

# R2E-MD PRELIMINARY REPORT

## – 3<sup>RD</sup>/4<sup>TH</sup> JULY 2011

### 19<sup>TH</sup> JULY LSWG MEETING



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# Main motivations for the R2E-MD

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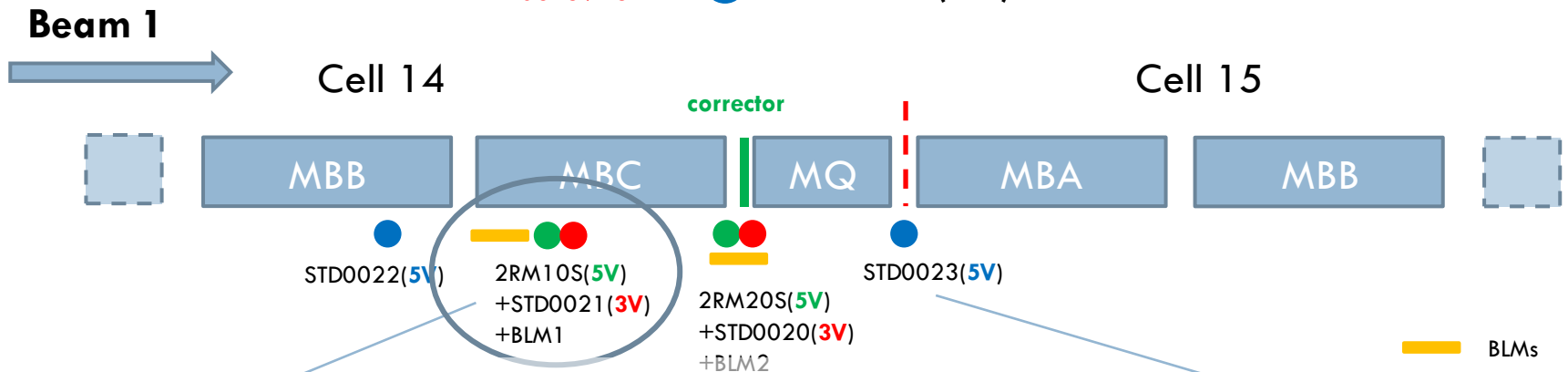
- Evaluation of the **R factor**  $\Phi_{th}/\Phi_{HEH}$  in tunnel locations → important parameter for the prediction of R2E-related radiation levels and **check radiation level gradient**
- **RadMon/BLM ratio**:
  - To be used in the LHC:
  - Also interested in the gradient between BLM location and below dipole equipments, expecting 3x if at the same longitudinal location
- Wanted also to verify (get a better idea) of the **ISO150 failure cross-section** (QPS equipment)

# Detector configurations for the test

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- FIP RadMon (5V)
- BatMon (3V)
- BatMon (5V)

2RM20S: 3925m  
2RM10S: 3913m



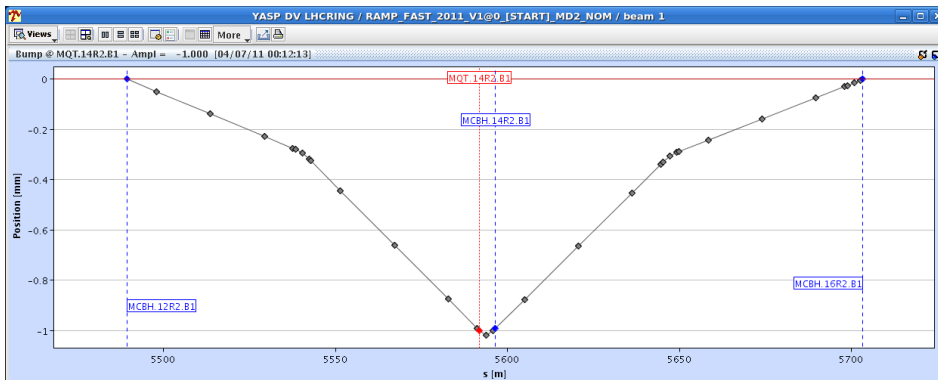
Location of the QPS equipment



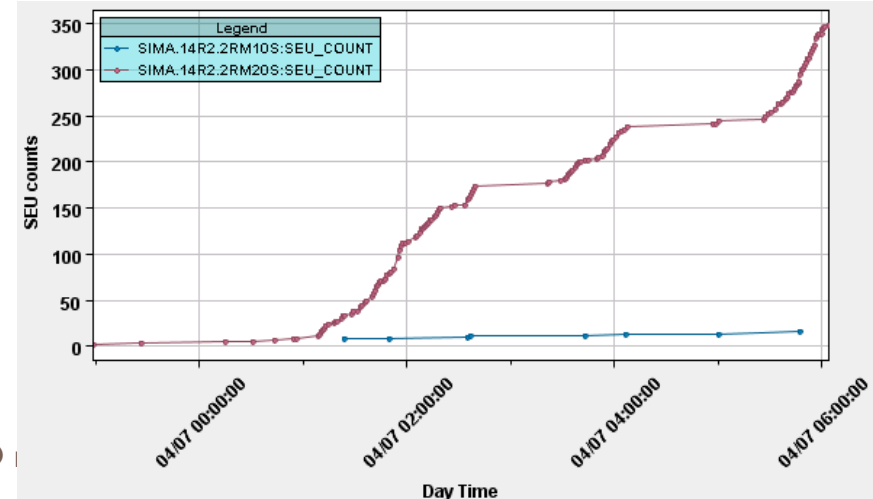
# Main settings during the test ([link](#))

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- 1<sup>st</sup> bump realized at +24mm (instead of -24mm) on MQT.14R2.B1,  $7.4 \cdot 10^9$  p/bunch → **lost sector 23!** ... but fast recovery, PM from old QPS of C14R2: voltage went up to 200 mV!
- Bump from -22mm to **-24mm** (up to  **$7 \cdot 10^9$  p/bunch**) → up to 10 counts/injection ( $\sim 10^7$  HEH/cm<sup>2</sup> below the interconnection)
- Bump was left +24mm (up to  $6 \cdot 10^9$  p/bunch) for  $\sim 10$  minutes in the night (no trip was observed)
- **Injection and dump sequence every  $\sim 45$  s** (SPS SC) ( $\sim$ longer than expected)



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# R factor evaluation/gradient!

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- A good knowledge of R ( $\Phi_{th}/\Phi_{HEH}$ ) reduces significantly the uncertainties for the tunnel radiation level estimates
- Its measure with RadMons requires **two devices operated at two different voltages** (in the same location):
  - 3V, high sensitivity to thermal neutrons
  - 5V, less sensitivity to th. neutrons with respect to high energy hadrons
- Test location have been:
  - Below the MB/MQ interconnect
  - Below the MBC towards MBB

$$r = \frac{S^{5V} \sigma_{HE}^{3V} - S^{3V} \sigma_{HE}^{5V}}{S^{3V} \sigma_{th}^{5V} - S^{5V} \sigma_{th}^{3V}}$$

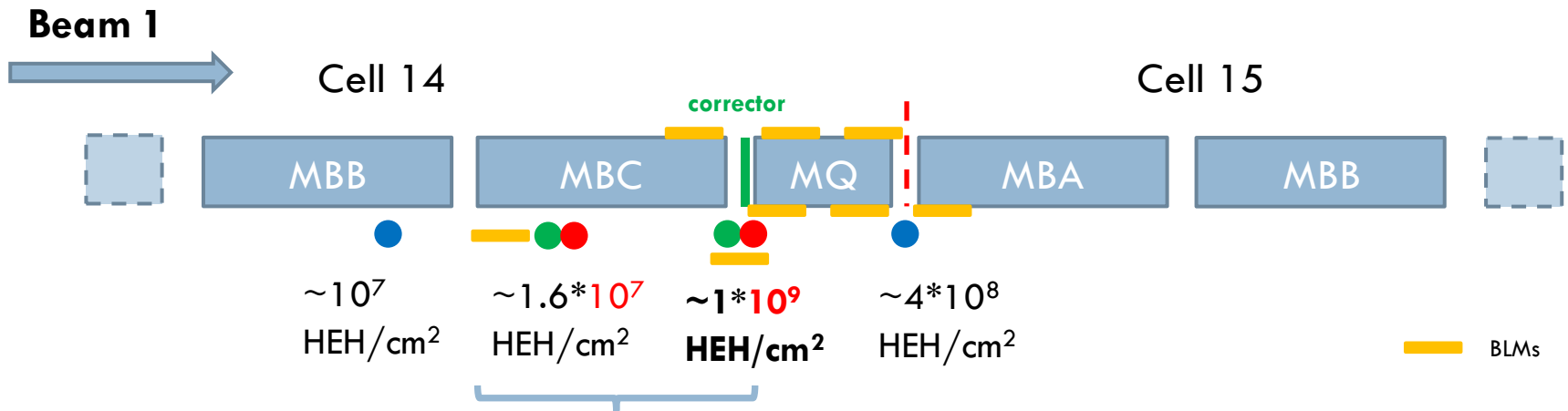
Below MB/MQ interconnect: **R=1.4 ( $\pm 40\%$ )**

Below MBC: **R~10 (x2 uncertainty)**

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# Radiation levels integrated over the course of the MD test

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Almost 2 order of magnitude reduction of fluence in ~11 meters!

- 9 PM QPS events observed (1<sup>st</sup> at 23h25 corresponding to the +24mm trip)!
- Radiation levels similar to those where QPS started to fail before firmware updates... → **further analysis by TE/MPE to get the failure cross-section ( $\sim 10^{-8}$  cm<sup>2</sup> from LHC events)**

# BLM/RadMon ratio

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- RadMon/BLM ratio → in the LHC experimentally found to be **~1 count (@5V)/mGy ( $\pm 50\%$ )**
    - RadMons located below the MB/MQ interconnect, compared with the closest BLM at beam height
  - A similar comparison has been performed during the MD, taking advantage of the configuration where a BLMMI is installed close to the RadMon below the interconnect
    - 345 counts (2RM20S)/110 mGy (BLMMI.14R2.B1120) → **~3.1 counts/mGy**
    - 345 counts (2RM20S)/325 mGy (BLMQI.14R2.B1110) → **~1.1 count/mGy**
- 1) BLM data confirms the factor of 3x of dose/HEH reduction extracted with FLUKA between beam axis and tunnel floor
  - 2) Confirmation of the 1 count/mGy extracted from LHC

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# BLM/RadMon dose comparison

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BLM values	Total dose (bckg subtracted)	RadFETs dose (RadMon)
BLMMI.14R2.B1I10	~1.8 mGy	
BLMMI.14R2.B1I20	<b>110 mGy</b>	~90 mGy (in Si)
BLMQI.14R2.B1I10	~ <b>325 mGy</b>	
BLMQI.14R2.B1I20	~155 mGy	
BLMQI.14R2.B1I30	~ <b>70 mGy</b>	~20 mGy (in Si) + ~3x lower than at beam axis (~60 mGy)
BLMQI.14R2.B2E10	~25 mGy	
BLMQI.14R2.B2E20	~72 mGy	
BLMQI.14R2.B2E30	~65 mGy	

## Notes:

- 1) dose in Si is not the same as the dose measured in BLMs (nitrogen) → 30%
- 2) RadFETs sensitivity at the lower edge (~10 mGy), big uncertainties to be expected



# Main outcomes of the R2E-MD

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Preliminary analysis conclusions:

- Evaluation of the **HEH gradient**
- Evaluation of the **R factor** ( $\Phi_{th}/\Phi_{HEH}$ )
- Calculation of the **BLM/RadMon ratio** for “close” locations (w/ mobile BLMs) and “far” locations (w/ fixed BLM on the MQ, similar to the LHC)
- Comparison between the **RadMon dose** and **BLM dose**
- **QPS sensitivity**: we observed several “QPS resets”, transparent to operation, analysis requested to TE/MPE → analysis ongoing
- Evaluation of the **BLM left/right asymmetry** and comments on the +24 and -24 mm asymmetry at MBs → analysis ongoing – BE/BI