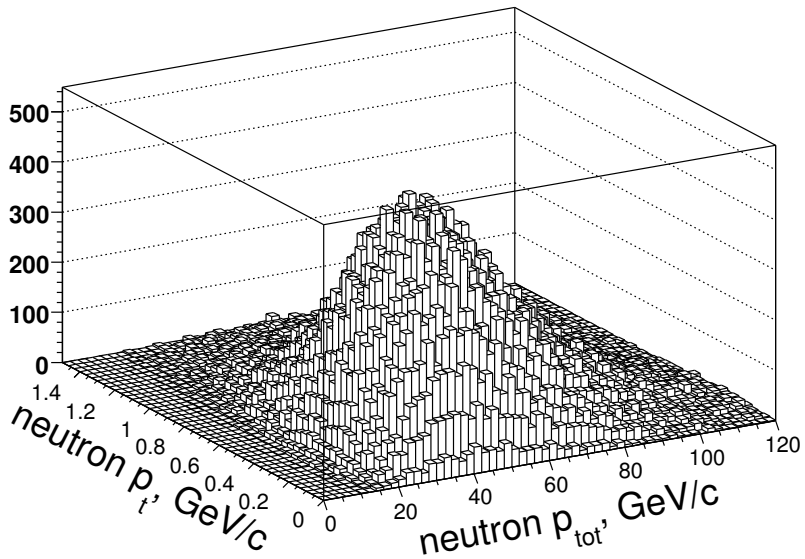
Fluka Neutrons and Protons

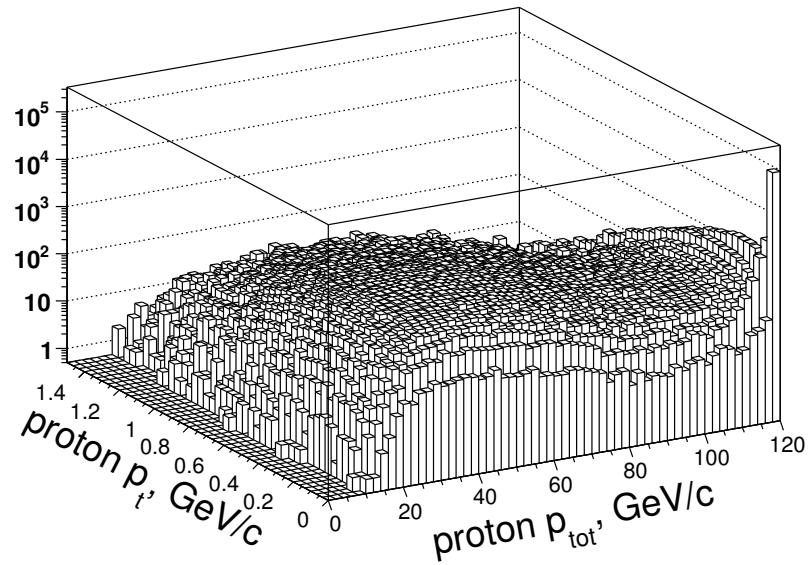
What is a pure Fluka prediction?

- p_t vs p_{tot} dependence
- N_n / N_p ratio
- fraction of neutrons in HCAL fiducial

Requirement: n or p should be a leading particle in an event

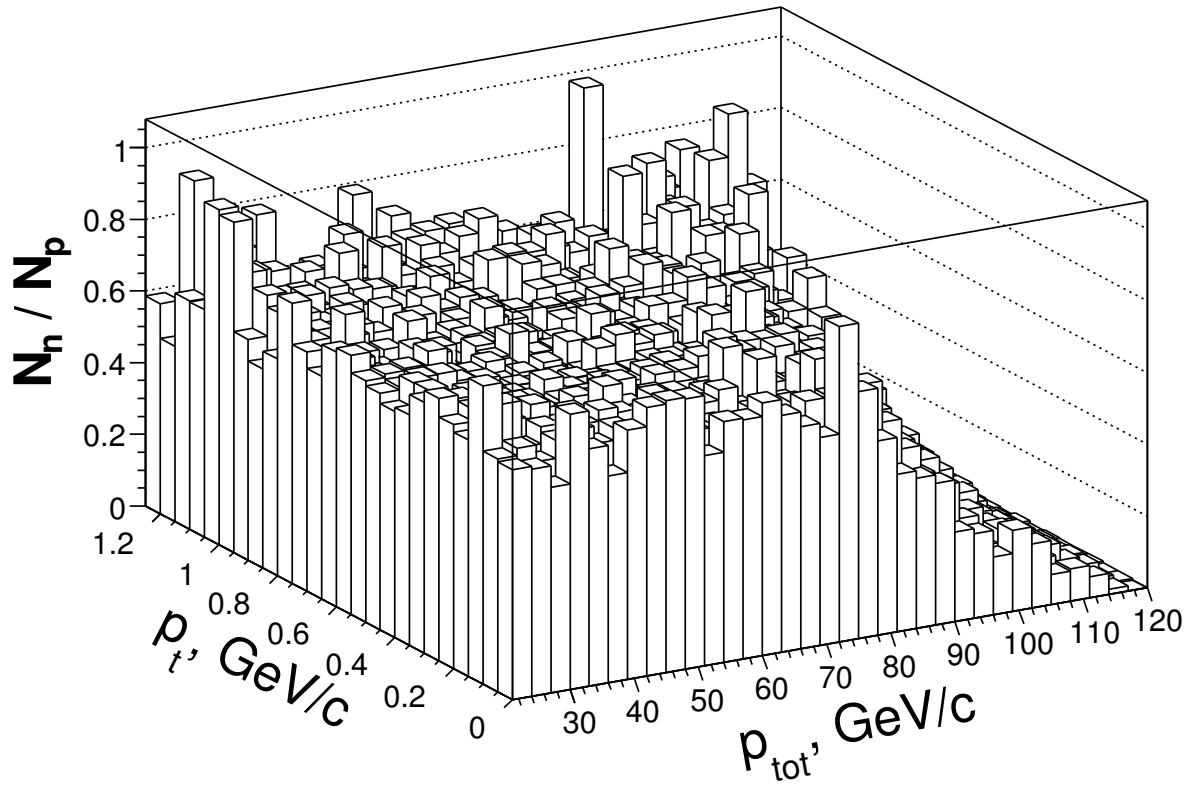
p_t vs p_{tot} dependence





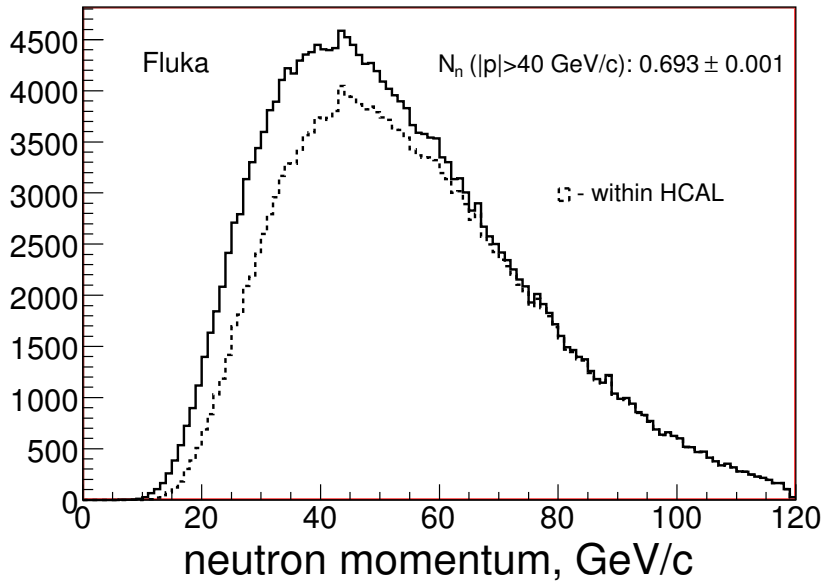
The p_t vs p_{tot} dependence for neutrons (on left) and protons (on right). One can see that the production spectra's for neutrons and protons are quite different. Neutron has a peak at $p_t \approx 0.7$ GeV/c and $p_{tot} \approx 50$ GeV/c, while proton dominated at $p_t \approx 0$ and $p_{tot}=p_{beam}$. Proton peak comes from the diffraction dissociation process. Both particles have a relatively low p_t values, which suggests that they have a narrow cone around of the beam line.

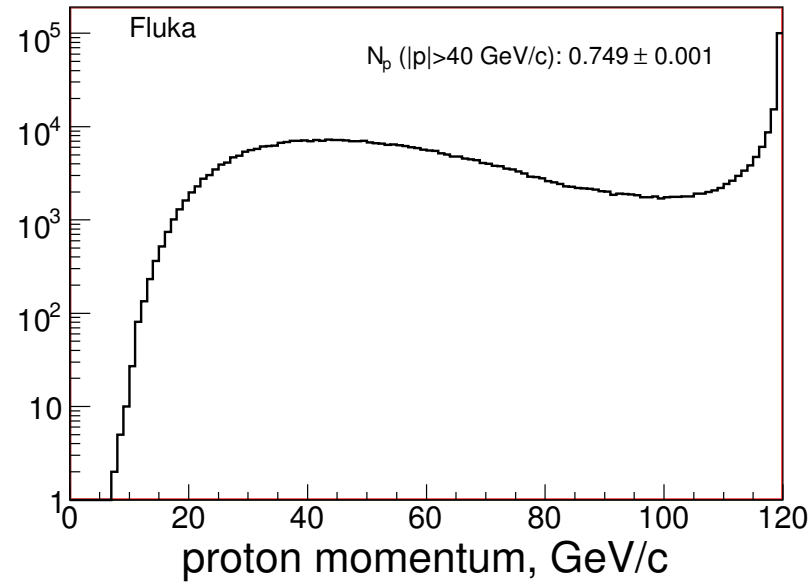
N_n / N_p ratio



Fluka N_n / N_p ratio prediction. One can see that $N_n/N_p \approx 0$ at $p_{tot}=p_{beam}$, rise up to it's maximum at $p_{tot} \approx 0.6 * p_{beam}$ then it has a plateau shape at lower p_{tot} values . The ratio looks uniform vs p_t values.

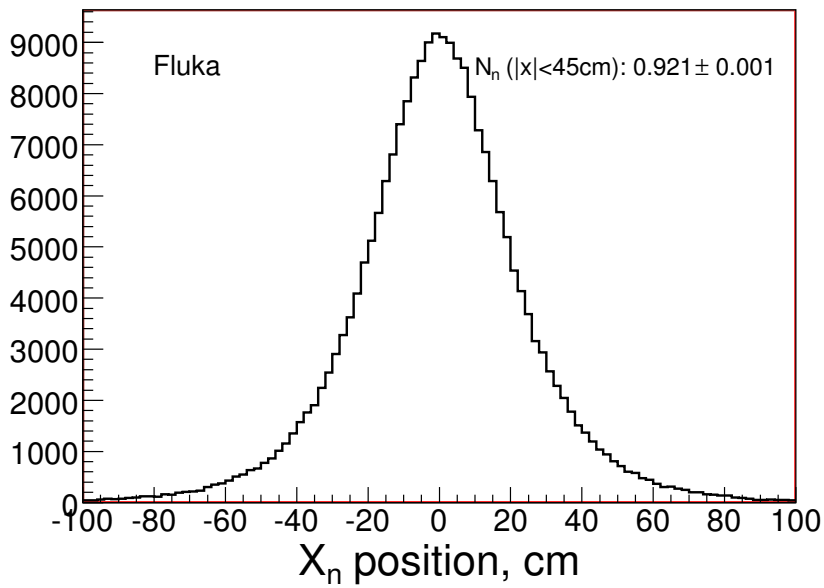
p_{tot}

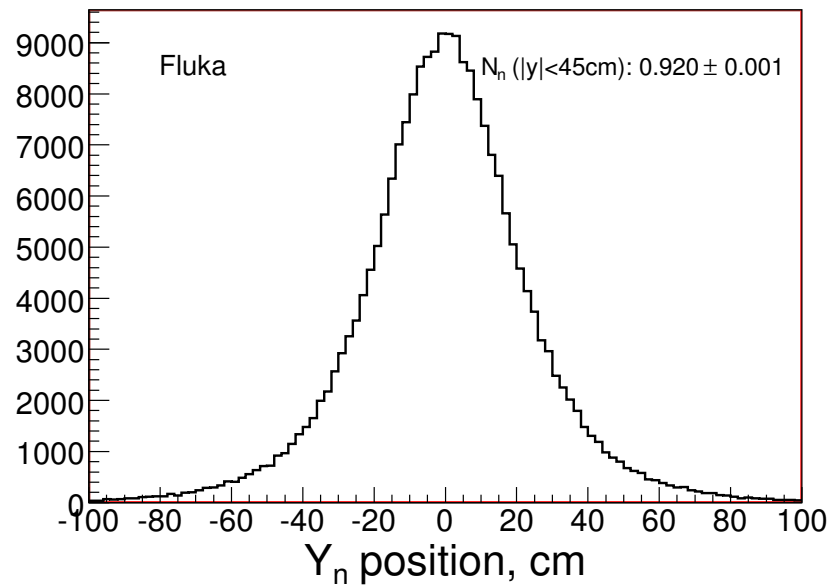




The p_{tot} distributions for neutrons (on left) and protons (on right).

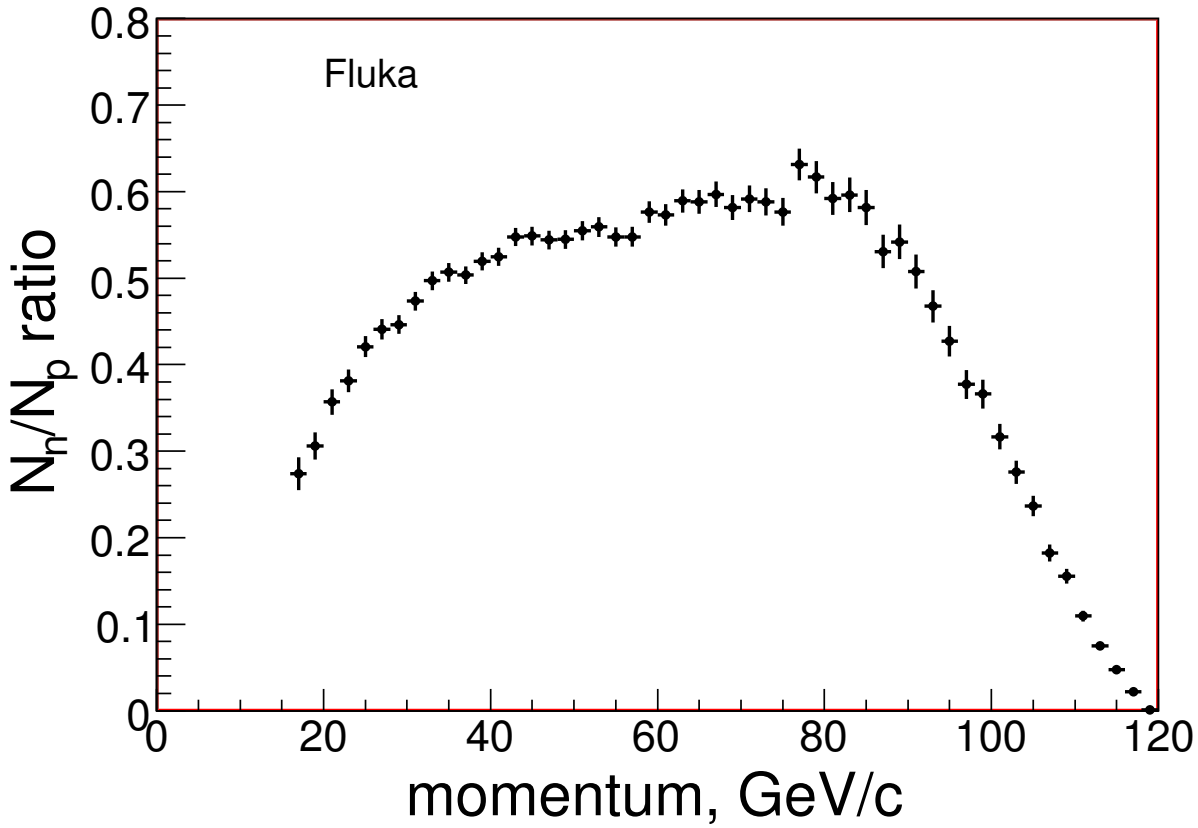
neutron X and Y positions





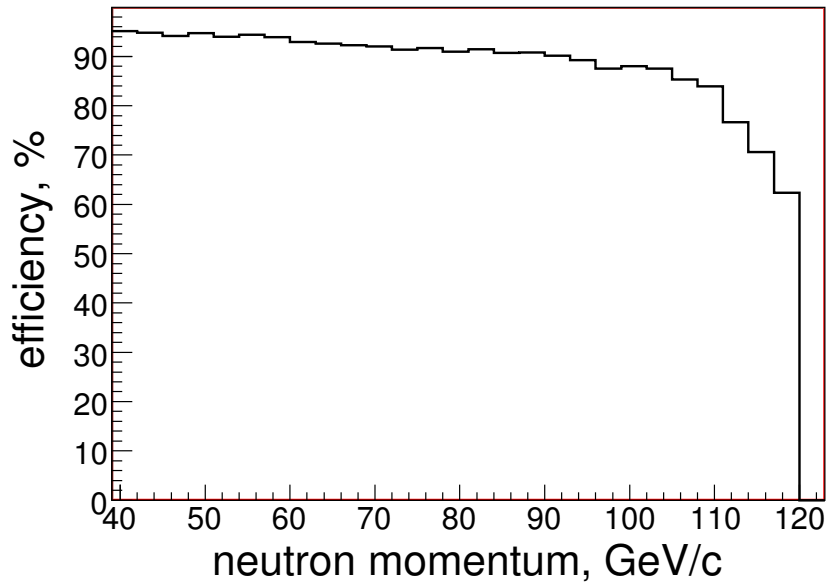
Fluka neutron X (on left) and Y (on right) positions at Z_{HCAL}. Fluka HCAL acceptance is 0.92^2=0.85

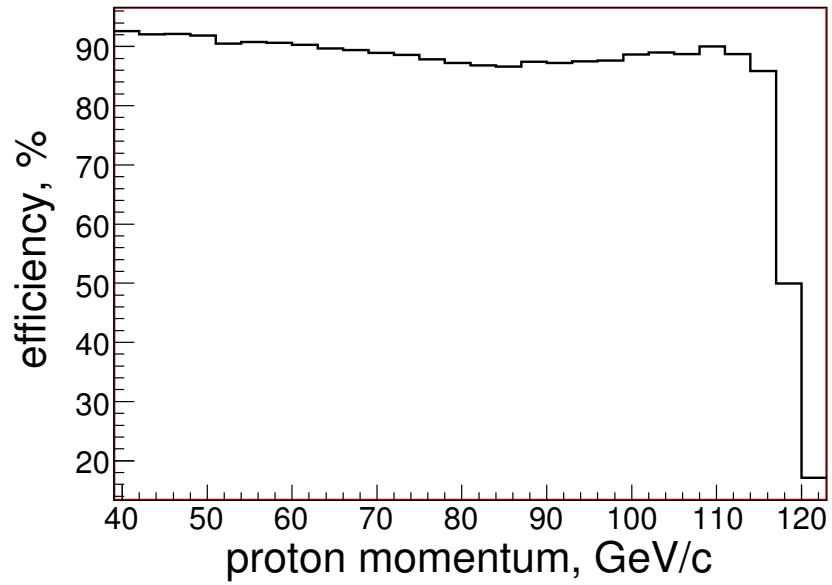
N_n / N_p ratio



Fluka 1D N_n / N_p ratio prediction.

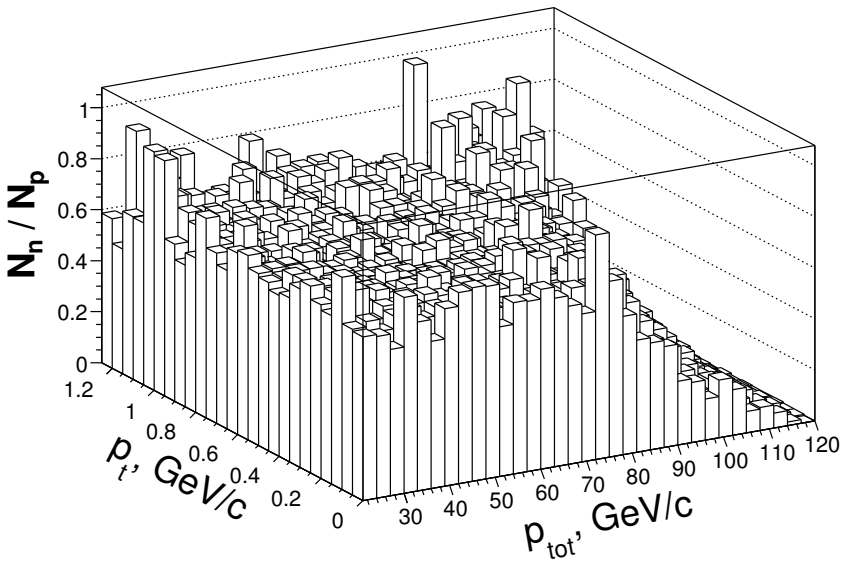
vertex reconstruction efficiency

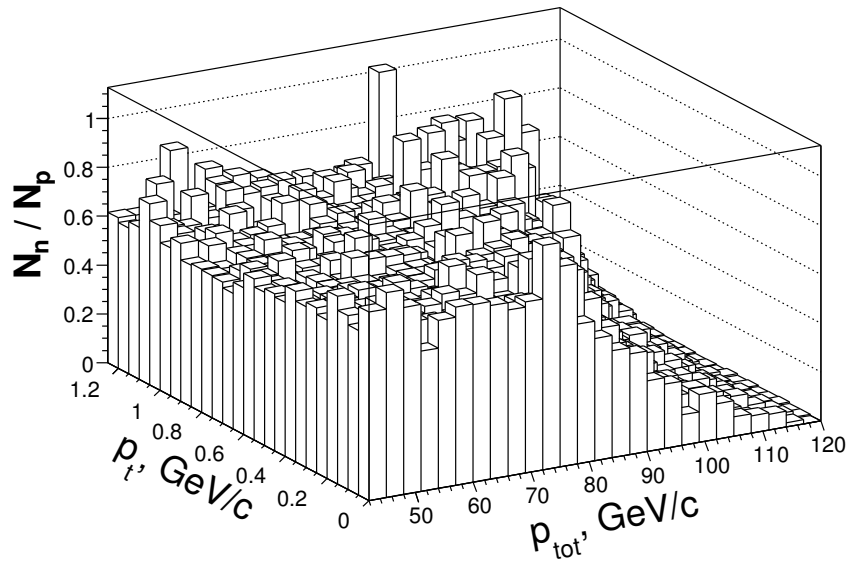




How often the vertex been reconstructed? While ago my answer was: (5.0$\pm$0.3)$\%$ for n and p. I found that the major inefficiency is due to of the number of TPC and track timing cuts. After dropping these cuts the efficiency appeared to be as one can see on above plots. What is a reason for fall at the high momentum? For the high momentum single track vertex the Z-position might be a way off from the target region. It is a vertex reconstruction issue.

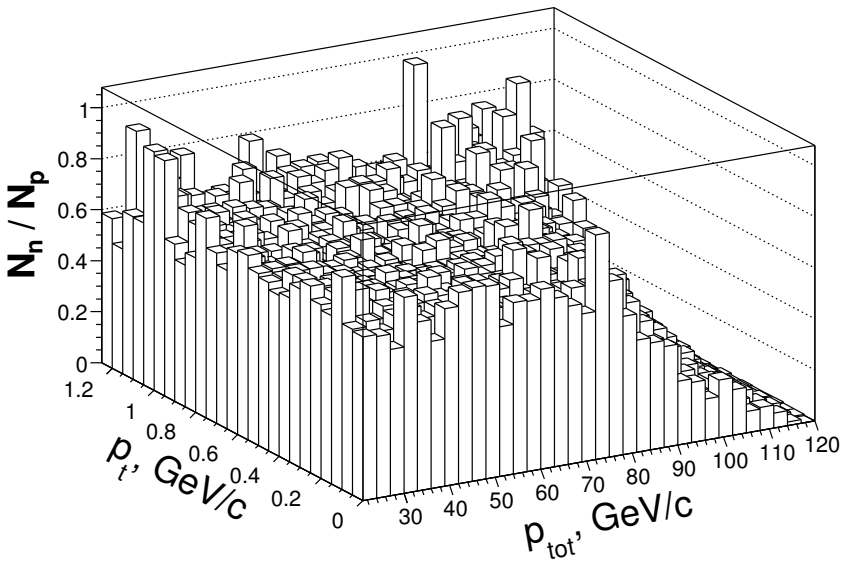
N_n / N_p: before and after vertex requirement

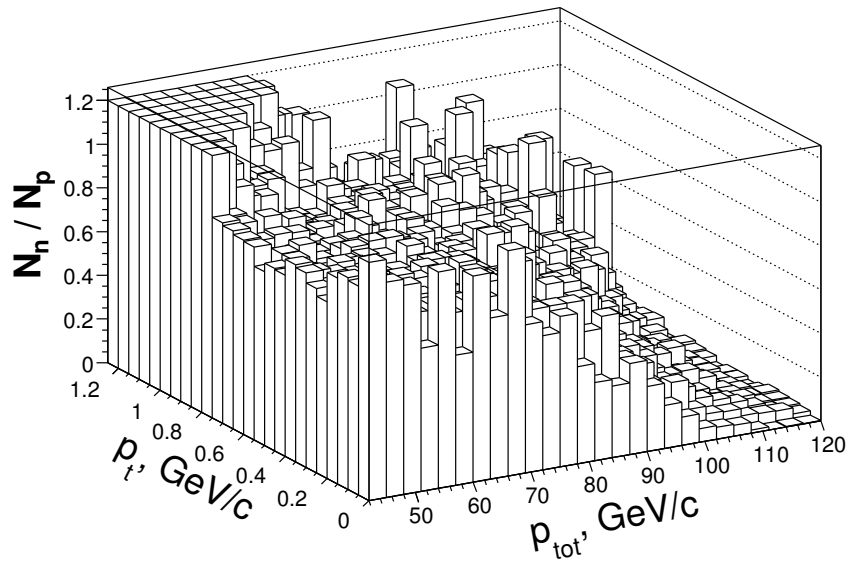




N_n / N_p ratio plots for two cases: before vertexing (on left) and when the vertex has been reconstructed (on right). The p_{tot} binning is different for these plots: on left it started at 21 GeV/c and from 42 GeV/c on right.

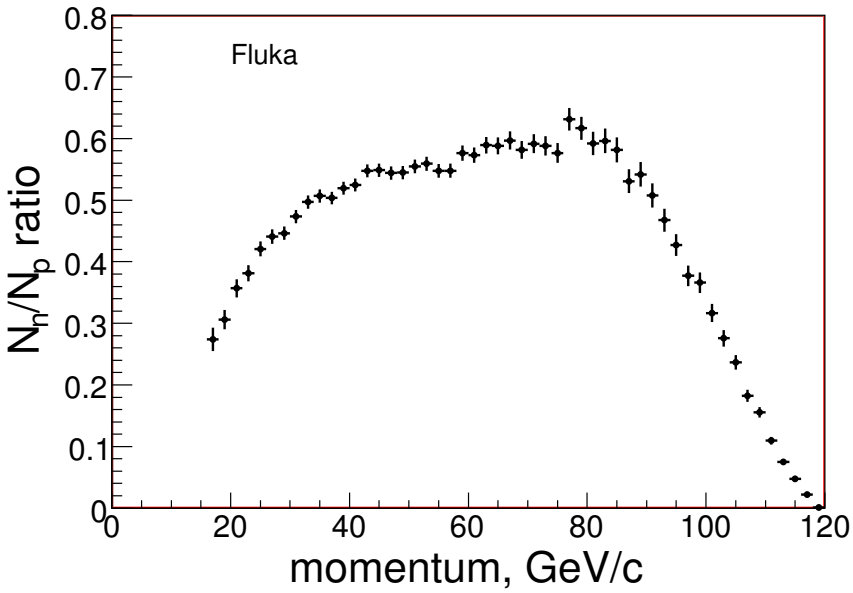
N_n / N_p: before and after reco

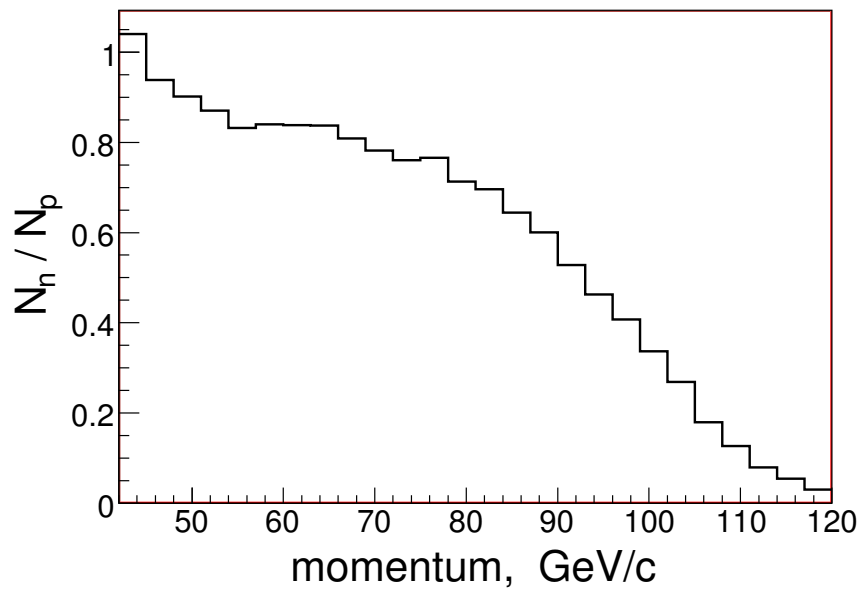




N_n / N_p ratio plots for two cases: before reconstruction (on left) and after (on right). On right plot Z-axis terminated at 1.2 - lack of low statistics in p_t. For right plot the neutron momentum smearing was applied.

N_n / N_p: before and after reco, cont





N_n / N_p ratio plots for two cases: before reconstruction (on left) and after (on right). For right plot the neutron momentum smearing was applied. What left to do: apply efficiency correction.