

FLUKA simulation and dose assessments for the beamline

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- Full beamline geometry implemented

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Detailed view of some components

- First quadrupole, first dipole, etc.

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- More detailed estimates on tunnel

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- Final steps towards end of project

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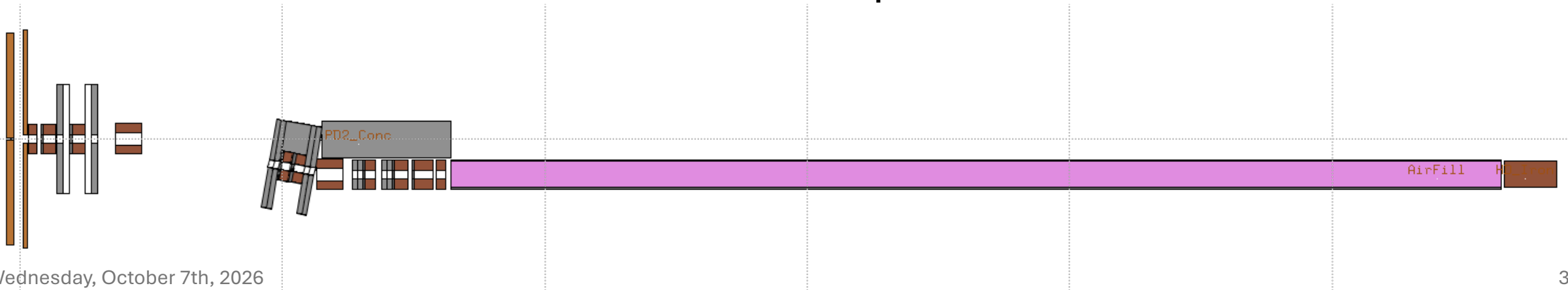
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Studies performed this year

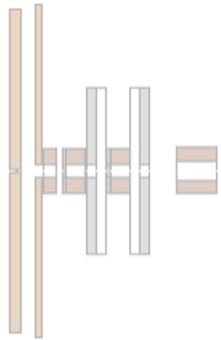
- After the optimization of the beamline, I rebuilt the whole model on FLUKA to assess a series of quantities:
 - dose in Gy/year in the whole beamline
 - dose in Gy/year in specific regions: first quadrupole (useful for comparison with studies from last year - ongoing), first dipole, entrance of the instrumented decay tunnel;
 - 1 MeV neutron-equivalent fluence in silicon on the whole beamline and specific regions.
- This is the render of the full beamline implemented in FLUKA:



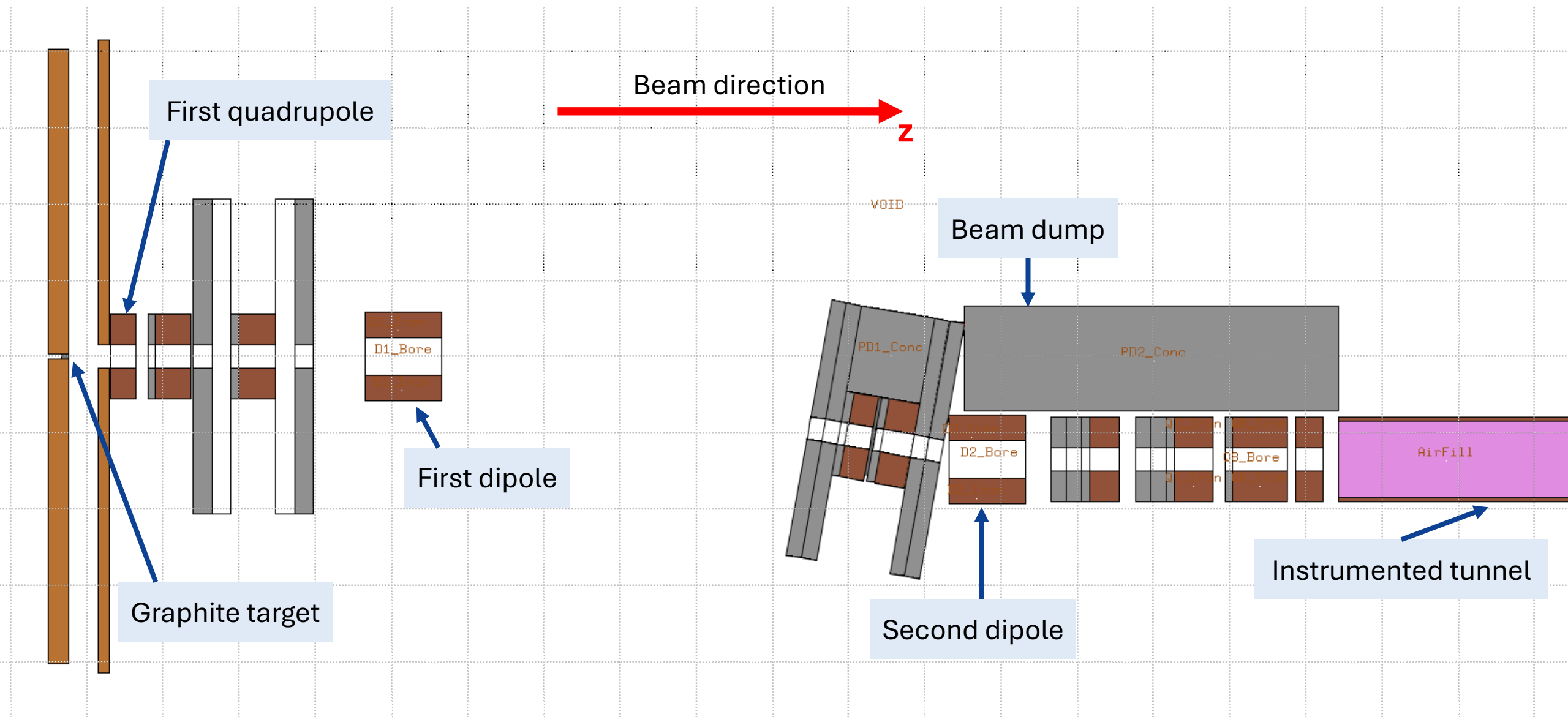
Studies performed this year

- After the optimization of the beamline, I rebuilt the whole model on FLUKA to assess:
 - dose in Gy
 - dose in Gy
 - studies from tunnel;
 - damage eq
 - specific results
- This is the result of the comparison with instrumented decay beamline and FLUKA:

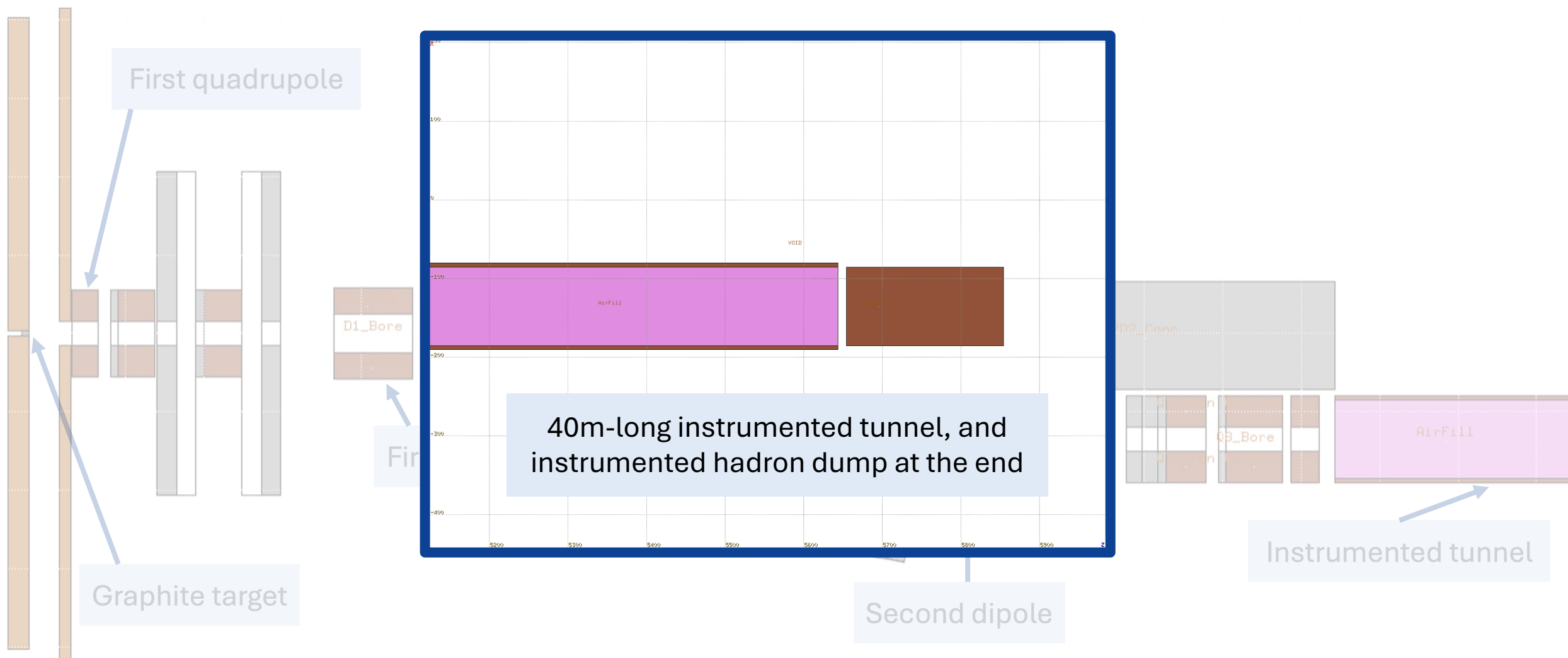
All results presented are preliminary and still a work in progress!



Detailed view of the beamline components



Detailed view of the beamline components



Detailed view of the beamline components

Updated target and shielding

Detailed view of the shielding configuration before the first quadrupole

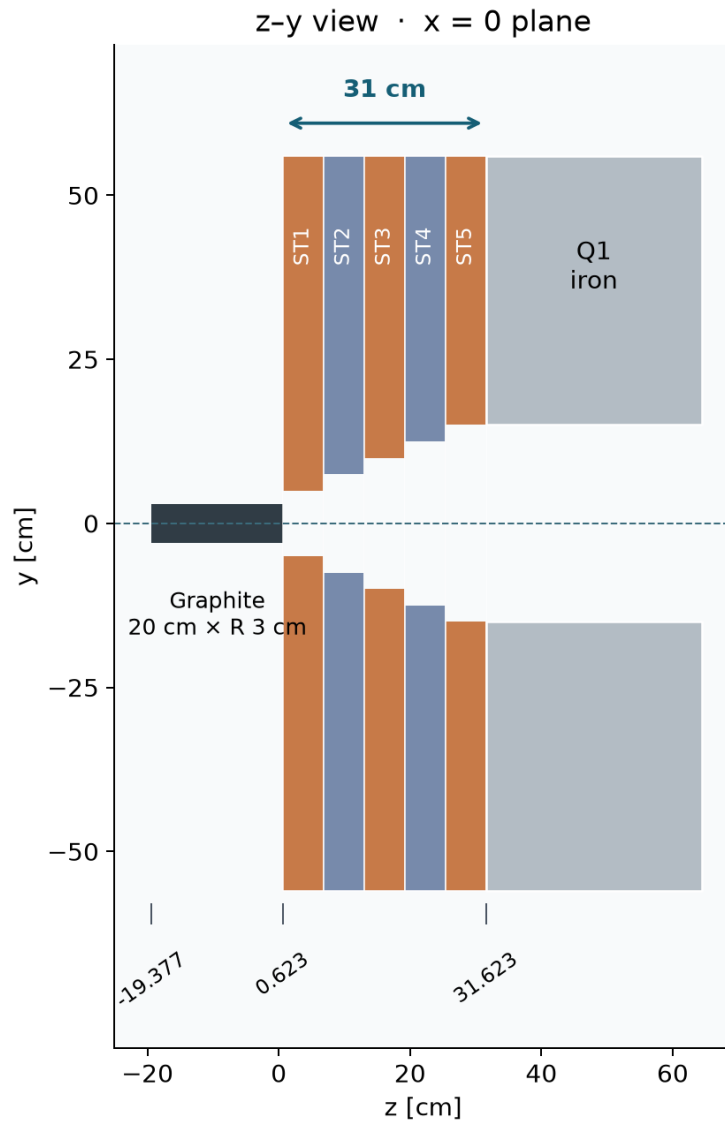
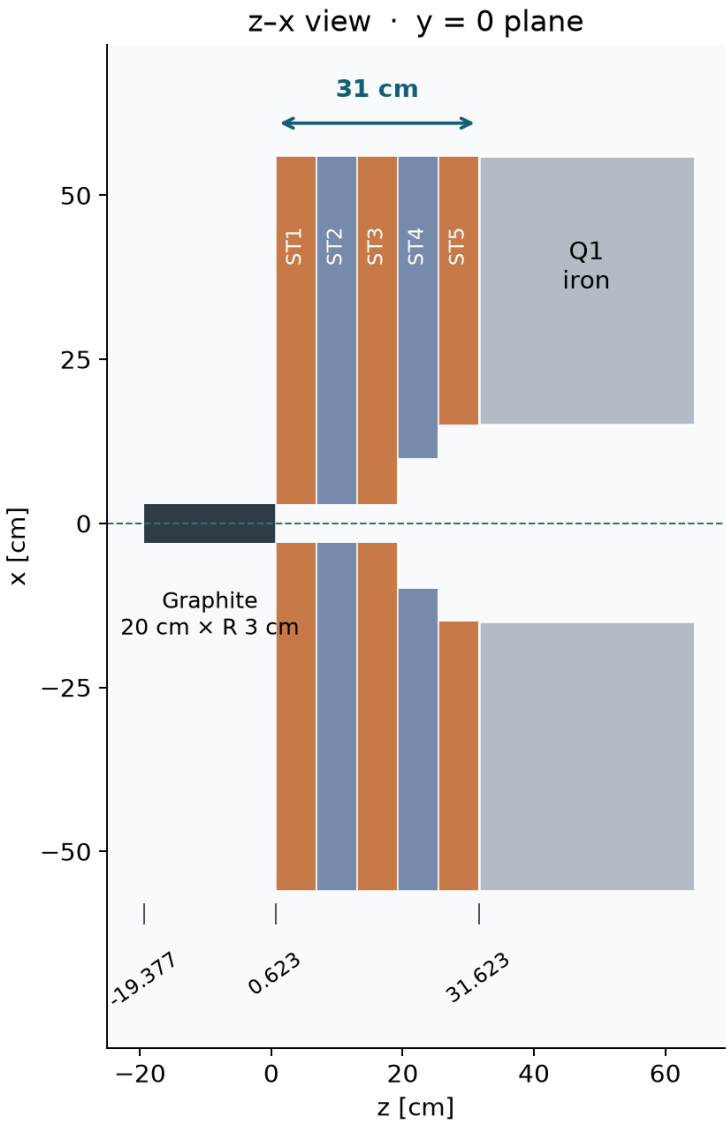


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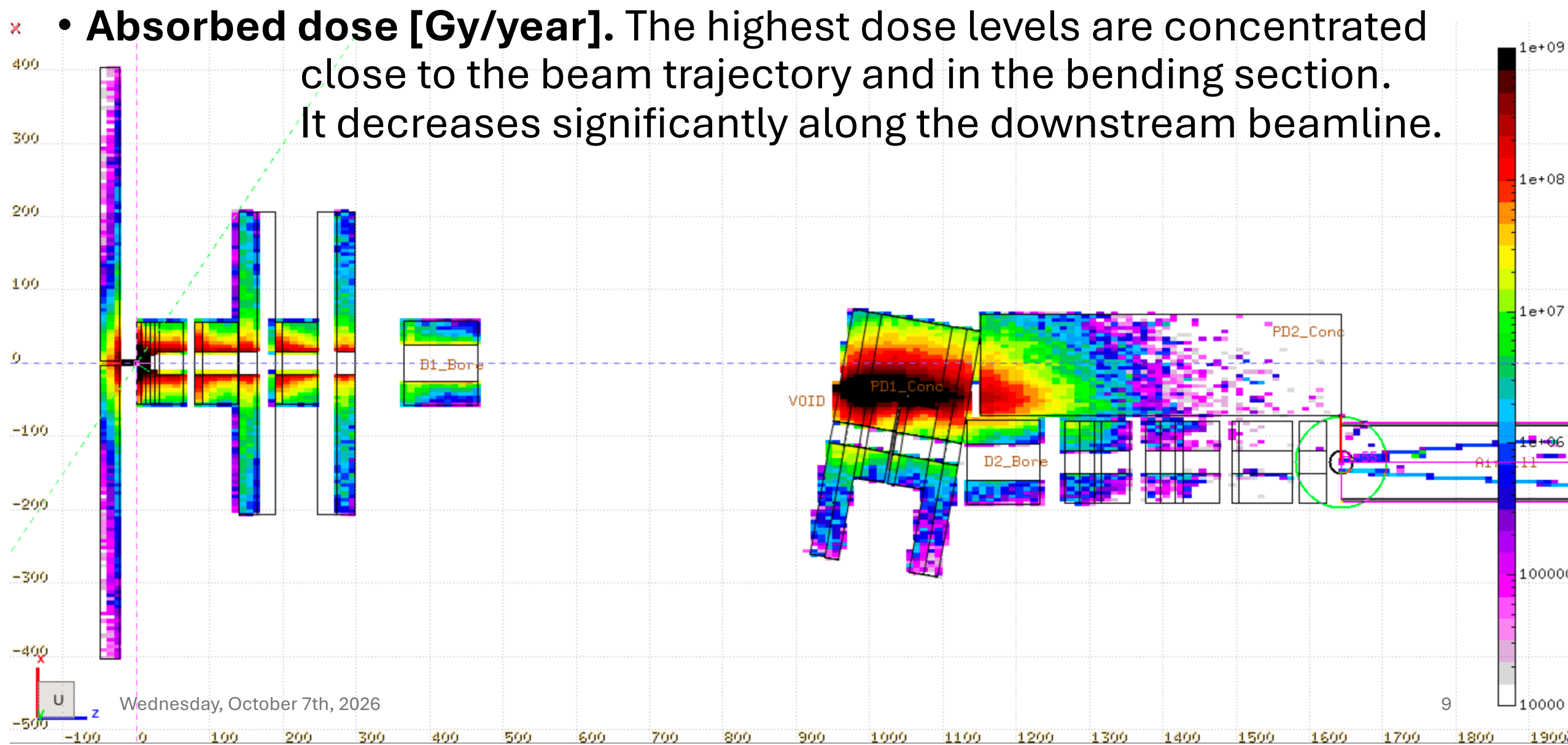
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Dose map of the upstream beamline



1 MeV neutron-equivalent fluence in Si

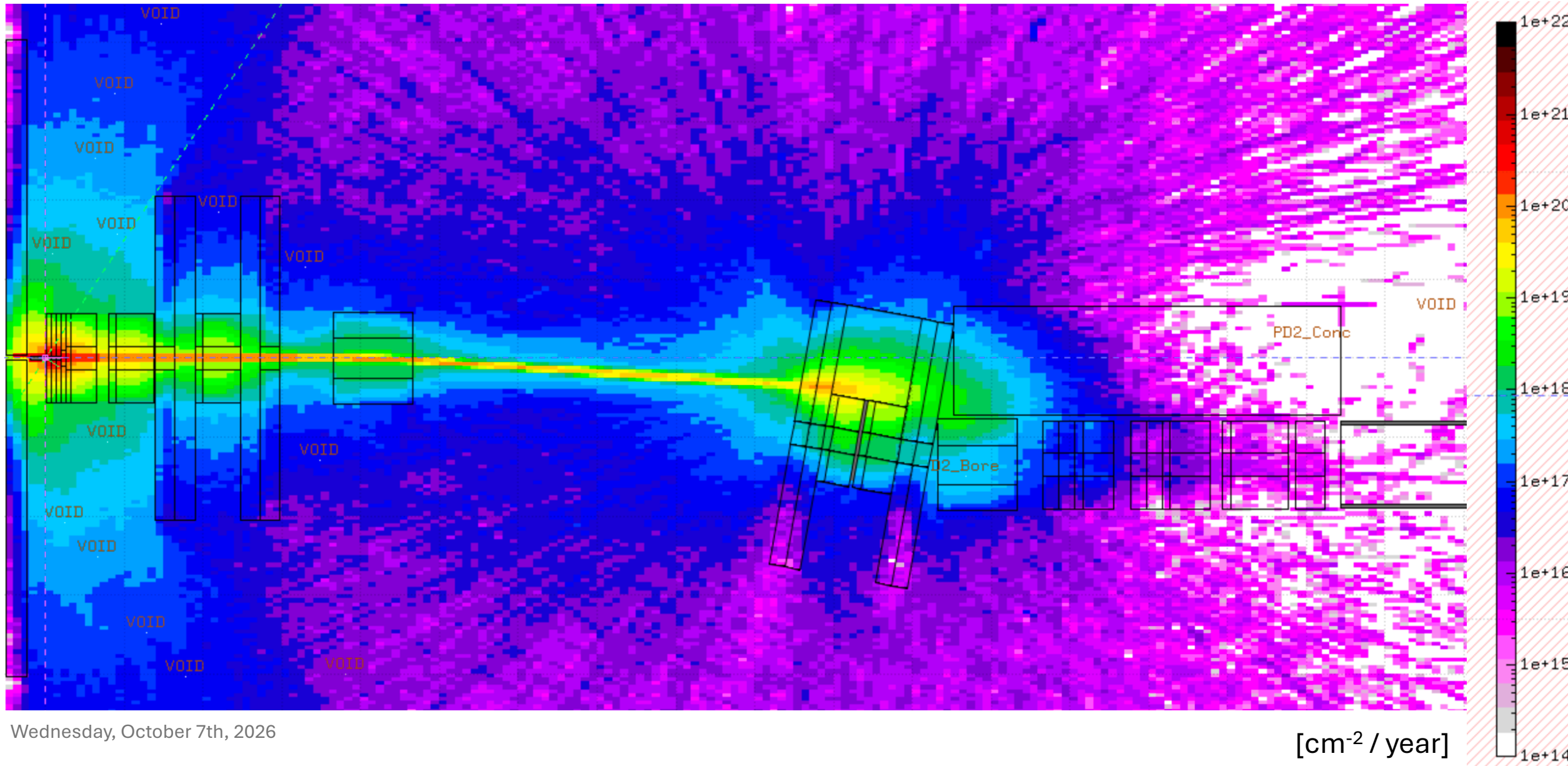


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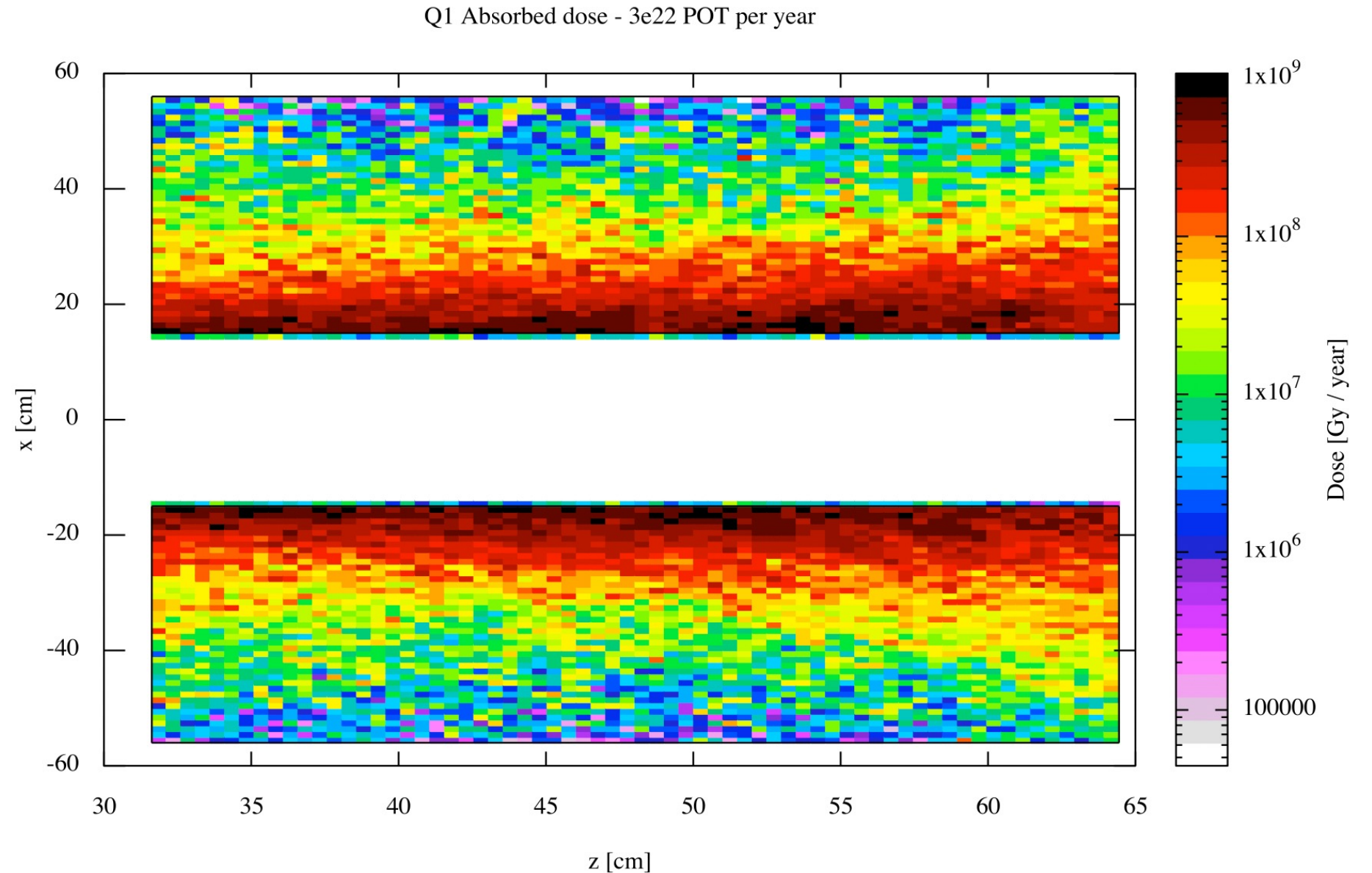
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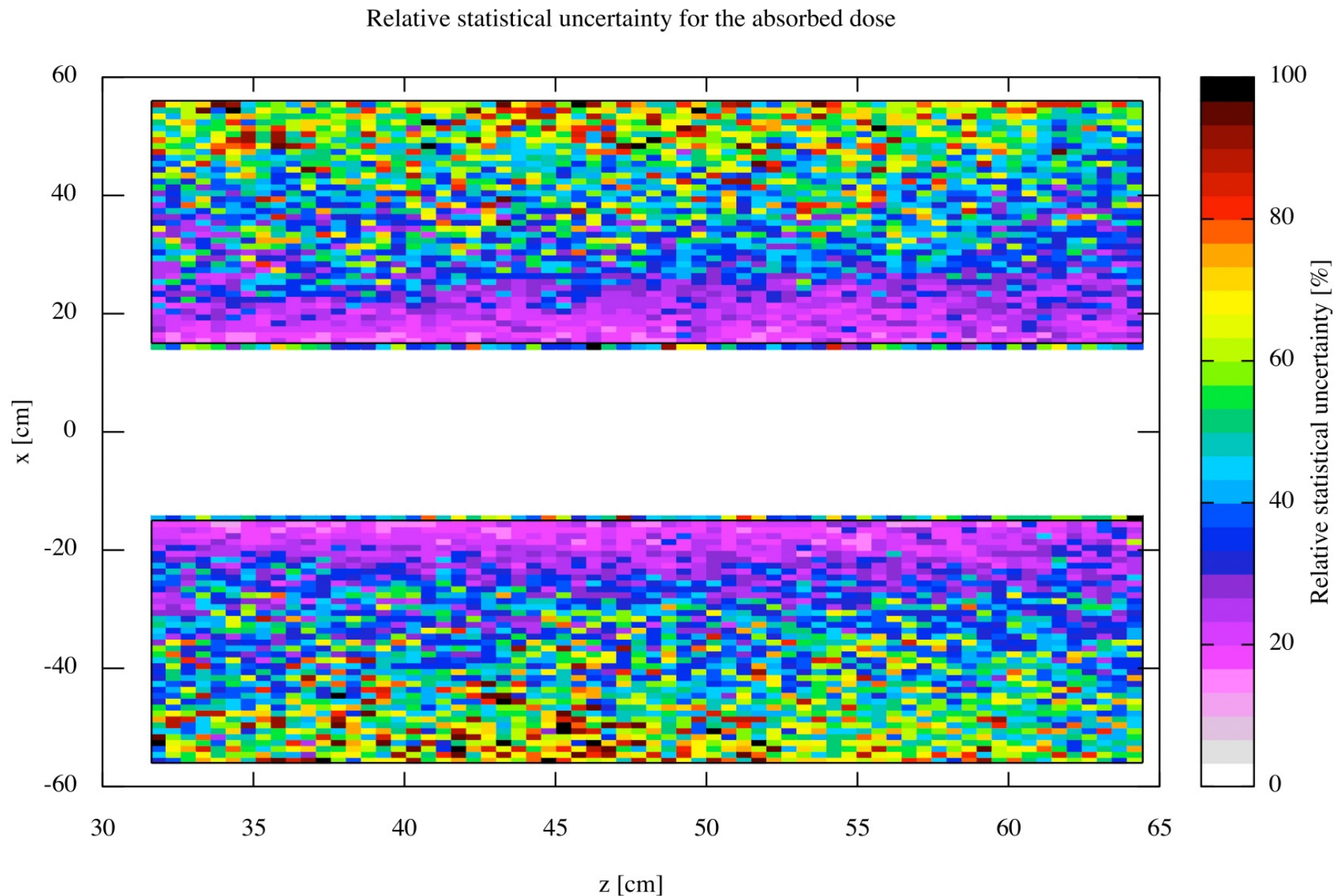
Absorbed dose at Q1

First quadrupole

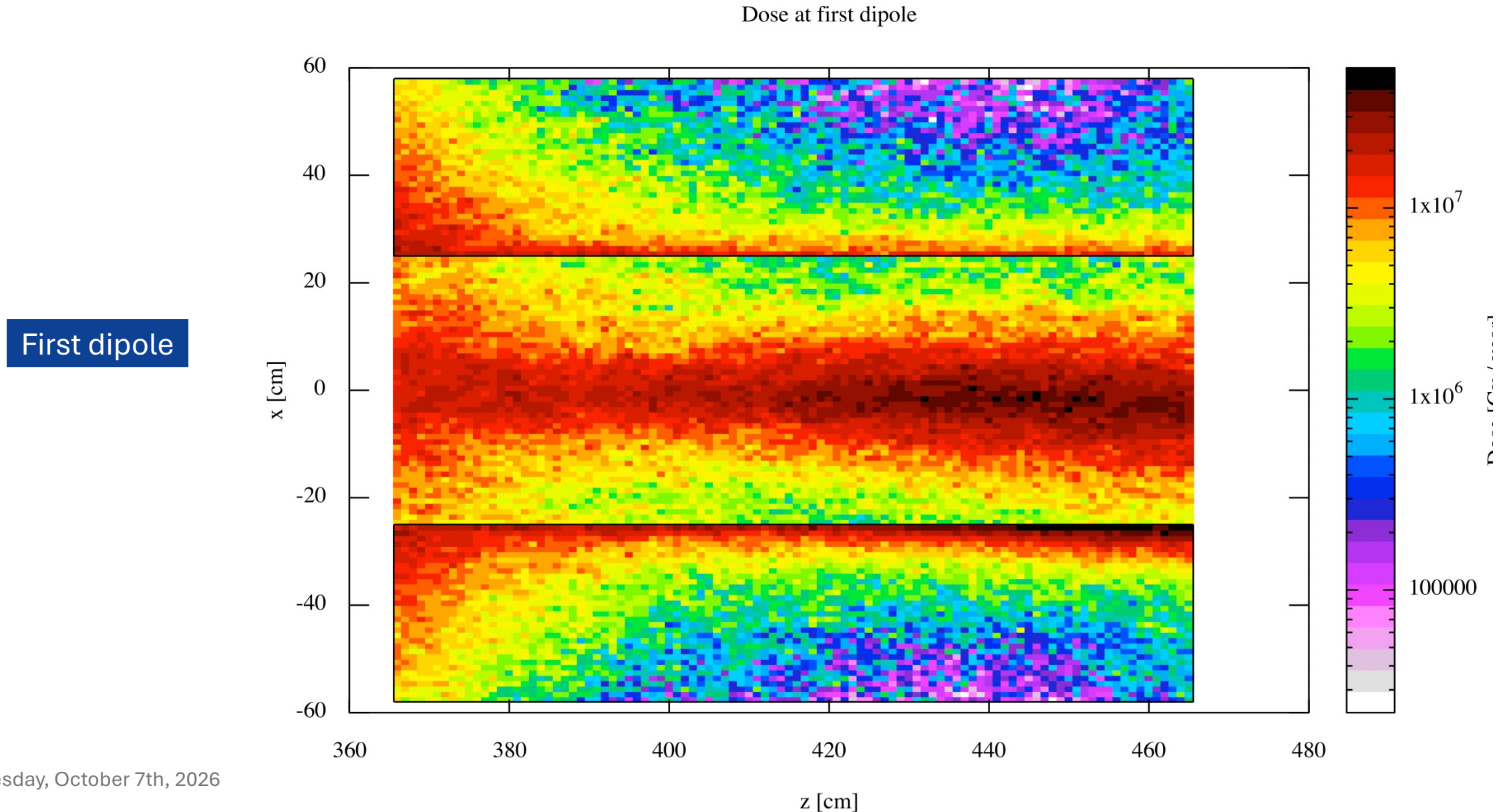


Statistical uncertainty of the Q1 dose map

First quadrupole
Statistical error

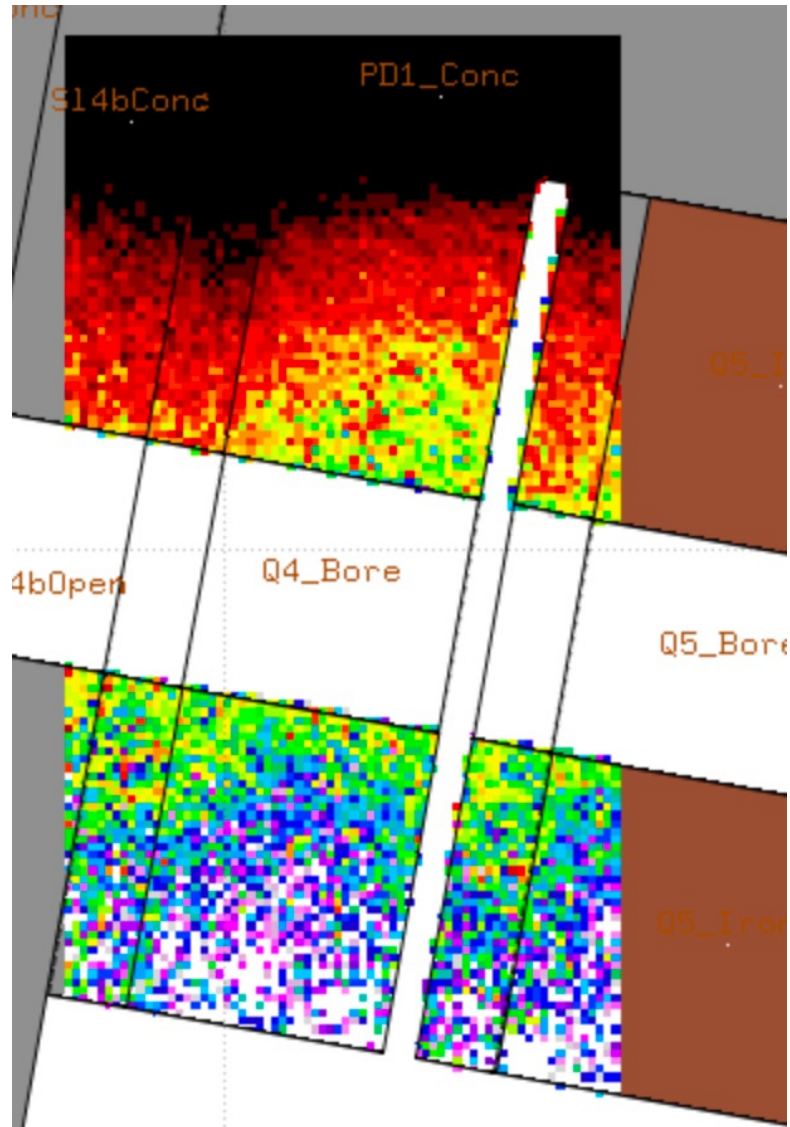


Dose absorbed at the first dipole



Dose distribution around Q4 and Q5

First
quadrupole
after bend



Second
quadrupole
after bend

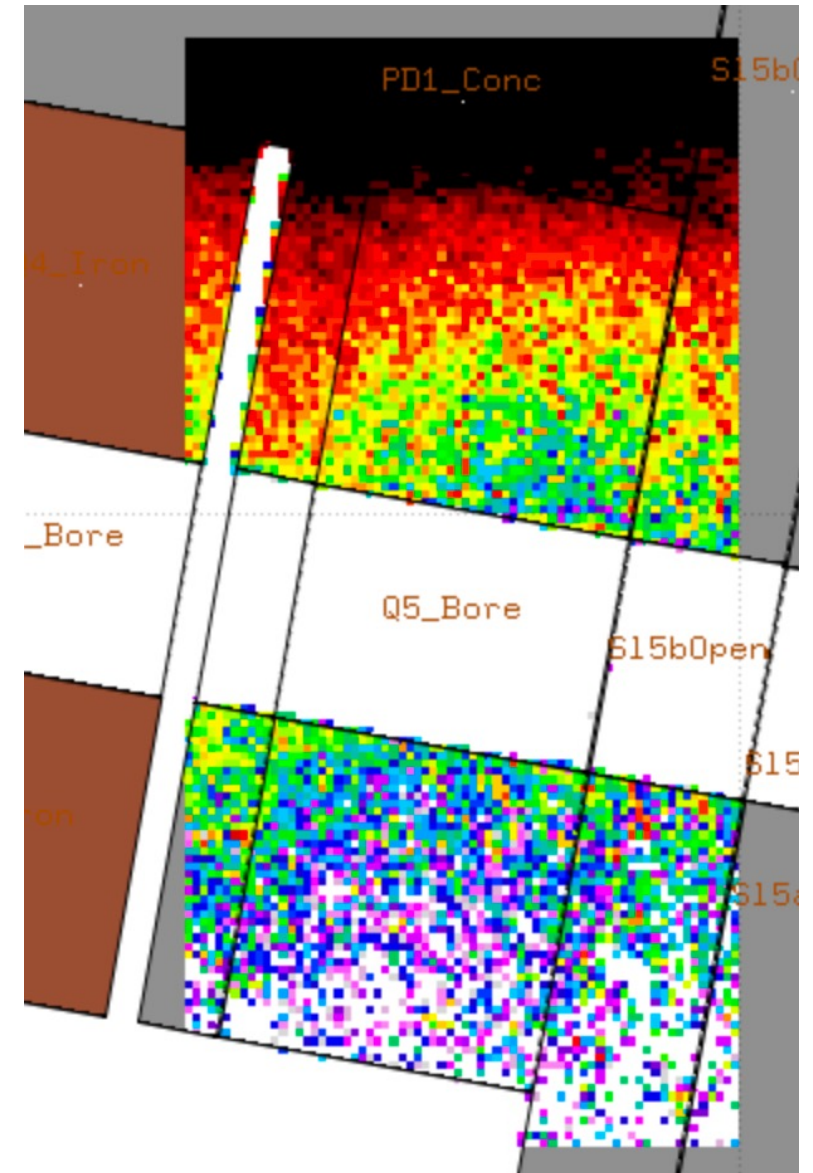


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- The updated ESSνSB+ beamline geometry has been implemented in FLUKA, providing preliminary absorbed-dose and 1 MeV neutron-equivalent fluence maps.
- The maps identify regions requiring particular attention near the target and in the bending section. Dedicated views of Q1, the first dipole and Q4–Q5 help locate radiation-exposed areas. Component assessments must distinguish the magnet materials from the surrounding shielding.
- Statistical uncertainties remain spatially non-uniform and must accompany the interpretation of local dose values. Further simulations will improve estimates in poorly sampled regions, with particular attention to the instrumented decay tunnel and the downstream hadron dump.
- Assessing the implications for magnet lifetime and detector suitability will require material-specific results and relevant radiation-tolerance data.

Thanks for your attention!