University *of* Massachusetts Amherst

η photo-production simulations

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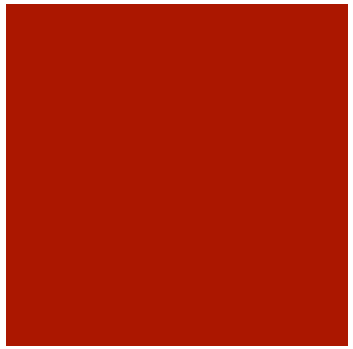
Goal: study the feasibility of a measurement of the η radiative decay width via Primakoff effect using GlueX apparatus

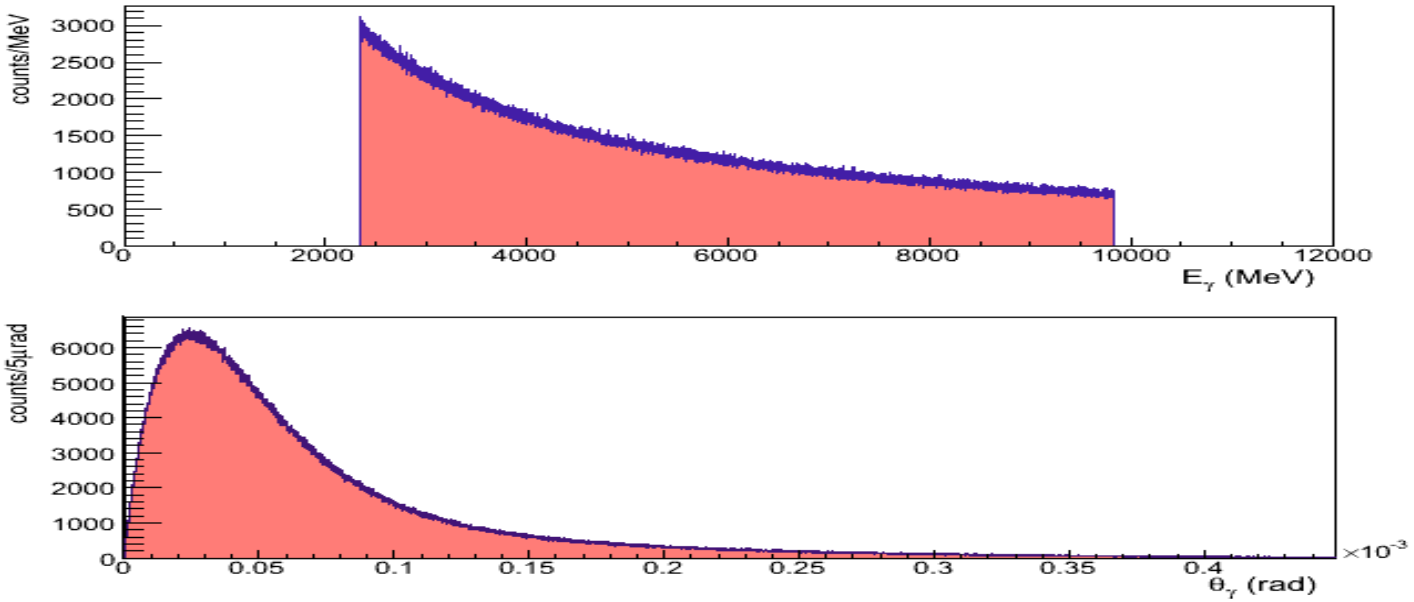


$\gamma p \rightarrow \eta p$ generator is needed

- Select θ_{γ} and E_{γ} according to the incoherent bremsstrahlung
- Use theoretical cross-section to select θ_{η} and generate $\left(E_{\eta}, \vec{p}_{\eta}\right)$ according to the kinematics
- Generate a vertex position within the target.

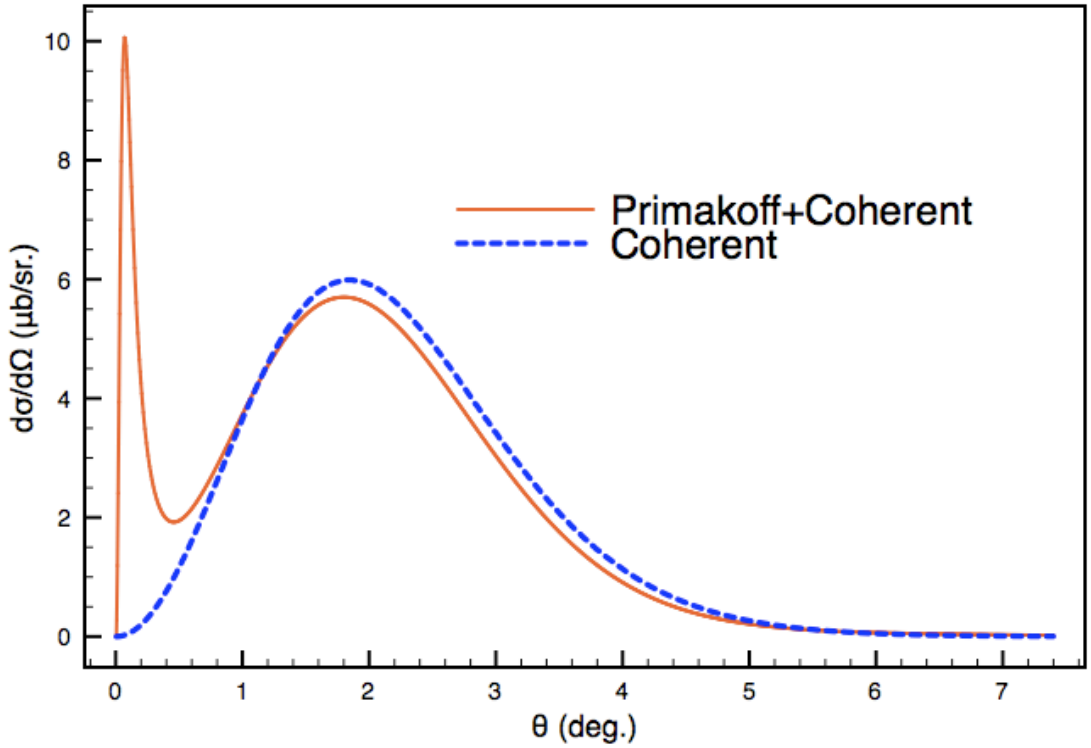
Incoherent Bremssrahlung Generator

- The shapes for the energy and the angular distributions “borrowed” from GEANT4.



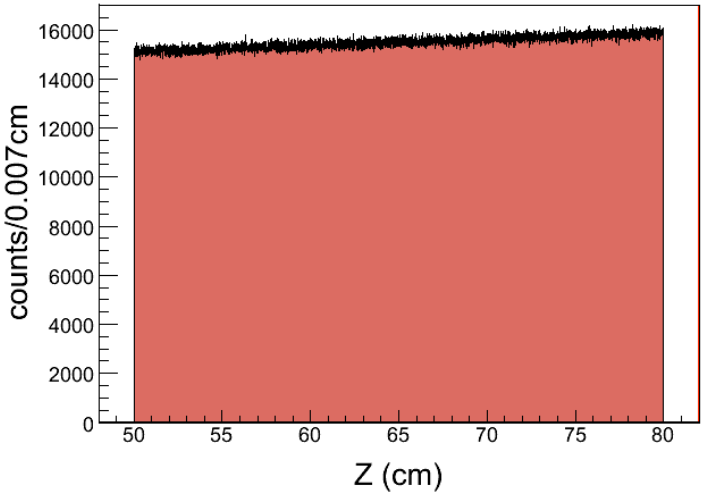
γp->ηp cross-section

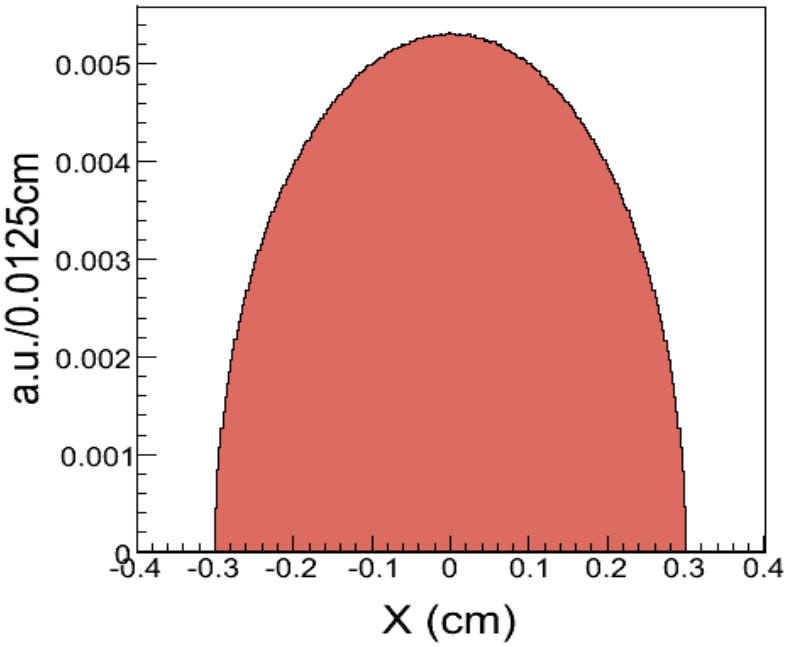
- Due to the negative interference of the amplitudes the Primakoff and coherent events cannot be generated separately

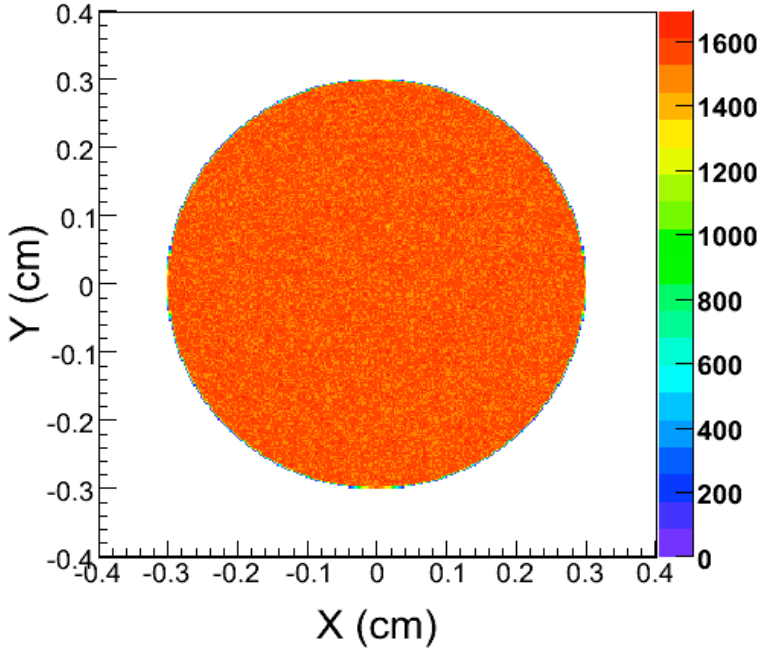


γp->ηp generator, vertex position

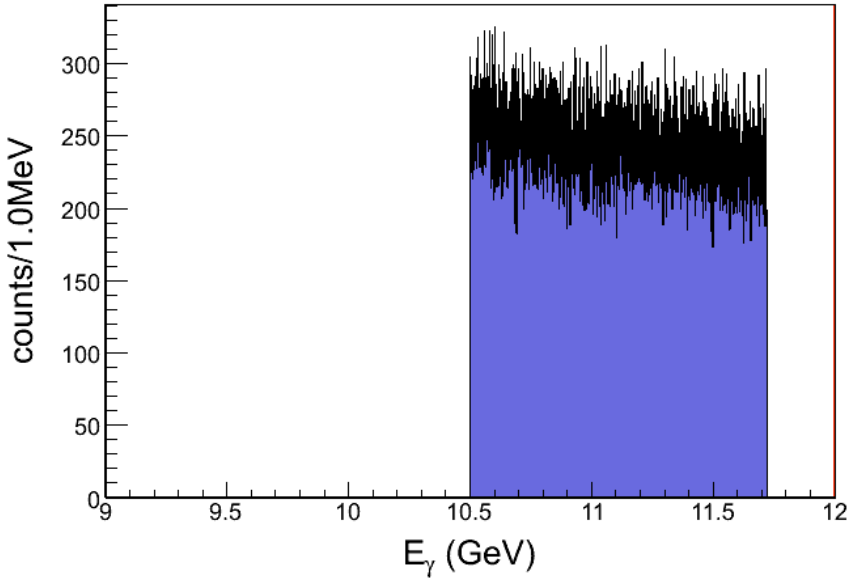
Target:
density = 0.0708 g/cm^3
attenuation length = 43.3 g/cm^2

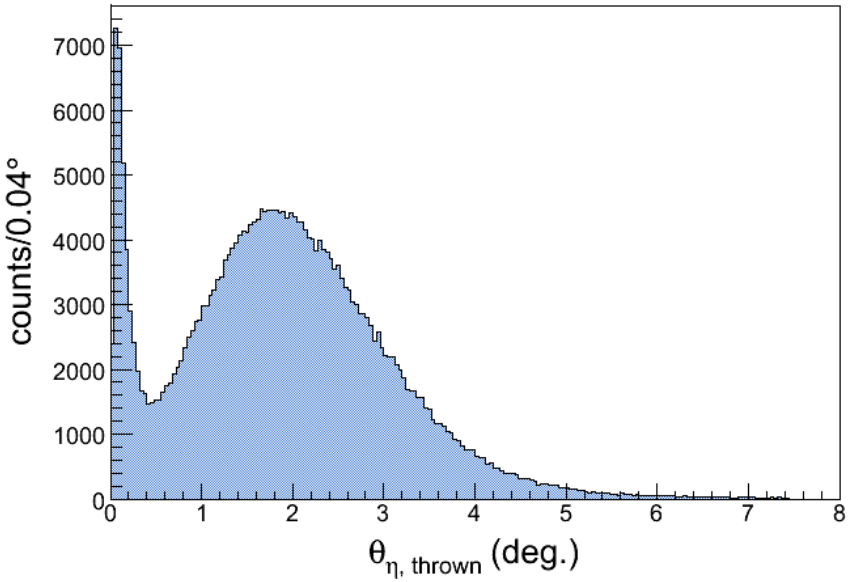


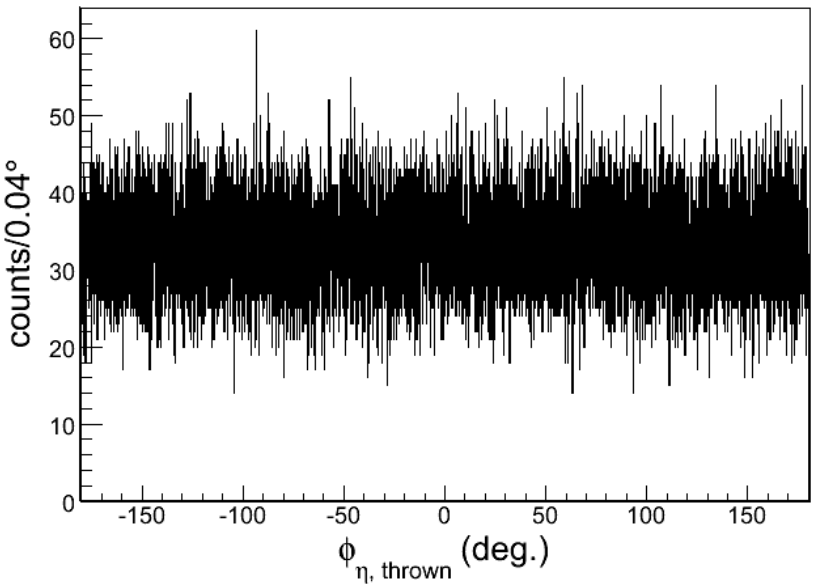


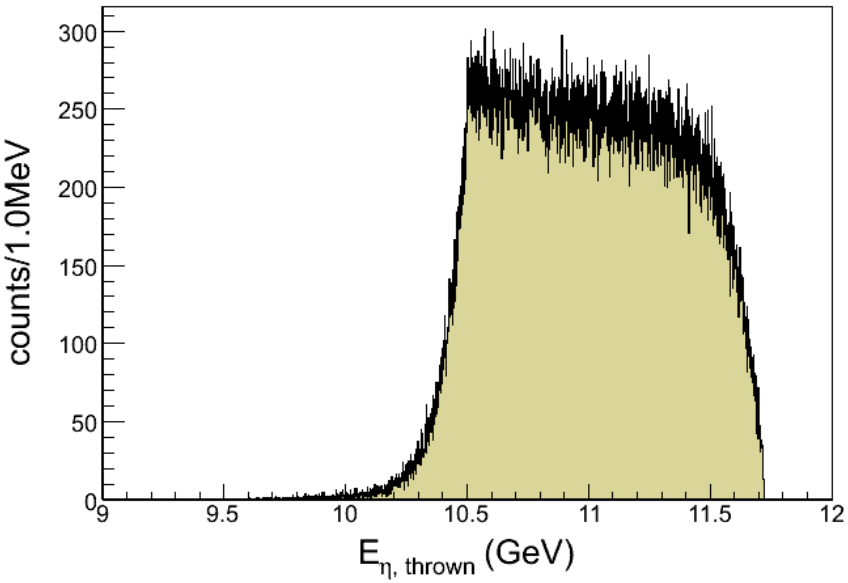


γp->ηp generator

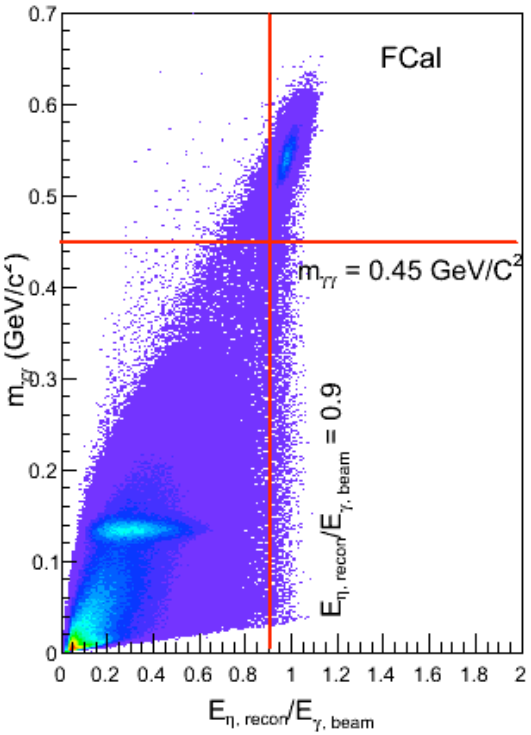


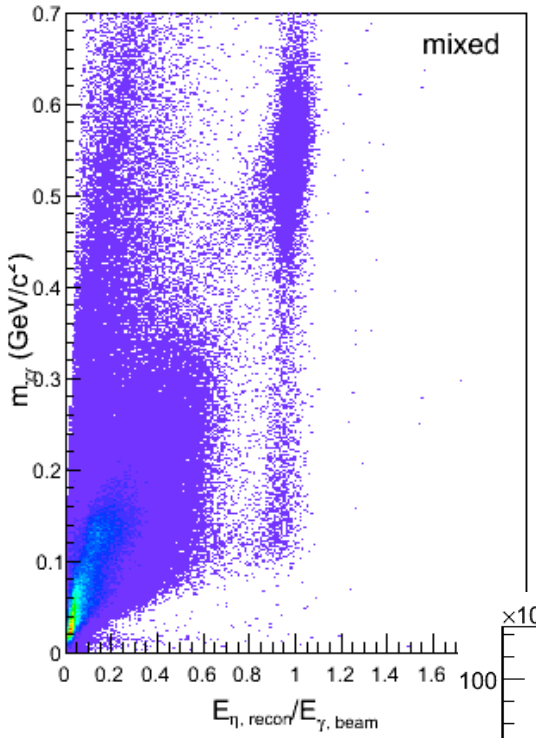


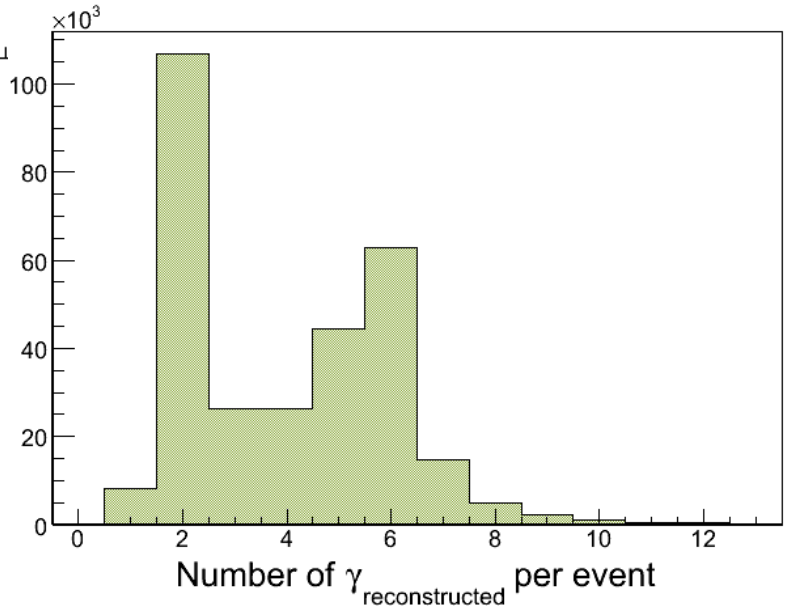




Looking at HDGeant output





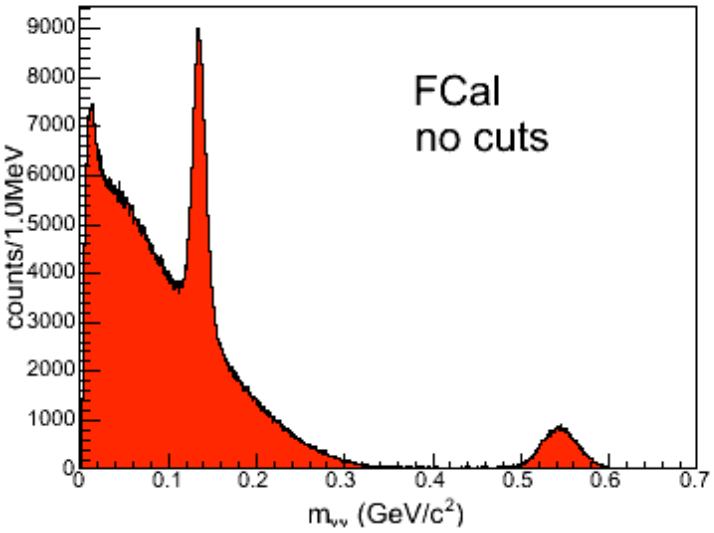


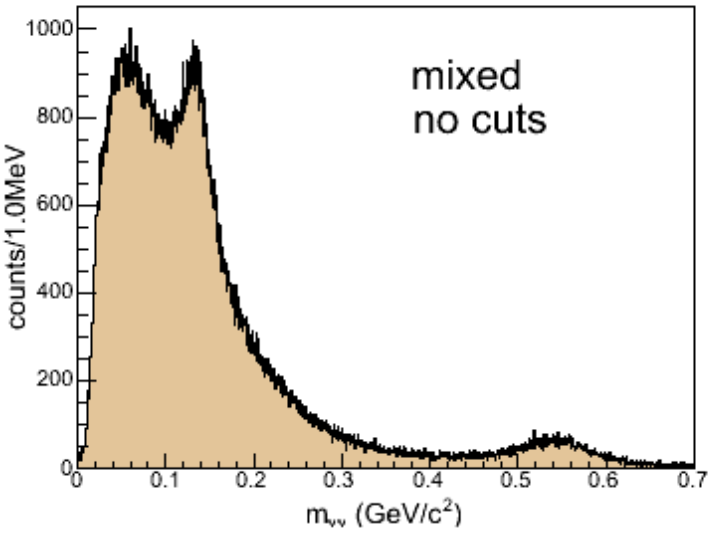
Dominant neutral modes:

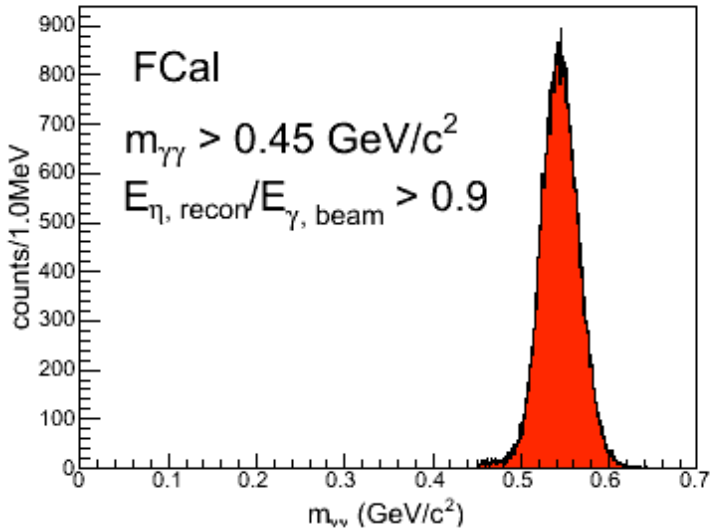
$\eta \rightarrow \gamma\ \gamma$ 39.33%

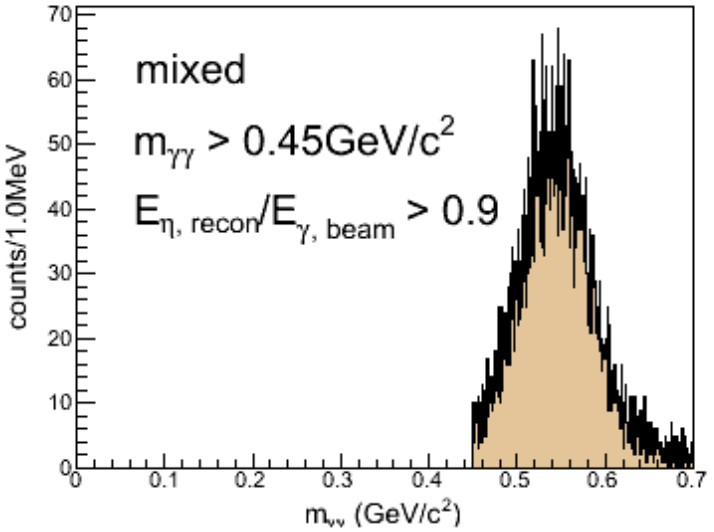
$\eta \rightarrow 3\pi^0$ 32.24%

Looking at HDGeant output

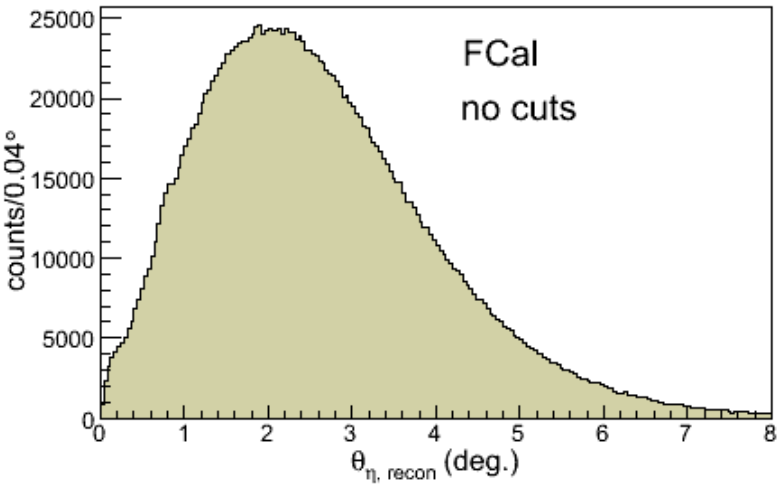


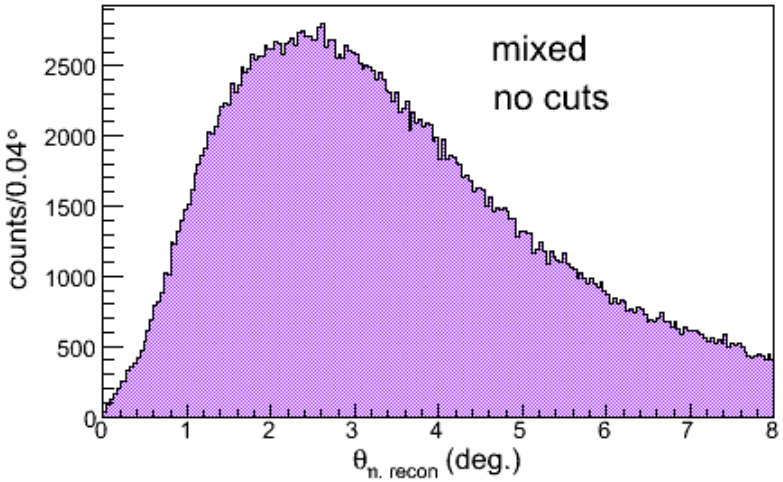


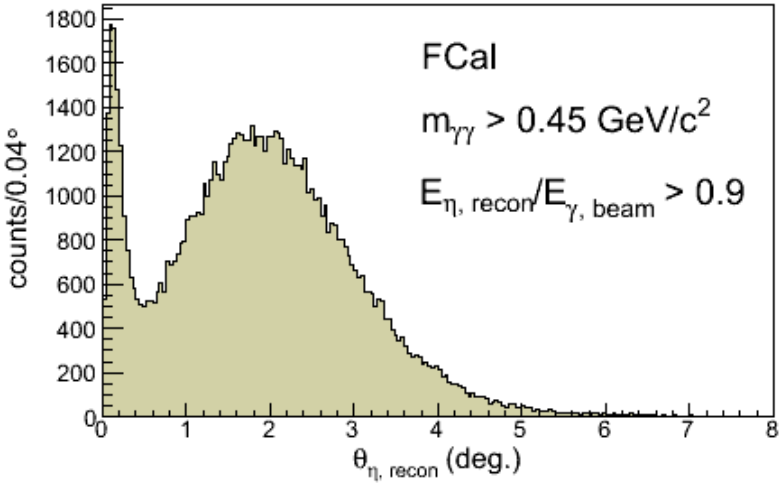


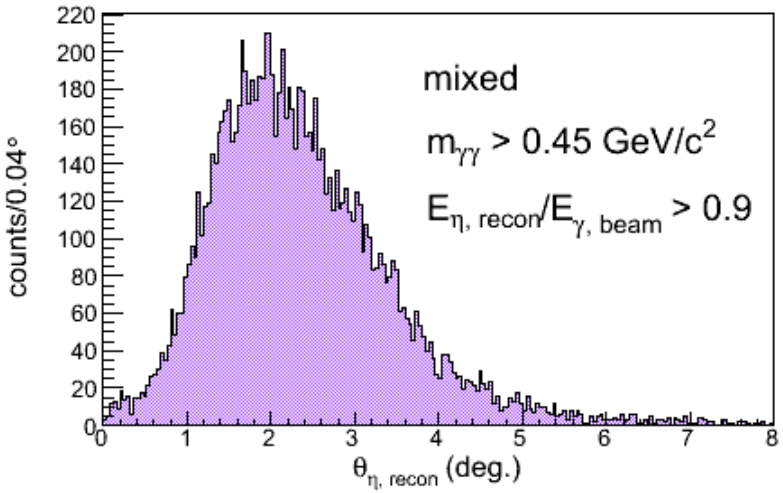


Looking at HDGeant output

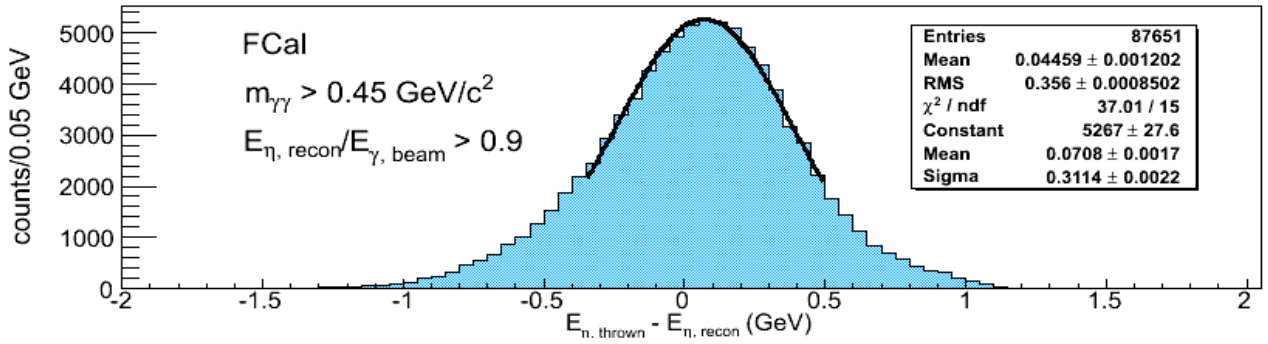


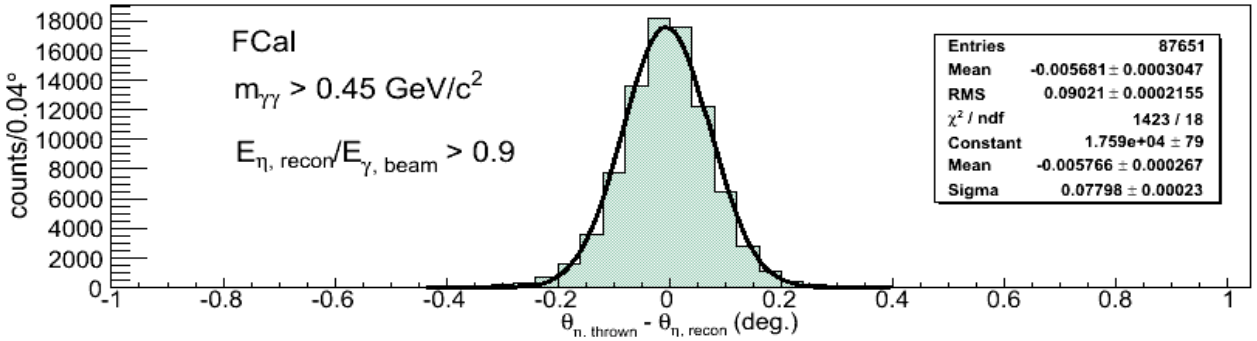


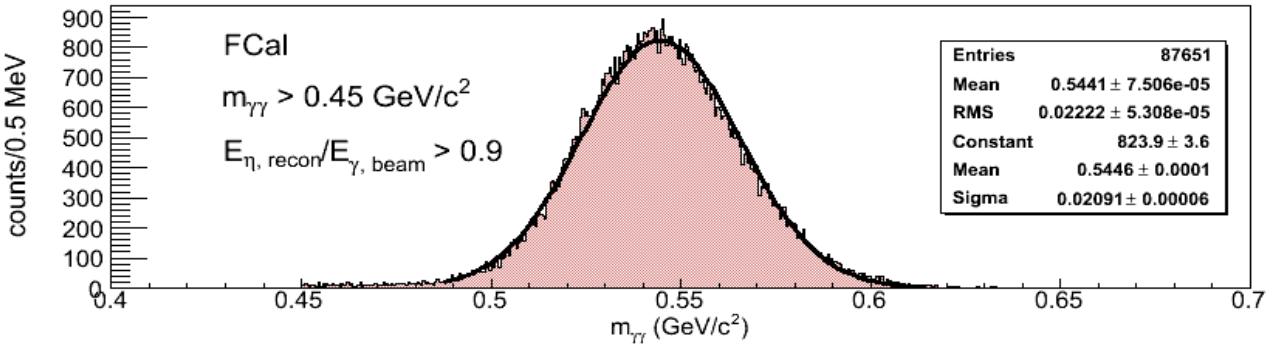




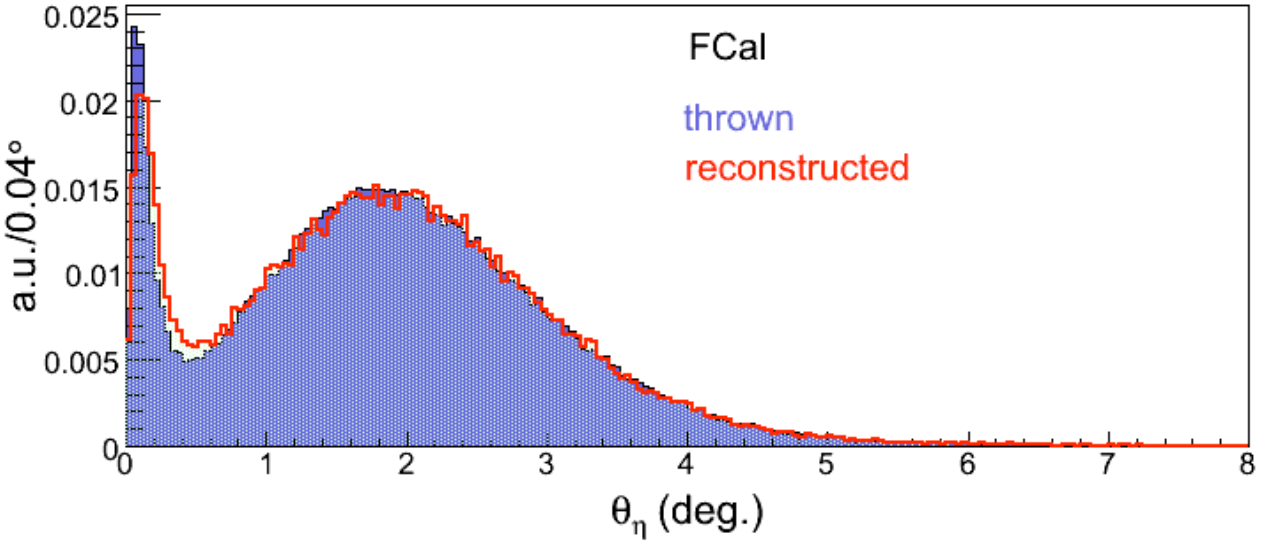
FCal resolutions for $\eta \rightarrow \gamma\ \gamma$ events

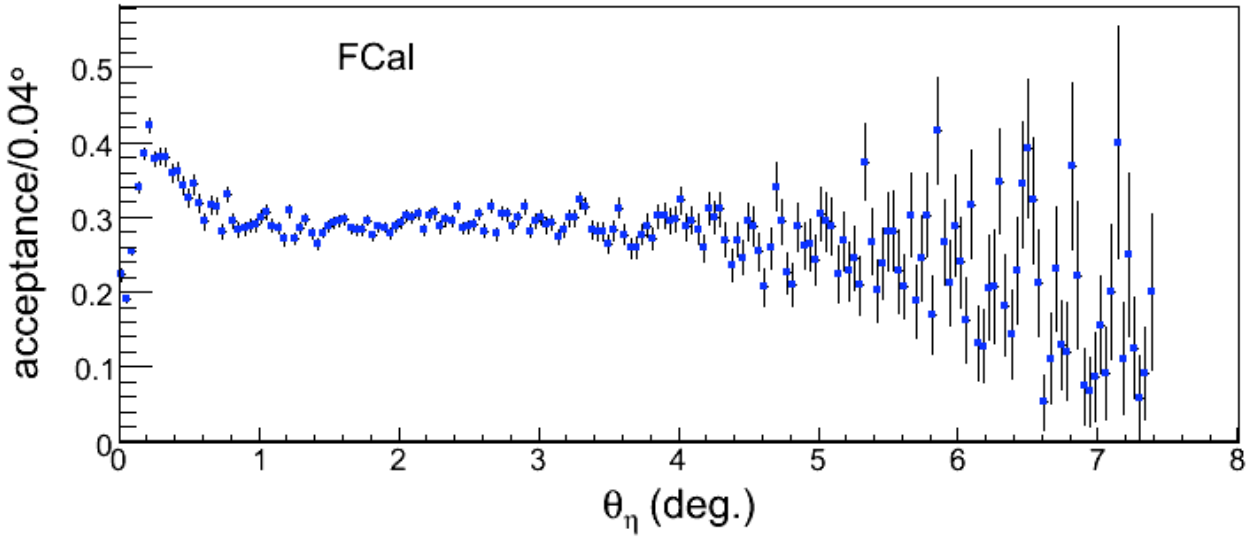






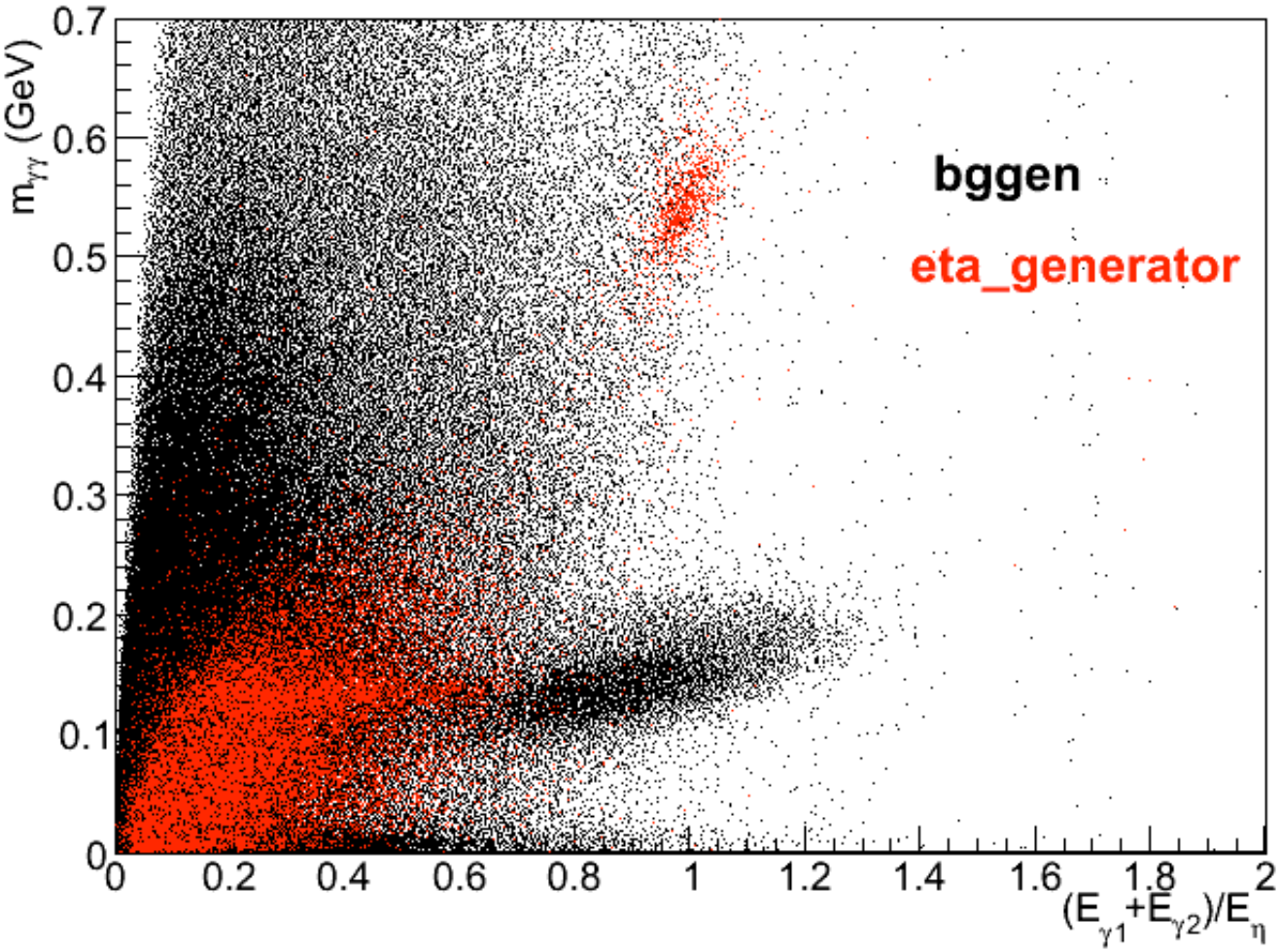
FCal acceptance for $\eta \rightarrow \gamma\ \gamma$ events





Acceptance for $\eta \rightarrow \gamma\ \gamma$ events ~ 70-75%

Backgrounds



The γ p-> η p events are excluded from the bggen outupt (process type 8)

$\sigma_{\text{hadr.}} \approx 124\,\mu$ b
$\sigma_{\text{Prim.}} \approx 0.00072\,\mu$ b
$\sigma_{\text{Prim.+coh.}} \approx 0.057\,\mu$ b