FLUKA Simulations for LUXE Forward Spectrometer

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Technical Specifications I

- Target – 10 um tungsten or 200 um Kapton (similar behaviour)
    - Radiation hardness of Kapton ~ 100 Gy
    - 5 cm x 5cm area
- Collimators (x2)
    - Length – 50 cm
    - Outer radius – 5 cm
    - Inner radius – 0.4 cm
    - Separation – 50cm
    - Distance from target – 50 cm

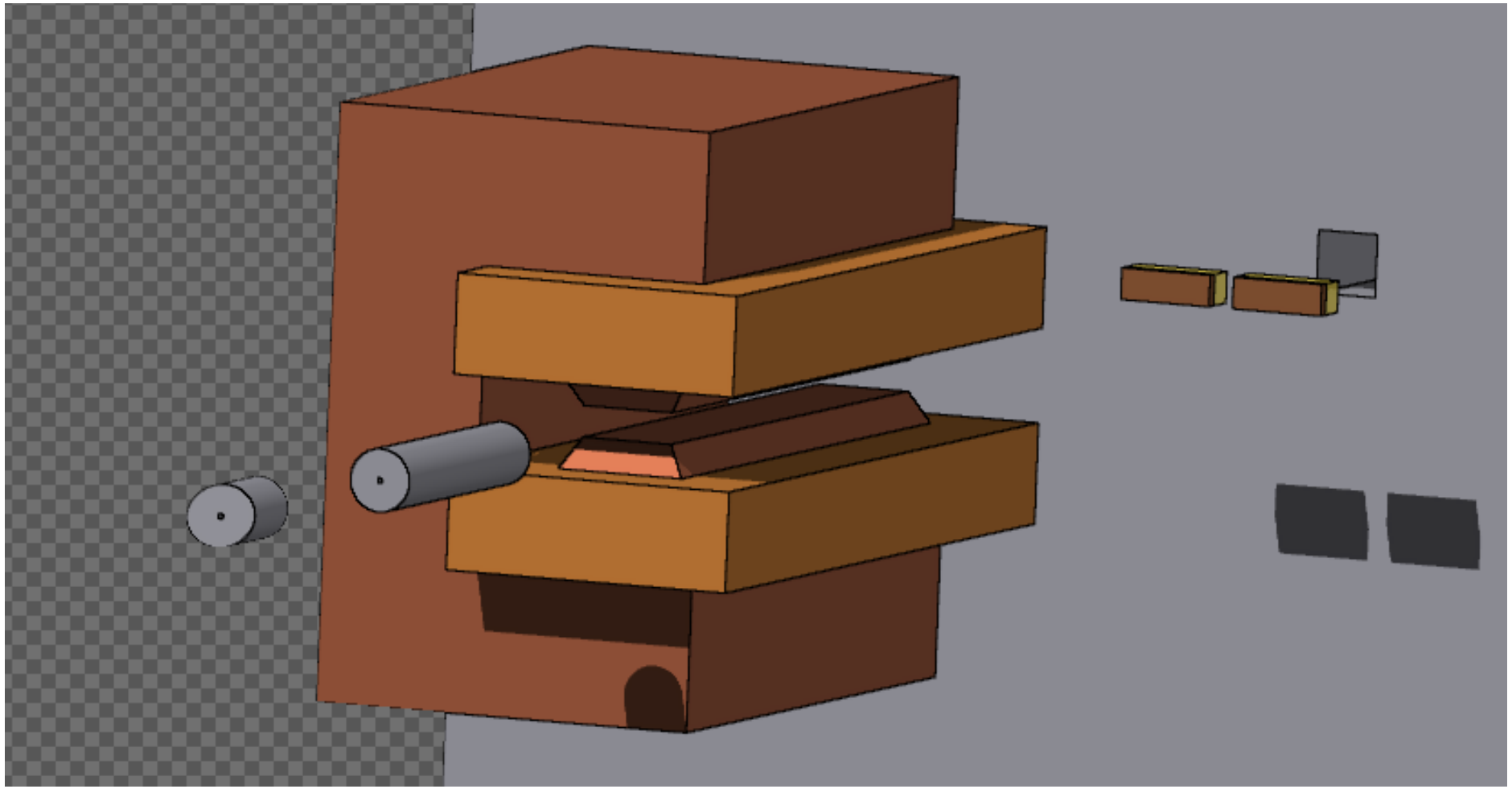
Technical Specifications II

- Scintillator screens (x2)
    - LYSO crystal
    - Bin size - 1 mm x 2 mm x 2 cm (higher res in plane of deflection)
    - Screen size - 15 cm x 5 cm x 2cm (to be increased to 30cm)
    - Bin numbers – 150 x 25 x 1 (increase to 300)
    - Radiation hardness ~ 1 Gy
    - Off axis displacement – 5 cm
    - Distance from target – 500 cm

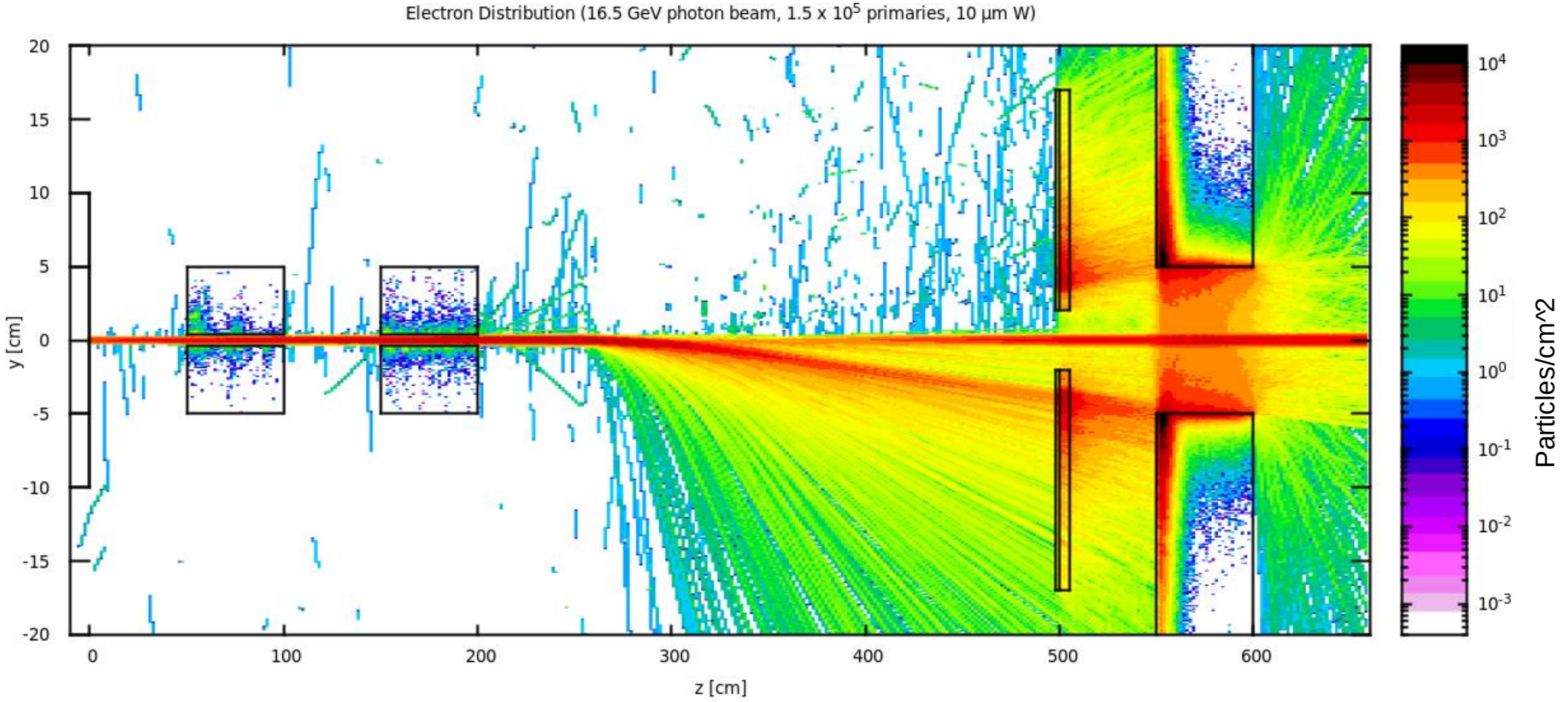
Dipole Magnet

- Effective length – 98 cm
- Effective width – 18 cm
- Effective height – 5 cm
- Field strength – 1.0 T (up to 1.4)
- Distance from magnet – 250 cm

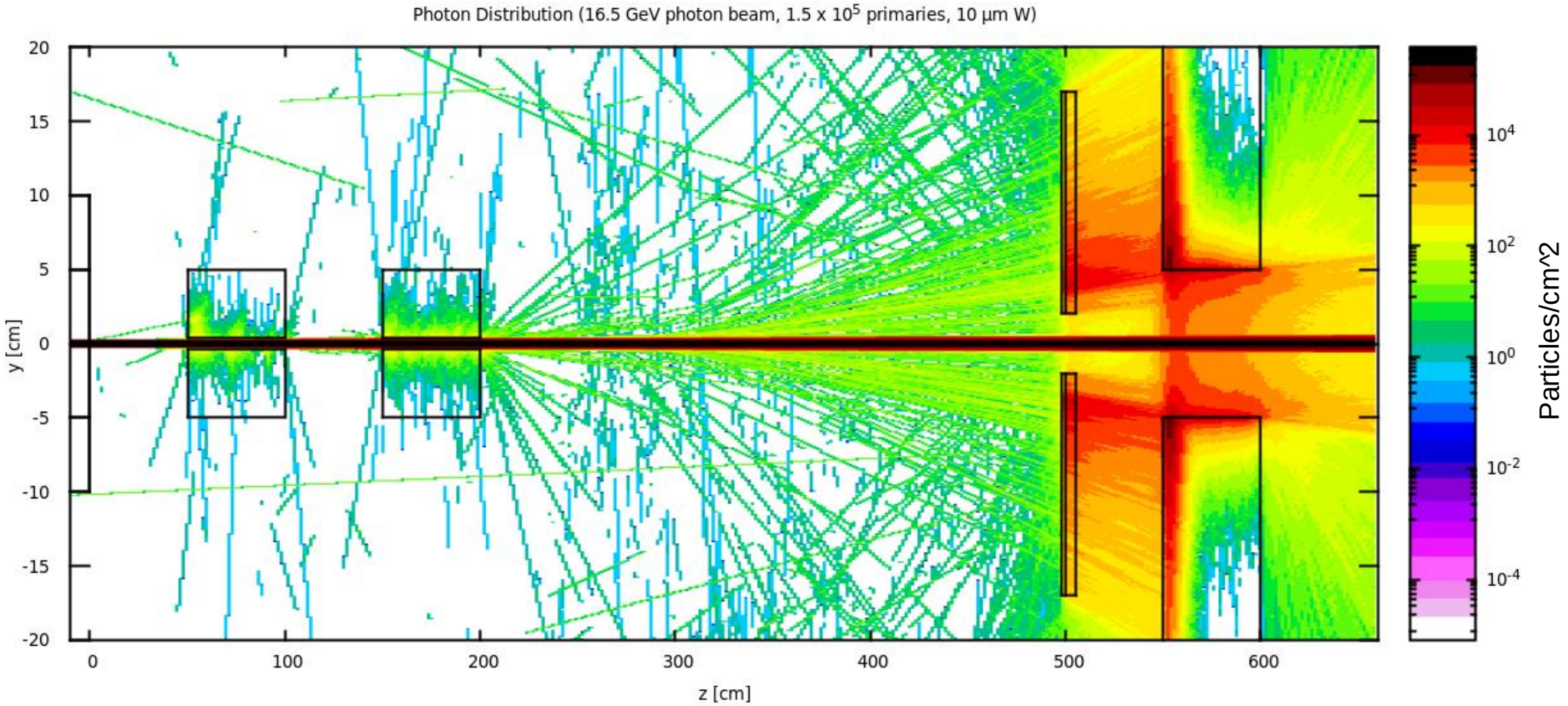
FLUKA Setup



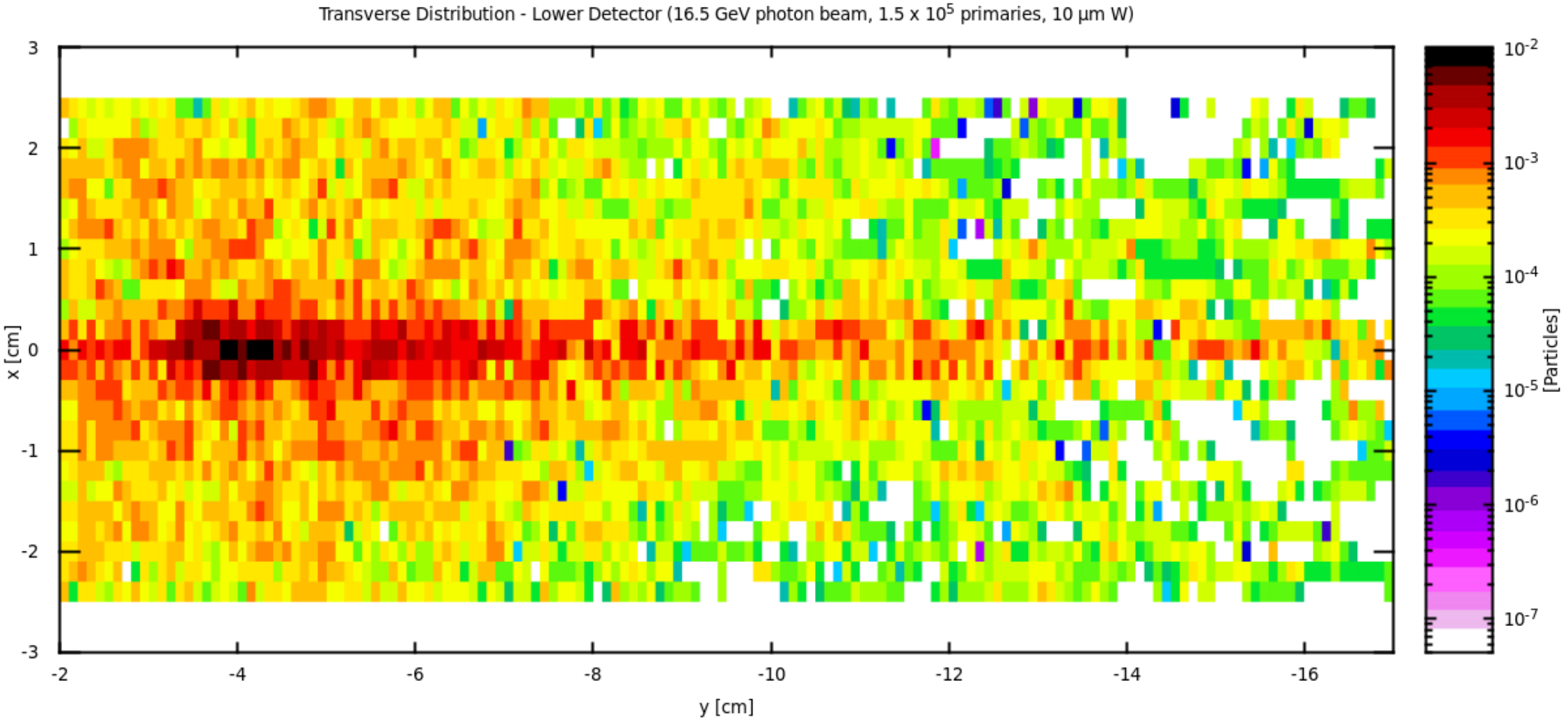
Response to Monoenergetic Beam - Electrons



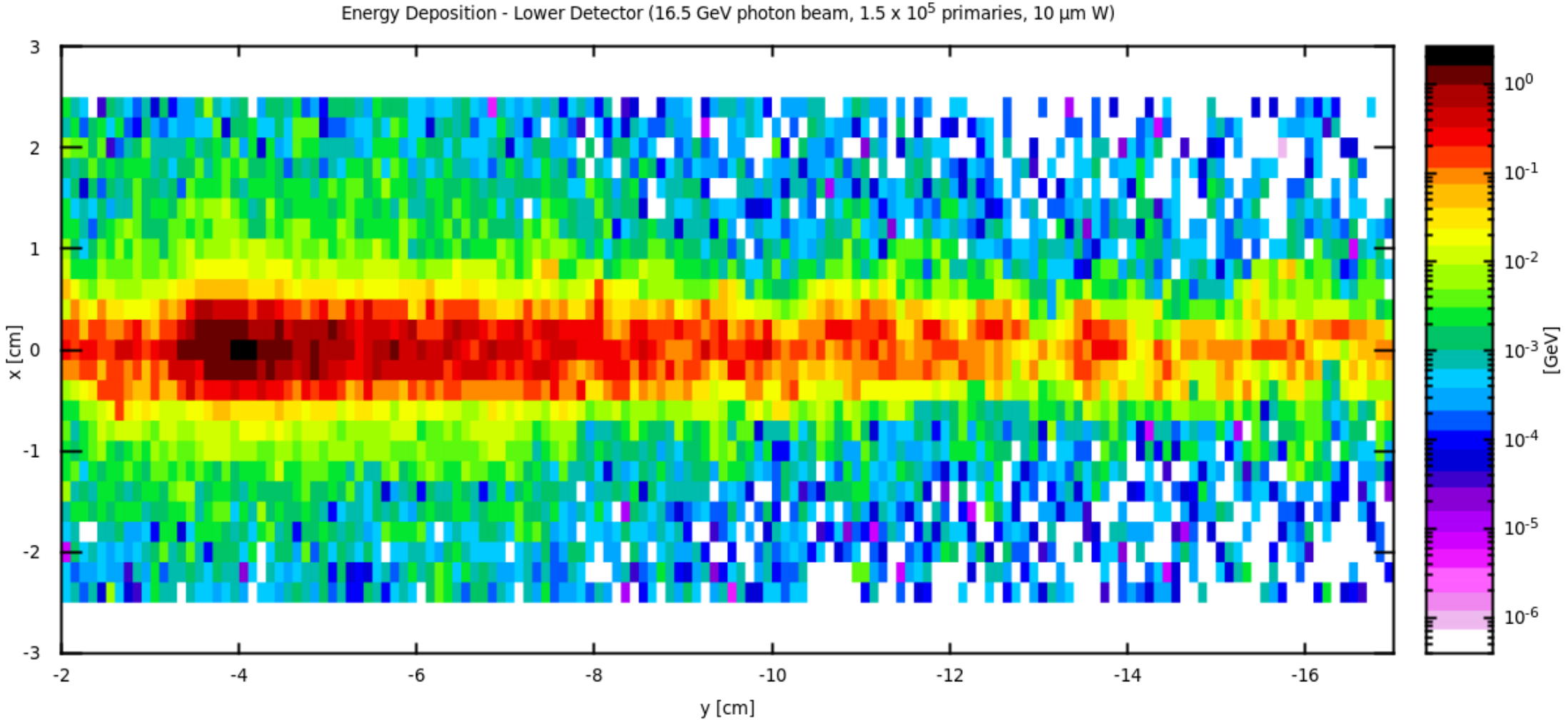
Response to Monoenergetic Beam - Photons



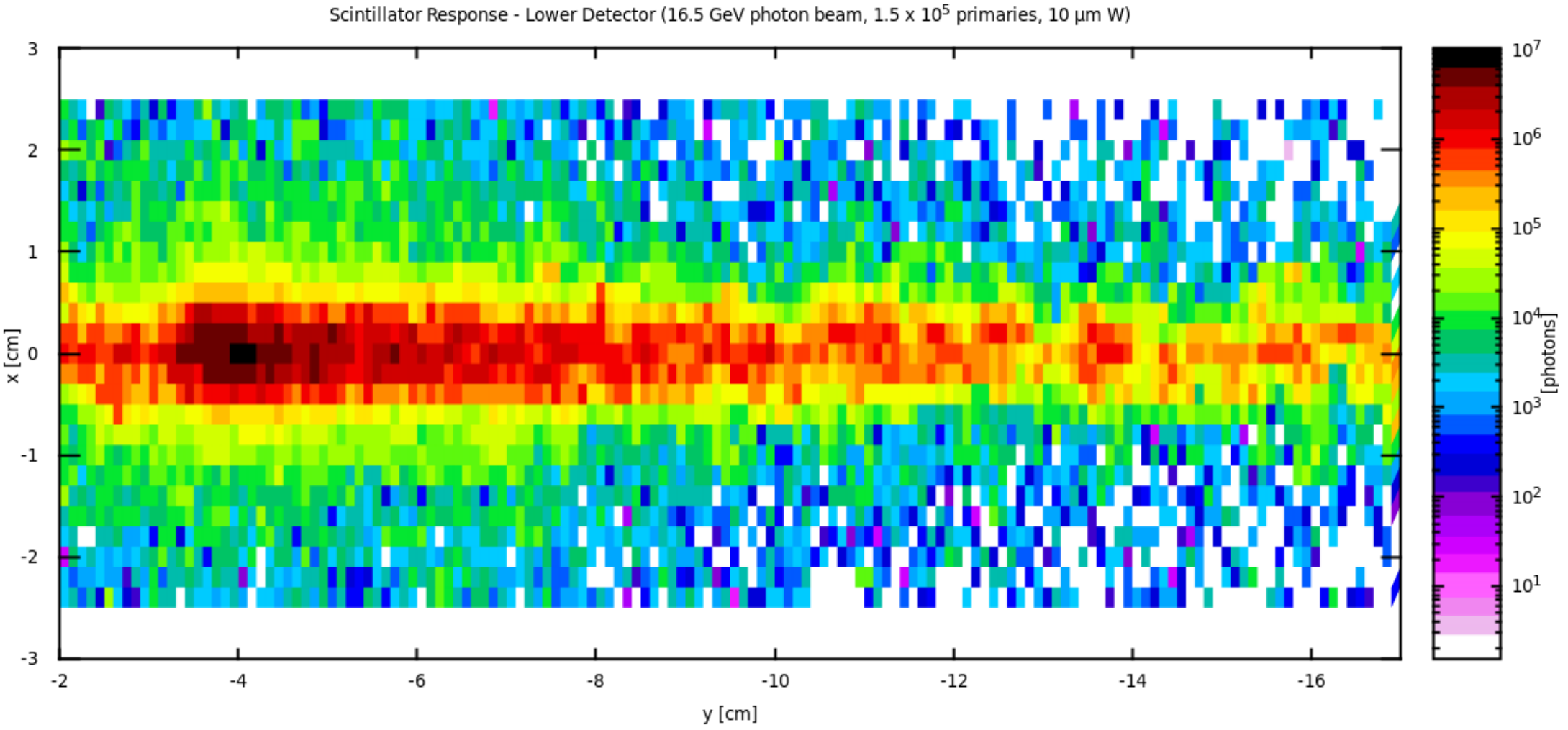
Deposition on Electron Detector (Particles)



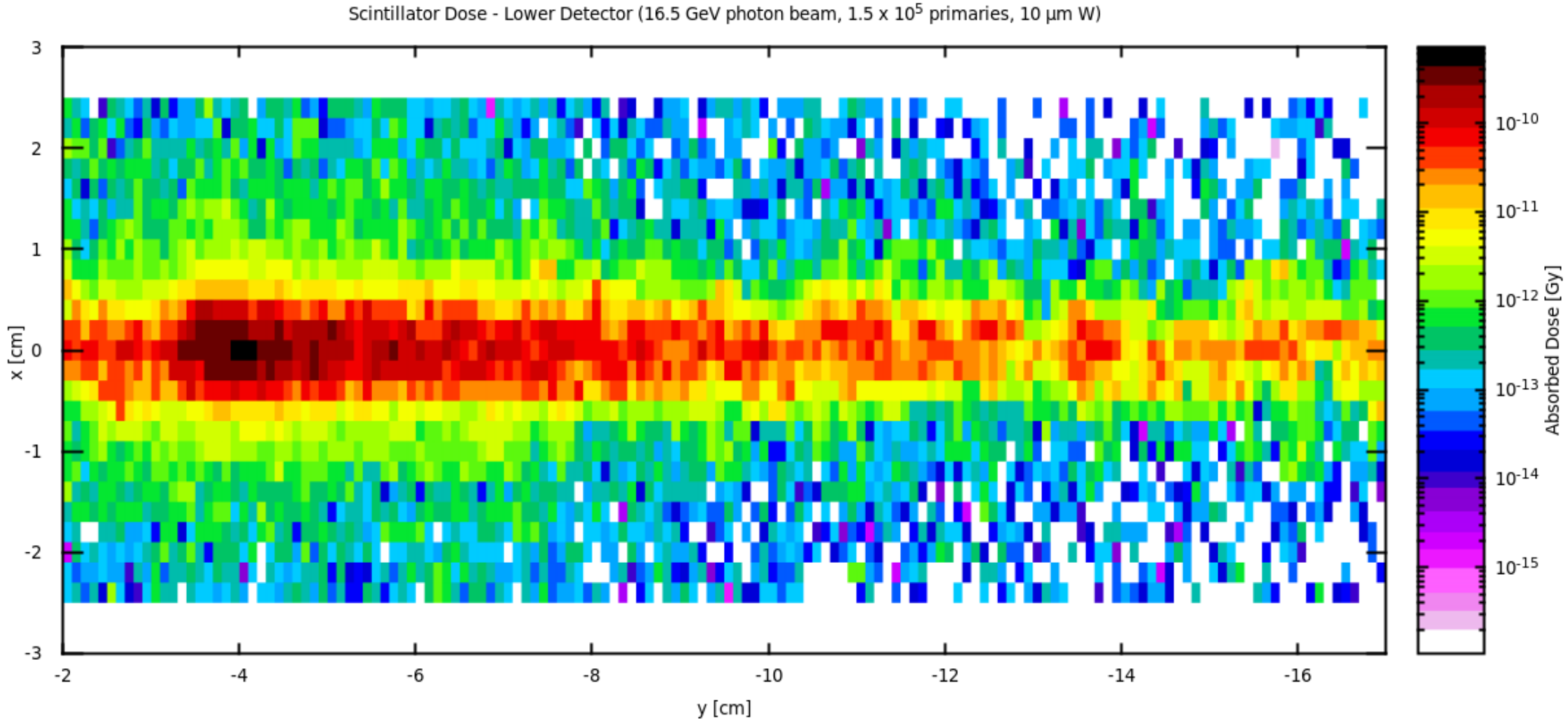
Deposition on Electron Detector (Energy)



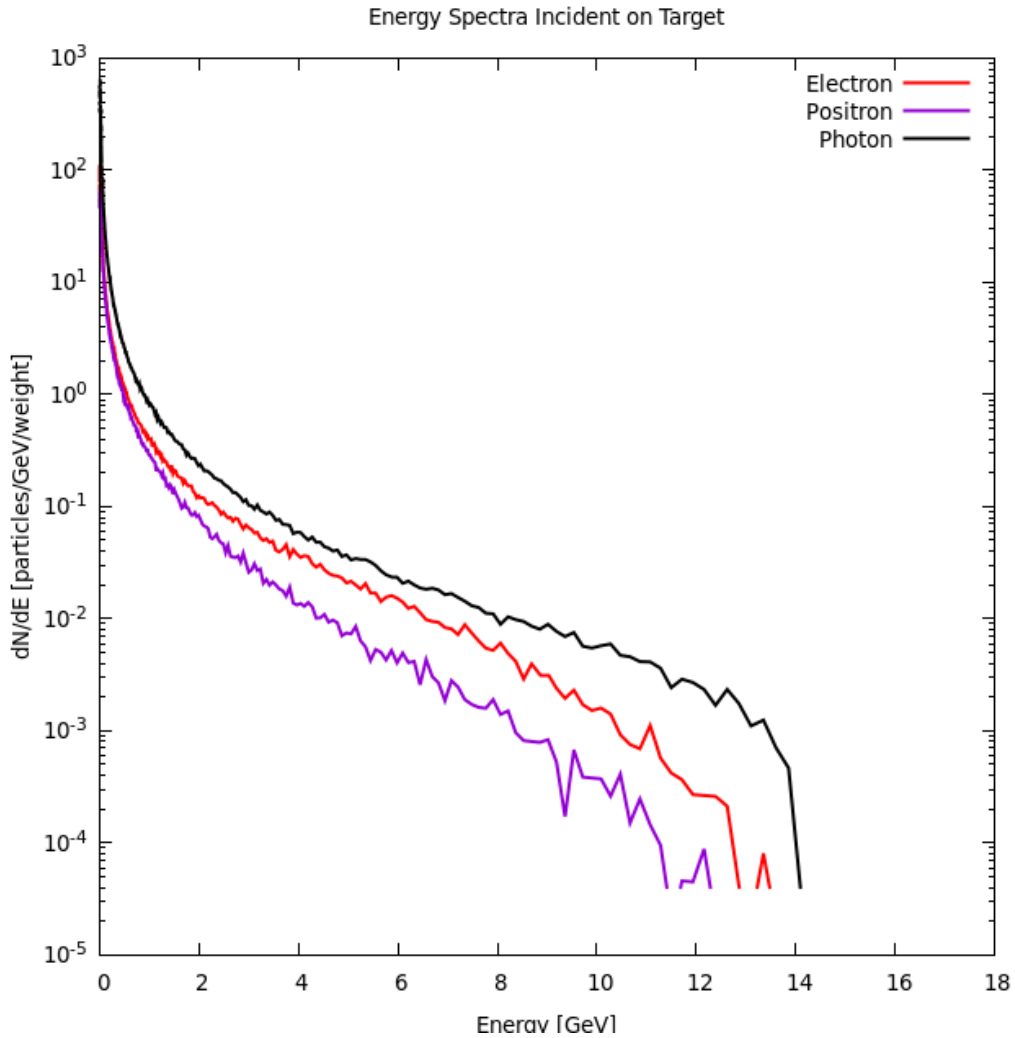
Scintillator Response - Electron Detector



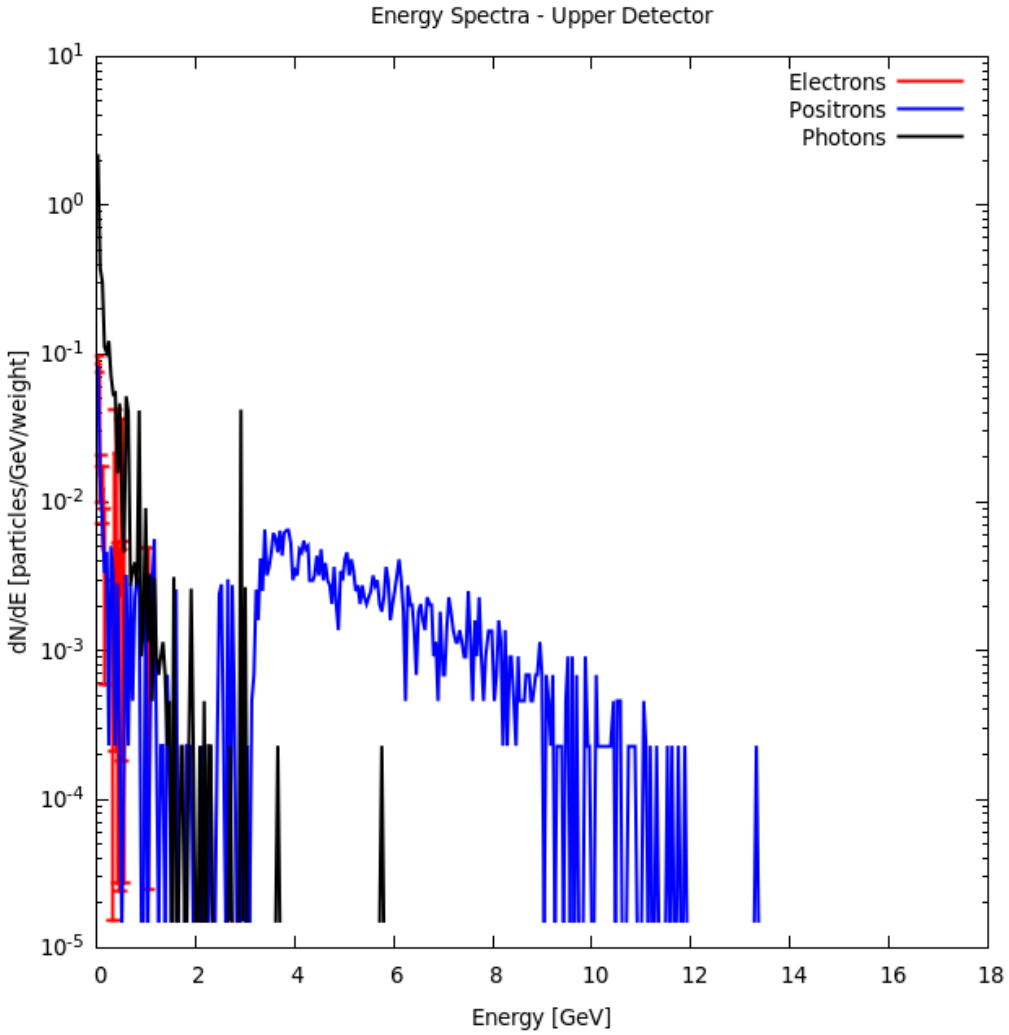
Radiation Dose on Electron Detector

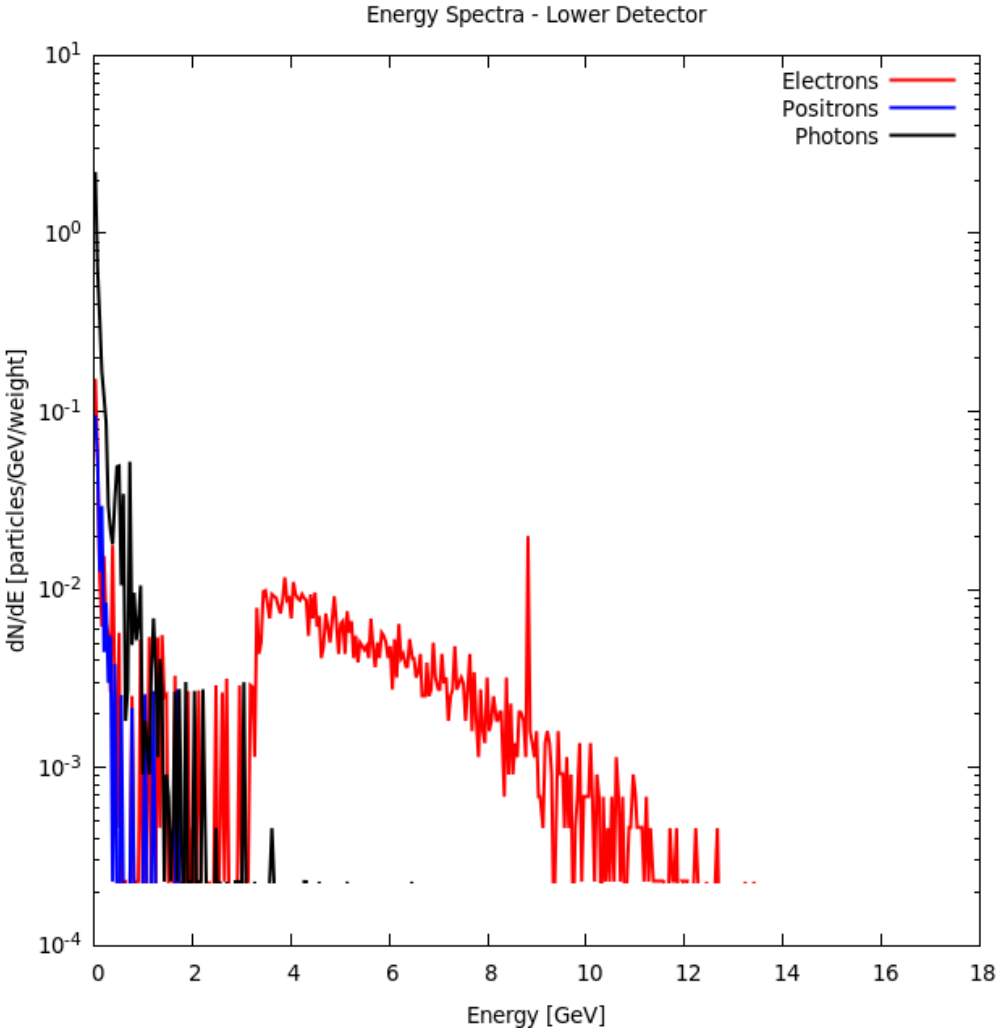


Trident Process - 0.35J laser

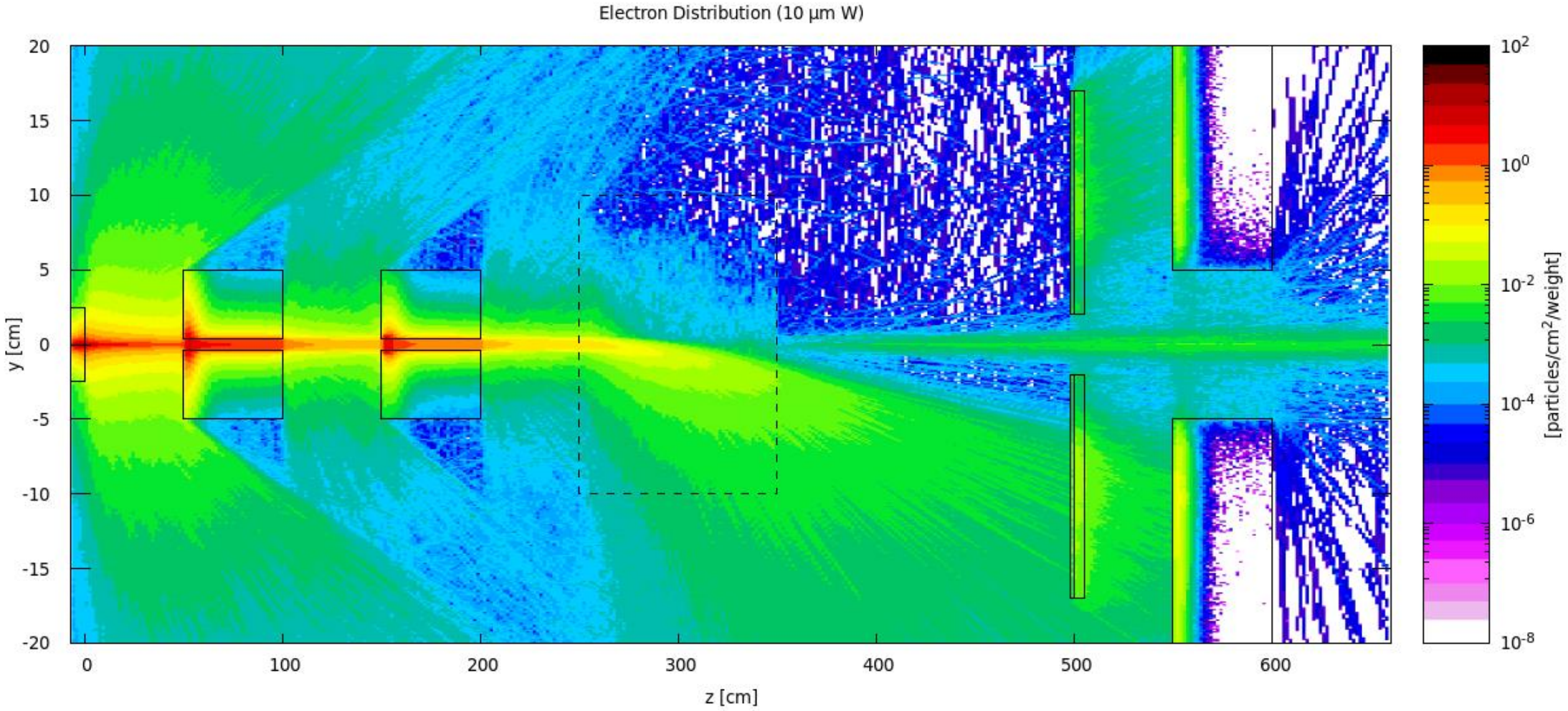


Energy Spectra Incident of Detectors

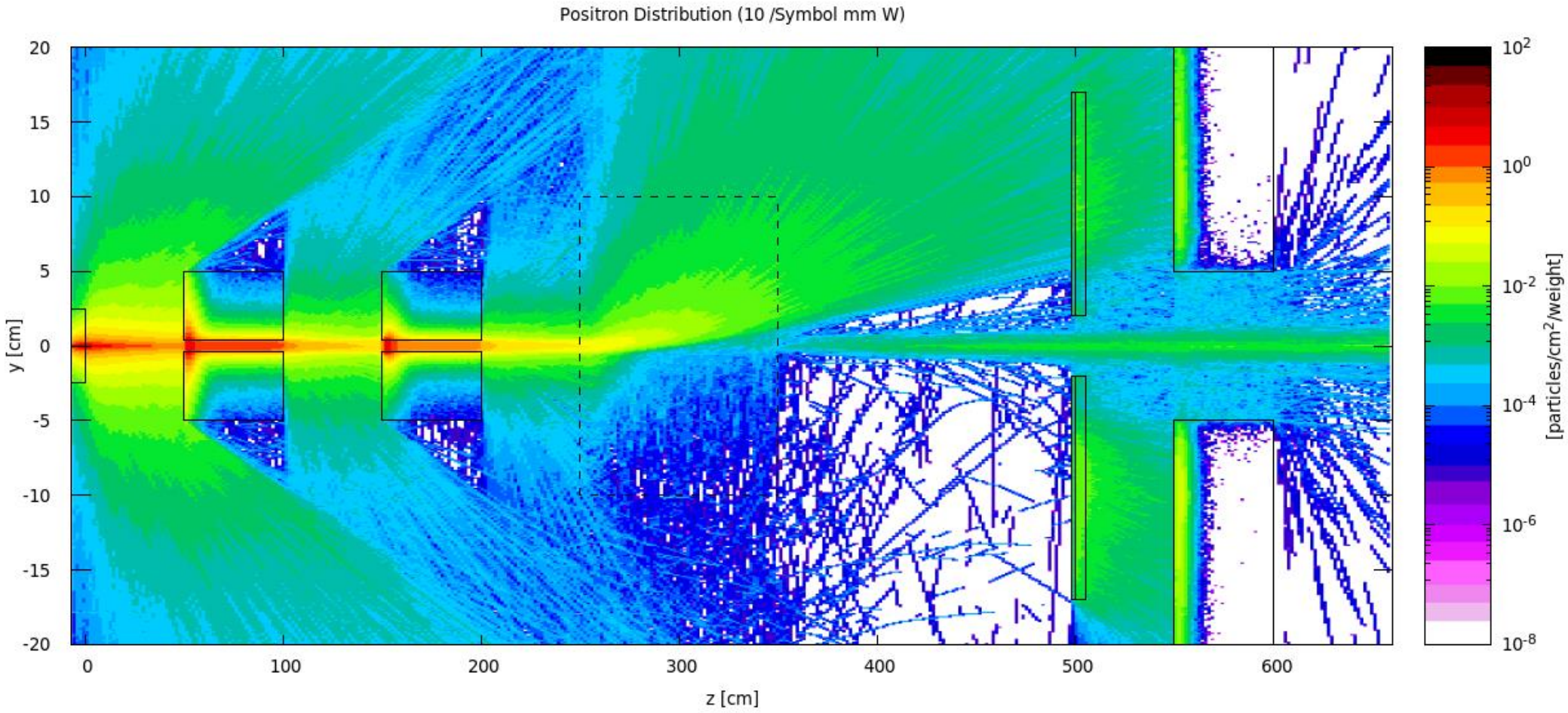




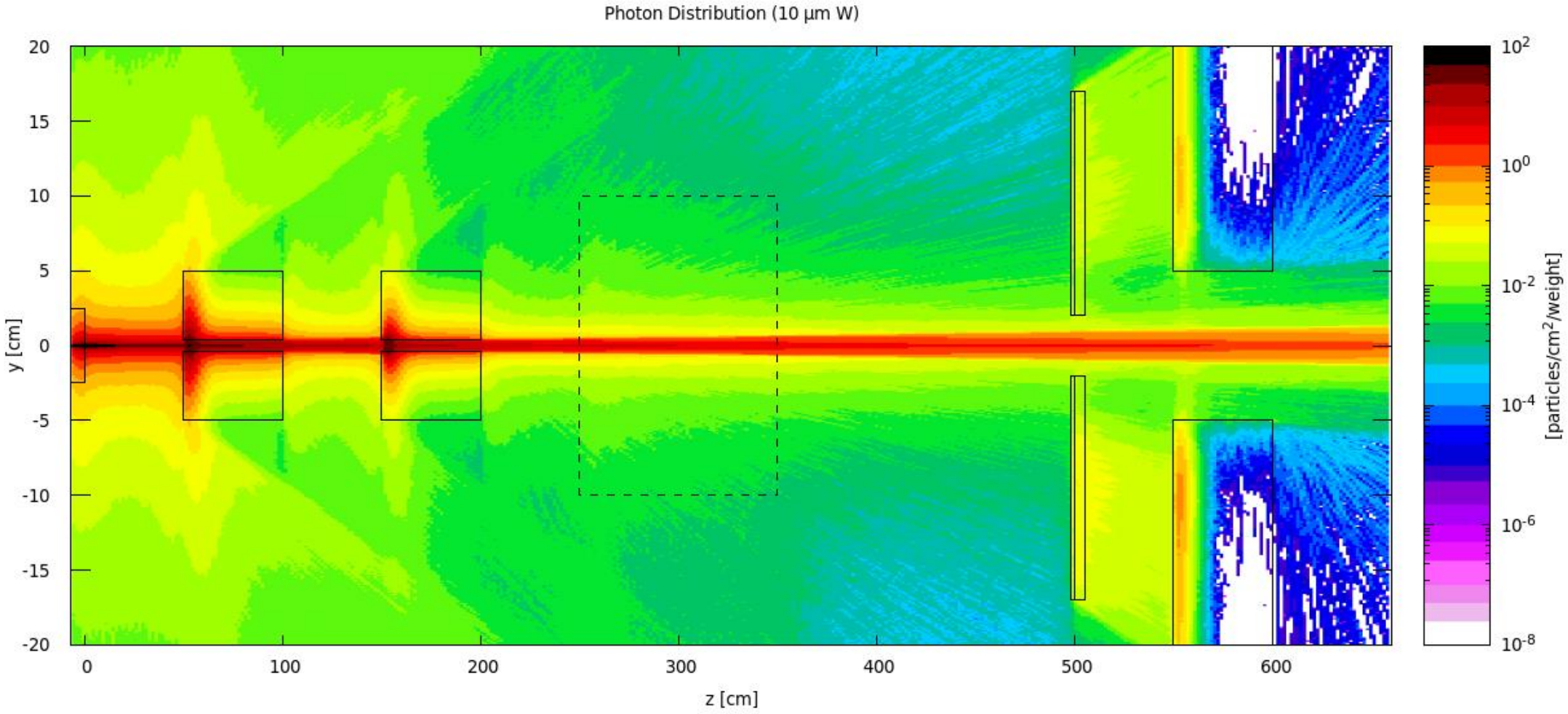
Response to 14 GeV trident process (0.35 J) - Electrons



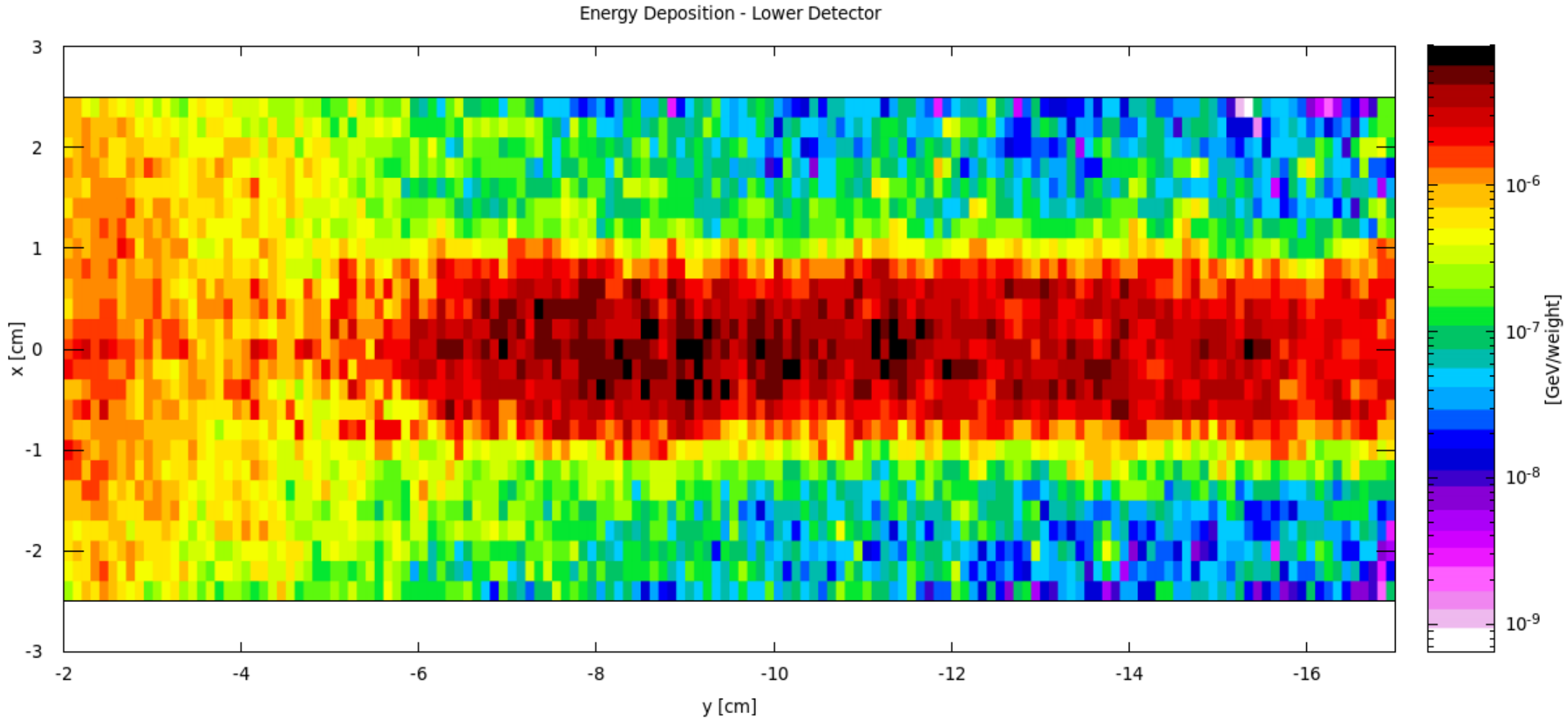
Response to 14 GeV trident process (0.35 J) - Positrons



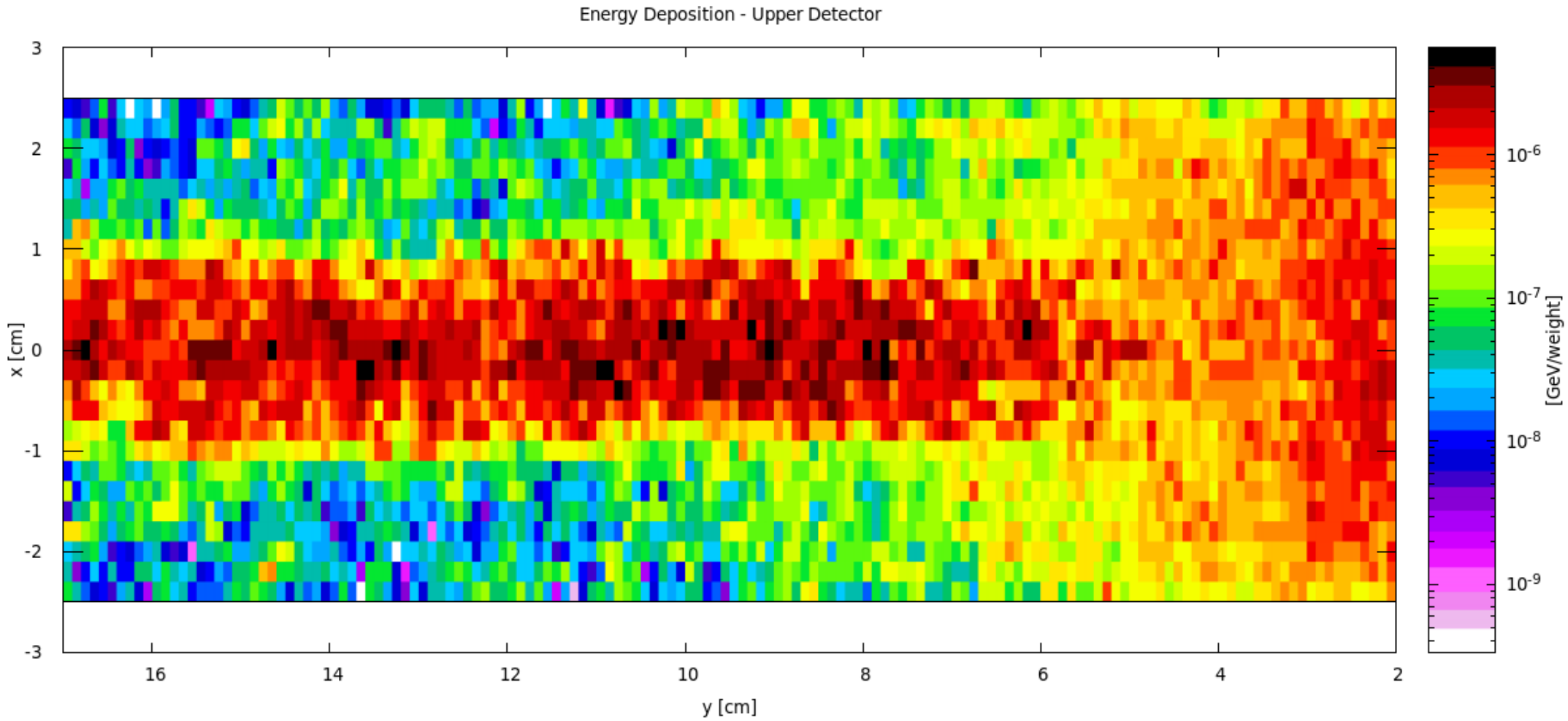
Response to 14 GeV trident process (0.35 J) - Photons



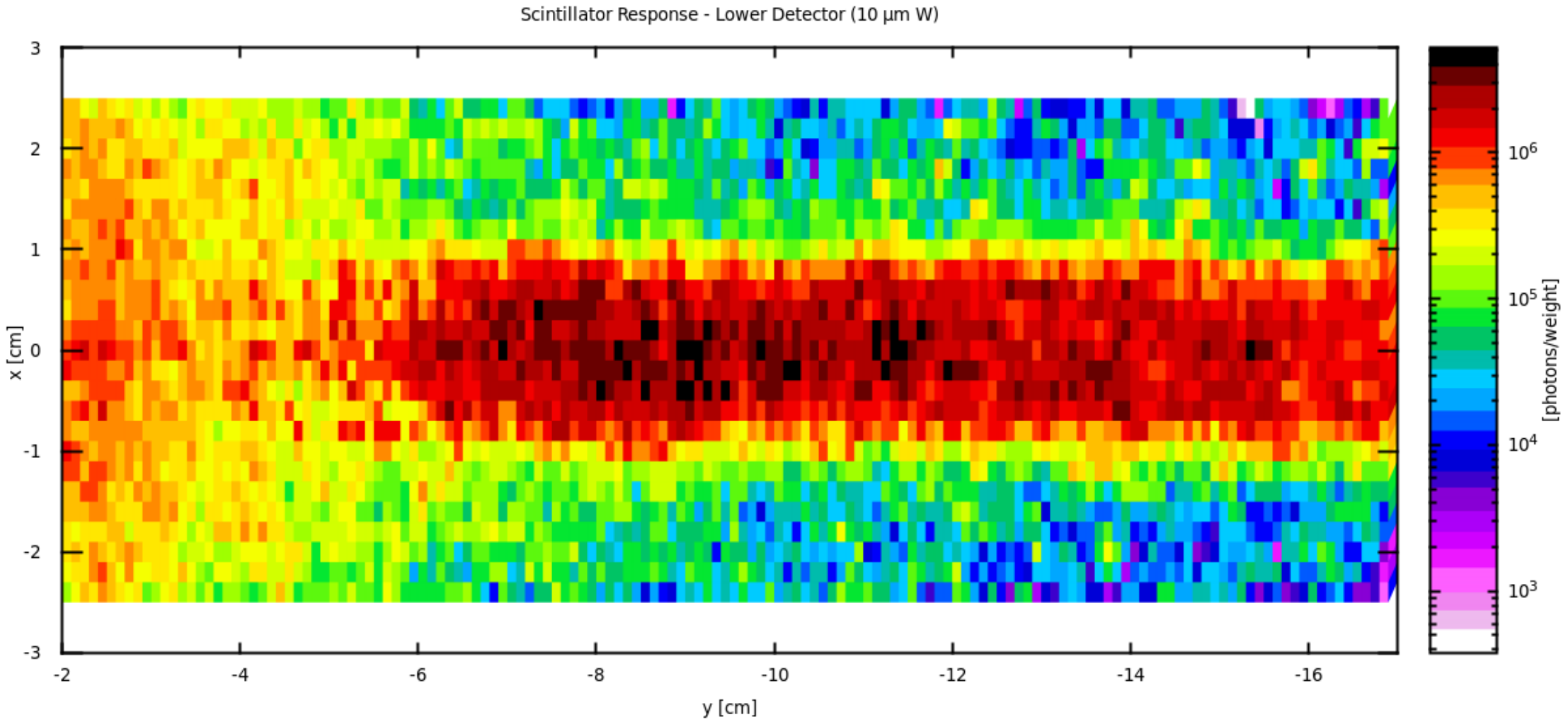
Energy Deposition – Electron Detector



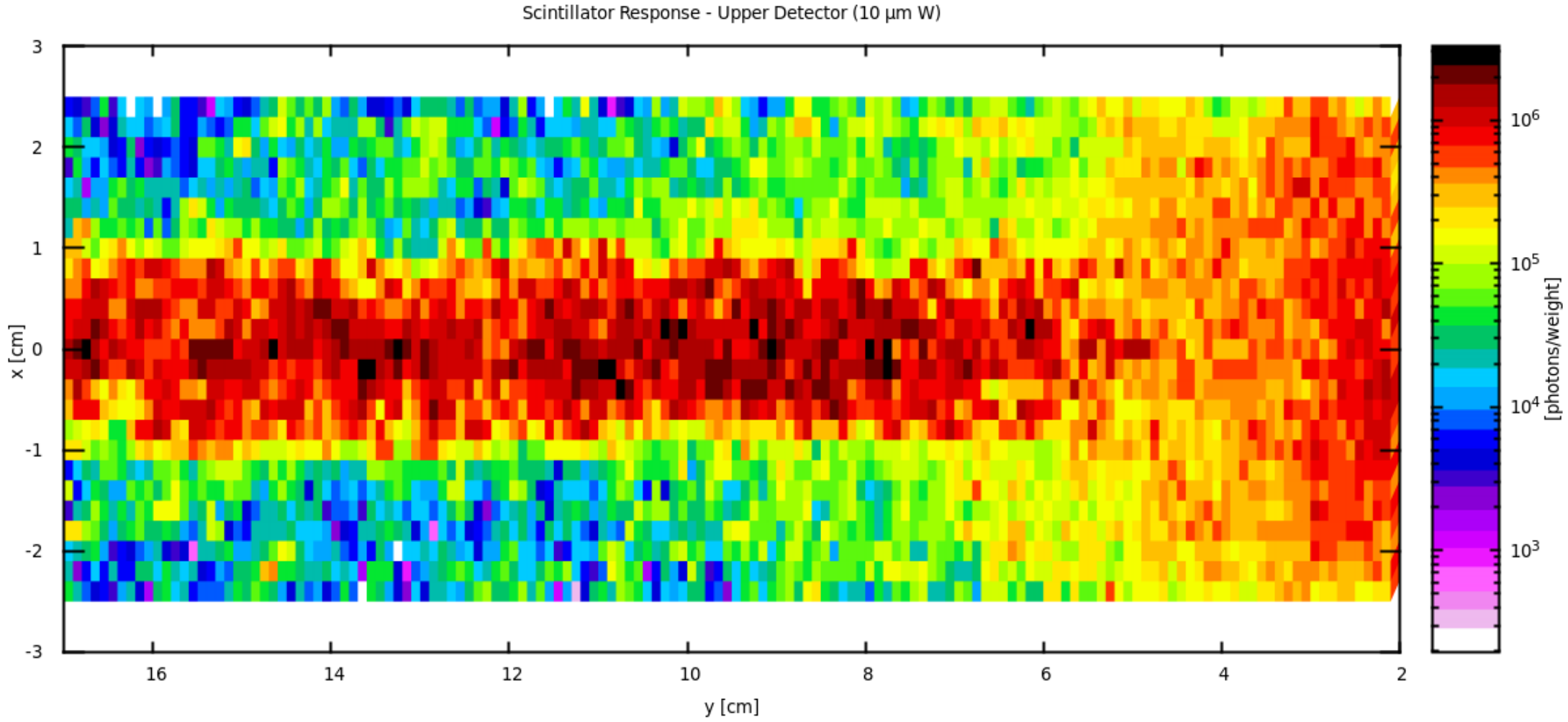
Energy Deposition - Positron Detector



Scintillator Response – Electron Detector



Scintillator Response - Positron Detector



Things to do

- Work out the normalisation factor for the trident process results
- Get a more accurate dose map of the scintillator screens
  - If dose ~10^-12 Gy/weight and weight ~ 10^9 -> dose = 10^-3 Gy
  - Radiation hardness of lyso ~ 1 Gy ==> 10^3 BX (bunch crossings) before burnout
  - @ 1 Hz, lifetime of screen ~ 10^3 s ~ 15 min...
- Try using deconvolution on the spectra at screen
- Try using a trident results for different laser energy/process (BPPP)