

BAYESIAN fit of event yield asymmetries

MARKOV-Chain diagnostics:

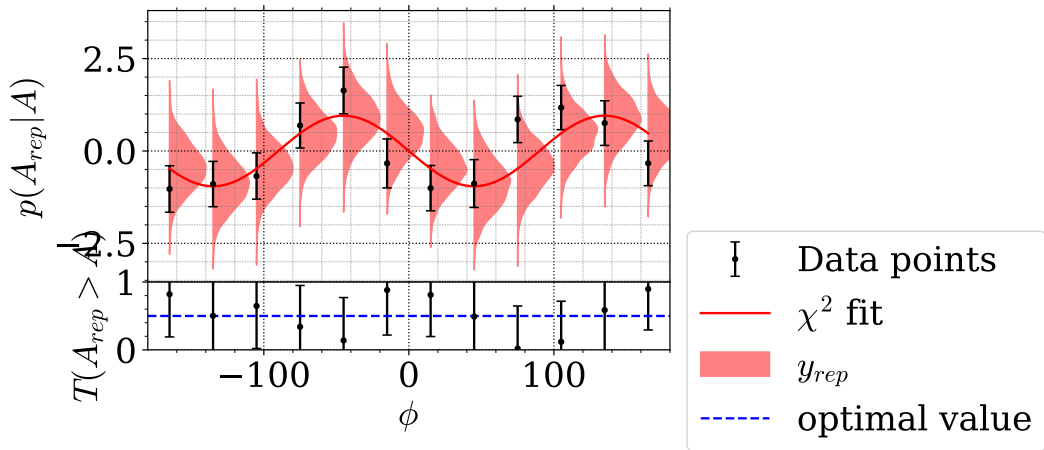
- ▶ MONTE-CARLO Standard-Error (MCSE)
- ▶ \hat{R}

Goodness of Fit:

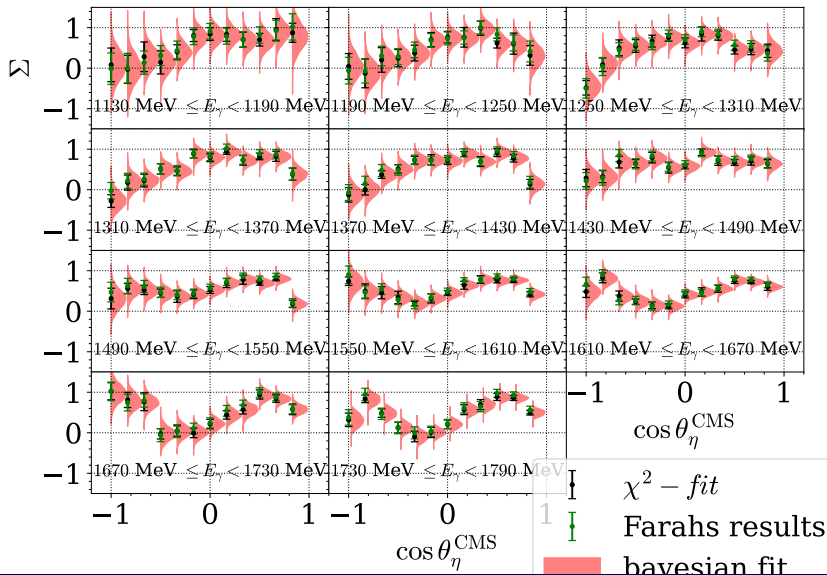
- ▶ p -value calculated from reproduced data

BAYESIAN fit of event yield asymmetries

$$1130 \leq E_\gamma < 1190, 0.67 \leq \cos \theta_\eta^{\text{CMS}} < 0.83$$



BAYESIAN fit of event yield asymmetries



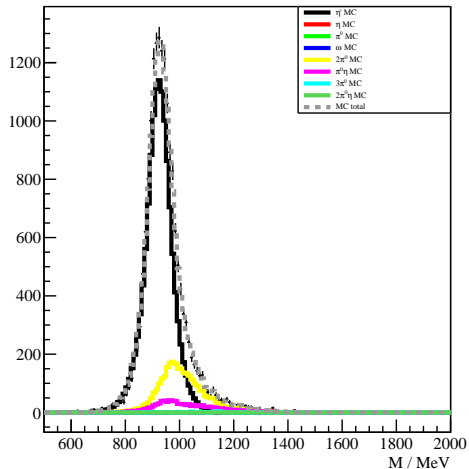
Event selection

2013 hydrogen beam time

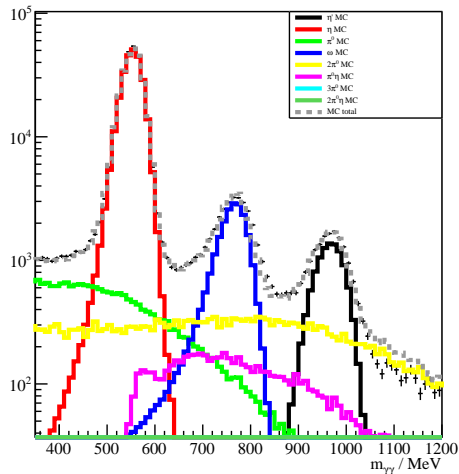
- ▶ charge cut (3 PED)
- ▶ time cuts (prompt peak and bkg subtraction)
- ▶ $E_\gamma > 1400$ MeV
- ▶ ~~$E_\gamma^{\text{calc}} > 1447$ MeV~~
- ▶ coplanarity
- ▶ polar angle
- ▶ missing mass
- ▶ invariant mass

Event selection

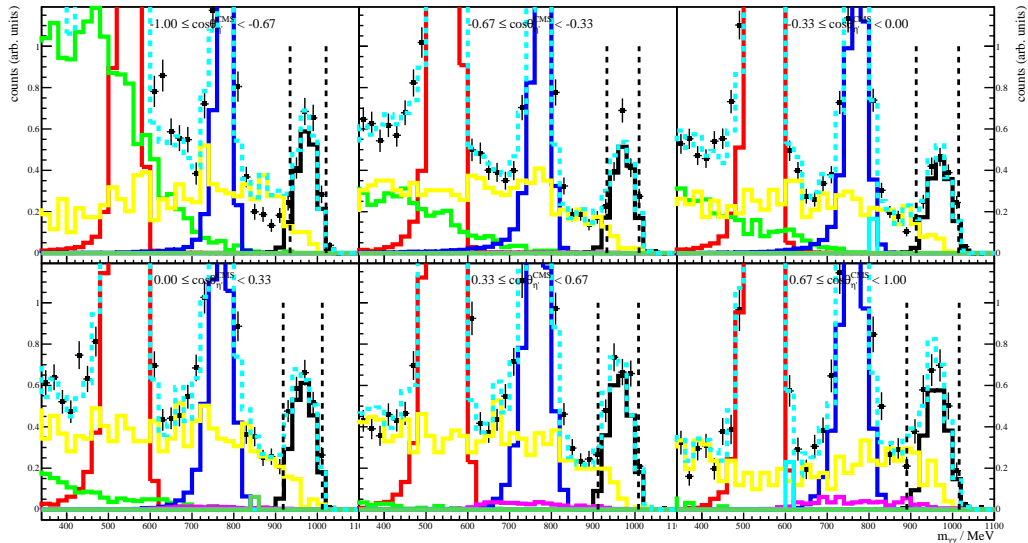
Missing mass



Invariant mass $m_{\gamma\gamma}$



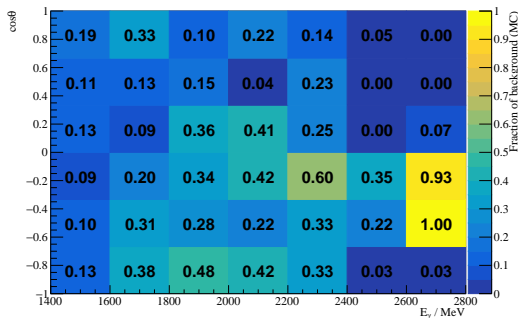
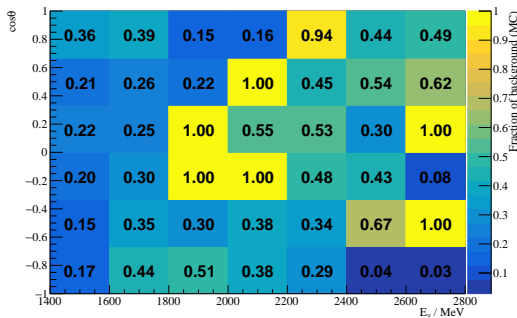
Event selection



Event selection

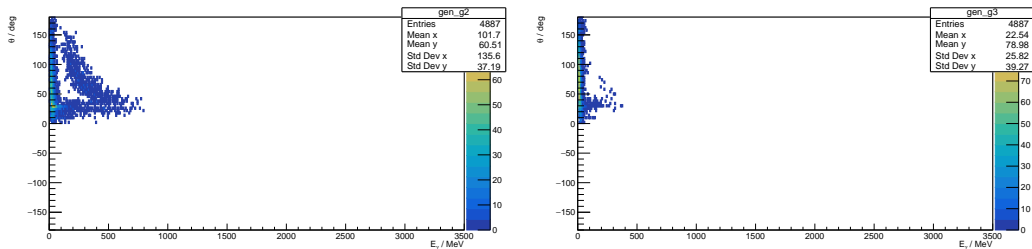
Additional cuts to (try to) reduce bkg:

- ▶ p in CB for $E_\gamma < 1500$ MeV
- ▶ $E_{\gamma_i} < 1500$ MeV
- ▶ $\text{ClusterPEDCount}(\gamma_i) = 1$
- ▶ $\text{Clustersize}(p) < 6$
- ▶ $\text{Clustersize}(\gamma_i)$ in FW



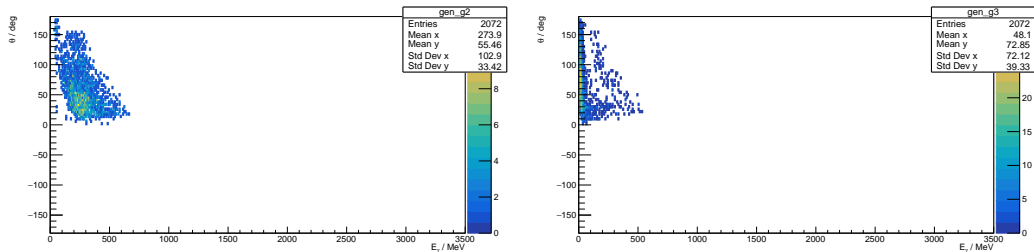
Investigation of Background contributions ($2\pi^0 \rightarrow 4\gamma$ and $\pi^0\eta \rightarrow 4\gamma$)

two cases: $E_\gamma \lesssim 20$ MeV, or $\theta_{\gamma_i} \approx \theta_{\gamma_j}$, combining two (or three) photons to one



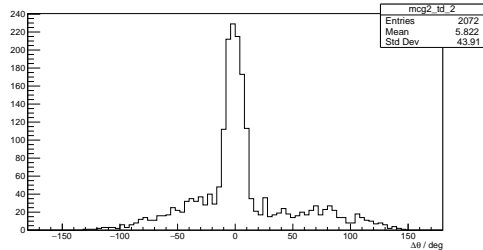
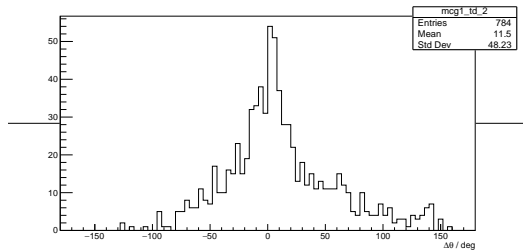
Two lowest energy photons of $2\pi^0$ production (MC)

Investigation of Background contributions ($2\pi^0 \rightarrow 4\gamma$ and $\pi^0\eta \rightarrow 4\gamma$)



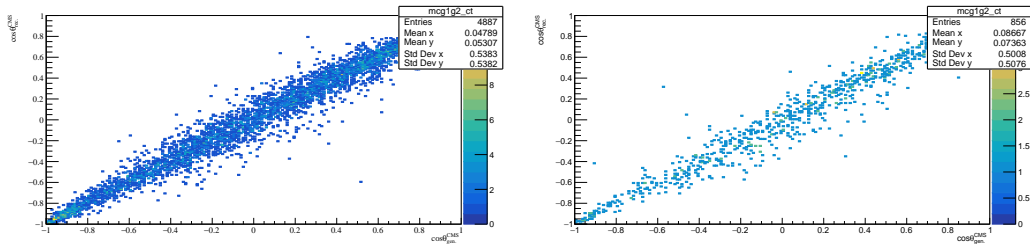
Two lowest energy photons of $\pi^0\eta$ production (MC)

Investigation of Background contributions ($2\pi^0 \rightarrow 4\gamma$ and $\pi^0\eta \rightarrow 4\gamma$)



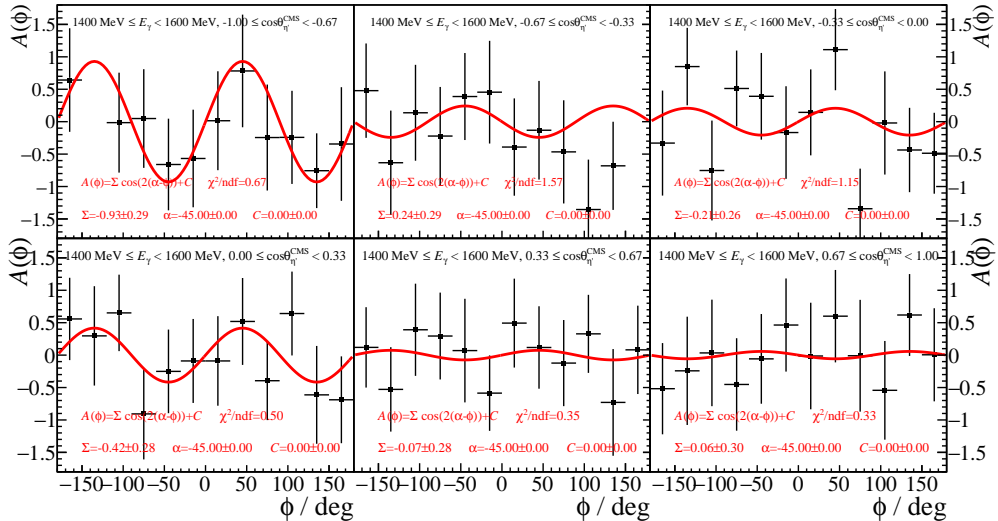
Angular difference between second lowest energy photon and one of the highest energy photons

Investigation of Background contributions ($2\pi^0 \rightarrow 4\gamma$ and $\pi^0\eta \rightarrow 4\gamma$)



gen. CMS angle vs. meas. CMS angle for background contributions

$$\text{Asymmetry } A(\phi) = \frac{N^\perp - N^\parallel}{p_\gamma^\parallel N^\perp + p_\gamma^\perp N^\parallel} = \Sigma \cos(2(\alpha^\parallel - \phi))$$



Beam asymmetry Σ

