THE UNIVERSITY OF WARWICK

Power Deposition in NuFact Target

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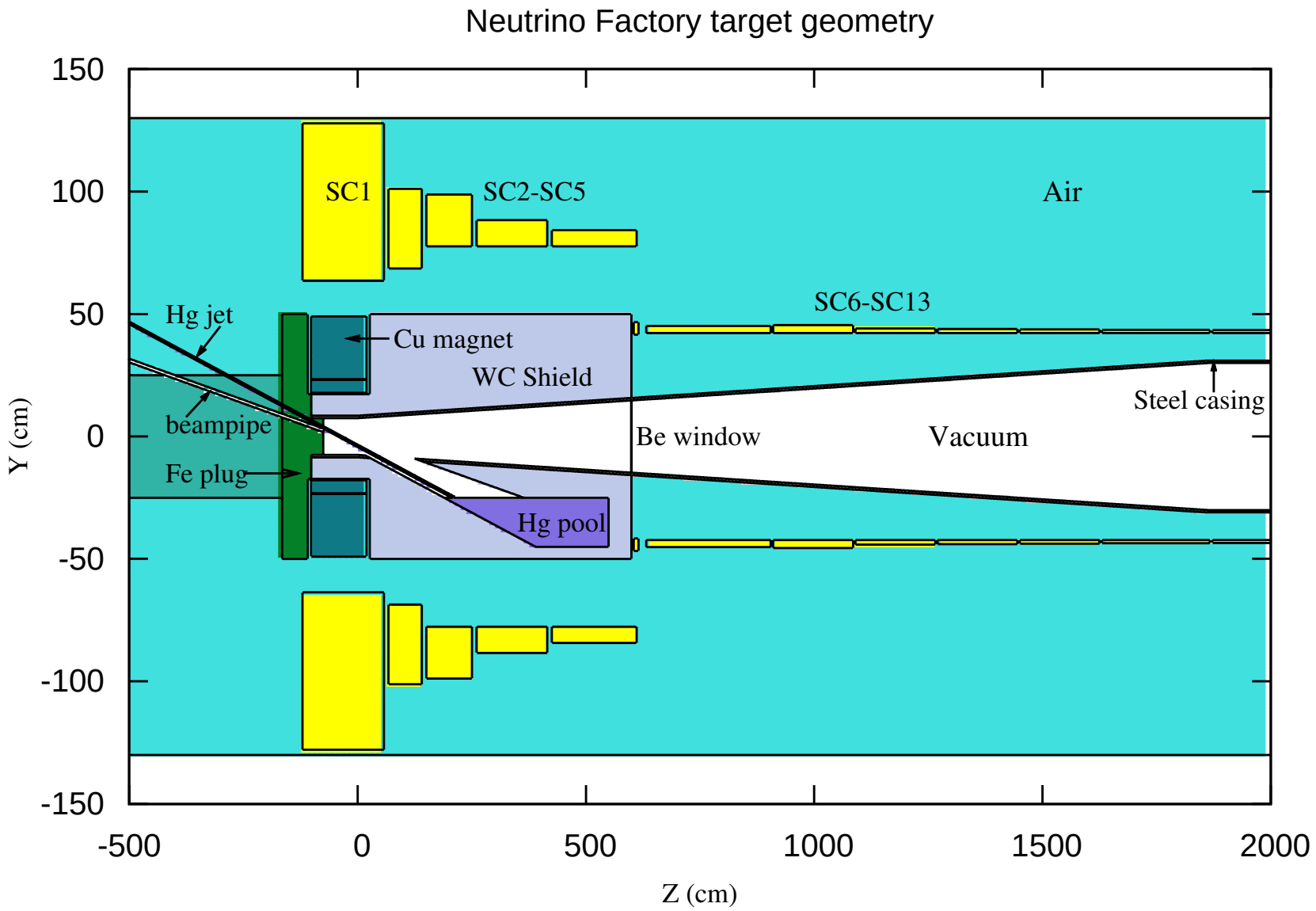
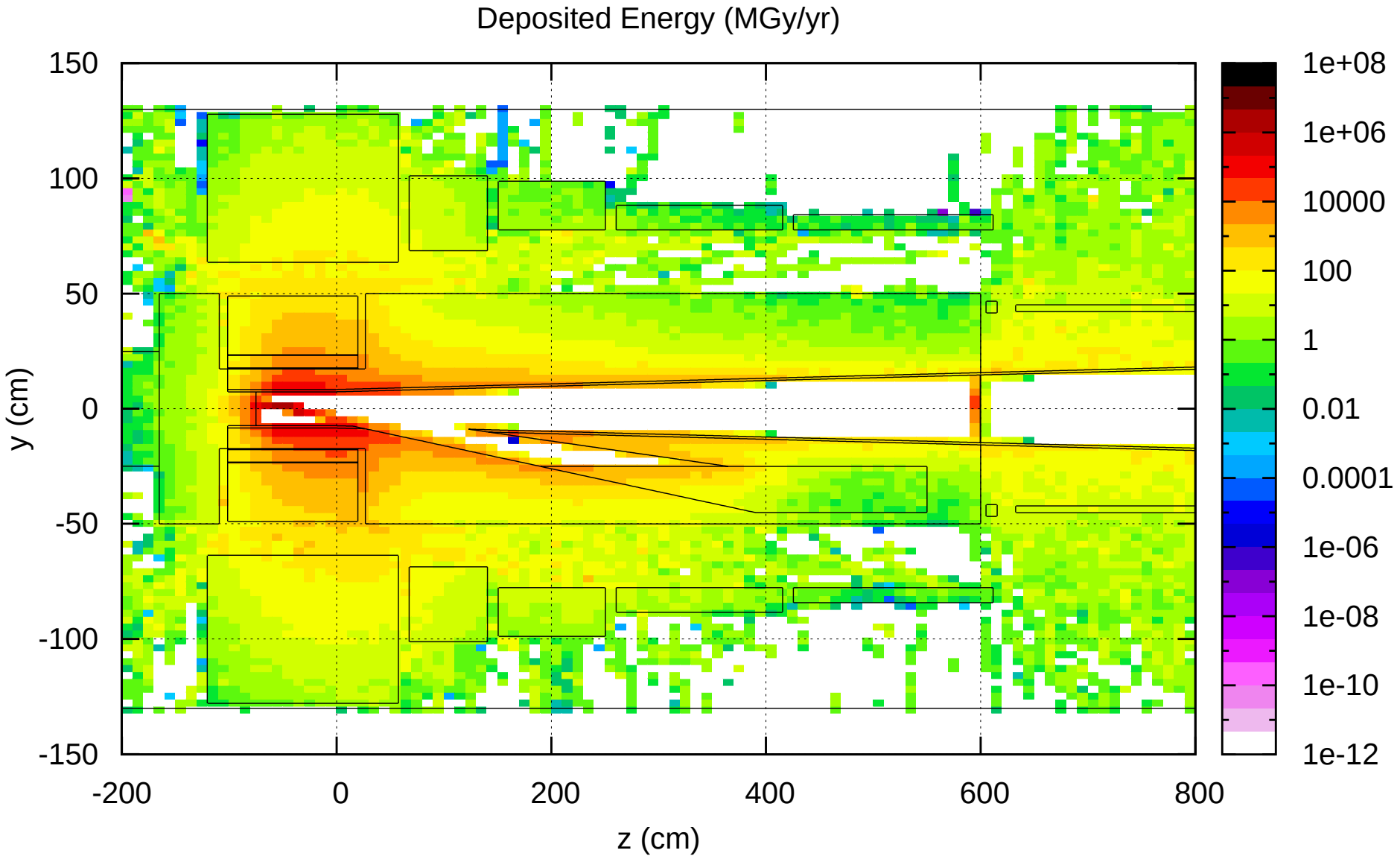
Introduction

- Using Fluka to estimate energy deposition for NuFact Hg jet target
- Study II geometry and magnetic field map
- Hg jet: $r = 0.5\,\text{cm}$, tilt θ=100 mr
- Parabolic proton beam $r_{\text{beam}} = 0.15\,\text{cm}$, tilt θ=67 mr; KE= 10 GeV
- Looking at energy per unit volume and deposited power in different regions
  - Proton rate $= 2.5 \times 10^{15}$ s^{-1} for 4 MW (10 GeV, 50 Hz)
  - Multiply energies by proton rate to get deposited power

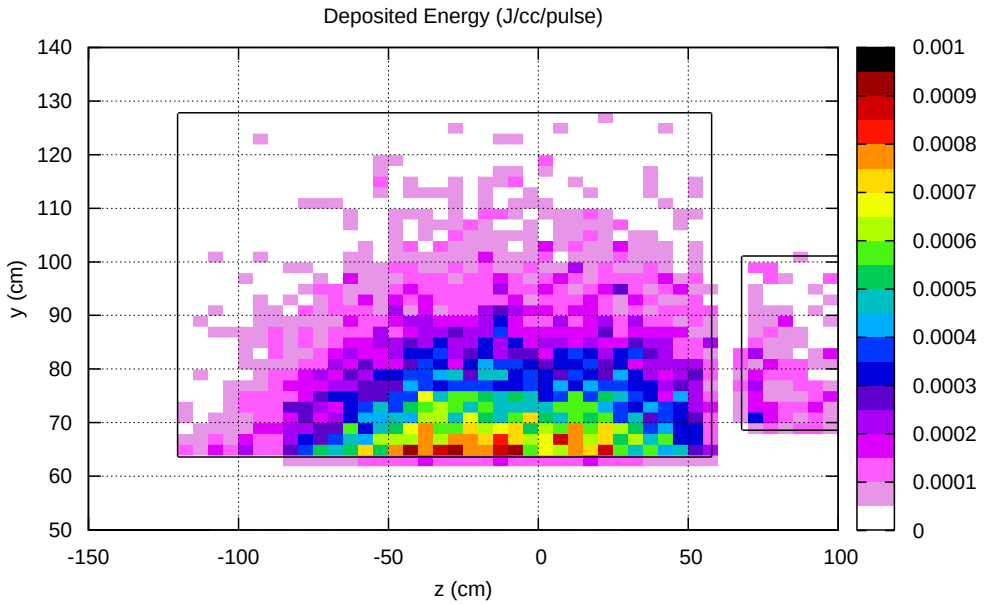
Fluka Geometry (Study II)

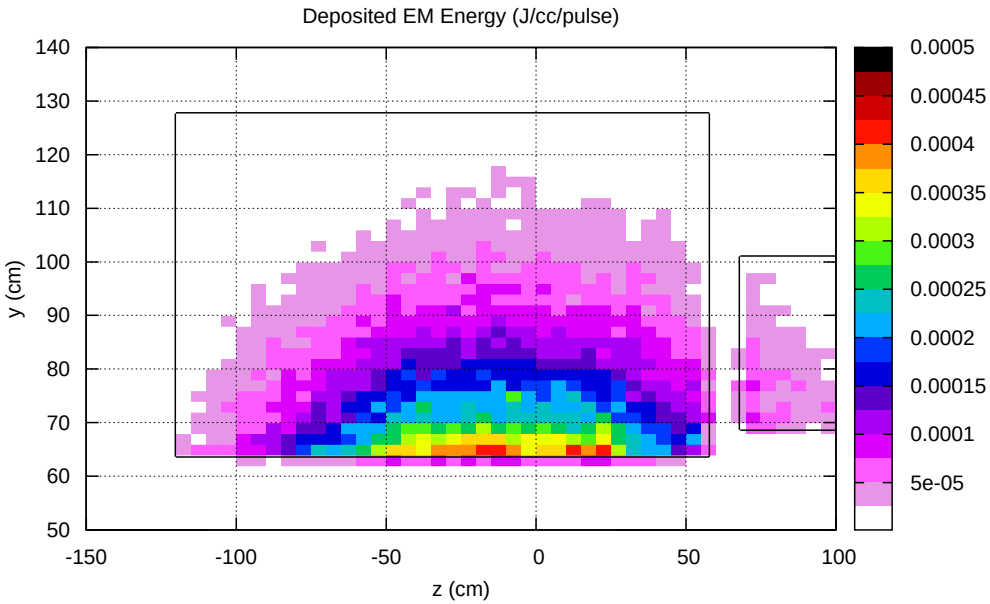


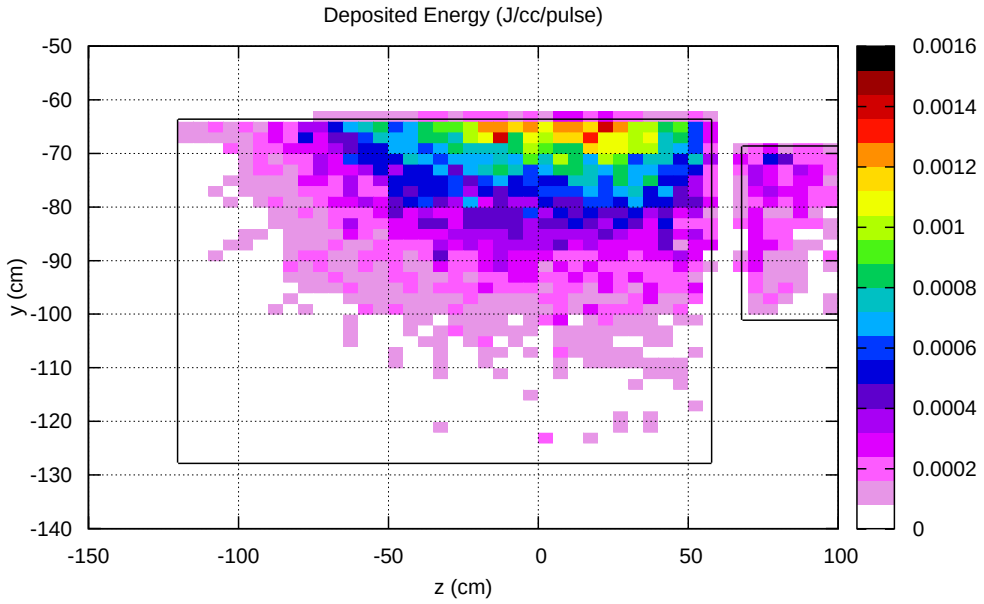
Energy deposition

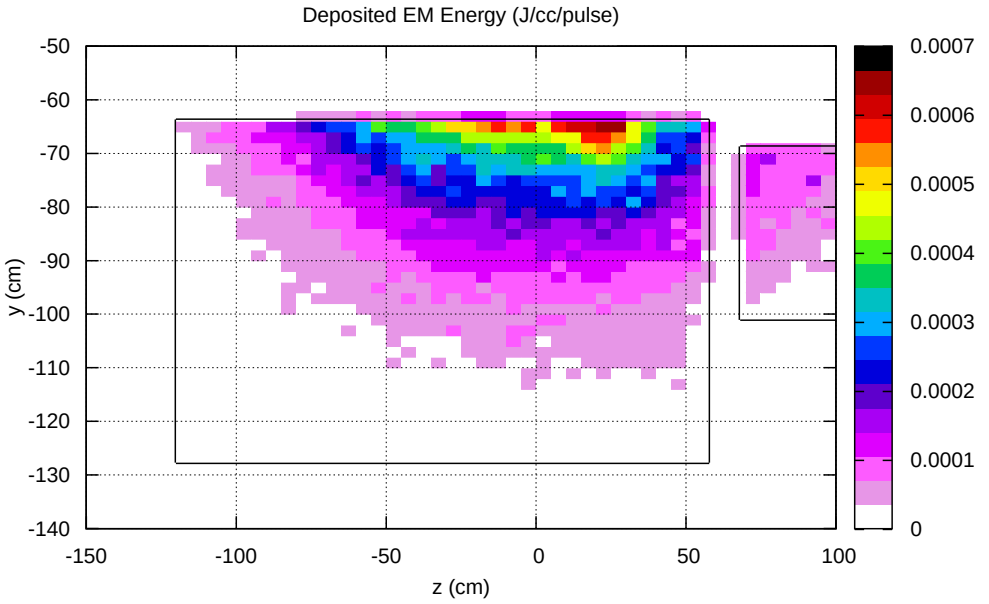


Energy deposition (J/cc/pulse) in SC Coil 1

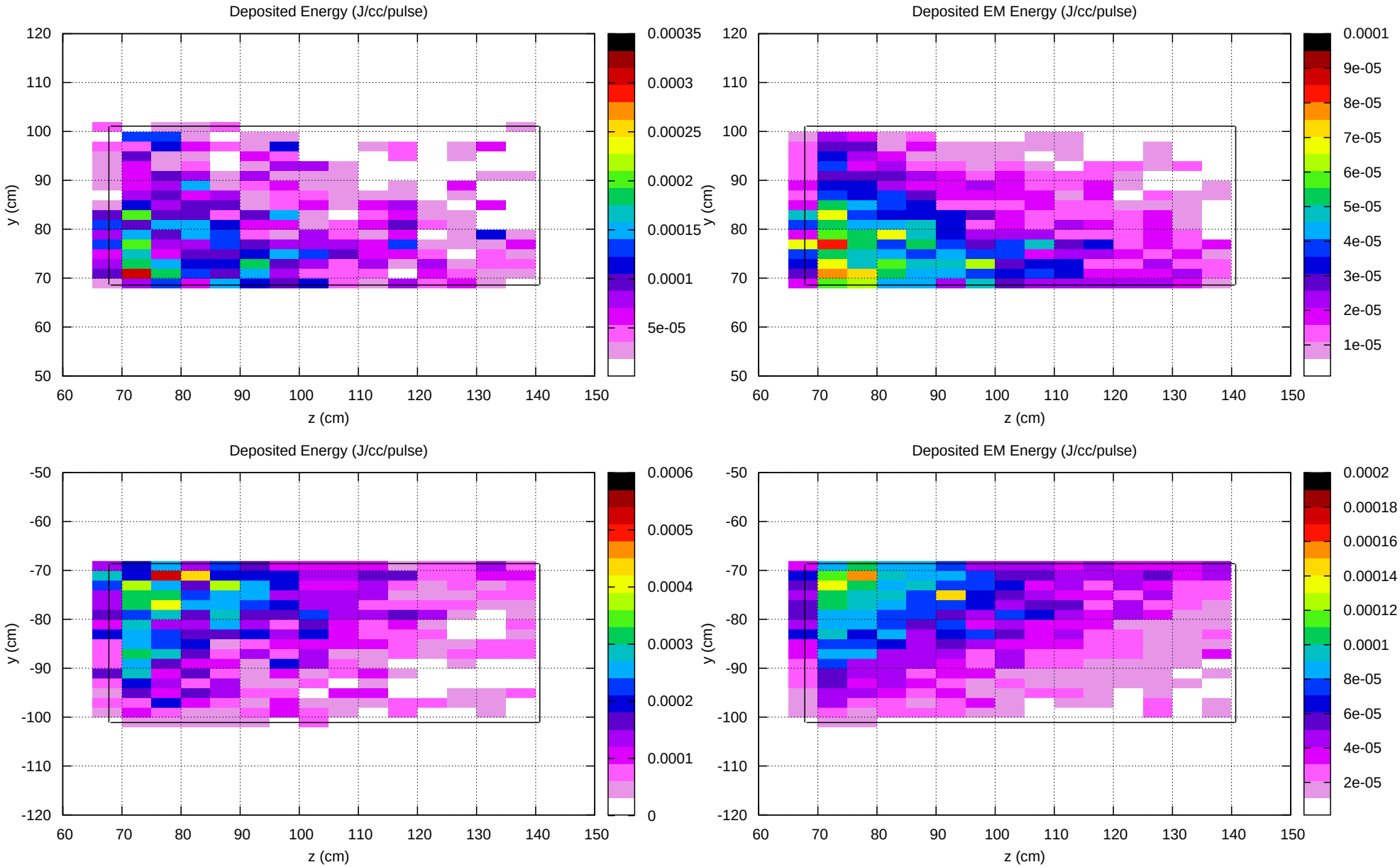




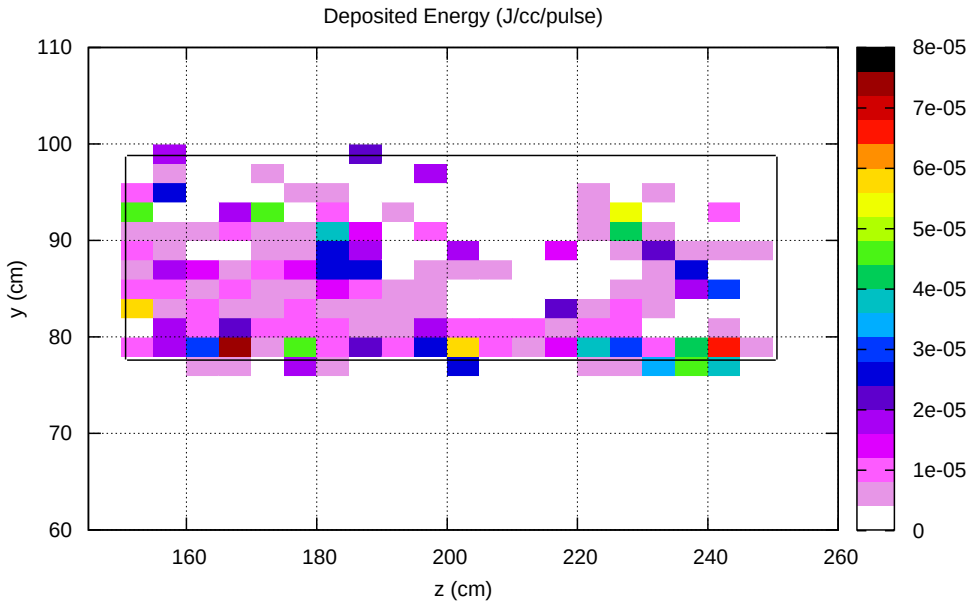


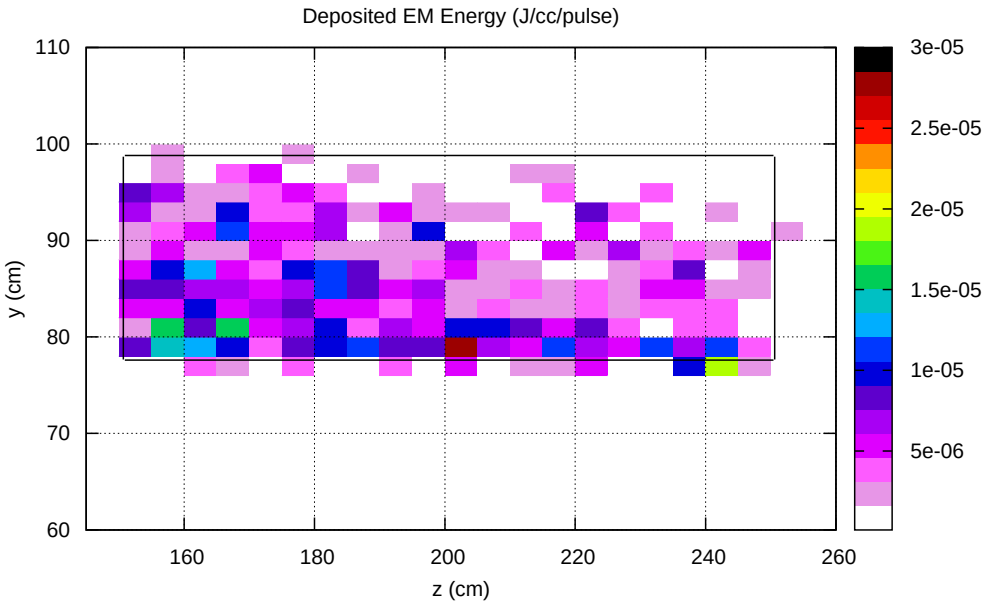


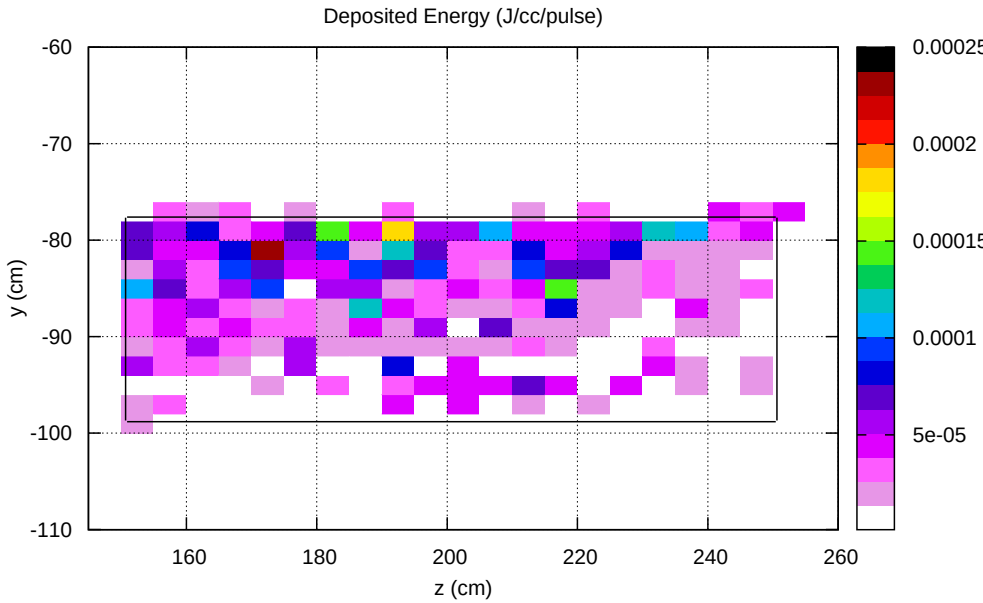
Energy deposition (J/cc/pulse) in SC Coil 2

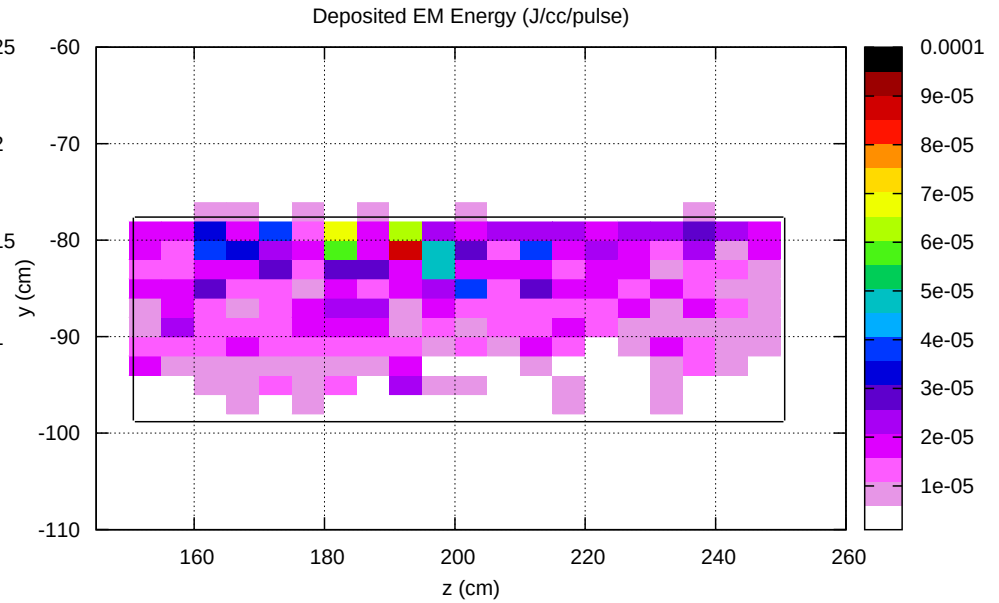


Energy deposition (J/cc/pulse) in SC Coil 3









Regional deposition of 4 MW beam power (all and EM-only)

Region	P_{all} (kW)	%	P_{em} (kW)	%
Hg Jet	400.9	10.0	178.0	4.5
Hg Pool inside WC shield	12.5	0.3	6.0	0.2
WC shield ($z < 27$ cm)	1845.5	46.1	923.2	23.1
WC shield ($z \geq 27$ cm)	848.3	21.2	361.9	9.1
Outer Fe yoke ($z < -165$ cm)	—	—	—	—
Inner Fe yoke ($z \geq -165$ cm)	15.2	0.4	6.3	0.2
Inner Cu coil ($18 \leq r \leq 23$ cm)	142.0	3.6	48.3	1.2
Outer Cu coil ($23 < r \leq 49$ cm)	90.3	2.3	28.4	0.7
SC Coil 1	52.7	1.3	23.8	0.6
SC Coil 2	5.5	0.1	2.0	0.1
SC Coil 3	1.2	—	0.5	—
SC Coil 4	0.4	—	0.1	—
SC Coil 5	0.1	—	—	—
SC Coil 6	< 0.1	—	—	—
SC Coil 7	1.1	—	0.5	—
SC Coil 8	0.5	—	0.2	—
SC Coil 9	0.2	—	0.1	—
SC Coil 10	0.1	—	—	—
SC Coil 11	0.1	—	—	—
SC Coil 12	0.1	—	—	—
SC Coil 13	0.7	—	0.3	—
Be window at 6 m	1.7	—	0.8	—
Other (mostly particles inside bore)	576.7	14.4	—	—

For any region: roughly half of deposited power is from EM interactions ($e^{\pm}$, γ)
For SC1, average power per unit mass is $\approx 1.1\,\mathrm{mW\,g^{-1}}$

Approximate distribution of beam power