Past and Current Scenarios for Threshold Calculation

Integration of Cryo-BLM to LHC triplets
05/12/16
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BLMs on the triplets

- Each triplet has 18 BLMs
  - 2 triplets/IP * 4 IPs = 144 monitors
- In Run1 grouped into 16 families divided in Beam 1 and Beam 2 families
- For Run2 families by position and IP into 16 families
  - IPs 1 and 5 are in the same family, IPs 2 and 8 are in the same family

BLM Families

RUN 1	
THRI_2_MQXB_LumLoss	2
THRI_3_MQXA_LumLoss	4
THRI_3_MQXB_LumLoss	4
THRI_B1.1_MQXA	8
THRI_B1.2_MQXA	16
THRI_B1.2_MQXB	23
THRI_B1.3_MQXA	7
THRI_B1.3_MQXB	6
THRI_B1.3B_MQXA	6
THRI_B2.1_MQXA	8
THRI_B2.2_MQXA	16
THRI_B2.2_MQXB	23
THRI_B2.3_MQXA	5
THRI_B2.3_MQXA_IL	3
THRI_B2.3_MQXB	6
THRI_B2.3B_MQXA	6

RUN 2	
THRI.IP15.P1_MQXA_FT	8
THRI.IP15.P2_MQXA_FT	16
THRI.IP15.P21_MQXB_FT	8
THRI.IP15.P22_MQXB_FT	8
THRI.IP15.P23_MQXB_FT	8
THRI.IP15.P3_MQXA_FT	16
THRI.IP15.P3_MQXB_FT	8
THRI.IP28.P1_MQXA_FT	8
THRI.IP28.P2_MQXA	16
THRI.IP28.P21_MQXB	8
THRI.IP28.P22_MQXB	8
THRI.IP28.P23_MQXB	8
THRI.IP28.P3_MQXA_FT	12
THRI.IP28.P3_MQXA_INJ_FT	3
THRI.IP28.P3_MQXA_RC_INJ_FT	1
THRI.IP28.P3_MQXB	8

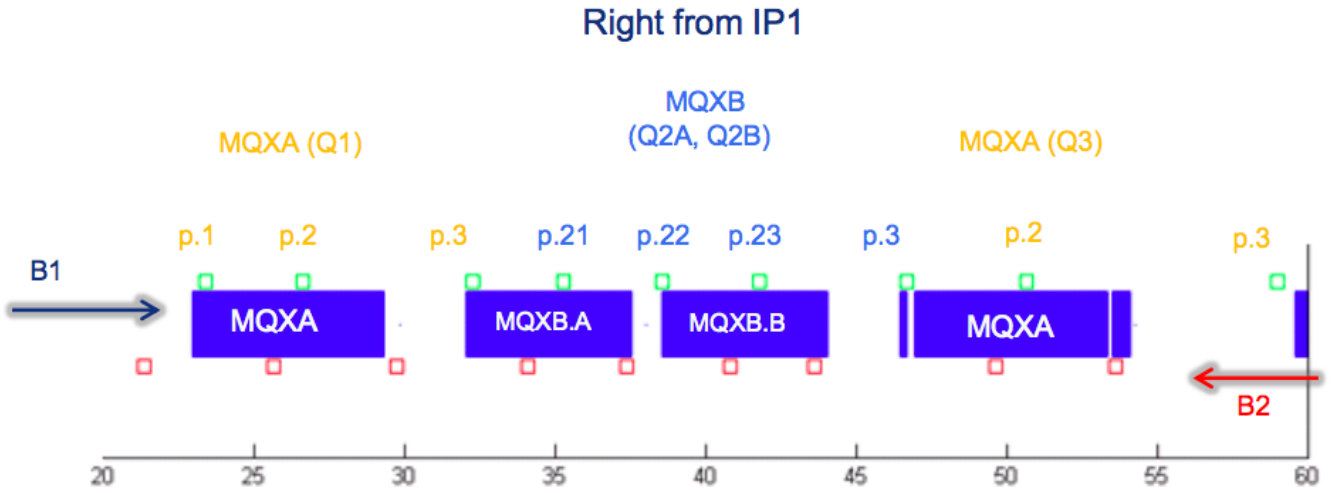
Beam Loss Scenarios

Assumption 1: Debris from pp interations in IP will not (repeatedly) quench triplet magnets.

Assumption 2: The Q2B orbit-bump scenario is selected as a scenario for quench prevention.

In absence of well-studied scenarios s Q1 and Q3 get thresholds of the MQ-dynamic-orbit-bump scenario (with MQXA/B quench levels).

Q1 scenario should be revised for a loss-scenario on TCTs.



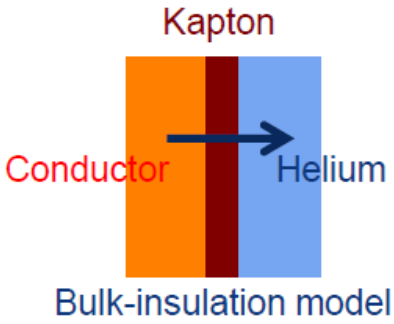
Quench Level

- Quench level calculated using QP3 – bulk insulation model at 1.9K
- Model is now in good agreement with published data (which remains valid until we have a quench/quench test!).

Magnet	MQPD	Luminosity 1E+34 [cm^{-2}·s^{-1}]		Luminosity 1.75E+34 [cm^{-2}·s^{-1}]	
		DPD	ratio DPD/MQPD	DPD	ratio DPD/MQPD
	[mW/cm3]	[mW/cm3]	-	[mW/cm3]	-
MQXB	13.05	4.43	0.34	7.75	0.59
MQXA	33.18	3.40	0.10	5.95	0.18

MQPD – minimum quench power density
DPD – debris power density

Luminosity:
1e34 – nominal for IP1 and IP5
1.75e34 - from Laurent Tavian at Evian 2012 -
limitation from the consolidation of the heat exchanger following the "triplet incident" during initial commissioning



Bulk-insulation model

L. Chiesa et al. "Thermal Studies of a High Gradient Quadrupole Magnet Cooled with Pressurized, Stagnant Superfluid," *IEEE Trans. on Applied Superconductivity*, Vol. 11, Issue 1 , March 2001, p.1625.

- Luminosity debris can not quench the magnets at 6.5 TeV
- Different loss scenario needed for the BLMs

Q2B loss scenario – BLM signal at quench

- One should assure that BLMs are not in the warning level (30% of the threshold)
- Ratio between the Warning level/Debris(10^{34}) should be greater than 1

$$\text{Applied Threshold} = 0.5 \cdot \text{BLMSignal@Quench}$$
$$\text{Warning level} = 0.3 \cdot \text{Applied Threshold}$$
$$\frac{\text{Warning level}}{\text{Debris}(1034)} > 1$$