Karlsruher Institut für Technologie

Beam loss system at CMS

Definition of BCML thresholds

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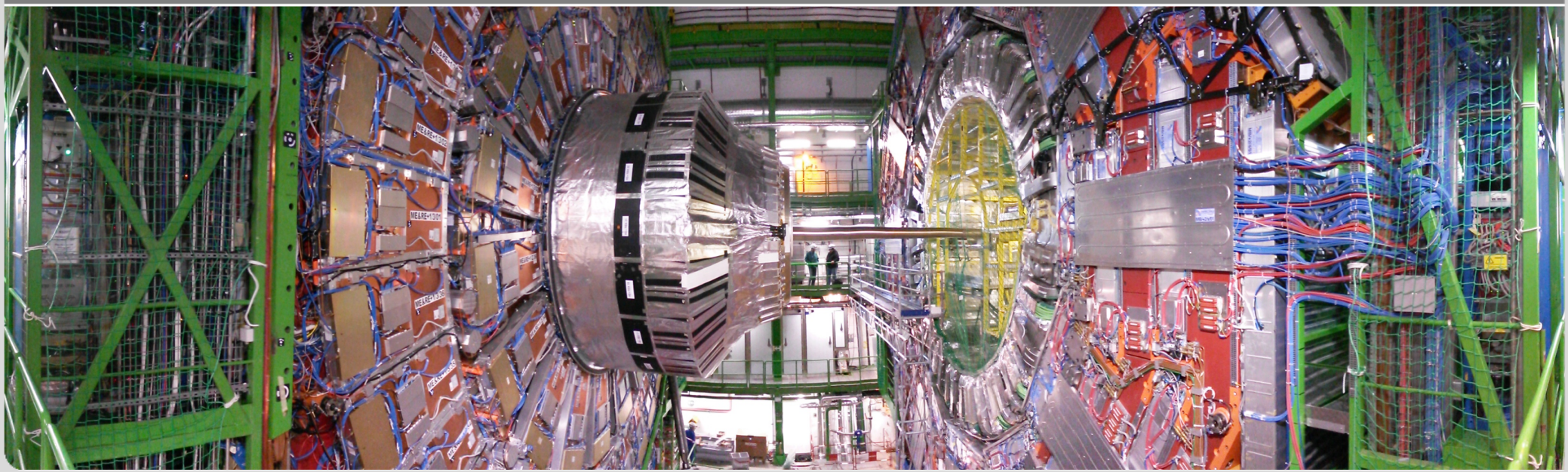
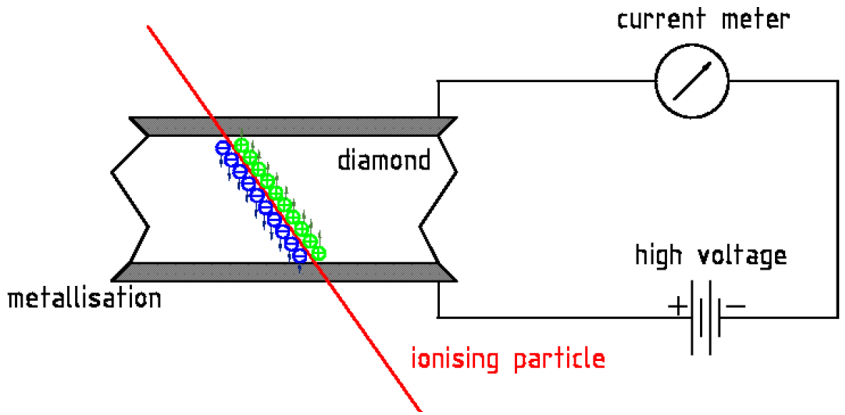
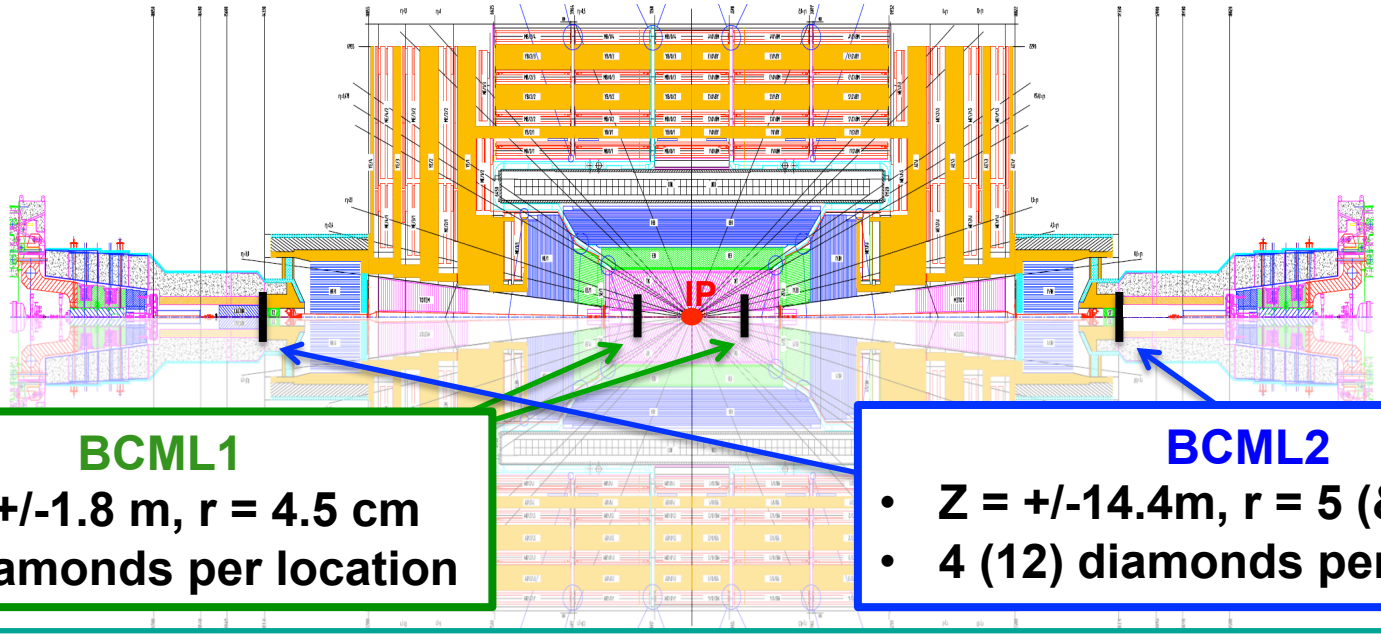


Beam loss system at CMS
BCML (Beam condition monitor leakage)

- Based on pCVD diamond sensors
- In total 16 active beam abort channels
- Working principle similar to BLM tubes, signal readout identical



Positions of diamond detectors at CMS



BCML1
- **Z = +/-1.8 m, r = 4.5 cm**
- **4 diamonds per location**

BCML2
- **Z = +/-14.4m, r = 5 (& 28) cm**
- **4 (12) diamonds per location**

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Florian Kassel

Definition of BCML thresholds at CMS

Running sum I: 40µs

- Based on tracker community's damage tolerance: 10^9 MIP/cm²
- Adding of a safety margin of 1000: 10^6 MIP/cm²
  10^6 MIP/cm²/40µs ~ 30µA (6150 ADC) for undamaged pCVD
- Even more conservative threshold set to **10µA (2050ADC)**

Running sum IV: 640µs

- New introduced in 2016 in for BCML1 because of reduced sensitivity in RS1.
- Definition equal to RS1 definition:
  10^6 MIP/cm²/640µs ~ 1.88µA (6150 ADC) for undamaged pCVD

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Definition of BCML thresholds at CMS

Running sum XII: 83s

- Thresholds is based on a data driven extrapolation
- Set to 3 x the expected signal (EDMS numbers: 1157274v3, 1236236v1)

The CMS BCML threshold definition for 2016 can be found in the EDMS document 1611082v1.

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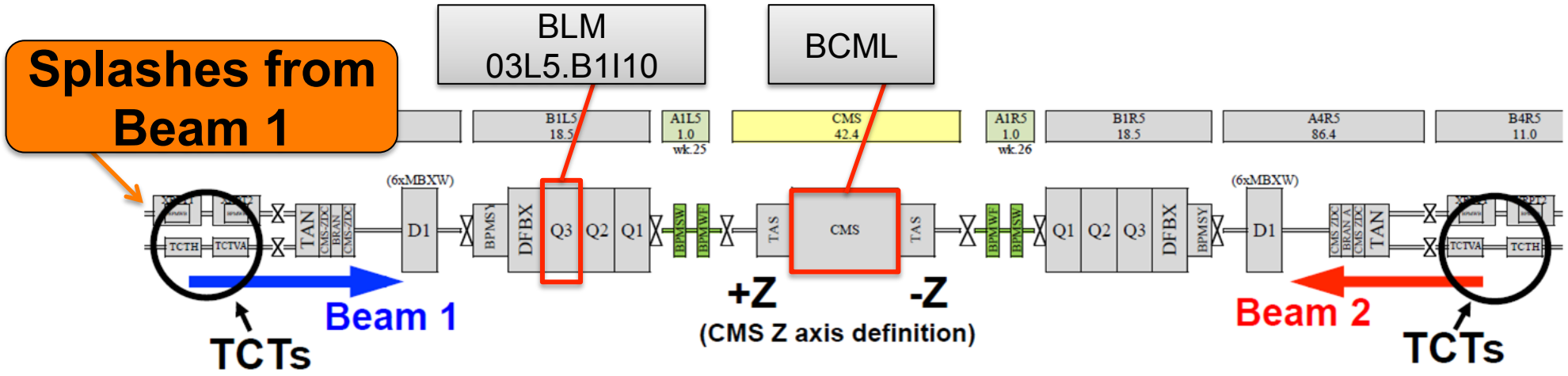
Splash events on 29th of march 2016

- Comparison between BLM tube (03L5.B1I10) and BCML detectors during splash events.
- Splash events created by Beam1 hitting the collimators upstream of CMS.
- Splash events with highest intensity caused a trigger of the beam abort by some of the BCML detectors.



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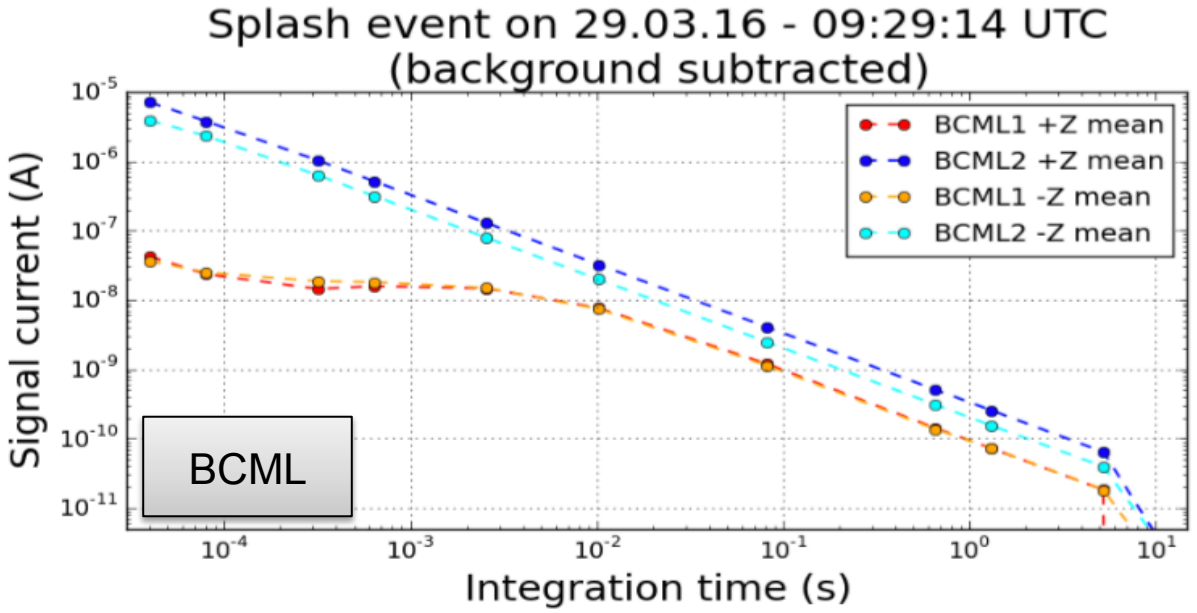
Splash events on 29th of march 2016

BCML2:

- RS1 +Z: up to 2200 ADC
  107% of beam abort
- RS1 –Z: up to 1090 ADC
  53% of beam abort
- (RS4: up to 2480 ADC)

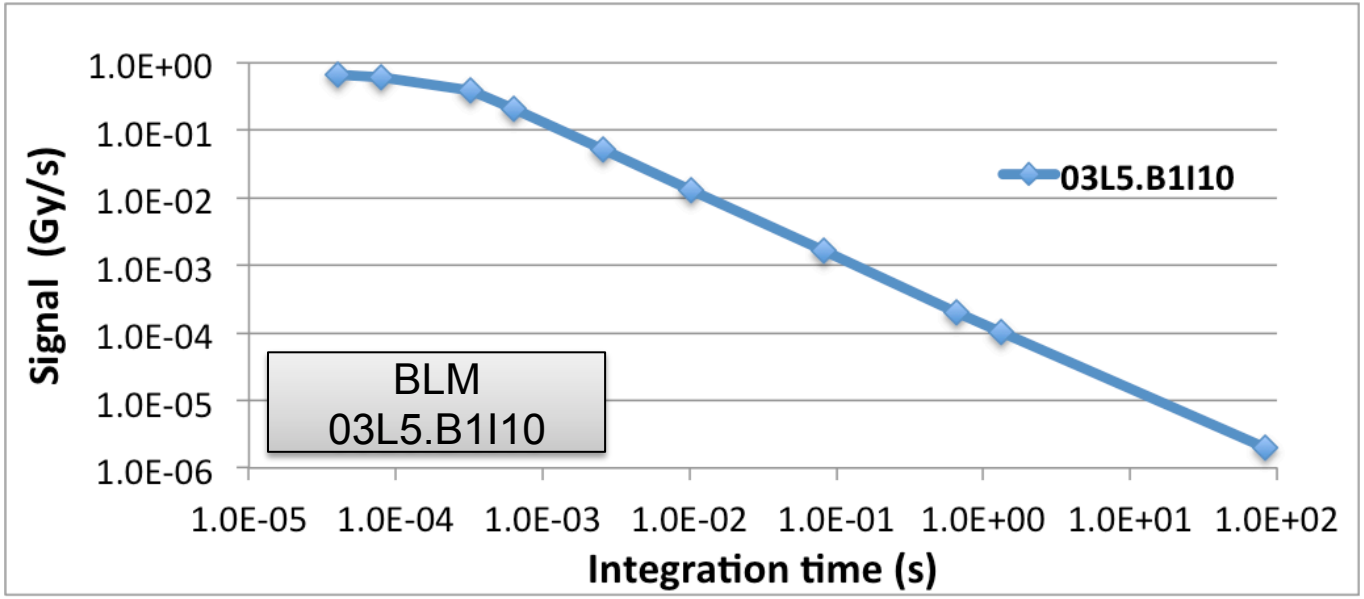
BCML1:

- RS4: up to 115 ADC
  3% of beam abort



BLM:

- RS1:
  20% of beam abort
- RS3:
  32% of beam abort
- RS4:
  31% of beam abort



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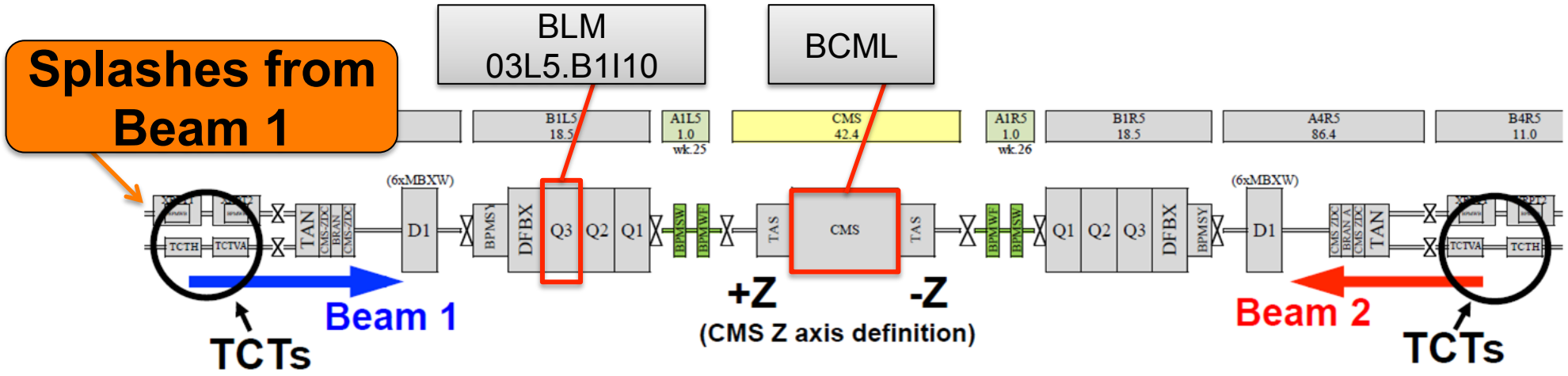
Conclusion

BCML abort threshold definition:

- RS1 and RS4 are based on the maximum damage tolerance of the CMS tracker.
- RS12 is 3 x the expected signal for nominal luminosity

Comparison of signals during splash events:

- BCML2 - RS1: **107% (+Z)** and 53% (-Z) of beam abort
- BLM: 20% (RS1) and **32% (RS3)** of beam abort



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BLM: % of beam abort for RSs

BLM aborts percentage	
RS	% of beam abort
1	20
2	20
3	**32**
4	31
5	22
6	14
7	10
8	7
9	5
12	0.1

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