Production of b jets and pairs of b jets

DPG Frühjahrstagung 2017

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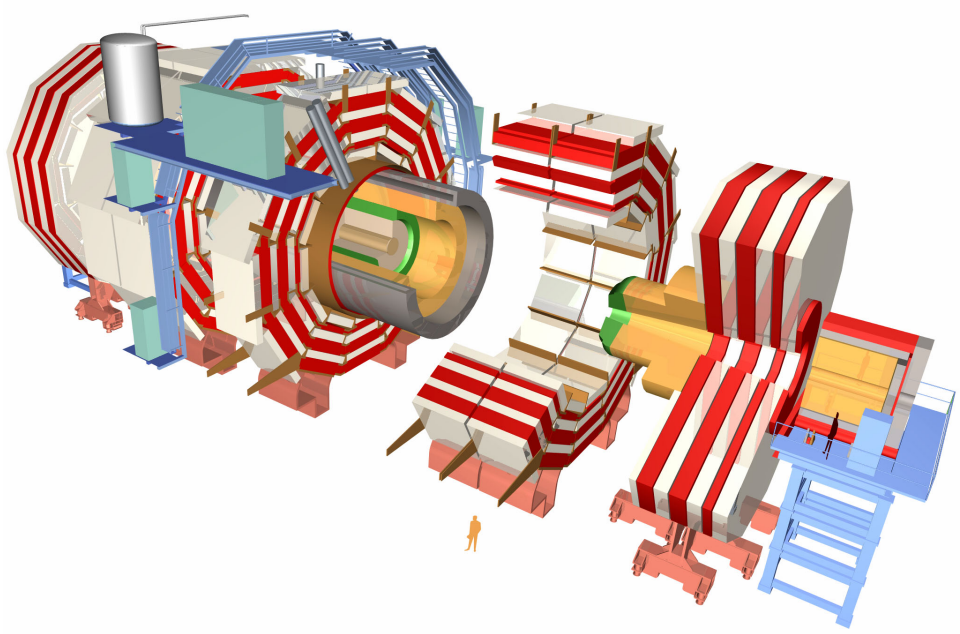
27 March 2017

Introduction I



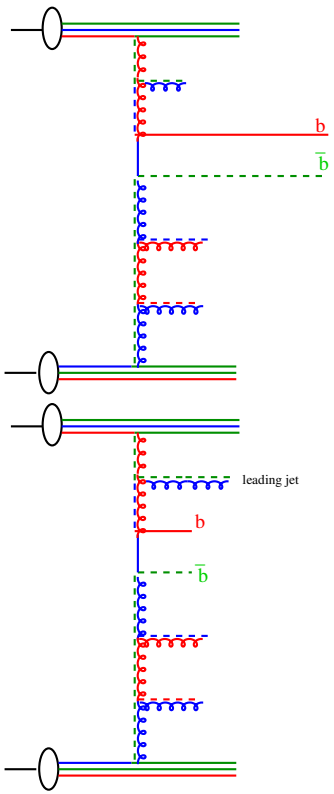
Motivation

- b jet inclusive $p_t(y)$ spectrum
  $\longrightarrow$ textbook precision measurement
- $b\bar{b}X$
  $\longrightarrow$ two-scale processes

Introduction II

Definition

- Jets are reconstructed with the anti-k_T ($R = 0.4$) algorithm
- b jets[1] are defined at hadron level, i.e. have to contain a B meson



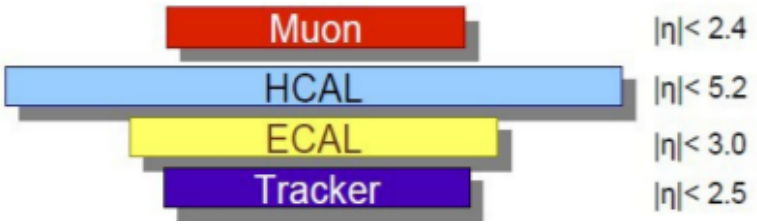
Today

- We present the precision measurement of the inclusive b jet $p_T(y)$ spectrum
- We describe the content of the signal, and in particular try to distinguish the fraction of b coming from the hard process to the ones coming from the parton shower

[1] or b "true" jets, as opposed to b-*tagged* jets

Selection & Datasets

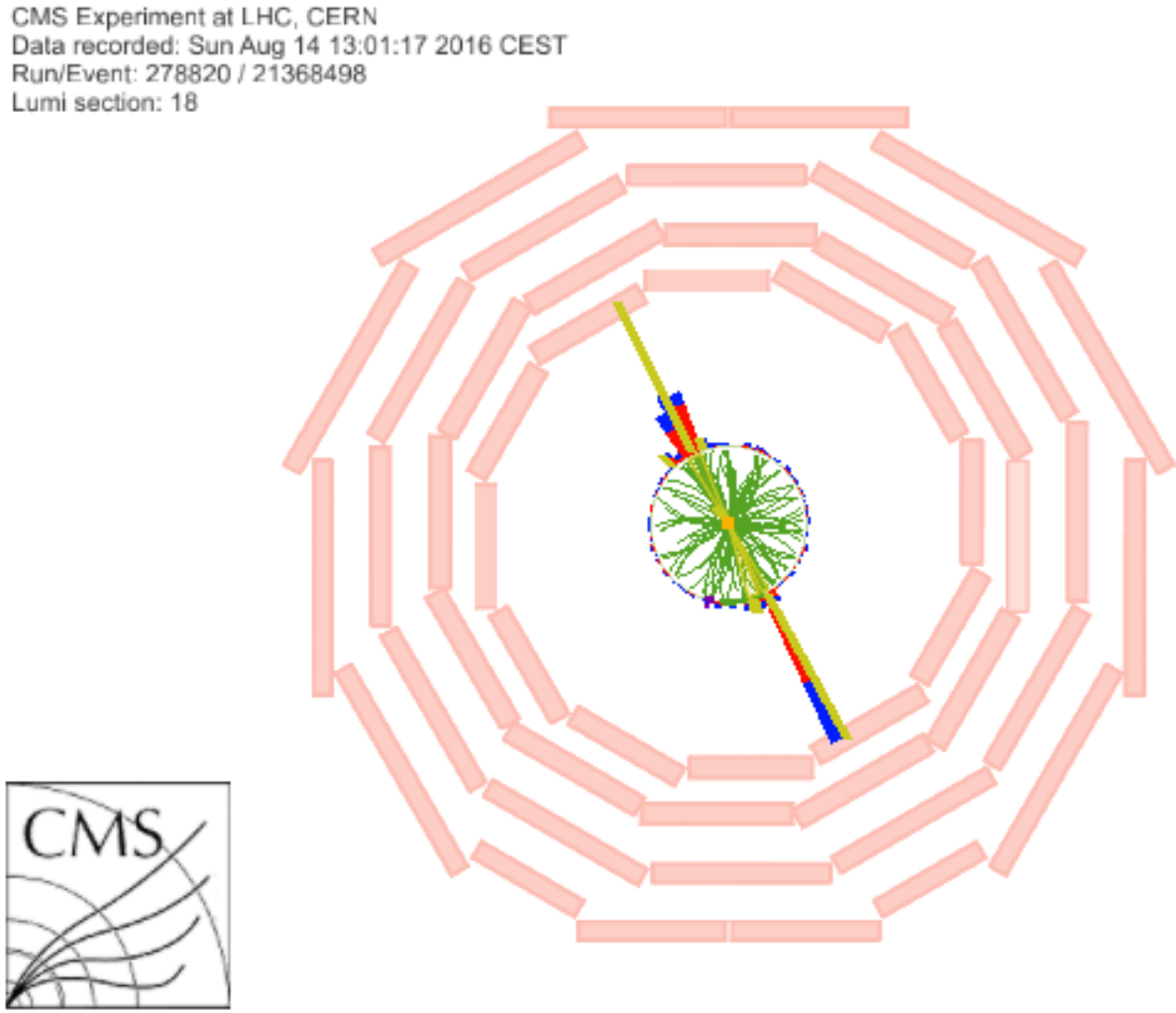
- event selection
  - *good* primary vertex
  - **MET**$/\sum E_T < 0.3$
- jet kinematics
  - $p_\perp^{\text{jet}} > 114\,\text{GeV}$
  - $|y^{\text{jet}}| < 2.4$
- reconstruction quality criteria
  - jet *tight ID*
  - **CSVv2** > 0.95 **(*tight* selection)**



$\longrightarrow$ **Bold** items will be discussed in this talk and *emphasised* items correspond to CMS standard definitions.

MC Pythia 8 and MadGraph (CMS official samples)

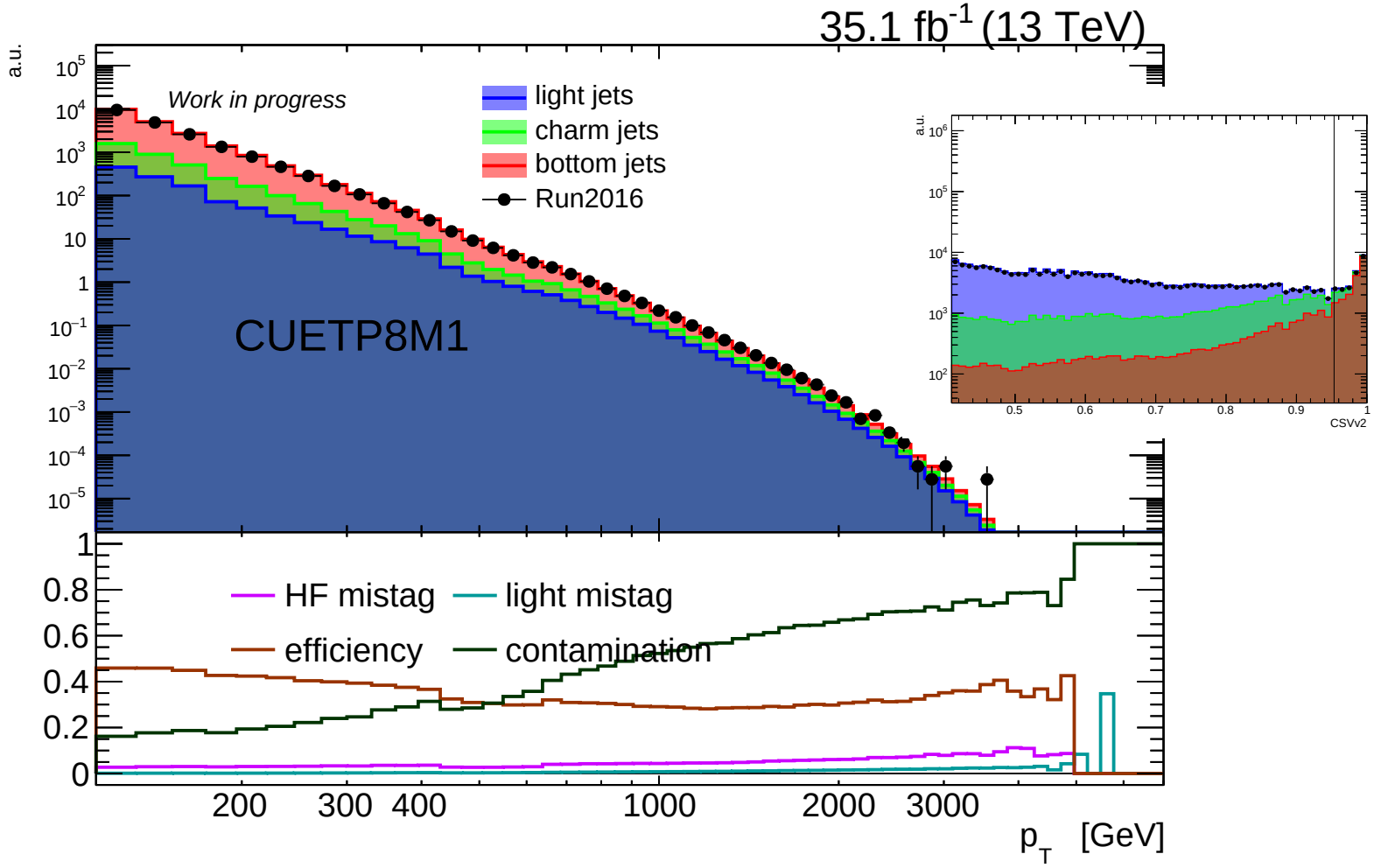
Data CMS 2016 data, $\sqrt{s} = 13\,\text{TeV}$ $(35.1\,\text{fb}^{-1})$



leading $p_T = 696\,\text{GeV},\ y = 0.24,\ \phi = 2.04,\ \text{CSVv2} = 0.967$

subleading $p_T = 694\,\text{GeV},\ y = 0.57,\ \phi = -1.07,\ \text{CSVv2} = 0.965$

b-tagging with CSVv2

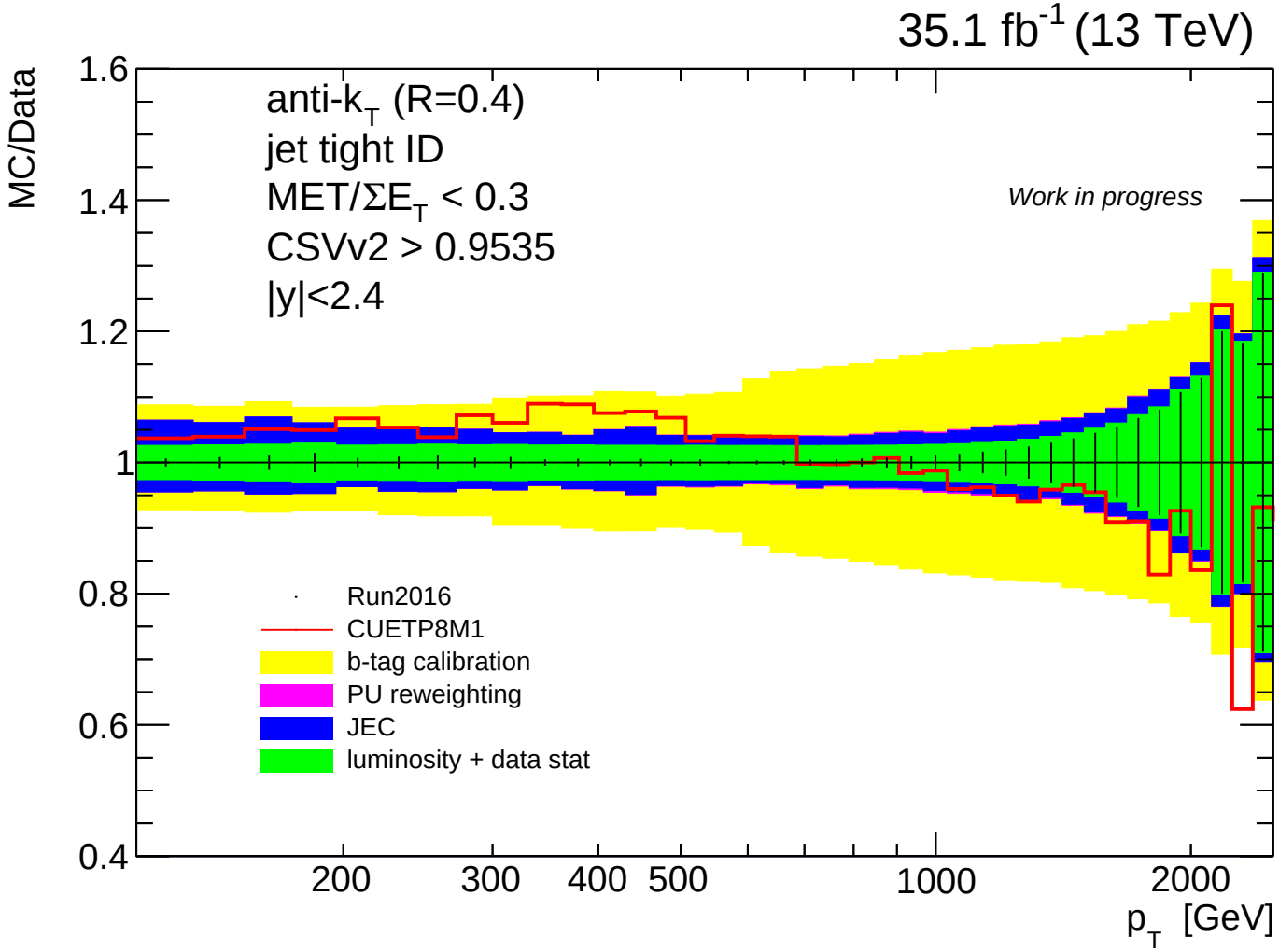


efficiency fraction of b-tagged jets among the b-true jets → **stable** even at high p_T

contamination fraction of non-b-true jets among the b-tagged jets → **dominant** at high p_T

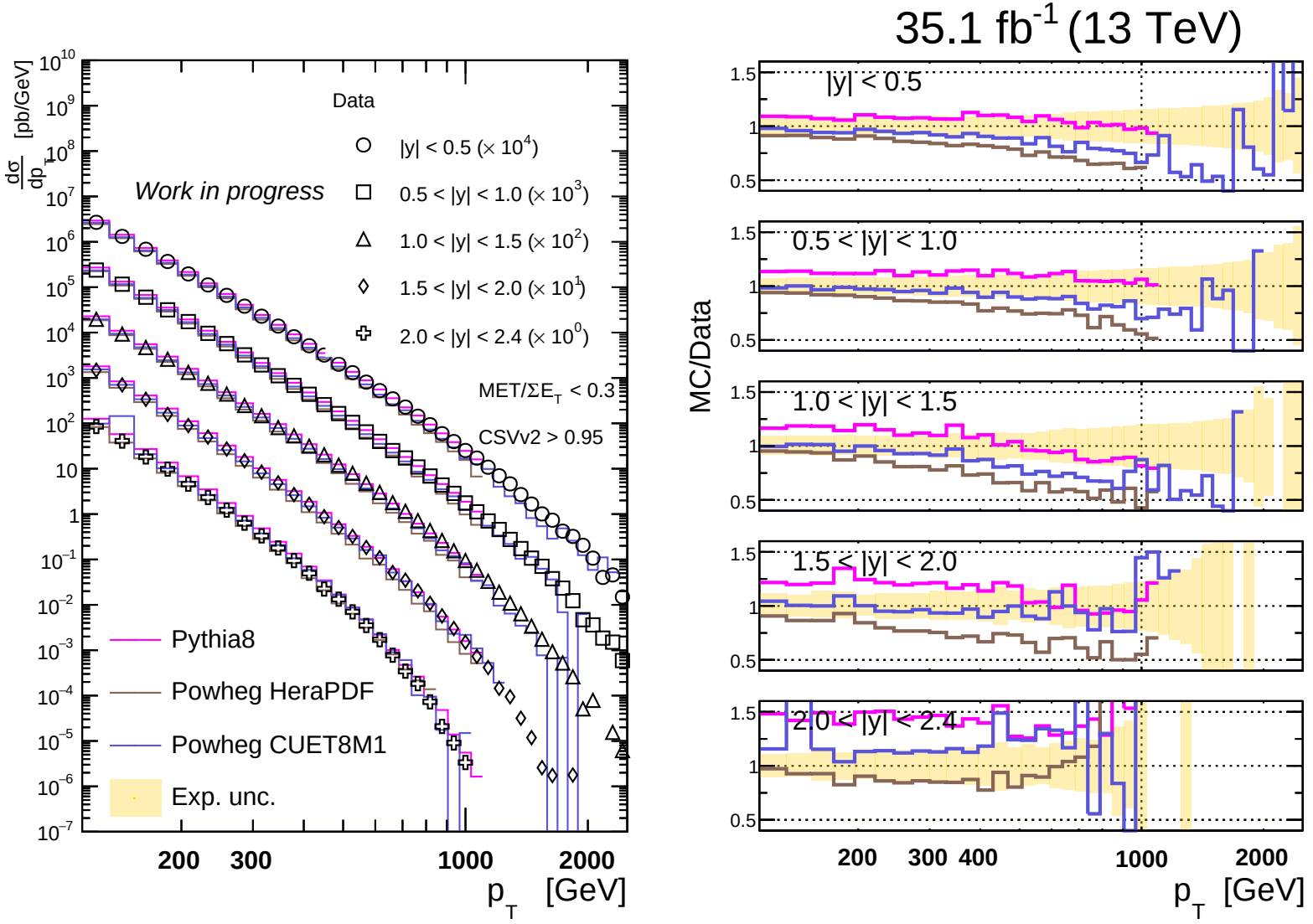
mistag fraction of b-tagged jets among the non-b-true jets → good control

Uncertainties



luminosity	2.5%
JEC	a few percent
b-calibration	a few percent, dominant contribution to the systematic uncertainty
PU reweighting	negligible

Comparison to generators

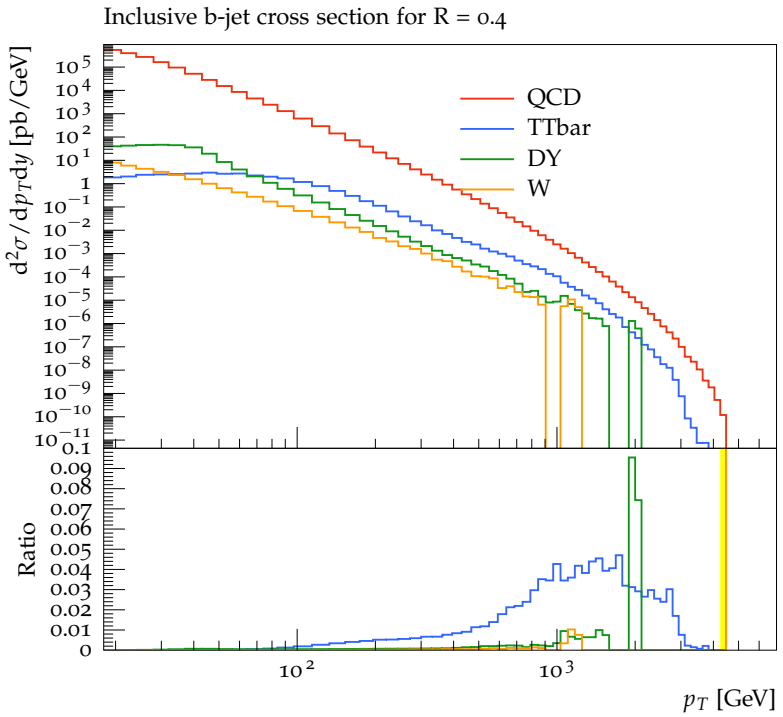


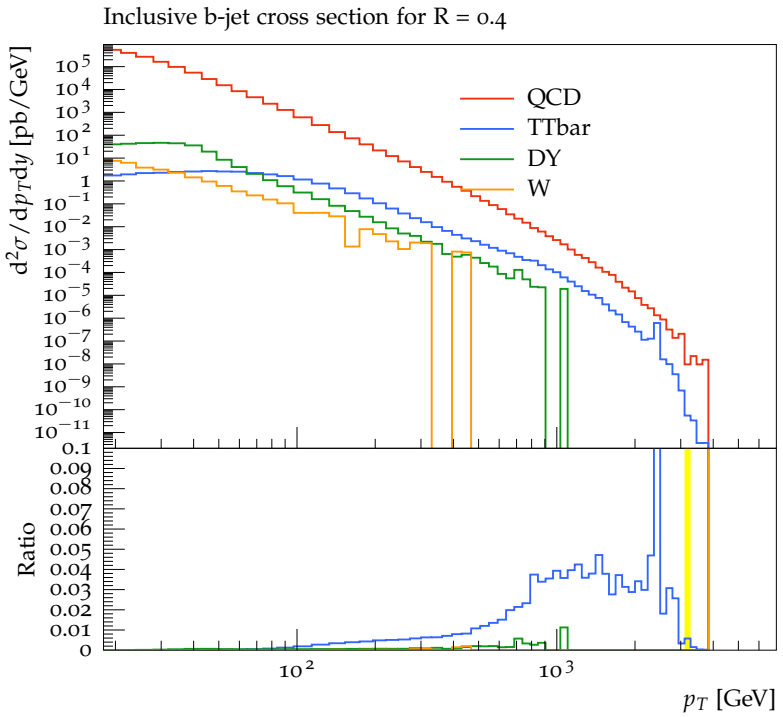
Pythia8	LO dijet ME + CMS UE tune M1
Powheg CUETM1	NLO dijet ME + CMS UE tune M1
Powheg HeraPDF	NLO dijet ME + CMS UE tune S1

Contributions to the b jet inclusive cross section

LHS: no cut-off on MET

RHS: MET$/\sum E_T < 0.3$

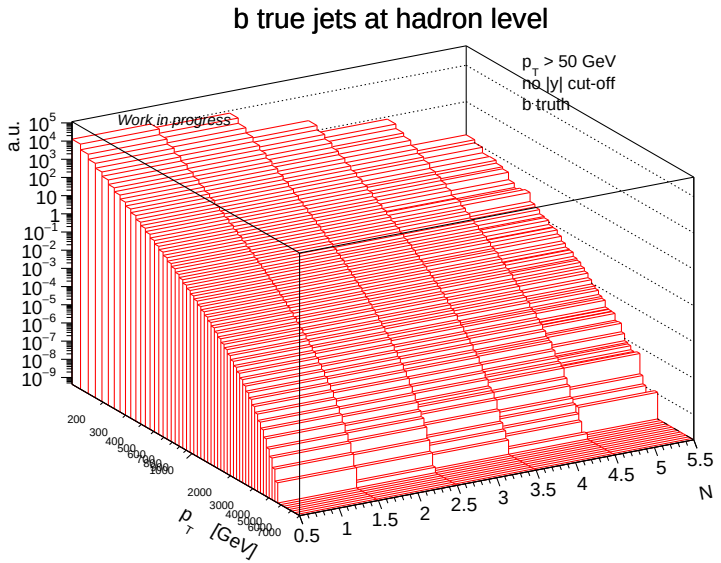


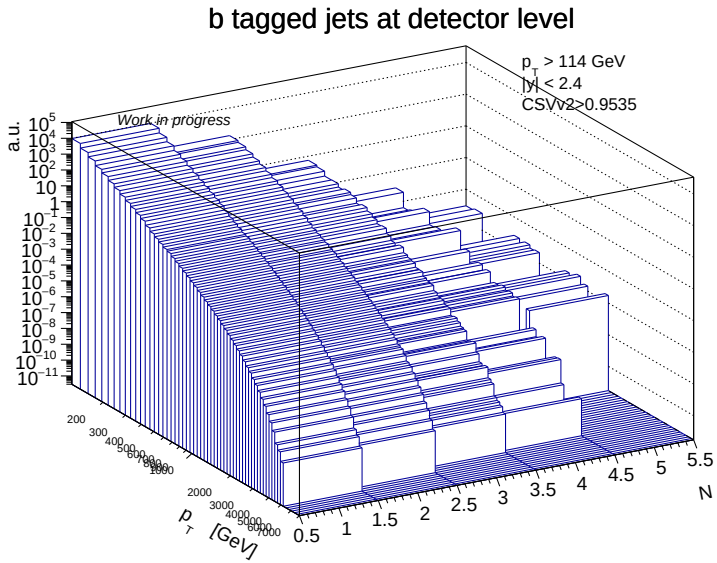


- Contributions from other processes than 5-flavour QCD are only relevant at high p_T
- The MET cut-off does not affect the standard QCD signal
- Only W contribution is affected by the cut-off on MET, but its contribution is anyway negligible

b multiplicity I

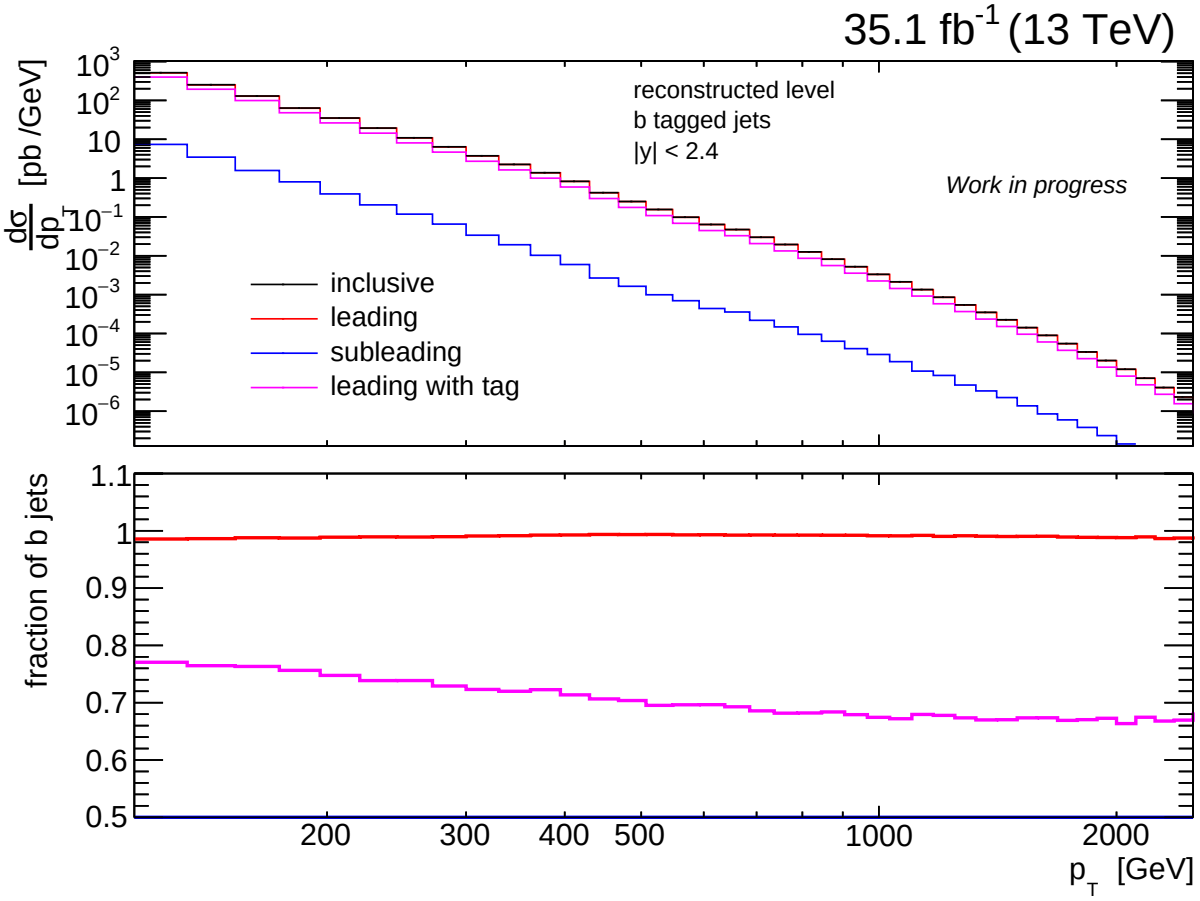
Plots from Pythia 8:

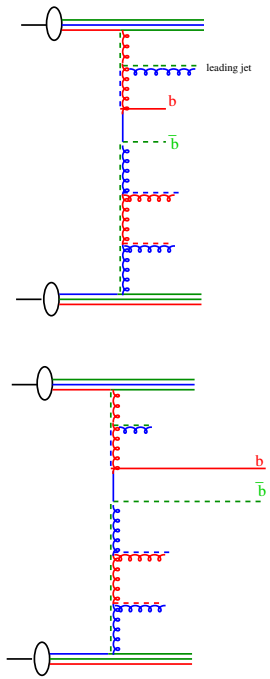




- b's are created in pairs
- but due to the acceptance of the detector, many b's are not reconstructed in the right multiplicity bin

b multiplicity II





- 95% of the b inclusive signal come are leading b jets
- 70% of the b inclusive signal come from leading jets

Summary

- The inclusive b jet $p_T(y)$ cross section was presented with CMS 2016 data at 13 TeV
- The p_T spectrum is measured up to the TeV scale.
- Comparison with theory was shown, and high p_T deviations should be investigated.
- The content of the signal was described.

Danke schön!