LUXE Simulation Analysis and Software

FLUKA Full Scale Simulations

K Fleck - 23/05/2022

FLUKA Simulations
General book-keeping

- Main directory: **/nfs/dust/luxe/group/MCProduction/tmp/flukaSim**

- **./data** contains the binary FLUKA output (bnn, bnx) -> these are accumulated over every 1000 runs. Also contains a ROOT file with spatial histograms

- Neutron energy spectra are written in individual .lis files

- **./fileCopies** contains running, amalgamation and analysis scripts

- 1000 **./run*** subdirectories for running simulations; usually ~ 950 finish successfully

- Number of primaries currently simulated:

  - Bnn files (spatial histograms) = 1.878×10^6

 - Bnx files (neutron energy spectra) = 0.948×10^6

FLUKA Simulations
Spatial histograms

- 9 TH3Ds available in ROOT file:

  - h_edep; energy deposition in GeV/primary

  - h_dose; absorbed dose in Gy/primary

  - h_(particle name); particle fluence in 1/cm2/primary

- Specific particles recorded: $e^{\pm}, \gamma, n^0, p^+, \mu^{\pm}$

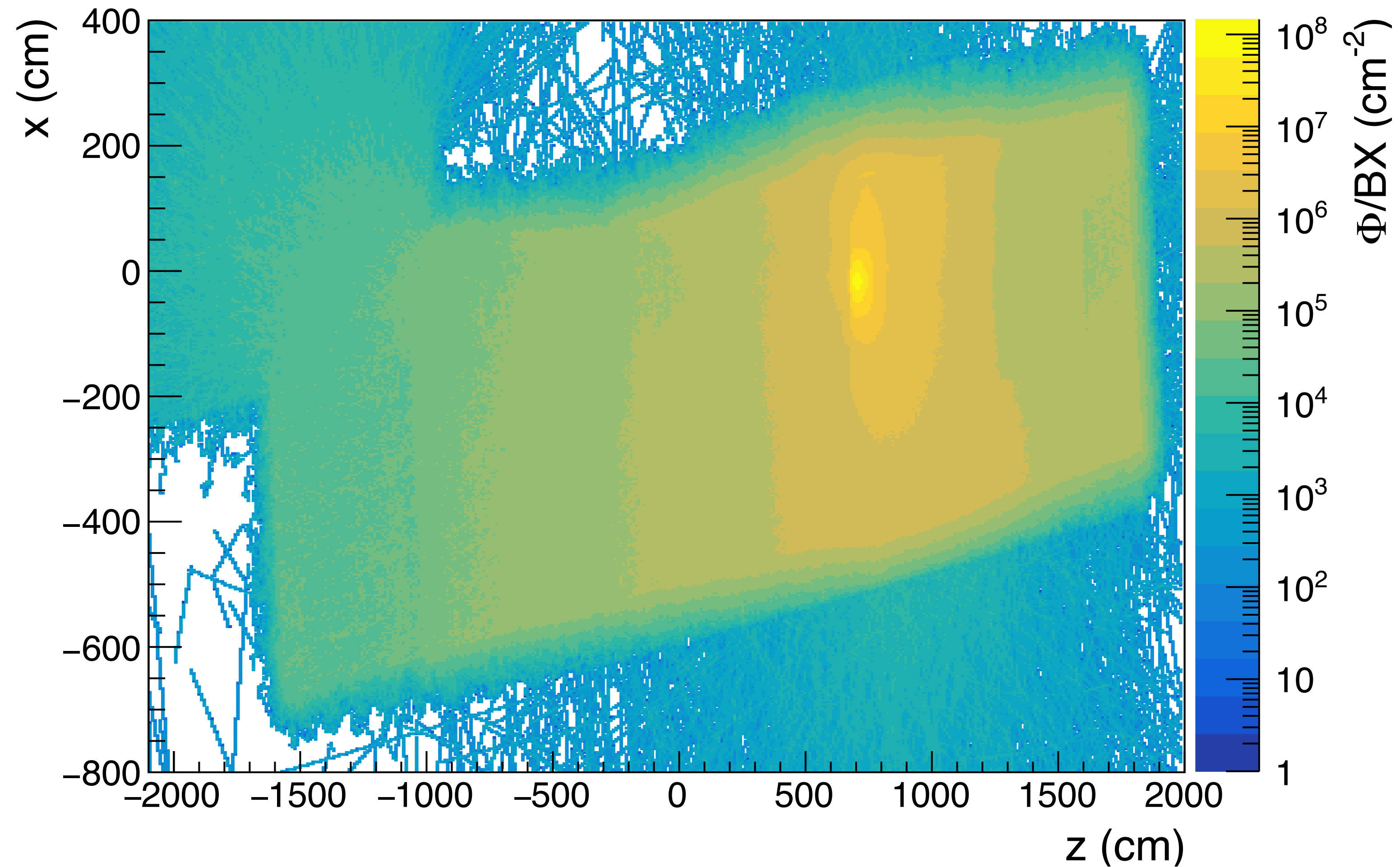- Need to scale all histograms by 1.5×10^9 to get per bunch crossing values

Spatial Histograms
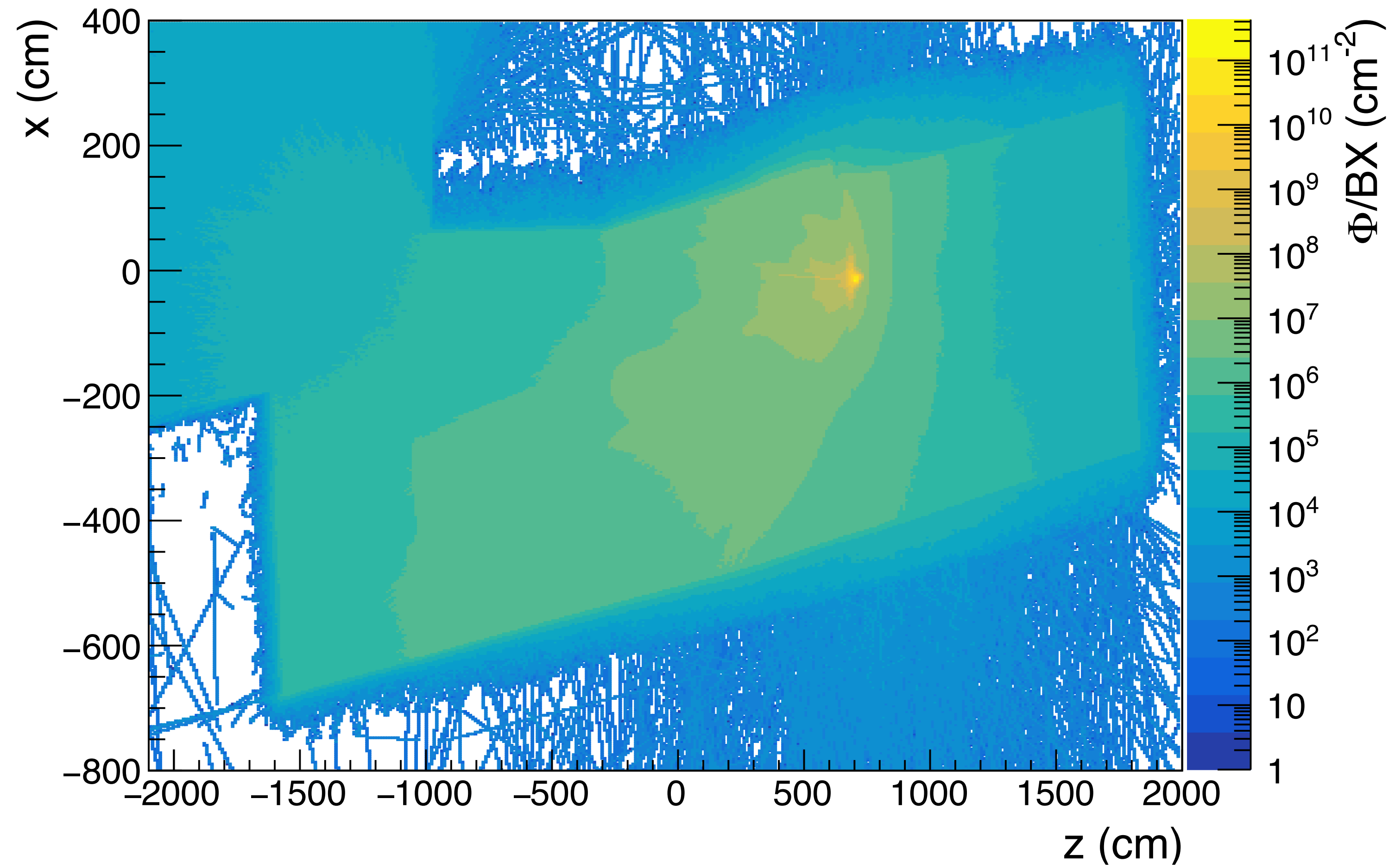## Energy deposition and absorbed dose
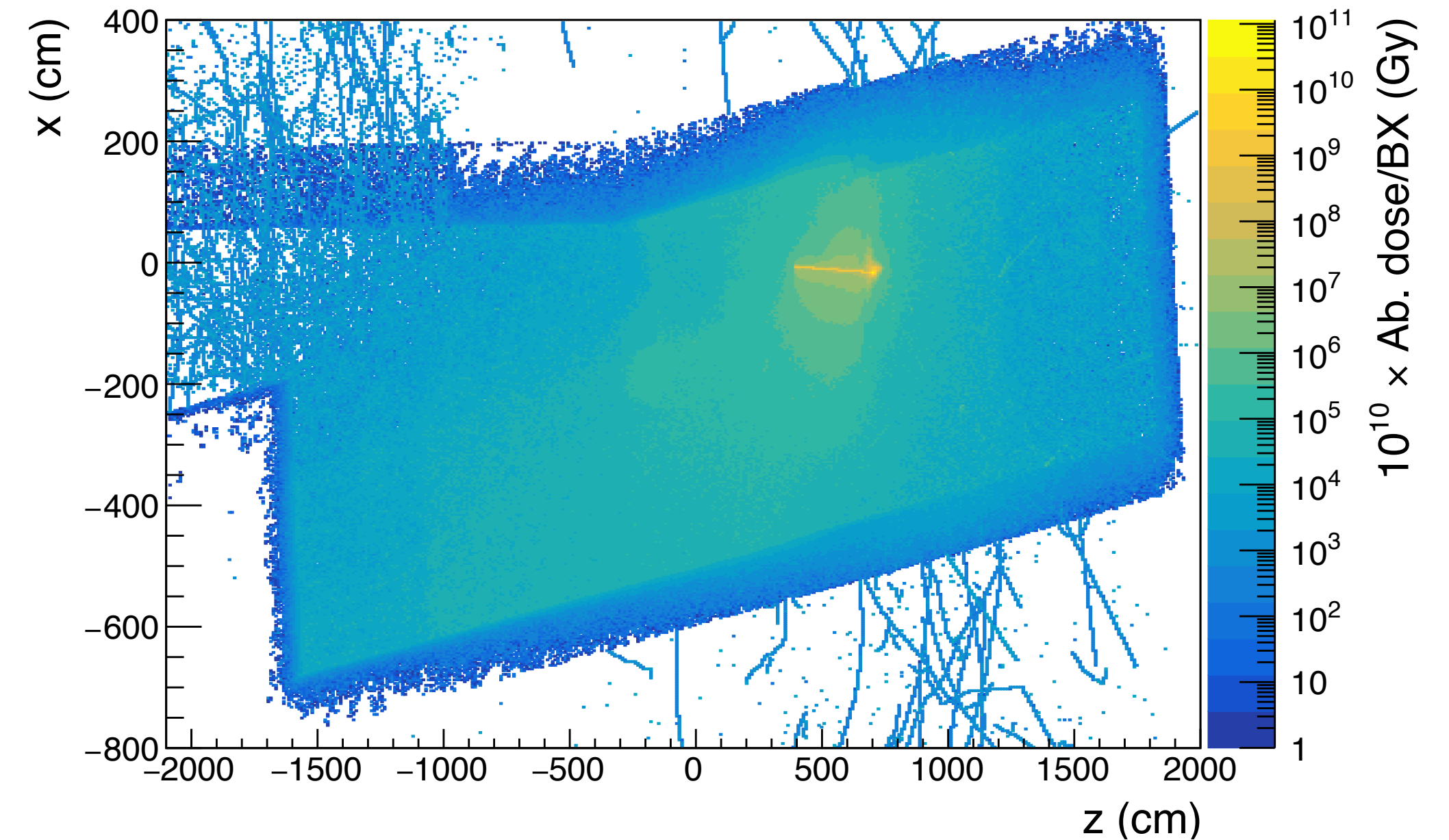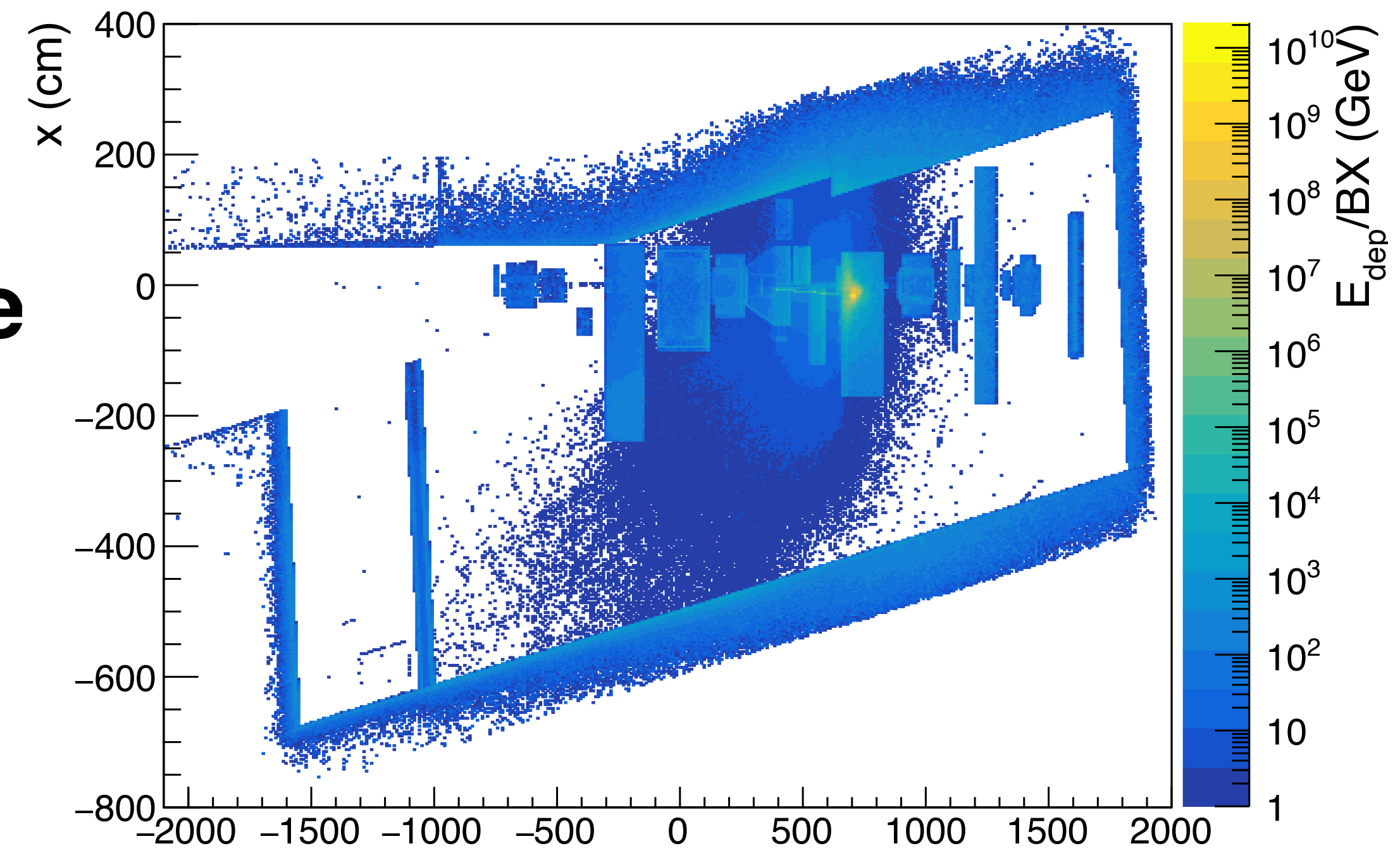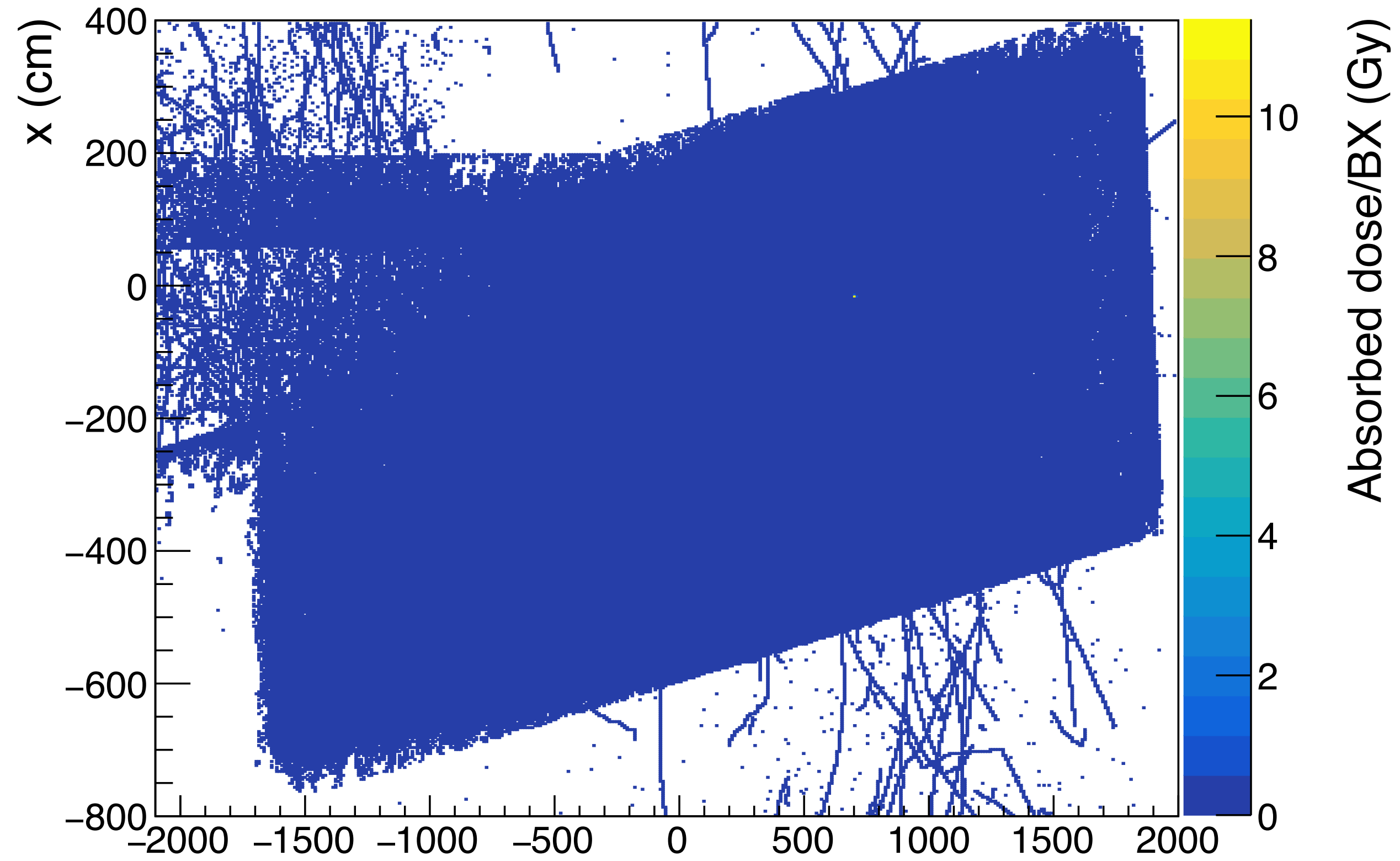
Spatial Histograms
Neutron fluence

# Spatial Histograms
Photon fluence

FLUKA Simulations

Neutron energy spectra

- In FLUKA, energy spectra are produced by a boundary crossing estimator (USRBDX) - can only be measured where there is a boundary between two distinct regions

- 13 key locations chosen to produce representative spectra:

  - xfelrac

  - IPmir1 and IPmir2; two mirrors inside IP chamber, parallel and perpendicular to beam line

  - tracker

  - tracElec, ecal, cerenk, gbp, bsmDet

  - IPcam1, IPcam2; camera area for imaging IP scintillators

  - GRScam1, GRScam2; camera area for imaging GRS scintillators

- Data is collected **logarithmically** in energy to allow visibility in a wider range of energies from 0 to

Neutron Energy Spectra

Example plots
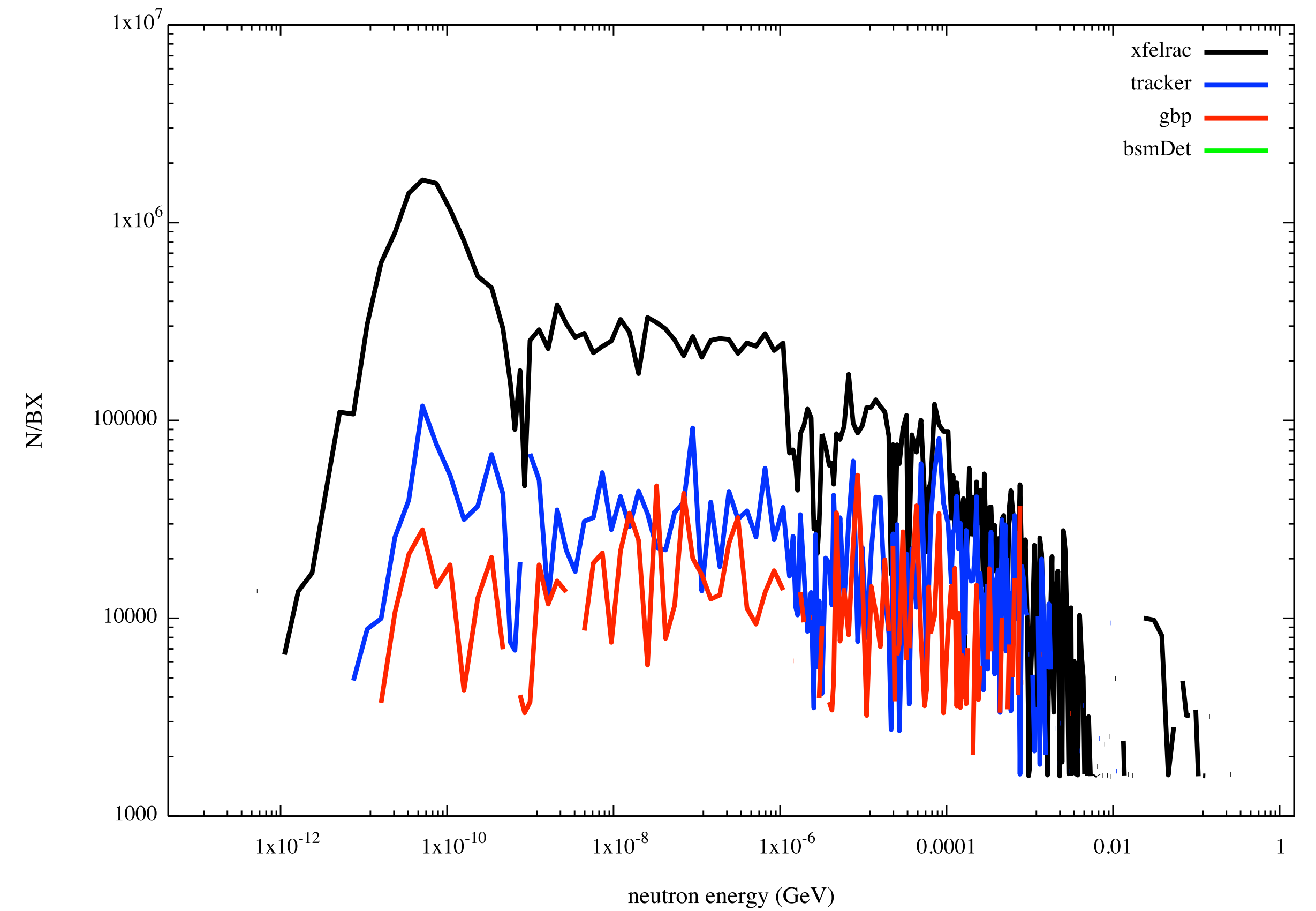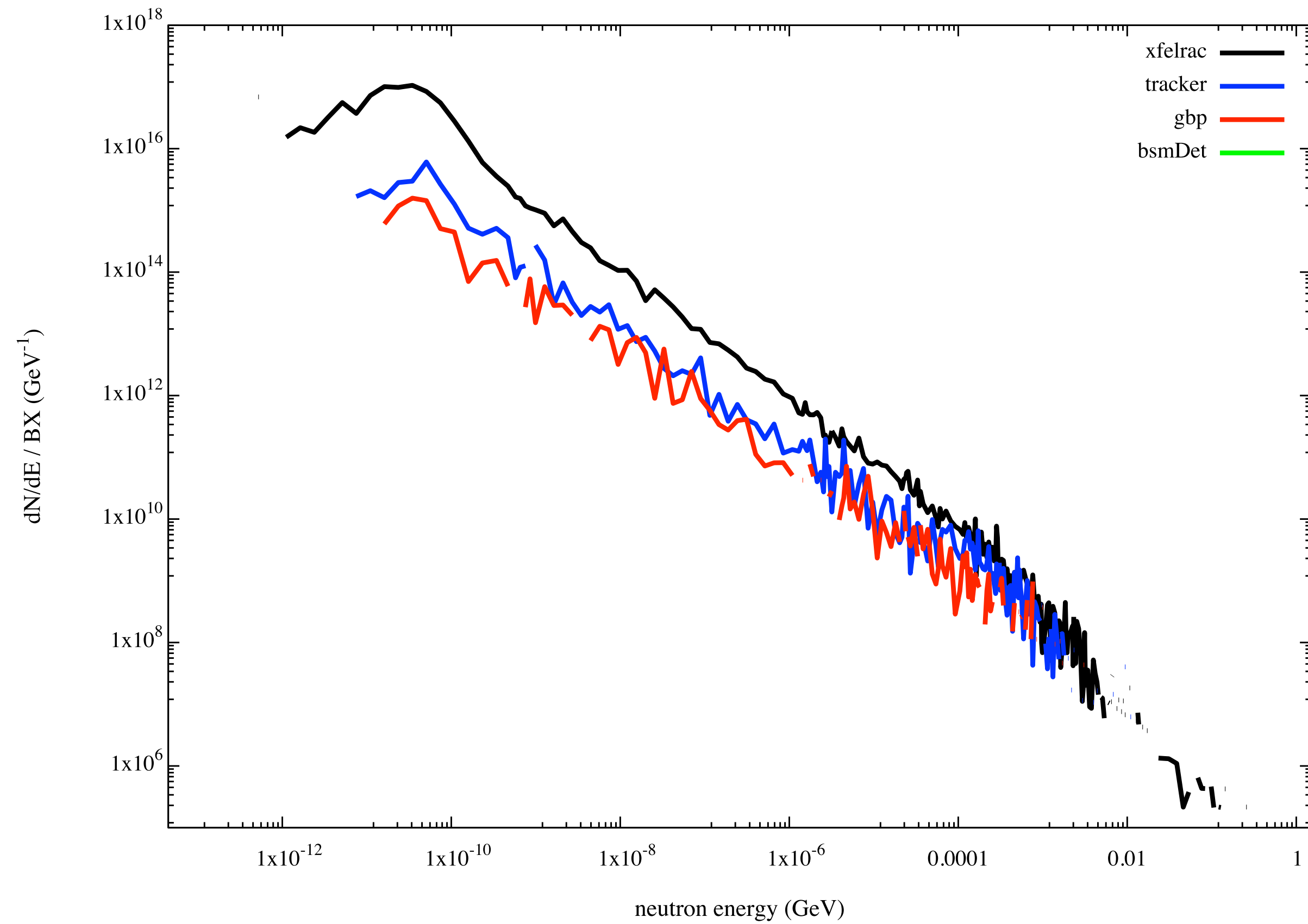
FLUKA Simulations
Outlook

- FLUKA simulations running - able to generate $\sim 0.95 \times 10^6$ primaries worth of data at each iteration

- Histograms of energy deposition, absorbed dose and specific particle fluences available in a ROOT file

- Working on including the neutron energy spectra also

- Possible to provide higher resolution histograms for specific areas if required - <u>detail on dimensions, location and what is to be scored is needed for this</u>

- What is the target level of statistics for these simulations?

- Also need to consider NCS photons coming from IP