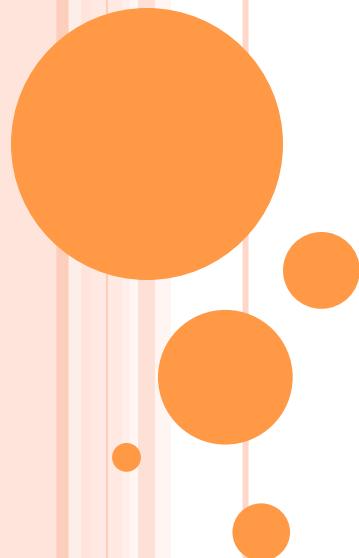


# UPDATE ON TTBAR L+JETS RESONANCES

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PCI2012

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# INTRODUCTION

- The Summer 2012 Top Resonances analysis is targeted at International Conference on High Energy Physics (ICHEP) July 7-8
- Analysis Contacts : **James Ferrando, Lucia Masetti**

**the 1+jets resonance search** - incorporating both

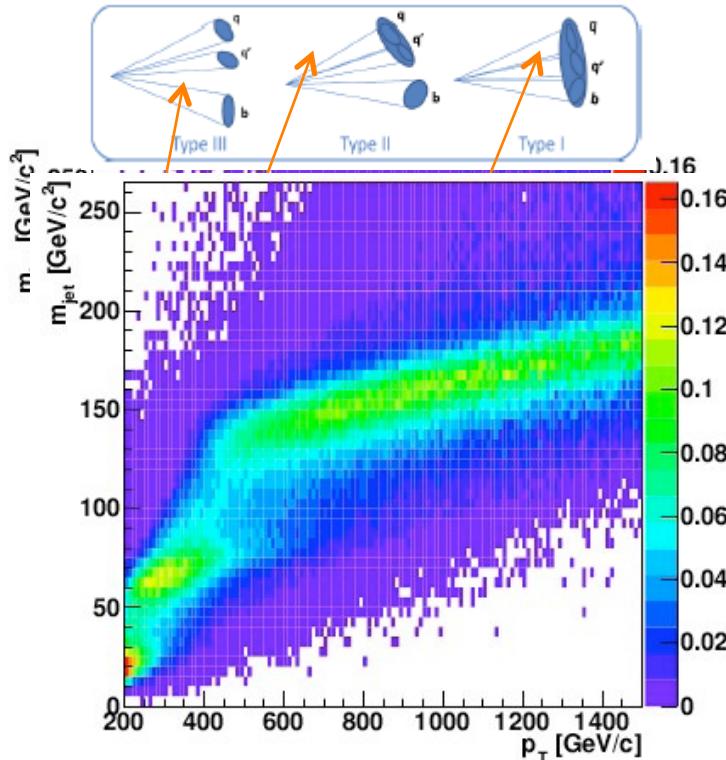
→ boosted and resolved approaches.

- The goal is to discover or set limits on single production of a heavy particle that decays to
- Benchmark models used are:
  - TopColor-assisted Technicolor (TC2) production
  - Kaluza Klein (KK) gluons
- Further important scenarios that could be added:
- KK Gravitons
- Scalars that decay to  $t\bar{t}$



# Topologies definition

The kinematics of  $t\bar{t}$  events drastically change as function of  $m_{t\bar{t}}$   
→ Various  $t\bar{t}$  mass regimes



## Low mass regime:

- Similar to 'standard' top reconstruction
- b-tagging
- **Resolved**

## High mass regime:

- Highly boosted top quarks
- Dedicated jet clustering
- **Boosted**

## Intermediate mass regime:

- Partial merges on hadronic side
- Leptons less isolated

## Overlap

Main goal is to participate to both Analyses:  
**Resolved and Boosted regimes**



# SOFTWARE SETUP

Official TopRootCore release:

**TopRootCoreRelease** framework provides all the required packages

- to select 1+jets selection top candidate events
- The framework is up to date with the latest
- TopCommonObject prescriptions
- **TopD3PDSelection:**
- Application performing event selection → CutFlow applications
- TopD3PDCorrections: application for object correction:  
scaling, smearing and SFs, including **systematics**
  - Avoiding a very painful way of searching, accessing, and implementing all kind of corrections

<https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TopRootCore>

<https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TopD3PDSelection>

<https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TopD3PDCorrections>

# TOPD3PD CORRECTIONS: SCALES & CORRECTIONS

**Scales:** List of weight/SF implemented in TopRootCoreRelease:

Lepton Trigger/ID/reco SF

bTag SF

pileUp weight (using the Period information from  
WhichPeriod tool)

W+jets SF from charge asymmetry

W+jets HF scale factor

W+jets shape (reweighting tool) [only for systematics]

**Corrections are applied to ALL the objects in the container,**

Electron Energy scaling/smearing

Muon Momentum scaling/smearing

Jet Momentum scaling/smearing

Energy variations are propagated to the MET  
through the topMET tool.



Very nice to have all  
these available there  
but it is not  
Straightforward!!

# CUTFLOW

- New development is needed to incorporate the dedicated cuts
- That match the ttbar topologies:
- Objection selection, correction, seaming and systematic
  
- Lepton isolation, trigger, jets collections, b-tagging
- Implementation of new cutflow with new selected objects require a deep comprehensive of the whole package of TopRootCore.

**Goal: New comparison with improved prescriptions**

The new implementation have to be well integrated with the application that use to run all corrections

- **D3PD2MiniSL** → application performs correction
- All the nominal smearing and scaling, MET corrections
- Including systemati“



# EVENT RECONSTRUCTION- $\chi^2$ SORTING

- Reconstruct neutrino  $p_Z$  from W mass constraint
- Find jets from top pair decay
- Jet combinatorial resolved via a  $\chi^2$  method
  - The method accounts for the W and the top reconstructed masses ,  $PT(t\bar{t})$ ,  $H_T$  fraction
  - Parameters and resolution are taken from Monte Carlo
- Jets selection
  - Keep up to 8 jets in the event for making a choice.
  - Consider all subset of 4 jets out of N, where  $4 \leq N \leq 8$
  - There are 70 subsets with 12 combinations for each.
  - Choose 4 jets which minimize  $\chi^2$  sorting method

Study of the selection efficiency of the perfect four jets in a parton matched  $t\bar{t}$  events, compared to the efficiency of missing either 1, 2, 3 or 4 jets

The performance are then determined on parton-matched SM  $t\bar{t}$  events

**Goal apply this method for the resolved analysis**



# ANALYSIS STATUS AND PLAN

- **CutFlow:**
- Implementation is almost done → still issue to be fixed
- needs to compare our numbers with the once of other groups
- **Timescale is very tight:**
- **Today we have to provide the input to calculate the limit**
- **Reconstruction and ttbar spectrum:**
- Boosted regime: needs to complete the object reconstruction into TopRootCoreRelease
- Resolver regime:
- Needs to integrated the chi  $\chi^2$
- into the TopRootCore package.
- 
- **Timescale is very tight too → first iteration has to provide during this week**
- 

