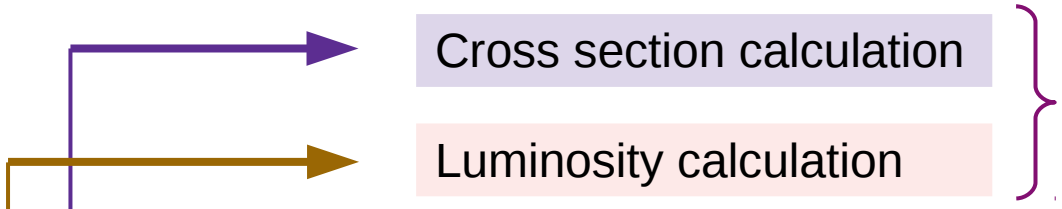
Compton events in simulation

Number of events calculation

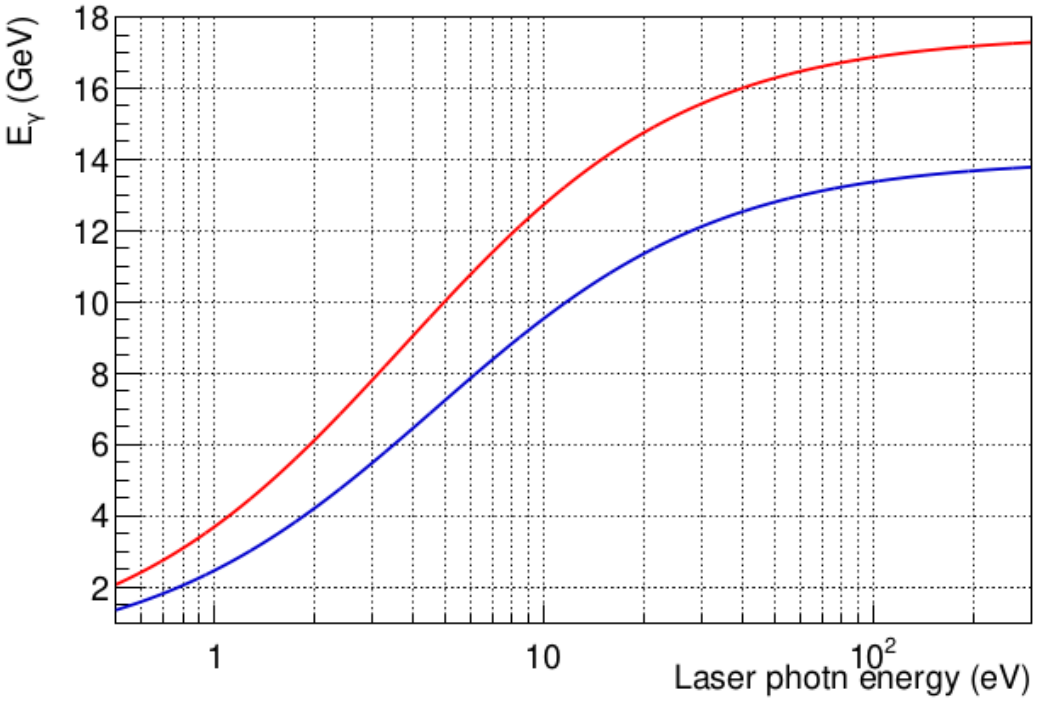



```
// Laser variables:
Elaser 1.5498E-9    // photon energy in GeV (800nm -> 1.5498eV)
Epulse 2.5e6        // energy per laser pulse in uJ  (should be 5E6)
alpha 0.3           // crossing angle in radian
sigmaxy 10.         // transverse size of pulse in um(round profile assumed!)
sigmaz  0.025       // longitudinal size of pulse in ps

nbxflip 2           // number of BXs between flips of laser helicity

// // Beam variables:
Ee 17.5          // beam energy in GeV
PX 0.0           // horizontal transverse polarisation
PY 0.0           // vertical transverse polarisation
PZ 0.0           // longitudinal polarisation
nelectron 6.25E+9  // number of electrons per bunch XFEL according to Matthew's talk
nbunch 1          // number of bunches per train
ttrain 1.0e3      // duration of bunch train in ms  (3250 bunches * 200ns bunch spacing)
// XFEL according to Mathew's talk
esigmax 0.030      // horizontal beam size in mm
esigmay 0.030      // vertical beam size   in mm
esigmaz 0.334      // longitudinal beam size in ps  (XFEL sigma_z = 20 um ; t = sigma_z / 300 um  * ps)
```

Luminosity calculation:

$$L = \frac{N_1 N_2}{2\pi\sqrt{\sigma_{1x}^2+\sigma_{2x}^2}\sqrt{(\sigma_{1y}^2+\sigma_{2y}^2)+(\sigma_{1z}^2+\sigma_{2z}^2)\tan(\frac{\phi}{2})}}$$

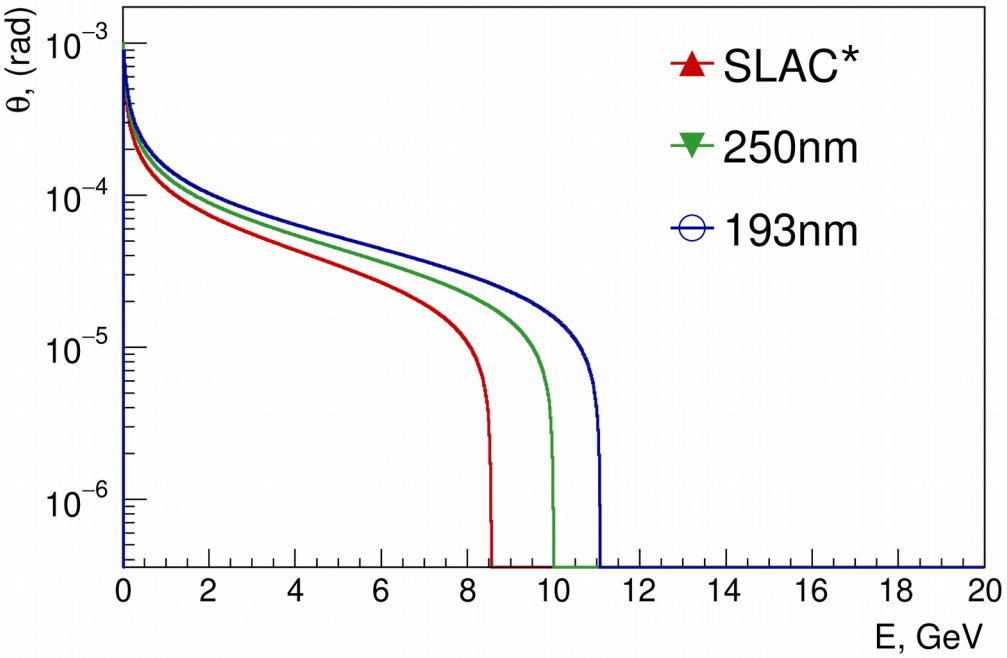
Angular distribution and rate estimation



Compton edge as a function of laser photon energy:
for electrons of
17.5 GeV (red)
and 14 GeV (blue).

- Polar angle as a function of Compton photon energy for 17.5 GeV e-;
- Most of the HE photons are within a cone of 10 μrad

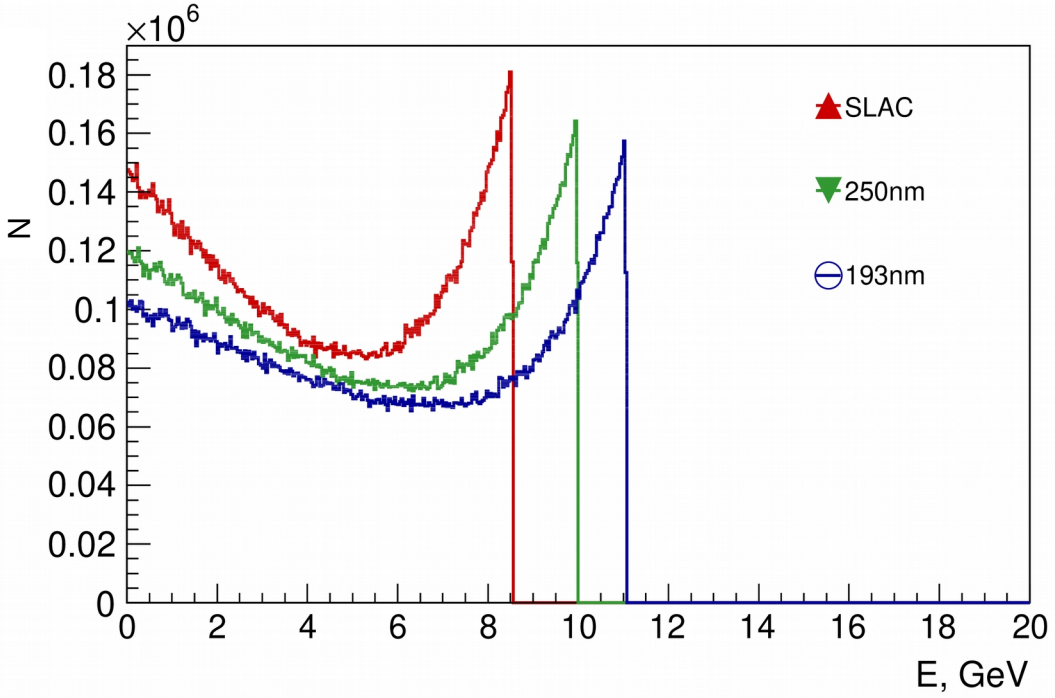
*SLAC: only laser is 3.56eV, electrons are EU.XFEL (17.5 GeV).
At SLAC – 19GeV and the edge is a little bit higher (9.7GeV).



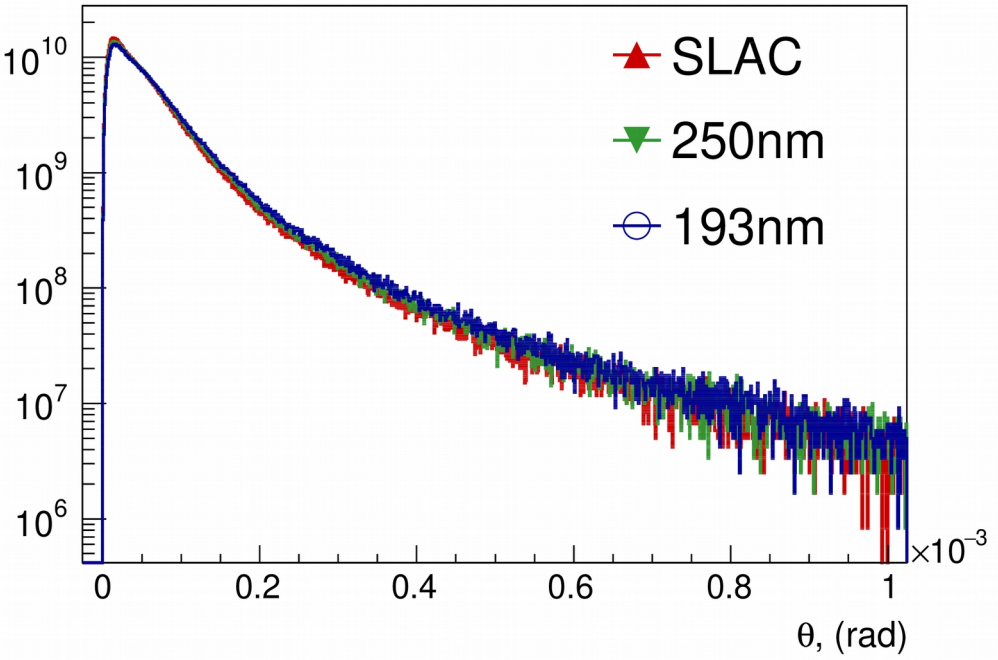
Eximer lasers with 193nm (6.42eV) beam,
Compton edge 11.07 GeV.
https://lightmachinery.com/lasers/excimer-lasers/ipex-700/
http://wavelength-oe.com/en/content.aspx?sid=1796
Energies: 250mJ, 450mJ;
Pulse: 12ns, 25ns;

Assuming it can be focused to ~10 μm spot, the number of Compton events is ~10.

Gamma spectra and polar angles

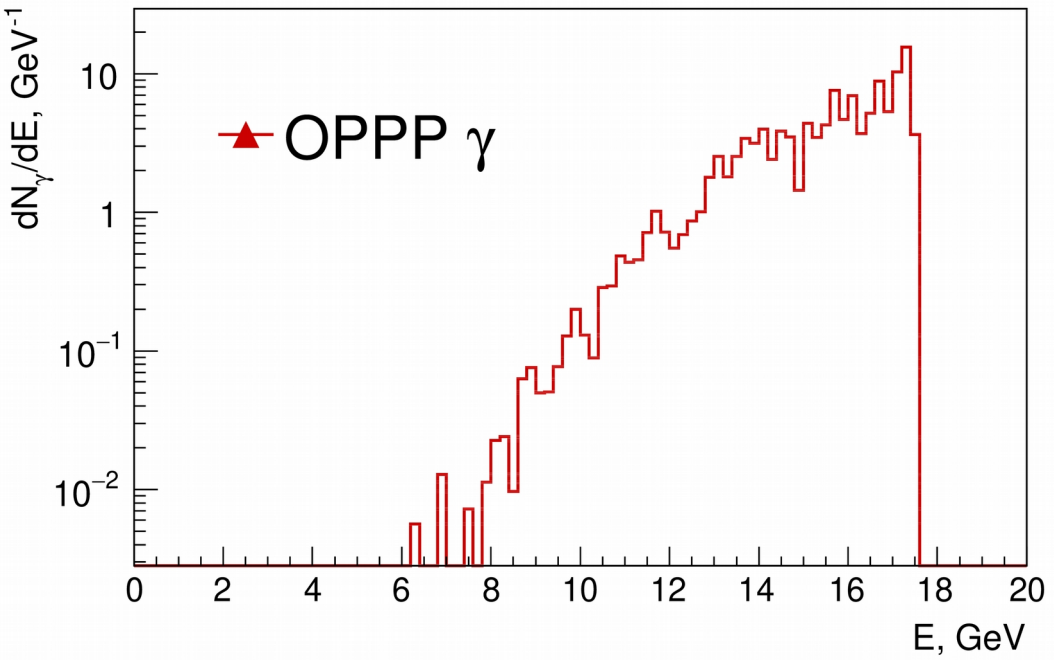


Not scaled to 1 BX

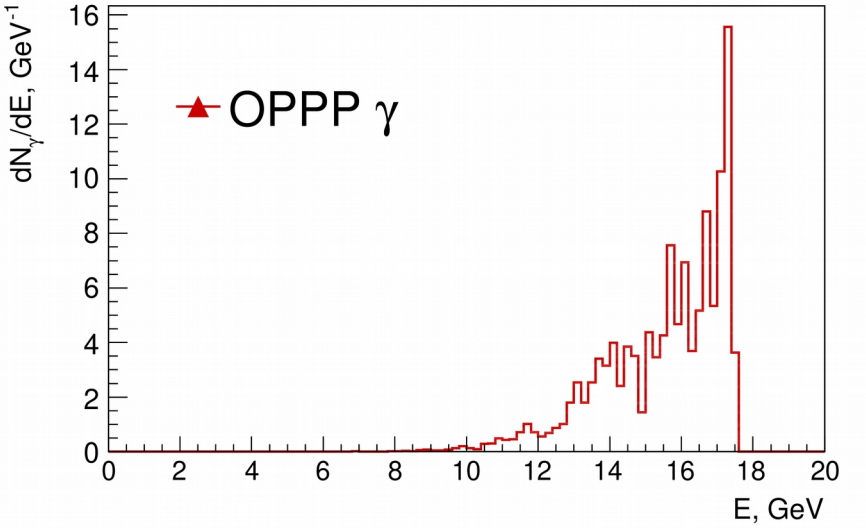


OPPP

Spectra of the photons (bremsstrahlung) that produced e-e+ pairs for 1.0J laser shot;



The same in linear scale



- Total number of pairs 24.5 per shot;
- Integral from 0 to 11 GeV: ~0.5 (2%);
- In the same time the population of low energy photons in bremsstrahlung spectra is higher than high energy photons, but their contribution to OPPP is small ~2% below 11 GeV.
- It looks like it is important to have photons close to 17.5 GeV for OPPP study.

OPPP

Fraction of pairs produced by photons with energy below Eγ in case of bremsstrahlung photons 1.0J laser shot;