

Forward Spectrometer Analysis 22/10/20

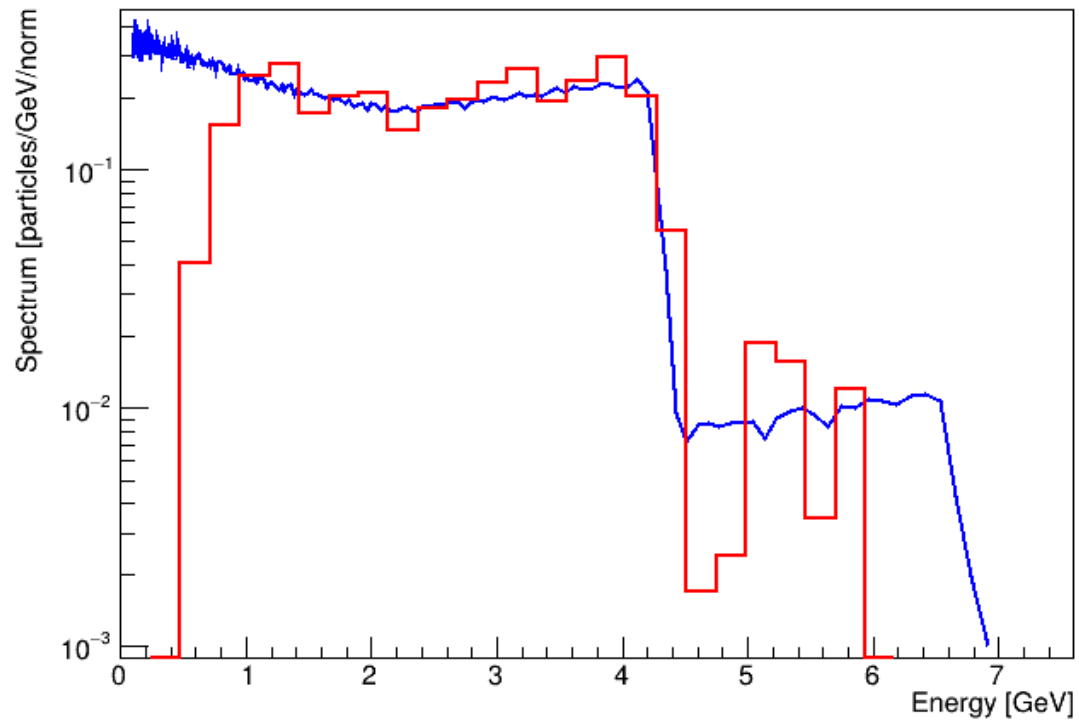
Kyle Fleck and Dr. Gianluca Sarri

Deconvolution of Electron Signal

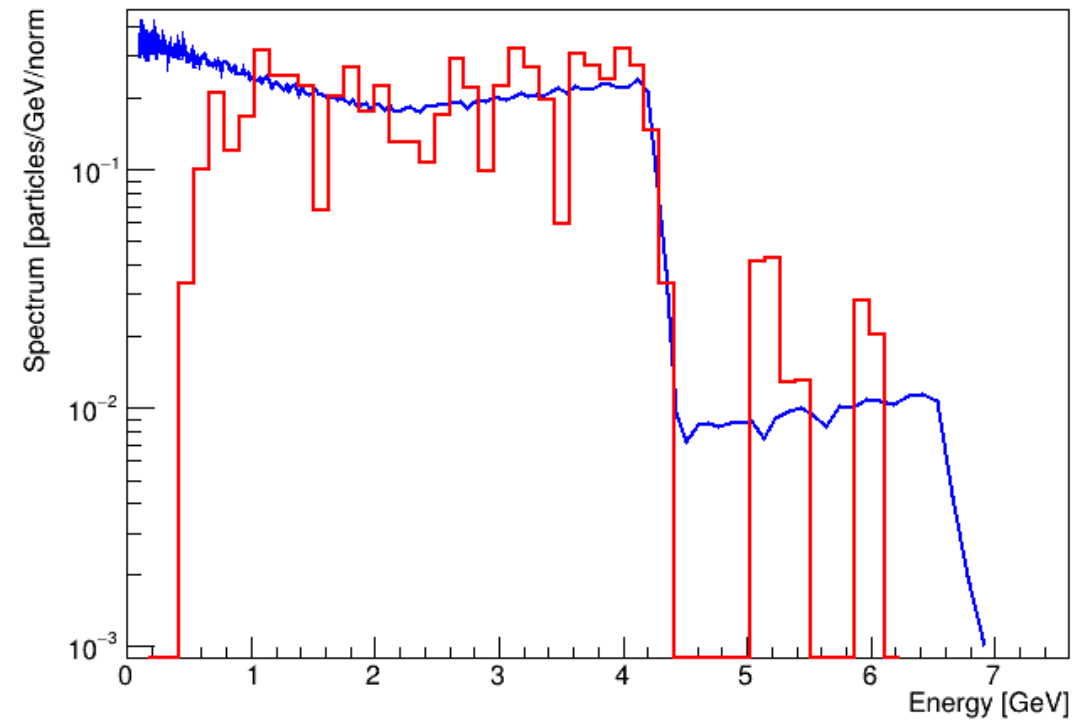
- Improved deconvolution algorithm – accounts for parabolic nature of the monoenergetic response curve for the electrons
- Basic edge finding implemented – differentiation method
- Looking into adapting FIR filters

Deconvolution

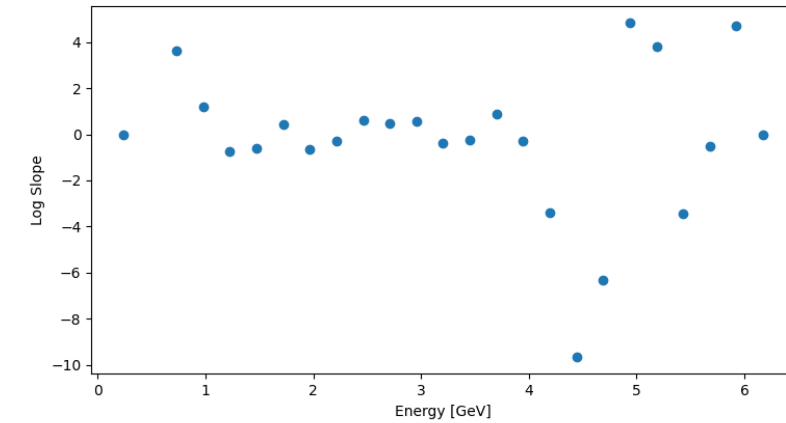
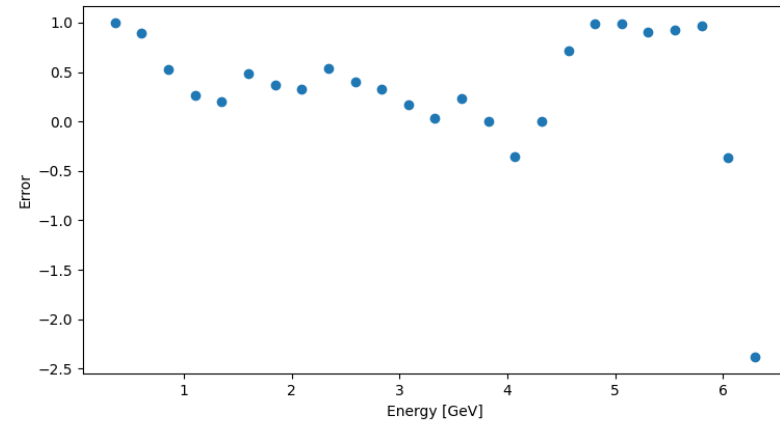
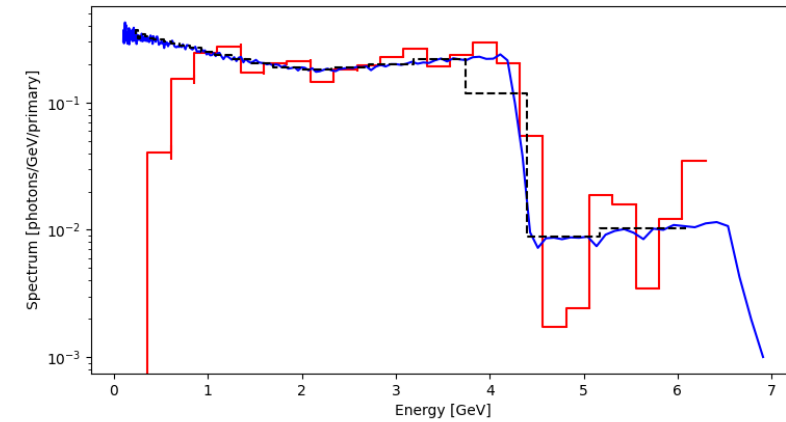
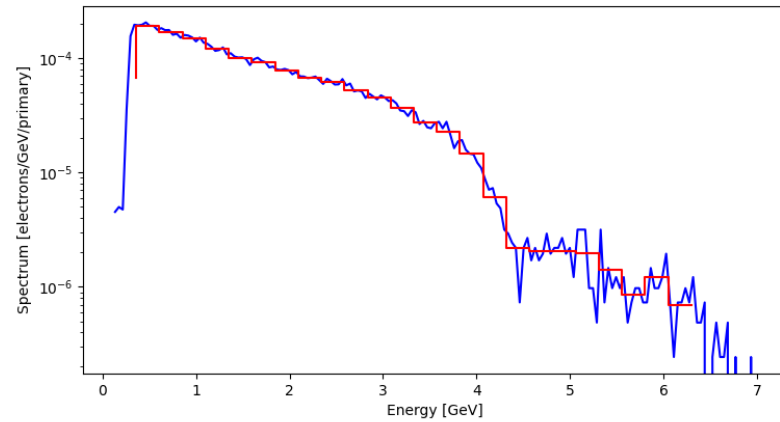
HICS 16.5 GeV 50 μm - 25 bins



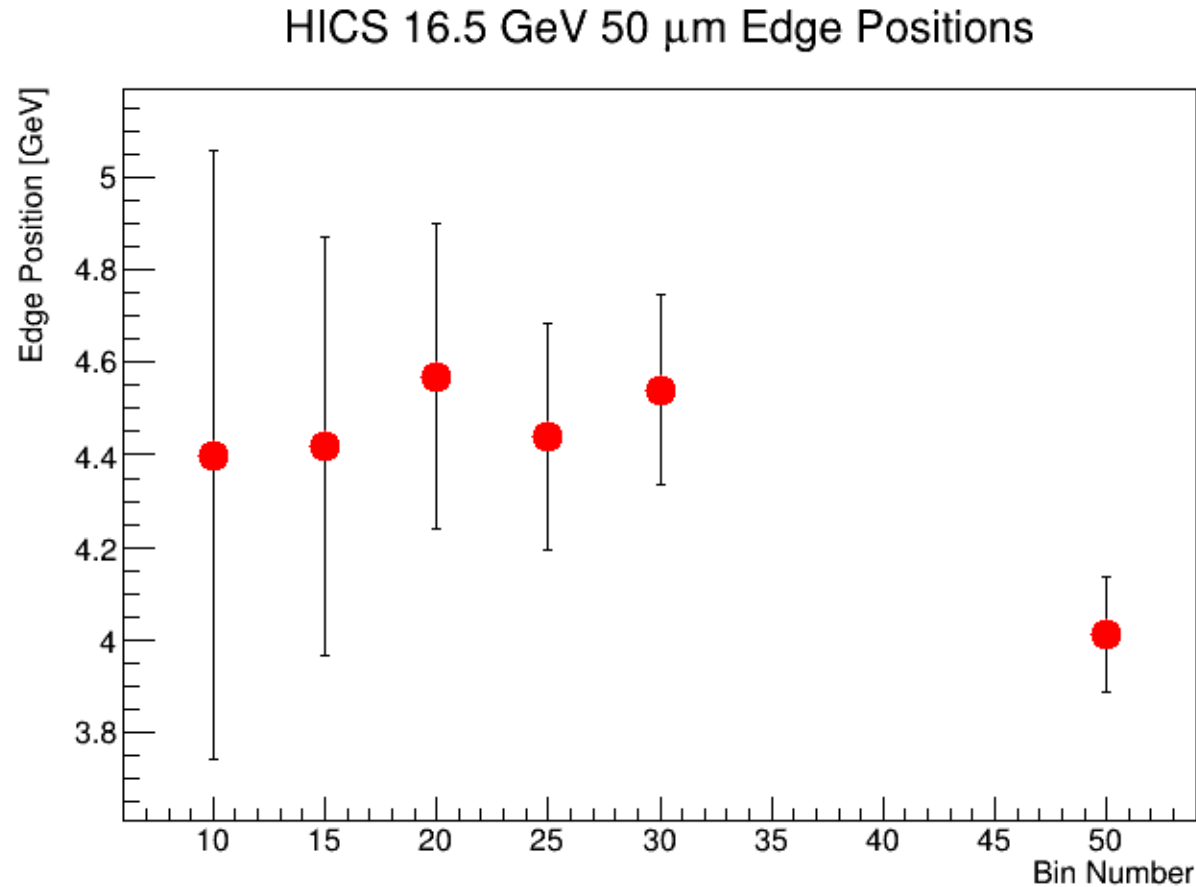
HICS 16.5 GeV 50 μm - 50 bins



Deconvolution – Detailed Results



Deconvolution – Edge Finding



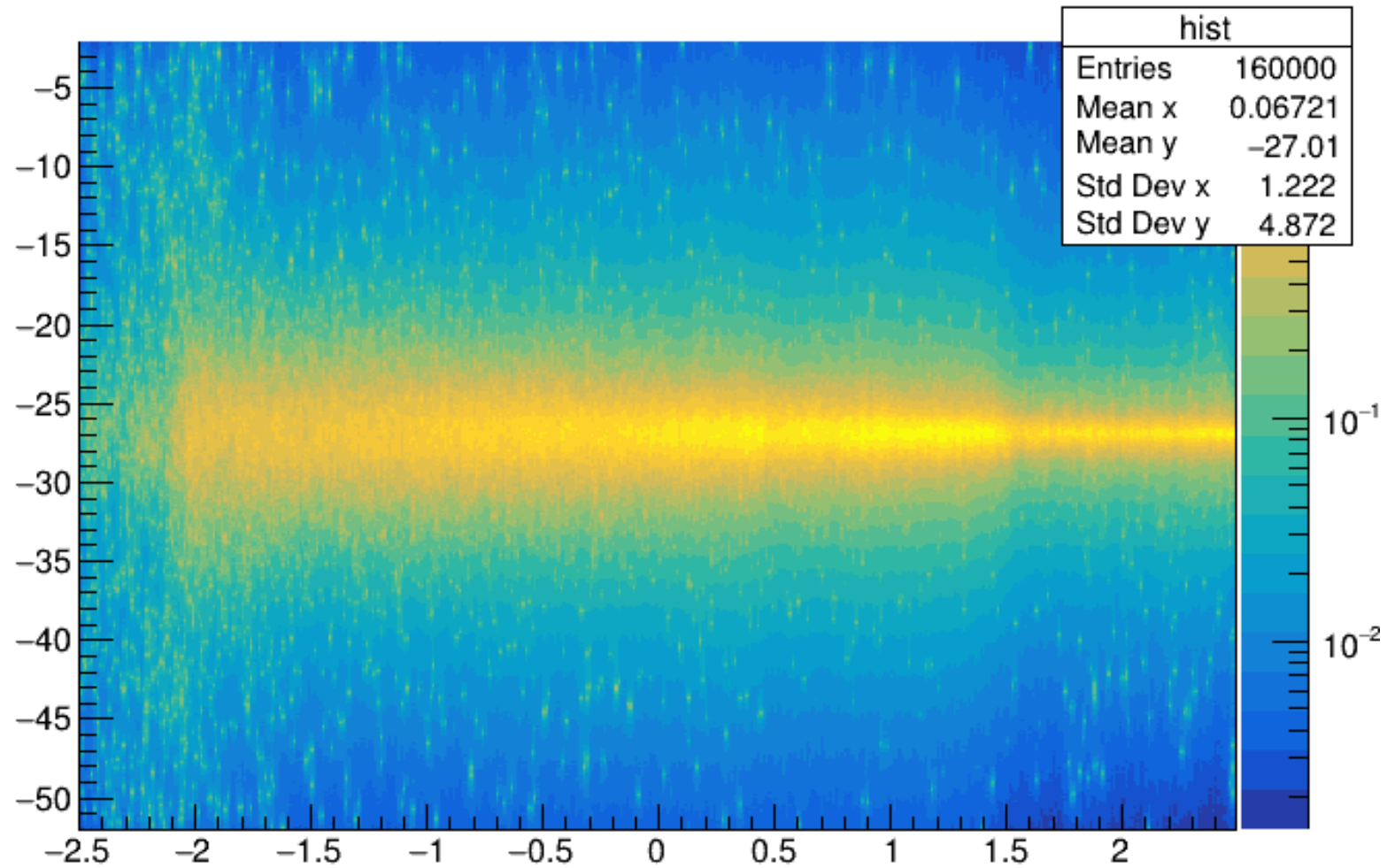
- Simple differentiation approach used for various bin widths (eqv. bin numbers)
- Error bars are the width of the bin currently – possible to improve this accuracy
- Mean edge position over all bin sizes

$$4.40 \pm 0.18 \text{ GeV}$$

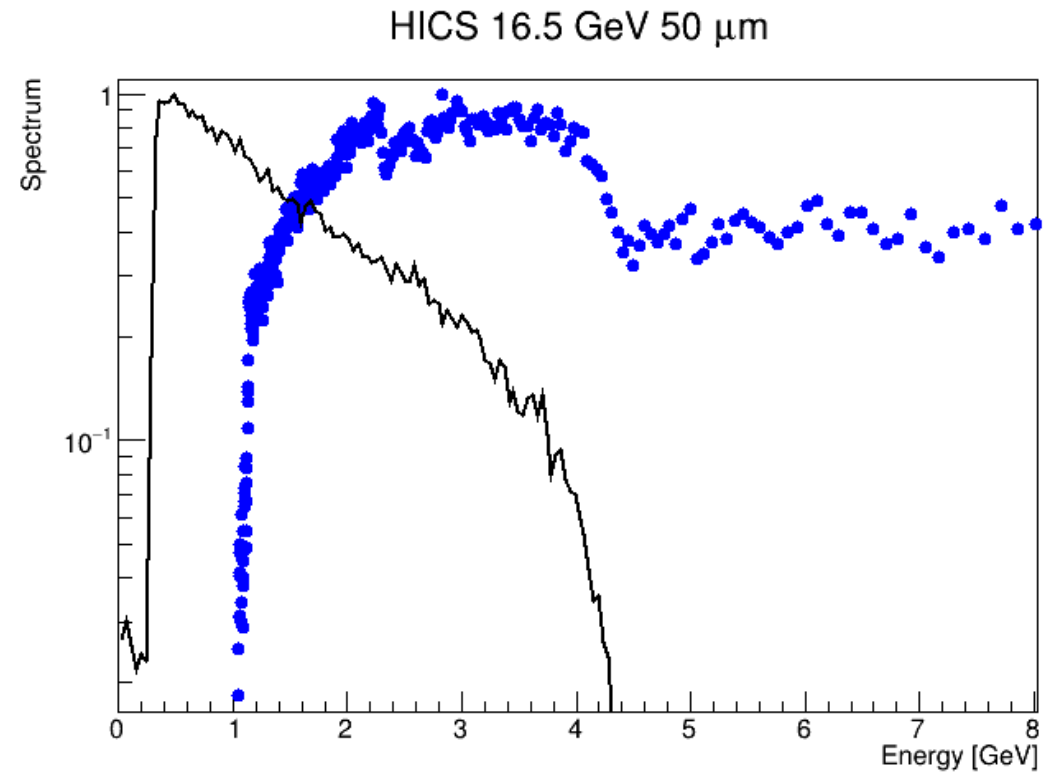
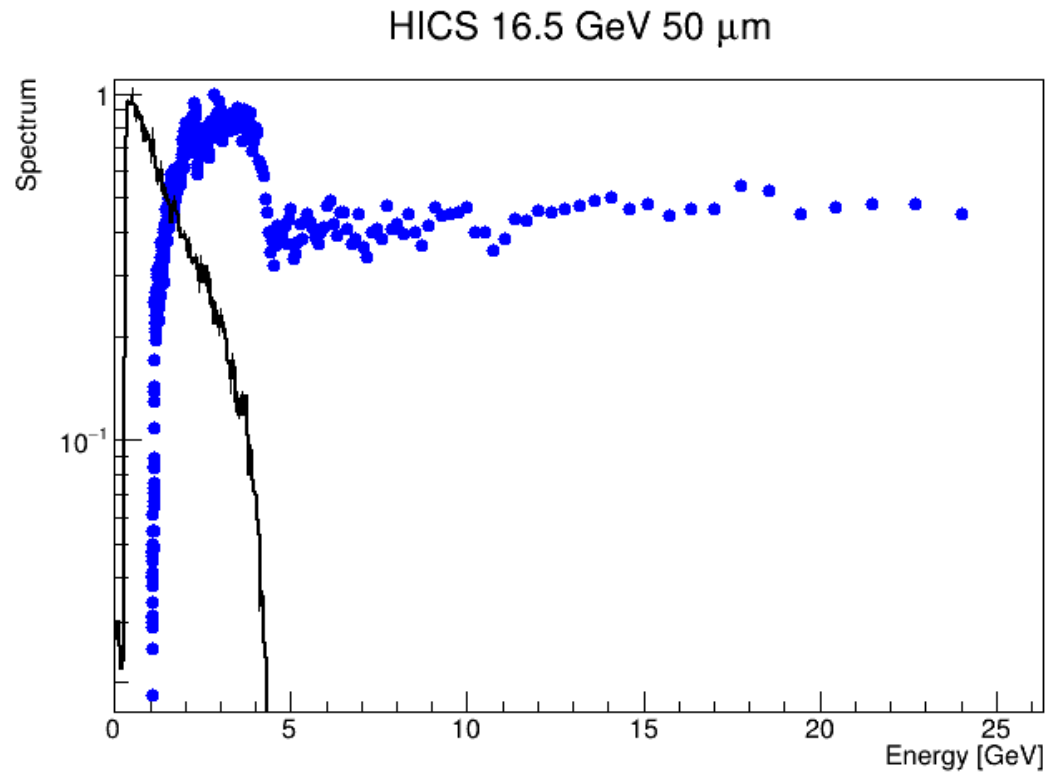
Electron Spectrum from Scintillator Screen

- Previous deconvolution work uses the 'true' electron spectrum as measured in FLUKA – this is not what will be measured in reality
- By nature of the geometrical setup in simulation, automatically includes energy cut-offs due to detector size
- Efficiency of conversion to scintillation photons of the LANEX screen also included in simulation – assumed to be approximately constant for incident energies > 1 GeV
- More details on the camera to be used needed as well

Scintillation Response - Air



Constructed Electron Spectrum - Air

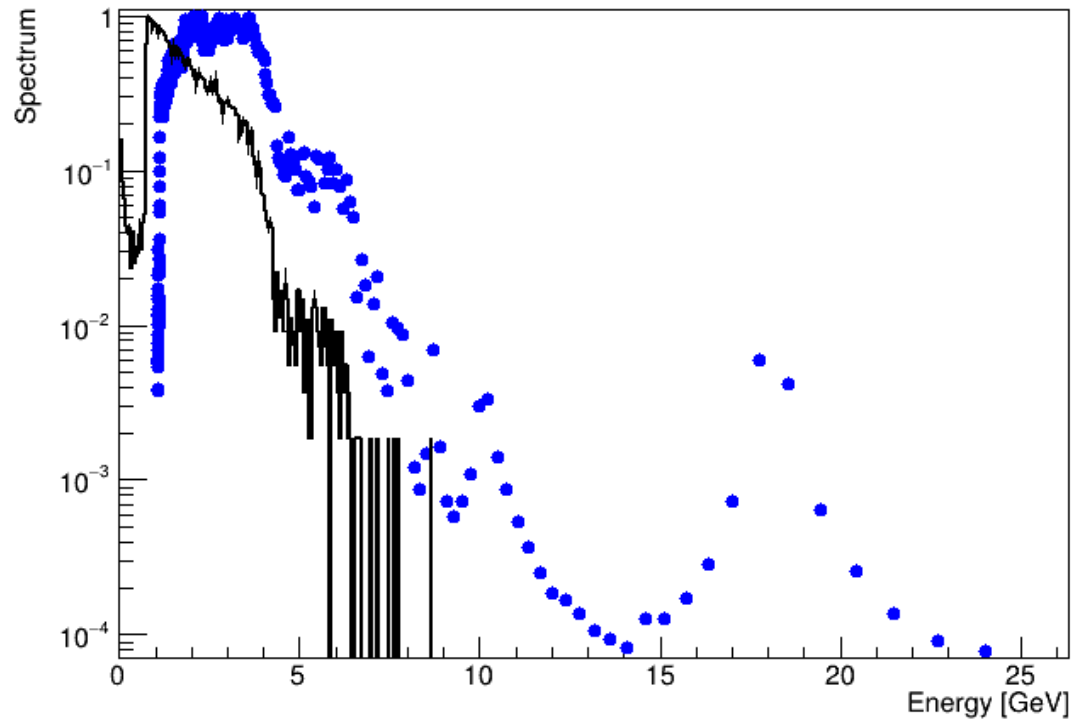


Constructed Electron Spectrum - Air

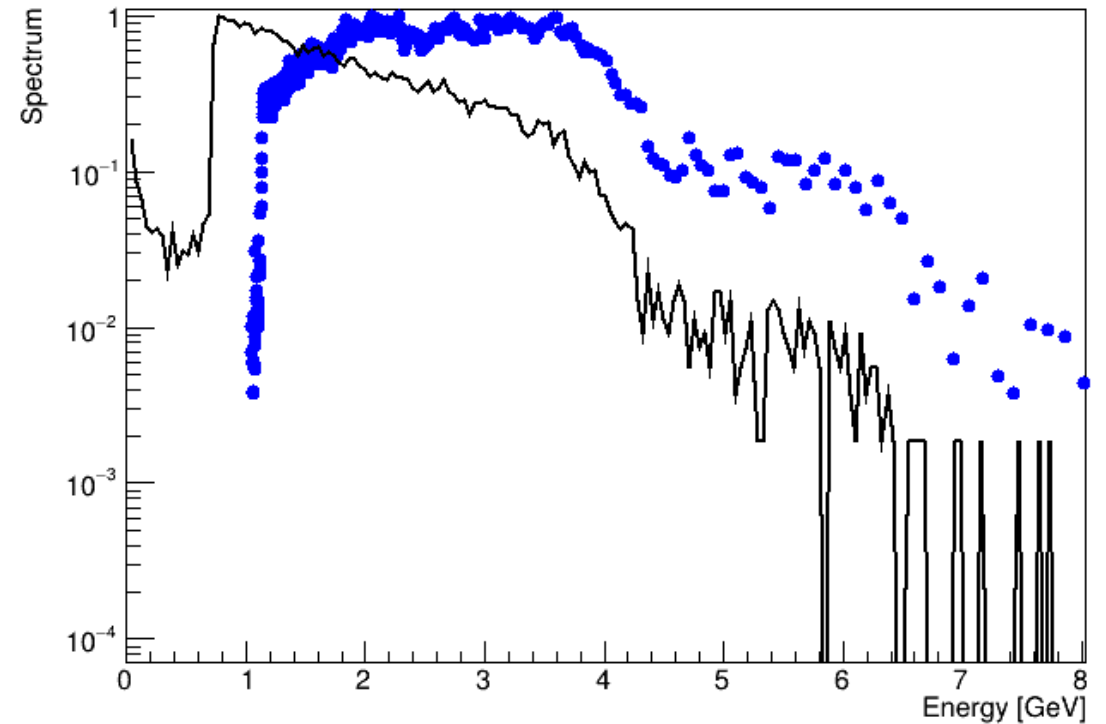
- Not a good reconstruction at all
- 3 most probable sources of noise – the air environment, backscattering from Cerenkov detectors and dissipation of scintillation photons within detector
- Normalisation is not implemented yet – this depends on the fractional energy deposited in the scintillator but is approximately constant for high energies
- Not important for deconvolution or edge finding – this is done relative to the input electron spectrum

Constructed Spectrum - Vacuum

HICS 16.5 GeV 50 μm



HICS 16.5 GeV 50 μm

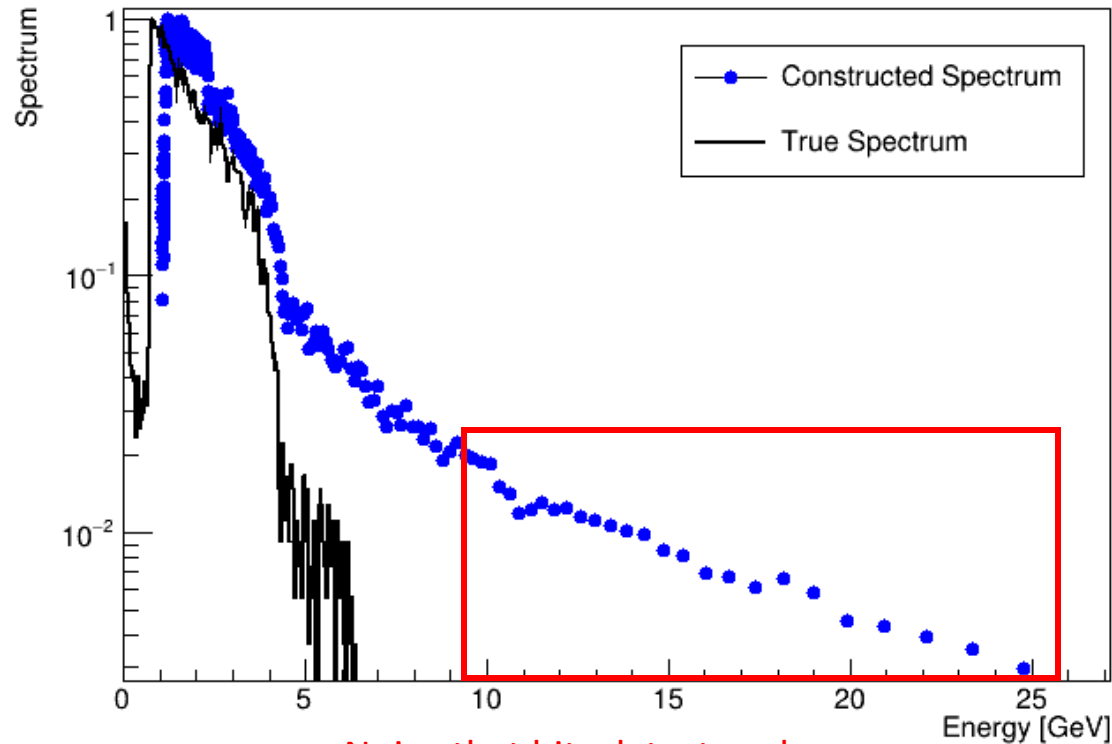


Constructed Spectrum - Vacuum

- Still not a perfect match but vacuum reduces noise on detector – spectrum shape more visible
- Haven't accounted for backscattering or dissipation

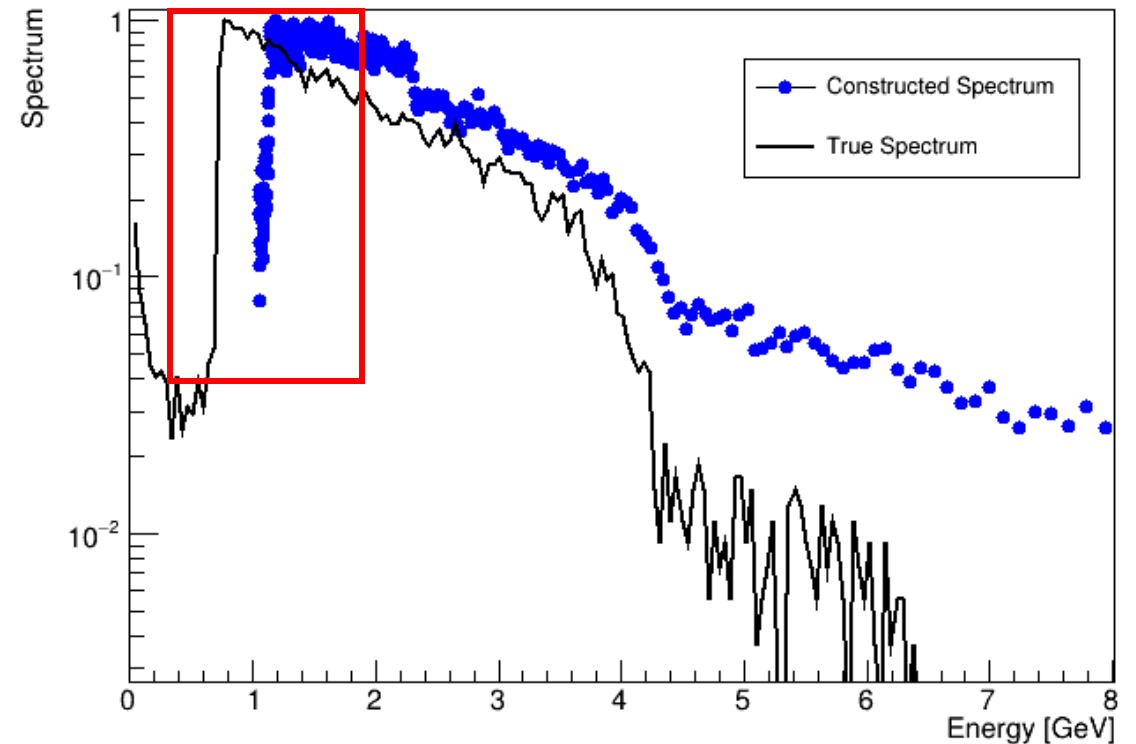
Fixes – Corrected Constructed Spectra (Air)

HICS 16.5 GeV 50 μm



Noise that hits detector close
to beam – construction
algorithm thinks this is caused
by high energy electrons

HICS 16.5 GeV 50 μm



Translational shift?