Finalizing Yields and Efficiencies

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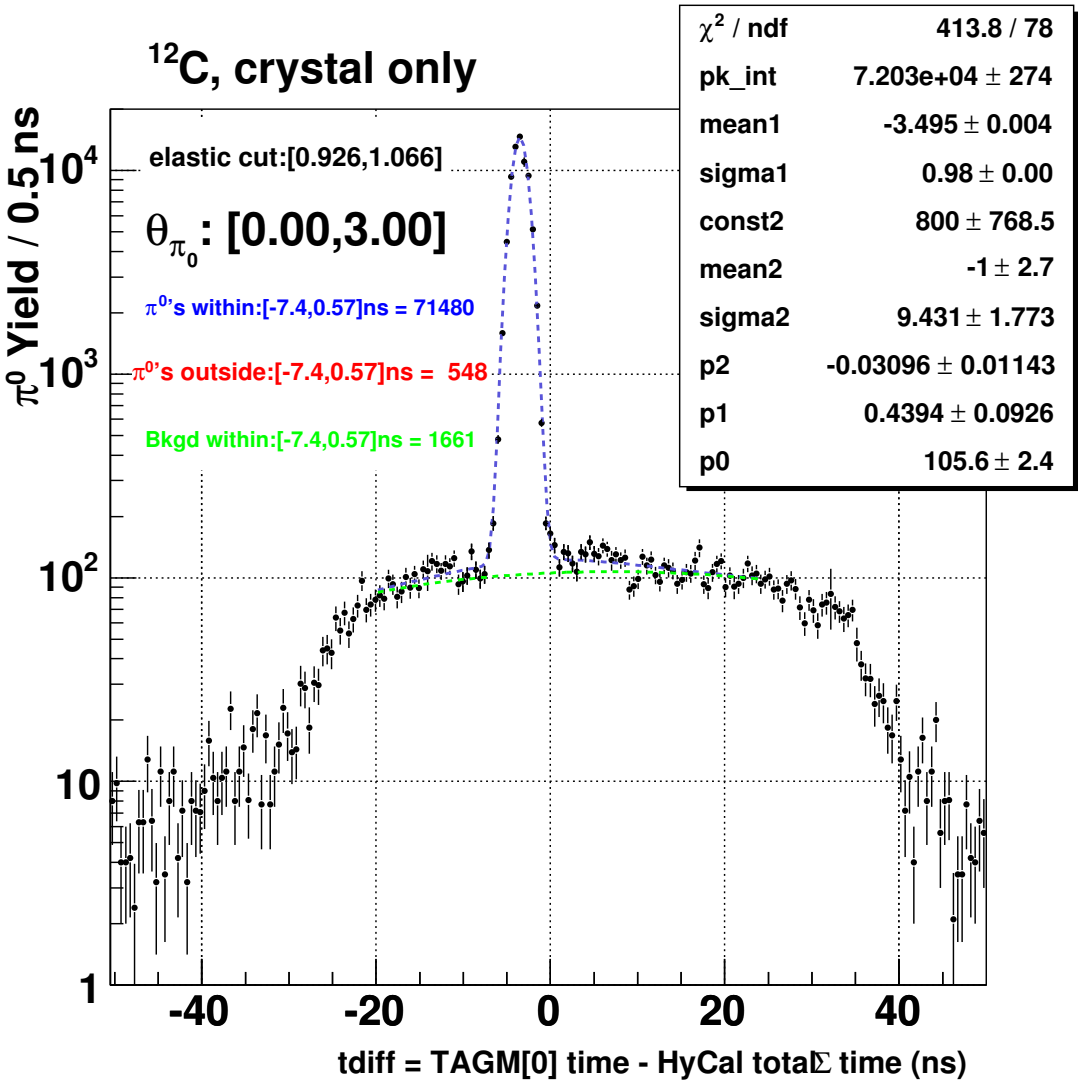
What's New in my Yield Analysis

- Finalized timing accidental background yield correction.
- Improved inelastic background evaluation (not finalized).
- $\sim$Finalized ^{208}Pb target yield.
- Finalized timing best-candidate selection efficiency.
- Evaluation of tdiff cut efficiency (work not finished, difficult to quantify, ideas?).
- Evaluation of elasticity cut efficiency (work in progress).

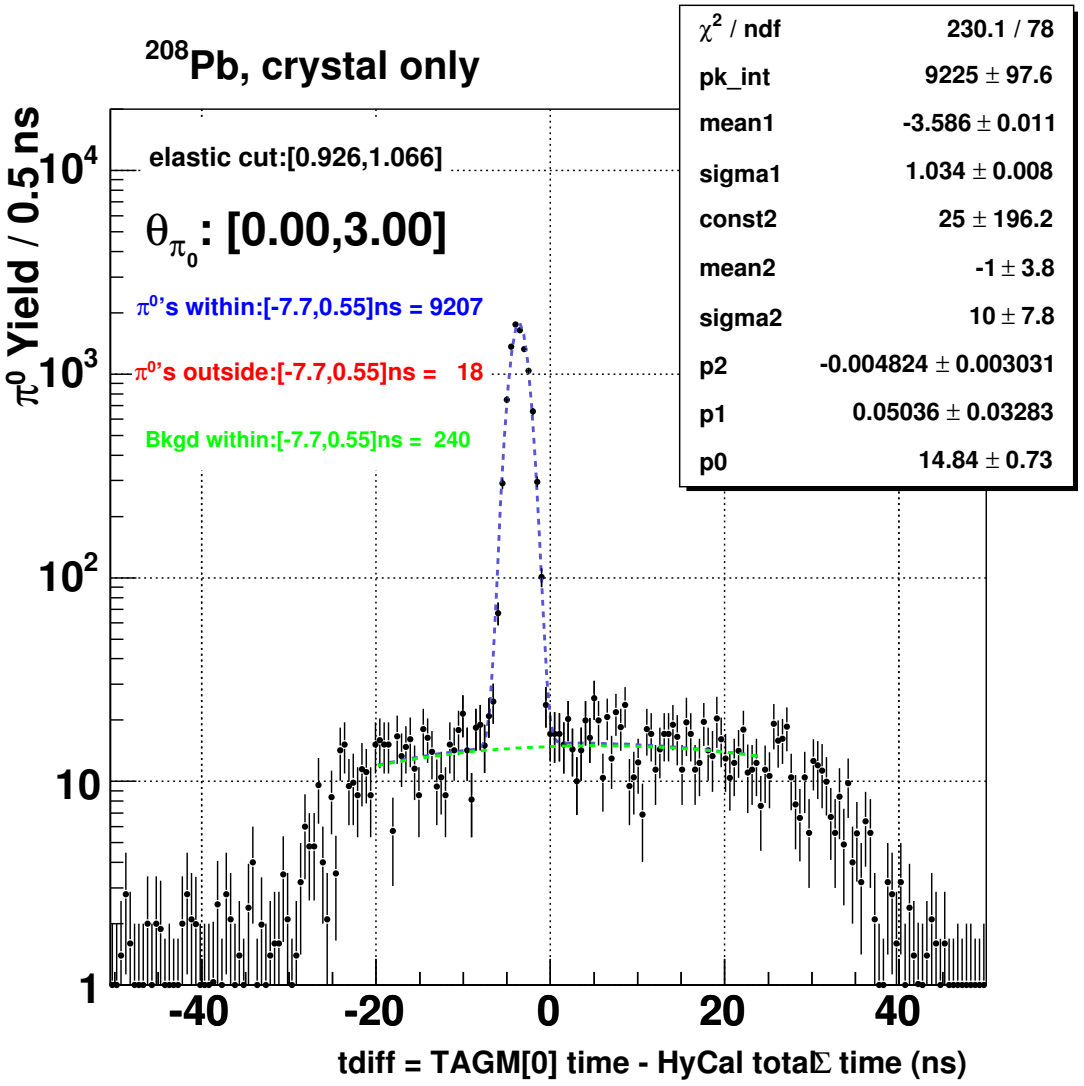
What's New in my Monte Carlo

- Using "full-blown" simulation (primsim/psim_digitize).
- ∼All experimental resolutions incorporated.
- π^0-events generated, tracked through setup, energy losses digitized into hardware bank, MC data passed through the exact set of analysis routines and cuts used on real data.
- Realistic coordinate, energy, $m_{\gamma\gamma}$, and angular resolutions arise naturally.
- Purpose: Geometric acceptance, reconstruction efficiency, and theoretical yield angular distributions folded with exerimental resolutions.

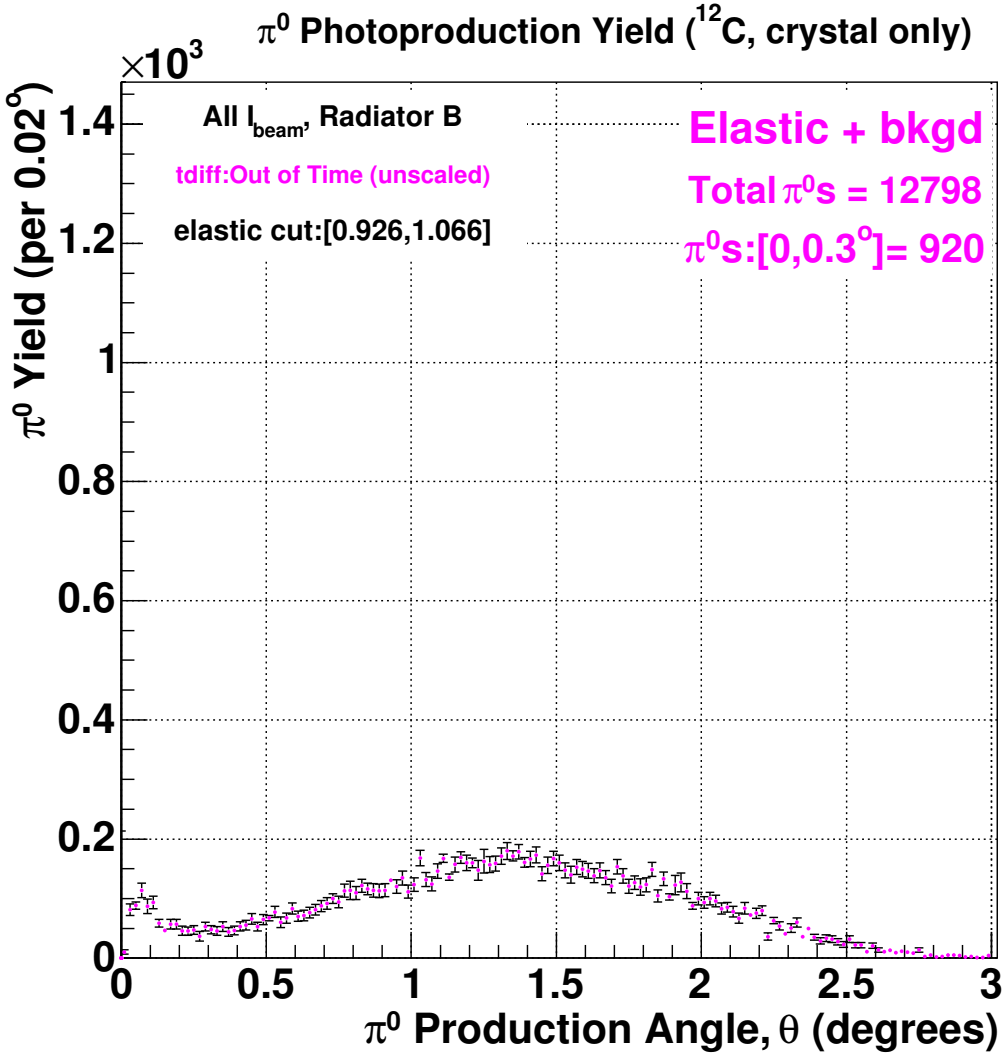
π^0 Yield vs. tdiff, ^{12}C



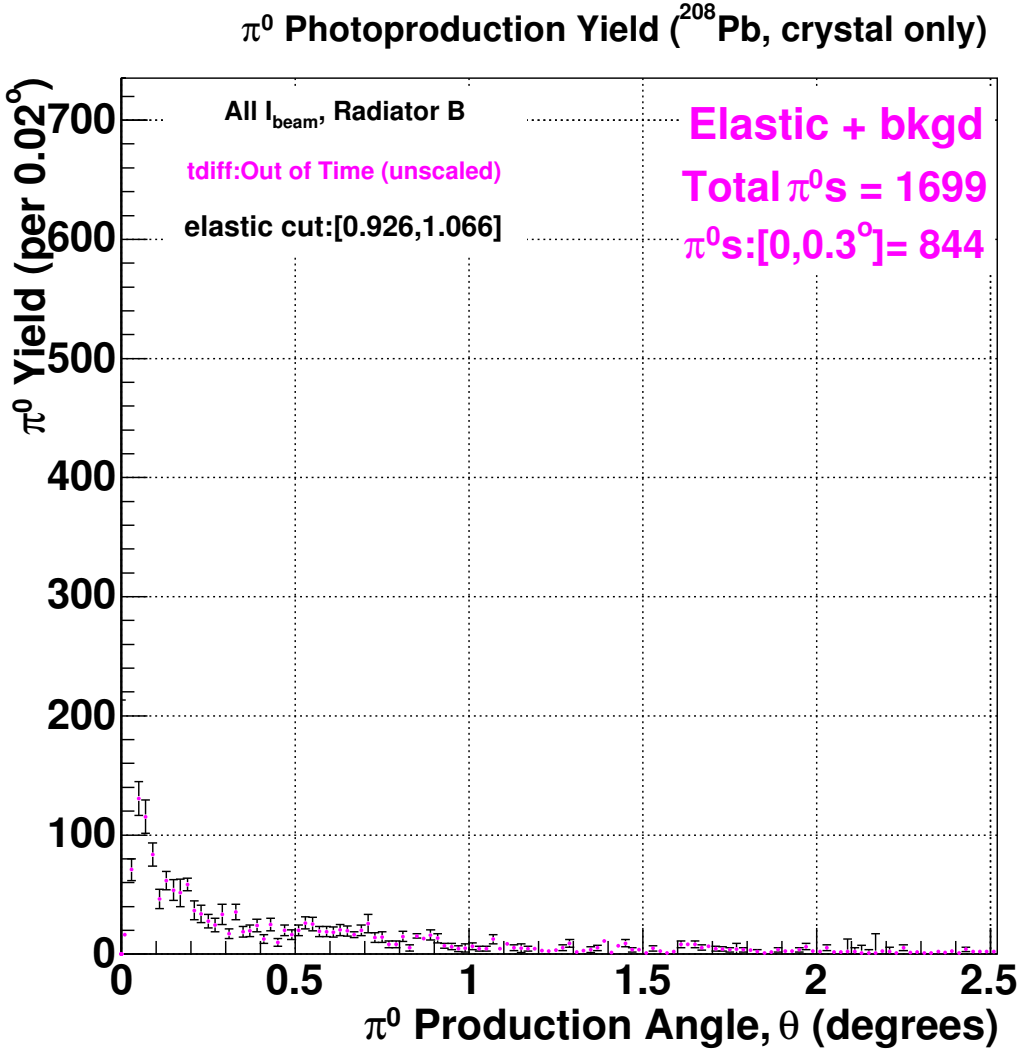
π^0 Yield vs. tdiff, ^{208}Pb



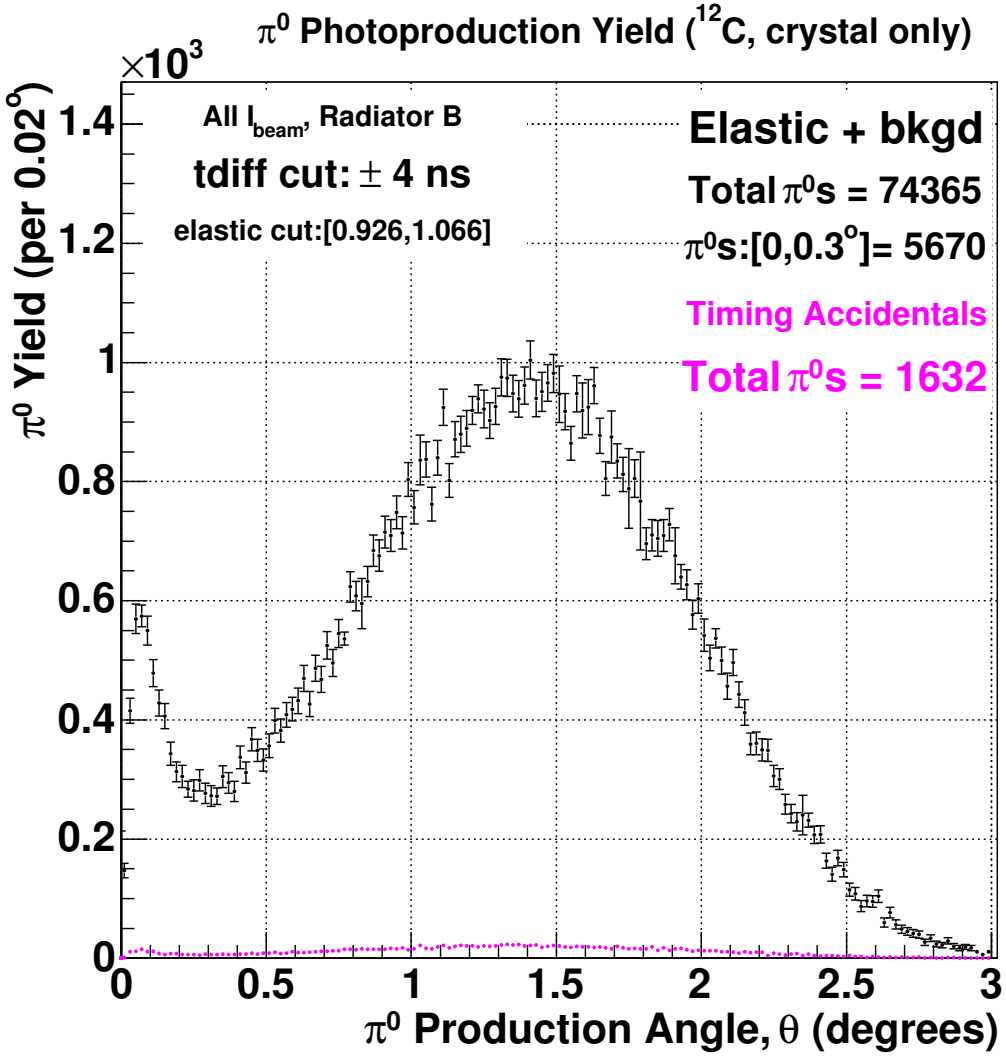
Out-of-Time Angular Yield (Unscaled), ^{12}C



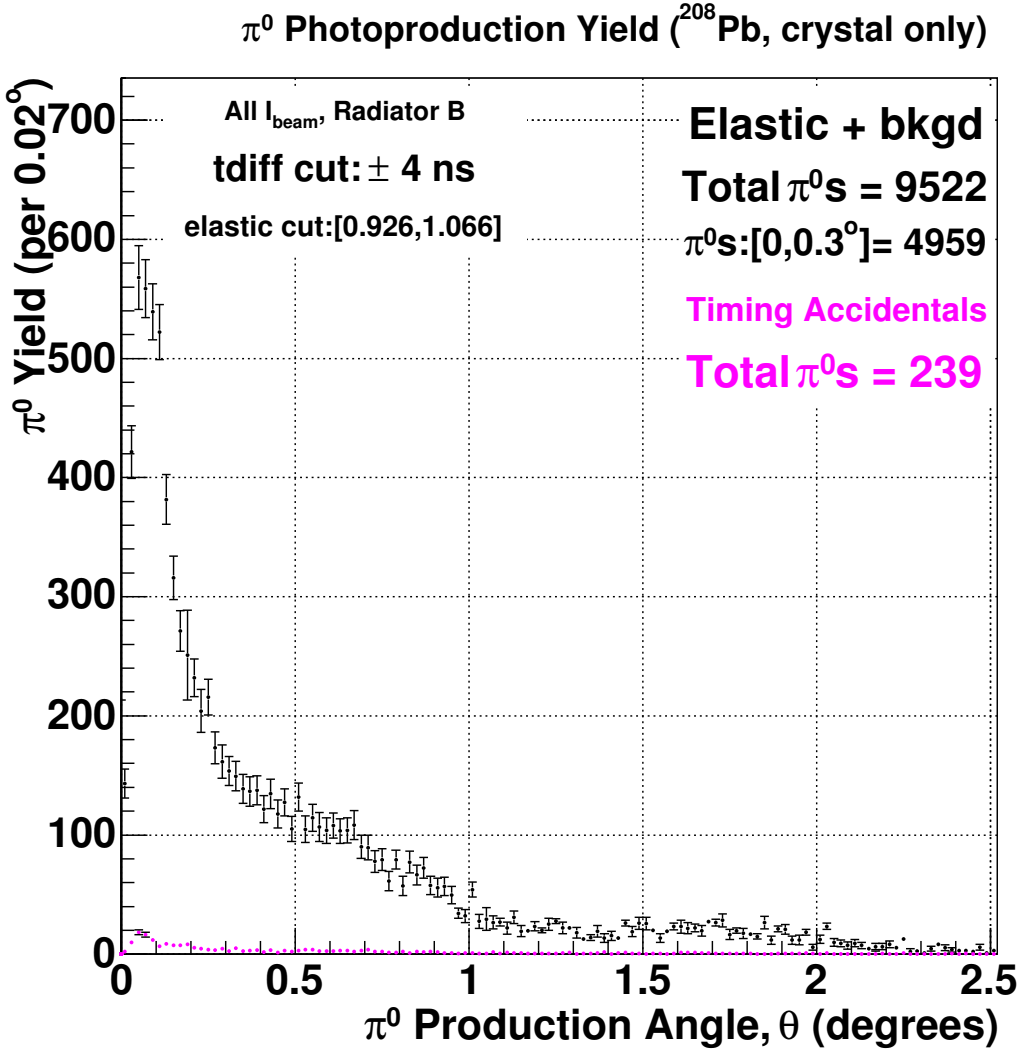
Out-of-Time Angular Yield (Unscaled), ^{208}Pb



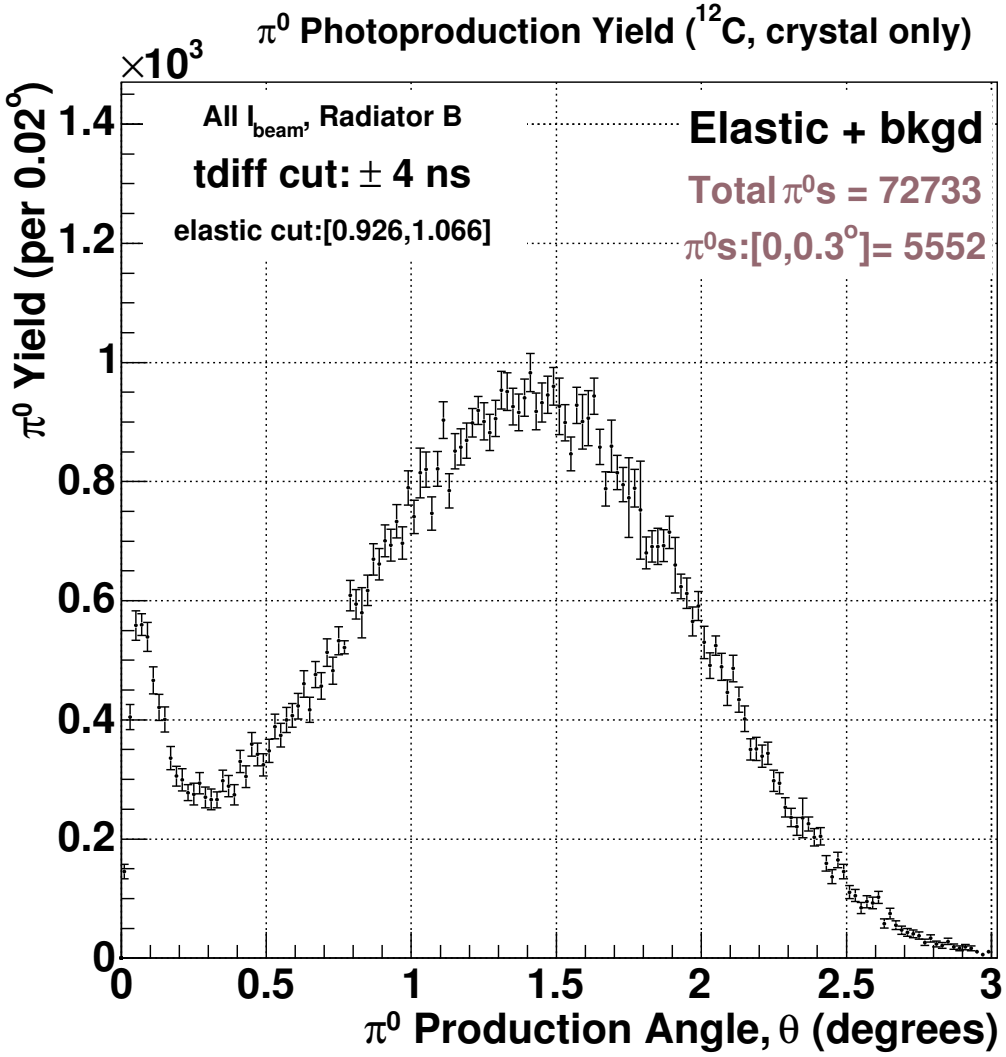
Component Angular Yields (Uncorrected), ^{12}C



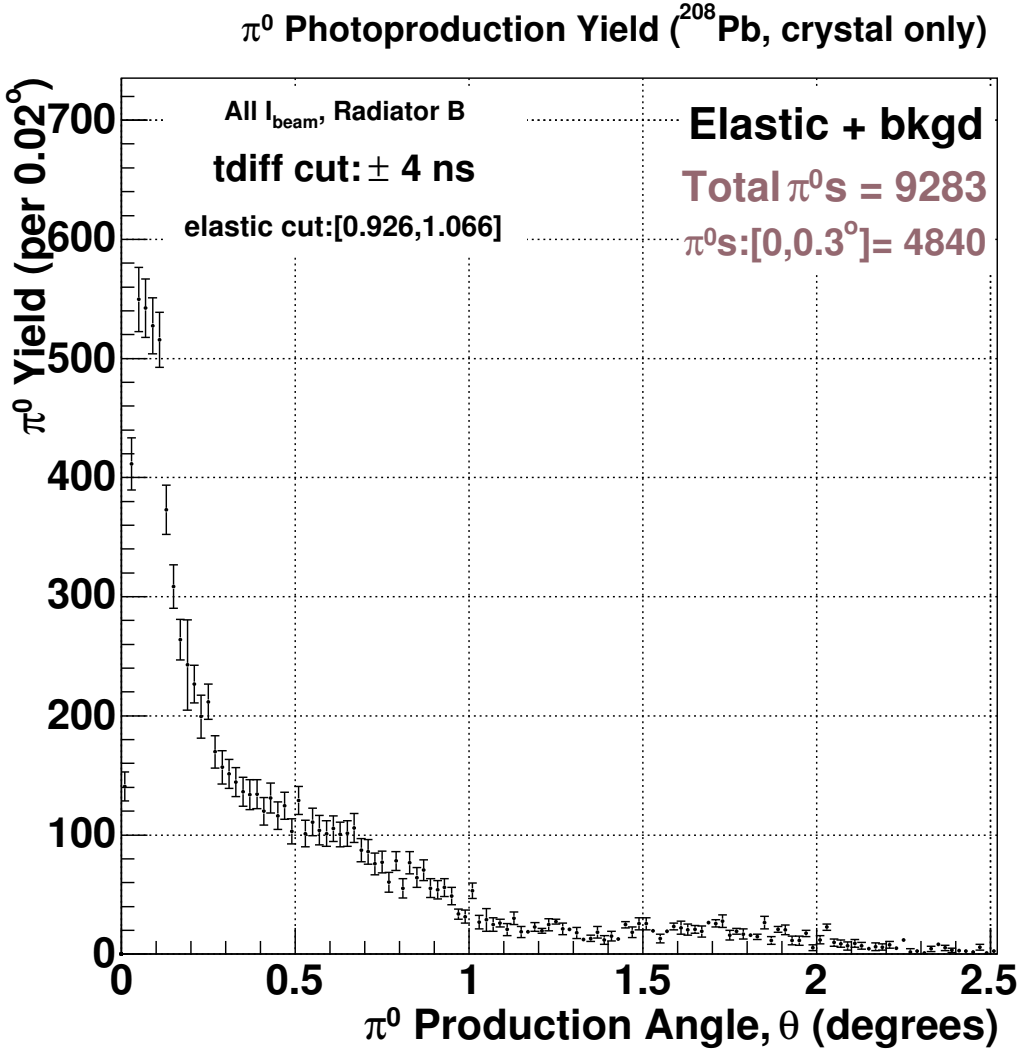
Component Angular Yields (Uncorrected), ^{208}Pb



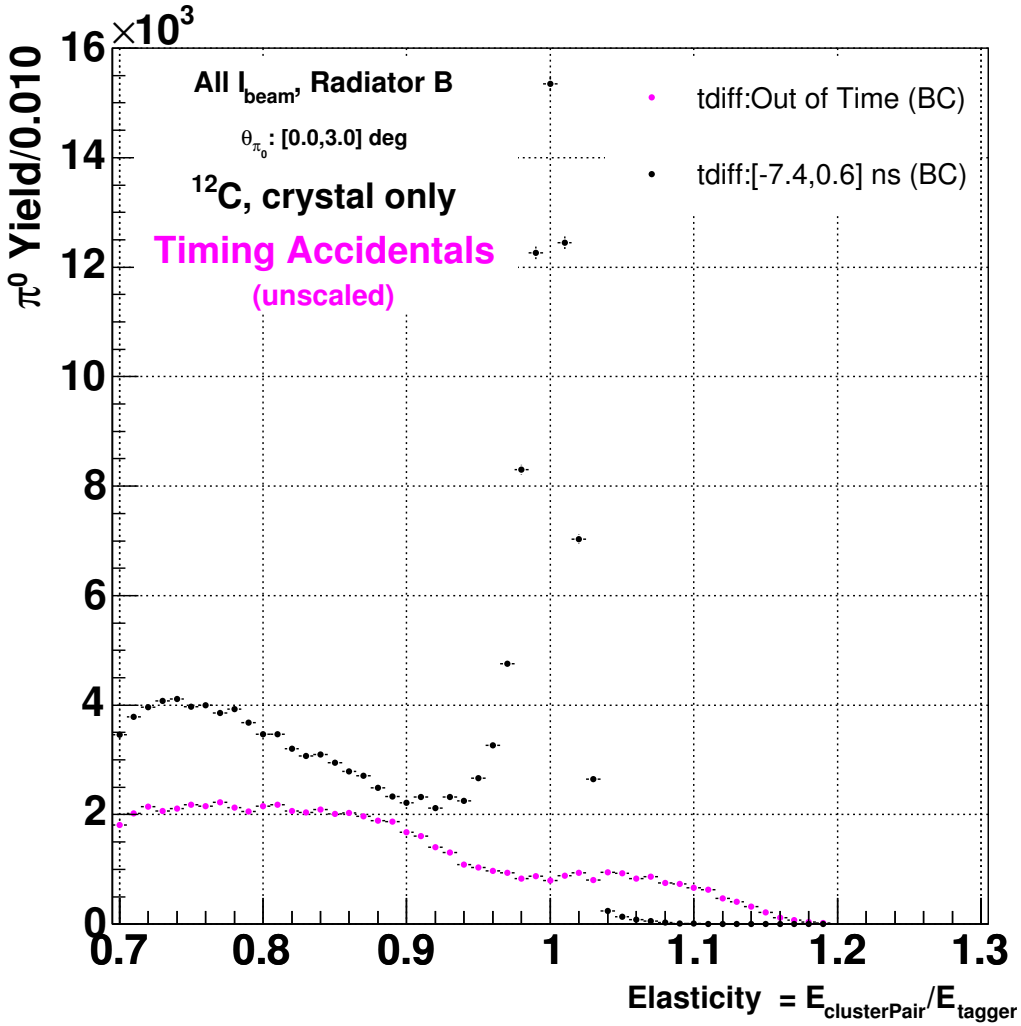
Angular Yield (Corrected for OOT bkgd), ^{12}C



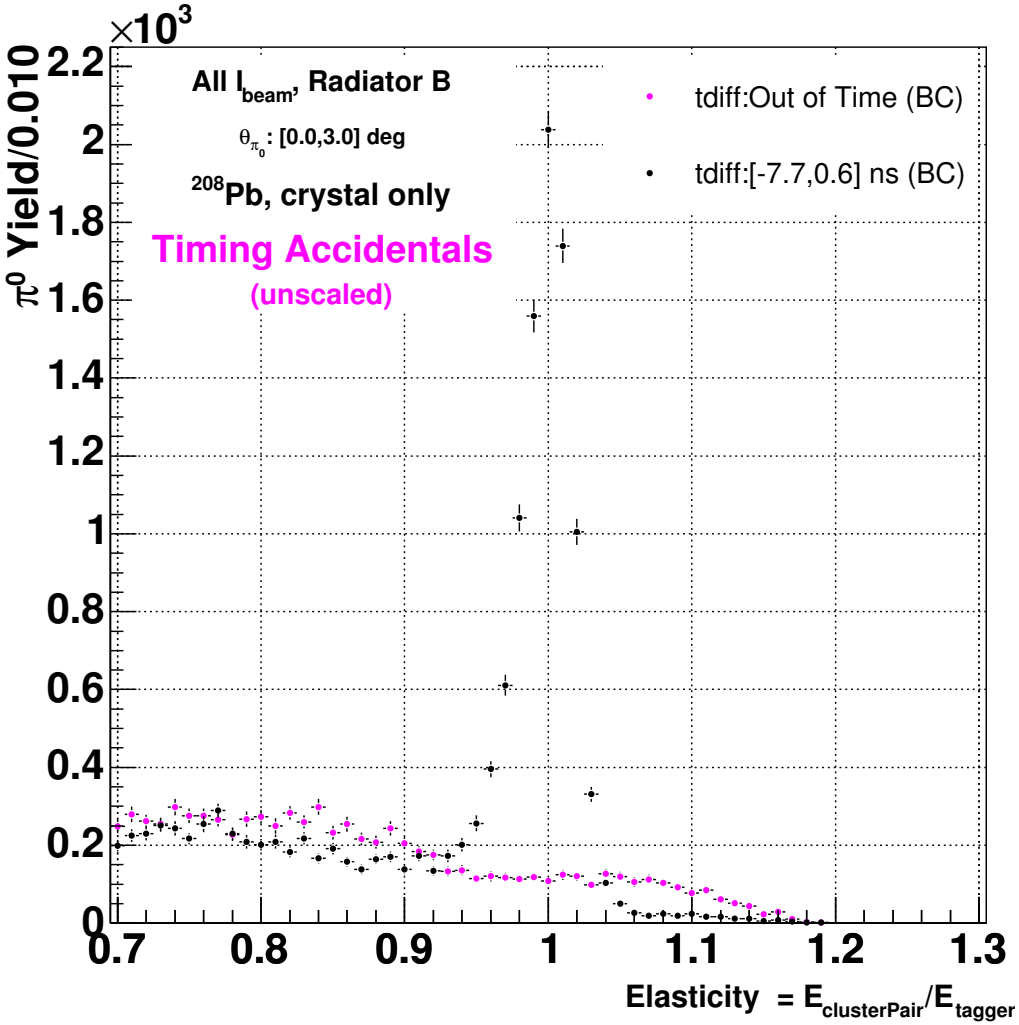
Angular Yield (Corrected for OOT bkgd), ^{208}Pb



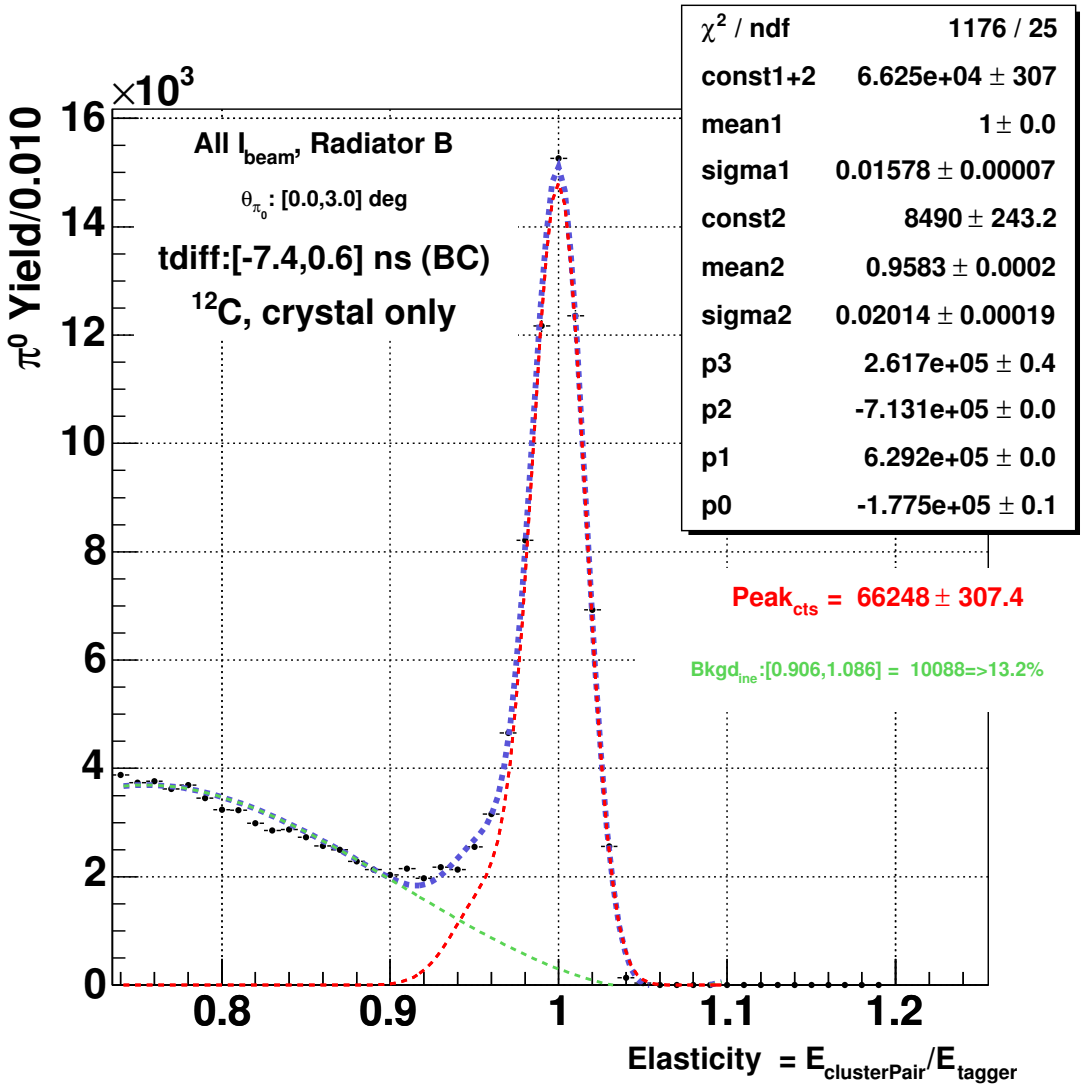
Out-of-Time Elasticity Yield (Unscaled), ^{12}C



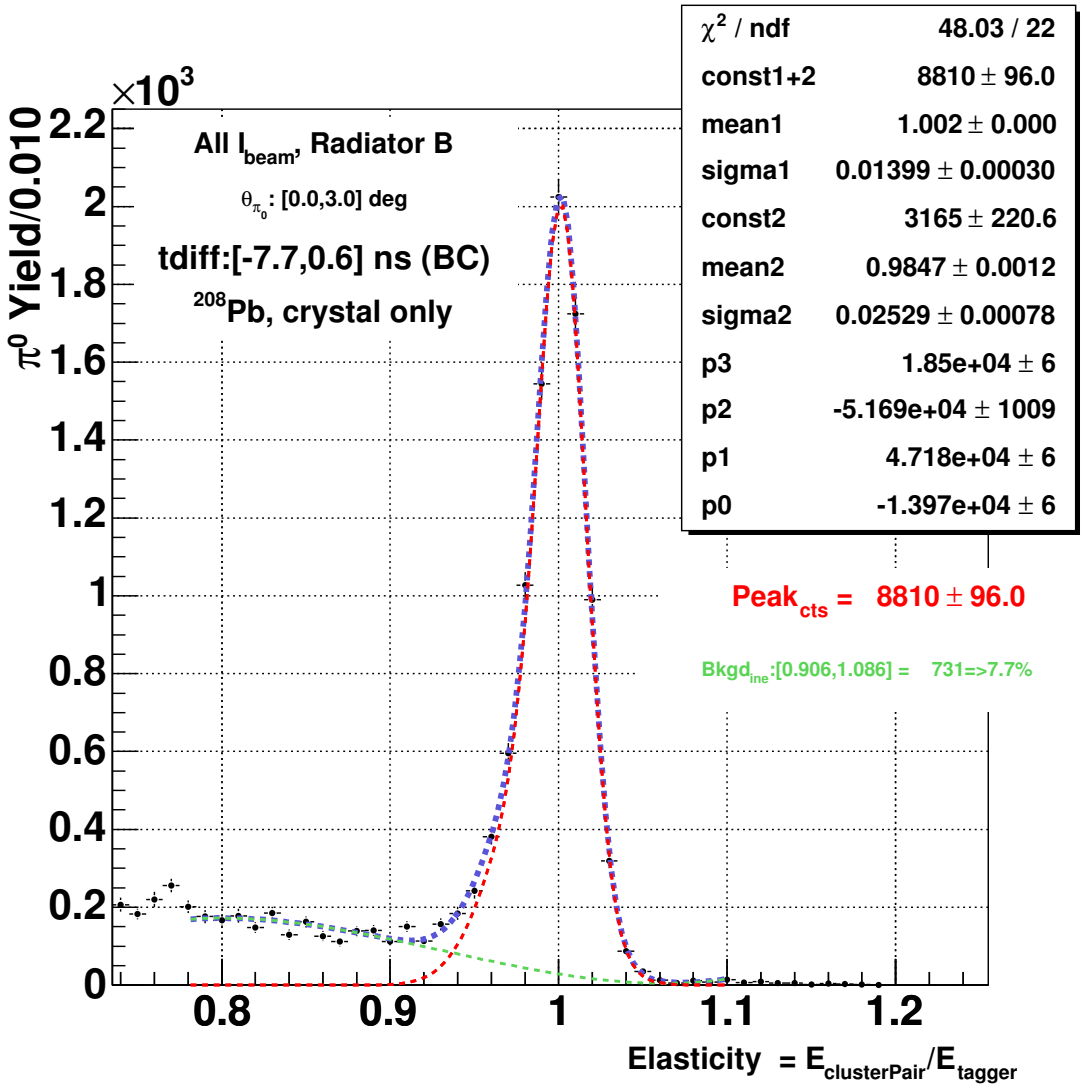
Out-of-Time Elasticity Yield (Unscaled), ^{208}Pb



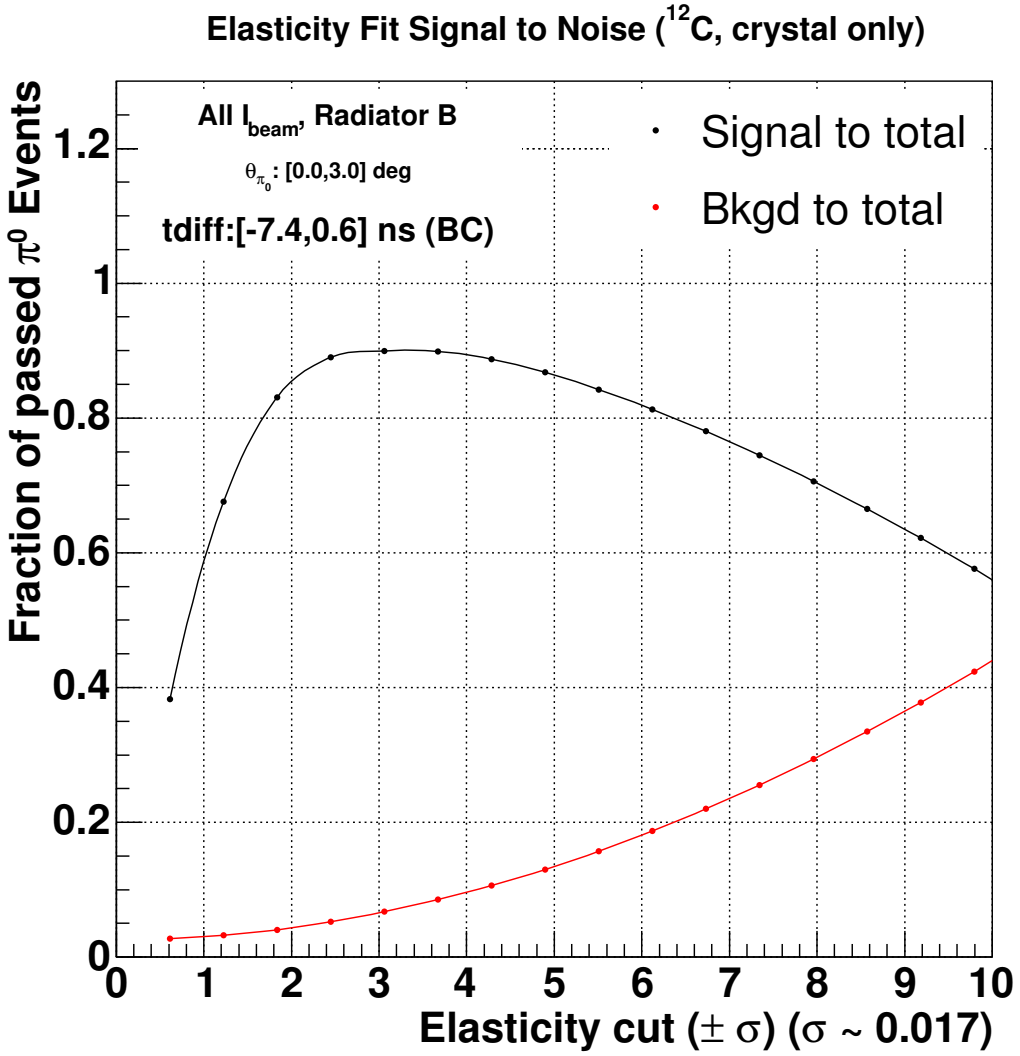
Elasticity Yield Fit (Corrected for OOT bkgd), ^{12}C



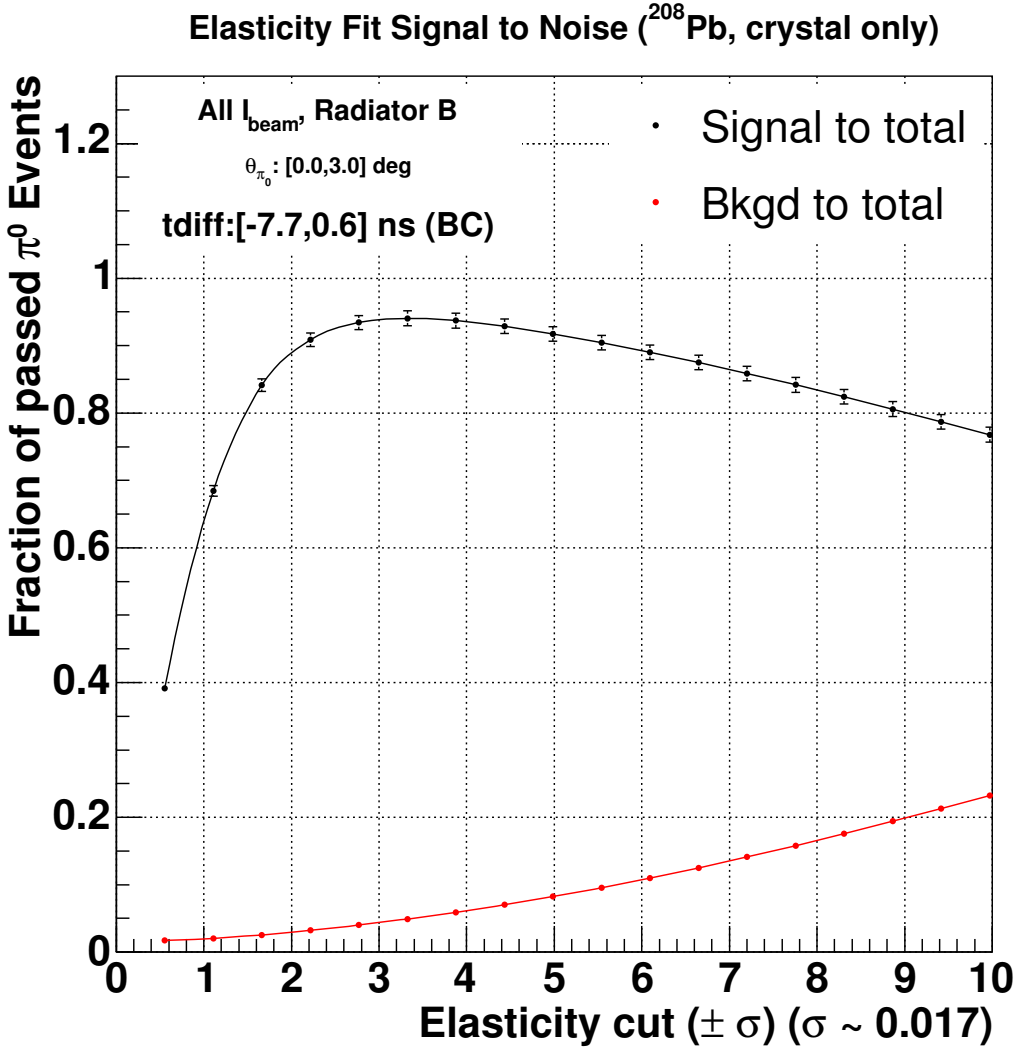
Elasticity Yield Fit (Corrected for OOT bkgd), ^{208}Pb



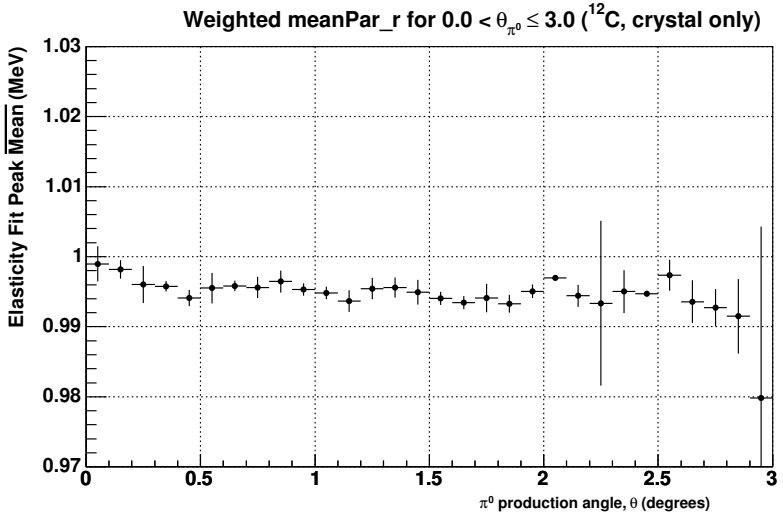
Elasticity Signal to Noise, ^{12}C

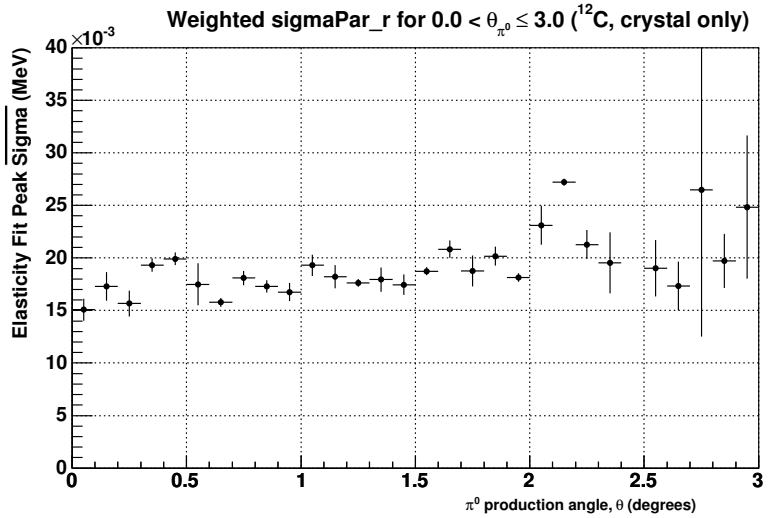


Elasticity Signal to Noise, ^{208}Pb

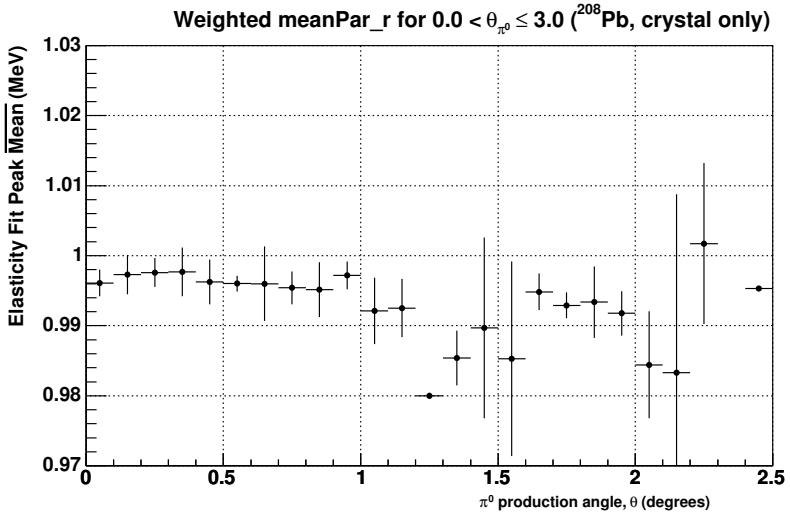


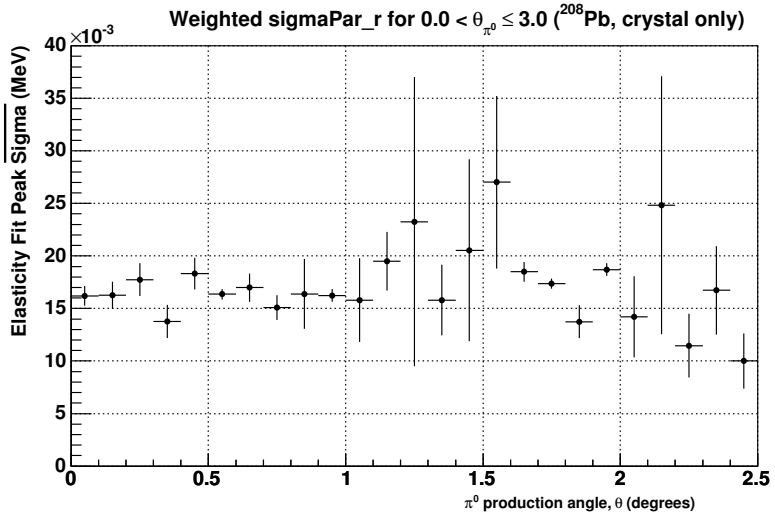
Inelastic Angular Yield Fit Parameters, ^{12}C



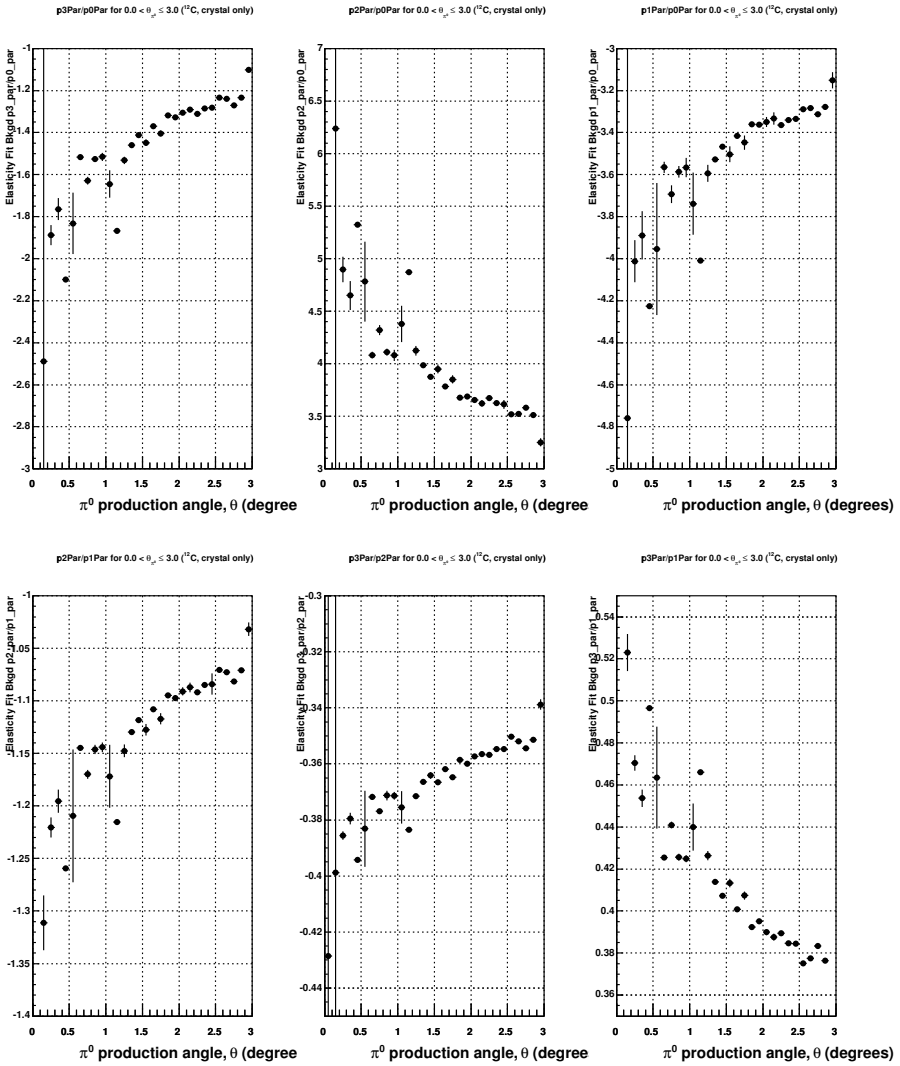


Inelastic Angular Yield Fit Parameters, ^{208}Pb

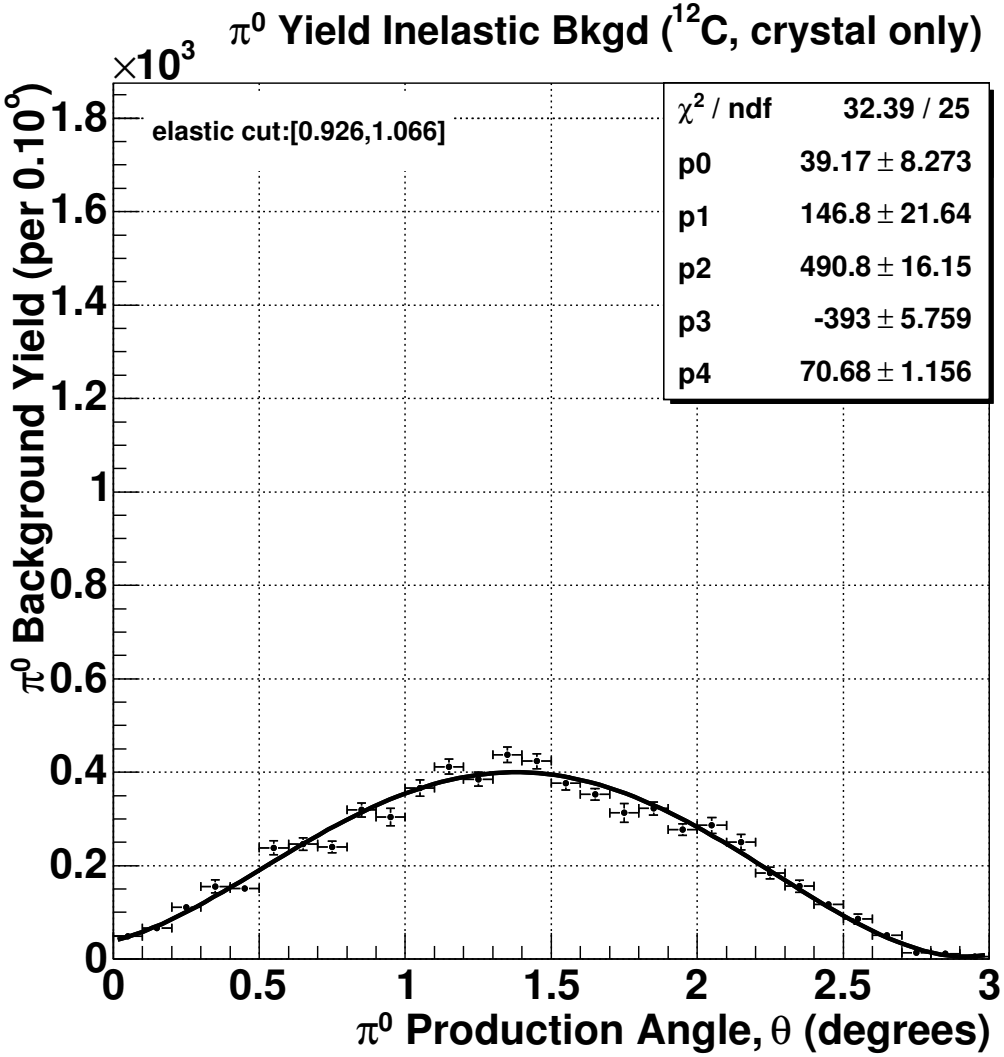




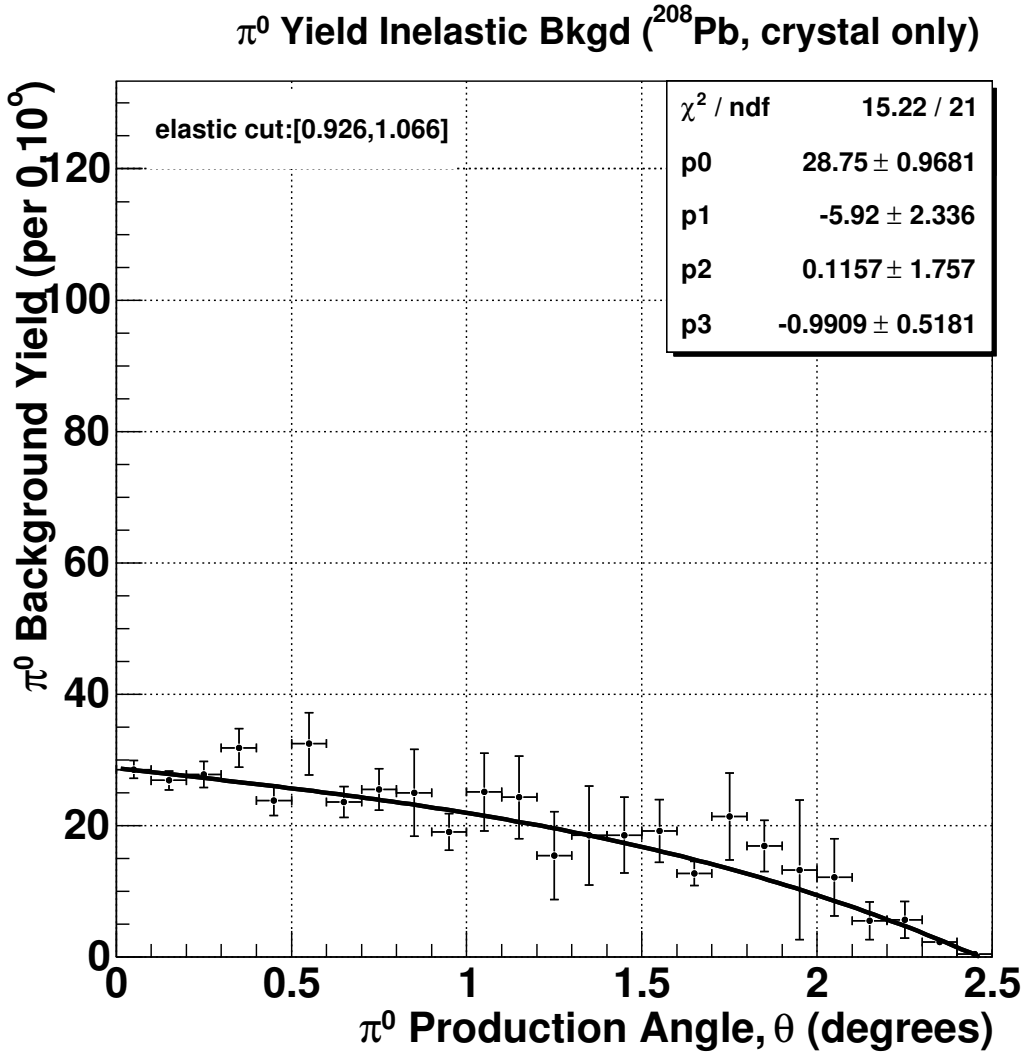
Inelastic Angular Yield Fit Parameters, ^{12}C



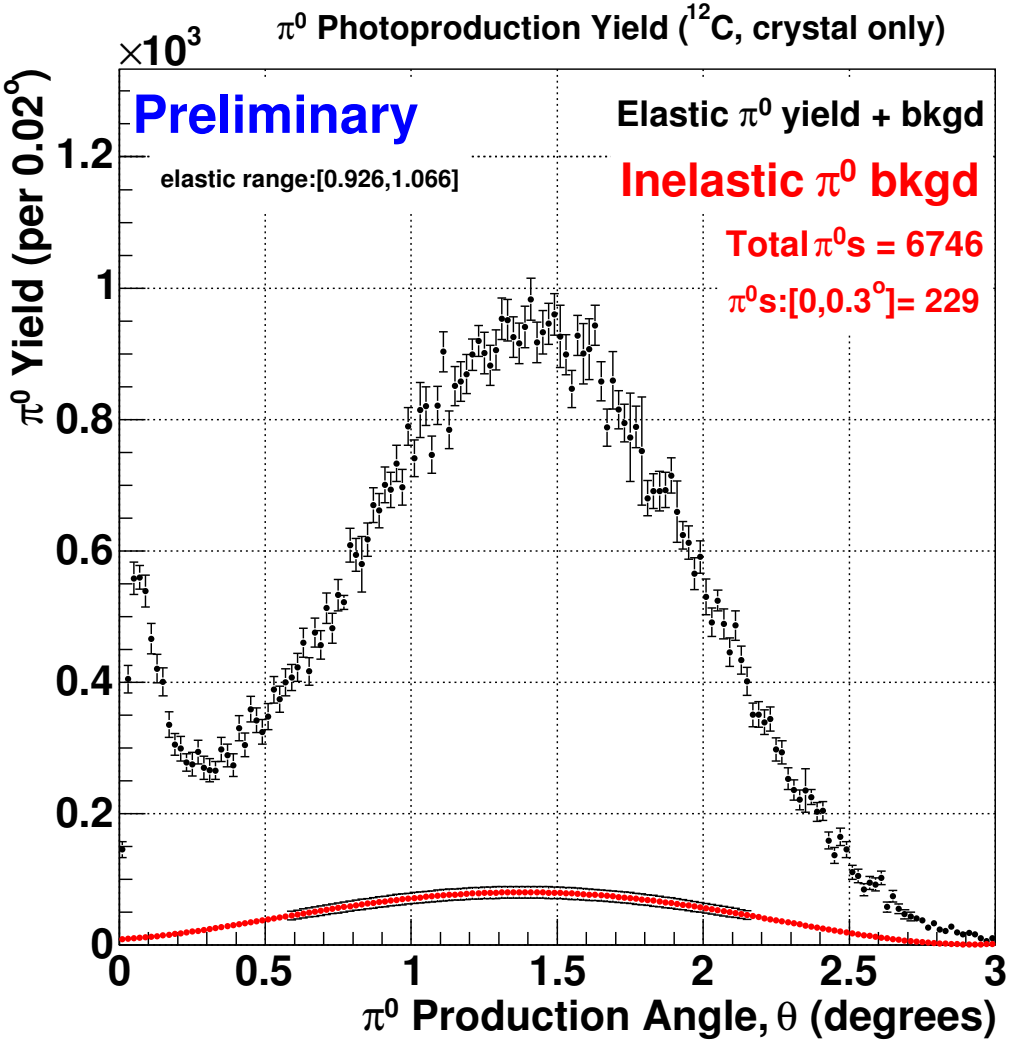
Inelastic Bkgd Angular Yield, ^{12}C



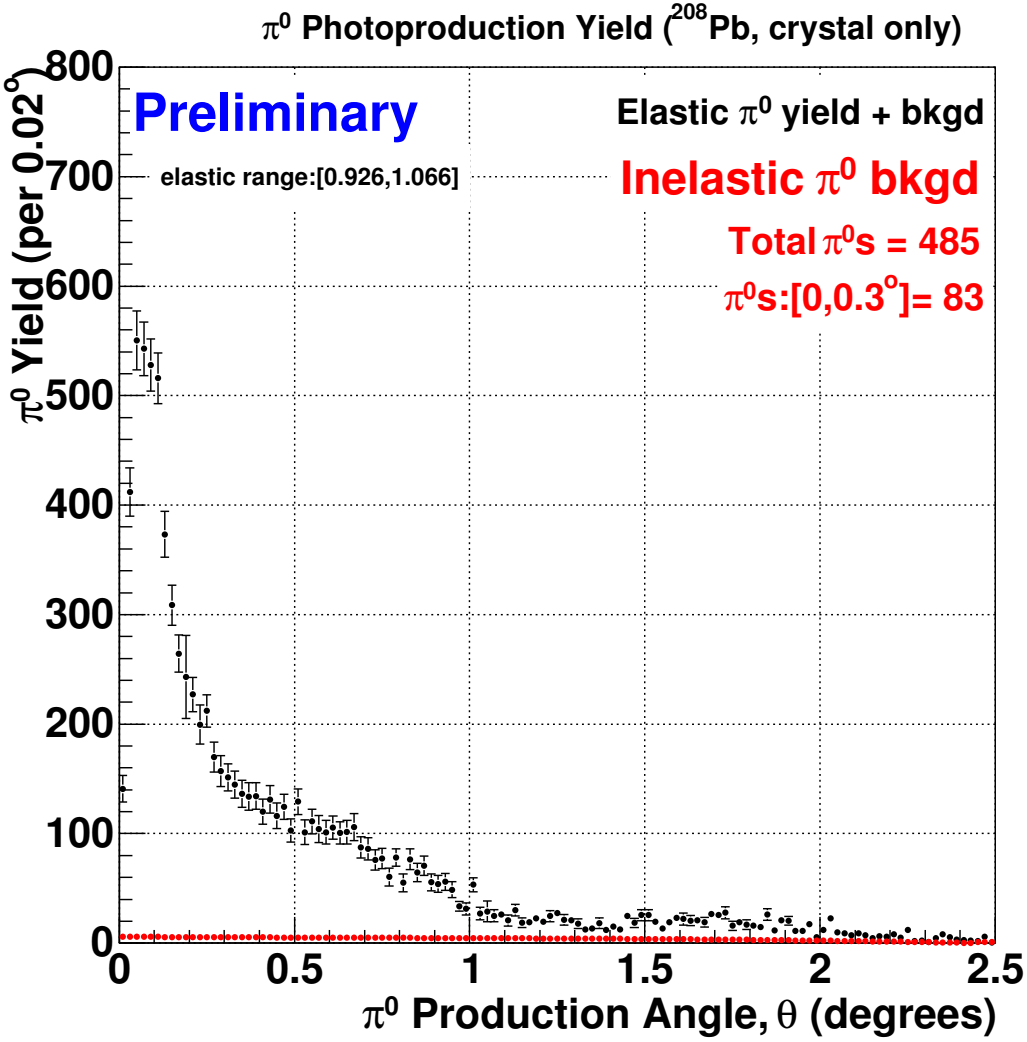
Inelastic Bkgd Angular Yield, ^{208}Pb



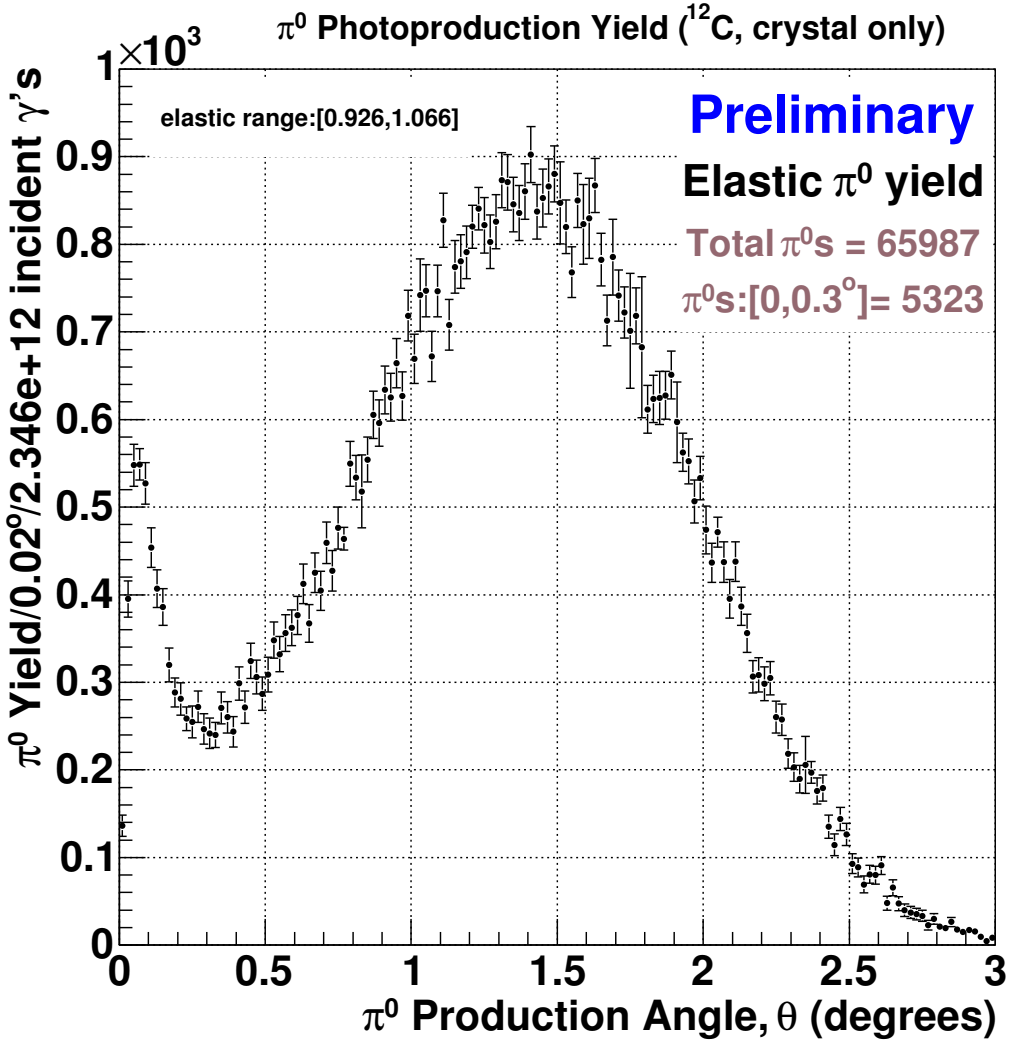
Angular Yield Components, ^{12}C



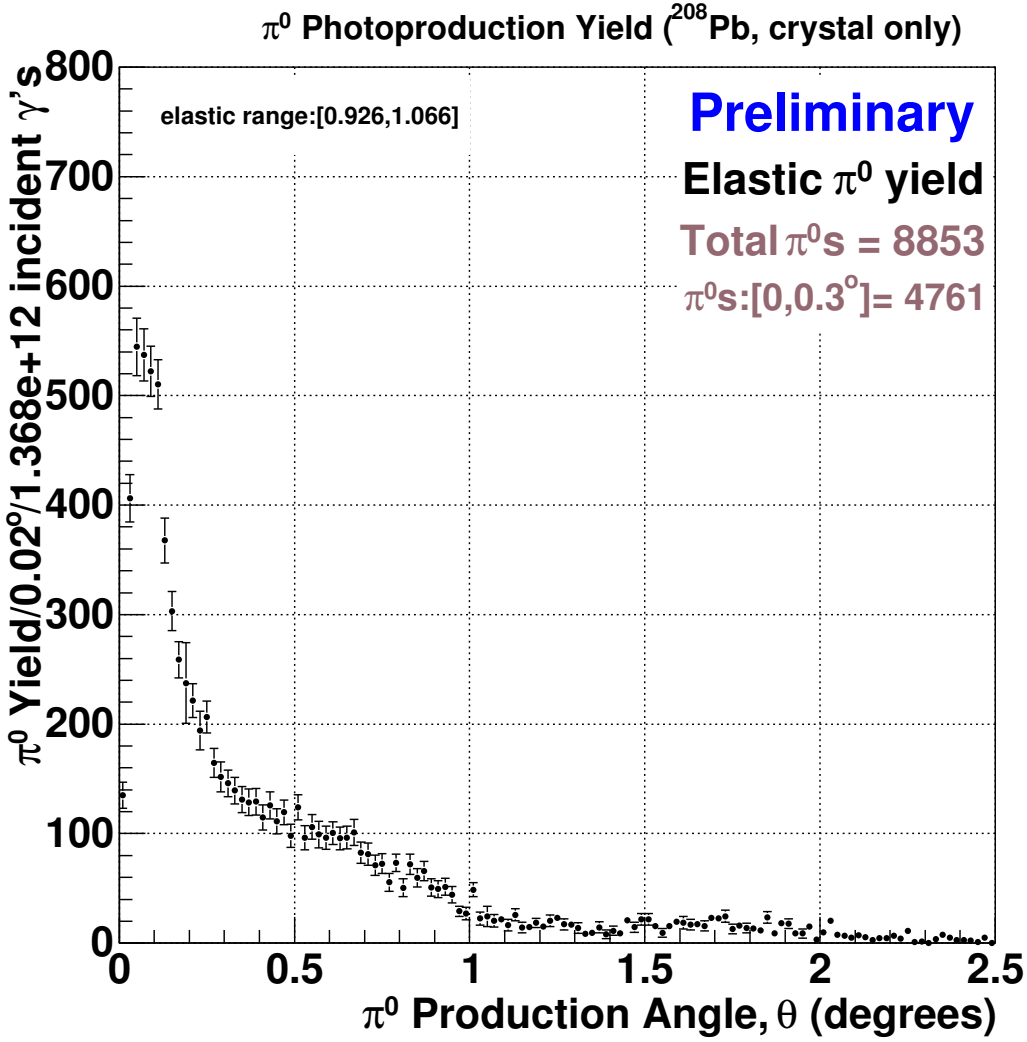
Angular Yield Components, ^{208}Pb



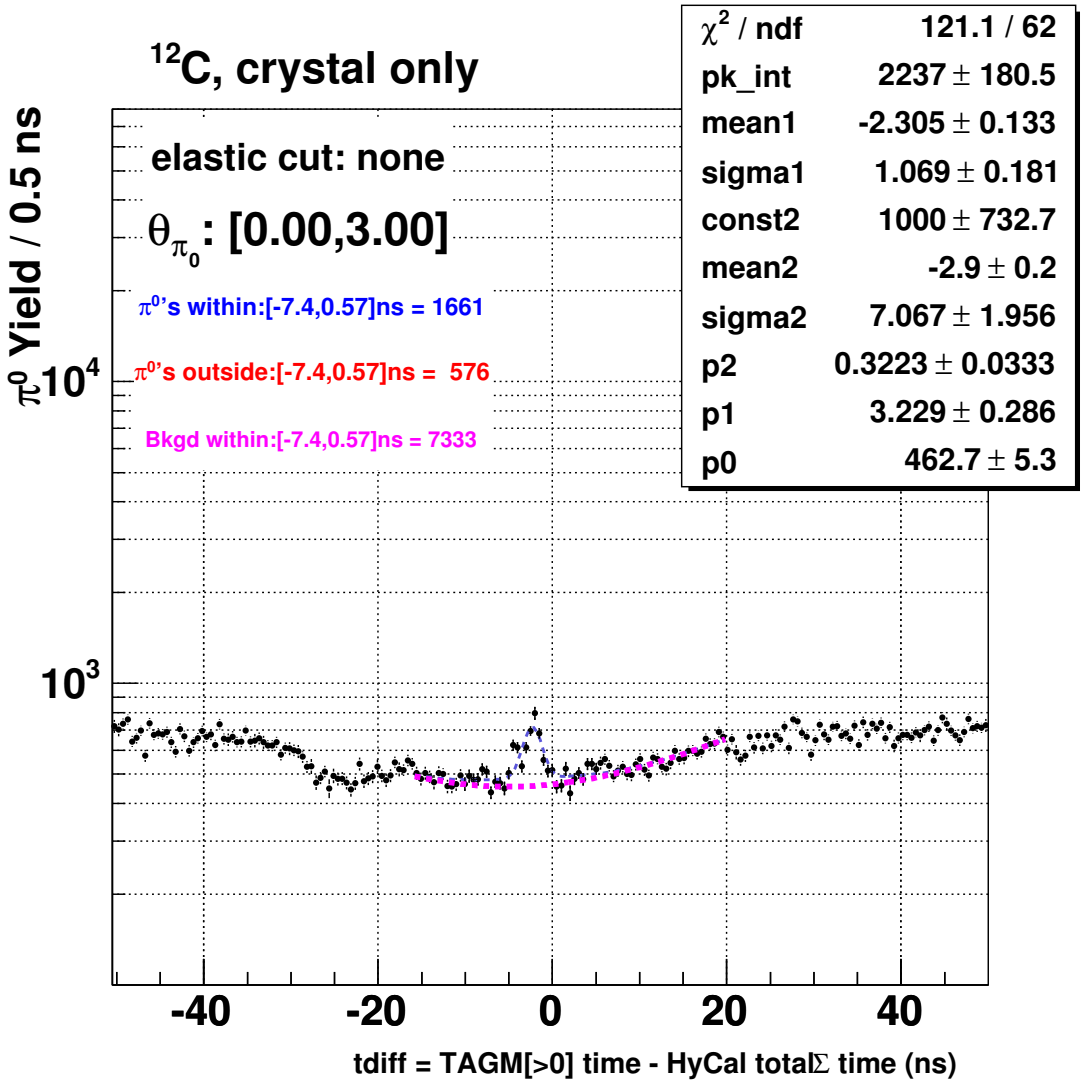
Final, Corrected Angular Yield, ^{12}C



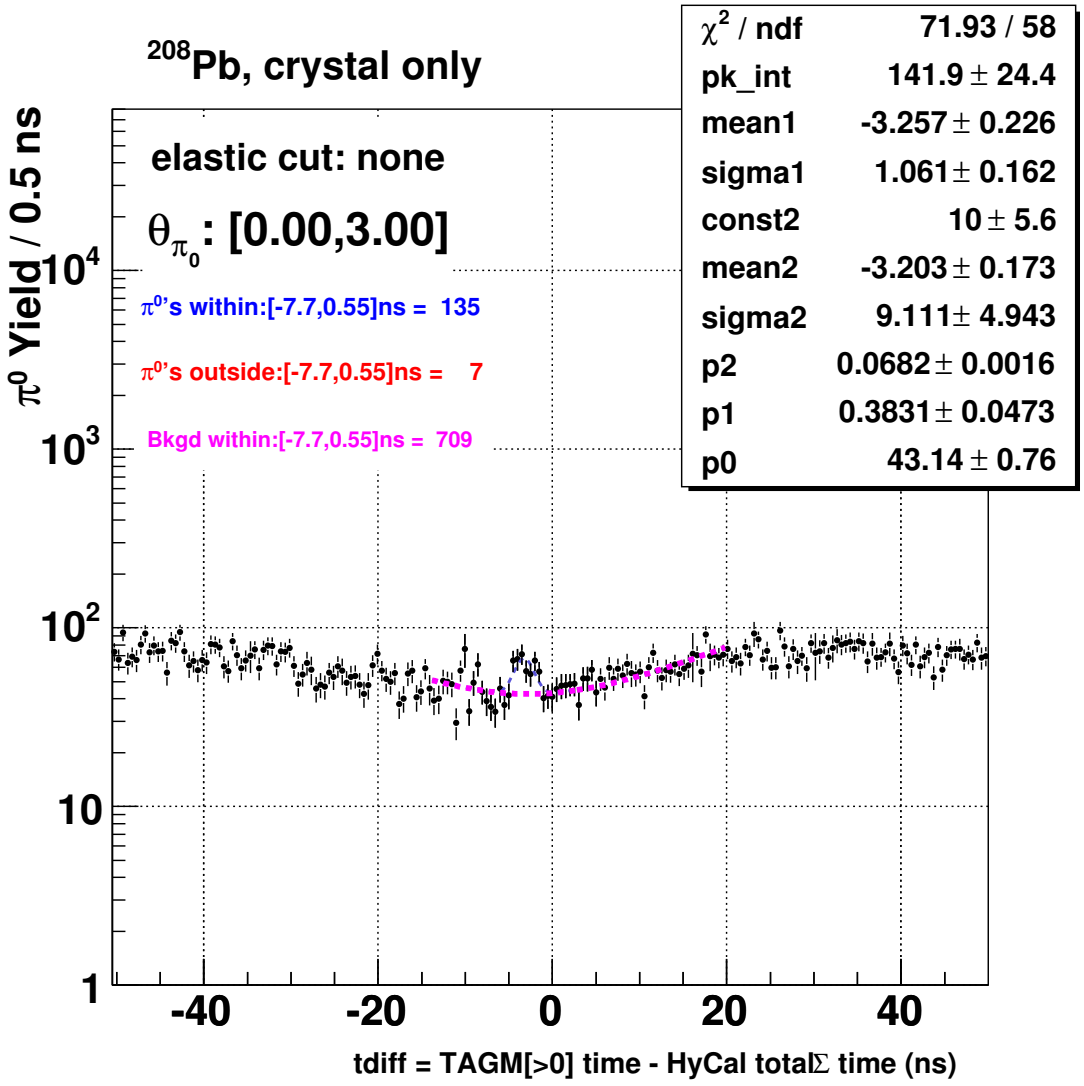
Final, Corrected Angular Yield, ^{208}Pb



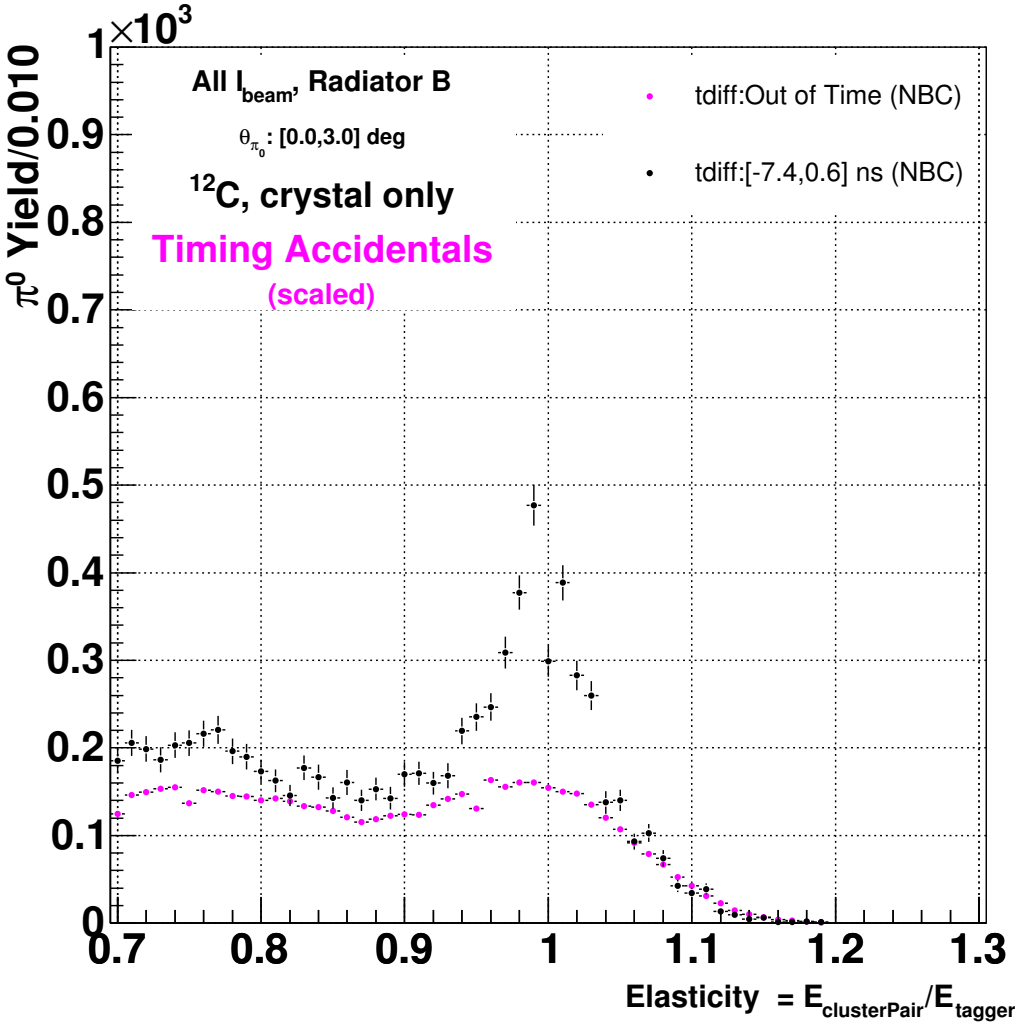
π^0 Yield vs. tdiff (NBC), ^{12}C



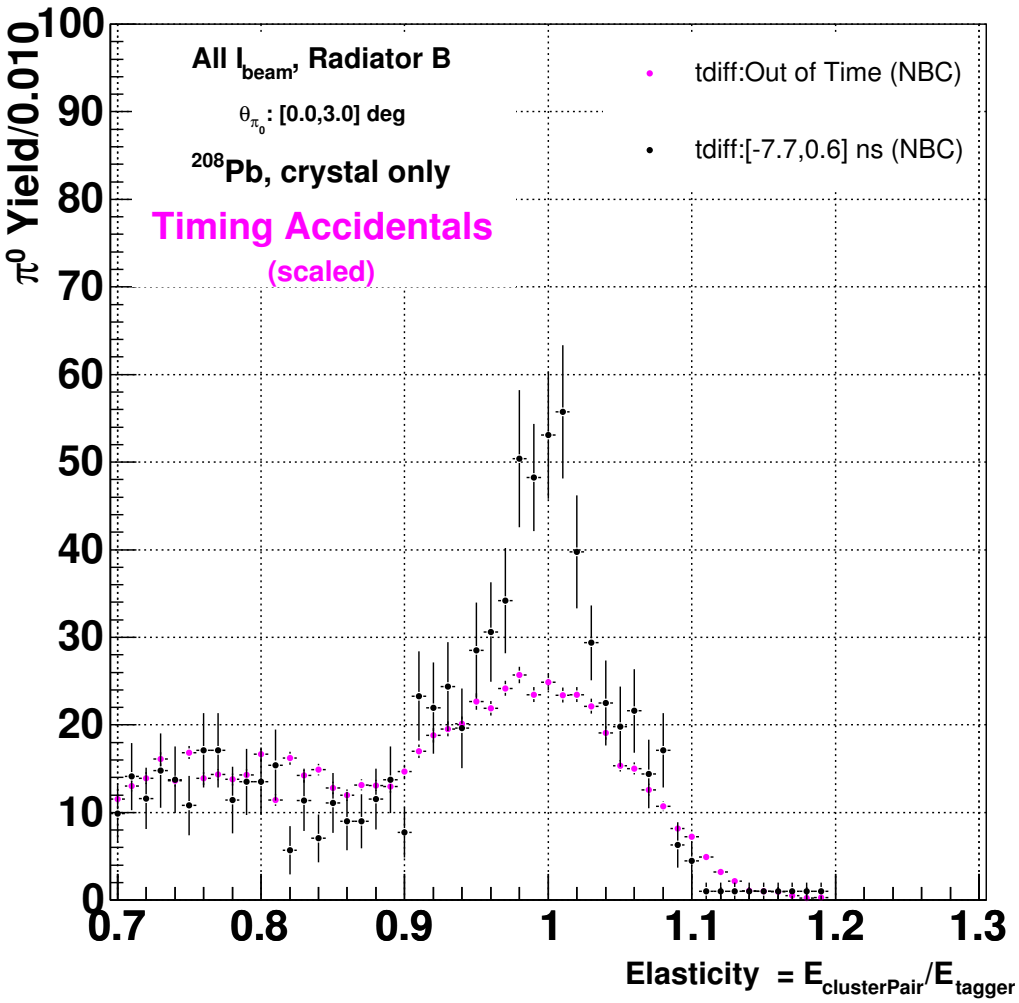
π^0 Yield vs. tdiff (NBC), ^{208}Pb



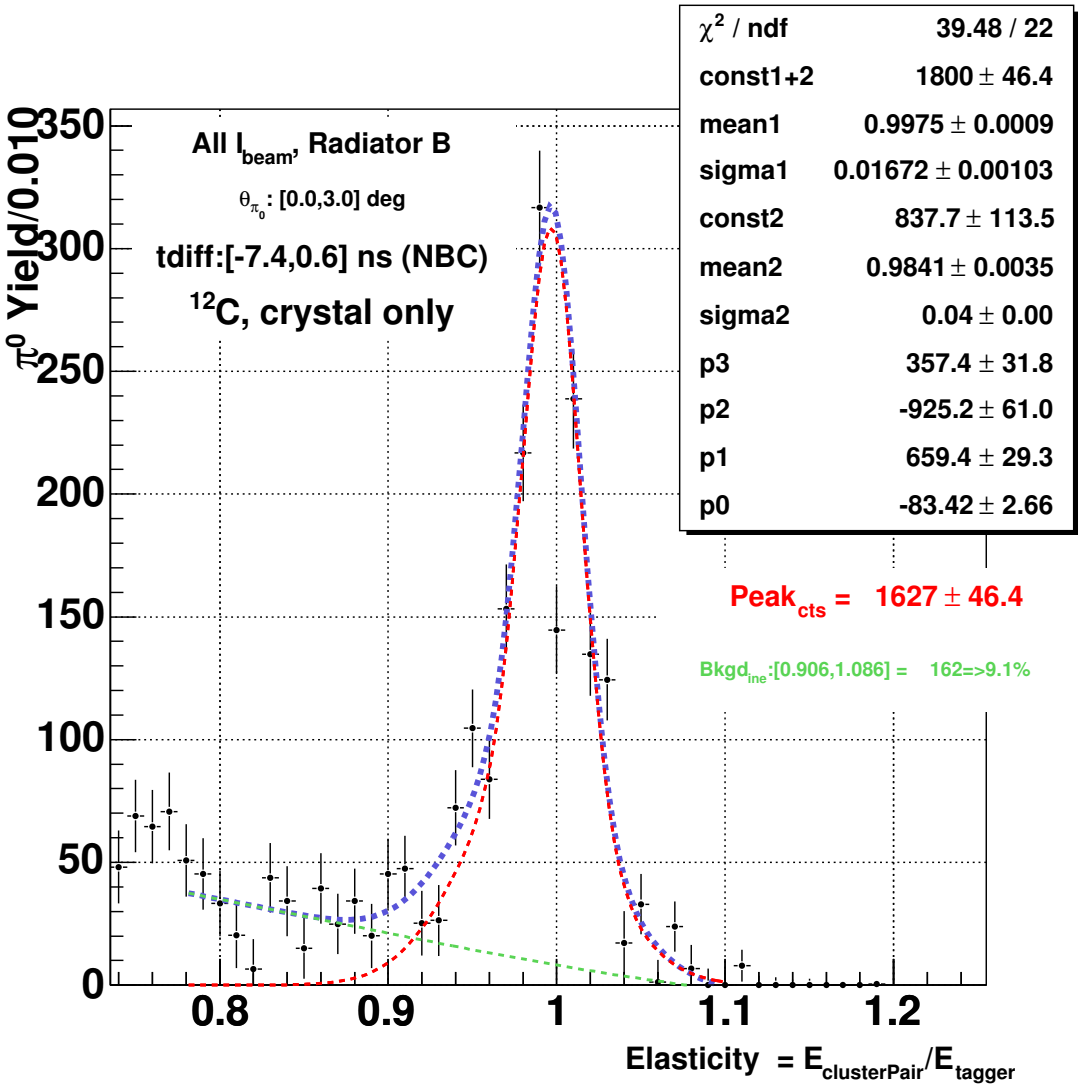
OOT (scaled)and IT Elasticity Yield (NBC), ^{12}C



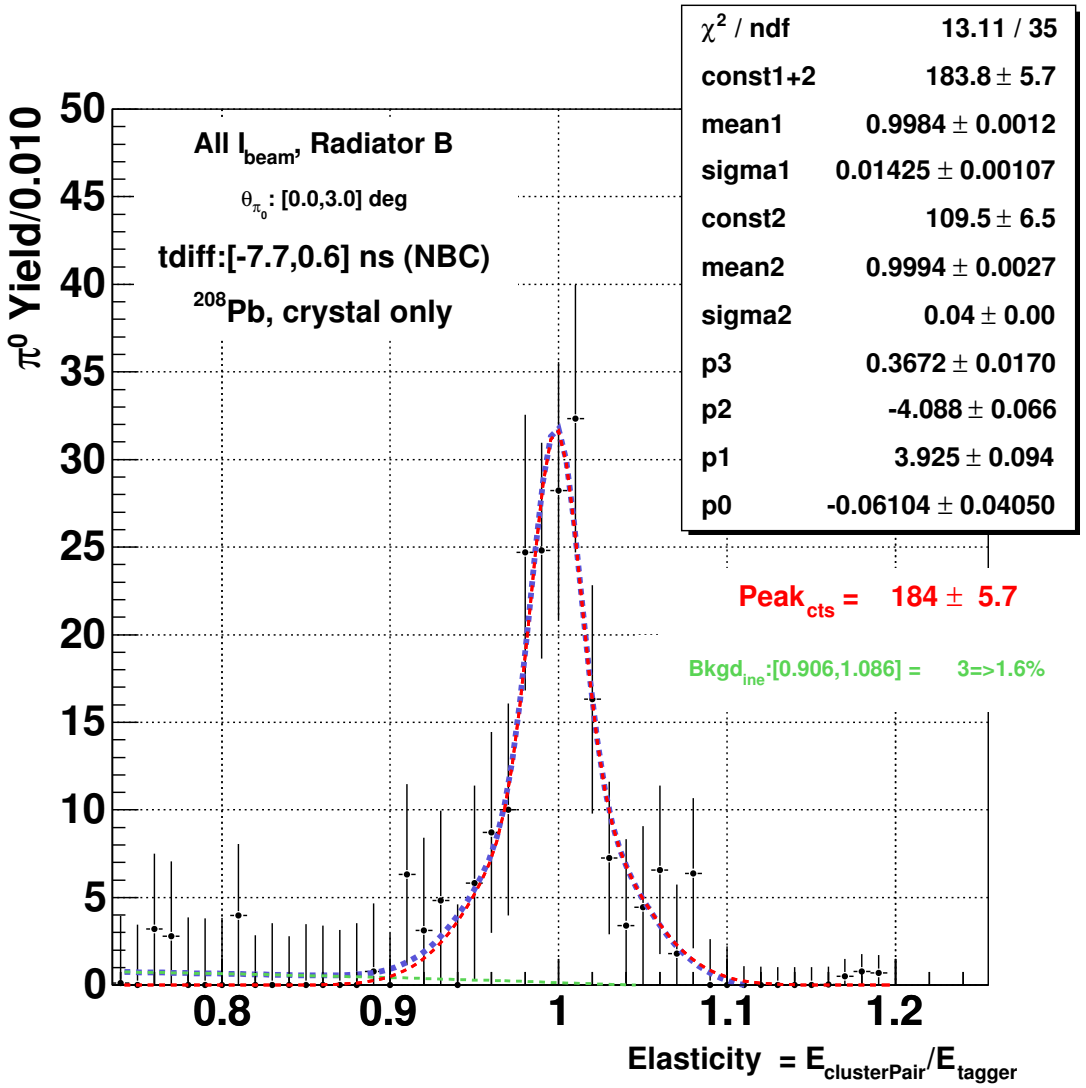
OOT (scaled)and IT Elasticity Yield (NBC), ^{208}Pb



In-Time Elasticity Yield (Corrected for OOT, NBC), ^{12}C



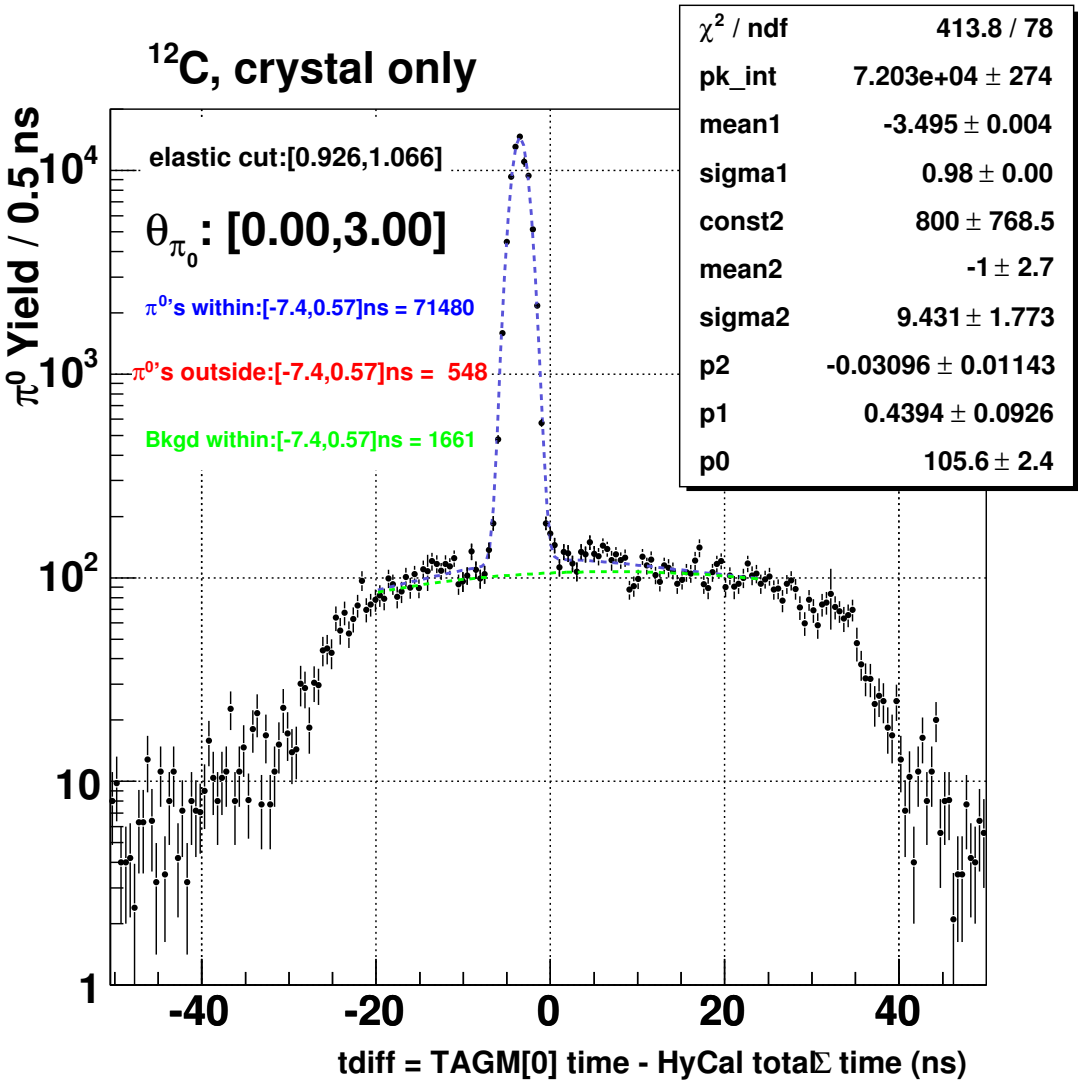
In-Time Elasticity Yield (Corrected for OOT, NBC), ^{208}Pb



Timing Best-Candidate Selection Efficiency

Target Used	BC Fit Peak Cts: π^0's	NBC Fit Peak Cts: lost π^0's	BC Selection Cut Efficiency
^{12}C	65824 ± 297	1627 ± 46	0.976 ± 0.0028
^{208}Pb	8701 ± 114	184 ± 6	0.979 ± 0.0033

Other π^0-Event Losses Related to tdiff Cut ?



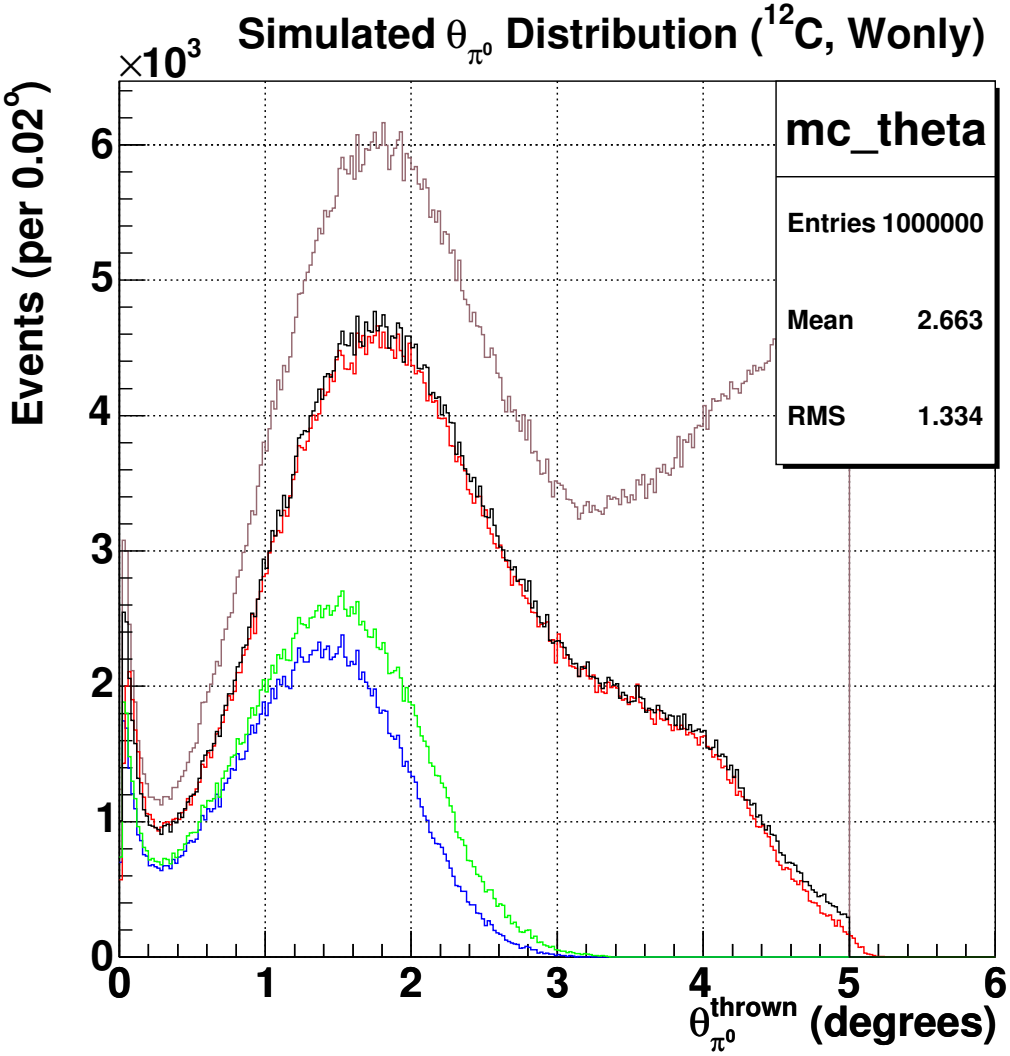
Re-Evaluation of Elasticity Cut Efficiency

- Fit elasticity distributions using HyCal response function–obtained from snake scan data.
- (work in progress)

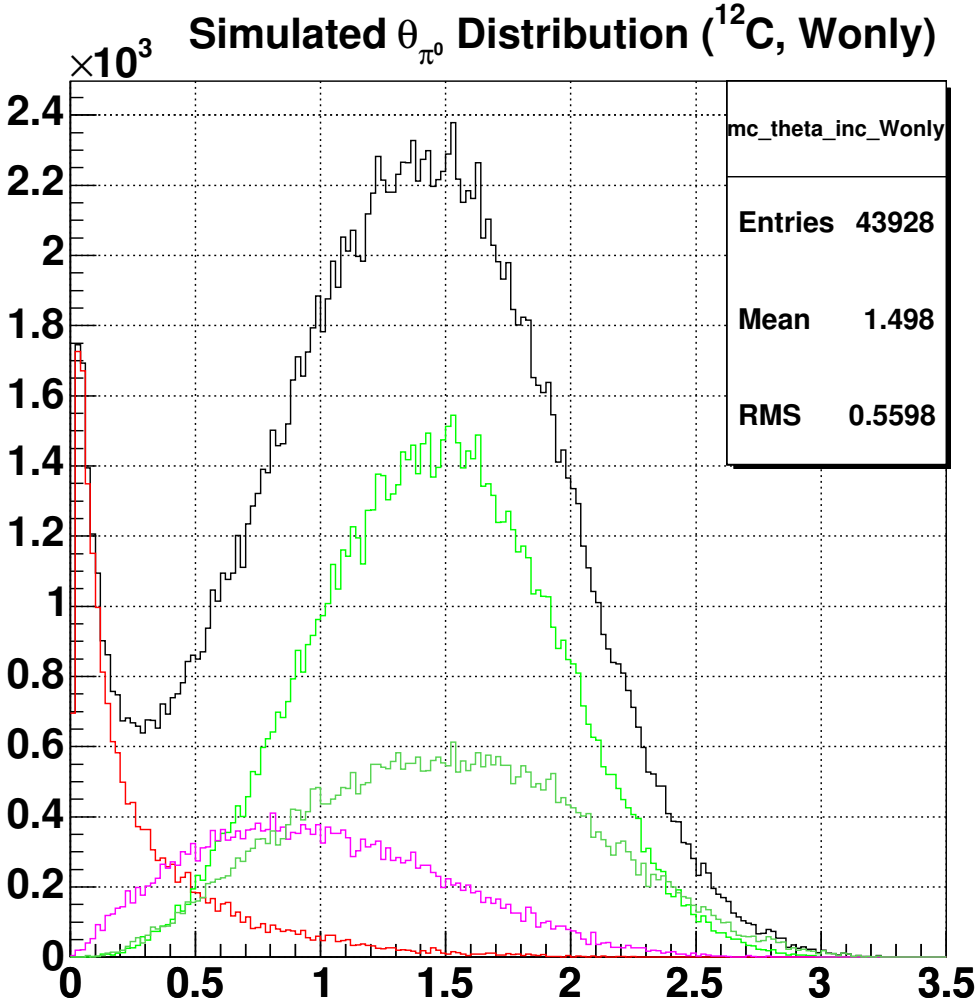
What's New in my Monte Carlo

- Using primsim to calculate acceptance and smear theory calculations.
- Experimental resolutions included: Beam divergence ($\pm 125 \mu$rad, spot size 2.5*mm*, realistic vertex (x,y,z), energy resolutions–channel by channel from database, pedestal smearing.

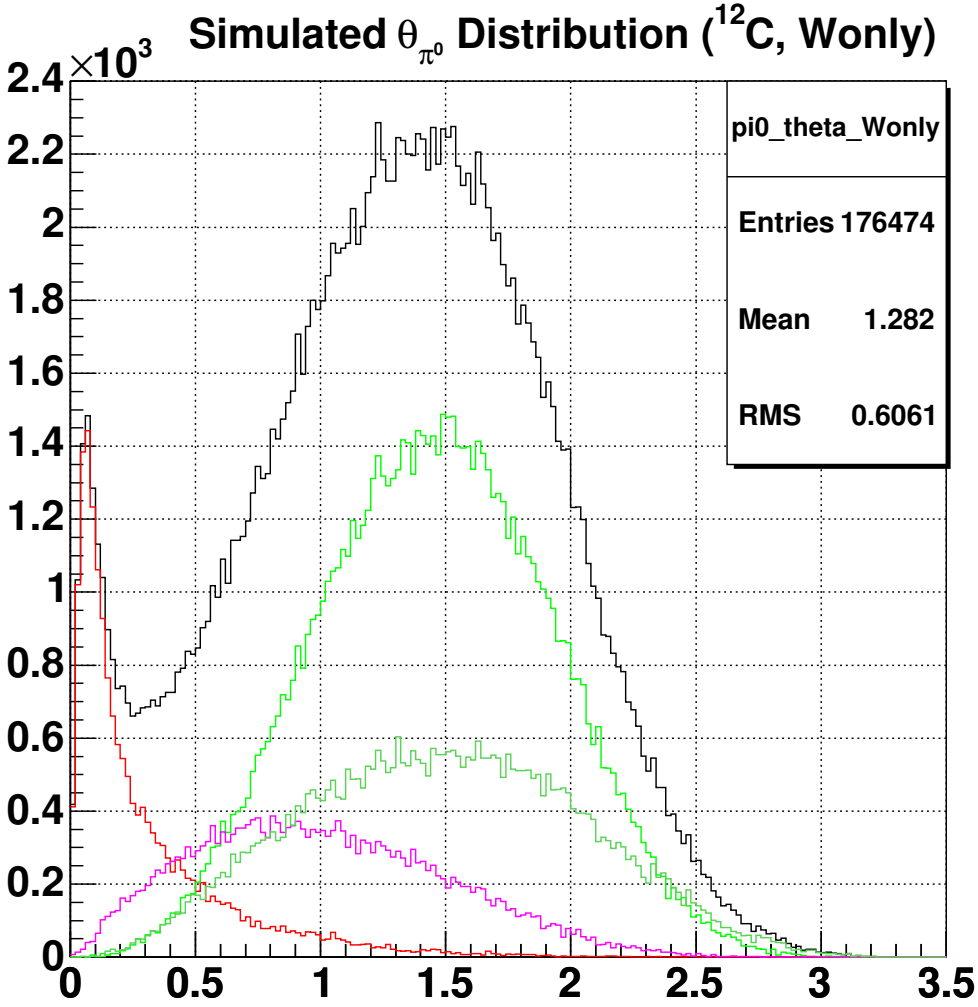
π^0 Photoproduction Event Generator, ^{12}C



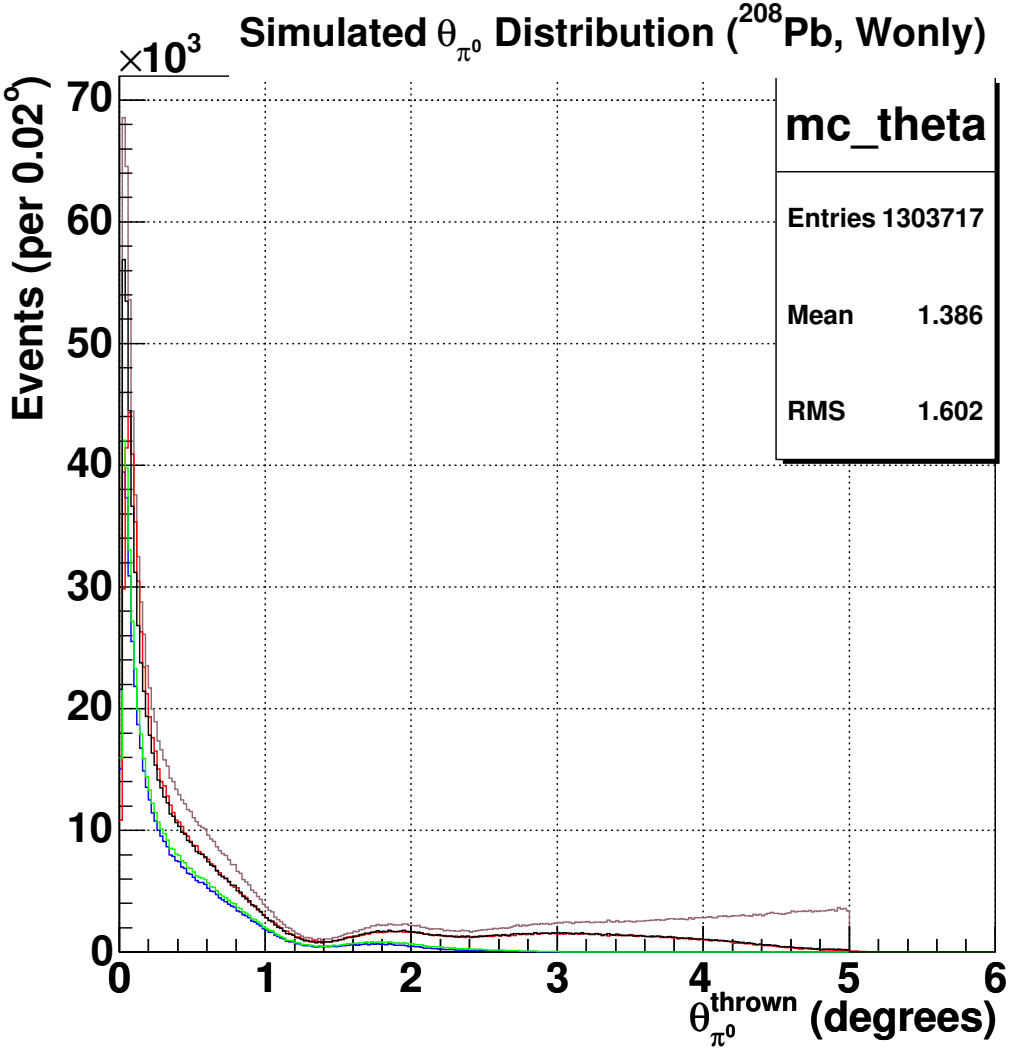
π^0 Photoproduction Event Generator (Thrown), ^{12}C



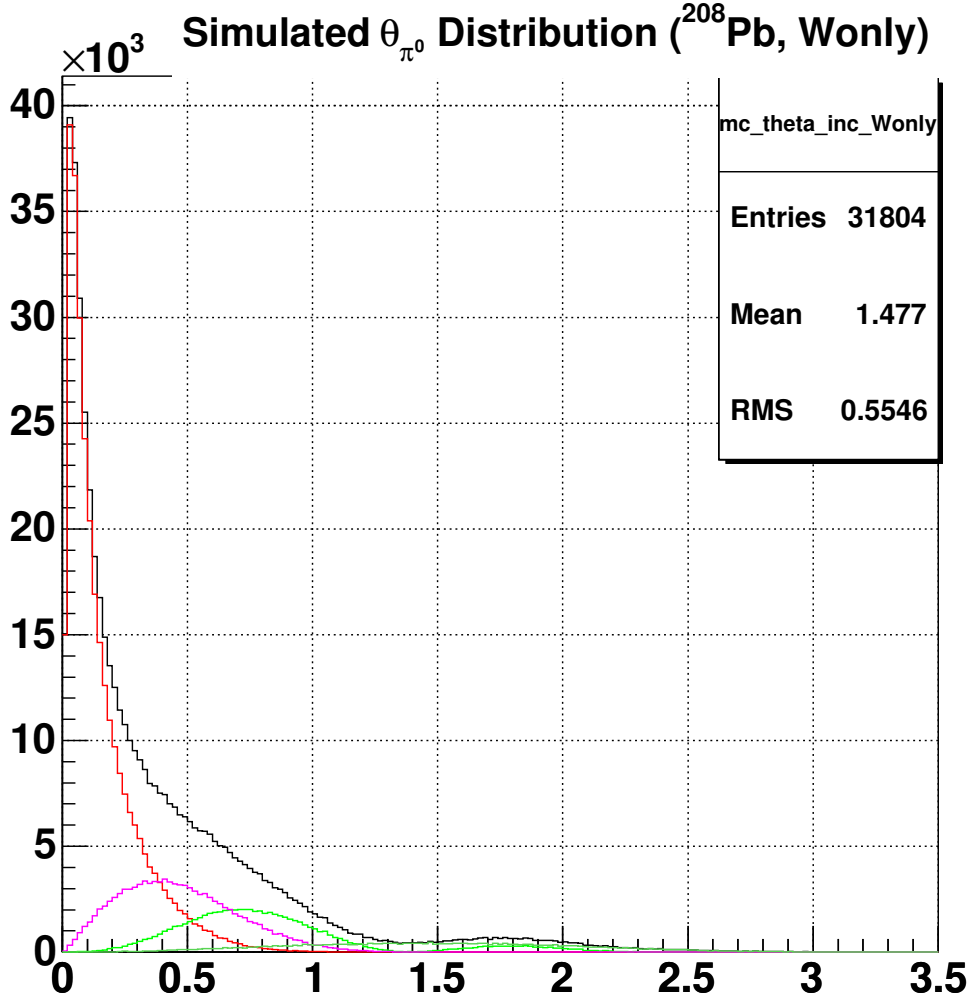
π^0 Photoproduction Event Generator (Recon), ^{12}C



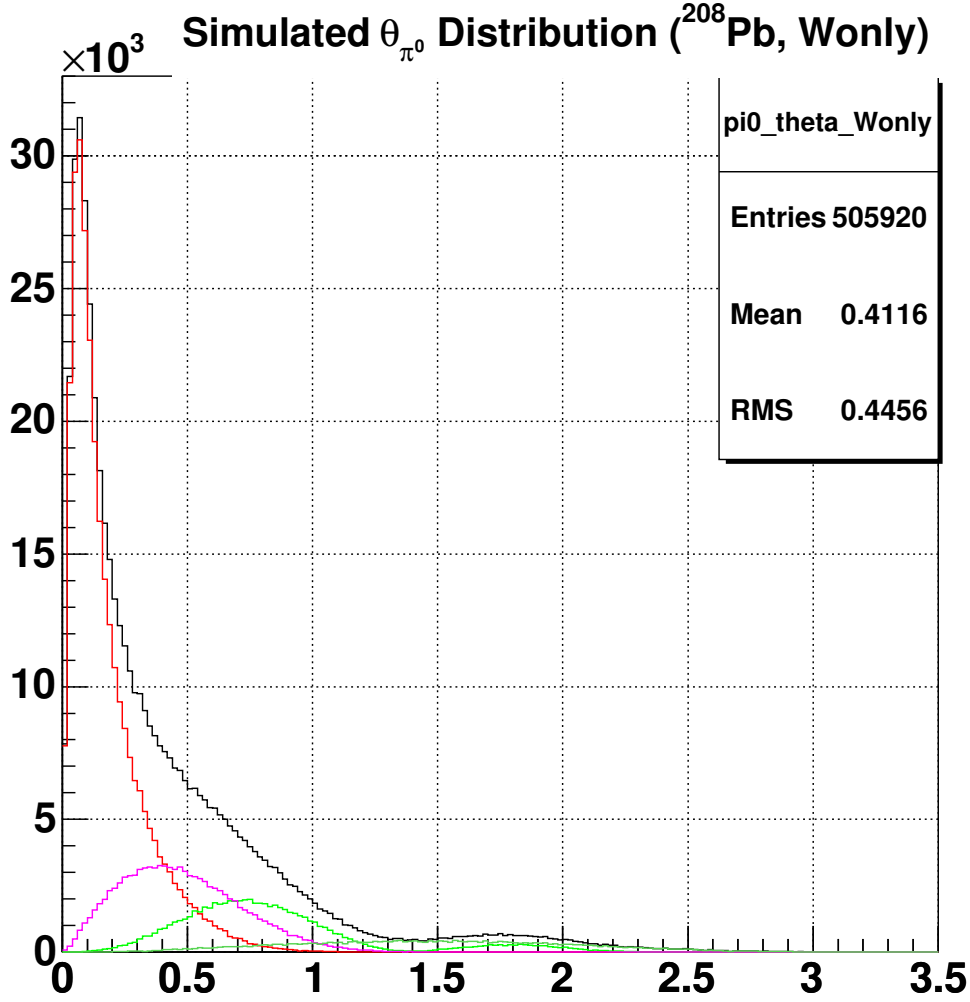
π^0 Photoproduction Event Generator, ^{208}Pb



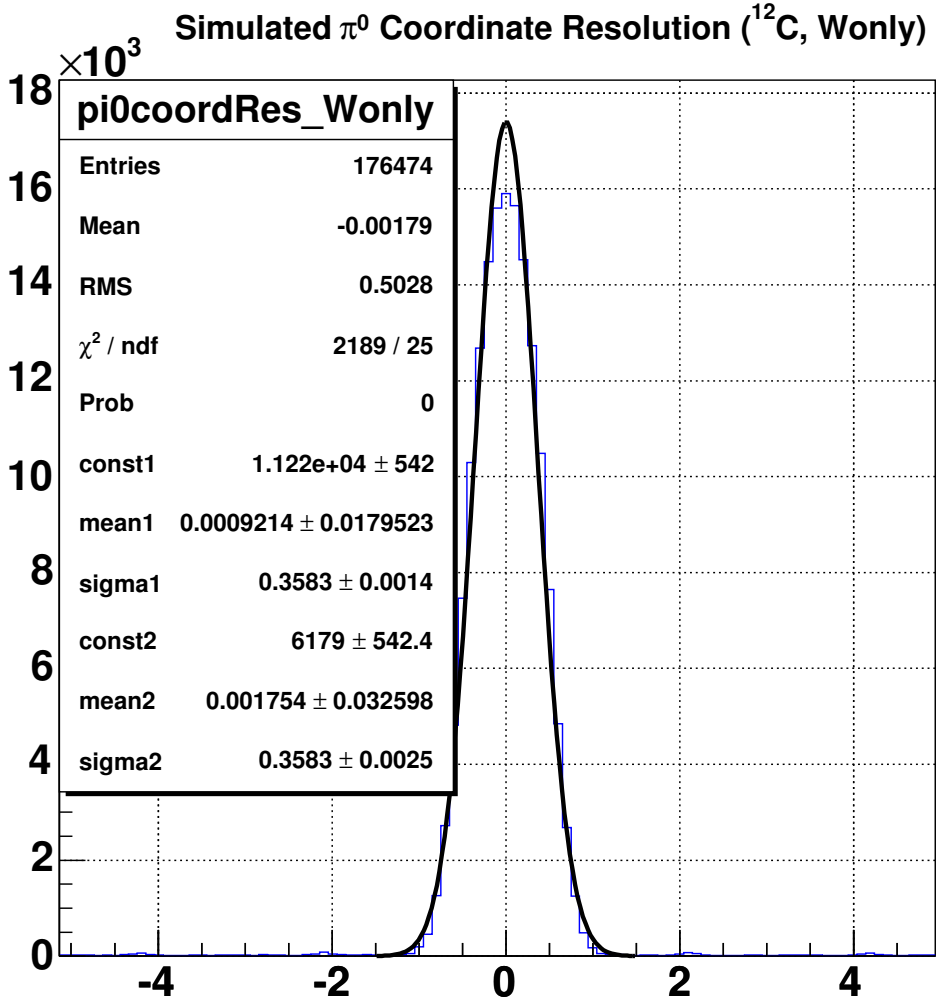
π^0 Photoproduction Event Generator (Thrown), ^{208}Pb



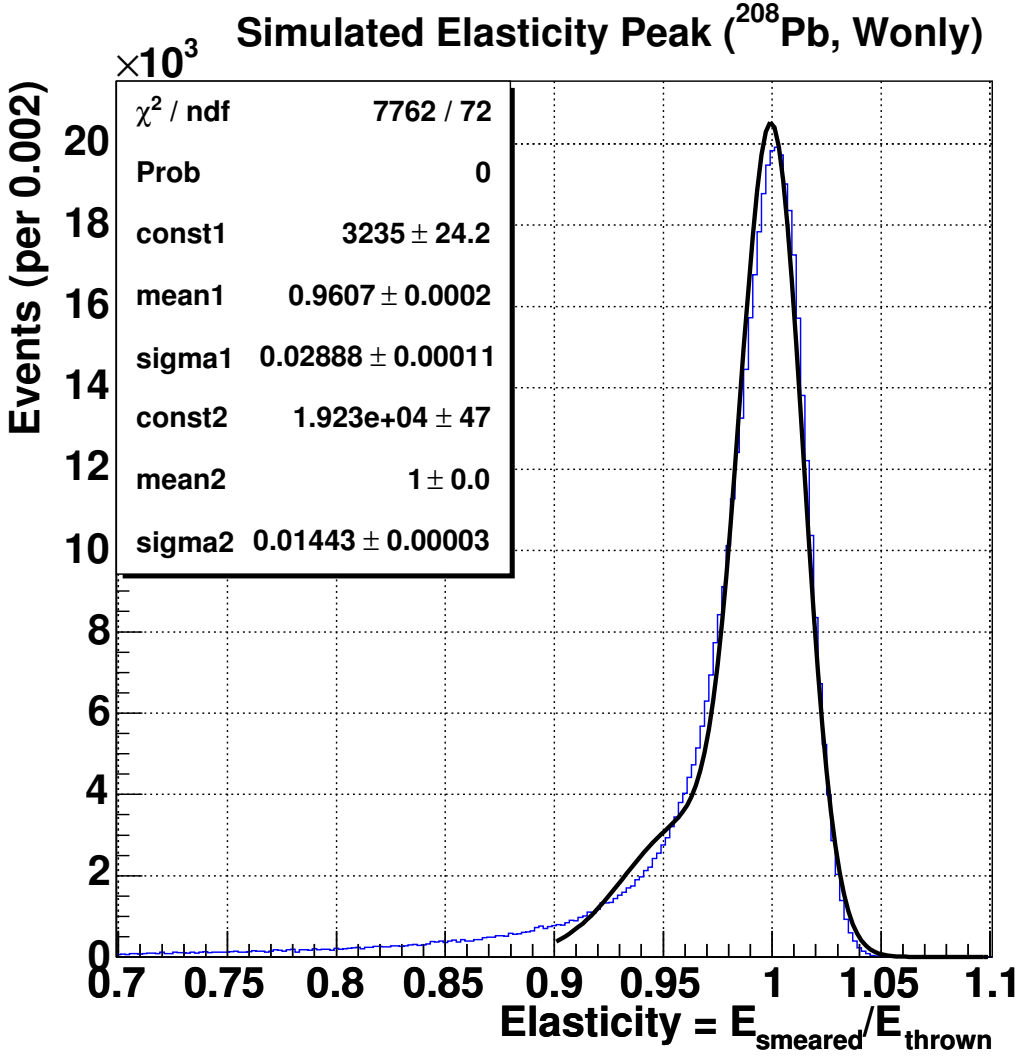
π^0 Photoproduction Event Generator (Recon), ^{208}Pb



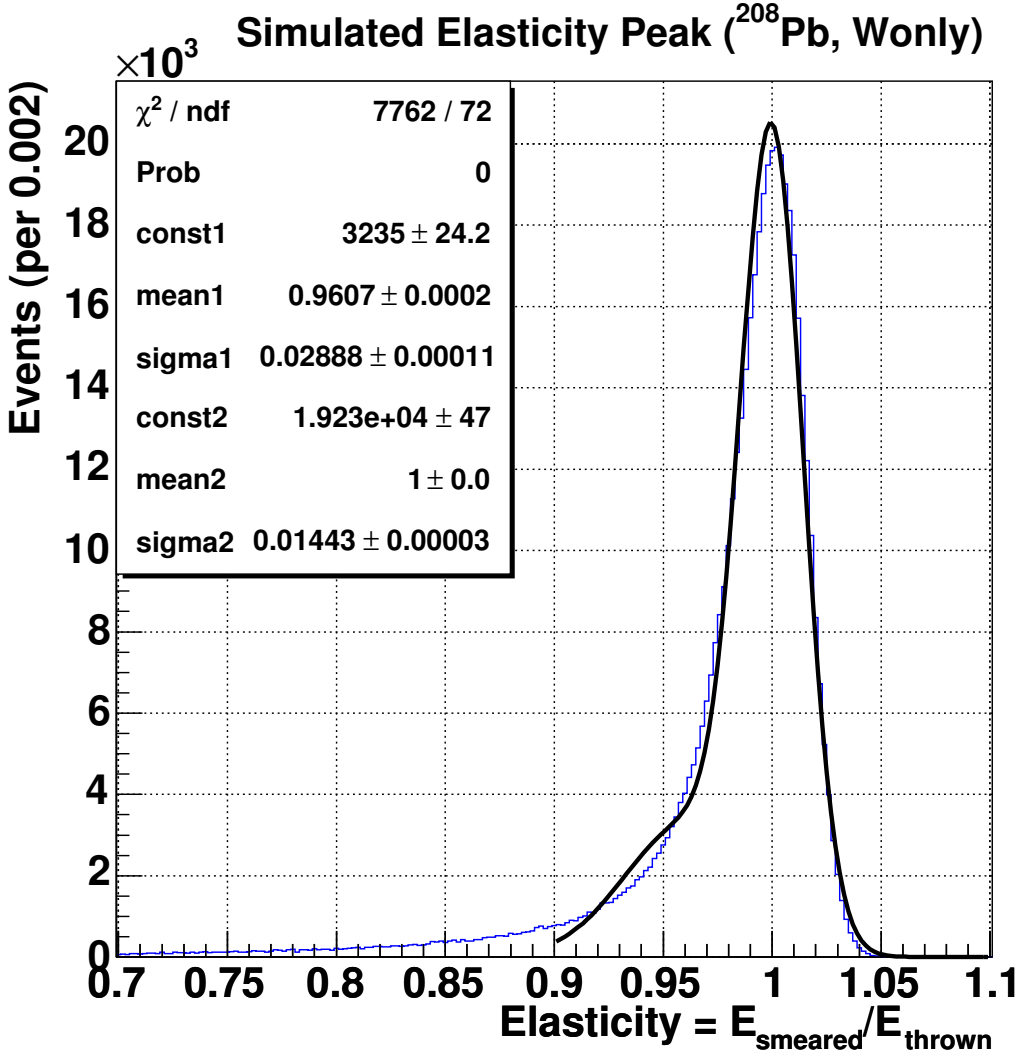
Coordinate Resolution



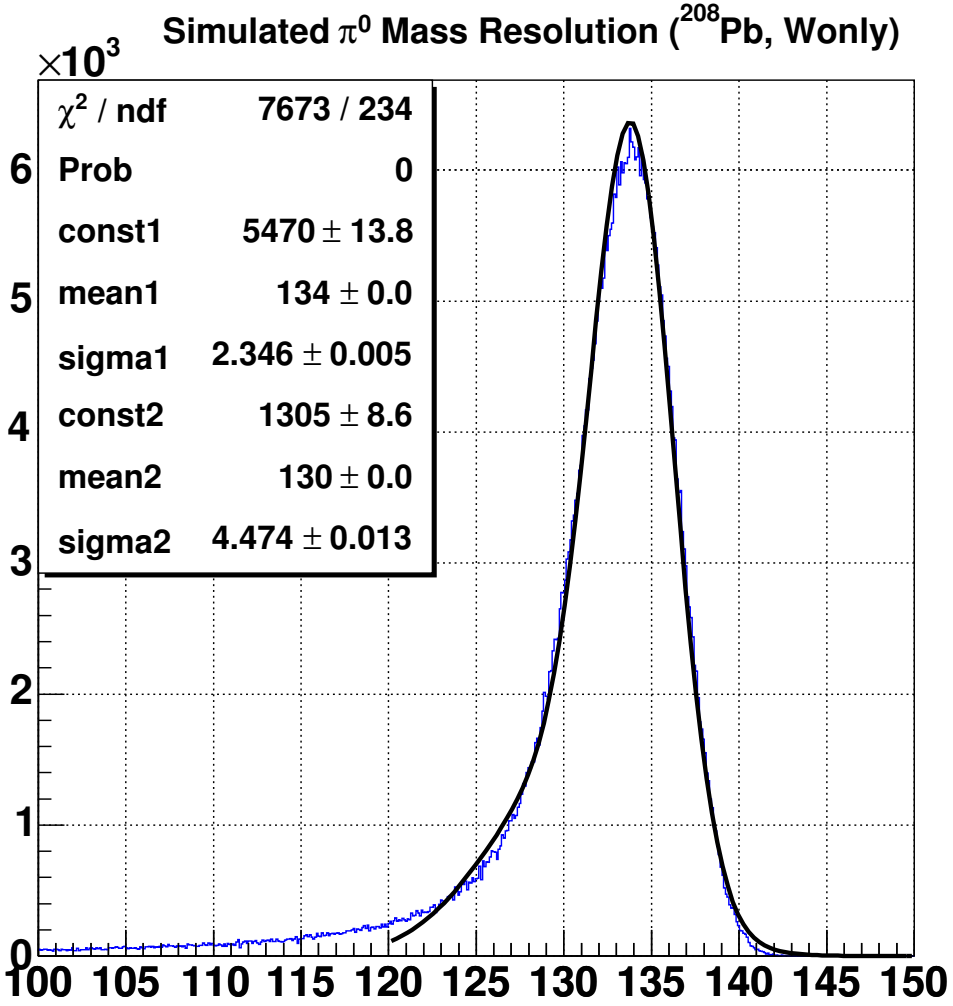
Energy Resolution



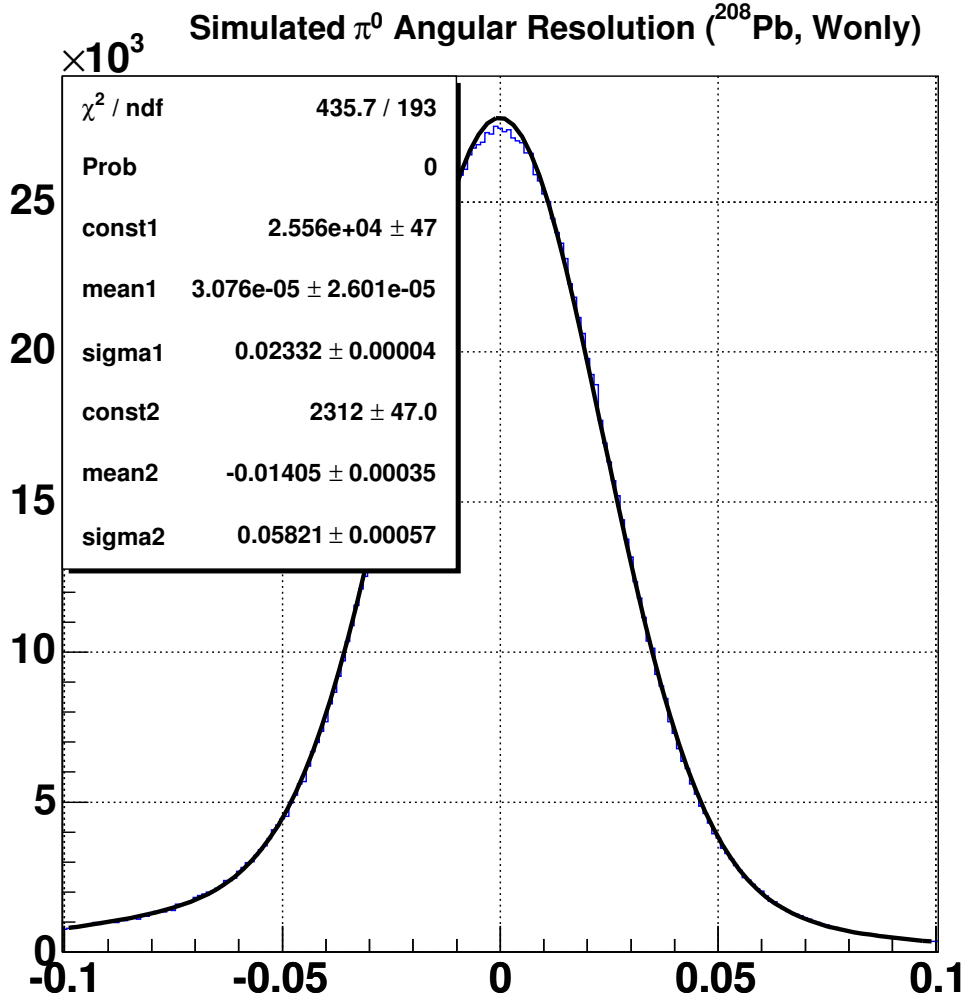
Energy Resolution



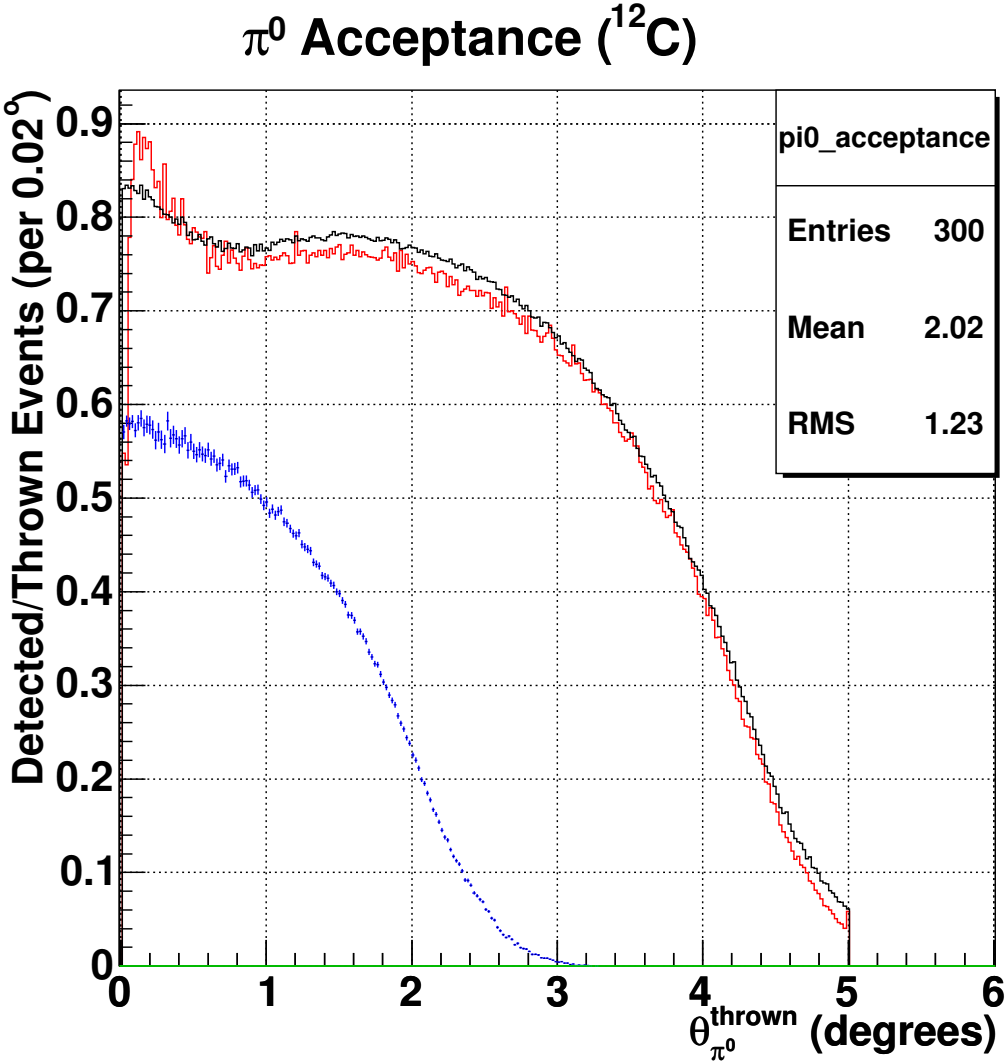
$m_{\gamma\gamma}$ Resolution



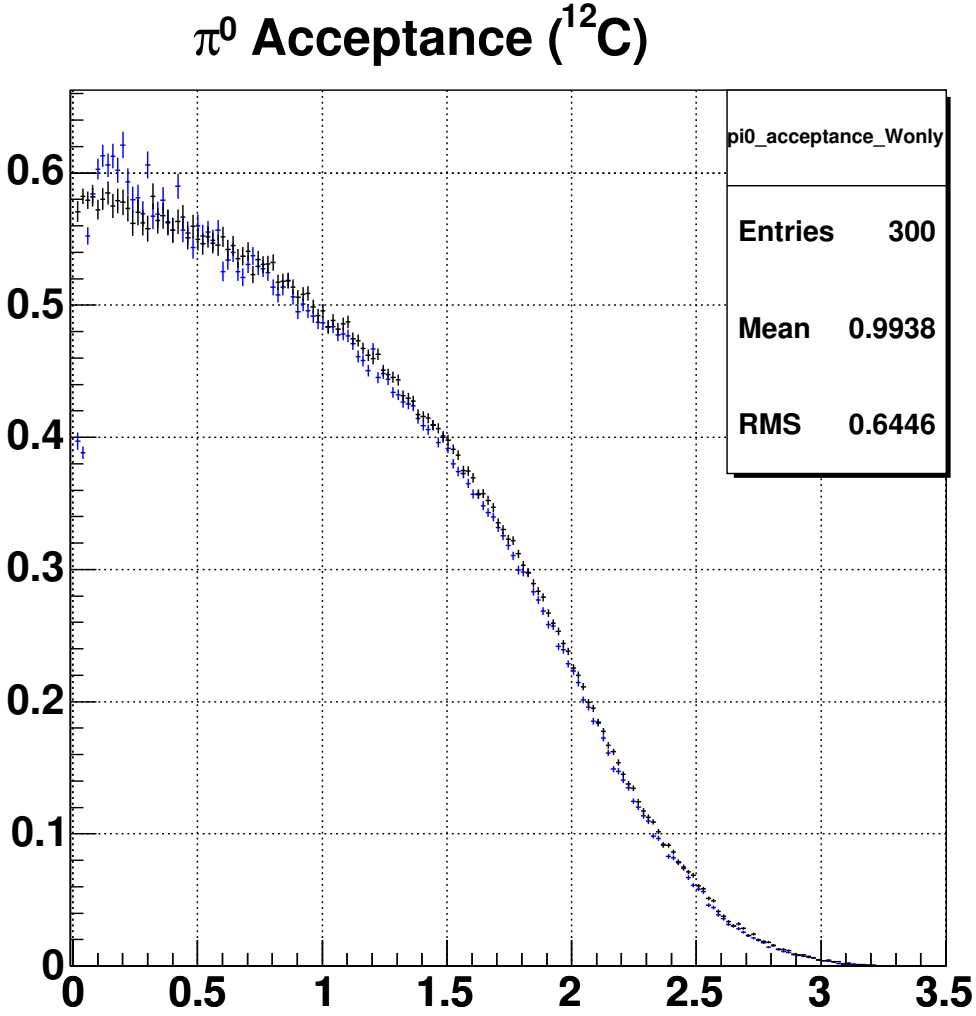
π^0 Angular Resolution



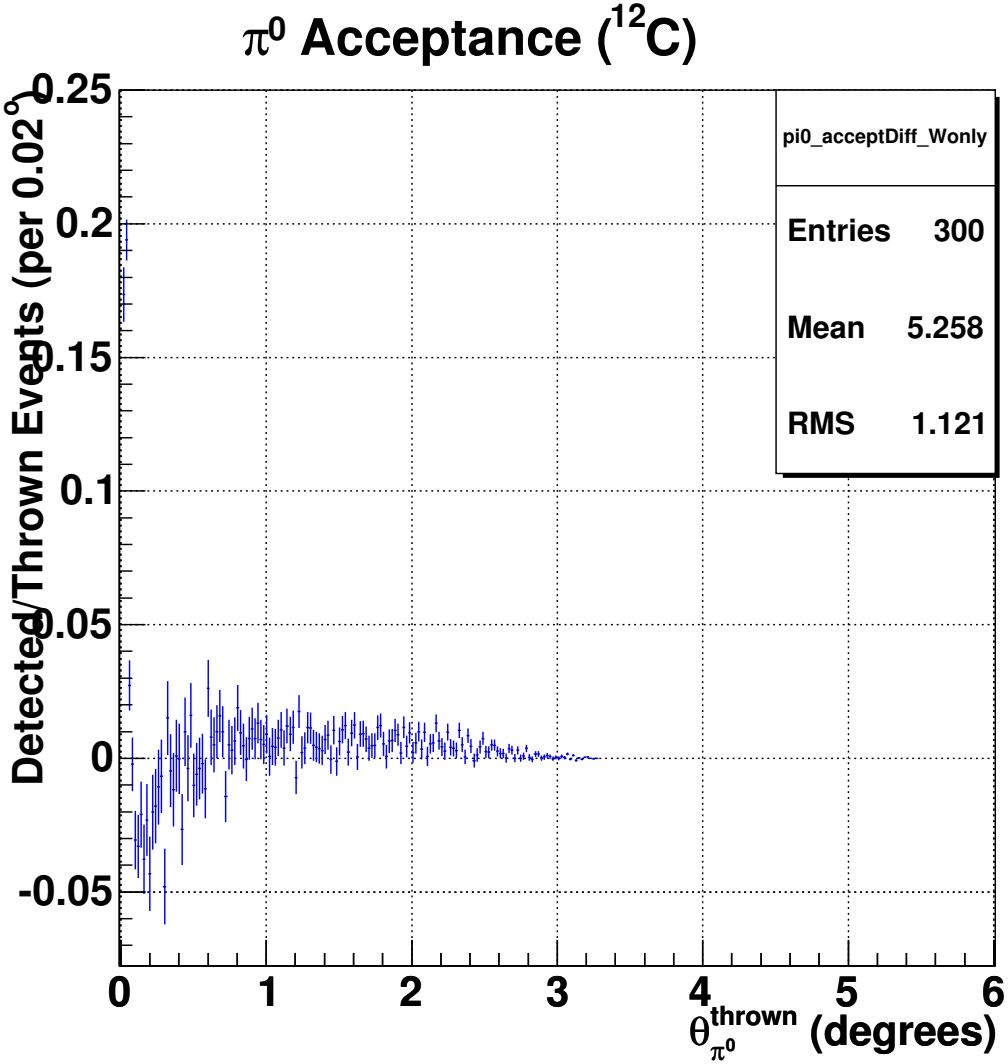
Geometric Acceptance × Recon. Efficiency, ^{12}C



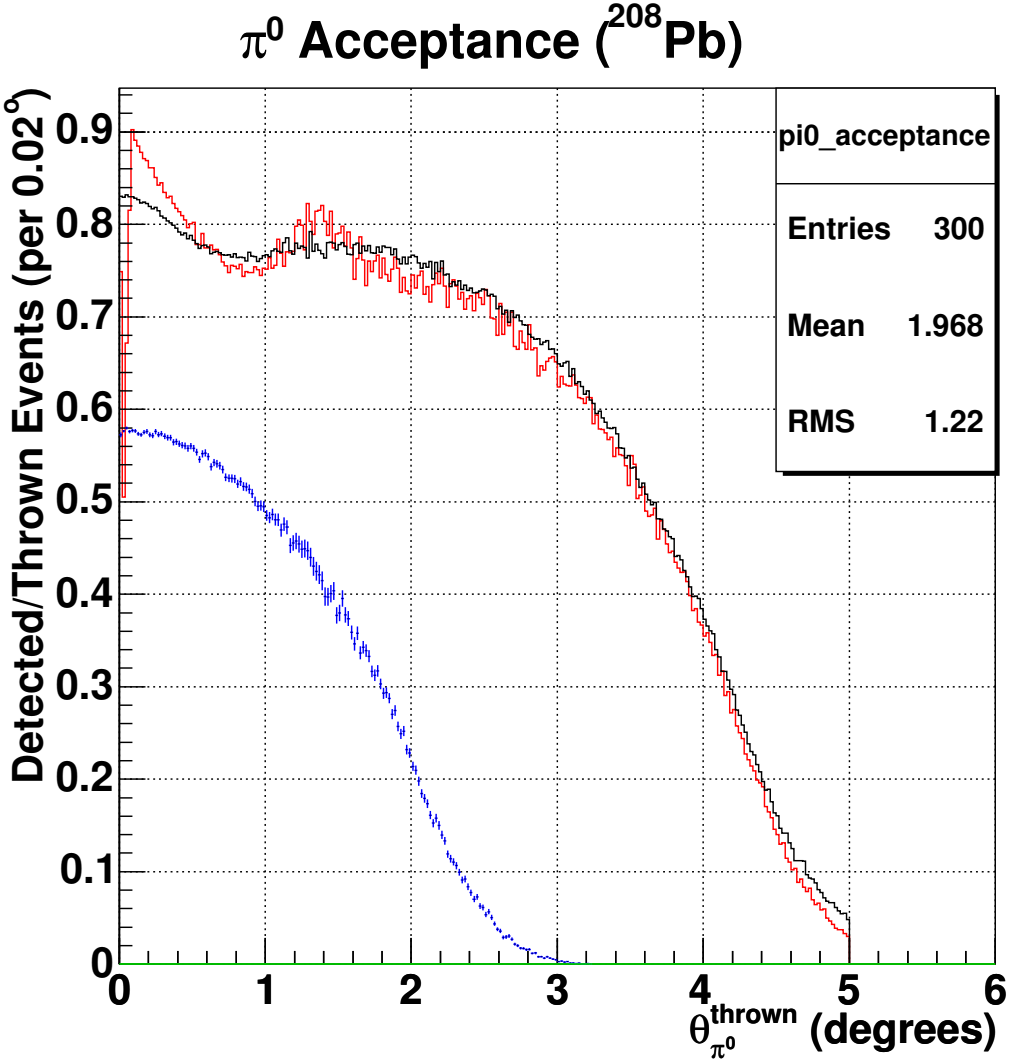
Geometric Acceptance × Recon. Efficiency, ^{12}C



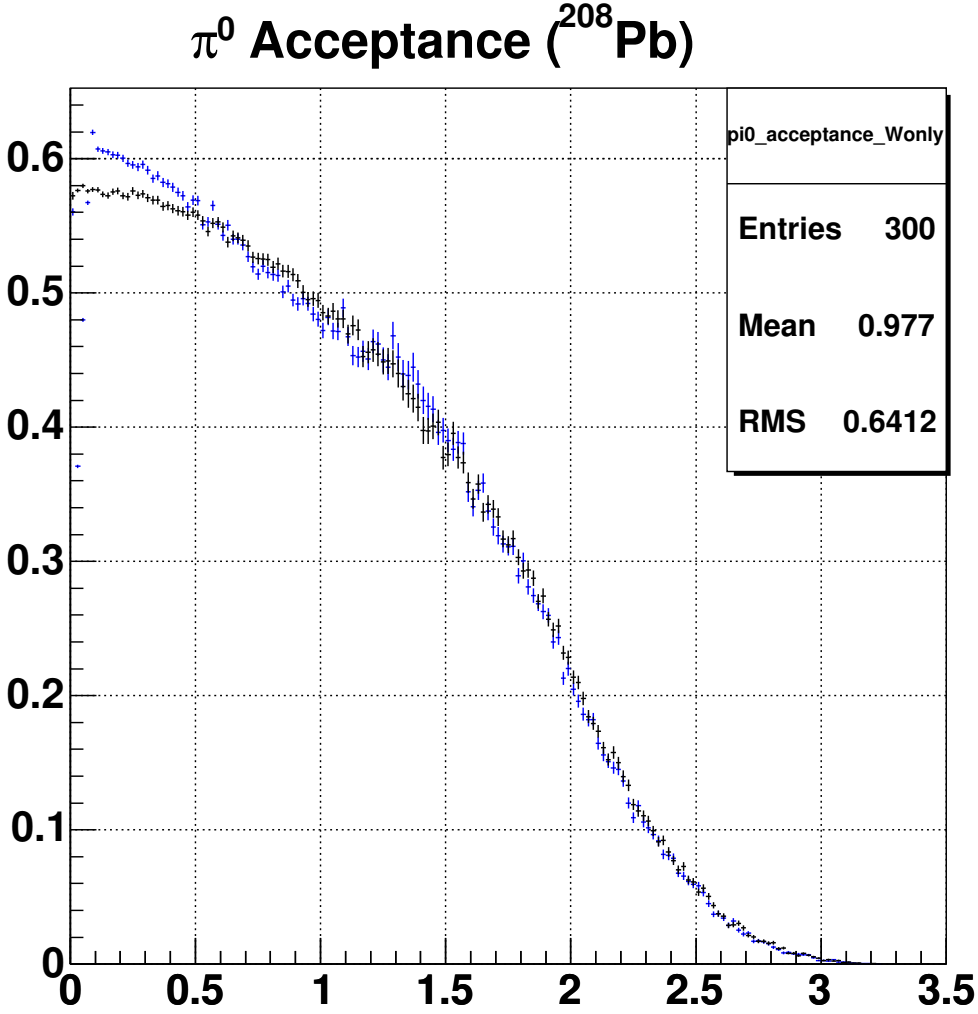
Diff. b/t Pure Geom. Accept and Recon Accept., ^{12}C



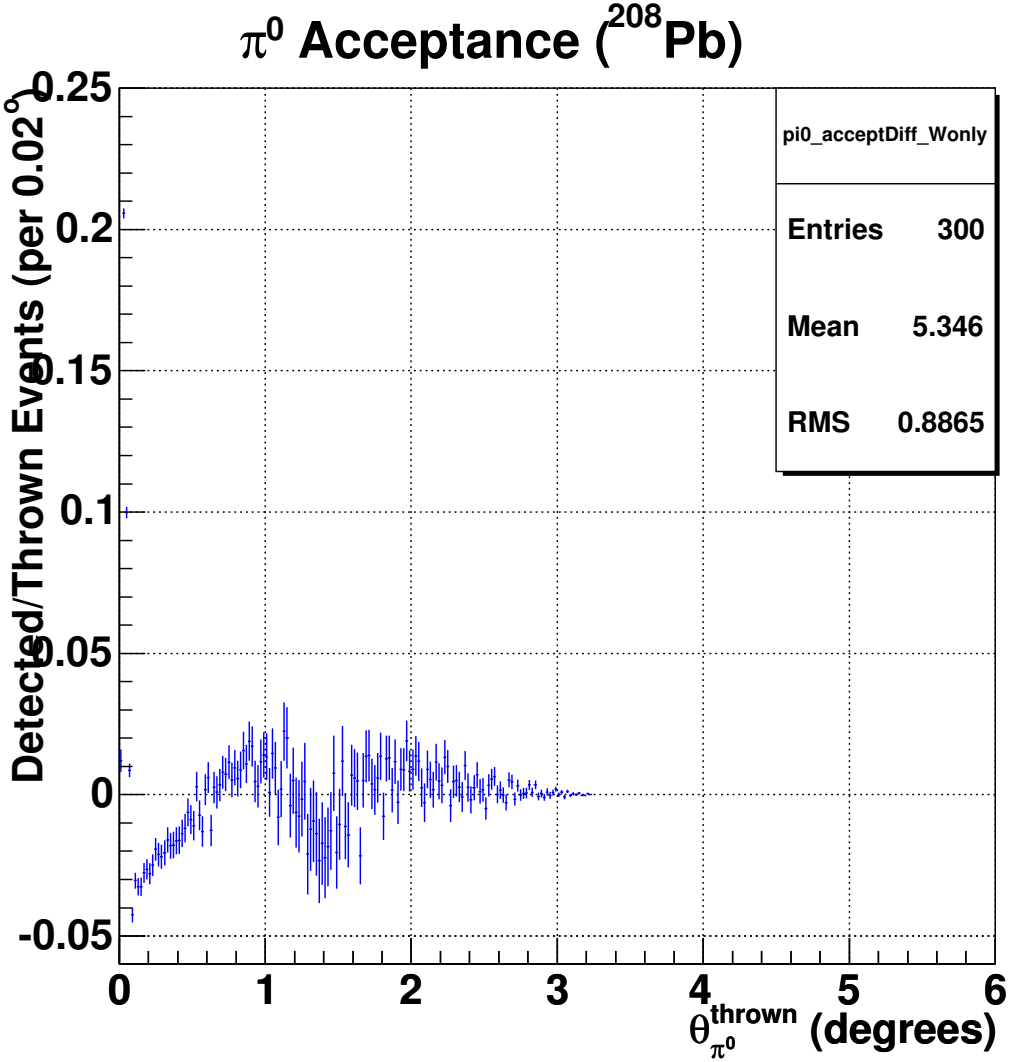
Geometric Acceptance × Recon. Efficiency, ^{208}Pb



Geometric Acceptance × Recon. Efficiency, ^{208}Pb



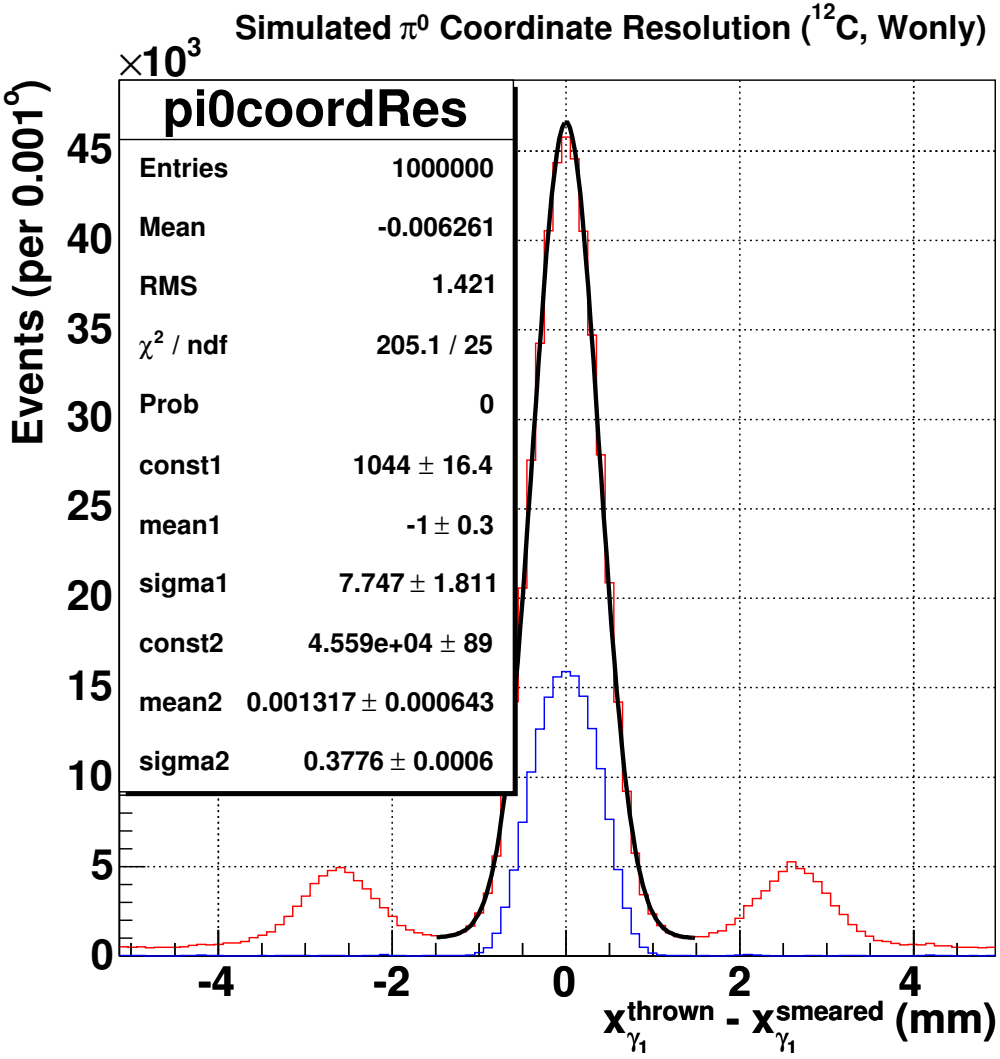
Diff. b/t Pure Geom. Accept and Recon Accept., ^{208}Pb



What's Missing in my Monte Carlo

- No timing accidental background simulated.
- No inelastic background simulated.
- π^0 energy loss for "incoherent" events not simulated, only angular distribution.

Lead Glass Coordinate reconstruction anamoly



Summary

- Finalize elasticity cut efficiencies.
- Finish analysis note write-up of yield and cross section determination.
- Resume width extraction systematic error studies–mostly for ^{208}Pb.
- Above includes, FF's and incoherent shape dependence,...
- Present latest width results for both targets at next Collaboration meeting.