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BOOSTER APPLICATIONS FACILITY REPORT

ADDENDUM

Brookhaven National Laboratory
Upton, New York 11973

January 1992

EDITED BY

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BOOSTER APPLICATIONS FACILITY REPORT

ADDENDUM

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INTRODUCTION

BOOSTER APPLICATIONS FACILITY REPORT ADDENDUM

INTRODUCTION

This proposal is based on the conceptual design and feasibility study (BNL report #52291) which was performed at the request, and with the support of NASA's Life Sciences Division. The BNL Booster, which is now being successfully commissioned with protons, will undergo similar tests and initial heavy-ion operation in early 1992. This accelerator is a fast cycling synchrotron, and therefore capable of sequentially delivering independent alternate pulses of different ions for two applications. Thus, after a pulse is injected in the Alternating Gradient Synchrotron (AGS) for further acceleration, there will be ample time to deliver a pulse of a different ion to a proposed Booster Applications Facility (BAF) before the next AGS pulse is required. Cost effective BAF operation and reliable beam delivery would result. This is guaranteed by the need to maintain all the systems in good operating condition for the main mission of the facility, which is the injection of AGS, and eventually of the Relativistic Heavy Ion Collider (RHIC). A large variety of high-Z high-energy (HZE) particles can be produced, ranging from maximum energies of 1.5 GeV/AMU for ions lighter than iron, to ~ 1.25 GeV/AMU for iron, and to ~ 350 MeV/AMU for gold.

An extensive reanalysis of the schedules and construction cost profiles for this project has now been performed and the results are summarized on page B1. The details can be found in the Appendix. Full operation of one irradiation cave with the corresponding ready-room and lab area could start in January 1995. The remaining two caves and their associated ready-rooms and labs would start operation in 1996. Total run-out costs for a ten year base operation of 2250 hrs/year of shared operation are summarized on page B2.

In response to DOE's request for fast track options we have investigated a temporary operating mode that could be implemented on the AGS floor starting in 1993. The Booster beams would be injected into the AGS, then slow extracted after little or no acceleration and delivered to one or two specially prepared irradiation rooms at the end of one of the

existing beam lines. A small ready-room with easy access to the irradiation room would be provided. The irradiation and ready rooms would be heated or air-conditioned as required. A minimum of 1000 hours per year could be provided in 1993 and 1994 before BAF operation starts in 1995. This arrangement would provide an early start, a smooth transition to BAF operation and the possibility of utilizing the same installations for future experimentation with higher energy heavy ions. Details of how this idea could be implemented together with rough construction and operating cost estimates are shown on pages C1 - C3. The construction costs would be in addition to the ones shown on page B1.

A new item in the present proposal which had not been included before is the implementation of a micro-beam capability. One of the several scientific justifications for such a system is summarized on page D1 and an estimate of achievable beam intensities is shown on page D2. Due to the good beam quality (low emittance), it is possible to obtain useful intensities for beam sizes which are of the same order as the size of mammalian cell nuclei. Such micro-beams will also be of interest for some aspects of micro electronic device testing.

Total operating cost for shared operation with 2250 hrs. and 4500 hrs. beam on target per year are similar to the costs presented in the original report. The appropriately escalated costs are summarized on pages E1 - E5. An hypothetical case of 4500 hrs. per year of dedicated (not shared) use has also been evaluated (see page E6). This last case would only be relevant were there no AGS high energy, nuclear physics, or RHIC programs at BNL.

The replacement and repair of critical accelerator components will be fully funded by the physics programs at the AGS and RHIC. Costs of repair or replacement of equipment directly associated with the Booster Applications Facility has been budgeted as part of the BAF operating costs.

Details of environmental impact issues and permits as well as estimated costs for Decommissioning and Decontamination (D&D) of the facility are summarized on pages F1 - F6.

Peter Thieberger October 31, 1991

SUMMARY OF COSTS AND SCHEDULES

****	BOOSTER APPLICATIONS FACILITY ONE CAVE OPERATING IN EARLY 1995 THREE CAVES OPERATING IN 1996	***	Commitment	
			FY92 K\$	At Year K\$
1992	Preliminary design. Review and approvals. Env. approvals start. Tandem upgrade start. Extraction supplies and components ordered.		3,072	3,101
1993	Detail design & bid award. Env. approvals. BAF Construction start. Tandem inter- connection start.		12,981	13,527
1994	End of construction. Equipment installation and testing for one cave and corresponding preparation room and lab.		7,065	7,705
1995	One cave operating. Equipment installation and testing in remaining caves + building.		3,166	3,592
1996	Full facility operational.		471	553

Totals:

26,755

28,478

BOOSTER APPLICATIONS FACILITY PROJECT SCHEDULE

ITEM	FY 92				FY 93				FY 94			
	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
	O N D	J F M	A M J	J A S	O N D	J F M	A M J	J A S	O N D	J F M	A M J	J A S
A/E SOLICITATION												
TITLE I												
PRELIMINARY DESIGN												
PROJT. MNGMT. PLAN												
REVIEW & APPROVAL												
ENVIRONMENTAL APPRVL												
TITLE II												
DETAIL DESIGN												
BID & AWARD												
TITLE III												
CONSTRUCTION INSPECT.												
MOBILIZATION												
EXCAVATION												
CONC. FND, WALLS, ROOF												
TUNNEL ERECTION												
EARTH SHIELDING												
PRE-ENGR'D BLDG												
EXTERIOR WALLS												
INTERIOR PARTITIONS												
INTERIOR FINISHES												
ELECTRICAL WORK												
MECHANICAL WORK												
SITE RESTORATION												
CLEAN UP / PUNCH LIST												

CONSTRUCTION COMPLETE 5-31-94

CONSTRUCTION START 5-1-93

*** BOOSTER APPLICATIONS FACILITY *** Estimate of total run-out costs for 10 years, 2250 hrs/year of shared operation.		FY92 K\$
1992 to 1996	Design, construction, installation and testing.	26,755
1995 to 2004	10 years of shared operation at 2250 hrs/year.	43,000
2005	BAF Decommissioning and Decontamination.	1,420

Total : 71,175

POSSIBILITY FOR EARLY WORK ON THE AGS FLOOR

1 GeV/Nucleon Ion Beams at the AGS

- Several Secondary beam lines could transport 1 GeV/Nucleon Heavy Ion Beams.
 - B1 E859/E866 Heavy Ion Experiment
 - A1 E810 Heavy Ion Experiment
 - C5 E814/E877 Heavy Ion Experiment
 - A3 Test Beam (Planned use for E864 H.I. exp.)
 - B2 Test beam being designed.
- Could serve several areas simultaneously.
 - Presently A1, B1, C5 run simultaneously for Heavy Ion experiments.
- Modifications to transport and experimental area would depend on program commitments and experimental locations.

Possible Modifications

- **Beam Line Instrumentation** (38K/Package)
A1, B1, and C5 probably require none.
- **Beam Plugs in Transport Line** (30K/Transport)
 - To allow quick on/off
 - Magnet stability
- **Magnets for Low Momentum Running**
where increased stability is required.
- **Shield Target Room**
 - Most areas could accommodate a
10' x 10' shield room.
 - Shielding 50K
 - Assumed beam stop used for end
of Target Room.
 - Utilities 10K
- **Nearby Support Room (10' x 20')** 30K
- **Interlock modifications and
radiation detectors** 10K

10/30/91
DIL

ESTIMATED

AGS MARGINAL OPERATING COSTS**
FOR AN INTERIM PROGRAM PRIOR TO BAF

	<u>COST (FY92 \$K)</u>
SALARY	2100
DTS	100
MSTC	400
POWER	500 (8 WEEKS OF 1 GeV Fe)
SPEC. PROC.	100
G&A (48.5%)	1400
	—
TOTAL	4600

TANDEM PUBLISHED RATES OF \$500/HOUR FULL COST RECOVERY.

TANDEM FULL COST RECOVERY @ 8 WEEKS = 670K\$

TOTAL TANDEM/AGS COSTS = \$5270K FOR 8 WEEKS OPERATION

**ASSUMES ADEQUATE BASE SUPPORT FROM DOE HEP AND NP.
WITHOUT THIS BASE SUPPORT THE COSTS ESCALATE SIGNIFICANTLY.

MICRO BEAM CAPABILITY

The Micro Beam Method for Estimating Risks
Due to Radiation Effects in the Brain during Space Travel

D. N. Slatkin, et al.
Brookhaven National Laboratory

Neurons are non-mitotic cells, which are in general radiation-hard. However, if a neuron is killed (e.g. by a very high dose of direct radiation), it does not regenerate from other cells.

In contrast, tissues essential for the survival or support of neurons, such as those lining blood vessels (endothelial cells), are not radiation-hard but, given sufficient time, can regenerate from nearby supporting tissues.

For low-dose-rate, prolonged exposure in space, the radiation hardness of the neurons is most relevant to considerations of the radiation risk to the brain, since there is ample time for the supporting tissues to regenerate.

When the same dose is given in a ground-based experiment, it is necessarily given in a much shorter period of time. The radiation-softness of neuron-supportive tissues then becomes the most relevant factor, since there may not be sufficient time to simulate the slow regeneration of such tissues that presumably would occur in space.

To estimate risks associated with space travel we must design experiments that measure the neuronal radiation-hardness independently from that of other types of brain cells, and do so using relatively short irradiation times (seconds or minutes). The time available for regeneration could well be inadequate, and we must find other ways to minimize the importance of damage to neuron-supportive tissues.

The microbeam method is a way of circumventing this experimental problem, since enough undamaged brain tissue will be left in the vicinity of each neuron to minimize or perhaps prevent indirect neuronal damage. Likewise in space, indirect neuronal damage is unlikely to occur.

October 04, 1991

Planar Micro-beam Intensity Estimate

Estimated emittance for maximum energy Booster beams:

$$\sim 4 \pi \text{ mm mrad}$$

$$2 \text{ mrad} \times 5 \text{ mm} = 10 \mu$$

Beam doesn't exceed $\pm 15 \mu$ over a depth Δz of $\pm 5 \text{ mm}$.

Phase-space area of microbeam:

$$10 \mu \times 4 \text{ mrad} = 4 \times 10^{-2} \text{ mm mrad}$$

$$\text{Transmission} = (4 \times 10^{-2} \text{ mm mrad}) / (4 \pi \text{ mm mrad})$$

$$= \boxed{3.2 \times 10^{-3}}$$

For 10^8 heavy ions per second from the Booster we can expect 3.2×10^5 ions per second in a planar beam $\sim 20 \mu$ wide with a field depth of 1 cm.

OPERATING COSTS

BOOSTER APPLICATIONS FACILITY OPERATIONS COST

The Booster Applications Facility (BAF) is expected to supply 2250 hours of ion beams yearly to NASA/DOE supported radiobiological and physics experiments. The funds necessary to support this endeavor will be supplied by NASA/DOE to BNL to provide for machine and beamline operations. We consider here the concurrent operations mode of the Booster. This assumes that the BAF program will share with other programs, such as high energy and nuclear physics, the operating time of the Booster. Note that the calculated costs are in FY1992 dollars and that the present DOE guidance for Booster and Tandem operations funding is assumed. The BAF costs will be reviewed on a yearly basis and be modified in response to changes in the DOE funding guidance and projected power costs.

For this concurrent running case we assume, for the near term future, to run the Booster approximately 26 weeks per year. An operational week is 168 hours, with a 36 hour maintenance period every 3 weeks, and a machine availability uptime of greater than 90%. We assume, for the NASA/DOE supported BAF program, that the Booster will supply beam for 24 hours per day, 7 days per week, except for maintenance periods. This results in approximately 14 weeks of elapsed time per year to acquire 2250 hours. In our cost calculation, we assume that most of the machine and personnel costs to provide beam is covered in the fractional base cost of items A and B in Table 1. The costs in Table 1 are broken down into labor (including fringe and overhead costs), purchases of materials and services (including overhead) and power costs (no overhead applied). We assume that the 14 weeks of operations are contiguous and are run concurrently with the AGS physics program. The determination of the fraction of the base costs is based upon the rationale that BAF requires 1/2 the Booster resources when it is operational, for a period of $14/26$ of the available Booster operating time. We thus arrive at a fraction of $0.27(A+B)$. In addition to this base cost are the BAF specific items that are not covered under the base Booster operation costs. These are identified as items C and D in Table 1. Item C identifies those costs related to Booster pulsing, extraction and external beamline operations. Item D identifies those costs related to experimental area operations. Included here are the incremental power costs, purchases for materials and services, and the cost of

additional personnel that are not presently available. The additional personnel include professional support, such as for dosimetry, optics, life science liaison, and engineering liaison, and the additional technical support to maintain the extensive machine, beamline and experimental area equipment. We have not identified the costs for animal care. We note that the shift operator and administrative support is included in the fractional base costs of A+B. In addition, we also note that the costs to be incurred by NASA, on a yearly basis, would be reduced if other programs, yet to be identified, were to use the BAF and thus share the costs. The present projection of hourly costs is \$1900 for 2250 hours per year.

Should the desired number of operations hours be otherwise, then the fraction of A+B costs and power costs in C+D would scale accordingly. The labor costs in C+D would not change and the purchase costs in C+D would vary slowly. For the case of 4500 hours per year operation, concurrent with other DOE supported activities, the charging algorithm would then be $0.5(A+B)+C+D$ (see Table 2). The projected hourly costs for 4500 hours of concurrent operations is \$1450 and a total yearly cost of \$6.5M.

We also have provided a cost estimate for the case of dedicated booster operations of 4500 hours, assuming that there is no other support from any other program, ie. there is neither AGS nor RHIC operations (see Table 3). This requires additional Booster staff to support shift operations, maintenance, training, quality assurance, and safety activities. In addition, the full Booster power costs are costed. The cost is estimated to be \$10.9M for a 4500 hour program.

TABLE 1

**BOOSTER APPLICATIONS FACILITY YEARLY OPERATIONS COSTS
(FY1992\$)**

	MPWR (FTE)	Labor* (M\$)	Purchases* etc. (M\$)	Power (@ \$70/MWH) (M\$) (MW) (Weeks)
A.Tandem	18	1.9	0.4	0.3 1.0 26
B.Booster	15	1.6	1.3	
C.Additional				
Pulsing				0.1 0.8 14
Extraction (33% DF)				0.3 1.6 14
Beamline	4	0.4	0.6	0.1 0.8 14
D.Experimental				
Areas	5	0.5	0.5	0.2 0.2 52

Proposed Charging Algorithm
for 2250 hours of shared use

TOTAL= .27(A+B)+C+D 1.9 1.6 0.8 = 4.3

HOURLY COST

\$1900/HOUR

* Includes 48.5% G&A

TABLE 2

**BOOSTER APPLICATIONS FACILITY YEARLY OPERATIONS COSTS
(FY1992\$)**

	MPWR	Labor*	Purchases* etc.	Power (@ \$70/MWH)		
	(FTE)	(M\$)	(M\$)	(M\$)	(MW)	(Weeks)
A.Tandem	18	1.9	0.4	0.3	1.0	26
B.Booster	15	1.6	1.3			
C.Additional Pulsing				0.2	0.8	26
Extraction (33% DF)				0.6	1.6	26
Beamline	4	0.4	0.8	0.2	0.8	26
D.Experimental Areas	5	0.5	0.7	0.2	0.2	52

Proposed Charging Algorithm
for 4500 hours of shared use

TOTAL= .5(A+B)+C+D 2.7 2.4 1.4 = 6.5

HOURLY COST

\$1450/HOUR

* Includes 48.5% G&A

TABLE 3

**BOOSTER APPLICATIONS FACILITY YEARLY OPERATIONS COSTS
(FY1992\$)**

	MPWR (FTE)	Labor* (M\$)	Purchases* etc. (M\$)	Power (@ \$70/MWH) (M\$) (MW) (Weeks)		
A.Tandem	18	1.9	0.4	0.3	1.0	26
B.Booster	25	2.5	1.3	0.9	3.0	26
C.Additional Pulsing				0.2	0.8	26
Extraction (33% DF)				0.6	1.6	26
Beamline	4	0.4	0.8	0.2	0.8	26
D.Experimental Areas	5	0.5	0.7	0.2	0.2	52

Proposed Charging Algorithm
for 4500 hours of dedicated use

$$\text{TOTAL} = 1.0(\text{A} + \text{B}) + \text{C} + \text{D} \quad 5.3 \quad 3.2 \quad 2.4 = 10.9$$

HOURLY COST

\$2425/HOUR

* Includes 48.5% G&A

10/30/91
DIL

ESTIMATED

AGS MARGINAL OPERATING COSTS**
FOR AN INTERIM PROGRAM PRIOR TO BAF

	<u>COST (FY92 \$K)</u>
SALARY	2100
DTS	100
MSTC	400
POWER	500 (8 WEEKS OF 1 GeV Fe)
SPEC. PROC.	100
G&A (48.5%)	1400
	—
TOTAL	4600

TANDEM PUBLISHED RATES OF \$500/HOUR FULL COST RECOVERY.

TANDEM FULL COST RECOVERY @ 8 WEEKS = 670K\$

TOTAL TANDEM/AGS COSTS = \$5270K FOR 8 WEEKS OPERATION
AT AN HOURLY COST OF \$3920.

**ASSUMES ADEQUATE BASE SUPPORT FROM DOE HEP AND NP.
WITHOUT THIS BASE SUPPORT THE COSTS ESCALATE SIGNIFICANTLY.

MARGINAL COSTS INCLUDE BOOSTER OPERATIONS

COSTS ASSUME MORE THAN ONE USER SIMULTANEOUSLY BEING
SERVICED AND COSTS TO MOVE EXPERIMENTS TO AVOID CONFLICTS
WITH HEP AND NP EXPERIMENTS ARE PAID BY THIS PROGRAM

ENVIRONMENTAL AND DECOMMISSIONING ISSUES

ENVIRONMENTAL IMPACT ISSUES
AND
ESTIMATED COST FOR
DECONTAMINATION AND DECOMMISSIONING
BOOSTER APPLICATIONS FACILITY

E. T. LESSARD
AGS DEPARTMENT
BROOKHAVEN NATIONAL LABORATORY

NOVEMBER 1, 1991

ENVIRONMENTAL COMPLIANCE ISSUES

NATIONAL ENVIRONMENTAL POLICY ACT

ENVIRONMENTAL EVALUATION FORM
ENVIRONMENTAL ASSESSMENT
FINDING OF NO SIGNIFICANT IMPACT (FONSI)

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

COMPUTE AIR ACTIVATION
DOCUMENT IMPACT

CLEAN AIR ACT

EVALUATE NON-RADIOACTIVE EMISSION POINTS

CLEAN WATER ACT

EVALUATE COMPLIANCE UNDER EXISTING BNL PERMIT
ASSESS IMPACT ON WETLANDS

SAFE DRINKING WATER ACT

EVALUATE GROUND WATER CONTAMINATION
INSTALL GROUND WATER MONITORS

WASTE GENERATION

EVALUATE MIXED, HAZARDOUS AND SOLID WASTE STREAMS

TIMETABLE AND COST FOR ENVIRONMENTAL ISSUES

<u>CONCURRENT ACTIVITIES</u>	<u>TIMETABLE</u>	<u>COST</u>
ENVIRONMENTAL ASSESSMENT (EA)	3-6 MONTHS	\$30,000
FONSI (FOLLOWS EA)	12-18 MONTHS	-
NEPA CATEGORICAL EXCLUSION ON BOOSTER EXTERNAL DUMP	3 MONTHS	\$5000
NY AIR EMISSION, NESHAPS, SPDES PERMITS, AND GROUND WATER MONITORING	12 MONTHS	\$50,000

RESIDUAL RADIATION OF FACILITY COMPONENTS

THE MATERIALS USED IN CONSTRUCTION ARE LIMITED IN NUMBER, THE MOST IMPORTANT BEING IRON, STEEL, COPPER, ALUMINUM, CONCRETE, OIL AND PLASTIC. LONG LIVED NUCLIDES FORMED AS A RESULT OF IRRADIATION ARE AS FOLLOWS:

Irradiated Material	Nuclide (half-life)
Plastic, Oil	^7Be (54 d)
Concrete	^{22}Na (2.6 y), ^{32}P (14.3 d), ^{45}Ca (165 d)
Aluminum	^{22}Na (2.6 y)
Iron, Steel	^{46}Sc (84 d), ^{51}Cr (28 d), ^{54}Mn (300 d), ^{57}Co (270 d), ^{58}Co (72 d), ^{60}Co (5.3 y), ^{55}Fe (2.9 y), ^{59}Fe (45 d)
Copper	^{65}Zn (245 d)

STUDIES OF PRIMARY BEAM LOSS AND ACTIVATION AT THE AGS HAVE PROVIDED A PRESCRIPTION TO PREDICT MAXIMUM ACTIVATION AND RESULTANT EXPOSURE RATE :

$$\chi = 4.1 \times 10^{-14} E^{1.2} N \ln(1 + T/t)$$

WHERE:

χ = exposure rate at 30 cm, mR/h,
E = nucleon energy, GeV,
N = nucleon loss rate, p/h,
T = irradiation time, h,
t = cooldown time, h.

SITE RESTORATION COST

DECONTAMINATION AND DECOMMISSIONING UNIT COST:

	<u>AMOUNT</u>	<u>COST PER BIN</u>
STEEL BIN COST	96 FT ³ OUTSIDE	\$700
STEEL BIN TRANSPORT COST	5 BINS / TRUCK	\$1,000
BOOK KEEPING, REMOVAL OF HAZARDOUS WASTE PARTS, AND RADIOACTIVITY DETERMINATION ¹	2 MAN-WEEKS	\$3,000
BURIAL COST	STEEL BIN	\$9,200
TOTAL FOR STEEL BIN (ITEMS < 100 mR/h)	96 FT ³ INSIDE	\$13,900
TOTAL FOR CONCRETE BIN (ITEMS > 100 mR/h)	80 FT ³ INSIDE	\$22,000

TOTAL COST FOR PACKING BINS AND BURIAL OF RADIOACTIVE PARTS:

	<u>VOLUME</u>	<u>TOTAL BINS</u>	<u>TOTAL COST</u>
BEAM LINE COMPONENTS	180 FT ³	2 STEEL	\$27,800
BEAM DUMPS	1300 FT ³	16 CON.	\$352,000
MAGNETS	180 FT ³	2 STEEL	\$27,800
TOTAL	1660 FT ³	20	\$407,600

¹ AGS Experience is 2 person-weeks per bin using FY91 waste certification requirements.

SITE RESTORATION COST

NON-HAZARDOUS NON-RADIOACTIVE D&D

	<u>AMOUNT</u>	<u>COST</u>
REMOVAL OF FACILITY	WALLS AND ROOF	\$1,000,000
BURIAL OF DEBRIS	4000 YD ³	\$20 / YD ³
TOTAL COST	-	\$1,080,000

CONSTRUCTION COST ESTIMATE DETAILS

**COST
SCHEDULE**

**H. Foelsche
Nov-91**

COST AND SCHEDULE

The cost and schedule baseline estimate is presented for a facility encompassing the necessary modifications of the accelerators, a beam distribution switchyard, and three experimental areas, fully equipped. One of these experimental areas is to be ready for commissioning by the first quarter of FY 1995, the other two by the first quarter of FY 1996. Scenarios and cost profiles stretching the schedule for completion to later years, or for a facility of reduced scope can be derived from this baseline information.

The baseline cost estimate for a full facility completed in FY 1995/96 as stated is 28.5 M\$ (at year \$), including 101.0 manyears of BNL manpower. This includes a contingency allowance for most systems of 25% for materials, 35% for personnel, and 20% for the conventional facilities. NOTE: This cost estimate includes zero (0%) contingency allowance for the Tandem MP6 voltage upgrade, since the costs are well established from a previous similar project on Tandem MP7.

The cost estimate summarized in these pages is based on detailed cost and manpower analyses of similar systems constructed and/or purchased by BNL in the recent past. The Summary Tables of the cost estimate are stated in FY92\$, or At-Year\$. More detailed backup information extending to lower levels of the Work Breakdown Structure is provided in Appendix II (Cost Estimate Details), and these continue to be stated in FY91\$.

The salary rates assumed in the detailed manpower analyses represent averages paid to BNL personnel in FY 1991 (see attached tabulation), and include an appropriate allowance for fringe benefits. In the summary tables these have been escalated to FY92\$ as well. The salary rates in the summary for each system represent averages which reflect the relative weight of the skills devoted to each.

It is assumed that BNL will charge a reduced overhead rate of 3.0% which is customary for construction projects, and that there are no other agency overhead charges.

Cost escalation factors for the outlying years are based on the most recent inflation rates assumed by the Department of Energy (DOE Guidance, updated February 1991), the same as those assumed for the Relativistic Heavy Ion Collider Project (RHIC). The cost extensions to "at year dollars" make the assumption that planned commitments for purchased materials are made uniformly over a given year and are expensed with an average delay of 6 months, and that the contractors' prices will reflect this delay. Salaries, on the other hand, are committed and fully expensed in the same year.

The schedule leading to a phased project completion in FY 1994 and FY 1995 is outlined in the attached tables. It assumes a small amount of early funding in FY 1992 for the purpose of proceeding with environmental approvals, to start in-house Title I Engineering, to solicit an Architect/Engineer firm for Title II design of conventional

facilities, as well as for starting detailed engineering of long-lead accelerator systems. With this early start the project should be ready for detailed design reviews in the first half of FY 1993. The modification of the Booster tunnel must be coordinated with a machine shutdown in the summer of 1992. The major cost commitments can be made in FY 1993 and FY 1994. Installation can then start in mid - FY 1994, with beam commissioning for Phase I beginning in the first quarter of FY 1995, and for Phase II at the start of FY 1996.

**COST SUMMARY
CONSTRUCTION AND OUTFITTING COSTS
BOOSTER APPLICATIONS FACILITY**

TOTAL COST	28.5 M\$ (AT YEAR \$)	Revised 10/30/91
	26.8 M\$ (FY 92 \$)	Revised 10/30/91
MATERIALS	21.1 M\$ (AT YEAR \$)	Revised 10/30/91
BNL LABOR	7.4 M\$ (101.0 MANYEARS)	Revised 10/30/91

INCLUDING: CONTINGENCY

MATERIALS	25 %
LABOR	35 %
BNL OVERHEAD	3 %

ESCALATION

DOE GUIDANCE, updated February 1991

	MATERIALS	LABOR
FY 92	1.000	1.000
FY 93	1.025	1.061
FY 94	1.053	1.126
FY 95	1.088	1.194
FY 96	1.102 cumulative	1.267

BNL SALARY RATES (FY 91)
Including Fringe Benefits

CLASSIFICATION	CODE	MONTHLY SALARY
Senior Scientist	1	7500
Junior Scientist	2	5000
Senior Engineer, Electrical	3	7000
Junior Engineer, Electrical	4	5500
Senior Engineer, Mechanical	5	7000
Junior Engineer, Mechanical	6	5500
Senior Engineer, Contract	7	4500
Junior Engineer, Contract	8	3500
Senior Computer Analyst	9	6000
Junior Computer Analyst	10	5000
Senior Designer	11	5500
Junior Designer	12	4500
Senior Designer, Contract	13	4200
Junior Designer, Contract	14	3300
Senior Technician, Electrical	15	5000
Junior Technician, Electrical	16	3500
Senior Technician, Mechanical	17	5000
Junior Technician, Mechanical	18	3500
Senior Technician, Electro-mechanical	19	5000
Junior Technician, Electro-mechanical	20	3500
Senior Technician, Electromechanical	21	2700
Junior Technician, Contract Labor	22	2000
Senior Technician, Contract Labor	23	6250
Senior Administrative	24	4200
Junior Administrative	25	3000
Senior Clerical/Support	26	2500
Junior Clerical/Support	27	6353
Building Trades	28	7303
Central Shops	29	5126
Staff Shop	30	6400
Davis Bacon Labor		

Figure 2

WBS #	DESCRIPTION	MATERIALS				PROJECT M&S		BNL LABOR SUMMARY				PROJECT TOTAL K\$
		Qt'y	unit	unit cost \$	cost basis	PROJECT M&S K\$	PROJECT M&S K\$	Net Project Months	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	
1.	BOOSTER APPLICATIONS FACILITY COST (AT YEAR \$)				28.5 M\$							
1.1	CONSTRUCTION (WITH CONTINGENCY)	1	LOT	6669581		0.0	6669.6	0.0	0	0.0	0.0	6669.6
1.2	EXTRACTION COMPONENTS	1	LOT	56295		0.0	56.3	62.6	5209	0.0	325.9	382.2
1.3	TRANSFER MAGNETS	1	LOT	1000853		68.2	932.6	92.4	4995	0.0	461.7	1394.4
1.4	EXTRACTION POWER SUPPLIES	1	LOT	245542		0.0	245.5	76.1	5135	0.0	391.0	636.5
1.5	TRANSFER POWER SUPPLIES	1	LOT	341030		0.0	341.0	21.6	5501	0.0	118.8	459.9
1.6	COLLINATORS, STRIPPERS, STOPS	1	LOT	873963		0.0	874.0	47.3	4279	0.0	202.3	1076.3
1.7	VACUUM SYSTEM	1	LOT	372975		32.2	340.8	56.3	6335	0.0	356.6	697.4
1.8	CONTROLS	1	LOT	442219		0.0	442.2	117.0	5522	0.0	646.0	1088.3
1.9	BEAM INSTRUMENTATION	1	LOT	380732		0.0	380.7	33.5	5780	0.0	193.6	574.4
1.10	EXPERIMENTAL AREA OUTFITTING	1	LOT	1623506		152.7	1470.8	62.7	4432	0.0	277.7	1748.5
1.11	UTILITIES & SERVICES	1	LOT	437740		0.0	437.7	11.0	6928	0.0	76.2	513.9
1.12	TANDEM & BEAM MODIFICATIONS (with contingency)	1	LOT	4256515		50.9	4205.6	154.4	5659	0.0	873.5	5079.1
1.13	INSTALLATION	1	LOT	1254618		20.4	1234.3	129.8	4966	5.2	642.7	1877.0
1.14	GENERAL SYSTEM SUPPORT	1	LOT	254500		86.5	168.0	73.0	5948	0.0	434.2	602.2
1.15	CONTINGENCY (1.2 to 1.14) (except 1.12)	25%	OF	6924008			1731.0	274.1	= 35%	1.8	1444.4	3175.4
1.16	BNL OVERHEAD	3.0%	OF ABOVE				585.9				193.3	779.3
	SUBTOTAL (FY 1992 K\$)					410.9	20116.1	1211.8	MAN MONTHS	7.0	6638.1	26754.3
1.	ESCALATION (FY93 to FY96)						985.5				738.4	1723.9
	TOTAL (AT YEAR K\$)					410.9	21101.6	101.0	MAN YEARS	7.0	7376.6	28478.1

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WBS #	DESCRIPTION	PROJECT TOTAL K\$	TOTAL COMMITMENT PROFILE (ANNUAL K\$)				
			FY 1991	FY 1992	FY 1993	FY 1994	FY 1995
1.	BOOSTER APPLICATIONS FACILITY						
1.1	CONSTRUCTION (WITH CONTINGENCY)	6669.6	0.0	685.0	5984.6	0.0	0.0
1.2	EXTRACTION COMPONENTS	382.2	0.0	239.8	142.4	0.0	0.0
1.3	TRANSFER MAGNETS	1394.4	0.0	40.8	889.9	380.1	83.5
1.4	EXTRACTION POWER SUPPLIES	636.5	0.0	433.1	182.1	21.3	0.0
1.5	TRANSFER POWER SUPPLIES	459.9	0.0	11.7	278.5	155.6	14.1
1.6	COLLINATORS, STRIPPERS, STOPS	1076.3	0.0	83.5	931.6	46.9	14.3
1.7	VACUUM SYSTEM	697.4	0.0	49.9	337.1	254.6	55.8
1.8	CONTROLS	1088.3	0.0	0.0	306.1	556.1	226.1
1.9	BEAM INSTRUMENTATION	574.4	0.0	0.0	299.4	235.1	39.8
1.10	EXPERIMENTAL AREA OUTFITTING	1748.5	0.0	0.0	231.0	839.4	678.1
1.11	UTILITIES & SERVICES	513.9	0.0	0.0	88.5	397.1	28.3
1.12	TANDEM & BEAM MODIFICATIONS	5079.1	0.0	1221.6	1954.9	1634.9	267.7
1.13	(with contingency) INSTALLATION	1877.0	0.0	0.0	132.3	1121.4	540.2
1.14	GENERAL SYSTEM SUPPORT	602.2	0.0	175.2	206.2	127.5	93.3
1.15	CONTINGENCY (1.2 to 1.14)	3175.4	0.0	41.7	638.6	1088.8	1032.5
1.16	(except 1.12) BNL OVERHEAD	779.3	0.0	89.5	378.1	205.8	92.2
	SUBTOTAL (FY 1992 K\$)	26754.3	0.0	3071.7	12981.4	7064.6	3166.1
	ESCALATION (FY93 to FY96)	1723.9	0.0	29.4	545.7	640.5	425.5
1.	TOTAL (AT YEAR K\$)	28478.1	0.0	3101.1	13527.2	7705.1	3591.6
	CUMULATIVE		0.0	3101.1	16628.2	24333.3	27924.9
							28478.1

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WBS #	DESCRIPTION	MATERIALS COMMITMENT PROFILE (ANNUAL K\$)					LABOR FY 1991	COMMITMENT & EXPENSE PROFILE (ANNUAL K\$)						
		FY 1991	FY 1992	FY 1993	FY 1994	FY 1995		FY 1996	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996
1.	BOOSTER APPLICATIONS FACILITY													
1.1	CONSTRUCTION (WITH CONTINGENCY)	0.0	685.0	5984.6	0.0	0.0	0.0	0	0	0	0	0	0	0
1.2	EXTRACTION COMPONENTS	0.0	43.5	12.8	0.0	0.0	0.0	0.0	196.3	129.6	0.0	0.0	0.0	0.0
1.3	TRANSFER MAGNETS	0.0	0.0	658.7	253.1	20.9	0.0	0.0	40.8	231.2	127.1	62.6	0.0	0.0
1.4	EXTRACTION POWER SUPPLIES	0.0	238.1	7.4	0.0	0.0	0.0	0.0	195.0	174.7	21.3	0.0	0.0	0.0
1.5	TRANSFER POWER SUPPLIES	0.0	0.0	239.2	101.8	0.0	0.0	0.0	11.7	39.3	53.8	14.1	0.0	0.0
1.6	COLLIMATORS, STRIPPERS, STOPS	0.0	7.1	849.4	3.1	14.3	0.0	0.0	76.4	82.2	43.8	0.0	0.0	0.0
1.7	VACUUM SYSTEM	0.0	0.0	194.3	126.9	19.5	0.0	0.0	49.9	142.8	127.7	36.3	0.0	0.0
1.8	CONTROLS	0.0	0.0	190.5	146.8	104.9	0.0	0.0	0.0	115.6	409.2	121.2	0.0	0.0
1.9	BEAM INSTRUMENTATION	0.0	0.0	275.6	105.2	0.0	0.9	0.0	0.0	23.9	130.0	39.8	0.0	0.0
1.10	EXPERIMENTAL AREA OUTFITTING	0.0	0.0	217.4	674.8	578.5	0.0	0.0	0.0	13.6	164.6	99.6	0.0	0.0
1.11	UTILITIES & SERVICES	0.0	0.0	66.2	349.5	22.1	0.0	0.0	0.0	22.3	47.6	6.3	0.0	0.0
1.12	TANDEM & BEAM MODIFICATIONS (with contingency)	0.0	1221.6	1590.2	1190.2	203.6	0.0	0.0	0.0	364.7	444.7	64.1	0.0	0.0
1.13	INSTALLATION	0.0	0.0	55.0	698.7	397.8	82.7	0.0	0.0	77.3	422.7	142.4	0.3	0.3
1.14	GENERAL SYSTEM SUPPORT	0.0	44.5	47.1	44.5	31.8	0.0	0.0	130.7	159.1	83.0	61.5	0.0	0.0
1.15	CONTINGENCY (1.2 to 1.14) (except 1.12)	0.0	41.7	393.4	664.8	461.8	169.4	0.0	0.0	245.3	424.1	570.7	204.4	204.4
1.16	BNL OVERHEAD	0.0	68.4	323.5	130.8	55.7	7.6	0.0	21.0	54.6	75.0	36.6	6.1	6.1
	SUBTOTAL (FY 1992 K\$)	0.0	2349.9	11105.3	4490.2	1911.0	259.7	0.0	721.7	1876.1	2574.3	1255.1	210.8	210.8
	ESCALATION (FY93 to FY96)	0.0	29.4	431.3	316.9	181.5	26.4	0.0	0.0	114.4	323.6	244.0	56.3	56.3
1.	T O T A L (AT YEAR K\$)	0.0	2379.3	11536.6	4807.1	2092.5	286.1	0.0	721.7	1990.6	2898.0	1499.1	267.1	267.1
	INFLATION FACTORS ::		1.000	1.025	1.053	1.088	1.102 *		1.000	1.061	1.126	1.194	1.267 *	1.267 *

WBS #	DESCRIPTION	MATERIALS				PROJECT M&S		BNL LABOR SUMMARY				PROJECT TOTAL K\$
		Qty	unit	unit cost \$	cost basis \$	INVENTORY M&S K\$	PROJECT M&S K\$	Net Project Months	Rate \$/month	AVAILABLE LABOR K\$	LABOR K\$	
COST ESTIMATE IN FY 1991 \$DOLLARS												
						403.60	19184.88	1211.8	4.87	6074.27		25259.15
1.	BOOSTER APPLICATIONS FACILITY											
1.1	CONSTRUCTION (WITH CONTINGENCY)											
1.1.1	BEAM TUNNELS	1	LOT	6551651		0.00	6551.65		0.00	0.00	0.00	6551.65
1.1.2	SUPPORT BUILDING	1	LOT	1057018		0.00	1057.02		0.00	0.00	0.00	1057.02
1.1.3	EXPERIMENTAL AREAS	1	LOT	810303		0.00	810.30		0.00	0.00	0.00	810.30
1.1.4	SITE WORK	1	LOT	1693755		0.00	1693.76		0.00	0.00	0.00	1693.76
1.1.5	CONTINGENCY (1.1.1 - 1.1.4)	1	LOT	510600		0.00	510.60		0.00	0.00	0.00	510.60
1.1.6	FIELD SUPERVISION & OVERHEAD	20% of		4071675		0.00	814.34		0.00	0.00	0.00	814.34
1.1.7	CONTRACTOR PROFIT & OVERHEAD	6% of		4886010		0.00	293.16		0.00	0.00	0.00	293.16
1.1.8	ENGINEERING & ADMINISTRATION	15% of		5179171		0.00	776.88		0.00	0.00	0.00	776.88
		10% of		5956046		0.00	595.60		0.00	0.00	0.00	595.60
1.2	EXTRACTION COMPONENTS											
1.2.1	SEPTUM MAGNET	1	LOT	55300		0.00	55.30		0.00	0.00	0.00	55.30
1.2.2	ELECTROSTATIC SEPTUM	1	UNIT	34800		0.00	34.80		0.00	0.00	0.00	34.80
		1	UNIT	20500		0.00	20.50		0.00	0.00	0.00	20.50
1.3	TRANSFER MAGNETS											
1.3.1	QUADRUPOLES	1	LOT	983156		67.00	916.16		0.00	0.00	0.00	916.16
1.3.2	H DIPOLE	25	UNITS	18780		0.00	469.49		0.00	0.00	0.00	469.49
1.3.3	C DIPOLE	3	EACH	70553		29.00	182.66		0.00	0.00	0.00	182.66
1.3.4	OCTUPOLES	1	EACH	112804		28.00	84.80		0.00	0.00	0.00	84.80
1.3.5	TRIM DIPOLES	6	EACH	9867		0.00	59.20		0.00	0.00	0.00	59.20
1.3.6	WOBBLER	16	EACH	3125		10.00	40.00		0.00	0.00	0.00	40.00
		2	EACH	40000		0.00	80.00		0.00	0.00	0.00	80.00
1.4	EXTRACTION POWER SUPPLIES											
1.4.1	SEPTUM MAGNET POWER SUPPLY	1	LOT	241200		0.00	241.20		0.00	0.00	0.00	241.20
1.4.2	E/S SEPTUM POWER SUPPLY	1	UNITS	35900		0.00	35.90		0.00	0.00	0.00	35.90
1.4.3	SEXTUPOLE POWER SUPPLY	2	EACH	22300		0.00	22.30		0.00	0.00	0.00	22.30
1.4.4	EXTRACTION BUMP POWER SUPPLY	2	EACH	10000		0.00	20.00		0.00	0.00	0.00	20.00
1.4.5	SPILL SERVO	8	EACH	20000		0.00	160.00		0.00	0.00	0.00	160.00
		1	EACH	3000		0.00	3.00		0.00	0.00	0.00	3.00
1.5	TRANSFER POWER SUPPLIES											
1.5.1	QUADRUPOLE POWER SUPPLY	1	LOT	335000		0.00	335.00		0.00	0.00	0.00	335.00
1.5.2	DIPOLE POWER SUPPLY	25	EACH	5000		0.00	125.00		0.00	0.00	0.00	125.00
1.5.3	OCTUPOLE POWER SUPPLY	4	EACH	35000		0.00	140.00		0.00	0.00	0.00	140.00
1.5.4	TRIM DIPOLE POWER SUPPLIES	6	EACH	5000		0.00	30.00		0.00	0.00	0.00	30.00
		16	EACH	2500		0.00	40.00		0.00	0.00	0.00	40.00
1.6	COLLIMATORS, STRIPPERS, STOPS											
1.6.1	ADJUSTABLE COLLIMATOR	1	LOT	858510		0.00	858.51		0.00	0.00	0.00	858.51
1.6.2	STRIPPER	8	ea	7045		0.00	56.36		0.00	0.00	0.00	56.36
1.6.3	BEAM STOPS	2	ea	6075		0.00	12.15		0.00	0.00	0.00	12.15
1.6.4	COLLIMATOR CONTROL PC-WER	3	ea	260000		0.00	780.00		0.00	0.00	0.00	780.00
		10	ea	1000		0.00	10.00		0.00	0.00	0.00	10.00
1.7	VACUUM SYSTEM											
1.7.1	INLINE COMPONENTS	1	LOT	366380		31.60	334.78		0.00	0.00	0.00	334.78
1.7.2	ION PUMPS & P.S.	1	lot	154460		31.60	122.86		0.00	0.00	0.00	122.86
1.7.3	ROUGHING STATIONS	1	lot	41520		0.00	41.52		0.00	0.00	0.00	41.52
1.7.4	VACUUM INSTRUM. & CONTROL	4	ea	24000		0.00	96.00		0.00	0.00	0.00	96.00
		1	lot	74400		0.00	74.40		0.00	0.00	0.00	74.40

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WBS #	DESCRIPTION	MATERIALS				PROJECT		BNL LABOR SUMMARY				PROJECT TOTAL K\$
		Qty	unit	unit cost \$	cost basis	INVENTORY M&S K\$	M&S K\$	Net Project Months	Rate \$/month	AVAILABLE LAE R K\$	LABOR K\$	
1.8	CONTROLS	1	LOT	434400		0.00	434.40	117.00	5204	0.00	608.90	1043.30
1.8.1	TIMING SYSTEM	1	lot	9500		0.00	9.50	5.00	4300	0.00	21.50	31.00
1.8.2	CONTROL ROOM	1	lot	113500		0.00	113.50	14.00	357	0.00	61.00	174.50
1.8.3	NETWORK	1	lot	37600		0.00	37.60	5.00	300	0.00	26.50	64.10
1.8.4	SOFTWARE DEVELOPMENT	1	lot	17000		0.00	17.00	18.00	5000	0.00	90.00	107.00
1.8.5	TVDG PROCESS CONTROLS	1	lot	26500		0.00	26.50	17.00	5735	0.00	97.50	124.00
1.8.6	BOOSTER EXTRACTION CONTROLS	1	lot	24200		0.00	24.20	14.00	6000	0.00	84.00	108.20
1.8.7	BEAM PROCESS CONTROLS	1	lot	50100		0.00	50.10	24.00	4850	0.00	116.40	166.50
1.8.8	INTERLOCK SYSTEM	1	lot	120000		0.00	120.00	6.00	5000	0.00	30.00	150.00
1.8.9	CONTROL SYSTEM INTEGRATION	1	lot	36000		0.00	36.00	14.00	5857	0.00	82.00	118.00
1.9	BEAM INSTRUMENTATION	1	LOT	374000		0.00	374.00	33.50	5448	0.00	182.50	556.50
1.9.1	BEAM PROFILE MONITOR	8	ea	33000		0.00	264.00	14.00	5857	0.00	82.00	346.00
1.9.2	SECONDARY EMISSION CHAMBERS	4	ea	1500		0.00	6.00	2.00	5000	0.00	10.00	16.00
1.9.3	FLAG SYSTEM	5	ea	10800		0.00	54.00	8.50	5353	0.00	45.50	99.50
1.9.4	DATA ACQUISITION & DISPLAY	1	lot	50000		0.00	50.00	9.00	5000	0.00	45.00	95.00
1.10	EXPERIMENTAL AREA OUTFITTING	1	LOT	1594800		150.00	1444.80	62.66	4178	0.00	261.77	1706.57
1.10.1	TARGET AREA B (CELL CULTURE)	1	lot	281000		50.00	231.00	10.00	4025	0.00	40.25	271.25
1.10.2	TARGET AREA A (LARGE BEAM)	1	lot	194000		50.00	144.00	9.50	4053	0.00	38.50	182.50
1.10.3	TARGET AREA C	1	lot	638000		50.00	588.00	20.00	3763	0.00	75.25	663.25
1.10.4	READY ROOM B	1	lot	43200		0.00	43.20	5.16	4606	0.00	23.77	66.97
1.10.5	READY ROOM A	1	lot	45200		0.00	45.20	5.00	4550	0.00	22.75	67.95
1.10.6	READY ROOM C	1	lot	36500		0.00	36.50	5.00	4550	0.00	22.75	59.25
1.10.7	SUPPORT LAB EQUIPMENT	1	lot	356900		0.00	356.90	8.00	4813	0.00	38.50	395.40
1.11	UTILITIES & SERVICES	1	LOT	430000		0.00	430.00	11.00	6529	0.00	71.82	501.82
1.11.1	ELECTRICAL POWER DISTRIBUTION	1	LOT	130000		0.00	130.00	3.00	6569	0.00	19.71	149.71
1.11.2	COOLING WATER SYSTEM	1	LOT	300000		0.00	300.00	8.00	6515	0.00	52.12	352.12
1.12	TANDEM & BEAM MODIFICATIONS	1	LOT	4181252		50.00	4131.25	154.35	5334	0.00	823.29	4954.54
1.12.1	MP6 TANDEM UPGRADE	1	LOT	2220002		0.00	2220.00	45.00	5333	0.00	249.00	2469.00
1.12.2	BEAM BYPASS	1	LOT	1961250		50.00	1911.25	109.35	5252	0.00	574.29	2485.54
1.13	INSTALLATION	1	LOT	1232434		20.00	1212.43	129.80	4680	4.87	605.75	1818.18
1.13.1	CABLE	1	lot	794910		0.00	794.91	29.87	5505	0.00	164.43	959.34
1.13.2	TRAY	4000	ft	15		0.00	60.00	0.00	0.00	0.00	0.00	60.00
1.13.3	COOLING WATER HOSE	1	lot	11024		0.00	11.02	5.73	5591	0.00	32.06	43.08
1.13.4	MISCELLANEOUS PARTS	1	lot	5000		0.00	5.00	1.00	6353	0.00	6.35	11.35
1.13.5	STAGING	1	lot	500		0.00	0.50	1.00	6353	0.00	6.35	6.85
1.13.6	RIGGING	1	lot	0		0.00	0.00	11.60	6353	0.00	73.69	73.69
1.13.7	SURVEY	1	lot	0		0.00	0.00	3.32	6353	0.00	21.09	21.09
1.13.8	HOOKUP	1	lot	0		0.00	0.00	28.93	3526	0.00	102.03	102.03
1.13.9	RUN & TEST	1	lot	0		0.00	0.00	33.01	3523	0.00	116.31	441.31
1.13.10	INSTALLATION SUPPORT	1	LOT	36000		20.00	16.00	15.33	5519	4.87	83.43	99.43
1.14	GENERAL SYSTEM SUPPORT	1	LOT	250000		85.00	165.00	73.00	5606	0.00	409.25	574.25
1.14.1	MANUFACTURING SUPPORT	1	LOT	210000		85.00	125.00	31.00	5145	0.00	159.50	284.50
1.14.2	DESIGN SUPPORT	1	LOT	15000		0.00	15.00	12.00	5500	0.00	66.00	31.00
1.14.3	ADMINISTRATION & MANAGEMENT	1	LOT	25000		0.00	25.00	30.00	6125	0.00	183.75	208.75
1.15	CONTINGENCY	25%	OF	6801580			1700.39	274.15	=	35%	1361.36	3061.76

H. Foetsche

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BOOSTER APPLICATIONS FACILITY

SCHEDULE

REVIEW OF PHASE II REPORT	11/91
FUNDING AND DOE APPROVAL FOR ENGINEERING	start 1/92
SOLICIT ARCHITECT ENGINEER	
TITLE I ENGINEERING	complete 8/92
TITLE II DESIGN, CONTRACT BID	complete 4/93
ENGINEERING OF BEAM COMPONENTS	complete 10/92
DETAILED DESIGN, REVIEW	complete 4/93
CIVIL CONSTRUCTION	start 5/93
Phase I Beneficial Occupancy	6/94
COMPONENT FABRICATION	Phase I 6/94 complete 6/95
COMPONENT INSTALLATION	Phase I 9/94 complete 9/95
OPERATIONS	Phase I start 12/94
Commissioning Phase II	start 10/95

BOOSTER APPLICATIONS FACILITY

SCHEDULE

		FY 92 .	FY 93 .	FY 94 .	FY 95 .
REVIEW OF PHASE II REPORT	11/91				
FUNDING AND DOE APPROVAL FOR ENGINEERING	start 1/92	*			
SOLICIT ARCHITECT ENGINEER					
TITLE I ENGINEERING	complete 8/92	*			
TITLE II DESIGN, CONTRACT BID	complete 4/93	*			
ENGINEERING OF BEAM COMPONENTS	complete 10/92		*		
DETAILED DESIGN, REVIEW	complete 4/93		*		
CIVIL CONSTRUCTION	start 5/93			*	
Phase I Beneficial Occupancy	6/94			*	
COMPONENT FABRICATION	Phase I 6/94 complete 6/95				*
COMPONENT INSTALLATION	Phase I 9/94 complete 9/95				*
OPERATIONS	Phase I start 12/94 Commissioning Phase II start 10/95				*

BOOSTER APPLICATIONS FACILITY PROJECT SCHEDULE

ITEM	FY 92				FY 93				FY 94														
	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q											
	O	N	D	J	F	M	A	M	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
A/E SOLICITATION																							
TITLE I																							
PRELIMINARY DESIGN																							
PROJT. MNGMT. PLAN																							
REVIEW & APPROVAL																							
ENVIRONMENTAL APPRVL																							
TITLE II																							
DETAIL DESIGN																							
BID & AWARD																							
TITLE III																							
CONSTRUCTION INSPECT.																							
MOBILIZATION																							
EXCAVATION																							
CONC. FND, WALLS, ROOF																							
TUNNEL ERECTION																							
EARTH SHIELDING																							
PRE-ENGR'D BLDG																							
EXTERIOR WALLS																							
INTERIOR PARTITIONS																							
INTERIOR FINISHES																							
ELECTRICAL WORK																							
MECHANICAL WORK																							
SITE RESTORATION																							
CLEAN UP / PUNCH LIST																							

CONSTRUCTION COMPLETE 5-31-94

CONSTRUCTION START 5-1-93

BROOKHAVEN NATIONAL LABORATORY

BOOSTER APPLICATIONS FACILITY

COST ESTIMATE

H. Foelsche

Nov-91

WBS #	DESCRIPTION	MATERIALS				PROJECT M&S				BNL LABOR SUMMARY				PROJECT TOTAL K\$	
		Qt'y	unit	unit cost \$	cost basis \$	cost inventory M&S K\$	PROJECT M&S K\$	Net Project #months	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$	PROJECT TOTAL K\$		
1.	BOOSTER APPLICATIONS FACILITY COST (AT YEAR \$)					28.5 MS									
1.1	CONSTRUCTION (WITH CONTINGENCY)	1	LOT	6669581		0.0	6669.6	0.0	0	0.0	0.0	6669.6	6669.6		
1.2	EXTRACTION COMPONENTS	1	LOT	56295		0.0	56.3	62.6	5209	0.0	325.9	382.2	382.2		
1.3	TRANSFER MAGNETS	1	LOT	1000853		68.2	932.6	92.4	4995	0.0	461.7	1394.4	1394.4		
1.4	EXTRACTION POWER SUPPLIES	1	LOT	245542		0.0	245.5	76.1	5135	0.0	391.0	636.5	636.5		
1.5	TRANSFER POWER SUPPLIES	1	LOT	341030		0.0	341.0	21.6	5501	0.0	118.8	459.9	459.9		
1.6	COLLIMATORS, STRIPPERS, STOPS	1	LOT	873963		0.0	874.0	47.3	4279	0.0	202.3	1076.3	1076.3		
1.7	VACUUM SYSTEM	1	LOT	372975		32.2	340.8	56.3	6335	0.0	356.6	697.4	697.4		
1.8	CONTROLS	1	LOT	442219		0.0	442.2	117.0	5522	0.0	646.0	1088.3	1088.3		
1.9	BEAM INSTRUMENTATION	1	LOT	380732		0.0	380.7	33.5	5780	0.0	193.6	574.4	574.4		
1.10	EXPERIMENTAL AREA OUTFITTING	1	LOT	1623506		152.7	1470.8	62.7	4432	0.0	277.7	1748.5	1748.5		
1.11	UTILITIES & SERVICES	1	LOT	437740		0.0	437.7	11.0	6928	0.0	76.2	513.9	513.9		
1.12	TANDEM & BEAM MODIFICATIONS (with contingency)	1	LOT	4256515		50.9	4205.6	154.4	5659	0.0	873.5	5079.1	5079.1		
1.13	INSTALLATION	1	LOT	1254618		20.4	1234.3	129.8	4966	5.2	642.7	1877.0	1877.0		
1.14	GENERAL SYSTEM SUPPORT	1	LOT	254500		86.5	168.0	73.0	5948	0.0	434.2	602.2	602.2		
1.15	CONTINGENCY (1.2 to 1.14) (except 1.12)	25%	OF	6924008			1731.0	274.1	=	35%	1444.4	3175.4	3175.4		
1.16	BNL OVERHEAD	3.0%	OF ABOVE				585.9				193.3	779.3	779.3		
	SUBTOTAL (FY 1992 K\$)					410.9	20116.1	1211.8	MAN MONTHS	7.0	6638.1	26754.3	26754.3		
	ESCALATION (FY93 to FY96)						985.5				738.4	1723.9	1723.9		
1.	TOTAL (AT YEAR K\$)					410.9	21101.6	101.0	MAN YEARS	7.0	7376.6	28478.1	28478.1		

(DOE GUIDANCE, FEBRUARY 1991 UPDATE)

WBS #	DESCRIPTION	PROJECT TOTAL K\$	TOTAL COMMITMENT PROFILE (ANNUAL K\$)						
			FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	
1.	BOOSTER APPLICATIONS FACILITY								
1.1	CONSTRUCTION (WITH CONTINGENCY)	6669.6	0.0	685.0	5984.6	0.0	0.0	0.0	0.0
1.2	EXTRACTION COMPONENTS	382.2	0.0	239.8	142.4	0.0	0.0	0.0	0.0
1.3	TRANSFER MAGNETS	1394.4	0.0	40.8	889.9	380.1	83.5	0.0	0.0
1.4	EXTRACTION POWER SUPPLIES	636.5	0.0	433.1	182.1	21.3	0.0	0.0	0.0
1.5	TRANSFER POWER SUPPLIES	459.9	0.0	11.7	278.5	155.6	14.1	0.0	0.0
1.6	COLLIMATORS, STRIPPERS, STOPS	1076.3	0.0	83.5	931.6	46.9	14.3	0.0	0.0
1.7	VACUUM SYSTEM	697.4	0.0	49.9	337.1	254.6	55.8	0.0	0.0
1.8	CONTROLS	1088.3	0.0	0.0	306.1	556.1	226.1	0.0	0.0
1.9	BEAM INSTRUMENTATION	574.4	0.0	0.0	299.4	235.1	39.8	0.0	0.0
1.10	EXPERIMENTAL AREA OUTFITTING	1748.5	0.0	0.0	231.0	839.4	678.1	0.0	0.0
1.11	UTILITIES & SERVICES	513.9	0.0	0.0	88.5	397.1	28.3	0.0	0.0
1.12	TANDEM & BEAM MODIFICATIONS (with contingency)	5079.1	0.0	1221.6	1954.9	1634.9	267.7	0.0	0.0
1.13	INSTALLATION	1877.0	0.0	0.0	132.3	1121.4	540.2	83.0	0.0
1.14	GENERAL SYSTEM SUPPORT	602.2	0.0	175.2	206.2	127.5	93.3	0.0	0.0
1.15	CONTINGENCY (1.2 to 1.14) (except 1.12)	3175.4	0.0	41.7	638.6	1088.8	1032.5	373.8	0.0
1.16	BNL OVERHEAD	779.3	0.0	89.5	378.1	205.8	92.2	13.7	0.0
	SUBTOTAL (FY 1992 K\$)	26754.3	0.0	3071.7	12981.4	7064.6	3166.1	470.5	0.0
	ESCALATION (FY93 to FY96)	1723.9	0.0	29.4	545.7	640.5	425.5	82.7	0.0
1.	T O T A L (AT YEAR K\$)	28478.1	0.0	3101.1	13527.2	7705.1	3591.6	553.2	0.0
	CUMULATIVE		0.0	3101.1	16628.2	24333.3	27924.9	28478.1	0.0

WBS #	DESCRIPTION	MATERIALS COMMITMENT PROFILE (ANNUAL K\$)					LABOR COMMITMENT & EXPENSE PROFILE (ANNUAL K\$)						
		FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996
1.	BOOSTER APPLICATIONS FACILITY												
1.1	CONSTRUCTION (WITH CONTINGENCY)	0.0	685.0	5984.6	0.0	0.0	0.0	0	0	0	0	0	0
1.2	EXTRACTION COMPONENTS	0.0	43.5	12.8	0.0	0.0	0.0	0.0	196.3	129.6	0.0	0.0	0.0
1.3	TRANSFER MAGNETS	0.0	0.0	658.7	253.1	20.9	0.0	0.0	40.8	231.2	127.1	62.6	0.0
1.4	EXTRACTION POWER SUPPLIES	0.0	238.1	7.4	0.0	0.0	0.0	0.0	195.0	174.7	21.3	0.0	0.0
1.5	TRANSFER POWER SUPPLIES	0.0	0.0	239.2	101.8	0.0	0.0	0.0	11.7	39.3	53.8	14.1	0.0
1.6	COLLIMATORS, STRIPPERS, STOPS	0.0	7.1	849.4	3.1	14.3	0.0	0.0	76.4	82.2	43.8	0.0	0.0
1.7	VACUUM SYSTEM	0.0	0.0	194.3	126.9	19.5	0.0	0.0	49.9	142.8	127.7	36.3	0.0
1.8	CONTROLS	0.0	0.0	190.5	146.8	104.9	0.0	0.0	0.0	115.6	409.2	121.2	0.0
1.9	BEAM INSTRUMENTATION	0.0	0.0	275.6	105.2	0.0	0.0	0.0	0.0	23.9	130.0	39.8	0.0
1.10	EXPERIMENTAL AREA OUTFITTING	0.0	0.0	217.4	674.8	578.5	0.0	0.0	0.0	13.6	164.6	99.6	0.0
1.11	UTILITIES & SERVICES	0.0	0.0	66.2	349.5	22.1	0.0	0.0	0.0	22.3	47.6	6.3	0.0
1.12	TANDEM & BEAM MODIFICATIONS (with contingency)	0.0	1221.6	1590.2	1190.2	203.6	0.0	0.0	0.0	364.7	444.7	64.1	0.0
1.13	INSTALLATION	0.0	0.0	55.0	698.7	397.8	82.7	0.0	0.0	77.3	422.7	142.4	0.3
1.14	GENERAL SYSTEM SUPPORT	0.0	44.5	47.1	44.5	31.8	0.0	0.0	130.7	159.1	83.0	61.5	0.0
1.15	CONTINGENCY (1.2 to 1.14) (except 1.12)	0.0	41.7	393.4	664.8	461.8	169.4	0.0	0.0	245.3	424.1	570.7	204.4
1.16	BNL OVERHEAD	0.0	68.4	323.5	130.8	55.7	7.6	0.0	21.0	54.6	75.0	36.6	6.1
	SUBTOTAL (FY 1992 K\$)	0.0	2349.9	11105.3	4490.2	1911.0	259.7	0.0	721.7	1876.1	2574.3	1255.1	210.8
	ESCALATION (FY93 to FY96)	0.0	29.4	431.3	316.9	181.5	26.4	0.0	0.0	114.4	323.6	244.0	56.3
1.	TOTAL (AT YEAR K\$)	0.0	2379.3	11536.6	4807.1	2092.5	286.1	0.0	721.7	1990.6	2898.0	1499.1	267.1
	INFLATION FACTORS ::		1.000	1.025	1.053	1.088	1.102 *		1.000	1.061	1.126	1.194	1.267 *

WBS #	DESCRIPTION	MATERIALS				PROJECT M&S		BNL LABOR SUMMARY				PROJECT TOTAL K\$
		Qty	unit	unit cost \$	cost basis \$	INVENTORY M&S K\$	PROJECT M&S K\$	Net Project Months	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	
COST ESTIMATE IN FY 1991 \$DOLLARS												
1.	BOOSTER APPLICATIONS FACILITY					403.60	19184.88	WITHOUT BNL OVERHEAD				25259.15
1.1	CONSTRUCTION (WITH CONTINGENCY)											
1.1.1	BEAM TUNNELS	1	LOT	6551651		0.00	6551.65			0.00	0.00	6551.65
1.1.1	SUPPORT BUILDING	1	LOT	1057018		0.00	1057.02			0.00	0.00	1057.02
1.1.2	EXPERIMENTAL AREAS	1	LOT	810303		0.00	810.30			0.00	0.00	810.30
1.1.3	SITE WORK	1	LOT	1693755		0.00	1693.76			0.00	0.00	1693.76
1.1.4	CONTINGENCY (1.1.1 - 1.1.4)	1	LOT	510600		0.00	510.60			0.00	0.00	510.60
1.1.5	FIELD SUPERVISION & OVERHEAD	20%	of	4071675		0.00	814.34			0.00	0.00	814.34
1.1.6	CONTRACTOR PROFIT & OVERHEAD	6%	of	4886010		0.00	293.16			0.00	0.00	293.16
1.1.7	ENGINEERING & ADMINISTRATION	15%	of	5179171		0.00	776.88			0.00	0.00	776.88
1.1.8		10%	of	5956046		0.00	595.60			0.00	0.00	595.60
1.2	EXTRACTION COMPONENTS	1	LOT	55300		0.00	55.30	62.56	4910	0.00	307.15	362.45
1.2.1	SEPTUM MAGNET	1	UNIT	34800		0.00	34.80	31.68	4966	0.00	157.31	192.11
1.2.2	ELECTROSTATIC SEPTUM	1	UNIT	20500		0.00	20.50	30.88	4852	0.00	149.84	170.34
1.3	TRANSFER MAGNETS	1	LOT	983156		67.00	916.16	92.44	4708	0.00	435.18	1351.33
1.3.1	QUADRUPOLES	25	UNITS	18780		0.00	469.49	32.00	4460	0.00	142.71	612.20
1.3.2	H DIPOLE	3	EACH	70553		29.00	182.66	10.00	5232	0.00	52.32	234.98
1.3.3	C DIPOLE	1	EACH	112804		28.00	84.80	24.00	5234	0.00	125.61	210.41
1.3.4	OCTUPOLES	6	EACH	9867		0.00	59.20	12.92	4893	0.00	63.22	122.42
1.3.5	TRIM DIPOLES	16	EACH	3125		10.00	40.00	8.19	3989	0.00	32.65	72.65
1.3.6	WOBBLER	2	EACH	40000		0.00	80.00	5.33	3500	0.00	18.67	98.67
1.4	EXTRACTION POWER SUPPLIES	1	LOT	241200		0.00	241.20	76.13	4840	0.00	368.48	609.68
1.4.1	SEPTUM MAGNET POWER SUPPLY	1	UNITS	35900		0.00	35.90	39.33	4690	0.00	184.48	220.38
1.4.2	E/S SEPTUM POWER SUPPLY	1	UNITS	22300		0.00	22.30	20.13	4751	0.00	95.66	117.96
1.4.3	SEXTUPOLE POWER SUPPLY	2	EACH	10000		0.00	20.00	2.53	5395	0.00	13.67	33.67
1.4.4	EXTRACTION BUMP POWER SUPPLY	8	EACH	20000		0.00	160.00	8.27	5242	0.00	43.33	203.33
1.4.5	SPILL SERVO	1	EACH	3000		0.00	3.00	5.87	5341	0.00	31.33	34.33
1.5	TRANSFER POWER SUPPLIES	1	LOT	335000		0.00	335.00	21.60	5185	0.00	112.00	447.00
1.5.1	QUADRUPOLE POWER SUPPLY	25	EACH	5000		0.00	125.00	8.67	5115	0.00	44.33	169.33
1.5.2	DIPOLE POWER SUPPLY	4	EACH	35000		0.00	140.00	3.07	5326	0.00	16.33	156.33
1.5.3	OCTUPOLE POWER SUPPLY	6	EACH	5000		0.00	30.00	3.60	5278	0.00	19.00	49.00
1.5.4	TRIM DIPOLE POWER SUPPLIES	16	EACH	2500		0.00	40.00	6.27	5160	0.00	32.33	72.33
1.6	COLLIMATORS, STRIPPERS, STOPS	1	LOT	858510		0.00	858.51	47.29	4033	0.00	190.71	1049.22
1.6.1	ADJUSTABLE COLLIMATOR	8	ea	7045		0.00	56.36	30.29	3454	0.00	104.61	160.97
1.6.2	STRIPPER	2	ea	6075		0.00	12.15	12.00	5719	0.00	68.61	80.76
1.6.3	BEAM STOPS	3	ea	260000		0.00	780.00	0.00	0	0.00	0.00	780.00
1.6.4	COLLIMATOR CONTROL POWER	10	ea	1000		0.00	10.00	5.00	3500	0.00	17.50	27.50
1.7	VACUUM SYSTEM	1	LOT	366380		31.60	334.78	56.29	5971	0.00	336.11	670.89
1.7.1	INLINE COMPONENTS	1	lot	154460		31.60	122.86	33.57	6889	0.00	231.27	354.13
1.7.2	ION PUMPS & P.S.	1	lot	41520		0.00	41.52	6.60	4409	0.00	29.10	70.62
1.7.3	ROUGHING STATIONS	4	ea	24000		0.00	96.00	0.21	5000	0.00	1.07	97.07
1.7.4	VACUUM INSTRUM. & CONTROL	1	lot	74400		0.00	74.40	15.91	4694	0.00	74.67	149.07

H. Foelsche

10/30/91

WBS #	DESCRIPTION	MATERIALS				PROJECT				BNL LABOR SUMMARY				PROJECT		PROJECT TOTAL K\$
		QTY	UNIT	unit cost \$	cost basis	cost INVENTORY K\$	M&S K\$	M&S K\$	Net Project Months	Rate \$/month	AVAILABLE LABOR K\$	LABOR K\$	LABOR K\$	LABOR K\$	LABOR K\$	
1.8	CONTROLS	1	LOT	434400		0.00	434.40		117.00	5204	0.00	608.90		1043.30		
1.8.1	TIMING SYSTEM	1	lot	9500		0.00	9.50		5.00	4300	0.00	21.50		31.00		
1.8.2	CONTROL ROOM	1	lot	113500		0.00	113.50		14.00	4357	0.00	61.00		174.50		
1.8.3	NETWORK	1	lot	37600		0.00	37.60		5.00	5300	0.00	26.50		64.10		
1.8.4	SOFTWARE DEVELOPMENT	1	lot	17000		0.00	17.00		18.00	5000	0.00	90.00		107.00		
1.8.5	TVDG PROCESS CONTROLS	1	lot	26500		0.00	26.50		17.00	5735	0.00	97.50		124.00		
1.8.6	BOOSTER EXTRACTION CONTROLS	1	lot	24200		0.00	24.20		14.00	6000	0.00	84.00		108.20		
1.8.7	BEAM PROCESS CONTROLS	1	lot	50100		0.00	50.10		24.00	4850	0.00	116.40		166.50		
1.8.8	INTERLOCK SYSTEM	1	lot	120000		0.00	120.00		6.00	5000	0.00	30.00		150.00		
1.8.9	CONTROL SYSTEM INTEGRATION	1	lot	36000		0.00	36.00		14.00	5857	0.00	82.00		118.00		
1.9	BEAM INSTRUMENTATION	1	LOT	374000		0.00	374.00		33.50	5448	0.00	182.50		556.50		
1.9.1	BEAM PROFILE MONITOR	8	ea	33000		0.00	264.00		14.00	5857	0.00	82.00		346.00		
1.9.2	SECONDARY EMISSION CHAMBERS	4	ea	1500		0.00	6.00		2.00	5000	0.00	10.00		16.00		
1.9.3	FLAG SYSTEM	5	ea	10800		0.00	54.00		8.50	5353	0.00	45.50		99.50		
1.9.4	DATA ACQUISITION & DISPLAY	1	lot	50000		0.00	50.00		9.00	5000	0.00	45.00		95.00		
1.10	EXPERIMENTAL AREA OUTFITTING	1	LOT	1594800		150.00	1444.80		62.66	4178	0.00	261.77		1706.57		
1.10.1	TARGET AREA B (CELL CULTURE)	1	lot	281000		50.00	231.00		10.00	4025	0.00	46.25		271.25		
1.10.2	TARGET AREA A (LARGE BEAM)	1	lot	194000		50.00	144.00		9.50	4053	0.00	38.50		182.50		
1.10.3	TARGET AREA C	1	lot	638000		50.00	588.00		20.00	3763	0.00	75.25		663.25		
1.10.4	READY ROOM B	1	lot	43200		0.00	43.20		5.16	4606	0.00	23.77		66.97		
1.10.5	READY ROOM A	1	lot	45200		0.00	45.20		5.00	4275	0.00	22.75		67.95		
1.10.6	READY ROOM C	1	lot	36500		0.00	36.50		5.00	4550	0.00	22.75		59.25		
1.10.7	SUPPORT LAB EQUIPMENT	1	lot	356900		0.00	356.90		8.00	4813	0.00	38.50		395.40		
1.11	UTILITIES & SERVICES	1	LOT	430000		0.00	430.00		11.00	6529	0.00	71.82		501.82		
1.11.1	ELECTRICAL POWER DISTRIBUTION	1	LOT	130000		0.00	130.00		3.00	6569	0.00	19.71		149.71		
1.11.2	COOLING WATER SYSTEM	1	LOT	300000		0.00	300.00		8.00	6515	0.00	52.12		352.12		
1.12	TANDEM & BEAM MODIFICATIONS	1	LOT	4181252		50.00	4131.25		154.35	5334	0.00	823.29		4954.54		
1.12.1	MP6 TANDEM UPGRADE	1	LOT	2220002		0.00	2220.00		45.00	5533	0.00	249.00		2469.00		
1.12.2	BEAM BYPASS	1	LOT	1961250		50.00	1911.25		109.35	5252	0.00	574.29		2485.54		
1.13	INSTALLATION	1	LOT	1232434		20.00	1212.43		129.80	4680	4.87	605.75		1818.18		
1.13.1	CABLE	1	lot	794910		0.00	794.91		29.87	5505	0.00	164.43		959.34		
1.13.2	TRAY	4000	ft	15		0.00	60.00		5.73	5591	0.00	32.06		60.00		
1.13.3	COOLING WATER HOSE	1	lot	11024		0.00	11.02		1.00	6353	0.00	6.35		43.08		
1.13.4	MISCELLANEOUS PARTS	1	lot	5000		0.00	5.00		1.00	6353	0.00	6.35		11.35		
1.13.5	STAGING	1	lot	500		0.00	0.50		1.00	6353	0.00	6.35		6.85		
1.13.6	RIGGING	1	lot	0		0.00	0.00		11.60	6353	0.00	73.69		73.69		
1.13.7	SURVEY	1	lot	0		0.00	0.00		3.32	6353	0.00	21.09		21.09		
1.13.8	HOOKUP	1	lot	0		0.00	0.00		28.93	3526	0.00	102.03		102.03		
1.13.9	RUN & TEST	1	lot	0		0.00	0.00		33.01	3523	0.00	116.31		441.31		
1.13.10	INSTALLATION SUPPORT	1	LOT	36000		20.00	16.00		15.33	5519	4.87	83.43		99.43		
1.14	GENERAL SYSTEM SUPPORT	1	LOT	250000		85.00	165.00		73.00	5606	0.00	409.25		574.25		
1.14.1	MANUFACTURING SUPPORT	1	LOT	210000		85.00	125.00		31.00	5145	0.00	159.50		284.50		
1.14.2	DESIGN SUPPORT	1	LOT	15000		0.00	15.00		12.00	5500	0.00	66.00		81.00		
1.14.3	ADMINISTRATION & MANAGEMENT	1	LOT	25000		0.00	25.00		30.00	6125	0.00	183.75		208.75		
1.15	CONTINGENCY	25%	OF	6801580			1700.39		274.15	=	35%	1361.36		3061.76		

H. Foelsche

10/30/91

WBS #	DESCRIPTION	QTY	unit	MATERIALS unit cost	unit cost	INVENTORY basis	M&S K\$	PROJECT M&S K\$	Quant	Time	Unit of Time	Man Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.1	CONSTRUCTION (WITH CONTINGENCY)	1 LOT		6551651			0.00	6551.65									6551.65
1.1.1	BEAM TUNNELS	1 LOT		1057018			0.00	1057.02									1057.02
1.1.1.1	Sheet Piling	2000 sf		25				50.00									
1.1.1.2	Concrete Tunnel/Headwalls	625 cy		350	625			218.75									
1.1.1.3	Access Halls, Entrances	100 cy		350				35.00									
1.1.1.4	Corrugated Tunnel	390 ft		300	400			117.00									
1.1.1.5	Emergency Exits	4 ea		30000				120.00									
1.1.1.6	Slab	170 cy		200	250			34.00									
1.1.1.7	Backfill	22000 cy		10	20000			220.00									
1.1.1.8	Mech. & Electr. Services	33% of		794750				262.27									
1.1.2	SUPPORT BUILDING	1 LOT		810303			0.00	810.30									810.30
1.1.2.1	Retaining Walls	375 cy		350				131.25									
1.1.2.2	Slab on Ground	200 cy		200	250			40.00									
1.1.2.3	Labs, Offices etc	6000 sf		65	4000			390.00									
1.1.2.4	Support Building	1200 sf		40				48.00									
1.1.2.5	Mech. & Electr. Services	33% of		609250				201.05									
1.1.3	EXPERIMENTAL AREAS	1 LOT		1693755			0.00	1693.76									1693.76
1.1.3.1	Structural Steel Trusses	0 ton		2000				0.00									
1.1.3.2	Structural Concrete	2750 cy		350				962.50									
1.1.3.3	Special Floors	2 ea		20000				40.00									
1.1.3.4	Misc. Metals, Pipes	1 lot		41000				41.00									
1.1.3.5	Water Proofing	25000 sf		2				50.00									
1.1.3.6	Pairing all Areas	50000 sf		0.50				25.00									
1.1.3.7	Backfill	15500 cy		10				155.00									
1.1.3.8	Mech. & Electr. Services	33% of		1273500				420.26									
1.1.4	SITE WORK	1 LOT		510600			0.00	510.60									510.60
1.1.4.1	Demolition & Clearing	3 wks		10000				30.00									
1.1.4.2	Excavation & Grading	1 lot		35000				35.00									
1.1.4.3	Sanitary & Storm	1 lot		20000				20.00									
1.1.4.4	Paving	3000 sy		20				60.00									
1.1.4.5	Power & Electrical	1 lot		30000				30.00									
1.1.4.6	Substation	1 lot		125000				125.00									
1.1.4.7	Top Soil & Seed	2 acres		10000				20.00									
1.1.4.8	Environmental Assessment	1 lot		85000				85.00									
1.1.4.9	Misc	33% of		320000				105.60									
1.1.5	CONTINGENCY (1.1.1 - 1.1.4)	20% of		4071675				814.34									814.34
1.1.6	FIELD SUPERVISION & OVERHEAD	6% of		4886010				293.16									293.16
1.1.7	CONTRACTOR PROFIT & OVERHEAD	15% of		5179171				776.88									776.88
1.1.8	ENGINEERING & ADMINISTRATION	10% of		5956046				595.60									595.60

WBS #	DESCRIPTION	QTY	unit	MATERIALS unit cost \$	cost basis	PROJECT INVENTORY M&S K\$	PROJECT M&S K\$	BNL LABOR SUMMARY Quant Time Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.2	EXTRACTION COMPONENTS	1	LOT	55300		0.00	55.30	MONTH	62.56	62.56		4910	0.00	307.15	362.45
1.2.1	SEPTUUM MAGNET	1	UNIT	34800		0.00	34.80	1 31.68 MONTHS	31.68	31.68		4966	0.00	307.1513	192.11
1.2.1.1	Coil	2	ea	1250		0.00	2.50	2 0.61 MONTH	1.23	1.23		2700	0.00	3.31	5.81
1.2.1.1.1	Conductor	2	lot	100			0.20	2 20 hr	0.27	0.27	21	2700		0.72	
1.2.1.1.2	Downfeed	1	lot	100			0.10	1 20 hr	0.13	0.13	21	2700		0.36	
1.2.1.1.3	Macor Insulators	2	lot	200			0.40	2 40 hr	0.53	0.53	21	2700		1.44	
1.2.1.1.4	Power Connection	1	ea	1500			1.50	1 20 hr	0.13	0.13	21	2700		0.36	
1.2.1.1.5	Cleaning	1	fluid	100			0.10	1 8 hr	0.05	0.05	21	2700		0.14	
1.2.1.1.6	Bakeout	1	lot	0			0.00	1 0.000 hr	0.00	0.00	21	2700		0.00	
1.2.1.1.7	Other	2	lot	100			0.20	2 8 hr	0.11	0.11	21	2700		0.29	
1.2.1.2	Core	2	lot	8425		0.00	16.85	2 1.28 MONTH	2.56	2.56		4292	0.00	10.99	27.84
1.2.1.2.1	Laminations	5000	lams	0.50			2.50							0.00	
1.2.1.2.2	Punching Die (amortized)	1	die	10000			10.00							0.00	
1.2.1.2.3	Fixtures (amortized)	1	lot	2000			2.00							0.75	
1.2.1.2.4	Miscellaneous Parts	2	lot	1000			2.00							0.75	
1.2.1.2.5	Setup	2	unit	150			0.15							0.93	
1.2.1.2.6	Degrease	1	fluid	0			0.00							0.93	
1.2.1.2.7	Bakeout	1	lot	0			0.00							3.73	
1.2.1.2.8	Stacking	2	unit	0			0.00							3.89	
1.2.1.2.9	Welding	2	unit	0			0.00							9.51	
1.2.1.3	Vacuum Vessel	1	ea	6000		0.00	6.00	1 1.41 MONTH	1.41	1.41		6729	0.00	0.00	15.51
1.2.1.3.1	Material	1	lot	1500			1.50							0.00	
1.2.1.3.2	Cutting & Machining	1	lot	0			0.00							6.82	
1.2.1.3.3	Flanges	10	ea	50			0.50							0.00	
1.2.1.3.4	Welding	1	lot	0			0.00							1.95	
1.2.1.3.5	Valves	1	ea	2000			2.00							0.00	
1.2.1.3.6	Ion Pump & Supply	1	see Vacuum				0.00							0.00	
1.2.1.3.7	Bellows	1	lot	1000			1.00							0.00	
1.2.1.3.8	Gaskets	1	lot	250			0.25							0.00	
1.2.1.3.9	Fasteners	1	lot	250			0.25							0.00	
1.2.1.3.10	Gauges	1	lot	500			0.50							0.00	
1.2.1.3.11	Leakcheck	1	ea	0			0.00							0.00	
1.2.1.3.12	Bakeout	1	lot	0			0.00							0.37	
1.2.1.4	Beam Tube	1	ea	2450		0.00	2.45	1 16 hr	0.11	0.11	18	3500	0.00	0.37	4.97
1.2.1.4.1	Tube	1	ea	1500			1.50	1 0.48 MONTH	0.48	0.48		5257		0.00	
1.2.1.4.2	Seal	1	ea	100			0.10							0.00	
1.2.1.4.3	Bellows	1	ea	500			0.50							0.00	
1.2.1.4.4	Welding	1	lot	0			0.00							1.95	
1.2.1.4.5	RF Treatment	1	lot	100			0.10							0.00	
1.2.1.4.6	Cleaning	1	fluid	150			0.15							0.07	
1.2.1.4.7	Bakeout	1	lot	0			0.00							0.07	
1.2.1.4.8	Other	1	lot	100			0.10							0.72	
1.2.1.5	Cable Termination	1	lot	2000			2.00							1.57	
1.2.1.6	Base & Supports	1	ea	4400		0.00	4.40	1 0.47 MONTH	0.47	0.47		3358	0.00	0.36	2.72
1.2.1.6.1	Base Plate	1	lot	1500			1.50							0.00	
1.2.1.6.2	Clamps & Blocks	12	ea	50			0.60							0.00	
1.2.1.6.3	Internal Adjustment Jacks	4	ea	50			0.20							0.00	
1.2.1.6.4	External Support Girder	1	ea	1500			1.50							0.00	
1.2.1.6.5	Jacks	4	ea	50			0.20							0.36	

H. Foetsche

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WBS #	DESCRIPTION	QTY	unit	MATERIALS unit cost \$	cost basis \$	PROJECT H&S K\$	BNL LABOR SUMMARY Quant Time Unit of Time	Man Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.2.1.6.6	Welding	1	lot	0		0.00	1 10 hr	0.07	28	7303		0.49	
1.2.1.6.7	Fasteners & Clamps	1	lot	400		0.40						0.00	
1.2.1.7	Magnet Assembly	1	lot	200		0.20	1 120 hr	0.80	20	3500		2.80	3.00
1.2.1.8	Bakeout	1	lot	200		0.20	1 40 hr	0.27	21	2700		0.72	0.92
1.2.1.9	Checkout	1	lot	0		0.00	1 80 hr	0.53	20	3500		1.87	1.87
1.2.1.10	Miscellaneous	1	lot	200		0.20	1 100 hr	0.67	21	2700		1.80	2.00
1.2.1.11	Septum Magnet Engineering	1	lot		0.00	0.00	MONTH 23.00	23.00		5283	0.00	121.50	121.50
1.2.1.11.1	Conceptual Design	1	lot			0.00	MONTH 1	1.00	5	7000		7.00	
1.2.1.11.2	Detailed Engineering	1	lot			0.00	MONTH 5	5.00	6	5500		27.50	
1.2.1.11.3	Detailed Design	1	lot			0.00	MONTH 8	8.00	12	4500		36.00	
1.2.1.11.4	Specify Parts	1	lot			0.00	MONTH 2	2.00	6	5500		11.00	
1.2.1.11.5	Bid & Award Parts	1	lot			0.00	MONTH 2	2.00	6	5500		11.00	
1.2.1.11.6	Supervision	1	lot			0.00	MONTH 3	3.00	6	5500		16.50	
1.2.1.11.7	Testing	1	lot			0.00	MONTH 1	1.00	6	5500		5.50	
1.2.1.11.8	Documentation	1	lot			0.00	MONTH 1	1.00	5	7000		7.00	
1.2.2	ELECTROSTATIC SEPTUM	1	UNIT	20500		20.50	1 30.88 MONTHS	30.88		4852	0.00	149.84	179.34
1.2.2.1	Electrodes	1	lot	7500		7.50	1 3.466 MONTH	3.47		2700		9.36	
1.2.2.1.1	Cathode	1	lot	2000		2.00	1 200 hr	1.33	21	2700		3.60	
1.2.2.1.2	Anode	1	lot	2000		2.00	1 200 hr	1.33	21	2700		3.60	
1.2.2.1.3	Downfeed	1	lot	100		0.10	1 20 hr	0.13	21	2700		0.36	
1.2.2.1.4	Macor Insulators	1	lot	200		0.20	1 40 hr	0.27	21	2700		0.72	
1.2.2.1.5	Feedthrough	1	ea	3000		3.00	1 20 hr	0.13	21	2700		0.36	
1.2.2.1.6	Cleaning	1	fluid	100		0.10	1 24 hr	0.16	21	2700		0.43	
1.2.2.1.7	Bakeout	1	lot	0		0.00	1 8 hr	0.05	21	2700		0.14	
1.2.2.1.8	Other	1	lot	100		0.10	1 1.41 MONTH	1.41		6729	0.00	9.51	15.51
1.2.2.3	Vacuum Vessel	1	ea	6000		6.00						0.00	
1.2.2.3.1	Material	1	lot	1500		1.50						0.00	
1.2.2.3.2	Cutting & Machining	1	lot	0		0.00						0.00	
1.2.2.3.3	Flanges	10	ea	50		0.50						1.95	
1.2.2.3.4	Welding	1	lot	0		0.00						0.00	
1.2.2.3.5	Valves	1	ea	2000		2.00						0.00	
1.2.2.3.6	Ion Pump & Supply	1	see Vacuum			0.00						0.00	
1.2.2.3.7	Bellows	1	lot	1000		1.00						0.00	
1.2.2.3.8	Gaskets	1	lot	250		0.25						0.00	
1.2.2.3.9	Fasteners	1	lot	500		0.50						0.00	
1.2.2.3.10	Gauges	1	lot	0		0.00						0.00	
1.2.2.3.11	Leakcheck	1	ea	0		0.00						0.00	
1.2.2.3.12	Bakeout	1	lot	0		0.00						0.00	
1.2.2.5	Cable Termination	1	lot	2000		2.00						0.00	
1.2.2.6	Base & Supports	1	ea	4400		4.40	1 0.47 MONTH	0.47	21	3558	0.00	1.57	2.72
1.2.2.6.1	Base Plate	12	lot	1500		1.50	1 20 hr	0.13	21	2700		0.36	
1.2.2.6.2	Clamps & Blocks	4	ea	50		0.60						0.00	
1.2.2.6.3	Internal Adjustment Jacks	4	ea	50		1.50						0.00	
1.2.2.6.4	External Support Girder	1	ea	1500		1.50						0.00	
1.2.2.6.5	Jacks	4	ea	50		0.20						0.36	
1.2.2.6.6	Welding	1	lot	0		0.00						0.49	
1.2.2.6.7	Fasteners & Clamps	1	lot	400		0.40						0.00	

WBS #	DESCRIPTION	MATERIALS				PROJECT		BNL LABOR SUMMARY							PROJECT		PROJECT TOTAL K\$
		Qty	unit	unit cost \$	cost basis	M&S K\$	M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	LABOR K\$	
1.2.2.7	Septum Assembly	1	lot	200		0.20		1	120 hr		0.80	0.80	20	3500		2.80	3.00
1.2.2.8	Bakeout	1	lot	200		0.20		1	40 hr		0.27	0.27	21	2700		0.72	0.92
1.2.2.9	Checkout	1	lot	0		0.00		1	80 hr		0.53	0.53	20	3500		1.87	1.87
1.2.2.10	Miscellaneous	1	lot	200		0.20		1	100 hr		0.67	0.67	21	2700		1.80	2.00
1.2.2.11	E/S Septum Engineering	1	lot		0.00	0.00			MONTH		23.00	23.00		5283	0.00	121.50	121.50
1.2.2.11.1	Conceptual Design	1	lot			0.00			MONTH		1	1	1.00	5	7000	7.00	
1.2.2.11.2	Detailed Engineering	1	lot			0.00			MONTH		5	5	5.00	6	5500	27.50	
1.2.2.11.3	Detailed Design	1	lot			0.00			MONTH		8	8	8.00	12	4500	36.00	
1.2.2.11.4	Specify Parts	1	lot			0.00			MONTH		2	2	2.00	6	5500	11.00	
1.2.2.11.5	Bid & Award Parts	1	lot			0.00			MONTH		2	2	2.00	6	5500	11.00	
1.2.2.11.6	Supervision	1	lot			0.00		0.125	24		3	3	3.00	6	5500	16.50	
1.2.2.11.7	Testing	1	lot			0.00			MONTH		1	1	1.00	6	5500	5.50	
1.2.2.11.8	Documentation	1	lot			0.00			MONTH		1	1	1.00	5	7000	7.00	

WBS #	DESCRIPTION	MATERIALS			PROJECT INVENTORY		PROJECT M&S K\$	Quant	BNL LABOR SUMMARY				AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
		Qty	unit	unit cost \$	cost basis	M&S K\$			Time	Unit of Time	Man Months	Net Project Months			
1.3	TRANSFER MAGNETS	1	LOT	983156		67.00	916.16		MONTH		92.44	92.44	0.00	435.18	1351.33
1.3.1	QUADRUPOLES	25	UNITS	18780		0.00	469.49	25	1.280	MONTH	32.00	32.00	0.00	142.71	612.20
1.3.1.1	Coils	100	coils	2180		0.00	218.00								218.00
1.3.1.1.1	Tooling (amortized)	1	set	28000		0.00	28.00								
	Winding Fixture	1	ea	10000			10.00								
	Annealing Rack	1	ea	2000			2.00								
	Wrapping Fixture	1	ea	6000			6.00								
	Curing Fixture	1	ea	10000			10.00								
	Copper Conductor	12000	lb	3.00			36.00								
1.3.1.1.2	Setup	100	coil	100.00			10.00								
1.3.1.1.3	Joint Brazing	0	joint	250.00			0.00								
1.3.1.1.4	Winding	500	turns	50.00			25.00								
1.3.1.1.5	End Fittings	200	ea	120.00			24.00								
1.3.1.1.6	Sandblasting	100	coil	50.00			5.00								
1.3.1.1.7	Annealing	100	coil	50.00			5.00								
1.3.1.1.8	Wrapping	100	coil	200.00			20.00								
1.3.1.1.9	Impregnation	100	coil	200.00			20.00								
1.3.1.1.10	Testing	100	coil	50.00			5.00								
1.3.1.1.11	Handling	100	coil	50.00			5.00								
1.3.1.1.12	Package	25	crate	200.00			5.00								
1.3.1.1.13	Supervision	100	coil	250.00			25.00								
1.3.1.1.14	Shipping	25	crate	200.00			5.00								
1.3.1.1.15	(cores	100	cores	1480			147.99								147.99
1.3.1.2	Laminations	79680	lam	0.67		0.00	53.72								
1.3.1.2.1	Die (amortized)	1	die	15000		15.00	0.00								
	Steel	40850	lb	0.42			17.16								
	Slitting	40850	lb	0.20			8.17								
	Stamping	79680	lam	0.30			23.90								
	Package	40850	lb	0.03			1.33								
	Shipping	40850	lb	0.08			3.27								
	Setup	100	core	100			10.00								
1.3.1.2.2	Degrease	100	core	40			4.00								
1.3.1.2.3	Stacking	100	core	40			4.00								
1.3.1.2.4	Misc Parts	100	lot	65			6.50								
1.3.1.2.5	Tie Bars	100	core	50			5.00								
1.3.1.2.6	End Plate	100	core	50			5.00								
1.3.1.2.7	Welding	100	core	100			10.00								
1.3.1.2.8	Painting	100	core	100			10.00								
1.3.1.2.9	Crating	25	sets	260			6.50								
1.3.1.2.10	Supervision	100	core	300			30.00								
1.3.1.2.11	Shipping	40850	lb	0.08			3.27								
1.3.1.2.12	Stand	25	unit	3100		0.00	77.50	25	0.12	MONTH	3	3	0.00	15.00	92.50
1.3.1.3	Stand	25	stand	1200			30.00	25	10 hr		1.67	1.67		8.33	
1.3.1.3.1	Jacks	100	jack	450			45.00	100	2 hr		1.33	1.33		6.67	
1.3.1.3.2	Miscellaneous Parts	25	lot	800		0.00	20.00						0.00	0.00	20.00
1.3.1.3.3	Miscellaneous Parts	25	set	50			1.25							0.00	
1.3.1.4	Fittings	25	set	100			2.50							0.00	
1.3.1.4.1	Coils Spacer Springs	25	set	100			2.50							0.00	
1.3.1.4.2	Coil Spacer Blocks	25	set	100			2.50							0.00	
1.3.1.4.3		25	set	100			2.50							0.00	

WBS #	DESCRIPTION	QTY	unit	MATERIALS cost \$	cost basis	PROJECT INVENTORY M&S K\$	PROJECT M&S K\$	Quant	Time	BNL LABOR SUMMARY Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$	
1.3.1.4.4	Water Manifold	25	ea	100		2.50										0.00		
1.3.1.4.5	Flok Meter	25	ea	200		5.00										0.00		
1.3.1.4.6	Interlock Harness	25	ea	200		5.00										0.00		
1.3.1.4.7	Other Parts	25	lot	50		1.25										0.00		
1.3.1.5	Transfer Quad Tooling	1	lot	1000		1.00										0.00		
1.3.1.6	Transfer Quad Assembly	25	magnet	100		2.50										87.71	90.21	
1.3.1.6.1	Staging	25	ea			0.00										8.47		
1.3.1.6.2	Assembly	25	ea	100		2.50										58.33		
1.3.1.6.3	Welding	25	ea			0.00										4.24		
1.3.1.6.4	Checkout	25	ea			0.00										16.67		
1.3.1.7	Miscellaneous	25	lot	100		2.50										0.00	2.50	
1.3.1.8	Transfer Quad Engineering	1	lot			0.00										40.00	40.00	
1.3.1.8.1	Conceptual Design	1	lot			0.00										0.00		
1.3.1.8.2	Detailed Engineering	1	lot			0.00										0.00		
1.3.1.8.3	Detailed Design	1	lot			0.00										0.70		
1.3.1.8.4	Specify Parts	1	lot			0.00										0.00		
1.3.1.8.5	Bid & Award Parts	1	lot			0.00										11.00		
1.3.1.8.6	Supervision	1	lot			0.00										16.50		
1.3.1.8.7	Testing	1	lot			0.00										5.50		
1.3.1.8.8	Documentation	1	lot			0.00										7.00		
1.3.2	H DIPOLE	3	EACH	70553		29.00	182.66									52.32	234.98	
1.3.2.1	Coils	12	coil	11117		28.00	105.40										105.40	
	Tooling (amortized)	1	set	28000		10.00	0.00											
	Winding Fixture	1	ea	10000		2.00	0.00											
	Annealing Rack	1	ea	2000		6.00	0.00											
	Wrapping Fixture	1	ea	6000		10.00	0.00											
	Curing Fixture	1	ea	10000		0.00												
	Copper Conductor	6120	lb	3.00		18.36												
	Setup	12	coil	100.00		1.20												
	Joint Brazing	12	joint	250.00		3.00												
	Winding	48	turns	50.00		2.40												
	End Fittings	24	ea	120.00		2.88												
	Sandblasting	12	coil	50.00		0.60												
	Annealing	12	coil	50.00		0.60												
	Wrapping	12	coil	200.00		2.40												
	Impregnation	12	coil	200.00		2.40												
	Testing	12	coil	50.00		0.60												
	Handling	12	coil	50.00		0.60												
	Package	6	crate	200.00		1.20												
	Supervision	12	coil	250.00		3.00												
	Shipping	6	crate	200.00		1.20												
	Cores	3	cores	21653		64.96												
1.3.2.2	Laminations	10950	lam	7.84		45.89												
1.3.2.2.1	Die (amortized)	1	die	40000		40.00												
	Steel	58364	lb	0.42		24.51												
	Slitting	58364	lb	0.20		11.67												
	Stamping	10950	lam	0.30		3.28												64.96

10/30/91

H. Foelsche

WBS #	DESCRIPTION	MATERIALS			PROJECT		BNL LABOR SUMMARY						PROJECT		
		qty	unit	unit cost \$	cost basis	INVENTORY M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	LABOR K\$
1.3.3.6.4	Checkout	1	ea			0.00	1	20 hr	0.13	0.13	17	5000		0.67	0.10
1.3.3.7	Miscellaneous	1	lot	100		0.10								0.00	
1.3.3.8	C Dipole Engineering	1	lot			0.00		MONTH	23.00	23.00		5283	0.00	121.50	121.50
1.3.3.8.1	Conceptual Design	1	lot			0.00		MONTH	1	1.00	5	7000		7.00	
1.3.3.8.2	Detailed Engineering	1	lot			0.00		MONTH	5	5.00	6	5500		27.50	
1.3.3.8.3	Detailed Design	1	lot			0.00		MONTH	8	8.00	12	4500		36.00	
1.3.3.8.4	Specify Parts	1	lot			0.00		MONTH	2	2.00	6	5500		11.00	
1.3.3.8.5	Bid & Award Parts	1	lot			0.00		MONTH	2	2.00	6	5500		11.00	
1.3.3.8.6	Supervision	1	lot			0.00	0.125	24	3	3.00	6	5500		16.50	
1.3.3.8.7	Testing	1	lot			0.00		MONTH	1	1.00	6	5500		5.50	
1.3.3.8.8	Documentation	1	lot			0.00		MONTH	1	1.00	5	7000		7.00	
1.3.4	OCTUPOLES	6	EACH	9867		0.00	6	2.15 MONTH	12.92	12.92		4893	0.00	63.22	122.42
1.3.4.1	Coils	48	ea	400		19.20								0.00	19.20
1.3.4.2	Cores	6	ea	3000		18.00								0.00	18.00
1.3.4.3	Supports	6	ea	1000		6.00	6	18 hr	0.72	0.72	18	3500		2.52	8.52
1.3.4.4	Miscellaneous Parts	6	lot	300		1.80								0.00	1.80
1.3.4.5	Trim Magnet Tooling	1	ea	10000		10.00								0.00	10.00
1.3.4.6	Assembly & Checkout	6	ea	500		3.00	6	80 hr	3.20	3.20	18	3500		11.20	14.20
1.3.4.7	Miscellaneous	6	ea	200		1.20								0.00	1.20
1.3.4.8	Octupole Engineering					0.00		MONTH	9	9.00	6	5500		49.50	49.50
1.3.5	TRIM DIPOLES	16	EACH	3125		10.00	16	0.51 MONTH	8.19	8.19		3989	0.00	32.65	72.65
1.3.5.1	Coils	32	ea	400		12.80								0.03	12.80
1.3.5.2	Cores	16	ea	400		6.40								0.00	6.40
1.3.5.3	Supports	16	ea	500		8.00	16	18 hr	1.92	1.92	18	3500		6.72	14.72
1.3.5.4	Miscellaneous Parts	16	lot	100		1.60								0.00	1.60
1.3.5.5	Trim Magnet Tooling	1	ea	10000		0.00								0.00	0.00
1.3.5.6	Assembly & Checkout	16	ea	500		8.00	16	40 hr	4.27	4.27	18	3500		14.93	22.93
1.3.5.7	Miscellaneous	16	ea	200		3.20								0.00	3.20
1.3.5.8	Trim Magnet Engineering					0.00		MONTH	2	2.00	6	5500		11.00	11.00
1.3.6	WOBBLER	2	EACH	40000		0.00	2	2.67 MONTH	5.33	5.33		3500	0.00	18.67	
1.3.6.1	Wobbler Magnet	2	ea	20000		40.00	2	200 hr	2.67	2.67	18	3500		9.33	49.33
1.3.6.2	Wobbler Power Supply	2	ea	20000		40.00	2	200 hr	2.67	2.67	18	3500		9.33	49.33

WBS #	DESCRIPTION	MATERIALS			PROJECT M&S		BNL LABOR SUMMARY				AVAILABLE LABOR		PROJECT LABOR		PROJECT TOTAL K\$
		qty	unit	cost \$	cost basis	cost basis	Quant	Time	Man Months	Net Project Months	Code	Rate \$/month	K\$	K\$	
1.4	EXTRACTION POWER SUPPLIES	1	LOT	241200	0.00	241.20	1	MONTH	76.13	76.13		4840	0.00	368.48	609.68
1.4.1	SEPTUM MAGNET POWER SUPPLY	1	UNITS	35900	0.00	241.20	1	39.33 MONTH	39.33	39.33		4690	0.00	368.4766	220.38
1.4.1.1	Transformer	1	ea	10000		10.00	1	80 hr	0.53	0.53	16	3500	0.00	1.87	11.87
1.4.1.2	Transistor Bank	1	ea	13600		13.60	1	4.80 MONTH	4.80	4.80	21	3056		1.44	28.27
1.4.1.2.1	Transistors	40	ea	200		8.00	40	2 hr	0.53	0.53	21	2700		1.44	
1.4.1.2.2	Connections	40	ea	10		0.40	40	2 hr	0.53	0.53	21	2700		0.72	
1.4.1.2.3	Resistor Assembly	1	ea	1000		1.00	1	40 hr	0.27	0.27	21	2700		0.72	
1.4.1.2.4	Enclosure	1	ea	3100		3.10	1	40 hr	0.27	0.27	21	2700		0.72	
1.4.1.2.5	Support Hardware	1	lot	500		0.50	1	40 hr	0.27	0.27	21	2700		0.72	
1.4.1.2.6	Voltage Divider	1	ea	200		0.20	1	40 hr	0.27	0.27	21	2700		0.72	
1.4.1.2.7	Oil	0.0000	lot	0		0.00	0.0000	16 hr	0.00	0.00	21	2700		0.00	
1.4.1.2.8	Miscellaneous	1	lot	400		0.40	1	80 hr	0.53	0.53	21	2700		1.44	
1.4.1.2.9	Assembly & Pretest	1	unit	0		0.00	1	320 hr	2.13	2.13	16	3500		7.47	3.88
1.4.1.3	Control Racks	1	ea	1000		1.00	1	160 hr	1.07	1.07	21	2700		2.88	14.00
1.4.1.4	Control System	1	ea	7000		7.00	1	2 MONTH	2.00	2.00	16	3500		5.60	
1.4.1.4.1	Master Controller	1	ea	5000	0.00	5.00	1	60 hr	0.40	0.40	16	3500		1.40	
1.4.1.4.2	Trigger Unit	1	ea	2000		2.00	1	2 MONTH	2.00	2.00	21	2700	0.00	5.40	8.70
1.4.1.5	Miscellaneous	1	lot	3300	0.00	3.30	1	80 hr	0.53	0.53	21	2700		1.44	
1.4.1.6.1	Local Cabling	1	lot	2000		2.00	1	80 hr	0.53	0.53	21	2700		1.44	
1.4.1.6.2	Cable Termination	1	lot	1000		1.00	1	80 hr	0.53	0.53	21	2700		0.72	
1.4.1.6.3	Input Power Distribution	1	lot	300		0.30	1	40 hr	0.27	0.27	21	2700		1.80	
1.4.1.6.4	Misc	1	lot	1000		1.00	1	100 hr	0.67	0.67	15	5000		8.00	9.00
1.4.1.7	System Assembly	1	lot	1000		1.00	1	240 hr	1.60	1.60	15	5000		6.67	6.67
1.4.1.8	System Pretest	1	lot			0.00	1	200 hr	1.33	1.33	15	5000		6.67	
1.4.1.9	Septum Power Engineering	1	lot		0.00	0.00		MONTH	26.00	26.00		5308	0.00	138.00	138.00
	Conceptual Design					0.00		MONTH	1	1.00	3	7000		7.00	
	Detailed Engineering					0.00		MONTH	5	5.00	4	5500		27.50	
	Detailed Design					0.00		MONTH	8	8.00	12	4500		36.00	
	Specify Parts					0.00		MONTH	2	2.00	4	5500		11.00	
	Bid & Award Parts					0.00		MONTH	2	2.00	4	5500		11.00	
	Supervision					0.00	0.25	24 MONTH	6	6.00	4	5500		33.00	
	Testing					0.00		MONTH	1	1.00	4	5500		5.50	
	Documentation					0.00		MONTH	1	1.00	3	7000		7.00	
1.4.2	E/S SEPTUM POWER SUPPLY	1	UNITS	22300	0.00	22.30	1	20.13 MONTH	20.13	20.13		4751	0.00	95.66	117.96
1.4.2.1	HV Power Supply	1	ea	10000		10.00	1	80 hr	0.53	0.53	16	3500		1.87	11.87
1.4.2.3	Control Racks	1	ea	1000		1.00	1	160 hr	1.07	1.07	21	2700		2.88	3.88
1.4.2.4	Control System	1	ea	5000	0.00	5.00	1	1.6 MONTH	1.60	1.60	16	3500	0.00	5.60	10.60
1.4.2.4.1	Master Controller	1	ea	5000		5.00	1	240 hr	1.60	1.60	16	3500		5.60	
1.4.2.6	Miscellaneous	1	lot	5300	0.00	5.30	1	2 MONTH	2.00	2.00	21	2700	0.00	5.40	10.70
1.4.2.6.1	Local Cabling	1	lot	2000		2.00	1	80 hr	0.53	0.53	21	2700		1.44	
1.4.2.6.2	Cable Termination	1	lot	2000		2.00	1	80 hr	0.53	0.53	21	2700		1.44	
1.4.2.6.3	Input Power Distribution	1	lot	1000		1.00	1	40 hr	0.27	0.27	21	2700		0.72	
1.4.2.6.4	Misc	1	lot	300		0.30	1	100 hr	0.67	0.67	15	5000		1.80	9.00
1.4.2.7	System Assembly	1	lot	1000		1.00	1	240 hr	1.60	1.60	15	5000		8.00	6.67
1.4.2.8	System Pretest	1	lot			0.00	1	200 hr	1.33	1.33	15	5000		6.67	

WBS #	DESCRIPTION	MATERIALS			PROJECT		BNL LABOR SUMMARY				PROJECT						
		Qty	unit	cost \$	cost basis M&S K\$	cost basis M&S K\$	PROJECT M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.4.2.9	E/S Septum Power Engineering	1	lot		0.00	0.00	0.00		MONTH		12.00	12.00		5438	0.00	65.25	65.25
	Conceptual Design						0.00		MONTH	0.5	0.5	0.50	3	7000		3.50	
	Detailed Engineering						0.00		MONTH	1.5	1.5	1.50	4	5500		8.25	
	Detailed Design						0.00		MONTH	3	3	3.00	12	4500		13.50	
	Specify Parts						0.00		MONTH	1	1	1.00	4	5500		5.50	
	Bid & Award Parts						0.00		MONTH	1	1	1.00	4	5500		5.50	
	Supervision						0.00	0.25	12 MONTH	3	3	3.00	4	5500		16.50	
	Testing						0.00		MONTH	1	1	1.00	4	5500		5.50	
	Documentation						0.00		MONTH	1	1	1.00	3	7000		7.00	
1.4.3	SEXTUPOLE POWER SUPPLY	2	EACH	10000		0.00	20.00		1.27 MONTH	2.53	2.53			5395	0.00	13.67	33.67
1.4.3.1	Sextupole Power Supply	2	ea	10000			20.00		40 hr	0.53	0.53	15		5000		2.67	22.67
1.4.3.2	Engineering Support						0.00		MONTH	2	2	2.00	4	5500		11.00	11.00
1.4.4	EXTRACTION BUMP POWER SUPPLY	8	EACH	20000		0.00	160.00		1.03 MONTH	8.27	8.27			5242	0.00	43.33	203.33
1.4.4.1	Bump Power Supply	8	ea	20000			160.00		80 hr	4.27	4.27	15		5000		21.33	181.33
1.4.4.2	Engineering Support						0.00		MONTH	4	4	4.00	4	5500		22.00	22.00
1.4.5	SPILL SERVO	1	EACH	3000		0.00	3.00		5.87 MONTH	5.87	5.87			5341	0.00	31.33	34.33
1.4.5.1	Spill Servo Hardware	1	lot	3000			3.00		80 hr	0.53	0.53	15		5000		2.67	5.67
1.4.5.2	Assembly & Test Labor	1	lot				0.00		200 hr	1.33	1.33	15		5000		6.67	6.67
1.4.5.3	Engineering Support	1	lot				0.00		MONTH	4	4	4.00	4	5500		22.00	22.00

WBS: #	DESCRIPTION	QTY	unit	MATERIALS unit cost \$	cost basis M&S K\$	PROJECT M&S K\$	Quant	Time Unit of Time	SNL LABOR SUMMARY Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.5	TRANSFER POWER SUPPLIES	1	LOT	335000	0.00	335.00		MONTH	21.60	21.60		5185	0.00	112.00	447.00
1.5.1	QUADRUPOLE POWER SUPPLY	25	EACH	5000	0.00	125.00	25	0.35 MONTH	8.67	8.67		5115	0.00	44.33	169.33
1.5.1.1	Quadrupole Power Supply	25	ea	5000		125.00	25	40 hr	6.67	6.67	15	5000		33.33	158.33
1.5.1.10	Engineering Support					0.00		MONTH	2	2.00	4	5500		11.00	11.00
1.5.2	DIPOLE POWER SUPPLY	4	EACH	35000	0.00	140.00	4	0.77 MONTH	3.07	3.07		5326	0.00	16.33	156.33
1.5.2.1	Dipole Power Supply	4	ea	35000		140.00	4	40 hr	1.07	1.07	15	5000		5.33	145.33
1.5.2.10	Engineering Support					0.00		MONTH	2	2.00	4	5500		11.00	11.00
1.5.3	OCTUPOLE POWER SUPPLY	6	EACH	5000	0.00	30.00	6	0.60 MONTH	3.60	3.60		5278	0.00	19.00	49.00
1.5.3.1	Octupole Power Supply	6	ea	5000		30.00	6	40 hr	1.60	1.60	15	5000		8.00	38.00
1.5.3.10	Engineering Support					0.00		MONTH	2	2.00	4	5500		11.00	11.00
1.5.4	TRIM DIPOLE POWER SUPPLIES	16	EACH	2500	0.00	40.00	16	0.39 MONTH	6.27	6.27		5169	0.00	32.33	72.33
1.5.4.1	Trim Supply	16	ea	2500		40.00	16	40 hr	4.27	4.27	15	5000		21.33	61.33
1.5.4.10	Engineering Support					0.00		MONTH	2	2.00	4	5500		11.00	11.00

WSS #	DESCRIPTION	QTY	unit	MATERIALS unit cost \$	cost basis M&S K\$	PROJECT INVENTORY M&S K\$	PROJECT M&S K\$	Quant	Time	BNL LABOR SUMMARY Unit Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.6	COLLIMATORS, STRIPPERS, STOPS	1	LOT	858510	0.00	858.51	0.00	8	3.786	MONTH	47.29	47.29	4033	0.00	190.71	1049.22	
1.6.1	ADJUSTABLE COLLIMATOR	8	ea	7045	0.00	56.36	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
1.6.1.1	Materials	8	lot	1700	0.00	13.60	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Brass	3760	lb	2.50	0.00	9.40	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Aluminum Stock	1600	lb	2.00	0.00	3.20	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Misc	8	lot	125	0.00	1.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
1.6.1.2	Purchases	8	lot	4300	0.00	34.40	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	ACME Shafts	16	shaft	400	0.00	6.40	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Rails & Bushings	32	rail	150	0.00	4.80	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Bellows Weldments	16	ea	250	0.00	4.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Bellows & Seals	16	ea	700	0.00	11.20	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Motors, Gears, Misc.	8	lot	1000	0.00	8.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
1.6.1.3	Weldments	8	lot	100	0.00	0.80	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
1.6.1.4	Stands	8	ea	845	0.00	6.76	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Aluminum Stock	2880	lb	2.00	0.00	5.76	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Misc Materials	8	lot	125	0.00	1.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
1.6.1.5	Assembly & Test	8	lot	100	0.00	0.80	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
1.6.1.6	Collimator Engineering	1	lot	100	0.00	0.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Conceptual Design	1	lot	100	0.00	0.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Detailed Engineering	1	lot	100	0.00	0.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Specify Parts	1	lot	100	0.00	0.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Bid & Award Parts	1	lot	100	0.00	0.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Supervision	1	lot	100	0.00	0.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Testing	1	lot	100	0.00	0.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
	Documentation	1	lot	100	0.00	0.00	0.00	8	0.586	MONTH	30.29	30.29	3454	0.00	104.61	160.97	
1.6.2	STRIPPER	2	ea	6075	0.00	12.15	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
1.6.2.1	Foil Holders	2	lot	2050	0.00	4.10	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Foil	20	foils	100.00	0.00	2.00	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Holder	20	ea	100.00	0.00	2.00	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Misc	2	lot	50.00	0.00	0.10	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
1.6.2.2	Purchases	2	lot	3600	0.00	7.20	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	ACME Shafts	2	shaft	400.00	0.00	0.80	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Rails & Bushings	4	rail	150.00	0.00	0.60	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Bellows Weldments	4	ea	250.00	0.00	1.00	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Bellows & Seals	4	ea	700.00	0.00	2.80	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Motors, Gears, Misc.	2	lot	1000.00	0.00	2.00	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
1.6.2.3	Weldments	2	lot	100.00	0.00	0.20	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
1.6.2.4	Stands	2	ea	225	0.00	0.45	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Aluminum Stock	100	lb	2.00	0.00	0.20	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Misc Materials	2	lot	125.00	0.00	0.25	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
1.6.2.5	Assembly & Test	2	lot	100.00	0.00	0.20	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
1.6.2.6	Stripper Engineering	2	lot	100.00	0.00	0.00	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Conceptual Design	1	lot	100.00	0.00	0.00	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Detailed Engineering	1	lot	100.00	0.00	0.00	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	
	Specify Parts	1	lot	100.00	0.00	0.00	0.00	2	6.00	MONTH	12.00	12.00	5719	0.00	68.61	80.76	

WBS #	DESCRIPTION	Q'ty	unit	MATERIALS unit cost \$	cost basis M&S K\$	PROJECT M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
	Bid & Award Parts					0.00			MONTH	0.5	0.50	6	5500		2.75	
	Supervision					0.00									0.00	
	Testing					0.00									0.00	
	Documentation					0.00			MONTH	0.25	0.25	5	7000		1.75	
1.6.3	BEAM STOPS	3	ea	260000	0.00	780.00										780.00
1.6.4	COLLIMATOR CONTROL POWER	10	ea	1000		10.00	10	0.50	MONTH	5.00	5.00	8	3500		17.50	27.50

WBS #	DESCRIPTION	MATERIALS				PROJECT		BRL LABOR SUMMARY					PROJECT		PROJECT TOTAL K\$	
		Qty	unit	cost \$	cost basis	INVENTORY M&S K\$	M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month		AVAILABLE LABOR K\$
1.7	VACUUM SYSTEM	1	LOT	366380		31.60	334.78		MONTH		56.29	56.29	5971	0.00	336.11	670.89
1.7.1	INLINE COMPONENTS	1	lot	154460		31.60	334.78	1	33.57	MONTH	33.57	33.57	6889	0.00	336.1065	354.13
1.7.1.1	Magnet Vacuum Chambers	1	lot	37500		0.00	37.50	25	20 hr	MONTH	5.73	5.73	7303	0.00	41.87	79.37
	Quadrupole Chamber	25	ea	500			12.50				3.33	3.33	7303		24.34	
	H Dipole Chamber	3	ea	3500			10.50	3	20 hr		0.40	0.40	28		2.92	
	C Dipole Chamber	1	ea	3500			3.50	1	20 hr		0.13	0.13	28		0.97	
	Octupole Chamber	6	ea	500			3.00	6	20 hr		0.80	0.80	28		5.84	
	Trim Magnet Chamber	16	ea	500			8.00	16	10 hr		1.07	1.07	28		7.79	
1.7.1.2	Belows Assemblies	102	ea	160			16.32	102	4 hr		2.72	2.72	7303		19.86	36.18
1.7.1.3	Tubes	1	lot	6500		0.00	6.50	1	MONTH		1.62	1.62	7303	0.00	11.83	18.33
	Short	20	ea	20			0.40	20	3 hr		0.40	0.40	28		2.92	
	Long	61	ea	100			6.10	61	3 hr		1.22	1.22	28		8.91	
1.7.1.4	Tees	10	ea	160			1.60	10	5 hr		0.33	0.33	28		2.43	
1.7.1.5	Flanges	1	lot	23140		0.00	23.14						7303			4.03
	Flange (Chamber Transition)	102	ea	20			2.04									25.14
	Flange (Tubes & Tees)	211	ea	100			21.10									
1.7.1.6	Valves	1	lot	34000			34.00	1	MONTH		0.17	0.17	3500	0.00	0.58	34.58
	In-Line	5	ea	2200			11.00	5	2 hr		0.07	0.07	18		0.23	
	Roughing	5	ea	2200			11.00	5	2 hr		0.07	0.07	18		0.23	
	All Metal Valve	1	ea	12000			12.00	1	5 hr		0.03	0.03	18		0.12	
1.7.1.7	Support Brackets (in-line)	40	ea	50			2.00	40	1 hr		0.27	0.27	18		0.93	2.93
1.7.1.8	Vacuum Tooling	1	lot	33400		31.60	1.80									1.80
	Magnet Chambers	1	lot	23000		23.00	0.00									
	Flanges	1	lot	7000		7.00	0.00									
	Belows	1	lot	400		0.40	0.00									
	Tee Assemblies	1	lot	600		0.60	0.00									
	Tubes	1	lot	600		0.60	0.00									
	Tube Supports	1	lot	1200		0.00	1.20									
1.7.1.9	Ion Pump Support Brackets								MONTH	12	12.00	18	3500	0.00	42.00	42.00
1.7.1.10	Assembly Manpower	1	lot			0.00	0.00		MONTH	21.5	21.50		5198		111.75	111.75
	In-Line System Engineering								MONTH	1	1.00	5	7000		7.00	
	Conceptual Design						0.00		MONTH	5	5.00	6	5500		27.50	
	Detailed Engineering						0.00		MONTH	8	8.00	12	4500		36.00	
	Specify Parts						0.00		MONTH	1	1.00	6	5500		5.50	
	Bid & Award Parts						0.00		MONTH	1	1.00	6	5500		5.50	
	Supervision						0.00		MONTH	1	1.00	6	5500		5.50	
	Testing						0.00	0.125	12	MONTH	1.5	1.50	6	5500	8.25	8.25
	Documentation						0.00		MONTH	3	3.00	6	5500		16.50	
							0.00		MONTH	1	1.00	6	5500		5.50	
1.7.2	ION PUMPS & P.S.	1	lot	41520		0.00	41.52	1	6.60	MONTH	6.60	6.60	4409	0.00	29.10	70.62
1.7.2.1	Beam Line Ion Pumps	10	ea	2400			24.00	10	5 hr		0.33	0.33	18		1.17	25.17
1.7.2.2	Special Extraction Ion Pumps	2	ea	8400			16.80	2	8 hr		0.11	0.11	18		0.37	17.17
1.7.2.3	Pump Support Brackets	12	ea	60			0.72	12	2 hr		0.16	0.16	18		0.56	1.28
1.7.2.4	Ion Pump Assembly Manpower						0.00		MONTH	3	3.00	18	3500		10.50	10.50
1.7.2.5	Ion Pump Engineering						0.00		MONTH	3	3.00	6	5500		16.50	16.50
1.7.3	ROUGHING STATIONS	4	ea	24000			96.00	4	0.053	MONTH	0.21	0.21	17		1.07	97.07

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WBS #	DESCRIPTION	MATERIALS				PROJECT		BNL LABOR SUMMARY						PROJECT			
		Qty	unit	cost \$	cost basis	INVENTORY	M&S	Quant	Time	Unit of time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	LABOR K\$	TOTAL K\$
1.7.4	VACUUM INSTRUM. & CONTROL	1	lot	74400		0.00	74.40	1	15.90	MONTH	15.91	15.91		4694	0.00	74.67	149.07
1.7.4.1	Penning Gauges	8	ea	600			4.80	8	1	hr	0.05	0.05	18	3500		0.19	4.99
1.7.4.2	PIG Controls w/IF Ports	8	ea	1800			14.40	8	4	hr	0.21	0.21	18	3500		0.75	15.15
1.7.4.3	Ion Pump Control w/IF Ports	12	ea	1800			21.60	12	4	hr	0.32	0.32	18	3500		1.12	22.72
1.7.4.4	Device Controllers	4	ea	6000			24.00	4	4	hr	0.11	0.11	18	3500		0.37	24.37
1.7.4.5	TC w/Control & IF Port	8	ea	1200			9.60	8	4	hr	0.21	0.21	18	3500		0.75	10.35
1.7.4.6	I & C Assembly Manpower						0.00			MONTH	6	6.00	18	3500		21.00	21.00
1.7.4.7	Vacuum I & C Engineering									MONTH	9	9.00	18	5611		50.50	50.50
	Conceptual Design									MONTH	1	1.00	5	7000		7.00	
	Detailed Engineering									MONTH	1	1.00	6	5500		5.50	
	Detailed Design									MONTH	2	2.00	12	4500		9.00	
	Specify Parts									MONTH	1	1.00	6	5500		5.50	
	Bid & Award Parts									MONTH	1	1.00	6	5500		5.50	
	Supervision									MONTH	1	1.00	5	7000		7.00	
	Testing									MONTH	1	1.00	6	5500		5.50	
	Documentation									MONTH	1	1.00	6	5500		5.50	

WBS #	DESCRIPTION	QTY	unit	MATERIALS unit cost \$	cost basis \$	PROJECT INVENTORY M&S K\$	PROJECT M&S K\$	Quant	BNL LABOR SUMMARY Time Unit of Months	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.8	CONTROLS	1	lot	434400		0.00	434.40	1	MONTH	117.00	117.00		5204	0.00	608.90	1043.30
1.8.1	TIMING SYSTEM	1	lot	9500		0.00	9.50	1	MONTH	5.00	5.00		4300	0.00	21.50	31.00
1.8.1.1	Decoder Chassis	2	ea	3100			6.20									
1.8.1.2	Timing Interface	3	ea	1100			3.30									
1.8.1.3	Timing Assembly	1	lot				0.00									
1.8.1.4	Timing Engineering	1	lot				0.00									
1.8.2	CONTROL ROOM	1	lot	113500		0.00	113.50	1	MONTH	14.00	14.00		4357	0.00	61.00	174.50
1.8.2.1	Console Computers	3	ea	6500			19.50									
1.8.2.2	Console Displays	2	ea	12000			24.00									
1.8.2.3	General Equipment	1	lot	70000			70.00									
1.8.2.4	Control Room Assembly	1	lot				0.00									
1.8.2.5	Control Room Engineering	1	lot				0.00									
1.8.3	NETWORK	1	lot	37600		0.00	37.60	1	MONTH	5.00	5.00		5300	0.00	26.50	64.10
1.8.3.1	Network Station	4	ea	7500			30.00									
1.8.3.2	Network Server/Bridge	1	ea	6500			6.50									
1.8.3.3	Network Interface	1	ea	1100			1.10									
1.8.3.4	Network Assembly	1	lot				0.00									
1.8.3.5	Network Engineering	1	lot				0.00									
1.8.4	SOFTWARE DEVELOPMENT	1	lot	17000		0.00	17.00	1	MONTH	18.00	18.00		5000	0.00	90.00	107.00
1.8.4.1	Development Computers	2	ea	5000			10.00									
1.8.4.2	Peripherals	2	ea	2000			4.00									
1.8.4.3	Purchased Programs	2	ea	1500			3.00									
1.8.4.4	Software Engineering	1	lot				0.00									
1.8.5	TVDG PROCESS CONTROLS	1	lot	26500		0.00	26.50	1	MONTH	17.00	17.00		5735	0.00	97.50	124.00
1.8.5.1	P.S. Controller	1	ea	10000			10.00									
1.8.5.2	Vacuum Controller	1	ea	4000			4.00									
1.8.5.3	Instrumentation Controller	1	ea	9000			9.00									
1.8.5.3	Safety Interface	1	ea	3500			3.50									
1.8.5.4	TVDG Controls Assembly	1	lot				0.00									
1.8.5.5	TVDG Controls Engineering	1	lot				0.00									
1.8.6	BOOSTER EXTRACTION CONTROLS	1	lot	24200		0.00	24.20	1	MONTH	14.00	14.00		6000	0.00	84.00	108.20
1.8.6.1	Septum/Bump/Foil Controls	1	ea	16700			16.70									
1.8.6.2	Drive Sextupole Controls	1	ea	3500			3.50									
1.8.6.3	Vacuum Controls	1	ea	4000			4.00									
1.8.6.4	Extraction Controls Assembly	1	lot				0.00									
1.8.6.5	Extraction Cont. Engineering	1	lot				0.00									
1.8.7	BEAM PROCESS CONTROLS	1	lot	50100		0.00	50.10	1	MONTH	24.00	24.00		4850	0.00	116.40	166.50
1.8.7.1	P.S. & Collimator Controls	1	lot	31100			31.10									
1.8.7.2	Vacuum Controls	1	lot	4000			4.00									
1.8.7.3	Instrumentation Controls	1	lot	15000			15.00									
1.8.7.4	Beam Controls Assembly	1	lot				0.00									
1.8.7.5	Beam Controls Engineering	1	lot				0.00									
1.8.8	INTERLOCK SYSTEM	1	lot	120000		0.00	120.00	1	MONTH	6.00	6.00		5000		30.00	150.00

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WBS #	DESCRIPTION	MATERIALS			PROJECT		BNL LABOR SUMMARY					PROJECT				
		Qty	unit	unit cost \$	cost basis	cost INVENTORY M&S K\$	PROJECT M&S K\$	Quant	Time	Unit of Time	Man Months	Code	Rate \$/month	AVAILABLE LABOR K\$	LABOR K\$	PROJECT TOTAL K\$
1.8.9	CONTROL SYSTEM INTEGRATION	1	lot	36000		0.00	36.00	1	MONTH	14.00	14.00		5857	0.00	82.00	118.00
1.8.9.1	Cables & Connectors	1	lot	10000			10.00									
1.8.9.2	Racks & Hardware	1	lot	15000			15.00									
1.8.9.3	Miscellaneous Parts	1	lot	5000			5.00									
1.8.9.4	Assembly Materials	1	lot	3000			3.00									
1.8.9.5	EDIA Materials	1	lot	3000			3.00									
1.8.9.6	Systems Assembly	1	lot				0.00	1	8 MONTH	8.00	8.00	15	5000		40.00	
1.8.9.7	Systems Engineering	1	lot				0.00	1	6 MONTH	6.00	6.00	3	7000		42.00	

WBS #	DESCRIPTION	Qty	unit	MATERIALS unit cost \$	cost basis \$	PROJECT INVENTORY M&S K\$	PROJECT M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.9	BEAM INSTRUMENTATION	1	LOT	374000		0.00	374.00	1		MONTH	33.50	33.50		5448	0.00	182.50	556.50
1.9.1	BEAM PROFILE MONITOR	8	ea	33000		0.00	374.00	8		MONTH	14.00	14.00		5857	0.00	182.50	346.00
1.9.1.1	Harps	8	ea	20000			160.00										
1.9.1.2	Readout Electronics	8	ea	12000			96.00										
1.9.1.3	Local Monitor Cabling	8	ea	1000			8.00				8.00	8.00	15	5000		40.00	
1.9.1.4	Profile Monitor Assembly	8	ea				0.00			6 MONTH	6.00	6.00	3	7000		42.00	
1.9.1.5	Profile Monitor Engineering	1	lot				0.00										
1.9.2	SECONDARY EMISSION CHAMBERS	4	ea	1500		0.00	6.00	4		0.5 MONTH	2.00	2.00	15	5000		10.00	16.00
1.9.3	FLAG SYSTEM	5	ea	10800		0.00	54.00	5		MONTH	8.50	8.50		5353	0.00	45.50	99.50
1.9.3.1	Flag Frame	5	ea	500			2.50										
1.9.3.2	Flag Box	5	ea	3000			15.00										
1.9.3.3	Flag Drive	5	ea	4300			21.50										
1.9.3.4	Flag Control Power	5	ea	1000			5.00										
1.9.3.5	Vidko System	5	ea	2000			10.00										
1.9.3.6	Flag System Assembly	5	ea				0.00			0.5 MONTH	2.50	2.50	15	5000		12.50	
1.9.3.7	Flag System Engineering	1	lot				0.00			6 MONTH	6.00	6.00	4	5500		33.00	
1.9.4	DATA ACQUISITION & DISPLAY	1	lot	50000		0.00	50.00	1		9 MONTH	9.00	9.00	15	5000		45.00	95.00

WBS #	DESCRIPTION	QTY	unit	MATERIALS cost \$	unit cost \$	PROJECT INVENTORY M&S K\$	PROJECT M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.10	EXPERIMENTAL AREA OUTFITTING	1	LOT	1594800		150.00	1444.80	1	MONTH	MONTH	62.66	62.66		4178	0.00	261.77	1706.57
1.10.1	TARGET AREA B (CELL CULTURE)	1	lot	281000		50.00	231.00	1	MONTH	MONTH	10.00	10.00		4025	0.00	40.25	271.25
1.10.1.1	Clean Room Facility	1	lot	100000			100.00										
1.10.1.2	Target Holder	50	ea	100			5.00									3.50	
1.10.1.3	Target Positioner (x,y)	1	ea	7000			7.00				1.00	1.00	16	3500		3.50	
1.10.1.4	Laser Alignment System	1	ea	2000			2.00				1.00	1.00	16	3500			
1.10.1.5	Extractor Tube	1	ea	30000			30.00										
1.10.1.6	Gas Manifold	1	ea	2000			2.00										
1.10.1.7	Target Bench	1	ea	5000			5.00										
1.10.1.8	Optical Bench	1	ea	50000		50.00	0.00				4.00	4.00	16	3500		14.00	
1.10.1.9	Ion Chamber	2	ea	25000			10.00										
1.10.1.10	Shielded Reference Area	1	ea	10000			10.00				1.00	1.00	16	3500		3.50	
1.10.1.11	Video System	1	ea	20000			20.00				1.50	1.50	15	5000		7.50	
1.10.1.12	General Outfitting Labor	1	lot				0.00				1.50	1.50	4	5500		8.25	
1.10.1.13	Target Room A Engineering	1	lot				0.00										
1.10.2	TARGET AREA A (LARGE BEAM)	1	lot	194000		50.00	144.00	1	MONTH	MONTH	9.50	9.50		4053	0.00	38.50	182.50
1.10.2.1	Animal Positioning Chairs	3	ea	10000			30.00				1.50	1.50	16	3500		5.25	
1.10.2.2	Target Holder	50	ea	100			5.00										
1.10.2.3	Target Positioner (x,y)	1	ea	20000			20.00				1.00	1.00	16	3500		3.50	
1.10.2.4	Laser Alignment System	1	ea	2000			2.00				1.00	1.00	16	3500		3.50	
1.10.2.5	Gas Manifold	1	ea	2000			2.00										
1.10.2.6	Target Bench	1	ea	5000			5.00										
1.10.2.7	Optical Bench	1	ea	50000		50.00	0.00				2.00	2.00	16	3500		7.00	
1.10.2.8	Ion Chamber (Large)	1	ea	50000			50.00										
1.10.2.9	Shielded Reference Area	1	ea	10000			10.00				1.00	1.00	16	3500		3.50	
1.10.2.10	Video System	1	lot	20000			20.00				1.50	1.50	15	5000		7.50	
1.10.2.11	General Outfitting Labor	1	lot				0.00				1.50	1.50	4	5500		8.25	
1.10.2.12	Target Room A Engineering	1	lot				0.00										
1.10.3	TARGET AREA C	1	lot	638000		50.00	588.00	1	MONTH	MONTH	20.00	20.00		3763	0.00	75.25	663.25
1.10.3.1	Miscellaneous	1	lot	5000			5.00										
1.10.3.2	Small Animal Holder	3	ea	3000			9.00										
1.10.3.3	Target Positioner (x,y)	1	ea	20000			20.00				1.00	1.00	16	3500		3.50	
1.10.3.4	Laser Alignment System	1	ea	2000			2.00				1.00	1.00	16	3500		3.50	
1.10.3.5	Gas Manifold	1	ea	2000			2.00										
1.10.3.6	Target Bench	1	ea	5000			5.00										
1.10.3.7	Optical Bench	1	ea	50000		50.00	0.00				2.00	2.00	16	3500		7.00	
1.10.3.8	Ion Chamber	1	ea	25000			25.00										
1.10.3.9	Shielded Reference Area	1	ea	10000			10.00				1.00	1.00	16	3500		3.50	
1.10.3.10	Video System	1	lot	10000			10.00				12.00	12.00	16	3500		42.00	
1.10.3.11	Microbeam Complete	1	lot	500000			500.00				1.50	1.50	15	5000		7.50	
1.10.3.12	General Outfitting Labor	1	lot				0.00				1.50	1.50	4	5500		8.25	
1.10.3.13	Target Room A Engineering	1	lot				0.00										
1.10.4	READY ROOM B	1	lot	43200		0.00	43.20	1	MONTH	MONTH	5.16	5.16		4606	0.00	23.77	66.97
1.10.4.1	Work Bench	2	ea	2000			4.00										
1.10.4.2	Laminar Flow Hood	1	ea	9000			9.00										
1.10.4.3	Sink/Counter	1	ea	1000			1.00										
1.10.4.4	Refrigerator	1	ea	1500			1.50										

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WBS #	DESCRIPTION	MATERIALS			PROJECT COST INVENTORY		BNL LABOR SUMMARY			PROJECT AVAILABLE		PROJECT TOTAL
		Qt'y	unit	cost basis \$	M&S K\$	M&S K\$	Quant	Time of Month	Man Months	Code \$/month	LABOR K\$	
1.10.4.5	Dual Incubator	1	ea	7200		7.20	1	24 hr	0.16	27	6353	1.02
1.10.4.6	Desk etc	1	ea	2000		2.00						
1.10.4.7	Magnetic Stirrer	1	ea	500		0.50						
1.10.4.8	Glassware	1	lot	1000		1.00						
1.10.4.9	Locking Cabinet	1	ea	500		0.50						
1.10.4.10	Equilibration Area	1	lot	3000		3.00						
1.10.4.11	Miscellaneous	1	lot	5000		5.00						
1.10.4.12	Gas Manifold	1	ea	2000		2.00			2.00	16	3500	7.00
1.10.4.13	Work Station Computer	1	ea	6500		6.50			1.50	15	5000	7.50
1.10.4.14	General Outfitting Labor	1	lot			0.00			1.50	4	5500	8.25
1.10.4.15	Ready Room A Engineering	1	lot			0.00			5.00		4550	22.75
1.10.5	READY ROOM A	1	lot	45200	0.00	45.20						67.95
1.10.5.1	Work Bench	2	ea	2000		4.00						
1.10.5.2	Hood	1	ea	15000		15.00						
1.10.5.3	Sink/Counter	1	ea	1000		1.00						
1.10.5.4	Refrigerator	1	ea	700		0.70						
1.10.5.5	Incubator	2	ea	2000		4.00						
1.10.5.6	Desk etc	1	ea	2000		2.00						
1.10.5.7	Magnetic Stirrer	1	ea	500		0.50						
1.10.5.8	Glassware	1	lot	1000		1.00						
1.10.5.9	Locking Cabinet	1	ea	500		0.50						
1.10.5.10	Equilibration Area	1	lot	3000		3.00						
1.10.5.11	Miscellaneous	1	lot	5000		5.00						
1.10.5.12	Gas Manifold	1	ea	2000		2.00			2.00	16	3500	7.00
1.10.5.13	Work Station Computer	1	ea	6500		6.50			1.50	15	5000	7.50
1.10.5.14	General Outfitting Labor	1	lot			0.00			1.50	4	5500	8.25
1.10.5.15	Ready Room B Engineering	1	lot			0.00			5.00		4550	22.75
1.10.6	READY ROOM C	1	lot	36500	0.00	36.50						59.25
1.10.6.1	Work Bench	2	ea	2000		4.00						
1.10.6.2	Hood	1	ea	5000		5.00						
1.10.6.3	Sink/Counter	1	ea	1000		1.00						
1.10.6.4	Refrigerator	1	ea	500		0.50						
1.10.6.5	Instrumentation	1	lot	10000		10.00						
1.10.6.6	Desk etc	1	ea	2000		2.00						
1.10.6.7	Locking Cabinet	1	ea	500		0.50						
1.10.6.8	Miscellaneous	1	lot	5000		5.00						
1.10.6.9	Gas Manifold	1	ea	2000		2.00			2.00	16	3500	7.00
1.10.6.10	Work Station Computer	1	ea	6500		6.50			1.50	15	5000	7.50
1.10.6.11	General Outfitting Labor	1	lot			0.00			1.50	4	5500	8.25
1.10.6.12	Ready Room C Engineering	1	lot			0.00			8.00		4813	38.50
1.10.7	SUPPORT LAB EQUIPMENT	1	lot	356900	0.00	356.90						395.40
1.10.7.1	Work Bench	4	ea	2000		8.00						
1.10.7.2	Cell Counter	1	ea	34000		34.00						
1.10.7.3	Sink/Counter	2	ea	1000		2.00						
1.10.7.4	Freezer (-20 deg)	1	lot	2500		2.50						
1.10.7.5	Nitrogen Dewars	1	lot	5000		5.00						
1.10.7.6	Balance	1	ea	4000		4.00						
1.10.7.7	Centrifuge	1	ea	6000		6.00						

WBS #	DESCRIPTION	MATERIALS			PROJECT INVENTORY		PROJECT M&S K\$	BNL LABOR SUMMARY				AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
		qt'y	unit	unit cost \$	cost basis	M&S K\$		Quant	Time	Unit of Time	Man Months			
1.10.7.8	Ice Maker	1	ea	3000		3.00								
1.10.7.9	Locking Cabinet	4	ea	500		2.00								
1.10.7.10	ph Meter	1	ea	3000		3.00								
1.10.7.11	Homogenizer	1	ea	3000		3.00								
1.10.7.12	Portable Hood	1	ea	1000		1.00								
1.10.7.13	Spiral Plater	1	ea	2000		2.00								
1.10.7.14	Spectrophotometer	1	ea	8000		8.00								
1.10.7.15	Power Supply	3	ea	2000		6.00								
1.10.7.16	Radioactive Waste Storage	1	lot	30000		30.00								
1.10.7.17	Radiation Monitors	10	ea	4000		40.00							7.00	
1.10.7.18	Cage Cleaning Area	1	lot	1000		1.00								
1.10.7.19	Animal Equipment	1	lot	97200	0.00	97.20								
1.10.7.19.1	Mouse Cages	200	ea	40		8.00								
1.10.7.19.2	Rat Cages	200	ea	40		8.00								
1.10.7.19.3	Primate Cages	3	ea	8000		24.00								
1.10.7.19.4	Cat Cages	3	ea	6500		19.50								
1.10.7.19.5	Dog Cages	4	ea	7300		29.20								
1.10.7.19.6	Cage Racks	4	ea	500		2.00								
1.10.7.19.7	Transport Cages	3	ea	1500		4.50								
1.10.7.19.8	Miscellaneous	1	lot	2000		2.00								
1.10.7.20	Desk	2	ea	1000		2.00								
1.10.7.21	General Outfitting Labor	1	lot			0.00		0.25	12 MONTH	3.00	3.00	15	5000	15.00
1.10.7.22	Support Lab Engineering	1	lot			0.00		0.25	12 MONTH	3.00	3.00	4	5500	16.50
								10	0.2 MONTH	2.00	2.00	16	3500	7.00

WBS #	DESCRIPTION	MATERIALS				PROJECT		Quant	BNL LABOR SUMMARY				Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
		Qty	unit	unit cost \$	cost basis K\$	INVENTORY M&S K\$	PROJECT M&S K\$		Time	Unit Time	Man Months	Net Project Months					
1.11	UTILITIES & SERVICES	1	LOT	430000		0.00	430.00		MONTH	11.00	11.00		6529	0.00		71.82	501.82
1.11.1	ELECTRICAL POWER DISTRIBUTION	1	LOT	130000		0.00	130.00		MONTH	3.00	3.00		6569	0.00		19.71	149.71
1.11.1.1	Experimental areas	1	lot	65000			65.00		MONTH	1	1.00	27	6353			6.35	
1.11.1.2	Power Supply House	1	lot	65000			65.00		MONTH	1	1.00	27	6353			6.35	
1.11.1.3	Power Engineering						0.00		MONTH	1	1.00	3	7000			7.00	
1.11.2	COOLING WATER SYSTEM	1	LOT	300000		0.00	300.00		MONTH	8.00	8.00		6515	0.00		52.12	352.12
1.11.2.1	Cooling System	1	lot	300000			300.00		MONTH	6	6.00	27	6353			38.12	
1.11.2.2	Cooling System Engineering						0.00		MONTH	2	2.00	5	7000			14.00	

WBS #	DESCRIPTION	QTY	unit	MATERIALS unit cost \$	cost basis	PROJECT INVENTORY M&S K\$	PROJECT M&S K\$	Quant	Time	BNL LABOR SUMMARY Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.12	TANDEM & BEAM MODIFICATIONS	1	LOT	4181252	50.00	4131.25				MONTH	154.35	154.35		5334	0.00	823.29	4954.54
1.12.1	MP6 TANDEM UPGRADE	1	LOT	2220002	0.00	2220.00				MONTH	45.00	45.00		5533	0.00	249.00	2469.00
1.12.1.1	Acceleration Tubes, etc	1	lot	1200000		1200.00											
1.12.1.2	Dead Section Pumps, etc	1	lot	200000		200.00											
1.12.1.3	Voltage Dividers	1	lot	260000		260.00											
1.12.1.4	Connection Improvements	1	lot	20000		20.00											
1.12.1.5	Equipotential Ring Mounts	1	lot	20000		20.00											
1.12.1.6	Additional SF6	1	lot	200000		200.00											
1.12.1.7	Charging System, etc	1	lot	200000		200.00											
1.12.1.8	Ion Source Equipment	1	lot	30000		30.00											
1.12.1.9	Beam Chopper, etc	1	lot	30000		30.00											
1.12.1.10	Corona Actuator	1	ea	10000		10.00											
1.12.1.11	Generating Voltmeter	1	ea	10000		10.00											
1.12.1.12	Chart Recorder	1	ea	10000		10.00											
1.12.1.13	Terminal Foil Changer	1	ea	10000		10.00											
1.12.1.14	MP6 Assembly Labor	1	lot			0.00										165.00	
1.12.1.15	MP6 Engineering	1	lot			0.00										84.00	
1.12.1.16	Miscellaneous	0%	of	2220000		0.00										0.00	
1.12.2	BEAM BYPASS	1	LOT	1961250	50.00	1911.25				MONTH	109.35	109.35		5252	0.00	574.29	2485.54
1.12.2.1	Magnet System	1	LOT	853000	50.00	803.00											803.00
1.12.2.1.1	90 Degree Dipole	2	ea	150000		90.00											
1.12.2.1.2	Power Supply (90 Degree)	2	ea	45000		80.00											
1.12.2.1.3	24 Degree Dipole	2	ea	40000	50.00	0.00											
1.12.2.1.4	Power Supply (24 Degree)	2	ea	25000		0.00											
1.12.2.1.5	Quadrupole Doubtlet	4	ea	22000		88.00											
1.12.2.1.6	Quad Power Supply	1	lot	70000		70.00											
1.12.2.1.7	Trim Magnet Pair	3	ea	6000		18.00											
1.12.2.1.8	Trim Power Supply	6	ea	5000		30.00											
1.12.2.1.9	Switching Magnet & P.S.	1	ea	75000		75.00											
1.12.2.1.10	NMR Gaussmeter	1	ea	40000		40.00											
1.12.2.1.11	Remove SREL Magnet	1	ea	12000		12.00											
1.12.2.2	Instrumentation System	1	LOT	223000	0.00	223.00											
1.12.2.2.1	Profile Monitors	4	ea	30000		120.00											
1.12.2.2.2	Monitor Electronics	4	ea	12000		48.00											
1.12.2.2.3	Beam Stops	2	ea	20000		40.00											
1.12.2.2.4	Analog Multiplexer	1	ea	15000		15.00											
1.12.2.3	Vacuum System	1	LOT	161000	0.00	161.00											
1.12.2.3.1	Pipe & Hardware	1	lot	40000		40.00											
1.12.2.3.2	Ion Pumps & P.S.	1	lot	35000		35.00											
1.12.2.3.3	Cryopumps & Controllers	1	lot	36000		36.00											
1.12.2.3.4	Ion Gauges, Controllers	1	lot	30000		30.00											
1.12.2.3.5	Valves	1	lot	20000		20.00											
1.12.2.4	Beam Line Control System	1	LOT	45000	0.00	45.00				MONTH	3.00	3.00		5000	0.00	15.00	60.00
1.12.2.4.1	Translator, etc	1	lot	15000		15.00											
1.12.2.4.2	Instrument Controllers	1	lot	20000		20.00											
1.12.2.4.3	Relay Extension	1	lot	10000		10.00											
1.12.2.4.4	Software Development	1	lot			0.00										15.00	
1.12.2.5	Other Items	1	LOT	57000	0.00	57.00										38.40	
1.12.2.5.1	Misc Mechanical Hardware	1	lot	15000		15.00											95.40

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WBS #	DESCRIPTION	MATERIALS			PROJECT M&S		BNL LABOR SUMMARY			PROJECT AVAILABLE LABOR		PROJECT TOTAL K\$
		Qt'y	unit	unit cost \$	cost basis M&S K\$	INVENTORY M&S K\$	Quant	Time of Time	Man Months	Code \$/month	LABOR K\$	
1.12.2.5.2	Installation	1	lot	12000		12.00	1	6 MONTH	6.00	6400	38.40	
1.12.2.5.3	Communications, Security	1	lot	30000		30.00						300.00
1.12.2.6	Conventional Construction	1	lot	300000		300.00						240.00
1.12.2.7	General Support Labor	1	lot			0.00	1	48 MONTH	48.00	5000	240.00	
1.12.2.8	Beam Line Engineering	1	lot			0.00	1	24 MONTH	24.00	5500	132.00	
1.12.2.9	Miscellaneous	25%	of	1289000		322.25	35%	81.0 MONTH	28.35		148.89	471.14

WBS #	DESCRIPTION	QTY	unit	MATERIALS unit cost \$	cost basis	INVENTORY M&S K\$	PROJECT M&S K\$	Quant	Time	Unit Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.13	INSTALLATION	1	LOT	1232434		20.00	1212.43	1	130.4	MONTH	130.47	129.80		4680	4.87	605.75	1818.18
1.13.1	CABLE	1	lot	794910		0.00	794.91	1	29.87	MONTH	29.87	29.87		5505	0.00	164.43	959.34
1.13.1.1	Extraction System Cable	1	lot	58690		0.00	58.69	1	3.44	MONTH	3.44	3.44		5634	0.00	19.38	
1.13.1.1.1	Septum&Bump Cable 500 MCM	8000	ft	7.00			56.00										
1.13.1.1.2	E/S Septum 100KV Coax	200	ft	5.00			1.00										
1.13.1.1.3	Purchase Connectors	1	lot	1690		0.00	1.69										
1.13.1.1.4	Installation	1	lot			0.00	0.00										
	Rigging	3	lot	0.00			0.00										
	Cut to Length	60	length	0.00			0.00										
	Add Connectors	120	conn	0.00			0.00										
	Test	60	length	0.00			0.00										
	Pull in Place	60	length	0.00			0.00										
1.13.1.2	Transfer Magnet Cable	1	lot	463320		0.00	463.32	1	18.08	MONTH	18.08	18.08		5615	0.00	101.51	
1.13.1.2.1	Purchase Cable 500 MCM	64800	ft	7.00			453.60										
1.13.1.2.2	Purchase Connectors	648	conn	15.00		0.00	9.72										
1.13.1.2.3	Installation	1	lot			0.00	0.00										
	Rigging	10	lot	0.00			0.00										
	Cut to Length	324	length	0.00			0.00										
	Add Connectors	648	conn	0.00			0.00										
	Test	324	length	0.00			0.00										
	Pull in Place	324	length	0.00			0.00										
1.13.1.3	Collimator Control Cable	1	lot	12600		0.00	12.60	1	0.313	MONTH	0.31	0.31		5038	0.00	1.58	
1.13.1.3.1	Purchase Cable	2500	ft	5.00			12.50										
1.13.1.3.2	Purchase Connectors	20	conn	5.00		0.00	0.10										
1.13.1.3.3	Installation	1	lot			0.00	0.00										
	Rigging	1	ea	0.00			0.00										
	Cut to Length	10	length	0.00			0.00										
	Add Connectors	20	conn	0.00			0.00										
	Test	10	length	0.00			0.00										
	Pull in Place	10	length	0.00			0.00										
1.13.1.4	Vacuum System Cable	1	lot	116120		0.00	116.12	1	1.373	MONTH	1.37	1.37		4793	0.00	6.58	
1.13.1.4.1	Purchase Cable	1	lot	35000		0.00	35.00										
	Power Cable	3000	ft	5.00			15.00										
	Vacuum I&C Cable	4000	ft	5.00			20.00										
1.13.1.4.2	Purchase Connectors	104	ea	780.00		0.00	81.12										
1.13.1.4.3	Installation	1	lot			0.00	0.00										
	Rigging	2	lot	0.00			0.00										
	Cut to Length	52	length	0.00			0.00										
	Add Connectors	104	conn	0.00			0.00										
	Test	52	length	0.00			0.00										
	Pull in Place	52	length	0.00			0.00										
1.13.1.5	Instrumentation Cable	1	lot	49530		0.00	49.53	1	0.99	MONTH	0.99	0.99		4730	0.00	4.68	
	Purchase Cable	9750	ft	5.00			48.75										
	Purchase Connectors	78	conn	10.00		0.00	0.78										
	Installation	1	lot			0.00	0.00										
	Rigging	1	lot	0.00			0.00										

WBS #	DESCRIPTION	MATERIALS				PROJECT		BNL LABOR SUMMARY							PROJECT	PROJECT
		Qty	unit	cost	cost basis	unit	M&S	Quant	Time	Unit	Man	Net	Code	Rate	AVAILABLE	LABOR
				\$	\$		K\$			Time	Months	Months	\$/month	K\$	K\$	K\$
1.13.1.6	Cut to Length	39	length	0.00			0.00	39	0.5 hr	0.13	0.13	27	6353		0.83	
	Add Connectors	78	conn	0.00			0.00	78	0.5 hr	0.26	0.26	22	2000		0.52	
	Test	39	length	0.00			0.00	39	0.5 hr	0.13	0.13	21	2700		0.35	
	Pull in Place	39	length	0.00			0.00	39	1.5 hr	0.39	0.39	27	6353		2.48	
	Controls Cable	1	lot	63500		0.00	63.50	1	2.746 MONTH	2.75	2.75		5603	0.00	15.39	
1.13.1.7	Purchase Cable	12500	ft	5.00			62.50									
	Purchase Connectors	100	conn	10.00		0.00	1.00									
	Installation	1	lot	0.00		0.00	0.00	1	2.746 MONTH	2.75	2.75	27	5603	0.00	15.39	
	Rigging	1	lot	0.00		0.00	0.00	1	12 hr	0.08	0.08	27	6353		0.51	
	Cut to Length	50	length	0.00		0.00	0.00	50	0.5 hr	0.17	0.17	27	6353		1.06	
1.13.1.8	Add Connectors	100	conn	0.00		0.00	0.00	100	0.5 hr	0.33	0.33	22	2000		0.67	
	Test	50	length	0.00		0.00	0.00	50	0.5 hr	0.17	0.17	21	2700		0.45	
	Pull in Place	50	length	0.00		0.00	0.00	50	6 hr	2.00	2.00	27	6353		12.71	
	Utilities/Services Cable	1	lot	21900		0.00	21.90	1	1.68 MONTH	1.68	1.68		5617	0.00	9.44	
	Purchase Cable 500 MCM	1500	ft	14.00		0.00	21.00									
1.13.1.9	Purchase Connectors	60	conn	15.00		0.00	0.90									
	Installation	1	lot	0.00		0.00	0.00	1	1.68 MONTH	1.68	1.68	27	5617	0.00	9.44	
	Rigging	1	lot	0.00		0.00	0.00	1	12 hr	0.08	0.08	27	6353		0.51	
	Cut to Length	30	length	0.00		0.00	0.00	30	0.5 hr	0.10	0.10	27	6353		0.64	
	Add Connectors	60	conn	0.00		0.00	0.00	60	0.5 hr	0.20	0.20	22	2000		0.40	
1.13.1.9.1	Test	30	length	0.00		0.00	0.00	30	0.5 hr	0.10	0.10	21	2700		0.27	
	Pull in Place	30	length	0.00		0.00	0.00	30	6 hr	1.20	1.20	27	6353		7.62	
	Interlock Cable	1	lot	9250		0.00	9.25	1	1.246 MONTH	1.25	1.25		4701	0.00	5.86	
	Purchase Cable	2500	ft	3.50		0.00	8.75									
	Purchase Connectors	100	conn	5.00		0.00	0.50									
1.13.1.9.2	Installation	1	lot	0.00		0.00	0.00	1	1.246 MONTH	1.25	1.25	27	4701	0.00	5.86	
	Rigging	1	lot	0.00		0.00	0.00	1	12 hr	0.08	0.08	27	6353		0.51	
	Cut to Length	50	length	0.00		0.00	0.00	50	0.5 hr	0.17	0.17	27	6353		1.06	
	Add Connectors	100	conn	0.00		0.00	0.00	100	0.5 hr	0.33	0.33	22	2000		0.67	
	Test	50	length	0.00		0.00	0.00	50	0.5 hr	0.17	0.17	21	2700		0.45	
1.13.1.9	Pull in Place	50	length	0.00		0.00	0.00	50	1.5 hr	0.50	0.50	27	6353		3.18	
	Interconnecting Busbar	1	lot	0		0.00	0.00	1	0.00 MONTH	0.00	0.00		5576	0.00	0.00	
	Purchase Materials	0.0000	lb	2.85		0.00	0.00	0.0000	0.10 MONTH	0.00	0.00	27	5576	0.00	0.00	
	Fabricate Busbar	0.0000	lot	10.00		0.00	0.00	0.0000	12 hr	0.00	0.00	22	2000		0.00	
	Rigging	0.0000	ea	10		0.00	0.00	0.0000	1 hr	0.00	0.00	21	2700		0.00	
1.13.2	Cut, Bend	0.0000	ea	10		0.00	0.00	0.0000	1 hr	0.00	0.00	21	2700		0.00	
	Insulate	0.0000	ea	0		0.00	0.00	0.0000	1 hr	0.00	0.00	21	2700		0.00	
	Installation Busbar	0.0000	ea	0		0.00	0.00	0.0000	1 hr	0.00	0.00	21	2700		0.00	
	TRAY	4000	ft	15.00		0.00	60.00	INCLUDES MANPOWER							60.00	
	COOLING WATER HOSE	1	lot	11024		0.00	11.02	1	5.733 MONTH	5.73	5.73		5591	0.00	32.06	
1.13.3	Purchase Hose	1060	ft	6.00		0.00	6.36									
	Purchase Connectors	212	conn	22.00		0.00	4.66									
	Installation	1	lot	0.00		0.00	0.00	1	5.733 MONTH	5.73	5.73	27	5591	0.00	32.06	
	Rigging	1	lot	0.00		0.00	0.00	1	12 hr	0.08	0.08	27	6353		0.51	
	Cut to Length	106	length	0.00		0.00	0.00	106	0.5 hr	0.35	0.35	27	6353		2.24	

H. Feelsche

10/30/91

WBS #	DESCRIPTION	MATERIALS				PROJECT		BNL LABOR SUMMARY						PROJECT			
		Q't'y	unit	cost \$	unit cost \$	INVENTORY M&S K\$	M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	LABOR K\$	PROJECT TOTAL K\$
	Add Connectors	212	conn	0.00		0.00	0.00	212	0.5 hr	1 MONTH	0.71	0.71	22	2000		1.41	
	Test	106	length	0.00		0.00	0.00	106	0.5 hr	1 MONTH	0.35	0.35	21	2700		0.95	
	Pull in Place	106	length	0.00		0.00	0.00	106	6 hr	1 MONTH	4.24	4.24	27	6353		26.94	
1.13.4	MISCELLANEOUS PARTS	1	lot	5000		5.00	5.00	1	1 MONTH	1 MONTH	1.00	1.00	27	6353		6.35	11.35
1.13.5	STAGING	1	lot	500		0.50	0.50	1	1 MONTH	1 MONTH	1.00	1.00	27	6353		6.35	6.85
1.13.6	RIGGING	1	lot			0.00	0.00	1	11.6 MONTH	11.6 MONTH	11.60	11.60	27	6353	0.00	73.69	73.69
1.13.6.1	Miscellaneous Equipment	10	lot	0		0.00	0.00	10	12 hr	12 hr	0.80	0.16	27	6353		5.08	
1.13.6.2	Extraction Magnets	2	ea	0		0.00	0.00	2	12 hr	12 hr	0.16	0.16	27	6353		1.02	
1.13.6.3	Transfer Magnets	51	ea	0		0.00	0.00	51	12 hr	12 hr	4.08	4.08	27	6353		25.92	
1.13.6.4	Extraction Power Supplies	12	ea	0		0.00	0.00	12	12 hr	12 hr	0.96	0.96	27	6353		6.10	
1.13.6.5	Transfer Power Supplies	51	ea	0		0.00	0.00	51	12 hr	12 hr	4.08	4.08	27	6353		25.92	
1.13.6.6	Collimators, Strippers	13	ea	0		0.00	0.00	13	12 hr	12 hr	1.04	1.04	27	6353		6.61	
1.13.6.7	Vacuum System	2	lot	0		0.00	0.00	2	12 hr	12 hr	0.16	0.16	27	6353		1.02	
1.13.6.8	Instrumentation	3	lot	0		0.00	0.00	3	12 hr	12 hr	0.24	0.24	27	6353		1.52	
1.13.6.9	Utilities & Services	1	lot	0		0.00	0.00	1	12 hr	12 hr	0.08	0.08	27	6353		0.51	
1.13.7	SURVEY	1	lot			0.00	0.00	1	3.32 MONTH	3.32 MONTH	3.32	3.32	27	6353	0.00	21.09	21.09
	Extraction Magnets	2	ea	0		0.00	0.00	2	6 hr	6 hr	0.08	0.08	27	6353		0.51	
	Transfer Magnets	51	ea	0		0.00	0.00	51	6 hr	6 hr	2.04	2.04	27	6353		12.96	
	Collimators, Strippers	13	ea	0		0.00	0.00	13	6 hr	6 hr	0.52	0.52	27	6353		3.30	
	Instrumentation	17	ea	0		0.00	0.00	17	6 hr	6 hr	0.68	0.68	27	6353		4.32	
1.13.8	HOOKUP	1	lot			0.00	0.00	1	28.93 MONTH	28.93 MONTH	28.93	28.93	20	3526	0.00	102.03	102.03
	Miscellaneous Equipment	10	lot	0		0.00	0.00	10	48 hr	48 hr	3.20	3.20	20	3500		11.20	
	Extraction Magnets	2	ea	0		0.00	0.00	2	16 hr	16 hr	0.21	0.21	20	3500		0.75	
	Transfer Magnets	51	ea	0		0.00	0.00	51	16 hr	16 hr	5.44	5.44	20	3500		19.04	
	Extraction Power Supplies	12	ea	0		0.00	0.00	12	32 hr	32 hr	2.56	2.56	16	3500		8.96	
	Transfer Power Supplies	51	ea	0		0.00	0.00	51	16 hr	16 hr	5.44	5.44	16	3500		19.04	
	Collimators, Strippers	13	ea	0		0.00	0.00	13	16 hr	16 hr	1.39	1.39	18	3500		4.85	
	Vacuum System	56	unit	0		0.00	0.00	56	4 hr	4 hr	1.49	1.49	20	3500		5.23	
	Instrumentation	17	unit	0		0.00	0.00	17	20 hr	20 hr	2.27	2.27	16	3500		7.93	
	Interlocks	50	unit	0		0.00	0.00	50	20 hr	20 hr	6.67	6.67	16	3500		23.33	
	Utilities & Services	1	lot	0		0.00	0.00	1	40 hr	40 hr	0.27	0.27	27	6353		1.69	
1.13.9	RUN & TEST	1	lot			0.00	325.00	1	33.01 MONTH	33.01 MONTH	33.01	33.01	20	3523	0.00	116.31	441.31
	Miscellaneous Equipment	10	lot	0		0.00	0.00	10	60 hr	60 hr	4.00	4.00	20	3500		14.00	
	Extraction Magnets	2	ea	0		0.00	0.00	2	20 hr	20 hr	0.27	0.27	20	3500		0.93	
	Transfer Magnets	51	ea	0		0.00	0.00	51	20 hr	20 hr	6.80	6.80	20	3500		23.80	
	Extraction Power Supplies	12	ea	0		0.00	0.00	12	40 hr	40 hr	3.20	3.20	16	3500		11.20	
	Transfer Power Supplies	51	ea	0		0.00	0.00	51	20 hr	20 hr	6.80	6.80	16	3500		23.50	
	Collimators, Strippers	13	ea	0		0.00	0.00	13	20 hr	20 hr	1.73	1.73	18	3500		6.07	
	Vacuum System	56	unit	0		0.00	0.00	56	8 hr	8 hr	2.99	2.99	20	3500		10.45	
	Instrumentation	17	unit	0		0.00	0.00	17	32 hr	32 hr	3.63	3.63	16	3500		12.69	
	Interlocks	50	unit	0		0.00	0.00	50	10 hr	10 hr	3.33	3.33	16	3500		11.67	
	Utilities & Services	1	lot	0		0.00	0.00	1	40 hr	40 hr	0.27	0.27	27	6353		1.69	
	Commissioning	250	hrs	1300		325.00											
1.13.10	INSTALLATION SUPPORT	1	LOT	36000		20.00	16.00	1	MONTH	MONTH	16.00	15.33		5519	4.87	83.43	99.43
1.13.10.1	Magnet Transporter	1	unit	20000		20.00	0.00	1	0.666 MONTH	0.67	-0.00	-0.00		7303	4.87	-0.00	-0.00
1.13.10.1.1	Transporter Parts	1	Lot	15000		5.00	0.00	1	100 hr	0.67	-0.00	-0.00	28	7303	4.87	-0.00	-0.00
1.13.10.1.2	Transporter Assembly	1	Lot	5000		0.00	0.00										

H. Foelsche

10/30/91

WBS #	DESCRIPTION	q'ty	unit	MATERIALS unit cost \$	cost basis	INVENTORY M&S K\$	PROJECT M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.13.10.2	Tooling	1	unit	6000		0.00	6.00	1	0.333	MONTH	0.33	0.33		7303	0.00	2.43	8.43
	Purchase Materials	1	Lot	5000			5.00										
	Fabricate Tooling	1	Lot	1000			1.00										
1.13.10.3	Miscellaneous Stores	1	Lot	10000			10.00										10.00
1.13.10.4	Installation Engineering	1	lot			0.00	0.00								0.00	81.00	81.00
1.13.10.4.1	Cable Engineering	1	lot			0.00	0.00								0.00	8.25	8.25
	Cable Layout	1	lot				0.00									5.50	5.50
	Specify Cables	1	lot				0.00									2.75	2.75
	Bid & Award Cables	1	lot				0.00									0.00	0.00
	Busbar Engineering	1	lot				0.00									0.00	0.00
1.13.10.4.2	Detailed Design Busbar	1	lot			0.00	0.00								0.00	0.00	0.00
	Specify Material	1	lot				0.00									0.00	0.00
	Bid & Award Material	1	lot				0.00									0.00	0.00
1.13.10.4.3	Cable Tray Engineering	1	lot			0.00	0.00								0.00	2.25	2.25
	Tray Layout	1	lot				0.00									2.25	2.25
	Specify Material	1	lot				0.00									0.00	0.00
	Bid & Award Material	1	lot				0.00									0.00	0.00
1.13.10.4.4	Cooling Water Hose	1	lot			0.00	0.00								0.00	2.25	2.25
	Water Distribution Plans	1	lot				0.00									0.00	0.00
	Specify Material	1	lot				0.00									0.00	0.00
1.13.10.4.5	Bid & Award Material	1	lot			0.00	0.00								0.00	0.00	0.00
	Magnet Transporter	1	lot				0.00									0.00	0.00
	Conceptual Design	1	lot				0.00									0.00	0.00
	Detailed Engineering	1	lot				0.00									0.00	0.00
	Detailed Design	1	lot				0.00									0.00	0.00
	Specify Parts	1	lot				0.00									0.00	0.00
	Bid & Award Parts	1	lot				0.00									0.00	0.00
1.13.10.4.6	Tooling	1	lot			0.00	0.00								0.00	2.25	2.25
	Specify Tools	1	lot				0.00									0.00	0.00
	Bid & Award Tools	1	lot				0.00									0.00	0.00
1.13.10.4.7	General Supervision	1	lot				0.00									66.00	66.00

WBS #	DESCRIPTION	QTY	unit	MATERIALS unit cost \$	cost basis M&S K\$	PROJECT INVENTORY M&S K\$	PROJECT M&S K\$	Quant	Time	Unit of Time	Man Months	Net Project Months	Code	Rate \$/month	AVAILABLE LABOR K\$	PROJECT LABOR K\$	PROJECT TOTAL K\$
1.14	GENERAL SYSTEM SUPPORT	1	LOT	250000	85.00	165.00	165.00			MONTH	73.00	73.00		5606	0.00	409.25	574.25
1.14.1	MANUFACTURING SUPPORT	1	LOT	210000	85.00	125.00	125.00			MONTH	31.00	31.00		5145	0.00	159.30	284.50
1.14.1.1	Tooling & Instruments	1	LOT	85000	85.00	0.00	0.00			MONTH	10.00	10.00		5000	0.00	50.00	
	Magnet Assembly Tooling	1	lot	25000	25.00	0.00	0.00			MONTH	2	2.00	17	5000		10.00	
	Power Supply Support	1	lot	25000	25.00	0.00	0.00			MONTH	2	2.00	17	5000		10.00	
	Collimator Assembly Tooling	1	lot	5000	5.00	0.00	0.00			MONTH	2	2.00	17	5000		10.00	
	Vacuum Assembly Support	1	lot	5000	5.00	0.00	0.00			MONTH	2	2.00	17	5000		10.00	
	Controls Assembly Support	1	lot	25000	25.00	0.00	0.00			MONTH	2	2.00	17	5000		10.00	
1.14.1.2	General Expenses	1	lot	100000		100.00				MONTH	3	3.00	4	5500		16.50	
1.14.1.3	Manufacturing QA	1	lot	25000		25.00				MONTH	12	12.00	19	5000		60.00	
1.14.1.4	Manufacturing Supervision	1	lot							MONTH	6	6.00	6	5500		33.00	
1.14.1.5	Manufacturing Engineering	1	lot							MONTH	12.00	12.00		5500	0.00	66.00	81.00
1.14.2	DESIGN SUPPORT	1	LOT	15000	0.00	15.00	15.00			MONTH	3	3.00	1	7500		22.50	
1.14.2.1	Beam Design	1	lot	10000		10.00	10.00			MONTH	3	3.00	11	5500		16.50	
1.14.2.2	Design Room Supervision	1	lot	5000		5.00	5.00			MONTH	6	6.00	12	4500		27.00	
1.14.2.3	General Design Expenses	1	lot							MONTH	30.00	30.00		6125	0.00	183.75	208.75
1.14.3	ADMINISTRATION & MANAGEMENT	1	LOT	25000	0.00	25.00	25.00			MONTH	15	15.00	3	7000		105.00	
1.14.3.1	Engineering Supervision	1	lot	5000		5.00	5.00			MONTH	7.5	7.50	1	7500		56.25	
1.14.3.2	Project Supervision	1	lot	5000		5.00	5.00			MONTH	7.5	7.50	1	7500		56.25	
1.14.3.3	Administrative Expenses	1	lot	15000		15.00	15.00			MONTH	7.5	7.50	25	3000		22.50	

WBS #	DESCRIPTION	MATERIALS				PROJECT		BNL LABOR SUMMARY					PROJECT		PROJECT TOTAL K\$	
		Q't'y	unit	cost \$	cost basis	cost inventory	M&S	Quant	Time	Unit	Man	Net	Code	Rate		AVAILABLE LABOR K\$
							K\$			of	Months	Project	\$/month			
							K\$			Time		Months				

BNL SALARY RATES (FY 91)
Including Fringe Benefits

CLASSIFICATION														
MONTHLY SALARY (FY1991)														
CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	7500	5000	7000	5500	7000	5500	4500	3500	6000	5000	5500	4500	4200	3300
2														
3														
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Installation Labor Table

CUT	Cable Cut	1	length	0.5	hrs	Senior Scientist
PULL	Cable Pull	1	length	6	hrs	Junior Engineer, Electrical
CONN	Connector Attachment	1	ea	0.5	hrs	Senior Engineer, Mechanical
TEST	Test Cable	1	length	0.5	hrs	Junior Engineer, Mechanical
RIGG	Rigging	1	unit	12	hrs	Junior Engineer, Contract
HUBM	Hookup Beam Component	1	unit	16	hrs	Senior Engineer, Contract
HUPS	Hookup Power Supply	1	unit	20	hrs	Senior Computer Analyst
HUCI	Hookup Contr. & Instr	1	unit	40	hrs	Junior Computer Analyst
HUUT	Hookup Utility	1	lot	4	hrs	Senior Designer
HUVA	Hookup Vacuum	1	unit	6	hrs	Junior Designer
SURV	Survey Beam Component	1	unit	20	hrs	Senior Designer, Contract
RTBM	Run & Test Beam Component	1	unit	20	hrs	Junior Designer, Contract
RTPS	Run & Test Power Supply	1	unit	32	hrs	Senior Technician, Electrical
RTCI	Run & Test Contr. & Instr	1	unit	8	hrs	Junior Technician, Electrical
RTVA	Run & Test Vacuum System	1	unit	1	hrs	Senior Technician, Mechanical
BCUT	Cut & Bend Busbar	1	unit	1	hrs	Junior Technician, Mechanical
BINSUL	Insulate Busbar	1	unit	1	hrs	Junior Technician, Electro-mechanical
BINST	Install Busbar	1	unit	1	hrs	Senior Technician, Electromechanical

Senior Administrative
Junior Administrative
Senior Clerical/Support
Junior Clerical/Support
Building Trades
Central Shops
Staff Shop
Davis Bacon Labor

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