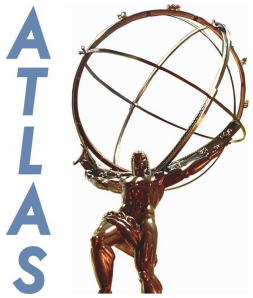
OF with PileUp Noise & SUSY 0-lepton analysis Status



Ximo

TileCal Valencia Meeting
5-November-2007

OF with PileUp Noise

- Studies done so far extensively presented during Tile Week 4 weeks ago: http://indico.cern.ch/materialDisplay.py?contribId=5&materialId=slides&confId=21730
- Latest new to be presented next week
- Many thanks to Belén and Esteban for their interest and suggestions on this study

QCD cleaning cuts

- **Definition of cuts to reduce contribution to QCD background for SUSY analysis.**
- **Cuts based on jet reconstruction quality:**
  - **Study on the energy deposition in the different parts of the calorimeter system. First set of cuts:**

	$\|\eta\| < 0.3$	$0.3 < \|\eta\| < 0.6$	$0.6 < \|\eta\| < 1.3$	$1.3 < \|\eta\| < 2.0$	$2.0 < \|\eta\| < 3.0$
$E_{\text{Tile2}}/E_{\text{Tot}}$	0.1	0.1	0.2	-	-
$E_{\text{Cryo}}/E_{\text{Tot}}$	0.15	-	0.2	-	-
$E_{\text{Gap}}/E_{\text{Tot}}$	-	-	0.2	0.2	-
$E_{\text{HEC}}/E_{\text{Tot}}$	-	-	-	0.5	0.8

- **Cuts based on the comparison of the reconstructed MET with MET from tracks:**
  - **MET<MET_{Trk}: μ inside the jet (can be seen at the tracker level, but not in the calorimeters)**
  - **MET>>MET_{Trk}: MET_{Trk} is not affected by issues in the calorimeter reconstruction → cross-check for reconstructed MET**

Cleaning cuts (private production)

- **Cut flow table (private 4-jet JX samples):**

		Total	Cut 1	Cut 2+3	Cut 4+5	Truth $\not\!\!E_T$>80 GeV	Cleanup
Signal	N_{events}	81300	30212	17991	13325	13321	10793
	σ (pb)	19.16	7.12	4.24	3.14	2.54	3.14
J5 (4 Jets)	N_{events}	197360	104017	74	14	7	12
	σ (pb)	3.5×10^{3}	1.8×10^{3}	1.31	0.25	0.12	0.21
J6 (4 Jets)	N_{events}	176019	114436	38	7	6	5
	σ (pb)	126	81.92	2.7×10^{-2}	5.0×10^{-3}	4.3×10^{-3}	3.6×10^{-3}

CUTS

1. 4 Jets && p_T(1st)>100 GeV && p_T(4th)>50 GeV
2. MET>100 GeV && MET>0.2 Meff
3. Sphericity>0.2
4. $\Delta\phi$(jet-MET)>0.2
5. NLeptons=0

- **Most of the events that survive the cleanup cuts actually have MET in the MC Truth**

Cleaning cuts (private production)

- **Cut flow table (private 4-jet JX samples):**

		Total	Cut 1	Cut 2	Cut 3	Cut 4	Cut 5	Cleanup
Signal	N_{events}	81300	30212	24226	17991	16870	13325	10793
	σ (pb)	19.16	7.12	5.71	4.24	3.98	3.14	2.54
J3	N_{events}	73250	252	1	1	1	1	0
	σ (pb)	5.9×10^{6}	20.0×10^{3}	80.27	80.27	80.27	80.27	0
J4	N_{events}	16000	1071	0	0	0	0	0
	σ (pb)	3.1×10^{5}	2.1×10^{4}	0	0	0	0	0
J5	N_{events}	120900	23185	38	20	5	5	4
	σ (pb)	1.3×10^{4}	2.4×10^{3}	3.93	2.07	0.52	0.52	0.41
J6	N_{events}	97750	28949	63	17	5	5	5
	σ (pb)	360	106.6	0.23	6.3×10^{-2}	1.8×10^{-2}	1.8×10^{-2}	1.8×10^{-2}
J7	N_{events}	213200	66957	92	4	2	2	1
	σ (pb)	5.71	1.79	2.5×10^{-3}	1.1×10^{-4}	5.4×10^{-5}	5.4×10^{-5}	2.7×10^{-5}

CUTS

1. 4 Jets && p_T(1st)>100 GeV && p_T(4th)>50 GeV
2. MET>100 GeV && MET>0.2 Meff
3. Sphericity>0.2
4. $\Delta\phi$(jet-MET)>0.2
5. NLeptons=0

- **More data being processed for the J4 dataset**
- **Strange events found (see next slide), for instance in J3 sample**

Strange Events

- Event found in the private J5 with 4-jet filter sample:

Monte Carlo Jets				Reconstructed Jets			
	η	φ	E_T(GeV)		η	φ	E_T(GeV)
JET 0	0.67	0.08	317.4	JET0	0.61	0.08	325.7
JET1	0.53	2.86	262.4	JET1	0.46	2.84	261.1
				JET2	0.91	1.53	185.0
JET2	1.66	2.97	92.8	JET3	1.64	2.99	89.2
MET (Truth)			8.7 GeV	MET(Reco)			195.5 GeV

- MC JET0 is split in 2 jets in the reconstruction
- Reconstructed JET0 does not have its counterpart in the MC, leading to large MET.

Strange Events

- This kind of events also found in official samples (J3):

Monte Carlo Jets				Reconstructed Jets			
	η	φ	E_T(GeV)		η	φ	E_T(GeV)
				JET0	0.56	1.24	256.14
JET 0	-0.58	-0.62	140.4	JET1	-0.72	-0.69	82.23
				JET3	-0.12	-0.54	58.4
JET1	-0.24	-3.14	82.0	JET2	-0.14	3.14	73.53
JET2	0.46	1.92	58.6	JET4	0.51	1.80	53.32
MET (Truth)			17.6 GeV	MET(Reco)			275.0 GeV

- MC JET0 is split in 2 jets in the reconstruction
- Reconstructed JET0 does not have its counterpart in the MC, leading to large MET.

Strange Events

- Reported this problem to the JetEtMiss group
- Got feedback from G.Unal:
  - This energy deposition exists at the HIT level.
  - Shower profile present in the calorimeters → Simulation and digitization OK
  - No particle from the primary vertex with large energy pointing where the energy is seen in the calorimeter
  - Very large (~300 GeV) proton coming from a secondary vertex in the beam pipe at z=4m and going backwards toward the central calorimeter.
  - No 4-momentum conservation (Problem in G4?)
  - Bug #30662 opened: https://savannah.cern.ch/bugs/index.php?30662
- Went to visit John Apostolakis (CERN, GEANT4 Spokesperson), but no answer yet.

Plans

- Some more data needed to complete the study (J4, other backgrounds for SUSY 0-lepton)
- Maybe some playing with the jet cuts
- First drafts getting ready…