Status Report on the "SUSY Blind Analysis"

OUTLINE

I. Reminders
II. Two Quick Blind Analyses
III. My Quick Analysis
IV. Conclusions

I. Reminders

• What is the SBA: It's a SUSY challenge that I proposed 2 years ago (LH07) to the experimentalists and the theorists within the SUSY hunters community

• Aim: This challenge is meant to test our search and reconstruction strategies whithout the knowledge of the hidden SUSY+Higgs signal

• Details:
  • see previous talks: LH07, GDR-SUSY, GDR-Terascale
  • website: http://www-clued0.fnal.gov/~muanza/Blind_SUSY_Analysis.html

I. Reminders

- How was it cooked:
  - Context: LHC @ 14 TeV, 0.1 fb^{-1}
  - Generator:
    - Pythia v6.3
    - PDF: CTEQ6LL (aka CTEQ6L1)
    - m_t = 172.7 GeV
    - Used only LO cross sections
  - Detector response:
    - fast simulation (based on old Atlfast2)
    - data format: simple root-tuples
  - Pseudo-data:
    - choose a SUSY model (Sdecay SLHA input file)
    - produce all the possible processes
    - use the Sdecay decay table
    - produce the SM background
    - remove MC truth, mix the events, reject events failing trigger

I. Reminders

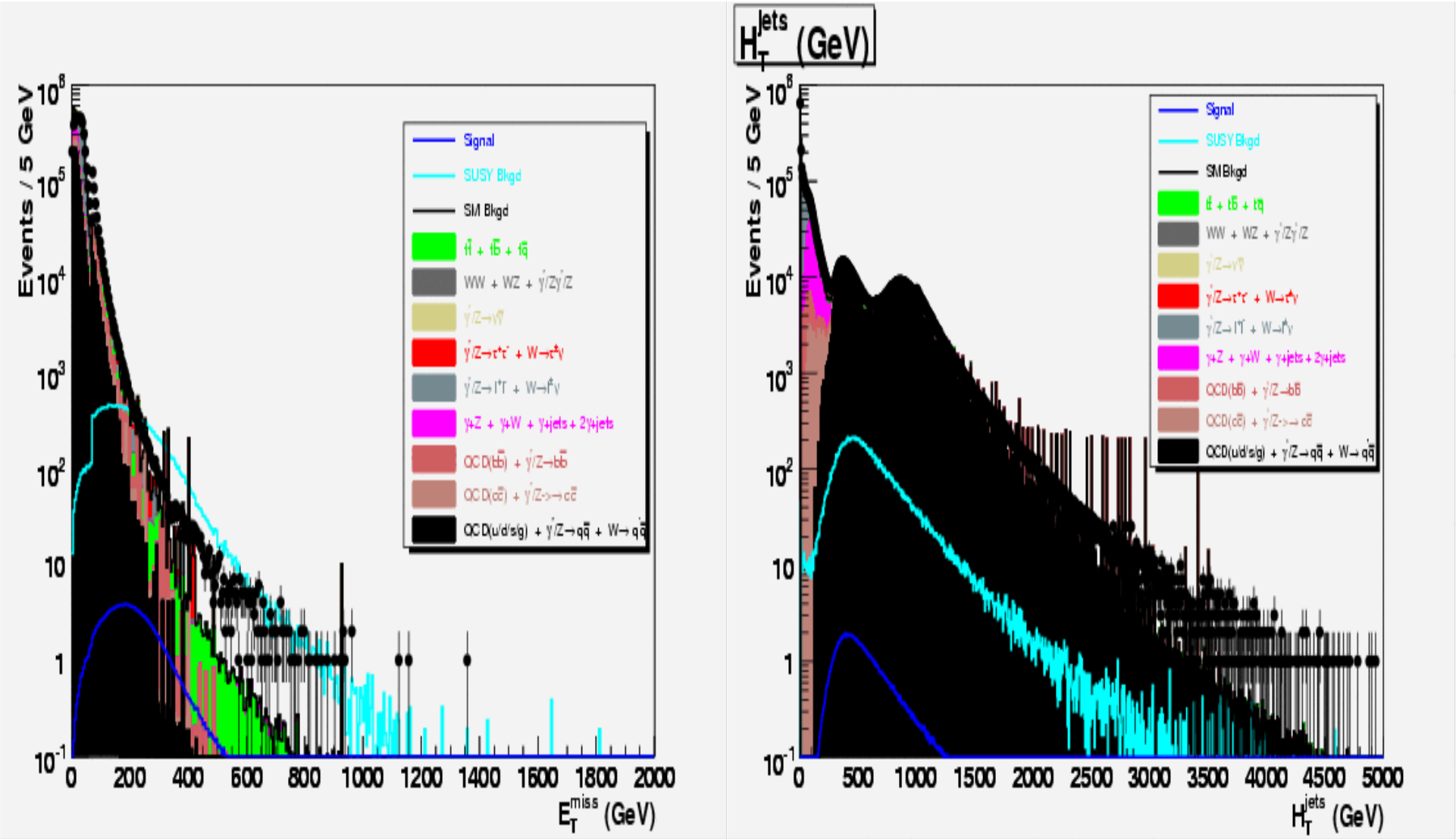
- How was it cooked: cont'd
  - Backgrounds :
    - provide all individual samples containing the MC truth
  - Experimental trick:
    - used worse resolutions for PsD than for MC
    - additional contribution to resolution: (7.5 GeV)/p_T(jet)
    - I revealed this trick 2 ½ months ago

I. Reminders

- Data Access:
  - On tapes: in HPSS @ CCIN2P3 in Lyon
  - SRB facility to copy files elsewhere (laptop)
- Data Volume:
  - PsD:
    - raw: 4.5 M evts, 12 Gb
    - skimmed: 20 k evts, 74 Mb (mE_T > 150 GeV)
  - MC BKGD:
    - raw: 146.3 M evts, 410 Gb
    - skimmed: 3.7 M evts, 13.1 Gb (mE_T > 150 GeV)
- Tools:
  - A template analysis code is provided
  - The cross sections for the MC BKGD are provided
  - The machinery to produce user samples is provided

I. Reminders

- Illustrations:
  - Event selection: trigger OR



I. Reminders

- Illustrations:
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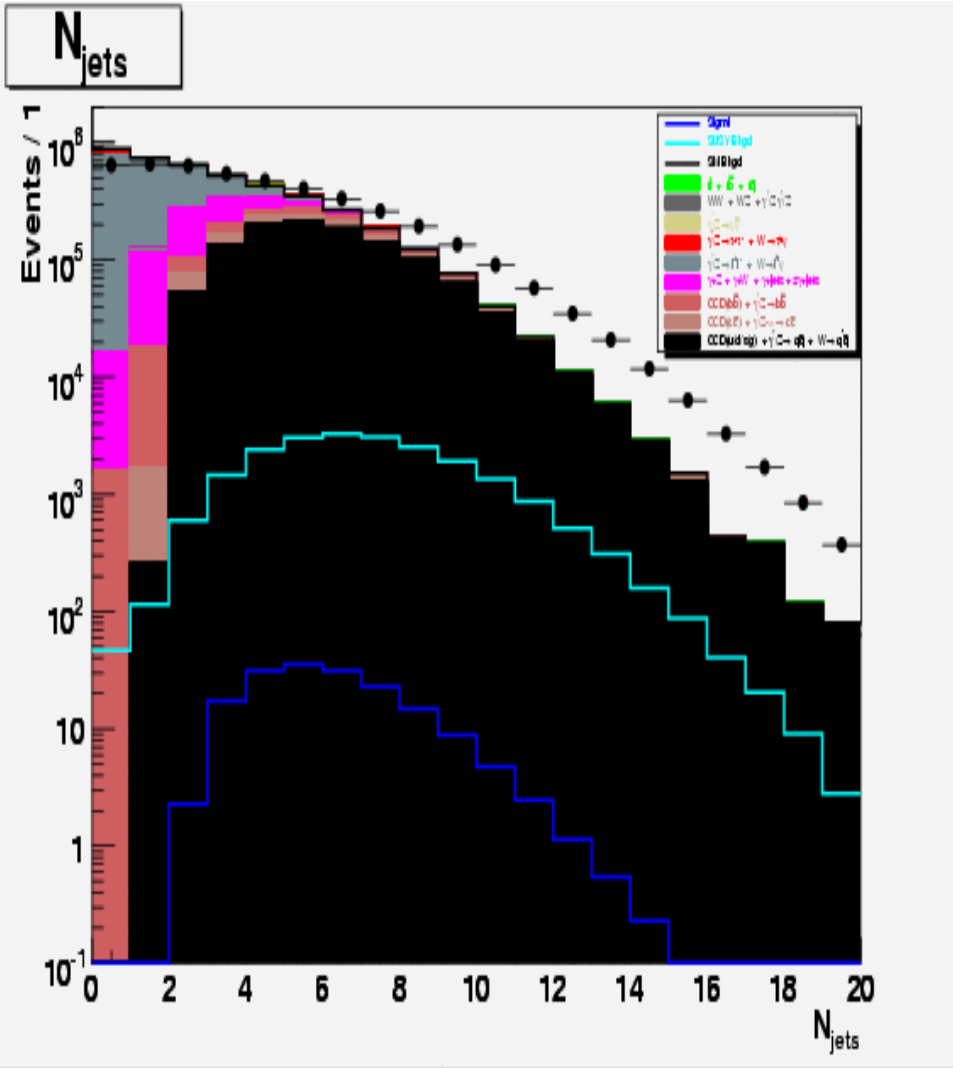

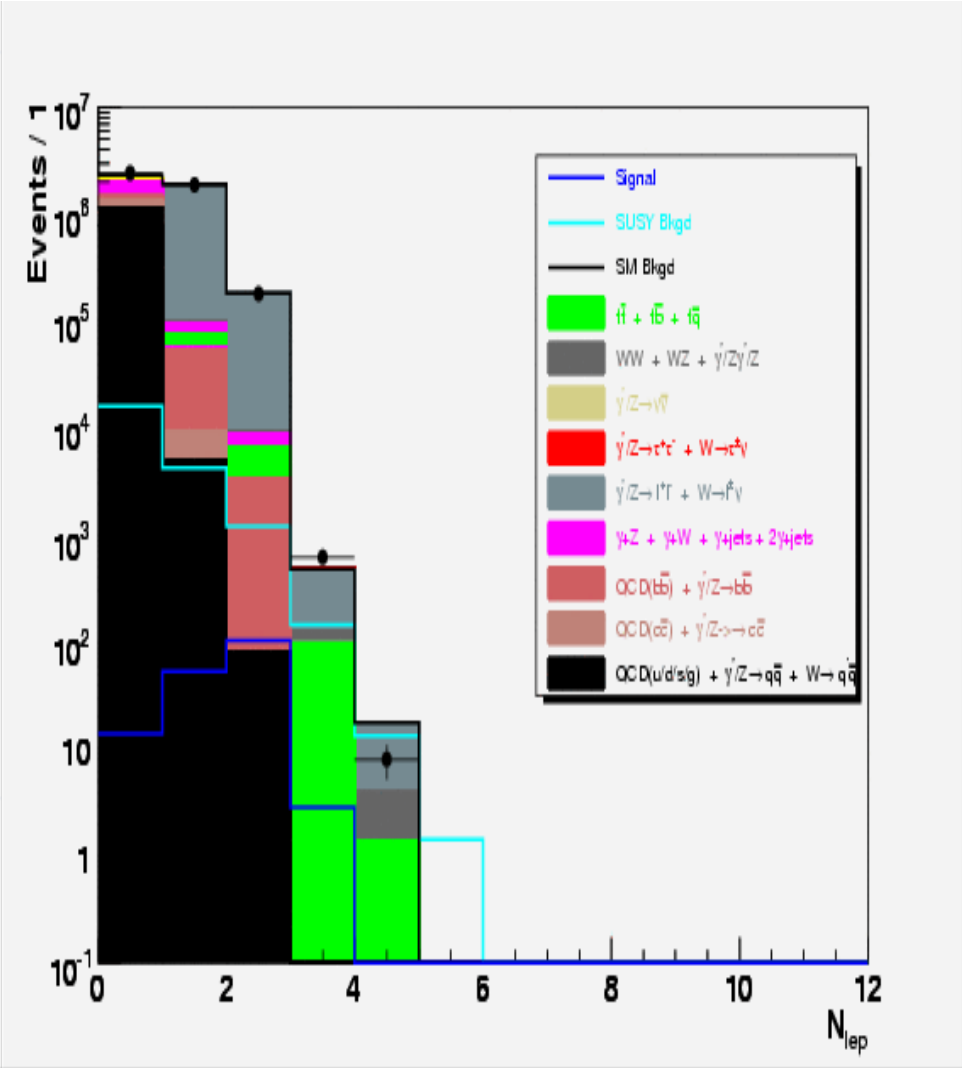

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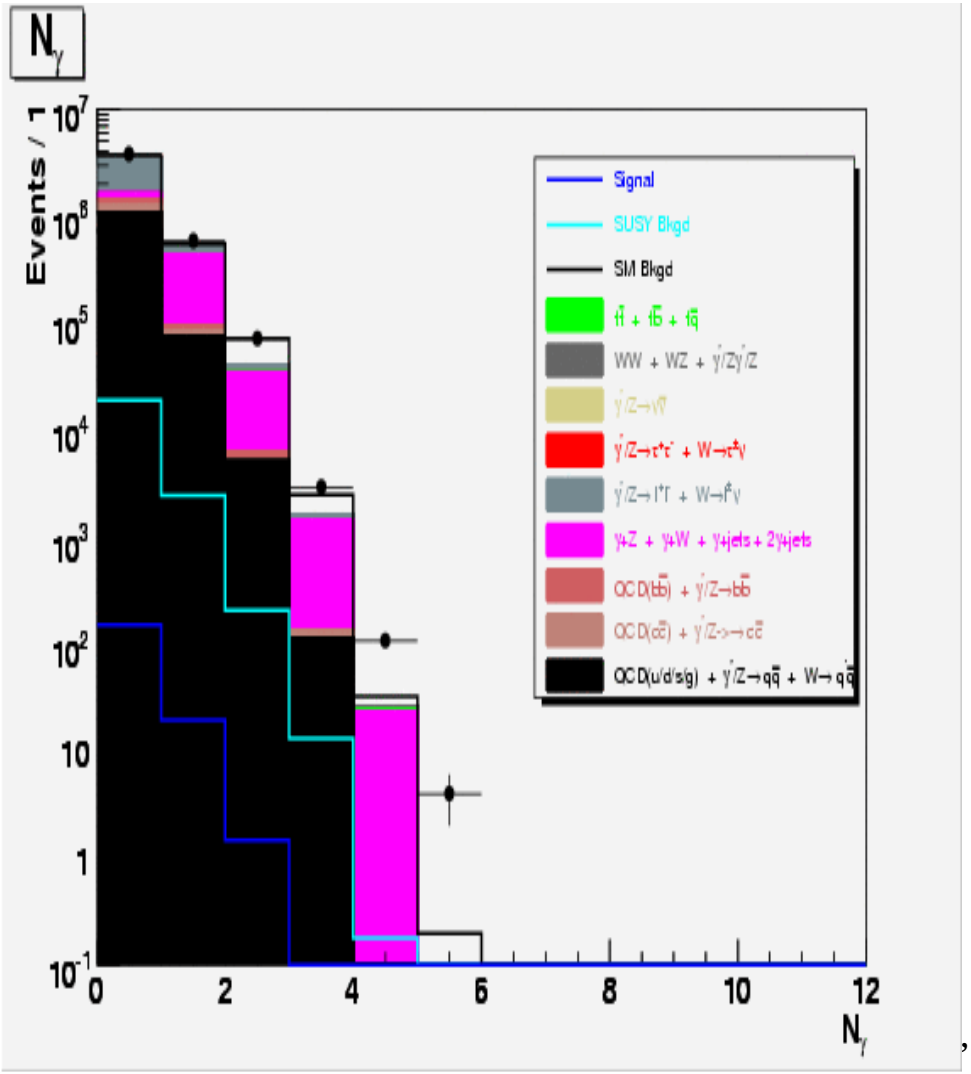

- The signal is easily visible in multijet + large mE_T topology
  ⇒ think of RPC SUSY
  ⇒ large contribution of ~q/~g pair production

- No obvious excess of isolated leptons or photons

II. Two Quick Blind Analyses

- P. Verdier (D0, CMS, IPN Lyon)

- Disclaimer:
  - this only very quick look at the challenge
  - done before I revealed the trick on the resolutions

II. Two Quick Blind Analyses

- D. Teyssier (CMS, Aachen)

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  - done before I revealed the trick on the resolutions

III. My Quick Analysis

- I tried to adopt a blind analyzer mindset

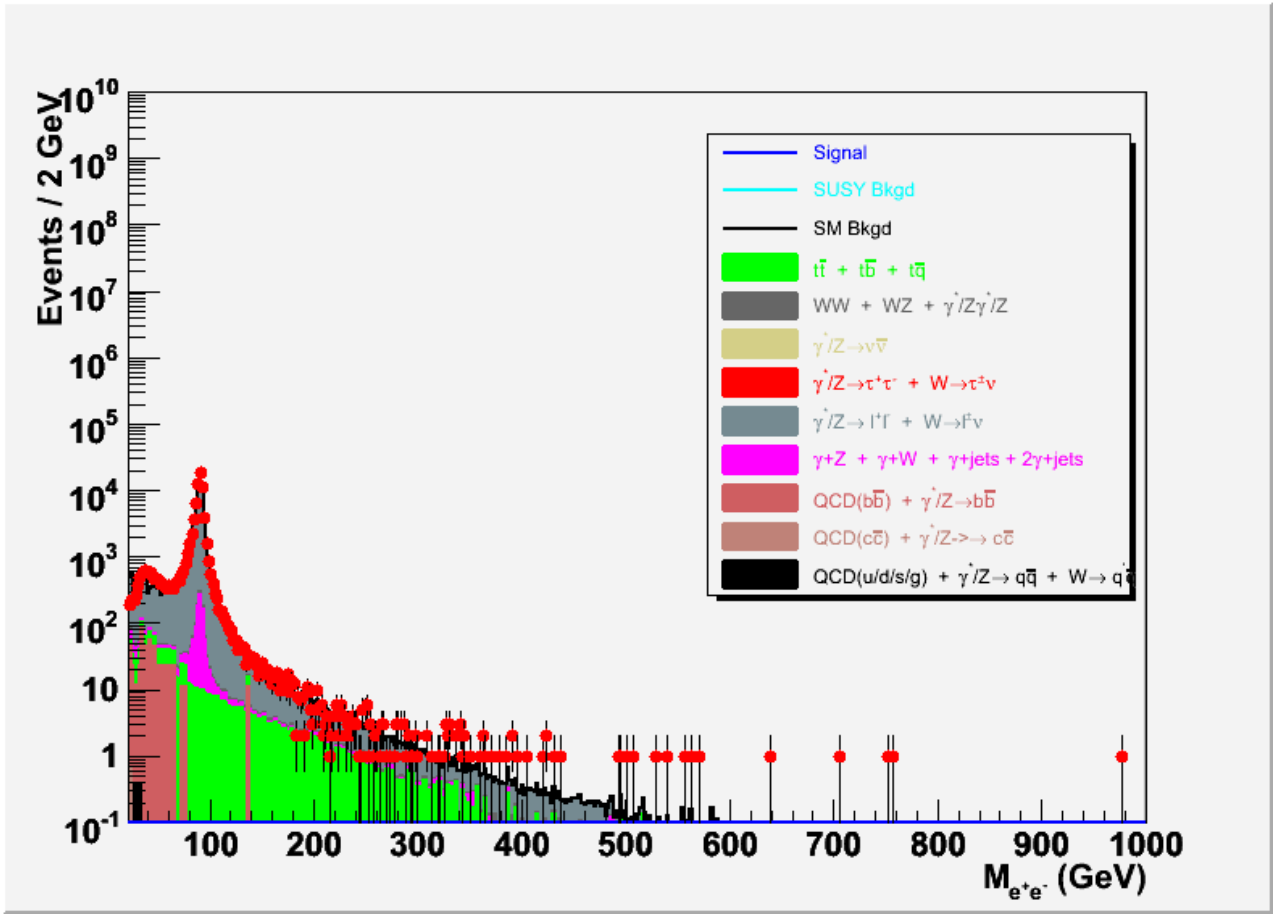
- Correcting the MC:
  - Over-smear the MC w/: $$\sigma = \sqrt{\sigma_{HL}^2 - \sigma_{LL}^2}$$

  - Correct the $e^{+/-}$, the γ, the jets
  - No corrections for the $\mu^{+/-}$
  - Correct the mET accordingly

  - Since the trigger cuts were applied on the PsD samples before this correction, there might be a remaining bias
  => cut much harder than at trigger LVL

III. My Quick Analysis

- Correcting the MC: cont'd



Confirm: normalization and resolution look OK

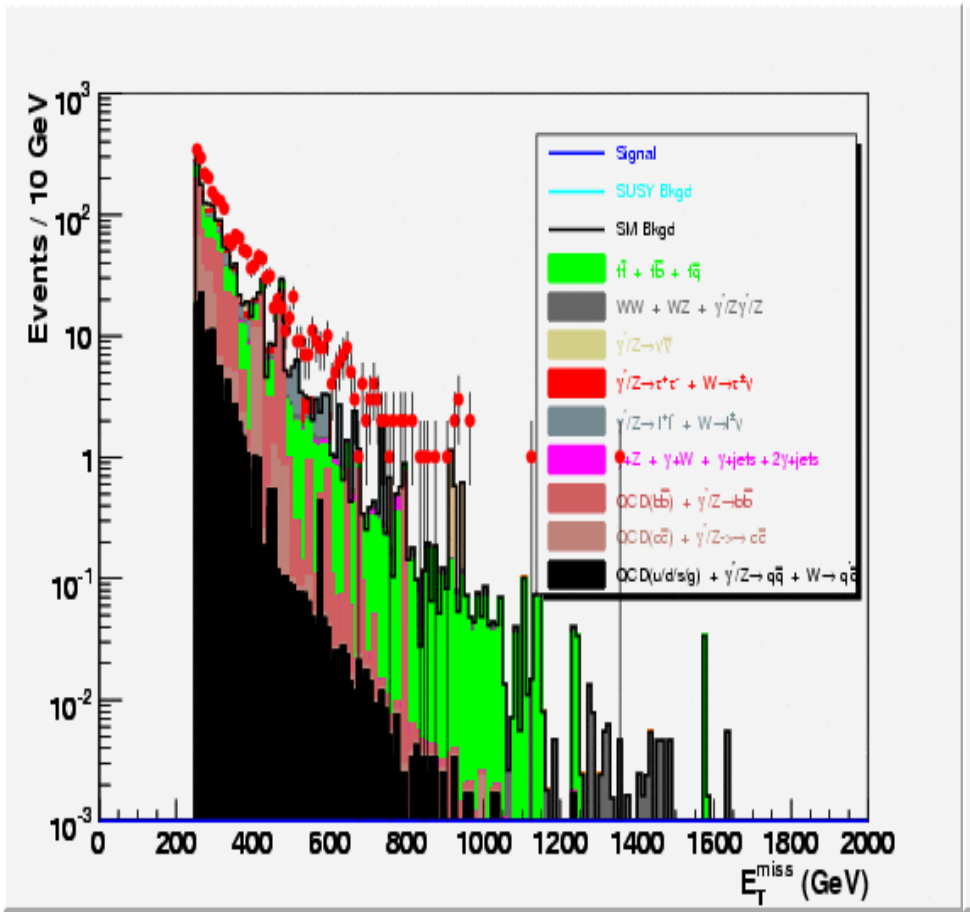
III. My Quick Analysis

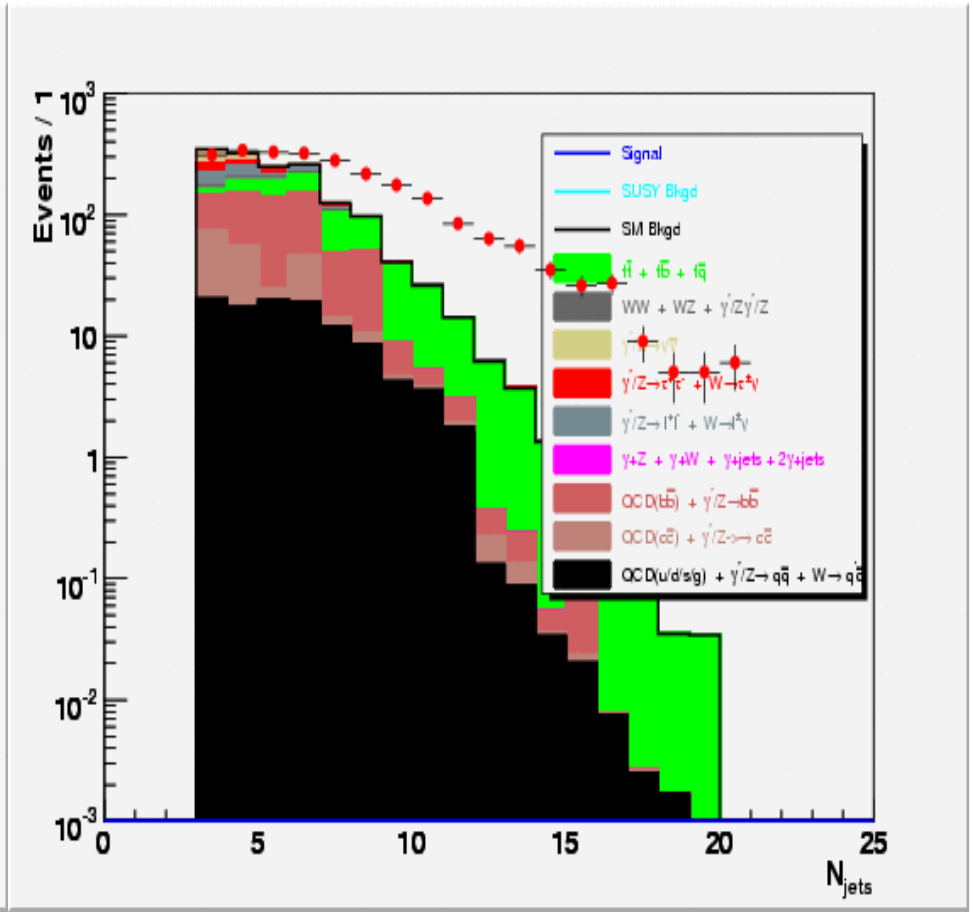
- I used the mET > 150 GeV skim

- Preselection:
  - Trigger OR
  - Njets > 2
  - mET > 250 GeV
  - Note: these plots below are not corrected for the resolutions
- Events yield:
  - Nobs=2411
  - Nexp=1483.1
  - S/sqrt(B)=24.1

Process	Nexp
QCD-HF	595.1
tt	326.4
W+jets	215.3
Z+jets	188.0
QCD-LF	106.2

III. My Quick Analysis





III. My Quick Analysis

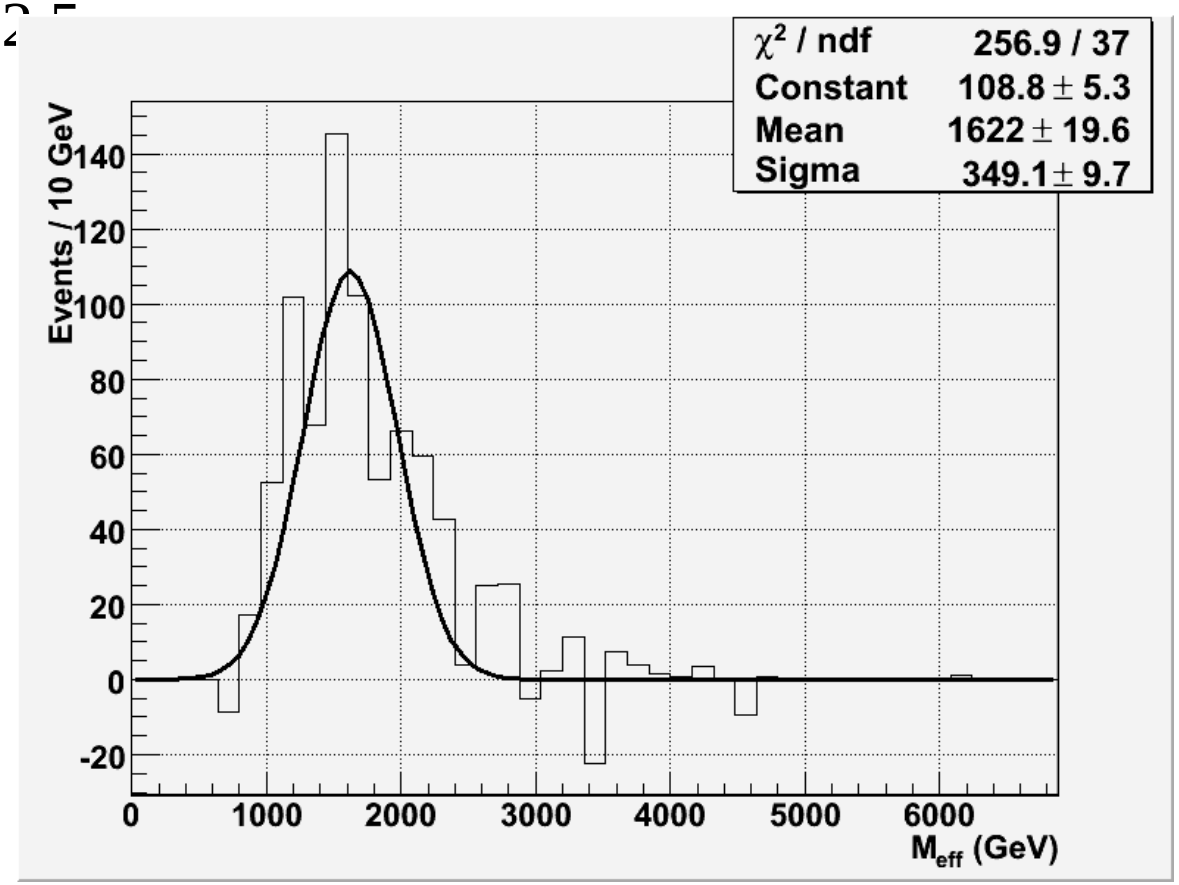
Preselection

Njets > 5

mET > 250 GeV

pT(jets) > (150.,100.,40.) GeV

|h(j0,j1)|<2.5



III. My Quick Analysis

- Then I followed 2 paths:

1. jets+mET
2. b+jets+mET

- <u>Selection 1</u>:
  - Preselection
  - Njets > 5
  - mET > 250 GeV
  - pT(jets) > (150.,100.,40.,20.) GeV
  - $|\eta(j0,j1)|<2.5$
  - Nlep=0
  - N(mux)=0
- Events yield:
  - Nobs=463
  - Nexp=140.8
  - S/sqrt(B)=27.2

III. My Quick Analysis

- Then I followed 2 paths:

1. jets+mET
2. b+jets+mET

- <u>Selection 2</u>:
  - Preselection
  - Njets > 5
  - mET > 250 GeV
  - pT(jets) > (150.,100.,40.,20.) GeV
  - $|\eta(j0,j1)|<2.5$
  - Nb-jets > 1
- Events yield:
  - Nobs=451
  - Nexp=157.4
  - S/sqrt(B)=23.4

III. My Quick Analysis

- Paths I searched:
  - trilpeton
  - SS-dilepton
  - Z(→2l)+jets+mET
- None give any clear structure
- Certainly need more work: nothing is obvious

IV. Conclusions

- The game looks much more complicated than anticipated

- Without clear excess in leptons topologies live is much harder

- No clear edges in the multijets selections

- I was hoping to derive some observable to pass on to SUSY fitters (Sfitter, Fittino) or the some OSET program… But I'm running out of ideas. Any suggestions?

- Can certainly imrpove the selection: remove more QCD ($\Delta\phi$)

- Any one willing to go further?

BACK-UP