Mott Run1 Analysis

Outline –

- Addition of uncertainty in target foil thickness (sigma_x) to analysis
- Energy spectra now time-of-flight cut before fitting
- Time-of-Flight cuts based on fit of Time-of-Flight Target peak
- Other developments to analysis techniques
- Sensitivity of A_0 and alpha to systematic time-of-flight and energy cuts – Gaussian fits of both time-of-flight and energy spectra

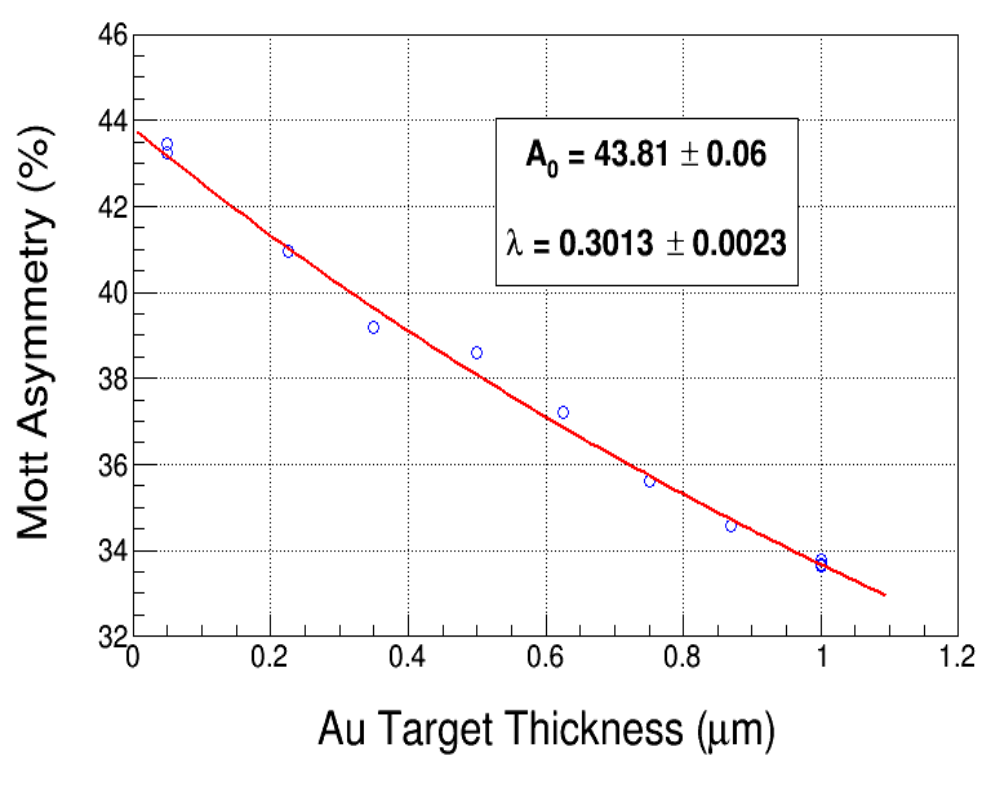
Addition of Uncertainty in Foil Thicknesses

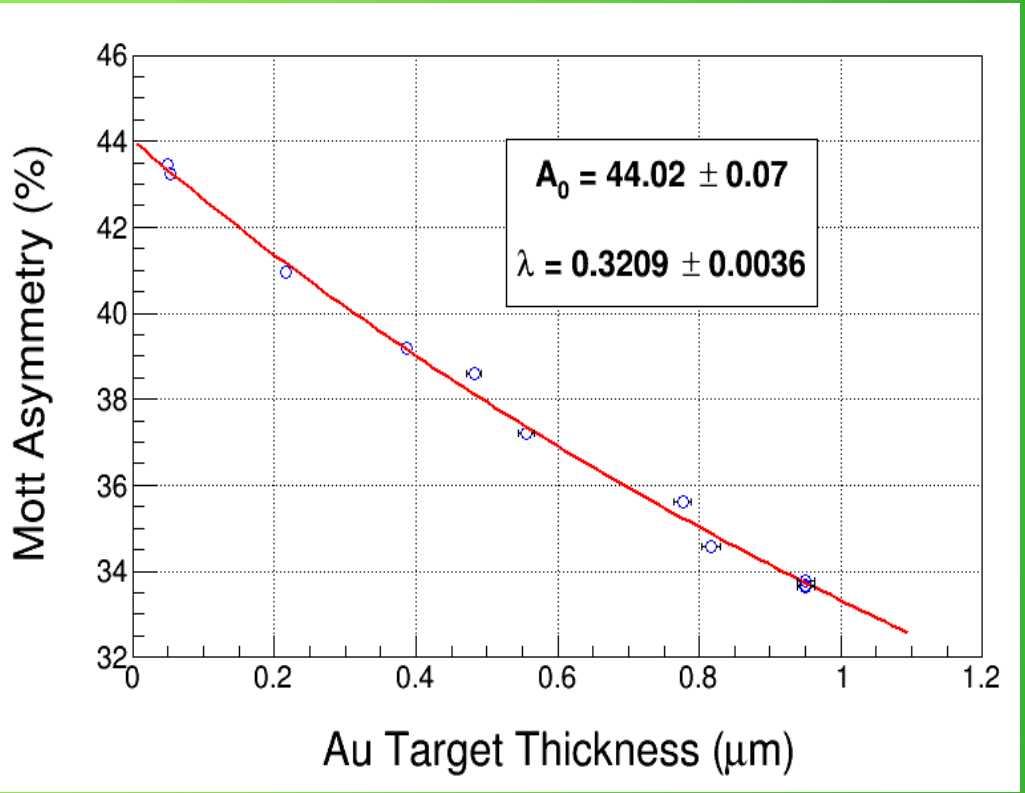
- Previously, fit curve of form A(x) = A_0 / (1 + alpha * x) with only uncertainties in Asymmetry (sigma_y).
- Now, taking into account both uncertainty in asymmetry and foil thickness.
- Additionally, measured foil thickness values being used rather than their nominal values as given by vendor

Sibling	Ladder Pos	Nominal (nm)	Thickness (nm)	+/- (nm)
5385	15	1000	950.55	12.35
3057	3	870	817.04	13.43
5134	4	750	776.3	12.41
7028	2	625	555.66	11.79
5275	5	500	482	10.19
5613	14	350	387.57	7.41
5613	8	350	387.57	7.41
7029	1	225	216.88	2.87
6809	12	50	52.19	2.14
no sibling	13	50	50	5

Addition of Uncertainty in Foil Thicknesses

- Fit on Time-of-flight hardcoded 48-58 ns analysis from July 1st
- A(x) = A_0 / (1 + lambda * x)





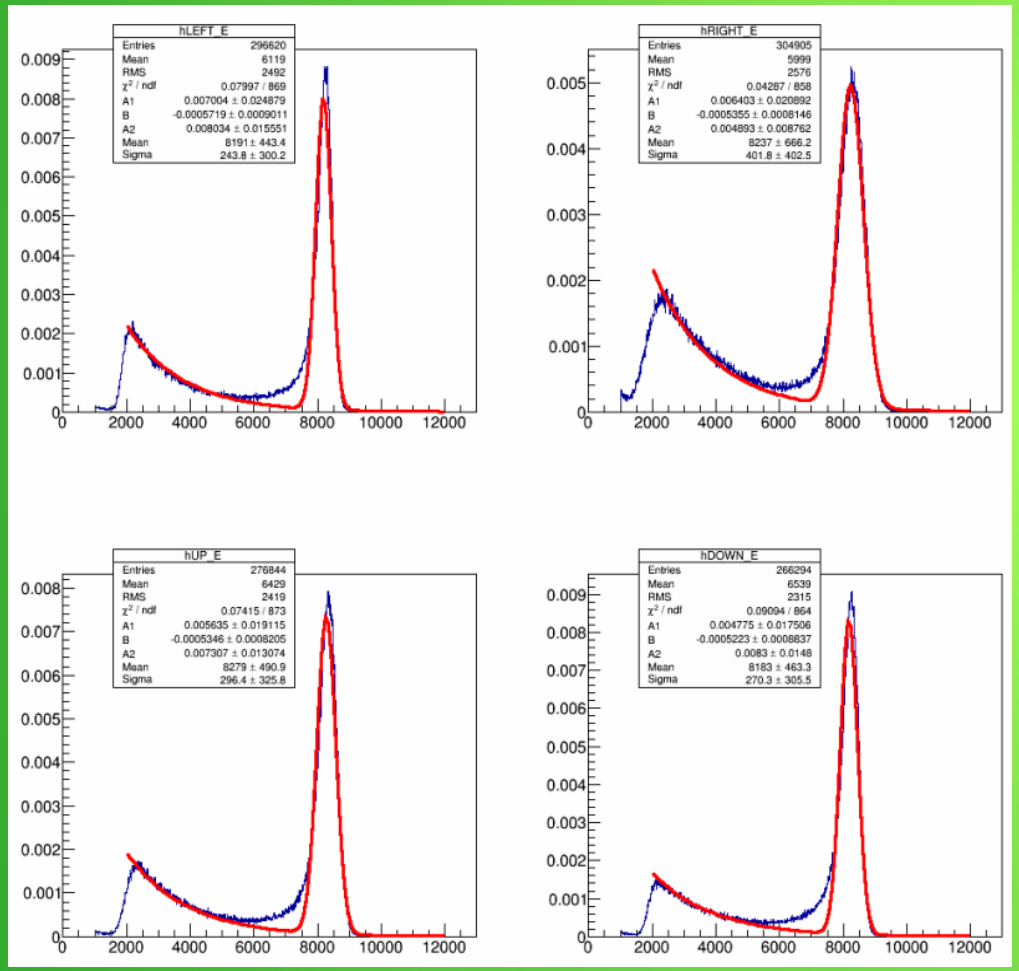
Data from July 1st --
- Nominal foil thicknesses
- No accounting for uncertainty in thickness

Same Asymmetry data from July 1st --
- Measured foil thicknesses
- Fit takes into account uncertainty in foil thicknesses and not just in measured asymmetry

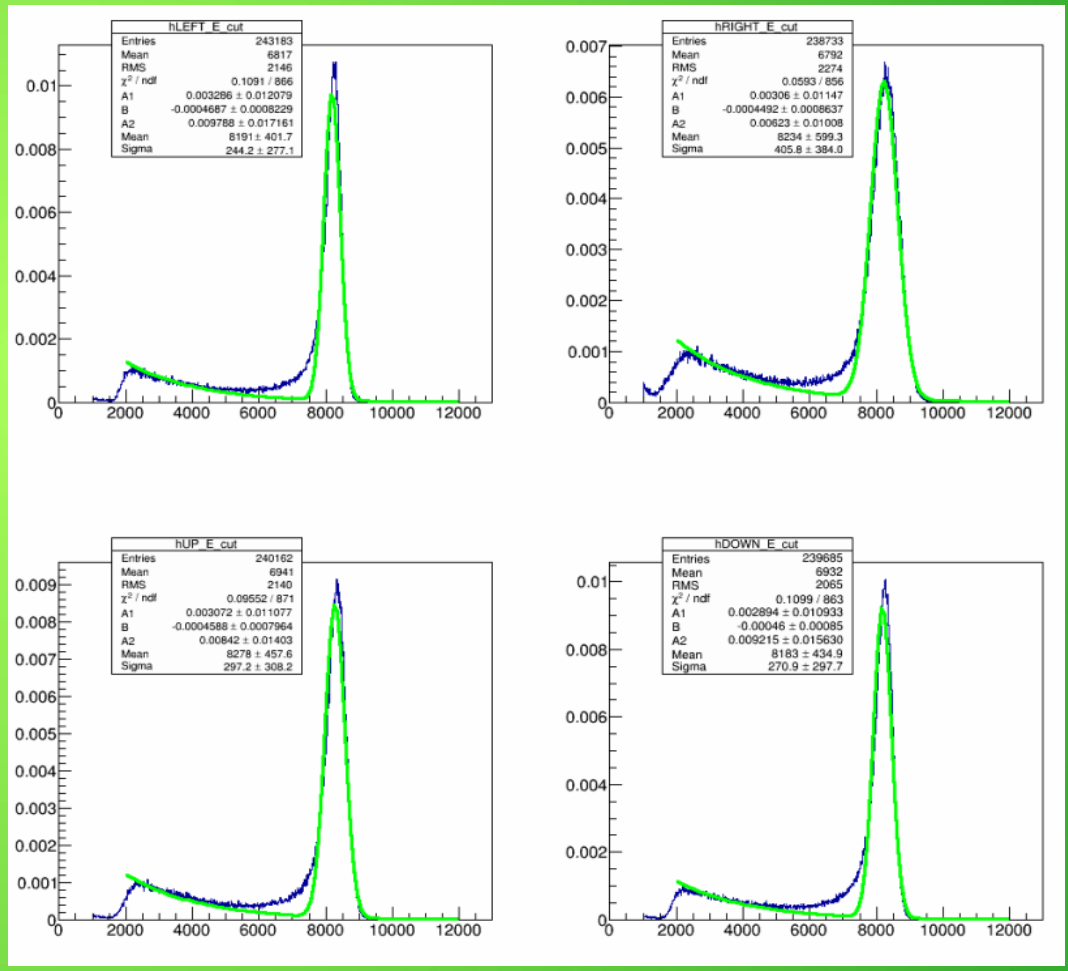
Energy Spectra Time-of-Flight Cut

Previously – Fit all events in energy spectra, raw data

Now – determine good time-of-flight events and only fit that data



Uncut energy spectra, run 7999

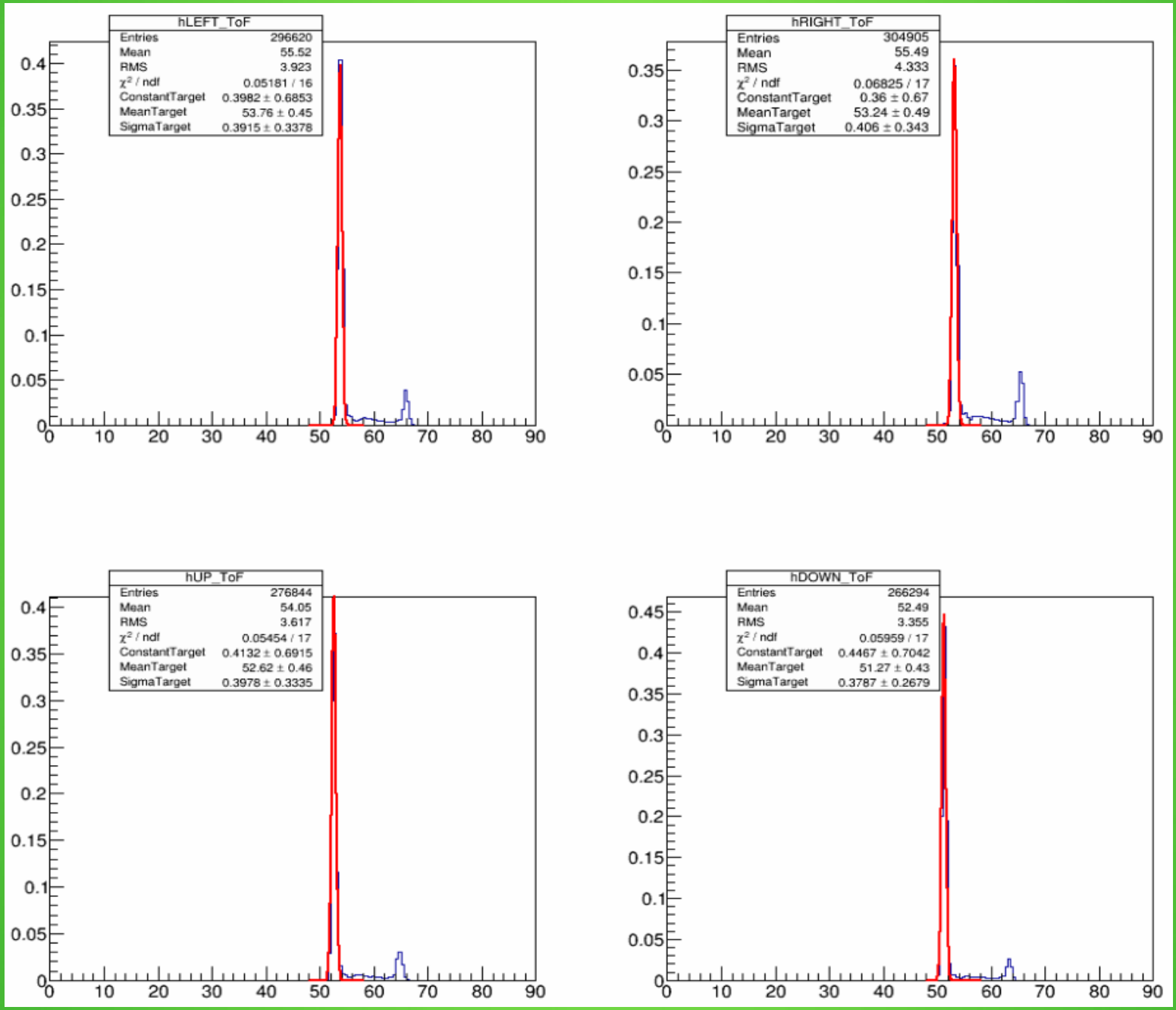


Time-of-flight cut energy spectra, 7999
(Note: ”old” time-of-flight cuts method)

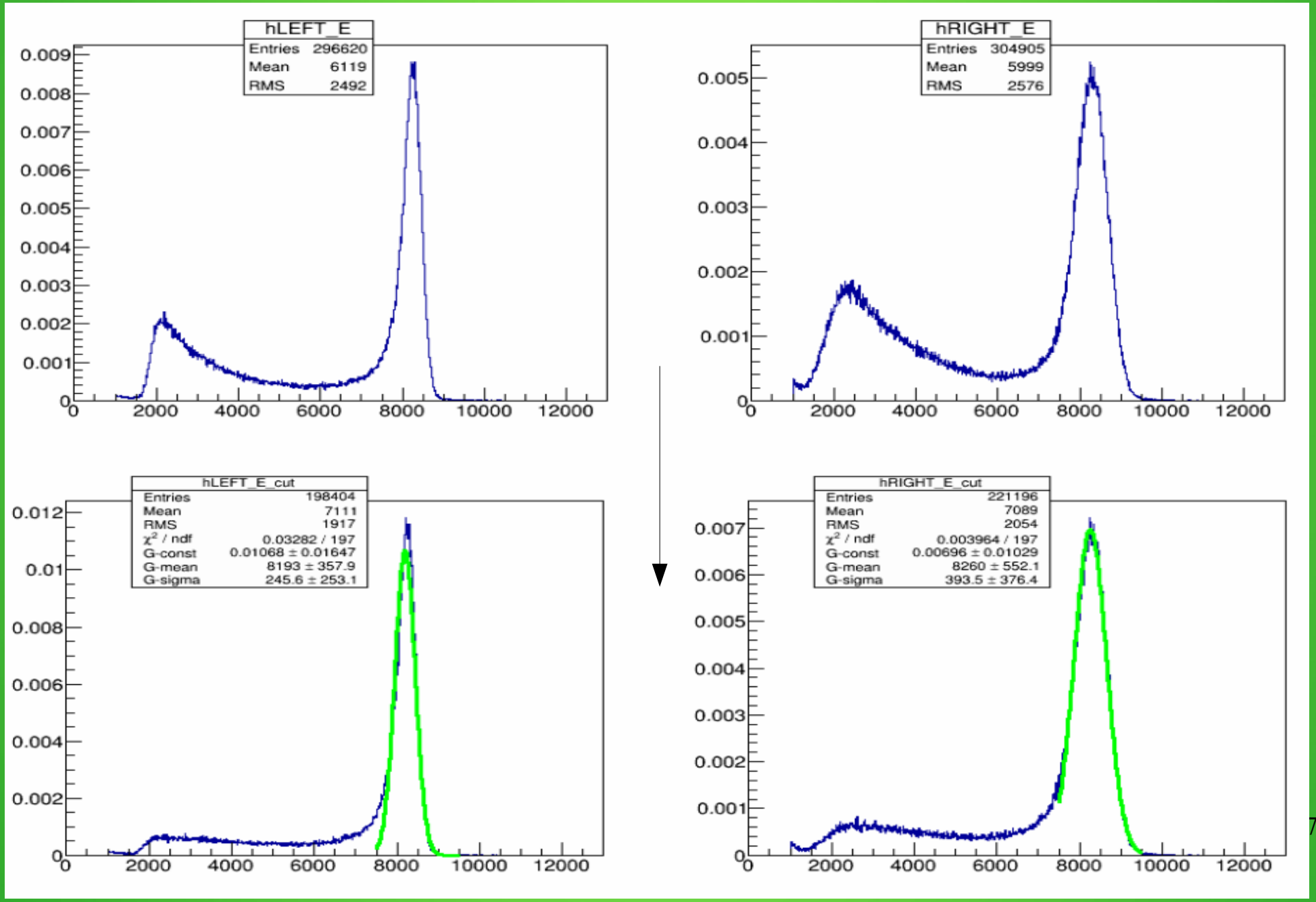
Time-of-Flight Cuts

- Previously (July 1st) – Time of Flight window and beginning of window for each detector set by user in config file; user determined by observation of time-of-flight plots
- New approach – fit time-of-flight spectra of target events (left peak, right peak is dump events) with a gaussian, determine time-of-flight cuts from this fit
- Separate fit for each detector
- Gaussian fit in range of 48-58 ns for all detectors
- Time-of-flight cuts on raw energy spectra determined from parameters of gaussian (i.e. Mean +/- some multiple of sigma)

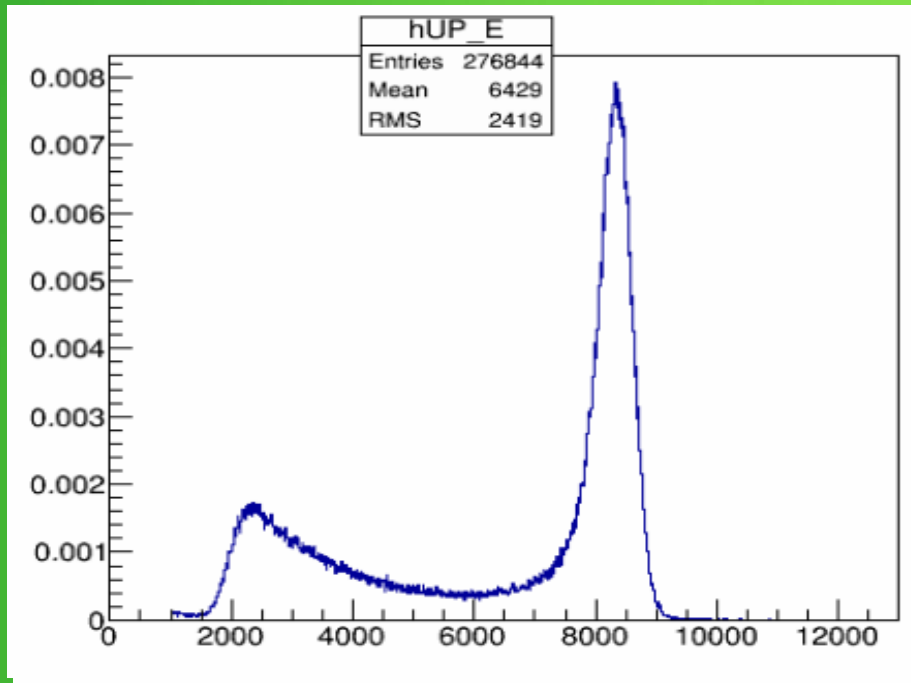
Time-of-Flight Cuts – Run 7999

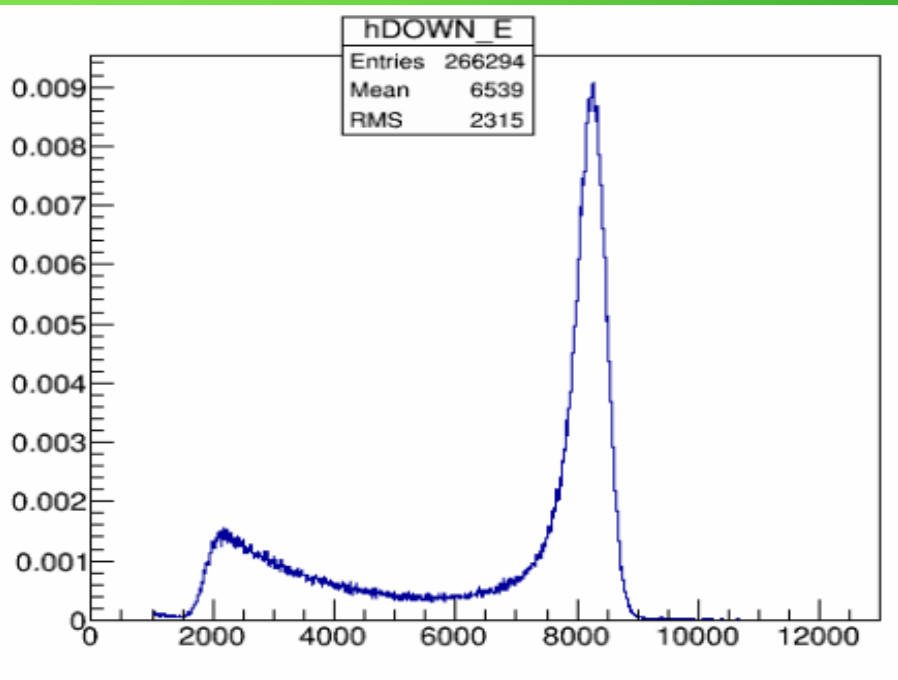


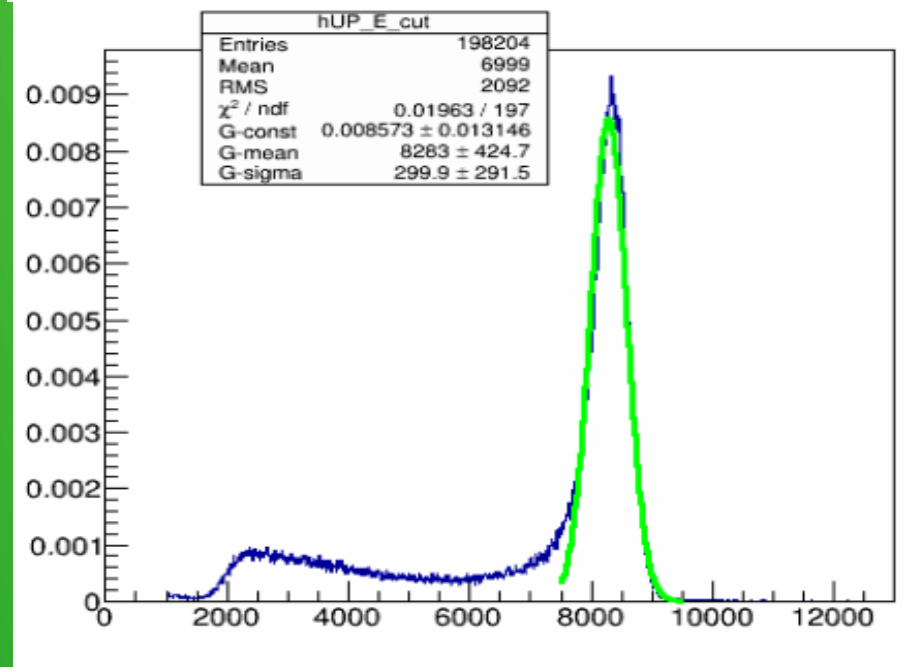
Run 7999, Energy spectra ToF-cut mean +/- sigma

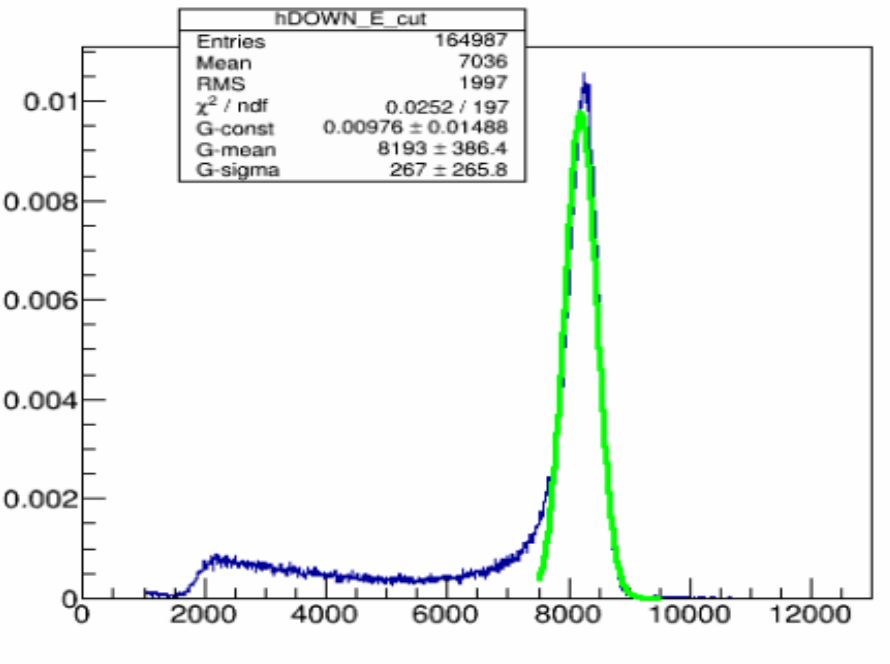


Run 7999, Energy spectra ToF-cut mean +/- sigma









Other Analysis Developments

- 8 cores and sufficient RAM on opsmdaq0 => able to run 8 versions of analysis code simultaneously, separate terminals
- Previously, one pass through data ~2 hours; nine passes through data running all simultaneously ~4 hours
- Post-analysis-code-processing – ie verifying successful fits, averaging together runs of the same foil thickness, generating asymmetry vs thickness plot, etc. – ~1 hr per data set

Sensitivity of A_0 and alpha to systematic time-of-flight and energy cuts

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