LHCC Poster Session – CERN – March 2016

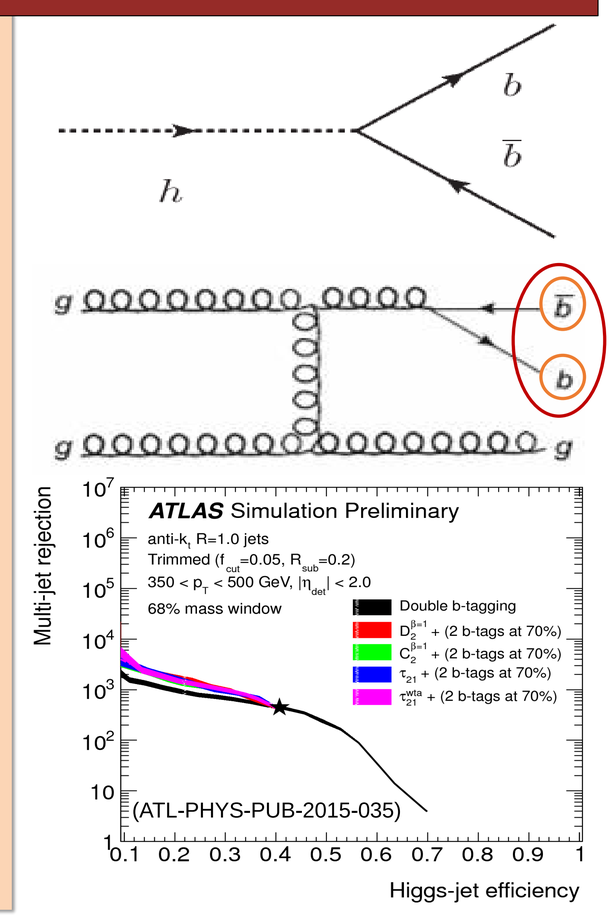
b-Tagging and Large Radius Jet Modelling in a g→*bb* rich sample at ATLAS

1. Introduction: g → bb

Boosted *H→bb* events are important for Higgs measurements and used in searches for new heavy resonances[1]. New techniques have been developed to identify boosted *H→bb*. Variables such as *b*-tagging discriminant scores, large radius jet mass and substructure variables are found to be good discriminants[2]. However, the modelling of these variables has to be checked in environments with close-by b-hadrons.

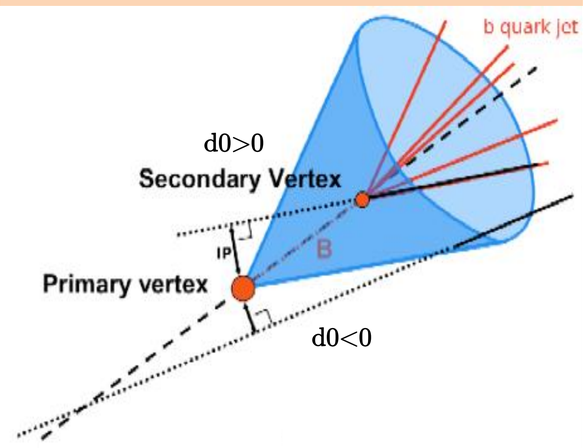
The gluon splitting to *bb* process resembles boosted *H→bb*.

- We use a large radius jet as a proxy for the gluon (red circle) and two small radius track jets as a proxies for the *b* quarks (orange circles).
- To increase the purity of the *g→bb* sample, we require one of the *b* jets to have a muon exploiting semi-leptonic decay of b-hadrons.
- Modelling of data by the simulation is checked after b-tagging



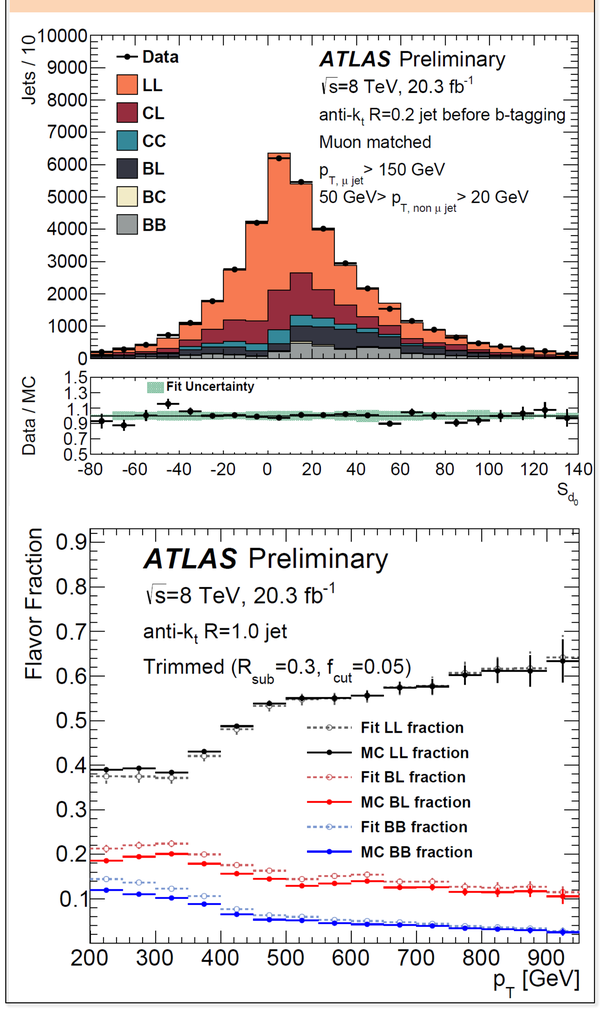
2. Flavor Fraction Correction

The gluon splitting model is largely un-constrained and can be mis-modelled in Monte Carlo. We have to ensure the flavor fractions before b-tagging are correct.



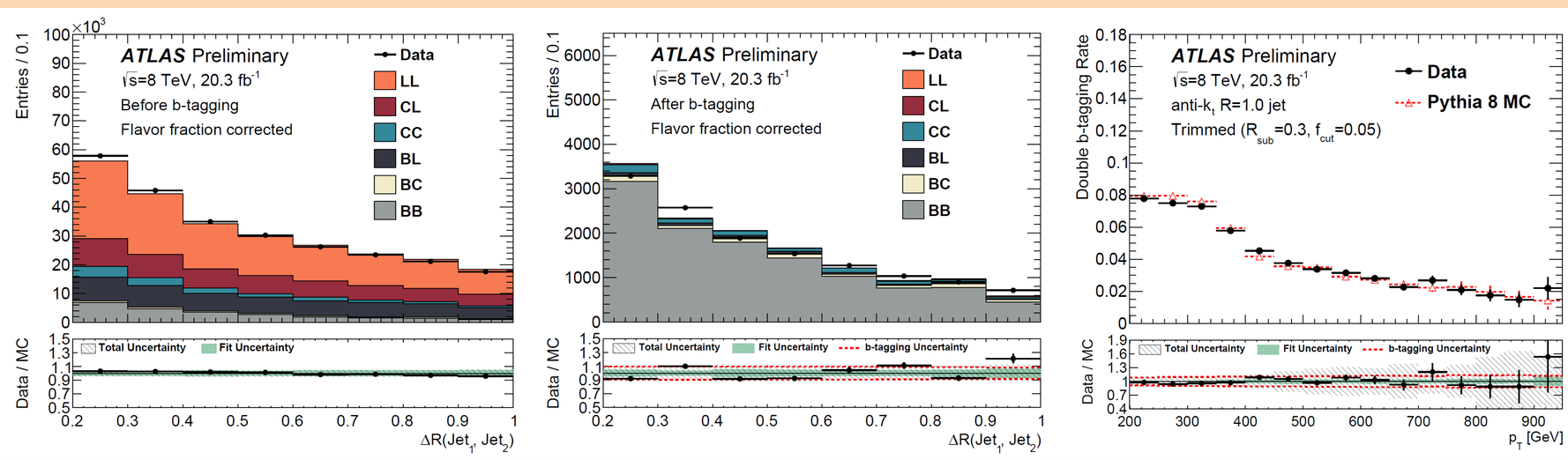
The track signed impact parameter significance s_{d0} is sensitive to the flavor of the jet. We fit the MC flavor fractions to the distribution of the largest s_{d0} track in the jet *before b-tagging*.

- Use a binned maximum likelihood fit.
- Fits are done in different jet p_T bins.
- Corrections as large as 20% are needed.



3. Modelling of Double b-Tagging in Boosted Topologies

Performance of double *b*-tagging in dense environment is expected to degrade because of the difficulty of estimating jet directions, sharing of tracks between jets and mis-labeling of flavors. The *b*-tagging scale factors and uncertainties are derived from samples where the jets are well isolated. We find that *these uncertainties cover any observed differences between data & MC in the g→bb sample*.

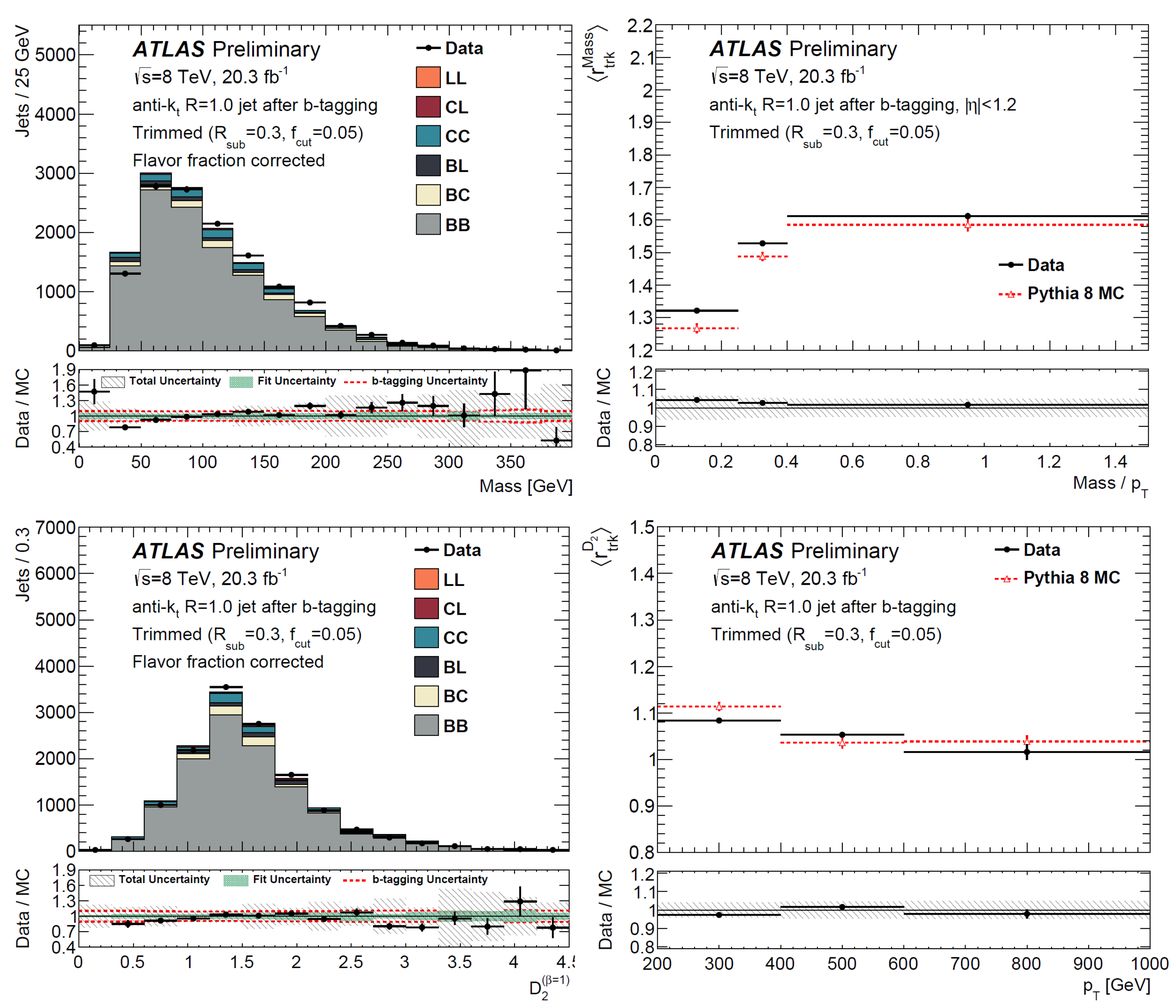


4. Modelling of Large Radius Variables

Large radius jet variables are calibrated in light flavor jet dominated samples[3]. We need to cross check the validity of the calibration in a heavy flavor sample. Using the *g→bb* sample, the data to MC agreement is found to be good for jet mass, jet p_T and D2[4].

We also cross checked the uncertainties of the variables derived from inclusive multi-jets sample and found *the existing uncertainties can cover the flavor dependence*.

(r_{trk}^{X} = Calorimeter X / Track X)



Reference

[1] EPJC 75 (2015) 412 [2] ATL-PHYS-PUB-2015-035 [3] ATL-PHYS-PUB-2015-015 [4] CERN-PH-EP-2015-204

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ATLAS EXPERIMENT