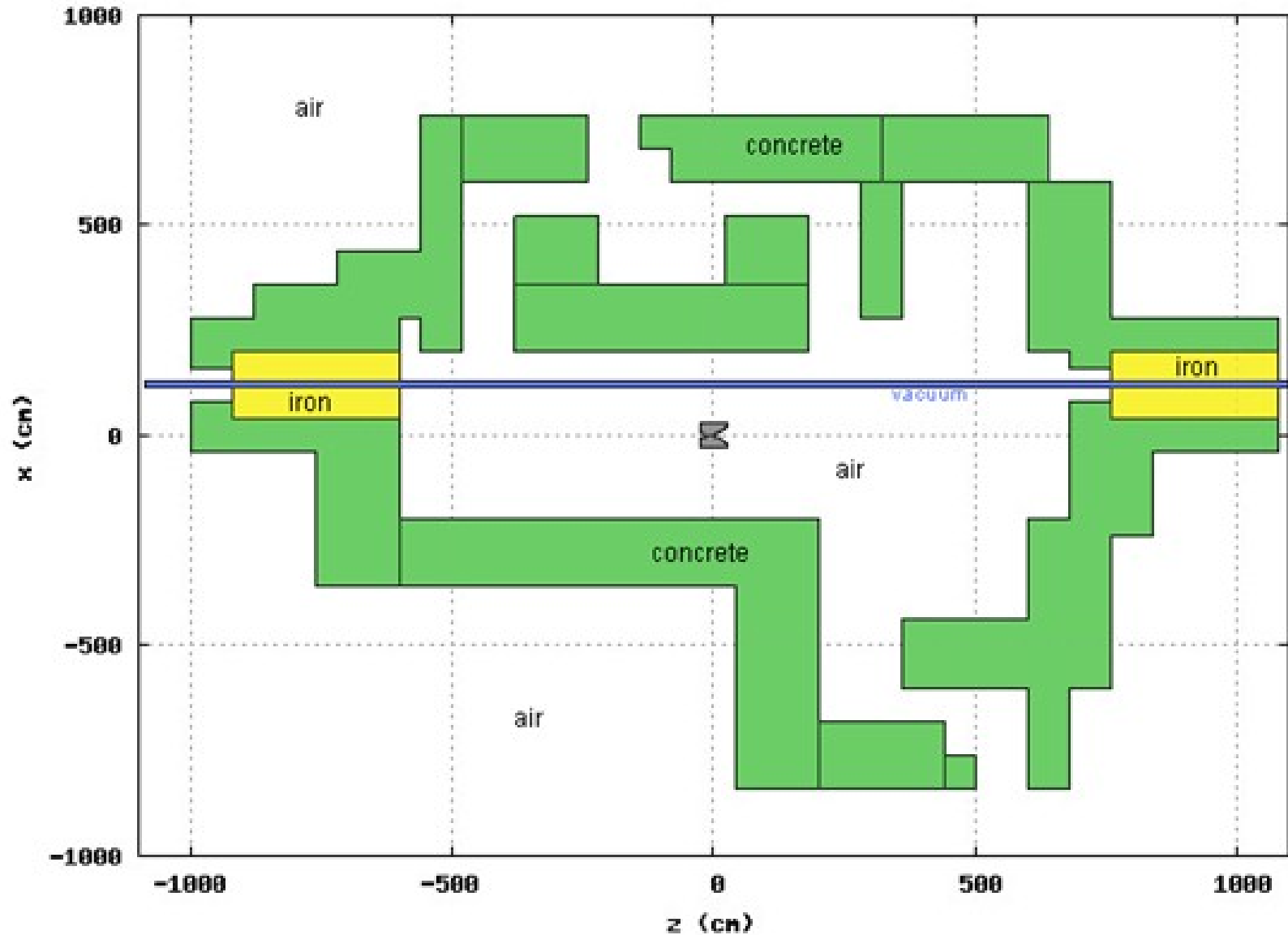


# Studies for GIF++

*30. 11. 2010*

# GIF++ Geometry

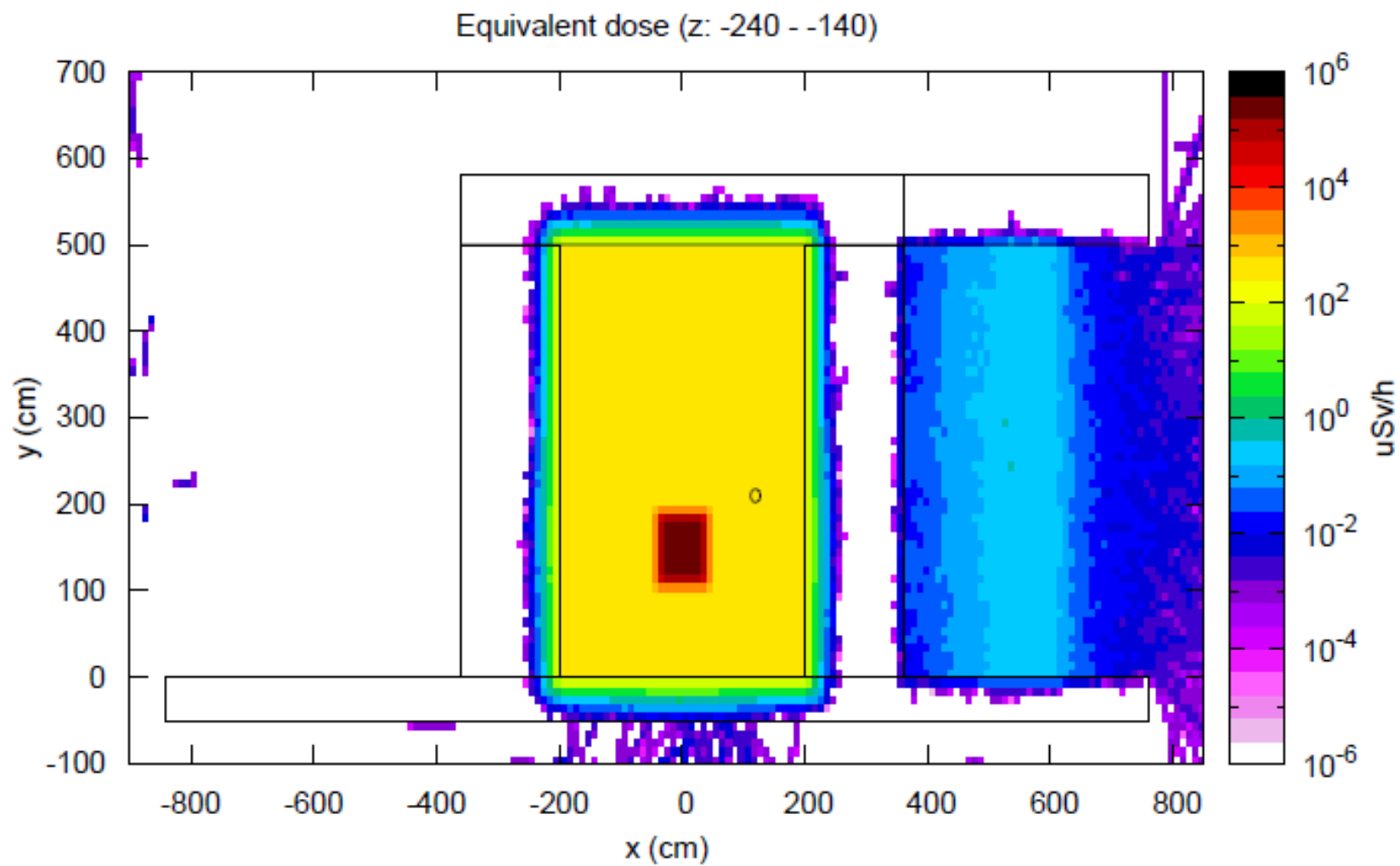


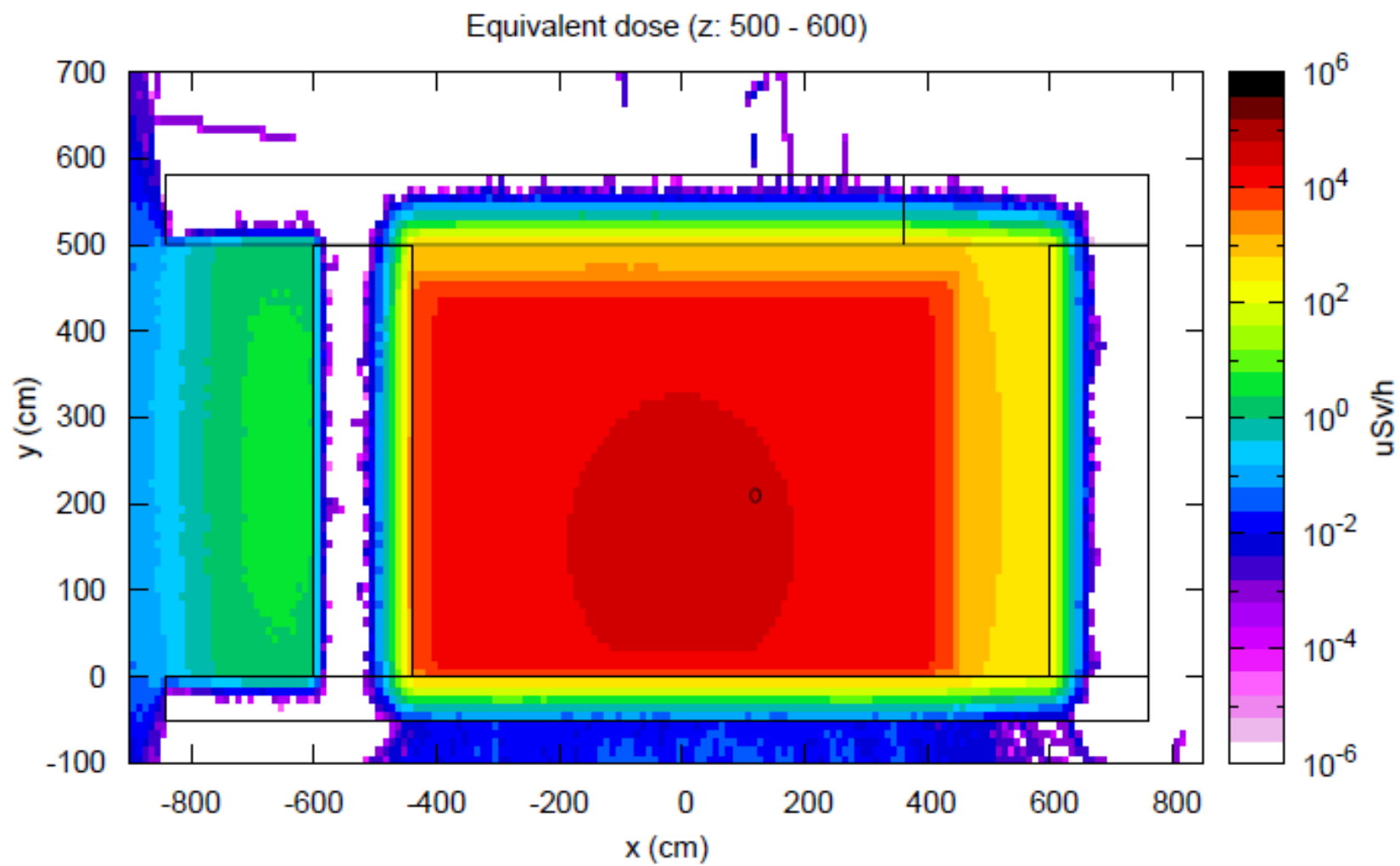
# Simulation specification

- Gamma source: 10TBq  $^{137}\text{Cs}$  (662 keV, 85% emission probability)
- Irradiator: lead box with two windows
  - Left squared  $20^\circ \cdot 20^\circ$
  - Right rectangular  $74^\circ$  (horizontal)  $\cdot$   $42^\circ$  (vertical:  $28^\circ$  upward +  $14^\circ$  downward)
- 160 cm thick concrete shielding
- 80 cm thick concrete roof

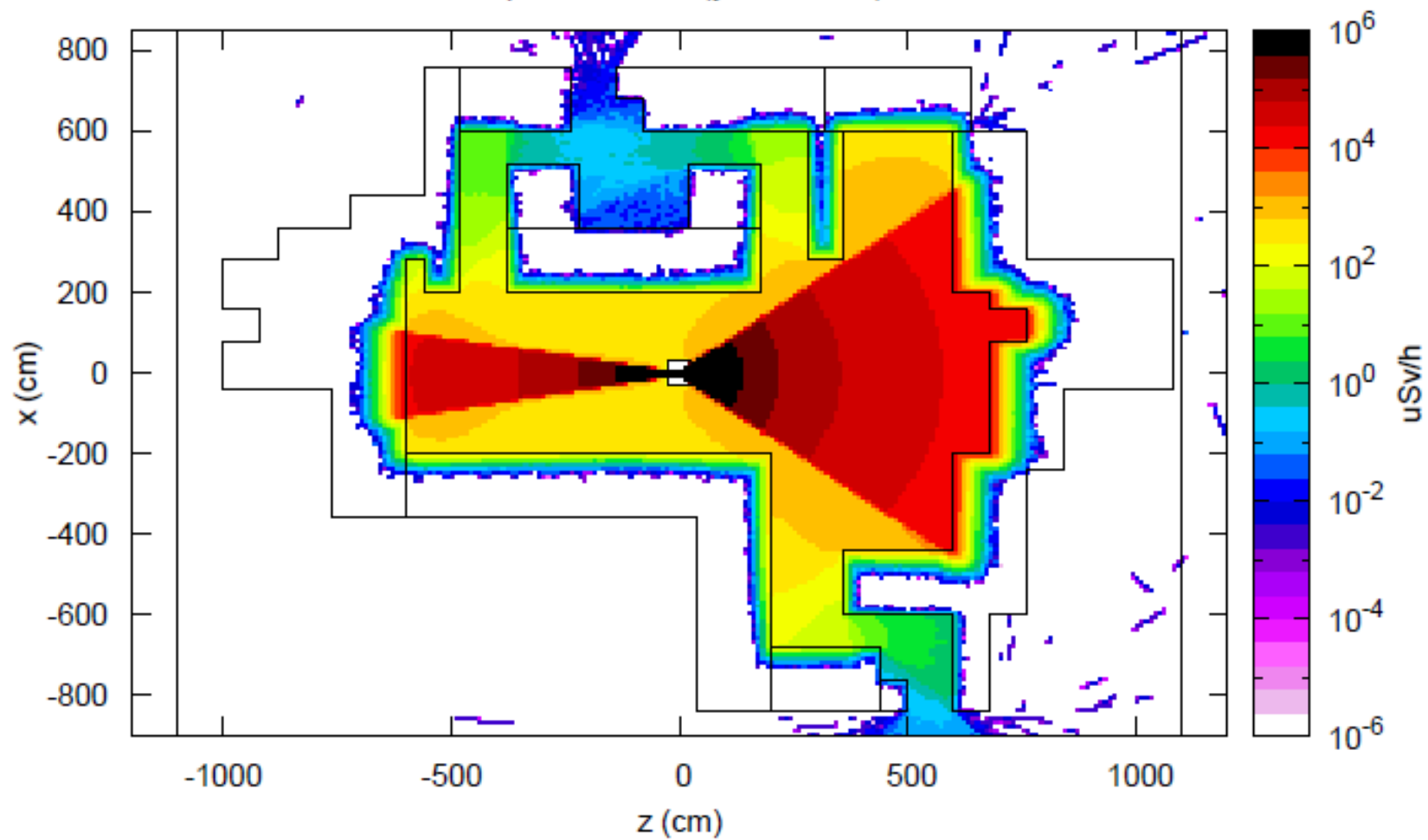
# Simulation tasks

- Prompt dose
- Photon current
- Radiation uniformity

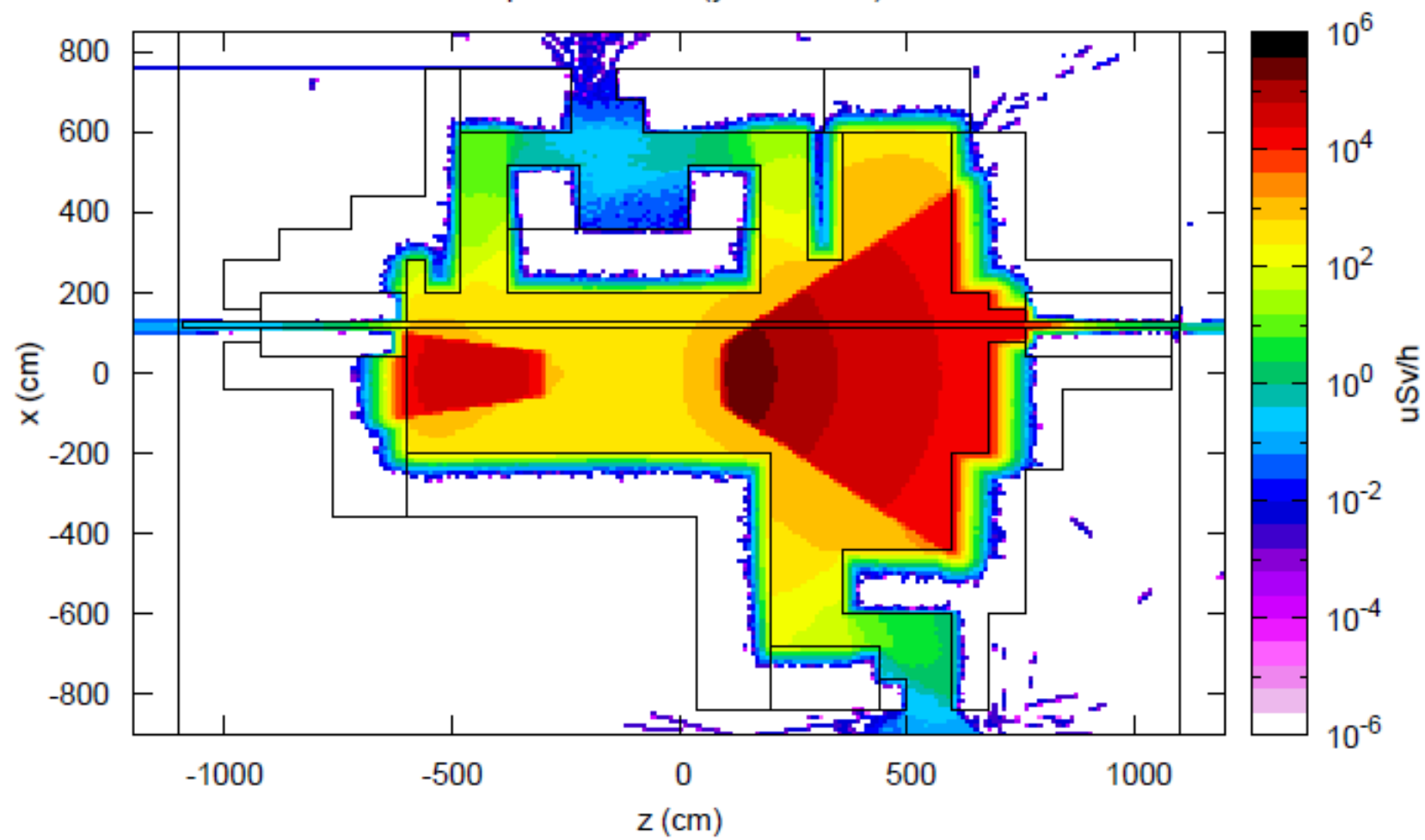




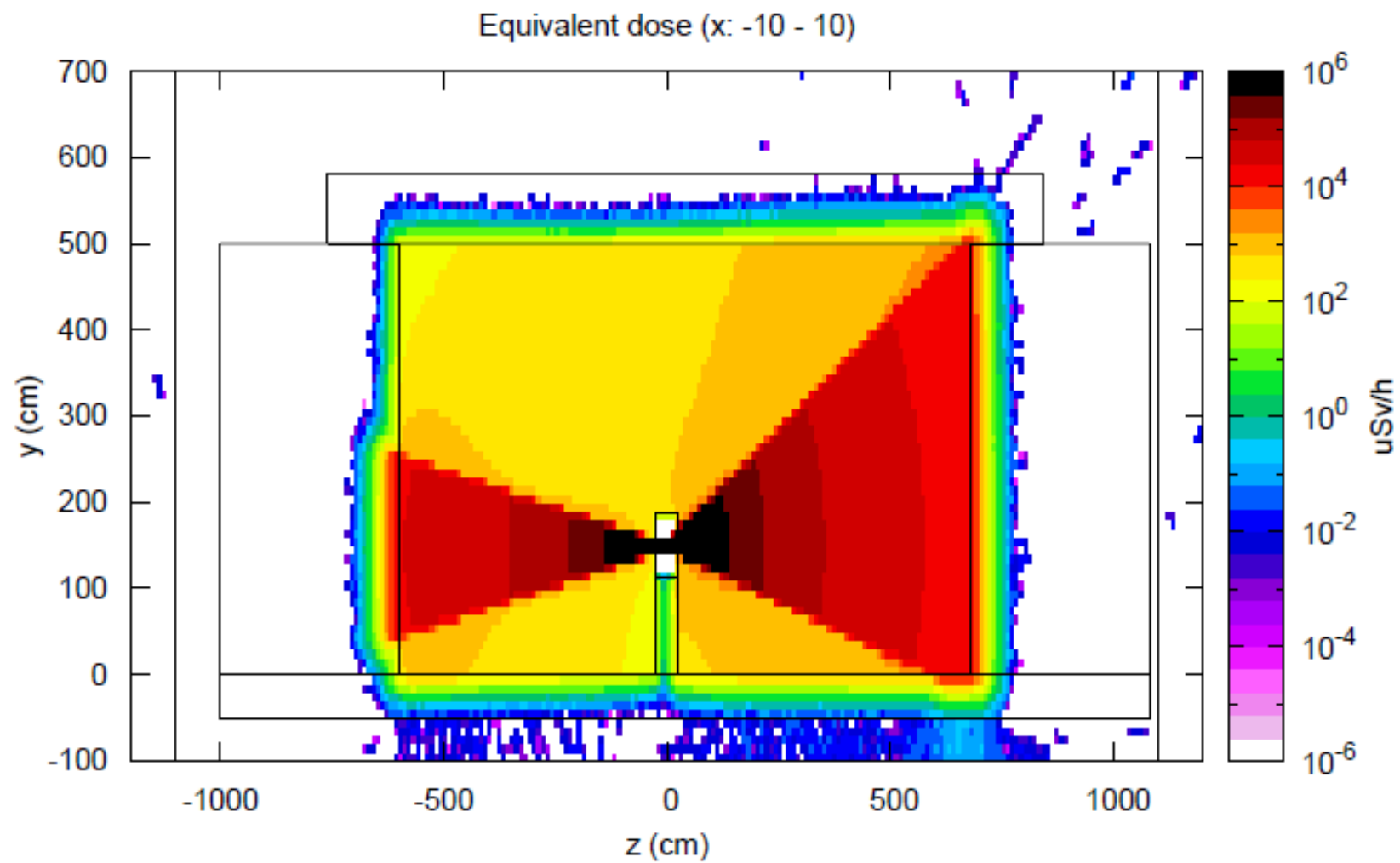
Equivalent dose (y: 140 - 160)

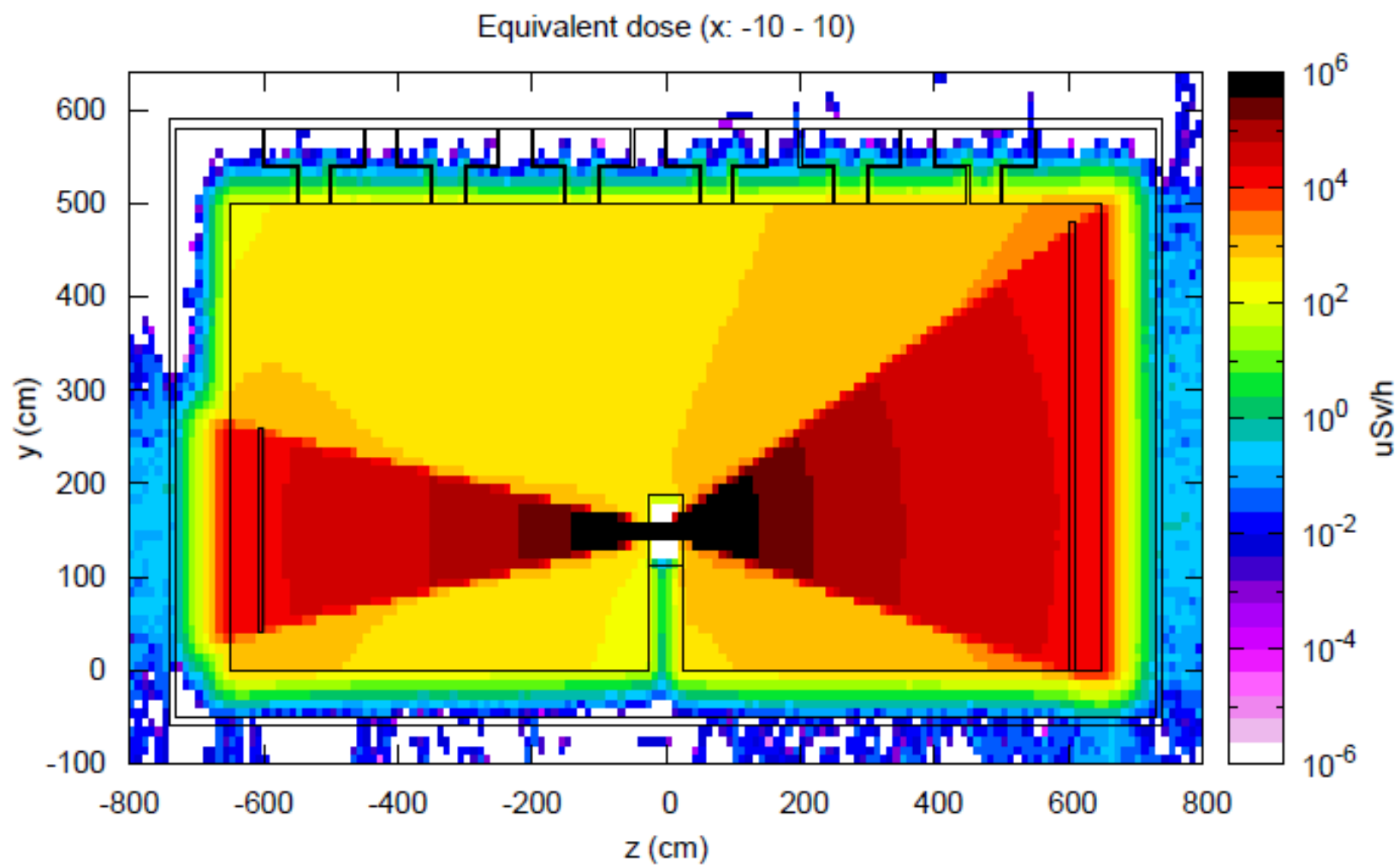


Equivalent dose (y: 200 - 220)

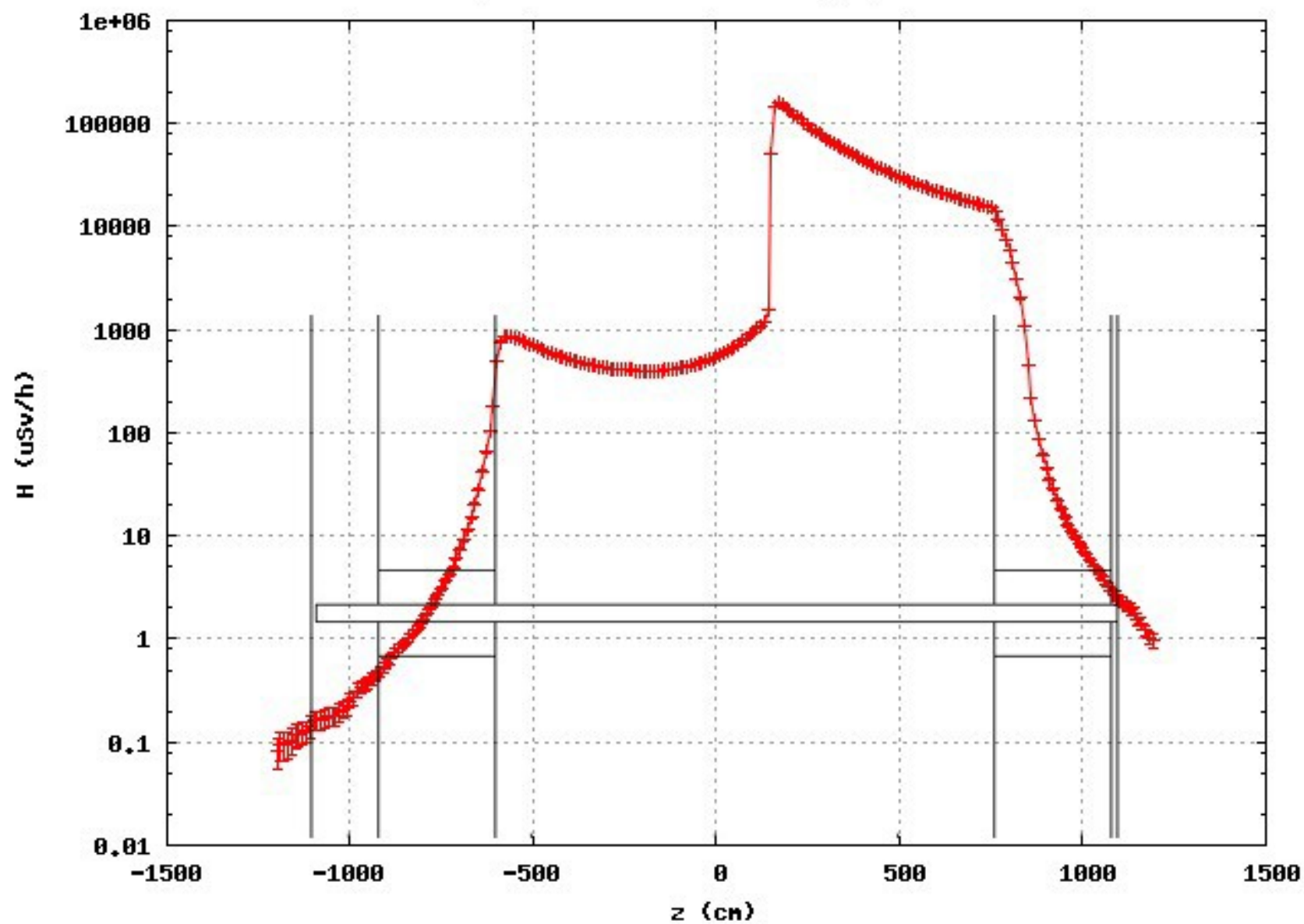


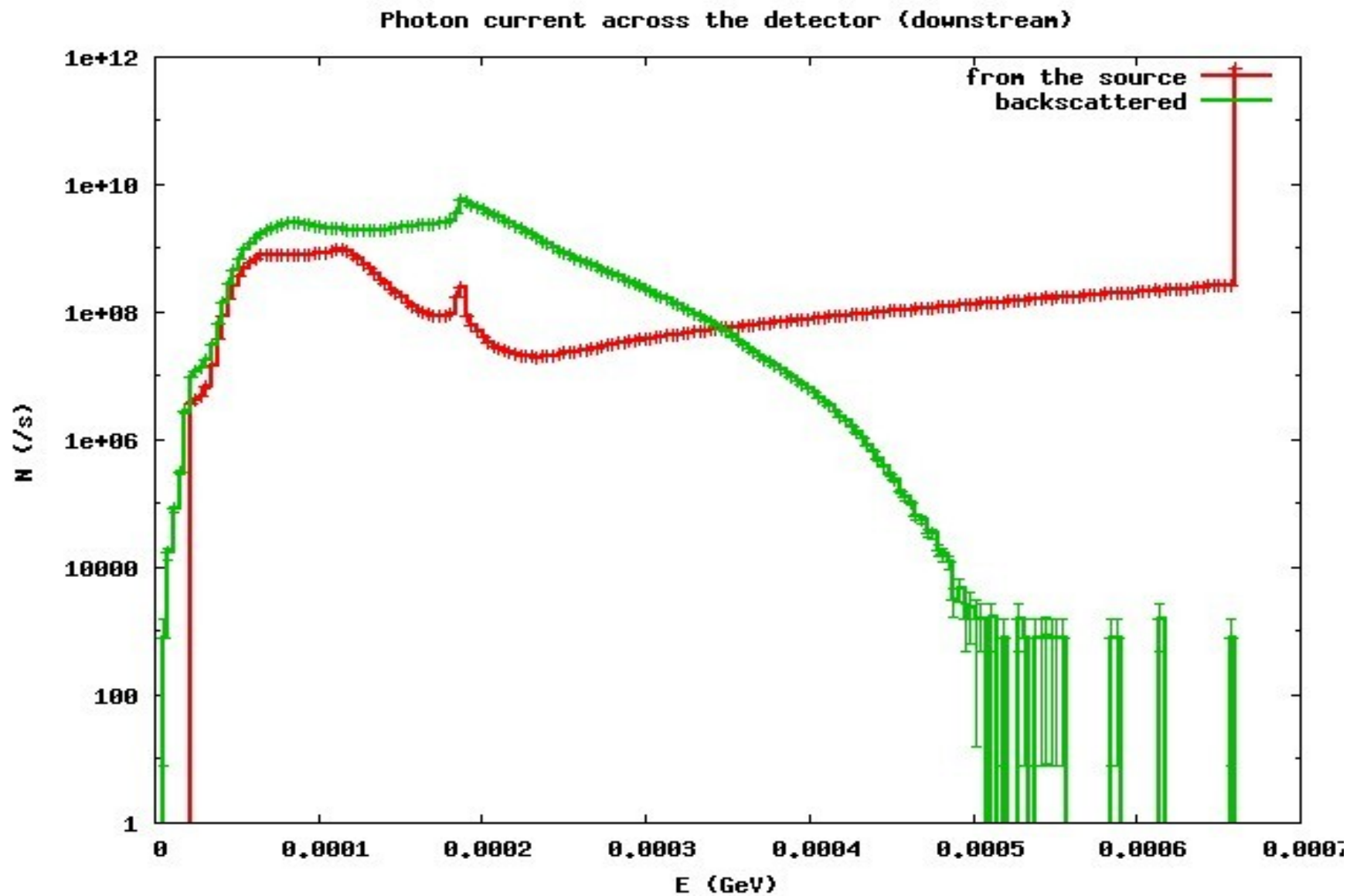






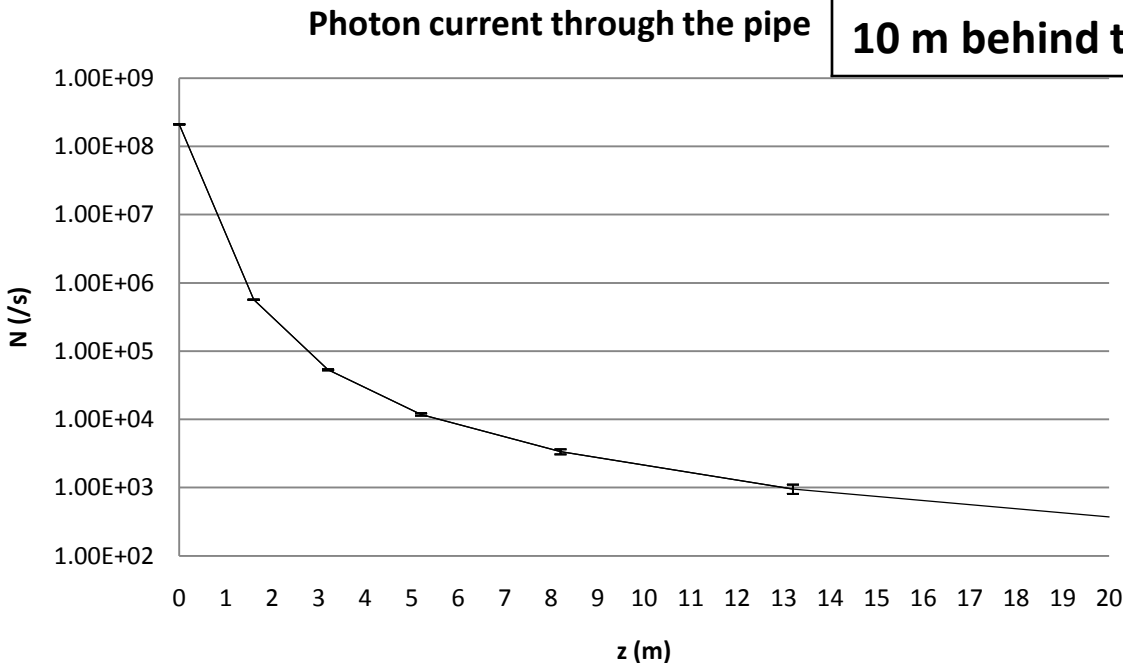
Equivalent dose rate along pipe axis





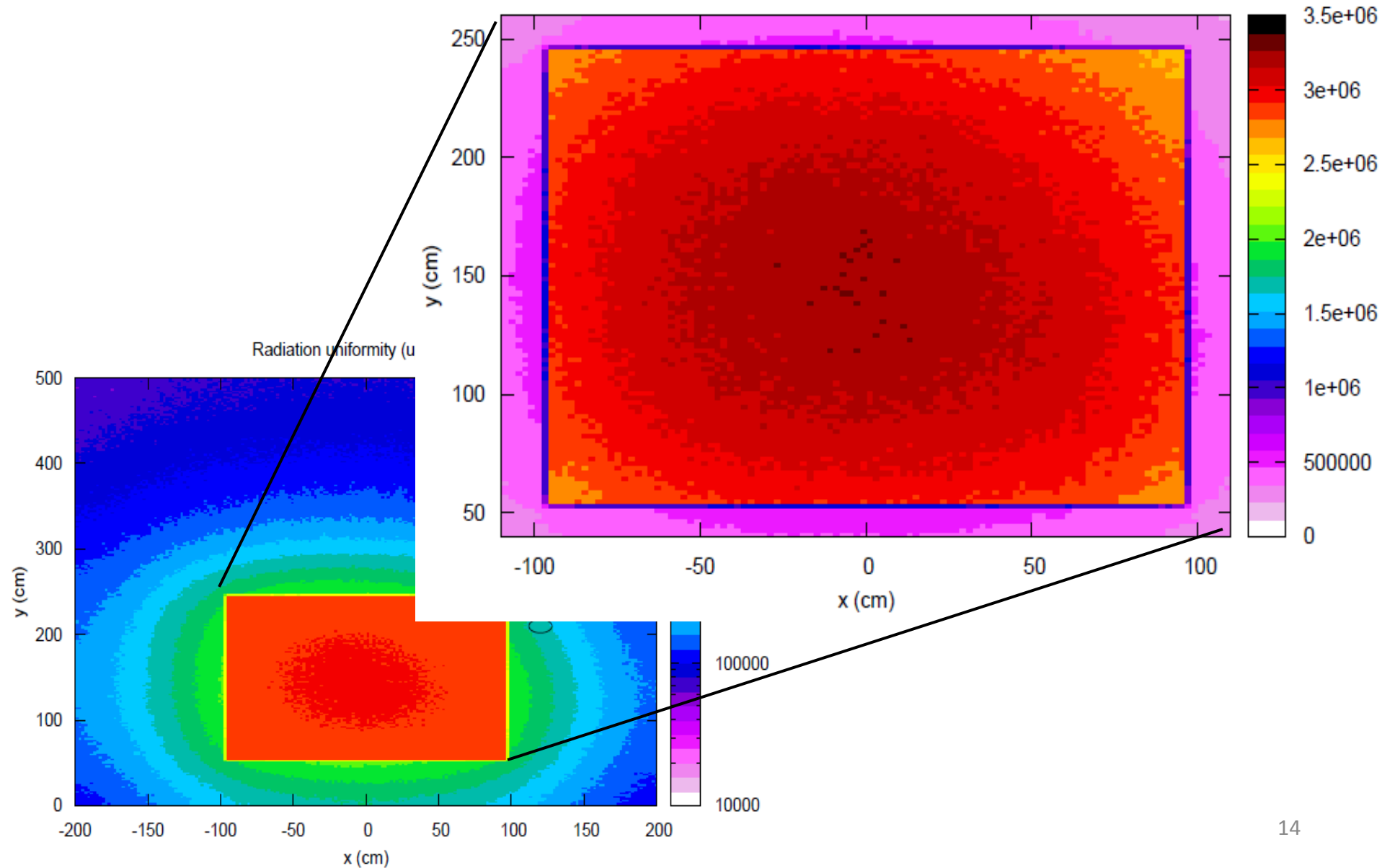
# Photon current through the beam-pipe

Position	N (s <sup>-1</sup> )
<b>Beginning of the shielding</b>	$2.5 \cdot 10^8$ ( $\pm 0.03$ %)
<b>Middle of the shielding</b>	$6.7 \cdot 10^5$ ( $\pm 0.6$ %)
<b>Out from the shielding</b>	$6.3 \cdot 10^4$ ( $\pm 2$ %)
<b>2 m behind the shielding</b>	$1.4 \cdot 10^4$ ( $\pm 4$ %)
<b>5 m behind the shielding</b>	$4.0 \cdot 10^3$ ( $\pm 9$ %)
<b>10 m behind the shielding</b>	$1.1 \cdot 10^3$ ( $\pm 16$ %)

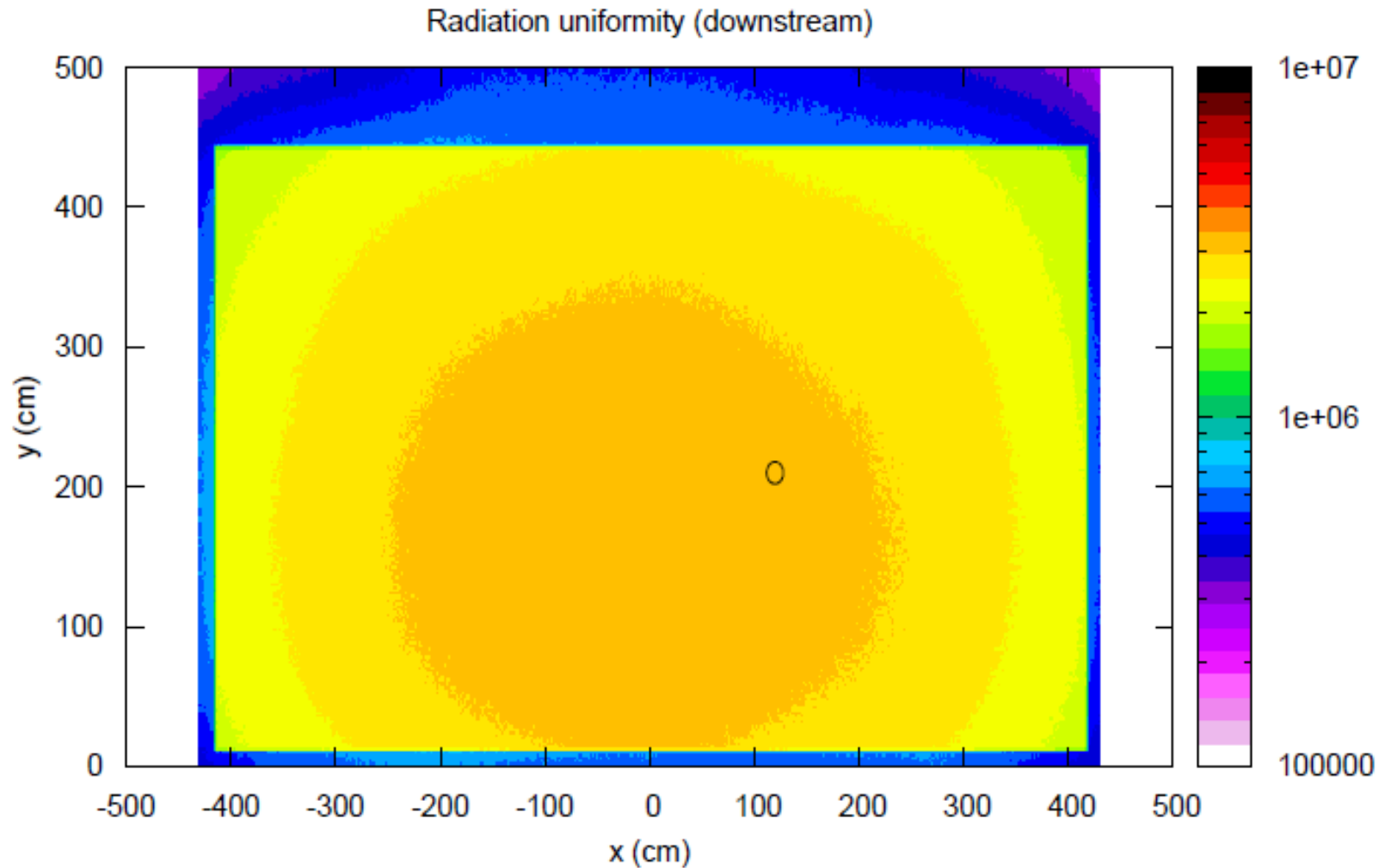


# Field uniformity - photon fluence

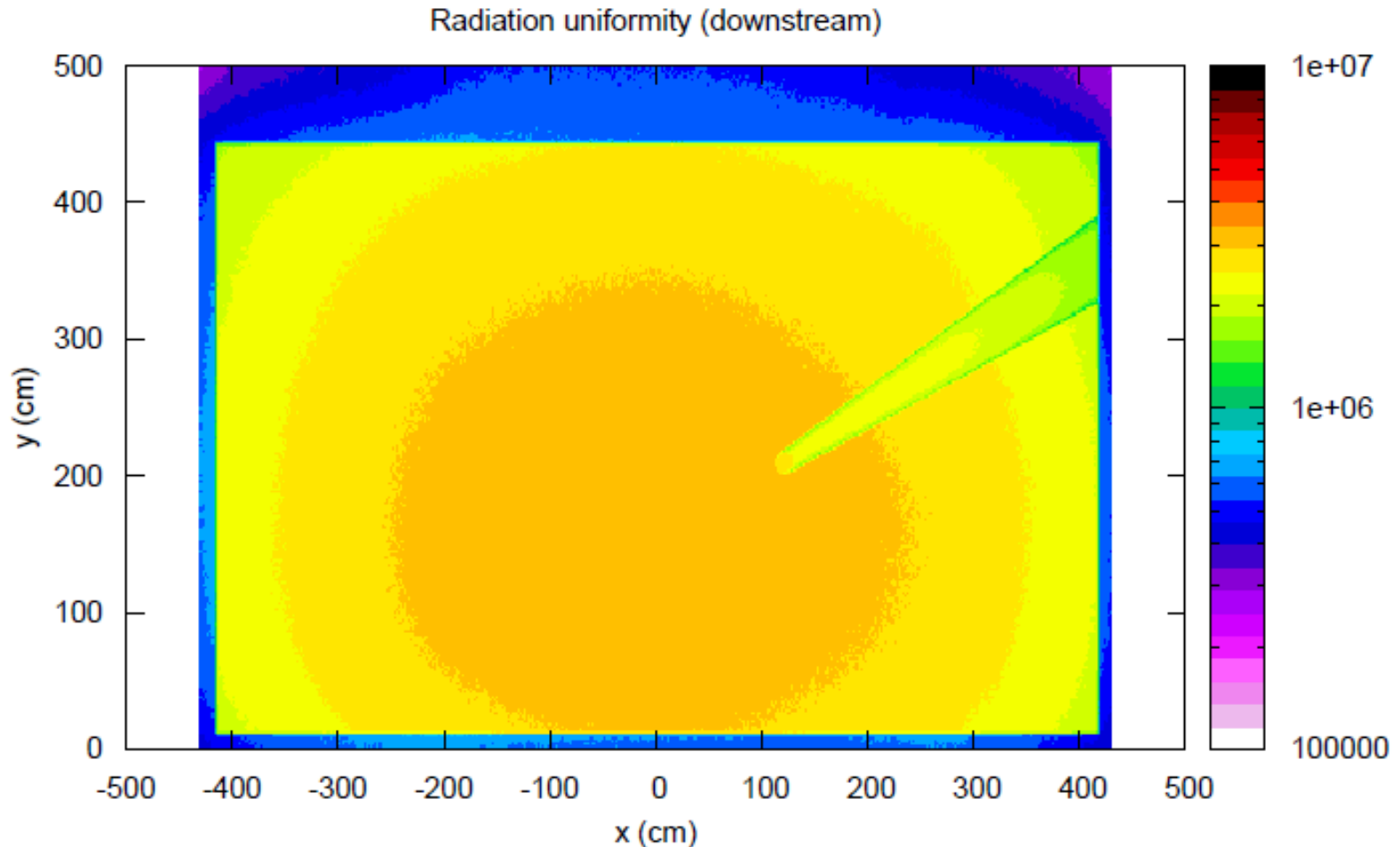
Radiation uniformity (upstream detail - linear scale)



# Field uniformity - photon fluence



# Field uniformity - photon fluence

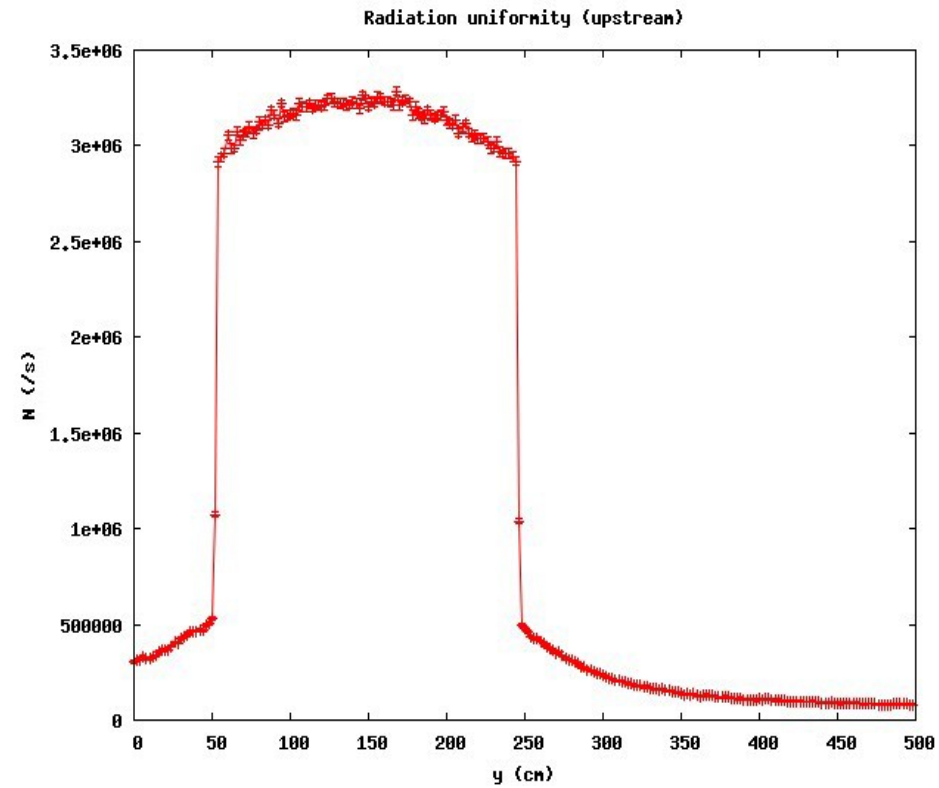
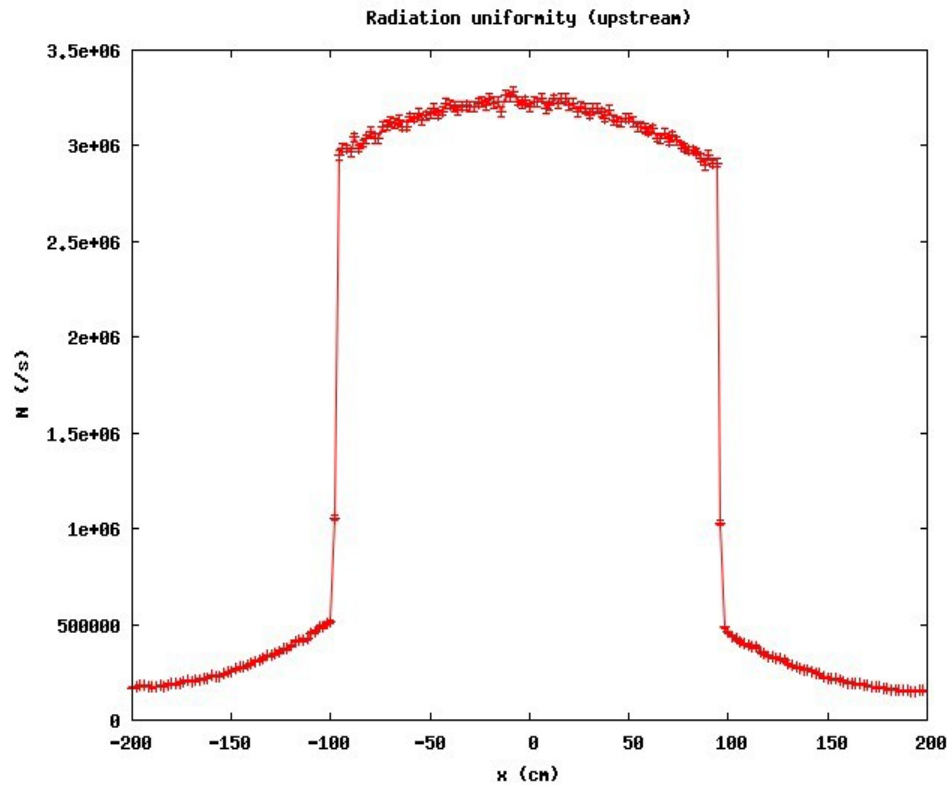


Aluminum beam-pipe ( $R_o=8.25\text{cm}$ ,  $R_i=7.95\text{cm}$ )

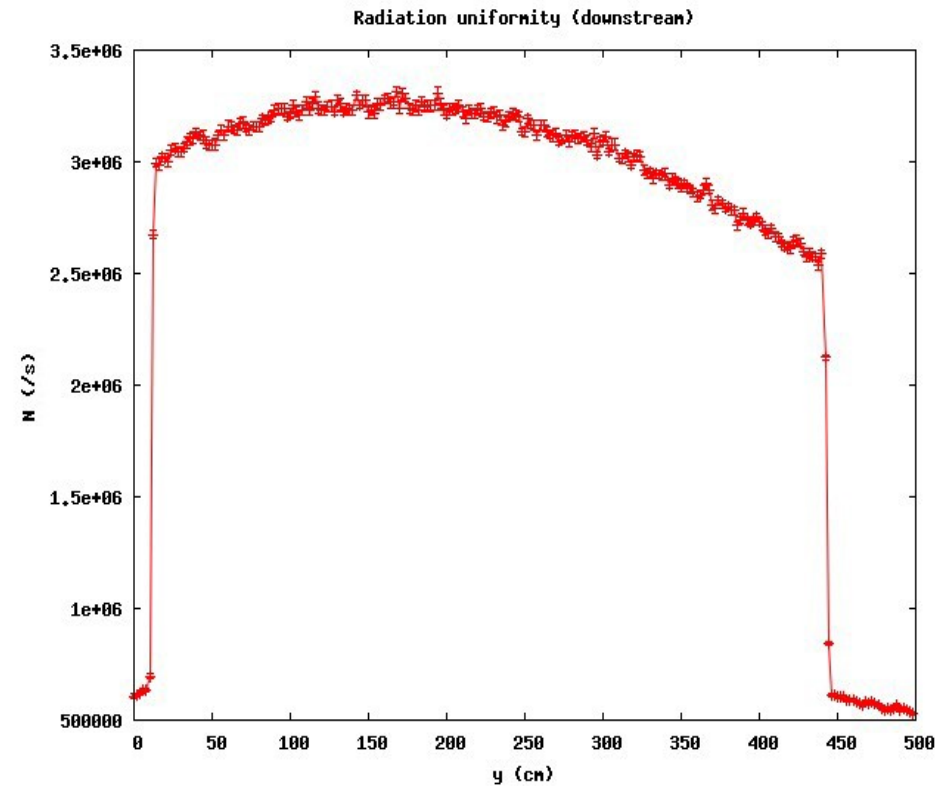
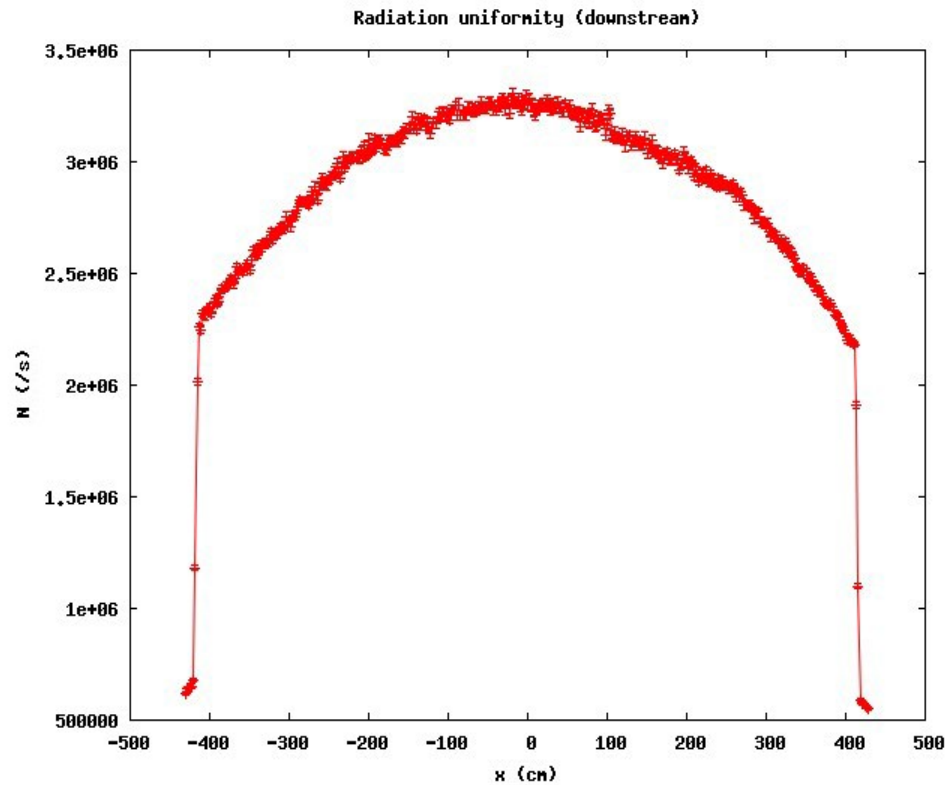
No aluminum activation



# Photon fluence - upstream



# Photon fluence - downstream

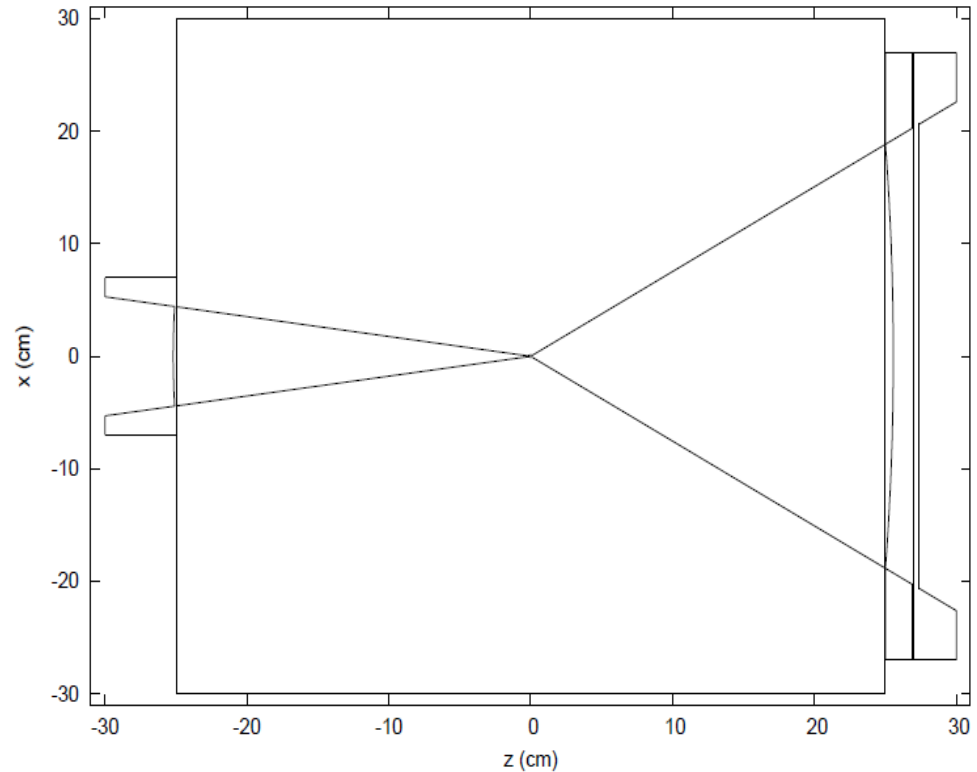


# Field uniformity

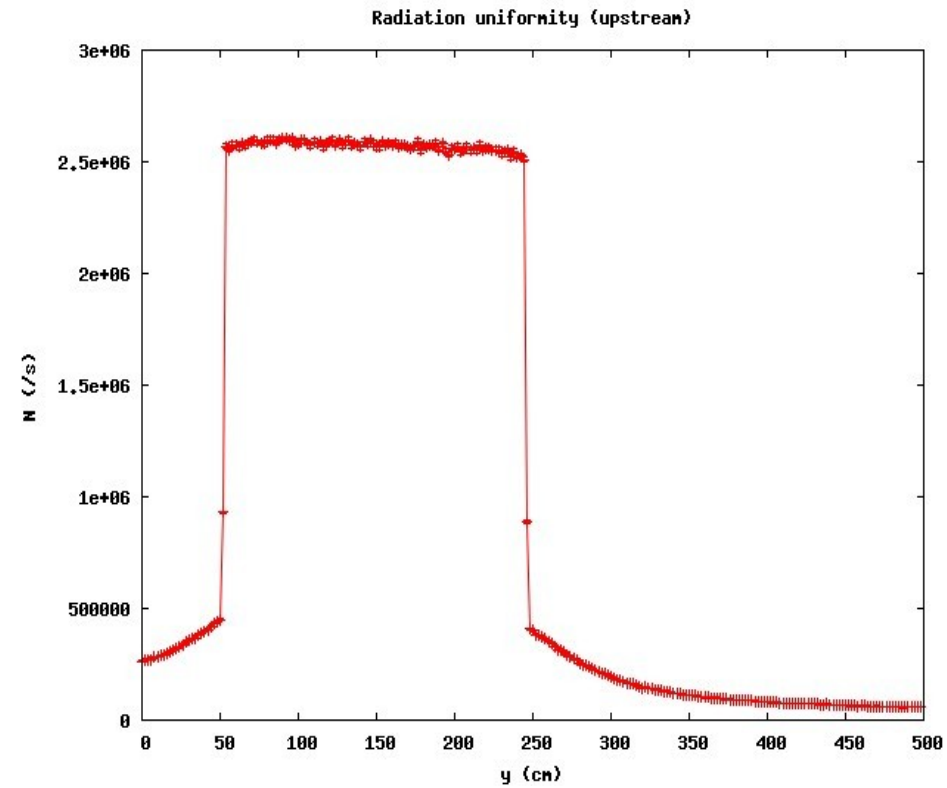
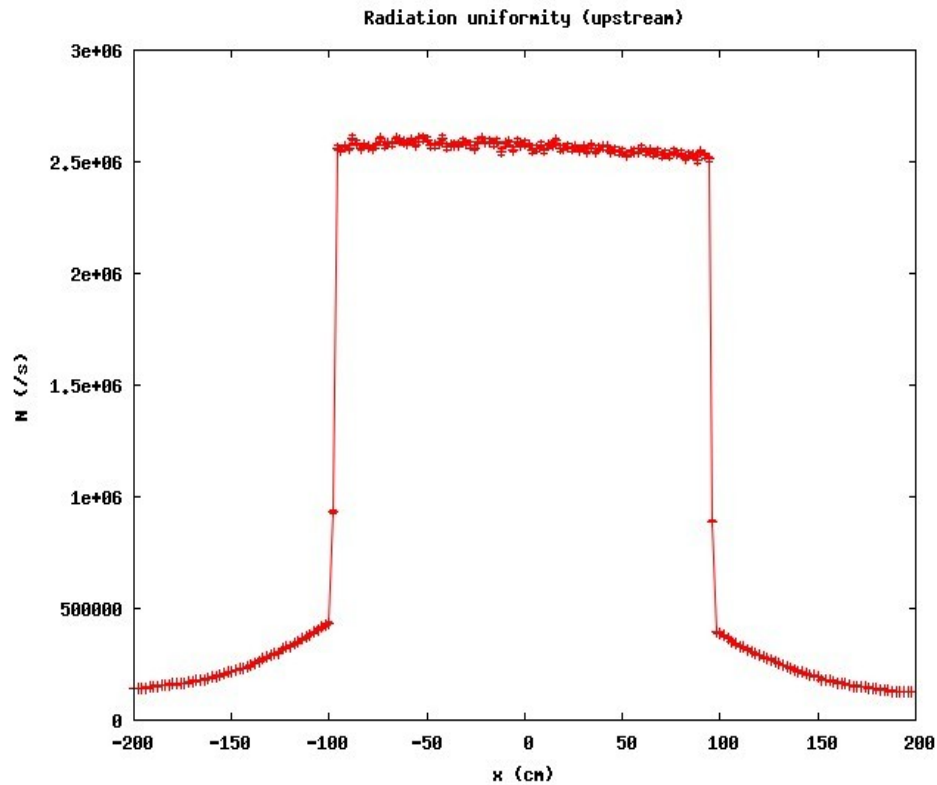
- Lead „lenses“

- *upstream*: spherical profile  
diameter 100 cm

- *downstream*: two cylindrical  
horizontal unification – 320cm diameter  
vertical unification – 260cm diameter upward part  
150cm diameter downward part

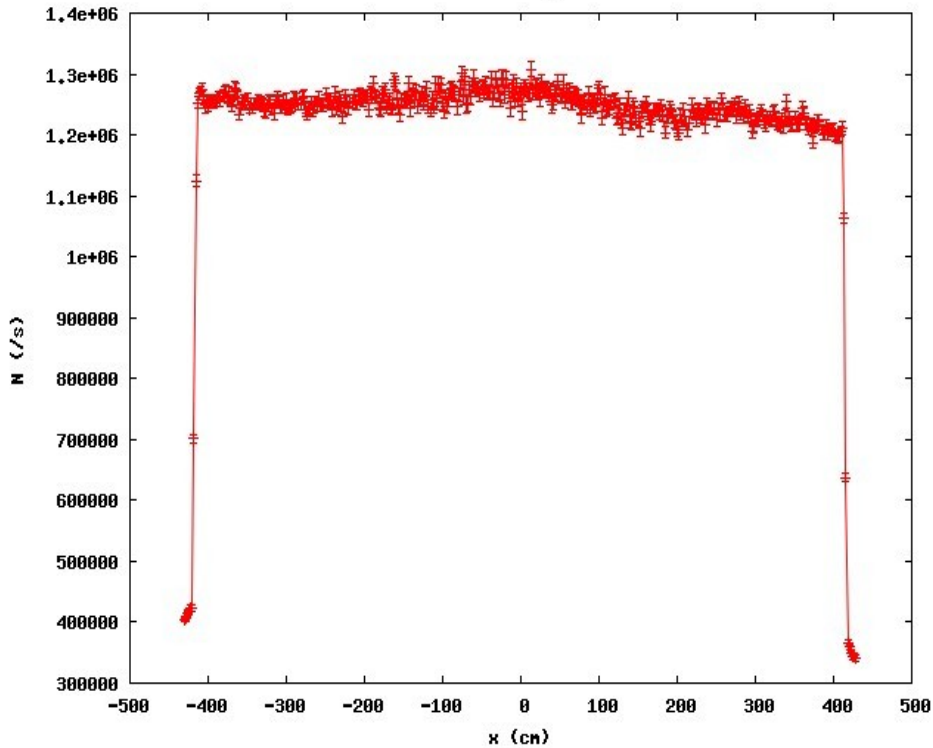


# Photon fluence - upstream

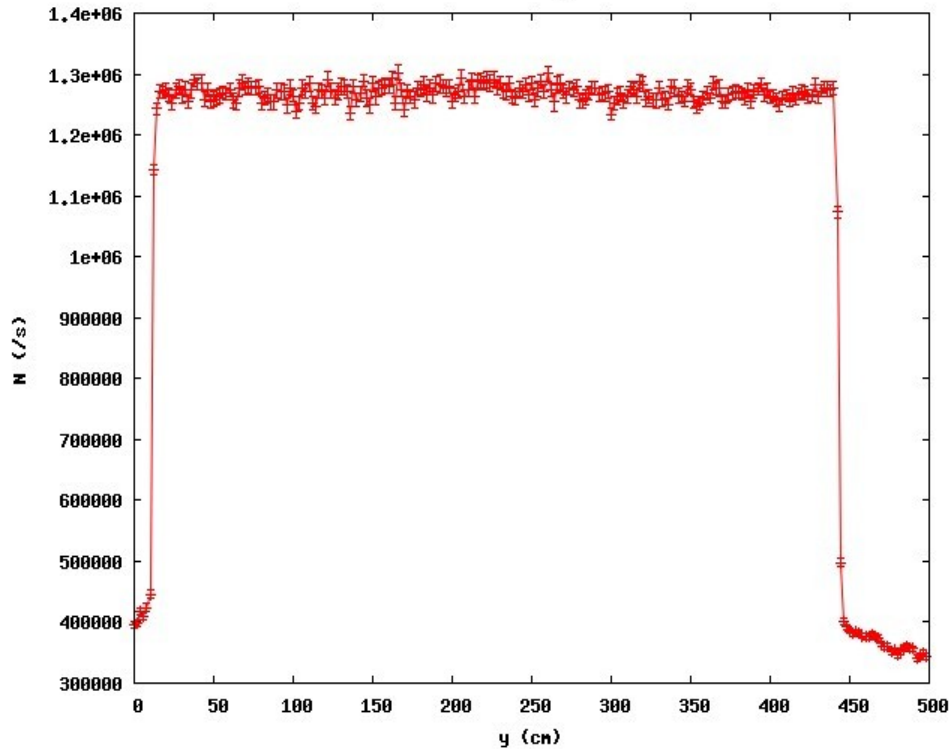


# Photon fluence - downstream

Radiation uniformity (downstream)



Radiation uniformity (downstream)



# Summary

- The proposed geometry should be sufficient in light of the dose rate outside the shielding.
  - Also behind the doors, the equivalent dose shouldn't exceed  $1 \mu\text{Sv/h}$ .
- The number of photons in the beam-pipe 10 m behind the shielding should be below  $2 \cdot 10^3/\text{s}$  for the  $10\text{TBq } ^{137}\text{Cs}$  source.
- Lead “lenses” was designed to sufficiently unify the elliptically deformed radiation field.

Thank you for your attention