UCL

Low Mass Di-b-jet in 2016

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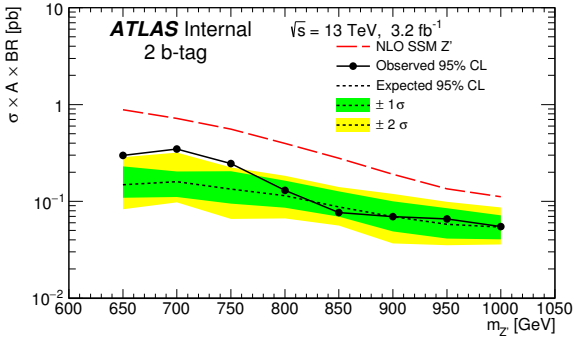
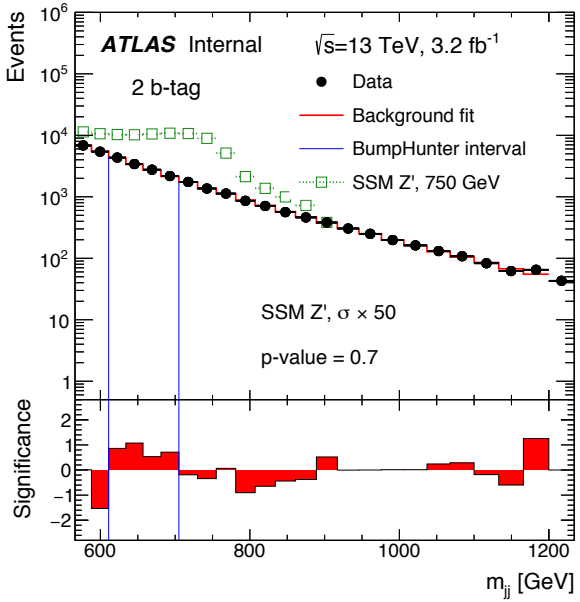
Di-bjet Meet

16 June 2016

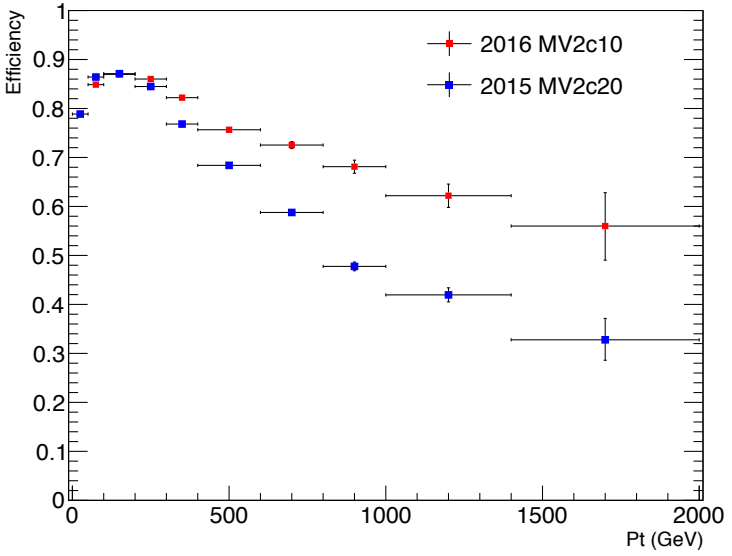
- **Low mass part of analysis done for LHCP**
  - Probed bb spectrum 566 < m_{bb} < 1200 GeV
  - Use b-jet triggers to get to low mass
  - No significant discrepancy seen





- **Can we add this in for ICHEP?**
  - Bolt-on to high mass analysis
    - Same analysis strategy as LHCP
    - b-Jet triggers in 2016 data
    - Working towards efficiencies and systematics

- **2016 Improvements**
  - Improved b-jet triggers (use MV2c20)
  - Improved b-tagging performance (MV2c10)
  - More data in 2016 (~10 fb^{-1})



Data / Event Selection

- **Data**
  - We will use 2016 data only
  - Different triggers used in 2015 and 2016

- **Trigger**

  - **Double b-jet trigger:**

    HLT_j150_bmv2c2077_split_j50_bmv2c2077_split

  - Leading jet
    => pT > 150 GeV
    => Tagged with online 77% OP

  - Subleadng jet
    => jet > 50 GeV
    => Tagged with online 77% OP

- **Kinematic Cuts**

  - **Leading Jet pT > 200 GeV**
  - **Subleading Jet pT > 80 GeV**
    - Derived to be above 99% eff.
    - Slide 16 of this talk
  - **$500 < m_{jj} < 1200$ GeV**
  - $|y^*| < 0.6$

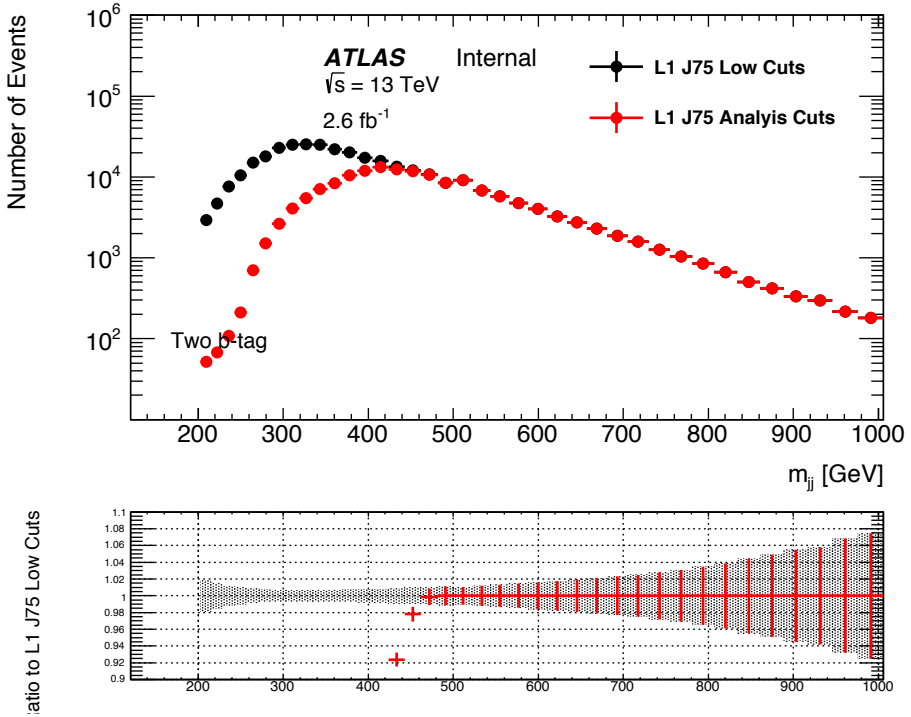
- **b-Tagging**
  - MV2c10
  - Only use two-tag category
  - Using fixed cut 70% for both jets
  - Same OP as used in LHCP

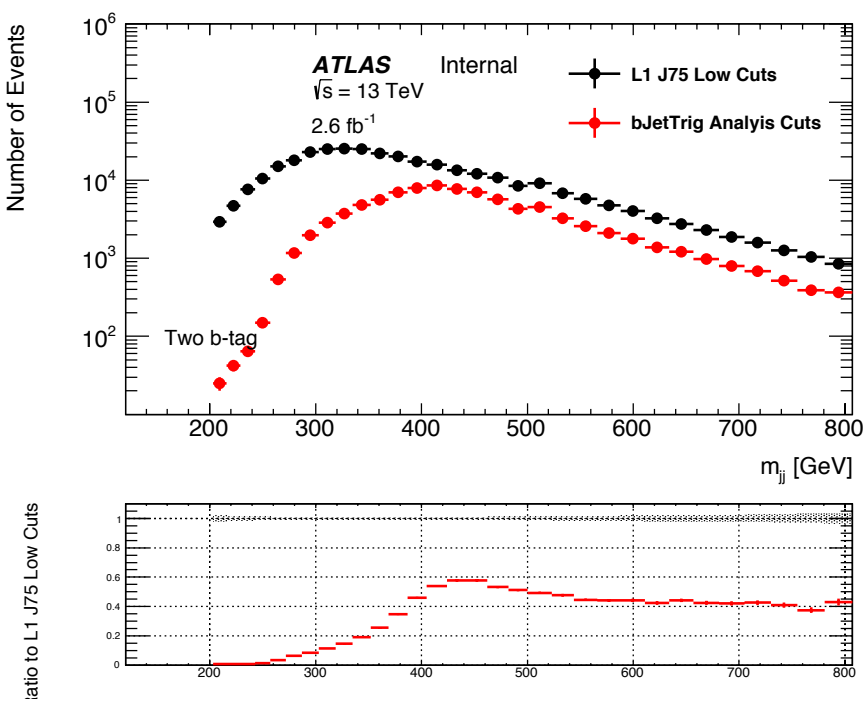
Kinematic Validation Plots

- **Validate Kinematics Cuts in Data**
  - 2016 data, 2.6 fb^{-1}
  - Use L1_J75 to test if fully efficient.

Low cuts = *L P_T > 150 GeV, SL P_T > 50 GeV*

Analysis cuts = *L P_T > 200 GeV, SL P_T > 80 GeV*

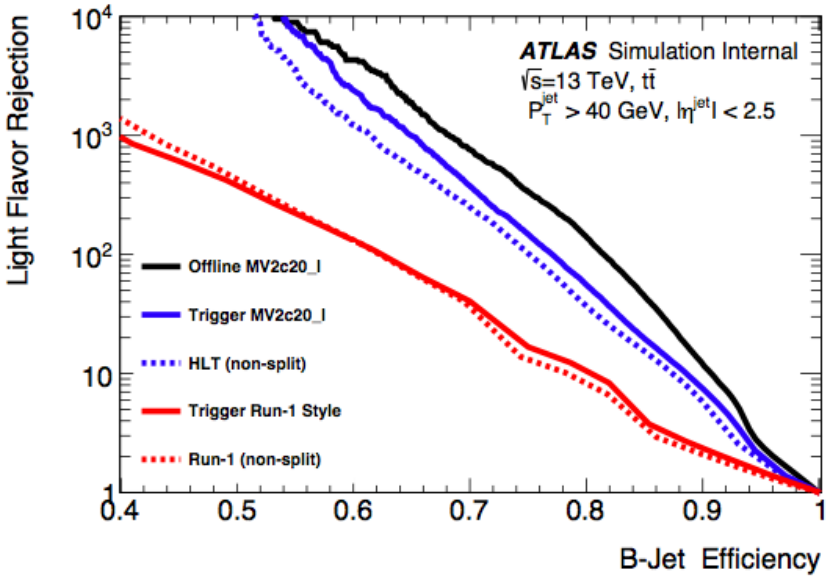


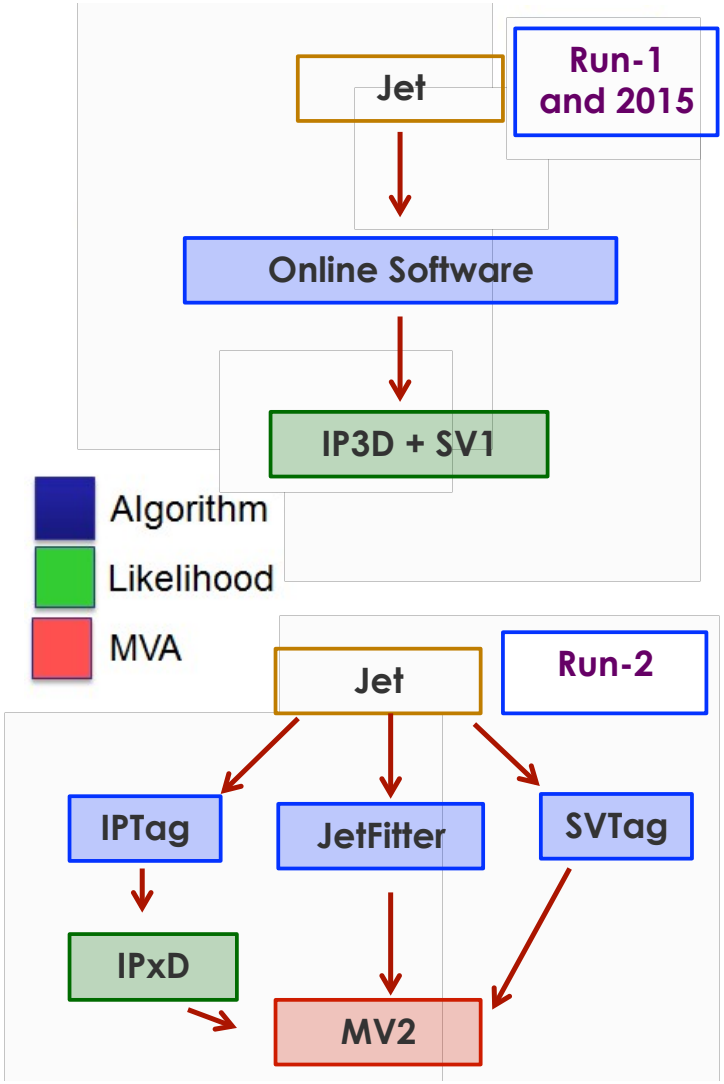


b-Jet Triggers

- **2015 and Run-1**
  - Online specific algorithms
  - **IP3D + SV1** algorithm used online

- **2015 and Run-1**
  - Offline algorithms in online environment
  - **MV2c20** algorithm run online
    - More consistent with offline
  - **Split configuration**
    - New approach improves tracking perf.





➡ **C. Varni Talk: See here**

b-Jet Triggers Systematics

- **Efficiencies and Systematics**
  - Follow same strategy as 2015 data as done for LHCP, see here
  - This strategy approved for LCHP in b-trigger group, exotics and ATLAS circ.

- **Efficiencies**

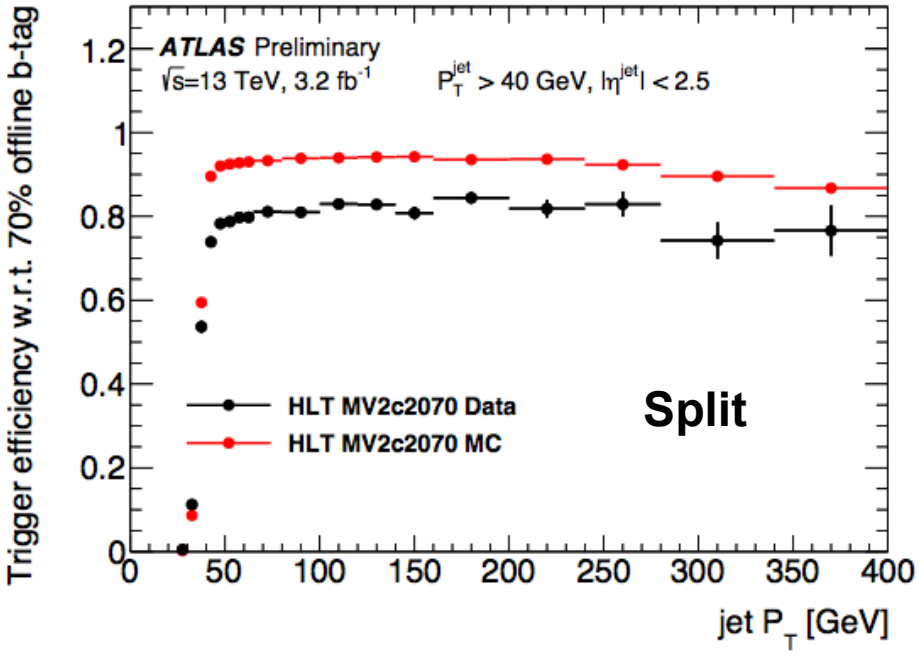
$$\text{b-Jet Trig Eff. wrt offline} = \frac{\text{\# b-Jets pass offline and online b-tagging}}{\text{\# b-Jets offline b-tagging}}$$

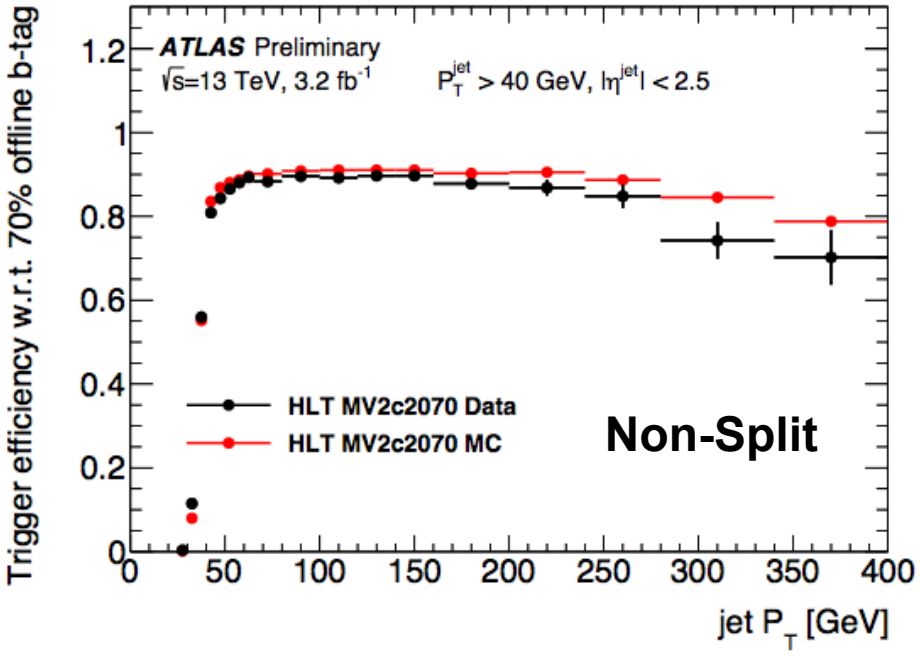
  - Use dilepton ttbar sample in b-jets.
  - Derive efficiencies from here in both Data and MC
  - Use Data extrapolation using when data stats are limited (jet $p_T > 120$ GeV)

- **Systematics**
  - Data and MC stats.
  - Data Extrapolation
  - Non b-jet Impurities in sample
  - Mismodelling of initial flavour fraction in MC
  - Mismodelling of non-b jet rejection by trigger in MC

b-Jet Triggers Efficiencies

$$\text{b-Jet Trig Eff. wrt offline} = \frac{\text{\# b-Jets pass offline and online b-tagging}}{\text{\# b-Jets offline b-tagging}}$$





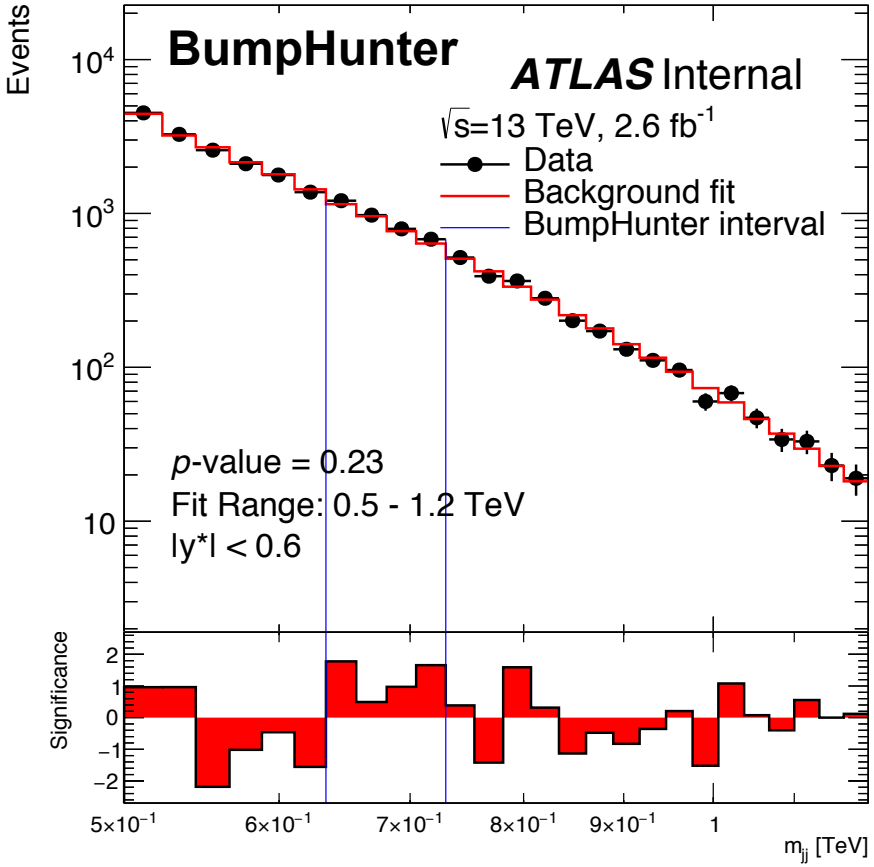
Difference possibly due to difference in vertexing performance

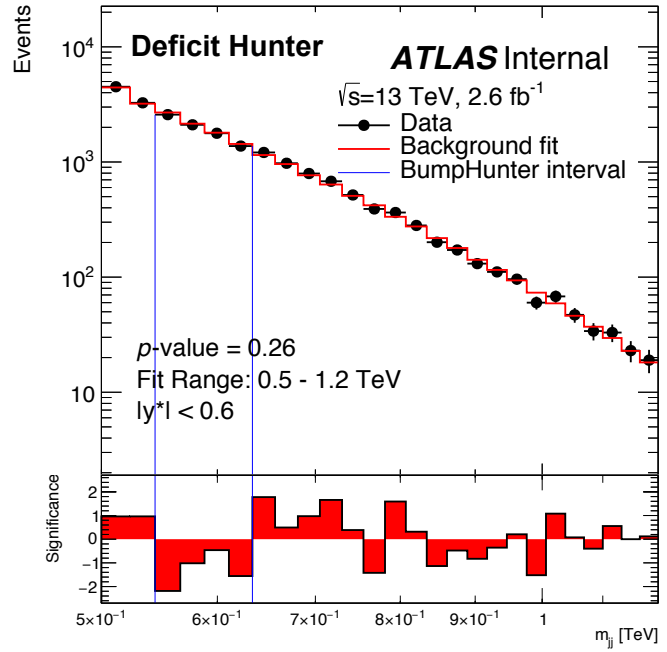
‘WORK IN PROGRESS’

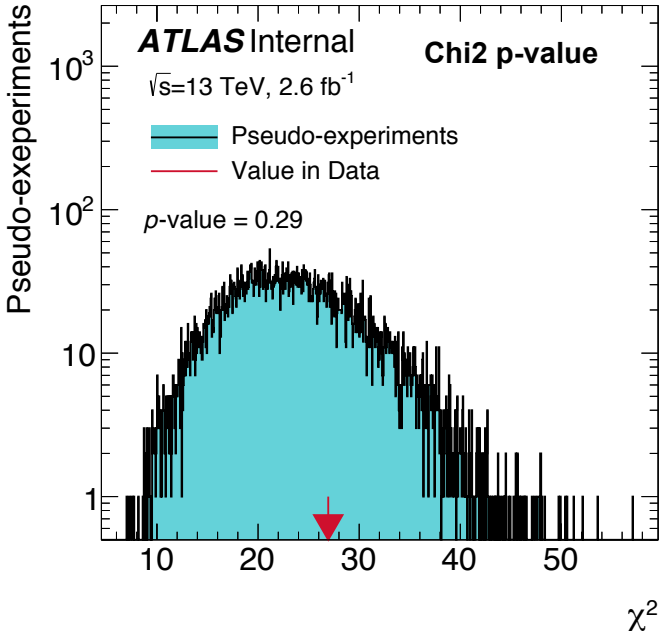
- bTrigger convenor

Fit to data - 2.6 fb^{-1}

- Using 3 parameter fit function
  - *Can change according to Wilks' procedure run on full data-set.*
- Carry out bump hunter procedure
- Also run on deficit hunter *(Allow deficit or bump)*
- Also look at Chi2 p-value



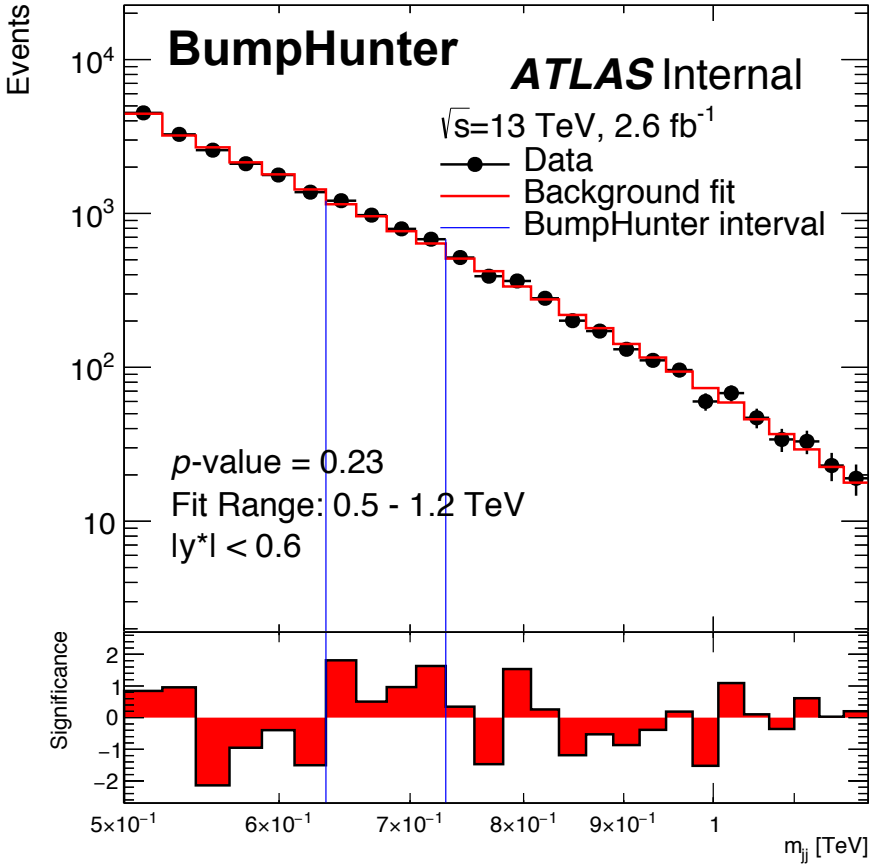


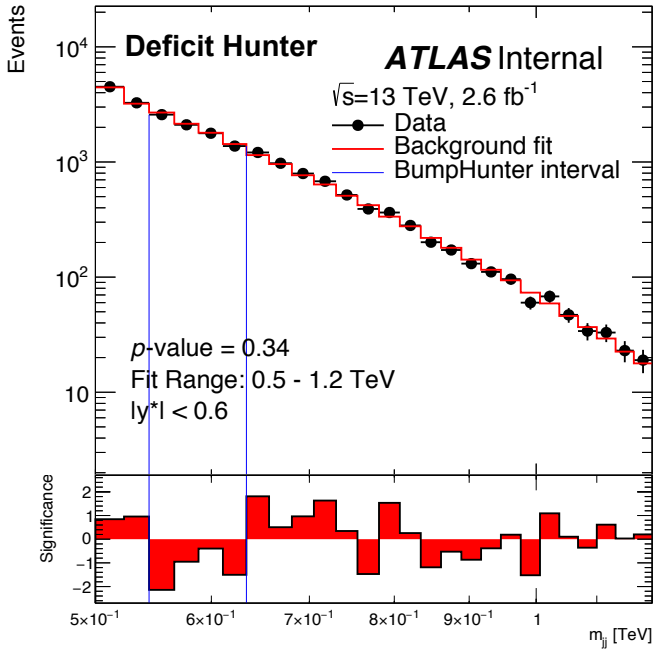


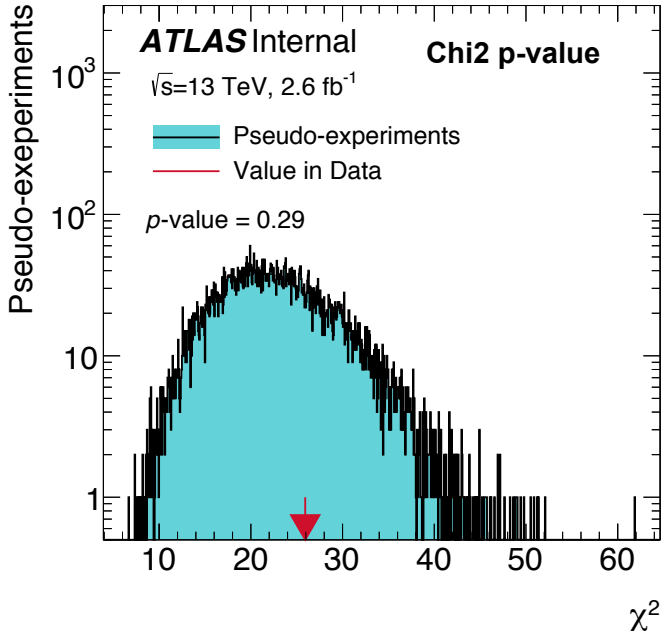
First Fits - 4 Parameter

Fit to data - 2.6 fb^{-1}

- Using 4 parameter fit function
  - *Can change according to Wilks' procedure run on full data-set.*
- Carry out bump hunter procedure
- Also run on deficit hunter *(Allow deficit or bump)*
- Also look at Chi2 p-value







10 Conclusions

- **We can add low mass channel for ICHEP**
  - The double bjet trigger exists
  - Framework is in place from LHCP
- **Things are starting to come together.**
  - Derived kinematics cuts
  - First look at data (fits + kinematic study)
  - b-jet triggers are being studied, we have framework for this.

To Do

- **MC studies**
  - Don't have MC yet
  - Running on Grid currently
  - Data/MC comparisons
- **Cut flows** - Produce for the data
- **Fit study tests**
  - Can use pre-tag data as CR again
- **b-Jet Trigger Eff.** - We have a strategy here
- **Signal Points**
  - Do we have Z' signal points
  - Cut flows and efficiencies
  - Prepare for limit setting

What are analysis team's views?

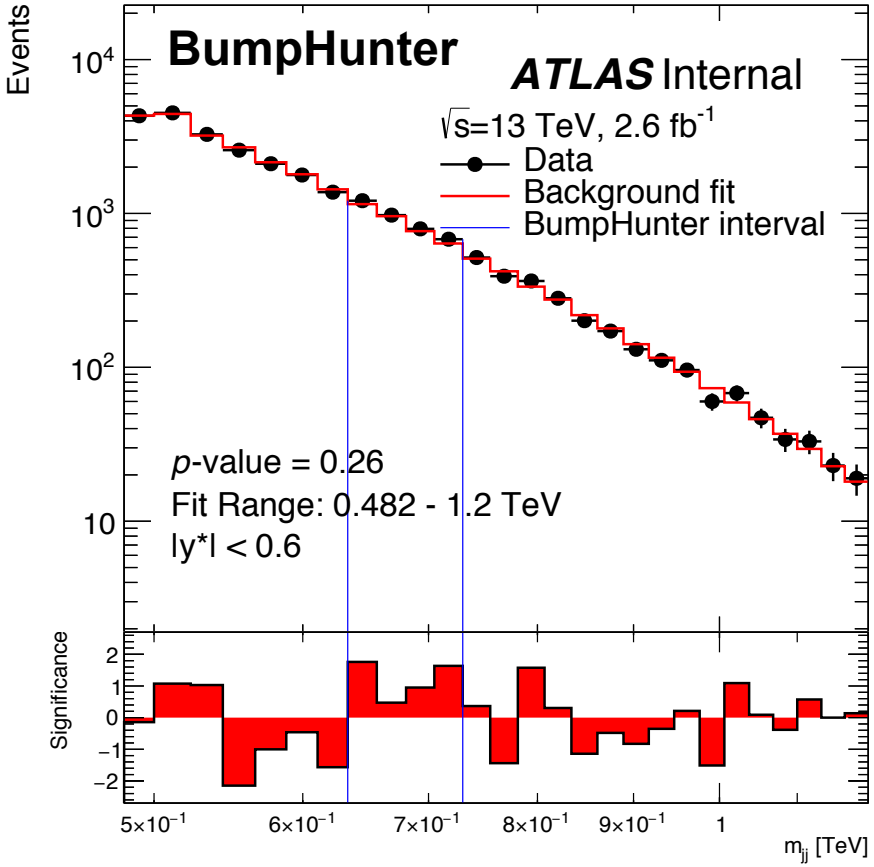
What is the timescale?

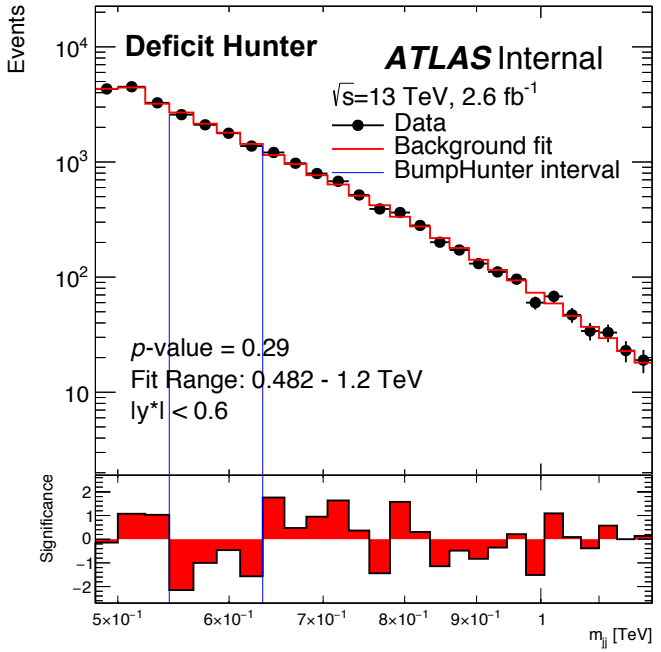
Backup

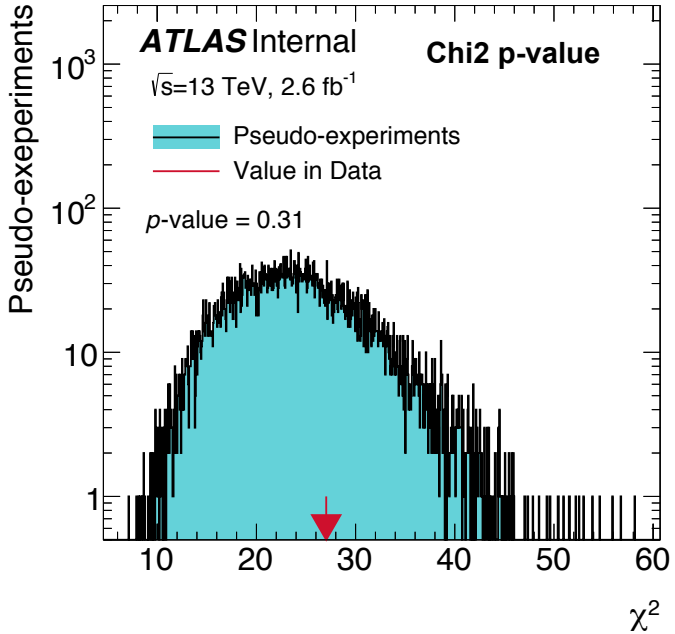
Fit to data - 2.6 fb^{-1}

- Using 3 parameter fit function

Range 480 - 1200



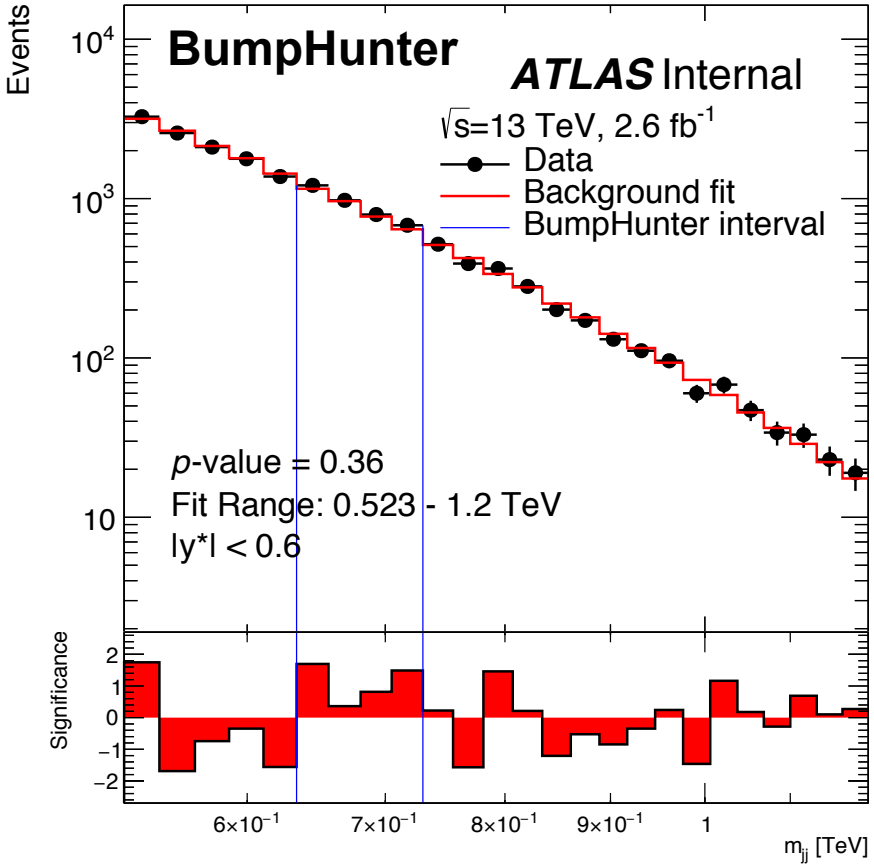


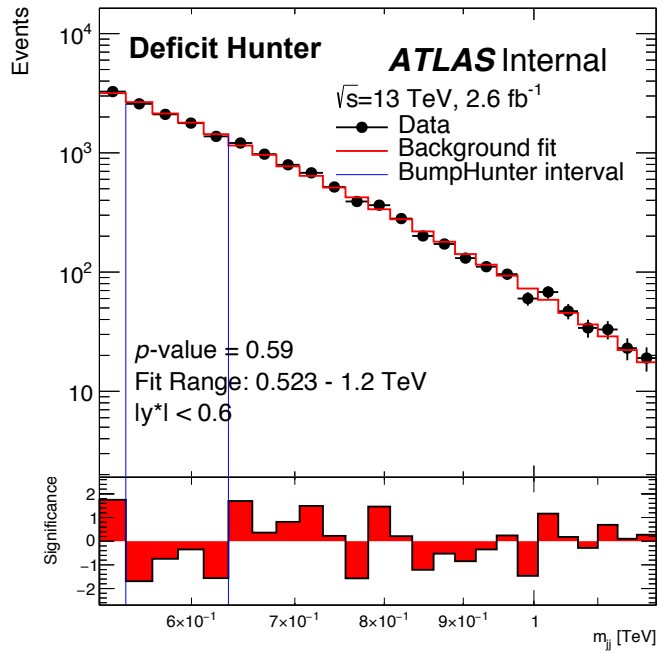


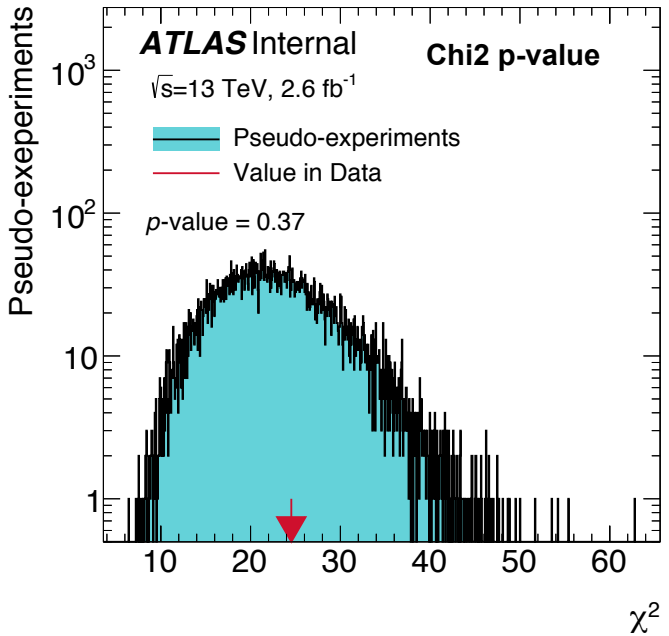
Fit to data - 2.6 fb^{-1}

- Using 3 parameter fit function

Range 520 - 1200







Fit to data - 2.6 fb^{-1}

- Using 3 parameter fit function

Range 500 - 1400