LUXE Background Study in Simulation

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LUXE Meeting
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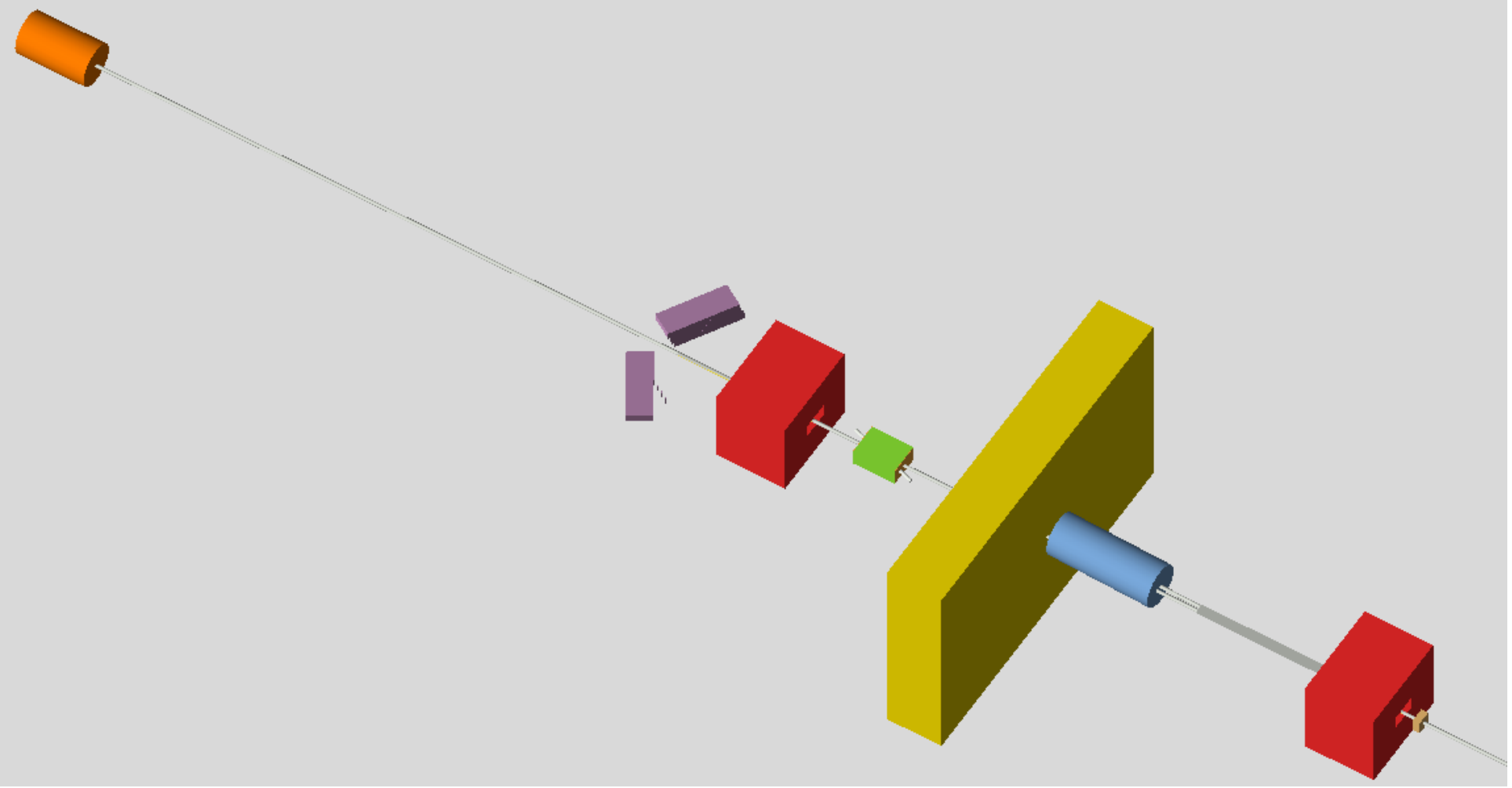
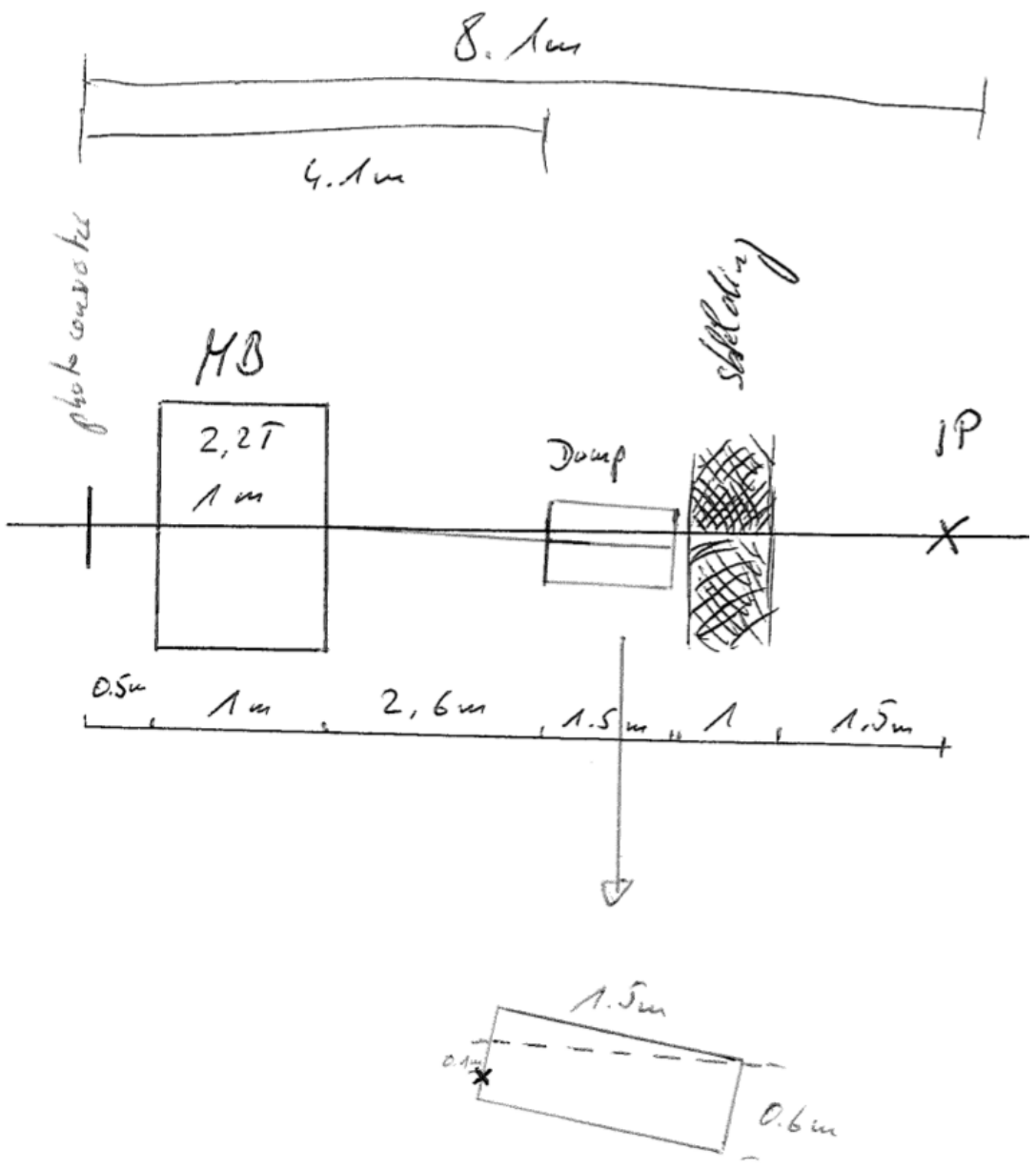
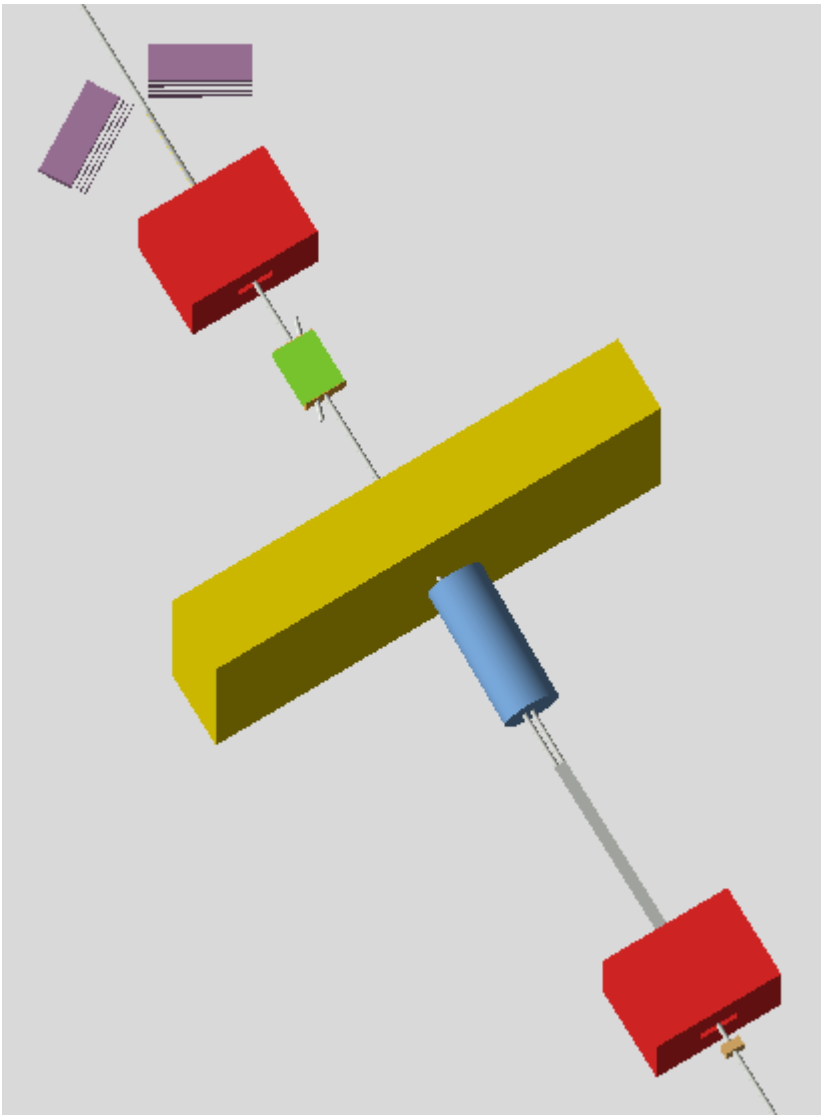
LUXE geometry in Geant4

- Check background in OPPP detectors: trackers and calorimeters;
- Optimize detectors position, shielding, beam pipes and windows;
- Establish a benchmark in a simple geometry for comparison with more detailed implementation.

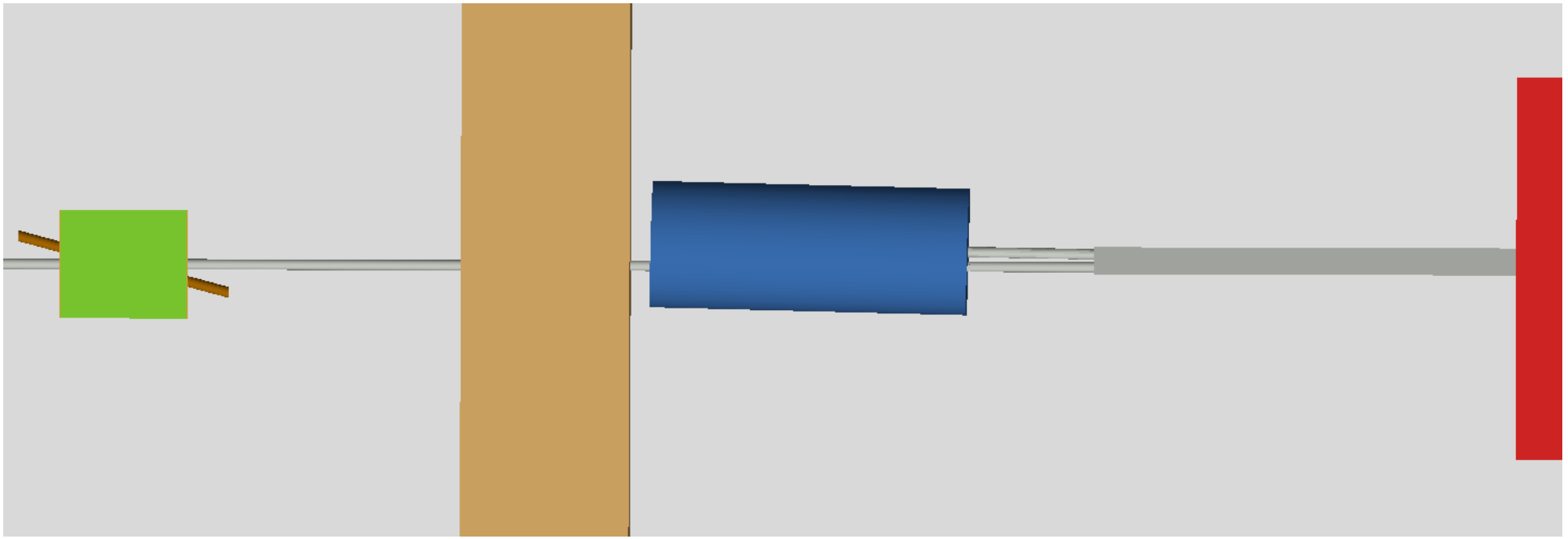


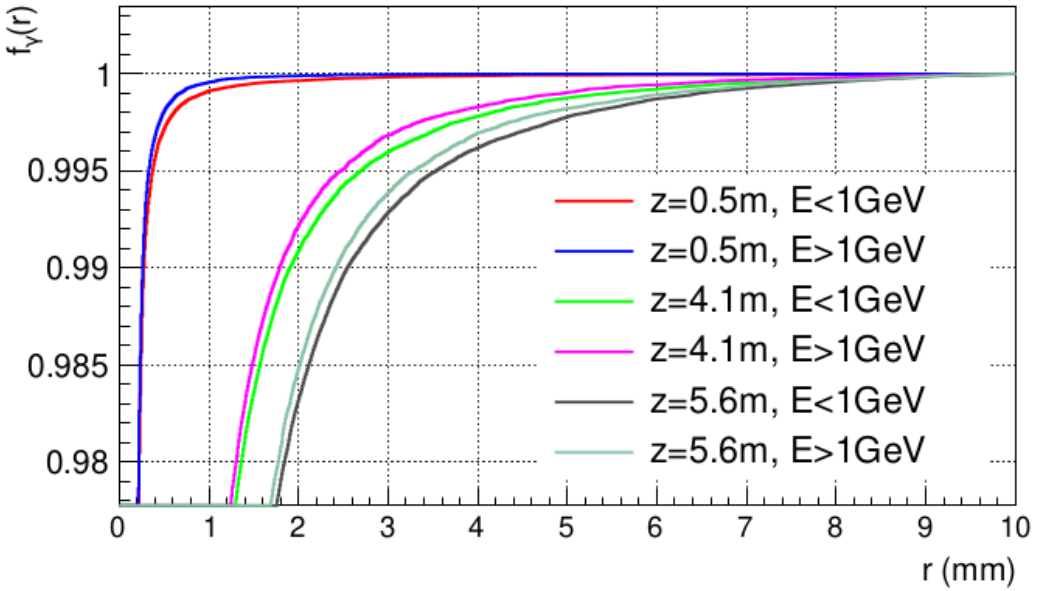
Sketch and Geant4



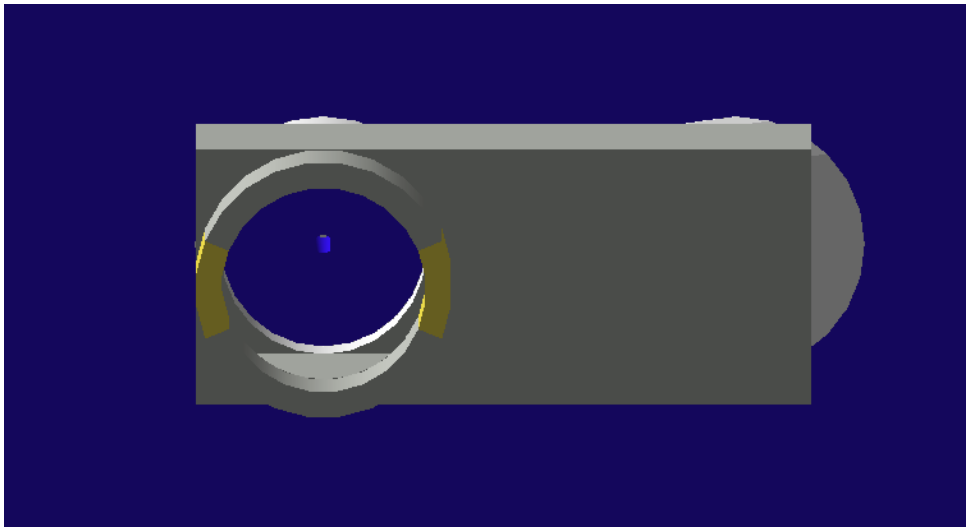


Beam Dump with Hole for Photons



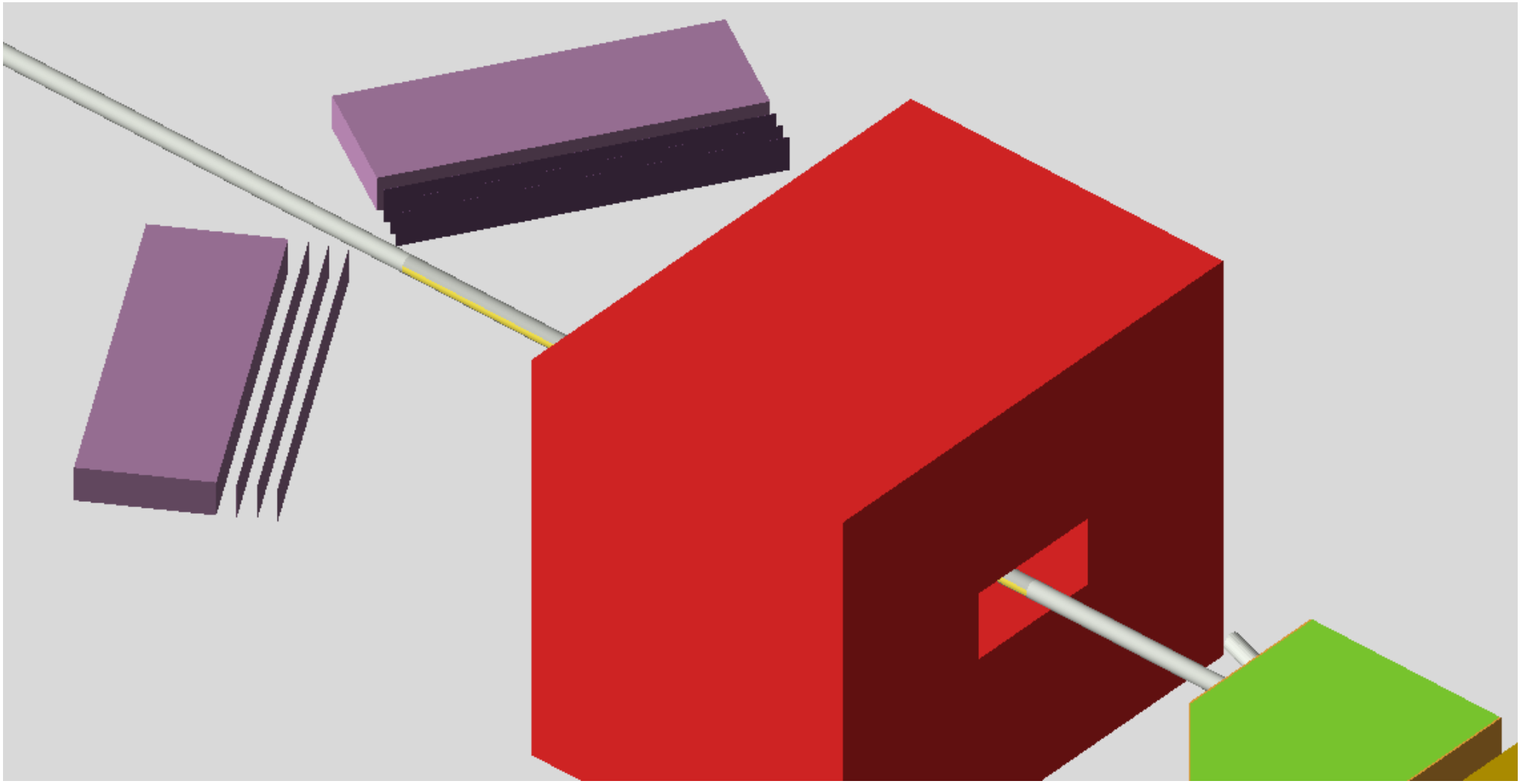


Fraction of photons inside the circle as a function of its radius for different distances from the target

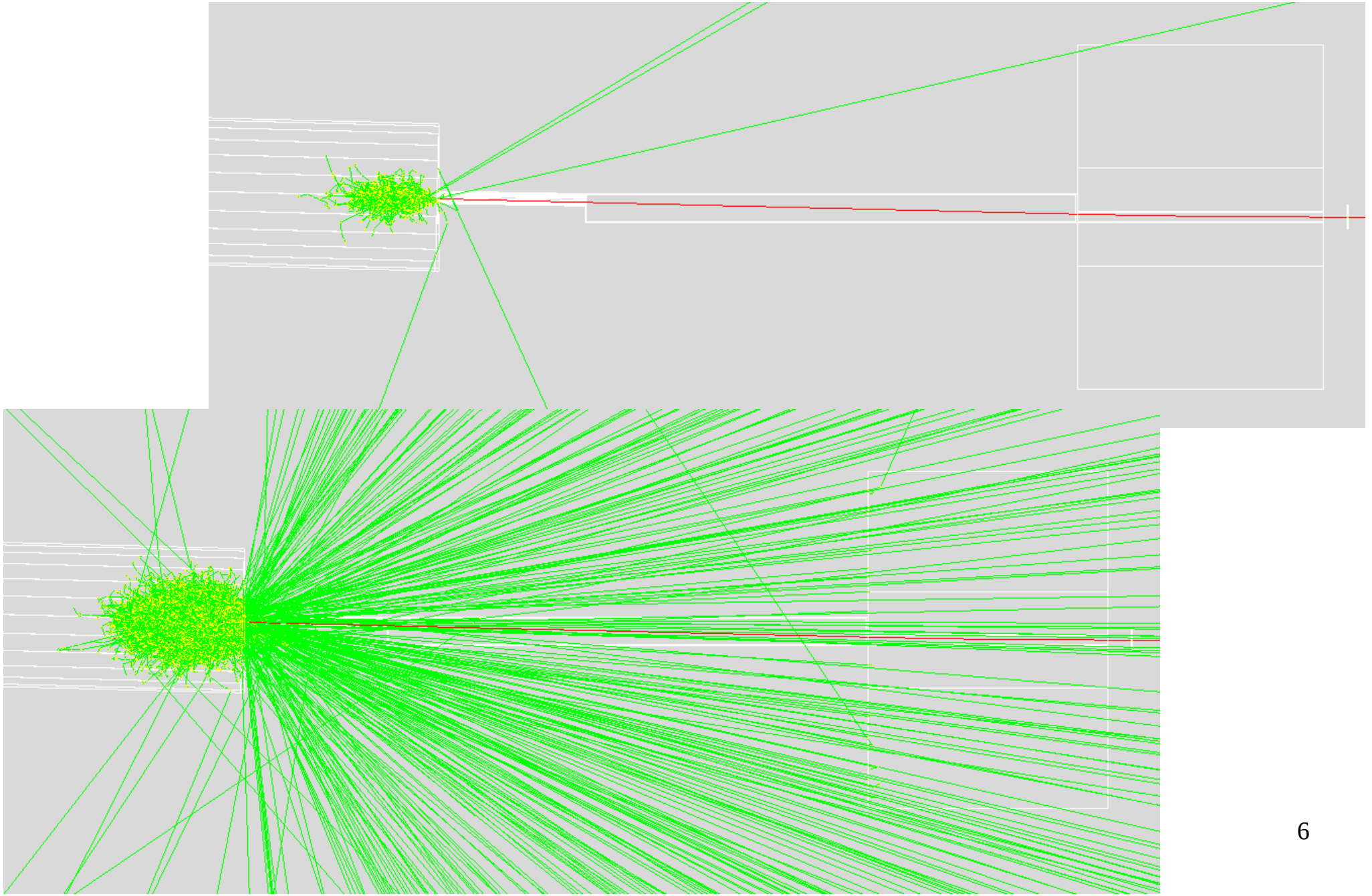


Front view of the beam dump through the beam pipe

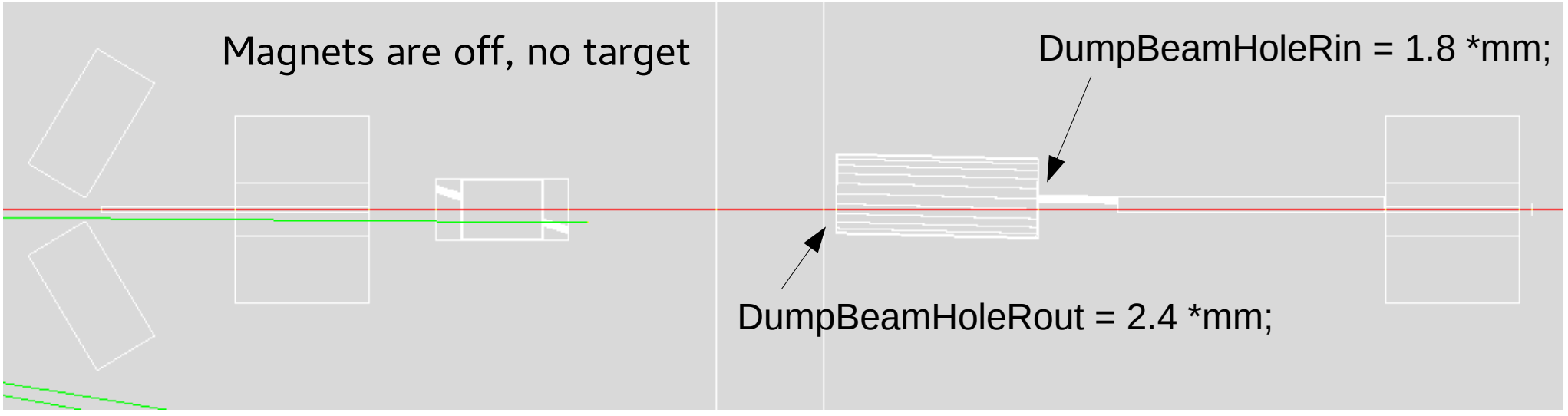
Tracking Planes

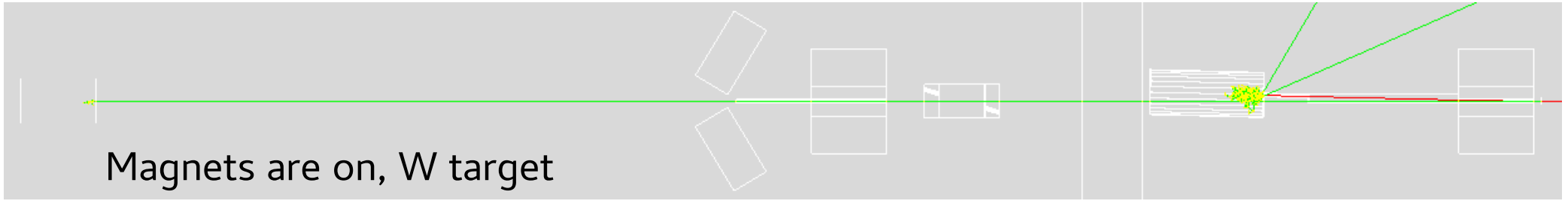


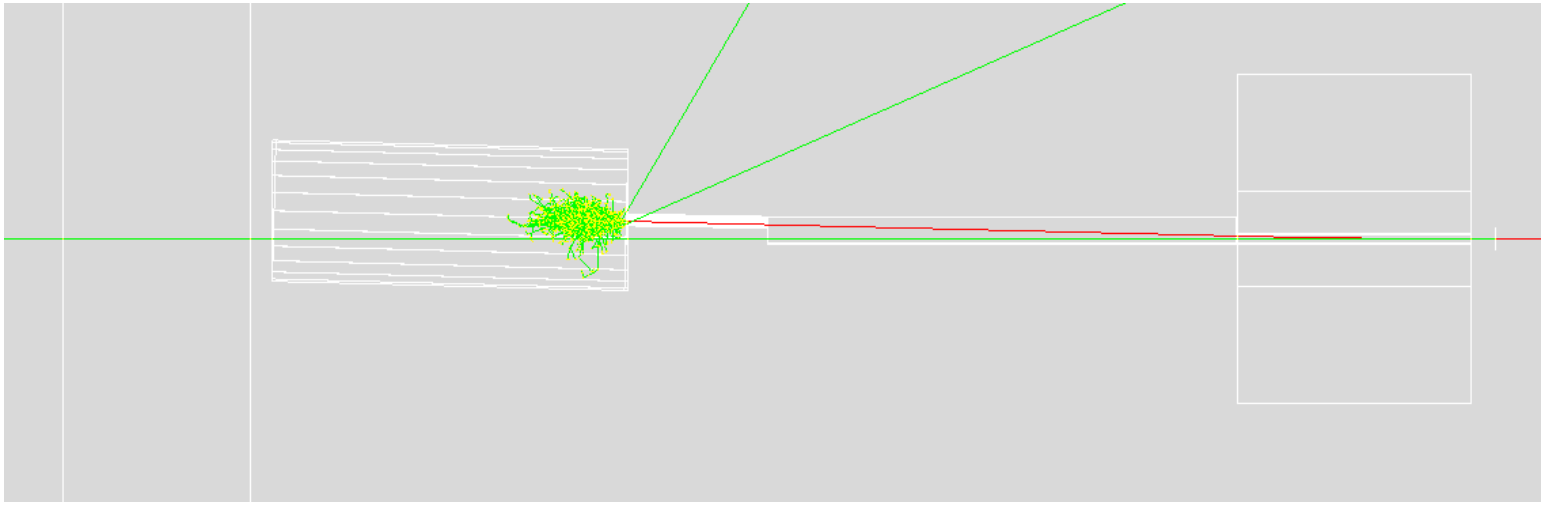
No Target, 1.4 T



Performance with test settings





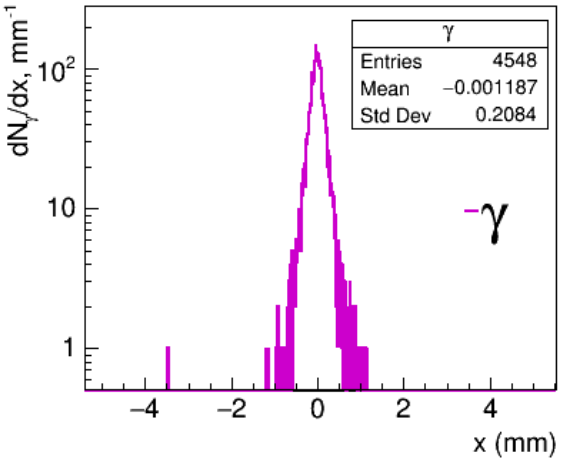


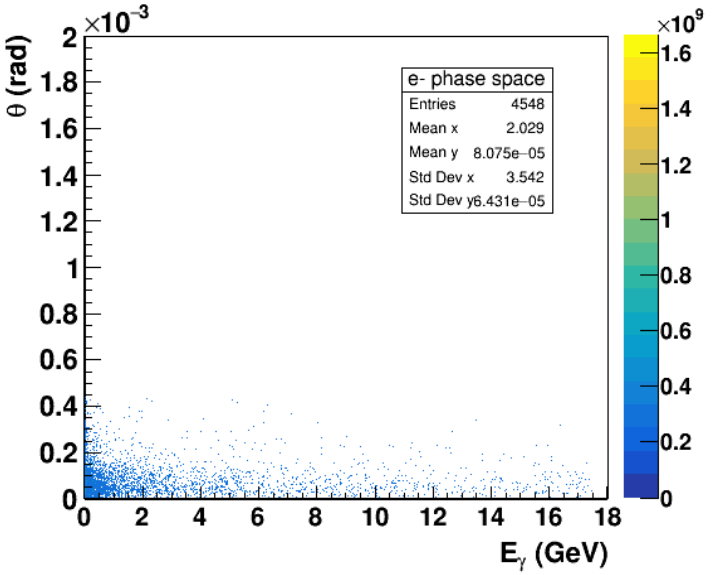
50k e-

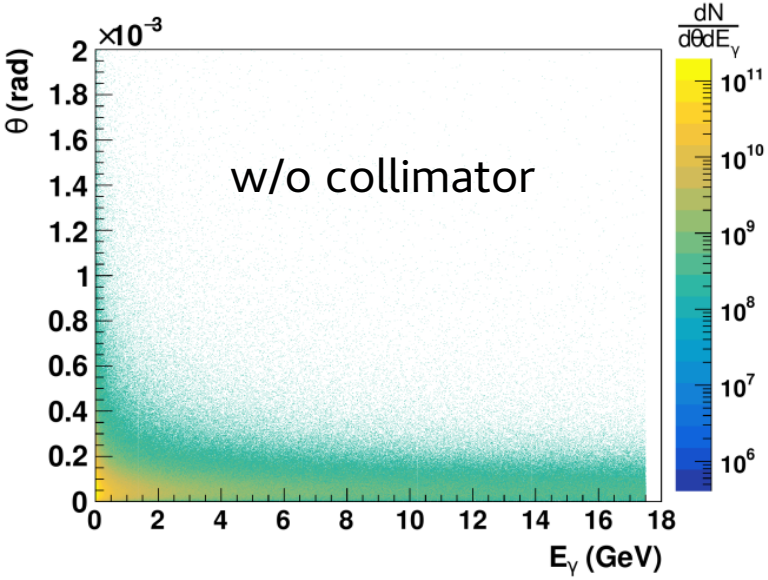
Simulated 50k events recording any track that enters detectors volume 1 was registered;

Row	pdg	E	vtxx	vtxy	vtxz	px	py	pz
0	-11	1.1105072	0.6417944	-1.773730	-3752.636	0.4198077	0.0007512	1.0286506

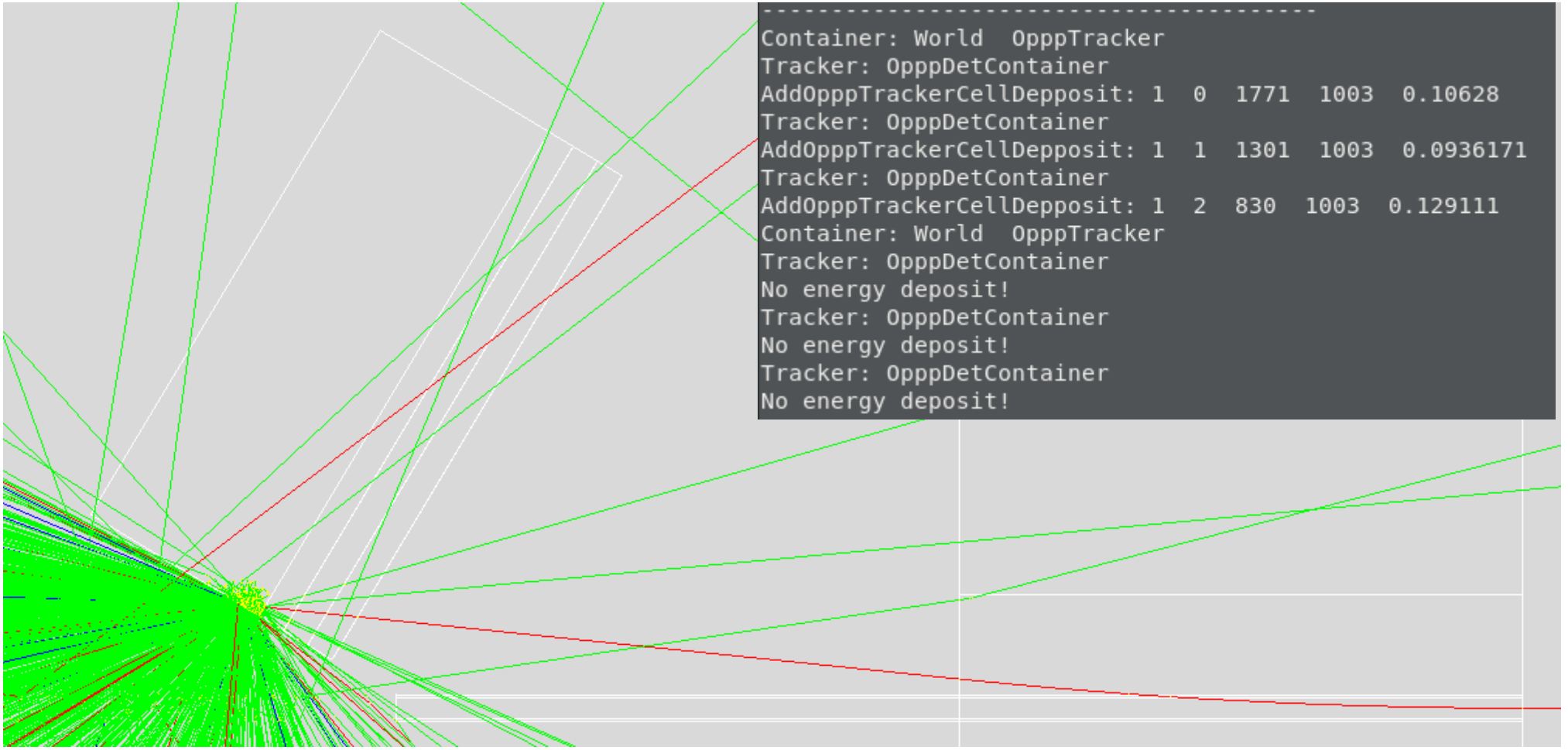
Bremsstrahlung photons 22.5 m from the collimator (beam dump)







Test with 17.5 GeV e- and 6 T

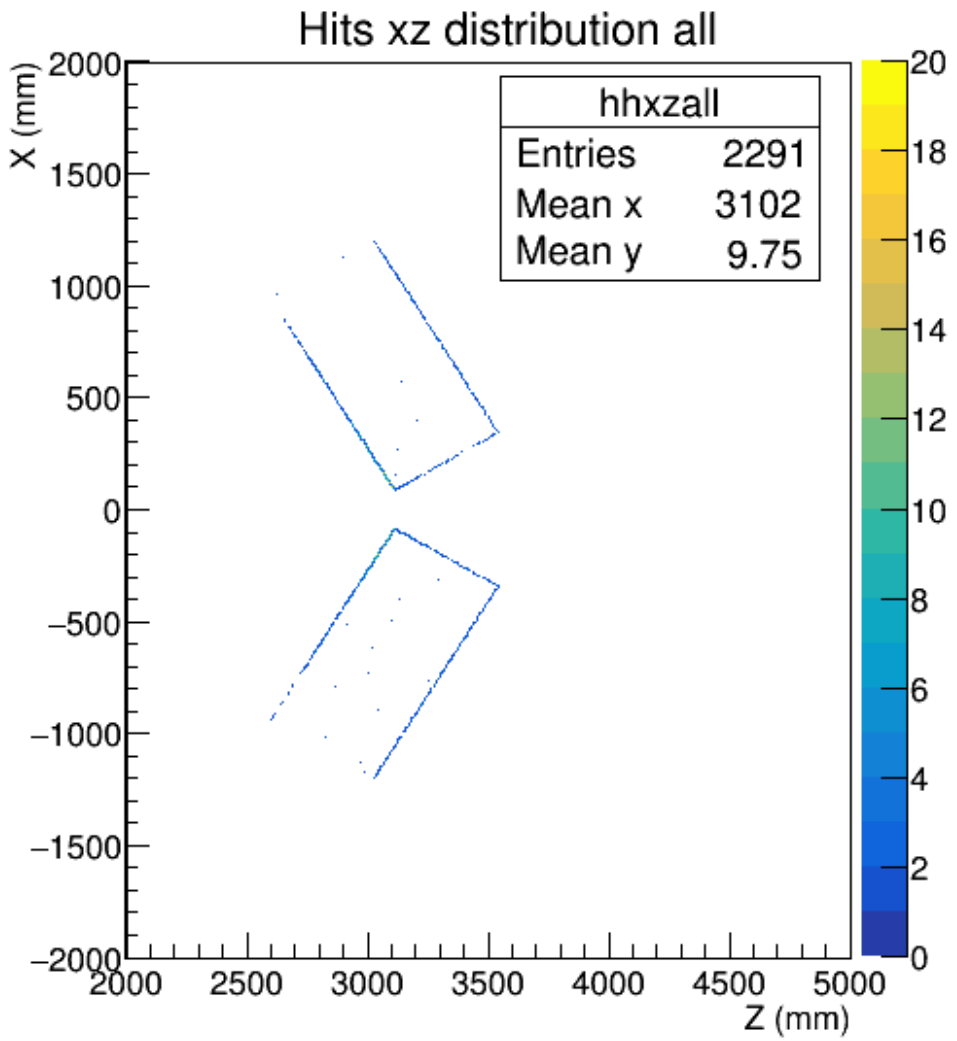



```
root [2] oppphits->Scan("*")
************************************************************************************************************************
*    Row   * Instance *   eventid *     detid *   layerid *     cellx *     celly *      edep *     hitid * track_lis *
************************************************************************************************************************
*        0 *        0 *         0 *         1 *         2 *       830 *      1003 * 0.0001291 *         2 *         1 *
*        1 *        0 *         0 *         1 *         1 *      1301 *      1003 * 9.361e-05 *         1 *         1 *
*        2 *        0 *         0 *         1 *         0 *      1771 *      1003 * 0.0001062 *         0 *         1 *
************************************************************************************************************************
```

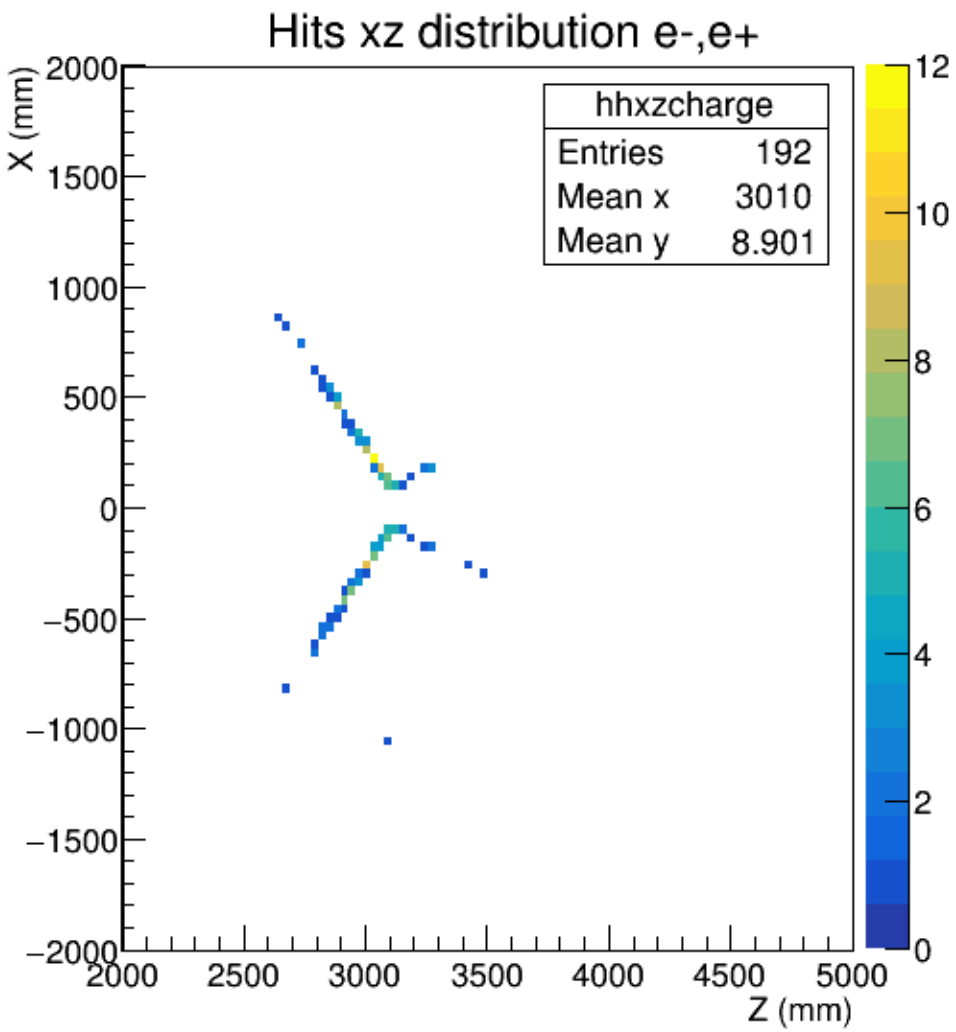
Track in detector volume

10.72M e-

All tracks entering detector container volume

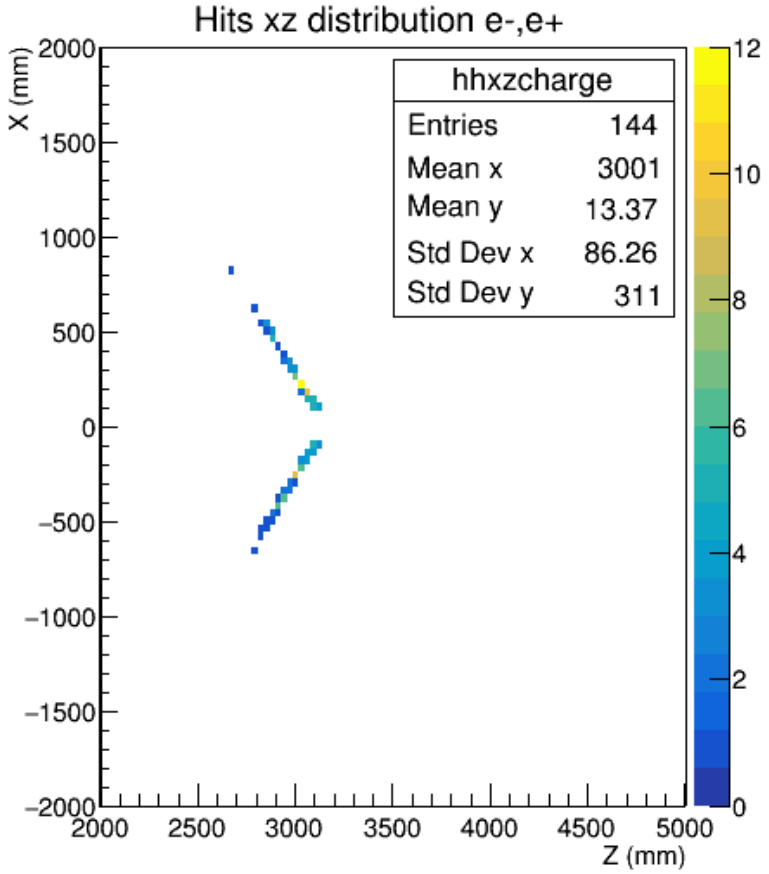


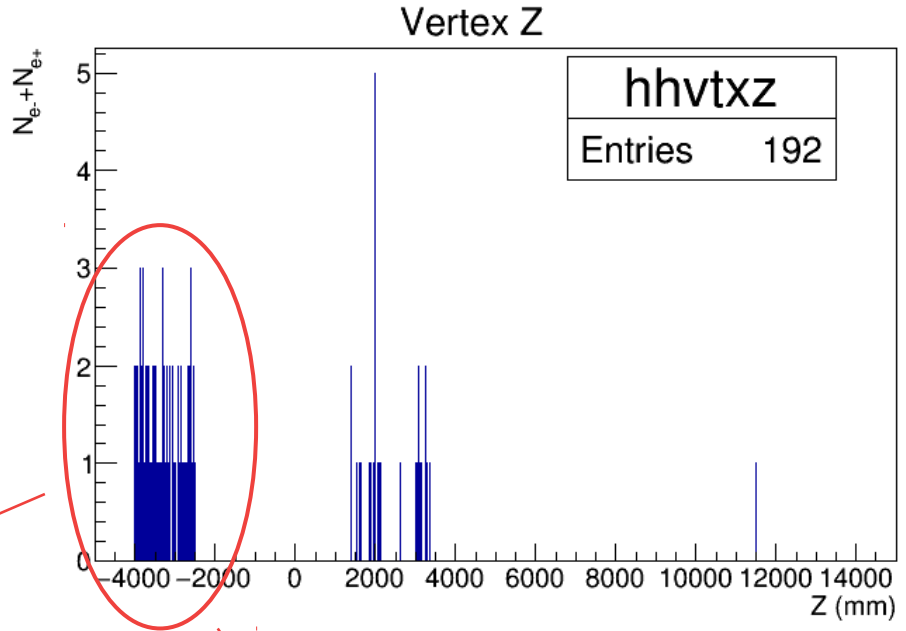
e+e- tracks entering detector container volume

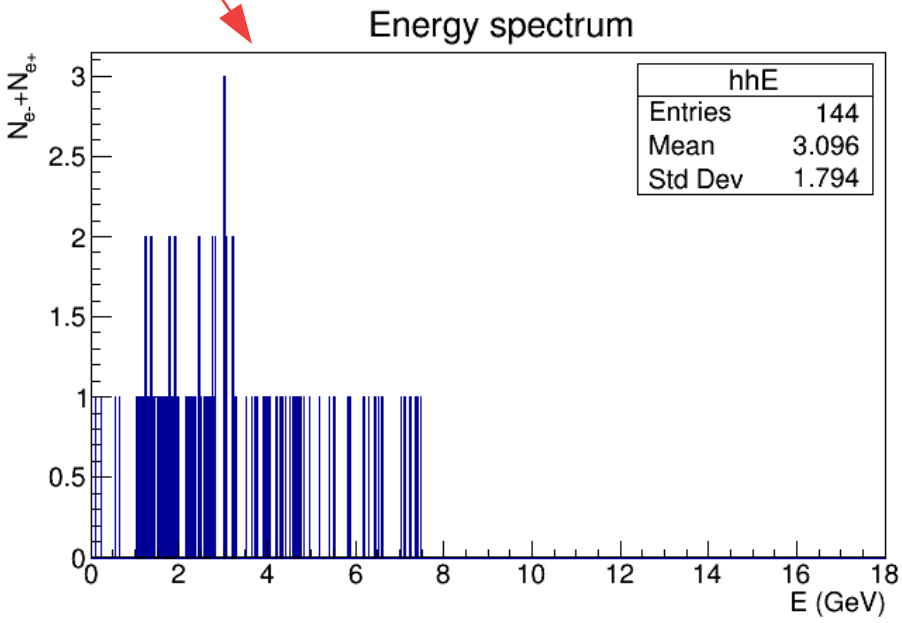


Hits with origin in collimator

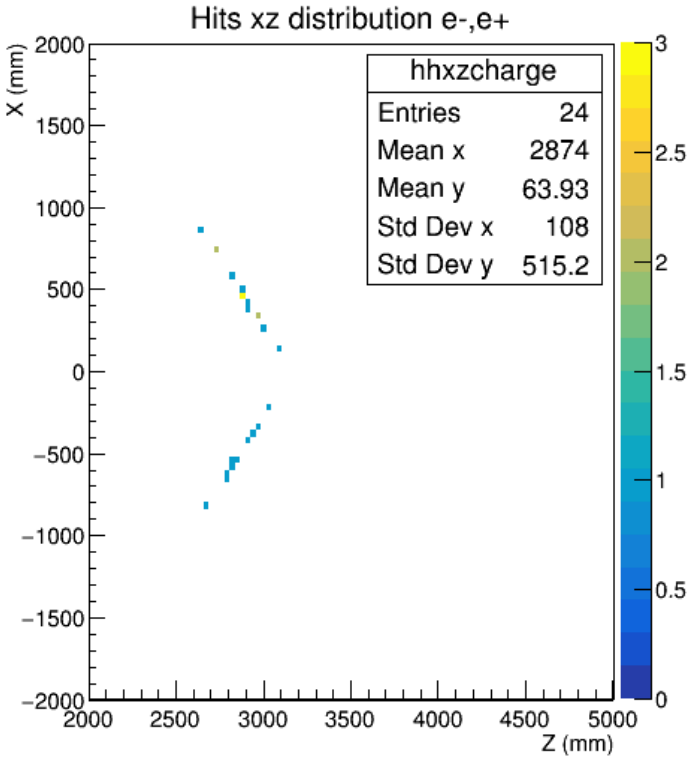
10.72 M electrons of
17.5 GeV
with 35 μm tungsten target
were simulated

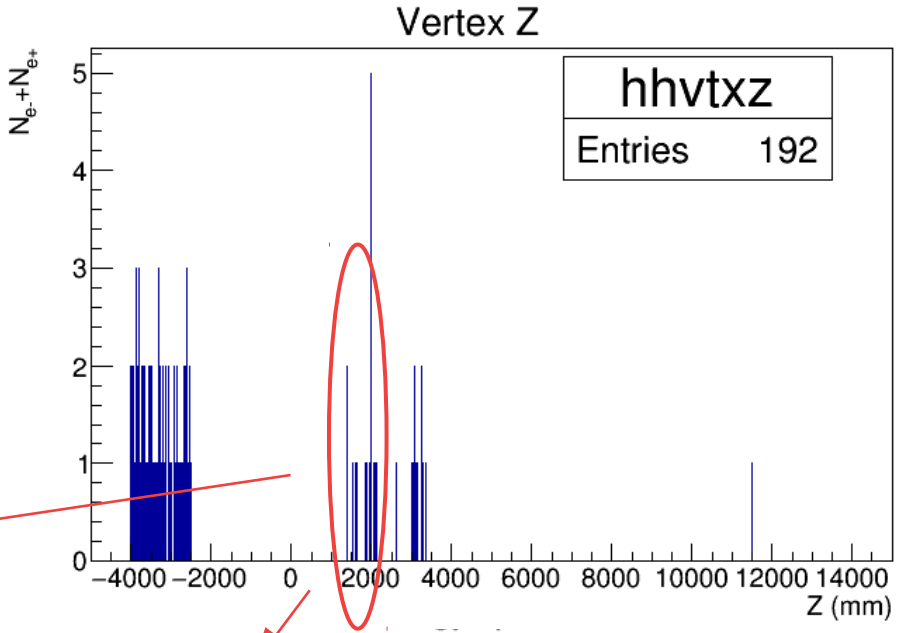


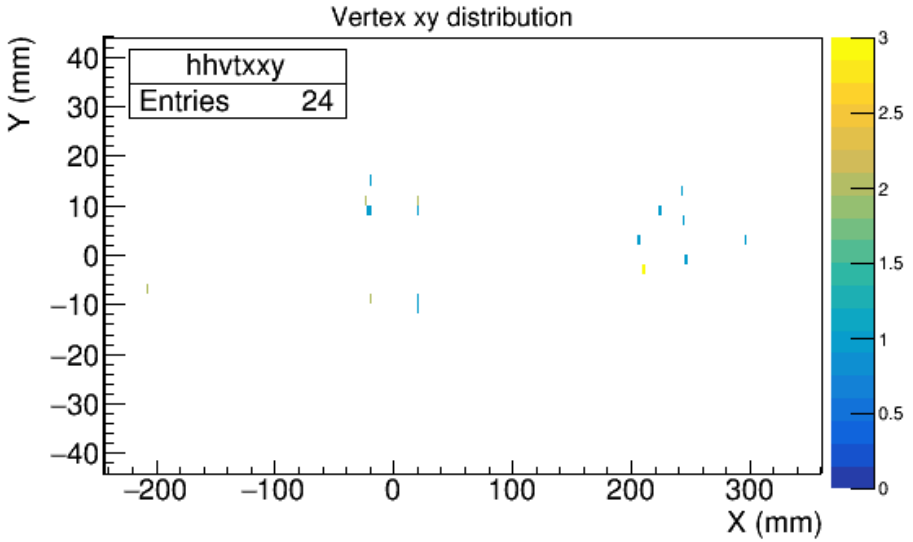


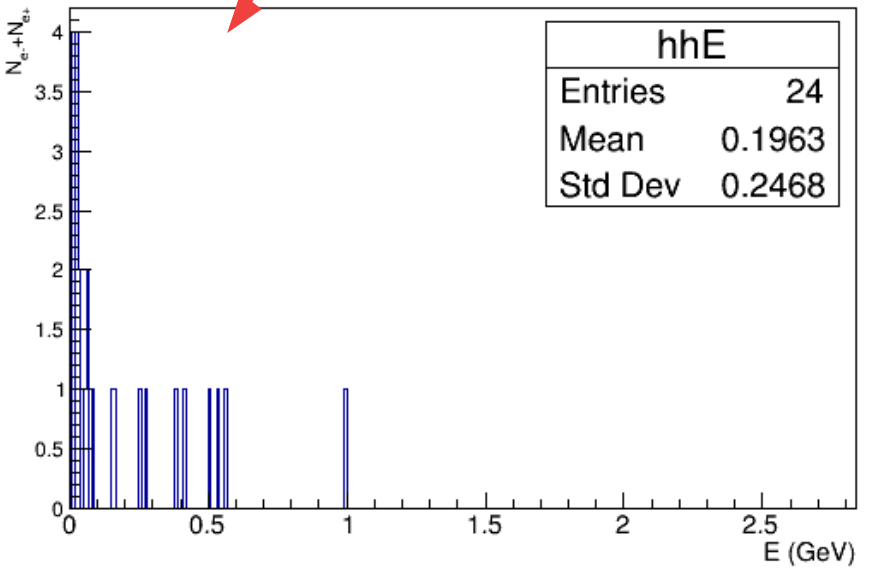


Hits with origin in spectrometer magnet

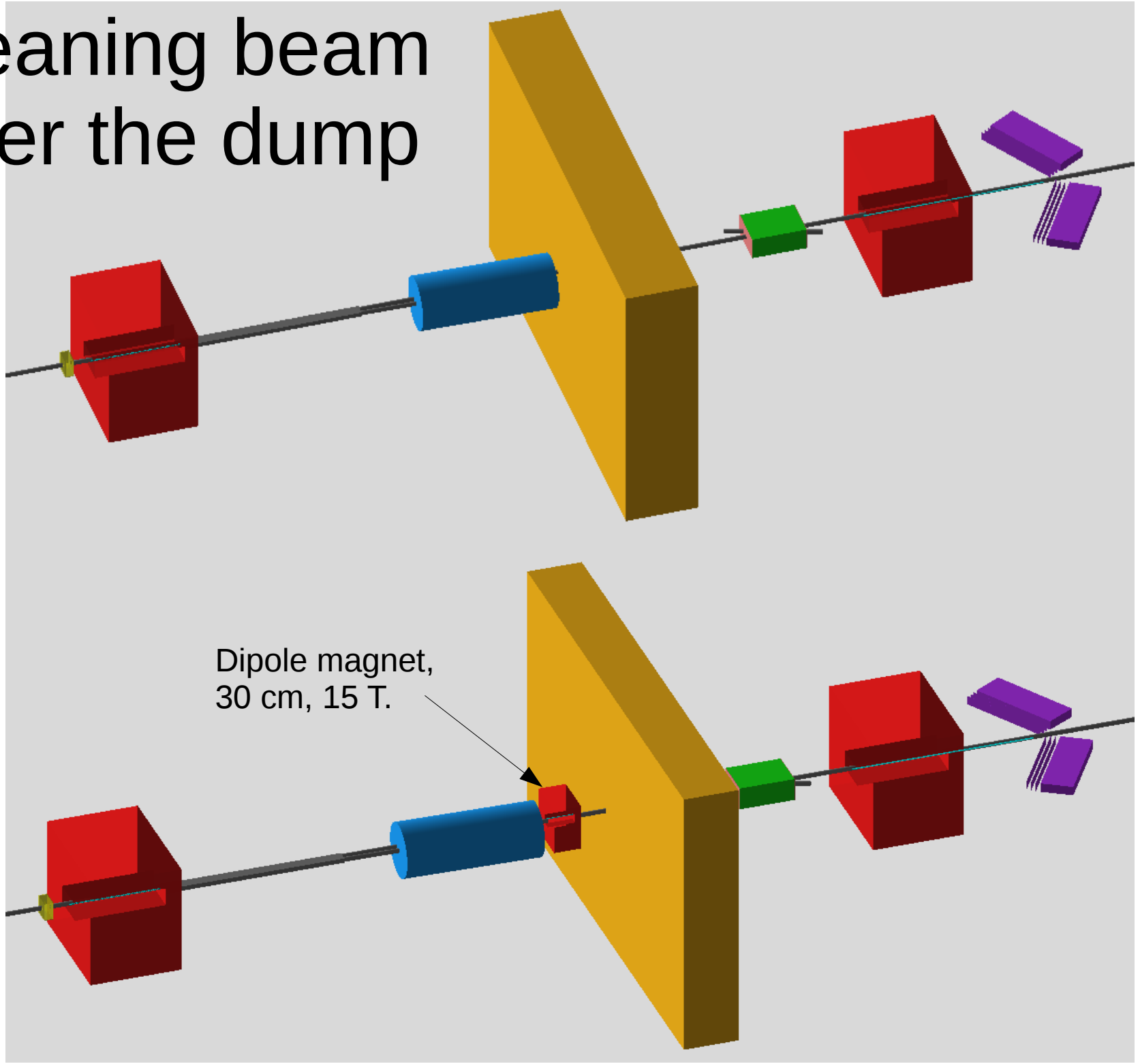




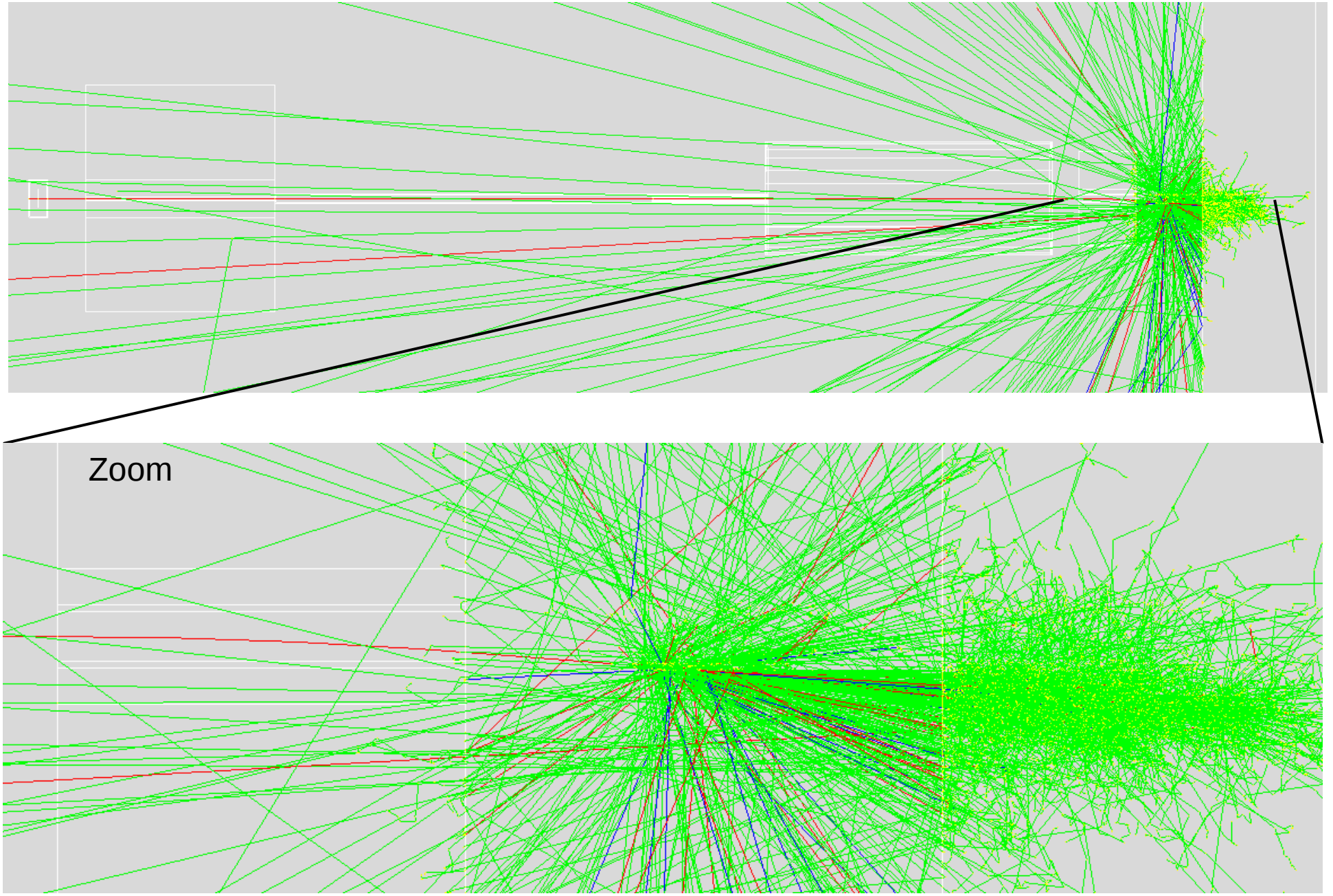




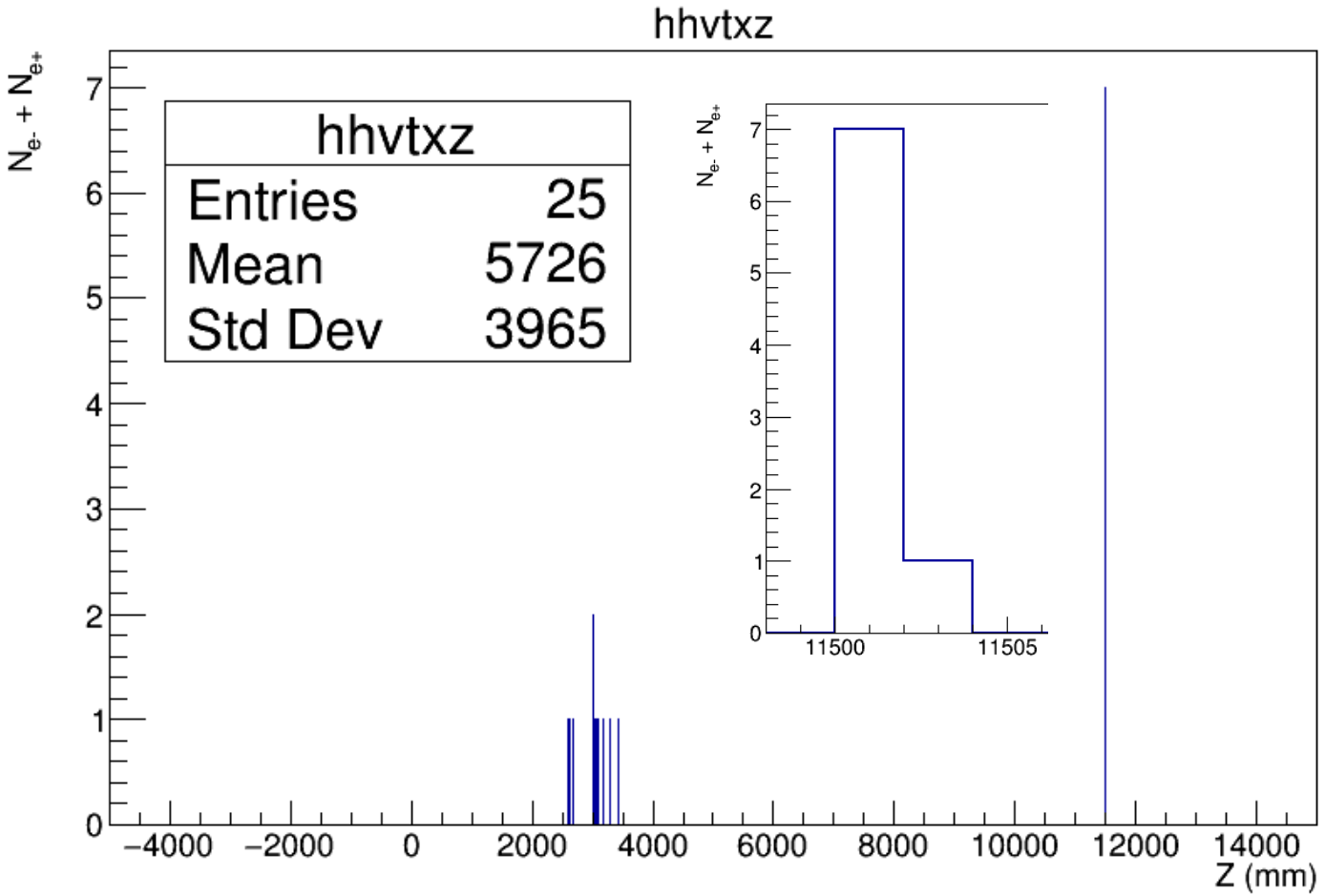
Cleaning beam after the dump



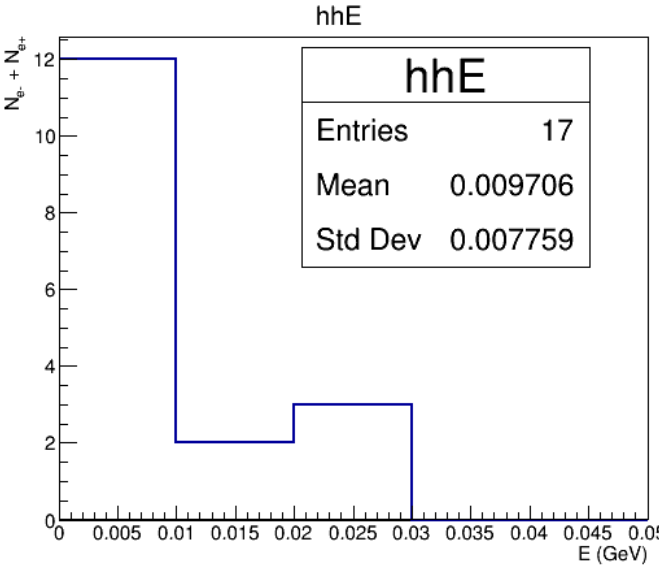
e-, 17.5 GeV

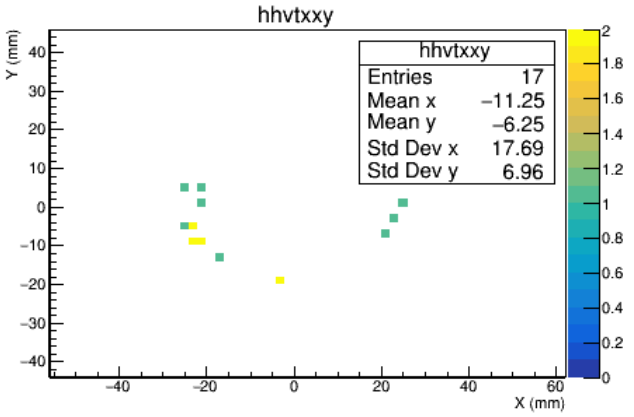


Z distribution of charged vertexes

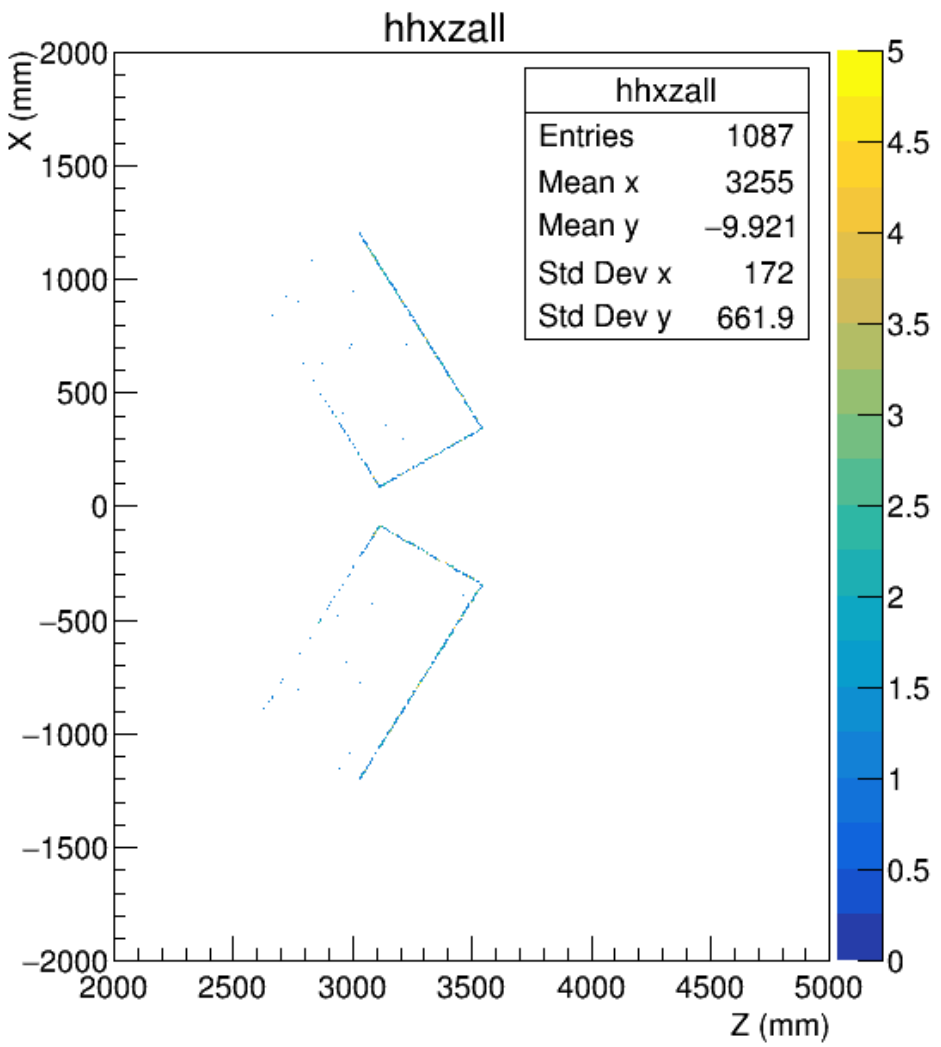


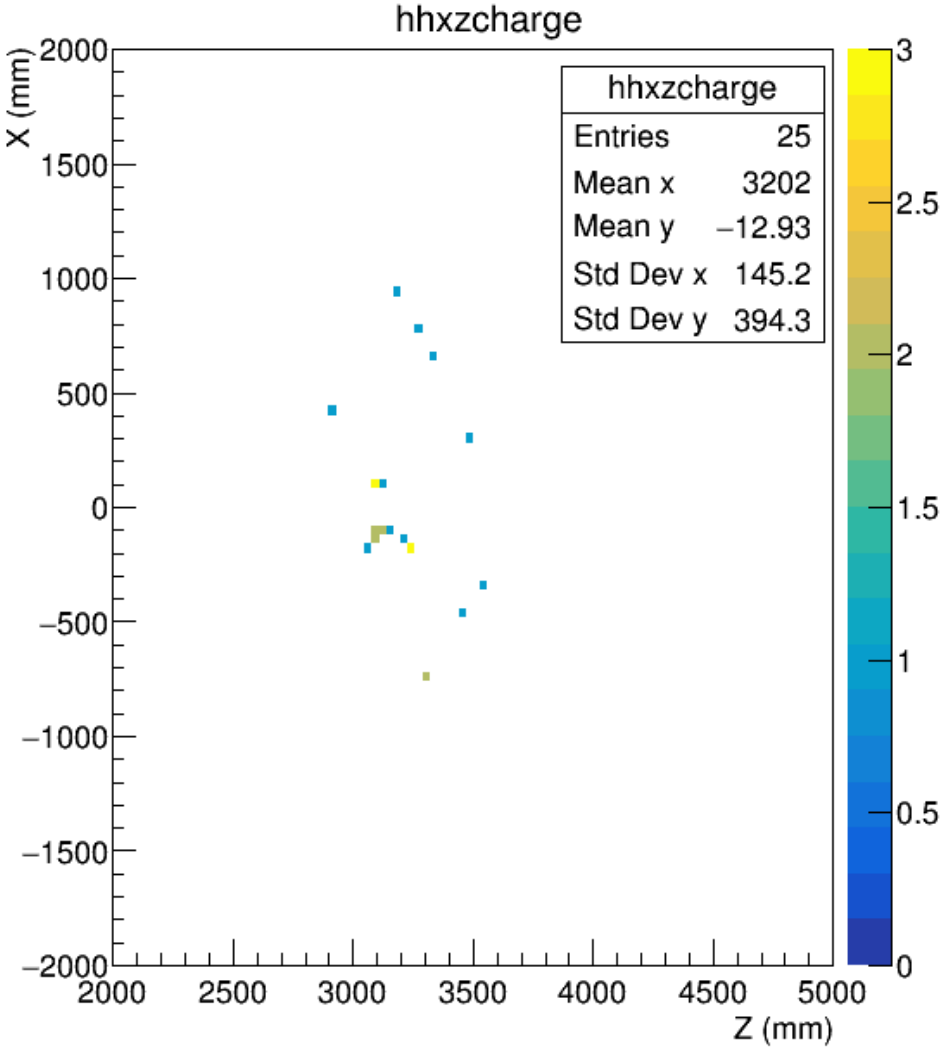
13.54 M e-



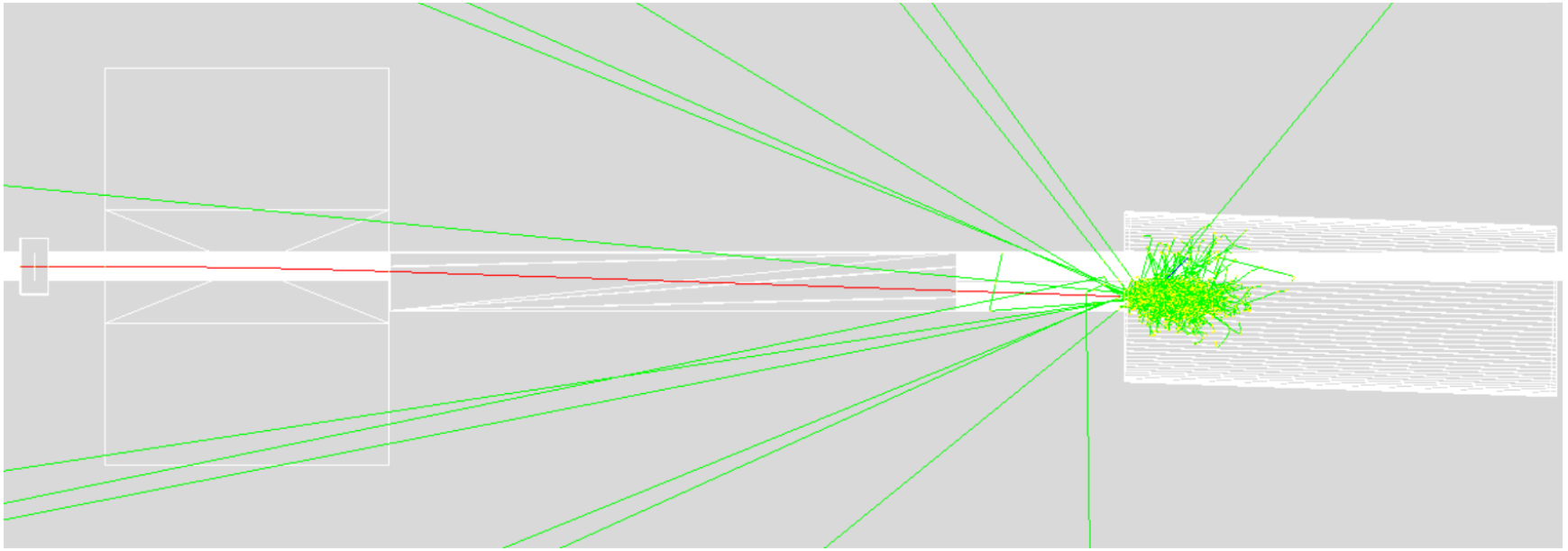


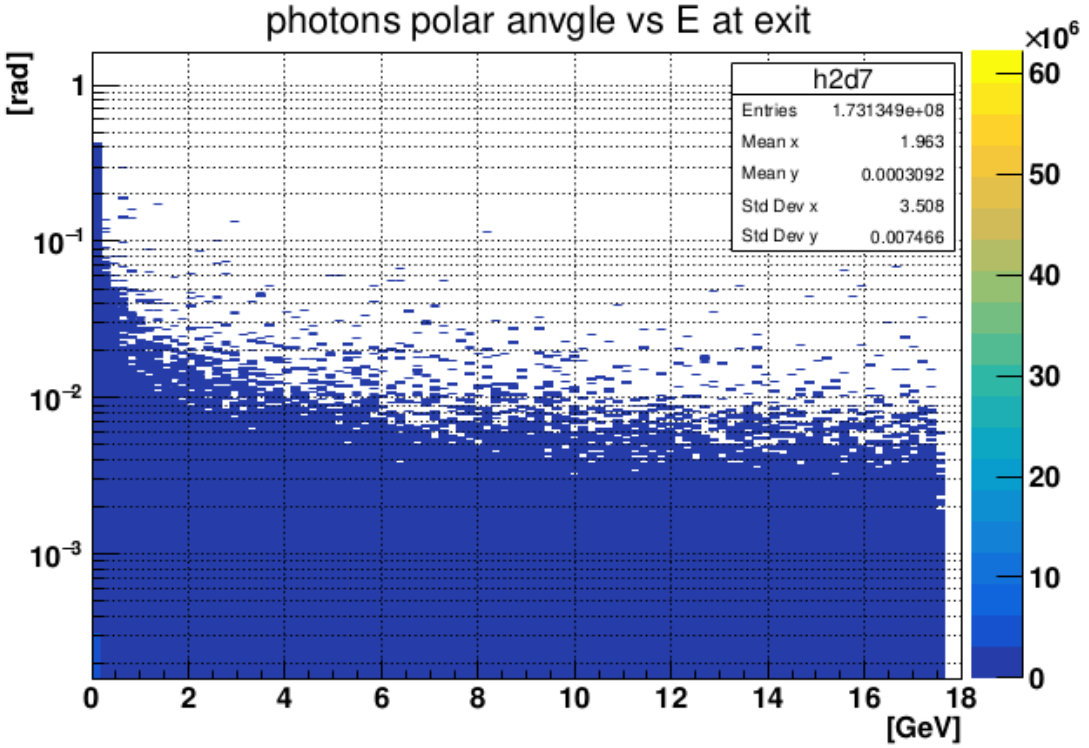
X vs Z Distribution of all and charged





Beam Pipe D = 10 cm

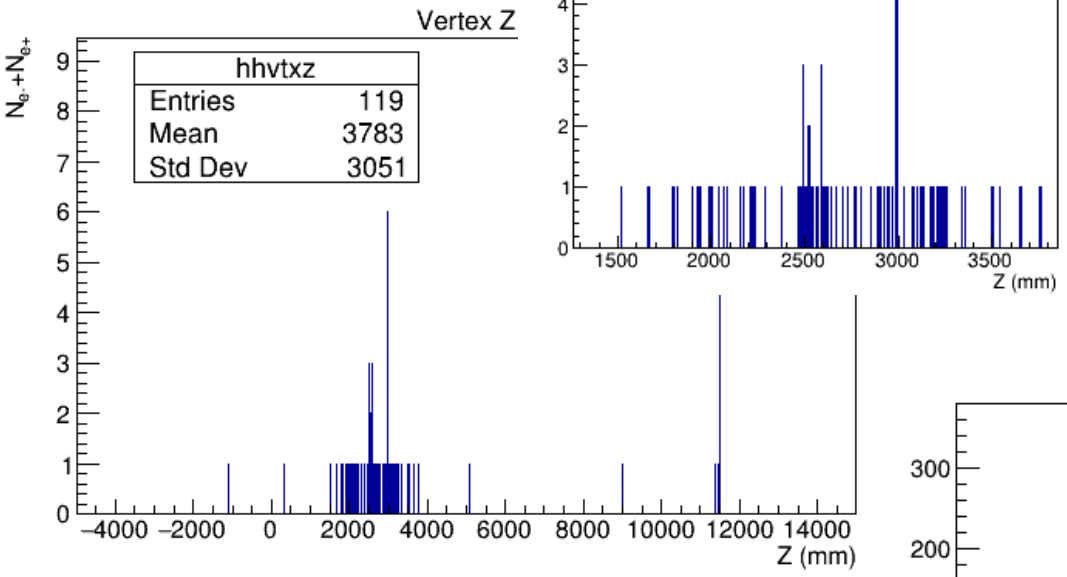


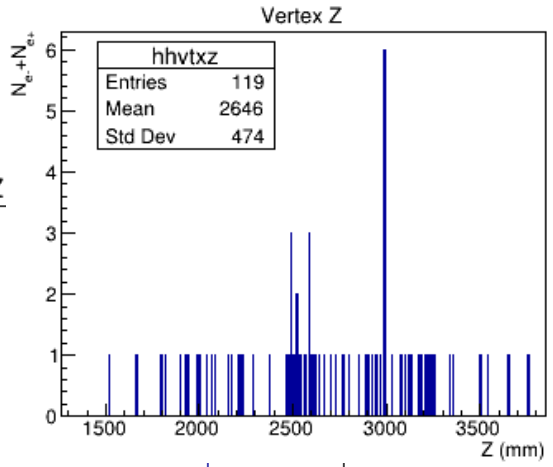


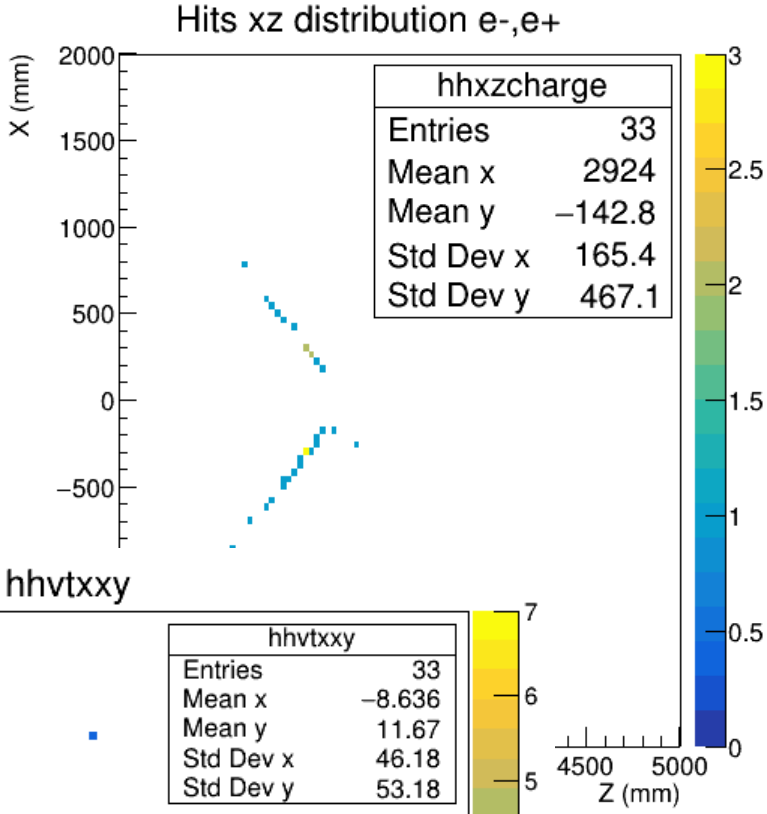
Electron energy (Ev): 1.75e+10
Magnetic field (T): 2
Curvature radius (m): 29.1869
Displacement at the exit from the magnet (m):0.017136
Angle (rad): 0.0342687
Displacement at 2.6 m from the magnet (m): 0.10627

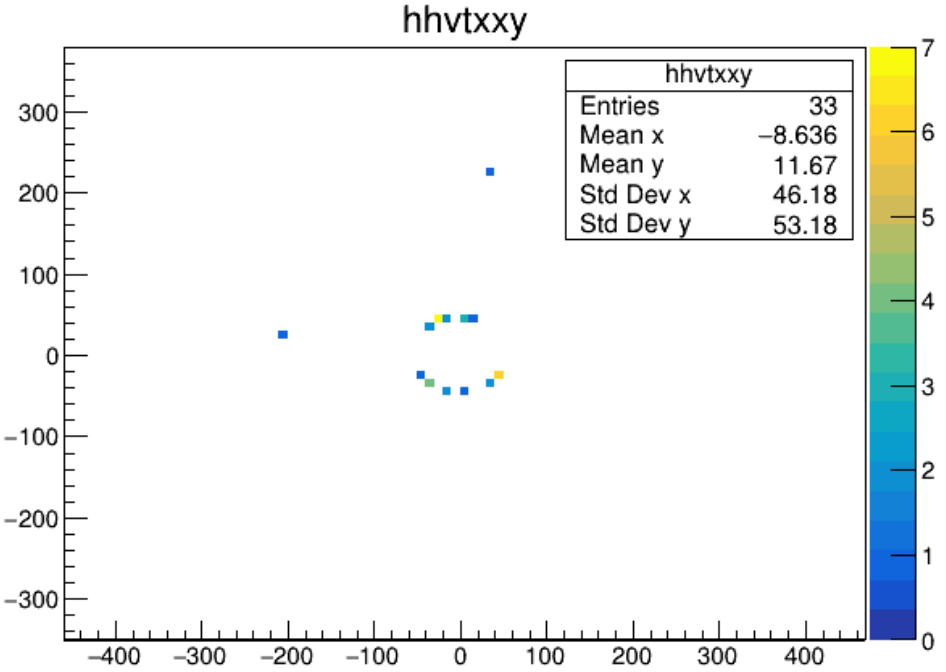
Beam Pipe D = 10 cm. Tracks in detector volume.

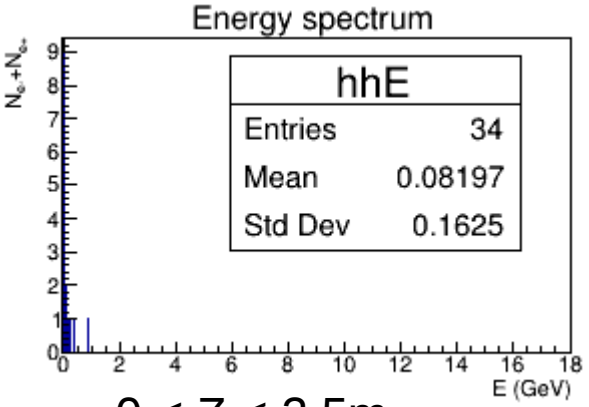
3M e-;
1m < Z < 2.5m











0 < Z < 2.5m

Cleaning magnet after collimator

root -l -q MagnetCurve.C'(17.5e9, 15.0, 0.3, 0.60)'

Elelctron energy (Ev): 1.75e+10
Magnetic field (T): 15
Curvature radius (m): 3.89158
Displacement at the exit from the magnet (m):0.0115807
Angle (rad): 0.077166
Displacement at 0.6 m from the magnet (m): 0.0579724

root -l -q MagnetCurve.C'(17.5e9, 1.3, 1.0, 2.0)'

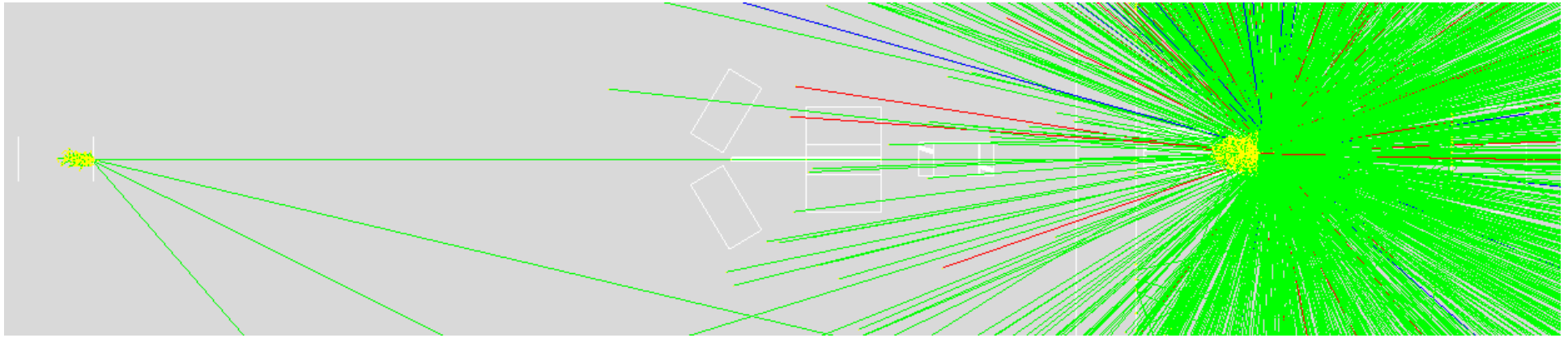
Elelctron energy (Ev): 1.75e+10
Magnetic field (T): 1.3
Curvature radius (m): 44.9029
Displacement at the exit from the magnet (m):0.0111365
Angle (rad): 0.0222721
Displacement at 2 m from the magnet (m): 0.0556882

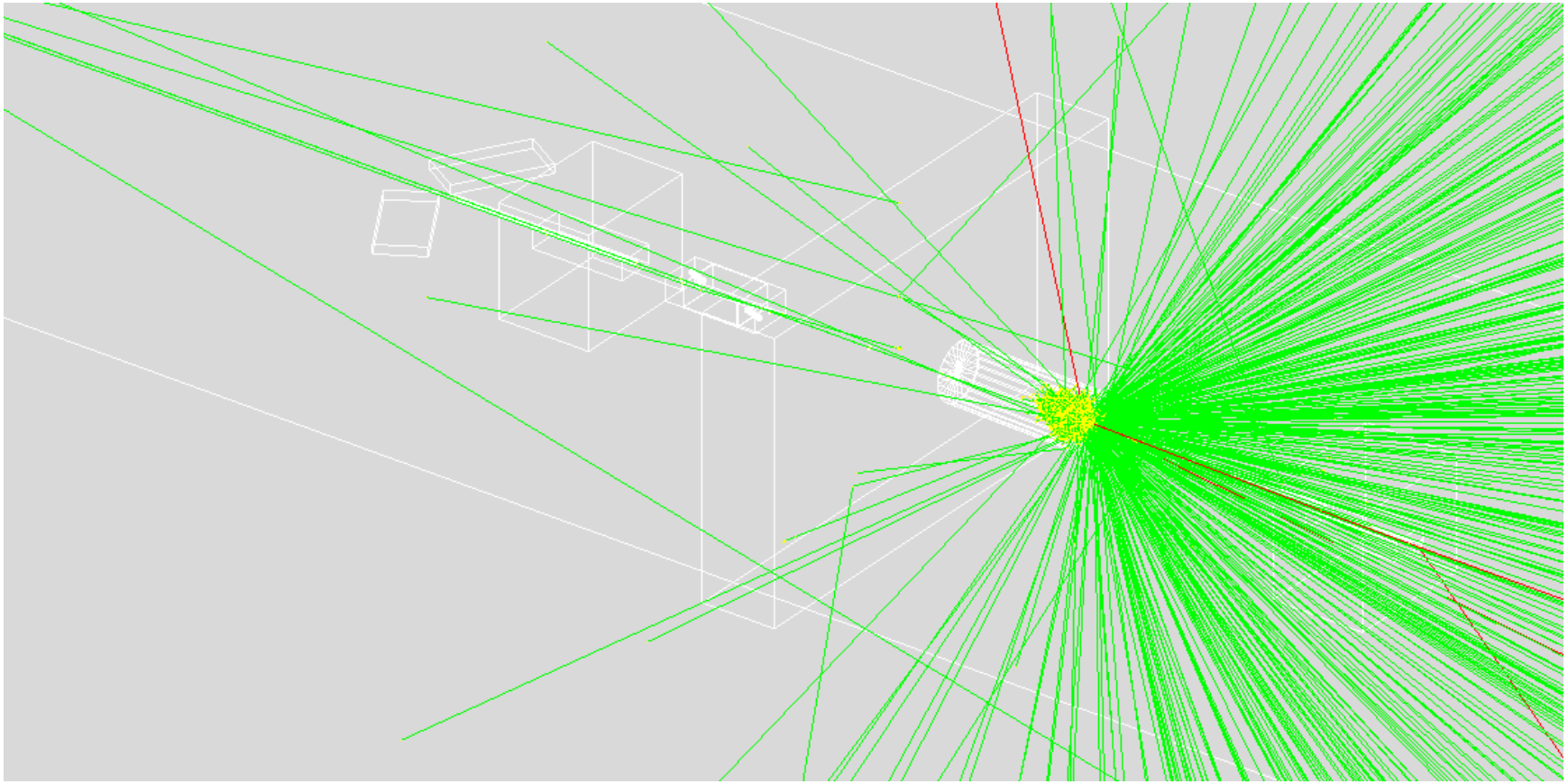
Summary and Plans

- Proceed with Geant4 simulation for background estimation.
- Compare results for different geometries.
- Comparison results with Fluka simulations made by Gianluca.
- Tune geometrical parameters of the setup in accordance with real technical requirements.

Backup

Tungsten Target, 1.4 T, ~30 e-





Sketches of Bremsstrahlung Area