

Update on GEANT4 Simulation

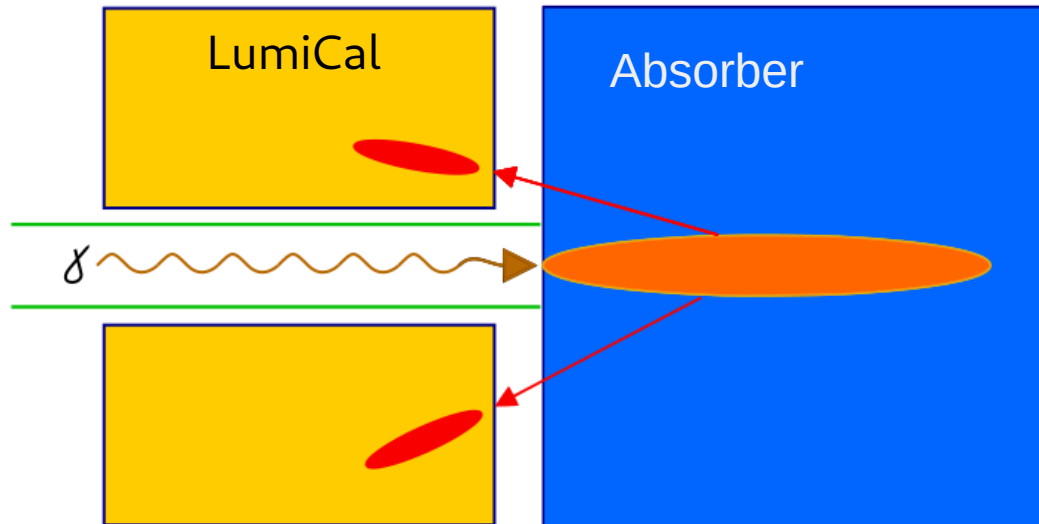
Oleksandr Borysov

LUXE S&A Meeting
August 1, 2022

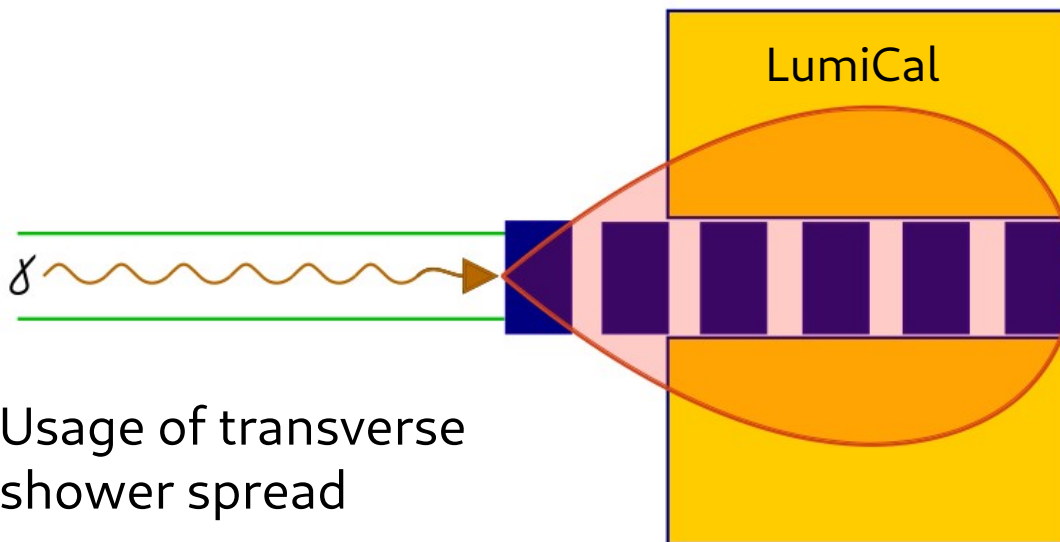
LUXE NPOD

Get extra space for BSM setup

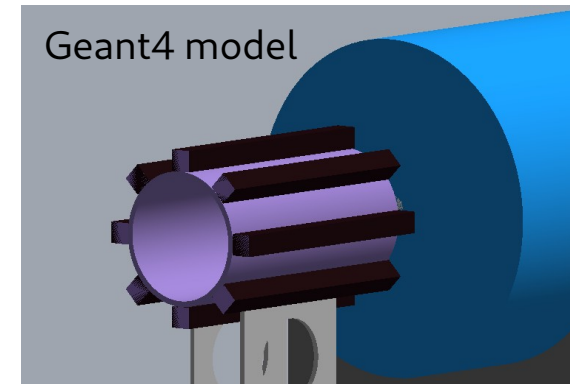
FCAL WS March 2019



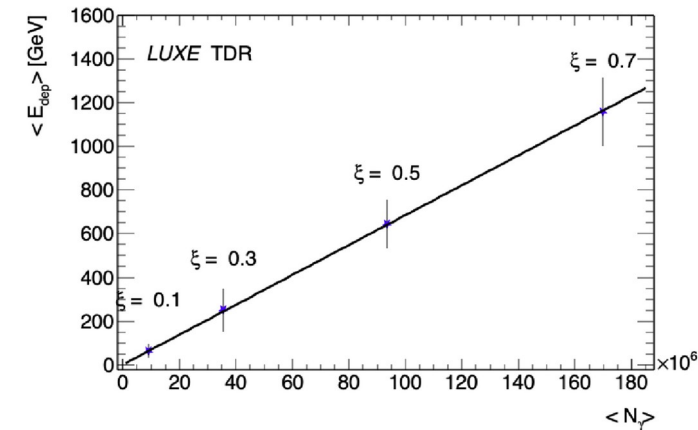
Usage of back scattering from absorber



Usage of transverse shower spread



Detector response obtained in Geant4 simulations



- Another possible implementation;
- It has not been studied;
- Might give ~ 0.6 m of space

NPOD MC

<https://confluence.desy.de/display/LUXE/Electron-laser+mode>

NPOD

Photon emission only (CP), with decreased particle weights.

waist w_0 w_0 (micron)	laser duration (fs)	e-beam energy (GeV)	RMS ξ ξ	peak ξ ξ	χ_e χ_e	N primaries	BXs	folder	ident	updated
10.0	120.0	16.5	3.41	3.41	0.654	1e8	5	-	e1npod_10x120_{0000-0004}	2022/05/20

/nfs/dust/luxe/group/MCProduction/Signal/ptarmigan-v0.9/e-laser/phase1/npod

File	e-	gamma	e+	All particles
e1npod_10x120_0000_particles.h5	86378324	349712990	0	436091314
e1npod_10x120_0001_particles.h5	86379853	349731809	0	436111662
e1npod_10x120_0002_particles.h5	86374877	349763105	0	436137982
e1npod_10x120_0003_particles.h5	86366277	349677662	0	436043939
e1npod_10x120_0004_particles.h5	86374407	349703765	0	436078172

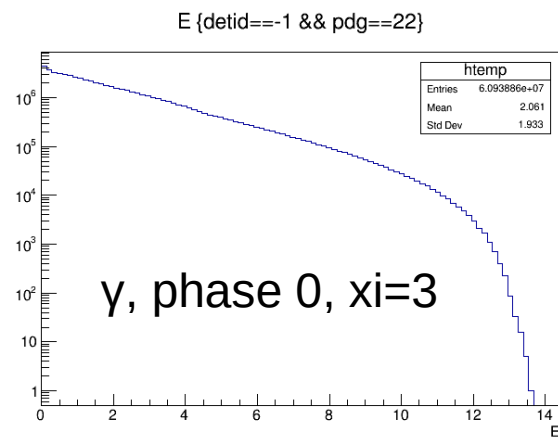
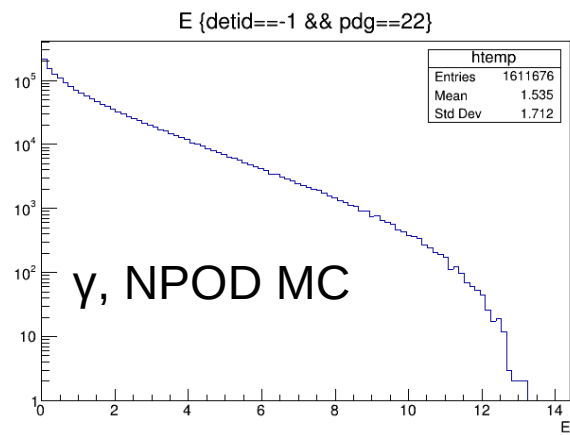
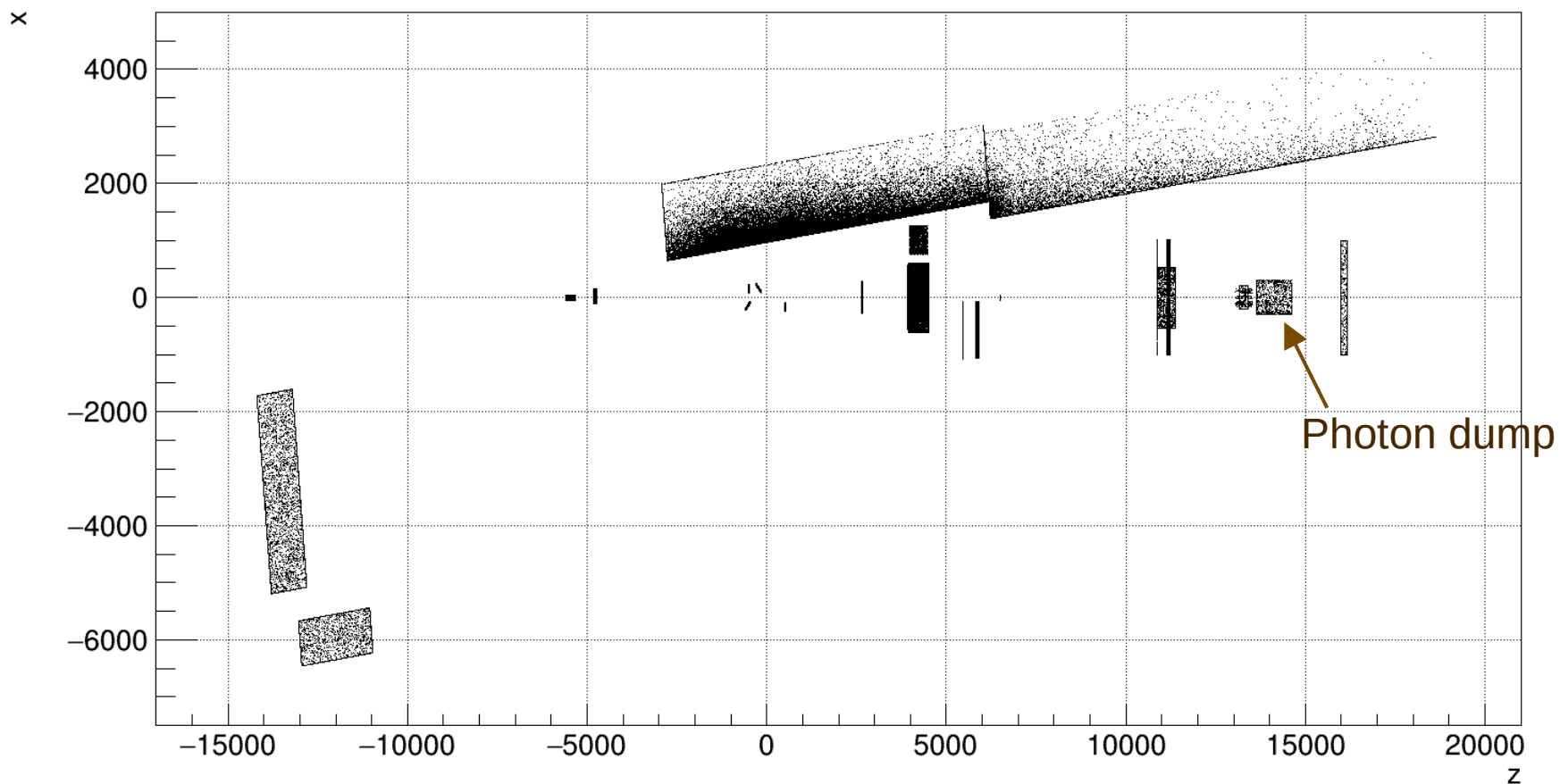
File size: 41 Gb

electron/photon weight: 15

Might require some disk space for G4 results

NPOD MC

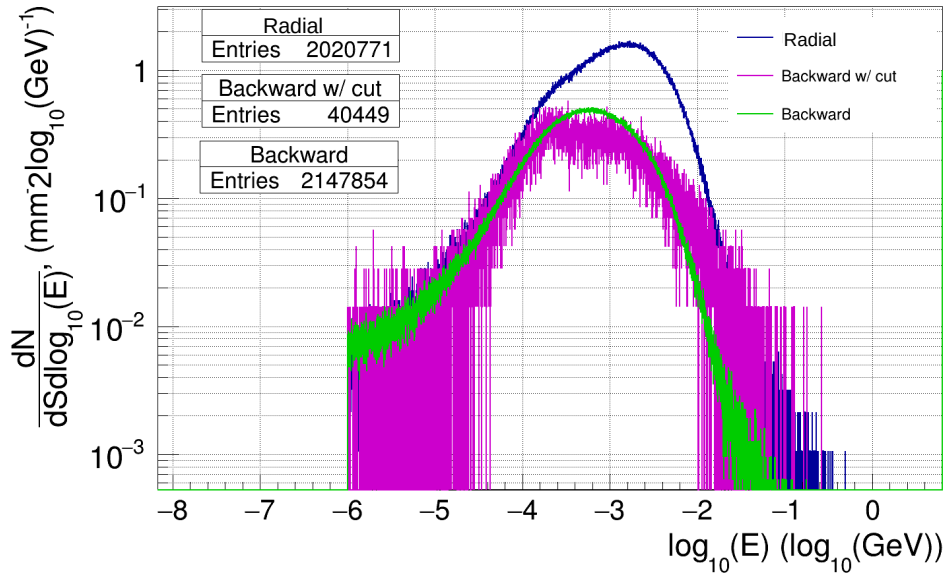
X:Z



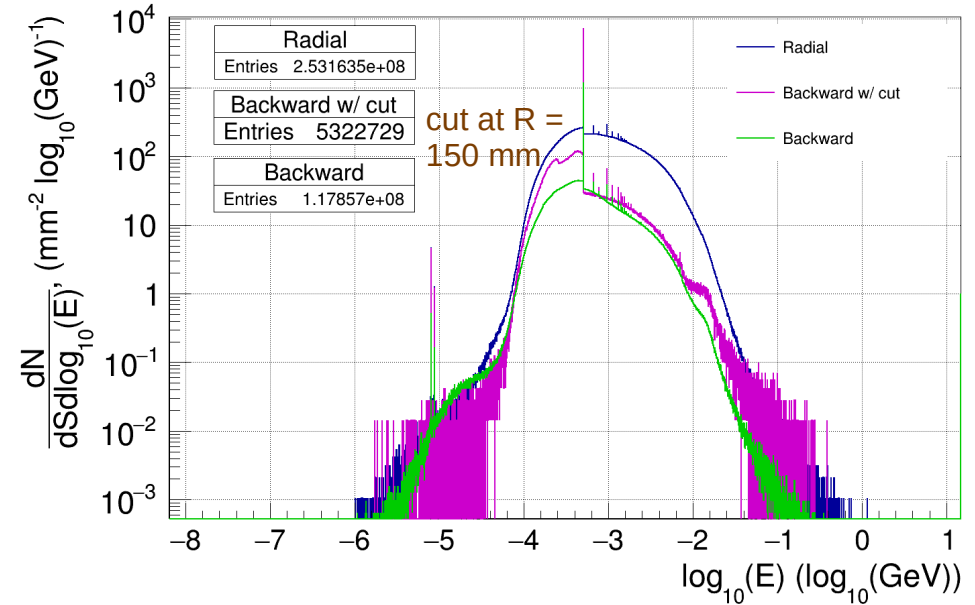
Spectra and energy flux of electrons and photons in different directions from the beam dump

- Spectra are similar;
- Flux can be adjusted by changing the distance to the detector and/or its effective area/volume.

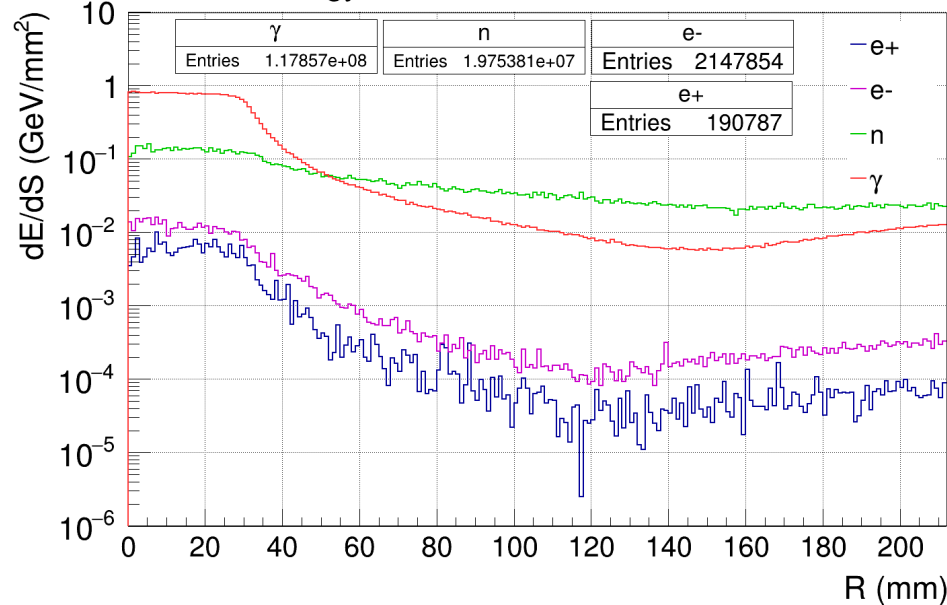
Spectra of electrons moving in different direction from the dump



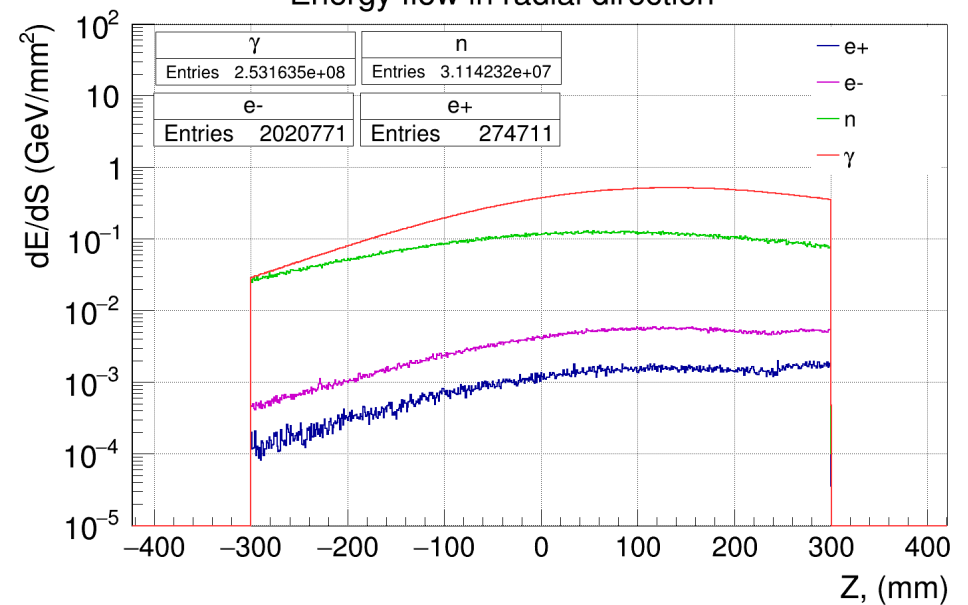
Spectra of photons moving in different directions from the dump



Energy flow in backward direction



Energy flow in radial direction



GEANT4 FAST SIMULATION

Reading primary particles from root tree (tuple)

- Assumes the structure of Tracks tree, the one which is in the output with tracks intercepted on the surfaces of specific volumes (detectors).
- Can be used to resimulate the response of specific detector when its internal design is changed;
 - another sensor material;
 - segmentation;
 - sensors position;
 - misalignment;
- Also used as an input for the fast simulation.

Settings in Geant4 configuration file (*.mac):

```
#/lxphoton/gun/beamType  mono
```

```
#/lxphoton/gun/beamType  gaussian
```

```
#/lxphoton/gun/SpectraFile  spectra_test1.txt
```

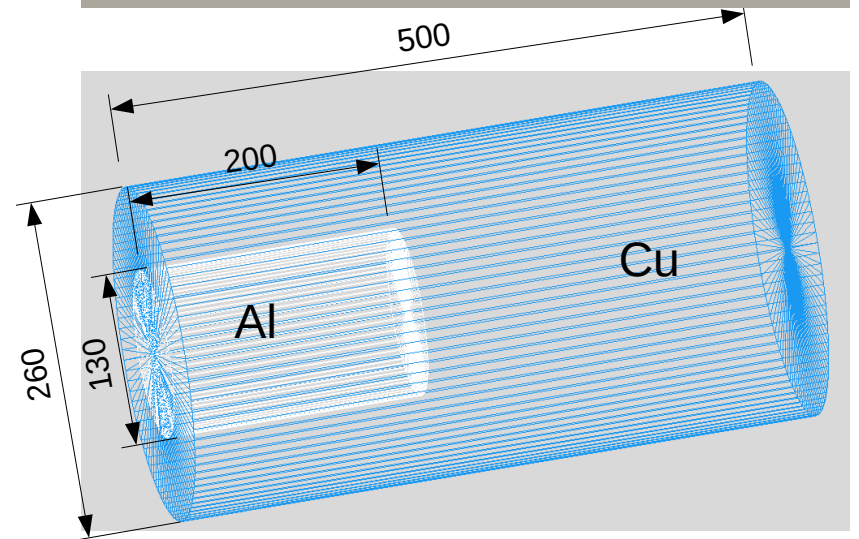
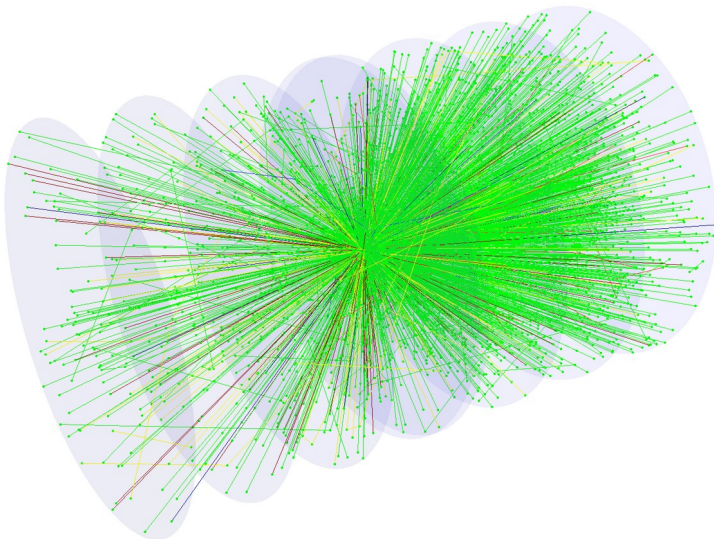
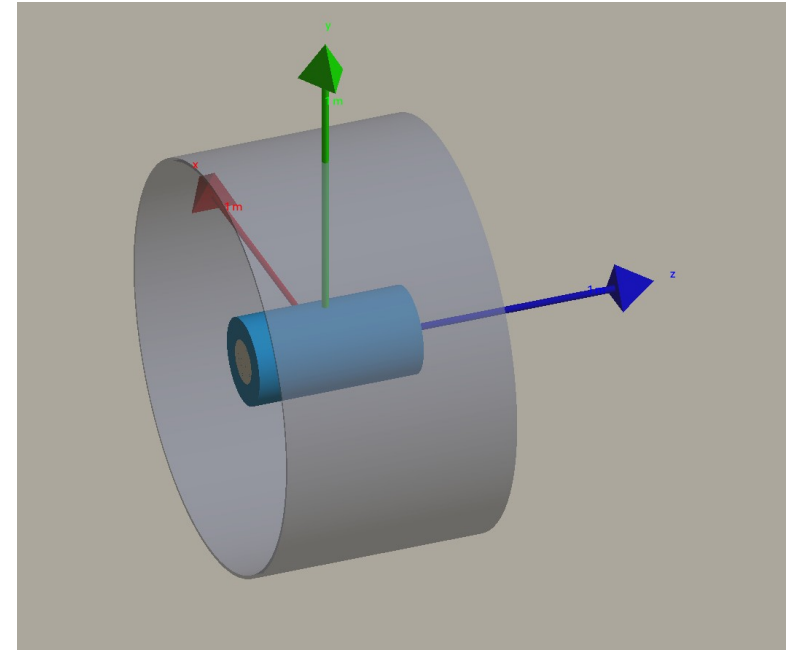
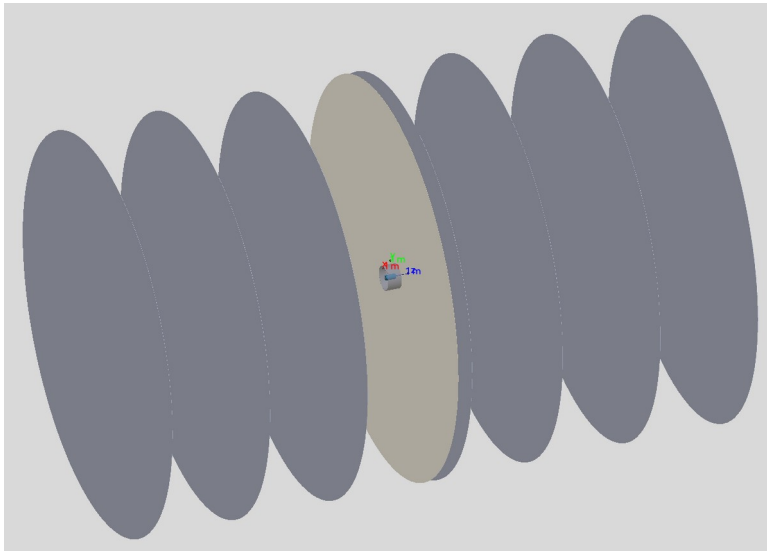
```
#/lxphoton/gun/beamType      mc  
#/lxphoton/gun/MCParticlesFile  test_data_0.out
```

```
#/lxphoton/gun/beamType      mchdf5  
#/lxphoton/gun/MCParticlesFile  file_name.h5
```

```
/lxphoton/gun/beamType      mctupleg4  
/lxphoton/gun/MCParticlesFile  file_with_tracks_tree.root
```


Beam dump simulation

The response of the beam dump on the electron beam simulated in simple geometry;
The particle flux is recorded on several surfaces around the dump;
Their flux can be generated based on histograms.



Primary particles in fast simulation and LUXE geometry

- Particles are generated on the plane $z=-35\text{cm}$ (10 cm upstream the beam dump);
- Back propagated geometrically to the surface of the beam dump in LUXE geometry, when possible:
 - Position on the cylinder;
 - Displacement;
 - Rotation;

