π^0 Lifetime Final Results

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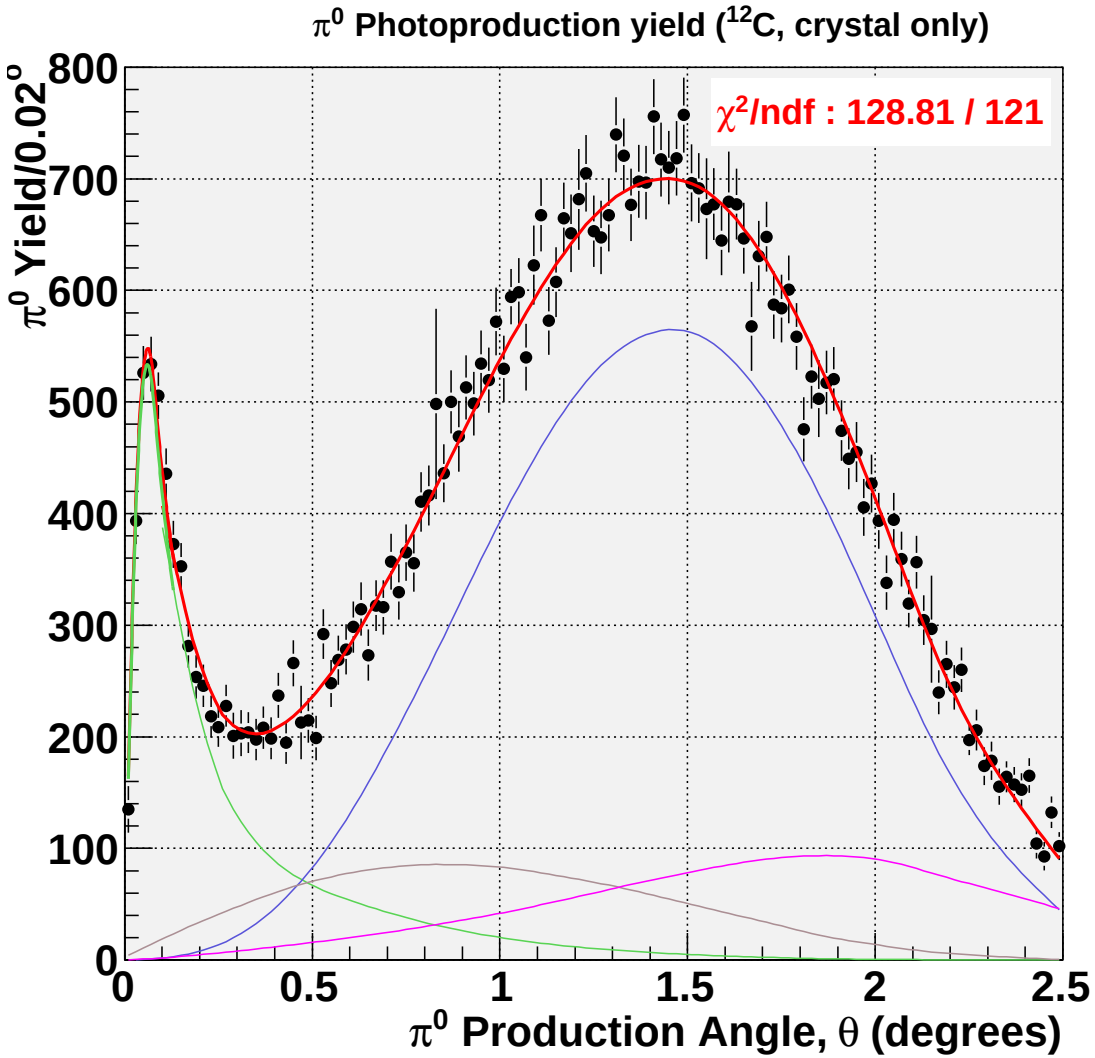
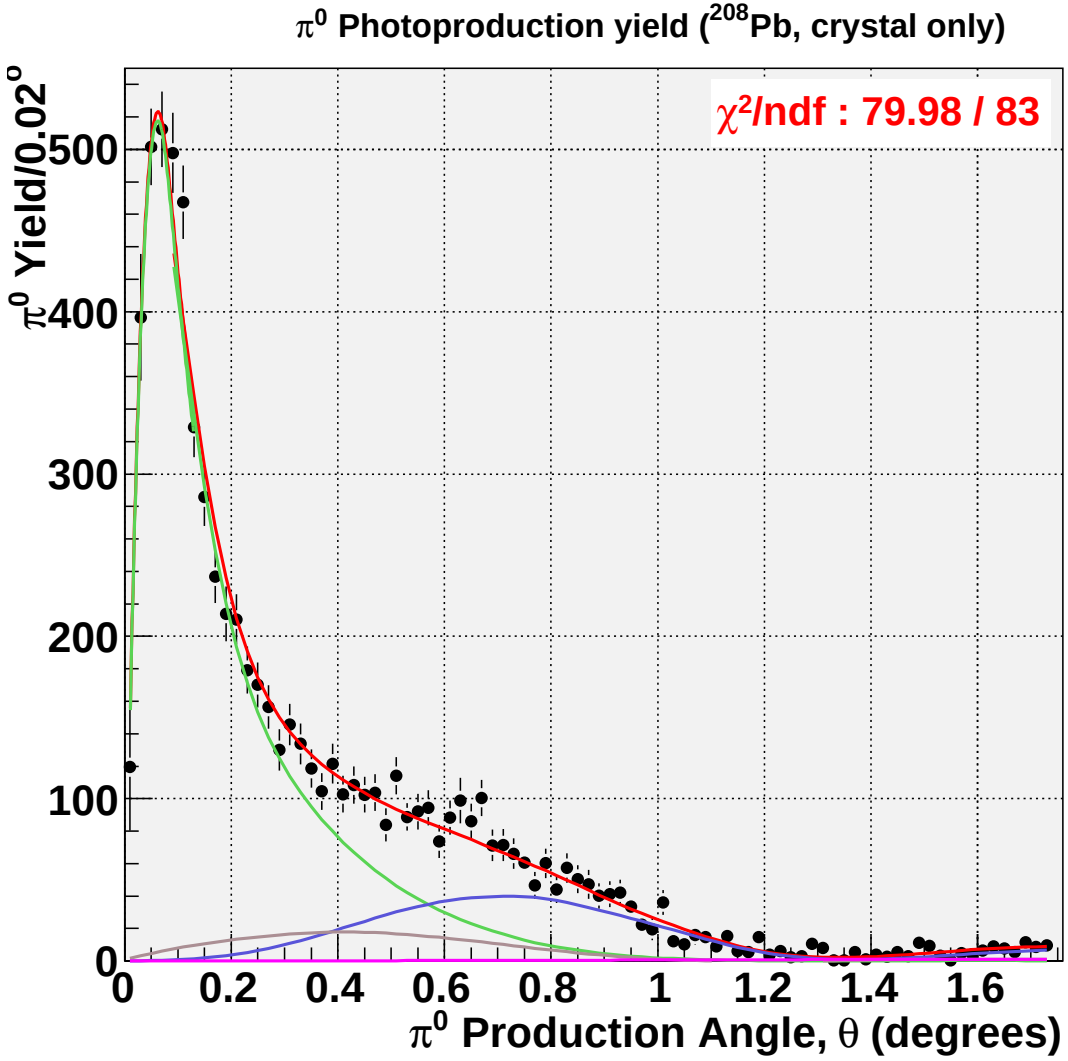
What's been done recently:

- Fit uses Tulios latest/final nuclear incoherent cross section calculation
- Fit uses same nuclear coherent cross section parameterization as Ilya: $(2.28E_0)^2 * ((2E_0m_p+m_p^2)^{0.641})^2$
- Fit uses Sergey's latest Coulomb and Strong form factor calculations (same as Ilya)
- Fit uses high statistics MC generated cross section shapes (smeared by exp resolutions)
- Performed check of the fitting algorithm stability for ^{12}C and ^{208}Pb
- Performed careful comparison of ^{12}C cross section with Ilya's

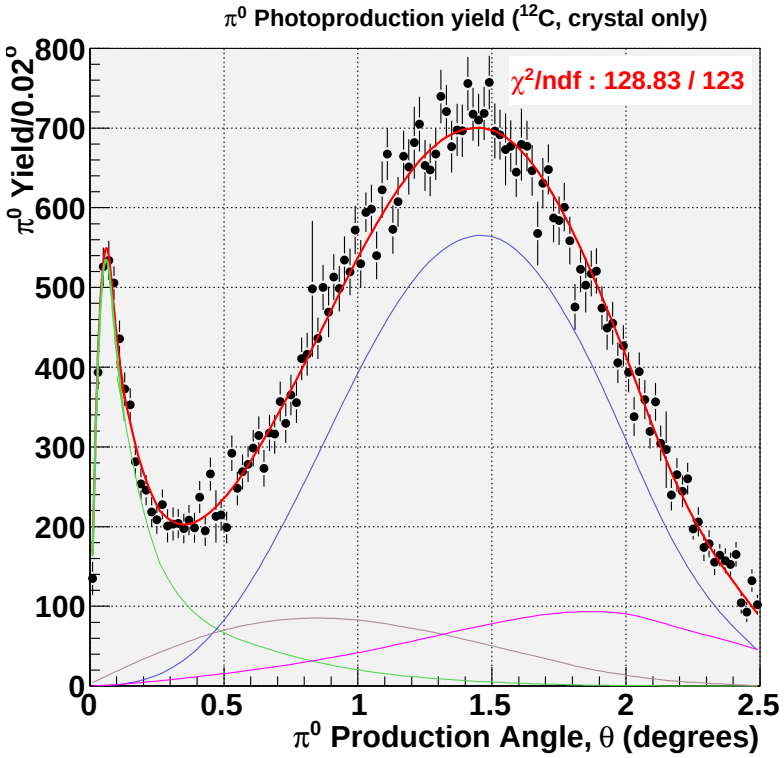
^{12}C: 4 parameter Independent Fit

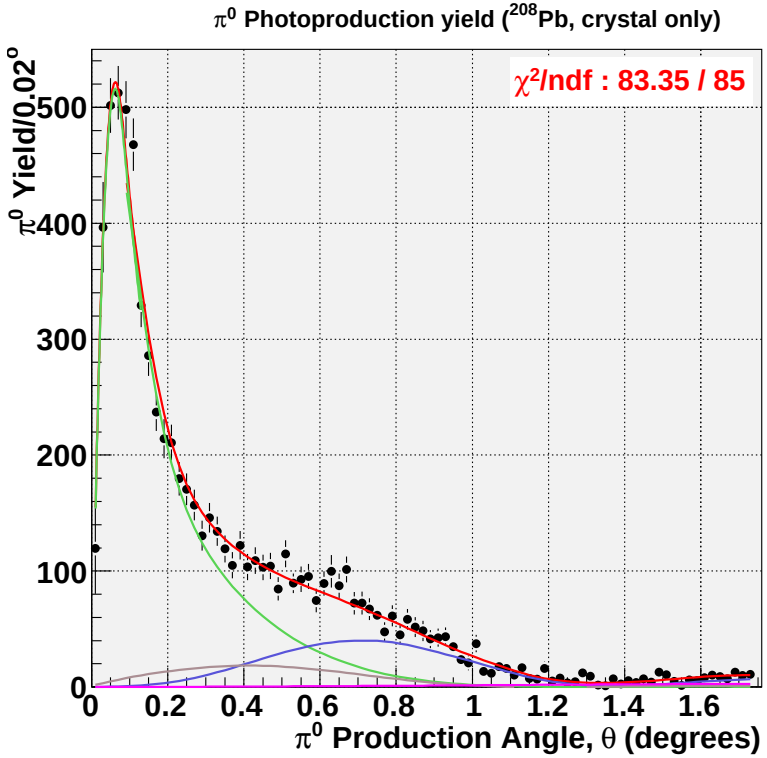


^{208}Pb: 4 parameter Independent Fit



7 parameter Combined Fits

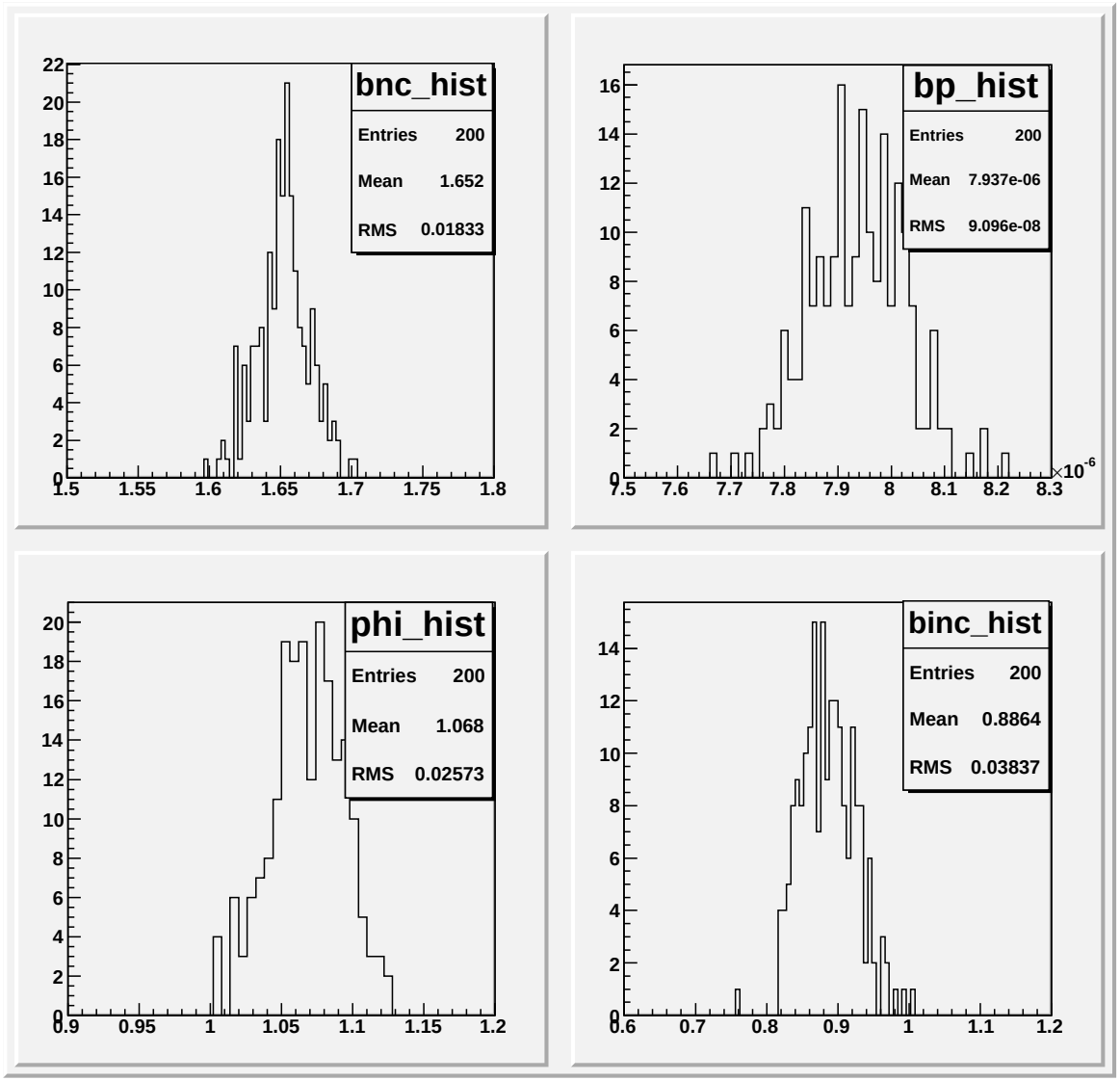




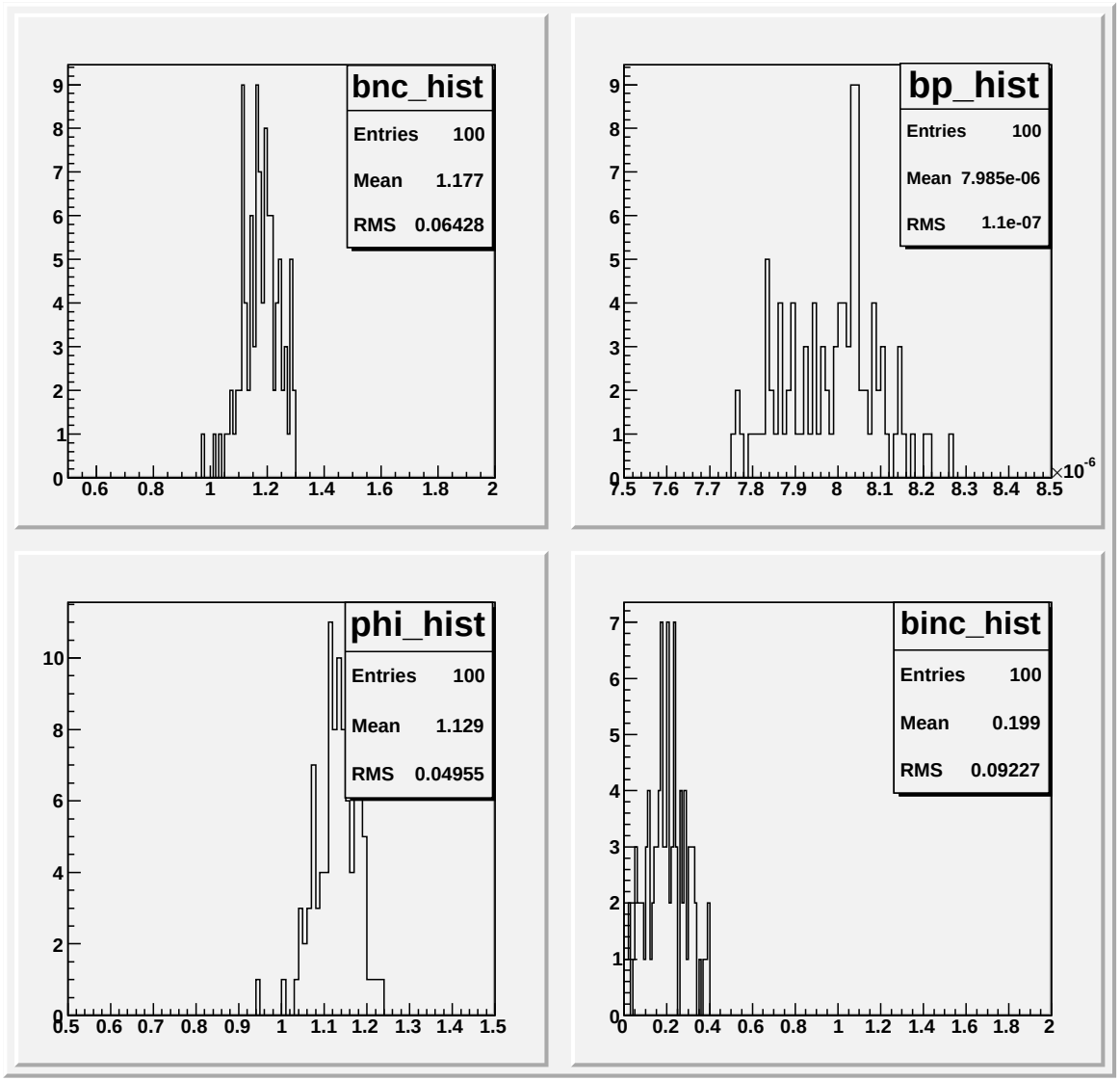
Yield Fit Parameter Summary: ^{12}C and ^{208}Pb

	$\Gamma_{\gamma\gamma}\pm$ fit err in eV (fit χ^2)	
Target	4 Parm Indep. Fits	7 Parm Comb. Fits
^{12}C	7.938 ± 0.153 (1.06)	7.959 ± 0.115 (1.05)
^{208}Pb	7.985 ± 0.174 (0.96)	7.959 ± 0.115 (0.98)
	$b_{NC}\pm$ fit err	
^{12}C	1.651 ± 0.033	1.653 ± 0.032
^{208}Pb	1.184 ± 0.111	1.190 ± 0.103
	$\phi\pm$ fit err in radians	
^{12}C	1.07 ± 0.044	1.07 ± 0.040
^{208}Pb	1.13 ± 0.080	1.12 ± 0.073
	$b_{INC}\pm$ fit err	
^{12}C	0.89 ± 0.069	0.89 ± 0.068
^{208}Pb	0.19 ± 0.178	0.44 ± 0.171

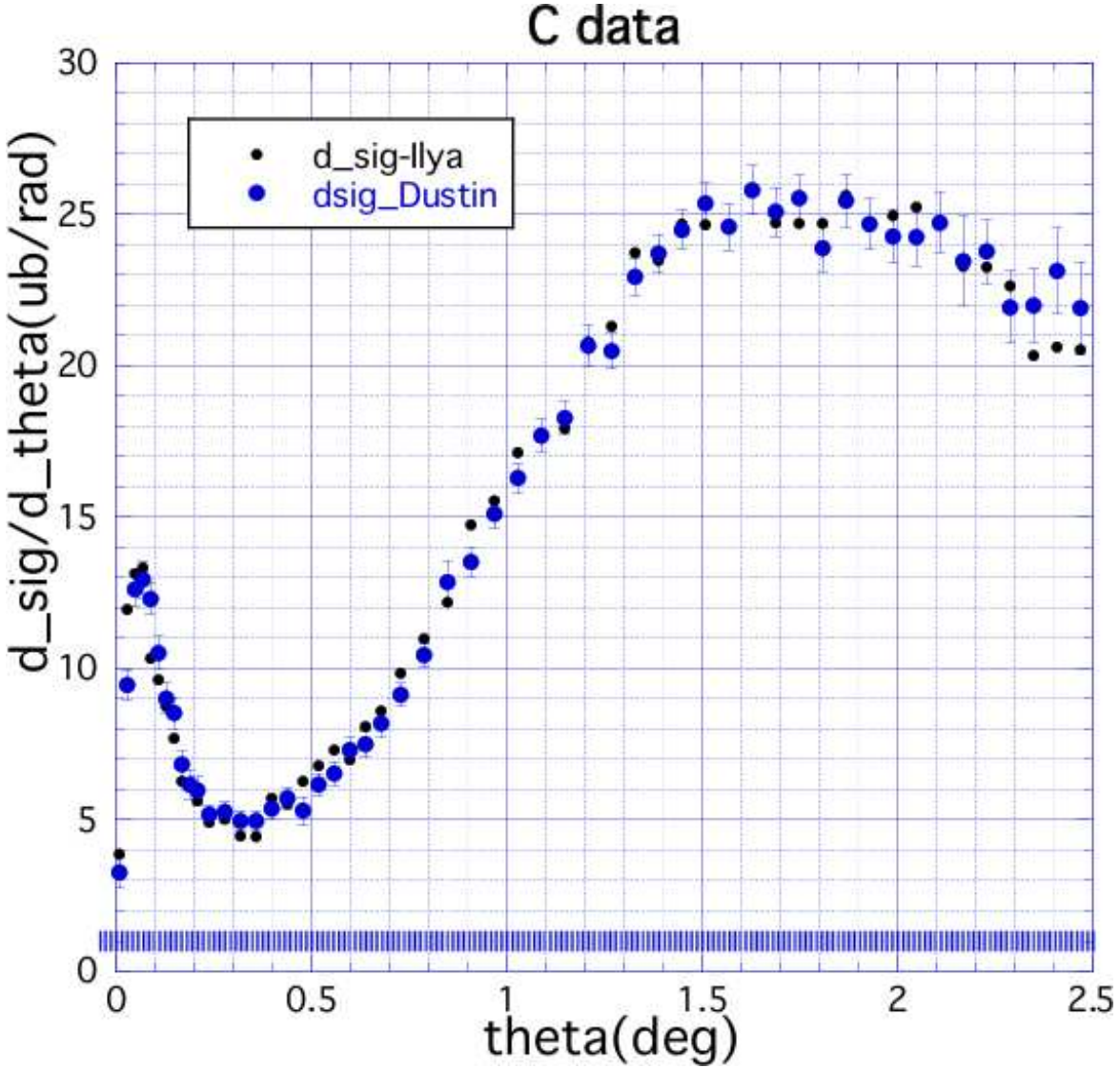
^{12}C: Fitter Stability



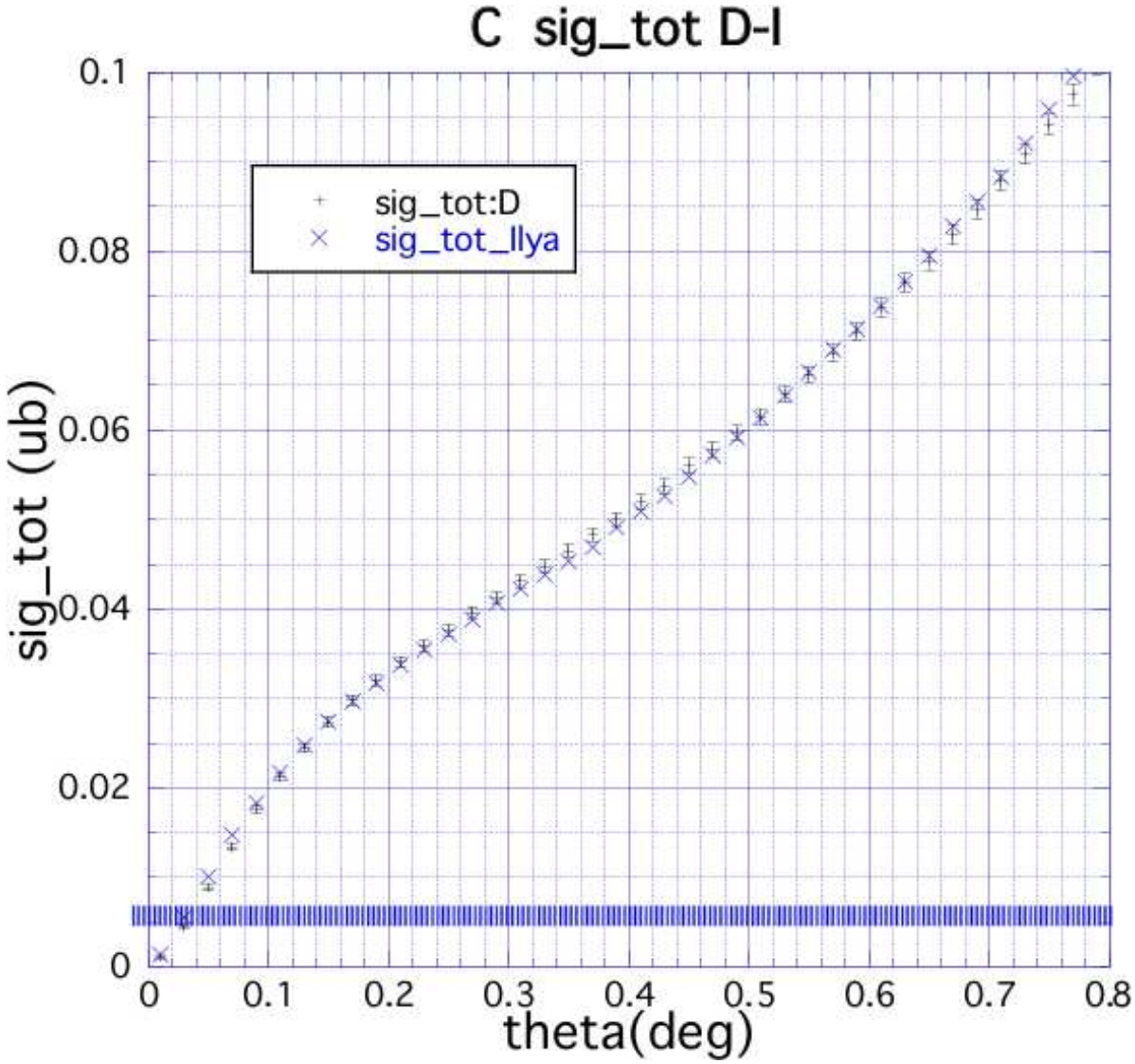
^{208}Pb: Fitter Stability



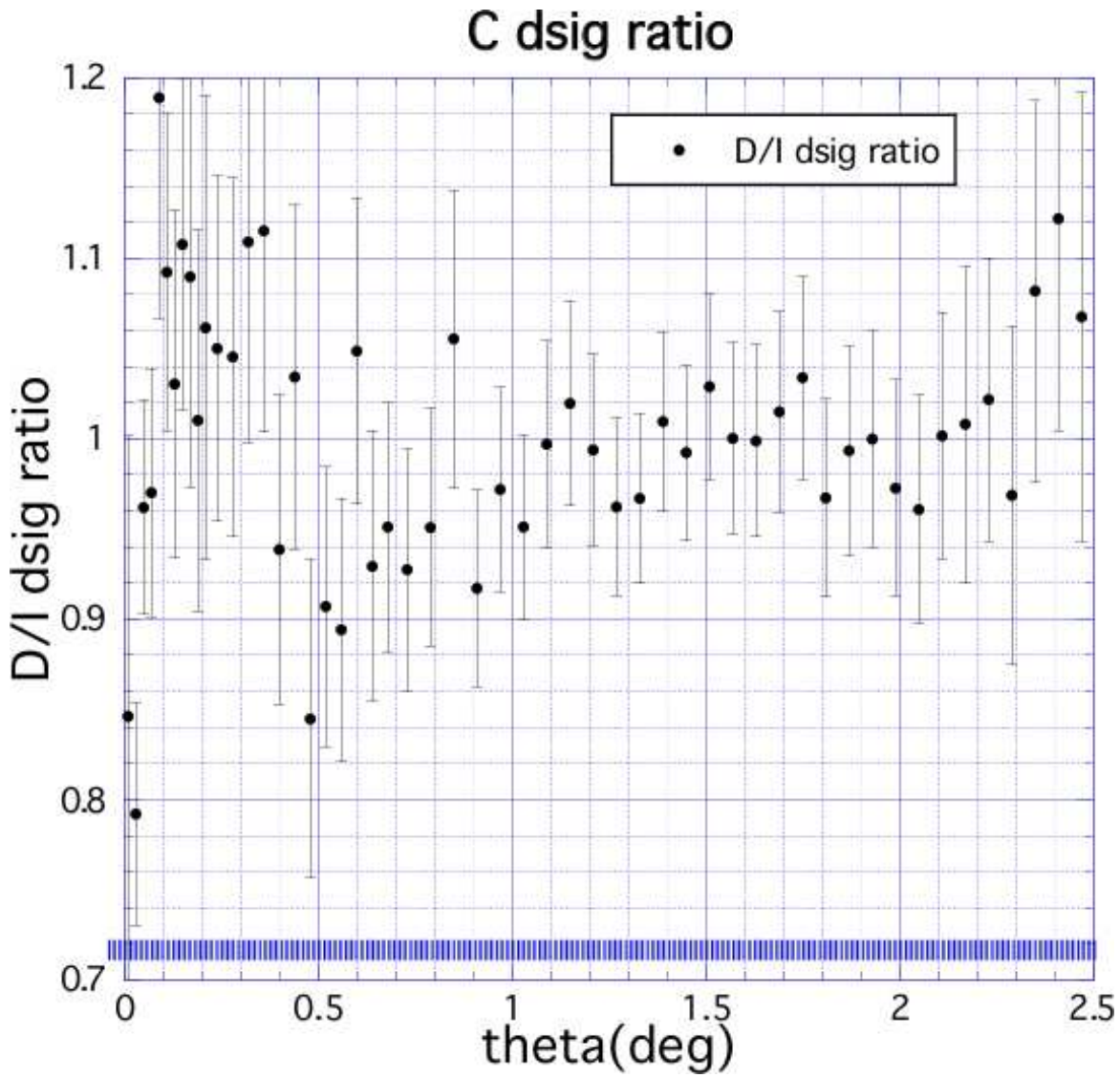
^{12}C Differential Cross Section Comparison



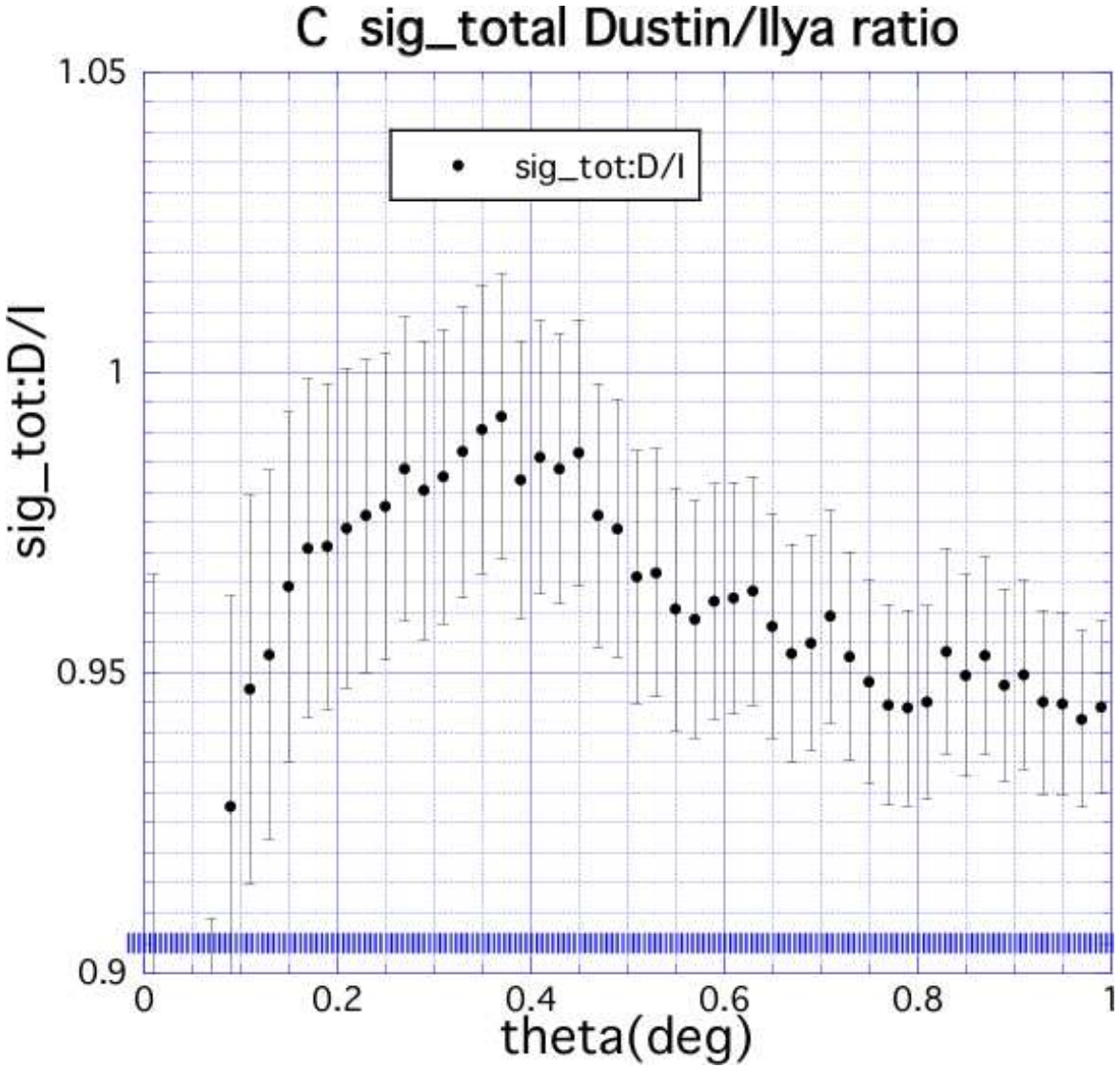
^{12}C Total Cross Section Comparison



^{12}C dsig Cross Section Ratio Comparison



^{12}C Total Cross Section Ratio Comparison



Systematic Error Table, part 1

Item	Error (%)
Photon Flux	± 0.97
Target Thickness	± 0.1
Branching Ratio ($\pi^0 \rightarrow \gamma\gamma$)	± 0.03
Yield Extraction	± 1.77
Timing Accidental Bkgd Corr.	± 0.22
ω Bkgd Subtraction ($\pm 20\%$)	± 0.26
Tagged Photon Energy	± 0.1
Fiducial Acceptance	± 0.30
Trigger Efficiency	± 0.1

Systematic Error Table, part 2

Item	Error (%)
Timing Cut	± 0.30
Elasticity Cut	± 0.25
Veto Cut	± 0.17
Theory Parameters	± 0.42
Incoherent Shape	± 0.28
Error Due to Group inconsistancy	± 1.1
Total Quadrature Sum (parts 1 & 2)	± 2.44

Summary

- Results have been stable within a standard deviation for years and the method has been stable
- Since last year and recent work, $\Gamma_{\gamma\gamma}$ results from ^{12}C have increased by ~ 0.06eV, and from ^{208}Pb have decreased by ~ 0.075eV
- I've done what has been asked and there have been no major problems found
- I've worked hard mainly on the ^{12}C XS's because I'm short on time
- XS comparisons with Ilya indicate small differences in shape in certain angular regions but none are bigger than 2 sigma and so are not serious
- However, these differences indicate that we should be careful to not underquote the errors

Final Results

	4 Parameter Independent Fits			
target	$\Gamma_{\gamma\gamma}$	fit (stat) err	syst err	total err
^{12}C:	7.938	0.153(1.93%)	0.194(2.44%)	0.247(3.11%)
^{208}Pb:	7.985	0.174(2.18%)	0.195(2.44%)	0.261(3.27%)
Average	7.962	0.164(2.05%)	0.195(2.44%)	0.255(3.20%)
	7 Parameter Combined-$\Gamma_{\gamma\gamma}$ Fits			
target	$\Gamma_{\gamma\gamma}$	fit (stat) err	syst err	total err
^{12}C:	7.959	0.115(1.45%)	0.194(2.44%)	0.226(2.84%)
^{208}Pb:	7.959	0.115(1.45%)	0.194(2.44%)	0.226(2.84%)
Average	7.959	0.115(1.45%)	0.194(2.44%)	0.226(2.84%)