

Boosted tops as a window to new physics

Clement Helsens (CERN)

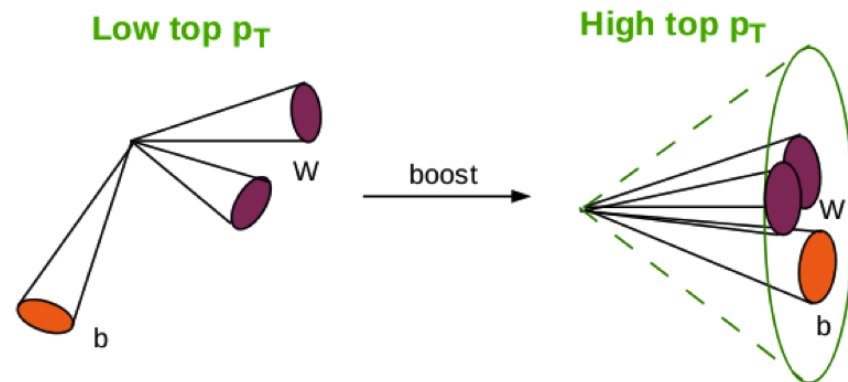
James Ferrando (Glasgow)

David Miller (Chicago)

Also discussions with Mangano, Fuks, Aguilar-Saavedra

Boosted tops?

- At LHC 8TeV boosted objects are becoming heavily used
- Will be a standard tool at 13TeV, what about 100TeV?
Entering super boosted regime $p_T(\text{top}) > 5\text{TeV}$
- cone size $R \sim 1 / \text{boost}$
 - $p_T = 200\text{GeV} \rightarrow R \sim 2$
 - $p_T = 1\text{TeV} \rightarrow R \sim 0.4$
 - $p_T = 10\text{TeV} \rightarrow R \sim 0.05$
- Minimal distance to resolve two partons: $\Delta R \sim 2m/p_T$

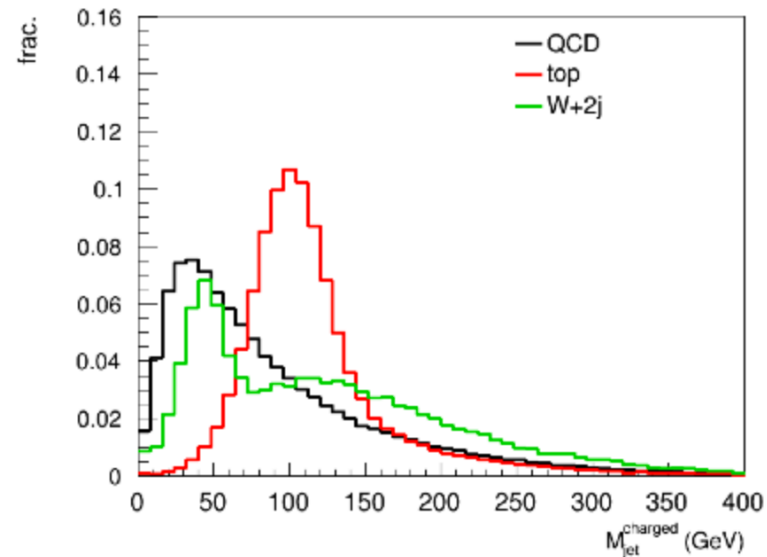
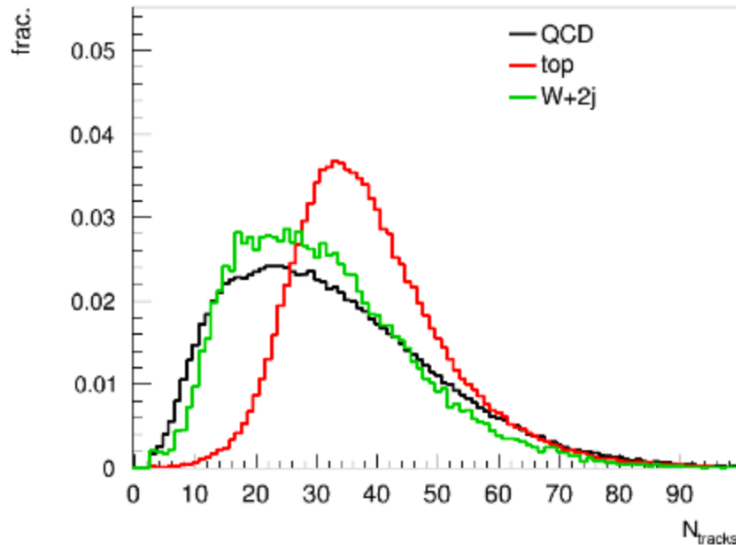


Boosted tops?

- At LHC 8TeV boosted objects are becoming heavily used
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Entering super boosted regime $p_T(\text{top}) > 5\text{TeV}$
- Applications
 - Resonance $Z' \rightarrow t\bar{t}$, $W' \rightarrow t\bar{b}$
 - Vector-like quarks $T \rightarrow Wb$, Zt , Ht $B \rightarrow Wt$, Zb , Hb
 - Top anomalous couplings $W^* \rightarrow t\bar{b}$
 - Top dipole moments (high $m_{t\bar{t}}$ spectrum, see Benjamin's talk)
 - Will also be very useful for
 - Susy searches
 - Select a clean sample of $t\bar{t}H$ (less combinatorics for $H \rightarrow b\bar{b}$)
- Impact on the detector design
 - Calorimeter depth, granularity
 - Is sub-structure off the table?

Preliminary studies

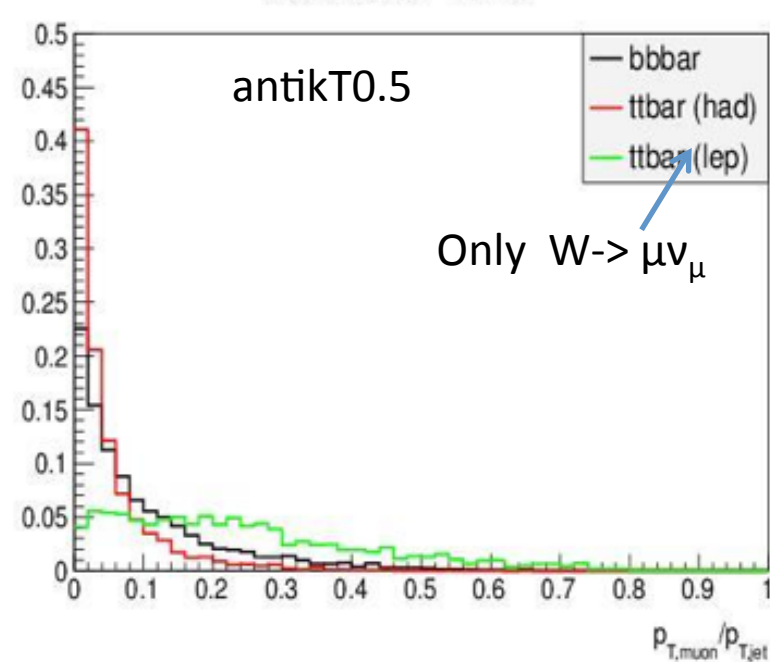
- M. Selvaggi showed that some simple tracking based observables can help in discriminating highly boosted top jets from QCD
- <http://indico.cern.ch/event/304759/contribution/6/material/slides/0.pdf>



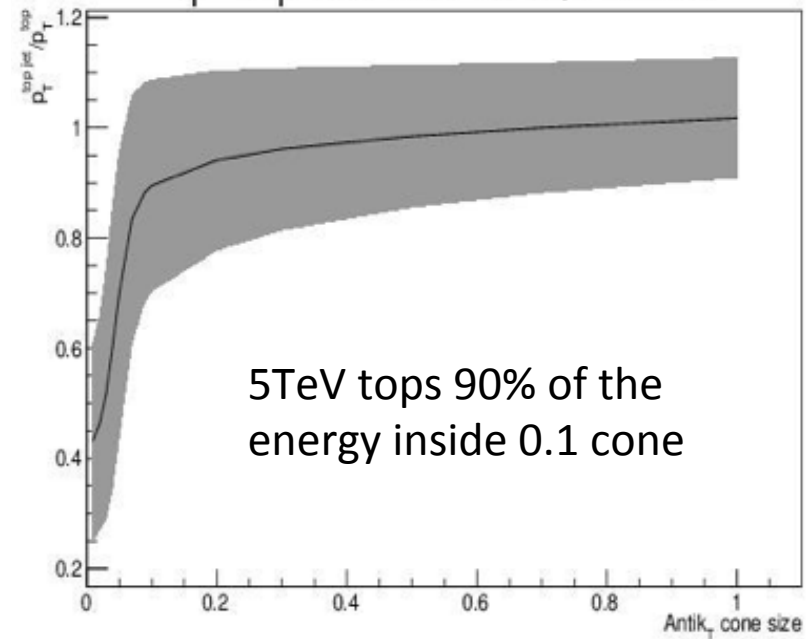
Preliminary studies

Madgraph + Pythia8,
 $p_T(\text{top}, b) > 5\text{TeV}$

Muon To Jet PT Ratio



$p_T^{\text{top jet}}/p_T^{\text{top}}$ ratio versus Antik_T cone size



- Need also to consider collinear W emission in jets as a BG (next talk)