADE IN EARLIER ANALYSIS) IS CORRECT AS LONG AS THE INCREASE IN OSCILLATION AMPLITUDE IS SMALL COMPARED TO THE INITIAL AMPLITUDE. THE PROBABILITY THAT THE BEAM RADIUS EXCEEDS A CERTAIN VALUE IS LARGER THAN THE PROBABILITY THAT THE OSCILLATION AMPLITUDE EXCEEDS THIS VALUE. FROM THIS, IT FOLLOWS THAT IF CONFIDENCE ESTIMATES OF THE BEAM RADIUS WERE DEDUCED BY INVESTIGATING THE BEHAVIOR OF ISOLATED PARTICLES, THE RESULTS WOULD BE UNDERESTIMATED AND MISLEADING IN CHOOSING TOLERANCES.

SMALL IMPROVEMENTS IN TOLERANCES YIELD LARGE IMPROVEMENTS IN BEAM RADIUS. FURTHERMORE, CORRECTIONS MAY BE APPLIED ALONG THE STRUCTURE IN THE FORM OF STEERING TO ELIMINATE COHERENT TRANSVERSE OSCILLATIONS - ON A PULSE TO PULSE BASIS IF NECESSARY. LOCALIZED REMATCHING CAN ALSO BE DONE, POSSIBLY ALSO USING QUADS AT 45 DEGREES TO THE REGULAR ONES. THE TOTAL NUMBER OF PARAMETERS OF A CORRECTING SECTIONS WOULD BE AT LEAST NINE. A MATCHING PROCEDURE IS DESCRIBED.

REFERENCE: 4

CATEGORY: ANALYSIS:

CAT-SOURCE: BRADLEY DATE-FNT: 770R15

MICROFILM:

STOR-LOC: MP-9 SPERG FILE:

1 75 TITLE....: A SMALL PROTON LINEAR ACCELERATOR AS A SOURCE OF NEUTRONS FOR RADIOTHERAPY

AUTHOR...: SWENSON, D.A.; KNAPP, F.A.;
AFFILIAT.: LASL-MP

DOC-TYPE.: INFORMAL REPORT
PAGES....: 7

REP-NUM...: LA-UR-76-2396
DATE-PUBL: 760000

ABSTRACT.: A PROGRAM OF DEVELOPMENT OF SMALLER, LESS EXPENSIVE AND MORE RELIABLE PROTON LINACS FOR MEDICAL APPLICATIONS SHOULD YIELD AN ATTRACTIVE ALTERNATIVE TO THE CYCLOTRON AS A SOURCE OF NEUTRONS FOR RADIOTHERAPY. THE MAJOR INNOVATIONS OF THIS PROGRAM THAT ARE APPLICABLE TO THE NEUTRON SOURCE APPLICATION ARE: HIGHER FREQUENCY STRUCTURES (450 MHz), HIGHER ACCELERATING GRADIENTS (5 MV/M), LOWER INJECTION ENERGY (FEW HUNDRED KV), AND ALTERNATING PHASE FOCUSING FOR THE FIRST FEW METERS, FOLLOWED BY PERMANENT-MAGNET QUADRUPOLE FOCUSING FOR THE REMAINDER OF THE LINAC. THE CURRENT STATUS OF THIS PROGRAM WILL BE DESCRIBED, AND A TENTATIVE DESIGN OF A SMALL PROTON LINAC AND AN ISOCENTRIC NEUTRON DELIVERY SYSTEM WILL BE PRESENTED.

SUBJECTS.: NEUTRON SOURCE; RADIOTHERAPY; BIOMEDICAL LINAC; LINAC DESIGN;

REFERENCE: 7

CATEGORY.: SPACE CHARGE; SYSTEM DESCRIPTION; SYSTEM DEVELOPMENT;

CAT-SOURC: BRADLEY DATE-ENT.: 770015

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

76 TITLE.....: RECENT DEVELOPMENTS IN MICROWAVE BEAM-POSITION MONITORS AT SLAC

AUTHOR.....: FARKAS, Z.D., HOGG, H.A., MARTIN, W.L., WILMINDER, A.R.,
AFFILIAT.: STANFORD UNIV

DOC-TYPE.: TALK; PUBLICATION;

PAGES.....: 6
DATE-PUBL: 760000

ABSTRACT.: THE DESIGN, INSTALLATION AND PERFORMANCE OF BEAM POSITION MONITORS INITIALLY INSTALLED AT
SLAC ARE REVIEWED BRIEFLY. THE USE OF RECEIVER SYSTEMS TO IMPROVE THE SENSITIVITY OF SWITCHBOARD
MONITORS IS DESCRIBED. TWO POSITION-MONITORING SYSTEMS DEVELOPED ESPECIALLY FOR POLARIZED
ELECTRON-BEAM EXPERIMENTS ARE DESCRIBED; THE FIRST IS A HOMOZYNE SYSTEM CAPABLE OF DETECTING 10
MICROMETER BEAM DISPLACEMENTS AT 100 MICROAMPERE BEAM CURRENTS, AND THE SECOND IS A TRAVELLING-
WAVE MONITOR WITH A LIMITER-NORMALIZED OUTPUT WHICH CAN BE USED DOWN TO 20 MICROAMPERE.

SUBJECTS.: BEAM POSITION MONITOR; STEERING; INSTRUMENTATION;

REFERENCE: 6

CATEGORY.: INSTRUMENTATION;

CAT-SOURCE: RADLEY DATE-ENT.: 770815

MICROFILM;

STOR-LOC.: MP-9 SPRNG FILE;

77 TITLE....: DRIFT TUBE LYNAC ERROR STUDIES

AUTHOR...: STOVALL, J.F.

AFFILIAT.: LASI-MP-3

DOC-TYPE.: INTERNAL REPORT

PAGES....: 10

REP-NUM...: MP-3-70

DATE-PUBL: 690124

ABSTRACT.: STUDIED QUADRUPOLE DISPLACEMENT, TILT, AND EXCITATION ERRORS, AND ACCELERATING FIELD AMPLITUDE, PHASE, AND FLATTENING ERRORS. NO SPACE CHARGE. TEN PARTICLES POSITIONED ON PHASE PLANE INITIALLY MATCHED BEAM PERIMETER, WITH OTHER FOUR COORDINATES AT SYNCHRONOUS POINTS TO AVOID COUPLING. PROBABILITY DISTRIBUTIONS FROM 100 RMS AT EACH CONDITION ARE GIVEN. CONCLUSIONS WERE 5 MILS, 1 DEGREE AND 1 PERCENT TOLERANCES FOR QUAD DISPLACEMENT, TILT AND EXCITATION. FOR ACCELERATING FIELD, ELLIPSES OF MATCHED SHAPE WERE FITTED. TWO PERCENT AMPLITUDE ERROR WAS UNACCEPTABLE EVEN WITH ZERO PHASE ERRORS. ONE PERCENT AND 2 DEGREES WERE OK. TILT TOLERANCE WAS 1 PERCENT. ALL NUMBERS PLUS-MINUS.

SUBJECTS.: ERROR TOLERANCE; RF FIELD ERRORS; ACCELERATING FIELD ERRORS;

REFERENCE: QUARTERLY STATUS REPORT LA-3712-MS (PERIOD ENDING APRIL 30, 1967 - P. 36 AND 37); INTERNAL REPORT MP-3/EAK/JMP/EJS/DAS-1;

CATEGORY.: ERROR ANALYSIS;

CAT-SOURCE: BRADLEY

DATE-FNT.: 770815

MICROFILM;

STOR-LOC.: MP-9 SPRPG FILE;

78 TITLE....: ADJUSTMENT OF A DOUBLE DRIFT HARMONIC BUNCHER AND BUNCH SHAPE MEASUREMENTS

AUTHOR....: KNOTT, J.; WARNER, D.J.; WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER; INTERNAL REPORT;
PAGES....: 5

RFP-NUM.: AECL-5677; CERN/PS/LIN 76-4;
DATE-PUBL: 761100; 761019;

CONFERENCE: PROC 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AECL-5677, P. 208;

ABSTRACT.: THE LONGITUDINAL BEAM MATCHING OF THE NEW 50 MEV LINAC IS ACHIEVED WITH A DOUBLE DRIFT
HARMONIC BUNCHER. FOR OPTIMUM BUNCHING EFFICIENCY THE RF PHASE DIFFERENCE BETWEEN THE TWO
CAVITIES SHOULD BE KNOWN AND CONTROLLED TO ABOUT 1 DEGREE (AT 202.56 MHZ). THE ADJUSTMENT OF
THE RF LEVELS AND PHASES IS BASED ON OBSERVATIONS OF THE BUNCH FORM VIA A BROAD-BAND PROBE
CONNECTED TO A TRAVELLING WAVE OSCILLOSCOPE. THE TIME BASE IS TIGHTLY LOCKED TO THE RF BY A
SPECIALLY DEVELOPED CIRCUIT ALLOWING A SYSTEMATIC STUDY OF DIFFERENT BUNCHING CONDITIONS. A
COMPARISON IS MADE BETWEEN SOME PRELIMINARY MEASUREMENTS AND THE WAVEFORMS PREDICTED BY A
SIMPLIFIED THEORY.

SUBJECTS.: BUNCHER; LONGITUDINAL MATCHING; INSTRUMENTATION; LONGITUDINAL PROFILE MEASUREMENT;

REFERENCE: CERN/MPS/LIN 74-1 (1974); CERN/MPS/LIN 72-6 (1972); CERN/MPS/LIN - NOTE 75-14 (1975);

CROSS-REF: IDN 337 MPLIR;

CATEGORY.: SPACE CHARGE; EXPERIMENTAL ANALYSIS; INSTRUMENTATION;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM;

STOR-LOC.: MP-9 SPCRG FILE;

1
79 TITLE....: RESULTS OF PARTICLE DYNAMICS CALCULATIONS

AUTHOR....: CRANDALL, K.R.; GOFFIN, R.C.; STOVALL, J.E.;
AFFILIAT.: LASL-MP-3

DOC-TYPE.: MEMO
PAGES....: 4

REP-NUM.: MP-3-126
DATE-PUBL: 7/10/72

ABSTRACT.: TEN RUNS FROM 750 KEV TO 800 MEV, INCLUDING SPACE CHARGE, TWO-PI CM-MRAD TRANSVERSE INPUT
EMITTANCE, UNIFORM DISTRIBUTION IN 4-D HYPERSPHERE, 750 KEV AND UNIFORM PLUS-MINUS 180 DEGREES
IN PHASE, 500 PARTICLES. PREPUNCHER AND PUNCHER INCLUDED (NO SETTINGS RECORDED), SCRAPERS
SIMULATED AT 40 AND 70 MEV, AND BUCKET ROTATOR USED AT 100 MEV. TRANSMISSION AT 100 MEV ABOUT
70 PERCENT OF INITIAL 500 PARTICLES, CORRESPONDING TO PEAK CURRENT OF 14 MA. AVERAGES AND
STANDARD DEVIATIONS OF (NORMALIZED) EMITTANCE DISTRIBUTIONS AT 10 PERCENT FRACTIONS ARE GIVEN
AT 100 AND 800 MEV. NO ERRORS ARE INCLUDED. TOTAL TRANSVERSE EMITTANCE GROWTH IS FACTOR OF 5-10
AT 100 MEV AND 6-7 AT 800 MEV IN TERMS OF 2 PI AT 750 KEV. ABOUT A FACTOR OF TWO GROWTH OCCURS
BETWEEN 90 AND 100 PERCENT. LONGITUDINAL FIGURES ARE ALSO GIVEN.

SUBJECTS.: SPACE CHARGE; LAMPE SIMULATION; EMITTANCE GROWTH;

CROSS-REF: IDN 224 MPI IR;

CATEGORY.: SPACE CHARGE; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM;

STOR-LOC.: MP-9 SPRNG FILE;

1 80 TITLE.....: NOTE ON PARTICLE MOTION COMPUTATIONS

AUTHOR...: GLUCKSTERN, R.L.

AFFILIAT.: UNIV OF MASSACHUSETTS/LASL CONSULTANT MP-00;

DOC-TYPE.: INTERNAL REPORT

REP-NUM...: MP-4/RLG-3

PAGES.....: 7

DATE-PUBL: 650728

ABSTRACT.: ANALYTIC GUIDES FOR COUPLING EFFECTS, USING LOWEST ORDER NONLINEAR COUPLING TERM. AN
OUTLINE IS GIVEN OF NUMERICAL CALCULATIONS THAT COULD BE DONE TO CHECK THE RESULTS.

SUBJECTS.: COUPLING; TRANSVERSE DYNAMICS; LONGITUDINAL DYNAMICS;

REFERENCE: R.L. GLUCKSTERN, RNL REPORT AADD-31, YALE REPORT Y-11;

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

1 TITLE..... BASIS FOR ESTIMATING TOLERANCE REQUIREMENTS FOR THE SIDE-COUPLED LTNAC

AUTHOR... CRANDALL, K.R.

AFFILIAT.: LASL-MP-4

DOC-TYPE.: INTERNAL REPORT

REP-NUM.: MP-4/KC-4

PAGES..... 20

DATE-PUBL.: 670918

ABSTRACT.: PERFECT LAMP LINAC TRANSVERSE ADMITTANCE ABOUT 4.0 PI AT 0 PROBABILITY, AND ABOUT 4.4 PI AT 50 PERCENT PROBABILITY. CHANGES IN PROBABILITY DISTRIBUTIONS WHEN QUADRUPOLE ERRORS ARE PRESENT ARE FOUND FROM NUMERICAL SIMULATIONS. EQUIVALENT ERRORS FOR REDUCTION OF THE 50 PERCENT LEVEL TO 3.5-4.0 PI ARE: DOUBLET DISPLACEMENT 5 MILS; QUAD DISPLACEMENT FROM DOUBLET AXIS 1.0 MIL; DOUBLET AXIS TILT 0.15 MRAD; QUAD TILT WITHIN DOUBLET 20.0 MRAD; A COMBINATION OF 2.5 MILS, 0.5 MILS, 0.1 MRAD, AND 10 MRAD OF THE ABOVE RESPECTIVELY (IMPORTANT NOTE - STEERING MADE ADMITTANCE BETTER THAN 4 PI AGAIN); A COMBINATION OF 5.0 MILS, 1.0 MILS, 0.15 MRAD, AND 20 MRAD (STEERING INCREASED ADMITTANCE TO ABOUT 4 PI AGAIN); DOUBLET ROTATION 4 DEGREES; QUAD ROTATION 0.2 DEGREE; DOUBLET FIELD STRENGTH 1.0 PERCENT; QUAD FIELD STRENGTH 0.25 PERCENT (WAS DOWN TO 3 PI FOR 1 PERCENT); COMBINATION OF 2.0 DEGREES, 0.15 DEGREE, 1.0 PERCENT AND 0.25 PERCENT OF THE LAST FOUR EFFECTS ABOVE RESPECTIVELY; COMBINATION OF ALL EIGHT ABOVE AT 2.5 MILS, 0.5 MILS, 0.1 MRAD, 10.0 MRAD, 1.0 DEGREE, 0.1 DEGREE, 0.5 PERCENT AND 0.1 PERCENT. IN ALL OF THE ABOVE, THE TAIL OF THE PROBABILITY DISTRIBUTION EXTENDED AT LEAST AS LOW AS 3 PI FOR SOME SETS OF ERRORS.

SUBJECTS.: ERROR TOLERANCE; QUADRUPOLE ERRORS; LAMP SIMULATION; ADMITTANCE;

NOTES..... IMPORTANT RESULT SHOWING AFTER THE FACT CORRECTION OF ERRORS - SEE ABSTRACT;

CROSS-REF: IDN 885 MPLIR; IDN 74 SPCRG;

CATEGORY.: SPACE CHARGE; ANALYSIS;

CAT-SOURC: WHADLEY

DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPCRG FILE;

R2 TITLE....: MRA, A FORTRAN IV CODE TO SIMULATE BEAM BUNCHING

AUTHOR...: CRANDALL, K.R.
AFFILIAT.: LASL-MP-4

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 21

REP-NUM...: MP-4/KC-3
DATE-PUBL: 670320

ABSTRACT.: SIMULATION OF DOUBLE-DRIFT DOUBLE-FREQUENCY BUNCHER SYSTEM, 2000 PARTICLES IN R, Z, R-PRIME, Z-PRIME, TRANSVERSE AND LONGITUDINAL SPACE CHARGE CALCULATED USING AN AREA-WEIGHTED R-Z GRID ON THE RAISTS OF CHARGE RINGS. TWO NEIGHBORING BUNCHES ON EACH SIDE WERE USED; THIS SEEMED TO BE SUFFICIENT. THE INPUT BEAM TO THE FIRST BUNCHER CAVITY WAS ASSUMED TO HAVE ZERO EMITTANCE. SAMPLE OUTPUTS ARE SHOWN AT VARIOUS POINTS AS THE PARTICLES PROGRESS THROUGH THE SYSTEM FOR A 50 MA CURRENT CASE WITH INITIAL RADIUS OF ABOUT 0.7 CM.

SUBJECTS.: SPACE CHARGE; BUNCHER;

REFERENCE: M.J. CODY, MATHEMATICS OF COMPUTATION, 19, NO. 89, 105 (JANUARY 1965);

CATEGORY.: SPACE CHARGE; SOFTWARE DOCUMENTATION; ANALYSIS;

CAT-SOURC: BRADLEY DATE-ENT.: 770815

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

1

R3 TITLE....: OPTIMUM RUNCER PARAMETERS FOR SMALL BEAM CURRENTS

AUTHOR....: CRANDALL, K.P.

AFFILIAT.: LASL-MP-4

DOC-TYPE.: INTERNAL REPORT

REF-NUM...: MP-4/KC-2

PAGES....: 10

DATE-PUBL: 670320

ABSTRACT.: OPTIMIZATION OF SINGLE-CAVITY, HARMONIC, AND DOUBLE-DRIFT RUNCER SYSTEMS IN TERMS OF
RUNCING THE MOST PARTICLES WITHIN A SPECIFIED PHASE SPREAD. EQUATIONS DEVELOPED, SOLVED
NUMERICALLY.

SUBJECTS.: RUNCER; PARAMETER SEARCH;

CATEGORY.: ANALYSIS;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1
84 TITLE....: QUARTERLY STATUS REPORT ON THE MEDIUM-ENERGY PHYSICS PROGRAM FOR THE PERIOD ENDING 681031

AUTHOR...: MP DIVISION
AFFILIAT.: LASL-MP

DOC-TYPE.: 1A-MS; PROGRESS REPORT;
PAGES....: 52

REP-NUM...: LA-4093-MS
DATE-PUBL.: 6A1210

ABSTRACT.: LINEARIZED EQUATIONS FOR LONGITUDINAL AND TRANSVERSE ENVELOPES WERE DERIVED FOLLOWING
ONUMA'S METHOD ASSUMING UNIFORM CHARGE DENSITY, THREE-DIMENSIONAL ELLIPSOIDAL PHASE SPACE
DISTRIBUTION AND LINEAR FORCES. PERFORMANCE FROM 0.75 MEV TO 5.3 MEV WAS STUDIED USING A
COMPUTER CODE NAMED BEAM Y-17. THE EFFECT OF CHANGING CURRENT LEVEL OR INPUT BEAM SIZE GIVEN
FIXED BEAMLINE PARAMETERS IS EXPLORED. AGREEMENT WITH PARMILA WAS GOOD; BEAM Y-17 IS
CONSIDERABLY FASTER. VARIOUS BUNCHER CONFIGURATIONS FOR HANDLING H+ AND H- BEAMS ARE DISCUSSED.

SUBJECTS.: BEAM TRANSPORT; SIMULTANEOUS BEAMS; MATCHING; BEAM Y-17 CODE;

NOTES....: SEE PAGES 38-44;

REFERENCE: 3

CATEGORY.: SPACE CHARGE; SYSTEM DEVELOPMENT;

CAT-SOURC: BRADLEY DATE-ENT.: 770A15

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

85 TITLE....: TOWARDS A RADIATION-FREE LINAC OF MESON OR NEUTRON GENERATOR TYPE

AUTHOR....: FEDOTOV, A.P.; MURIN, B.P.;
AFFILIAT.: RADITECHNICAL INSTITUTE, MOSCOW, USSR

DOC-TYPE.: INFORMAL REPORT; CONF PAPER;
PAGES....: 4

REP-NUM.: AECL-5677
DATE-PIRL: 761104

CONFERENCE: PROC 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AECL-5677, P. 377;

ABSTRACT.: ALLOWABLE PERSONNEL DOSE (2.8 MRAD/HR GAMMA ONE METER FROM LINAC ONE HOUR AFTER SHUTDOWN) AND RESULTING BEAM LOSS SPECIFICATIONS FOR USSR MESON FACTORY IN BEAM CURRENT AND REQUIRED VACUUM VS ENERGY. TOTAL LOSS IN HIGH-ENERGY PORTION IS 60 HADAMPS, OR 6 PARTS IN 10^{11} S FOR AVERAGE CURRENT OF 1 MA. TRANSVERSE FILTERING INVOLVES HALF A RADIAL OSCILLATION WAVELENGTH AT SMALL APERTURE; A TRANSMISSION COEFFICIENT IS CALCULATED FOR A GAUSSIAN INPUT. THE LOSS AT EACH ELEMENT MUST BE FOUND FOR HEAT REMOVAL DESIGN. A LONGITUDINAL FILTER IS PROPOSED WHICH USES TWO TRANSVERSE ELECTRIC RESONANT RF CAVITIES, AT X_1 AND X_2 THE LINAC FREQUENCY, TO TRANSVERSE CHOP THE BEAM, FOLLOWED BY A STANDARD DOUBLE-DRIFT DOUBLE-FREQUENCY LONGITUDINAL BUNCHER. (APPARENTLY ARE CONSIDERING SUCH A SYSTEM FOR EACH BEAM INDEPENDENTLY.) DEFLECTING VOLTAGES FOR THE CHOPPER CAVITIES ARE 31.6 KV AND 29.2 KV; THEY ARE BOTH 0.12 M LONG.

VACUUM SHOULD BE BETTER THAN ABOUT 2 PARTS IN 10^{11} TORR FOR AN AVERAGE H^- CURRENT OF 1/0 MA FROM 100-1000 MEV. THE MAXIMUM QUAD MAGNETIC INDUCTION MUST NOT EXCEED 3 KG AT 1000 MEV AT 100 MA OF H^- .

MAXIMUM SOLENOIDAL FIELDS ARE ALSO GIVEN VS ENERGY.

SUBJECTS.: BEAM LOSS; BEAM SPILL; TRANSVERSE DEFLECTION BUNCHER; RADIOACTIVITY; LONGITUDINAL BUNCHING; BUNCHER; H^- RESIDUAL GAS CHARGE EXCHANGE; H^- MAGNETIC FIELD DISSOCIATION; SOLENOIDAL FOCUSING;

COMMENTS.: RADIATION FREE CRITERION STATED AS GAMMA DOSE AT ONE METER FROM LINAC LESS THAN 2.8 MRAD/HR AFTER ONE HOUR HAS ELAPSED SINCE SHUTDOWN. AFTER LONG OPERATION, FOUR-DIMENSIONAL TRANSVERSE PHASE VOLUME FILTERING, AND TWO-DIMENSIONAL LONGITUDINAL FILTERING ARE PROPOSED. VACUUM AND MAGNETIC CHARACTERISTICS ARE DISCUSSED.

NOTES....: ADDED TRANSVERSE EMITTANCE DUE TO CHOPPER IS NOT MENTIONED, SEE REMARKS OF J. CLAUSS, REDUCTION OF LOSSES IN LINACS FOR PROTONS OR HEAVY IONS, IDN 10.

REFERENCE: A

CATEGORY.: SPACE CHARGE; SYSTEM DEVELOPMENT; ANALYSIS;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

86 TITLE..... DOUBLE DRIFT BUNCHER - PART A: WITHOUT SPACE CHARGE

AUTHOR....: EMIGH, C.R.
AFFILIAT.: LASL-MP-4

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 8

REP-NUM...: MP-4/CRE-1
DATE-PUBL: 651200

ABSTRACT.: TO DATE THE MORE POPULAR APPROACH TO BUNCHING A PROTON BEAM FOR ACCEPTANCE INTO A LINAC HAS BEEN THE HARMONIC BUNCHER. DEPENDING ON THE NUMBER OF HARMONICS USED THIS BUNCHER IS CAPABLE OF OUTING SOME 80 TO 95 PERCENT OF THE BEAM CURRENT FROM THE INJECTOR INTO THE ACCEPTANCE BUCKET OF THE LINAC. OTHER MORE EXOTIC BUT UNTRIED BUNCHERS HAVE BEEN PROPOSED TO INCREASE THE CAPTURE EFFICIENCY. OF MORE IMPORTANCE FOR A HIGH INTENSITY MACHINE SUCH AS OURS IS NOT SO MUCH THE CAPTURE EFFICIENCY BUT MORE THE BEAM LOSS WITHIN THE LINAC AT THE HIGHER ENERGIES. A PROPOSED BUNCHER TO REDUCE THIS LOSS, PERHAPS SIGNIFICANTLY, HAS BEEN INVESTIGATED BY COMPUTER STUDIES AND WILL BE EXPLAINED IN THE FOLLOWING PARAGRAPHS. (TURNS OUT TO BE A DOUBLE-DRIFT DOUBLE-FREQUENCY BUNCHER.)

SUBJECTS.: BUNCHER; BEAM LOSS; BEAM SPILL;

CROSS-REF: IDN 790 MPLTH;

CATEGORY.: EQUIPMENT DESIGN;

CAT-SOURC: BRADLEY DATE-ENT.: 770915

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

1
A7 TITLE....: TRANSVERSE BEAM BLOW-UP IN STANDING-WAVE LINACS

AUTHOR...: GLUCKSTERN, R.L.

AFFILIAT.: UNIV OF MASSACHUSETTS/LASL CONSULTANT MP-DD;

DOC-TYPE.: INTERNAL REPORT

REP-NUM...: MP-DD/1

PAGES.....: 10

DATE-PUBL: 670829

ABSTRACT.: RESULTS ARE GIVEN, FOR BOTH PROTON AND ELECTRON LINACS, FOR SINGLE CAVITY AND SUCCESSIVE CAVITY RESONANCES, AND APPLIED TO LAMPF AND EPA. THE ONLY EFFECT POSSIBLE FOR LAMPF WOULD BE THE SINGLE CAVITY BLOWUP, FOR WHICH A STARTING CURRENT OF 3 A IS CALCULATED. FOR EPA, THE STARTING CURRENT FOR THE SINGLE CAVITY EFFECT IS 4 MA FOR NO ACCELERATION AND 10 MA FOR ACCELERATION. THE COOPERATIVE CAVITY EFFECT STARTING CURRENTS ARE 5 MA AND 17 MA.

SUBJECTS.: TRANSVERSE BEAM BLOWUP;

REFERENCE: 5

CATEGORY.: ANALYSIS; THEORY;

CAT-SOURC: BRADLEY

DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

88 TITLE....: A NUMERICAL EXPERIMENT ON SPACE-CHARGE EFFECTS

AUTHOR....: CRANDALL, K.R.
AFFILIAT.: LASL-MP-4

DOC-TYPE.: INTERNAL REPORT; CONF PAPER;
PAGES....: 25

REP-NUM.: MP-4/KC-1; LA-3609;
DATE-PUBL: 660914; 661200;

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3609, P. 233;

ABSTRACT.: TEST OF KV ASSUMPTION OF UNIFORM CHARGE DENSITY PHASE-SPACE DISTRIBUTION. EFFECTS OF SPACE-CHARGE ON CHARGE DENSITY AND PHASE-SPACE DISTRIBUTION IN AXIALLY SYMMETRIC, NON-ACCELERATING BEAMS ARE EXPLORED. ALL PARTICLES ARE AT SAME AXIAL VELOCITY; BEAM RADIUS AND CHARGE DENSITY CHANGE SLOWLY SO SPACE CHARGE ELECTRIC FIELD IS ENTIRELY RADIAL. TREATMENT USES RINGS OF CHARGE WHICH SHRINK OR GROW AND ROTATE. A 50 MA, 5 PI BEAM USING A KV SURFACE ELLIPSOIDAL DISTRIBUTION IS CALCULATED; NUMERICAL RESULTS AGREES WITH THEORY IN THAT THE CHARGE DENSITY REMAINS RELATIVELY UNIFORM AND THE PHASE SPACE IS NOT WARPED. PROBLEM ALSO WORKED AS IT SHOULD WHEN RUN BACKWARD.

UNIFORM DENSITY, 50 MA AND 200 MA BEAMS WITH EMITTANCES OF 1, 5 AND 10 PI CM-MRAD WERE THEN RUN. AS EMITTANCE INCREASED, CHARGE DENSITY TENDED TO BECOME HIGHER AT THE CENTER OF THE BEAM, AND SOMETIMES OSCILLATED BETWEEN UNIFORM CHARGE DENSITY AND HIGHER DENSITY IN CENTER. NON-UNIFORM DENSITY CAUSES PHASE SPACE WARPING AND PROFILE DIFFERING FROM PROFILE EQUATION.

FOR A GAUSSIAN DENSITY, 50 MA AND EMITTANCES OF 0, 1, 5 AND 10 PI CM-MRAD, EVEN THE SMALL EMITTANCE BEAMS WERE DISTORTED IN PHASE SPACE. THE ZERO EMITTANCE BEAM OSCILLATES BETWEEN HIGH DENSITY IN THE CENTER AND HIGH DENSITY AT THE BEAM EDGE.

SUBJECTS.: SPACE CHARGE; PHASE SPACE DISTRIBUTION;

NOTES....: MP-4/KC-1 = 21 PAGES, LA-3609 = 4 PAGES;

REFERENCE: I.M. KAPCHINSKIY AND V.V. VLADIMIRSKIY, LIMITATIONS OF PROTON BEAM CURRENT IN A STRONG FOCUSING LINEAR ACCELERATOR ASSOCIATED WITH THE BEAM SPACE CHARGE, CONF ON HIGH-ENERGY ACCEL AND ISTR, CERN, GENEVA (1959); T.R. WALSH, A NORMAL BEAM WITH LINEAR FOCUSING AND SPACE-CHARGE FORCES, JOURNAL OF NUCI ENERGY, PART C, VOL. 5, 17-22 (1963);

CATEGORY.: SPACE CHARGE; ANALYSIS; EXPERIMENTAL PROPOSAL;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM;

STOP-LOC.: MP-9 SPERG FILE;

1

89 TITLE.....: HIGH ENERGY BEAM TRANSPORT OF INTENSE BEAM

AUTHOR....: GLICKSTERN, R.L.

AFFILIAT.: UNIV OF MASSACHUSETTS/LASL CONSULTANT MP-00;

DOC-TYPE.: INTERNAL REPORT

REP-NUM...: MP-00/3

PAGES.....: 9

DATE-PUBL: 680900

ABSTRACT.: CONSIDERS TRANSPORT OF A HIGH ENERGY BEAM WHERE SPACE CHARGE IS A CONSIDERATION.

SUBJECTS.: BEAM TRANSPORT; SPACE CHARGE; MATCHING;

REFERENCE: 3

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

1
90 TITLE....: LINEAR ACCELERATOR DEVELOPMENT AT BROOKHAVEN NATIONAL LABORATORY

AUTHOR....: BATCHELOR, K.
AFFILIAT.: BNL

DOC-TYPE.: TALK; PUBLICATION;
PAGES....: 10

DATE-PUBL: 760914

CONFERENCE: 1976 PROTON LINEAR ACCEL CONF. CHALK RIVER, ONTARIO, CANADA, SEPTEMBER 14-17, 1976;

ABSTRACT.: THIS PAPER DESCRIBES THE OPERATING EXPERIENCE ON THE 200 MEV PROTON INJECTOR LINAC OF THE A. G.S., EMPHASIZING DEVELOPMENTS IN FIELD PHASE AND AMPLITUDE CONTROL AND BEAM DIAGNOSTICS. DEVELOPMENTS IN AUXILIARY USE OF THE MACHINE ARE ALSO DESCRIBED.

SUBJECTS.: OPERATING EXPERIENCE; RF FIELD CONTROL; RF PHASE; RF AMPLITUDE; SPILL DETECTION;

NOTES....: THREE INDEPENDENT REDUNDANT PHASE AND AMPLITUDE MONITORS; ANY DISAGREEMENT GREATER THAN 0.2 PERCENT IN AMPLITUDE OR 0.5 DEGREES IN PHASE IS INVESTIGATED. FEEDFORWARD BEAM CURRENT SIGNAL IS DIFFERENTIATED AND SHAPED INDIVIDUALLY FOR EACH OF THE NINE MODULES BY A CENTRALLY LOCATED RF PROGRAM MULTIPLEXER. CONTROL TO WITHIN PLUS-MINUS 0.1 PERCENT OVER MOST OF BEAM PULSE WITH BEAM LOADING OF UP TO 50 PERCENT. A NEW PRECISION SHIELDED RF PROBE IS BEING USED. NEW IONIZATION RADIATION MONITOR IS DETAILED.

REFERENCE: 9

CATEGORY.: SPACE CHARGE; SYSTEM DESCRIPTION; SYSTEM DEVELOPMENT;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

1 91 TITLE....: LINAC BEAM CORE MODELING FROM WIRE-SCANNER DATA

AUTHOR...: LAW, A.G.
AFFILIAT.: LASL-MP-9

DOC-TYPE.: LA-MS
PAGES....: 24

REP-NUM.: LA-6894-MS
DATE-PURL: 77MAR8

ABSTRACT.: THIS STUDY INTRODUCES MATHEMATICAL MODELING OF ACCELERATOR BEAMS FROM DATA COLLECTED BY WIRE SCANNERS. DETAILS ABOUT A BEAM CORE $D(x, x', y, y')$ ARE EXAMINED IN SEVERAL SITUATIONS: (A) FOR A DISCRETIZATION OF THE PROJECTION INTO XY-SPACE, A MAXIMUM-ENTROPY SOLUTION AND A MINIMUM-ENTROPY SOLUTION ARE DEVELOPED AND DISCUSSED, (B) FOR UNDISCRETIZED XY-SUBSPACE, A TWO-DIMENSIONAL GAUSSIAN APPROXIMATION IS OBTAINED BY LEAST SQUARES, AND (C) FOR FOUR-DIMENSIONAL SPACE, THE FIT OF A SINGLE GAUSSIAN TO DATA FROM A SUCCESSION OF WIRE SCANNERS IS INVESTIGATED.

SUBJECTS.: EMISSION; RECONSTRUCTION TECHNIQUE; BEAM PROFILE; WIRE SCANNER;

REFERENCE: 11

CATEGORY.: MATHEMATICS; ANALYSIS;

CAT-SOURCE: JAMESON DATE-ENT.: 771006

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

92 TITLE.....: DOUBLE DRIFT BUNCHER - PART C: A COMPARISON WITH THE SIMPLE BUNCHER AND THE HARMONIC BUNCHER

AUTHOR.....: CRANDALL, K.D.; EMIGH, C.R.

AFFILIAT.: LASL-MP-4

DOC-TYPE.: INTERNAL REPORT

PAGES.....: 16

REP-NUM.....: MP-4/KRC-CRF-1
DATE-PUBL: 670120

ABSTRACT.: DEVELOPMENT OF MANY RINGS AVERAGED (MRA) CODE FOR STUDY OF BUNCHER SYSTEMS, CAN TREAT
SOLENOIDAL LENS BUT NOT QUADRUPOLE. USES R-Z MESH, AND CONSIDERS ADJACENT BUNCHES. FIGURES SHOW
A COMPARISON OF THE MAXIMUM PERCENTAGE OF PARTICLES THAT CAN BE BUNCHED WITHIN A CERTAIN PHASE
SPREAD FOR DIFFERENT TYPES OF BUNCHERS. FOR EXAMPLE, WITH A DOUBLE-DRIFT, DOUBLE-FREQUENCY
BUNCHER, ABOUT 90 PERCENT CAN BE CAPTURED WITHIN PLUS-MINUS 30 DEGREES AT ZERO CURRENT, FALLING
TO 75 PERCENT AT 100 MA.

SUBJECTS.: BUNCHER, SOLENOIDAL FOCUSING; SPACE CHARGE;

CATEGORY.: SPACE CHARGE; EQUIPMENT DESIGN; SYSTEM PERFORMANCE;

CAT-SOURCE: RADLEY DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPCHG FILE:

93 TITLE....: RESULTS OF BUCKET ROTATOR/895 MHZ PHASE SCAN EXPERIMENT

AUTHOR....: CRANDALL, K.R.

AFFILIAT.: LASL-MP-9

DOC-TYPE.: MEMO

PAGES.....: 13

DATE-PUBL: 750211

ABSTRACT.: THE MAIN OBJECTIVE OF THIS EXPERIMENT WAS TO ESTIMATE THE LONGITUDINAL EMITTANCE OF THE BEAM AT THE EXIT OF TANK 4. THE TECHNIQUE INVOLVES MEASURING THE PHASE SPREAD OF THE BEAM AT THE ENTRANCE TO MODULE 5 FOR A VARIETY OF BUCKET ROTATOR AMPLITUDES. FOR EACH BUCKET ROTATOR SETTING, ONE EQUATION RELATES THE PHASE SPREAD AT MODULE 5 TO THE 3 ELLIPSE PARAMETERS REPRESENTING THE BEAM AT THE EXIT OF TANK 4. GIVEN 3 OR MORE PHASE SPREAD MEASUREMENTS AT DIFFERING BUCKET ROTATOR AMPLITUDES, ONE CAN SOLVE FOR THE 3 LONGITUDINAL EMITTANCE ELLIPSE PARAMETERS. AFTER THE LONGITUDINAL EMITTANCE IS KNOWN, THE PROPER BUCKET ROTATOR AMPLITUDE CAN BE SPECIFIED FOR MATCHING THE EMITTANCE TO THE ACCEPTANCE OF THE 895 MHZ LINAC.

THE H- BEAM WAS MEASURED. 50 PERCENT OF THE BEAM WAS WITHIN A 12 DEGREE (895 MHZ DEGREES) TOTAL PHASE SPREAD, 70 PERCENT WITHIN 22 DEGREES, 90 PERCENT WITHIN 56 DEGREES. A DIFFERENT ORIENTATION OF THE CORE PARTICLES FROM THE HALO PARTICLES WAS OBSERVED.

SUBJECTS.: BUCKET ROTATOR; LONGITUDINAL EMITTANCE; PHASE SCAN;

CROSS-REF: IDN 94;

CATEGORY.: SPACE CHARGE; EXPERIMENTAL REPORT; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770815

MICROFILM:

STOR-LDC.: MP-9 SPORG FILE;

94 TITLE.....: RESULTS OF LONGITUDINAL EMITTANCE MEASUREMENT AT 100 MEV

AUTHOR....: CRANDALL, K.P.

AFFILIAT.: LASL-MP-9

DOC-TYPE.: MEMO

PAGES.....: 19

DATE-PUBL: 750925

ABSTRACT.: SEE IDN 93. SIMILAR RESULTS WERE OBTAINED WITH THE H+ BEAM, WITH SOMEWHAT SMALLER EMITTANCE. NUMEROUS QUESTIONS ARE RAISED, BECAUSE THE RESULTS DID NOT AGREE WITH EXPECTATIONS FROM MODELING IN SEVERAL RESPECTS. (THIS WAS THE FIRST THOROUGH MEASUREMENT OF THE TYPE,) MANY FIGURES ARE INCLUDED TO SHOW VARIOUS ASPECTS OF THE ANALYSIS.

SUBJECTS.: BUCKET ROTATOR; LONGITUDINAL EMITTANCE; PHASE SCAN;

CROSS-REF: IDN 93;

CATEGORY.: SPACE CHARGE; EXPERIMENTAL ANALYSIS;

CAT-SOURC: BRADLEY

DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

95 TITLE.....: EMITTANCE, ENTROPY AND INFORMATION

AUTHOR...: LAWSON, J.D.; LAPOSTOLLE, P.M.; GLUCKSTERN, R.L.;

AFFILIAT.: RUTHERFORD LAB; CENTRE NATIONAL D ETUDES DE TELECOMMUNICATIONS; UNIV OF MASSACHUSETTS/LASL
CONSULTANT MP=CO;

DOC-TYPE.: JOURNAL PUBLICATION;

PAGES.....: 5

DATE=PUBL: 732000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 5, 61-65 (1973);

ABSTRACT.: THE EMITTANCE OF A CHARGED PARTICLE BEAM CAN BE CONSIDERED AS A MEASURE OF THE DISORDER IN
THE TRANSVERSE MOTION OF THE PARTICLES. THE RELATION OF THIS CONCEPT TO THE ENTROPY OF THE
DISTRIBUTION IN TRANSVERSE PHASE SPACE IS EXPLORED, AND A THERMODYNAMIC DESCRIPTION OF A BEAM
AS A TWO DIMENSIONAL GAS IS DEVELOPED. THE CONNECTION WITH INFORMATION IN BEAMS WHICH CAN BE
FOCUSED TO FORM AN IMAGE IS NOTED.

SUBJECTS.: EMITTANCE; ENTROPY; THERMODYNAMIC MODEL;

REFERENCE: 10

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY

DATE-ENT.: 770815

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

96 TITLE....: INTENSITY REDUCING SIEVES FOR ACCELERATOR EXPERIMENTS

AUTHOR....: KOZIOL, H.
AFFILIAT.: LASL-MP-3

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 7

RFP-NUM...: MP-3-74-3
DATE-PURL: 741011

ABSTRACT.: DISCUSSION OF THE USE OF SIEVES TO CHANGE BEAM INTENSITY TO AID INVESTIGATION OF COLLECTIVE EFFECTS. DESIGN DETAILS ARE GIVEN.

SUBJECTS.: BRIGHTNESS; STEVE; BEAM INTENSITY;

CATEGORY.: SPACE CHARGE; EQUIPMENT PROPOSAL;

CAT-SOURCE: BRADLEY DATE-ENT.: 770815

MICROFILM:

STOR-LDC.: MP-9 SPACE FILE;

97 TITLE....: ALTERNATING PHASE FOCUSED LINACS

AUTHOR....: SWENSON, D.A.
AFFILIAT.: LASL-MP-14

DOC-TYPE.: JOURNAL PUBLICATION;
PAGES.....: 7

DATE-PURL: 760000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 7, 61-67 (1976);

ABSTRACT.: AN ARRAY OF ALTERNATING PHASE FOCUSED LINAC STRUCTURES ARE PRESENTED WHICH SHOW PROMISE FOR ACCELERATION OF PROTONS AND HEAVY IONS AT HIGHER FREQUENCY AND FROM LOWER ENERGIES THAN CURRENTLY POSSIBLE WITH MAGNETICALLY FOCUSED DRIFT TUBE LINACS. IN THESE STRUCTURES, THE TRANSVERSE, AS WELL AS THE LONGITUDINAL FOCUSING FORCES ARE PRODUCED BY THE RF FIELDS, BY ARRANGING THE DRIFT TUBE LENGTHS, AND HENCE THE GAP POSITIONS, IN AN APPROPRIATE WAY, IN A STANDING WAVE DRIFT TUBE LOADED STRUCTURE, THE PARTICLES CAN BE MADE TO EXPERIENCE ACCELERATION AND A SUCCESSION OF FOCUSING AND DEFOCUSING FORCES WHICH RESULT IN SATISFACTORY CONTAINMENT OF THE BEAM. DEPENDENCE ON ADDITIONAL FOCUSING FIELDS, A SCALING LAW IS DESCRIBED WHICH TRANSFORMS THE BASIC PHASE SEQUENCES TO OTHER SYNCHRONOUS ENERGIES, WAVELENGTHS, PARTICLE MASSES AND CHARGE STATES. A GRAPHICAL PARAMETER SPACE IS DEVELOPED AS AN AID IN SELECTING SUITABLE BASIC PHASE SEQUENCES, AND TECHNIQUES ARE DISCUSSED FOR GENERATING LINACS. THREE ALTERNATING PHASE FOCUSED LINACS ARE PRESENTED AS EXAMPLES, ONE FOR PROTONS, AND THE OTHERS FOR HEAVY IONS. THE GEOMETRY AND PERFORMANCE OF EACH ARE DESCRIBED.

SUBJECTS.: ALTERNATING PHASE FOCUSING; LINAC DESIGN;

REFERENCE: 19

CATEGORY.: SPACE CHARGE; SYSTEM DESCRIPTION; SYSTEM DEVELOPMENT;

CAT-SOURC: BRADLEY DATE-ENT.: 770415

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

98 TITLE....: COLLECTION OF MEMOS ON BEAM DENSITY DISTRIBUTION AND EMITTANCE RECONSTRUCTION FROM WIRE SCANNER DATA

SUBTITLE.: MEMOS LAW TO JAMESON, NO SUBJECT GIVEN, BUT ON THE TOPIC OF BEAM DENSITY RECONSTRUCTION FROM TWO VIEWS, DATED 761019, 761105, 761203, 761220, 770104, 770105; TWO-LAYER MAX, MINERRO, 751220; MINIMUM STRUCTURE APPROACH TO TWO-LAYER MAX, MINERRO, 761106; REGULARIZATION AND TWO-LAYER MAX, MINERRO, 760126; GRAPHICAL EXPERIMENTATION FOR TEST WIRE-SCAN DISTRIBUTIONS, LAW, 761213; THE DECEMBER 8-10/76 GLUCKSTERN VISIT (COMMENTS ON RECONSTRUCTION PROBLEMS), LAW, 761217; FITTING A GAUSSIAN CORE TO XY-DATA FROM ONE WIRE SCAN, LAW, 770211; THE CORE RECONSTRUCTION FOR TEST DATA OF SINGLE GAUSSIAN FORM, LAW, 770224; MODELS OF AN (ANALYTIC) HALO IN X-Y DATA, LAW, 770317; GAUSSIAN CENTRES FOR DATA COLLECTED BY A SINGLE WIRE, LAW, 770712;

AUTHOR....: LAW, A.G.; MINERRO, G.N.;

AFFILIAT.: LASL-MP-9; LASL-TD-9;

DOC-TYPE.: MEMO

PAGES....: 03

DATE-PUBL: 761019; 770712;

ABSTRACT.: SEE TITLES

SUBJECTS.: EMITTANCE; RECONSTRUCTION TECHNIQUE; BEAM PROFILE; WIRE SCANNER;

CATEGORY.: MATHEMATICS; ANALYSIS;

CAT-SOURCE; JAMESON

DATE-ENT.: 771006

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

99 TITLE....: STABILITY OF PHASE SPACE DISTRIBUTIONS IN TWO DIMENSIONAL BEAMS

AUTHOR....: GLUCKSTERN, R.L.; CHASMAN, R.W.; CRANDALL, K.R.;
AFFILIAT.: UNIV OF MASSACHUSETTS/LASL CONSULTANT MP-DD; RNL; LASL-MP-9;

DOC-TYPE.: TALK; PUBLICATION;
PAGES....: 27
REF-NUM.: LCO-063
DATE-PUHL: 7/10/72

CONFERENCE: PROC 1970 PROTON LINEAR ACCEL CONF, BATAVIA, ILLINOIS, VOL. 2, 823-849, SEPT. 28 - OCT. 2, 1970;

ABSTRACT.: THE MOST CONVENIENT METHOD FOR INCLUDING SPACE CHARGE FORCES IN BEAM DYNAMICS CALCULATIONS IS THAT PROPOSED BY KARCHINSKY AND VLADIMIRSKY. THIS DISTRIBUTION CORRESPONDS TO AN ELLIPSOIDAL SHELL IN 4-DIMENSIONAL PHASE SPACE, LEADING TO UNIFORM DISTRIBUTIONS IN ALL TWO DIMENSIONAL PROJECTIONS, AND TO LINEAR SPACE CHARGE FORCES. BEAM EMITTANCE MEASUREMENTS ARE FOR THE MOST PART NOT COMPLETELY CONSISTENT WITH THE KV DISTRIBUTION. PHASE SPACE AND REAL SPACE PROJECTIONS INDICATE INSTEAD A CENTRAL CORE OF HIGH DENSITY SURROUNDED BY A TAIL OR HALO OF LOWER DENSITY. THE PRESENT WORK IS AN EFFORT TO DETERMINE WHETHER OR NOT THE MATCHED KV DISTRIBUTION IS STABLE. NUMERICAL ORBIT CALCULATIONS FOR AN AZIMUTHALLY SYMMETRIC UNACCELERATED KV BEAM HAVE BEEN PERFORMED WITH A CONSTANT EXTERNALLY APPLIED RADIAL RESTORING FORCE IN AN EFFORT TO SEE WHETHER THE DISTRIBUTION IN THE TOTAL ENERGY OF EACH PARTICLE REMAINS UNCHANGED. IN ADDITION, A FAMILY OF OTHER STATIONARY 4-DIMENSIONAL PHASE SPACE DISTRIBUTIONS IS STUDIED ANALYTICALLY AND COMPUTATIONALLY. THE TOTAL BEAM ENERGY FOR FIXED INTENSITY AND RMS EMITTANCE IS EXPLORED IN AN EFFORT TO DETERMINE WHICH DISTRIBUTION IS MOST STABLE.

SUBJECTS.: PHASE SPACE DISTRIBUTION; EMITTANCE; EQUILIBRIUM DISTRIBUTIONS;

NOTES....: RESULTS MAY BE CONFUSED BY MACRO-PARTICLE MODEL PRODUCING COLLISION-LIKE EFFECTS VIA NUMERICAL ASPECTS OF THE COMPUTER COMPUTATION.

REFERENCE: 7

CATEGORY.: SPACE CHARGE; ANALYSIS; THEORY;

CAT-SOURCE: BRADLEY DATE-FNT.: 7/7/815

MICROFILM:

STOP-LOC.: MP-9 SPERG FILE;

100 TITL:.... STUDIES ON THE BEAM DYNAMICS OF THE HIGH-INTENSITY PROTON BEAM LINE IN THE INJECTOR COMPLEX OF LAMPF

AUTHOR....: GOPLEN, R.C.; STEVENS, R.R., JR.;
AFFILIAT.: LASL-MP-9

DOC-TYPE.: LA-MS
PAGES.....: 56

REP-NUM...: LA-5046-MS
DATE-PUBL: 7/30/80

ABSTRACT.: THE INITIAL OPERATION AND EXPERIMENTAL STUDIES CARRIED OUT ON THE HIGH INTENSITY PROTON BEAM LINE IN THE INJECTOR AREA OF LAMPF ARE DESCRIBED. A DESCRIPTION OF THIS BEAM LINE TOGETHER WITH THE DESIGN BEAM TRANSPORT CALCULATIONS ARE PRESENTED. DETAILED COMPARISONS BETWEEN CALCULATED AND OBSERVED BEAMS ARE MADE. PRELIMINARY RESULTS ON ELECTRON NEUTRALIZATION EFFECTS IN THIS BEAM LINE ARE ALSO PRESENTED.

SUBJECTS.: ION SOURCE; BEAM TRANSPORT; MATCHING; SPACE CHARGE; SIEVE; NEUTRALIZATION;

NOTES....: ORIGINAL DESIGN CRITERIA WAS TO KEEP X AND Y SIZES NEARLY EQUAL. PRESENT BEAMS DO NOT ACHIEVE SO MUCH ABOUT THIS. MATCHING PARAMETERS AT LINAC ENTRANCE FOR 1.4 PI CM-MRAD, 25 MA BEAM WITH BUNCHERS OFF ARE ALPHA X = -0.2, BETA X = 8.0 CM/RAD, ALPHA Y = -0.1, BETA Y = 18.0 CM/RAD. GRADIENT OF INITIAL QUAD = -4500 GAUSS/CM.

SPACE CHARGE EFFECTS WERE STUDIED BY INSERTING SCREENS NEAR THE COLUMN EXIT. DISTINCT ROTATIONS WERE OBSERVED DOWNSTREAM. THE LOW DENSITY CASES AGREED WELL WITH CALCULATIONS.

DATA-REFC: MANY FIGURES AND TABLES;

CROSS-REF: ION 249. MPLTR;

CATEGORY.: SPACE CHARGE; EXPERIMENTAL ANALYSIS; SYSTEM PERFORMANCE;

CAT-SOURCE: JAMESON DATE-ENT.: 771007

MICROFILM:

STOR-LOC.: MP-9 SPRG FILE;

101 TITLE....: STATISTICAL POPULATION OF THE LINAC BEAM TRANSVERSE PHASE SPACE
SEC-TITLE: INTRO., A REVIEW OF SOME PROPERTIES OF GAUSSIAN DISTRIBUTIONS, ESTIMATION OF THE PARAMETERS
OF A BIVARIATE NORMAL DISTRIBUTION FROM A SET OF EXPERIMENTAL DATA, ESTIMATION OF THE ERRORS
AFFECTING THE MEASUREMENTS, GENERATION OF A REASONABLE SET OF INITIAL COORDINATES, RESULTS
AND CONCLUSIONS.

AUTHOR...: EADJE, W.T.; MARTINI, M.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 24

REP-NUM...: MPS/INT. LT 48-9
DATE-PUBL: 680412

ABSTRACT.: IN THIS REPORT THE POSSIBILITY OF FINDING SOME DESCRIPTION OF THE PHASE SPACE DISTRIBUTION
OF THE BEAM INJECTED INTO THE PS LINAC IS STUDIED. THE STUDY IS LIMITED TO TRANSVERSE PHASE
SPACE (I.E. TO A 4-DIMENSIONAL HYPERVOLUME). THE PHYSICAL DISTRIBUTION OF THE PARTICLES IS
SIMULATED BY A MULTIVARIATE GAUSSIAN DISTRIBUTION WITH PARAMETERS ESTIMATED FROM A SET OF
EXPERIMENTAL MEASUREMENTS. THE RESULTS WILL BE EMPLOYED IN A COMPUTER PROGRAM DESCRIBING THE
MOTION OF THE BEAM THROUGH THE LINAC.

SUBJECTS.: PHASE SPACE DISTRIBUTION; GAUSSIAN DISTRIBUTION; FITTING; STATISTICAL FITTING; SPACE CHARGE;
MAXIMUM LIKELIHOOD ESTIMATES;

NOTES....: DISCUSSES CHI-SQUARE FIT OF BIVARIATE GAUSSIAN. THE ACTUAL PHYSICAL DISTRIBUTION IN 4-
DIMENSIONAL PHASE SPACE FOR A 50 MA, 50 MEV BEAM FROM THE CERN LINAC HAS PROJECTIONS IN THE Y-
PRIME, Y-PRIME PLANE WHICH ARE FITTED WELL BY BIVARIATE GAUSSIAN DISTRIBUTIONS. IN THE OTHER
FIVE PLANES, THE BEST FITTING GAUSSIANS DO NOT GIVE A COMPLETE DESCRIPTION OF THE DATA. THERE
IS POSSIBLY A SYSTEMATIC DEVIATION IN THE RESIDUALS.

WORRIED ABOUT LOST PARTICLES SHOWING UP IN EMITTANCE MEASUREMENTS - ESTIMATED MAYBE AS HIGH
AS 10 PERCENT.

PAPER DEALS WITH HOW TO FIT A GAUSSIAN TO BEAM MEASUREMENT DATA, AND HOW TO TRANSFORM A
UNIFORM DISTRIBUTION OF RANDOM NUMBERS TO A PROPER SET OF INPUT COORDINATES.

REFERENCE: 7

CATEGORY.: EXPERIMENTAL ANALYSIS; STATISTICAL FITTING; SPACE CHARGE;

CAT-SOURCE: JAMESON DATE-ENT.: 771006

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

102 TITLE....: INTENSITY DEPENDENT EFFECTS AND SPACE CHARGE LIMIT INVESTIGATIONS ON CERN LINEAR INJECTOR AND SYNCHROTRON

AUTHOR....: LAPOSTOLLE, P.M.; TAYLOR, C.S.; TETU, P.; THORNDALH, L.;
AFFILIAT.: CERN

DOC-TYPE.: REPORT
PAGES.....: 78

REP-NUM..: CERN 68-35
DATE-PUBL: 6A1012

ABSTRACT.: EXPERIMENTAL WORK ON SPACE CHARGE EFFECTS AT CERN ON THE PS AND ITS LINAC INJECTOR WAS STARTED IN 1967 IN AN ATTEMPT TO CONFIRM THEORETICAL INTENSITY LIMITS.

VARIOUS UNEXPECTED EFFECTS HAVE BEEN OBSERVED WHICH REQUIRE MORE ACCURATE EXPERIMENTAL INVESTIGATION AND PERHAPS MORE DEVELOPMENT OF THE VARIOUS THEORETICAL APPROACHES AT PRESENT UNDER WAY TO EXPLAIN THEM.

SUBJECTS.: EMITTANCE; OPERATING EXPERIENCE; EMITTANCE DIFFERENCE BETWEEN PLANES; SPACE CHARGE; PHASE SPACE DISTRIBUTION;

NOTES....: BACKGROUND FROM EARLIER MEASUREMENTS OBSERVE DENSITY DISTRIBUTION IN REAL OR 2-D PHASE SPACE IS NOT UNIFORM, BUT TAILS EXIST, OFTEN AS FAR AS THE BOUNDARIES OF THE ACCEPTANCE. INTENSITY/PHASE SPACE AREA CURVES ARE SUGGESTED AS A BETTER DEFINITION OF BEAM EMITTANCE (NEVER CAUGHT ON). IN MEASUREMENTS DURING 1966-1967, STRONG X-Y COUPLING AS A FUNCTION OF CURRENT (SPACE CHARGE) WAS OBSERVED. A BEAM WHOSE CENTRAL PART HAD BEEN REMOVED BY A BAR AT THE INPUT BUT WAS STILL OF HIGH INTENSITY CAME OUT AT 50 MEV STILL ELLIPTICAL, WITH HIGHEST DENSITY IN THE CENTER. MEASUREMENTS ALSO REPORTED AT 1966 CONFERENCE - RANGED FROM 10-100 MA. EMITTANCE SEEMED TO VARY AS CURRENT TO THE $1/3-1/2$ POWER. THE EFFECT OF WIGGLE FACTOR IN QUADRUPOLE FOCUSING SYSTEMS WAS MEASURED, AND SMALLER WIGGLE PRODUCED SMALLER EMITTANCE GROWTH. THIS RESULT AND THE IDEA THAT OUTPUT EMITTANCE CANNOT BE REDUCED BELOW A CERTAIN VALUE (PROPORTIONAL TO $1+1/3$) NO MATTER HOW SMALL THE INPUT EMITTANCE WERE PREDICTED BY THE THERMODYNAMIC MODEL OF LAPOSTOLLE IN A PHENOMENOLOGICAL SENSE.

DIFFERENCES IN EMITTANCE BETWEEN PLANES WAS OBSERVED, AND EXPERIMENTS WERE DONE TO SEE IF THE EFFECT COULD BE EXPLAINED BY INCREASED LONGITUDINAL TO TRANSVERSE COUPLING IN THE PLANE WHERE THE BEAM SIZE WAS LARGER EARLY IN THE MACHINE. THE RESULTS INDICATED THAT THE ACTION OF THE FIRST QUADS IS LARGE; A REDUCTION IN THE STRENGTH OF A HORIZ FOCUSING QUAD INCREASED HORIZ EMITTANCE WITHOUT CHANGING VERTICAL - SAME EFFECT FOR INCREASE IN STRENGTH OF HORIZ DEFOCUSING, AND FOR VERTICAL PLANE, AN INJECTION MISALIGNMENT IN EITHER PLANE DID NOT AFFECT THE OUTPUT EMITTANCES AT HIGH CURRENT. THE INCREASE OF EMITTANCE IN ONE DIRECTION DUE TO QUADRUPOLE MISADJUSTMENT IS GENERALLY ACCOMPANIED BY AN INCREASE IN ENERGY SPREAD. THE MOST SENSITIVE QUADS IN THIS RESPECT WERE NUMBER 6 AND 7. A MISADJUSTMENT OF THE RF FIELD LEVEL INCREASES THE ENERGY SPREAD AND ALSO SLIGHTLY DETEIORATED THE TRANSVERSE EMITTANCES, PARTICULARLY THE LARGER ONE IF A DIFFERENCE HAS BEEN PRODUCED BY A QUADRUPOLE MISADJUSTMENT. THE SENSITIVITY OF TRANSVERSE EMITTANCES AND ENERGY SPREAD TO QUAD OR RF MISADJUSTMENTS INCREASES WITH INTENSITY.

IT IS CLEAR THAT A MAJOR PART OF THE EMITTANCE GROWTH EFFECT OCCURS WITHIN THE FIRST PHASE OSCILLATION. THE NUMBER OF TERMS IN THE TAYLOR EXPANSION OF THE RADIAL FIELD OF A CIRCULAR BEAM WITH GAUSSIAN CURRENT DENSITY NECESSARY TO KEEP AN ACCURACY OF 1% PERCENT OF THE MAXIMUM VALUE AT A DISTANCE R FROM THE AXIS IS GIVEN; DEGREE 13 IS NEEDED FOR $R = 1.5A$ AND 21 FOR $R = 2A$, WHERE A IS THE RADIUS CONTAINING $(1-1/e)$ OF THE BEAM.

SOME EXPERIMENTS USING THE PS AS AN ANALYZER ARE DESCRIBED; OTHERS OF THIS TYPE ARE PLANNED.

APPENDICES COVER STATISTICS OF PARTICLE COLLISIONS - ELASTIC SCATTERING ON RESIDUAL GAS MOLECULES, COLLISIONS BETWEEN PARTICLES, EMITTANCE GROWTH, EXTENSION OF LIOUVILLE'S THEOREM TO

COUPLED MOTIONS - LINEAR AND NONLINEAR COUPLING, LINEAR COUPLING FOR THREE COORDINATES,
ADDITIONAL FORMS OF LIOUVILLE'S THEOREM OR POINCARÉ INVARIANTS, DISCUSSION OF THE INVARIANT
RELATIONS WITH LINEAR AND NONLINEAR COUPLINGS; SPACE CHARGE FIELD CORRESPONDING TO VARIOUS
DENSITY DISTRIBUTIONS WITH CYLINDRICAL SYMMETRY - UNIFORM IN 4-D, UNIFORM IN 6-D AFTER
DEBUNCHING, GAUSSIAN, SEMI-UNIFORM (RAMPED EDGE).

REFERENCE: 2A

CATEGORY: SPACE CHARGE; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: JAMESON DATE-ENT.: 771206

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1
143 TITLE....: THE DESIGN OF PROTON LINEAR ACCELERATORS FOR ENERGIES UP TO 200 MEV
SEC-TITLE: INTRO; COMPUTER PROGRAMS; SELECTION OF CAVITY GEOMETRY; GENERATION OF EXACT CAVITY DIMENSIONS;
PARTICLE DYNAMICS; MECHANICAL ENGINEERING CONSIDERATIONS;

AUTHOR...: AUSTIN, R.; EDWARDS, T.W.; O'MEARA, J.E.; PALMER, M.L.; SWENSON, D.A.; YOUNG, D.E.;
AFFILIAT...: MIRA

DOC-TYPE...: REPORT
PAGES....: 165

REP-NUM...: 713
DATE-PUB...: 650701

ABSTRACT...: A STUDY OF PROTON LINEAR ACCELERATORS OF ENERGY UP TO 200 MEV USING DRIFT TUBE LOADED
CAVITIES RESONANT AT 200 MC IS DESCRIBED. SUCH AN ACCELERATOR IS USEFUL AS AN INJECTOR FOR A
HIGH ENERGY SYNCHROTRON. TWO COMPUTER PROGRAMS HAVE BEEN USED EXTENSIVELY IN THIS STUDY; ONE IS
USED TO CALCULATE THE RESONANT FREQUENCY AND RF FIELDS IN THE APPROPRIATE LINEAR ACCELERATOR
GEOMETRY, THE OTHER IS USED TO CALCULATE PARTICLE MOTION IN THE ACCELERATOR. FROM THE FIELD
COMPUTATIONAL PROGRAM A VARIETY OF RESONANT CAVITY CONFIGURATIONS HAVE BEEN INVESTIGATED, AND
AN OPTIMUM STRUCTURE HAS BEEN CHOSEN ON THE BASIS OF MINIMIZING THE RF POWER COSTS AND THE
STRUCTURE LENGTH COSTS. SEVERAL OPTIMIZED SETS OF PARAMETERS FOR A LINEAR ACCELERATOR ARE GIVEN.
MORE DETAILED STUDIES WERE DONE ON ONE OF THE SETS OF PARAMETERS INCLUDING PARTICLE DYNAMICS
STUDIES. TABLES OF DRIFT TUBE DIMENSIONS ARE GIVEN. FROM THE SPECIFICATION OF PARAMETERS,
MECHANICAL ENGINEERING STUDIES HAVE BEEN MADE TO EVOLVE A DESIGN WHICH CAN BE FABRICATED AND
FROM WHICH REALISTIC CONSTRUCTION COSTS CAN BE ESTIMATED. SOME DETAILS OF MECHANICAL MODELS
CONSTRUCTED TO TEST DESIGN FEATURES ARE GIVEN.

SUBJECTS...: MESSYMESH CODE; PARMILA CODE; LINAC DESIGN; BEAM DYNAMICS; MECHANICAL ENGINEERING;

REFERENCE: 23

CATEGORY...: SYSTEM DESIGN;

CAT-SOURCE: JAMESON DATE-ENT.: 771007

MICROFILM;

STOP-LOC.: MP-9 SPORG FILE;

104 file....; INTRODUCTION TO ACCELERATOR THEORY
SECTION: PARTIAL DIFFERENTIAL EQUATIONS; SYNCHROTRON OSCILLATION; REFERENCE BOOKS ON ACCELERATOR THEORY;
APPENDIX ON TRANSFER MATRICES;

AUTOMOBILES SUZUKI, INC.
AFFILIATE: KKK

DOC-TYPE: REPORT (SFT10N)
PAGES: 59

NATF-PHIL: 770000

ABSTRACT: THE THEORY OF ALTERNATING-GRADIENT SYNCHRONONS IS DESCRIBED TOGETHER WITH THE PRINCIPLE OF AG FOCUSING IN HEAVY TRANSPORT SYSTEMS AND STORAGE RINGS. RETARDATION AND SYNCHROTRON OSCILLATIONS ARE TREATED IN A LINEAR APPROXIMATION. THE THEORY OF NON-LINEAR OSCILLATIONS IS SKETCHED IN CONNECTION WITH THE SYNCHROTRON OSCILLATION. HISTORICAL DEVELOPMENT OF ACCELERATORS IS BRIEFLY DESCRIBED.

SUBJECTS: REAR DYNAMICS; TWISS PARAMETERS; HAMILTONIAN FORMALISM;
COMMENTS: GOOD BASIC DEVELOPMENT OF AG FOCUSING AND LONGITUDINAL MOTION
REFERENCE: 16

CATFERRY; INFURY

DATE-FNT: 7

MICROFILM:

STOR-100; WP-9 SPFBG F11F1

105 TITLE....: MAGNETIC FIELDS FOR TRANSPORTING CHARGED BEAMS
SPEC-TITLE: BENDING MAGNETS; QUADRUPOLES; SEXTUPOLES; OCTUPOLES; SEPTUM MAGNETS; COMBINED FUNCTION
MAGNETS; ELECTROSTATIC SEPTUMS;

AUTHOR....: PARZEN, G.
AFFILIAT.: BNL

DOC-TYPE.: REPORT
PAGES.....: 98

REP-NUM.: BNL 58536
DATE-PUBL: 7/6/68

ABSTRACT.: THE TRANSPORT OF CHARGED PARTICLE BEAMS REQUIRES MAGNETIC FIELDS THAT MUST BE SHAPED CORRECTLY AND VERY ACCURATELY. DURING THE LAST 20 YEARS OR SO, MANY STUDIES HAVE BEEN MADE, BOTH ANALYTICALLY AND THROUGH THE USE OF COMPUTER PROGRAMS, OF VARIOUS MAGNETIC SHAPES THAT HAVE PROVED TO BE USEFUL. MANY OF THE RESULTS FOR MAGNETIC FIELD SHAPES CAN BE APPLIED EQUALLY WELL TO ELECTRIC FIELD SHAPES. THIS REPORT GATHERS TOGETHER THE RESULTS THAT HAVE MORE GENERAL SIGNIFICANCE AND WOULD BE USEFUL IN DESIGNING A CONFIGURATION TO PRODUCE A DESIRED MAGNETIC FIELD SHAPE.

THE FIELD SHAPES STUDIED INCLUDE THE FIELDS IN DIPOLES, QUADRUPOLES, SEXTUPOLES, OCTUPOLES, SEPTUM MAGNETS, COMBINED-FUNCTION MAGNETS, AND ELECTROSTATIC SEPTUMS. WHERE POSSIBLE, EMPIRICAL FORMULAS ARE PROPOSED, BASED ON COMPUTER AND ANALYTICAL STUDIES AND ON MAGNETIC FIELD MEASUREMENTS. THESE EMPIRICAL FORMULAS ARE OFTEN EASIER TO USE THAN ANALYTICAL FORMULAS AND OFTEN INCLUDE EFFECTS THAT ARE DIFFICULT TO COMPUTE ANALYTICALLY. IN ADDITION, RESULTS GIVEN IN THE FORM OF TABLES AND GRAPHS SERVE AS ILLUSTRATIVE EXAMPLES.

THE FIELD SHAPES STUDIED INCLUDE UNIFORM FIELDS PRODUCED BY WINDOW-FRAME MAGNETS, C-MAGNETS, H-MAGNETS, AND COSINE MAGNETS; LINEAR FIELDS PRODUCED BY VARIOUS TYPES OF QUADRUPOLES; QUADRATIC AND CUBIC FIELDS PRODUCED BY SEXTUPOLES AND OCTUPOLES; COMBINATIONS OF UNIFORM AND LINEAR FIELDS; AND SEPTUM FIELDS WITH SHARP BOUNDARIES.

SUBJECTS.: BEAM TRANSPORT; BENDING MAGNETS; QUADRUPOLE FOCUSING;

CATEGORY.: SYSTEM DESIGN

CAT-SOURCE: JAMESON DATE-ENT.: 7/10/77

MICROFILM:

STOR-LOC.: NP-9 SPECIFIC FILE;

1 106 TITLE....: COMPUTER AIDED EXTRACTOR DESIGN

AUTHOR...: COOPER, W.S.; HALBACH, K.; MAGYARY, S.R.;
AFFILIAT.: LBL

DOC-TYPE.: REPORT
PAGES....: 16

REF-NUM.: LBL-3317
DATE-PUBL: 741001

CONFERENCE: PROC SECOND SYMPOSIUM ON ION SOURCES AND FORMATION OF ION BEAMS, BERKELEY, CA, OCTOBER 22-25,
1974;

ABSTRACT.: WE HAVE DEVELOPED A COMPUTER PROGRAM, WOLF, WHICH SIMULATES ION EXTRACTION FROM A PLASMA
AND ACCELERATION THROUGH AN ELECTRODE STRUCTURE AND OPTIMIZES THE PERFORMANCE OF THE EXTRACTOR
(MINIMIZES THE FINAL BEAM DIVERGENCE) BY VARYING THE POTENTIALS, SHAPES, AND POSITIONS OF THE
ELECTRODES. WOLF ALSO FINDS THE SELF-CONSISTENT SHAPE AND POSITION OF THE PLASMA EQUIPOTENTIAL
REPRESENTING THE EMITTER. THE MEASURED PERFORMANCE OF OUR SLOT EXTRACTORS AGREES WELL WITH THE
COMPUTED PERFORMANCE BASED ON OUR MODEL FOR THE PLASMA IF THE IONS ARE ASSUMED TO HAVE A
TEMPERATURE OF ABOUT 1 EV AT THE EMITTER. THE MOST IMPORTANT FACTORS AFFECTING THE BEAM
DIVERGENCE ARE, IN DECREASING ORDER OF IMPORTANCE, 1) GROSS ELECTROSTATIC LENS EFFECTS,
INCLUDING THE SPACE-CHARGE OF THE IONS, 2) THE INITIAL ION TEMPERATURE, 3) THE SHAPE OF THE
FIRST, OR "BEAM-FORMING", ELECTRODE, AND 4) THE SHAPE AND POSITION OF THE PLASMA SHEATH EDGE,
OR EMITTER.

SUBJECTS.: ION SOURCE; EXTRACTOR; WOLF CODE; SPACE CHARGE;

REFERENCE: 11

CATEGORY.: SYSTEM DESIGN; SPACE CHARGE;

CAT-SOURCE: JAMESON DATE-ENT.: 771007

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE

107 TITLE....: A CRITICAL STUDY OF EMITTANCE MEASUREMENTS OF INTENSE LOW-ENERGY PROTON BEAMS

AUTHOR....: EVANS, I.W.; WANNER, D.J.;

AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT; PUBLICATION;

PAGES....: 30

RFP-NUM.: CERN/PPS/LIN 72-1

DATE-PUBL: 720308

JOURNAL.: NUCLEAR INSTRUMENTS AND METHODS 194, 61-70 (1972);

ABSTRACT.: THE MEASUREMENT OF EMITTANCE IN LOW ENERGY PROTON BEAMS SUFFERS FROM TWO PERTURBING EFFECTS: 1) THE NEUTRALISATION OF THE BEAM BY BACKSTREAMING SECONDARY ELECTRONS AND 2) THE SPACE CHARGE BLOW-UP OF THE BEAM SAMPLE BETWEEN DEFINING AND ANALYSING APPARATUS. AN EXPERIMENTAL STUDY SHOWS A SIGNIFICANT CHANGE OF THE EMITTANCE ORIENTATION WHEN BIAS IS USED TO ELIMINATE THE SECONDARY ELECTRONS. BIASED AND NON-BIASED CASES ARE ALSO COMPARED WITH COMPUTED DYNAMICS INCLUDING SPACE CHARGE. CRITERIA FOR THE SLIT SIZE AND DRIFT DISTANCE WHICH MAKE THE SPACE CHARGE BLOW-UP NEGLIGIBLE ARE DERIVED. IN ADDITION A TRANSVERSE COHERENT OSCILLATION OF THE PROTON BEAM, WHICH WAS REVEALED DURING THE MEASUREMENTS, IS DISCUSSED BRIEFLY.

SUBJECTS.: EMITTANCE MEASUREMENT; EMITTANCE; SPACE CHARGE; NEUTRALIZATION; BIASING;

COMMENTS.: SPACE CHARGE BLOWUP IN STRIP BEAMS, RELATIVE IMPORTANCE OF SPACE CHARGE AND EMITTANCE IN GOVERNING BEAM DYNAMICS, SECONDARY ELECTRON EMISSION FROM THE DEFINING APERTURES, EXPERIMENTAL DETAILS AND RESULTS, COMPARISON WITH DYNAMICS CALCULATIONS.

NOTES....: GEOMETRICAL RELATIONS GIVEN TO INSURE EMITTANCE TERM IS GREATER THAN SPACE CHARGE TERM IN MEASUREMENT; SECONDARY EMISSION COEFFICIENT FOR PERPENDICULAR IMPACT AT 100 KEV ABOUT 4, AT 500 KEV ABOUT 2, AT 3 MEV ABOUT 0.5; APERTURES MADE OF TANTALUM PLATES MOUNTED ON INVAR BARS; SLIT WIDTHS NEEDED AT 500 KEV WERE LESS THAN 0.3 MM (10-12 MILS) REPRODUCIBLE TO PLUS MINUS 0.1 MM.

SAW HIGH NOISE LEVEL (OSCILLATION) ON JAWS, EVEN THOUGH BEAM CURRENT ENVELOPE SHOWED LITTLE. WAS FUNCTION OF POSITION OF THE SLIT ACROSS THE BEAM, AND REACHED AS MUCH AS 50 PERCENT MODULATION NEAR THE EDGE. WAS DUE TO A COHERENT TRANSVERSE OSCILLATION AT 770 KHZ. WILL BE TRANSFORMED BY APERTURE FROM RADIAL OSCILLATION TO LONGITUDINAL DENSITY OSCILLATION. CAN BE MINIMIZED BY ADJUSTING ION SOURCE GAS PRESSURE AND MAGNETIC FIELD.

DID APERTURE SCANNING - 2 MM SLIT SCANNING 2 MM SLIT. CURRENT MEASUREMENTS MADE WITH XMM FAR DOWNSTREAM WITH LARGE PIPE FOLLOWING A CLEARING MAGNET.

MAIN EFFECT OF JAW BIASING (POSITIVE VOLTAGE) ON EMITTANCE MEASUREMENTS IS ROTATION; NOT MUCH EFFECT ON AREA OR TOTAL CURRENT IN GIVEN EMITTANCE. BIASING ACTS LIKE A LINEAR LENS PLUS DRIFT. PHYSICAL SIZE OF BEAM IS BIGGER WITH BIAS.

CURRENT VS EMITTANCE CURVES SEEM TO FIT UNIFORM DENSITY PHASE SPACE DISTRIBUTION IN SOME BETTER THAN GAUSSIAN. AGREEMENT BETWEEN THEORY AND EXPERIMENT BEST AT 160 MA WITH BIAS, WORSE EITHER SIDE IN CURRENT; BEST AT ZERO CURRENT WITH NO BIAS. NEUTRALIZATION DISTANCES TO AT LEAST 50 CM FROM THE APERTURES WERE OBSERVED.

REFERENCE: LOW ENERGY NEUTRALIZATION - M. KAMINSKY, ATOMIC AND IONIC IMPACT PHENOMENON, SPRINGER-VERLAG, BERLIN, 1965; + 10;

DATA-RECD: IMPORTANT FIGURES AND CHARTS;

CATEGORY.: EXPERIMENTAL ANALYSTS; SPACE CHARGE;

CAT-SOURC: JAMESON

DATE-ENT.: 771027

MICROFILM:

STOR-LOC.: HP-9 SPRG FILE:

1 12A TITLE....: TRANSVERSE SPACE-CHARGE EFFECTS IN BUNCHED BEAMS IN A TRANSPORT SYSTEM

AUTHOR....: CLAUS, J.
AFFILIAT.: RNL

DOC-TYPE.: INTERNAL REPORT
PAGES....: 16

REP-NUM.: RNL 13123; AACC-144;
DATE-PUBL: 680801

ABSTRACT.: TRANSPORT FROM THE END OF THE RNL LINAC TO THE AGS IS CONSIDERED, ASSUMING ZERO ENERGY SPREAD AND LONGITUDINAL SPACE CHARGE FORCES (DEBUNCHED) AND CYLINDRICAL SYMMETRY. NO FOCUSING, PERIODIC FOCUSING, STRONG FOCUSING, AND MOMENTUM RECOMBINING BENDS ARE CONSIDERED ANALYTICALLY, INCLUDING THE WAY MATCHED CONDITIONS CHANGE WITH CURRENT. NUMERICAL EXAMPLES ARE GIVEN. THE CONCLUSION IS THAT THE BEAM WILL SHOW EMITTANCE BLOWUP IN THE CHANNEL, WHICH MAY BE REDUCED BY STRONG FOCUSING, MATCHING, AND KEEPING ENERGY SPREAD SMALL.

SUBJECTS.: SPACE CHARGE; BEAM TRANSPORT; EMITTANCE GROWTH;

REFERENCE: 7

CATEGORY.: THEORY; ANALYSIS;

CAT-SOURCE: JAMESON DATE-ENT.: 771007

MICROFILM:

STOP-IND.: MP-9 SPERG FILE

1 109 TITLE....: PRELIMINARY SPACE CHARGE CONSIDERATIONS IN THE AGS

AUTHOR...: CLAUS, J.
AFFILIAT.: RAL

DOC-TYPE.: INTERNAL REPORT
PAGES....: 37

REP-NUM...: AADD-140
DATE-PUBL: 680311

ABSTRACT.: REVIEW OF HV 1959 PAPER AND APPLICATION TO AGS.

SUBJECTS.: CIRCULAR MACHINES; SPACE CHARGE;

REFERENCE: 10

CATEGORY.: SPACE CHARGE; CIRCULAR MACHINES;

CAT-SOURCE: JAMESON DATE-ENT.: 771007

MICROFILM:

STOR-LOC.: MP-9 SPACE FILE;

1 110 TITLE...: ON A UNIFORM CHARGE DENSITY OF A BEAM AND ITS PHASE SPACE DISTRIBUTION

AUTHOR...: OHNUMA, S.
AFFILIAT.: YALE UNIV

DOC-TYPE.: REPORT
PAGES...: 10

REP-NUM...: Y-16
DATE-PUB.: 660916

ABSTRACT.: STUDY OF THE KV DISTRIBUTION, BASED ON FOURIER TRANSFORM OF THE PARTICLE DISTRIBUTION.

SUBJECTS.: SPACE CHARGE; PHASE SPACE DISTRIBUTION;

REFERENCE: 6

CATEGORY.: THEORY; SPACE CHARGE;

CAT-SOURCE: JAMESON DATE-ENT.: 771027

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

111 TITLE.....: SPACE CHARGE DERUNCHING IN CHARGED PARTICLE BEAMS

AUTHOR....: INMAN, F.W.; MURAY, J.J.;
AFFILIAT.: UPAC; H-P;

DOC-TYPE.: JOURNAL ARTICLE
PAGES.....: 9

DATE-PUBL: 660400

JOURNAL...: IEEE TRANSACTIONS ON NUCLEAR SCIENCE, APRIL 1966;

ABSTRACT.: ONE OF THE FACTORS INFLUENCING THE PROPERTIES OF A PULSED BEAM IS THE GROWTH OF THE CHARGE BUNCHES DUE TO SPACE CHARGE FORCES. THE GROWTH ALONG THE DIRECTION OF MOTION OF THE BUNCH DEGRADES THE TIME-STRUCTURE OF THE PULSED BEAM AND THE GROWTH TRANSVERSE TO THE DIRECTION OF MOTION DE-FOCUSES THE BEAM. ALTHOUGH THE SPACE CHARGE EFFECT IS ONLY IMPORTANT AT HIGH CURRENT DENSITIES, IT MUST BE CONSIDERED A LIMITING FACTOR IN ANY PULSED BEAM SYSTEM. A GENERAL METHOD OF OBTAINING THE FIELD IN THE BUNCH TO SECOND ORDER IN V/C WAS DEVELOPED. FROM THIS THE MOTION OF CHARGES IN THE BUNCH WAS OBTAINED BY NUMERICAL INTEGRATION FOR THE CASE OF A GAUSSIAN DISTRIBUTION OF SPACE CHARGE UNDER THE ASSUMPTION THAT THE CHARGE DISTRIBUTION REMAINS GAUSSIAN. SOLUTIONS ARE PRESENTED IN A DIMENSIONLESS, GRAPHICAL FORM WHICH CAN EASILY BE SCALED FOR A PARTICULAR PROBLEM.

SUBJECTS.: SPACE CHARGE; DERUNCHING; GAUSSIAN DISTRIBUTION;

NOTES....: GROWTH RATIOS AND TIME DERIVATIVES OF DIMENSIONS ARE PLOTTED AGAINST NORMALIZED TIME FOR VARIOUS STARTING BUNCH SHAPES - PROLATE AND OBLATE SPHEROIDS.

CATEGORY.: SPACE CHARGE; NUMERICAL COMPUTATION; THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771007

MICROFILM;

STORE-LOC.: MP-9 SPERG FILE;

112 TITLE....: LIMITATIONS OF PROTON BEAM CURRENT IN A STRONG FOCUSING LINEAR ACCELERATOR ASSOCIATED WITH THE
BEAM SPACE CHARGE
SEC-TITLE: INTRO. EQUATIONS OF TRANSVERSE OSCILLATIONS; EQUATIONS FOR BEAM ENVELOPES; THE CASE OF SMOOTH
ENVELOPES; RESULTS OF NUMERICAL INTEGRATION OF EQUATIONS FOR ENVELOPES;

AUTHOR...: KAPCHINSKIY, I.M.; VLADIMIRSKIY, V.V.;
AFFILIAT.: ITEP, USSR

DOC-TYPE.: CONFERENCE ARTICLE
PAGES.....: 15

DATE-PUBL: 590000

CONFERENCE: PROC INTNATL CONF ON HIGH ENERGY ACCELERATORS, CERN, P 274-288 (1969);

ABSTRACT.: ESTIMATES OF THE DEPENDENCE OF BEAM SIZES WITH CURRENT AT DIFFERENT QUADRUPOLE FOCUSING
STRENGTHS AND PHASE VOLUMES ARE PRESENTED. A NUMBER OF SPECIAL CASES IN WHICH THE EQUATIONS OF
MOTION REMAIN LINEAR DUE TO SPECIAL CHOICE OF THE INITIAL PHASE SPACE DISTRIBUTION OF THE
PARTICLES. OTHER ASSUMPTIONS - BEAM CROSS-SECTION IS MUCH SMALLER THAN FOCUSING PERIOD,
PARTICLES MOVE IN LINEAR FIELD CLOSE TO AXIS, LOW PETA, GAP ENERGY INCREMENT IS SMALL SO
SYNCHROTRON OSCILLATION PERIOD IS MUCH GREATER THAN ACCELERATION PERIOD. MANY FIGURES ARE GIVEN
SHOWING DEPENDENCE OF BEAM RADIUS AND MATCHED INITIAL CONDITIONS UPON A DIMENSIONLESS COLLUM-
RADIUS.

SUBJECTS.: SPACE CHARGE; KV DISTRIBUTION; PHASE SPACE DISTRIBUTION; EMITTANCE GROWTH;

REFERENCE: 7

CATEGORY.: SPACE CHARGE; THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771007

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

113 TITLE....: SPACE CHARGE EFFECTS

AUTHOR....: TAYLOR, C.S.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 7

REP-NUM...: MPS/LIN - NOTE 6A-6
DATE-PUBL: 681018

ABSTRACT.: THIS NOTE CONCERNED WITH SPACE CHARGE EFFECT ON PARTICLE RADIAL MOTION IN A CONTINUOUS BEAM,
IN TERMS OF THE SIX PROJECTIONS OF A 4-D HYPERVOLUME, FOR UNIFORM AND NONUNIFORM DENSITY.

SUBJECTS.: SPACE CHARGE; PHASE SPACE DISTRIBUTION; EMITTANCE GROWTH;

NOTES..... SPACE CHARGE EFFECT IS EXPLAINED USING TWO POINTS IN THE PHASE SPACE AND SEEING WHAT
HAPPENS IN THE PROJECTIONS. EMITTANCE GROWTH DUE TO A NONUNIFORM CHARGE DISTRIBUTION IS
ESTIMATED.

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURC: JAMESON

DATE-ENT.: 771007

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

1 114 TITLE....: GROWTH OF PHASE SPACE IN HIGH INTENSITY PROTON BEAMS DUE TO NONUNIFORM RADIAL CHARGE DISTRIBUTION

AUTHOR....: TURNER, C.W.; BENNETT, G.W.;
AFFILIAT.: RNL

DOC-TYPE.: INTERNAL REPORT
PAGES....: 22

REF-NUM.: AADD-114
DATE-PUBL: 66072A

ABSTRACT.: SUMMARIZES RESULTS OF EFFORTS TO GET QUANTITATIVE INFORMATION ON THE RATE OF GROWTH OF APPARENT EMITTANCE AREA IN DRIFTING HIGH INTENSITY PROTON BEAMS WITH NONUNIFORM RADIAL CHARGE DISTRIBUTION.

SUBJECTS.: SPACE CHARGE; PHASE SPACE DISTRIBUTION; EMITTANCE GROWTH; HOLLOW BEAM;

NOTES....: USES METHOD OF BACKWARD PROJECTION TO A VIRTUAL SOURCE. THE PRODUCT OF VIRTUAL SOURCE DIAMETER TIMES THE ANGLE OF CONVERGENCE OF THE VIRTUAL TRAJECTORIES EQUALS EMITTANCE AREA. RESULTS FOR 780 KEV, 200 MA PROTONS WITH ZERO INITIAL EMITTANCE AREA AND RADIAL VELOCITY. TREATS UNIFORM CHARGE DISTRIBUTION, TRIANGULAR (WHERE EMITTANCE AREA INCREASED INITIALLY, DECREASED TO NEAR ZERO, AND THEN GREW AGAIN, DUE TO CHANGES IN CHARGE DISTRIBUTION), HOLLOW DISTRIBUTION, BEAM WITH NEGATIVE CORE GIVING CHARGE DENSITY EQUAL TO 50 MA, 780 KEV PROTONS.

HOLLOW DISTRIBUTIONS CAUSE MORE GROWTH THAN AXIALLY PEAKED ONES. QUESTIONS HOW MUCH PHASE SPACE GROWTH OCCURS FROM ION-SOURCE TO 750 KEV, WHETHER INITIAL EMITTANCE AREA OR UNIFORMITY OF RADIAL CHARGE DISTRIBUTION SHOULD BE OPTIMIZED AT THE ION SOURCE EXTRACTOR.

CATEGORY.: SPACE CHARGE; NUMERICAL COMPUTATION;

CAT-SOURC: JAMESON DATE-ENT.: 771027

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

115 TITLE....: SELF-CONSISTENT PARTICLE DISTRIBUTION AND THE LIMIT CURRENT IN LINEAR ACCELERATORS

AUTHOR....: BONDAREV, N.I.; VLASOV, A.D.;

AFFILIAT.: RTI, USSR

DOC=TYPE.: CONFERENCE ARTICLE

PAGES....: 4

DATE=PUHL: 650000

CONFERENCE: PROC INTNATL CONF ON HIGH ENERGY ACCELERATORS, FRASCATI, P 621-624 (1965);

ABSTRACT.: DEALS WITH THE PROBLEM OF SELF-CONSISTENT PARTICLE DISTRIBUTION IN LINACS, NEGLECTING EFFECTS OF NEIGHBORING BUNCHES, WALLS, OFF-AXIS BEAM, AND ELECTRON AND ION SPACE CHARGE OF RESIDUAL GAS. IT IS SHOWN THAT A UNIFORM CHARGE DISTRIBUTION WITHIN AN ELLIPSOID IS APPROXIMATELY SELF-CONSISTENT. EQUATIONS ARE GIVEN FOR LIMITING CURRENT.

SUBJECTS.: SPACE CHARGE; PHASE SPACE DISTRIBUTION; CURRENT LIMIT;

CATEGORY.: SPACE CHARGE; THEORY;

CAT=SOURCE: JAMESON

DATE=ENT.: 771007

MICROFILM:

STOR=LOC.: MP-9 SPERG FILE;

1
116 TITLE....: ON THE SPACE-CHARGE DIVERGENCE OF AN AXIALLY SYMMETRIC BEAM
SEC-TITLE: INTRO, NORMAL TREATMENT - NO BOUNDARY CONDITIONS; BEAM DIVERGENCE IN A COAXIAL CONDUCTING
CYLINDER; AN ALTERNATIVE APPROXIMATE TREATMENT; EXPERIMENTAL RESULTS;

AUTHOR....: HARRISON, F.R.
AFFILIAT.: APPE, HARWELL

DOC-TYPE.: PAPER
PAGES....: 8

DATE-PUBL: 580000

ABSTRACT.: AN EXAMINATION IS MADE OF THE ASSUMPTIONS CUSTOMARILY USED IN ESTIMATING THE EFFECT OF
SPACE-CHARGE IN AN AXIALLY SYMMETRIC BEAM. IT IS SHOWN THAT, SUBJECT TO CERTAIN RESTRICTIONS,
THE ASSUMPTIONS ARE CONSISTENT WITH A COAXIAL, CYLINDRICAL CONDUCTING BOUNDARY. FOR SMALL
AMOUNT OF DIVERGENCE IN AN INITIALLY PARALLEL BEAM, A HYPERBOLA SOLUTION IS PROPOSED AS AN
ALTERNATIVE TO THE USUAL SOLUTION WHICH INVOLVES A TABULATED FUNCTION. IT IS THEN ARGUED THAT
IN SOME CASES THERE IS REASON FOR RELIEVING THAT THE HYPERBOLA SOLUTION MAY BE AS GOOD, OR
BETTER, AN APPROXIMATION THAN THE USUAL, EVEN WHEN THE DIVERGENCE IS NOT SMALL.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH;

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURC: JAMESON DATE-ENT.: 771027

MICROFILM:

STOR-LOC.: MF-9 SPERG FILE;

117 TITLE.....: STEADY STATE ACCELERATION OF PARTICLES IN THE PRESENCE OF SPACE CHARGE

AUTHOR.....: IEREEV, A.N.; ZHILKOV, F.A.;
AFFILIAT.: P.N. LEBEDEV PHYS. INST., USSR

DOC-TYPE.: JOURNAL ARTICLE

PAGES.....: 7

DATE-PUBL: 660600

JOURNAL...: NUCLEAR INSTRUMENTS AND METHODS 45, 218-242 (1966);

ABSTRACT.: THE PHASE MOTION IN CYCLIC ACCELERATORS IN THE PRESENCE OF A PROPER FIELD OF A BUNCH IS INVESTIGATED. SELF-CONSISTENT STATIONARY DISTRIBUTIONS OF THE DENSITY AND THE CORRESPONDING DISTRIBUTIONS OF THE POTENTIAL ARE DETERMINED. A GENERAL EXPRESSION FOR THE CHARGE LIMIT IS OBTAINED, WHICH DOES NOT DEPEND ON THE DISTRIBUTION OF PARTICLES IN THE PHASE PLANE. IT IS SHOWN THAT EVEN IN THE ABSENCE OF AN EXTERNAL RF FIELD IT IS POSSIBLE TO HAVE A STEADY SELF-PHASED STATE DUE TO THE ACTION OF THE PROPER FIELD.

SUBJECTS.: SPACE CHARGE; PHASE SPACE DISTRIBUTION; CURRENT LIMIT;

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURC: JAMESON DATE-ENT.: 771007

MICROFILM:

STOR-LOC.: MP-9 SPHC FILE;

118 TITLE....: QUELQUES RELATIONS ENTRE DES DISTRIBUTIONS DE TYPE HYPERELLIPTIQUE DANS DES ESPACES A DEUX,
TROIS, QUATRE ET SIX DIMENSIONS (IN FRENCH)

AUTHOR...: LAPOSTOLLE, P.M.
AFFILIAT.: CERN

DOC-TYPE...: INTERNAL REPORT
PAGES....: 9

RFP-NUM...: ISR-304 LIN/64-42
DATE-PUBL: 661026

ABSTRACT.: SEE TITLE. ARTICLE IN FRENCH. RELATIONS BETWEEN HYPERELLIPTIC DISTRIBUTIONS IN 2, 3, 4
AND 6 DIMENSIONS.

SUBJECTS.: SPACE CHARGE; PHASE SPACE DISTRIBUTION; ELLIPSE FORMULATION;

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771007

MICROFILM:

STOR-LOC.: HP-9 SPERG FILE;

119 TITLE....: REMARQUES SUR LE COEFFICIENT "S" DE TEMPS DE TRANSIT (IN FRENCH)

AUTHOR...: LAPOSTOLLE, P.M.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 10

REP-NUM...: ISR-303 LIN/64-31
DATE-PUBL: 661025

ABSTRACT.: REMARKS ON THE TRANSIT TIME COEFFICIENT "S"

SUBJECTS.: TRANSIT TIME FACTOR; LINAC DESIGN;

CATEGORY.: LINAC DESIGN;

CAT-SOURC: JAMESON DATE-ENT.: 771007

MICROFILM:

STOR-LOC.: MP-9 SPRG FILE;

1

120 TITLE.....: ON THE RATE AND TYPE OF BLOWUP OF DENSE PARTICLE BEAMS

AUTHOR....: BLEWETT, J.P.
AFFILIAT.: RNL

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 11

REP-NUM...: A400-98
DATE-PUBL.: 660210

ABSTRACT.: THIS REPORT DESCRIBES A PRELIMINARY INVESTIGATION OF THE EFFECTS OF SPACE-CHARGE FIELDS IN DENSE BEAMS OF CHARGED PARTICLES. IT WILL BE SHOWN THAT A PARTICLE BEAM HAVING A UNIFORM DISTRIBUTION OF CHARGE WILL CONTINUE TO HAVE A UNIFORM CHARGE DISTRIBUTION, THE BELIEF THAT DENSE BEAMS TEND TO BECOME HOLLOW WILL BE SHOWN TO BE INCORRECT IN SEVERAL REPRESENTATIVE CASES.

THE RESULTS OF THE ABOVE ANALYSIS INDICATE THAT ANY CHARGE DISTRIBUTION IN A DENSE BEAM OTHER THAN A UNIFORM ONE IS UNDESIRABLE. IT CAN BE EXPECTED THAT APPARENT EMITTANCE WILL GRADUALLY INCREASE FOR ANY NON-UNIFORM DISTRIBUTION.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH; PHASE SPACE DISTRIBUTION;

NOTES.....: ASSUMES ZERO TRANSVERSE VELOCITY, NO TRAJECTORY CROSSING, HIGH ENOUGH ENERGY SO VELOCITY OF PARTICLES AT CENTER OF BEAM IS NOT SIGNIFICANTLY AFFECTED BY LOWER POTENTIAL THERE, BEAM TRAVELING IN FREE SPACE.

CATEGORY.: SPACE CHARGE, THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771007

MICROFILM;

STOR-LDC.: MP-9 SPERG FILE;

1 121 TITLE....: SPACE CHARGE EFFECTS ON THE QUADRUPOLE FOCUSING SYSTEM IN LOW ENERGY PROTON LINEAR ACCELERATORS

AUTHOR...: OHNUMA, S.
AFFILIAT.: YALE UNIV

DOC-TYPE.: INTERNAL REPORT
PAGES....: 43

REP-NUM.: Y-17
DATE-PUBL: 670119

ABSTRACT.: IN THE DESIGN OF A QUADRUPOLE FOCUSING SYSTEM, IT IS IMPORTANT TO CALCULATE THE STABILITY DIAGRAM AND ASSOCIATED BETATRON OSCILLATION PARAMETERS. WHEN THE CURRENT OF THE BEAM IS LARGE, IT BECOMES NECESSARY TO CONSIDER THE EFFECT OF SPACE CHARGE ON THESE PARAMETERS. A COMPUTER PROGRAM HAS BEEN PREPARED FOR THIS PURPOSE AND THE RESULTS ARE PRESENTED FOR (+) (-) (+) (-) QUADRUPOLE ARRANGEMENTS WHEN THE SPACE CHARGE IS UNIFORMLY DISTRIBUTED IN A THREE-DIMENSIONAL ELLIPSOID. ALTHOUGH THE PROGRAM ITSELF IS QUITE GENERAL, THE EFFECT OF THE IMAGE CHARGE IS NOT INCLUDED IN THE PRESENT RESULTS.

IN ORDER TO FIND THE LONGITUDINAL PHASE DAMPING APPROXIMATELY WHEN THE SPACE CHARGE EFFECT DESTROYS THE FAMILIAR (VELOCITY) $\sim 3/4$ DEPENDENCE, LINEARIZED EQUATIONS FOR THE LONGITUDINAL AND TRANSVERSE ENVELOPES OF THE PARTICLE BUNCH HAVE BEEN SOLVED SIMULTANEOUSLY ASSUMING THAT THE ELLIPSOIDAL SHAPE OF THE BUNCH IS MAINTAINED THROUGHOUT. RESULTS FOR TWO CASES ARE GIVEN IN TABLE I. WHEN THE CURRENT IS LARGE, IT IS NOT TOO EASY TO SUPPRESS THE "PULSATION" OF THE TRANSVERSE BEAM ENVELOPE DUE TO THE LONGITUDINAL "PULSATION"

SUBJECTS.: SPACE CHARGE; QUADRUPOLE FOCUSING; STABILITY DIAGRAM; LINAC DESIGN; PHASE DAMPING;

NOTES....: PARTICLES ASSUMED UNIFORMLY DISTRIBUTED IN ELLIPTIC CYLINDER OR IN ELLIPSOID, NO WALL EFFECTS. ALL PARTICLES GET SAME DEFOCUSING FROM ACCELERATING FIELD; THUS IMPORTANT COUPLINGS ARE NEGLECTED. LONGITUDINAL MOTION IS LINEARIZED AND ELLIPSOIDAL SHAPE MAINTAINED. FIELD FROM NEIGHBORING BUNCHES NEGLECTED. DIFFERENCE OF PARTICLE VELOCITIES IN BUNCH NEGLECTED.

SHOWS PULSATION IN PHASE AND RADIUS ALONG LINAC.

REFERENCE: 24

CATEGORY.: SPACE CHARGE; LINAC DESIGN; THEORY;

CAT-SOURC: JAHESON DATE-ENT.: 771007

MICROFILM;

STOR-LOC.: MP-9 SPRNG FILE;

122 TITLE....: INCOMPATIBILITY THEOREM IN THE THEORY OF LINEAR ACCELERATORS - A CASE STUDY

AUTHOR....: ZADIN, D.G.

AFFILIAT.: RTI, USSR

DOC-TYPE.: JOURNAL ARTICLE

PAGES.....: 12

DATE-PUBL: 760000

JOURNAL...: PARTICLE ACCELERATORS, VOL. 7, 151-162 (1976);

ABSTRACT.: THE INCOMPATIBILITY THEOREM (IT) STATING THAT RADIAL STABILITY AND PHASE STABILITY CANNOT BE OBTAINED SIMULTANEOUSLY IN THE LINAC ACCELERATING FIELD HAS BEEN USED TO ARGUE THAT SPECIAL FOCUSING DEVICES ARE INDISPENSABLE IN ANY LINAC. AS LATER SEVERAL SELF-FOCUSING SYSTEMS EVOLVED SOME LIMITATIONS WERE INTRODUCED IN THE THEOREM. HOWEVER, A NUMBER OF IMPLICIT IT ASSUMPTIONS REMAINED UNNOTICED. THIS PAPER PRESENTS AN ANALYSIS OF THE VARIOUS PROOFS AND "ILLUSTRATIVE" INTERPRETATIONS OF THE IT (E.G., THE PROOF USING THE FARNSHAW THEOREM AND MCILLAN'S PROOF) TO IDENTIFY BOTH ITS EXPLICIT AND IMPLICIT ASSUMPTIONS. IN PARTICULAR, EACH OF THE PROOFS ASSUMES THE ACCELERATING FIELD AMPLITUDE TO BE FLAT ALONG THE LINAC. AS SOON AS THIS ASSUMPTION IS ABANDONED THE FEASIBILITY OF SIMULTANEOUS RADIAL AND PHASE STABILITIES BECOMES APPARENT IN A TILTED-FIELD LINAC. IT IS NOTED IN PASSING THAT THE TRADITIONAL DEFINITION OF THE EQUIVALENT TRAVELING WAVE (THE "ACCELERATING WAVE") LACKS RIGOROUSNESS AND A NEW DEFINITION OF SUCH A WAVE ORBITING THE FOURIER DECOMPOSITION IS SUGGESTED. THE DIFFERENCE BETWEEN THE CONCEPT OF STABILITY AND THE CONCEPT OF FOCUSING BUNCHING IS EMPHASIZED TO SHOW THAT THE STABILITY CRITERIA COMMONLY USED MAY IN GENERAL BE AVOIDED IN THE ACCELERATING STRUCTURE.

SUBJECTS.: INCOMPATIBILITY THEOREM; RADIAL STABILITY; PHASE STABILITY; LINAC DESIGN; ALTERNATING PHASE FOCUSING; TILTED FIELD; PARAMETER SEARCH;

COMMENTS.: VERY INTERESTING PAPER.

NOTES.....: IMPORTANT COMMENTS ON SIMULTANEOUS RADIAL AND PHASE STABILITY. USE OF TILTED FIELD OUTLINED. PHASE TRAPPING REGION IS GREATER THAN 3π SURFS.

CATEGORY.: LINAC DESIGN; THEORY;

CAT-SOURC: JAMESON

DATE-ENT.: 771007

MICROFILM:

STOR-LOC.: HP-9 SPERG FILE;

123 TITLE....: BEAM DYNAMICS IN A PROTON LINAC WITH SPACE CHARGE

AUTHOR....: MARTINI, M.; PROME, M.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT; JOURNAL ARTICLE;
PAGES....: 16

REP-NUM.: CERN/MPS/LIN 49-14
DATE-PUBL: 490725

JOURNAL..: SEE ALSO 7TH INTNATL CONF ON HIGH ENERGY ACCELERATORS, YEREVAN, 1969;

ABSTRACT.: BEAM DYNAMICS CODES MAPRO1 AND MAPRO2 ARE PRESENTED AND COMPARED WITH RESULTS FROM BNL CODES. THE EQUATIONS OF MOTION TRANSFER THE SIX COORDINATES OF EACH PARTICLE, EVALUATING THEM AT FINITE INTERVALS A FEW TIMES DURING THE CELL LENGTH, IN CONTRAST WITH SMALL STEP INTEGRATION TECHNIQUES; IN PARTICULAR, EVALUATION OCCURS AT END OF FIRST QUAD, AT DYNAMICAL CENTER OF CELL WHERE AXIAL SYNCHRONOUS PARTICLE HAS TRAVELED 1/2 THE RF PERIOD, AT BEGINNING OF 2ND QUAD AND AT END OF CELL WHICH IS MIDDLE OF SECOND QUAD. SIMPLIFYING HYPOTHESES ARE: THE MOTION IS NON-RELATIVISTIC, AND MAGNETIC FIELD EFFECTS ARE IGNORED, NO BEAM LOADING, QUADRUPOLE MISALIGNMENTS OR FRINGING FIELDS, NEIGHBORING WALLS OR BUNCHES.

SPACE CHARGE EFFECT IS INTRODUCED AS AN IMPULSE TWICE PER CELL, AT CENTER OF DRIFT TUBES AND AT DYNAMICAL CENTER OF CELL.

IN MAPRO1 A SUM OVER PARTICLES METHOD IS USED, TO KEEP COMPUTATION TIME REASONABLE AND AVOID COLLISIONS, A PARTICLE IN CELL METHOD IS USED. (UP TO 27001 CELLS.) A CONVENIENT CELL SIZE IS ABOUT 1 MM X 1 MM. THE FORCES ARE PRECALCULATED AND A TABLE LOOKUP USED. FOUR QUADRUPOLE IMAGING IMPOSES A SYMMETRY CONSTRAINT, FOR 500 PARTICLES AND 37 SPACE CHARGE COMPUTATIONS, C/C MAPRO1 TIME WAS 4.5 MINUTES. THE TIME FOR ONE CALCULATION OF THE SPACE CHARGE TABLE IS ABOUT 2 SECONDS.

IN MAPRO2, THE SPACE CHARGE CALCULATION ASSUMES THAT THE REAL SPACE PARTICLE DISTRIBUTION CAN BE APPROXIMATED BY A GAUSSIAN HAVING THE SAME SECOND MOMENT WITH RESPECT TO CARTESIAN COORDINATES WITH ORIGIN IN THE BARYCENTER OF THE BUNCH. PROGRAM IS DESIGNED TO HANDLE 5000 PARTICLES (20000 EFFECTIVE). THE COORDINATES ARE ONLY STORED ONE SECTION AT A TIME, SAVING MEMORY. IT TAKES 34 SECONDS TO DO THE CASE OUTLINED ABOVE, ABOUT X4 LESS.

FOR COMPARISON PURPOSES, RESULTS HERE USE UNIFORM RANDOM FILLING OF 4-D TRANSVERSE HYPERELLIPTOID AND INDEPENDENT UNIFORM RANDOM FILLING OF ELLIPSE IN LONGITUDINAL PLANE. (HOWEVER, PROGRAM BUNCH CAN BE USED TO TAKE A DC BEAM THRU BUNCHERS IN 6-D AND OUTPUT RESULTS TO MAPRO. MAXIMUM LIKELIHOOD ESTIMATED 4-D GAUSSIAN WAS DERIVED FROM THE SIX PROJECTIONS.) RESULTS SHOW OUTPUT EMITTANCE VS INPUT EMITTANCE QUALITATIVELY LIKE CHASMAN'S; MAPRO2 YIELDS EMITTANCE GROWTHS ABOUT 20 PERCENT HIGHER THAN MAPRO1, CONSIDERED ACCEPTABLE. MESH SIZE IN MAPRO1 PROBABLY REDUCES SPACE CHARGE FORCES. ENVELOPES DIFFER BY AROUND 10 PERCENT, SHOWS EMITTANCE GROWTH VS INPUT BRIGHTNESS, INPUT VS OUTPUT CURRENT, TYPICAL MAPRO1 AND MAPRO2 OUTPUTS, AND INITIAL FILLING FROM BUNCH.

OUTPUT EMITTANCE WILL BE BETWEEN LOWER THRESHOLD AND ADMITTANCE LIMIT.

SUBJECTS.: SPACE CHARGE; BEAM DYNAMICS; MAPRO1 CODE; MAPRO2 CODE; EMITTANCE GROWTH; BRIGHTNESS; CURRENT LIMIT;

REFERENCE: 10

DATA-RECD: COMPARISON OF MAPRO1 AND MAPRO2; INDIRECT COMPARISON WITH BNL RESULTS;

CATEGORY.: LINAC DESIGN; SPACE CHARGE; NUMERICAL COMPUTATION; SOFTWARE;

CAT-SOURCE: JAMESON

DATE-ENT.: 771007

MICROFILM;

STOR-LOC.: MP-9 SPORG FILE;

124 TITLE....: BEAM LOADING IN LINEAR ACCELERATORS

AUTHOR....: LEISS, J.F.
AFFILIAT.: NRS

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES....: 14

DATE-PUBL: 650600

CONFERENCE: 1ST NATIONAL PARTICLE ACCEL CONF, WASHINGTON, D.C., MARCH 14-17, 1965;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-12, NO. 3, P 566 (JUNE 1965);

ABSTRACT.: THE INTERACTION OF THE BUNCHED PARTICLE BEAM IN A LINEAR ACCELERATOR WITH THE WAVEGUIDE STRUCTURE PRODUCES SEVERAL EFFECTS WHICH GO UNDER THE GENERAL NAME OF BEAM-LOADING. THESE EFFECTS INCLUDE REDUCTION, REDISTRIBUTION, AND PHASE SHIFT OF THE RF FIELD IN THE WAVEGUIDE, CHANGES IN THE TUNING OF THE WAVEGUIDE STRUCTURE, EXCITATION OF OTHER WAVEGUIDE MODES, AND VARIOUS TRANSIENT PHENOMENA.

A DISCUSSION OF THESE VARIOUS EFFECTS AND METHODS FOR THEIR CALCULATION WILL BE PRESENTED.

SUBJECTS.: BEAM LOADING; ACCELERATOR STRUCTURE; RF SYSTEM;

REFERENCE: 9

CATEGORY.: SYSTEM DESIGN; THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771010

MICROFILM:

STOR-LOC.: NP-9 SPERG FILE;

125 TITLE....: TRANSVERSE BEAM BLOW-UP IN A STANDING WAVE LINAC CAVITY

AUTHOR...: GLUCKSTERN, R.L.; RUTLER, H.S.;

AFFILIAT.: UNIV OF MASSACHUSETTS/LASL CONSULTANT MP-DD; LASL;

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;

PAGES....: 6

DATE-PUBL: 650600

CONFERENCE: 1ST NATIONAL PARTICLE ACCEL CONF, WASHINGTON, D.C., MARCH 10-12, 1965;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-12, NO. 3, P 607 (JUNE 1965);

ABSTRACT.: THE THEORY OF THE INTERACTION OF A BEAM WITH TRANSVERSE MODES IN A STANDING WAVE LINEAR ACCELERATOR IS SUMMARIZED AND APPLIED TO THE DESIGN PARAMETERS FOR RECENTLY PROPOSED PROTON LINACS. APPROXIMATE RESULTS ARE DERIVED FOR THE LIMITING CURRENT AND THESE ARE CHECKED AND EXTENDED BY DETAILED NUMERICAL CALCULATION OF THE BUILD-UP OF TRANSVERSE FIELDS. FOR THE CONTEMPLATED LINACS, THE CURRENT LIMIT IS OF THE ORDER OF 10 AMPERES, SAFELY ABOVE THE DESIGN VALUES.

SUBJECTS.: TRANSVERSE BEAM BLOWUP; ACCELERATOR STRUCTURE;

CATEGORY.: THEORY; NUMERICAL CALCULATION;

CAT-SOURCE: JAMESON

DATE-ENT.: 771010

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

1 126 TITLE....: CALCULATION OF SPACE CHARGE EFFECTS IN BEAM TRANSPORT

AUTHOR...: CATURA, P.C.

AFFILIAT.: PPA

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;

PAGES....: 5

DATE-PUBL: 650600

CONFERENC: 1ST NATIONAL PARTICLE ACCEL CONF, WASHINGTON, D.C., MARCH 10-12, 1965;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-12, NO. 3, P 630 (JUNE 1965);

ABSTRACT.: METHODS OF CALCULATING SPACE CHARGE EFFECTS WHICH ARE PRESENTLY AVAILABLE HAVE AS THEIR BASIS THE ASSUMPTION OF UNIFORM CHARGE DENSITY OVER THE BEAM CROSS SECTION. IN DESIGN OF A HIGH INTENSITY BEAM TRANSPORT SYSTEM, IT IS IMPORTANT TO KNOW HOW SENSITIVE PARAMETERS OF THE DESIGN ARE TO THIS ASSUMPTION. THIS QUESTION HAS BEEN INVESTIGATED BY PROPAGATING PHASE PLOTS ALONG THE BEAM AXIS FOR SPACE CHARGE FIELDS FROM BOTH A UNIFORM CHARGE DENSITY AND A CHARGE DENSITY GIVING A NORMAL DISTRIBUTION. NORMALIZATION WAS SUCH THAT THE FIELD FROM THE UNIFORM DENSITY WAS A LEAST-SQUARES FIT TO THE FIELD FROM THE CHARGE DENSITY OF NORMAL DISTRIBUTION. RESULTS OF COMPUTATIONS FOR 20 MA OF 3.0 MEV PROTONS INDICATE THAT WHILE THE PHASE PLOT SHOWED CONSIDERABLE DISTORTION FROM EFFECTS OF THE NORMAL CHARGE DENSITY, PARAMETERS OF THE PLOT WHICH EFFECT DESIGN OF A TRANSPORT SYSTEM WERE NOT CHANGED APPRECIABLY. FROM THESE CALCULATIONS IT SEEMS THAT UNLESS CLOSE MATCHING OF AN ACCEPTANCE PHASE PLOT IS IMPERATIVE, DESIGN OF A TRANSPORT SYSTEM IS RELATIVELY INSENSITIVE TO CHARGE DISTRIBUTION IN THE BEAM.

SUBJECTS.: SPACE CHARGE; BEAM TRANSPORT; PHASE SPACE DISTRIBUTION;

CATEGORY.: NUMERICAL CALCULATION;

CAT-SOURCE: JAMESON

DATE-ENT.: 771010

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

171

127 TITLE....: BEAM DYNAMICAL CALCULATIONS WITH REALISTIC FIELDS IN A DRIFT TUBE LINEAR ACCELERATOR

AUTHOR...: RICH, M.
AFFILIAT.: LASL

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES.....: 5

DATE-PUBL: 650600

CONFERENCE: 1ST NATIONAL PARTICLE ACCEL CONF, WASHINGTON, D.C., MARCH 10-12, 1965;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-12, NO. 3, P 639 (JUNE 1965);

ABSTRACT.: A METHOD FOR NUMERICAL BEAM DYNAMICS STUDIES OF DRIFT TUBE TYPE LINEAR ACCELERATORS USING ELECTROMAGNETIC FIELDS SIMILAR TO THOSE ENCOUNTERED IN ACTUAL MACHINES IS PRESENTED. RESULTS OF CALCULATIONS FOR A 90 MEV ACCELERATOR ARE GIVEN AND COMPARISONS MADE WITH SIMILAR CALCULATIONS IN WHICH THE AXIAL ELECTRIC FIELD IS ASSUMED SPATIALLY CONSTANT WITHIN THE ACCELERATING GAP.

SUBJECTS.: BEAM DYNAMICS; GAP FIELD DISTRIBUTION;

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771010

MICROFILM;

STOR-LOC.: MP-9 SPRNG FILE;

128 TITLE....: TRANSPORT OF INTENSE ION BEAMS
SEC-TITLE: SOLUTION OF THE ENVELOPE EQUATIONS; TRANSPORT AT HIGH ENERGY; TRANSPORT AT LOW ENERGY;
CRITIQUE OF THE ENVELOPE EQUATION APPROACH;

AUTHOR....: LANHEPTSON, G.; LASLETT, L.J.; SMITH, L.;
AFFILIAT.: LRL

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES.....: 3

DATE-PUBL: 770600

CONFERENCE: PROC 1977 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 16-18,
1977;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-24, NO. 3, P 993 (JUNE 1977);

ABSTRACT.: THE POSSIBILITY OF USING INTENSE BURSTS OF HEAVY IONS TO INITIATE AN INERTIALLY CONFINED
FUSION REACTION HAS STIMULATED INTEREST IN THE TRANSPORT OF INTENSE UN-NEUTRALIZED HEAVY ION
BEAMS BY QUADRUPOLE OR SOLENOID SYSTEMS. WE HAVE EXAMINED THIS PROBLEM IN SOME DETAIL, USING
NUMERICAL INTEGRATION OF THE COUPLED ENVELOPE EQUATIONS FOR THE QUADRUPOLE CASE. THE GENERAL
RELATIONS WHICH EMERGE ARE USED TO DEVELOP EXAMPLES OF HIGH ENERGY TRANSPORT SYSTEMS AND AS A
BASIS FOR DISCUSSING THE LIMITATIONS IMPOSED BY A TRANSPORT SYSTEM ON ACHIEVABLE INTENSITIES
FOR INITIAL ACCELERATION.

SUBJECTS.: SPACE CHARGE; CURRENT LIMIT; KV DISTRIBUTION; QUADRUPOLE FOCUSING; SOLENOIDAL FOCUSING; BEAM
TRANSPORT;

NOTES.....: INCOHERENT IMAGE FORCES EVALUATED AND CONSIDERED SMALL IN COMPARISON TO NONLINEAR FIELDS
FROM NONLINEARITIES IN THE CHARGE DISTRIBUTION. INVESTIGATED EQUILIBRIUM DISTRIBUTIONS FOR
ROUND BEAM IN FIELD-FREE REGION CONDUCTED BY SOLENOID - FOUND IN ALL CASES THE SPATIAL
DISTRIBUTION TENDS TOWARDS UNIFORMITY WITH INCREASING CURRENT, ALTHOUGH INDIVIDUAL PARTICLE
MOTION BECOMES HIGHLY NONLINEAR EXCEPT FOR THE KV DISTRIBUTION. NOT CLEAR WHETHER ANY OTHER
DISTRIBUTION IS BETTER THAN KV FOR A REAL BEAM DESCRIPTION. MANY OF THESE DISTRIBUTIONS ARE
STABLE FOR SMALL PERTURBATIONS, BUT KV IS UNSTABLE FOR A LARGE NUMBER OF MODES. HOWEVER, THEY
PREFER TO RELIEVE THE SPECIAL MATHEMATICAL PROPERTIES OF THE KV MAKE IT QUALITATIVELY CORRECT
FOR REALISTIC DISTRIBUTIONS.

THEIR METHOD DOES NOT LEND ITSELF DIRECTLY TO QUAD FOCUSING, BUT THEY TRACED PARTICLES IN A
FIELD WITH LINEAR PART FROM ENVELOPE EQUATION PLUS CURIC TERMS APPROPRIATE TO A PARABOLIC
DENSITY PROFILE OF THE SAME OUTER DIMENSION. RESULTS INDICATE A QUAD TRANSPORT MAY BE SUBJECT
TO UNSTABLE BEHAVIOR AT HIGH INTENSITY.

REFERENCE: 5

CATEGORY.: SPACE CHARGE; THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771010

MICROFILM:

STOR-LCC.: MP-9 SPRNG FILE;

1 129 TITLE....: ON THE GENERATION AND FOCUSING OF INTENSE ION BEAMS FOR PELLETT FUSION

AUTHOR...: REISER, M.
AFFILIAT.: UNIV OF MARYLAND

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES....: 3

DATE-PUBL: 770600

CONFERENCE: PROC 1977 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 16-18, 1977;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-24, NO. 3, P 1009 (JUNE 1977);

ABSTRACT.: THE CURRENT LIMITS OF MAGNETIC FOCUSING SYSTEMS ARE EXAMINED AND APPROXIMATE FORMULAS FOR LONG SOLENOIDS AND PERIODIC CHANNELS WITH SHORT LENSES (SOLENOIDS AND QUADRUPOLE DOUBLETS) ARE DERIVED. THE CHARACTERISTICS AND LIMITATIONS OF CONVENTIONAL SOURCES, PULSED ION DIODES, AND COLLECTIVE-FIELD ACCELERATORS FOR THE GENERATION OF INTENSE, ENERGETIC ION BEAMS ARE COMPARED. USE OF A COLLECTIVE-ION ACCELERATOR WITH DEBUNCHER IS SUGGESTED AS INJECTOR INTO AN INDUCTION ACCELERATOR.

SUBJECTS.: SPACE CHARGE; BEAM TRANSPORT; CURRENT LIMIT; QUADRUPOLE FOCUSING; SOLENOIDAL FOCUSING;

REFERENCE: 11

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURC: JAMESON DATE-ENT.: 771009

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

134 TITLE....: LONGITUDINAL AND TRANSVERSE SPACE CHARGE LIMITATIONS ON TRANSPORT OF MAXIMUM POWER BEAMS

AUTHOR...: KWHL, T.K.; MARTIN, P.L.;

AFFILIAT.: ANL

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;

PAGES....: 3

DATE-PUBL: 770600

CONFERENCE: PROC 1977 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 16-18, 1977;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-24, NO. 3, P 1025 (JUNE 1977);

ABSTRACT.: THE MAXIMUM TRANSPORTABLE BEAM POWER IS A CRITICAL ISSUE IN SELECTING THE MOST FAVORABLE APPROACH TO GENERATING IGNITION PULSES FOR INERTIAL FUSION WITH HIGH ENERGY ACCELERATORS. MASCHKE AND COURANT HAVE PUT FORWARD EXPRESSIONS FOR THE LIMITS ON TRANSPORT POWER FOR QUADRUPOLE AND SOLENOIDAL CHANNELS. WE HAVE INCLUDED IN A MORE GENERAL WAY THE SELF CONSISTENT EFFECT OF SPACE CHARGE DEFOCUSING ON THE POWER LIMIT. THE RESULTS SHOW THAT NO LIMITS ON TRANSMITTED POWER EXIST IN PRINCIPAL. IN GENERAL, QUADRUPOLE TRANSPORT MAGNETS APPEAR SUPERIOR TO SOLENOIDS EXCEPT FOR TRANSPORT OF VERY LOW ENERGY AND HIGHLY CHARGED PARTICLES. LONGITUDINAL SPACE CHARGE EFFECTS ARE VERY SIGNIFICANT FOR TRANSPORT OF INTENSE BEAMS.

SUBJECTS.: SPACE CHARGE; BEAM TRANSPORT; CURRENT LIMIT; QUADRUPOLE FOCUSING; SOLENOIDAL FOCUSING;

REFERENCE: F.D. COURANT, ERDA SUMMER STUDY OF HEAVY IONS FOR INERTIAL FUSION, REPORT NO. LBL-5543, P 72 (DECEMBER 1976);

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURCE: JAMESON

DATE-ENT.: 771000

MICROFILM:

STAR-LOC.: KP-9 SPERG FILE

1 131 TITLE....: THE ACCELERATOR-BREEDER, AN APPLICATION OF HIGH-ENERGY ACCELERATORS TO SOLVING OUR ENERGY PROBLEMS

AUTHOR...: GRAND, P.; BATCHELOR, K.; POWELL, J.R.; STEINBERG, M.;
AFFILIAT...: RNL

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES....: 3

DATE-PUBL: 770600

CONFERENCE: PROC 1977 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 16-18, 1977;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-24, NO. 3, P 1043 (JUNE 1977);

ABSTRACT.: THE RISING COSTS OF U235 AND OTHER FOSSIL FUELS, AND THE SCHEDULE FOR IMPLEMENTING THE BREEDER REACTOR HAVE RENEWED INTEREST IN THE UTILIZATION OF ACCELERATORS FOR BREEDING U233 OR PU239. THIS PAPER DISCUSSES SOME OF THE BASIC ACCELERATOR PARAMETERS AND CHOICES TO BE MADE IN ORDER TO MEET THE TECHNICAL AND ECONOMIC REQUIREMENTS OF SUCH A FACILITY.

SUBJECTS.: ACCELERATOR-BREEDER; ENFP; SYSTEM DESIGN;

REFERENCE: 11

CATEGORY.: SYSTEM DESIGN; ENFP;

CAT-SOURCE: JAMESON DATE-ENT.: 771009

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1 132 TITLE....: DEVELOPMENT OF KEK INJECTOR LINAC
AUTHOR...: TANAKA, J., ET AL.:
AFFILIAT.: KEK
DOC-TYPE.: CONF PAPER, JOURNAL ARTICLE,
PAGES.....: 3 DATE-PUBL: 770600
CONFERENCE: PROC 1977 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 16-18,
1977;
JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-24, NO. 3, P 1124 (JUNE 1977);
ABSTRACT.: OPERATING PERFORMANCE OF 20 MEV KEK LINAC TO CURRENTS OF 150 MA. MEASURED NORMALIZED
EMITTANCE AT 20 MEV FOR 90 PERCENT OF THE BEAM IS 0.62 PI CM MRAD IN VERTICAL AND 0.54 PI CM
MRAD IN HORIZONTAL FOR 137 MA ACCELERATED BEAM.
SUBJECTS.: SPACE CHARGE; OPERATING EXPERIENCE;
REFERENCE: R
CATEGORY.: SPACE CHARGE; OPERATING EXPERIENCE;
CAT-SOURCE: JAMESON DATE-ENT.: 771009
MICROFILM;
STOR-LOC.: MP-9 SPRNG FILE;

133 TITLE....: THEORY OF LONGITUDINAL INSTABILITY FOR BUNCHED ELECTRON AND PROTON BEAMS

AUTHOR....: RUGGIERO, A.R.
AFFILIAT.: ENAL

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES.....: 3

DATE-PUBL: 770600

CONFERENC: PROC 1977 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 16-18, 1977;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-24, NO. 3, P 1205 (JUNE 1977);

ABSTRACT.: WE DISCUSS AN ORIGINAL APPROACH FOR THE TREATMENT OF THE LONGITUDINAL STABILITY OF HIGH-INTENSITY PROTON AND ELECTRON BUNCHES. THE GENERAL ANALYSIS IS DIVIDED IN THREE STEPS. FIRST, WE SEARCH FOR A STATIONARY BUNCH DISTRIBUTION WHICH IS MATCHED TO THE EXTERNAL RF FORCES AS WELL AS TO THE CURRENT DEPENDENT INDUCED FIELDS. WE QUESTION THE EXISTENCE OF SUCH DISTRIBUTION. SECOND, WE CHECK THE STABILITY OF THE STATIONARY SOLUTION BY APPLYING A SMALL PERTURBATION AND OBSERVING WHETHER THIS IS INITIALLY DAMPED OR NOT. AT THIS POINT A STABILITY CONDITION IS DERIVED IN TERMS OF CURRENT, SURROUNDING IMPEDANCE AND BUNCH SIZE. IN THE LAST STEP ONE SHOULD QUESTION WHAT HAPPENS TO THE BEAM IN CASE THE STABILITY CONDITION IS NOT SATISFIED. THE PROBLEM HERE IS THE DETERMINATION OF THE FINAL BUNCH CONFIGURATION. WE WILL NOT DEAL MUCH WITH THIS STEP. WE OBSERVE THAT THE "OVERSHOOT FORMULA" WHICH IS DERIVED FROM NUMERICAL CALCULATION IS USUALLY APPLIED TO PROTON BUNCHES, WHEREAS COMMONLY THE ASSUMPTION IS MADE AN ELECTRON BUNCH MATCHES ALWAYS ITS SIZE TO THE STABILITY CONDITION.

THE ORIGINALITY OF OUR APPROACH STAYS IN THE COMBINATION OF THE THREE STEPS. ALL PREVIOUS THEORIES EITHER CONSIDER ONLY THE FIRST STEP OR COMBINE THE SECOND AND THIRD ONES BUT DISREGARD THE FIRST. SOMETIMES, IN THE LATTER CASE, THE MODIFICATION OF THE POTENTIAL WELL IS INTRODUCED AD HOC.

OUR THEORY APPLIES TO THE CASE OF A REAL FREQUENCY INDEPENDENT IMPEDANCE.

SUBJECTS.: SPACE CHARGE; LONGITUDINAL INSTABILITY; CIRCULAR MACHINES;

NOTES.....: DISAGREES WITH SACHERER AND HERFORD ON SOME POINTS. APPLIED MOSTLY TO CIRCULAR MACHINES.

REFERENCE: 11

CATEGORY.: SPACE CHARGE; THEORY; CIRCULAR MACHINES;

CAT-SOURCE: JAMESON DATE-ENT.: 771009

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

130 TITLE...: STRUCTURE RESONANCES IN PROTON LINEAR ACCELERATORS

AUTHOR...: BARKHODARYAN, A.V.; KOSHKAREV, D.G.;

AFFILIAT.: ITEP, USSR

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;

PAGES....: 3

DATE-PUBL: 770600

CONFERENCE: PROC 1977 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 16-19, 1977;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-24, NO. 3, P 1411 (JUNE 1977);

ABSTRACT.: CONSIDERS EFFECT OF FOCUSING CHANNEL PERTURBATIONS WITH SIGNIFICANT COMPONENTS AT FREQUENCY MULTIPLES OF THE FOCUSING PERIOD. NONLINEARITIES IN THE MAGNETIC FIELD AND RANDOM PERTURBATIONS OF THE FOCUSING FIELD ARE CONSIDERED. PARTICLE LOSSES ARE ESTIMATED; LOSSES AT THE 10^{-4} LEVEL ARE PREDICTED FOR THE PARAMETERS OF THE MESON FACTORY LINAC WHEN PASSING THROUGH THE $1/4$ RESONANCE, FOR FIELD NONLINEARITIES ON THE ORDER OF ONE PERCENT.

SUBJECTS.: BEAM LOSS; ACCELERATOR STRUCTURE RESONANCES; RF FIELD ERRORS; BEAM SPILL; ERROR TOLERANCE;

REFERENCE: 4

CATEGORY.: LINAC DESIGN; THEORY;

CAT-SOURCE: JAMESON

DATE-ENT.: 771009

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1
135 TITLE....: RE PERTURBATION MEASUREMENTS IN LONG LINAC CAVITIES - 670600

AUTHOR...: OWEN, C.W.; RADMER, C.A.; YOUNG, D.E.;
AFFILIAT.: MURA

DOC-TYPE.: CONF PAPER, JOURNAL ARTICLE;
PAGES....: 4

DATE-PUBL: 670600

CONFERENCE: U.S. NATIONAL PARTICLE ACCEL CONF. WASHINGTON, D.C., MARCH 1-3, 1967;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-14, NO. 3, P 286 (JUNE 1967);

ABSTRACT.: BEAD SIZE EFFECTS ARE CONSIDERED. NO BALL SIZE EFFECT FOR BALLS UP TO 0.25 IN DIAMETER WAS APPARENT OVER THE REGION OF THE GEOMETRIC GAP, AND IN THE HOLE HALF THE ACCURACY OF THE MEASUREMENT WAS NOT SUFFICIENT TO DETERMINE THE CORRECTION. THE STRONG COUPLING IN AN (UNCOMPENSATED) LONG STRUCTURE RESULTS IN THE SPREADING OF THE BEAD PERTURBATION IN ONE CELL TO MANY OTHER CELLS. THIS SHOWS UP AS A FIELD TILT (MAY BE OF ORDER SEVERAL PERCENT) IN THE MEASUREMENT AND A CORRECTION MUST BE MADE.

SUBJECTS.: FIELD DISTRIBUTION; BEAD PERTURBATION MEASUREMENT; MEASUREMENT ERROR;

REFERENCE: 4

CATEGORY.: MEASUREMENTS, ERROR ANALYSIS;

CAT-SOURC: JAMESON DATE-ENT.: 771014

MICROFILM;

STOR-LOC.: MP-9 SPEC FTL;

136 TITLE....: REVISED LINAC BEAM DYNAMICS EQUATIONS

AUTHOR....: SCHNITZER, P.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES.....: 5

DATE-PUBL: 67H600

CONFERENCE: U.S. NATIONAL PARTICLE ACCEL CONF, WASHINGTON, D.C., MARCH 1-3, 1967;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-14, NO. 3, P 557 (JUNE 1967);

ABSTRACT.: THE SET OF EQUATIONS FOR PHOTON LINAC BEAM DYNAMICS GIVEN BY P. LAPOSTOLLE AT THE FRASCATI CONFERENCE (1965) IS DERIVED AGAIN BY A MORE RIGOROUS METHOD AND EXTENDED TO INCLUDE RELATIVISTIC EFFECTS. THIS IS ACCOMPLISHED BY A SYSTEMATIC CLASSICAL PERTURBATION THEORY USING EXPANSIONS WITH RESPECT TO SMALL PERTURBATION PARAMETERS, ONE DESCRIBING THE INFLUENCE OF THE FIELD ON THE FREE-PARTICLE MOTION, THE OTHER RELATIVISTIC EFFECTS. THIS PERMITS ESTIMATES OF THE ACCURACY.

THE FORMULAE GIVEN IN THIS PAPER AND DERIVED BY FIRST ORDER PERTURBATION THEORY SEEM TO BE SUFFICIENT (FOR SAY 3-4 PERCENT) TO TREAT BEAM DYNAMICS IN A LINAC GAP AS LONG AS SPACE CHARGE EFFECTS AND RADIATION LOSSES CAN BE NEGLECTED, FOR ANY ENERGY OF THE PROTONS GREATER THAN 5 MEV. AT LOWER ENERGIES THE 2ND ORDER EFFECTS BECOME IMPORTANT, AT 0.5 MEV THEY COULD RISE TO 12 PERCENT. UNFORTUNATELY THERE EXIST AT PRESENT NO EXPRESSIONS FOR THESE. NUMERICAL INVESTIGATIONS IN SIMPLE CASES SHOW THAT, AS FAR AS ENERGY GAIN IS CONCERNED, 1ST ORDER RESULTS ARE AS ACCURATE AS 1 PERCENT EVEN AT 0.5 MEV, BUT ENERGY IS STATIONARY, WHILE THE OTHER QUANTITIES ARE NOT.

SUBJECTS.: BEAM DYNAMICS; TRANSIT TIME FACTOR; S-COEFFICIENT;

NOTES....: ZERO SPACE CHARGE AND RADIATION LOSS.

REFERENCE: 5

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771014

MICROFILM:

STOW-LOC.: MP-9 SPRNG FILE;

137 TITLE....: SPACE-CHARGE EFFECTS ON THE QUADRUPOLE FOCUSING SYSTEM IN LOW-ENERGY PROTON LINEAR ACCELERATORS

AUTHOR....: OHNUMA, S.; VITALE, J.N.;

AFFILIAT.: YALE UNIV

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;

PAGES....: 8

DATE-PUBL: 670600

CONFERENCE: U.S. NATIONAL PARTICLE ACCEL CONF, WASHINGTON, D.C., MARCH 1-3, 1967;

JOURNAL...: IEEE TRANS, NUCL, SCI., VOL. NS-14, NO. 3, P 590 (JUNE 1967);

ABSTRACT.: A GENERAL COMPUTER PROGRAM HAS BEEN USED TO CALCULATE THE STABILITY DIAGRAM FOR (+)(-)(+)(-) QUADRUPOLE ARRANGEMENTS WHEN THE SPACE CHARGE IS UNIFORMLY DISTRIBUTED IN AN ELLIPTIC CYLINDER OR AN FILIPSOID. LINEARIZED EQUATIONS FOR LONGITUDINAL AND TRANSVERSE ENVELOPES OF THE BUNCH HAVE BEEN SOLVED SIMULTANEOUSLY IN ORDER TO FIND THE VELOCITY DEPENDENCE OF THE PHASE DAMPING.

SUBJECTS.: SPACE CHARGE; STABILITY DIAGRAM; BEAM TRANSPORT; COUPLING;

REFERENCE: 21

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON

DATE-ENT.: 771014

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

13R TITLE....: COMPUTER CALCULATIONS OF EFFECT OF SPACE CHARGE ON LONGITUDINAL BEAM DYNAMICS IN PROTON LINEAR ACCELERATORS

AUTHOR....: BENTON, A.; CHASMAN, R.W.; AGRISELLIS, C.;
AFFILIAT.: RNL

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES.....: 4

DATE-PUBL: 670600

CONFERENCE: U.S. NATIONAL PARTICLE ACCEL CONF, WASHINGTON, D.C., MARCH 1-3, 1967;

JOURNAL..: IEEE TRANS. NUCL. SCI., VOL. NS-14, NO. 3, P 577 (JUNE 1967);

ABSTRACT.: MODELS ASSUMING CYLINDRICAL SYMMETRY AND A FIXED TRANSVERSE BEAM RADIUS BUT ALLOWING ONLY LONGITUDINAL VARIATION OF CHARGE DENSITY ARE STUDIED BY NUMERICAL COMPUTATION.

IN THE POINT-DISK (PD) PROGRAM, THE CONTRIBUTIONS OF THE INDIVIDUAL DISKS TO THE FORCE AT A POINT ON THE AXIS ARE SUMMED; THE POINT-DISK-IMAGE (PDI) (MODEL USED BY MORTON) IS OBTAINED IN THE SAME WAY BUT INCLUDES THE EFFECTS OF IMAGE CHARGES INDUCED ON ORBIT TUBES AND THE INFLUENCE OF NEIGHBORING BUNCHES; THE DISK-DISK (DD) CALCULATION STARTS FROM THE FORCE BETWEEN TWO COAXIAL CHARGED DISKS AND SUMS THE CONTRIBUTION FROM ALL OTHER DISKS TO THE FORCE ON ANY ONE OF THEM.

RESULTS SHOW CONSIDERABLY MORE CURRENT (FACTOR OF 2.5-5) CAN BE ACCELERATED THAN PREDICTED BY THEORY USING STATIC CALCULATIONS WHICH DO NOT CONSIDER ACCELERATION. THESE THEORIES SHOW LIMITING CURRENTS ARE REACHED FOR SPACE CHARGE/RF LINEAR RESTORING FORCE RATIOS OF 0.3 TO 1.0. COMPUTER CALCULATIONS WERE REPEATED FOR A SIMULATED NON-ACCELERATING LINAC AND VERY GOOD AGREEMENT WITH THE THEORY WAS OBTAINED. THE ASSUMPTION OF A UNIFORMLY CHARGED ELLIPSOIDAL DISTRIBUTION IS SATISFACTORY FOR CURRENTS UP TO ABOUT 30 MA.

SUBJECTS.: SPACE CHARGE; LONGITUDINAL DYNAMICS; PHASE SPACE DISTRIBUTION; CURRENT LIMIT;

REFERENCE: 11 + K.T. BONDAREV, A.D. VLASOV, J. NUCL. ENERGY, PART C 8, 599 (1966);

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771014

MICROFILM;

STOP-LOC.: MP-9 SPFCG FILE;

139 TITLE....: ON THE DESIGN OF A HIGH INTENSITY PROTON LINEAR ACCELERATOR

SEC-TITLE: BUNCHING; CONVENTIONAL BUNCHER; ADIABATIC BUNCHER; PROPOSED DOUBLE BUNCHER; STUDIES TO BE MADE; ACCELERATION; DISTANT EFFECT; BEAM LOADING - FREQUENCY SHIFT; LOCAL EFFECT; TRANSVERSE AND LONGITUDINAL SPACE CHARGE EFFECTS; PHASE LAW PROPOSED FOR A HIGH-INTENSITY LINEAR ACCELERATOR; STUDIES TO BE MADE; CHOICE OF STRUCTURES - TRANSIENTS;

AUTHOR....: LAPOSTOLLE, P.M.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES....: 5

DATE=PUBL: 670600

CONFERENCE: U.S. NATIONAL PARTICLE ACCEL CONF, WASHINGTON, D.C., MARCH 1-3, 1967;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-14, NO. 3, P 572 (JUNE 1967);

ABSTRACT.: SEE TITLE AND SEC-TITLE. CONVENTIONAL SINGLE BUNCHERS SHOW A REDUCED TRAPPING EFFICIENCY DUE TO SPACE CHARGE ACTING OVER A DRIFT LENGTH. THE ADIABATIC BUNCHER WILL HAVE ROUGHLY THE SAME LIMIT. A DOUBLE BUNCHER, AT THE SAME OR WITH HARMONIC FREQUENCIES, IS SUGGESTED. THE DISTANT EFFECT REFERS TO BEAM LOADING BY THE DC COMPONENT OF THE BEAM. A PHASE LAW STARTING FROM 45-60 DEGREES AND REDUCING ALONG THE ACCELERATOR TO 20-25 DEGREES IS SUGGESTED. FURTHER REDUCTION WOULD MAKE AMPLITUDE TOLERANCES TOO CRITICAL. TRADE-OFFS ARE SUGGESTED, FOR EXAMPLE, A CHOICE WHICH WOULD KEEP THE BUCKET AREA CONSTANT, OR WOULD MINIMIZE THE NON-LINEAR TERMS IN THE EQUATIONS OF NON-LINEAR MOTION $(\Phi - \text{SUR} = S / \Phi - \text{SUR} = S, 0) = (V - \text{SU} - S / V - \text{SUR} = S, 0) \approx 3/5$ FOR THE LATTER. FOR CONSTANT BEAM DIAMETER, THE EXPONENT IS 1/3. ALLOWING THE BEAM SIZE TO GROW BUT LIMITING THE GROWTH TO BEING SLOWER THAN THE INCREASE IN VELOCITY SO AS NOT TO PRODUCE UNNECESSARY COUPLING BETWEEN RADIAL AND LONGITUDINAL MOTIONS CORRESPONDS TO AN EXPONENT OF 2/3 ABOVE. SUGGESTS LOWER FREQUENCIES AND LARGE DIAMETER BEAMS AT INJECTION MIGHT BE ATTRACTIVE, AND MAYBE SEVERAL LINACS OPERATING AT A SUB-HARMONIC COULD FILL ALL THE BUCKETS OF A SUBSEQUENT HIGHER FREQUENCY ACCELERATOR. INVESTIGATION OF EXPECTED EMISSIONS IS A PRIMARY REQUIREMENT.

SUBJECTS.: SPACE CHARGE; PARAMETER SEARCH; SYNCHRONOUS PHASE LAW; LINAC DESIGN;

REFERENCE: 20 + P. HORTON, "LONGITUDINAL SPACE CHARGE EFFECTS", RSI, 36, P 1826 (1965);

CATEGORY.: LINAC DESIGN;

CAT-SOURCE: JAMESON DATE=ENT.: 771014

MICROFILM;

STOP-LOC.: NP-9 SPORG FILE;

140 TITLE....: MEASUREMENTS AND CALCULATIONS ON THE 50-MEV BROOKHAVEN LINAC

AUTHOR...: HATCHER, K.; CHASMAN, R.W.; WERNITZ, T.;
AFFILIAT.: RNL

DOC-TYPE.: CONF PAPER
PAGES....: 6

REP-NUM...: LA-3609
DATE-PUBL: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3609 P. 2A;

ABSTRACT.: THE PROPOSED ACS CONVERSION PROGRAM CALLS FOR ACCELERATED PEAK BEAM CURRENTS IN EXCESS OF 100 MA FROM THE NEW INJECTOR LINAC. THE DATA PRESENTED REPRESENT A SERIES OF MEASUREMENTS AND CALCULATIONS CARRIED OUT ON THE EXISTING LINAC. ALTHOUGH THE RESULTS WERE TAKEN WITH AN ACCELERATED BEAM CURRENT IN THE REGION OF 30 MA, MANY OF THE RESULTS ARE DIRECTLY APPLICABLE TO THE NEW PROPOSAL SINCE THE PRESENT CAVITY LENGTH IS MORE THAN ONE AND A HALF TIMES GREATER THAN ANY CAVITY IN THE NEW PROPOSAL. MEASUREMENTS OF THE TRANSIENT AND STEADY-STATE PHASE AND AMPLITUDE CHANGES BETWEEN CENTER AND END OF THE CENTER-FED CAVITY ARE PRESENTED, TOGETHER WITH CALCULATED VALUES OBTAINED FROM THE THEORY OF T. NISHIKAWA. BEAM ENERGY MEASUREMENTS ARE ALSO PRESENTED TOGETHER WITH SOME COMPUTATIONAL DATA FROM BROOKHAVEN AND FROM D. YOUNG AT MURK.

SUBJECTS.: PHASE SPACE DISTRIBUTION; BEAM LOADING; LONGITUDINAL TUNING; ENERGY SPECTRA;

NOTES....: SENSITIVITY OF OUTPUT ENERGY (OR PHASE) SPREAD TO RF LEVEL. OUTPUT PHASE EQUALS INPUT PHASE PLUS INTEGRAL FROM INPUT TO OUTPUT OF $k \sin \theta - L$ DS, WHERE $k \sin \theta - L$ IS LONGITUDINAL WAVE NUMBER. WITH FLAT FIELD IN RNL MACHINE, A 3 PERCENT RF LEVEL CHANGE GIVES 180 DEGREES CHANGE IN OUTPUT PHASE; I.E. 1.5 PERCENT TO GO FROM MINIMUM TO MAXIMUM SPREAD.

PHASE SHIFT OF 2-3 DEGREES WAS MEASURED ALONG THE 100 FT. STRUCTURE AT 32 MA ACCELERATED CURRENT. FIELD AMPLITUDE VARIATION DUE TO 30 MA BEAM LOADING WITH A 10 PERCENT COMPENSATION PULSE WAS ABOUT ONE PERCENT 50 FEET FROM THE DRIVE POINT. EXTRA PHASE SHIFT OF ABOUT 2 DEGREES WAS INTRODUCED BY THE COMPENSATION PULSE, IN THE SAME DIRECTION. (NO PHASE COMPENSATION USED; ALSO NO POST COUPLERS IN TANK.)

REFERENCE: 5

CATEGORY.: EXPERIMENTAL ANALYSIS; MEASUREMENTS; OPERATING EXPERIENCE;

CAT-SOURCE: JAMESON DATE-ENT.: 771010

MICROFILM:

STOR-LOC.: NP-9 SPECG FILE;

141 TITLE....: PROGRESS REPORT ON THE CERN-PS LINAC

AUTHOR...: TAYLOR, C.S.; WARNER, D.J.; RIDCK, F.; TETU, P.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 12

REF-NUM...: LA-3600
DATE-PUBL: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3600, P. 48;

ABSTRACT.: THIS PAPER DISCUSSES THE BEHAVIOUR OF THE CERN-PS LINAC AT CURRENTS OF 50 TO 100 MA. THE DIFFICULTIES OF BUNCHING AT THE HIGHER CURRENTS ARE FIRST DESCRIBED, AND THEN THE TRANSVERSE BEAM PROPERTIES AT 50 - 60 MA, IN PARTICULAR BLOWUP, ARE DISCUSSED IN DETAIL AS A BACKGROUND TO THE BEHAVIOUR AT 100 MA. THE MEASURES WHICH ARE BEING TAKEN TO COMBAT BEAM LOADING ARE DESCRIBED, AND THE HEATING EFFECTS OF THE HIGH BRILLIANCE 500 KEV BEAM MENTIONED. A METHOD OF EMITTANCE MEASUREMENT USING A COMPUTER IS REPORTED, AND WE GIVE SOME COMMENTS ON OUR EXPERIENCE WITH THE STATISTICAL ANALYSIS OF MACHINE PARAMETERS.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH; BUNCHER; CURRENT CONTOURS; BRIGHTNESS; COLLIMATION; EMITTANCE MEASUREMENT; BUNCHER BEAM LOADING;

NOTES....: BUNCHER LOADING - KLYSTRON THEORY WAS NOT ADEQUATE TO EXPLAIN EFFECT, WHICH WAS 70 PERCENT VOLTAGE DECREASE; CHANGE DECREASED TO 30 PERCENT AFTER SEVERAL WEEKS OF OPERATION, AND LATER TO 14 PERCENT. POOR TRAPPING EFFICIENCY; 64 PERCENT AT 10 MA, 50 PERCENT AT 50 MA, 30 PERCENT AT 100 MA. WEAK DEPENDENCE OF ACCELERATED CURRENT ON BUNCHER VOLTAGE. DECREASE IN CURRENT AT LINAC WHEN BUNCHER TURNED ON.

AT 150 MA INTO BUNCHER, EMITTANCE PATTERN WAS ROTATED CORRESPONDING TO A DEFOCUSING LENS ABOUT $1.2/\text{M}$. 260 MA ARRIVED AT THE LINAC. DENSITY DECREASED TO 60 PERCENT. EMITTANCE AREA MEASUREMENT WAS NOT MEANINGFUL.

USING A SIEVE TO GET 100 MA IN SAME INPUT EMITTANCE AS ABOVE, THERE WAS SLIGHT ROTATION OF EMITTANCE PATTERN CORRESPONDING TO A DEFOCUSING LENS LESS THAN $0.2/\text{M}$. 100 MA ARRIVED AT LINAC. CORE DECREASED IN DENSITY TO 90 PERCENT OF UNBUNCHED DENSITY; EMITTANCE AREA INCREASED FROM 2.29 TO 2.35 PT CM MPAD NORMALIZED.

FOR 17 KEV AXIAL BUNCHER FIELD, TRANSVERSE EFFECT IS LIKE A LENS OSCILLATING AT 200 MHZ BETWEEN PLUS AND MINUS $1.0/\text{M}$ WITH PHOTONS ACCEPTED BY LINAC MAINLY AT THE MAXIMUM DEFOCUSING POINT.

FOUND CHANGES IN RF PARAMETERS ONLY AFFECTED HALO REGIONS OF PHASE SPACE.

SIEVING X3 IN CURRENT MADE NO CHANGE IN EMITTANCE BLOWUP, WHICH WAS ABOUT X3 TO 50 MEV.

ERRORS IN EMITTANCE MEASUREMENTS ARE DISCUSSED.

SUCCESSIVE COLLIMATION OF INPUT BEAM BY RECTANGULAR COLLIMATORS, SCALED TO ORIGINAL AXIS RATIOS, SHOWED REMOVING PHASE SPACE AND CURRENT FROM THE OUTER PARTS OF PHASE SPACE AT 500 MPAD REDUCED DENSITY OVER THE WHOLE PHASE SPACE AT 50 MEV (MEANING SIZE OF EMITTANCE AREA AT 10 PERCENT OF BEAM). MANY INTERESTING CURVES OF INTEGRATED EMITTANCE VS CURRENT FOR DIFFERENT CONDITIONS.

RECOMMEND SETTING BUNCHERS ON BASIS OF MINIMIZING OUTPUT EMITTANCE RATHER THAN ON TOTAL CURRENT.

1

DESCRIBE FITTING FUNCTION TO GET CURRENT CONTOURS FROM EMITTANCE MEASUREMENT: $J(U,V) = (A1 \cdot U^2 + B1 \cdot U + C1) \cdot V^2 + (A2 \cdot U^2 + B2 \cdot U + C2) \cdot V + A3 \cdot U^2 + B3 \cdot U + C3$ WHERE U,V ARE POSITION AND ANGLE COORDINATES.

REFERENCE: 12

CATEGORY.: OPERATING EXPERIENCE; MEASUREMENTS; ANALYSIS;

CAT-SOURCE: JAMESON DATE-ENT.: 771011

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

1 142 TITLE..... RF PERTURBATION MEASUREMENTS IN LONG LINAC CAVITIES - 661200

AUTHOR... OWEN, C.W.; RADMER, C.A.; YOUNG, D.E.;
AFFILIAT... MURA

DOC-TYPE... CONF PAPER
PAGES..... 6

REP-NUM... LA-3609
DATE-PUBL... 661200

CONFERENCE... PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3609, P. 140;

ABSTRACT... SEE TITLE

SUBJECTS... HEAD PERTURBATION MEASUREMENT; FIELD DISTRIBUTION; ACCELERATOR STRUCTURE;

NOTES..... FOUND HALL SIZE EFFECT IN HEADPULL MEASUREMENT LESS THAN 2 PERCENT EVEN FOR VERY LARGE
HALLS.

DISCUSS A STRONG COUPLING OF FREQUENCY PERTURBATIONS FROM AN END WALL SHIFT - REFERENCE 1.
SMITH, WERK DER PHYSIK VOL. 44, P. 379-381. THIS SAME EFFECT CAN CAUSE AN ERROR - AS THE HALL
GOES THRU A CELL IT CHANGES THE FIELD IN A LONG TANK. A RATIO PLOT OF FIELD DISTRIBUTIONS WITH
DIFFERENT HALL SIZES SHOWS DEFINITE TILT (15 PERCENT) IN ANL LINAC.

CLAIM HIGHER FIELD IN FIRST FEW CELLS IS BETTER, GIVING MORE ACCEPTANCE AND HENCE MAKING
OUTPUT ENERGY LESS SENSITIVE TO RF LEVEL IN TANK.

REFERENCE: 5

CATEGORY... MEASUREMENTS; ANALYSIS;

CAT-SOURCE... JAMESON DATE-ENT... 771010

MICROFILM;

STOR-LOC... MP-9 SPERG FILE;

143 TITLE..... MEASUREMENTS OF THE LINEAR-ACCELERATOR EXIT BEAM OF THE BEVATRON INJECTOR

AUTHOR...: ALLISON, R.W., JR., ET AL.;
AFFILIAT.: LRL

DOC-TYPE.: CONF PAPER
PAGES.....: 14

REF-NUM.: LA-3609
DATE-PUBL: 661200

CONFERENC: PROC 1966 LINAC ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, (ASL REPORT LA-3609, P. 34)

ABSTRACT.: A SERIES OF MEASUREMENTS OF THE CHARACTERISTICS OF THE LINEAR ACCELERATOR (LINAC) EXIT BEAM WERE MADE TO DETERMINE IF VARIATIONS IN BEAM POSITION, EMITTANCE, AND ENERGY SPREAD WERE PRESENT. THESE MEASUREMENTS SHOW THAT BEAM-POSITION MOVEMENTS DUE TO VOLTAGE RIPPLE ON THE PREINJECTOR AND LINAC RF SYSTEMS OCCUR.

POSITIONS WERE MEASURED WITH A RESONANT 200-MHZ INDUCTION ELECTRODE WHICH DETECTS THE CENTER OF GRAVITY OF THE BEAM. IN ADDITION, A SERIES OF MOMENTUM MEASUREMENTS WERE MADE TO STUDY FILAMENTATION OF THE LINAC BEAM, AND THE EFFECT OF THE PREBUNCHER AND DEBUNCHER. A CORRELATION HAS BEEN OBTAINED BETWEEN ENERGY RIPPLE AND THE BEAM POSITION JITTER. AN EMITTANCE DEVICE THAT USES A SWEEPING MAGNETIC FIELD FOR MEASURING EMITTANCE WAS CONSTRUCTED, AND A PRELIMINARY STUDY WAS MADE OF THE LINAC EMITTANCE VARIATION WITH INTENSITY AND TANK GRADIENT.

SUBJECTS.: ALIGNMENT; QUADRIPOLE UNROLLING; RF AMPLITUDE SCAN; TIME DEPENDENT EFFECTS; EMITTANCE; ENERGY SPECTRA.

NOTES.....: NOTE VERY STRONG DEPENDENCE OF LONGITUDINAL PROFILE OF TANK RF LEVEL. SHOW "UNROLLING OF QUADS" DATA ON BEAM CENTER MOVEMENT, AND MOVEMENT OF BEAM CENTER VS. LINAC RF LEVEL. AT NORMAL OPERATING CONDITIONS, BEAM IS OFFSET -0.4 CM VERTICALLY AND +0.21 CM HORIZONTALLY IN POSITION, - 2.1 MRAD VERTICALLY AND -1.4 MRAD HORIZONTALLY. LARGE CHANGES ARE SEEN WITH QUAD UNROLLING. SIMILAR CHANGES WITH RF LEVEL ARE SEEN, ESPECIALLY IN VERTICAL, ALTHOUGH RECENT REALIGNMENT TO PLUS-MINUS 0.1 MM OF LINAC MAIN COMPONENTS (NOT QUADRUPOLES) HAD BEEN DONE, COULD NOT CORRECT VERTICAL OFFSET BY STEERING AT ENTRANCE - LOST BEAM CURRENT FIRST. TIME DEPENDENT EFFECTS DURING THE PULSE ARE MEASURED. EMITTANCE MEASUREMENTS SHOW EMITTANCE FOR VARIOUS FRACTIONS OF THE BEAM, AND AS FUNCTIONS OF EXIT BEAM CURRENT AND SYNCHRONOUS PHASE. THEY CONTEND NO EMITTANCE GROWTH WAS OBSERVED IN THE LINAC. ENERGY SPECTRA, OUTPUT ENERGY, SYNCHRONOUS PHASE AND NUMBER OF PHASE OSCILLATIONS ARE MEASURED AS FUNCTION OF LINAC RF LEVEL (AMPLITUDE SCAN).

REFERENCE: 7

CATEGORY.: MEASUREMENTS; OPERATING EXPERIENCE; EXPERIMENTAL ANALYSIS;

CAT-SOURC: JAMESON DATE-ENT.: 771010

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

144 TITLE..... COUPLED MOTION IN LOW-ENERGY PROTON LINEAR ACCELERATORS

AUTHOR...: OHNUMA, S.
AFFILIAT.: YALE UNIV

DOC-TYPE.: CONF PAPER
PAGES.....: 6

REP-NUM...: LA-3689
DATE-PUBL: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3689, P. 214;

ABSTRACT.: THE INCREASE IN APPARENT EMITTANCE DUE TO LONGITUDINAL TRANSVERSE COUPLING IS INVESTIGATED FROM A VIEWPOINT BASED ON THE STRONG FOCUSING SYSTEM THEORY OF COUPANT AND SNYDER. THE UNCOUPLED TRANSVERSE MOTION IS ESSENTIALLY LINEAR BUT THE UNCOUPLED PHASE OSCILLATION IS SOLVED EXACTLY BY NUMERICAL CALCULATIONS. MISALIGNMENTS AND X-Y COUPLING ARE IGNORED. DERIVES FORMULA FOR SINGLE PARTICLE, EXTENDS TO PARTICLES WITH OTHER LONGITUDINAL PHASE VALUES, THEN SHOWS DISTORTION OF ELLIPSE FROM COUPLING AND INCREASE IN EFFECTIVE EMITTANCE DUE TO THE WHOLE COLLECTION OF PARTICLES.

SUBJECTS.: COUPLING; EMITTANCE GROWTH;

REFERENCE: 11 + E.D. COURANT AND H.S. SNYDER, ANNALS OF PHYSICS 3, 1 (1958);

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771012

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

1
145 TITLE....: COMPARISON OF THE PARTICLE MOTIONS AS CALCULATED BY TWO DIFFERENT DYNAMICS PROGRAMS

AUTHOR...: SWENSON, D.A.; YOUNG, D.E.; AUSTIN, R.;
AFFILIAT.: LASL; MIRA;

DOC-TYPE.: CONF PAPER
PAGES....: 4

REF-NUM...: LA-3609
DATE-PUBL: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3620, P.
229;

ABSTRACT.: COMPARISON BETWEEN LINDY, A THREE-DIMENSIONAL PROGRAM WITH QUADRUPOLE FIELDS AND CAPABLE OF
HANDLING 2D CELLS, AND PARMILA. SHOWS DEVELOPMENT OF RADIAL EQUATION, ENERGY GAIN ACROSS A CELL,
AND TRANSIT TIME FACTOR.

SUBJECTS.: SOFTWARE; NUMERICAL COMPUTATION; BEAM DYNAMICS CODES; LINDY CODE; PARMILA CODE;

CATEGORY.: SOFTWARE; NUMERICAL COMPUTATION;

CAT-SOURC: JAMESON DATE-FRT.: 771012

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

146 TITLE.....: SPACE CHARGE EFFECTS ON LONGITUDINAL MOTION IN PROTON LINACS

AUTHOR....: RENTON, A.; AGRITELLIS, C.; LAPOSTOLLE, P.M.;
AFFILIAT.: RNL

DOC-TYPE.: CONF PAPER
PAGES.....: 2

REP-NUM.: LA-3609
DATE-PUBL: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF. LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3609, P. 243;

ABSTRACT.: NO RESULTS REPORTED. HOWEVER, COMMENTS BY LAPOSTOLLE ON BUNCHERS ARE INTERESTING; ABOUT A FORMULA FROM TRAVELING WAVE THEORY FOR SPACE CHARGE WHICH SAYS PRODUCT OF BUNCHING VOLTAGE AND DRIFT LENGTH MUST BE CONSTANT TO PRODUCE BUNCHING, AND IN ADDITION, THE PRODUCT OF THE LENGTH AND THE SQUARE (FOURTH??) ROOT OF THE CURRENT MUST BE BELOW A CERTAIN OTHER VALUE IN ORDER TO RETAIN THE LINEAR APPROXIMATION AND AVOID A SATURATION EFFECT. SEEMS TO AGREE WITH CERN EXPERIMENTAL RESULTS. SUGGESTS BUNCHER SHOULD BE A LINAC CAVITY WITH PERHAPS LINEARLY VARYING ELECTRIC FIELD. SIMILAR EQUATIONS WOULD APPLY (BUT HERE HE SAYS FOURTH ROOT OF CURRENT TIMES LENGTH). THEN THE REST OF THE LINAC WOULD HAVE A FIRST CAVITY WHERE SYNCHRONOUS PHASE DECREASES WITH ENERGY, STARTING MAYBE AS HIGH AS 60-70 DEGREES AND DECREASING TO 20-30 DEGREES, KEEPING THE BUCKET AREA ALMOST CONSTANT DURING ACCELERATION. THIS WOULD KEEP THE BEAM NEARLY THE SAME DISTANCE FROM THE BOUNDARY, WHICH IS THE SAME AS EQUATING THE NON-LINEAR TERMS IN THE PHASE-DIRECTION AND THE ENERGY-BETA DIRECTION, THUS MINIMIZING THEIR EFFECT.

SUBJECTS.: BUNCHER;

REFERENCE: P.M. LAPOSTOLLE, CERN REPORT AR/INT. SG/65-15, JULY 15, 1965 (ON SPACE CHARGE EFFECTS IN ACCELERATOR CELLS); T.D. NEWTON, AECL-2614, CHALK RIVER, CANADA (ON EQUILIBRIUM DISTRIBUTION OF BUNCH TRAVELING IN IMPERFECTLY CONDUCTING PIPE), OBTAINS EQUILIBRIUM CHARGE DISTRIBUTION, AND DECREASES IN LONGITUDINAL AND TRANSVERSE PHASE SPACE AREA RESULTING FROM THE COMBINATION OF SPACE CHARGE FORCES AND IMAGE FORCES FROM THE PIPE;

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771012

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

1
147 TITLE.....: PHASE SPACE REPRESENTATION OF ABERRATIONS DUE TO LONGITUDINAL FIELDS IN QUADRUPOLES
SFC=TITLE; TWO-DIMENSIONAL APPROACH; FOUR-DIMENSIONAL APPROACH;

AUTHOR....: REGENSTREIF, F.; TANGUY, P.;
AFFILIAT.: RENNES

DOC-TYPE.: CONF PAPER
PAGES.....: 5

REP=NUM.: LA-3609
DATE=PUBL: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3609, P.
2451

ABSTRACT.: IN A CERTAIN NUMBER OF PRACTICAL ARRANGEMENTS, THE LENGTH OF A QUADRUPOLE USED FOR FOCUSING
PURPOSES MAY BE COMPARABLE TO ITS APERTURE. THIS CAN HAPPEN FOR INSTANCE AT THE EXIT OF A SHORT
RE-ACCELERATING COLUMN OR IN THE FIRST FOCUSING STAGES OF A LINEAR ACCELERATOR. WE HAVE TRIED
TO REPRESENT IN PHASE SPACE THE SITUATION AT THE EXIT OF A FOCUSING SYSTEM WHERE THE PRESENCE
OF A LONGITUDINAL FIELD AND THE COUPLING DUE TO ABERRATIONS MAY INFLUENCE THE BEAM BEHAVIOR.

SUBJECTS.: QUADRUPOLE FIELD ABERRATIONS; EMITTANCE GROWTH; BEAM TRANSPORT;

CATEGORY.: THEORY;

CAT=SOURCE: JAMESON DATE=ENT.: 771012

MICROFILM:

STOR=LOC.: NP-9 SPERG FILE

14A TITLE.....: THE EFFECT OF QUADRUPOLE FRINGING FIELDS ON COUPLING IN LINACS
SEC-TITLE: INTRO, QUADRUPOLE FRINGING FIELDS; AMPLITUDE VARIATION AND EMITTANCE CHANGE; TRANSVERSE BEAM CHANGES;

AUTHOR....: GLUCKSTERN, R.L.
AFFILIAT.: UNIV OF MASSACHUSETTS/LASL CONSULTANT MP-DO

DOC-TYPE.: CONF PAPER
PAGES.....: 4
REF-NO.: LA-3609
DATE-PUBL.: 661200

CONFERENCE: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3609, P. 250;

ABSTRACT.: THE EFFECT OF QUADRUPOLE FRINGING FIELDS ON TRANSVERSE EMITTANCE HAS RECENTLY BEEN POINTED OUT BY REGENSTREIF. HE FINDS SERIOUS ABERRATIONS WHICH MUST BE TAKEN INTO ACCOUNT IN THE DESIGN OF TRANSPORT SYSTEMS. THE PURPOSE OF THIS NOTE IS TO EXAMINE THE EFFECTS OF QUADRUPOLE FRINGING FIELDS IN LINACS ON THE TRANSVERSE MOTION.

WE HAVE OBTAINED THE DISTORTION OF THE TRANSVERSE PHASE SPACES DUE TO FRINGING FIELDS IN THE MAGNETS OF THE STRONG FOCUSING SYSTEM. FOR A BEAM WITH FIXED CIRCULAR SYMMETRY THERE IS ESSENTIALLY NO CHANGE IN THE RADIAL OSCILLATION AMPLITUDE. FOR A BEAM WITH RECTANGULAR CROSS SECTION, THERE WILL BE AN INCREASE IN EACH TRANSVERSE OSCILLATION AMPLITUDE BY OF THE ORDER OF 20 PERCENT FOR TYPICAL LINAC DESIGNS.

THE FOREGOING ANALYSIS IS SUBJECT TO THE FOLLOWING LIMITATIONS:

1) WE HAVE USED THE SMOOTHED APPROXIMATION FOR THE TRANSVERSE OSCILLATIONS. FOR TYPICAL PARAMETERS USED IN PROTON LINACS, THIS SHOULD BE VALID TO OF THE ORDER OF 10 PERCENT.

2) WE HAVE INCLUDED ONLY TERMS UP TO THE ORDER x^4 IN THE MAGNETIC SCALAR POTENTIAL AND HAVE EVALUATED ONLY THOSE WHICH GIVE LARGE CONTRIBUTIONS AT THE MAGNET ENDS.

3) WE HAVE APPROXIMATED THE FRINGING FIELD BY TAKING A "RECTANGULAR" MODEL FOR THE VARIATION OF QUADRUPOLE FIELD WITH THE AXIAL COORDINATE. OUR MOST SERIOUS ERROR PROBABLY OCCURS HERE. IT SHOULD BE POSSIBLE, HOWEVER, TO ESTIMATE THIS ERROR FROM THE NUMERICAL RESULTS OF REGENSTREIF FOR A VARIETY OF ASSUMPTIONS ABOUT THE SHAPE OF THE FRINGING FIELD.

4) WE HAVE RETAINED AS THE DOMINANT TERM ONLY THAT ONE CONTAINING THE PHASE $2\phi \sin x + 2\phi \sin y$. IN ADDITION WE HAVE ASSUMED A SIMPLE VARIATION OF PARAMETERS WITH VELOCITY. THE LATTER EFFECT CAN EASILY BE CORRECTED FOR AN ACTUAL DESIGN, WHEREAS THE FORMER SHOULD BE UNIMPORTANT, EXCEPT POSSIBLY FOR A SMALL RESONANCE AT $\mu \sin x = \mu \sin y = 90$ DEGREES.

SUBJECTS.: QUADRUPOLE FIELD ABERRATIONS; EMITTANCE GROWTH;

REFERENCE: 3

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771012

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

149 TITLE....: OPTIMIZATION CRITERIA FOR STANDING WAVE TRANSVERSE MAGNETIC DEFLECTION CAVITIES
SEC-TITLE: INTRO; MICROWAVE CHARACTERISTICS; GENERAL EXPRESSIONS FOR E AND H FIELDS; COMPARISON OF TH101
AND TE101 DEFLECTION FIELD CHARACTERISTICS; COMPARISON OF TH110 AND TE102 DEFLECTION FIELD
CHARACTERISTICS; COMPARISON OF BEAM ABERRATION EFFECTS; COMPARISON OF ELECTRIC FIELD MAXIMA;
BEAM DEFLECTION AND ABERRATION CALCULATIONS; EXAMPLES;

AUTHOR...: HAINSON, J.
AFFILIAT.: MIT

DOC-TYPE.: CONF PAPER
PAGES....: 29

REP-NUM...: LA-3609
DATE-PUBL: 661200

CONFERENC: PROC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3609, P.
303;

ABSTRACT.: SEE TITLE AND SEC-TITLE

SUBJECTS.: BUNCHER; TRANSVERSE DEFLECTION BUNCHER;

NOTES....: DEVELOPMENT IS FOR ELECTRON BEAMS.

REFERENCE: 6

CATEGORY.: THEORY; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: JAMPSON DATE-ENT.: 771012

MICROFILM:

STOP-LOC.: MP-9 SPRG FILE;

150 TITLE.....: DESIGN OF A 20 MEV PROTON LINEAR ACCELERATOR, NEW INJECTOR FOR SATURNE

AUTHOR...: PRDME, M.
AFFILIAT.: CEN

DOC-TYPE.: CONF PAPER
PAGES.....: 7

REP=NUM...: LA-3609
DATE=PUBL: 661200

CONFERENCE: PRDC 1966 LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 3-7, 1966, LASL REPORT LA-3609, P. 403;

ABSTRACT.: DESIGN PHILOSOPHY FOR A 20 MEV LINAC, 750 KEV INJECTOR, 20 MA CURRENT, 620 US PULSE, AND OUTPUT ENERGY CONTINUOUSLY VARIABLE AROUND 20 MEV AT A 1 KEV/US RATE. FIELD AND SYNCHRONOUS PHASE WERE VARIED ALONG THE LINAC; FROM 45 DEGREES TO 25 DEGREES IN PHASE.

SUBJECTS.: PARAMETER SEARCH; SYNCHRONOUS PHASE LAW; LINAC DESIGN;

REFERENCE: 2

CATEGORY.: LINAC DESIGN;

CAT-SOURCE: JAMESON DATE-ENT.: 771012

MICROFILM:

STOR-LOC.: HP-9 SPERG FILE;

151 TITLE....: COMPARISON OF TWO METHODS FOR CALCULATING SPACE CHARGE EFFECTS IN DRIFT TUBE LINACS

AUTHOR....: STOVALL, J.E.

AFFILIAT.: LASL-MP-3

DOC-TYPE.: INTERNAL REPORT

REP-NUM.: MP-3-19

PAGES....: 16

DATE-PUBL: 680122

ABSTRACT.: SCHEFF I - RING METHOD REQUIRES CYLINDRICAL SYMMETRY, SPEED DEPENDS ON SQUARE OF MESH-SIZE, BUT THIS IS HELD CONSTANT, SO SPEED DEPENDS LINEARLY ON NUMBER OF PARTICLES, 0.75 SECONDS/CELL FOR 500 PARTICLES. XMA, PHIMAX, PHIRMS GRAPHED THROUGH TANK 1 FOR 0.1, 10, 20 MA.

SCHEFF II - SEEMS FORCES, USING THREE SYMMETRIC IMAGE CHARGES FOR EVERY PARTICLE - EACH AT 1/4 ORIGINAL CHARGE. SYMMETRIC IMAGES COMPENSATE FOR SMALL RANDOM SAMPLE SIZE. SPEED DEPENDS ON SQUARE OF PARTICLES USED, 30 SECONDS/CELL FOR 500 PARTICLES.

SAME PLOTS, NO SIGNIFICANT DIFFERENCE.

SUBJECTS.: SPACE CHARGE; SCHEFF CODE; PARMILA CODE;

CROSS-REF: IDN 333, MPL10;

CATEGORY.: NUMERICAL CALCULATION; SOFTWARE; SPACE CHARGE;

CAT-SOURC: JAMESON

DATE-ENT.: 771012

MICROFILM;

STOR-LOC.: MP-9 SPRNG FILE;

152 TITLE....: A FAMILY OF IMPROVED LINAC BUNCHERS

SEC-TITLE: ISOCRONOUS DEFLECTOR; ISOCRONOUS DEFLECTOR-REDEFLECTOR; DEFLECTOR-REDEFLECTOR AND A
BUNCHING GAP; DEFLECTOR-REDEFLECTOR AND TWO PHASED BUNCHING GAPS; SUBHARMONIC DEFLECTOR AND
BUNCHER; CONICAL-SCAN DEFLECTOR AND BUNCHER; BUNCHING VOLTAGE AND DRIFT LENGTH; SECOND-ORDER
TERMS IN THE BUNCH WIDTH; PARALLEL-PLATE DEFLECTOR; CROSSED-FIELD DEFLECTOR; PARALLEL PLATES
IN TANDEM; TWISTED PARALLEL-PLATE DEFLECTOR; TWISTED RIBBON DEFLECTOR; RF DRIVE FOR
DEFLECTORS; LENSES; REDEFLECTION ERRORS; THE BUNCHER; BUNCHING DUE TO END EFFECTS IN THE
DEFLECTORS; REMARKS;

AUTHOR....: BERINGER, R.; GLUCKSTERN, R.L.;
AFFILIAT.: PNL; YALE UNIV;

DOC-TYPE.: CONF PAPER
PAGES.....: 38

DATE-PUBL: 640720

CONFERENCE: 1964 LINEAR ACCEL CONF. MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION, JULY 20-24, 1964;

ABSTRACT.: DESCRIPTION AND MATHEMATICAL ANALYSIS OF BUNCHERS USING AN RF DEFLECTOR TO SEPARATE PHASE
REGIONS IN SPACE SO THAT EACH PHASE REGION CAN BE BUNCHED INDEPENDENTLY WITH A SINUSOIDAL FIELD.

ATTEMPTS TO COMBINE ELEMENTS INTO A SYSTEM ARE NOT TOO SUCCESSFUL DUE TO CONFLICTING
REQUIREMENTS AND COMPONENT INADEQUACIES; CHIEFLY, UNWANTED BUNCHING BY THE DEFLECTION FIELDS,
VERY HIGH FIELDS IN THE DEFLECTORS, AND REDEFLECTION ERRORS. THE SIMPLE SYSTEM OF TWO
NONSYNCHRONOUS TWISTED RIBBON DEFLECTORS SEEMS TO WARRANT FURTHER STUDY.

SUBJECTS.: BUNCHER; LONGITUDINAL INSTABILITY; TRANSVERSE DEFLECTION BUNCHER;

NOTES.....: MENTION TAILS CAN GIVE UNDESIRABLE RADIATION, AND POSSIBLE CONFUSION IN THE INSTRUMENTATION
OF A LONG LINAC.

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771209

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

153 TITLE....: APPLICATION OF CALCULATED FIELDS TO THE STUDY OF PARTICLE DYNAMICS

AUTHOR...: SWENSON, D.A.
AFFILIAT...: MURA

DOC-TYPE...: CONF PAPER
PAGES....: 13

DATE-PUBL: 640720

CONFERENCE: 1964 LINEAR ACCEL CONF, MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION, JULY 20-24, 1964,

ABSTRACT.: IMPROVEMENTS TO THE CALCULATION OF GAP ACCELERATION ARE REPORTED. PREVIOUS WORK USED A TRANSIT TIME FACTOR AND RADIAL IMPULSE CALCULATED FROM A FIELD ASSUMED UNIFORM ACROSS THE GAP AND ZERO IN THE CRIFT-TURE. USING DATA ON ACTUAL FIELD DISTRIBUTION FROM HESSYMFESH, THE CALCULATED FIELD DISTRIBUTIONS ARE REDUCED TO A FEW COEFFICIENTS WHICH REFLECT MORE PRECISELY THE EFFECT OF THE FIELDS ON PARTICLE MOTION.

SUBJECTS.: BEAM DYNAMICS; GAP FIELD DISTRIBUTION; TRANSIT TIME FACTOR;

CATEGORY.: THEORY; NUMERICAL CALCULATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771009

MICROFILM;

STOR-LOC.: MP-9 SPORG FILE;

154 TITLE....: BEAM DYNAMICS CALCULATIONS FOR ALVAREZ-TYPE LINEAR ACCELERATORS

AUTHOR....: RICH, M.
AFFILIAT.: LASI

DOC-TYPE.: CONF PAPER
PAGES....: 12

DATE-PUBL: 640720

CONFERENCE: 1964 LINEAR ACCEL CONF, MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION, JULY 20-24, 1964;

ABSTRACT.: NUMERICAL CALCULATIONS USING ACCURATE NUMERICAL INTEGRATION OF THE EQUATIONS OF MOTION ARE COMPARED TO THE IMPULSE-TYPE APPROXIMATION OF A UNIFORM GAP FIELD WITH ZERO DRIFT TUBE FIELD, AND TO AN APPROXIMATION WHICH TREATS OFF-AXIS FIELDS THROUGH TERMS IN R^{*3} PLUS RADIAL AND LONGITUDINAL IMPULSE TERMS WHICH THE PARTICLES EXPERIENCE ON ENTERING OR LEAVING THE GAP. COMPARISON OF THE LATTER APPROXIMATION AND THE NUMERICAL INTEGRATION AGREED TO ABOUT FOUR SIGNIFICANT FIGURES IN ENERGY AND ABSOLUTE PHASE, WHILE THE IMPULSE APPROXIMATION WAS NOTICEABLY POORER.

SUBJECTS.: BEAM DYNAMICS; GAP FIELD DISTRIBUTION;

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771049

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

155 TITLE..... COUPLED PHASE AND RADIAL MOTION IN LINEAR ACCELERATORS

AUTHOR.... SWENSON, D.A.
AFFILIAT.: MURA

DOC-TYPE.: CONF PAPER
PAGES..... 13

DATE-PUBL: 631021

CONFERENCE: MINUTES OF THE CONF ON PROTON LINEAR ACCELERATORS AT YALE UNIV, OCT. 21-25, 1963;

ABSTRACT.: USE OF PARMILA TO INVESTIGATE COUPLED PHASE AND RADIAL MOTION. SIGNIFICANT ROTATIONS IN TRANSVERSE ADMITTANCE ARE SEEN FOR PARTICLES WITH DIFFERENT LONGITUDINAL COORDINATES; THE COMMON AREA FOR PARTICLES AT $\pm 20.0, \pm 20$ DEGREES IS ABOUT 1/2 THAT FOR EACH INDEPENDENTLY, PARTICLES WITH DIFFERENT TRANSVERSE COORDINATES HAVE CONSIDERABLY DIFFERENT LONGITUDINAL ACCEPTANCES.

SUBJECTS.: TRANSVERSE ADMITTANCE; LONGITUDINAL ACCEPTANCE; COUPLING; MATCHING;

NOTES..... KEEP THIS IN MIND FOR MATCHING PROCEDURES.

CATEGORY.: NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771027

MICROFILM:

STOP-LOC.: MP-2 SPERG FILE;

156 TITLE....: A NEW TECHNIQUE FOR HIGH PRECISION ALIGNMENT OF LINEAR ACCELERATORS

AUTHOR...: BETZ, W.D.
AFFILIAT.: KANSAS STATE UNIV

DOC-TYPE.: CONF PAPER
PAGES...: 8

REP-NUM...: RNL 50120 (C-54)
DATE-PUBL: 680520

CONFERENCE: PROC 1968 PROTON LINEAR ACCEL CONF, ACCEL DEPT, BROOKHAVEN NATL LAB, MAY 20-24, 1968, RNL 50120 (C-54), P. 601

ABSTRACT.: THIS PAPER PRESENTS A NEW ALIGNMENT AND SURVEILLANCE TECHNIQUE OF HIGH ACCURACY. UTILIZING ASYMMETRICAL EFFECTS PRODUCED IN THE LIGHT DISTRIBUTION OF A LASER BEAM, THIS NEW METHOD SHOWS REMARKABLE ADVANTAGES: ANY NUMBER OF OBJECT-POINTS CAN BE PLACED ON A STRAIGHT LINE AND DISPLACEMENTS OF 0.01 MM, FOR EXAMPLE, ARE DETECTABLE IN DISTANCES FROM ZERO TO SEVERAL KILOMETERS, PROVIDED THAT THE DISTURBING INFLUENCES OF TURBULENCE AND REFRACTION IN THE ATMOSPHERE ARE ELIMINATED. THE SETUP IS VERY SIMPLE, AND ALL TARGETS REPRESENTING OBJECT-POINTS ARE IDENTICAL. THEREFORE, THE EQUIPMENT TO BE USED, INCLUDING THE DETECTION UNIT, IS INDEPENDENT OF ALL DISTANCES INVOLVED. THE ALIGNMENT CAN BE DONE SIMULTANEOUSLY IN TWO DIMENSIONS, BOTH VISUALLY AND FULLY AUTOMATED. SPECIAL APPLICATIONS TO LINEAR ACCELERATORS WITH LENGTHS UP TO SEVERAL KILOMETERS WILL BE DISCUSSED AND COMPARED WITH CONVENTIONAL AND EXISTING ALIGNMENT TECHNIQUES. LIMITATIONS AND DISTORTING EFFECTS WILL ALSO BE CONSIDERED.

SUBJECTS.: ALIGNMENT;

REFERENCE: R

CATEGORY.: MEASUREMENTS;

CAT-SOURCE: JAMESON DATE-ENT.: 771015

MICROFILM:

STOR-LDC.: MP-9 SPORG FILE:

157 TITLE....: RECENT PROGRESS IN LINAC PRE-ACCELERATORS

AUTHOR....: SLUYTERS, T.J.M.
AFFILIAT.: BNL

DOC-TYPE.: CONF PAPER
PAGES....: 12

REP-NUM...: BNL 50120 (C-54)
DATE-PUBL: 680520

CONFERENCE: PROC 1968 PROTON LINEAR ACCEL CONF, ACCEL DEPT, BROOKHAVEN NATL LAB, MAY 20-24, 1968, BNL 50120
(C-54), P. 22A;

ABSTRACT.: LINEAR ACCELERATORS PUT OUT BEAM CURRENTS IN EXCESS OF 100 MA, OPERATING WITH ABOUT THREE TIMES LARGER PREINJECTOR CURRENT (CFRN, SERPUKHOV). EXPERIENCE WITH THESE MACHINES AND RECENT NUMERICAL CALCULATIONS BY P. CHASMAN (BNL) SUGGEST THAT EFFICIENT OPERATION IMPOSES SPECIFIC REQUIREMENTS ON THE PREINJECTOR BEAMS. THE EXACT REQUIREMENTS BEING UNKNOWN THE IDEAL PREINJECTOR SHOULD PROVIDE FOR ADJUSTABILITY OF THE BEAM CHARACTERISTICS, CONTROLLED AT THE ENTRANCE OF THE LINAC.

RECENT DEVELOPMENT IN PREINJECTORS HAS MAINLY CONCENTRATED ON BEAM CURRENTS BELOW 200 MA WITH THE OBJECT TO PRE-ACCELERATE, TRANSPORT AND BUNCH BEAMS WITHOUT DILUTION AND TO MATCH THEM TO THE LONGITUDINAL AND TRANSVERSE PHASE SPACES OF THE LINEAR ACCELERATOR.

WE SHALL CONSIDER DEVELOPMENTS OF THE ION SOURCE, SUCH AS THE CONTROL OF THE CURRENT AND UNIFORMITY OF THE PLASMA Emitter IN THE EXPANSION CHAMBER OF THE DIODPLASMATRON AND A POSSIBLE RELATION BETWEEN EXPANSION CHIP GEOMETRIES AND THE APPARENT SOURCE EMITTANCES. WE SHALL SUMMARIZE THE RESULTS OBTAINED WITH LOW AND HIGH GRADIENT ACCELERATION WITHOUT SIGNIFICANT APPARENT DILUTION UP TO 750 KV WITH AND WITHOUT PREFOCUSING. FINALLY WE SHALL DISCUSS SOME IDEAS FOR THE TRANSPORT REGION BETWEEN ACCELERATOR AND LINAC.

203

SUBJECTS.: INJECTOR; EMITTANCE; BEAM TRANSPORT;

REFERENCE: 21

CATEGORY.: SYSTEM DESIGN;

CAT-SOURCE: JAMESON DATE-ENT.: 771015

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

158 TITLE....: PRELIMINARY STUDY OF A HIGHER ENERGY PRE-INJECTOR FOR THE CERN PS

AUTHOR...: HUGUENIN, J.; TALLGREN, H.; WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 24

REP-NUM...: RNL 50120 (C-54)
DATE-PUBL: 680520

CONFERENC: PROC 1968 PROTON LINEAR ACCEL CONF, ACCEL DEPT, BROOKHAVEN NATL LAB, MAY 20-24, 1968, RNL 50120
(C-54), P. 269;

ABSTRACT.: STUDY OF THE ADVANTAGES GAINED FROM INCREASING THE INJECTION ENERGY TO A LINAC; RESULTS
INDICATE THAT AN INCREASE TO 2.4-2.5 MEV WOULD BE QUITE INTERESTING. TECHNOLOGICAL RELIABILITY
AND OPERATIONAL ASPECTS ARE DISCUSSED.

SUBJECTS.: INJECTION ENERGY; INJECTOR;

NOTES....: NUMEROUS DIAGRAMS; WIGGLE FACTOR ANALYSIS; LINAC ACCEPTANCE; QUADRUPOLE LENS STRENGTH;
ACCELERATING FIELD DEFOCUSING; TRANSIT TIME FACTOR; BUNCHING EFFICIENCY;

REFERENCE: 22

CATEGORY.: SYSTEM DESIGN;

CAT-SOURCE: JAMESON DATE-ENT.: 771015

MICROFILM:

STDR-LOC.: MP-9 SPERG FILE

1 159 TITLE....: BUNCHING

AUTHOR....: LAPOSTOLLE, P.M.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 11

REP-NUM.: BNL 50120 (C-54)
DATE-PUBL: 680520

CONFERENCE: PROC 1968 PHOTON LINEAR ACCEL CONF, ACCEL DEPT, BROOKHAVEN NATL LAB, MAY 20-24, 1968, BNL 50120
(C-54), P. 317:

ABSTRACT.: REVIEW OF BUNCHER TYPES. AT HIGH CURRENT, SPACE CHARGE INHIBITS BUNCHING BY REPULSION AND BY INTRODUCING RADIAL DEPENDENCE IN THE MODULATION SINCE SPACE CHARGE REPULSION IS PURELY LONGITUDINAL ON AXIS BUT PARTLY TRANSVERSE OFF-AXIS. COMPARISON WITH KLYSTRON THEORY SHOWS TRANSVERSE EFFECTS ARE FUNDAMENTAL AND MUST BE INCLUDED. SIGNIFICANT INCREASE IN BEAM SIZE IS SEEN. THE VOLUME DENSITY MODULATION OCCURS MOSTLY IN THE OUTER PART OF THE BEAM, WITH LESS MODULATION ON AND NEAR THE AXIS. THIS SHOWS UP AS A HIGHER TRAPPING EFFICIENCY IN THE LINAC NEAR THE BEAM BOUNDARY THAN NEAR THE AXIS, AND LEADS TO THE THOUGHT THAT A CENTRAL DIAPHRAGM (CIRCULAR OR ELLIPTICAL) COULD BE USED TO REMOVE ALL THE PARTICLES WITH UNWANTED PHASES. THE ACCELERATING BUNCHER, WHERE THE BEAM COMING FROM A CONVENTIONAL BUNCHER IS ACCELERATED ON THE UNSTABLE PHASE OF A LINAC IS MENTIONED; THE IMMEDIATE ACCELERATION GIVES SPACE CHARGE LITTLE TIME TO ACT, AND TRANSVERSE FOCUSING IS OBTAINED AT THE SAME TIME THE LONGITUDINAL DISTRIBUTION IS BEING FORMED.

SUBJECTS.: BUNCHER; SPACE CHARGE;

REFERENCE: 15

CATEGORY.: SYSTEM DESIGN; SPACE CHARGE; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON; DATE-ENT.: 771015

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

16P TITLE.....: DESIGN OF A BUNCHER AND THE TRANSPORT SYSTEM IN ITS DRIFT SPACE FOR THE 200 MEV RNL INJECTOR
LINAC

AUTHOR....: AGRITELLI, C.; CHASMAN, R.W.;
AFFILIAT.: RNL

DOC-TYPE.: CONF PAPER
PAGES.....: 10

REP-NUM.: RNL 50120 (C-56)
DATE-PUBL.: 680520

CONFERENCE: PROC-1968 PROTON LINEAR ACCEL CONF, ACCEL DEPT, BROOKHAVEN NATL LAB, MAY 20-24, 1968, RNL 50120
(C-54), P. 320

ABSTRACT.: REQUIREMENTS WERE OPTIMAL BUNCHING EFFICIENCY AND TRANSVERSE MATCHING FROM 50-400 MA, AND
ABILITY TO PRODUCE A TIGHT BEAM BUNCH AT LOW CURRENT FOR ACCELERATOR TUNING. COMPUTER PROG-A
USED POINT-DISC MODEL. RESULTS ARE GIVEN FOR SINGLE AND DOUBLE BUNCHERS.

SUBJECTS.: BUNCHER; SPACE CHARGE;

CATEGORY.: NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771015

MICROFILM:

STOR-LOC.: MP-9 SPRG FTIF;

161 TITLE....: DOUBLE-DRIFT BUNCHER

AUTHOR....: EMIGH, P.R.
AFFILIAT.: LASI

DOC-TYPE.: CONF PAPER
PAGES....: 8

REP-NUM.: PNL 5012M (C-54)
DATE-PUBL: 6R0520

CONFERENCE: PROC 1968 PROTON LINEAR ACCEL CONF, ACCEL DEPT, BROOKHAVEN NATL LAB, MAY 20-24, 1968, PNL 5012M
(C-54), P. 33R;

ABSTRACT.: THE MORE POPULAR THEORETICAL APPROACH TO BUNCHING A PROTON BEAM FOR ACCEPTANCE INTO A LINAC HAS BEEN THE HARMONIC BUNCHER. DEPENDING ON THE NUMBER OF HARMONICS USED, THIS BUNCHER IS CAPABLE OF PUTTING UP TO 95 PERCENT OF THE BEAM CURRENT FROM THE INJECTOR INTO THE ACCEPTANCE BUCKET OF THE LINAC. FOR A HIGH-INTENSITY MACHINE, HOWEVER, BEAM LOSS WITHIN THE LINAC AT THE HIGHER ENERGIES IS MORE IMPORTANT THAN THE CAPTURE EFFICIENCY. A PROPOSED BUNCHER TO REDUCE BEAM LOSS, PERHAPS SIGNIFICANTLY, IS THE DOUBLE-DRIFT BUNCHER FIRST SUGGESTED BY OHNUMA AS EARLY AS 1963. A COMPENDIUM OF THE RESULTS OF OUR STUDIES OVER THE PAST FEW YEARS ON THE DOUBLE-DRIFT BUNCHER IS PRESENTED HEREIN.

SUBJECTS.: BUNCHER, SPACE CHARGE;

REFERENCE: 4

CATEGORY.: NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771015

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

11

1622 TITLE.....: LONGITUDINAL SPACE-CHARGE EFFECTS IN BUNCHES

AUTHOR.....: LEE-WHITING, G.F., ORRISON, J.H.,

AFFILIATION.....: AEC

DOC-TYPE.....: CONF PAPER

PAGES.....: 7

REF-NUM.....: BNL 58128 (C-64)

DATE-PUBL: 680520

CONFERENCE: PROC 1968 BROOKHAVEN LINEAR ACCEL CONF., ACCEL DEPT, BROOKHAVEN NATL LAB, MAY 20-24, 1968, BNL 58128
(C-64), P. 3047

ABSTRACT.....: SEE TITLE

SUBJECTS.....: BUNCHES; SPACE CHARGE;

CATEGORY.....: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON

DATE-ENT.: 771015

MICROFILM:

STORE-LOC.: MP-9 SPRNG FILE:

163 TITLE....: LONGITUDINAL AND TRANSVERSE T AND S TRANSIT TIME COEFFICIENTS

AUTHOR....: SCHWYZER, P.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 7

REF-NO.: BNL 50120 (C-54)
DATE-PRINT: 196824

CONFERENCE: PROC 1968 PROTON LINEAR ACCEL CONF, ACCEL DEPT, BROOKHAVEN NATL LAB, MAY 20-24, 1968, BNL 50120 (C-54), P. 400;

ABSTRACT.: DIFFERENCE EQUATIONS DESCRIBING THE MOTION OF A PROTON THROUGH AN ACCELERATING GAP HAVE BEEN GIVEN BY P. CARPSTEAD AT THE FRASCATI CONF (1965) AND BY THE AUTHOR (WASHINGTON CONF, 1967). THE DYNAMICAL COEFFICIENTS CONTAINED IN THEM ARE DISCUSSED HERE. THERE ARE TWO TYPES, CALLED T- AND S-COEFFICIENTS. T-COEFFICIENTS BELONG TO MOTION ACROSS THE WHOLE GAP AND HAVE A SIMPLE FORM (TRANSIT TIME FACTOR TIMES A MODIFIED BESSEL FUNCTION). DIFFERENCE EQUATIONS THROUGH THE FIRST HALF OF THE GAP NEEDED TO DETERMINE THE MID-GAP VALUES OF THE PARTICLE COORDINATES, INVOLVE IN ADDITION S-COEFFICIENTS. EXACT EXPRESSIONS (SERIES EXPANSIONS) FOR THE LATTER ARE GIVEN HERE ASSUMING THAT THE FOURIER COEFFICIENTS OF $E \cos \theta$ (PEAK), THE LONGITUDINAL FIELD ALONG THE GAP CIRCUMFERENCE, ARE KNOWN. APPROXIMATIONS FOR THE S-COEFFICIENTS ARE DISCUSSED. CORRECTED TABLES OF NON-RELATIVISTIC AND RELATIVISTIC DIFFERENCE EQUATIONS ARE GIVEN.

SUBJECTS.: ACCELERATOR STRUCTURE; TRANSIT TIME FACTOR; S-COEFFICIENT; T-COEFFICIENT;

REFERENCE: 7

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771315

MICROFILM:

STOR-LOC.: HP-9 SPERG FILE:

164 TITLE.....: THE INJECTOR COMPLEX FOR THE LAMPF ACCELERATOR

AUTHOR....: ALLISON, P.W.; EMIGH, C.R.; STEVENS, R.R., JR.;
AFFILIAT.: LASL

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;
PAGES.....: 5

DATE-PUBL: 690600

CONFERENCE: PRIDE 1969 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, WASHINGTON, D.C., MARCH 5-7, 1969;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-16, NO. 3, P 135 (JUNE 1969);

ABSTRACT.: THE PRESENT PLANNING AND DESIGN GOALS FOR THE LAMPF INJECTOR COMPLEX INCLUDE A HIGH-INTENSITY H⁺ BEAM, AN H⁻ BEAM, AND POLARIZED H⁺ AND H⁻ BEAMS. SINCE SIMULTANEOUS ACCELERATION OF H⁺ AND H⁻ BEAMS WILL BE ATTEMPTED BY THE LAMPF ACCELERATOR, A DUAL BEAM-TRANSPORT SYSTEM FOR BLENDING THESE BEAMS INTO A COMMON CHANNEL WILL BE NECESSARY IN THE INJECTOR AREA. PROVISION ALSO IS MADE FOR INJECTING EITHER H⁺ OR H⁻ POLARIZED BEAMS INTO THE SYSTEM. A HIGH-QUALITY BEAM OF PROTONS (PI CH-MHAD EMITTANCE AND 26 MA) HAS BEEN PRODUCED BY A VON ARDENNE DUOPLASMATRON AND A PIERCE EXTRACTION ACCELERATING COLUMN. PROBLEMS OF SIMULTANEOUS BUNCHING AND MATCHING OF H⁺ AND H⁻ BEAMS OF DIFFERENT INTENSITIES HAVE BEEN STUDIED. THE ENTIRE INJECTOR COMPLEX IS UNDER COMPUTER CONTROL AND SHOULD PROVIDE REASONABLY SOPHISTICATED PULSE PROGRAMMING FLEXIBILITY.

SUBJECTS.: SPACE CHARGE; SIMULTANEOUS BEAMS; BUNCHER; BEAM TRANSPORT;

REFERENCE: 11

CATEGORY.: SYSTEM DESIGN; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771016

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

165 TITLE....: SPACE CHARGE FORCES IN A LINAC BUNCHER

AUTHOR...: CHIDLEY, R.G.; LEE-WHITING, G.E.;
AFFILIAT.: AECL

DOC-TYPE.: CONF PAPER, JOURNAL ARTICLE;
PAGES.....: 3

DATE-PUBL: 690600

CONFERENCE: PROC 1969 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, WASHINGTON, D.C., MARCH 5-7, 1969;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-16, NO. 3, P 207 (JUNE 1969);

ABSTRACT.: A METHOD IS DESCRIBED FOR CALCULATING THE THREE-DIMENSIONAL MOTION OF CHARGED PARTICLES IN A LINAC BUNCHER. THE SPACE-CHARGE FORCES ARE CALCULATED IN THE CONTINUOUS-FLUID APPROXIMATION. THIRD-ORDER EFFECTS IN QUADRUPOLE MAGNETS AND IN ACCELERATING CAVITIES ARE INCLUDED.

SUBJECTS.: SPACE CHARGE; BUNCHER; 3-D MOTION; THIRD ORDER EFFECTS;

REFERENCE: LEE-WHITING, G.E. AND ORMEROD, J.H., PROC 1968 PROTON LINEAR ACCEL CONF, BNI 50120 (C-54), P. 346 (104 162);

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771016

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

166 TITLE....: ON TRANSVERSE SPACE-CHARGE EFFECTS IN BUNCHED BEAMS

AUTHOR....: CLAUS, J.
AFFILIAT.: RNL

DOC-TYPE.: CONF PAPER, JOURNAL ARTICLE;
PAGES....: 5

DATE-PUBL: 690600

CONFERENCE: PROC 1969 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, WASHINGTON, D.C., MARCH 5-7, 1969;

JOURNAL...: IEEE TRANS, NUCL. SCI., VOL. NS-16, NO. 3, P 216 (JUNE 1969);

ABSTRACT.: ASSUMES MONOENERGETIC PARTICLES MOVING THRU TRANSPORT SYSTEM, NO ACCELERATION. LONGITUDINAL SPACE-CHARGE NEGLECTED. THIN TRANSVERSE SECTIONS OF THE BUNCH ARE UNIFORMLY POPULATED ELLIPTICAL CYLINDERS, WHOSE HORIZONTAL AND VERTICAL EMITTANCES ARE UNIFORMLY POPULATED ELLIPSES. THE POPULATION DENSITY TAPERS TO ZERO AT EACH END OF THE BUNCH. ENVELOPE EQUATIONS ARE DERIVED FOR MATCHED AND SLIGHTLY MISMATCHED BEAMS. APPLICATION TO THE BUNCHED BEAM SHOWS THE SLICES EMITTANCES SLIP WITH RESPECT TO EACH OTHER. EMITTANCE GROWTH IN LINACS AND BENDING MAGNETS ARE DISCUSSED.

SUBJECTS.: SPACE CHARGE;

REFERENCE: 9

CATEGORY.: SPACE CHARGE; THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771016

MICROFILM:

STOR-LOC.: NP-9 SPERG FILE;

167 TITLE....: DESIGN OF THE LOW-ENERGY BEAM TRANSPORT SYSTEM OF THE BROOKHAVEN 200-MEV INJECTOR LINAC

AUTHOR....: AGRITELLI, C.; CHASMAN, R.W.; SLUYTERS, T.J.M.;

AFFILIAT.: RNL

DOC-TYPE.: CONF PAPER; JOURNAL ARTICLE;

PAGES. ...: 6

DATE-PUBL: 690600

CONFERENCE: PROC 1969 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, WASHINGTON, D.C., MARCH 5-7, 1969;

JOURNAL...: IFFE TRANS. NUCL. SCI., VOL. NS-16, NO. 3, P 221 (JUNE 1969);

ABSTRACT.: THE DISTANCE BETWEEN THE 200-MEV LINAC AND THE 750-KEV PREINJECTOR IS DESIGNED TO BE APPROXIMATELY 8 M. A 200-MA BEAM WITH A PHASE-SPACE AREA OF 4.5 PI CM-MRAD MUST BE TRANSPORTED AND BUNCHED OVER THIS LENGTH WITH MINIMUM LOSS IN BEAM QUALITY. AS WAS FIRST POINTED OUT BY REGENSTREIF, NONLINEARITIES DUE TO QUADRUPOLE FRINGING FIELDS CAN CAUSE SERIOUS EMITTANCE GROWTH IN LOW-ENERGY TRANSPORT CHANNELS. IN ORDER TO DESIGN A SATISFACTORY SYSTEM AN EFFORT WAS MADE TO KEEP THIS EFFECT AS SMALL AS POSSIBLE.

IT IS THE PURPOSE OF THIS PAPER TO DESCRIBE HOW A SUITABLE SYSTEM WAS CHOSEN AND TO SHOW RESULTS ON BEAM PROFILES AND EMITTANCES ALONG THE SYSTEM WHICH WERE OBTAINED FROM NUMERICAL BEAM DYNAMICS CALCULATIONS INCLUDING FRINGING FIELDS AND SPACE-CHARGE EFFECTS. RESULTS OBTAINED FOR TWO OTHER, LESS DESIRABLE, SYSTEMS ARE ALSO SHOWN.

NUMERICAL CALCULATIONS, TAKING INTO ACCOUNT THE EFFECTS OF SPACE CHARGE AND QUADRUPOLE FRINGING FIELDS, SUGGEST THAT AT 750 KEV A 200-MA BEAM WITH AN EMITTANCE OF 4.5 PI CM-MRAD CAN BE TRANSPORTED AND BUNCHED OVER APPROXIMATELY 8 M WITH MODERATE LOSS IN BEAM QUALITY. THE EMITTANCE GROWTH CAUSED BY TRANSPORTING THE BEAM UP TO THE BUNCHER (APPROX 7.5 M) IS ONLY ABOUT 35 PERCENT. THIS GROWTH, HOWEVER, IS INCREASED TO ABOUT 100 PERCENT BETWEEN BUNCHER AND LINAC ENTRANCE.

SUBJECTS.: SPACE CHARGE; BUNCHER; BEAM TRANSPORT; QUADRUPOLE ERRORS;

REFERENCE: 6

CATEGORY.: NUMERICAL COMPUTATION; SYSTEM DESIGN;

CAT-SOURCE: JAMESON

DATE-ENT.: 771016

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

168 TITLE....: BEAM TRANSPORT POSSIBILITIES OF THE LOW ENERGY BEAM TRANSPORT SYSTEM (LEBT) OF THE NEW 50 MEV LINAC

AUTHOR....: CRANDALL, K.P.; WEISS, M.;
AFFILIAT.: LASL-MP-9; CERN;

DOC-TYPE.: INTERNAL REPORT
PAGES....: 46

REP-NUM.: CERN/PS/LIN 77-27
DATE-PUBL: 770724

ABSTRACT.: THE LEBT OF THE NEW 50 MEV LINAC IS ANALYSED WITH RESPECT TO ITS CAPABILITY OF TRANSPORTING PRE-INJECTOR BEAMS OF DIFFERENT INTENSITIES AND EMITTANCES; THE SITUATION IN THE TRANSVERSE PHASE SPACE IS OF MAIN CONCERN.

SOME FORMULAE SHOWING GENERAL FEATURES OF TRIPLET FOCUSING ARE DERIVED; THEY ARE USEFUL FOR THE DESIGN AND ASSESSMENT OF LIMITATIONS OF A BEAM TRANSPORT SYSTEM. THE LEBT ACCEPTANCE IS ALSO CALCULATED AND THE LIMITATIONS INDICATED; IN THIS RESPECT, A GENERAL FOCUSING DIAGRAM IS PRESENTED, WHICH, BY APPROPRIATE SCALING REMAINS VALID FOR ALL BEAMS.

FOR THE OPERATION OF LEBT, A PROCEDURE OF SETTING THE FOCUSING PARAMETERS IS DESCRIBED; IT MAKES USE OF THE EXISTING BEAM MEASURING POSSIBILITIES AND OF THE ON-LINE BEAM TRANSPORT PROGRAM TRACE. SOME EXAMPLES ARE GIVEN.

SUBJECTS.: SPACE CHARGE; BEAM TRANSPORT; TRIPLET;

NOTES....: APPENDIX ON MAXIMUM FOCUSING STRENGTH OF A SYMMETRIC TRIPLET, AND PERMISSIBLE DISTANCE BETWEEN TRIPLETS.

REFERENCE: 7

CATEGORY.: ANALYSIS; EXPERIMENTAL RESULTS;

CAT-SOURCE: JAMESON DATE-ENT.: 771219

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

1 169 TITLE.....: TRACE - AN INTERACTIVE BEAM TRANSPORT PROGRAM FOR UNBUNCHED BEAMS

AUTHOR.....: CRANDALL, K.P.
AFFILIAT.: CERN/LASL-MP-9;

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 18

REP-NUM.: PS/LIN/NOTE 77-3
DATE-PUBL: 770203

ABSTRACT.: DESCRIPTION OF THE FOUR-DIMENSIONAL BEAM-TRANSPORT PROGRAM WRITTEN FOR USE AT CERN ON THE
LINAC PDP 11/45.

SUBJECTS.: TRANSVERSE DYNAMICS; BEAM TRANSPORT; TRACE CODE; TOUCH PANEL;

CATEGORY.: SOFTWARE DOCUMENTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771019

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

170 TITLE....: ADDENDUM TO PROGRAM TRACE

AUTHOR...: CRANDALL, K.R.
AFFILIAT.: CERN/LASL-MP-9;

DOC-TYPE.: INTERNAL REPORT
PAGES....: 10

REP-NUM...: PS/LIN/NOTE 77- 15
DATE-PUBL: 770811

ABSTRACT.: DESCRIBES MODIFICATIONS TO THE TRACE FOUR-DIMENSIONAL BEAM TRANSPORT PROGRAM TO INCLUDE A HARMONIC BUNCHER AND AN ENERGY SPREAD CORRECTOR FOR SIMULATION OF THE TRANSVERSE DYNAMICS BETWEEN THE BUNCHER AND LINAC. THE CHANGE IN TRANSVERSE EMITTANCE DUE TO THE BUNCHER IS ALSO CALCULATED.

SUBJECTS.: TRACE CODE; TRANSVERSE DYNAMICS; BUNCHER; EMITTANCE GROWTH; ENERGY SPREAD CORRECTOR;

NOTES....: APPENDIX ON CHANGE IN TRANSVERSE EMITTANCE AT HARMONIC NUMBER GAP.

REFERENCE: 3

CATEGORY.: SOFTWARE DOCUMENTATION; ANALYSIS;

CAT-SOURCE: JAMESON DATE-ENT.: 771019

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

171 TITLE..... MEASUREMENTS ON THE UNBUNCHED 500 KEV BEAM IN THE 3 MEV EXPERIMENTAL AREA

AUTHOR....: KNOTT, J.; TETU, P.; WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 30

REP-NUM...: MPS/LIN/NOTE 75-1
DATE-PUBL.: 750129

ABSTRACT.: STUDIES OF THE PROPERTIES OF THE UNBUNCHED 500 KEV BEAM, AND TESTS OF THE HARDWARE AND SOFTWARE INVOLVED IN THE COMPUTER CONTROLLED MEASUREMENTS. PROGRAM INVOLVED SETUP OF 300 MA, 50 US BEAM, EMITTANCE MEASUREMENT VS. CURRENT, CONTROL OF COUPLING BETWEEN TRANSVERSE PLANES, TESTS OF PROTON PERCENTAGE, BEAM TRANSPORT CALCULATION CHECKS.

SUBJECTS.: BEAM TRANSPORT; SPACE CHARGE; EMITTANCE; NEUTRALIZATION;

NOTES.....: USED 20 V POSITIVE BIAS ON COLLECTOR PLATES, AND 120V VOLTS POSITIVE ON THE APERTURES. WITH BIAS, EMITTANCE WAS ROTATED COUNTERCLOCKWISE AND ANGULAR PROFILE WAS CHANGED, SURPRISING EFFECTS ON EMITTANCE FROM TRIPLETIS ARE NOTED. COUPLING BETWEEN PHASE-PLANES WAS STUDIED BY MEASURING THE EMITTANCE IN ONE PLANE AS A FUNCTION OF A BEAM SAMPLE FROM VARIOUS POSITIONS IN THE OTHER PLANE. STRONG COUPLINGS WERE SEEN ESPECIALLY AT CURRENTS OF 200 MA AND UP.

A DEFINITION IS DERIVED (APPENDIX) FOR A CHARACTERISTIC EMITTANCE IN TERMS (THE MEAN EMITTANCE) OF A DENSITY DISTRIBUTION FUNCTION OF THE FORM $I = I(E)$ WHERE E DESCRIBES EQUIDENSITY CONTOURS IN THE PHASE PLANE. IT EQUALS APPROX $(\sum \text{OVER } J \text{ OF } E \sum J \text{ TIMES } I(E \sum J)) / (\sum \text{OVER } J \text{ OF } I(E \sum J))$. A CENTRAL CURRENT DENSITY IS THEN DEFINED AT THE TOTAL CURRENT OVER THE CHARACTERISTIC EMITTANCE. COMPUTATION CAN BE MADE EASILY BY COMPUTER ANALYSIS PROGRAM BY VARYING THE THRESHOLD.

REFERENCE: L.R. EVANS AND D.J. WARNER, STUDIES OF SPACE CHARGE NEUTRALIZATION IN INTENSE 500 KEV PROTON BEAMS, CERN/MPS/LIN 71-3; L.R. EVANS AND D.J. WARNER, SPACE CHARGE NEUTRALIZATION OF INTENSE CHARGED PARTICLE BEAMS; SOME THEORETICAL CONSIDERATIONS, CERN/MPS/LIN 71-2;

CATEGORY.: EXPERIMENTAL RESULTS;

CAT-SOURCE: JAMESON DATE-ENT.: 771019

MICROFILM:

STOR-IDC.: MP-9 SPORG FILE:

172 TITLE..... STATUS OF NEW PROTON LINACS (1970)

AUTHOR.... (CONFERENCE SUMMARY)
AFFILIAT.:

DOC-TYPE.: CONF PROCEEDINGS

PAGES..... 196

DATE-PUBL: 7/00925

CONFERENCE: PROC 1970 PROTON LINEAR ACCEL CONF, NATL ACCEL LAB, BATAVIA, ILLINOIS, VOL. 1, A. STATUS OF NEW PROTON LINACS AND H. BEAM DIAGNOSTIC MEASUREMENTS, SEPT. 28 - OCT. 2, 1970;

ABSTRACT.: PERFORMANCE DATA: BNL-750 KEV, EIN = 19.5 PI CM MRAD AT 90 PERCENT; E10MEV = 6 PI HORIZ, 7.5 PI VERT (ALTHO VERT BETTER MATCHED AT INPUT), IIN = 270 MA, I10MEV = 210 MA, DELTA E10MEV = 1.5 MEV FWHM.

NAL-750 KEV, E10MEV = 16.5 CM MRAD HORIZ, 21.0 CM MRAD VERT, BOTH AT 90 PERCENT; IIN = 210 MA, IOUT = 150 MA; ENERGY SPREAD AT 10 MEV = 0.1 MEV AT 90 PERCENT.

CFN-750 KEV, EIN = 0.2 CM MRAD NORM AT 90 PERCENT, E20MEV = 0.14 CM MRAD NORM AT 80 PERCENT IN HORIZ, 0.36 IN VERT; IIN = 30 MA, I20MEV = 15 MA.

CFN NOTES FROM NUMERICAL CALCULATIONS THAT MACHINE ACTS LIKE EMITTANCE ADDER, WITH EOUT = EIN + K_T, WHERE K = 6 CM MRAD/A FOR THEIR CASE.

IN ROUND TABLE DISCUSSION, NEED FOR STANDARDIZING EMITTANCE MEASUREMENTS IS NOTED; ALSO THE NEED FOR A GENERAL SPECIFICATION FOR EMITTANCE OF AN ARBITRARY DENSITY DISTRIBUTION. MULTIDIMENSIONAL PHASE SPACE MEASUREMENTS ARE NEEDED TO CHECK OUT THEORETICAL PREDICTIONS. CONCERN OVER WHETHER FLUTTER FACTOR FROM ALTERNATING GRADIENT FOCUSING IS A PROBLEM OR NOT.

DOUBLE BEAMS WERE NOTED AT BNL; APPARENTLY THE SECOND COMPONENT WAS 5-10 PERCENT OF THE TOTAL CURRENT.

NAL REPORTS ON PHASE SCAN TYPE MEASUREMENTS, AND COMMENTS ON DIFFERENCES IN MEASURED EMITTANCES BETWEEN X AND Y PLANES; THE DIFFERENCE REVERSED WHEN THE QUADS WERE SWITCHED FROM - + - + TO + - + -.

SUBJECTS.: EMITTANCE GROWTH; SPACE CHARGE; AGREEMENT BETWEEN THEORY AND EXPERIMENT;

CATEGORY.: SYSTEM PERFORMANCE; SPACE CHARGE; DIRECTIONS;

CAT-SOURC: JAMESON

DATE-ENT.: 771022

MICROFILM:

STOR-LOC.: PP-9 SPERG FILE;

173 TITLE..... EXPERIENCES WITH POST COUPLER STABILIZED STRUCTURES IN THE NAL LINAC

AUTHOR.... OWEN, C.W.; WIDENRANT, J.D.;
AFFILIAT.: NAL

DOC-TYPE.: CONF PAPER
PAGES..... 15

DATE-PUBL: 700928

CONFERENCE: PROC 1970 PHOTON LINEAR ACCEL CONF, NATL ACCEL LAB, BATAVIA, ILLINOIS, VOL. 3, P. 315, SEPT. 28
- OCT. 2, 1970;

ABSTRACT.: USED SLUG TUNERS INSTEAD OF END CELL PERTURBATIONS TO PRODUCE $\pm$ PERTURBATIONS FOR FREQ-
SENSITIVITY CHECK. KEPT FREQUENCY APPROX CONSTANT DURING TUNING BY ADJUSTING AVERAGE
PENETRATION OF TUNERS. FINAL FREQUENCY ADJUSTMENT IN OPERATION MADE WITH ONE TUNER, WHICH
PERTURBED FIELD $\pm$ TO 1 TO 2 PERCENT OVER ENTIRE RANGE; REALLY ONLY REQUIRED DURING TRANSIENTS,
THEN RETURNED TO NOMINAL POSITION. DISCUSS TAPER OF DRIFT-TUBE IN POST-COUPLER GAP ALONG
STRUCTURE.

SUBJECTS.: BEAM PERTURBATION MEASUREMENT; STABILIZED STRUCTURE; FIELD DISTRIBUTION; ACCELERATOR STRUCTURE;

CATEGORY.: SYSTEM PERFORMANCE; LINAC DESIGN;

CAT-SOURCE: JAMESON DATE-ENT.: 771022

MICROFILM;

STOR-LOC.: MP-9 SPORG FILE;

174.TITLE.....: THE ROLE OF SPACE CHARGE IN BEAM TRANSPORT

AUTHOR....: OSHER, J.F.

AFFILIAT.: LLL

DOC-TYPE.: PREPRINT

PAGES....: 20

REP-NUM...: UCRL-79311

DATE-PUBL: 770325

CONFERENCE: SUBMITTED TO INTNATL CONF ON LOW ENERGY ION BEAMS, UNIV OF SALFORD, ENGLAND, SEPT. 5-8, 1977;

ABSTRACT.: THIS PAPER REVIEWS SPACE CHARGE AS IT EFFECTS ION BEAM TRANSPORT. THE APPROACH HERE WILL BE (1) TO DERIVE BEAM-CURRENT CRITERIA FOR DIVERGENCE FROM SPACE CHARGE, (2) REVIEW RECENT THEORETICAL MODELS FOR FRACTIONAL SPACE-CHARGE NEUTRALIZATION, (3) DISCUSS SPACE-CHARGE-RELATED OBSERVATIONS ON ION-BEAM TRANSPORT IN A SPECIFIC EXPERIMENTAL SYSTEM, AND (4) BRIEFLY NOTE SEVERAL APPLICATIONS USING SPACE CHARGE. EXPERIMENTAL MEASUREMENTS OF EFFECTIVE SPACE CHARGE ARE DISCUSSED FOR A DC ION-SOURCE TEST STAND USING A 90 DEGREE DOUBLE-FOCUSING MAGNET FOR SPECIES SEPARATION AND FOR A SOLENOIDAL LENS MAGNET FOR TRIM FOCUS OF THE ION BEAM PREPARATORY TO ENTRANCE INTO A 400-KV ACCELERATOR COLUMN.

SUBJECTS.: SPACE CHARGE; BEAM TRANSPORT; NEUTRALIZATION;

REFERENCE: 32

CATEGORY.: THEORY; EXPERIMENTAL RESULTS; REVIEW PAPER;

CAT-SOURCE: JAMESON

DATE-ENT.: 771021

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

175 TITLE..... NUMERICAL METHODS FOR SOLVING ABERRATION AND SPACE CHARGE PROBLEMS IN BEAM TRANSPORT SYSTEMS

AUTHOR...: TANGUY, P.
AFFILIAT.: RENNES

DOC-TYPE.: CONF PAPER
PAGES.....: 20

DATE-PUBL: 700920

CONFERENCE: PROC 1970 PHOTON LINEAR ACCEL CONF, NATL ACCEL LAB, BATAVIA, ILLINOIS, VOL. 2, P. 771, SEPT. 20
- OCT. 2, 1970;

ABSTRACT.: NUMERICAL METHODS HAVE BEEN SET UP TO FOLLOW THE BEAM BEHAVIOUR IN AN ARBITRARY TRANSPORT
SYSTEM TAKING INTO ACCOUNT ALL NON LINEAR FORCES EXPERIENCED BY THE PARTICLES AT THE BEAM.
VARIOUS DISTRIBUTIONS IN THE FOUR DIMENSIONAL PHASE SPACE HAVE BEEN CONSIDERED UNDER THE
ASSUMPTION OF AN ESSENTIALLY NON-LAMINAR FLOW.

AN APPLICATION HAS BEEN MADE TO THE PRESENT PREINJECTOR OF THE CERN SYNCHROTRON; THE
RESULTS OBTAINED ARE CONSISTENT WITH EXPERIMENTAL EVIDENCE.

SUBJECTS.: SPACE CHARGE; QUADRUPOLE ERRORS; COMBINED SPACE CHARGE AND ABERRATIONS; COUPLING;

NOTES.....: CONSIDERS COMBINED SPACE CHARGE AND ABERRATIONS FOR BEAMS WITH AND WITHOUT ROTATIONAL
SYMMETRY (BUT WITH TWO PLANES OF SYMMETRY), NON-LAMINAR FLOW. FOR ROTATIONALLY SYMMETRIC BEAMS,
EACH STEP FOR 7000 PARTICLES TAKES LESS THAN 1 S ON A 6600. FOR NON-ROTATIONALLY SYMMETRIC
BEAMS, IT IS ASSUMED THAT THE SPACE CHARGE MAGNETIC FIELD IS ZERO, THE ONLY ELECTRIC FIELD IS
DUE TO SPACE CHARGE, THE EXTERNAL MAGNETIC FIELD IS THAT OF A SYSTEM OF QUADRUPOLES, BEAM IS ON-
AXIS AND HAS TWO SYMMETRY PLANES, METHOD COULD BE EXTENDED TO NO SYMMETRY.

REFERENCE: A

CROSS-REF: IDN 210, SPORG;

CATEGORY.: NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771022

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

1 176 TITLE.....: AN INVESTIGATION OF THE NONLINEAR DYNAMICS OF A PROTON BEAM USING THE HYDRODYNAMIC APPROACH

AUTHOR....: DAVIES, A.J.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 20

DATE-RIHL: 720928

CONFERENCE: PHOC 1979 PROTON LINEAR ACCEL CONF, NATL ACCEL LAB, BATAVIA, ILLINOIS, VOL. 2, P. 791, SEPT. 29
- OCT. 2, 1979;

ABSTRACT.: A STUDY HAS BEEN MADE OF THE DYNAMICS OF THE PROTON BEAM IN THE PRE-INJECTOR REGION OF THE
CERN LINAC, WHERE THE BEAM HAS APPROXIMATE ROTATIONAL SYMMETRY. IT IS SHOWN THAT THE
HYDRODYNAMIC APPROACH (ALLOWING FOR PARTICLE OVERTAKING AND THE NON-LINEAR EFFECTS OF SPACE
CHARGE) CAN GIVE A SATISFACTORY DESCRIPTION OF THE BEAM DYNAMICS.

THE NUMERICAL PROGRAMME HAS BEEN DESIGNED TO OPERATE IN A SEMI-INTERACTIVE MANNER, VIA A
REMOTE CATHODE RAY DISPLAY, WITH A CDC 6600 COMPUTER AND HAS PROVEN A POWERFUL TOOL IN
INVESTIGATING THE PROPERTIES OF THE PROTON BEAM. TYPICAL RESULTS ARE PRESENTED AND DISCUSSED.

SUBJECTS.: SPACE CHARGE; INJECTOR;

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771022

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

177 TITLE....: LINAC QUADRUPOLE GRADIENTS AND MATCHING PARAMETERS AT DIFFERENT BEAM INTENSITIES

AUTHOR....: HRU, R., WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 17

DATE=PUBL: 700928

CONFERENCE: PROC 1974 PROTON LINEAR ACCEL CONF, NATL ACCEL LAB, BATAVIA, ILLINOIS, VOL. 2, P. 851, SEPT. 24
- OCT. 2, 1974;

ABSTRACT.: WITH HIGHER BEAM INTENSITIES THE REQUIRED STRENGTH OF LINAC QUADRUPOLES AS WELL AS THE
PARAMETERS OF THE MATCHED BEAM DIFFER MORE AND MORE FROM THE ZERO SPACE CHARGE VALUES. A SIMPLE
METHOD OF CALCULATION IS PRESENTED BY WHICH THE QUADRUPOLE GRADIENTS, MATCHING PARAMETERS AND
LINAC ACCEPTANCES FOR ANY BEAM CURRENT CAN BE OBTAINED. THE BEAM IS CONSIDERED AS A UNIFORMLY
CHARGED ELLIPSOID AND THE WHOLE TREATMENT IS LINEAR.

A COMPUTER PROGRAMME HAS BEEN DEVELOPED TO DETERMINE THE ABOVE PARAMETERS. IT TRACKS, IN
ADDITION, THE BEAM THROUGH THE COMPUTED STRUCTURE AND DISPLAYS ITS ENVELOPE ON A GRAPHICAL
OUTPUT. IN THIS WAY IT IS POSSIBLE TO SEE HOW WELL THE BEAM IS MATCHED.

THE RESULTS OBTAINED FOR ++- AND +- STRUCTURES ARE PRESENTED.

SUBJECTS.: SPACE CHARGE; MATCHING;

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE=ENT.: 771422

MICROFILM:

STOR=LOC.: MP-9 SPRG FILE;

17A TITLE..... THE PROBLEMS OF PARTICLE TRANSMISSION IN A HIGH INTENSITY PROTON ACCELERATOR COMPLEX

AUTHOR...: TAYLOR, C.S.
AFFILIAT...: CERN

DOC-TYPE...: CONF PAPER
PAGES.....: 1A

DATE-PUBL: 70092A

CONFERENCE: PROC 1970 PROTON LINEAR ACCEL CONF, NATL ACCEL LAB, BATAVIA, ILLINOIS, VOL. 2, P. 881, SEPT. 2A
- OCT. 2, 1970;

ABSTRACT.: THIS PAPER DISCUSSES SOME OF THE GENERAL PROBLEMS OF HIGH-INTENSITY PROTON ACCELERATORS, THAT IS THE EFFICIENCY OF THE ACCELERATOR FOR THE TRANSMISSION OF PARTICLES, AND THE ALLIED QUESTIONS OF THE OPTIMIZATION OF THE MANY VARIABLES WHICH CAN AFFECT THE INTENSITY, AND THE STATISTICAL BEHAVIOUR OF THE MACHINE. SOME COMMENTS ARE MADE ON OPERATIONAL ASPECTS OF HIGH INTENSITY MACHINES, AND ON THE FEASIBILITY OF APPROACHING PHASE SPACE DENSITY CONSERVATION IN PROTON ACCELERATORS.

SUBJECTS.: OPTIMIZATION; SYSTEM DESIGN; STATISTICAL BEHAVIOR;

NOTES.....: GENERAL DEFINITION OF AN EMITTANCE CONSTANT OR E-FOLDING EMITTANCE, IN UNITS OF $(\text{AREA}/\pi) \cdot \beta\gamma$, GIVES AN EQUATION FOR THE CURRENT I WITHIN A GIVEN DENSITY CONTOUR OF EMITTANCE EM FOR A TOTAL CURRENT OF I_0 : $I = I_0 (1 - F \cdot (EM/EM_0))$. THE INFLUENCE OF TRAPPING EFFICIENCY AND A BLOWUP FACTOR ARE ADDED. OPTIMIZATION IS ARGUED TO PRODUCE INPUT-OUTPUT CORRELATIONS SKEWED TOWARD HIGH OUTPUT BECAUSE OPTIMIZATION IS USUALLY A PROCESS OF FORCING THE MEAN VALUE TOWARD THE HIGHEST MAXIMUM VALUE. IN A CHAIN OF MACHINE, SUBOPTIMIZATION AT INTERMEDIATE LEVELS MAY PRODUCE BETTER TOTAL OPTIMIZATION THAN SERIAL OPTIMIZATION AT EACH STAGE.

REFERENCE: 15

CATEGORY.: SYSTEM DESIGN; OPERATING EXPERIENCE;

CAT-SOURCE: JAMESON DATE-ENT.: 771022

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

179 TITLE....: PROPOSAL FOR A HIGHER ENERGY PREINJECTOR FOR THE CERN PS

AUTHOR....: BERNARD, P.; HUGUENIN, J.; TALIGREN, U.; WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 27

DATE-PUBL: 7/0092R

CONFERENCE: PHOC 1978 PROTON LINEAR ACCEL CONF, NATL ACCEL LAB, BATAVIA, ILLINOIS, VOL. 2, P. 1027, SEPT.
28 - OCT. 2, 1978

ABSTRACT.: A PAPER ON THE "PRELIMINARY STUDY OF A HIGHER ENERGY PREINJECTOR FOR THE CERN PS" WAS
PRESENTED AT THE 1968 BROOKHAVEN CONFERENCE, IN WHICH THE EXPECTED IMPROVEMENTS IN THE LINAC
BEAM TO FOLLOW SUCH A CHANGE WERE DISCUSSED. THE CONTINUATION OF THE STUDY PRODUCED SOME
INTERESTING RESULTS WHICH ARE THE SUBJECT OF THE PRESENT PAPER. THESE INCLUDE HIGH VOLTAGE TEST
(TO 1.2 MV) ON THE CERN HIGH GRADIENT ACCELERATOR TUBE, ION OPTICAL CALCULATIONS AND PROPOSALS
FOR THE DESIGN OF THE HT GENERATOR.

WE CONCLUDE THAT IT SEEMS FEASIBLE, TAKING A REASONABLE TECHNOLOGICAL RISK, TO CONSTRUCT A
PRESSURIZED 500 MA PREINJECTOR WITH A FINAL ENERGY OF 1.4 MEV. DETAILS OF THE LAYOUT OF SUCH A
PREINJECTOR ARE INCLUDED.

SUBJECTS.: INJECTOR; INJECTION ENERGY;

CATEGORY.: SYSTEM DESIGN; PARAMETER SEARCH;

CAT-SOURCE: JAMESON DATE-ENT.: 771022

MICROFILM:

STOR-LOC.: NP-9 SPORG FILE;

1 180 TITLE.....: EMITTANCE MEASUREMENTS IN A 200-MEV BEAM TRANSPORT SYSTEM

AUTHOR....: CLAUS, J., SNIJTERS, T.J.M.,
AFFILIAT.: RNI

DOC-TYPE.: CONF PAPER
PAGES.....: 7

DATE-PUBL: 198928

CONFERENCE: PROC 1978 PROTON LINEAR ACCEL CONF, NATL ACCEL LAB, BATAVIA, ILLINOIS, VOL. 2, P. 1087, SEPT,
28 - OCT, 2, 1978

ABSTRACT.: IN THIS PAPER WE CONSIDER OPTIMUM POSITIONS FOR BEAM PROFILE MONITORS, TO BE USED FOR BEAM
EMITTANCE MEASUREMENT IN THE HIGH ENERGY BEAM TRANSPORT (HEBT) SYSTEM BETWEEN THE 200-MEV
CONVERSION LYNAC AND THE AGS AT BROOKHAVEN NATIONAL LABORATORY. WE ALSO CONSIDER SOME
CHARACTERISTICS OF POSSIBLE PROFILE MONITORS.

SUBJECTS.: EMITTANCE; RECONSTRUCTION TECHNIQUE; BEAM PROFILE MEASUREMENTS;

NOTES.....: RECONSTRUCTION OF EMITTANCE FROM WIRE-SCANNER PROFILES, ACCURACY CONSIDERATIONS.

CATEGORY.: THEORY; MEASUREMENTS;

CAT-SOURCE: JAMFSON DATE-ENT.: 771022

MICROFILM:

STOR-LOC.: MP-9 SPARC FILE;

181 TITLE....: THE EFFECT OF SPACE CHARGE IN BEAM TRANSPORT LINES

AUTHOR....: SACHFERER, F.J.; SHERWOOD, T.R.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 2

DATE-PUBL: 710600

CONFERENCE: PROC 1971 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 1-3,
1971;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-18, NO. 3, P 1066 (JUNE 1971)

ABSTRACT.: DESCRIBES NONLINEAR PROGRAM 6-D, 650 PARTICLES. LOOKING AT 2-D PROJECTIONS WITH GAUSSIAN
DISTRIBUTION, REMAINS GAUSSIAN, TRANSVERSE RMS EMITTANCE GROWS 5 PERCENT FOR 100 MA, 10 PERCENT
FOR 200 MA. THEREFORE RMS EMITTANCE IS VERY CLOSE TO THAT OBTAINED BY LINEAR VERSION, WHICH
ADDS SPACE CHARGE INCREMENTALLY AS AN IMPULSE EFFECT.

((((RMS ENVELOPES ARE INSENSITIVE TO DISTRIBUTION PROVIDED BEAM KEEPS ELLIPSOIDAL FORM AND
EMITTANCE GROWTH IS NEGLIGIBLE)))).

IN A 100 MA, 50 MEV PROTON LINE, CORRESPONDING TO A PEAK CURRENT OF 2.5A DUE TO 2CM BUNCH
LENGTH, MU APPROX OR EQUAL TO 1/3. THIS CHANGES WAIST LOCATIONS ETC., ALSO LONGITUDINAL SPACE
CHARGE INCREASES ENERGY SPREAD 400-200-300 KEV. TWISTING AND FILAMENTING.

SUBJECTS.: SPACE CHARGE; RMS EMITTANCE; EMITTANCE GROWTH; PHASE SPACE DISTRIBUTION; LINEAR CODE; BEAM CODE;

REFERENCE: C

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-FNT.: 771022

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

182 TITLE.....: STUDIES OF SPACE CHARGE NEUTRALIZATION IN INTENSE 500 KEV PROTON BEAMS

AUTHOR....: EVANS, I.R.; WARNER, D.J.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES.....: 5

DATE-PUBL: 710600

CONFERENCE: PROC 1971 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 1-4, 1971;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-18, NO. 3, P 106A (JUNE 1971);

ABSTRACT.: SOME ASPECTS OF THE TRANSPORT OF INTENSE 500 KEV PROTON BEAMS HAVE BEEN INVESTIGATED IN THE CERN 3 MEV EXPERIMENTAL LINAC. RESULTS ARE PRESENTED FOR THE CURRENT TRANSMITTED THROUGH A KNOWN SET OF RESTRICTING APERTURES. THESE CURRENTS ARE CONSIDERABLY HIGHER THAN THE THEORETICAL VALUES FOR A UNIFORM DENSITY ZERO EMITTANCE BEAM. TO EXPLAIN THESE RESULTS IN REGIONS WHERE THE PRESSURE IS TOO LOW (10^{-6} TORR) FOR THE WELL KNOWN GAS NEUTRALISATION MECHANISM, WE PROPOSE THAT THE BEAM IS PARTIALLY NEUTRALISED BY SECONDARY ELECTRONS PRODUCED FROM METALLIC SURFACES IN THE BEAM PIPE. USING A SPECIALLY DESIGNED APPARATUS WHICH ENABLES ELECTRONS TO BE REMOVED FROM THE BEAM OVER A SUBSTANTIAL FRACTION OF ITS PATH WE FIND THAT THE MEASURED CURRENTS ARE MORE CONSISTENT WITH AN UNNEUTRALISED BEAM. IN ADDITION THIS APPARATUS HAS ENABLED US TO DETERMINE A VERY HIGH VALUE FOR THE SECONDARY ELECTRON EMISSION COEFFICIENT FOR PROTON IMPACT NEAR GLANCING INCIDENCE. FINALLY THE POSSIBLE PERTURBING EFFECT OF SECONDARY ELECTRONS ON EMITTANCE MEASUREMENTS IN OUR LOW ENERGY DRIFT SPACE IS DISCUSSED.

SUBJECTS.: SPACE CHARGE; EMITTANCE MEASUREMENT; NEUTRALIZATION;

NOTES.....: REFERENCES TO SOURCE STUDIES - NON-LINEAR S.C. FORCES AND IONS ABERRATIONS SERIOUSLY REDUCE BEAM BRILLIANCE.

MAX CURRENT THAT CAN BE PASSED THRU 2 APERTURES - DAWSON'S INTEGRAL.

BEAM USUALLY PARTLY NEUTRALIZED BECAUSE MORE CURRENT GOES THRU THAN PREDICTED FOR UNNEUTRALIZED BEAM. BUNCHER RESULTED IN X-RAY AT UNNEUTRALIZED LEVEL.

GAS NEUTRALIZATION - IONIZATION OF HYDROGEN; $I_N = 1/NG \times \Sigma \times V$ WHERE NG IS GAS CONCENTRATION, Σ IS IONIZATION CROSS-SECTION, V IS PROTON VELOCITY. FOR HYDROGEN AT 500 KEV PROTONS, Σ IS APPROX TO $5 \times 10^{-17} \text{ CM}^2$. IF PRESSURE = 2×10^{-6} TORR, I_N IS APPROX TO 30 MICROSEC.

SECONDARY ELECTRON NEUTRALIZATION - COEFF VERY LARGE AT GRAZING ANGLES - MEASURE 27 AT ANGLE OF APPROX 2 DEGREES. WILL OCCUR ESPECIALLY WHERE THERE ARE LOSSES. IF EACH LOST PROTON MAKES 30 ELECTRONS AT AVERAGE VELOCITY OF 1/10 THE PROTON VELOCITY, NEED LOSE ONLY 0.3 PERCENT OF BEAM OVER DISTANCE EQUAL TO BEAM DIAMETER TO MAINTAIN NEUTRALIZATION. WILL AFFECT EMITTANCE MEASUREMENTS - SEE REFERENCE 11, BUT HASN'T MUCH EFFECT ON AREA AND SHAPE - DENSITY DID CHANGE. REEL UNRESOLVED.

REFERENCE: 11

CATEGORY.: THEORY; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: JAMESON

DATE-ENT.: 771022

MICROFILM;

STOR-LOC.: MP-9 SPRNG FILE;

183 TITLE....: POSSIBLE EMITTANCE INCREASE THROUGH FILAMENTATION DUE TO SPACE CHARGE

AUTHOR....: LAPOSTOLLE, P.M.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 4

DATE-PUBL: 71P600

CONFERENCE: PROC 1971 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 1-4, 1971;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-18, NO. 3, P 1101 (JUNE 1971);

ABSTRACT.: THE STUDY OF OSCILLATIONS WHICH CAN TAKE PLACE IN A BEAM UNDER SPACE CHARGE CONDITIONS HAS BEEN EXTENDED TO OTHER DISTRIBUTIONS THAN THE ONE DESCRIBED BY KAPCHINSKY AND VLADIMIRSKY (K.V.) IN 1950. TWO SETS OF EQUATIONS SIMILAR TO THE ONES THEY ESTABLISHED CAN BE WRITTEN PROVIDED AXIS AND EMITTANCE VALUES ARE REPLACED BY RMS EXPRESSIONS APPLICABLE TO ANY TYPE OF DISTRIBUTION. IN CASE OF A NON K.V. DISTRIBUTION, THE COMPARISON OF THESE SETS GIVES DIFFERENTIAL EQUATIONS RELATING THE RMS EMITTANCES TO CORRECTING TERMS WHICH DEPEND ON THE CHARGE DISTRIBUTION INSIDE THE BEAM. SUCH EQUATIONS CAN BE USED TO INTERPRET SOME RMS EMITTANCE INCREASES OBSERVED EITHER WITH A MISMATCH IN A SMOOTH FOCUSING CHANNEL OR WITH A MISMATCHED BEAM IN AN AC FOCUSING SYSTEM.

SUBJECTS.: SPACE CHARGE; RMS EMITTANCE;

REFERENCE: 12

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771022

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1 184 TITLE..... RMS ENVELOPE EQUATIONS WITH SPACE CHARGE - 710600

AUTHOR...: SACHNER, F.J.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 3

DATE=PUPL: 710600

CONFERENCE: PROC 1971 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 1-5, 1971;

JOURNAL...: TEEF TRANS. NUCL. SCI., VOL. NS-18, NO. 3, P 1105 (JUNE 1971);

ABSTRACT.: ENVELOPE EQUATIONS FOR A CONTINUOUS BEAM WITH UNIFORM CHARGE DENSITY AND ELLIPTICAL CROSS-SECTION WERE FIRST DERIVED BY KAPCHINSKY AND VLADIMIRSKY (K-V). IN FACT, THE K-V EQUATIONS ARE NOT RESTRICTED TO UNIFORMLY CHARGED BEAMS, BUT ARE EQUALLY VALID FOR ANY CHARGE DISTRIBUTION WITH ELLIPTICAL SYMMETRY, PROVIDED THE BEAM BOUNDARY AND EMITTANCE ARE DEFINED BY RMS (ROOT-MEAN-SQUARE) VALUES. THIS RESULTS BECAUSE (1) THE SECOND MOMENTS OF ANY PARTICLE DISTRIBUTION DEPEND ONLY ON THE LINEAR PART OF THE FORCE (DETERMINED BY LEAST SQUARES METHOD), WHILE (11) THIS LINEAR PART OF THE FORCE IN TURN DEPENDS ONLY ON THE SECOND MOMENTS OF THE DISTRIBUTION. THIS IS ALSO TRUE IN PRACTICE FOR THREE-DIMENSIONAL BUNCHED BEAMS WITH ELLIPSOIDAL SYMMETRY, AND ALLOWS THE FORMULATION OF ENVELOPE EQUATIONS THAT INCLUDE THE EFFECT OF SPACE CHARGE ON BUNCH LENGTH AND ENERGY SPREAD.

THE UTILITY OF THIS RMS APPROACH WAS FIRST DEMONSTRATED BY LAPOSTOLLE FOR STATIONARY DISTRIBUTIONS. SUBSEQUENTLY, GLUCKSTERN PROVED THAT THE RMS VERSION OF THE K-V EQUATIONS REMAIN VALID FOR ALL CONTINUOUS BEAMS WITH AXIAL SYMMETRY. IN THIS REPORT THESE RESULTS ARE EXTENDED TO CONTINUOUS BEAMS WITH ELLIPTICAL SYMMETRY AS WELL AS TO BUNCHED BEAMS WITH ELLIPSOIDAL FORM, AND ALSO TO ONE-DIMENSIONAL MOTION.

A RATHER SURPRISING AND USEFUL RESULT HAS BEEN FOUND FOR BEAMS IN FREE SPACE, NAMELY THAT THE LINEAR PART OF THE SELF-FIELD DEPENDS MAINLY ON THE RMS SIZE OF THE DISTRIBUTION AND ONLY VERY WEAKLY ON ITS EXACT FORM. USING THIS RESULT, ENVELOPE EQUATIONS FOR THE RMS BEAM SIZE HAVE BEEN DERIVED THAT ARE EXACT FOR CONTINUOUS BEAMS OF ELLIPTICAL SYMMETRY, AND IN PRACTICE ALSO VALID FOR BUNCHED BEAMS OF ELLIPSOIDAL FORM. THE MAIN RESTRICTION IN APPLYING THESE EQUATIONS IS THAT THE TIME DEPENDENCE OF THE RMS EMITTANCE MUST BE KNOWN A PRIORI.

POSSIBLE USES OF THE EQUATIONS INCLUDE THE SPECIFICATION OF STATIONARY OR MATCHED STATES IN THE PRESENCE OF SPACE CHARGE. FOR EXAMPLE, THE PERIODIC SOLUTION OF EQ. (35) FOR ALTERNATING-GRADIENT STRUCTURES, INCLUDING RADIO FREQUENCY CAVITIES, SPECIFIES THE MATCHED BEAM SIZE (BOTH LONGITUDINAL AND TRANSVERSE) AS A FUNCTION OF RMS EMITTANCES AND INTENSITY. THE LARGEST MATCHED SIZE ATTAINABLE WITHOUT EXCEEDING APERTURE LIMITS OR BUCKET SIZE DETERMINES A SPACE-CHARGE LIMIT. FOR A BEAM MATCHED IN THIS WAY, ENVELOPE OSCILLATIONS ABOUT THE PERIODIC SOLUTION ARE SUPPRESSED, ALTHOUGH HIGHER MODES OF OSCILLATIONS (SEXTUPOLE, OCTUPOLE, ETC.) MAY OCCUR. SUPPRESSION OF THE HIGHER MODES WILL REQUIRE CONSTRAINTS, AS YET UNDETERMINED, ON THE HIGHER MOMENTS OF THE DISTRIBUTION. ANOTHER USE IS THE DESIGN OF LOW-ENERGY BEAM TRANSFER LINES.

SUBJECTS.: SPACE CHARGE; RMS EMITTANCE; RMS ENVELOPE EQUATIONS; MULTIDIMENSIONAL MOMENT EQUATIONS;

NOTES..... IMPORTANT PAPER. REMEMBER THAT ELLIPTICAL SYMMETRY IS REQUIRED AND TIME DEPENDENCE OF RMS EMITTANCE MUST BE KNOWN A PRIORI.

REFERENCE: A

1
CROSS-REF: IDN 42, SPERG:

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON

DATE-ENT.: 771022

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

1 145 TITLE....: OPERATING EXPERIENCE WITH THE NAL 200-MEV LINAC

AUTHOR....: CURTIS, C.D.; GRAY, E.R.; LINDAHL, P.V.; OWEN, C.M.; SHEA, M.F.; YOUNG, D.F.;
AFFILIAT.: NAL

DOC-TYPE.: CONF PAPER
PAGES....: 8

REP-NUM.: LA-5115
DATE-PUBL: 7/21/72

CONFERENCE: PROF 1972 PHOTON LINEAR ACCEL CONF, IASL, LOS ALAMOS, NM, OCTOBER 10-13, 1972, LAST REPORT LA-5115, P. 171

ABSTRACT.: AT LOW CURRENTS (15-30 MA) THE 200 MEV EMITTANCE AREA IS SOMEWHAT LESS THAN ONE PI UNNORMALIZED. IF THE INPUT EMITTANCE IS DECREASED BY ADJUSTING THE ION SOURCE, THE OUTPUT EMITTANCE ALSO GOES DOWN, SHOWING VALUE OF BRIGHTER SOURCE. AT 30 MA, THE AREA IS ABOUT 3.6 MPAD CM FOR 90 PERCENT OF BEAM, WITH NO PARAMETER ADJUSTMENTS IN THE LINAC. BEAM EMITTANCE AT 750 KEV IS NEARLY INDEPENDENT OF CURRENT. GROWTH OCCURS MOSTLY IN FIRST 10 MEV; THIS MAY AFFECT THE FRINGES MORE THAN THE CORE. ABOVE 10 MEV, SIGNIFICANT GROWTH IS SOMETIMES SEEN; THERE IT LOOKS LIKE EITHER THE CORE GROWS RELATIVELY MORE THAN THE FRINGES OR ELSE THE WHOLE BEAM GROWS. DIFFERENTIAL GROWTH BETWEEN HIGH AND LOW CURRENT IS NOT OBSERVED CONSISTENTLY BELOW 10 MEV, WHILE THERE TENDS TO BE MORE GROWTH FOR THE HIGH CURRENT BEAMS ABOVE 10 MEV. THE RELATIVE GROWTH BELOW AND ABOVE 10 MEV CHANGES WITH INPUT MATCHING, BUT THE 200 MEV EMITTANCE STAYS ESSENTIALLY CONSTANT FOR A GIVEN BEAM CURRENT.

DELTA P/P INCREASES SLOWLY WITH CURRENT TO ABOUT 0.35 PERCENT AT 30 MA FOR 90 PERCENT OF THE BEAM, UNCORRECTED FOR FINITE EMITTANCE. AT (32 MA BUNCHER ON/42 MA BUNCHER OFF) A SLIGHT INCREASE IN ENERGY SPREAD AT 200 MEV WAS OBSERVED WITH BUNCHER ON; AT (40 MA/20 MA) THERE WAS NO DIFFERENCE. IN ANOTHER EXPERIMENT, 20 MA WAS ACCELERATED WITH NOMINAL LINAC SETTINGS AND BUNCHER OFF; THEN THE SAME CURRENT WAS OBTAINED WITH THE FIRST CAVITY FIELD REDUCED AND THE BUNCHER ON. THE LATTER CASE GAVE SMALLER DELTA-P/P AT 200 MEV, BUT THE TRANSVERSE EMITTANCE WAS THE SAME.

A MEASUREMENT OF BEAMS WITH SLIT-REDUCED INPUT EMITTANCE SHOWS APPARENT COUPLING ABOVE 10 MEV.

SMOOTH VARIATION OF LINAC OUTPUT ENERGY WAS TRIED DOWN TO 37 MEV.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH; COUPLING; MOMENTUM SPREAD; VARIABLE OUTPUT ENERGY;

REFERENCE: 11

CATEGORY.: EXPERIMENTAL RESULTS;

CAT-SOURCE: JAMESON DATE-ENT.: 7/7/73

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE

1 185 TITLE..... ACCELERATOR RESEARCH AND DEVELOPMENT WITH THE CERN 3 MEV LINAC

AUTHOR.... WARNER, D.J.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES..... 8

REF-NUM...: LA-5115
DATE-PUBL: 721100

CONFERENCE: PRUC 1972 PROTON LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 10-13, 1972, LASL REPORT LA-5115, P. 33;

ABSTRACT.: ORIGINAL INTENT OF THEORY EXPERIMENT WORK UNDER SPACE CHARGE CONDITIONS WAS NOT FOLLOWED DUE TO OBSERVATION OF THE DOMINANT ROLE OF NEUTRALIZATION ON THE INPUT DYNAMICS AND LACK OF DATA COLLECTION FACILITIES FOR THE LARGE AMOUNT OF DATA THAT WOULD BE NEEDED FOR A THOROUGH ION MEASUREMENTS WITH 200 MA BEAM, INVESTIGATIONS OF NEUTRALIZATION EFFECTS, ERRORS IN EMITTANCE MEASUREMENTS, AND BROADBAND LONGITUDINAL PROBS ARE DESCRIBED.

SUBJECTS.: SPACE CHARGE; EMITTANCE MEASUREMENT; EMITTANCE GROWTH; NEUTRALIZATION;

NOTES....: BUNCHER BEAM LOADING OF ABOUT 5 PERCENT, BUT SOMETIMES AS HIGH AS 12 PERCENT, OBSERVED. THEORY SAYS THIS IS A 2ND ORDER EFFECT DUE TO VARIATION OF TRANSIT TIME FACTOR WITH ENERGY, AVERAGED ACROSS GAP. NEUTRALIZATION PERSISTS IN MAGNETIC FIELD BUT CAN BE SUPPRESSED BY POSITIVELY BIASED ELECTRODES. SPACE CHARGE AND NEUTRALIZATION EFFECTS CAN CAUSE ERRORS IN EMITTANCE MEASUREMENTS, PRINCIPALLY BY ROTATION. EMPIRICAL METHODS OF CHECKING MATCHING, ETC. ARE THEREFORE ALMOST ESSENTIAL BECAUSE CORRECT MEASUREMENTS ARE EXTREMELY DIFFICULT TO MAKE.

REFERENCE: 0

CATEGORY.: EXPERIMENTAL RESULTS;

CAT-SOURCE: JAMESON DATE-ENT.: 771021

MICROFILM:

STOR-LDC.: MP-9 SPERG FILE;

187 TITLE.....: CALCULATIONS AND MEASUREMENTS ON REDUCTION OF THE ENERGY SPREAD AND THE VARIATION IN MEAN ENERGY OF THE 200-MEV LINAC BEAM AT BROOKHAVEN

AUTHOR....: RACHELOR, K.; CHASMAN, H.W.; FEWELL, N.;
AFFILIAT.: RNL

DOC-TYPE.: CONF PAPER
PAGES.....: 6

REP-NUM.: LA-5115
DATE-PUBL: 721100

CONFERENCE: PROC 1972 PROTON LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 12-13, 1972, LASL REPORT LA-5115, P. 411

ABSTRACT.: DURING THE FIRST YEAR OF OPERATION OF THE 200-MEV INJECTOR LINAC AT BROOKHAVEN, IT PROVED DESIRABLE TO REDUCE THE ENERGY SPREAD AND VARIATION IN MEAN ENERGY OF 200-MEV WITHOUT CHANGE IN CURRENT TRANSMISSION. ONE WAY TO ACCOMPLISH THIS IS TO MAINTAIN THE DESIGN VALUE OF STABLE PHASE ANGLE AT THE INPUT OF THE MACHINE AND TO REDUCE IT CONTINUOUSLY FROM THERE ON TO THE END OF THE LINAC. IN PRACTICE IT IMPLIES LOWERING THE ELECTRIC FIELDS IN THE TANKS TO MAINTAIN THE SYNCHRONOUS ACCELERATION FOR WHICH THE MACHINE WAS DESIGNED. THE EFFECT IS THAT THE AVAILABLE PHASE ACCEPTANCE CONFORMS MORE CLOSELY TO THE LONGITUDINAL EMITTANCE OF THE BEAM AND DOES NOT GROW WITH ENERGY AS IN THE CASE OF CONSTANT SYNCHRONOUS PHASE.

COMPUTER STUDIES WERE PERFORMED AND A "SYNCHRONOUS PHASE LAW" WAS FOUND THAT COMBINED REDUCED ENERGY SPREAD AND MORE STABLE AVERAGE ENERGY AT 200-MEV WITH UNCHANGED CURRENT TRANSMISSION FOR BEAMS UP TO 100 MA. ALSO, ITS TOLERANCE REQUIREMENTS WITH RESPECT TO RF PHASE AND AMPLITUDE WERE MET BY THE EXISTING RF SYSTEM. THE COMPUTED LONGITUDINAL BEAM PARAMETERS OF 200-MEV WERE COMPARED TO THOSE CALCULATED FOR THE DESIGN FIELDS AND A DEFINITE IMPROVEMENT WAS INDICATED. THE FIELDS IN THE LINAC TANKS WERE THEN ADJUSTED ACCORDINGLY AND THE OUTPUT ENERGY SPREAD AND MEAN ENERGY SENSITIVITY TO RF PHASE AND AMPLITUDE ERRORS WERE MEASURED AND COMPARED TO THEIR CORRESPONDING VALUES AT DESIGN FIELD LEVELS.

SUBJECTS.: SYNCHRONOUS PHASE LAW; RF FIELD ERRORS; LINAC DESIGN;

NOTES.....: RF FIELD ERRORS PLAYED A CRITICAL ROLE IN DECIDING ON THE BEST VARIATION OF SYNCHRONOUS PHASE. NOTICED ERRORS IN SETTING AMPLITUDE AND CHANGES IN AMPLITUDE (AS MUCH AS 5 PERCENT ERRORS) USING TANK PROBES.

REFERENCE: 3

CROSS-REF: IDN 21, 18A, SPERG;

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771023

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE

1
188 TITLE.....: THE DEPENDENCE OF TRANSVERSE EMITTANCE GROWTH ON THE QUADRUPOLE FOCUSING STRENGTH IN THE
BROOKHAVEN 200 MEV LINAC

AUTHOR....: BATCHELOR, K.; CHASMAN, R.W.; FEWELL, N.; WITKOVER, R.;
AFFILIAT.: RNL

DOC-TYPE.: CONF PAPER
PAGES.....: 4

REP-NUM.: LA-5115
DATE-PUBL: 721100

CONFERENCE: PROC 1972 PROTON LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 10-13, 1972, LASL REPORT LA-
5115, P. 47;

ABSTRACT.: INPIIT BEAM WAS 150 MA, 750 KEV, ABOUT 5 PI CM MRAD EMITTANCE IN BOTH PLANES (APPARENTLY 100
PERCENT OF BEAM). SINGLE BUNCHER, BEAM WAS MATCHED FOR TANK 1 QUAD SETTINGS AT 0.8, 1.0 AND 1.2
X NORMAL. EMITTANCES WERE MEASURED AT 10 MEV, NORMALIZED TO 45 MA CURRENT OBTAINED WITH DESIGN
QUADS. CORRELATION BETWEEN QUAD STRENGTH AND EMITTANCE AREA WAS FEELT NOT TO EXIST. (IT IS
INTERESTING TO NOTE THAT THE DESIGN SETTING PRODUCED THE SMALLEST EMITTANCE FOR THE 90-100
PERCENT LEVEL IN BOTH PLANES.) AT NORMAL QUAD SETTINGS, EMITTANCE GROWTH OF A FACTOR OF 2-2.5
OCCURRED FOR 50-80 PERCENT OF THE BEAM; THE GROWTH DECREASED FROM 80-100 PERCENT TO A FACTOR OF
1.4-1.5. CALCULATIONS SHOWED NEARLY THE SAME EMITTANCE AT 10 MEV, BUT MUCH LARGER AREA AND
WIGGLE FACTOR AT LOWER ENERGY FOR THE WEAKER QUAD SETTINGS. IT IS SUGGESTED THAT THE RESULTS
VERIFY THE CONCLUSION THAT THE UPPER LIMIT OF TRANSVERSE EMITTANCE IS DETERMINED BY THE SIZE OF
THE LONGITUDINAL EMITTANCE ONLY AND NOT BY MACHINE PARAMETERS, WHILE THE LATTER WOULD INFLUENCE
THE RATE OF EMITTANCE GROWTH, SUGGEST THAT BETTER TRANSVERSE EMITTANCE WOULD HAVE TO COME FROM
BETTER LONGITUDINAL MATCHING AT INJECTION.

SUBJECTS.: EMITTANCE GROWTH; QUADRUPOLE LAW;

NOTES.....: NOTE COMMENT IN ABSTRACT ABOUT DESIGN QUAD VALUES INFLUENCE ON TOTAL AREA, AND SMALLER
GROWTH FOR HAD.

REFERENCE: R

CROSS-REF: TDN 21, 147, SPERG;

CATEGORY.: EXPERIMENTAL RESULTS; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771023

MICROFILM:

ST04-LOC.: MP-9 SPERG FILE;

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189 TITLE....: STATISTICAL BEAM TRANSPORT FOR HIGH INTENSITY ION CURRENTS

AUTHOR...: FMIGH, C.W.
AFFILIAT.: LASL

DOC-TYPE.: CONF PAPER
PAGES....: 9

REP-NUM...: LA-5115
DATE-PUBL: 721100

CONFERENCE: PROC 1972 PROTON LINEAR ACCEL CONF, LASL, LOS ALAMOS, NM, OCTOBER 10-13, 1972, LASL REPORT LA-5115, P. 182;

ABSTRACT.: AN RMS AVERAGE DESCRIPTION FOR NONRELATIVISTIC BEAMS. THE SIZE AND GROWTH OF THE BEAM ARE RELATED TO THE RMS VALUES OF BOTH POSITIONS AND VELOCITIES OF THE INDIVIDUAL PARTICLES.

SUBJECTS.: SPACE CHARGE; EMITTANCE; RMS METHOD;

REFERENCE: 6

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771023

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

194 TITLE..... REAL-TIME MEASUREMENTS OF PROTON BUNCH FORM

AUTHOR.... EVANS, I.R.; WARNER, D.J.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES..... 7

REP-NUM.: LA-5115
DATE-PUBL: 721100

CONFERENCE: PROC 1972 PRITON LINEAR ACCEL CONF, LASI, LOS ALAMOS, NM, OCTOBER 10-13, 1972, LASL REPORT LA-5115, P. 349;

ABSTRACT.: DESTRUCTIVE COAXIAL PROBE, BANDWIDTH REQTS; SOME POSSIBLE COAXIAL PROBE GEOMETRIES; CHOICE OF LINE IMPEDANCE; TRANSMISSION LINE AND OSCILLOSCOPE; PROBE DESIGN; PROBE OPERATION; THEORY FOR PROBE OPERATION CONSIDERING BASIC BUNCHING THEORY, RADIAL VARIATION OF TRANSIT TIME FACTOR ACROSS BUNCHER APERTURE, EFFECT OF TRANSIT TIME IN THE PROBE, EFFECTS OF CABLE ATTENUATION, OSCILLOSCOPE RESPONSE; COMPUTED RESULTS AND EXPERIMENTAL RESULTS,

SUBJECTS.: LONGITUDINAL MEASUREMENTS; WIDEBAND PROBES;

REFERENCE: 6

CATEGORY.: INSTRUMENTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771023

MICROFILM:

STOR-LOC.: NP-9 SPERG FILE;

191 TITLE..... BUNCHING OF FIRST PROTON BEAMS WITH SIX-DIMENSIONAL MATCHING TO THE LINAC ACCEPTANCE - 730600

AUTHOR..... KISS, M.
AFFILIAT.: CERN

DOC-TYPE: CONF PAPER
PAGES..... 3

DATE-PUBL: 730600

CONFERENCE: PROC 1973 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, SAN FRANCISCO, CA, MARCH 5-7, 1973

JOURNAL... IEEE TRANS. NUCL. SCI., VOL. NS-20, NO. 3, P 877 (JUNE 1973)

ABSTRACT: A METHOD HAS BEEN DEVELOPED FOR THE DETERMINATION OF BUNCHING PARAMETERS IN THE FRAME OF A SIX-DIMENSIONAL BEAM-MATCHING TO THE LINAC ACCEPTANCE. IN THE ABSENCE OF SPACE CHARGE, INITIAL SOLUTIONS FOR THE BUNCHER DISTANCE, VOLTAGE AND EFFICIENCY, WHICH SATISFY THE MATCHING REQUIREMENTS, ARE FOUND ANALYTICALLY OR WITH ANGLIARY COMPUTER PROGRAMS. THEN AN ITERATIVE CALCULATION IS APPLIED TO SOLVE THE MORE GENERAL BUNCHING PROBLEM IN THE PRESENCE OF SPACE CHARGE.

IN THE ABOVE-MENTIONED ANALYSIS, THE BEAM IS REPRESENTED AS AN ENTITY, DESCRIBED BY THE SECOND MOMENTA OF PARTICLE COORDINATES AND VELOCITIES. ALL THE FORCES ARE LINEARIZED; THE EVOLUTION OF R.M.S. VALUES DEPENDS PRIMARILY ON THE LINEAR FORCE COMPONENT.

SUBJECTS: SPACE CHARGE; BUNCHER; MATCHING; PERIOD CODE;

REFERENCE: 3

CROSS-REF: ION 213, SPERG;

CATEGORY: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON
DATE-ENT: 771024

MICROFILM:

STOR-LOC: WP-9 SPERG FILE;

1 192 TITLE.....: SINGLE- AND DOUBLE-DRIFT BUNCHERS AS POSSIBLE INJECTION SCHEMES FOR THE CPS LINAC

AUTHOR....: BRU, R.; WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER; INTERNAL REPORT;
PAGES.....: 3

REP-NUM...: CERN/MPS/LIN 73-1
DATE-PUBL: 730600; 730200

CONFERENCE: PROC 1973 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, SAN FRANCISCO, CA, MARCH 5-7,
1973;

JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-20, NO. 3, P 963 (JUNE 1973);

ABSTRACT.: TWO BUNCHING SCHEMES ARE CONSIDERED IN THE FRAME OF THE CPS LINAC, ONE WITH A SINGLE
BUNCHER, THE OTHER WITH A DOUBLE-DRIFT HARMONIC BUNCHER. THE MATCHING OF THE BEAM TO THE LINAC
ACCEPTANCE IN SIX PHASE-SPACE DIMENSIONS IS ACHIEVED BY COMPUTER PROGRAMS IN AN ITERATIVE WAY;
ZERO CURRENT SOLUTIONS ARE FOUND FIRST, AND THEN THE INTENSITY IS PROGRESSIVELY RAISED UNTIL
200 MA ARE TRAPPED INTO THE LINAC.

SUBJECTS.: BUNCHER; SPACE CHARGE; MATCHING; PREINJ CODE; BUNCH CODE;

REFERENCE: 9

CATEGORY.: NUMERICAL COMPUTATION; SYSTEM DESIGN;

CAT-SOURCE: JAMESON DATE-ENT.: 771024

MICROFILM;

STOR-LOC.: MP-9 SPRG FILE;

1 193 TITLE....: PARTICLE TECHNICAL INSTITUTE ACTIVITY IN THE LINAC FIELD - 761100

AUTHOR....: MURIN, R.D.
AFFILIAT.: RTI

DOC-TYPE.: CONF PAPER
PAGES....: 7

REF-NUM...: AFCL-5477
DATE-PUBL: 761140

CONFERENC: PROC 1976 PHOTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AFCL-5477, P. 20;

ABSTRACT.: SPACE CHARGE EFFECTS - BUNCHING OF SINGLE COMPONENT AND SIMULTANEOUS BEAMS, BUNCH DIVIDE
INTO MACROBUNCHES AND VLASOV EQUATION INTEGRATED ALONG MACROPARTICLE PATH. ALGORITHMS GIVE A
CONSERVATIVE MODEL IMPLYING THAT NET ENERGY OR NET MOMENTUM ARE CONSERVED ON A LAGRANGIAN OR
EULERIAN MESH, HIGHEST ACCURACY FOR THE COULOMB FORCES, AND MAKE KINETIC PARAMETERS (SCATTERING
CROSS-SECTION, ETC.) OF SET OF MACROPARTICLES MATCH THAT OF A REAL BUNCH.

FOUND EFFECTIVE EMITTANCE INCREASE OF UP TO 90 PERCENT AT 20 MA IN BUNCHER DUE TO
NONLINEAR SPACE CHARGE AND LONG-TRANSVERSE COUPLING. ALSO 15 PERCENT INCREASE DUE TO EFFECT OF
PARTICLES OF ONE CHARGE BEING PRESENT IN THE BUCKET FOR THE OPPOSITE CHARGE. EFFECTS NOT
IMPORTANT BELOW 100 MA.

HAVE ALSO DONE ANALYTIC WORK ON DISTRIBUTIONS AND ON QUADRUPOLE ABERRATIONS - CLOSED FORM
SOLUTIONS FOR BEAM SIZE VS. HARMONICS AND PROPERTIES OF THE CHANNEL.

IN WORK ON ALTERNATING PHASE FOCUSED LINACS, THEY PREDICT STABILITY LOST WITH APERTURE
RADIUS R GREATER THAN $0.2 \text{ PETA} \cdot \text{LAMBDA}$. THIS LEADS TO AN UPPER LIMIT OF ACCELERATED CURRENT FOR
A GIVEN INJECTION ENERGY APPROXIMATE $I = (22)(E0A)^{2/3}(\text{LAMBDA})^{1/3} \text{CHI}$ (MA) WHERE CHI IS A FUNCTION
REPRESENTING THE PARAMETERS OF A STRUCTURE PERIOD AND E0 IS EMITTANCE. WITH E0=0, CHI = 0.14 TO
0.26, I IS APPROXIMATE 20-25 MA. PARTICLE CALCULATIONS SHOWED 60 PERCENT OF ABOVE ESTIMATE, AND
EXPERIMENTAL LINAC A LITTLE LESS THAN THAT EVEN - MAYBE 13 PERCENT TRAPPING FACTOR.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH; QUADRUPOLE FIELD ABERRATIONS; ALTERNATING PHASE FOCUSING;

NOTES....: INDICATES WORK HAS BEEN ACCOMPLISHED IN SPACE-CHARGE EFFECTS ON SINGLE-COMPONENT BEAM
BUNCHING, SIMULTANEOUS BUNCHING OF H+ AND H-, USING INTEGRATION OF VLASOV EQUATION ALONG A
MACROPARTICLE PATH. COMPUTER ALGORITHMS USE A CONSERVATIVE MODEL IN WHICH NET ENERGY OR NET
MOMENTUM ARE CONSERVED ON A LAGRANGIAN OR EULERIAN MESH, AND OTHER CONSIDERATIONS. RESULTS
INDICATE PARTICLES BETWEEN H+ AND H- BUNCHES ARE ALL AT NEARLY THE SAME ENERGY, AND THAT
PARTICLES OF ONE KIND CAN BE TRAPPED INTO BUNCHES OF THE OTHER KIND, PRODUCING SIGNIFICANT
EFFECTS AT HIGH CURRENTS. CLOSED FORM RELATIONSHIPS BETWEEN BEAM SIZE AND NONLINEAR FIELD
HARMONIC AMPLITUDE ARE MENTIONED BUT NOT GIVEN.

RE ACCELERATING STRUCTURE ABOVE 100 MEV, RF POWER SUPPLY AND FIELD CONTROL SYSTEMS,
ELECTRON LINACS, BEAM MEASURING INSTRUMENTATION, AND ALTERNATING PHASE FOCUSED LINACS ARE
DISCUSSED. A CURRENT LIMIT FOR THE LATTER, GIVEN IN TERMS OF ACCELERATING FIELD AMPLITUDE,
WAVELENGTH, APERTURE RADIUS, AND A STRUCTURE PERIOD PARAMETER, INDICATES 20-25 MA FOR 100 KEV
INJECTION. EXPERIMENTAL RESULTS WERE NOT THIS GOOD.

REFERENCE: 31

CATEGORY.: ANALYSIS; EXPERIMENTAL RESULTS;

CAT-SOURCE: JAMESON DATE-ENT.: 771026

1
MICROFILM:

STOW-LOC.: MP-9 SPRG FILE:

194 TITLE....: HIGH CURRENT PROTON LINEAR ACCELERATORS AND NUCLEAR POWER

AUTHOR....: TUNNICLIFFE, P.R.; CHIDLEY, R.G.; FRASER, J.S.;
AFFILIAT.: CRNL

DOC-TYPE.: CONF PAPER
PAGES....: 9

REP-NUM.: AECL-5677
DATE-PUBL: 761100

CONFERENCE: PROC 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT, 14-17, 1976, REPORT
AECL-5677, P. 36;

ABSTRACT.: THIS PAPER OUTLINES A POSSIBLE ROLE THAT HIGH-CURRENT PROTON LINEAR ACCELERATORS MIGHT PLAY
AS "ELECTRICAL BRIDGES" IN THE FORTHCOMING NUCLEAR-POWER ECONOMY. A HIGH-POWER BEAM OF
INTERMEDIATE ENERGY PROTONS DELIVERED TO AN ACTINIDE-ELEMENT TARGET SURROUNDED BY A BLANKET OF
FERTILE MATERIAL MAY PRODUCE FISSILE MATERIAL AT A COMPETITIVE COST. CRITERIA FOR TECHNICAL
PERFORMANCE AND, IN A CANADIAN CONTEXT, FOR COSTS ARE GIVEN AND THE MAJOR PROBLEM AREAS
OUTLINED NOT ONLY FOR THE ACCELERATOR AND ITS ASSOCIATED RF POWER SOURCE BUT ALSO FOR THE
TARGET ASSEMBLY.

SUBJECTS.: SPACE CHARGE; SYSTEM DESIGN;

NOTES....: RAISE INJ. ENERGY TO OVERCOME SPACE CHARGE LIMIT, FOR ING: 248 MHZ, 75 T/M (7.5 KG/CM) MAX
QUAD GRADIENT AND INJECTOR NORMALIZED EMITTANCE 0.4 PI MM MRAD , THE SPACE-CHARGE LIMIT VS. I/G.
ENERGY WAS: (0.75 MEV = 65 MA), (1.035 MEV = 110 MA), (1.503 MEV = 240 MA);

REFERENCE: 32

CATEGORY.: SYSTEM DESIGN;

CAT-SOURCE: JAMESON DATE-ENT.: 771026

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

195 TITLE....: ACCELERATING STRUCTURE OF THE CERN NEW 50 MEV LINAC

AUTHOR....: WARNER, D.J.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 5

RFP-NUM.: AFCL-5677
DATE-PUBL: 761100

CONFERENCE: PROC 1976 PHOTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AFCL-5677, P. 49;

ABSTRACT.: THE DESIGN OF THE POST-COUPLED ALVAREZ STRUCTURE IS PRESENTED WITH EMPHASIS ON FEATURES WHICH ARE NOVEL AND CRITICAL ESPECIALLY AS REGARDS ACCELERATION OF HIGH CURRENTS (150 MA) TO 50 MEV. AMONG TOPICS TREATED ARE THE SEQUENCE OF COMPUTATIONAL TECHNIQUES LEADING FROM UNIT CELL (E.M. FIELD) CALCULATIONS TO DYNAMICS OF THE COMPLETE LINAC, AND MODEL MEASUREMENTS WHICH JUSTIFY THE DRIFT-TUBE GRIDDER SUPPORT APPROACH AND OUR PARTICULAR POST-COUPLER ARRANGEMENT.

SUBJECTS.: SPACE CHARGE; CERN BEAM DYNAMICS CODES; PARAMETER SEARCH; RUNCHEP;

NOTES....: STRUCTURE DESIGN TOOLS INCLUDE: CLASL - SORT OF A SUPERFISH - TO GET CAVITY PARAMETERS USING SPECIFIC GEOMETRY.

GENLIN - VERY SIMILAR TO PARMILA GENLIN.

ADAPT - CALCULATES MATCHING PARAMETERS AT BEGINNING OF LINAC, ASSUMING LINEAR SPACE-CHARGE, AND XFORMS THRU CAVITIES MAINTAINING MATCH. CAN TREAT DISCONTINUITIES BETWEEN QUAD BATCHES AND BETWEEN TANKS.

MAPRO1 - GENERAL PARTICLE DISTRIBUTION.

CHOICE OF OPERATING PARAMETERS BETWEEN 0.75 AND 10 MEV: NEED LARGE PHI SUB S, WHERE THE ABSOLUTE VALUE OF PHI SUB S IS GREATER THAN 30 DEGREES AT 0.75 MEV TO CONTAIN MATCHED 150 MA, AND WHERE THE ABSOLUTE VALUE OF PHI SUB S GREATER THAN OR=TO 25 DEGREES AT 10 MEV TO AVOID LONGITUDINAL STABILITY PROBLEMS AT HIGHER ENERGIES. CAN SPECIFY AXIAL ELECTRIC FIELD LAW IN CODE. THEIR RUNCHEP SYSTEM CAN MATCH BEAM BOTH LONGITUDINAL AND XVERSE OVER USEFUL RANGE OF PHASE WIDTH (25 DEGREES TO 35 DEGREES). ADAPT IS GIVEN PHASE WIDTH AND YIELDS MATCHED ENERGY SPREAD, BEAM DIMENSIONS, REQ'D GRADIENTS AND STABILITY FOR DIFFERENT SYNCHRONOUS PHASE LAWS. FURTHER STUDIES ON INITIAL VALUES OF ALPHA AND BETA ARE DONE WITH MAPRO1 AND EVOLUTION IS STUDIED. NEED APPROX 7 PERCENT INCREASE IN BETA FROM ADAPT VALUES FOR GOOD MATCHING.

CASES = A.) PHI SUB S = -40 DEGREES TO -25 DEGREES, INPUT PHASE WIDTH = 35 DEGREES (WAS FAR FROM SPACE CHARGE LIMIT BUT HAD EXCESSIVE LONGITUDINAL INPUT EMITTANCE (35 DEGREES X 50 MEV)); B.) PHI SUB S = -40 DEGREES TO -25 DEGREES, INPUT PHASE WIDTH = 25 DEGREES; C.) PHI SUB S = -35 DEGREES TO -25 DEGREES, INPUT PHASE WIDTH = 30 DEGREES; (NOTE: CASES B AND C SIMILAR, BUT C PREFERRED BECAUSE SMALLER PHI SUB S VARIATION WOULD BE MORE FLEXIBLE IN OPERATION).

ABOVE WITH STRONGEST POSSIBLE CONSTANT MU PRACTICAL WITH QUAD DESIGN. WITH LOWER MU, XVERSE EMITTANCE INCREASE AT 150 MA IS GREATER BUT LONGITUDINAL INCREASE IS LESS.

DESIGN PROCEDURE: SPECIFY W IN, W OUT, # TANKS, # CELLS, ACCELERATING RATE, TILT, SYNCHRONOUS PHASE LAW, CONTINUITY OF W SUB S, W SUB S/DZ AND PHI SUB S IN GENLIN. FOR MU = 30 DEGREES, INPUT PHASE WIDTH = 31 DEGREES, TRANSVERSE EMITTANCE AT 0.75 MEV NORMALIZED = 2.6 PI MM MRAD; WITH DMA .LF. 1 .LF. 150 MA; LONGITUDINAL EMITTANCE AT 0.75 MEV VARIES FROM 1.8 PI MEV DEGREES TO 0.9 PI MEV DEGREES, LONGITUDINAL EMITTANCE AT 50 MEV VARIES FROM 1.7 PI MEV DEGREES TO 2.0 PI MEV DEGREES, TRANSVERSE EMITTANCE INCREASE FOR ALL CURRENTS IS LESS THAN 15 PERCENT.

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HOWEVER IN PRACTICE WOULD TRY TO OPERATE WITH CONSTANT LONGITUDINAL EMITTANCE RATHER THAN
CONSTANT PHASE WIDTH AT 0.75 PFV. A 10 PERCENT INCREASE IN LONGITUDINAL EMITTANCE CAN OFTEN
OCCUR DUE TO MISMATCH AT TANK INTERSPACES.

REFERENCE: 11

CATEGORY: NUMERICAL COMPUTATION; SYSTEM DESIGN;

CAT-SOURCE: JAMESON

DATE-ENT.: 771026

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

106 TITLE..... A FERTERON LINEAR FOR A HIGH-INTENSITY NEUTRON SOURCE

AUTHOR....: STAPLES, J., ET AL.:

AFFILIAT.: IBM

DOC-TYPE.: CONF PAPER

PAGES.....: 5

REF-PUB...: AECI-5677

DATE-PUB.: 761100

CONFERENCE: FBNC 1976, PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT AECI-5677, P. 1481

ABSTRACT.: THE PRELIMINARY DESIGN OF AN ACCELERATOR SUITABLE TO MEET THE FLUX AND NEUTRON ENERGY REQUIREMENTS OF A CTR MATERIALS TEST FACILITY IS PRESENTED. THE SPECIFICATIONS OF SUCH A FACILITY CALL FOR A NEUTRON FLUX OF 10^{14} N/CM²-SEC DISTRIBUTED OVER AN AREA OF ABOUT 1×2 CM² WITH A NEUTRON SPECTRUM SIMILAR TO THAT ANTICIPATED FROM A FUSION REACTOR. A 30 MEV FERTERON LINEAR PRODUCING A CW BEAM OF 125 MA, UPGRADABLE TO 40 MEV AT 25 MA AT A LATER DATE, WOULD PRODUCE THE RELATIVELY BROAD SPECTRUM OF NEUTRONS AT THE REQUIRED INTENSITY.

BEAM DYNAMICS AT THE REQUIRED CURRENT DICTATE AN INJECTION ENERGY OF 750 KEV AND A FREQUENCY OF 50 MHZ. THE AVERAGE AXIAL FIELD OF 1 MV/M RESULTS IN A MAX POWER DENSITY OF SLIGHTLY LESS THAN THE SUPERHILAC AT FULL GRADIENT AND 30 PERCENT DUTY FACTOR. EACH OF THE SEVEN CAVITIES WILL HAVE ITS OWN R.F. POWER SOURCE FOR A 125 MA BEAM INTENSITY, EXPANDABLE TO 250 MA BY DOUBLING THE NUMBER OF R.F. SOURCES. ATTENTION TO THE LOW-ENERGY BEAM INTERCEPT ON THE DRIFT TUBES AND DIFFUSIVE LOSSES PRODUCING NEUTRONS AND ATTENDANT ACTIVATION PROBLEMS ARE DISCUSSED.

SUBJECTS.: SPACE CHARGE; SYSTEM DESIGN; FLUTTER-FACTOR;

NOTES.....: MORE SIZE INCREASE BY 40 PERCENT FOR STRONG FOCUSING "FLUTTER-FACTOR", AND ADDITIONAL 45 PERCENT STAY-CLEAR. SIMULTANEOUS BEAMS BY HAVING SIDE-BY-SIDE BEAMS THRU SIDE-BY-SIDE DRIFT TUBES.

CATEGORY.: SYSTEM DESIGN:

CAT-SOURCE: JAMESON

DATE-ENT.: 771026

MICROFILM:

STOP-LOC.: HP-9 SCORG FILE;

197 TITLE..... THE PROPOSED BROOKHAVEN ACCELERATOR BASED NEUTRON GENERATOR

AUTHOR.... GRAND, P.; HATCHER, K.; CHASMAN, R.W.; BREADINE, R.;
AFFILIAT.: RNL

DOC-TYPE.: CONF PAPER
PAGES.....: 7

REF-NUM.: AFCL-5677
DATE-PUBL: 7/11/80

CONFERENCE: PROC 1976 REGIONAL LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AFCL-5677, P. 1531

ABSTRACT.: THE P+T NEUTRON SOURCE CONCEPT, WHICH INCLUDES A HIGH-CURRENT DEUTERON LINAC, IS AN OUTGROWTH OF ATTEMPTS MADE TO USE THE RNL, 200-MEV PROTON LINAC PLTP FACILITY TO DO RADIATION DAMAGE STUDIES. THIS CONCEPT WAS FIRST PROPOSED BY RNL IN 1973. IT INCLUDED A 100 MA, 30-MEV DEUTERON LINEAR ACCELERATOR AND A FAST-FLOWING LIQUID LITHIUM JET, AS THE TARGET. THE LATEST DESIGN IS NOT VERY DIFFERENT EXCEPT THAT THE CURRENT IS NOW 200 MA AND THE LINAC ENERGY HAS BEEN RAISED TO 35-MEV. BOTH PARAMETERS WERE CHANGED TO OPTIMIZE THE EFFECTIVENESS OF THE FACILITY WITH RESPECT TO FLUX, EXPERIMENTAL VOLUME AND MATCH TO 14-MEV NEUTRON-RADIATION-DAMAGE EFFECTS.

SUBJECTS.: SPACE CHARGE; SYSTEM DESIGN; MATCHING; FLUTTER-FACTOR;

NOTES..... INJECTION AT LESS THAN 50V KEV DESIRED FOR I .LE. 200 MA; BASED ON CHALK RIVER EXPERIE OF THIS IS TOO BAD BECAUSE IT MEANS MULTI-ELECTRODE ACCELERATING COLUMN WHICH THEY HAVE HAD TROUBLE WITH.

BENT DOUBLE BUNCHER WITH MOMENTUM SCRAPING.

STRONG TRANSVERSE FOCUSING IMPLIES HIGH QUAD STRENGTH.

STRONG LONGITUDINAL FOCUSING IMPLIES HIGH RF STRENGTH, I.E. HIGH GRADIENT.

FOR FIXED MAGNETIC PERIOD, QUAD GRADIENT VARIES INVERSELY AS BETA ASSUMING FIXED RATIO OF MAGNET TO CELL LENGTH.

HAS MATCHING EQUATIONS --- "FLUTTER FACTOR" REFERENCE IS OXNOMA AND VITALE, IEEE TRANS. NUCL. SCI. AS-14, NO. 5, P. 593, (1967). FLUTTER FACTOR LIMIT WHEN BEAM SIZE = 2/3 APERTURE.

APERTURE LIMITATION DUE TO TRANSIT TIME FACTOR APPROX=TO $6.7 \times 10^{11} \times 3$ WAVELENGTH.

ESTIMATE OF ENERGY SPREAD OF BUNCH AT INJECTION.

INJECTION ENTRANCE (TRANSVERSE) FROM MEASUREMENTS = UN-NORMALIZED $I \times 3.7 \text{ PI} \times 10^{11} \times 4 \text{ M. RAD. WITH } I \text{ IN APPS.}$

REFERENCE: 2)

CATEGORY.: SYSTEM DESIGN; THEORY;

CAT-SOURCE: JAMESON DATE-ENT.: 771026

MYCREFILE:

STCH-LOC.: MP-9 SOURCE FILE;

FOR TITLE..... OPERATION OF THE BRABCO-HEVA ELECTRON TEST ACCELERATOR

AUTHOR..... FRASER, J.S., ET AL.:
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER

PAGES..... 5

REF-NUM.: AFCL-5477
DATE-PUBL: 761100

CONFERENCE: BRUC 1976 PHOTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AFCL-5477, P. 1061

ABSTRACT.: THE ELECTRON TEST ACCELERATOR HAS BEEN BUILT TO MODEL THE BEHAVIOUR OF THE HIGH ENERGY

PORTION OF A PROTON LINEAR ACCELERATOR WHICH WOULD BE SUITABLE FOR BREEDING FISSILE MATERIAL.
THE TEST ACCELERATOR AND ITS CONTROL SYSTEMS HAVE BEEN TESTED AT 100 PERCENT DUTY FACTOR
PRODUCING A BEAM OF ELECTRONS AT 1.5 MEV AND CURRENTS UP TO 20 MA WHERE THE INCIDENT BE WOULD
ITS SHARPED EQUALLY BETWEEN THE STRUCTURE DISSIPATION AND THE BEAM LOADING. THE STRUCTURE WAS
PERMANENT SATISFACTORILY IN ALL RESPECTS AT DISSIPATION POWER DENSITIES UP TO 5 KW/CELL WHERE
IN THE COUPLING OF THE TRANSMISSION LINE TO THE CAVITY, THE AMPLITUDE DEPRESSION IN AND PHASE
LAG ALONG THE STRUCTURE, AND THE PHASE LAG OF THE STRUCTURE FIELD. THE PHASE ACCEPTANCE, THE
VARIATION OF TRANSMISSION WITH BUNCHER-ACCELERATOR PHASE SHIFT AND THE BEAM ENERGY SPREAD, WE
IN QUALITATIVE AGREEMENT WITH BEAM DYNAMICS CALCULATIONS.

SUBJECTS: SPACE CHARGE; BEAM LOADING; 100 PERCENT DUTY FACTOR EXPERIMENT; BUNCHED BEAM LOADING;

NOTES..... DISCUSSION OF BEAM LOADING IN BUNCHERS. - LARGE ERRORS IN PHASE ARISING AT LINAC - TONK
BUT DIFFERENCE FROM BUNCHER CAVITY WITHIN THAT FROM REFERENCE LINE.

THAT PARTIAL EXTINCTION GROWTH REDUCTION FOR INCREASED SPACE BETWEEN BUNCHER AND LINAC.

USE 1A DEGREES TAPERED COLLIMATORS (COPPER) TO AVOID SPLITTING AT GUN CATHODE.

REFERENCE: 15

CATEGORY: EXPERIMENTAL RESULTS

LAST-SOURCE: JAMESON

DATE-ENT: 771026

WICR00114

STOR-LOC: W-0 SPRNG E111

199 TITLE....: COUPLING BETWEEN TRANSVERSE OSCILLATIONS IN LINACS

AUTHOR....: GLOCKSTEIN, R.I.; STEVENS, R.P., JR.; ALLISON, P.W.;
AFFILIAT.: LASL-HP

DOC-TYPE.: MEMO
PAGES....: 24

REP-NO.: HP-DO/2
DATE-PUBL: 670800

ABSTRACT.: DATA X-Y COUPLING COMES FROM LONGITUDINAL VARIATION OF QUAD GRADIENT IN CRINGING REGIO.
USES IMPULSE APPROXIMATION. THIS COUPLING WILL NOT MAKE THE BEAM RADIUS GROW, ONE TRANSVERSE
DIMENSION MAY INCREASE, BUT OTHER WILL DECREASE AT SAME TIME.

HIGHER MULTIPLE FIELD COUPLINGS ARE TREATED, ALSO USING IMPULSE APPROXIMATION, AGAIN $Y \leftrightarrow X$
 $X \leftrightarrow Y$ SHOULD NOT GROW, HOWEVER, ENVELOPE AROUND MAX. AMPLS MAY GROW.

NUMERICAL CALCULATIONS FOR 800 MHZ LINAC STARTING AT 100 MEV, WITH 32 SHORT TANKS AND 72
LONG TANKS, BORE 1.25 INCH AND 1.5 INCH RESPECTIVELY, GRADIENTS 2.27 - 3.3 KG/CM AND MATCHED AT
TRANSITIONS. FOR PERFECT LINAC, ACCEPTANCE IS 4.5 PT CM-MRAD, INCLUDING COUPLING TERMS RESULTED
IN A 20-30 PERCENT INCREASE OVER UNCOUPLED PREDICTIONS IN OVERALL ENVELOPE.

SUBJECTS.: TRANSVERSE OSCILLATIONS; QUADRUPOLE ERRORS; COUPLING;

CROSS-REF: IDA 1194, "P.L.T."

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771021

MICROFILM:

STR-LOC.: HP-9 SPERG FILE;

2nd title.....: BEAM MEASUREMENTS ON THE HIGH-INTENSITY PROTON TARGET OF LAMPF

AUTHOR.....: STEVENS, P.R., JR., ET AL.; GELFA, W.C., ET AL.

AFFILIATION.....: LANS-MP-6

DOC-TYPE.....: LABS

PAGES.....: 35

ABSTRACT.....: ILLUMINATION RATES BY SETTING EXTRACTION VOLTAGE PARAMETRICALLY AS FUNCTION OF CURRENT.

GRAPH OF PROTON FRACTION AS FUNCTION OF EXTRACTION CURRENT.

AT 50 MA, FWHM = 1.25 PL TW-MEAN, 70 PERCENT PROTONS, SIZE APPROX 1 CM, DIV APPROX 10-10.6 W/CM².

GRAPH OF BEAM SIZE WITH EXTRACTION BEAM CURRENT. CENTRAL SPOT 1-COMES LINEARLY IN SIZE, THERAPY. SAME RESULT FROM BEPPO-COL ANALYSIS FIGS. 39 AND 40.

ANALYSIS OF INTENSITY PROFILE SHOWS X 2 DISCREPANCY BETWEEN TWO METHODS OF MEASUREMENTS.

SUBJECTS.....: ILLUMINATION; EXTRACTION; BEAMS;

REFERENCE.....: 1

CROSS-REF.....: ILL-251, WPT-11

CATEGORY.....: EXPERIMENTAL RESULTS

CAT-SOURCE.....: JAFFSON

DATE-FILE.....: 771221

MICROFILM.....:

STOR-LOC.....: MP-6 SP-60 FILE

1
201 TITLE....: RDS MK2 LINAC DESIGN MODIFICATIONS DUE TO LENGTH ERRORS

AUTHOR....: CHANDALL, K.R.
AFFILIAT.: LASL-MP-9

DOC-TYPE.: MEMO
PAGES.....: 21

DATE-PUHL: 740701

ABSTRACT.: DETAILS THE EFFECT OF NON-RANDOM LENGTH ERRORS IN A LONG LINAC AND A PROCEDURE FOR
OPTIMIZING THE ADJUSTMENT OF RF MODULE AMPLITUDE AND PHASE IN THE PRESENCE OF SUCH ERRORS.

SUBJECTS.: LINAC DESIGN; OPTIMIZATION; RF AMPLITUDE; RF PHASE; LONGITUDINAL DYNAMICS;

CROSS-REF: TON 52, 10114;

CATEGORY.: LINAC DESIGN; OPTIMIZATION;

CAT-SOURCE: JAMESON

DATE-ENT.: 771021

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE:

1 242 TITLE..... DOUBLE DRIFT BUNCHER - PART II: INCLUDING SPACE CHARGE

AUTHOR...: EMIGH, P.P.; HEDDMARSH, A.C.

AFFILIAT.: LASL-MP-4

DOC-TYPE.: MEMO

REP-NUM...: MP-4/CRF, AC-1

PAGES....: 47

DATE-PUBL: 660906

ABSTRACT.: MUCH ANALYTICAL DEVELOPMENT FOR MANY-DISKS METHOD, MANY-DISKS WITH SOLENOID, MANY-RINGS, MANY-ELLIPTICAL-RINGS, EVOLVED INTO THE MANY-RINGS-AVERAGED APPROACH OF CRANDALL.

SUBJECTS.: SPACE CHARGE; BUNCHER; MRA CODE

CROSS-REF: ILM 862, MPLTR

CATEGORY.: THEORY; NUMERICAL COMPUTATION

CAT-SOURCE: JAMESON

DATE-ENT.: 771021

MICROFILM:

STAR-JOEL: MP-9 SPERG FILE

2-3 TITLE....: COMPUTER SIMULATION OF BEAM BUNCHING

AUTHOR....: CHANDALL, P.W.

AFFILIAT.: LASI-AP-3

DOC-TYPE.: TALK

PAGES....: 2

DATE-PRIN.: 670419

CONFERENCE: PROC SYMPOSIUM ON COMPUTER SIMULATION OF PLASMA AND MANY-BODY PROBLEMS, SPONSORED BY NASA,
WILLIAMSBURG, VA, APRIL 19-21, 1967, NASA REPORT SP-153, P. 197

ABSTRACT.: FREE SPACE, CYLINDRICAL SYMMETRY, 2000 PARTICLES; R=7.

RECTANGULAR AREA-WEIGHTED LESH METHOD. COMPUTER TIME GOES AS NUMBER OF PARTICLES AND AS
SQUARE OF NUMBER OF MESH POINTS AT WHICH FIELDS ARE COMPUTED.

SUBJECTS.: SPACE CHARGE; BUNCHING

CROSS-REF: ID: 693. 7112

CATEGORY.: NUMERICAL COMPUTATION

CAT-SOURCE: JAMESON DATE-ENT.: 771221

MICROFILM:

STAR-LOC.: NP-9 SPACE FILE

254 TITLE....: ACCELERATOR PERFORMANCE TESTS

AUTHOR....: CHADWELL, K.W., ET AL.;
AFFILIAT.: LASL-MP

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 20

DATE-PUBL: 771019

ABSTRACT.: COMMENT THAT PREBUNCHER PHASE SCANS DO NOT AGREE WITH THEORY, AND THAT THEY ALSO DID NOT AGREE DURING 5 MEV TESTS, REFERENCE AN MP-3 MEMO, 7710712. HYPOTHEZIZED MAYBE DUE TO EXCESSIVE LONGITUDINAL SPACE CHARGE EFFECT. LATER TEST SHOWS PRE-BUNCHER PHASE-SCANS ARE BEAM CURRENT DEPENDENT.

ESTIMATE OF TOTAL EMITTANCE FROM RMS EMITTANCE USING RMS AND TOTAL WIDTH OF WIRE-SCANNER PROFILE: TOTAL EMITTANCE = (TOTAL WIDTH/RMS WIDTH)**2 X RMS EMITTANCE.

VARIATION OF TRANSVERSE EMITTANCE WITH BUNCHER AMPLITUDE; APPROX 50 PERCENT GROWTH FROM ZERO TO DESIGN AMPLITUDES - BOTH BUNCHERS ON.

SUBJECTS.: SPACE CHARGE; BUNCHER; EMITTANCE GROWTH;

CROSS-REF: TDN 1065, HELIX;

CATEGORY.: EXPERIMENTAL RESULTS;

CAT-SOURC: JAMESON DATE-ENT.: 771021

MICROFILM;

STOR-LOC.: MP-R SPECG FILE;

205 TITLE..... CHALK RIVER EXPERIENCE IN THE OPERATION OF HIGH CURRENT 100 PERCENT DUTY FACTOR ACCELERATING COLUMNS

AUTHOR....: HARRIS, J., ET AL.:
AFFILIAT.: CRNL

DOC-TYPE.: CONF PAPER
PAGES.....: 4

REP-NUM.: AFCL-5677
DATE-PUBL: 761100

CONFERENCE: PROG 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT AFCL-5677, P. 1711

ABSTRACT.: TWO HIGH CURRENT 100 PERCENT DUTY FACTOR DC ACCELERATORS HAVE BEEN BUILT AND ARE BEING COMMISSIONED AT CHALK RIVER. ONE IS A 750 KEV (EVENTUALLY 3 MEV) ACCELERATOR DESIGNED TO INVESTIGATE PROBLEMS IN THE ACCELERATION OF DC PROTON BEAMS IN THE 50-100 MA RANGE; THE OTHER IS A 25 MA, 300 KEV D+ DC ACCELERATOR DESIGNED FOR A 4×10^{12} S⁻¹ FAST NEUTRON SOURCE. THE 750 KEV ACCELERATOR HAS BEEN IN OPERATION WITH BEAM CURRENTS UP TO 40 MA. BEAM INDUCED VOLTAGE BREAKDOWN PROBLEMS ENCOUNTERED IN THE COMMISSIONING OF THE HIGH-GRADIENT ACCELERATING COLUMNS OF THESE ACCELERATORS WILL BE DESCRIBED. CHANGES IN COLUMN DESIGN PHILOSOPHY BROUGHT ABOUT BY THESE PROBLEMS WILL BE DISCUSSED.

SUBJECTS.: CW OPERATION; SPACE CHARGE; INJECTION; ACCELERATING COLUMN;

REFERENCE: 6

CATEGORY.: SYSTEM OPERATIONS; EXPERIMENTAL ANALYSIS;

CAT-SOURCE: JAMESON DATE-FRT.: 771106

MICROFILM:

STOR-IDC.: MP-9 SPERG FILE;

1
2NA TITLE....: PROPERTIES OF HEAVY ION LINACS WITH ALTERNATING PHASE FOCUSING

AUTHOR...: REITINGHOFF, P.; JUNIOR, P.; KLEIN, H.;
AFFILIAT.: INST. ANG. PHYS., FRANKFURT;

DOC-TYPE.: CONF PAPER
PAGES....: 7

REP-NUM...: AECI-5677
DATE-PUBL: 761100

CONFERENCE: PRDC 1976 PHOTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AECI-5677, P. 238;

ABSTRACT.: OPTICAL MODEL FOR HELIX AND SPIRAL RESONATOR, COMPUTATIONAL RESULTS FOR ALTERNATING-PHASE-
FOCUSED LINACS, SOME CONSIDERATIONS OF THE EFFECTS OF ERRORS.

SUBJECTS.: ALTERNATING PHASE FOCUSING; ACCELERATOR STRUCTURE;

REFERENCE: 17

CATEGORY.: SYSTEM DESIGN; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771126

MICROFILM:

STOR-LOC.: MP-9 SPEC FILES

207 TITLE....: BEAM OPTICS IN THE NEW 50 MEV LINAC

SUB-TITLE: GENERAL DESIGN PRINCIPLES - MATCHING, CHOICE OF SYNCHRONOUS PHASE, CHOICE OF MAGNET LAW,
CHOICE OF BEAM SPACE-CHARGE PARAMETERS, DESCRIPTION OF BEAM OPTICS - MATCHING AT LINAC I-P-T,
BUNCHING AND 0.75 MEV BEAM TRANSPORT, ACCELERATION FROM 0.75 MEV TO 50 MEV.

AUTHOR....: WARNER, D.J.; KRISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER; INTERNAL REPORT;
PAGES....: 6

REF-NO.: AECL-5677; CERN/PS/LIN 76-2
DATE-PRIN.: 761100; 761101

CONFERENCE: PROC 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AECL-5677, P. 205;

ABSTRACT.: A COMPREHENSIVE TREATMENT OF THE BEAM OPTICS, INCLUDING BUNCHING, MATCHING, AND
ACCELERATION, IS PRESENTED FOR THE NEW 50 MEV LINAC. IT IS BASED ON A COMBINED USE OF
ANALYTICAL APPROACHES AND COMPUTATIONS, FIRSTLY USING OPTIMIZATION TECHNIQUES WITH LINEARIZED
FORCES AND THEN NUMERICAL BEAM SIMULATION WITH NON-LINEARITIES INCLUDED. THE MATCHING BETWEEN
DIFFERENT PARTS OF THE ACCELERATOR AND THE CHOICE OF OPERATING CONDITIONS ARE SHOWN TO BE
IMPORTANT IN BOTH TRANSVERSE AND LONGITUDINAL PHASE PLANES, ESPECIALLY IF A WIDE RANGE OF BEAM
INTENSITIES (UP TO 150 MA) IS SPECIFIED. FOR THE DESCRIPTION OF THE GLOBAL BEAM CHARACTERISTICS
R.M.S. VALUES OF PHASE-SPACE COORDINATES ARE USED.

SUBJECTS.: SYSTEM DESIGN; BEAM DYNAMICS; MATCHING; SPACE CHARGE; SYNCHRONOUS PHASE LAW; QUADRUPOLE LENS

NOTES....: RATHER COMPLETE OVERVIEW OF DYNAMICS FACTORS IN DESIGN. MATCHING IS AN AXIOMATIC
REQUIREMENT - A MISMATCH IN ONE PLANE AUTOMATICALLY INTRODUCES MISMATCH IN OTHERS WHEN SPACE
CHARGE IS PRESENT, EVEN IN LINEAR (RMS) CASE. DISCUSSION OF SPACE CHARGE EFFECTS USING RMS
EMITTANCE AS GIVEN BY SACHREP.

GIVE CURRENT LIMIT FORMULA FOR NON-ACCELERATING CASE, THIS PESSIMISTIC ESTIMATE. PLOTS
GIVEN FOR TRANSVERSE ACCEPTANCE AND MATCHED ENERGY SPREAD AS FUNCTION OF CURRENT.

A 7 PERCENT INCREASE IN THE LONGITUDINAL MATCHING FACTOR FOUND IN THE LINEAR CALCULATION IS
FOUND IN PRACTICE TO ACCOUNT FOR THE NON-UNIFORM LONGITUDINAL POTENTIAL WELL AND ASYMMETRIC
INJECTION.

PREDICTED PERFORMANCE FOR THE LINAC AT 150 MA IS LITTLE OR NO GROWTH (MAYBE 20 PERCENT)
IN TRANSVERSE EMITTANCE FROM 0.75-50 MEV, BUT FACTOR OF 2.3 GROWTH IN LONGITUDINAL EMITTANCE.

REFERENCE: 10

CATEGORY.: SYSTEM DESIGN;

CAT-SOURCE: JAMESON DATE-ENT.: 771106

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

20R TITLE..... FIELD CONTROL IN A STANDING WAVE STRUCTURE AT HIGH AVERAGE BEAM POWER

AUTHOR...: MC NEILAN, J.; FRASER, J.S.; MC MICHAEL, G.F.;
AFFILIAT...: CRN

DOC-TYPE...: CONF PAPER
PAGES.....: 4

REP-NUM...: AFCL-5677
DATE-PUBL: 761104

CONFERENCE: PROC 1976 REGION LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT, 14-17, 1976, REPORT
AFCL-5677, P. 2911

ABSTRACT...: A 100 PERCENT DUTY FACTOR ELECTRON BEAM HAS BEEN ACCELERATED THROUGH A GRADED-META SIDE-
COUPLED STANDING WAVE STRUCTURE OPERATING IN $\pi/2$ MODE. THREE NON-INTERACTING CONTROL LOOPS ARE
NECESSARY TO PROVIDE THE ACCELERATING FIELD AMPLITUDE AND PHASE AND TO CONTROL STRUCTURE
RESONANCE. THE PRINCIPAL DISTURBANCES HAVE BEEN IDENTIFIED AND MEASURED OVER THE BEAM CURRENT
RANGE OF 0 TO 20 MA. DESIGN DETAILS ARE PRESENTED OF CONTROL LOOPS WHICH REGULATE THE
ACCELERATING FIELD AMPLITUDE TO ± 0.3 PERCENT AND ITS PHASE TO ± 0.5 DEGREES FOR 50
PERCENT BEAM LOADING.

SUBJECTS...: RF FIELD CONTROL; CW OPERATION;

REFERENCE: 12

CATEGORY...: SYSTEM DESIGN; EXPERIMENTAL RESULTS;

CAT-SOURCE: JAMESON DATE-ENT...: 771146

MICROFILM:

STOR-LOC...: NP-9 SPERG FILE;

249 TITLE....: OPERATION OF THE KEK 20 MEV INJECTOR LINAC

AUTHOR....: TANAKA, J., ET AL.:
AFFILIAT.: KEK

DOC-TYPE.: CONF PAPER
PAGES.....: 5

REF-NUM.: AFEL-5677
DATE-PUBL: 7/11/76

CONFERENCE: PAC 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AFEL-5677, P. 333:

ABSTRACT.: A GENERAL DESCRIPTION OF THE OPERATIONAL BEHAVIOR OF THE KEK 20 MEV INJECTOR LINAC WILL BE
GIVEN. COPPER PLATINGS ON THE DRIFT TUBES AND THE INNER SURFACE OF THE TANK HAVE BEEN GREAT
ADVANTAGE TO THE HIGH POWER BE EXCITATION. THE BUNCHER DEBUNCHER AND BEAM LOADING COMPENSATION
SYSTEM HAVE BEEN OPERATED SUCCESSFULLY. THE MAXIMUM BEAM CURRENT OF 150 MA WAS ACCELERATED S-
EAM. THE ENERGY SPREAD WAS LESS THAN ± 0.1 PERCENT WITHOUT DEBUNCHER AND ± 0.3 PERCENT WITH
DEBUNCHER AT THE EXITANCE OF 1.6 PI CM RAD AND BEAM CURRENT OF 120 MA. THIS PAPER ALSO
INCLUDES THE EXPERIMENTAL AND CALCULATED RESULTS OF TILTING OF THE TANK FIELD DISTRIBUTION.

SUBJECTS.: EXITANCE MEASUREMENT; SPACE CHARGE; TILTED FIELD; ELECTRIC FIELD LAW;

REFERENCE: 2

CATEGORY.: SYSTEM PERFORMANCE; EXPERIMENTAL RESULTS;

CAT-SOURCE: JAMESON DATE-ENT.: 7/11/76

MICROFILM:

STER-LDC.: 15-9 SPERG FILE;

1
214 TITLE.... IMPROVEMENT IN THE 20 MEV BEAM BRIGHTNESS AT SATURN

AUTHOR...: CHAPQUARD, P.A.; OLIVIER, P.;
AFFILIAT...: CEA

DOC-TYPE...: CONF PAPER
PAGES.....: 4

REP-NUM...: AFCL-5677
DATE-PUBL: 761100

CONFERENCE: PAC 1976 PROTON LINEAR ACCEL CONF, CHALK RIVER, ONTARIO, CANADA, SEPT. 14-17, 1976, REPORT
AFCL-5677, V. 372

ABSTRACT...: CONSIDERATIONS OF BEAM SIZE IN BUNCHER AND MATCHING. EXPERIMENTAL RESULTS ARE ALSO GIVEN.
COMPARISON BETWEEN THEORY AND EXPERIMENT IS GOOD FOR 50 PERCENT OF BEAM.

SUBJECTS...: SPACE CHARGE; MATCHING; BUNCHER;

REFERENCE: 4

CATEGORY...: COMPUTATION; EXPERIMENTAL RESULTS;

DATE-SOURC: JAN 58 DATE-ENT.: 771106

MICROFILM:

SIZE-LOC...: PP-9 SPERG FILE;

211 TITLE....: CALCULATION OF QUADRUPOLE FOCUSING IN A LINAC AND ADAPTATION OF BUNCH WITH THE PRESENCE OF SPACE CHARGE (IN FRENCH)

AUTHOR....: HRIH, R.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 63

REP-NUM.: PDS/LIN/7V-10
DATE-PUBL.: 701105

ABSTRACT.: THEORETICAL STUDY, CALCULATION OF FOCUSING STRUCTURE AND ADAPTATION OF BUNCH, DESCRIPTION AND UTILIZATION OF PROGRAM ADAPT, RESULTS AND INTERPRETATION, CONCLUSION, APPENDICES ON TRANSFER OF EMITTANCE ELLIPSES ALONG THE STRUCTURE, CALCULATION OF ELLIPTIC INTEGRALS OCCURRING DURING THE SPACE CHARGE FORCE CALCULATIONS.

SUBJECTS.: SPACE CHARGE; QUADRUPOLE FOCUSING; ADAPT CODE; CONJUGATE POINT ELLIPSE REPRESENTATION;

REFERENCE: 22

CATEGORY.: THEORY; NUMERICAL COMPUTATION; SOFTWARE DOCUMENTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1

212 TITLE..... SOME NOTES ON THE NEW LINAC STRUCTURE ALIGNMENT

AUTHOR..... KARRER, D.G.

AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT

PAGES..... 19

REF-NO.: PBS/LIN NOTE 75-34

CAT-PUB.: 751124

ABSTRACT.: ALIGNMENT PROCEDURES, PHILOSOPHY, EFFECT OF ERRORS IN DRIFT TUBE TRANSVERSE POSITION, OAK
OUTLINE. MECHANICAL METHODS ARE PROPOSED WHEREVER POSSIBLE IN PREFERENCE TO OPTICAL METHODS.
OPTICAL METHODS USED ONLY FOR LONGER DISTANCES (OVER 3M). THEY HAVE REMOVABLE DRIFT TUBE
SUPPORT BUNDLES LESS THAN 3.5M LONG. PROVISION FOR CHECKING AFTER ASSEMBLY.

SUBJECTS.: ALIGNMENT; ERROR TOLERANCE;

CATEGORY.: SYSTEM DESIGN;

CAT-SOURCE: JAMESON

DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: BR-9 SPORG FILE:

213 TITLE....: BUNCHING OF INTENSE PROTON BEAMS WITH SIX-DIMENSIONAL MATCHING TO THE LINAC ACCEPTANCE - 710200

AUTHOR....: WEISS, M.

AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT

PAGES....: 7

REP-NUM.: CERN/PS/LT 73-2

DATE-PUBL: 730200

CONFERENCE: SEE ALSO 1973 PARTICLE ACCEL CONF;

ABSTRACT.: A METHOD HAS BEEN DEVELOPED FOR THE DETERMINATION OF BUNCHING PARAMETERS IN THE FRAME OF A SIX-DIMENSIONAL BEAM-MATCHING TO THE LINAC ACCEPTANCE. IN THE ABSENCE OF SPACE CHARGE, INITIAL SOLUTIONS FOR THE BUNCHER DISTANCE, VOLTAGE AND EFFICIENCY, WHICH SATISFY THE MATCHING REQUIREMENTS, ARE FOUND ANALYTICALLY OR WITH AUXILIARY COMPUTER PROGRAMS. THEN AN ITERATIVE CALCULATION IS APPLIED TO SOLVE THE MORE GENERAL BUNCHING PROBLEM IN THE PRESENCE OF SPACE CHARGE.

IN THE ABOVE-MENTIONED ANALYSIS, THE BEAM IS REPRESENTED AS AN ENTITY, DESCRIBED BY THE SECOND MOMENTS OF PARTICLE COORDINATES AND VELOCITIES. ALL THE FORCES ARE LINEARIZED; THE EVOLUTION OF R.M.S. VALUES DEPENDS PRIMARILY ON THE LINEAR FORCE COMPONENT.

SUBJECTS.: SPACE CHARGE; BUNCHER; MATCHING; PAFINJ CODE;

NOTES....: THIS INTERNAL REPORT INCLUDES AN APPENDIX "TRANSVERSE EMITTANCE INCREASE IN AN RF GAP" WHICH WAS NOT SUBMITTED TO THE CONFERENCE (ION 191);

REFERENCE: 3

CROSS-REF: ID 101, SPORG;

CATEGORY.: NUMERICAL COMPUTATION; THEORY;

CAT-SOURCE: JAMESON

DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: ND-9 SPORG FILE;

1 214 TITLE..... CAVITY FIELD MEASUREMENTS BY PERTURBATION; SOME REQUIREMENTS FOR A COMPUTERIZED SYSTEM

AUTHOR...: WARNER, D.J.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 13

REP-NUM...: PS/LIN/NOTE 7A-2
DATE-PUBL: 760129

ABSTRACT.: REVIEWS BASIC PERTURBATION METHOD FOR CAVITY FIELD MEASUREMENTS, APPLICATION TO 500 MHZ
MODEL AND NEW LINAC, AND LISTS REQUIREMENTS FOR COMPUTERIZED AUTOMATIC SYSTEM. PREFER PHASE
READPULL TO USUAL FREQUENCY READPULL, USE HP NETWORK ANALYZER.

SUBJECTS.: READ PERTURBATION MEASUREMENT; PHASE READPULL; FIELD DISTRIBUTION;

REFERENCE: 4

CATEGORY.: EXPERIMENTAL TECHNIQUE;

CAT-SOURCE: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

215 TITLE.....: EVOLUTION IN THE FIRST DESIGN (3RD VERSION): CHOICE OF QUADRUPOLE TRIPLETS

AUTHOR...: RRII, H., WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 17

REP-NUM...: MPS/LIN/NOTE 74-4
DATE-PURL: 741103

ABSTRACT.: SEE TITLE. CONSIDERATION OF SPACE CHARGE LED TO CHANGES IN FIRST TRIPLET AFTER ACCELERATING COLUMN, NOMINAL INPUT BEAM, AND SAFETY FACTORS WHICH ARE ADDED TO THE TRANSPORT DESIGN.
DISCUSSION OF INHERENT ERRORS - BEAM INTENSITY AND DENSITY FLUCTUATIONS.

SUBJECTS.: BEAM TRANSPORT; SPACE CHARGE; SAFETY FACTORS; QUADRUPOLE FOCUSING;

REFERENCE: 3

CATEGORY.: SYSTEM DESIGN;

CAT-SOURC: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE:

1 216 TITLE.....: SOME THOUGHTS ABOUT THE PRESENT SITUATION OF THE 50 MEV LINAC AND THE ADVANTAGES OF A FAST
FEEDBACK SYSTEM

AUTHOR...: HASFROTH, H.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 5

REP-NUM...: MPS/LIN/NOTE 74-3
DATE-PUBL.: 740301

ABSTRACT.: DECIDES A FAST FEEDBACK SYSTEM WOULD COMPLICATE SETUP AND NOT PROVIDE A BETTER BEAM ON THE
OLD LINAC. APPARENTLY DOES NOT KNOW ABOUT SIMULTANEOUS PHASE AND AMPLITUDE CONTROL.

SUBJECTS.: RF FIELD CONTROL;

CATEGORY.: SYSTEM PERFORMANCE;

CAT-SOURC.: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

217 TITLE....: RF POWER REQUIREMENTS FOR THE 405 MHZ BUNCHER

AUTHOR...: WARNER, D.J.

AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT

REP-NUM...: MPS/LIN/NOTE 74-2

PAGES....: 5

DATE-PUBL: 740228

ABSTRACT.: WILL REQUIRE ABOUT 16 KW MAXIMUM AT 405 MHZ, 50 KW AT 202.5 MHZ. TRANSIT TIME FACTOR ABOUT
0.35 FOR 405 MHZ BUNCHER.

SUBJECTS.: BUNCHER, RF SYSTEM;

CATEGORY.: SYSTEM DESIGN;

CAT-SOURC: JAMESON

DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

1
210 TITLE....: PROGRAM FOR THE CALCULATION OF THE ACCEPTANCE OF A LINAC FOR DIFFERENT STRUCTURES AND FOR NON-
SYNCHRONOUS PARTICLES (IN FRENCH)

AUTHOR...: DESCUSSE, J.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 53

REP-NUM...: CERN/MPs/LIN 70-4
DATE-PUBL: 700510

ABSTRACT.: THEORY, ORGANIZATION, AND DESCRIPTION OF PROGRAMS ACCEPT, PHASE, TRANSF, ELLIP AND DRA-
SUBJECTS.: ACCEPTANCE; NON-SYNCHRONOUS PARTICLES; ACCEPT CODE; PHASE CODE; TRANSF CODE; ELLIP CODE; DRA-
CODE;

CATEGORY.: SOFTWARE DOCUMENTATION; THEORY; NUMERICAL COMPUTATION;

CAT-SOURC: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE:

219 TITLE....: NUMERICAL METHODS FOR STUDYING THE EFFECTS OF SPACE CHARGE AND GEOMETRIC ABERRATIONS IN BEAM
TRANSPORT SYSTEMS (IN FRENCH)

AUTHOR....: TANGUY, P.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 117

REP-NUM.: CERN/PPS/LIN 70-1
DATE-PUBL: 700316

CONFERENCE: SEE ALSO 1970 PROTON LINAC CONF;

ABSTRACT.: DETAILED WRITEUP OF PAPER PUBLISHED IN ENGLISH IN 1970 PROTON LINAC CONF. COMPUTER PROGRAMS
REVOL - RADIAL SYMMETRY, AND TRAJ - NO SYMMETRY OF REVOLUTION.

SUBJECTS.: SPACE CHARGE; QUADRUPOLE FIELD ABERRATIONS; BEAM TRANSPORT; TRAJ CODE; REVOL CODE;

REFERENCE: 19

DATA-NEED: 50 FIGURES

CROSS-REF: IDN 175. SPERG;

CATEGORY.: NUMERICAL COMPUTATION; SOFTWARE DOCUMENTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

220 TITLE....: TRIP REPORT; LASL SPACE CHARGE WORKSHOP OCT. 31 - NOV. 2, 1977

AUTHOR....: VAUGHAN, J.R.M.
AFFILIAT.: IITTON

DOC-TYPE.: MEMO
PAGES....: 4

DATE-PURL: 771109

CONFERENCE: LASL SPACE CHARGE WORKSHOP, OCT. 31 - NOV. 2, 1977;

ABSTRACT.: SUMMARY OF IDEAS CONCERNING APPLICATION OF FOURIER TRANSFER METHOD TO LINAC SPACE CHARGE PROBLEMS. FOURIER ANALYSIS CYCLIC REDUCTION METHOD MAY BE APPLICABLE TO PUNCHING REGION. AFTER PUNCHING, HIGH HARMONICS WOULD BE NEEDED TO MAINTAIN RESOLUTION. THE PRESENT FACR METHOD IS AXISYMMETRIC. A 3-D CODE IS POSSIBLE, BUT WOULD BE A MAJOR STEP.

SUBJECTS.: FOURIER ANALYSIS CYCLIC REDUCTION; FFT; SPACE CHARGE; CODE DEVELOPMENT;

CATEGORY.: NUMERICAL COMPUTATION; CODE DEVELOPMENT;

CAT-SOURCE: JAMESON DATE-ENT.: 771114

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE

1

221 TITLE.....: REMARKS ON LASI SPACE CHARGE WORKSHOP, OCT. 31 - NOV. 2, 1977

AUTHOR....: FRASER, J.S.

AFFILIAT.: CRNL

DOC-TYPE.: LETTER

PAGES.....: 5

DATE-PURL: 771108

CONFERENCE: LASI SPACE CHARGE WORKSHOP, OCT. 31 - NOV. 2, 1977;

ABSTRACT.: SUMMARY OF MEETING AND COMMENTS - THEORY, COMPUTER CODES, MEASUREMENTS, GENERAL IMPRESSIONS.

SUBJECTS.: SPACE CHARGE; CODE DEVELOPMENT; EMISSION;

CATEGORY.: MEASUREMENT; THEORY; CODE DEVELOPMENT;

CAT-SOURCE: JAMESON

DATE-ENT.: 771110

MICROFILM:

STOR-IDC.: NP-9 SPERG FILE;

222 TITLE..... H- SOURCE TESTS FOR LAMPE

AUTHOR...: ALLISON, P.W.
AFFILIAT.: LASL-P-5

DOC-TYPE.: MEMO
PAGES.....: 3

DATE-PURL: 771104

CONFERENC: LASL SPACE CHARGE WORKSHOP, OCT. 31 - NOV. 2, 1977;

ABSTRACT.: DISCUSSION OF USING THE DUDNIKOV SOURCE TO TEST BRIGHT H- BEAMS IN THE LAMPE ACCELERATOR.
ABOUT 30 MA COULD BE DELIVERED AT 7.5 HZ X 1 MSEC PULSE LENGTH, EMITTANCE WOULD BE DIFFERENT IN
THE TWO PLANES, ALLOWING MEASUREMENT OF EMITTANCE GROWTH WITH SAME CURRENT BUT DIFFERENT
EMITTANCE. SOURCE COULD BE ROTATED TO EXCHANGE PLANES. TIME REQUIREMENTS AFTER PREPARATION: 2
DAYS SETUP, 2 DAY TEARDOWN.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH; DUDNIKOV H- ION SOURCE; BRIGHT H- BEAM;

CATEGORY.: EXPERIMENTAL PROPOSAL;

CAT-SOURCE: JAMESON DATE-ENT.: 771110

MICROFILM;

STOR-LOC.: MP-9 SPRG FILE;

1 223 TITLE.....: SPACE CHARGE WORKSHOP RECOMMENDATIONS
AUTHOR.....: STEVENS, W.P., JR.
AFFILIAT.: LASL-MP-12
DOC-TYPE.: MEMO
PAGES.....: 4
DATE-PIHL: 771107

CONFERENCE: LASL SPACE CHARGE WORKSHOP, OCT. 31 - NOV. 2, 1977;

ABSTRACT.: DISCUSSION OF WORKSHOP AND RELATION TO LAMP OPERATION AND DEVELOPMENT,

SUBJECTS.: SPACE CHARGE; ION SOURCE; BEAM TRANSPORT; EMISSION GROWTH;

CATEGORY.: EXPERIMENTAL PROGRAM;

CAT-SOURCE: JAMFSON DATE-ENT.: 771114

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

1
224 TITLE....: PARTICLE DYNAMICS CODE DEVELOPMENT

AUTHOR....: STAPLES, J.
AFFILIAT.: LBL

DOC-TYPE..: LETTER
PAGES.....: 2

DATE-PUB.: 771124

CONFERENCE: LASL SPACE CHARGE WORKSHOP, OCT. 31 - NOV. 2, 1977;

ABSTRACT.: THOUGHTS ON CODE DEVELOPMENT NEEDED FOR NEW APPLICATIONS, ARGUES THAT LINEARIZED CODES CAN GIVE ONLY GUIDELINES AND PARAMETER SENSITIVITIES IN SMALL SECTIONS OF LINACS, AND THAT PRESENT MACROPARTICLE CODES HAVE SO MANY ARTIFICIALITIES THAT THEIR PREDICTIONS CANNOT BE TRUSTED TOO FAR. POINTS OUT THAT AN ADVANTAGE OF THE FFT METHOD MAY BE THAT THE GAP FIELDS MAY BE EASILY TRANSFORMED AND INCLUDED IN A NATURAL WAY INTO THE BASIC FFT ALGORITHM. ADVOCATES NOT LOSING SIGHT OF POSSIBLE DEVELOPMENT OF NEW CODES.

SUBJECTS.: SPACE CHARGE; CODE DEVELOPMENT; FFT;

CATEGORY.: CODE DEVELOPMENT; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771124

MICROFILM;

STOR-LOC.: MP-9 SPACE FILE;

225 TITLE....: GENERAL PROPERTIES OF FIELDS AND BEAM DYNAMICS IN A LINAC GAP
SEC-TITLE: INTRO AND REVIEW; GENERAL PROPERTIES OF THE FIELD; BEAM DYNAMICS COEFFICIENTS; MOTION OF A
PROTON IN A SPATIALLY UNIFORM TIME-HARMONIC FIELD; APPROXIMATION SCHEMES; NON-RELATIVISTIC
MOTION OF A PROTON IN A REALISTIC FIELD; RELATIVISTIC MOTION;

AUTHOR...: SCHNITZER, R.
AFFILIAT.: CERN

DOC-TYPE.: YELLOW REPORT
PAGES....: 177

REP-NUM...: CERN 69-3
DATE-PUBL: 690312

ABSTRACT.: EXTENSIVE AND DETAILED DERIVATION ON NON-REL AND RELATIVISTIC DIFFERENCE EQUATIONS FOR
SINGLE PROTON IN LINAC GAP, EXTENDING LAPOSTOLLE RESULTS FROM 1965 PRASCATTI CONFERENCE.
INTEGRAL REPRESENTATIONS AND BEAM DYNAMICS COEFFICIENTS WHICH ARE FOURIER TRANSFORMS OF THE
FIELD. Y AND S-COEFFICIENTS.

SUBJECTS.: GAP EQUATIONS; LONGITUDINAL DYNAMICS; FOURIER TRANSFORM; RF FIELD; BEAM DYNAMICS; TRANSIT TIME
FACTOR; S-COEFFICIENT;

REFERENCE: 43

CROSS-REF: IDN 134, 163 AND 34, SPERG;

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURC: JAMESON DATE-ENT.: 771112

INTERCITL:

STOR-LOC.: MP-9 SPERG FILE

1 226 TITLE.....: COMPUTER SIMULATION OF SPACE CHARGE EFFECTS IN THE LINAC-BOOSTER TRANSFER LINE

AUTHOR....: MORRISON, J.

AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT

PAGES.....: 18

REP-NUM...: CERN/MPS/LIN. 60-19

DATE-PUBL: 691015; REV. 710100;

ABSTRACT.: DESCRIPTION OF PROGRAM BEAM TRANSPORT LINE FROM LINAC OUTPUT TO BOOSTER, CAN INCLUDE MAGNETIC LENSES, DRIFTS AND RF CAVITIES. OFFSHOOT OF BUNCH PROGRAM.

SUBJECTS.: SPACE CHARGE; BEAM TRANSPORT; BEAM CODE;

REFERENCE: 3

CATEGORY.: NUMERICAL COMPUTATION; SOFTWARE DOCUMENTATION;

CAT-SOURCE: JAMESON

DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

227 TITLE..... COMPUTATIONAL METHODS AND COMPUTER PROGRAMS FOR LINEARIZED ANALYSIS OF PERIODIC STRUCTURES AND
BEAM TRANSPORT SYSTEMS UNDER SPACE CHARGE CONDITIONS

AUTHOR...: BRU, B., WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 54

REF-NUM...: CERN/PS/LIN 72-4
DATE-PUBL: 741026

ABSTRACT.: THIS PAPER DESCRIBES THE COMPUTATIONAL METHODS AND A SERIES OF PROGRAMS BASED UPON THEM FOR
THE DETERMINATION OF PERIODIC OR QUASI-PERIODIC FOCUSING STRUCTURES WITH ACCELERATION (LINACS)
AND BEAM TRANSPORT SYSTEMS (PRE-INJECTORS AND INFLECTORS) WITH SPACE CHARGE EFFECTS INCLUDED.
ALL THE FORCES IN THE PROGRAMS ARE LINEARIZED EXCEPT FOR THE BUNCHER, WHERE THE NONLINEARITIES
CREATE THE LONGITUDINAL BEAM ENTAILANCE. HERE A NOVEL METHOD FOR THE TREATMENT OF THE TRANSITION
FROM A FOUR-DIMENSIONAL PHASE SPACE (CONTINUOUS BEAM) TO A SIX-DIMENSIONAL ONE (BUNCHED BEAM)
HAS BEEN DEVELOPED.

SOME AUXILIARY PROGRAMS CALCULATING STABILITY DIAGRAMS FOR PERIODIC STRUCTURES OR THE
FOCUSING OF SYMMETRIC TRIPLETS ARE ALSO INCLUDED. THE PROGRAM OUTPUTS ARE IN NUMERICAL AND
GRAPHICAL FORM; THE CPU TIME REQUIRED ON THE CDC 6600 COMPUTER RANGES FROM A FEW SECONDS UP TO
LESS THAN A MINUTE.

SUBJECTS.: SPACE CHARGE; BUNCHER; BEAM TRANSPORT; MAGNET FOCUSING STABILITY DIAGRAMS; LINAC CODE; PREINJ
CODE; INFLEC CODE; STAB CODE; TRIPL CODE;

REFERENCE: 16

DATA-RECD: PROGRAM FLOW CHARTS, SAMPLE OUTPUTS, MAGNET STABILITY DIAGRAMS, OTHERS;

CATEGORY.: THEORY; NUMERICAL COMPUTATION; SOFTWARE DOCUMENTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: PP-9 SPERG FILE

228 TITLE.....: COMPUTER SIMULATION OF LINAC BEAM DYNAMICS WITH SPACE CHARGE

AUTHOR...: MARTINI, M.
AFFILIAT...: CERN

DOC-TYPE...: INTERNAL REPORT
PAGES.....: 22

REP-NUM...: CERN/MPS/LTA 49-23
DATE-PUBL: 691200

ABSTRACT.: STUDY OF FIRST 10 MEV OF ACCELERATION IN A FEED STRUCTURE TO FIND CURRENT LIMIT AND PHASE SPACE DISTRIBUTION AS FUNCTION OF INPUT CURRENT, INJECTION ENERGY AND QUADRUPOLE GRADIENT. USED MAPRO2. CURRENTS 200, 400, 600 MA. INJECTION ENERGY .52, .79, 1.1, 1.51 MEV. FOUR MAGNET STRENGTHS. 12 BEST CASES THEN RUN WITH 4500 PARTICLES. 40 TRANSVERSE AND 20 LONGITUDINAL ELLIPSE FITTING WITH INITIAL TRANSVERSE EMITTANCE PROPORTIONAL TO CURRENT, AND CONSTANT ENERGY SPREAD. MATCHED DIMENSIONS COMPUTED FOR BOTH TRANSVERSE AND LONGITUDINAL. THERE WAS AN OPTIMUM QUADRUPOLE LAW FOR EACH INPUT CURRENT WHICH GAVE THE MOST OUTPUT CURRENT. THE INFLUENCE OF INCREASING THE INJECTION ENERGY ON OUTPUT CURRENT DEPENDS STRONGLY ON THE INPUT CURRENT LEVEL. AT 200 MA THERE WAS A GAIN UP TO 0.79 MEV BUT NOT THEREAFTER, WHILE AT 600 MA, OUTPUT CURRENT KEPT ON INCREASING ROUGHLY LINEARLY WITH INJECTION ENERGY. TRANSVERSE AND LONGITUDINAL EMITTANCE BREAKUP FOR THE RMS BEAM ARE GIVEN. OUTPUT BRIGHTNESS IS SUGGESTED AS A FIGURE OF MERIT. RELATIONSHIPS FOR EMITTANCE FOR FRACTIONAL AMOUNTS OF BEAM ARE GIVEN IN THE FORM OF $I \propto I_{TOTAL}(F, F_{TOTAL})$, E.G. AT THE INPUT, FOR TRANSVERSE $I \propto I_{TOT}(F/F_{TOT} - .5(F/F_{TOT})^{.5})$, AND FOR LONGITUDINAL $I \propto (I/F_{TOT})^2$. AT THE OUTPUT, AN EXPONENTIAL FIT WAS ATTEMPTED: $I \propto I_{TOT} - F_{TOT}(F/F_{TOT})$. CORE DENSITY STAYS HIGHER WITH HIGHER INJECTION ENERGY.

SUBJECTS.: SPACE CHARGE; INITIAL ACCELERATION; CURRENT LIMIT; EMITTANCE GROWTH; MAPRO2 CODE; PARAMETER SEARCH;

REFERENCE: A

CATEGORY.: PARAMETER STUDY; SYSTEM DESIGN; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

220 TITLE.....: 750 KEV BEAM MEASUREMENTS, STAGE 1

AUTHOR...: HASEGAWA, H.; HONE, M.; KNOTT, J.; WEISS, M.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES.....: 15

REP-NUM...: PS/LIN/NOTE 74-22
DATE-PUBL.: 761203

ABSTRACT.: PRELIMINARY MEASUREMENTS OF NEW ION SOURCE AND 750 KEV ACCELERATING COLUMN. CURRENTS UP TO
200 MA, OBTAINED EMITTANCE OF ROUGHLY 1.5×10^{-21} PI CM MRAD NORMALIZED. SOURCE INSTABILITIES
WERE OBSERVED AT CURRENTS OF 100 MA AND BELOW.

SUBJECTS.. SPACE CHARGE; EMITTANCE; ION SOURCE; ACCELERATING COLUMN;

REFERENCE: 5

CATEGORY.: EXPERIMENTAL RESULTS;

CAT-SOURC: JAMESON DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

230 TITLE....: RMS FORMALISM AND TRANSPORT OF AN UNBUNCHED 750 KEV BEAM (IN FRENCH)

AUTHOR...: GUYARD, J.

AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT

REP-NUM...: PS/LIN/NOTE 77-A

PAGES....: 19

DATE-PUBL: 770410

ABSTRACT.: RMS FORMALISM FOR BEAM TRANSPORT, DETERMINATION OF MODEL PARAMETERS, QUALITY FACTORS IN RMS
EMITTANCE MEASUREMENT, COMPARISON OF MEASUREMENTS WITH DYNAMICS CALCULATIONS, ESPECIALLY
CONCERNED WITH BEAMS WITH MORE THAN ONE MASS COMPONENT.

SUBJECTS.: RMS EMITTANCE; EMITTANCE MEASUREMENT; MULTI-COMPONENT BEAMS;

NOTES....: H- BEAM EMITTANCE MEASUREMENT AT LAMPF;

REFERENCE: 7

CATEGORY.: EXPERIMENTAL TECHNIQUE; EXPERIMENTAL RESULTS;

CAT-SOURCE: JAMFSON

DATE-ENT.: 771112

MICROFILM:

STOR-LOC.: HP-9 SPORG FILE;

231 TITLE....: SIGNIFICANT PARAMETERS OF A 500 KEV PROTON BEAM RESULTING FROM MEASUREMENT OF THE QUADRATIC
AVERAGE (IN FRENCH)

AUTHOR...: GUYARD, J.; MARCE, L.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 31

REP-NUM...: CERN/PS/LT 75-1
DATE-PUBL: 750610

ABSTRACT.: DISCUSSES ERRORS IN MEASURING EMITTANCE, SYSTEM RESOLUTION, DENSITY OF COLLECTOR PLATES,
RESOLUTION OF COLLECTOR, PROBLEMS WITH SECONDARY ELECTRONS, EXTRAPOLATION TO ZERO SLIT WIDTH,
ANALYTIC TREATMENT, COMPUTATIONS.

SUBJECTS.: EMITTANCE MEASUREMENT;

CATEGORY.: EXPERIMENTAL TECHNIQUE;

CAT-SOURCE: JAMFSON DATE-ENT.: 771113

MICROFILM:

STOR-LOC.: MP-9 SPRNG FILE;

232 TITLE.....: A COMPARISON OF VARIOUS METHODS FOR DETERMINING PARTICLE BEAM PHASE-SPACE DISTRIBUTION

AUTHOR.....: VAN STEENBERGEN, A.
AFFILIATION:

DOC-TYPE: CONF PAPER
PAGES.....: 6

DATE-PUBL: 1965

CONFERENCE: PHOT V INTRINAT CONF ON HIGH ENERGY ACCELERATORS, FIASCATI, ITALY, SEPT. 9-14, 1965, CERN, P.
311

ABSTRACT: DISCUSSION OF THREE BEAM PHASE-SPACE DISTRIBUTION MEASUREMENTS; TWO PAIRS OF CROSSED SLITS,
TWO SLITS, AND CROSSED SLITS PLUS PHOTOGRAPHIC FILM. ANALYTIC MEASUREMENT.
SUBJECTS: FLUORESCENT MEASUREMENT; PHASE SPACE DISTRIBUTION;

REFERENCE: 6

CATEGORY: THEORY

CAT-SOURCE: JAMISON
DATE-ENTR: 771117

MICROFILM:

STOP-LOC: WP-9 SPRING FILE

1 233 TITLE....: AN APPROACH TO 200 MHZ BUNCH MEASUREMENTS AND LIMITATIONS ON LONGITUDINAL PHASE PROFILES

AUTHOR...: WARNER, D.J.
AFFILIAT.: CERN

DOC-TYPE.: CONF PAPER
PAGES....: 6

DATE-BURL: 660000

CONFERENCE: PROC V INTNATL CONF ON HIGH ENERGY ACCELERATORS, FRASCATTI, ITALY, SEPT, 9-16, 1965, CERN, P. 612

ABSTRACT.: BROADBAND SYSTEMS FOR MEASURING LONGITUDINAL BEAM SHAPE. DISCUSSION OF DEFLECTION BUNCHER SYSTEMS, INCLUDING PRACTICAL REQUIREMENTS, MIGHT HOLD INCREASE IN TRANSVERSE EMITTANCE TO 47%. MATCHING ACCOMPLISHED WITH 3 HARMONIC BUNCHERS TO GIVE APPROXIMATE SAWTOOTH.

SUBJECTS.: LONGITUDINAL PROFILE MEASUREMENT; WIDE-BAND BEAM MONITOR; DEFLECTING BUNCHER; CHOPPER; SAWTOOTH BUNCHER.

REFERENCE: 7

CATEGORY.: INSTRUMENTATION; THEORY; EQUIPMENT DESIGN;

CAT-SOURCE: JAMESON DATE-ENT.: 771117

MICROFILM:

STOR-IDC.: NP-9 SPERG FILE:

1 234 TITLE.....: BEAM EMITTANCE MEASUREMENTS ON THE NAL 200-MEV LINAC

AUTHOR...: GRAY, E.R.
AFFILIAT.: FNAL

DOC=TYPE.: CONF PAPER
PAGES.....: 2

DATE=PUPL: 710600

CONFERENCE: 1971 PARTICLE ACCEL CONF ON ACCEL ENGINEERING AND TECHNOLOGY, CHICAGO, ILL., MARCH 1-3, 1971;
JOURNAL...: IEEE TRANS. NUCL. SCI., VOL. NS-18, NO. 3, P. 941 (JUNE 1971);

ABSTRACT.: EMITTANCE MEASUREMENT USING THREE BEAM-WIDTH MEASUREMENTS IN A DRIFT SPACE, WITHOUT
ASSUMPTION OF ELLIPTICAL SHAPE. ITERATIVE METHOD CONVERGES IN ABOUT 5 ITERATIONS. BEST RES L'S
REQUIRE A WAIST AT THE CENTER MEASURING PLANE.

SUBJECTS.: EMITTANCE MEASUREMENT; RECONSTRUCTION TECHNIQUE;

CATEGORY.: EXPERIMENTAL TECHNIQUE;

CAT=SOURCE: JAMESON DATE=ENT.: 771116

MICROFILM:

STOR=LOC.: MP-9 SPERG FILE:

235 TITLE..... MEASURING PROBLEMS IN THE ADAPTATION (MATCHING) OF A HIGH INTENSITY 500 KEV PROTON BEAM (1
FRENCH)

AUTHOR....: GUYARD, J.; MARCE, I.;

AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT

PAGES.....: 17

REP-NUM...: MPS/LIN/NOTE 75-22

DATE-PUBL: 750005

ABSTRACT.: CONTINUES FROM THE LOW-INTENSITY ANALYSIS IN CERN/MPS/LIN 75-1, IDN 231, TO THE PROBLEMS
ENCOUNTERED IN DEFINING THE SIGNIFICANT PARAMETERS FOR MATCHING HIGH INTENSITY BEAMS, I.e.
ELLIPTICAL PHASE SPACE DISTRIBUTIONS; MULTI-COMPONENT BEAMS. GRAPHICAL METHOD FOR EXTRAPOLATING
TO ZERO MEASUREMENT THRESHOLD, SEPARATION OF BEAM CORE FROM HALO, EFFECT OF FINITE SLIT WIDTH,
GRAPHICAL PROCEDURE FOR EXTRAPOLATING TO ZERO SLIT WIDTH, THIS TYPE OF ERROR CAN CAUSE WHAT
APPEARS TO BE EMITTANCE GROWTH, SINCE THE RESULT DEPENDS ON BEAM SHAPE AND ORIENTATION.

SUBJECTS.: EMITTANCE MEASUREMENT; SPACE CHARGE; MATCHING; EMITTANCE GROWTH;

CROSS-REF: CERN/MPS/LIN 75-1, IDN 231, SPORG;

CATEGORY.: MEASUREMENT ERRORS; EXPERIMENTAL TECHNIQUE;

CAT-SOURCE: JAMESON

DATE-ENT.: 771116

MICROFILM:

STOR-LOC.: MP-9 SPORG FILE;

235 TITLE....: MEASURING PROBLEMS IN THE ADAPTATION (MATCHING) OF A HIGH INTENSITY 500 KEV PROTON BEAM (IN FRENCH)

AUTHOR....: GUYARD, J.; MARCE, I.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 17

REP-NUM.: MPS/LIN/NOTE 75-22
DATE-PUBL: 750905

ABSTRACT.: CONTINUES FROM THE LOW-INTENSITY ANALYSIS IN CERN/MPS/LIN 75-1, IDN 231, TO THE PROBLEMS ENCOUNTERED IN DEFINING THE SIGNIFICANT PARAMETERS FOR MATCHING HIGH INTENSITY BEAMS. NON-ELLIPTICAL PHASE SPACE DISTRIBUTION; MULTI-COMPONENT BEAMS. GRAPHICAL METHOD FOR EXTRAPOLATING TO ZERO MEASUREMENT THRESHOLD, SEPARATION OF BEAM CORE FROM HALO. EFFECT OF FINITE SLIT WIDTH. GRAPHICAL PROCEDURE FOR EXTRAPOLATING TO ZERO SLIT WIDTH. THIS TYPE OF ERROR CAN CAUSE WHAT APPEARS TO BE EMITTANCE GROWTH, SINCE THE RESULT DEPENDS ON BEAM SHAPE AND ORIENTATION.

SUBJECTS.: EMITTANCE MEASUREMENT; SPACE CHARGE; MATCHING; EMITTANCE GROWTH;

CROSS-REF: CERN/MPS/LIN 75-1, IDN 231, SPCRG;

CATEGORY.: MEASUREMENT ERRORS; EXPERIMENTAL TECHNIQUE;

CAT-SOURC: JAMESON DATE-ENT.: 771116

MICROFILM;

STOR-LOC.: MP-9 SPCRG FILE;

236 TITLE....: BUNCH 74: AN IMPROVED MULTIPARTICLE BEAM SIMULATION PROGRAM
SEC-TITLE: GENERAL OBSERVATIONS ON MULTIPARTICLE PROGRAMS; INITIAL COORDINATES OF PARTICLES; PARTICLE
DYNAMICS IN BEAM TRANSPORT COMPONENTS; CALCULATION OF SPACE CHARGE EFFECT IN BUNCH 74; INPUTS
OF BUNCH 74; OUTPUTS OF BUNCH 74; SUMMARY OF PREVIOUS PAPERS RELEVANT TO THE DEVELOPMENT OF
BUNCH 74; STRUCTURE OF THE PROGRAM BUNCH 74;

AUTHOR....: BRU, R.; WARNER, D.J.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 41

REP-NUM.: CERN/PPS/LIN 75-2
DATE-PUBL: 751215

ABSTRACT.: THIS REPORT CONTAINS A DESCRIPTION OF THE PRINCIPLES AND STRUCTURE OF A MULTIPARTICLE
COMPUTER PROGRAM USED PARTICULARLY FOR THE SIMULATION OF BEAM DYNAMICS IN THE PRE-BUNCHING
REGION (LEBT) OF A PHOTON LINAC. THE ORIGINAL VERSION OF THIS PROGRAM, DEVELOPED IN 1967, HAS
SINCE PASSED THROUGH SEVERAL STAGES OF IMPROVEMENT UNTIL IN ITS PRESENT FORM IT HAS BEEN USED
TO CHECK THE DESIGN OF A COMPLEX BUNCHING AND MATCHING SCHEME FOR THE NEW CERN 50 MEV LINAC.
SEVERAL INTERNAL REPORTS AND NOTES HAVE BEEN PRODUCED DESCRIBING PARTICULAR STAGES IN THE
IMPROVEMENT OF THE PROGRAM BUT RATHER THAN MERELY DESCRIBE RECENT IMPROVEMENTS WE PREFER TO
MAKE THE PRESENT PAPER SUFFICIENTLY COMPREHENSIVE TO STAND ON ITS OWN. WITH THE ABOVE IN MIND,
BRIEF SUMMARIES OF THE CONTENTS OF PREVIOUS RELEVANT PAPERS ARE GIVEN IN APPENDIX I.

SUBJECTS.: SPACE CHARGE; BEAM DYNAMICS; BUNCHER; BUNCH 74 CODE; BEAM TRANSPORT;

REFERENCE: 9

CATEGORY.: THEORY; NUMERICAL COMPUTATION; SOFTWARE DOCUMENTATION;

CAT-SOURC: JAMESON DATE-ENT.: 771116

MICROFILM:

STOR-LOC.: MP-9 SPERG FILE;

1

237 TITLE....: COUPLING BETWEEN THE MOMENTS OF A DISTRIBUTION FUNCTION

AUTHOR...: GERMAIN, P.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 5

REP-NUM...: MPS/DL/NOTE 74-14
DATE-PUBL: 740509

ABSTRACT.: SEE TITLE

SUBJECTS.: PHASE SPACE DISTRIBUTION; COUPLING;

CATEGORY.: THEORY;

CAT-SOURC: JAMESON DATE-ENT.: 771116

MICROFILM;

STOR-LOC.: MP-9 SPERG FILE;

238 TITLE..... THE PROPERTIES OF PARTICLE BEAMS IN OPTICAL MATCHING SYSTEMS, IN TERMS OF PHASE-PLANE ELLIPSE SHAPES

AUTHOR.... HEReward, H.G.
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES..... 29

REP-NUM.: PS/INT. 7H 59-5
DATE-PUBL: 590323

ABSTRACT.: IN SECTION I WE DESCRIBE THE BEHAVIOR OF THE SHAPE OF THE PHASE-PLANE ELLIPSE, WHICH DEFINES THE OPTICAL PROPERTIES OF A BEAM, AS THE BEAM PASSES THROUGH THE THIN LENSES AND DRIFT-LENGTHS OF AN OPTICAL SYSTEM, AND SHOW THAT THE SHAPE CAN BE DESCRIBED BY MEANS OF ONE COMPLEX NUMBER, WHICH CHANGES ACCORDING TO SIMPLE RULES IN PASSING THROUGH THE OPTICAL ELEMENTS. SECTIONS II AND III CONTAIN EXAMPLES OF HOW TO SET UP AND SOLVE MATCHING PROBLEMS BY THIS METHOD, AND A GRAPH IS GIVEN FOR THE CASE OF TWO VARIABLE LENSES IN FIXED POSITIONS, THE BEHAVIOUR OF THE BEAM ENVELOPE, AND THE RELATION BETWEEN OUR METHOD AND THAT OF WALSH IS DISCUSSED IN IV. LONG LENSES, AND TWO DIMENSIONAL PROBLEMS, ARE BRIEFLY CONSIDERED IN V AND VI RESPECTIVELY. THE EFFECT ON THE BEAM OF A MISMATCH IS GIVEN BY A GRAPH IN SECTION VI, WHICH CAN BE USED IN QUESTIONS OF TOLERANCES ON THE OPTICAL ELEMENTS, THE RELATION BETWEEN THIS METHOD AND THE EQUIVALENT MATRIX OPERATIONS IS GIVEN IN AN APPENDIX.

SUBJECTS.: MATCHING; ELLIPSE FORMULATION;

REFERENCE: 4

CATEGORY.: THEORY;

CAT-SOURCE: JAMESON

DATE-ENT.: 771116

MICROFILM;

STOR-LOC.: MP-9 SPPG FILE;

1 239 TITLE....: TRANSVERSE PROPERTIES OF THE PS-LINAC BEAM

AUTHOR....: TAYLOR, C.S.; TETU, P.;
AFFILIAT.: CERN

DOC-TYPE.: INTERNAL REPORT
PAGES....: 17

REP-NUM.: MPS/INT, LIN 6A-2
DATE-PUBL: 660314

ABSTRACT.: THE REPORT CONTAINS AN EXPERIMENTAL DESCRIPTION OF THE TRANSVERSE BEHAVIOUR OF THE PS-LINAC BEAM. THE BEHAVIOUR IS DESCRIBED IN TERMS OF THE HYPERVOLUME PROJECTION ON TO A TWO-DIMENSIONAL TRANSVERSE PHASE PLANE. THE DISTRIBUTION OF PARTICLES IN THIS PROJECTION IS SEEN TO BE DETERMINED AT ENERGIES LESS THAN 12 MEV. THE RULES OF PHASE COUPLING AND QUADRUPOLE IMPERFECTIONS ARE DISCUSSED IN RELATION TO BEAM BLOW-UP.

SUBJECTS.: SPACE CHARGE; EMITTANCE GROWTH; PHASE SPACE COUPLING; QUADRUPOLE FIELD ABERRATIONS; SIEVE;
BUNCHER; EMITTANCE MEASUREMENT FOUR-DIMENSIONAL;

NOTES....: CURRENTS UP TO 60 MA. EFFECTS OF RF. OBSERVATION OF EMITTANCE GROWTH OF FACTOR 3 BELOW 12 MEV. EMITTANCE GROWTH AS FUNCTIONS OF INPUT CURRENT AND EMITTANCE USING INPUT COLLIMATION, AND WITH SIEVE. ADJUSTED BUNCHER PHASE AND VOLTAGE AWAY FROM NOMINAL SETTINGS WHILE RETAINING SAME ACCELERATED CURRENT AND FOUND ONE SETTING WHERE OUTPUT EMITTANCE WAS REDUCED 10 PERCENT AND CENTRAL PHASE SPACE DENSITY WAS INCREASED TO 30 PERCENT. FIGURES ARE GIVEN FOR REQUIRED INCREASE IN QUAD STRENGTH TO COMPENSATE FOR SPACE CHARGE AT DIFFERENT CURRENTS.

CATEGORY.: EXPERIMENTAL RESULTS;

CAT-SOURCE: JAMESON DATE-ENT.: 771116

MICROFILM:

STOR-LOC.: MP-9 SPRPG FILE;

248 TITLE..... MEASUREMENT OF BEAM EMITTANCE USING THE 9040 CALCULATOR (IN FRENCH)

AUTHOR....: UNKNOWN

AFFILIAT.: SATURNE

DOC-TYPE.: INTERNAL REPORT

REP-NUM...: SEDAP-SFFS 10 75-34

PAGES.....: 20

DATE-PURL: 750526

ABSTRACT.: TWO PROGRAMS ARE DESCRIBED; USING MEASUREMENTS AT ONE PLANE AT THREE DIFFERENT GRADIENTS OF A QUADRUPOLE, AND USING MEASUREMENTS AT THREE DIFFERENT PLANES.

SUBJECTS.: EMITTANCE MEASUREMENT; RECONSTRUCTION TECHNIQUE;

CATEGORY.: THEORY; NUMERICAL COMPUTATION;

CAT-SOURCE: JAMESON DATE-ENT.: 771116

MICROFILM;

STOR-LOC.: MP-9 SPORG FILE;