Update on LUXE GEANT4 Geometry.

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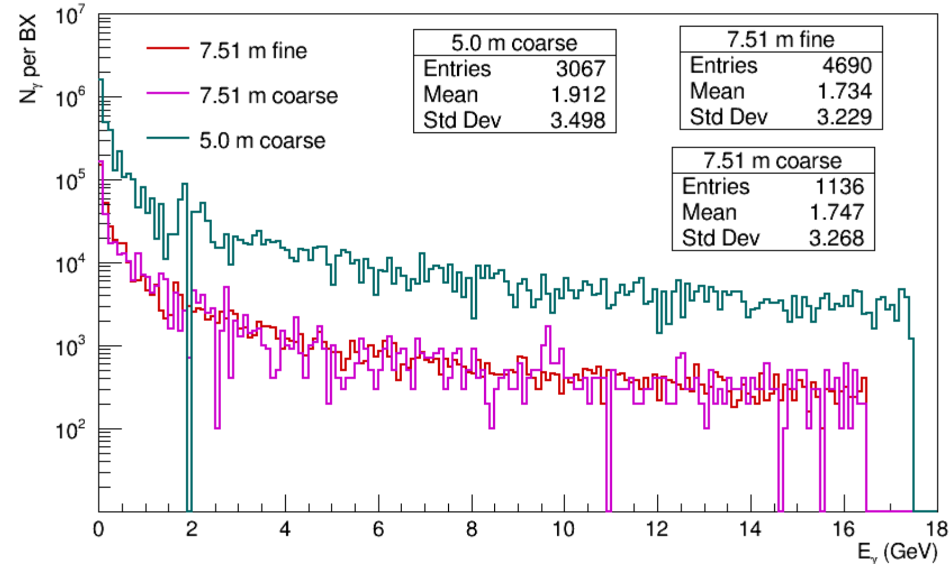
Bremsstrahlung, target 7.51m and 5m to IP

5 m from the target to IP;
6.25e9 electrons
17.5 GeV

7.51 m from the target to IP;
1.5e9 electrons
16.5 GeV

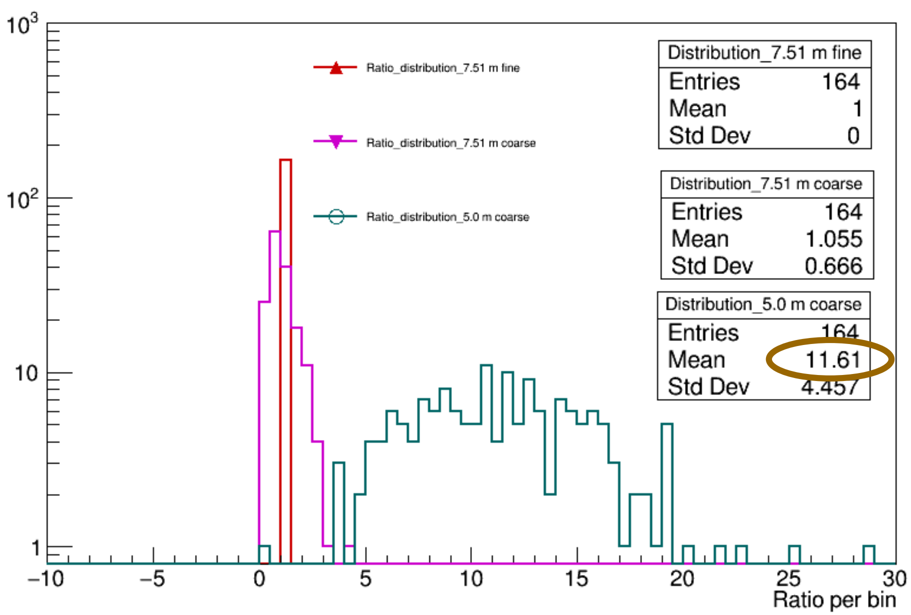


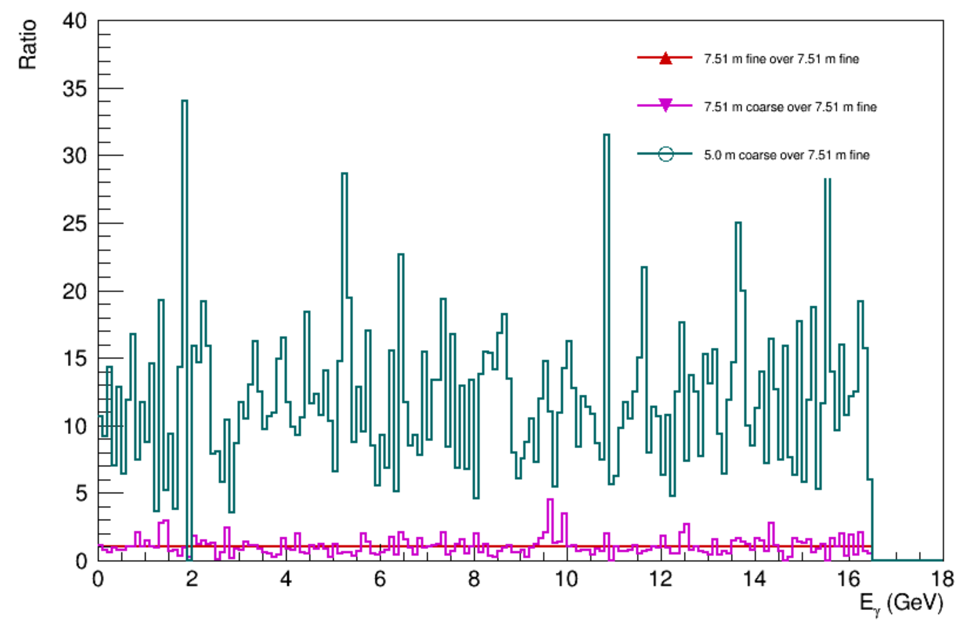
$$N_\gamma(R) = \frac{R_0^2}{R^2} N_\gamma(R_0) \qquad \left(\frac{7.51}{5.0}\right)^2 = 2.256 \qquad \left(\frac{6.25}{1.5}\right) = 4.17$$

9.4

Energy dependence is not obvious for scaling:

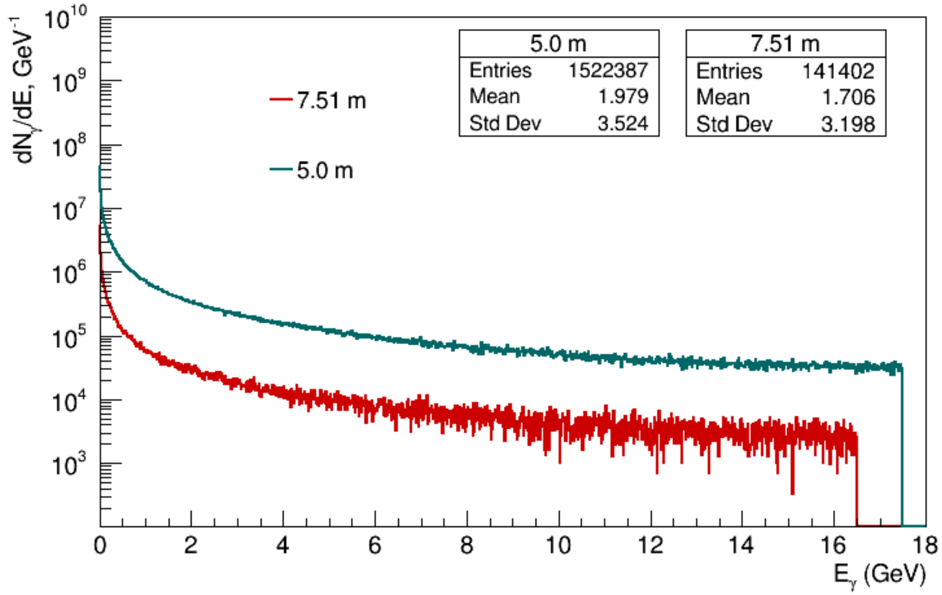
$$N_\gamma = \frac{d}{X_0}\left[\frac{4}{3}\ln\left(\frac{k_{\max}}{k_{\min}}\right) - \frac{4(k_{\max}-k_{\min})}{3E} + \frac{k_{\max}^2 - k_{\min}^2}{2E^2}\right]$$



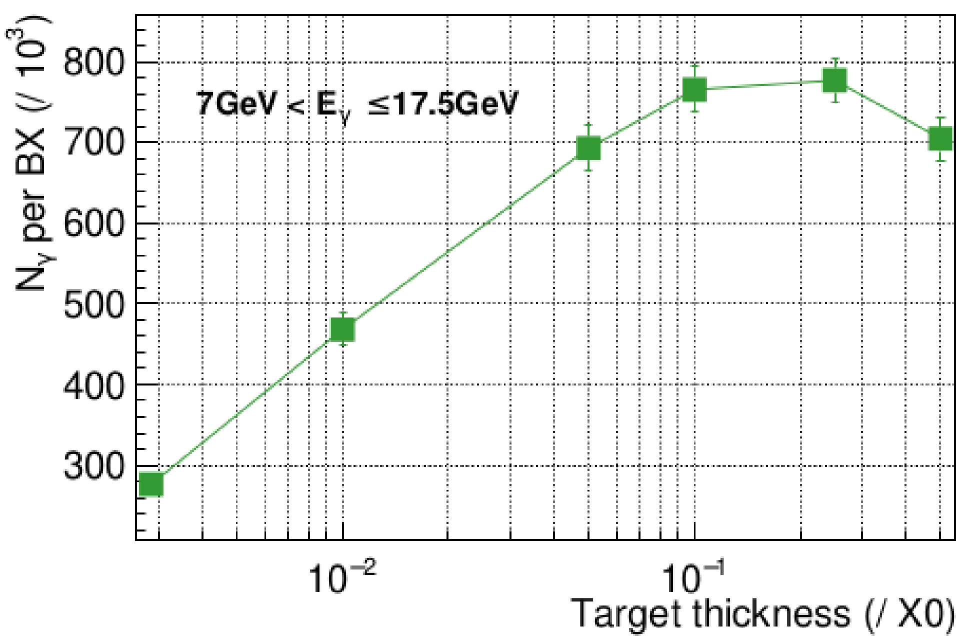


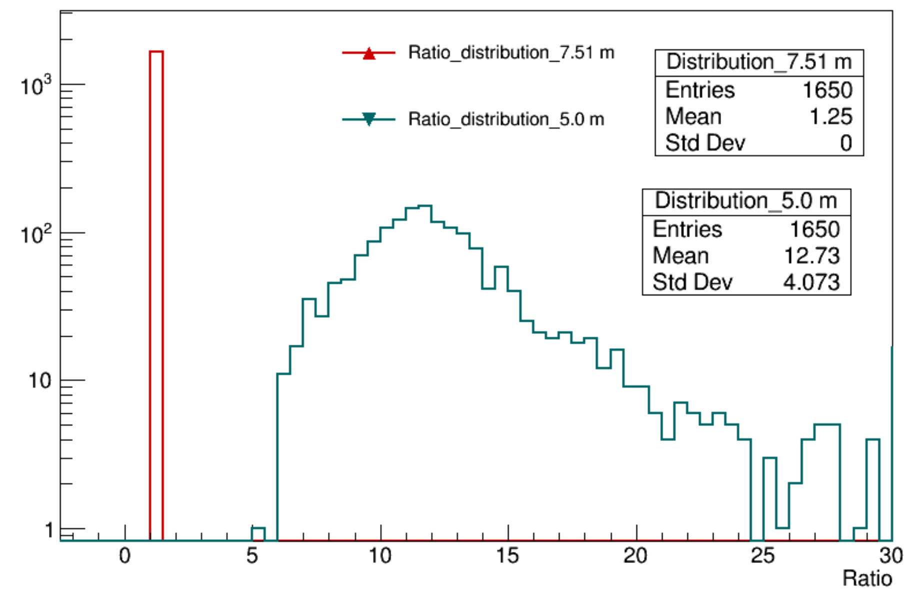
Bremsstrahlung, target 7.51m and 5m to IP

0.31 BX
Photons at IP and
|x| < 25 um &&
|y| < 25 um

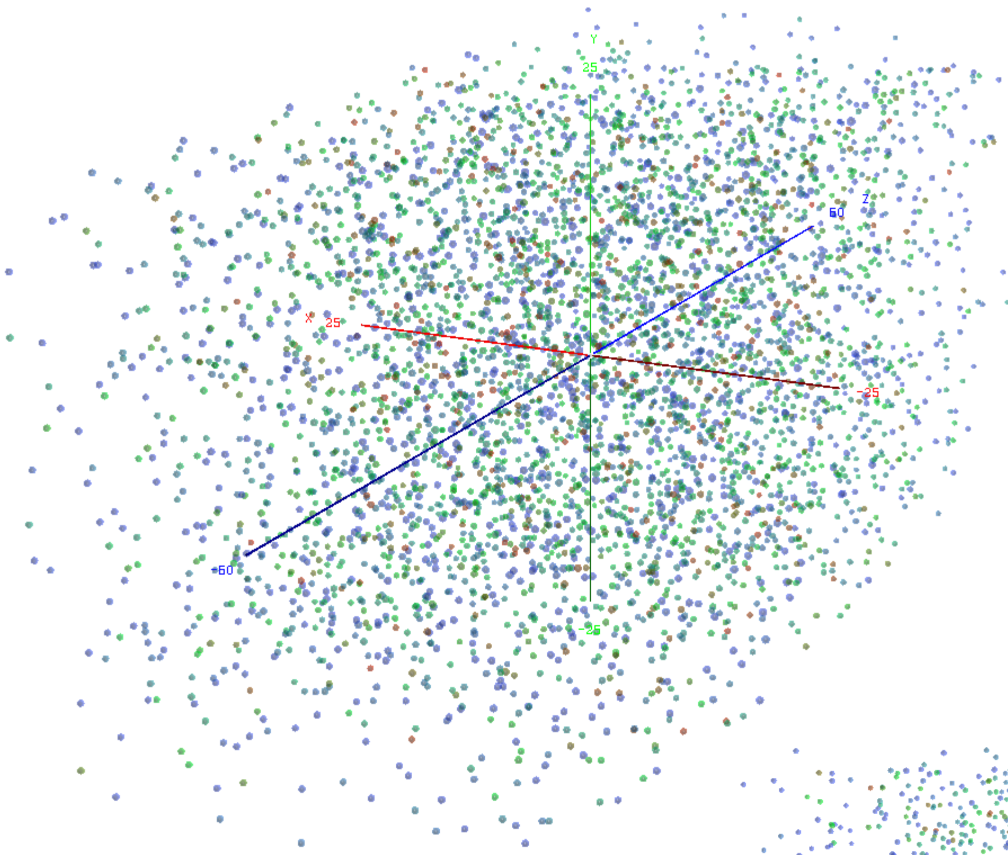


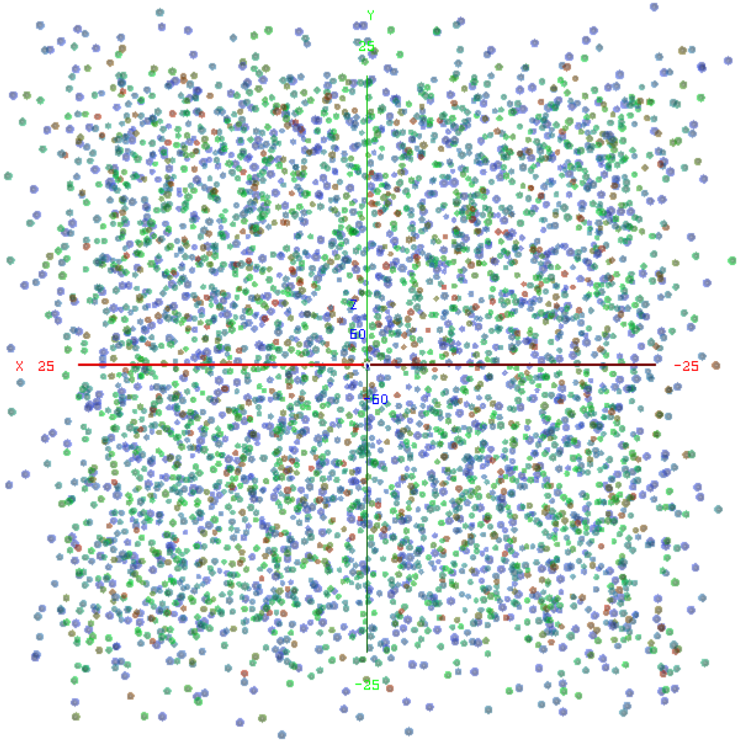
Number of photon as a function of
target thickness

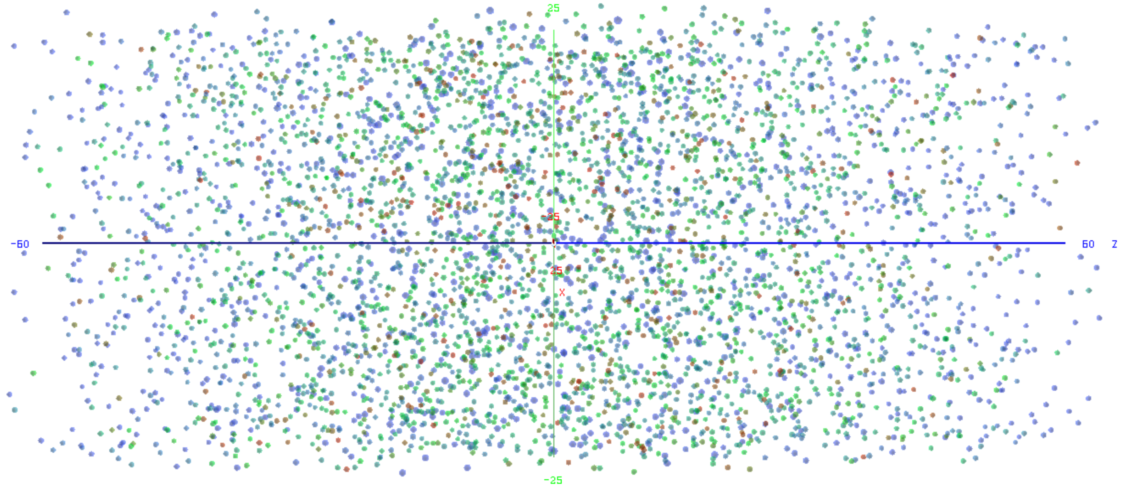




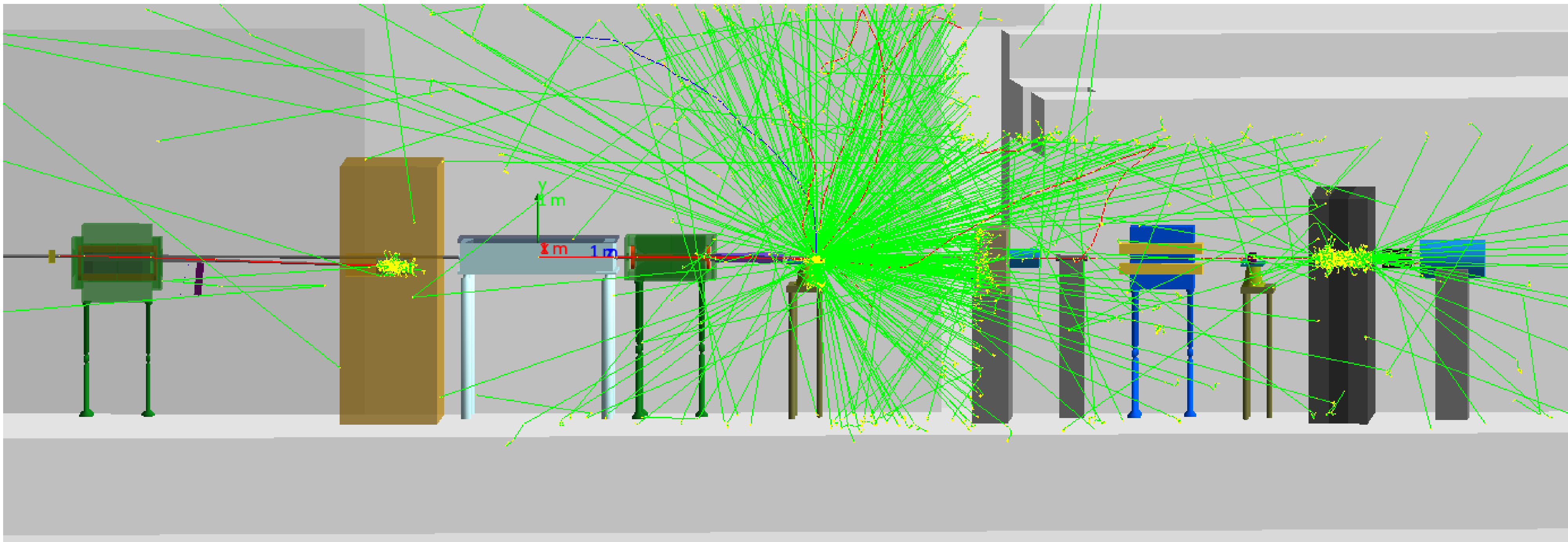
Spacial distribution





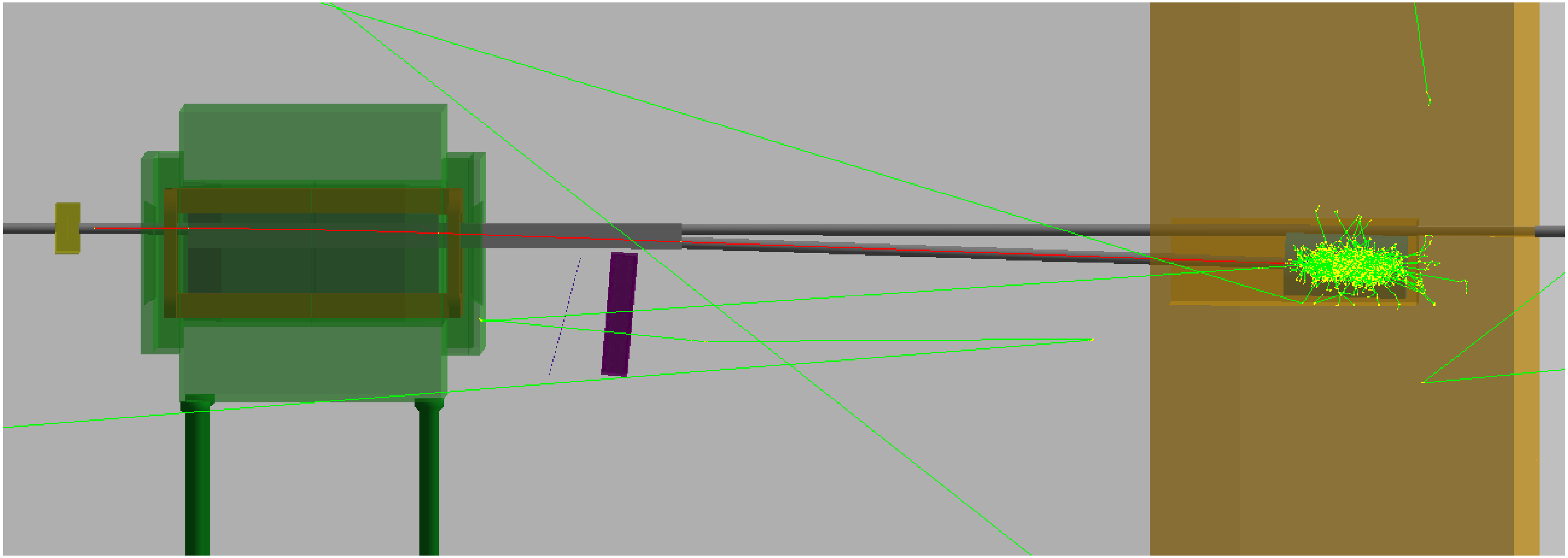


Magnet test



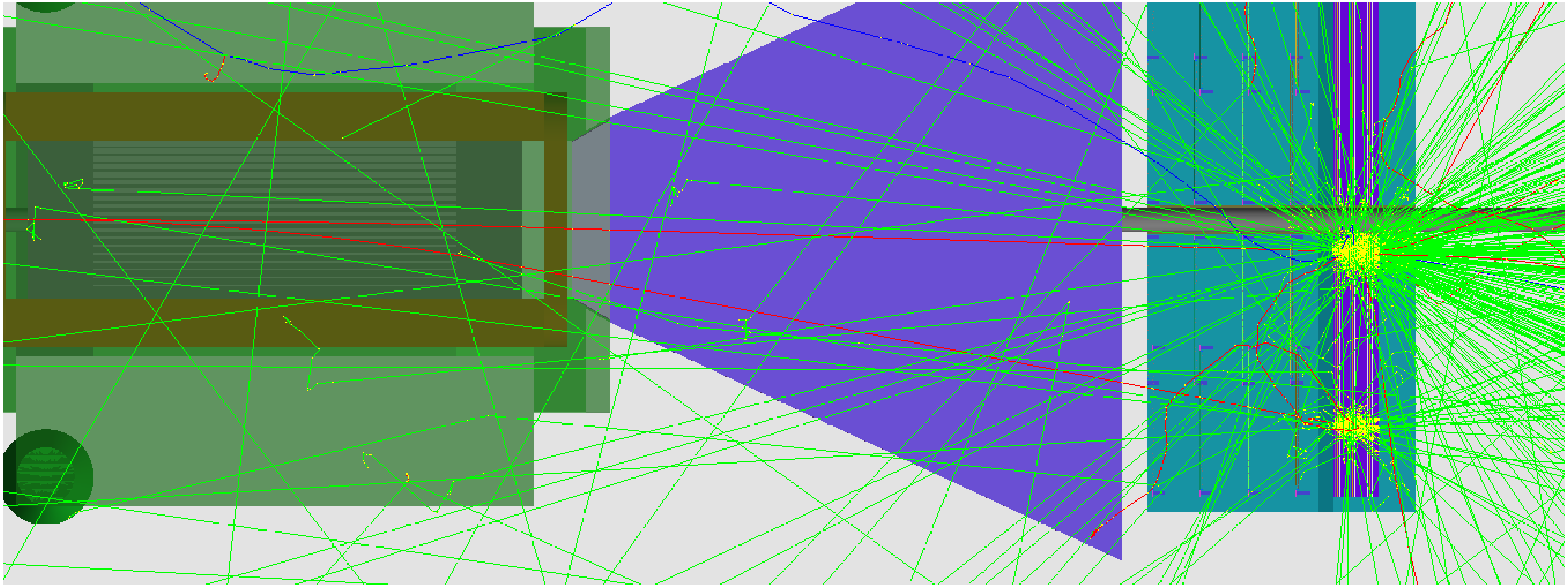
16.5 GeV,   z = -7.4 m, right behind the target
16.5 GeV,   z = 0, IP
2.6 GeV,   z = 0, IP
16.5 GeV,   z = 5.02, before the target of gamma spectrometer

Electron beam dump magnet in BPPP setup



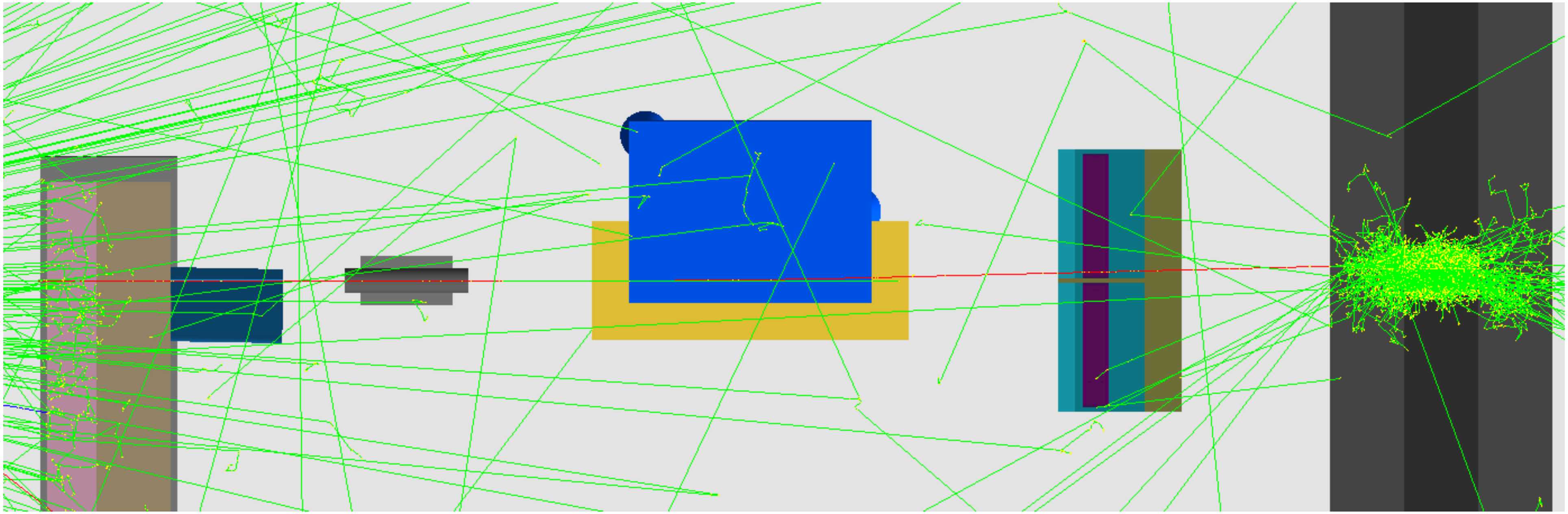
16.5 GeV,   z = -7.4 m, right behind the target;
1.8 T.

e+e- spectrometer magnet in BPPP setup



16.5 GeV,   z = 0, IP
2.6 GeV,   z = 0, IP
-1.6 T.

Gamma spectrometer



16.5 GeV,   z = 5.02, before the target of gamma spectrometer;
1.4 T.

Sensitive volumes output

/luxe/run/add_sensitive_volume OPPPSensitive:1000:0:1
/luxe/run/add_sensitive_volume ECalSensor:2000:3:2
/luxe/run/add_sensitive_volume LysoCal:3000:0:1
/luxe/run/add_sensitive_volume LeadGlass:4000:1:0

/luxe/run/add_sensitive_volume av_1_impr_1_logicTAUIChamberBPipeFlange_pv_12:5010:1:0
/luxe/run/add_sensitive_volume TypMBEndCap:5020:1:0
/luxe/run/add_sensitive_volume scintArmPhysical:5030:1:0
/luxe/run/add_sensitive_volume CerenkovWingPhysical:5040:1:0
/luxe/run/add_sensitive_volume ComptonCerenkov:5050:1:0
/luxe/run/add_sensitive_volume CeillingA:5060:1:0
/luxe/run/add_sensitive_volume CeillingB:5070:1:0
/luxe/run/add_sensitive_volume BeamWallA:5080:1:0
/luxe/run/add_sensitive_volume BeamWallB:5090:1:0
/luxe/run/add_sensitive_volume BeamWallC:5100:1:0
/luxe/run/add_sensitive_volume OuterWallA:5110:1:0
/luxe/run/add_sensitive_volume OuterWallB:5120:1:0
/luxe/run/add_sensitive_volume BackWall:5130:1:0
/luxe/run/add_sensitive_volume Floor:5140:1:0
/luxe/run/add_sensitive_volume HICSShieldingSide:5150:1:0
/luxe/run/add_sensitive_volume HICSShieldingMiddle:5160:1:0
/luxe/run/add_sensitive_volume av_11_impr_1_logicOPPPTopPlate_pv_0:5170:1:0
/luxe/run/add_sensitive_volume av_11_impr_1_logicOPPPBottomSupport_pv_1:5180:1:0
/luxe/run/add_sensitive_volume av_11_impr_1_logicOPPPDetSupportBall_pv_2:5190:1:0
/luxe/run/add_sensitive_volume av_11_impr_1_logicOPPPDetSupportBall_pv_3:5200:1:0
/luxe/run/add_sensitive_volume av_11_impr_1_logicOPPPDetSupportBall_pv_4:5210:1:0
/luxe/run/add_sensitive_volume av_11_impr_1_logicOPPPHexTop_pv_5:5220:1:0
/luxe/run/add_sensitive_volume av_11_impr_1_logicOPPPHexMiddle_pv_6:5230:1:0
/luxe/run/add_sensitive_volume OPPPBasePlate:5240:1:0
/luxe/run/add_sensitive_volume OPPPBaseLeg:5250:1:0

Hits Tree

```
analysisManager->CreateNtuple("HitTracks", "Tracks which produced hits in sensitive detectors");
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->CreateNtupleDColumn(3, "weight");
analysisManager->FinishNtuple(3);
```

Tree of tracks which produced hits

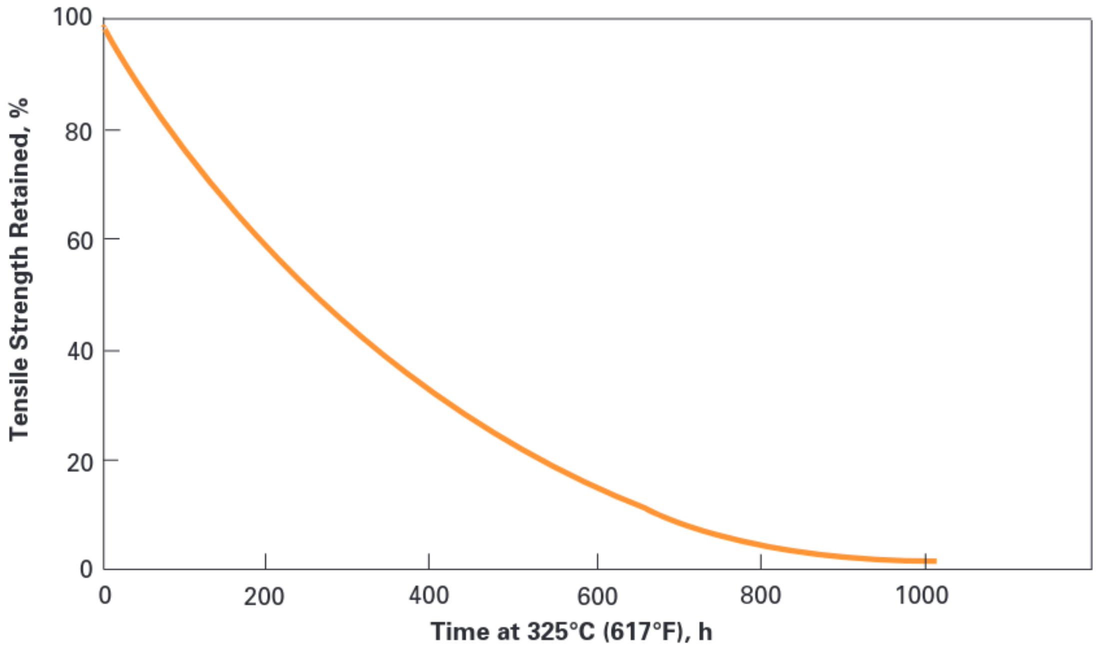

```
analysisManager->CreateNtuple("HitTracks", "Tracks which produced hits in sensitive detectors");
analysisManager->CreateNtupleIColumn(3, "eventid");
analysisManager->CreateNtupleIColumn(3, "trackid", fvTracks);
analysisManager->CreateNtupleDColumn(3, "vtxx", fVtxx);
analysisManager->CreateNtupleDColumn(3, "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->CreateNtupleDColumn(3, "weight");
analysisManager->FinishNtuple(3);
```


- 100k events ~100MB;
- 1BX is about 150 TB seems not reasonable;
- Keep generated MC for further study;
- Reduce number of sensitive volumes;
- and establish energy threshold for hit tracks;

Kapton properties

DUPONT™ KAPTON®
SUMMARY OF PROPERTIES

Figure 6. Tensile Strength vs. Aging in Air at 325°C (617°F), Type HN Film, 25 µm (1 mil)



THERMAL AGING

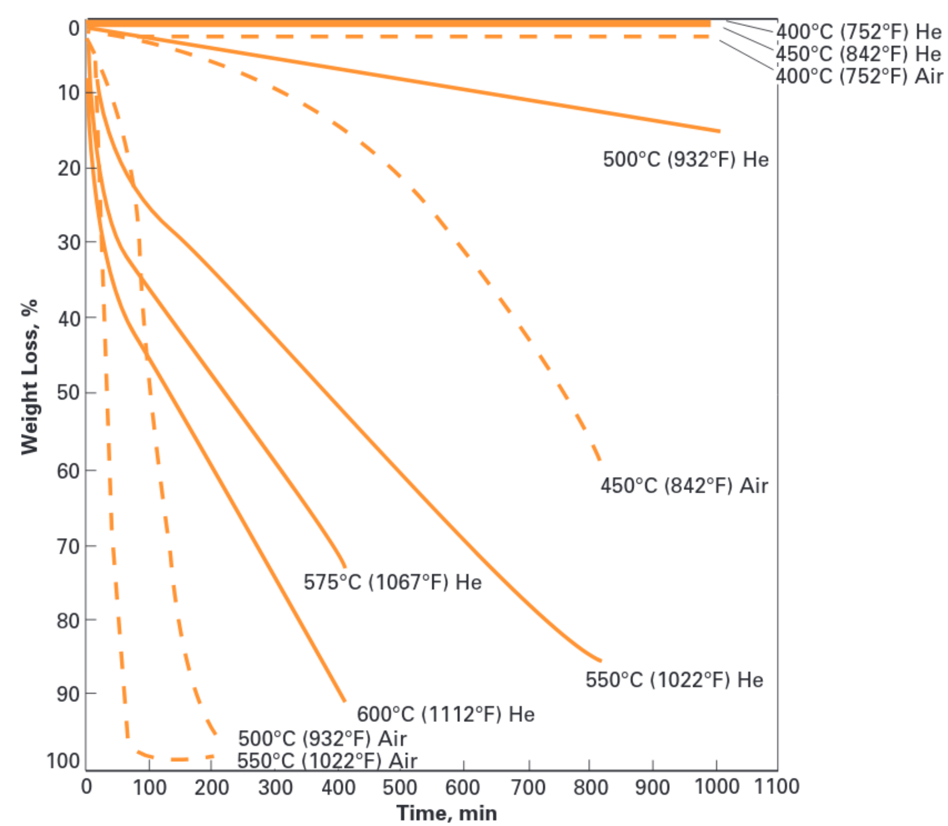
The useful life of Kapton® polyimide film is a function of both temperature and oxygen concentration. In accordance with UL-746B test procedures, the thermal life of Kapton® was determined at various temperatures. At time zero and 325°C (617°F), the tensile strength is 234 MPa (34,000 psi) and the elongation is 67%. The results are shown in **Figures 6–8**.

Polyimide (PI) Material Properties

Thermal

Max Service Temperature	221 - 241	°C
Melting Temperature	375 - 401	°C

Figure 10. Isothermal Weight Loss, Type HN Film, 25 µm (1 mil)



The application of the Kapton as a material for the window in vacuum system for exit of the dense electron or photon beam probably is not very reliable.

Geant4 estimation

```
/gun/particle gamma
/gun/energy 10.0 GeV
```

```
The run was 100000 gamma of 10 GeV through 200 um  of G4_KAPTON (density: 1.42 g/cm3 )

Total energy deposit in absorber per event = 21.51 eV  +- 3.568 eV
```

eDep	21.51	eV
Density	1.42	g/cm3
Spec heat capac	1390	J/kg/C
Beam radius	2.00E-05	m
Thickness	2.00E-04	m
Volume	2.51E-13	m3
Mass	3.57E-10	kg
dT	0.006938	

```
/gun/particle e-
/gun/energy 16.5 GeV
```

```
The run was 10000 e- of 16.5 GeV through 200 um  of G4_KAPTON (density: 1.42 g/cm3 )

Total energy deposit in absorber per event = 44.65 keV +- 242.2 eV
```

eDep	4.47E+04	eV
Density	1.42	g/cm3
Spec heat capac	1390	J/kg/C
Beam radius	2.00E-05	m
Thickness	2.00E-04	m
Volume	2.51E-13	m3
Mass	3.57E-10	kg
dT	14.40119	