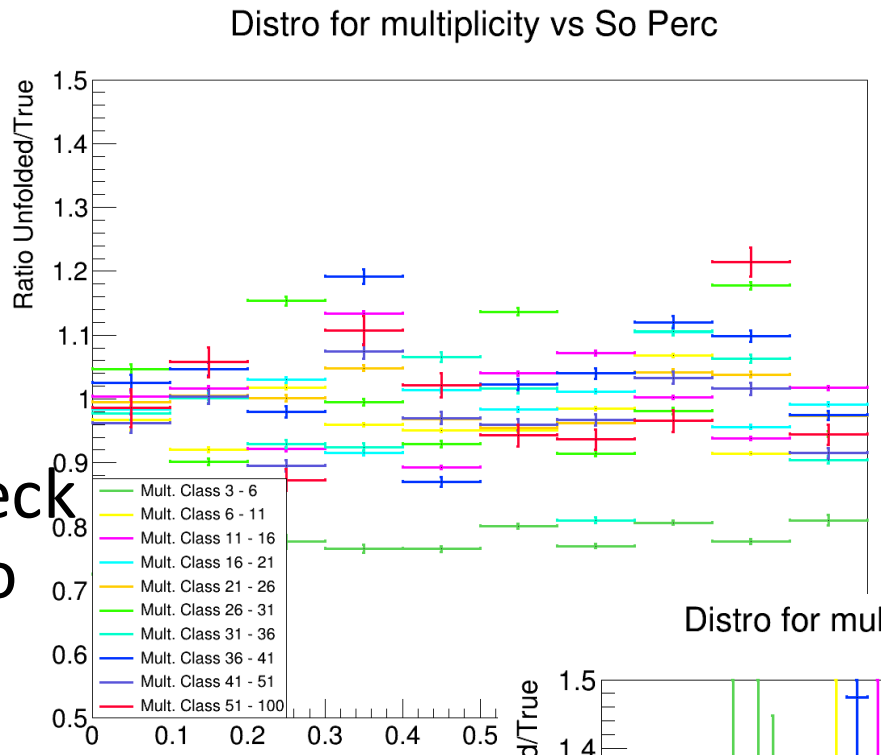
p T spectra as a function of Multiplicity and Transverse Spherocity in pp collisions using a Bayesian Unfolding

16/04

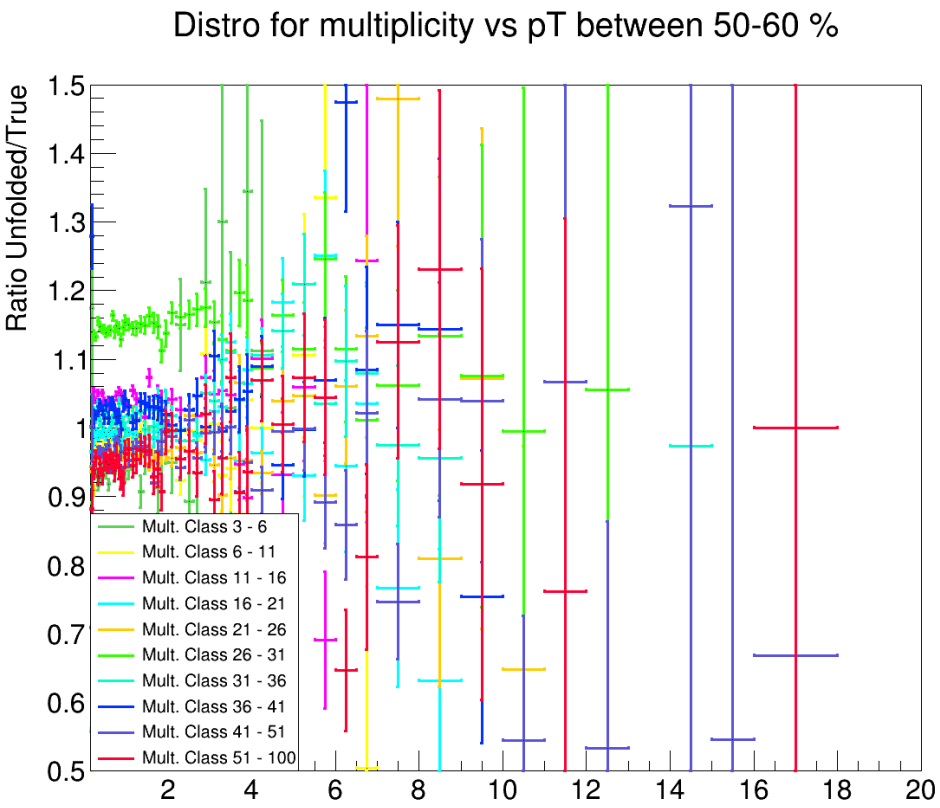
Background

- I rewrite the unfolding method from scratch to check if there was an error, and so far I have not found any.

- Both unfoldings, of particle tracks and events have some major issues, but the invariant yield (which is a ratio of the two) kind of works.



Event Distribution Closure Test



Particle Distribution Closure Test

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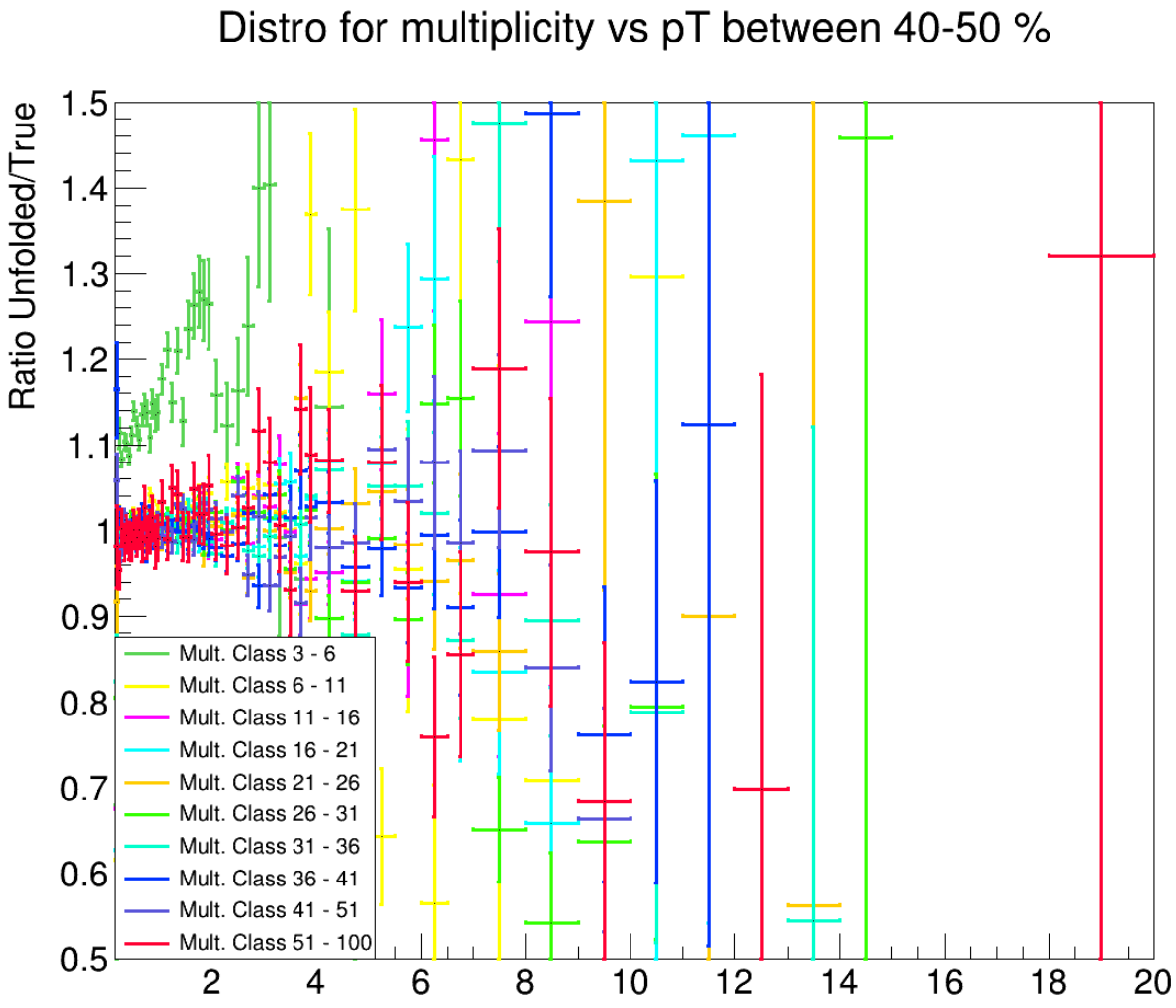


Invariant Yield
Closure Test

D'Angostini Original Paper

This paper presents a different approach, based on Bayes' theorem, recognized by statisticians as the most powerful tool for making statistical inferences. The main advantages with respect to other unfolding methods are:

— it is theoretically well grounded;

— it can be applied to multidimensional problems;

— it can use cells of different sizes for the distribution of the true and the experimental values;

— the domain of definition of the experimental values may differ from that of the true values;

— it can take into account any kind of smearing and migration from the true values to the observed ones;

— it gives the best results (in terms of its ability to reproduce the true distribution) if one makes a realistic guess about the distribution that the true values follow, but, in case of total ignorance, satisfactory results are obtained even starting from a uniform distribution;

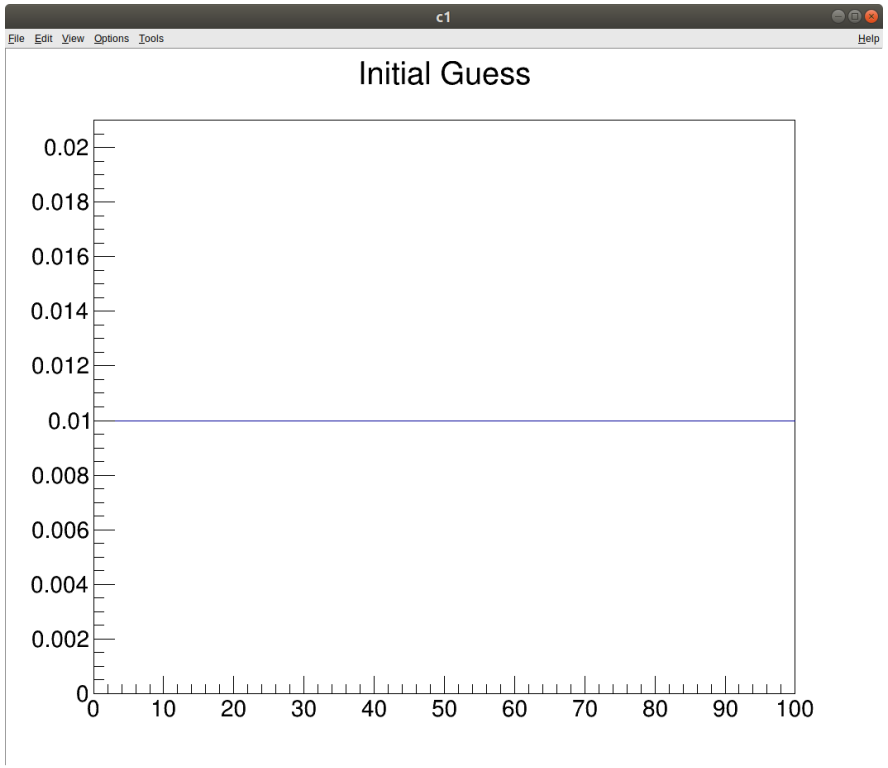
— it can take different sources of background into account;

— it does not require matrix inversion;

— it provides the correlation matrix of the results;

— it can be implemented in a short, simple and fast program, which deals directly with distributions and not with individual events.

What if instead of using a uniform distribution as an initial guess, we use a very similar distribution to the expected one?



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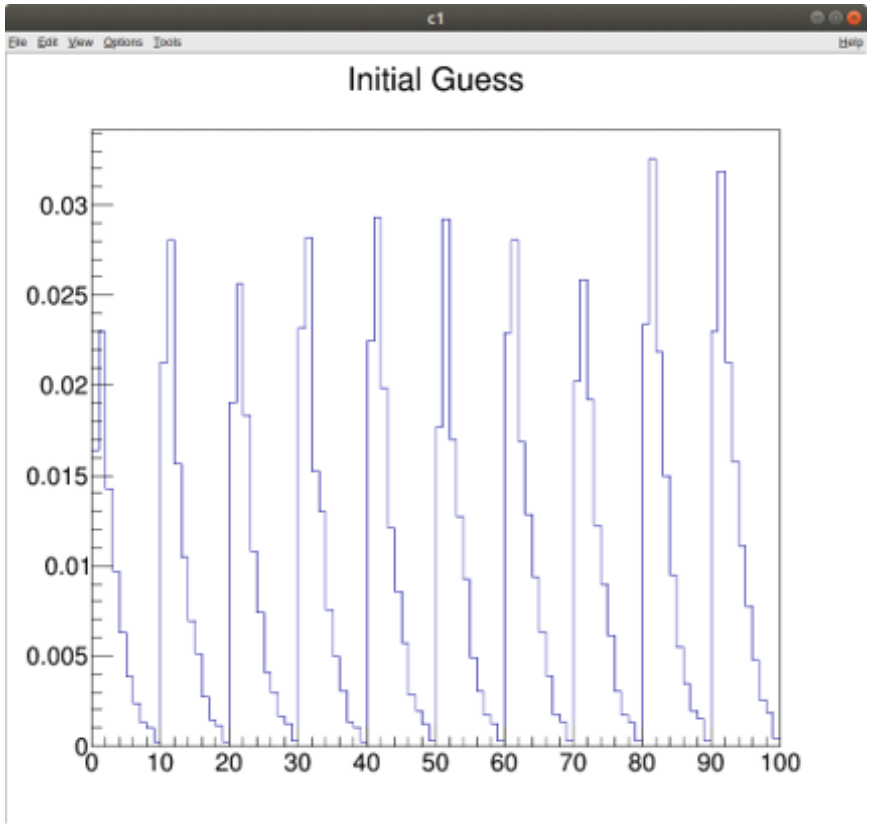
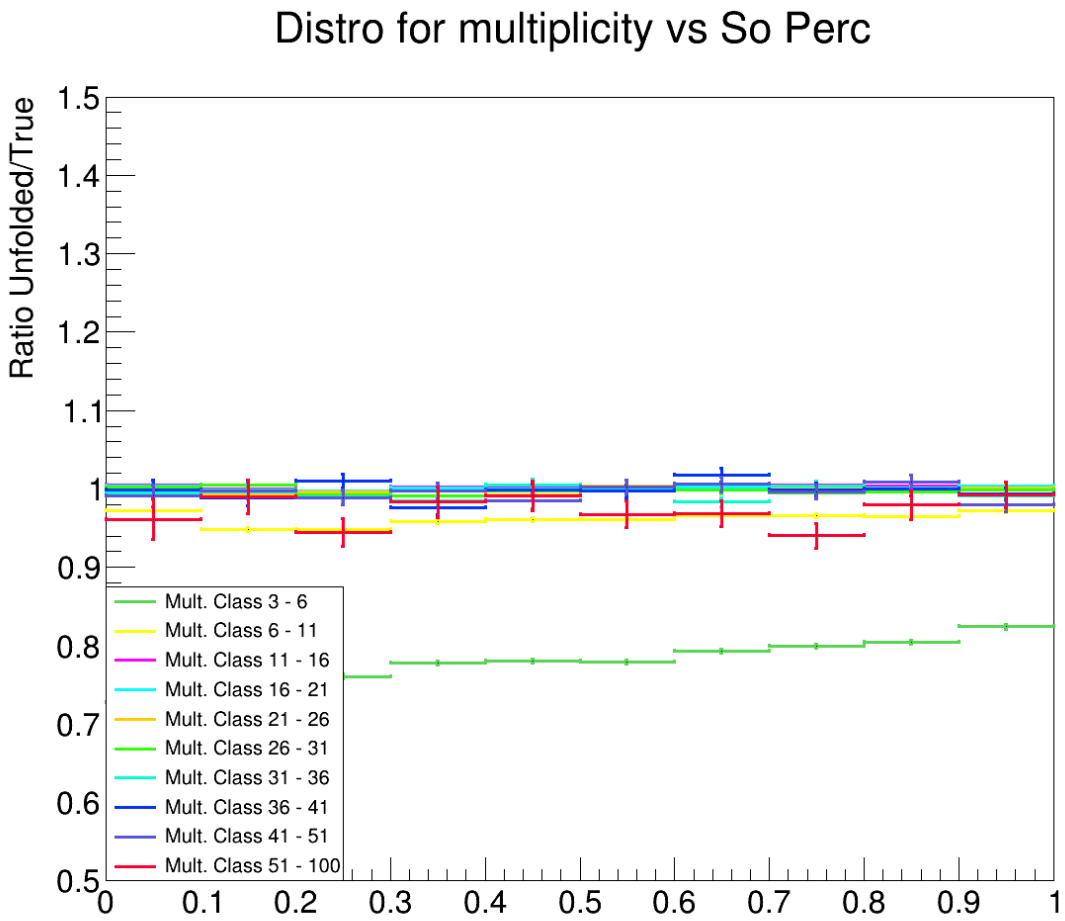
Like the measured one

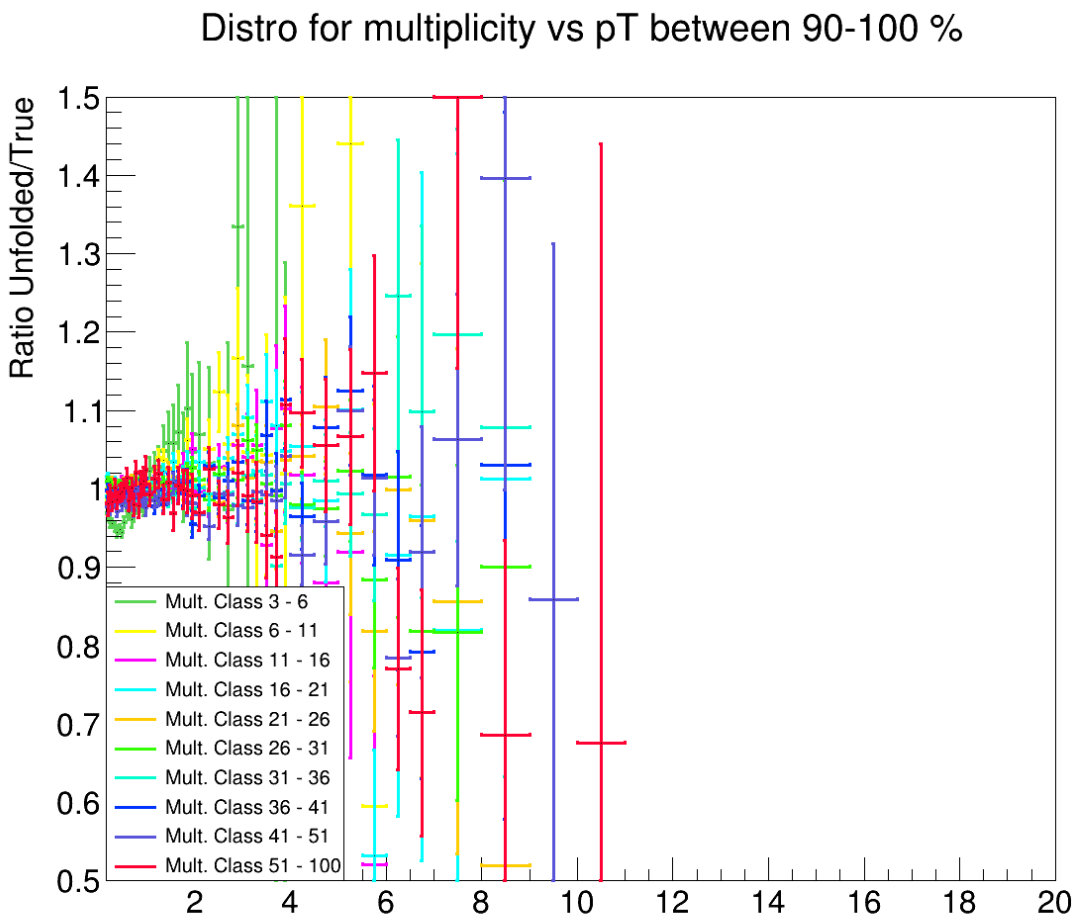


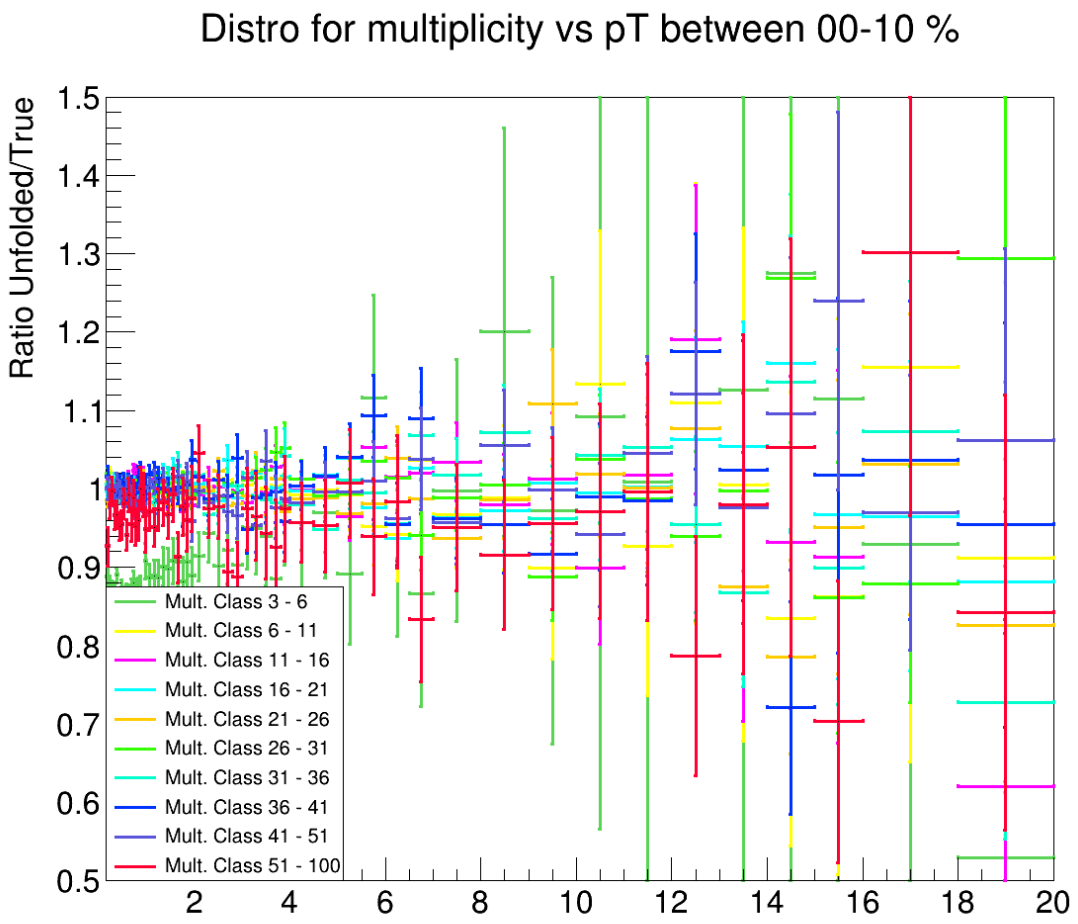
Result: Event Unfolding with new guess (3 iterations)

Event Distribution
Closure Test



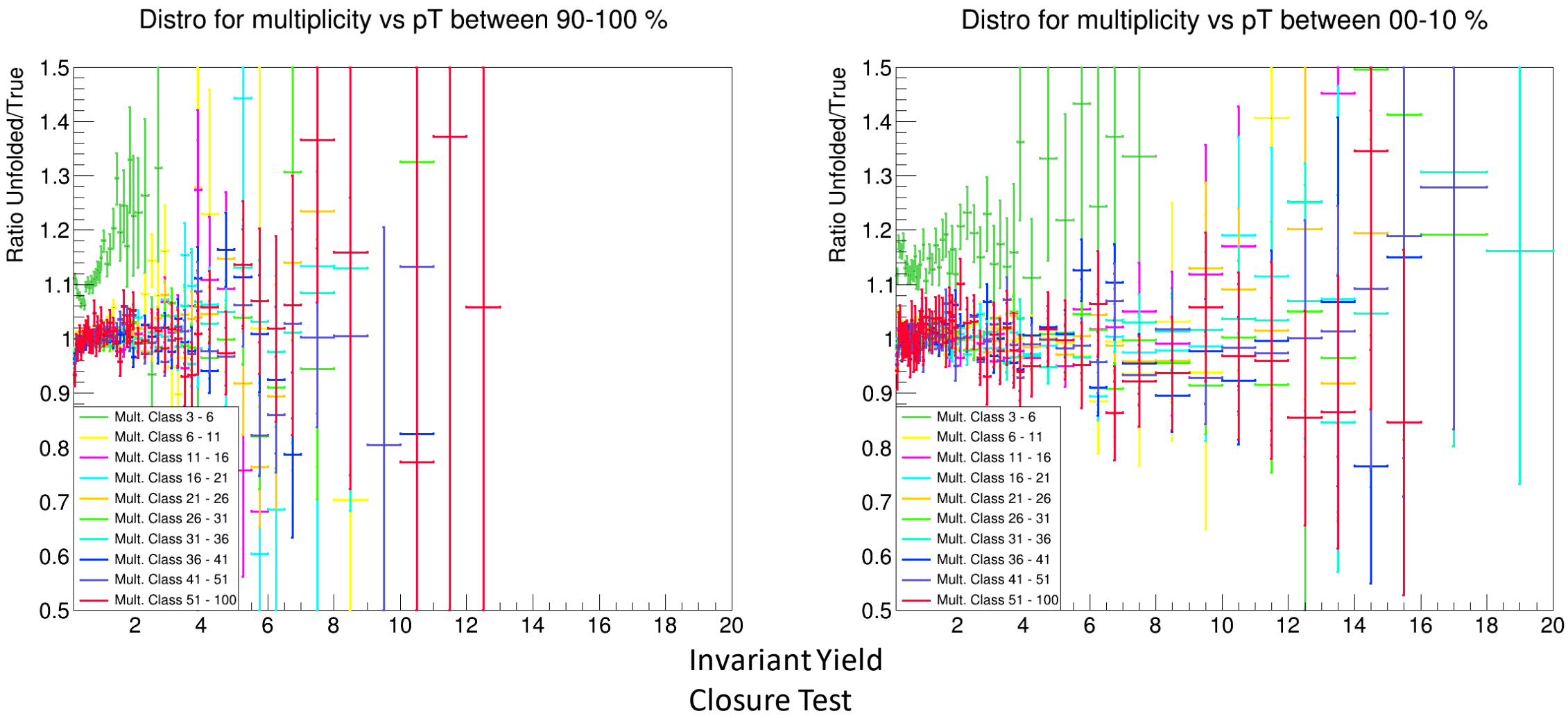
Particle Unfolding with new guess (3 iterations)





Particle Distribution
Closure Test

Invariant Yield with new guess (3 iterations)

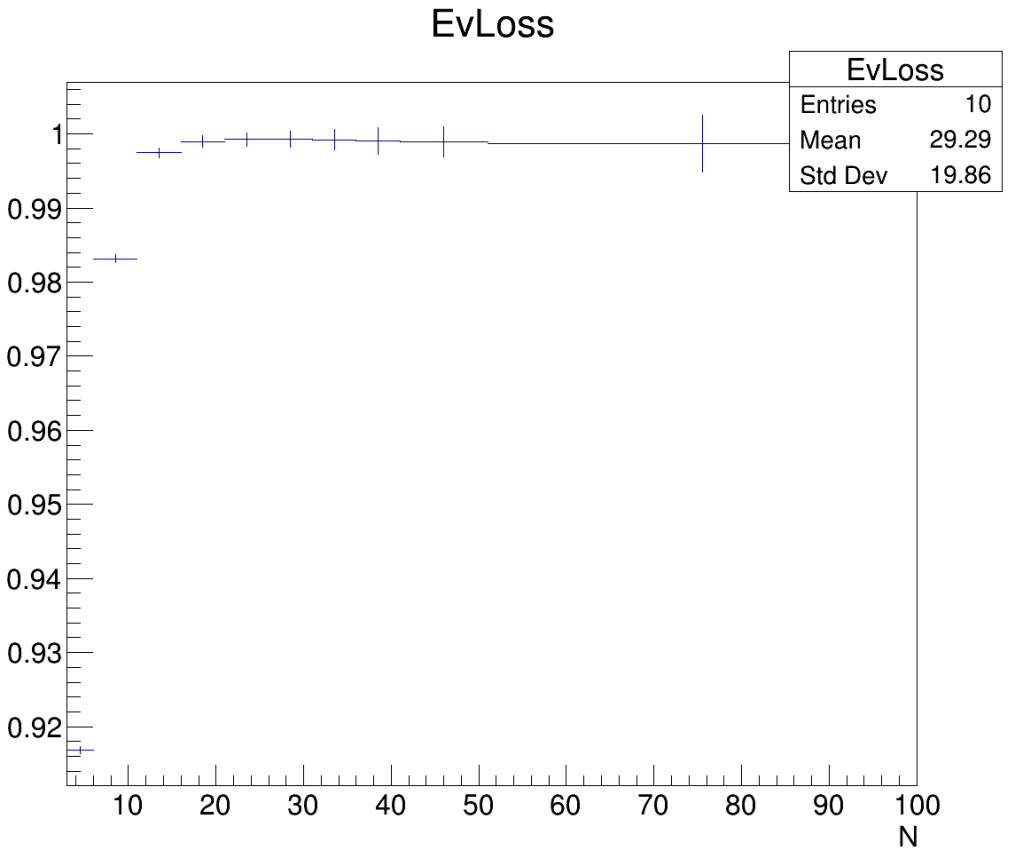


Conclusions

- If we improve the guess, using the measure one distribution, we found a better behavior.
- Probably drop the first multiplicity bin

after/before Physics Selection (Spherocity Independent)

Event Loss



Signal Loss