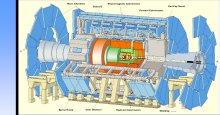


Missing Transverse Energy Requirements from SUSY searches

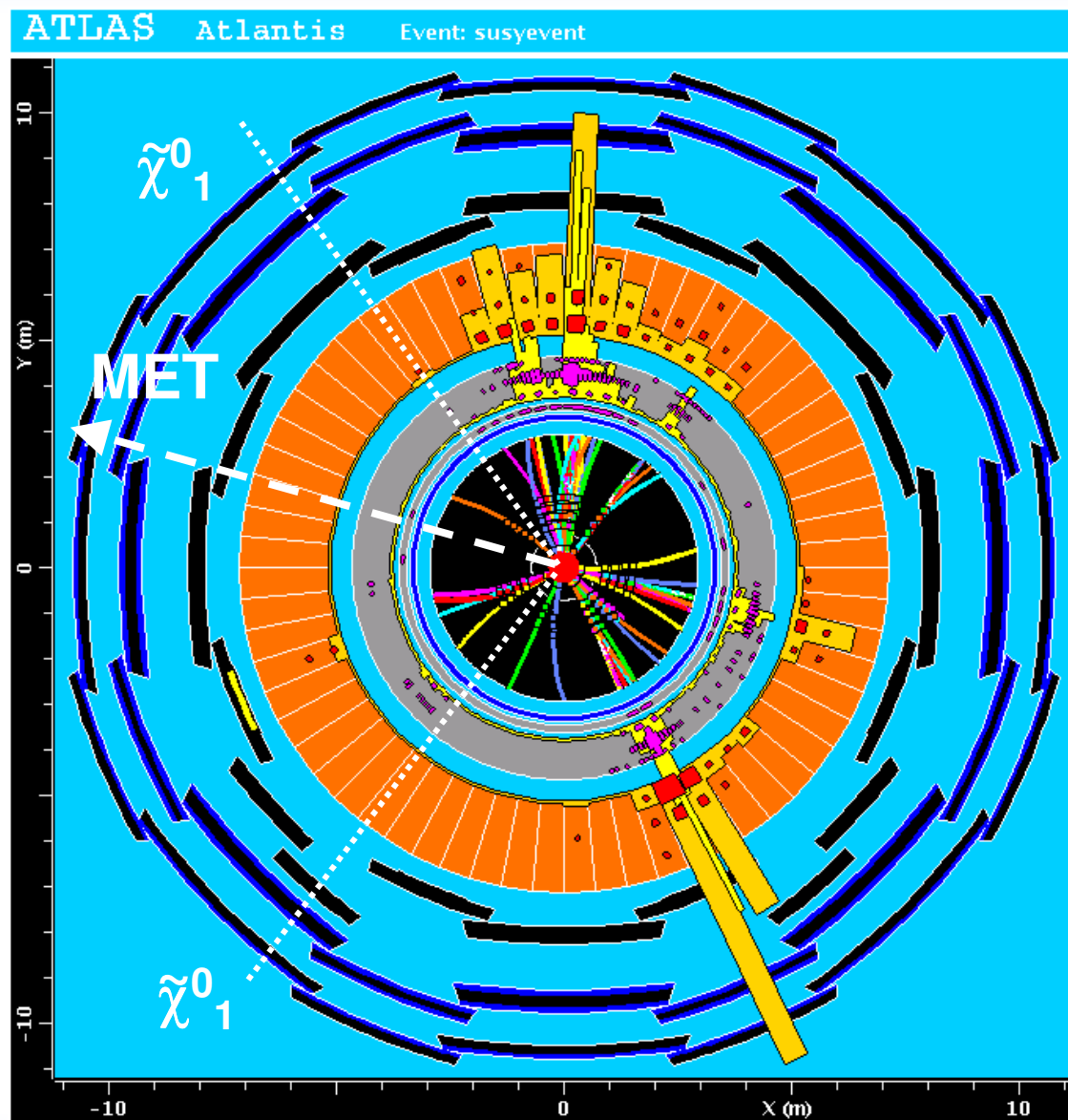
Dan Tovey,
University of Sheffield



Motivation

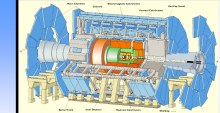


- R-Parity conserving SUSY models provide an explanation for the existence of Dark Matter in the universe \rightarrow stable, neutral, Lightest Supersymmetric Particle (often lightest neutralino).
- Invisible DM particles pair-produced in LHC collisions \rightarrow MET.
- MET / DM particle production main signature for RPC SUSY.

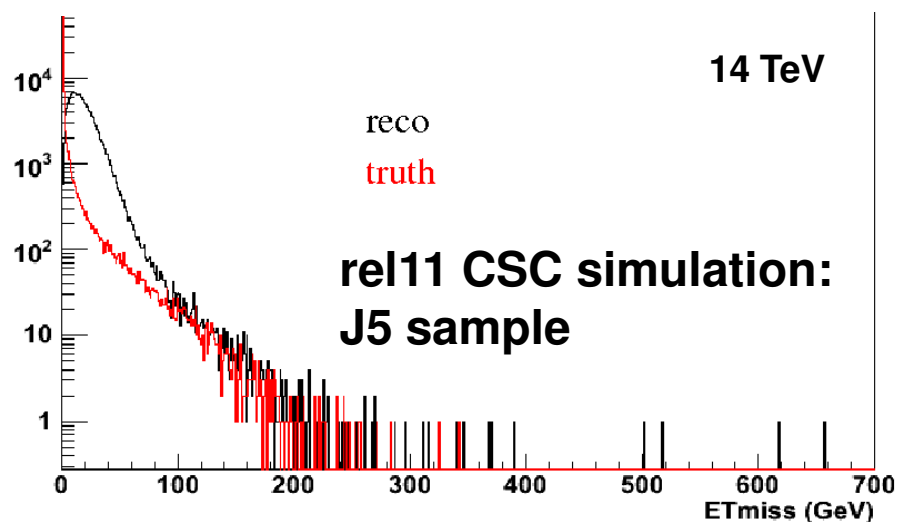
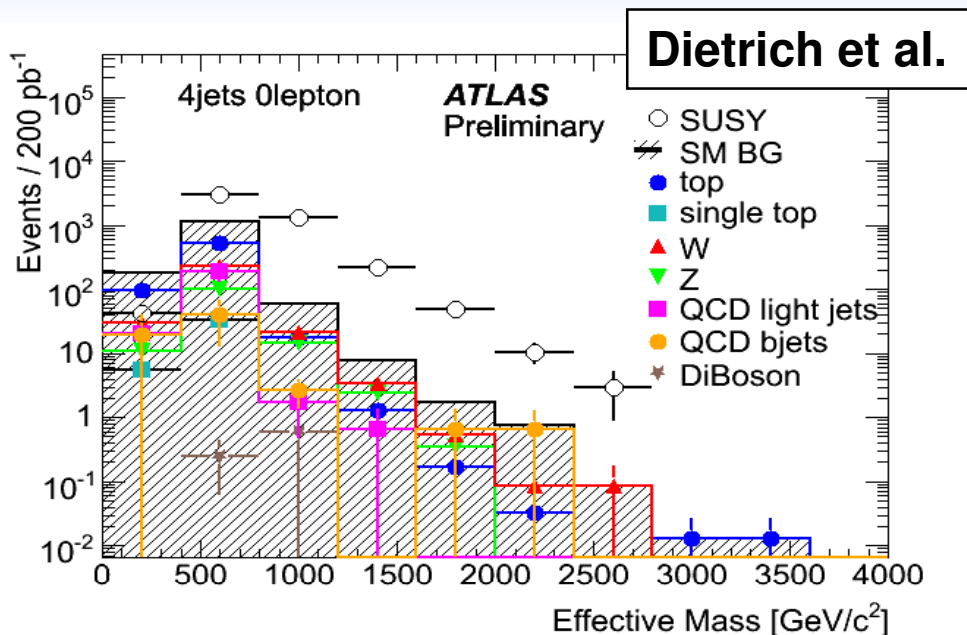




Non-Gaussian Tails

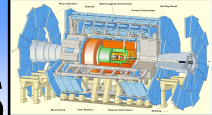


- Inclusive SUSY searches typically impose hard cuts on jets and MET (>100 GeV).
- Early data potentially exceeds Tevatron reach.
- Non-gaussian MET tails enhance QCD jet backgrounds \rightarrow hard to model \rightarrow dangerous!
- Priority (1): Minimise tails / event cleaning
 - CSC studies: HF (real MET) dominated tail
- Priority (2): Understand remainder
 - Data-driven strategies



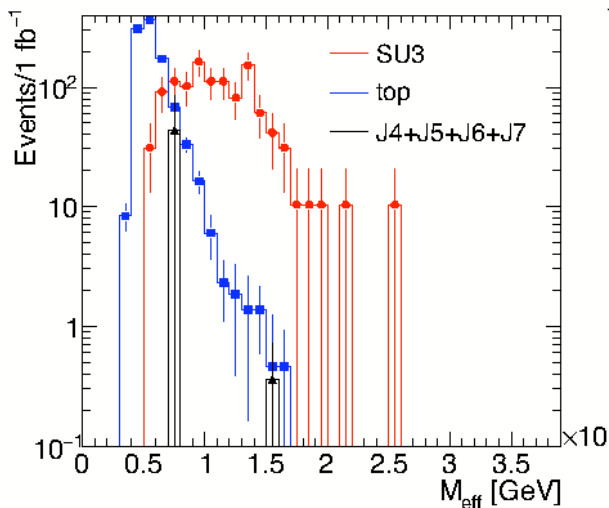


Impact of LAr LVPS Problems

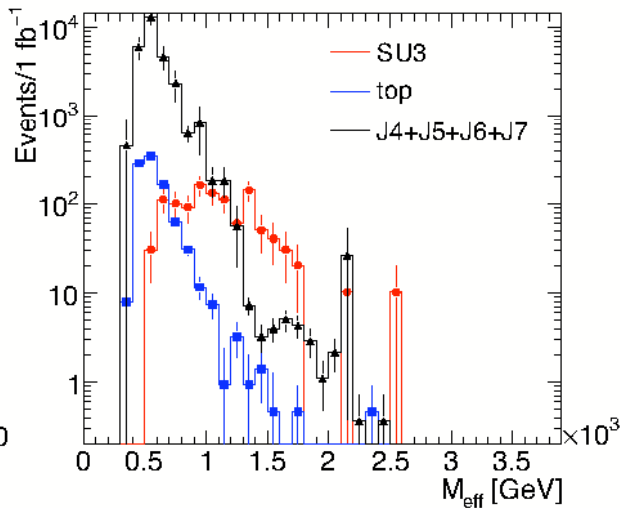


- Impact on events passing CSC inclusive 0-lepton SUSY cuts
- Uses LAr cell killer (Feng, Choudalakis)
- Biggest impact on QCD jet background (fake MET)

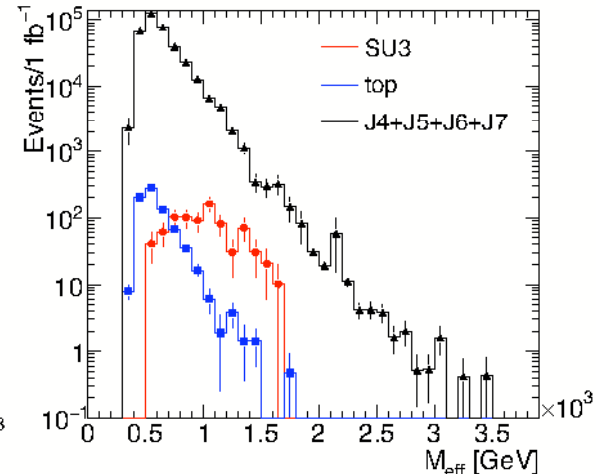
Full Calorimeter



One LVPS Dead



8 LVPS Dead

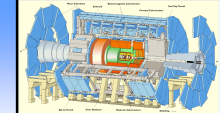


Gray + Hughes, SUSY ETmiss subgroup, 15th April

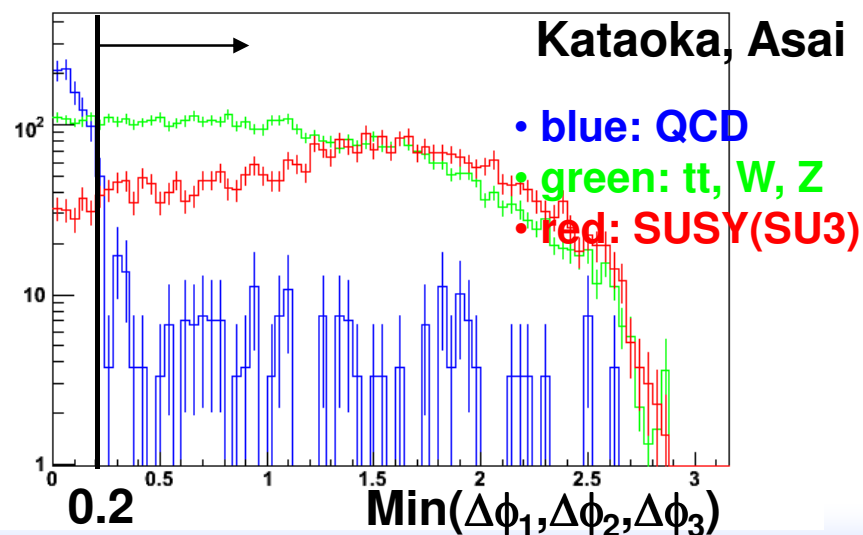
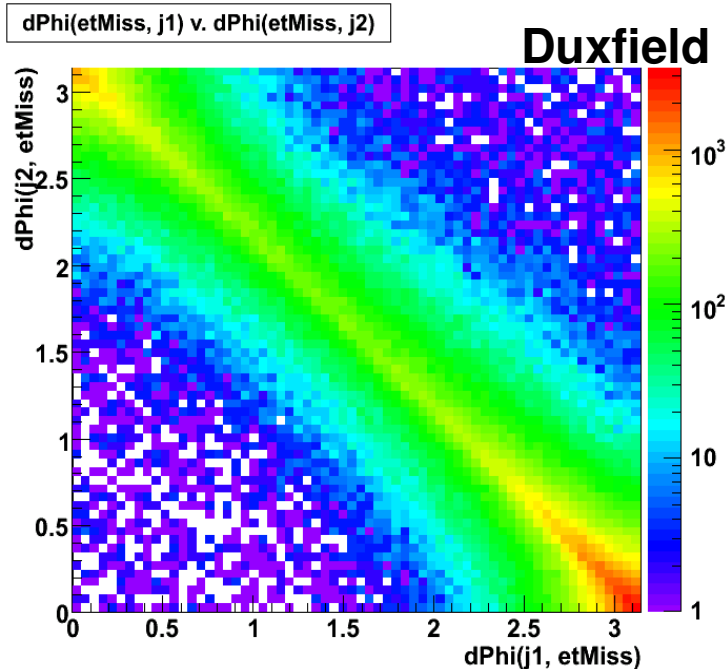
- Remediation with MET ϕ cuts studied



Event Cleaning

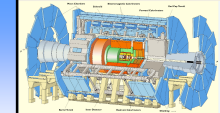


- **Rejection of non-collision tails** (calo problems, coherent noise, beam-halo, beam-gas, cosmics)
 - Cell masking + interpolation
 - Jet EM/charged fraction
 - EMBPS quantities
 - Calo timing
 - Etc.
- **Rejection of badly-measured events** (event pile-up, jet punch-through, dead material losses etc.)
 - PrimVtx position / object match
 - MuSpecShower
 - Jet fiducialisation / dead regions
 - Jet-MET ϕ correlations
 - Etc.



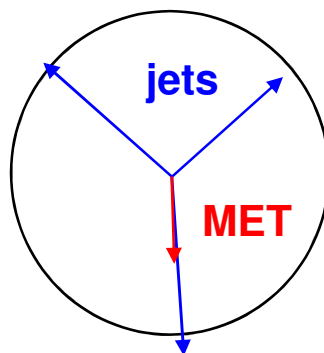


Jet Tail Estimation

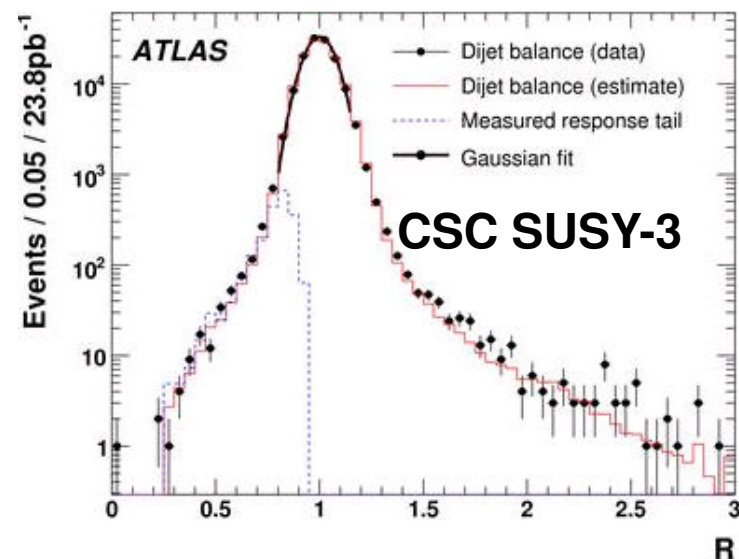
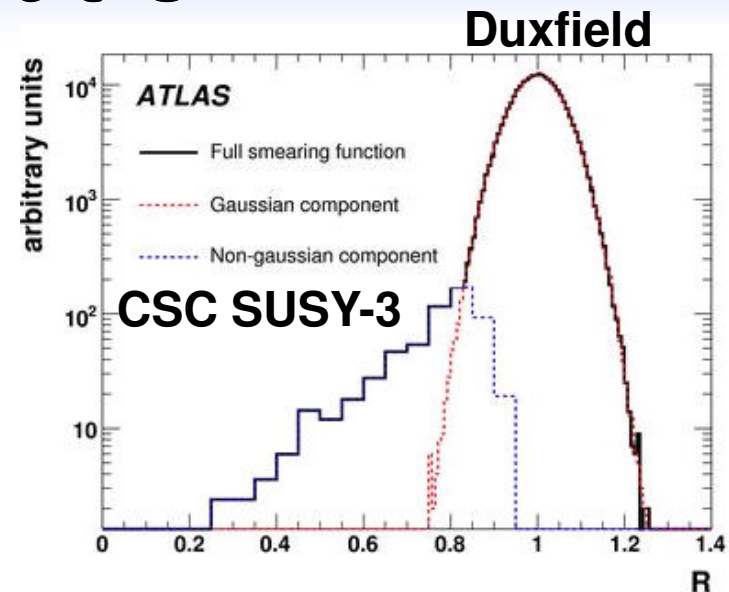


- Use “Mercedes” events where MET vector associated with one jet.
- Measure jet resolution tail comparing jet p_T with MET:

$$R = \frac{p_T^{\text{jet}}}{p_T^{\text{jet}} + E_T^{\text{miss}}}$$

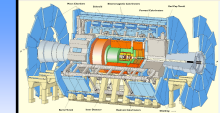


- Use γ +jet and dijet events to measure full response function with correct tail normalisation
- Recent studies to develop prescaled acolinear jet trigger: maximise stats

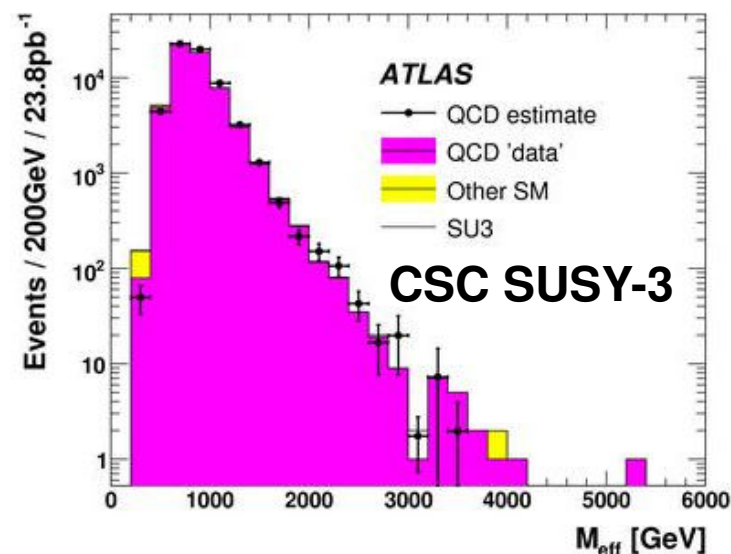
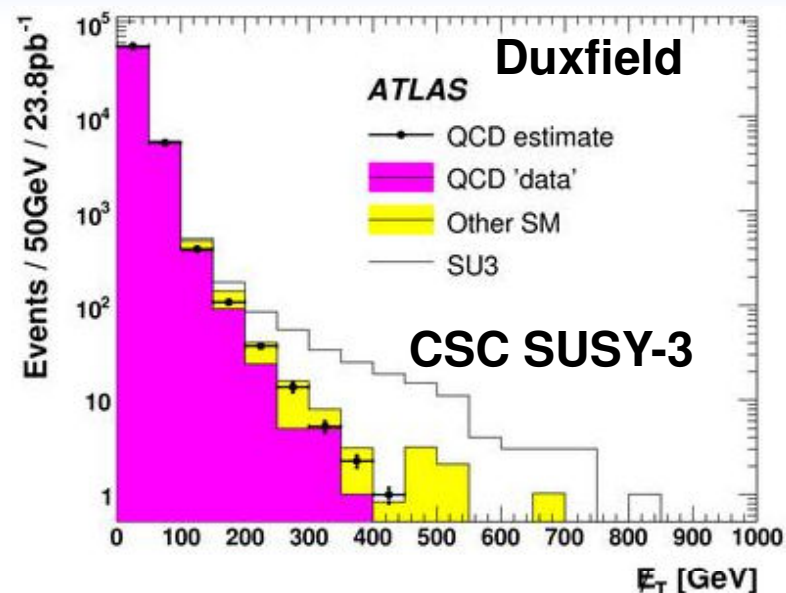




MET Tail Estimation

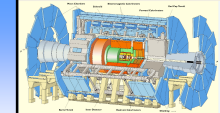


- Use in MC or smear multi-jet events to reproduce MET tail.
- Sensitive to both 'fake' MET and 'real' MET (neutrinos) collimated in jet direction
- SUSY: provides useful measure of both components together
- Jet/ETmiss: Could provide a useful diagnostic tool if components can be separated





Impact of Resolution



- **Example: jets + MET + 1-lepton**
- **Most promising channel for early data**
 - **Reject QCD jet background with lepton requirement**
- **Background dominated by semi-leptonic $t\bar{t}$ and $W(\rightarrow l\nu)+\text{jets}$**
- **Reject with $m_T(l\nu) > 100$ GeV cut.**
- **Significant background remains: MET mis-measurement dominates $m_T < 130$ GeV region.**
- **Resolution improvements directly improve S/B**
- **Gaussian performance more important for measurements ...**

