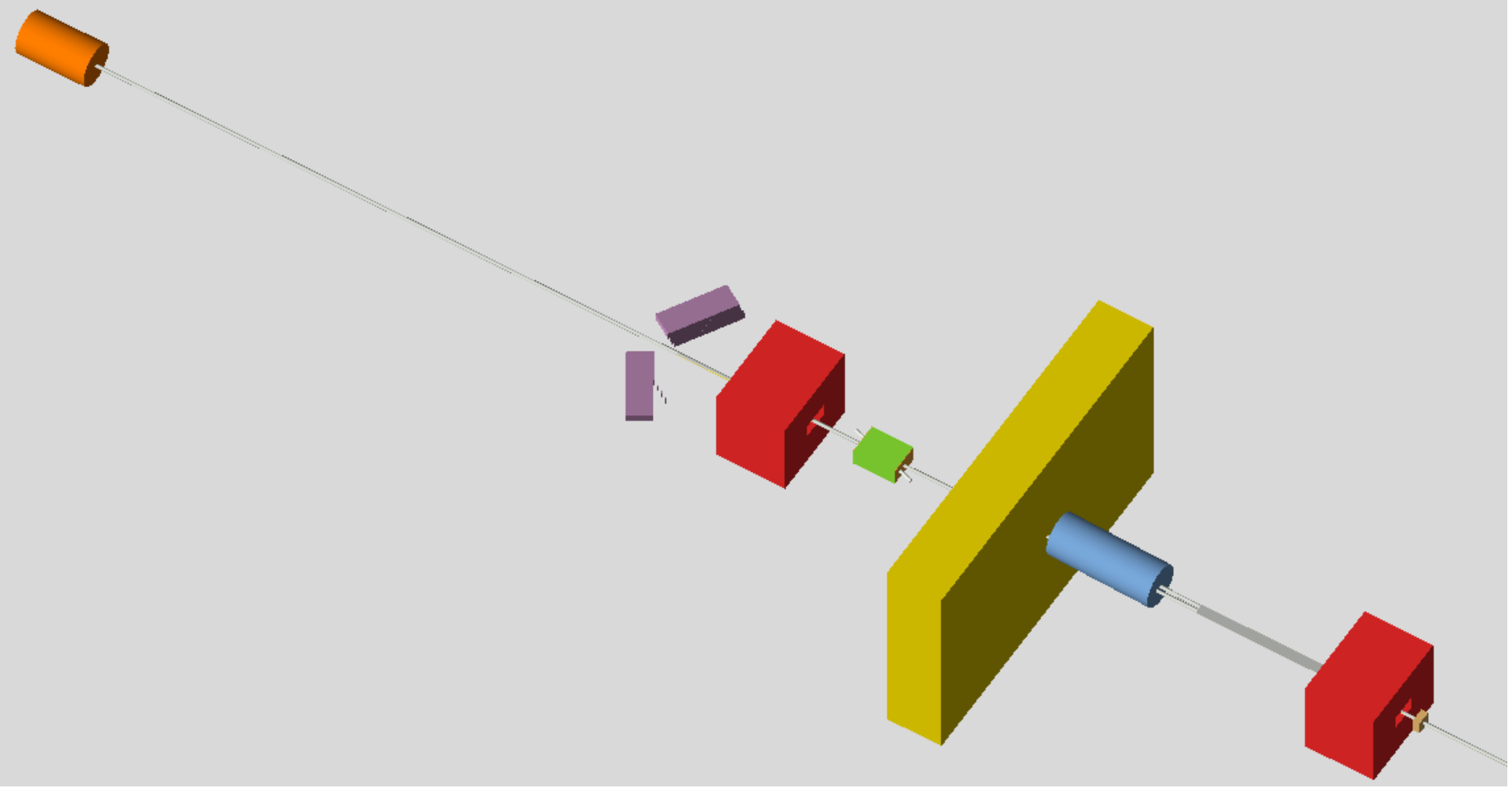
LUXE Background Study in Simulation

Oleksandr Borysov

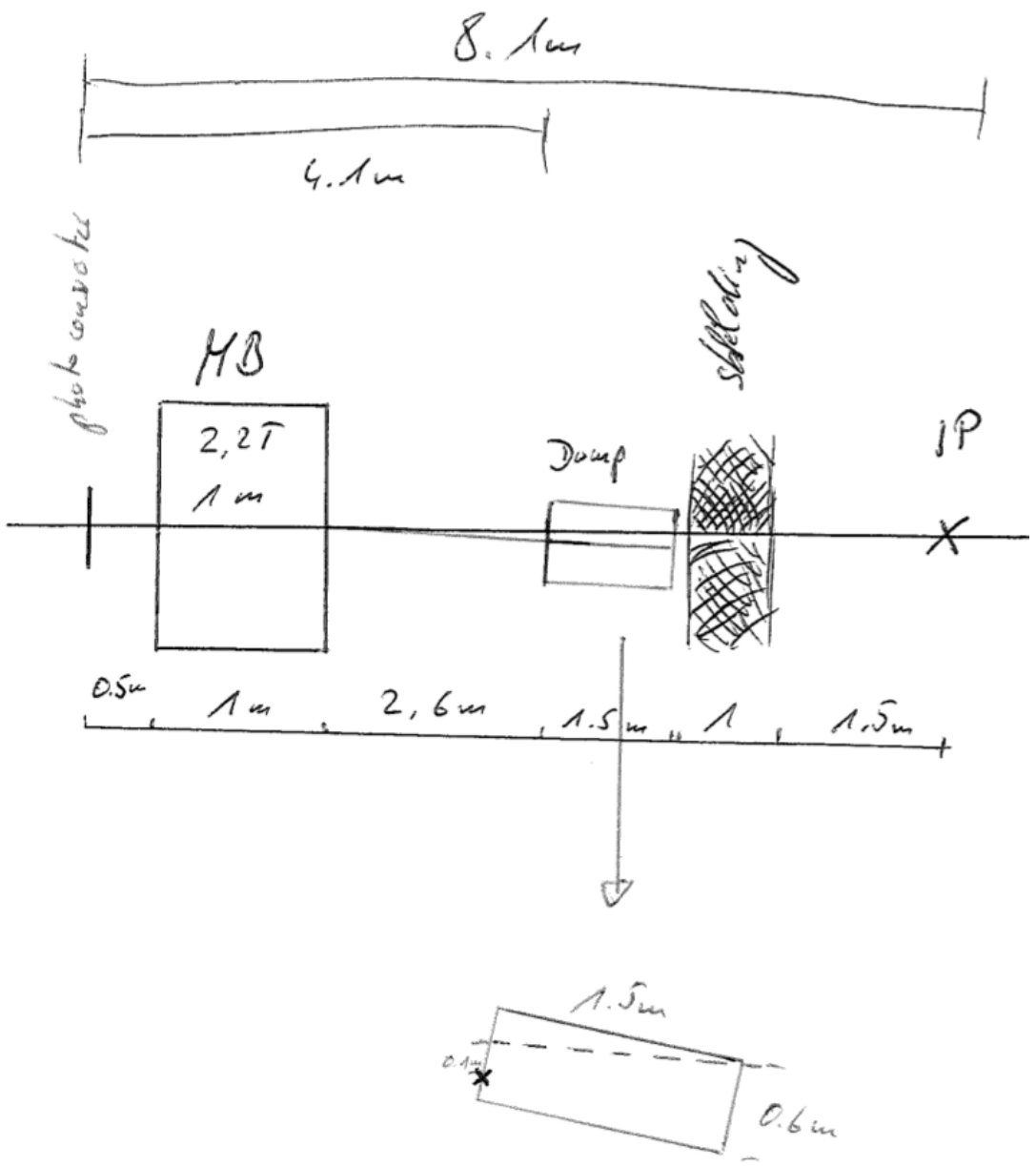
LUXE Meeting
June 18, 2019

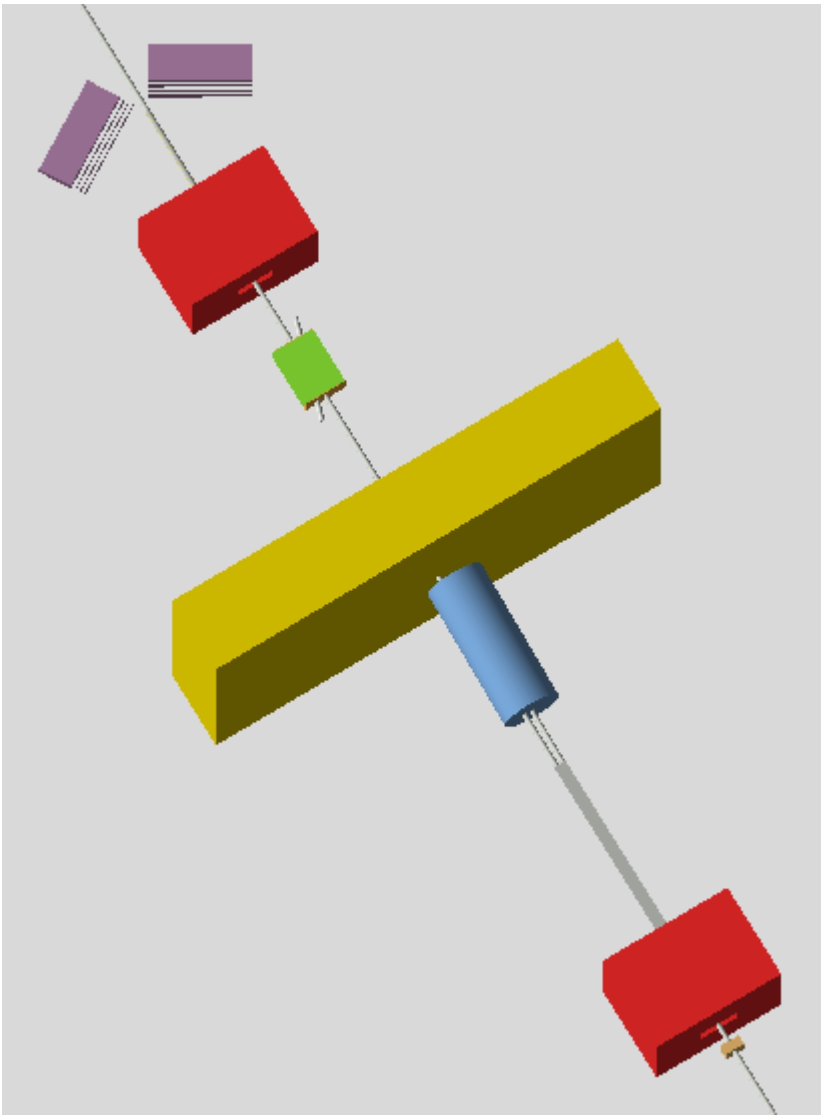
LUXE geometry in Geant4

- 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.

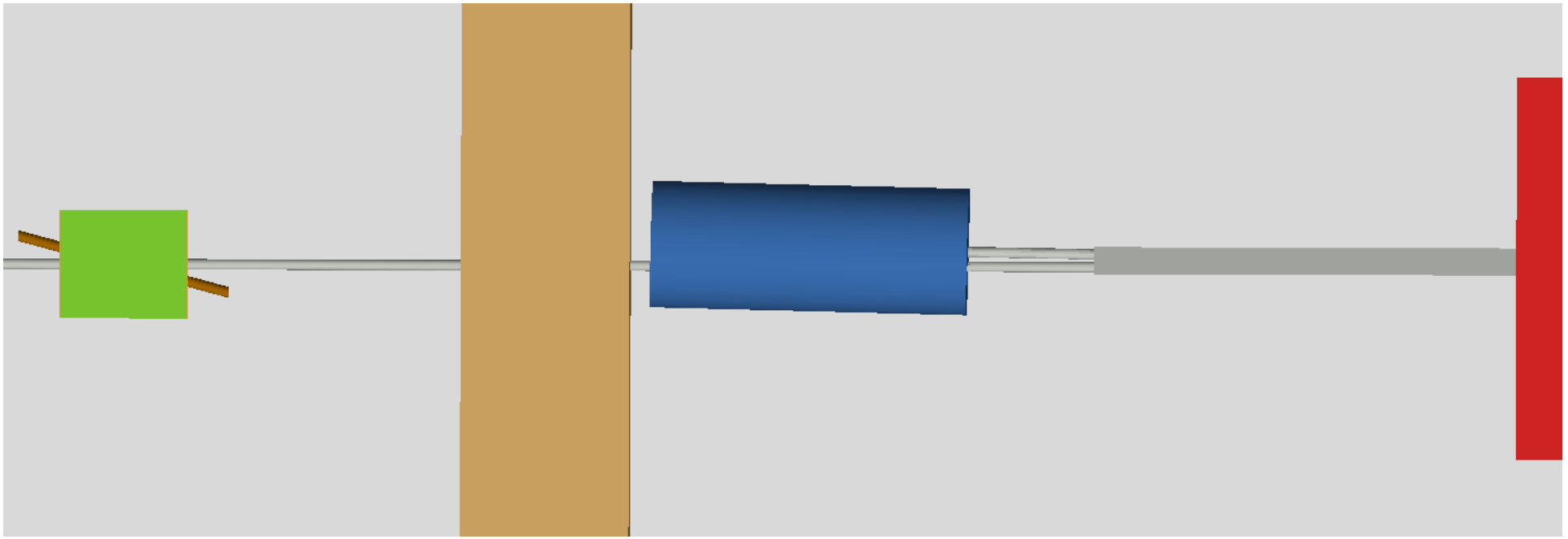


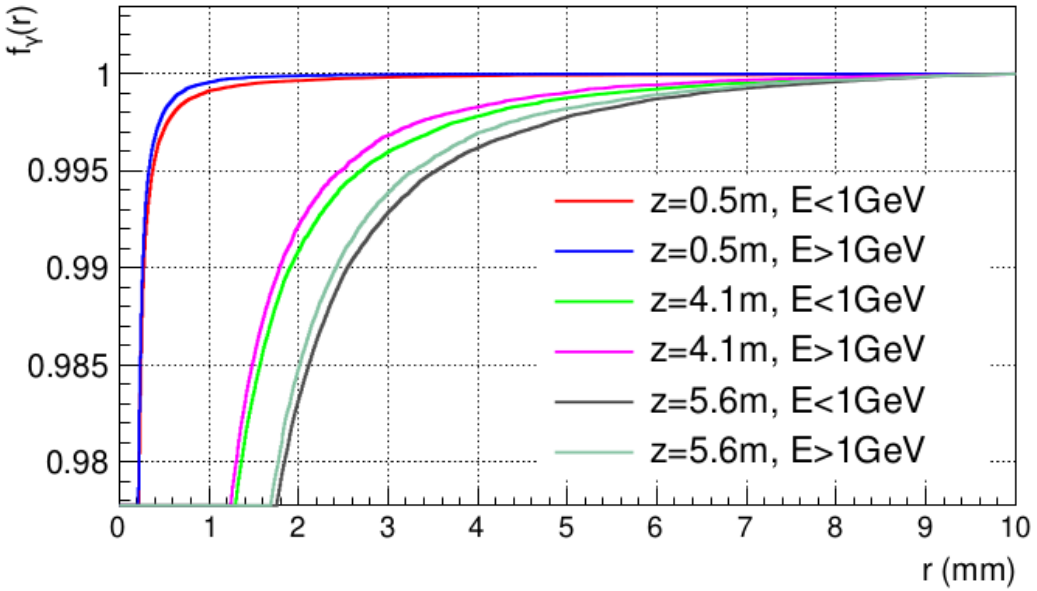
Sketch and Geant4



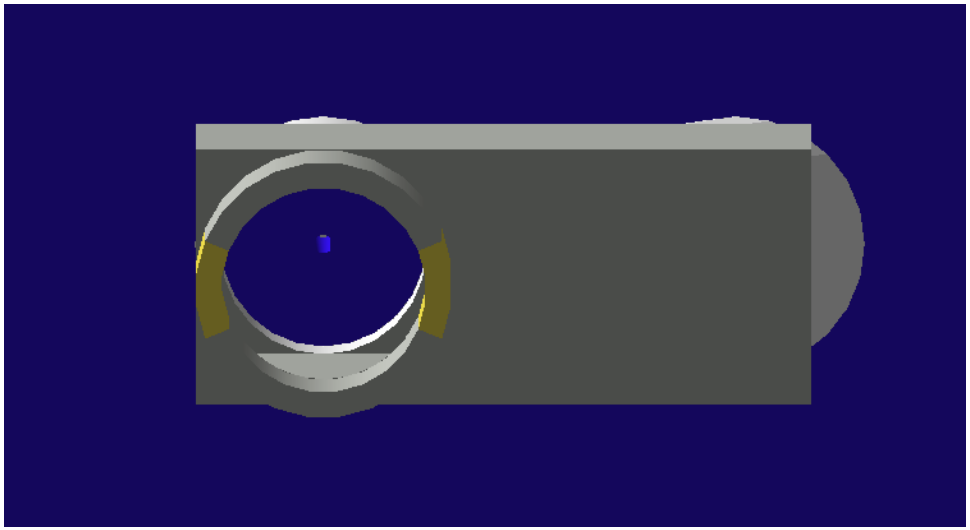


Beam Dump with Hole for Photons



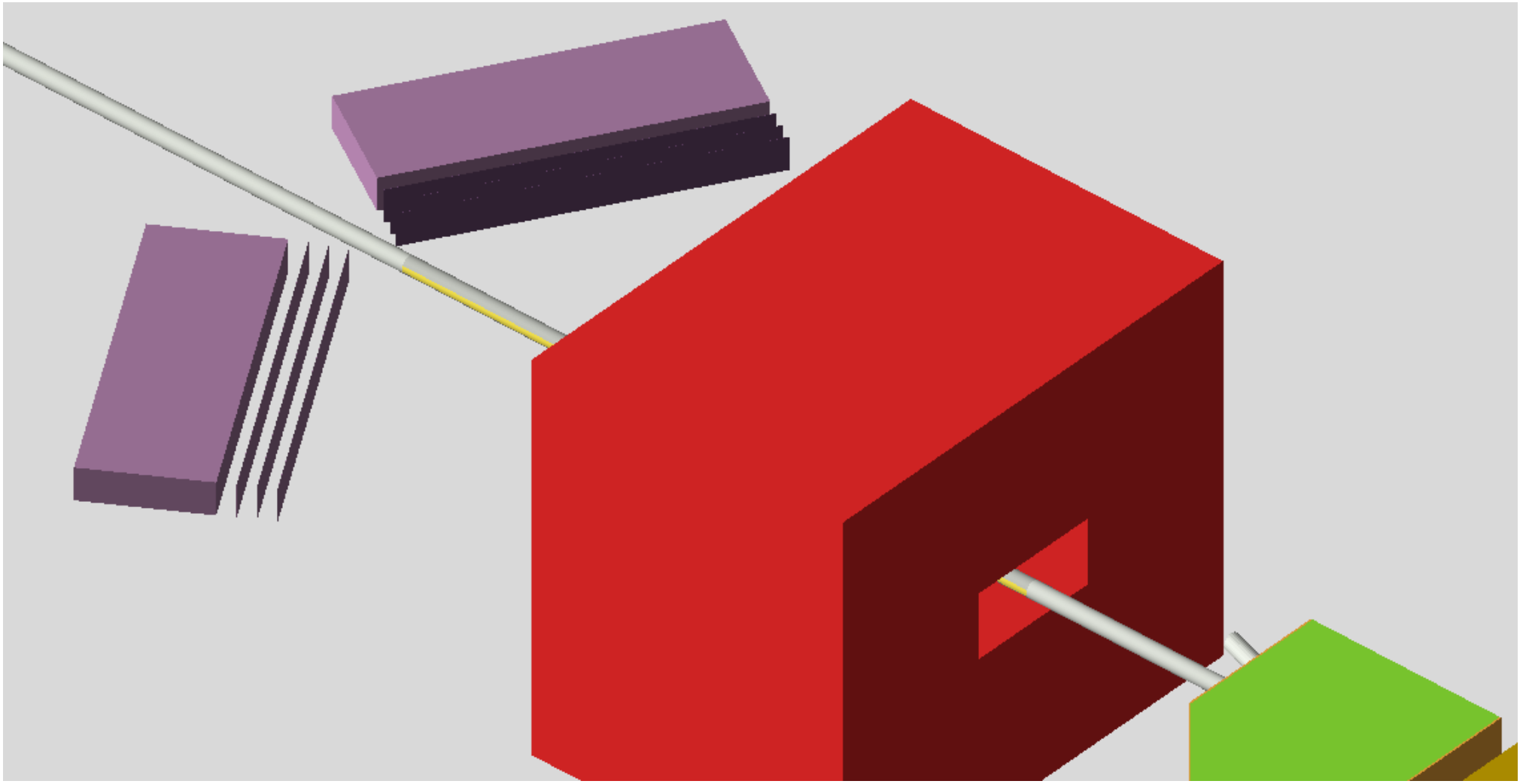


Fraction of photons inside the circle as a function of its radius for different distances from the target

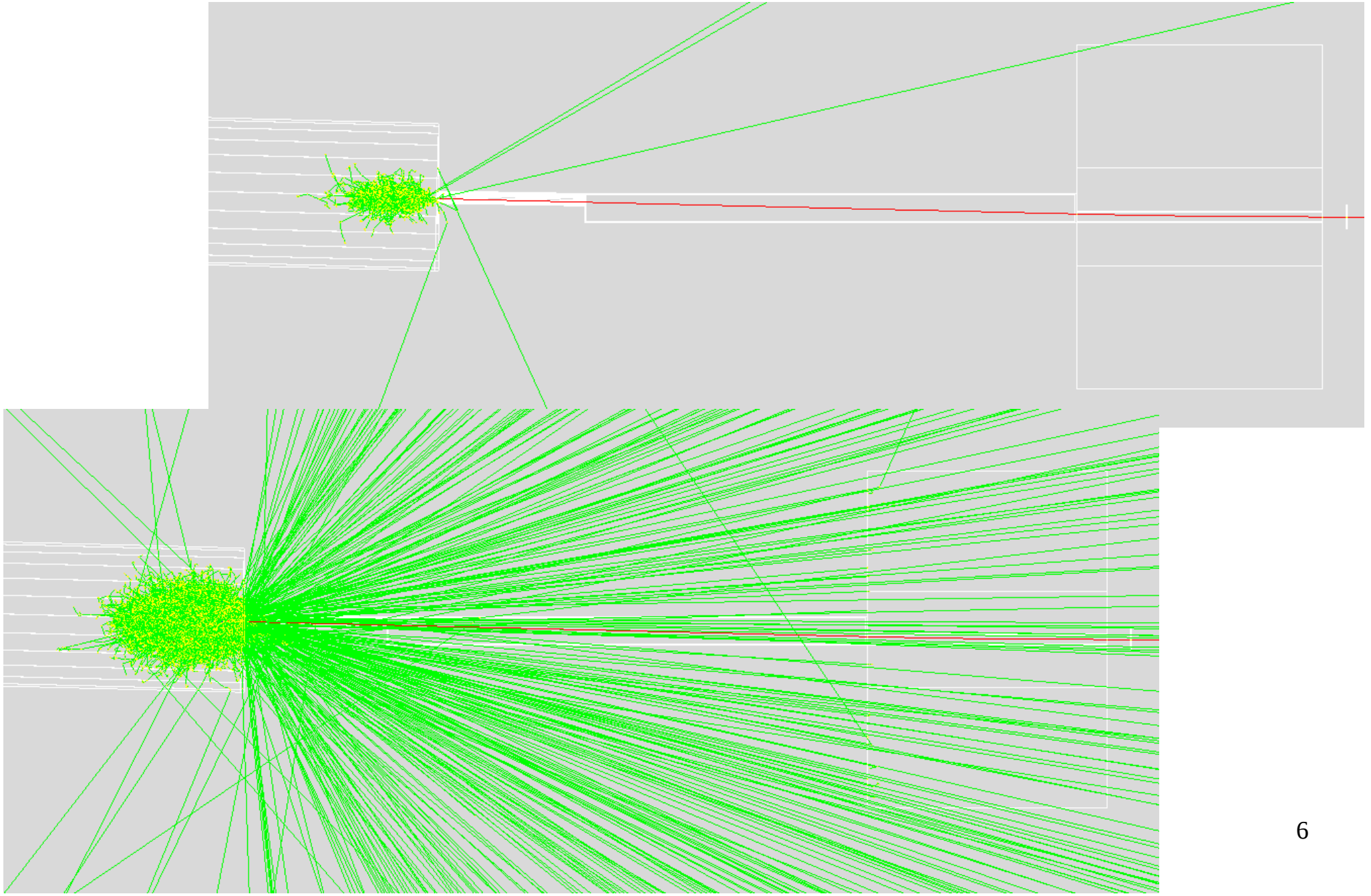


Front view of the beam dump through the beam pipe

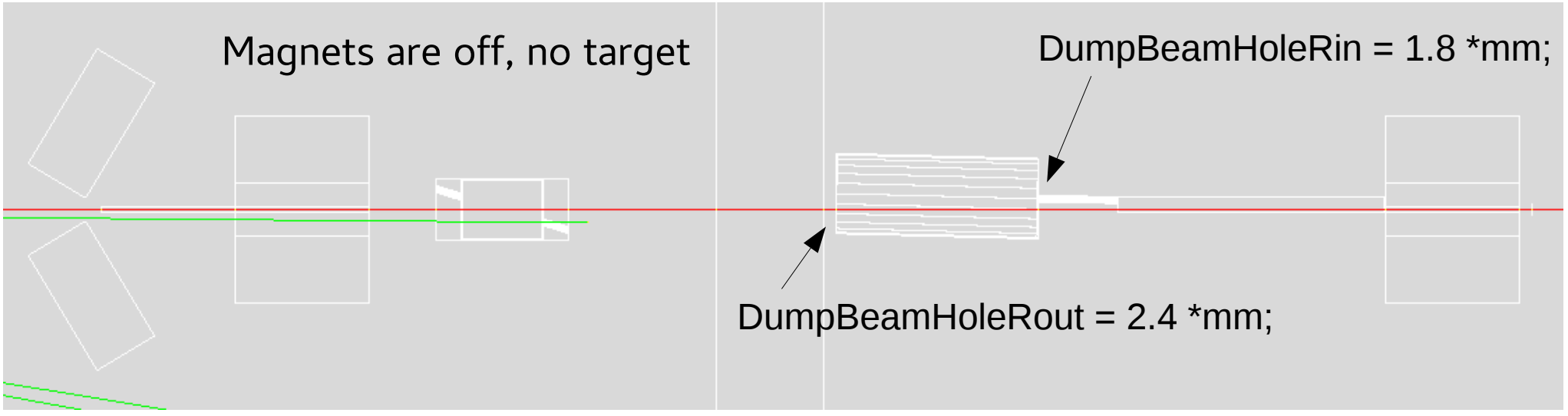
Tracking Planes

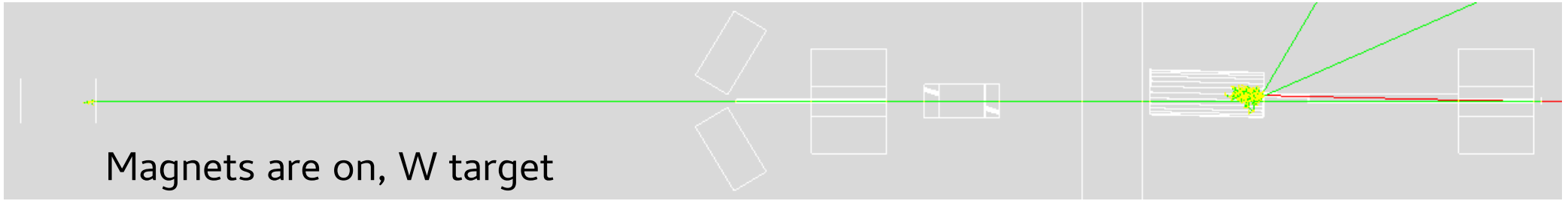


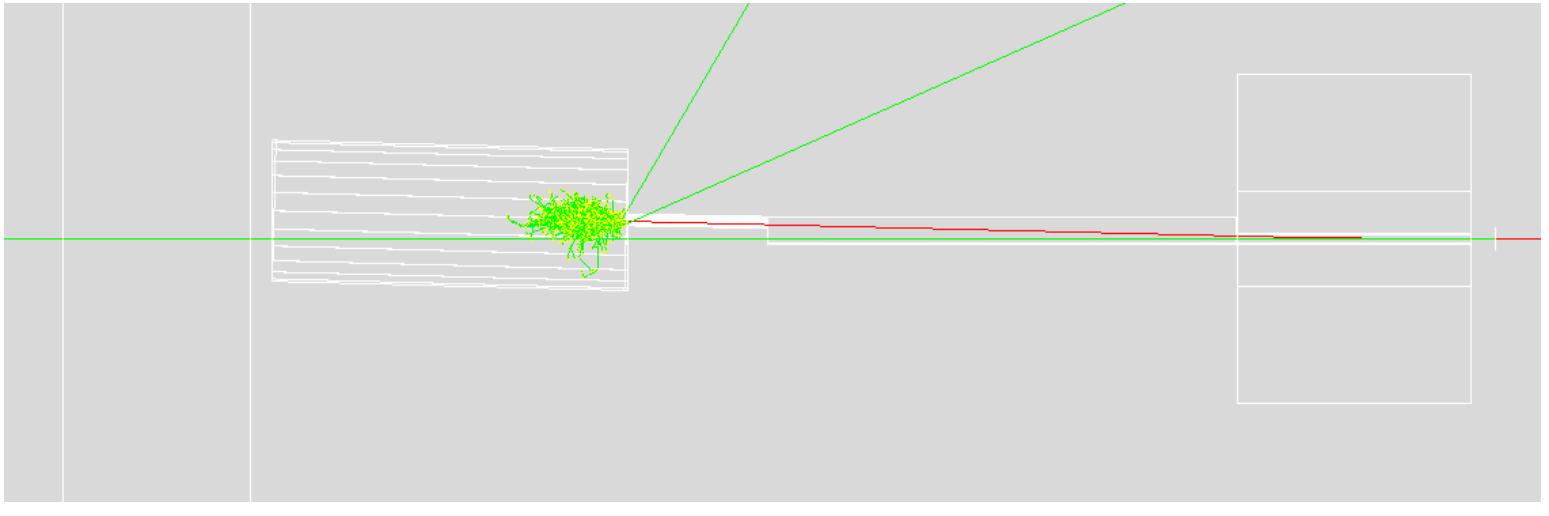
No Target, 1.4 T



Performance with test settings





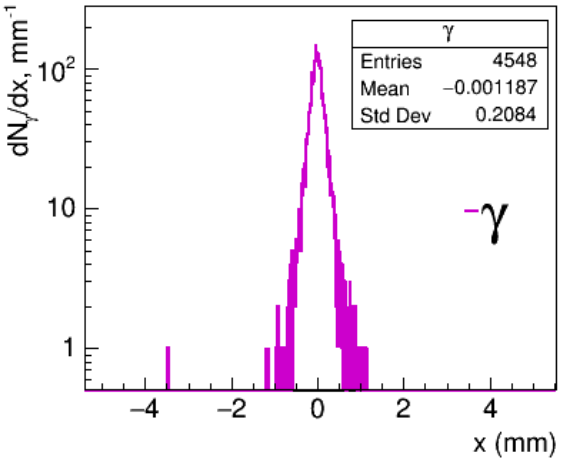


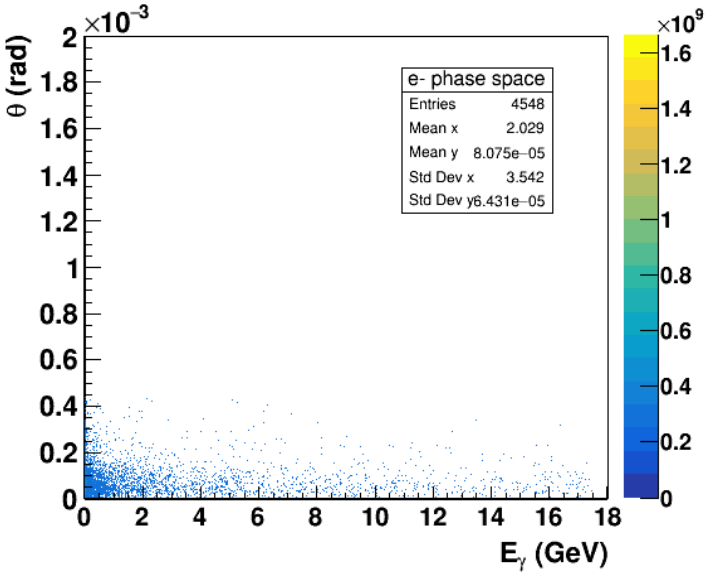
50k e-

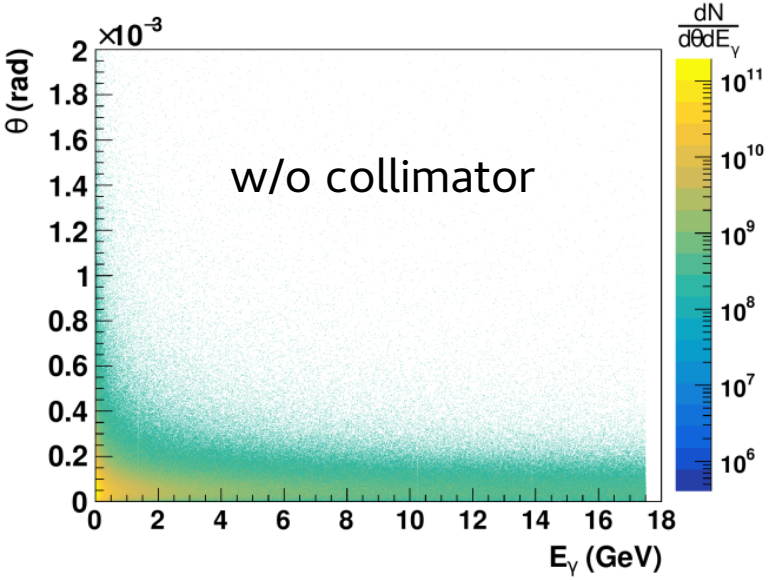
Simulated 50k events recording any track that enters detectors volume 1 was registered;

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

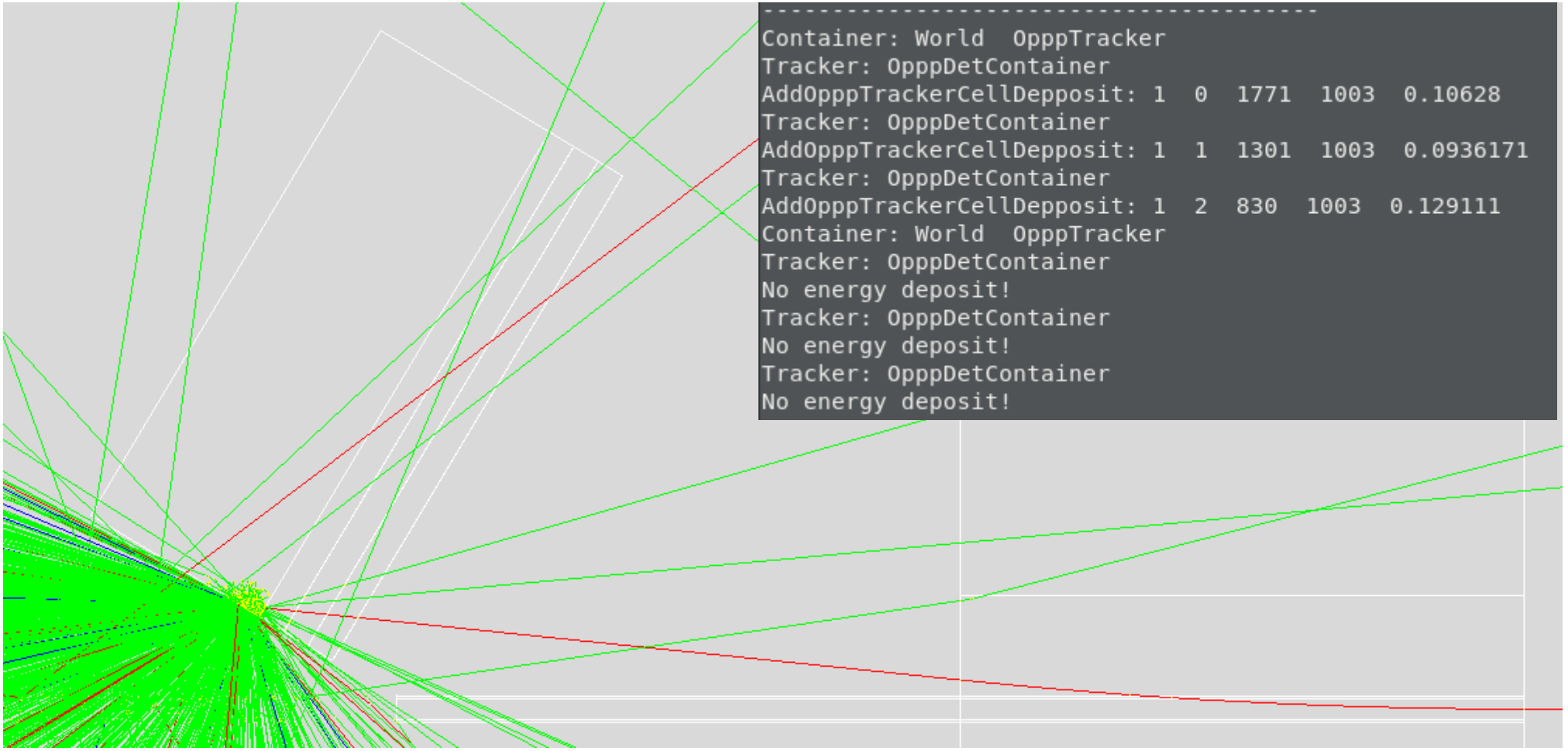
Bremsstrahlung photons 22.5 m from the collimator (beam dump)







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 *
************************************************************************************************************************
```

Output

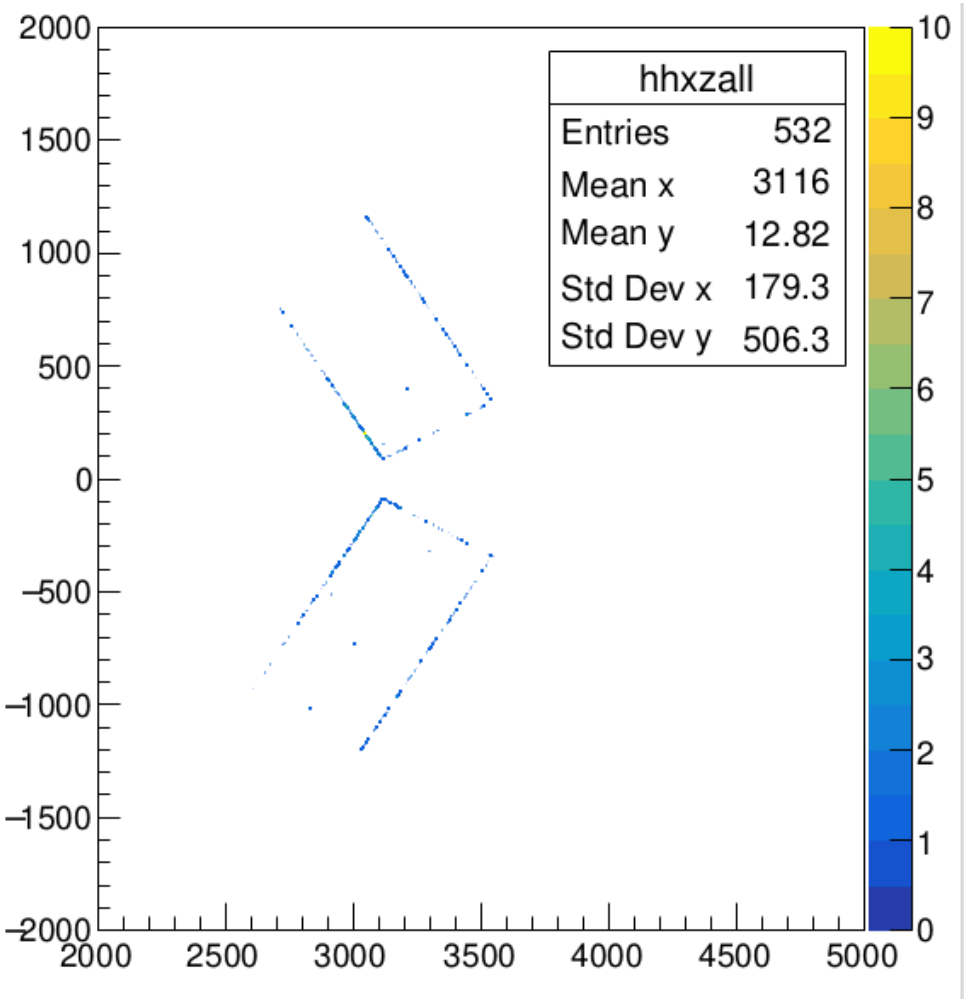
```
analysisManager->CreateNtuple("opppdet", "Tracks hitting OPPP detector");
analysisManager->CreateNtupleDColumn(1, "E");
analysisManager->CreateNtupleDColumn(1, "x");
analysisManager->CreateNtupleDColumn(1, "y");
analysisManager->CreateNtupleDColumn(1, "z");
analysisManager->CreateNtupleDColumn(1, "t");
analysisManager->CreateNtupleDColumn(1, "vtxx");
analysisManager->CreateNtupleDColumn(1, "vtxy");
analysisManager->CreateNtupleDColumn(1, "vtxz");
analysisManager->CreateNtupleDColumn(1, "px");
analysisManager->CreateNtupleDColumn(1, "py");
analysisManager->CreateNtupleDColumn(1, "pz");
analysisManager->CreateNtupleDColumn(1, "theta");
analysisManager->CreateNtupleDColumn(1, "phi");
analysisManager->CreateNtupleIColumn(1, "pdg");
analysisManager->CreateNtupleIColumn(1, "physproc");
analysisManager->CreateNtupleIColumn(1, "detid");
analysisManager->CreateNtupleDColumn(1, "xlocal");
analysisManager->CreateNtupleDColumn(1, "ylocal");
analysisManager->CreateNtupleDColumn(1, "zlocal");
analysisManager->CreateNtupleIColumn(1, "eventid");
analysisManager->FinishNtuple(1);

analysisManager->CreateNtuple("oppphits", "Hits in OPPP tracking detector");
analysisManager->CreateNtupleIColumn(2, "eventid");
analysisManager->CreateNtupleIColumn(2, "detid");
analysisManager->CreateNtupleIColumn(2, "layerid");
analysisManager->CreateNtupleIColumn(2, "cellx");
analysisManager->CreateNtupleIColumn(2, "celly");
analysisManager->CreateNtupleDColumn(2, "edep");
analysisManager->CreateNtupleIColumn(2, "hitid");
analysisManager->CreateNtupleIColumn(2, "track_list", fvHitTrackList) ;
analysisManager->FinishNtuple(2);
```

```
analysisManager->CreateNtuple("oppptracks", "Tracks in OPPP tracking detector");
analysisManager->CreateNtupleIColumn(3, "eventid");
analysisManager->CreateNtupleIColumn(3, "trackid", fvTracks) ;
analysisManager->CreateNtupleDColumn(3, "vtxx", fVtxx);
analysisManager->CreateNtupleDColumn(3, "vtxy", fVtxy);
analysisManager->CreateNtupleDColumn(3, "vtxz", fVtxz);
analysisManager->CreateNtupleDColumn(3, "px", fPx);
analysisManager->CreateNtupleDColumn(3, "py", fPy);
analysisManager->CreateNtupleDColumn(3, "pz", fPz);
analysisManager->CreateNtupleDColumn(3, "E", fE);
analysisManager->CreateNtupleIColumn(3, "pdg", fPDG);
analysisManager->CreateNtupleIColumn(3, "pproc", fPhysProc);
analysisManager->CreateNtupleIColumn(3, "ptid", fPTId);
analysisManager->FinishNtuple(3);
```

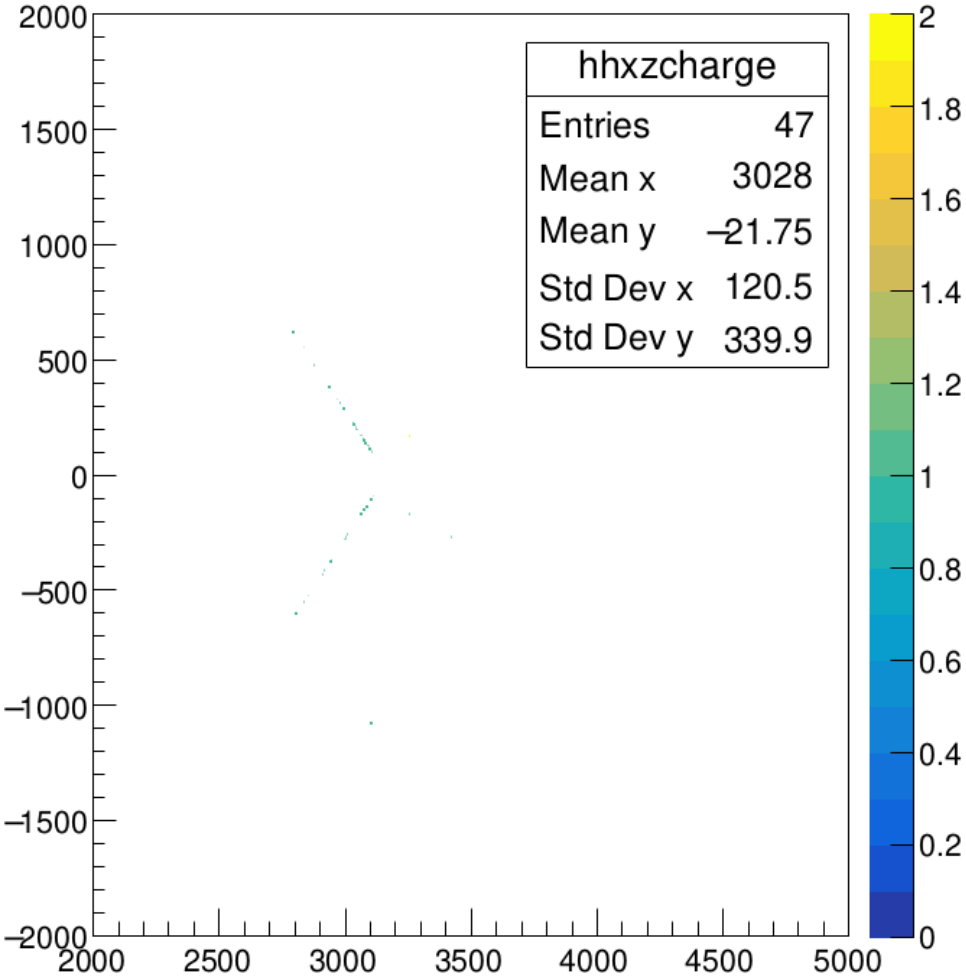
Track in detector volume

2.91M e-

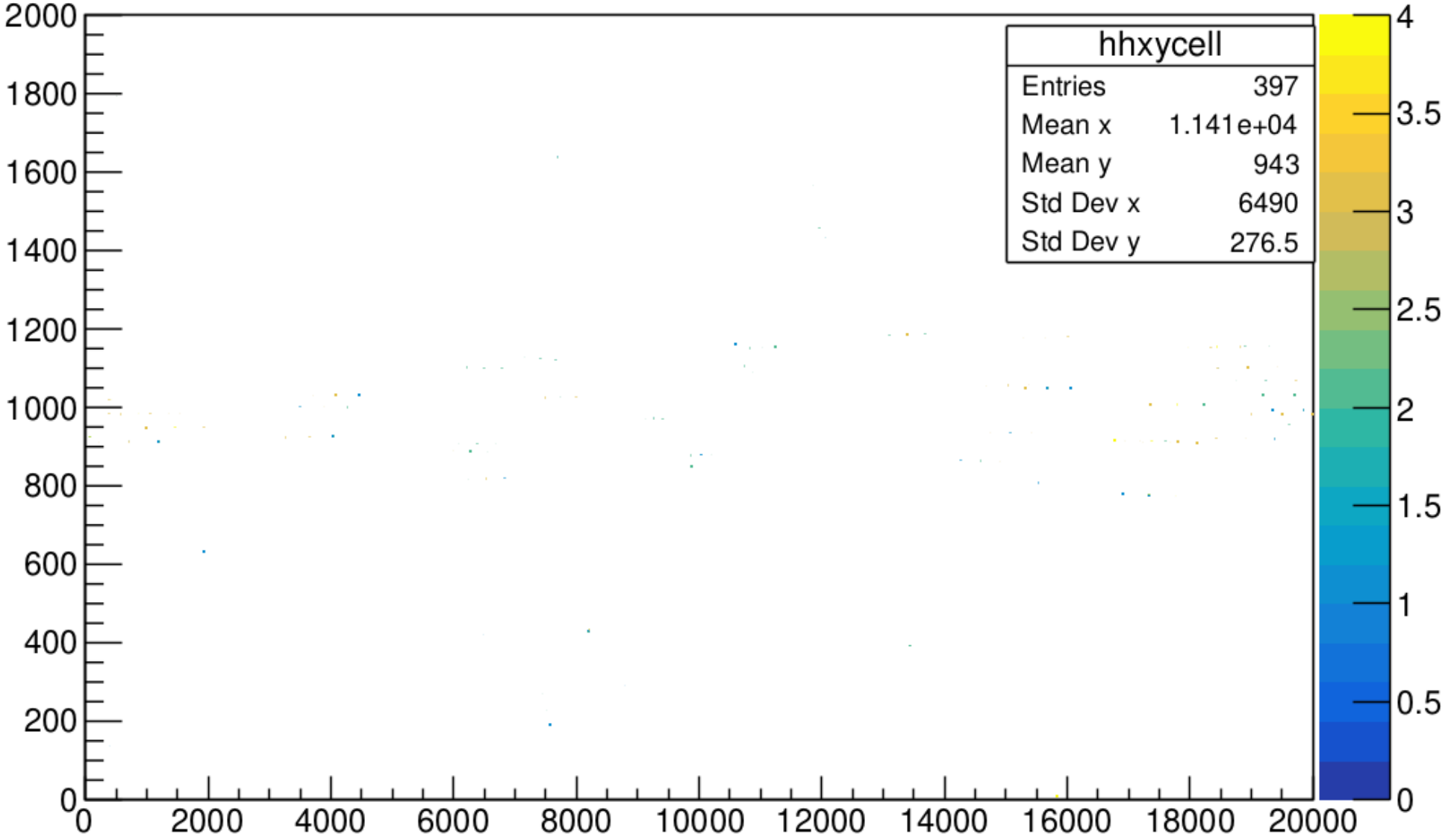
All tracks entering detector container volume



e+e- tracks entering detector container volume



Hits in tracking planes

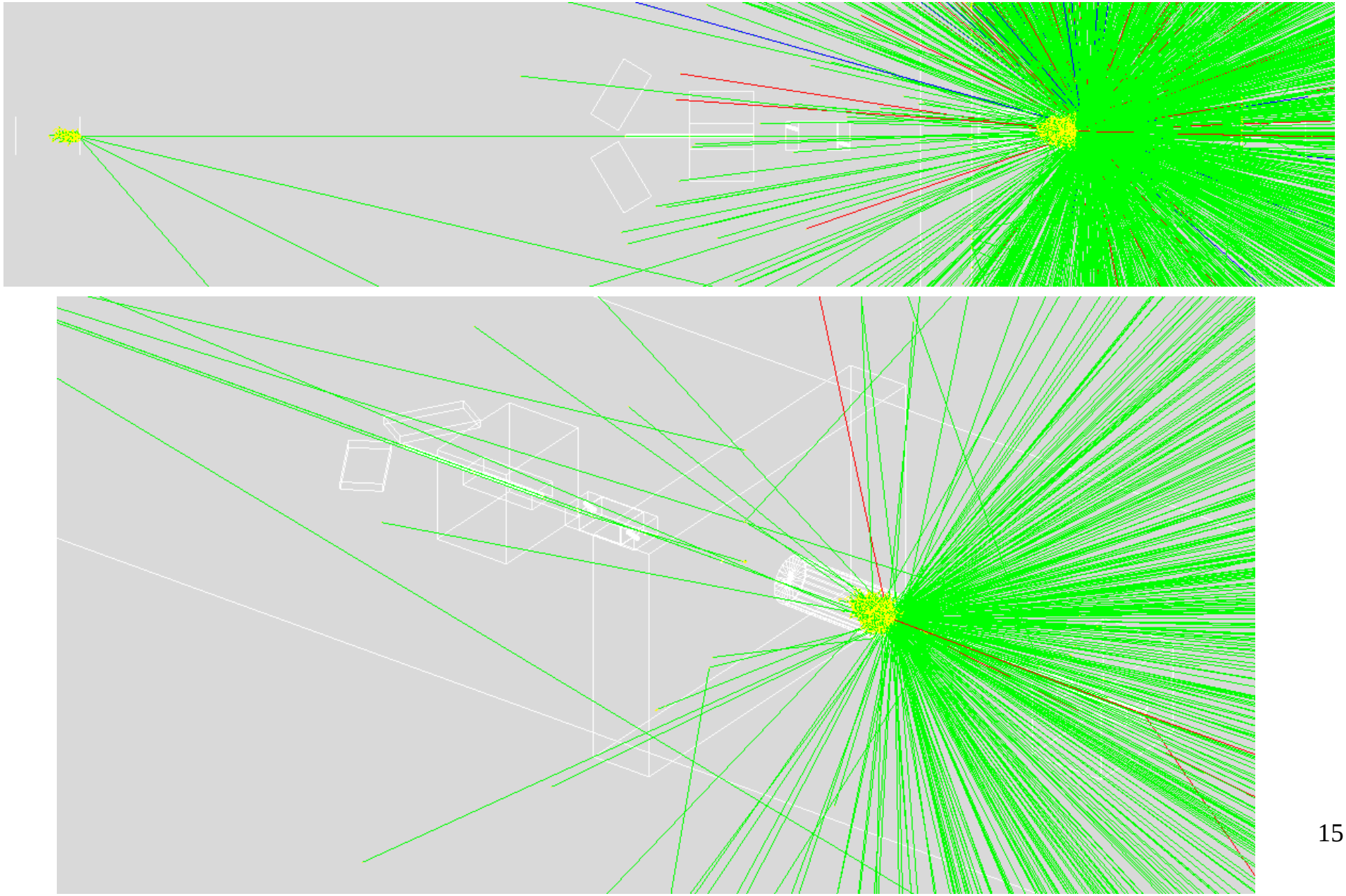


Summary and Plans

- 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