The yields were defined as

$$Y_{\rm scl} = \frac{N_{\rm scl}}{Q_{\rm tot}}, \tag{5.18}$$

$$Y_{\rm no.trk} = \frac{N_{\rm acc}}{Q_{\rm tot} \cdot \epsilon_{\rm cpuLT}}, \tag{5.19}$$

$$Y_{\rm trk} = \frac{N_{\rm acc}}{Q_{\rm tot} \cdot \epsilon_{\rm cpuLT} \cdot \epsilon_{\rm htrk}}, \tag{5.20}$$

where Eq. 5.18 is the yield calculated from the total number of HMS pre-trigger scaler counts normalized by the total charge, Eq. 5.19 defines the charge normalized yield (using accepted HMS triggers) corrected for computer live time but does not use tracking information in the event selection criteria, and Eq. 5.20 defines a charge normalized yield that uses tracking information in the event selection criteria and is therefore also corrected for the tracking efficiency. The associated histograms used to determine the counts for each of these yield calculations are shown below.

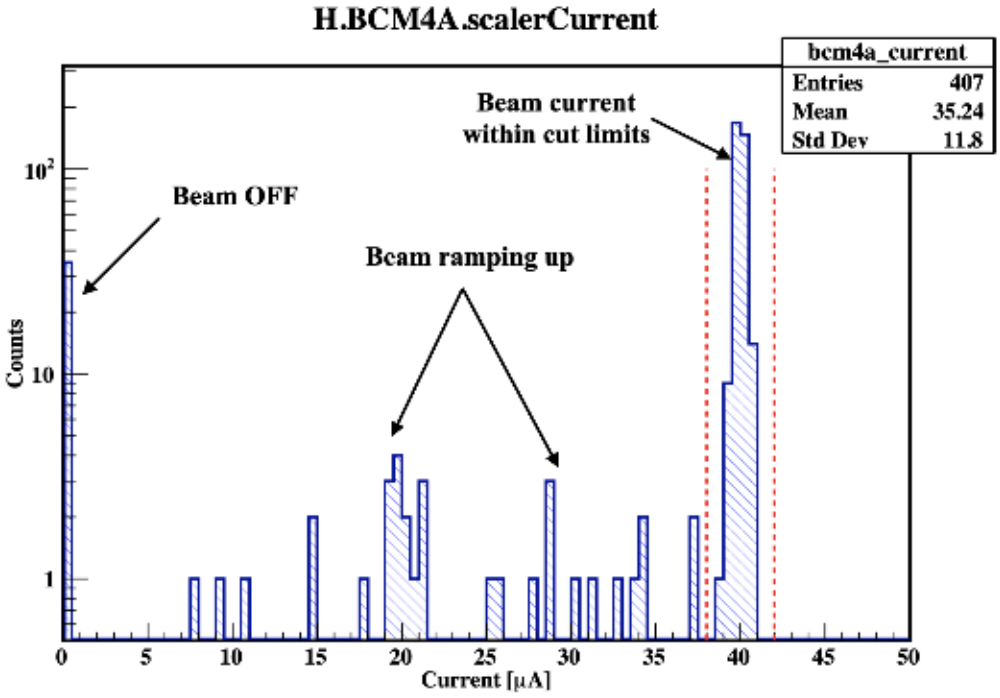

Figure 5.6: Example of a BCM scaler current cut used to determine the yield.

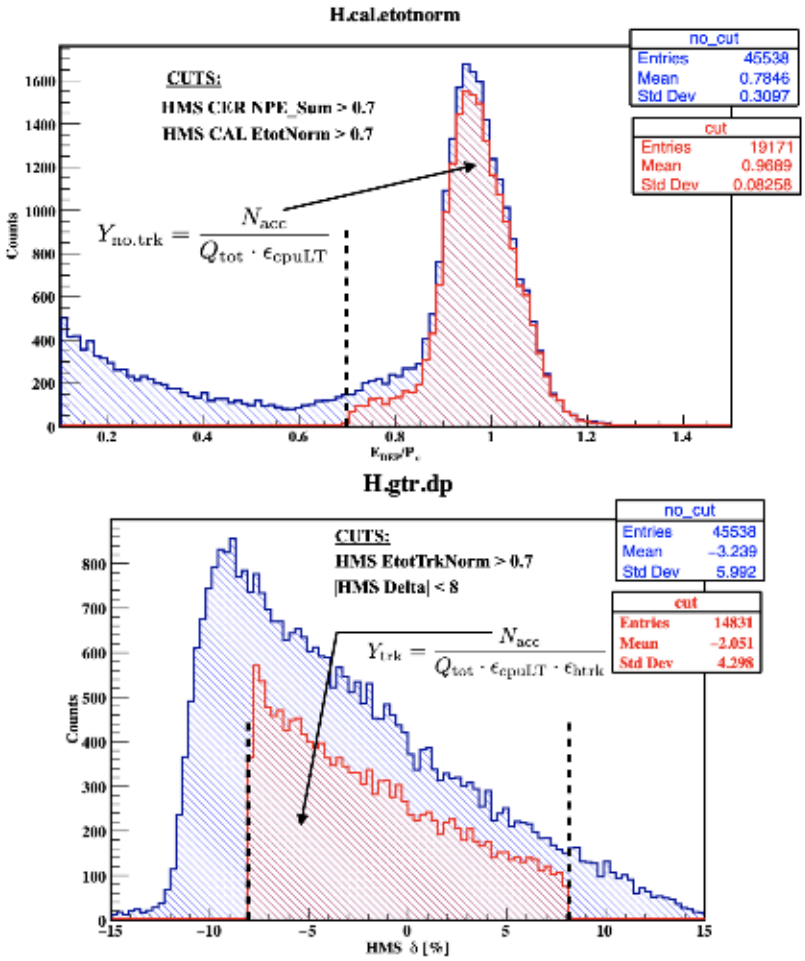

Figure 5.7: Example of the histograms used to determine the non-tracking (top) and tracking (bottom) yields. Top: x-axis shows the total deposited energy in the calorimeter normalized by the central spectrometer momentum, $E_{\rm DEP}/P_{\rm c}$. Bottom: x-axis shows the HMS momentum acceptance, δ, in percent.

Figure 5.8 shows the charge normalized yields using BCM4A (red) and BCM4B (black) beam current cuts in the event selection process. This study was done to check the behavior of both BCMs at very high currents. As can be seen from the normalized yields using the LH_2 and LD_2 targets, above $\sim$ 75 μA, the BCM4A yield is significantly lower than the BCM4B yield indicating that BCM4A begins to saturate above this current (see Ref. 159).

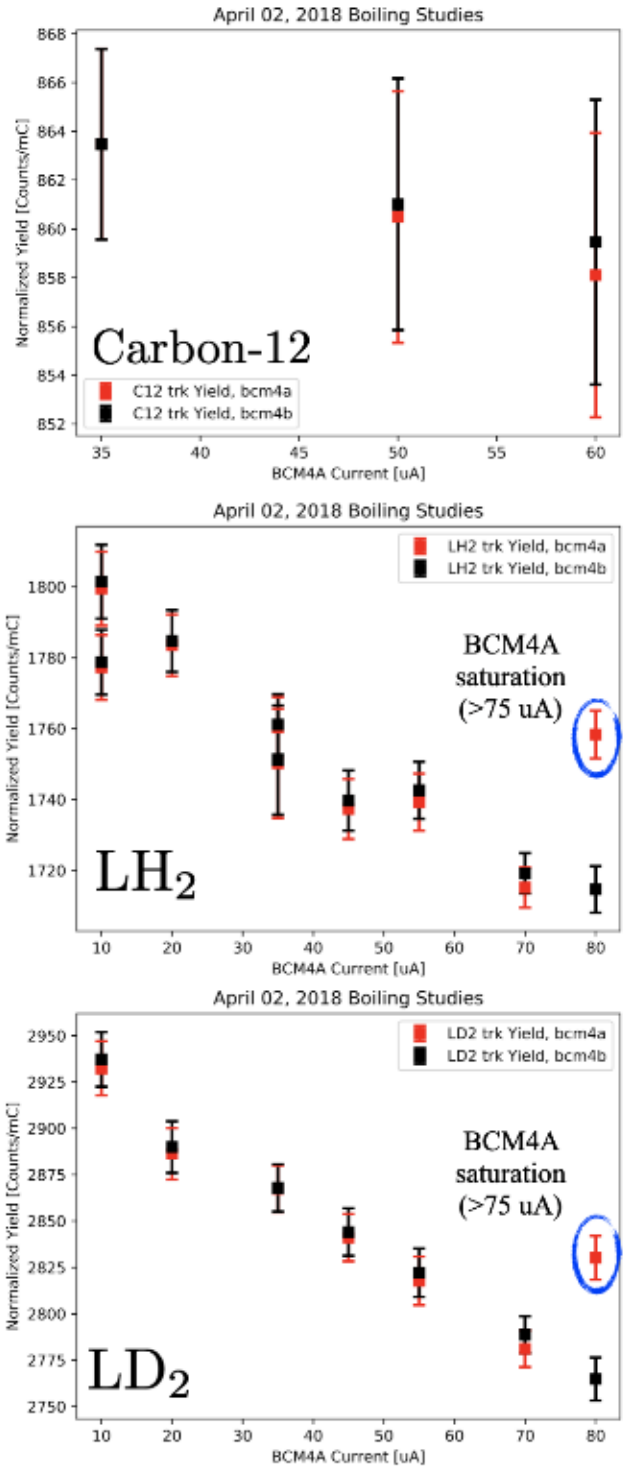

Figure 5.8: Normalized tracking yields using BCM4A (red) and BCM4B (black) beam current cuts on carbon-12 (top), LH_2 (middle) and LD_2 (bottom) targets.