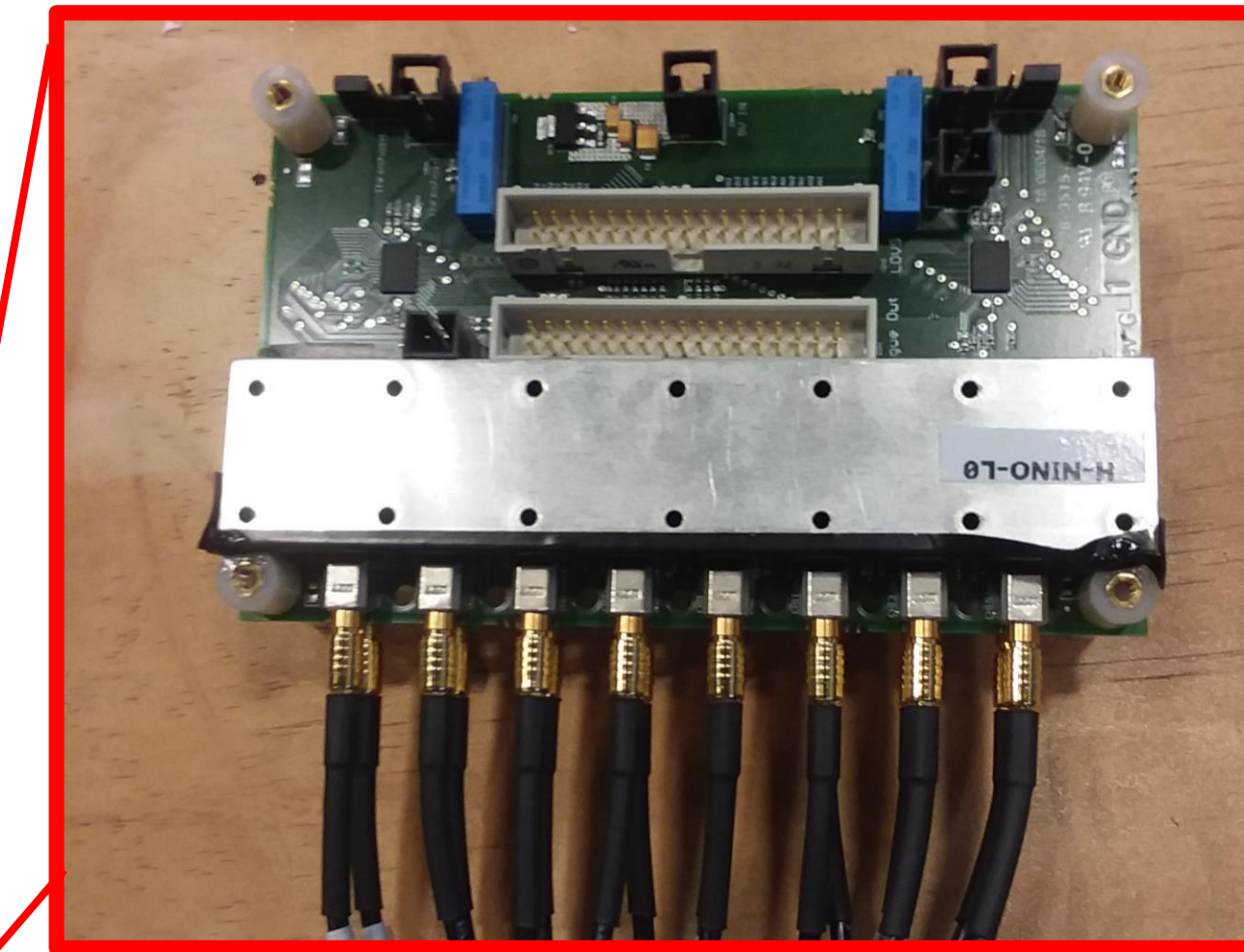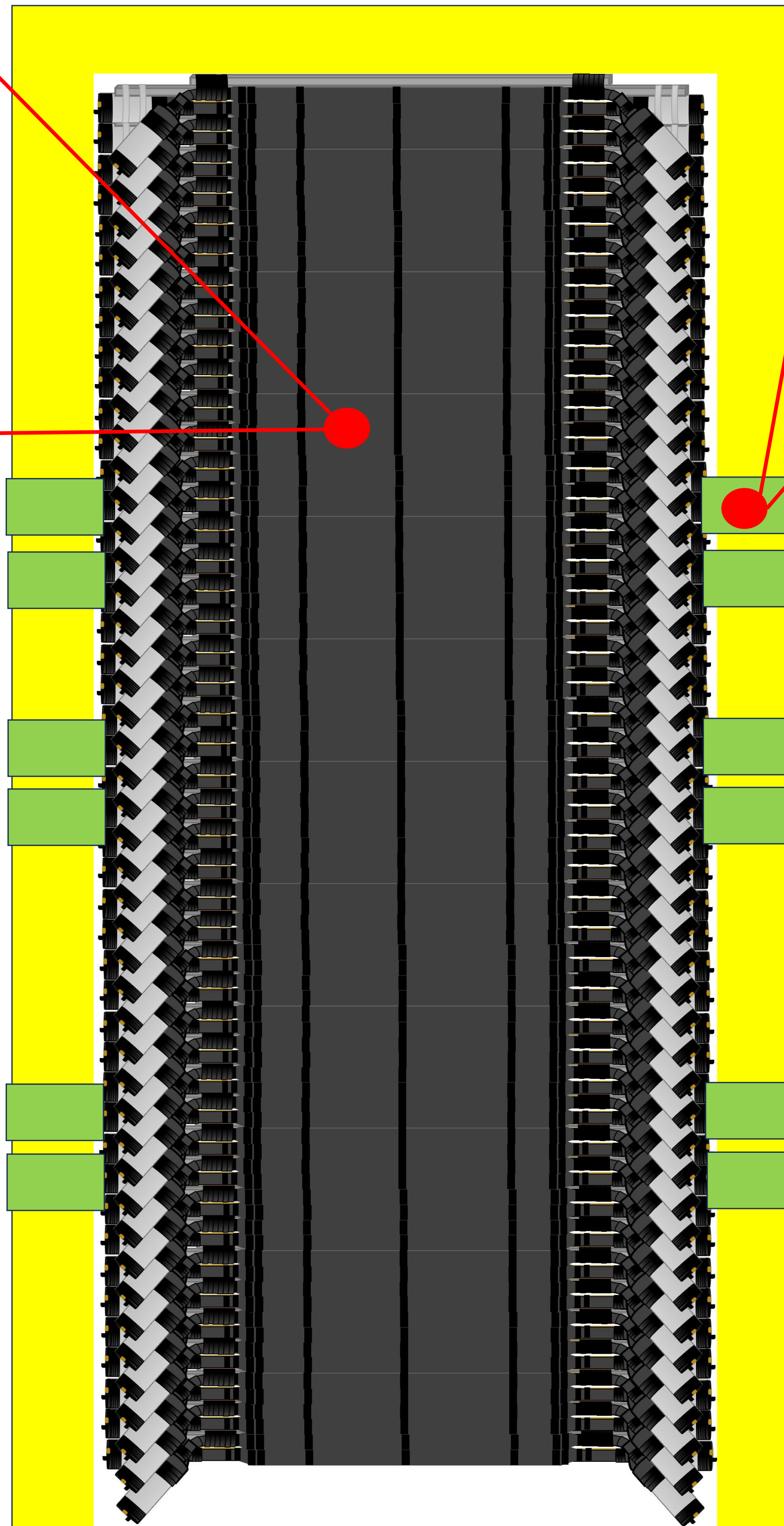# BIGBITE TIMING HODOSCOPE

The BigBite Timing Hodoscope (TH) is used for precision time stamping of scattered electrons. TH is made of 90 scintillator bars stacked to form a plane. Bars connect to light guides on each side. Light guides connect to two single-anode PMTs on either end.

Each PMT connects to a NINO amplifier-discriminator card channel, which outputs logic (TDC) and analogue (ADC) signals. TDC and ADC are used to calibrate and analyze detector performance. A time over threshold (TOT) variable is also calculated for analysis.
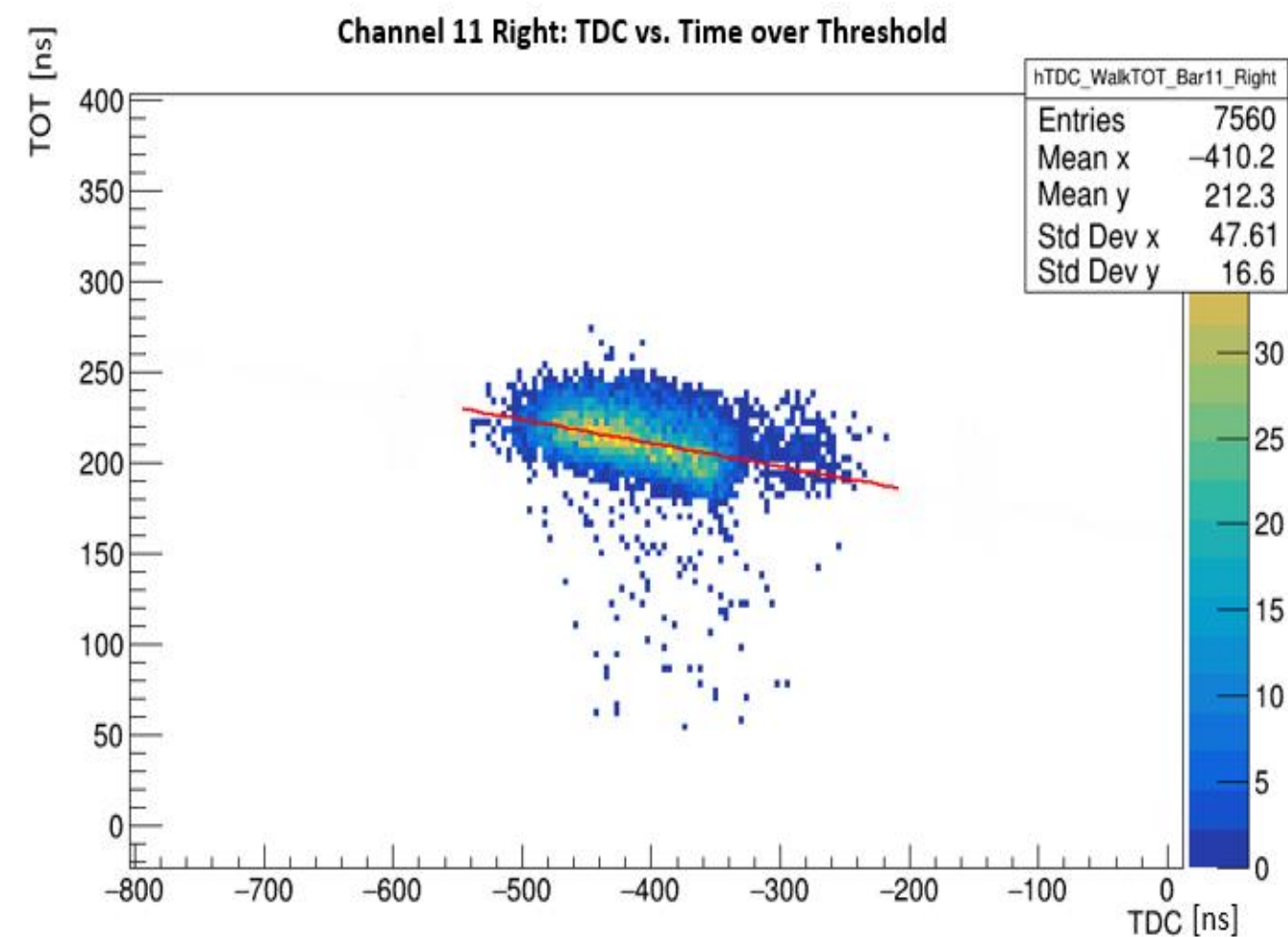
Calibrations for the TH include time alignment, time-walk, time-zero offset, and scintillator speed-of-light. Plotting TDC versus TOT (left) allows for fit parameters to correct for the time-walk effect caused by PMTs.

Timing and TOT cuts are applied to the TDC data along with cuts on energy ratio and hit positions from calorimeters to ensure only elastic electrons for physics analysis. After cuts, analysis of detector rates, accidentals ratios, energy deposit, track matching efficiency (right), and position resolutions (below) is averaged over each bar in the TH.
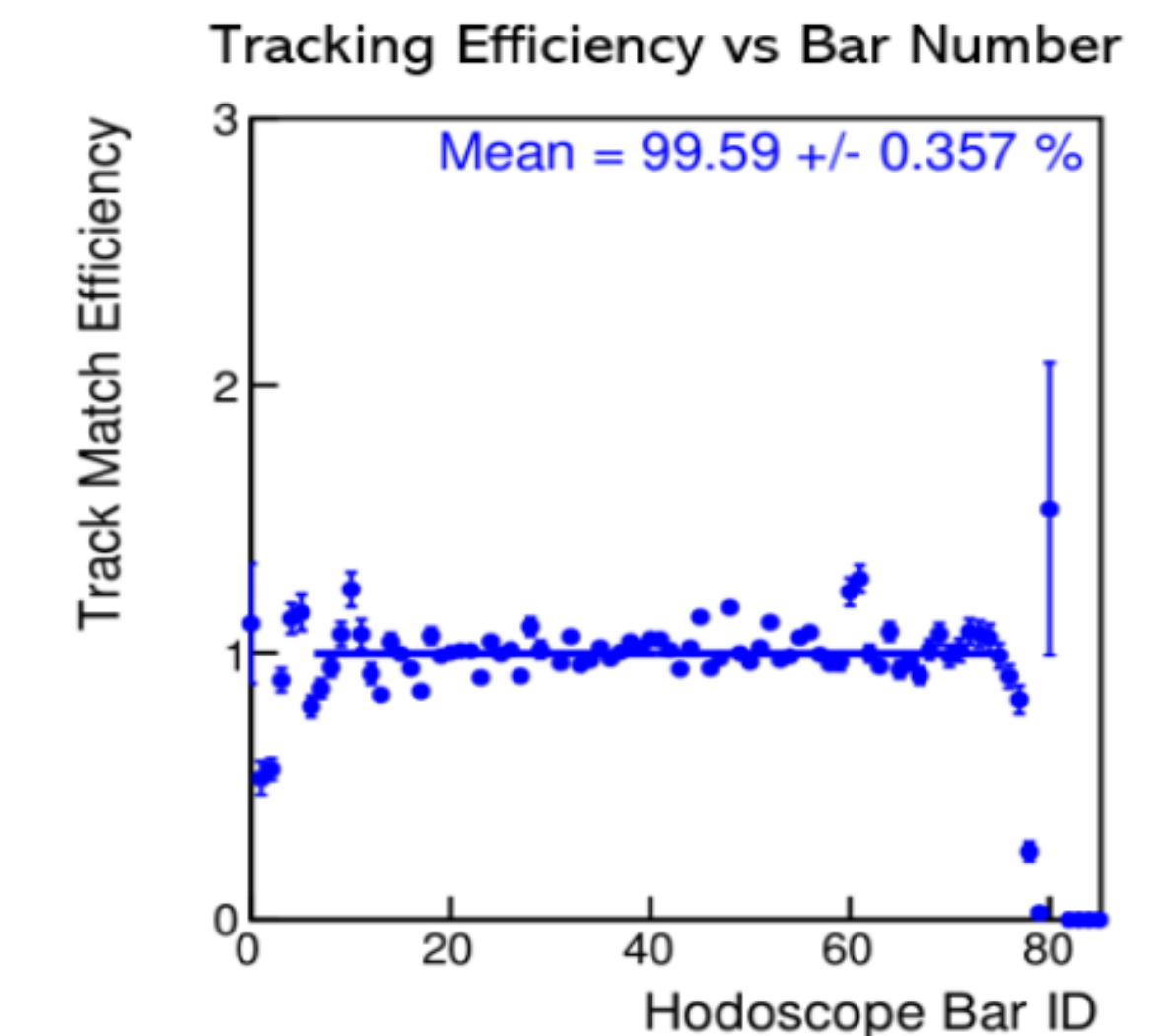
The performance analysis procedure is repeated for each form factor experiment kinematic setting relevant to the Hall A Super BigBite physics program. TH time resolution was degraded relative to intrinsic resolution, which requires further study, and was largely influenced by TH being placed behind a lead glass pre-show detector.

Channel 11 Right: TDC vs. Time over Threshold

hTDC_WalkTOT_Bar11_Right	
Entries	7560
Mean x	-410.2
Mean y	212.3
Std Dev x	47.61
Std Dev y	16.6

Time Resolution vs Bar Number
Mean = 458.5 +/- 1.120 ps

Tracking Efficiency vs Bar Number
Mean = 99.59 +/- 0.357 %

X and Y Position Resolutions vs Bar Number
Mean = 1.58 +/- 0.002 cm
Mean = 3.60 +/- 0.006 cm