

UPDATE ON $T\bar{T}B\bar{A}R$ $L+JETS$ RESONANCES

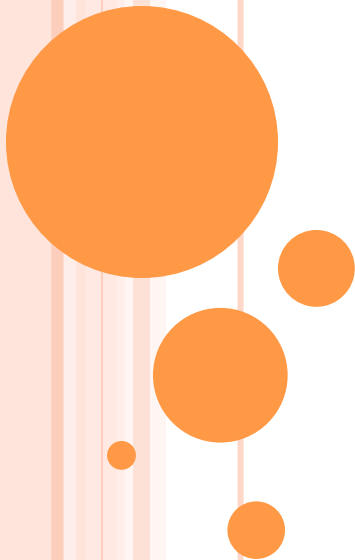
F. Fassi, M. A. Hyaya

(On *behalf* of the Rabat & Valencia groups)

IFIC-Valencia

PCI2012

30 April 2012



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 l+jets resonance search - incorporating both

→ boosted and resolved approaches.

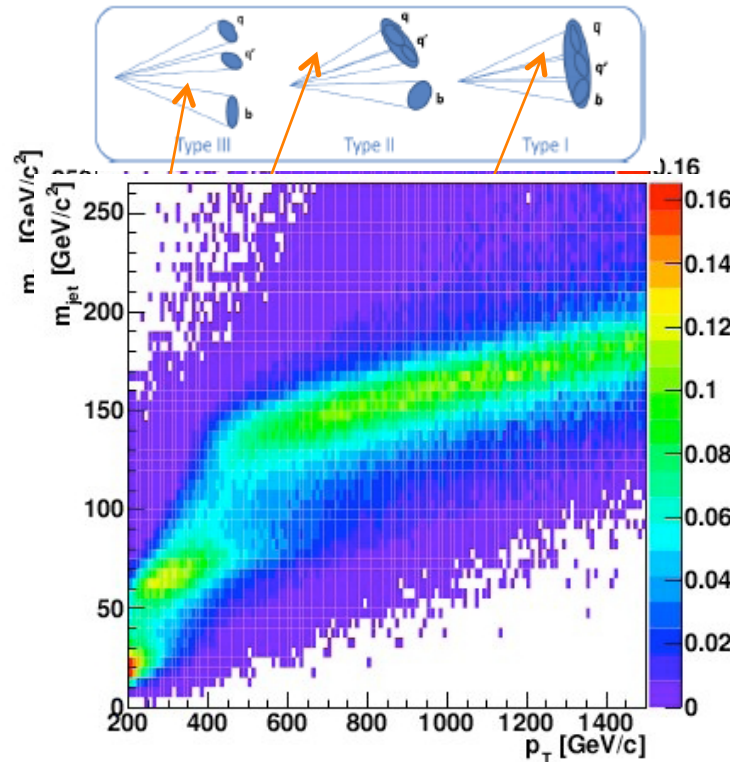
- The goal is to discover or set limits on single production of a heavy
- particle that decays to Benchmark models used are:
 - **TopColor-assisted Technicolor (TC2) production**
 - **Kaluza Klein (KK) gluons**
- Further important scenarios that could be added:
- KK Gravitons
- Scalars that decay to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



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 l+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 objet 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>

TOPD3PDCORRECTIONS: 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 $t\bar{t}$ bar 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- χ^2 SORTING

- Reconstruct neutrino p_z from W mass constraint
- Find jets from top pair decay
- Jet combinatorial resolved via a χ^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 χ^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 TopRootCoreRelase
- Resolver regime:
- Needs to integrated the chi χ^2
- into the TopRootCore package.
-
- **Timescale is very tight too → first iteration has to provide during this week**
-

