

Peak power density (beam lifetime 12 min)

Peak power density for HL-LHC for 12 min BLT (mW/cm ³)										
TCLD position	PROTONS					IONS				
	Cell 8/9			Cell 11		Cell 8/9			Cell 11	
	MB	MQ	11T	MB	MQ	MB	MQ	11T	MB	MQ
No TCLD	21	9.9	-	12	13	57	27	-	57	36
MBB.8	6.6	8.1	11	8.7	13	5.4	15	21	36	33
MBA.9	6.0	8.1	48	<0.3	<0.3	6.0	3.6	33	<0.003	<0.003

Ions: 1248 bunches 2.1e8 ions/bunch

Protons: 8.81e11 p/s assuming 2760b 2.3e11 p / bunch

Quench limit for MB could be ~20 mW/cm³ for steady state losses at 6.377 T (V)

If the quench limit of the 11T is found to be higher than other SC magnets, MBA.9 position would be better for ions and for cell 11 cleaning

Factor of 3 added → previous benchmarks showed a factor 3 underestimation in DS with respect to BLM measurements

Peak has been radially averaged along the coils → steady state losses (not averaged factor of 2-3 higher)

Peak power density (beam lifetime 1 h)

Peak power density for HL-LHC for 1h BLT (mW/cm ³)										
TCLD position	PROTONS					IONS				
	Cell 8/9			Cell 11		Cell 8/9			Cell 11	
	MB	MQ	11T	MB	MQ	MB	MQ	11T	MB	MQ
No TCLD	4.2	2	-	2.4	2.6	11	5.4	-	11	7.2
MBB.8	1.3	1.6	2.2	1.7	2.6	1.1	3	4.2	7.2	6.6
MBA.9	1.2	1.6	9.6	<0.06	<0.06	1.2	0.7	6.6	<0.0006	<0.0006

Ions: 1248 bunches 2.1e8 ions/bunch

Protons: 1.755e11 p/s assuming 2760b 2.3e11 p / bunch

Quench limit for MB could be
~20 mW/cm³ for steady state
limit 6.277T-14

If the quench limit of the 11T is found to be higher than other SC magnets, MBA.9 position would be better for ions and for cell 11 cleaning

Factor of 3 added → previous benchmarks showed a factor 3 underestimation in DS with respect to BLM measurements

Peak has been radially averaged along the coils → steady state losses (not averaged factor of 2-3 higher)

Heat load to the most exposed 11T cold mass

Heat load to the 11T cold mass for HL-LHC (W)				
TCLD position	PROTONS		IONS	
	<i>BLT (12 min)</i>	<i>BLT (1 h)</i>	<i>BLT (12 min)</i>	<i>BLT (1 h)</i>
MBB.8	170	35	330	65
MBA.9	300	60	630	130

Ions: 1248 bunches 2.1e8 ions/bunch

Protons: 2760b 2.3e11 p / bunch

Factor of 3 added → previous benchmarks showed a factor 3 underestimation in DS with respect to BLM measurements
Most power is deposited on the **yoke, coils and collars** of the 11T (~65% of the total)