Preliminary $\Gamma_{\gamma\gamma}$

Dustin McNulty
MIT/JLab/UKy
PrimEx Collaboration
mcnulty@jlab.org

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What's New in my Analysis

- Incorporated Veto–dramatic enhancement in π^0 signal to noise for small θ_{π^0}.
- Improved inelastic bkgd evaluation/correction–fixed problem with $m_{\gamma\gamma}$ fits at high elasticity ($x > 1.04$), constrained inelastic bkgd parameterization to give consistent shape as a function of θ_{π^0} (work not finished).

Stat. Error Assessment Table for $\Gamma_{\gamma\gamma}$ (^{12}C, rad B only)

$\Gamma_{\gamma\gamma}$ (eV)	Statistical (+ fit) Error (%)	Inc. Model
8.03	$\pm$1.46	Cascade (5.2 GeV)
8.07	$\pm$1.47	Fermi Gas
8.27	$\pm$1.75	Glauber
8.12	**$\pm$1.6**	**Average (before flux Correction)**
7.93	**$\pm$1.6**	**Average (after 2.4% flux Correction)**

Systematic Error Table for $\Gamma_{\gamma\gamma}$

Item	Error (%)	Comment
Yield $m_{\gamma\gamma}$ fits + inelastic bkgd corr.	± 0.98	
inelastic bkgd shape uncertainty	± 0.75	
Photon flux	± 1.0	
Incoherent XS shape uncertainty	± 1.48	Which shape to use?
Nuclear coh. XS energy dep.	± 0.04	
Detection/Recon efficiency	$\pm 1.5^*$	Includes veto + trigger eff.
Fiducial Acceptance	$\pm 1.5^*$	Geom. eff. + beam align.
Event Selection	± 1	Best in time candidate
Target thickness + branch ratio	0.06	0.05 + 0.03 in quadrature
Tagged Photon Energy	0.10	
Total	$\pm$**3.2**	**Combined in Quadrature**

Preliminary Result

$$7.929 \text{ eV } \pm 0.127 (1.6\%) \text{ Stat}$$

$$\pm 0.254 (3.2\%) \text{ Syst}$$

Summary

- Need more work on systematic error: Primarily reconstruction efficiency and acceptance.
- Need to evaluate ^{208}Pb target $\Gamma_{\gamma\gamma}$ result and include in systematic.
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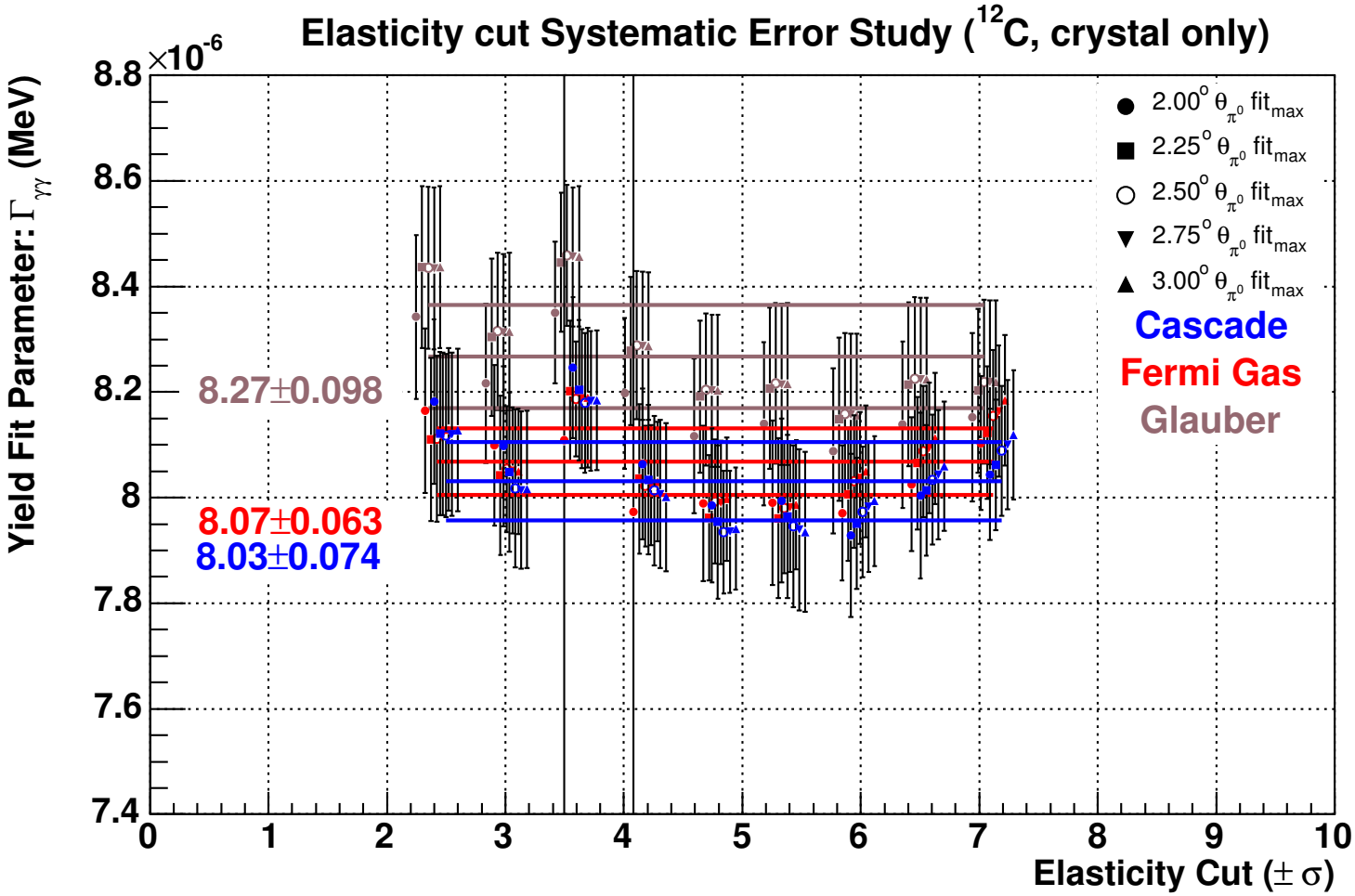
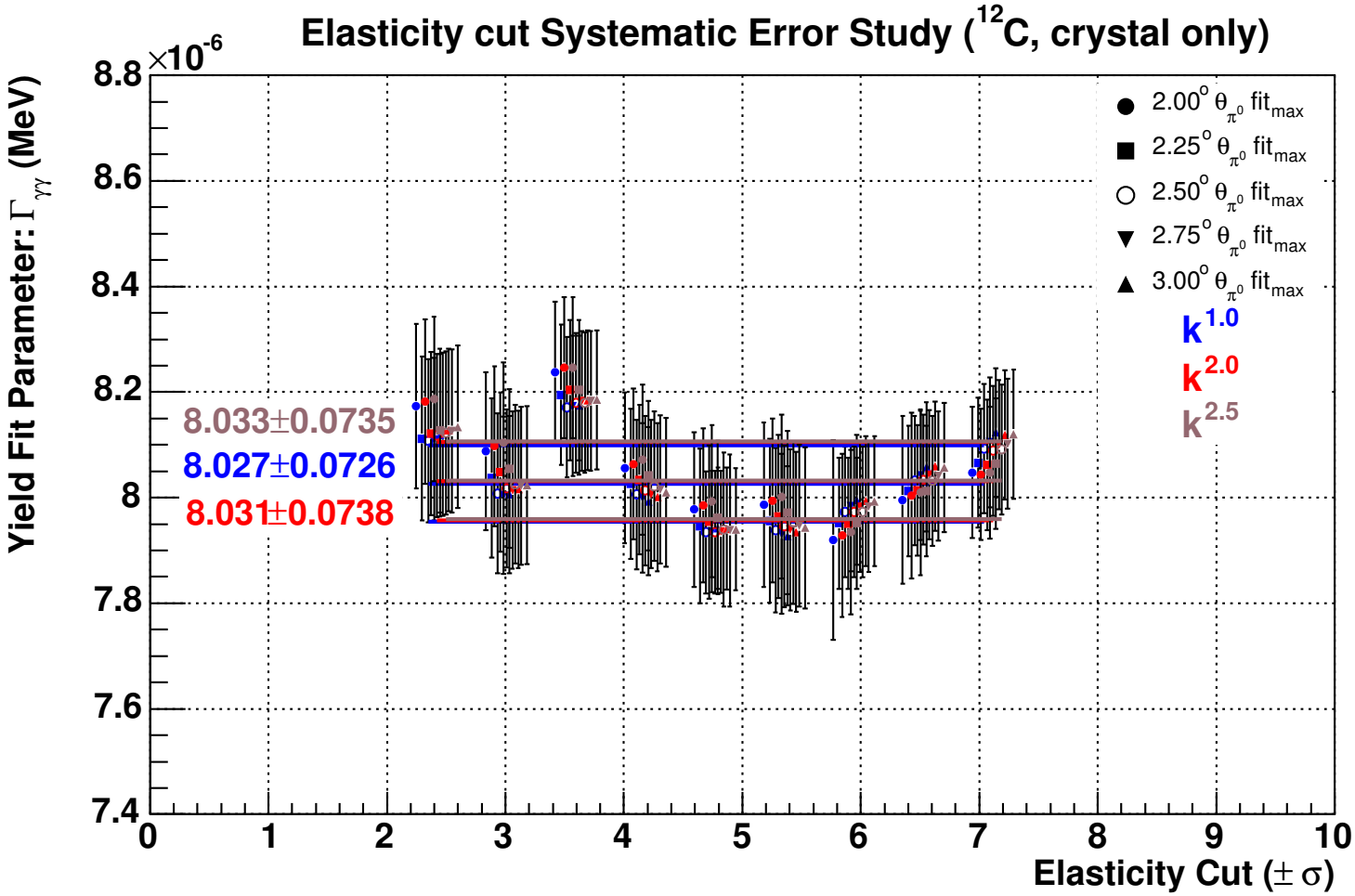
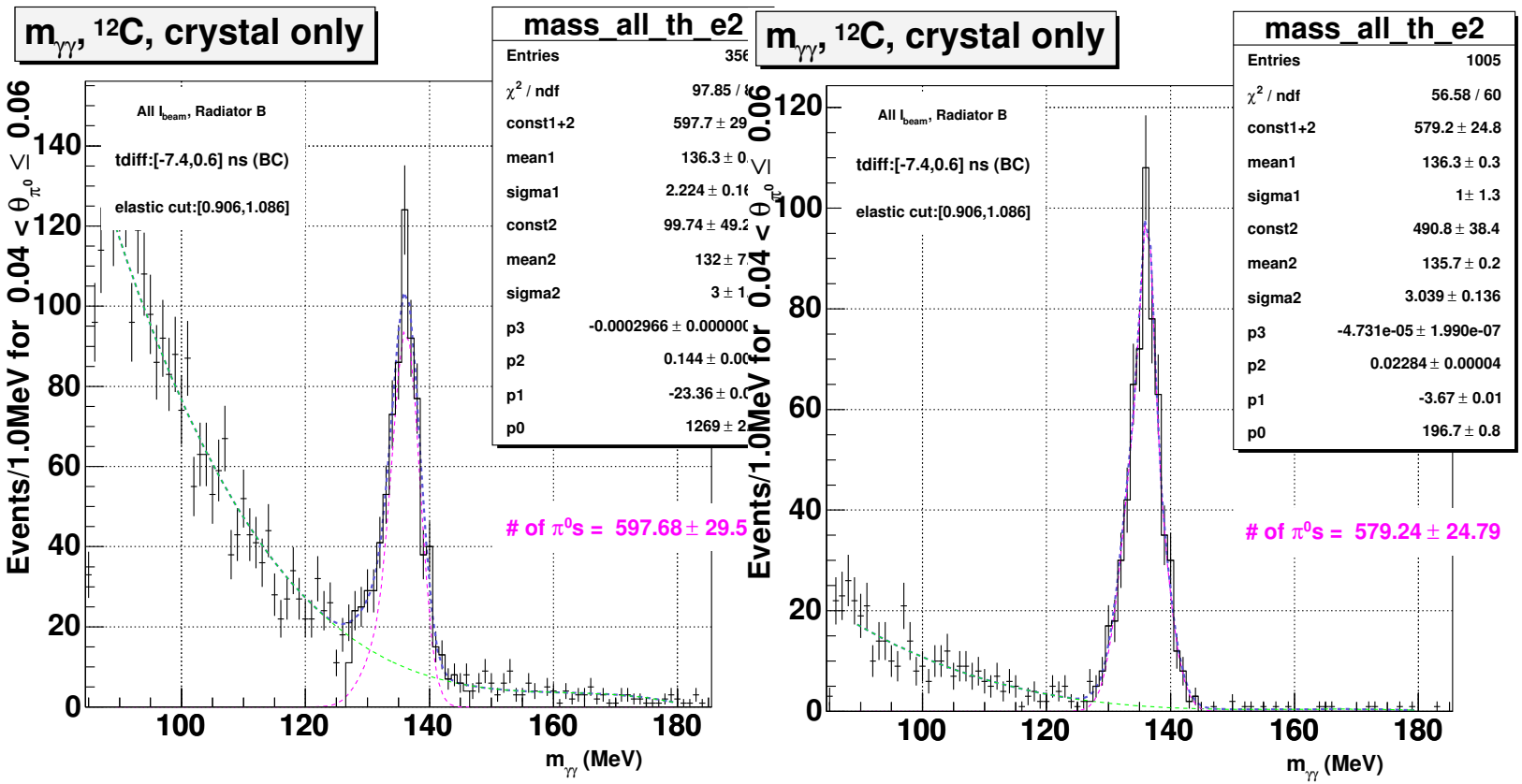
Incoherent Shape and Elasticity Cut Dependence



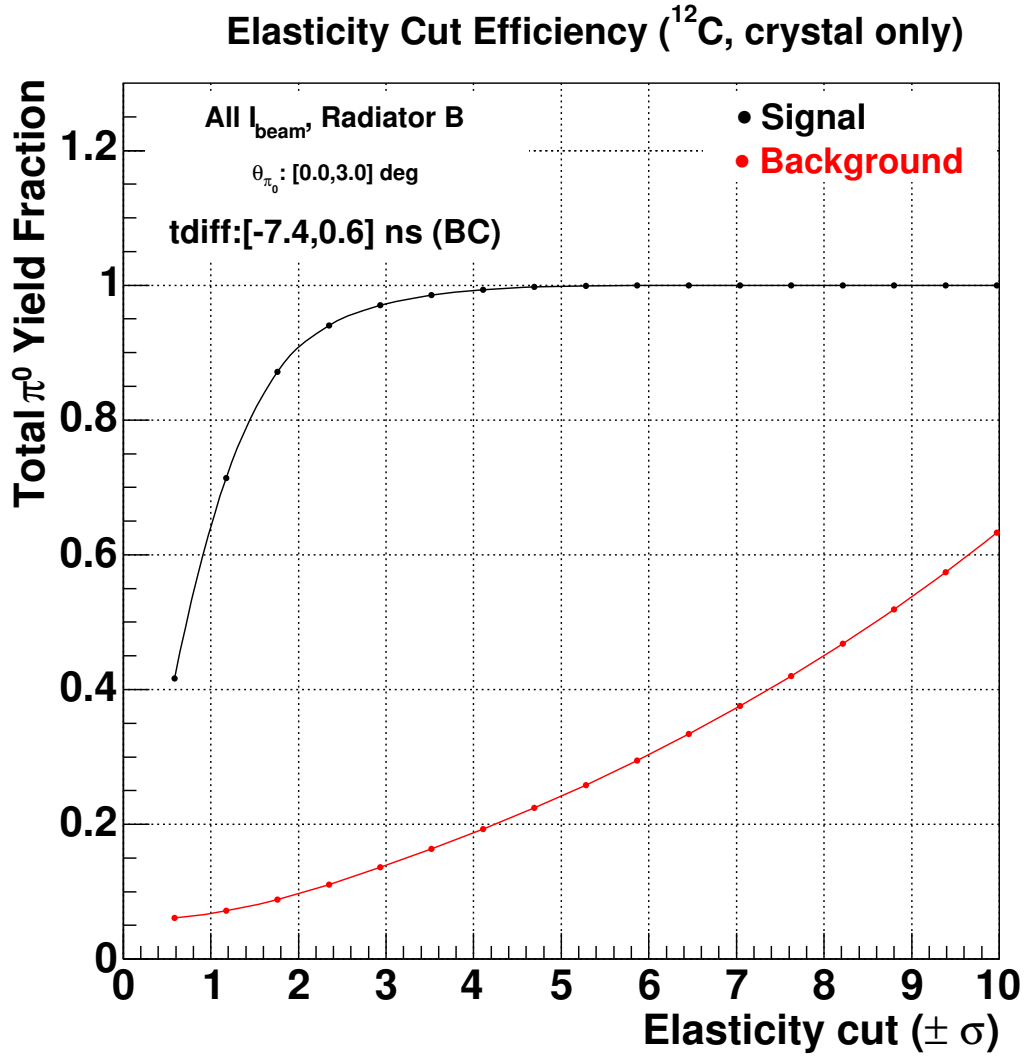
Nuclear Coherent Energy Dependence Uncertainty



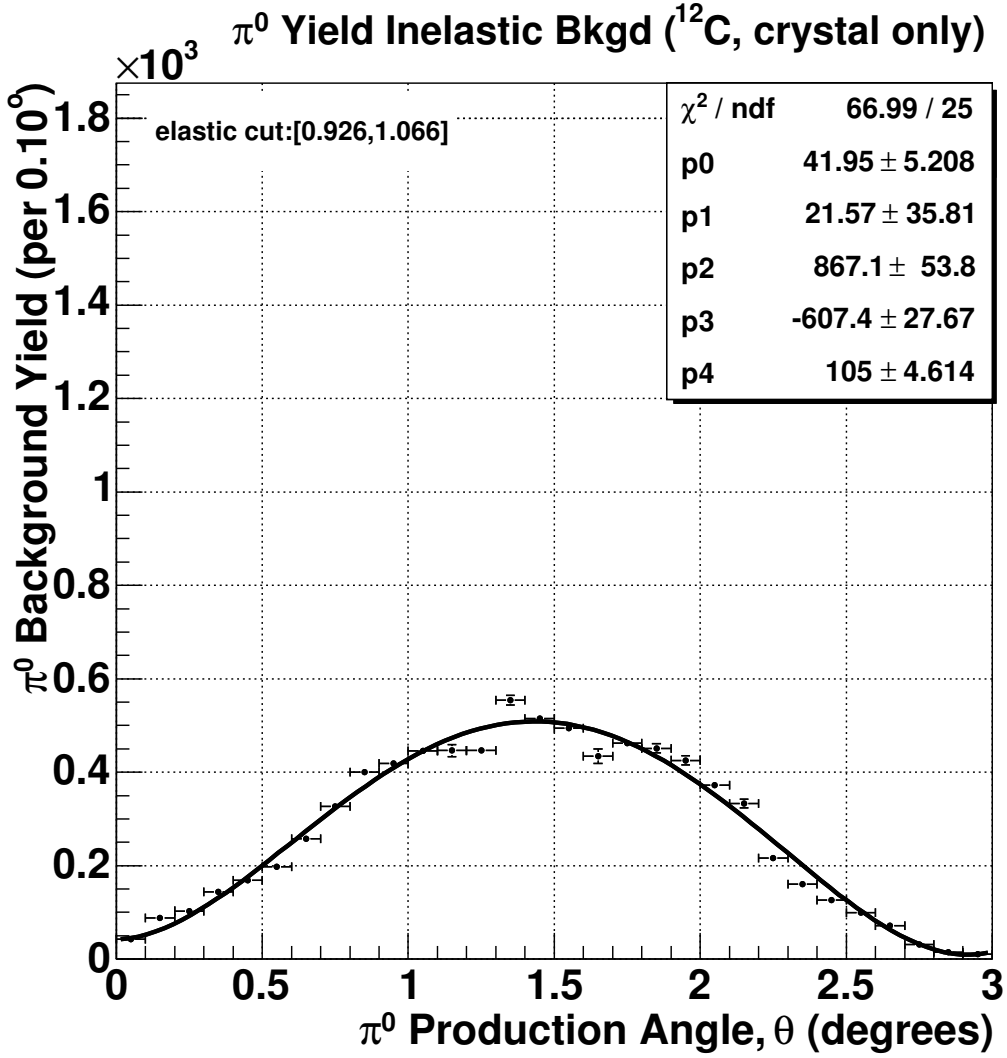
Effect of Veto: Before(left plot), after(right plot)



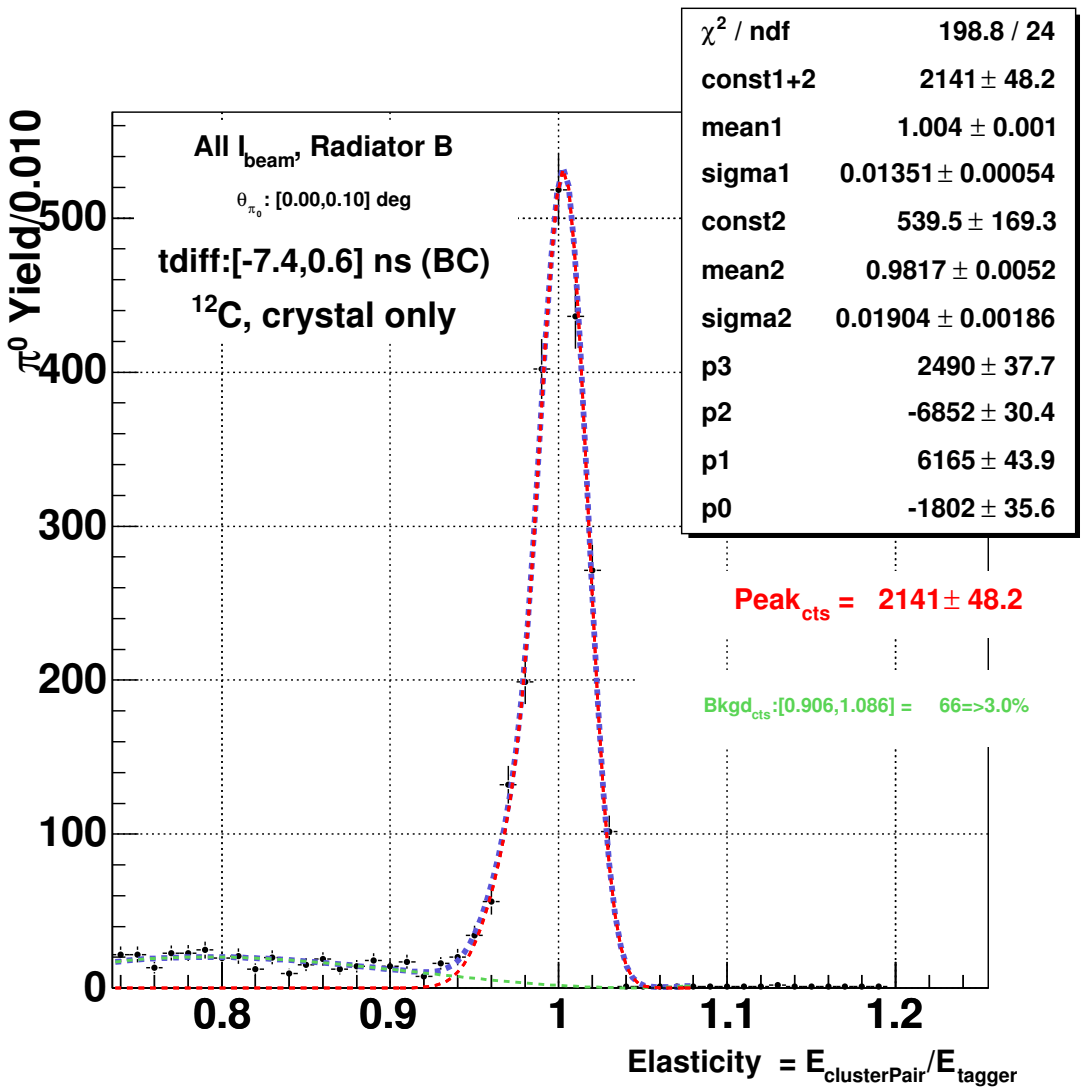
Elasticity Cut Efficiency (All θ_{π^0})



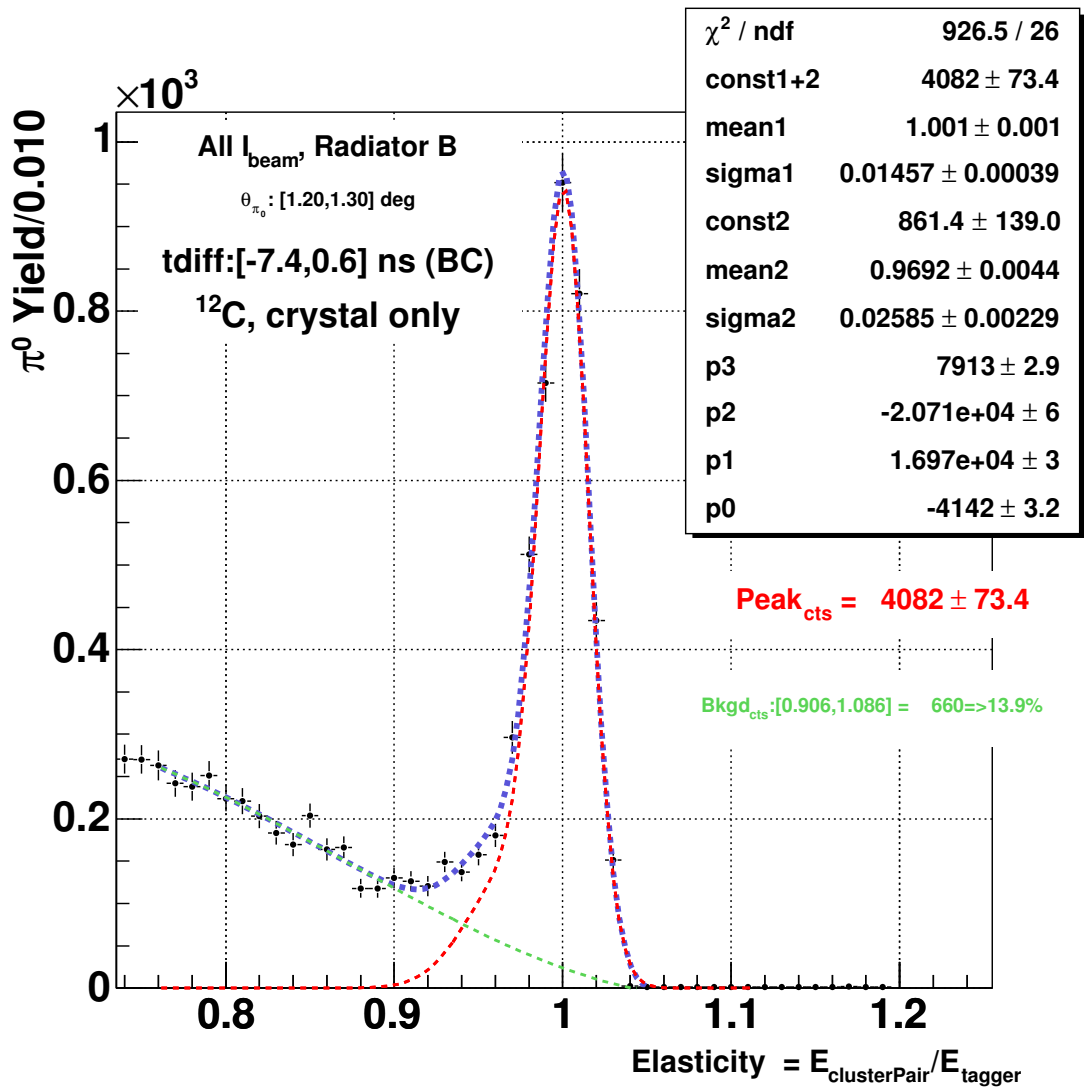
Inelastic Bkgd (under elastic peak) Yield



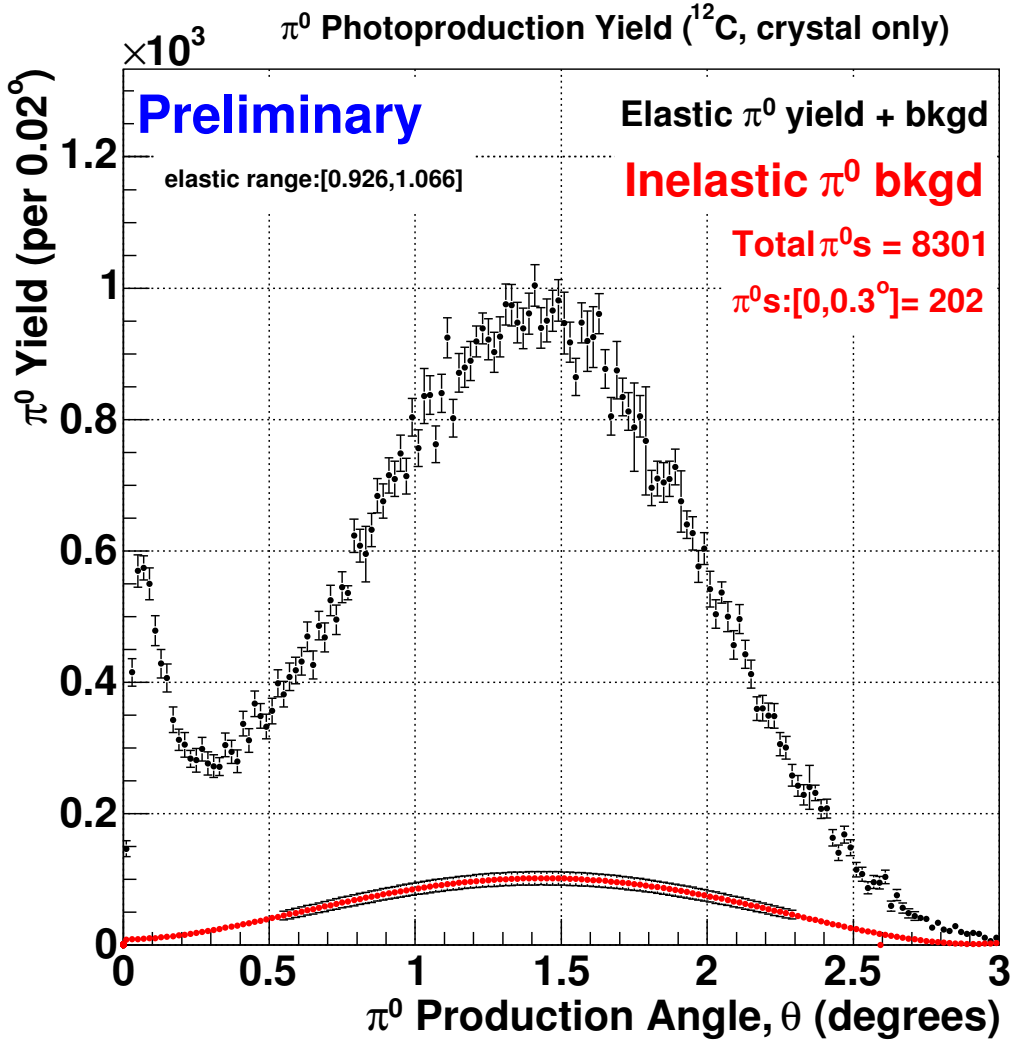
Example Elasticty Yield Bkgd Fit: Primakoff Region



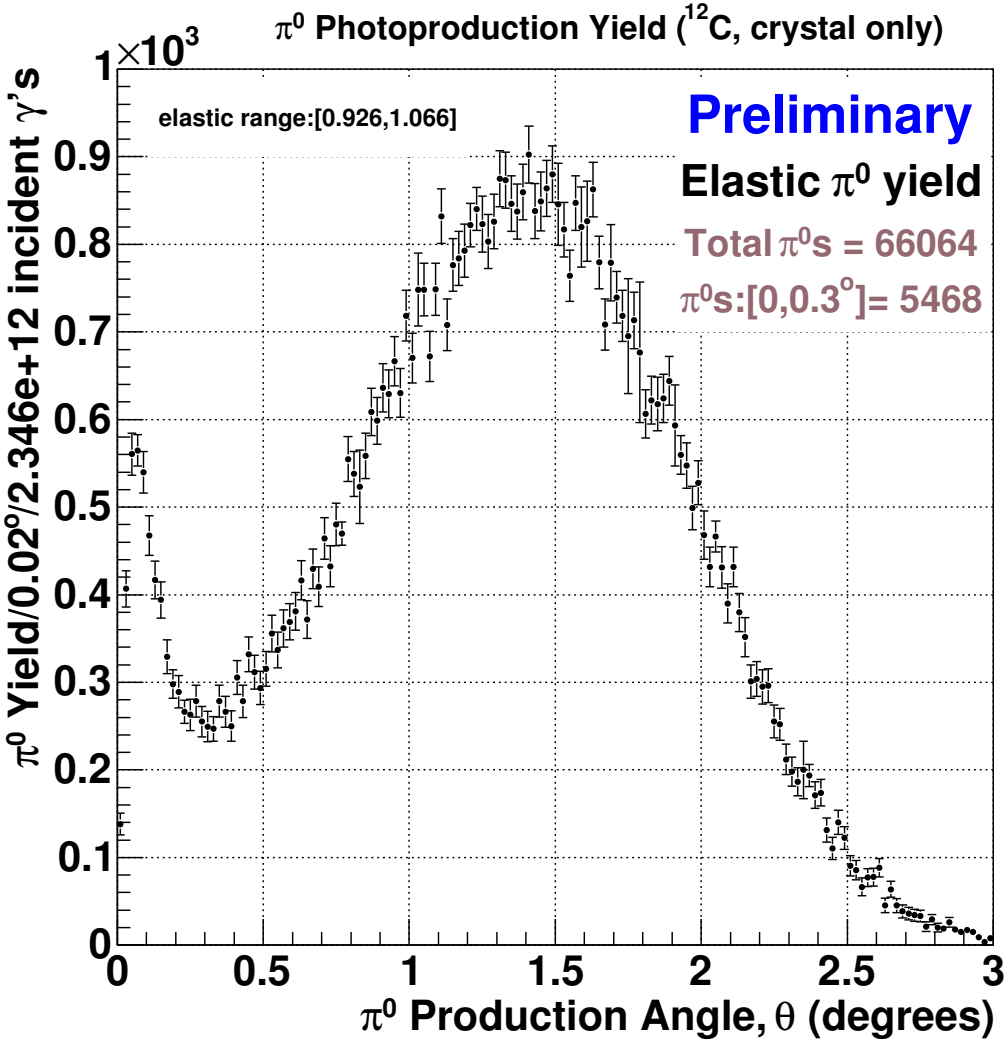
Example Elasticty Yield Bkgd Fit: NC Peak Region



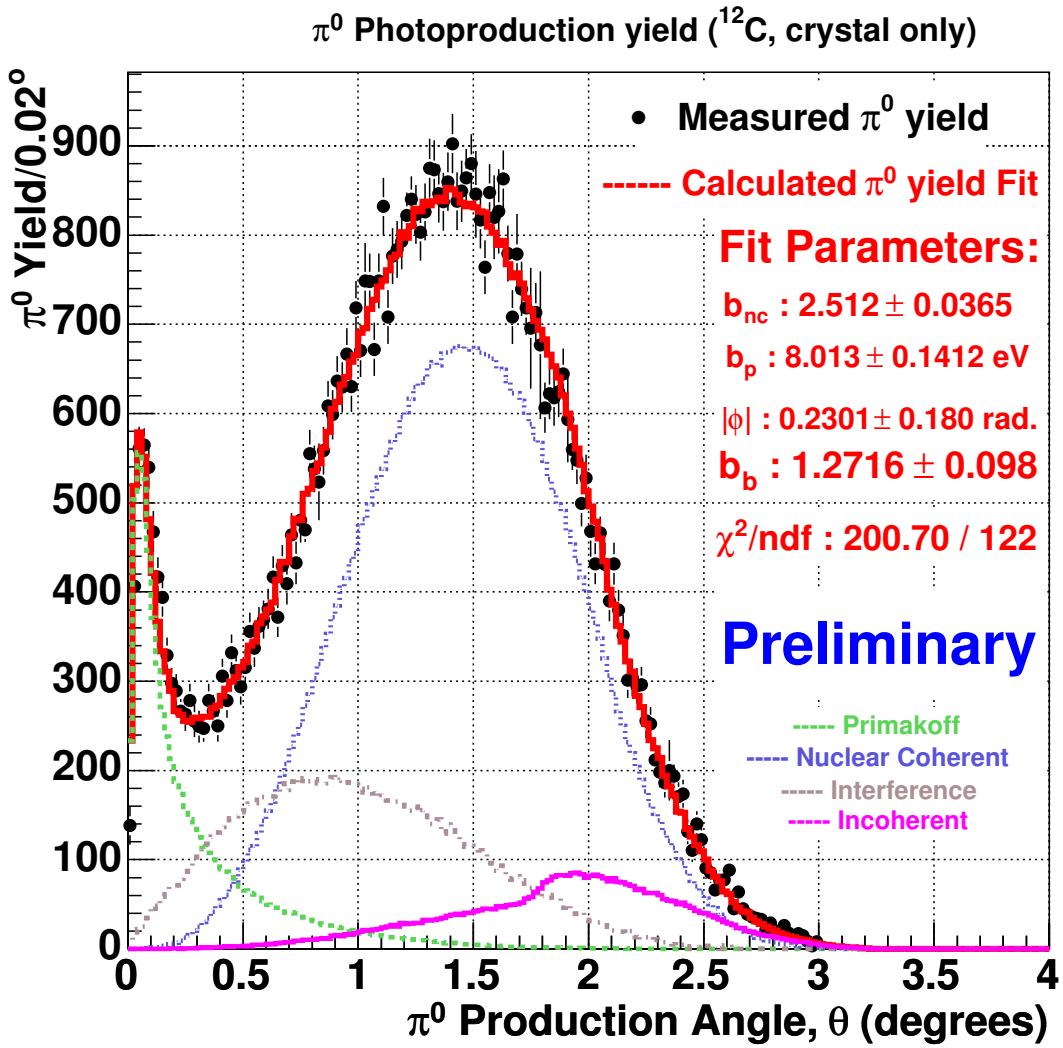
Uncorrected Yield Spectra



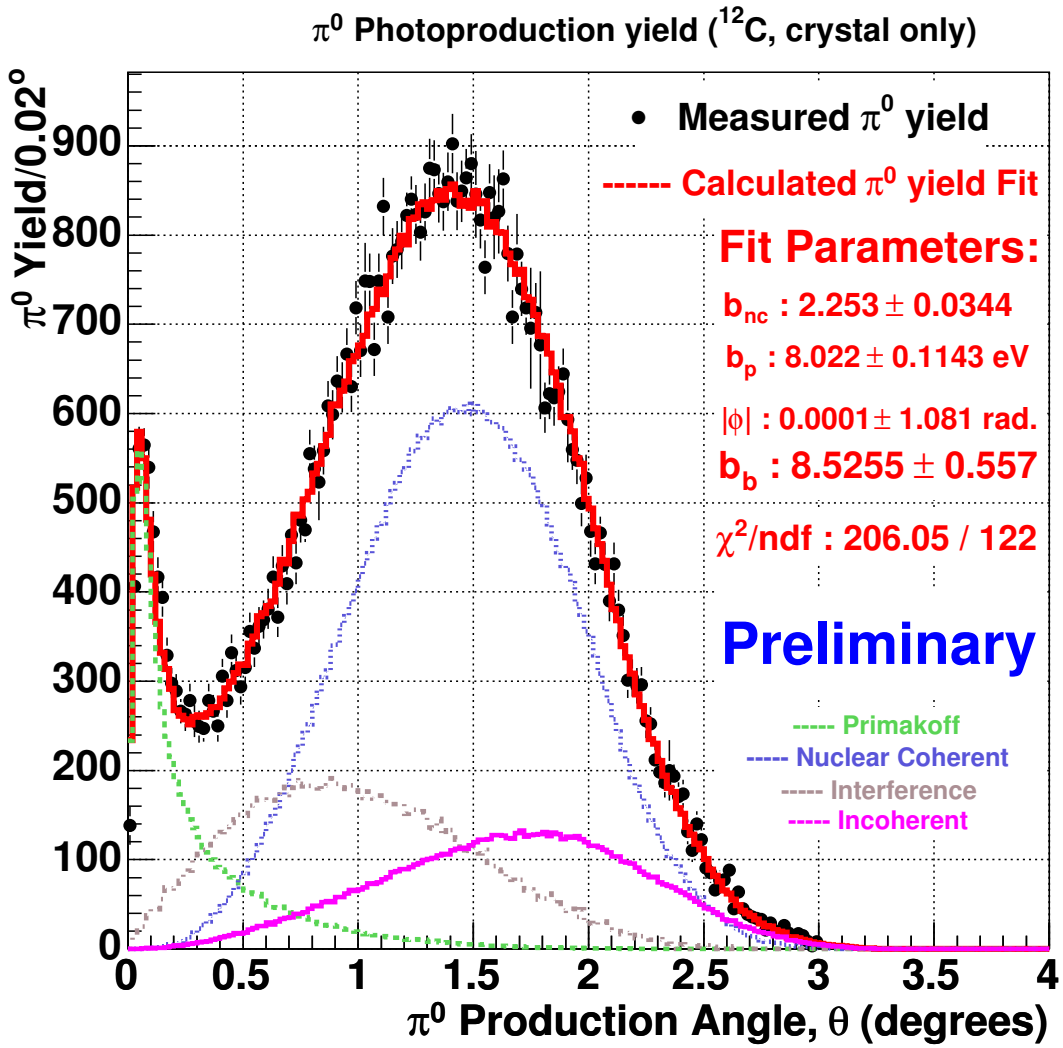
Bkgd Corrected Yield



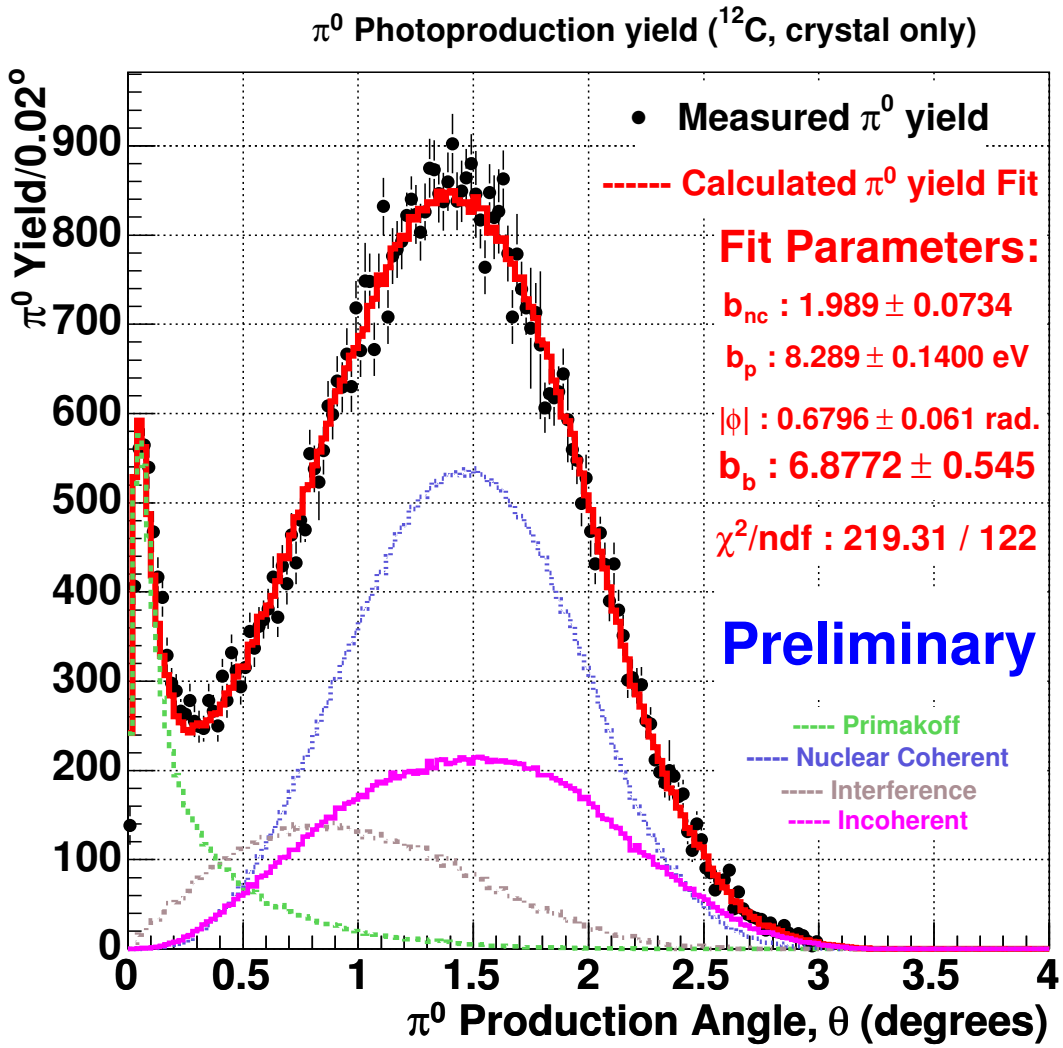
Example Yield Fit: Using Cascade 5.2 GeV

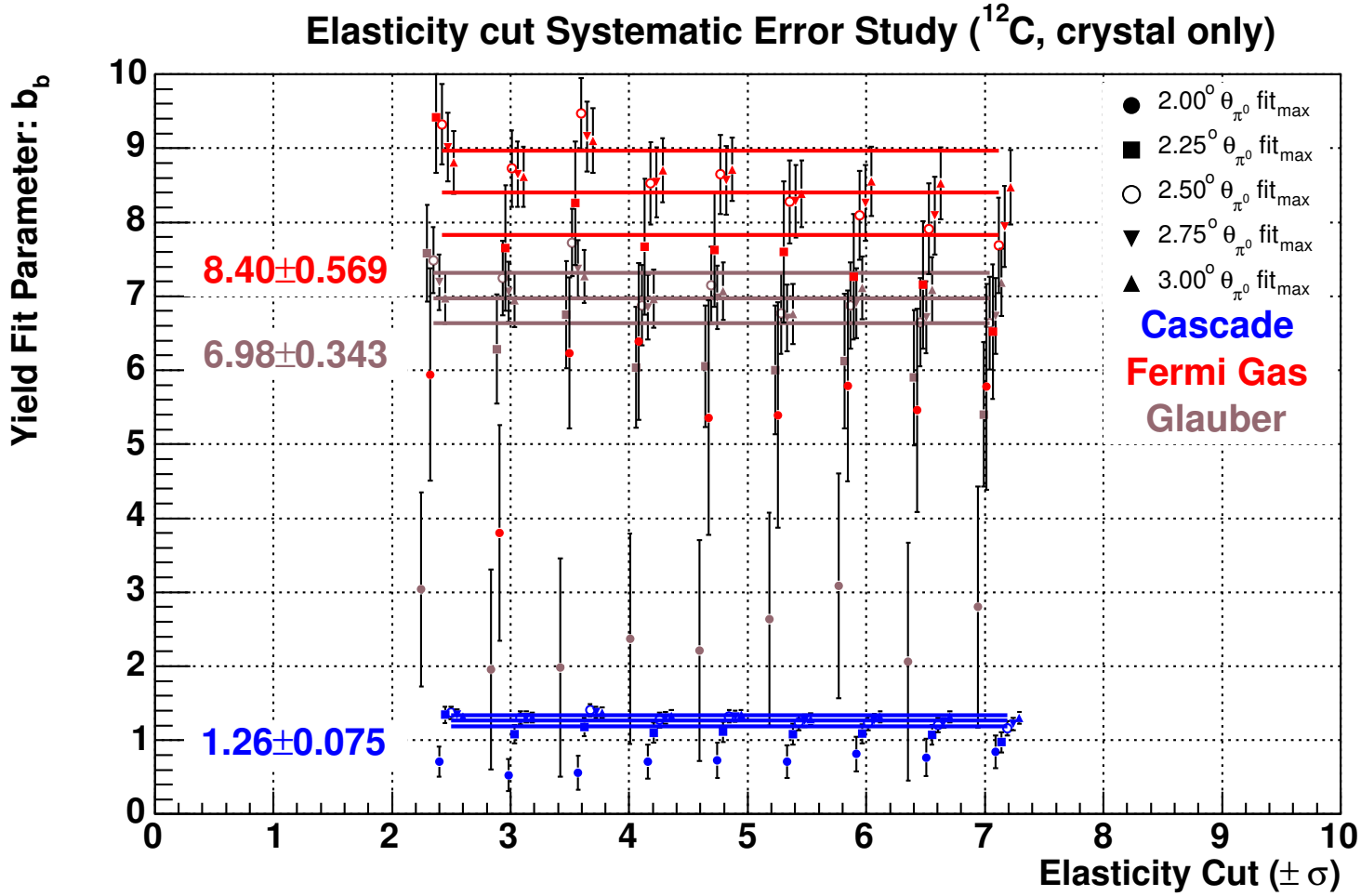


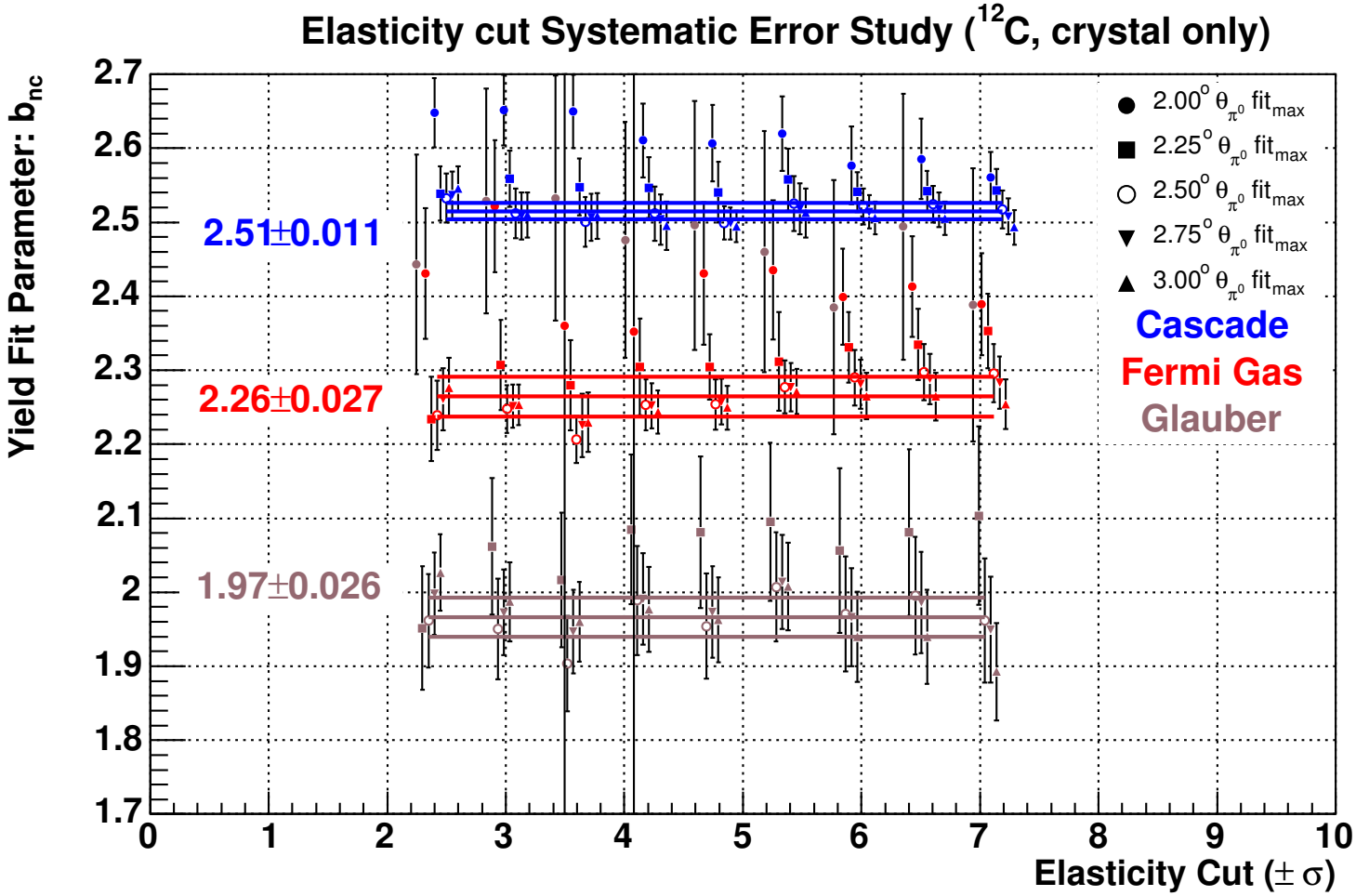
Example Yield Fit: Using Fermi Gas

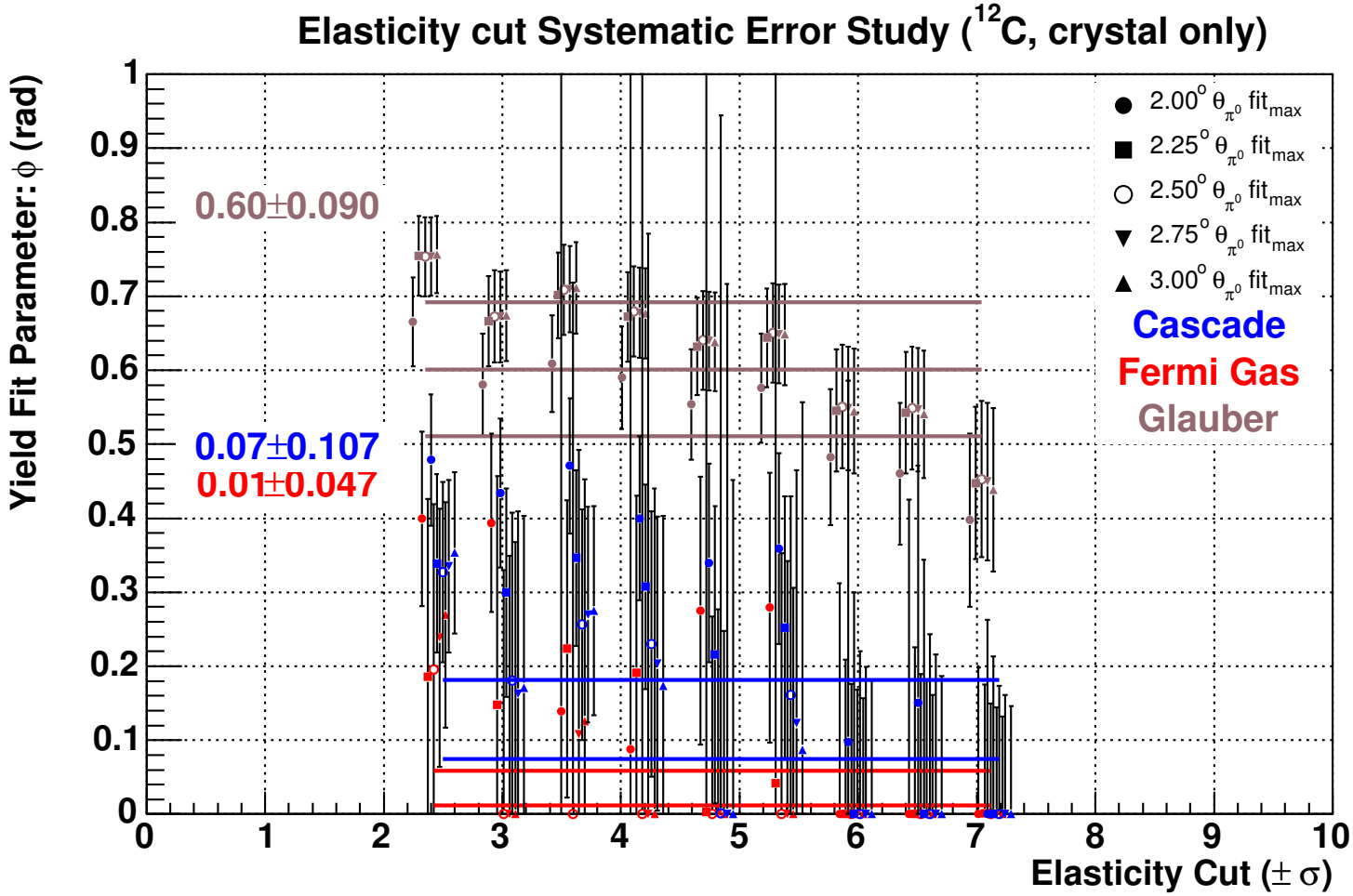


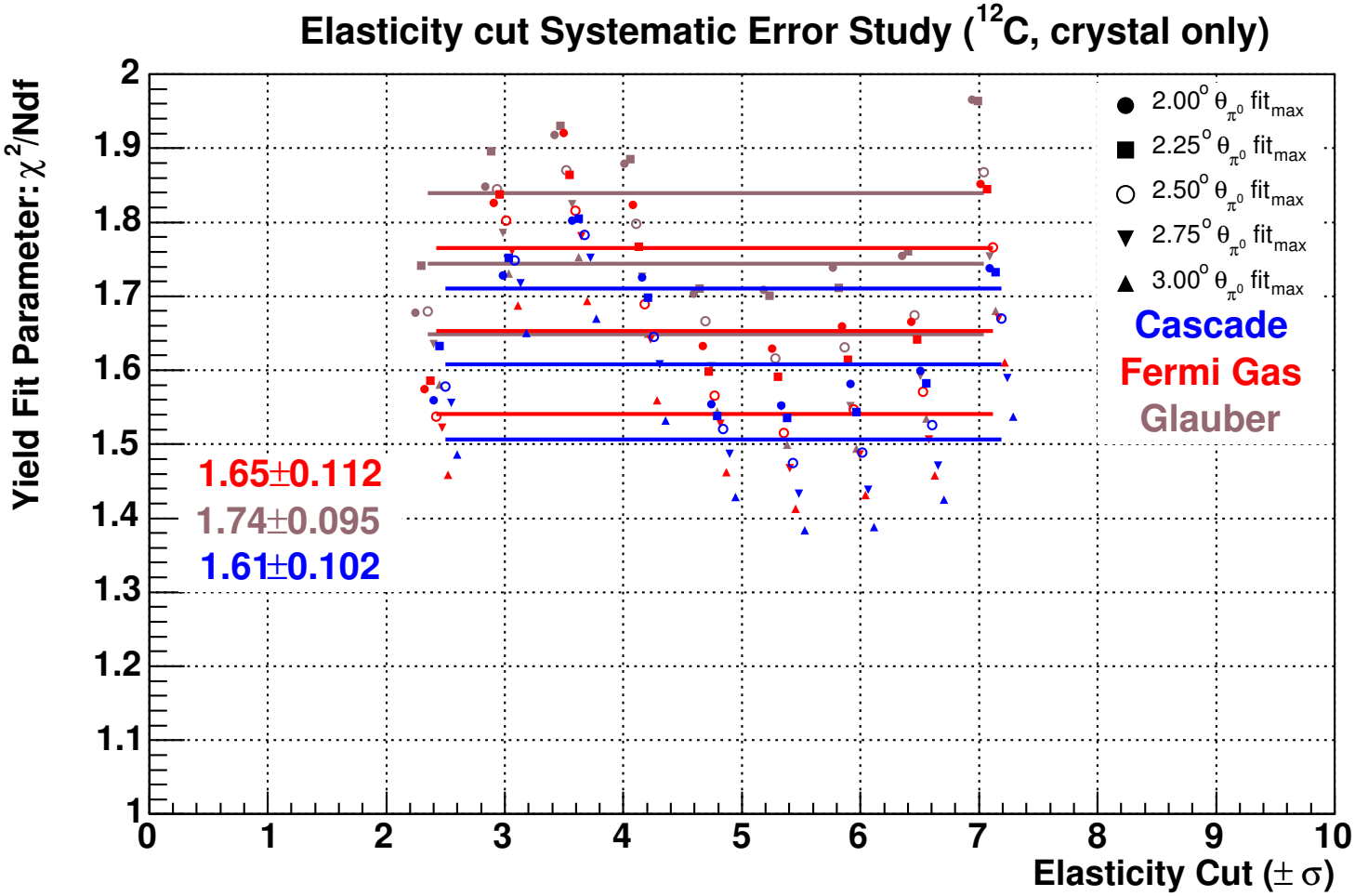
Example Yield Fit: Using Glauber (Sergey)



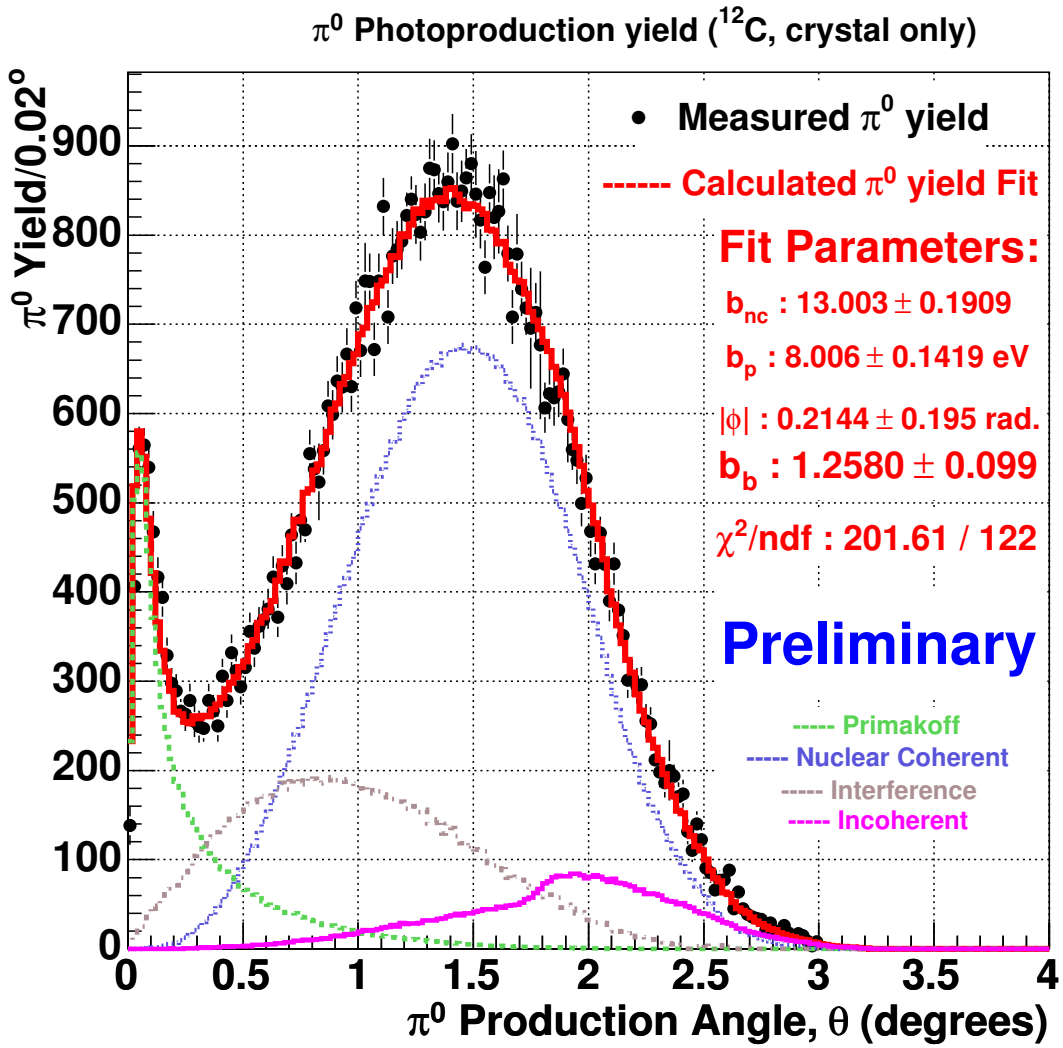

Elasticity cut Systematic Error Study (^{12}C, crystal only)
Yield Fit Parameter: b_b
Elasticity Cut ($\pm\sigma$)
8.40±0.569
6.98±0.343
1.26±0.075
2.00° θ_{π^0} fit$_{max}$
2.25° θ_{π^0} fit$_{max}$
2.50° θ_{π^0} fit$_{max}$
2.75° θ_{π^0} fit$_{max}$
3.00° θ_{π^0} fit$_{max}$
Cascade
Fermi Gas
Glauber


Elasticity cut Systematic Error Study (^{12}C, crystal only)
Yield Fit Parameter: b_{nc}
Elasticity Cut ($\pm\sigma$)
2.51±0.011
2.26±0.027
1.97±0.026
$2.00^{o}\ \theta_{\pi^0}$ fit_{max}
$2.25^{o}\ \theta_{\pi^0}$ fit_{max}
$2.50^{o}\ \theta_{\pi^0}$ fit_{max}
$2.75^{o}\ \theta_{\pi^0}$ fit_{max}
$3.00^{o}\ \theta_{\pi^0}$ fit_{max}
Cascade
Fermi Gas
Glauber

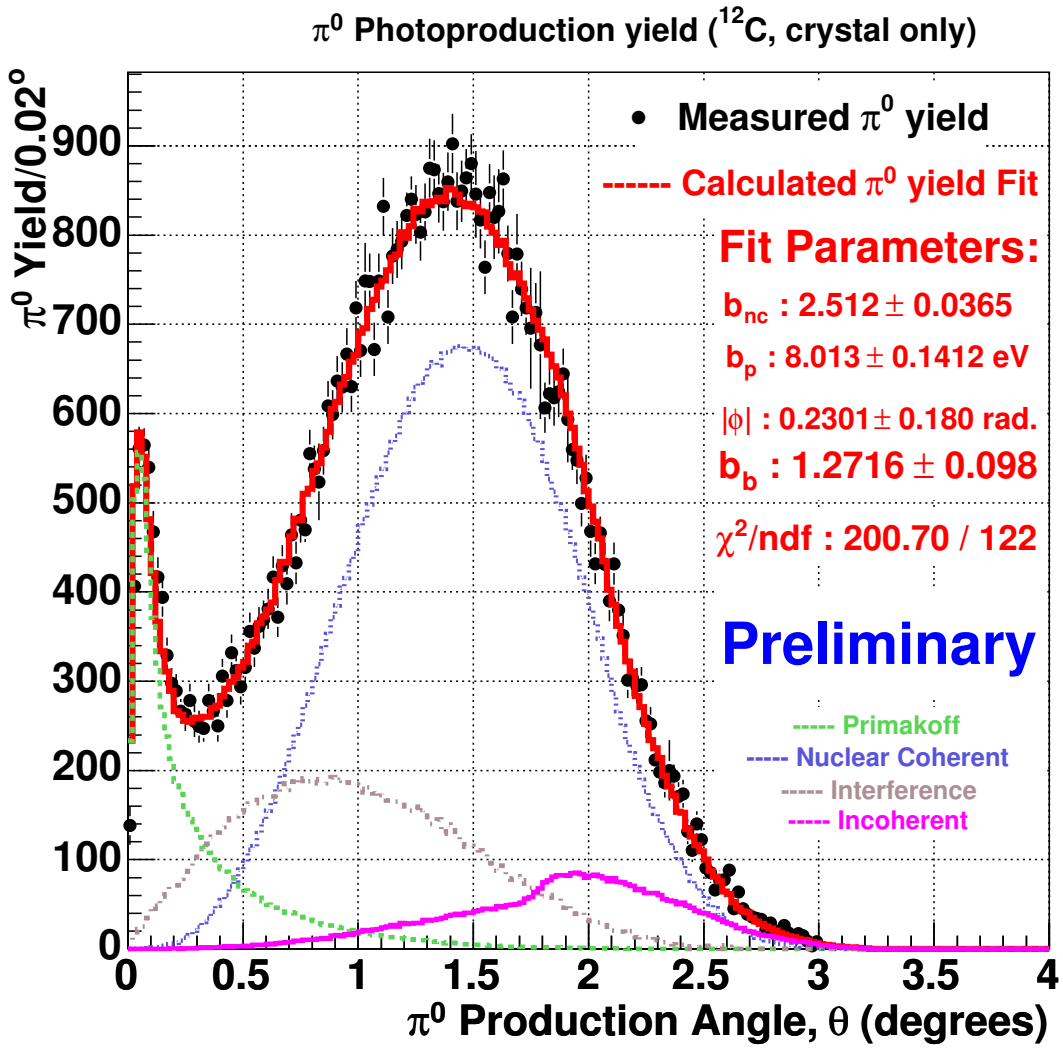

Elasticity cut Systematic Error Study (^{12}C, crystal only)
Yield Fit Parameter: ϕ (rad)
Elasticity Cut ($\pm\sigma$)
0.60±0.090
0.07±0.107
0.01±0.047
2.00° θ_{π^0} fit$_{max}$
2.25° θ_{π^0} fit$_{max}$
2.50° θ_{π^0} fit$_{max}$
2.75° θ_{π^0} fit$_{max}$
3.00° θ_{π^0} fit$_{max}$
Cascade
Fermi Gas
Glauber


Elasticity cut Systematic Error Study (^{12}C, crystal only)
Yield Fit Parameter: χ^2/Ndf
Elasticity Cut ($\pm\sigma$)
2.00° θ_{π^0} fit$_{max}$
2.25° θ_{π^0} fit$_{max}$
2.50° θ_{π^0} fit$_{max}$
2.75° θ_{π^0} fit$_{max}$
3.00° θ_{π^0} fit$_{max}$
Cascade
Fermi Gas
Glauber
1.65±0.112
1.74±0.095
1.61±0.102

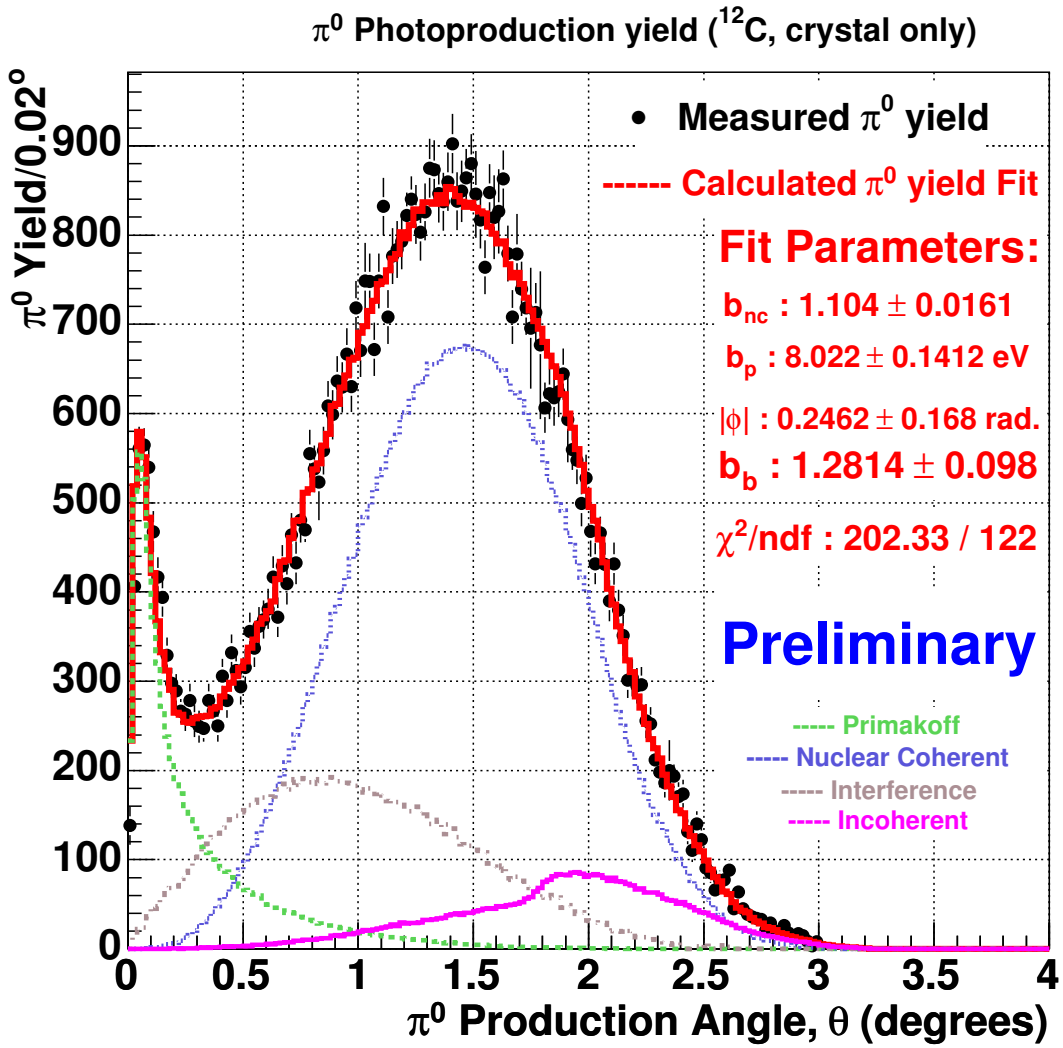
Example Yield Fit: Using Cascade 5.2 GeV ($k^{1.0}$)

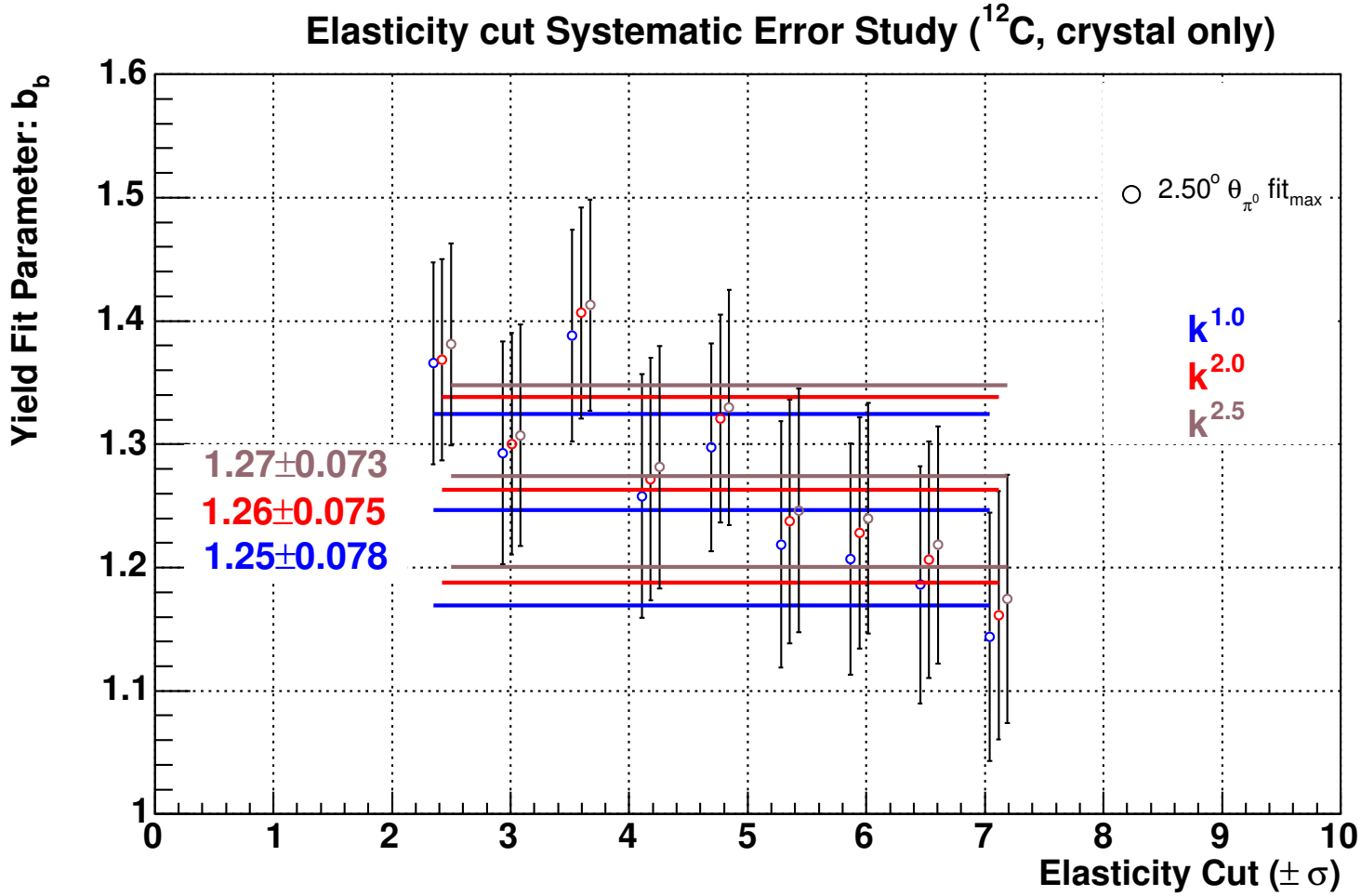


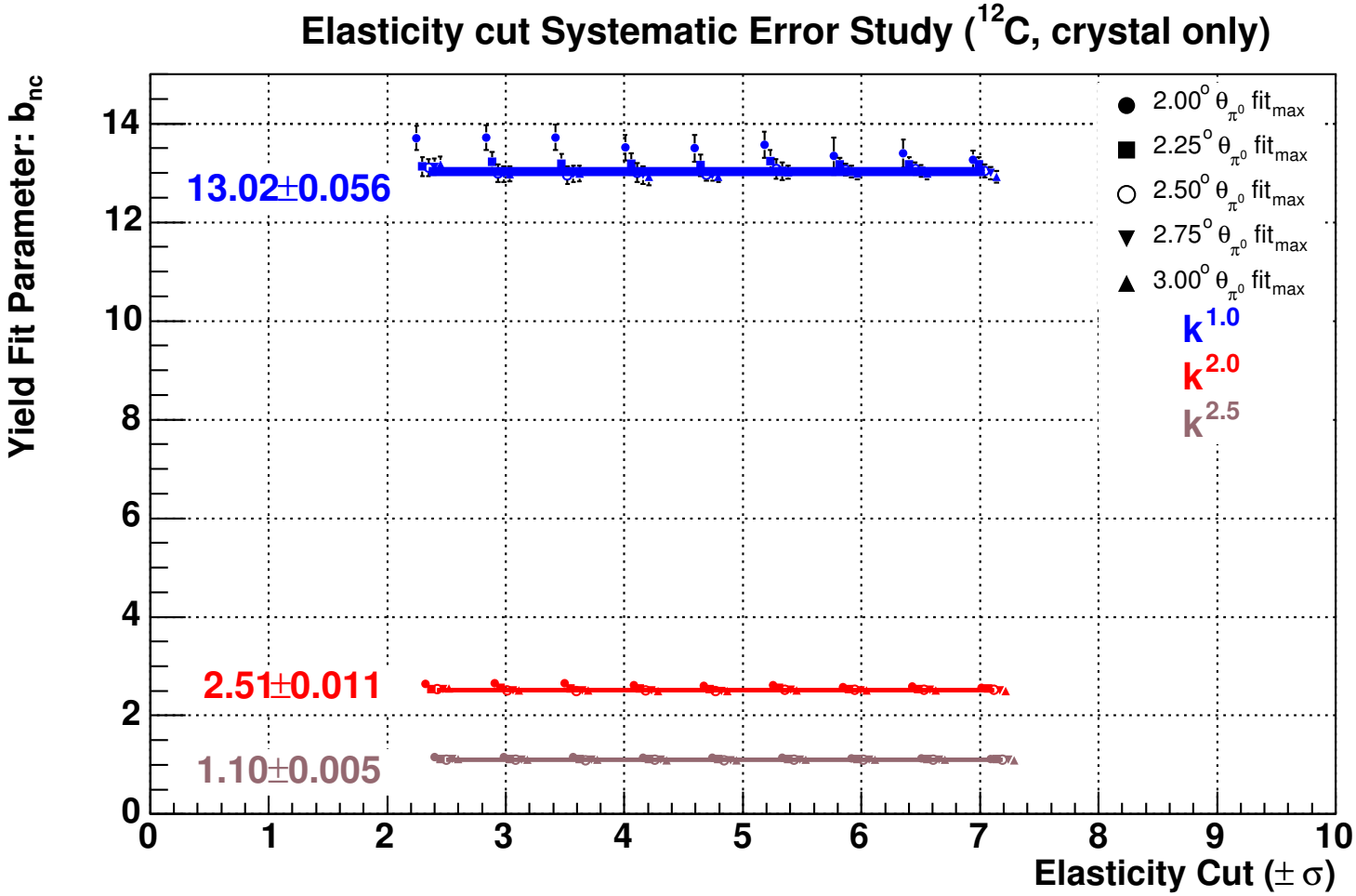
Example Yield Fit: Using Cascade 5.2 GeV ($k^{2.0}$)

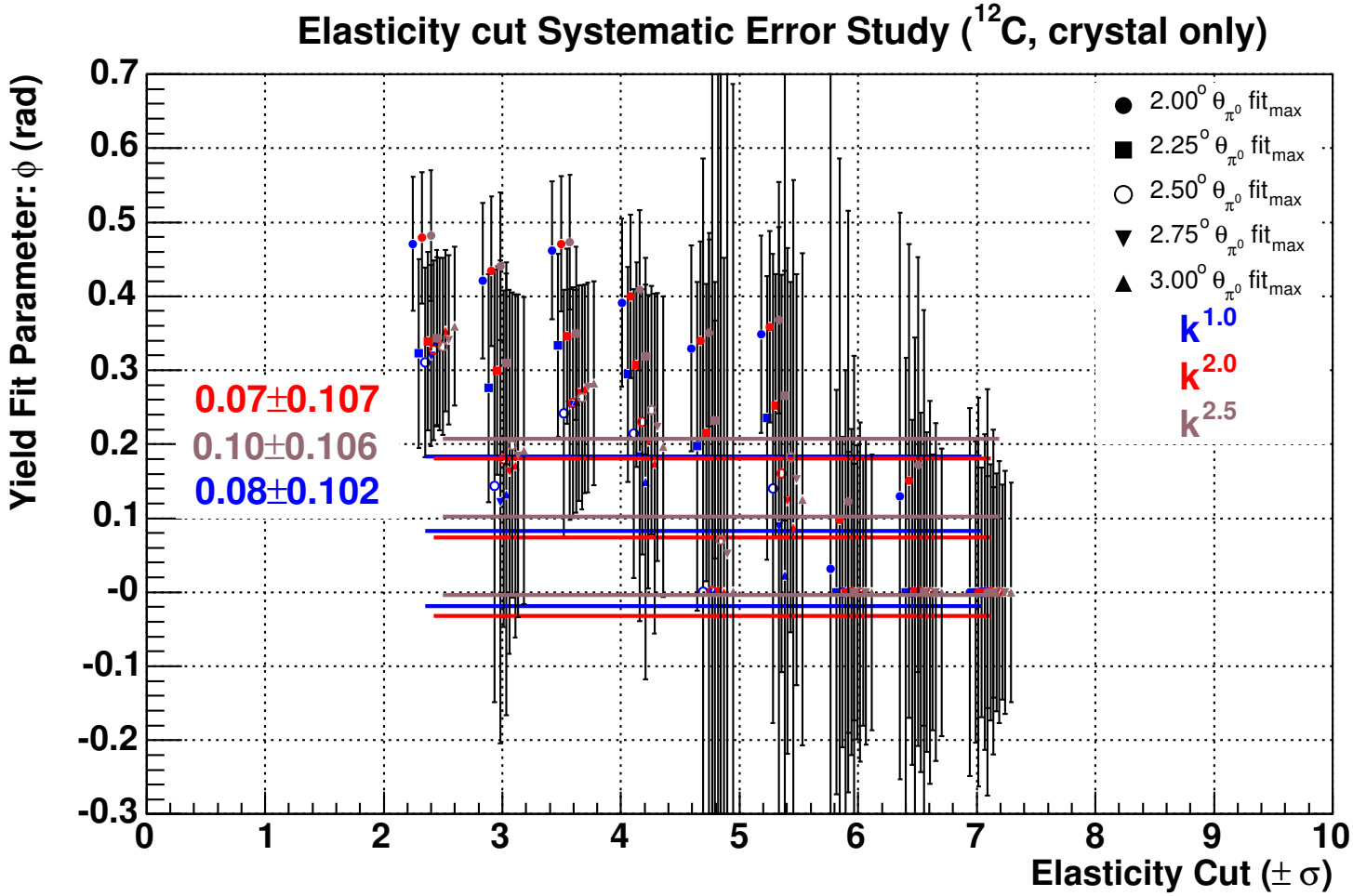


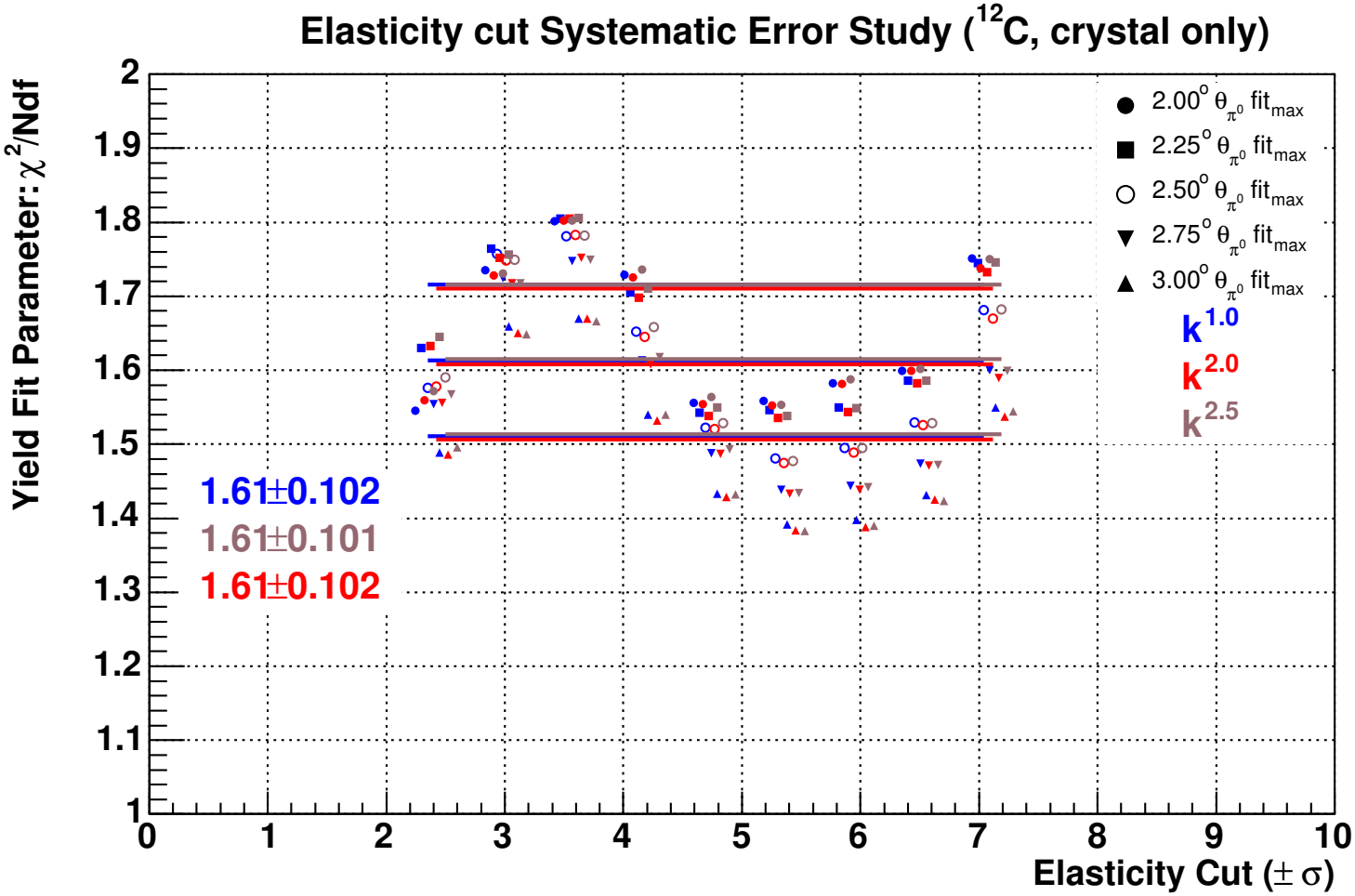
Example Yield Fit: Using Cascade 5.2 GeV ($k^{2.5}$)




Elasticity cut Systematic Error Study (^{12}C, crystal only)
Yield Fit Parameter: b_b
Elasticity Cut ($\pm\sigma$)
2.50° θ_{π^0} fit_{max}
$k^{1.0}$
$k^{2.0}$
$k^{2.5}$
1.27±0.073
1.26±0.075
1.25±0.078


Elasticity cut Systematic Error Study (^{12}C, crystal only)
Yield Fit Parameter: b_{nc}
Elasticity Cut ($\pm\sigma$)
13.02±0.056
2.51±0.011
1.10±0.005
2.00° θ_{π^0} fit$_{max}$
2.25° θ_{π^0} fit$_{max}$
2.50° θ_{π^0} fit$_{max}$
2.75° θ_{π^0} fit$_{max}$
3.00° θ_{π^0} fit$_{max}$
$k^{1.0}$
$k^{2.0}$
$k^{2.5}$


Elasticity cut Systematic Error Study (^{12}C, crystal only)
Yield Fit Parameter: ϕ (rad)
Elasticity Cut ($\pm\sigma$)
$2.00^{o}\ \theta_{\pi^0}$ fit$_{max}$
$2.25^{o}\ \theta_{\pi^0}$ fit$_{max}$
$2.50^{o}\ \theta_{\pi^0}$ fit$_{max}$
$2.75^{o}\ \theta_{\pi^0}$ fit$_{max}$
$3.00^{o}\ \theta_{\pi^0}$ fit$_{max}$
$k^{1.0}$
$k^{2.0}$
$k^{2.5}$
0.07±0.107
0.10±0.106
0.08±0.102


Elasticity cut Systematic Error Study (^{12}C, crystal only)
Yield Fit Parameter: χ^2/Ndf
Elasticity Cut ($\pm\sigma$)
2.00° θ_{π^0} fit$_{max}$
2.25° θ_{π^0} fit$_{max}$
2.50° θ_{π^0} fit$_{max}$
2.75° θ_{π^0} fit$_{max}$
3.00° θ_{π^0} fit$_{max}$
$k^{1.0}$
$k^{2.0}$
$k^{2.5}$
1.61±0.102
1.61±0.101
1.61±0.102