ESS requirements fo the high-beta cryo-modules

EUROPEAN SPALLATION SOURCE

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5th SPL Collaboration meetin

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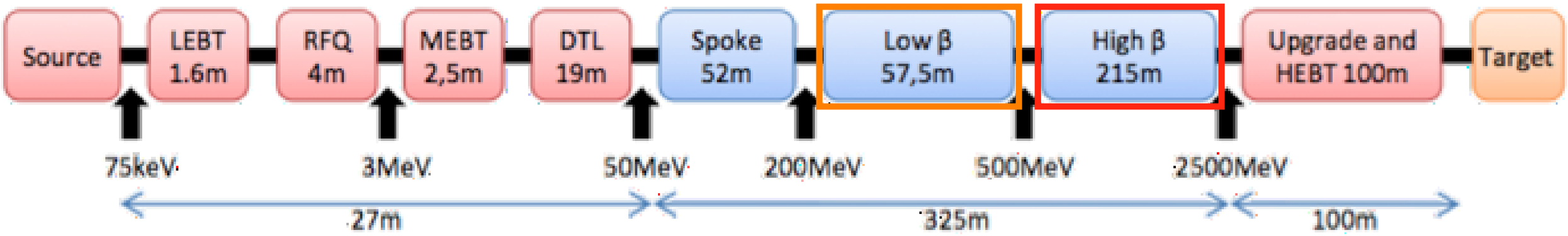
Linac layout



	Length (m)	Input Energy (MeV)	Frequency (MHz)	Geometric β	# of Sections	Temp (K)
RFQ	4	75 × 10-3	352.2	--	1	≈ 300
DTL	19	3	352.2	--	3	≈ 300
Spoke	52	50	352.2	0.45	14 (3c)	≈ 2
Low Beta	57.5	200	704.4	0.65	10 (4c)	≈ 2
High Beta	215	500	704.4	0.86	19 (8c)	≈ 2
HEBT	100	2500	--	--	--	--

ESS requirements for the high-beta cryo-modules

Cavities

beta	0.86
cells / cavity	5
frequency	704.42 MHz
gradient	18 MV/m
coupler power	1.2 MW

Cryomodules (series)

orientation	horizontal
length	?
cavities / module	6 or 8
T	2 K
magnets	warm or cold ?

Cryomodules (prototype)

orientation	horizontal ±
cavities / module	4
T	2 K

High level parameters

macro pulse current	50 mA
macro pulse length	2 ms
pulse rep rate	20 Hz
duty factor	4 %

ESS CM Milestones

dec.	2012	design update finalized
	2013	start cryomodule prototype test
late	2015	start series production of cryomodules
	2017	linac installation ready
	2018	first protons
	2019	first neutrons

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ELLIPTICAL CAVITIES, HIGH BETA (G. Devanz) 22-Nov-10

Parameter	Unit	Value	Status	Date	Validator	Comment
Output energy		2500	Active		M. Lindroos	
Length, elliptical high beta sector	m	~215	Draft		G. Devanz	
RF frequency	MHz	704.42	Active	23-Oct-10	S. Peggs	
Temperature	K	2	Active	23-Oct-10	G. Devanz	
Geometric beta		0.86	Active	23-Oct-10	R. Duperrier	Tech Note ESS/AD/xxx
Operational voltage	MV				M. Eshraqi	Maximum
Expected gradient, horizontal	MV/m	18	Active	23-Oct-10	R. Duperrier	Tech Note ESS/AD/xxx
Expected gradient, vertical test	MV/m	20	Active	23-Oct-10	R. Duperrier	Tech Note ESS/AD/xxx
Cavity Q0		2.0E+10	Draft	22-Nov-10	G. Devanz	
Fundamental mode Qext		6.8E5	Draft	22-Nov-10	G. Devanz	for Ib=50 mA
Fundamental mode R/Q	Ohm	500	Draft	22-Nov-10	G. Devanz	
Number of modules			Draft		M. Eshraqi	
Number of rf power sources			Draft		E. Rathsman	one source per cavity
Power coupler power, to beam	MW	1.2	Active	22-Nov-10	G. Devanz	Maximum
Number of cells per cavity		5	Active	23-Oct-10	R. Duperrier	
Cavity length	m	1.3	Draft	08-Nov-10	G. Devanz	flange to flange
Length of cryomodule	m				W. Hees	
Transverse acceptance						
Longitudinal acceptance						
Cavities per cryomodule		6	Active	23-Oct-10	R. Duperrier	
Quadrupoles per module					M. Eshraqi	