AGS EXPERIMENTS — 1984, 1985, 1986

J.C. Depken

February 1986

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AGS DEPARTMENT

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AGS Experiments - 1984, 1985, and 1986

This report contains:

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2. • Table of Beam Parameters and Fluxes
3. • Experiment Schedule "as run"
4. • Experiment long range schedule
5. • A listing of experiments by number
11. • Two-page summaries of each experiment begin here, also ordered by number

This is a **third edition**. Please forward suggestions and changes for future editions to:

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Brookhaven National Laboratory
Building 911B
Upton, New York 11973.

Mr. Rippie Bowman designed the cover. The cutoff date for approved experiments to be included in the report was November 26, 1985, the date of the Long Range Schedule shown on page 4.

AGS EAST EXPERIMENTAL AREA
PROPOSED EXPERIMENTAL ARRANGEMENT
FY 1986

U LINE TO
NEUTRINO AREA

ν Oscillations
ve, $\nu\mu$ Scattering

Beam	Experiment	University
A1	747	BNL/CCNY
A1	810	BNL/CCNY/Johns Hopkins/LJL
A1	817	BNL/Houston/Rice/SEMass
A2	Test Beam	Many users
A3	780	BNL/Yale
B1	793	U.C. Berkeley/LBL
B1	802	BNL/Hiroshima/LBL/MIT/Tokyo(INS)/Naseda
B1	804	Indiana/Michigan
B1	806	Siegen
B1	808	Krakow/Louisiana St/Minnesota
B2	771	BNL/Fia.St/SE Mass/Indiana
B5	766	Col/Mass/Mexico/Fermilab
B5	791	UCLA/LANL/Penn/Princeton/Stanford/Temple/Va. & Mary
C1	785	BNL/Minn/SE Mass
C1	814	Berlin/BNL/CERN/LANL/Stony Brook/Tel Aviv/New Mexico
C2	774	Houston/BNL/New Mexico/Vassar
C2	781	BNL/MIT/Houston/CHU/Vassar/NTU
C2	788	CHU/BNL/Houston/New Mexico/MIT/Vassar/Ill
C2	798	BNL/CHU/Fia.St./Houston/LANL/Rutgers/Texas/Vassar
C2	820	Brandeis/BNL/Indiana/MIT/Osaka/Houston/Texas/Vassar
C2	773	Brandeis/BNL/Indiana/MIT/Osaka/Houston/Texas/Vassar
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C8	811	Boston/Birmingham/British Columbia/K.F.K.L./Budapest/TRIUMF
D1	794	Nich/BNL/Md/Motre Dam/Rice/Texas A&M/ETH/Zurich
D1	782	Nich/BNL/Copen/Md/Miami/W.Dam/Rice/ETH/Texas A&M
D1	801	San Francisco St.
D1	819	Iowa St.
D1	825	Oregon St./LBL/BNL/Marburg/Oslo/Purdue/Studevik
D2	796	Wash Mary/Virginia St/G.Harpo/Marwick/BNL/CERN-CNRS Grenoble/
D4	745	Uppsala/Tech.Univ./Munchen/Paris
D6	777	Columbia/CERN/BNL
D7	734	Yale/BNL/Wash/SIN
D8	776	BNL/Brown/KEK/Osaka/Penn/Stony Brook
D8	816	BNL/Columbia/Illinois/Johns Hopkins/BNL
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AGS BEAMS - January 1986

Separated Beams					Flux/10 ¹² protons on target									
Beam	GeV/c	$\frac{\Delta p}{p}$ (%) (FWHM)	Prod. Angle	Ω (msr)	K ⁺	K ⁻	p	$\bar{p}$	π^+	π^-	@ GeV/c	Purity	Remarks	
B2, B4	1.5-6(K) 1.5-9($\bar{p}$)	5	3°	0.3	2.7x10 ⁵	1.2x10 ⁵	2x10 ⁷	10 ⁵	4x10 ⁷	3x10 ⁷	4	$\pi^-/K^- \sim 3$	L = 81 m.	
C2, C4	< 1.1	4	10.5°	2.6	4x10 ⁴	1.2x10 ⁴	2x10 ⁷	2x10 ³	8x10 ⁷	8x10 ⁷	0.75	$\pi^-/K^- \sim 10$	L = 15 m.	
C6, C8	< 0.8	6	5°	10	2x10 ⁵	6x10 ⁴	1.4x10 ⁸	1.4x10 ⁴	6x10 ⁸	6x10 ⁸	0.7	$\pi^-/K^- \sim 20$	L = 15 m.	
Unseparated Charged Beams														
A1*	5-24	3	0°	0.2						10 ⁶	22		To MPS: L = 130 m;	
B1*	5-28	5	0°	0.3	2x10 ⁶	4x10 ⁵	5x10 ⁷	1.3x10 ⁵	4.4x10 ⁷	3x10 ⁷	10		L = 75 m.	
C1*	1-24	5	0°	0.8	6x10 ⁶	7x10 ⁵	2x10 ⁸	1.4x10 ⁵	7x10 ⁷	5x10 ⁷	13	$\mu^-/\pi^- = 0.3$	L = 61 m.	
D6	0-6	16	2°	0.5	2x10 ⁷	7x10 ⁶	2x10 ⁸		2x10 ⁸	1x10 ⁸	6		L = 32 m.	
Neutral Beams								K _L	n					
A3*	1-28		0°	0.045				10 ⁸	3x10 ⁹		1-28		Alternates with A1; L = 8 m.	
B5*	1-28		1-4.5°(V)	0.1				5x10 ⁷	1.5x10 ⁹		9-28		Based on E791 est; L = 10 m.	
Muon Channel						μ^-								
D2, D4	.05-.15(μ)	9(π)	55°(π)	50(π)		2x10 ⁶					0.10		Flux in 100 cm ² with $\Delta p/p = \pm 2\%$	
Neutrino Beam						ν	$\bar{\nu}$							
U						2x10 ⁹ /m ² 10 ⁸ /m ²	1.4x10 ⁹ /m ²					1.4x10 ¹³ ppp typical	Fast spill, flux avg. over 1.5m radius. Wide Band Horn, $\langle E_\nu \rangle = 1.4\text{GeV/c}$ Narrow Band Horn, $\langle E_\nu \rangle = 1.3\text{GeV/c}$ $\pm 5\%$	

* Note that 0° beam lines can be used for polarized protons and/or heavy ion beams.

AAS SCHEDULE A5 RUN

By: D. LAZARUS

Date: 10-23-85

. . . List of Experiments . . .

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EXPERIMENT SUMMARIES

Experimental arrangement. S_1 - S_5 are beam defining scintillation counters; V_1 is a veto counter surrounding the Cu moderator; V_2 , a downstream veto counter; H, a beam-defining hodoscope; πL and πR , pion spectrometers including Al moderator; and $\check{C}$, a Cherenkov counter to detect kaons. The laminar target assembly is shown with three Ge detectors located below. Inset: a typical K^-p interaction in the region between target sheets.

<p align="center">Experiment 723 - A Precision Measurement of the Magnetic Moment of the Negative Sigma Hyperon by the Exotic Atoms Technique</p>
--

College of William and Mary	M. Eckhause, J. Ginkel, P.P. Guss, D.W. Hertzog, D. Joyce, J.R. Kane, C. Kenney, J. Kraiman, W.C. Phillips, W.F. Vulcan, R.E. Welsh, R.J. Whyley, R.G. Winter
Boston University	E. Austin, G.W. Dodson, J.P. Miller, F. O'Brien, B.L. Roberts, D.R. Tieger
Carnegie-Mellon University	R.B. Sutton
California Institute of Technology	R.J. Powers
University of Wyoming	A.R. Kunselman
Spokesmen:	B.L. Roberts, R.E. Welsh

The magnetic moment of the Σ^- hyperon is determined from measurements of fine structure splittings of x-ray transitions in exotic atoms. The use of targets consisting of sheets of Pb or W immersed in liquid hydrogen and of a tagging technique utilizing the π^+ emitted in the reaction $K^-p \rightarrow \Sigma^-\pi^+$, results in improved signal-to-noise ratio by a factor of 15 over that in previous experiments.

Results obtained from a number of transitions in different targets serve to determine the consistency of the relevant atomic corrections. The result obtained to date is $\mu(\Sigma^-) = (-1.111 \pm 0.031 \pm 0.011)\mu_N$.

Precision determination of atomic transition energies will be used to extract the masses of the negative kaon and negative sigma hyperons. The results are expected to be a factor of 2 to 3 more precise than the tabulated masses.

BNL NEUTRINO DETECTOR

FRONT VIEW

DETAIL A

INSTITUTIONS

BNL
BROWN
KEK
OSAKA
TOKYO (INS)
PENNSYLVANIA
SUNY STONYBROOK

NEUTRINO BEAM DIRECTION

MAIN DETECTOR, ELEVATION

GAMMA
CATCHER

MUON
SPECTROMETER

<p align="center">Experiment 734 - A Measurement of the Elastic Scattering of Neutrinos from Electrons and Protons</p>

Brookhaven National Laboratory	L.A. Ahrens, S.H. Aronson, B.G. Gibbard, M.J. Murtagh, D.H. White
Brown University	J.L. Callas, D. Cutts, M. Diwan, J. Hoftun, R.E. Lanou
National Laboratory for High Energy Physics (KEK)	K. Abe, K. Amako, S. Kabe, T. Shinkawa, S. Terada
Osaka University	Y. Kurihara, Y. Nagashima, Y. Suzuki, Y. Yamaguchi
University of Pennsylvania	E.W. Beier, L.S. Durkin, S.M. Heagy, A.K. Mann, H.H. Williams
SUNY Stony Brook	D. Hedin, M. Marx, E. Stern
Spokesman:	D. Hywel White

A principal goal of the experiment is to measure the cross section for the reaction $\nu_\mu + e^- \rightarrow \nu_\mu + e^-$ with a sensitivity of ~ 2 events/day and to measure the cross section for the reaction $\bar{\nu}_\mu + e^- \rightarrow \bar{\nu}_\mu + e^-$ with a sensitivity of ~ 1 event/day. These measurements will provide important constraints on the weak coupling of the electron.

The experiment is designed also to measure the semileptonic exclusive processes of elastic scattering $\nu + p \rightarrow \nu + p$, the charged current quasi-elastic reaction $\nu + n \rightarrow \mu^- + p$ and single pion production. The measurement of elastic scattering will determine to high accuracy the Lorentz structure of the hadronic weak neutral current (WNC). Quasi-elastic scattering is used to obtain the normalization for the elastic scattering of neutrinos from both electrons and protons. The single pion production measurements will provide useful information on the isotropic spin structure of the hadronic neutral current and determine the backgrounds in the elastic scattering processes.

$k_\alpha = 8.226 \text{ keV}$
 $k_\beta = 9.748 \text{ keV}$
 $k_\gamma = 10.280 \text{ keV}$
 $L_\alpha = 1.520 \text{ keV}$

<p>Experiment 745 - An Improved Test of QED - An Experiment to Measure Vacuum Polarization in the 3d-3p Transitions in Muonic Helium</p>
--

Brookhaven National M. May
Laboratory

CERN and E. Zavattini
Columbia University

Columbia University J. Derdarian, J. French, A.M. Sachs

Spokesman: A. Sachs

Present experiments test vacuum polarization effects in QED to an accuracy of 0.2 to 0.4%. This experiment is designed to make an order of magnitude improvement in these tests by a precise measurement of 3d-3p transitions in muonic helium, where the level separation is given almost entirely by the vacuum polarization terms.

The transition between high angular momentum states is selected to avoid the uncertainties in the r.m.s. charge radius of helium - an uncertainty which limits the accuracy of the 2s-2p experiments. However, since the lifetimes in the d and p states are 10^{-11} to 10^{-12} sec, the experimental technique involves inducing transitions with a CO_2 laser during the fast initial cascade and detecting the transitions by an increase in the emission of K_β x-rays.

In order to make a beam of stopping negative muons at the AGS, the design uses the SREL muon channel at 55 deg from the 28 GeV proton beam. The flexibility of the AGS accelerator permits the extraction of a short pulse of protons, producing an intense pulse of stopping muons, which is well matched to the laser pulse.

E747

<p align="center">Experiment 747 - A High Statistics Study of ϕ and $\phi\phi$ Production from π^-p and K^-p Interactions at 22 GeV/c</p>

Brookhaven
National
Laboratory

A. Etkin, K.J. Foley, R.S. Longacre, W.A. Love,
T.W. Morris, E.D. Platner, A.C. Saulys

Brookhaven National
Laboratory and City
College of New York

S.J. Lindenbaum

City College of
New York

C.S. Chan, M.A. Kramer, J. Piekarz

Spokesman:

S.J. Lindenbaum

This experiment is a continuing search for glueballs in the Zweig suppressed reaction $\pi^-p \rightarrow \phi n$. Three states have already been found: the $g_T(2050)$, $g_T(2300)$ and $g_T(2350)$, all with $I_G^{PC} = 0^{+2^{++}}$. If QCD is correct and the OZI rule is universal, these states must be produced by at least one glueball and probably three. The glueball resonance conclusion fits the unusual striking characteristics of this data (Etkin et al., Observation of Three 2^{++} Resonances in the Glueball-Enhanced Channel $\pi^-p \rightarrow \phi n$. Phys. Lett. B, in press). Alternative explanations have been shown to be incorrect and do not fit the data or both (S.J. Lindenbaum and R.S. Longacre, The Glueball Resonance and Alternative Explanations of the Reaction $\pi^-p \rightarrow \phi n$. Phys. Lett. B, in press).

E748

0 1 2m

<p align="center">Experiment 748 - Polarization in pp Elastic Scattering at Medium and High P_1^2 from 15 to 28.5 GeV/c</p>

University of Michigan	K.A. Brown, R.J. Bruni, P.R. Cameron, D.G. Crabb, R. Cummings, M. Fujisaka, M. Hajazifar, F.Z. Khari, A.D. Krisch, A.M.T. Lin, S.L. Linn, R.S. Raymond, T. Shima, K.M. Terwilliger
Brookhaven National Laboratory	G.T. Danby, Y.Y. Lee, L. Ratner
University of Copenhagen	P.H. Hansen
University of Maryland	D.C. Peaslee
University of Miami	A. Perlmutter
University of Notre Dame	J.R. O'Fallon
Texas A&M University	T.S. Bhatia, G. Glass, L.C. Northcliff
ETH, Zurich	M. Simonius
Spokesman:	A.D. Krisch

This experiment uses a polarized proton target to study the analyzing power, A , with good statistical precision, in pp elastic scattering as a function of P_1^2 .

In the large P_1^2 region Regge models are not considered to be applicable but some geometrical or eikonal theories have made predictions. Thus precise data in this region would be a good test of these models. For the higher P_1^2 region the validity of QCD and constituent interchange models might be tested because these models predict A to be zero. A further motivation is that precise measurements of A are necessary to calibrate the polarimeters for the proposed polarized proton beam at the AGS.

Data on A exist at 24 GeV/c for $P_1^2 < 4.5(\text{GeV}/c)^2$ but the statistical precision is generally poor. To improve on the statistical error beams of 10^{10} to 10^{11} protons/pulse are used and the experiment run in an extracted beam. The detection system is a two arm magnetic spectrometer employing scintillation counters with tight momentum and angular constraints.

S Exp. 149-0 scale 1/4"=1'-0"
by R. L. MARASCA

**Experiment 749 - A Measurement of Milliweak CP Violations in
 $K_L - K_S$ Decays Through the Determination of ϵ'**

Brookhaven
National
Laboratory

R.L. Larsen, L.B. Leipuner, W.M. Morse

Yale University

R.K. Adair, K. Black, S.R. Blatt, M.K. Campbell
H. Kasha

Spokesman:

Scientific - R.K. Adair/L.B. Leipuner

This experiment intends to make an accurate determination of any difference in the ratio of charged to neutral two pion decays for K_S and K_L meson decays. Superweak CP violation models lead to no difference in the ratios, milliweak models generally predict different values for the two decay ratios.

E751

Experiment 751 - Measurement of Hyperon Radiative Decay
--

Brandeis University	J. Bensinger, M. Fortner, L. Kirsch, H. Piekarz, R. Poster, L. Spencer, P. Zogrofu
Southeastern Massachusetts University	Z. Bar-Yam, J. Dowd, W. Kern
University of Notre Dame	J.M. Bishop, N.N. Biswas, N.M. Cason, V.P. Kenney, M. Rath, R. Ruchti, W.D. Shephard
Duke University	A. Goshaw, L. Fortney, E. McCrory, W. Robertson
Spokesman:	R. Poster

This experiment is involved with the measurement of the weak radiative hyperon decays $\Xi^0 \rightarrow p\gamma$, $\Xi^0 \rightarrow \Lambda\gamma$ and $\Omega^- \rightarrow \Xi\gamma$ in the MPS with a lead glass hodoscope.

<p>Experiment 754 - Determination of the Dynamics of Positive Muon Motion in Aluminum</p>

Bell Laboratories	A.T. Fiory, R.P. Mirnich
Brookhaven National Laboratory	A.N. Goland, Y.C. Jean, K.G. Lynn
College of William and Mary	W.J. Kossler
George Mason University	W.F. Lankford
Virginia State University	C.E. Stronach
Spokesman:	W.J. Kossler

This experiment is a detailed study of positive muon depolarization (μ^+ SR) in single crystal and polycrystalline samples of aluminum as a function of temperature and orientation in zero and applied transverse magnetic fields. The measurements are intended to discriminate between recent models of μ^+ motional behavior in metals: Anderson localization, quantum diffusion, classical diffusion, trapping/detrapping at impurities and in impurity-induced strain fields. The aluminum will be doped with various concentrations of Ag, Cu, Ga, In, Mg, Si and Zn impurities, selected in order to vary such parameters as valence difference, solubility and lattice distortion. Classification of μ^+ dynamics as a function of sample state variables is essential to the future use of μ^+ SR in more complicated condensed matter systems.

The well-documented SREL muon channel at the AGS installed for QED Experiment #745 provides a unique opportunity for condensed matter research using muons during times when the slow extracted proton beam is incident on the B-line production target. The SREL channel with a wedge magnet and possibly focussing elements tunable for 125 MeV/c muons will create a high intensity, high duty factor μ^+ beam competitive with those found elsewhere in the world.

Initial beam studies will use scintillators and wire chambers common to high-energy physics experiments. Newly designed and relatively standard apparatus will be used for data taking.

<p align="center">Experiment 755 - π^-p Two-Body Exclusive Reactions at 90° from 8 GeV/c to 18 GeV/c</p>
--

Brookhaven
National
Laboratory

D.S. Barton, G.M. Bunce, A.S. Carroll, Y. Makdisi

University of
Minnesota

B. Baller, J. Blazey, H. Courant, K. Heller,
S. Heppelmann, M. Marshak, E. Peterson, M. Shupe,
D.S. Wahl

Southeastern
Massachusetts
University

S. Gushue, J. Russell

Spokesmen:

M. Marshak, G. Bunce

This experiment measures a number of two-body exclusive cross sections around 90° in the center of mass,

$$\pi^-p \rightarrow p\pi^-, p\rho^-, pA_2^-, \pi^+\Delta^-, K^+\Sigma^-, K^+\Upsilon^{*-} \text{ and } \Lambda K \quad (1)$$

for two incident π^- momenta, 10 GeV/c and 13.5 GeV/c where the rate for exclusive reactions becomes very small. Our interest is to study hard scattering with exclusive reactions, reactions which are accessible only in the AGS energy range. Exclusive cross section ratios, energy dependence and polarization should provide important tests of any strong interaction theory, complementing the 90° inclusive work being done at higher energy.

The apparatus consists of a single-arm FWC/drift chamber spectrometer triggered by the high-momentum stable positive particles in (1), and a wide-angle non-magnetic arm which will allow polarization analysis of the unstable particles.

An extension was approved in the fall of 1983 to study $\pi^+p \rightarrow p\pi^+, K^+\Sigma^+, \pi^+K^+\Upsilon^{*+}, K^+p \rightarrow pK^+, K^+\Delta^+; pp \rightarrow pp, pA^+;$ and for additional running with the negative beam, tagging K^- , to study (in addition to π^-p) $K^-p \rightarrow pK^-, \Lambda\pi^0, \Lambda\eta, \Lambda\rho^0, \Lambda\omega, \Lambda\eta', \Lambda\phi$, etc.

<p align="center">Experiment 766 - Study of Ω^- Production, the $S = -3$ System; Search for New Resonances; Development of a New Approach to Data Acquisition and Analysis</p>
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Nevis Laboratory Columbia University	M. Church, E. Gottschalk, R. Hylton, B. Knapp, P. Stern, L. Wiencke
University of Massachusetts	E. Hartouni, D. Jensen, M. Kreisler, M. Rabin, J. Uribe
University of Mexico	C. Avilez, W. Correa, J. Escalona
Fermilab	D. Christian, G. Gutierrez, S. Holmes, J. Strait, A. Wehmann
Spokesmen:	C. Avilez, B. Knapp, M. Kreisler

Since its discovery in 1964 by a team of Brookhaven scientists, there has been surprisingly little learned about the Ω^- . In particular some of its quantum numbers, spin for example, have never been measured; almost nothing is known about its production mechanisms; and there have been almost no systematic studies of the $S = -3$ system.

A new approach to the problems of event selection, triggering, data acquisition, and analysis which exist in the high interaction rate, complex topology environment available at high energy proton machines such as the AGS is being developed. We believe we can solve these problems with a spectrometer utilizing modern electronics technology which will eventually be capable of efficiently reconstructing with full numerical precision more than 10^5 complex events per second. This will allow unprecedented event selectivity and sensitivity to rare phenomena.

In order to develop this technology a study of the Ω^- system is the first major physics goal. We hope to:

1. Develop the on-line hardware processing technology
2. Amass a large enough sample of Ω^- events in np or pp interactions to be able to (a) determine the Ω^- spin, (b) measure the Ω^- production cross sections in a variety of completely specified exclusive final states, and (c) search for other $|S| = 3$ resonances.

E767

E767 SETUP

<p>Experiment 767 - Development of a Low Energy Antineutron Source and Measurement of $\bar{n}p$ Annihilation Cross Sections Near $\bar{N}N$ Threshold</p>
--

Brookhaven
National
Laboratory

D.I. Lowenstein

University
of Houston

M. Furic, E.V. Hungerford, B.W. Mayes, L.S. Pinsky
L. Tang, Y. Xue

Pennsylvania State
University

T. Armstrong, C. Elinon, A. Hicks, R.A. Lewis,
W. Lochstet, B.Y. Oh, G.A. Smith, J. Whitmore

Rice University

J. Krnk, G.S. Mutchler, W. von Witsch

Spokesman:

G.A. Smith

This experiment is concerned with the development of a low energy antineutron source and measurement of $\bar{n}p$ annihilation cross section near $\bar{N}N$ threshold. The construction of an antineutron beam permits the study of the $\bar{N}N$ interaction at very low energies where dE/dx limits the usefulness of $\bar{p}$ beams. $\bar{n}$'s are produced by 500 MeV/c $\bar{p}$ in the charge exchange reaction $\bar{p}p \rightarrow \bar{n}n$.

1. No charged particle leaves hydrogen target.
2. At least three charged particles at PWC1 or PWC2.
3. At least 2 GeV energy deposit in lead glass.'

1 FOOT

<p>Experiment 769 - Search for Glueballs and Other Meson States</p>

University of Notre Dame	J.M. Bishop, N.N. Biswas, N.M. Cason, V.P. Kenney, R.C. Ruchti, W.D. Shephard
Brandeis University:	J. Bensinger, L. Kirsch, F. Lomanno, W. Morris, R. Poster
Brookhaven National Laboratory	A. Etkin, K.J. Foley, R. Longacre, W.A. Love, T.J. Morris, E.D. Platner, V.A. Polychronakos, A. Saulys, C.D. Wheeler
Brookhaven National Laboratory and City College of New York	S.J. Lindenbaum
City College of New York	M. Kramer, Y. Terramoto
Duke University	L. Fortney, A. Goshaw, W. Walker
Spokesman:	N.M. Cason

Proposed to use a 1 m^2 lead glass hodoscope at the downstream end of the MPS to search for and study neutral mesons produced in π^-p interactions at 21 GeV/c. The reactions to be studied are $\pi^-p \rightarrow nK_S^0 K_S^0 \pi^0$ and $\pi^-p \rightarrow nK_S^0 K_S^0 \eta^0$. The sensitivity of the experiment is of the order of 100 observed events per nanobarn. The primary motivation of this search is to investigate previously unobserved final states in order to determine the isotopic spin, charge conjugation, and spin-parity of the produced mesons. The ultimate goal then is to determine the internal structure of the mesons--i.e. whether they are standard $q\bar{q}$ states, 4 quark ($qq\bar{q}\bar{q}$) states, or glueballs.

EXPT'L LAYOUT

PRIMARY TRIG.: $RAM \{ P_2, P_3, \bar{C}_1 - H_1 \} + \text{OTHERS}$

SECONDARY TRIG.: $n \rightarrow n+2 (\pi^-)$
 $n \geq 4 (k^- \& \bar{p})$

E771

<p align="center">Experiment 771 - Study of E-meson Characteristics in π^-p, K^-p and $\bar{p}p$ Interactions</p>

Brookhaven
National
Laboratory

S.U. Chung, R.C. Fernow, H. Kirk, S.D. Protopopescu,
D. Weygand

Florida State
University

J. Albright, J.H. Goldman, S. Hagopian, V. Hagopian,
J.E. Lannutti, D. Reeves

Indiana
University

A. Dzierba, T. Marshall, H. Neal, S. Teague,
D. Zieminska

Southeastern
Massachusetts
University

Z. Bar-Yam, J. Dowd, W. Kern, H. Rudnicka

Spokesman:

S.U. Chung

The $E(1420)$ was discovered over a decade ago; yet it has remained a relatively obscure resonance due mainly to relatively small production cross sections in the conventional channels. Information on its branching ratios into $K\bar{K}\pi$ and $\eta\pi\pi$ and even its spin-parity are so far contradictory. Recently, the E meson has taken on an added topical significance after its observation in the radiative J/ψ decay. The speculations are that there are two states in the E region, a conventional $q\bar{q}$ meson and a glueball which is a bound state of gluons.

The aim of Exp. 771 is to perform a definitive analysis of the E mesons as observed in π^- , K^- and $\bar{p}$ beams at 6 to 8 GeV/c. It is anticipated that the statistics of the E -meson events in these reactions will be one to two orders of magnitude better than any that have hitherto been available. The experiment is performed at the MPS with a fast-forward K^+ trigger augmented by a multiplicity requirement near the LH_2 target.

The Hypernuclear Spectrometer and Liquid Deuterium Target with Range Hodoscope.

<p>Experiment 773 - Search for $S=-1$ Dibaryon States in the Λp Missing Mass Spectrum Near the ΣN Threshold in the Reaction $d(K^- \pi^-) \Lambda p$</p>
--

Brandeis University	L. Bensinger, L. Kirsch, H. Piekarz
Brookhaven National Laboratory	S. Bart, R.E. Chrien, P.H. Pile, R.J. Sutter
Indiana University	T. Ward
Massachusetts Institute of Technology	M. Deutsch, J. Piekarz
Osaka University	T. Fukuda, T. Shibata
University of Houston	E.V. Hungerford, T. Kishimoto, B. Mayes, L.S. Pinsky
University of Texas	M. Barlett, G.W. Hoffman
Vassar College	R.L. Stearns
Spokesmen:	H. Piekarz

This experiment proposes to search for strange dibaryon resonances in the Λp missing mass region above the ΣN threshold. In this region previous experiments have detected a threshold cusp due to the opening of the ΣN channel. But at higher momentum transfers a broader structure appears underlining the cusp which may be a predicted $S=-1$ dibaryon resonance. It is proposed to enhance this shoulder relative to the cusp by using a range hodoscope to reject spectator nucleons and events proceeding through the ΣN channel and by choosing the appropriate momentum transfer to enhance the reaction. A study of the relative magnitudes of the cusp and shoulder with respect to momentum transfer will be made to determine the orbital angular momentum of this enhancement.

- 40 -

Experiment 774 - Search for Σ -Hypernuclear Levels in ^4He
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University of Houston	E.V. Hungerford, B.W. Mayes, H. Piekarz, L.S. Pinsky
Brookhaven National Laboratory	S. Bart, R. Chrien, P. Pile
University of New Mexico	B. Bassaleck
Vassar College	R. Stearns
Spokesman:	E.V. Hungerford

The experiment has observed narrow Σ hypernuclear structure in the (K^- , π^+) reaction using ^{12}C and ^7Li targets at incident momentum of 715 MeV/c. The object of the experiment is to obtain the Σ -nucleus spin orbit parameter. The structure in the ^{12}Be is consistent with structure seen earlier in the KEK data. The structure in the $^7_\Sigma$ data are consistent with the predicted spectrum, however further analysis is needed to extract the interaction parameters.

The experiment will also attempt to observe a state in the Σ hypernuclear system ($\text{NNp}\Sigma^-$) for all particles in the 1s shell.

The selectivity model predicts one narrow state to be populated in this reaction if the level is bound or nearly bound. This state may also be narrow if it lies high in the continuum through a correction to the $\text{AN} \rightarrow \Sigma\text{N}$ conversion channel as postulated by Gal, et al. It is important to test these conclusions in one of the lightest possible systems.

Experiment 776 - ν -Oscillation Experiment at BNL

Columbia University	C.Y. Chi, N. Kondakis, W. Lee, B. Rubin, R. Seto, C. Stoughton, G. Tzanakos
University of Illinois	E. O'Brien, T. O'Halloran, K. Reardon
Johns Hopkins University	B. Blumenfeld, C. Chien, L. Duncan, E. Lincke, L. Lueking, L. Madansky, A. Pevsner
Spokesman:	W. Lee

This experiment is designed to search for $\nu_\mu \rightarrow \nu_e$ neutrino oscillation. The sensitivity limits are $\Delta m^2 \approx .03 \text{ eV}^2$ at μ full mixing, and $\sin^2 2\alpha \approx 10^{-3}$ at large Δm^2 . The 240 ton detector is a finely segmented EM calorimeter using drift tubes and concrete (90 planes) interspersed with scintillators (10 planes), followed by a toroidal magnetic spectrometer.

The detector is located 1 km from the neutrino source. A newly designed, two-horn dichromatic neutrino beam is used at $E_\nu = 1.3 \text{ GeV}$ for pion neutrinos and $E_\nu = 3 \text{ GeV}$ for kaon neutrinos.

This experiment has run during the winter 1984, Summer and Fall 1985.

EXP. # 777

Experiment 777 - Search for the Rare Decay Mode $K^+ \rightarrow \pi^+ \mu^+ e^-$

Brookhaven National Laboratory	N.J. Baker, T. Erickson, H.A. Gordon, D.M. Lazarus, T.W. Ludlam, V.A. Polychronakos, P. Rehak, M.J. Tannenbaum
Yale University	C. Campagnari, P.S. Cooper, N. Hadley, W.D. Herold, M. Zeller
University of Washington	V. Chaloupka, H.J. Lubatti, J.E. Rothberg, E. Yagel, K.K. Young
Schweizerisches Institut für Nuklearforschung	J. Egger, H. Kasper
Spokesman:	M.E. Zeller

This is a proposal to measure the branching ratio of the decay $K^+ \rightarrow \pi^+ \mu^+ e^-$ with a statistical sensitivity of 5×10^{-12} and systematic sensitivity of better than 10^{-11} . The apparatus involves a high flux, unseparated K^+ beam with momentum 6 GeV/c and a spectrometer which measures the momentum and species of all of the final state particles. The beam design is based on an existing beam modified to reduce the number of ambient muons passing through the detector. In addition to high kaon fluxes, 2×10^7 /machine pulse, features of the experiment that make such sensitivity possible are the low probability of a negatively charged electron and a muon from a K^+ decay, i.e. a good trigger signature, and the ability for good particle identification at low energies. The apparatus is thus designed around good electron identification employing atmospheric pressure Cerenkov counters and a lead scintillator shower detector.

In addition to $K^+ \rightarrow \pi^+ \mu^+ e^-$, we will collect several hundred times the present data sample for the reaction $K^+ \rightarrow \pi^+ e^+ e^-$. This will enable us to study the Dalitz plot distribution for this decay and look for possible $e^+ e^-$ state in the mass range $140 < M_{ee} < 340$ MeV.

Experiment 778 - Study of Nuclear Fragments Produced from
P-Nucleus Collisions in the Threshold Region $1 < P < 28 \text{ GeV/c}$
Using a Warm Gas Jet Internal Target

Purdue
University

A. Bujak, D.C. Carmony, L.J. Gutay, A.S. Hirsch,
G. Paderewski, N.T. Porile, C. Sangster,
R.P. Scharenberg, B.C. Stringfellow

Spokesman: R.P. Scharenberg

The primary objective of this experiment is to study the production of heavy nuclear fragments by protons incident on nuclear targets in the threshold region of $1 < p < 28 \text{ GeV/c}$. The novel features of this experiment are:

1. Fragment identification over a wide range of fragment mass and charge: $4 \leq A_f \leq 33$, $2 \leq Z_f \leq 13$. On the basis of a recently completed experiment, there is strong experimental evidence that these fragments are a manifestation of a system undergoing a phase transition.
2. An acceptance for a wide range of fragment kinetic energies which permits: (a) measurement below the peak in the kinetic energy distribution ($\sim 1 \text{ MeV/nucleon}$), (b) measurement well above the peak, enabling a determination of the kinetic energy slope parameter.
3. A determination of the fragment yields $Y(Z_f, A_f)$ as a function of beam energy. Since there is a paucity of fragment data in the threshold region, it is proposed to make a systematic study with a single apparatus, thereby avoiding normalization problems which exist in the literature.
4. The use of a 2 ng/cm^2 gas jet target located in the main ring beam line.

Experiment 779 - Use of 28-GeV Proton External Beam for Nuclear Spectroscopy and Nuclear Reaction Studies

Brookhaven
National
Laboratory

Y-Y. Chu, S. Katcuff

Spokesman:

S. Katcuff

This experiment uses a simple pneumatic rabbit system leading to the U-beam line which permits short irradiations and rapid retrieval of thin targets. The immediate purpose is to produce a number of new, or little studied, neutron-rich nuclides below thorium, measure their γ -ray spectra, and determine their level schemes.

In addition to the nuclear spectroscopic investigations cross sections for production of selected near target highly neutron-rich nuclei are measured. These data shed new light on the cascade phase of medium-energy nuclear reactions.

$\sim 22''$ GAP ; $\Delta p \sim 220 \text{ MeV/c}$

<p>Experiment 780 - A Search for the Flavor Changing Neutral Currents $K_L^0 \rightarrow \mu + e$ and $K_L^0 \rightarrow e^+e^-$</p>
--

Brookhaven
National
Laboratory

E. Jastrzembski, R.C. Larsen, L.B. Leipuner,
W.M. Morse

Yale
University

R.K. Adair, H. Greenlee, H. Kasha, E. Mannelli,
M. Mannelli, M.P. Schmidt, S.F. Schaffner, C.B. Schwarz

Spokesmen:

Scientific - M.P. Schmidt/W.M. Morse

This experiment is to be conducted in the A-3 external proton beam using a flux of about 10^{12} protons per pulse at $E_p \approx 30$ GeV.

The basic detector will consist of sets of mini-drift chambers placed about a 72D18 magnet to form a spectrometer, an atmospheric pressure hydrogen Cerenkov Counter, a large lead glass array, and iron/scintillator range stack.

The experimenters intend to search for the transitions $K_L^0 \rightarrow \mu e$ and $K_L^0 \rightarrow e^+e^-$ with a sensitivity to branching ratios larger than 10^{-10} . These flavor changing neutral currents are highly suppressed in the Standard Model, and the observation of these decays would imply the existence of new interactions.

The hypernuclear spectrometer at Brookhaven. Quadrupole magnets Q1-Q6, dipole magnets D1 and D2. Multiwire proportional chambers P1-P6, scintillation counters S0-S2, Cerenkov counters CK and CP, scintillation counter hodoscope H. The target is surrounded by intrinsic germanium detectors Ge.

<p align="center">Experiment 781 - Spin Dependence of the Lambda Nucleus Interaction Determined by Observation of Hypernuclear Gamma Rays</p>
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Brookhaven
National
Laboratory

R.E. Chrien, M. May, P. Pile, S. Bart

Massachusetts
Institute of
Technology

M. Deutsch

University of
Houston

E.V. Hungerford, R. Mayes, L. Pinsky

Carnegie-Mellon
University

P. Barnes

Vassar College

R.L. Stearns

New York
University

B. Budick

Spokesmen:

M. Deutsch, M. May

This is a proposal to measure the γ -ray transitions between hypernuclear states which differ only by the orientation of the lambda spin with respect to the angular momentum of the nuclear core. This directly measures the spin dependence of the Λ nucleus interaction independent of any model. We expect these spin dependent splittings to be less than 300 keV. Germanium detectors will be used to observe the γ rays in coincidence with a pure sample of hypernuclear events in a narrow range of excitation energy selected by the hypernuclear spectrometer in LESBI at the AGS. This proposal continues the research begun in Experiment 760, the first experiment to utilize this ($K\pi, \gamma$) coincidence technique. The probable energy range of the γ rays to be observed is inferred from the results of Experiment 760 and is very much lower than previous theoretical estimates. Extended in 1984.

E782

<p align="center">Experiment 782 - Spin-Spin Effects in Medium and High $P_{\perp}^2$ Elastic p-p Scattering</p>
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University of Michigan	R.J. Bruni, P.R. Cameron, D.G. Crabb, R. Cummings, I. Gialas, F.Z. Khiari, A.D. Krisch, A.M.T. Lin, R.R. Raylman, R.S. Raymond, T. Roser, K.M. Terwilliger
Brookhaven National Laboratory	K.A. Brown, G.T. Danby, Y.Y. Lee, L.G. Ratner
University of Maryland	D.C. Peaslee
University of Notre Dame	J.R. O'Fallon
Rice University	J.B. Roberts
Texas A&M University	T.S. Bhatia, G. Glass, L.C. Northcliff
ETH, Zurich	M. Simonius
Spokesman:	A.D. Krisch

This experiment will utilize the new unique AGS polarized proton beam capability and our polarized proton target to measure spin-spin effects in proton-proton elastic scattering. We will measure the elastic differential cross sections in pure initial spin states in a completely unexplored energy and momentum transfer region. The physics motivation is both the excitement of studying a totally unexplored area, and the further study of the large and dramatic high- $P_{\perp}^2$ spin-spin effect discovered at the ZGS. The ratio of the spin parallel to antiparallel p-p elastic cross section reached $\sigma_{\uparrow\uparrow}:\sigma_{\downarrow\downarrow} = 4$ at the maximum ZGS $P_{\perp}^2$ of 5.6 (GeV/c)^2 at 12.75 GeV/c. The ratio will be observed to see if it will continue to rise, to plateau, or to drop off as predicted by QCD quark interchange models. The unexpected ZGS results suggest that this proposed experiment should be very exciting.

$$\Delta\theta = \pm 25^\circ$$

$$0^\circ \leq \Delta\phi \leq 10^\circ$$

EXPERIMENTAL LAYOUT

<p align="center">Experiment 785 - Single Spin Asymmetry Measurement in Inclusive P+p Reactions at 24 GeV/c at High $P_{\perp}$</p>

Brookhaven
National
Laboratory

D.S. Barton, G. Bunce, A. Carroll, Y. Makdisi

University
of Minnesota

H. Courant, K. Heller, S. Heppelman, M. Marshak,
S.Z. Saroff, M. Shupe

Southeastern
Massachusetts
University

J.J. Russell

Spokesmen:

Y. Makdisi, M. Shupe

This experiment proposes to utilize the upcoming AGS capability to accelerate and extract polarized proton beams to measure single spin asymmetries (A_n) of inclusively produced pions, kaons, protons, antiprotons and lambda hyperons through the reactions:

$$p \uparrow + p \rightarrow \pi^{\pm} X$$

$$K^{\pm} X$$

$$p X$$

$$\Lambda X$$

The existing single arm spectrometer of Experiment 755 situated in the zero degree beam line C1 will be used. The above reactions will be studied up to 90° in the center of mass system, thus at high $P_{\perp}$ and low Feynman X .

**E-787
DETECTOR**

E. GARDNER
10-16-88

Experiment 787 - A Study of the Decay $K^+ \rightarrow \pi^+ \nu \bar{\nu}$

Brookhaven
National
Laboratory

M.S. Atiya, I-H. Chiang, T.F. Kycia, K.K. Li,
L.S. Littenberg, A.J. Stevens, R.C. Strand,
C.L. Woody

Princeton University

D. Akerib, W.C. Louis, D. Marlow, P. Meyers,
M. Selen, F.C. Shoemaker, A.J.S. Smith

TRIUMPF

S. Ahmad, G. Azuelos, E. Blackmore, D. Bryman,
L. Felawka, P. Kitching, T. Kuno, T. Numao,
J.-M. Poutissou, R. Poutissou

Spokesman:

T.F. Kycia

This experiment proposes to search for $K^+ \rightarrow \pi^+ X^0 \bar{X}^0$ where X^0 is any neutral, light and weakly interacting particle with a sensitivity of 2×10^{-10} , three magnitude higher than the present limit.

The decay $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ provides a sensitive test of the standard model of weak and electromagnetic interactions, a way of searching for new generations of quarks and leptons and a measure of the mixing angles in the present six quark models.

The decay $K^+ \rightarrow \pi^+ X^0 \bar{X}^0$ is also an excellent place to search for evidence of the variety of neutral, light and weakly interacting particles such as axions, familons, and the supersymmetric photino, goldstino, and scalar higgs (shiggs) predicted by current theories.

E788

⑧

Will Measure Γ^p , Γ^n , Γ^π to $\approx 14\%$.

τ to $\approx 10\%$.

$E(p)$ to $\approx 15\%$.

$E(n)$ to $\approx 10\% - 20\%$.

<p align="center">Experiment 788 - The Four Fermion Weak Interaction and the Decay of ${}^4_{\Lambda}\text{He}$ and ${}^3_{\Lambda}\text{He}$</p>
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Carnegie-Mellon University	P. Barnes, G. Diebold, G. Franklin, R. Grace, D. Hertzog, C. Maher, B. Quinn, R. Rieder, J. Seydoux, J. Szymanski
Brookhaven National Laboratory	R. Chrien, S. Bart, P. Pile, R. Sutter
University of Houston	E.V. Hungerford, T. Kishimoto, L.G. Tang
University of New Mexico	B. Bassalleck
Vassar College	R. Stearns
Spokesmen:	P.D. Barnes, G. Franklin

This experiment proposes to study the four fermion weak interactions through investigation of the $\Lambda N \rightarrow NN$ interaction as manifested in the weak decay of hypernuclei. Using the $K^- + A \rightarrow \pi^- + {}^A_{\Lambda}$ reaction to form ${}^4_{\Lambda}\text{He}$ and ${}^3_{\Lambda}\text{He}$, it is proposed to determine the life time and the four partial decay rates that characterize the weak decay. Because the Λ and the nucleons are all in relative s states one can extract from the decay rates information on the elementary $\Lambda N \rightarrow NN$ spin-isospin amplitudes.

The AGS hypernuclear spectrometer at the separated kaon beam, LESBI, will be used to tag the formation of ${}^4_{\Lambda}\text{He}$ and ${}^3_{\Lambda}\text{He}$. The Carnegie-Mellon range and timing spectrometer will be used to measure the time spectrum and energy distribution of pion and proton decay products from the tagged events. Coincident neutrons will be detected in a time of flight neutron spectrometer. Previous data of this type is either non-existent or of very poor quality. The life time measurement will be based on the coincident proton spectrum with a system that has been demonstrated to be capable of $\sigma \approx 100$ ps prompt time resolution.

**Experiment 789 - Search for $\xi(2.22)$ Formation
in $\bar{p}p$ Interactions**

New York University J.H. Christenson, E. Hummel, G. Kreiter,
P. Nemethy, J. Sculli, Ming Zuo

Brookhaven National P. Yamin
Laboratory

Spokesman: J. Sculli

This experiment proposes to measure the cross section for $\bar{p}p \rightarrow K^+K^-$ in the region of the $\xi(2.22)$. If the peak cross section for $\sigma(\bar{p}p \rightarrow \xi \rightarrow K^+K^-)$ exceeds one microbarn, it is expected to observe the state and measure the width.

E790

<p align="center">Experiment 790 - Nuclear Stopping Power Measurements with 18 GeV/c Protons</p>

Brookhaven
National
Laboratory

D.S. Barton, G. Bunce, A.S. Carroll, Y.Y. Chu,
J.B. Cumming, P.E. Haustein, S. Katcoff,
T. Ludlam, Y. Makdisi, L.P. Remsberg

University of
Minnesota

B. Baller, J. Blazey, B. Collick, H. Courant,
M. Marshak, E. Peterson, M. Shupe, D.S. Wahl

Southeastern
Massachusetts
University

S. Gushue, J. Russell

Massachusetts
Institute of
Technology

M. Bloomer, R. Brooks, R.J. Ledoux, S.G. Steadman

Spokesman:

L.P. Remsberg

This experiment uses the E755 Single Arm Spectrometer to measure inclusive proton spectra produced from nuclear targets by 18 GeV/c protons. These data will be used to obtain the nuclear stopping power, or rate of energy loss, of high energy-protons traversing nuclear matter. Recent experiments have shown that, contrary to previous expectations regarding nuclear transparency, there is a sizable slowing down of a high energy proton as it passes through a nucleus. This has a major impact on the design of the heavy-ion collider since it results in a broadening of the fragmentation regions in nucleus-nucleus collisions. A significantly high beam energy is required to achieve sufficient separation between the two fragmentation regions and produce the nearly baryon-free central region which is generally thought to be the most favorable condition for the production and observation of the quark-gluon plasma.

A plan view of the experimental apparatus. The beam defining elements are not shown.

<p align="center">Experiment 791 - A Study of Very Rare K_L Decays</p>
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University of California, Los Angeles	R.D. Cousins, J. Konigsberg, P. Melese, W.E. Slater
Los Alamos National Laboratory	J.S. Frank, W.W. Kinnison, D.M. Lee, R.J. McKee, G.H. Sanders
University of Pennsylvania	K. Arisaka, P. Knibbe, W.R. Molzon, J. Urheim, W.D. Wales
Stanford University	S. Axelrod, G. Bonneaud, G.M. Irwin, J. Margulies, C.J. Martoff, D. Ouimette, J.L. Ritchie, Q. Trang, S.G. Wojcicki
Temple University	L.B. Auerbach, V.L. Highland, W.K. McFarlane
College of William and Mary	M. Chapman, M. Eckhause, J. Ginkel, P. Guss, D. Joyce, J.R. Kane, C. Kenney, R.E. Welsch, R.J. Whyley, R.G. Winter, W.F. Vulcan
Spokesman:	S.G. Wojcicki
Deputy Spokesmen:	R.D. Cousins, W.R. Molzon

This experiment investigates rare K_L decays. The first priority is a search for the decay $K_L \rightarrow \mu e$ with a branching ratio sensitivity of 10^{-14} . A positive signal would be the first demonstration of the nonconservation of separate lepton number. The experimenters can also collect 10^3 - 10^4 events from the decay $K_L \rightarrow \mu^+ \mu^-$. With such a sample the longitudinal polarizations of the positive muons can be measured with a precision of 10-20%. A nonzero value is indicative of a new CP violating interaction. There is presently no experimental information on the muon polarization in this decay. The experiment will search for the decay $K_L \rightarrow e^+ e^-$. Since Standard Model predictions lie below the sensitivity of the experiment, a positive result would be another indication of new physics. The experiment also proposes to search for other rare decays: $K_L \rightarrow \pi^0 e^+ e^-$; $K_L \rightarrow \pi^0 \mu e$; $K_L \rightarrow \mu \mu \gamma$, $K_L \rightarrow e e \mu \mu$, etc.

E793

Cross section through target and detector stack. Thicknesses of CR-39 and Pb sheets are 0.06 cm and 0.5 cm respectively.

**Experiment 793 - Search for Fractionally Charged Nuclei in
15A GeV Sulfur - Oxygen Collisions**

University of P.B. Price and M.H. Salamon
California - Berkley

Spokesman: P.B. Price

This experiment proposes to use a stack of CR-39 plastic track detectors to look for fractionally charged projectile fragments produced in collisions of 15A GeV sulfur nuclei with lead targets. The expected charge resolution is $\sigma_Z = 0.06e$ for fragments with $19 e/3 < Z < 47e/3$. Using similar equipment, an upper limit of $\sim 10^{-3}$ has been set on the fraction of projectile fragments with fractional charge in 2.1A GeV argon collisions with a plastic target at the LBL Bevalac. Theoretical considerations suggest that, if QCD is broken, quarks might become separated during a nucleus-nucleus collision and form quark-nucleus complexes if the CM energy is high enough. With its order-of-magnitude higher energy than the Bevalac, the Brookhaven heavy ion accelerator may permit this goal to be achieved.

Additional goals of the experiment are to measure the interaction mean free paths of projectile fragments, to look for forward-directed fragments with higher Z than the projectile, and to measure the dependence of detector response on Lorentz factor of the beam.

E794

<p>Experiment 794 - One-Spin Effects in $p+p \rightarrow p+p$ at High-P_1^2</p>

University of Michigan	P.R. Cameron, D.G. Crabb, G. deMuth, I. Gialas, F.Z. Khiari, A.D. Krisch, A.M.T. Lin, R.S. Raymond, R.R. Raylman, T. Roser, K.M. Terwilliger
Brookhaven National Laboratory	K.A. Brown, G.T. Danby, L.G. Ratner
University of Maryland	D.C. Peaslee
University of Notre Dame	J.R. O'Fallon
Rice University	J.B. Roberts
Texas A&M University	T.S. Bhatia, G. Glass, L.C. Northcliffe
ETH, Zurich	M. Simonius
Spokesman:	A.D. Krisch

This experiment will scatter a high intensity unpolarized proton beam from the polarized proton target and measure the left-right asymmetry or Analyzing Power in proton-proton elastic scattering. The elastic differential cross-sections in different initial spin states in the large- P_1^2 region from 6.5 to 8 (GeV/c)² will be measured. The physics motivation is both the study of the totally unexplored area beyond $P_1^2 = 6.5$ (GeV/c)² and the improvement of the precision at 6.5 (GeV/c)² where recent AGS experiment E748 found a huge and unexpected value of A. The experiment will observe whether A continues to rise sharply in this previously unexplored hard-scattering region.

PROPOSED SLOW $\bar{n}$ DETECTOR

[PLAN VIEW]

DIMENSIONS

- 1] OUTER DC: 151(h) x 107(v) x 15(d) cm
- 2] INNER DC: 151(h) x 56(v) x 15(d) cm
- 3] M COUNTERS: 122(h) x 15(v) x 0.6(d) cm
- 4] NEUTRON CTRS: 100(h) x 100(v) x 20(d) cm
- 5] TARGET: 50(l) x 40(w) cm (60L)

<p align="center">Experiment 795 - Measurement of the Imaginary Part of the I=1 NN S-Wave Scattering Length at Threshold</p>

Brookhaven National Laboratory	D.I. Lowenstein
University of Houston	M. Furic, E. Hungerford, T. Kishimoto, B. Mays, L. Pinsky, L. Tang, Y. Xue
Karlsruhe	S. Cierjacks, H. Poth
University of New Mexico	B. Bassalleck
Pennsylvania State University	T.A. Armstrong, R.A. Lewis, W. Lochstet, B.Y. Oh, S.M. Playfer, G.A. Smith, J. Whitmore
Rice University	J. Buchanan, J. Clement, J. Kruk, G. Mutchler, B. Moss, W. von Witsch
Spokesman:	G.A. Smith

This experiment proposes to measure $\beta\sigma_A$ (antineutron velocity*annihilation cross section) for antineutron-proton annihilation at energies extremely close to NN threshold. This quantity is proportional to the imaginary part of the I=1 NN S-wave scattering length. Such a measurement may reveal dramatic departures from the classical $\beta\sigma_A = \text{constant}$ dependence, which would be suggestive of the existence of bound NN states. The energy region in question ($T_n \lesssim 1 \text{ MeV}$) has never been explored, and may be studied with practical upgrades to the existing E767 apparatus. The measurement would be complimentary to recently completed E767, which measured antineutron-proton annihilation cross sections at higher energies ($5 < T_n < 125 \text{ MeV}$), and the proposed continuance of E767 utilizing a tagged antineutron beam.

E796

<p align="center">Experiment 796 - μSR Experiments on Hydrides, Fluctuating Magnetic Fields in Solids and Knight Shifts</p>

College of William and Mary	W.J. Kossler, H. Schone, B. Hitti, J. Kempton, Y. Li
Virginia State University	C.E. Stronach
George Mason University	W.F. Lankford
University of Warwick	E. Seymour
Brookhaven National Laboratory	A. Goland, K. Lynn, Y.J. Uemura
CEN-CNRS Grenoble	J.P. Boucher, J. Chappert, D. Fruchart, P. Vulliet, A. Yaouanc
University of Uppsala	O. Hartmann, E. Karlsson, E. Wäckelgaard, R. Wappling
Technische Universität München	L. Asch, M. Kalvius
Université de Paris	J.P. Renard
Spokesman:	W.J. Kossler

This experiment uses the D4 stopping muon beam to carry out six μ SR experiments. The experiments are:

1. Muon sites and motion in non-magnetic hydrides.
2. Field fluctuations and magnetic hydrides.
3. A study of the one-dimensional antiferromagnetic $(\text{CH}_3)_4\text{NMnCl}_3$.
4. Strain induced muon precession frequency shifts in ferromagnets.
5. Magnetic fields in heavy fermion superconductors.
6. Giant Knight shifts in vacancies.

<p align="center">Experiment 798 - Study of Strangeness in Nuclei by Use of the (π^+, K^+) Reaction</p>
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Brookhaven National Laboratory	S. Bart, R.E. Chrien, P.H. Pile, R.J. Sutter
Carnegie-Mellon University	P.D. Barnes, G. Diebold, G.B. Franklin, D. Herzog, J. Seydoux, J. Szymanski
Florida State University	H. Plendl
University of Houston	E.V. Hungerford, T. Kishimoto
Los Alamos National Laboratory	J.F. Amann, T.S. Bhatia, J.A. McGill, E.C. Milner, J. C. Peng, R. Silbar, H.A. Thiessen
Rutgers University	C. Glashausser
University of Texas	M. Barlett, R. Fergerson, G.W. Hoffman
TRIUMF	D. Gill
Vassar College	R.L. Stearns
Spokesmen:	J.C. Peng, P.H. Pile

This experiment proposes to extend the (π^+ , K^+) measurements of E758 by searching for high-spin hypernuclear states in ^{16}O , ^{28}Si , and ^{40}Ca and by searching for dibaryon resonances in deuterium. Targets of ^{12}C and ^{16}O will be examined to establish confidence in the calculated quasi-free production. The experimenters intend to measure the ground state excitation in ^{28}Si and possibly ^{40}Ca and to look for highly-excited, deep-lying states in ^{12}C .

a. mercury tanks

Expt. 801 - Layout

RWB
11-21-85

<p>Experiment 801 - A Search for Quarks Produced in Heavy Ion Mercury Interactions</p>
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San Francisco
State University

R.W. Bland, C.L. Hodges, M. Savage

Lawrence Berkeley
Laboratory

H. Mattis, H. Pugh

Fermilab

R. Tokarek

University of
California (Irvine)

G. Shaw

Spokesman:

R.W. Bland

This experiment proposes to search for fractional charges produced in heavy-ion collisions at the BNL heavy-ion accelerator. Mercury will serve both as a production target and to stop reaction products. It will subsequently be distilled, then searched for quarks by a thoroughly proven automated Millikan technique.

The target will consist of a number of "tuna-can" shaped containers of mercury, arranged in the form of a long cylinder, with a radius of about 0.5 hadronic interaction lengths and with a length of 11 interaction lengths. It is designed to stop most hadronic secondaries produced in the heavy-ion collisions.

The mercury from the target will be distilled down to a 100-milligram residue with fractionally charged particles being retained in the residue by image-charge forces and an applied electric field. An estimated one milligram of the final residue can be searched for fractional charges using the stable-matter quark search apparatus at San Francisco State University. A sensitivity to one fractional charge per 10^{11} heavy-ion collisions is expected, an improvement of 10 over the current limit, set at an energy eight times lower.

In addition four liquid-nitrogen tanks will be placed in the beam. Fractionally charged particles stopping in these tanks will be collected on gold-plated glass fibers biased at ± 5000 V. After the exposure the gold will be dissolved in small mercury drops, which will be measured in the SFSU Millikan apparatus.

EXPERIMENT #802

<p align="center">Experiment 802 - Studies of Particle Production at Extreme Baryon Densities in Nuclear Collisions at the AGS</p>

Brookhaven National Laboratory	A. Alburger, D. Beavis, P.D. Bond, C. Chasman, Y.Y. Chu, J.B. Cumming, E. Duek, O. Hansen, P. Haustein, S. Katcoff, M.J. LeVine, T. Ludlam, J. Olness, A. Pfoh, L.P. Remsberg, A. Shor, A. Sunyar, M. Tanaka, M.J. Tannenbaum, P. Thieberger, J.M. van Dijk, P. Vincent, H. Wegner
Hiroshima University	T. Sugikate
Lawrence Berkeley Laboratory	M. Crawford, D. Greiner, P. Lindstrom, T. Mulera, V. Perez-Mendez
Massachusetts Institute of Technology	H.A. Enge, L. Grodzins, R.J. Ledoux, S.G. Steadman, D. Woodruff
University of Tokyo and INS	Y. Akiba, H. Hamagaki, O. Hashimoto, S. Homma, Y. Miake, S. Nagamiya, I. Tanihata, X. Torikoshi
Waseda University	T. Doke, J. Kikuchi
Spokesmen:	O. Hansen, S. Nagamiya

An experiment using ^{32}S and ^{16}O beams from the Tandem-AGS accelerator at $T/A = 14.6$ GeV/a.m.u. is proposed. Semi-inclusive spectra of $P^\pm$, $\pi^\pm$, $K^\pm$, d , α , and ϕ will be measured with a 25 msr single arm magnetic spectrometer. The primary physics goal is to establish effective temperatures in the hard nucleus-nucleus collisions and to measure particle production cross sections. These quantities may indicate if phase transition to a quark-gluon plasma has taken place. Particle identification for p , π , and K will be provided up to 4 GeV/c. Neutral transverse energy-flow will be recorded using a segmented Pb-glass wall. The trigger arrangements, in addition to the Pb-glass, encompass a 500 pad streamer tube arrangement for multiplicity, a forward plastic Cernekov multiplicity counter and a 0° thin scintillator to veto events with high Z forward going projectile fragments. An active target arrangement will be developed.

Charge distribution of projectile fragments measured with 1.7 cm of their points of interaction. 75 primary Ar nuclei were included for calibration.

<p>Experiment 804 - A Search for Fractional Charge with Heavy Ion Beams at the Brookhaven AGS</p>

Indiana University S.P. Ahlen

University of G. Tarle
Michigan

Spokesmen: S.P. Ahlen, G. Tarle

This experiment proposes to extend studies initiated at the Bevalac to search for fractional charge production in high energy nucleus-nucleus collisions with high precision track etch detectors. Although no candidates were observed in the Bevalac experiments, it is possible that the dramatic increase in energy available at the AGS would be sufficient to allow quark deconfinement for the first time.

Fig.1

Fig.2

Experiment 805 - A Search for Galactic Axions

University of Rochester	A.C. Melissinos, J. Rogers, W. Wuensch
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Fermilab	W.B. Fowler, F. Nezrick
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Brookhaven National Laboratory	H. Halama, A. Prodell, P. Thompson
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Spokesman:	A.C. Melissinos and H. Halama
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Evidence indicates that the axion must have a light mass ($m_a \approx 10^{-5} \text{eV}$), and it has been suggested that axions may form the dark matter in the galaxies. In spite of their weak coupling axions can be detected through their electromagnetic conversion to a photon in the presence of a strong static field. The frequency of the converted photons ($\nu = m_a c^2/h$) is in the microwave range, and we propose to search the region $1 < \nu < 20 \text{ GHz}$ in a period of 24 months. In the most current cosmological models the axions should be found in the lower part of this spectrum. In addition we will establish limits for any other component of the cosmic radiation that couples to two photons, even if it has a continuous spectrum in this frequency range.

Automatic Track Measuring System

<p>Experiment 806 - Nuclear Fragmentation in Heavy Ion Collisions at 15 GeV/amu</p>
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University
of Siegen

C. Brechtmann, H. Drechsel, J. Draute
W. Heinrich

Spokesman:

W. Heinrich

This experiment proposes to expose stacks of plastic nuclear track detectors at the Tandem-AGS Accelerator Complex to 15 GeV/amu ^{32}S beam. Nuclear fragmentation cross sections of beam nuclei and fragments with charges $Z > 6$ will be measured for collisions with different targets. The energy independence of the cross sections and the validity of the factorization of these cross sections into a target and a projectile-depending-part at high energies will be tested. The experiment is designed to detect unexpected large emission angles of the fragments. The anomalous interaction mean free path effect will also be investigated. A new technique of automatic readout for the plastic detectors will be used which will allow the measurement of large quantities of tracks in these passive detectors.

Fig. 1. Schematic diagram of emulsion stack exposures.

Fig. 2. Schematic diagram of the emulsion chamber exposures.

**Experiment 808 - Interactions of 14.1 GeV/amu Nuclei from 160
to ^{197}Au in Light and Heavy Targets**

Institute of
Nuclear Physics
Krakow, Poland

A. Jurak, R. Holynski, B. Wilczynska, H. Wilczynski,
W. Wolter, B. Wosiek, K. Wozniak

Louisiana State
University

W.V. Jones and A. Olszewski

University of
Minnesota

P.S. Freier, C.J. Waddington

Spokesman:

C.J. Waddington

This experiment proposes to use nuclear track emulsions for investigating interactions of 160 , ^{32}S and, when available, ^{108}Ag and ^{197}Au nuclei in light (plastic) and heavy (emulsion, lead, silver, and/or gold) targets. Emphasis will be placed on the analysis of central collisions by selecting events exceeding a given threshold of target excitation, as defined by the number of low energy fragments emitted from the target nucleus.

Measurements in the emulsions will include (1) the charges and emission angles of the projectile fragments, (2) the number and emission angles of the produced charged particles, (3) the number and angular distributions of heavily ionizing particles emitted from the emulsion target nuclei, and, for a subset of the events (4), the number and energy of electron pairs in restricted angular regions. The data will permit studies of (1) projectile fragmentation modes, including transverse momentum distributions and possible dependences on the topology of the interactions, (2) the pseudo-rapidity distributions (including structure, correlations, etc) of charged particles and the dependence of the multiplicity on the number of interacting nucleons, and (3) the possibility of enhanced production of direct photons/electrons in high density matter.

E810

<p align="center">Experiment 810 - A Search for Quark Matter (QGP) and other New Phenomena Utilizing Heavy Ion Collisions at the AGS</p>

Brookhaven National Laboratory	A. Etkin, K.J. Foley, R.W. Hackenburg, R.S. Longacre, W.A. Love, T.W. Morris, E.D. Platner, A.C. Saulys
City College of New York and BNL	S.J. Lindenbaum
City College of New York	C. Chan, M.A. Kramer
Johns Hopkins University	P. Halman, L. Madansky
Lawrence Berkeley Laboratory	W. Geist, C. Gruhn, M. Heiden
Spokesmen:	S.J. Lindenbaum and E.D. Platner

This experiment proposes to study heavy ion collisions at the AGS by measuring the angles and momenta of virtually all charged particles emitted in each event. Particle identification will be determined where possible.

The experimenters will look for anomalous behavior in rapidities (or pseudorapidities), multiplicity, strangeness enhancements, $P_T(E_T)$, energy flow; possibly observe Hanbury-Brown and Twiss effects, deflagration (detonations), and other new phenomena. These observations will be on an event-by-event basis so that particularly interesting classes of events can be selected and added together to search for new effects implying a QGP or other new states of matter in a manner which tends to maximize signal-to-background ratios.

<p align="center">Experiment 811 - Radiative Kaon Capture and Hyperon Weak Radiative Decay</p>

Boston University	E.C. Booth, C. Heisey, K.P. Gall, E.K. McIntyre, J.P. Miller, B.L. Roberts, W. VanRiper, D. Whitehouse
University of Birmingham	J. Lowe, N. Hessay
University of British Columbia	F. Entezami, M.D. Hasinoff, D.F. Measday, A. Noble, S. Stanislaus, C. Waltham
" Kozponti Fizikai Kutató Intézet	D. Horvath
TRIUMF	M. Salomon
Brookhaven National Laboratory	M. Sakitt, J. Skelly
Case Western Reserve University	W. Fickinger, D.K. Robinson
Spokesmen:	B.L. Roberts/J.P. Miller

This experiment proposes to measure the branching ratios for $p(K^-, \gamma)\Lambda$ and $p(K^-, \gamma)\Sigma^0$ as well as the weak radiative decay $\Sigma^+ \rightarrow p + \gamma$ using stopped kaons from LESB II. These will be measured simultaneously using a large, high resolution NaI total absorption scintillation counter (TASC) to detect the photons. The weak radiative decay $\Lambda \rightarrow n + \gamma$ will be measured in the second half of the experiment. K^- will be stopped in LH_2 . The photon spectrum in coincidence with a K^- stop will contain the radiative capture photons. The radiative capture branching ratio for $Kp \rightarrow \Lambda\gamma$ is expected to be measured to a few percent. The observation of the $\Sigma^0\gamma$ final state is less certain as the branching ratio is completely unknown. We will have a sensitivity down to 7×10^{-5} . These two ratios will provide detailed information on the quark wavefunctions inside the Λ , Σ^0 , and the $\Lambda(1405)$. The weak radiative decay photons will appear in two tagged spectra. $\Lambda(\Sigma^+)$ production will be tagged by detecting the monoenergetic $\pi^0(\pi^-)$ associated with their production. The branching ratio for weak radiative decay (WRD) of the Σ^+ will check several controversial experiments. The branching ratio measurement for the WRD of the Λ will be the first measurement. We also request 100 hours to measure the branching ratio for $K^-d \rightarrow n\Lambda\gamma$ as well as to study the backgrounds present. This will be the first measurement of radiative capture in deuterium and will determine the feasibility of the other experiments in deuterium.

Schematic drawing of the experimental set-up proposed

**Experiment 814 - Study of Exotic Nuclear States Via Coulomb
or Diffractive Projectile Excitation**

HIM für
Kernforschung
(Berlin)

H. Homeyer

Brookhaven National
Laboratory

I. Stumer

CERN

W.J. Willis

Los Alamos
National Laboratory

J. Boissevain, H.C. Britt, N.J. DiGiacomo,
A. Gavron, B.V. Jacak, P.L. McGaughey,
W.E. Sondheim, J.W. Sunier, H. Von Hecke

State University of
New York, Stony Brook

N. Alamanos, P. Braun-Munzinger, P. Paul,
J. Stachel

University of
Tel Aviv

O. Benary, S. Dagan, D. Lissauer, Y. Oren

Spokesman:

P. Braun-Munzinger

Exotic nuclear states may be produced in peripheral projectile excitation reactions. This experiment proposes to set up a forward spectrometer which will allow a completely exclusive study of such reactions with high precision in the mass, charge and fragment excitation energy determination. The experiment will search for bound states or resonances of multi-neutron or multi-neutron- systems as well as for other (rare) decay mode of the excited projectile. Coulomb and diffractive excitation can be separated and isolated via their different dependence on target mass (charge).

LAY OUT OF THE CALORIMETER TOP VIEW

E816

Fiducial volume for γ interactions
 4×0

muon identification
Sci = Trigger hodoscopes
Xi = Flash tube + iron planes
XY = Flash tube planes

Experiment 816 - Search for Neutrino Oscillations
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Boston University G. Bernardi, J. Stone

Brookhaven National M.J. Murtagh, D.H. White
Laboratory

CERN C. Detraz, J.M. Perreau, M. Ferro-Luzzi

LPNHE Paris P. Asrier, J. Chauveau, A. Diaczek, J. Dumarchez,
F. Kovacs, A. Letessier, J.M. Levy, Y. Pons,
A.M. Touchard, F. Vannucci

Spokesman: F. Vannucci

This experiment proposes to repeat, with 20 times more statistics, an experiment done at CERN in the low energy PS neutrino beam. A possible excess of exclusive events with electrons gives a tantalizing indication of oscillations. The effect is based on about 20 events.

PROPOSED LAYOUT OF M.P.S. WITH TRIGGER COUNTERS.

ER17

Experiment 817 - Polarization Transfer in Hyperon Production

Rice University	S.D. Baker, B.E. Bonner, J.A. Buchanan, J.M. Clement, M.D. Corcoran, I.M. Duck, N. Krishna, J.W. Kruk, H.E. Miettinen, G.S. Mutchler, G.C. Phillips, J.B. Roberts, P.M. Stevenson, S.R. Tonse
Brookhaven National Laboratory	A. Birman, S.U. Chung, R.C. Fernow, H. Kirk, S. Protopopescu
University of Houston	W. Mayes, L. Pinsky
Southeastern Massachusetts University	S. Bar-Yam, J. Dowd, W. Kern, E. King
Spokesmen:	B.E. Bonner and J.B. Roberts

Since the discovery that inclusively produced hyperons are polarized, the underlying cause of the effect has remained a mystery. No perturbative QCD predictions are possible for the kinematic range covered by experiment, but simple parton-based theories that explain the effect in terms of breaking of strings or Thomas precession of strongly accelerated quarks have had a remarkable degree of success in explaining the effect. This experiment proposes to measure the hyperon polarization when produced by a polarized proton beam. The question being addressed is how much the hyperon polarization is influenced by that of the proton; firm predictions independent of the exact mechanism responsible for the hyperon polarization can be made. This should test whether the fundamental ideas of how the reaction proceeds are valid.