

SPALLATION NEUTRON SOURCE ACCELERATOR PARAMETERS

SUPERCONDUCTING RF LINAC			
Output energy	1.00	GeV	
Length	157.321	m	23 cryomodules + 22 warm spaces
RF frequency	805	MHz	
Transition energy between sections	387	MeV	Design value
Focusing structure	Doublet		warm quads between cryos outside vacuum
Number of quadrupoles	67		Includes doublet for CCL-SCL transition
Number of quadrupoles with H&V dipole windings	67		32 Powered
Quad type	EM		
Number of quadrupole PS for matching	8		2 for CCL-SCL matching, 6 for SCL-HEBT matching
Number of quadrupole PS for doublets	29		2 with shunts for SCL1 and SCL2 transition
Number of steerer PS	32		
Peak med beta cavity surface field	27.5	MV/ m	Uncertainty is +/- 2.5 MV/m
Peak high beta cavity surface field	35.0	MV/ m	Uncertainty is +2.5 / -7.5MV/m
Medium beta cavity geometrical beta	0.61		
High beta cavity geometrical beta	0.81		
Number of med beta cryomodules	11		
Number of high beta cryomodules	12		
Warm space between cryomodule valves	1.6	m	Between gate valves
Period length med beta	5.839	m	
Period length high beta	7.891	m	
Length of 186 MeV differential pumping section	2.35	m	CCL to SRF distance
Length for nine additional high beta cryomodules	71.019	m	
Warm beam pipe vacuum	1.E-09	Torr	

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SRF LINAC CAVITIES			
Cavity type	elliptical		
Cavity operating mode	pi		
Cavity material	Niobium		
Cavity material thickness	4 mm		3.8 mm after processing
Cavity operating temperature	2.1 K		
Number of cells per cavity	6		
Cavities per cryomodule med beta	3		
Cavities per cryomodule high beta	4		
Med beta coupling constant	1.61 %		
High beta coupling constant	1.61 %		
Qo med beta	>5E+9		
Qo high beta	>5E+9		
r/Q med beta	220-440 Ω /m		Function of beam velocity, $r/Q=Rsh/Qo$
r/Q high beta	170-570 Ω /m		Function of beam velocity, $r/Q=Rsh/Qo$
Medium Beta Cavity external Q	7.30E+05		
High Beta Cavity external Q	7.00E+05		
External Q variation	+/- 20 %		
Half band width (-3 db point), med β , high β	550, 575 Hz		$f(1/2)=f_0/(2Q_{ex})$
Cavity stiffeners	yes		
Piezo tuners	81		1 per medium and high beta cavity
Expected frequency swing due to Lorentz force with piezo compensation	< 470 Hz		
Microphonic amplitude limit	+/- 100 Hz		Six sigma
Maximum detuning range, med. Beta	2300 Hz		Most heavily loaded cavity - no piezo compensation, klystron power limit
Maximum detuning range, high Beta	1000 Hz		Most heavily loaded cavity - no piezo compensation, klystron power limit
Available Klystron power, med. Beta	408 kW		
Available Klystron power, high Beta	522 kW		
Cavity active length med beta	0.682 m		
Cavity active length high beta	0.906 m		
Total cavity length med beta	1.067 m		
Total cavity length high beta	1.291 m		
E_{peak}/E_0 med beta	1.84		
E_{peak}/E_0 high beta	1.53		
B_{peak}/E_{peak} med beta	2.10 mT//MV/m		
B_{peak}/E_{peak} high beta	2.14 mT//MV/m		
E_0 med beta	13.4 - 16.4 MV/m		
E_0 high beta	17.9 - 24.4 MV/m		
Energy gain per cavity, med. Beta	4.61 - 6.77 MeV		
Energy gain per cavity, high Beta	8.17 - 14.41 MeV		
B_{peak} med beta	52.0 - 63.5 mT		
B_{peak} high beta	58.9 - 80.3 mT		
Cavity field flattness	8 %		$(V_{max} - V_{min}) / V_{avg}$, after welding
Synchronous phase med beta	20.5 deg		
Synchronous phase high beta	19.5 deg		

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SRF LINAC CRYOMODULES			
Shield static heat load med beta cryomodule	170	W	
Shield static heat load high beta cryomodule	200	W	
2.1 K static heat load med beta cryomodule	25	W	
2.1 K static heat load high beta cryomodule	28	W	
Cavity dynamic heat load per med beta cryomodule	16	W	
Cavity dynamic heat load per high beta cryomodule	28	W	
Magnetic field at cryomodules from rebar	0.0001	T	
Cavity displacement tolerance relative to cryomodule	+/-1	mm	Maximum
Cavity tilt tolerance relative to cryomodule	+/-1	mrad	Maximum
Cryomodule transverse alignment tolerance	+/-1	mm	Maximum
SRF LINAC POWER COUPLERS			
Power couplers per cavity	1		
Number of power couplers	81		
Maximum power of coupler	550	kW	
Power coupler type	KEK-B		
Power coupler vacuum	5.E-09	Torr	
SRF LINAC HOM COUPLERS			
HOM couplers per cavity	2		
Number of HOM couplers	2 x 81		
HOM coupler type	TTF		
Qext at 805 MHz	> 3x10 ¹¹		
SRF LINAC TUNERS			
Number of tuners	81		
Tuner tuning rate	3000	Hz/sec	Minimum
Tuner tuning range	+/-100	kHz	from 805 MHz