

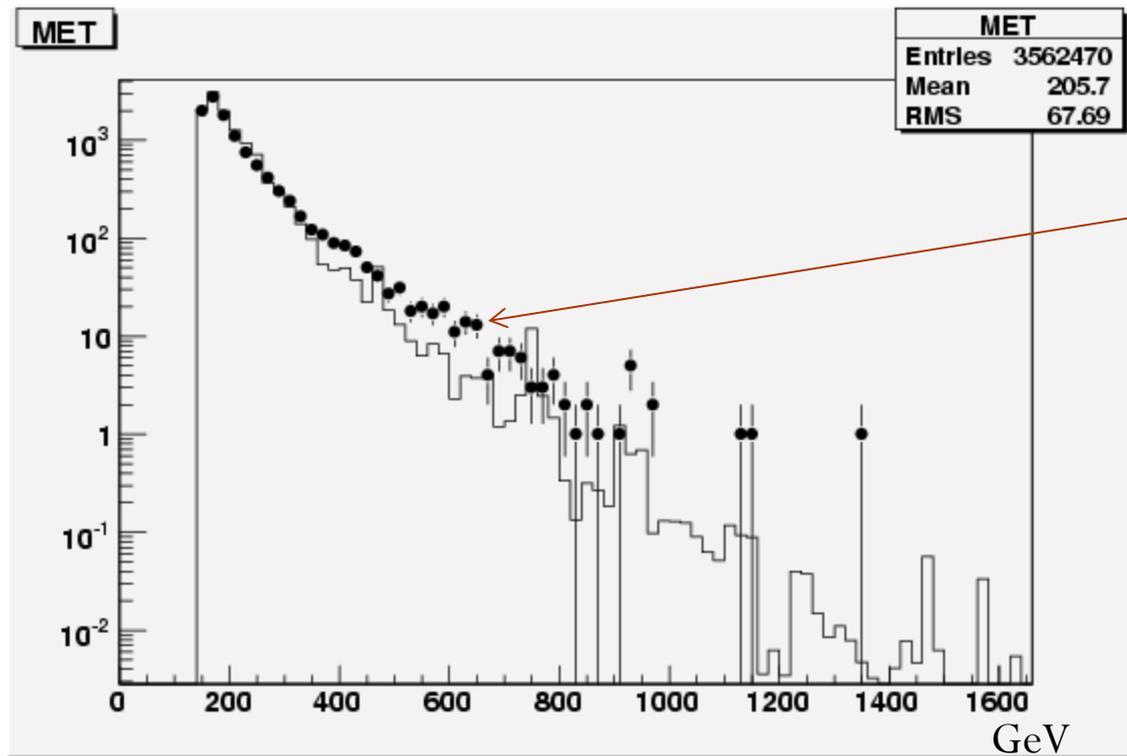
# SUSY search : blind analysis

D. Teyssier, III Phys. Inst. A, RWTH Aachen

# Search strategy summary

- skimmed samples mEt150 used (whole background and data)
- x-sections and MC generated numbers extracted from demo program to normalize
  
- look at basic quantities at preselection level, ie. skimming and trigger included
- problem already seen in jet energy scale (in “First results” from P. Verdier)
- try to solve by both recalculating MHT (instead of MET) and cutting hard on the jet leading transverse momentum
- plugged the “muon(s) + high Pt jets + MET” analysis developed in Aachen IIIA

# Preselection level : raw MET

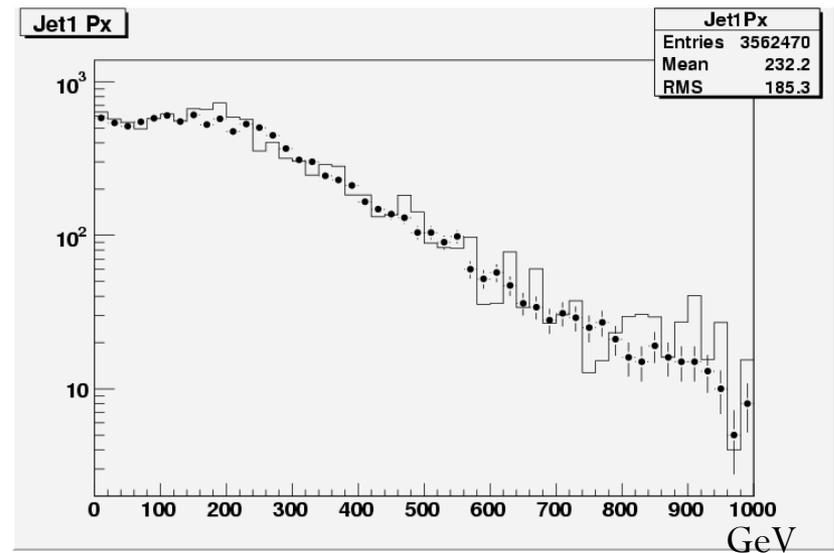
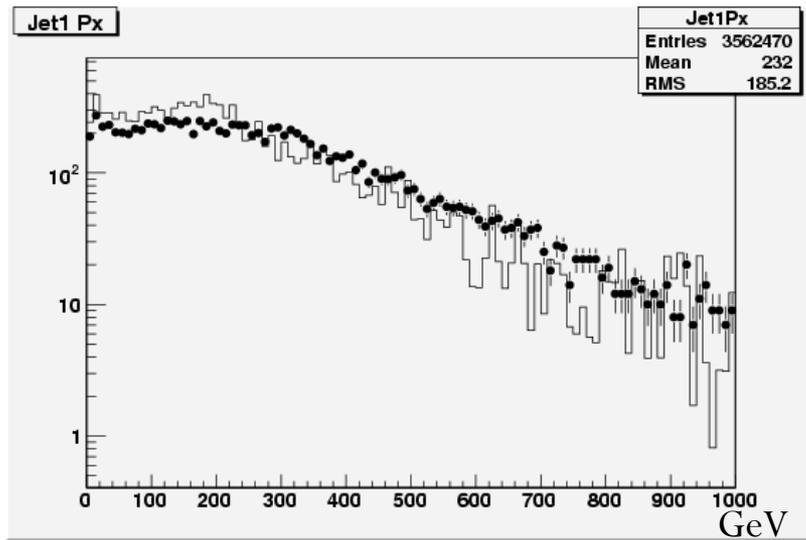


... looks like SUSY ?

... but

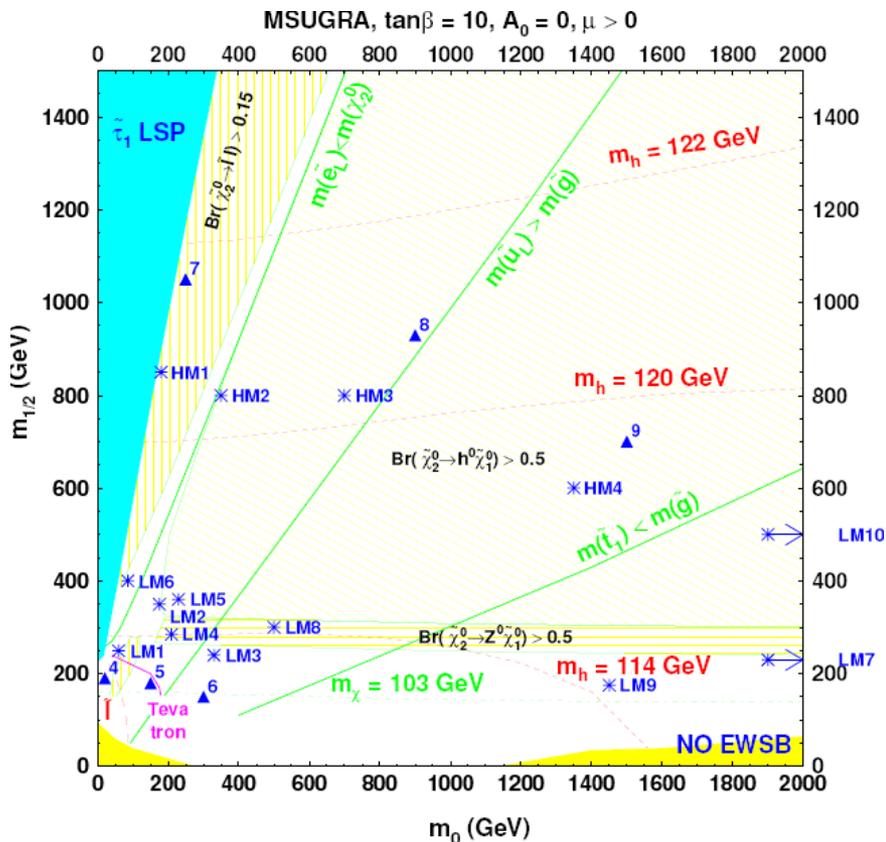
# $P_x$ leading jet :

- Raw  $p_x$  component (left plot) : excess at high momentum, but deficit at lower
- Rescaling JES by 20% (right plot) : now both shape and normalization are ok



# Analysis strategy :

- inspired from our CMS Aachen mSUGRA analysis in the topology “muon(s), MET and high Pt Jets”
- several reference low mass (LM) points chosen :

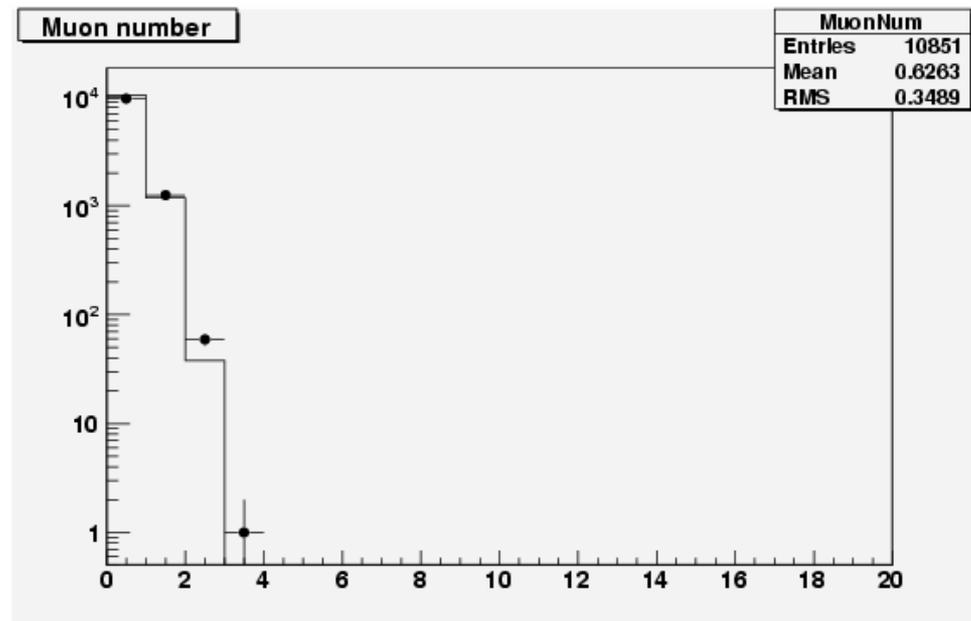


$$A_0 = 0 \quad \mu > 0$$

|     | $m_0$<br>(GeV) | $m_{1/2}$<br>(GeV) | $\tan\beta$ | $\sigma_{\text{LO}}$ (pb) |
|-----|----------------|--------------------|-------------|---------------------------|
| LM1 | 60             | 250                | 10          | 43.5                      |
| LM2 | 185            | 350                | 35          | 7.9                       |
| LM4 | 210            | 285                | 10          | 19.0                      |
| LM5 | 230            | 360                | 10          | 6.3                       |
| LM9 | 1450           | 175                | 50          | 9.7                       |

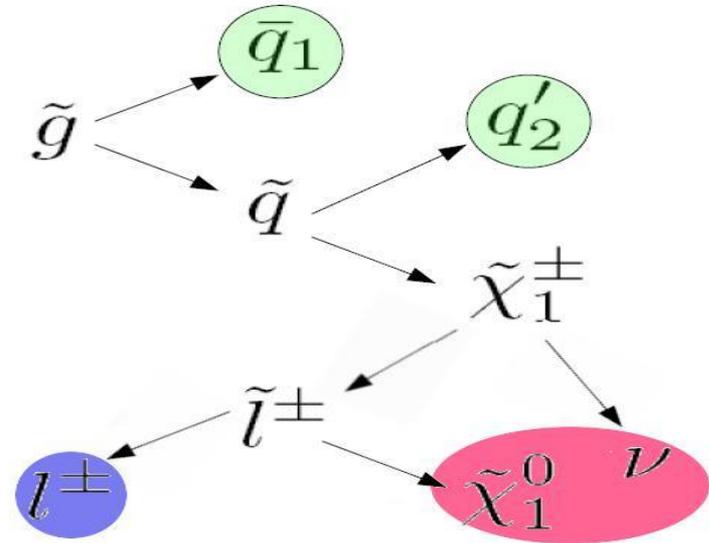
# Cuts applied :

- at least one muon : the aim is to focus on the prompt lepton coming from W/Z bosons or s-leptons in the SUSY cascade
- the use of sub-trigger single and di-muons facilitates at the start-up
- easy removal of QCD by isolated muon requirement
- distribution of the number of muons at the preselection level shows already a kind of disagreement :



# Cuts applied :

Example of susy cascade :  
several high Pt jets and large  
MET are expected

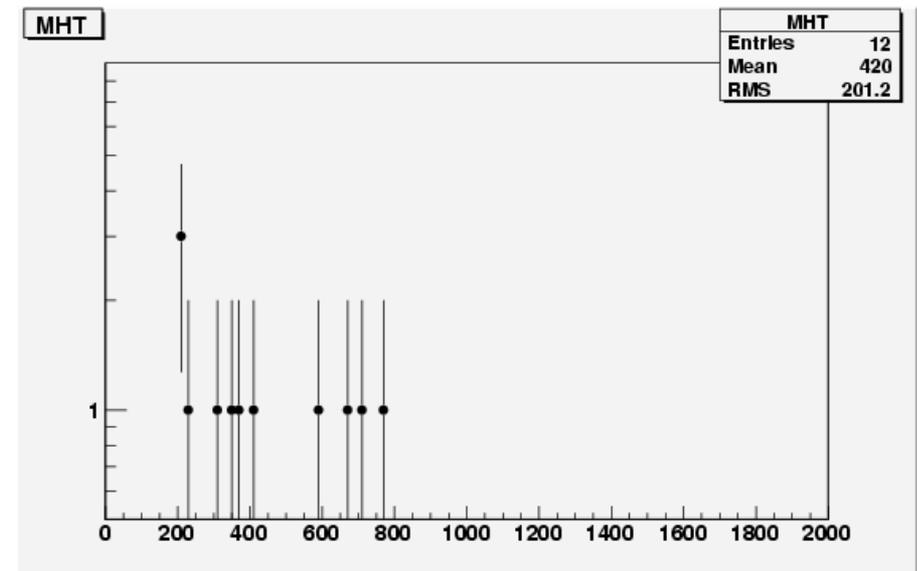


- four jets with following Pt threshold : 300, 250, 80, 80 GeV
- large MHT (recalculated taking into account for modified JES), should be greater than 200 GeV
- $MHT = \sum \text{Jets (Pt} > 40 \text{ GeV)}$  kind of MET with threshold and without other objects than jets

# MHT after all cuts applied :

- cuts applied :
  - skimming ( $\text{MET} > 150 \text{ GeV}$ )
  - trigger “all”
  - at least one isolated muon
  - four jets with thresholds
  - large MHT

- Data : 12 (conservative), 31 (using raw jets pt)
- MC :  $< 0.1$
- no need of CL estimator : there would be discovery with such excess by comparison with SM backgrounds
- the point is : did we control or not the MET/MHT tail ?



# Excess significant ?

- Difference between conservative (using modified JES) and raw results shows that any jets + MET selection depends hardly on JES determination, probably highest source of systematic uncertainty
- Need data-driven method (“ABCD” in CMS jargon, or sided-band method) to determine correctly the level of background, never trust MC blindly : the method consists in extracting the shape and the normalization from other parts of the distribution
- Admitting the low level of background, this excess can correspond to LM1 scenario, just above the Tevatron exclusion :
  - excess compatible with cross-section (NLO  $\sim 50$  pb) taking into account of the guessed efficiency
  - nevertheless, the level of background is lower than the expected one in the CMS analysis : main background remaining in any SUSY leptonic search is the  $t\bar{t}$
  - in the LM1 scenario, 40% of the events contain at least one muon
  - heavy gluino/squarks ( $> 500$  GeV) produced
  - large MET from the LSP ( $\tilde{\chi}_1^0$ )