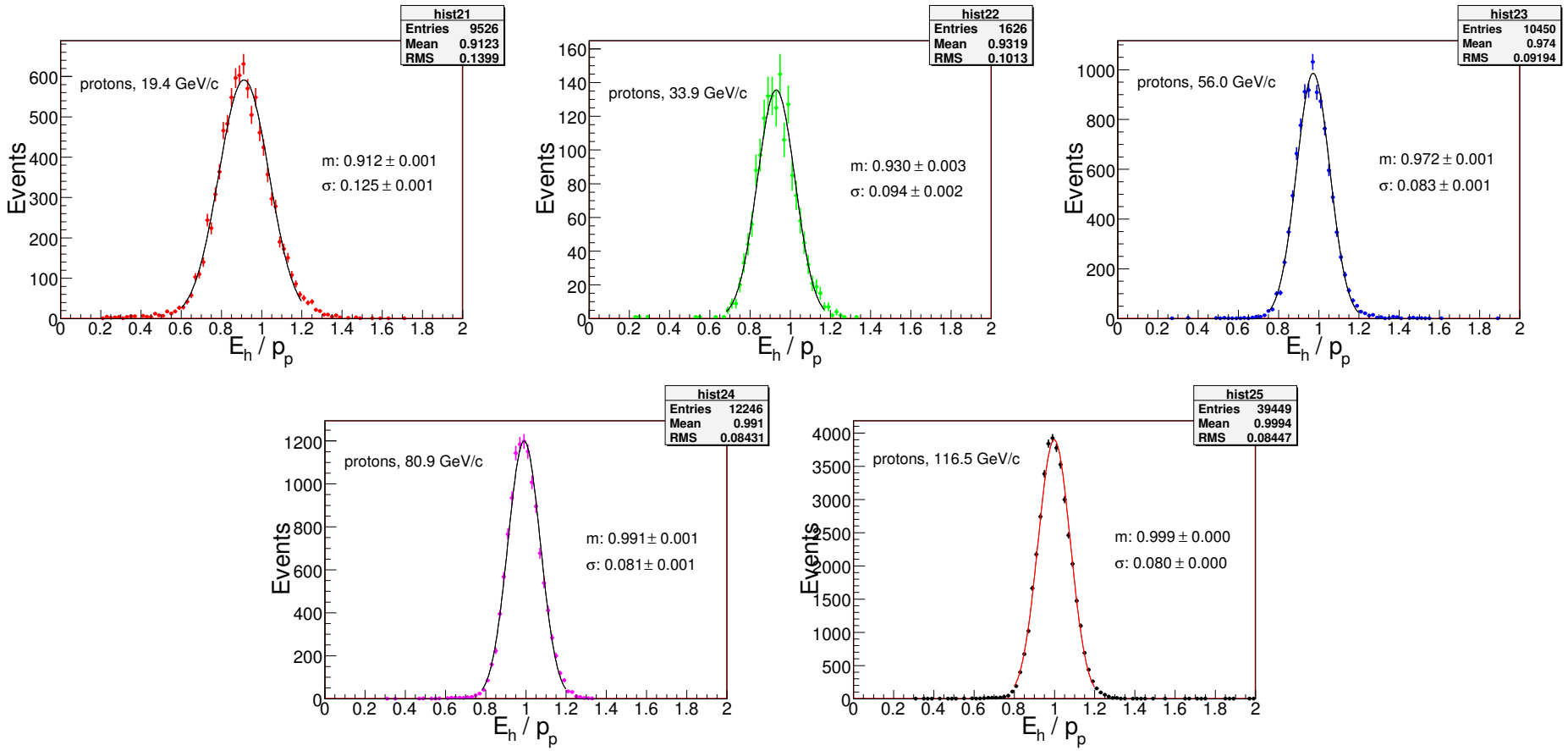
University of Michigan

MIPP

Monte Carlo Neutron Update

- refit HCAL resolution
- redo neutron momentum smearing
- redo N_n / N_p ratio
- trigger studies

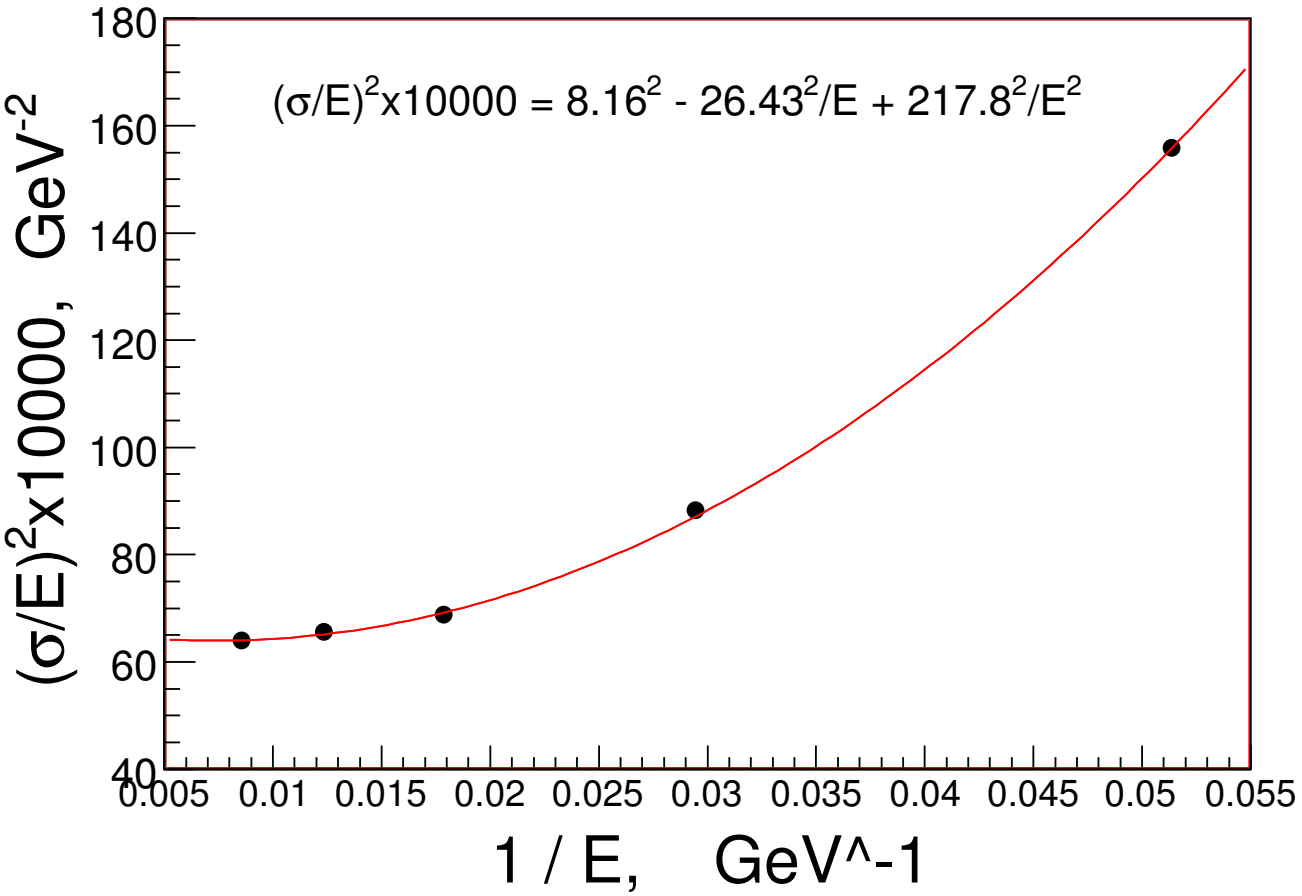
E_h / p_p



E_h / p_p ratio distributions for 20, 35, 58, 84 and 120 GeV/c protons.

Note: E-p distribution appeared to be flat.

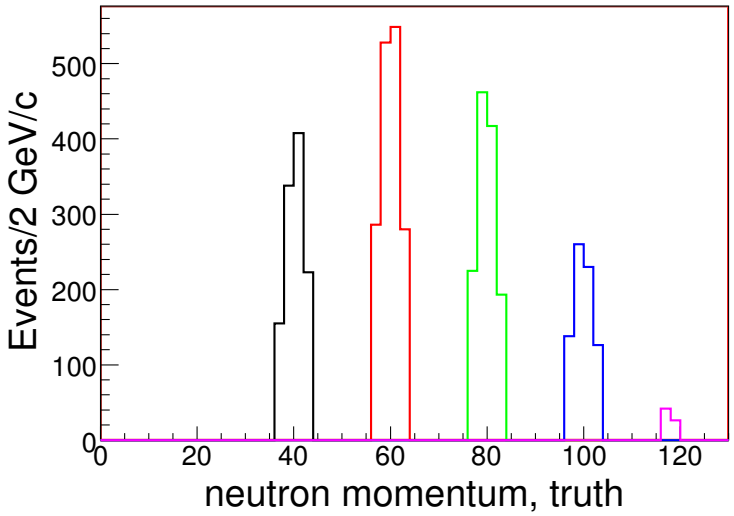
HCAL energy resolution

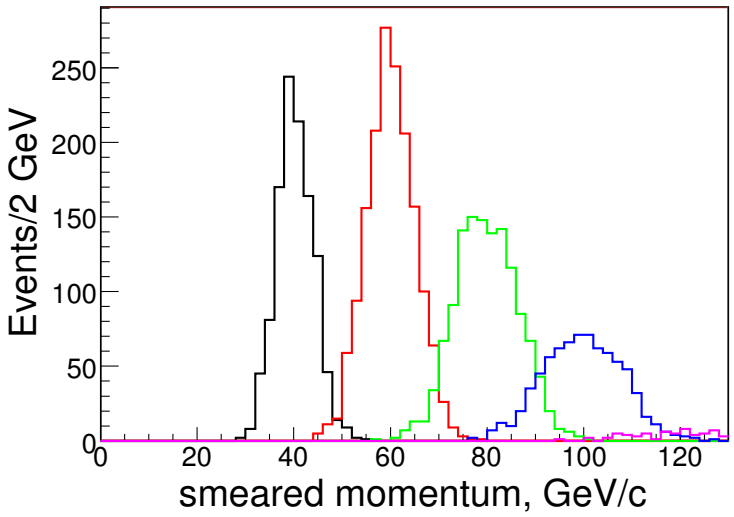


The HCAL energy resolution: $(\sigma/E)^2$ vs 1/E dependence.

Each data point comes from fit of the E_h / p_p distributions.

redo smearing





$(\sigma/E)^2 \times 10000 = 8.16^2 - 26.43^2/E + 217.8^2/E^2$

$\sigma_E = E_n * (\sigma/E) / 100$

$\sigma_n = \sqrt{\sigma_E^2 - m_n^2}$

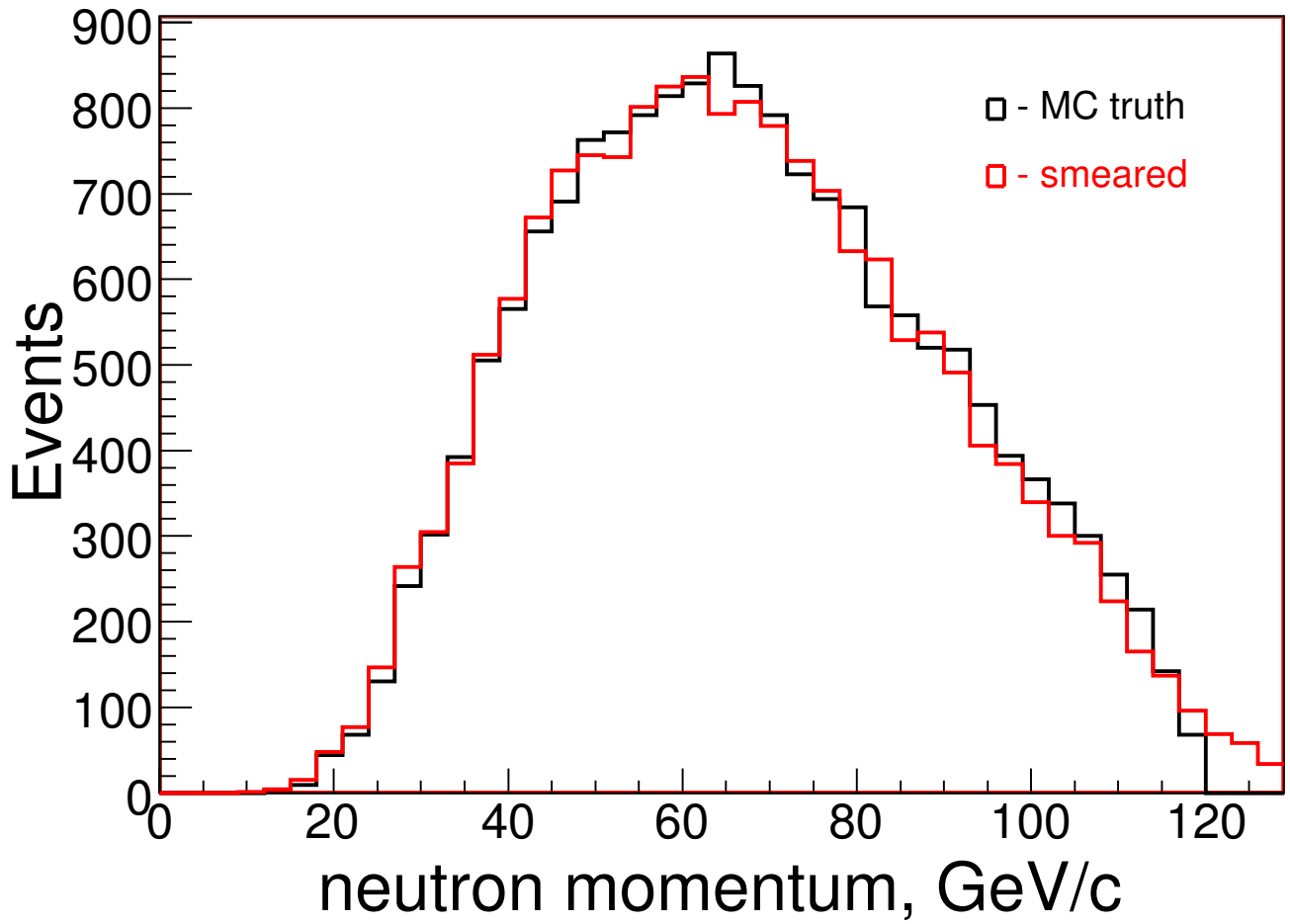
Δp_i = gRandom$\rightarrow$Gaus(0, σ_n),

Finally: $p_{smear} = p_{n,truth} + \Delta p_i$

Top plot illustrates the events with selected momentum (truth) within $\pm$3 GeV.

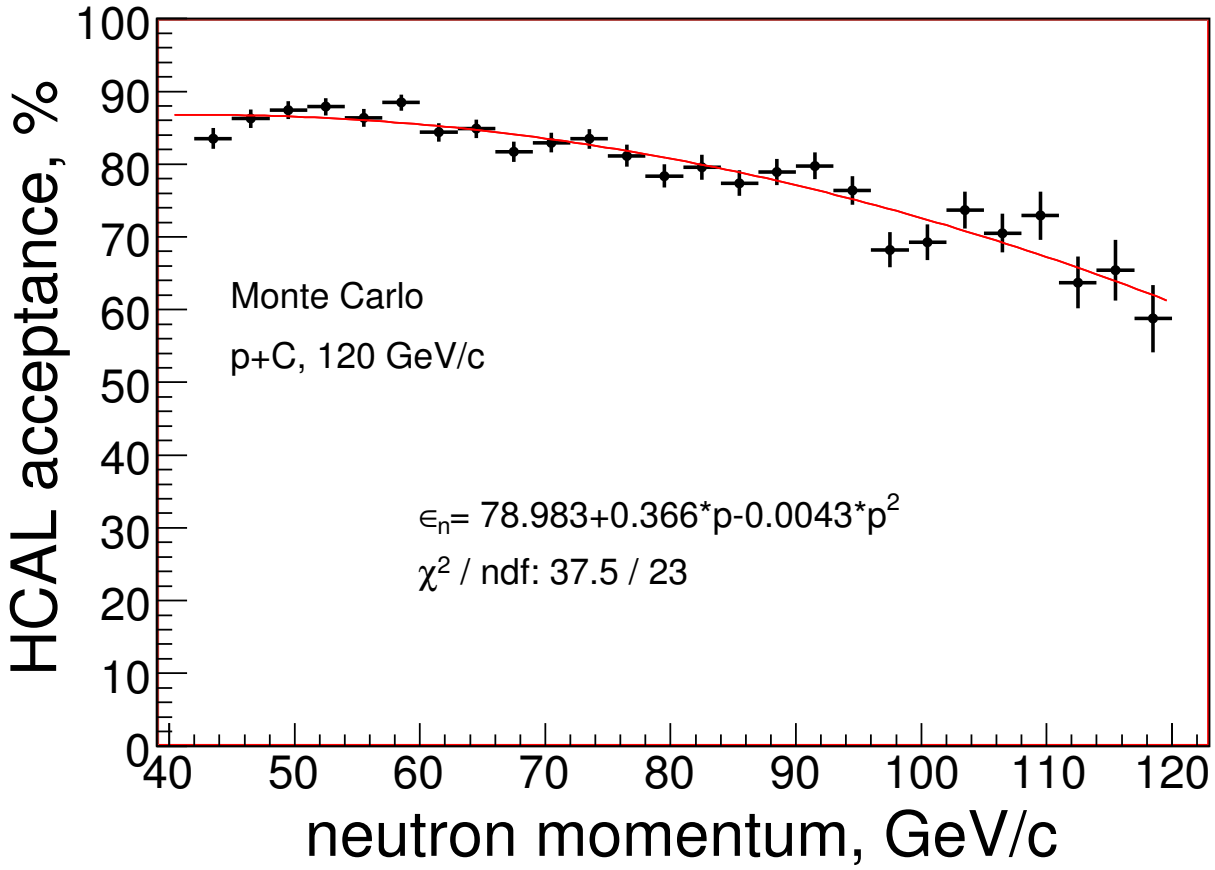
Bottom plot illustrates what happens after smearing applied.

Monte Carlo: truth spectrum vs smeared



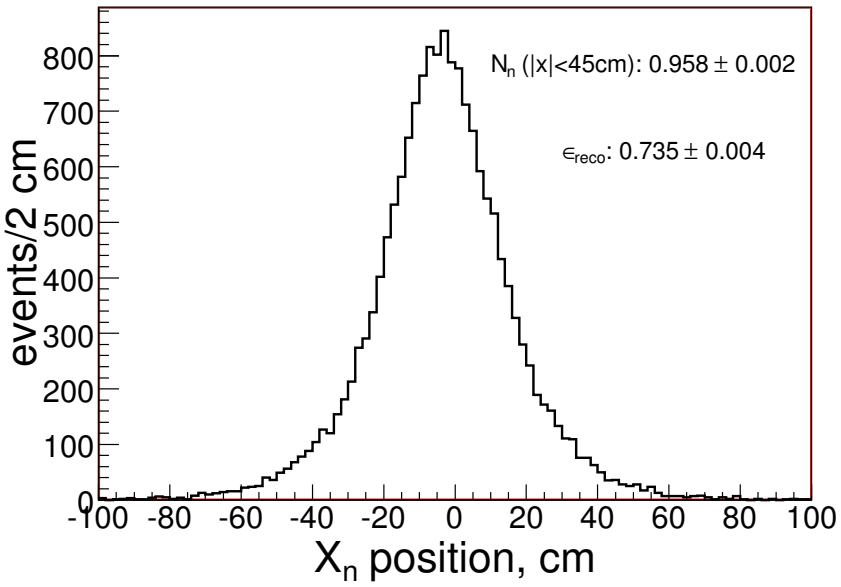
Black plot - Fluka neutron production spectrum, red plot - smearing applied.

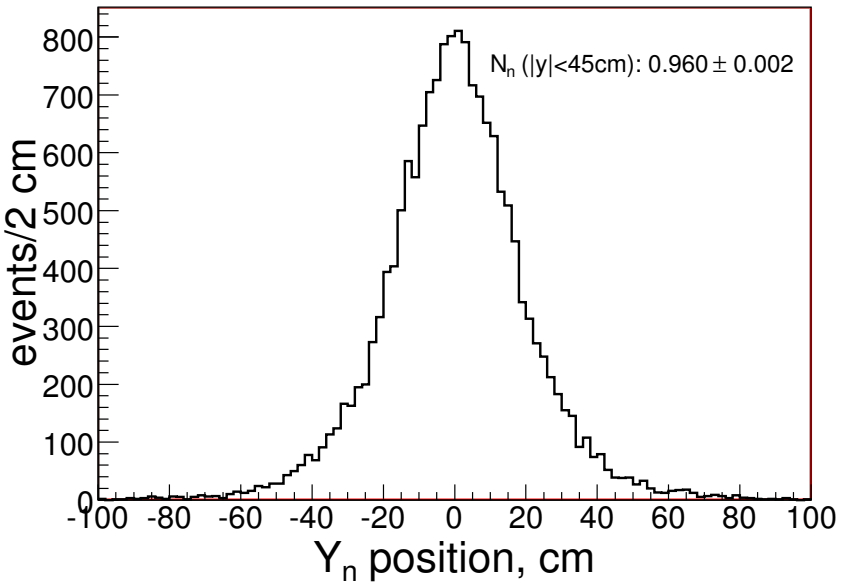
redo neutron efficiency, ϵ_n



Updated neutron reconstruction efficiency vs momentum.

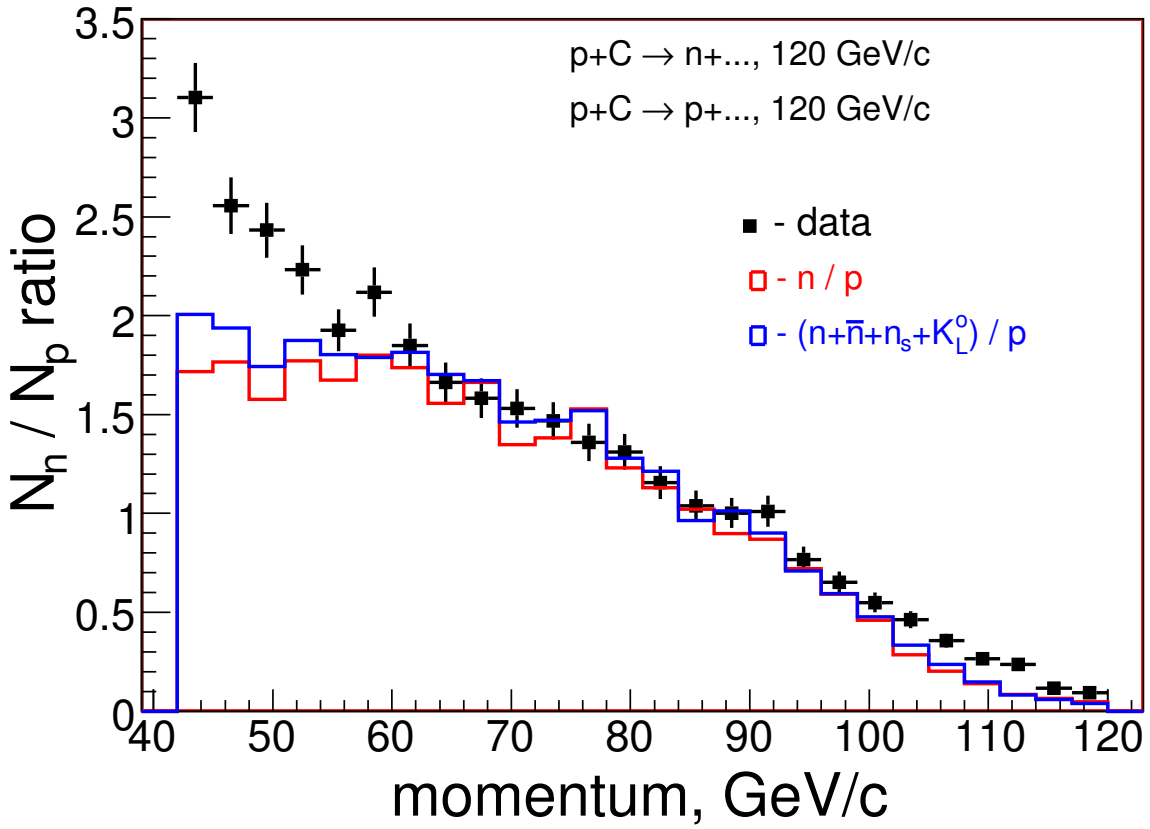
neutron X and Y positions





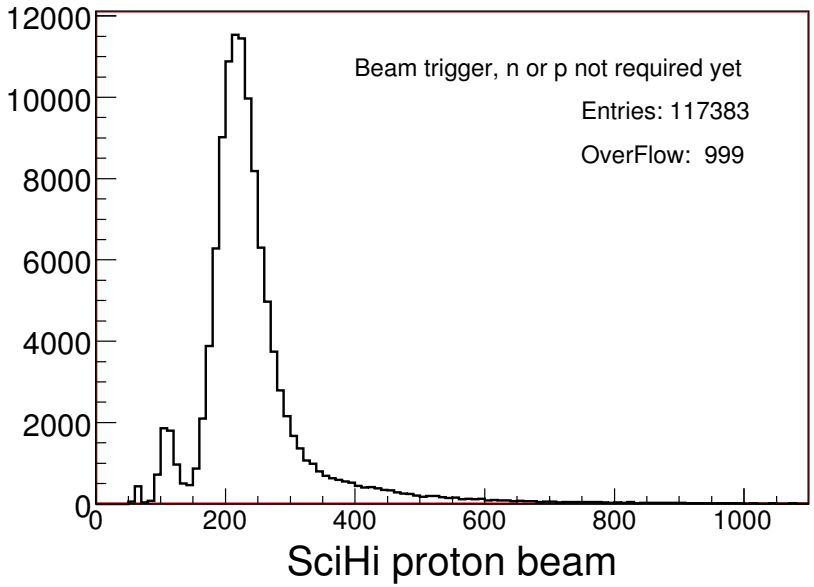
The inclusive neutron X (on left) and Y (on right) positions at Z_{HCAL}. MC HCAL acceptance is 0.96^2. An average neutron reconstruction efficiency appeared to be 0.735 ± 0.004. I wish to find what cause this difference.

N_n / N_p ratio, SciHi triggers

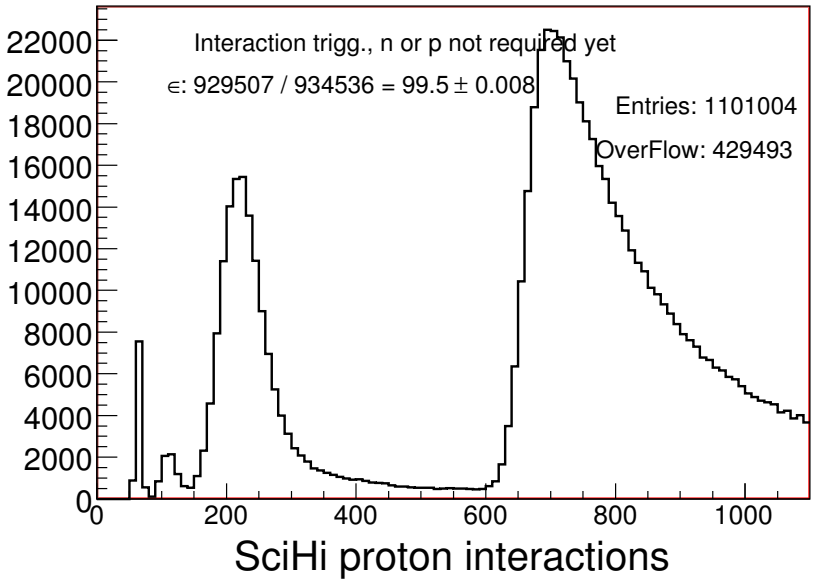


N_n / N_p ratio for inclusive neutrons and protons. Red plot - Fluka n/p ratio prediction. Blue plot - Monte Carlo (Fluka + Geant) (n + $\bar{n}$ + n_s + K_L^o) / p prediction.

beam and interaction triggers



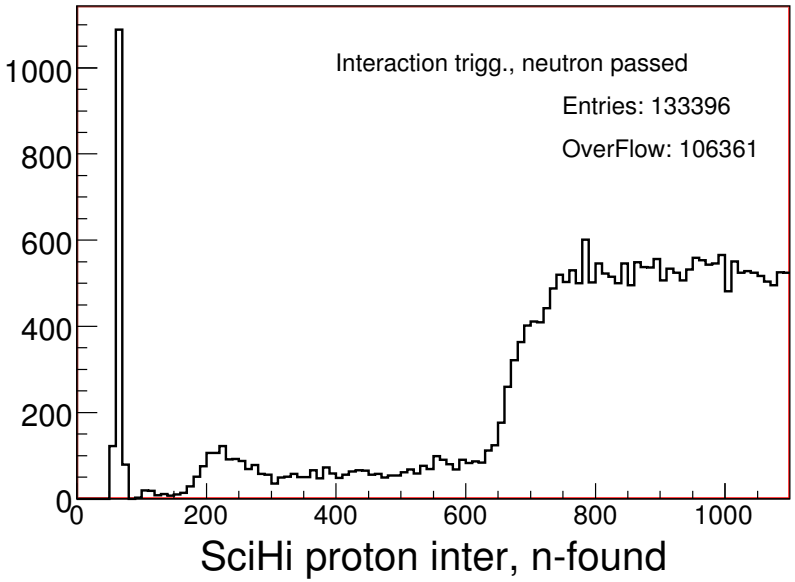
SciHi proton beam



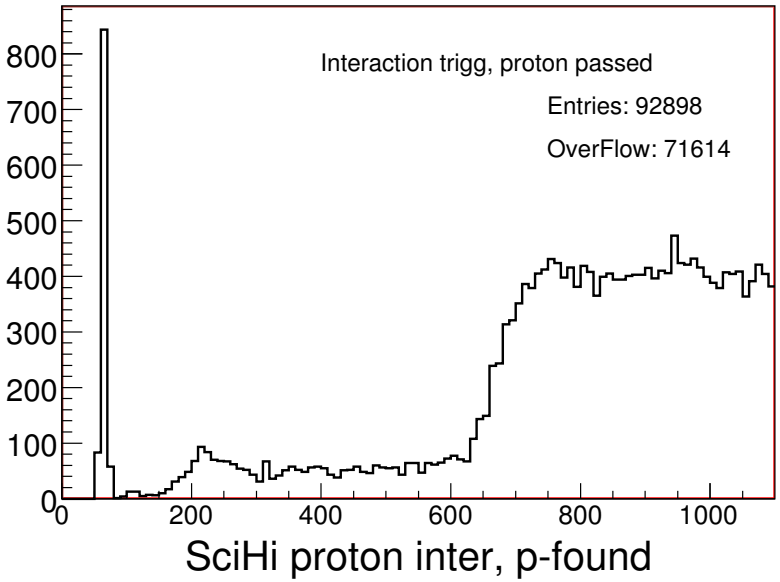
SciHi proton interactions

The trigger scintillator ADC distributions for the proton beam (left) and proton interactions (on right). The inclusive neutron or proton not required yet.. The peak at 200 counts is MIP, data above ADC$>$650 illustrates where the interactions start-up.

interaction triggers only



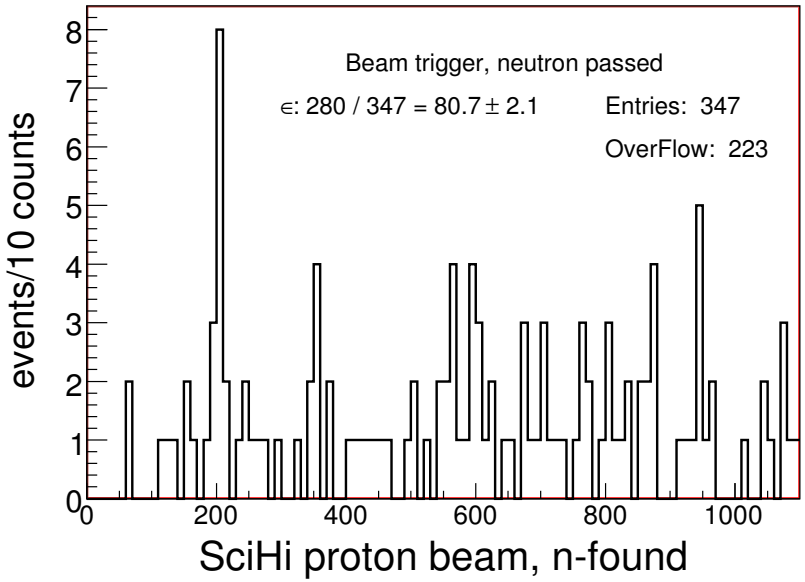
SciHi proton inter, n-found

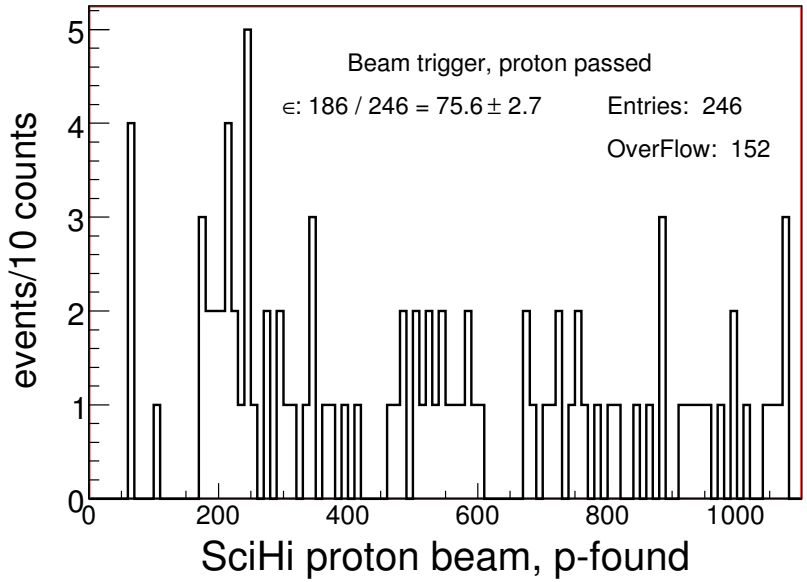


SciHi proton inter, p-found

The trigger scintillator ADC distributions for the inclusive neutrons (left) and protons (right) using the proton interaction triggers only. These samples are completely bias to the triggers. ADC$>$650 is about 3*MIP.

beam triggers only





The trigger scintillator ADC distributions for the inclusive neutrons (left) and protons (right) using the proton beam triggers only. These are the minimal trigger bias samples. It can be used to estimate the trigger efficiencies: ϵ_{trig} = N(sciADC>650) / N_{all}