The Partial Run 2 To Do List

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Berkeley Searches Workshop

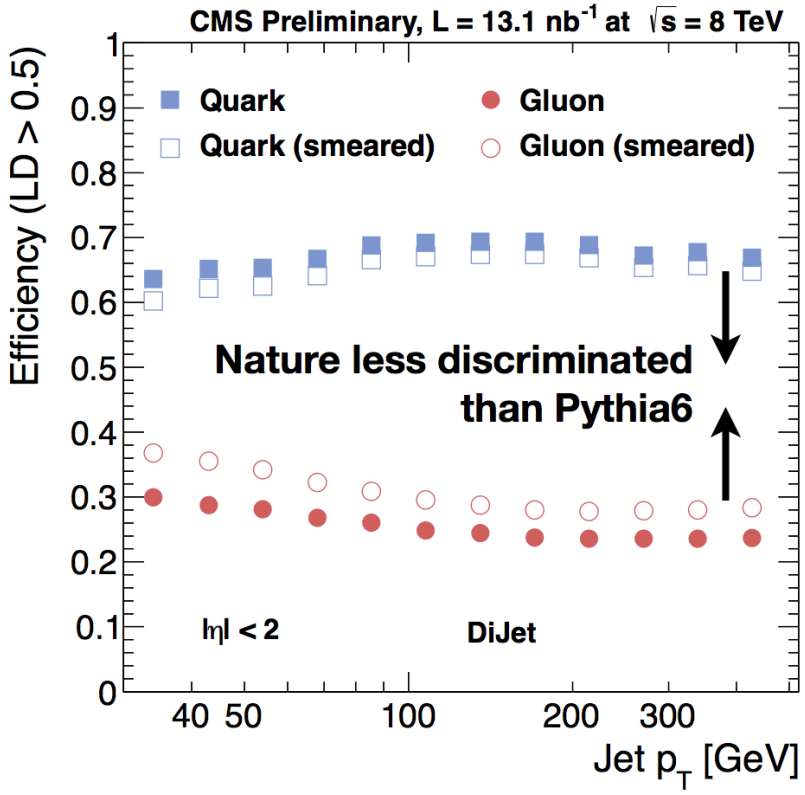
30 Jan 2014

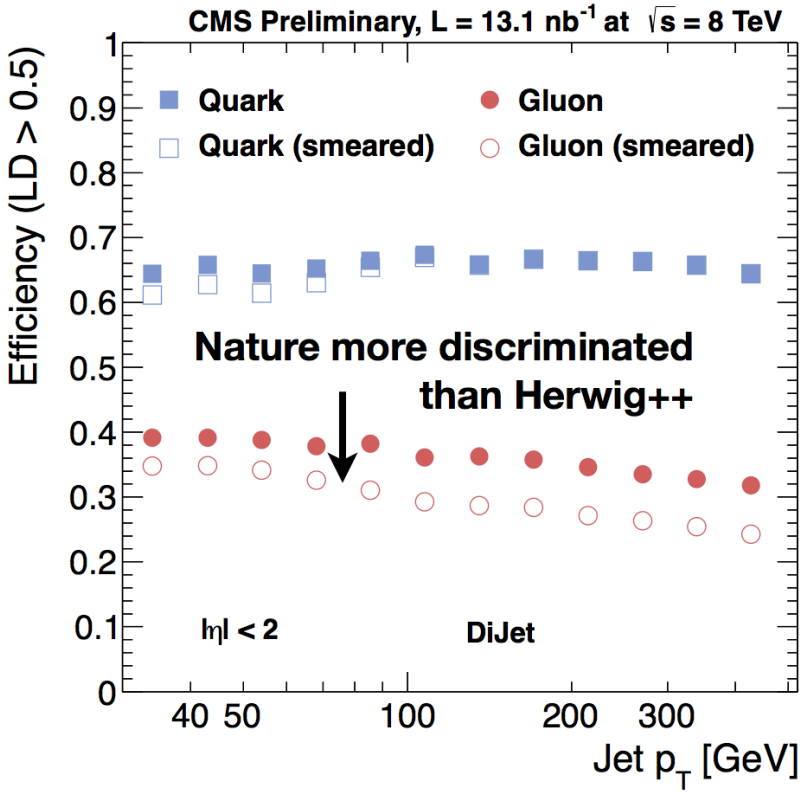
My To Do: Learn to use Indico Permissions

… Yeah…

Theorist To Do: Pay Attention

- For all the talk of "no discrepancies" at the LHC, there are a lot of published discrepancies
- We don't yell about these, because they aren't as exciting as a resonance
- But it's awfully hard to claim that the can't help hide a resonance (or some other new physics) that might be there!





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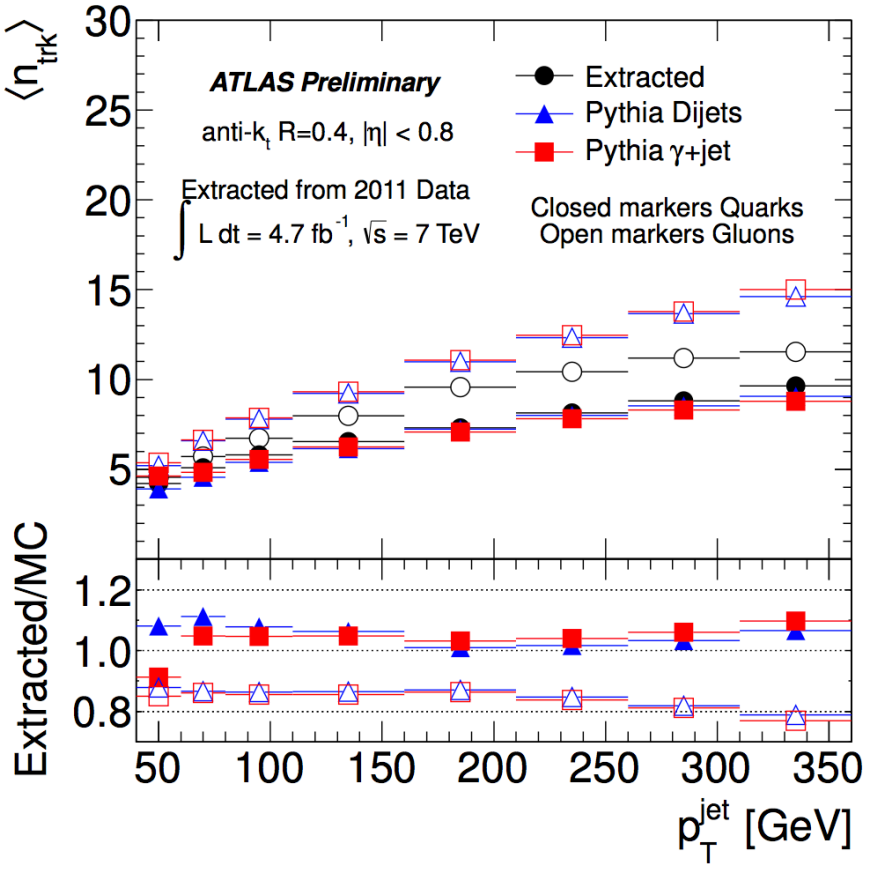
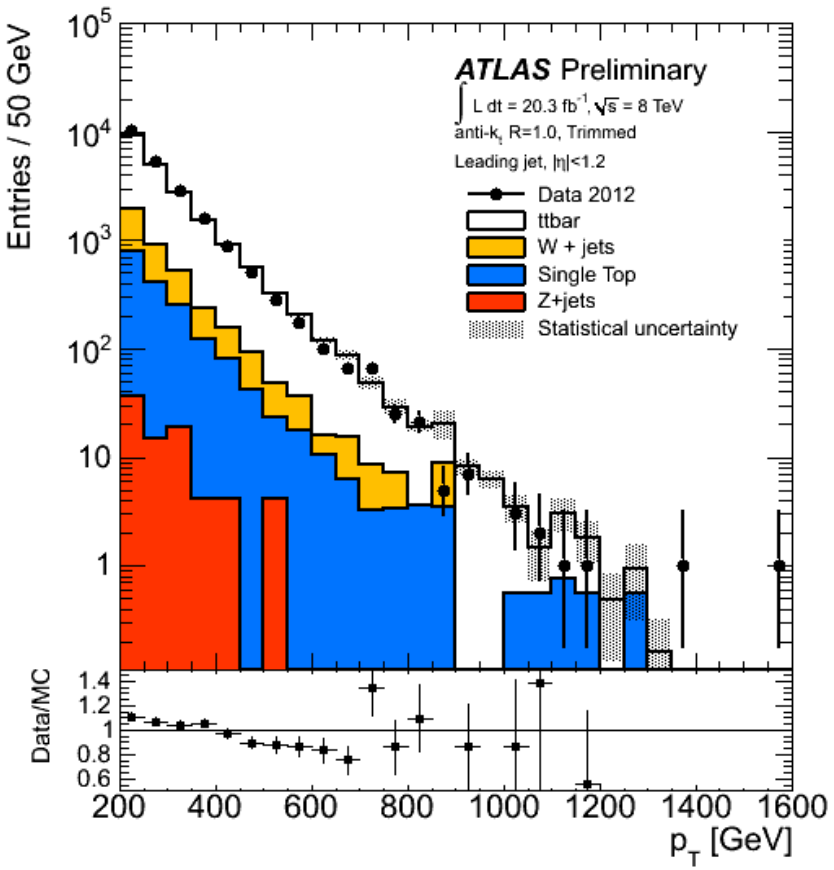
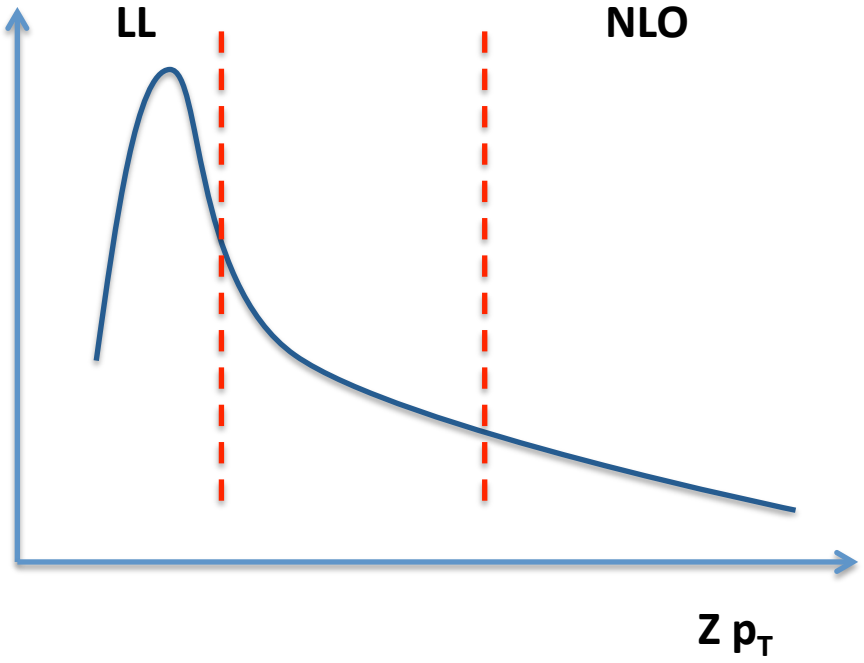




ATLAS To Do: Our Homework

- Am I the only one who feels like I need to read a LOT more generator papers and manuals after this workshop?
- We are quite casual about thinking "NLO means better", but it is clear that that is **NOT** always the case!!
- We keep normalizing inclusive distributions to NNLO cross-sections, but are we are actually improving agreement in the tails when we do that? Can we prove it?



Joint To Do: Uncertainties

- They should always be accompanied by theoretical uncertainties. If not, demand for them!

- Typical procedure for accuracy of generator = accuracy of the observable, e.g. NLO
  - Independent μ_R, μ_F variations.
  - PDF error set envelope (PDF4LHC recommendation?)
  - Matching to a different parton shower(Herwig vs. Pythia), MPI on/off
  - Caveat: The shower only preserves the total probability. After acceptance cuts, rates and distributions can change drastically.

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- To that ATLAS usually adds at least one generator comparison, tune comparison (sometimes), "other effect" modeling
  - Generator authors want to put their neck out and try to provide *the complete but minimal list* of uncertainties that they think should be applied to their samples?
  - Any ATLAS folks want to put money on whether we've noticed all the "other effects", like Z/W offshell-ness, heavy flavor appearance in shower diagrams and its removal... ?

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- It is likely that *everyone would benefit* if we could centralize the way uncertainties are assigned and then *tell the generator authors* when their predictions suck (show search plots with multiple generators without any fancy phase-space reweighting).
- Maybe then the generator masters could help us with the slopes we see?

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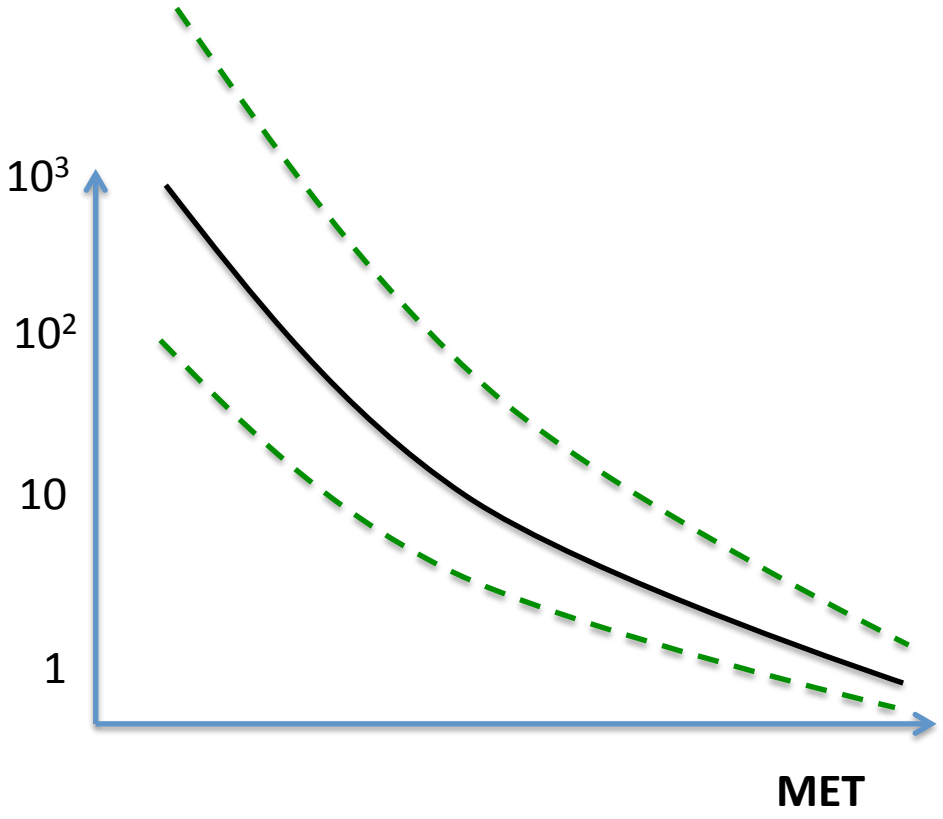
- What I learned today: external reweighting of PDFs is bogus for NLO generators (cool!). We NEED badly the internal uncertainty calculations propagated through for run 2!

Theorist To Do: Learn About Profiling

- Find your favorite experimentalist
- Learn why "big" and "conservative" don't mean the same thing anymore when it comes to uncertainties



This situation being fed into a fit will usually result in too small an uncertainty at high-pT, particularly if the author intended there to be some kind of systematic decorrelation of the uncertainty band at high p_T.

ATLAS To Do: Pick on someone bigger

- We need a recommendation by the start of run 2 for what a small background is, when its treatment can be simplified, and what checks should be done to prove it

REDACTED

(FOR SO MANY REASONS…)

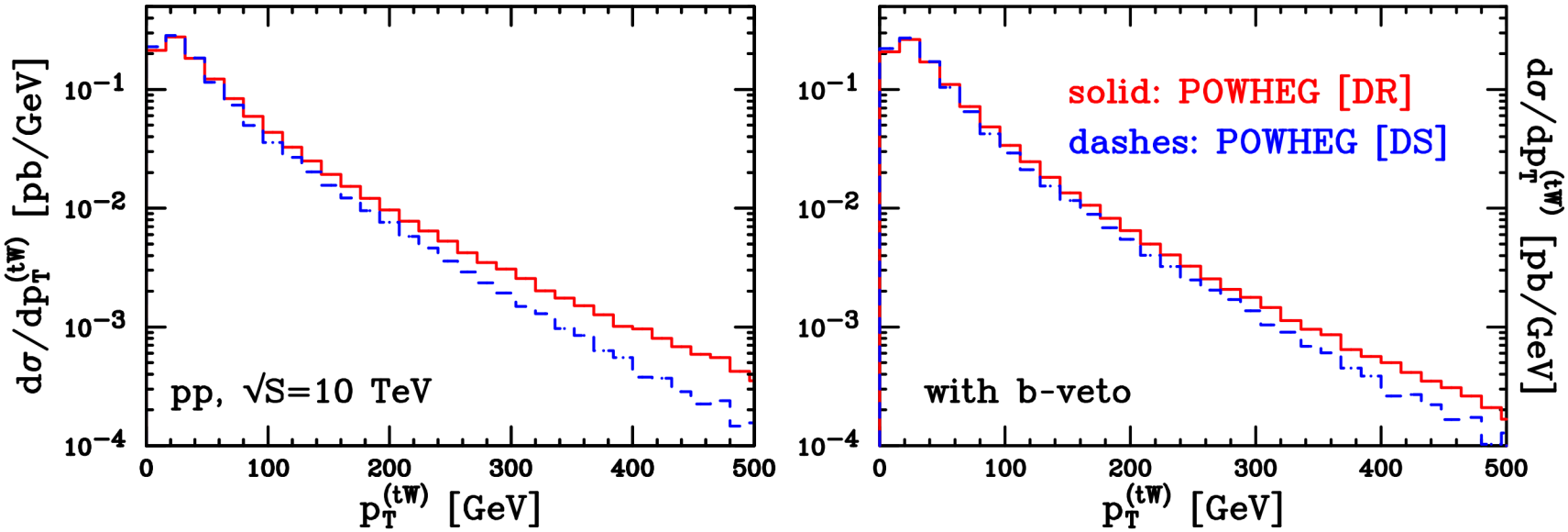
ATLAS To Do: Centralized Faking

- We should have "harmonized" objects in run 2
  - We hope!
  - This should also make theorists lives easier…
- Doesn't that mean we can finally use a central method for fake estimates?
  - Trigger scale factors too? Centralized everything???

Pro tip:
Do not image search "fakes" while in a professional environment…

Joint To Do: Generation Paradigm Shift?

- We have been taking a very non-quantum mechanical view of event generation on the whole
  - "Generate ttbar events"
  - "Generate single top events"
- That is starting to bite us. We might have to work together to slowly change paradigms into a "final state generation"
  - "Generate bblνlν"
  - Puts top and single top into one sample, but frees us from this problem:



Joint To Do: Generation Paradigm Shift?

Doing this would certainly free us from the question of what is correlated between samples.
Does anyone take PDF uncertainties as correlated between samples?
Even if those samples have the same PDF?
What about signal and background?
And remember when you answer, uncorrelated != conservative…

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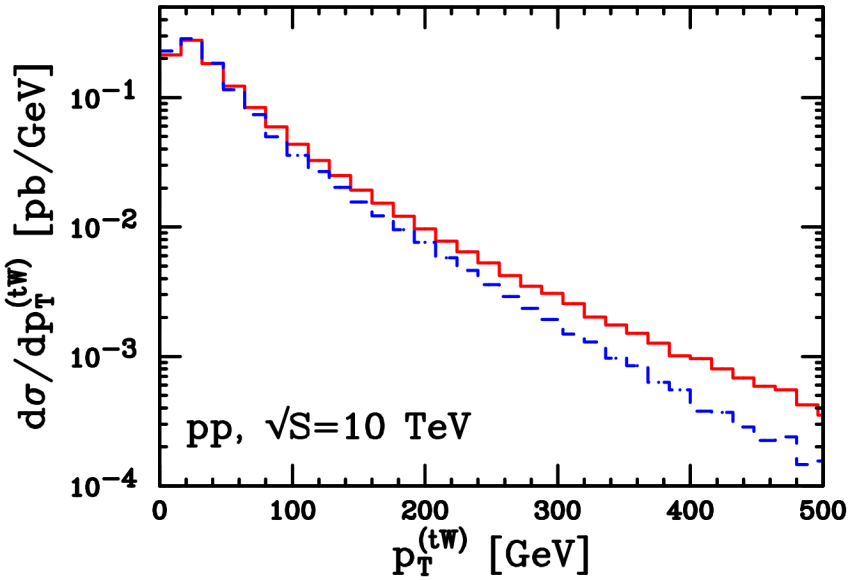
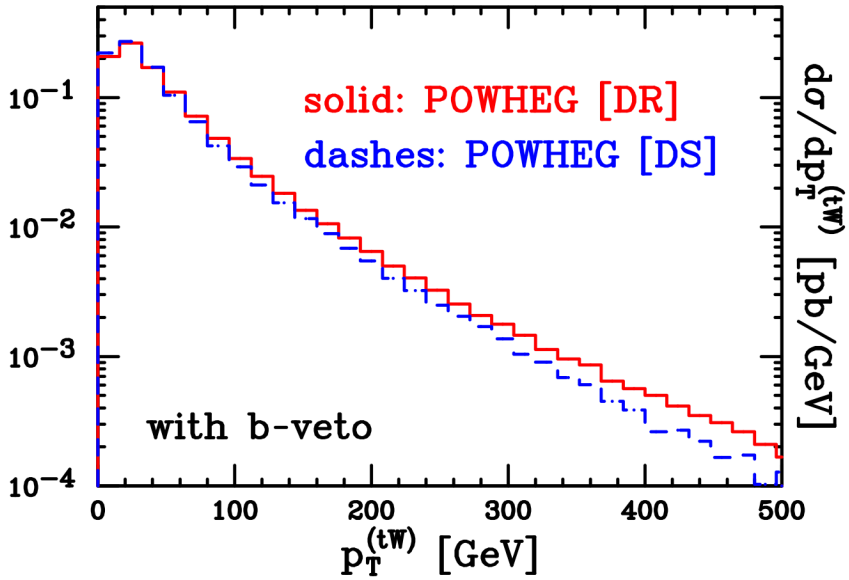




Theorist To Do: Do Unto Others…

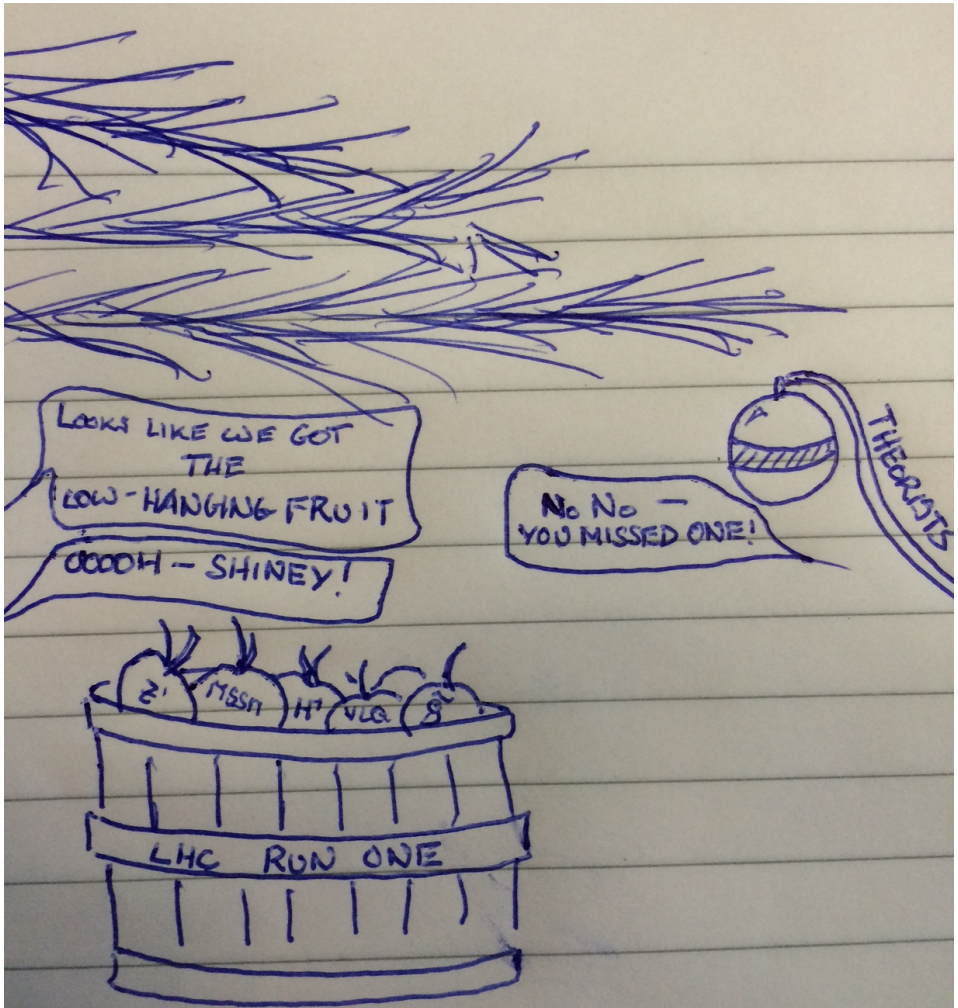
- I've always wanted to see a cut flow in a *theory* paper
- ATLAS isn't uniquely qualified to select a benchmark point
  - Actually, the people who know the model best (usually the theorists) are the ones you want doing that
- Keep in mind the competition between the strongest limits on your model and the simplest analysis
  - Yes, if we add something, we can do better
  - Yes, if we make things simpler, it can be easier for you to use
  - But the two aren't always compatible!

- **Simulation challenges:**
  - Can't reproduce vertexing algorithms in theorist-level simulations – rely on approximations (Detailed cut flows and parameterized efficiencies essential).

- Jets+met: constraining power:
  - ATLAS standard cuts on MET, p_T, η, Δ_ϕ
  - CMS cuts on α_T and H_T also.
- Jets+met: reproducibility:
  - ATLAS: independent bins
  - ATLAS: exclusion limits provided
  - CMS: not independent bins
  - CMS: statical analysis must be redone

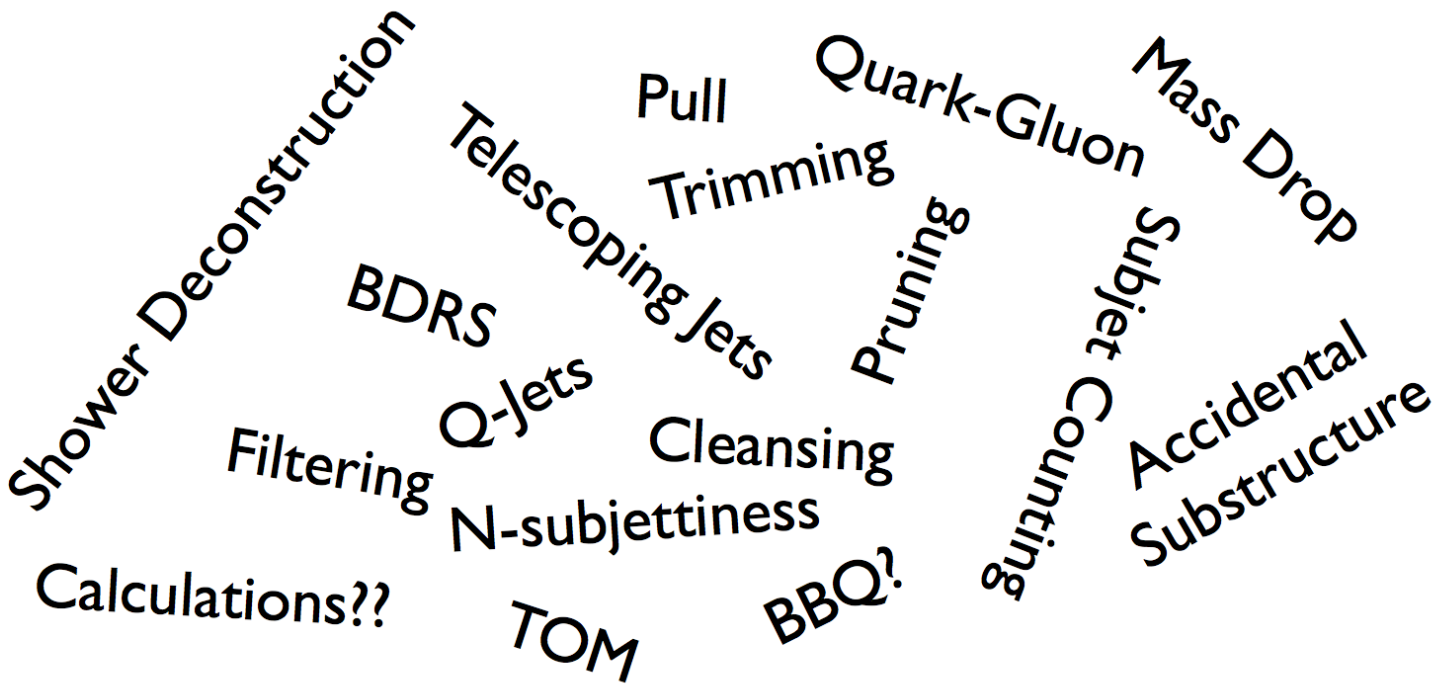
ATLAS To Do: Keep Hunting Models

- We heard about several interesting models that "could work"
- I confess that I want to go after the low hanging fruit at 13 TeV rather than keep looking for *new* low hanging fruit…



Joint To Do: Reality Check

- Jet substructure cannot be an infinite dimensional problem
- Still, with the variables we are introducing, it feels that way
- SUSY has some of this to!! I'm looking at you, MCT
- Can we *prove* which should be the main discriminants? Can we show that they have better resiliance or discrimination?
  - Maybe some do better in some places, maybe they are orthogonal and can be combined…



Thanks to the Organizers

- These guys made all our lives considerably easier
- And thanks to the session leaders and speakers as well
- To do for the next run: don't let yourself get thrown under the bus so easily

- And a VERY big thanks to Tami Blackwell, without which this week would have been a coffee-less, food-less chaotic mess





Thanks for coming to LBL