HSE
Radiation Protection

RP studies at TCC8 bridge - update

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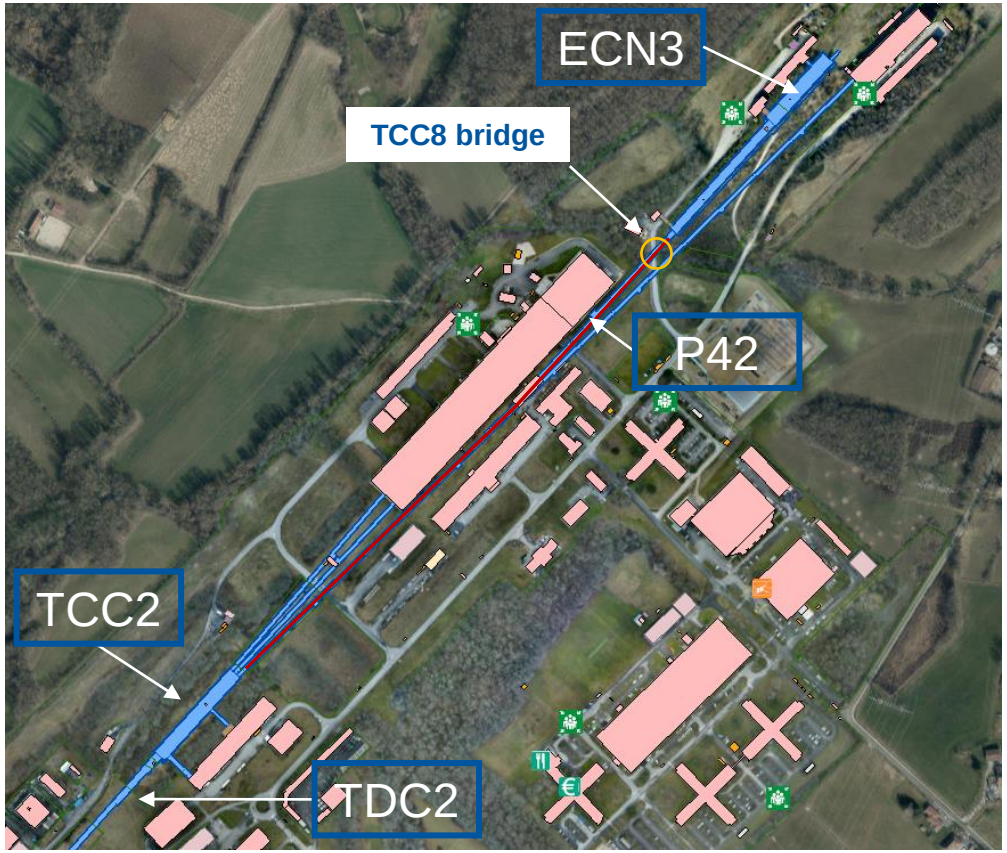
EDMS 3053484

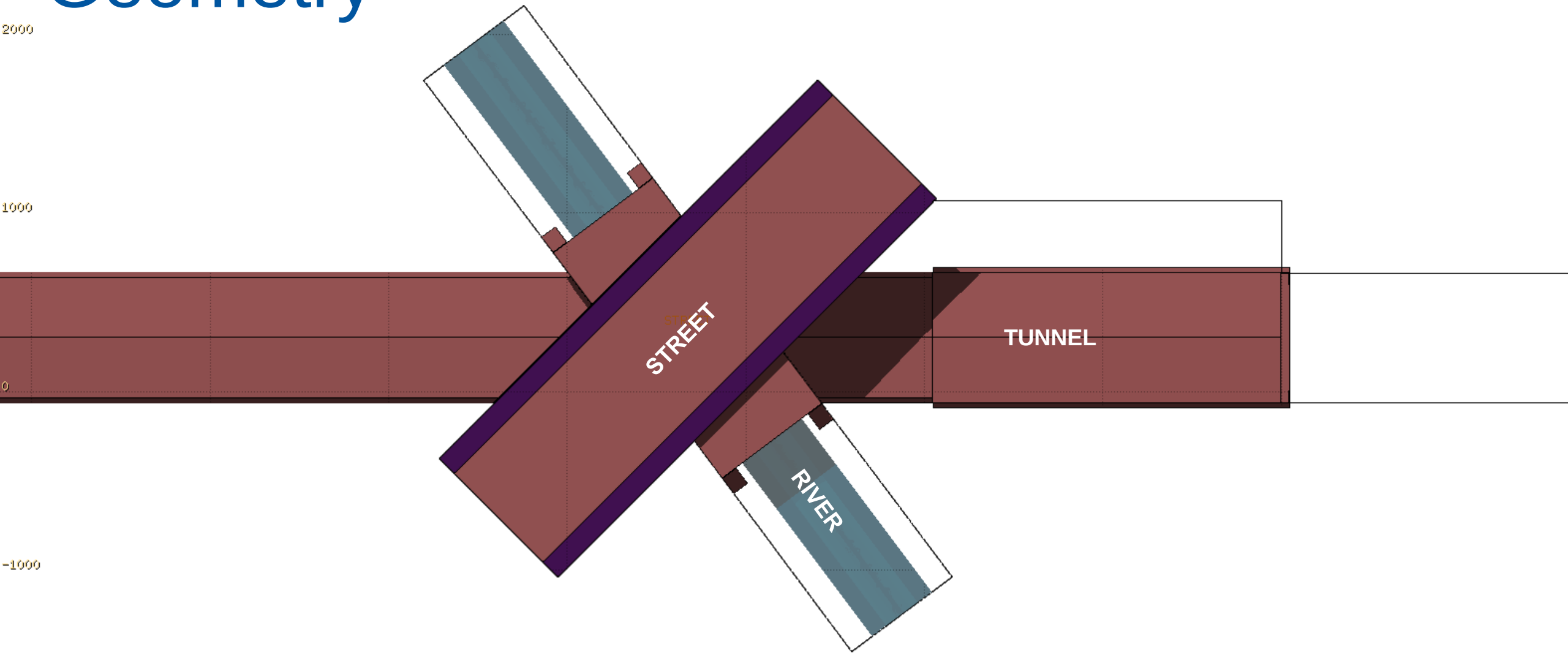
Introduction



SPS extraction

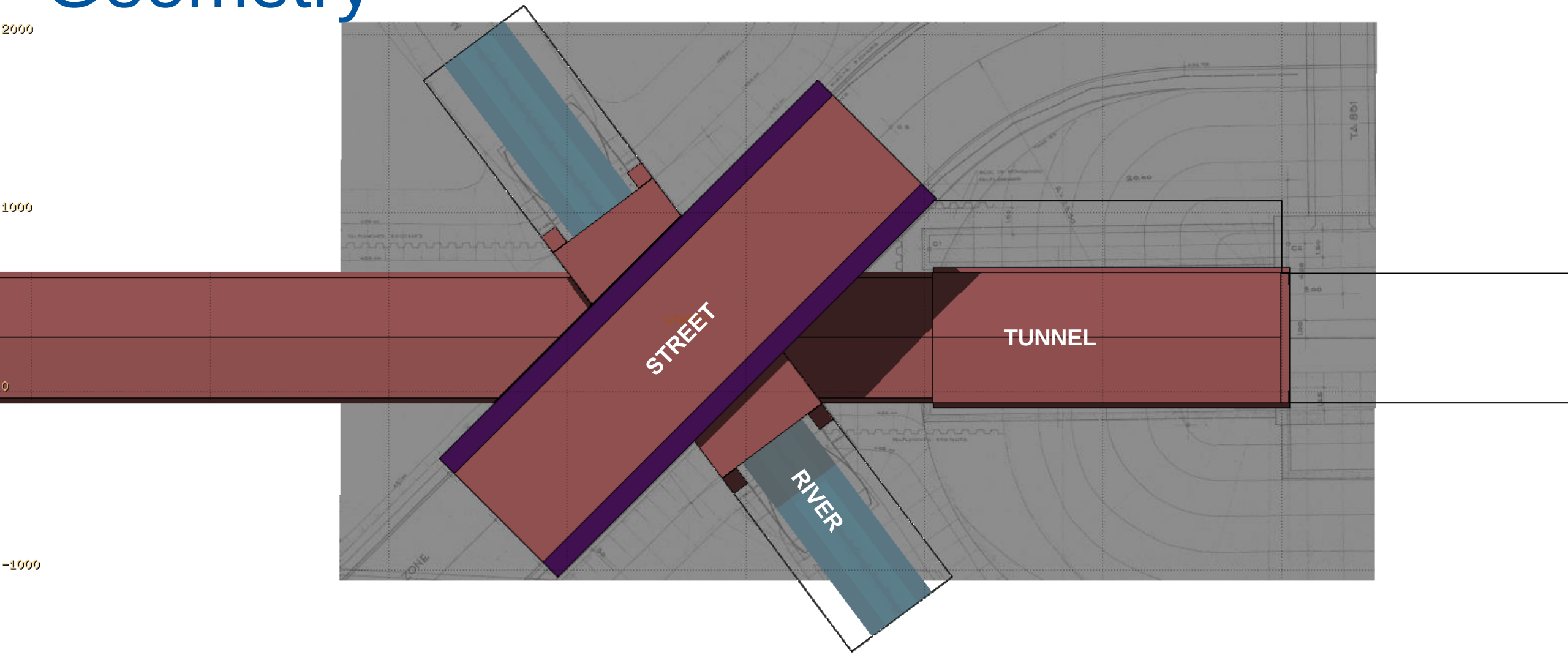
- Within the ECN3 Beam Delivery Task Force the shielding weakness at the bridge towards TCC8/ECN3 above the P42 beamline in TDC85 was identified
- An RP survey had shown radiation levels close to the area classification limit (2.5 uSv/h, Non-designated Area) during NA62 beam operation (EDMS 2924384)
- In view of the future intensity increase for HI-ECN3 additional shielding must be installed and/or beam losses must be reduced
- Preliminary FLUKA studies for shielding improvements were performed (EDMS 2815402)
- Update on new FLUKA studies (EDMS 3053462) with a refined model according to the latest CE drawings as well as a more realistic source term

Geometry



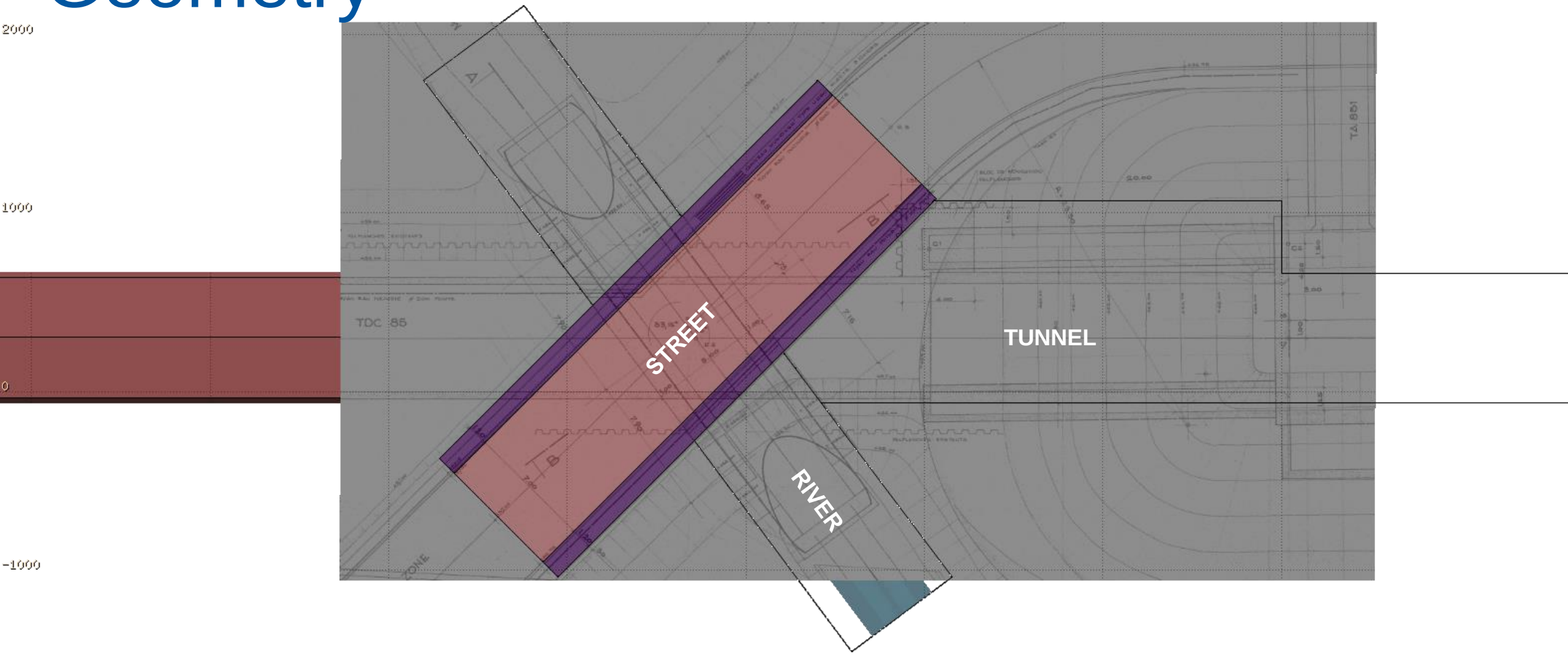
3D FLUKA model - TT85, river, bridge and street top view

Geometry



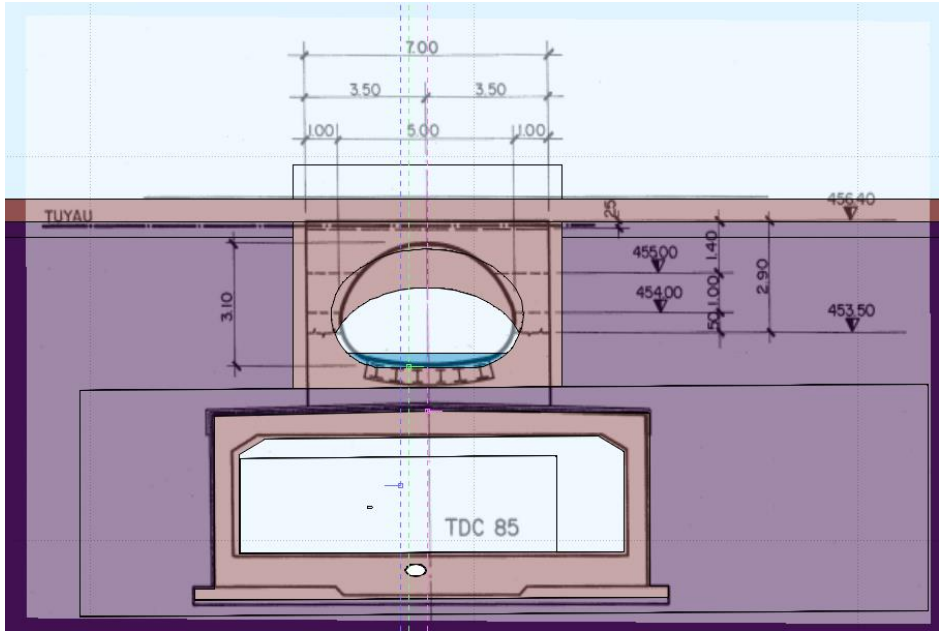
3D FLUKA model - TT85, river, bridge and street top view – technical drawing

Geometry

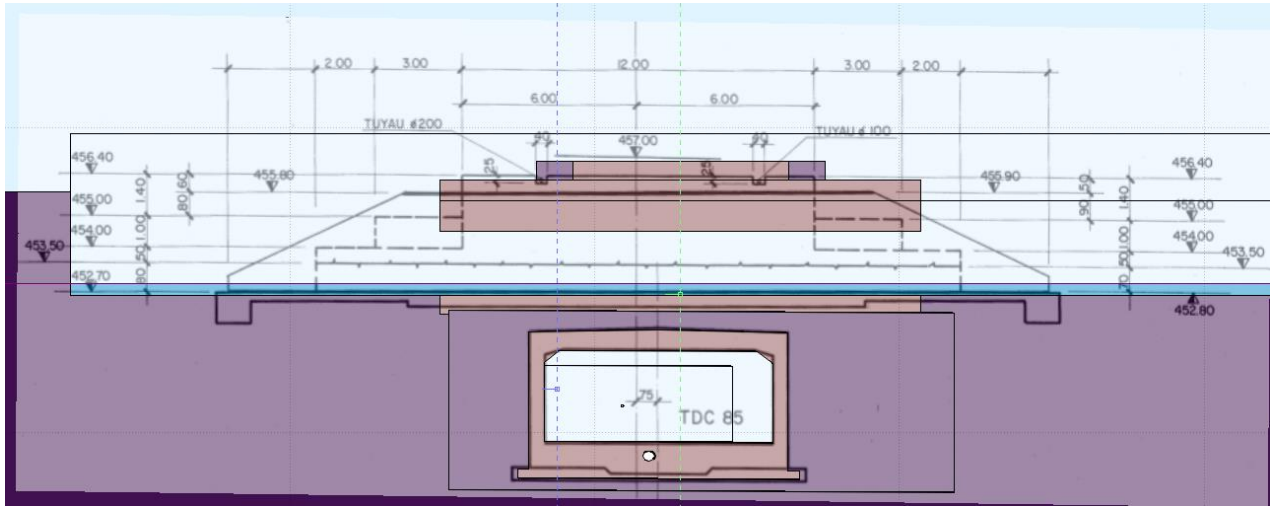


3D FLUKA model - TT85, river, bridge and street top view – technical drawing

Geometry



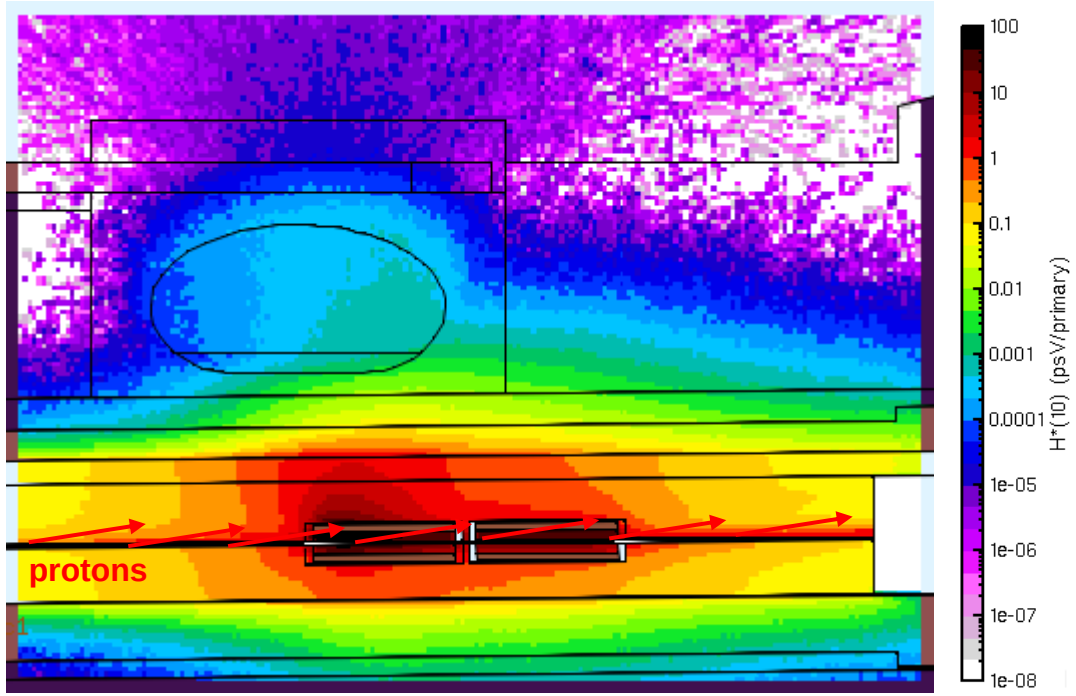
Transversal bridge – FED 185620



Longitudinal bridge – FED 185620

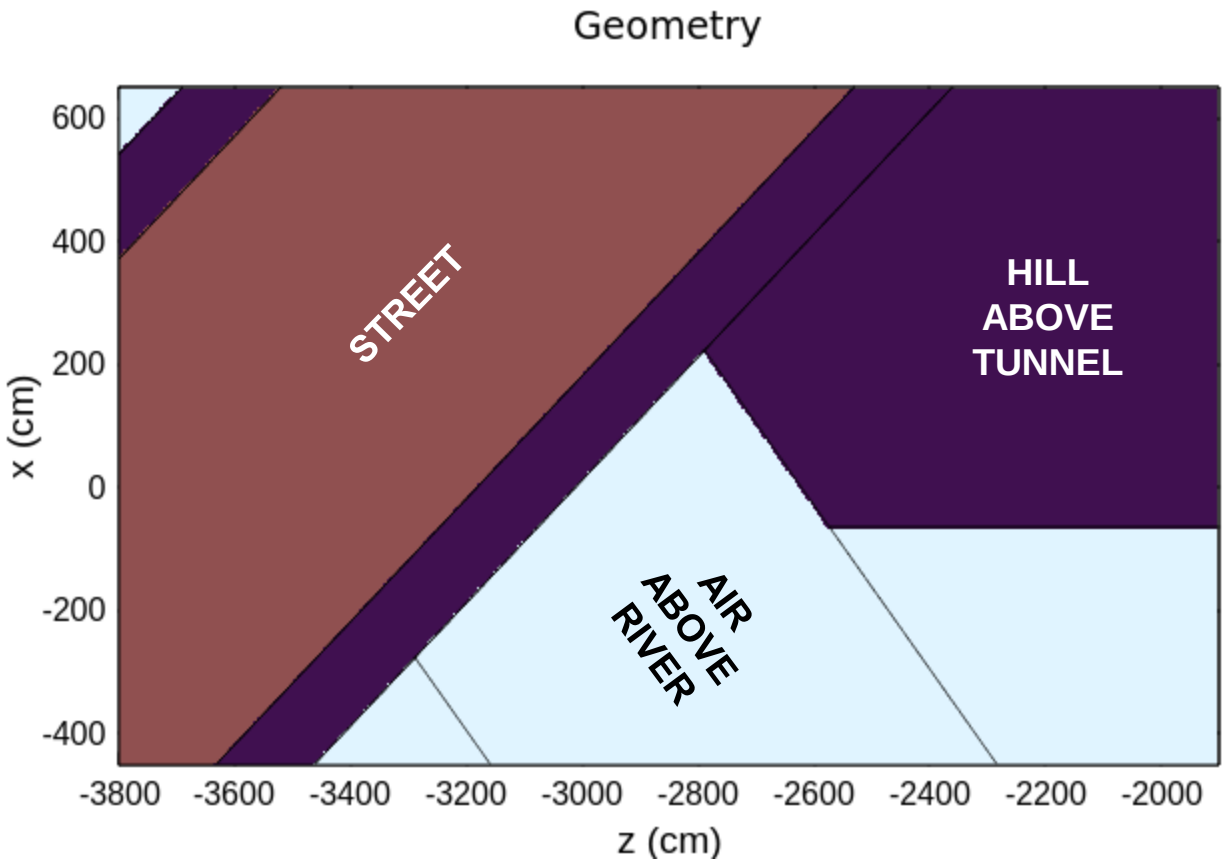
Source term

- 400 GeV/c proton sampled at nominal position from 15 m upstream first magnet (QNL.792) to 5 m downstream second magnet (QNL.795)
- Proton sampled with vertical direction 40 mrad higher than nominal beam direction
- Protons impact on beam pipe (modelled as 1.5 mm Al) → finally hit the first magnet creating hot spot

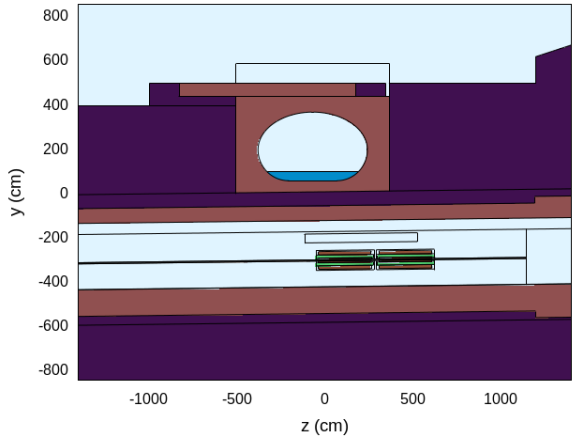


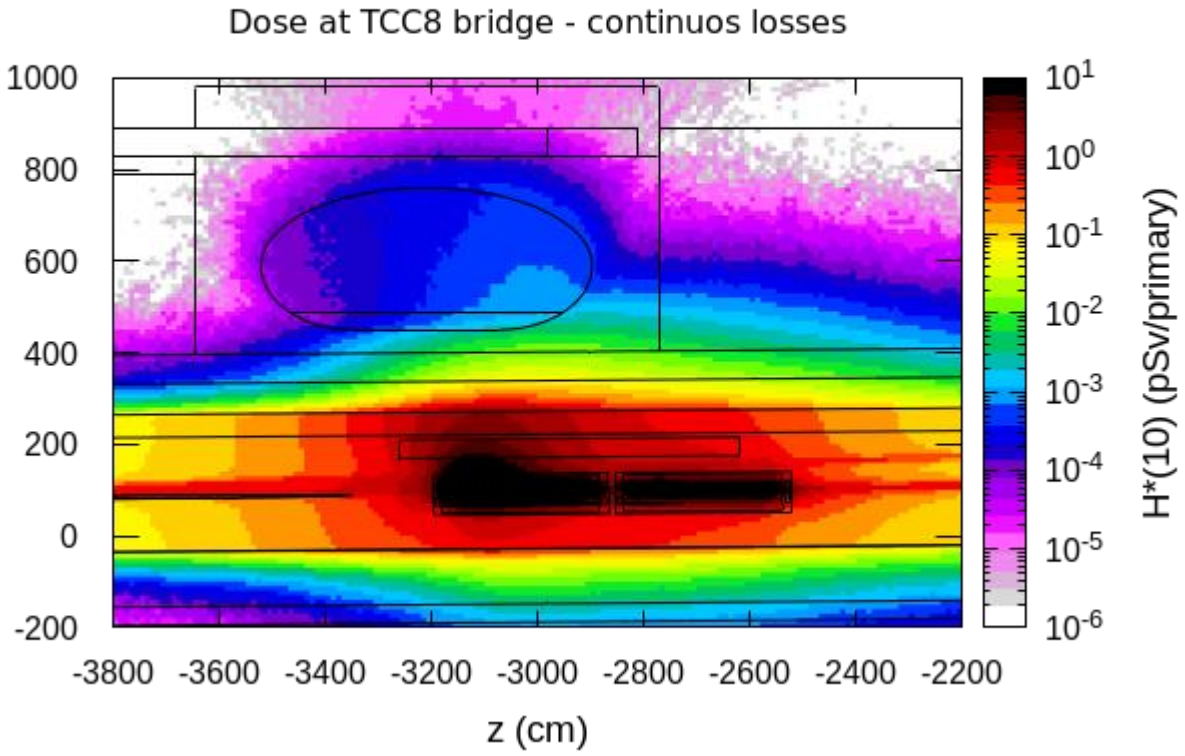
- It aims to best represent the real beam losses with a qualitative (and not quantitative) approach

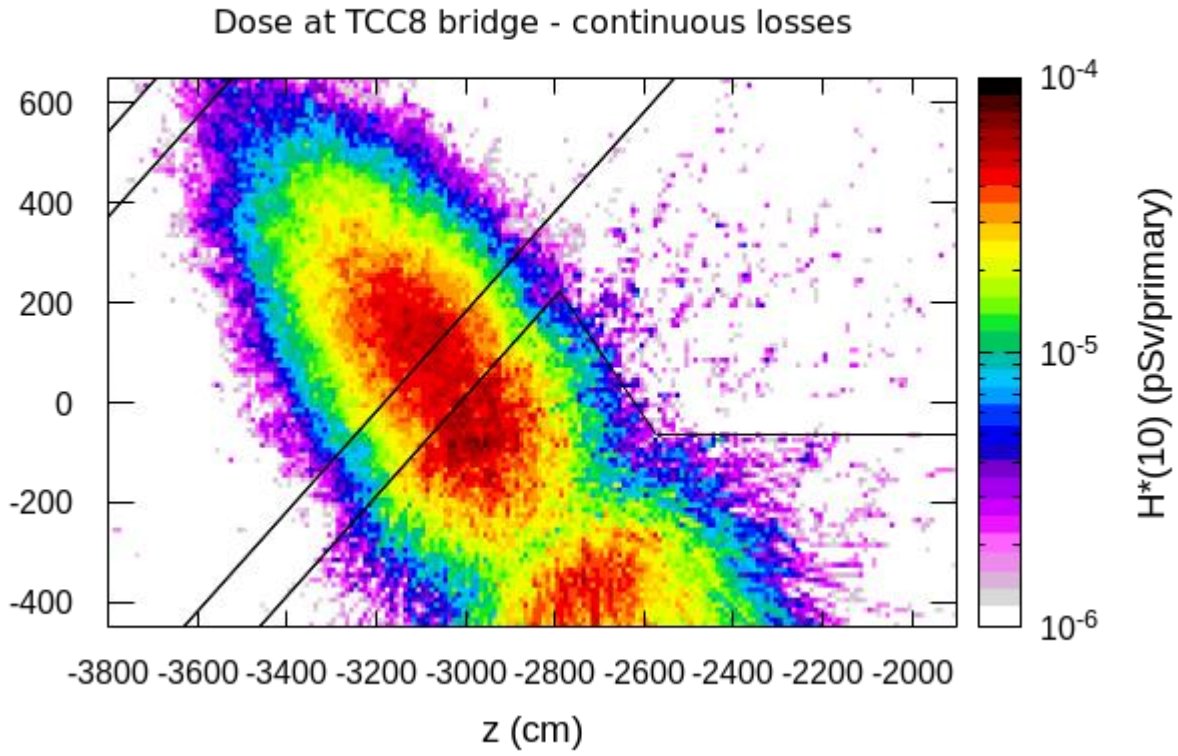
Dose at top of the road - geometry



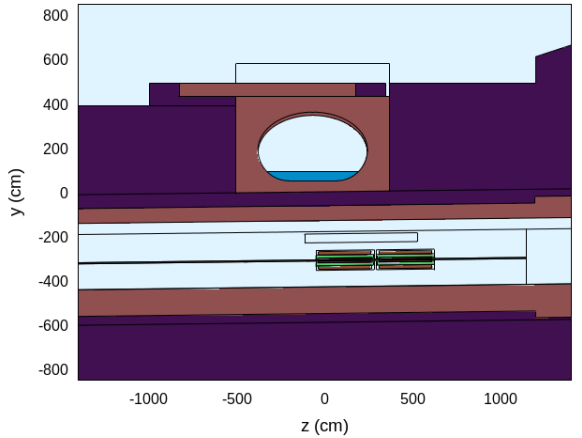
Dose at top of the road - current

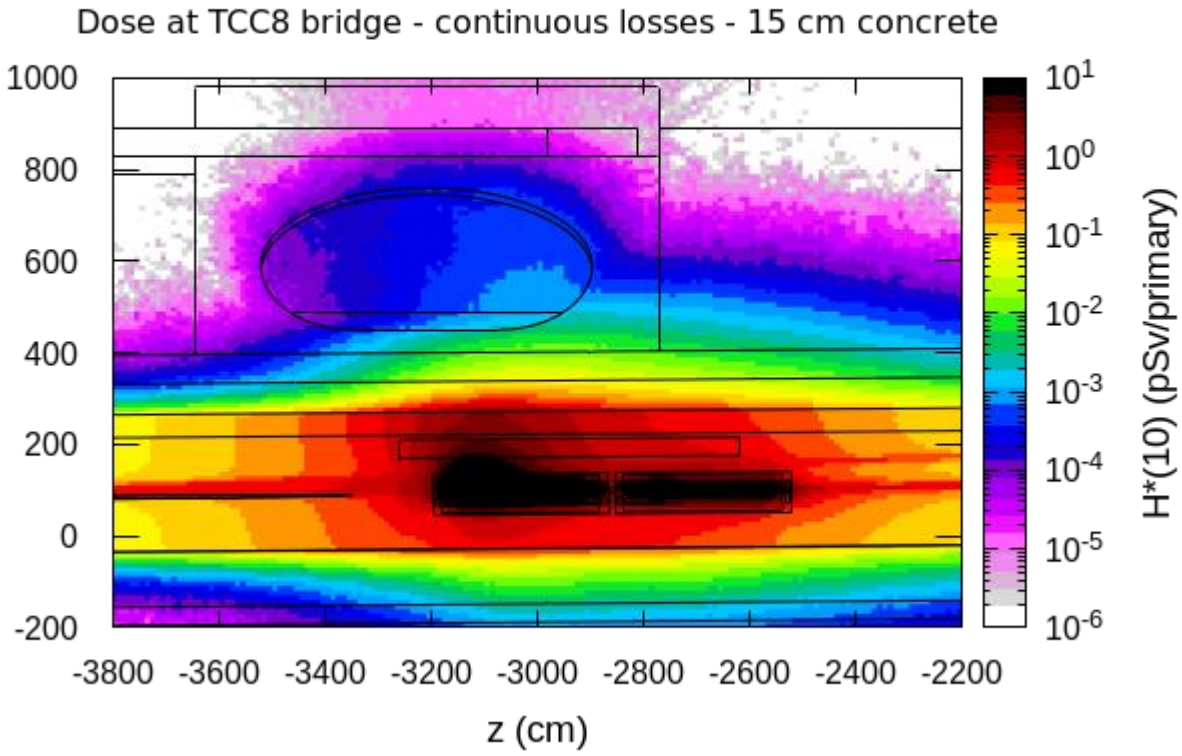


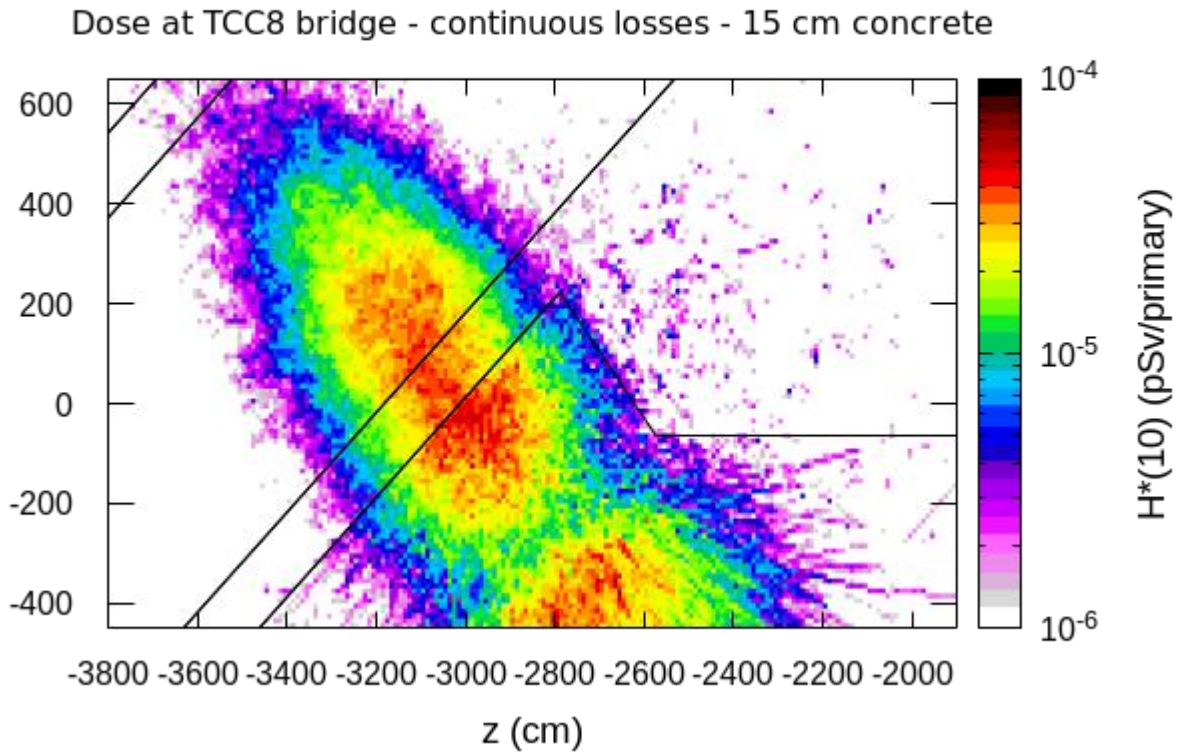




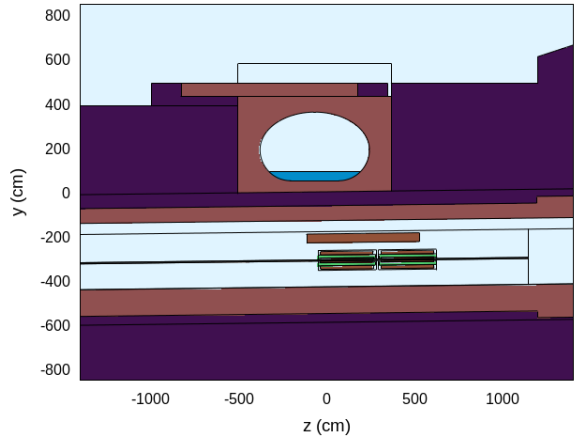
Dose at top of the road - 15 cm concrete

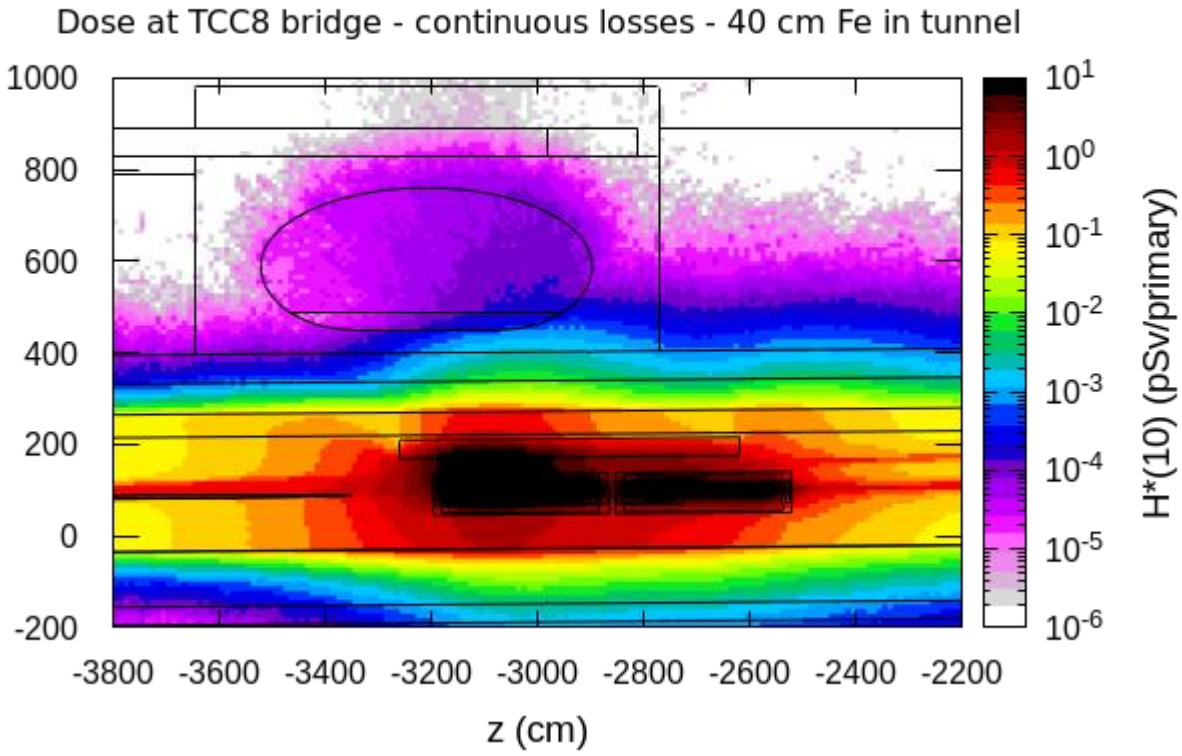


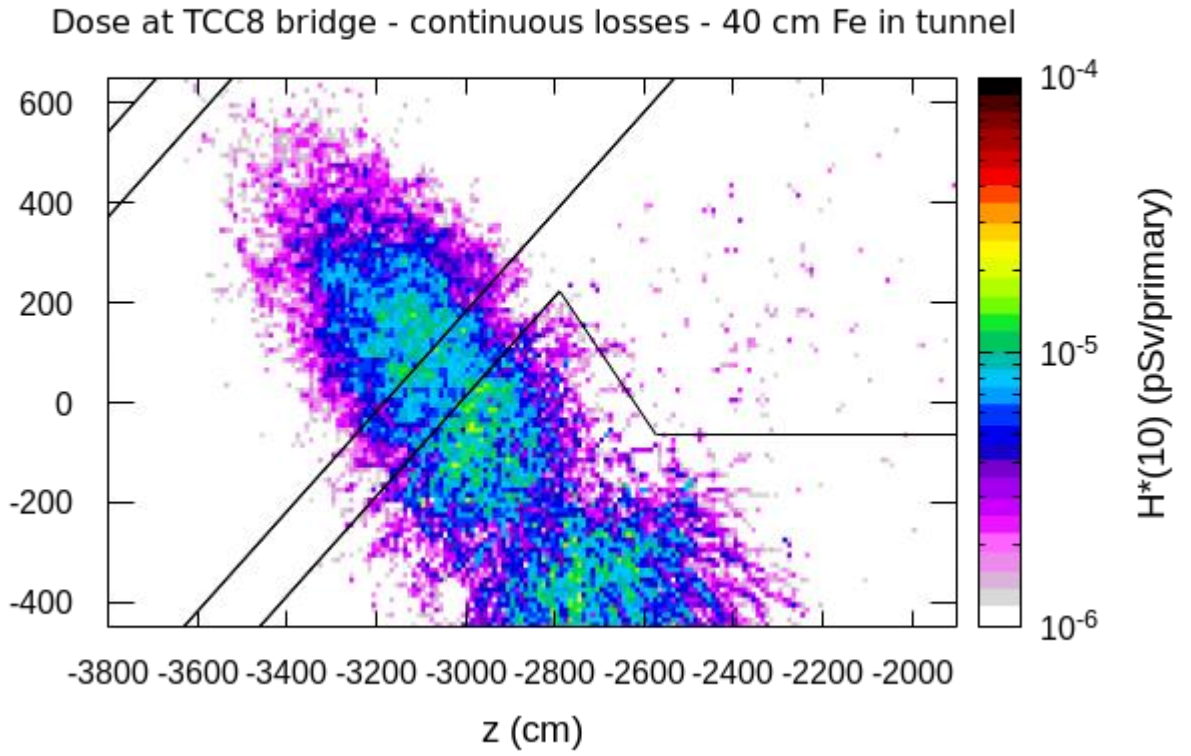




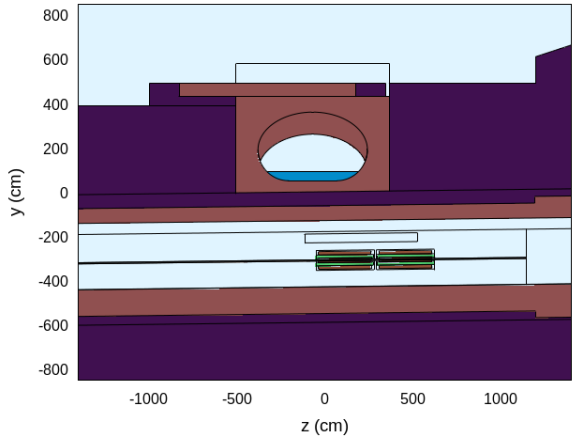
Dose at top of the road – 40 cm Fe

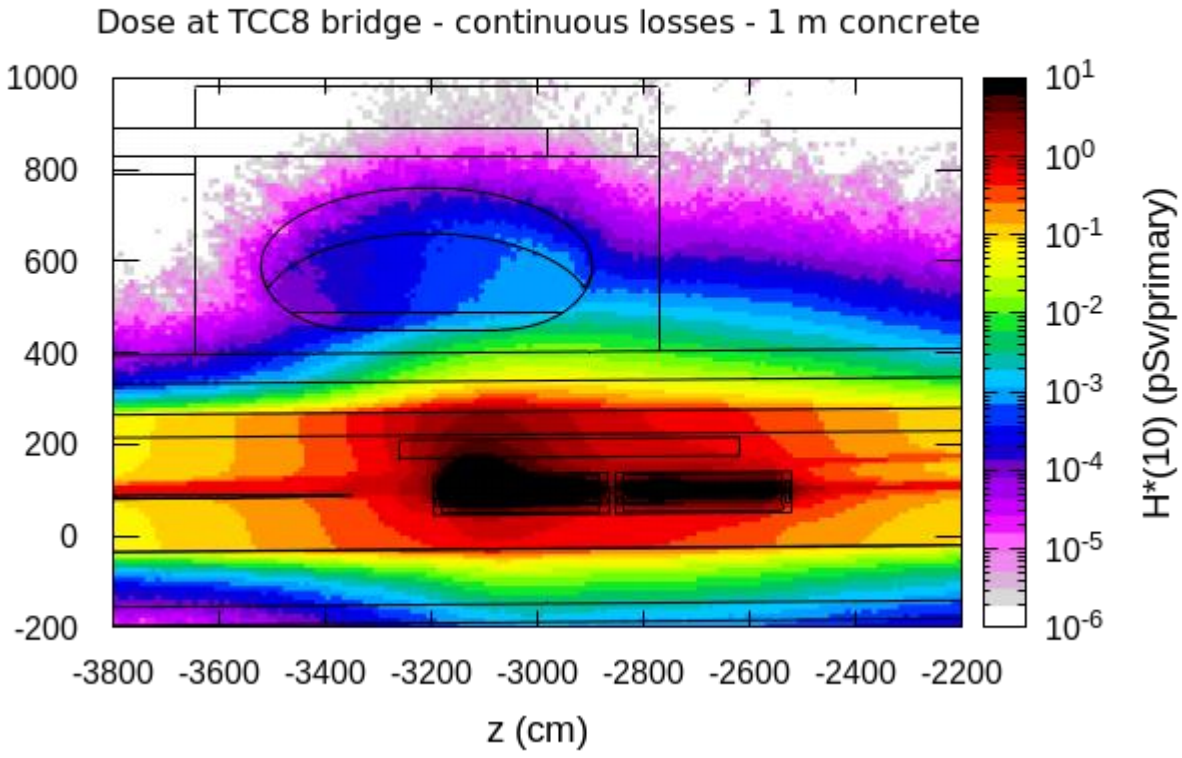


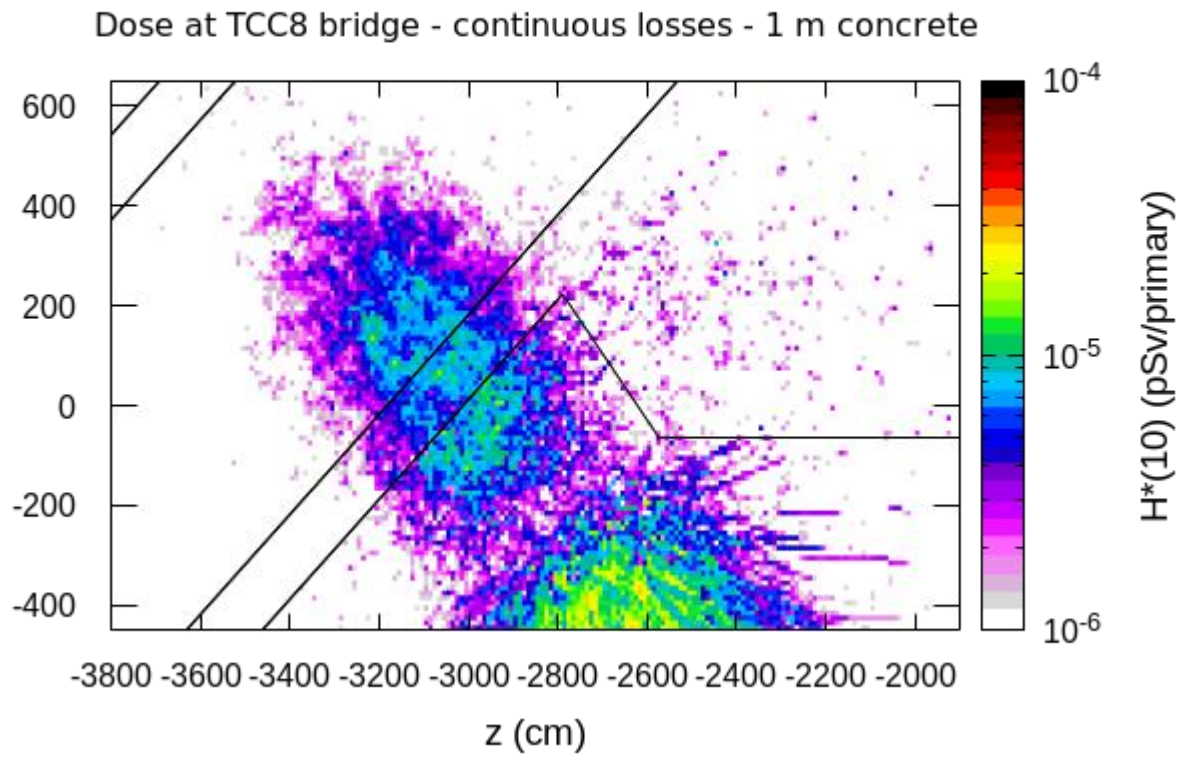




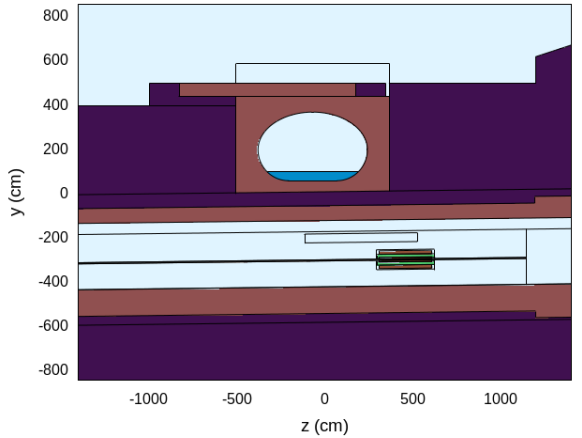
Dose at top of the road - 1 m concrete

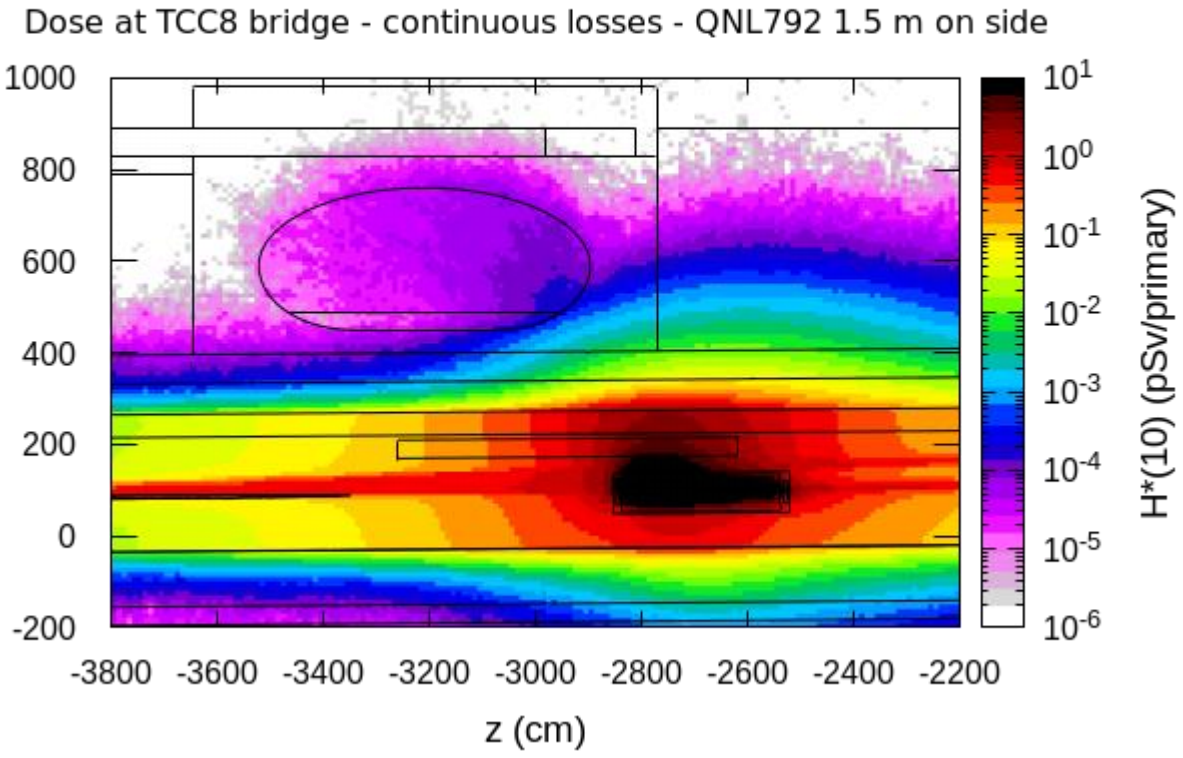


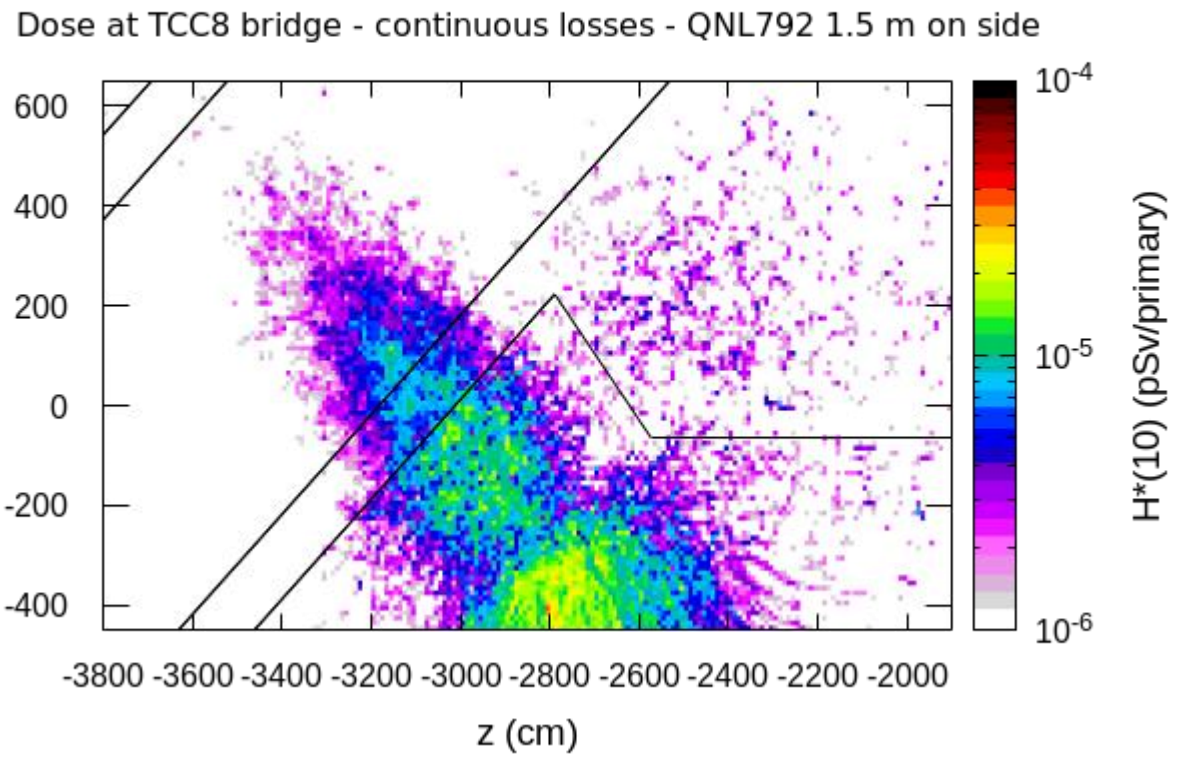




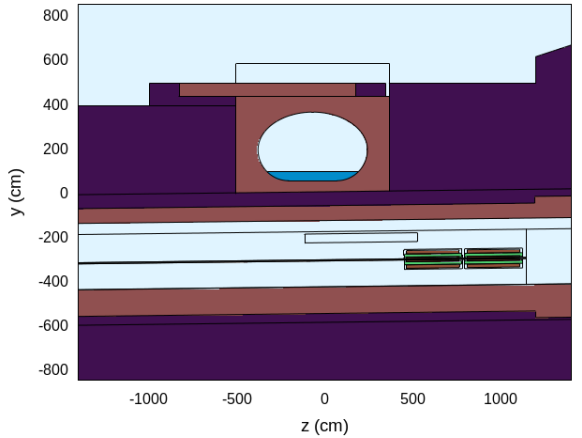
Dose at top of the road – QNL792 moved of 1.5 m on the side

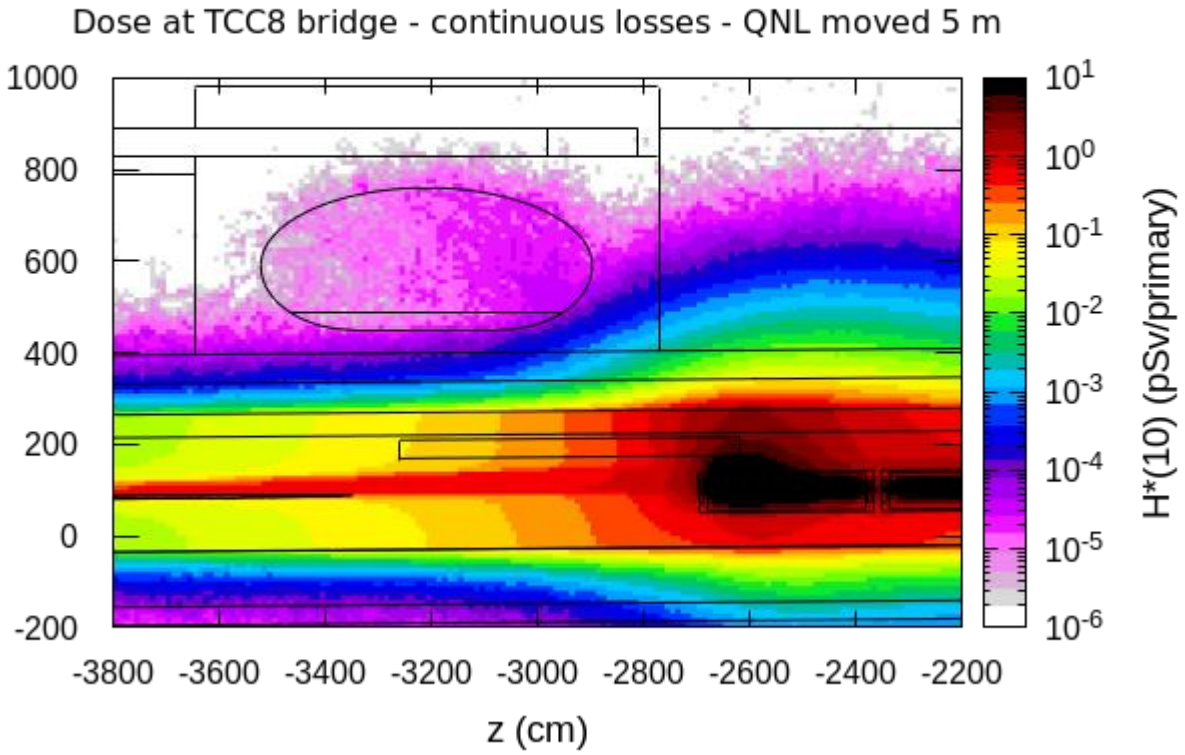


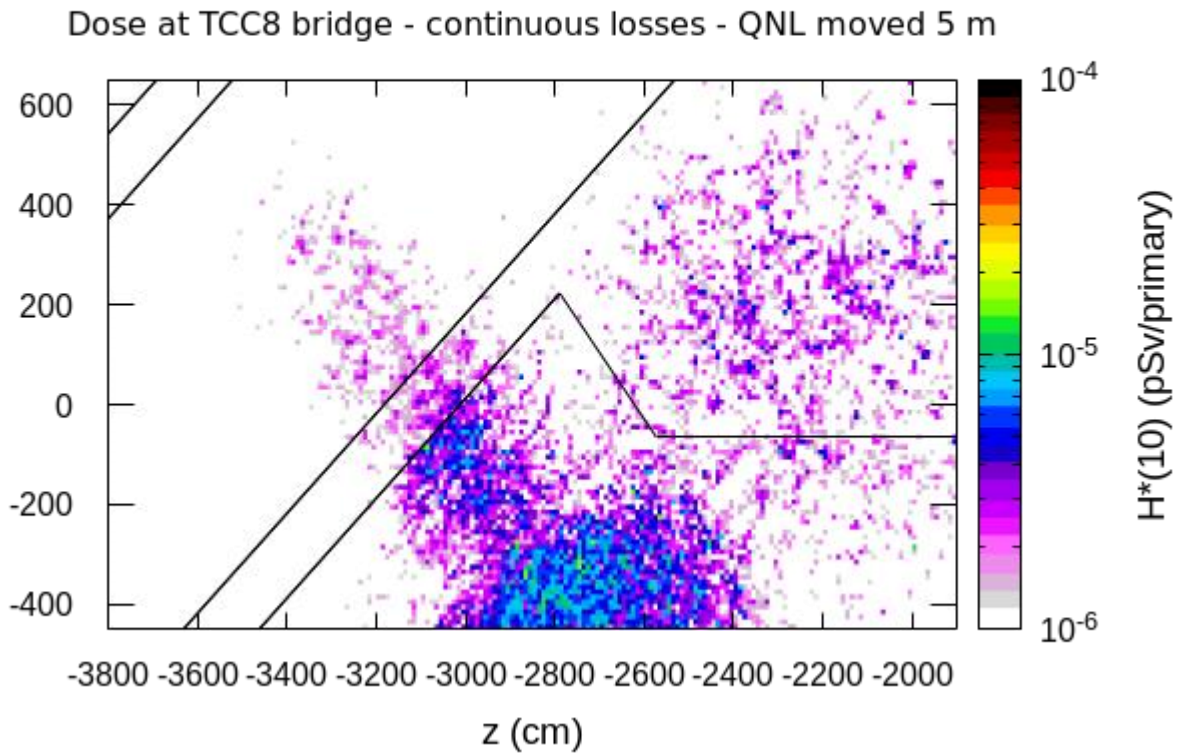




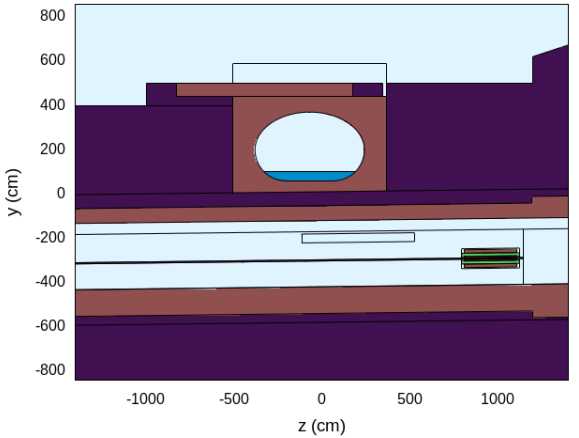
Dose at top of the road - QNL moved of 5 m

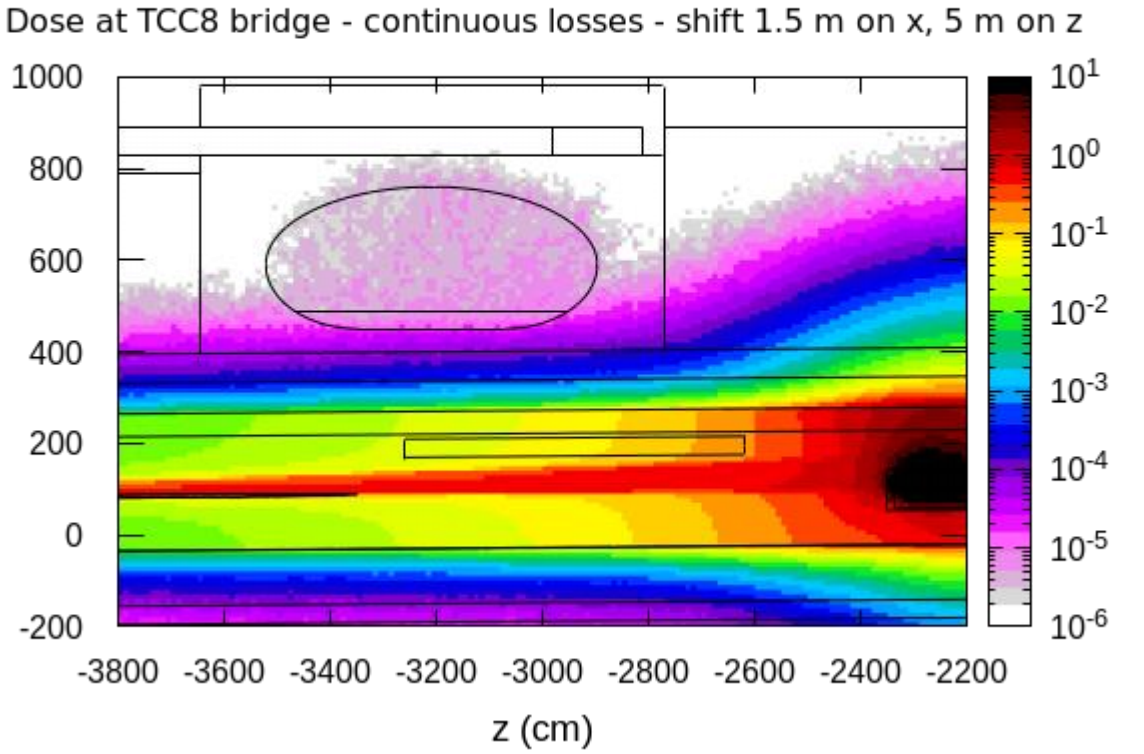


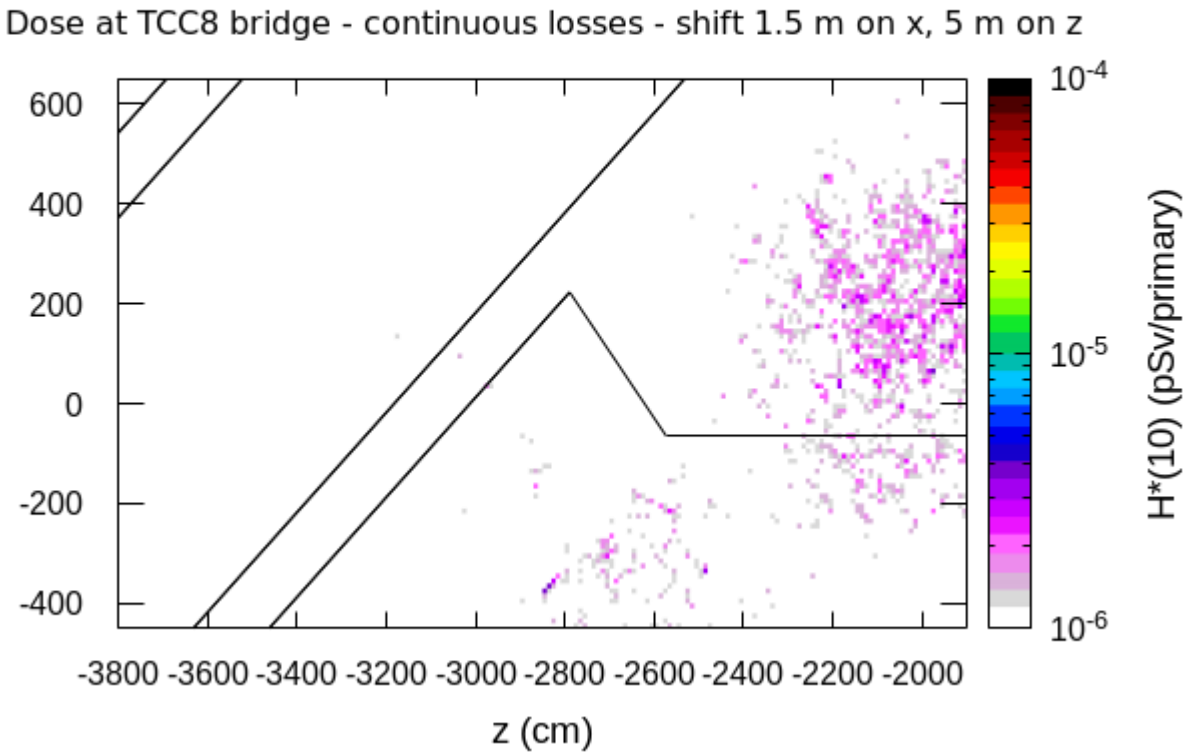




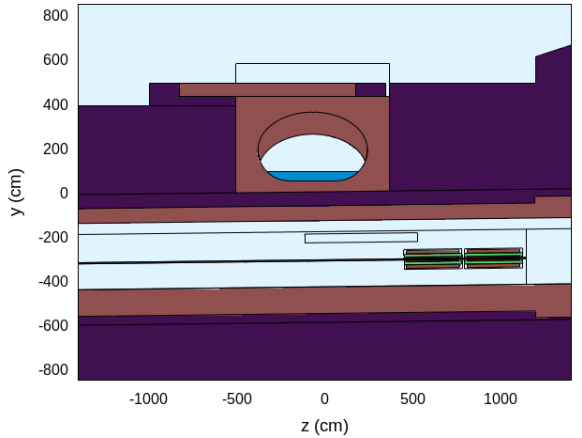
Dose at top of the road – 1.5 m shift on side QNL792 and 5 m shift QNL795

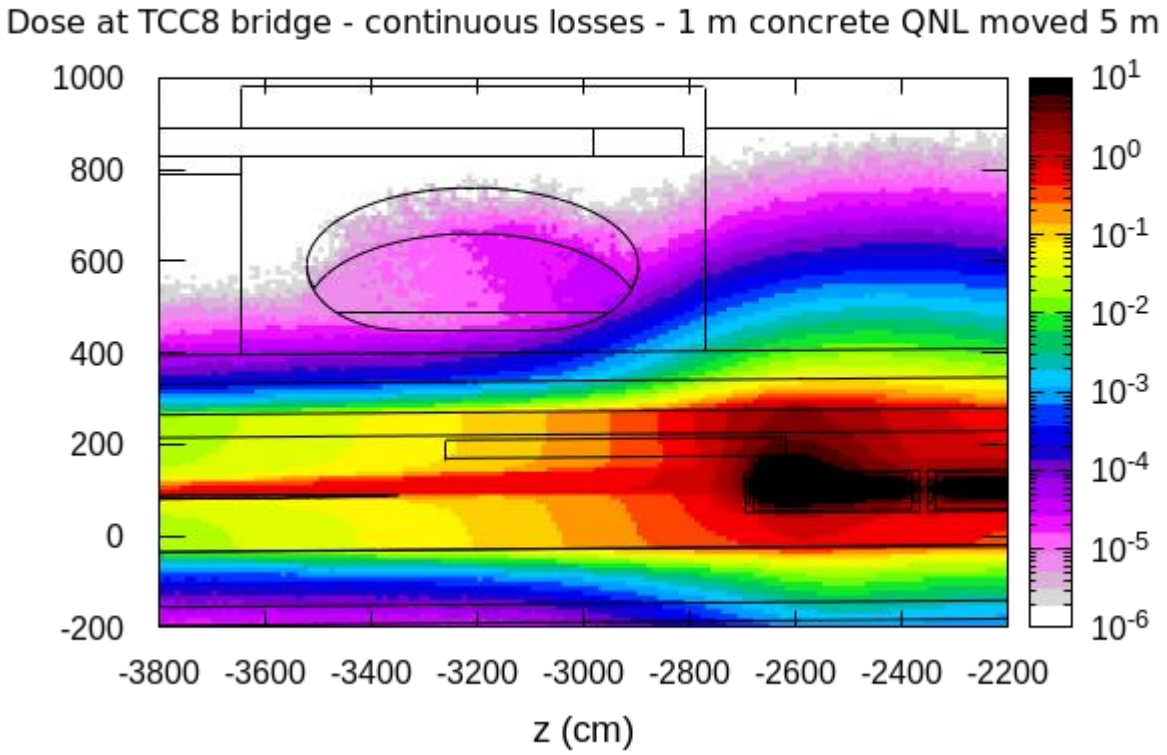


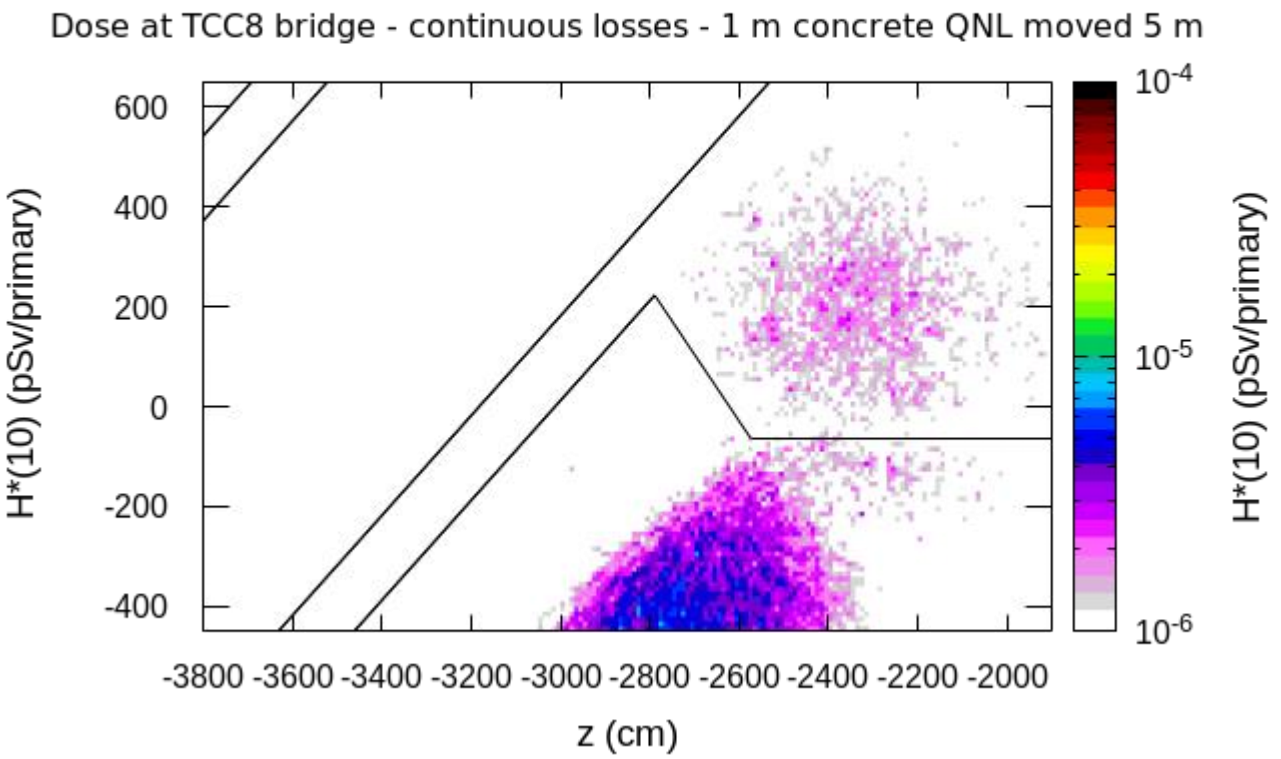




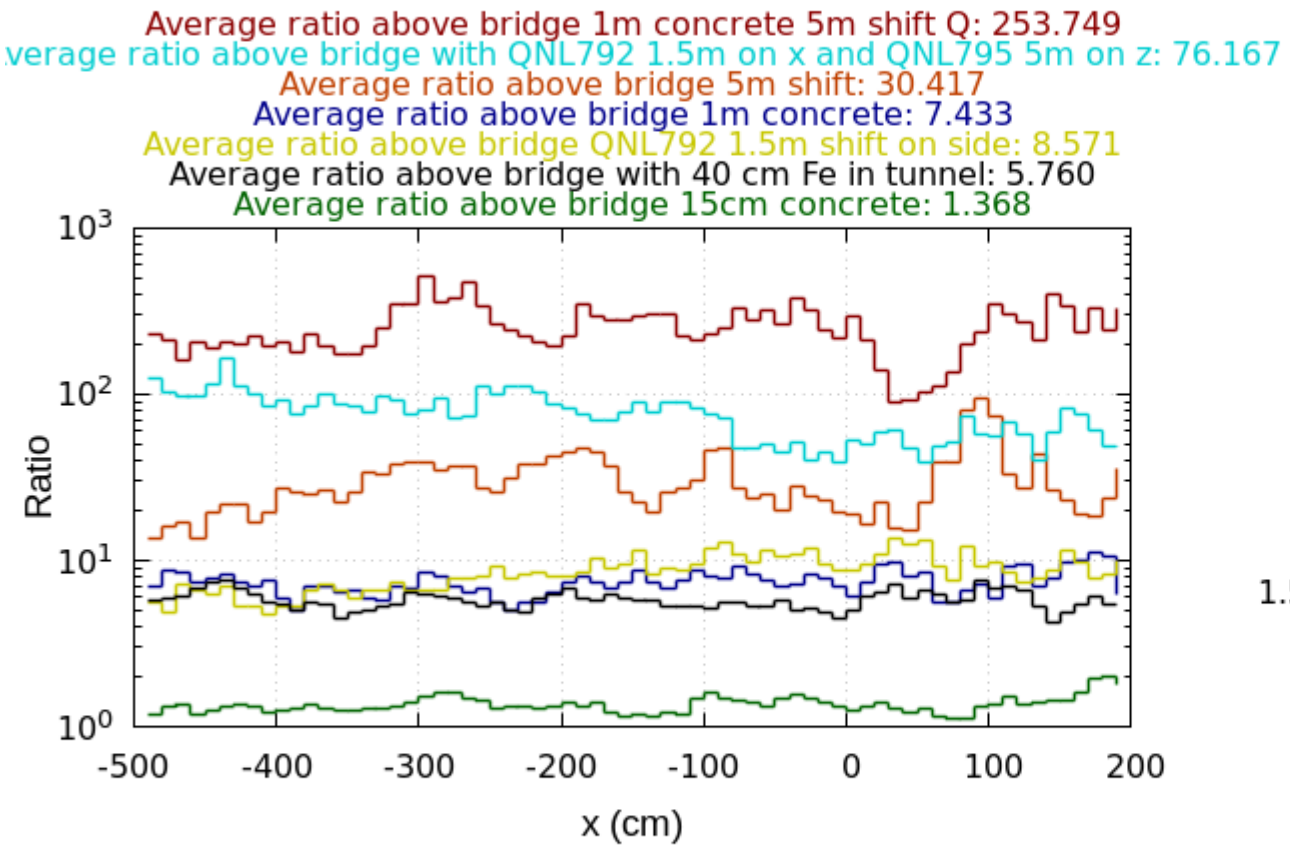
Dose at top of the road - 1 m concrete QNL moved of 5 m

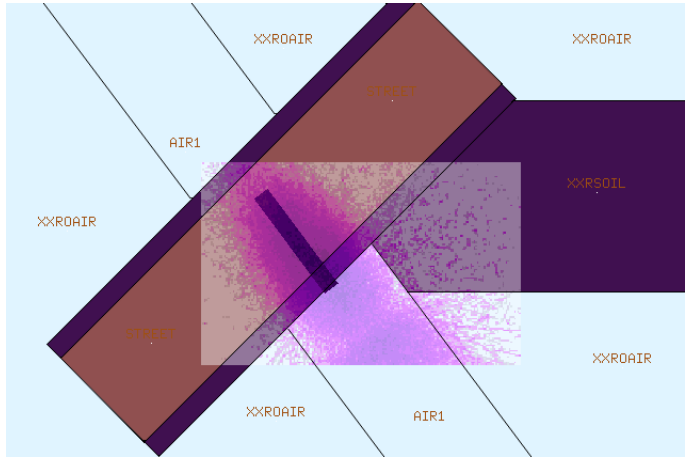






Ratio





Conc 1m - Move 5m QNLs
Move 5m QNLs
Conc 1m
Move 1.5m side QNL792
Conc 15cm
Fe 40cm
1.5m side QNL792 - 5m shift QNL795

Conclusions

- New FLUKA studies were performed for the TCC8 bridge with a refined model and a more realistic source term
- Different scenarios were compared to the current situation:
  - Additional 15 cm of concrete → factor 1.4 reduction
  - Additional 40 cm of iron in the tunnel → factor 5.8 reduction
  - Additional 1 m of concrete → factor 7.4 reduction
  - QNL.792 shifted 1.5 m laterally →factor 8.6 reduction
  - Both magnets shifted 5 m downstream → factor 30.4 reduction
  - QNL.792 shifted 1.5 m laterally and QNL.795 shifted 5 m downstream → factor 76.1 reduction
  - Additional 1 m of concrete + shift of magnets 5 m downstream → factor 253 reduction
- **Shifting the magnets is the most effective mitigation measure**

Next steps

- Possibility to shift the magnets QNL.X0450792 and QNL.X0450795 to be investigated by BE