GEANT4 Simulation of background radiation study for APEX

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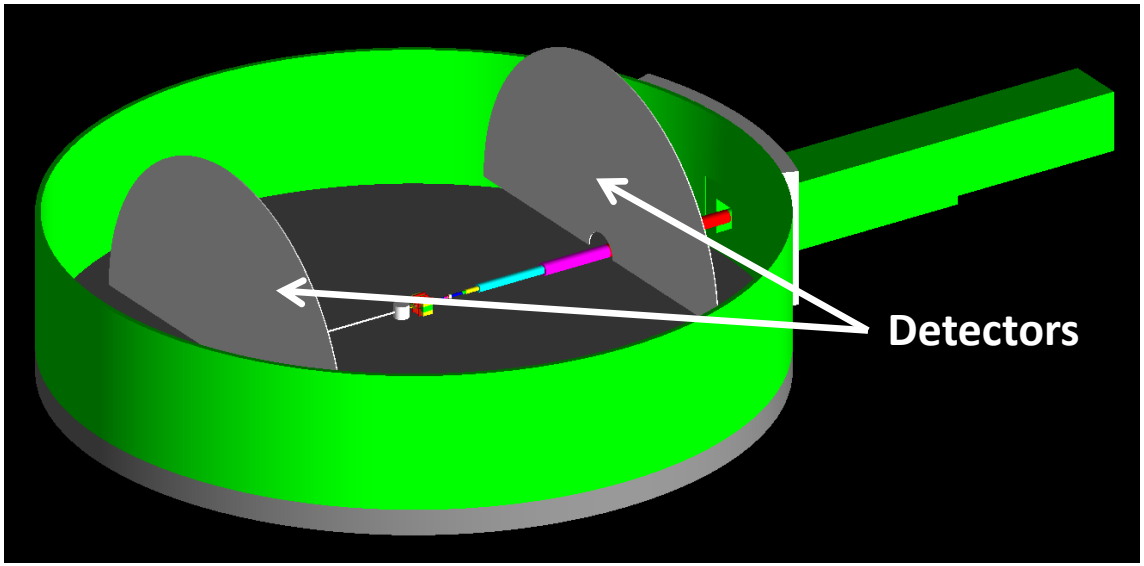
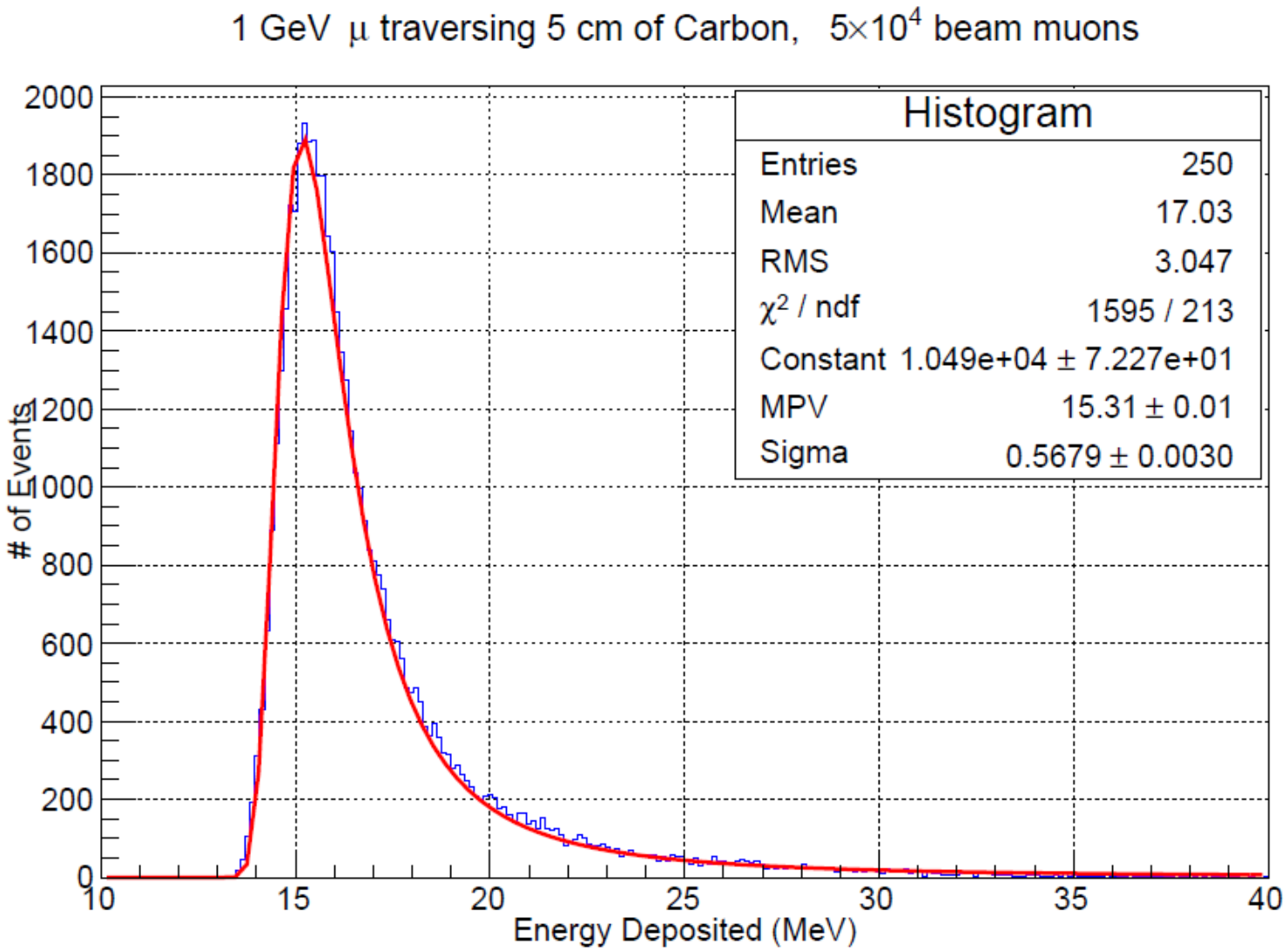
Neutron dose rate calculation



- Placed 2 semi circle shaped detectors 16m away from hall center.
- Area $\sim 350\ m^2$ each.

Tested upstream detector for energy deposition



Tested upstream detector for energy deposition

Material = 5 cm thick Carbon

μ^- beam energy = 1GeV

Equations were taken from "Techniques for Nuclear and Particle Physics Experiments" – by Leo.

$$\Delta_{mp} = \xi \left[\ln\left(\frac{\xi}{\varepsilon}\right) + 0.198 - \delta \right]$$

where, $\xi = 2\pi N_a r_e^2 m_e c^2 \rho \frac{Z}{A}\left(\frac{z}{\beta}\right)^2 x$

$$\Delta_{mp} = 20\ MeV$$

From PDG booklet,

$K = 4\pi N_a r_e^2 m_e c^2 = 0.307\ MeV\ mol^{-1}\ cm^2$

$$\xi = \frac{K}{2}\rho\frac{Z}{A}\left(\frac{z}{\beta}\right)^2 x$$

$\rho = 2\ gcm^{-3}$ (Density of Carbon)

$Z = 6$ (Atomic Number of Carbon)

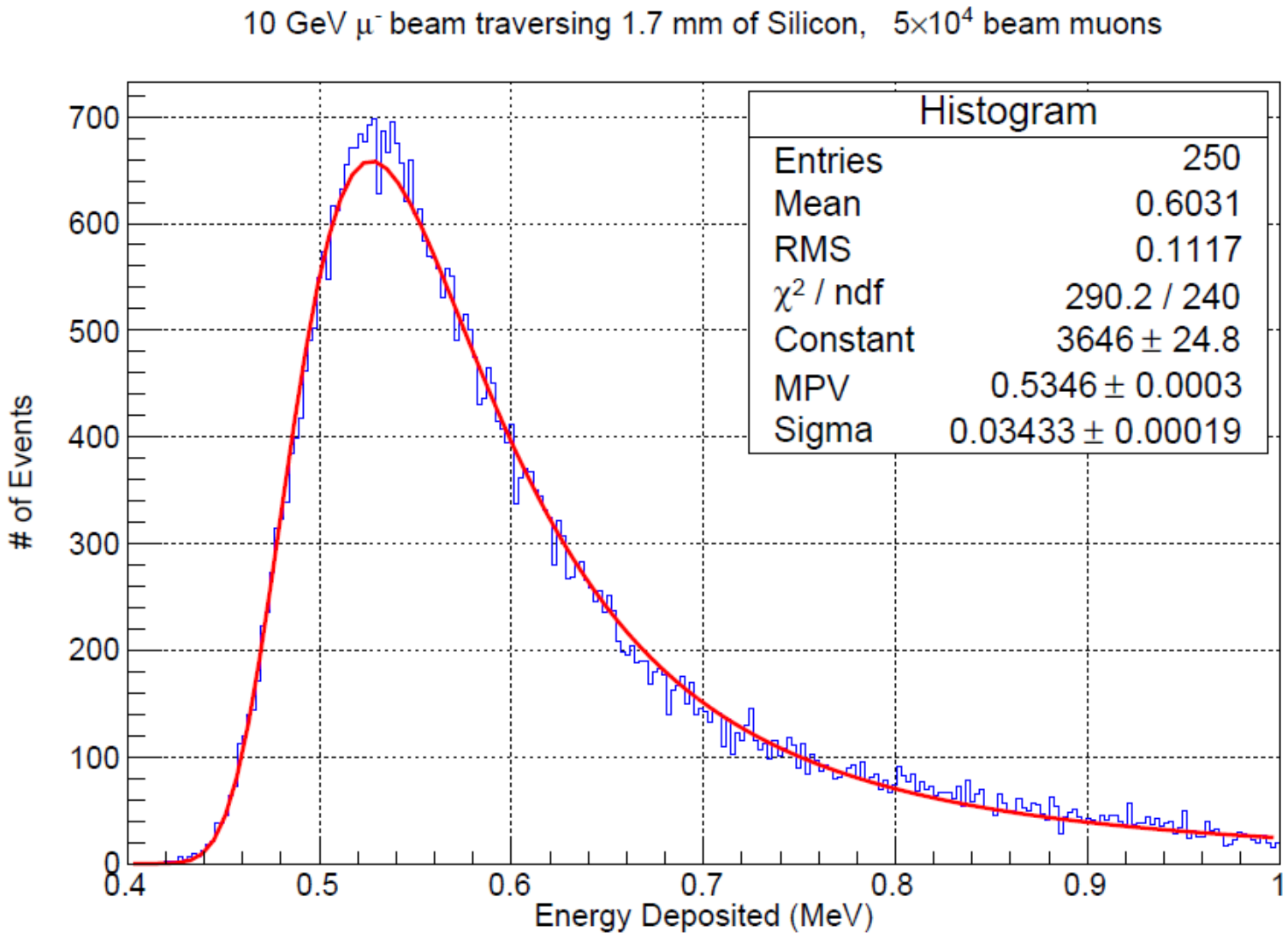
$A = 12\ gmol^{-1}$ (Atomic mass)

$z = -1$ (charge number of incident particle muon)

$\beta = 0.99$

$x = 5\ cm$ (thickness of the material)

Tested upstream detector for energy deposition



Tested upstream detector for energy deposition

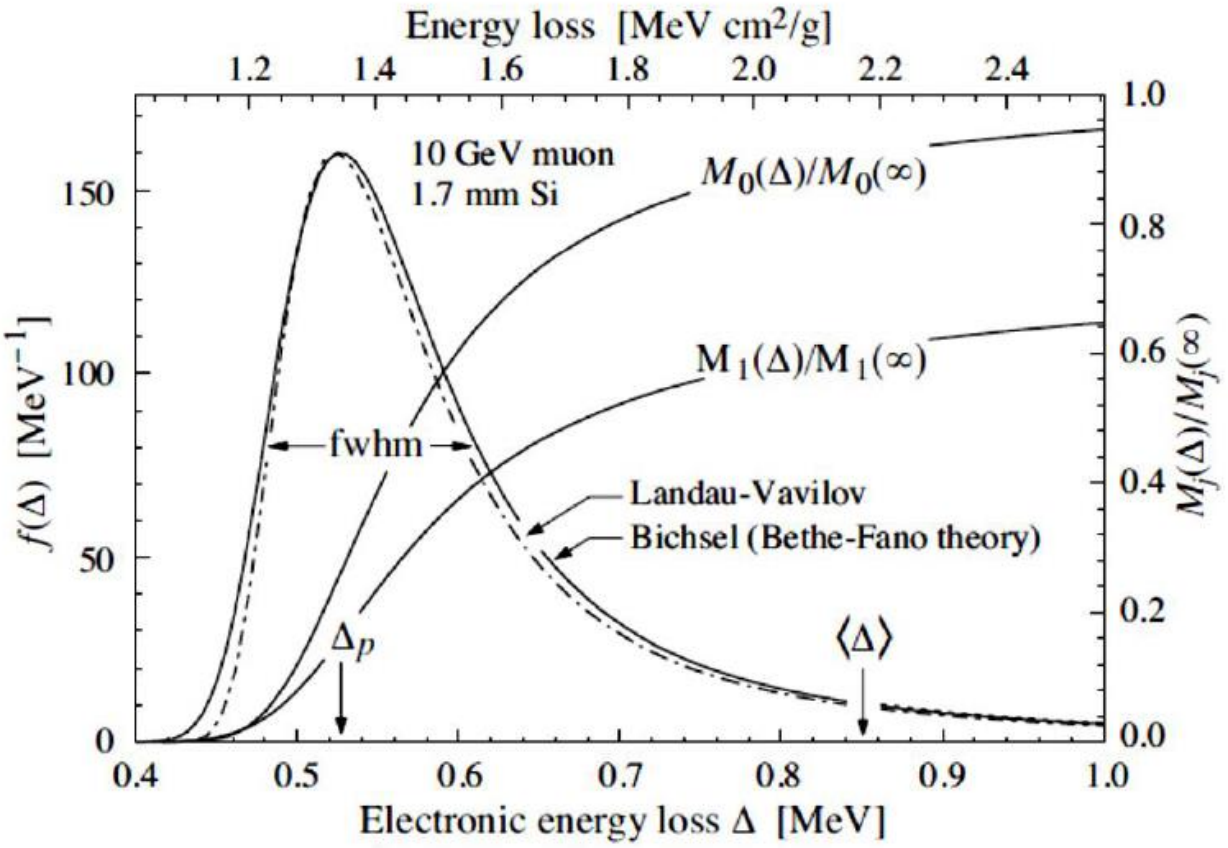
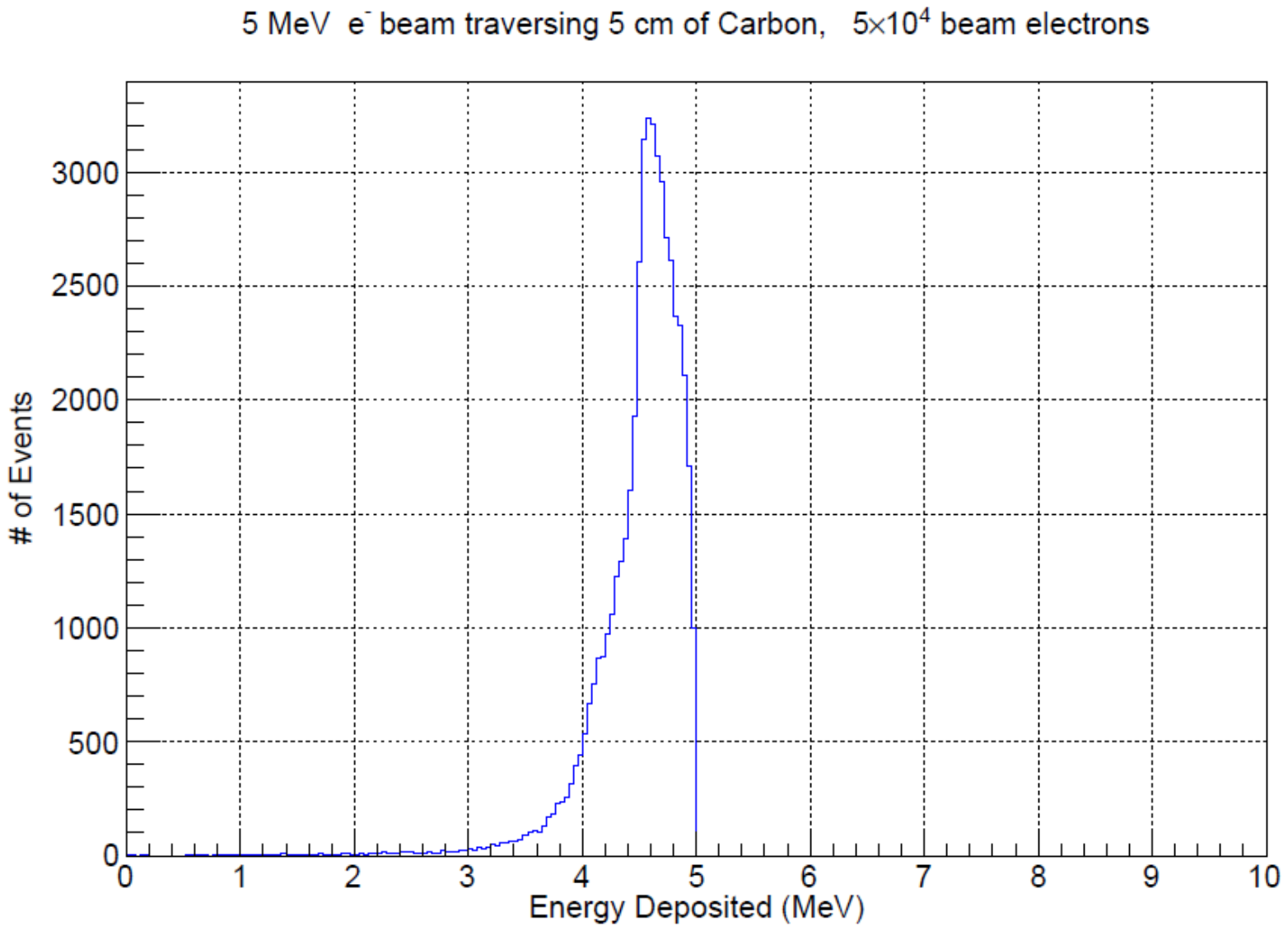
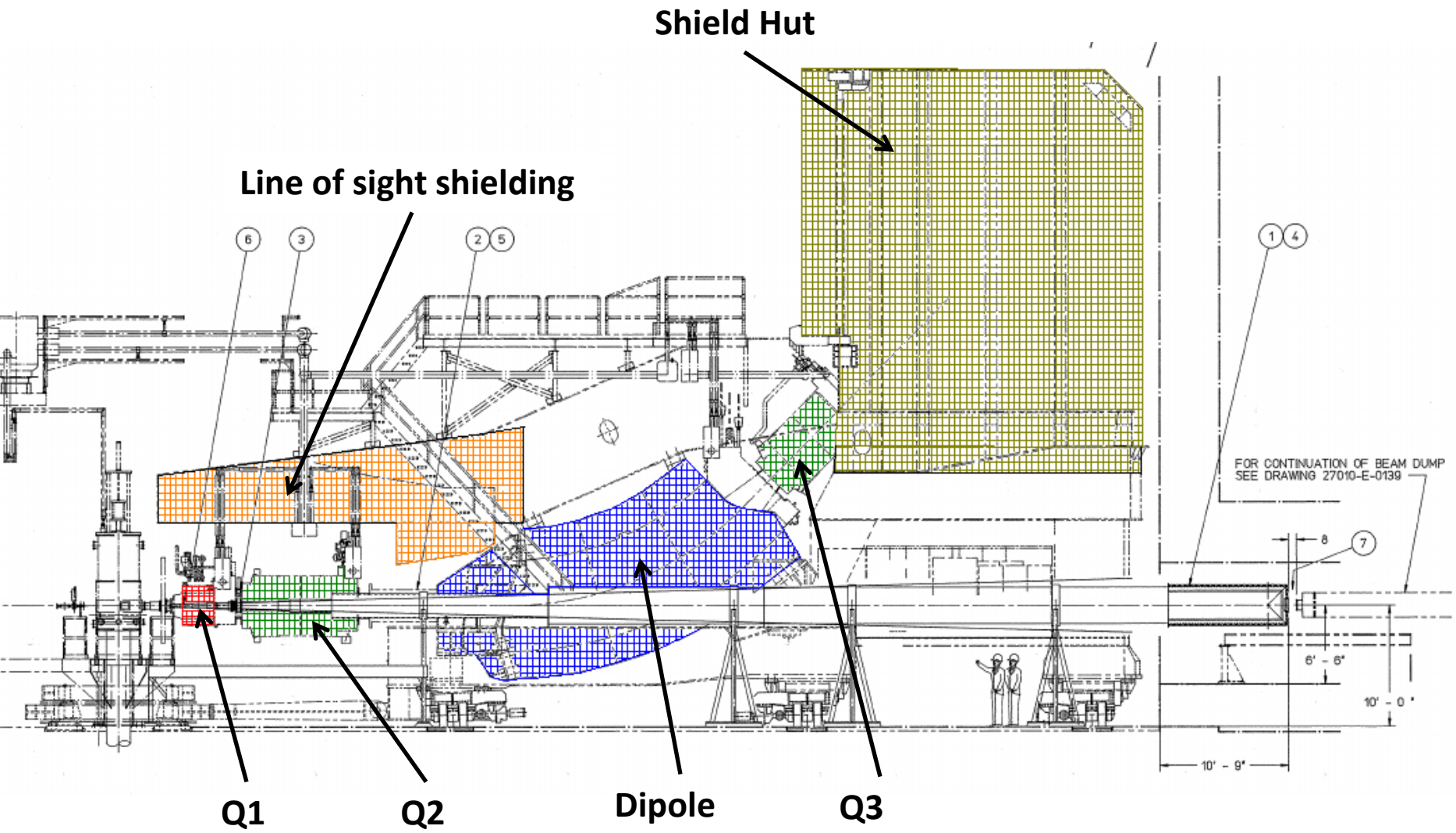


Figure 30.7: Electronic energy deposit distribution for a 10 GeV muon traversing 1.7 mm of silicon, the stopping power equivalent of about 0.3 cm of

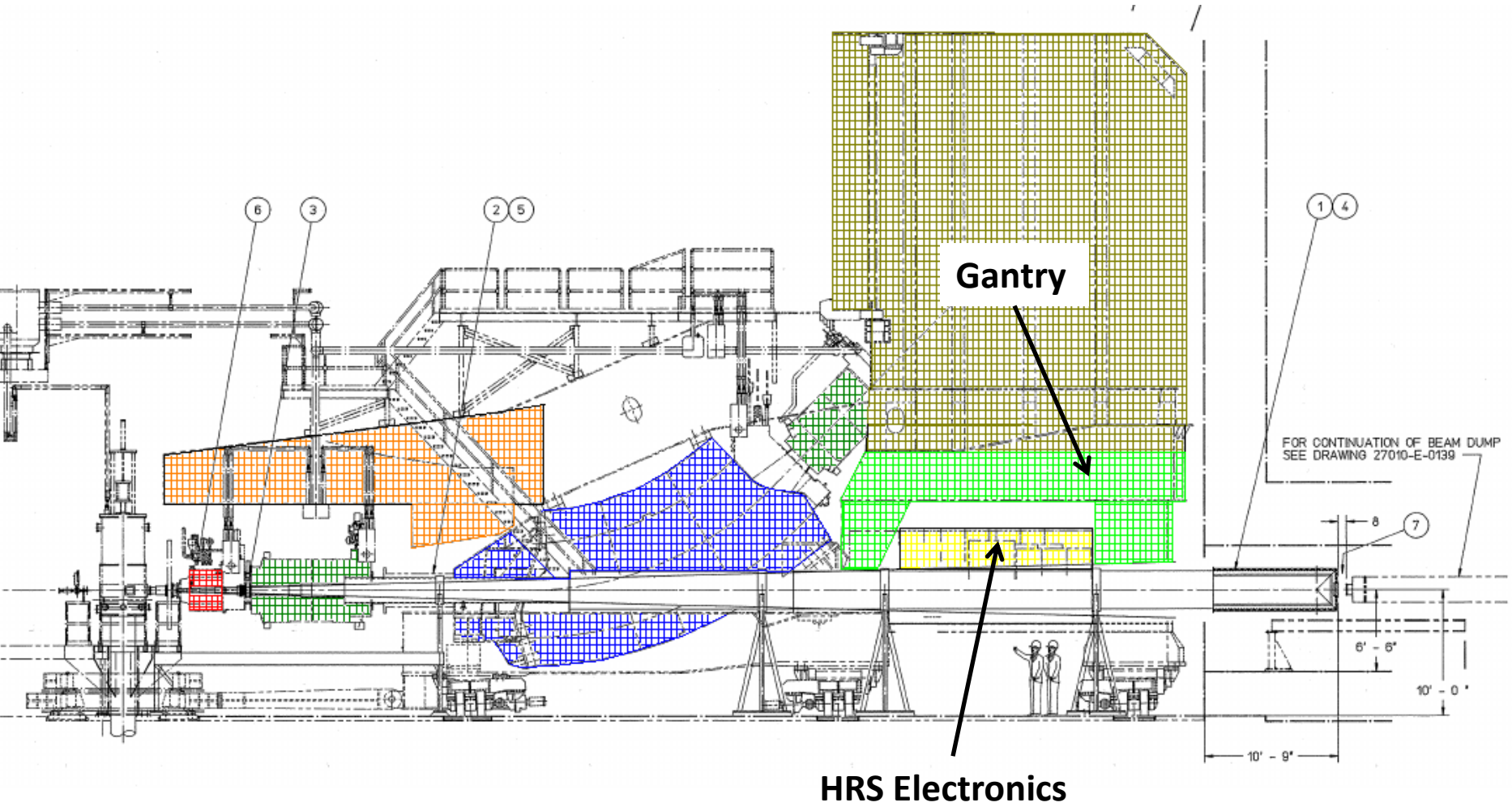
Tested upstream detector for energy deposition



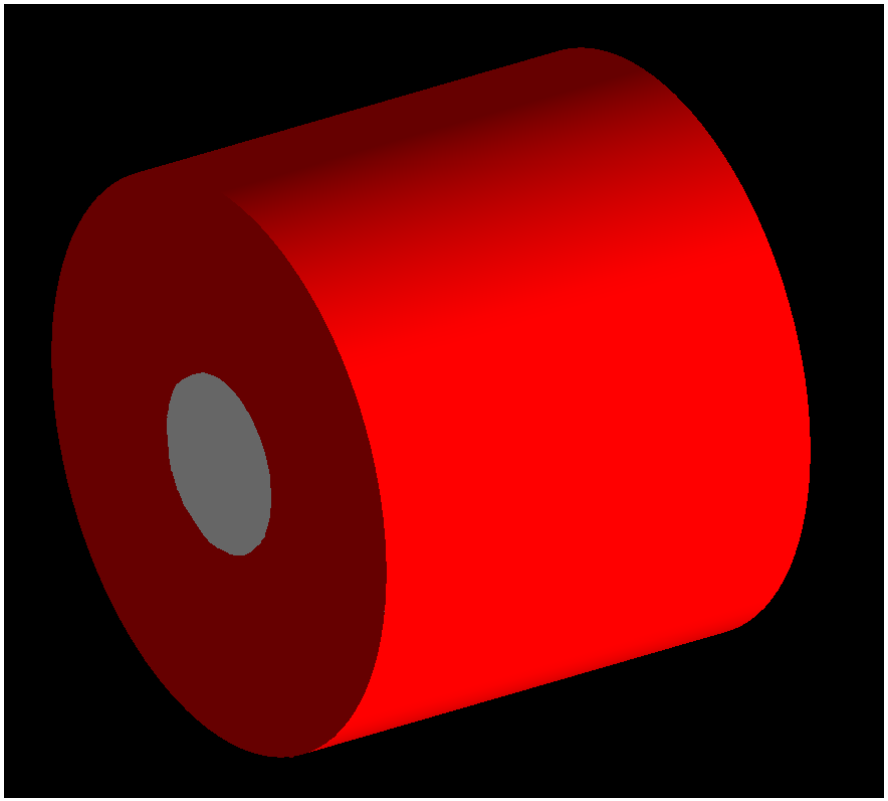
Description of HRS



Description of HRS



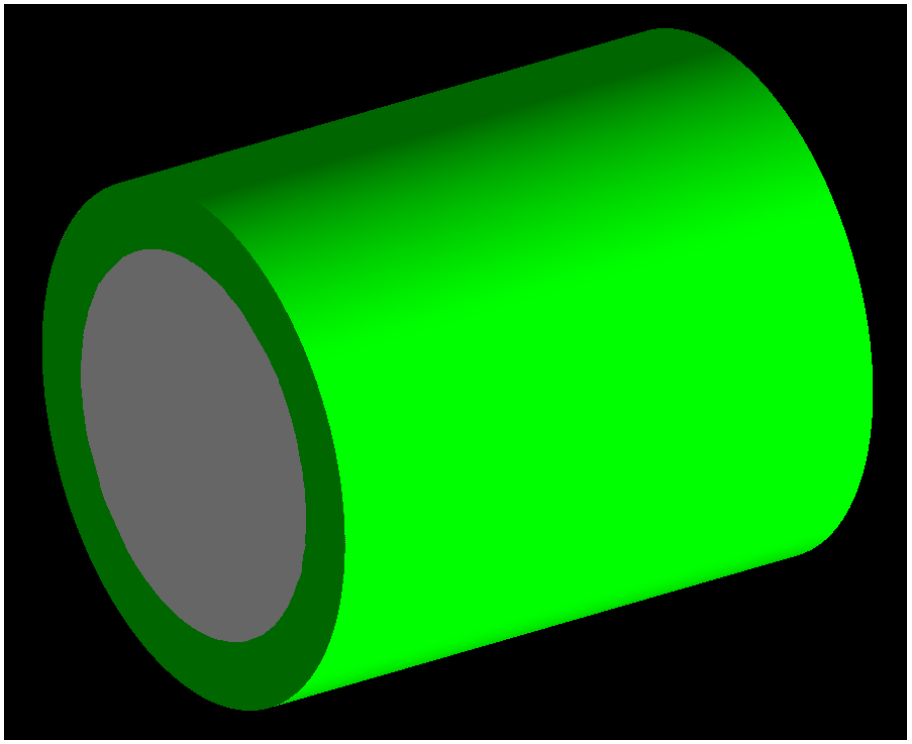
Q1 Magnet



Iron tube

Vacuum tube

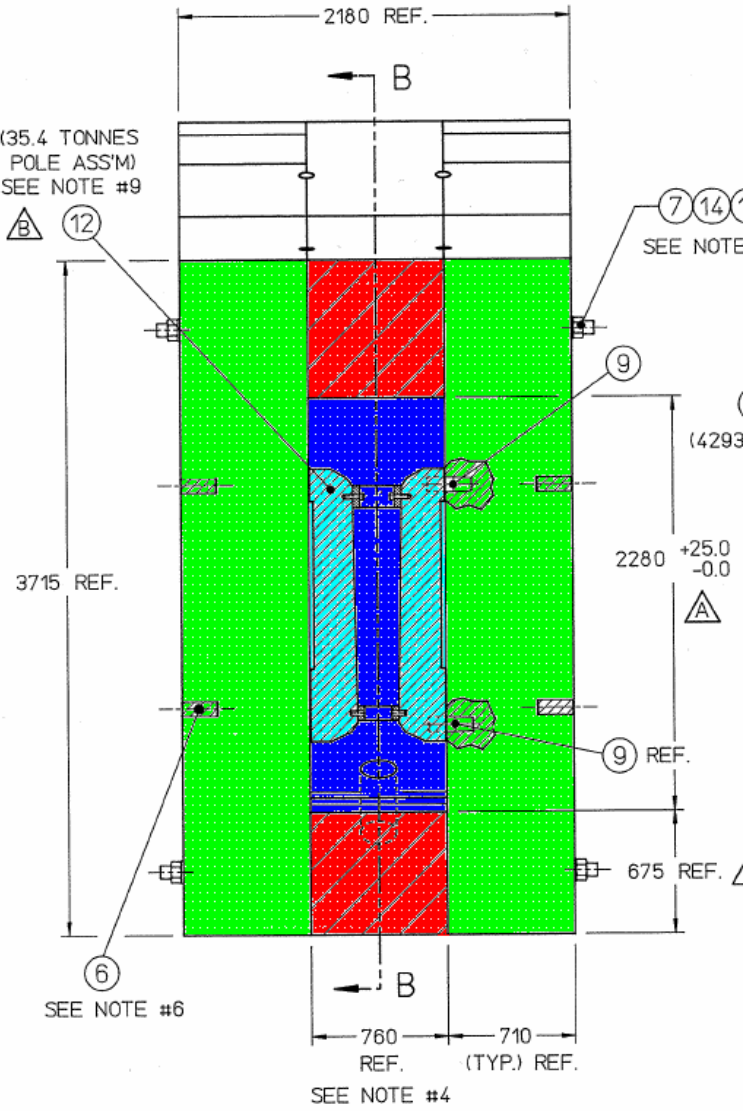
Q2 Magnet

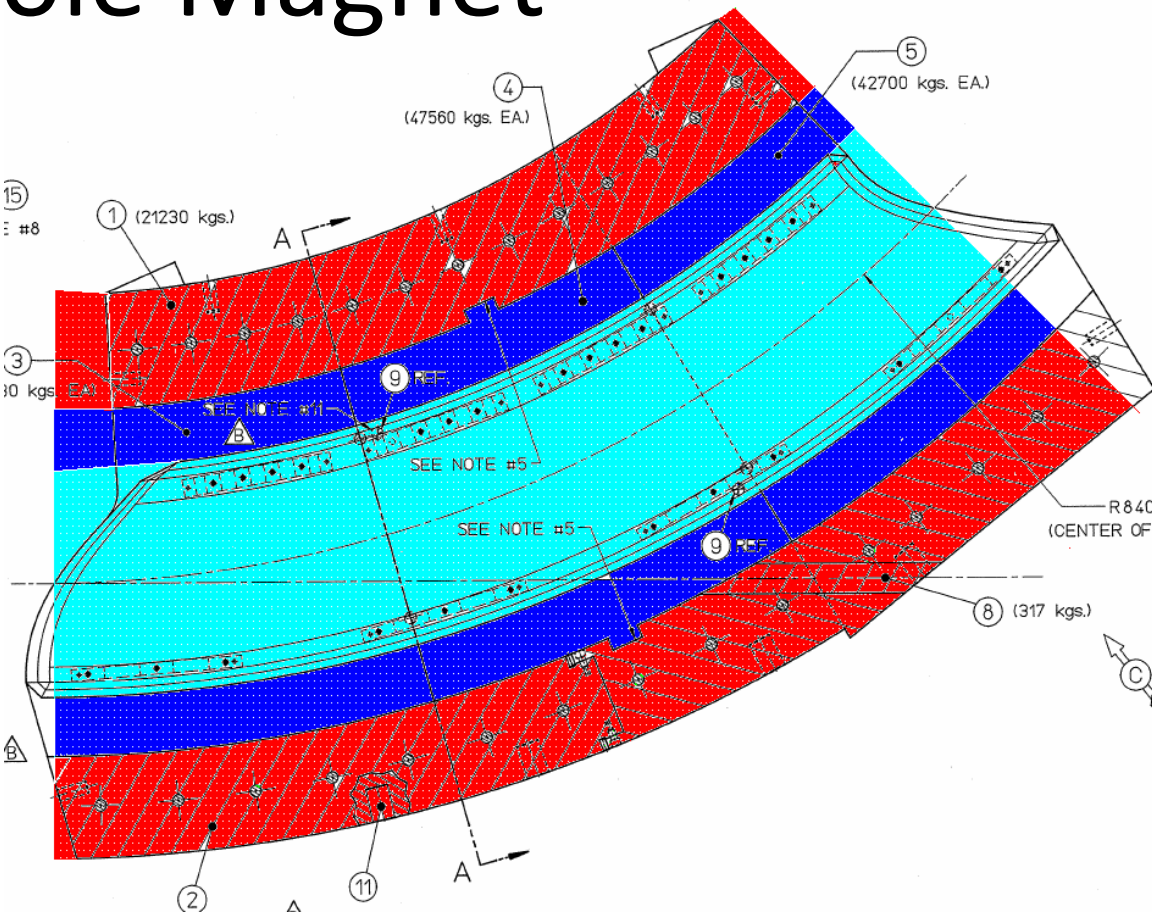


Iron tube

Vacuum tube

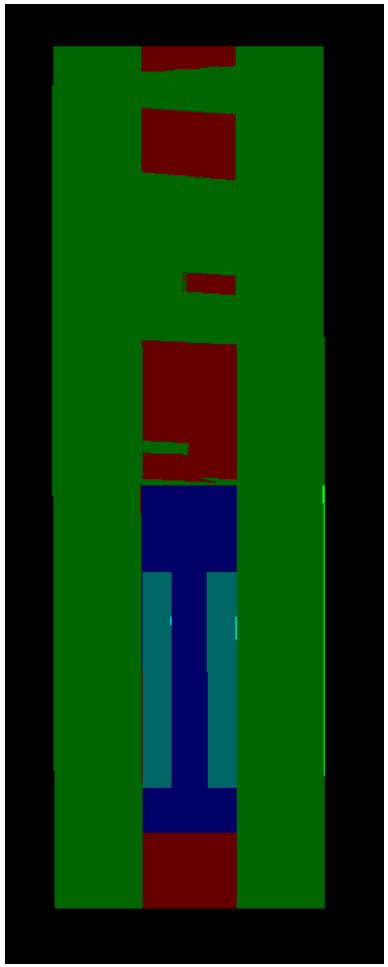
Dipole Magnet

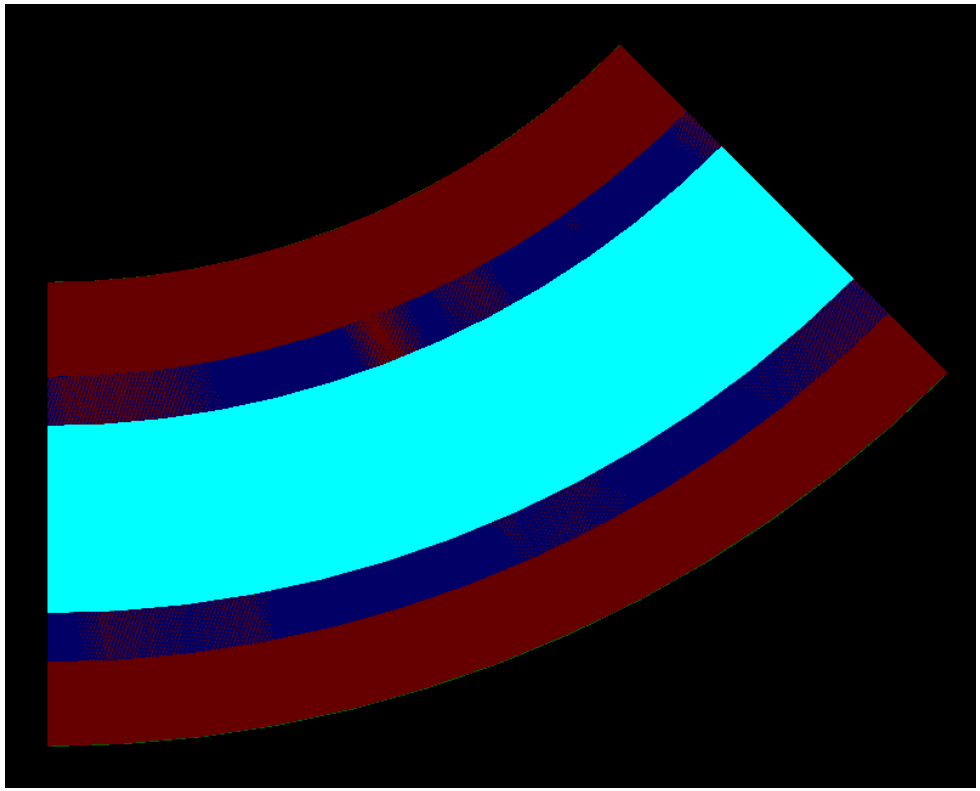




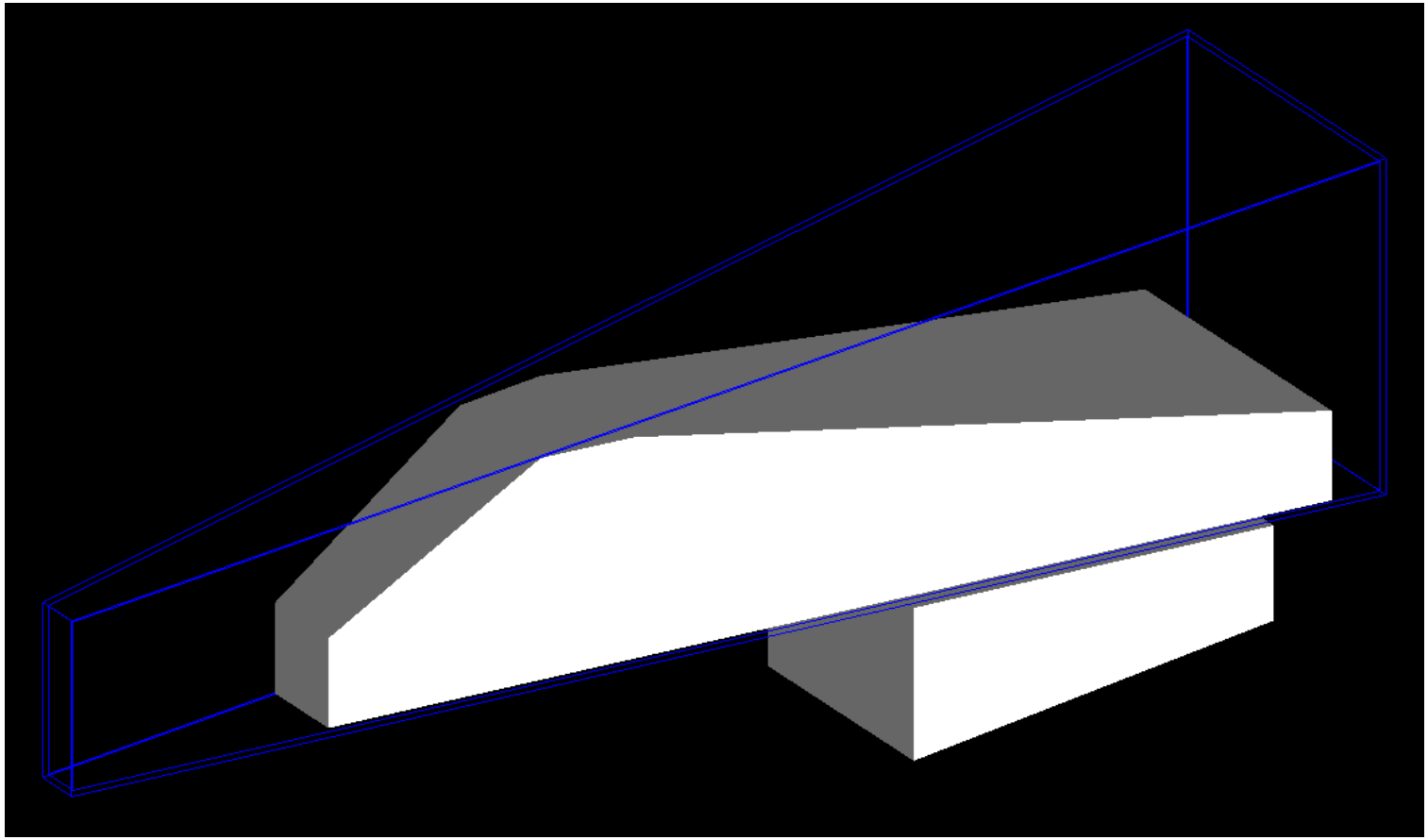
- Dipole Iron Assembly
- Dipole Iron Yoke
- Vacuum gap
- Iron Poles

Dipole Magnet





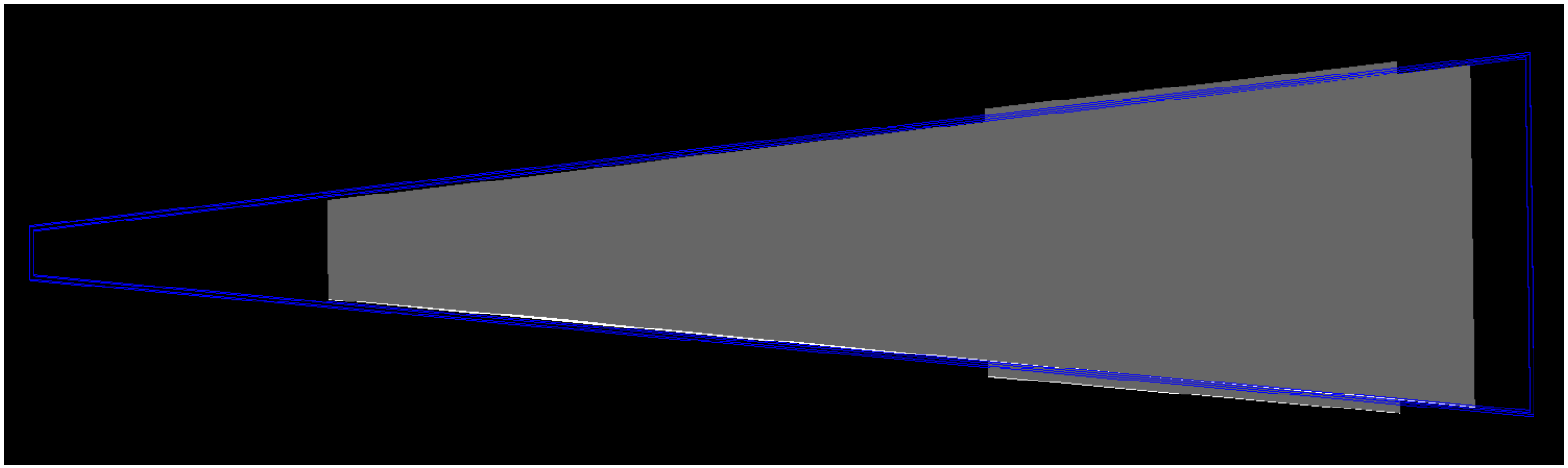
Line of sight shielding



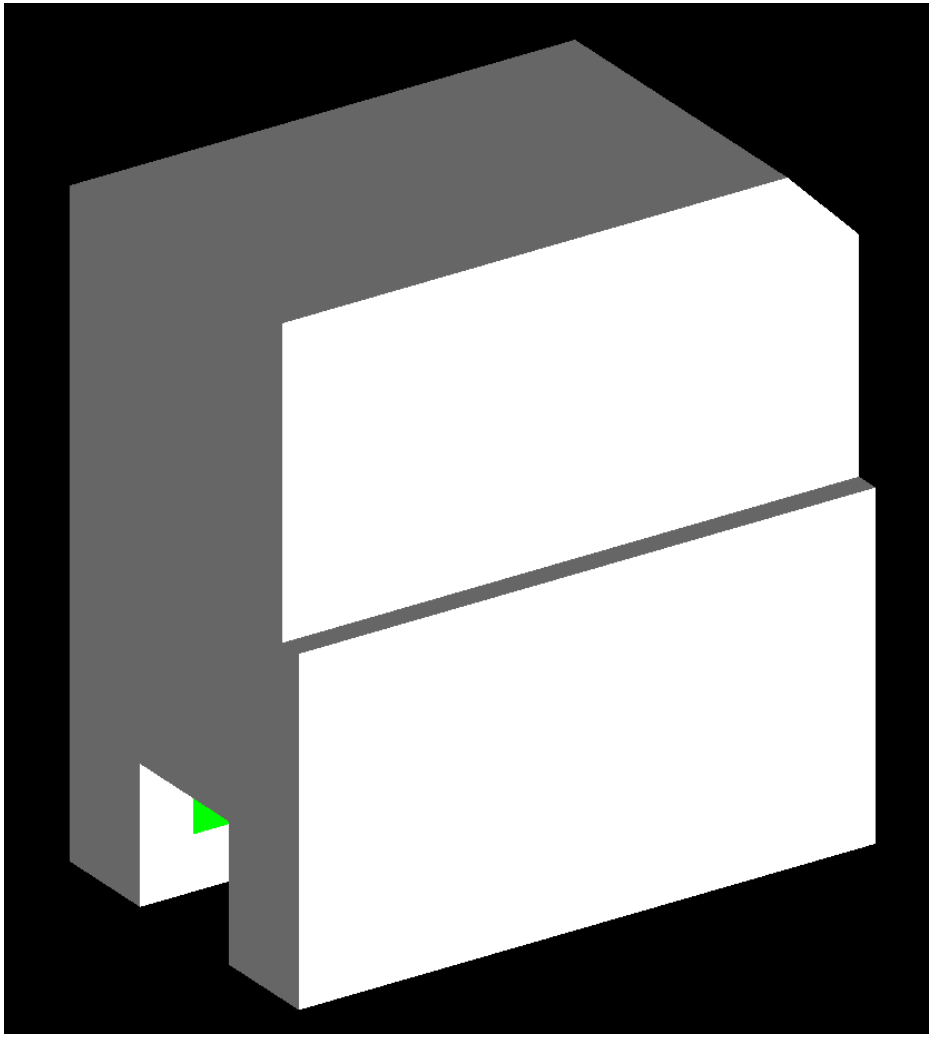
Steel frame

Concrete structure

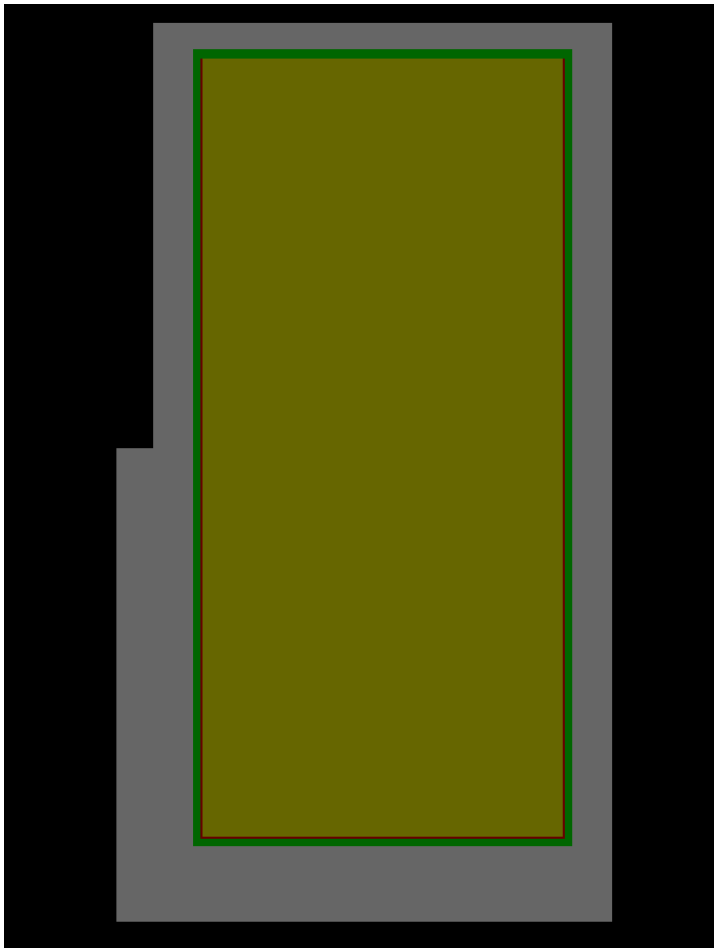
Line of sight shielding – Top View



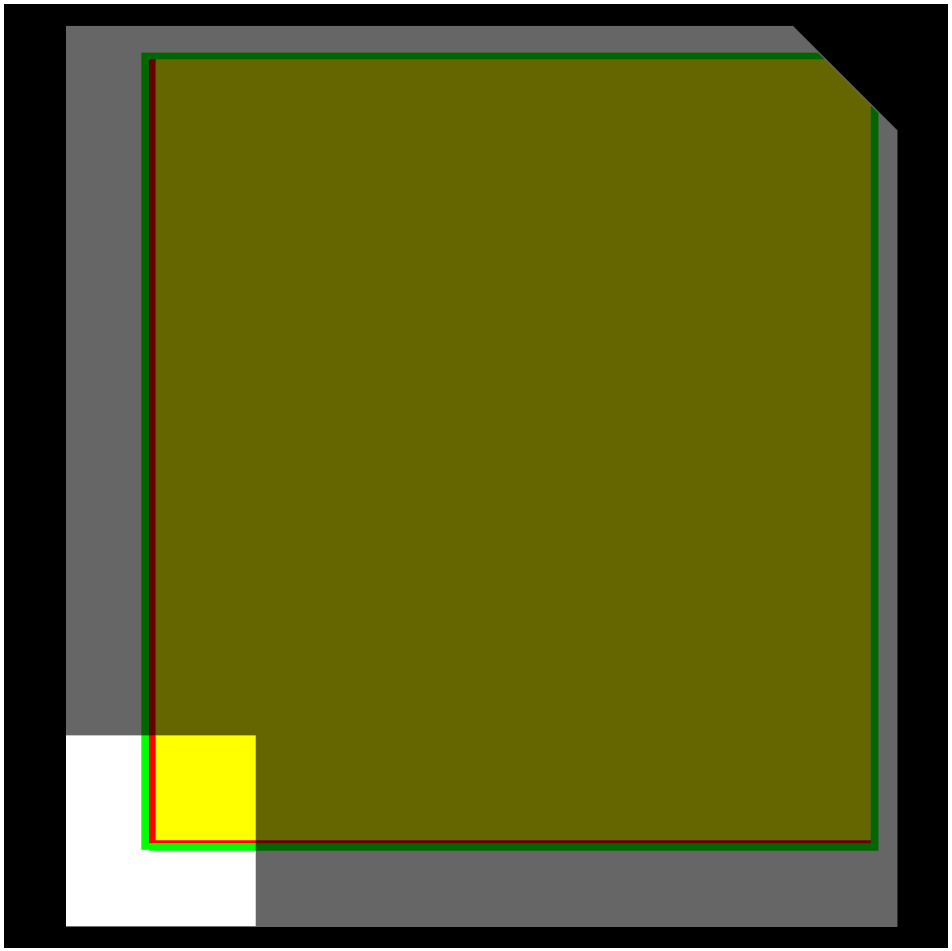
HRS Shield Hut



HRS Shield Hut

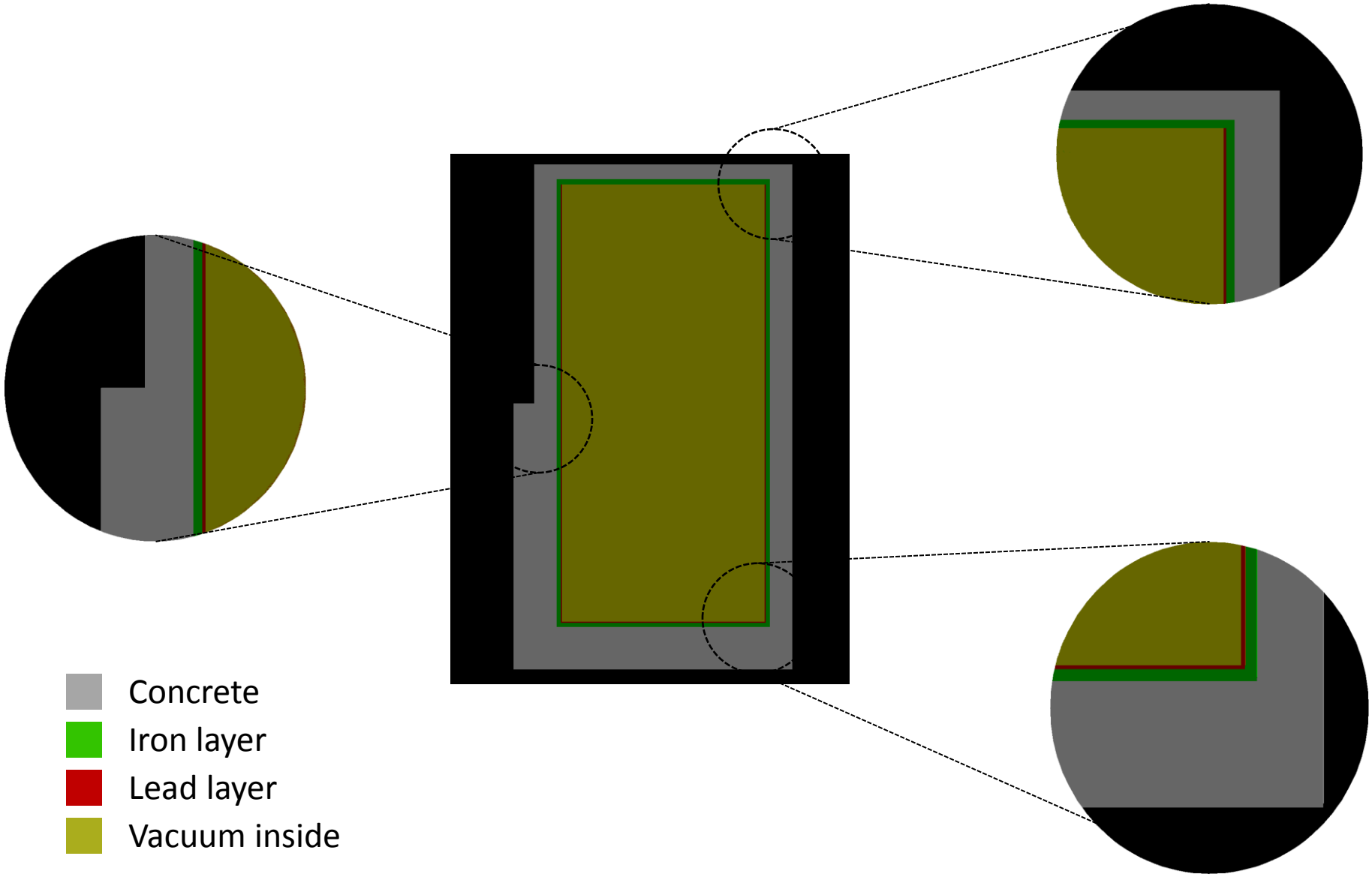


Front View

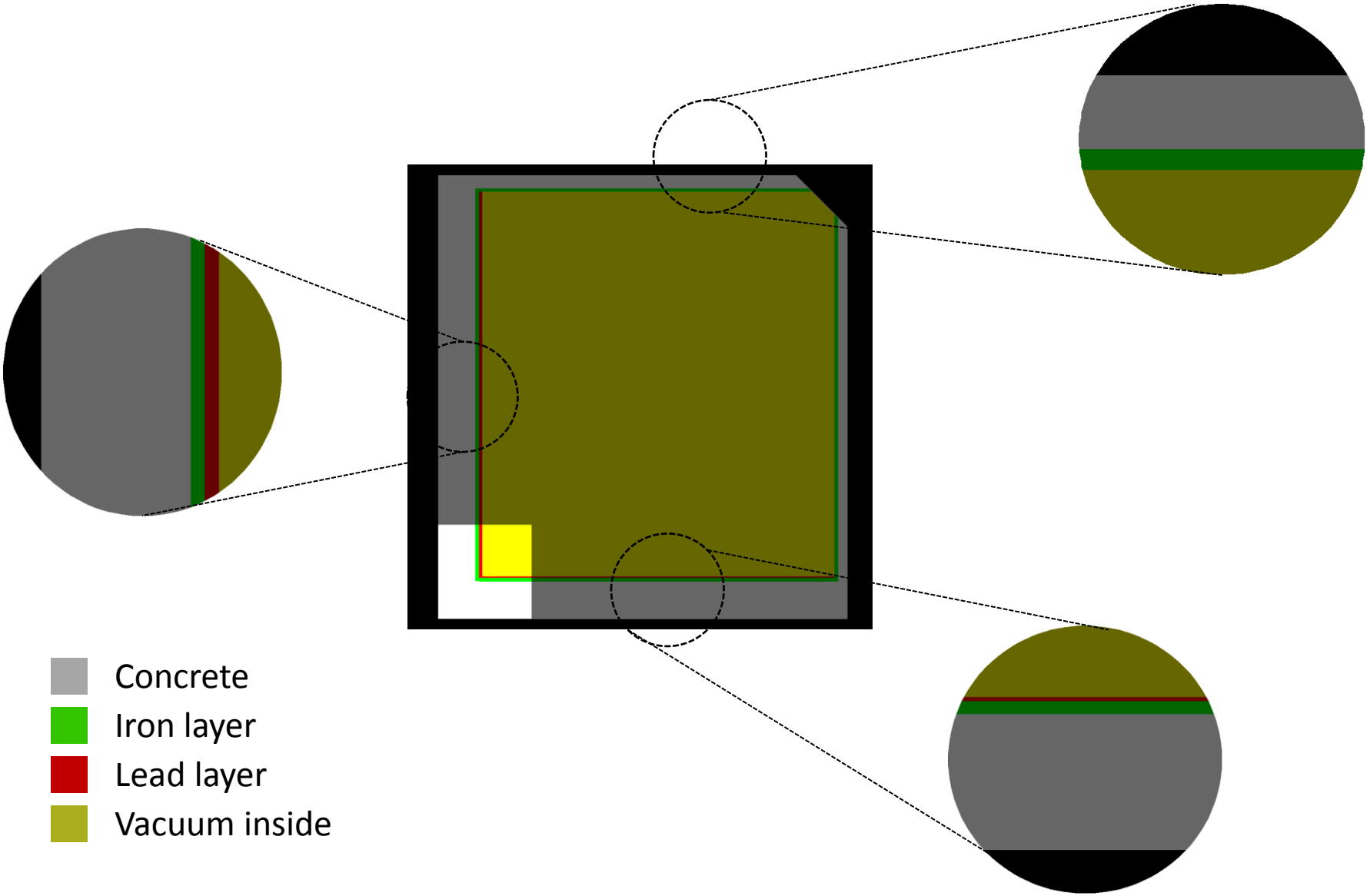


Side View

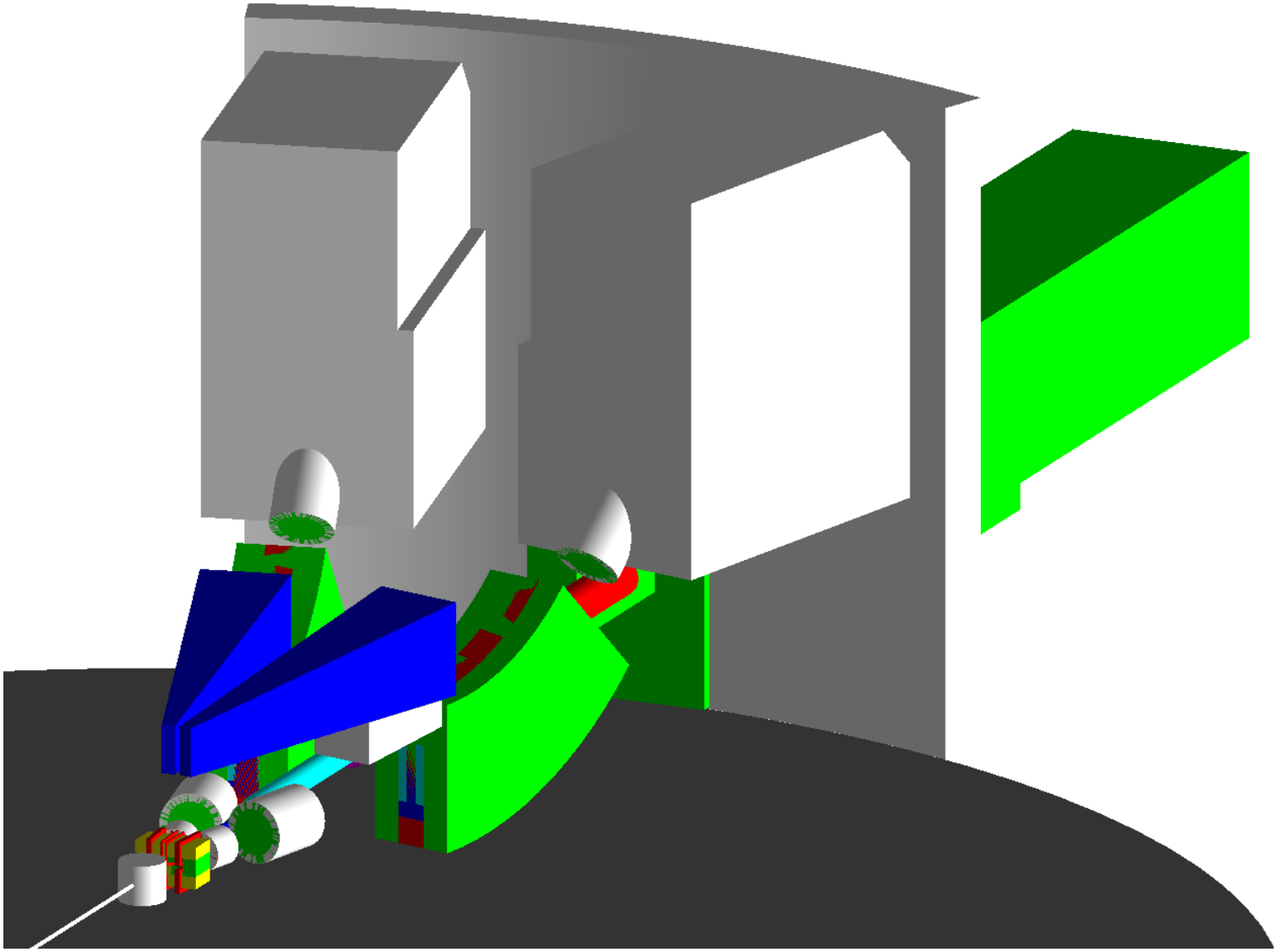
HRS Shield Hut - Front View



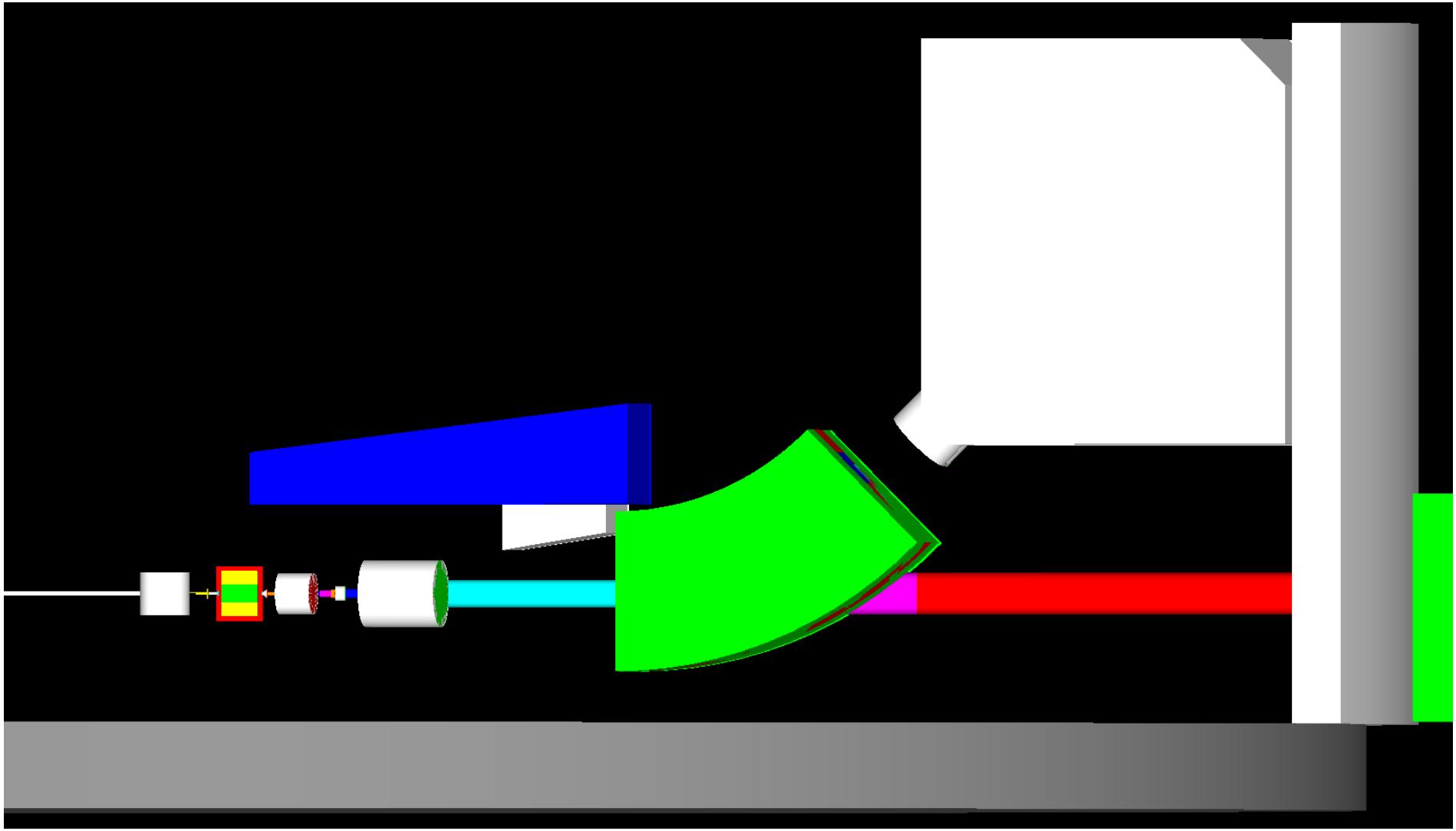
HRS Shield Hut - Side View



Hall A Geant4 description



Hall A Geant4 description



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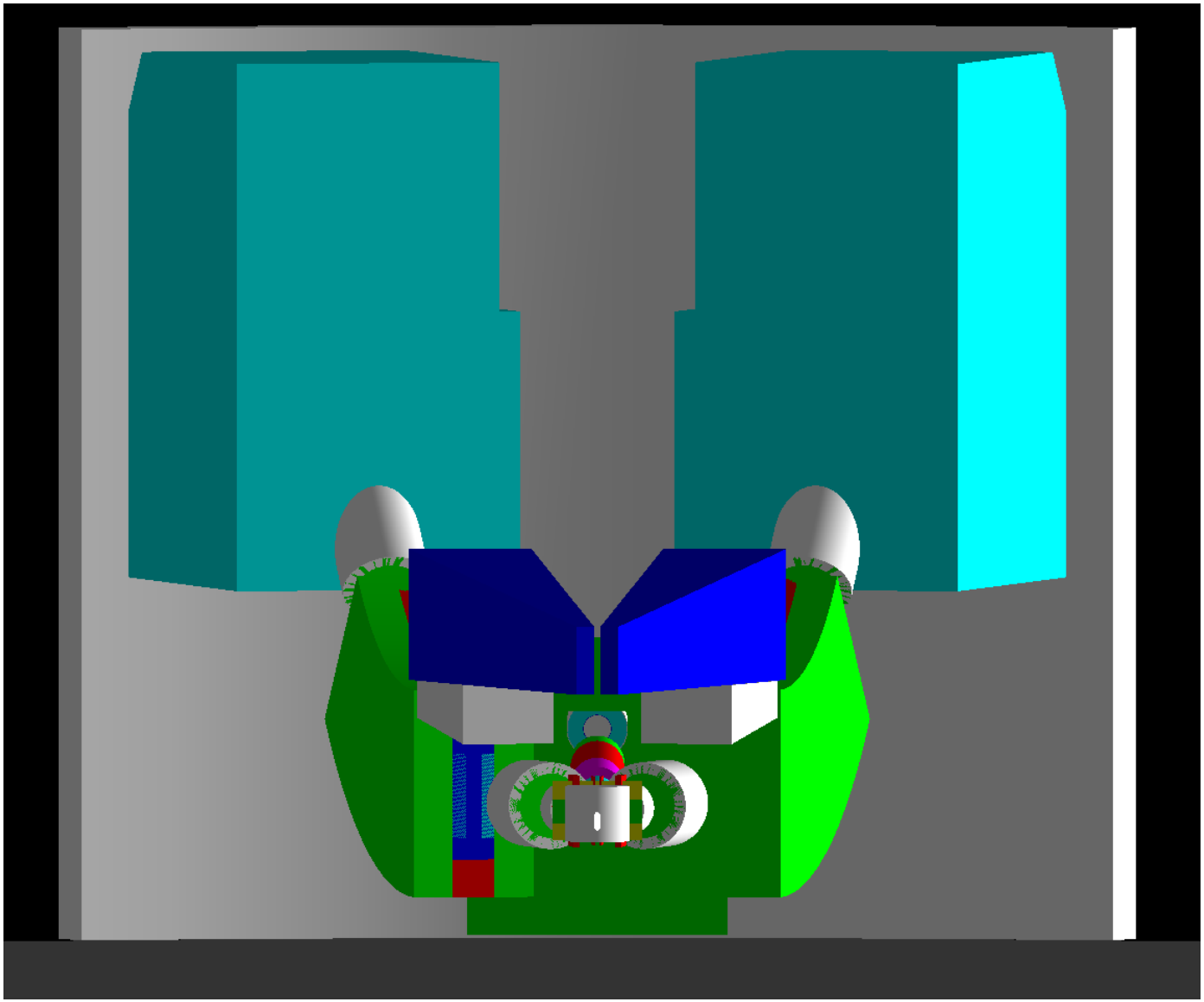

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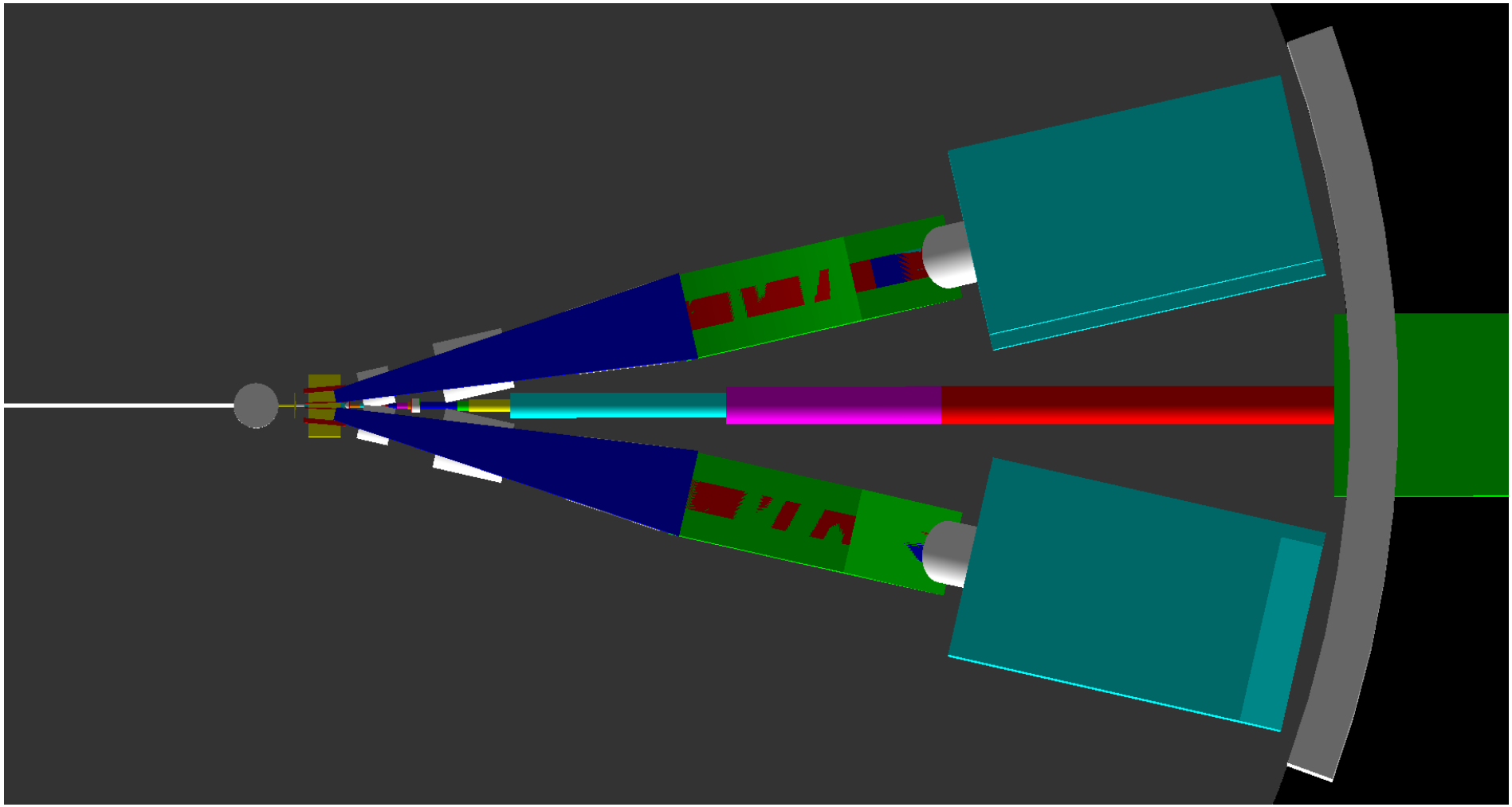

Hall A Geant4 description