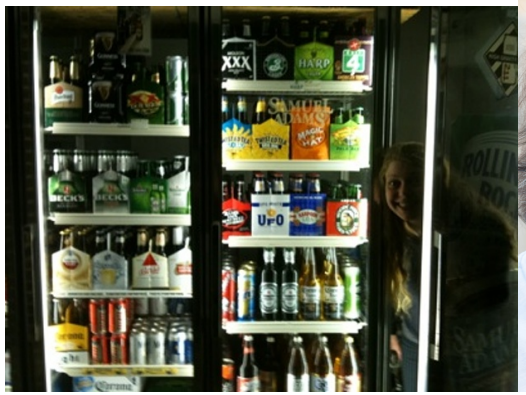
# BOOST 2015 - Experimental Summary

Lily Asquith (Sussex)

August 14, 2015

# What a difference five years makes

- This is the 7th Boost conference, which alternates between US and Europe.
- Five years ago at Princeton was my first boost.
- Combining the 2011 blog post from Jon with this year's from Christoph yields interesting results.




# What a difference five years makes

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# What a difference five years makes

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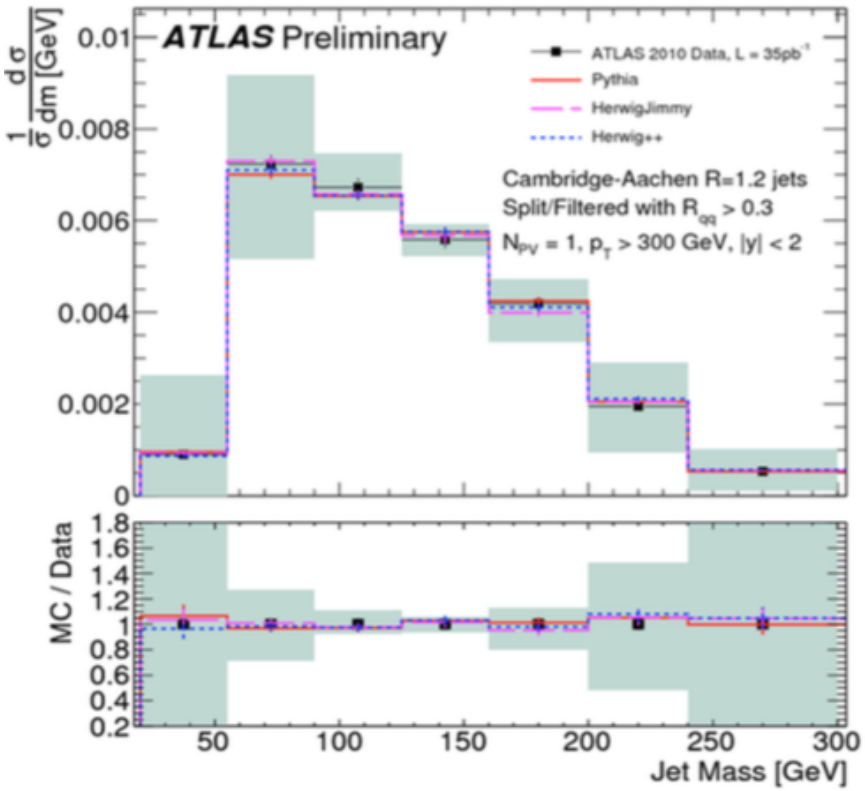
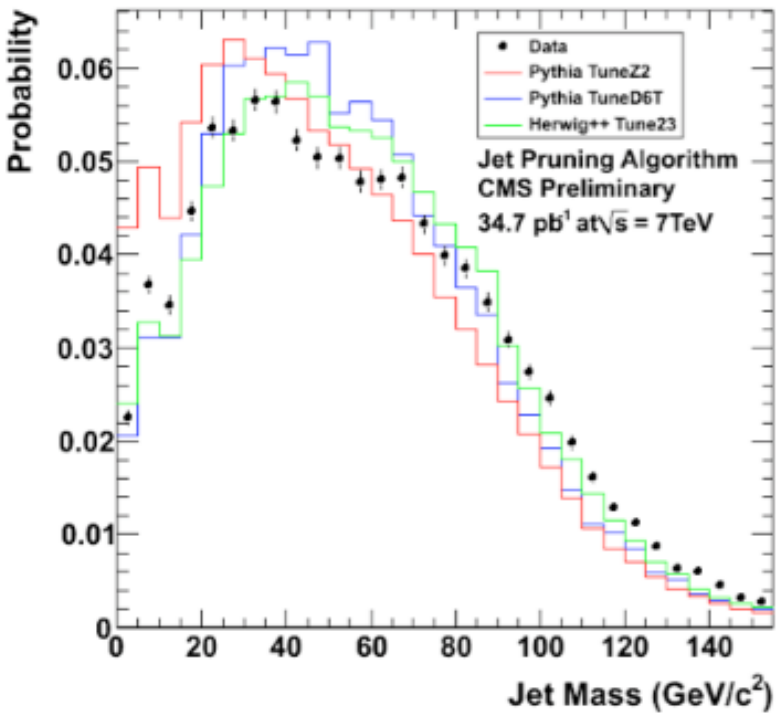
- Five years ago at Princeton was my first boost.
- Combining the 2011 blog post from Jon with this year's from Christoph yields interesting results. Thanks Dmitris for noting this.
- Results shown at Princeton were the very first from the LHC, using 35/pb of $\sqrt{s} = 7$ TeV data.
- This year we have 100/pb at $\sqrt{s} = 13$ TeV.
- Let's see how far we have come!

# Jet mass **then** and now

ATLAS 2010



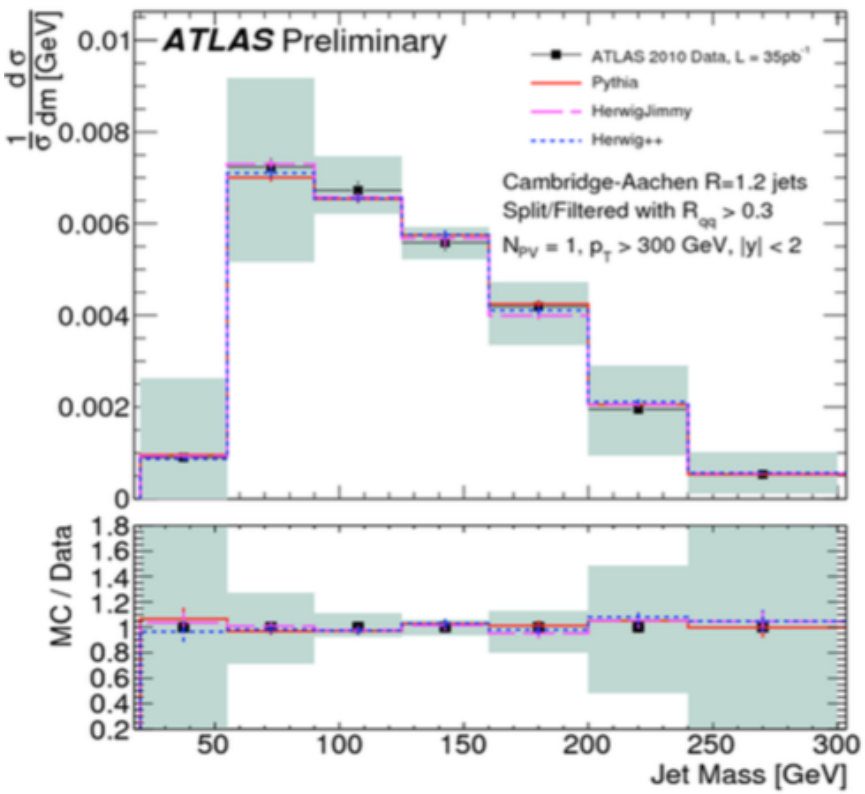

CMS 2010



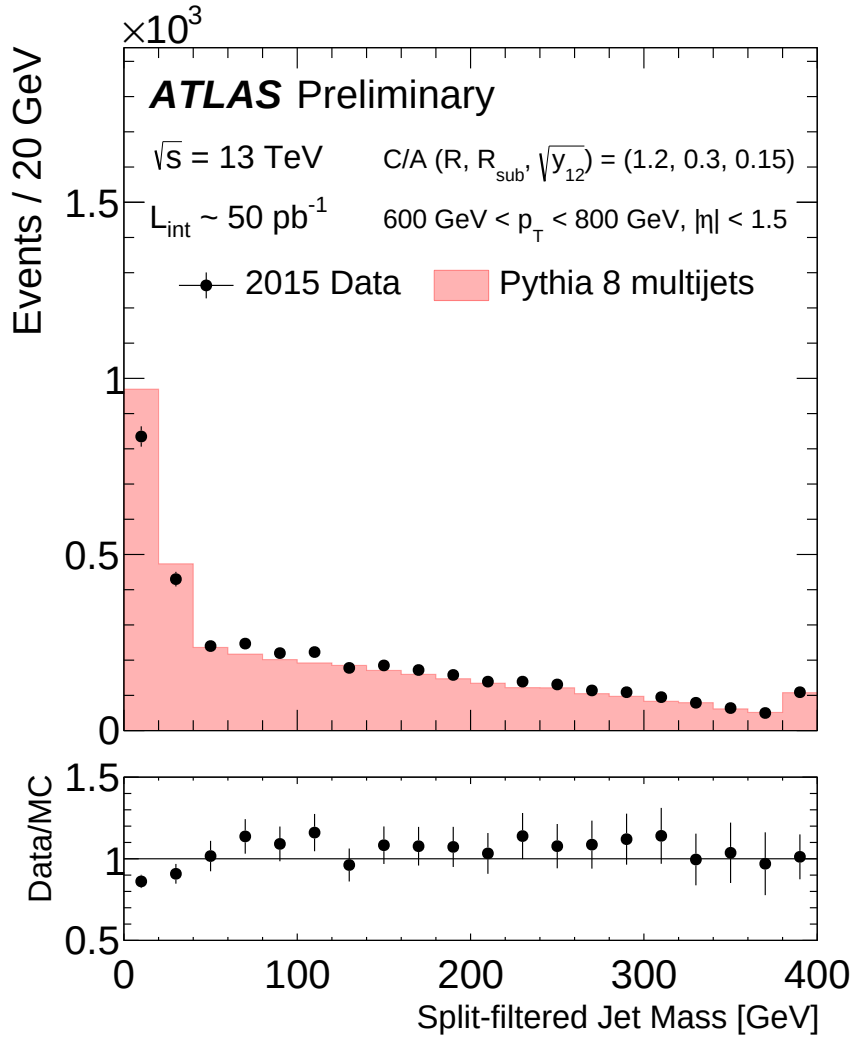

The work that went into these plots was astronomical.

# Jet mass then and now

ATLAS 2010




ATLAS 2015



# Overview

- Intro
- Top tagging
- Vector boson tagging
- Higgs tagging
- QCD
- Run 2 and beyond

Note: Pride dictates that I will update these slides with links and references at some point...

# PHILOSOPHY

Boost is about:

1. Tagging high pT objects (SM and BSM)
2. Improving measurements (pileup, mass resolution etc)

ATLAS and CMS have taken different approaches to these things from day one.

ATLAS:
AKT4 CA12 split-fitered (BDRS)
AKT10 trimmed (R3/R2)
N-subjettiness WTA
JVT/ $\rho$
D2

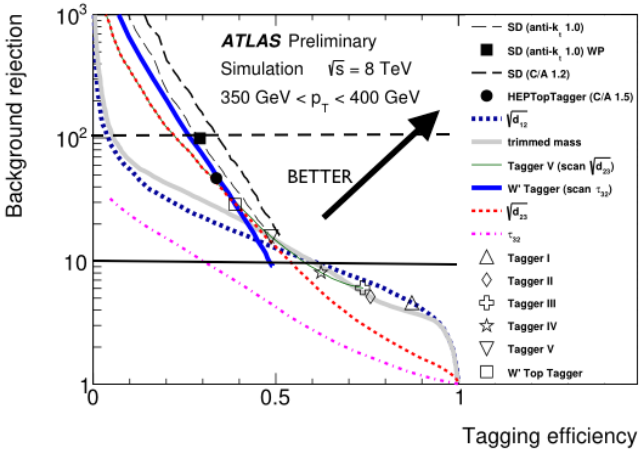
CMS:
AKT5 CA8 pruned (p510)
CA15 HTT
N-subjettiness one-pass
Puppi
Soft drop

# TOP TAGGING

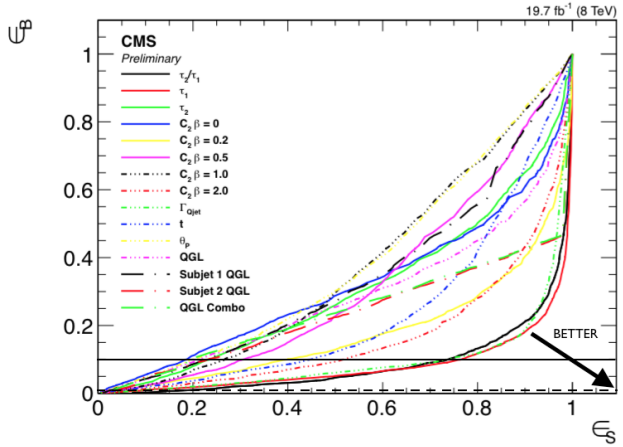
# TOP TAGGING PERFORMANCE

- Matt LeBlanc of ATLAS and Gregor Kasieczka of CMS gave us updates of the top tagging performance in MC:

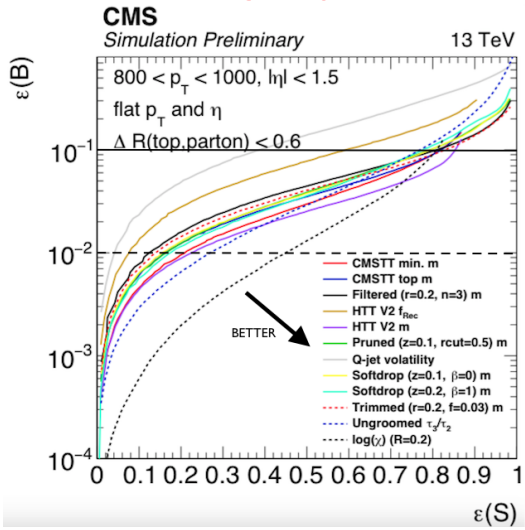
ATLAS 8 TeV




CMS 8 TeV




CMS 13 TeV

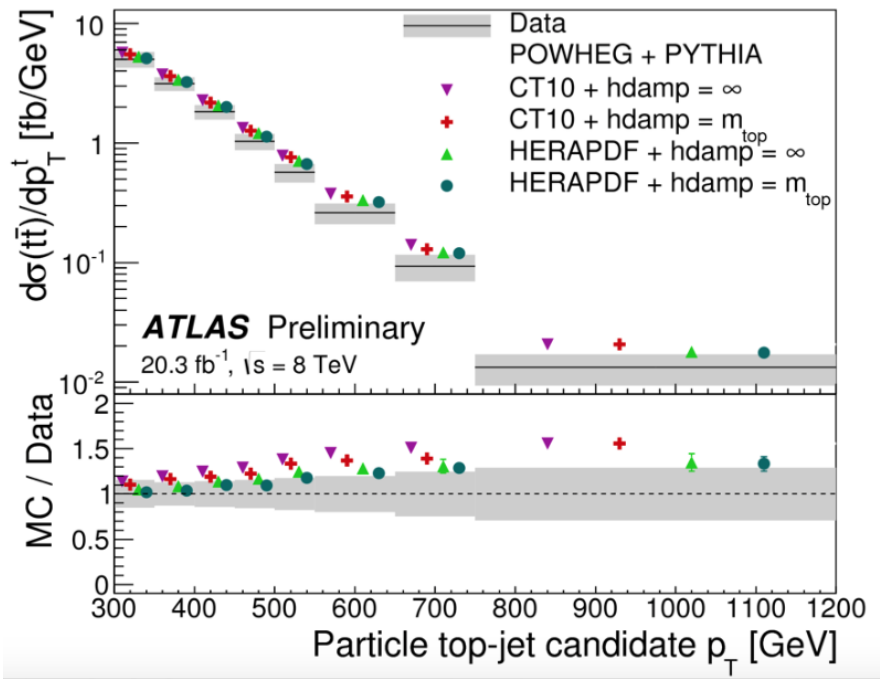



- Both experiments quite fancy shower deconstruction, but code is still private.

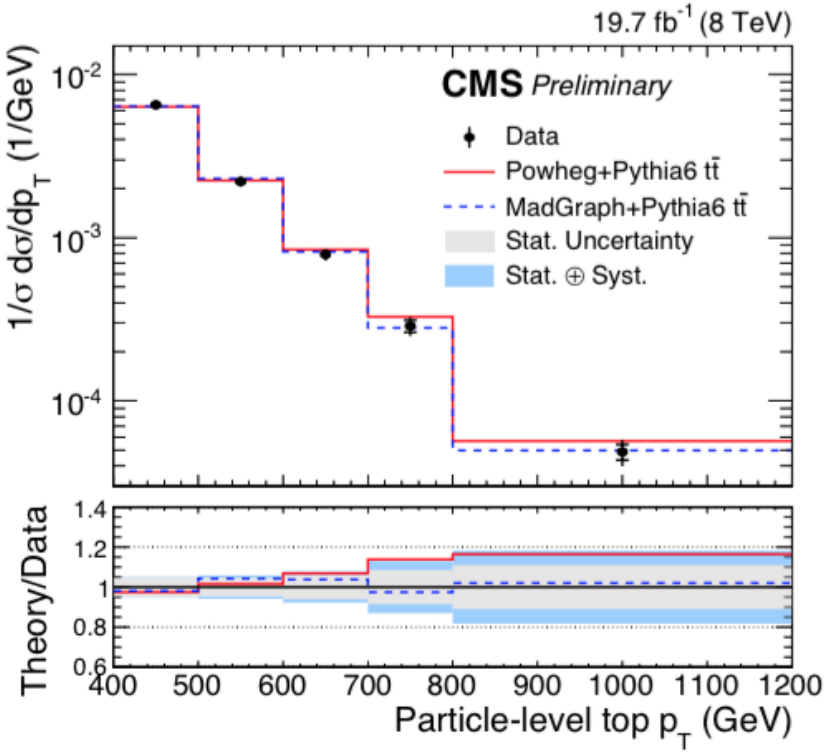
# TOP TAGGING IN USE : CROSS -SECTIONS

- Jean-Francois Arguin of ATLAS and Susan Dittmer of CMS presented high pT ttbar cross section results

ATLAS




CMS

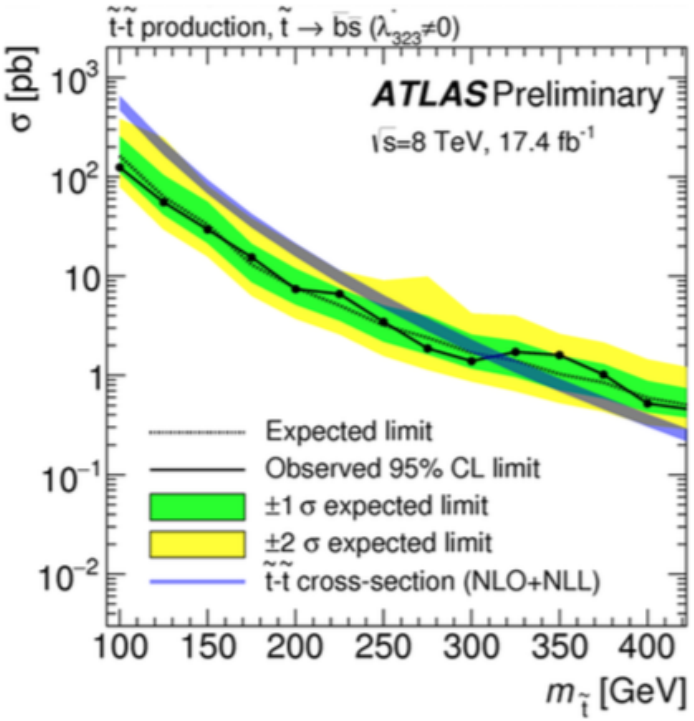



- These kinds of measurements give our techniques credibility.

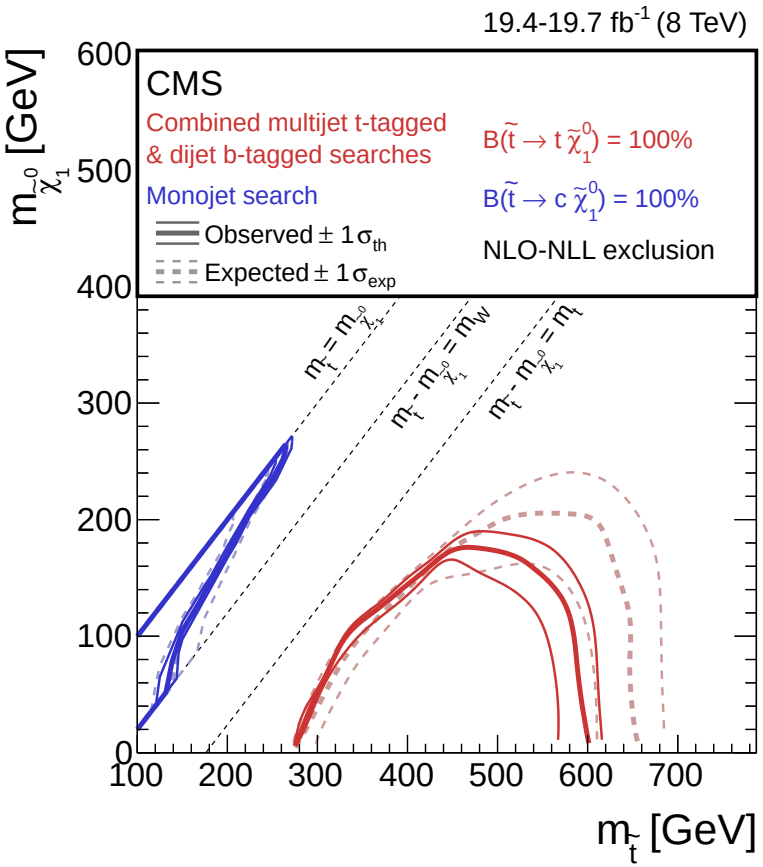
# TOP TAGGING FOR SUSY SEARCHES

- Michael Kagan of ATLAS and Justin Pilot and Jim Dolen of CMS presented BSM searches with boosted tops:

ATLAS




CMS

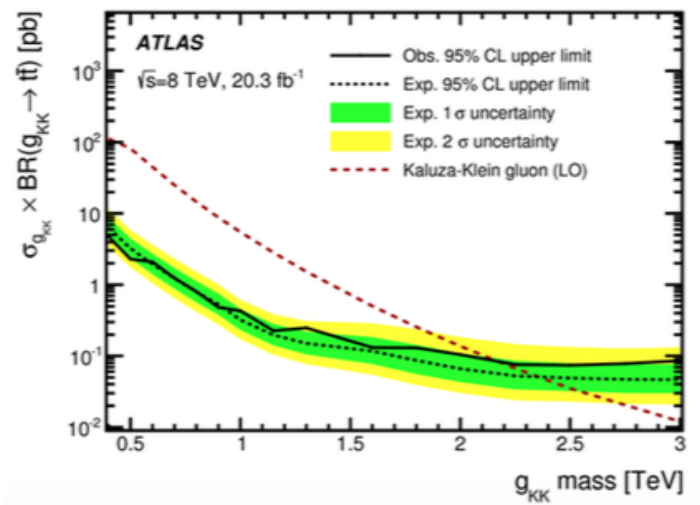



- Different channels shown this week. Both use objects at different scales (reclustering for ATLAS, HTT for CMS)

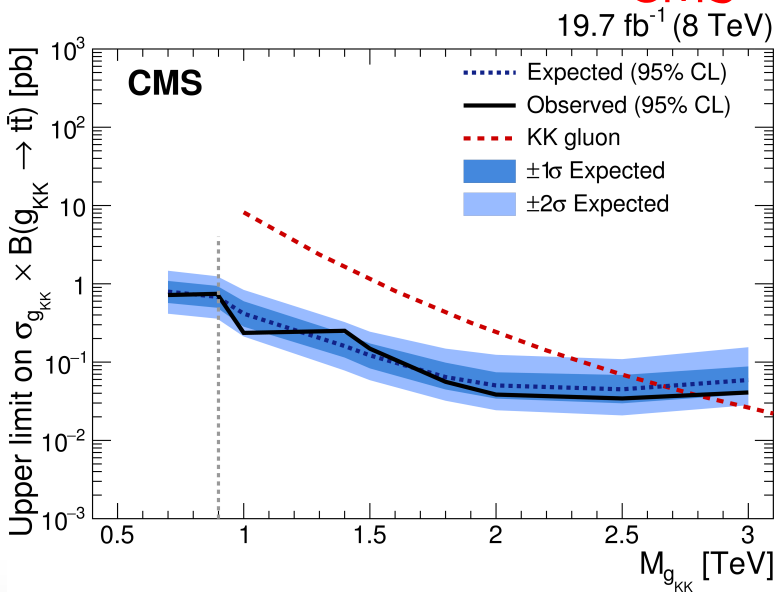
# TOP TAGGING FOR KKGluon SEARCHES

- Michael Kagan of ATLAS and Justin Pilot and Jim Dolen of CMS presented BSM searches with boosted tops:

ATLAS

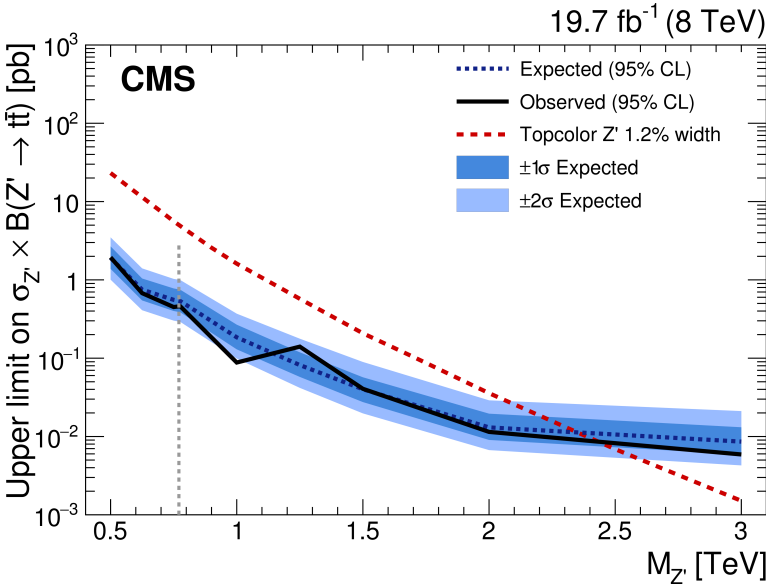


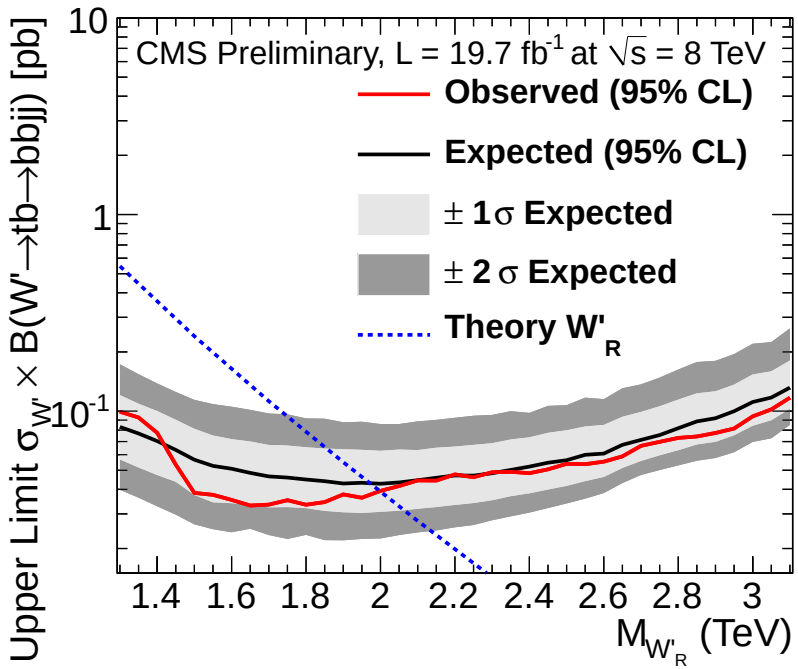

CMS



# TOP TAGGING FOR OTHER EXOTICA SEARCHES

- Michael Kagan of ATLAS and Justin Pilot and Jim Dolen of CMS presented BSM searches with boosted tops:



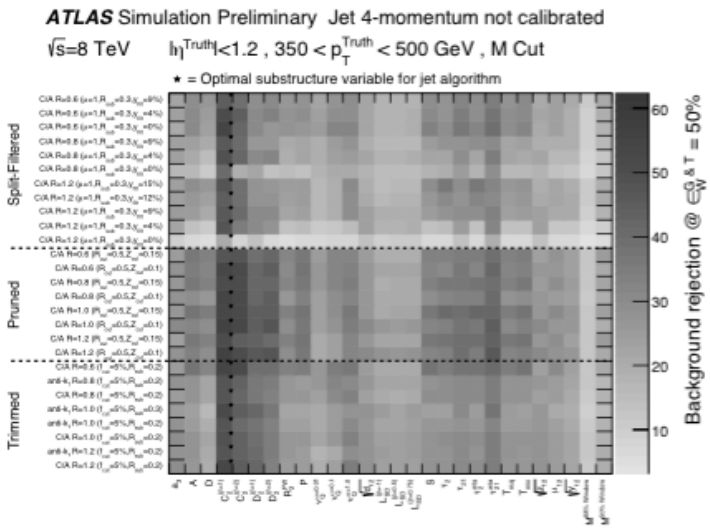



# VECTOR BOSON TAGGING

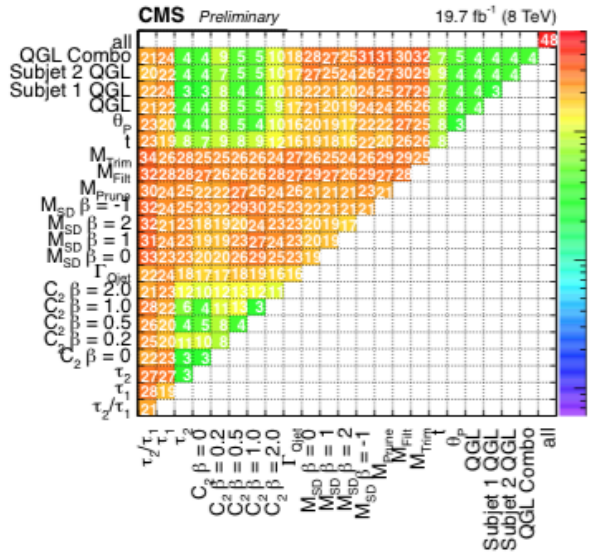
# V TAGGING PERFORMANCE: MC

- Julien Caudron of ATLAS and Gregor Kasieczka of CMS caught us up on the V tagging progress from ATLAS in the last year:

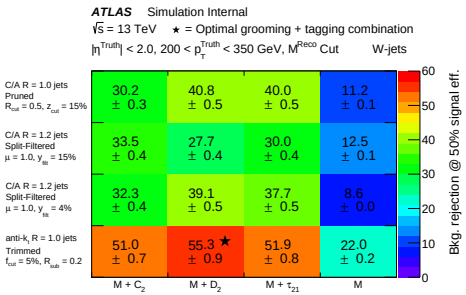
ATLAS 8 TeV




CMS 8 TeV




ATLAS 13 TeV




- Baseline for ATLAS in run 2 is R2D2 - Anti-kT R=1.0 jets trimmed with R=0.2 subjets, then mass and D2 used for tagging.
- Baseline for CMS is Anti-kT R=0.8 jets pruned / soft-drop, then mass and Tau21 used for tagging.

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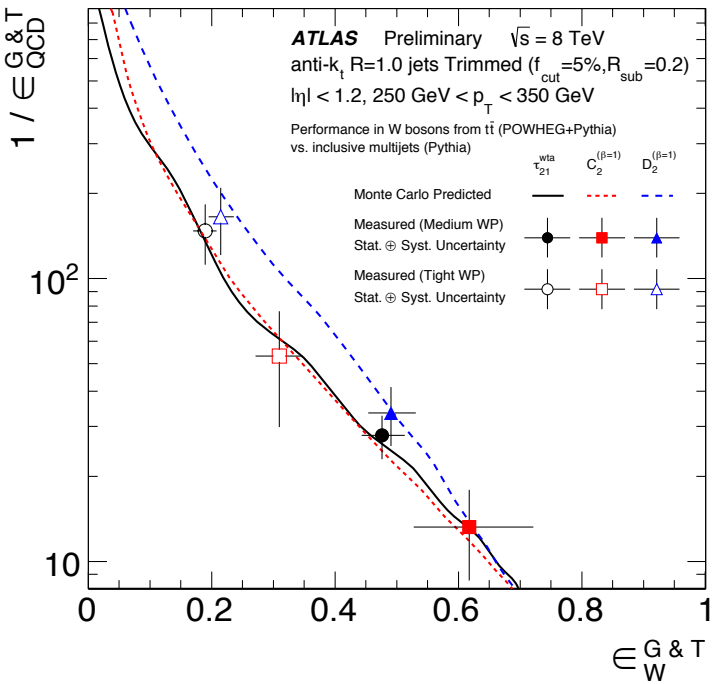
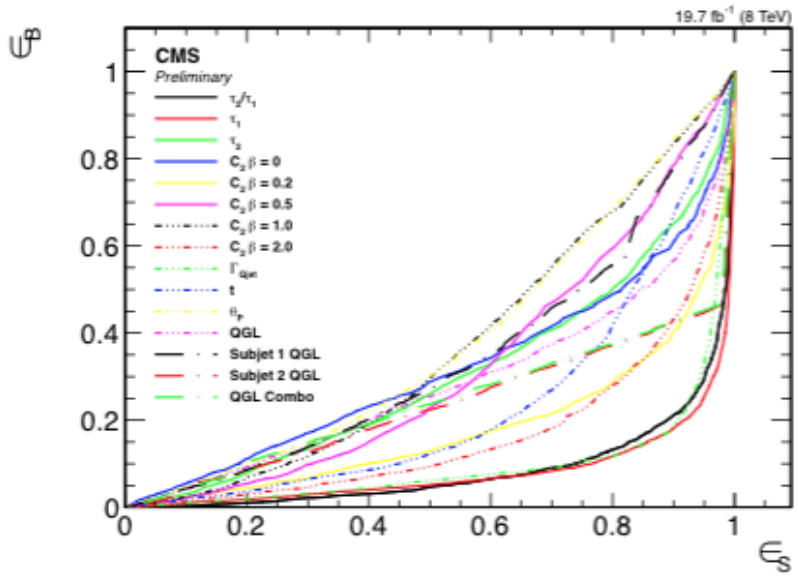
ATLAS 8 TeV

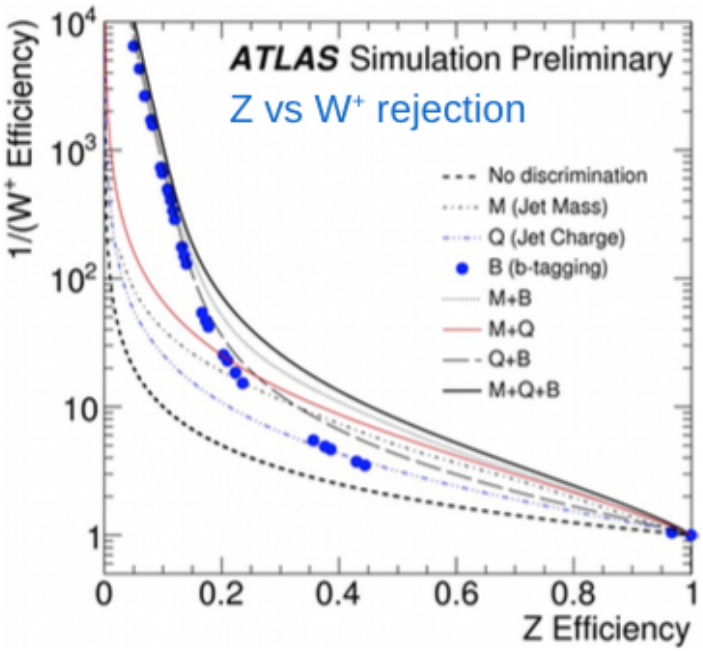


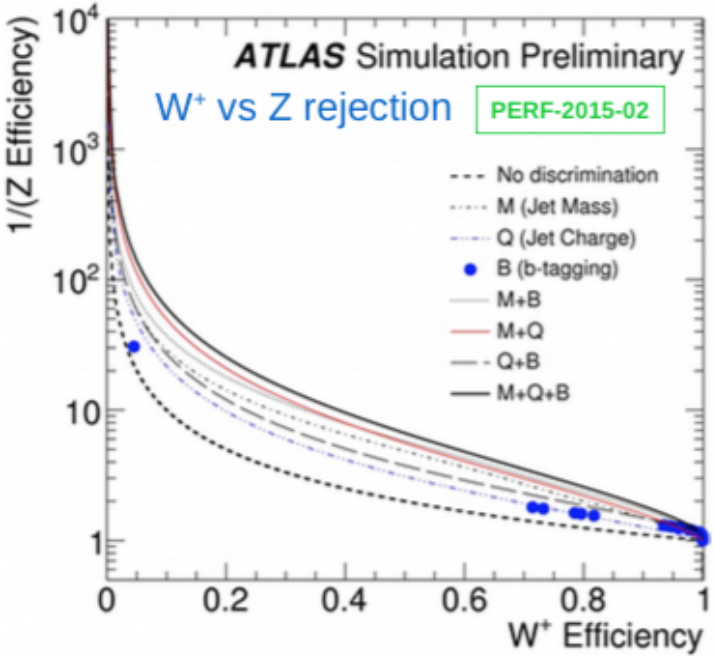

CMS 8 TeV

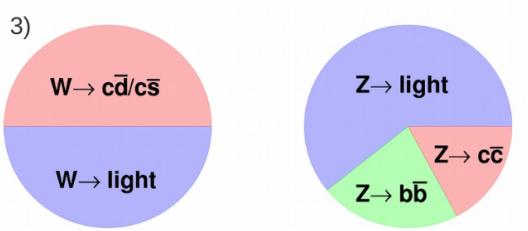


# V TAGGING PERFORMANCE: MC

- Julien Caudron presented W/Z discrimination from ATLAS



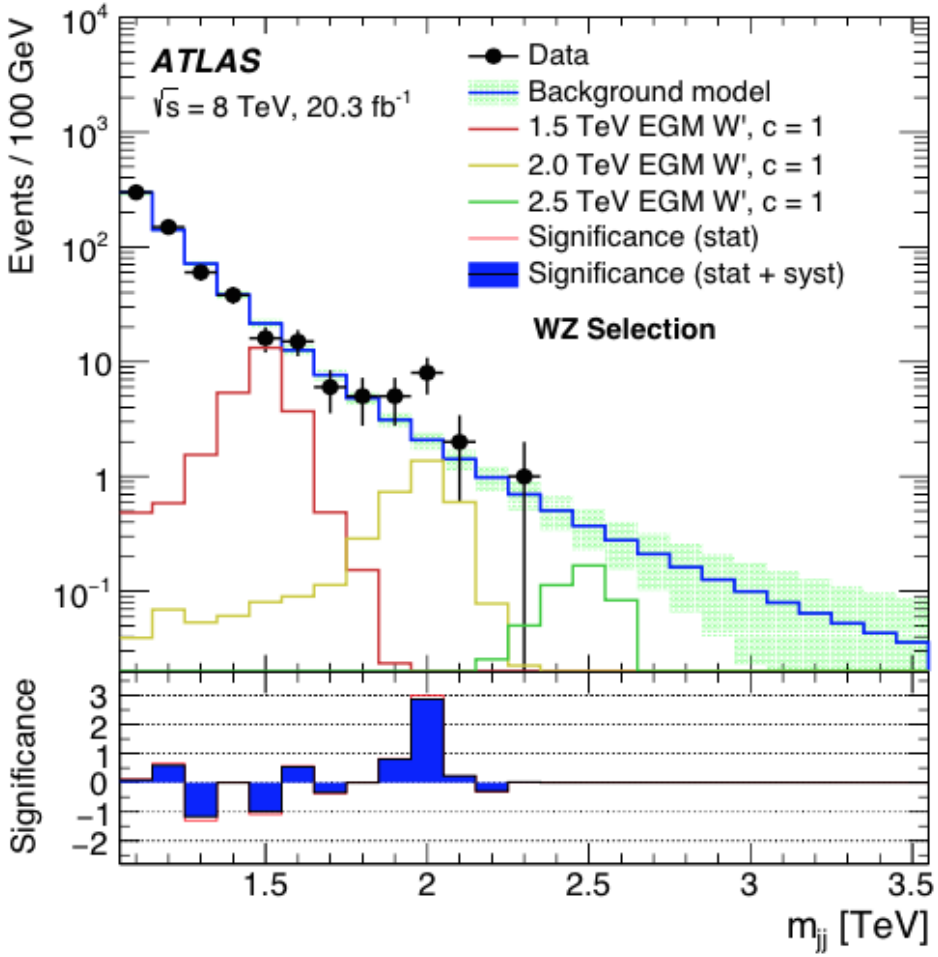



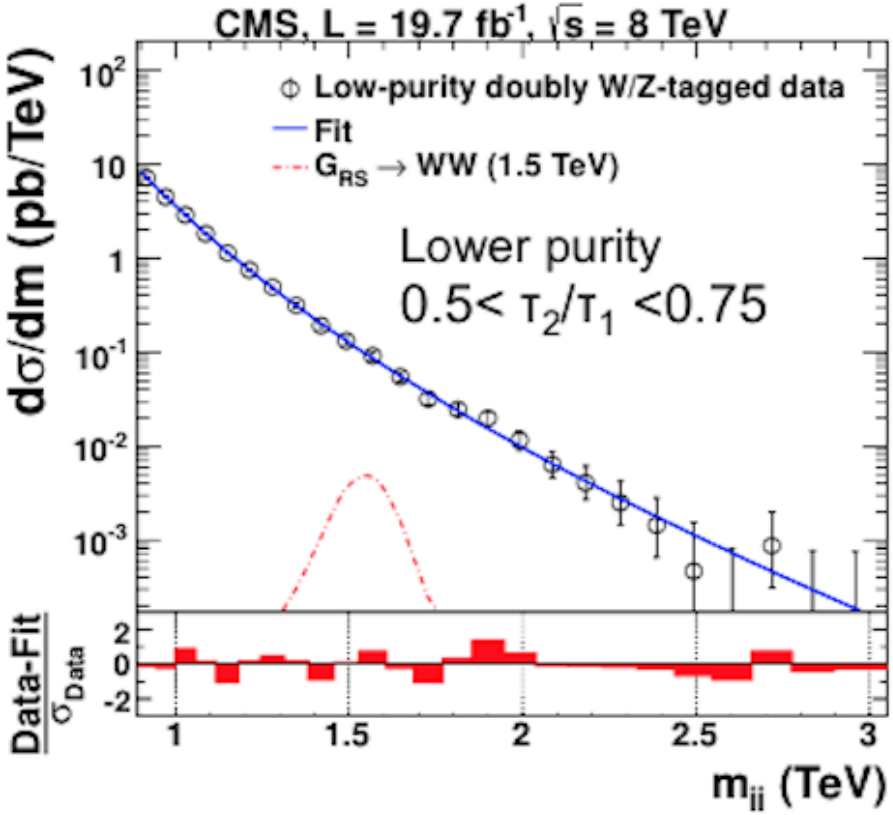
# V TAGGING FOR VV SEARCHES

- Chris Delitzsch of ATLAS and Andreas Hinzmann of CMS presented BSM searches with boosted vector bosons:

ATLAS

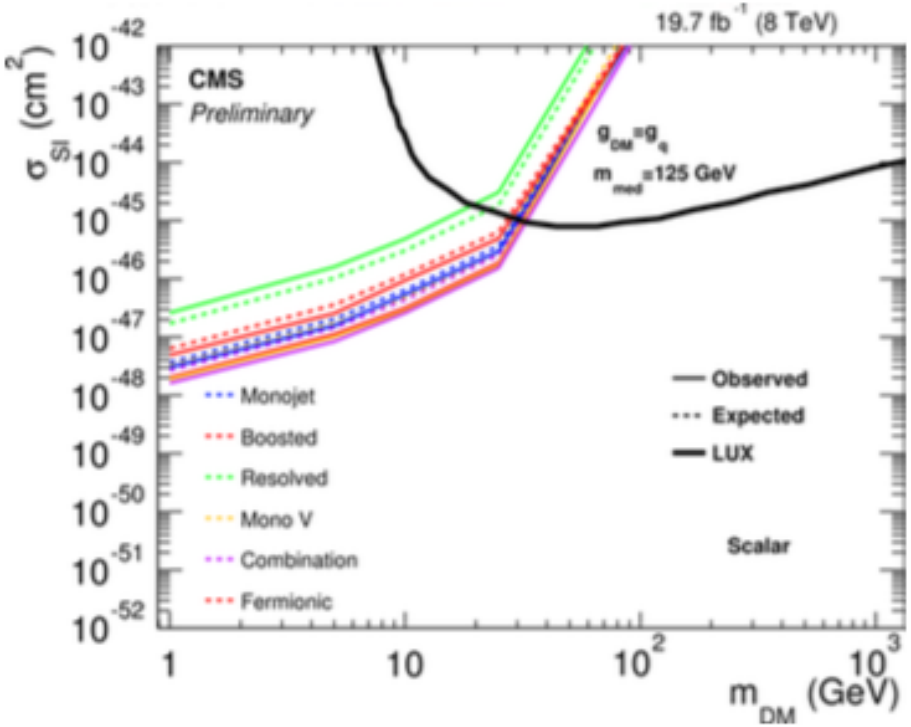


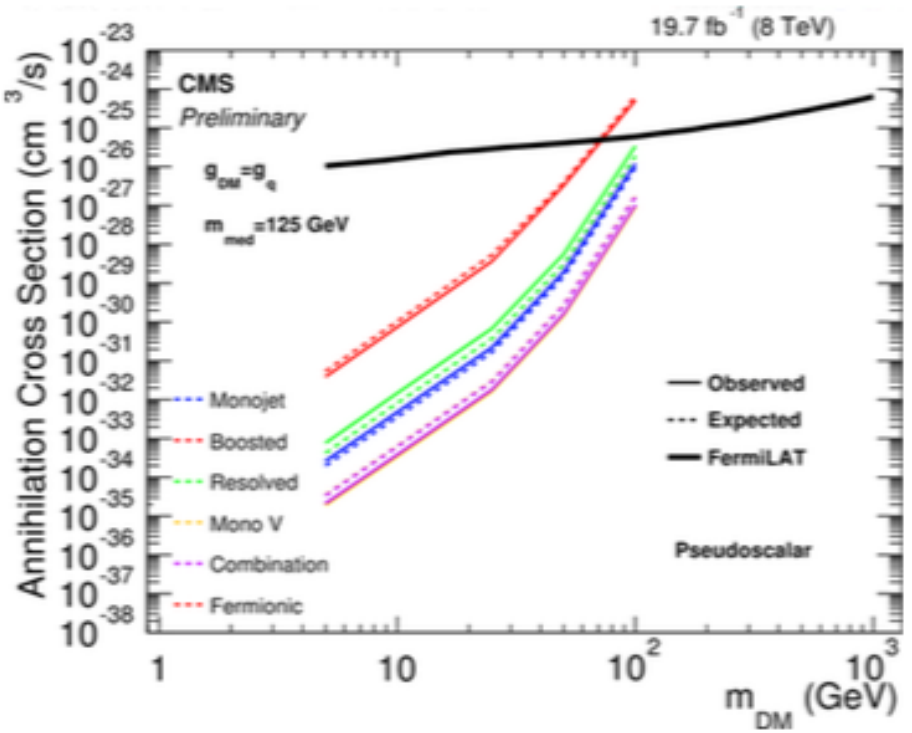

CMS



# V TAGGING FOR DARK MATTER

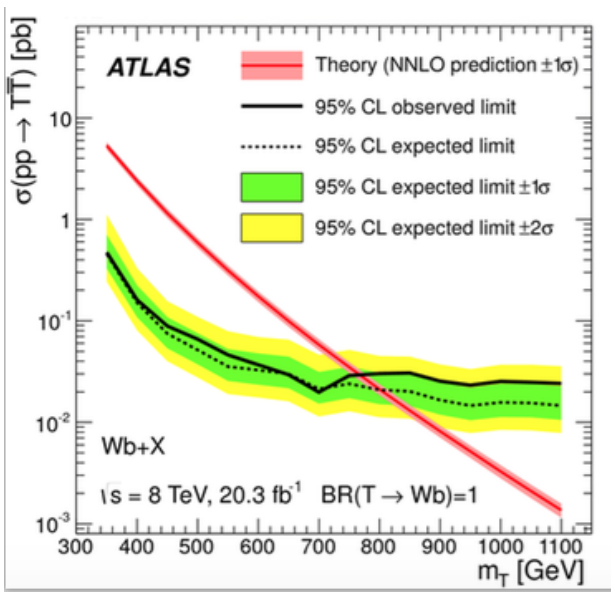
- Kristian Hahn presented CMS searches for DM with boosted vector bosons:

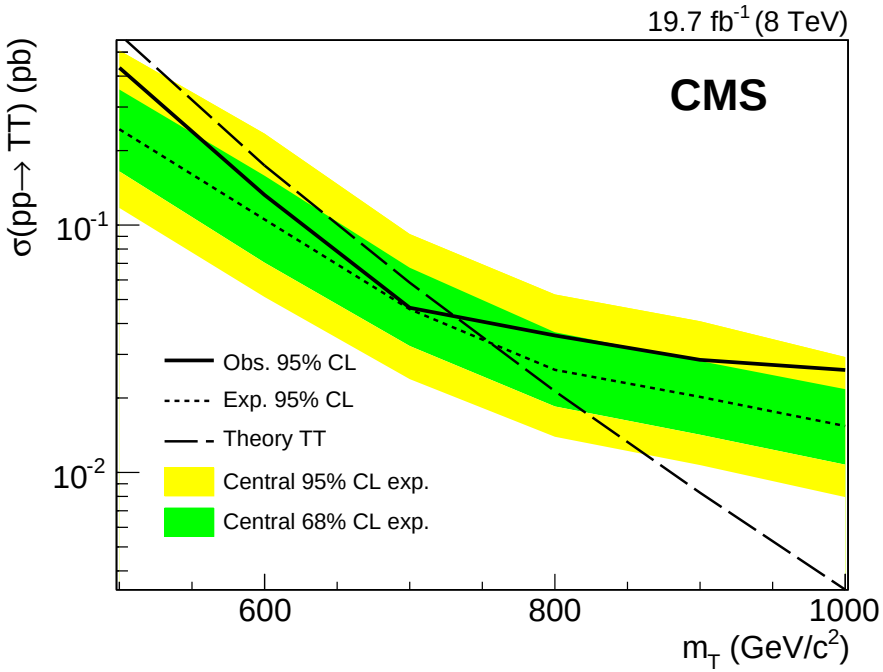


# V TAGGING FOR VLT SEARCHES

- Michael Kagan of ATLAS and Justin Pilot and Jim Dolen of CMS presented BSM searches with vector-like tops using boosted boson tagging:



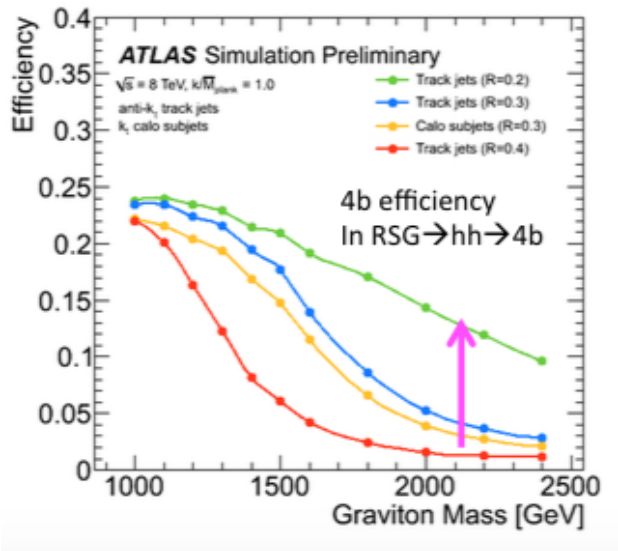



# HIGGS/B TAGGING

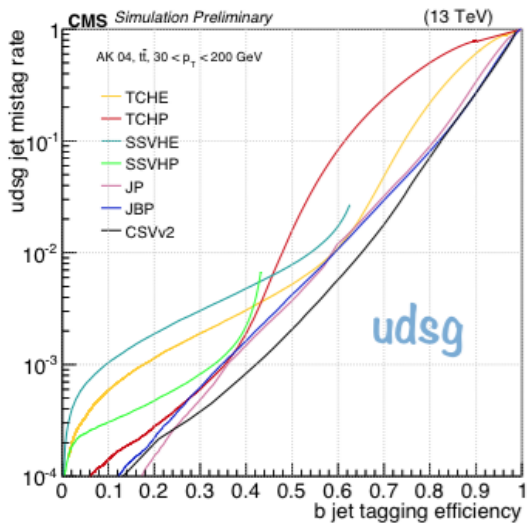
# B TAGGING PERFORMANCE

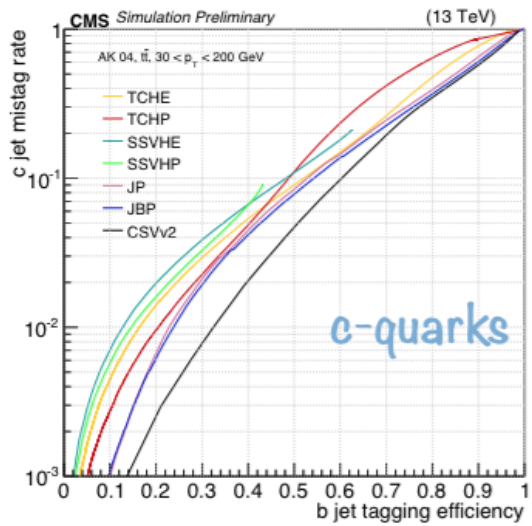
- Michael Kagan of ATLAS and Caterina Venieri of CMS gave us updates of b-tagging performance:

ATLAS 8 TeV




CMS 13 TeV




- Both experiments find benefit in b-tagging small R subjets.

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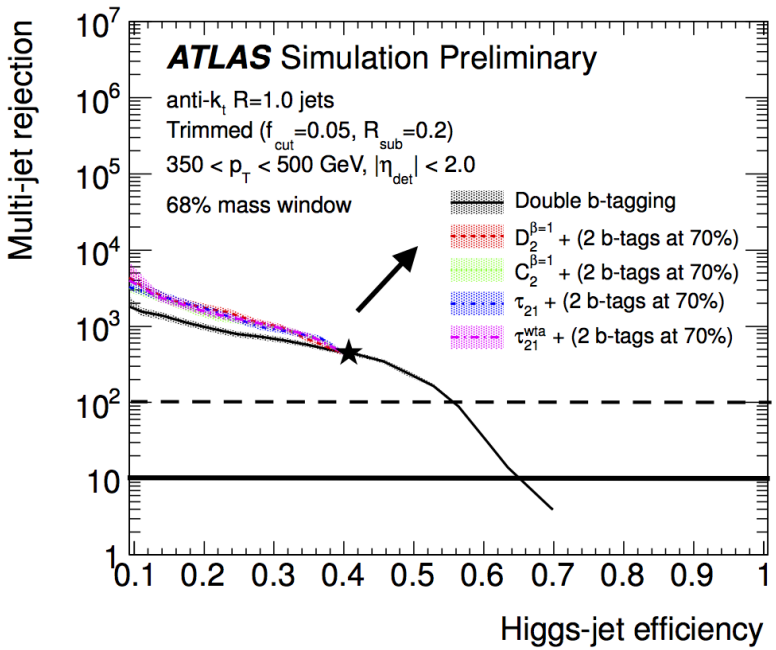
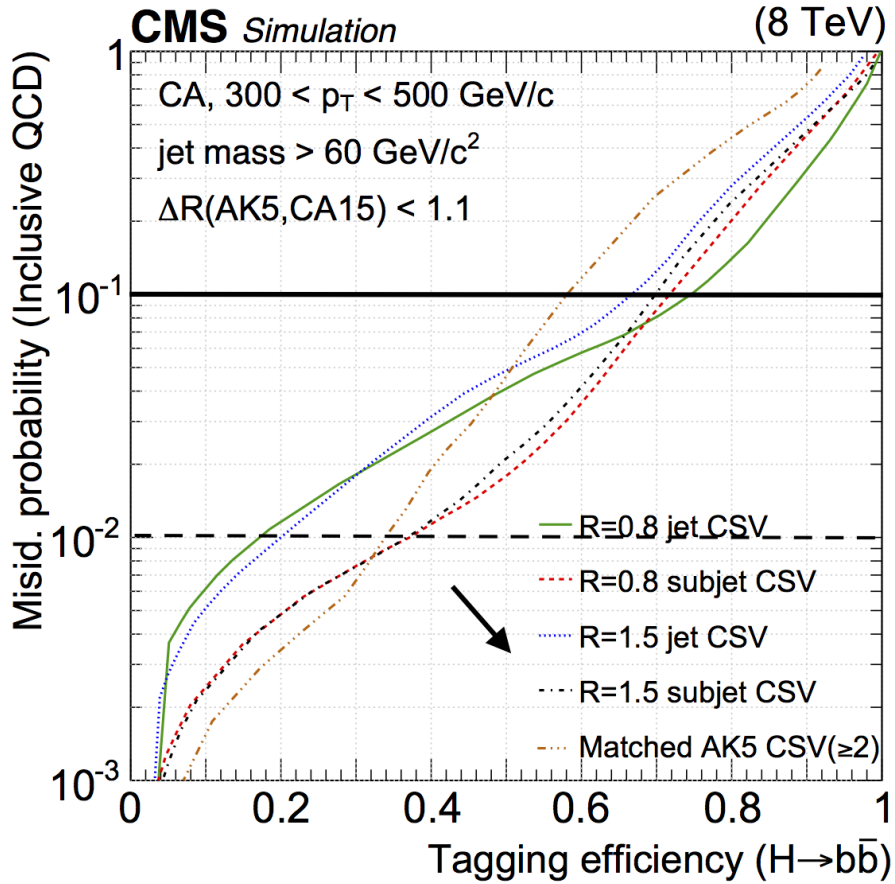



CMS 8 TeV

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# H TAGGING FOR SEARCHES

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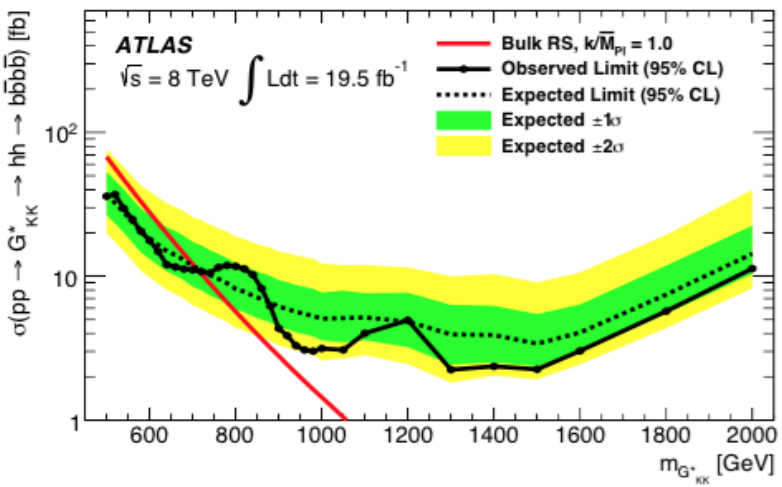
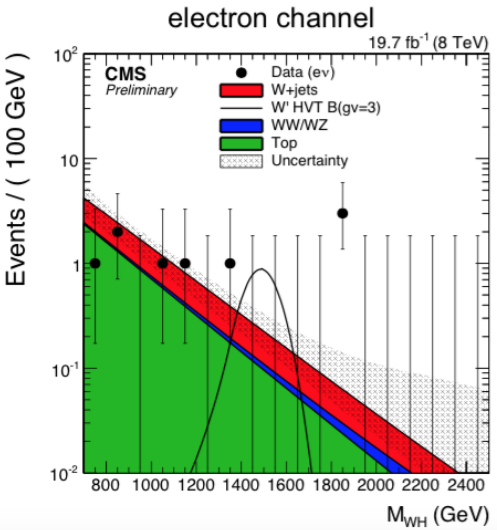
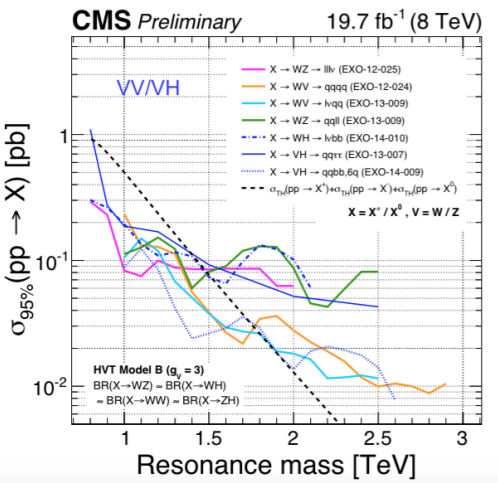
ATLAS




CMS

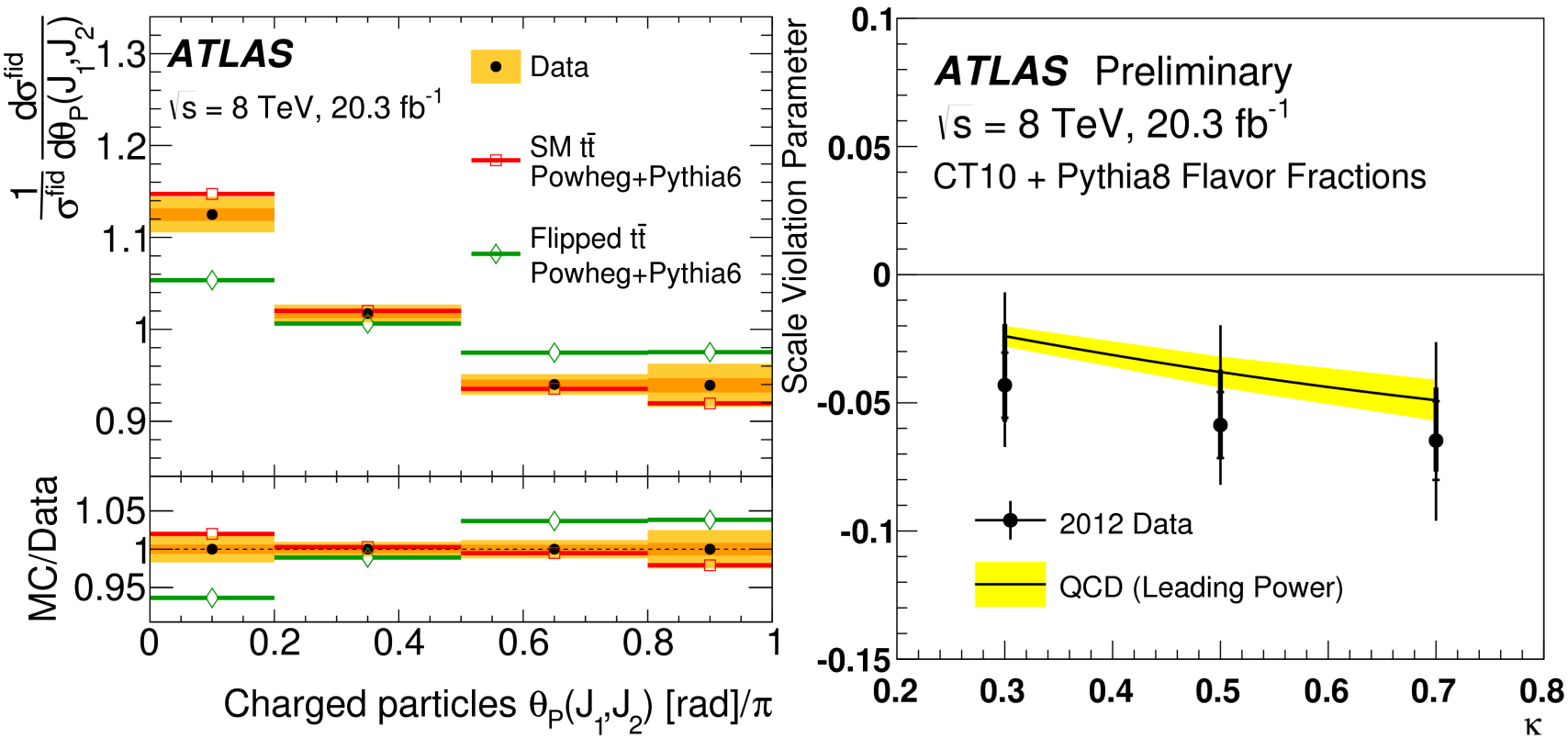


# QCD

# SM MEASUREMENTS

- Ben Nachman of ATLAS presented recent measurements using color flow and jet charge:



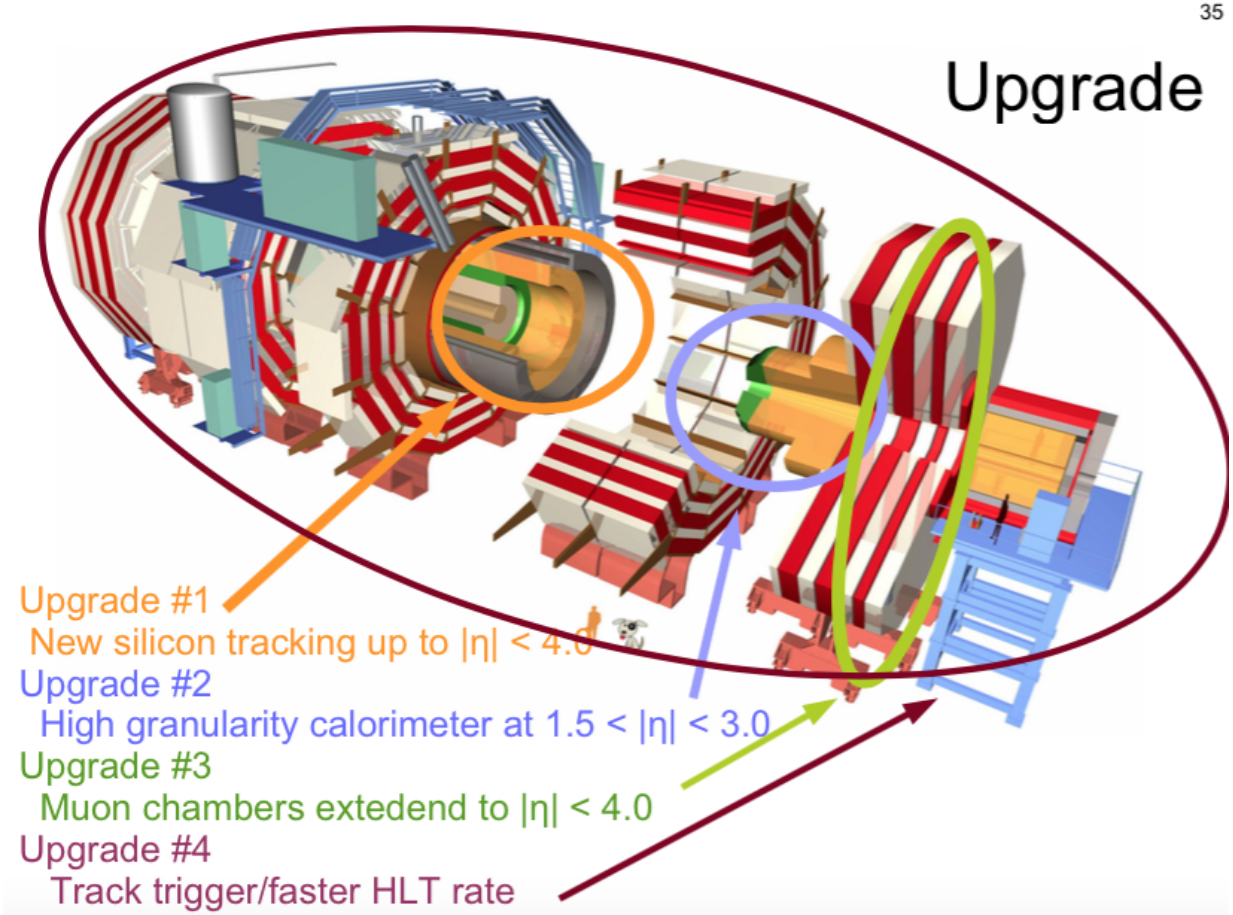
# Solenoidarity

- Solenoid cooling system has been a bit of a headache for the CMS detector.
- Hard for CMS and ATLAS, and mainly for the outside community who are going to have a to wait a bit longer.
- We could still get 5-10/fb this year.



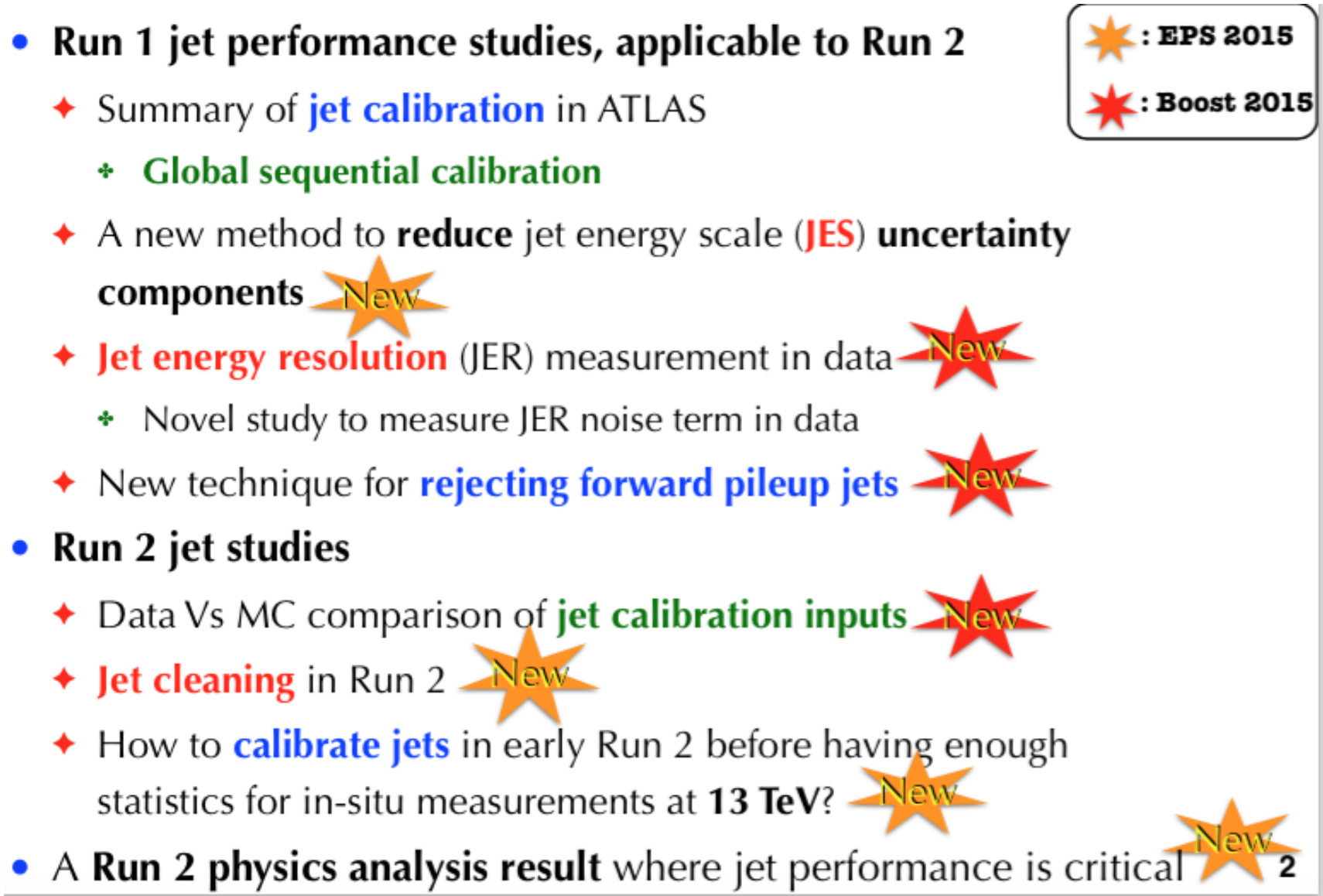
**Many improvements in the detector and consolidation work during LS1 (2013-14)**

- New 4th pixel layer: IBL detector
- New pixel Service Quarter Panels (nSQP)
- Replacement of all calorimeter Low Voltage power supplies
- Consolidation of TileCal read-out electronics
- Finish the installation of the Extra Endcap muon chambers
- Additional chambers in the feet and elevators region
- New LUCID (LUminosity measurement using a Cherenkov Integrating Detector)
- New Central Trigger Processor: L1 rate increase from 75 kHz to 100 kHz
- New L1 topological trigger
- Unified High Level Trigger architecture



# Jets in run 2

- Arantxa Ruiz Martinez and Dimitris Varouchas presented the impressive early run 2 results from ATLAS



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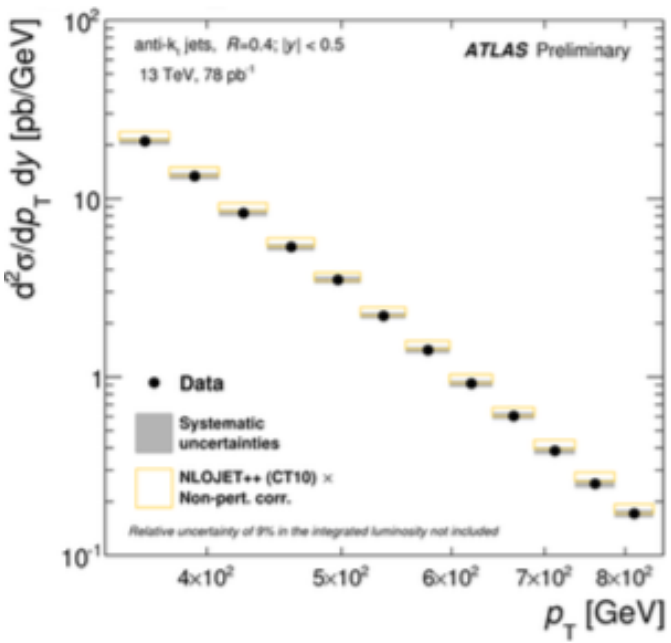
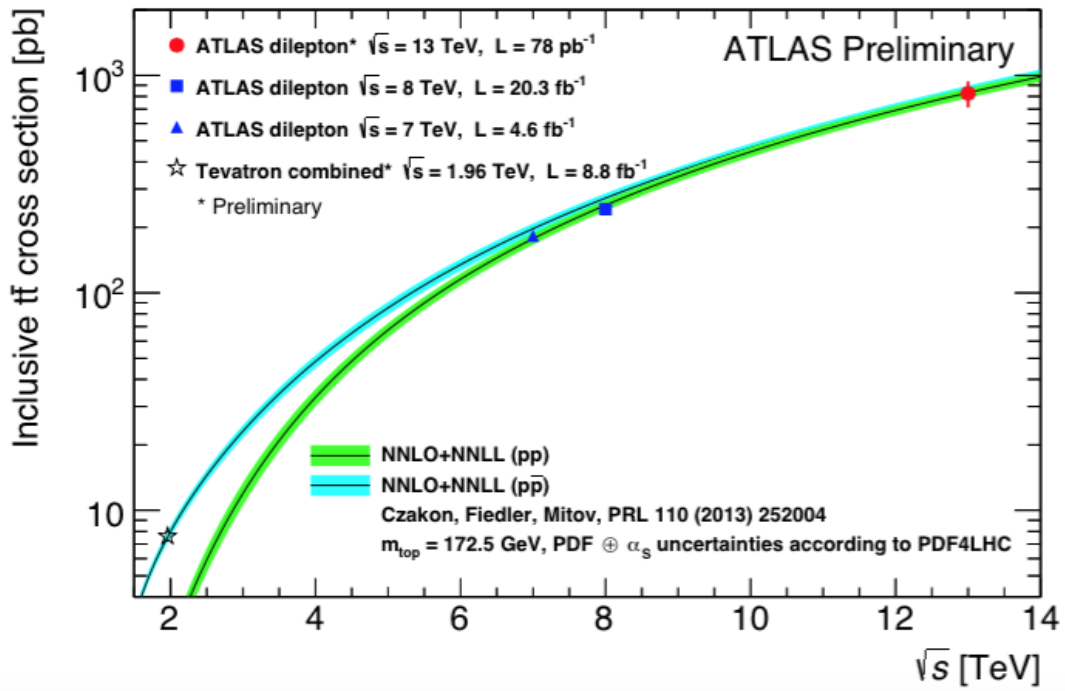
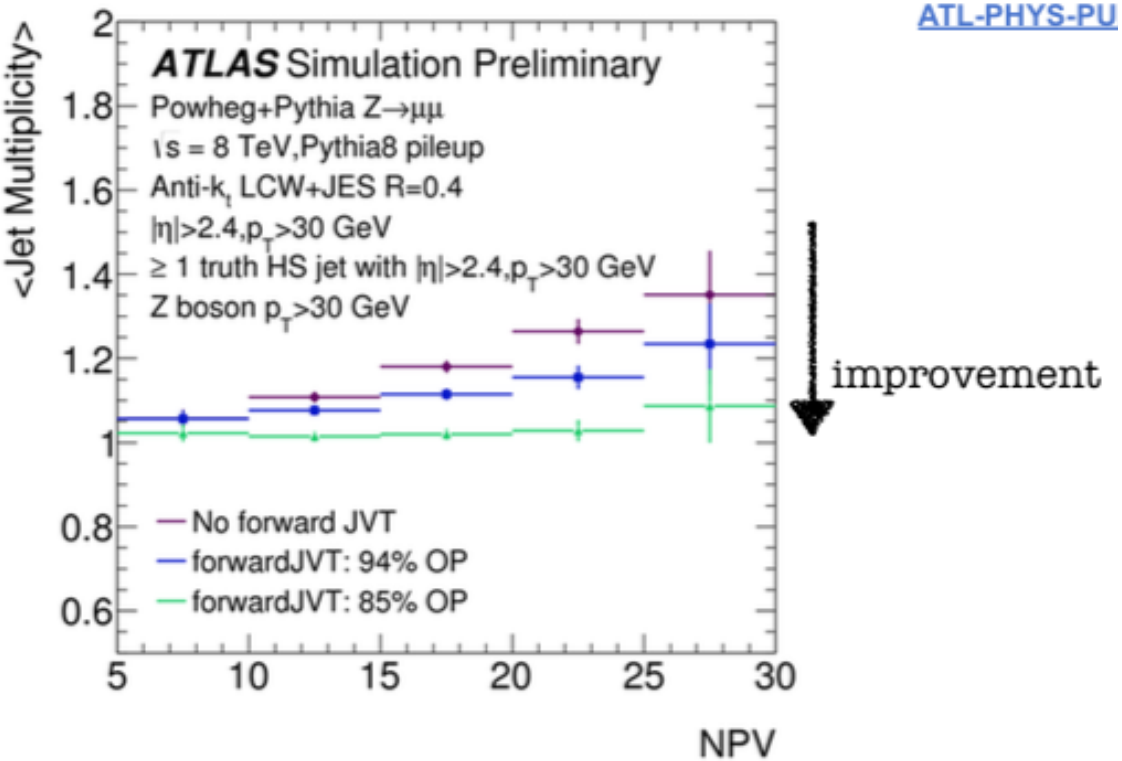


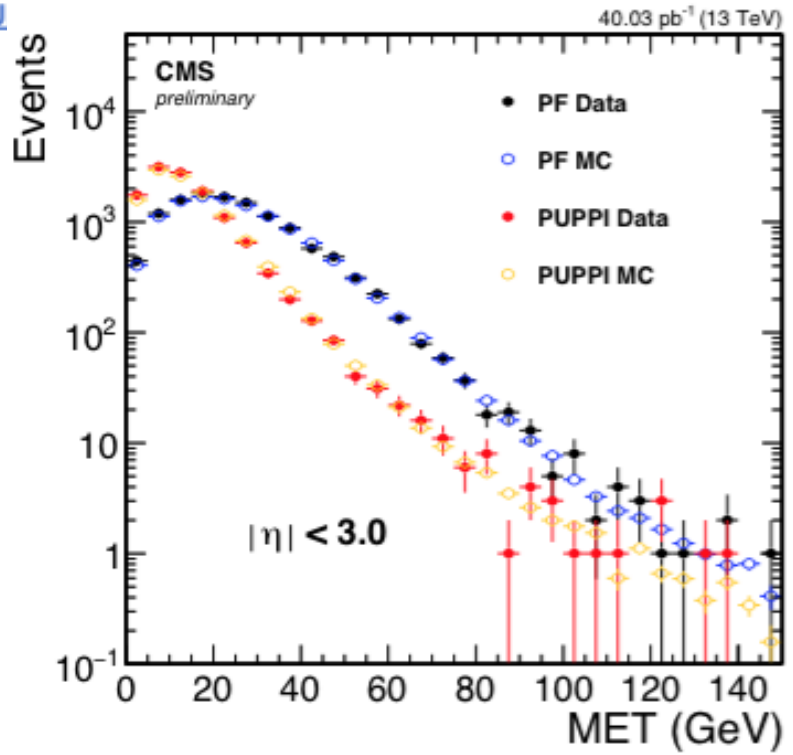
# Pileup

- Pileup techniques were summarised by Dimitris Varouchas for ATLAS and Satoshi Hasegawa and Phil Harris for CMS




ATL-PHYS-PU

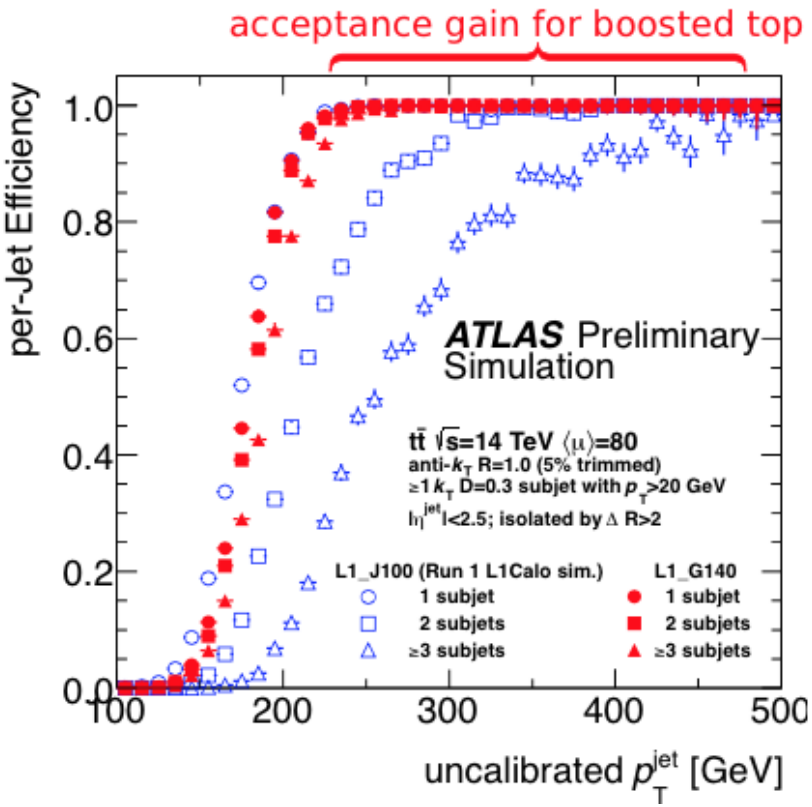
improvement

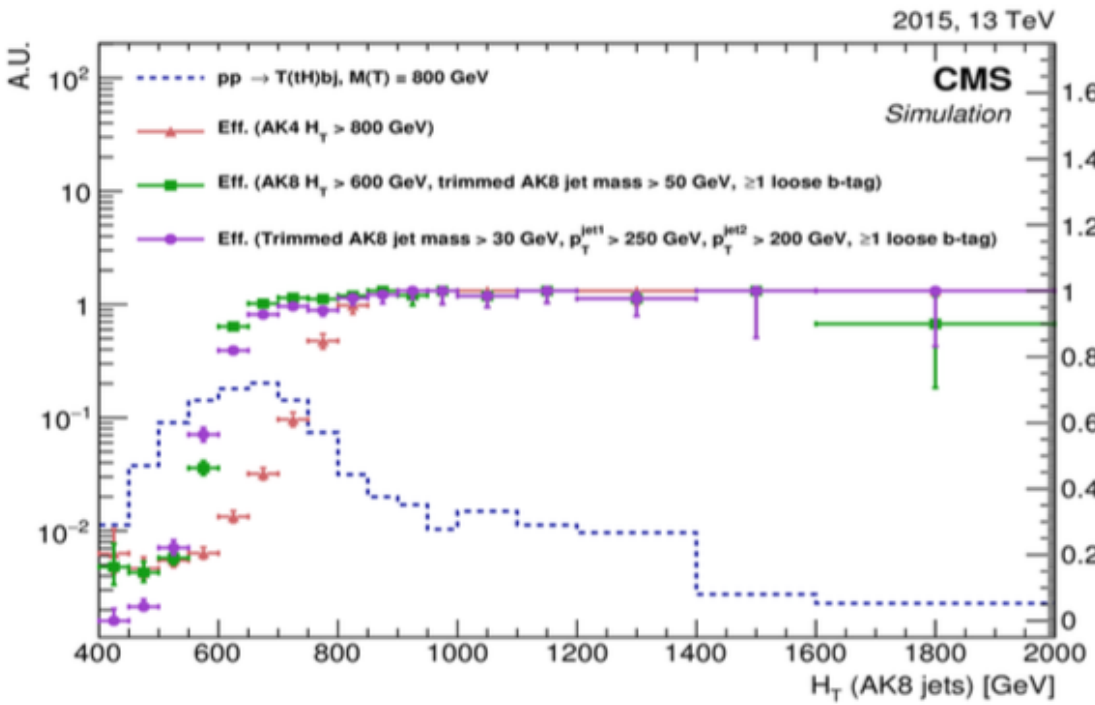



- New method of forward jet vertex tagging for ATLAS.
- CMS tested MET pileup correction in 13 TeV data.

# Triggers in run 2 and run 3

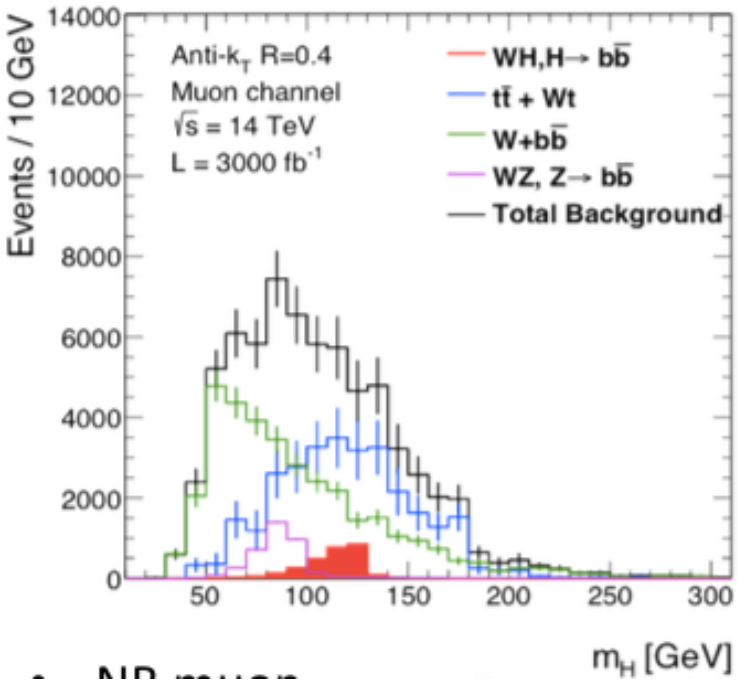
- Dylan Sheldon Rankin and Michael Begel presented trigger news for CMS and ATLAS respectively:

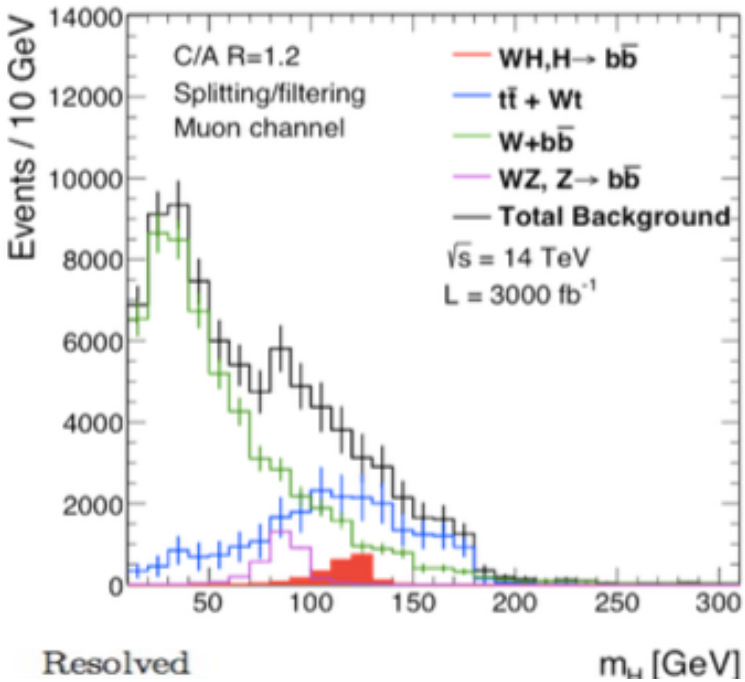


# Future

- Jon Butterworth discussed future prospects for BDRS



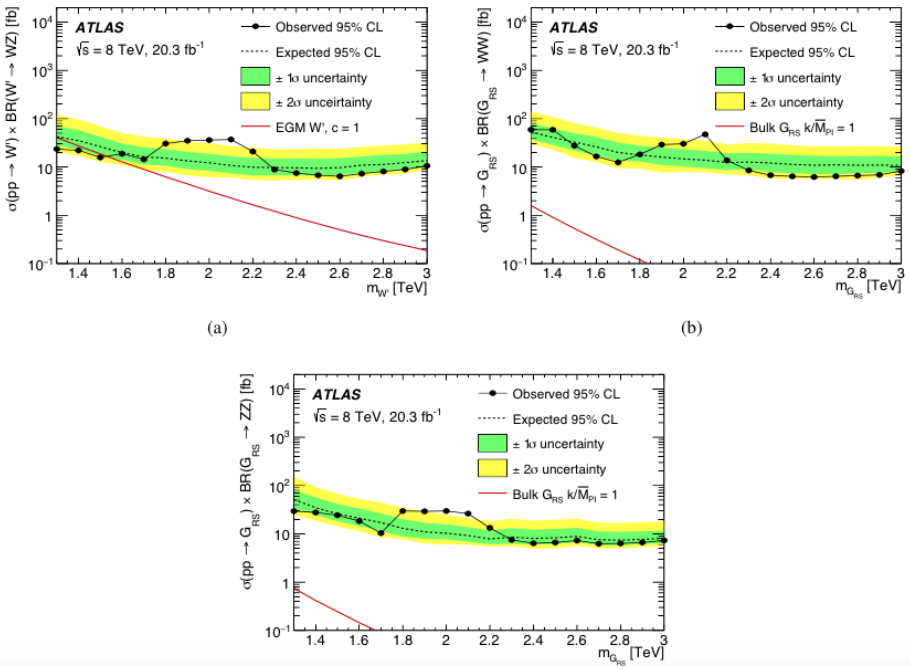



# The Panel

Have we done enough to ensure the confidence of our colleagues?
Have a couple of baselines that ATLAS and CMS are close to one another with?
Is this dangerous actually?

# Fin.

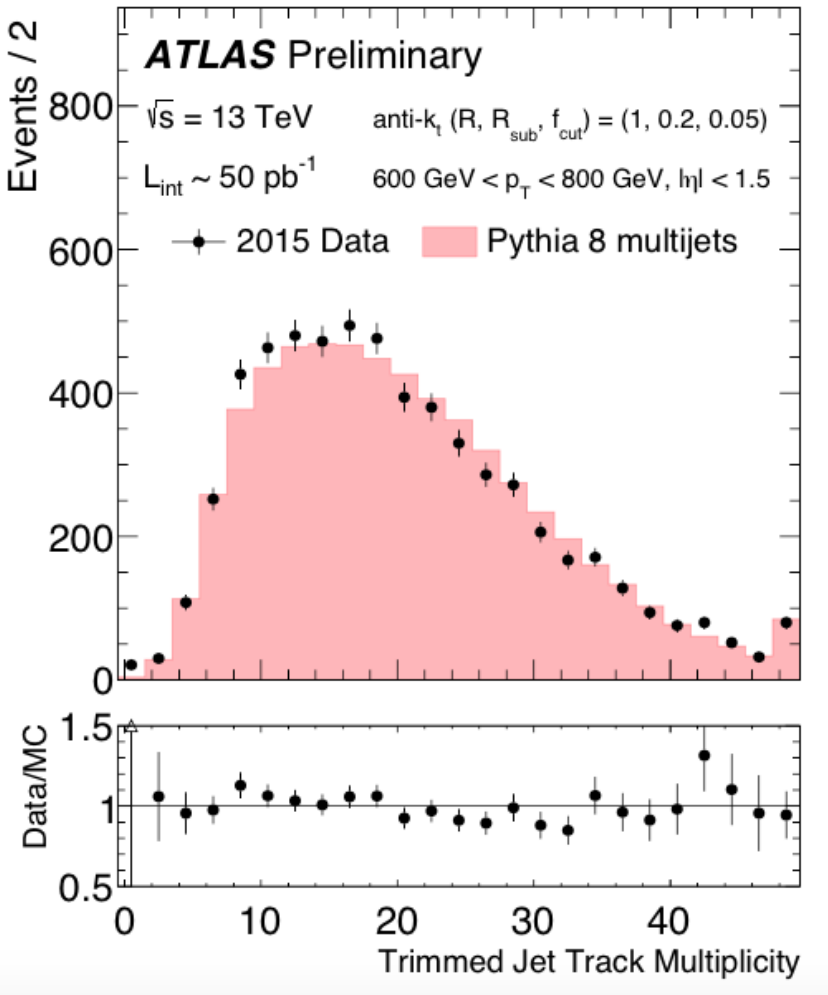
# The Diboson Excitement

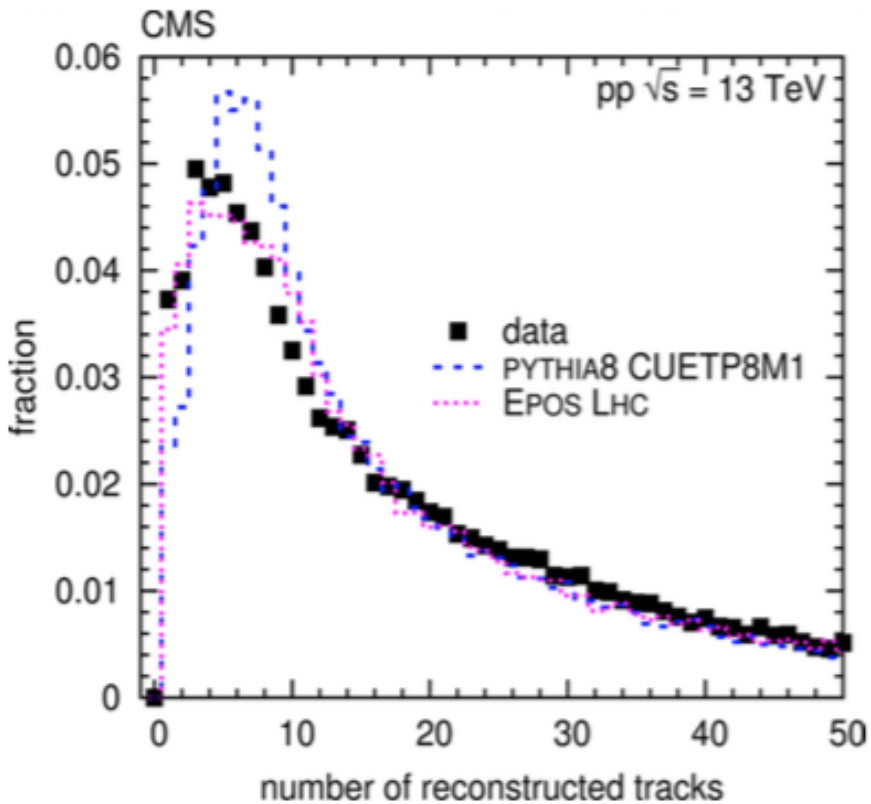



- Statistical fluctuation ?
- Mismodeling ?
- Detector efect?
- Some sort of resonance?

# 2015 data : N tracks

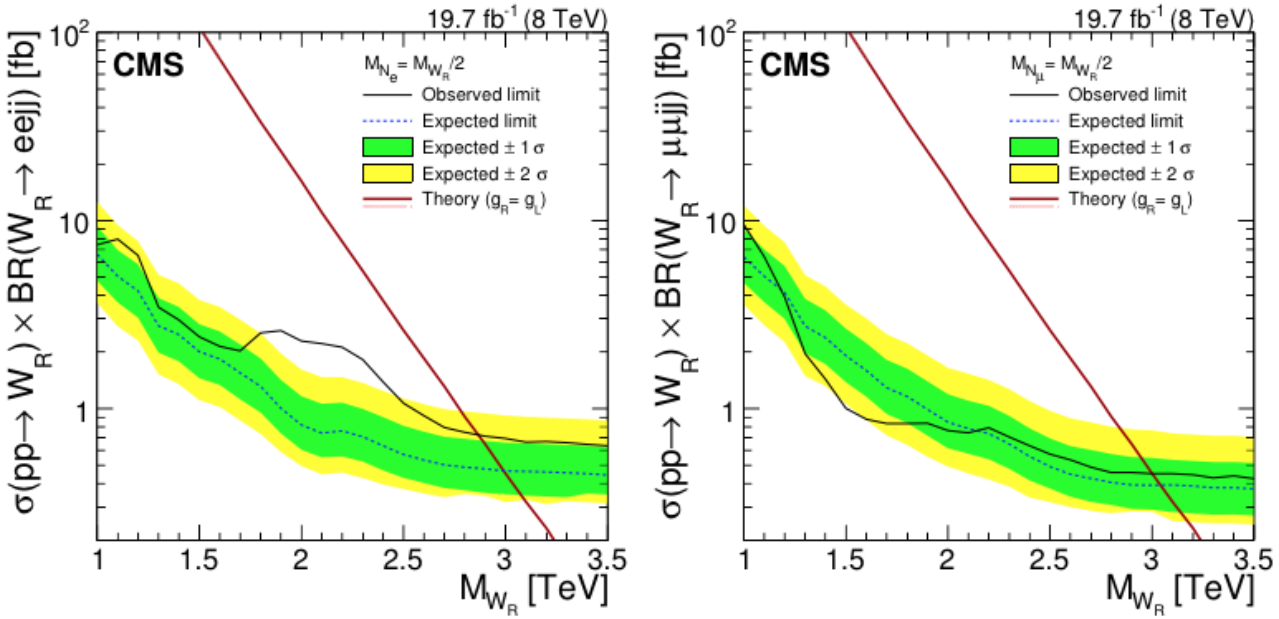
- A controversial variable ?



# $W' \to eN \to e^+e^-jj$

CMS find an excess of $e^+e^-jj$. No excess of $e^+e^+jj$ and no excess of $\mu^+\mu^+jj$ or $\mu^+\mu^-jj$. ATLAS find no excess of $\mu^+\mu^+jj$ or $e^-e^-jj$.




This analysis uses antikt5 jets and no substructure techniques.