

# $\Lambda_b^0 \rightarrow \Lambda_c^+ \pi^-$ Lifetime Measurement

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FNAL

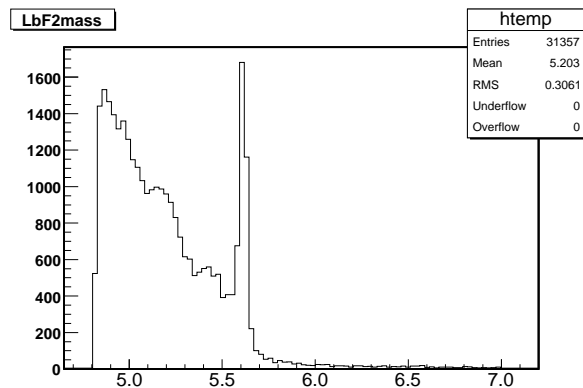
November 13, 2007

## Talk Outline

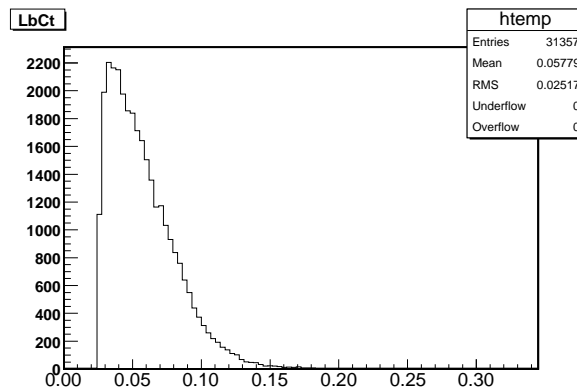
- Toy MC Setup
- Systematic Error Results
- Schedule and Outlook

# Toy MC Setup

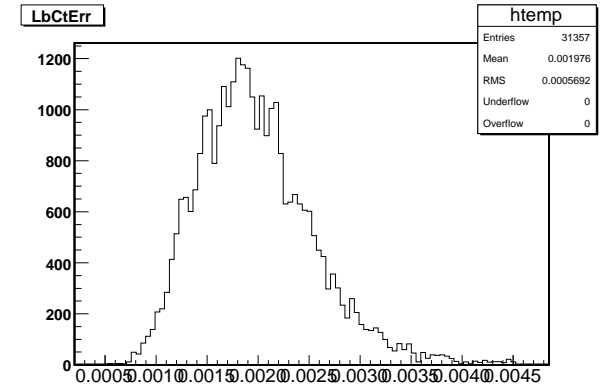
- Mass,  $ct$ , and  $\sigma_{ct}$  PDF's from the fit are used to generate Toy MC.
- RooFit's Accept/Reject utilities are used to generate events.
  - Determine maximum (fmax) of PDF by repeated random sample.
  - Throw a uniform random variable,  $x$ , for the variable to be generated
  - Throw another uniform random number ( $\#$ ) between 0 and fmax.
  - Accept the event if  $\# < f(x)$ .



mass



$ct$



$\sigma_{ct}$

# Toy MC Setup II

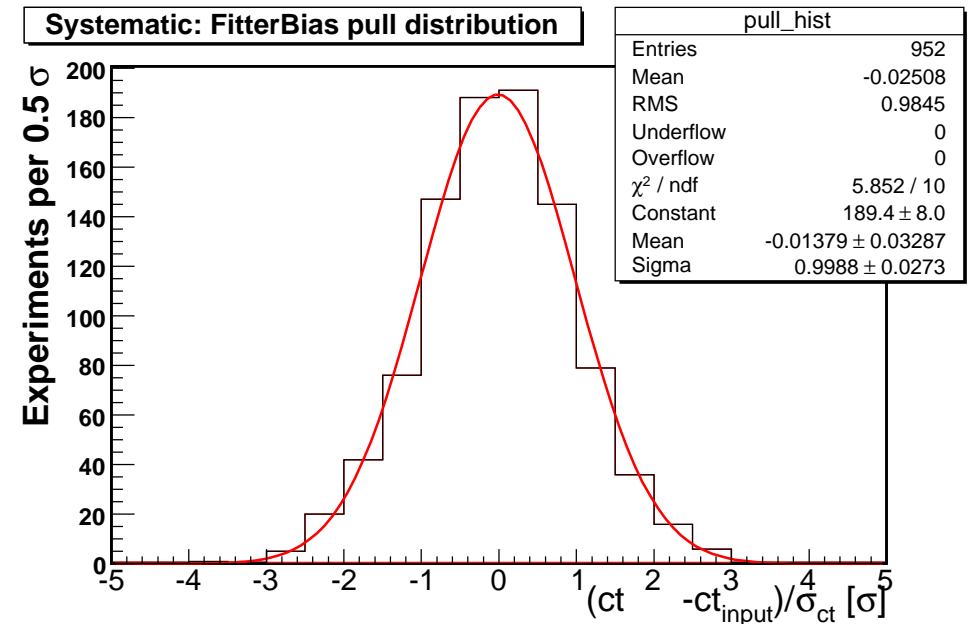
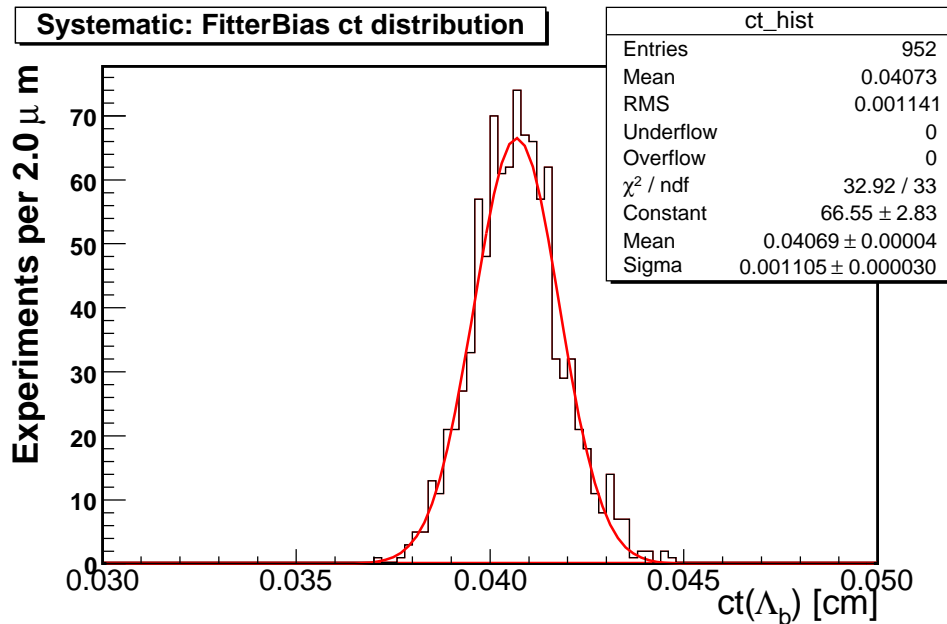
1. Fit the Blinded Data sample w/ the “Rigged” PDF.
2. Using the Rigged Fit result, generate the Rigged Toy Dataset.
3. Fit the Rigged Toy Dataset w/ the Baseline Fit.
4. Systematic is difference between; the Rigged Fit and the Baseline fit to Rigged Data.

Generate Toy MC samples with statistics similar to data sample.

Run 1000 pseudo-experiments per systematic.

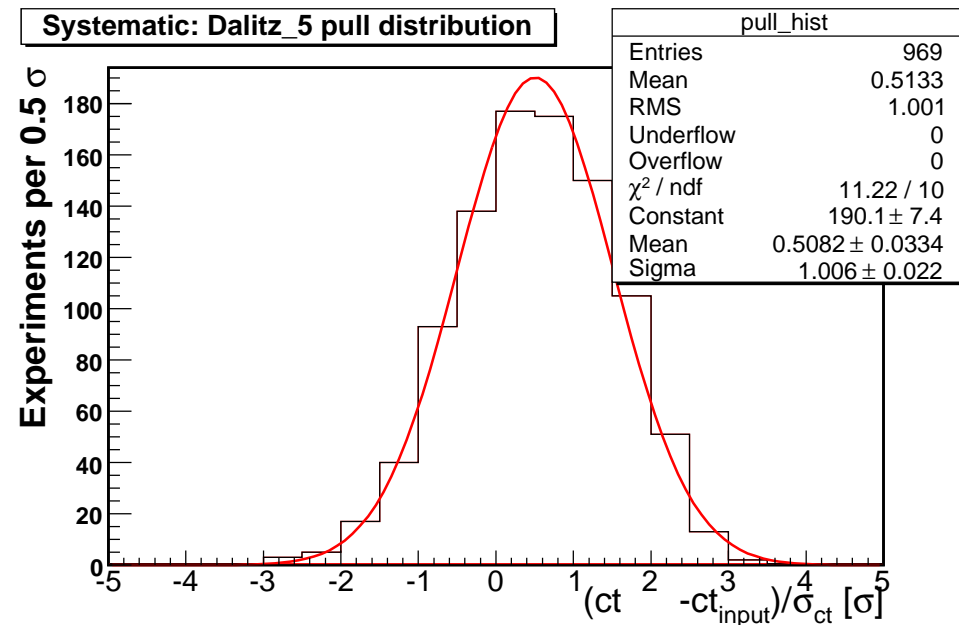
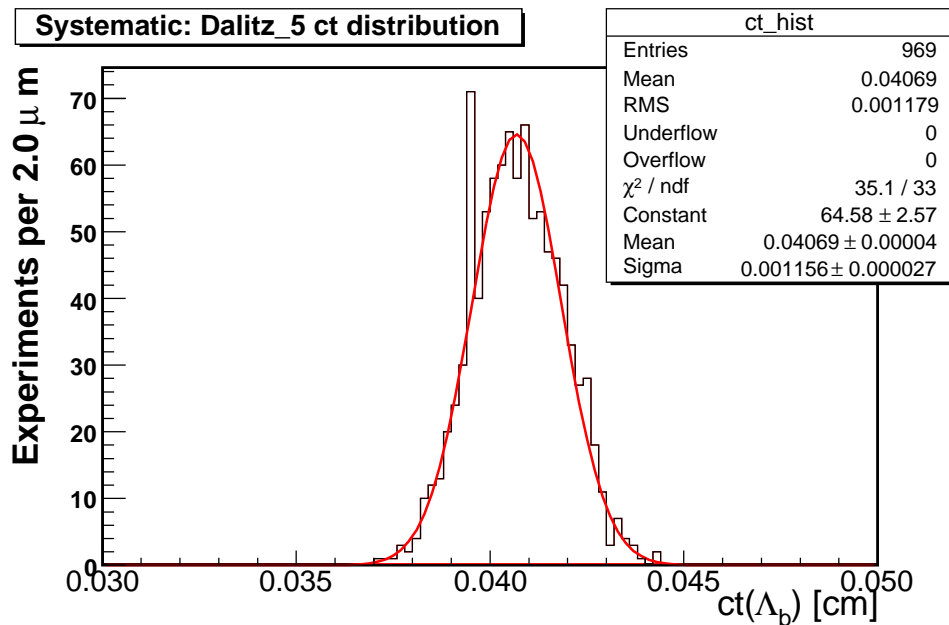
# Systematics: Fitter Bias

Sample	Rigged $ct$	Result	Diff
Fitter Bias	$407.0\mu m$	$406.9\mu m$	$0.1\mu m$
Quoted Systematic			negligible

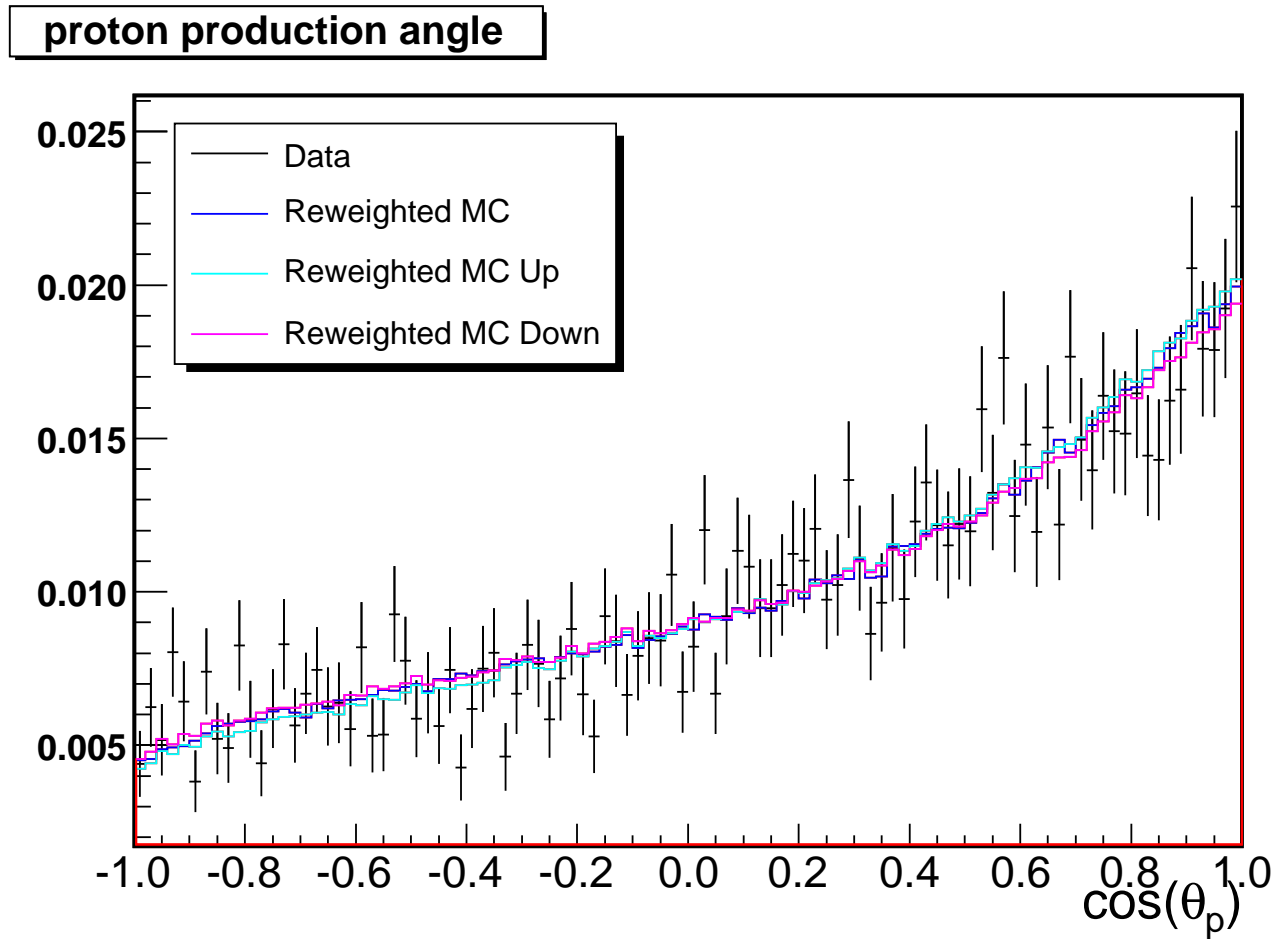


# Systematics: $\Lambda_c$ Dalitz Fractions

Sample	$pK^*$	$\Delta^{++}K$	$\Lambda(1520)\pi$	$pK\pi$	Rigged	Result	diff
Baseline	0.227	0.122	0.255	0.397	NA	$407.0\mu m$	NA
Dalitz_1	0.190	0.174	0.331	0.305	$403.9\mu m$	$406.1\mu m$	$2.2\mu m$
Dalitz_2	0.252	0.430	0.163	0.154	$402.6\mu m$	$408.5\mu m$	$5.9\mu m$
Dalitz_3	0.383	0.143	0.234	0.240	$399.2\mu m$	$404.7\mu m$	$5.5\mu m$
Dalitz_4	0.297	0.145	0.100	0.458	$402.3\mu m$	$407.1\mu m$	$4.8\mu m$
Dalitz_5	0.441	0.120	0.267	0.171	$400.5\mu m$	$406.9\mu m$	$6.4\mu m$
Quoted Systematic							$6\mu m$

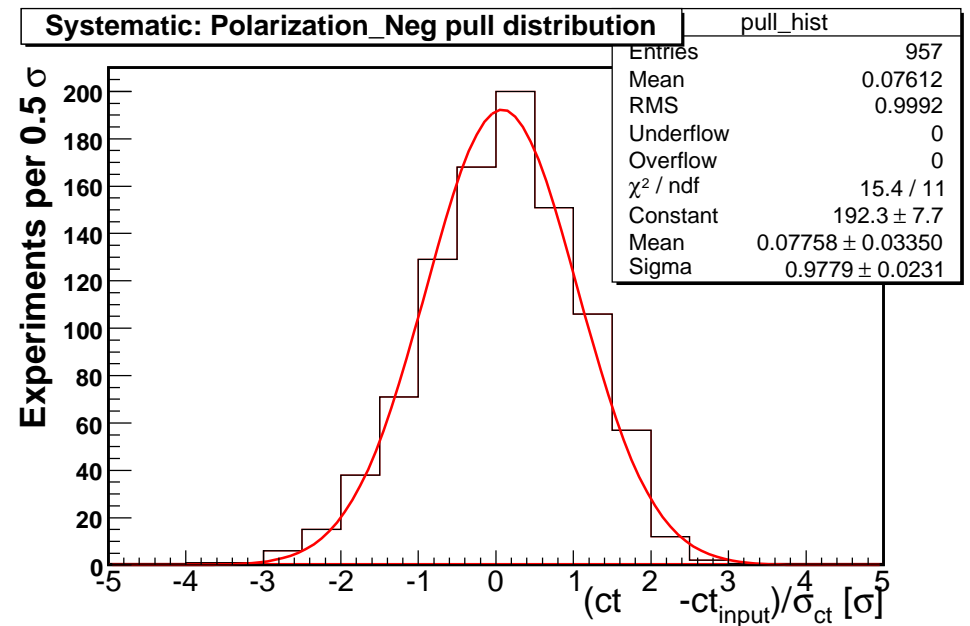
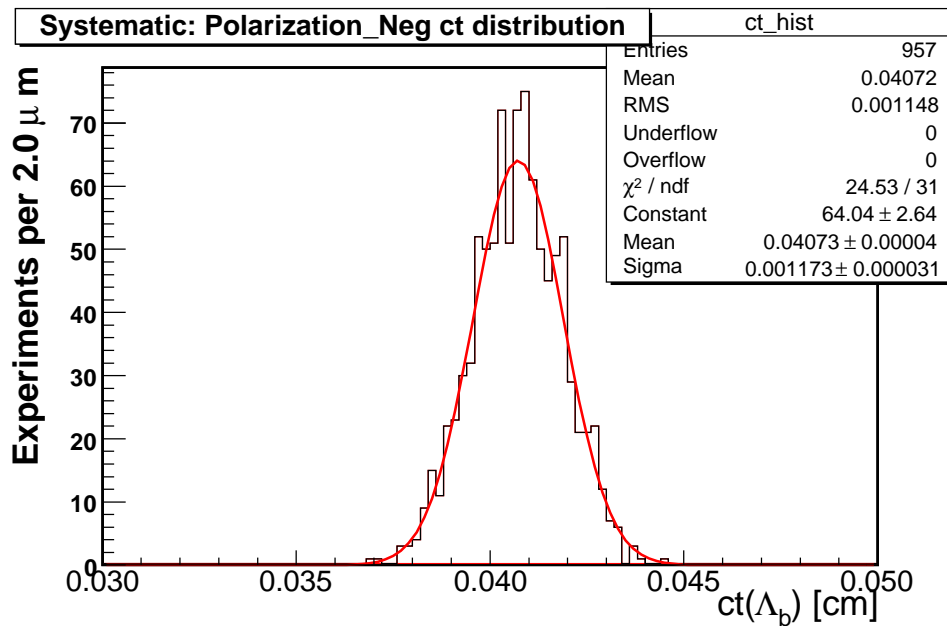


# Systematics: $\Lambda_b^0$ Polarization Re-weighting

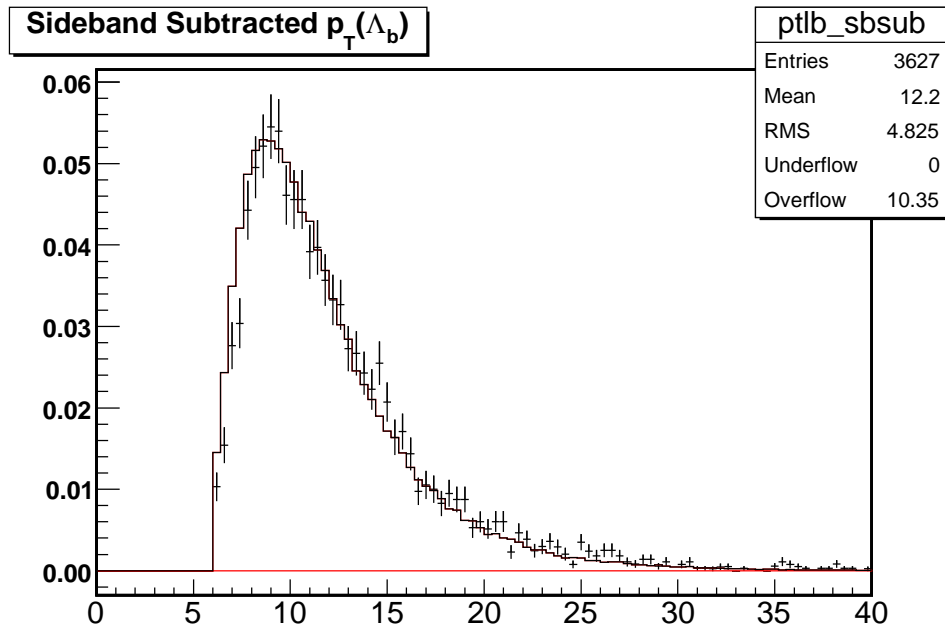


# Systematics: $\Lambda_b^0$ Polarization Re-weighting

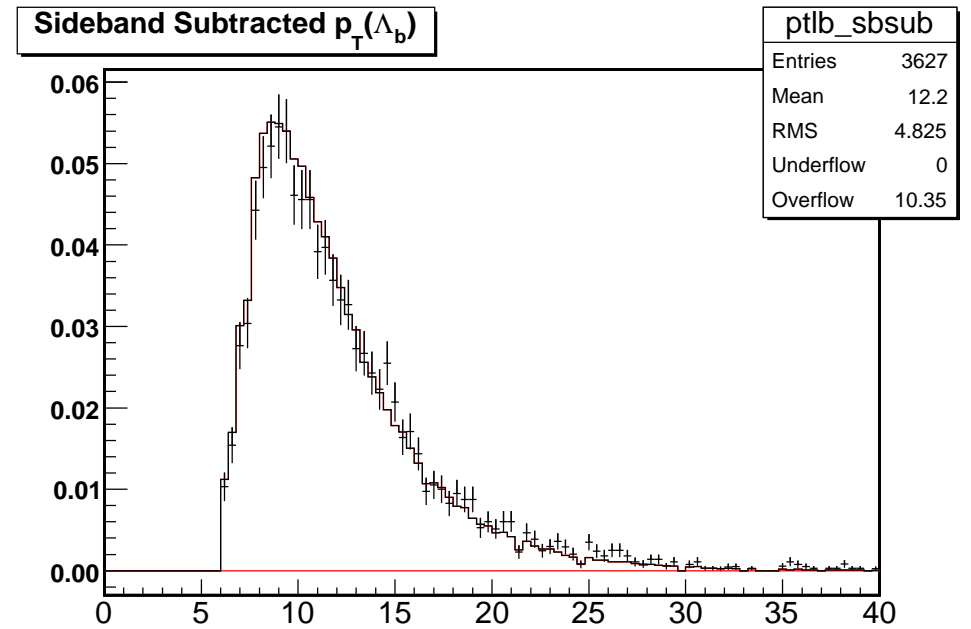
Sample	Rigged $ct$	Result	Diff
Polarization +	$407.2\mu m$	$407.5\mu m$	$0.3\mu m$
Polarization -	$405.7\mu m$	$407.3\mu m$	$1.6\mu m$
Quoted Systematic:			$1.5\mu m$



# Systematics: $p_T(\Lambda_b^0)$ Re-weighting



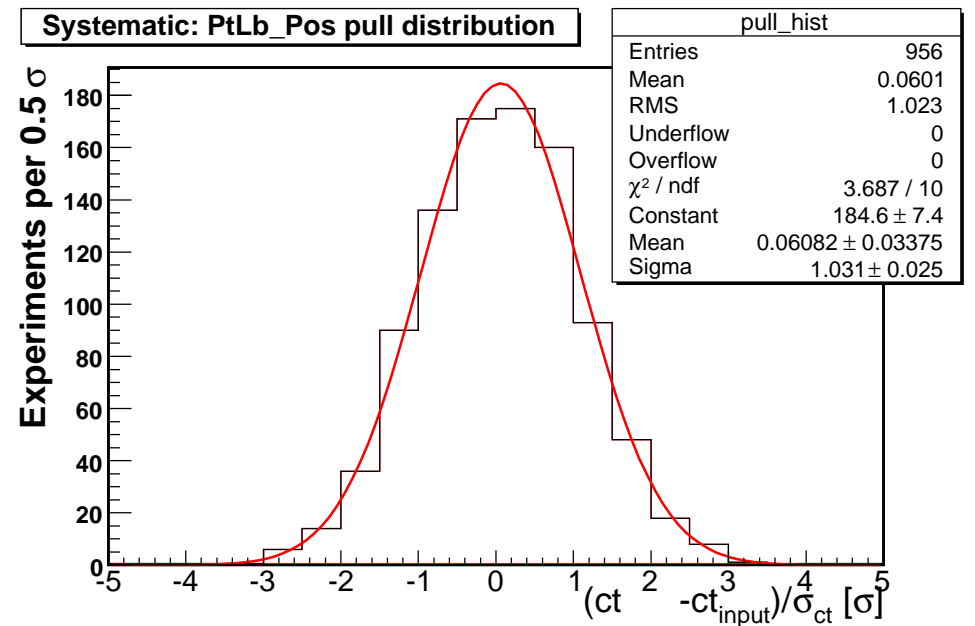
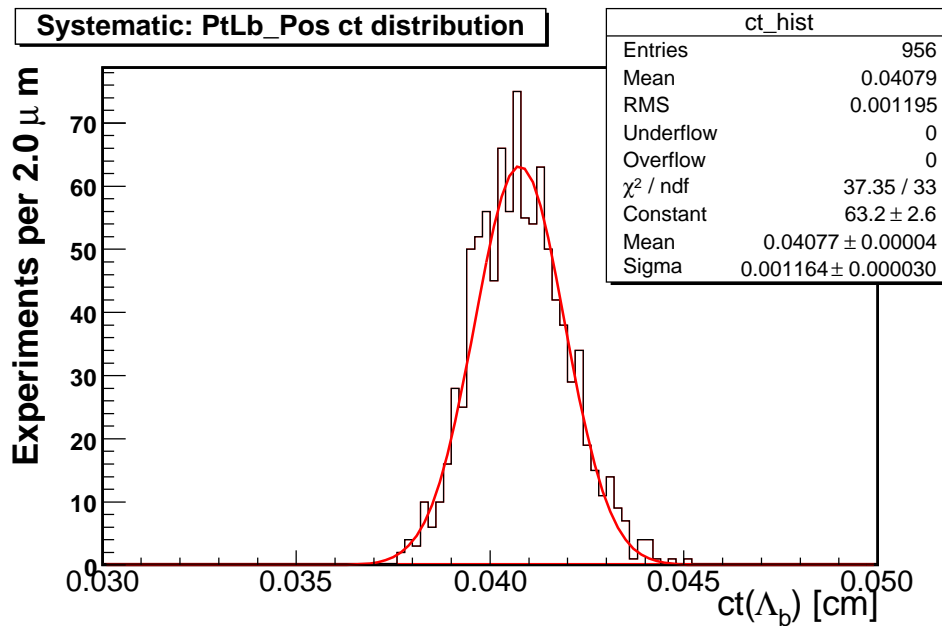
Before Re-Weighting



After Re-Weighting

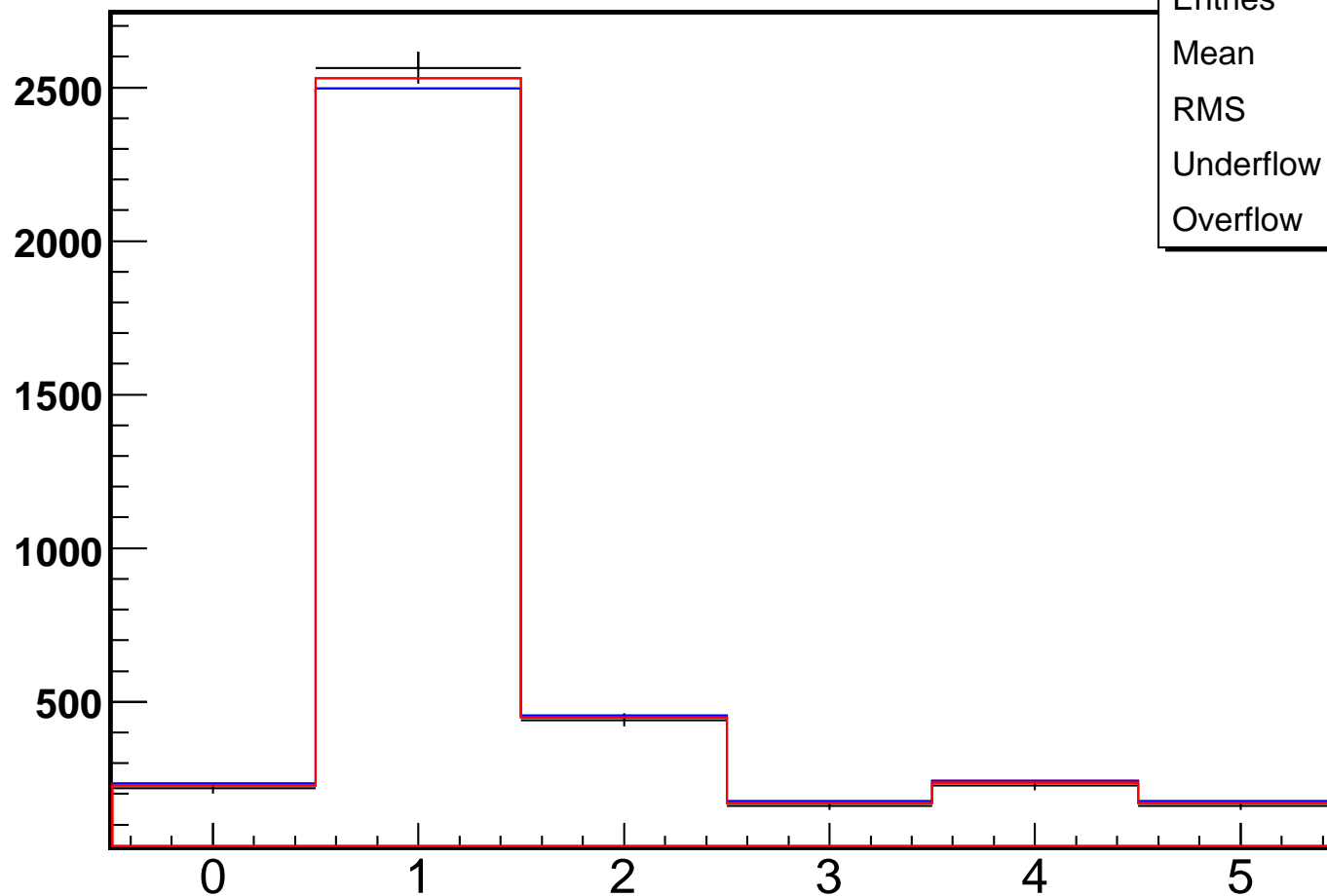
# Systematics: $p_T(\Lambda_b^0)$ Re-weighting

Sample	Rigged $ct$	Result	Diff
$p_T(\Lambda_b^0) +$	$406.7\mu m$	$407.7\mu m$	$1.0\mu m$
$p_T(\Lambda_b^0) -$	$406.9\mu m$	$407.7\mu m$	$0.8\mu m$
Quoted Systematic:			$1.0\mu m$



# Systematics: TrigCode Re-weighting

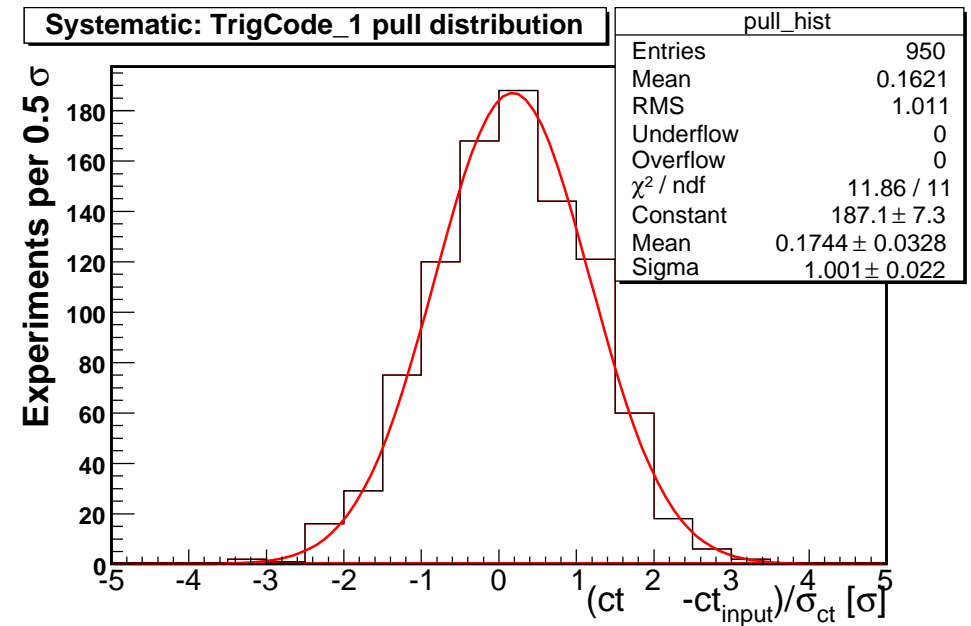
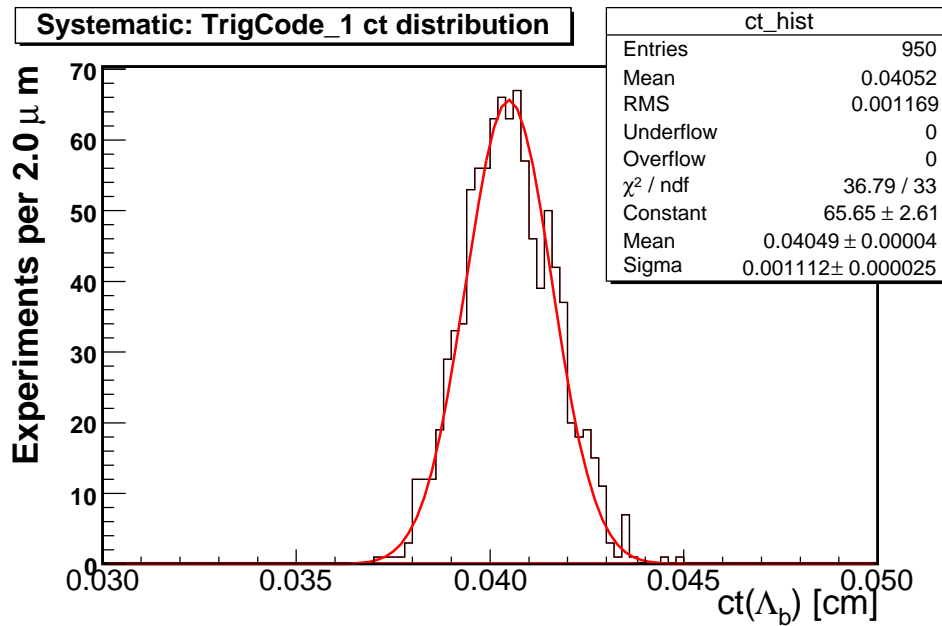
Signal by Trigger Category



syst_data_hist	
Entries	3782
Mean	1.509
RMS	1.171
Underflow	0
Overflow	0

# Systematics: TrigCode Re-weighting

Sample	Rigged $ct$	Result	Diff
TrigCode_1	$402.7\mu m$	$404.9\mu m$	$2.2\mu m$
TrigCode_2	$408.1\mu m$	$406.3\mu m$	$-1.8\mu m$
Quoted Systematic:			$2.0\mu m$

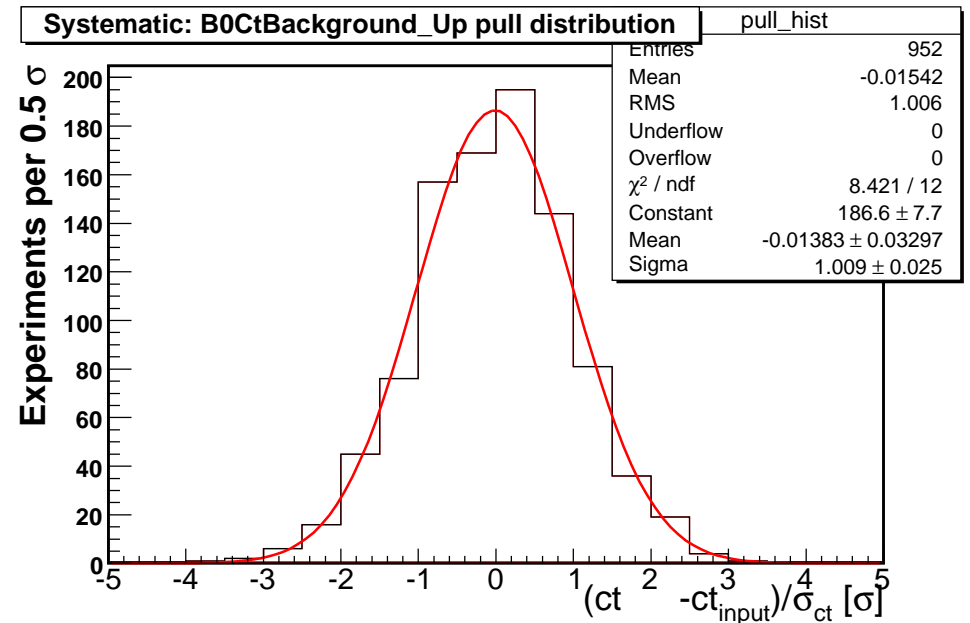
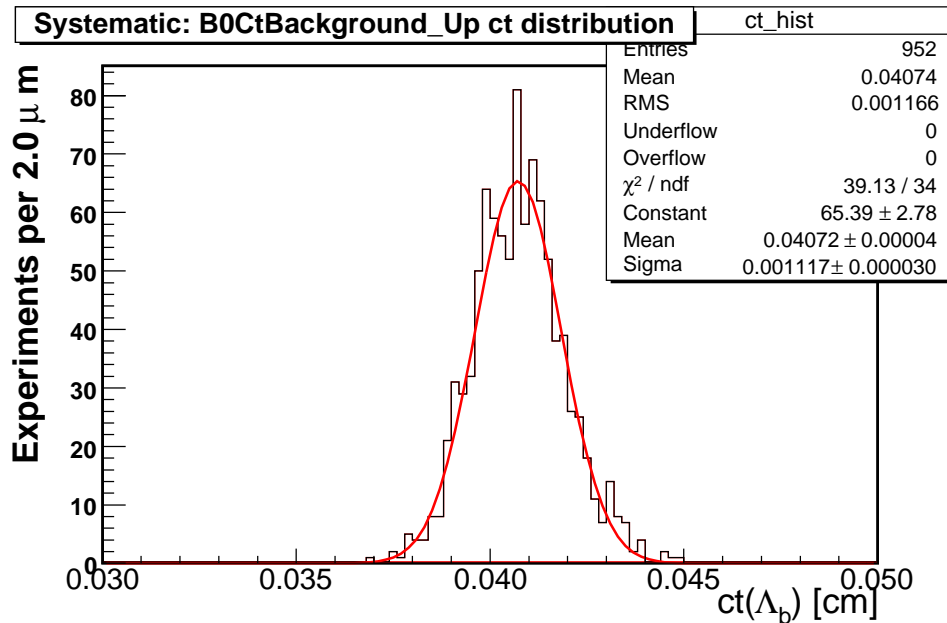


# Systematics: $B^0 \tau$ Parameter

PDG lists  $c\tau(B^0) = 460 \pm 10 \mu m$

We use  $c\tau(B^0)_+ = 470 \mu m$  and  $c\tau(B^0)_- = 450 \mu m$  to evaluate our systematics.

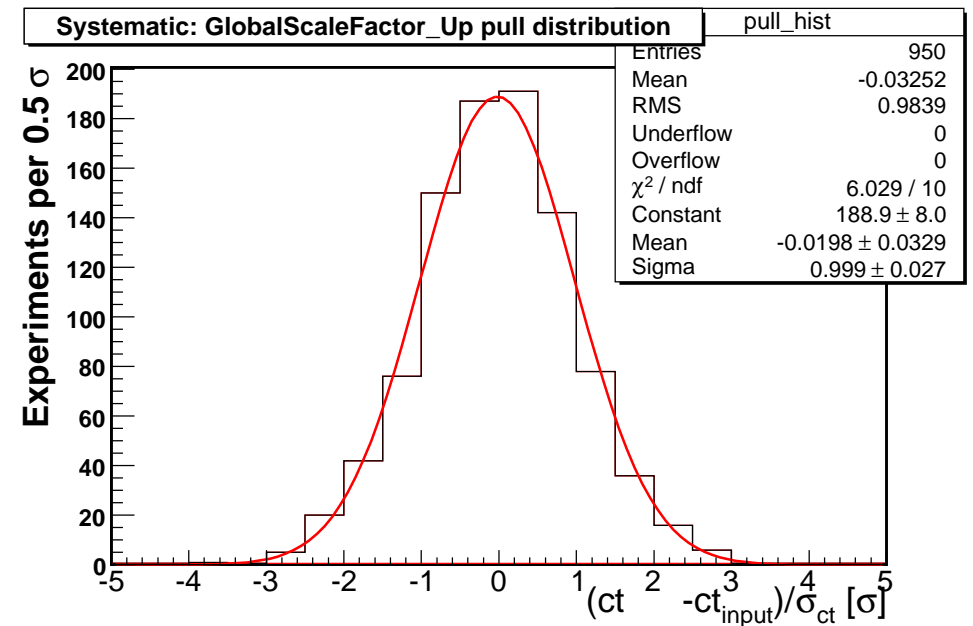
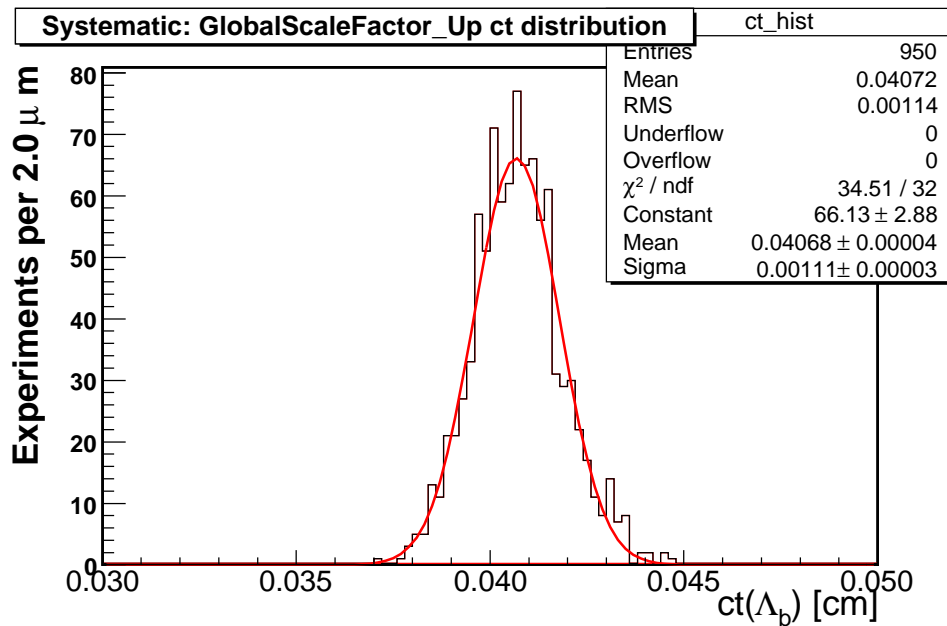
Sample	Rigged $ct$	Result	Diff
$c\tau(B^0)_+$	$407.0 \mu m$	$407.2 \mu m$	$0.2 \mu m$
$c\tau(B^0)_-$	$407.1 \mu m$	$407.0 \mu m$	$-0.1 \mu m$
Quoted Systematic:			negligible



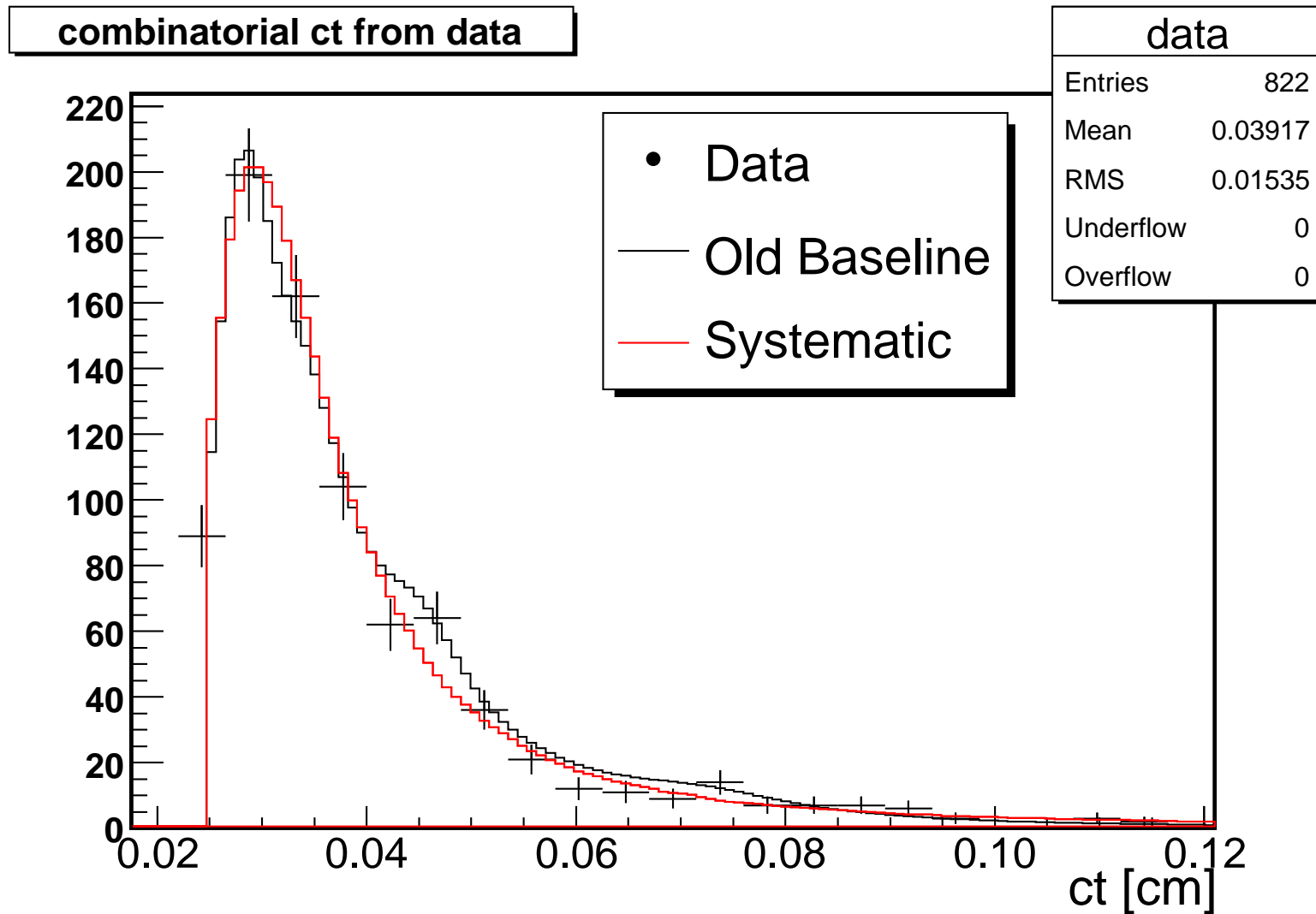
# Systematics: Global $\sigma_{ct}$ Scale Factor

We use a double Gaussian resolution function for  $\sigma_{ct}$ . We weight both Gaussians up and down by 20% for this systematic.

Sample	Rigged $ct$	Result	Diff
$S_{\sigma_{ct}} + 20\%$	$407.1\mu m$	$406.8\mu m$	$-0.3\mu m$
$S_{\sigma_{ct}} - 20\%$	$407.1\mu m$	$406.9\mu m$	$-0.2\mu m$
Quoted Systematic:			negligible

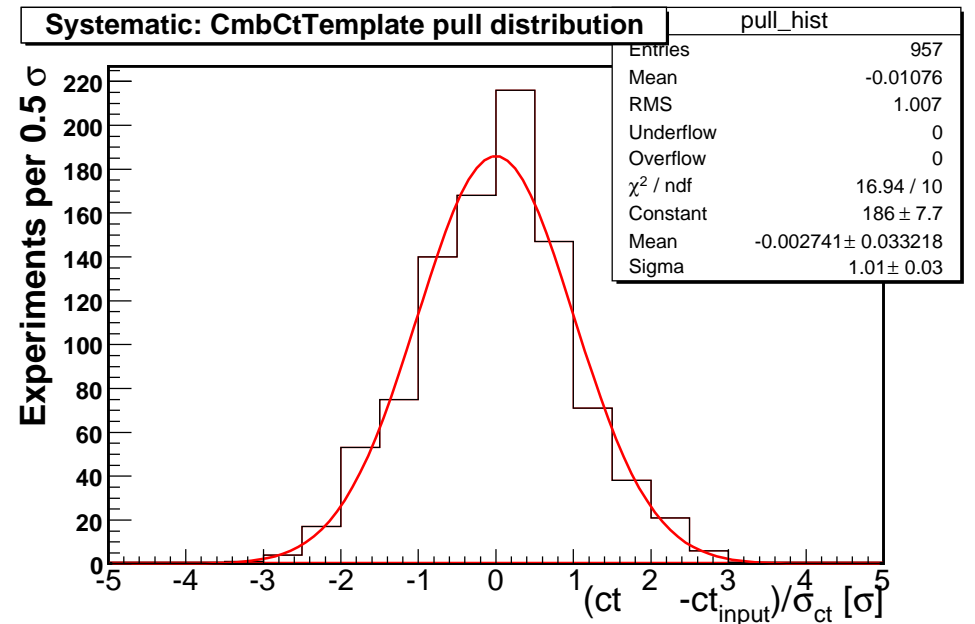
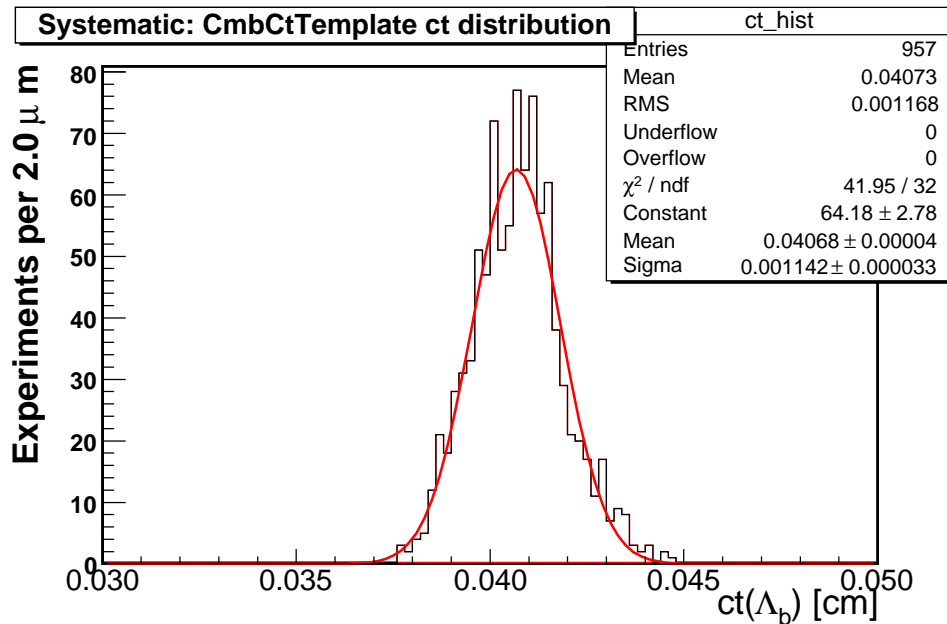


# Systematics: Combinatorial $ct$ Distribution



# Systematics: Combinatorial $ct$ Distribution

Sample	Rigged $ct$	Result	Diff
Parameterized	$406.8\mu m$	$406.8\mu m$	$0.0\mu m$
Quoted Systematic:			negligible



# Systematics: Summary Table

Systematic	Status
Alignment	$2\mu m$ (cdfnote 8524)
SVT-SVX d0 correlation	$1\mu m$ (cdfnote 7386)
$\Lambda_c$ Dalitz structure	$6\mu m$
Data-MC comparison: TrigCode re-weighting	$2\mu m$
Data-MC comparison: $pt(\Lambda_b^0)$ spectrum	$1\mu m$
$\Lambda_b^0$ polarization	$1.5\mu m$
Fitter bias	negligible
$ct$ background ( $B$ $\tau$ -parameter)	negligible
Global scale factor	negligible
Combinatorial $ct$ distribution	negligible
$\sigma_{ct}$ binning	negligible
Sample Composition	Setup ( $4\mu m$ )
Efficiency Histogram Smoothing	Setup (negligible)

## Schedule and Outlook

- We have a good first pass at most of the systematics.
- We will have an updated version of our note before Thanksgiving.
- We plan to pre-bless the week after Thanksgiving.