Adding NA61 Data to PPFX

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Mar. 11th, 2024

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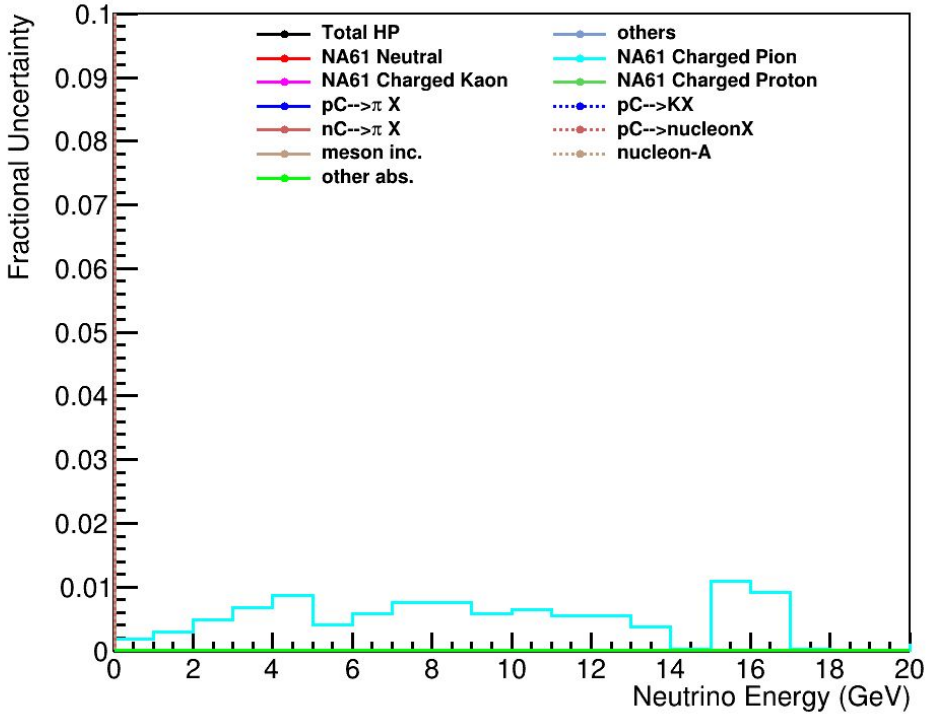
Problem found

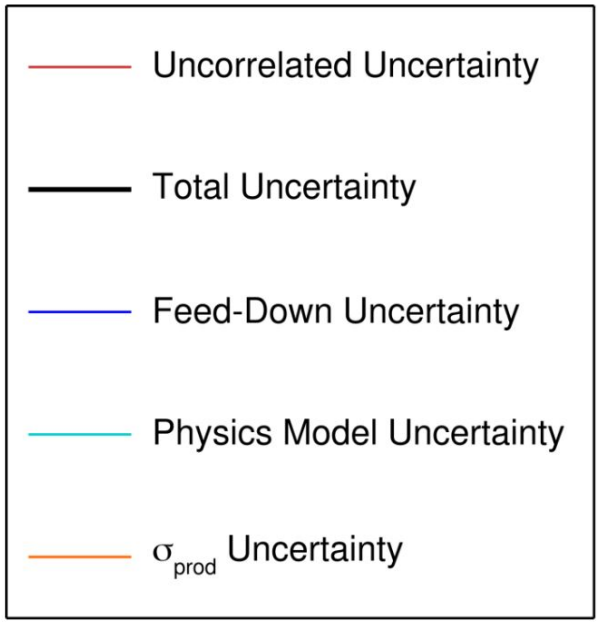
- Turned everything off, except for the NA61 pCp^{+} weight → Still saw a 13% uncertainty…
- Replaced the total uncertainty with a 4% flat uncertainty → Still saw a 13% uncertainty…
- Tracked down a bug in my weight calculator
  - For default NA49 reweighter, the numerator of the wgt is
    - Universe_sys + Universe_stat - CV = CV + sys + CV + stat - CV = CV + sys + stat
  - In my case, I have not separated out the correlated piece from the total uncertainty
    - Universe_sys - CV = CV + sys - CV = sys
    - Above has been fixed → CV + sys

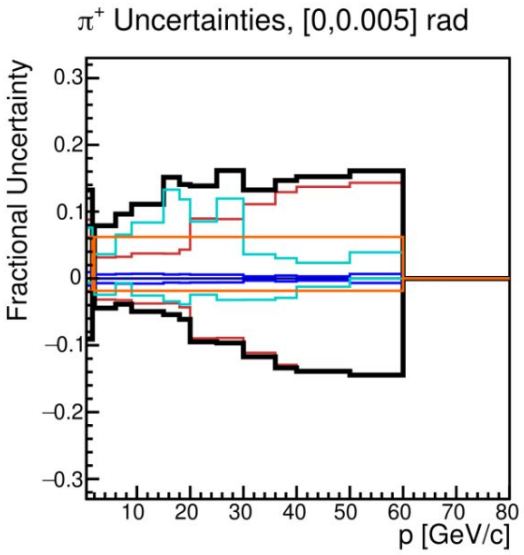
Testing

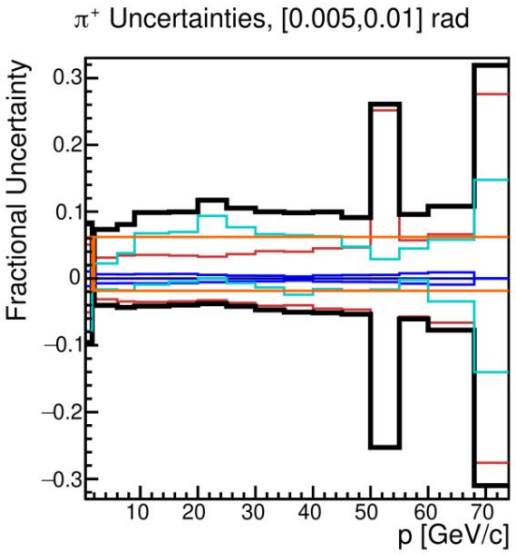
- Turned everything off, except for NA61 pi+ data
- For a 4% flat uncertainty. I finally got something reasonable



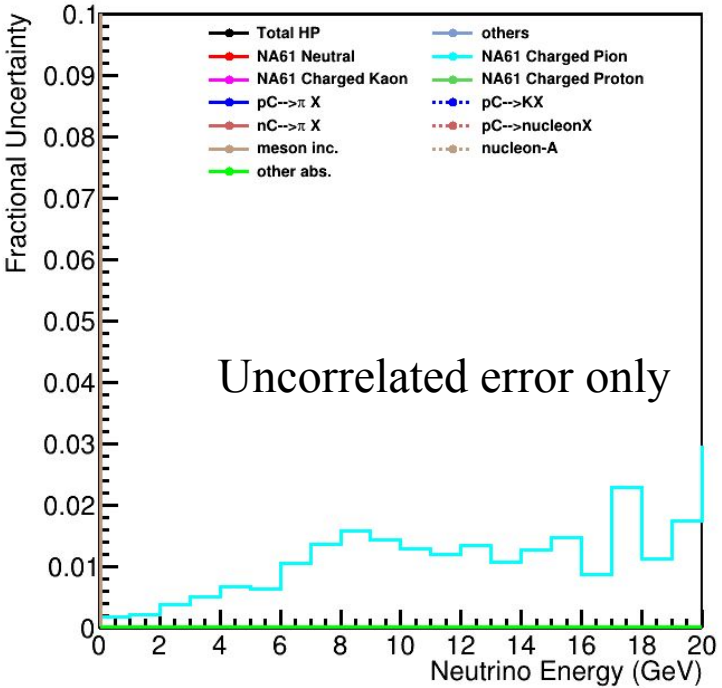
NA61 Pi+ Uncertainty Breakdown

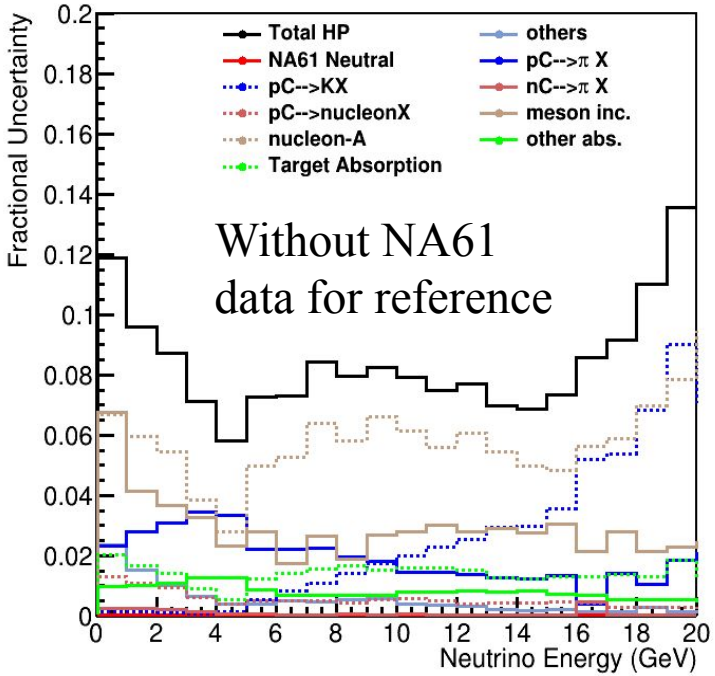






Putting NA61 uncertainty in





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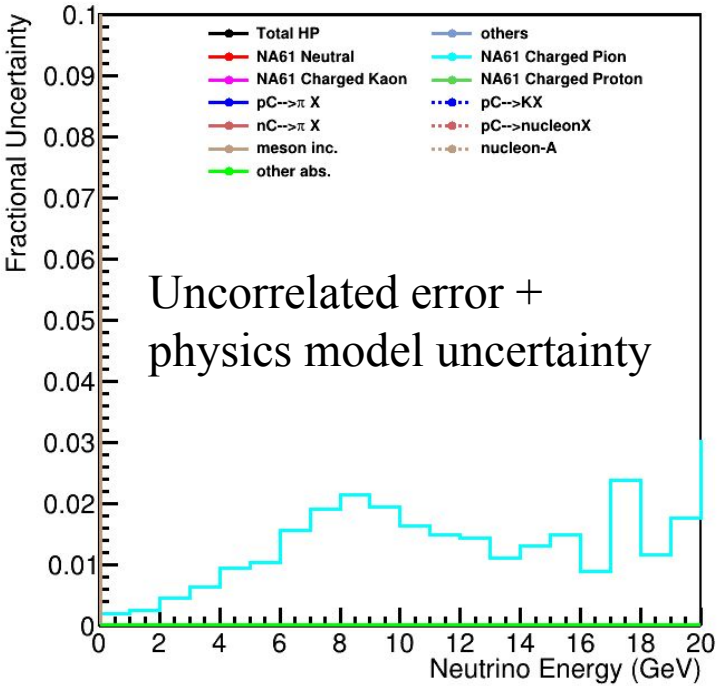
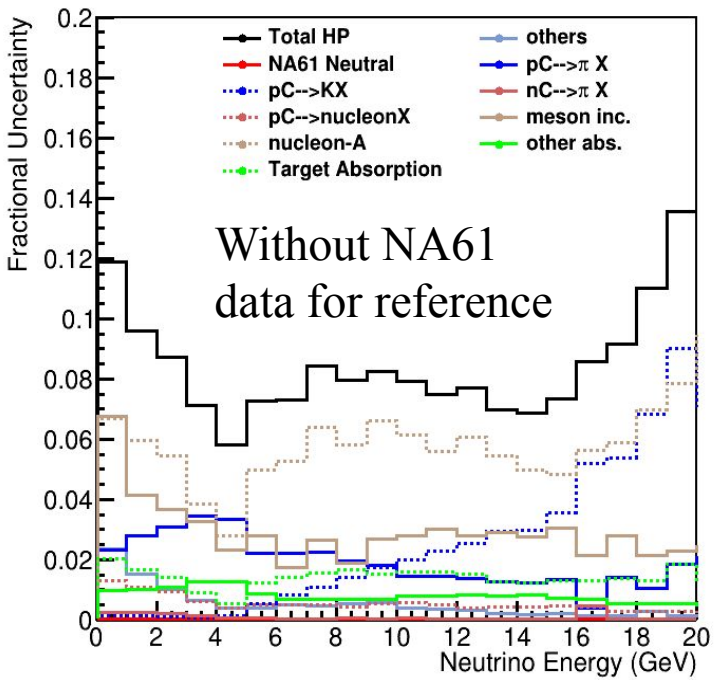
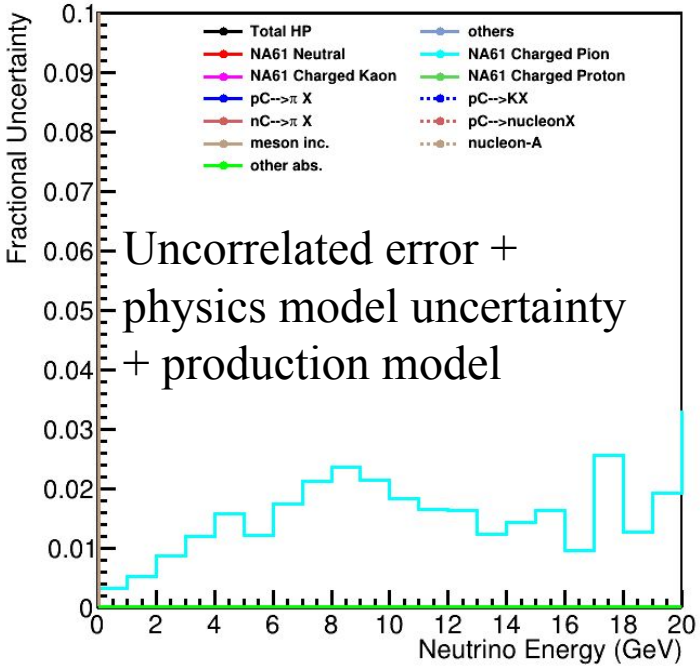
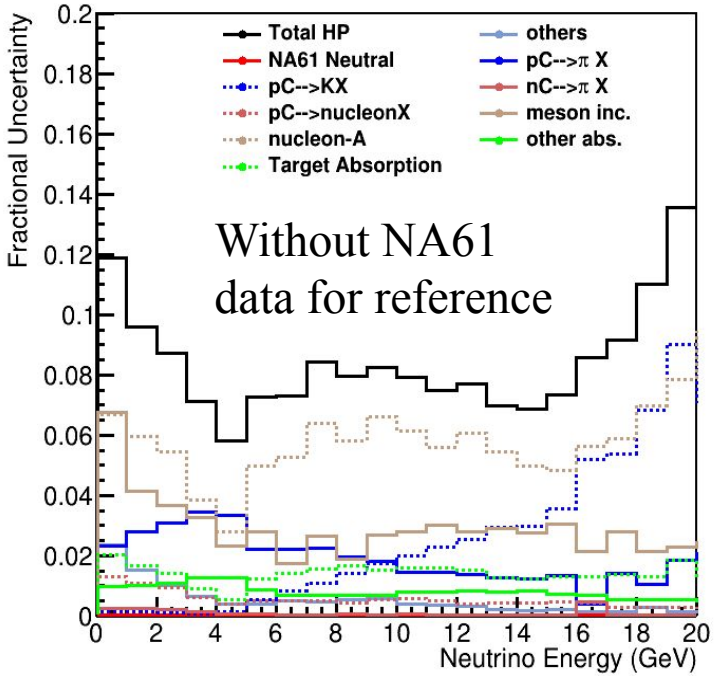




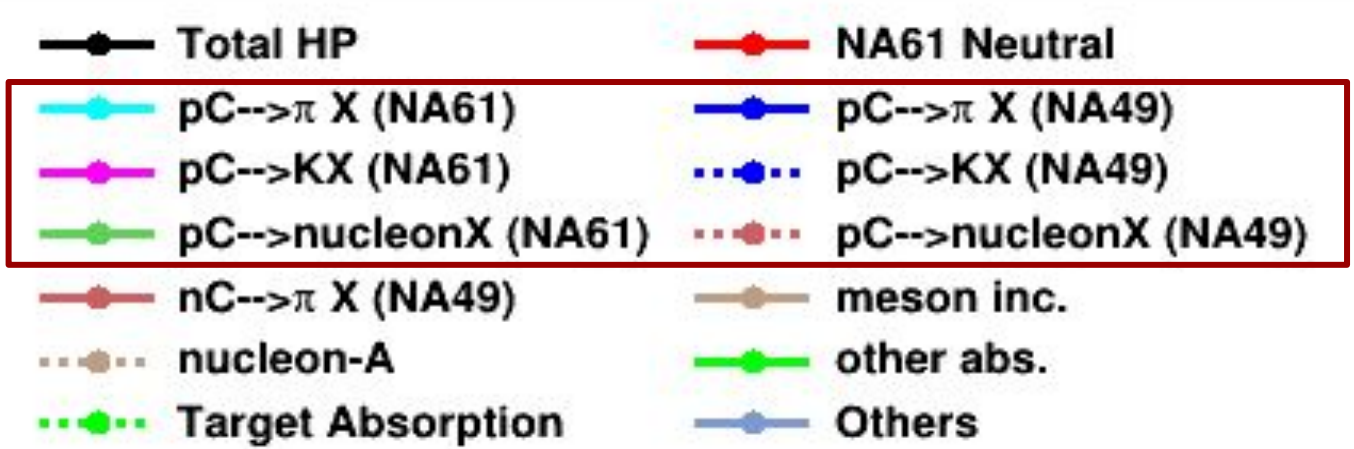
Putting NA61 uncertainty in





Turn on all NA61 reweighters

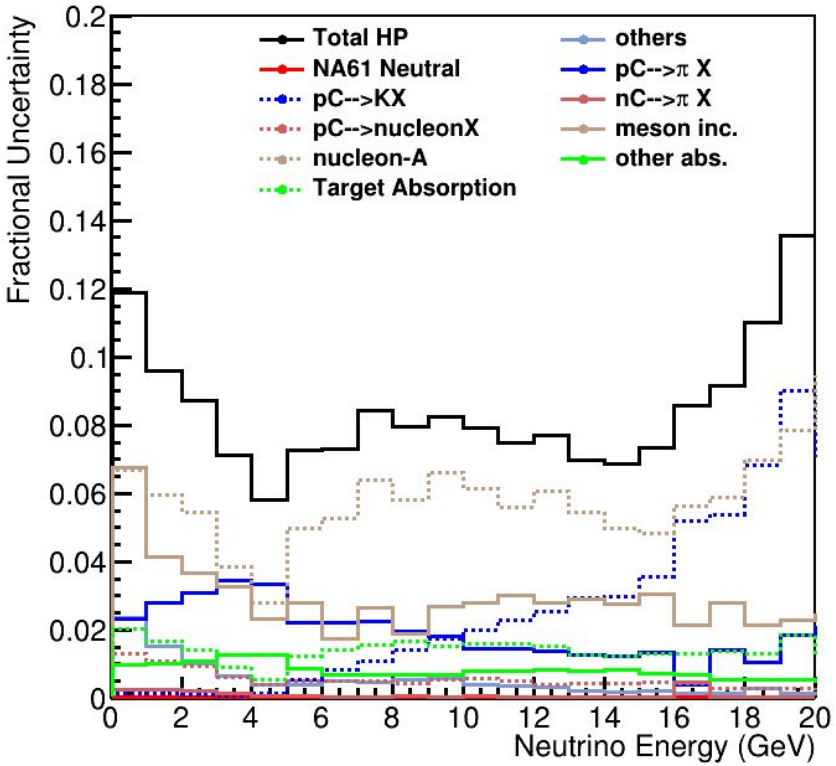
- NA61 pC120 only applies when proton momentum > 115 GeV/c

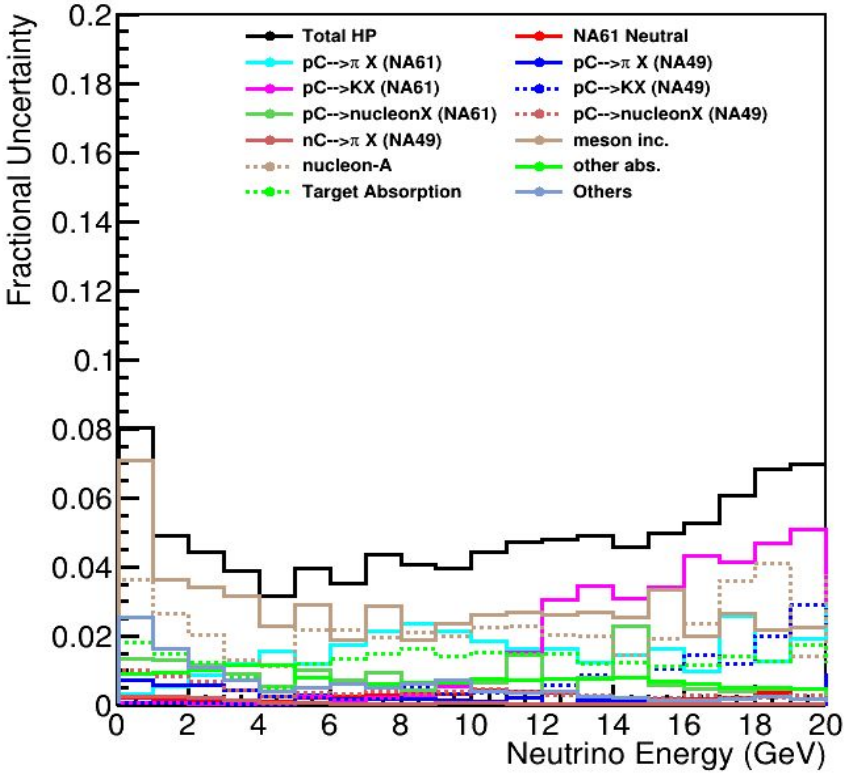


Before

After (No corr. yet)

ν_μ

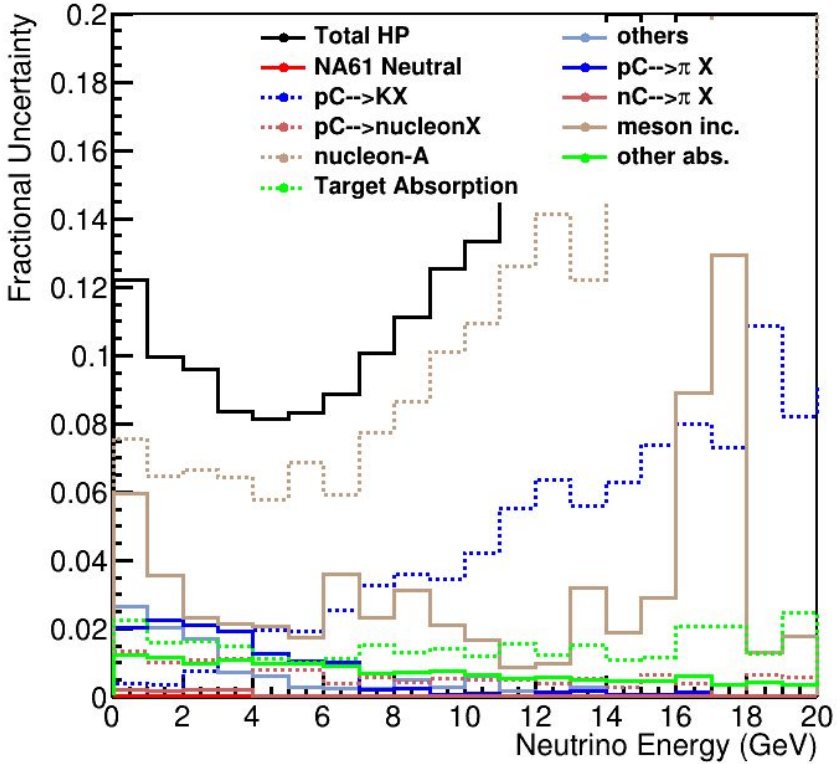


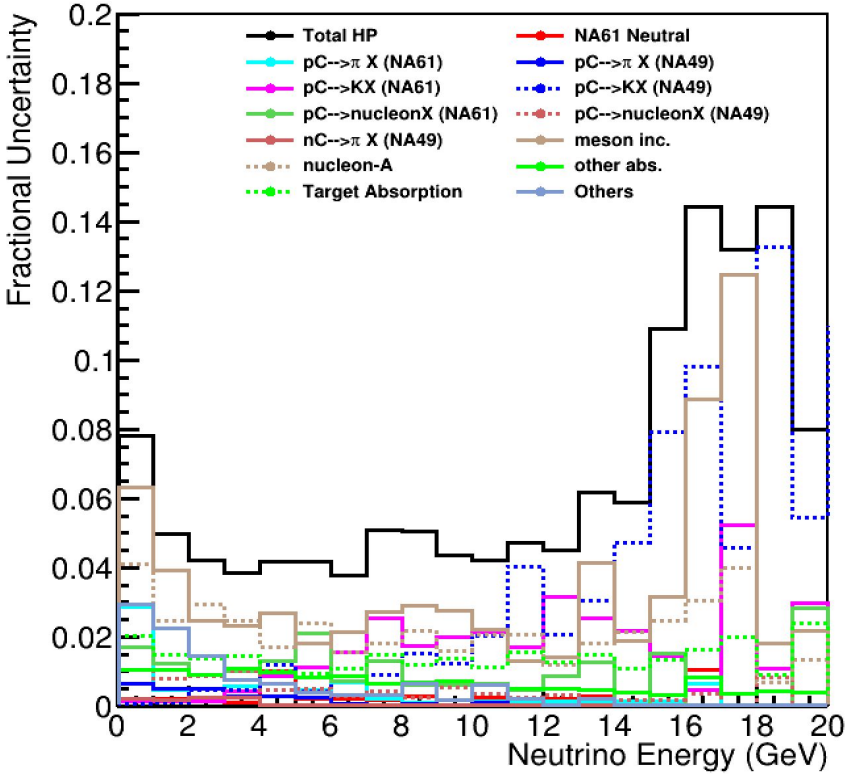


Before

After (No corr. yet)

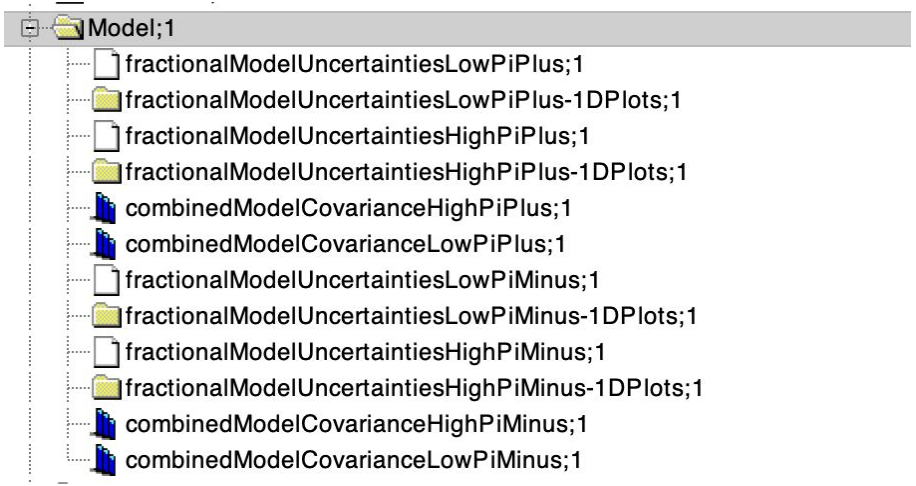
ν_e





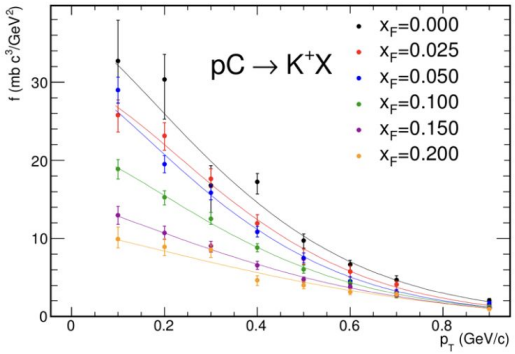
Trying to add correlation

- Problem with physics model uncertainty
  - High and low uncertainties are not the same
  - But high and low covariance matrices are the same
  - Can not reproduce the 1D uncertainty from the covariance matrices
- Production cross section uncertainty does not have this problem
- Contacting author…

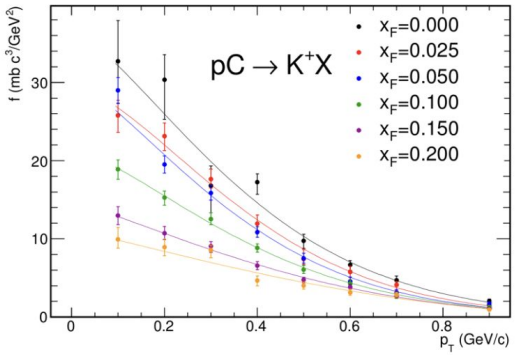


Comment from former NA49 collaborator

- Was able to meet with former NA49 collaborator (Andrzej Rybicki) to go over all the datasets in PPFX
- The only problematic one is the kaon production data, which was never presented to the NA49 collaboration
  - G. M. Tinti, Ph.D. thesis (2010), FERMILAB-THESIS-2010-44.
- Andrzej does not consider it as an NA49 result and recommend removing it from PPFX



(a) K^+.



(b) K^-.

FIG. 4.29: NA49 invariant differential cross-section of charged kaon production in proton carbon interactions [68].

NA61 pC @ 90 GeV/c results

- pC @ 90 GeV/c results coming soon
- In addition to charged and neutral hadron production multiplicities, Kyle, the grad student will also report the momentum scaling between NA61's 90 GeV and 120 GeV results
- Any advice on producing the FLUKA histogram at 90 GeV?

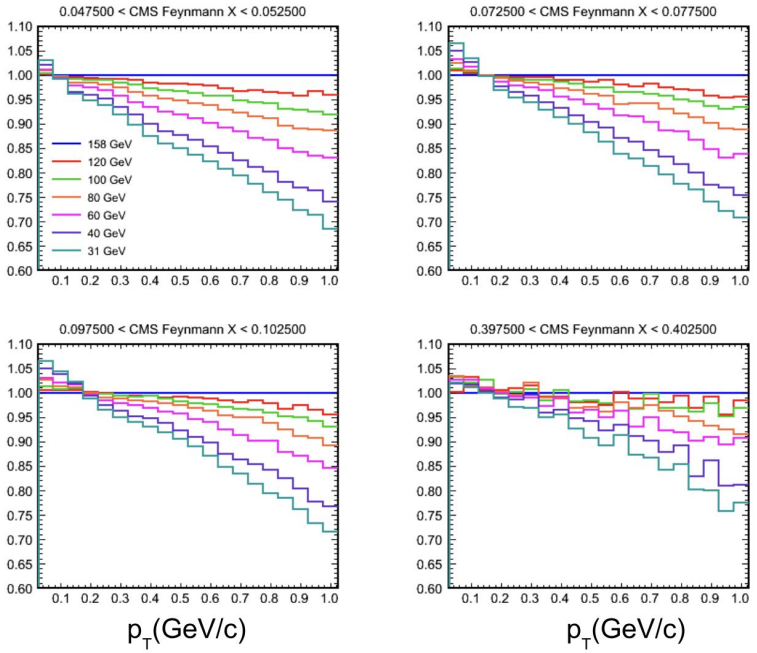
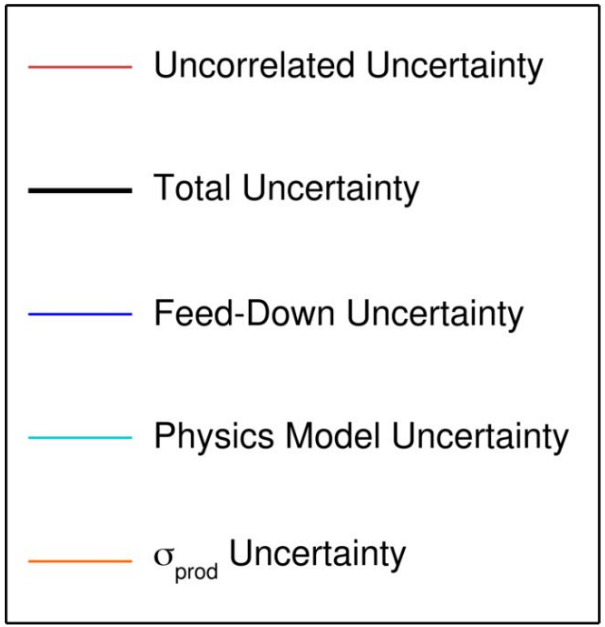
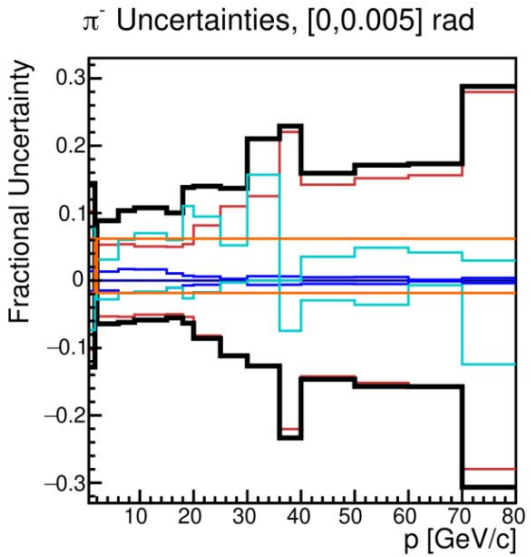


FIG. 4.5: FLUKA energy scaling correction for invariant cross-section data taken at 158 GeV to lower energy down to 31 GeV. This is split in four x_F ranges.

Backup





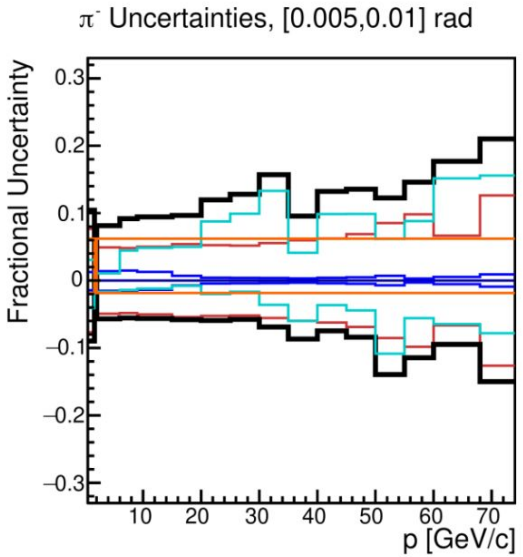


FIG. 24: Systematic uncertainty breakdown for the combined π^- analysis. Two representative angular bins are shown.

Update at the DUNE collaboration meeting last May

Effect on Breakdown of Hadron Interactions

ν_μ