

Compton analysis

Analysis updates

- Cross section calculations with radiative corrections
- Double Compton kinematics applied according to radiative corrections calculations
- Extended Carbon data set (15nA and 5nA beam current runs) was used
- Syst. error budget table presented

Compton event selection

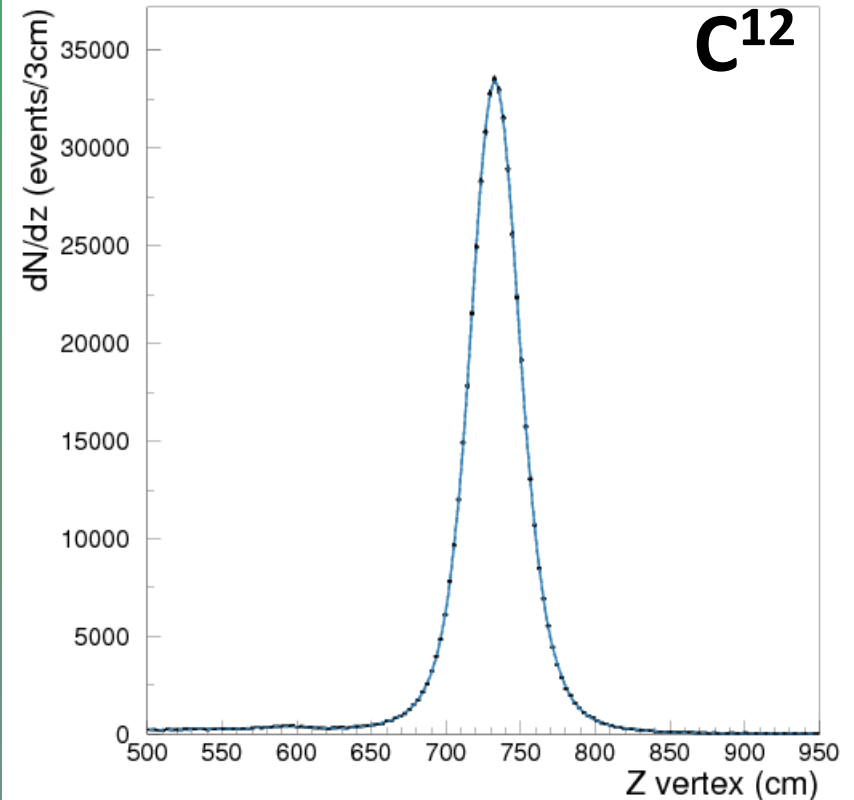
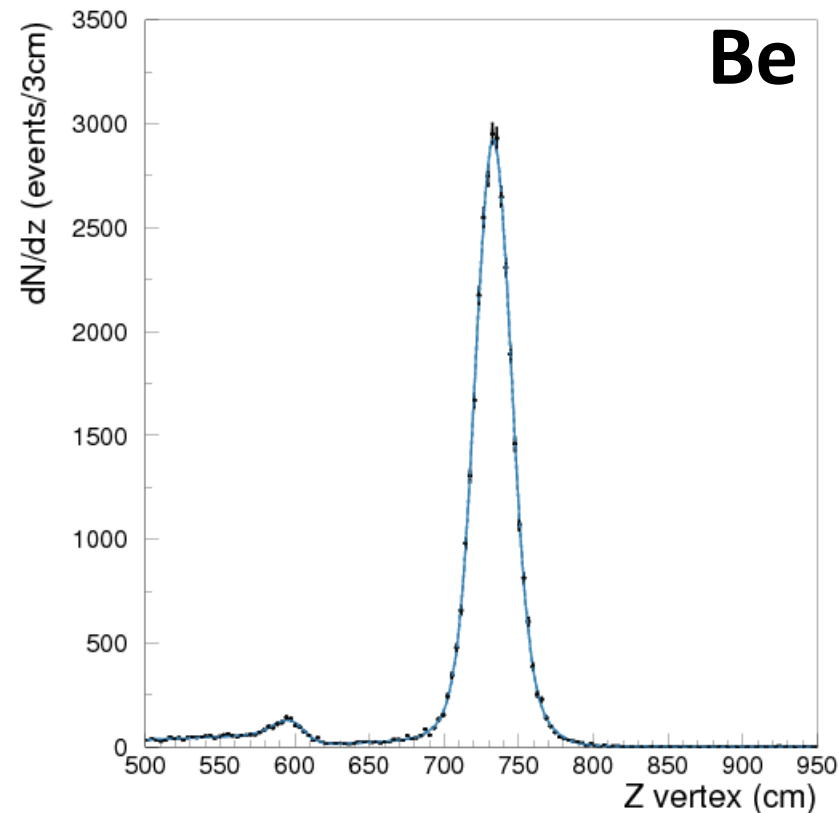
- 11 “production” T-counters were used (no low energy T-counters included in analysis)
- Minimum cluster energy 0.5 GeV
- Minimum cluster pair energy 3.5 GeV
- Tdif cut 4.5 ns (“timing sidebands” subtracted)
- Best-in-time beam candidate only
- PWO-only with 4 central vertical columns off
- χ^2 of kinematic fit <100

Kinematic constraint

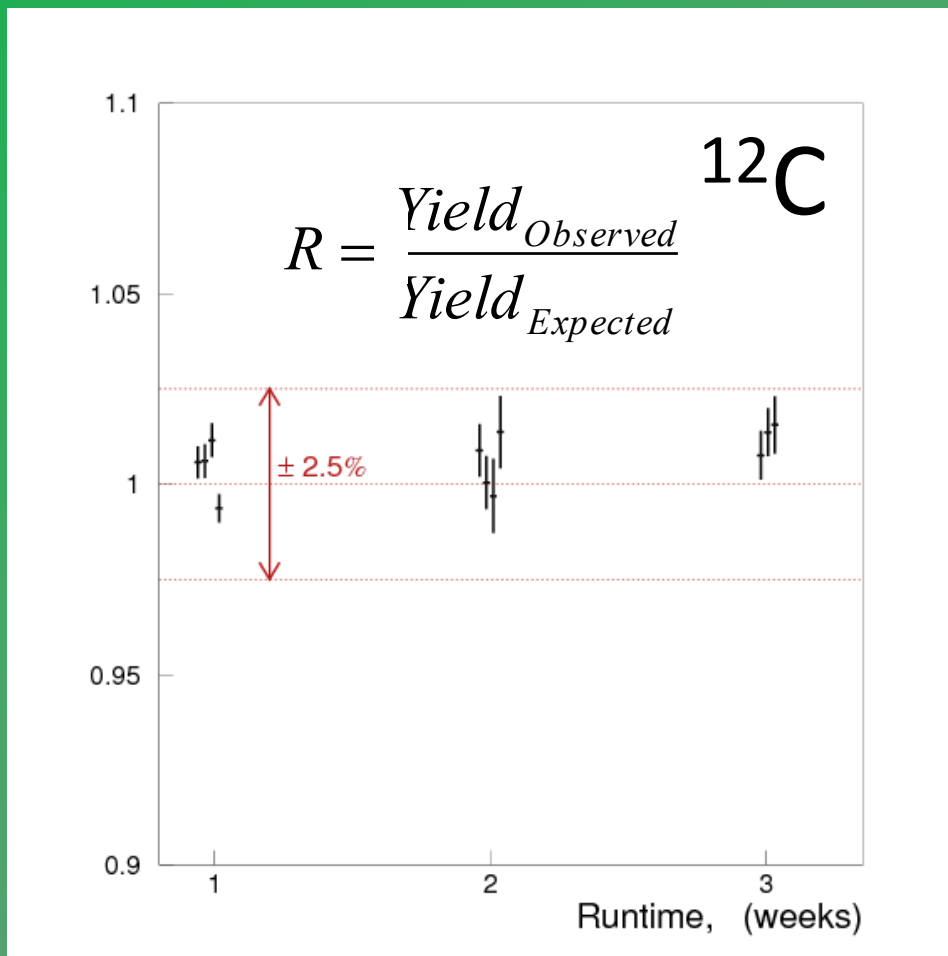
- Energy conservation: $E_\gamma = E_{\gamma'} + E_{e^-}$
- Momentum conservation: $P_{x,y,\gamma} = -P_{x,y,e^-}$
- $\chi^2 = \sum_{i=1}^2 (\epsilon_i - E_i)^2 / \sigma_{\epsilon_i}^2 + (x_i - X_i)^2 / \sigma_{x_i}^2 + (y_i - Y_i)^2 / \sigma_{y_i}^2$
- Corrected coordinates and energies used in further analysis

Yield extraction, two targets

Z coordinate of reconstructed event, calculated assuming Compton kinematics, used to extract yield



Yield stability VS Runtime



$$Yield_{Expected} = Flux \cdot \frac{Z\rho N_A}{\mu} \cdot \sum_{i=1}^{11} W_i \epsilon_i \sigma_i$$

Where:

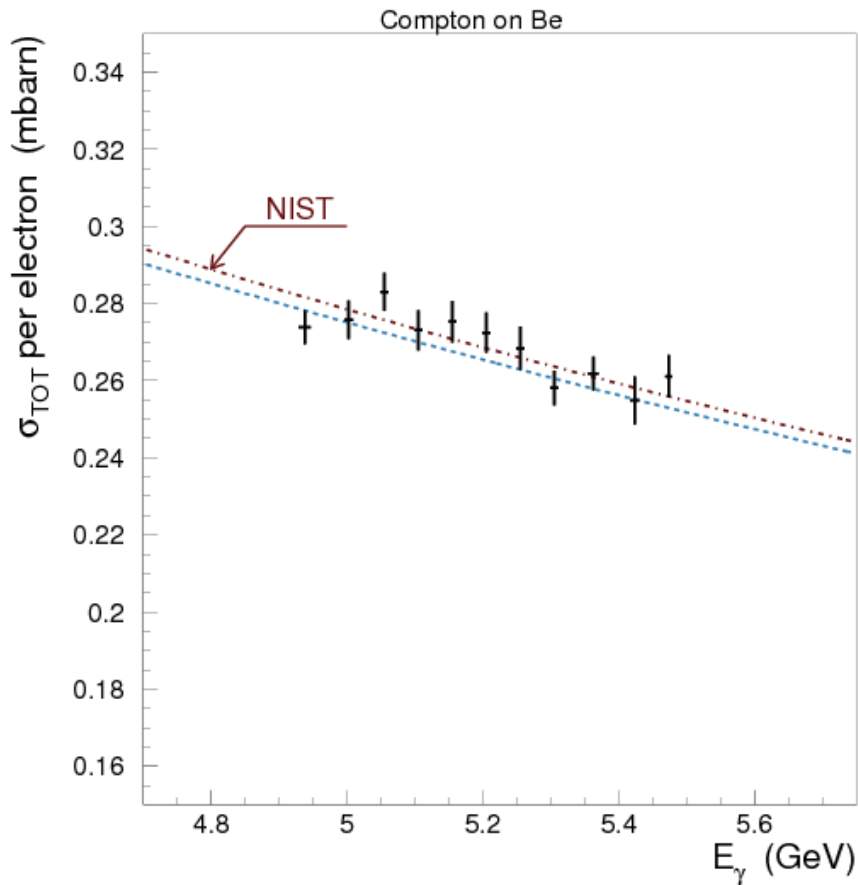
W_i - fraction of flux

ϵ - efficiency

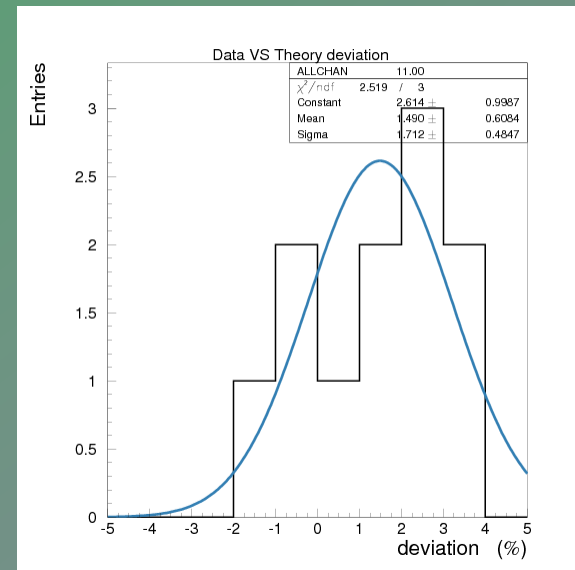
σ - cross section

for i^{th} T-counter

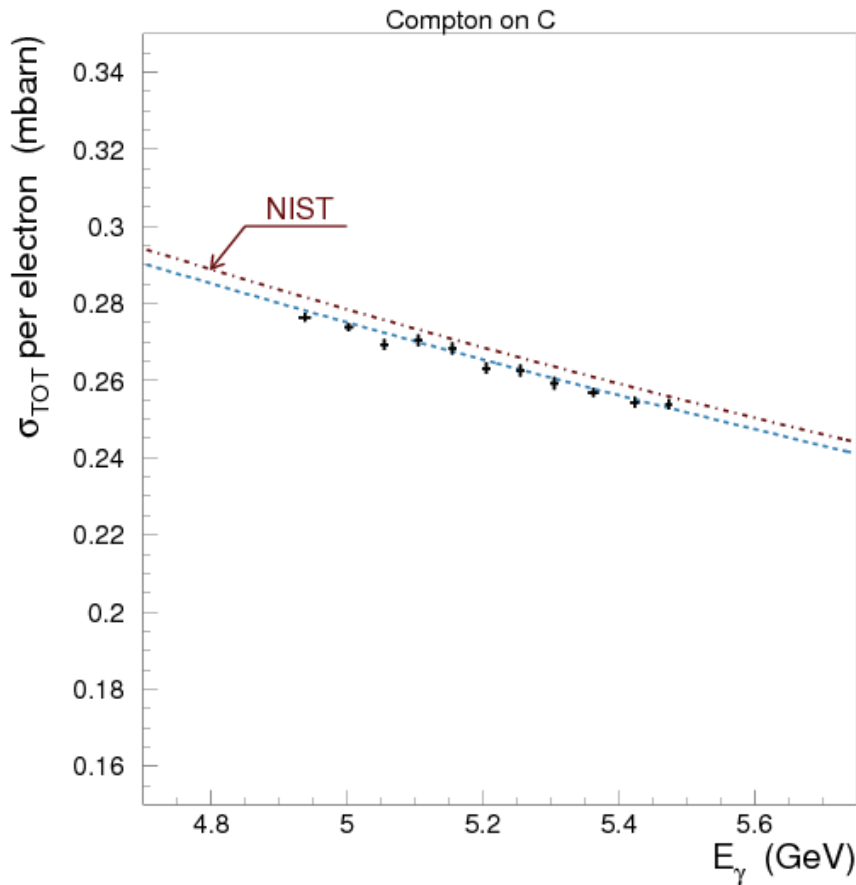
Total cross section, Be



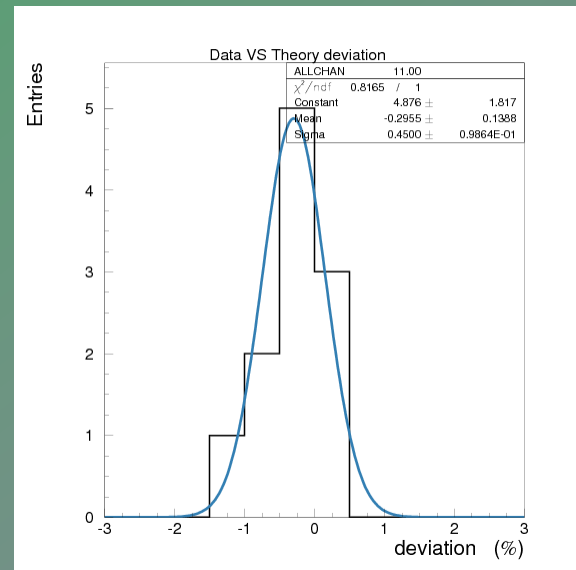
Data VS Theory Deviation:
Mean = $+1.5\% \pm 0.6\%$
= $1.7\% \pm 0.5\%$



Total cross section, C



Data VS Theory Deviation:
Mean = -0.3% \pm 0.13%
 σ = 0.45% \pm 0.1%



Error budget

- Stat. errors: Be – 2%; ^{12}C – 0.5%
- Syst. error:

Contributions	Errors, [%]
Photon Beam Flux	1.0
Target	0.1
Beam parameters	0.3
Setup acceptance	0.3
Yield extraction	1.5
■ cut	<0.1
Min. cluster energy cut	0.12
Model errors	?
Total	1.9

Conclusion

- Cross section values are in agreement with predicted by theory calculations within stat. and systematic error:
 - Carbon: -0.3% shift with 0.45% spread
 - Beryllium: +1.5% shift with 1.7% spread
- Estimated total syst. error for extracted cross sections 1.9%, total error (Carbon) 1.9%

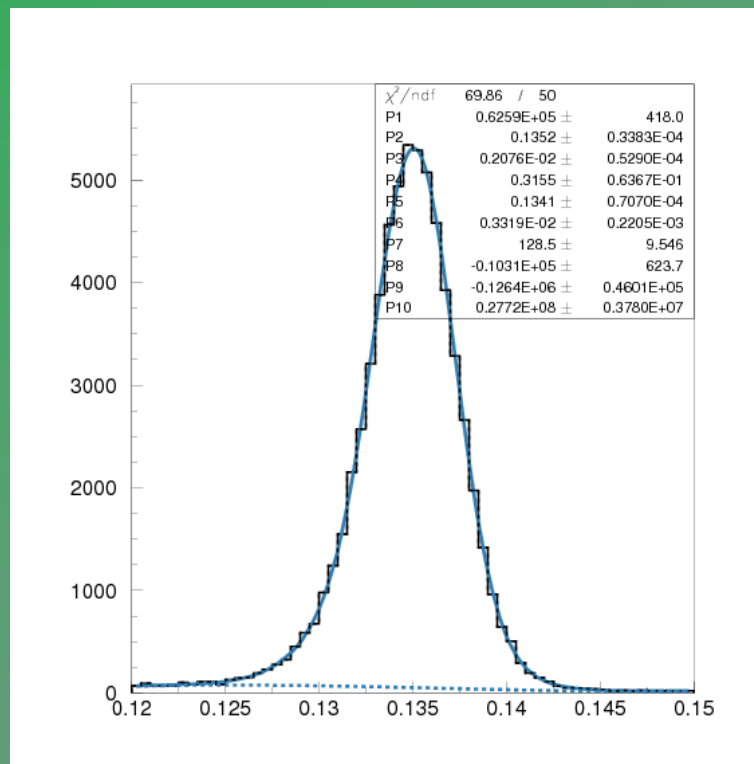
Spare slides

Unconstrained pi0 analysis

- Same cuts and selection as in constraint analysis:
 - Tdif cut 4.5ns
 - Crystal only HyCal part
 - Best-in-time beam candidate
 - Veto cut applied

Pi0 distribution on invariant mass

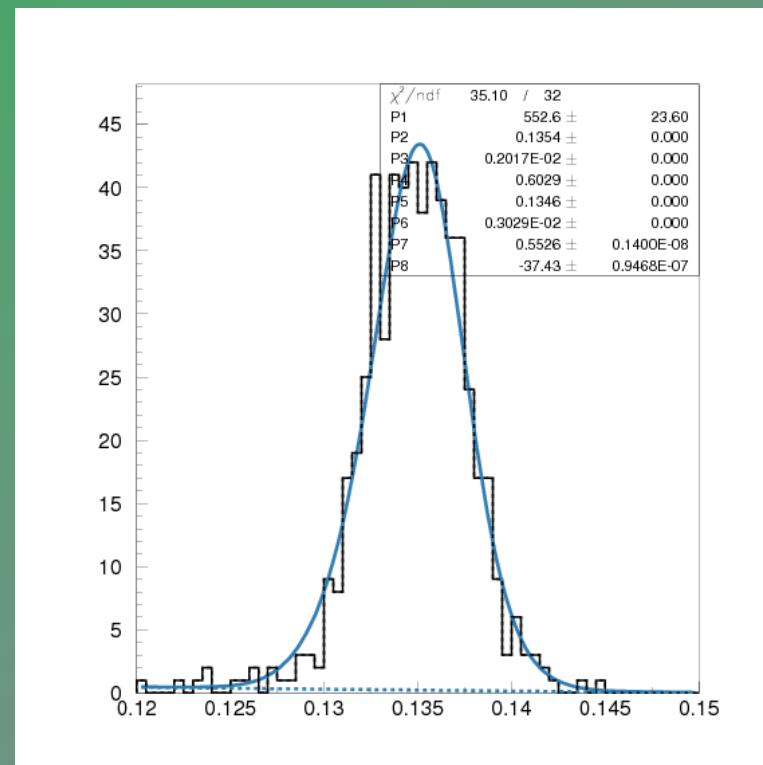
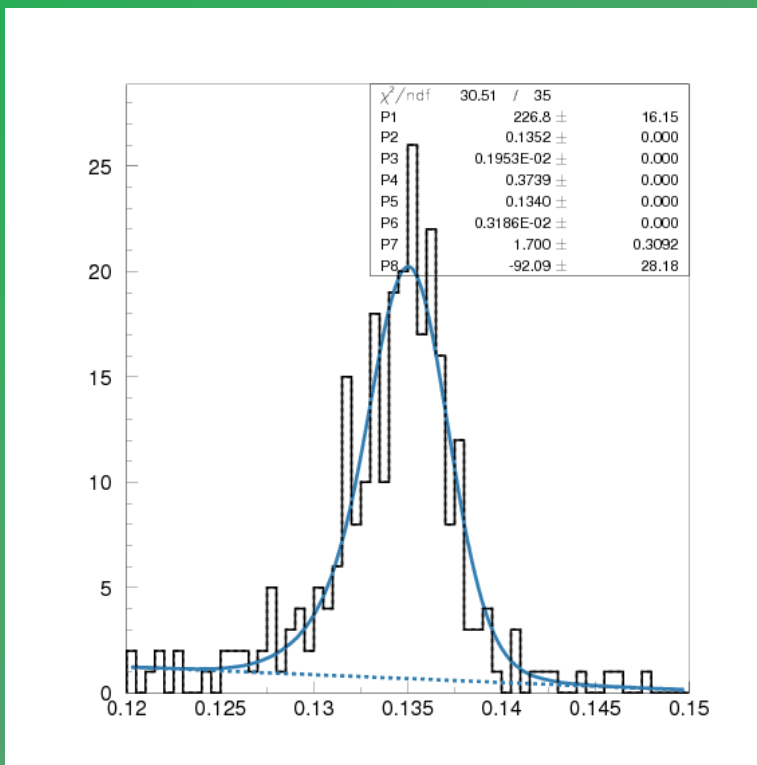
■ = 0 – 2.7 ■



Pi0 distribution on invariant mass

$\sigma = 0.2$

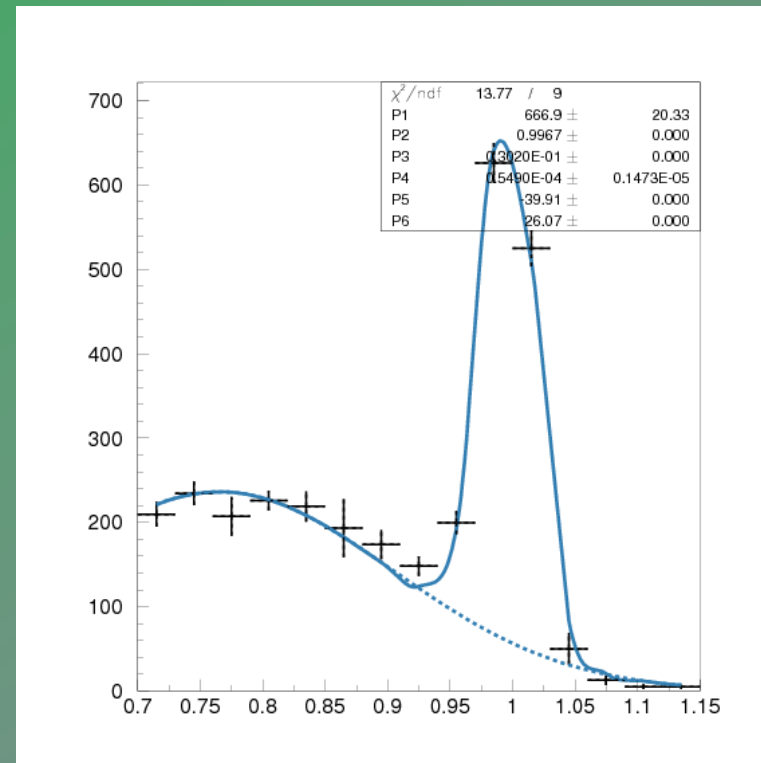
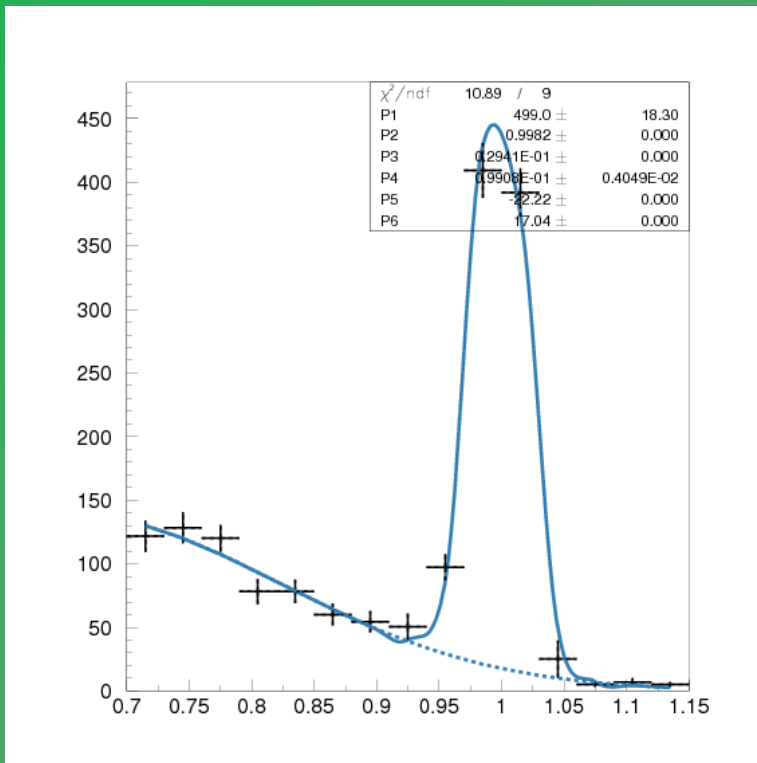
$\sigma = 2.0$



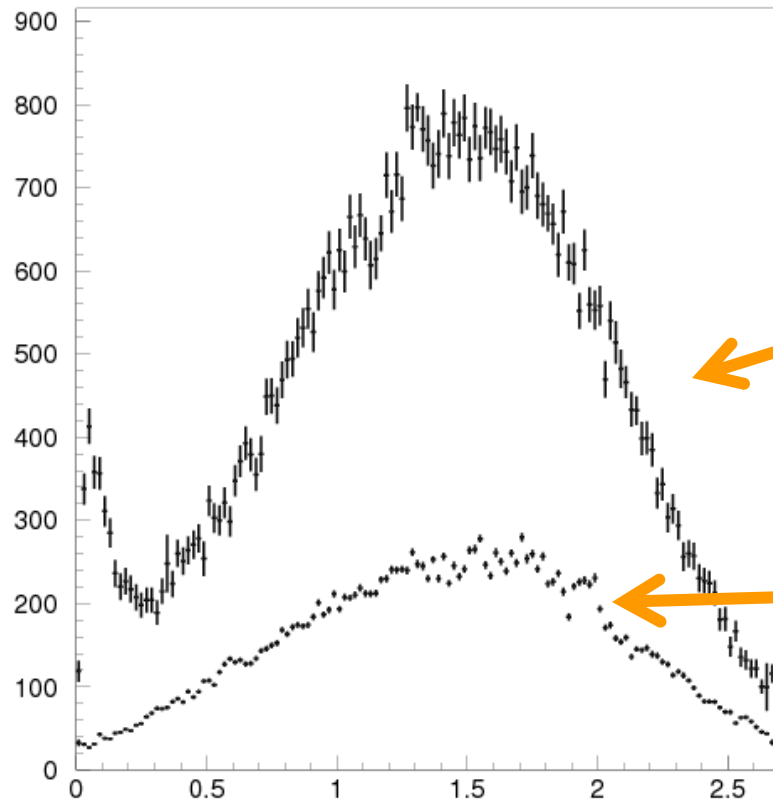
Pi0 distribution on elasticity

$\epsilon = 0.2$

$\epsilon = 2.0$



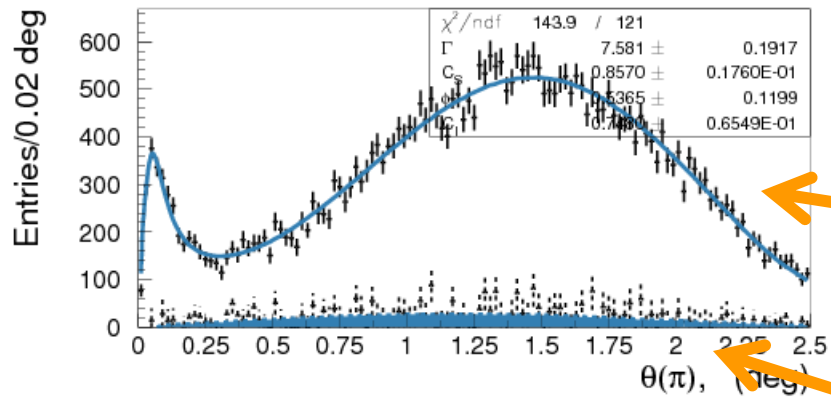
Pi0 dN/dθ distribution



Elastic + inelastic

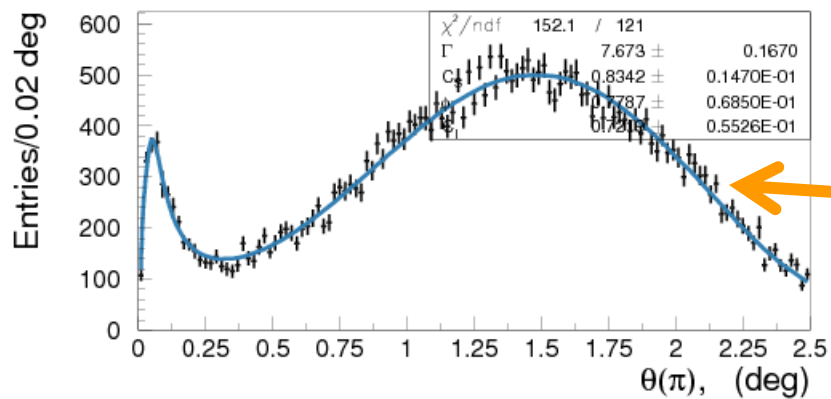
Inelastic ($x = 0.85 \dots 1.15$)

dN/dθ fit



$\Gamma = 7.59 \pm 0.19$ eV
 $\phi = 0.33 \pm 0.12$ rad.

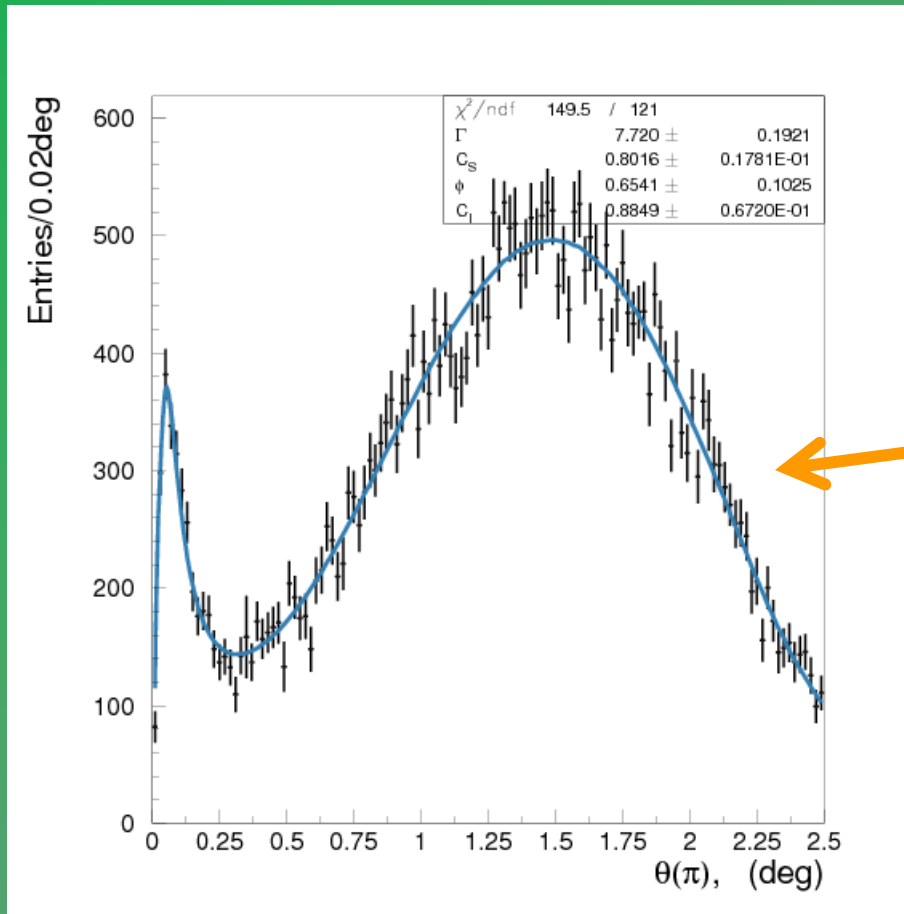
Unconstrained



Difference

Constrained

$dN/d\theta$ fit, ω subtracted



$\Gamma = 7.72 \pm 0.19$ eV
 $\phi = 0.65 \pm 0.10$ rad.

Unconstrained

Error budget contribution: 0.4%