COMPTON ANALYSIS REPORT

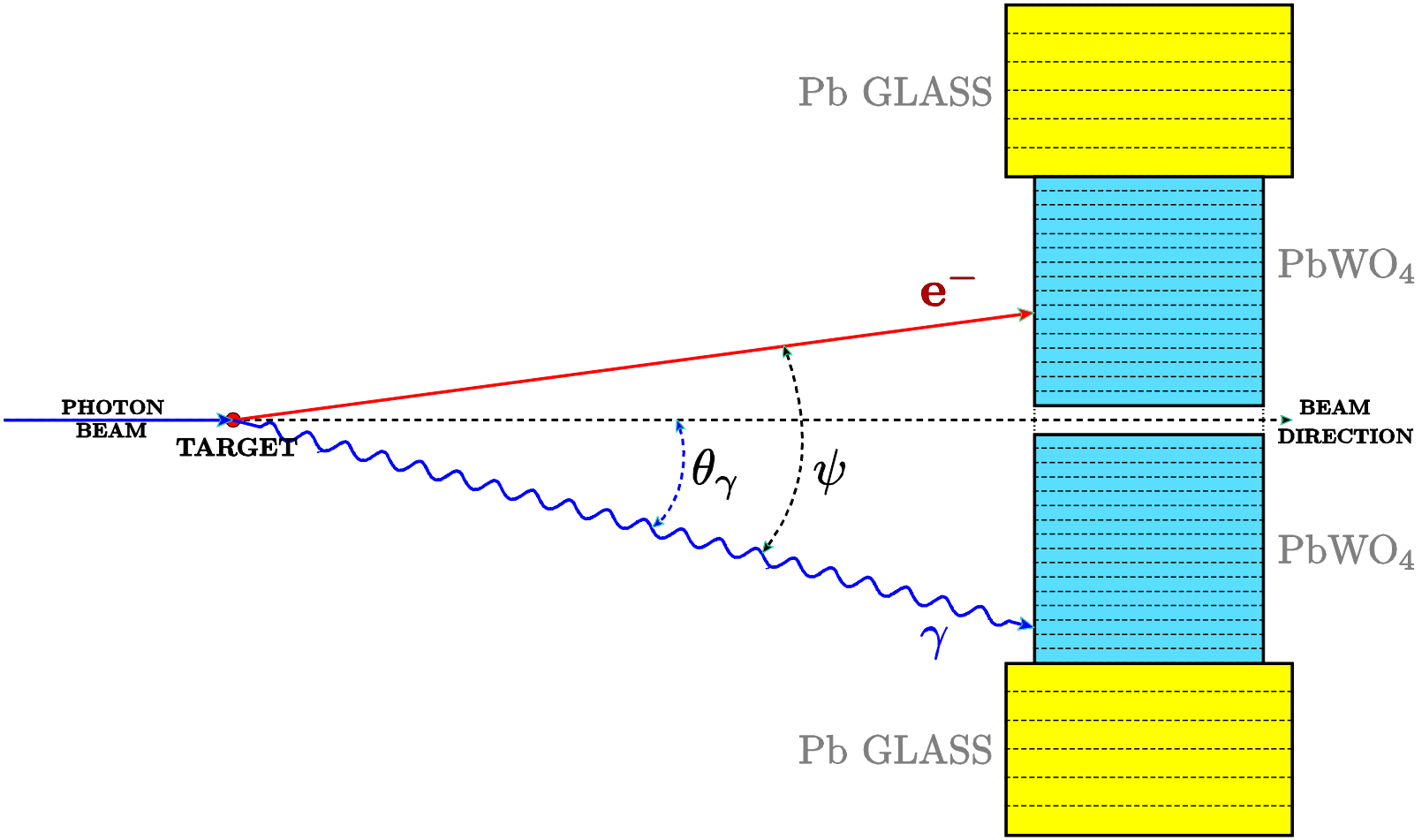
PAWEL AMBROZEWICZ

NC A&T

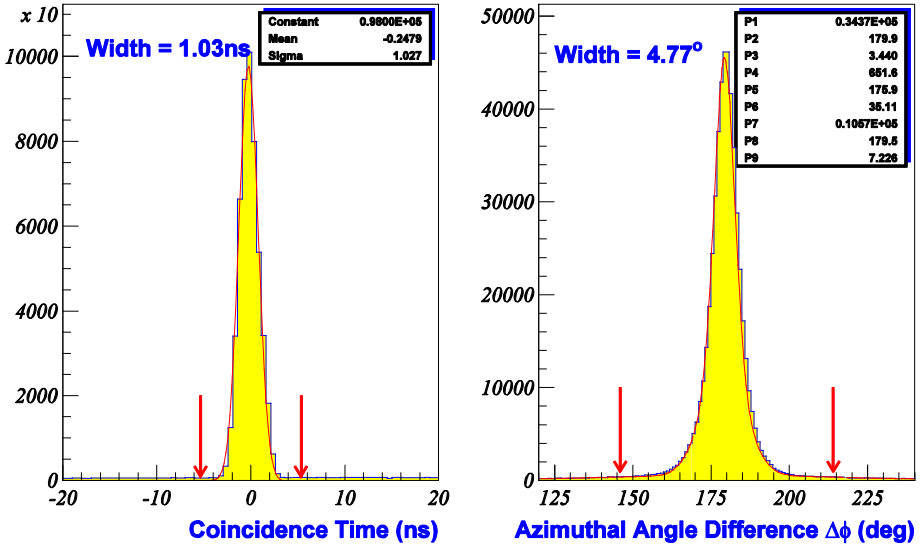
OUTLINE:

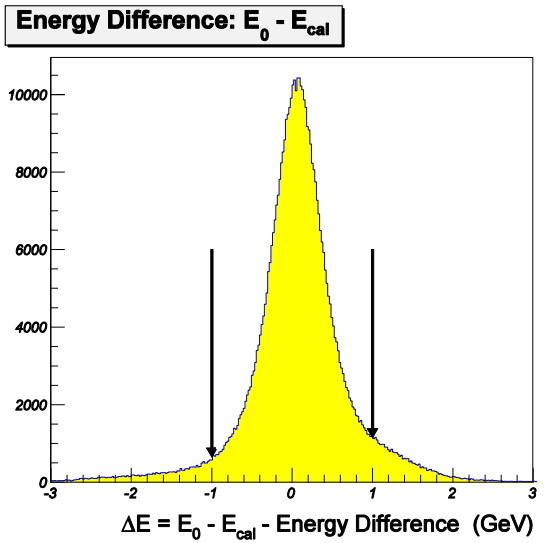
- Event Selection
- Extraction Procedure
- Yield Fits
- Results
  - Total Cross Section
  - Total Cross Section (Large Statistics)
  - Forward Solid Angle Cross Section
  - Differential Cross Section
  - Time Stability
  - Uncertainties
- Summary

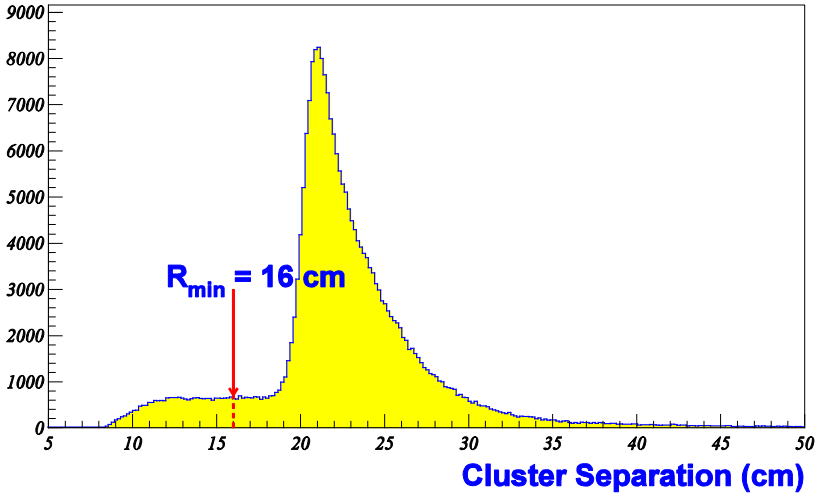
COMPTON EVENT

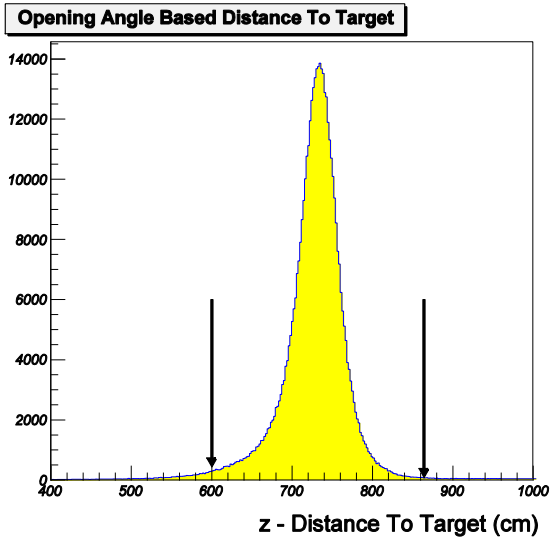


SELECTION CUTS

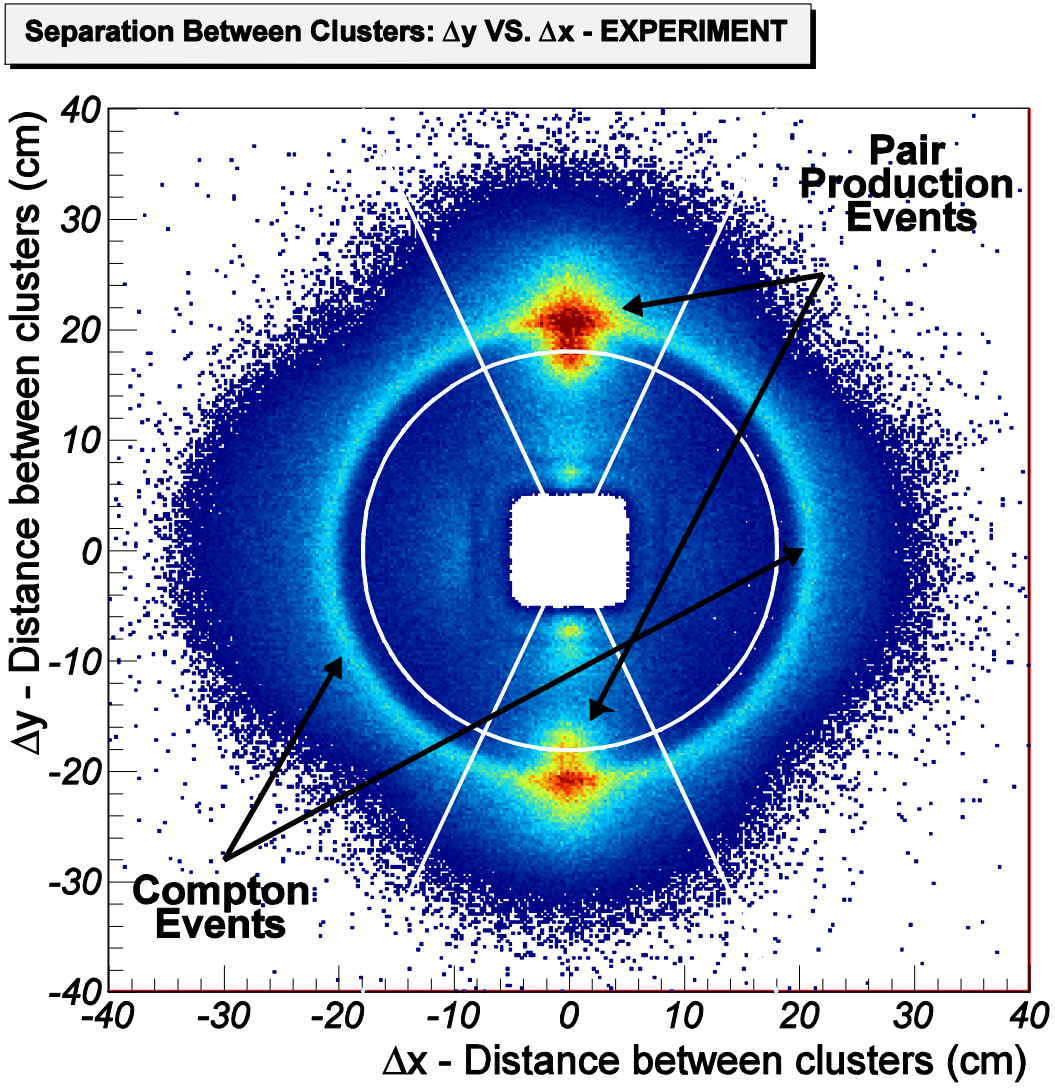






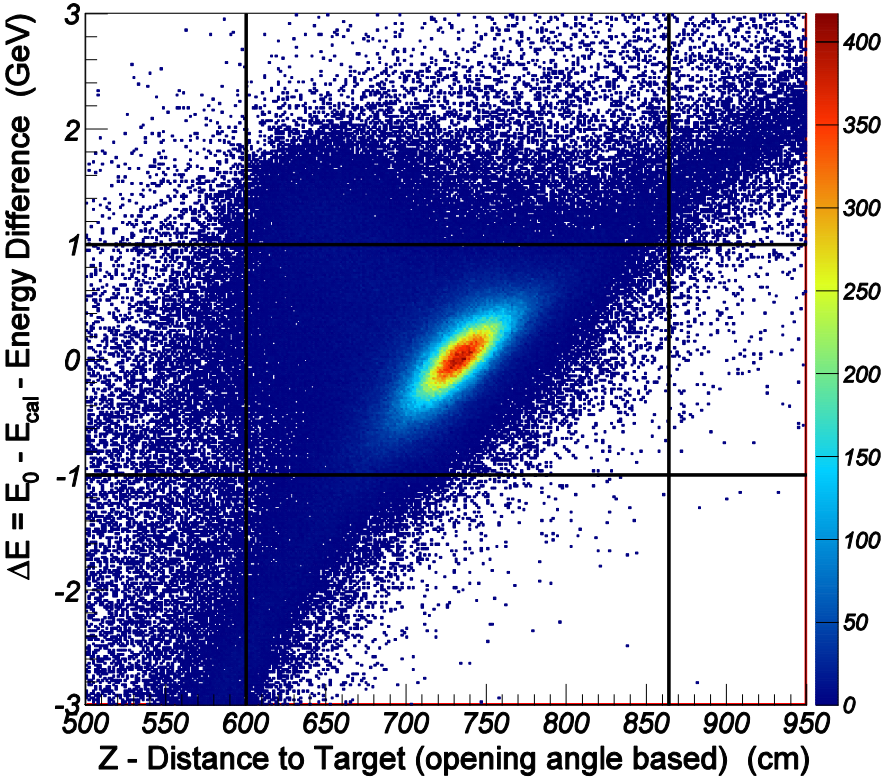


SELECTION CUTS

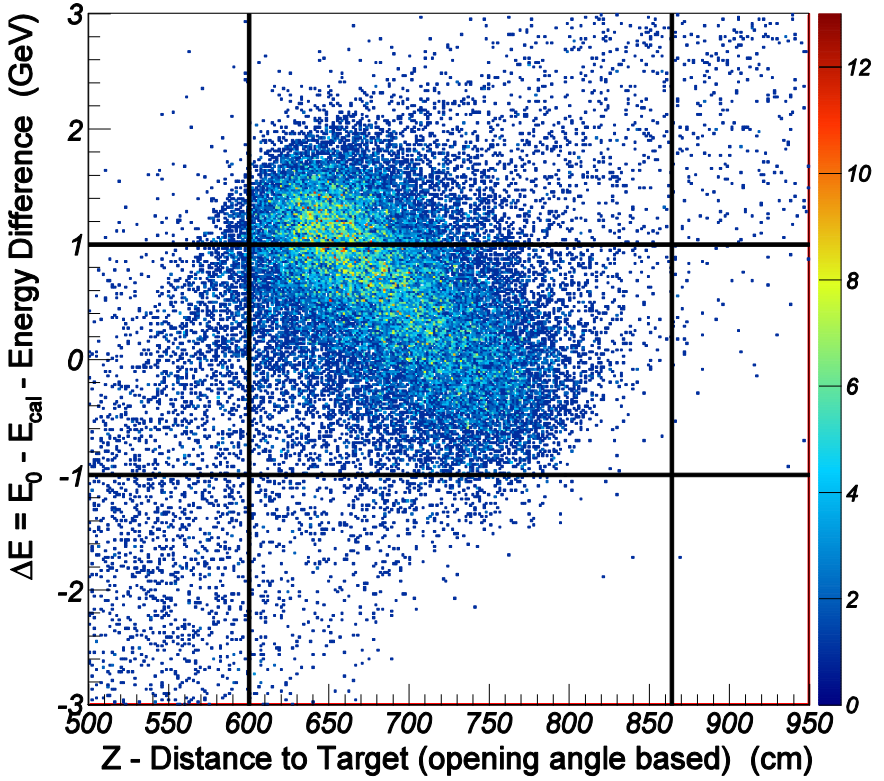


SELECTION CUTS

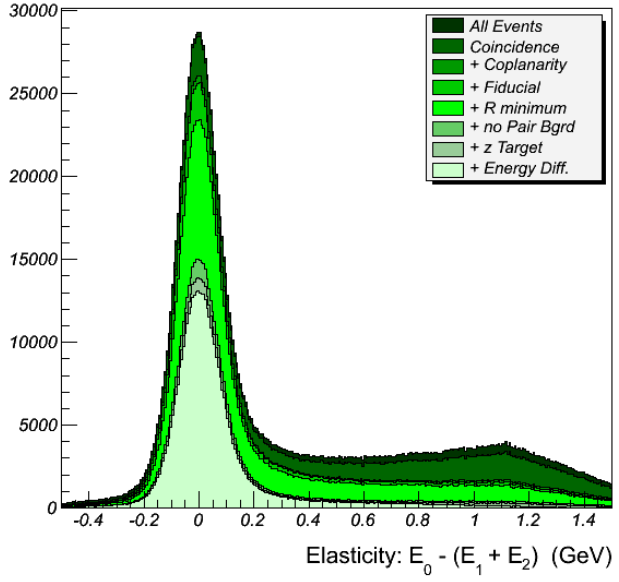
ΔE & Z Cuts in ΔE-Z Plane - Coincidence

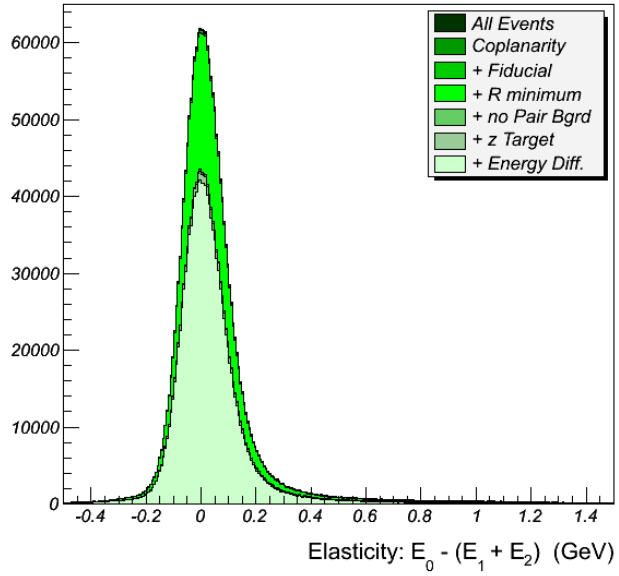


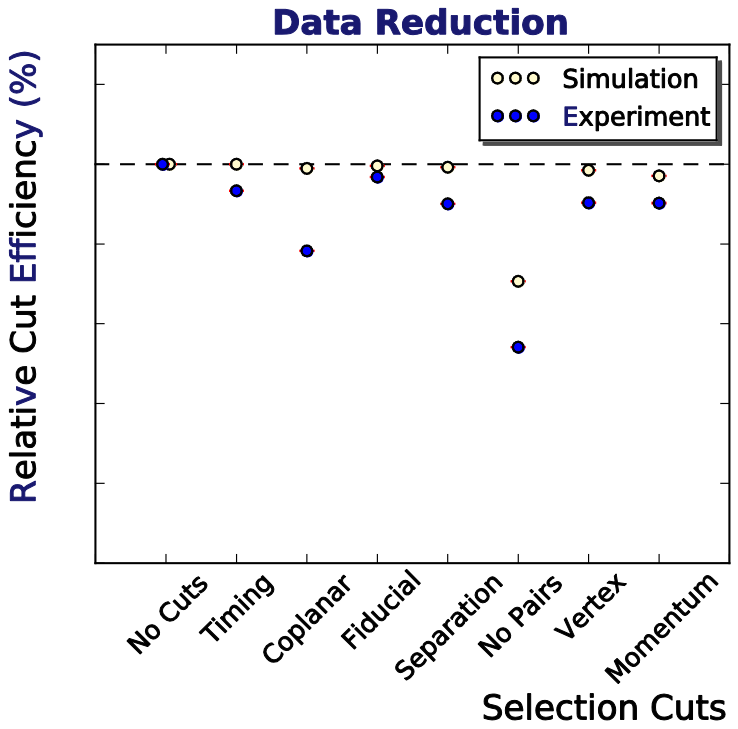
ΔE & Z Cuts in ΔE-Z Plane - Accidental



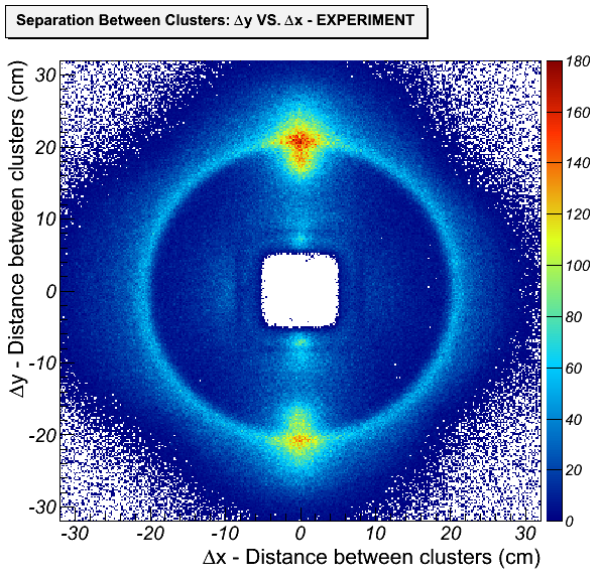
SELECTION CUTS

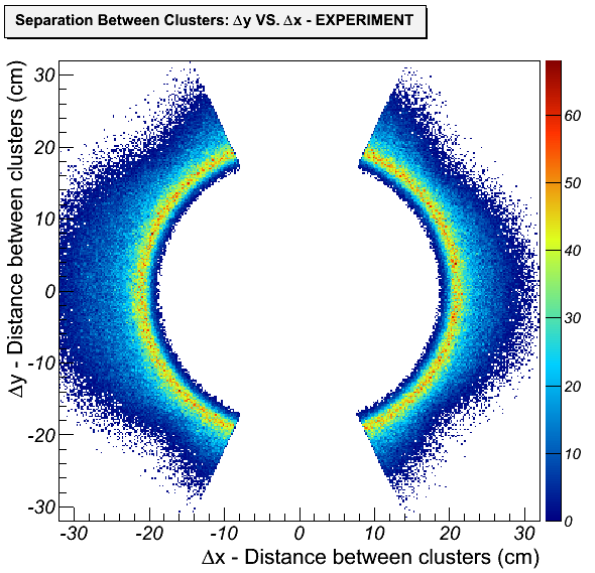


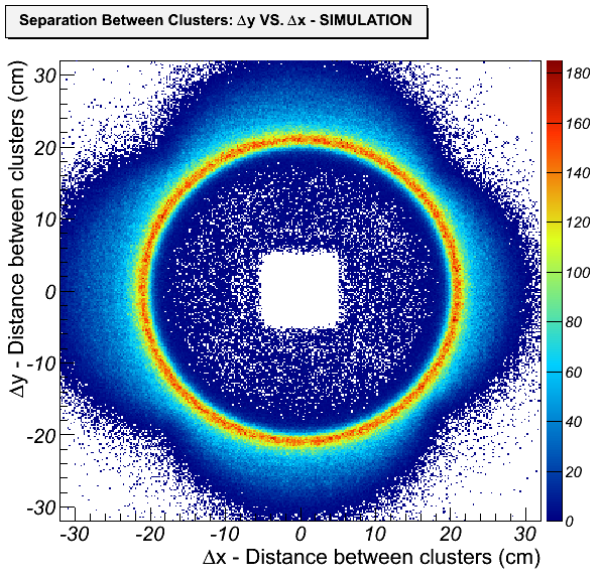


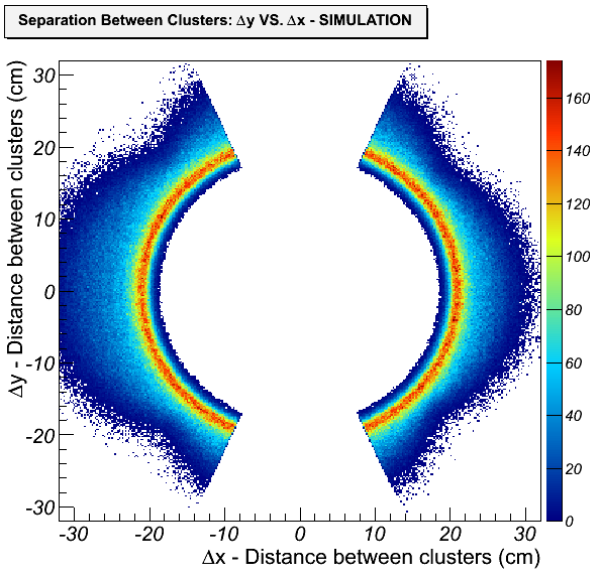


SELECTION CUTS

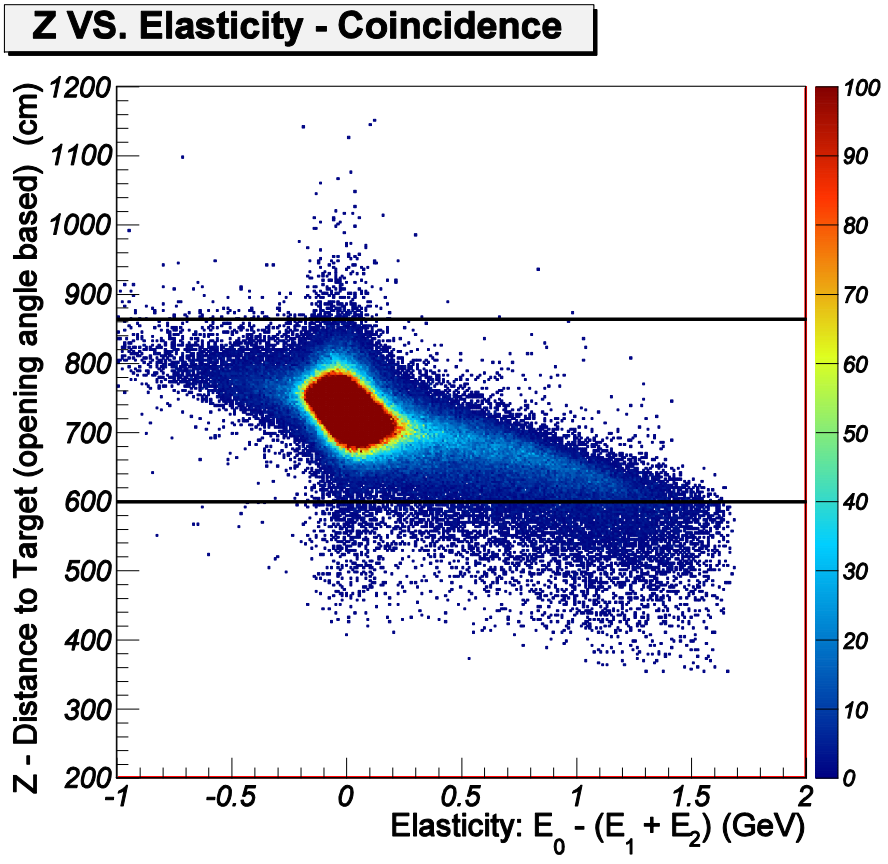


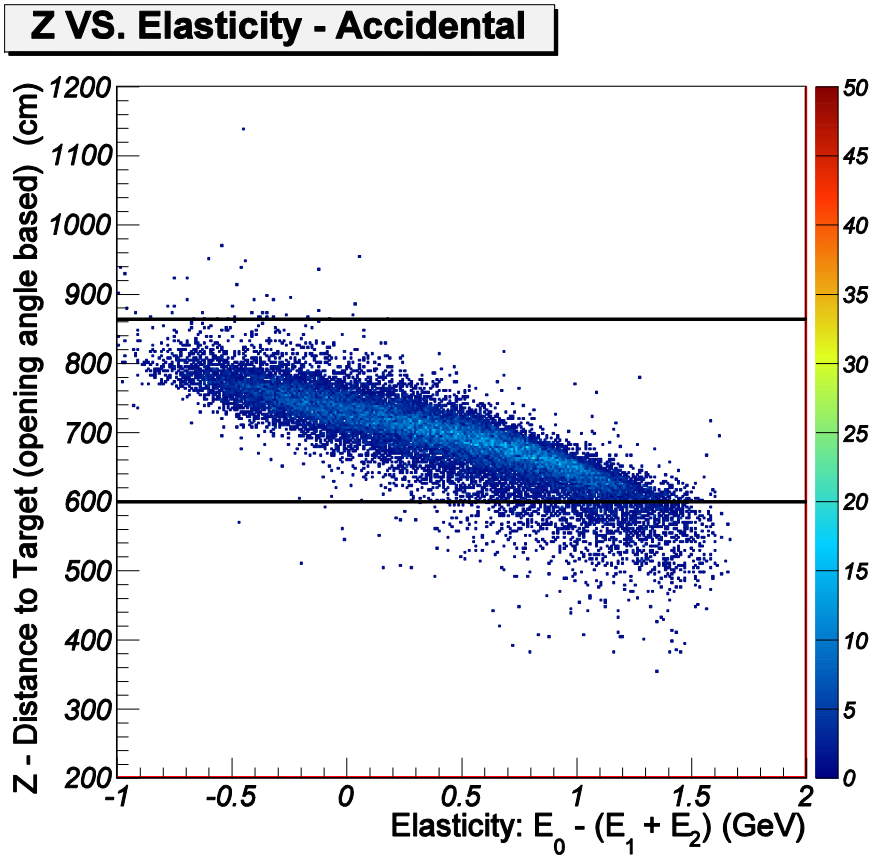




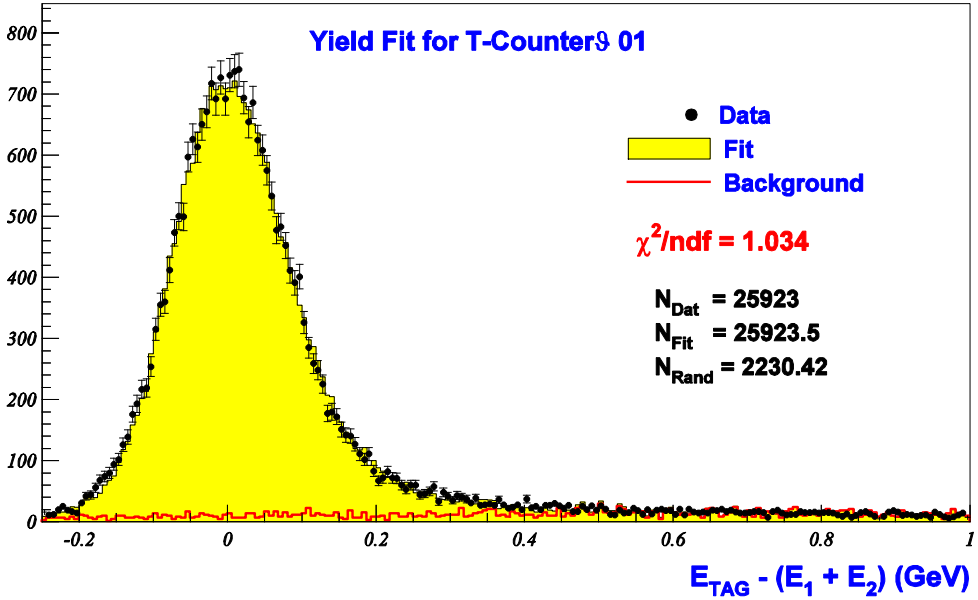


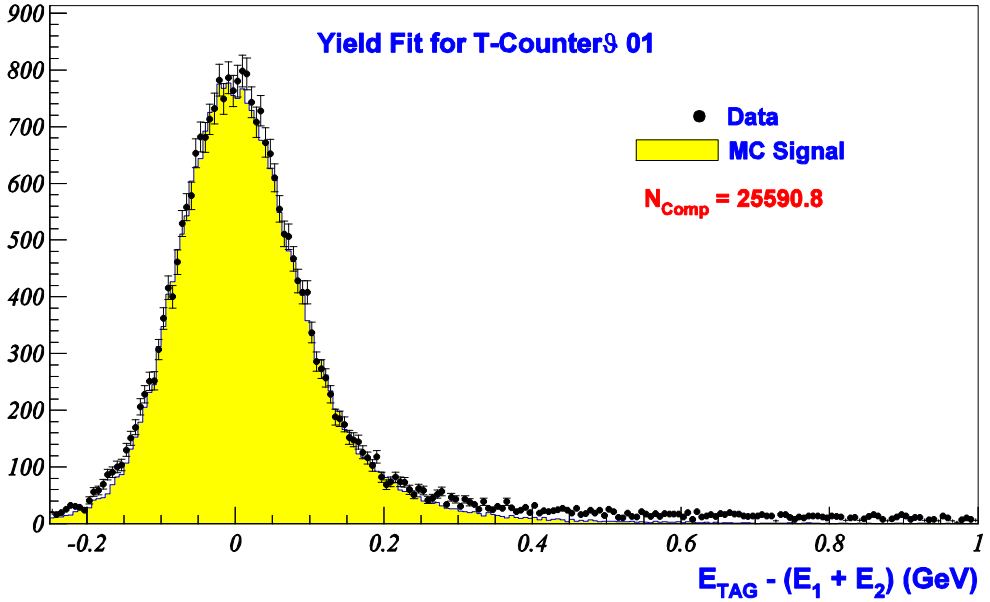
BACKGROUND MODEL





LINE SHAPE YIELD FITS





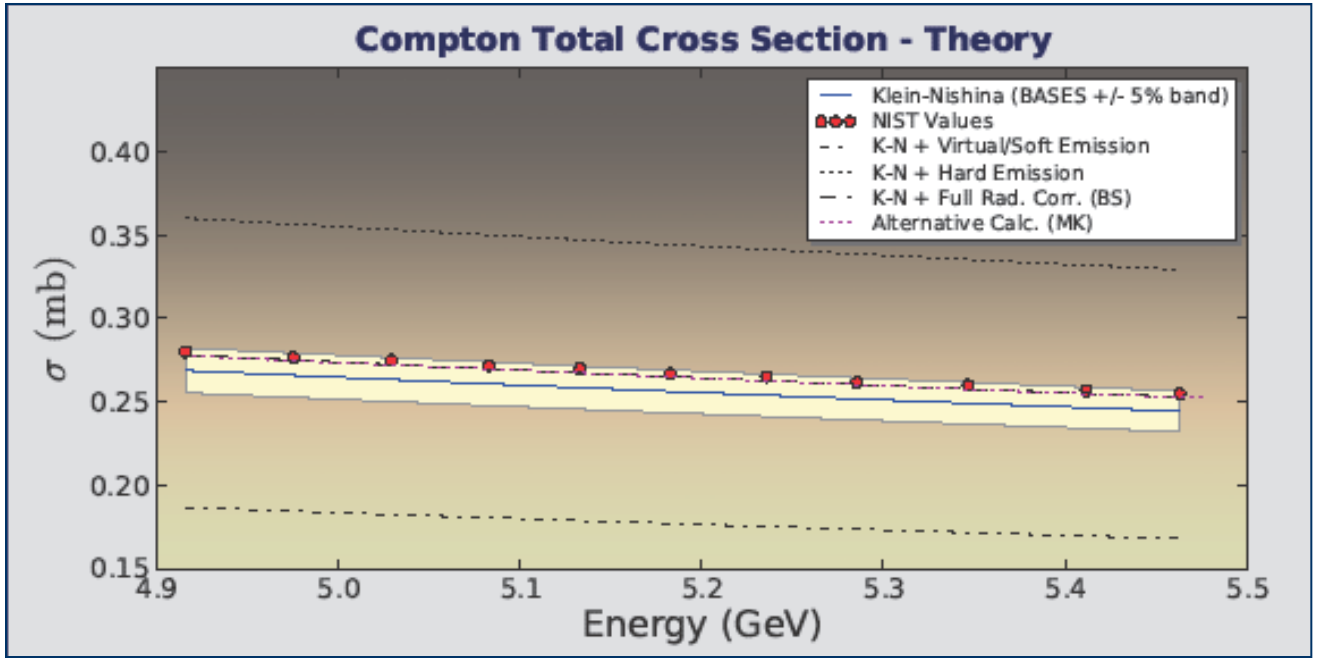
CROSS SECTION EXTRACTION PROCEDURE

TOTAL CROSS SECTION

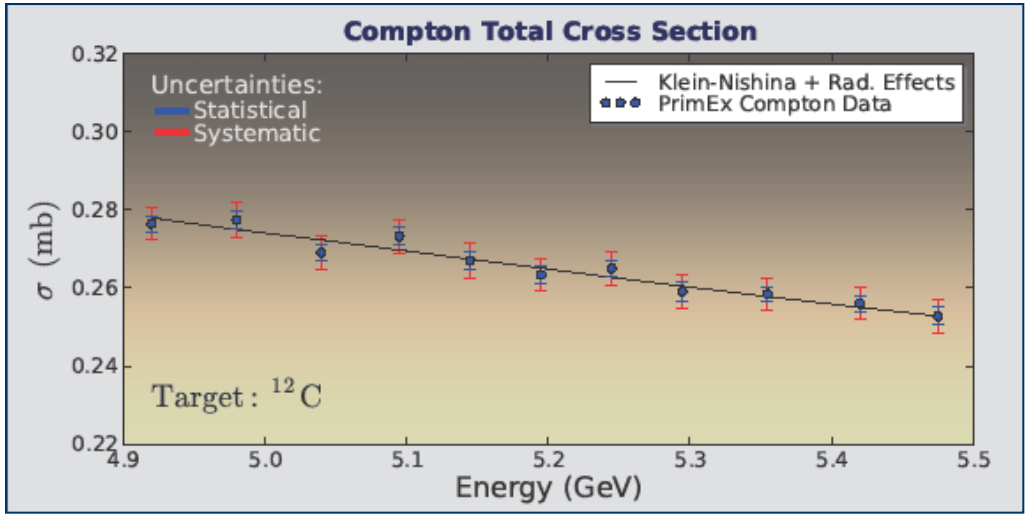
$$\left\langle \frac{d\sigma}{dv} \right\rangle = \frac{1}{n_e \, \Gamma_\gamma \, \mathcal{A}_{exp}} \frac{N}{\Delta v}$$

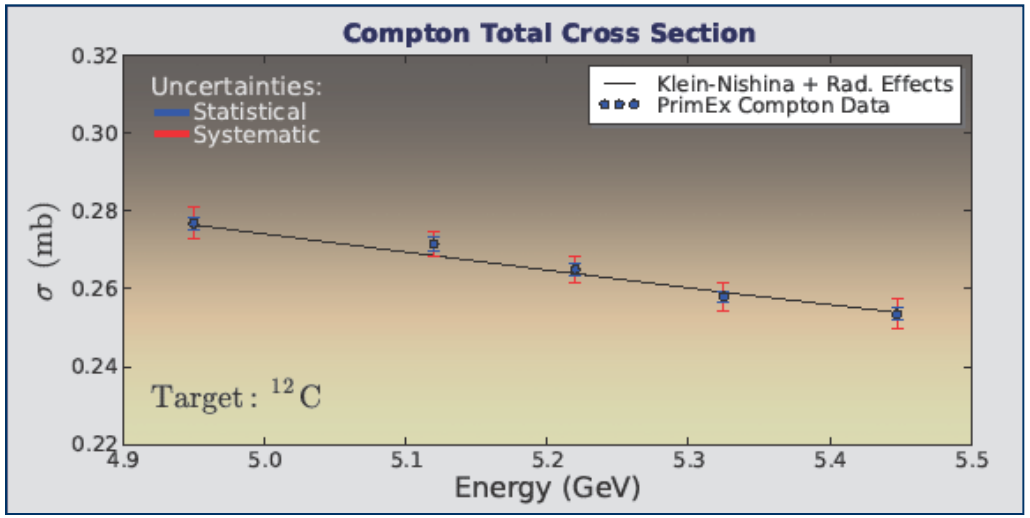
FORWARD SOLID ANGLE CROSS SECTION

$$\sigma_{DAT} = \sigma_{KN} \frac{Y_{DAT}}{Y_{MC}}$$

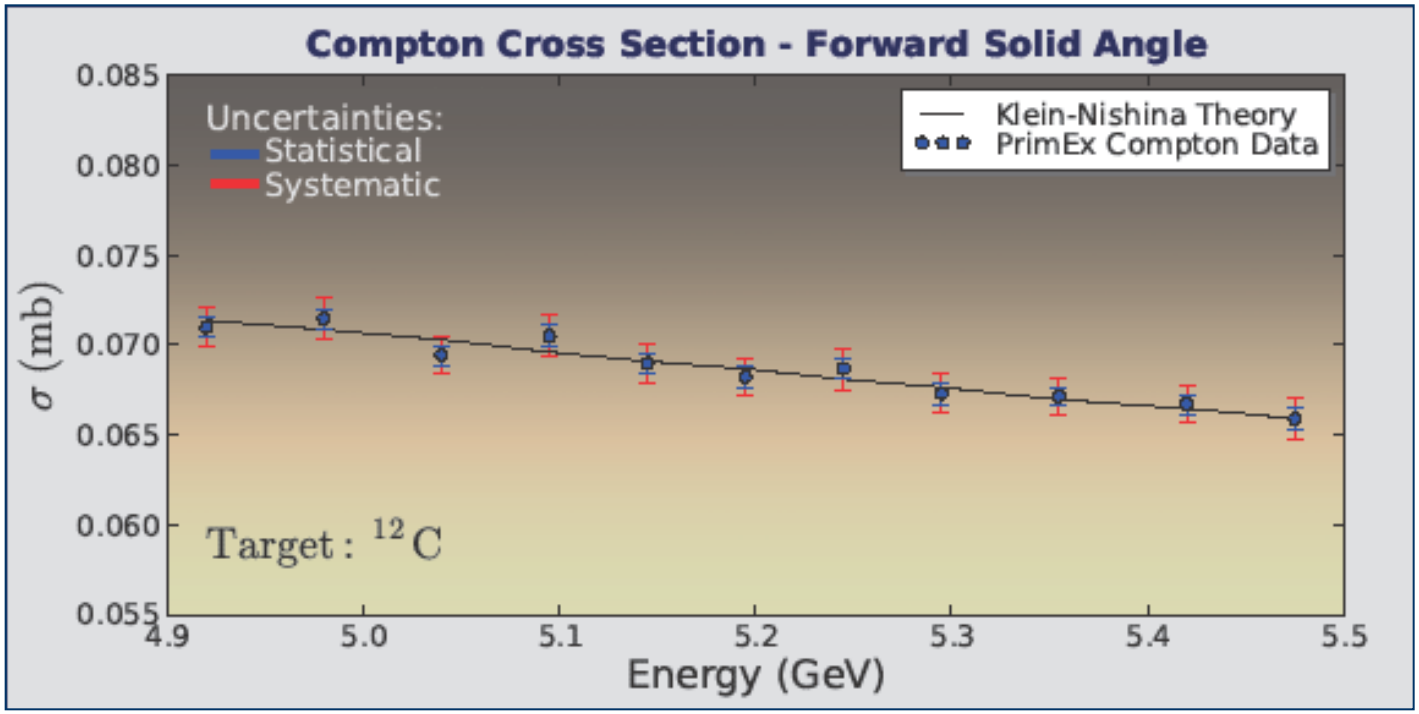


TOTAL CROSS SECTION



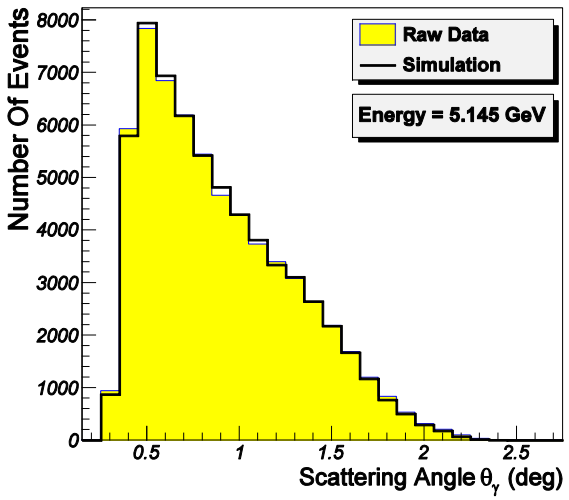


FORWARD SOLID ANGLE CROSS SECTION

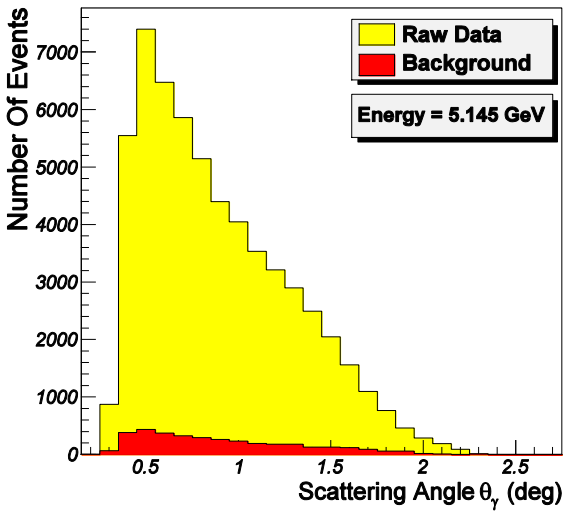


DIFFERENTIAL CROSS SECTION

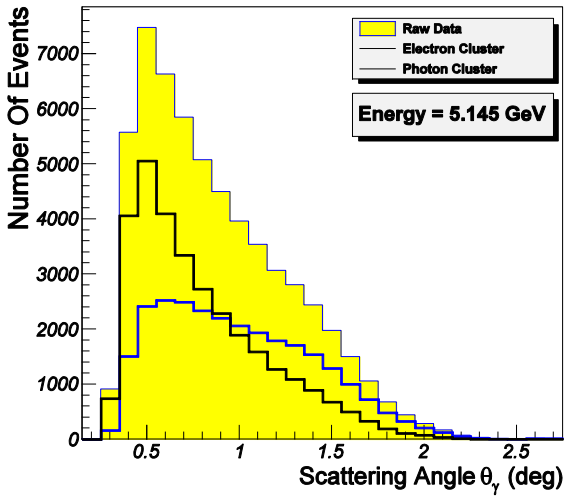
Two Cluster Angular Distributions



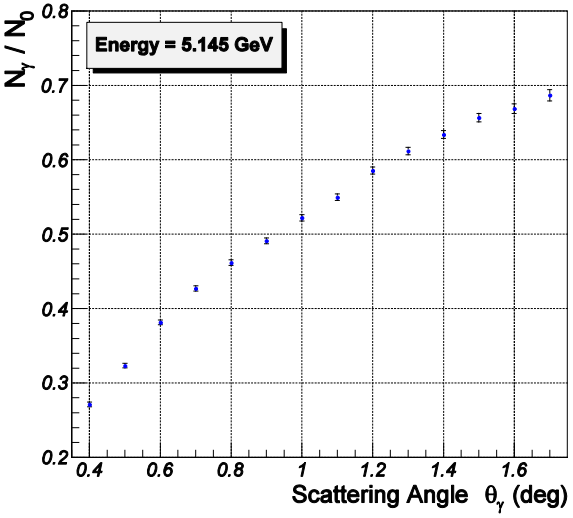
Signal/Background Distributions - Data



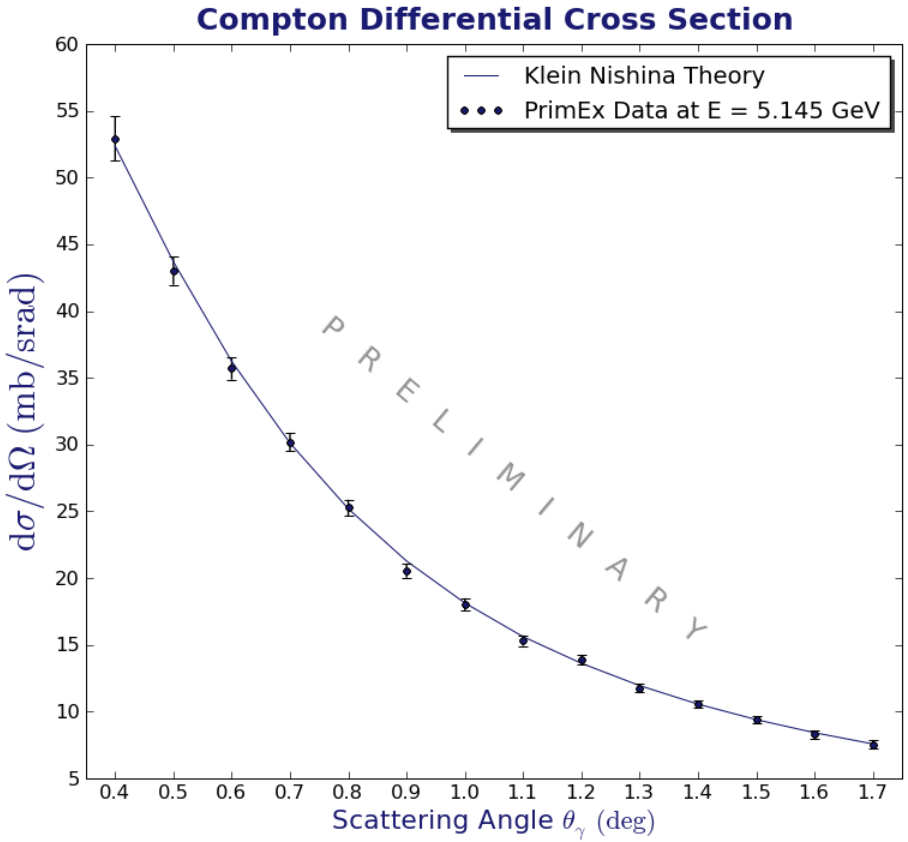
Electron And Photon Angular Distributions

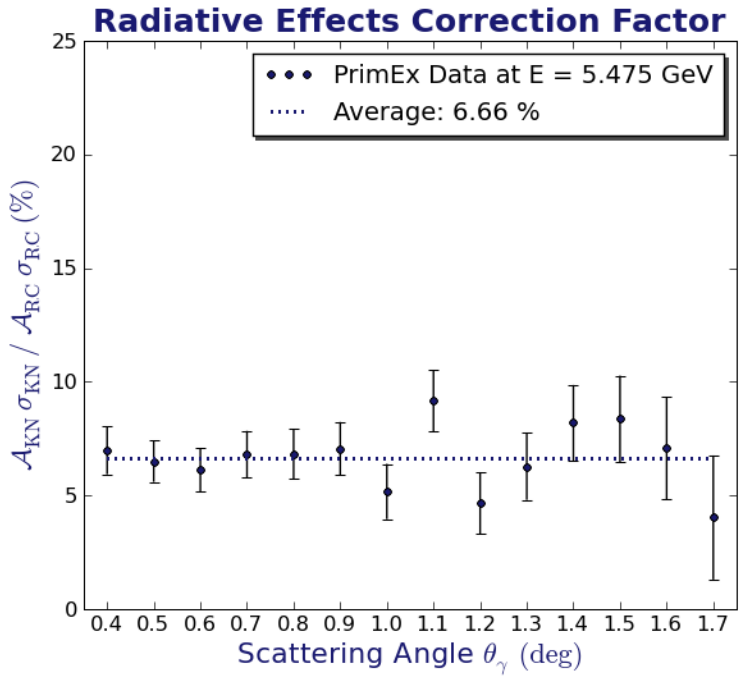


Relative Number Of γ's Per θ_γ Bin

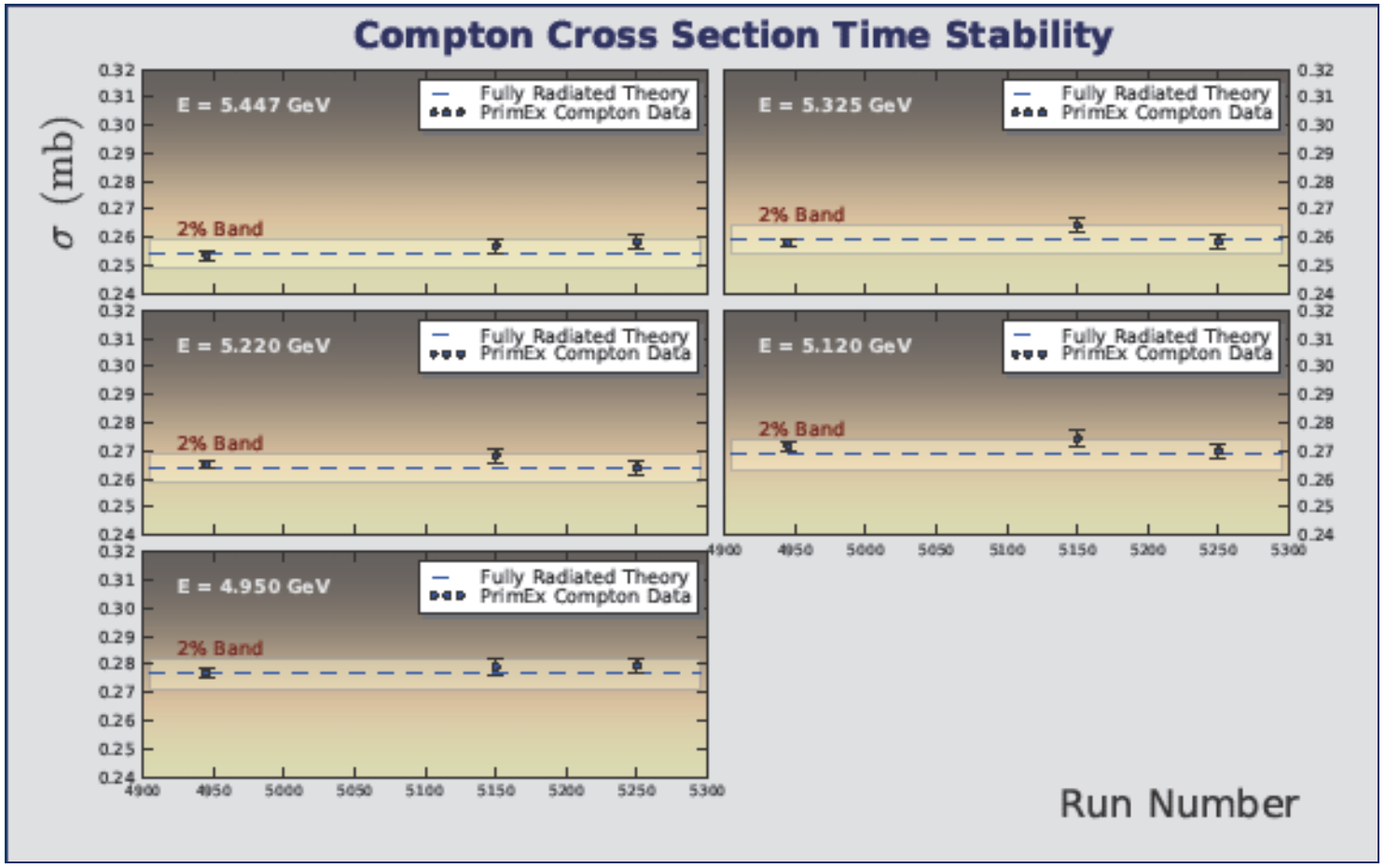


DIFFERENTIAL CROSS SECTION



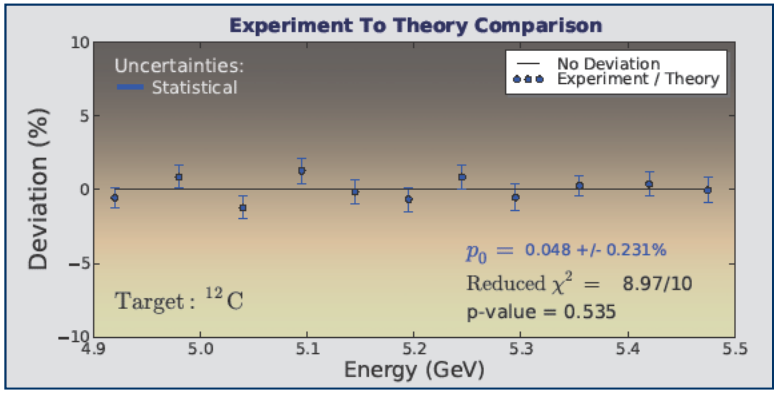


TIME STABILITY



COMPARISON WITH THEORY

TOTAL CROSS SECTION



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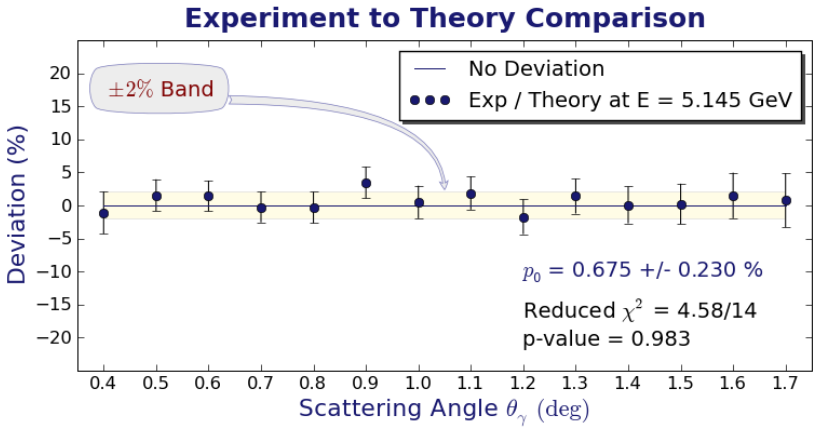
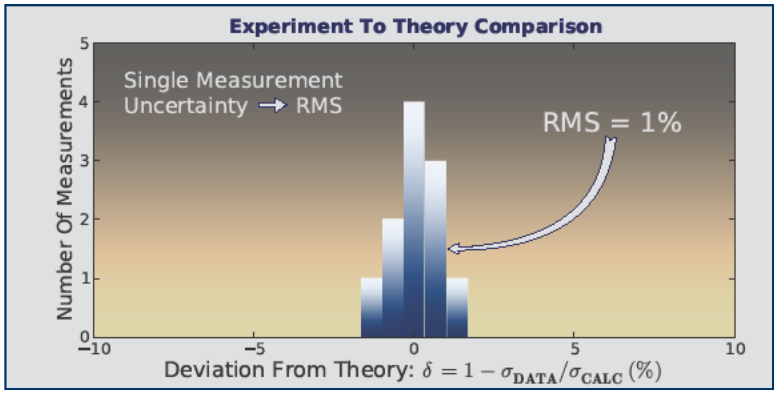
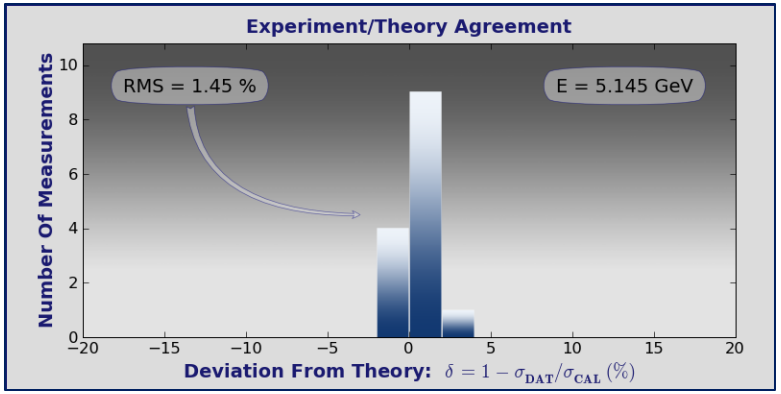






UNCERTAINTIES

TCtr	Flux	Tgt	Selection Cuts					Fit	HyCal	Errors		
			ΔT_{coin}	$\Delta\phi$	Rad. Tail	Sg/Bg	Geom.		Res.Fn.	Syst.	Stat.	Total
1	1.0	0.05	0.09	0.07	0.045	0.81	0.64	0.063	0.5	1.53	0.88	1.77
2	1.0	0.05	0.01	0.08	0.045	0.68	0.67	0.063	0.5	1.47	0.82	1.68
3	1.0	0.05	0.01	0.09	0.045	0.82	0.59	0.063	0.5	1.51	0.71	1.67
4	1.0	0.05	0.03	0.08	0.045	0.69	0.62	0.063	0.5	1.46	0.89	1.71
5	1.0	0.05	0.13	0.10	0.045	0.72	0.76	0.063	0.5	1.54	0.84	1.76
6	1.0	0.05	0.08	0.07	0.045	0.66	0.53	0.063	0.5	1.41	0.83	1.64
7	1.0	0.05	0.03	0.07	0.045	0.70	0.65	0.063	0.5	1.48	0.85	1.70
8	1.0	0.05	0.03	0.06	0.045	0.62	0.66	0.063	0.5	1.44	0.84	1.67
9	1.0	0.05	0.08	0.07	0.045	0.76	0.40	0.063	0.5	1.42	0.78	1.62
10	1.0	0.05	0.03	0.08	0.045	0.77	0.57	0.063	0.5	1.48	0.77	1.67
11	1.0	0.05	0.06	0.09	0.045	0.63	0.59	0.063	0.5	1.42	0.72	1.59

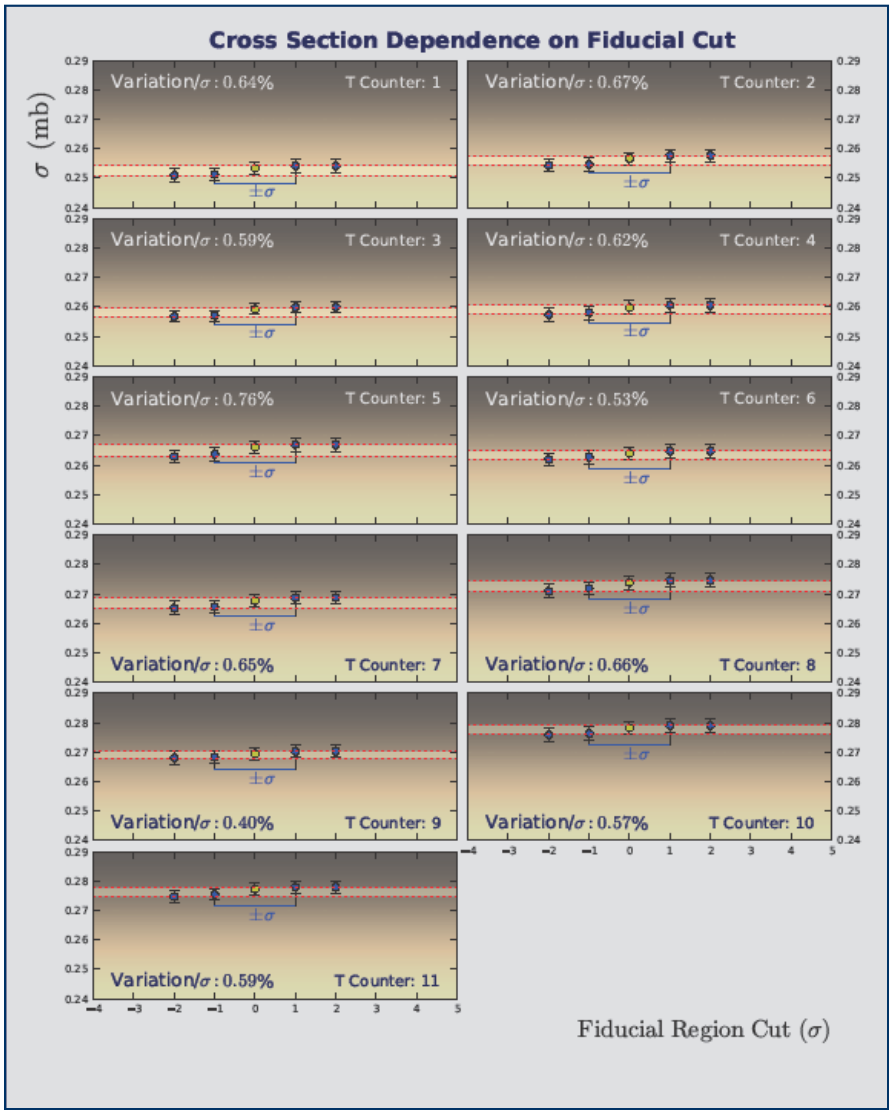
Table 4.1: Systematic uncertainties. All values are in %. Statistical error accounts for yield and photon flux fluctuations.

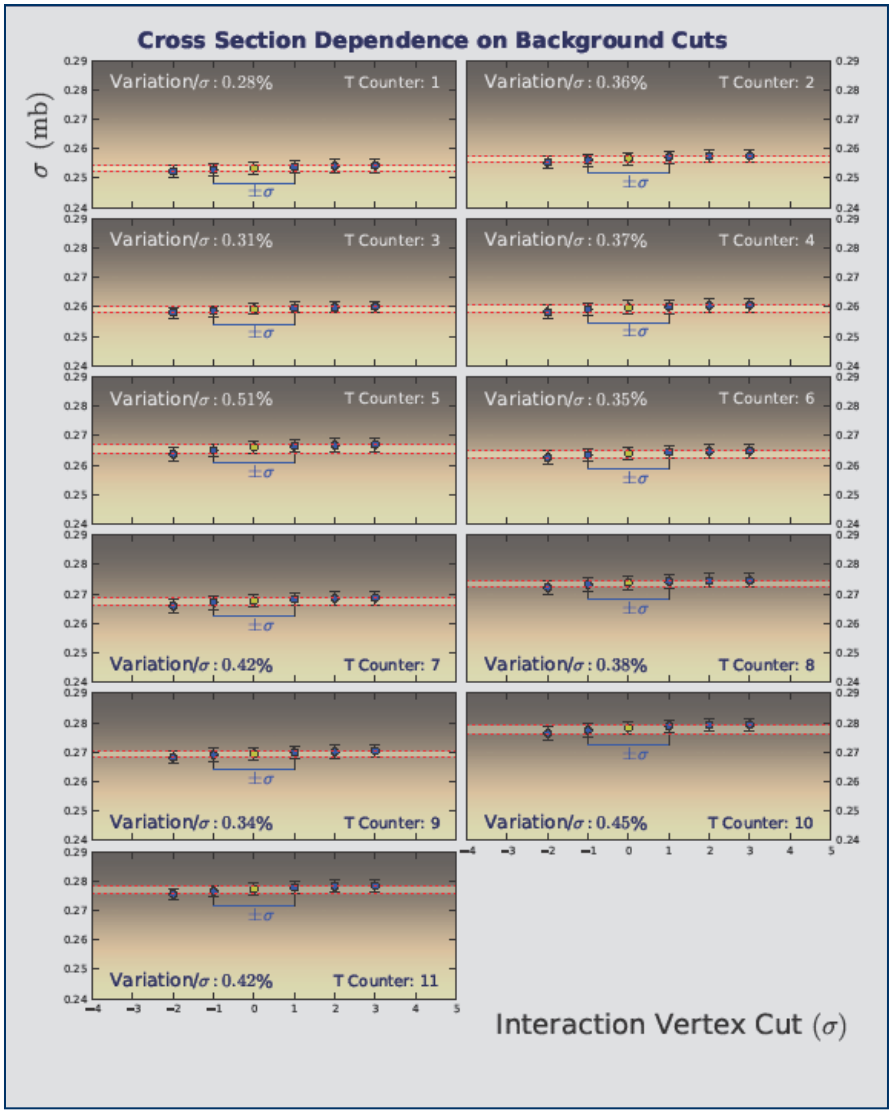
UNCERTAINTIES

TCtr	Flux	Tgt	Selection Cuts					Fit	HyCal Res.Fn.	Errors		
			ΔT_{coin}	$\Delta\phi$	RC Tail	Sg/Bg	Geom.			Syst.	Stat.	Total
1-2	1.0	0.05	0.03	0.065	0.098	0.91	0.46	0.063	0.5	1.52	0.61	1.64
3-4	1.0	0.05	0.03	0.065	0.098	0.68	0.42	0.063	0.5	1.38	0.57	1.50
5-6	1.0	0.05	0.03	0.065	0.098	0.46	0.40	0.063	0.5	1.28	0.60	1.42
7-8	1.0	0.05	0.03	0.065	0.098	0.33	0.37	0.063	0.5	1.23	0.61	1.37
10-11	1.0	0.05	0.03	0.065	0.098	0.85	0.36	0.063	0.5	1.46	0.54	1.55

Table 4.2: Experimental uncertainties. All values are in %. Statistical error accounts for yield and photon flux fluctuations.

UNCERTAINTIES





SUMMARY

This excellent data set provided:

- Good control of systematics
- Wide range of results:
  - Total cross sections for 11 energy bins
  - HyCal Solid Angle cross sections (11 energy bins)
  - Differential cross sections

    15 angle bins for each energy
- Results compare very well with theory

Improvements:

- Simulation of the background would help to:
  - reduce systematic uncertainties
  - increase control of systematics