

WBS	Req.	Parameter	Base Value	Unit	Comment
1. 0.		SPALLATION NEUTRON SOURCE			
1. 0.	x	Proton beam power on target	1.5	MW	
1. 0.	x	Proton beam energy on target	1.0	GeV	
1. 0.	x	Average beam current on target	1.5	mA	
1. 0.	x	Protons per second on target	9.4 E+15	protons/s	
1. 0.	x	Maximum pulse rate	60	Hz	
1. 0.	x	Protons per pulse on target	1.6E+14	protons	
1. 0.	x	Charge per pulse on target	25	uC	
1. 0.	x	Energy per pulse on target	25	kJ	
1. 0.	x	Peak H- front-end current	41	mA	
1. 0.	x	Linac beam duty factor	6	%	
1. 0.	x	Accumulator ring circumference	248.0	m	
1. 0.	x	Ring filling time	1.0	ms	
1. 0.	x	Number of injected turns	1060	turns	
1. 0.	x	Orbit rotation and chopping frequency	1.058	MHz	
1. 0.	x	Orbit rotation time	945	ns	
1. 0.	x	Ring injection pulse length chopper	645	ns	
1. 0.	x	Ring injection kicker gap chopper	300	ns	
1. 0.	x	Ring filling fraction	68	%	
1. 0.	x	Ring extraction pulse length	695	ns	
1. 0.	x	Ring extraction kicker gap	250	ns	
1. 0.	x	Maximum uncontrolled beam loss	1	W/m	
1. 3.		FRONT END			
1. 3.	x	Ion	H minus		
1. 3.	x	RFQ output energy	2.5	MeV	
1. 3.	x	Peak output current	41	mA	
1. 3.	x	Front end length from IS back flange to DTL	7.494	m	
1. 3.	x	Beam-floor distance	50.0	in	
1. 3. 1.		ION SOURCE AND LEBT			
1. 3. 1.	x	H minus IS type	RF volume		Multicusp Cs-enhanced
1. 3. 1.		Peak H- ion source current	51	mA	Assuming 80% front end Trans.
1. 3. 1.		Electron suppression	mag deflection		

1. 3. 1.		Extraction gap electric field	40 kV/cm	
1. 3. 1.		LEBT focusing configuration	2 einzel lenses	
1. 3. 1.		LEBT H&V position offset steering	mechanical	LEBT on sliding mount
1. 3. 1.		LEBT H&V angle offset steering	electrical	Bias 2nd einzel lens quadrants
1. 3. 1.		LEBT deflection chopper peak voltage +/-	2.5 kV	145 mrad
1. 3. 1.	x	RFQ input energy	65 keV	
1. 3. 1.		Length of LEBT	12 cm	
1. 3. 1.	x	Estimated output rms norm H&V emittance	0.20 pi-mm-mrad	
1. 3. 1.	x	IS lifetime	3 weeks	Maintenance cycle
1. 3. 1.	x	IS replacement time	2 hour	
1. 3. 2.		RFQ ACCELERATOR		
1. 3. 2.	x	Output energy	2.5 MeV	
1. 3. 2.	x	Maximum peak output current	41 mA	
1. 3. 2.	x	RF frequency	402.5 MHz	
1. 3. 2.		Structure type	4 vane	4 modules
1. 3. 2.		Vane total length	3.723 m	
1. 3. 2.		Stable phase	-30 deg	
1. 3. 2.		Transverse mode stabilization	pi mode rods	
1. 3. 2.		Nominal aperture radius ro	3.51 mm	
1. 3. 2.		Vane transverse radius	3.51 mm	
1. 3. 2.		Rms surface field during macropulse	1.85 Kilpatrick	
1. 3. 2.		Rms macropulse structure power	630 kW	Assumes 67% of Cu Q
1. 4. 1.	x	Number of 2.5 MW peak power klystrons	1	
1. 3. 2.		Simulated output rms norm H emittance w/ no errors	0.21 pi-mm-mrad	10,000 particles
1. 3. 2.		Simulated output H Twiss beta	0.16 m	
1. 3. 2.		Simulated output H Twiss alpha	-1.61	
1. 3. 2.		Simulated output rms norm V emittance w/ no errors	0.21 pi-mm-mrad	10,000 particles
1. 3. 2.		Simulated output V Twiss beta	0.19 m	
1. 3. 2.		Simulated output V Twiss alpha	1.90	
1. 3. 2.		Simulated output rms L emittance at 402.5 MHz	0.104 pi-MeV-deg	10,000 particles
1. 3. 2.		Simulated output rms energy spread	9.2 keV	
1. 3. 2.		Simulated output phase spread	11.4 deg	
1. 3. 3.		MEBT		
1. 3. 3.		Length	3.62 m	
1. 3. 3.	x	Output peak operating current	52 mA	
1. 3. 3.		Number of quadrupoles	14	

1.	3.	3.	Quads 1-4 and 11-14 clear bore dia	3 cm	
1.	3.	3.	Quads 5 - 10 clear bore dia	4.0 cm	
1.	3.	3.	Effective quad lengths	6.1/6.6 cm	Narrow/wide bore
1.	3.	3.	Maximum quad gradient	35 T/m	
1.	3.	3.	Number of two-plane beam steerers	6	Quad poletip windings
1.	3.	3.	Number of rebuncher cavities	4	
1.	3.	3.	Rebuncher cavity type	TM010 pillbox	Single gap
1.	3.	3.	x Rebuncher cavity frequency	402.5 MHz	
1.	3.	3.	Rebuncher peak voltage integral	75,45,51,106 kV	
1.	3.	3.	x Simulated output rms norm H emittance with errors	0.27 pi-mm-mrad	
1.	3.	3.	x Simulated output H Twiss beta	0.51 m	Under study to match DTL input
1.	3.	3.	x Simulated output H Twiss alpha	-0.59	Under study to match DTL input
1.	3.	3.	x Simulated output rms norm V emittance with errors	0.27 pi-mm-mrad	
1.	3.	3.	x Simulated output V Twiss beta	0.18 m	Under study to match DTL input
1.	3.	3.	x Simulated output V Twiss alpha	-0.41	Under study to match DTL input
1.	3.	3.	Simulated output rms L emittance with errors	0.126 pi-MeV-deg	At 402.5 MHz
1.	3.	3.	x Simulated output rms energy spread	13.9 keV	
1.	3.	3.	x Simulated output rms phase spread	8.7 deg	
1.	3.	3.	Quad gradient rms tolerance	1 %	
1.	3.	3.	Rebuncher cavity field rms tolerance	2 %	
1.	3.	3.	Rebuncher cavity phase rms tolerance	1 deg	
1.	3.	3.	Quad position rms tolerance on sub-raft	0.025 mm	
1.	3.	3.	Sub-raft position rms tolerance on major support	0.04 mm	
1.	3.	3.	x Simulated additional emittance growth w/ uncorr errors	10 %	For all three planes
1.	4.	5.	TRAVELING WAVE CHOPPERS		
1.	4.	5.	x Number of choppers	2	Chopper and antichopper
1.	4.	5.	x chopper length	0.35 m	
1.	4.	5.	x Full rise/fall time	10 ns	
1.	4.	5.	x Beam-on duty factor	68 %	
1.	4.	5.	x Gap	1.8 cm	
1.	4.	5.	x Total deflection voltage	+/- 2350 V	18 mrad deflection
1.	4.	5.	x Post chopper off/on beam-current ratio	1.0E-4	Goal 1.0E-5
1.	3.	3.	DIAGNOSTICS		
1.	3.	3.	Number of beam current toroids	2	
1.	3.	3.	Number of profile monitors	5	
1.	3.	3.	Number of beam scrapers	1	

1. 3.	3.	Number of two-plane stripline BPMs	6	Inside quads, include phase meas..
1. 3.	3.	Number of emittance scanners	1	
1. 4.		LINAC		
1. 4.	x	Simulated output energy	1000 MeV	
1. 4.	x	Output energy 95% probability uncertainty +/-	15 MeV	
1. 4.	x	Average beam current	1.6 mA	
1. 4.	x	Average macropulse current	28 mA	
1. 4.	x	Peak macropulse current	41 mA	
1. 4.		Protons per micro bunch	6.5E+08	
1. 4.		RF duty factor	7.2 %	HV Gate Duty Factor
1. 4.		Peak total RF power	50.4 MW	???
1. 4.		Average total RF power	2.9 MW	???
1. 4.		Average beam power	1.6 MW	
1. 4.	x	Specified ac wall power for RF	25 MW	???
1. 4.	x	Simulated output H&V rms norm emittance w/ errors and w/ jitter	0.41 pi-mm-mrad	Under study
1. 4.	x	Simulated output transverse centroid jitter +/-	0.20 mm	Under study
1. 4.	x	Simulated output H&V rms norm emittance w/ errors and w/ jitter	0.50 pi-mm-mrad	Under study
1. 4.	x	Simulated output H Twiss beta	10.1 m	Under study
1. 4.	x	Simulated output H Twiss alpha	-1.85	Under study
1. 4.	x	Simulated output V Twiss beta	5.3 m	Under study
1. 4.	x	Simulated output V Twiss alpha	1	Under study
1. 4.	x	Simulated output L rms emittance w/ errors	0.6 pi-MeV-deg	Under study
1. 4.	x	Simulated output rms energy spread	0.33 MeV	Under study
1. 4.	x	Simulated output total phase width	12.6 deg	Under study
1. 4.	x	Maximum output energy jitter +/-	2.2 MeV	99.99%
1. 4.	x	Total linac length	279.933 m	Excludes 47.346m for 6 more high-beta cryomodules
1. 4.	x	Linac tunnel width x height	14X10 ft	No crane
1. 4.	x	Linac tunnel length	321.781 m	Excludes 9.233 m of DTL in FE bldg and includes 3.735 m of contingency
1. 4.	x	Beam-floor distance	50.0 in	
1. 4.		Quad transverse displacement rms tolerance	0.07 mm	Limit +/- 0.13 mm
1. 4.		Quad tilt rms tolerance	6 mrad	Limit +/- 10 mrad
1. 4.		Quad roll rms tolerance	3 mrad	Limit +/- 5 mrad

1. 4.		Quad gradient rms tolerance	0.14 %	Limit +/- 0.25 %
1. 4.		Distance rms tolerance between end gaps of segs	0.15 mm	Limit +/- 0.25 mm
1. 4.		Tolerance rms between adjacent gaps in a segment	0.03 mm	Limit +/- 0.05 mm
1. 4.		Segment end transverse displacement rms tolerance	0.3 mm	Limit +/- 0.5 mm
1. 4. 2.		DTL ACCELERATOR		
1. 4. 2.	x	RF frequency	402.5 MHz	
1. 4. 2.	x	Output energy	86.8 MeV	
1. 4. 2.		Number of tanks	6	
1. 4. 2.		Max Kilpatrick field	1.3	
1. 4. 2.		Bore radius	1.25 cm	
1. 4. 2.		Focusing structure	FFODDO	
1. 4. 2.		Focusing period	6 beta-lambda	
1. 4. 2.		Quadrupole type	permanent mag	
1. 4. 2.		Quad integral GL	1.295 T	
1. 4. 2.		Quad location	inside DTs	
1. 4. 2.	x	Total length	36.573 m	Tank 1 entry plane to tank 6 exit plane
1. 4. 2.	x	Average operating vacuum pressure	1.8E-07 Torr	
1 4 2		Tank 1 length	4.1519 m	Between inside end walls
1 4 2		Tank 1 inside diameter	TBD cm	Superfish diameter = 43.0 cm
1 4 2		Tank 1 drift-tube diameter	9 cm	
1 4 2		Tank 1 stem diameter	1.905 cm	DT 49, 52, 55, 58 have 2.54 cm
1 4 2		Tank 1 number of cells	60	
1 4 2		Tank 1 number of drift tubes	59	
1 4 2		Tank 1 number of post couplers	19	
1 4 2		Tank 1 energy gain	5.023 MeV	
1 4 2		Tank 1 synchronous phase	-36 deg	Average, ramp is -45 to -27
1 4 2		Tank 1 stored energy	4.78 J	
1 4 2		Tank 1 cavity power	0.337 MW	
1 4 2		Tank 1 average E_0T	1.495 MV/m	
1 4 2		Tank 1 shunt impedance ZT^2	27.56 MW/m	
1 4 2		Tank 1 unloaded Q	35,887	
1 4 2		Tank 1 cavity-to-waveguide coupling	1.508	
1 4 2		Tank 1 external Q	23,803	
1 4 2		Tank 1 loaded Q	14,311	@34 mA average current
1 4 2		Tank 1 beam power	0.171 MW	@34 mA average current
1 4 2		Tank 1 detuning angle	-8.4 deg	@34 mA average current
1 4 2		Tank 2 length	6.0622 m	Between inside end walls

1	4	2	Tank 2 inside diameter	TBD cm	Superfish diameter = 43.0 cm
1	4	2	Tank 2 drift-tube diameter	9 cm	
1	4	2	Tank 2 stem diameter	1.905 cm	DT 36, 39, 42, 45 have 2.54 cm
1	4	2	Tank 2 number of cells	48	
1	4	2	Tank 2 number of drift tubes	47	
1	4	2	Tank 2 number of post couplers	23	
1	4	2	Tank 2 energy gain	15.315 MeV	
1	4	2	Tank 2 synchronous phase	-25 deg	
1	4	2	Tank 2 stored energy	16.51 J	
1	4	2	Tank 2 cavity power	1.046 MW	
1	4	2	Tank 2 average E_0T	2.787 MV/m	
1	4	2	Tank 2 shunt impedance ZT^2	45.03 MW/m	
1	4	2	Tank 2 unloaded Q	39,919	
1	4	2	Tank 2 cavity-to-waveguide coupling	1.498	
1	4	2	Tank 2 external Q	26,646	
1	4	2	Tank 2 loaded Q	15,980	@ 34 mA average current
1	4	2	Tank 2 beam power	0.521 MW	@34 mA average current
1	4	2	Tank 2 detuning angle	-5.3 deg	@34 mA average current
1	4	2	Tank 3 length	6.3233 m	Between inside end walls
1	4	2	Tank 3 inside diameter	TBD cm	Superfish diameter = 45.0 cm
1	4	2	Tank 3 drift-tube diameter	11 cm	
1	4	2	Tank 3 stem diameter	3.175 cm	
1	4	2	Tank 3 number of cells	34	
1	4	2	Tank 3 number of drift tubes	33	
1	4	2	Tank 3 number of post couplers	16	
1	4	2	Tank 3 energy gain	16.951 MeV	
1	4	2	Tank 3 synchronous phase	-25 deg	
1	4	2	Tank 3 stored energy	21.69 J	
1	4	2	Tank 3 cavity power	1.302 MW	
1	4	2	Tank 3 average E_0T	2.958 MV/m	
1	4	2	Tank 3 shunt impedance ZT^2	42.48 MW/m	
1	4	2	Tank 3 unloaded Q	42,212	
1	4	2	Tank 3 cavity-to-waveguide coupling	1.442	
1	4	2	Tank 2 external Q	29,204	
1	4	2	Tank 3 loaded Q	17,247	@ 34 mA average current
1	4	2	Tank 3 beam power	0.576 MW	@34 mA average current
1	4	2	Tank 3 detuning angle	-4.8 deg	@34 mA average current
1	4	2	Tank 4 length	6.4131 m	Between inside end walls

1	4	2	Tank 4 inside diameter	TBD cm	Superfish diameter = 45.0 cm
1	4	2	Tank 4 drift-tube diameter	11 cm	
1	4	2	Tank 4 stem diameter	3.175 cm	
1	4	2	Tank 4 number of cells	28	
1	4	2	Tank 4 number of drift tubes	27	
1	4	2	Tank 4 number of post couplers	27	
1	4	2	Tank 4 energy gain	16.79 MeV	
1	4	2	Tank 4 synchronous phase	-25 deg	
1	4	2	Tank 4 stored energy	21.15 J	
1	4	2	Tank 4 cavity power	1.259 MW	
1	4	2	Tank 4 average E_0T	2.889 MV/m	
1	4	2	Tank 4 shunt impedance ZT^2	42.49 MW/m	
1	4	2	Tank 4 unloaded Q	42,472	
1	4	2	Tank 4 cavity-to-waveguide coupling	1.453	
1	4	2	Tank 4 external Q	29,222	
1	4	2	Tank 4 loaded Q	17,311	@ 34 mA average current
1	4	2	Tank 4 beam power	0.571 MW	@34 mA average current
1	4	2	Tank 4 detuning angle	-4.8 deg	@34 mA average current
1	4	2	Tank 5 length	6.2958 m	Between inside end walls
1	4	2	Tank 5 inside diameter	TBD cm	Superfish diameter = 45.0 cm
1	4	2	Tank 5 drift-tube diameter	11 cm	
1	4	2	Tank 5 stem diameter	3.175 cm	
1	4	2	Tank 5 number of cells	24	
1	4	2	Tank 5 number of drift tubes	23	
1	4	2	Tank 5 number of post couplers	23	
1	4	2	Tank 5 energy gain	15.916 MeV	
1	4	2	Tank 5 synchronous phase	-25 deg	
1	4	2	Tank 5 stored energy	21.36 J	
1	4	2	Tank 5 cavity power	1.27 MW	
1	4	2	Tank 5 average E_0T	2.789 MV/m	
1	4	2	Tank 5 shunt impedance ZT^2	38.56 MW/m	
1	4	2	Tank 5 unloaded Q	42,526	
1	4	2	Tank 5 cavity-to-waveguide coupling	1.45	
1	4	2	Tank 5 external Q	29,338	
1	4	2	Tank 5 loaded Q	17,361	@ 34 mA average current
1	4	2	Tank 5 beam power	0.571 MW	@34 mA average current
1	4	2	Tank 5 detuning angle	-4.9 deg	@34 mA average current
1	4	2	Tank 6 length	6.3379 M	Between inside end walls

1	4	2	Tank 6 inside diameter	TBD cm	Superfish diameter = 45.0 cm
1	4	2	Tank 6 drift-tube diameter	11 cm	
1	4	2	Tank 6 stem diameter	3.175 cm	
1	4	2	Tank 6 number of cells	22	
1	4	2	Tank 6 number of drift tubes	21	
1	4	2	Tank 6 number of post couplers	21	
1	4	2	Tank 6 energy gain	14.333 MeV	
1	4	2	Tank 6 synchronous phase	-35 deg	Average, ramp is -25 to -45
1	4	2	Tank 6 stored energy	21.48 J	
1	4	2	Tank 6 cavity power	1.281 MW	
1	4	2	Tank 6 average E_0T	2.761 MV/m	
1	4	2	Tank 6 shunt impedance ZT^2	37.71 MW/m	
1	4	2	Tank 6 unloaded Q	42,412	
1	4	2	Tank 6 cavity-to-waveguide coupling	1.38	
1	4	2	Tank 6 external Q	30,728	
1	4	2	Tank 6 loaded Q	17,818	@ 34 mA average current
1	4	2	Tank 6 beam power	0.487 MW	@34 mA average current
1	4	2	Tank 6 detuning angle	-6.4 deg	@34 mA average current

1. 4. 5. **DTL DIAGNOSTICS**

1.	4.	5.	Number of beam position and phase monitors	12
1.	4.	5.	Number of beam loss monitors	12
1.	4.	5.	Number of current monitors	6
1.	4.	5.	Number of wire scanners	6
1.	4.	5.	Number of Faraday cups	5
1.	4.	5.	Number of harps	2

1. 4. 4. **CCL ACCELERATOR**

1.	4.	4.	x	RF frequency	805 MHz
1.	4.	4.	x	Output energy	185.7 MeV
1.	4.	4.		Number of accelerating cells per segment	8
1.	4.	4.		Number of segments per module	12
1.	4.	4.		Number of RF modules	4
1.	4.	4.		DTL to CCL physics distance	24.319 cm
1.	4.	4.		DTL to CCL mechanical space	19.229 cm
1.	4.	4.		Minimum intersegment mechanical space	32.659 cm
1.	4.	4.		Max Kilpatrick field	1.3
1.	4.	4.		Bore radius	1.5 cm

1. 4. 4.	Focusing structure	FODO	
1. 4. 4.	Focusing period	13 beta-lambda	
1. 4. 4.	Number of quadrupoles	49	
1. 4. 4.	Quad type	EM	
1. 4. 4.	Quad integral GL at entry	2.445 T	
1. 4. 4.	Quad integral GL at exit	0.767 T	
1. 4. 4.	Quad location	between segs.	Outside vacuum
1. 4. 4.	Number of steering dipoles	16	Under study
1. 4. 4.	Number of BPMs	8	Under study
1. 4. 4.	CCL accelerator length not including space to CCL	55.119 m	
1. 4. 4.	CCL system length including space to CCL	55.3618 m	
1. 4. 4. x	Average operating vacuum pressure	0.9E-7 Torr	
1 4 4	Module 1 length	11.8392 m	Nominal physics length
1 4 4	Module 1 cell-to-cell coupling	5.33 %	
1 4 4	Module 1 energy gain	20.334 MeV	
1 4 4	Module 1 synchronous phase	-30 deg	
1 4 4	Module 1 stored energy	6.858 J	
1 4 4	Module 1 cavity power	2.127 MW	
1 4 4	Module 1 average E_0T	1.983 MV/m	Average over module length
1 4 4	Module 1 shunt impedance ZT^2	21.89 M \dot{U} /m	Average over module length
1 4 4	Module 1 unloaded Q	16,310	
1 4 4	Module 1 cavity-to-waveguide coupling	1.325	Total for two irises
1 4 4	Module 1 external Q	12,309	
1 4 4	Module 1 loaded Q	7,015	@ 34 mA average current
1 4 4	Module 1 beam power	0.691 MW	@ 34 mA average current
1 4 4	Module 1 detuning angle	-4.6 deg	@ 34 mA average current
1 4 4	Module 2 length	12.9455 m	Nominal physics length
1 4 4	Module 2 cell-to-cell coupling	5.06 %	
1 4 4	Module 2 energy gain	23.979 MeV	
1 4 4	Module 2 synchronous phase	-30 deg	
1 4 4	Module 2 stored energy	8.489 J	
1 4 4	Module 2 cavity power	2.465 MW	
1 4 4	Module 2 average E_0T	2.139 MV/m	Average over module length
1 4 4	Module 2 shunt impedance ZT^2	24.02 M \dot{U} /m	Average over module length
1 4 4	Module 2 unloaded Q	17,418	
1 4 4	Module 2 cavity-to-waveguide coupling	1.331	Total for two irises
1 4 4	Module 2 external Q	13,089	
1 4 4	Module 2 loaded Q	7,473	@ 34 mA average current

1	4	4	Module 2 beam power	0.815 MW	@ 34 mA average current
1	4	4	Module 2 detuning angle	-4.7 deg	@ 34 mA average current
1	4	4	Module 3 length	14.0013 m	Nominal physics length
1	4	4	Module 3 cell-to-cell coupling	4.8 %	
1	4	4	Module 3 energy gain	26.074 MeV	
1	4	4	Module 3 synchronous phase	-29.5 deg	Average, ramp is -30 to -29
1	4	4	Module 3 stored energy	9.086 J	
1	4	4	Module 3 cavity power	2.493 MW	
1	4	4	Module 3 average E_0T	2.14 MV/m	Average over module length
1	4	4	Module 3 shunt impedance ZT^2	25.71 M \dot{U} /m	Average over module length
1	4	4	Module 3 unloaded Q	18,432	
1	4	4	Module 3 cavity-to-waveguide coupling	1.356	Total for two irises
1	4	4	Module 3 external Q	13,597	
1	4	4	Module 3 loaded Q	7,825	@ 34 mA average current
1	4	4	Module 3 beam power	0.887 MW	@ 34 mA average current
1	4	4	Module 3 detuning angle	-4.9 deg	@ 34 mA average current
1	4	4	Module 4 length	14.9951 m	Nominal physics length
1	4	4	Module 4 cell-to-cell coupling	4.56 %	
1	4	4	Module 4 energy gain	28.412 MeV	
1	4	4	Module 4 synchronous phase	-28 deg	Average, ramp is -29 to -27
1	4	4	Module 4 stored energy	9.66 J	
1	4	4	Module 4 cavity power	2.53 MW	
1	4	4	Module 4 average E_0T	2.146 MV/m	Average over module length
1	4	4	Module 4 shunt impedance ZT^2	27.29 M \dot{U} /m	Average over module length
1	4	4	Module 4 unloaded Q	19,311	
1	4	4	Module 4 cavity-to-waveguide coupling	1.382	Total for two irises
1	4	4	Module 4 external Q	13,975	
1	4	4	Module 4 loaded Q	8,108	@ 34 mA average current
1	4	4	Module 4 beam power	0.966 MW	@ 34 mA average current
1	4	4	Module 4 detuning angle	-4.9 deg	@ 34 mA average current

1. 4. 5.

CCL DIAGNOSTICS

1. 4. 5.	Number of beam position and phase monitors	16
1. 4. 5.	Number of beam loss monitors	24
1. 4. 5.	Number of current monitors	2
1. 4. 5.	Number of wire scanners	8

1. 4.

SUPERCONDUCTING RF LINAC

1. 4.	x	RF frequency	805 MHz	
1. 4.	x	Peak med beta cavity surface field	27.5 MV/ m	Uncertainty is +/- 2.5 MV/m
1. 4.	x	Peak high beta cavity surface field	35.0 MV/ m	Uncertainty is +2.5 / -7.5MV/m
1. 4.	x	Medium beta cavity geometrical beta	0.61	
1. 4.	x	High beta cavity geometrical beta	0.81	
1. 4.	x	Number of med beta cryomodules	11	
1. 4.	x	Number of high beta cryomodules	12	
1. 4.	x	Cryomodule length med beta	4.239 m	Includes gate valves
1. 4.	x	Cryomodule length high beta	6.291 m	Includes gate valves
1. 4.	x	Warm space between cryomodule valves	1.6 m	Between gate valves
1. 4.	x	Period length med beta	5.839 m	
1. 4.	x	Period length high beta	7.891 m	
1. 4.	x	Total SRF linac length	157.321 m	23 cryomodules + 22 warm spaces
1. 4.	x	Length of 186 MeV differential pumping section	2.35 m	Contains quad doublet, understudy
1. 4.	x	Last warm space for quad	1.6 m	
1. 4.	x	Length of 969 MeV differential pumping section	3.0 m	Contains quad doublet, understudy
1. 4.	x	Length for nine additional high beta cryomodules	71.019 m	
1. 4.	x	Total length for SRF linac	235.290 m	
1. 4.		Simulated transition energy between sections	379 MeV	????
1. 4.		Transverse focusing lattice	warm doublets	
1. 4.		Warm beam pipe vacuum	1.00E-09 Torr	
1. 4.	x	Beam height	50.0 inches	
1. 4.		SRF LINAC CAVITIES		
1. 4.		Cavity type	elliptical	
1. 4.		Cavity operating mode	pi	
1. 4.		Cavity material	Niobium	
1. 4.		Cavity material thickness	4 mm	3.8 mm after processing
1. 4.		Cavity operating temperature	2.1 degree K	
1. 4.		Number of cells per cavity	6	
1. 4.		Number of med beta cavities	33	
1. 4.		Number of high beta cavities	60	
1. 4.		Cell length med beta	0.1136 m	
1. 4.		Medium beta cavity geometrical beta	0.61	
1. 4.		Cell length med beta	0.1136 m	
1. 4.		Iris radius med beta inner cell	0.043 m	
1. 4.		Iris radius med beta HOM coupler end cell	0.043 m	
1. 4.		Iris radius med beta power coupler end cell	0.065 m	

1. 4.	Equator radius med beta inner cell	0.16376 m
1. 4.	Equator radius med beta HOM coupler end cell	0.16376 m
1. 4.	Equator radius med beta power coupler end cell	0.16698 m
1. 4.	Dome radius med beta inner cell	0.035 m
1. 4.	Dome radius med beta HOM coupler end cell	0.0336 m
1. 4.	Dome radius med beta power coupler end cell (inner)	0.03456 m
1. 4.	Dome radius med beta power coupler end cell (outer)	0.03435 m
1. 4.	a/b med beta inner cell	0.59
1. 4.	a/b med beta HOM coupler end cell	0.67
1. 4.	a/b med beta power coupler end cell (inner)	0.59
1. 4.	a/b med beta power coupler end cell (outer)	0.67
1. 4.	A/B med beta inner cell	1
1. 4.	A/B med beta HOM coupler end cell	1
1. 4.	A/B med beta power coupler end cell (inner)	1
1. 4.	A/B med beta power coupler end cell (outer)	1
1. 4.	Angle med beta inner cell	7 deg
1. 4.	Angle med beta HOM coupler end cell	8.36 deg
1. 4.	Angle med beta power coupler end cell (inner)	7 deg
1. 4.	Angle med beta power coupler end cell (outer)	10 deg
1. 4.	High Beta cavity geometrical beta	0.81
1. 4.	Cell length high beta	0.151 m
1. 4.	Iris radius high beta inner cell	0.0488 m
1. 4.	Iris radius high beta HOM coupler end cell	0.0488 m
1. 4.	Iris radius high beta power coupler end cell	0.07 m
1. 4.	Equator radius high beta inner cell	0.16416 m
1. 4.	Equator radius high beta HOM coupler end cell	0.16416 m
1. 4.	Equator radius high beta power coupler end cell	0.16588 m
1. 4.	Dome radius high beta inner cell	0.05237 m
1. 4.	minor asix/2 high beta HOM coupler end cell, A	0.05170 m
1. 4.	major asix/2 high beta HOM coupler end cell, B	0.05687 m
1. 4.	Dome radius high beta power coupler end cell (inner)	0.05213 m
1. 4.	Dome radius high beta power coupler end cell (outer)	0.05508 m
1. 4.	a/b high beta inner cell	0.556
1. 4.	a/b high beta HOM coupler end cell	0.556
1. 4.	a/b high beta power coupler end cell (inner)	0.556
1. 4.	a/b high beta power coupler end cell (outer)	0.588
1. 4.	A/B high beta inner cell	1
1. 4.	A/B high beta HOM coupler end cell	0.91

1. 4.		A/B high beta power coupler end cell (inner)	1	
1. 4.		A/B high beta power coupler end cell (outer)	1	
1. 4.		Angle high beta inner cell	7 deg	
1. 4.		Angle high beta HOM coupler end cell	7.97 deg	
1. 4.		Angle high beta power coupler end cell (inner)	7 deg	
1. 4.		Angle high beta power coupler end cell (outer)	7 deg	
1. 4.		Mid beta coupling constant	1.61 %	
1. 4.		High beta coupling constant	1.61 %	
1. 4.		Qo med beta	>5e9	
1. 4.		Qo high beta	>5e9	
1. 4.		R/Qo med beta	350 Ohms/m	
1. 4.		R/Qo high beta	500 Ohms/m	
1. 4.		Medium B Cavity external Q	7.30E+05	
1. 4.		High Beta Cavity external Q	7.00E+05	
1. 4.		Q variation +/-	20 %	
1. 4.		Typical band width	1600 Hz	
1. 4.		Cavity stiffeners	yes	
1. 4.		Lorentz force detuning coefficient-medium beta	2.9 Hz/(MV/m)^2	
1. 4.		Lorentz force detuning coefficient-high beta	1.2 Hz/(MV/m)^2	
1. 4.		Lorentz force coefficient variation +/-	50 %	
1. 4.		Microphonic amplitude limit +/-	100 Hz	Six sigma
1. 4.		Cavity active length med beta	0.6816 m	
1. 4.		Cavity active length high beta	0.906 m	
1. 4.		Total cavity end space for couplers	0.385 m	
1. 4.		Total cavity length med beta	1.0666 m	
1. 4.		Total cavity length high beta	1.291 m	
1. 4.	x	Peak med beta cavity surface field Epeak	27.5 MV/ m	Uncertainty is +/- 2.5 MV/m
1. 4.	x	Peak high beta cavity surface field Epeak	35.0 MV/ m	Uncertainty is +2.5 / -7.5MV/m
1. 4.		Epeak/Eacc interior cells med beta	2.63	
1. 4.		Epeak/Eacc interior cells high beta	2.14	
1. 4.		Bpeak/Epeak interior cells med beta	2.07 mT//MV/m	???
1. 4.		Bpeak/Epeak interior cells high beta	2.14 mT//MV/m	???
1. 4.		Eacc interior cells med beta	10.5 MV/m	???
1. 4.		Eacc interior cells high beta	12.8 MV/m	???
1. 4.		Eo interior cells med beta	13.5 MV/m	???
1. 4.		Eo interior cells high beta	16.6 MV/m	???
1. 4.		Bpeak interior cells med beta	57 mT	???
1. 4.		Bpeak interior cells high beta	59 mT	???

1. 4.	SRF LINAC CRYOMODULES		
1. 4.	Cavities per cryomodule med beta	3	
1. 4.	Cavities per cryomodule high beta	4	
1. 4.	Cryomodule length med beta	4.239 m	
1. 4.	Cryomodule length high beta	6.291 m	
1. 4.	Cryomodule diameter	0.914 m	
1. 4.	Shield static heat load med beta cryomodule	170 W	
1. 4.	Shield static heat load high beta cryomodule	200 W	
1. 4.	2.1 K static heat load med beta cryomodule	25 W	
1. 4.	2.1 K static heat load high beta cryomodule	28 W	
1. 4.	Cavity dynamic heat load per med beta cryomodule	16 W	
1. 4.	Cavity dynamic heat load per high beta cryomodule	18 W	
1. 4.	Magnetic fields at cryomodules from rebar	0.0001 T	
1. 4.	Cavity displacement tolerance relative to cryomodule	+/-1 mm	Maximum
1. 4.	Cavity tilt tolerance relative to cryomodule	+/-1 mrad	Maximum
1. 4.	Cryomodule alignment tolerance	+/-1 mm	Maximum
1. 4.	SRF LINAC POWER COUPLERS		
1. 4.	Power couplers per cavity	1	
1. 4.	Number of power couplers	93	
1. 4.	Maximum power of coupler	550 kW	
1. 4.	Power coupler design	KEK-B	
1. 4.	Power coupler vacuum	5.00E-09 Torr	
1. 4.	SRF LINAC HOM COUPLERS		
1. 4.	HOM couplers per cavity	2	
1. 4.	Number of HOM couplers	2 x 92	
1. 4.	HOM coupler design	TTF	
1. 4.	SRF LINAC TUNERS		
1. 4.	Number of tuners	93	
1. 4.	Tuner tuning rate	3000 Hz/min	
1. 4.	Tuner tuning range	+/-100 kHz	
1. 4. 12.	SRF LINAC CYROPLANT		
1. 4. 12.	Primary circuit temperature	2.1 K	
1. 4. 12.	Primary circuit pressure	0.041 bar	

1. 4. 12.	Primary circuit static load per review 9.12.00	900 W	
1. 4. 12.	Primary circuit dynamic load	500 W	
1. 4. 12.	Primary circuit capacity per review 9.12.00	2,800 W	
1. 4. 12.	Primary circuit margin	100 %	50 % @ 1.3GeV
1. 4. 12.	Secondary circuit temperature	5 K	
1. 4. 12.	Secondary circuit pressure	3 bar	
1. 4. 12.	Secondary circuit static load	5 g/s	
1. 4. 12.	Secondary circuit dynamic load	2.5 g/s	
1. 4. 12.	Secondary circuit capacity	15 g/s	
1. 4. 12.	Secondary circuit margin	100 %	
1. 4. 12.	Shield circuit temperature	35-55 K	
1. 4. 12.	Shield circuit pressure	4.0-3.0 bar	
1. 4. 12.	Shield circuit static load	5530 W	
1. 4. 12.	Shield circuit dynamic load	0 W	
1. 4. 12.	Shield circuit capacity	8300 W	
1. 4. 12.	Shield circuit margin	50 W	

1. 4. 9. SRF LINAC FOCUSING QUADRUPOLES

1. 4. 9.	Lattice	warm doublets	
1. 4. 9.	Number of quadrupole singlets	64 ?????	Includes quads for additional cryomods
1. 4. 9.	Number of quad singlets with H&V dipole windings	64 ?????	
1. 4. 9.	Number of powered quad H&V dipole windings	33 ?????	Quads will steer in their focusing plane
1. 4. 9.	Aperture diameter	8 cm	
1. 4. 9.	Maximum outer diameter	0.55 m	
1. 4. 9.	Iron core length	0.35 m	
1. 4. 9.	Effective length	0.41 m	
1. 4. 9.	Max pole tip field	0.3 T	
1. 4. 9.	Max gradient	7.2 T/m	
1. 4. 9.	Max integrated gradient	2.98 T	

1. 4. 5. SRF LINAC DIAGNOSTICS

1. 4. 5.	Number of beam position and phase monitors	32
1. 4. 5.	Number of beam loss monitors	64
1. 4. 5.	Number of current monitors	3
1. 4. 5.	Number of wire scanners	32

1. 4. 1. RF POWER SYSTEMS

1. 4. 1.	Modulator type	IGBT
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1.	4.	1.	402.5 MHz klystron peak RF power	2.5 MW	Includes 25 % control margin
1.	4.	1.	Number of RFQ 402.5 MHz klystrons	1	
1.	4.	1.	Number of 402.5 MHz klystrons per DTL tank	1	
1.	4.	1.	Number of DTL 402.5 MHz klystrons	6	
1.	4.	1.	Total number of 402.5 MHz klystrons	7	
1.	4.	1.	Number of 402.5 MHz klystrons per transmitter	1	
1.	4.	1.	Number of 402.5 MHz klystrons per modulator	2	
1.	4.	1.	Number of 402.5 MHz circulators	7	
1.	4.	1.	402.5 MHz klystron efficiency	58 %	
1.	4.	1.	402.5 MHz klystron average RF power	0.175 MW	
1.	4.	1.	402.5 MHz RF field tilt rms tolerance in tank	0.06 %	
1.	4.	1.	805 MHz CCL klystron peak power	5 MW	Includes 25 % control margin ????
1.	4.	1.	Number of 805 MHz klystrons per CCL module	1	
1.	4.	1.	Number of CCL 805 MHz klystrons	4	
1.	4.	1.	Number of 5 MW HEBT 805 MHz klystrons	2	
1.	4.	1.	Number of 805 MHz klystrons per transmitter	1	
1.	4.	1.	Number of 805 MHz klystrons per modulator	2	
1.	4.	1.	Number of 805 MHz circulators	6	
1.	4.	1.	805 MHz 5 MW klystron efficiency	55 %	
1.	4.	1.	SRF klystron peak power	0.55 MW	Includes 33 % control margin ?????
1.	4.	1.	Number of SRF cavities per klystron	1	
1.	4.	1.	Number of SRFL 805 MHz klystrons	92	????
1.	4.	1.	Number of SRF klystrons per transmitter	6 or 5	????
1.	4.	1.	Number of SRF klystrons per HV power conditioner	12 or 11	????
1.	4.	1.	Number of SRF klystron circulators	92	????
1.	4.	1.	805 MHz klystron average RF power	0.35 MW	
1.	4.	1.	805 MHz 550 KW klystron efficiency	63 %	
1.	4.	1.	RF module phase dynamic rms tolerance	0.5 deg	Limit +/- 0.75 deg
1.	4.	1.	RF module amplitude dynamic rms tolerance	0.5 %	Limit +/- 0.75 deg
1.	4.	1.	RF module phase static rms tolerance	1 deg	Limit +/- 1.0 deg
1.	4.	1.	RF module amplitude static rms tolerance	0.6 %	Limit +/- 1.0 %
1.	4.	1.	RF segment amplitude static rms tolerance	0.6 %	Limit +/- 1.0 %
1.	4.	1.	RF field response time	100 us	depends on DTL CCL Nb linac
1.	4.	1.	x Klystron gallery width x height	30x20 ft	
1.	5.	1.	HEBT BEAM LINE		
1.	5.	1.	x Total HEBT length	169.49 m	Diff pumping to inj septum center

1. 5. 1.	x	Length of additional linac dump beam line	42 m	
1. 5. 1.	x	Length of linac to achromat matching section LAMS	40 m	
1. 5. 1.	x	Number of LAMS FODO cells	5.0	8.0 m per FODO cell
1. 5. 1.	x	Length of achromat	59 m	
1. 5. 1.	x	Number of achromat FODO cells	4	14.0 m per FODO cell
1. 5. 1.	x	Achromat total bend angle	90 deg	
1. 5. 1.	x	Achromat maximum dispersion	6.8 m	
1. 5. 1.	x	Length of achromat to ring matching section ARMS	70 m	
1. 5. 1.	x	Number of ARMS FODO cells	7.5	8.0 m per FODO cell
1. 5. 1.		Number of Ludewig betatron collimators	2	
1. 5. 1.		Number of betatron foil collimators	2	
1. 5. 1.		Location of momentum collimator	achromat center	
1. 5. 1.	x	Rms energy spread at achromat center	0.72 MeV	
1. 5. 1.	x	Energy scrape with momentum collimator	+/- 3.0 MeV	
1. 5. 1.	x	Energy total jitter before energy corrector	+/- 2.2 MeV	Under study
1. 5. 1.	x	Energy total jitter after energy corrector	+/- 0.2 MeV	
1. 5. 1.	x	Rms energy spread before energy spreader	0.85 MeV	
1. 5. 1.	x	Total time ave energy spread at foil	+/- 4.0 MeV	
1. 5. 1.	x	Number of energy sweeps per macropulse	100	
1. 5. 1.	x	Simulated output H&V rms norm emittance w/ errors and w/ jitter	0.41 pi-mm-mrad	Under study
1. 5. 1.	x	Simulated output transverse centroid jitter +/-	0.20 mm	Under study
1. 5. 1.	x	Simulated output H&V rms norm emittance w/ errors and w/ jitter	0.50 pi-mm-mrad	Under study
1. 5. 1.		Foil H Twiss beta	8.75 m	
1. 5. 1.		Foil H Twiss alpha	0.058	
1. 5. 1.		Foil V Twiss beta	13.25 m	
1. 5. 1.		Foil V Twiss alpha	0.039	
1. 5. 1.	x	Tunnel width x height	17x18 ft	Crane hook at 10 ft 3 in
1. 5. 1.	x	Beam-floor distance	50.0 in	
1. 5. 1.	x	Operating vacuum pressure	5E-8 to 1E-8 Torr	From SRFL to Ring
1. 5. 1.		HEBT MAGNETS		
1. 5. 1.		Number of 11.25 deg C type dipoles	8	
1. 5. 1.		11.25 deg dipole field	0.21 T	
1. 5. 1.		11.25 deg dipole gap	8 cm	
1. 5. 1.		11.25 deg dipole length	5.3 m	
1. 5. 1.		Number of 7.5 deg dipoles	1	

1.	5.	1.	7.5 deg dipole field	0.21 T	
1.	5.	1.	7.5 deg dipole gap	8 cm	
1.	5.	1.	7.5 deg dipole length	3.55 m	
1.	5.	1.	Number of 12 cm bore quadrupoles	31	25 (HEBT) + 6 (linac dump)
1.	5.	1.	12 cm bore quad gradient	5.5 T/m	
1.	5.	1.	12 cm bore quad length	0.5 m	
1.	5.	1.	Number of 21 cm bore quadrupoles	9	Same as ring quads
1.	5.	1.	21 cm bore quad gradient	3 T/m	
1.	5.	1.	21 cm bore quad length	0.5 m	
1.	5.	1.	Number of 26.4 cm bore injection dump quadruples	1	
1.	5.	1.	Injection dump quad gradient	3.6 T/m	
1.	5.	1.	Injection dump quad length	0.4 m	
1.	5.	1.	Number of 12x12 cm dipole correctors	12	
1.	5.	1.	12x12 cm corr length	0.2 m	
1.	5.	1.	12x12 cm corr field	0.03 T	
1.	5.	1.	Number of 24x24 cm correctors	5	
1.	5.	1.	24x24 cm corr length	0.3 m	
1.	5.	1.	24x24 cm corr field	0.02 T	
1.	5.	1.	Dipole magnetic field errors +/-	0.01 %	Integrated at full acceptance
1.	5.	1.	Quadrupole magnetic field errors +/-	0.1 %	Integrated at full acceptance
1.	5.	1.	Dipole corrector magnetic field errors +/-	1.0 %	Integrated at full acceptance
1.	5.	1.	Magnet translation rms alignment tolerance	0.1 mm	
1.	5.	1.	Magnet pitch and yaw rms alignment tolerance	1 mrad	
1.	5.	1.	Magnet rotation rms alignment tolerance	2 mrad	
1.	5.	1.	Number of dipole ps	3	700 A and 40,40,150 V
1.	5.	1.	Number of quadrupole ps	26	200-800 A and 15-60 V
1.	5.	1.	Number of corrector bipolar PS	36	20 A and 30 V
1.	4.	5.	HEBT RF CAVITIES		
1.	4.	5.	x Number energy corrector cavities	1	
1.	4.	5.	x Energy corrector cavity location	92 m	From the linac ????
1.	4.	5.	x Energy corrector frequency	805 MHz	Same as CCL
1.	4.	5.	x Energy corrector aperture dia	4.8 cm	
1.	4.	5.	x Energy corrector peak voltage EoTL	4 MV	
1.	4.	5.	x Energy corrector length	1.14 m	7 accelerating cells
1.	4.	5.	x Energy corrector RF requirement	0.4 MW	
1.	4.	5.	x Number energy spreader cavities	1	
1.	4.	5.	x Energy spreader cavity location	140 m	From the linac ????

1. 4. 5.	x	Energy spreader frequency	805.0 +/- 0.1 MHz	Same as CCL
1. 4. 5.	x	Energy spreader aperture dia	4.8 cm	
1. 4. 5.	x	Energy spreader peak voltage EoTL	4 MV	
1. 4. 5.	x	Energy spreader length	1.14 m	7 accelerating cells
1. 4. 5.	x	Energy spreader RF requirement	0.4 MW	
1. 5. 7.		HEBT DIAGNOSTICS		
1. 5. 7.		Number of beam position and phase monitors	22	
1. 5. 7.		Number of beam loss monitors	40	
1. 5. 7.		Number of current monitors	5	
1. 5. 7.		Number of wire scanners	11	
1. 5. 7.		Number of harps	2	
1. 5. 7.		Number of beam in gap monitors	1	
1. 5. 7.		Number of phase width monitors	1	
1. 5.		ACCUMULATOR RING		
1. 5.	x	Proton magnetic rigidity	5.6575 Tm	
1. 5.	x	Max uncontrolled ring beam loss	0.01 %	1 nA/m
1. 5.	x	Unnormalized 99% emittance	160 pi-mm-mrad	347 pi-mm-mrad normalized
1. 5.		Ring betatron acceptance	480 pi-mm-mrad	
1. 5.		Collimator acceptance	225-240 pi-mm-mrad	Under study
1. 5.		Expected momentum acceptance	+/- 1.0	
1. 5.		Full beam momentum acceptance	+/- 2.0 %	
1. 5.		Zero betatron amplitude momentum acceptance	+/- 3.8 %	
1. 5.		Bunching factor	0.44	Dual harmonic RF
1. 5.		Space charge uniform-beam Laslett tune shift	0.14	No wall impedance
1. 5.	x	Ring circumference	248 m	
1. 5.	x	Average radius	39.47 m	
1. 5.	x	Lattice superperiods	4	
1. 5.		Max dispersion in straight sections	<10 cm	
1. 5.		Arc lattice	4 FODO cells	
1. 5.		Arc FODO cell length	8 m	
1. 5.		Drift in arc FODO cells	2x1 m	
1. 5.		Straight section lattice	2 doublets	
1. 5.		Short drift in long straights	2X6.85 m	
1. 5.		Long drift in long straights	12.5 m	
1. 5.		Phase advance per arc FODO cell	90 deg	

1. 5.		Nominal betatron H tune	6.32	Design tunes 5.8-6.3
1. 5.		Nominal betatron V tune	5.80	Design tunes 4.8-5.8
1. 5.		Transition gamma	5.25	
1. 5.		Frequency slip factor	-0.198	
1. 5.		Natural H chromaticity	-7.7	
1. 5.		Natural V chromaticity	-6.4	
1. 5.		Maximum dispersion function	3.7 m	Nominal tunes
1. 5.		Maximum H/V Twiss beta	27/13 m	Nominal tunes
1. 5.		Electron bounce frequency from proton charge	100-175 MHz	
1. 5.	x	Ring tunnel width x height	17x18 ft	Crane hook at 10 ft 3 in
1. 5.	x	Offset for injection painting V dynamic bump	4.6 cm	
1. 5.	x	Ring V beamline offset wrt HEFT beamline	-4.6 cm	
1. 5.	x	Ring beam-floor distance	48.2 in	
1. 5.	x	Offset for injection painting H dynamic bump	4.0 cm	
1. 5.	x	Offset for injection H static bump	10.0 cm	
1. 5.	x	Ring H beamline offset wrt HEFT beamline	14.0 cm	
1. 5.	2.	RING INJECTION SYSTEM		
1. 5.	2.	Foil size HxV	4x8 mm	3 open sides
1. 5.	2.	Foil thickness	300 ug/cm ²	
1. 5.	2.	Linac beam missing foil	2 %	
1. 5.	2.	Neutral Ho beam from foil	2 %	H- beam is negligible
1. 5.	2.	Stripped electron beam power	2 kW	
1. 5.	2.	Stripped electron radius	1.2 cm	B=0.25 T
1. 5.	2.	Stripped electron beam dump	copper	Water cooled Cu block
1. 5.	2.	Transverse painting scheme	correlated	Understudy
1. 5.	2.	Average foil hits per proton	6	Understudy
1. 5.	2.	Number of H and V in-ring kicker magnets	4 and 4	
1. 5.	2.	Kicker magnet time constant	300 us	
1. 5.	2.	Kicker HxV aperture	20.6 X 23.5 cm	Picture frame outside vacuum
1. 5.	2.	Long kicker max horizontal kick angle	9.5 mrad	
1. 5.	2.	Short kicker max horizontal kick angle	1.0 mrad	
1. 5.	2.	Long kicker max vertical kick angle	6.7 mrad	
1. 5.	2.	Short kicker max vertical kick angle	0.4 mrad	
1. 5.	2.	Long kicker max horizontal magnetic field	0.79 T	
1. 5.	2.	Short kicker max horizontal magnetic field	0.16 T	
1. 5.	2.	Long kicker max vertical magnetic field	0.56 T	
1. 5.	2.	Short kicker max vertical magnetic field	0.06 T	

1. 5. 2.	Long kicker core length	0.48 m	
1. 5. 2.	Short kicker core length	0.16 m	
1. 5. 2.	Long kicker effective length	0.68 m	
1. 5. 2.	Short kicker effective length	0.35 m	
1. 5. 2.	Number of injection kicker ps	8	110A-100V to 1400A-800V
1. 5. 2.	Programmable injection kicker ps	yes	
1. 5. 2.	Number of dc in-ring horizontal bump magnets	4	IDH1-IDH4
1. 5. 2.	IDH1 bending angle	42 mrad	
1. 5. 2.	IDH1 HxV aperture	18.0 x 23.6 cm	Septum
1. 5. 2.	IDH1 effective magnetic length	0.863 m	
1. 5. 2.	IDH1 core length	0.572 m	
1. 5. 2.	IDH1 magnetic field	0.33 T	PS for 0.275 T
1. 5. 2.	IDh2 bending angle	46.2 mrad	
1. 5. 2.	IDH2 HxV aperture	17.0 x 23.6 cm	C magnet
1. 5. 2.	IDH2 magnetic effective length	0.872 m	
1. 5. 2.	IDH2 core length	0.572 m	
1. 5. 2.	IDH2 magnetic field	0.30 T	PS for 0.30 T
1. 5. 2.	IDH3 bending angle	42 mrad	
1. 5. 2.	IDH3 HxV aperture	22.0 x 23.6 cm	C magnet
1. 5. 2.	IDH3 magnetic effective length	0.99 m	
1. 5. 2.	IDH3 core length	0.69 m	
1. 5. 2.	IDH3 magnetic field	0.24 T	PS for 0.24 T
1. 5. 2.	IDH4 bending angle	46.2 mrad	
1. 5. 2.	IDH4 HxV aperture	38.0 x 23.6 cm	C magnet
1. 5. 2.	IDH4 magnetic effective length	0.89 m	
1. 5. 2.	IDH4 core length	0.514 m	
1. 5. 2.	IDH4 magnetic field	0.36 T	PS for 0.294 T
1. 5. 2.	Injection septum bend angle	110.8 mrad	
1. 5. 2.	Injection septum HxV aperture	6.2 x 7.4 cm	
1. 5. 2.	Injection septum magnetic length	3.00 m	
1. 5. 2.	Injection septum core length	2.93 m	
1. 5. 2.	Injection septum magnetic field	0.25 T	PS for 0.208 T
1. 5. 2.	Injection septum thickness	1.0 cm	
1. 5. 2.	Injection dump septum bend angle	100 mrad	
1. 5. 2.	Injection dump septum VxH aperture	16.5 x 6.2 cm	
1. 5. 2.	Injection dump septum magnetic length	1.80 m	
1. 5. 2.	Injection dump septum core length	1.54 m	
1. 5. 2.	Injection dump septum magnetic field	0.37 T	PS for 0.31 T

1. 5. 2.	Injection dump septum thickness	1.0 cm	
1. 5. 2.	Injection dipole magnetic field errors +/-	0.1 %	Integrated at full acceptance
1. 5. 2.	Injection kicker field errors +/-	1.0 %	Integrated at full acceptance
1. 5. 2.	Number of injection dc ps (4 dip, 2 sept, 1 quad)	7	820-4000 A and ~20 V
1. 5. 2.	Number of corr ps	2	20 A and 30 V

1. 5. 3. **RING MAGNET SYSTEM**

1. 5. 3.	Core material	1006 steel	Solid core
1. 5. 3.	Number of H frame sector dipoles	32	33 w/ reference dipole
1. 5. 3.	Dipole magnetic field	0.7935 T	
1. 5. 3.	Dipole bend angle	11.25 deg	Bending radius = 7.996 m
1. 5. 3.	Dipole gap	17 cm	HGFW = 23 cm
1. 5. 3.	Dipole pole width	45 cm	
1. 5. 3.	Dipole magnetic path length	1.4 m	
1. 5. 3.	Dipole radius of curvature	7.6394 m	
1. 5. 3.	Dipole sigitta	3.85 cm	
1. 5. 3.	Dipole magnetic field tolerance	+/- 0.0001	
1. 5. 3.	Number of arc regular quadrupoles	28	
1. 5. 3.	Bore of arc regular quads	21.0 cm	
1. 5. 3.	Magnetic length of arc regular quads	0.50 m	
1. 5. 3.	Magnetic gradient of arc regular quads	4.7-5.6 T/m	
1. 5. 3.	Maximum poletip field of arc regular quads	0.49-0.59 T	
1. 5. 3.	Number of arc large quadrupoles	8	
1. 5. 3.	Bore of arc large quads	26.4 cm	
1. 5. 3.	Magnetic length of arc large quads	0.50 m	
1. 5. 3.	Magnetic gradient of arc large quads	4.7-5.6 T/m	
1. 5. 3.	Maximum poletip field of arc large quads	0.61-0.73 T	
1. 5. 3.	Number of straight section long quadrupoles	8	
1. 5. 3.	Bore of straight section long quads	30.0 cm	
1. 5. 3.	Magnetic length of straight section long quads	0.70 m	
1. 5. 3.	Magnetic gradient of straight section long quads	4.3-5.2 T/m	
1. 5. 3.	Maximum poletip field of straight section long quads	0.65-0.78 T	
1. 5. 3.	Number of straight section short quadrupoles	8	
1. 5. 3.	Bore of straight section short quads	30.0 cm	
1. 5. 3.	Magnetic length of straight section short quads	0.55 m	
1. 5. 3.	Magnetic gradient of straight section short quads	4.3-5.2 T/m	
1. 5. 3.	Maximum poletip field of straight section short quads	0.65-0.78 T	
1. 5. 3.	Number of 24x24 cm dipole and multipole correctors	28	

1. 5. 3.	24x24 cm corrector length	0.3 m	
1. 5. 3.	24x24 cm corrector field	0.02 T	
1. 5. 3.	Number of 26x26 cm correctors	8	
1. 5. 3.	26x26 cm corrector length	0.3 m	
1. 5. 3.	26x26 cm corrector field	0.02 T	
1. 5. 3.	Number of 31x31 cm correctors	8	
1. 5. 3.	31x31 cm corrector length	0.3 m	
1. 5. 3.	31x31 cm corrector field	0.02 T	
1. 5. 3.	Ring dipole magnetic field errors +/-	0.01 %	Integrated at full acceptance
1. 5. 3.	Ring quadrupole magnetic field errors +/-	0.01 %	Integrated at full acceptance
1. 5. 3.	Chromaticity sextupoles +/-1	1.0 %	Integrated at full acceptance
1. 5. 3.	Dipole, quad, skew quad, sext, skew sext, oct, skew oct magnetic field errors +/-	1.0 %	Integrated at full acceptance
1. 5. 3.	Poletip machining tolerance	+/- 0.05 mm	
1. 5. 3.	Poletip mating tolerance	+/- 0.05 mm	
1. 5. 3.	Quad displacement rms alignment tolerance	0.1 mm	
1. 5. 3.	Dipole roll rms alignment tolerance	0.2 mrad	
1. 5. 3.	Magnet translation rms alignment tolerance	0.1 mm	
1. 5. 3.	Magnet pitch rms alignment tolerance	0.2 mrad	
1. 5. 3.	Magnet yaw rms alignment tolerance	0.5 mrad	
1. 5. 3.	Magnet rotation rms alignment tolerance	0.2 mrad	
1. 5. 3.	Magnet twist rms tolerance	0.5 mrad	
1. 5. 4.	RING POWER SUPPLIES		
1. 5. 4.	Dipole primary ps	4600 A	400 V
1. 5. 4.	Quadrupole primary ps QV1	900 A	300 V
1. 5. 4.	Quadrupole primary ps QH2	900 A	500 V
1. 5. 4.	Quadrupole primary ps QH3	900 A	350 V
1. 5. 4.	Quadrupole primary ps QV11	1000 A	300 V
1. 5. 4.	Quadrupole primary ps QH10	1000 A	350 V
1. 5. 4.	Number of dipole and sext corr bipolar PS	56	20 A and 30 V
1. 5. 4.	Number of skew quad and oct corr ps	18	20 A and 60 V
1. 5. 4.	Number of quad corr ps	7	50 A and 30 V
1. 5. 5.	RING VACUUM SYSTEM		
1. 5. 5.	x Average operating vacuum pressure	1.0E-08 Torr	
1. 5. 5.	Chamber material	Stainless steel	TiN coating

1. 5. 6.	RING RF SYSTEM		
1. 5. 6.	RF system type	1st and 2nd harm	
1. 5. 6.	x Total Injected energy spread	+/- 4 MeV	
1. 5. 6.	x Total extracted energy spread	+/- 10 MeV	
1. 5. 6.	Bucket area	17 eV-sec	
1. 5. 6.	Bunch area with 250ns gap	10 eV-sec	Wo/ space charge or parasitics
1. 5. 6.	Cavity length	1.7 m	
1. 5. 6.	Accelerating gaps per cavity	2	
1. 5. 6.	1st harmonic frequency	1.188 MHz	
1. 5. 6.	Number 1st harmonic cavities	3	
1. 5. 6.	Voltage per first harmonic gap	6.7 kV	
1. 5. 6.	Total 1st harmonic voltage per turn	40 kV	
1. 5. 6.	x 2nd harmonic frequency	2.376 MHz	
1. 5. 6.	Number of 2nd harmonic cavities	1	
1. 5. 6.	Voltage per 2nd harmonic gap	10 kV	
1. 5. 6.	Total 2nd harmonic voltage per turn	20 kV	
1. 5. 6.	x Beam current 1st harmonic amplitude	52 A	
1. 5. 6.	Beam current 2nd amplitude	4 A	
1. 5. 6.	Peak bunched beam current	96 A	
1. 5. 6.	Space charge L impedance iZ/n	150 Ohms	
1. 5. 6.	Broad band L wall resistance	50 Ohms	
1. 5. 6.	Ferrite material	Phillips 4M2	
1. 5. 6.	Beam loading compensation	feed forward	
1. 5. 6.	Phase loop bandwidth	5-30 kHz	
1. 5. 6.	Gain loop bandwidth	5-30 kHz	
1. 5. 6.	RF tube	Thompson 558	
1. 5. 6.	Anode charging PS voltage	15 kV	DC
1. 5. 6.	Anode charging PS current	3.33 A	Average
1. 5. 6.	Anode charging PS regulation	0.5 %	
1. 5. 6.	Anode charging PS ripple	0.3 %	Peak to peak
1. 5. 6.	Screen PS voltage	2 kV	DC
1. 5. 6.	Screen PS current	2 A	Average
1. 5. 6.	Screen PS regulation	0.2 %	
1. 5. 6.	Screen PS ripple	0.3 %	Peak to peak
1. 5. 7.	RING DIAGNOSTICS		
1. 5. 7.	Number of beam position monitors	44	Striplines at each quad
1. 5. 7.	Number of beam loss monitors	119	Fast and slow monitors

1. 5. 7.	Number of beam current monitors	2	
1. 5. 7.	Number of wire scanners	1	
1. 5. 7.	Number of foil video monitors	1	
1. 5. 7.	Number of beam in gap monitors	1	Kicker and detector
1. 5. 7.	Number of ionization profile monitors	1	Residual gas ionization monitor
1. 5. 7.	Number of tune measurement systems	1	Kicker excited and FFT analyzed
1. 5. 8.	RING COLLIMATION		
1. 5. 8.	Number of scrapers	1	
1. 5. 8.	Number of Ludewig type collimators	3	7 total Ludewig type collimators
1. 5. 8.	Halo attenuation factor in Ludewig collimator	10,000:1	
1. 5. 8.	Halo attenuation factor in ring	20:1	For 480 pi mm mrad acceptance
1. 5. 8.	Power absorption capacity per collimator	20 kW	
1. 5. 8.	Total mass per collimator	35 metric tons	
1. 5. 9.	RING EXTRACTION		
1. 5. 9. x	Extraction type	single turn	Fast kicker and Lambertson
1. 5. 9. x	Beam extraction time gap	250 ns	
1. 5. 9. x	Kicker rise time	200 ns	0 to 97%
1. 5. 9.	Kicker flattop time	700 ns	
1. 5. 9.	Number of fast ferrite kicker sections	14	
1. 5. 9.	Kicker vertical downward deflection angles	1.16 -1.65 mrad	Full aperture kickers
1. 5. 9.	Kicker integral field	6400 - 9200 Gauss cm	
1. 5. 9.	Kicker horizontal gaps	14.3 - 19.5 cm	
1. 5. 9.	Kicker vertical gaps	13.1 - 25.0 cm	
1. 5. 9.	Kicker core length per section	40 cm	Core spacing 8 cm
1. 5. 9.	Kicker total length	2 x 3.28 m	
1. 5. 9.	Vertical displacement at Lambertson entrance	16.8 cm	
1. 5. 9.	Beam extracts to target with 13 of 14 kickers inoperable	yes	
1. 5. 9.	Number of PFNs	14	
1. 5. 9.	Number of PFN ps	14	
1. 5. 9.	Lambertson horizontal bend angle	16.8 deg	
1. 5. 9.	Lambertson septum thickness	1 cm	
1. 5. 9.	Lambertson field free region HxV gap	30x14 cm	
1. 5. 9.	Lambertson core length	2.1 m	
1. 5. 9.	Lambertson magnetic field	0.8 T	
1. 5. 9.	Extraction Lambertson magnetic field errors +/-	0.1 %	Integrated at full acceptance
1. 5. 9.	Extraction Lambertson max residual field +/-	8 Gauss	Other table has 1 Gauss

1. 5. 9.	Extraction kicker field errors +/-	1.0 %	Integrated at full acceptance
1. 5. 9.	Lambertson PS	2000 A	20V dc
1. 5. 10.	RTBT BEAM LINE		
1. 5. 10.	x Beam spot on target H x V	200 x 70 mm	
1. 5. 10.	x Number of Ludewig betatron collimators	2	
1. 5. 10.	x Target H Twiss beta	83 m	
1. 5. 10.	x Target H Twiss alpha	0	
1. 5. 10.	x Target V Twiss beta	10.2 m	
1. 5. 10.	x Target V Twiss alpha	0	
1. 5. 10.	x Beam line length	150.75 m	Lambertson center to target
1. 5. 10.	x Number of 11.6 m FODO cells	15	
1. 5. 10.	x Ring extraction dump beam line length	28 m	
1. 5. 10.	x Tunnel width x height	17x18 ft	Crane hook at 10 ft 3 in
1. 5. 10.	x Beam-floor distance	39.2 to 41.0 in	Start at 39.2 and end at 41.0
1. 5. 10.	x RTBT elevation wrt ring	-0.2286 m	
1. 5. 10.	x Operating vacuum pressure	1E-8 to 1E-7 Torr	From ring to target
1. 5. 10.	RTBT MAGNETS		
1. 5. 10.	Number of vertical dipoles	1	
1. 5. 10.	Vertical dipole gap	17 cm	
1. 5. 10.	Vertical dipole length	0.5 m	
1. 5. 10.	Vertical dipole field	0.25 T	
1. 5. 10.	Number of 17.0 deg H switcher dipoles	1	
1. 5. 10.	Switching dipole gap	17 cm	
1. 5. 10.	Switching dipole length	2.44 m	
1. 5. 10.	Switching dipole magnetic field	0.66 T	
1. 5. 10.	Number of 21 cm bore quads including 2 for dump	23	
1. 5. 10.	21 cm quad gradient	4.5 T/m	
1. 5. 10.	21 cm quad length	0.50 m	
1. 5. 10.	Number of 31 cm bore quads including 2 for dump	4	
1. 5. 10.	31 cm quad gradient	7.00 T/m	
1. 5. 10.	31 cm quad length	0.50 m	
1. 5. 10.	Number of 36 cm bore spreading quadrupoles	5	
1. 5. 10.	Spreading quad gradient	3 T/m	
1. 5. 10.	Spreading quad length	1.00 m	
1. 5. 10.	Number of 24 x 24 cm dipole correctors	16	

1. 5. 10.		24 x 24 cm corr length	0.3 m	
1. 5. 10.		24 x 24 cm corr field	0.02 T	
1. 5. 10.		Number of 36x36 cm spreading correctors	4	
1. 5. 10.		36x36 cm corr length	0.3 m	
1. 5. 10.		36x36 cm corr field	0.02 T	
1. 5. 10.		RTBT dipole magnetic field errors +/-	0.01 %	Integrated at full acceptance
1. 5. 10.		RTBT quadrupole magnetic field errors +/-	0.1 %	Integrated at full acceptance
1. 5. 10.		RTBT dipole corrector magnetic field errors +/-	1.0 %	Integrated at full acceptance
1. 5. 10.		Magnet translation rms alignment tolerance	0.1 mm	
1. 5. 10.		Magnet pitch and yaw rms alignment tolerance	1 mrad	
1. 5. 10.		Magnet rotation rms alignment tolerance	1 mrad	Extraction and RTBT
1. 5. 10.		Number of dipole PS	2	2000A-50V and 900A-80V
1. 5. 10.		Number of quadrupole PS	21	700A-50V to 800A-120V
1. 5. 10.		Number of corrector bipolar PS	32	20 A and 30 V
1. 5. 7.		RTBT DIAGNOSTICS		
1. 5. 7.		Number of beam position monitors	17	
1. 5. 7.		Number of beam loss monitors	57	
1. 5. 7.		Number of current toroids	5	
1. 5. 7.		Number of wire scanners	5	
1. 5. 7.		Number of harps	2	
1. 6.		TARGET SYSTEMS		
1. 6.	x	Number of target stations	1	
1. 6.	x	Number of neutron beam shutters	18	
1. 6.	x	Number of neutron beam lines	24	
1. 6.	x	Proton beam floor distance	78 inches	
1. 6. 4.		TARGET VESSEL		
1. 6. 4.		Material	316 SS	
1. 6. 4.		Atmosphere	He	At < 0.1 MPa
1. 6. 4.	x	Proton beam window material	Inconel 718	
1. 6. 4.	x	Proton beam window thickness	4.0 mm	
1. 6. 4.	x	Proton beam window coolant	light water	
1. 6. 4.	x	Proton beam window coolant thickness	1.5 mm	
1. 6. 1.		TARGET ASSEMBLIES		

1. 6. 1.	x	Front cross section of target VxH	104x 404 mm	
1. 6. 1.	x	Beam spot on target VxH	70x200 mm	
1. 6. 1.	x	Tolerance on beam centroid H&V	+/- 2 mm	
1. 6. 1.	x	Normal peak current density	0.25 A/m ²	
1. 6. 1.	x	Normal time ave power within beam spot	90 %	
1. 6. 1.	x	Time ave current density over beam spot	0.143 A/m ²	
1. 6. 1.	x	Normal single pulse peak density	2.57E+16 protons/m ²	
1. 6. 1.	x	Off normal single pulse density	3.2E+16 protons/m ²	For 2 pulses max
1. 6. 1.	x	Unscheduled beam off > 5s	50 per day	
1. 6. 1.	x	Unscheduled beam off >300 s	10 per day	
1. 6. 1.		Target material	Hg	Hg inventory < 2.0 cubic m
1. 6. 1.		Hg nominal operating temperature	60 - 90 deg C	
1. 6. 1.		Hg target nominal operating pressure	0.3 MPa	
1. 6. 1.		Hg power loading	1.2 MW	
1. 6. 1.		Shell material	316 SS LN	
1. 6. 1.		Shell temperature	<200 deg C	
1. 6. 1.		Shroud material	316 SS LN	
1. 6. 1.		Shroud cooling	light water	
1. 6. 1.		Target plug material	Fe-alloy water SS	
1. 6. 2.		AMBIENT MODERATORS		
1. 6. 2.	x	Number of moderators	1	
1. 6. 2.	x	Moderator material	light water	
1. 6. 2.	x	Position	below target	Upstream
1. 6. 2.		CRYOGENIC MODERATORS		
1. 6. 2.	x	Number	3	
1. 6. 2.	x	Moderator material	supercritical H	
1. 6. 2.	x	Position	downstream below	
1. 6. 2.	x	Viewed face	120 x 100 mm	
1. 6. 2.	x	Pre moderator	light water	
1. 6. 2.	x	Non grooved surfaces	yes	
1. 6. 2.	x	Poison upstream top only	Al clad Gd	
1. 6. 2.	x	Decoupler upstream top only	Cd	
1. 6. 3.		REFLECTOR ASSEMBLIES		
1. 6. 3.		Reflector material	Be / Pb	
1. 6. 3.		Configuration	nested cylinders	

1. 6. 3.	Coolant		heavy water	
1. 6. 3.	Outer diameter of Be		0.64 m	With heavy water
1. 6. 5.	TARGET SYSTEM SHIELDING			
1. 6. 5. x	Number of single channel shutters		12	
1. 6. 5. x	Number of multi channel shutters		6	
1. 6. 5. x	Shutter configuration		ISIS type	Light water cooled
1. 6. 5. x	Neutron HxV channel within single shutter		200 x 220 mm	
1. 6. 9.	BEAM DUMPS			
1. 6. 9. x	Number of beam dumps		3	
1. 6. 9. x	Minimum target diameter		300 mm	
1. 6. 9. x	Tolerance on beam center		+/- 50 mm	
1. 6. 9.	Materials		Fe-alloy Cu SS	
1. 6. 9.	Cooling		light water	
1. 6. 9.	Atmosphere		He	At 0.1 MPa
1. 6. 9.	Reentrant		yes	
1. 6. 9. x	Maximum single pulse energy		42 kJ	
1. 6. 9.	LINAC DUMP			
1. 6. 9. x	Maximum power		33 kW	
1. 6. 9. x	Operational hours per year		500 hr	
1. 6. 9. x	Pulse length		0.1 to 1.0 ms	
1. 6. 9. x	Maximum horizontal beam size		60 mm	
1. 6. 9. x	Maximum vertical beam size		60 mm	
1. 6. 9.	RING INJECTION DUMP			
1. 6. 9. x	Maximum power		200 kW	
1. 6. 9. x	Operational hours per year		5000 hr	
1. 6. 9. x	Nominal pulse length		0.1 to 1.0 ms	
1. 6. 9. x	Maximum horizontal beam size		200 mm	
1. 6. 9. x	Maximum vertical beam size		100 mm	
1. 6. 9.	RING EXTRACTION DUMP			
1. 6. 9. x	Maximum power		33 kW	
1. 6. 9. x	Operational hours per year		500 hr	
1. 6. 9. x	Nominal pulse length		600 ns	

- 1. 6. 9. x Maximum horizontal beam size 200 mm
- 1. 6. 9. x Maximum vertical beam size 200 mm

1. 7. **NEUTRON INSTRUMENTATION (Reference Suite)**

1. 7. 4. **INSTRUMENT #1 High Resolution Backscattering Spectrometer**

- 1. 7. 4. Beam Line 2
- 1. 7. 4. Moderator location top-upbeam
- 1. 7. 4. Moderator material liquid H2
- 1. 7. 4. Moderator coupling decoupled
- 1. 7. 4. Moderator-sample distance 84 m

1. 7. 5. **INSTRUMENT #2 Magnetism Reflectometer**

- 1. 7. 5. Beam Line 4a
- 1. 7. 5. Moderator location top downbeam
- 1. 7. 5. Moderator material liquid H2
- 1. 7. 5. Moderator coupling coupled
- 1. 7. 5. Moderator-sample distance 17 m
- 1. 7. 5. Sample-detector distance 2 m

1. 7. 6. **INSTRUMENT #3 Liquids Reflectometer**

- 1. 7. 6. Beam Line 4b
- 1. 7. 6. Moderator location top downbeam
- 1. 7. 6. Moderator material liquid H2
- 1. 7. 6. Moderator coupling coupled
- 1. 7. 6. Moderator-sample distance 13 m
- 1. 7. 6. Sample-detector distance 1.5 m

1. 7. 7. **INSTRUMENT #4 - Chopper Spectrometer** TBD

1. 7. 8. **INSTRUMENT #5 - SANS** TBD

1. 7. 9. **INSTRUMENT #6 - Engineering Diffractometer** TBD

1. 7. 10. **INSTRUMENT #7** TBD

1. 7. 11. **INSTRUMENT #8** TBD

1. 7. 12. **INSTRUMENT #9** TBD

1. 7. 13. **INSTRUMENT #10** TBD

1. 7. **NEUTRON INSTRUMENTATION**

1. 7. 4.		High-resolution backscattering spect.
1. 7. 4.	Beam Line	
1. 7. 4.	Moderator location	
1. 7. 4.	Moderator material	
1. 7. 4.	Moderator coupling	
1. 7. 4.	Moderator-sample distance	m
1. 7. 5.		Magnetism reflectometer
1. 7. 5.	Beam Line	
1. 7. 5.	Moderator location	
1. 7. 5.	Moderator material	
1. 7. 5.	Moderator coupling	
1. 7. 5.	Moderator-sample distance	m
1. 7. 5.	Sample-detector distance	m
1. 7. 6.		Liquids reflectometer
1. 7. 6.	Beam Line	
1. 7. 6.	Moderator location	
1. 7. 6.	Moderator material	
1. 7. 6.	Moderator coupling	
1. 7. 6.	Moderator-sample distance	m
1. 7. 6.	Sample-detector distance	m

1. 9.

CONTROLS

1. 9.	x	Macropulse rate	subharm of 60 Hz
1. 9.	x	Single macropulse capability	yes
1. 9.	x	Macropulse variable length	0.10 to 1.0 ms
1. 9.	x	Linac beam ramp up	20 us
1. 9.	x	Chopper variable beam pulse length	645 to 65 ns
1. 9.	x	Chopper variable gap length	300 to 880 ns
1. 9.	x	Single mini (or turn) pulse capability	yes