Update on LUXE GEANT4 Simulation.

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Gamma laser setup

16.5 GeV gamma-laser setup

- 7.53e9 (5.022 Bxs);
- Location: /nfs/dust/luxe/group/MCProduction/Background/gammalaser/09102020_lxb18e/Merged/Files
- Setup corresponds to commit b18e55ec (master branch)

Volumes where particles are intercepted and saved to Tracks tree:

- OPPPSensorFlex:1000
- OPPPECal:2000
- LysoCal:3000
- ComptonCerenkov:3100
- GammaCalo:4000
- IPVolume:5000 with energy cut IPVolume 0.5 GeV
- scintArmPhysical:6000
- CerenkovWingPhysical:6100

Can be used to study the monitoring accuracy/efficiency

Sensitive volumes with segmentation and records of deposited energy in Hits tree:

- OPPPSensitive (ALPIDE segmentation)
- EcalSensor (5x5mm^2)
- LysoCal
- LeadGlass
- scintArmPhysical

Sensitive detector settings

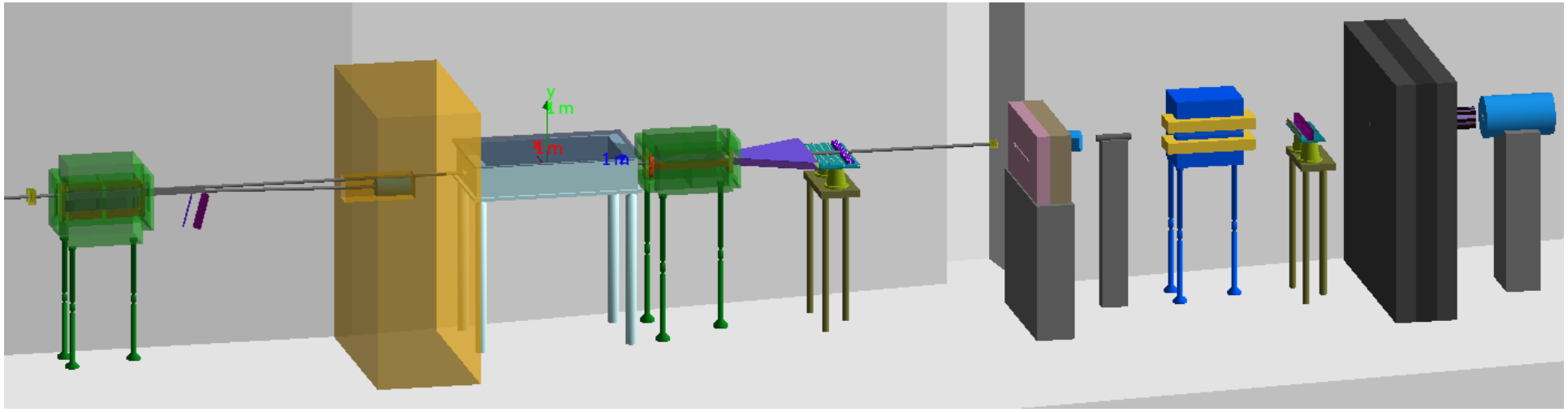
```
root [7] DetSettings->Scan("detid:det_name:n_cell_x:n_cell_y:size_x:size_y:translation_x:translation_y:translation_z:e_phi:e_theta:e_psi")
************************************************************************************************************************************************************
*    Row   *     detid *  det_name *  n_cell_x *  n_cell_y *    size_x *    size_y * translati * translati * translati *     e_phi *   e_theta *     e_psi *
************************************************************************************************************************************************************
*        0 *      3000 *   LysoCal *       300 *        25 *       500 *        50 *       260 *         0 *  10880.25 *         0 *         0 *         0 *
*        1 *      3001 *   LysoCal *       300 *        25 *       500 *        50 *      -260 *         0 *  10880.25 *         0 *         0 *         0 *
*        2 *      4000 * LeadGlass *         1 *         1 *        38 *        38 * 8.512e-15 *  -139.016 * 13279.992 * 0.7853981 *         0 * 0.7853981 *
*        3 *      4001 * LeadGlass *         1 *         1 *        38 *        38 * 98.299156 * -98.29915 * 13279.992 * 0.3926990 *         0 * 0.3926990 *
*        4 *      4002 * LeadGlass *         1 *         1 *        38 *        38 *   139.016 *         0 * 13279.992 *         0 *         0 *         0 *
*        5 *      4003 * LeadGlass *         1 *         1 *        38 *        38 * 98.299156 * 98.299156 * 13279.992 * -0.392699 *         0 * -0.392699 *
*        6 *      4004 * LeadGlass *         1 *         1 *        38 *        38 * 8.512e-15 *   139.016 * 13279.992 * -0.785398 *         0 * -0.785398 *
*        7 *      4005 * LeadGlass *         1 *         1 *        38 *        38 * -98.29915 * 98.299156 * 13279.992 * -1.178097 *         0 * -1.178097 *
*        8 *      4006 * LeadGlass *         1 *         1 *        38 *        38 *  -139.016 * 1.702e-14 * 13279.992 * -1.570796 *         0 * -1.570796 *
*        9 *      4007 * LeadGlass *         1 *         1 *        38 *        38 * -98.29915 * -98.29915 * 13279.992 * 1.1780972 *         0 * 1.1780972 *

*      196 *      6000 * scintArmP *      1000 *       200 *       500 *       100 *         0 *      -330 *     -5240 *        -0 * 0.2617993 * 1.5707963 *
************************************************************************************************************************************************************
```

There are also mass, material name and density to help in estimation of radiation absorbed dose

Fields:

- Dump magnet 1.8T;
- IP magnet 1.6T;
- Gamma spectrometer 1.4T

Setup geometry



Electron laser setup

16.5 GeV electron-laser setup

Edge study

Trident study

- MC: w0_100000nm, w0_50000nm, w0_20000nm, w0_10000nm, w0_8000nm, w0_3000nm
- For w0_50000nm, w0_20000nm and w0_3000nm - IP magnet at 2T
- Background (1.259 BXs)
- Setup corresponds to commit 63452ae7 (hics branch)

Volumes where particles are intercepted and saved to Tracks tree:

- OPPPSensorFlex:1000
- OPPPECal:2000
- LysoCal:3000
- GammaCalo:4000
- ScintArmPhysical:6000
- CerenkovWingPhysical:6100
- ComptonElectronScintilator:6200
- ComptonElectronCerenkov:6300
- ComptonCerenkov:6500
- Primary particle: -1

Sensitive volumes with segmentation and records of deposited energy in Hits tree:

- OPPPSensitive (ALPIDE segmentation)
- EcalSensor (5x5mm^2)
- LysoCal
- LeadGlass
- scintArmPhysical

Summary

Gamma laser setup available MC:

- Background for tracker and ECAL;
- Signal and background based on selection cuts for:
  - gamma spectrometer;
  - Bremsstrahlung monitor (scintillartor and Cherenkov);
  - gamma monitor;

Electron laser setup available MC:

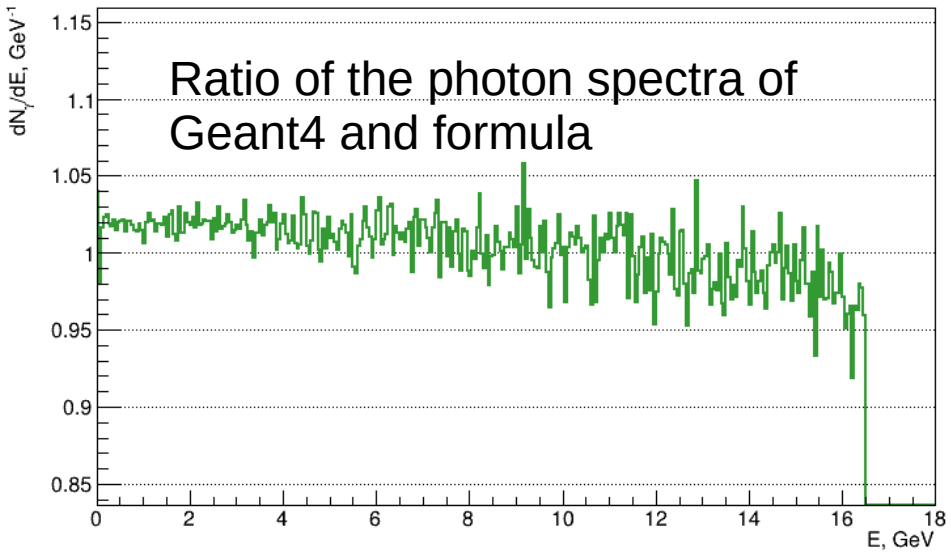
- Signal and background based on selection cuts for:
  - tracker and ECAL (trident);
  - gamma spectrometer;
  - Bremsstrahlung monitor (scintillartor and Cherenkov);
  - gamma monitor.
- Background: pure electron background, requires correct weighting.

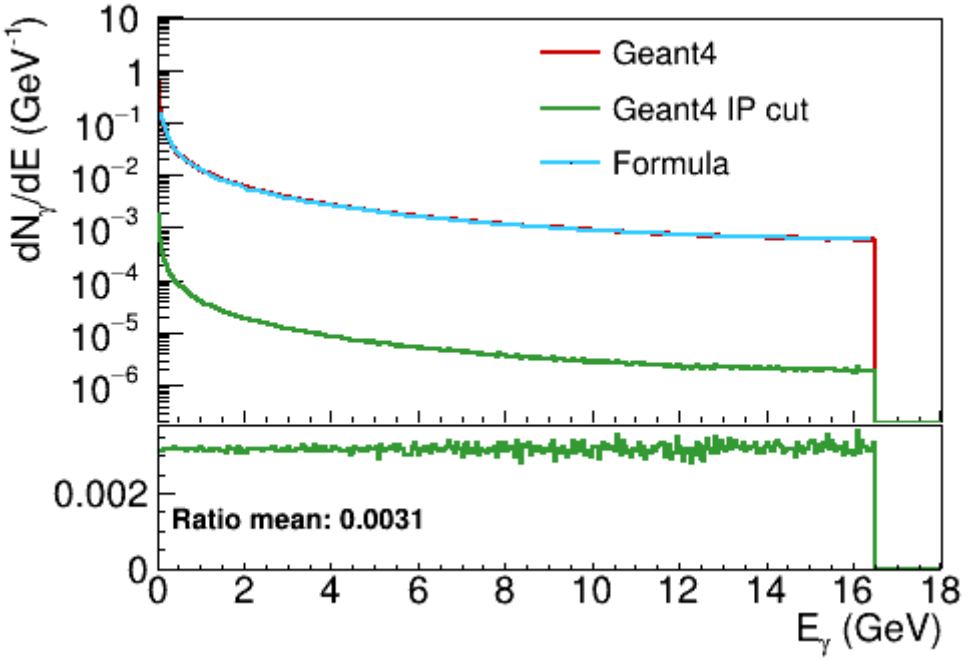
Geometry update based on simulation and tests for electron laser setup:

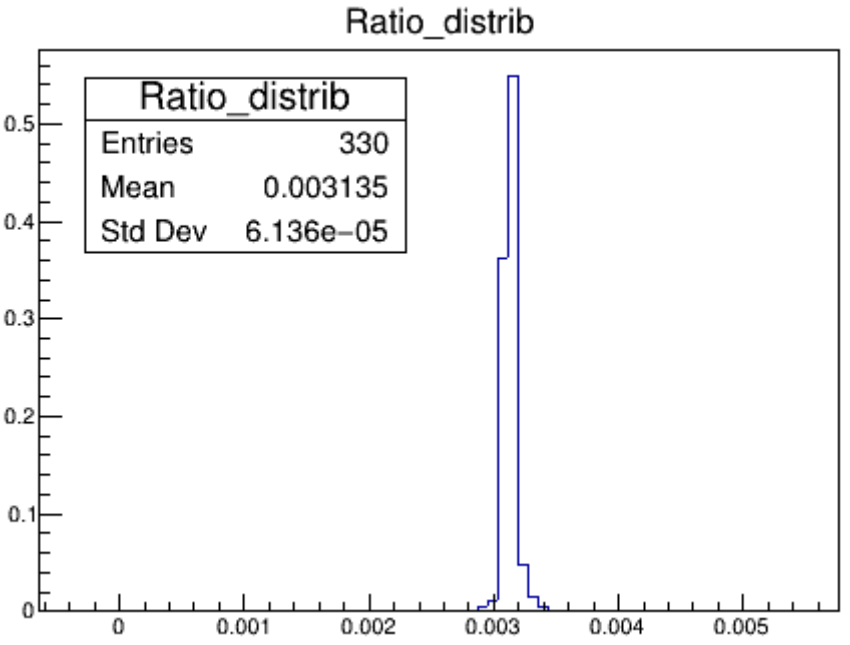
- Lanex screens of gamma spectrometer extended to 1m;
- Optimized position of scintillator screen and Cherenkov for 1T and 2T field of the IP magnet;
- Combined lead beam dump for 1T and 2T field of the IP magnet;

Bremsstrahlung photons

$$\frac{dN_\gamma}{dE_\gamma} = \frac{X}{E_\gamma X_0}\left(\frac{4}{3} - \frac{4}{3}\frac{E_\gamma}{E_e} + \left(\frac{E_\gamma}{E_e}\right)^2\right)$$







- Drop for high energies is because some high energy photons convert in the target and it is not considered by the formula.
- For the low energy domain the discrepancy probably comes from the binning of the histogram. The ratio is in the middle of the bin, but for falling distribution it is not correct, nevertheless the difference is small.

Photons position distribution