A look at backgrounds coming from bggen

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The MC data

- Turned on all decays within bggen except for $\pi^+ \pi^-$ and K^0_L
- Generated one million bggen events from E_γ = 8.5 to 9.0 GeV
- Processed the bggen events through HDParaSim (from release-2009-02-24)
- Modified the invariant_mass_hists plugin to obtain plots

Type of events coming out of bggen

NOTE: concentrating on final states that contain a proton.

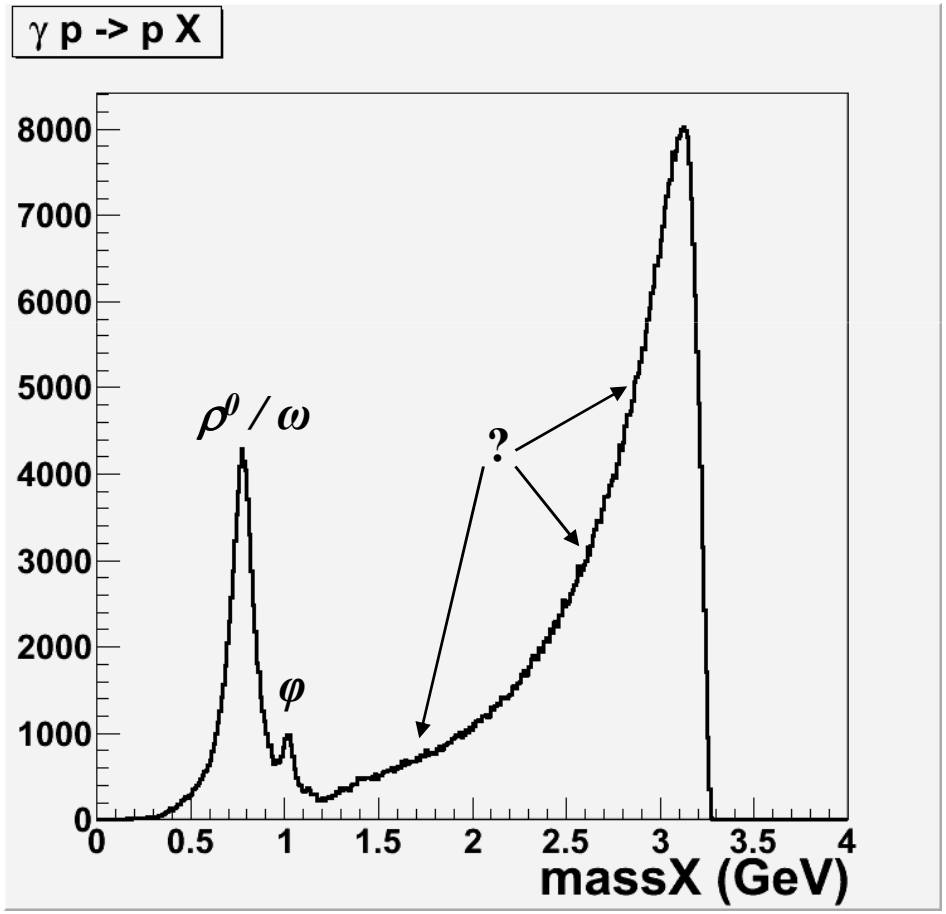
Two main types of proton events from bggen:

- Light vector meson + proton (i.e. $\rho^0 p$, ωp, φp)
- quark + diquark + $\overline{\text{quark}}$ + quark $\rightarrow$ hadrons

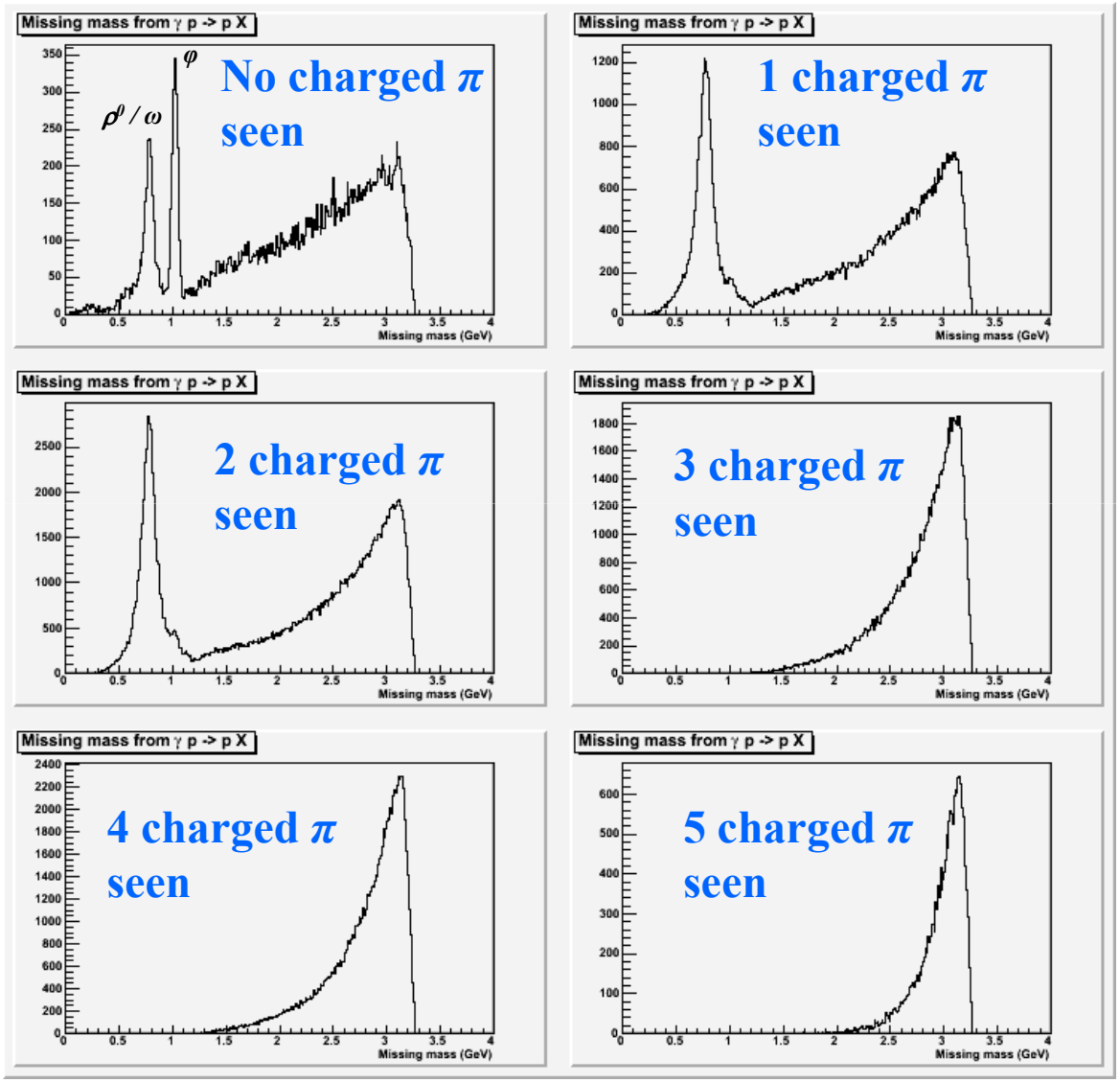
Example:
$d + (uu)_1 + \bar{d} + d \rightarrow$
string fragmentation + cluster fragmentation $\rightarrow$
$\Delta^{++}\ K^*(892)^0\ K^*(892)^-$

Mass X from $\gamma\, p \rightarrow p\, X$

- Vector mesons are clearly visible
- The rest of the background is comprised of a nearly random-looking selection of hadrons



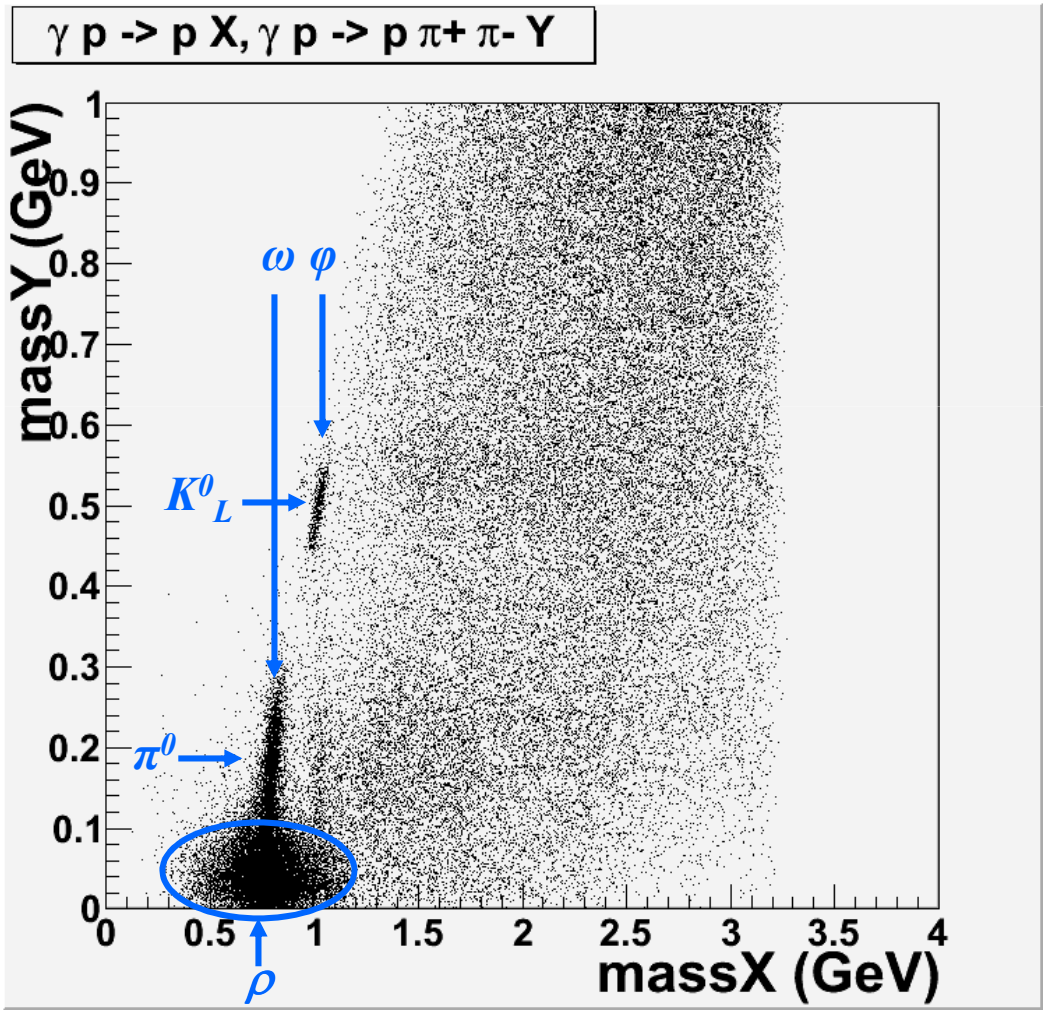
Mass X from $\gamma\, p \rightarrow p\, X$ with charged π requirements



Mass Y vs. Mass X

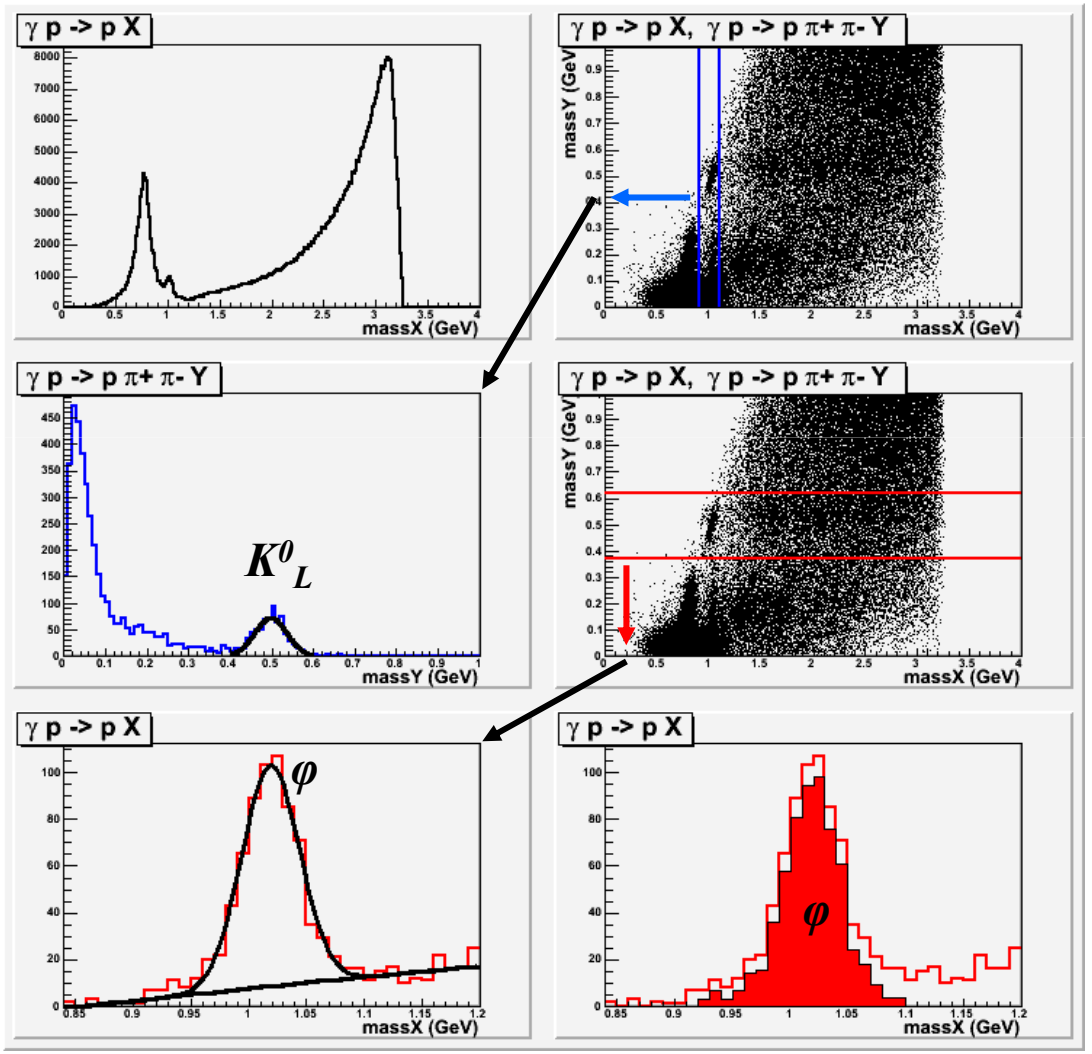
- It will be difficult to distinguish between ρ and ω using missing mass of Y

- The $\varphi \rightarrow K^0_L K^0_s$ should be easy to find using missing mass of Y



Efficiency of detecting $\gamma\, p \rightarrow p\, \varphi \rightarrow p\, \pi^+\, \pi^-\, K^0_L$ using simple cuts

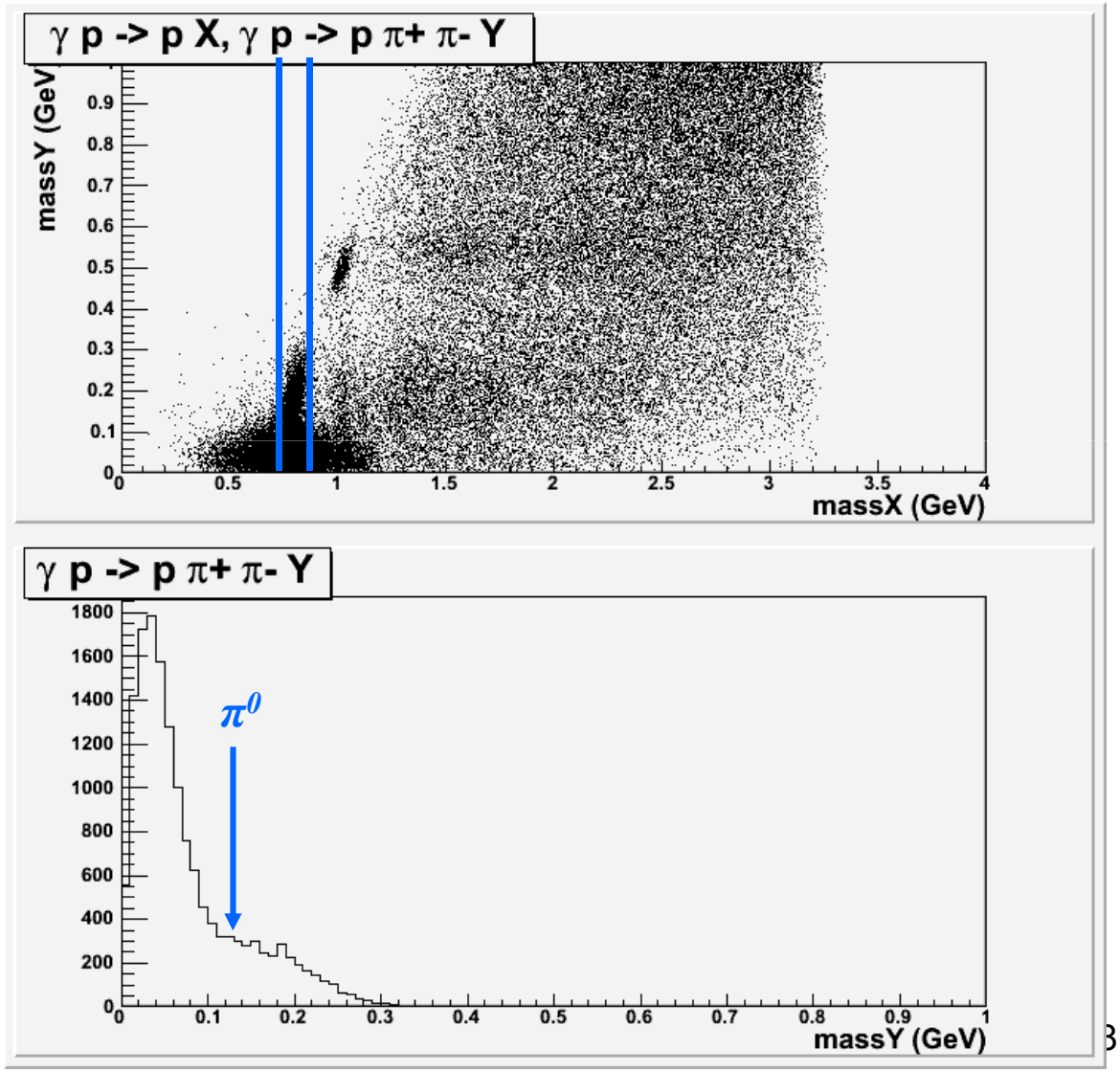
- Clean signal
- Efficiency = 55.3%



Mass *Y* vs. Mass *X*

- Projected from mass *X* = 0.7 to 0.85 GeV onto the mass *Y* axis

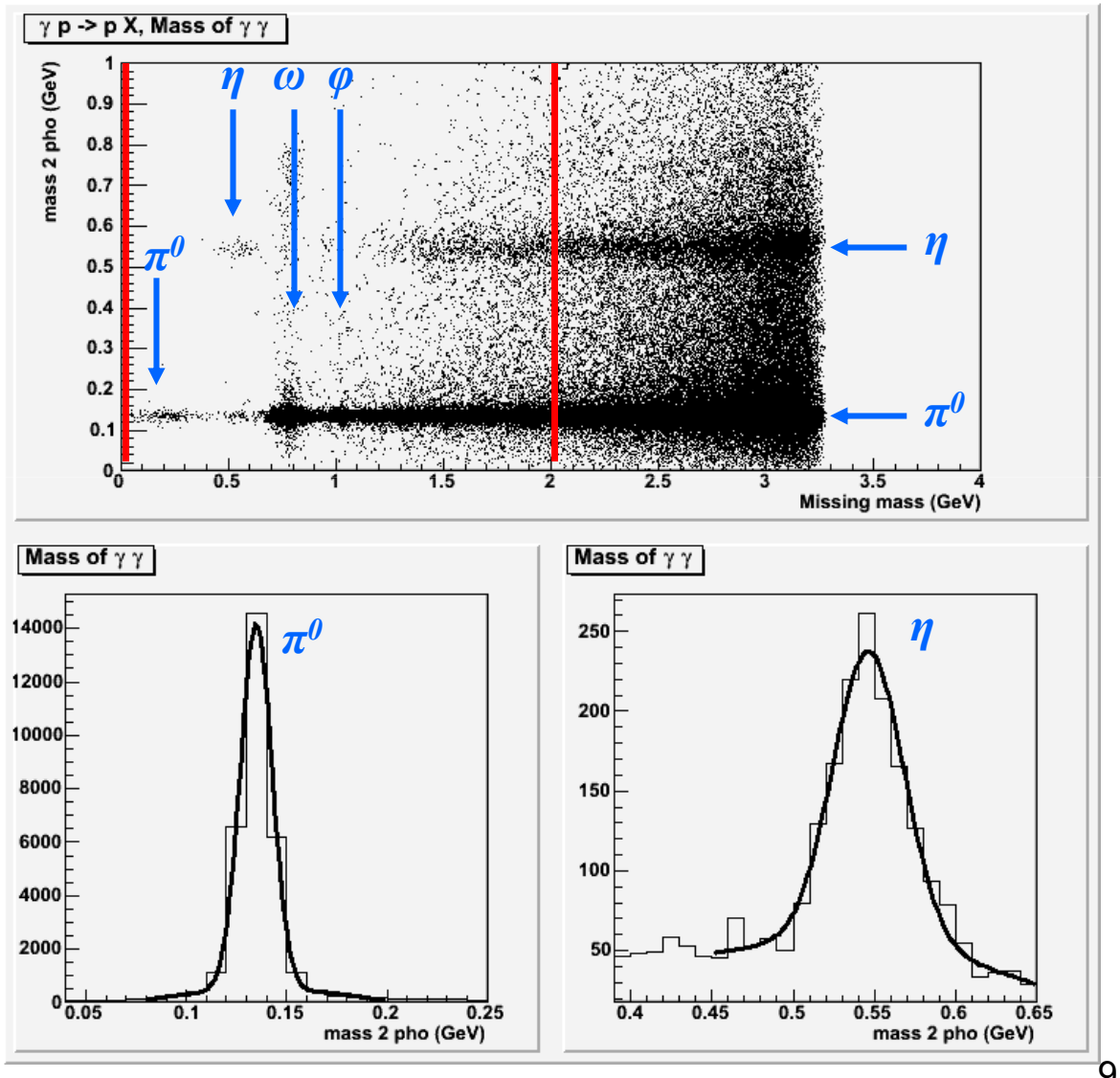
- Can't distinguish between mass *Y* = 0 and mass *Y* = mass π^0



Mass of 2 photons vs. Mass X from $\gamma\, p \rightarrow p\, X$

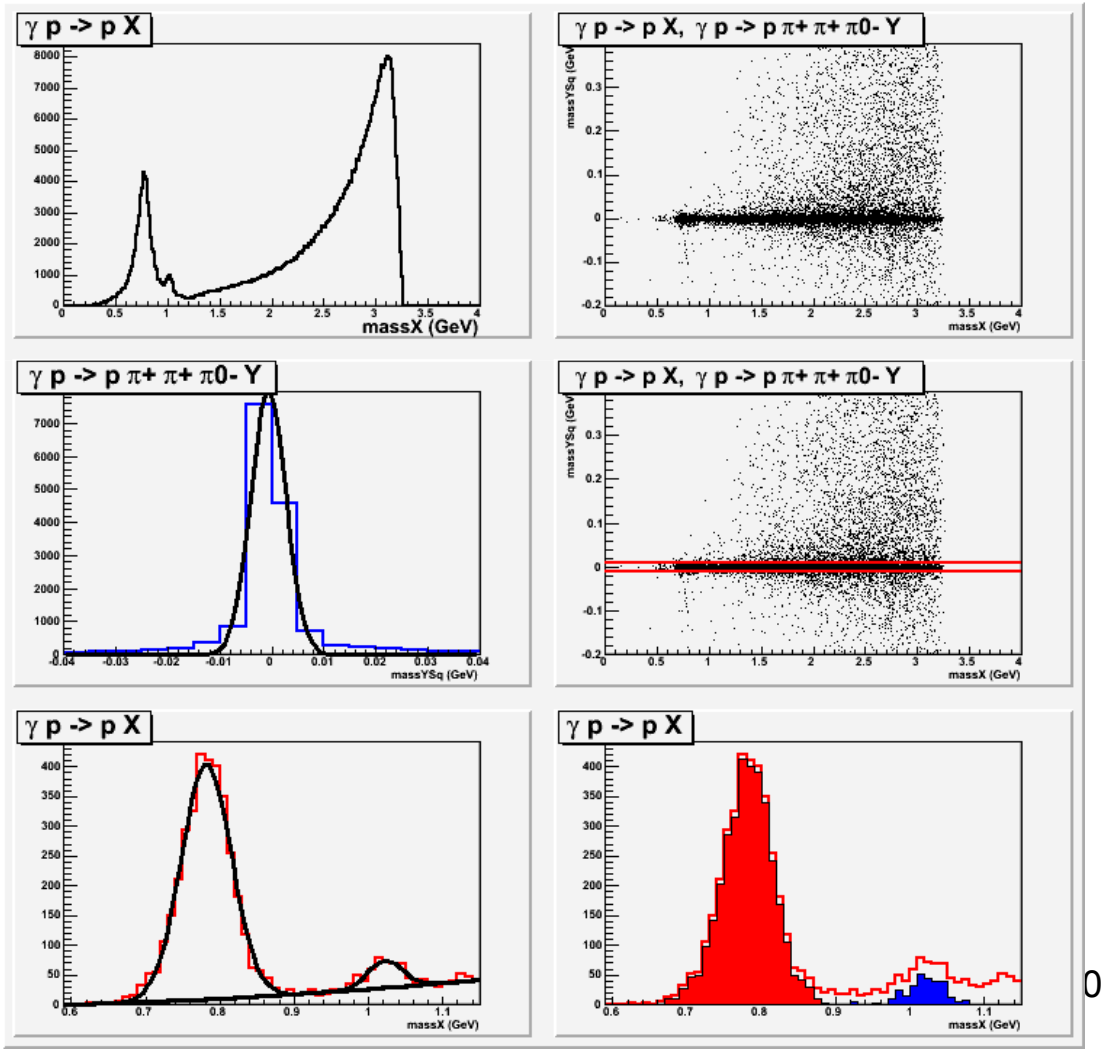
- Took projection:
  GeV <Mass X< 2.0 GeV
onto mass 2 photon axis

- Obtain reconstructed π^0 and η as shown



Efficiency of detecting $\gamma p \rightarrow p \varphi \rightarrow p \pi^+ \pi^- \pi^0$ AND $\gamma p \rightarrow p \omega \rightarrow p \pi^+ \pi^- \pi^0$ using simple cuts

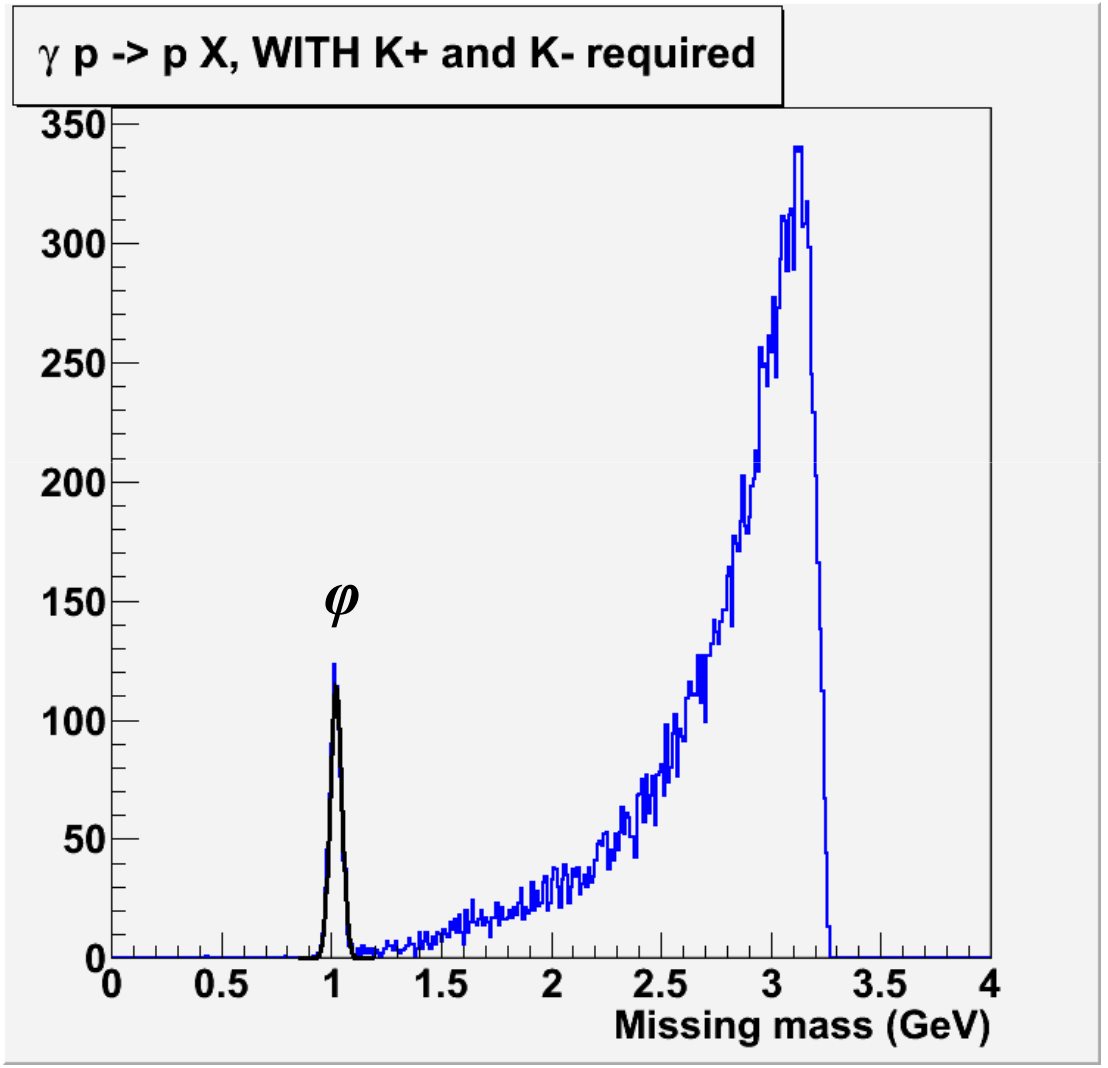
- Can't distinguish between mass $Y = 0$ and mass Y = mass π^0 (as expected)
- ρ^0 contamination no longer a concern
- Efficiency for ω = 30.3%
- Efficiency for φ = 37.3%



Mass X from $\gamma\, p \rightarrow p\, X$ with $K^+\, K^-$ required

- If the kaons can be reliably identified, the φ is a super clean signal

- Efficiency for $\gamma\, p \rightarrow p\, \varphi \rightarrow K^+\, K^-$ = 33.9%



Summary and future work

- The light vector mesons should be able to be easily measured using simple cuts

- In the near future, will study reactions with 3 charged pions in the final state.