UCL

Flavour Composition Studies

Laurie McClymont, Andreas Korn

8 December 2015

Introduction

- We want to understand how varying the flavour composition will affect the fitting function.
  -Are the fitting functions robust to flavour composition?

- Vary the amount that different flavour combinations contribute.
- Then fit to the new mjj spectrum using usual functions.
- We want to see if we can break the fit...

Details

Pythia8EvtGen MC Di-Jet Sample
- di-b-jet Ntuple production

Standard Dijet Resonance Cuts
- Leading Jet p_T > 440 GeV
- Sublead Jet p_T > 50 GeV
- $|y^*| < 0.6$
- m_{jj} > 1100 GeV

Using fixed cut 85% for both jets.
- mbb_fix_8585

Cone matching truth flavour
- jetHadronConeExclTruthLabelID

Work Flow

`phys-exotics/jdm/dijet/inputs/Btag/MC15_DiJet_20151104`

Use DijetHelpersPackage:

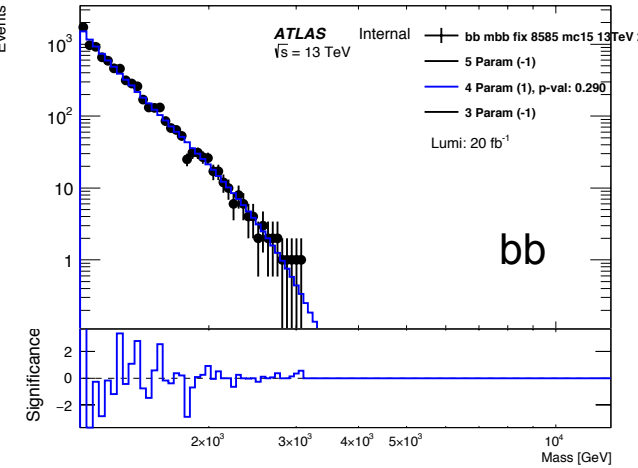
Create Histograms and merge slices
- *makeStandardHistograms.py*
- *plotStandardPlots.py*

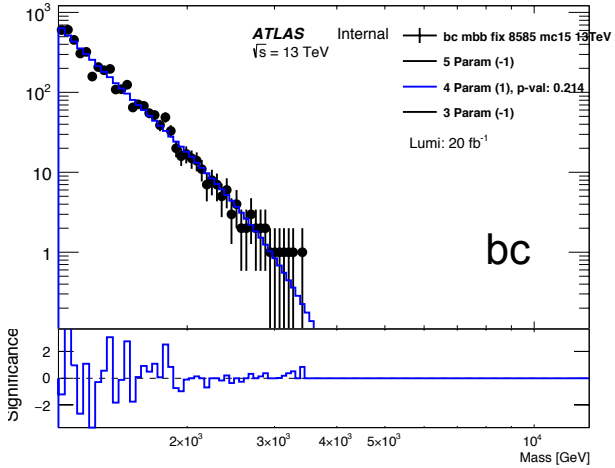
- Fit 20ifb smooth histos using *singleFit.py*
- Create data-like using from these fits
=> Will discuss this step in following slides

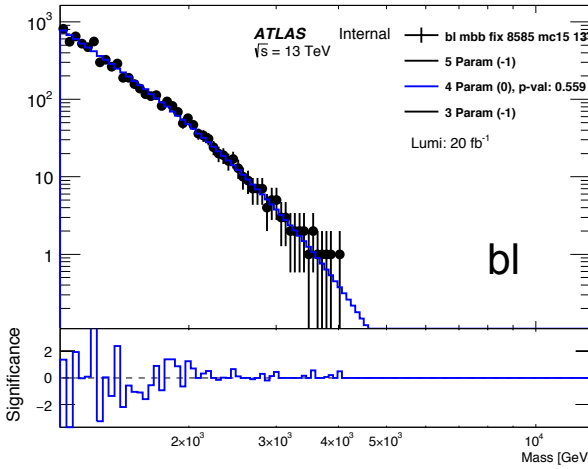
Fit spectrums and make some plots
- *singleFit.py*
- *plotSingleFit.py*

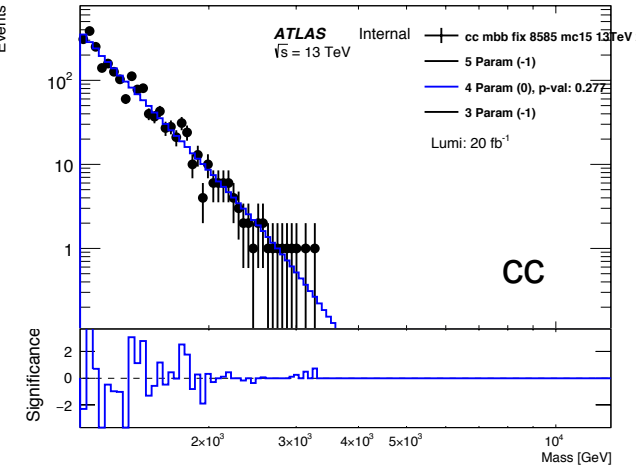
Fit to Flavour Fractions

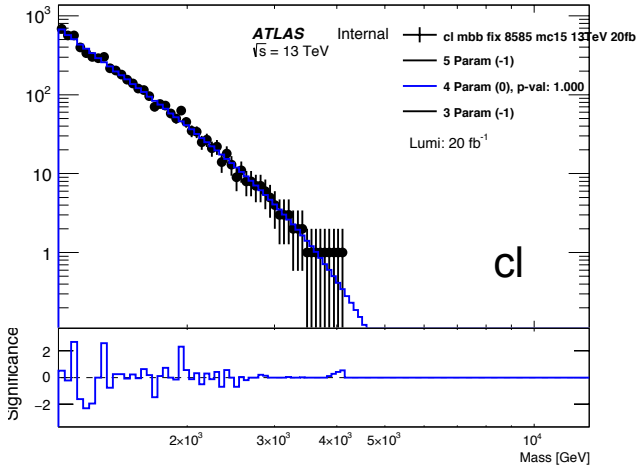
- Extract flavour fractions from 20 ifb of MC using truth information.
- Fit to smooth distributions (rounded to integer) using 4 parameter fitting function.
- Use these fits as templates to model the shape of the flavour fractions.

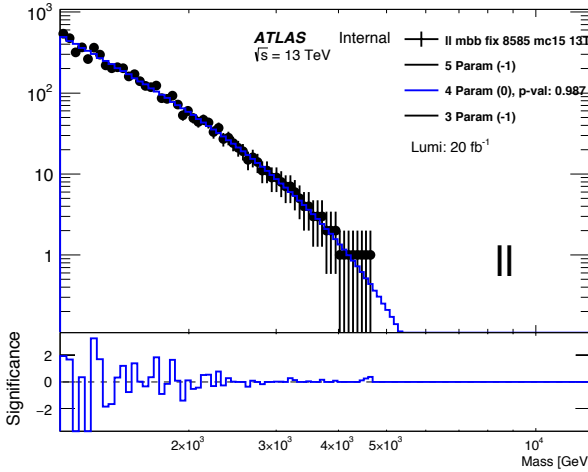








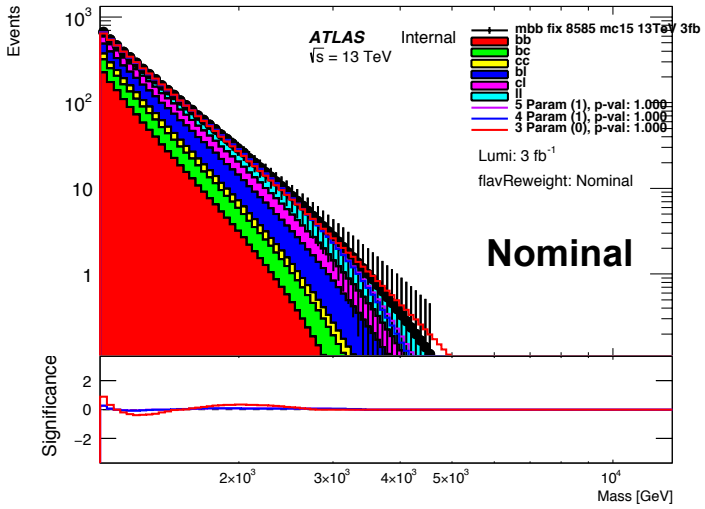


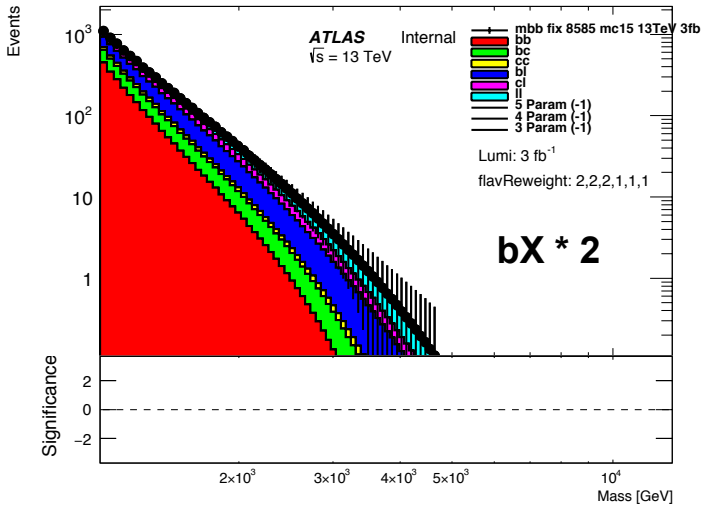


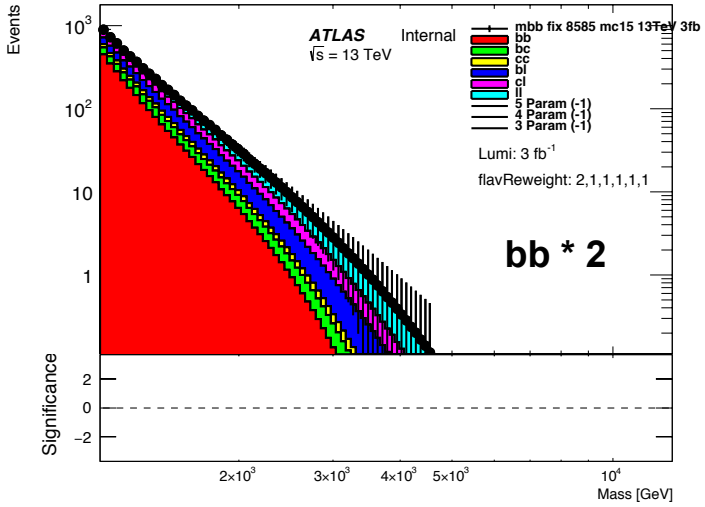
Need to look at errors, here they are poisson. => Maybe I should fit scaled that is truncated at 0.5

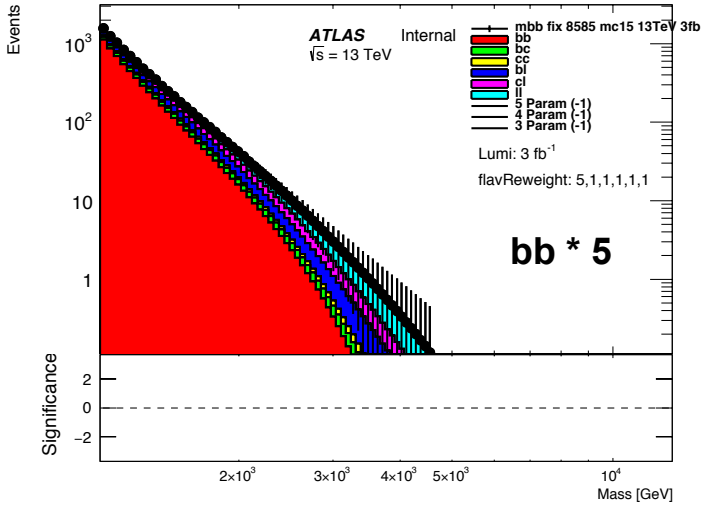
Combining Flavour Composition

- Then combine histograms by,
  => Creating histograms from fits scaled to 3ifb.
  => Adding the fractions in different ways to produce various spectra.
- This creates new scaled distributions from which we can create data-like MC.



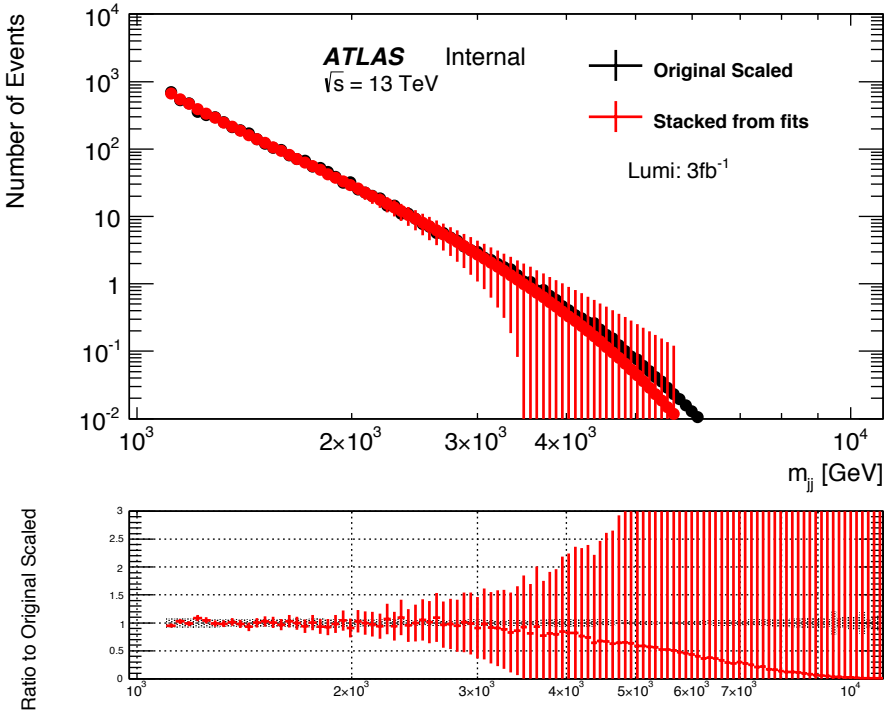






Comparing Nominal to Original Spectrum

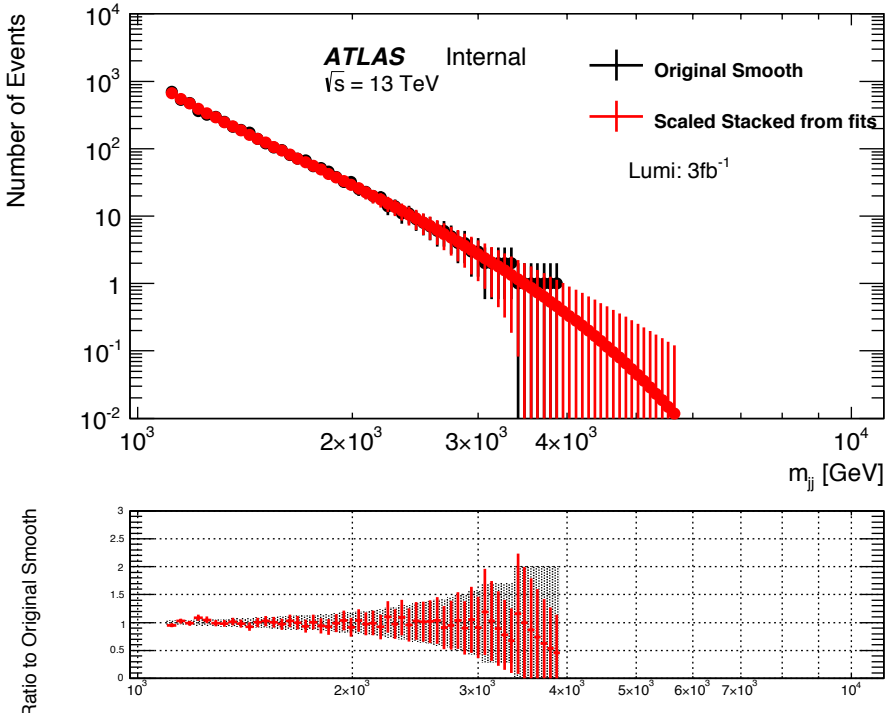
- Compare nominal produced from stacking to original MC sample
  => To validate that our procedure for producing distributions is valid.



Matches well in region where nEvents > 1

Some differences in tail of distribution.

=> All within errors.



Smooth means
- rounded to one
- poisson errors

Smooth distributions was what was originally fitted to
=> Comparison is good.

Comparing the shapes

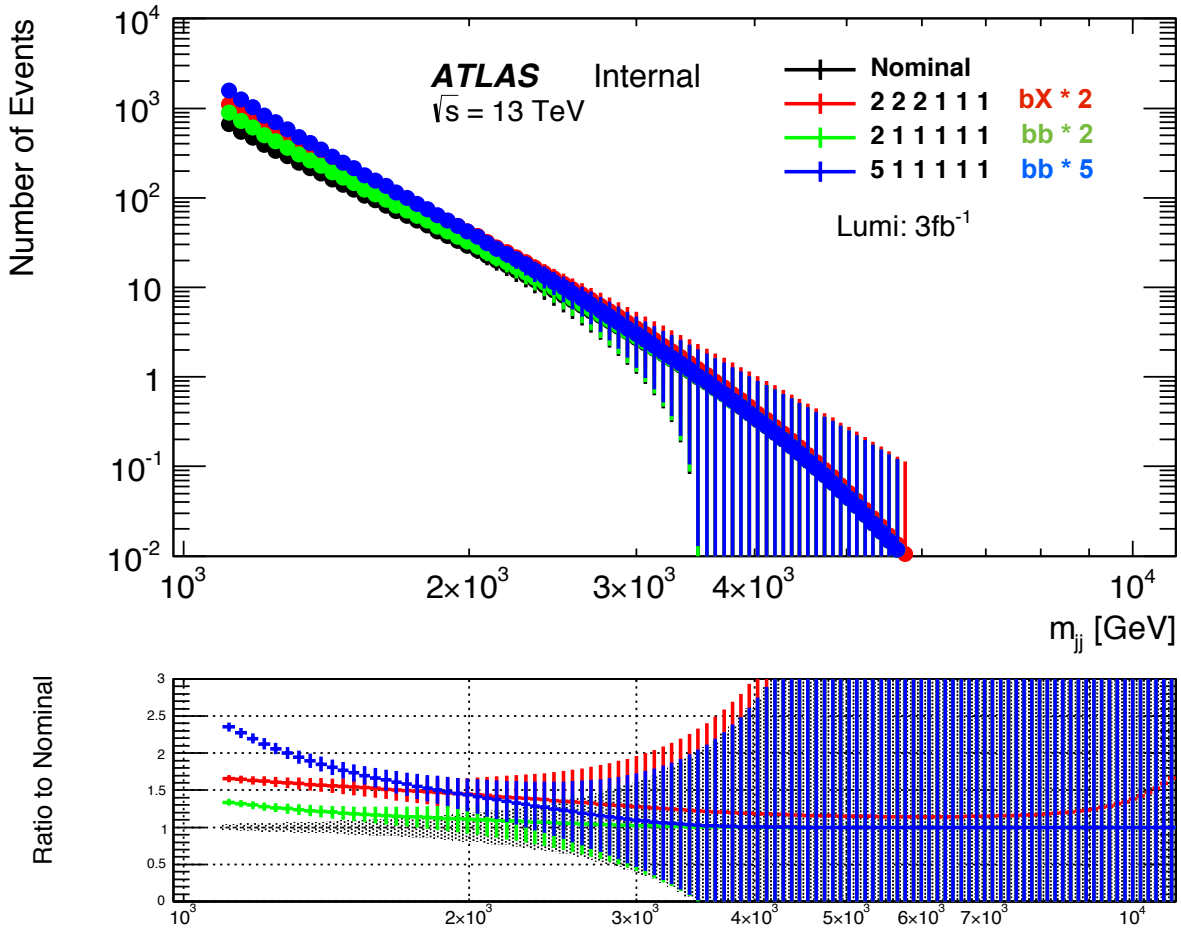
- Compare how different these spectra actually are...

=> 1 1 1 1 1 1 = Nominal, no reweighing.

=> 2 2 2 1 1 1 = double contribution of bb, bc, bl

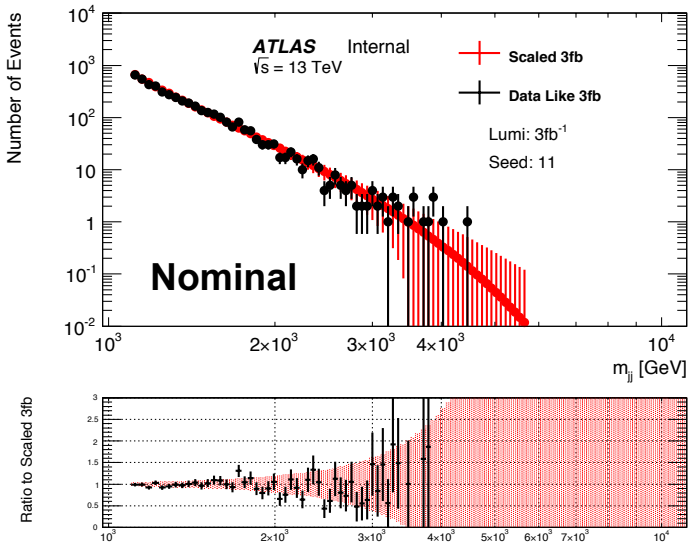
=> 2 1 1 1 1 1 = double contribution of bb

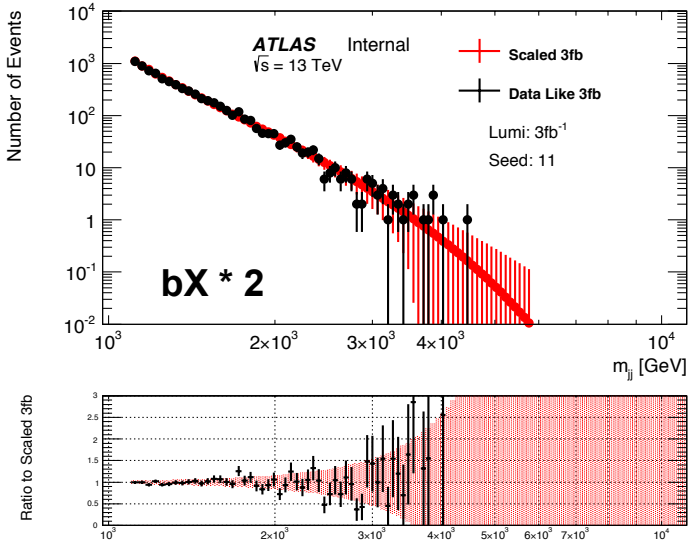
=> 5 1 1 1 1 1 = quintuple contribution of bb

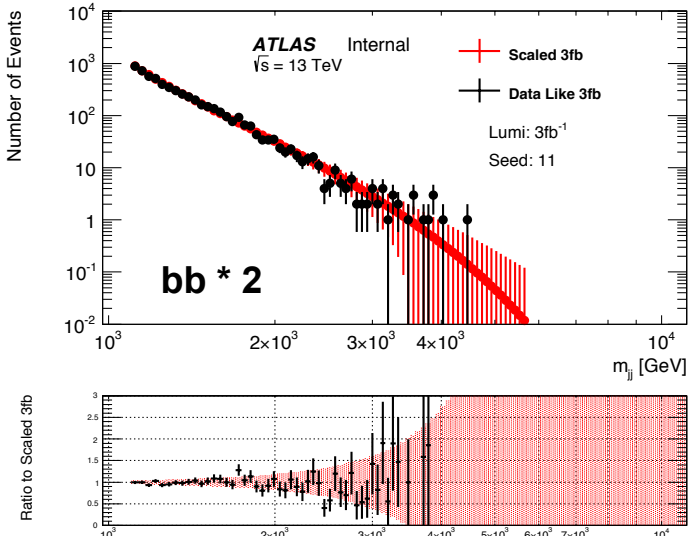


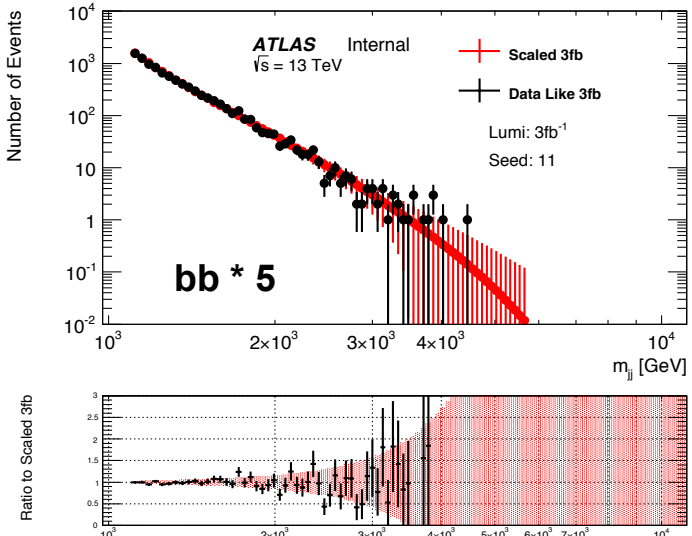
Making Data-Like Monte Carlo

- Make data-like
  => Poisson fluctuating using scaled distribution as mean entry.
- This creates new scaled distributions from which we can create data-like MC.



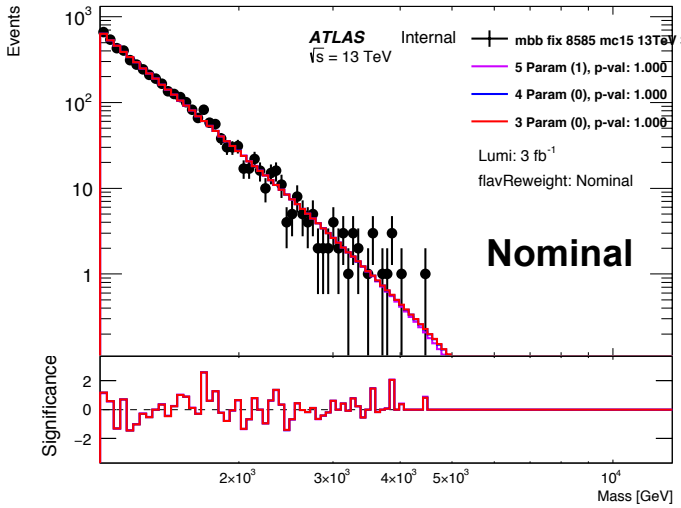


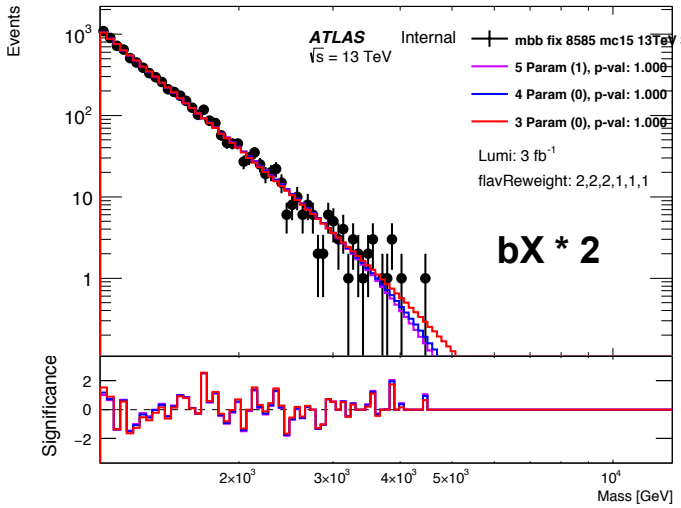


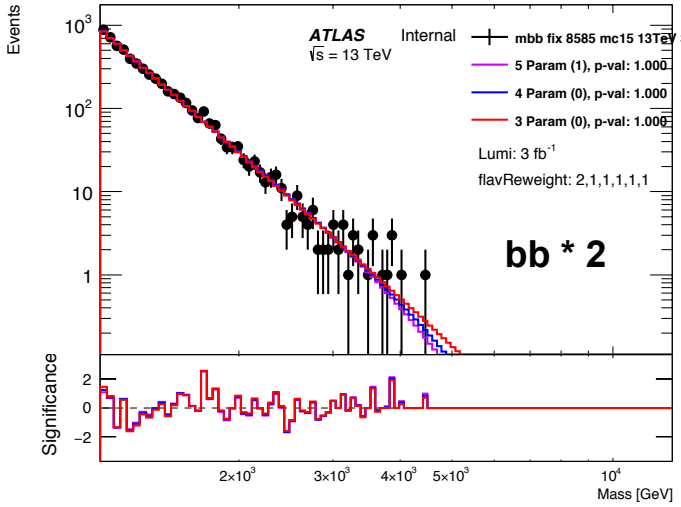


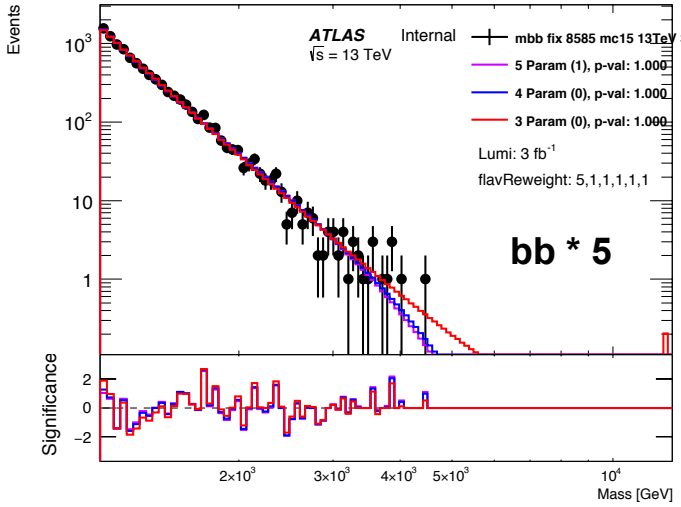
Fitting Procedure

- We then fit to each of our different combinations using the all our fitting functions
- Strong performance in all cases
  => However 3 parameter fit splits from others as weighting increases.









Conclusions

- Considered a selection of different contributions from different components

- We see:

=> No obvious artefacts added to spectrum

=> No problems with fits (High p-value)

Next Steps

- Try to fit to a scaled distribution, to improve quality (p-value) of original fit to the fractions.

- Play with combinations further.

    => Consider decreasing fraction of b-jets.

- Any other suggestions welcomed!