



Flavour Composition and Spurious Signal

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Di-bjet (non)-Meet

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Plan: Study Just Data with Trigger Only

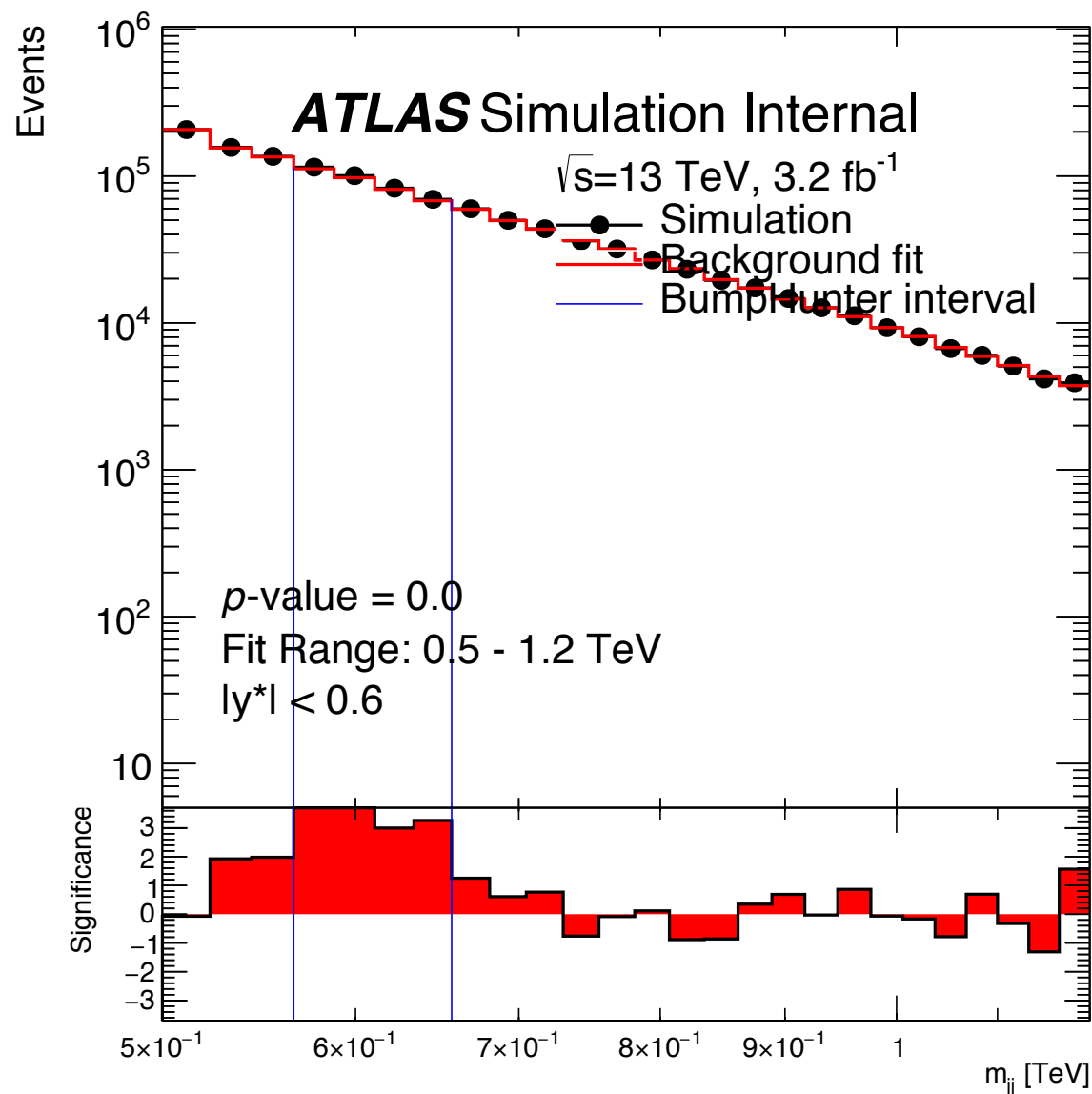
- Hopefully this show that online tagging is a smooth procedure
- We have shown in MC that offline tagging is smooth (see slide 9+)
- If online is smooth and offline is smooth \Rightarrow (online + offline) will be smooth

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



3 Fitting to HLT distribution



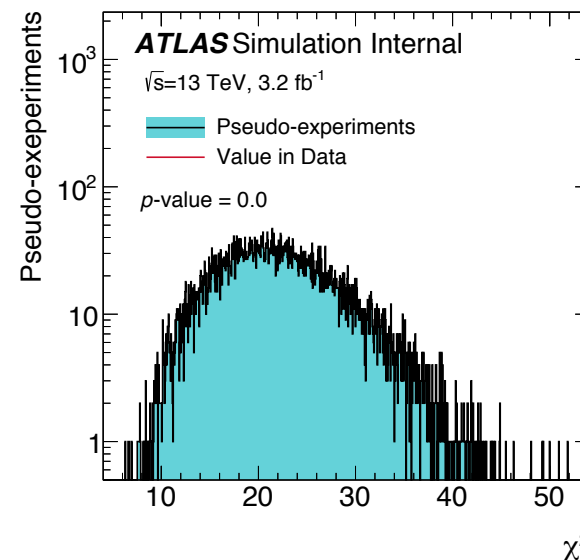
Data:

HLT_j175_bmedium_j60_bmedium
No offline tagging

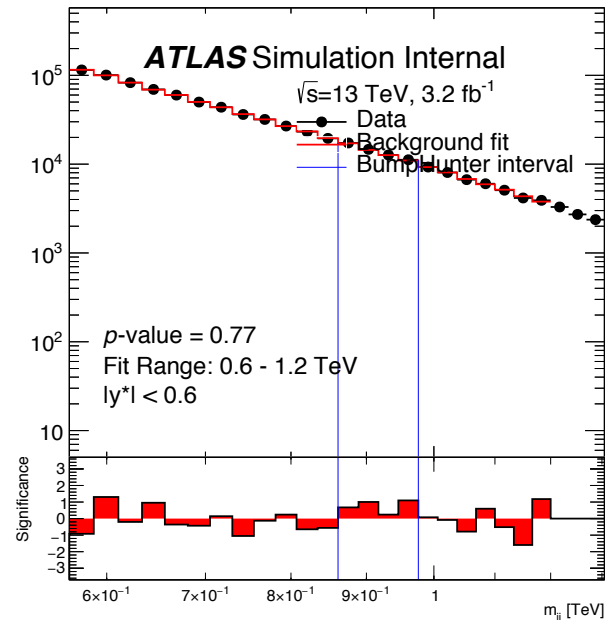
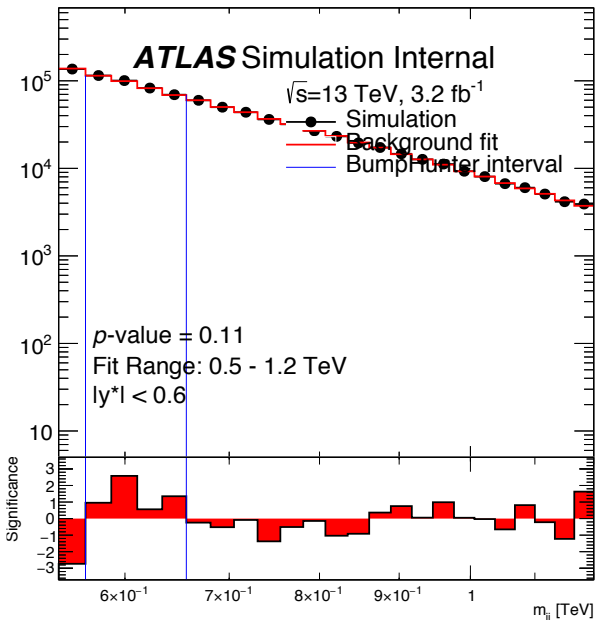
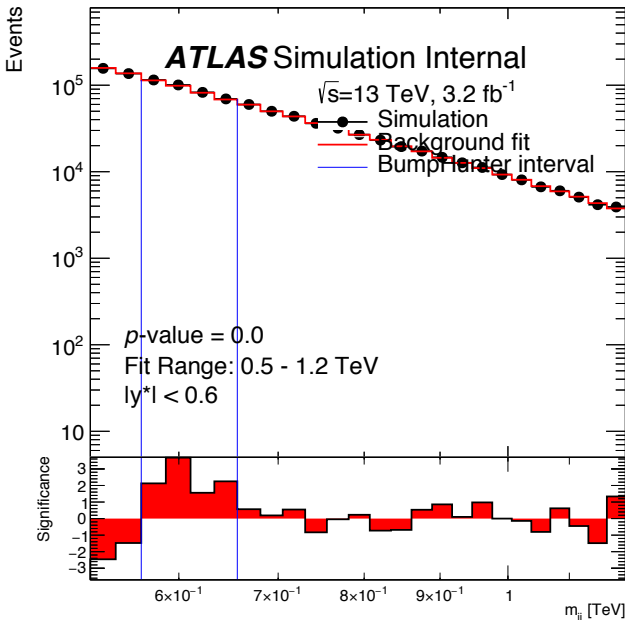
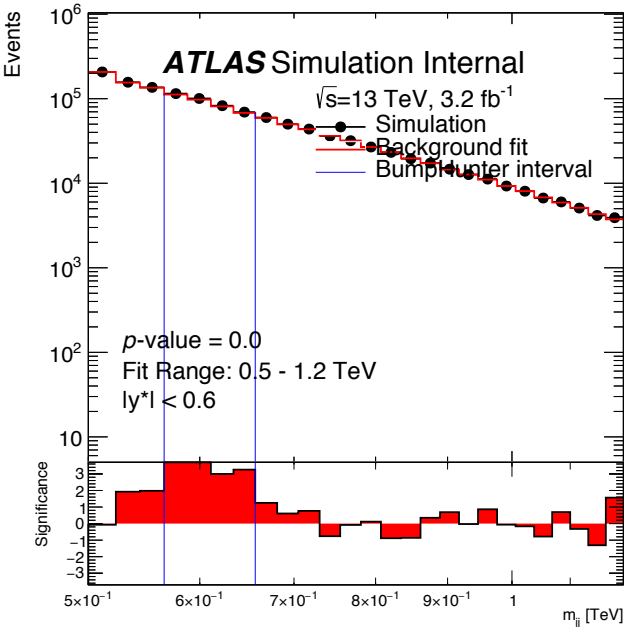
3 Para Fit Function
Fit Range: 500-1200

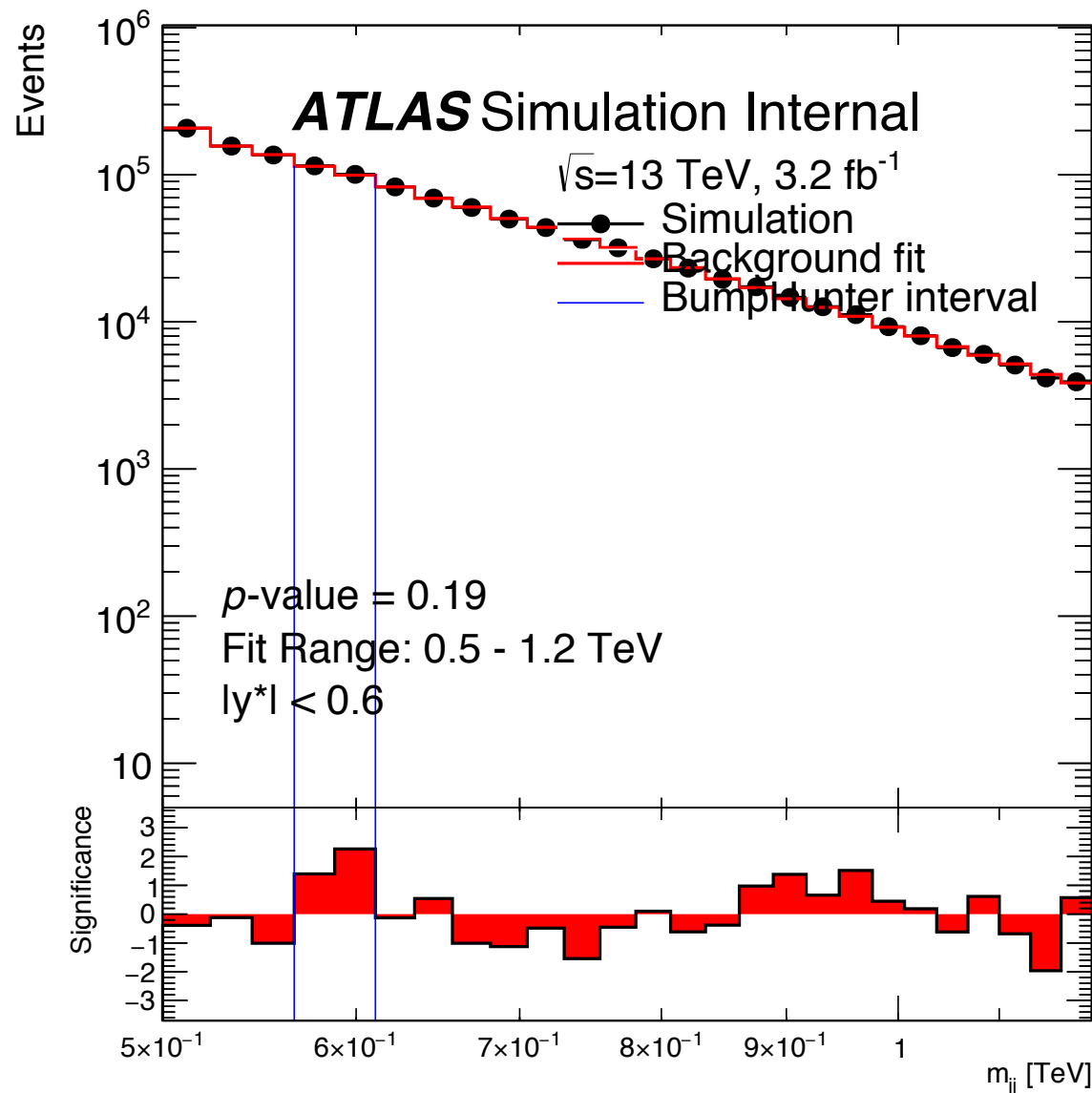
bH Range = 566-677 GeV
bH p-value = 0.0005

After window removal
bH p-value = 0.6389



<u>Bottom Bin</u> <u>Of Fit Range</u>		500
523	544	566



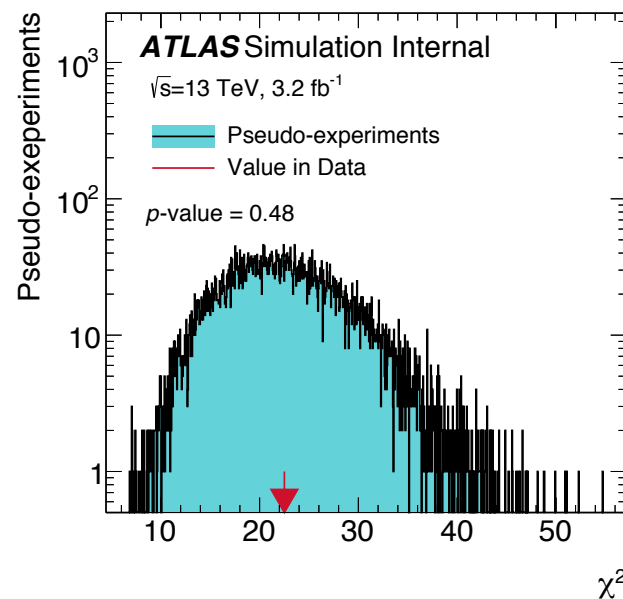


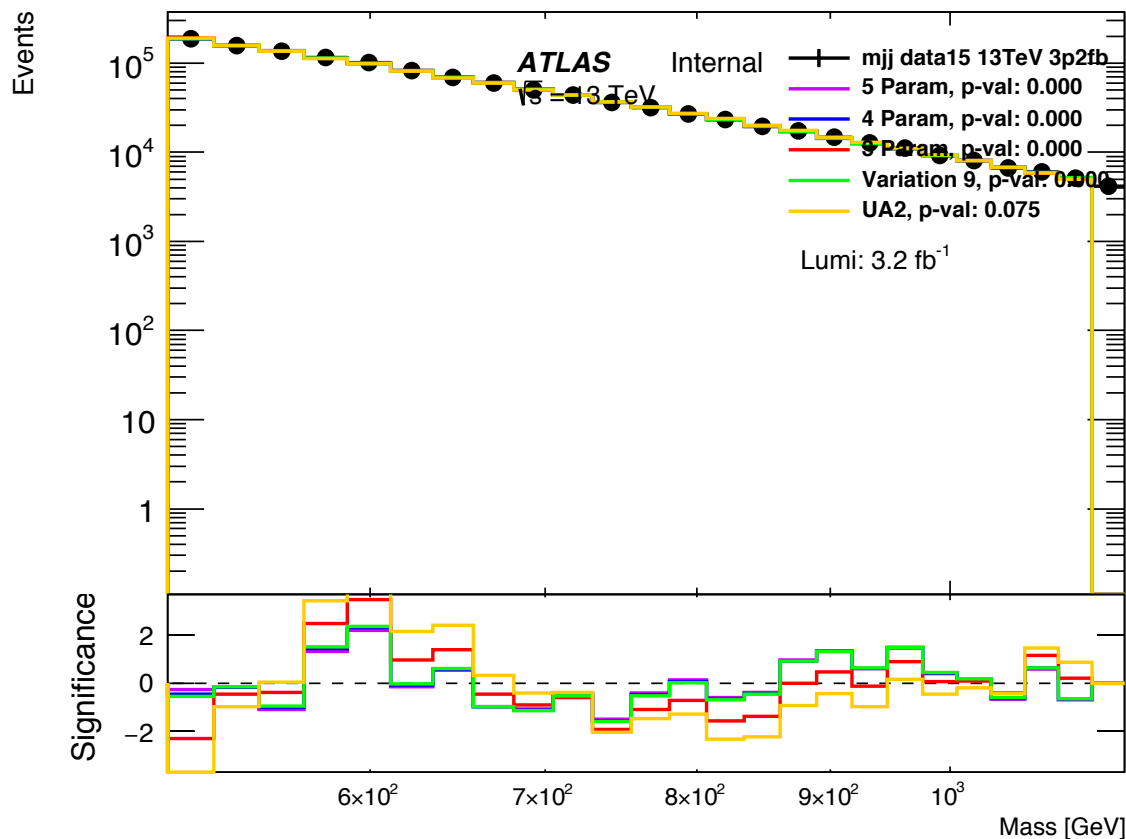
Data:
HLT_j175_bmedium_j60_bmedium
No offline tagging

4 Para Fit Function

Fit Range: 500-1200

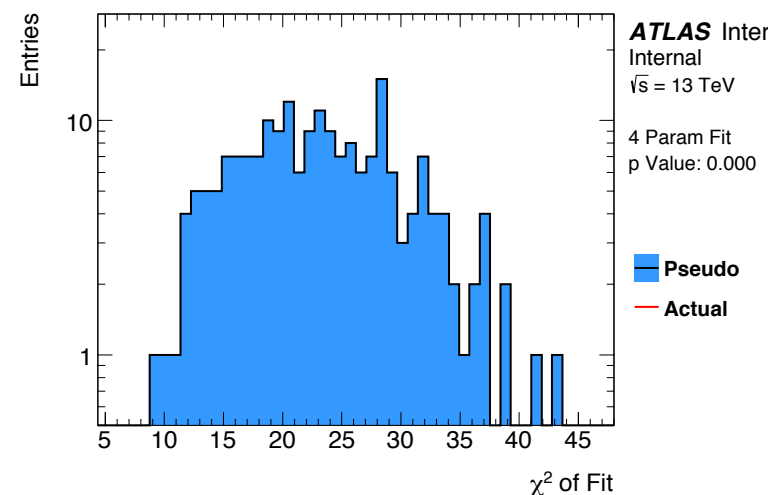
*** final values
*** BH $p\text{-value} = 0.1876 \pm 0.00390392$
*** BH value = 5.27154
*** BH range = 566 - 611





This was wrong fit range:

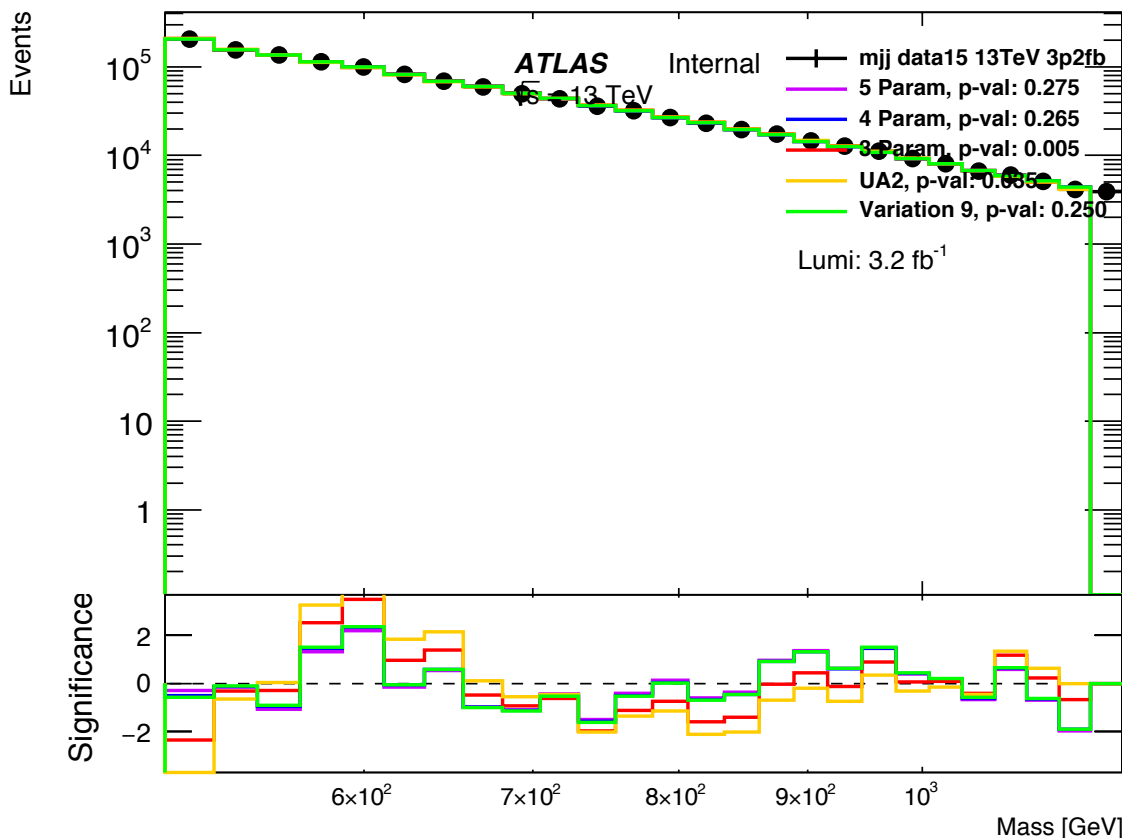
- Bottom bin should be changed to 500 GeV
- Didn't pick up last two bins



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

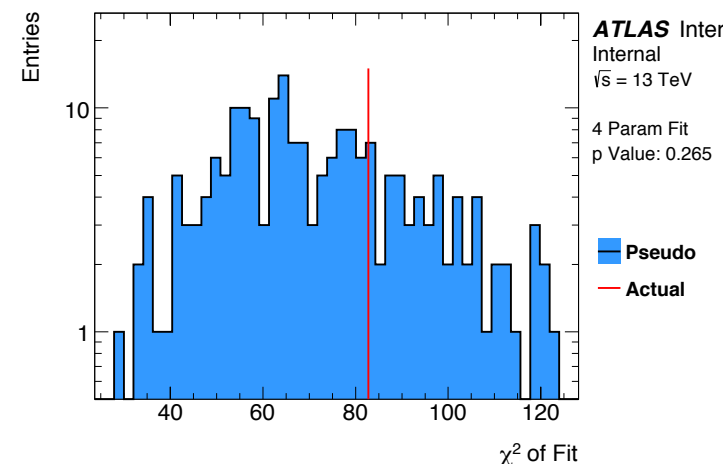
Variation 9:
$$f_{new9}(x) = p_0(1-x)^{p_1+p_2\log(x)}x^{p_3+p_4\log(x)}$$

UA2:
$$f_{UA2}(x) = p_0x^{p_1}e^{-p_2x-p_3x^2}$$



Better fit range!

Better fits
=> except for 3 P and UA2



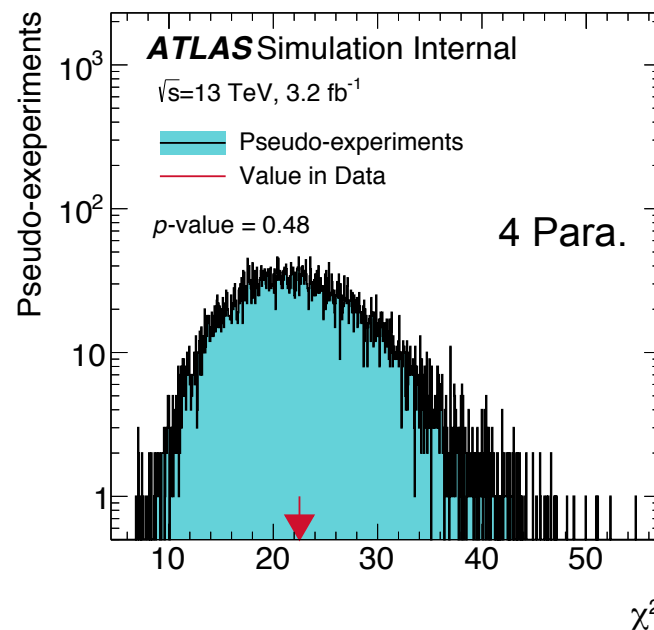
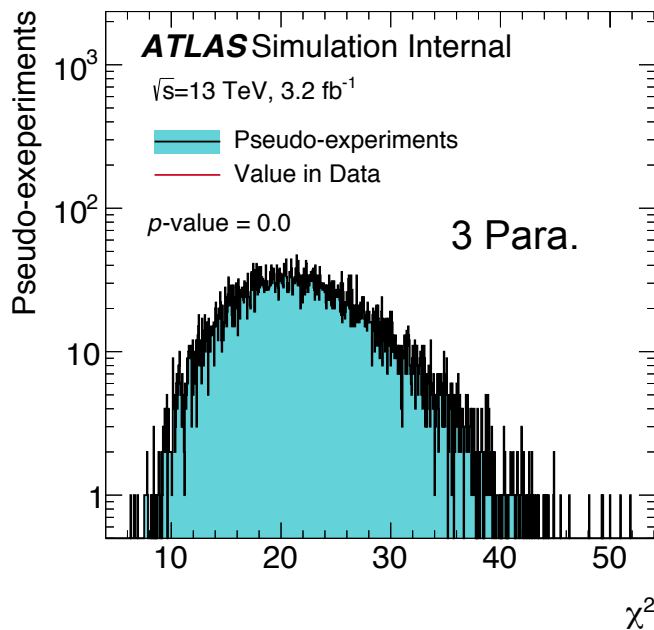
Standard Dijet (3,4,5):
$$f(x) = p_0(1-x)^{p_1} x^{p_2+p_3 \ln(x)+p_5 \ln(x)^2}$$

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

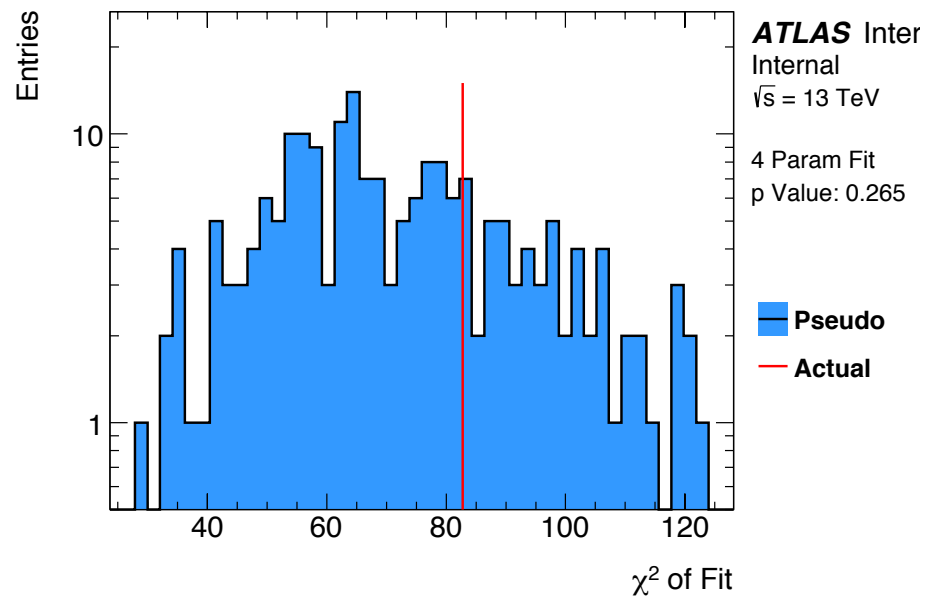
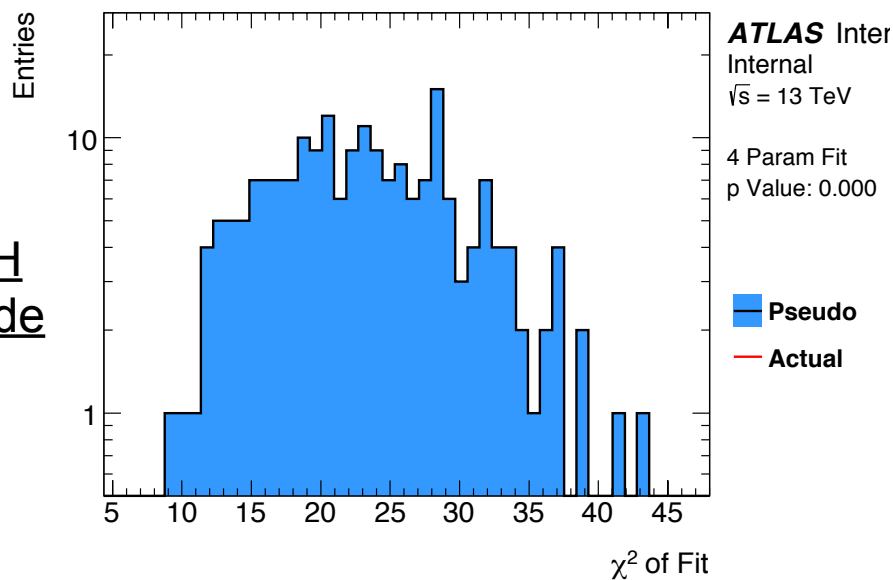
UA2:
$$f_{UA2}(x) = p_0 x^{p_1} e^{-p_2 x - p_3 x^2}$$



Stat
Code



DH
Code





Last time:

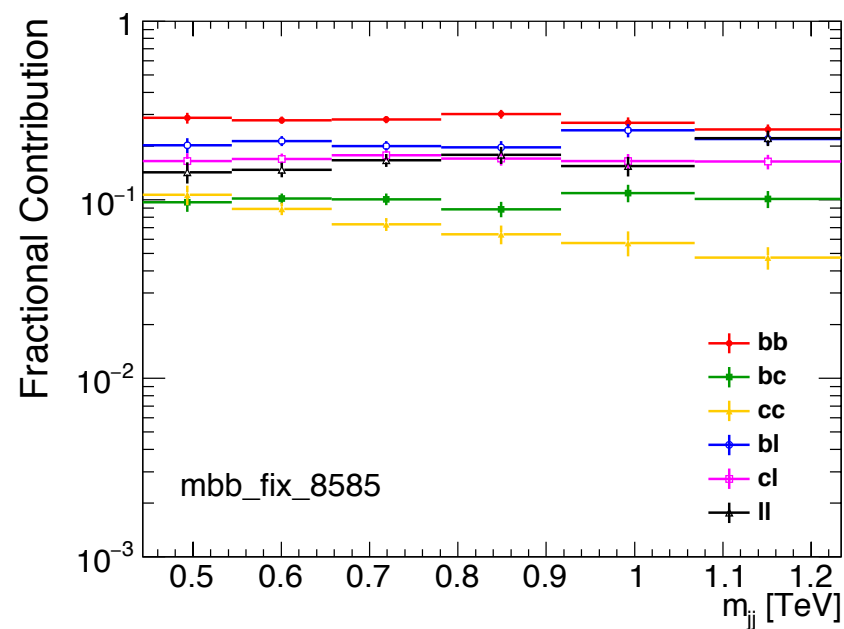
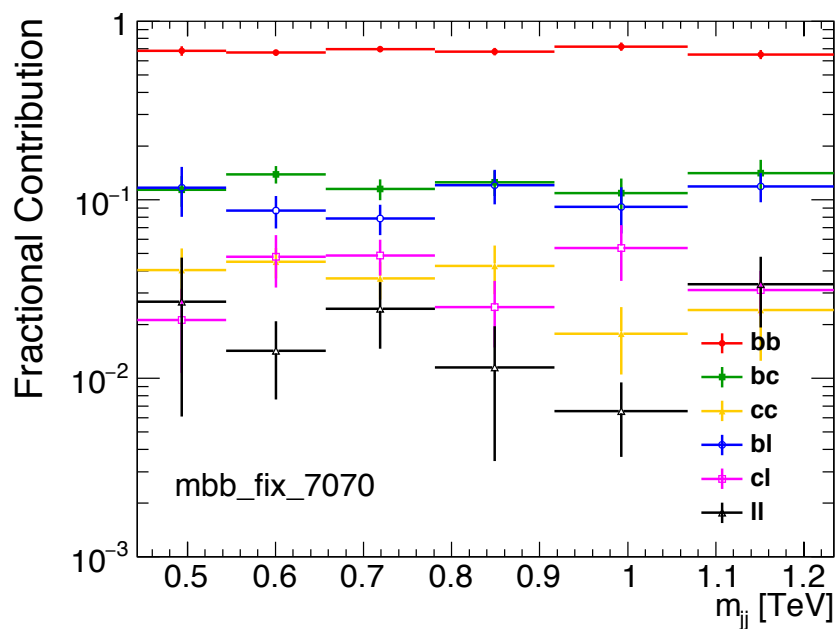
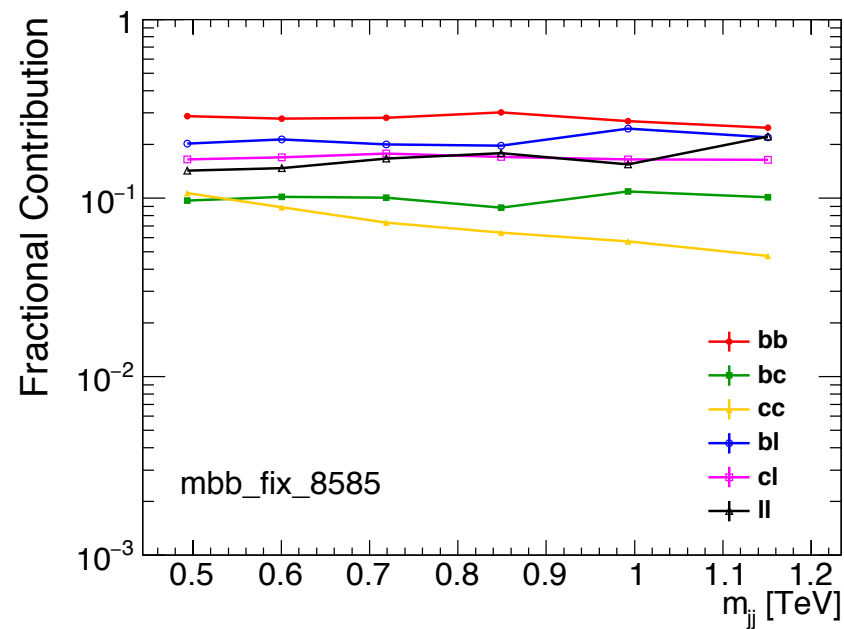
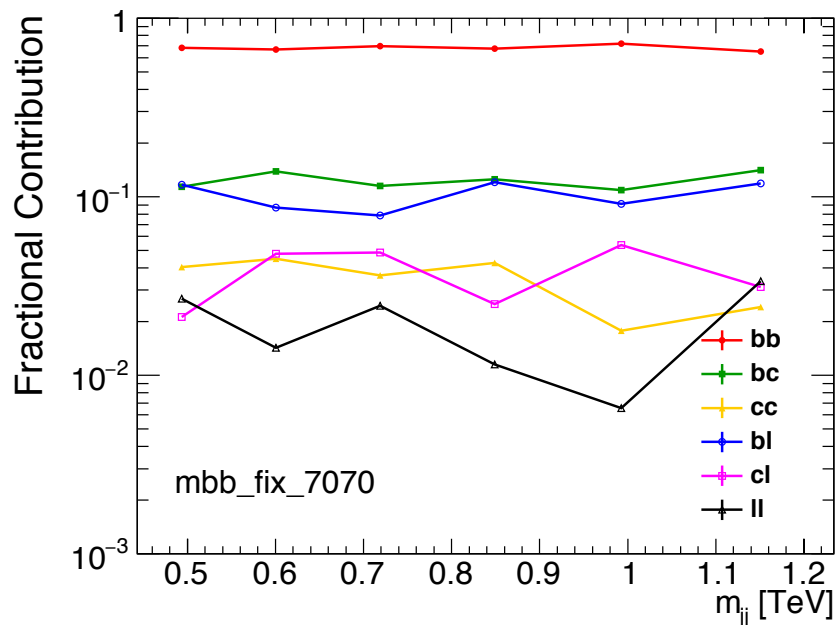
- Studied flavour composition of offline b-tagging only - (*slide 3*)
- Performed some spurious signal checks - (*slide 4*)

Problems:

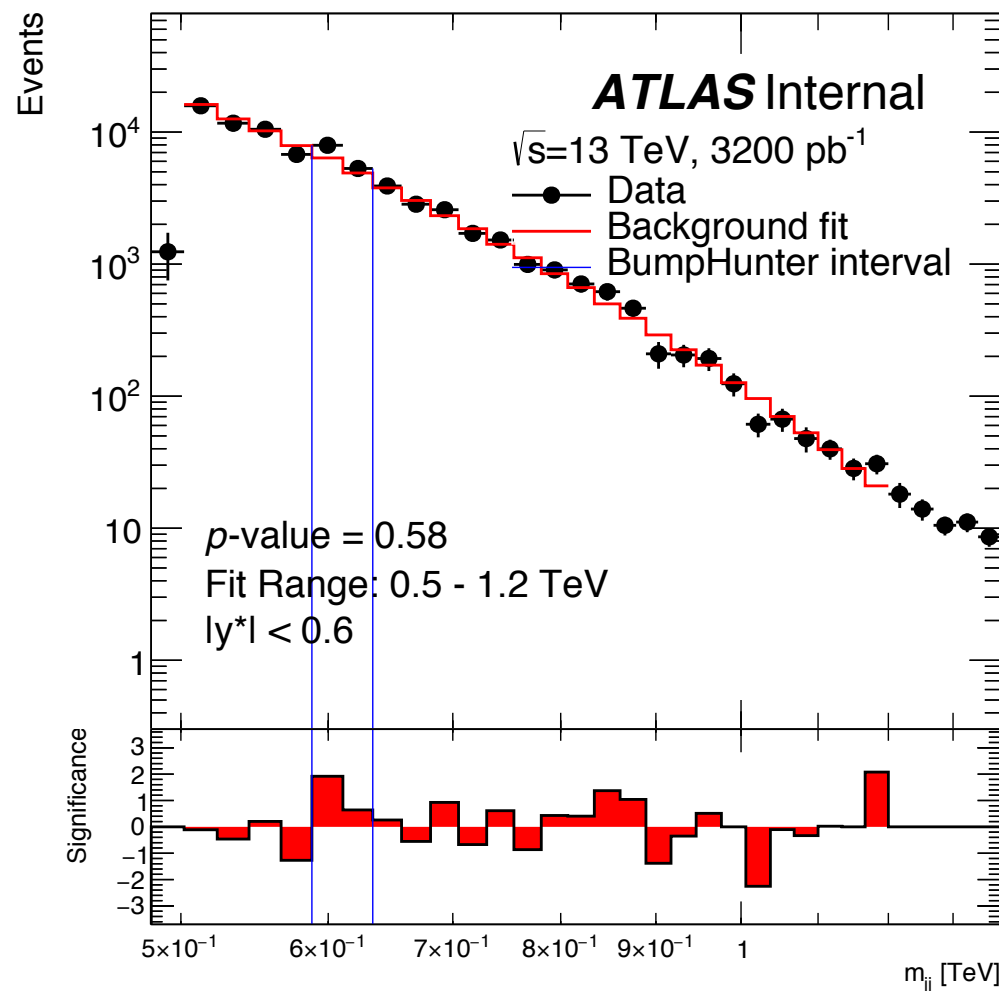
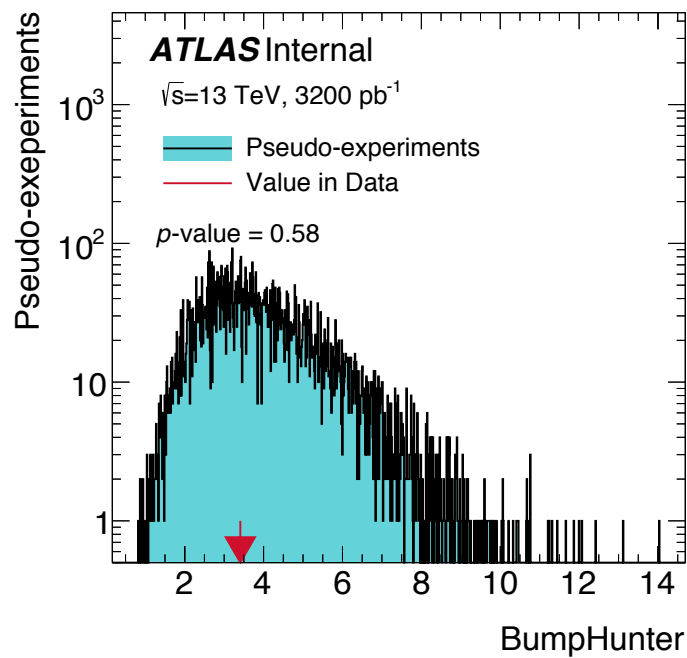
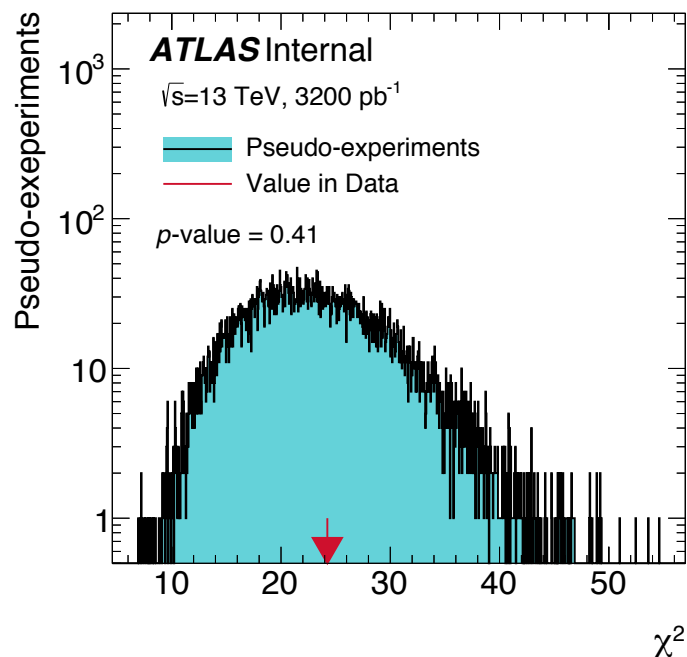
- For flavour composition, not considered effect of online b-tagging on c/l-jets
- For spurious signal, effective entries are smaller than scaled distribution
 - Hence, MC errors > poisson errors.
 - (*slide 5*)

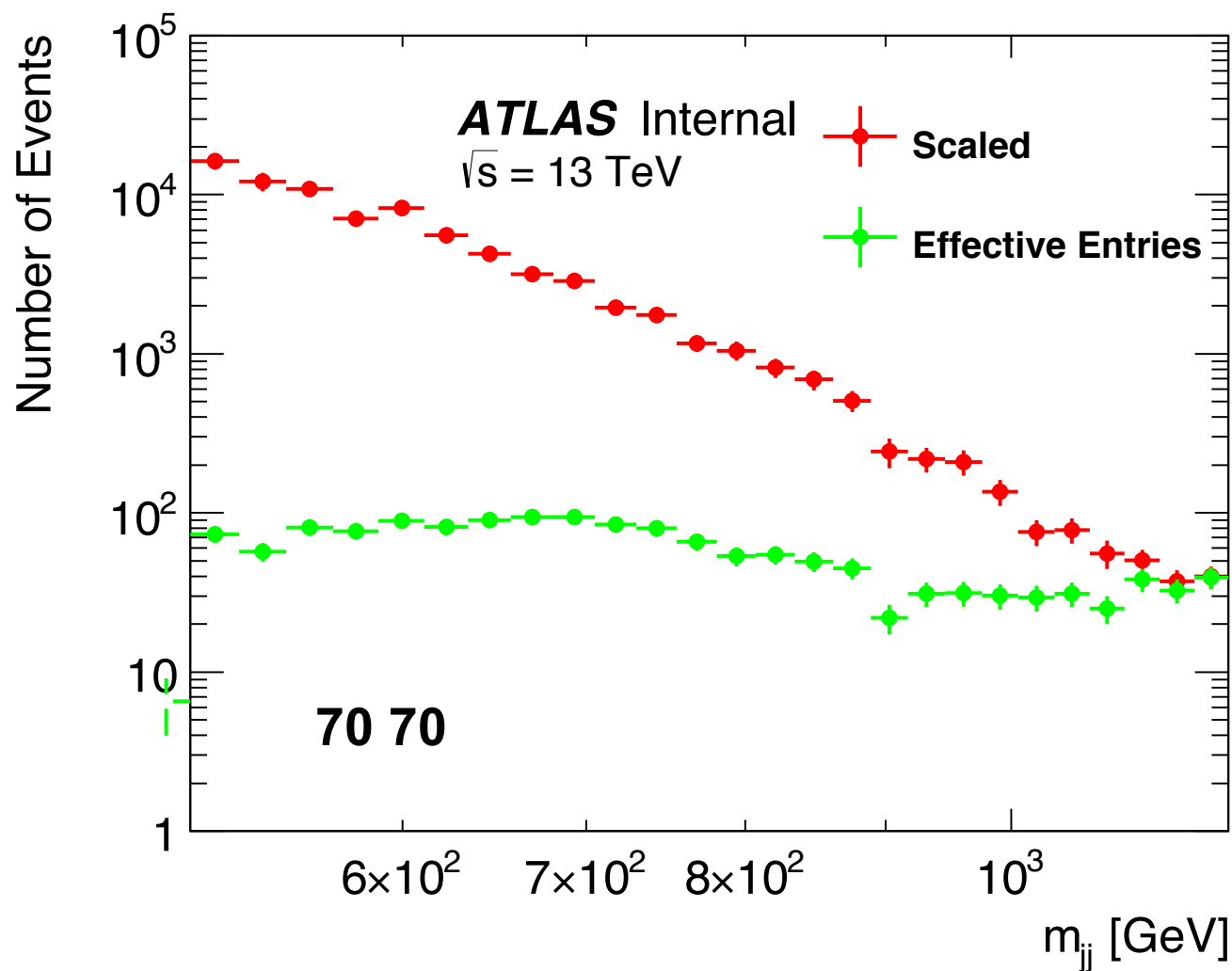
Event Selection

- **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



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





Scaled > Effective Entries
Thus, MC drives errors

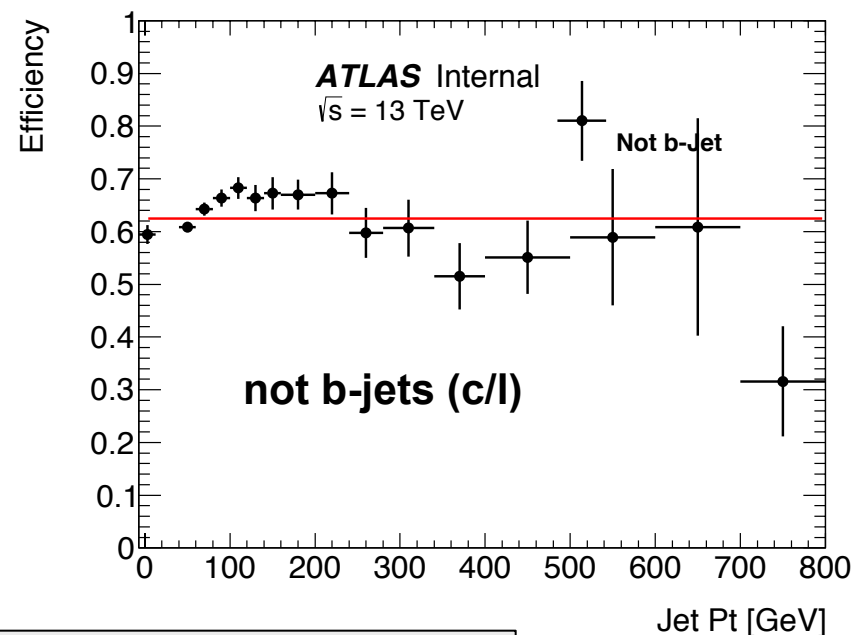
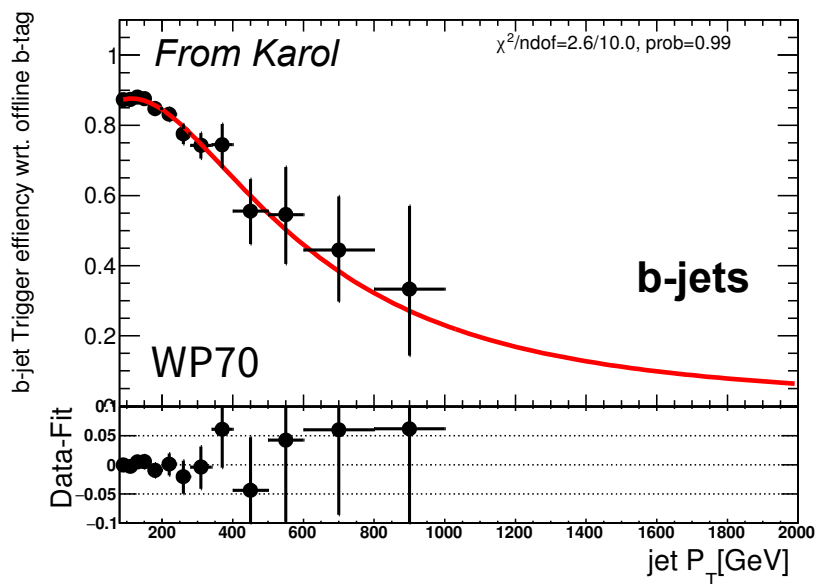


Problem 1:

- 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



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



b-Jet Trigger Eff. Applied

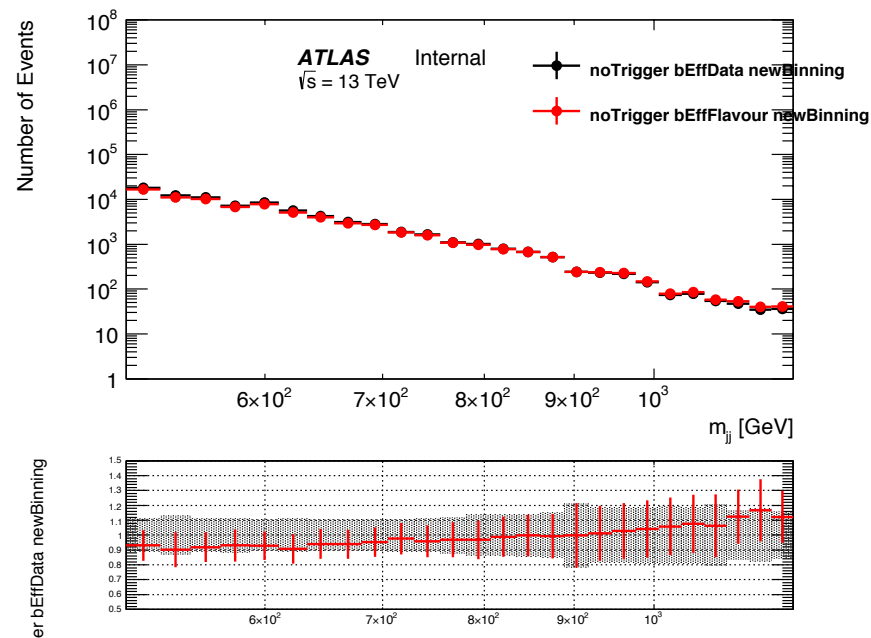
- b-jet trigger efficiency applied to all jets
- As was done before

Flavour Dependant Trigger Eff.

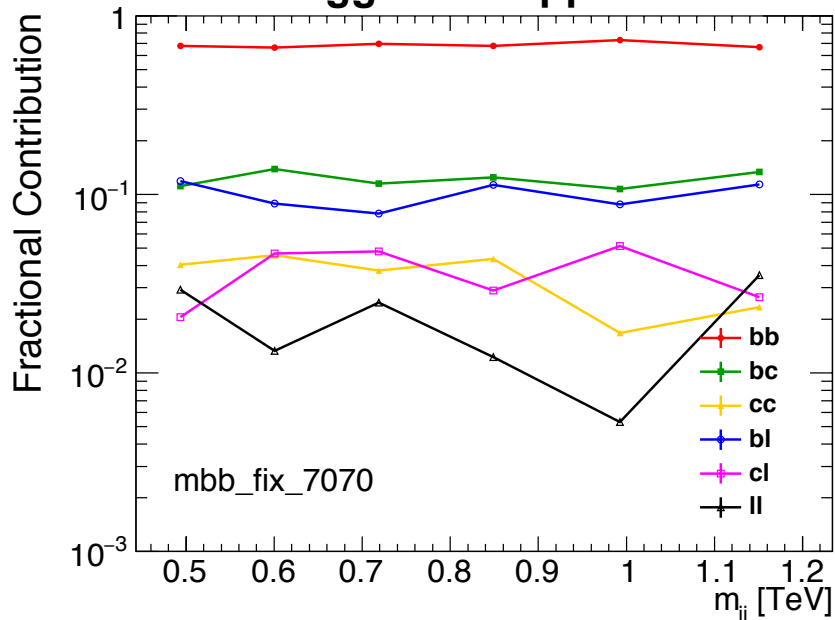
- b-jet trigger eff. applied to b-jets
- Not b-jet trigger eff. applied to not b-jets

Doesn't really change too much!

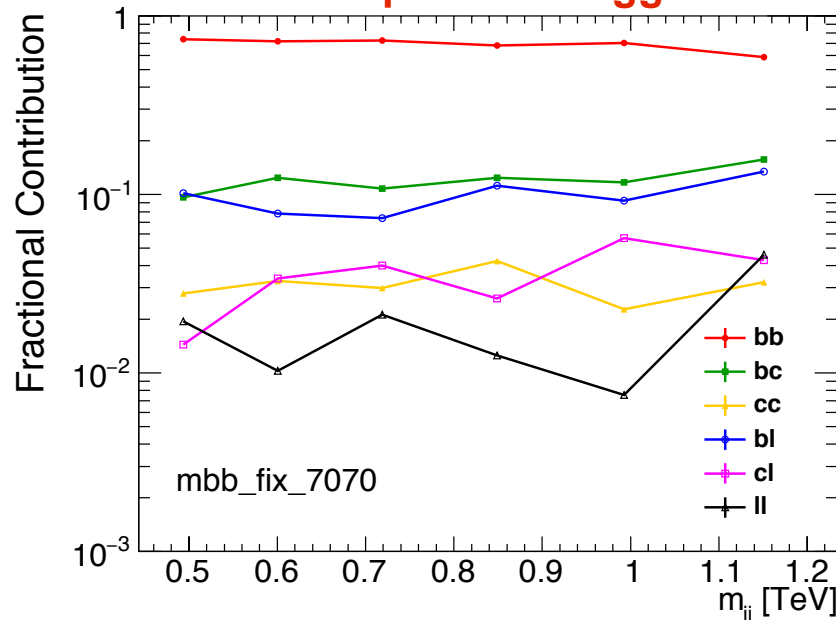
- Still smooth



b-Jet Trigger Eff. Applied



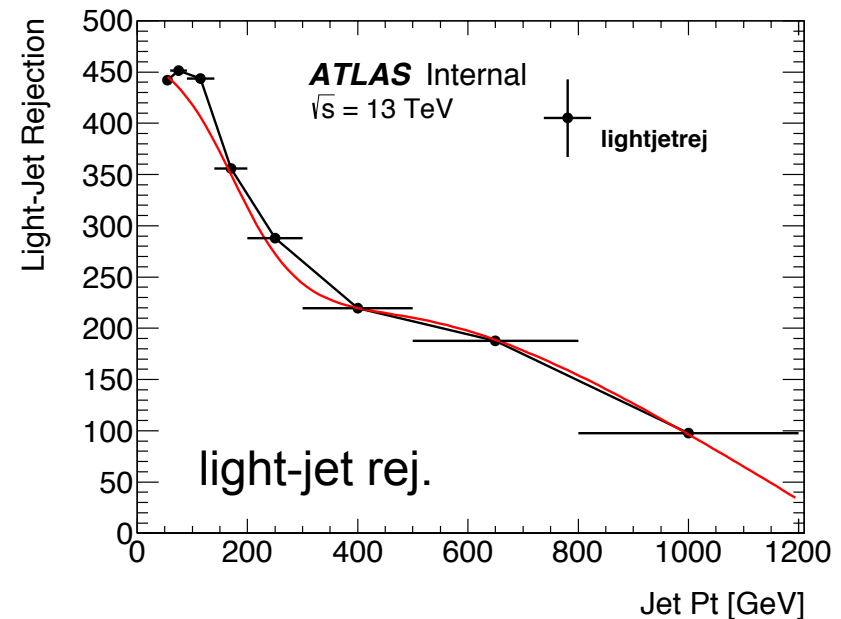
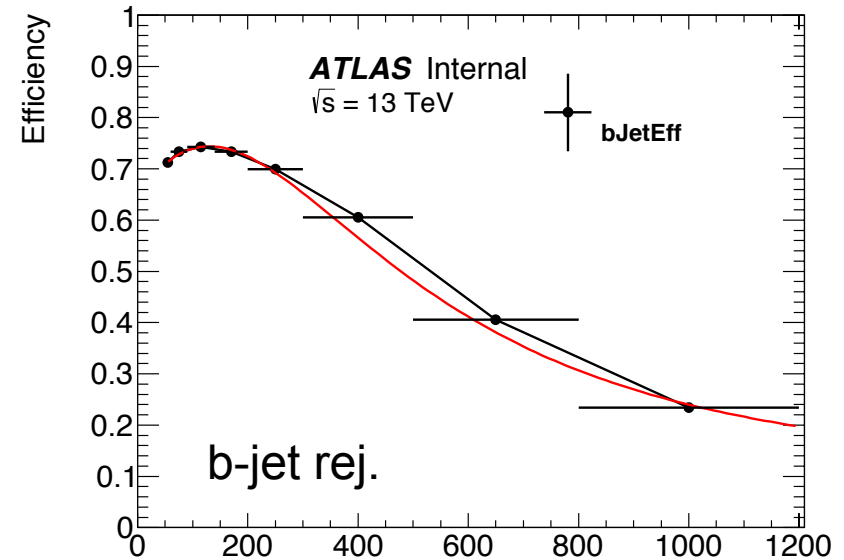
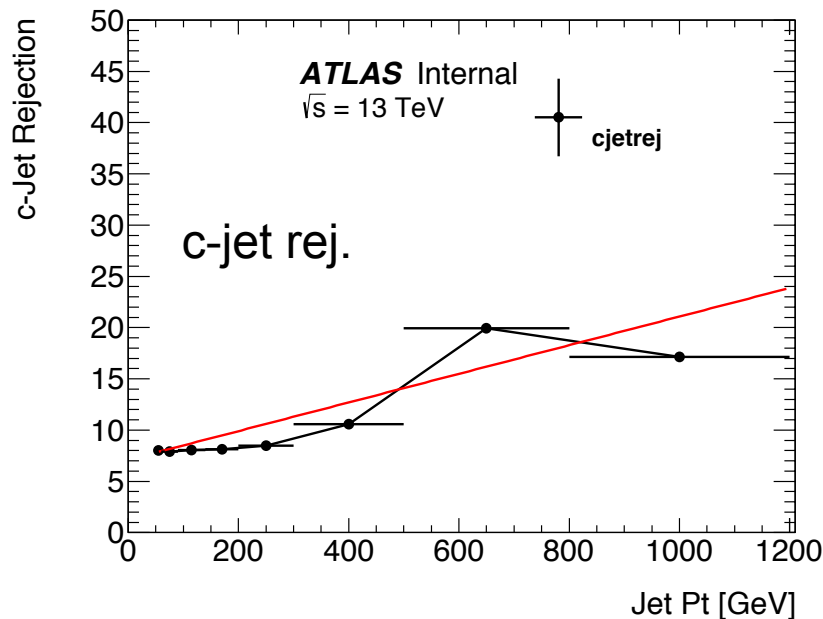
Flavour Dependant Trigger Eff.

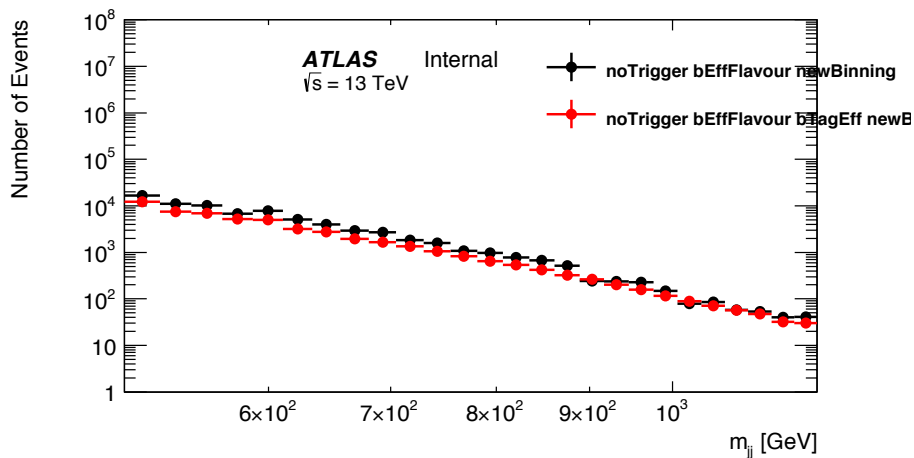
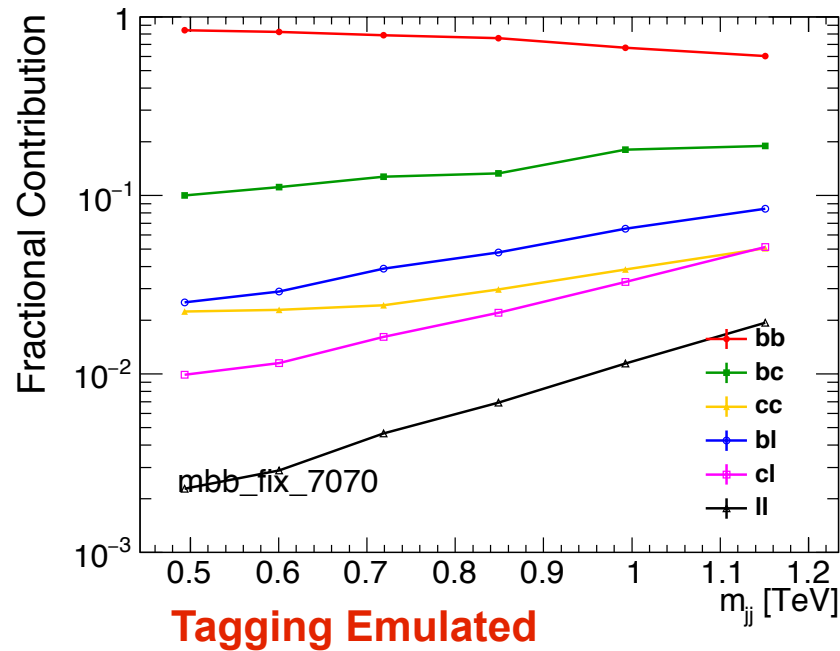
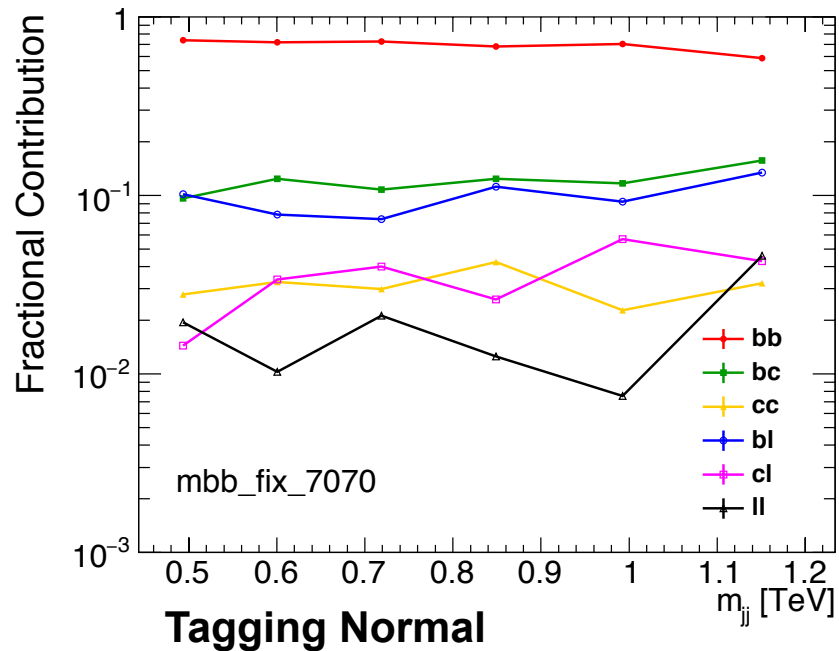


Problem 2: For spurious signal, eff. entries < scaled dist. => MC drives errors

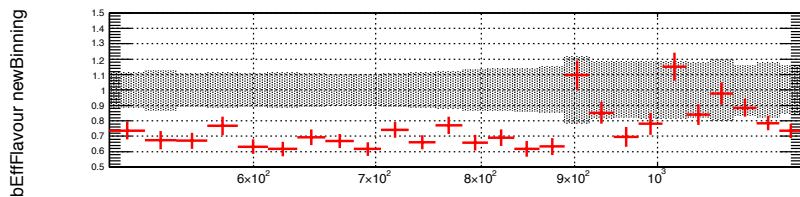
We will try:

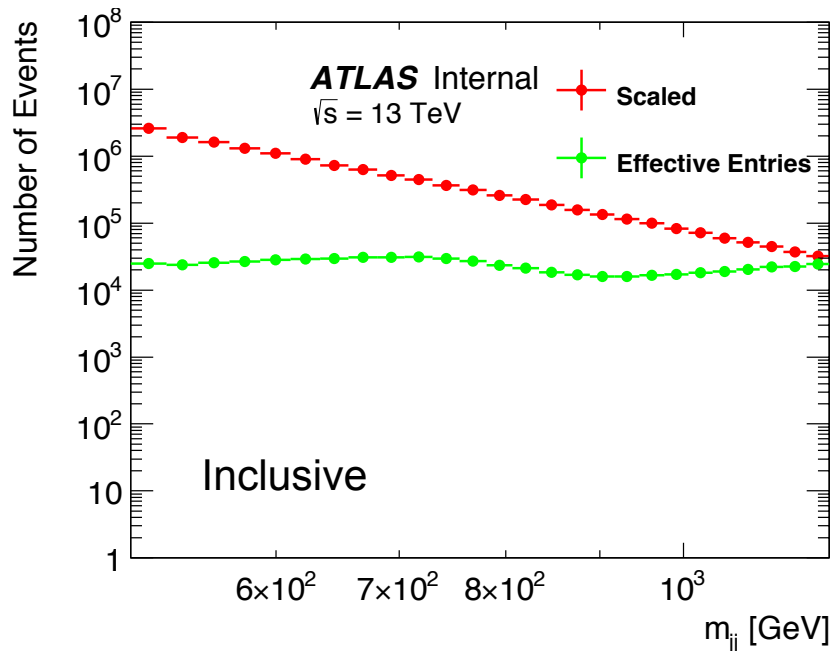
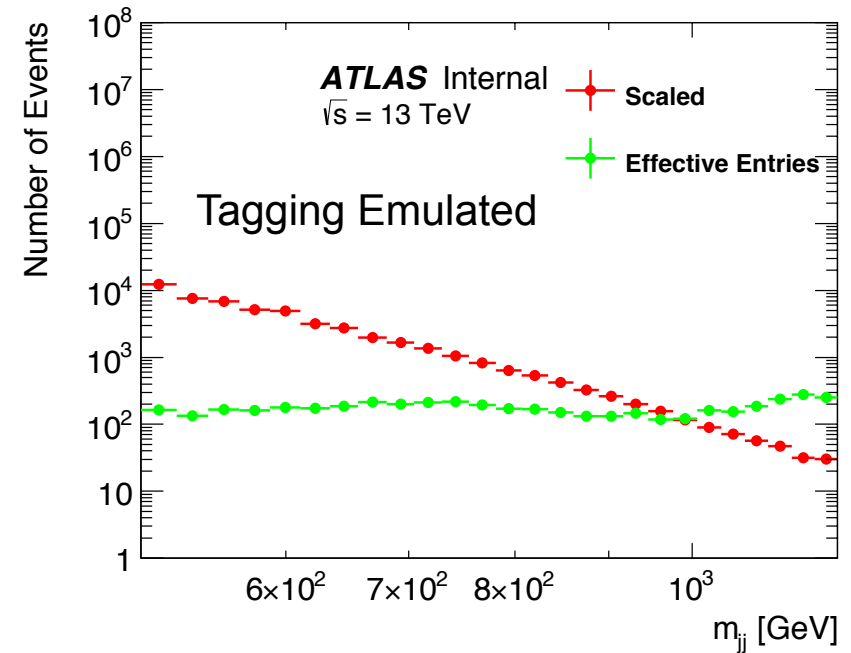
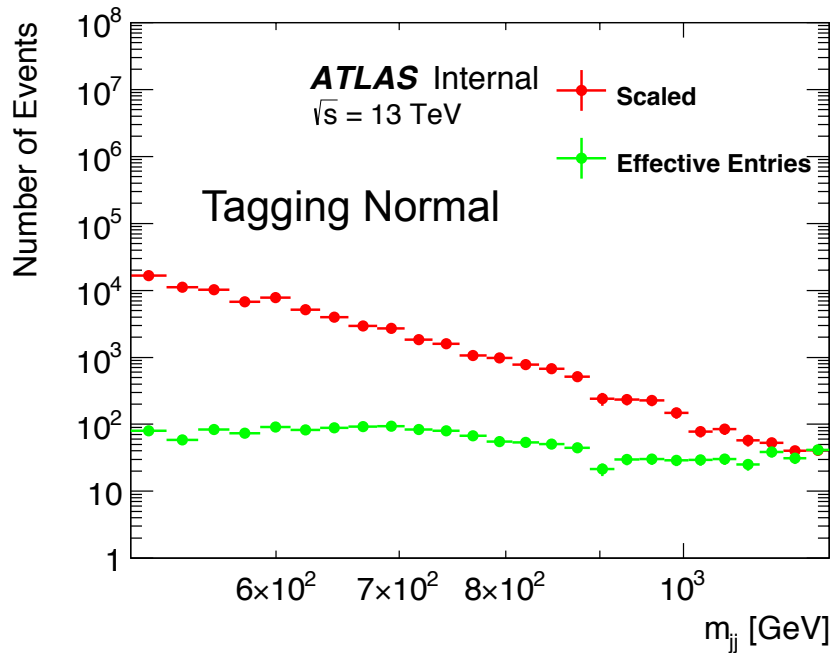
- Don't tag, this throws away stats.
- Instead reweight jets by tagging efficiency
 - Flavour dependant
- Efficiencies taken from ttbar event
 - (*Moriond note: Appendix G*)
- Fit to these
 - (*fits are not perfect*)





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





- 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...

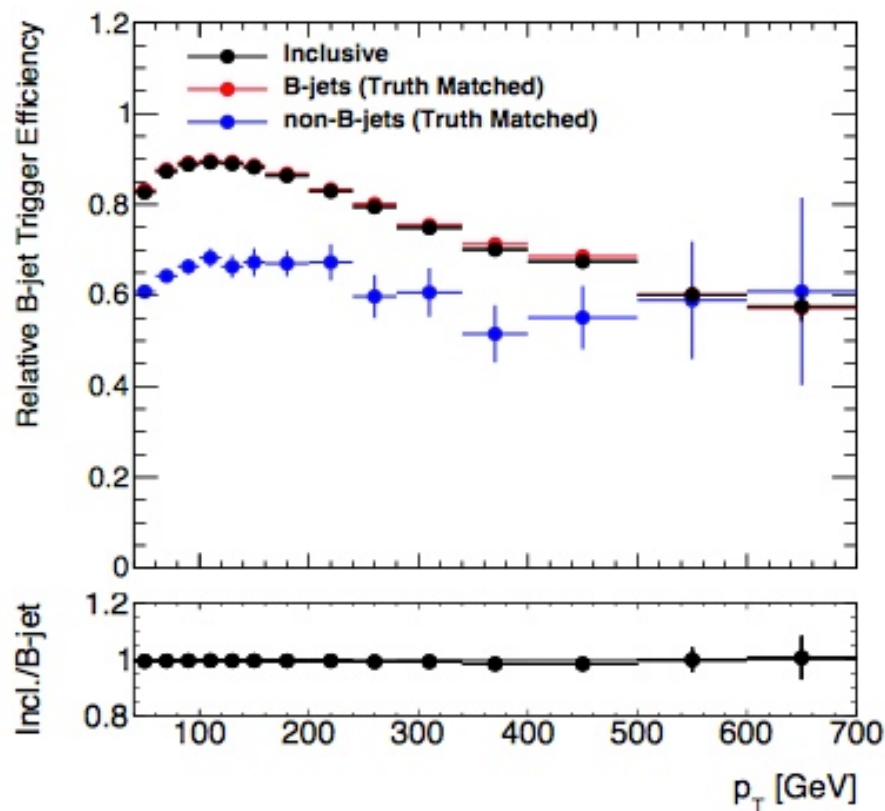


UCL

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

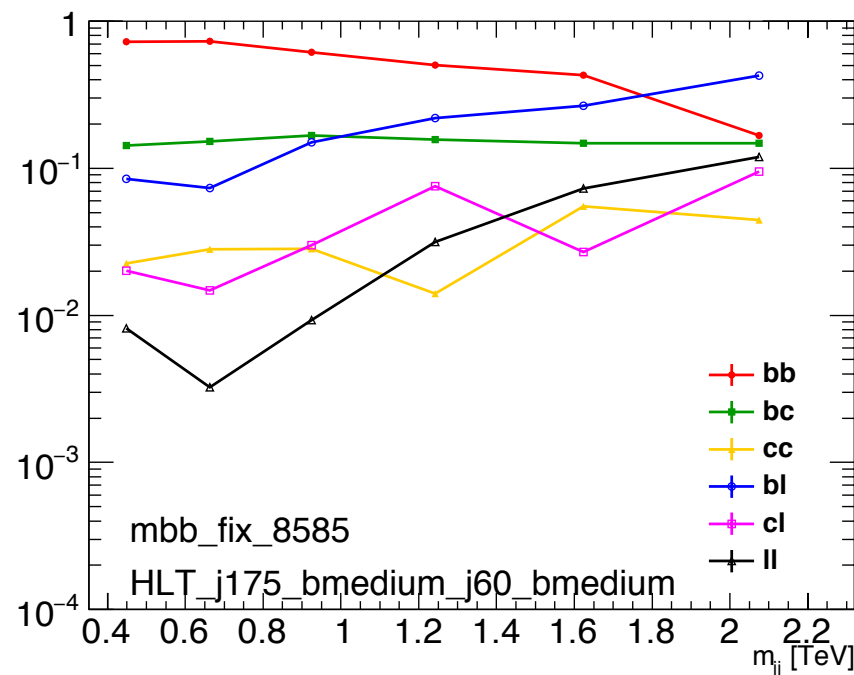
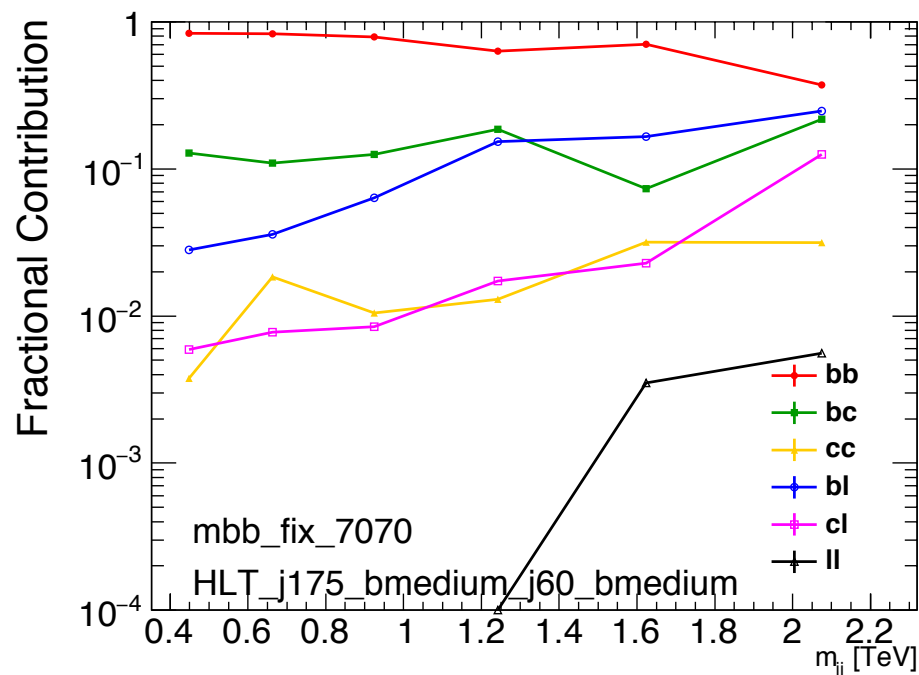


- Apply this to non-B jets to emulate effect of online trigger on flavour fraction

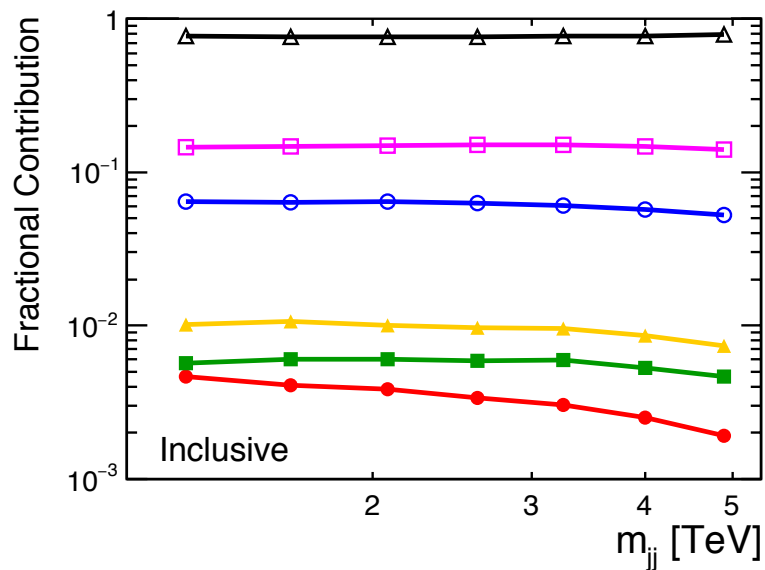


- HLT_j175_bmedium_j60_bmedium
- Leading jet $p_T > 200$ GeV, $|\eta| < 2.5$
- Subleading jet $p_T > 80$ GeV, $|\eta| < 2.5$
- $|y^*| < 0.6$

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



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



ATLAS Simulation
 $\sqrt{s} = 13$ TeV

