



ATLAS-CAT top physics - status report



Richard Hawkings

ATLAS-CAT-physics meeting, 24/05/06

- A brief status report
 - People involved and their interests
 - Studies using TopView - some practicalities and example developments
 - Final remarks



People and interests



- People involved so far, and areas of interest:
 - **Maria Jose Costa:** top cross section, relation to top mass, theoretical/MC aspects, jet algorithms, b-tagging via inner detector work
 - **Tancredi Carli:** Calorimeter calibration, jet algorithms, Et-miss. W/Z+jet physics in collaboration with SM group, Sherpa MC. Single top as path to new physics.
 - **Philipp Fleischmann:** Heavy flavour production, b-tagging using soft mouns, b-jet energy scale
 - **Pamela Ferarri:** First cross-section measurements, b-tagging (already some work with **Eva Stanecka** and **Andi Salzburger/Andi Wildauer**), path to single top/H
 - **Richard Hawkings:** heavy flavours and b-tagging; SM measurements. B-tagging calibration, commissioning and alignment aspects
 - **Grant Gorfine:** b-tagging: top-specific algorithms and calibration
- Also expressions of interest from:
 - Martin Aleksa, Silvia Schuh, Francesco Spano, Fabiola Gianotti, Pippa Wells, ...
- Unfortunately, only a small amount of concrete work so far... (lack of time)
 - Several people have tried out TopView examples, focus today on that and work done by Pamela and Richard in going further towards real analysis with TopView



TopView and analysis objectives



- What is EventView?:
 - A set of utility classes to build an analysis-tailored 'view' of the AOD final-state objects (selection, removal of duplicates and ambiguities)
 - Plus common utilities to do combination, association and output to AthenaAware ntuple
- What is TopView?
 - A python-based configuration of EventView classes to do a simple semileptonic top reconstruction (only explored ttbar events so far, not single top version)
 - An abstraction of job configuration beyond the usual 'joboption.txt' use of Python
- How can we use it for our analysis ?
 - Run on AOD events to reconstruct ttbar final states from leptons, b-jets, light jets
 - Can optionally redo b-tagging to explore different algorithms (this works!)
 - Produce the EventView ntuple and analyse it:
 - Using basic ROOT histogramming / ntuple analysis
 - Using more complex code in ROOT classes or standalone, additional selection/histograms, even perhaps refined ntuple production..?
 - We are playing with the various possibilities, looking towards top cross section and b-tagging calibration applications



Practicalities



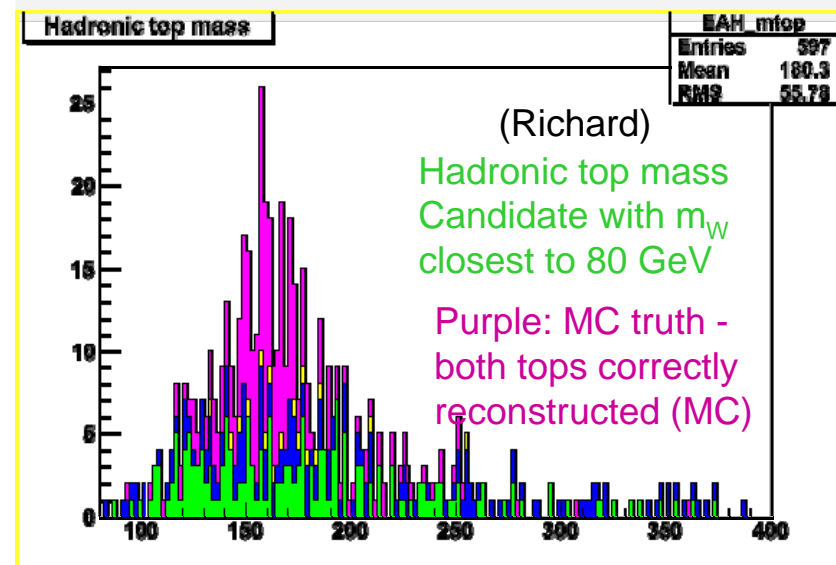
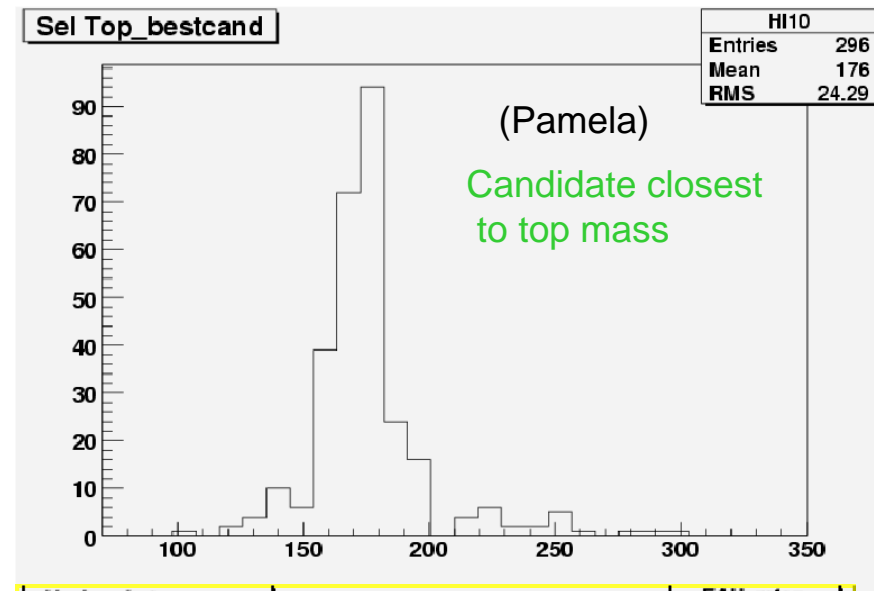
- Using release 11.0.41/42 - TopView-00-00-08
 - Not quite the latest tags, but working! Upgrade after release 12 ...
- Data samples - focusing on CSC data (looking forward!), not Rome samples
 - CSC sample A includes 10k ttbar (run 4100, 22pb⁻¹), no fully hadronic events
 - Can run TopView analysis of 10k AOD in 1-3 hours on a 3 GHz PC
 - Sample on local disk to avoid Castor waiting (1.8 GB)
 - Would need a > 1hour CAT queue to do this on lxbatch, plus disk space ...
 - Ntuple from TopView O(few MB) for 10k events - analysis in ROOT is very fast
- Main non-ttbar background is from W+4jets
 - Old Rome sample A7_w4jets (3017 - 200k, 168 pb⁻¹) cannot be used with TopView (generated/reconstructed with release 10)
 - Discussion with Ivo van Vulpen - no W+4jet 4-vectors for CSC generated yet
 - Want to use Alpgen, but still working on matching issues - discussion in T&P week
 - RH started to re-reconstruct some digitisation files with release 11.0.42
 - Around 800 events/day in background on desktop PC - can get 20 pb⁻¹ in a few weeks
 - Could also try to use lxbatch or the Grid, but not limited by sample availability now!



Selection examples



- Typically, looking at selection of:
 - 1 isolated e or μ , $p_T > 30$ GeV
 - E_t -miss > 20 GeV
 - At least 4 jets, $p_T > 40$ GeV, $|\eta| < 2.5$
 - Two jets having b-tag weight > 3
- Selection efficiencies typically O(5%)
 - Trying to reproduce #s from previous studies using TopView software ...
- A couple of examples (no W+4j)..... \Rightarrow
- Typical issues:
 - What is best selection for x-sec
 - Especially in early days, need 2 tops?
 - How to select best combination in event
 - TopView can give you them all...
 - Understanding MC truth information
 - Worry about jet energy scale calibration

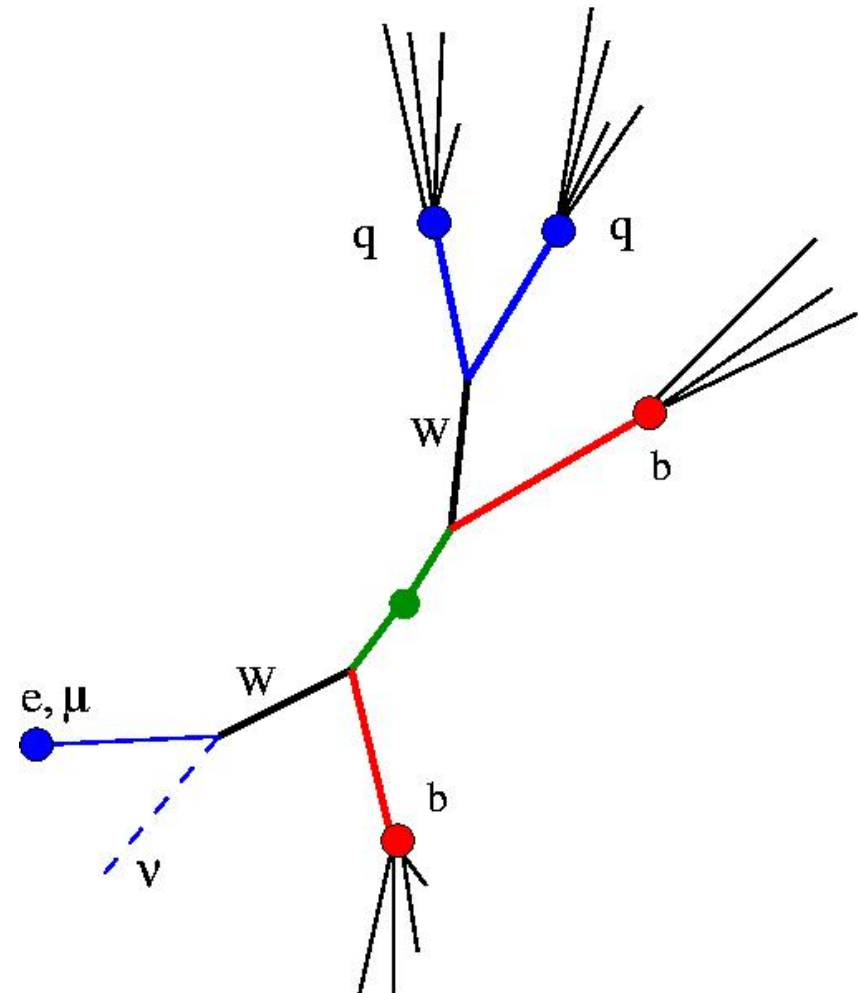




Going further - combinatorics



- ttbar event has at least 4 jets
 - Which jets to pair to make W?
 - Which to pair with W to make top?
- Current TopView strategy:
 - Divide jets into light and b-tagged collections
 - Form W among light jets - take all combs.
 - Associate only one b-jet (nearest in ΔR) to each W (hadronic/leptonic)
- Reconfiguring TopView to change this:
 - Try ALL combinations without regard to b-tagging info, and select best afterwards
 - Needed for b-tagging calibration:
 - Make no requirements on one b-jet, and study b-tagging distributions (kinematically sel. b)
 - Make no requirements on W jets, and study b-tagging distributions (kinematically sel. udsc)
 - Not trivial, but can be done with TopView+ ntuple analysis afterwards
 - Can probably migrate $\text{comb}^n \text{sel}^n$ to TopView





Final remarks



- Work limited largely by lack of time to contribute so far
 - Many people involved in detector commissioning etc, though 'interested' ...
- TopView/EventView does seem to be useful for 'real' analysis work
 - But not trivial to understand, python is an additional complication
 - Some people looking at Athena AOD-analysis options
- ATLAS top group still focusing on Rome-data studies
 - Non-availability of background samples for CSC-based analysis
 - Big opportunity to contribute with a leading role in the forward-going work
- Next steps
 - Establish 'reference selections' and TopView configuration for 11.0.41
 - Can then give to more people as end-user tools - enable 'common' group activities
 - Possibility of output ntuple for wider studies (handling of combinatorics?)
 - Start to focus more on real physics/detector questions:
 - Calibration and alignment - e.g. rerunning from ESD
 - Ingredients for initial cross-section measurement