

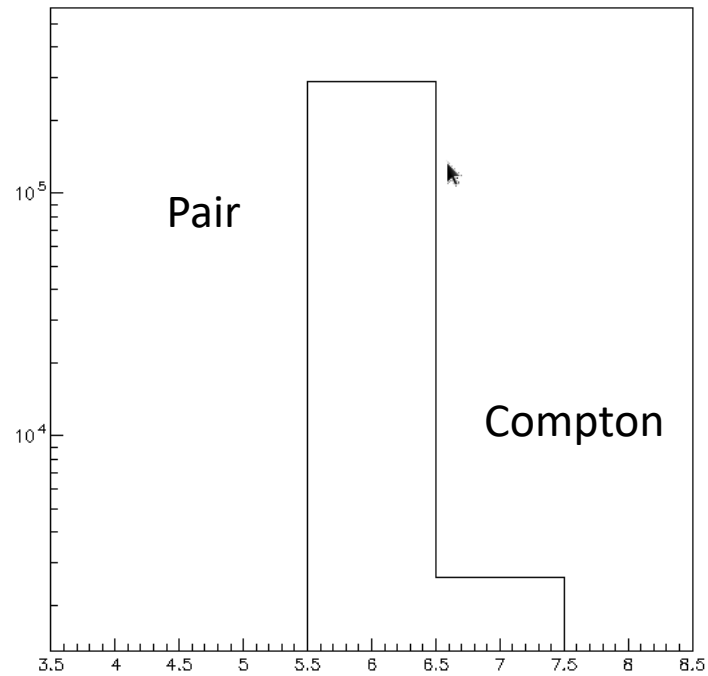
**Verification of the Pair Spectrometer Acceptance using
Compton events**

(work progress)

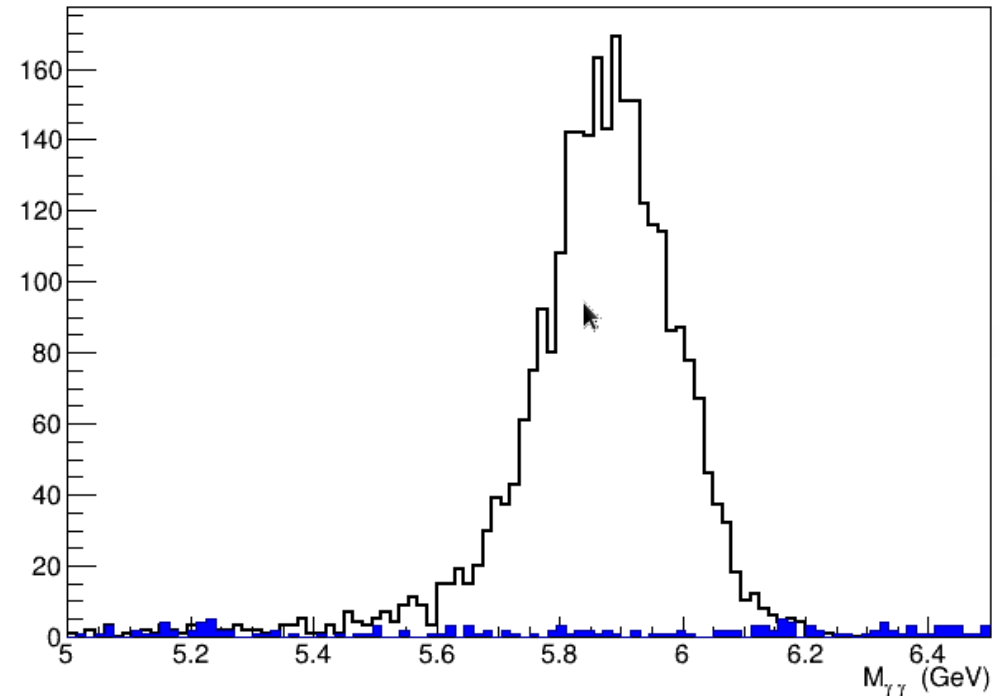
Sasha, June 19, 2020

Pair Production in Geant

Geant process (LMEC)



σ (Compton) / σ (Pair) = 0.09 at 6 GeV (He target)
NIST - 0.087

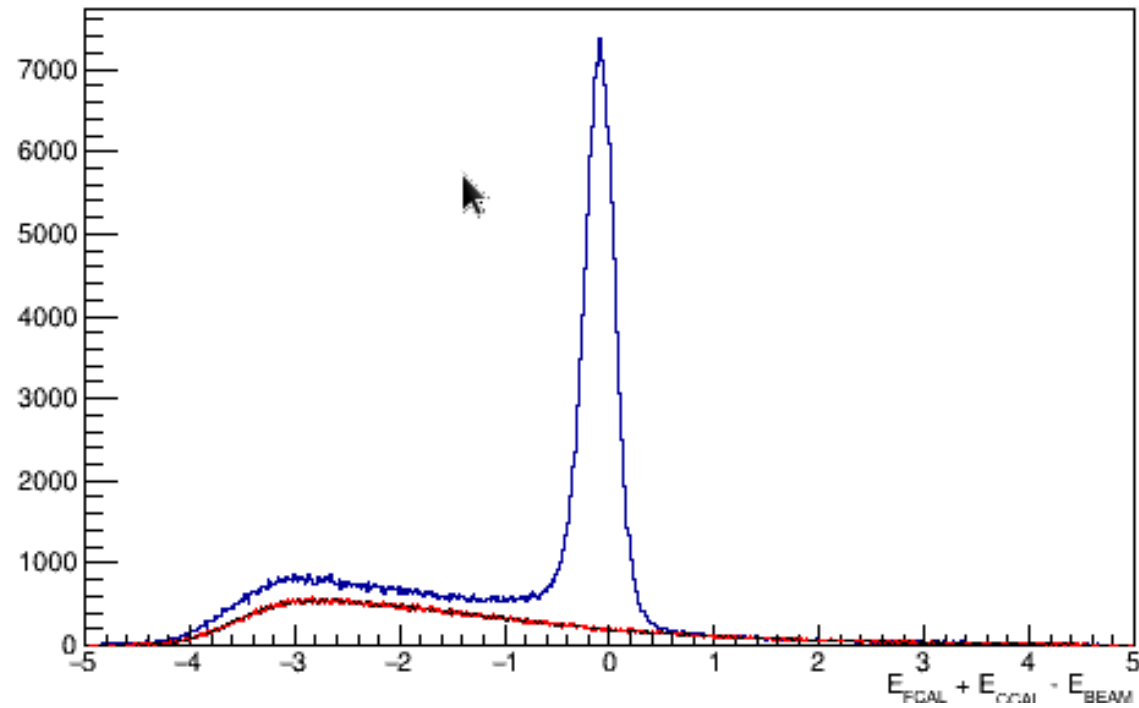


Fraction of pair under Compton peak: 3 – 5 %

Background: Empty Target

Process larger empty target sample

Empty Target, 6 - 7 GeV



Slides from Previous Meeting

Comments Regarding MC Simulation

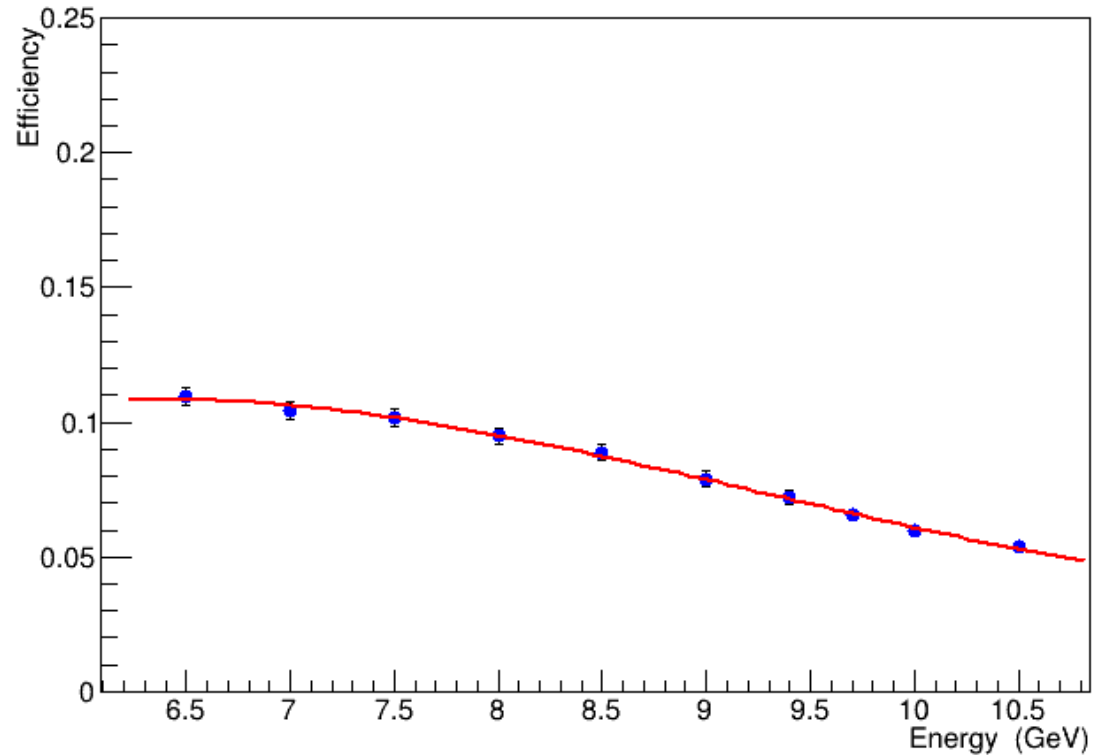
- For MC simulation set JANA_CALIB_CONTEXT to “variation = mc”
(for data processing use “variation = default “)
 - CCDB tables with variation “mc” will be used during in Geant and mcsmeas
- Assigned variation “MC” to the beam_spot Monte Carlo table. Added PS acceptance to the CCDB
- Some minor issues 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 than 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 ($\Delta t = 8 \text{ ns}$), $\Delta t (\text{FCAL} - \text{RF}) < 3 \text{ ns}$
 - $E_{\text{CCAL}} > 1 \text{ GeV}$, $E_{\text{FCAL}} > 0.5 \text{ GeV}$
 - fiducial cuts in calorimeters:
exclude fc al inner ring, $-7 \text{ cm} < X_{\text{CCAL}} < 9 \text{ cm}$, $-9 \text{ cm} < Y_{\text{CCAL}} < 9 \text{ cm}$

Monte Carlo Simulation: Compton Events

Reconstruction efficiency, Run 61914



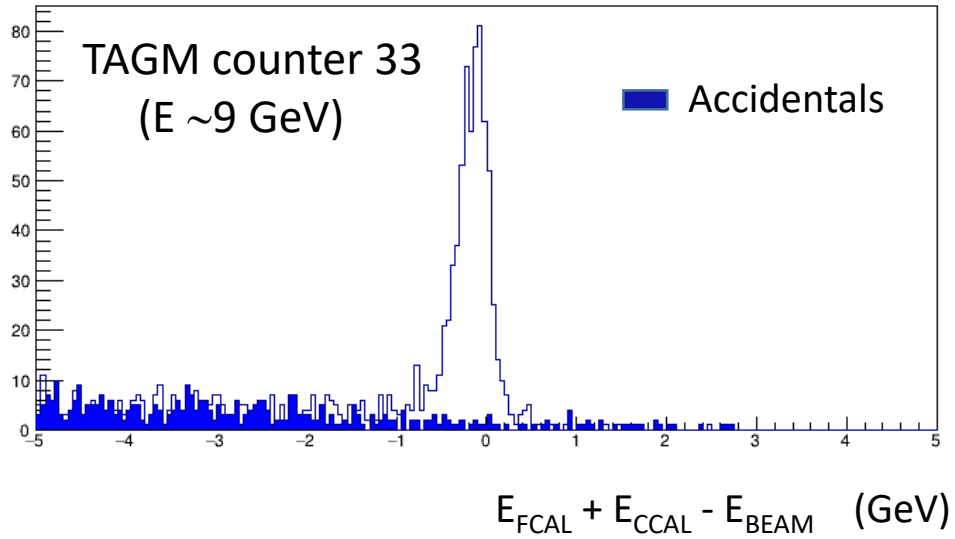
Monte Carlo samples generated by Igal using Pawel event generator

- Radiative corrections included

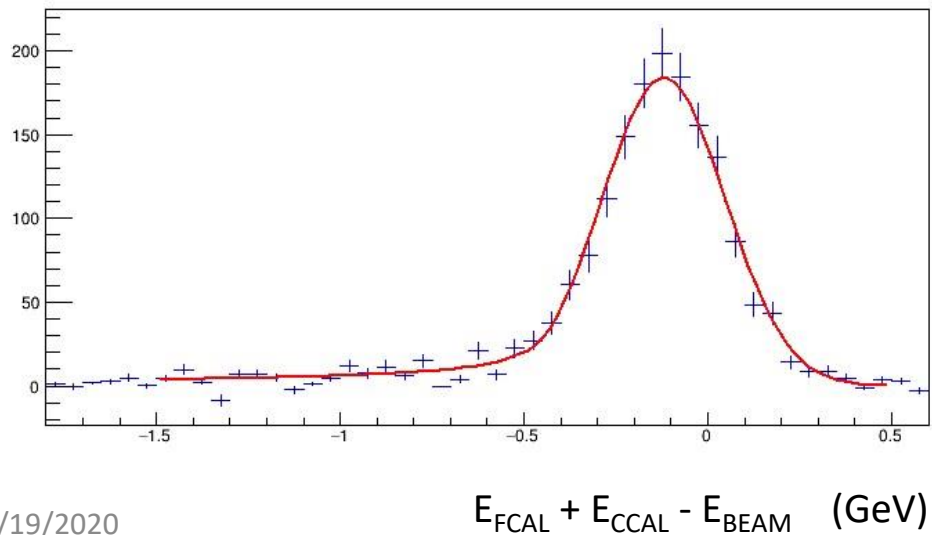
- Igal has implemented the generator to the GlueX framework (to be checked) !

Compton Reconstruction

Run 61914



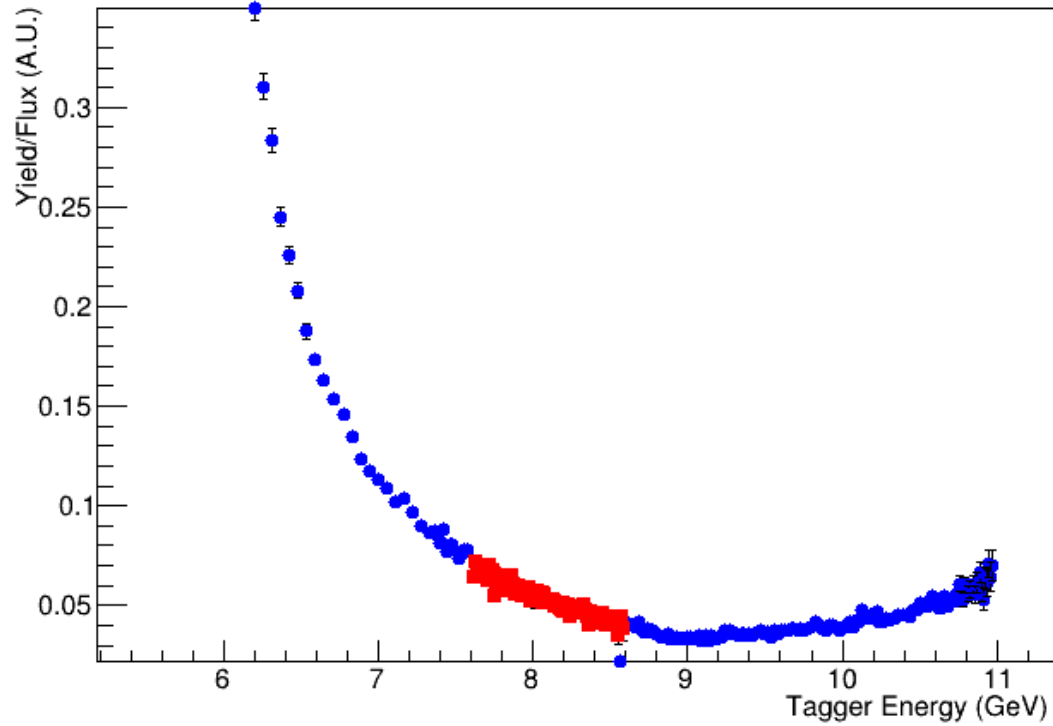
- Subtract accidentals
- Subtract background using empty target runs
- Fit for event yield using a Crystal Ball function



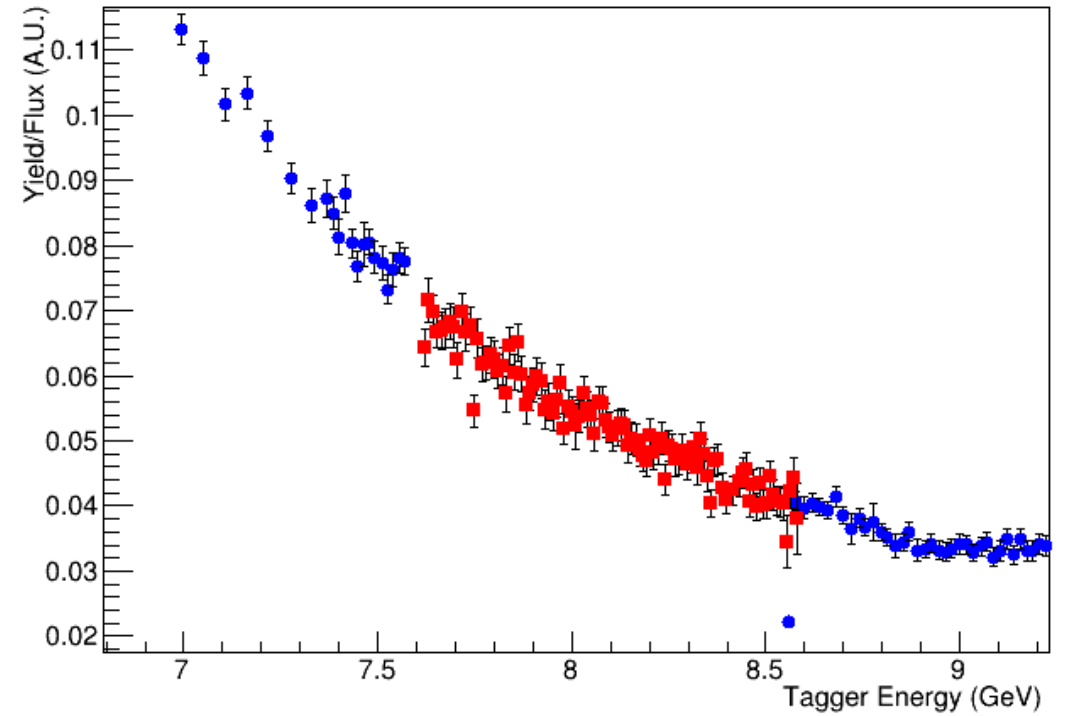
Flux Normalized Yield

Run 61914

Flux normalized yield

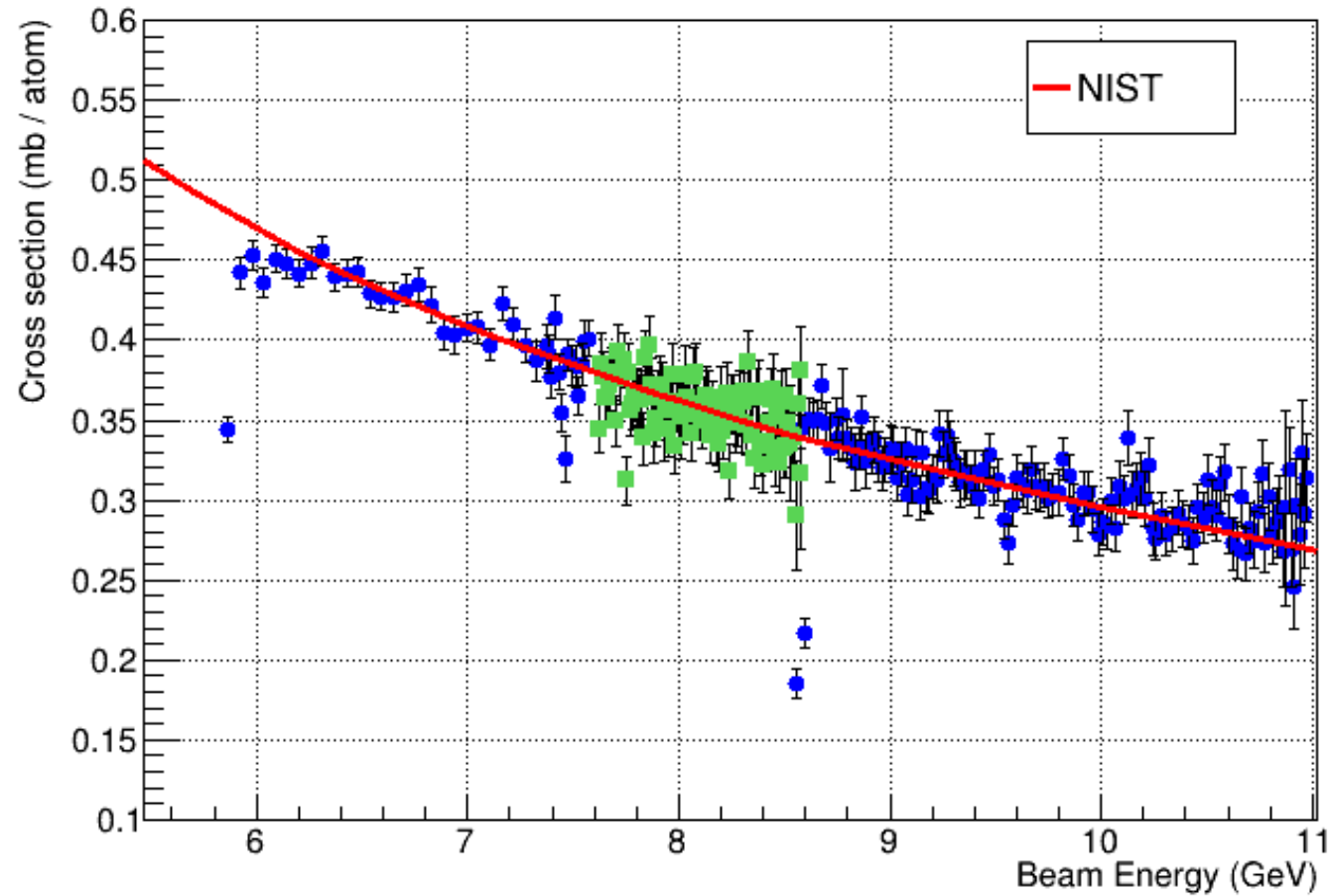


Flux normalized yield



Compton Cross Section

He target, Run 61914, 50 nA



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