Electron beam in simulation

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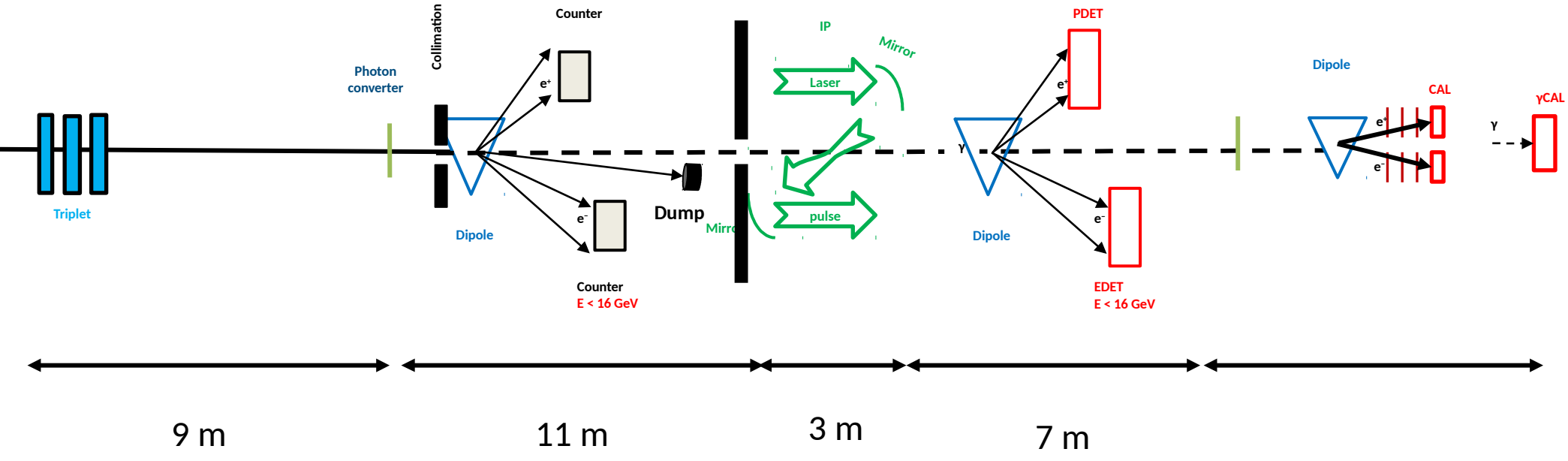
LUXE Meeting
December 03, 2018

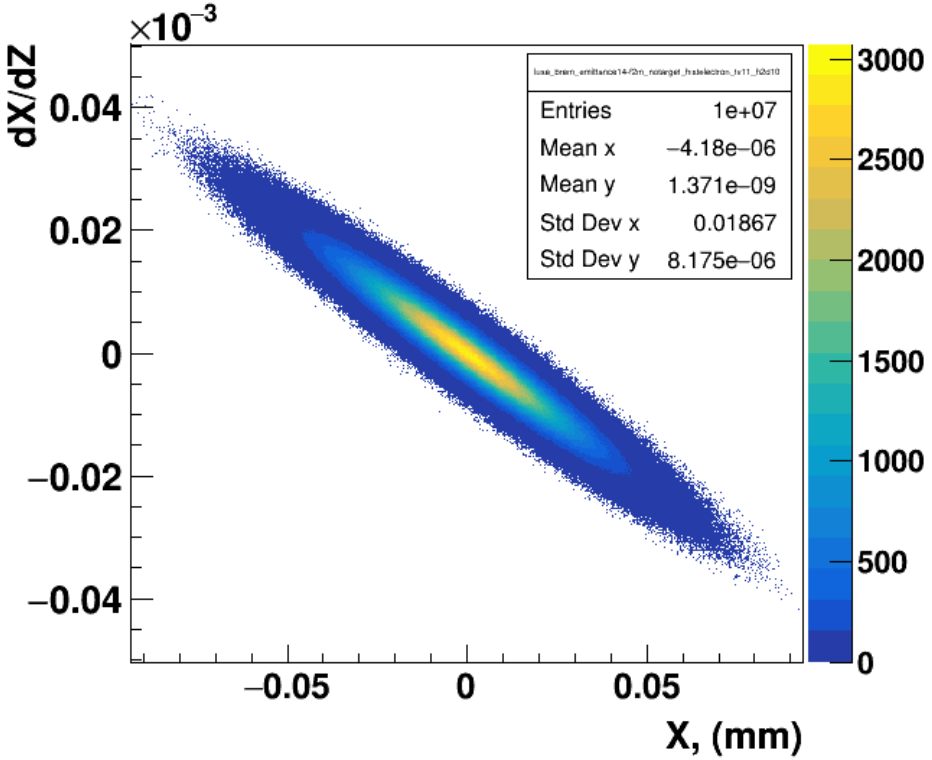
Photon-Photon collisions at LUXE

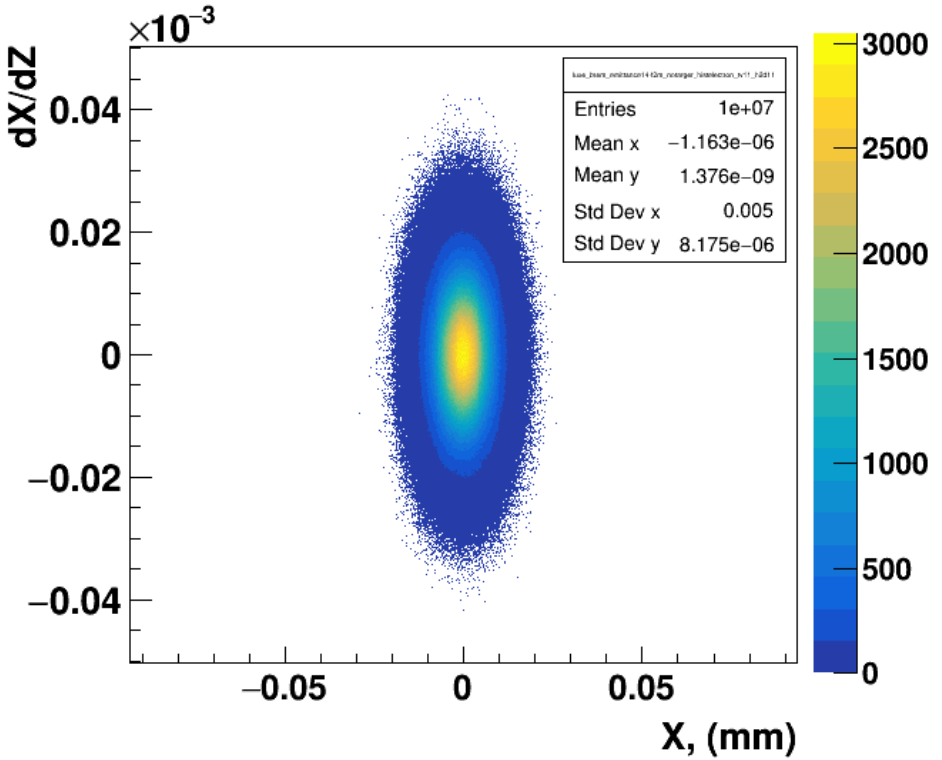


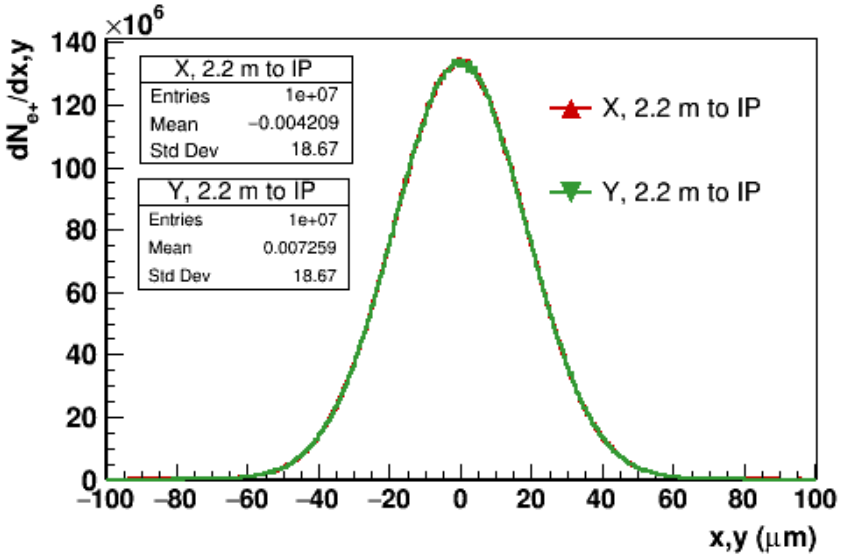
Preliminary estimates!

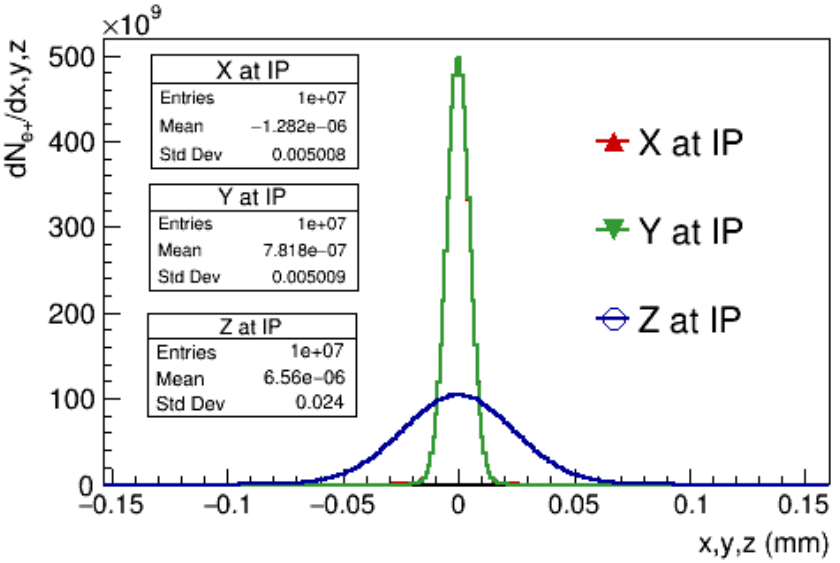
For simulations the distance between the Photon converter and IP is 2 m.

Electron beam settings for simulation





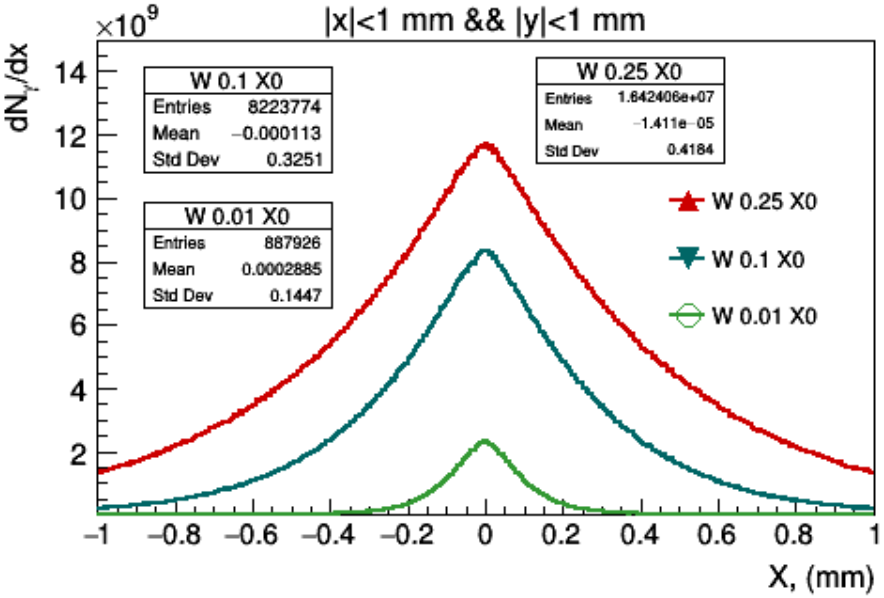


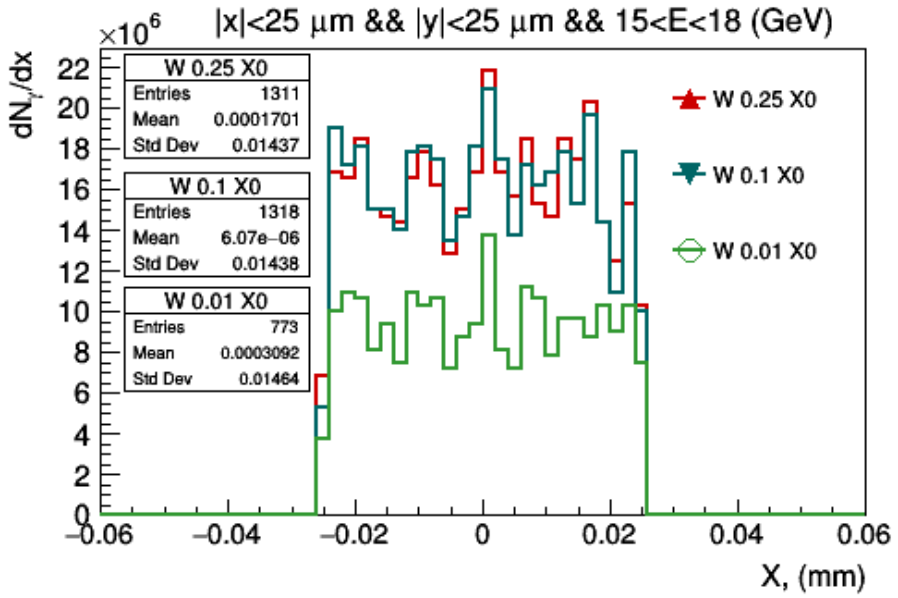


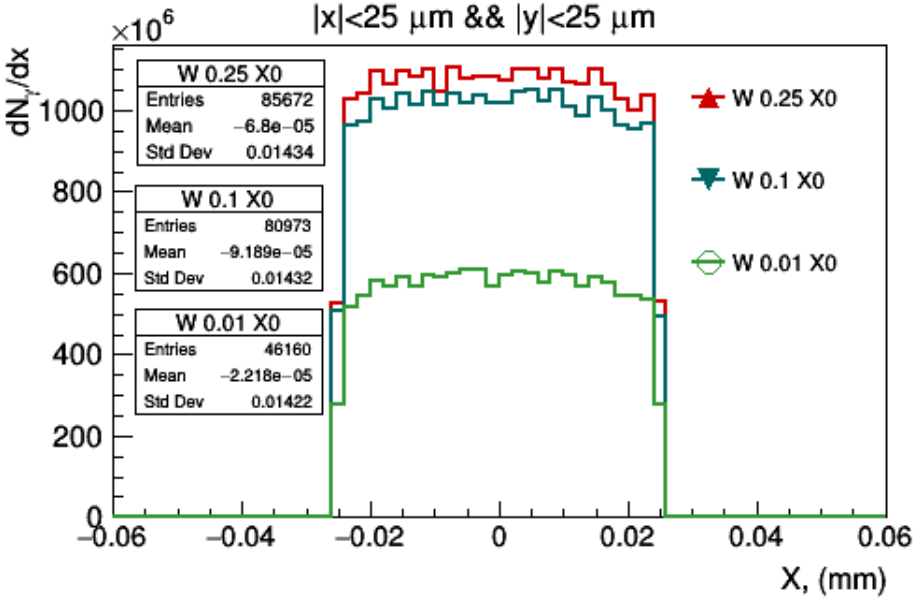
Bremsstrahlung Production

- Gaussian beam;
- Different tungsten thickness, 2m from IP;
- 10M electrons;
- Bin content multiplied by 625/bin_width.

The fraction of photons inside
|x|<25um and
|y|<25um
can be estimated as 46160/887926 = 0.052.
More accurate estimation is on the next page.

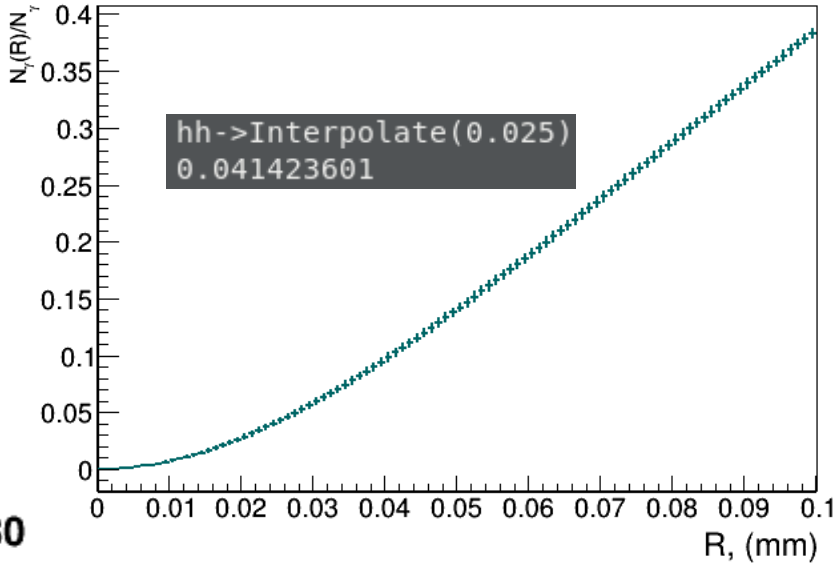






Fraction of photons as a function of spot size (R)

Tungsten 1%X0.
Taking into account overflow
and underflow bins (~0.3%)
the fraction of photons inside R < 25um is 4.1%

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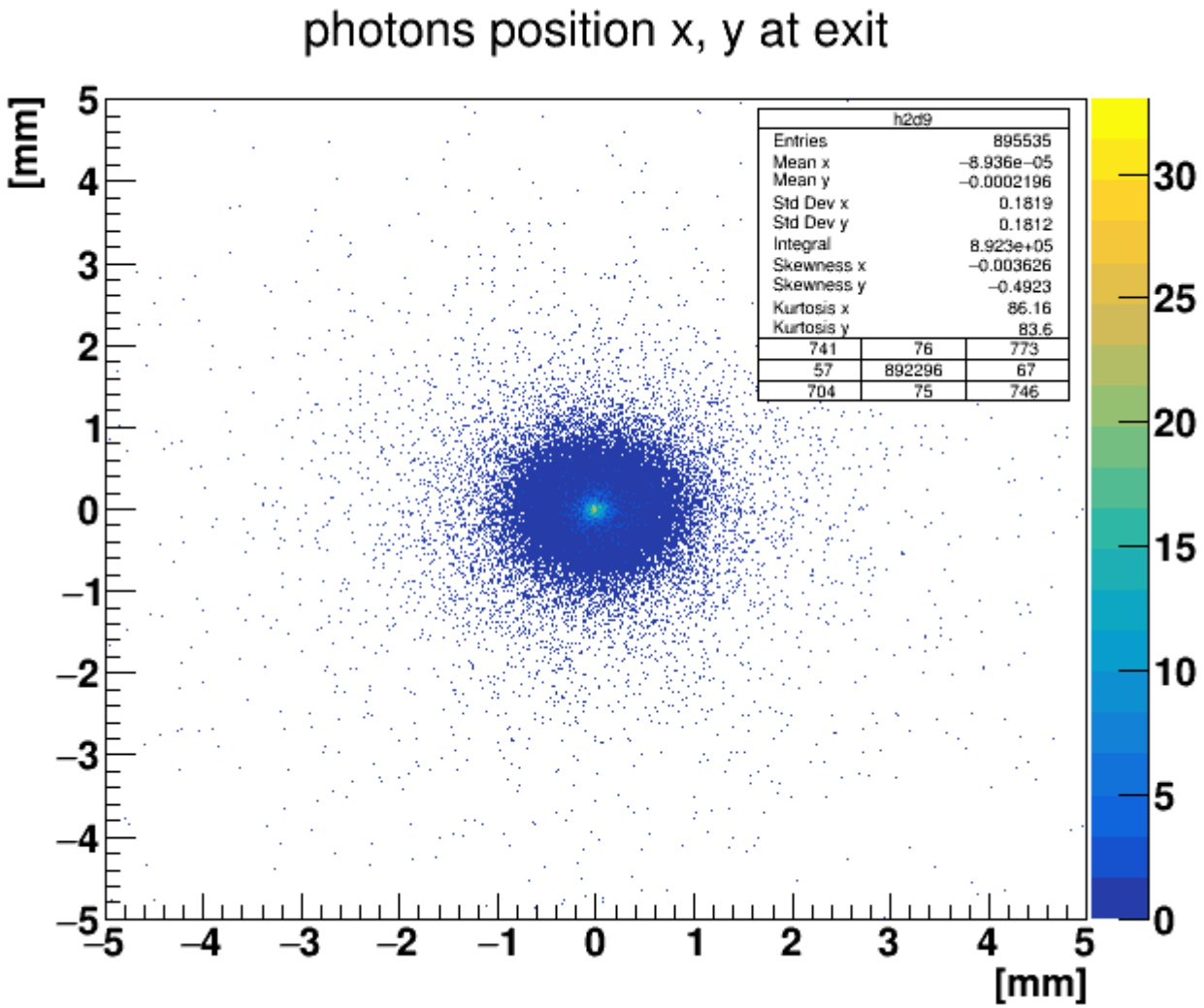


Geant4 bremsstrahlung model

Seltzer-Berger bremsstrahlung model

In order to improve accuracy of the model described above a new model *G4SeltzerBergerModel* have been design which implementing cross section based on interpolation of published tables [SB85][SB86]. Single-differential cross section can be written as a sum of a contribution of bremsstrahlung produced in the field of the screened atomic nucleus $d\sigma_n/dk$, and the part $Z\,d\sigma_e/dk$ corresponding to bremsstrahlung produced in the field of the Z atomic electrons,

$$\frac{d\sigma}{dk} = \frac{d\sigma_n}{dk} + Z\frac{d\sigma_e}{dk}\,.$$

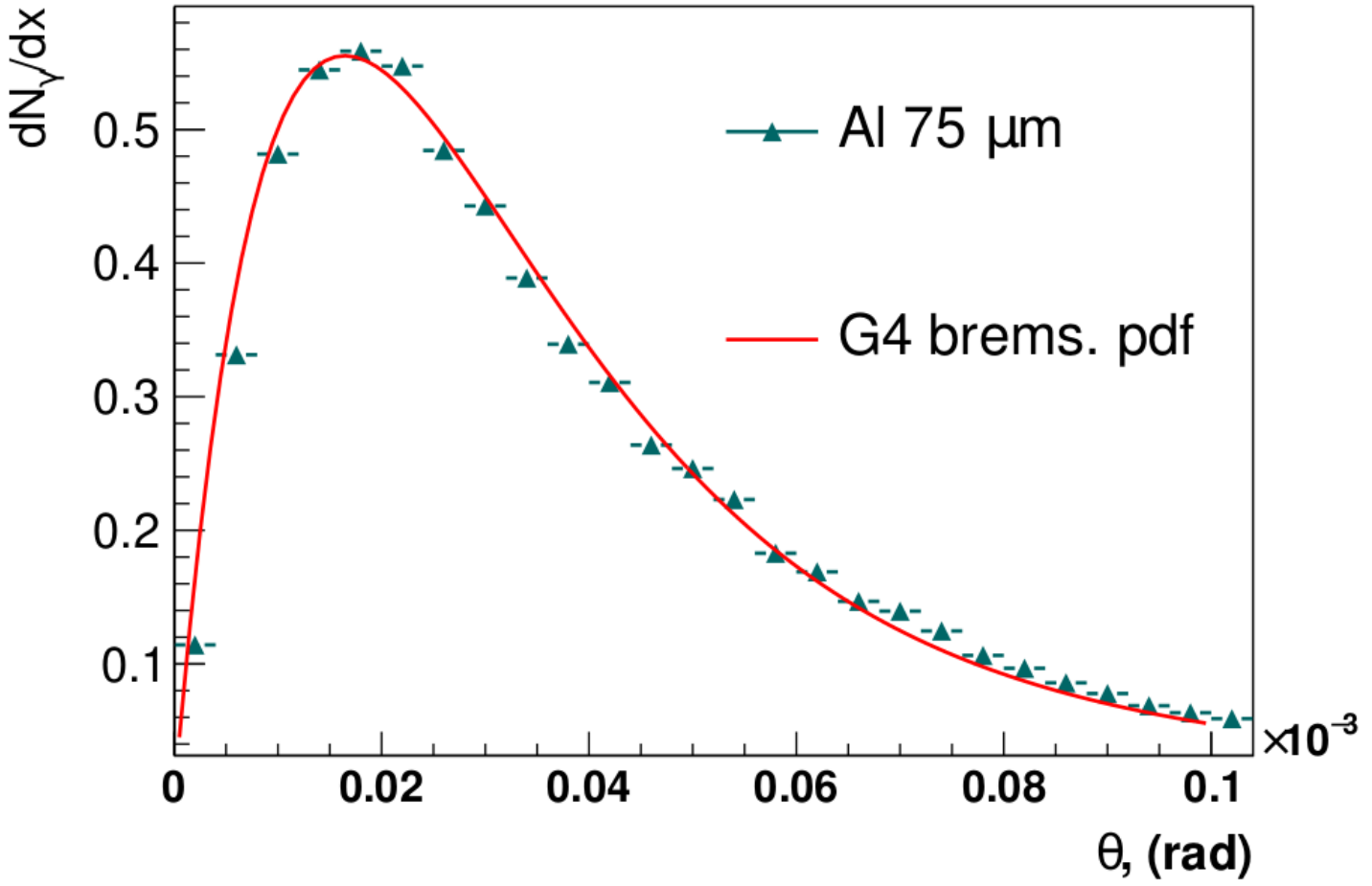
.... The angular dependence is contained in the variable $u = E\theta m^{-1}$. For a given value of u the dependence of the shape of the function on Z, E and $\epsilon = k/E$ is very weak. Thus, the distribution can be approximated by a function

$$f(u) = C\left(ue^{-au} + due^{-3au}\right)$$

where

$$C = \frac{9a^2}{9+d} \qquad a = 0.625 \qquad d = 27$$

Comparison between simulation and model distribution



Summary and plans

- Gaussian beam in Geant4 app has been implementated.
- Bremsstrahlung simulation with Gaussian beam is available.
- Check what exactly are ε_x, ε_y, ε_z, assuming $\sigma^*_x = \sigma^*_y = 5$ μm and $\sigma^*_z = 24$ μm (80 fs).