Unfolding Closure Test Results

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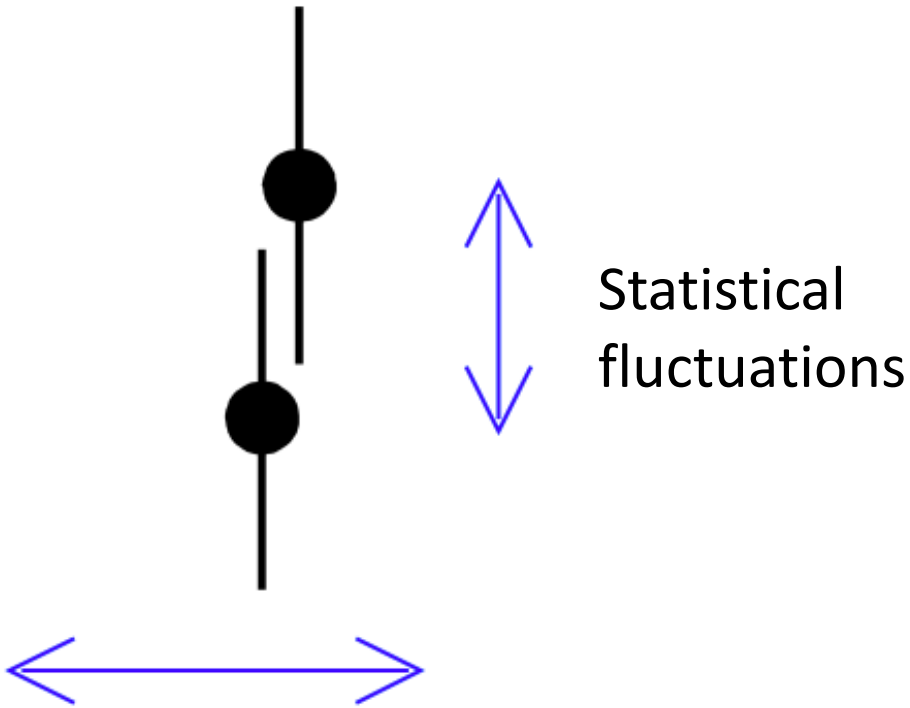
Unfolding overview



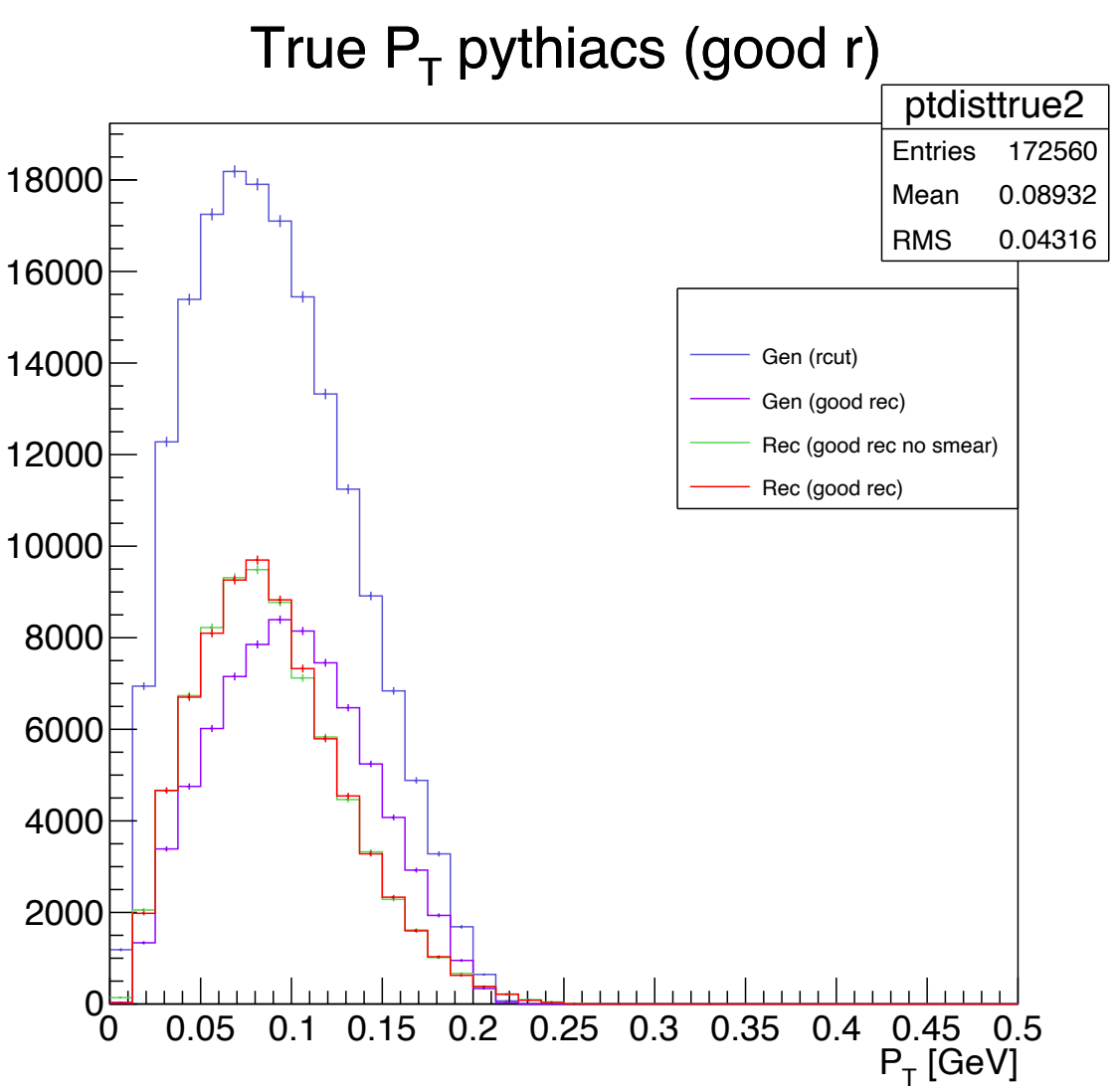
Unfolding:

- Is used to correct for migration effects in the presence of statistical fluctuations.

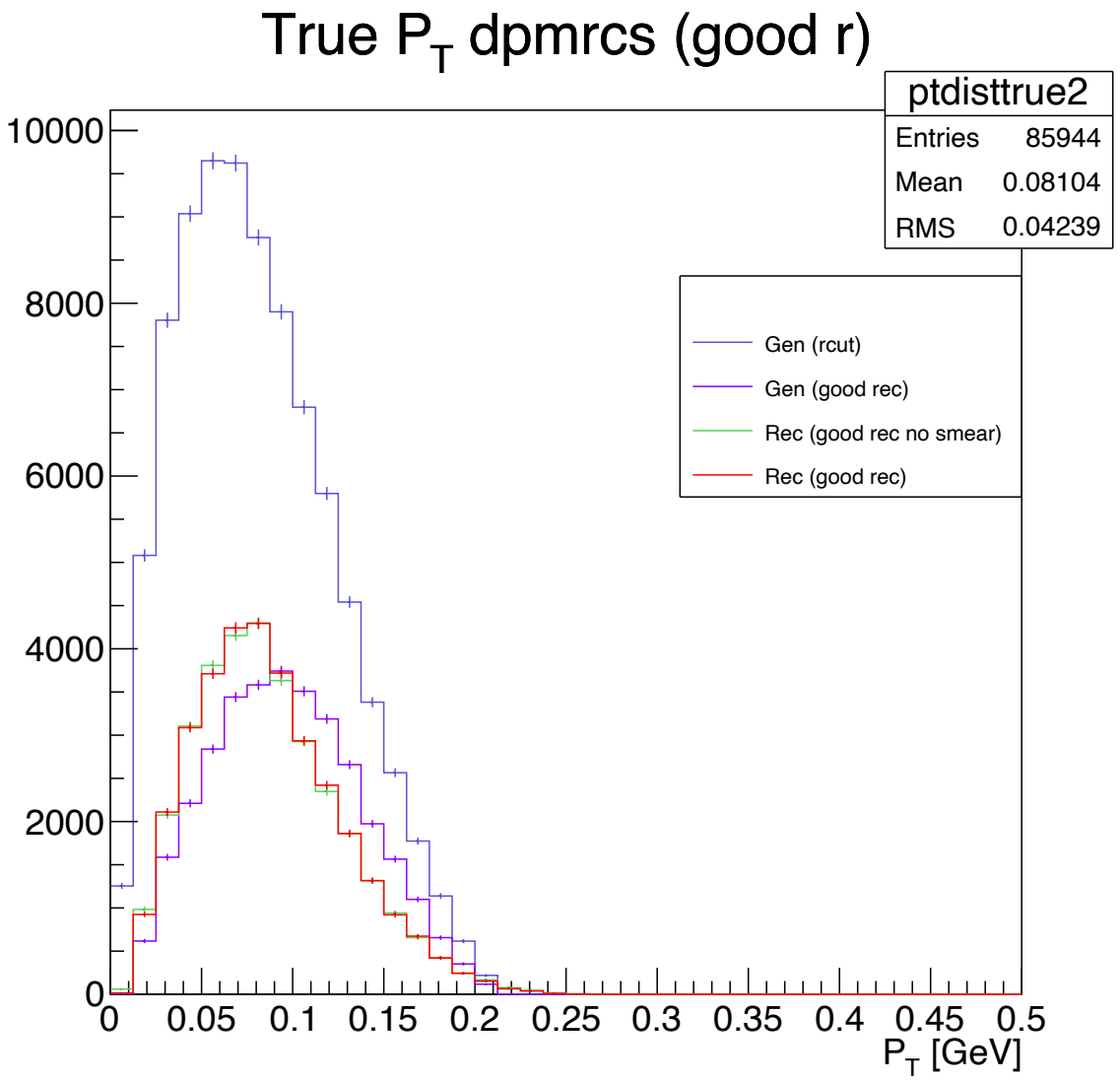
Result:

- Is an estimation of the “truth” distribution.
- Covariance matrix (statistical uncertainties)

One-dimensional pt unfolding closure test – Unfolding inputs

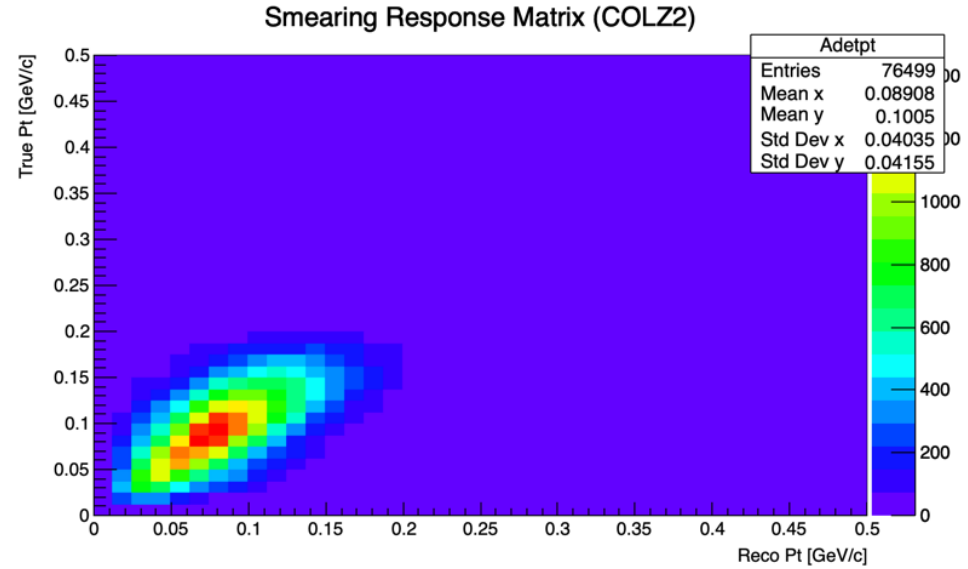


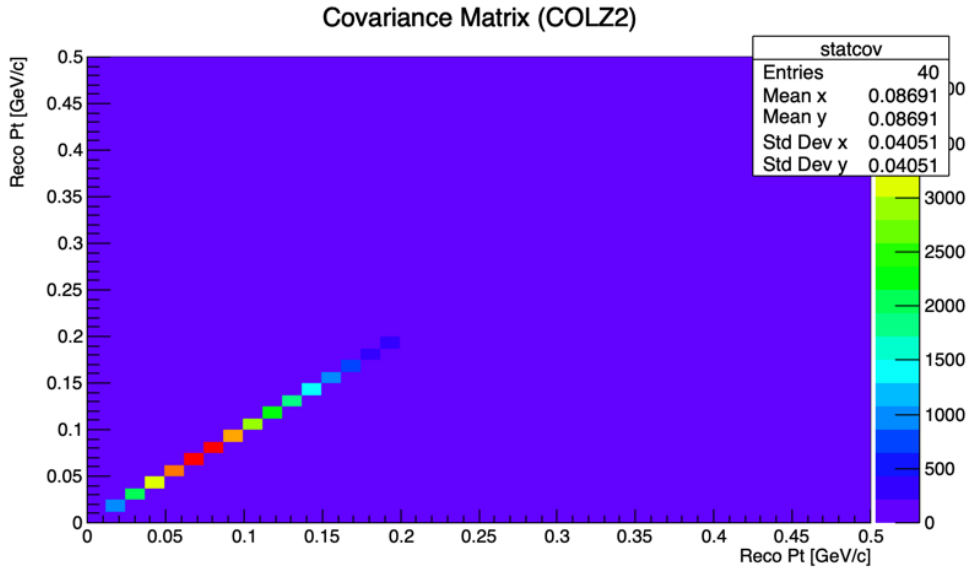
PYTHIA



DPMJET

One-dimensional pt unfolding closure test – Unfolding inputs

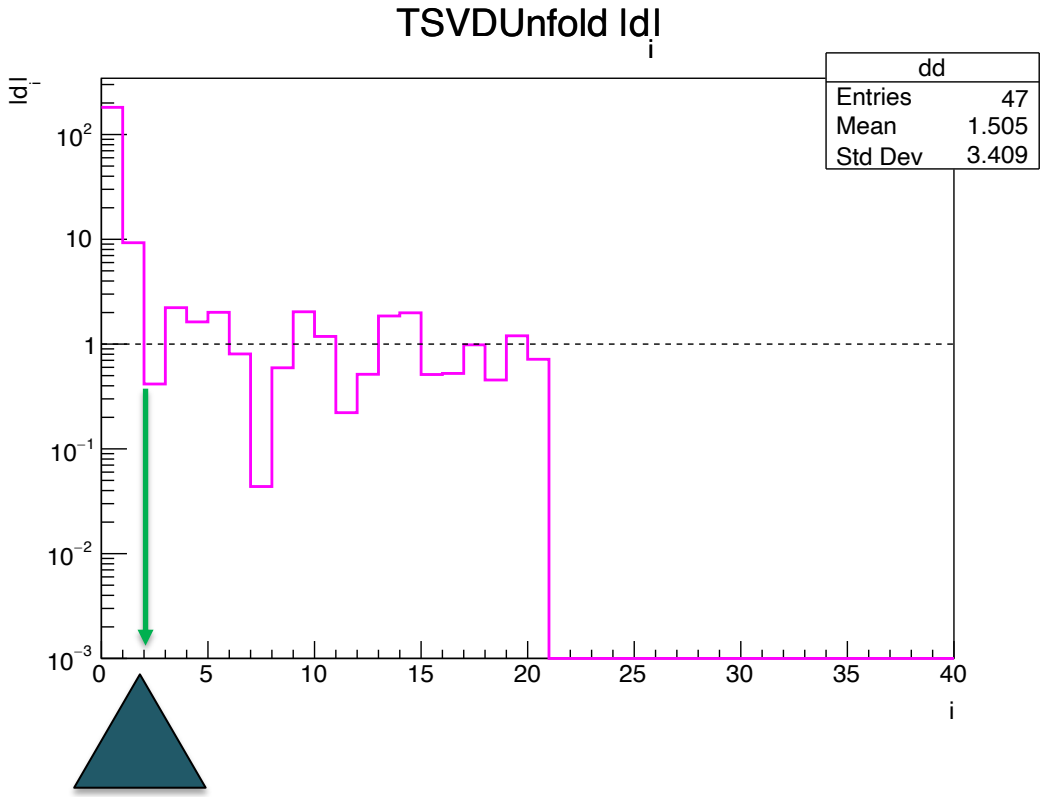


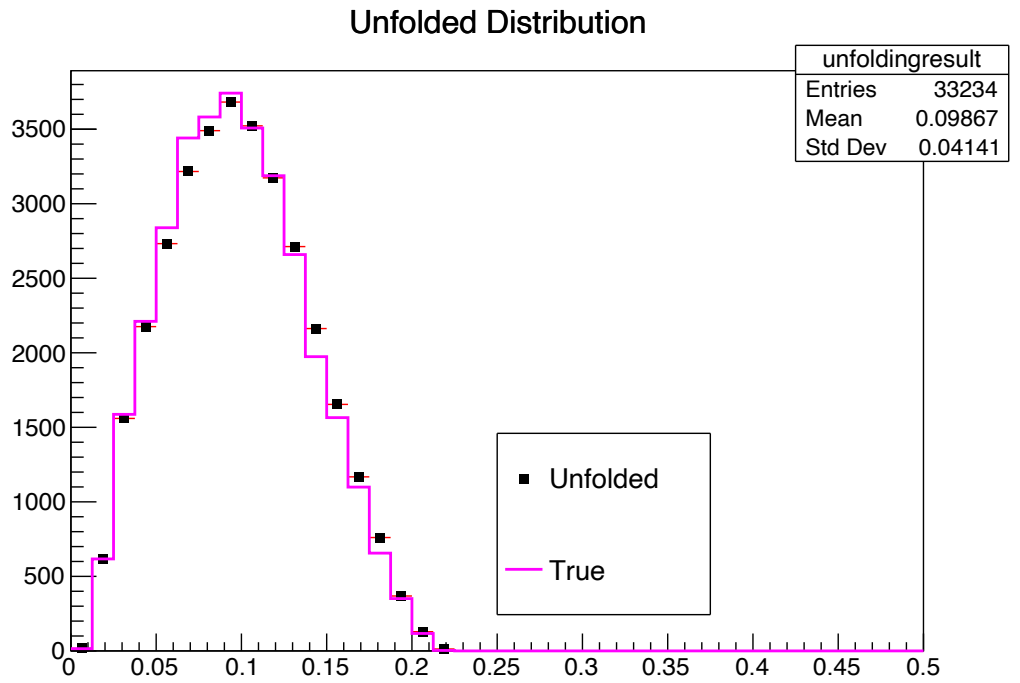


- Detector smearing matrix from pythia Monte Carlo.
- It is correlation of the measured pt and the true pt distribution from red and purple lines in left panel of previous slide.
- Pythia detector response matrix is used to unfold dpmjet meaured distribution in red on the right panel in previous slide.
- With statistical uncertainty, expect to reproduce dpmjet's truth pt distribution in purple line in right panel of previous slide.

- Input covariance matrix obtained from the square of the errors of the measured pt (red line) distribution from dpmjet Monte Carlo sample in right panel of previous slide.

One-dimensional pt unfolding closure test





Unfolded the measured pt distribution using regularization parameter = 2

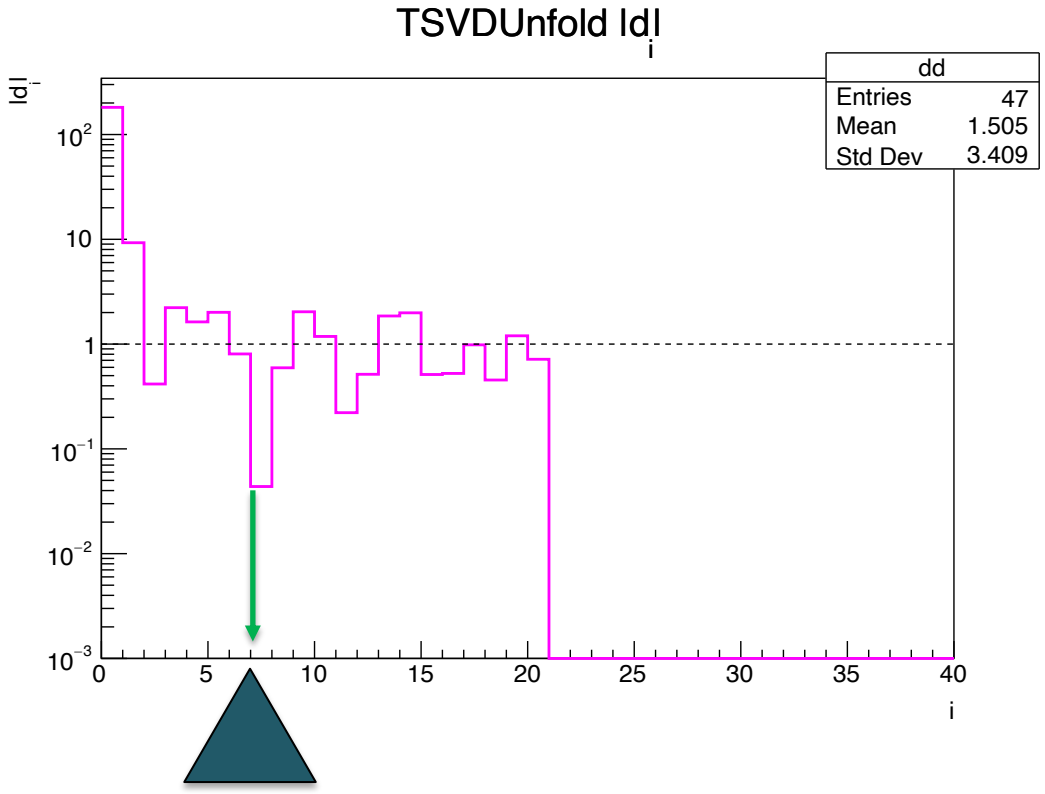
Parameter = 2 gives the best minimum curvature = 0.000007 and maybe chosen as optimum value.

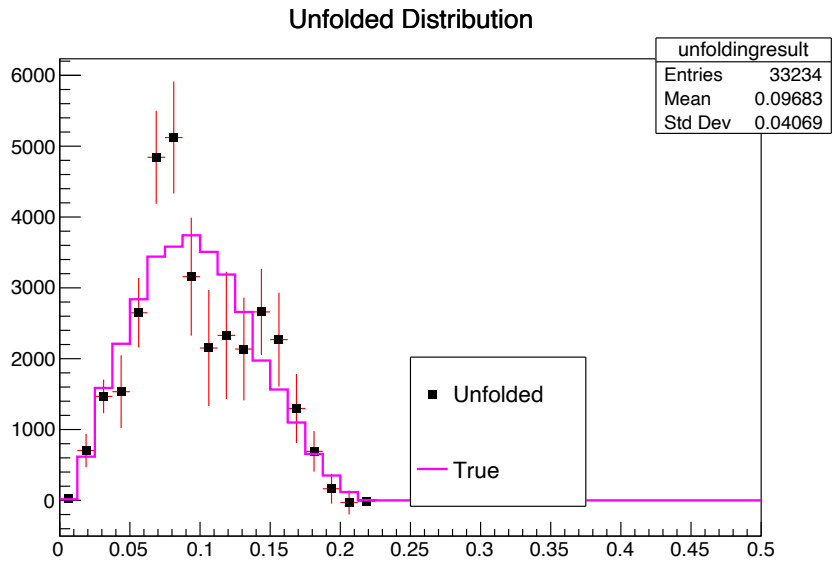
Magenta line: True distribution from dpmjet MC.

Solid black boxes: Unfolded distribution.

Unfolded distribution has been scaled to match the statistics between dpmjet and pythia.

One-dimensional pt unfolding closure test





Unfolded the measured pt distribution using regularization parameter = 7

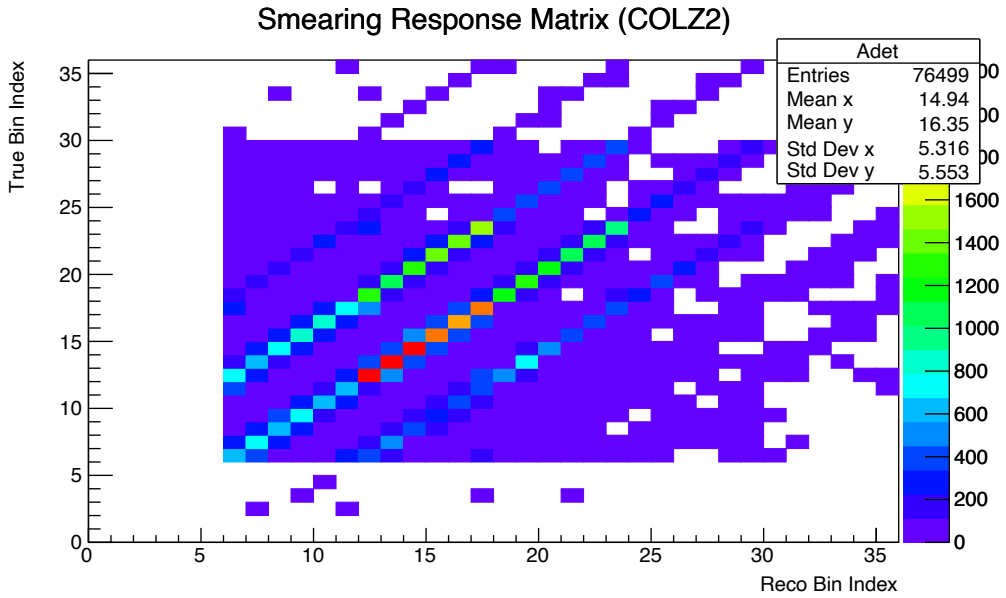
Regularization parameter = 7 gives a large minimum curvature = 0.343233.
Best minimum curvature should be almost zero.

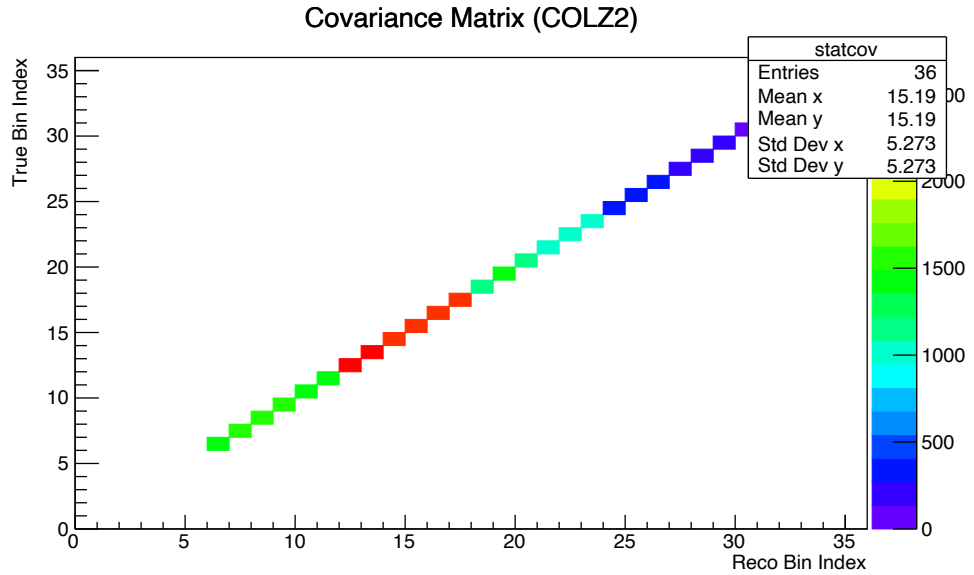
Magenta line: True distribution from dpmjet MC.

Solid black boxes: Unfolded distribution.

Unfolded distribution has been scaled to match the statistics between dpmjet and pythia.

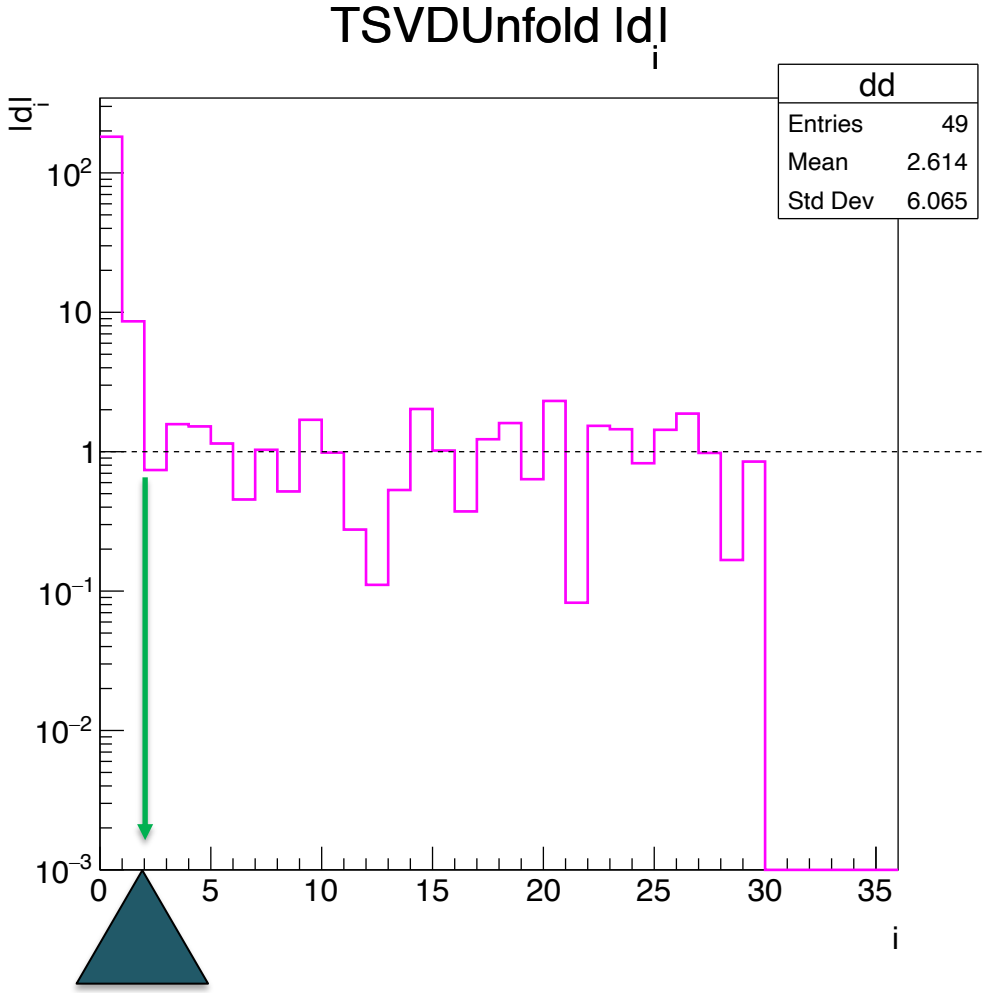
Two-dimensional pt unfolding closure test – Unfolding inputs



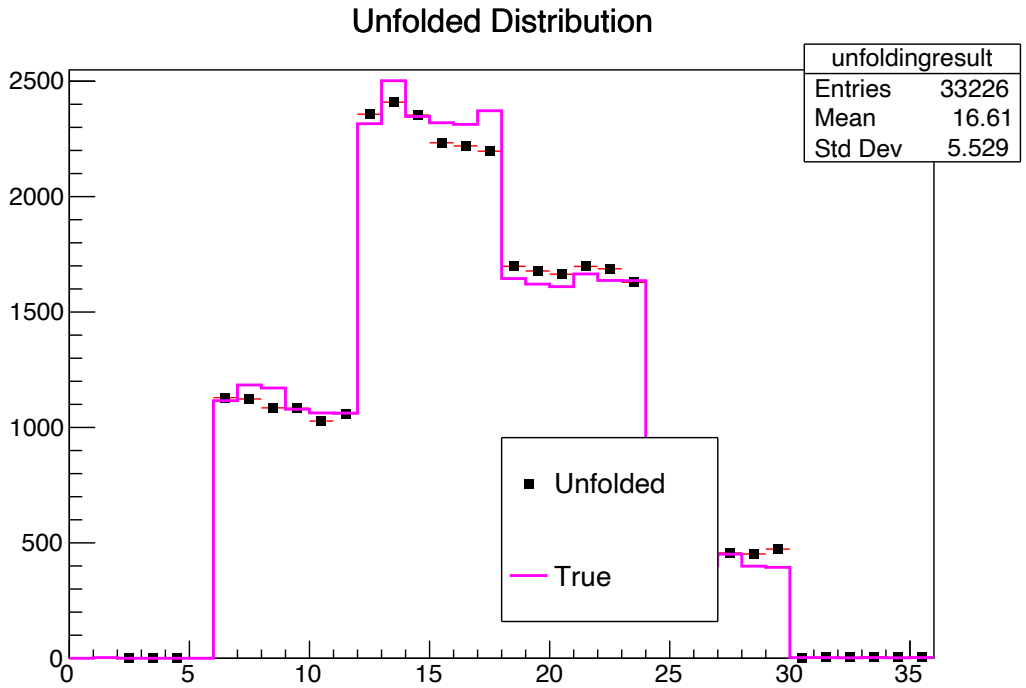


- Correlation matrix between true and measured pt in phi distributions.
- Two variables are being used here: pt and azimuth (phi)
- Input covariance matrix obtained from the square of the errors of the measured pt distribution from dpmjet Monte Carlo sample.

One-dimensional pt unfolding closure test



Unfolded the measured pt distribution using regularization parameter = 2
Minimum curvature = 0.000002

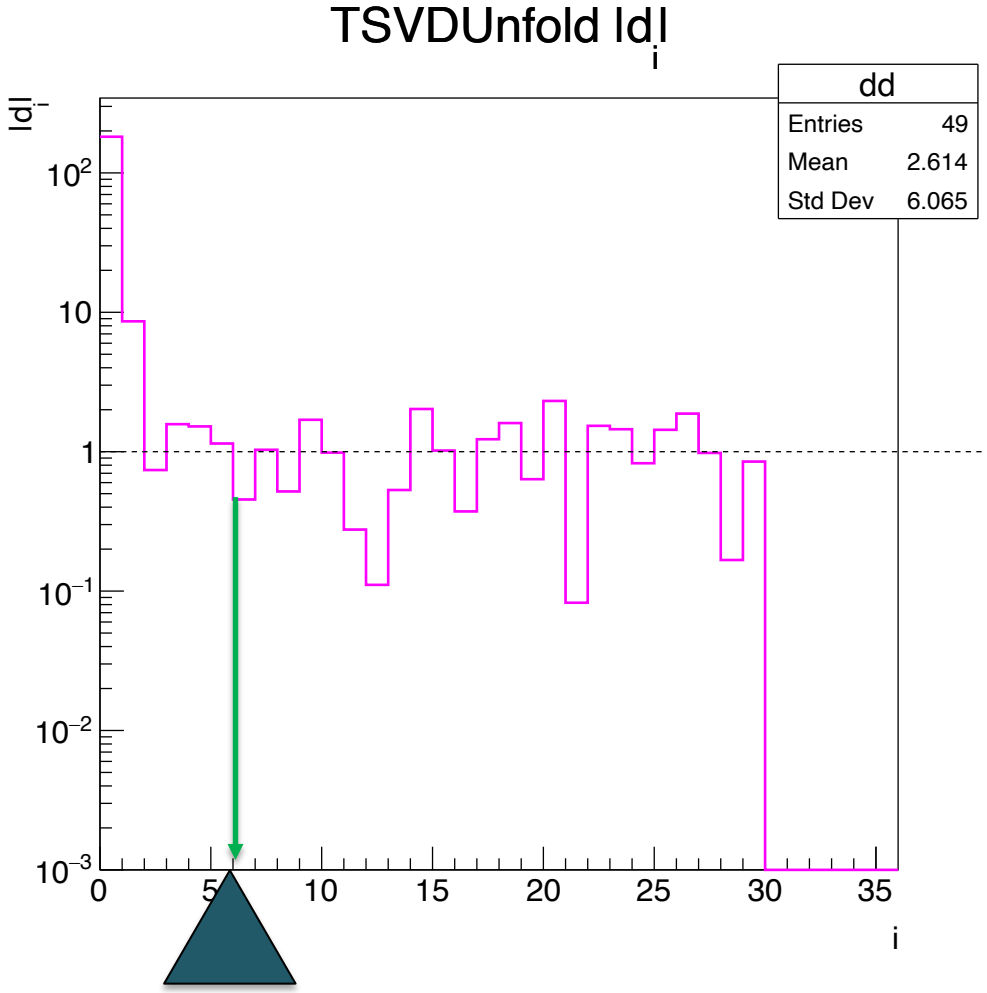


Magenta line: True distribution from dpmjet MC.

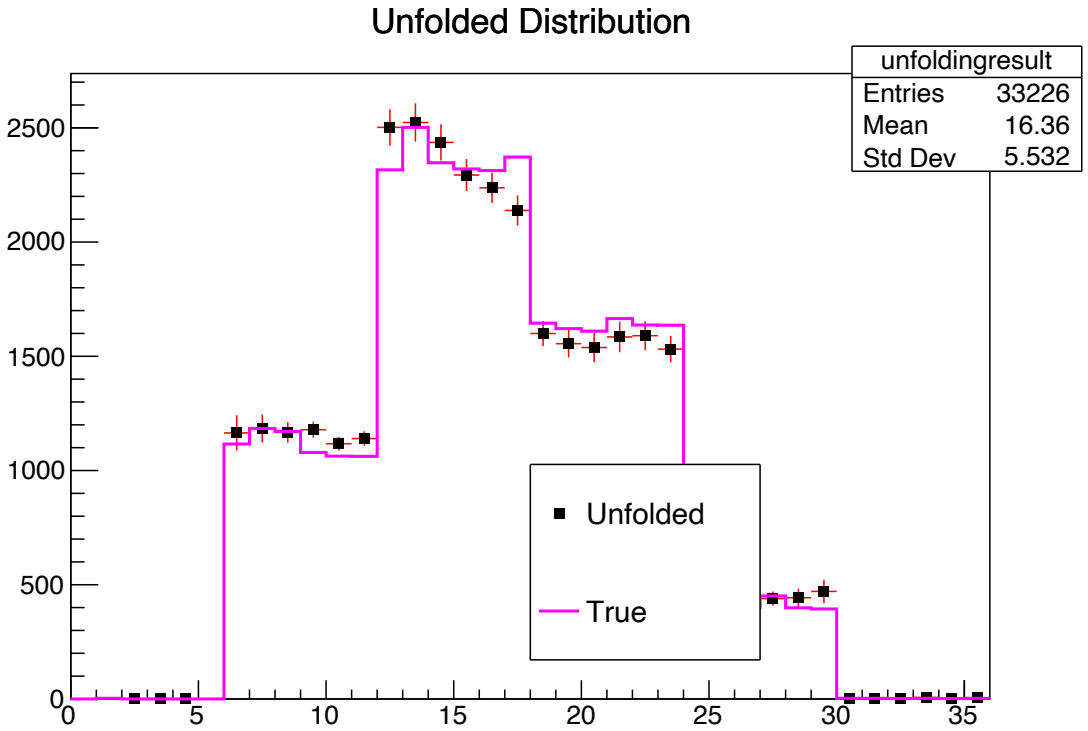
Solid black boxes: Unfolded distribution.

Unfolded distribution has been scaled to match the statistics between dpmjet and pythia.

One-dimensional pt unfolding closure test



Unfolded the measured pt distribution using regularization parameter = 6
Minimum curvature = 0.000331



Magenta line: True distribution from dpmjet MC.

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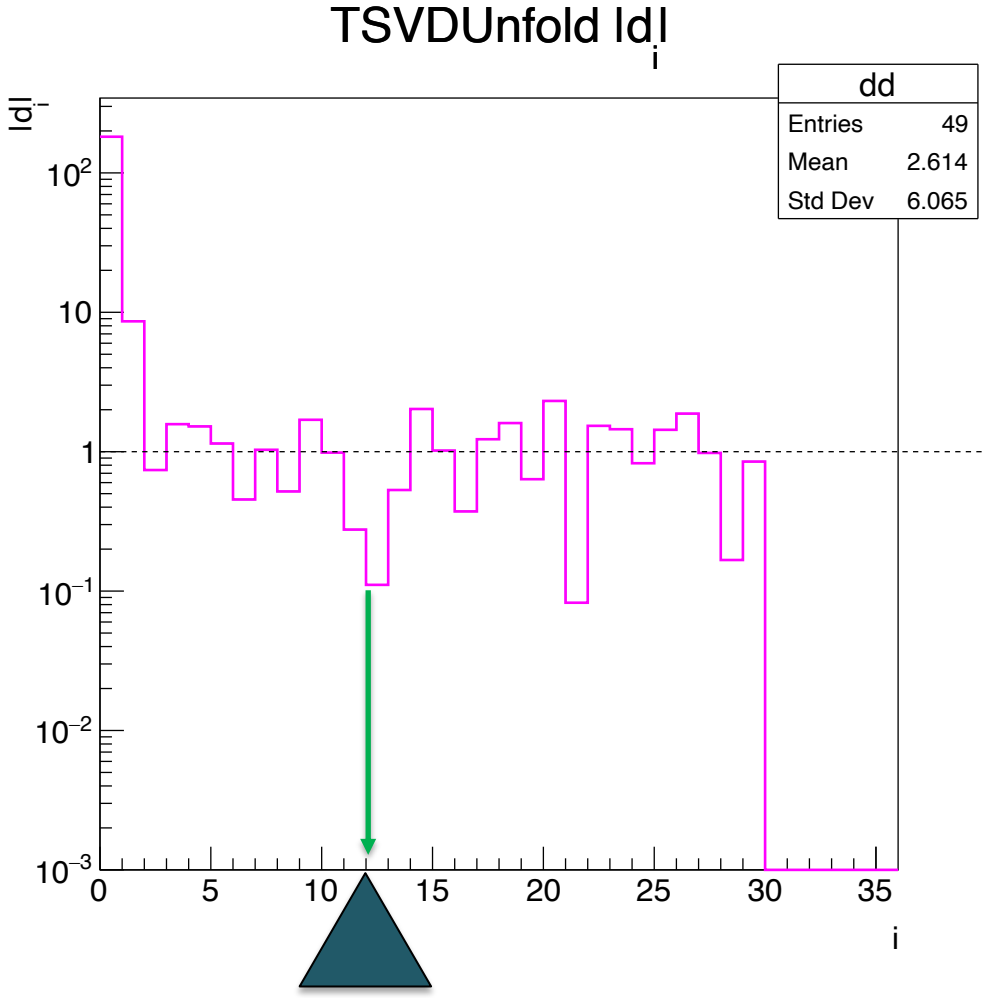
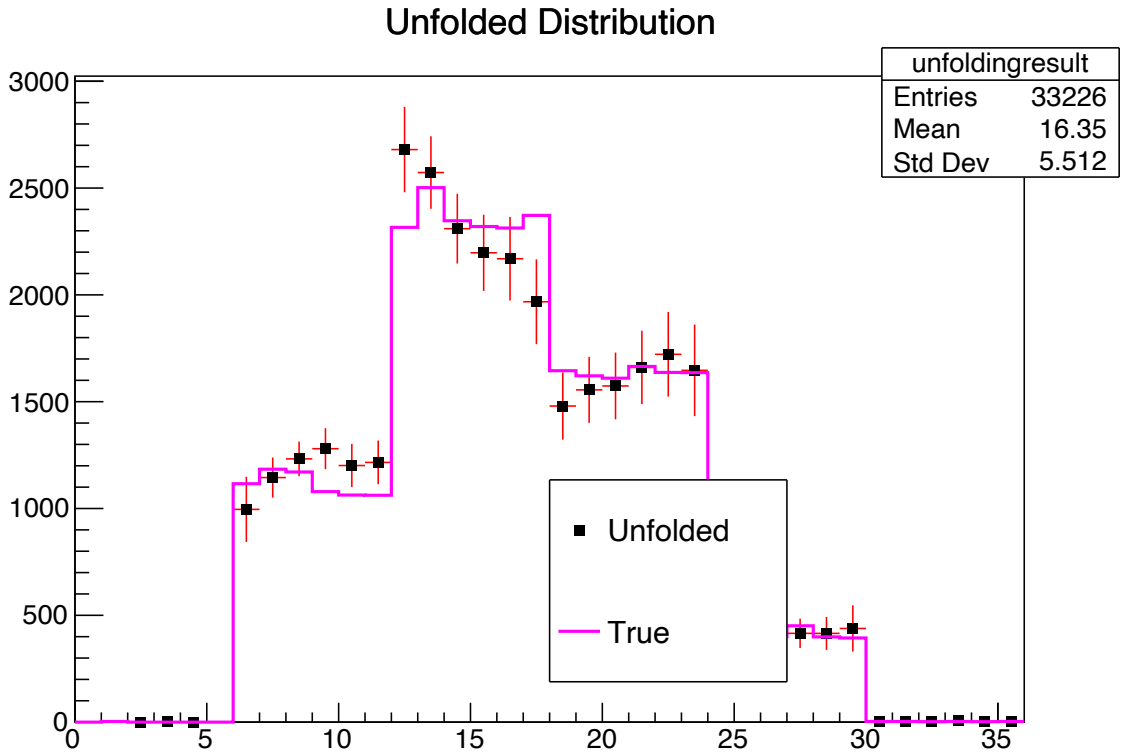
Unfolded distribution has been scaled to match the statistics between dpmjet and pythia.

One-dimensional pt unfolding closure test



Unfolded the measured pt distribution using regularization parameter = 12
Minimum curvature = 0.009416



Magenta line: True distribution from dpmjet MC.

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Summary

- Calculated measured pt distributions using acceptance cut calculated from average weighted x and y position variables (x_ev and y_ev), having no spikes.

- The x[ipart] and y[ipart] position variables still show some spikes even after applying the the number of smd > 1 cut condition. Not used in this unfolding cross-check. Still working on eliminating all spikes from x[ipart] and y[ipart] variables to use these variables in the unfolding. Tried algorithm of finding best ipart but not successful yet.

- Closure test seems to work well at small regularization parameter = 2 than at larger regularization parameter = 7 where it fails for the 1D case

- Similar trend for the 2D case. Lower values of regurization seem to agree better.

- Need to optimize unfolding code to work in PHENIX rcas computing machine. This closure test result is obtained using code compiled on local PC with CINT so far.

To do list (Schedule)

Period	Task
May 27 ~ May 30	Resolve remaining problems in the unfolding
June 1 ~ June 7	Unfolding and studying asymmetry weights by trying various functional forms for the true pt dependence of asymmetries.
June 8 ~ June 14	Optimize weight to mimic actual pT dependence of pp/pA data