THE UNIVERSITY OF WARWICK

FLUKA Energy Deposition Studies for IDS120j

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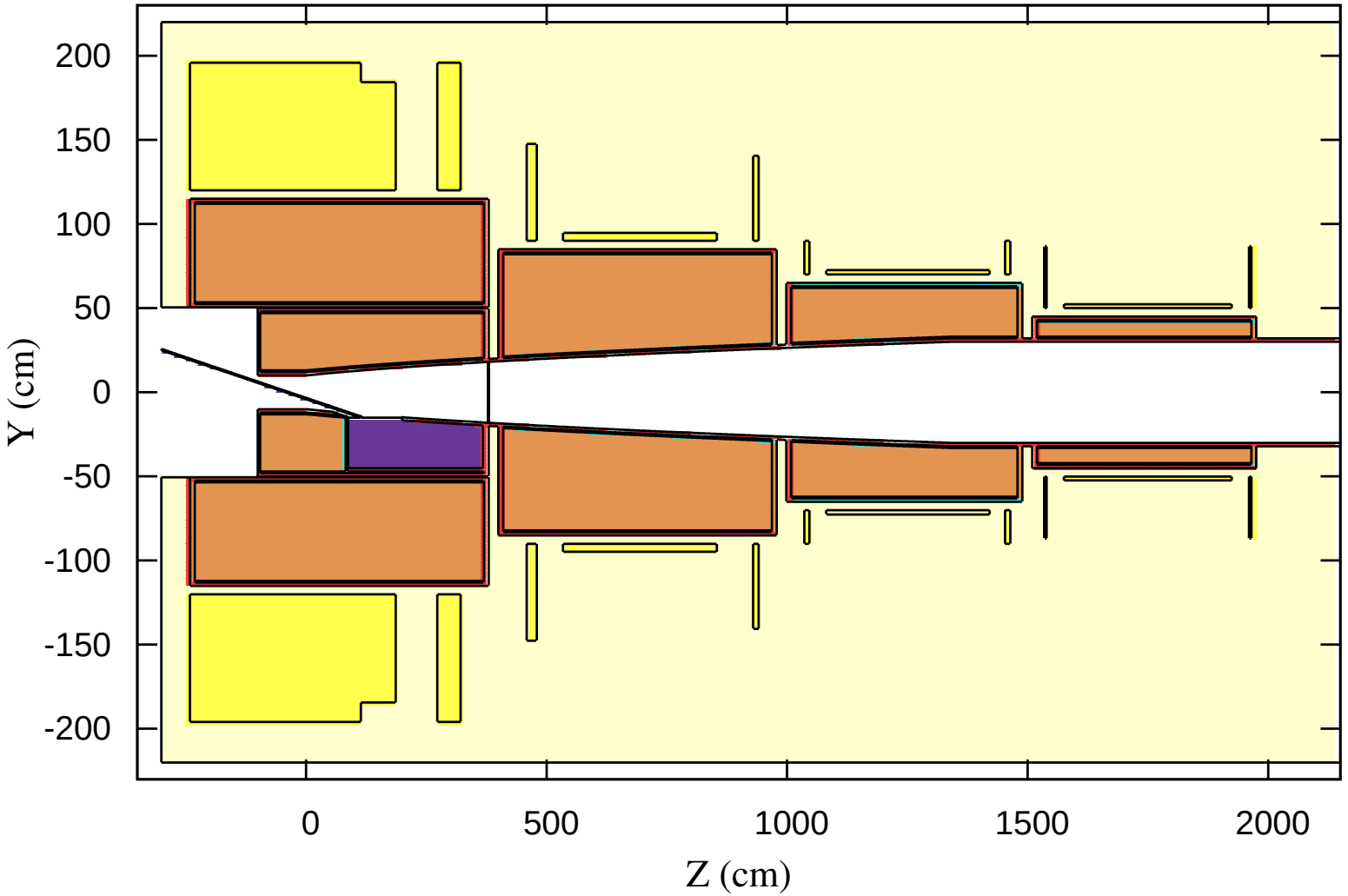
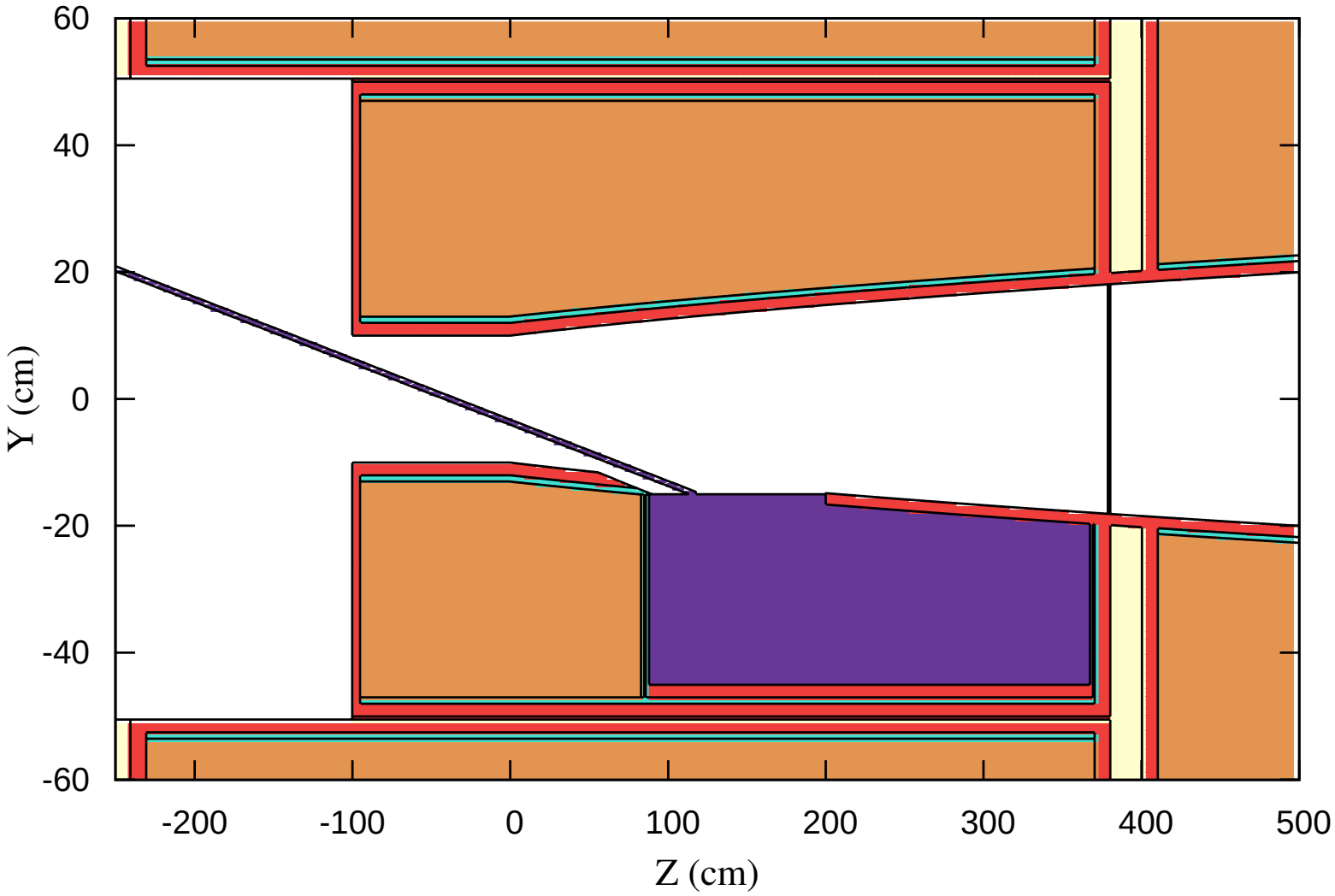
Introduction

- Using Fluka 2011.2.13 for energy deposition study of IDS120j geometry
- Hg jet: $r = 0.4\,\mathrm{cm}$, tilt $\theta = 97\,\mathrm{mr}$.
- Gaussian proton beam $\sigma_x = \sigma_y = 0.12\,\mathrm{cm}$, KE $= 8\,\mathrm{GeV}$ ("P12" starting point)
- Shielding: 60% W + 40% He ($\rho_{eff} = 9.48\,\mathrm{g/cc}$)
- Proton rate $= 3.125 \times 10^{15}\ \mathrm{s}^{-1}$ for $4\,\mathrm{MW}$ ($8\,\mathrm{GeV}$, $50\,\mathrm{Hz}$)
- Multiply (average) energies by proton rate to get deposited power

Fluka model of IDS120j geometry

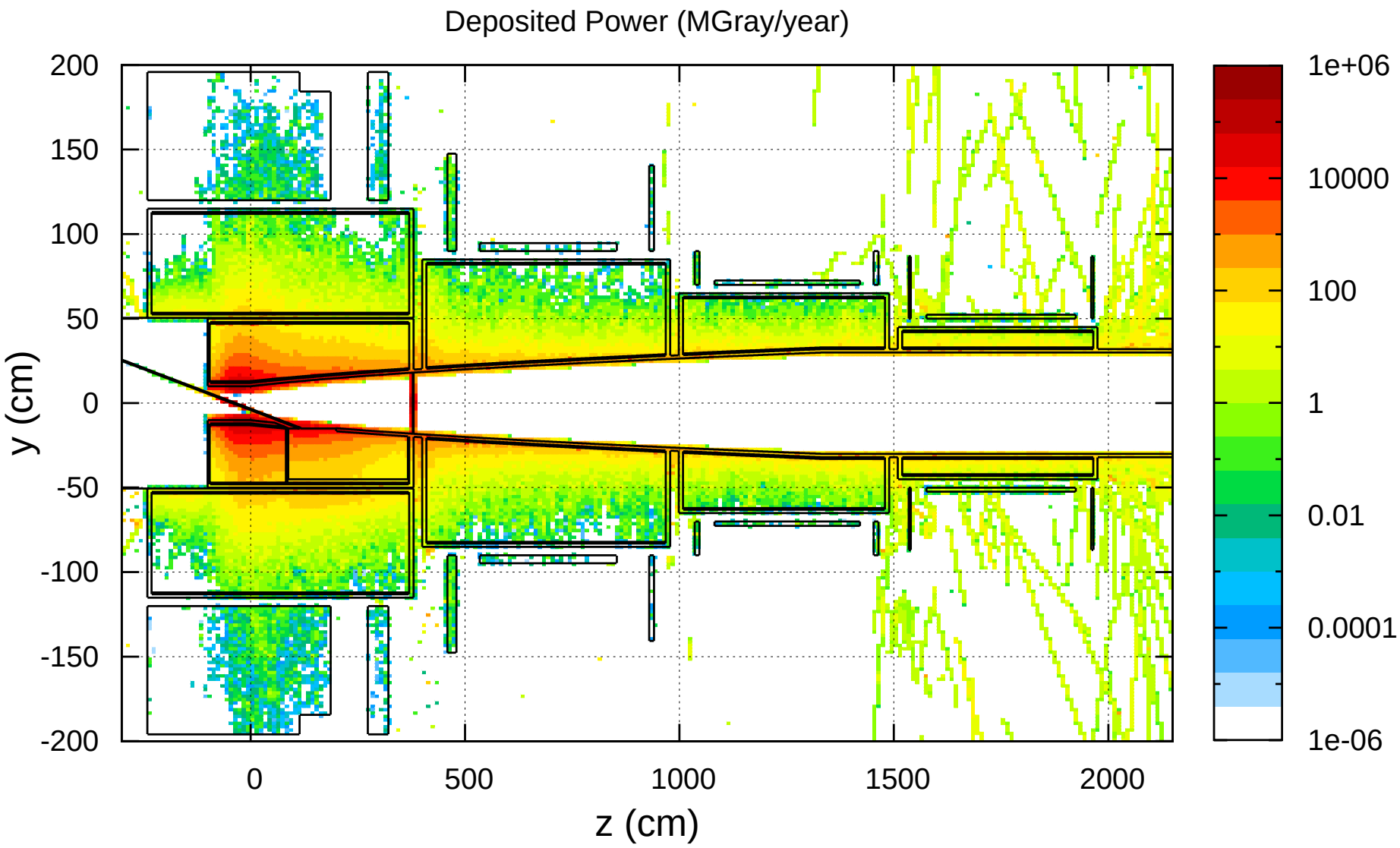


Fluka model of IDS120j geometry (zoom)



The gap is 20 cm.

Typical distribution of beam power



Power deposition in SC coils

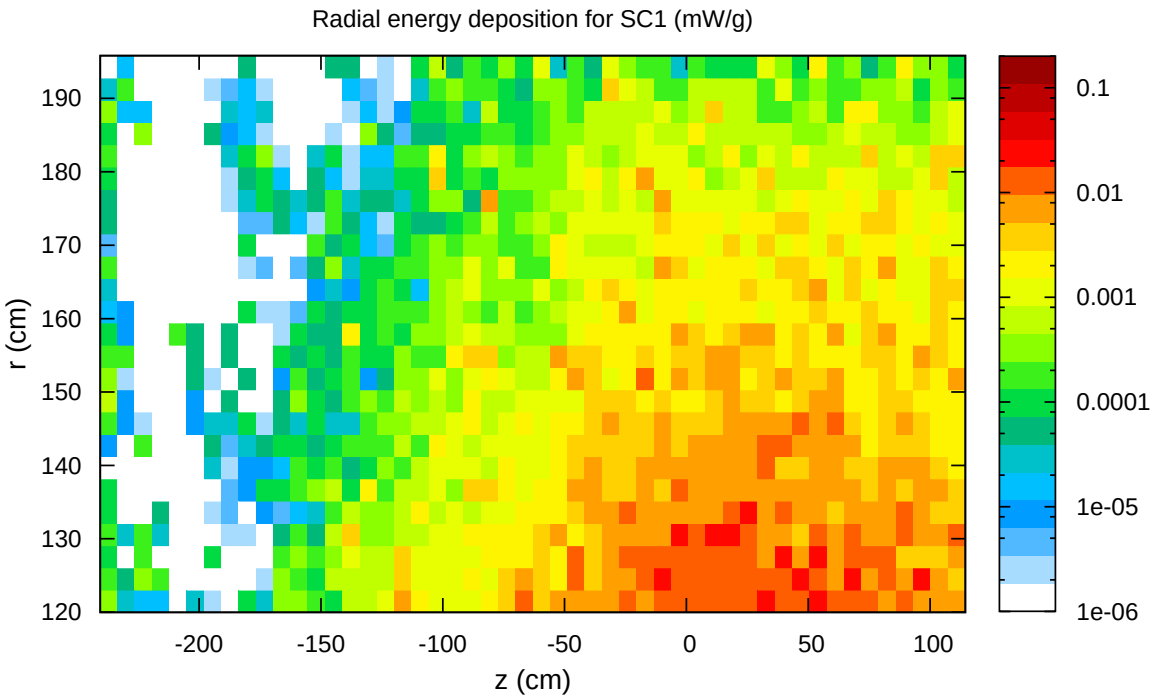
Region	P (kW)
SC Coil 1	0.361 ± 0.042
SC Coil 2	0.064 ± 0.019
SC Coil 3	0.030 ± 0.011
SC Coil 4	0.064 ± 0.019
SC Coil 5	0.012 ± 0.007
SC Coil 6	0.005 ± 0.004

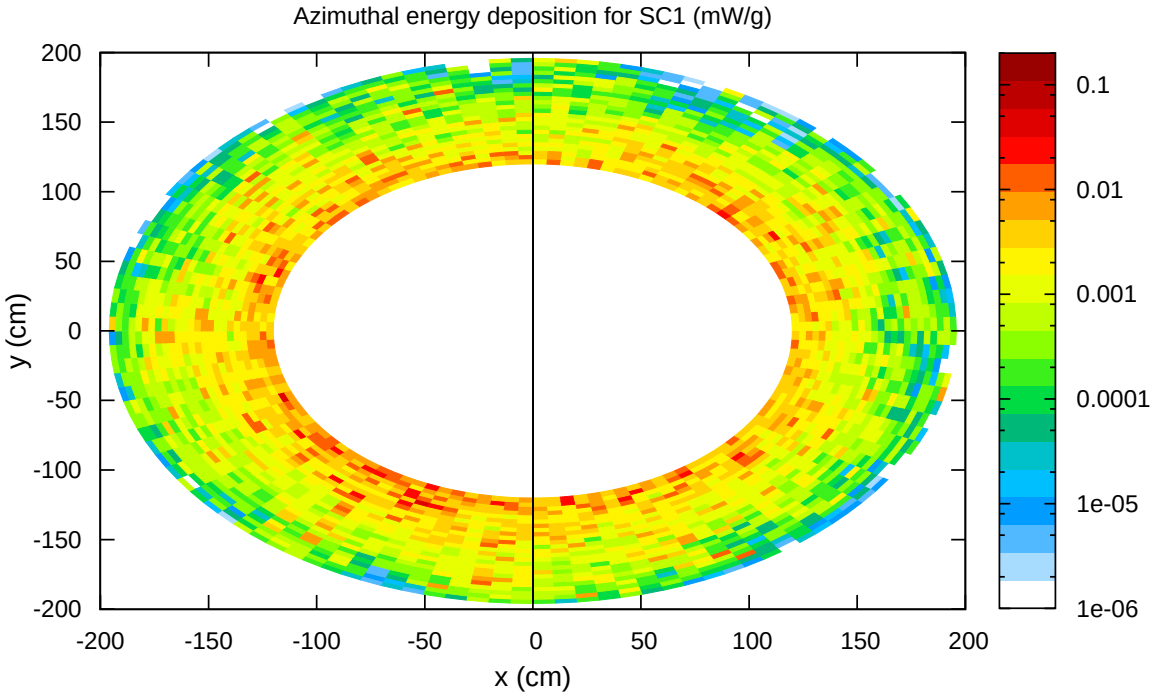
Region	P (kW)
SC Coil 7	0.013 ± 0.009
SC Coil 8	0.020 ± 0.007
SC Coil 9	0.005 ± 0.004
SC Coil 10	0.103 ± 0.040
SC Coil 11	0.197 ± 0.014
SC Coil 12	0.026 ± 0.012

Total SC power deposition $\approx 0.9\,\mathrm{kW}$

Power deposition in all regions

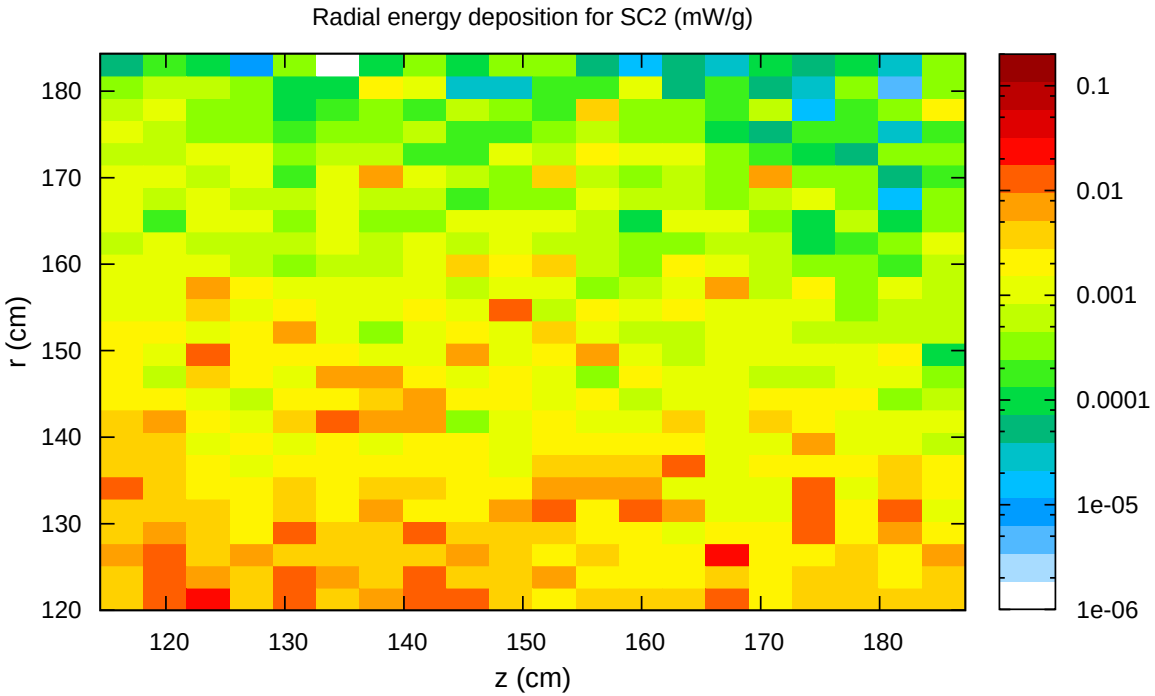
Region	P (kW)
SC coils 1–12	0.90 ± 0.07
Shielding for SC1–3	1569.7 ± 8.1
Shielding for SC4–6	69.6 ± 2.3
Shielding for SC7–9	25.9 ± 1.1
Shielding for SC10–12	50.5 ± 0.4
Beam pipe up to Be window	830.8 ± 5.5
Beam pipe from Be window	115.7 ± 2.8
Hg Pool Container Vessel	5.0 ± 0.2
Hg Jet	416.9 ± 2.3
Hg Pool	200.1 ± 4.3
Be Window	8.2 ± 0.1
Total	3293.3 ± 11.6

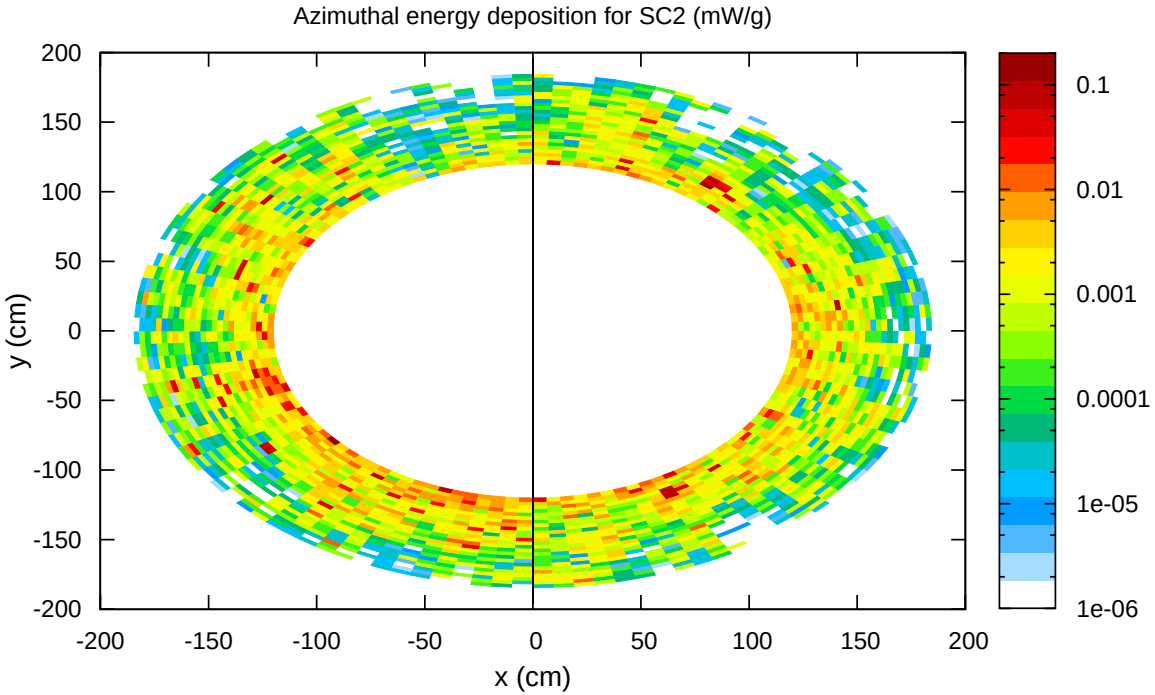




SC1 power deposition

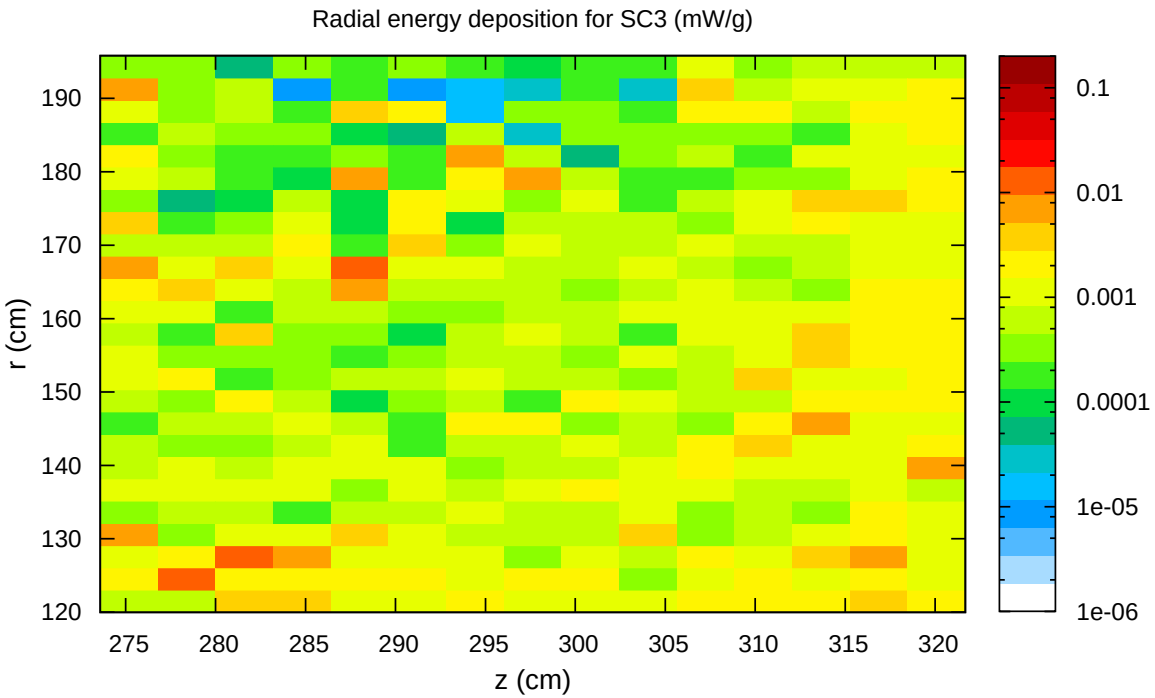
$P_{\text{peak}} < 0.1\,\text{mW/g}$

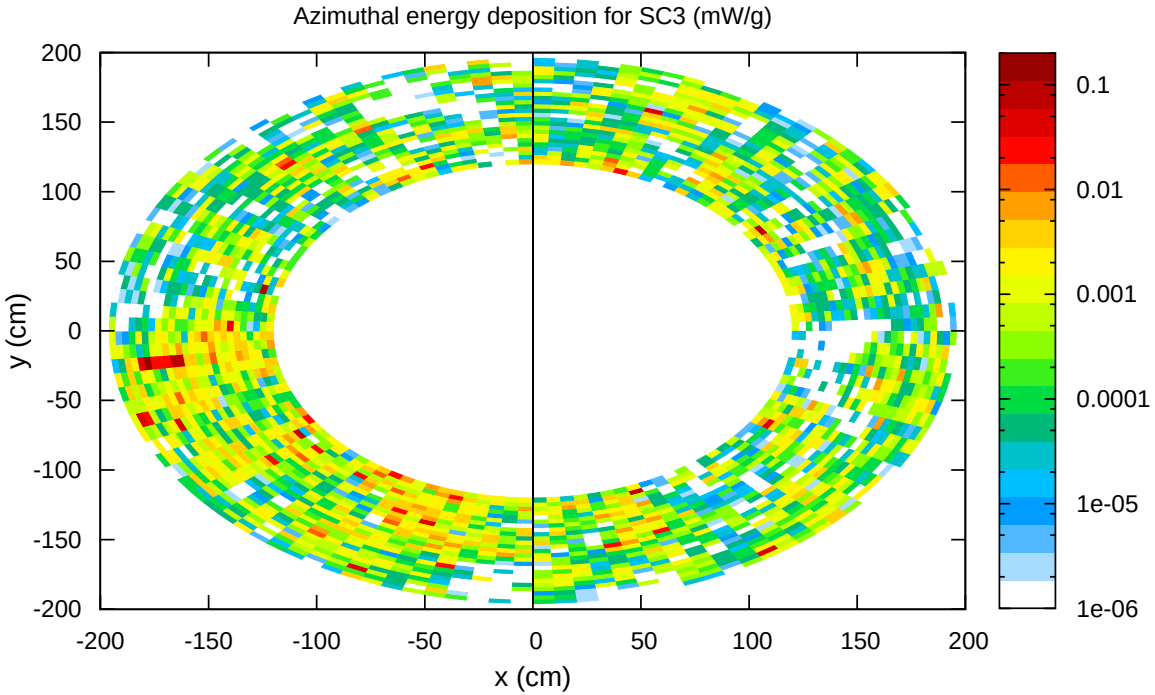




SC2 power deposition

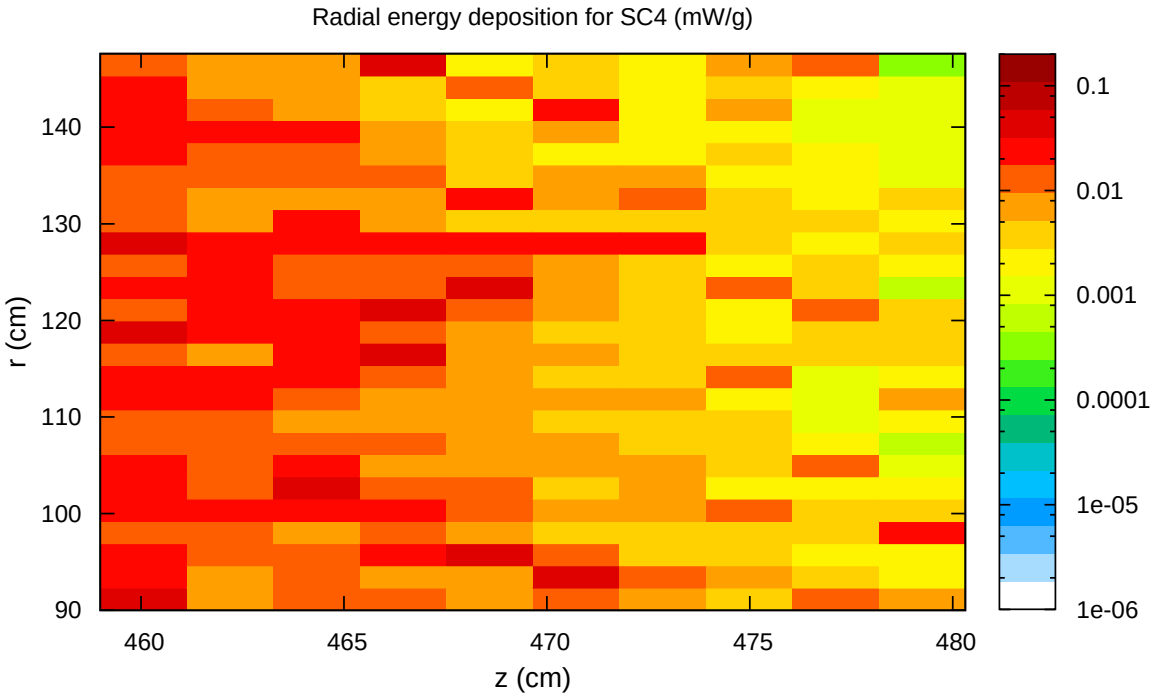
$P_{\text{peak}} < 0.1\,\text{mW/g}$

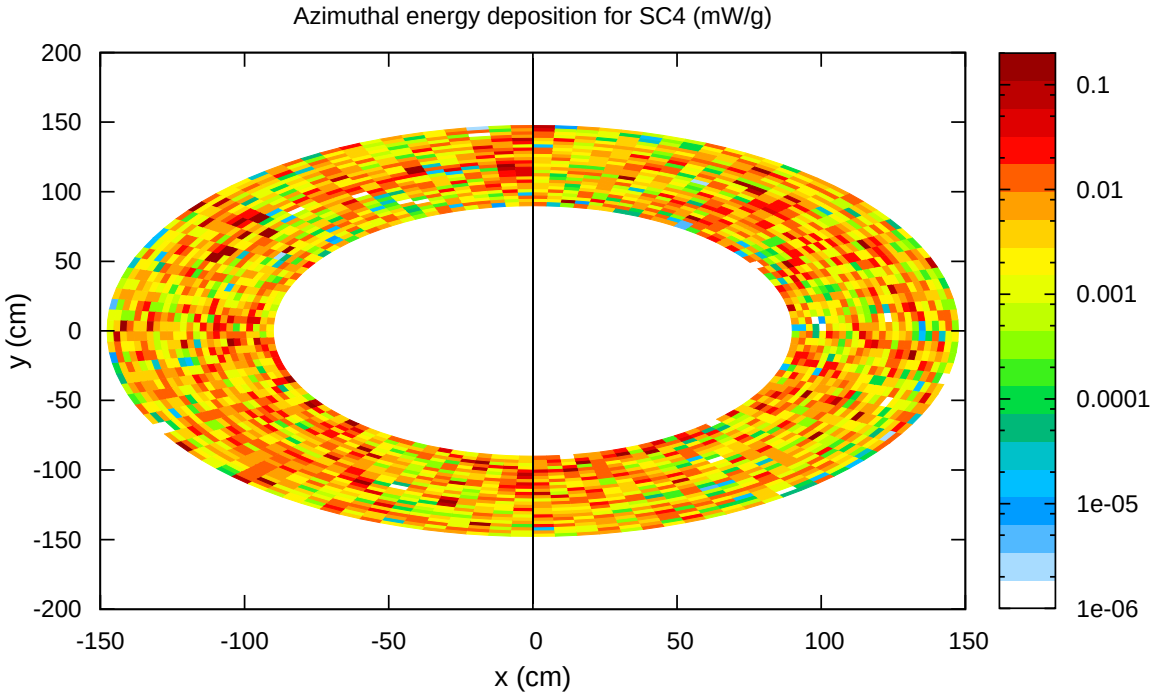




SC3 power deposition

$P_{\text{peak}} < 0.1\,\text{mW/g}$





SC4 power deposition

Radial $P_{\text{peak}} < 0.1\,\text{mW/g}$

Azimuthal $P_{\text{peak}} < 0.2\,\text{mW/g}$

Summary

- Shown Fluka energy deposition results for IDS120j geometry
- Power deposition in SC coils below 1 kW
- All coils have peak energy density below 0.1 mW/g, except SC4:
  - SC4 has maximum azimuthal peak energy density ≈ 0.2 mW/g
  - Need slightly more shielding near SC4