MODEL STORAGE RING FOR 6 GEV OPERATION AS A SYNCHROTRON RADIATION SOURCE

PARAMETER LIST

Comments: (– To be completed), (* To be defined by workshop)

LATTICE PARAMETERS

Energy (GeV)	6+10%
Beam current (mA)	100
Number of stored electrons	1.6×10^{12}
Magnet bending radius (m)	30.05
Bending field (Tesla)	0.67 (6 GeV)
Circumference (m)	800
Revolution period (microsec)	2.67
Horizontal betatron wavenumber	34.11
Vertical betatron wavenumber	13.12
Number of symmetrical periods	16
Horizontal phase advance per half cell (degrees)	383.71 U to W*
Vertical phase advance per half cell (degrees)	147.62 U to W*
Maximum horizontal beta (m)	30
Maximum vertical beta (m)	30
Maximum dispersion (m)	0.413
Momentum compaction	0.38×10^{-3}
Synchrotron damping time (millisec)	4.2
Horizontal betatron damping time (millisec)	8.4
Vertical betatron damping time (millisec)	8.4
Horizontal emittance (m.rad 10% coupling)	7.3×10^{-9}
Vertical emittance (m.rad 10% coupling)	0.73×10^{-9}
Horizontal full aperture (mm)	60
Vertical full aperture (mm)	50
Beam height from the floor (m)	1.5

* Undulator Cell	ϕ_x	$0.899(2\pi)$	ϕ_y	$0.2430(2\pi)$
Wiggler Cell		$1.232(2\pi)$		$0.5771(2\pi)$

CHROMATICITY CORRECTION	
Number of sextupole families	2 (6 sextupoles per cell)
Horizontal uncorrected chromaticity	-85.5
Vertical uncorrected chromaticity	-37.13
HARMONIC CORRECTION	14 sextupoles per cell, 7 families
Horizontal dynamic half-aperture	
(# of beam size st. dev. off coupling)	66
Vertical dynamic half-aperture	
(# of beam size st. dev. in full coupling)	112
Full dynamic aperture area with no energy deviation	3700
Full dynamic aperture area at 10 energy standard deviations	2750
WIGGLER STRAIGHT SECTIONS	
Number	16
Free length (m)	6
Horizontal beta (m)	1.37
Vertical beta (m)	1.24
Horizontal r.m.s. beam size with 10% coupling (mm)	0.100
Vertical r.m.s. beam size with 10% coupling (mm)	0.030
Horizontal r.m.s. beam divergence with 10% coupling (mrad)	0.073
Vertical r.m.s. beam divergence with 10% coupling (mrad)	0.024

UNDULATOR STRAIGHT SECTIONS

Number	16
Free length (m)	6
Horizontal beta (m)	22.52
Vertical beta (m)	13.15
Horizontal r.m.s. beam size with 10% coupling (mm)	0.405
Vertical r.m.s. beam size with 10% coupling (mm)	0.098
Horizontal r.m.s. beam divergence with 10% coupling (mrad)	0.018
Vertical r.m.s. beam divergence with 10% coupling (mrad)	0.007

BENDING MAGNET SOURCE

Number	32
Horizontal beta (m)	0.92
Vertical beta (m)	24.4
Horizontal r.m.s. beam size with 10% coupling (mm)	0.082
Vertical r.m.s. beam size with 10% coupling (mm)	0.133
Horizontal r.m.s. beam divergence with 10% coupling (mrad)	0.089
Vertical r.m.s. beam divergence with 10% coupling (mrad)	0.005

DIPOLES

Number	64	
Type	C	
Length (m)	2.95	
Field strength (Tesla)	0.667	
Gap (mm)	60	
Gradient	0	
Number of coils per magnet	*	2
Number of turns per coil	*	20
Current density (A/mm**2)	*	2.71
Power per magnet (kW)	*	12.3 (6.6 GeV)
Estimated total power demand (MW)	*	1.0 (6.6 GeV)

QUADRUPOLES

Number	320	
Lengths (m)	0.5(256) 0.9(64)	
Number of independent families	5	
Maximum gradient (Tesla/m)	18.3	
Bore diameter (mm)	80	
Number of coils per magnet	*	4
Number of turns per coil	*	39
Maximum current density(A/mm**2)	*	4.5
Maximum current (A)	*	344
Maximum power per magnet (kW)	*	5.39, 9.04*
Estimated total power demand (MW)	*	1.75, 0.732*

*For 0.5 and 0.9 m quads respectively (6.6 GeV)

SEXTUPOLES

Number		224	
Number of independent families		7	
Length (m)		0.4	
Maximum gradient (T/m**2)		280	
Bore diameter (mm)		80	
Number of coils per magnet	*	6	
Number of turns per coil	*	16	
Maximum current density (A/mm**2)	*	5.69	6.6 GeV
Maximum correction winding excitation (A)	*	--	6.6 GeV
Maximum power per magnet (kW)	*	2.2	6.6 GeV
Estimated total power demand (MW)	*	0.623	6.6 GeV

ORBIT CORRECTION SCHEME

Number of horizontal pick-ups	192
Number of vertical pick-ups	192
Number of horizontal correctors	128 + 64 BLW
Number of vertical correctors	128
Maximum strength of horizontal correctors (mT*m)	150
Maximum strength of vertical correctors (mT*m)	75

POWER SUPPLIES

(All magnets will have independent PS's with possible exception of BENDS.)

Regulation of Quad PS's (ppm)	10
Regulation of Sext PS's (ppm)	100
Regulation of Bend PS's (ppm)	10
Regulation of Corrector PS's (ppm)	100

RF Parameters @ 6 GeV	
Peak Voltage	8.50 MV
Total Energy Radiated per Turn in Bending Magnets	3.8 MeV
Total Energy Radiated per Turn in Insertion Devices (assumed)	3.93 MeV
Frequency	350.76 MHz
Harmonic Number	936
Type of Cavity	Single Cell-reentrant Spherical
Number of Cavities	12
Cavity Excitation Power (for 12 Cavities)	0.576 MW
Total Shunt Impedance	125.4 MΩ
Input Power to Each Cavity	
Nominal operation (100 mA beam current w/o ID)	73.6 kW
Nominal operation (100 mA beam current with ID)	101.8 kW
Maximum design (250 mA with ID)	161.0 kW
Maximum Electric Field on Surface of Cavity @ Maximum Voltage	5.4 MV/m
Bunch Length, σ_z, m, @ $I_B = 0$	6.74×10^{-3}
σ_E/E	9.4×10^{-4}
$\Delta E/E)_{rf}$ bucket	0.9%
Phase Oscillation Wave Number ν_s	6×10^{-3}
Synchrotron Frequency	≈2.0 kHz
Phase Stable Angle	116.5°
Cavity	
Cavity Length w/o Drift Tube	0.426 m
Cavity Material	OFHC Copper
Shape & Dimension	See attached fig.
Power Amplifier	
Klystron Type	Thompson CSF TH2089
RF Power Output	1 MW
Number of Cavities Driven by Each Klystron	4
Klystron Efficiency	68%
DC Power Per Klystron	1.47 MW
Total Power from Mains	~5.5 MW

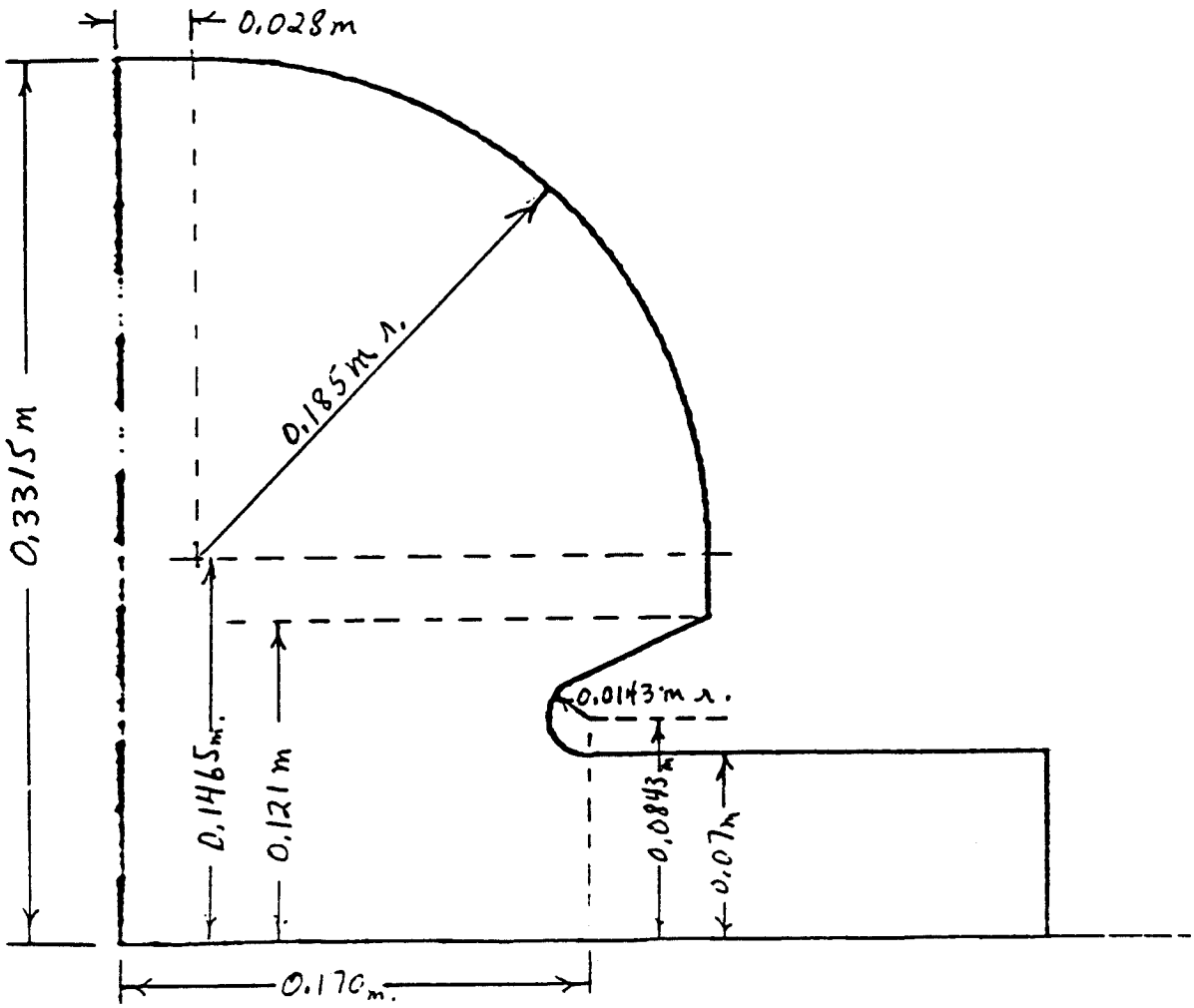


Figure
350-MHz KEK-Style Cavity

LATTICE ELEMENTS: WKSPLAT2:HP9121,700,1

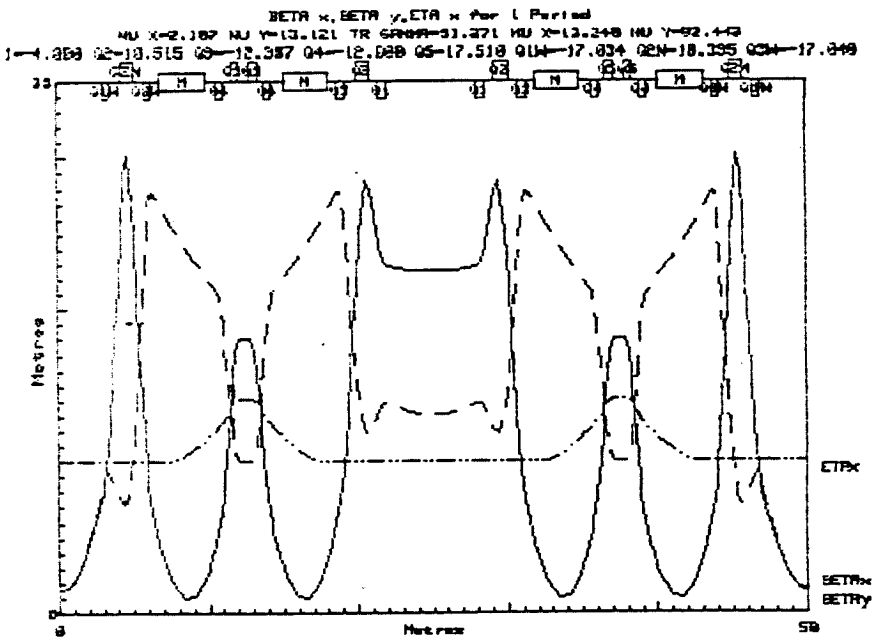
Brho = 20.01390 Momentum in GeV = 5.9999

NAME	TYPE	VAR	LEN,ANG	B,B′	N,GAP	Rho,K,ETC
L	DRFT	0.0	3.000000	0.000000	0.000000	0.000000
Q1W	QUAD	0.0	.500000	-17.033900	0.000000	-.851103
L1	DRFT	0.0	.700000	0.000000	0.000000	0.000000
Q2W	QUAD	0.0	.900000	18.334930	0.000000	.916110
L2	DRFT	0.0	.700000	0.000000	0.000000	0.000000
Q3W	QUAD	0.0	.500000	-17.039680	0.000000	-.851392
L3	DRFT	0.0	.600000	0.000000	0.000000	0.000000
E	EDGE	0.0	2.812500	.666054	0.000000	.033280
M	BEND	0.0	2.950000	.666054	0.000000	30.048465
E	EDGE	0.0	2.812500	.666054	0.000000	.033280
L4	DRFT	0.0	.800000	0.000000	0.000000	0.000000
Q4	QUAD	0.0	.500000	-12.000000	0.000000	-.599583
L5	DRFT	0.0	.450000	0.000000	0.000000	0.000000
Q5	QUAD	0.0	.500000	17.509520	0.000000	.874868
L6	DRFT	0.0	.400000	0.000000	0.000000	0.000000
L6	DRFT	0.0	.400000	0.000000	0.000000	0.000000
Q5	QUAD	0.0	.500000	17.509520	0.000000	.874868
L5	DRFT	0.0	.450000	0.000000	0.000000	0.000000
Q4	QUAD	0.0	.500000	-12.000000	0.000000	-.599583
L4	DRFT	0.0	.800000	0.000000	0.000000	0.000000
E	EDGE	0.0	2.812500	.666054	0.000000	.033280
M	BEND	0.0	2.950000	.666054	0.000000	30.048465
E	EDGE	0.0	2.812500	.666054	0.000000	.033280
L3	DRFT	0.0	.600000	0.000000	0.000000	0.000000
Q3	QUAD	2.2	.500000	-12.387208	0.000000	-.618930
L2	DRFT	0.0	.700000	0.000000	0.000000	0.000000
Q2	QUAD	1.2	.900000	10.514716	0.000000	.525371
L1	DRFT	0.0	.700000	0.000000	0.000000	0.000000
Q1	QUAD	0.0	.500000	-4.000000	0.000000	-.199861
L	DRFT	0.0	3.000000	0.000000	0.000000	0.000000
RFL						

WKSPLAT2 MATCHED FUNCTIONS FOR 16 PERIOD(S)

TOTAL LENGTH= 800.00000 METERS, TOTAL BEND= 359.9999 DEGREES

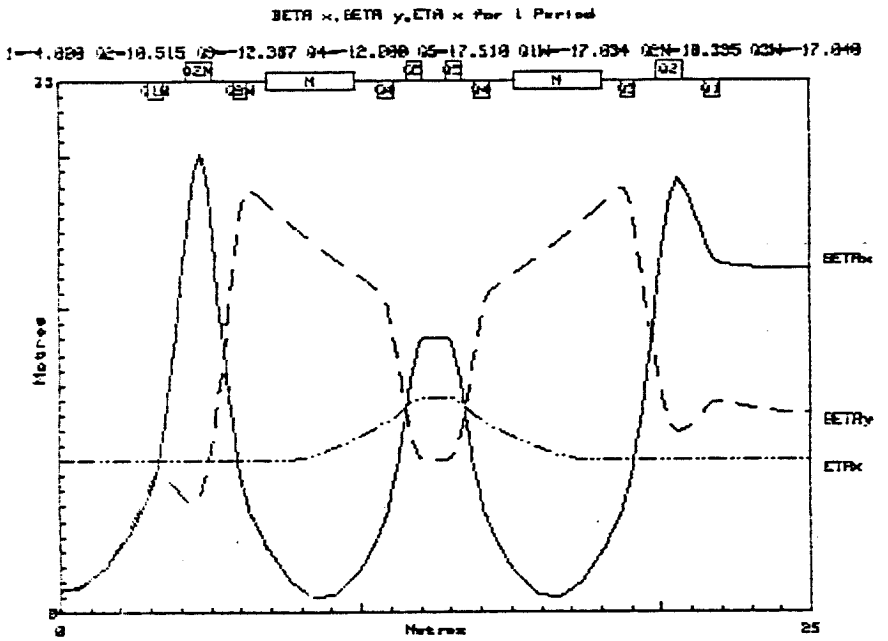
BETAX=	1.367 METERS	ALPHAX=	0.000	NUX=	34.1072
BETAY=	1.242 METERS	ALPHAY=	-0.000	NUY=	13.1212
ETAX =	-0.000 METERS	ETA'X =	-0.000	TRGAMMA=	51.3713



Eta Function is multiplied by 10
and displaced by 10 meters

INJECTION MODE

BETA0X=	1.3666	ALPHA0X=	-0.0000
BETA0Y=	1.2424	ALPHA0Y=	0.0000
ETA0=	-0.0000	ETA0'=	-0.0000



Eta Function is multiplied by 10
and displaced by 10 meters

TOTAL LENGTH= 400.00000 METERS, TOTAL BEND= 179.9999 DEGREES

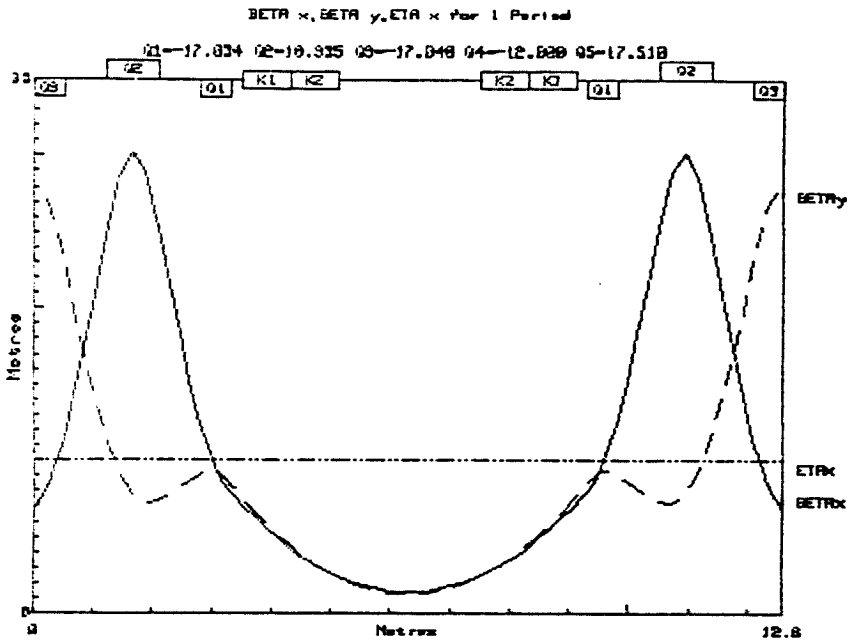
BETAX=	22.516 METERS	ALPHAX=	-0.000	NUX=	0.0000
BETAY=	13.146 METERS	ALPHAY=	0.000	NUY=	0.0000
ETA X=	-0.0000 METERS	ETA'X =	0.0000		
X(CM)=	.157	X'(MR)=	.070	R12=	0.0000
Y(CM)=	.038	Y'(MR)=	.029	R34=	-0.0000
M(1,6)=	0.000	M(2,6)=	-0.000	M(5,6)=	-.0095

STOR(8/30/85)

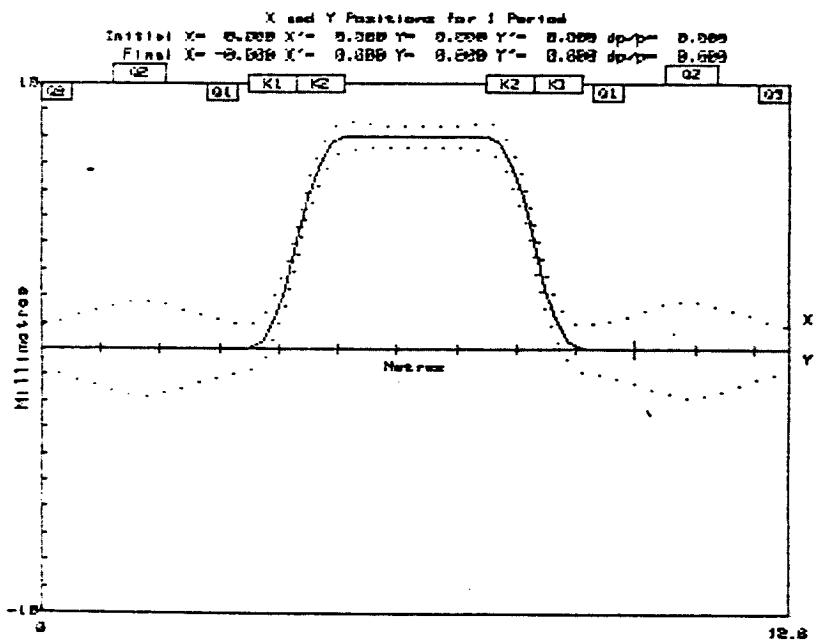
STORAGE RING INJECTION PARAMETERS

4 Bumpers		
	Fields	0.25 T
	Lengths	0.8 m
	Time Constant	2 μsec
Septum Magnet		
	Field	1.0 T
	Length	2.0 m
	Septum	2.0 mm
	Gap	1 cm
	(Can be segmented into pulsed and d.c. part)	

INJECTION ORBIT



Eta Function is multiplied by 10
and displaced by 10 meters



LATTICE ELEMENTS: WIGINJSS:HP9121,700,1

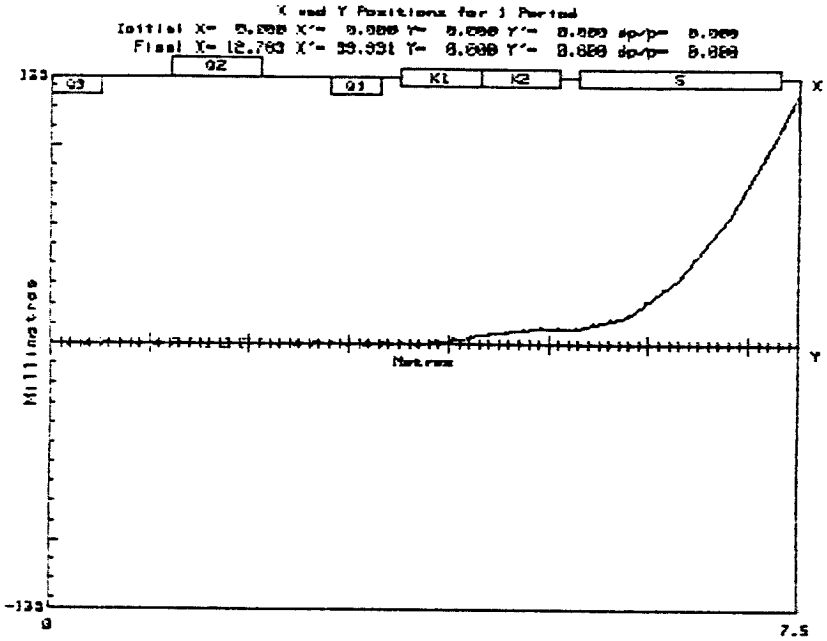
Brho = 20.01390 Momentum in GeV = 5.9999

NAME	TYPE	VAR.	LEN,ANG	B,B′	N,GAP	Rho,K,ETC
Q3	QUAD	2.2	.500000	-17.039680	0.000000	-.851392
L2	DRFT	0.0	.700000	0.000000	0.000000	0.000000
Q2	QUAD	1.2	.900000	18.334930	0.000000	.916110
L1	DRFT	0.0	.700000	0.000000	0.000000	0.000000
Q1	QUAD	0.0	.500000	-17.033900	0.000000	-.851103
LK1	DRFT	0.0	.200000	0.000000	0.000000	0.000000
K1	KICK	0.0	.800000	.250000	9.993055	.012491
K2	KICK	0.0	.800000	-.250000	-9.993055	-.012491
LL	DRFT	0.0	1.200000	0.000000	0.000000	0.000000
RFL						

Parameters: k1, k2

Risetime ∿2 μsec

INJECTION ORBIT WITH SEPTUM ON (S)



LATTICE ELEMENTS: WIGINJSS:HP9121,700,1

Brho = 20.01390 Momentum in GeV = 5.9999

NAME	TYPE	VAR	LEN,ANG	B,B′	N,GAP	Rho,K,ETC
Q3	QUAD	2.2	.500000	-17.039680	0.000000	-.851392
L2	DRFT	0.0	.700000	0.000000	0.000000	0.000000
Q2	QUAD	1.2	.900000	18.334930	0.000000	.916110
L1	DRFT	0.0	.700000	0.000000	0.000000	0.000000
Q1	QUAD	0.0	.500000	-17.033900	0.000000	-.851103
LK1	DRFT	0.0	.200000	0.000000	0.000000	0.000000
K1	KICK	0.0	.800000	.250000	9.993055	.012491
K2	KICK	0.0	.800000	-.250000	-9.993055	-.012491
LK1	DRFT	0.0	.200000	0.000000	0.000000	0.000000
S	KICK	0.0	2.000000	1.000000	99.930548	.049965
LK1	DRFT	0.0	.200000	0.000000	0.000000	0.000000

VACUUM SYSTEM

General Construction

a. Materials will be Al and S.S. where appropriate as in operating storage rings without antechambers.

b. In Situ Bakeout will be provided.

c. Pumping will be by Triode Ion Pumps, Distributed Ion Pumps and NEG where appropriate.

d. Isolation valves will segment system into appropriate segments (32).

e. External photon beam channels

f. Heat managements

Specifications

Operating pressure will be in the nanotorr region, consistent with achieving $\geq$ 10 hour lifetimes with insertion devices defining the vertical aperture at 8 mm, at full operating power; ie, 100 mA at 6 GeV.

8-30-85

Vacuum 6.6 GeV Max, (6 GeV Nom)

Machine has 32 cells, each with two dipole magnets and two experimental channels.

Per Each Cell:

High Vacuum Pumping

Chamber Pumping (two chamber lengths total ~ 22m)

Consider two* NeG strips for main pumping (100 l/s/m effective NeG pumping)

400 l/s/m of chamber or (200 l/s/m effect) x 22 -- 4400 l/s

Ion pumps two, 60 l/s each ----------120 l/s

Crotch Areas - two per cell

NeG lump pump 700 l/s or (350 l/s effect) ---------- 700 l/s

Total per cell, High Vacuum Pumping ---------- 5220 l/s

Desorption (6.42×10^{-5} T l/s for 6.6 GeV machine)

Per cell desorption = 2×10^{-6} T l/s after 150 amp hrs.

Thermal outgassing = 5.5×10^{-7} T l/s per cell.

Per cell; total desorption ----------2.55×10^{-6} T l/s

Cell Pressure = $\frac{2.55 \times 10^{-6}}{5220}$ ---------- 0.5×10^{-9} T

Rough Pumping

One-half Turbo molecular pump, use branch lines so 16 total pumps (500 l/s each) are used for the machine.

Gauges

Ion gauge - one, (readouts)

Pirani - one, (controls)

Gas Analyzers - one sensor

*The two main NeG pump strips in the pumping system lower the pressure by a factor of approximately two (0.9×10^{-9} T to 0.5×10^{-9} T) as compared to the use of only one strip in the system. The second strip increases the overall machine pumping costs by 8% or less than $100 K while substantially increasing the pumping reserve.

8-30-85

Fast Acting Valves - two per cell

Construction either of Viton seal valve with slits or metal shell operated valves.

Bakout use NeG strips at 150° C

Cooling

Chambers (two)	350 kW
Crotches (two)	576 kW

Bellows - four without insertion devices.

Totals

High Vacuum Pumping 32 x 5220	167,040 l/s
Machine Desorption after 150 amp hours	8.16×10^{-5} T l/s
Pressure	0.5×10^{-9} T
Rough pumping, 16 turbomolecular at 500 l/s	8,000 l/s
Gauges - Ion	32
- Pirani	32
Gas analyzers (32 photomultiplier sensors with eight readout devices)	32
Fast acting valves	64
Bakeout - use NeG strips	
Bellows	128

BELOW AS OF 8-13-85 R Wehrle

PLEASE NOTIFY FOR SUBSEQUENT CHANGES

2 INSULATIONS = 2 × 0.238 = 0.476 CM

2 SHIMS = 2 × 0.2 = 0.400 CM

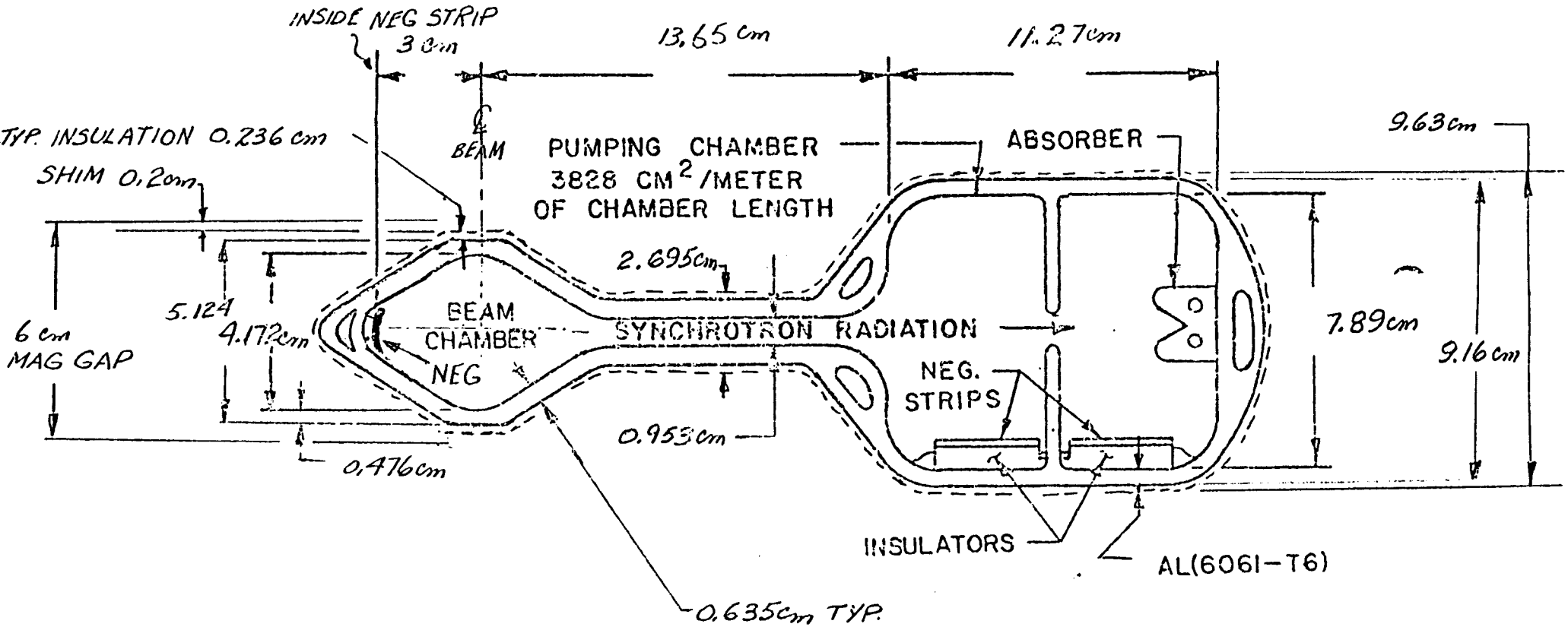
0.876 CM TOTAL SHIMS + INSULATION

MAG GAP − 0.876 CM = 5.124 CM BEAM CHAMBER HEIGHT OUTSIDE

5.124 − 2(0.47625) = 4.172 CM INNER BEAM CHAMBER HEIGHT

0.953 + 2(0.635) + 2(0.236) = 2.695 Cm CHANNEL + INSULATION OVERALL HEIGHT

7.89 + 1.27 + 0.476 = 9.63 cm



LIGHT SOURCE STORAGE RING VACUUM CHAMBER

8-30-85

INJECTION SYSTEM

General Requirements

The injection system (complex of accelerators) must provide positrons at 6 GeV with sufficient flux, such that assuming 10% acceptance by the storage ring, the fill time to 100 mA should be less than ten minutes. The system should allow flexibility in the variety of filling patterns of the storage ring. The system listed below is an example which satisfies the above requirements.

POSITRON SOURCE (LINACS AND ACCUMULATOR)

Parameters supplied by JMP are from ERSP option, which contains 50 MV/m energy gain of linac 5 A peak current.

Because a ring design is not available for ERSP, we would like to propose copying of PETRA/PIA which operates well.

ELECTRON/POSITRON LINAC

		PIA
Energy (MeV)	160./250.	200/450
Peak current (A)	5.000/0.012	1.5/0.0032
Maximum repetition rate (Hz)	60	50
Pulse length (nanoseconds)	12	100
Energy spread	0.035/0.010	-1.005
Emittance (microrad.m)	1.50/10.00	-1 < 20
Number of sections	2/2	5/7
Length of sections (m)	2.00/2.50	5.2/5.2
Number of klystrons	1/2	5/7
Power/klystron (max) (MW)	0.38E+02	0.24E+02
Frequency (MHz)	3000	3000
e^+/e^- Conversion efficiency (1/GeV)	0.15	0.002

POSITRON DAMPING/ACCUMULATOR RING

		PIA
Beam energy (GeV)	0.25	0.45
Beam current (mA)	2.20	16
Repetition rate for charging (Hz)	30	50
Repetition rate for extraction (Hz)	10	4
Circumference (m)	20.430	28.8
Emittance (Pi*m*rad)	0.43E−07	3.0E-07
Energy spread (sigma)	0.32E−03	2.9 E-04
Revolution period (nanoseconds)	68.12	96.2
Superperiodicity	4	2
Horizontal betatron wavenumber	2.94	1.75
Vertical betatron wavenumber	2.77	1.69
Momentum compaction	0.46E−01	0.31
Magnet bending radius (m)	0.509	1.00
Bending field (Tesla)	1.630	1.5
Maximum horizontal beta (m)	4.00	9.0
Maximum vertical beta (m)	2.30	9.0
Maximum dispersion (m)	1.40	3.0
Horizontal uncorrected chromaticity	−5.20	-5.3
Vertical uncorrected chromaticity	−2.00	-1.5
Horizontal betatron damping time (millisec)	38.00	24
RF frequency (MHz)	58.700	10.4, 125
Harmonic number	4	1, 12
Number of positrons/bunch	0.900E+09	1 E 10
Energy loss per turn (KeV)	0.680	3.63
Peak rf voltage (KV)	120.000	22 kV

INJECTOR SYNCHROTRON

1. Parameters given by JMP have been slightly adjusted to match an 800 m storage ring.

2. Extraction from injector synchrotron is added.

3. Injection to synchrotron is added.

INJECTOR SYNCHROTRON

Beam energy (GeV)	6.00
Nominal current, multibunch (mA)	20.0
Nominal current, single bunch (mA)	0.1
Maximum repetition rate (Hz)	10.0
Circumference (m)	287.18
Horizontal emittance at 6 GeV (m.rad)	1.3E−07
Vertical emittance at 6 GeV (m.rad)	1.1E−08
Revolution period (microsec)	0.954
Magnet bending radius (m)	24.500
Horizontal betatron wavenumber	10.38
Vertical betatron wavenumber	8.38
Lattice type	Separated function, FODO
Number of cells	36
Dipole length (m)	2.4060
Quadrupole length (m)	0.60
Cell length (m)	
Maximum dipole field (Tesla)	0.816
Maximum quadrupole gradient (T/m)	14.4
Dipole field at injection (Gauss)	
Horizontal full aperture (mm)	58.0
Vertical full aperture (mm)	28.0
Maximum horizontal beta (m)	13.5
Minimum horizontal beta (m)	1.90
Maximum vertical beta (m)	13.90
Minimum vertical beta (m)	2.55
Maximum dispersion (m)	0.90
Minimum dispersion (m)	0.011
Momentum compaction	0.12E−01
Synchrotron damping time at 6 GeV (millisec)	1.22

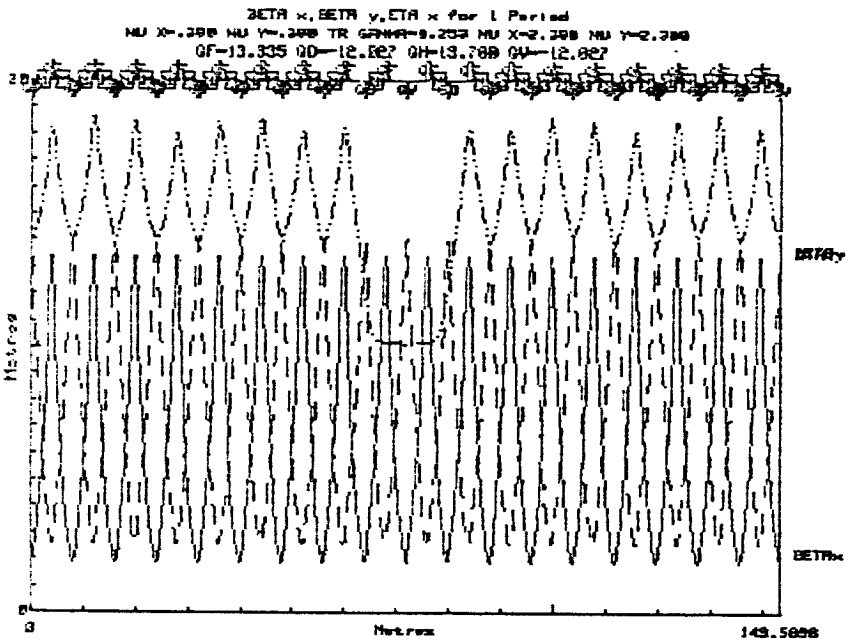
INJECTOR SYNCHROTRON (Continued)

Horizontal betatron damping time at 6 GeV (millisec)	2.44
Vertical betatron damping time at 6 GeV (millisec)	2.44
RF frequency (MHz)	350.76
Harmonic number	336
Relative energy dispersion	0.870E−03
Peak energy loss per turn (MeV)	4.0
Number of cavities	2
Number of cells per cavity	5
Peak voltage (Megavolt)	6.0
Total shunt impedance (Megohm)	113.2
Peak power requirement (KW)	400
Number of klystrons	1

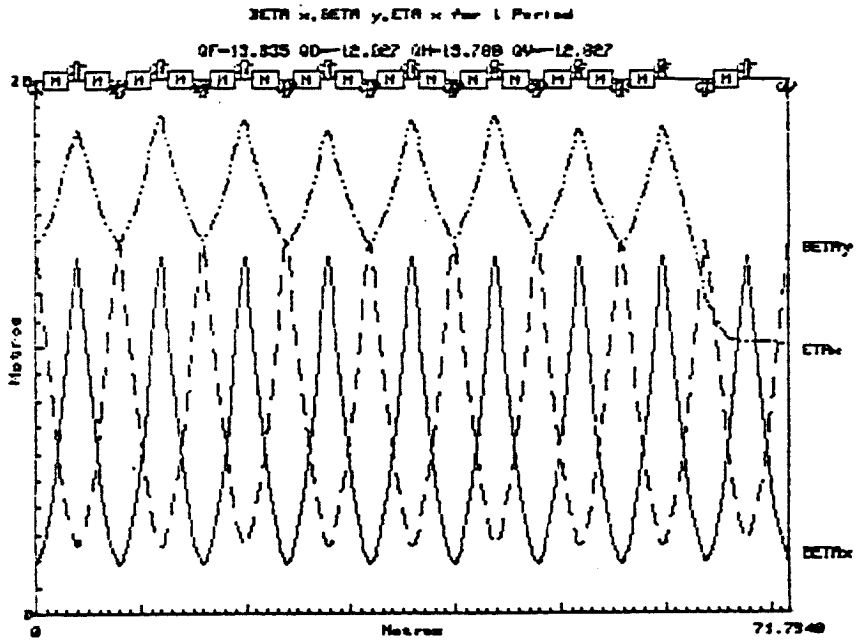
ESRP 6GEV BST MATCHED FUNCTIONS FOR 2 PERIOD(S)

TOTAL LENGTH= 287.17920 METERS, TOTAL BEND= 360.0848 DEGREES

BETAX=	1.889 METERS	ALPHAX=	0.000	NUX=	10.3800
BETAY=	13.911 METERS	ALPHAY=	-0.000	NUY=	8.3800
ETAX =	.383 METERS	ETA'X =	-0.000	TRGAMMA=	9.2529



Eta Function is multiplied by 10
and displaced by 10 meters

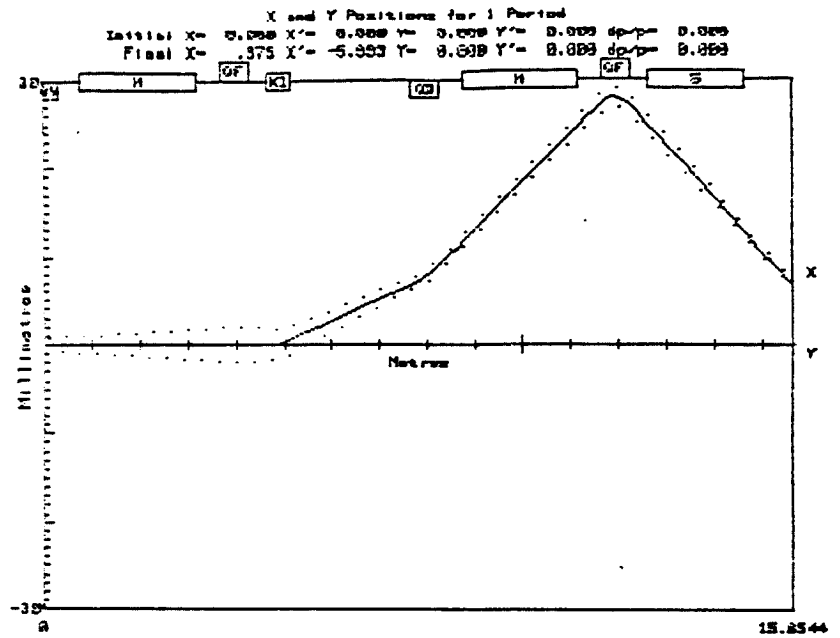


Eta Function is multiplied by 10
and displaced by 10 meters

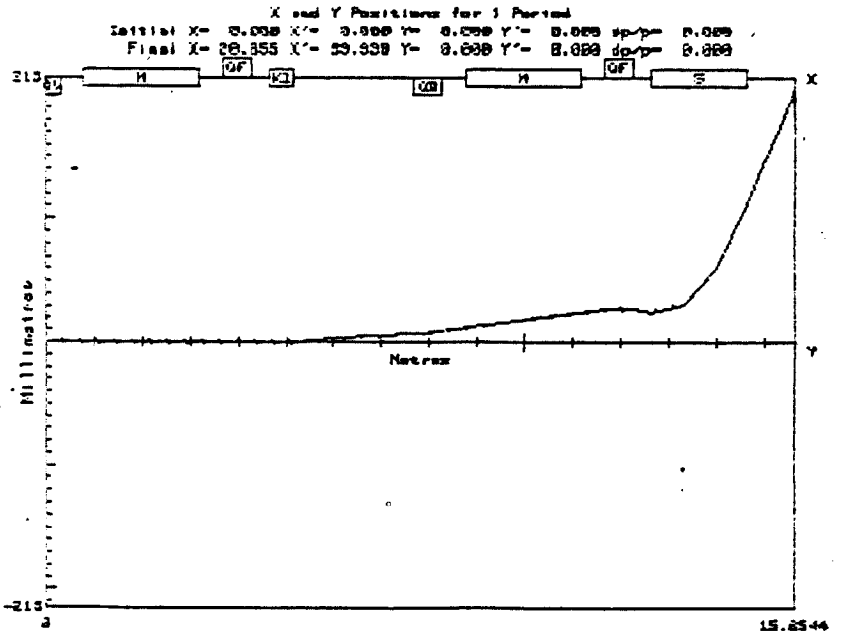
LATTICE ELEMENTS: ES6GEVFIT:HP9121,700,1

Brho = 20.01384 Momentum in GeV = 5.9999

NAME	TYPE	VAR	LEN,ANG	B,B′	N,GAP	Rho,K,ETC
7(						
QV	QUAD	2.2	.300000	-12.027497	0.000000	-.600959
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
M	BEND	0.0	2.406000	.816840	0.000000	24.501543
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
QF	QUAD	1.2	.600000	13.634746	0.000000	.681266
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
M	BEND	0.0	2.406000	.816840	0.000000	24.501543
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
QV	QUAD	2.2	.300000	-12.027497	0.000000	-.600959
)						
QV	QUAD	2.2	.300000	-12.027497	0.000000	-.600959
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
M	BEND	0.0	2.406000	.816840	0.000000	24.501543
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
QF	QUAD	1.2	.600000	13.634746	0.000000	.681266
L2	DRFT	0.0	3.388600	0.000000	0.000000	0.000000
QD	QUAD	2.2	.600000	-12.027497	0.000000	-.600959
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
M	BEND	0.0	2.406000	.816840	0.000000	24.501543
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
QF	QUAD	1.2	.600000	13.634746	0.000000	.681266
L2	DRFT	0.0	3.388600	0.000000	0.000000	0.000000
QV	QUAD	2.2	.300000	-12.027497	0.000000	-.600959
RFL						



Extraction kicker on
Septum off

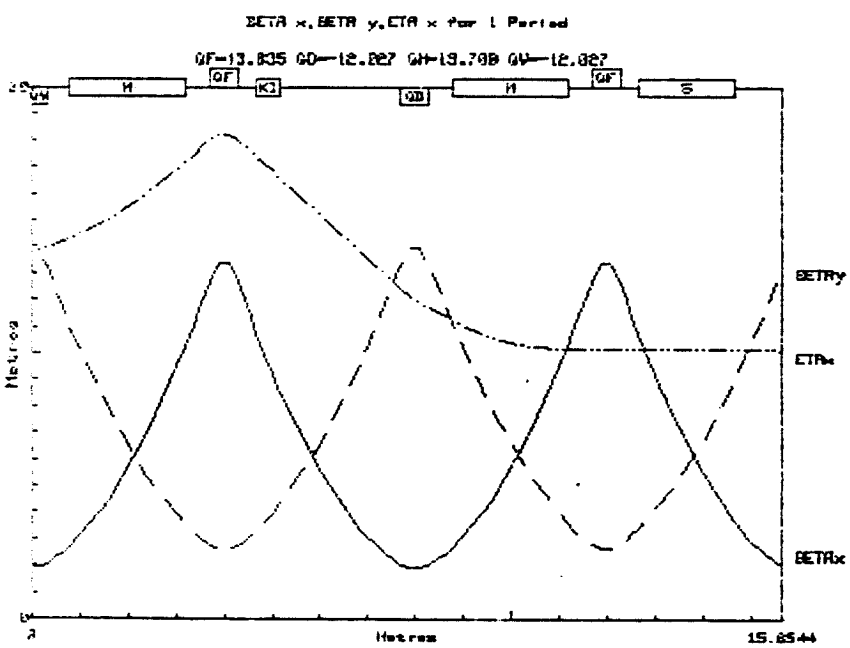


Extraction kickers and
septum on

LATTICE ELEMENTS: ESBSTEXT:HP9121,700.1

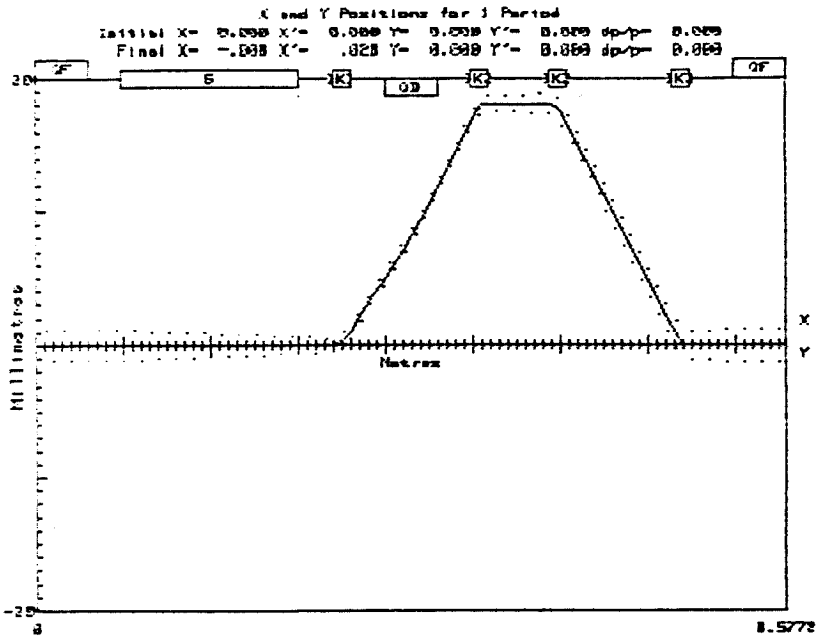
Brho = 20.01380 Momentum in GeV = 5.9998

NAME	TYPE	VAR	LEN,ANG	B,B'	N,GAP	Rho,K,ETC
QV	QUAD	2.2	.300000	-12.027497	0.000000	-.600960
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
M	BEND	0.0	2.406000	.816840	0.000000	24.501494
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
QF	QUAD	1.2	.600000	13.634746	0.000000	.681267
LK1	DRFT	0.0	.388600	0.000000	0.000000	0.000000
K1	KICK	0.0	.500000	.100000	2.498271	.004997
LK2	DRFT	0.0	2.500000	0.000000	0.000000	0.000000
QD	QUAD	2.2	.600000	-12.027497	0.000000	-.600960
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
M	BEND	0.0	2.406000	.816840	0.000000	24.501494
E	EDGE	0.0	2.812500	.816840	0.000000	.040814
L1	DRFT	0.0	.491300	0.000000	0.000000	0.000000
QF	QUAD	1.2	.600000	13.634746	0.000000	.681267
LS1	DRFT	0.0	.388600	0.000000	0.000000	0.000000
S	KICK	0.0	2.000000	1.000000	99.930848	.049966
LS2	DRFT	0.0	1.000000	0.000000	0.000000	0.000000

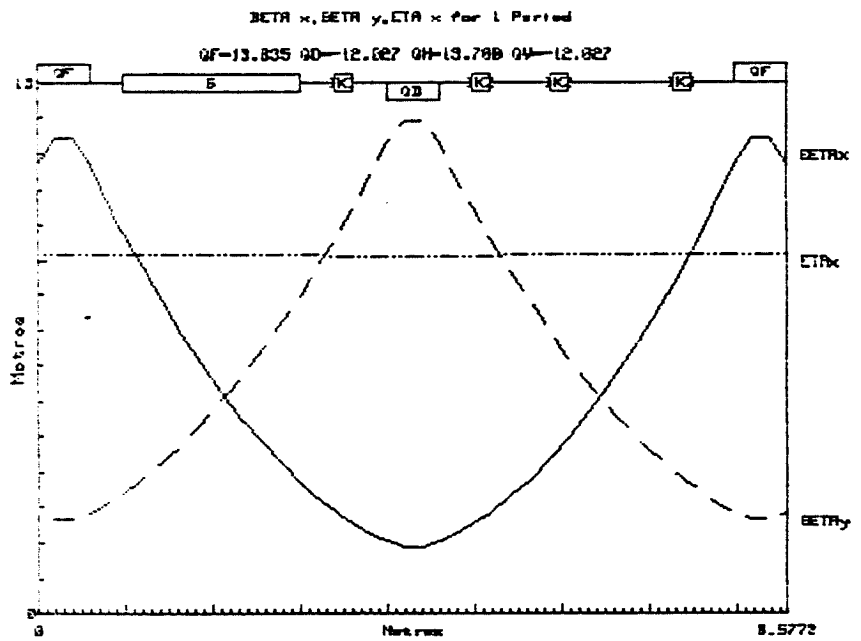


Twiss functions at extraction straight section

Eta Function is multiplied by 10
and displaced by 10 meters



Injection orbit distortion



Eta Function is multiplied by 10
and displaced by 10 meters

LATTICE ELEMENTS: ESINJ45:HP9121,700,1

Brho = 1.50100 Momentum in GeV = .4500

NAME	TYPE	VAR	LEN,ANG	B,B'	N,GAP	Rho,K,ETC
QF	QUAD	1.2	.600000	1.022610	0.000000	.681286
LS1	DRFT	0.0	.388600	0.000000	0.000000	0.000000
S	KICK	0.0	2.000000	.000010	.000999	.000007
IL1	DRFT	0.0	.400000	0.000000	0.000000	0.000000
IK1	KICK	0.0	.200000	.075080	10.003997	.050020
IL1	DRFT	0.0	.400000	0.000000	0.000000	0.000000
QD	QUAD	2.2	.600000	-.902060	0.000000	-.600973
LS1	DRFT	0.0	.388600	0.000000	0.000000	0.000000
IK2	KICK	0.0	.200000	-.097430	-12.982012	-.064910
TFL	DRFT	0.0	.700000	0.000000	0.000000	0.000000
2	KICK	0.0	.200000	-.097430	-12.982012	-.064910
IL2	DRFT	0.0	1.200000	0.000000	0.000000	0.000000
IK3	KICK	0.0	.200000	.097430	12.982012	.064910
IL3	DRFT	0.0	.500000	0.000000	0.000000	0.000000
QF	QUAD	1.2	.600000	1.022610	0.000000	.681286

BEAMLINES & INSERTIONS

	Host Lab	PRT's*
Number of straight sections available for wiggler or undulators	28	
Assume one beamline per wiggler** or undulator port		
Number of insertion lines instrumented for this project	8	8
Number of insertion beamlines completed annually thereafter	1	3
For this project:		
Wigglers	3	3
Undulators	5	5
Assume one beamline per dipole port**		
Number of dipole beamlines instrumented for this project	8	8
Number of dipole beamlines completed annually thereafter	1	5
Length of beamlines (source to experimental station)		
Insertion type	80 m	
Dipole type	60 m	
Provide for long beamline capability (Now, future, not at all)	Now (~1 km)	

Vacuum chambers designed so that future insertion or dipole beamlines can be added without modification of vacuum chambers and with minimum "vacuum-break" shutdowns of the storage ring.

* PRT lines will not be instrumented as part of the project. This column is included to project the rate at which the system will reach saturation.

** The radiation spread from wiggler and bending magnet ports will be sufficient to accommodate two beamlines. The additional beamlines should be assigned to PRT's.

CONVENTIONAL CONSTRUCTION

We include here description of our current thinking on this matter for your information. Note that our plan does not include a positron accumulator building.

8/30/85

BUILDING SPECIFICATIONS

CONVENTIONAL CONSTRUCTION

1. Site independent design. The following are not to be included in this study:

   - housing
   - central dining and food preparation areas
   - support space for large shops, shipping and receiving, site security, and fire protection
   - electrical power transmission and step down to 13.6 kv
   - water wells, transmission or treatment
   - sanitary sewer treatment
   - steam generation plant (assume steam on site)

2. Building and Tunnels

   - foundations to be of reniforced concrete on footings with concrete floor slabs (no pilings)
   - buildings to be of structural steel framing with insulated, metal clad panels
   - linac housed in reinforced concrete structure
   - booster and storage ring to be in steel arch or reinforced concrete tunnels
   - assume service buildings for magnet and vacuum power supplies, chilled water, HVAC, rf power, etc., to have an area of approximately 12 to 15% of the building area served
   - exerimental beam line area

     beam line length ~100 meters
     clear height above beamline 4.5 meters
     crane coverage 2 cranes @ 5 tons
     perimeter aisle 2 meters

   - laboratories

     general purpose laboratories 20
     number based on number of beamlines at proportion of 1 lab per 3 ports
     special purpose laboratories 17
     clean rooms
     dark rooms
     others?

   - other spaces

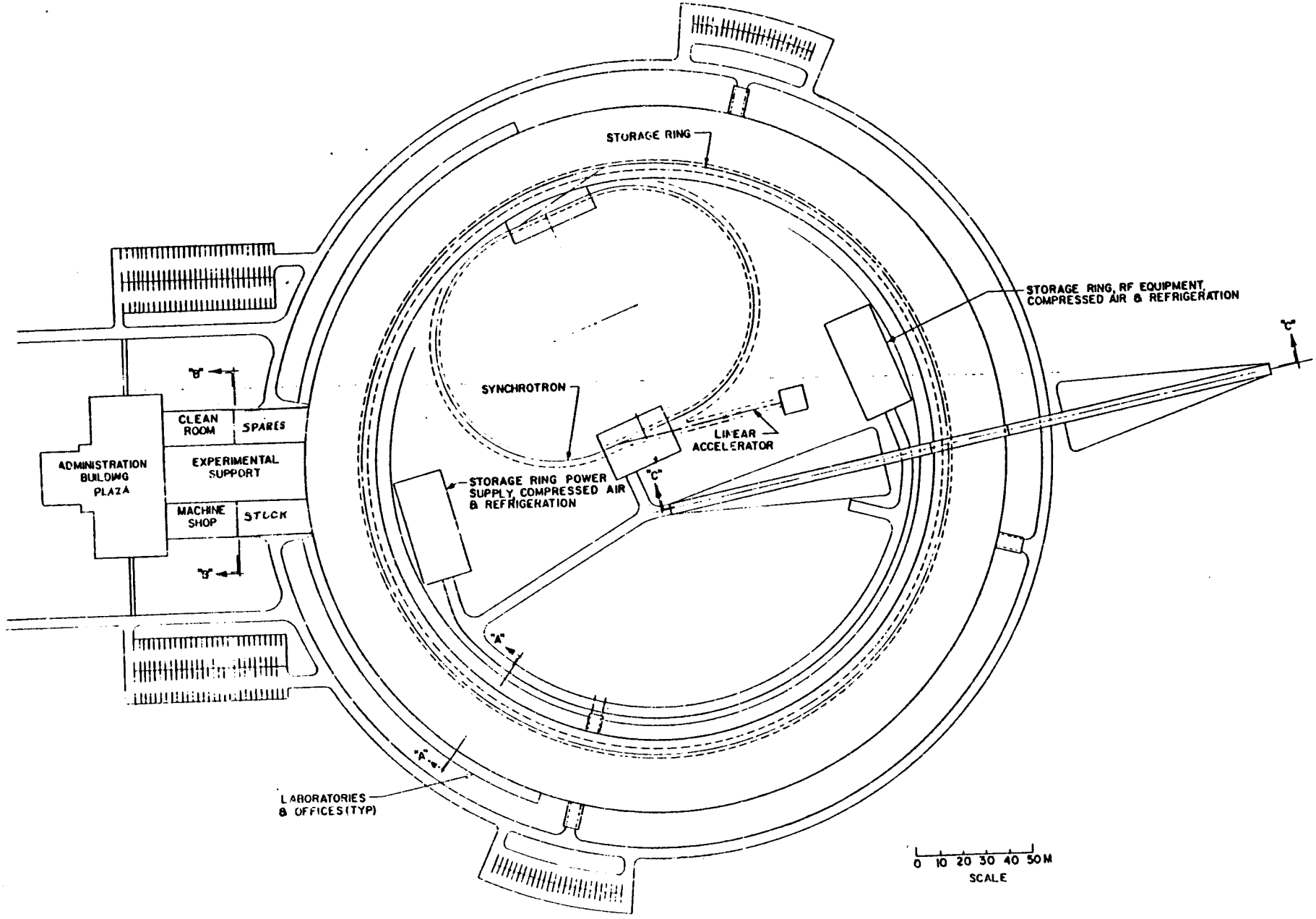
     offices for staff and users
     technical and administrative work areas
     experimental set up space
     storage
     local receiving and supply
     conference, seminar, and "quiet" rooms
     kitchen and lunch rooms

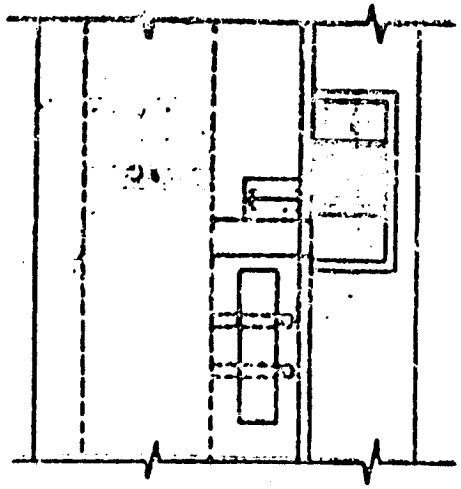
3. HVAC

- experimental space, offices, and labs to have HV & AC
- service buildings, linac and machine tunnels to have HV & AC

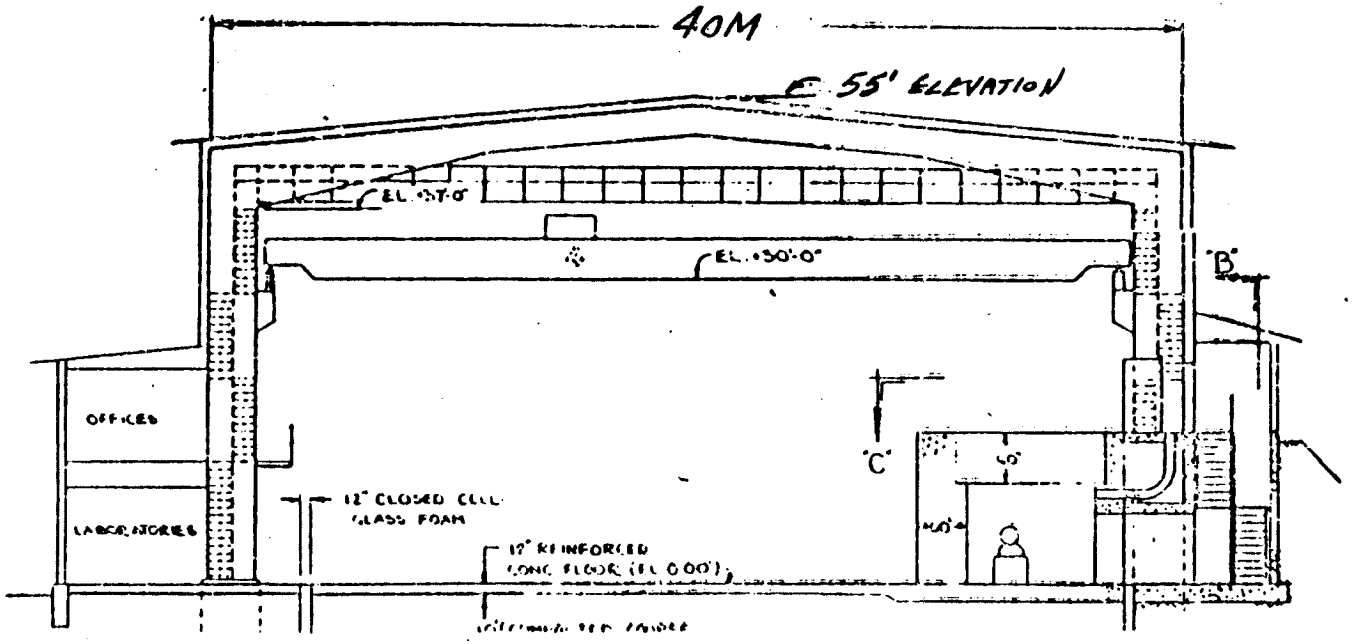
4. Shielding

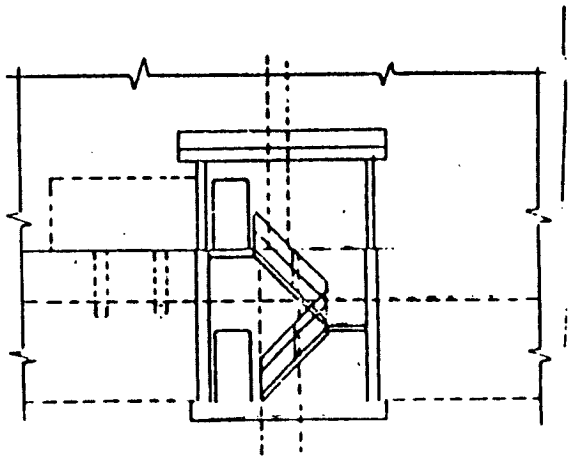
- assume 1.5 meter thick regular density concrete between storage ring, linac, or booster and areas accessible to personnel

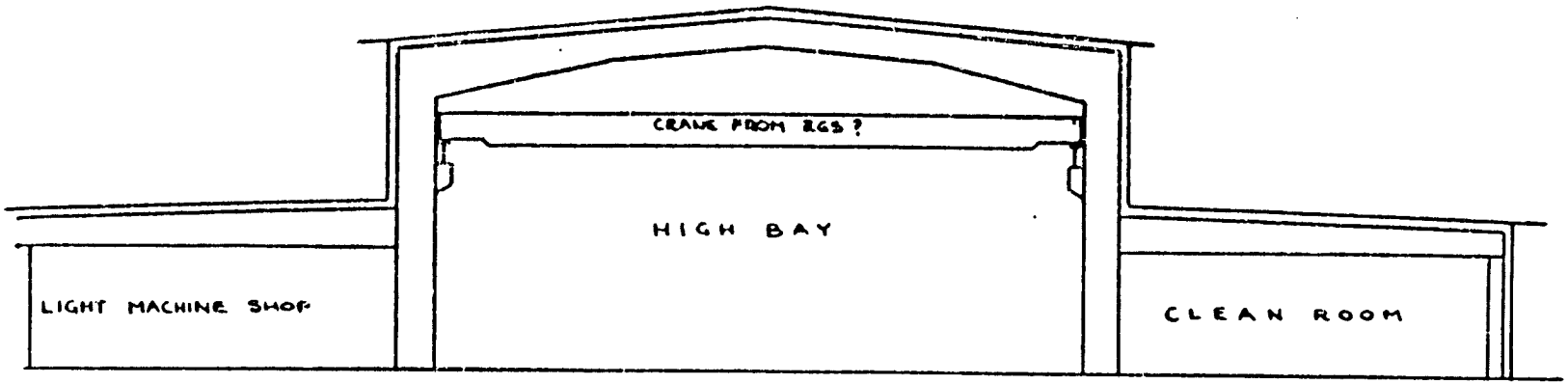

STORAGE RING
STORAGE RING, RF EQUIPMENT, COMPRESSED AIR & REFRIGERATION
"C"
SYNCHROTRON
LINEAR ACCELERATOR
"C"
STORAGE RING POWER SUPPLY, COMPRESSED AIR & REFRIGERATION
"B"
CLEAN ROOM
SPARES
ADMINISTRATION BUILDING PLAZA
EXPERIMENTAL SUPPORT
MACHINE SHOP
STOCK
"B"
"A"
"A"
LABORATORIES & OFFICES (TYP)
0 10 20 30 40 50 M
SCALE



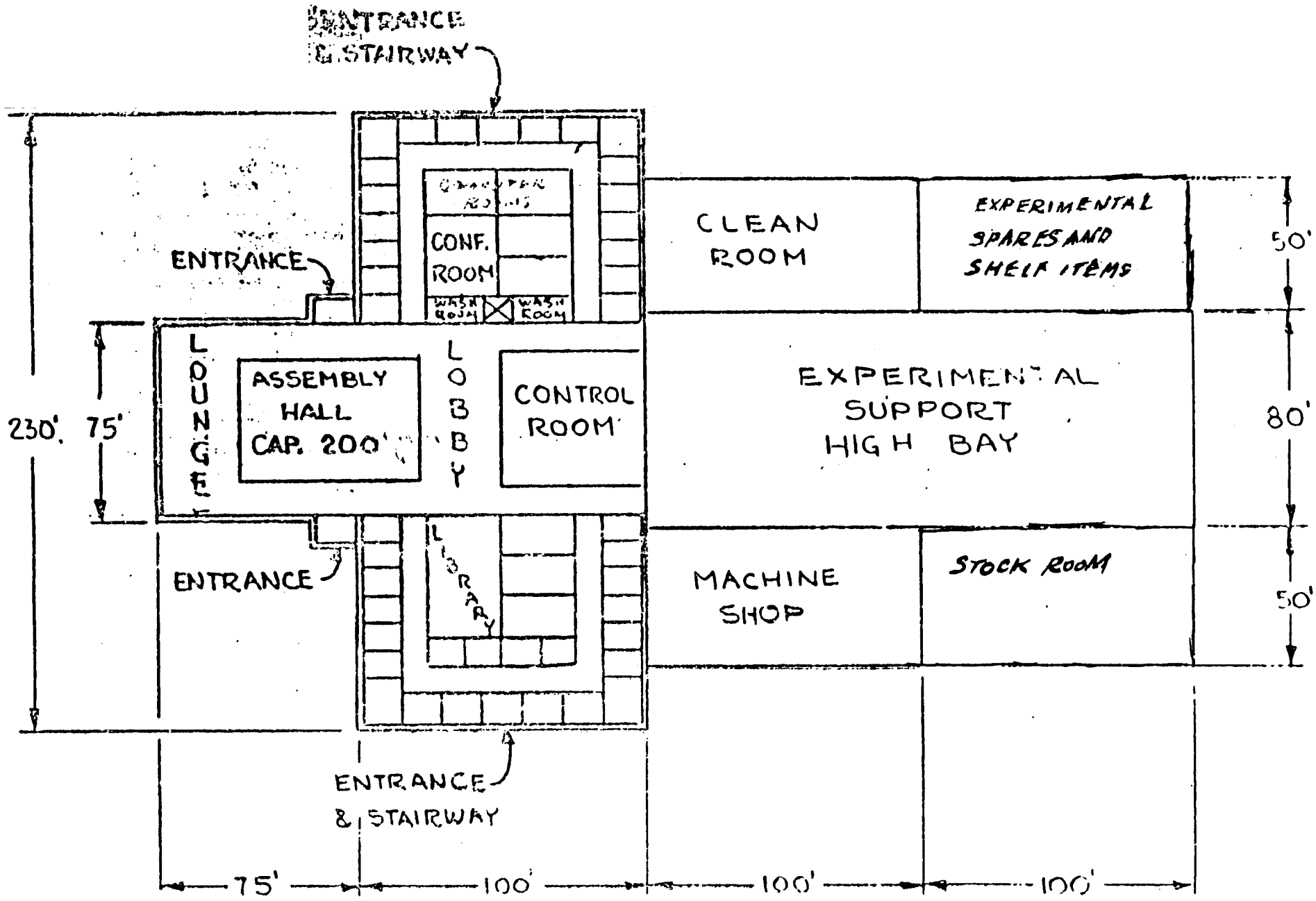
SECTION 'C-C'


40M
℄ 55' ELEVATION
EL. 37'-0"
EL. +30'-0"
'B'
'C'
OFFICES
LABORATORIES
12" CLOSED CELL GLASS FOAM
12" REINFORCED CONC. FLOOR (EL. 0.00')





SECTION B-B
SCALE: 1" = 10'-0


ENTRANCE & STAIRWAY
CONF. ROOM
WASH ROOM
WASH ROOM
ENTRANCE
LOUNGE
ASSEMBLY HALL CAP. 200
LOBBY
CONTROL ROOM
LIBRARY
ENTRANCE
ENTRANCE & STAIRWAY
CLEAN ROOM
EXPERIMENTAL SPARES AND SHELF ITEMS
EXPERIMENTAL SUPPORT HIGH BAY
MACHINE SHOP
STOCK ROOM
230'
75'
50'
80'
50'
75'
100'
100'
100'

SCALE: 1" = 50'-0"

6 GeV {RATIONALE FOR EST} 8/30/85

1. ELECTRICAL POWER

1.1 LIGHTING
- 1.1.1 OFFICES (3W/FT^2)
- 1.1.2 EXPERIMENTAL HALL (1W/FT^2)
- 1.1.3 TUNNELS (1W/FT^2)

1.2 RECEPTACLES
- 1.2.1 OFFICES (4600W/ 120FT^2)
- 1.2.2 LABS (54000W/450FT^2)
- 1.2.3 MACHINE AND EXPERIMENTAL HALLS (25000W EVERY 10meters AROUND OUTSIDE OF BUILDING)
- 1.2.4 EACH EXPERIMENTAL BEAM LINE (30000W {64 BEAMS})
- 1.2.5 TUNNELS (25000W EVERY 10 meters) EXCEPT STORAGE RING
- 1.2.6 STORAGE RING TUNNELS (3.75kW - VACUUM & 5kW - OTHER EVERY TO meters)

1.3 UTILITY POWER IS EQUAL TO 1.4kW/24.16m^2 IN ALL BUT THE STORAGE RING & EXPERIMENTAL HALL WHERE IT IS MULT. BY 2 DUE TO THE HEIGHT OF THE BUILDING THIS COVERS HVAC.

1.4 MACHINE POWER
- 1.4.1 RF {LINAC } G. MAVROGENES 8/23/85 [125kVA ac mains @6.6GeV
- 1.4.2 RF {BOOSTER} B. KUSTOM 8/20/85 [400kW *1/.68*1/.8*1/.95 @ 6GeV
- 1.4.3 RF {STORAGE RING} B. KUSTOM 8/20/85 [5.5MVA ac mains]
- 1.4.4 LINAC {MAGNETS} 50% OF RF
- 1.4.5 STORAGE RING {MAGNETS} W. PRAEG 8/30/85 [650kW dipoles+1558kW quads+391 sext @6GeV](magnet sum *1/.8*1/.95)
- 1.4.6 SCALING FACTOR FOR MAGNET POWER FROM 6 TO 6.6GeV= 6.6^2/6^2.
- 1.4.7 SCALING FACTOR FOR RF POWER FROM 6 TO 6.6 GeV= 1 (AS PER B. KUSTOM {CURRENT WILL CHANGE AND POWER WILL REMAIN THE SAME}
- 1.4.8 LINAC AND INJECTOR MAGNETS WILL USE ~ 5% OF RF.
- 1.4.9 FOR ESTIMATING THE ELECTRICAL POWER NEEDED FOR MAGNET OPERATION K. THOMPSON GAVE US 100% FOR DIPOLES, 50% FOR QUADS AND 66% FOR SEXTIPOLES
- 1.4.10 INJECTOR MAGNET POWER IS ESTIMATED AS 2 * THE STORAGE RING DIPOLE POWER + 1/4 OF THE STORAGE RING QUAD POWER

2. COOLING WATER

2.1 ALL WATER FLOW IS CALCULATED ON A dT OF 13.89°C

2.2 5°C WATER dP=100PSI

2.3 26.7°C WATER dP=150PSI

2.4 POWER FOR 5°C WATER IS FOR PUMPING IT 2 TIMES AND COOLING IT WITH A RATIO OF PUMPED TO COOLED AND PUMPED OF 1.4/0.4.

3. ROOF LOADING -- 20LBS/FT^2

4. ESTIMATE OF ELECTRICAL USAGE [% OF INSTALLED AVERAGED OVER A YEAR]

BUILDING	LIGHTING	RECEPTICAL	UTILITIES	MACHINE
1. LINAC				
1.1 LINAC SUPPORT	23%	70%	20%	
1.2 LINAC	23%	70%	20%	8%
1.3 LINAC INJECTOR	23%	70%	20%	8%
2. INJECTOR				
2.1 INJECTOR TUNNEL	5%	80%	20%	8%
2.1 INJECTOR				
3. STORAGE RING & EXPERIMENTAL HALL	100%	50%	30%	100%(DI) 50%(QM)
3.1 RING BEAM TUNNEL	5%	10%	40%	66%(SM) 100%(VAC)
3.2 RING EXPERIMENTAL AREA				
4. UTILITY BUILDINGS	20%	50%	30%	
4.1 STORAGE RING UTILITY BUILDING 1				
4.2 STORAGE RING UTILITY BUILDING 2	20%	25%	30%	
5. EXPERIMENTAL SUPPORT BUILDINGS				
5.1 HIGH BAY	20%	23%	20%	
5.2 EXPERIMENTAL HALL ANNXS OFFICES	33%	7%	23%	
5.3 EXPERIMENTAL HALL ANNXS LABS	33%	7%	23%	
5.4 WASH ROOM & UTILITY AREA	50%	5%	23%	
5.5 AIR LOCK BUILDINGS	90%			
6. MAIN OFFICE AND LAB PLAZA				
6.1 OFFICES	20%	5%	23%	
6.2 LABS	23%	5%	23%	
6.3 ASSEMBLY HALL	5%	2.5%	23%	

6.4 LIBRARY	33%	7%	23%
6.5 COMPUTER ROOM	100%	70%	50%
6.6 CONTROL ROOM	100%	70%	23%
6.7 CONFERENCE ROOM	8%	5%	23%
6.8 CONFERENCE ROOM	8%	5%	23%
6.9 LOBBY	100%	5%	23%
6.10 LOUNGE	20%	5%	23%
6.11 MACHINE SHOP	23%	25%	23%
6.12 CLEAN ROOM	20%	10%	23%
6.13 STOCK ROOM	23%	5%	23%
6.14 EXPERIMENTAL SPARE PARTS AND SHELF ITEMS	23%	5%	23%
6.15 WASH ROOM & UTILITY AREA	50%	5%	23%
6.16 HALLS	100%	5%	23%
6.17 STAIRS & ELEVATORS	100%	5%	23%
6.18 SERVICE FLOOR	90%	20%	10%
7. MEDICAL BEAM LINE	0		
8. MEDICAL TREATMENT BUILDING	50%	20%	33%
9. TANGENTIAL EXPERIMENTAL BUILDINGS (OPTIONAL)	100%	50%	30%
10. SITE ACCESS			
10.1 ROADS	50%		
10.2 PARKING	50%		
10.3 PARKING	50%		
10.3 BRIDGE	50%		
10.4 SIDEWALKS	50%		

BUILDING SPECIFICATIONS OF A MODEL FACILITY FOR THE 6 GeV LIGHT SOURCE (CIVIL ENGINEERING)

_DING	NO.	GROSS SIZE-m	GROSS FLOOR AREA [m^2]	GROSS VOLUME-m^3]	NET USABLE VOLUME-m^3	FLOOR LOAD LBS/FT^2-Pa	FLOOR BASE STABILITY LBS/FT^2-Pa
1. LINAC							
1.1 LINAC SUPPORT	1					800.0	1600.0
width=		10				14303.2	28606.4
length=		10	100.0				
height=		3		305.0	259.3		
1.1 LINAC & KLYSTRON GALLERY	1					800.0	1600.0
width=		4				14303.2	28606.4
length=		20	80.0				
height=		6		488.0	414.8		
1.2 LINAC INJECTOR	1					800.0	1600.0
width=		21				14303.2	28606.4
length=		30	630.0				
height=		5		2835.0	2409.8		
2. INJECTOR							
2.1 INJECTOR TUNNEL	1					1000.0	2000.0
width=		4				17879.0	35758.0
circumferatial length=		312	1248.2				
height=		4		4993.0	4244.0		
2.1 INJECTOR SUPPORT	1					800.0	1600.0
width=		16				14303.2	28606.4
length=		40	640.0				
height=		5		2880.0	2448.0		
3. STORAGE RING & EXPERIMENTAL HALL	1					1500.0	3000.0
inside rad=		114				26818.5	53637.0
outside rad=		154	33559.7				
height=		18		596021.1	476816.9		
3.1 RING BEAM TUNNEL	1					1500.0	3000.0
inside rad=		114				26818.5	53637.0
outside rad=		122	6244.3				
height=		6		35155.4	21093.2		
3.2 RING EXPERIMENTAL AREA	1		27315.5			1500.0	3000.0
inside rad=		122				26818.5	53637.0
outside rad=		154	27746.5				
height=		18		560865.8	448692.6		
4. UTILITY BUILDINGS							
4.1 STORAGE RING UTILITY BUILDING 1	1					500.0	1000.0
width=		21				8939.5	17879.0
length=		45	945.0				
height=		5		4252.5	3614.6		
4.2 STORAGE RING UTILITY BUILDING 2	1					500.0	1000.0
width=		21				8939.5	17879.0
length=		45	945.0				
height=		5		4252.5	3614.6		
5. EXPERIMENTAL SUPPORT BUILDINGS							
5.1 HIGH BAY	1					500.0	1000.0
width=		25				8939.5	17879.0
length=		60	1500.0				
height=		12		18285.0	14628.0		
5.2 EXPERIMENTAL HALL ANNXS OFFICES	100					200.0	
width=		3				3575.8	
length=		4	1200.0				
height=		3		3660.0	3202.5		
5.3 EXPERIMENTAL HALL ANNXS LABS	27					200.0	400.0
width=		4				3575.8	7151.6
length=		12	1296.0				
height=		3		3952.8	3458.7		

5.4 WASH ROOM & UTILITY AREA	8				200.0	
width=		3			3575.8	
length=		4	96.0			
height=		3		292.8	0.0	
5.5 AIR LOCK BUILDINGS	6				500.0	1000.0
width=		7			8939.5	17879.0
length=		10	390.0			
height=		6		2379.0	0.0	
6. MAIN OFFICE AND LAB PLAZA						
6.1 OFFICES	76				200.0	
width=		3			3575.8	
length=		4	816.8			
height=		3		2491.3	2179.9	
6.2 LABS	10				200.0	
width=		4			3575.8	
length=		8	343.8			
height=		3		1048.5	917.4	
6.3 ASSEMBLY HALL	1				200.0	400.0
width=		13			3575.8	7151.6
length=		19	250.6			
height=		6		1528.5	1337.4	
6.4 LIBRARY	1				200.0	
width=		8			3575.8	
length=		13	98.9			
height=		3		102.0	89.2	
6.5 COMPUTER ROOM	1				200.0	
width=		8			3575.8	
length=		13	98.9			
height=		3		301.8	256.5	
6.6 CONTROL ROOM	1				200.0	
width=		14			3575.8	
length=		15	215.3			
height=		3		656.8	558.3	
6.7 CONFERENCE ROOM	2				200.0	
width=		7			3575.8	
length=		9	128.5			
height=		3		391.9	343.0	
6.8 CONFERENCE ROOM	4				200.0	
width=		4			3575.8	
length=		8	137.5			
height=		3		419.4	367.0	
6.9 LOBBY	2				200.0	
width=		8			3575.8	
length=		20	331.6			
height=		3		1011.3	0.0	
6.10 LOUNGE	1				200.0	
width=		8			3575.8	
length=		20	165.8			
height=		3		505.6	442.4	
6.11 MACHINE SHOP	1				500.0	1000.0
width=		14			8939.5	17879.0
length=		29	419.3			
height=		5		2247.6	1910.5	
6.12 CLEAN ROOM	1				200.0	400.0
width=		14			3575.8	7151.6
length=		29	419.3			
height=		5		2247.6	1910.5	
6.13 STOCK ROOM	1				200.0	400.0
width=		14			3575.8	7151.6
length=		29	419.3			
height=		5		2247.6	1966.7	

6.14 EXPERIMENTAL SPARE PARTS AND SHELF ITEMS	1				200.0	400.0
width=		14			3575.8	7151.6
ngth=		29	419.3			
,eight=		5		2247.6	1966.7	
6.15 WASH ROOM & UTILITY AREA	12				200.0	
width=		3			3575.8	
length=		5	180.0			
height=		3		549.0	0.0	200.0
6.16 HALLS	6					3575.8
width=		3				
length=		53	884.2			
height=		3		2696.8	0.0	
6.17 STAIRS & ELEVATORS	4					200.0
width=		3				3575.8
length=		4	43.0			
height=		6		262.2	0.0	
6.18 SERVICE FLOOR	1				300.0	600.0
width=		31			5363.7	10727.4
length=		64	1944.1			
height=		3		5929.6	0.0	
7. MEDICAL BEAM LINE	1					
width=		1				
length=		1000	500.0			
height=		1		250.0	0.0	
8. MEDICAL TREATMENT BUILDING	1				200.0	400.0
width=		25			3575.8	7151.6
length=		25	625.0			
height=		6		3812.5	3050.0	
TANGENTIAL EXPERIMENTAL BUILDINGS (OPTIONAL)	1				300.0	600.0
width=		50			5363.7	10727.4
length=		150	7500.0			
height=		12		90000.0	76500.0	
10. SITE ACCESS						
10.1 ROADS	1					
width=		7				
length=		1953	14198.7			
10.2 PARKING	2					
width=		28				
length=		66	3643.2			
10.3 PARKING	2					
width=		16				
length=		56	1808.3			
10.3 BRIDGE	1					
width=		28				
length=		265	7319.2			
height=		19				
10.4 SIDEWALKS	2					
width=		2				
length=		24	83.3			
			OFFICE&LAB [m^2]	GROSS[m^3]	USABLE[m^3]	
TOTALS			11408.4	765544.3	608906.6	

BUILDING SPECIFICATIONS OF A MODEL FACILITY FOR THE 6 GeV LIGHT SOURCE (CIVIL ENGINEERING)

BUILDING	ELECTRICAL POWER @6.6GeV LIGHTING [kW]	EXPERIMENTAL RECEPTICAL [kW]	UTILITIES	MACHINE [kW] RF/MAGNET	NOTES
1. LINAC					
1.1 LINAC SUPPORT	1.1	100	5.8	0	
1.1 LINAC & KLYSTRON GALLERY	1.7	90	4.6	164.5 82.3	
1.2 LINAC INJECTOR	6.8	225	36.5	25	
2. INJECTOR					
2.1 INJECTOR TUNNEL	13.4	465	72.3	774 1689.5	
2.1 INJECTOR SUPPORT	6.9	275	37.1	60	
3. STORAGE RING & EXPERIMENTAL HALL	361.1	4195	1944.7	5500 4137.9	
3.1 RING BEAM TUNNEL	67.2	400	361.8	300	VACUUM, ETC.
3.2 RING EXPERIMENTAL AREA		1920	1582.8		
4. UTILITY BUILDINGS					
4.1 STORAGE RING UTILITY BUILDING 1	10.2	325	54.8		
4.2 STORAGE RING UTILITY BUILDING 2	10.2	325	54.8		
5. EXPERIMENTAL SUPPORT BUILDINGS					
5.1 HIGH BAY	48.4	425	86.9		
5.2 EXPERIMENTAL HALL ANNXS OFFICES	38.7	460	69.5		
5.3 EXPERIMENTAL HALL ANNXS LABS	41.8	1458	75.1		

5.4 WASH ROOM & UTILITY AREA	1	36.8	5.6
5.5 AIR LOCK BUILDINGS	4.2		
6. MAIN OFFICE AND LAB PLAZA			
6.1 OFFICES	26.4	349.6	47.3
6.2 LABS	11.1	540	19.9
6.3 ASSEMBLY HALL	8.1	13.8	14.5
6.4 LIBRARY	3.2	9.2	5.7
6.5 COMPUTER ROOM	3.2	54	5.7
6.6 CONTROL ROOM	7	54	12.5
6.7 CONFERENCE ROOM	4.1	18.4	7.4
6.8 CONFERENCE ROOM	4.4	36.8	8
6.9 LOBBY	10.7	9.2	19.2
6.10 LOUNGE	5.4	9.2	9.6
6.11 MACHINE SHOP	13.5	112	24.3
6.12 CLEAN ROOM	13.5	54	24.3
6.13 STOCK ROOM	4.5	9.2	24.3

6.14 EXPERIMENTAL SPARE PARTS AND SHELF ITEMS	13.5	18.4	24.3	
6.15 WASH ROOM & UTILITY AREA	1.9	55.2	10.4	
6.16 HALLS	9.5	27.6	51.2	
6.17 STAIRS & ELEVATORS	0.5	18.4	2.5	
6.18 SERVICE FLOOR	20.9	500	112.7	
7. MEDICAL BEAM LINE	0	0	0	
8. MEDICAL TREATMENT BUILDING	20.2	388	36.2	
9. TANGENTIAL EXPERIMENTAL BUILDINGS (OPTIONAL)	80.7	1000	434.6	
10. SITE ACCESS				
10.1 ROADS	30.6			
10.2 PARKING	7.8			
10.3 PARKING	3.9			
10.3 BRIDGE	23.6			
10.4 SIDEWALKS	0.2			
TOTALS	941.1	13976.8	5286.9	12733.2
SUM OF TOTALS				32938

BUILDING SPECIFICATIONS OF A MODEL FACILITY FOR THE 6 GeV LIGHT SOURCE (CIVIL ENGINEERING)

BUILDING	COOLING WATER 5°C [GPM]	COOLING WATER 26.7°C [GPM]	ELECTRIC POWER REQUIRED TO PUMP THE WATER 2X [kW-5°C](ref)	[kW-26.7°C]
1. LINAC				
1.1 LINAC SUPPORT	0		0.0	
1.1 LINAC & KLYSTRON GALLERY	44.7		19.4	
		22.4		4.2
1.2 LINAC INJECTOR		6.8		1.3
2. INJECTOR	210.5		91.6	
2.1 INJECTOR TUNNEL		459.5		85.7
2.1 INJECTOR SUPPORT		16.3		3.0
3. STORAGE RING & EXPERIMENTAL HALL	1496		650.7	
		1125.5		209.8
3.1 RING BEAM TUNNEL		81.6		15.2
3.2 RING EXPERIMENTAL AREA				
4. UTILITY BUILDINGS				
4.1 STORAGE RING UTILITY BUILDING 1				
4.2 STORAGE RING UTILITY BUILDING 2				
5. EXPERIMENTAL SUPPORT BUILDINGS				
5.1 HIGH BAY				
5.2 EXPERIMENTAL HALL ANNXS OFFICES				
5.3 EXPERIMENTAL HALL ANNXS LABS				

5.4 WASH ROOM & UTILITY AREA

5.5 AIR LOCK BUILDINGS

6. MAIN OFFICE AND LAB PLAZA

6.1 OFFICES

6.2 LABS

6.3 ASSEMBLY HALL

6.4 LIBRARY

6.5 COMPUTER ROOM

6.6 CONTROL ROOM

6.7 CONFERENCE ROOM

6.8 CONFERENCE ROOM

6.9 LOBBY

6.10 LOUNGE

6.11 MACHINE SHOP

6.12 CLEAN ROOM

6.13 STOCK ROOM

6.14 EXPERIMENTAL SPARE PARTS AND SHELF ITEMS

6.15 WASH ROOM & UTILITY AREA

6.16 HALLS

6.17 STAIRS & ELEVATORS

6.18 SERVICE FLOOR

7. MEDICAL BEAM LINE

8. MEDICAL TREATMENT BUILDING

9. TANGENTIAL EXPERIMENTAL BUILDINGS (OPTIONAL)

10. SITE ACCESS

10.1 ROADS

10.2 PARKING

10.3 PARKING

10.3 BRIDGE

10.4 SIDEWALKS

	[GPM]	[GPM]	[kW]	[kW]	
TOTALS	1751.2	1712.1	761.7	319.2	
CARRIED FROM ELECTRICAL POWER SHEET				32938.0	[kW]
TOTAL ELECTRICAL POWER INSTALLED [kVA]				34018.9	[kW]

8/30/85

ELECTRICAL OPERATING ESTIMATE

BUILDING SPECIFICATIONS OF A MODEL FACILITY FOR THE 6 GeV LIGHT SOURCE (CIVIL ENGINEERING)

ELECTRICAL POWER IS A PERCENTAGE OF INSTALLED FOR OPERATING

BUILDING	LIGHTING [kW]	EXPERIMENTAL RECEPTICAL[kW]	UTILITIES [KW]	MACHINE[kW] RF/MAGNET	NOTES
1. LINAC					
1.1 LINAC SUPPORT	0.3	70.0	1.2	0.0	
1.1 LINAC & KLYSTRON GALLERY	0.4	157.5	0.9	13.2 6.6	
1.2 LINAC INJECTOR	1.6	157.5	7.3	2.0	
2. INJECTOR				61.9	
2.1 INJECTOR TUNNEL	0.7	372.0	14.5	135.2	
2.1 INJECTOR SUPPORT	1.6	192.5	7.4	4.8	
3. STORAGE RING & EXPERIMENTAL HALL	361.1	1468.3	583.4	5500.0 2686.0	
3.1 RING BEAM TUNNEL	3.4	40.0	144.7	300.0	VACUUM, ETC
3.2 RING EXPERIMENTAL AREA		960.0	633.1		
4. UTILITY BUILDINGS					
4.1 STORAGE RING UTILITY BUILDING 1	2.0	81.3	16.4		
4.2 STORAGE RING UTILITY BUILDING 2	2.0	81.3	16.4		
5. EXPERIMENTAL SUPPORT BUILDINGS					
5.1 HIGH BAY	9.7	97.8	17.4		
5.2 EXPERIMENTAL HALL ANNXS OFFICES	12.8	32.2	16.0		
5.3 EXPERIMENTAL HALL ANNXS LABS	13.8	102.1	17.3		

5.4 WASH ROOM & UTILITY AREA	0.5	1.8	1.3
5.5 AIR LOCK BUILDINGS	3.8		
6. MAIN OFFICE AND LAB PLAZA			
6.1 OFFICES	5.3	17.5	10.9
6.2 LABS	2.6	27.0	4.6
6.3 ASSEMBLY HALL	0.4	0.3	3.3
6.4 LIBRARY	1.1	0.5	1.3
6.5 COMPUTER ROOM	3.2	37.8	2.9
6.6 CONTROL ROOM	7.0	37.8	6.3
6.7 CONFERENCE ROOM	0.3	0.9	1.7
6.8 CONFERENCE ROOM	0.4	1.8	1.8
6.9 LOBBY	10.7	0.5	4.4
6.10 LOUNGE	1.1	0.5	2.2
6.11 MACHINE SHOP	3.1	28.0	24.3
6.12 CLEAN ROOM	2.7	5.4	24.3
6.13 STOCK ROOM	1.0	0.5	24.3

6.14 EXPERIMENTAL SPARE PARTS AND SHELF ITEMS	3.1	0.9	24.3	
6.15 WASH ROOM & UTILITY AREA	1.0	2.8	10.4	
6.16 HALLS	9.5	1.4	51.2	
6.17 STAIRS & ELEVATORS	0.5	0.9	2.5	
6.18 SERVICE FLOOR	18.8	100.0	112.7	
7. MEDICAL BEAM LINE	0.0	0.0	0.0	
8. MEDICAL TREATMENT BUILDING	10.1	77.6	36.2	
9. TANGENTIAL EXPERIMENTAL BUILDINGS (OPTIONAL)	80.7	500.0	434.6	
10. SITE ACCESS				
10.1 ROADS	15.3			
10.2 PARKING	3.9			
10.3 PARKING	2.0			
10.3 BRIDGE	11.8			
10.4 SIDEWALKS	0.1			
TOTALS	609.0	4656.1	2261.5	8709.6
SUM OF TOTALS				16236.3

BUILDING SPECIFICATIONS OF A MODEL FACILITY FOR THE 6 GeV LIGHT SOURCE (CIVIL ENGINEERING)

BUILDING	COOLING WATER 5°C [GPM]	COOLING WATER 26.7°C [GPM]	ELECTRIC POWER REQUIRED TO PUMP THE WATER 2X [kW-5°C](ref)	[kW-26.7°C]
1. LINAC				
1.1 LINAC SUPPORT	0.0		0.0	
1.1 LINAC & KLYSTRON GALLERY	3.6		1.6	
		22.4		4.2
1.2 LINAC INJECTOR		6.8		1.3
2. INJECTOR	16.8		7.3	
2.1 INJECTOR TUNNEL		459.5		85.7
2.1 INJECTOR SUPPORT		16.3		3.0
3. STORAGE RING & EXPERIMENTAL HALL	1496.0		650.7	
		1125.5		209.8
3.1 RING BEAM TUNNEL		81.6		15.2
3.2 RING EXPERIMENTAL AREA				
4. UTILITY BUILDINGS				
4.1 STORAGE RING UTILITY BUILDING 1				
4.2 STORAGE RING UTILITY BUILDING 2				
5. EXPERIMENTAL SUPPORT BUILDINGS				
5.1 HIGH BAY				
5.2 EXPERIMENTAL HALL ANNXS OFFICES				
5.3 EXPERIMENTAL HALL ANNXS LABS				

5.4 WASH ROOM & UTILITY AREA

5.5 AIR LOCK BUILDINGS

6. MAIN OFFICE AND LAB PLAZA

6.1 OFFICES

6.2 LABS

6.3 ASSEMBLY HALL

6.4 LIBRARY

6.5 COMPUTER ROOM

6.6 CONTROL ROOM

6.7 CONFERENCE ROOM

6.8 CONFERENCE ROOM

6.9 LOBBY

6.10 LOUNGE

6.11 MACHINE SHOP

6.12 CLEAN ROOM

6.13 STOCK ROOM

6.14 EXPERIMENTAL SPARE PARTS AND SHELF ITEMS

6.15 WASH ROOM & UTILITY AREA

6.16 HALLS

6.17 STAIRS & ELEVATORS

6.18 SERVICE FLOOR

7. MEDICAL BEAM LINE

8. MEDICAL TREATMENT BUILDING

9. TANGENTIAL EXPERIMENTAL BUILDINGS (OPTIONAL)

10. SITE ACCESS

10.1 ROADS

10.2 PARKING

10.3 PARKING

10.3 BRIDGE

10.4 SIDEWALKS

	[GPM]	[GPM]	[kW]	[kW]	
TOTALS	1516.4	1712.1	659.6	319.2	
CARRIED FROM ELECTRICAL POWER SHEET				16236.3	[kW]
TOTAL ELECTRICAL POWER kVA OPERATING 100% OF THE TIME				17215.1	[kW]