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# FLUKA estimates of R2E levels for HL-LHC in IR7 DS

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on behalf of the FLUKA team

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# Motivation and background

## FLUKA simulations of IR7 in a HL-LHC scenario

First preliminary estimate of the dose and High Energy Hadron fluences below the cryostats and comparison to R2E limits in that zone

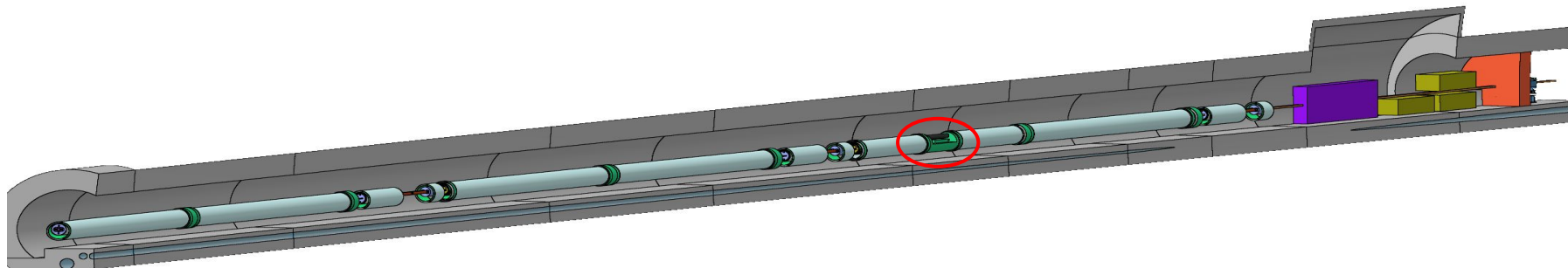
200 Gy over all HL-LHC period (M. Brugger)

Evaluate, from an R2E point of view:

- ★ Potential need to relocate existing electronic racks of QPS and Cryogenics
- ★ Viability of the new equipment installation

# Considerations of this study

- ★ 7 TeV, relaxed collimator settings, 1 DS collimator (current baseline for HL-LHC)

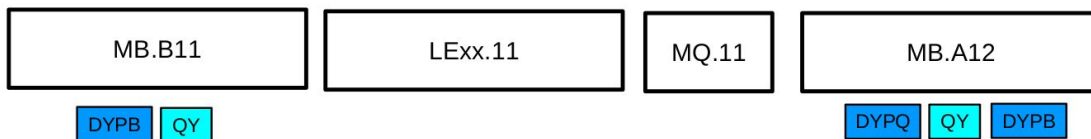



- ★ All results normalized to  $1 \times 10^{18}$  protons lost in the collimation system for the whole HL-LHC period
  - Very conservative assumption since losses in HL-LHC will depend mainly on the hours of stable beams and on beam intensity

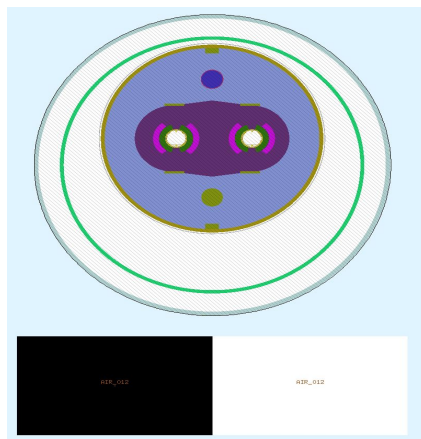
*More accurate normalization based on circulating beam intensities is under investigation*

# R2E: electronic racks location

With input from M. Brugger



 = QPS  = Cryo



**Equipment installed mostly underneath MBs**

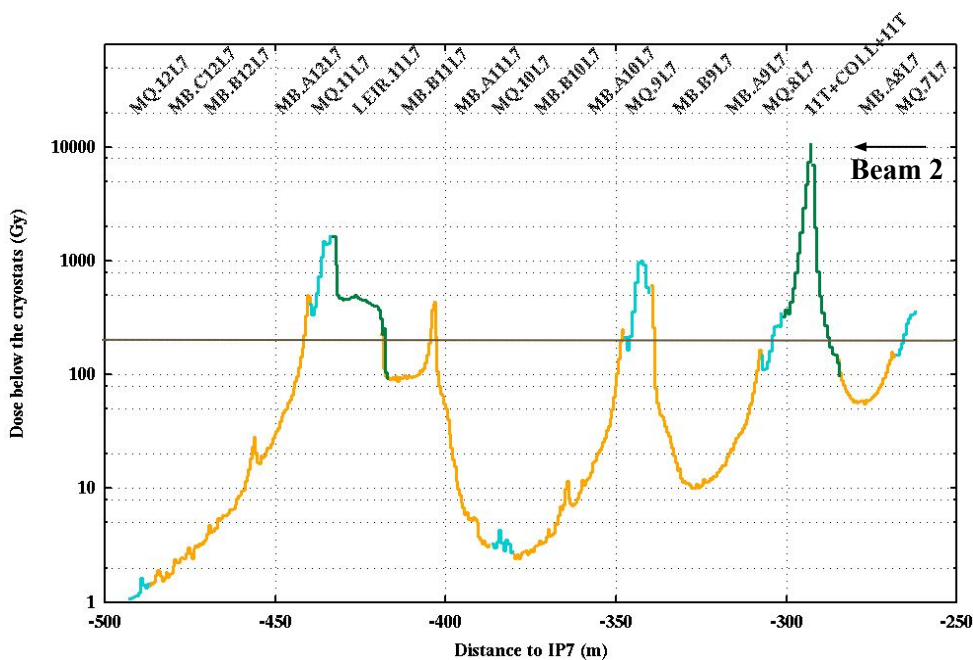
**Lifetime determined by dose levels**

**High Energy Hadron fluence is less relevant since most of the electronics should be SEE proof in this area**

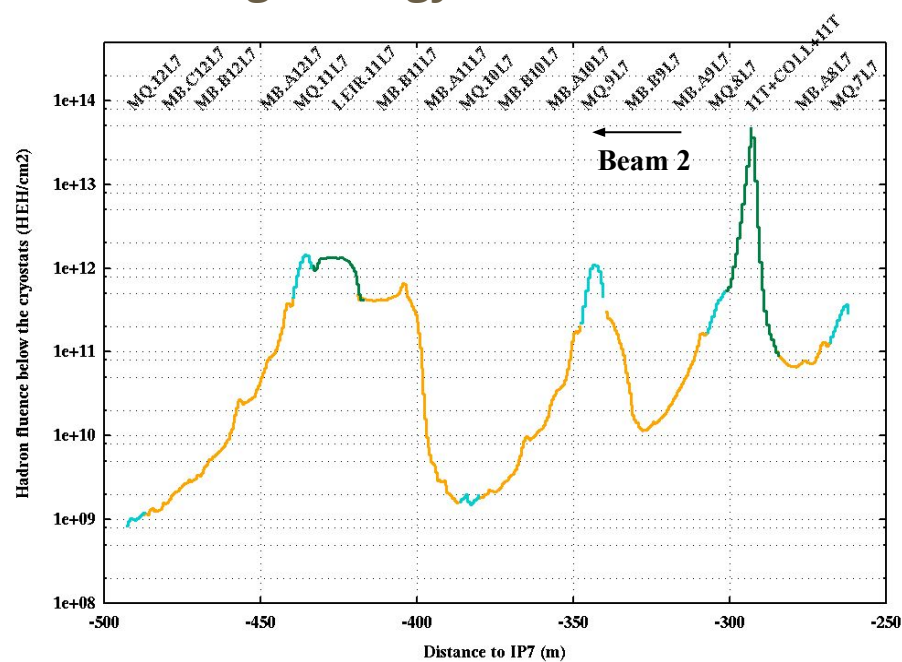
A. Lechner, "BFPP losses in the connection cryostat: power deposition and dose estimates for Run 2 (and some outlook to HL-LHC)", LMC, 02/09/15.

# Dose and HEH fluence below cryostats in IR7

## Dose

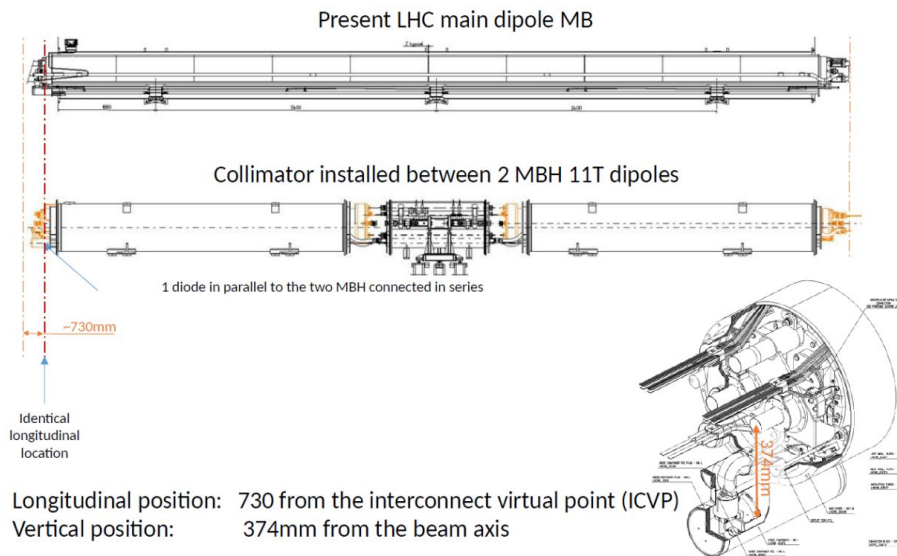


## High Energy Hadron fluence

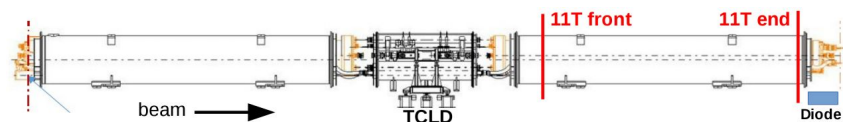


# Exposure of cold diode in 11T magnets

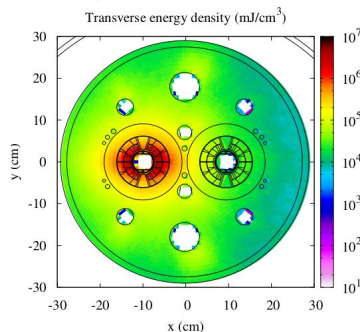
Diode position (F. Rodriguez Mateos, H. Prin)



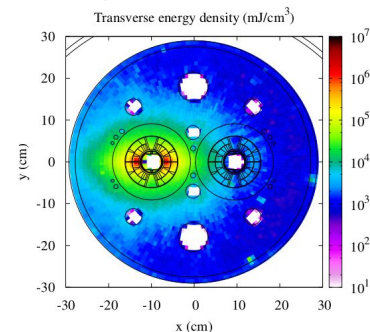
- On both sides of the IP, the diode is located on the left side of the collimator
- Hence, in the DS left of the IP the diode is **downstream of the collimator**



11T magnet front:



11T magnet end:



A. Lechner, "Update of dose estimates at the level of the cold diode for the 11T magnets", HL-LHC TCC, 30/06/16.

**Dose to the diode: 2-3 KGy**  
**Fluence to the diode:  $\sim 5 \times 10^{12}$  neutrons of 1 MeV/cm<sup>2</sup>**  
**to induce a certain damage in silicon**

