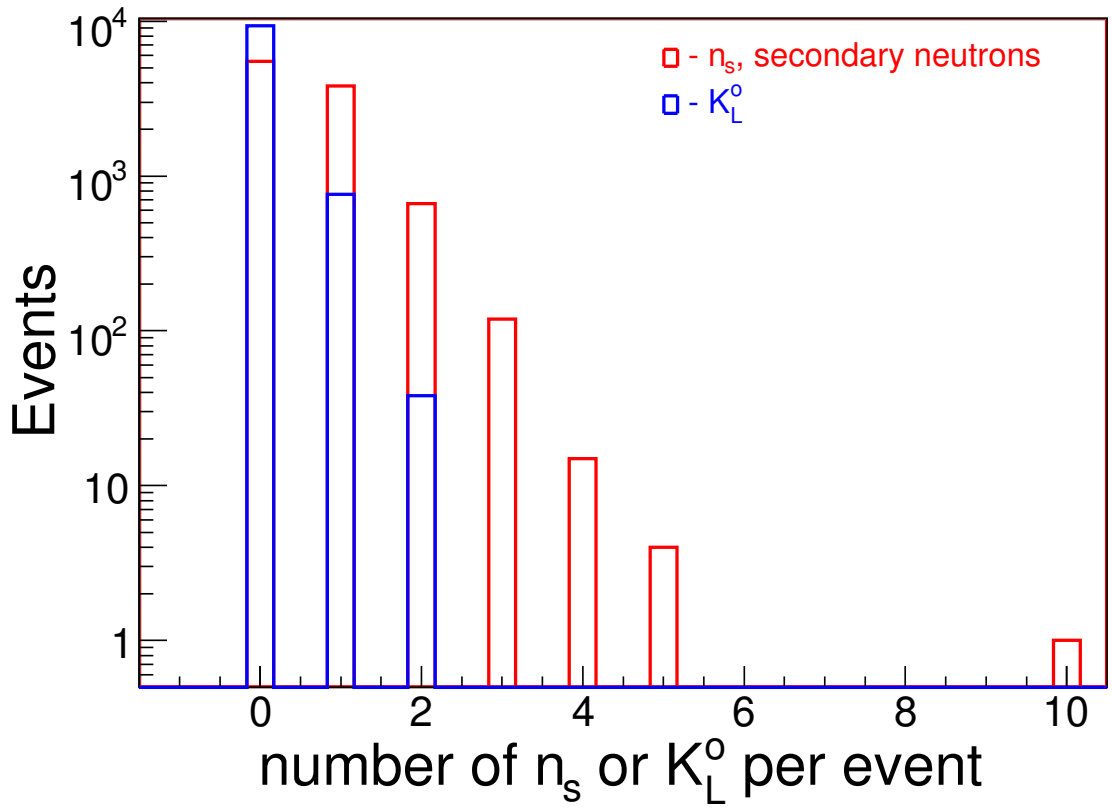
Monte Carlo Neutron Update

MC sample: Andre's pC interactions at 120 GeV

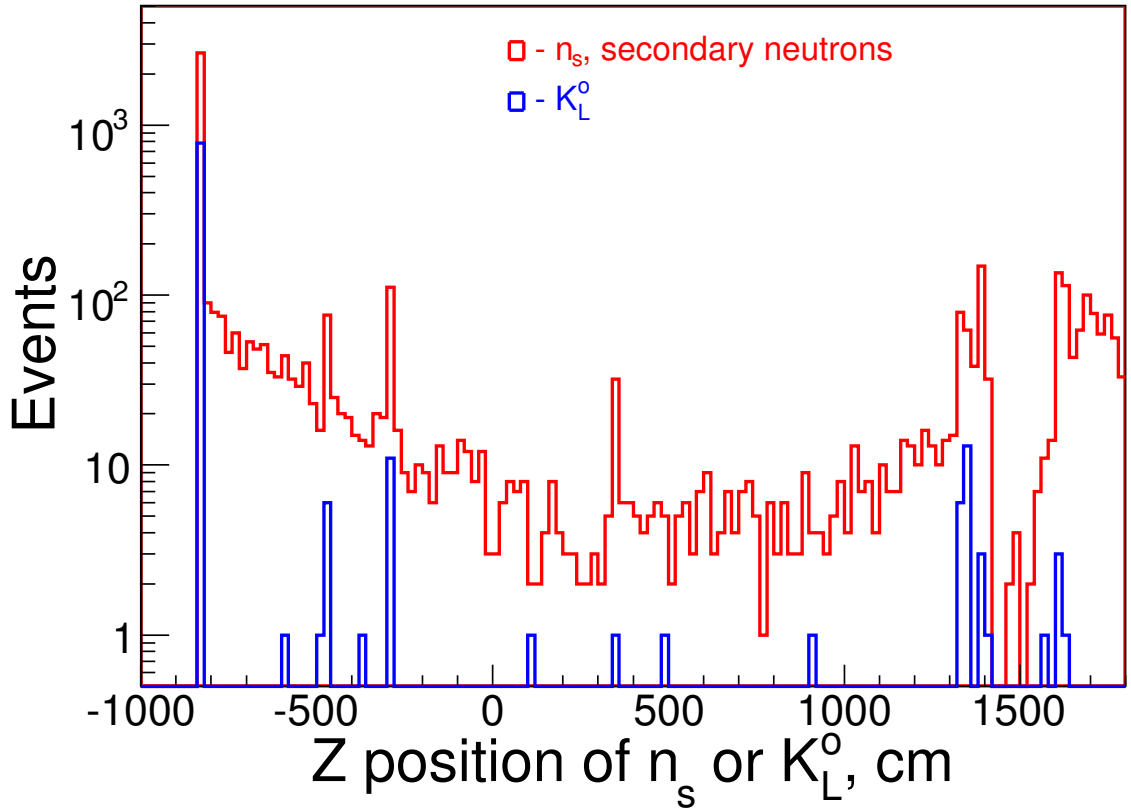
- K_L^o and secondary neutron, n_s, contributions studies
- update HCAL acceptance
- update proton efficiency
- K_L^o + n_s contribution to N_n / N_p ratio

number of n_s and K_L^o in event



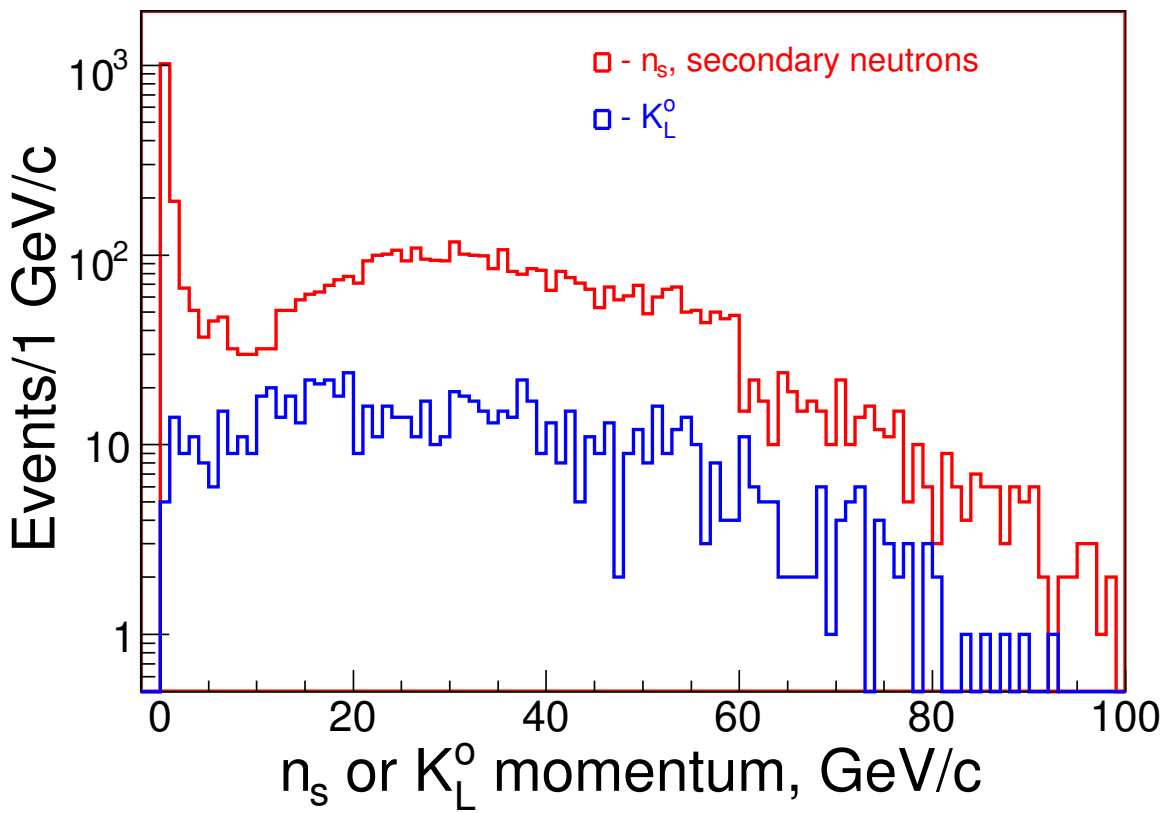
The number of the secondary neutrons, n_s, and K_L^o in Monte Carlo event. They all pointing into the HCAL fiducial and due to of that they might generate a fake neutron signal. Requirement: n_s and K_L^o should not be in event where the leading neutron or proton were found.

Z position of n_s and K_L^o



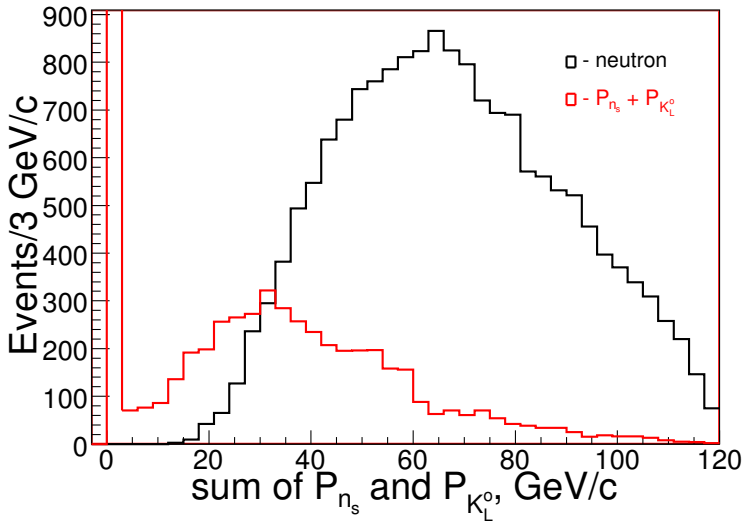
The Z position of n_s and K_L^o in Monte Carlo event. First left spike - target position, second - Ckov, third - ToF wall, at 350 cm - front of RICH, next - RICH downstream wall, EMCAL - at 1612.

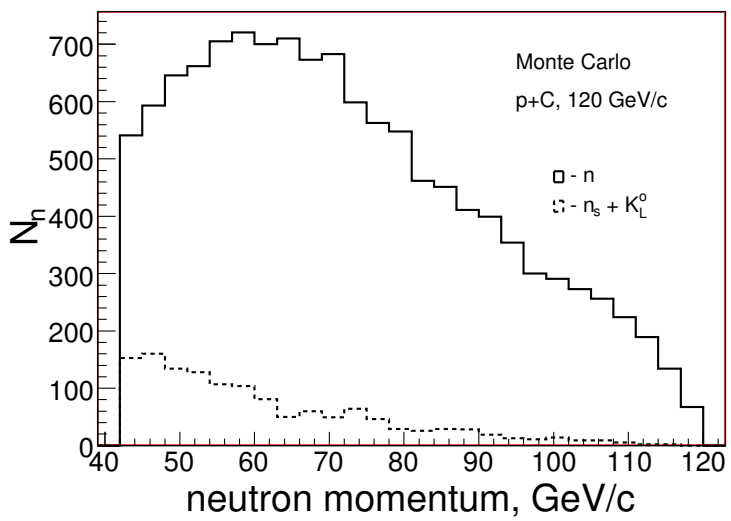
momentum of n_s and K_L^o



The momentum of the n_s, and K_L^o in Monte Carlo event.

sum of n_s and K_L^o momentums

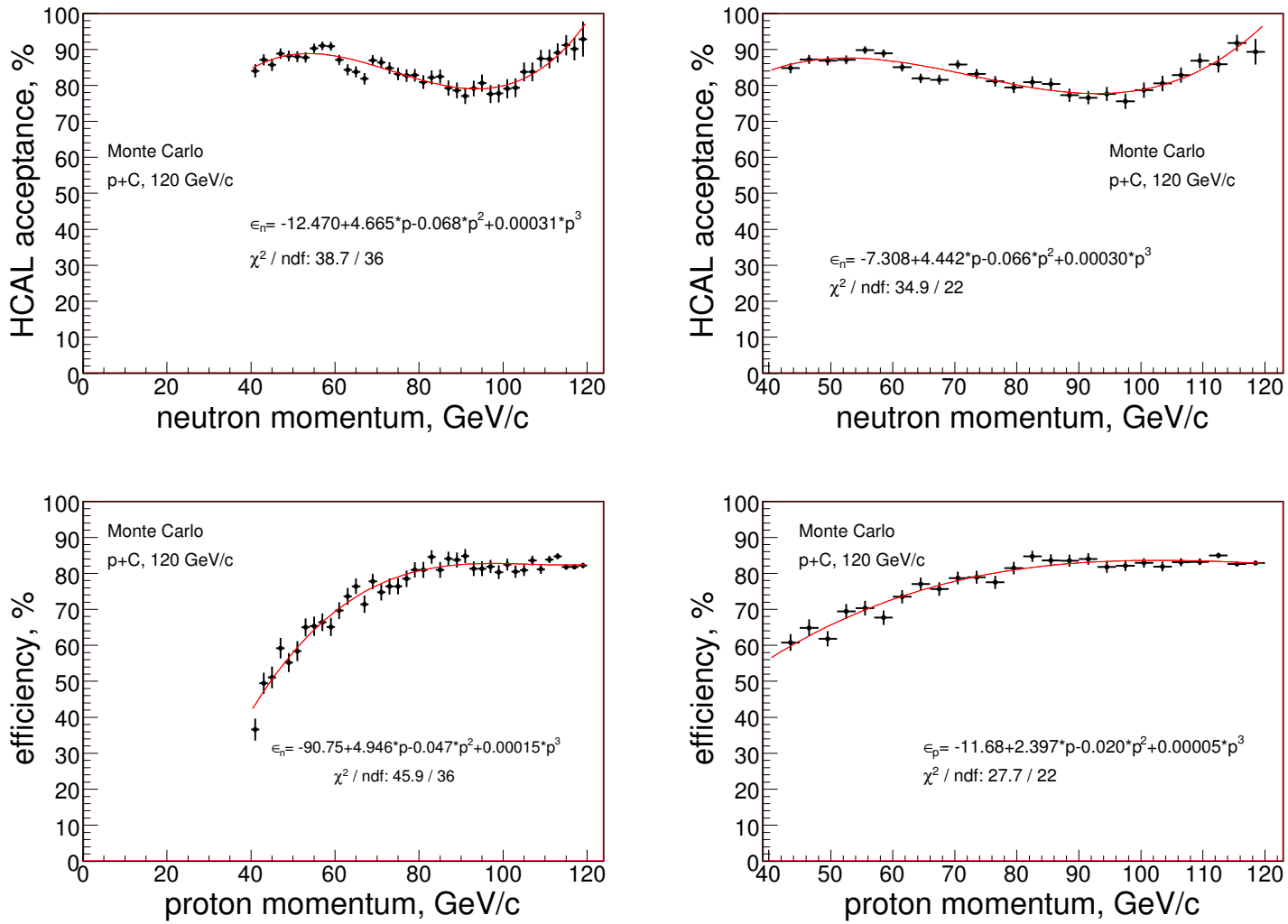




Top plot - the sum of n_s, and K_L^o momentums in Monte Carlo event. Since they all pointing into HCAL fiducial then it presented as a cumulative momentum (red plot). Black line plot represents the leading neutrons produced in the primary interaction.

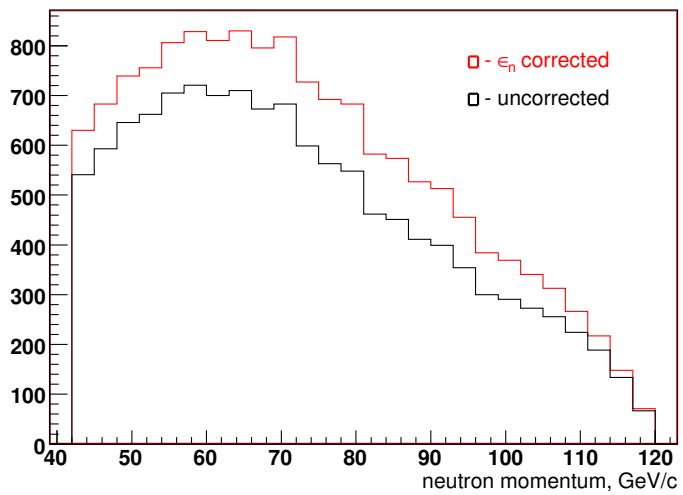
Bottom plot - the sum of n_s, and K_L^o momentums which passed the neutron selection cuts (dashed plot). So, the dashed plot represents the fake neutron candidates from n_s and K_L^o sources. Black line plot represents the primary neutrons survived the same selection cuts.

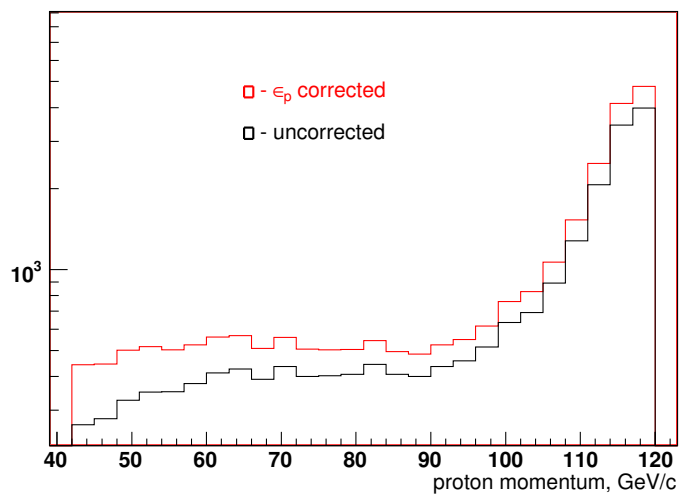
recalculate ϵ_n and ϵ_p



Left plots - what was before, right - updated version: rebinning and proton selection

Monte Carlo: correcting for efficiencies

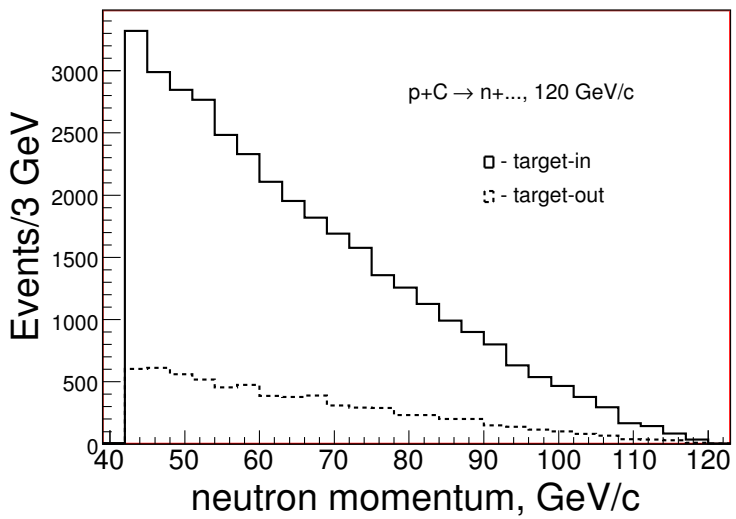


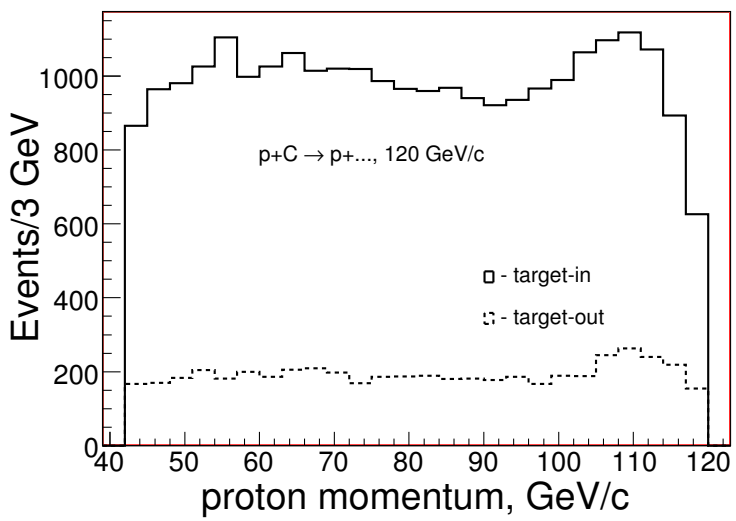


Top plot - Monte Carlo inclusive neutron spectrum: red plot - corrected for the inefficiency, black - uncorrected

Bottom plot - Monte Carlo inclusive proton spectrum: red plot - corrected for the proton inefficiency, black - uncorrected

real data: target-in vs target-out

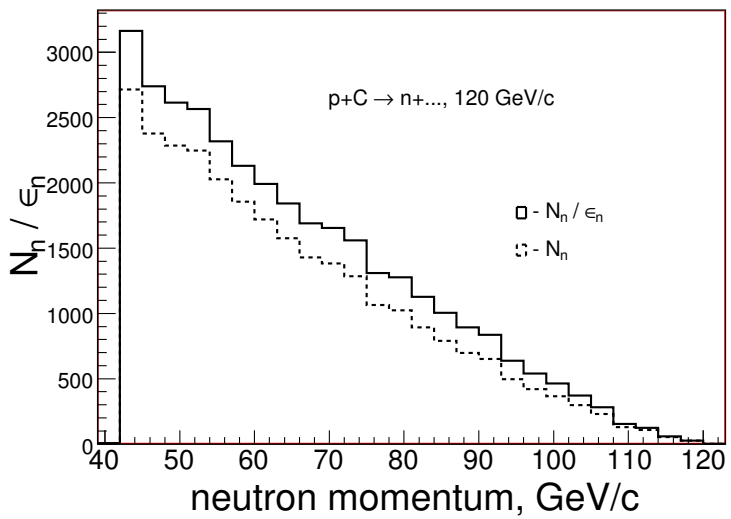


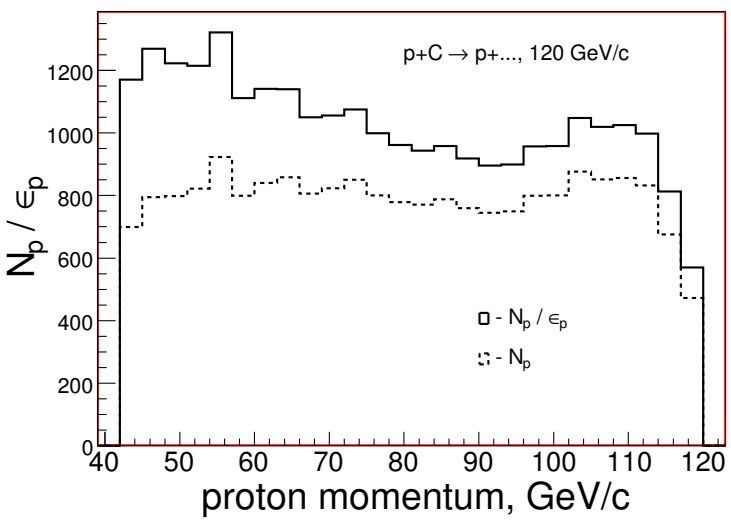


Top plot - the inclusive neutron spectrum, updated binning.

Bottom plot - the inclusive proton spectrum. Particle selection in RICH: the window to grab the data point was ± 1.2 cm along the radius axis, now in orthogonal direction to slope.

real data: correcting for efficiencies

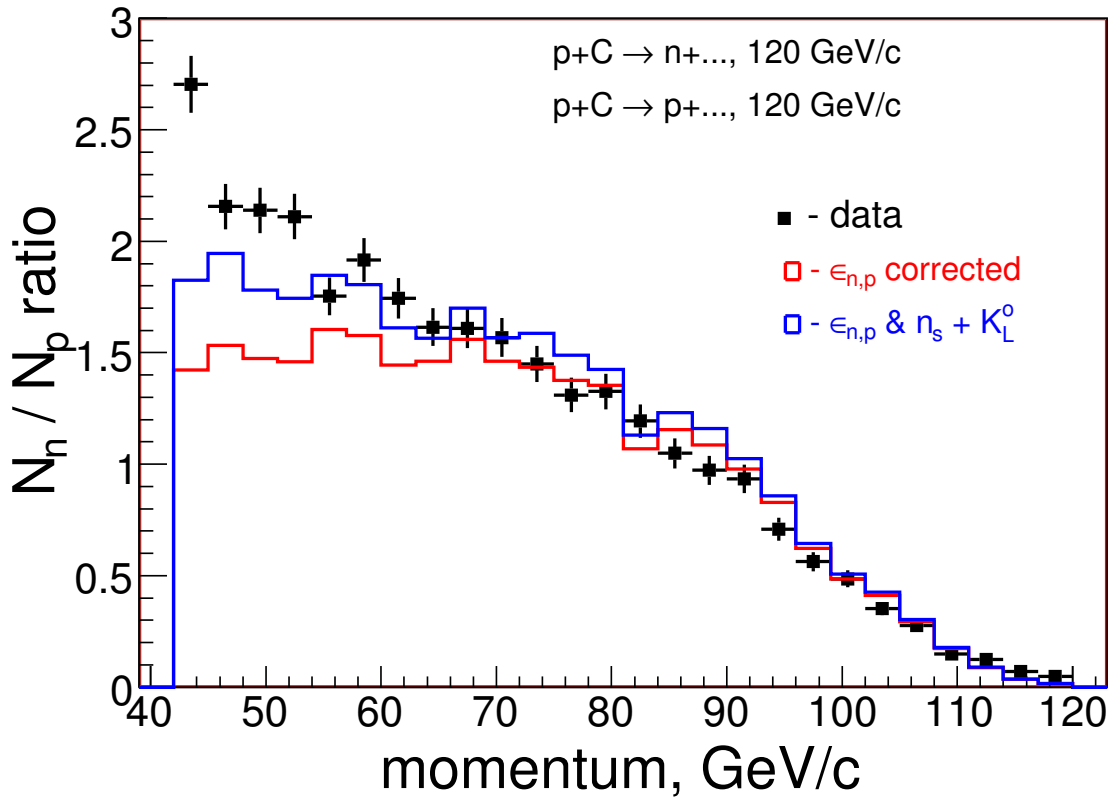




Top plot - the inclusive neutron spectrum. The target-out data was subtracted, then it corrected for the HCAL acceptance.

Bottom plot - the inclusive proton spectrum. The target-out data was subtracted, then it corrected for the proton reconstruction efficiency.

N_n / N_p ratio



The N_n / N_p ratio for the inclusive neutrons and protons. Red plot - Fluka prediction when only the inefficiencies taken in account. Blue plot - Fluka prediction which includes the inefficiencies and the cumulative contributions from the secondary neutrons and K^o_L.