




Review of radiation levels in RR77 and RR73

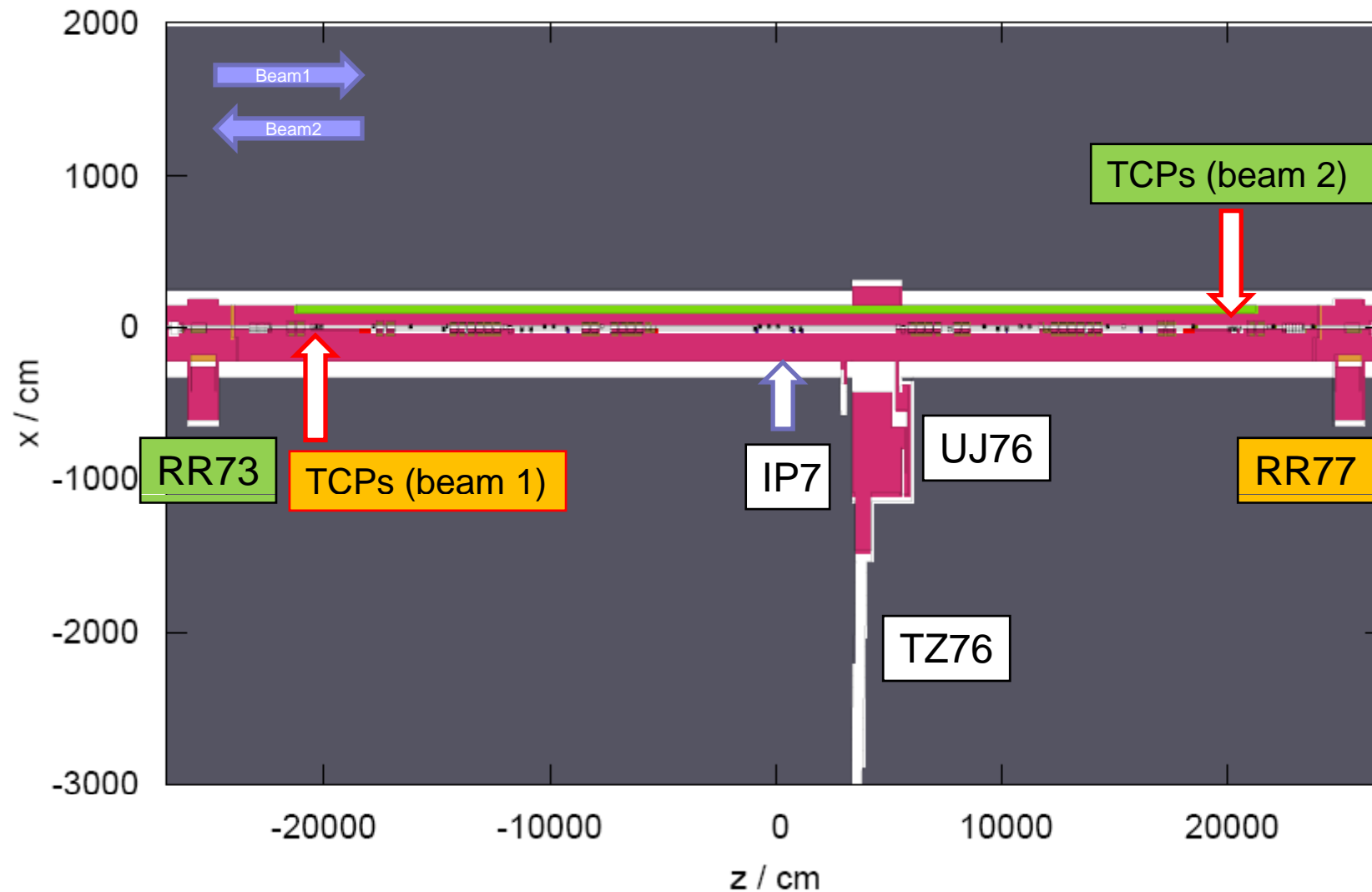
The FLUKA team



RR Shielding Options - FLUKA Calculations

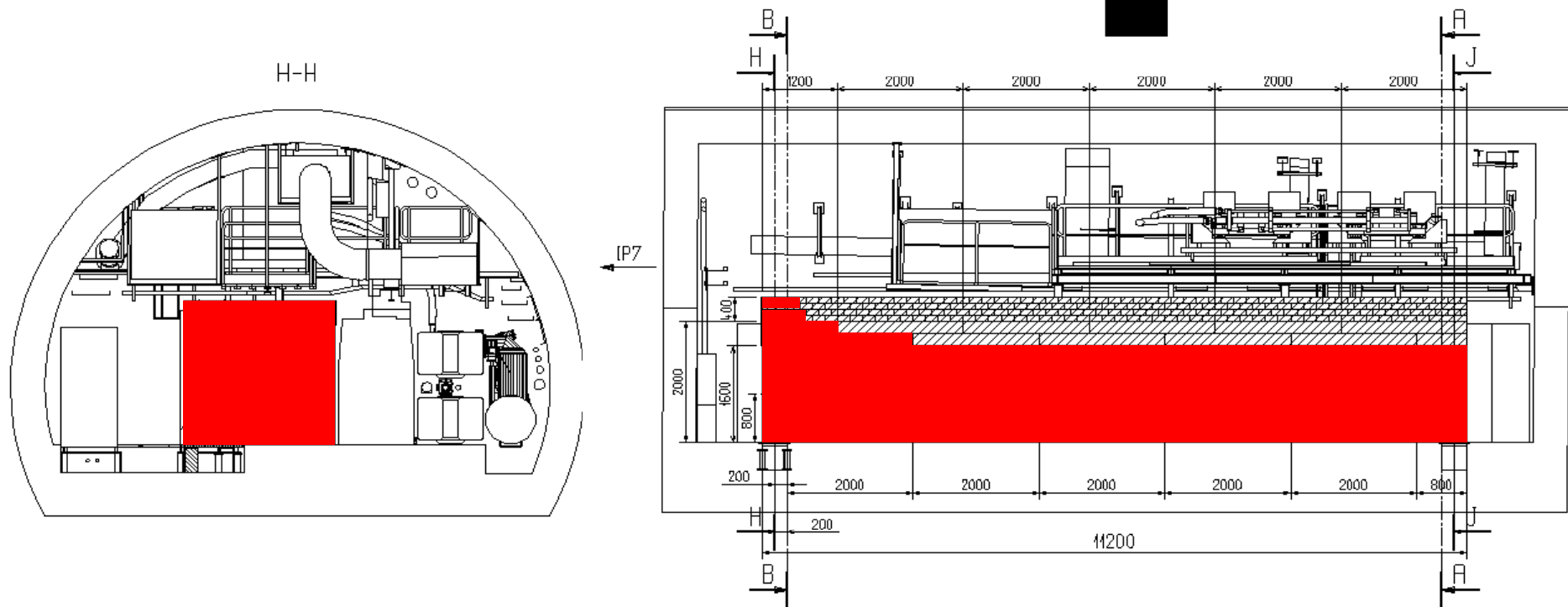
- FLUKA simulations performed based on the **RR shielding installation options** suggested by S. Weisz
- Impacts & Options to be studied – **High-Energy Hadron Fluence ONLY**
 - **Past situation**
 - **Efficiency of different shielding parts**
 - **Best solution**
 - **Other possible constraints**
- Applied loss scenario
 - Beam 1 only, 7 TeV, nominal losses
 - Mixed case horizontal, vertical, skew – 1/3 each
- Loss assumptions as used for normalization of the following results
 - Annual loss: **1.15×10^{16} protons per year (nominal)**

Fluka geometry:IR7



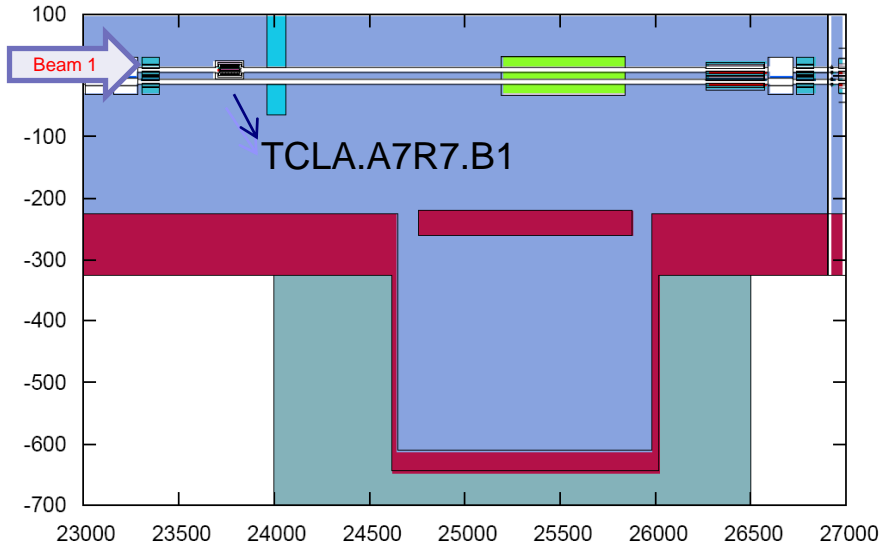
Just as a Reminder

S. Weisz, 4th R2E Meeting, 20.06.2008,

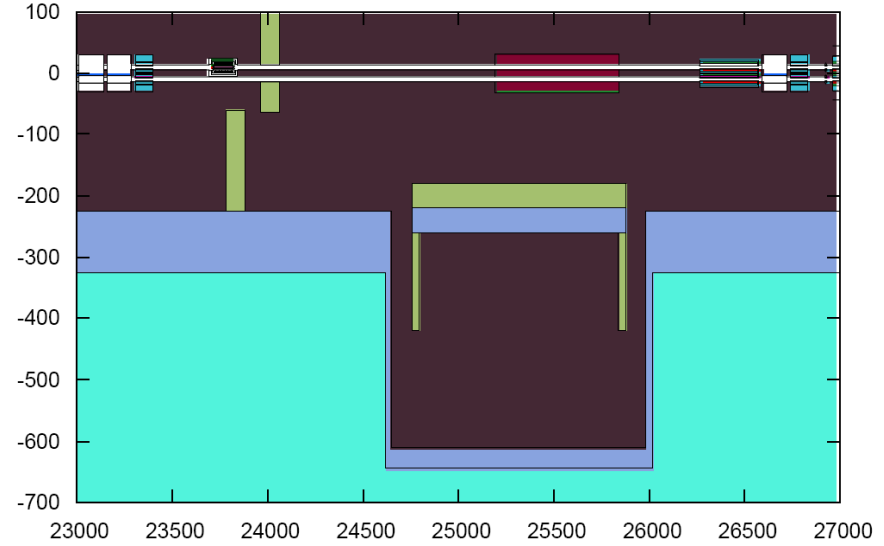


Different Geometry Options

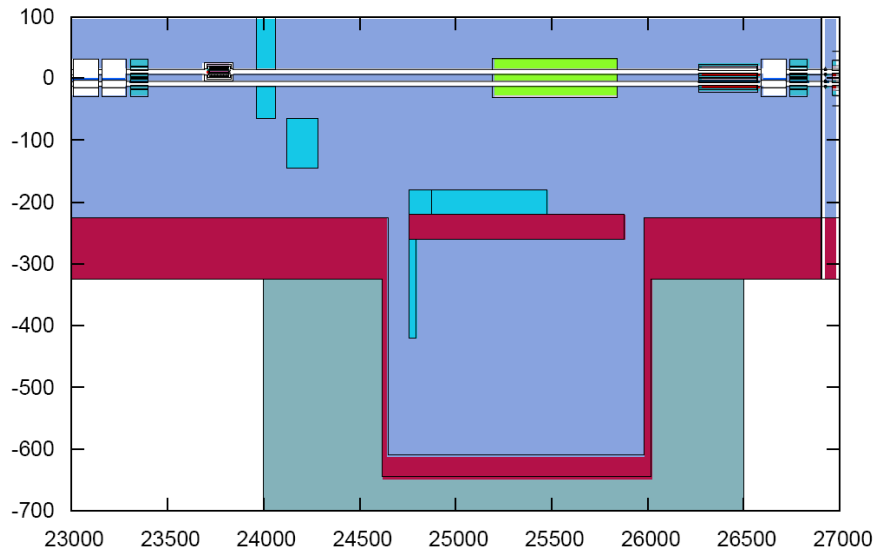
RR77 geom As Currently Installed



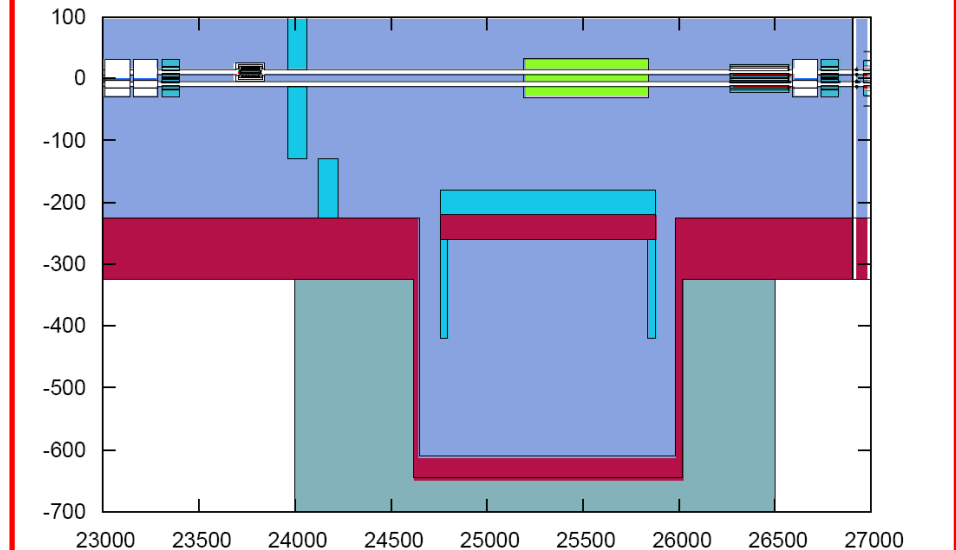
RR77 geom Full Shielding (Wrong Layout)



RR77 geom - Possible Temporary Solution

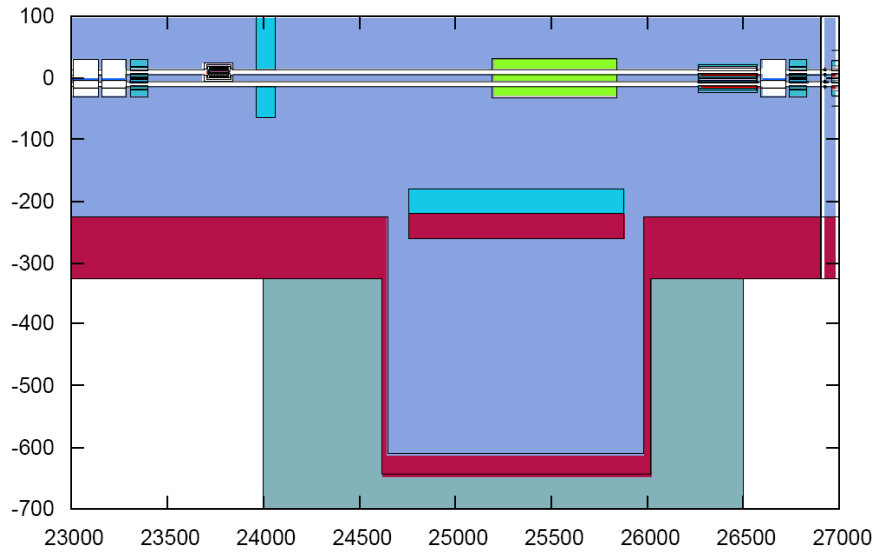


RR77 geom Full Shielding (Original Design)

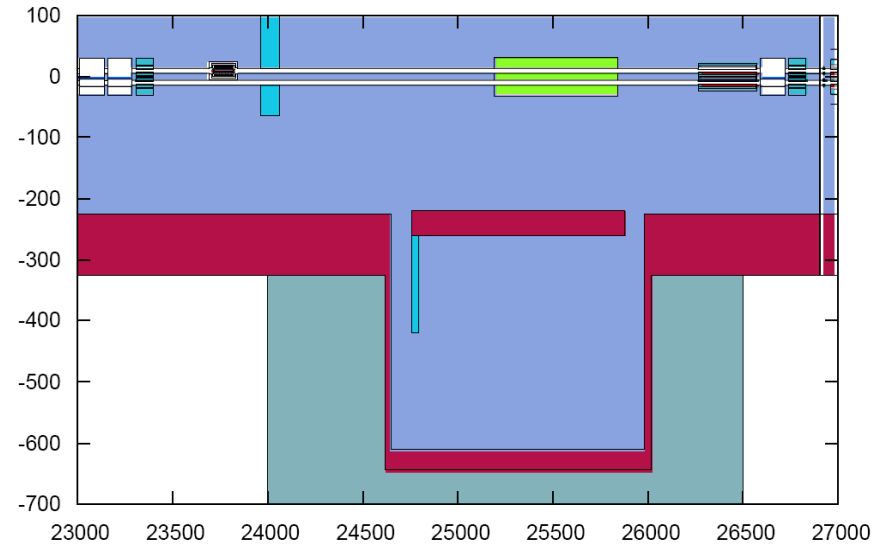


Different Geometry Options

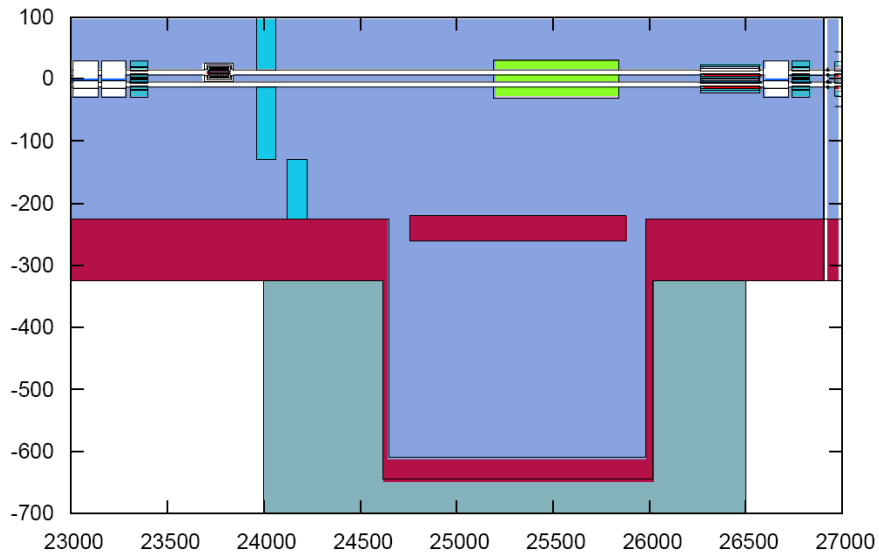
RR77 geom - Only Long Side Shield



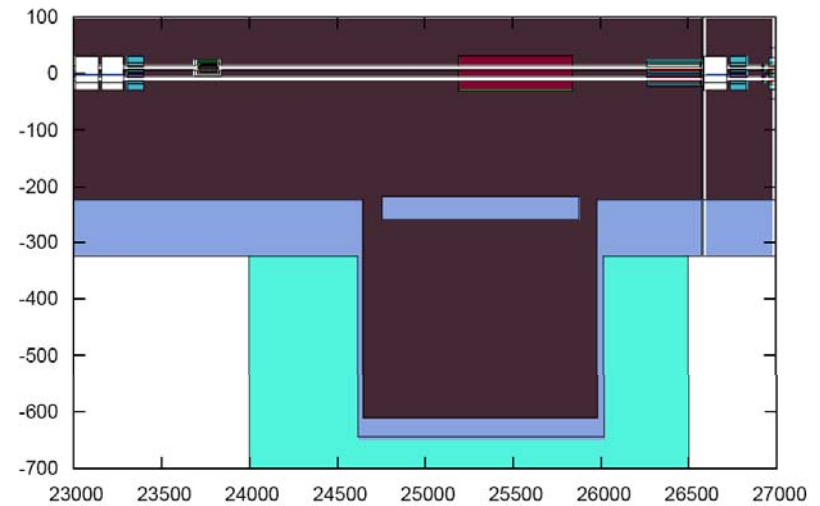
RR77 geom - Only 90Deg Shielding



RR77 geom - Only Maze

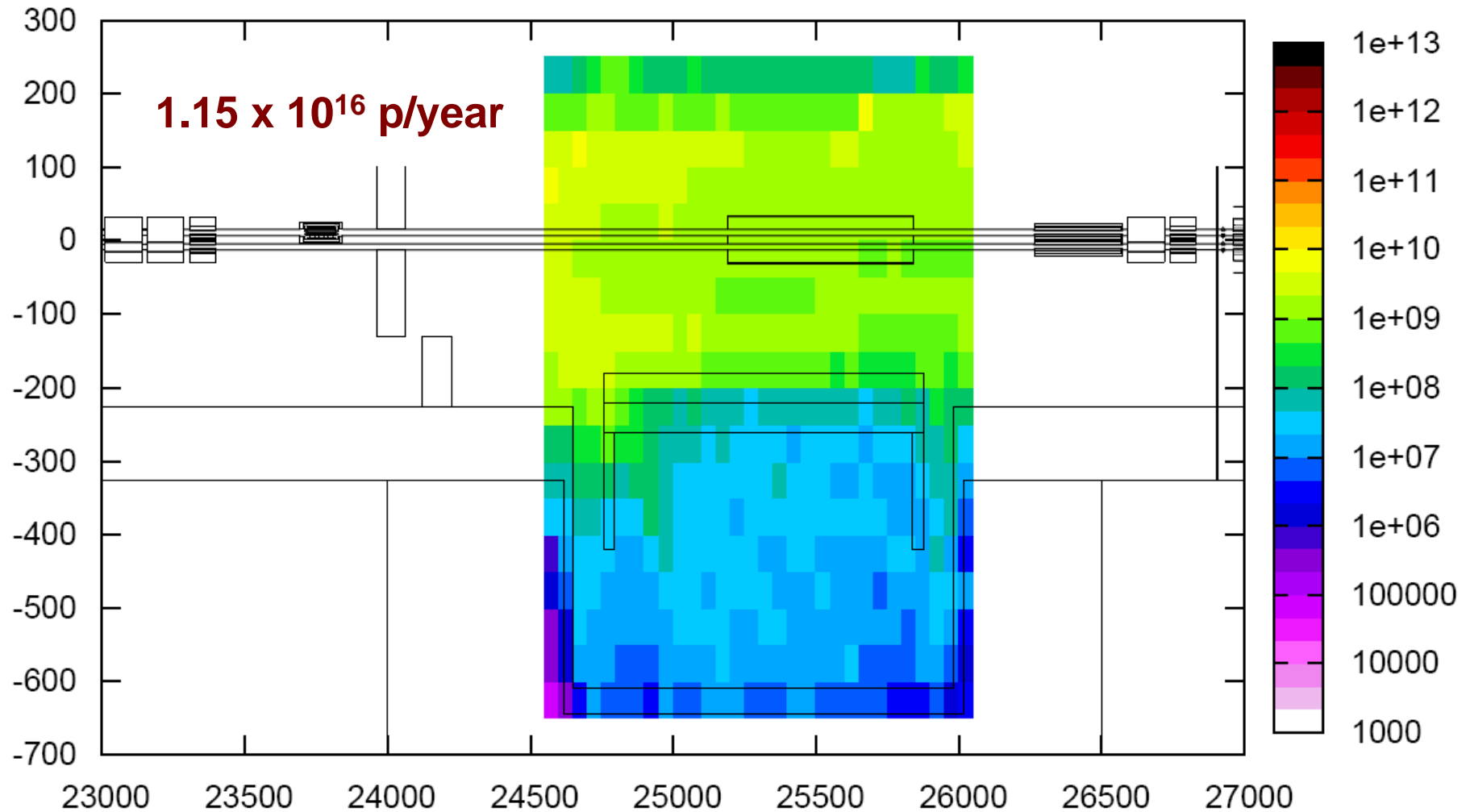


RR77 geom Without Shielding

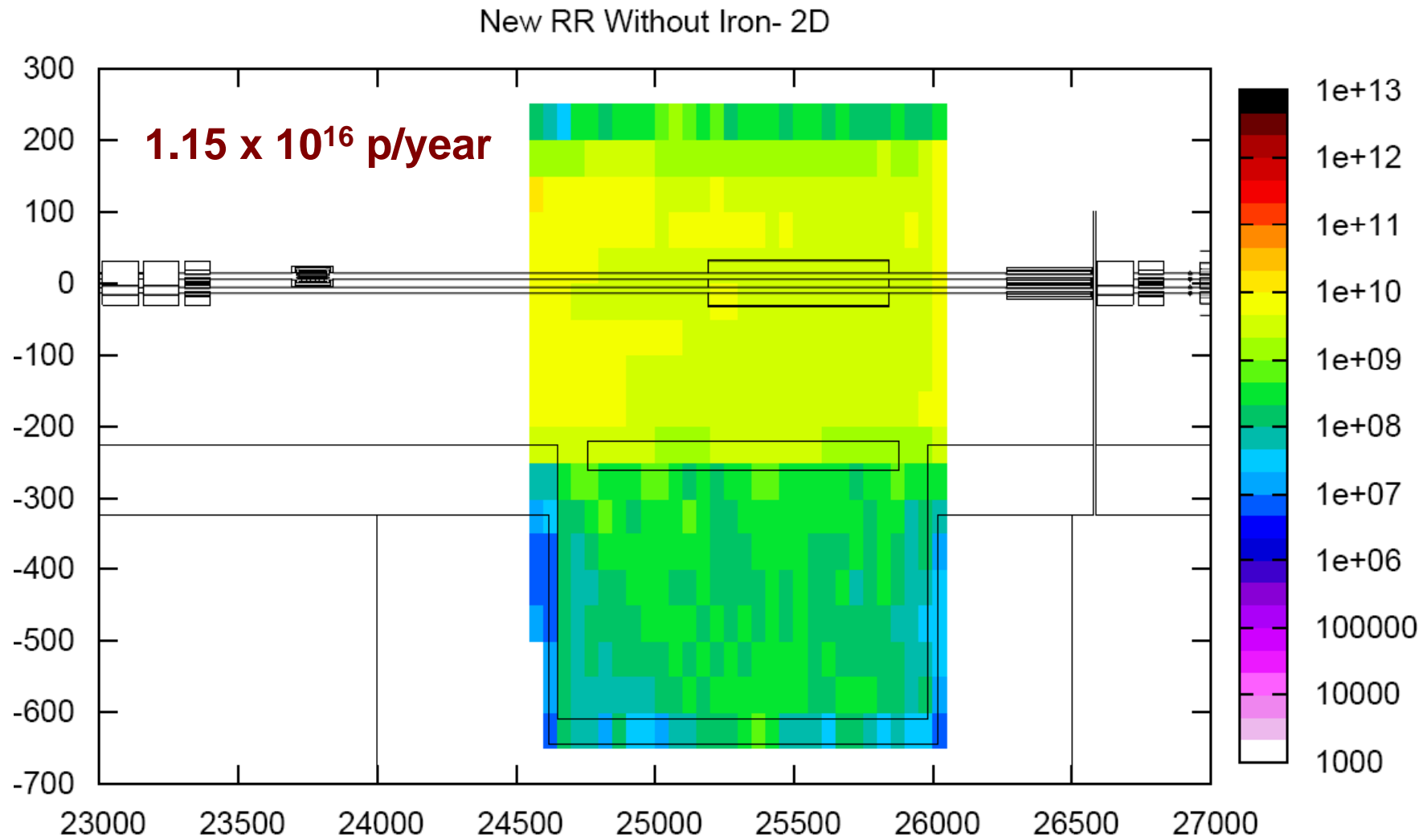


The Perfect Case

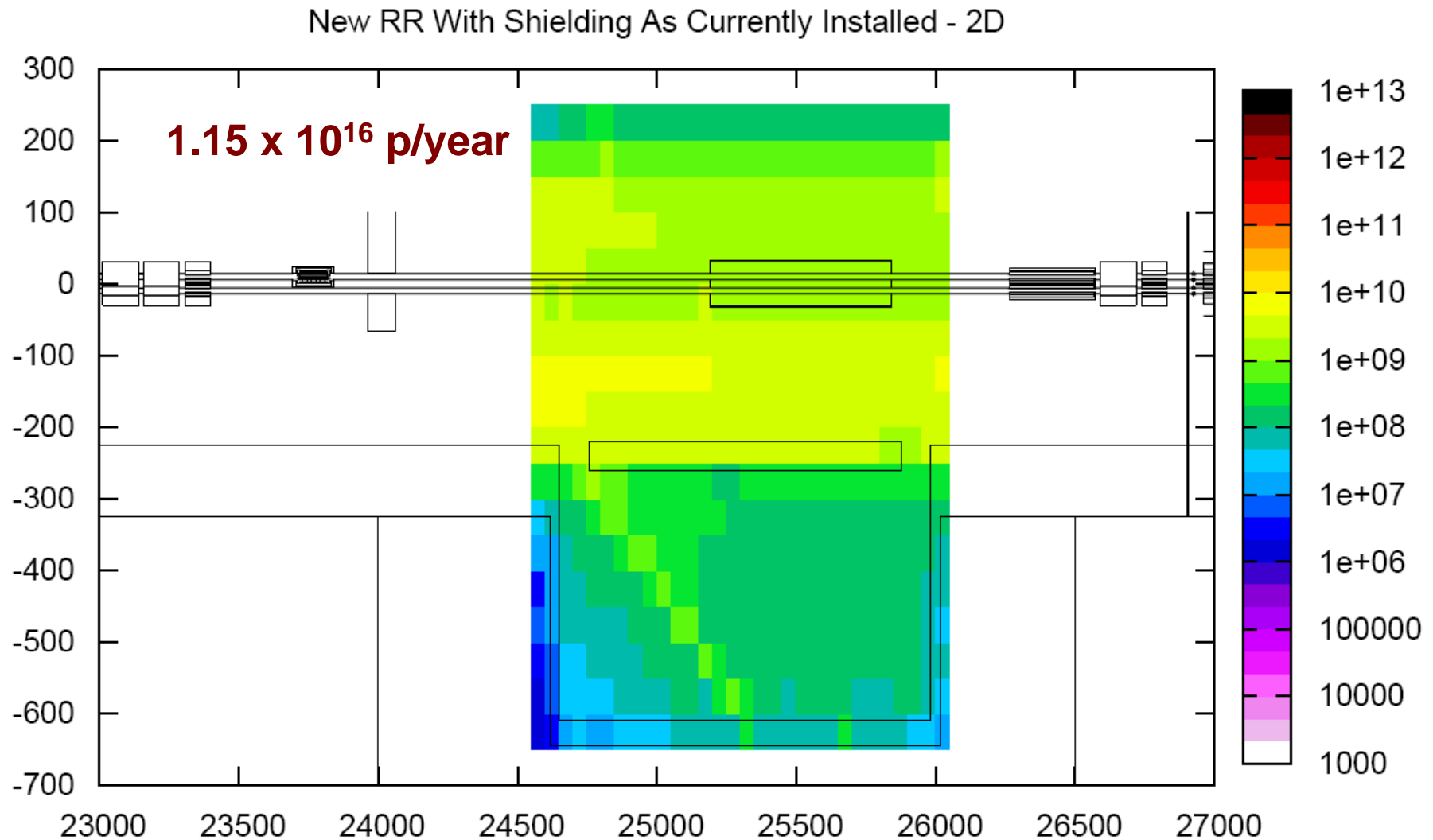
New RR With Full Shielding Correct Maze - 2D



The Unshielded Case



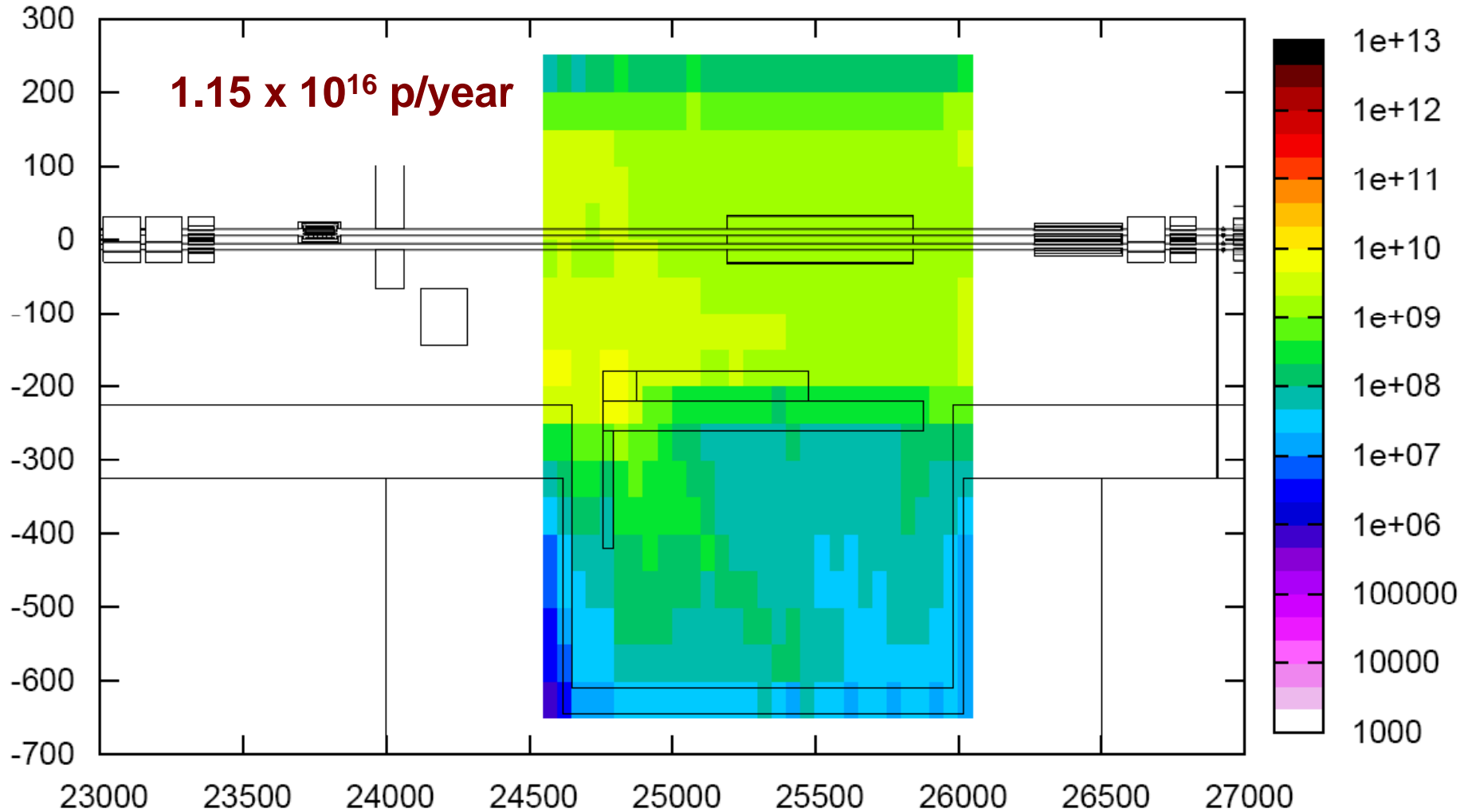
The First Shielding Leg acting as 'Spoiler'



Impact of the 'Temporary Solution'

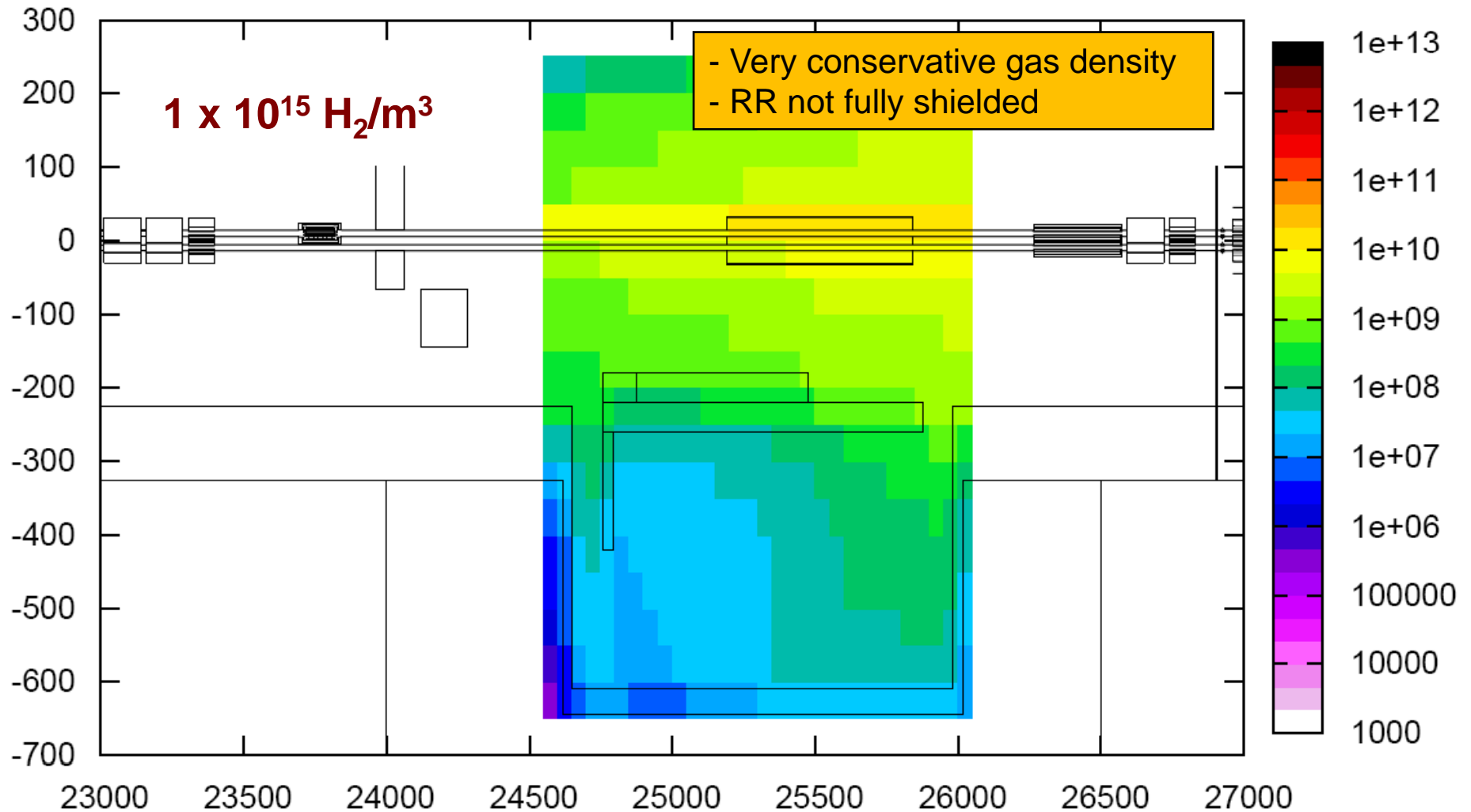
(not relevant anymore, since full shielding will be implemented during the shutdown)

New RR With Possible Temporary Solution - 2D



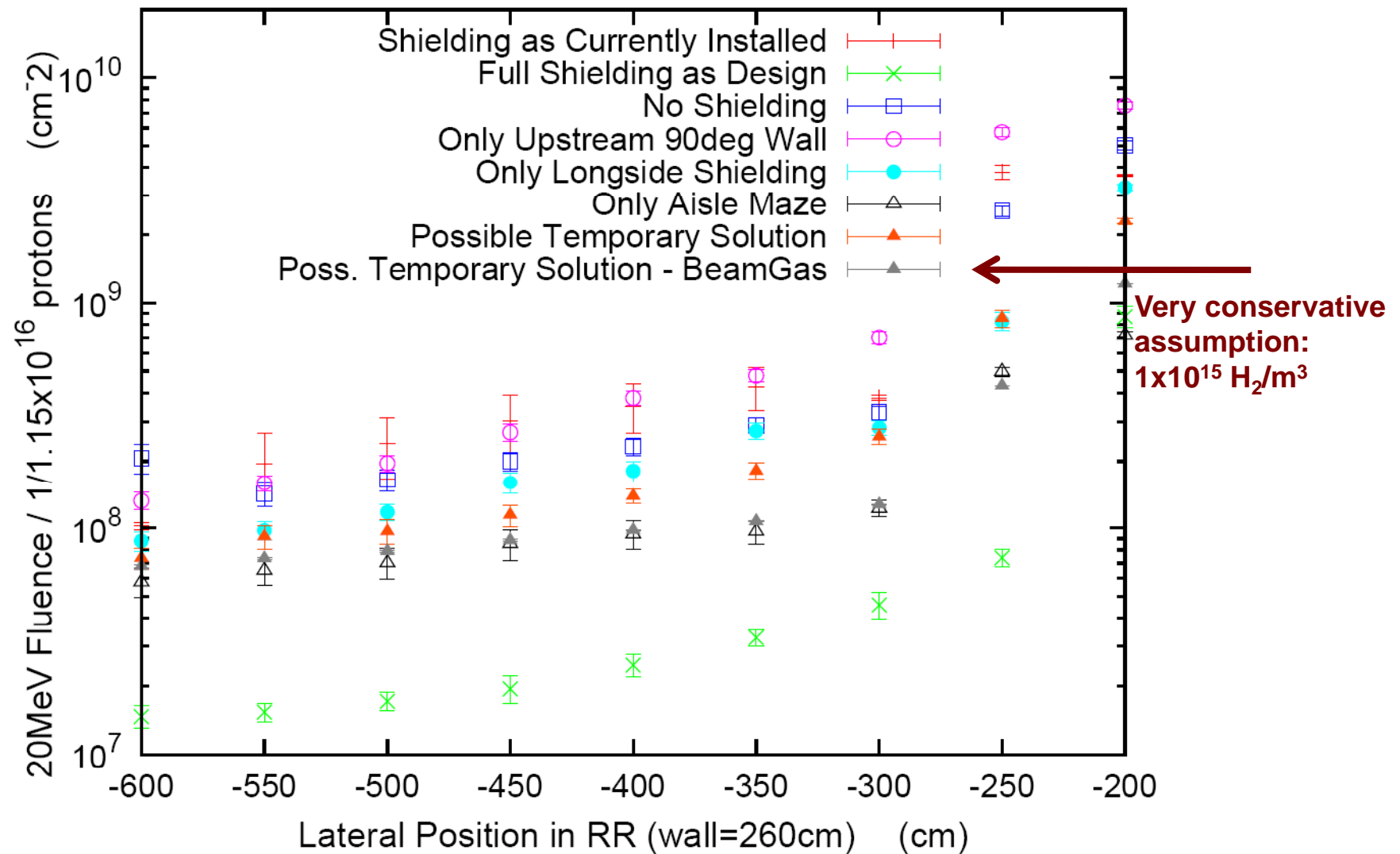
Temporary Solution and Beam-Gas (Beam 2)

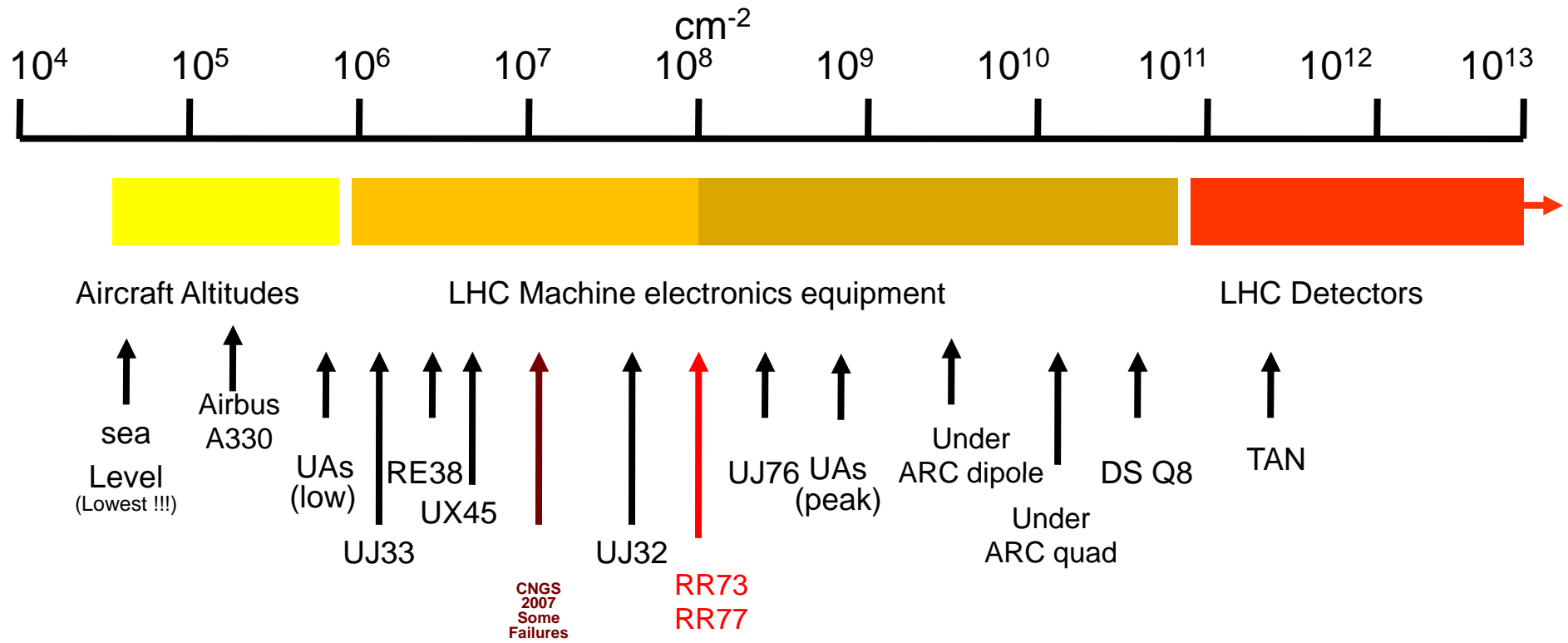
New RR With Upstream 90deg Wall Only - BeamGas B2 - 2D



Combined Results – Norm.: 1×10^{16} p/year

RR 20MeV Shielding Options





*e.g., some estimated LHC-Levels for Hadrons
($E > 20 \text{ MeV}$) per cm² per nominal year*



Conclusions

- **Previous installed shielding (one leg only) is 'worst case possible'**
- **Temporary solution** (simplified block + part of the direct RR shielding) is the **best compromise (patch!)**
- Beam-Gas only an issue if **maximum gas density** values ($1 \times 10^{15} \text{ H}_2/\text{m}^3$) are reached
- **Design solution offers best protection** and **will be installed** during the shutdown (possibly not up to the full height; to be checked with respect to electronics location)
- For **nominal conditions this still results in several $1 \times 10^7 \text{ cm}^2/\text{year}$** high-energy hadron fluence
- The current calculations are based on the **perfect nominal case** and **respective safety margins should be taken into account**
- **Suggested safety margin** (given the uncertainty in the loss distribution, as well as statistical limitations and long distances): at **least a factor of 2-3**

- **Adding extra shielding and relocation of all electronics are not an option:**
 - **It's important to be sure the electronics in RR77 and RR73 can withstand the radiation levels foreseen**