Results Chapter: Compton Edges

Ruth Jacobs

LUXE technical meeting
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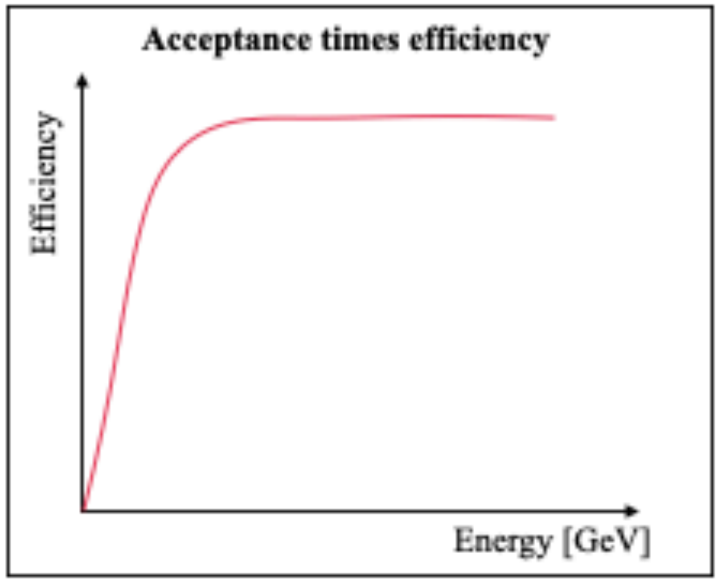
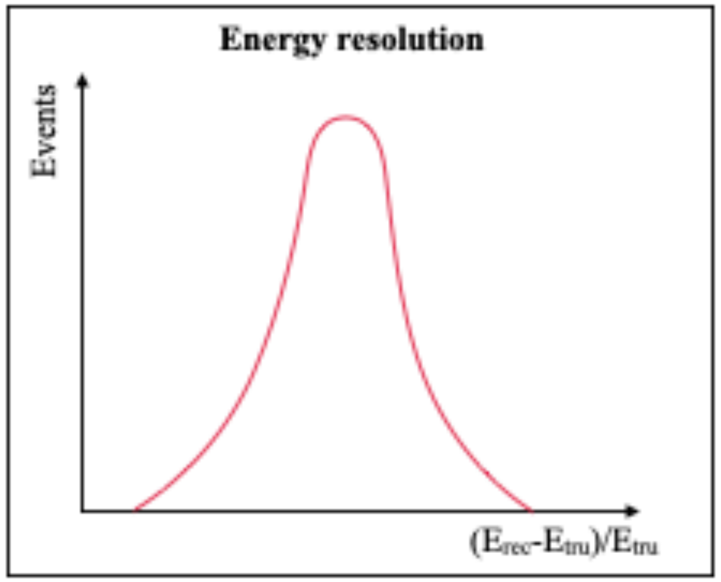
HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

Strategy



X



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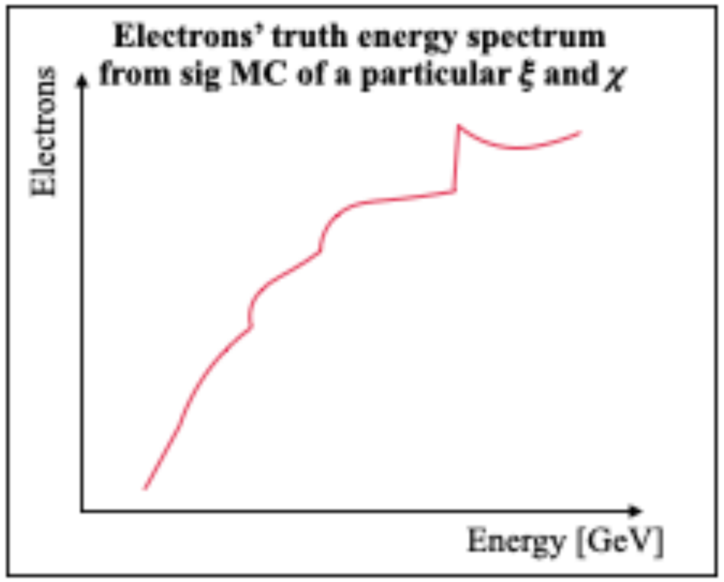

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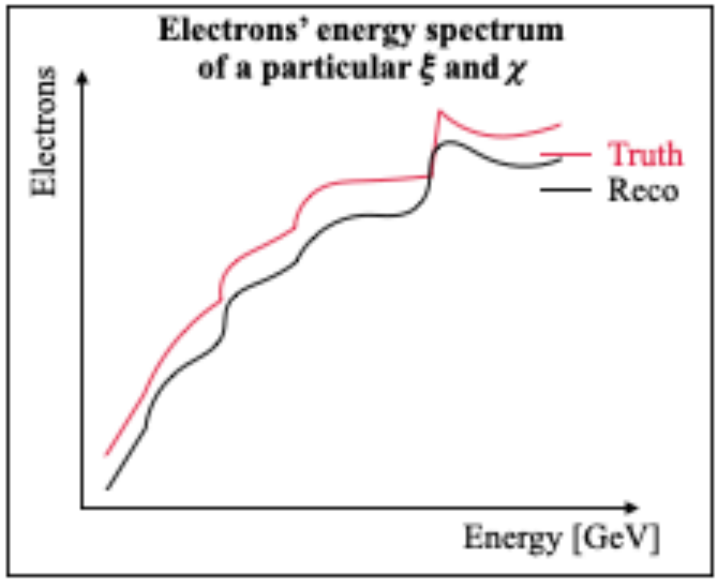
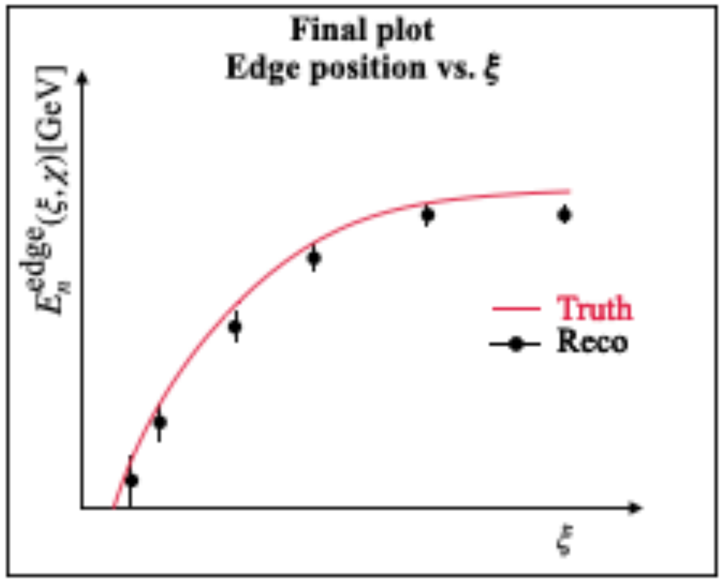
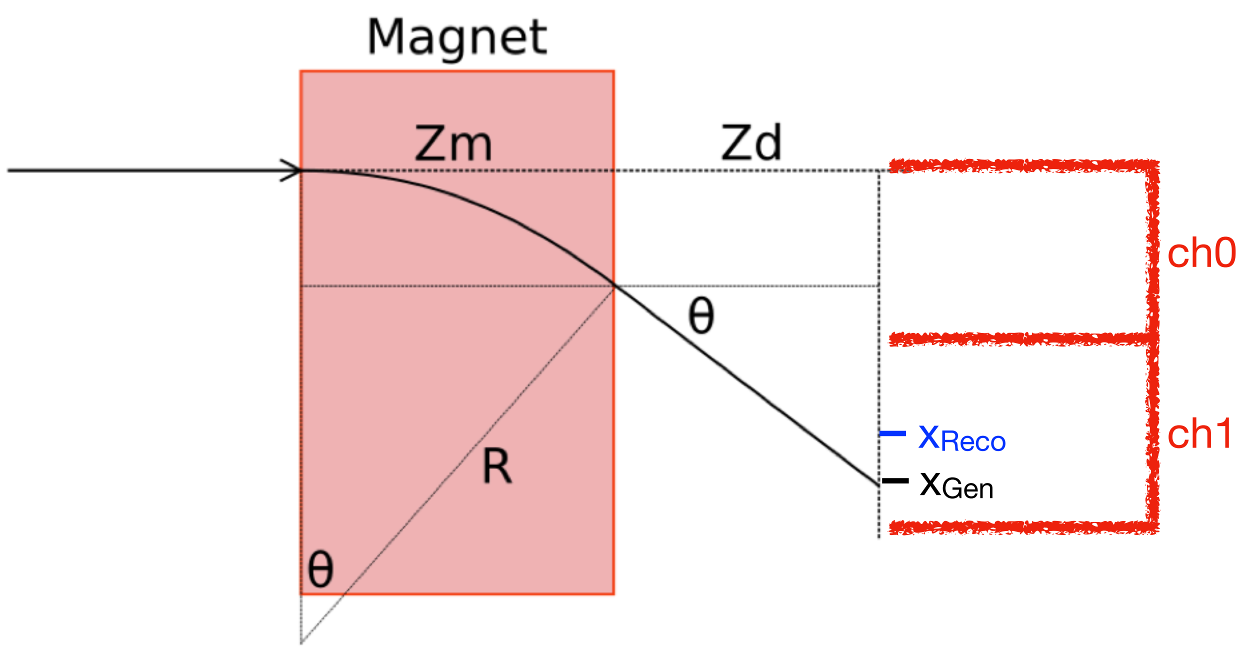


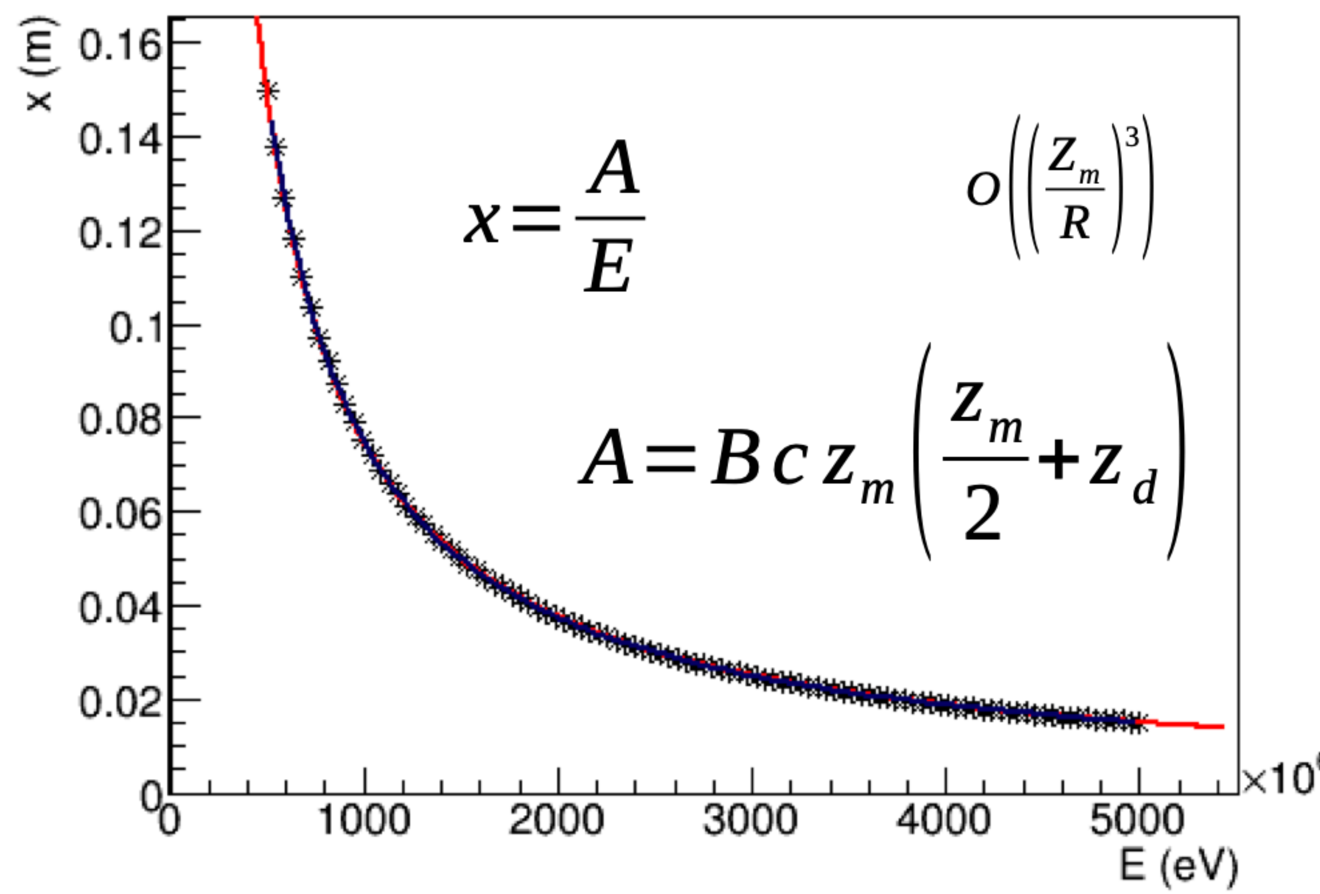
$\Longrightarrow$ edge finding algorithm $\Longrightarrow E_n^{\mathrm{edge}}(\xi,\chi)$



Fastsim

from [Sasha's slides]





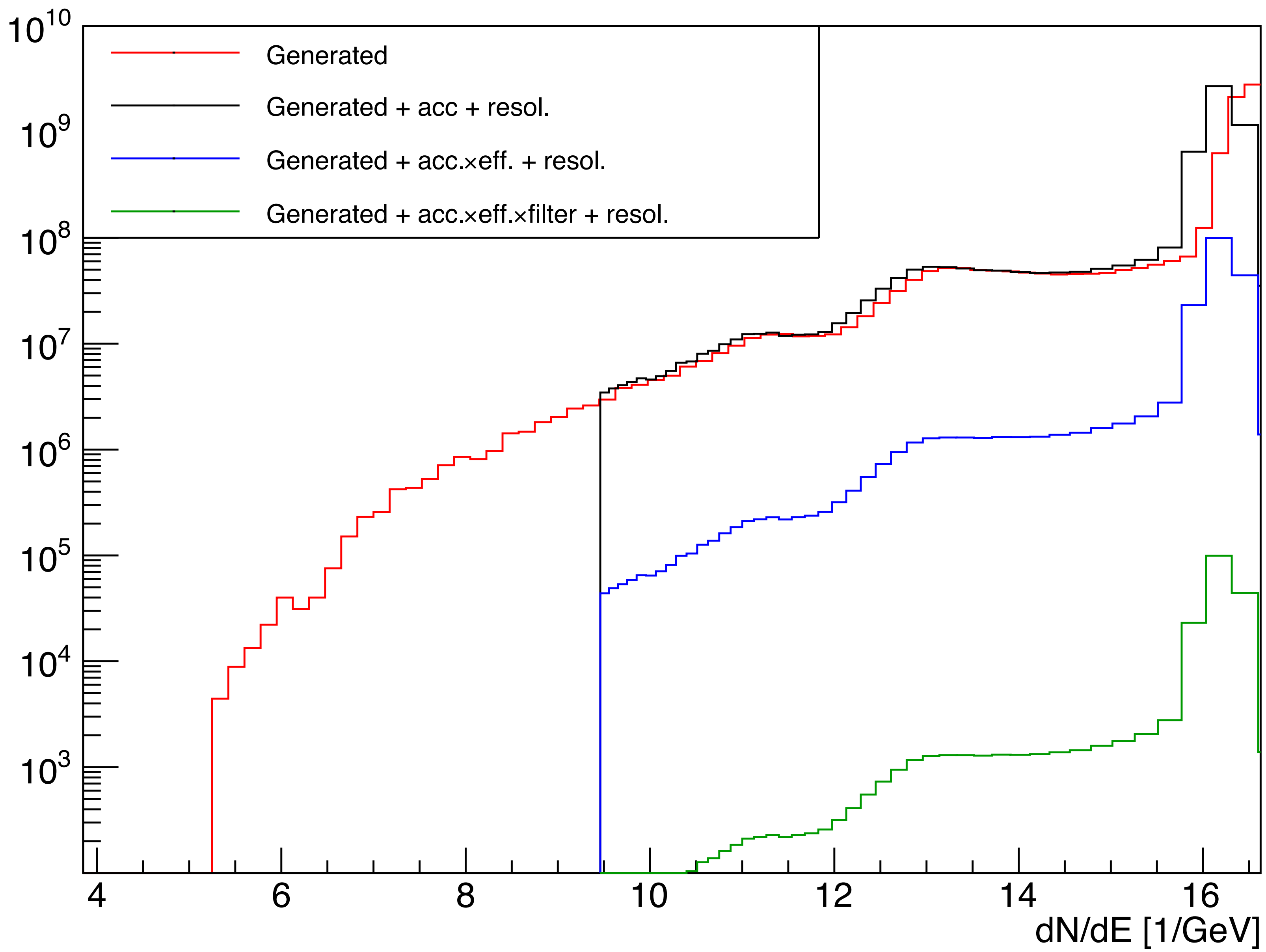
- parametrization of the magnetic field using formula for E(x), x(E)
- encapsulated read-in Tonys of MC (*.out files, *.stdhep files can be added), based on Sasha's code in lcpolmc
- simple detector parametrization (position, span, photodetector)
- somehow now getting similar to lcpolmc, but no more dependence on ancient fortran-style random generators
- code here: https://stash.desy.de/projects/BREM/repos/fastsimsuite/browse

Acceptance x Efficiency & Resolution

- acceptance: driven by span of the detector
- efficiency: - photodetector quantum efficiency (λ -dependent)
  - channel reflectivity
  - filter transmission

$$\kappa = \int_{\lambda_{\text{min}}}^{\lambda_{\text{max}}} QE(\lambda) \cdot \epsilon_{\text{refl}} \cdot \epsilon_{\text{filter}}$$

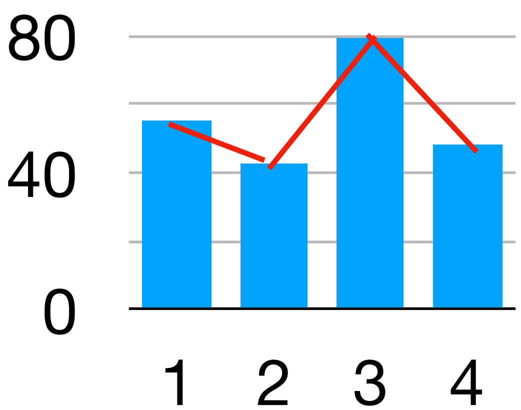
- resolution: driven by segmentation of the detector



Edge Finding?

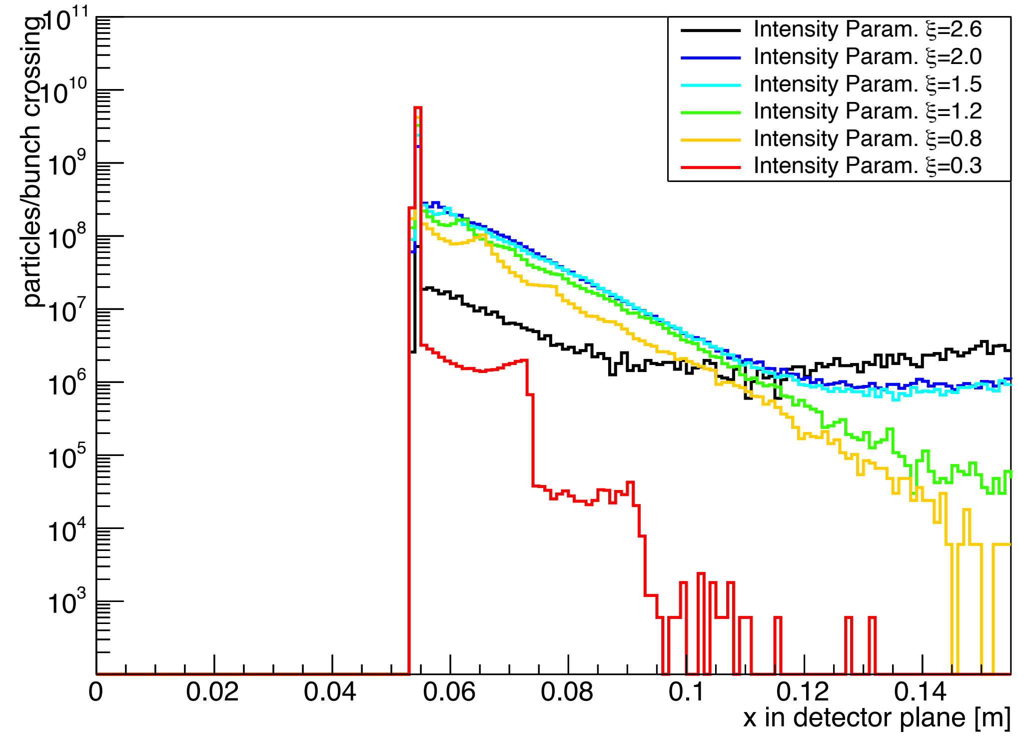
Differentiation Prescription

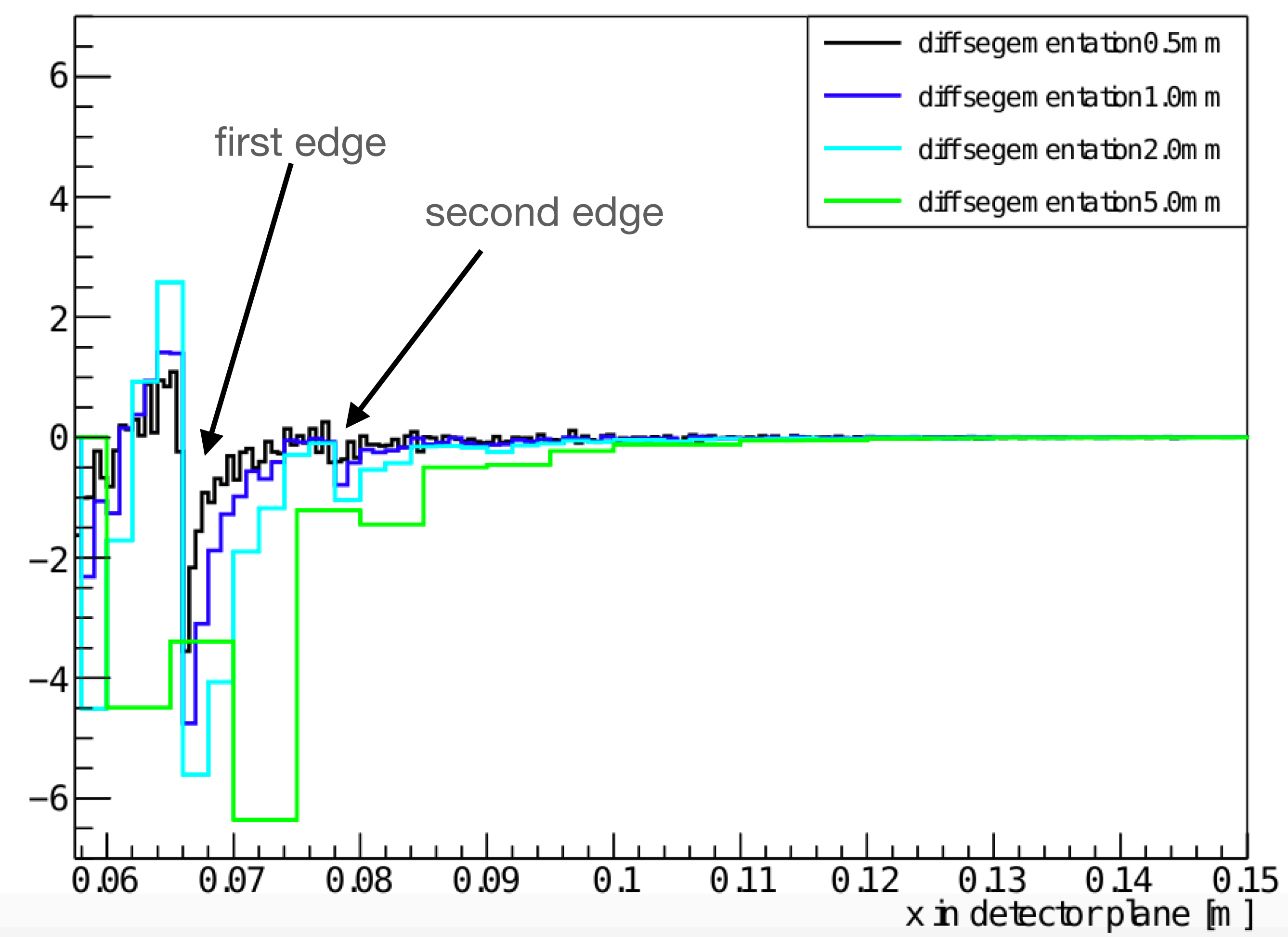
- get electron x distribution
- calculate slope bin-by-bin
  (average over (i,i-1) and (i,i+1)



- find the bin with minimum slope
  → edge

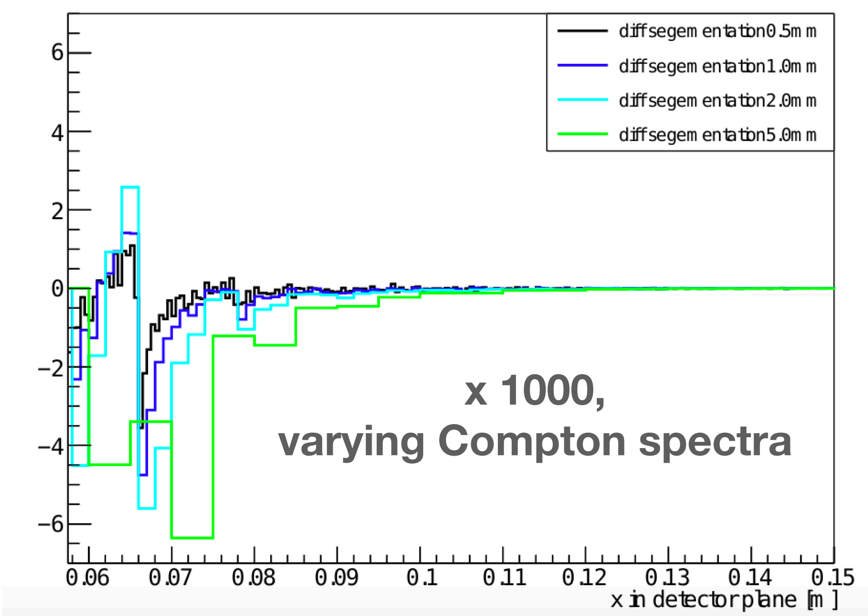
- in reality need to define a window where to look for the first edge
- for high xi this gets difficult, as you get closer to the beam

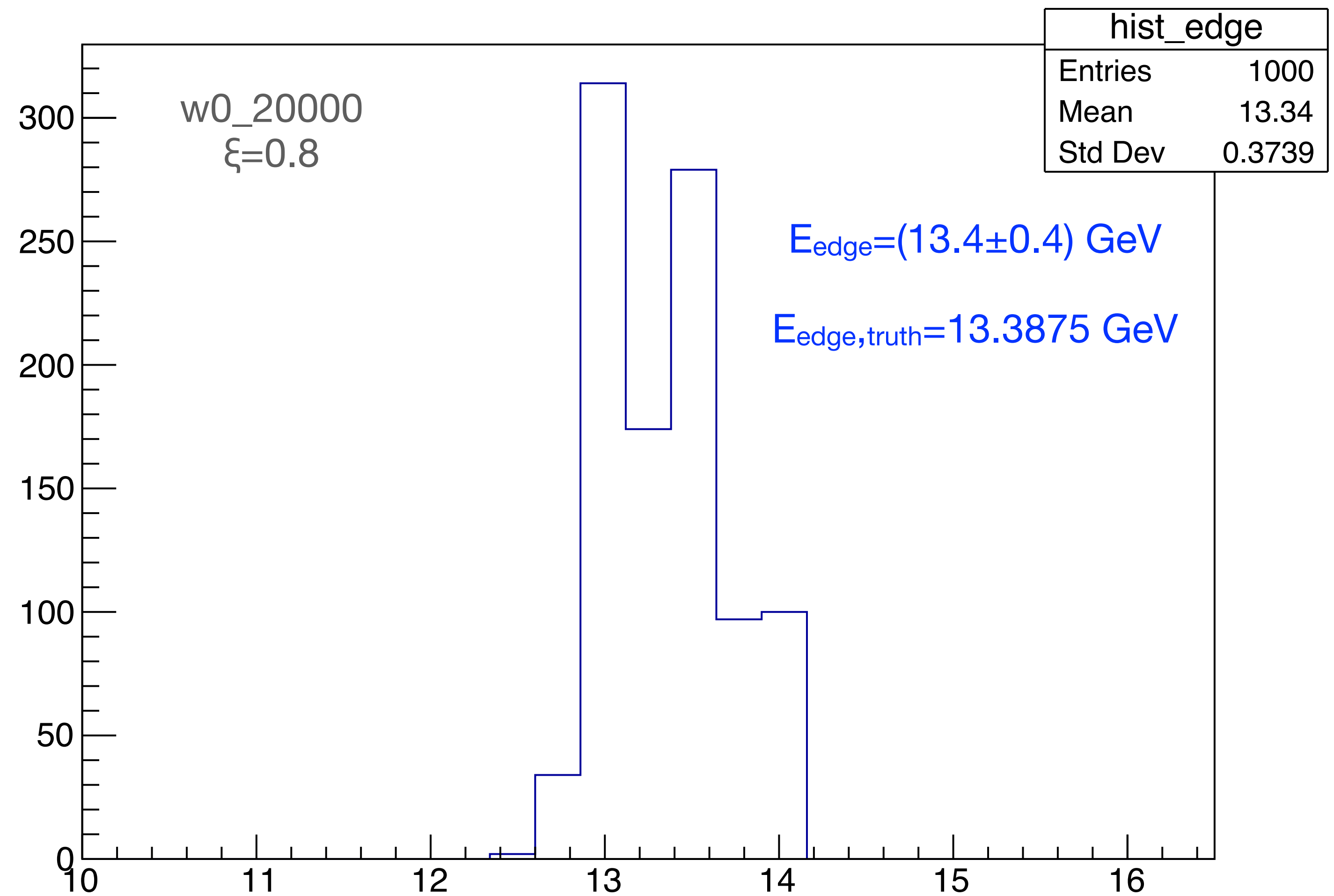




Statistical Uncertainty

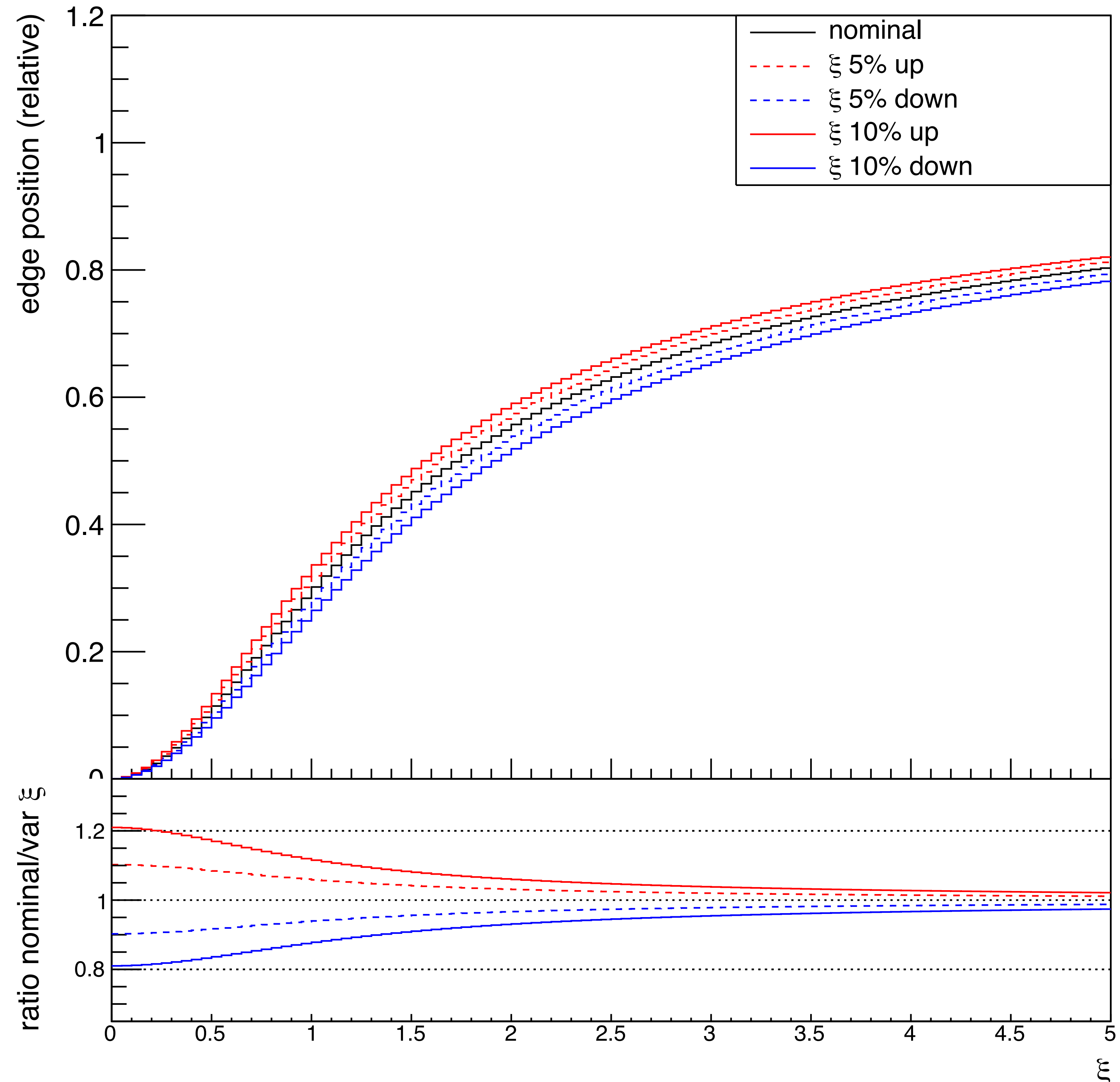
- Statistical: “On average, a primary electron leaves 8 Cerenkov photons”
  → Poissonian errors
- Toy approach: vary count rates in pseudo-experiments, rederive edges





Systematic Uncertainties

- LASER intensity
  - assume $1/\mathrm{sqrt}(1+\xi^2)$ behaviour
- Misalignment
  - few percent effect, neglect
- Non-linearities (photo-detector, readout electronics):
  - has been measured for prototype setup (thesis C. Helebrandt
  - few percent effect
  - test for SiPMs!
- Backgrounds: need to understand
- something I forgot?



10% LASER uncertainty → 20% uncertainty on edge position at low ξ