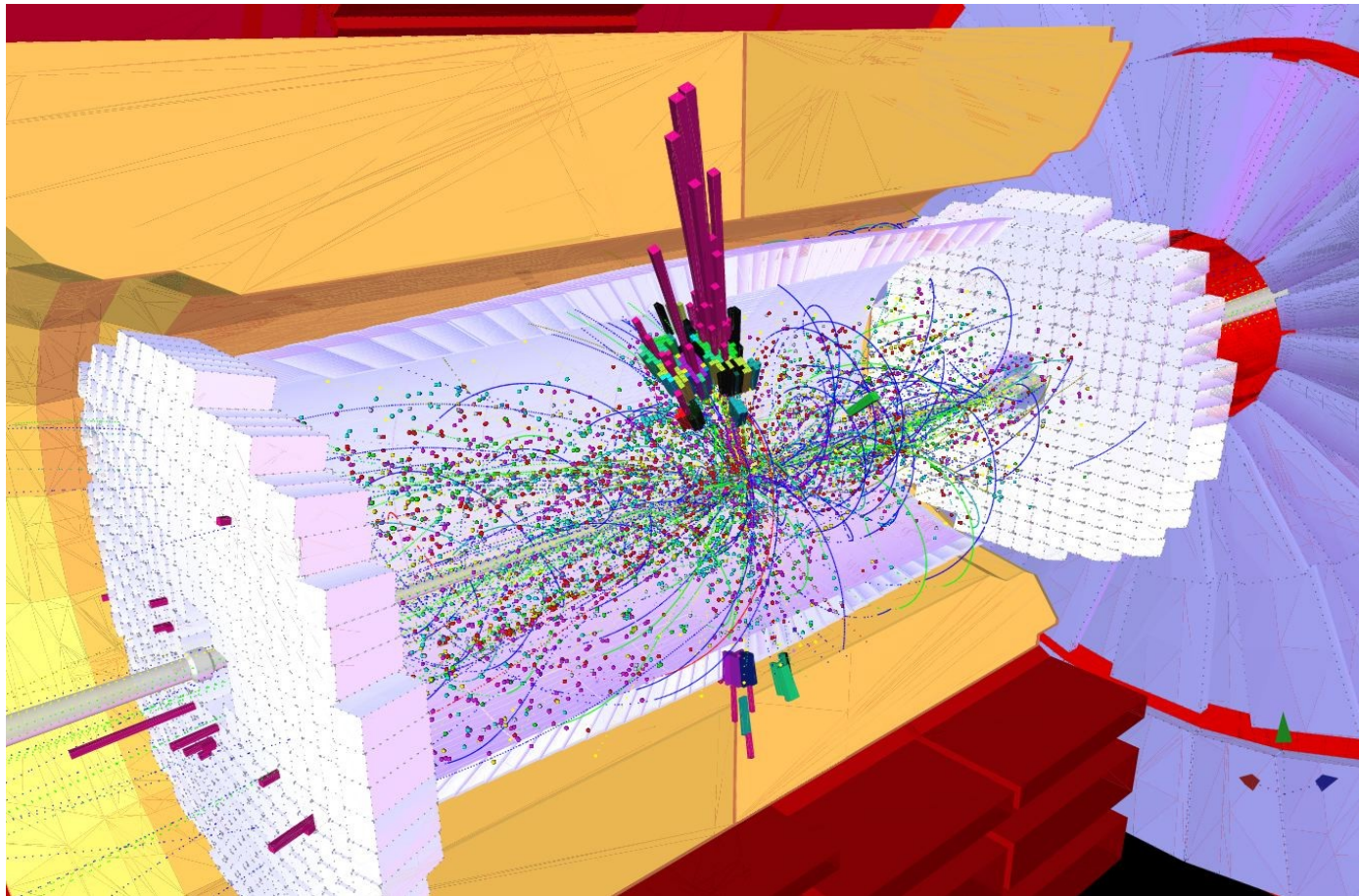


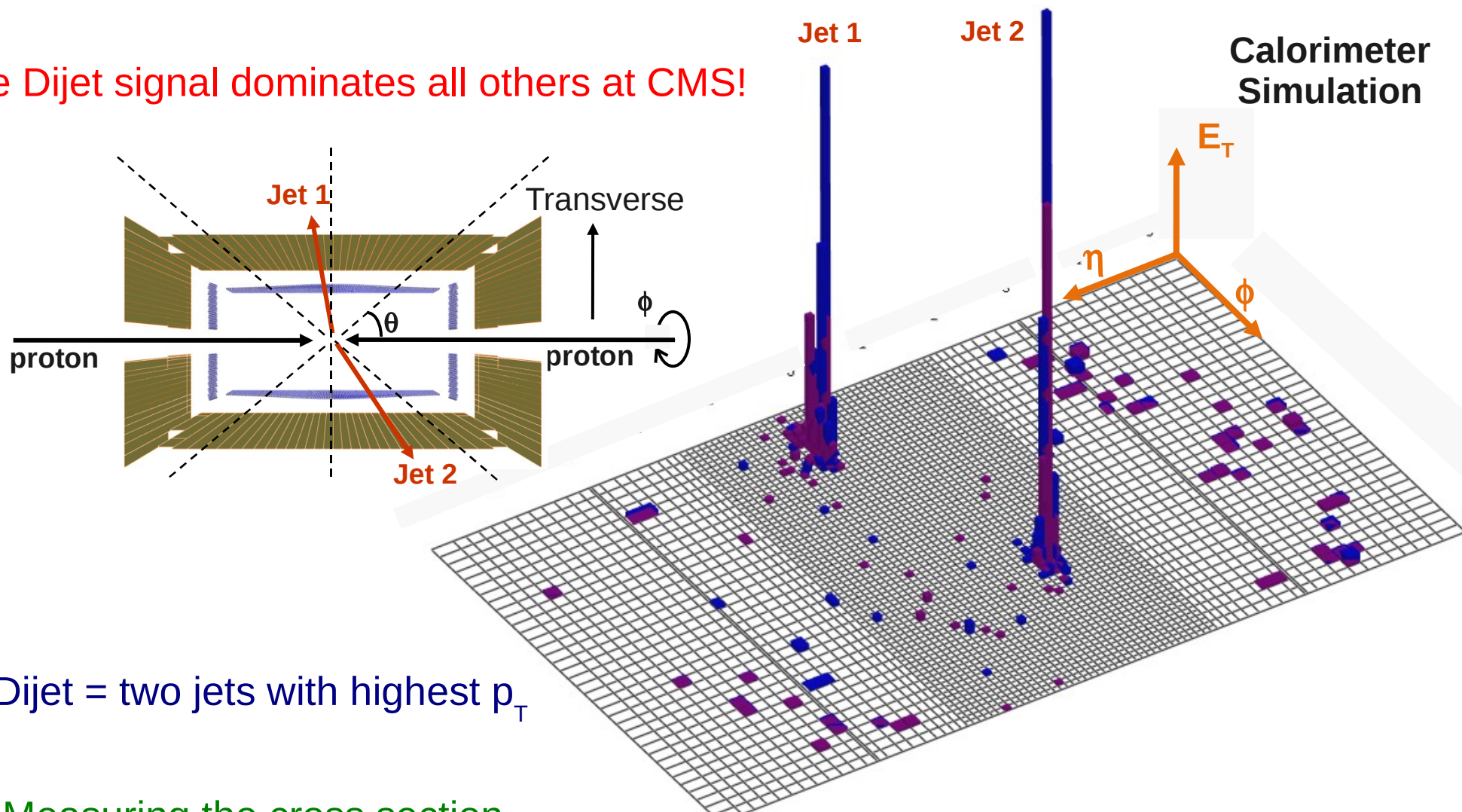
Inclusive Jets

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Jets

The Dijet signal dominates all others at CMS!



Dijet = two jets with highest p_T

Measuring the cross section
of all jets within a specified range in η



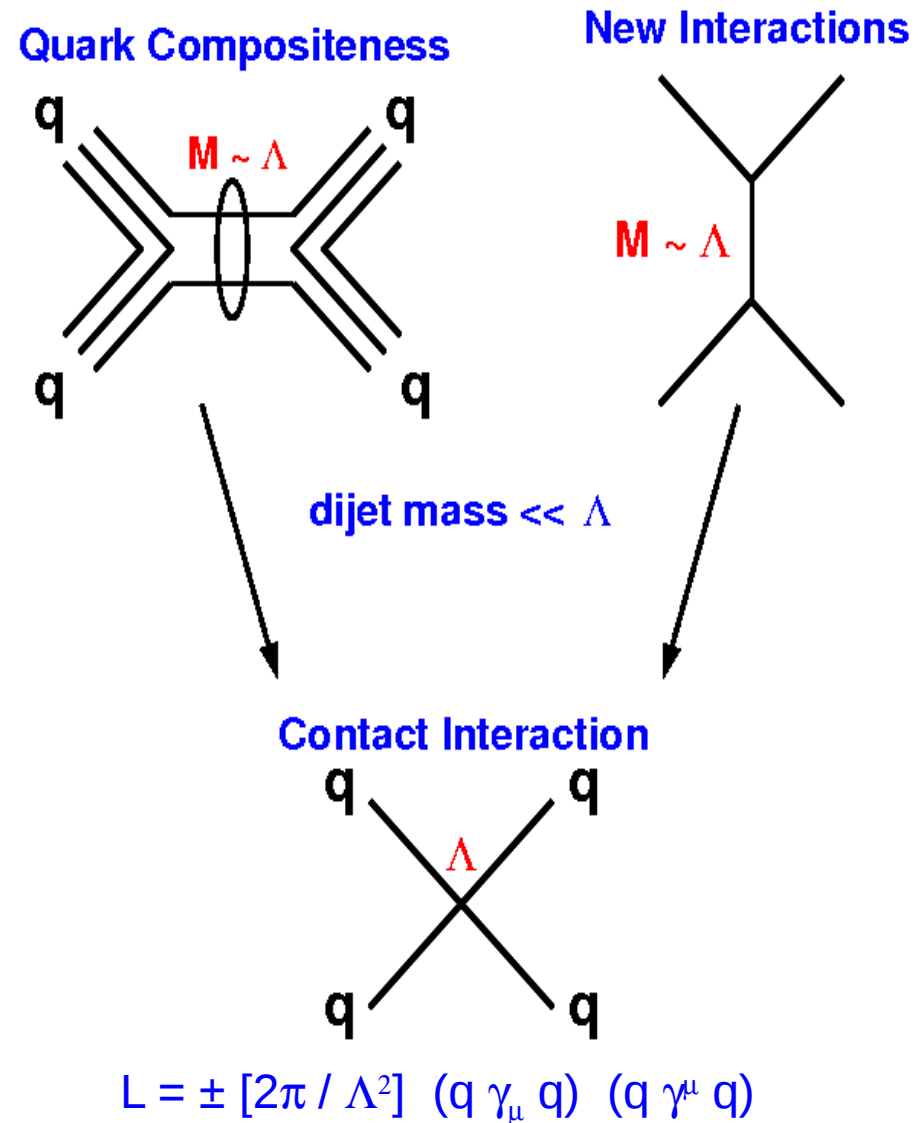
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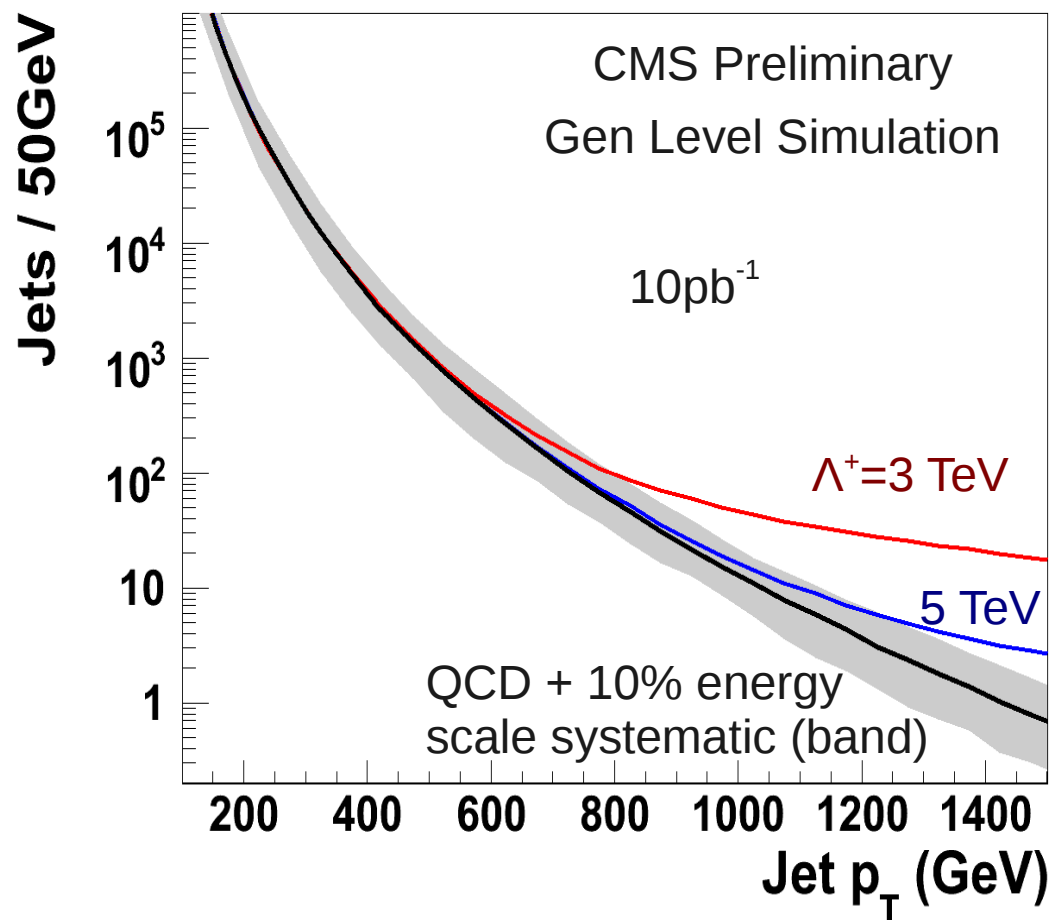
New Physics One Might See

- The inclusive jet cross section is primarily a QCD measurement, however:
- New physics like quark compositeness or some new interaction at a high scale (Λ) can be modeled by a contact interaction at much lower dijet mass or jet p_T .
- Such an interaction would manifest as differing from standard model QCD:
 - Jet spectrum would be enhanced at high transverse momentum
 - Jet angular distribution would be very different.
- CMS has access to Λ above what has been excluded so far ($\Lambda^+ = 2.7$ TeV from D0, PRL 82, 2457 1999)

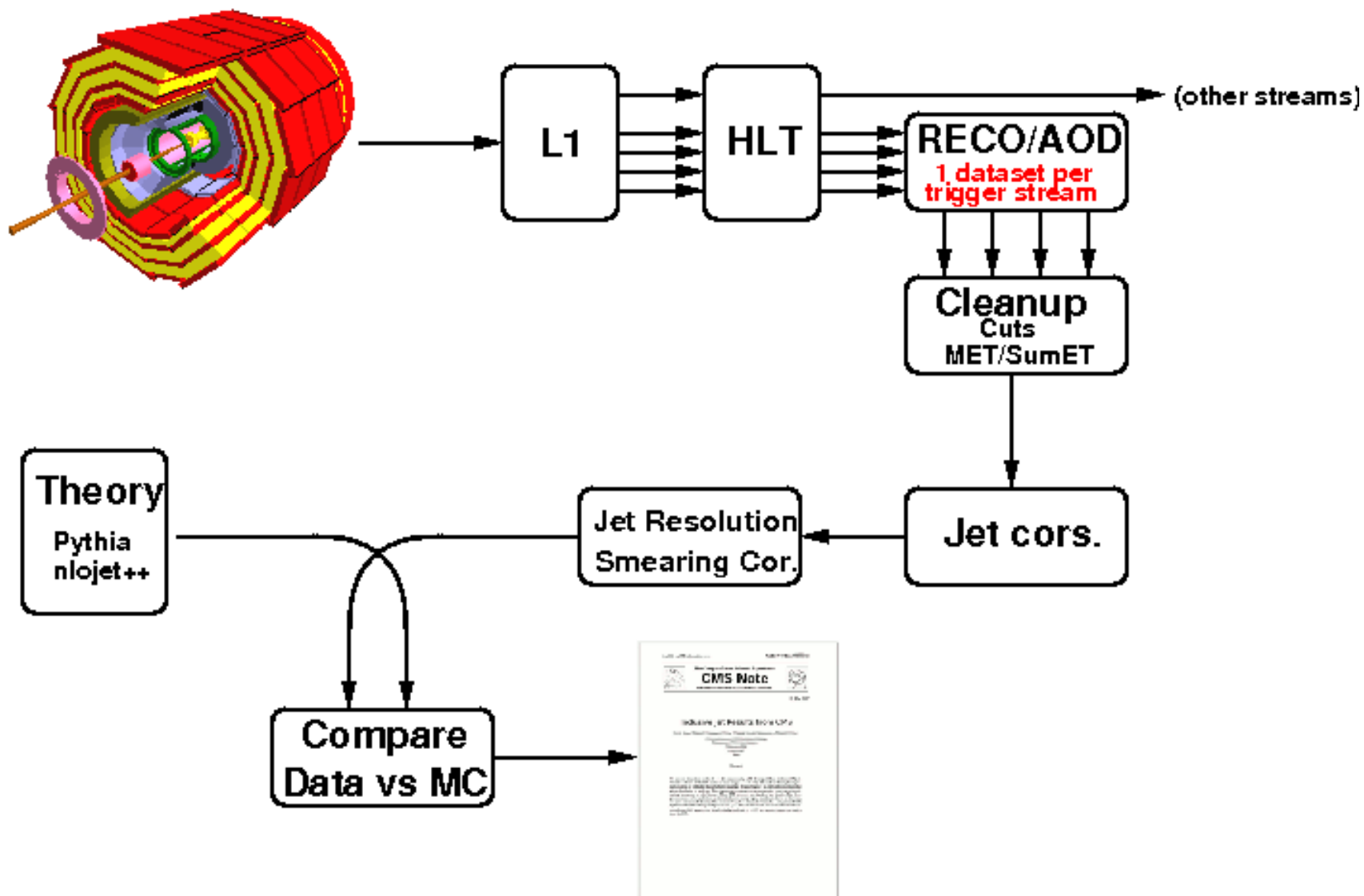


Inclusive Jets & Contact Interactions

- Inclusive jet rate in 50 GeV bins for integrated luminosity of 10pb^{-1}
 - QCD measurement that is sensitive to new physics
- Shaded area is a 10% estimated jet energy scale uncertainty at startup
 - Expected to be dominant uncertainty
- **Contact interaction discovery potential above Tevatron limits**



An Analysis Sketch...

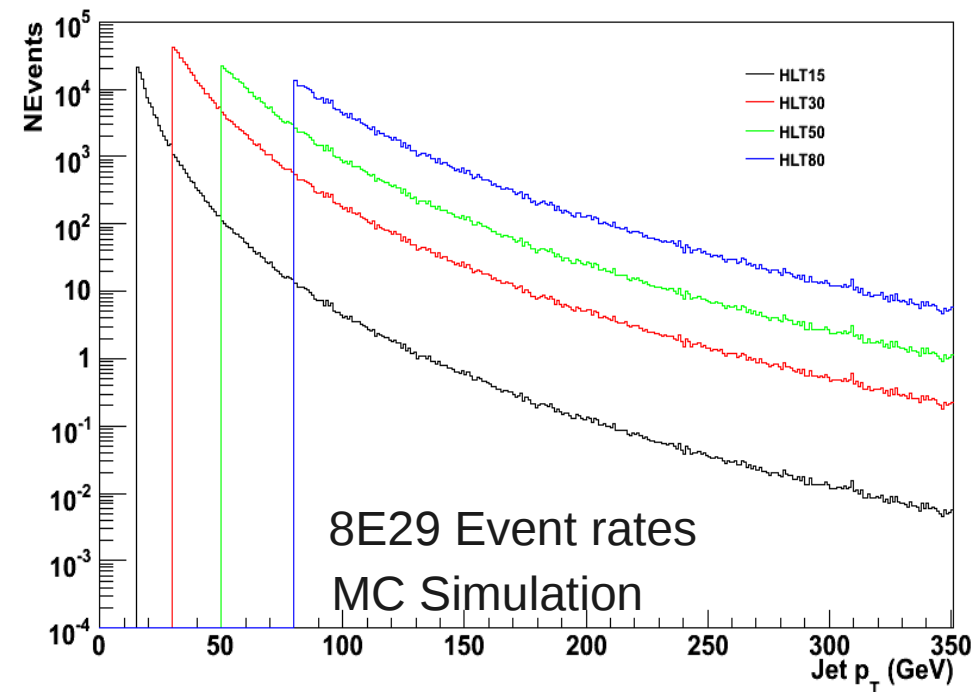


First Piece: Trigger

- The jet production cross section falls very steeply vs jet p_T
- Lower p_T triggers would saturate rate if not **prescaled**
- An example trigger table and plot of the resulting event rates shown at the left
- Good coverage for wide p_T range
- Overlaps between triggers are used to measure the efficiency

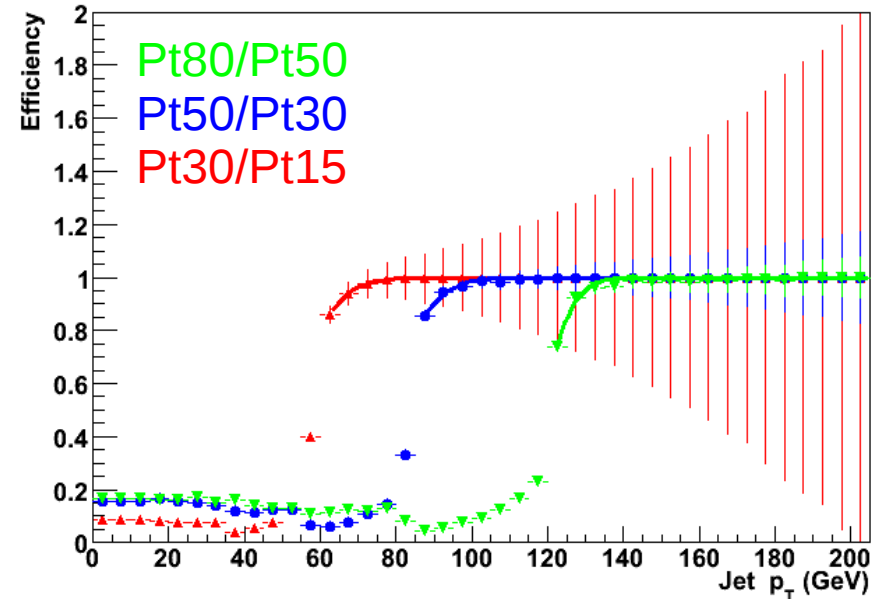
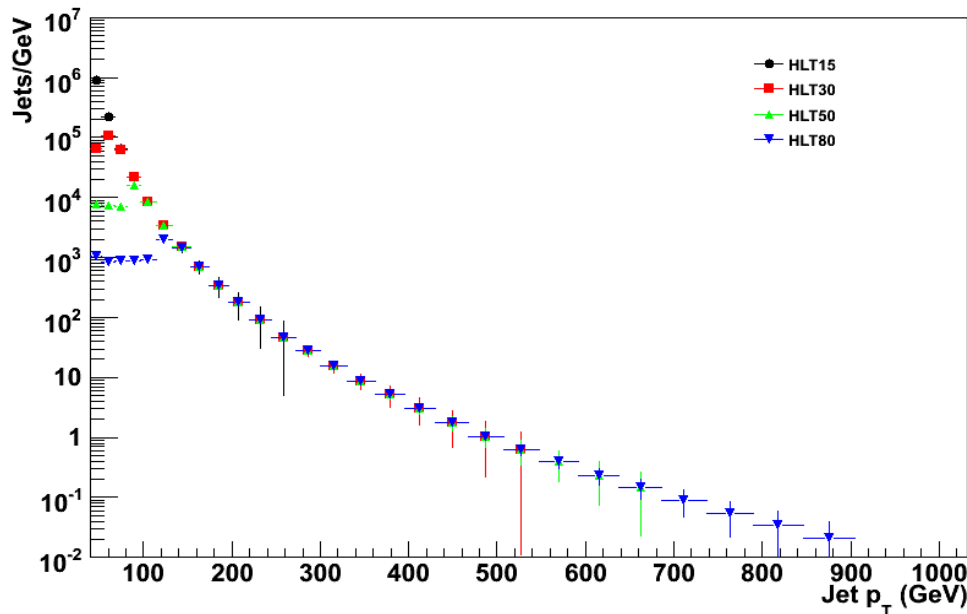
| Path | Threshold | Prescale | Rate |
|------------|-----------|----------|---------|
| HLT_Jet30 | 30 GeV | 25 | 15.5 Hz |
| HLT_Jet50 | 50 GeV | 5 | 6.4 Hz |
| HLT_Jet80 | 80 GeV | 1 | 3.5 Hz |
| HLT_Jet110 | 110 GeV | 1 | 0.8 Hz |

September 8E29 Jet trigger menu



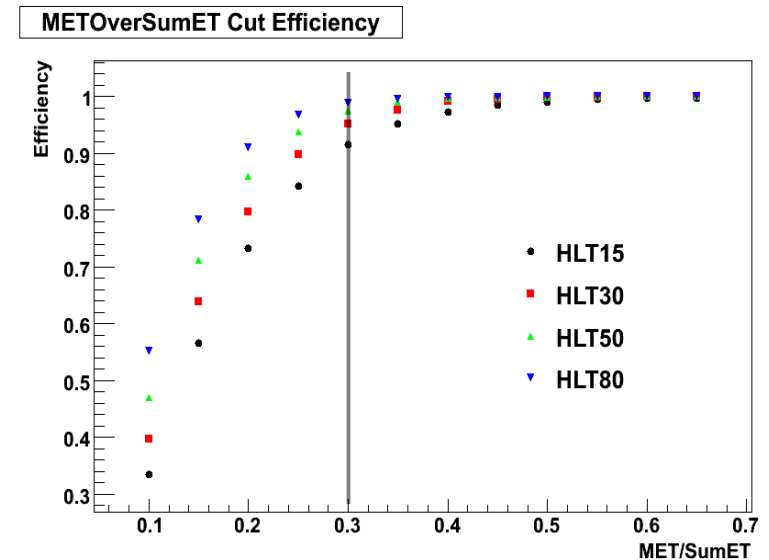
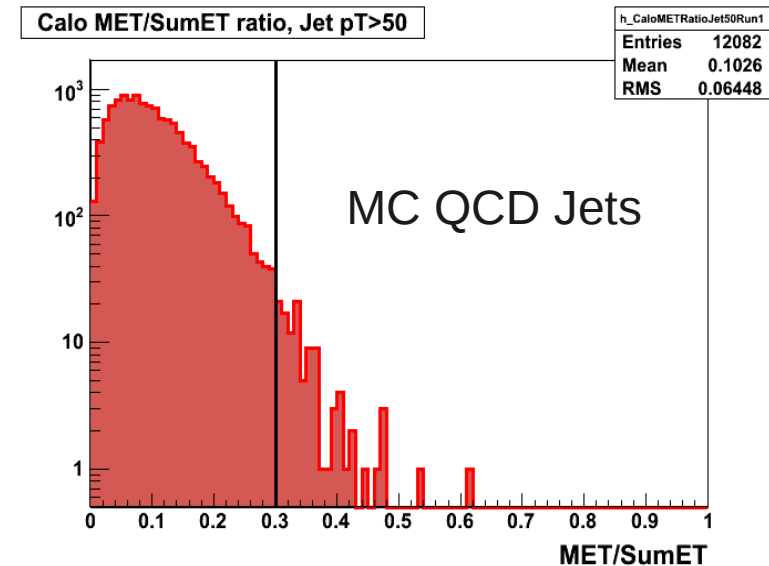
Trigger Efficiency

- Prescale values are used to reassemble the triggered data into a more continuous p_T spectrum (left)
- Ratios of the different triggered samples within the overlap regions are used to measure the efficiencies of each trigger (and provide a correction to the measured cross section)



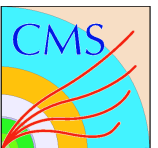
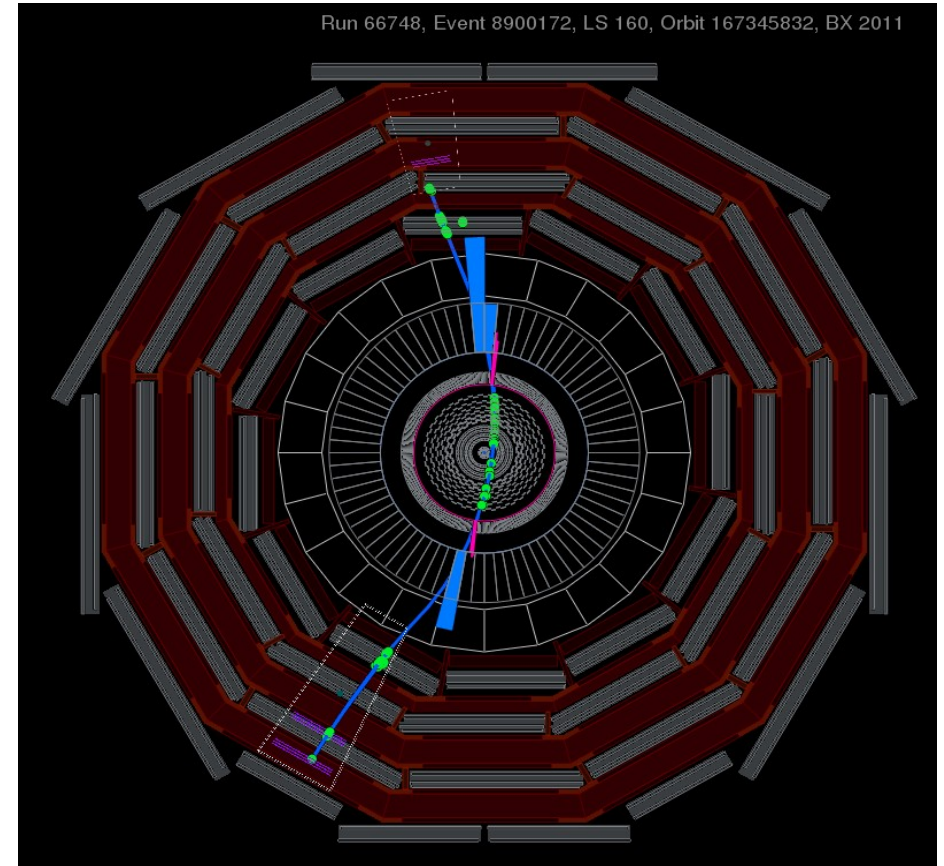
Event Cleanup, MET/SumET

- QCD jets will tend to balance p_T
- Many unwanted things will not however: Cosmic rays, detector noise, beam halo...
- These will be a significant background to the highest p_T jets
- We plan to employ a cut on the relative missing E_T , or MET to reduce these effects
- From MC studies we see that we don't see as much



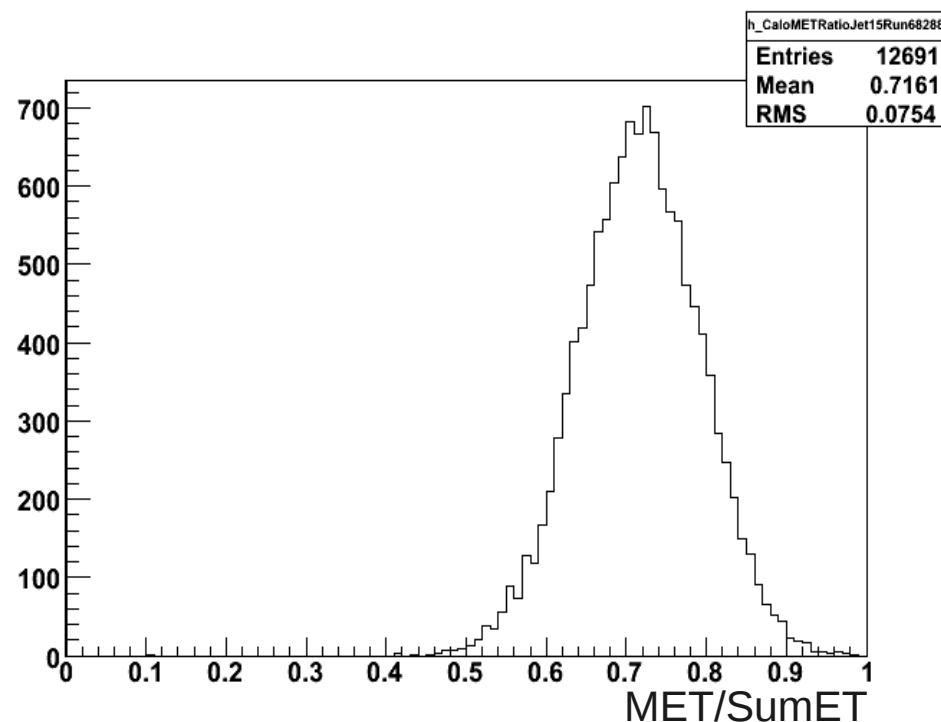
CRAFT

- 1 month running period from mid October to mid November last year
- Detector ran with magnetic field on – in “beam on” condition, but without beam.
- Excellent environment to look at some of the kinds of events we will need to “clean up”
 - Cosmic rays, detector noise
- Also important for the purposes of learning our detector's quirks



MET/SumET in CRAFT... what?

- We wanted to evaluate how this MET/SumET quantity looked in the CRAFT global run data
- Looked through the RunSummary database to find a run which had all the detectors active.
- Then proceeded to analyze this run as if it were jet data.
- What we found was a bit surprising (but surprising in an expected kind of way ☺)
- The MET/SumET ratio had a beautiful gaussian shape centered at around 0.7!
- A proposed cut at 0.3 would have removed all these events!



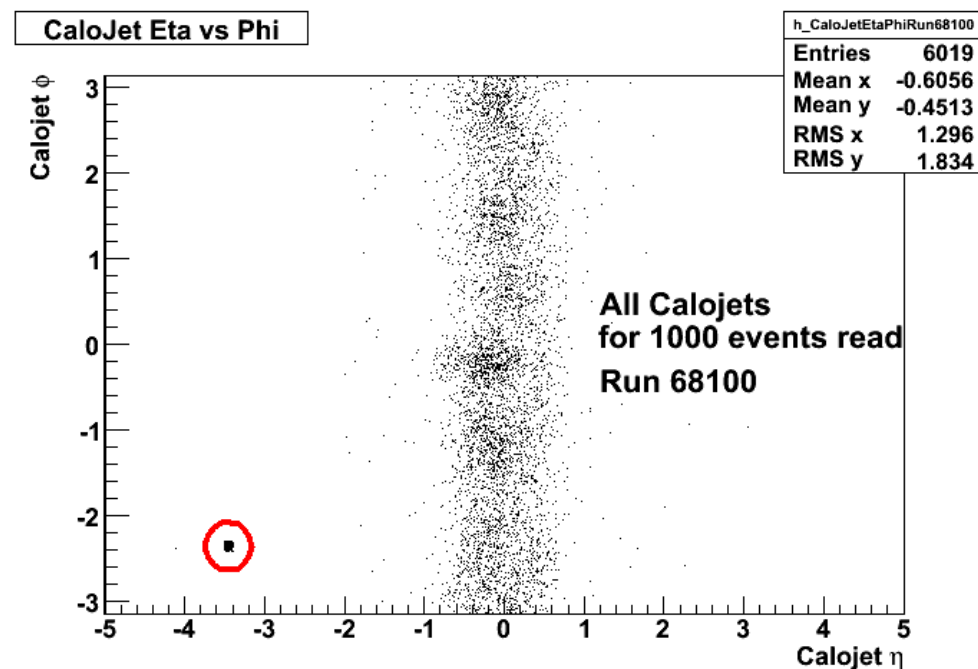
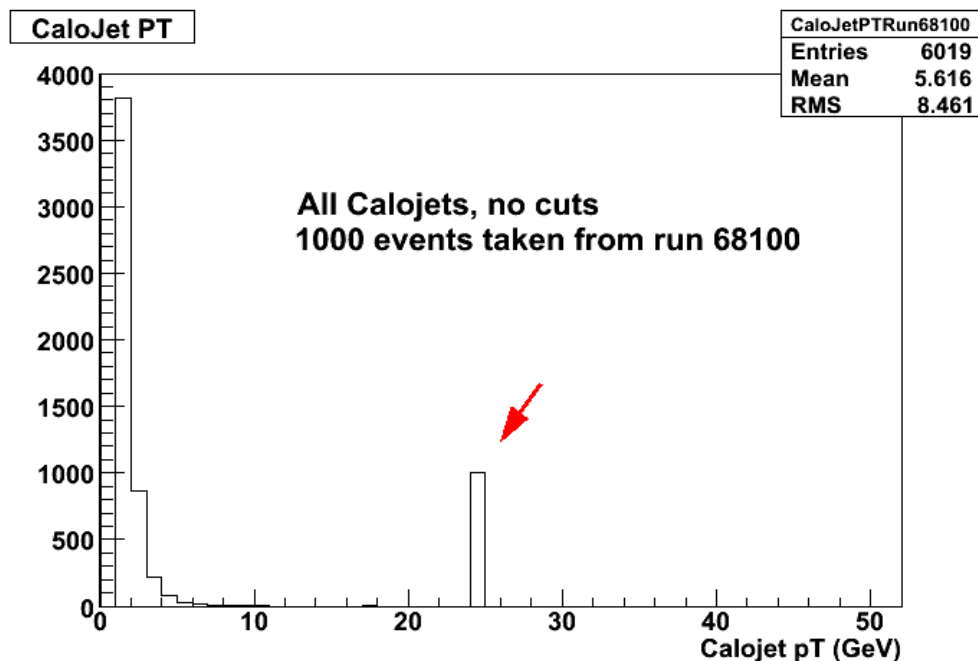
Start investigating

- Something horrible has clearly happened here!
- First stop was the global run elog at:
<https://cmsdaq.cern.ch/elog/?gexp=all>
- In the log entries for this run we saw indications in the trigger config that this run may have been an Ecal laser calibration run.
- But even checking other runs we still see MET/SumET ~ 0.7 .
- Another possibility is that there is a “hot channel”, something wrong in the electronics that turned a tower on all the time.
- We consulted with an Hcal expert, and sure enough, there was a hot channel in the forward Hcal!



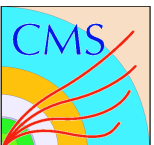
A Hot Tower...

- Throughout much of the CRAFT data we find a hot tower in the negative eta region of the HF (since fixed, plots below)
- These kinds of problems will be afflicting us in the data that we will begin to do QCD physics analyses on later on this year.
- It is important to try to understand how to work with/around these kinds of problems now, and the global run data we already have provides this opportunity!



We're diving in!

- Most of the data we will take in this experiment will contain jets.
- It will be important **right away** to understand the inclusive jet spectrum
- **Many new physics signals** could manifest themselves as **early** deviations from the inclusive jet cross section
- We are actively pushing forward, testing inclusive jet measurement techniques on current detector data to prepare for the data ahead
- There will be many interesting problems and exciting work ahead as we move from taking more cosmic ray data, to data with beams through the detector, and finally collisions!
- Still much to do, and still much room for people to join the effort and make an impact!



People studying Inclusive Jets @ CMS

- Robert Harris, Kostas Kousouris, David Mason, [FNAL](#)
- Pratima Jindal, [Purdue Calumet](#) (@FNAL)
- Michael Heinrich, Andreas Oehler, Klaus Rabberz, [Karlsruhe](#)



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