Search for $t\bar{t}$ Resonances Decaying Fully Hadronically

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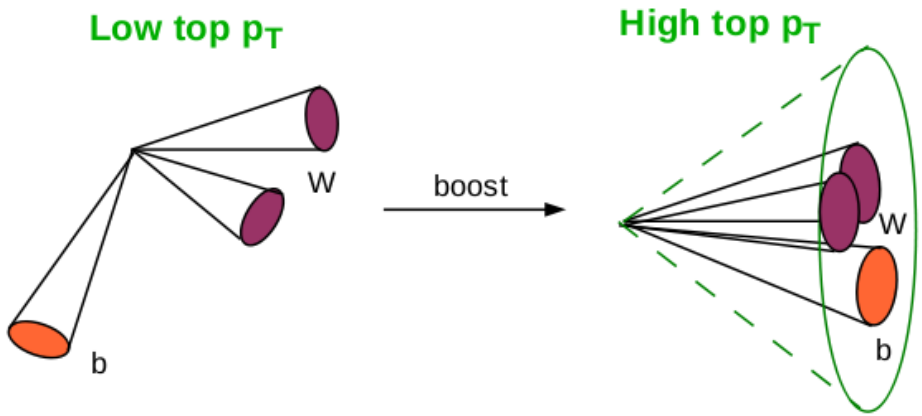
Introduction

Boosted Objects at the LHC

- For the first time, boosted objects (high p_t) will be created in copious quantities at the LHC.
- The fully hadronic channel was thought to be an impossible channel. In the last few years the field of jet substructure has devoleped very quickly giving a chance to resolve objects decaying fully hadronically.



The HepTopTagger

- The HEPTopTagger (Plehn et al.) finds and reconstructs the 4-momentum of boosted top quarks ($p_t > 200$ GeV)
- It acts on "fat" jets, R = 1.5 clustered with the Cambridge/Achen algorithm. Then examines substructure to find subjets compatible with the top quark hadronic decay.
- Has been extensively validated and recently used for a fully hadronic search at ATLAS.

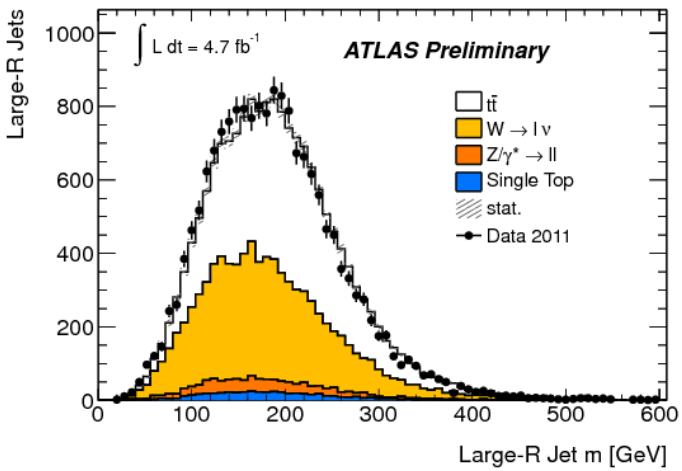


Figure: "Fat" jet with R=1.5

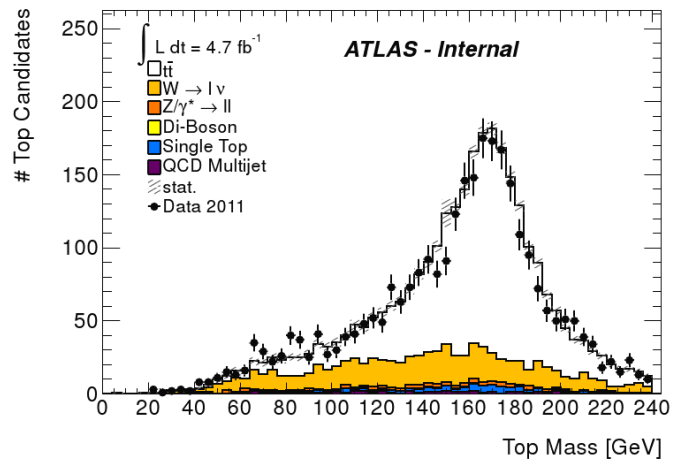


Figure: Top mass spectrum after top tagging.

Search for $t\bar{t}$ resonances decaying fully hadronically.

- Strategy: 2 top tags, 2 b-tags. Main background: $t\bar{t}$ and multijet QCD. "ABCDEF" for background determination.
- Search extended previous ATLAS limits on Z' and KK gluon production based on the lepton + jets final state.
  0.70 TeV$< m_{Z'} <$ 1.00 TeV and 1.28 TeV $< m_{Z'} <$ 1.32 TeV

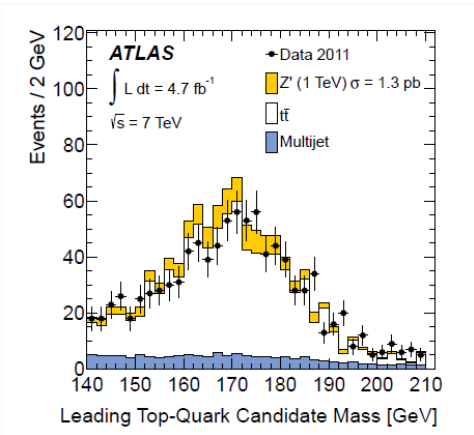


Figure: Leading top mass in $t\bar{t}$ search.

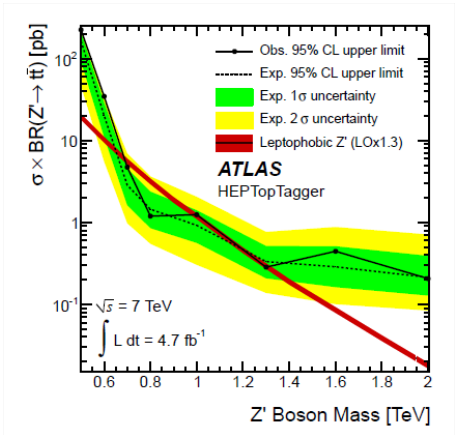


Figure: Z' limits with the HEPTopTagger.

Personal Contribution

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- The HEPTopTagger contains internal parameters that can be tuned for optimal performance. A tight, medium or loose configurations is available and will depend on each specific search.)

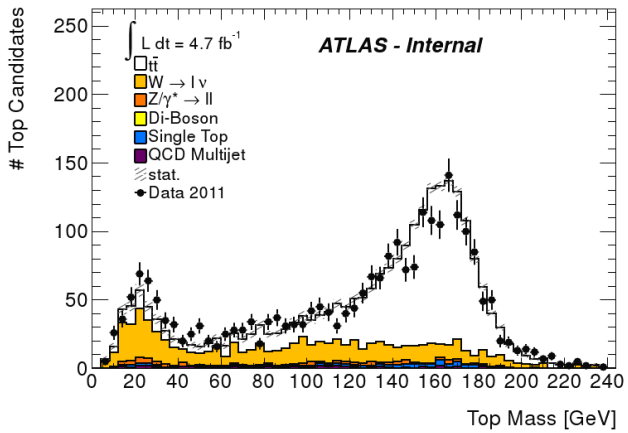

Figure: Medium Settings, R=1.5

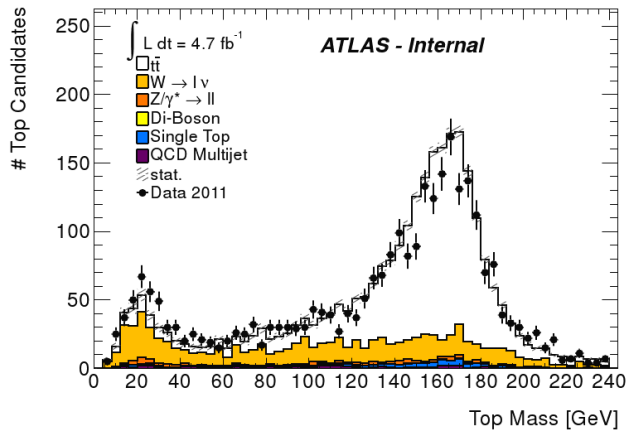

Figure: Medium settings, R=1.8

Personal Contribution

Was...

- Next, try a multivariate analysis.

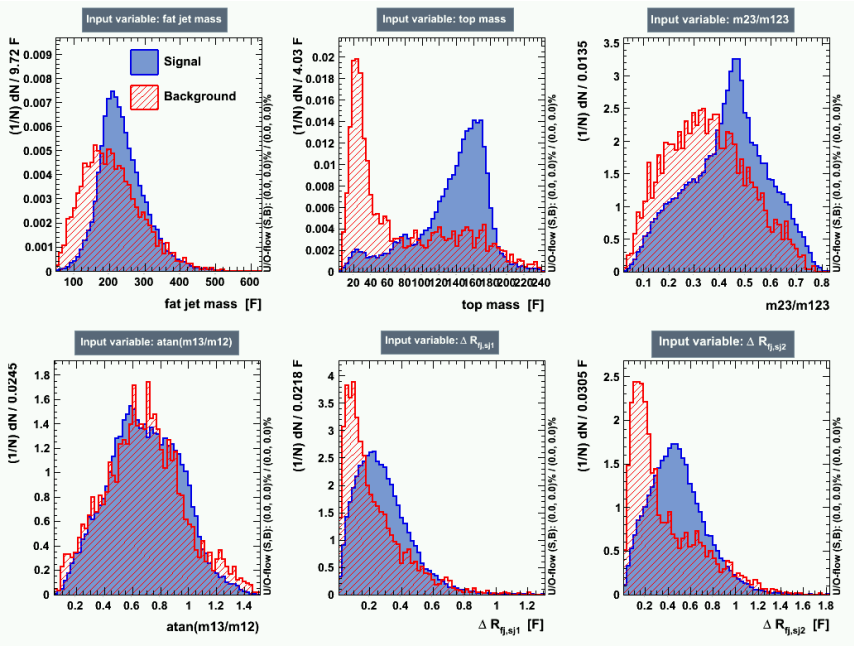

Figure: Possible discriminating variables

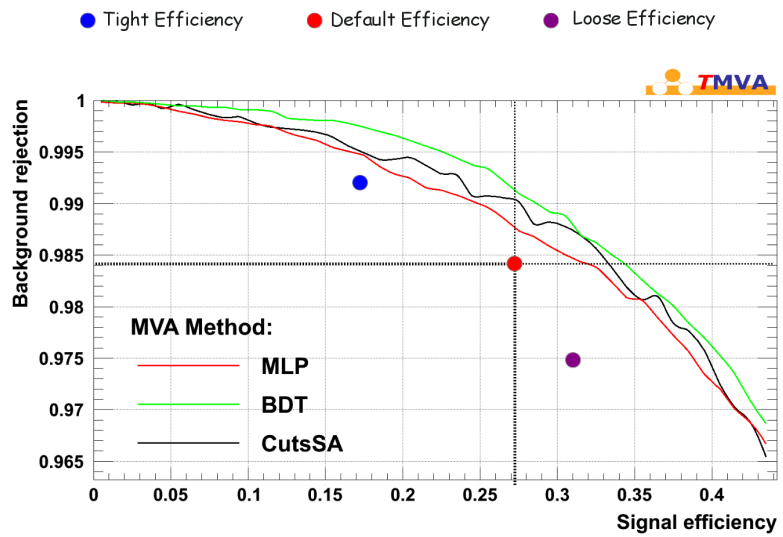

Figure: Multivariate Analysis in the p_t spectrum 300-450 GeV in fat jet p_t.

Personal Contribution

Will be...

- Search will be updated to the 2012 full data set.
- For now goal is to optimize analysis to the 2012 full data see and see if there is room from improvement with different parameters and with MV analysis.