Simulations dedicated/to be dedicated to the experiments

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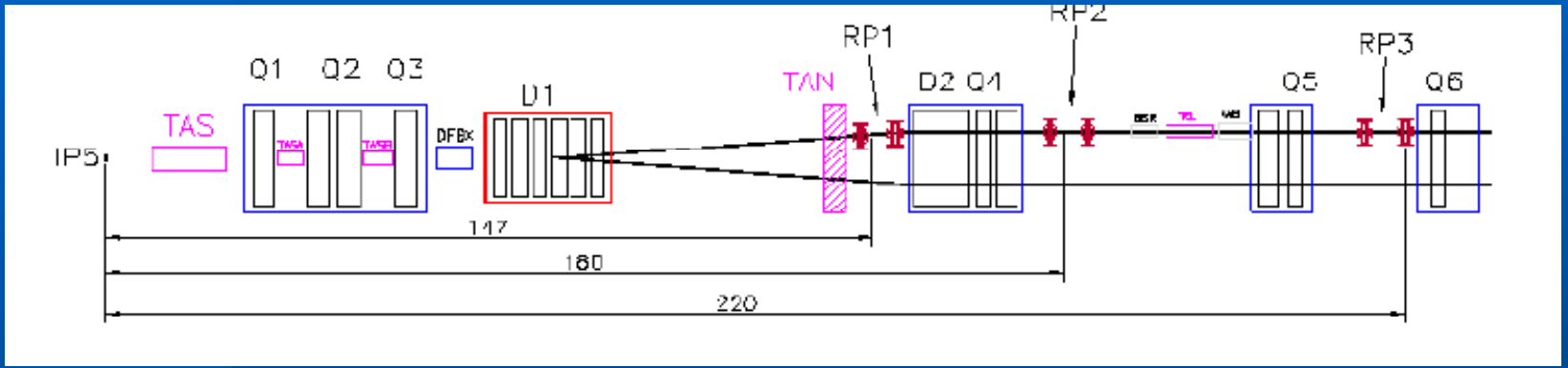
Work done explicitly for the experiments protection

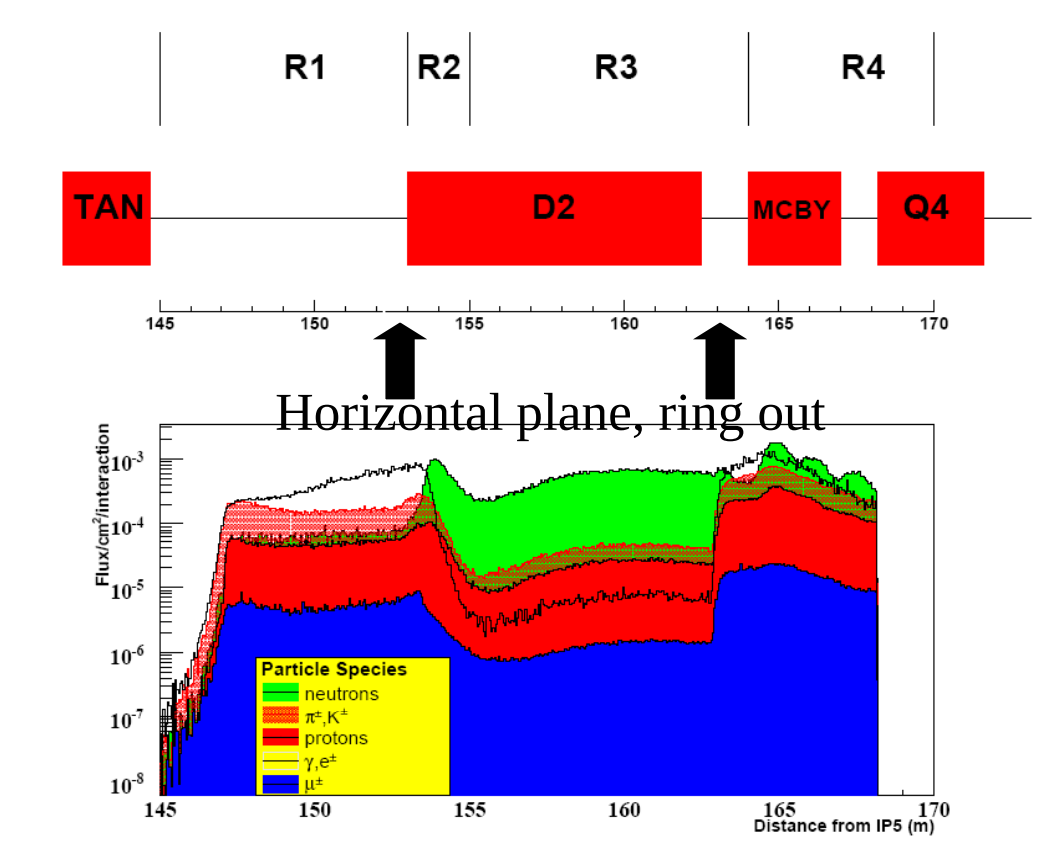
- Setting errors studies started by Oliver Brüning a few years ago (in particular IR8). No written documentation.
- **“Accidental beam losses during injection in the interaction region IR1”, D. Bocian, LHC Project Note 335**
- **“LHC experiments beam interlocking”, D. Macina, W. Smith, J. Wenninger, June 8, 2006, EDMS 653932**
- **“Energy deposition in the window of the TOTEM Roman Pot for the nominal TOTEM run”, E. Dimovasili, D. Macina, TS-Note-2005-051**
- **“Recommended locations of beam loss monitors for the TOTEM Roman Pots”, R. Hall-Wilton, D. Macina, V. Talanov , LHC Project Note 386**
- **“Recommended locations of beam loss monitors for the TOTEM Roman Pots”, R. Hall-Wilton, D. Macina, V. Talanov , LHC Project Note 386**

Recommended locations of BLM for the TOTEM Roman Pots (1)



- **MARS simulation: 7 TeV p hitting the RP and transported (E_{cut} = 100 MeV) through the standalone cryostat downstream**
- **Particles scored outside cryostat**

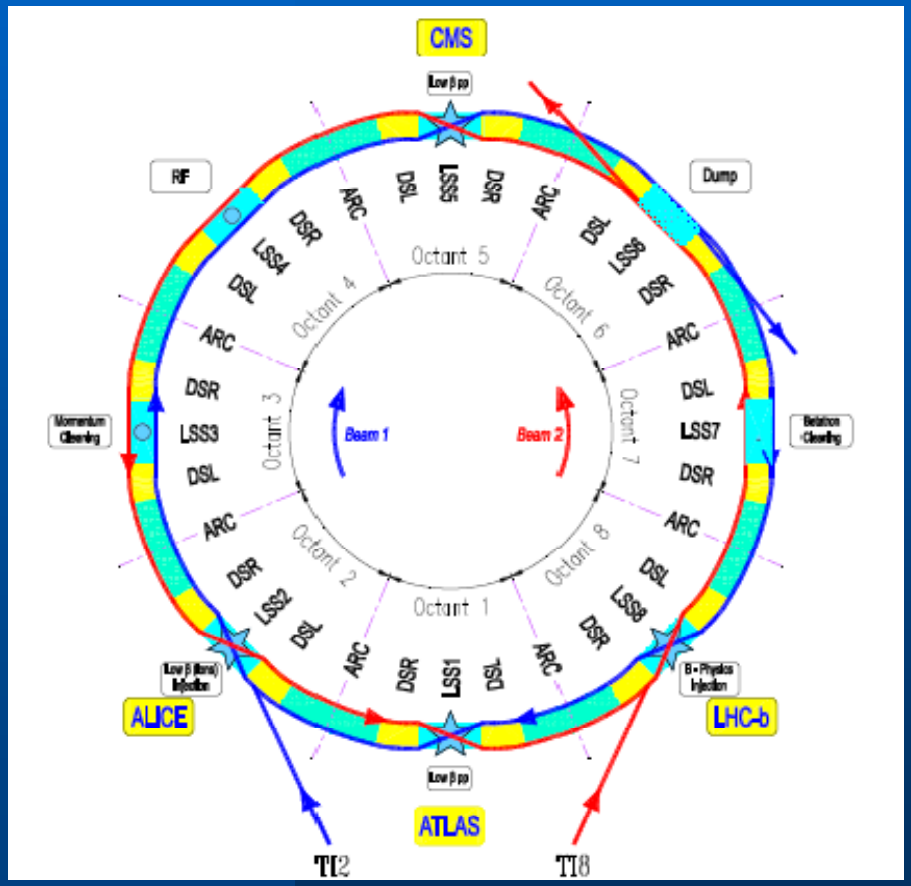
Recommended locations of BLM for the TOTEM Roman Pots (2)



Recommended locations of BLM for the TOTEM Roman Pots (3)

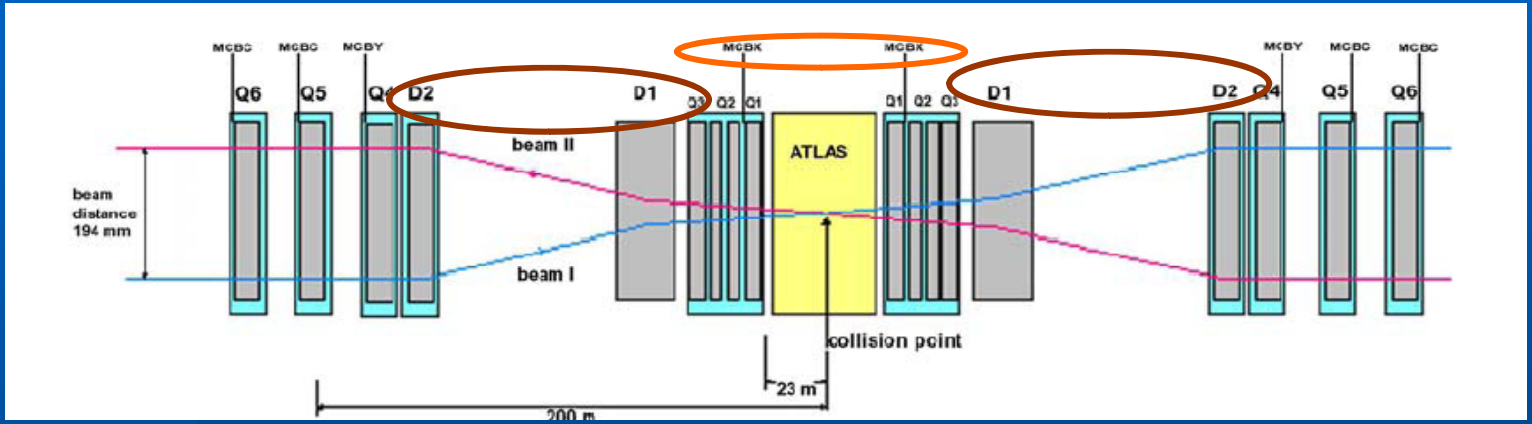
- **Results are available for both TOTEM-ATLAS RP**
- **Recommended locations successfully integrated in the LHC layout (L. Ponce)**
- **Estimation of the “accident signal” over the background (pp interactions) available soon**
- **BLM Commissioning: to be discussed between the machine and the experiments**

Accidental beam losses during injection due to settings errors



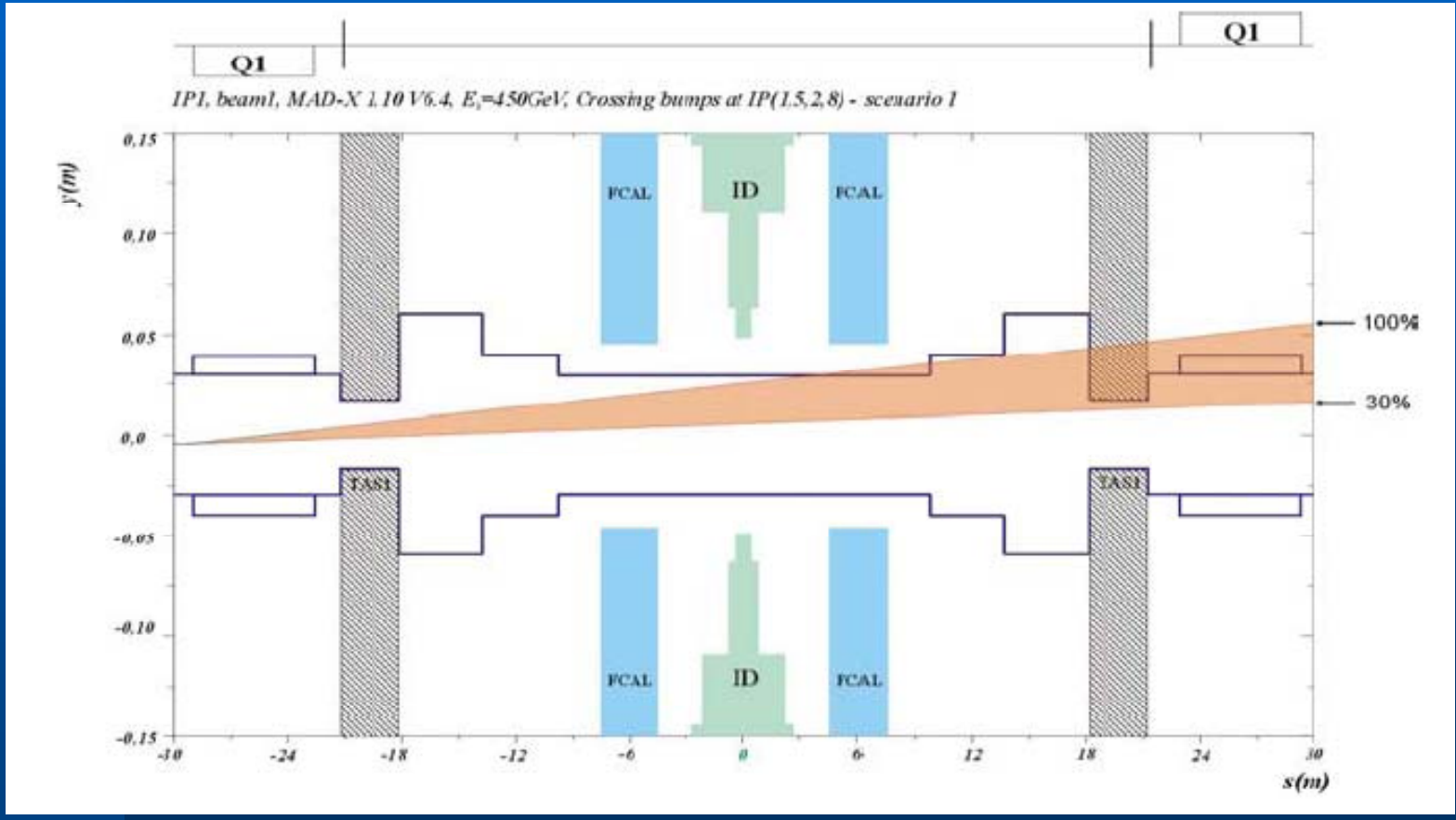
- **Injection accidents in IR1 and IR5 only possible due to errors in the settings of the magnets in the LSS1 and LSS5**
- **Injection accidents in IR2 and IR8 possible BOTH due to errors in the settings of the magnets in the LSS2 and LSS8 AND to failure of the injection system (see V. Kain's talk)**

Accidental beam losses during injection in the interaction region IR1

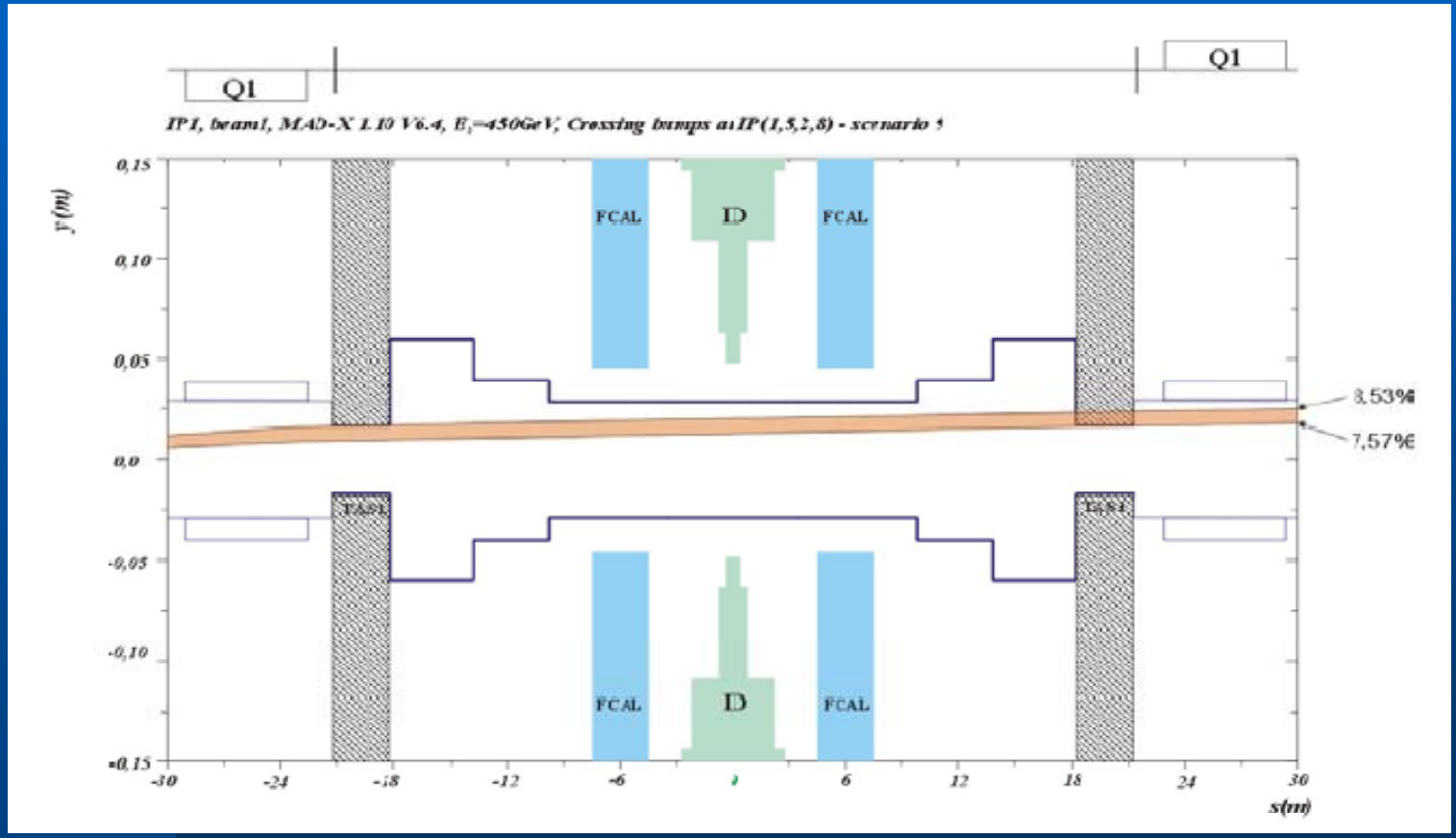


- **Injection accidents in IR1 (IR5) due to errors in the settings of the magnets in the LSS1 (LSS5)**
- **450 GeV p and injection in empty machine**
- **Potentially dangerous magnets (large bending strength): D1, D2 and MCBX (orbit corrector for both crossing angle and parallel separation)**

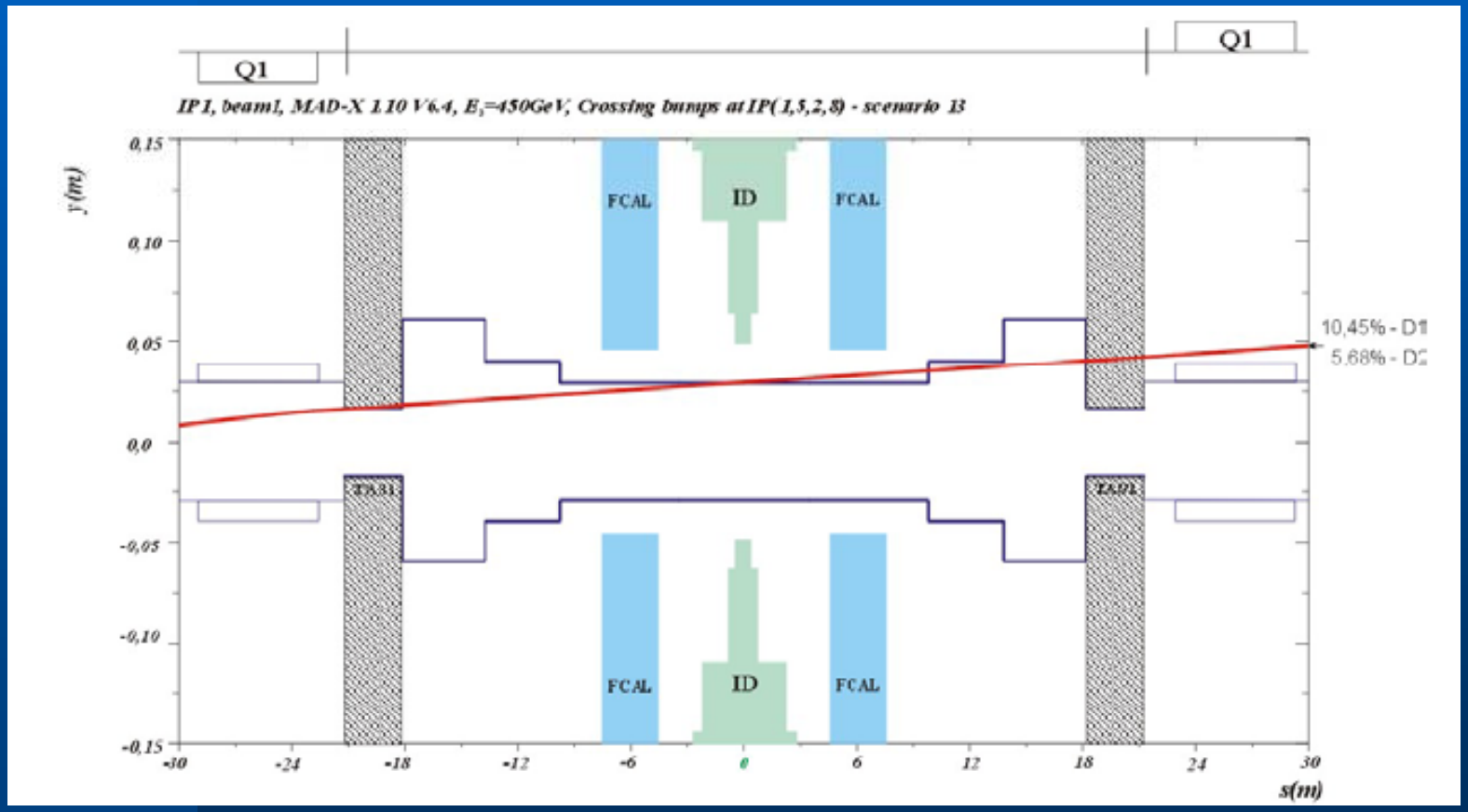
MCBXH wrong settings (30-100%) nominal at injection is 5%



D1 wrong settings (7.57-8.53%) nominal at injection 5.97 %



Combination of wrong settings: D1=10.45% (nominal 5.97%) & D2=5.68% (nominal 4.32%)



Conclusions

- **Setting errors can drive the beam directly in the experimental area**
- **Detailed simulation (optics 6.4) for IR1. Similar situation in IR5**
- **Optics is different in IR2 and IR8 but conclusions are the same**

Questions

- Do we need detailed simulations for the remaining IRs or the conclusion based on the analysis in IR1 is sufficient?
- Can setting errors drive the beam in the TAN detectors?
- What is the maximum beam/bunch intensity that can be injected in an empty machine?
- Could we interlock the current values of the most dangerous magnets in the LSS to avoid setting errors?