-NA61 incident pion data into PPFX- Data Interpolation

Nilay Bostan

University of Notre Dame

2021/07/09

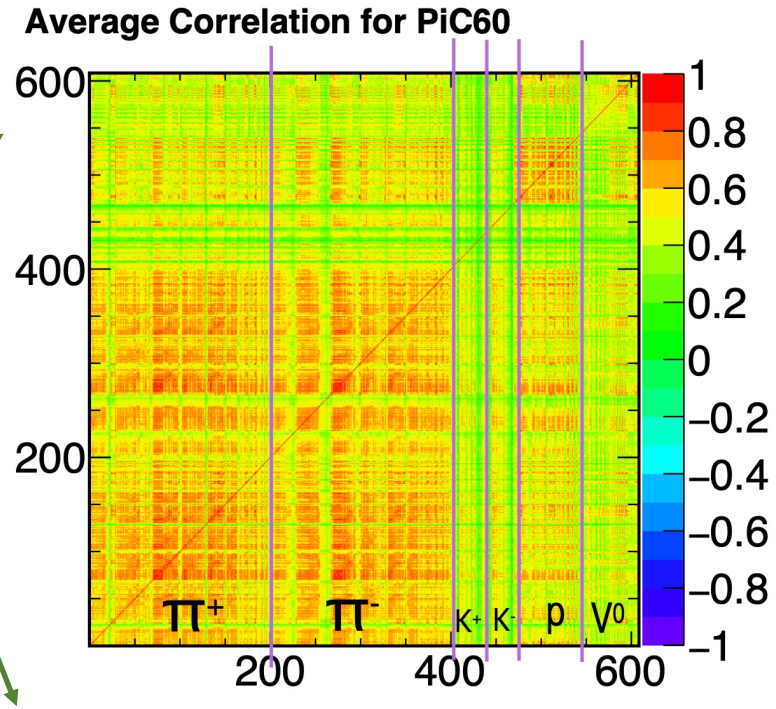
PPFX group meeting

Introduction

- NA61 collaboration has just released correlation and covariance matrices for π^+C and π^+Be interactions at 60 GeV.

https://edms.cern.ch/ui/#!master/navigator/document?D:100441751:100441751:subDocs

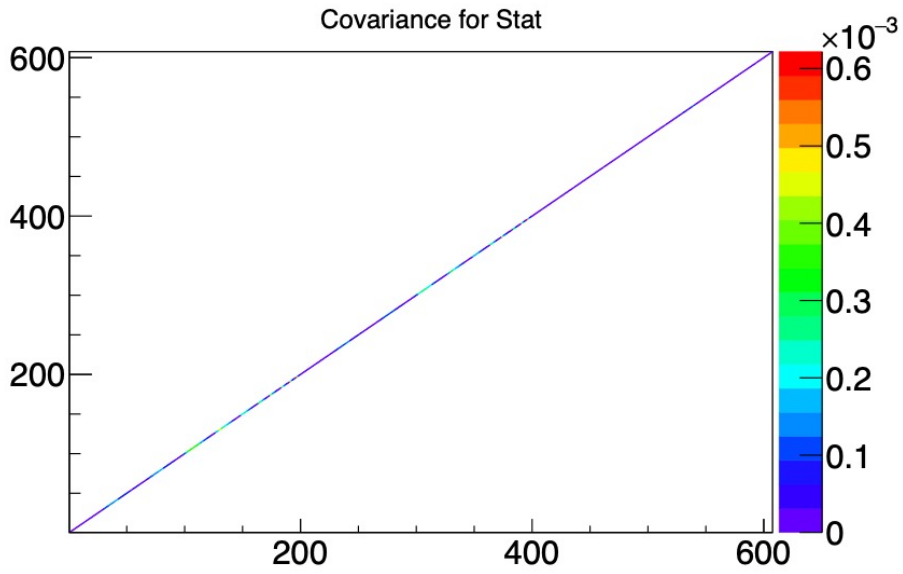
Plots from NA61/PPFX meeting (A. Marino)



- We have currently these files:

-> Average Correlation for PiC60

-> Total correlations and covariances for each error category are given separately for the upper and lower bands



Introduction

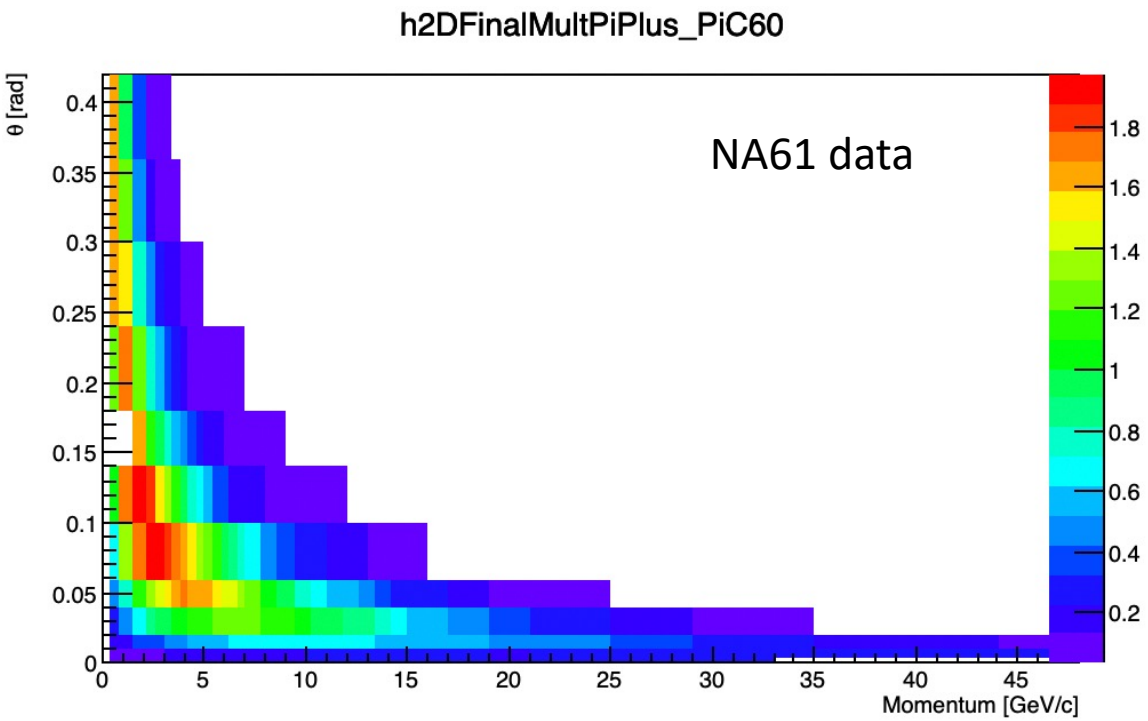
- We use a covariance matrix to generate “many universes”.
  -> We treated the NA61 statistical and systematic uncertainties independently.
  -> Diagonal covariance for Statistical uncertainty.
  -> Systematic uncertainties, we apply the Cholesky decomposition to get the lower matrix triangle and multiply by the random shifts given the Cholesky output.

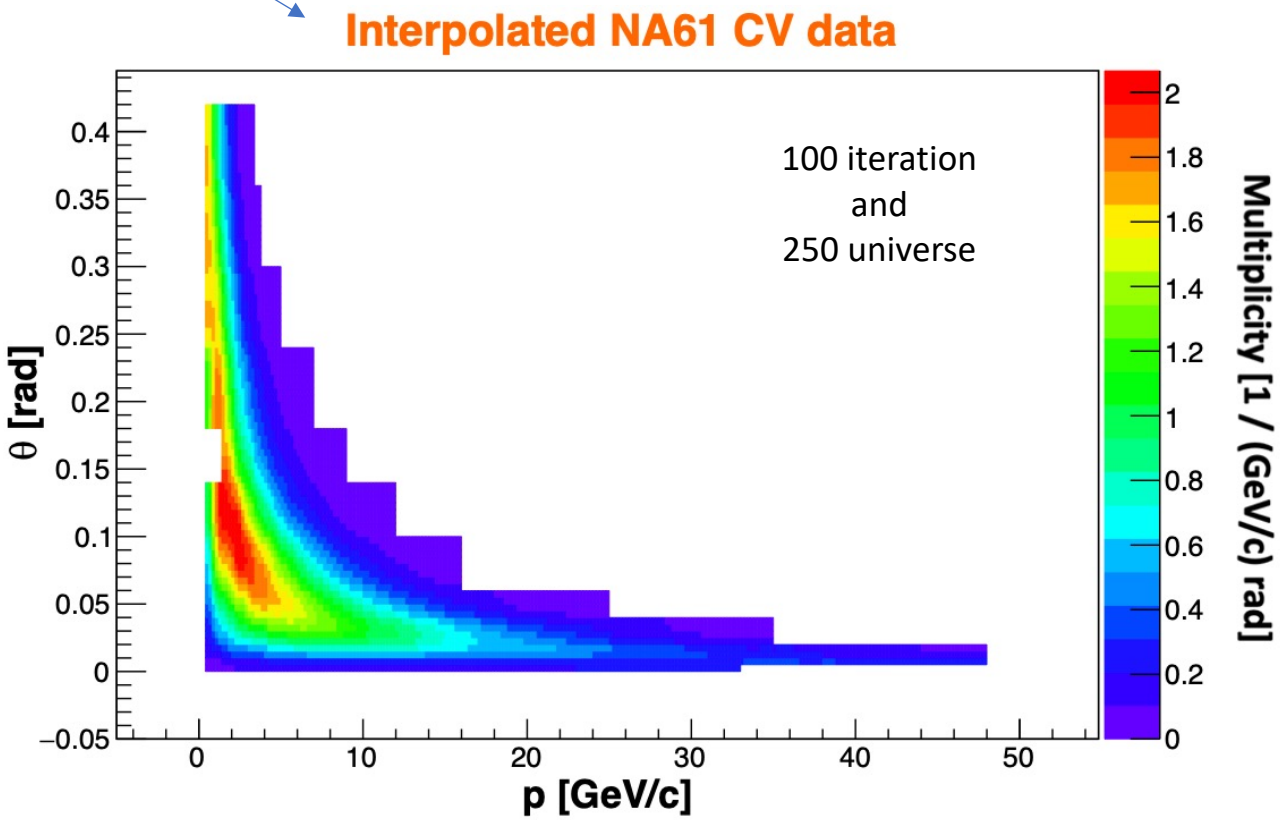
- In our first approach, we used 50% systematic correlation.
- Now, in this presentation, we are using the real NA61 correlation.
  -> We use the Average correlation for systematic to construct covariance matrix for systematic.

- As a reminder, we interpolate the data with the integral preserving interpolation technique (Antoni`s procedure) in each universe generated by the uncertainty.

  -> Specs: 100 iteration for the interpolation and generating 250 universe.

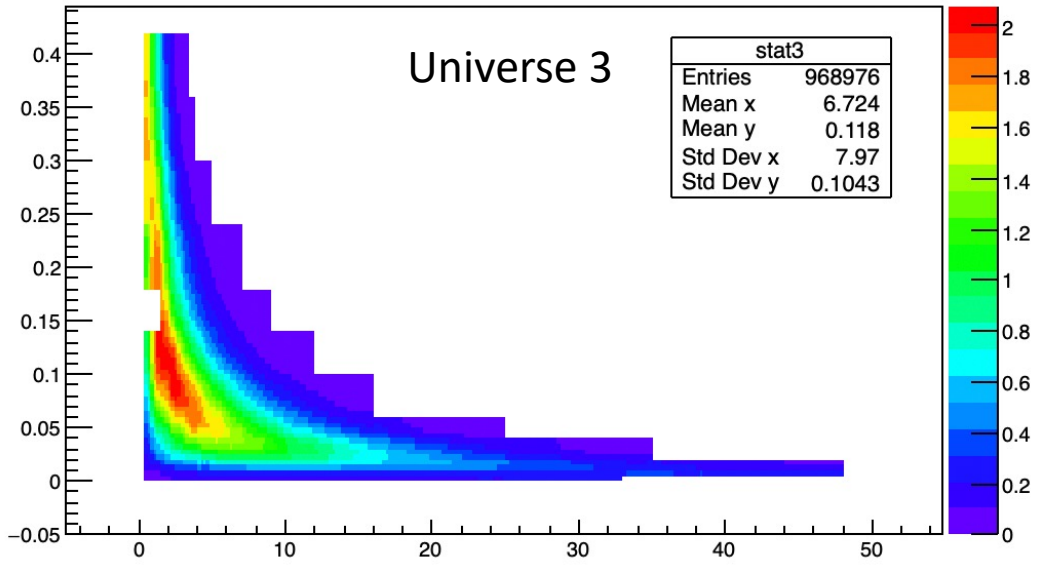
NA61 data and data interpolation

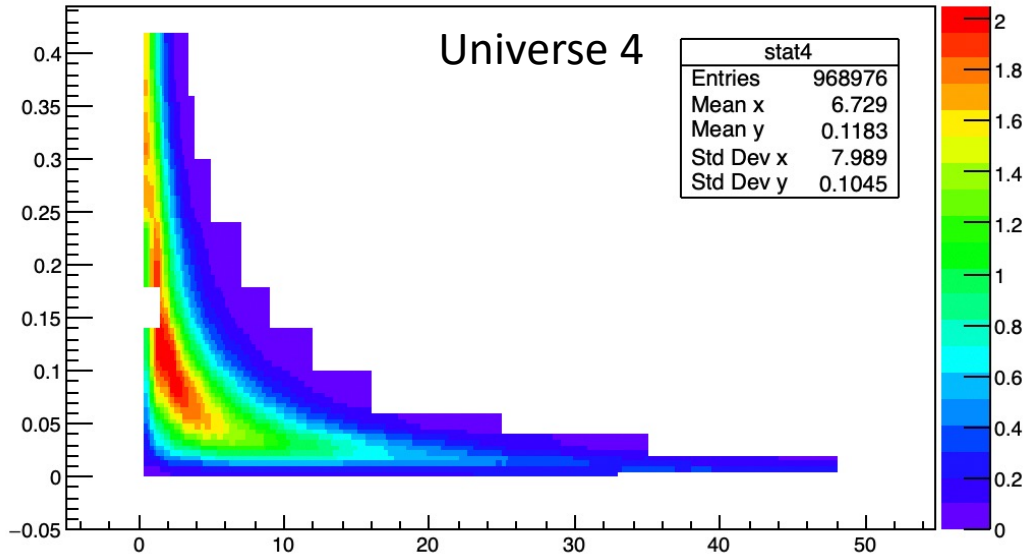




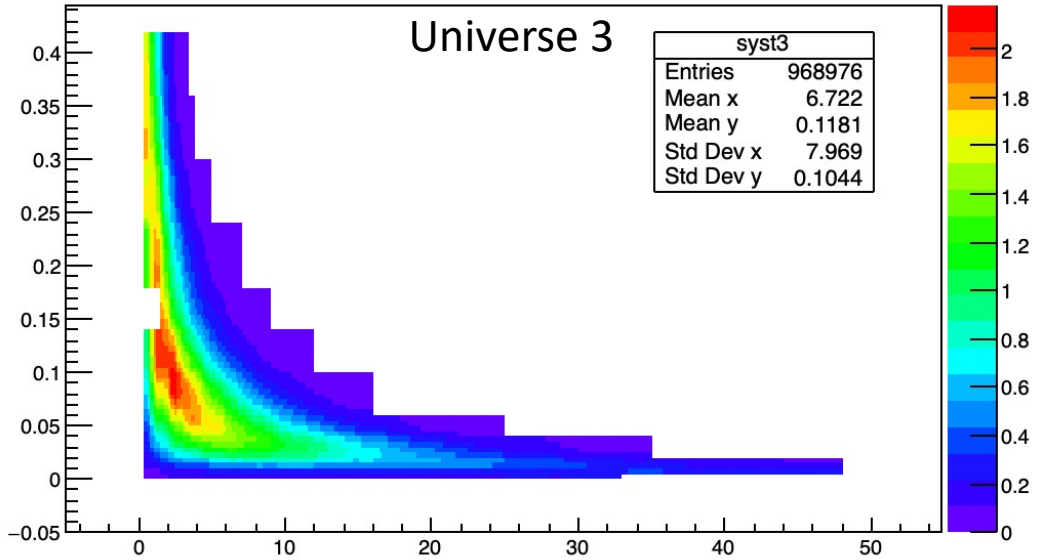
A couple of universes as an examples:

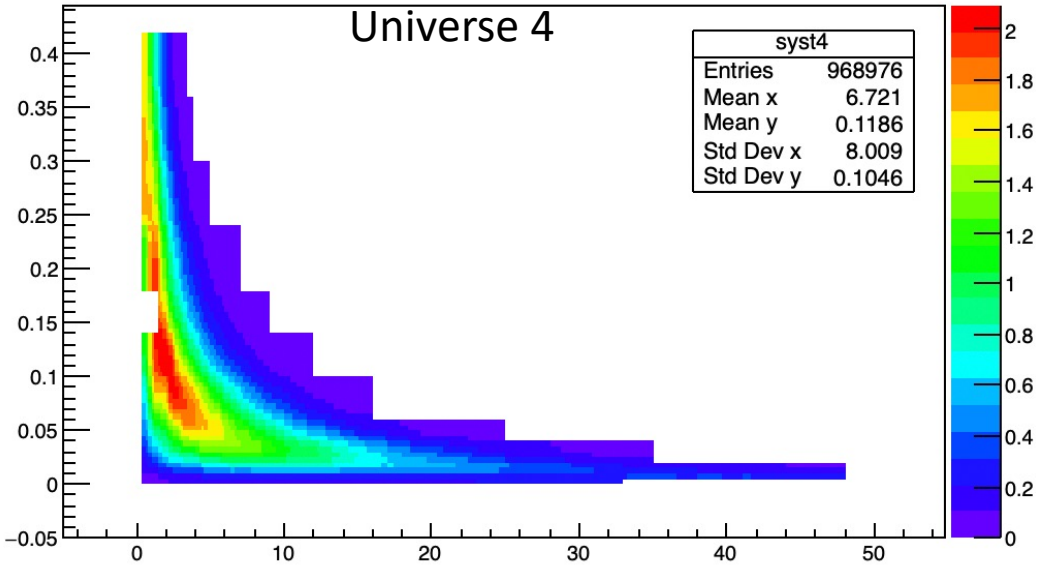
Stats universes:





Syst. universes





Conclusion

- **In this talk, I showed the NA61 60 GeV interpolated data by using the integral preserving interpolation technique and the real correlation just provided by the NA61 collaboration.**

- **I am working implementing this into the PPFX.**

  -> Adding the data and covariance

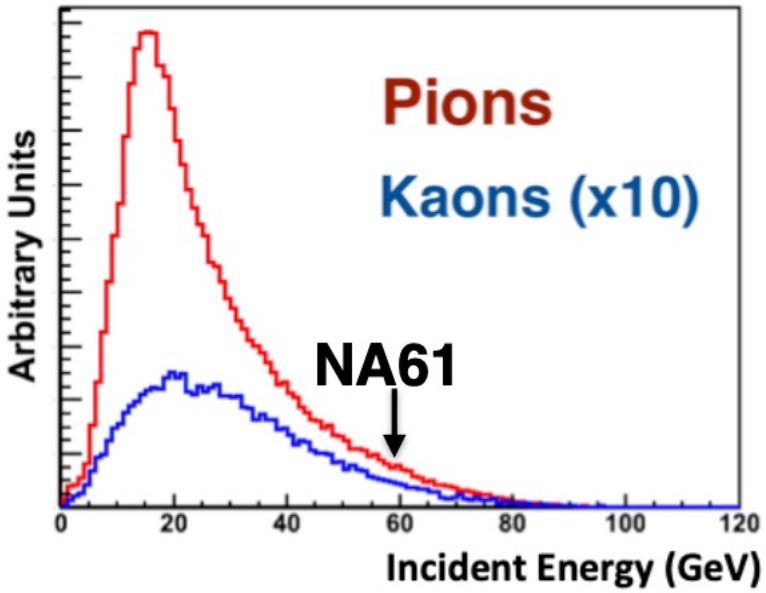
  -> Updating the ThinTargetIncMesonReweighter (PPFX) class.

Thank you very much for listening,
and
Any comments and/or suggestions are welcome!!!

Pion kinematics at DUNE

- Incident pions at LBNF and NuMI peaked at ~ 20 GeV with a wider spectrum in 10-40 GeV.
- NA61 data is at 60 GeV. Our current efforts include a scaling the data to lower energies.

Incident energy of π and K per ν_μ at DUNE



- NA61 provides good data coverage for π → π for LBNF and NuMI, and with a small uncertainties (typically statistical ~ 2% and systematics ~ 5%).