FCAL Efficiency w/ $\gamma p \to \omega p$, $\omega \to \pi^+ \pi^+ \pi^0, \pi^0 \to \gamma(\gamma)$
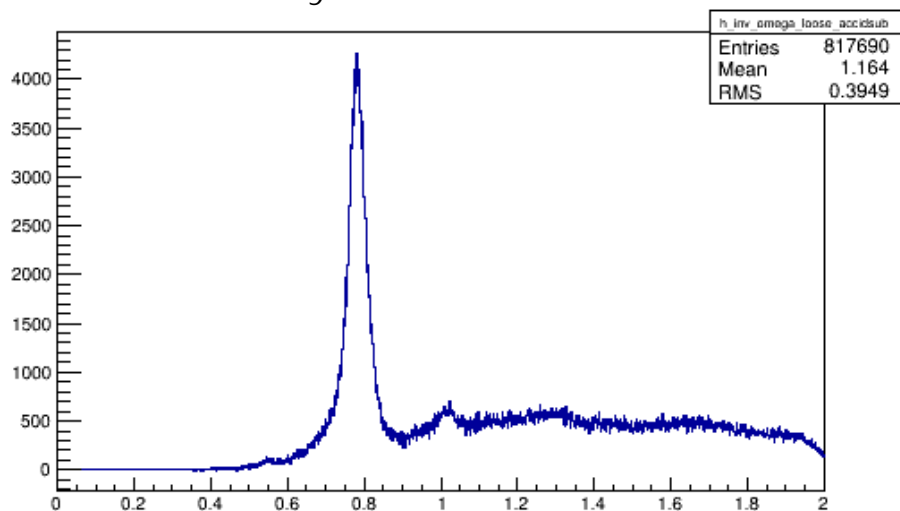
- Initially found photon > 500 MeV

- # neutrals candidates for other photon
  - 0 or 1 candidate(s) in FCAL
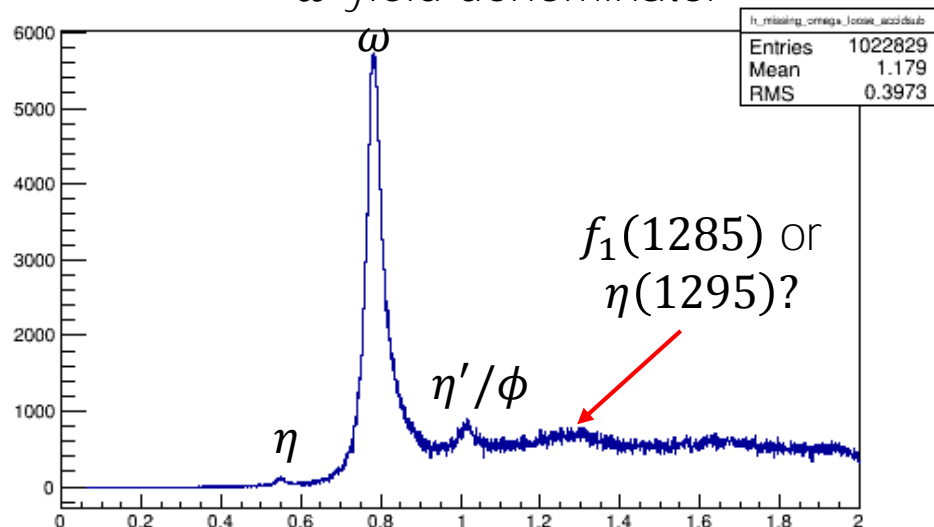 - 0 candidates in BCAL

Masses In 2016 Data

- Topology: $\gamma p \rightarrow \pi^+\pi^-\gamma(\gamma)$, no π^0 requirement yet
- Accidental subtracted (1 bunch before & after in time)

ω yield numerator

h_inv_omega_loose_accidsub	
Entries	817690
Mean	1.164
RMS	0.3949

$\pi^+\pi^-\gamma\gamma$ inv. mass (GeV)

ω yield denominator

h_missing_omega_loose_accidsub	
Entries	1022829
Mean	1.179
RMS	0.3973

ω

η
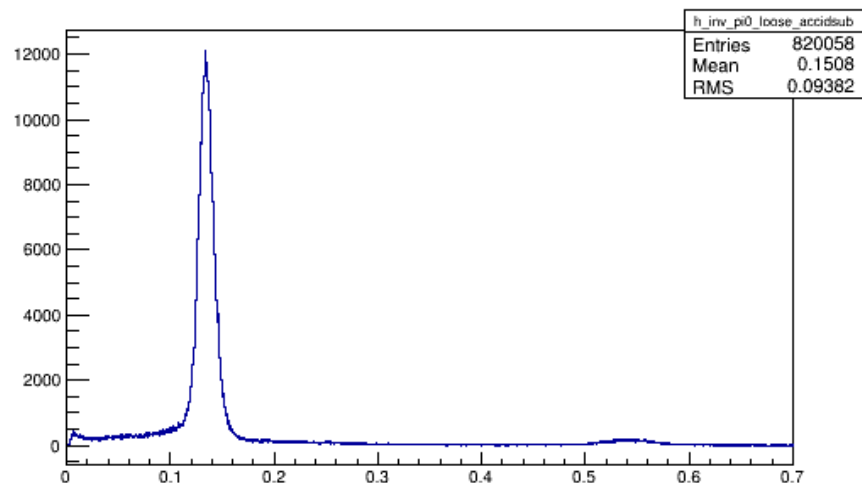
η'/ϕ

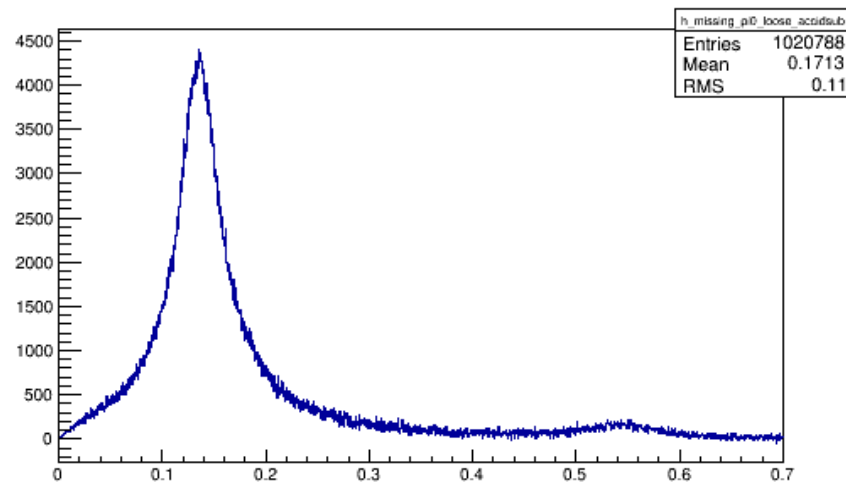$f_1(1285)$ or $\eta(1295)$?

Recoil against p mass (GeV)

Masses In 2016 Data, cont.

- Accidental subtracted (1 bunch before & after in time)
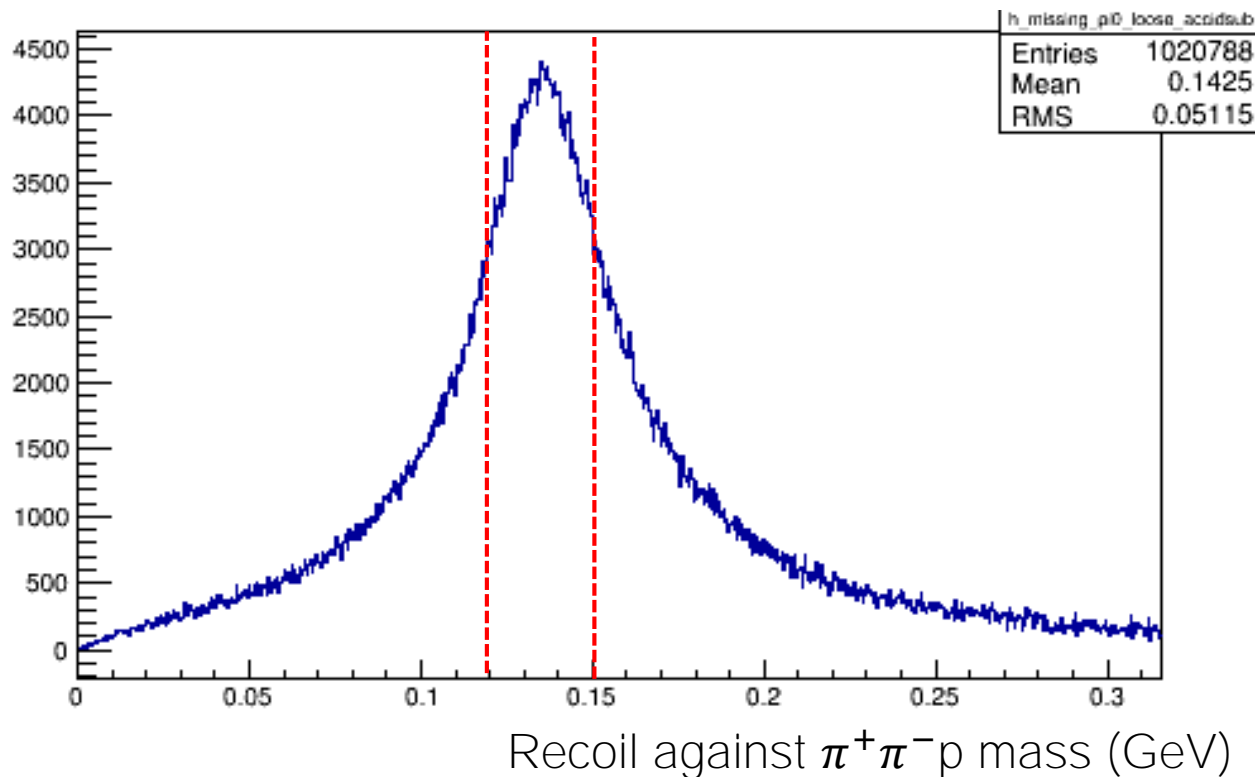- No ω mass cuts

$\gamma\gamma$ inv. mass (GeV)
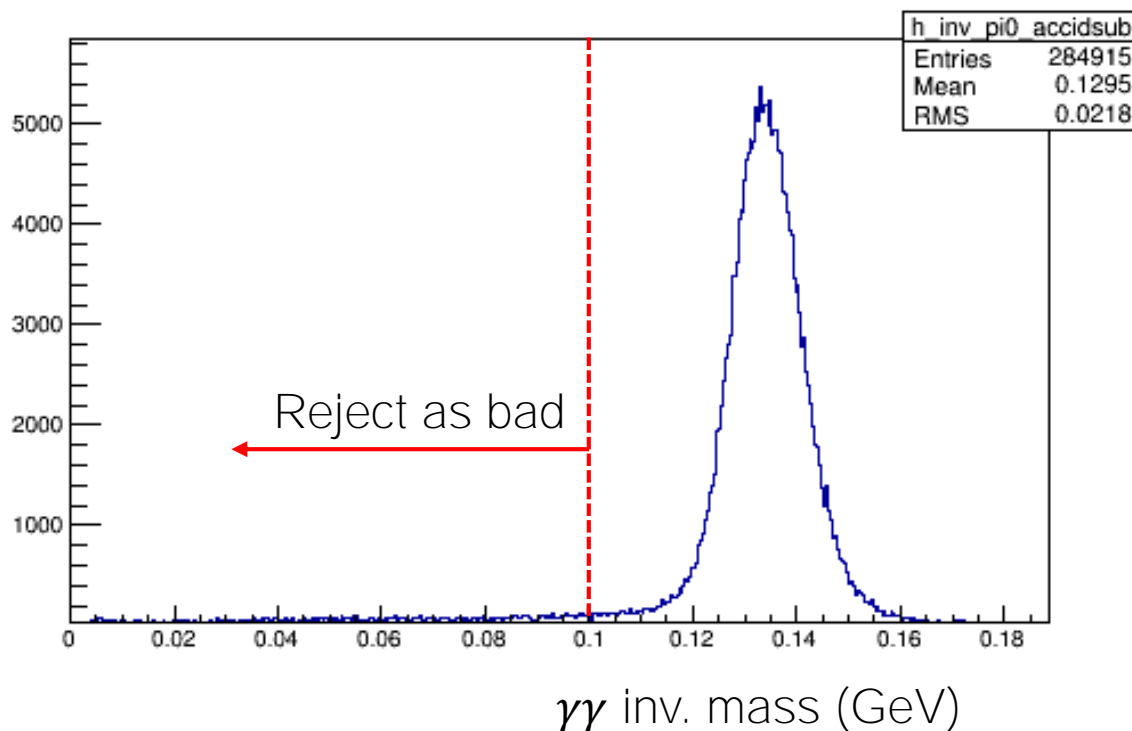
Recoil against $\pi^+\pi^-$p mass (GeV)

Cleaning Up ω Distributions

- Improve purity of numerator and denominator with missing π^0 cut (veto η, suppress some bkg)

Recoil against $\pi^+\pi^-$p mass (GeV)

Post-Missing π^0 Cut

- Purity already looking very good!
- Reject candidates below 0.1 GeV in numerator

$\gamma\gamma$ inv. mass (GeV)

$\Delta\phi$ Distribution

- Accidental subtracted
- Cut for today: $\pm 15°$ of being back-to-back

h_deltaphi_loose_accidsub	
Entries	1027483
Mean	180.3
RMS	12.78

$\phi_{proton} - \phi_{\pi^+\pi^-\gamma\gamma}$ (degrees)
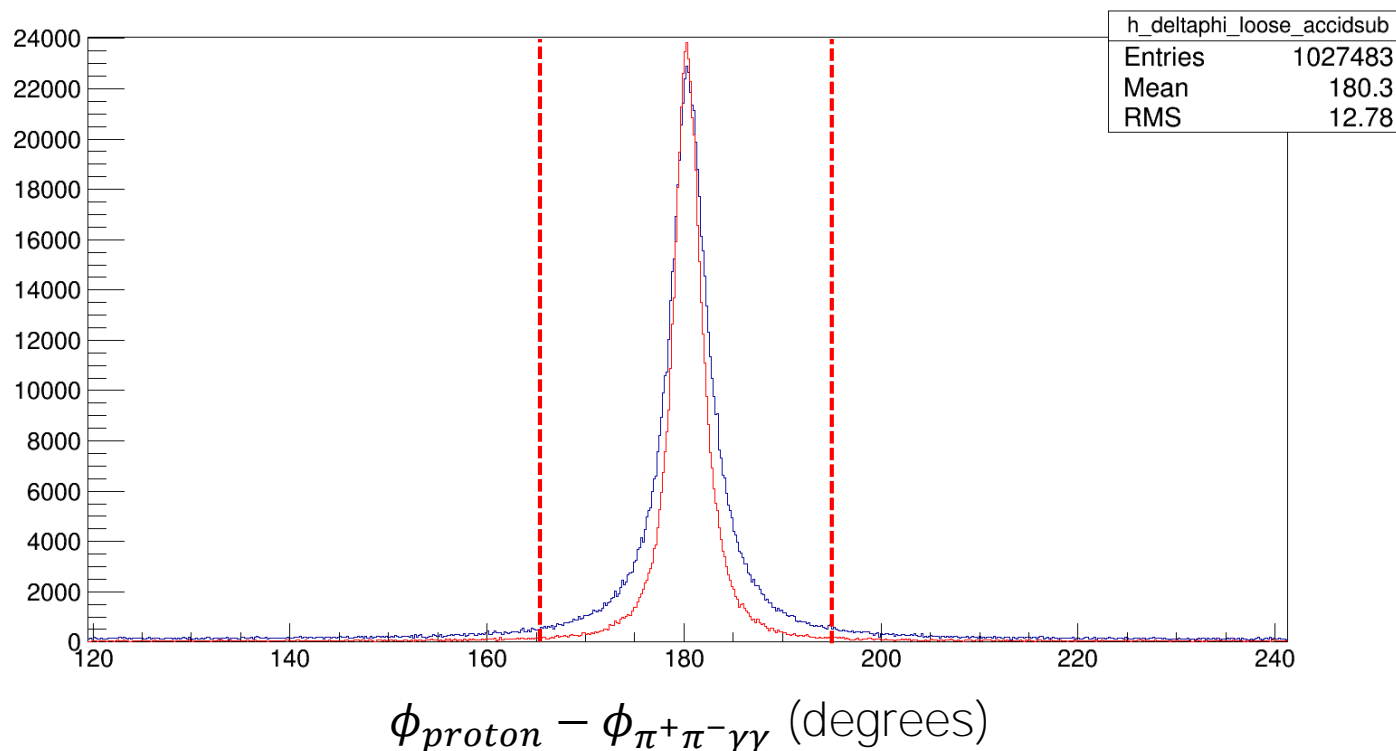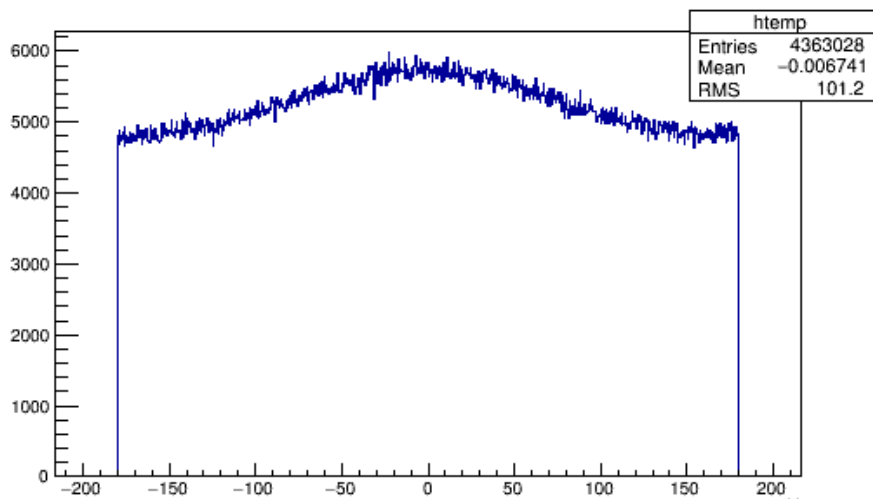
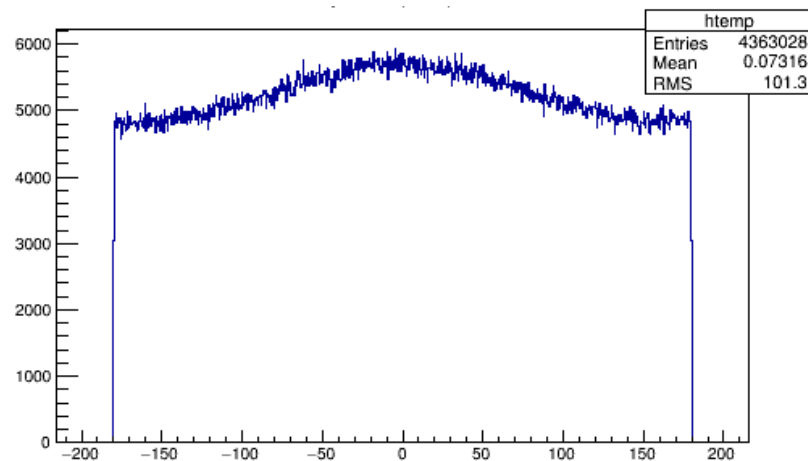# Why is missing 4-momenta not flat in ϕ?

- All other ϕ distributions are flat (proton, $\pi^{\pm}$, $\gamma\gamma$)

Pre-kinematic fit

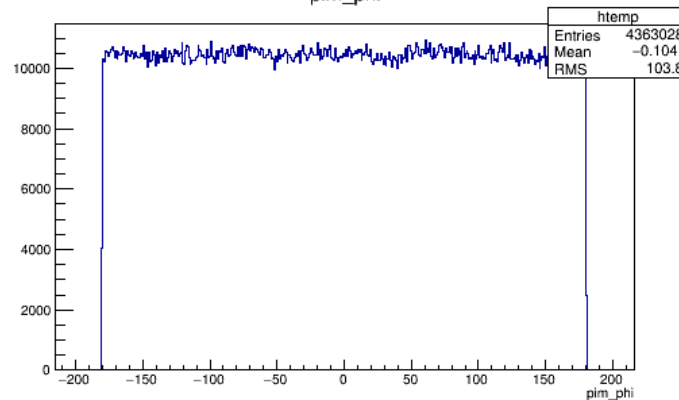Missing 4-momenta ϕ

Post-kinematic fit

Missing 4-momenta ϕ
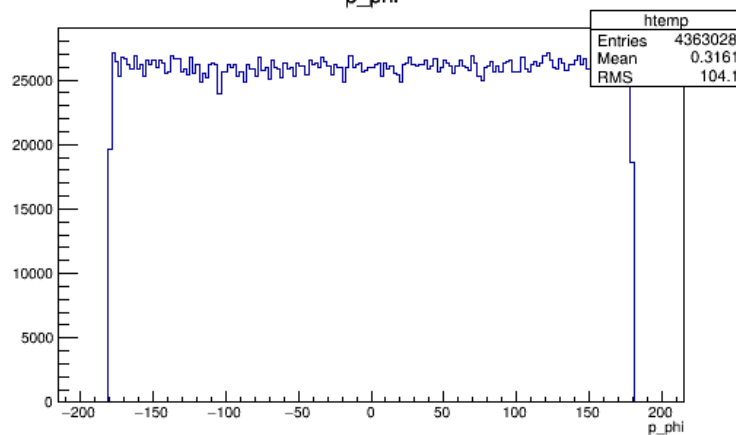
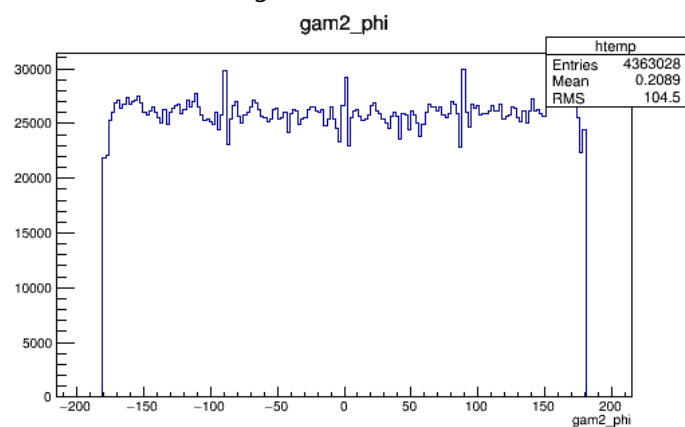# Other ϕ Distributions
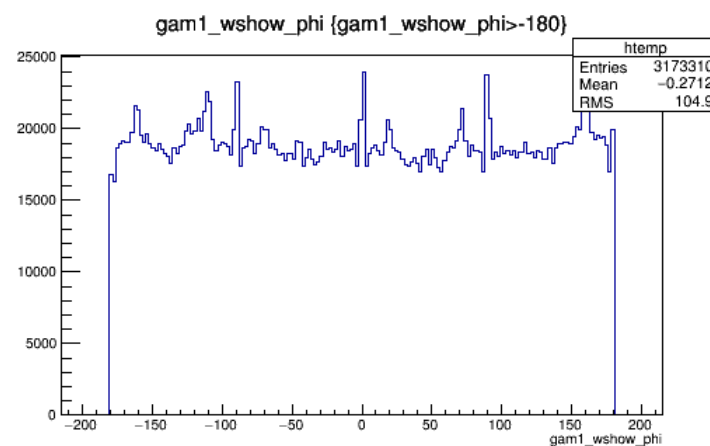
π^+

π^-
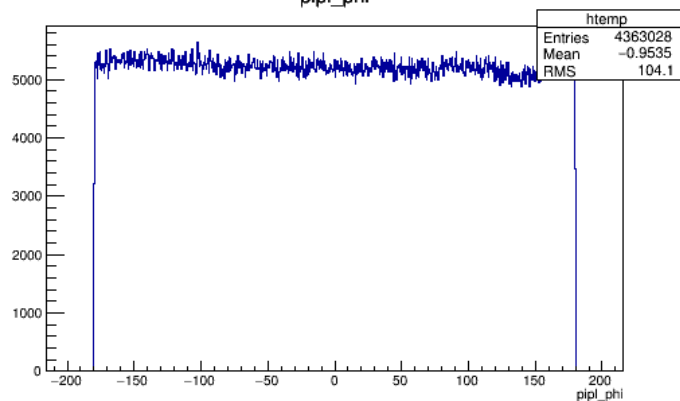
$proton$

Other ϕ Distributions
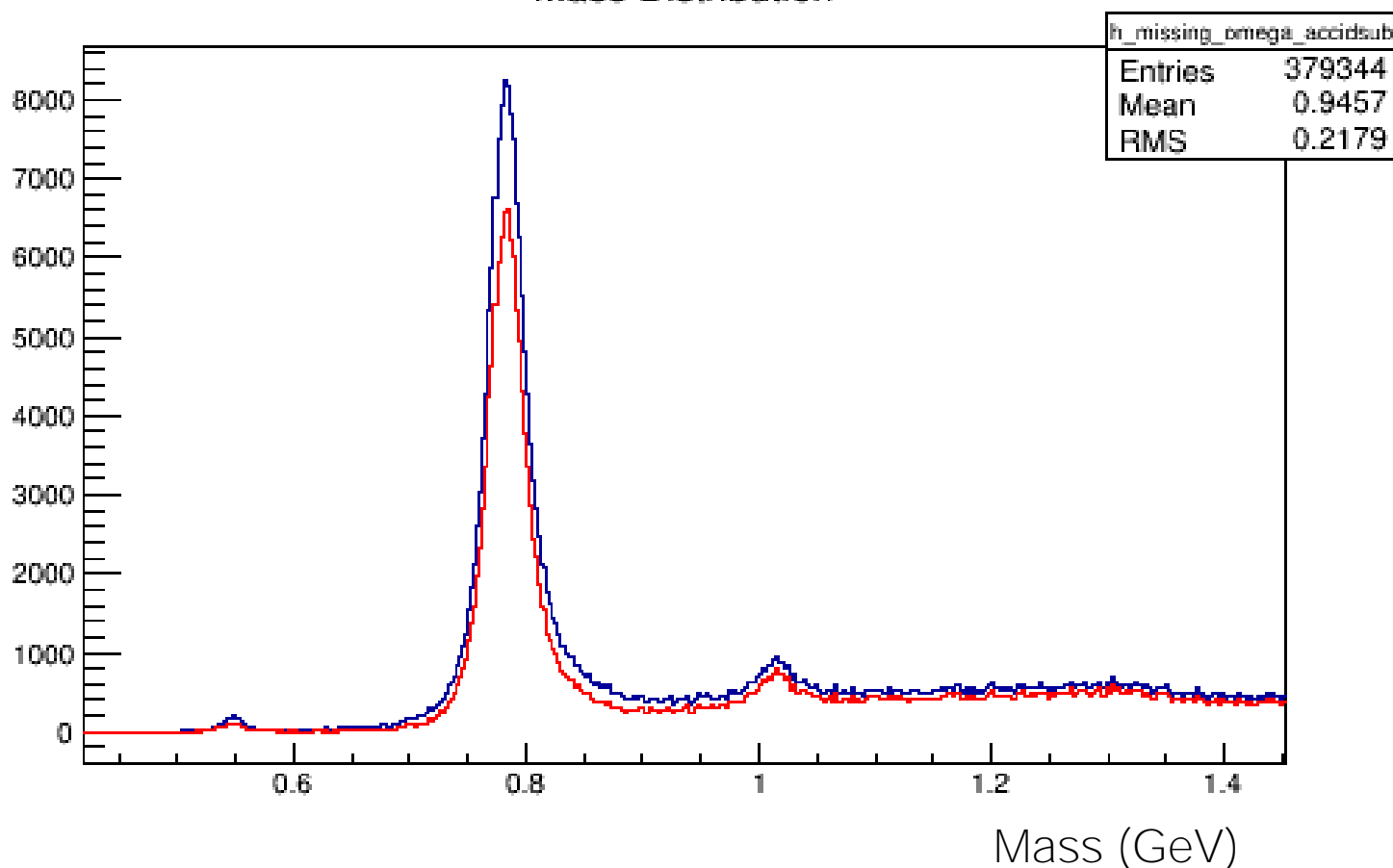
Initially found neutral

Second neutral candidate

Final Results

Blue: *recoil against p* mass
Red :$\pi^+ \pi^+ \gamma\gamma$ mass (w/ inv. $\gamma\gamma$ mass and $\Delta\phi$ cuts)

Mass Distribution

h_missing_omega_accidsub	
Entries	379344
Mean	0.9457
RMS	0.2179

Mass (GeV)

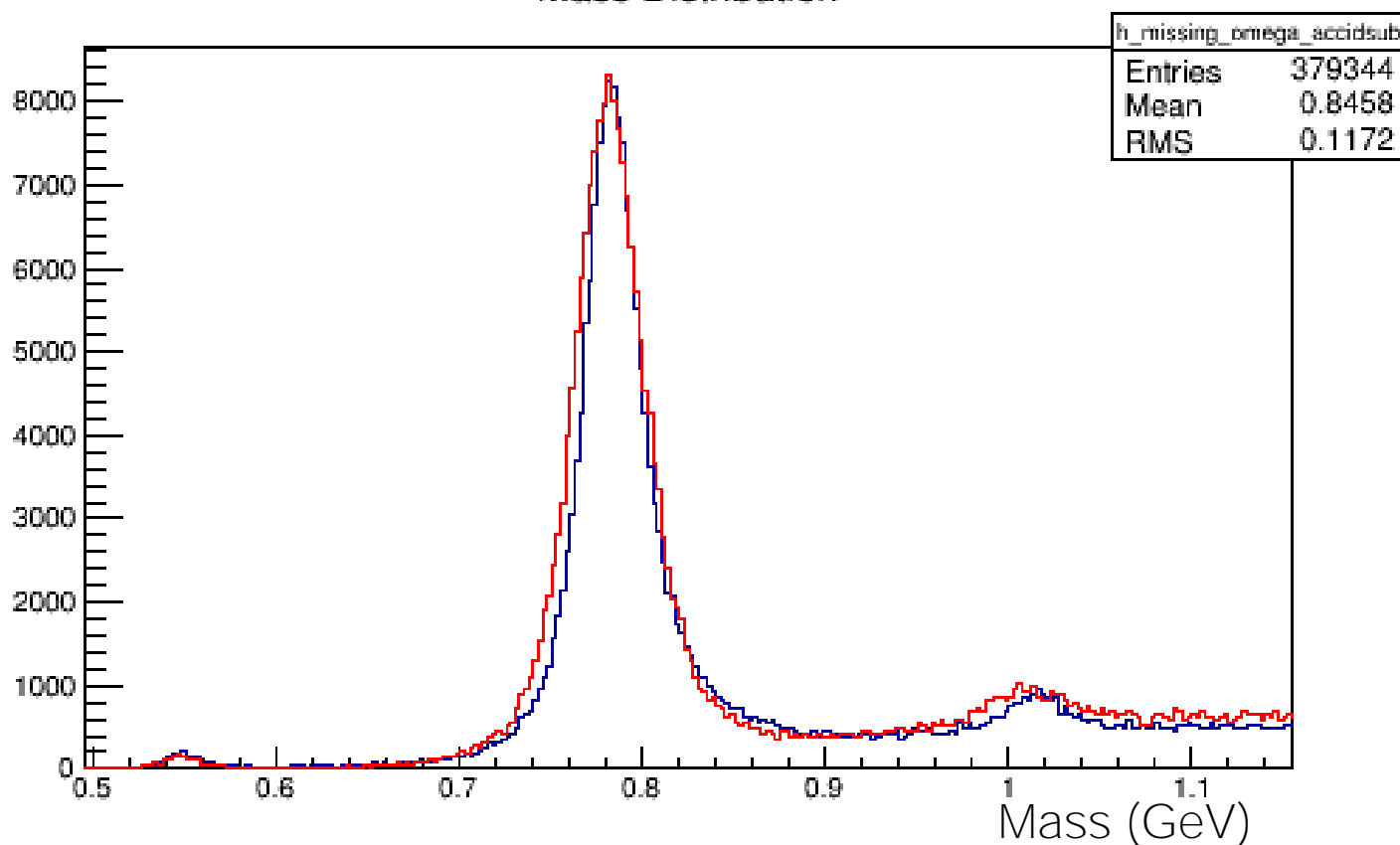Efficiency: yield of blue / yield of red

Final Results (scaled)

Blue: *recoil against p* mass
Red : $\pi^+\pi^+\gamma\gamma$ mass (w/ $\mathbf{inv.}\,\gamma\gamma$ mass and $\Delta\phi$ cuts)

Signal shapes of missing vs. found ω are slightly different…