UCL

Flavour Composition and Spurious Signal

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Di-bjet (non)-Meet

03 May 2016

Plan: Study Just Data with Trigger Only

- Hopefully this show that online tagging is a smooth procedure
- We have shown in MC that offline tagging is smooth (see slide 9+)
- If online is smooth and offline is smooth => (online + offline) will be smooth

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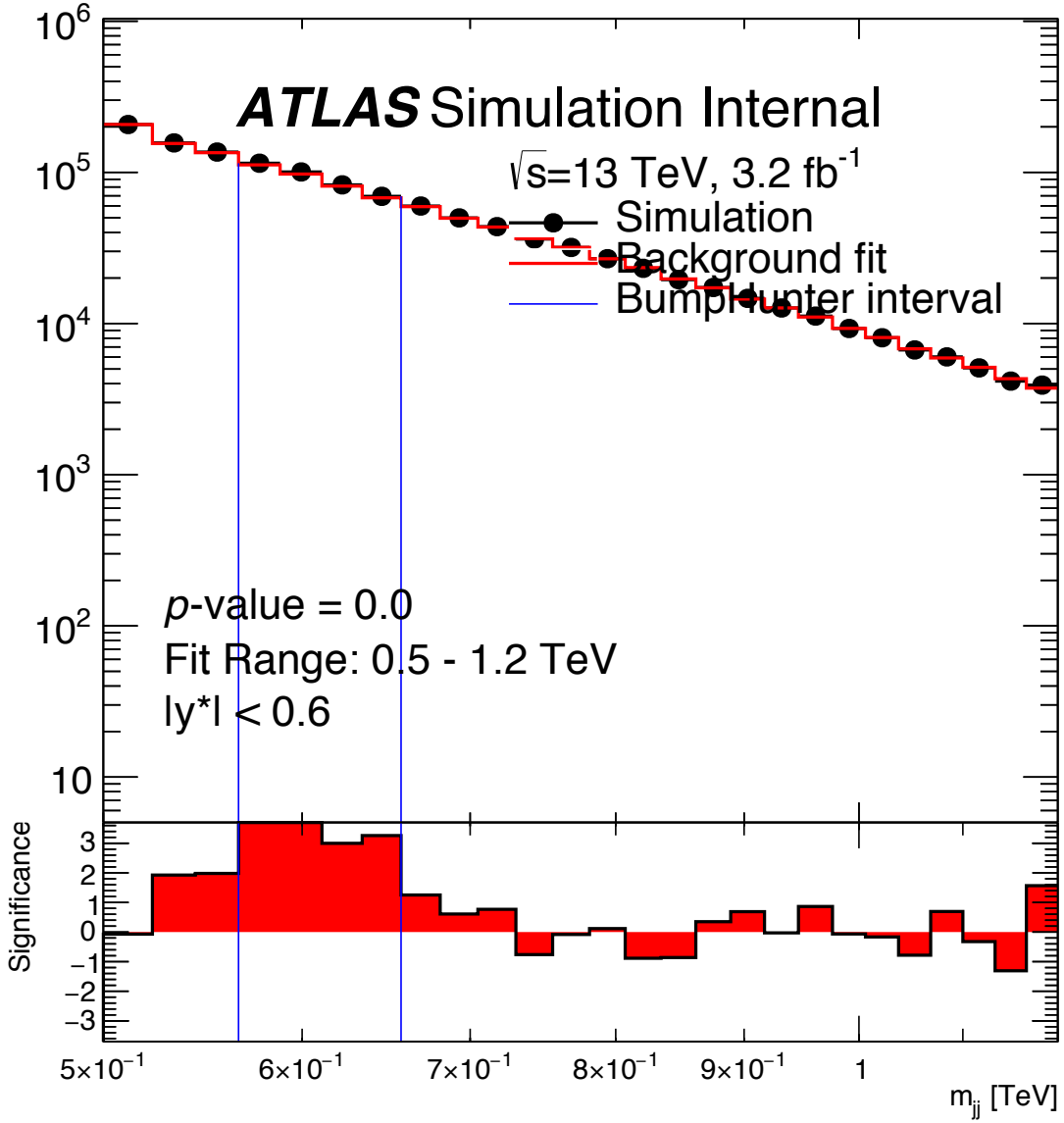
Event Selection

- **Full data set**
- **b-Jet Trigger**
  - *HLT_j175_bmedium_j60_bmedium*

- No offline tagging
- Leading jet p_T > 200 GeV, $|\eta|$ < 2.5
- Subleading jet p_T > 80 GeV, $|\eta|$ < 2.5
- $|y^*|$ < 0.6
- 500 < m_{jj} < 1200 GeV

Fitting to HLT distribution

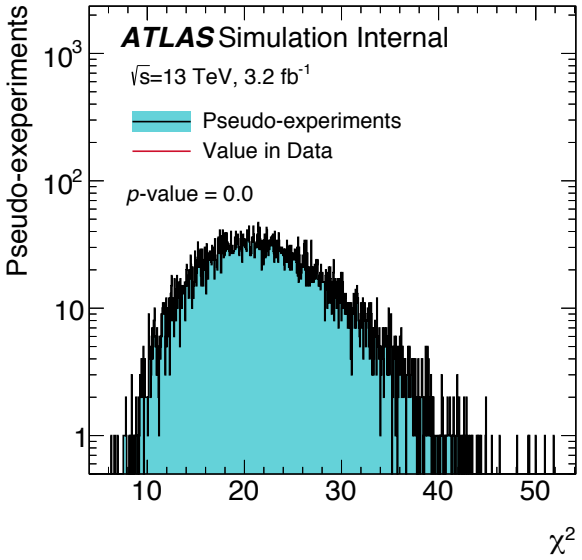


Data:
HLT_j175_bmedium_j60_bmedium
No offline tagging

3 Para Fit Function
Fit Range: 500-1200

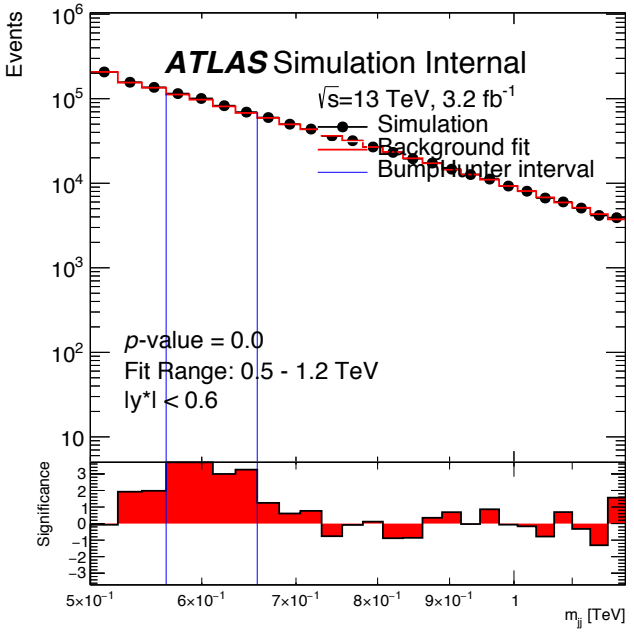
bH Range = 566-677 GeV
bH p-value = 0.0005

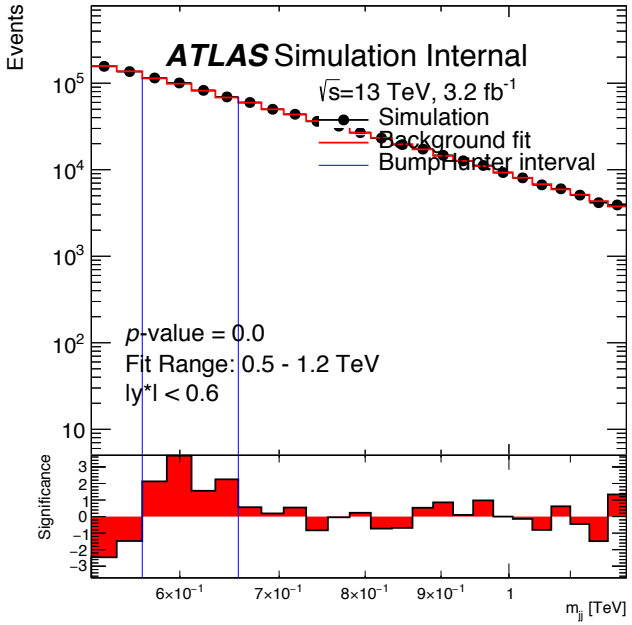
After window removal
bH p-value = 0.6389

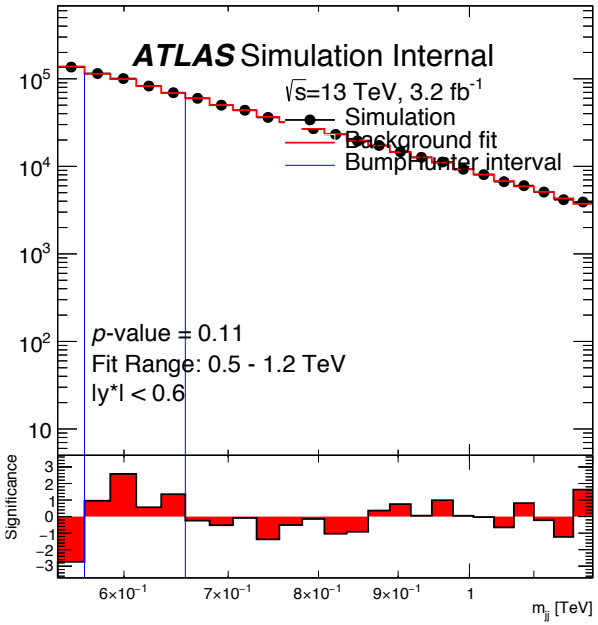


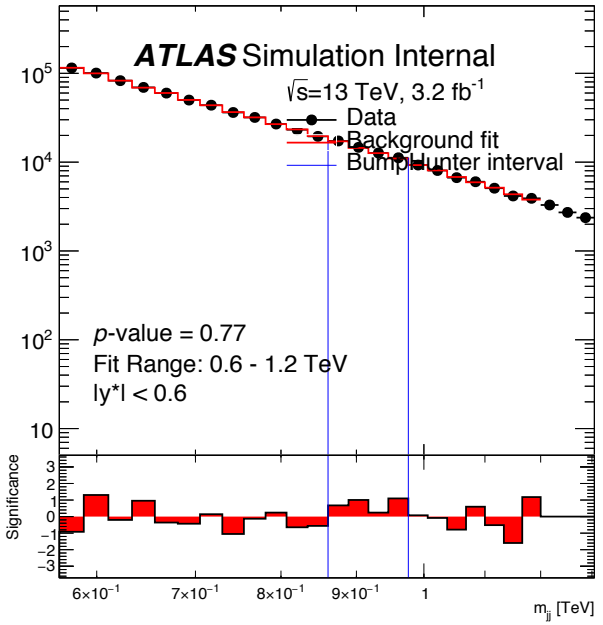
Changing the Fit Range

Bottom Bin Of Fit Range		500
523	544	566

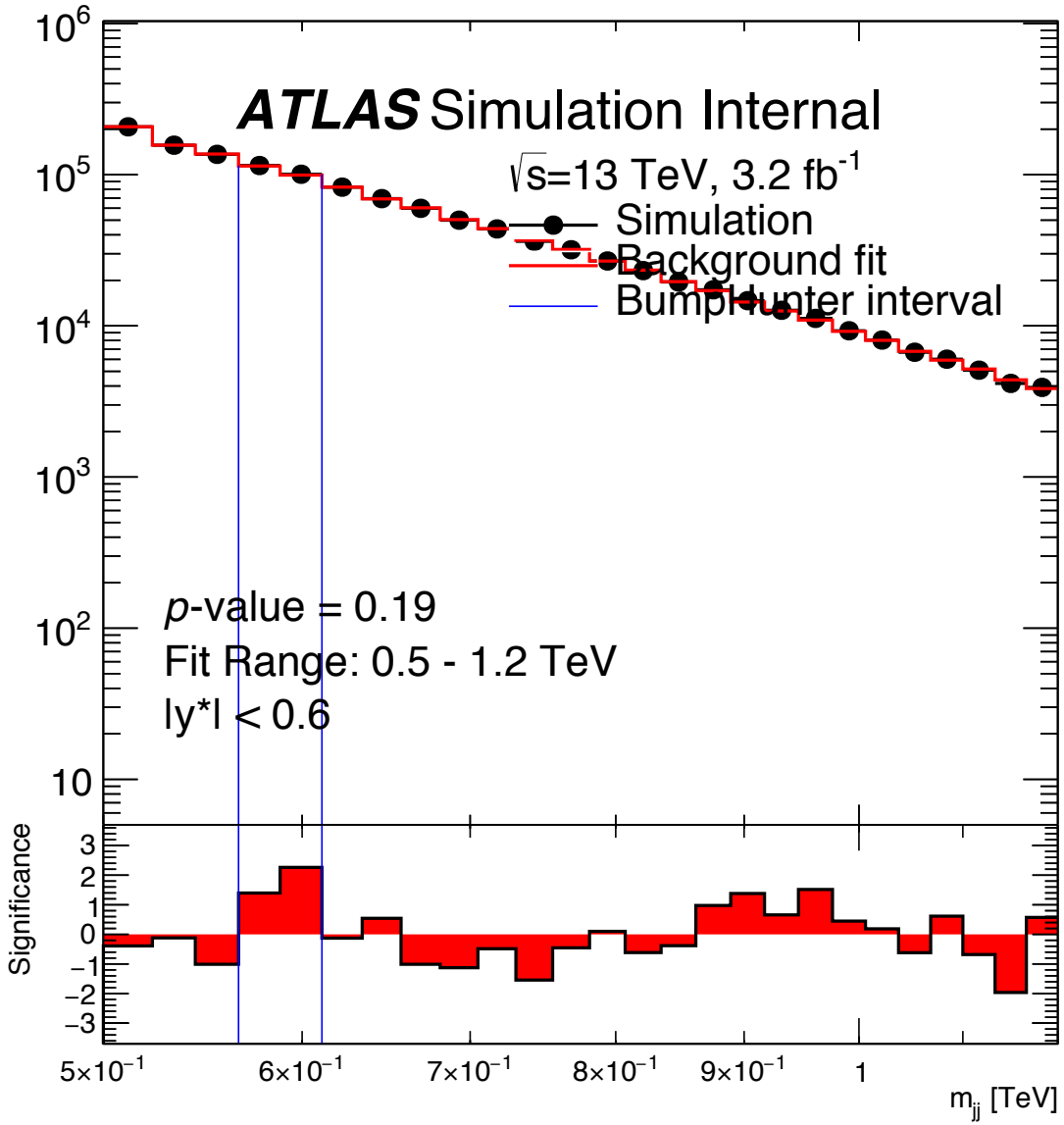








Fitting to HLT distribution - 4 Para Fit Function



Data:

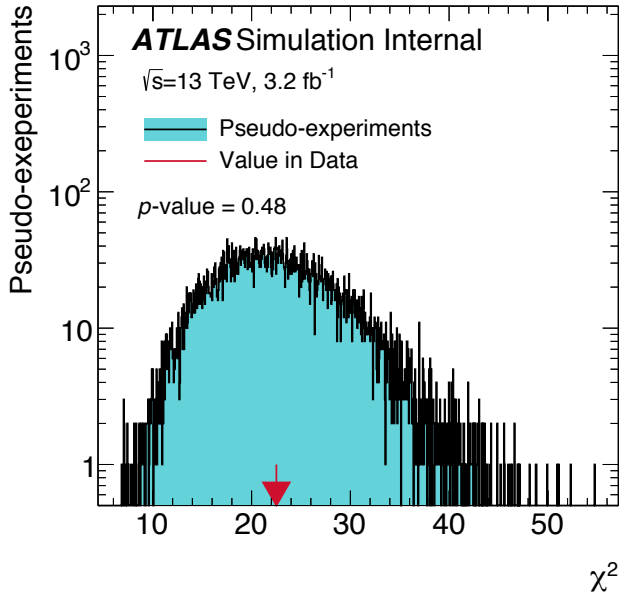
HLT_j175_bmedium_j60_bmedium

No offline tagging

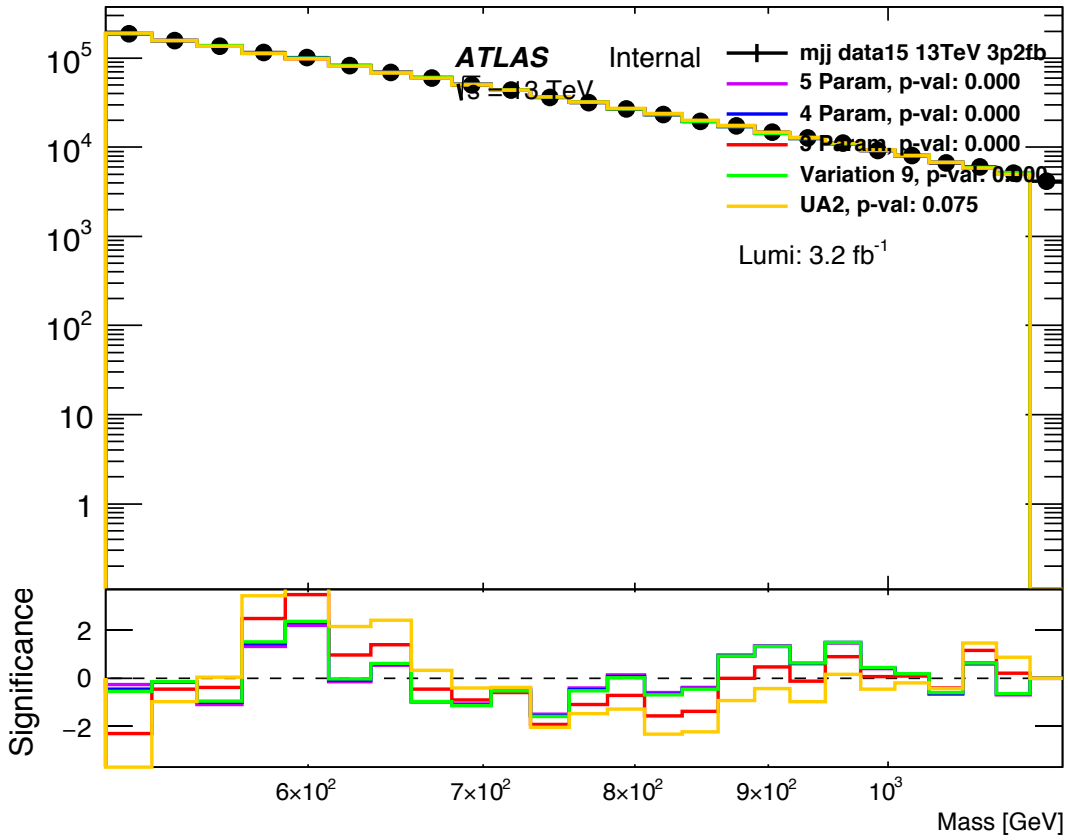
4 Para Fit Function

Fit Range: 500-1200

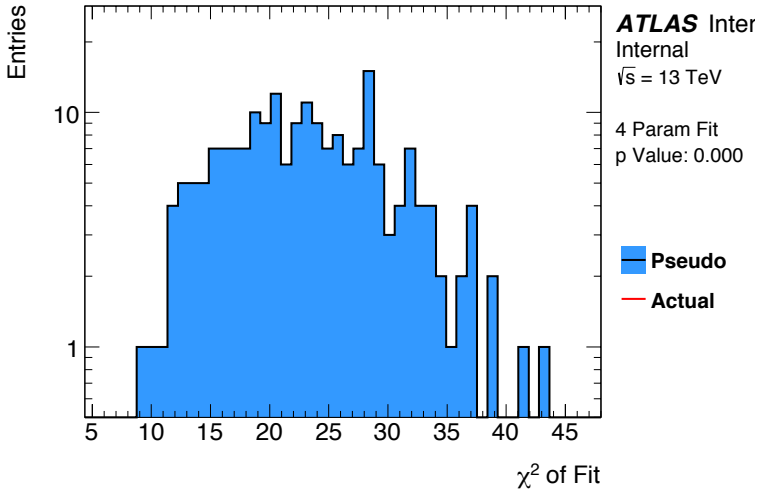
```
*** final values
*** BH p-value = 0.1876 +/- 0.00390392
*** BH value = 5.27154
*** BH range = 566 - 611
```



Other Fit Functions - Take 1



This was wrong fit range:
- Bottom bin should be changed to 500 GeV
- Didn't pick up last two bins

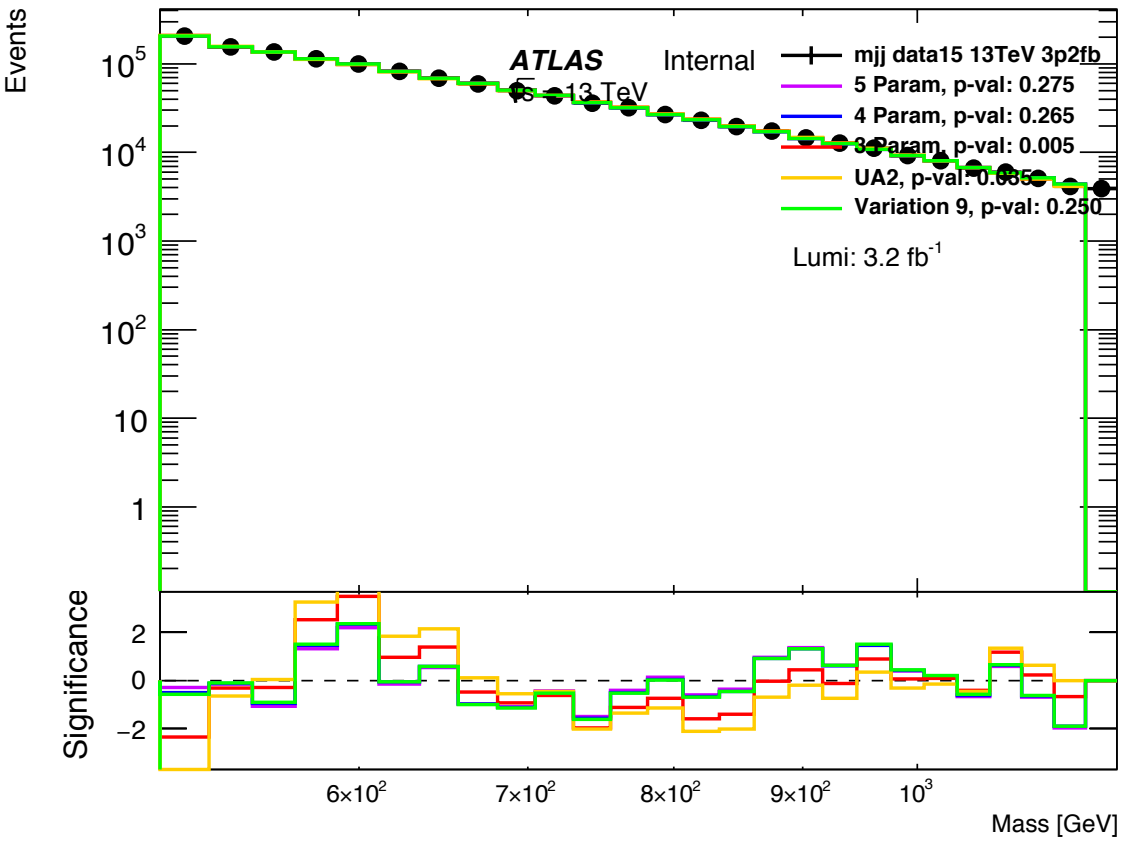


Standard Dijet (3,4,5): $f(x) = p_0(1-x)^{p_1}x^{p_2+p_3 ln(x)+p_5 ln(x)^2}$

Variation 9: $f_{new9}(x) = p_0(1-x)^{p_1+p_2\log(x)}x^{p_3+p_4\log(x)}$

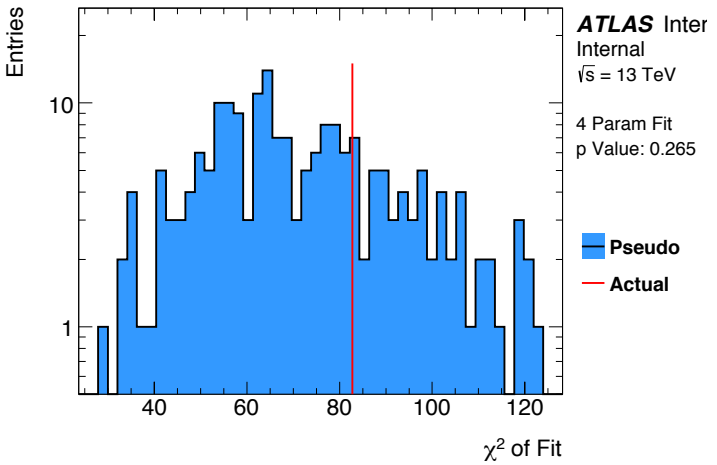
UA2: $f_{\mathrm{UA2}}(x) = p_0\, x^{p_1}\, e^{-p_2 x-p_3 x^2}$

Other Fit Functions - Take 2



Better fit range!

Better fits
=> except for 3 P and UA2



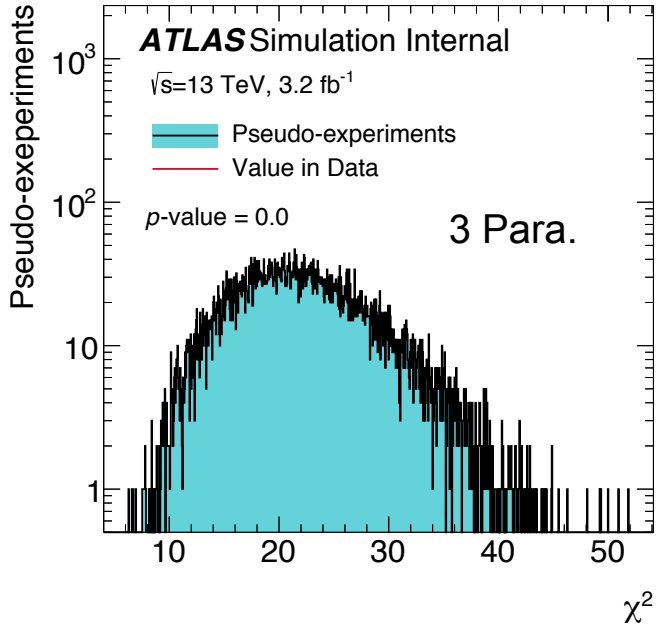
Standard Dijet (3,4,5): $f(x) = p_0(1-x)^{p_1}x^{p_2+p_3 ln(x)+p_5 ln(x)^2}$

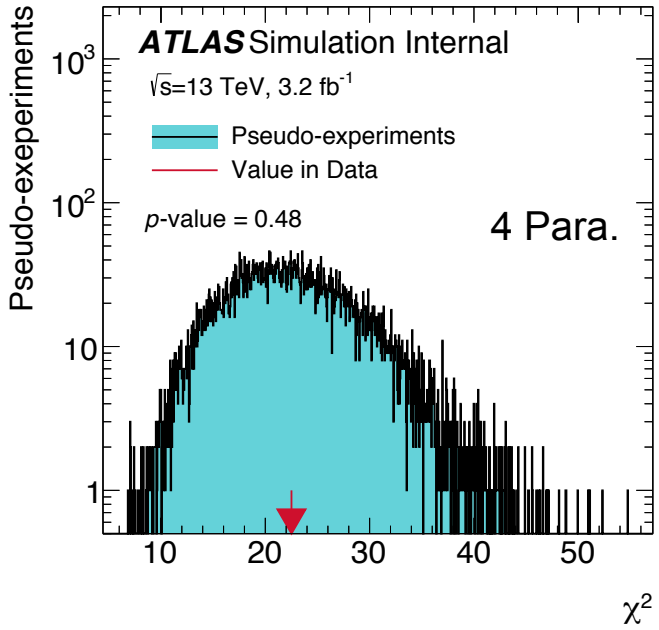
Variation 9: $f_{new9}(x) = p_0(1-x)^{p_1+p_2\log(x)}x^{p_3+p_4\log(x)}$

UA2: $f_{\mathrm{UA2}}(x) = p_0\, x^{p_1}\, e^{-p_2 x-p_3 x^2}$

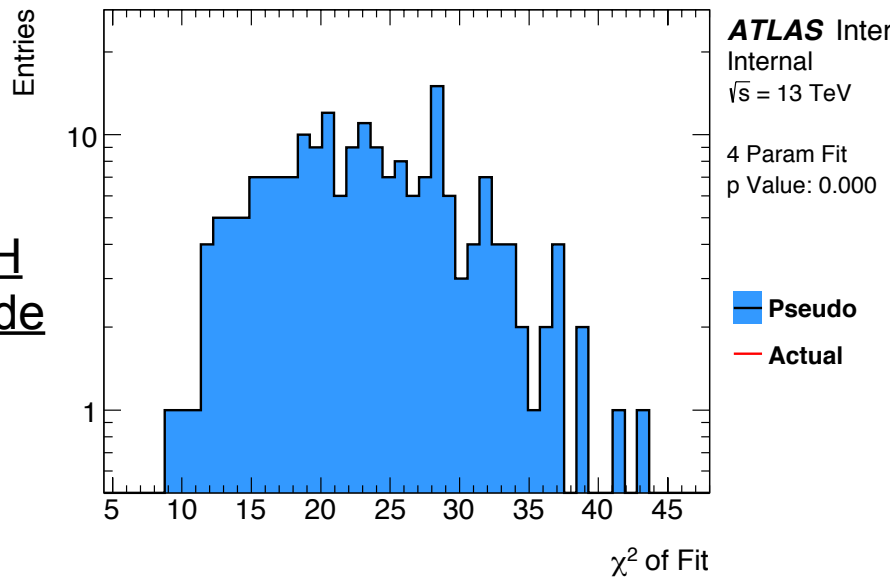
Chi2 Plots

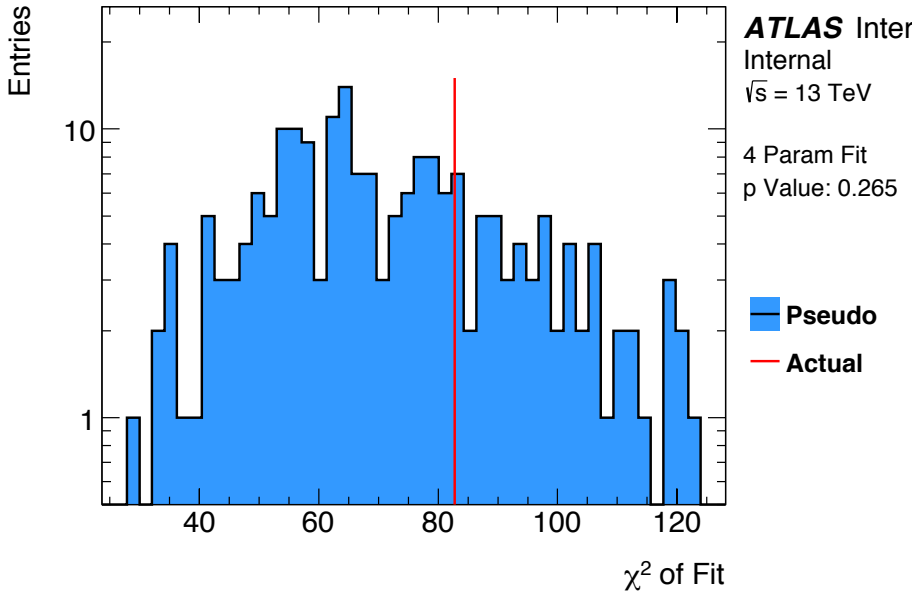
Stat Code





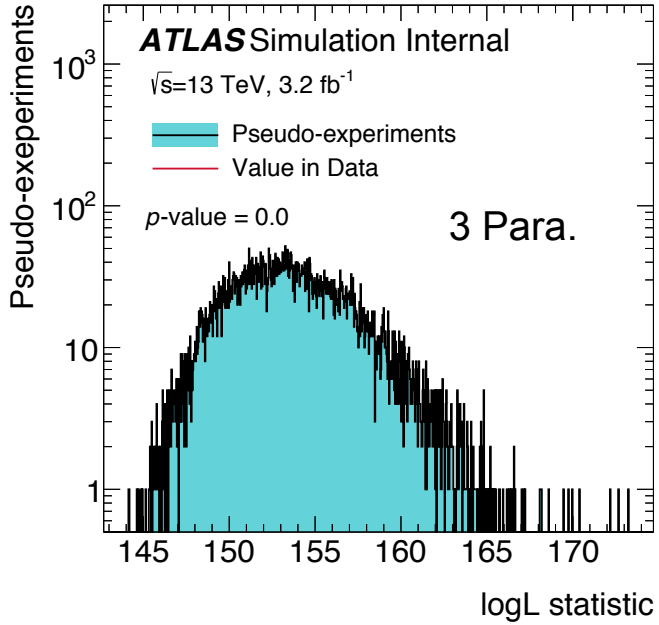
DH Code

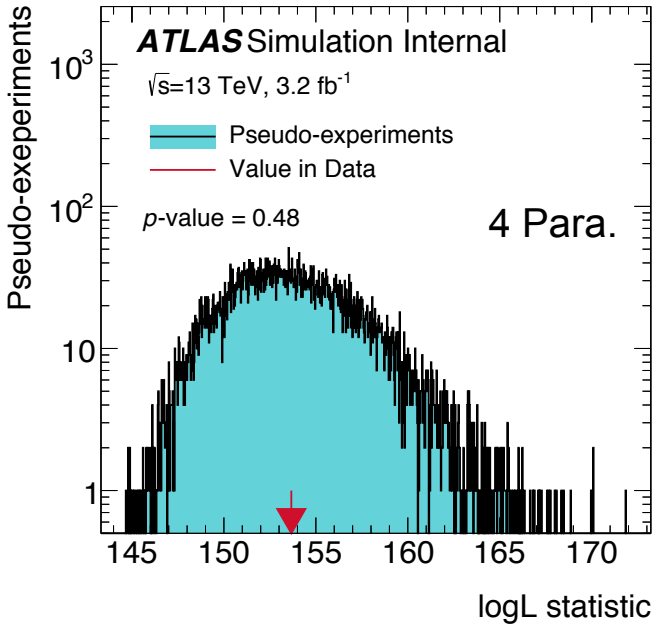




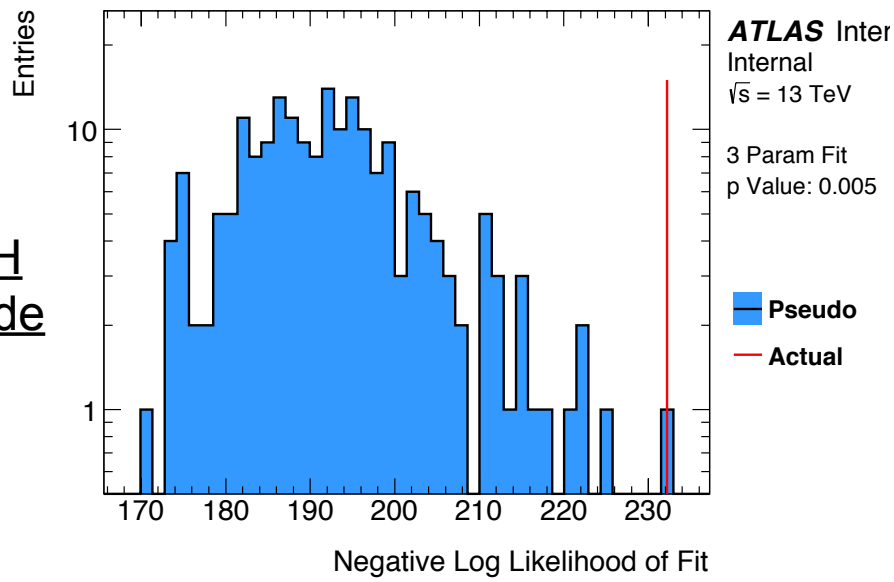
Chi2 Plots

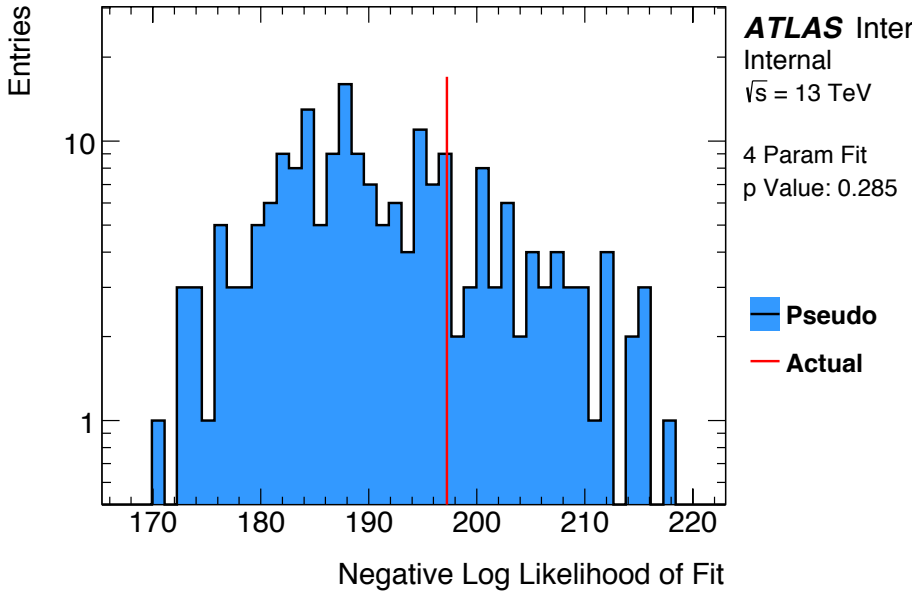
Stat Code





DH Code





Last time:
- Studied flavour composition of offline b-tagging only - *(slide 3)*
- Performed some spurious signal checks - *(slide 4)*

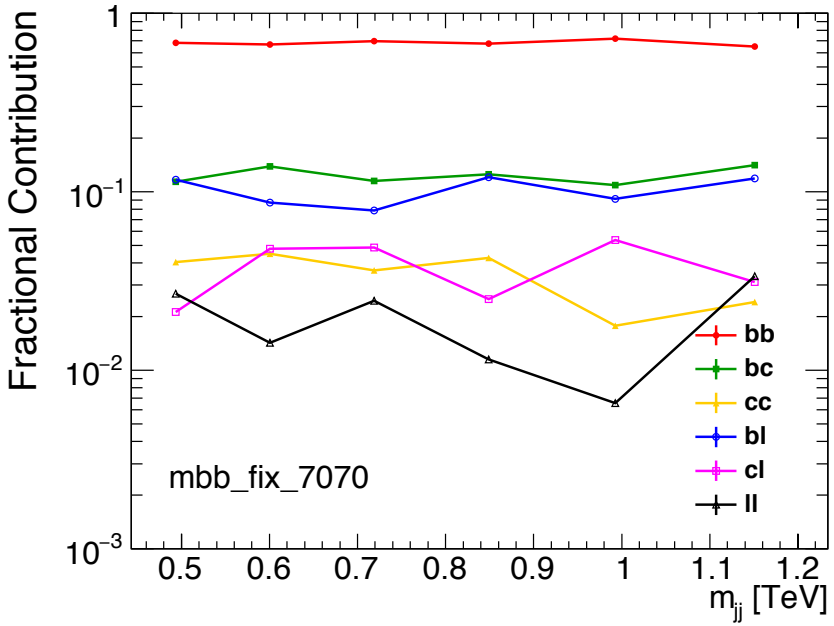
Problems:
- For flavour composition, not considered effect of online b-tagging on c/l-jets
- For spurious signal, effective entries are smaller than scaled distribution
  - Hence, MC errors > poisson errors.
  - *(slide 5)*

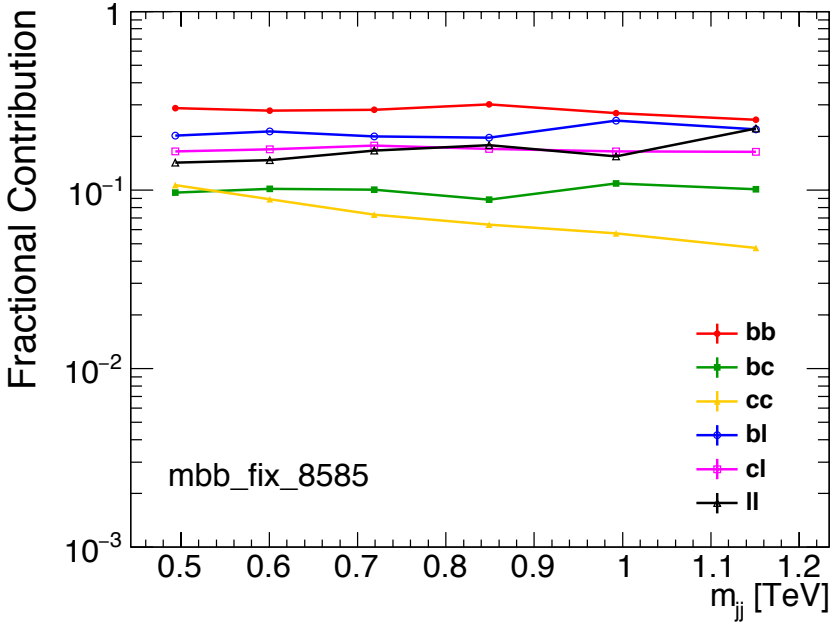
Event Selection

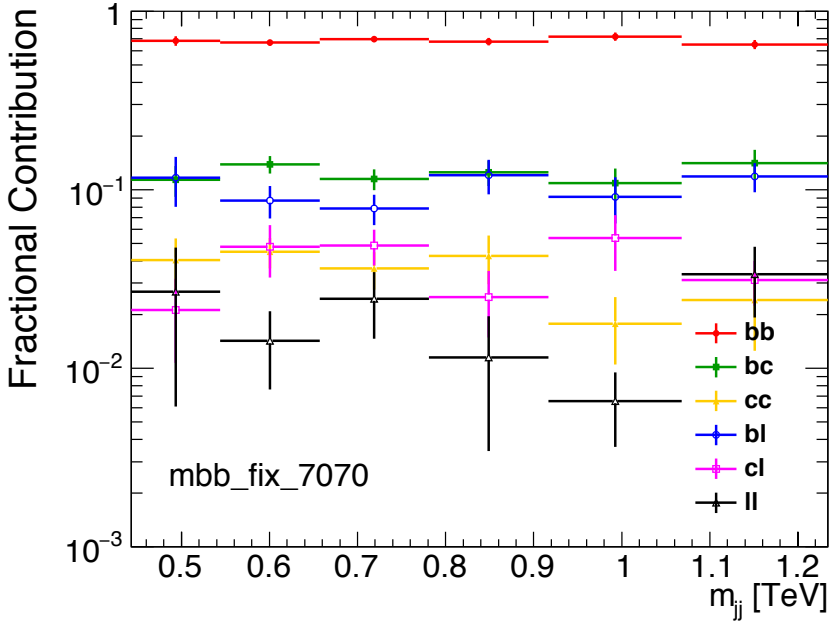
- **No Trigger**
- **Trigger Eff. Applied**
  - *HLT_j175_bmedium_j60_bmedium*
  - Emulate trigger using bTrig Effs.
  - Histograms from John
  - Same Landau Fits as Karol

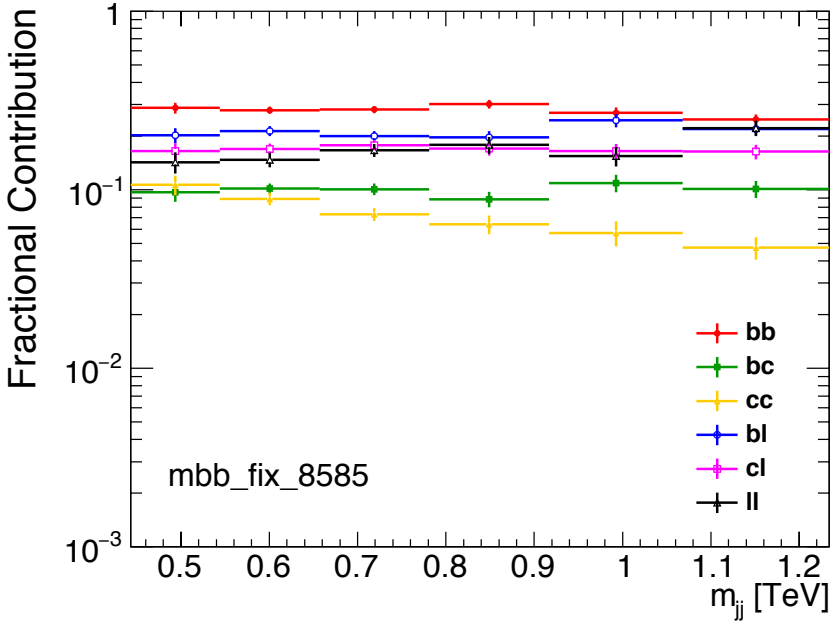
- 70% Eff. WP
- Leading jet p_T > 200 GeV, $|\eta|$ < 2.5
- Subleading jet p_T > 80 GeV, $|\eta|$ < 2.5
- $|y^*|$ < 0.6
- 500 < m_{jj} < 1200 GeV

Flavour Composition 750 GeV - no Trigger

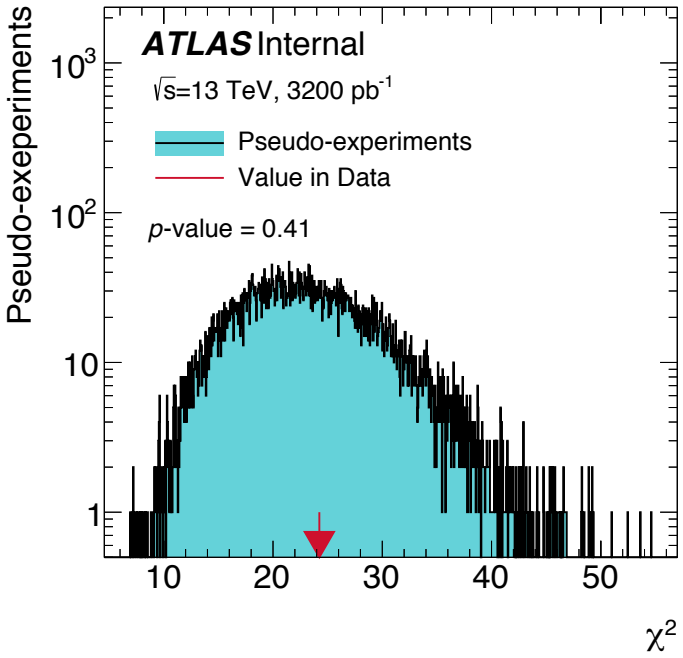


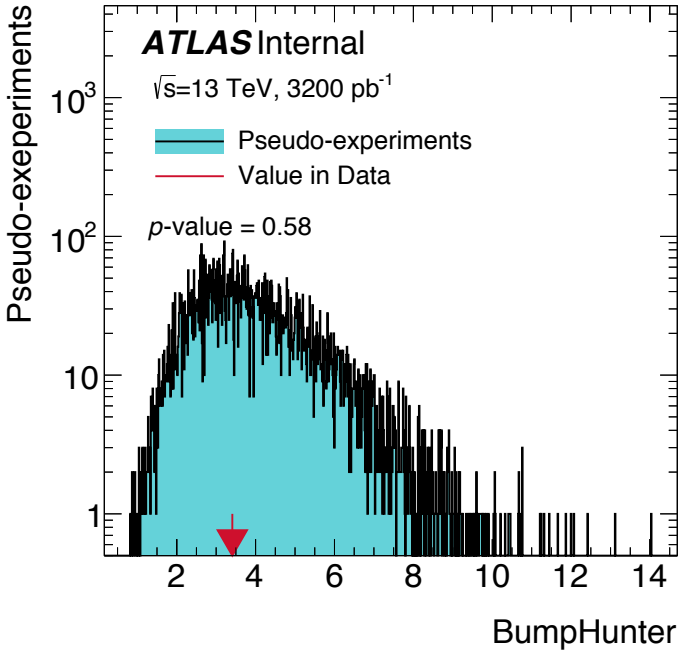




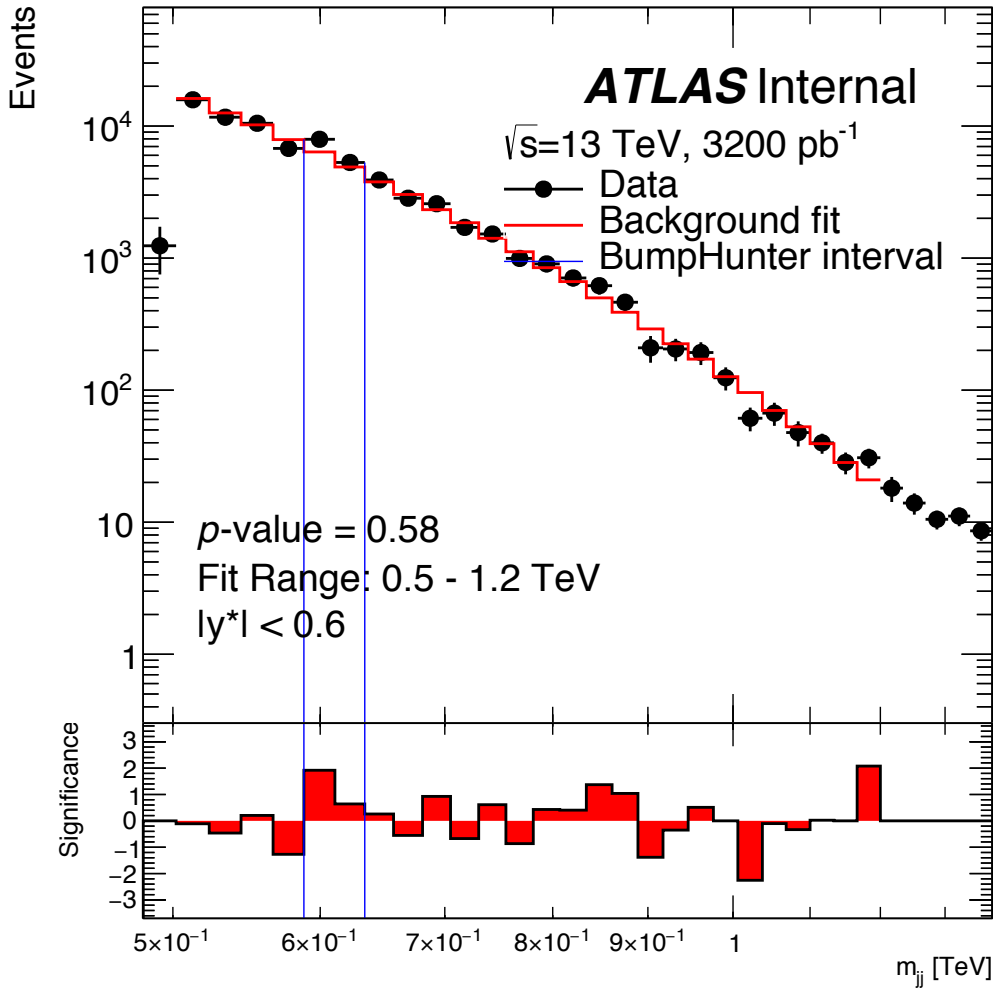


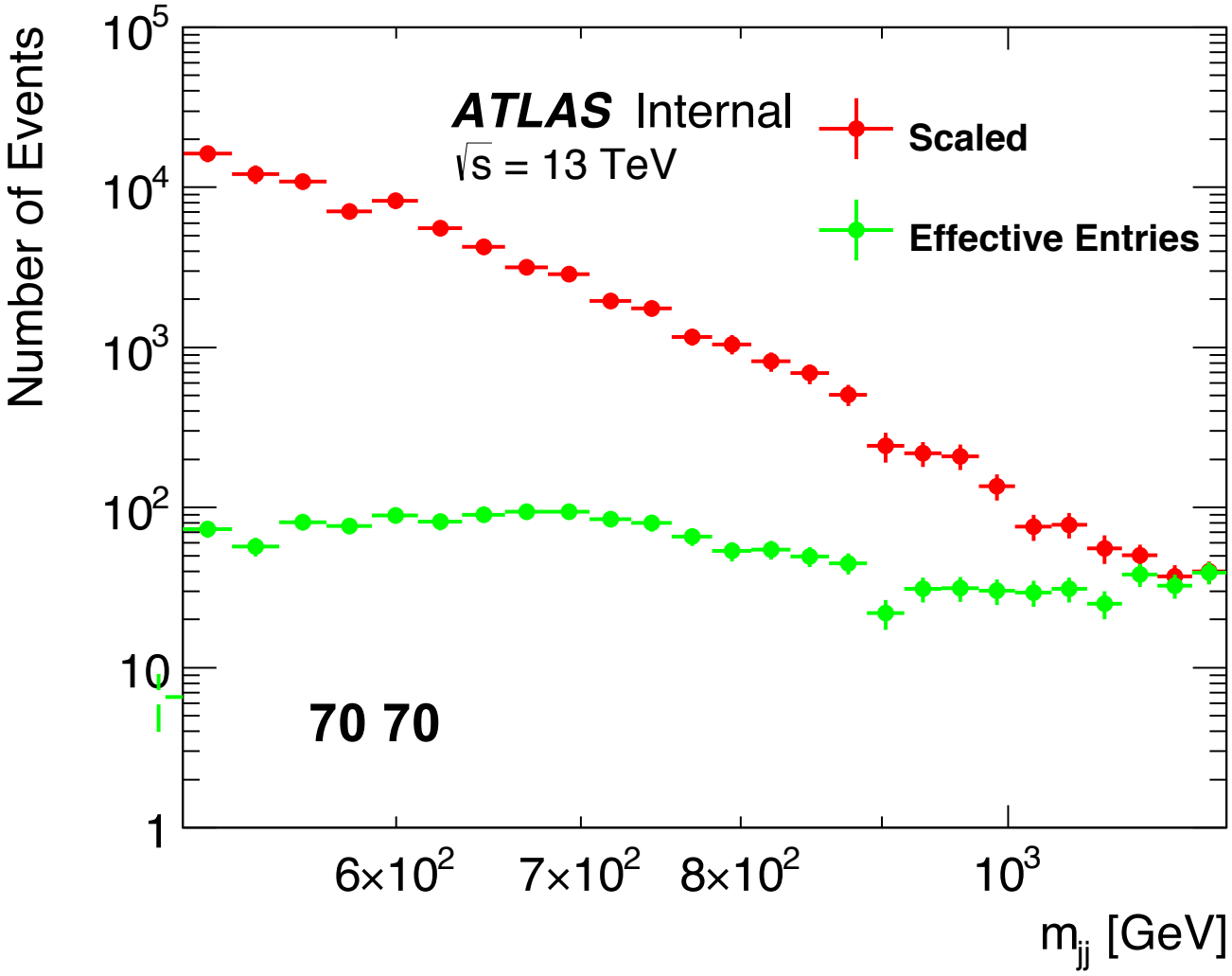
Spurious Signal Check





- **Trigger Eff. Applied - Emulate Trigger - Smooth Landau fit function**
- **70% Eff. Point**





Scaled > Effective Entries

Thus, MC drives errors

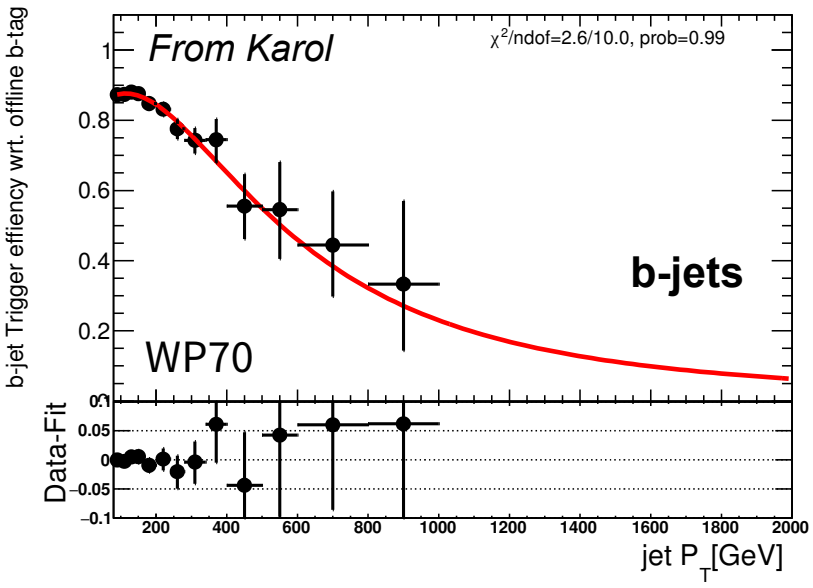
Emulating Online Tagging Efficiency

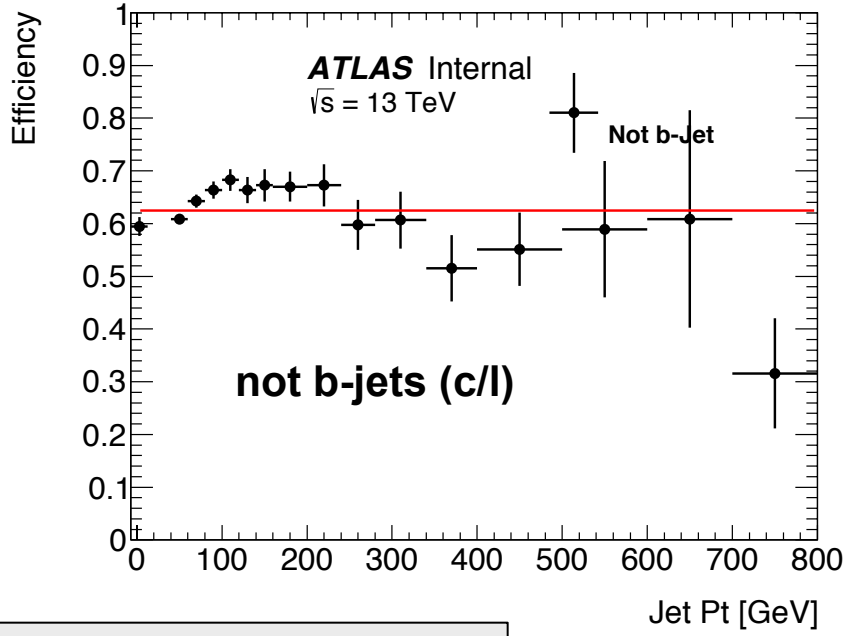
Problem 1:

- For flavour composition, not considered effect of online b-tagging on c/l-jets

We will try:

- Non truth b-jet trigger efficiency measured in fully leptonic ttbar sample
  - These are likely to be gluons
- We can fit to this and use this to estimate non-b-jet online efficiency
- For first iteration fit with flat line





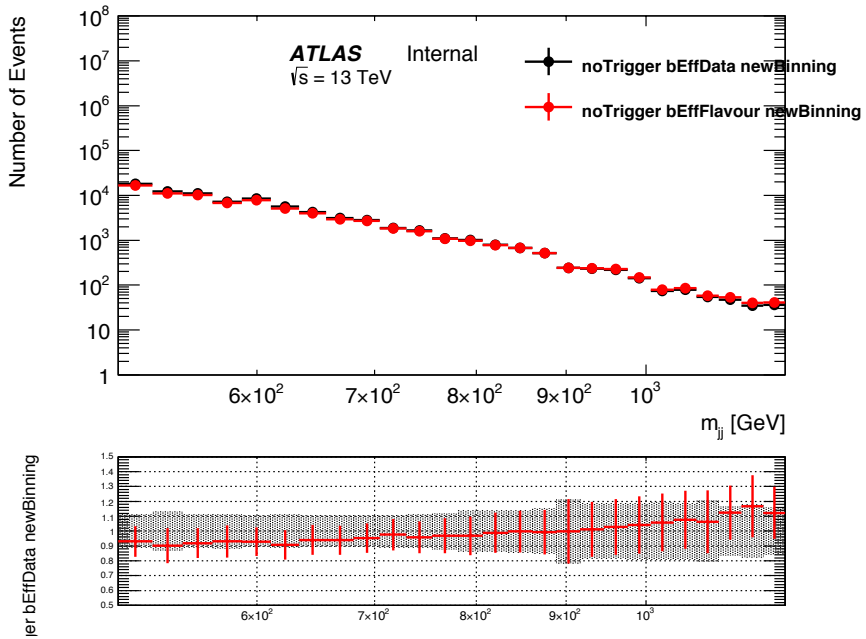
X-Jet Trig Eff. wrt offline = $\frac{\text{\# X-Jets pass offline and online b-tagging}}{\text{\# X-Jets online b-tagging}}$

Flavour Dependant Trigger Eff.

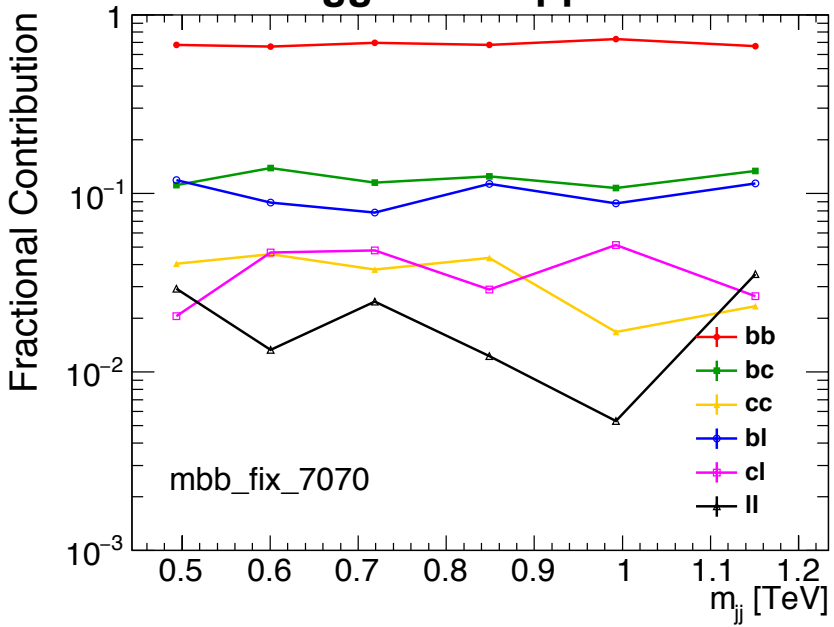
b-Jet Trigger Eff. Applied
- b-jet trigger efficiency applied to all jets
- As was done before

Flavour Dependant Trigger Eff.
- b-jet trigger eff. applied to b-jets
- Not b-jet trigger eff. applied to not b-jets

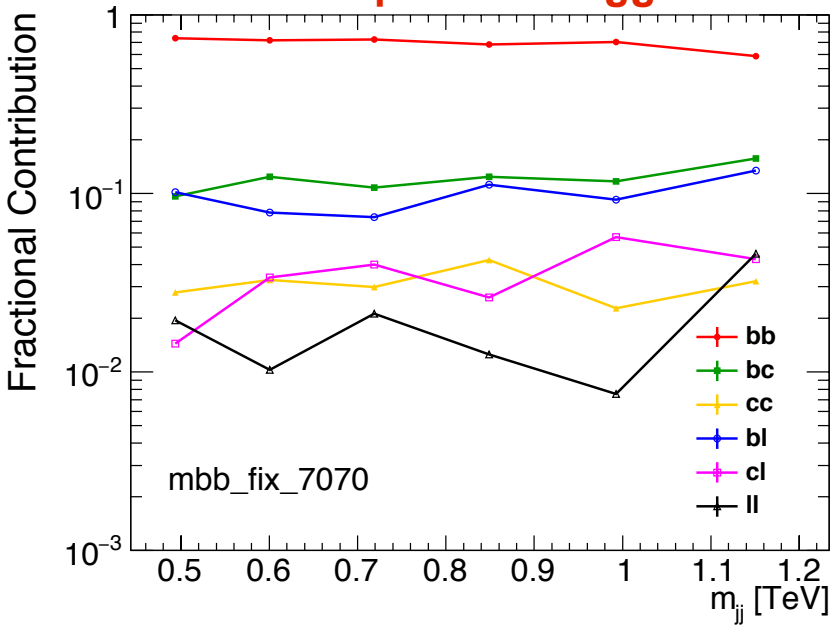
Doesn't really change too much!
- Still smooth



b-Jet Trigger Eff. Applied



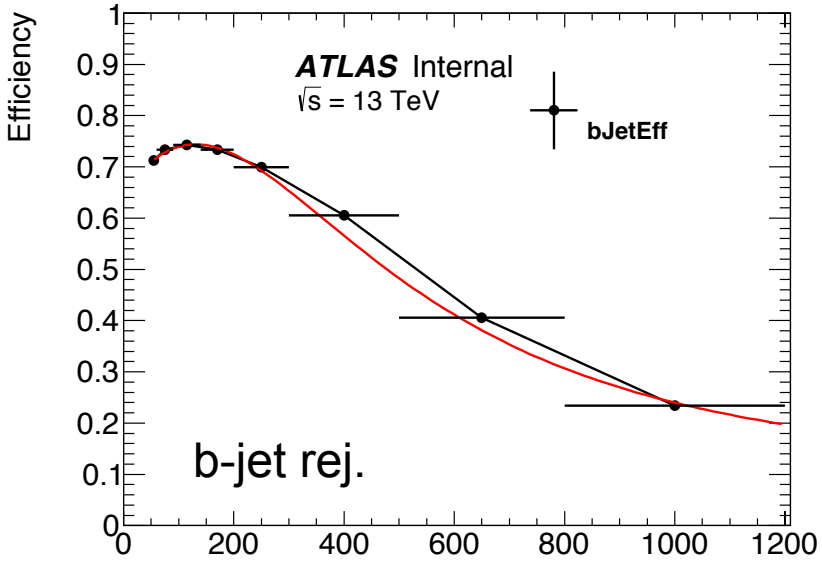
Flavour Dependant Trigger Eff.

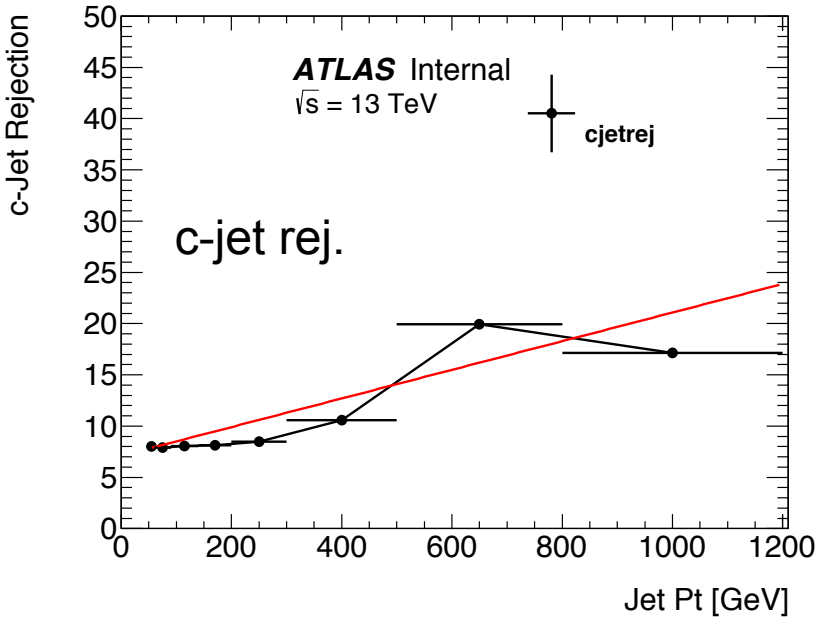


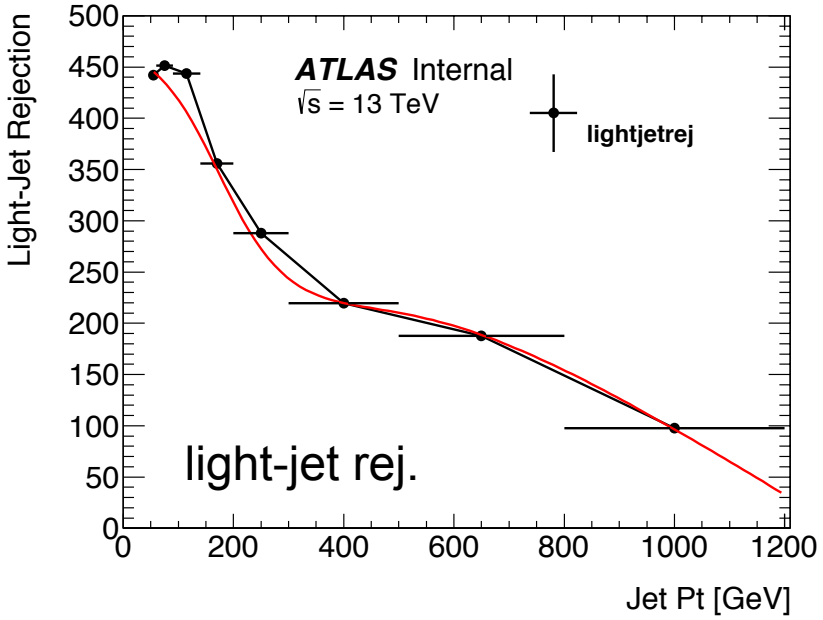
Problem 2: For spurious signal, eff. entries < scaled dist. => MC drives errors

We will try:

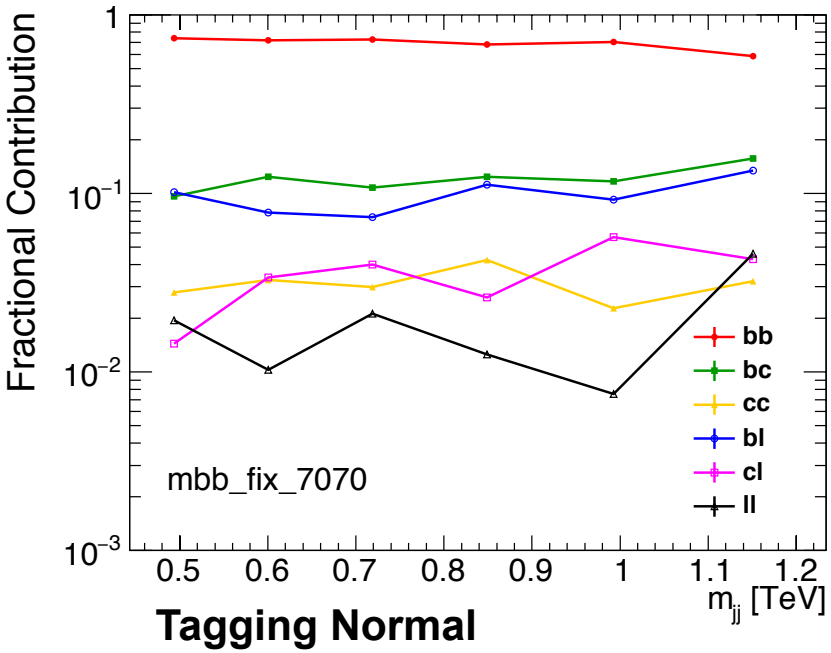
- Don't tag, this throws away stats.
- Instead reweight jets by tagging efficiency
  - Flavour dependant
- Efficiencies taken from ttbar event
  - *(Moriond note: Appendix G)*
- Fit to these
  - *(fits are not perfect)*



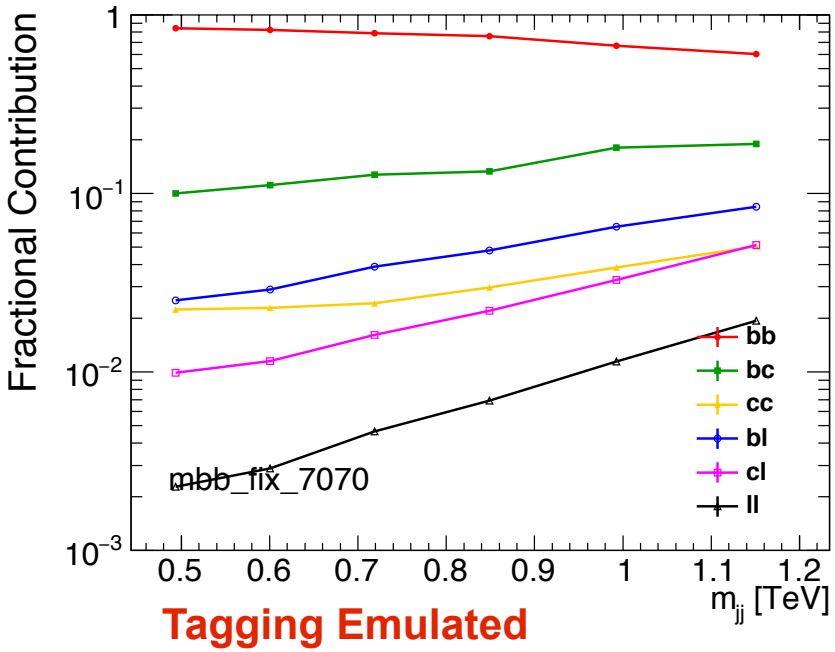




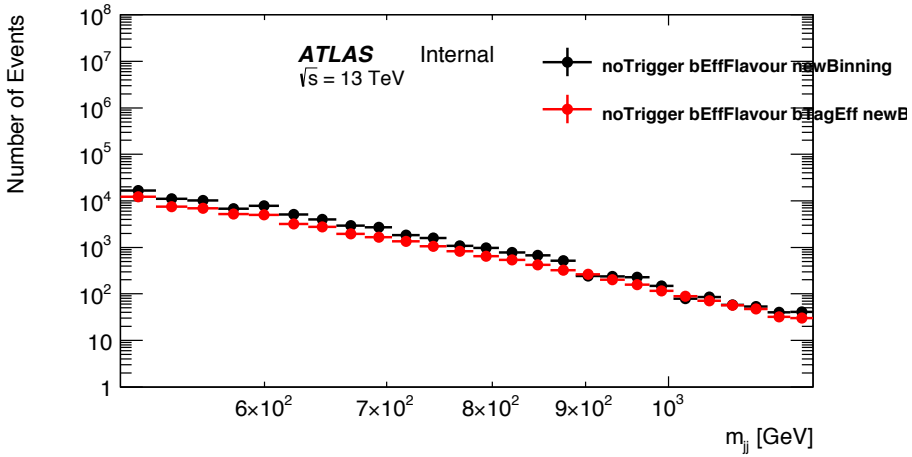
Flavour Composition and Mjj Spectrum

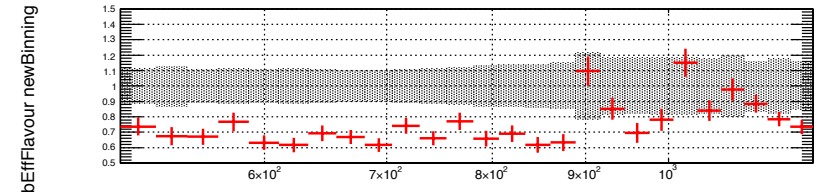


Tagging Normal



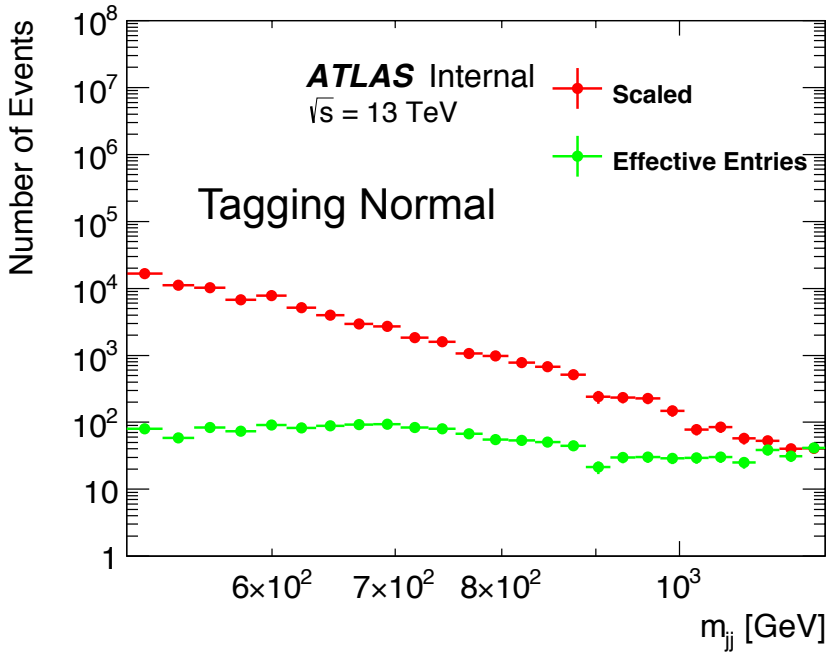
Tagging Emulated

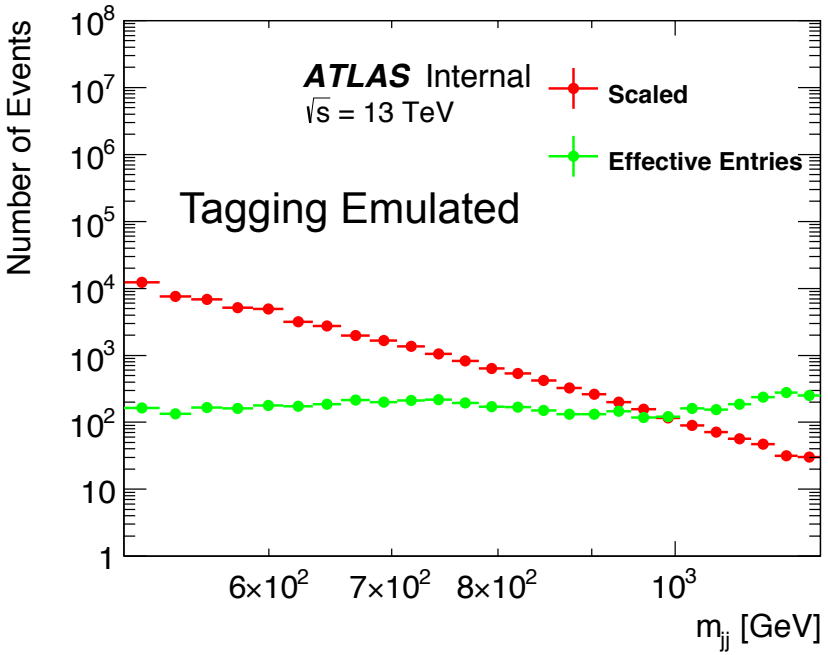


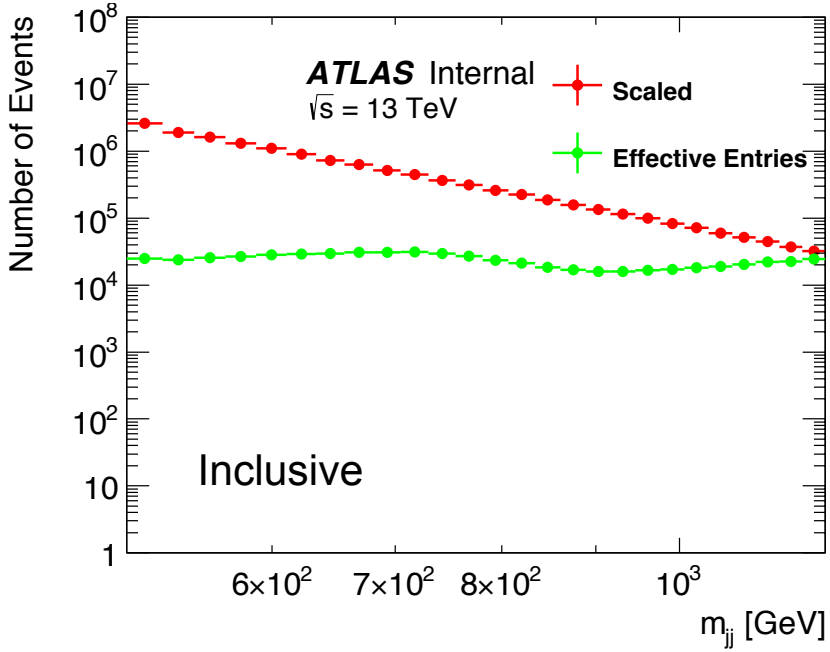


- **Emulated** not matching **Normal**
- Could improve
  - Play with fits - *(Particularly light)*
  - Include eta dependant eff.s

Gain in Effective Entries



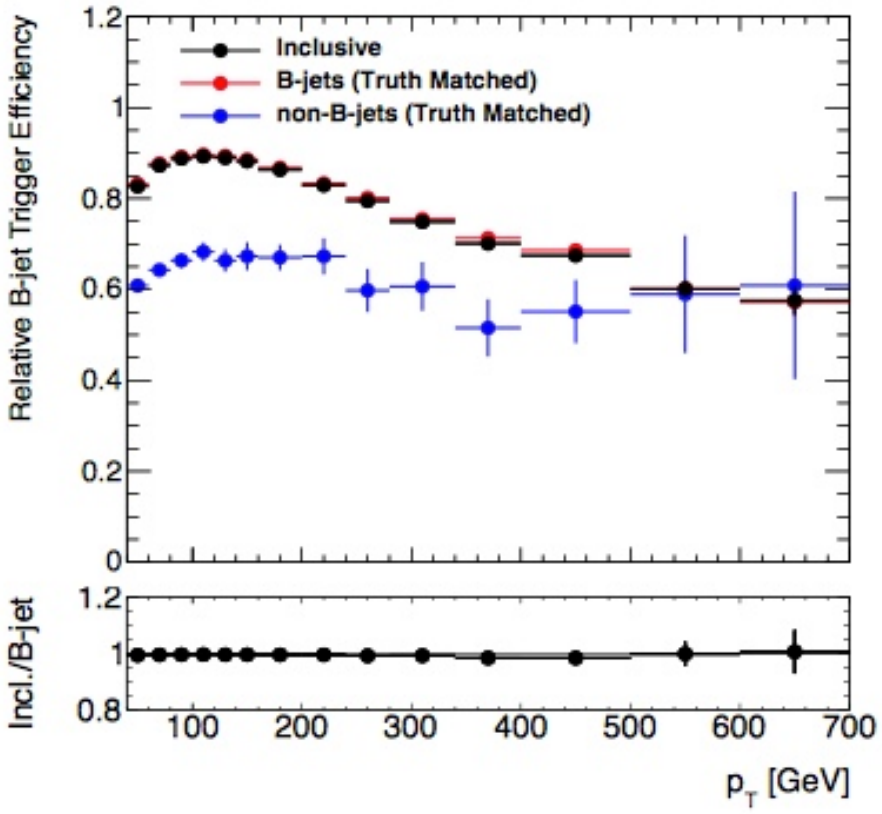




- Gain in effective entries is small
  - Sum of weights dominated by bb
  - This is because bb has largest weights
  - I think N_{bb} limits us!
- I don't think this is worth continuing
- Another possibility to try:
  - Find average weight per m_{jj} bin
  - Reweight all events by this
  - Not flavour dependant
  - Need a think...

Backup

- Study online tagging's effect on flavour composition
- From John we have an estimate online efficiencies w.r.t offline for non-B jets

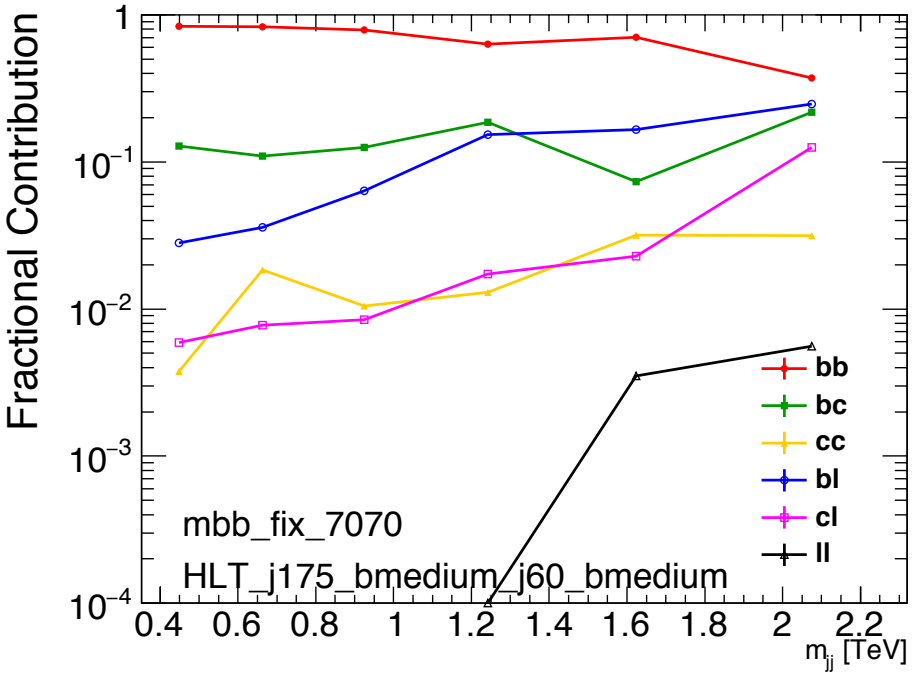


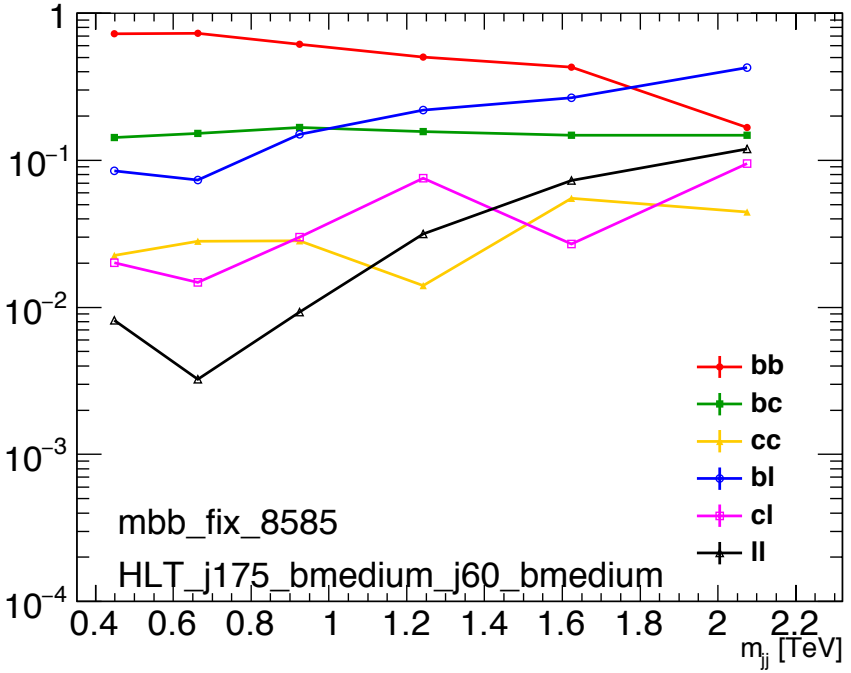
- Apply this to non-B jets to emulate effect of online trigger on flavour fraction

Flavour Composition 750 GeV - bJet Trigger

- HLT_j175_bmedium_j60_bmedium
- Leading jet p_T > 200 GeV, |η| < 2.5
- Subleading jet p_T > 80 GeV, |η| < 2.5
- |y*| < 0.6

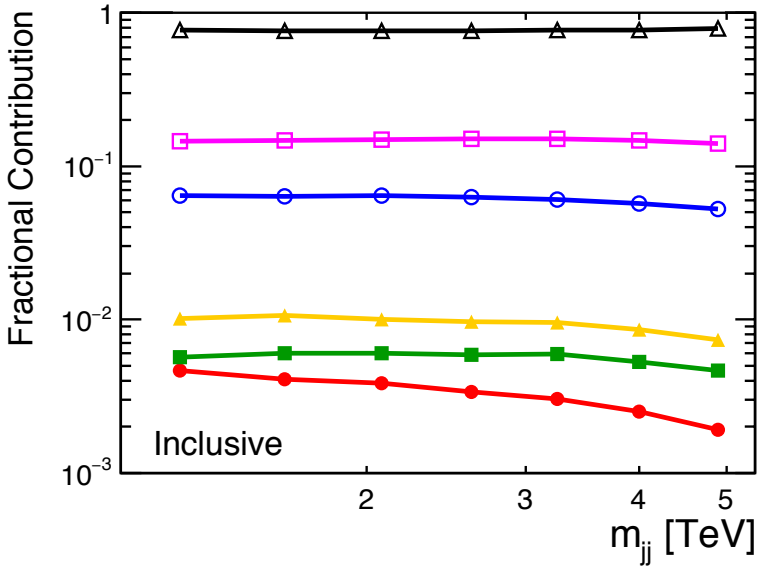
- No Trigger Eff. Applied
- 70% / 85% Eff. Point

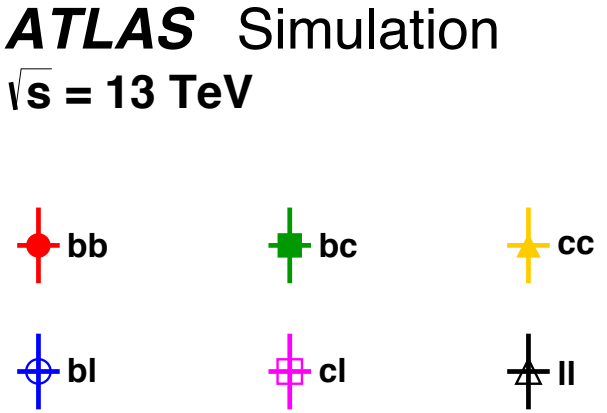


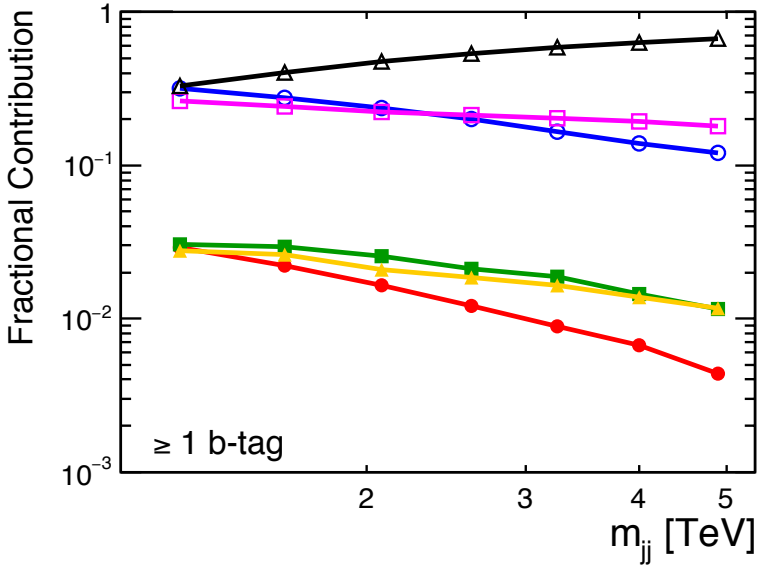


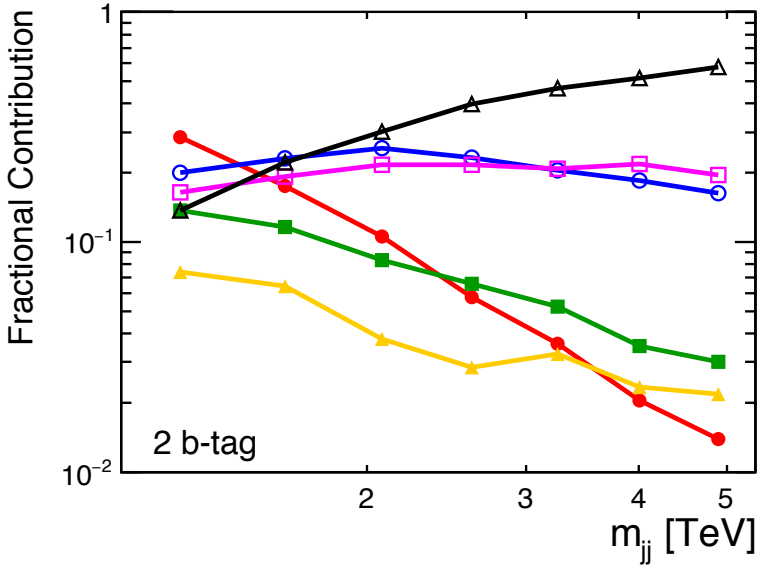
- **Dominant bb contribution**
- **Different Trigger WP in MC and Data**

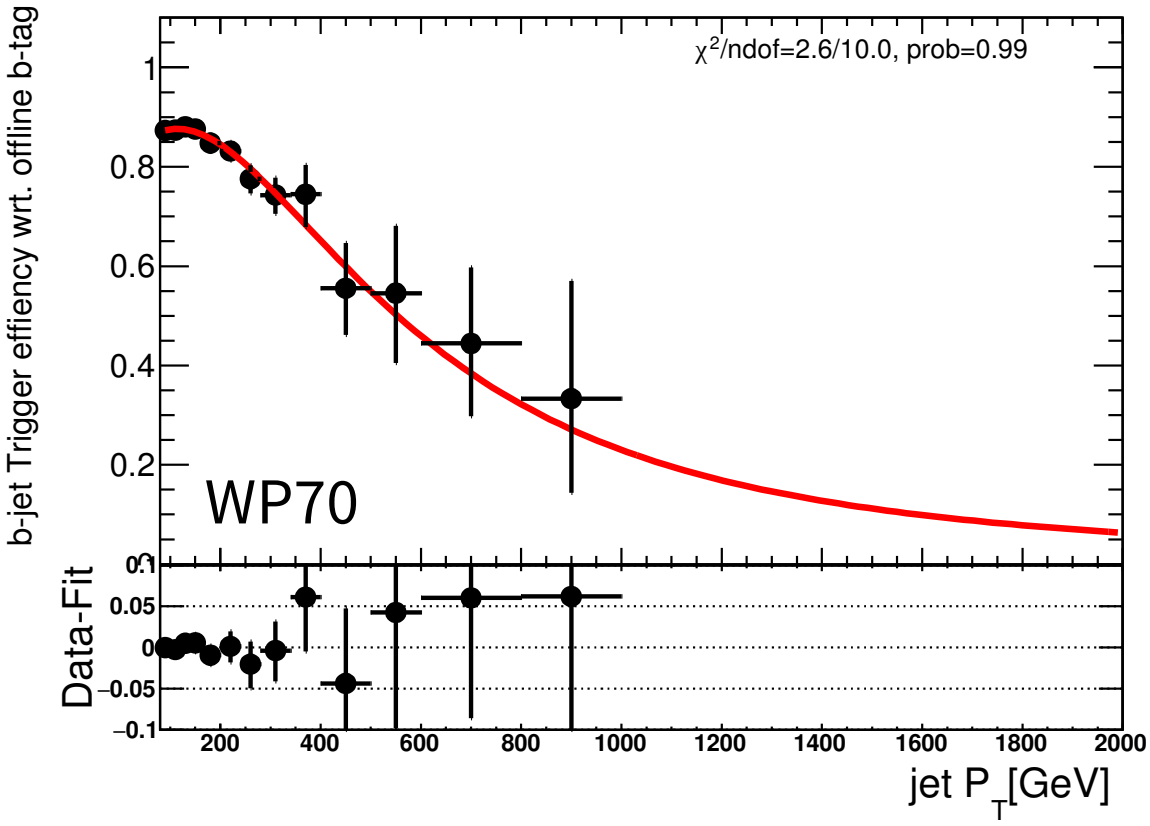
Flavour Composition Previously










b-jet Trigger effiency wrt. offline b-tag
χ²/ndof=2.6/10.0, prob=0.99
WP70
Data-Fit
jet P_T[GeV]