Top quark mass measurements with J/ψ and D mesons in the ATLAS experiment

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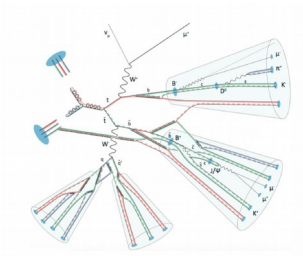
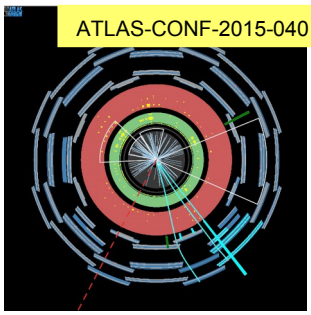
https://indico.in2p3.fr/event/23801

Studies of $t\bar{t}$ pairs with in final state with a B-hadron decaying either in J/ψ (b→J/ψ→ μμ) or in (μ)D^0→ (μ)Kπ or in $D^*(2010)^+ \to D^0\pi$ mesons offer alternative methods to measure m(top) using the sensitivity of m(lJ/ψ), m(lμD^0), m(l$D^*(2010)^+$) to m(top).

Motivations

- purely leptonic/tracking observables less sensitive to JES than the ones from jet reco
- still sensitive to parton shower, hadronization, b-fragmentation effects…
- help to reduce the uncertainties in combination of all measurements

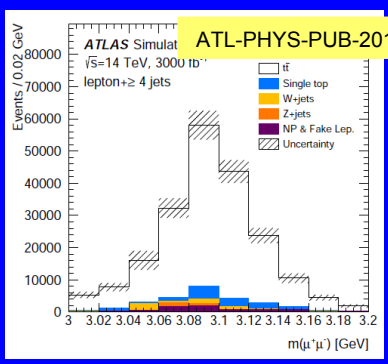




$t\bar{t}$ event with a J/ψ (b→J/ψ→ μμ) in final state

Prospects for HL-LHC

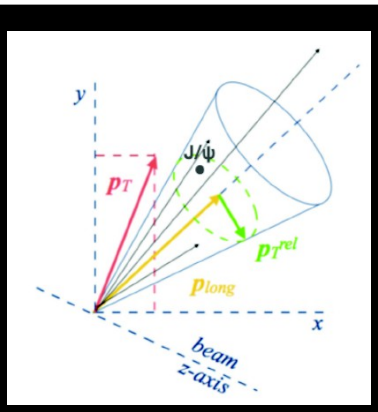
Projections for the top quark mass measurement accuracy using $t\bar{t}$ → lepton+jets events with J/ψ→μ+μ− in the final state at √s=14 TeV at the High-Luminosity LHC with 3000 fb−1 of proton-proton collisions with the ATLAS experiment.



Invariant mass distribution of the dimuon events

A statistical uncertainty of 0.14 GeV is expected, with a systematic uncertainty of 0.48 GeV.

Low BR final states



Scheme of b→J/ψ system to define the different observables

b-fragmentation studies:

- use $t\bar{t}$ events with b→J/ψ
- check our knowledge of hadronization of b-quarks in hadron collider
- today's partonic shower generators tuned to LEP results based on ee→Z→bb
- ATLAS study (published) :
  - use of $t\bar{t}$ dilepton events
  - several observables

$$z^{ch}_{T,b} = \frac{p^{ch}_{T,b}}{p^{ch}_{T,jet}} \qquad z^{ch}_{L,b} = \frac{\vec{p}^{\,ch}_{b} \cdot \vec{p}^{\,ch}_{jet}}{|p^{ch}_{jet}|^2}$$

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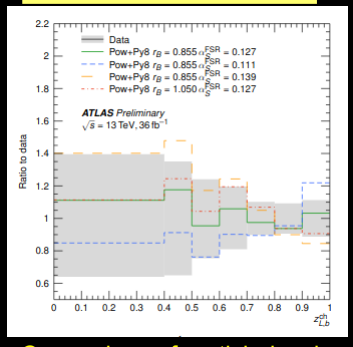

Comparison of particle-level observables between Powheg+Pythia8 A14 variations and unfolded data

https://lpnhe.in2p3.fr/atlas