# Analysis Status and Big-Hand Report

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# **Big-Hand Calibration Outline**

- Full Review of Process
  - Intra Plane Calibration
  - Position Calibration
  - Plane to Plane Calibration
  - Time of Flight Calculation
  - Fitting and Testing
- Example Histograms from script
- Results
- Future

### Intra Plane Calibration



## Intra-plane Cuts

- Cut to make sure that V1 or V2 fired and is within time window (<10 ns).
- Cut to make sure that hit is within time window (<30 ns).
- Make sure that the event takes place within the target (<.21 m).</li>
- Make sure that the difference between the vector direction of the hit (as calculated from bars in the cluster and position of the hit) and the vector direction of the q vector is less than .08 m(.06 m) for X (Y).
- Veto and Direction cuts are ignored for Glascow detectors.
- Remove events lacking information(D.ctimeL1A[0]<4000)

Invariant mass cut |M-1| < .2 and preshower cut  $E_{PreShower} < 450$ 

## **Position Calibration**

- Determine proper neutron bar by position of hit along marker bar.
- Position along the neutron bar is then compared to known location of Marker Bar.



### Plane to Plane Calibration

- Clusters begin in the first plane.
- Clusters have 6 bars (3 bars if Glascow).
- Clusters have an energy weighted depth of .017.
- Looks for hits in each later plane which are close to the cluster bar in X position and in time. •Calibrates time of later plane bar with N1 plane bar accounting for depth of bar. Х Calibrates both mean time **First Plane** and position to N1.



Ζ

## **Time of Flight Calculation**

• Due to path to Big Bite:

$$BB_{\text{ScintTime}} - \frac{1}{3} (.95 * \sqrt{1 + BB_{\text{trackXmom}}^2 + BB_{\text{trackYmom}}^2} + \text{corrections})$$

• Due to path to Big Hand:

 $\sqrt{BH_{PathLength}^{2} + Vertex^{2} - 2*BH_{PathLength}} * Vertex*Particle_{Direction} / (Particle_{Speed})$ 

• Final Time:

 $Time = BH_{Time} - BH_{PathCorrection} - BB_{PathCorrection} + RF_{correction} + .05 * L1A - Correction$ 

# Fitting and Testing

- Two stage fitting process, gaussian and gaussian + flat background.
- Bins sizes are:
  - 500 ps for Glascow detectors
  - 333 ps for detector 2 plane 1
  - 200 ps for all other detectors
- Testing runs through loop of events 2<sup>nd</sup> time but with offsets to mean time applied.

### **Example Histograms**



After the test application of offset.



The initial filled histogram. This is the offset for the time of flight between Big Bite and Big Hand.

### Example Histogram



The overall calibration. Different time difference positions refer to different planes (in order N1 tof, N2, N3, N4, N5, N6, and N7 diff, and N1 position). Errors are the sigma, rather then the uncertainty in mean position. Certain Glascow detectors have problems due to detectors being removed and/or not working. X is after test.

### **Result Histogram**



Plot of run after calibration. Peaks are all aligned. Uncertainty on plot is still sigma, not uncertainty in peak. Here both the X after the test, and + before, are aligned. Some of the problems with Glascow are due to lack of statistics (not enough files were replayed to test them).

### **Quasi-Elastic Resolution**



### **Future Plans**

- Presentation Aug. 8<sup>th</sup> for Maryland.
- 2<sup>nd</sup> (3<sup>rd</sup> ?) look at time walk effects, propagation speed of medium, and veto detector calibration.
- Analysis of kin 3 (am currently am looking at neutron momentum compared to neutron missing momentum).
- With apparent resolutions of the bars being of the same order as resolution of the detector, further improvement is not expected.



Missing Momentum