Verification of the Pair Spectrometer Acceptance using Compton events

(work progress)

Sasha, June 12, 2020

Comments Regarding MC Simulation

- For MC simulation set JANA_CALIB_CONTEXT to “variation = mc”
  (for data processing use “variation = default “)
  - CCDB tables with variation “mc” will be used during in Geant and mcsmear

- Assigned variation “MC” to the beam_spot Monte Carlo table. Added PS acceptance to the CCDB

- Some minor issues with the latest version of Geant 3
  (inconsistency between the old and new geometries in digitization hitFTOF, temporary fixed, need to do more tests)

Compton Reconstruction

- Start looking on runs with the smallest beam flux, 50 nA, He target

  - uncertainties in the He target density (expected to be less that 5 %)

  - small fraction of accidentals (in tagger and CCAL clusters). Try to check the shape of Compton cross section

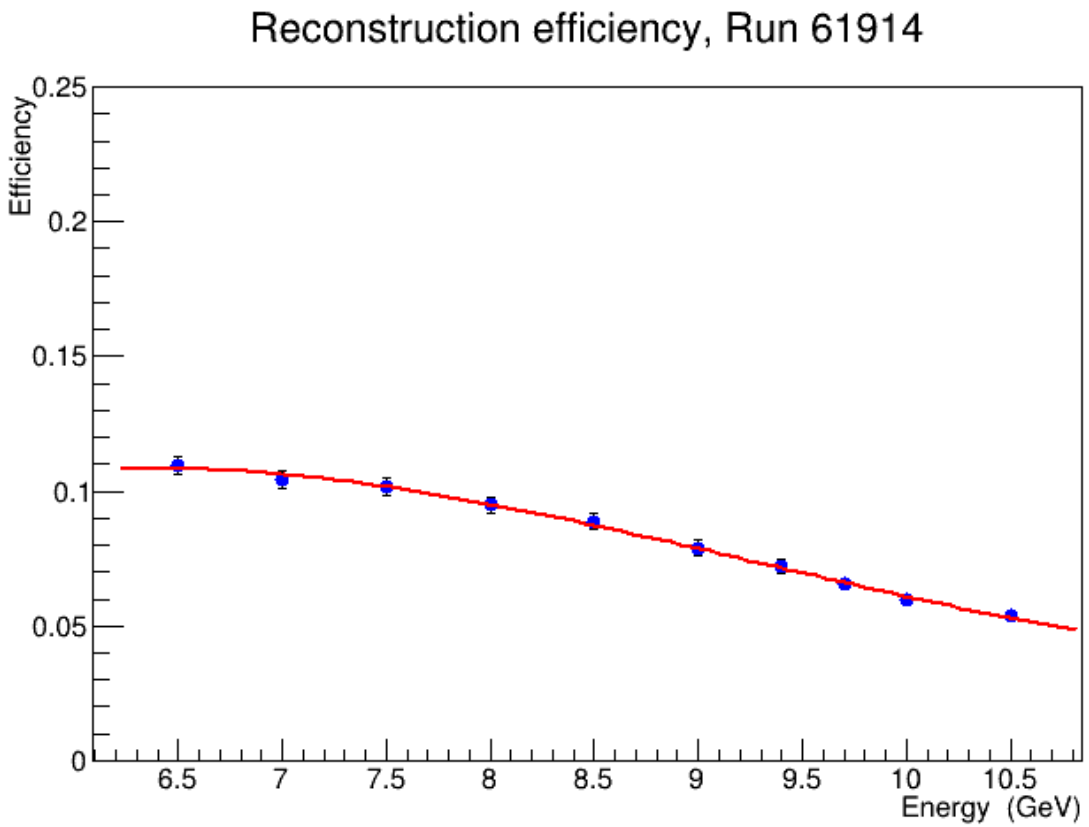
- Event selection

  - one cluster in the FCAL and one in the CCAL (Δ t = 8 ns), Δ t (FCAL – RF) < 3 ns

  - E_{CCAL} > 1 GeV, E_{FCAL} > 0.5 GeV

  - fiducial cuts in calorimeters:
    exclude fcal inner ring, -7 cm < X_{CCAL} < 9 cm, -9 cm < Y_{CCAL} < 9 cm

Monte Carlo Simulation: Compton Events



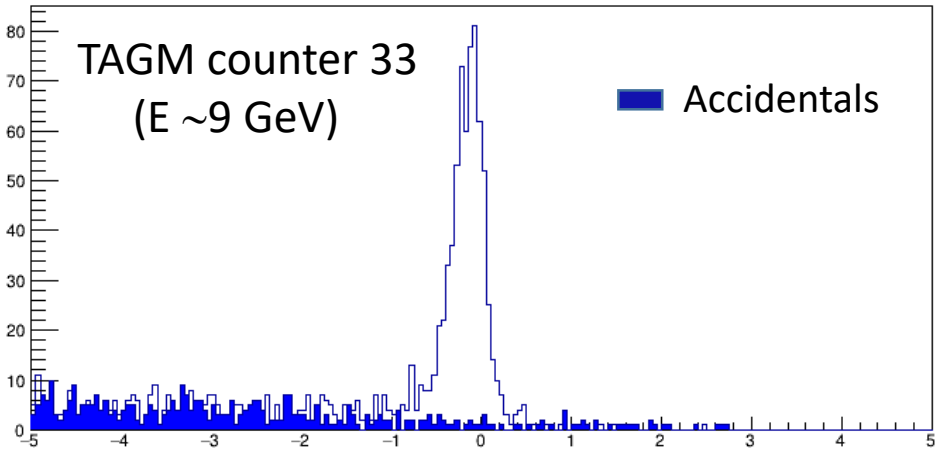
Monte Carlo samples generated by Igal using Pawel event generator

- Radiative corrections included

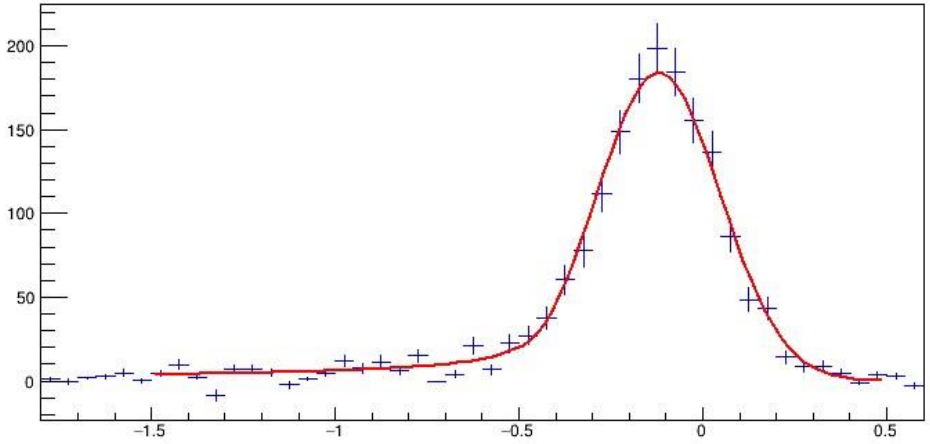
- Igal has implemented the generator to the GlueX framework (to be checked) !

Compton Reconstruction

Run 61914



$E_{FCAL} + E_{CCAL} - E_{BEAM}$ (GeV)

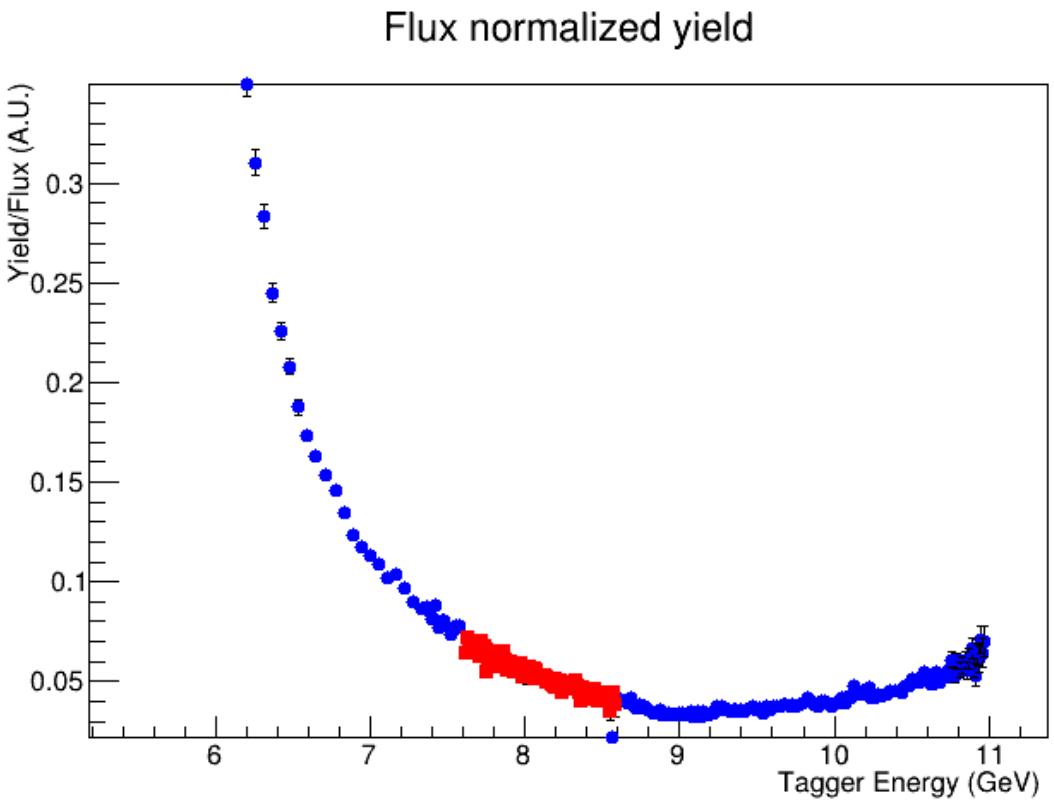


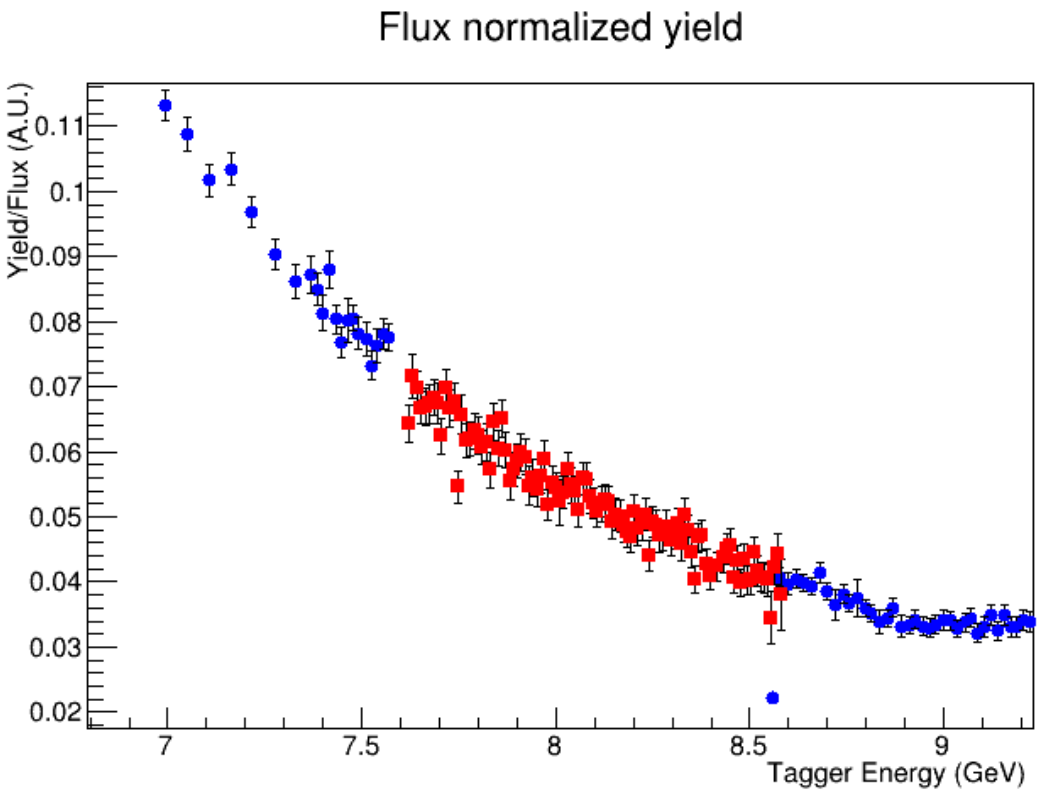
$E_{FCAL} + E_{CCAL} - E_{BEAM}$ (GeV)

- Subtract accidentals
- Subtract background using empty target runs
- Fit for event yield using a Crystal Ball function

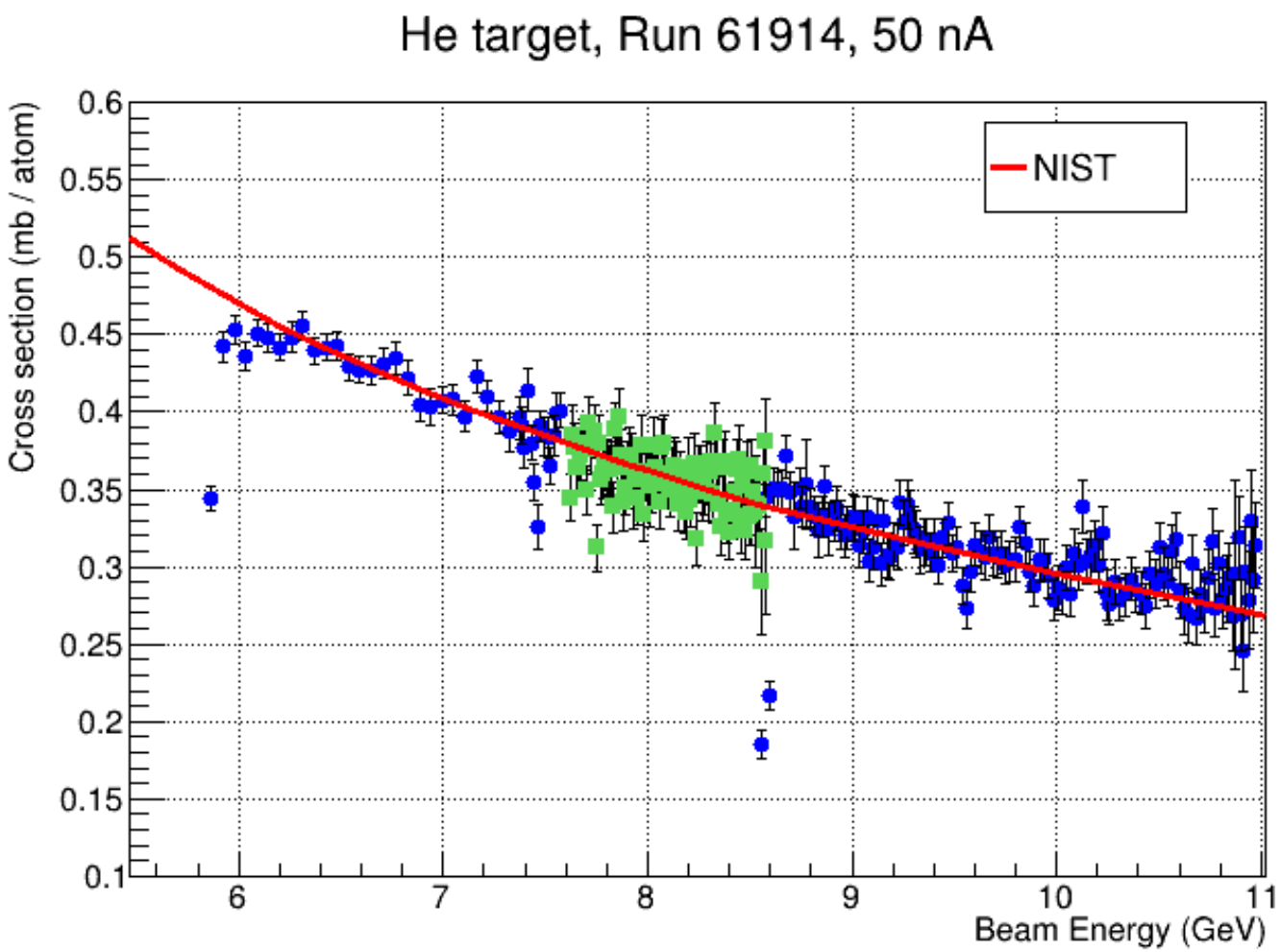
Flux Normalized Yield

Run 61914





Compton Cross Section



Note: there are uncertainties in He target density

- Shape of the cross section is in a relatively good agreement with theoretical predictions
- need to check with larger statistics