



b-tagging calibration using $t\bar{t}$ events with the ATLAS experiment

Agnieszka Leyko

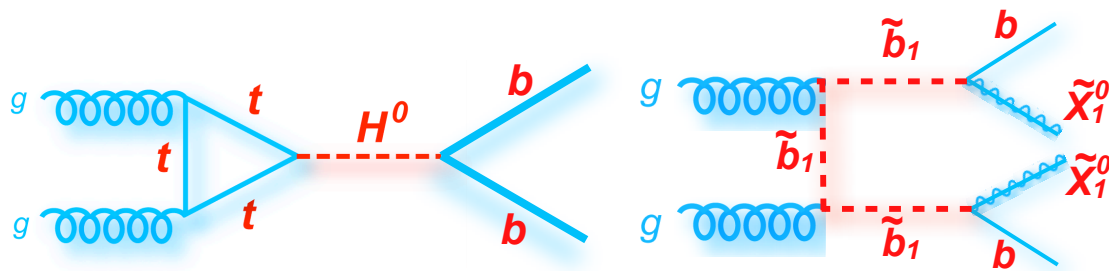
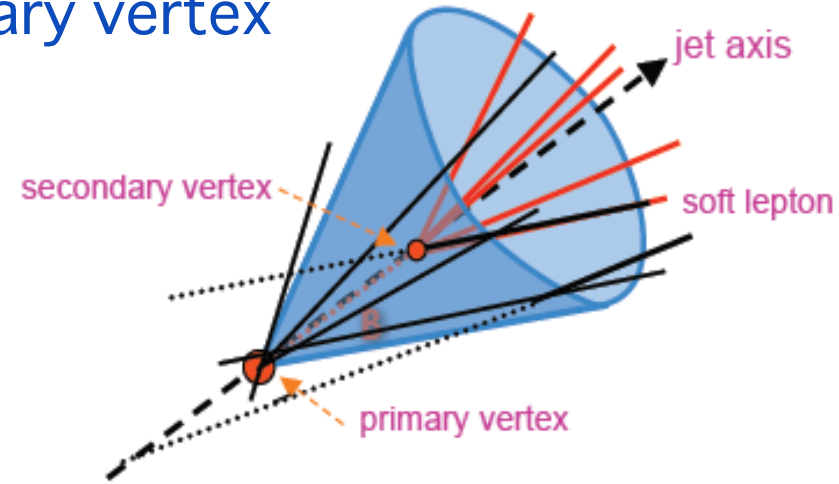
on behalf of the ATLAS collaboration

University of Bonn

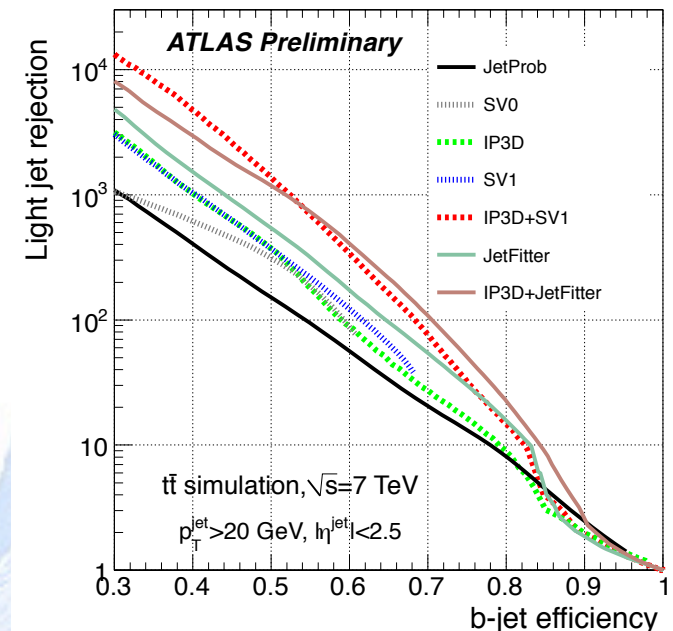
b-tagging



- ✦ b-quark hadronizes to a B-hadron, which lifetime is long enough for us to be able to reconstruct the secondary vertex
- ✦ Algorithms allowing to recognize a jet originating from a b-quark:
 - secondary vertex based
 - impact parameter based
 - combination of above, often using neural networks
- ✦ Performance of b-tagging crucial for new physics searches



rejection rate is a ratio of all jets to jets that were tagged (inverse of efficiency)



calibration with jets containing muons



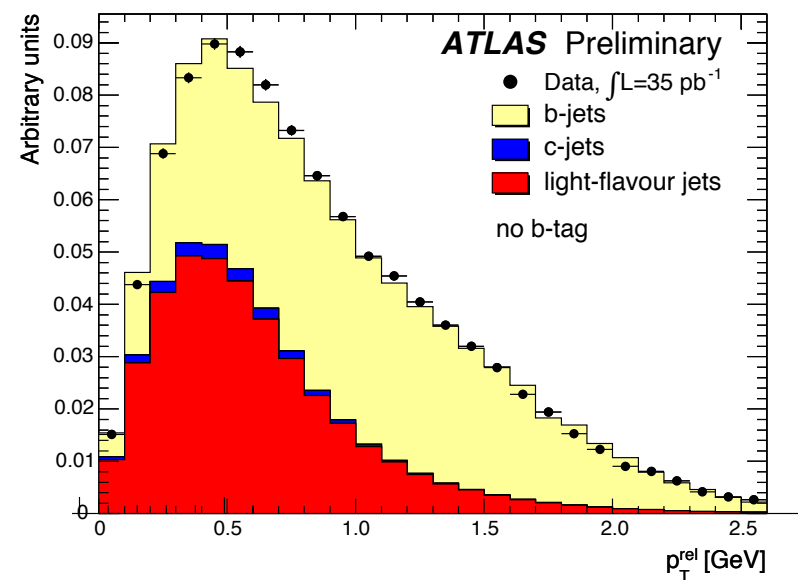
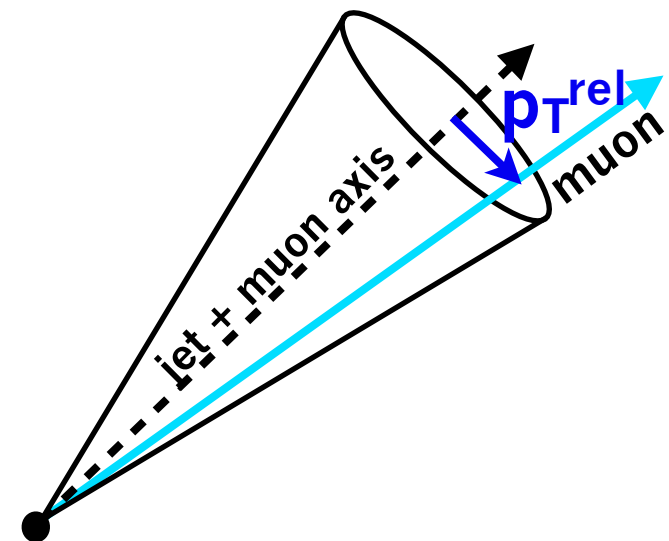
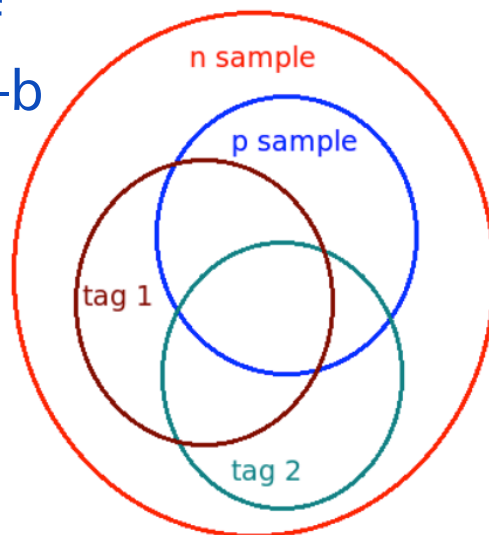
- ✦ performed on a QCD multijet sample
- ✦ only $\sim 20\%$ b-jets contain a muon
- ✦ 2 methods (statistically correlated):

p_{T}^{rel} :

p_{T}^{rel} templates to extract the b/c/light jet yields in the pre-tagged and tagged sample

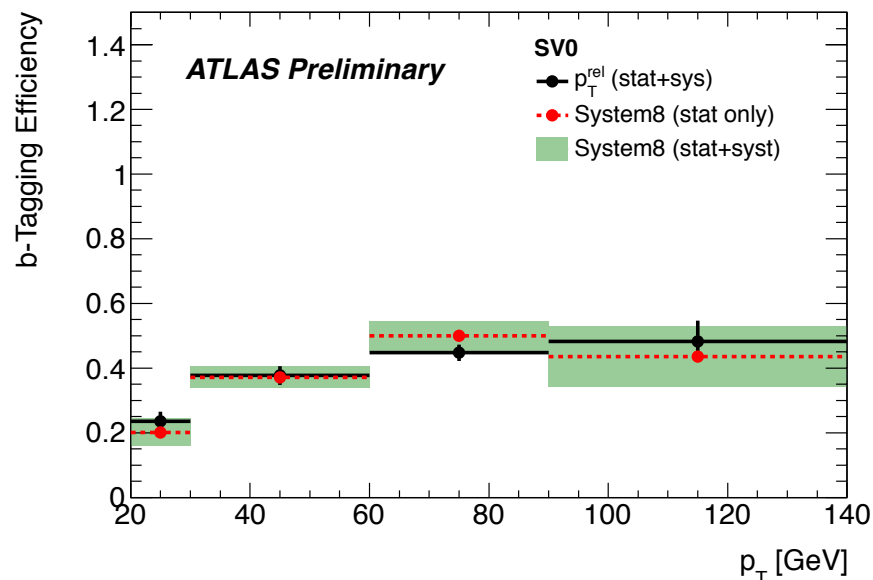
system8:

two samples with different b-purity, applying a soft muon tagger and the tagger under test. Solves a system of equations for b and non-b jets efficiencies and fractions



calibration with jets containing muons

results with 2010 data



results for SV0 tagger
50% efficiency working point

tagging efficiency in data for p_T^{rel} and system8

- ✦ data-simulation scaling factors consistent with 1
- ✦ total syst. uncertainty 5-25% depending on tagger and jet p_T , mostly:
 - modeling of heavy flavour production, decays and fragmentation
 - jet energy scale and resolution
 - pileup modeling
- ✦ rely on low p_T jet triggers (statistical limitations)
- ✦ upper limit on the jet p_T

calibration with $t\bar{t}$ events



- ♦ LHC is a top factory
- ♦ top decays $\sim 100\%$ to Wb

\Rightarrow at least 2 b-jets in event

- clear event signature:

dilepton channel:

2 leptons + 2 jets + E_T^{miss}

single lepton channel:

1 lepton + 4 jets + E_T^{miss}

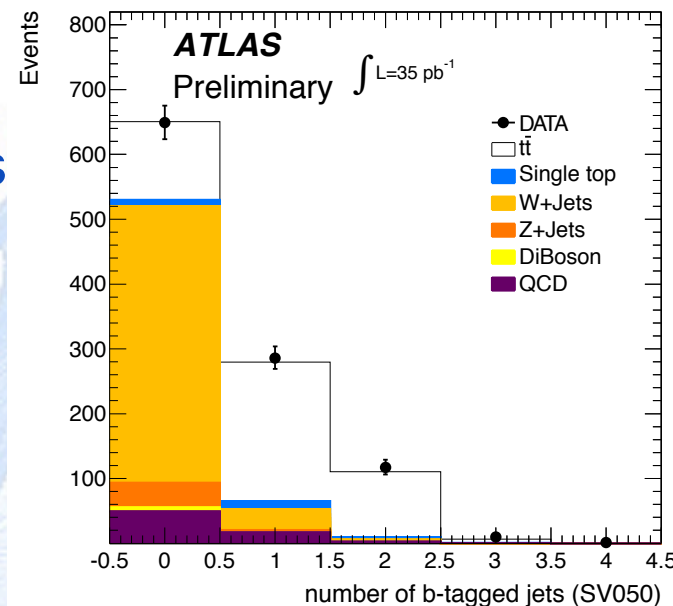
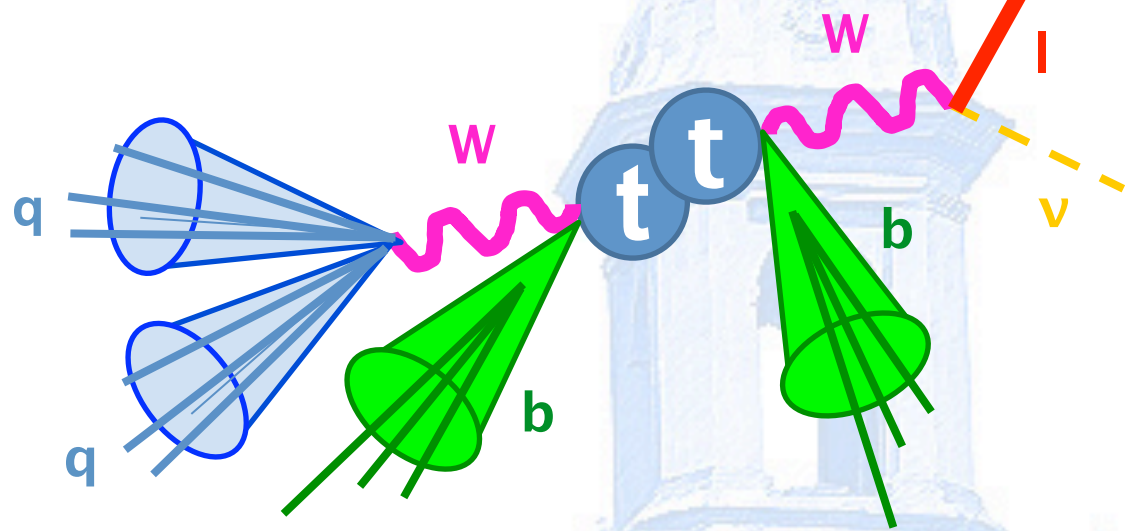
in 5 fb^{-1} ~ 0.5 million dilepton and single lepton events

tag counting:

fitting number of tagged jets

kinematic selection:

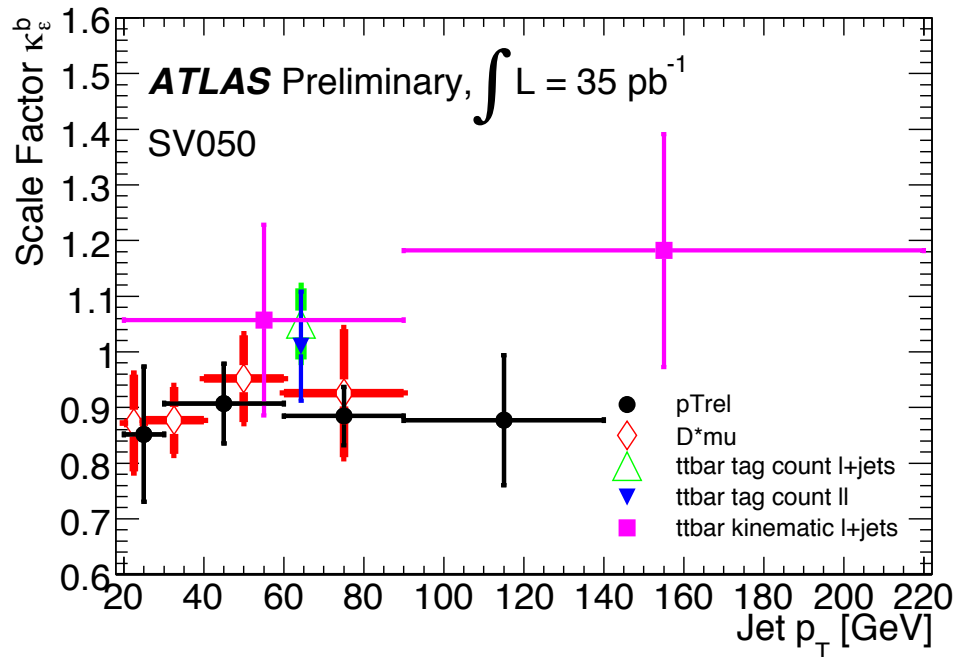
calculating the tagging rate of jets in events passing “standard” $t\bar{t}$ selection criteria



most of the $t\bar{t}$ methods are not statistically correlated!

calibration with $t\bar{t}$ events

results & future plans



Current results:

- ♦ first ATLAS results with 2010 data
- ♦ data-MC scaling factors higher than for the baseline methods, but within uncertainties

Future plans:

- ♦ update with 2011 data ready very soon for both kinds of calibrations methods
- ♦ combination of results planned
 - will allow to significantly reduce uncertainty (b-tagging uncertainty is a dominant uncertainty for most of analyses)

Summary:

- ♦ very promising methods
 - large statistics
 - reach high p_T jets



THANK YOU!