HF jets analysis

09.06.2020 ALICE@IFJ meeting

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Outline

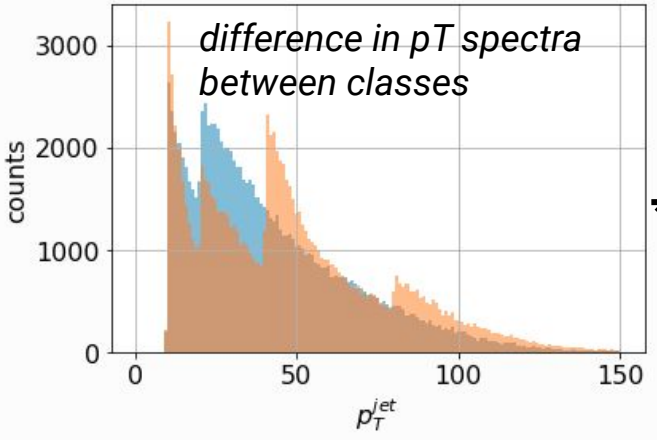
1. Progress in HF-jets analysis
    - number of b-jets observed in data & b-fraction
    - correction on model efficiency (for given score threshold)
2. Plans for next week

MC

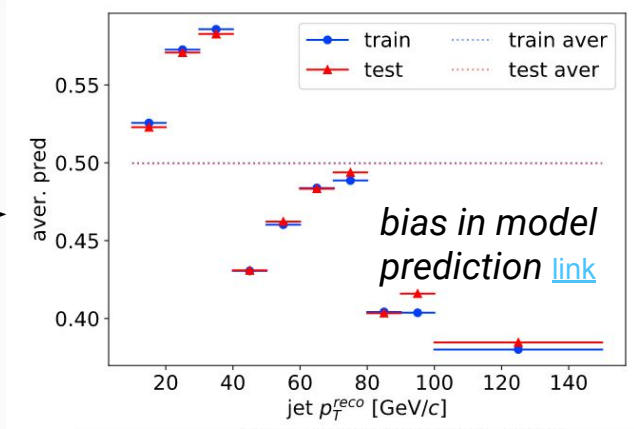
- PYTHIA in hard pt-bins -- unrealistic pT distribution
- enhanced b & c -- unrealistic flavour mixture

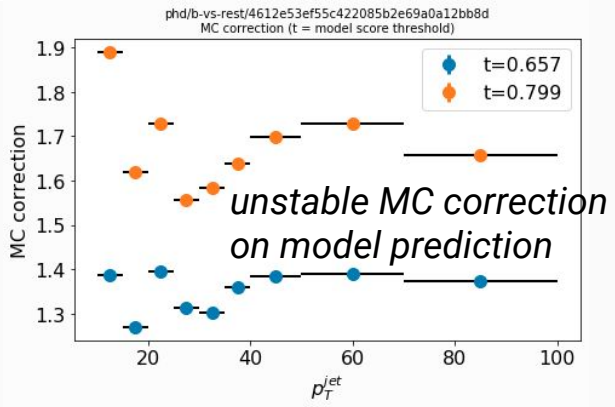
both necessary for training

pT distribution alignment



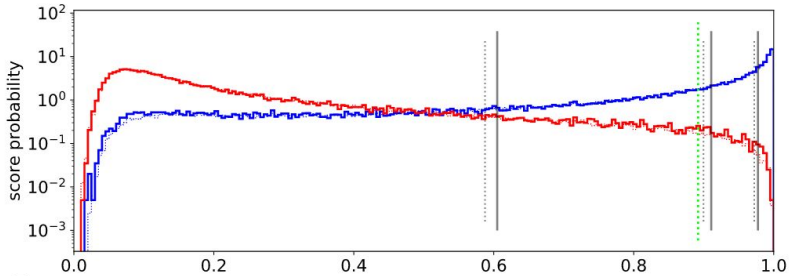
results in:

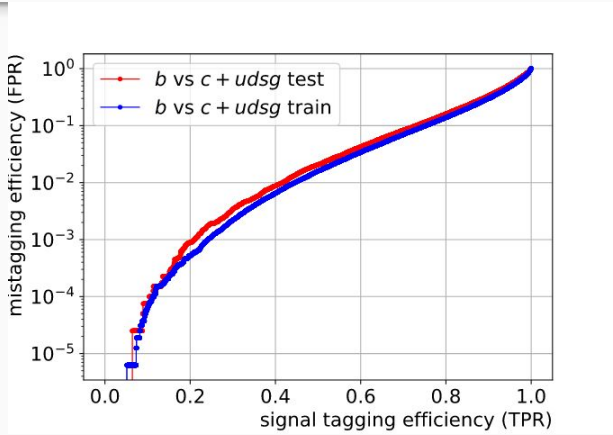


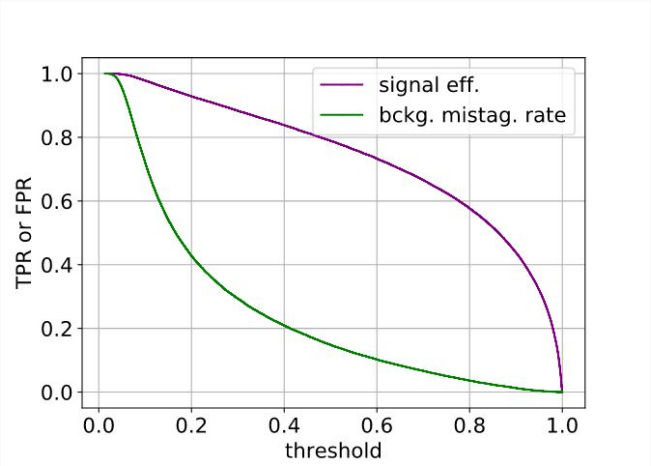


same effect observed, even after removing from input vector pT and most correlated features!

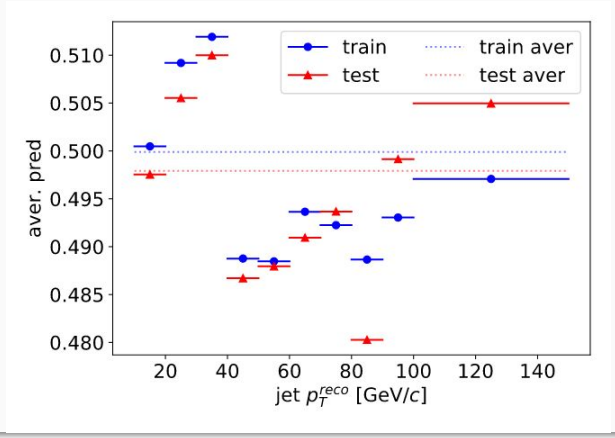
model with aligned pT distribution





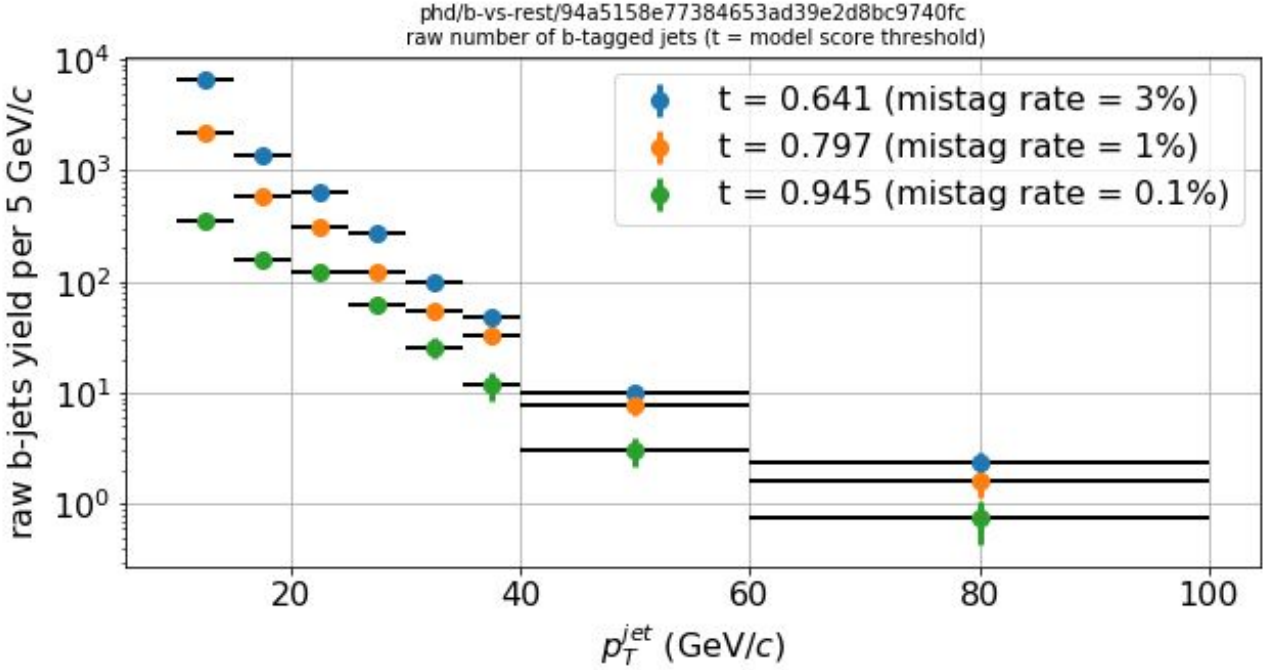


LINK TO PLOTS



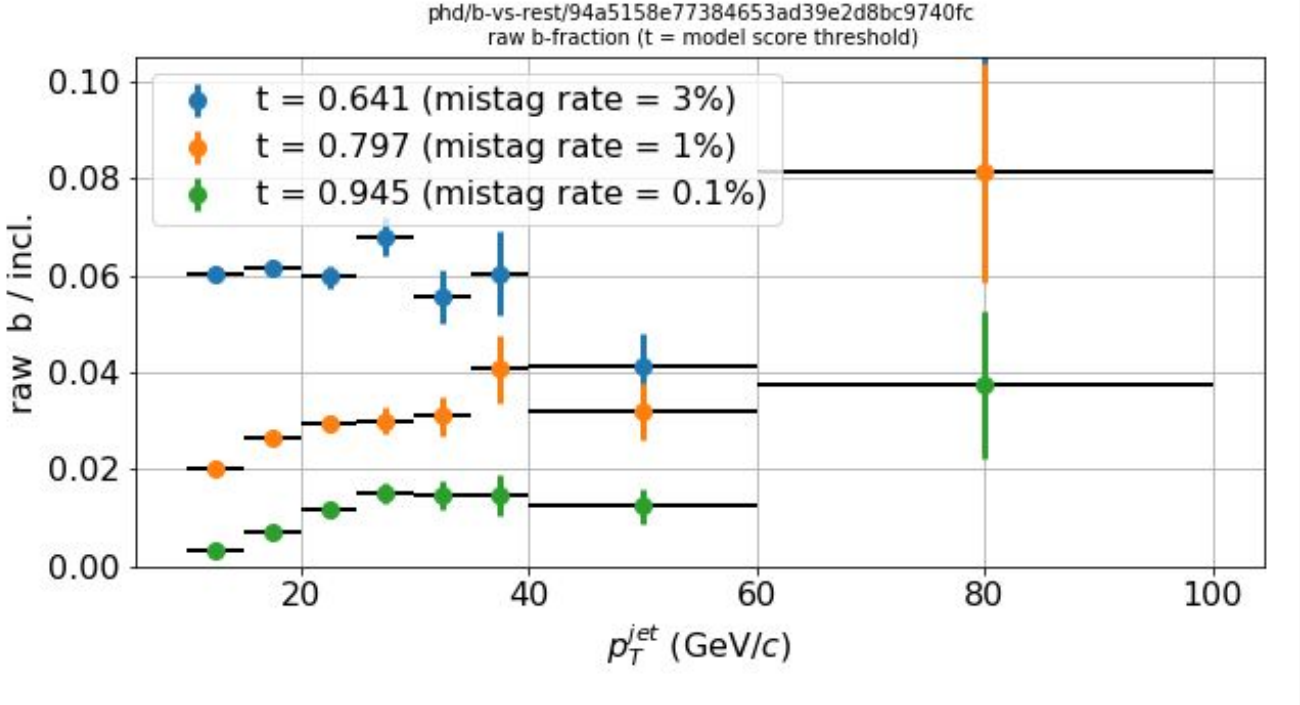
number of b-jets (raw)

$$N_{\text{raw}}^{b-tagged} = |model(jet) > threshold|$$



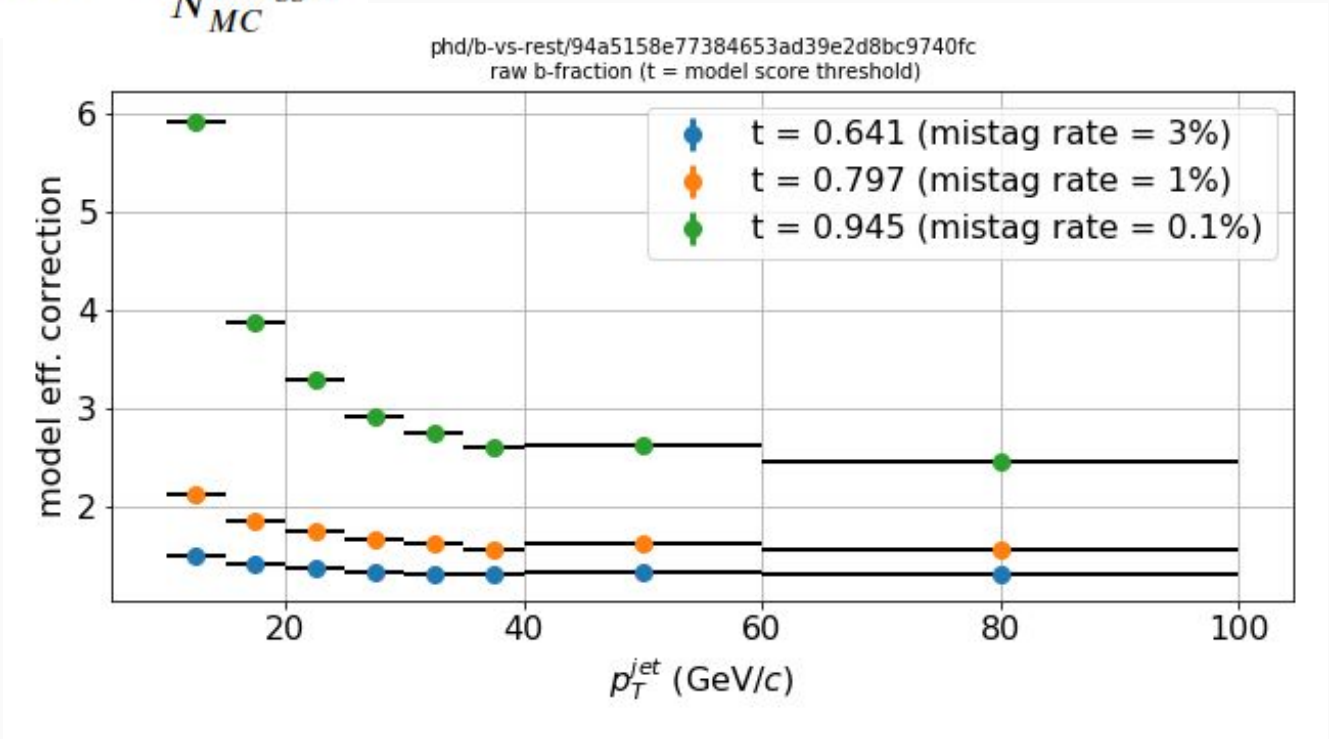
b-fraction (raw)

$$f_b^{\text{raw}} = \frac{N_{\text{raw}}^{b-tagged}}{N^{incl.}}$$



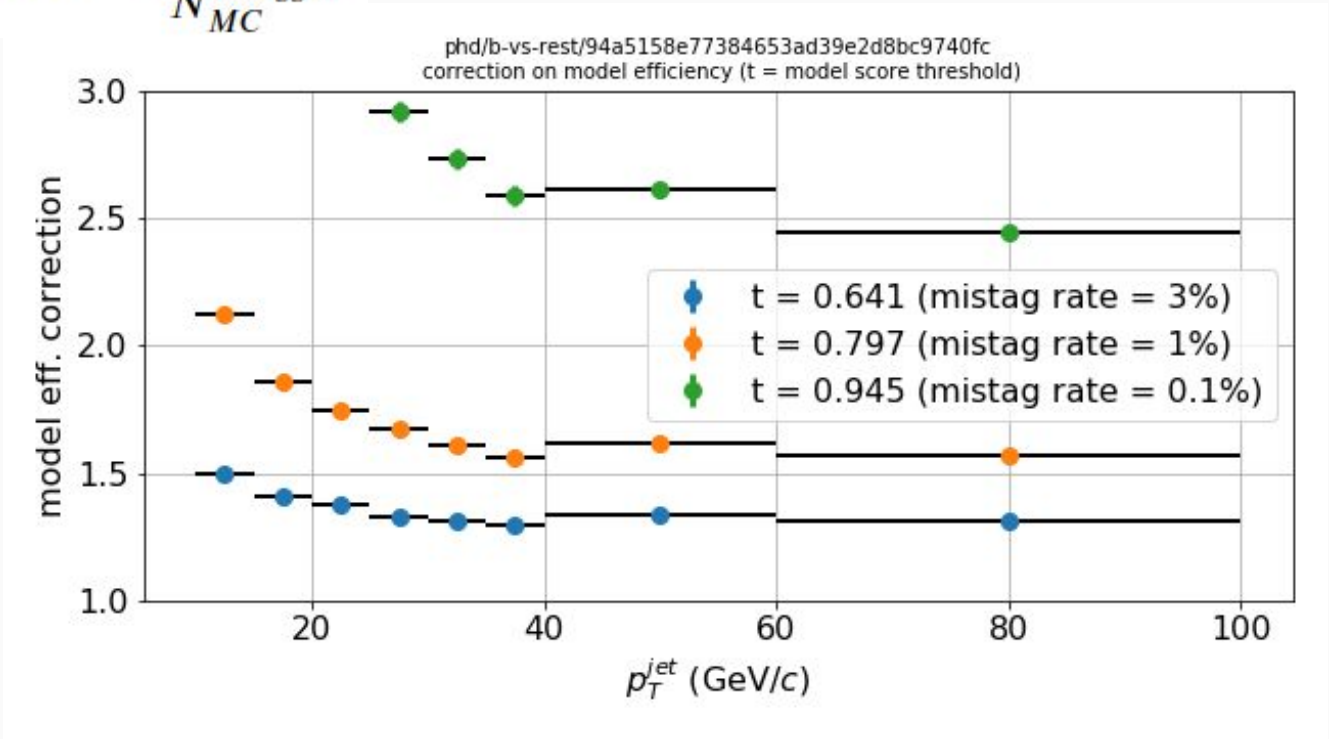
MC correction on model efficiency

$$\text{correction} = \frac{N_{MC}^{true\ b}}{N_{MC}^{b-tagged}}$$



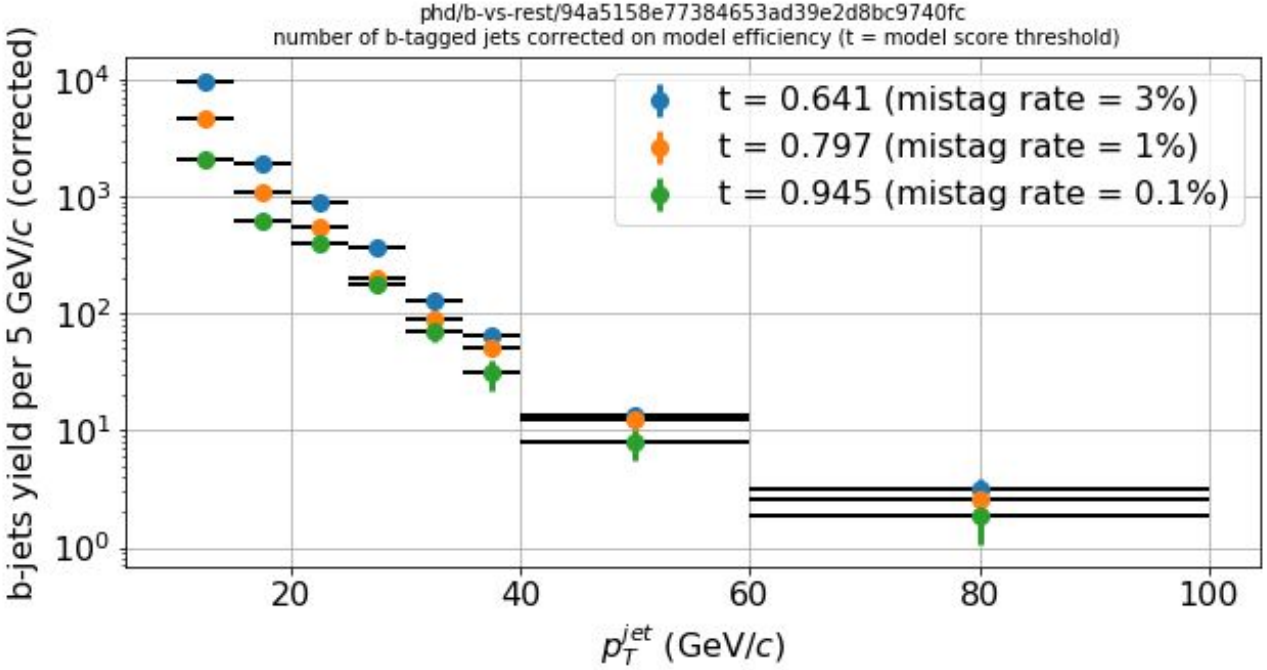
MC correction on model efficiency *zoomed*

$$\text{correction} = \frac{N_{MC}^{true\ b}}{N_{MC}^{b-tagged}}$$



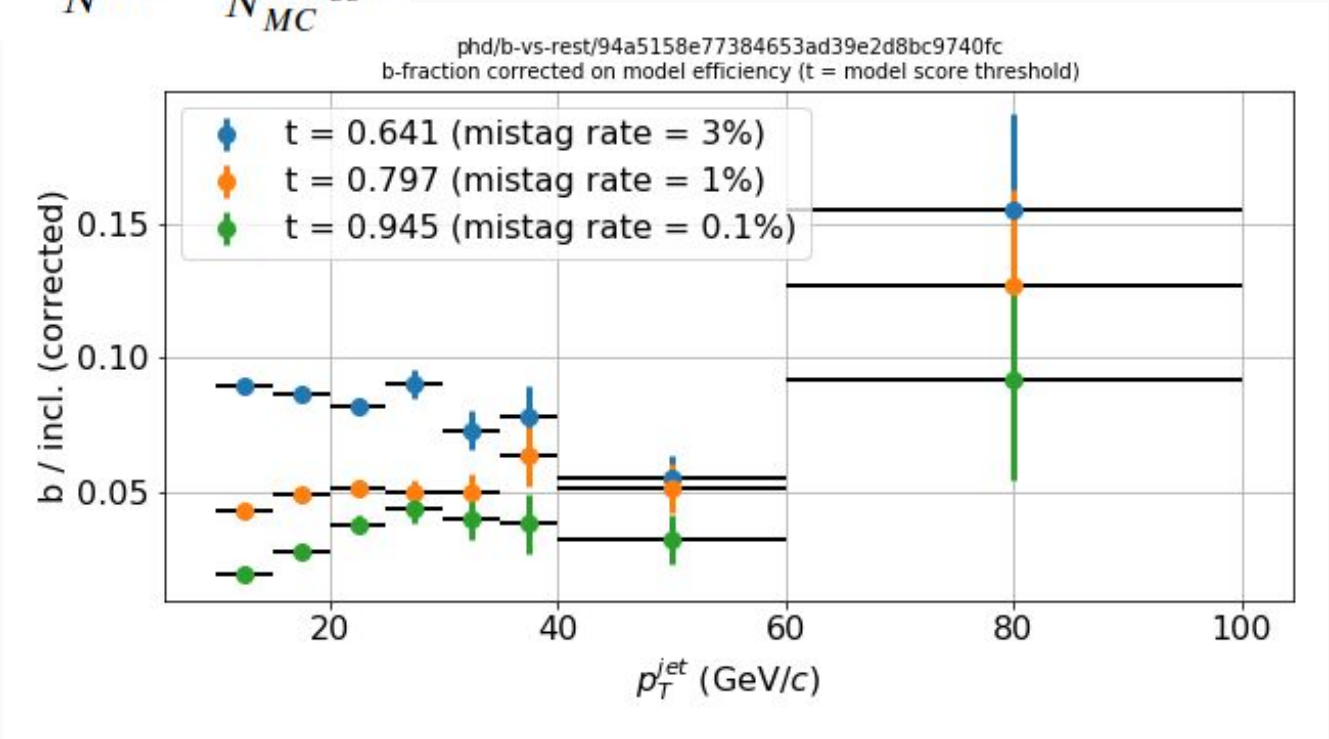
number of b-jets (corrected)

$$N_{\text{corr}}^{b-tagged} = N_{\text{raw}}^{b-tagged} \frac{N_{MC}^{true\ b}}{N_{MC}^{b-tagged}}$$



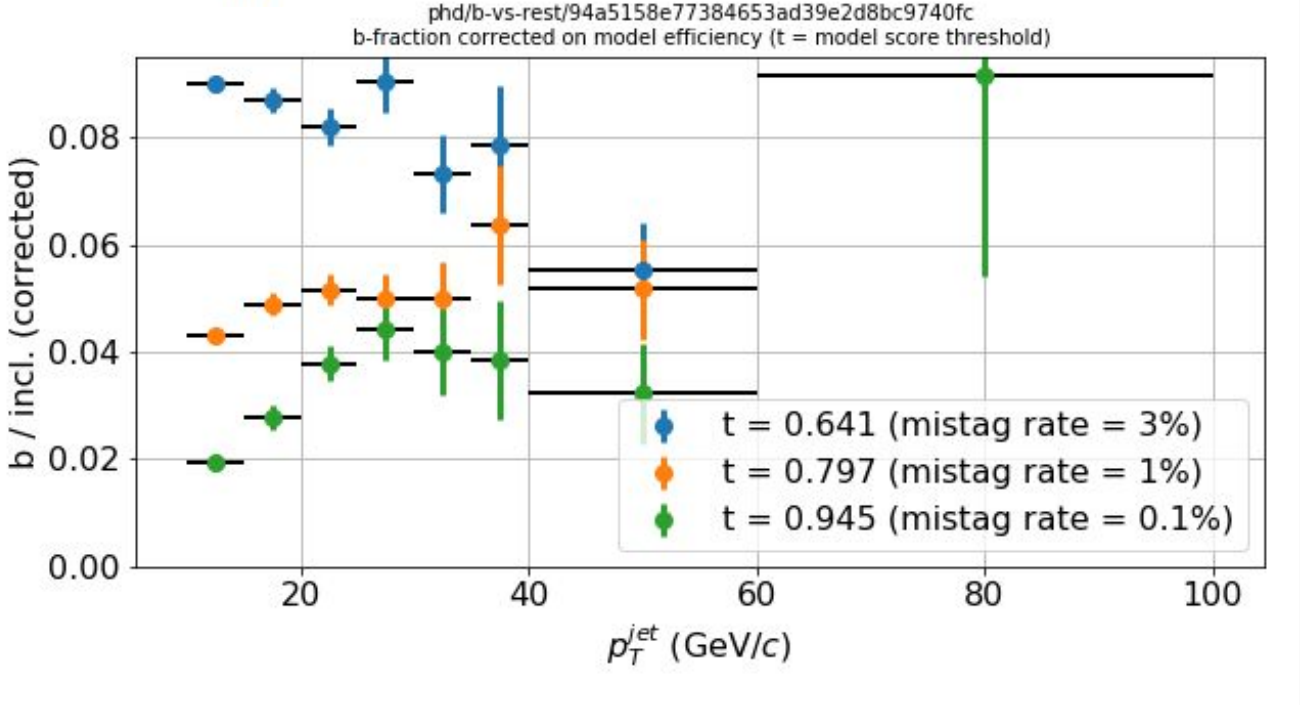
b-fraction (corrected)

$$f_b^{\text{corr}} = \frac{N_{\text{raw}}^{b-tagged}}{N^{incl.}} \frac{N_{MC}^{true\ b}}{N_{MC}^{b-tagged}}$$

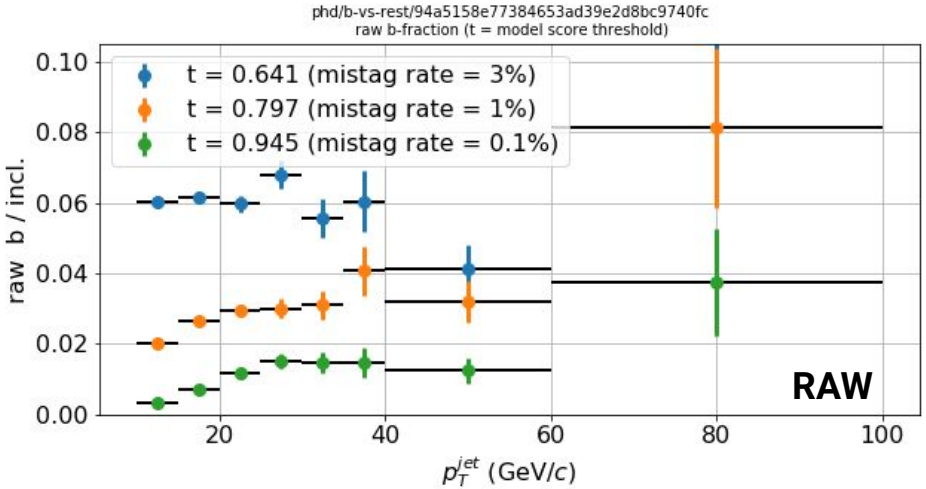


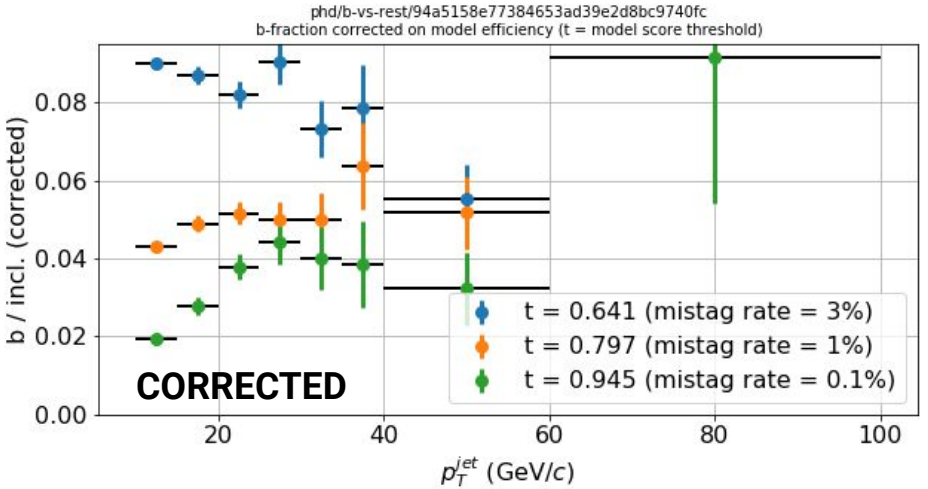
b-fraction (corrected) *zoomed*

$$f_b^{\text{corr}} = \frac{N_{\text{raw}}^{b-tagged}}{N^{incl.}} \frac{N_{MC}^{true\ b}}{N_{MC}^{b-tagged}}$$



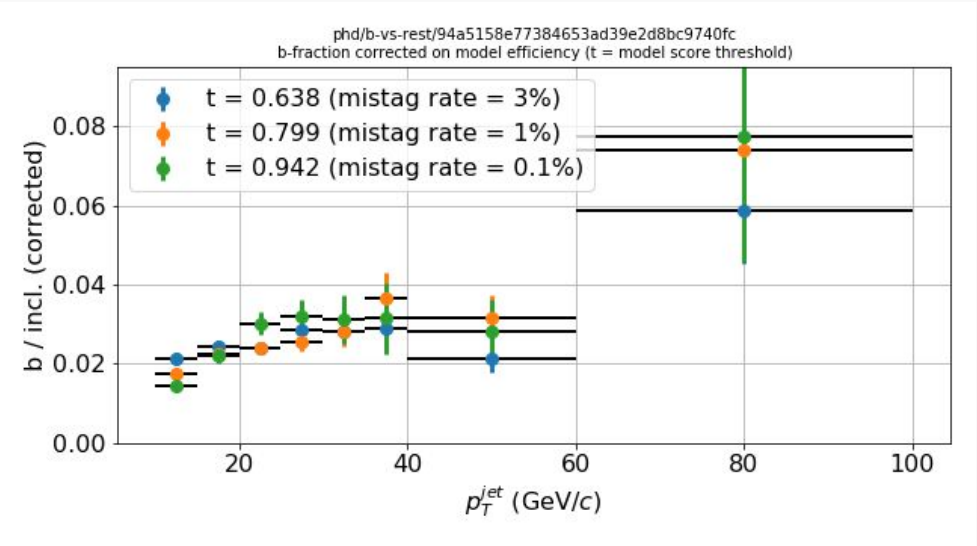
b-fraction (raw vs corrected)





- the same ordering is observed in both raw and corrected b-fraction -- somehow the corrections are *too weak*
- results very stable across many models with changed hyperparameters / input vector

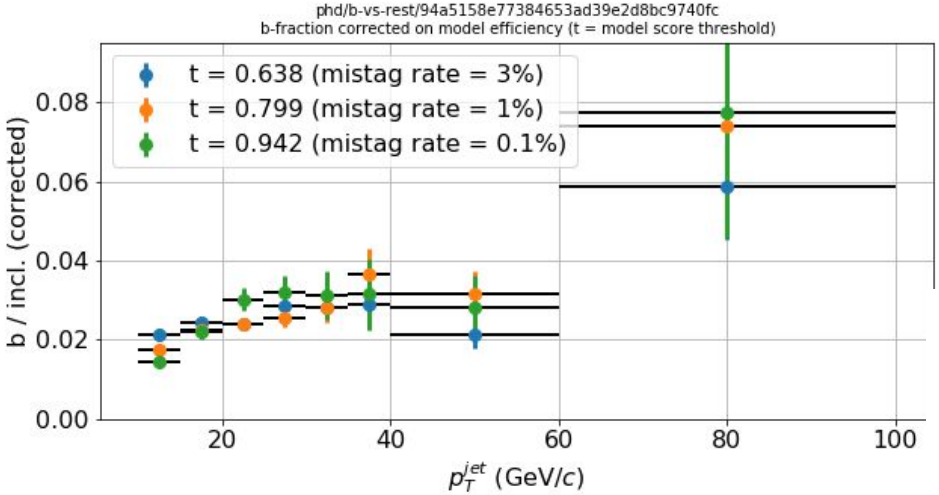
problem source (corrected b-fraction, different MC mix)



before for calculating the MC correction (not for training) I used:
50% b + 50% udsg + 5% c

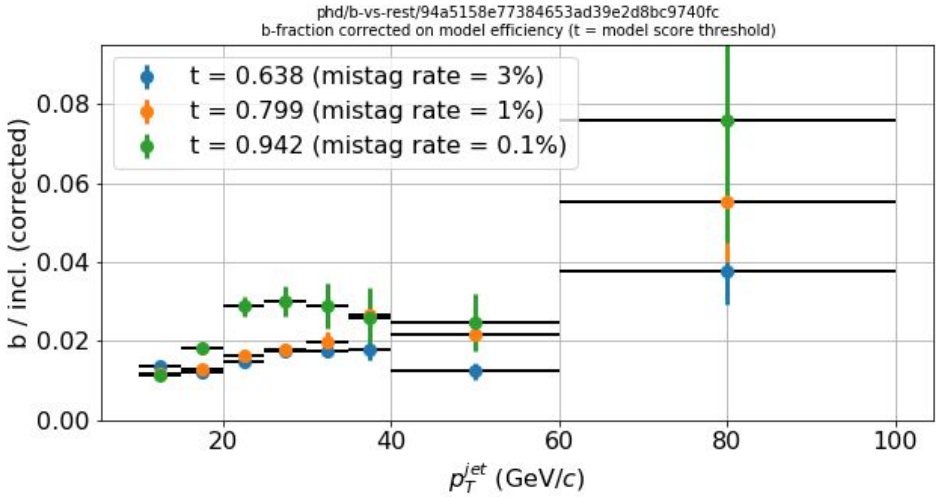
here:
~90% udsg + ~10% c + 2% b

problem source (corrected b-fraction, different MC mix)



before for calculating the MC correction (not for training) I used:
50% b + 50% udsg + 5% c

here:
~90% udsg + ~10% c + 2% b **OR** 1% b



- *changes in MC mix change correction strength*
- *the method require using realistic MC mix (including pT dependence)*

Further steps (discussion)

Backup

discussion about ML in PWG-JE

- discussion initiated during HP approvals during PF, analysis by Laura & Hannah (Yale) presentation analysis-note
- LHC15o
- biggest concern: bias from using PYTHIA fragmentation, potential solutions:
  - use JEWEL - works fine in PbPb in CMS/ATLAS - but: not integrated in ALICE framework
  - use pp embedded in PbPb - but: embedding is challenging (in timescale of HP)
  - variation = quark-gluon fragmentation - already done
  - change training

discussion about ML in PWG-JE: q-vs-g fragmentation

- the question if quark and gluon fragmentations are large enough variation:

YES

-

NO

- Peter:
  - q/g is fine syst. variation but not representative of quenching effects
  - g -> q+qbar or q radiating hard gluon - ambiguous definition
  - mechanism generating q/g differences is different than Eloss in medium - multiple soft gluons emissions

Peter

- Peter:
  - q/g is fine syst. variation but not representative of quenching effects
  - g -> q+qbar or q radiating hard gluon - ambiguous definition
  - mechanism generating q/g differences is different than Eloss in medium - multiple soft gluons emissions
  - Toy model with tuned qhat

Mateusz

q/g differences are substantial, *vide* http://jets.physics.harvard.edu/qvg/

the issue is whether this difference captures the variations in the shower induced by interactions in the QG

James

- one has to take into account not only medium-induced radiation but also medium response - use e.g. JEWEL
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