Neutral Efficiencies With $\omega \rightarrow 3\pi$

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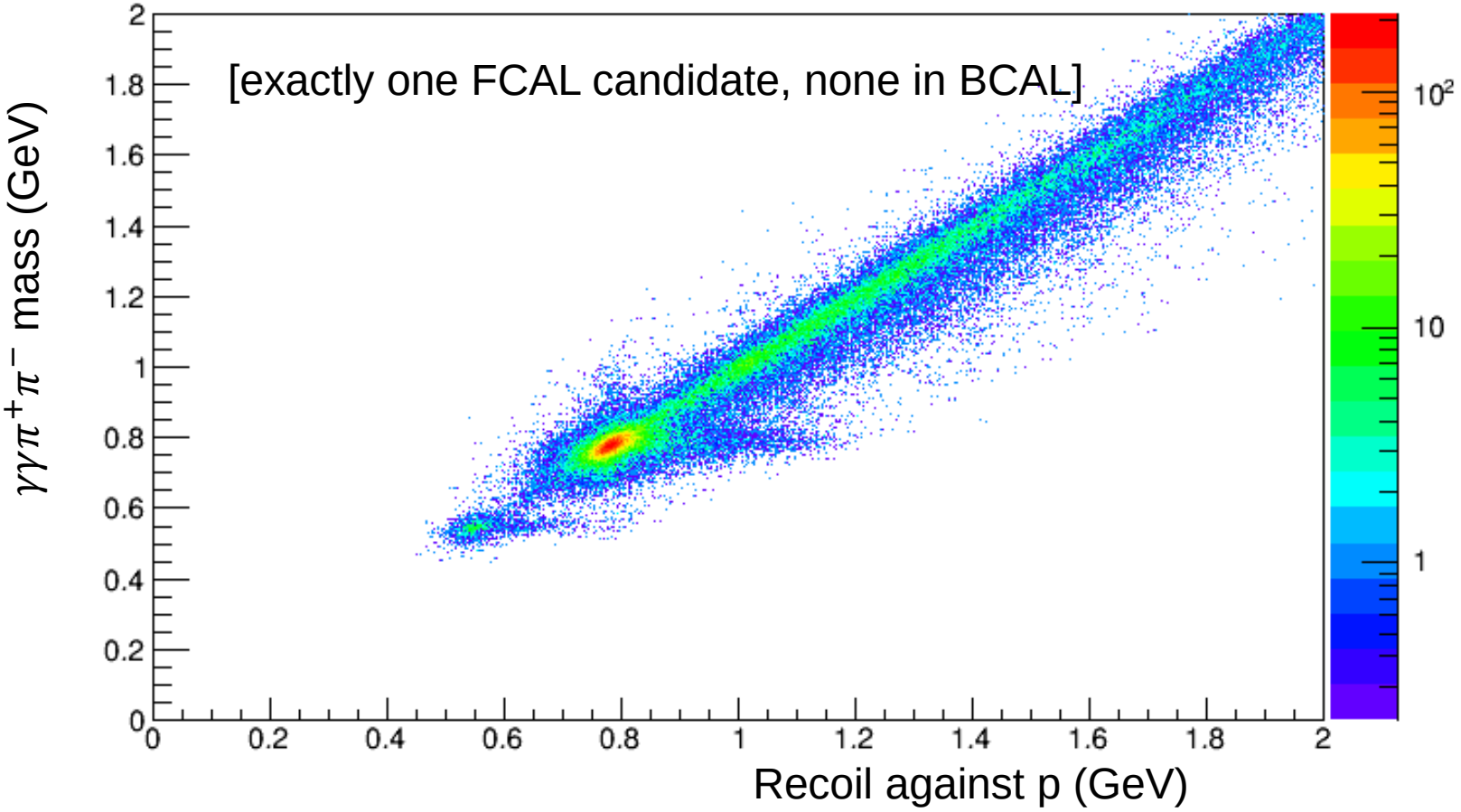
2017 Data: 2D Plot



Challenge: omega yields from X-axis and Y-axis inconsistent

Reformulating

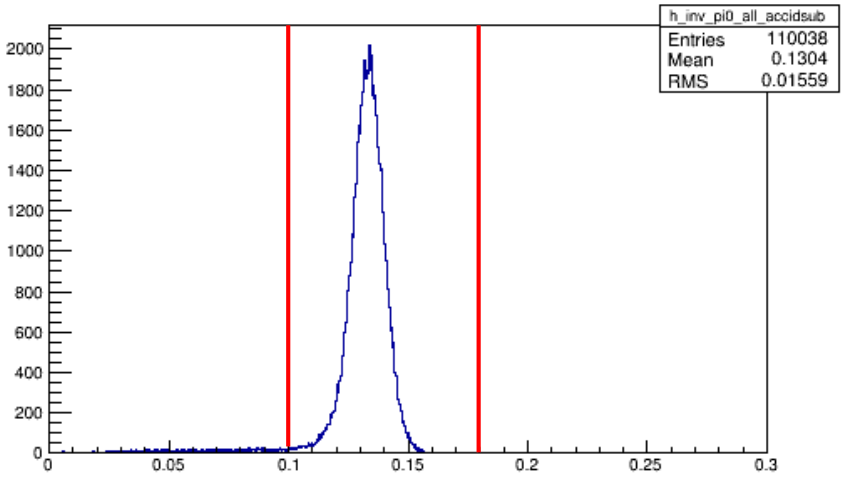
- No luck characterizing and cutting those tail events…
  - Long tail does show up in gen_omega_3pi workfest sample
- Other ways out?
- Two methods appear to give agreement with some non-workfest approved data samples
  - Coherent peak 2017 data
  - MC: 8.5 GeV beam E, genr8, no bkg
  - Work today will be in verifying with workfest data + MC

Method 1:

- $\epsilon = \frac{Numerator\ \omega\ yield}{Denominator\ \omega\ yield}$
- Numerator:
  - ω from recoil distribution
  - 1 FCAL shower found, no BCAL showers
  - $\gamma\gamma$ mass loosely consistent with π^0
- Denominator
  - ω from recoil distribution
  - 1 or 0 FCAL showers, no BCAL showers
- Pro: fitting to same quantity, same shape
- Possible con: $\gamma\gamma$ mass cut could have different response b/w MC and data?

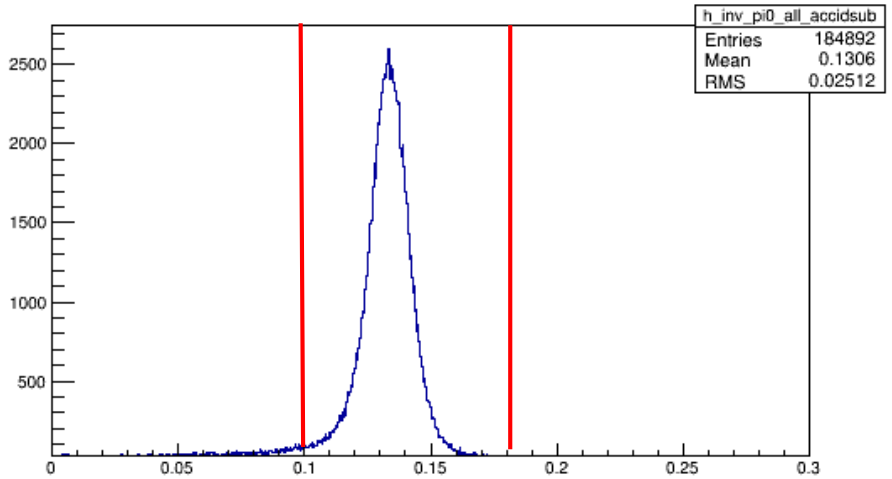
$\gamma\gamma$ Cut

Signal MC



$\gamma\gamma$ mass (GeV)

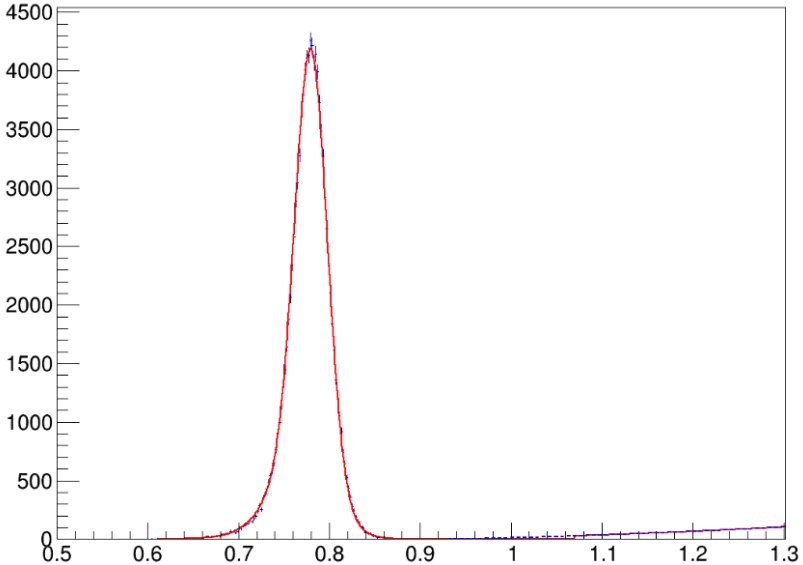
Data



$\gamma\gamma$ mass (GeV)

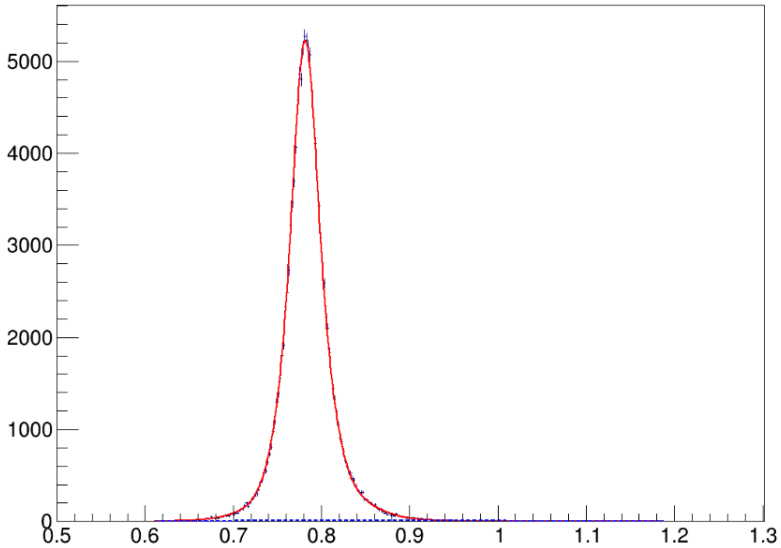
Signal MC

Numerator



Recoil against p (GeV)

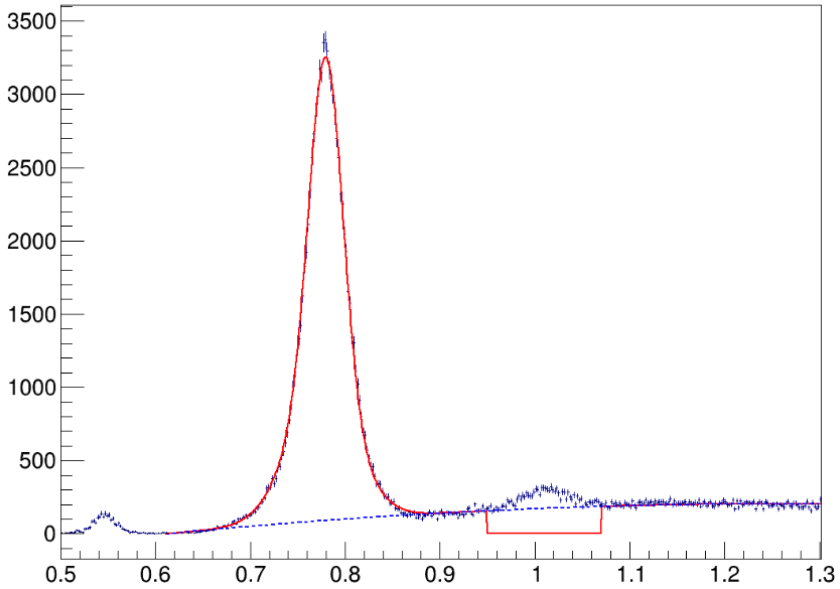
Denominator



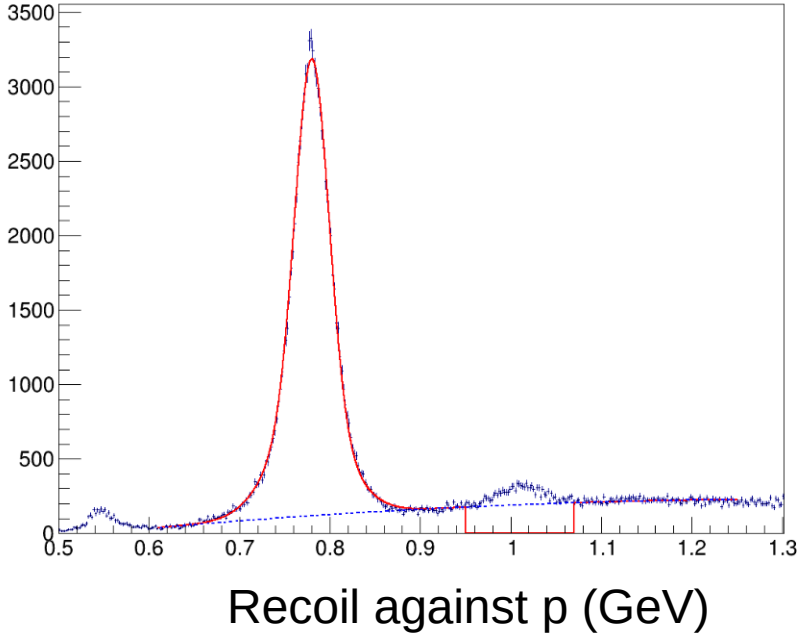
Recoil against p (GeV)

2017 Coherent Peak Data

Numerator



Denominator



Method 2:

- $\epsilon = \frac{Inv_\omega}{Inv_\omega + Lost_\omega}$, where
- Inv_ω:
  - ω from invariant mass distribution
  - 1 FCAL shower found, no BCAL showers
- $Lost_\omega$:
  - ω from recoil distribution, where
  - Missing 4-momenta points to FCAL, but
  - No FCAL or BCAL showers

Method 2: cont.

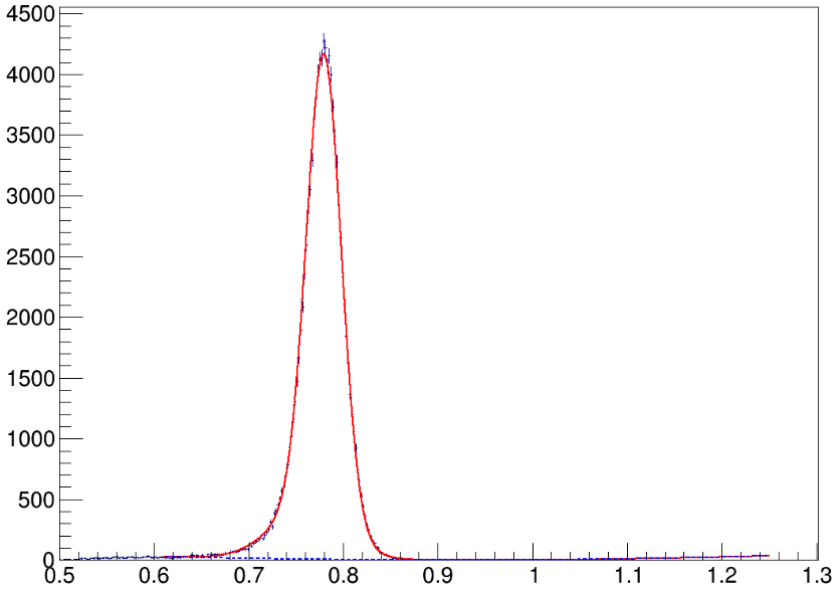
- Compared to old approach of $\epsilon = \frac{inv\ \omega}{recoil\ \omega}$
- Best guesses:
  - Recoil ω gets underestimated, efficiency gets overestimated by about 4%
  - Efficiency is $\approx 80\%$
- Only smaller "inefficiency" piece might be affected in new scheme
  - Reduces to $\approx$ 0.8% systematic underestimate
- Easier pill to swallow

Method 2: cont.

- Pros:
  - Not relying on anything from $\gamma\gamma$ distribution, should decouple from calorimeter resolution/response
- Possible cons:
  - Fitting to invariant mass vs. recoil mass shapes
  - Has ≈0.8% systematic that we know of

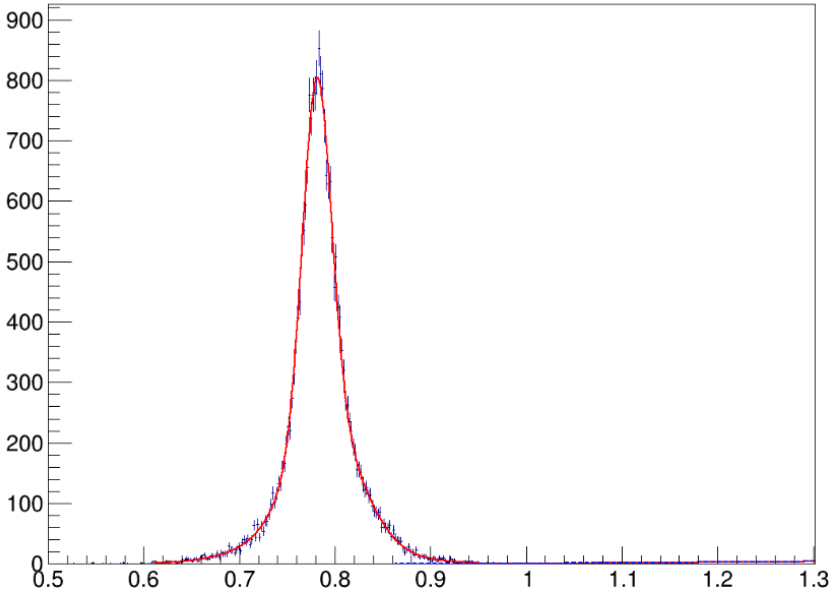
Signal MC

Invariant Mass Found



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

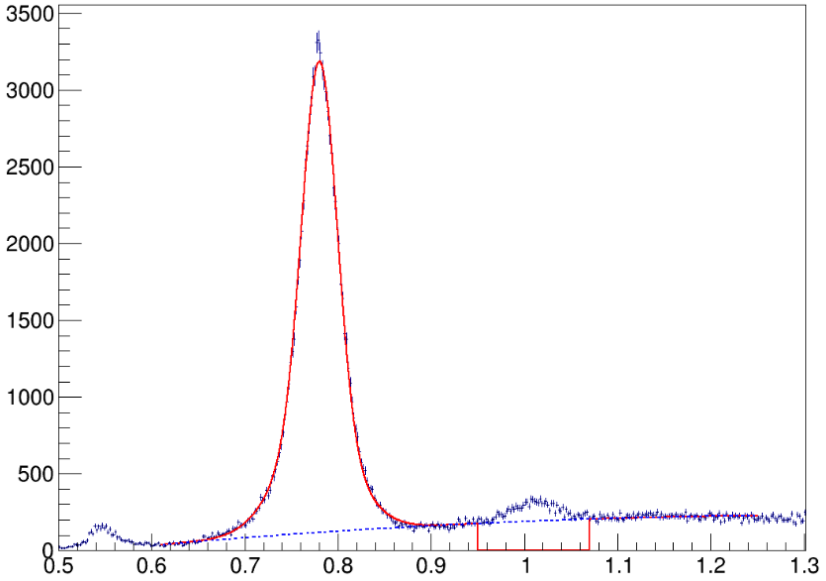
"Inefficiency"



Recoil against p (GeV)

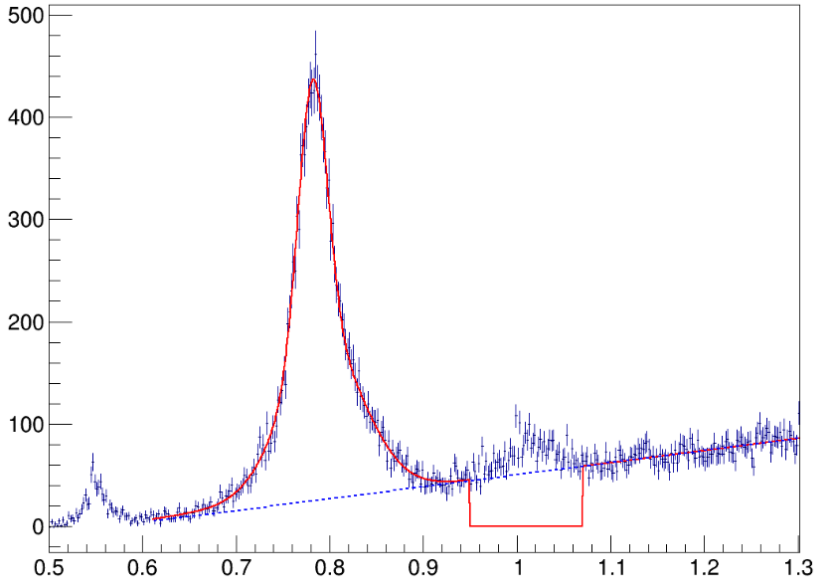
2017 Coherent Peak Data

Invariant Mass Found



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

"Inefficiency"



Recoil against p (GeV)

Results:

- Signal MC:
  - Method 1: 83.0%
  - Method 2: 82.4%
- 2017 coherent peak data:
  - Method 1: 85.8%
  - Method 2: 86.7% (or 86.2% with best guess for underestimation)
- Don’t compare data/MC numbers yet!
  - MC lacks beam E spectrum and kinematic considerations
- Both show good agreement between methods
- No statistical errors yet, not hard but not trivial

Next Steps

- Verify with workshop-approved datasets!
- Ahmed has processed with workshop data skim and MC, has been waiting on me
- Will report on those, hopefully before end of day