# Investigations on unfolding

## with RooUnfold

**Patrick L.S. Connor**

Deutsches Elektronen-Synchrotron

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# Introduction

In the current slides, a code for unfolding studies is described[1]:

- requires latest RooUnfold version and Root6
- resolution and pt spectrum to be defined by the user
  $\longrightarrow$ trivial RM can also be defined
- compares different unfolding methods available in RooUnfold
  $\longrightarrow$ at least two methods should give similar results

Tests on MadGraph, Pythia8 and Run2015CD can be found in the other presentation on the same slot.

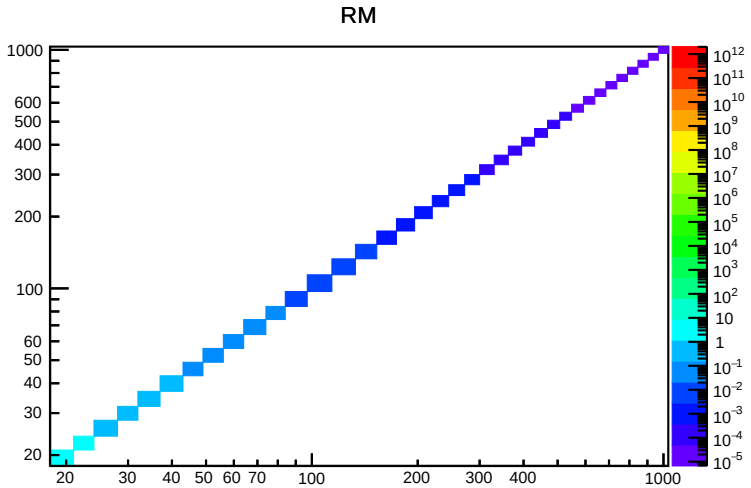
[1] available on same indico page

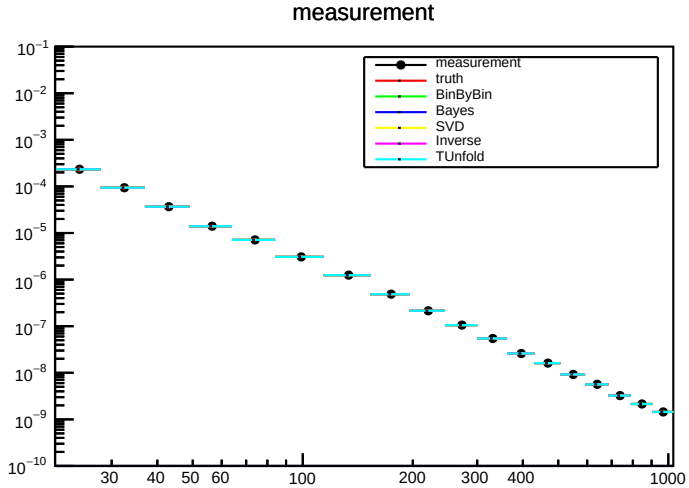
# Unfolding methods

| | |
|---|---|
| bin/bin | correct central values but wrong handling of statistical uncertainties |
| Bayes | iterative procedure, good experiences in previous analyses, converges but unknown number of iterations |
| Inversion | best on principle, but possible instabilities if statistics is too low |
| TUnfold | likelihood minimisation, including regularisation, recommended by statistics comitee, developer is at DESY |
| SVD | ... |

# Tool

- works with latest RooUnfold version in Root6
- produces a canvas with RM, resolution in pt bins, statistically independent reconstructed spectrum, ratio of the different unfolding methods with the "measured" spectrum
- $\sigma = 1/p_T^4$
- binning can easily be changed, shown in the following with the jet standard binning
- only a trivial and a gaussian smearing have been tried so far


RM


measurement
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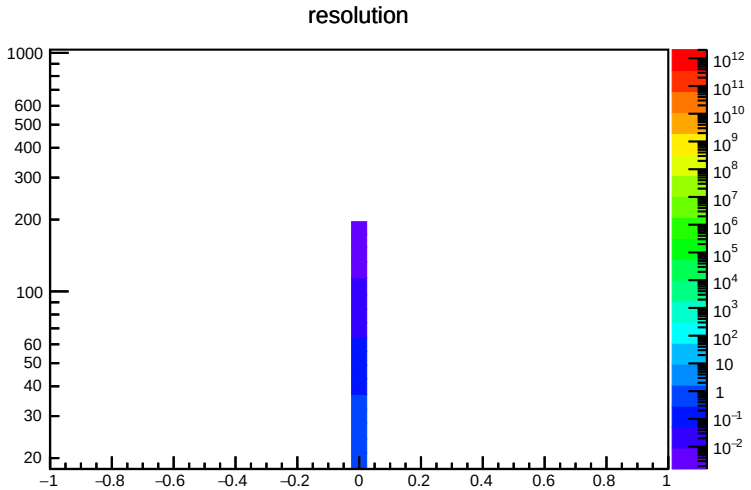
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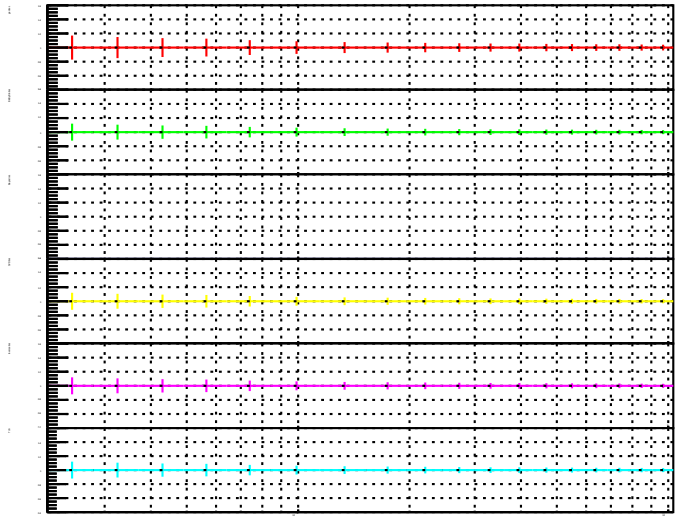

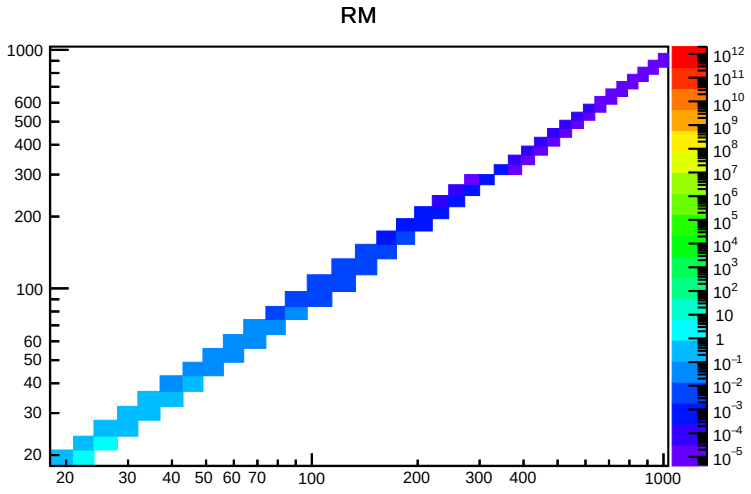
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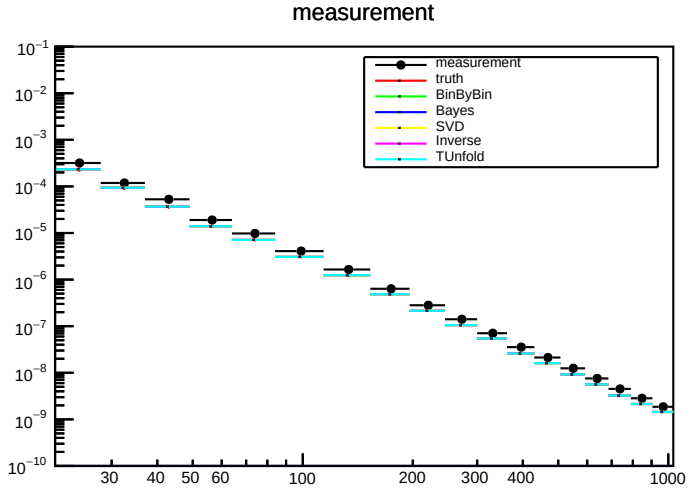
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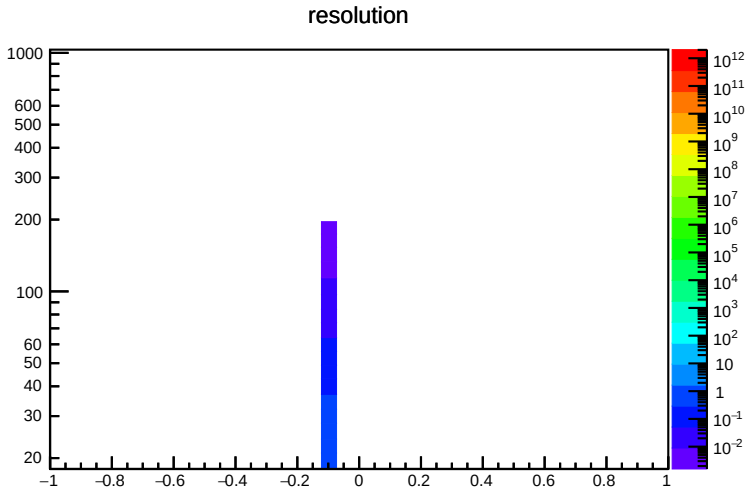
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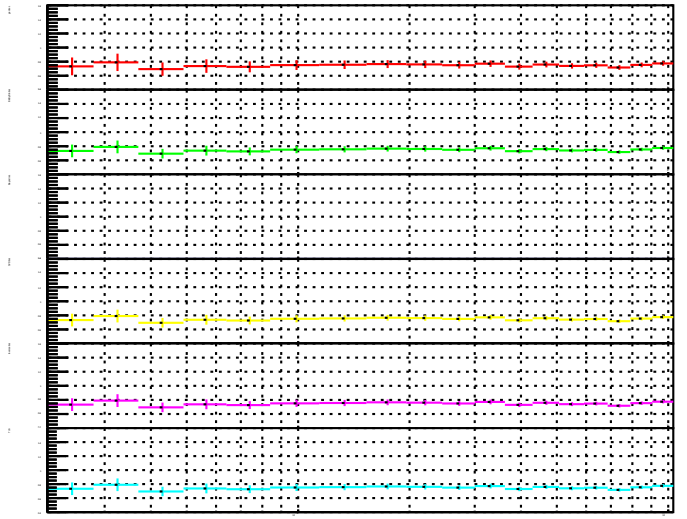

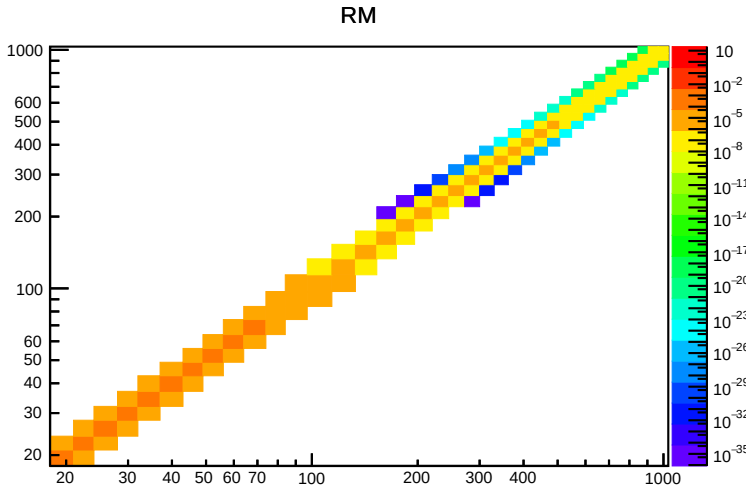
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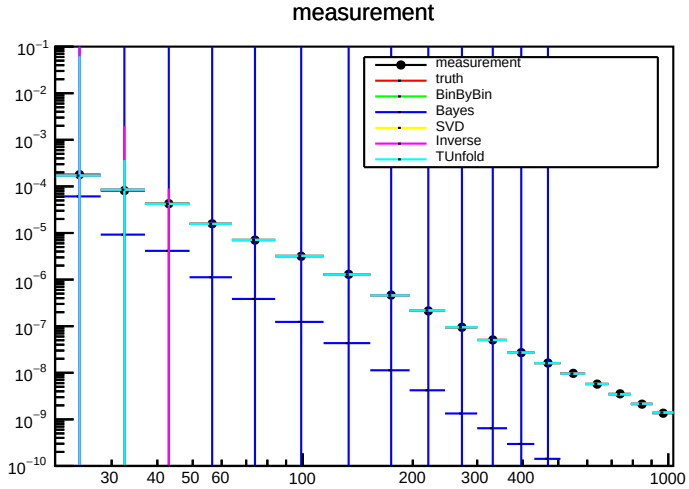
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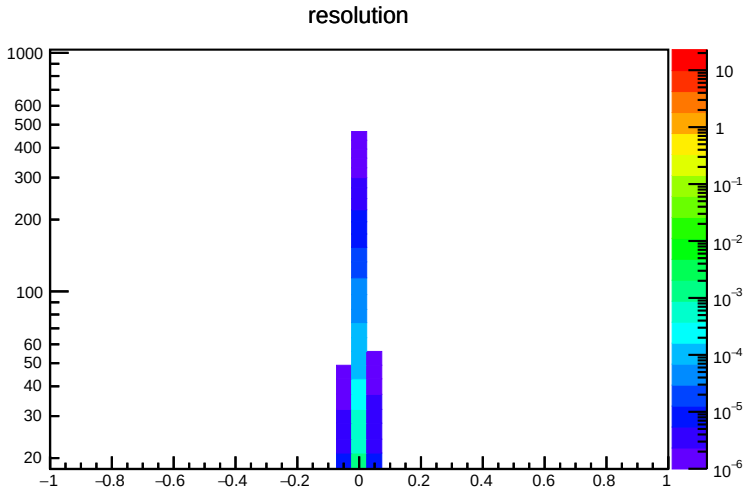
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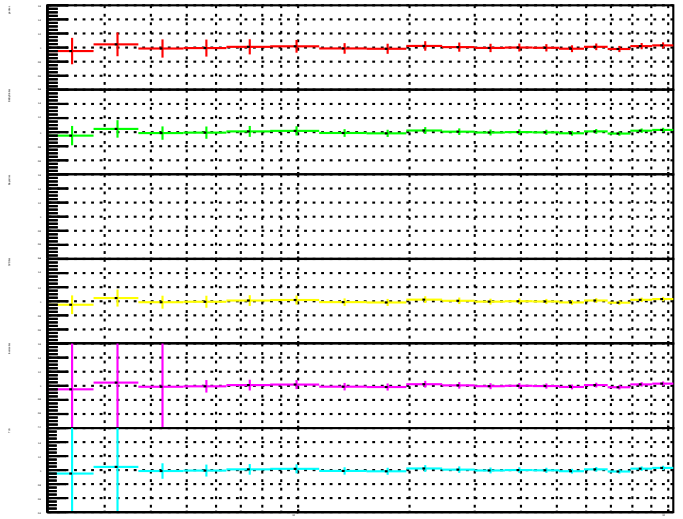

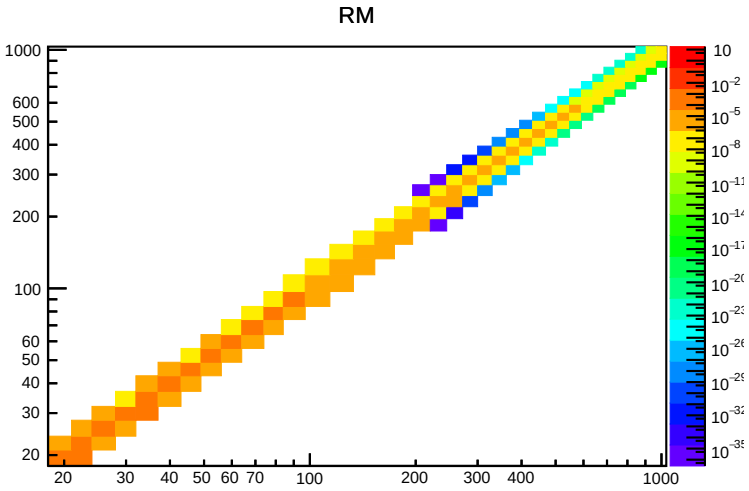
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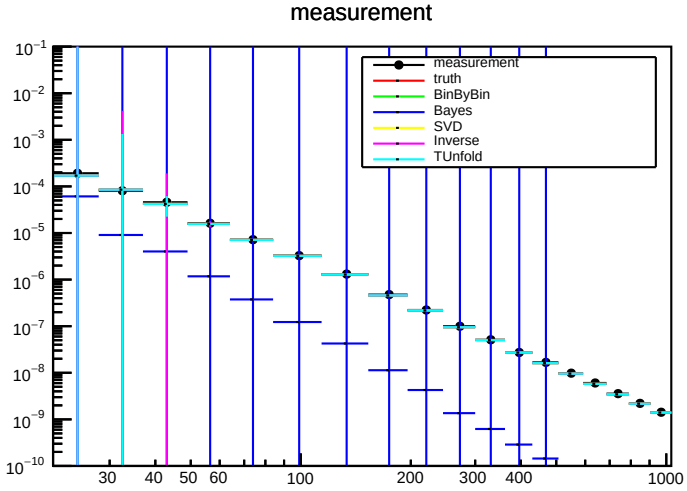
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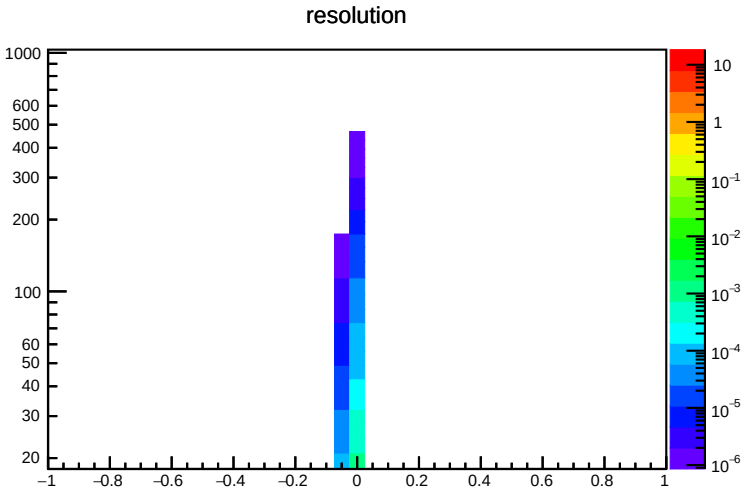
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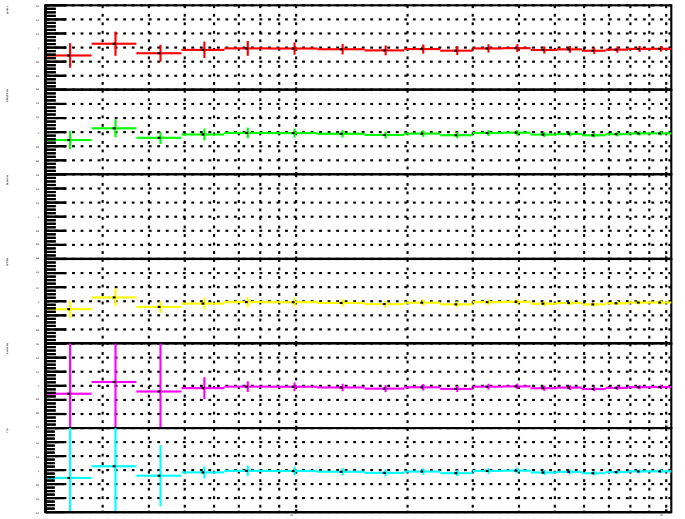

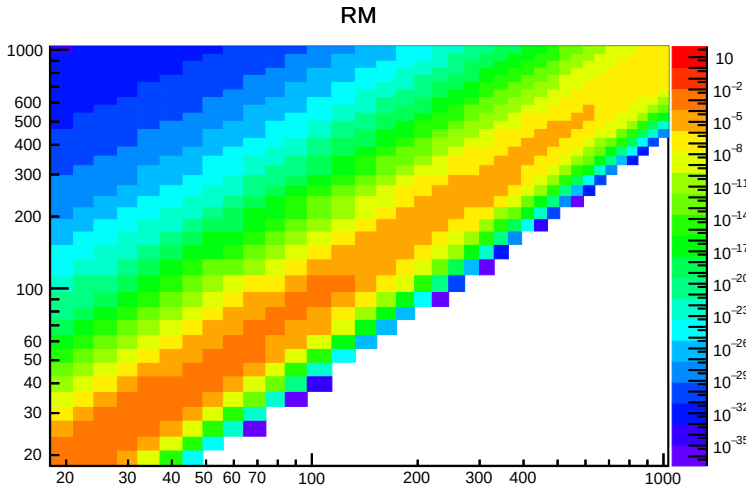
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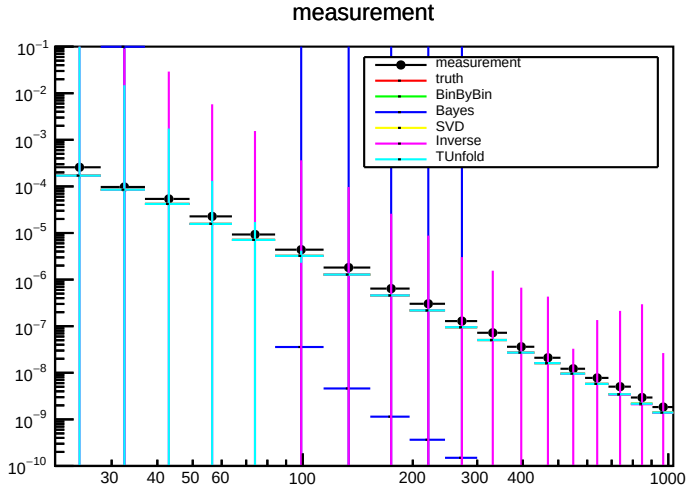
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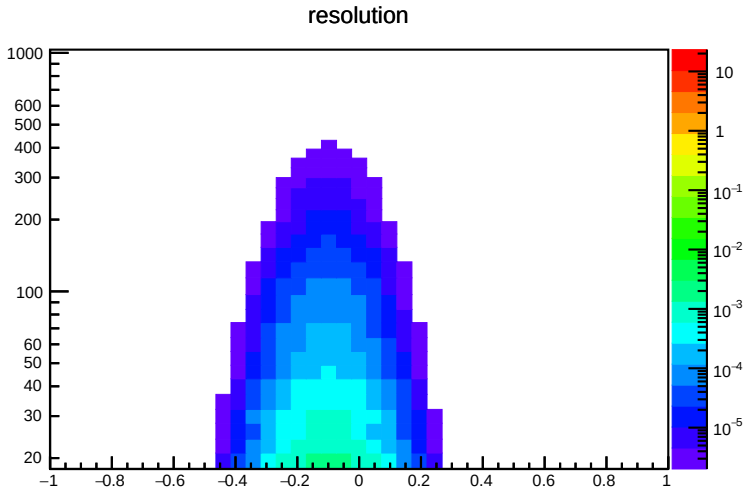
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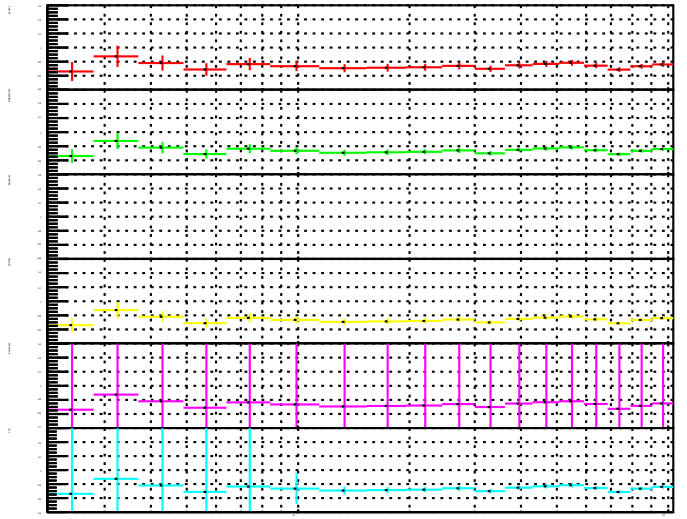

# Early conclusions

From this unfolding model and from previous investigations (see other attachment to the indico page)

- no unfolding method looks 100% reliable in any conditions
  $\longrightarrow$ find the conditions under which they are reliable
- parameters that can matter:
  1. normalisation (only for Bayes)
  2. binning (especially for Bayes and Inversion)
  3. uncertainties (especially for Inversion and TUnfold)