MD340 - Collimation Quench Test for Protons at 6.5 TeV

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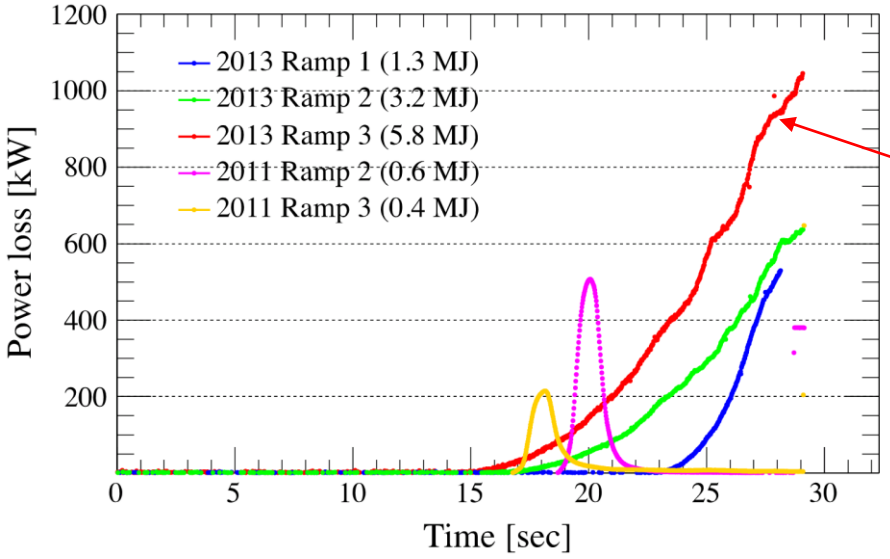
Introduction and Motivations

- DS downstream of IR7:
  - Affected by leakage from betatron collimation system (single diffractive events);
  - Limiting location for collimation losses (near Q8);
  - Relevance for maximum intensity reach for RunII, RunIII and HL-LHC;
- Working principle of MD:

  Induce large betatron losses at TCPs (by means of ADT excitation) and monitor the behavior of SC magnets in DS;
- Procedure identical to that of 2013, but with 6.5 TeV beam energy, implying smaller margin to quench;

Introduction and Motivations



Beam Energy [TeV]	Quench Level (QP3) [mW/cm³] Steady State	Ramp	Endep [mW/cm³]
4	66.5	115-140	25-70 (Fluka)
6.5	43	74-90	25-140 (aim)

Naïve scaling of quench level (B. Auchmann)

This year: let's try to flatten losses, 1MW over 5-10s;

Year of Test	Beam Energy [TeV]	settings	cleaning (h) []	Loss at TCP (P_{TCP}) [kW]	Loss at DS (h x P_{TCP}) [W]	Factor wrt 2013
2011	3.5	operational	6.60E-04	215	142	0.14
				510	337	0.34
2013	4	relaxed	9.50E-04	530	504	0.50
				640	608	0.61
		mm-kept settings		1050 "Reference"	998	1
2015	6.5	operational	4.00E-04	~~2494~~ Forbidden	~~998~~	~~1~~
	Confirmed by simulations!		x2.5	1000	400	0.4
		relaxed	1.00E-03	1000	1000	1

Procedure

- Same as that of 2013, but at 6.5 TeV (instead of 4 TeV);
  - Three ramps to 6.5 TeV:
    1. ADT set up (+full set of qualification LMs of relaxed settings), with 3 nominal bunches (SBF, <3E11 p);
    2. Quench attempt with operational collimation settings and 500-1000 kW, with 144+72 bunches (final numbers depend on previous fill);
    3. Quench attempt with relaxed collimation settings and 500-1000 kW, with 144+72 bunches (depending on previous fill);
  - Optics: flat top (no squeeze, no collapsing of separation bumps at IPs);
- Preparation:
  - ADT: required a bit of time to recall the settings used in 2013 (gain and gating) and testing them;
  - BLMs: present thresholds must be raised to allow for larger beam losses:
    - Operational collimation settings: scaling of qualification LMs (after TS2) to estimate new thresholds:
      - analysis on RS09 (LMs) done; → same AT applied to long RSs;
      - Short RSs still to decide what to do exactly;
    - Relaxed collimation settings: need for qualification LMs → squeezed in beforehand? In the same MD? (e.g. after ADT set-up)
  - Online monitor of losses (kW);

Additional Slides

Documentation

- MPP procedure *being finalized*;
- MD3-2011 DS Quench Test#2 – MPP procedure;
- MD4-2011: Quench Margin at 3.5 TeV – MPP procedure;
- Quench Test 2013: Quench Margin at 4TeV:
  - MPP procedure;
  - MD note: “Collimation Quench Test with 4 TeV Proton Beams”;
  - PRSTAB article: “Testing Beam-Induced Quench Levels of LHC Superconducting Magnets”;