HSE

Occupational Health & Safety
and Environmental Protection unit

Radiation levels in AEgIS for updated ELENA transfer line

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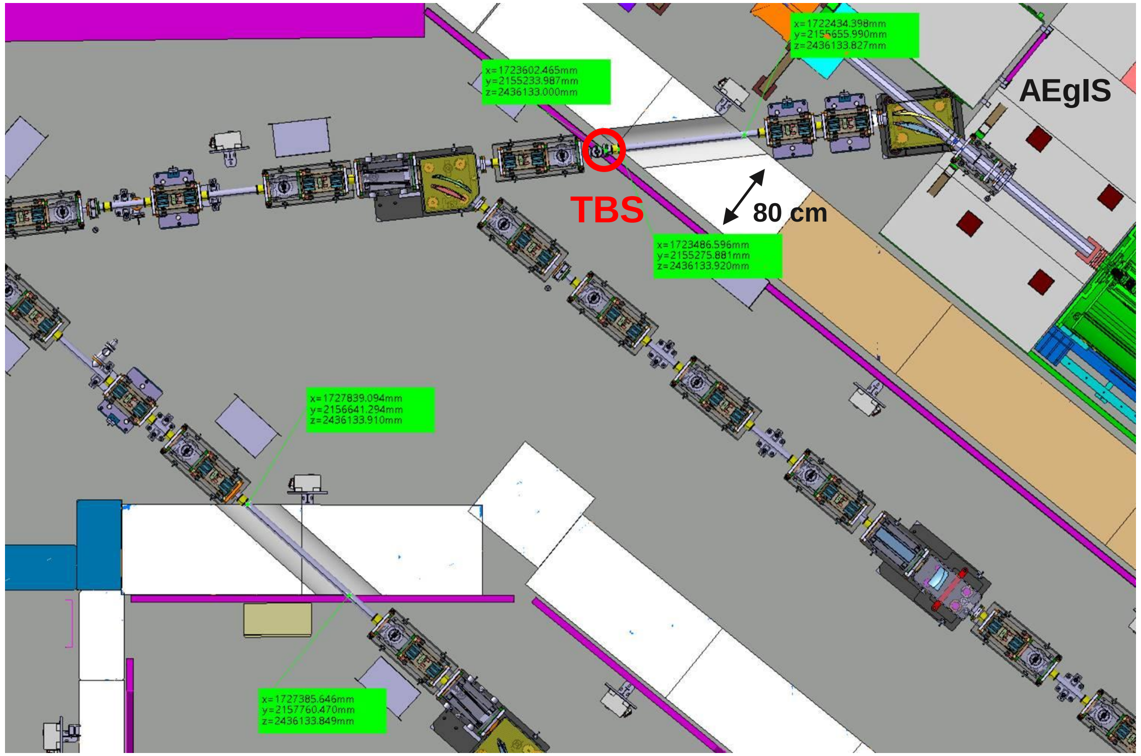
Introduction

- For ELENA transfer lines to experiments, **holes** in **shielding walls** are required for beam pipes passage
  - Holes: 200 mm diameter
  - Beam pipe: 63mm inner diameter – 67mm outer diameter stainless steel
  - Shielding: 800 mm thick concrete
- **Safety elements** (EIS-b) of different transfer lines are either beam stoppers (**TBS**) or Interlocked Power Supplies (**IPS**) (EDMS 1381617)
- All safety elements are at sufficient distance to experimental shielding walls in order to reduce radiation levels passing through hole, except for **AEgIS**, where **TBS** is **located directly before shielding wall**
- AEgIS zone is Supervised Radiation Area with permanent workplace (3 uSv/h limit)
- Radiation levels in the AEgIS zone for different materials filling the hole around the beam pipe were studied

Technical drawing of ELENA-AEgIS transfer line



From F. Butin

FLUKA simulations (EDMS 2172436)

Cases considered

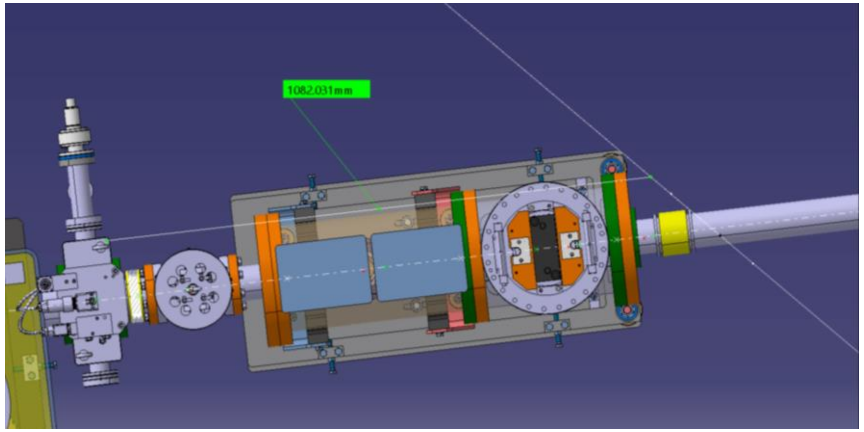
- 5e5 pbar / s average intensity (very conservative to assume nominal intensity to be continuously lost on the beam stopper as it is an **incident case** → but is there any system to stop it and if so how quickly? No RP monitor in AEgIS to detect such losses on the beam stopper)
- Beam stopper position:
  - Directly in front of shielding wall (no shift)
  - 70 cm upstream of shielding wall (before ZQNA)
- 80 cm shielding wall
- Beamline inclination:
  - No inclination
  - 42° inclination (estimated via drawing)
- Shielding around beam pipe:
  - No shielding (air)
  - Sand (1.6 g/cm3)
  - Stainless steel 316L (8.03 g/cm3)

Conclusions

- A permanent beam loss (very conservative assumption) on the beam stopper would lead to a maximum (no filling) of 15 uSv/h in a working position
- In that case, sand and stainless steel filling would reduce the dose rates to ~10 uSv/h and ~5 uSv/h, respectively
- A further beam stopper shift by 70 cm would bring it further down to below 3 uSv/h

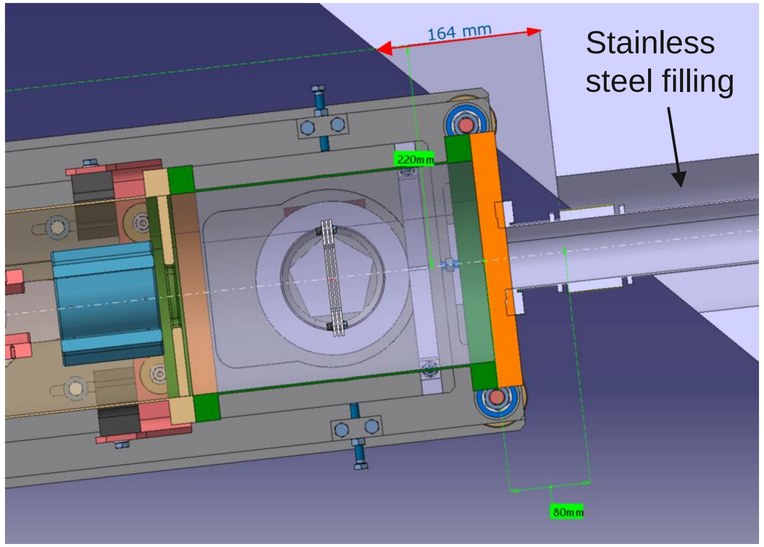
Updated transfer line setup (EDMS 2265799)

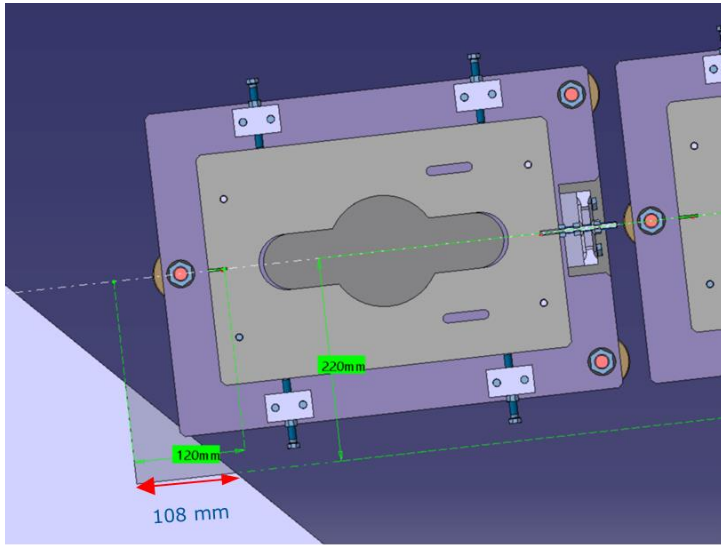
Beam stopper shifted further upstream:



- Beam stopper blade located 98.2 cm upstream of the shielding wall (before ZQNA)

Cut-outs in shielding wall for beam-line equipment:





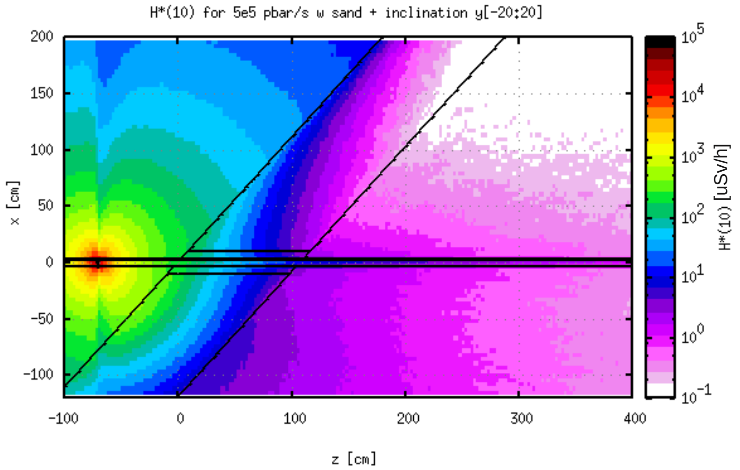
- For the updated simulations, cut-outs of 16.4x17.7x100cm^3 were conservatively assumed on both sides

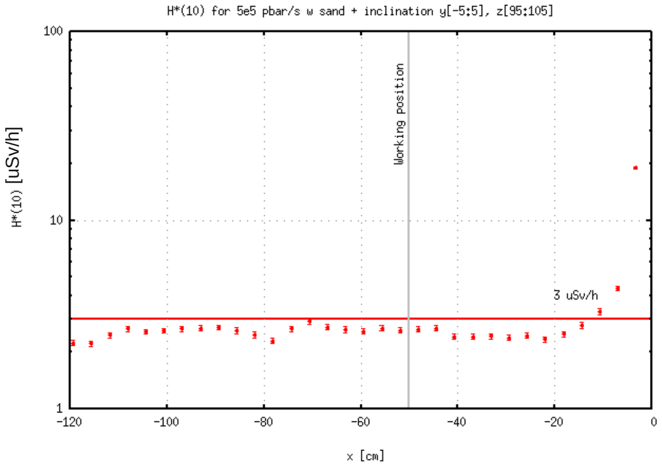
- Average beam intensity, stainless steel shielding around the beam pipe and beam-line inclination as given on the previous slide were furthermore assumed for the updated simulations

Results

Former results

(EDMS 2172436) with sand and 70 cm distance

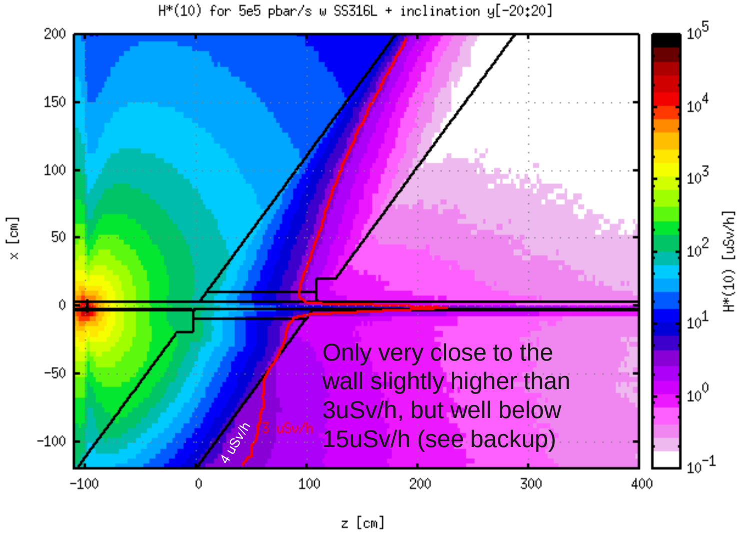


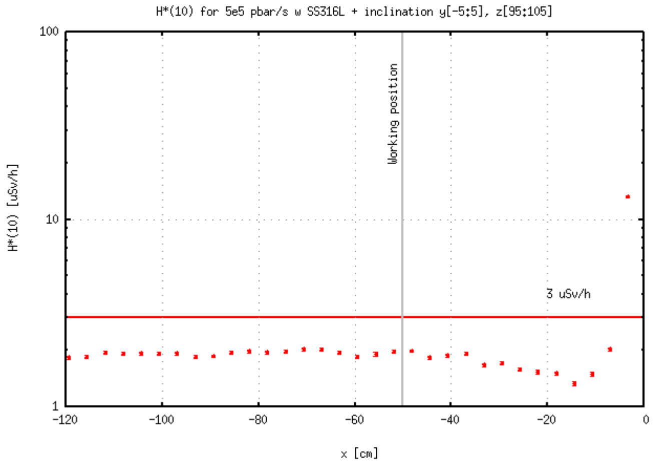


- Main contribution from wall itself
- <3 uSv/h at working position (50 cm distance beam pipe, ~40 cm from wall)
- Beam line equipment will further reduce dose rates

New results

with stainless steel, cut-outs and 98.2 cm distance





- Still main contribution from wall itself
- Cut-outs ok
- Even lower dose rates wrt. former simulations due to larger distance
- Beam line equipment will further reduce dose rates

Summary and conclusions

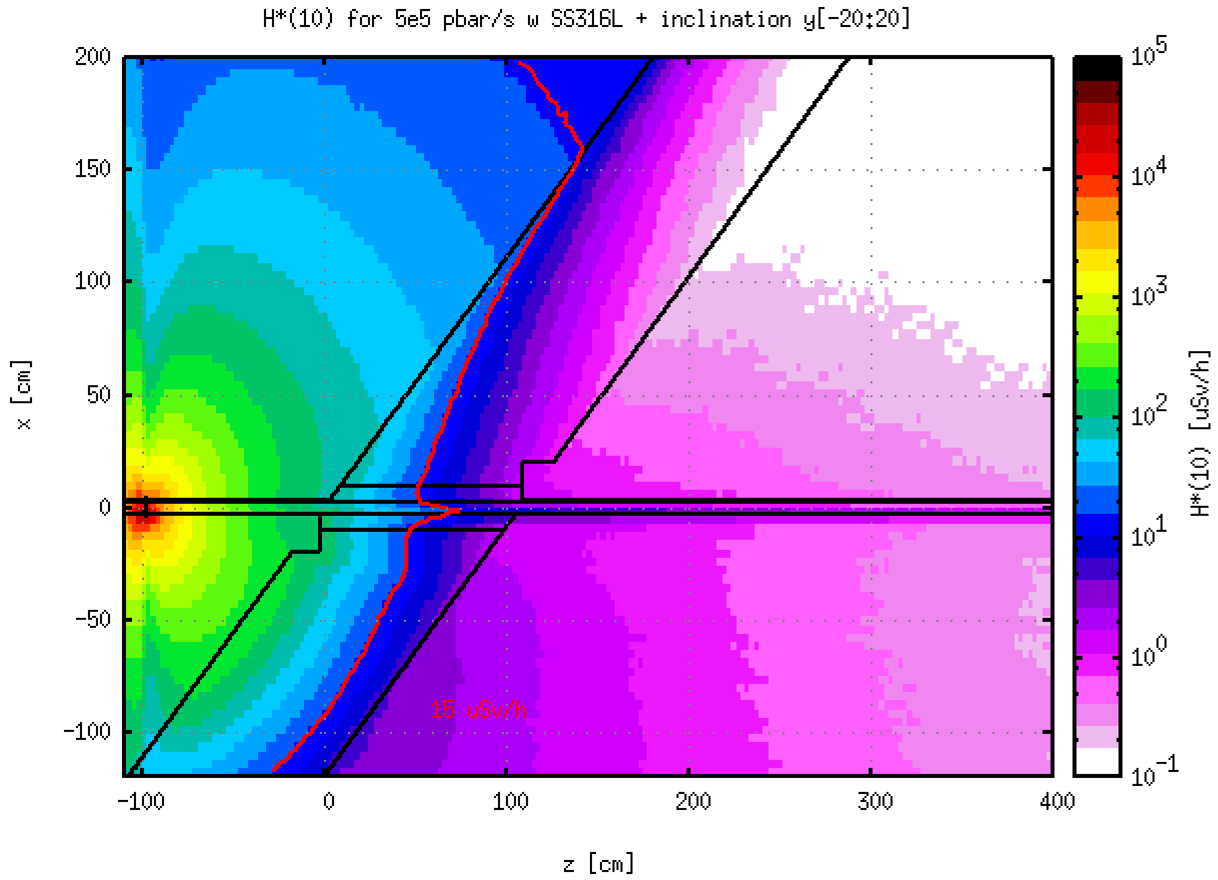
- Radiation levels in the AEgIS zone were studied for the updated transfer line setup (2265799)
- The new setup includes a distance of 98 cm distance to the shielding wall, cut-outs of the shielding wall for beam-line elements and stainless steel shielding around in the beam-pipe within the shielding wall
- A permanent beam loss (very conservative assumption) on the beam stopper would lead to less than 3 uSv/h for working positions in the AEgIS zone and is thus in compliance with the area classification

Backup slides

Results

New results

with stainless steel, cut-outs and 98.2 cm distance



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