

New Non-SUSY Physics at the LHC

Experimental Introduction

M. Narain & G. Brooijmans

“Experimental” View

- LHC opens exploration of new scale, beyond TeV
- As experimenters we should keep our eyes open for the unexpected
 - A priori knowledge essentially contained in
 - Violation of unitarity in WW scattering
 - EWK constraints on Higgs mass
- Still guided by theoretical models (unavoidable)
 - Look at wide variety of signatures
 - Some come back!
 - Interpretation comes after discovery

Experiments at the LHC

- Many of the features many are used to at the Tevatron
 - Z's, W's, γ +jets, (top) ... for calibration; MET, mostly faked by a variety of resolution effects, etc.
 - Trigger issues, ...
- A number of new features
 - W, Z, top are now “light”
 - Can be produced with large p^T , need for new reconstruction approach
 - Quite different η distributions
 - Surprises?

Organizationally

- Experimentally, natural organization is by final state
 - Reflected in structure of webpages, etc
- Encourage participation in all topics during our stay in Les Houches
 - Exchange of ideas, brainstorming are key to making this as productive as possible
 - Apply ideas developed to tackle one problem to a different area
- Have programmed ample time for discussion (mornings) and work (afternoons)

Topics (1) - Resonances

Tim Tait, Tracey Berry, Henri Bachacou, Nathalie Besson, Maarten Boonekamp, Marie Legendre, Kevin Black, Saurabh D. Rindani

- Dileptons

- Resonance discovery reach already studied quite a bit
 - Some more statistical work
- New ideas to determine properties
 - $Z' + \text{jet}$

- Diphotons

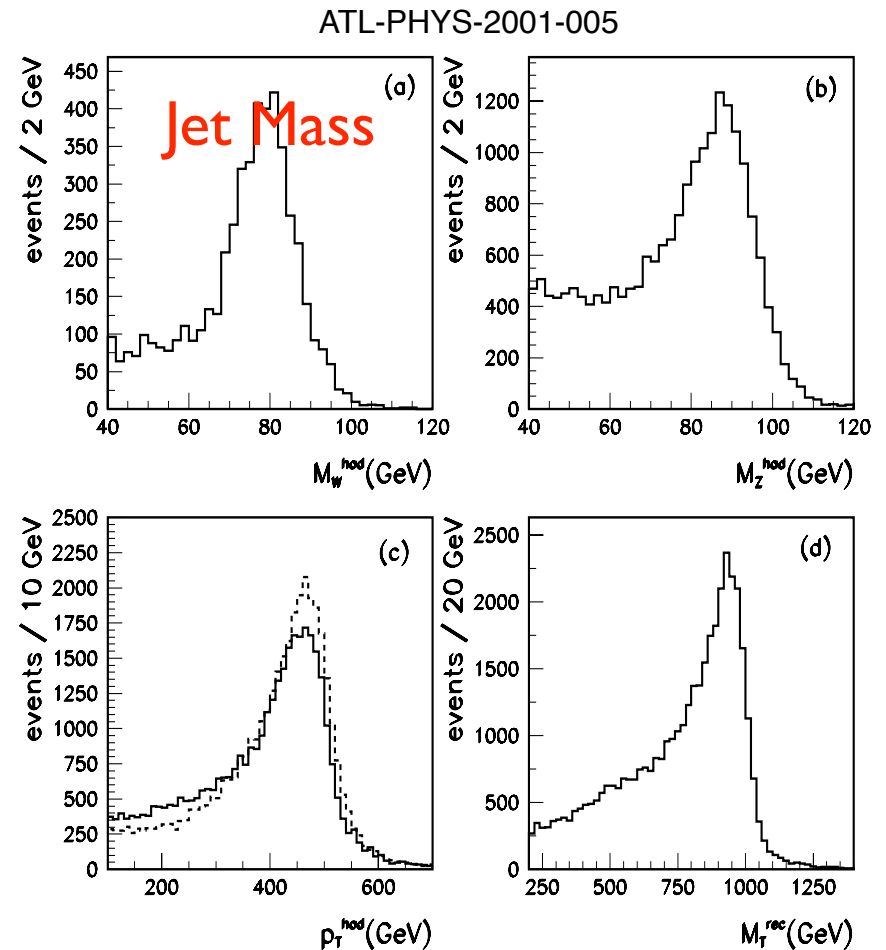
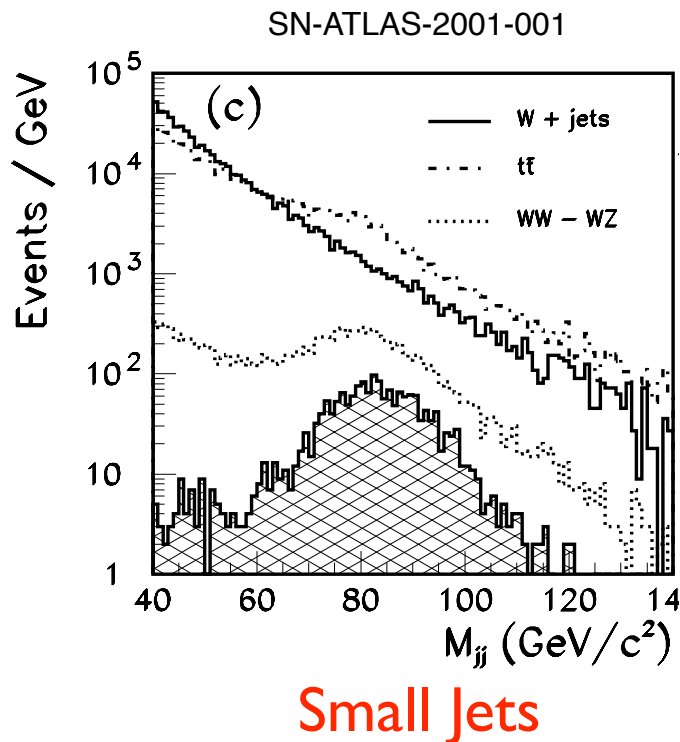
Ash Data, Bogdan Dobrescu, Adam Martin, Saurabh D. Rindani

- New resonances (so far only theorists interested?)

- **WW, WZ**

- Some studies done (TC, Z'), certainly more to do

- High p_T W/Z hadronic decays: jetmass, small jets inside bigger jet, ysplitter, ...



Topics (2)

Ashesh Datta, Bogdan Dobrescu, Gustaaf Brooijmans, Saurabh D. Rindani, Tim Tait, Jose Santiago, Krishnamoorthy Sridhar, Greg Landsberg, Ben Lillie, Slava Bunichev, Edward Boos, Hooman Davoudiasl, Shufang Su, Adam Martin, Veronica Sanz

- $t\bar{t}$, $t\bar{b}$
 - Lots of recent phenomenological activity
 - Interesting experimental challenges at high p^T
 - B decays outside beampipe reconstructible?
 - Top as a “monojet”
- Dijets Harris, Essen (not here)
 - In principle feasible (ATL-PHYS-92-010)
- Displaced vertices in resonance decays (hidden valley)
 - Nobody yet?

Topics (3): Cascades

- Lepton+jets+MET (no top)

Pedro Ribeiro, Jay Hubisz, Andreas Nyffeler, Saurabh D. Rindani

- Outside of SUSY limited experimental work so far - difficult backgrounds

- Lepton+photon

Bogdan Dobrescu, Saurabh D. Rindani

- Experimental work mostly on excited leptons, need to understand methodology for non-resonant signals

- Jets + MET

Jay Hubisz, Andreas Nyffeler

- (Only theorists so far?)

- top + X

Ashesh Datta, Jay Hubisz, Eduardo Ros, Shufang Su, Marcel Vos, Roberto Contino, Antonio Delgado, Christophe Grojean, Geraldine Servant, Meenakshi Narain

- Still much to understand, as with tt, tb

Topics (4): Cascades

- (b-)jet + lepton/ γ /W/Z
- Limited experimental studies so far, lots of work to do!

Bogdan Dobrescu, Jose Santiago, Ken Lane,
Adam Martin, Rogerio Rosenfeld, Veronica Sanz,
Andreas Nyffeler, Shufang Su, Marcel Vos

Topics (5)

- Final state “scan”

Nadia Adam, Tracey Berry, Meenakshi Narain, Samir Ferrag, Greg Landsberg

 - Ways to combine signatures, statistical issues, etc.
- Resonance below threshold

Slava Bunichev, Edward Boos

 - (Only theorists so far?)
- Black Holes

Greg Landsberg

 - Still trying to understand exactly what those look like...

Tools

- From an experimental point of view, important to be able to do fast “prototyping”
- Get a first idea if a signature is even remotely possible
 - What does the signal actually look like?
 - Rough estimate of backgrounds
- Suggest new possibilities to theorists
- ATLAS and CMS have fast simulations
- But enforcement of data-taking rules is starting
 - We cannot share plots made with ATLAS/CMS tools without internal review -> not useful here, during stay in Les Houches

Tools (2)

- PGS is probably ok for initial study of many topics at this workshop
 - (PGS == Evolution of SHW, used in LHC olympics)
- PGS is probably not adequate for some studies
 - E.g. top “monojet” reconstruction
 - Exchange ideas here, continue work later
- Proceedings due at the end of the year -> chance to repeat analysis with better simulation, get approved
- Of course, free to use other tools

Not A Summary

- Many interesting things to explore
 - Some new signatures
 - Some recently re-emphasized issues
 - ...
- A great environment
 - Ample time for both brainstorming and quick tests
- Expect a fair amount of refining to be done in the next few months
 - Proceedings before the end of the year

- Kick-off session at 2 pm today in Amis de la Nature II
- Introduce everybody
- Talk to people working on similar topics