

Combinatorics Study for $\eta' \pi^0$ MC Sample

For Uniqueness Tracking Task Force

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Reaction and Decays

$$\gamma p \rightarrow \eta' \pi^0 p$$

$$\pi^0 \rightarrow \gamma\gamma$$

$$\eta' \rightarrow \pi^+ \pi^- \eta$$

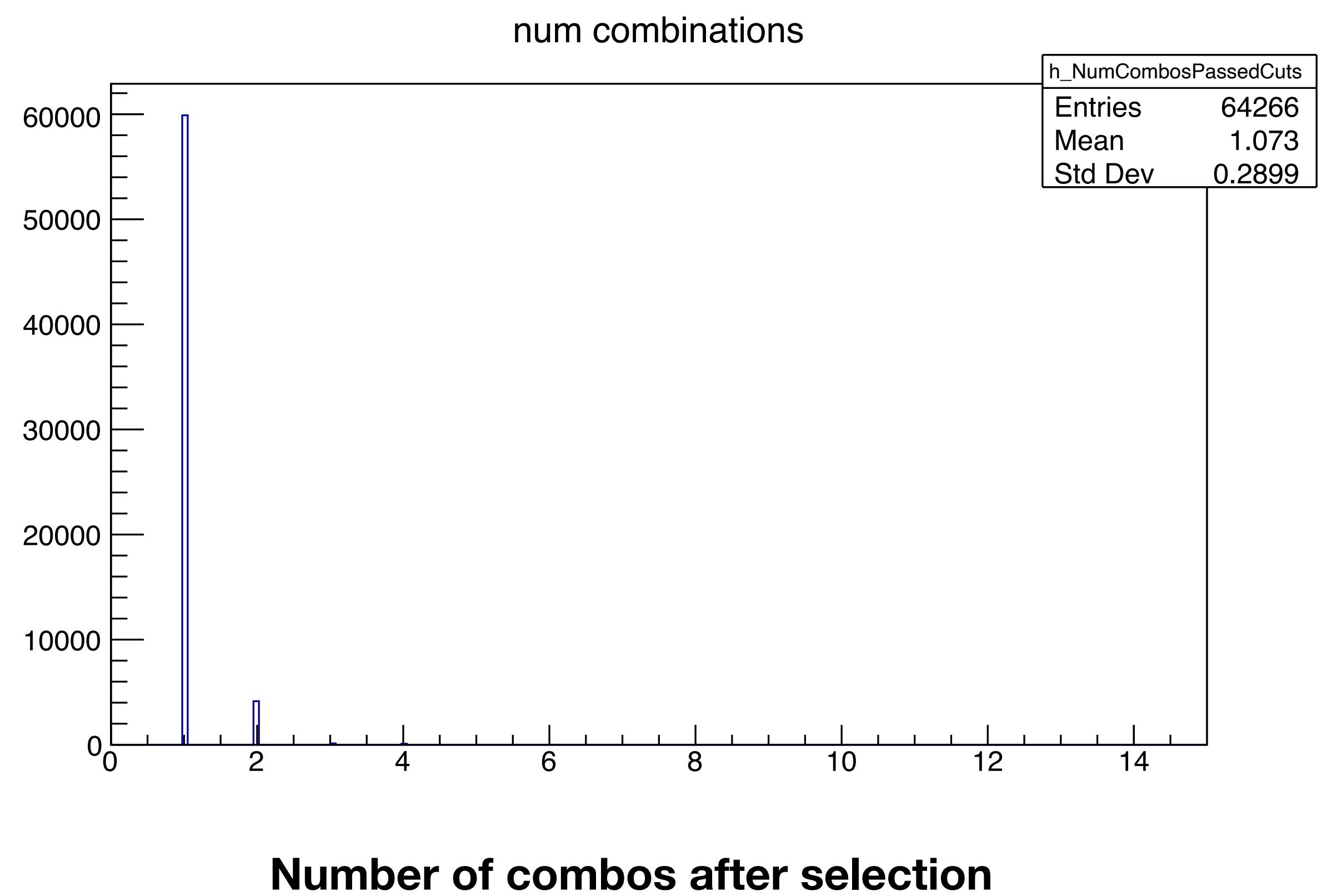
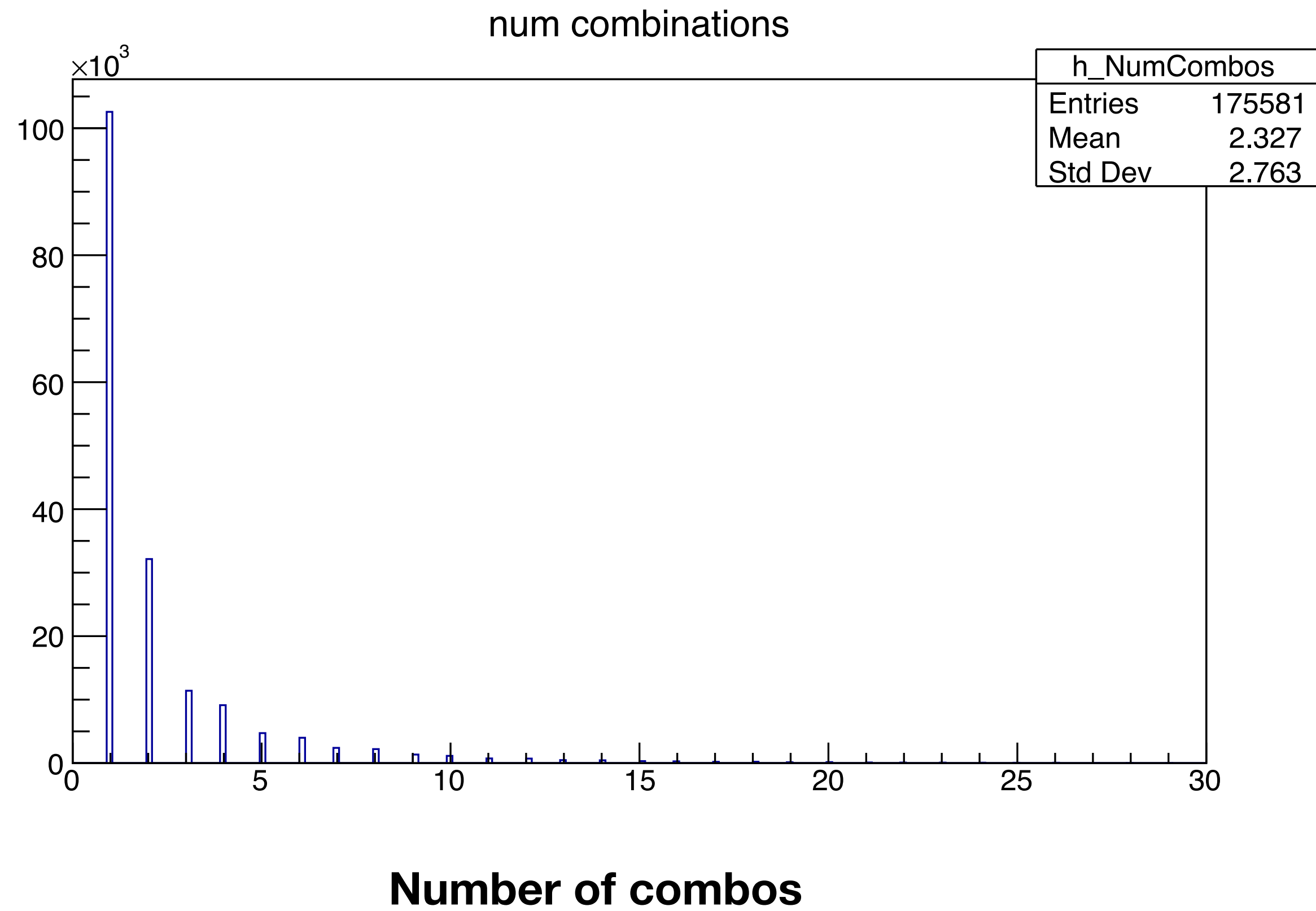
$$\eta \rightarrow \gamma\gamma$$

- Generator : Gen_amp
- Reconstruction Efficiency not very impressive
- Some 175k $\eta' \pi^0$ events reconstructed from 10M generated events

Event Selection

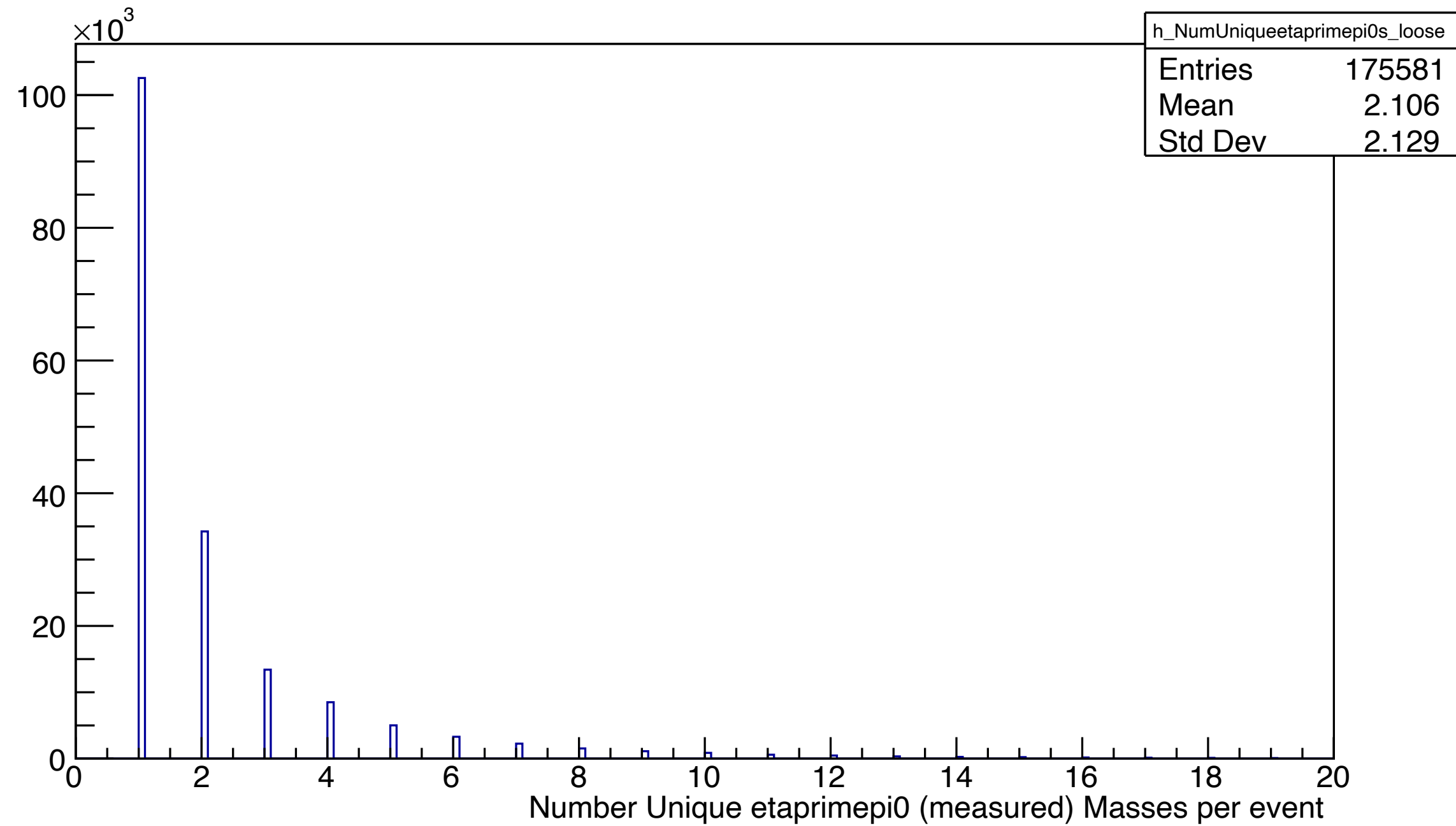
- π^0 and η mass not constrained in kinfit
- $\chi^2/NDF < 5$
- At least one combo consistent with an η'
 - $|m_{\pi^+\pi^-\eta} - m_{\eta'}| < 50 \text{ MeV}$
- FCAL shower quality > 0.5 required for all 4 Photons

Num of Combos

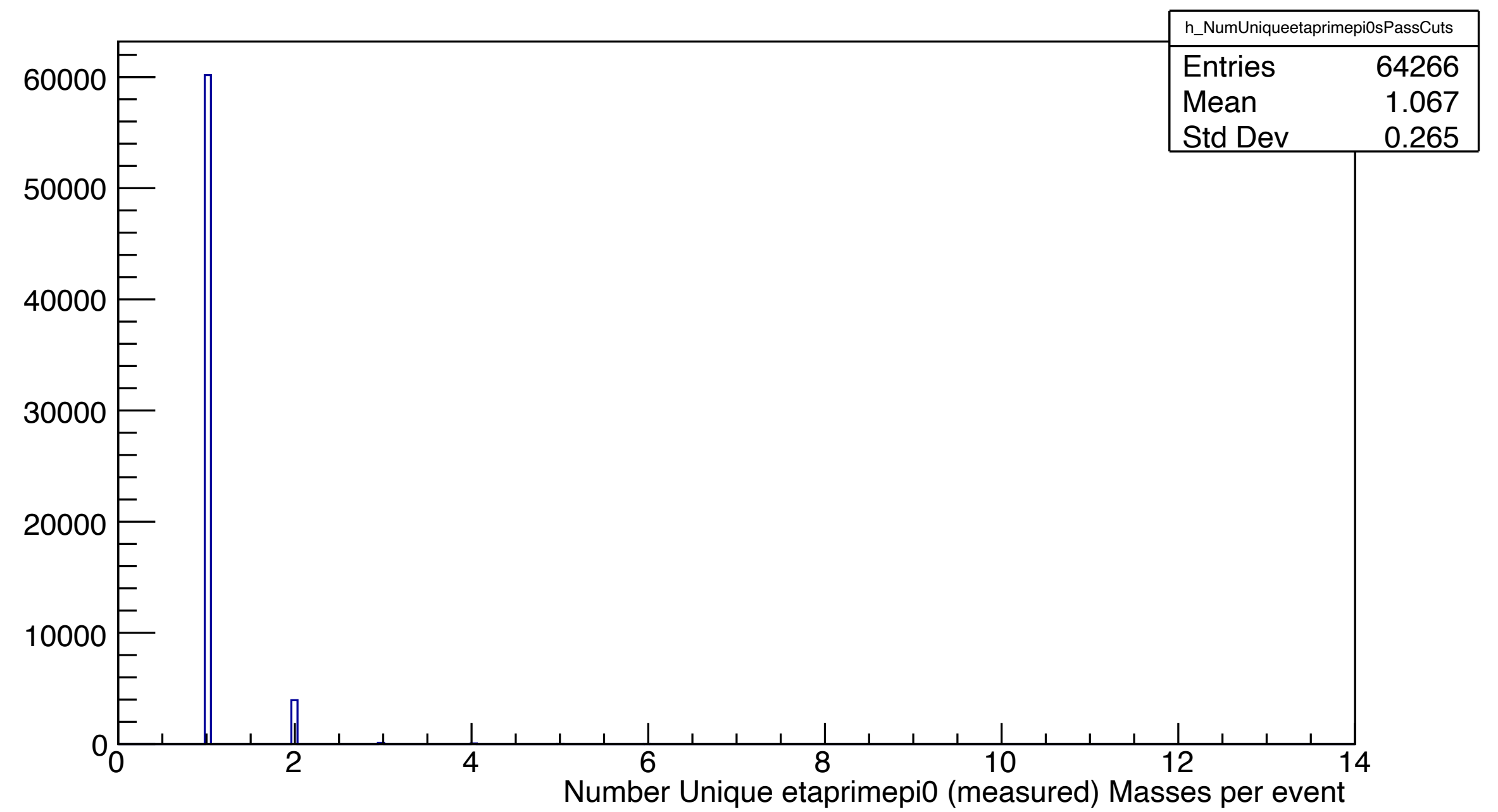


Num of Unique $\eta' \pi^0$ Combos

Before Selection



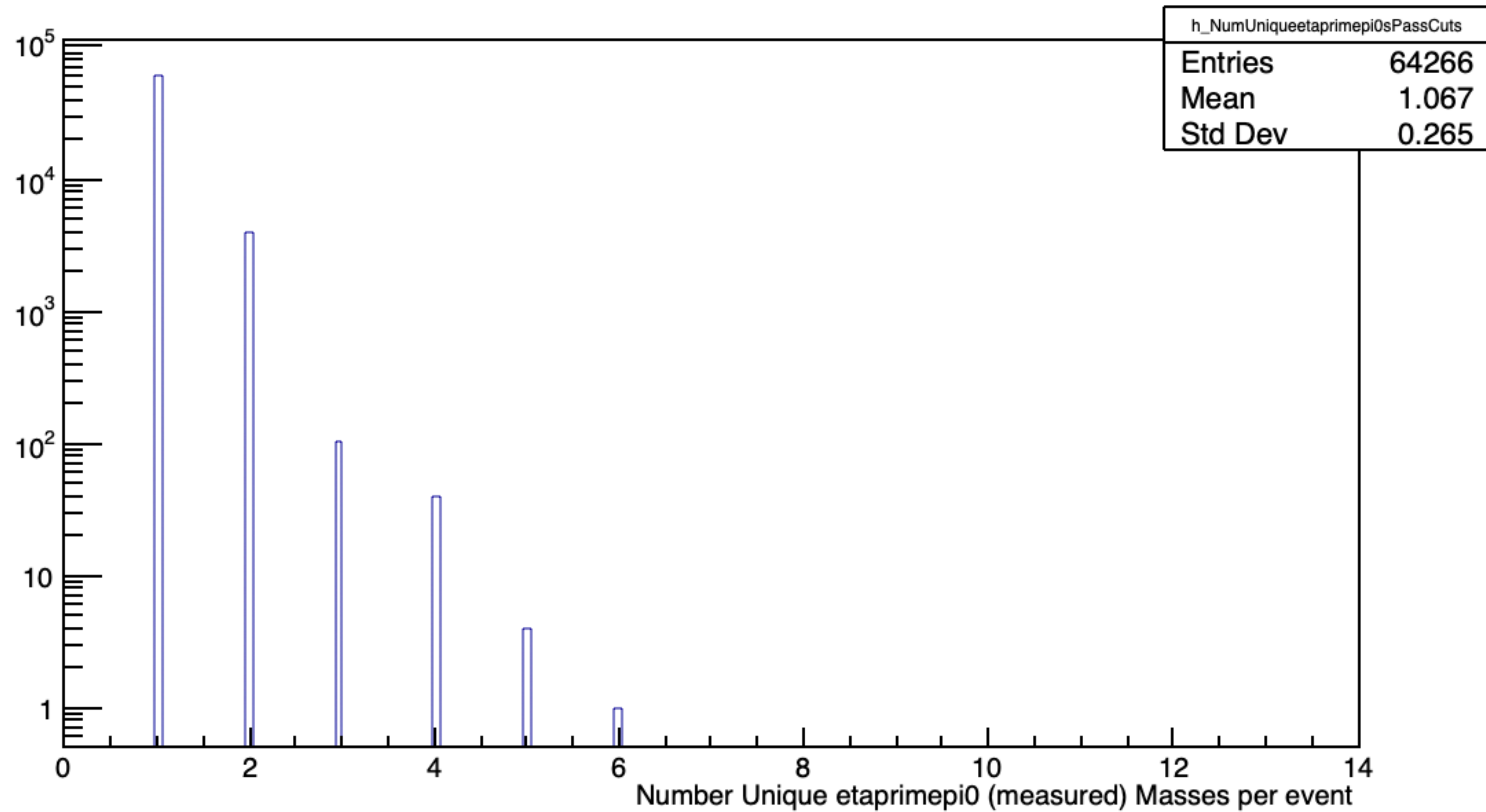
After Selection



Only 1 unique combo of $\eta' \pi^0$: 94%

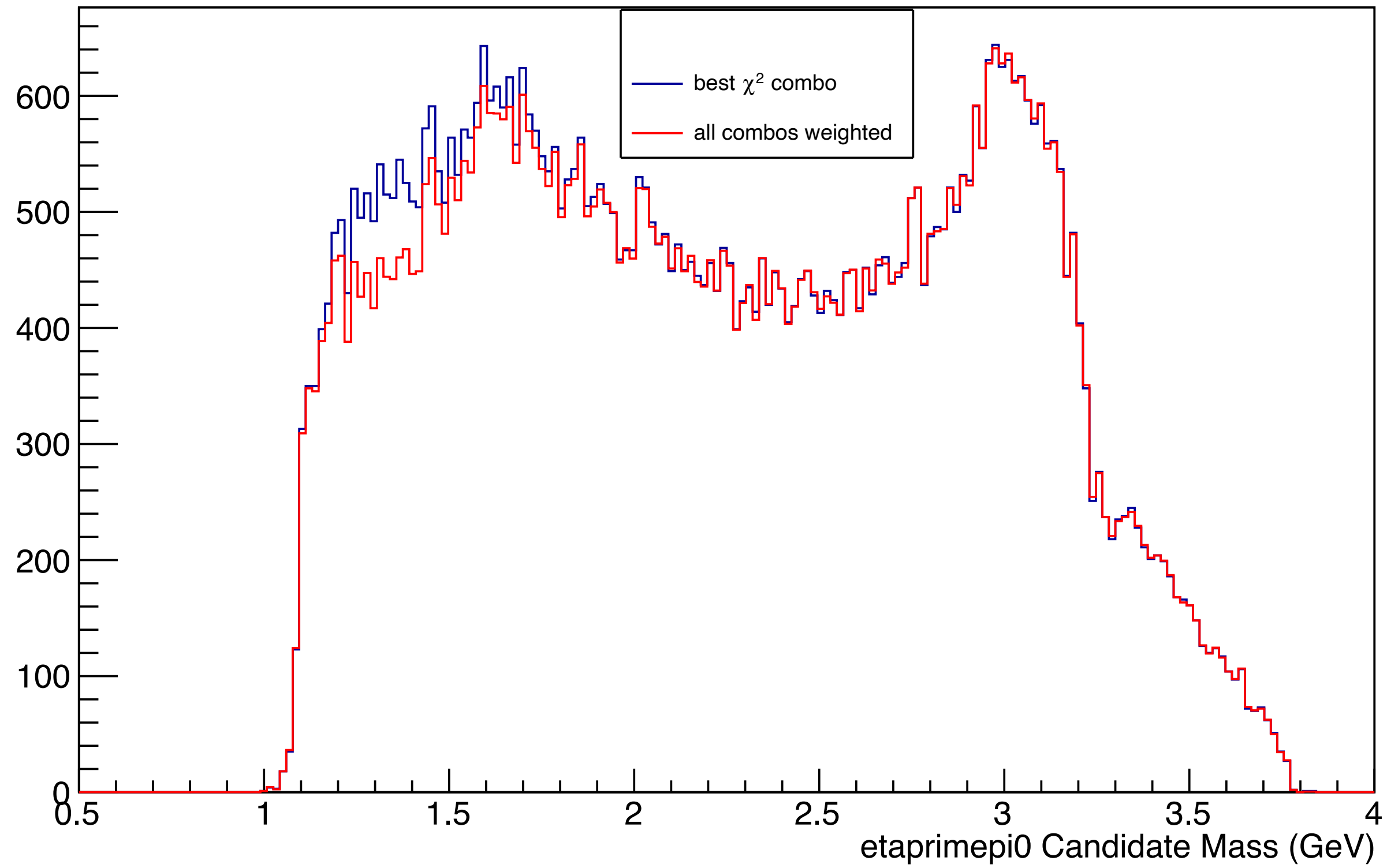
Num of Unique $\eta' \pi^0$ Combos

After Selection

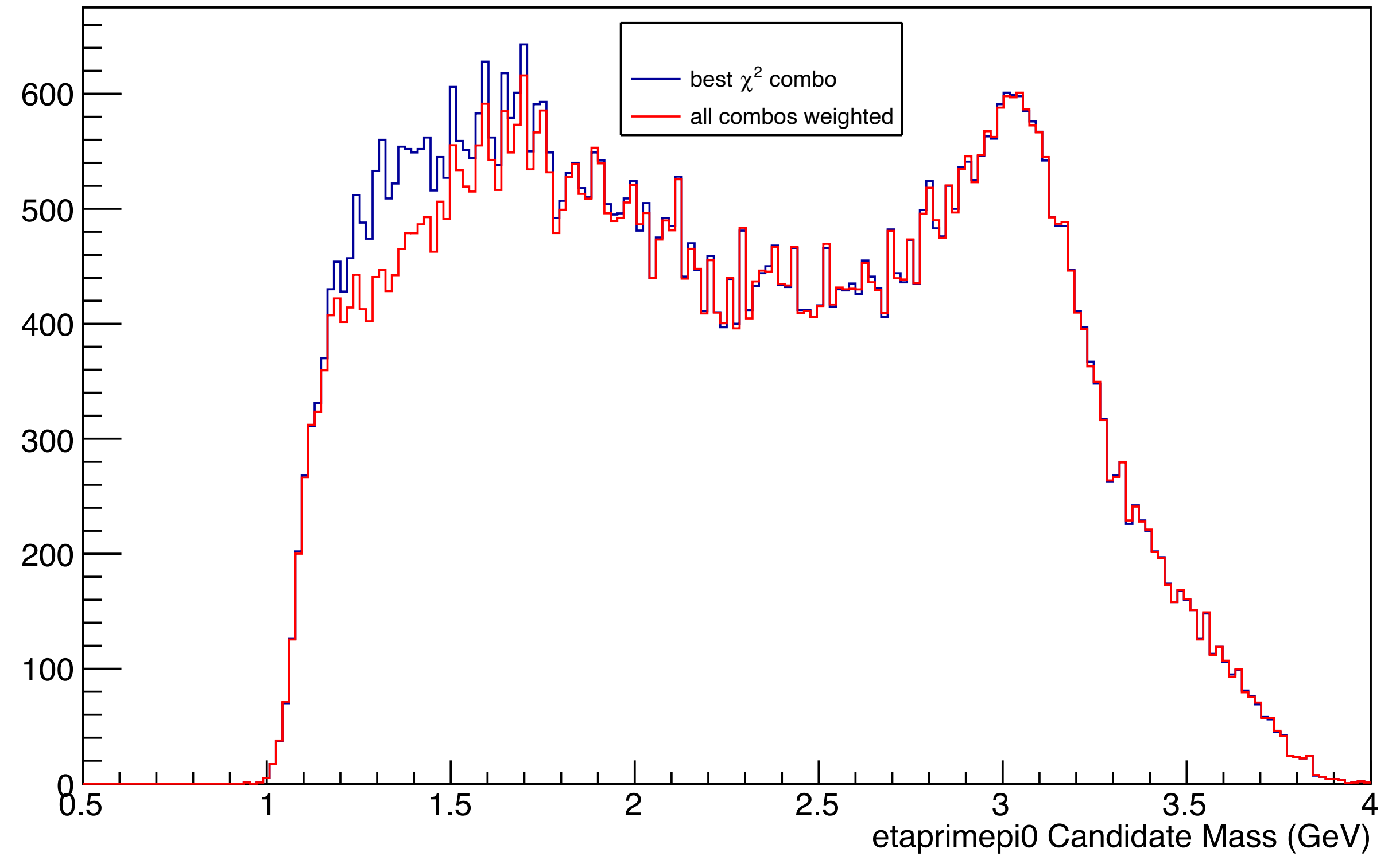


$\eta' \pi^0$ Invariant Mass

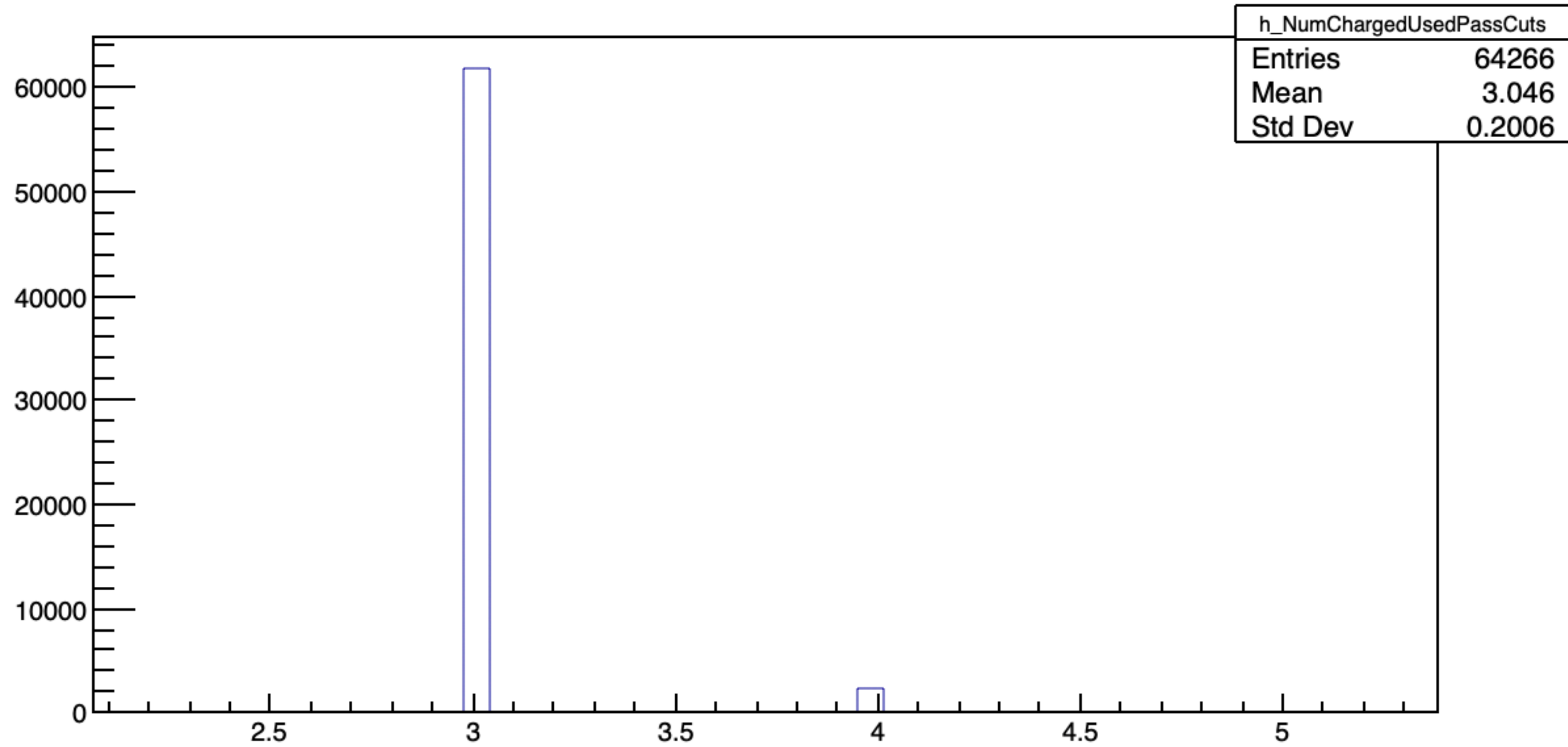
Measured



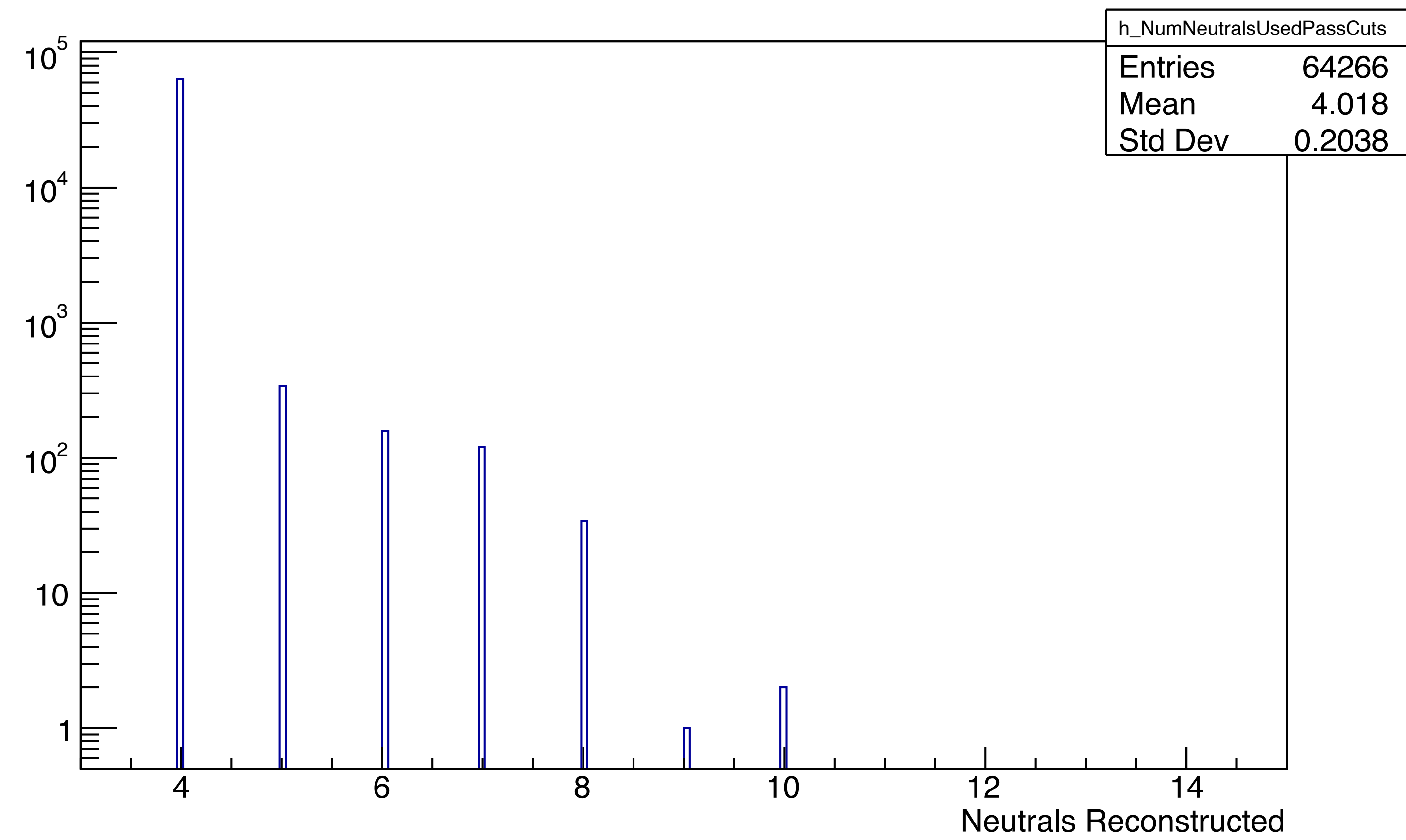
Kinfit



Charged Tracks Used



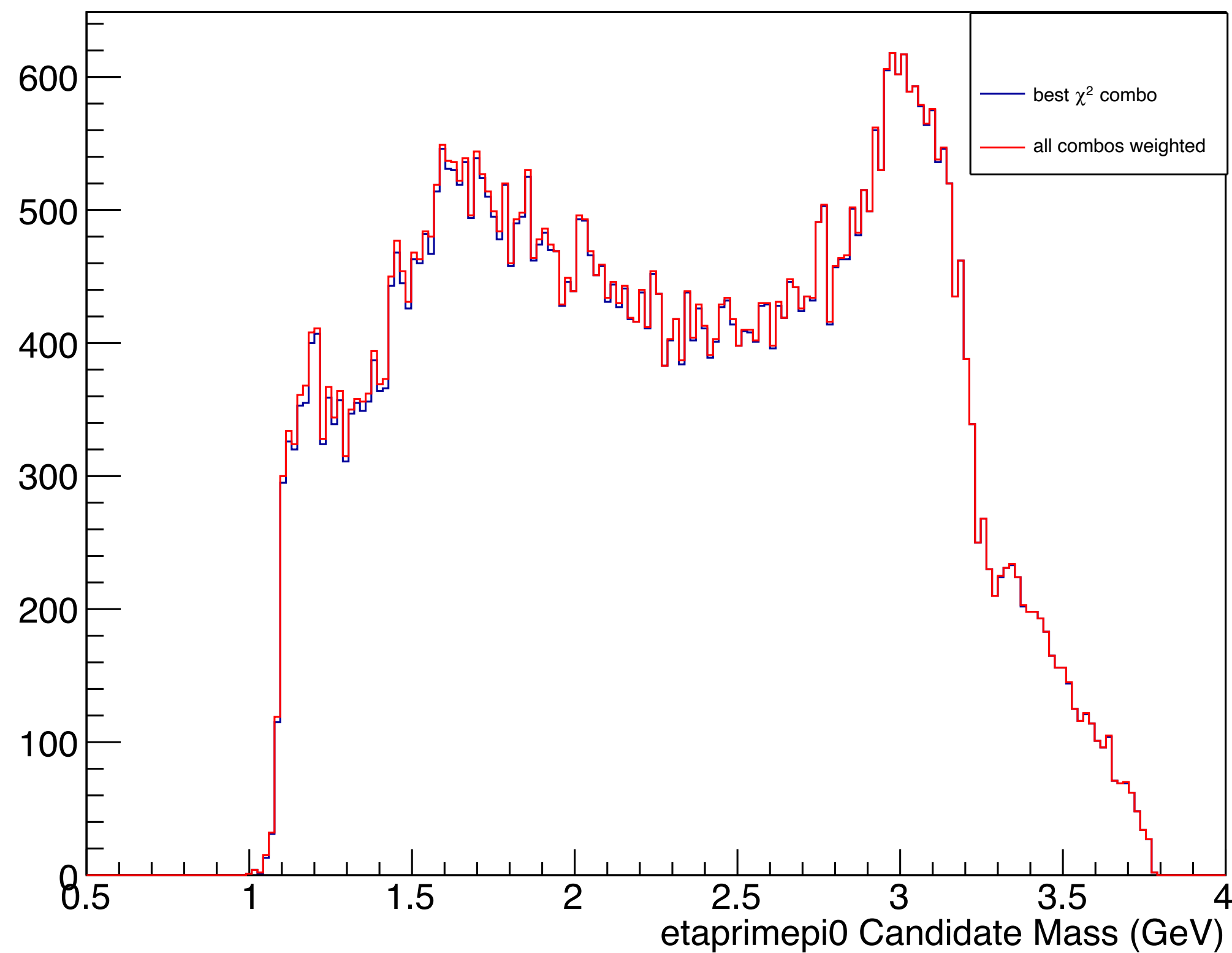
Neutral Showers Passing Selection



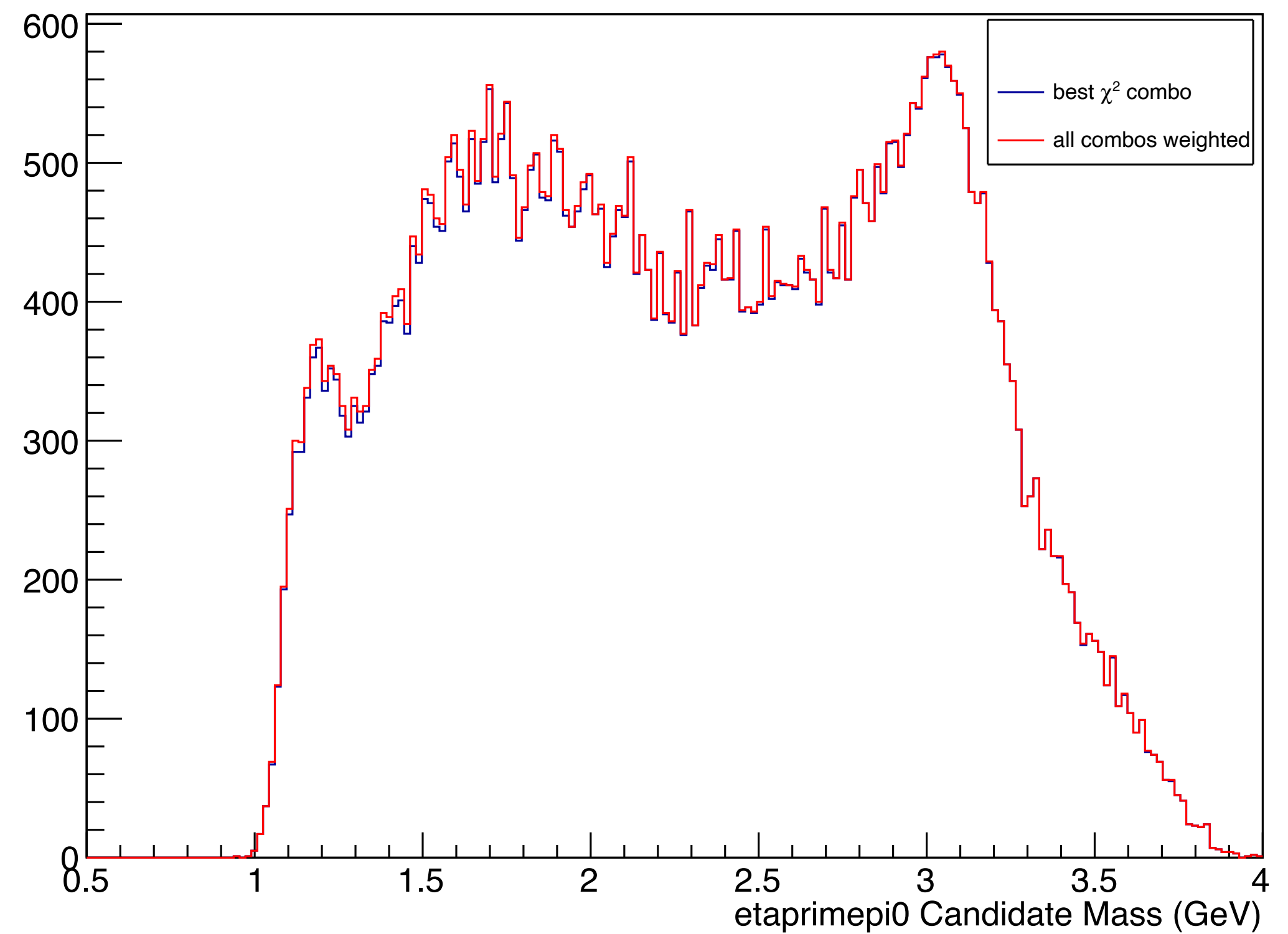
$\eta' \pi^0$ Invariant Mass

- **Only 1 unique $\eta' \pi^0$ candidates only (i.e. exactly 4 photons pass selection)**

Measured



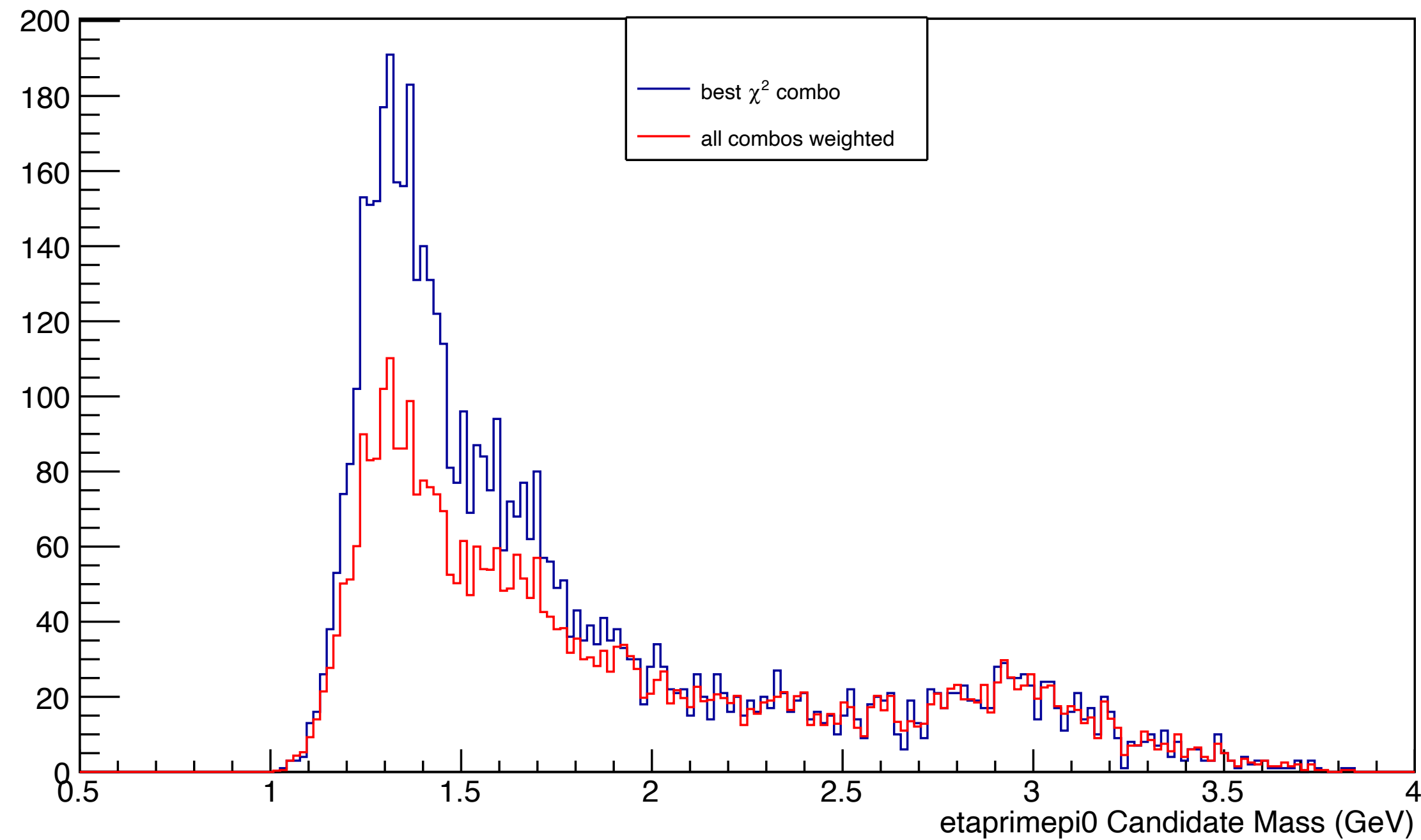
Kinfit



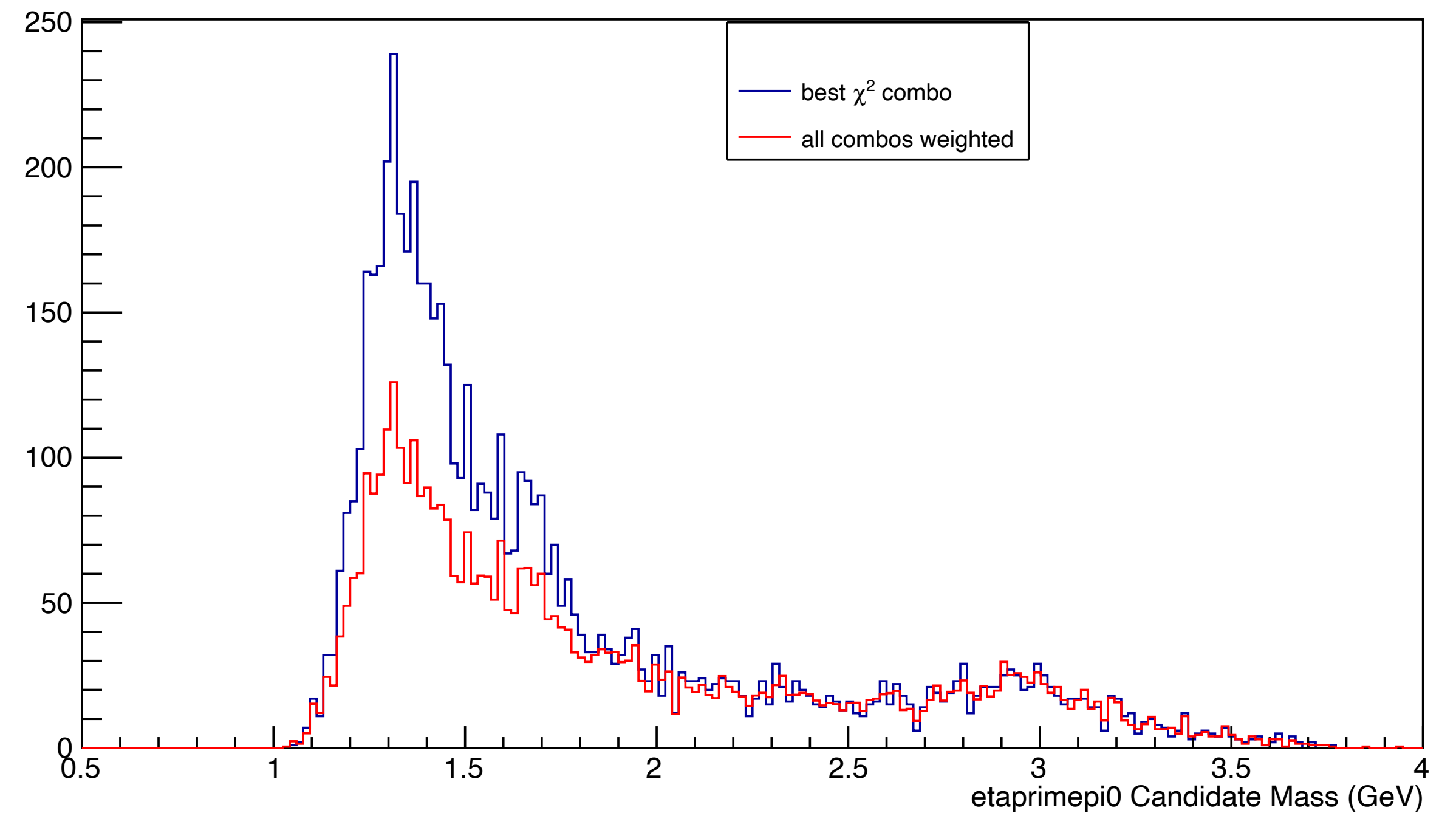
$\eta' \pi^0$ Invariant Mass

- **2+ unique $\eta' \pi^0$ candidates only (extra showers or tracks pass selection)**

Measured



Kinfit



- **Seems to disagree more compared to Jon's b1 channel**