Fit Studies
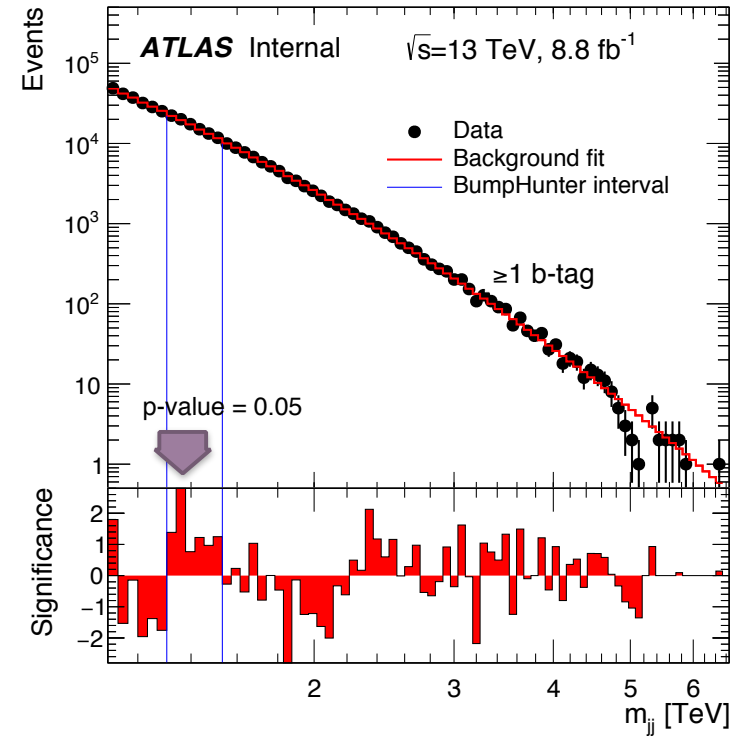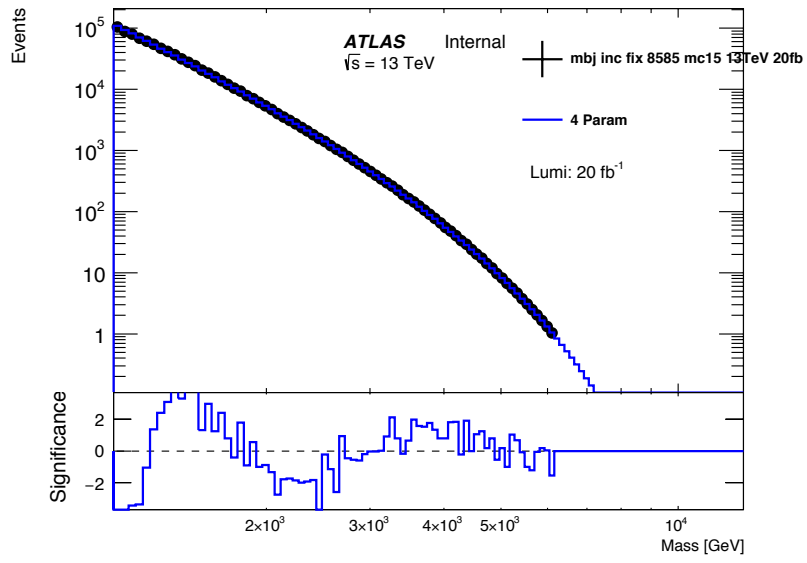
Laurie McClymont,

Di-b-jet Analysis Team

- **Evidence that fit is performing badly in mbj case at low masses - Seen before**

- **Change mjj range used**
  - Shown previously that at 1341 GeV fit is improved

- **Where should we put the cut**
  - Study p-values against mjj cut off in MC
  - Look for plateau in p-values
  - Use MC to show us where we expect a stable fit region

- **Fit to MC**
  - MC errors, number of MC entries rather than poisson errors
  - 'Short' - cut off where we expect one event (limits upper mass range)
  - Fit using search phase.
  - MC - 20160713
    => Fixed b-tagging bug that was discussed in EB meeting
    => Updated scale factors
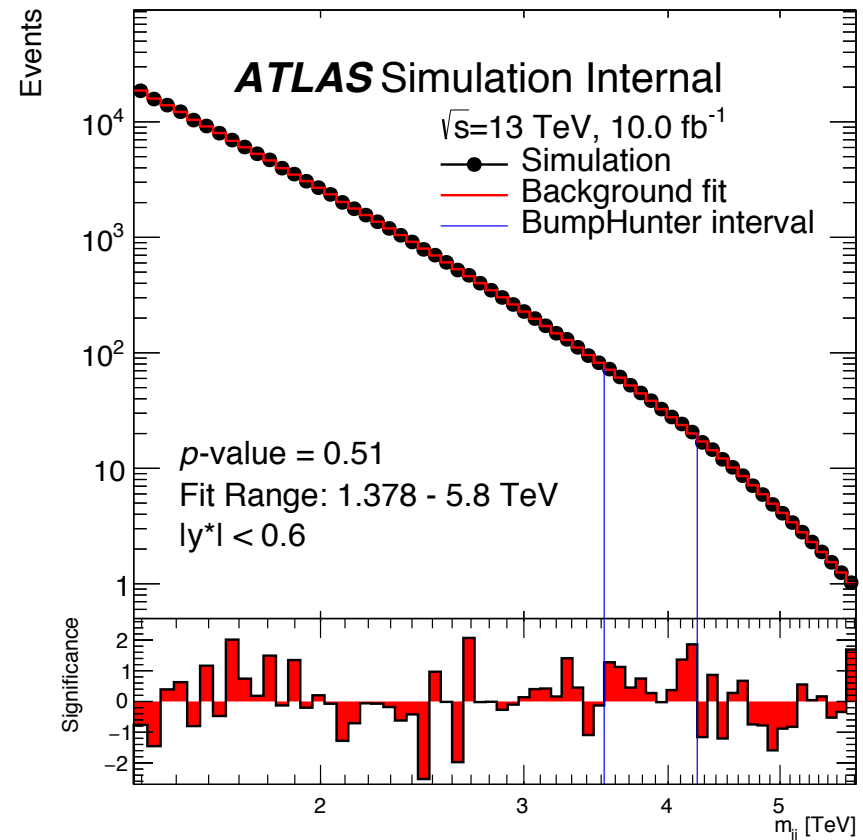
>= 1 b-tag : 4-par
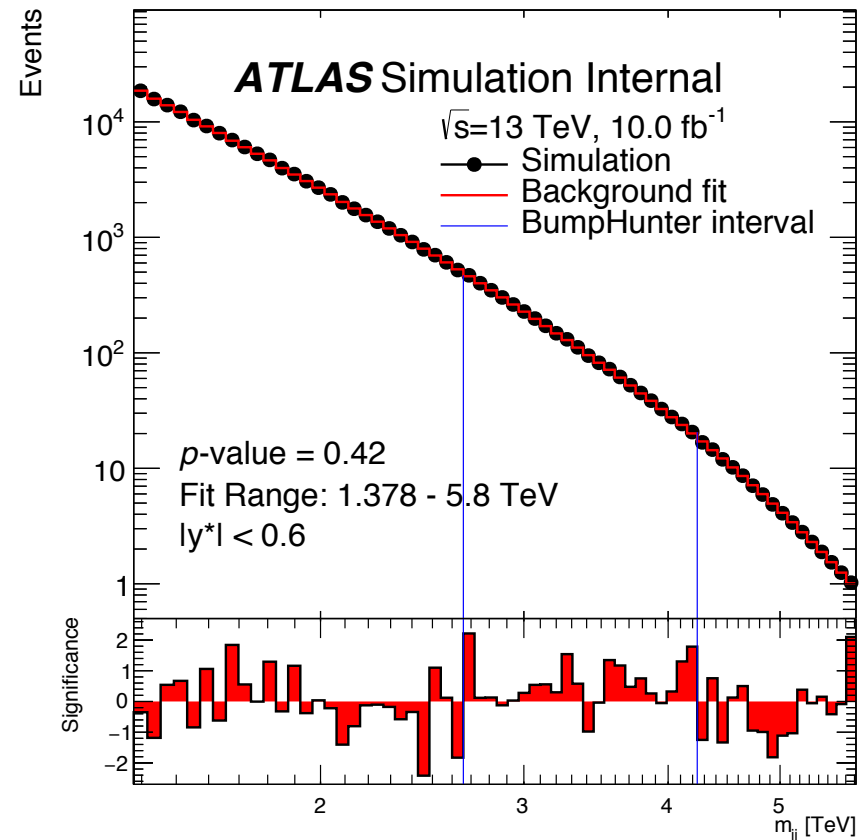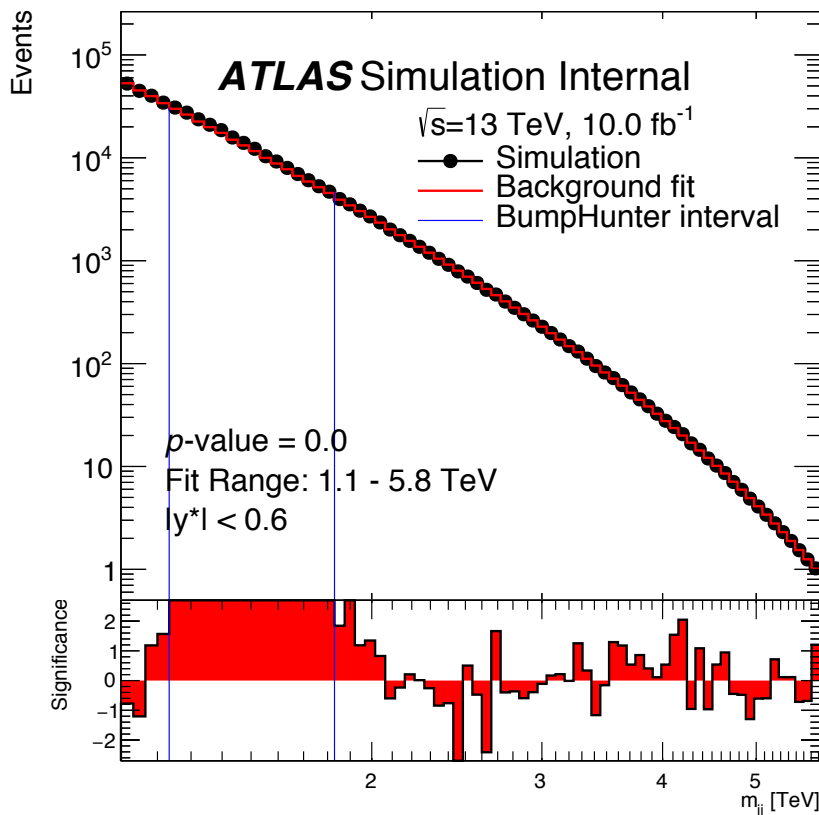
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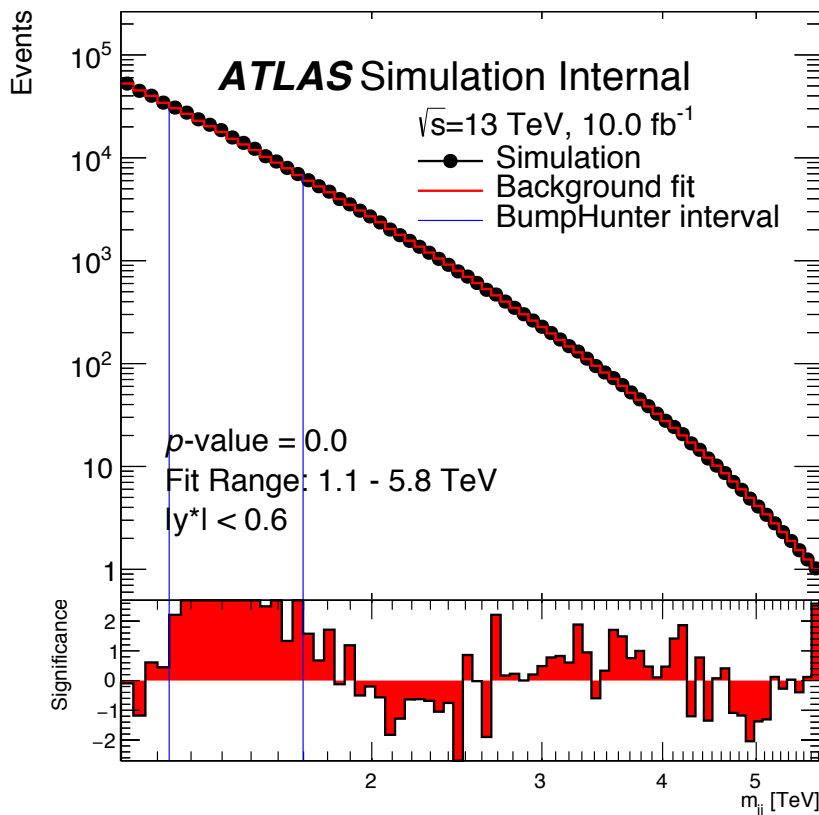   => Updated scale factors
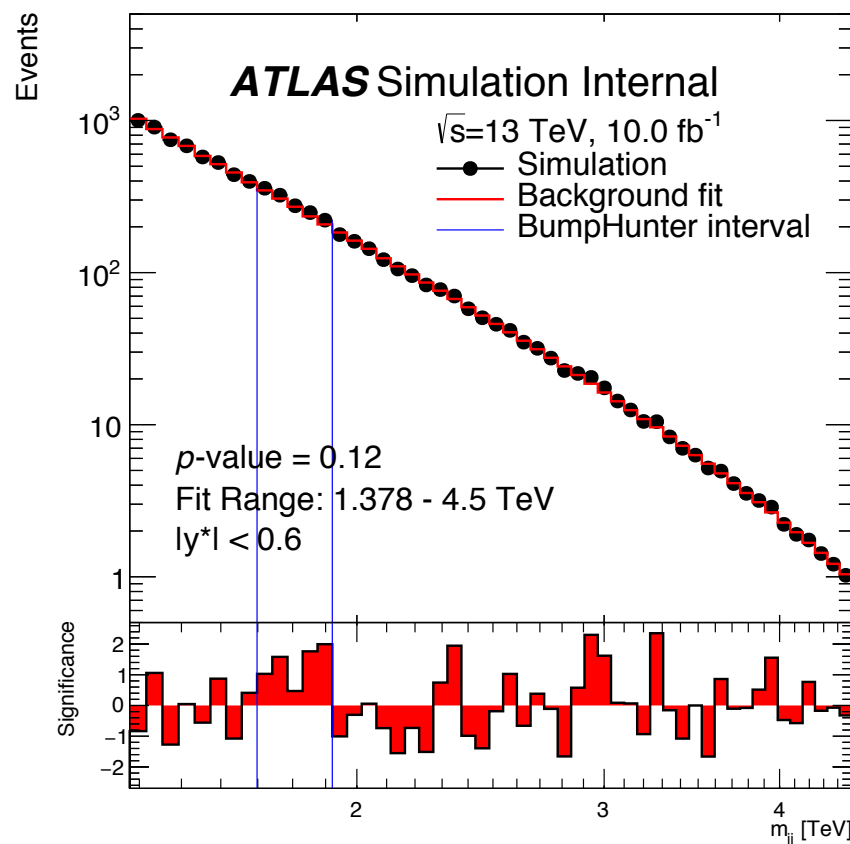
>= 1 b-tag : 5-par

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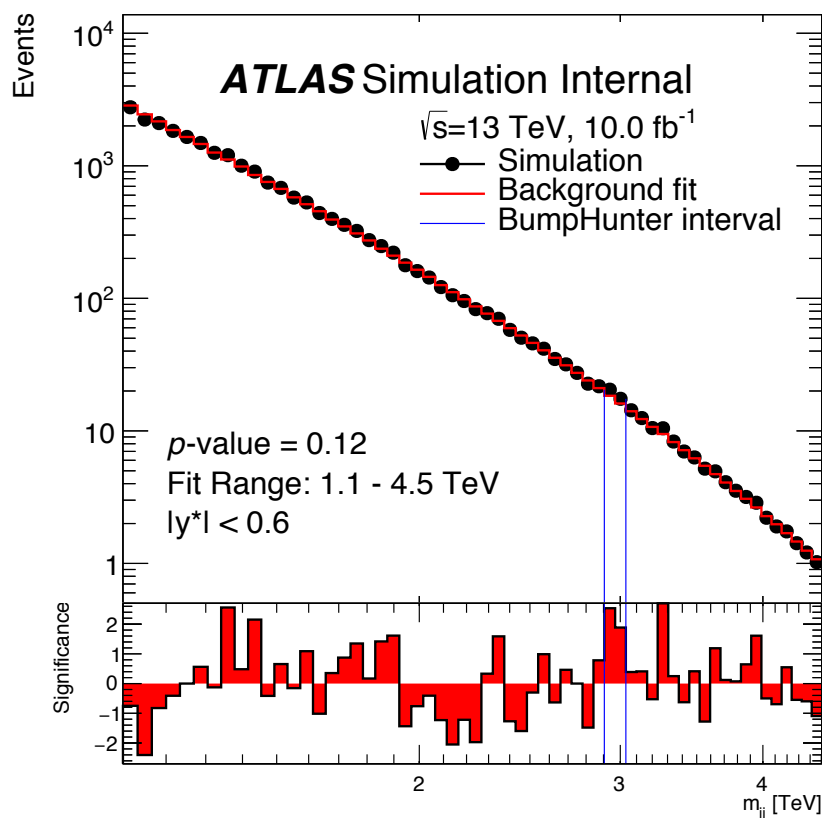   => Updated scale factors

2 b-tag : 4-par

- **Fit to MC**
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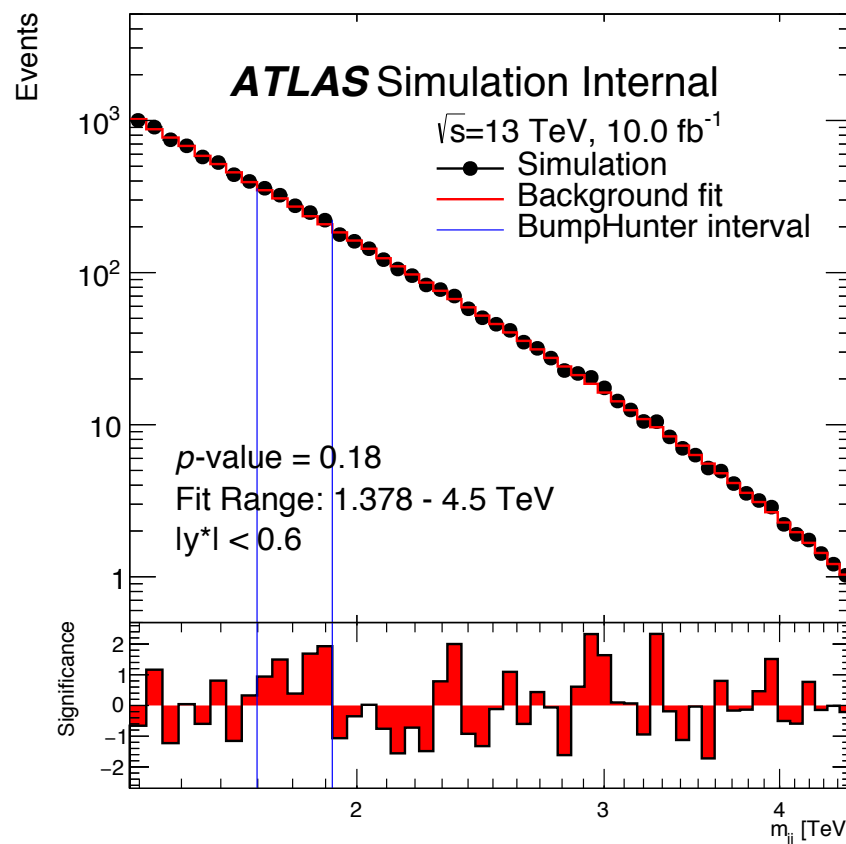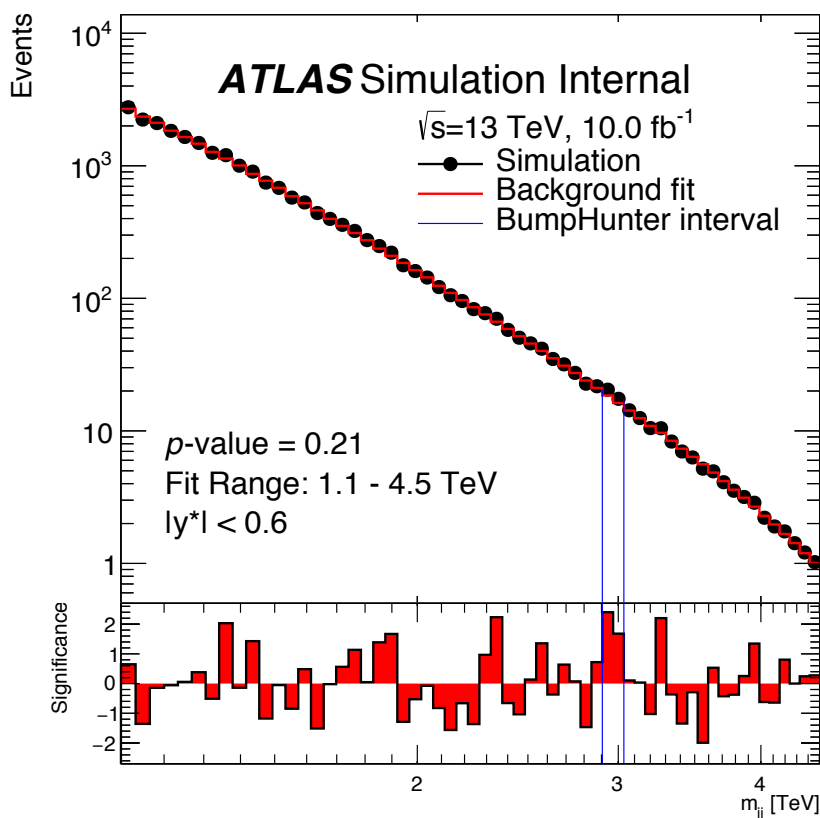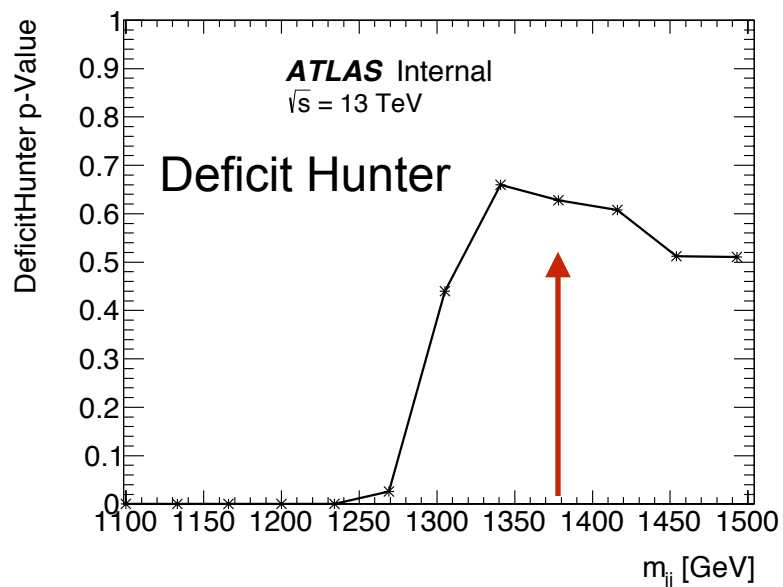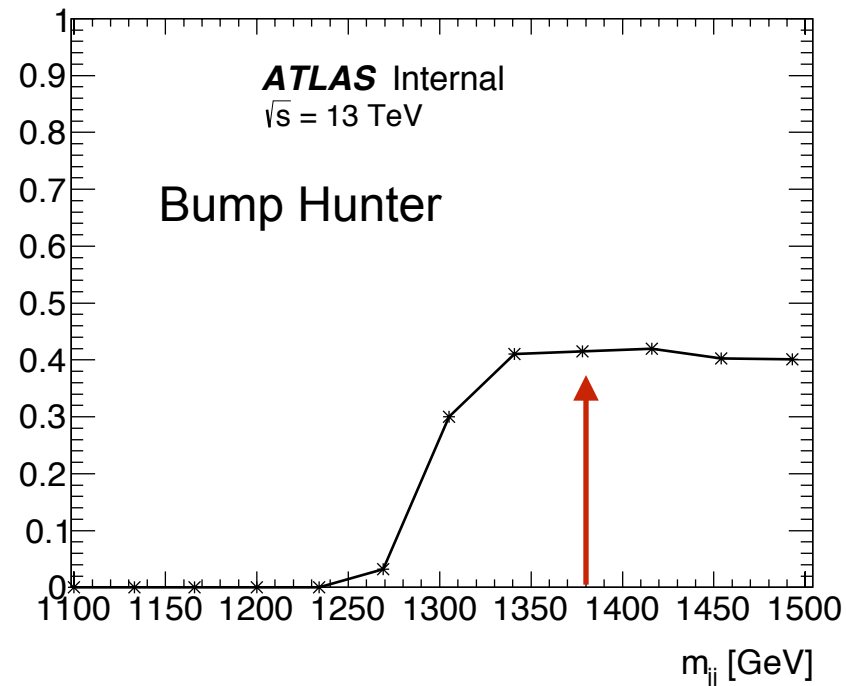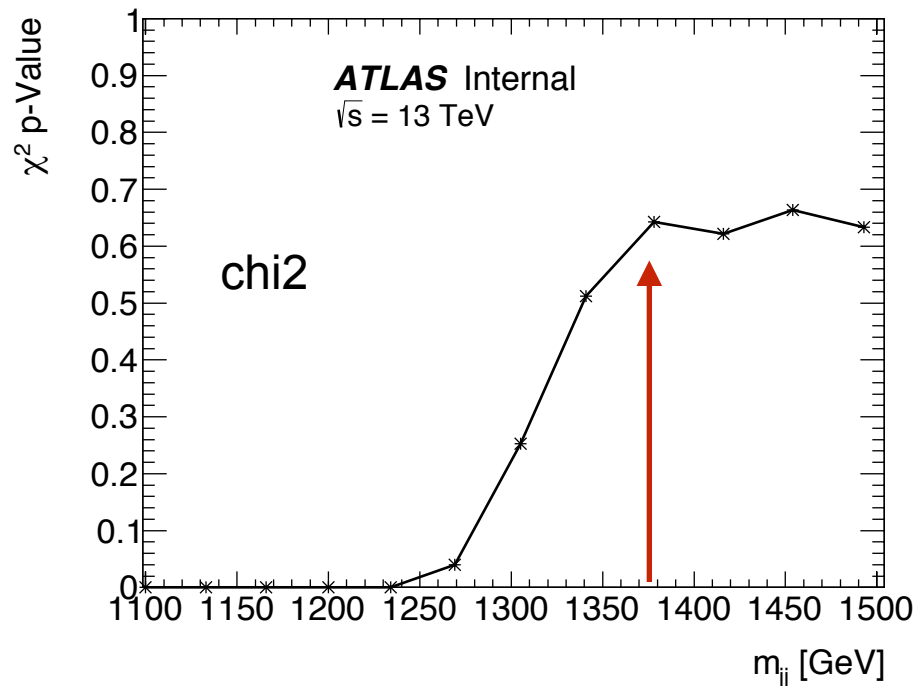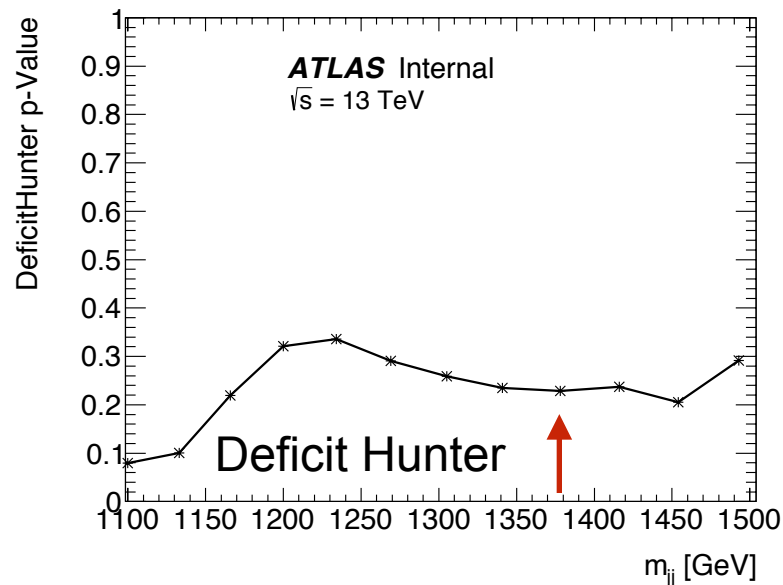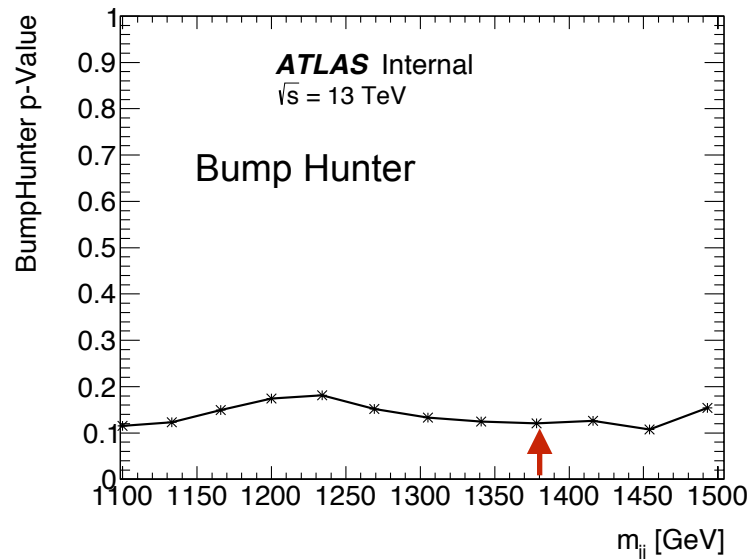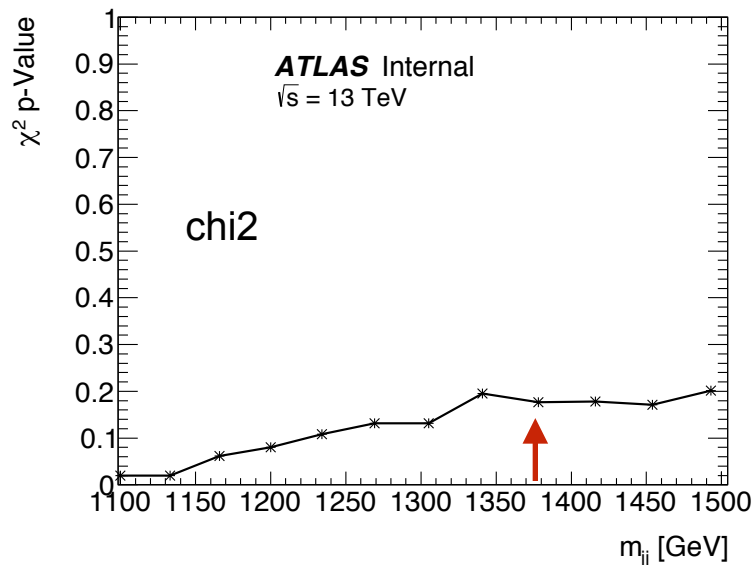   => Updated scale factors

2 b-tag : 5-par

MC - 20160713
4 parameter fit function
Inclusive 1 b-tag category
Short @ 10 fib (cut off at 1 event)

Plateau at 1378 GeV

- Shows that mjj > 1378 GeV
  is a stable fitting region

UCL

chi2

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

χ^2 p-Value

m_{jj} [GeV]

Bump Hunter

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

BumpHunter p-Value

m_{jj} [GeV]

Deficit Hunter

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

DeficitHunter p-Value

m_{jj} [GeV]

MC - 20160713
4 parameter fit function
2 b-tag category
Short @ 10 fib (cut off at 1 event)

- **Why are p-values lower than 1-tag?**
- Errors given by MC stats
- We are sensitive to fluctuations in MC production
- Seems here there are some fluctuations…

- **We are ok in data-like**
- These flucts are smaller than Poisson flucts we will see in data (especially at high mass)
- Spurious signal study shows good fit quality

Stable fit region by 1378 GeV

MC - 20160712
4 parameter fit function
2 b-tag category
Short @ 10 fib
- (cut off at 1 event)

Plateau- at 1378 GeV
- Shows that mjj > 1378 GeV
  is a stable fitting region

- **Why are p-values lower than 1-tag?**
- Errors given by MC stats
- We are sensitive to fluctuations
  in MC production
- Seems here there are some
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- Spurious signal study shows
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mjj > 1.1 TeV
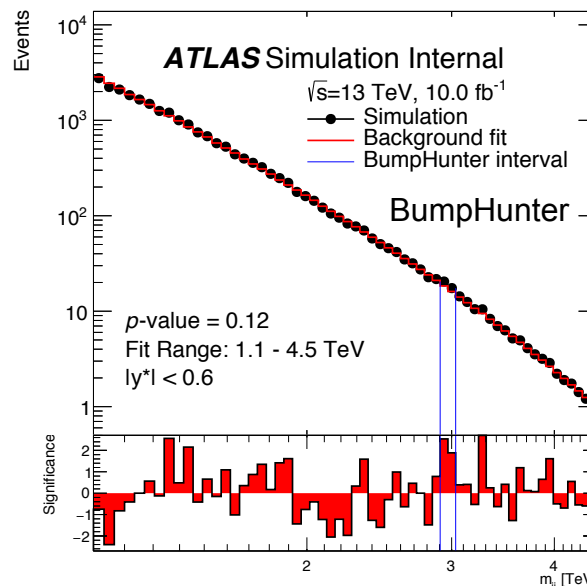
mjj > 1.378 TeV
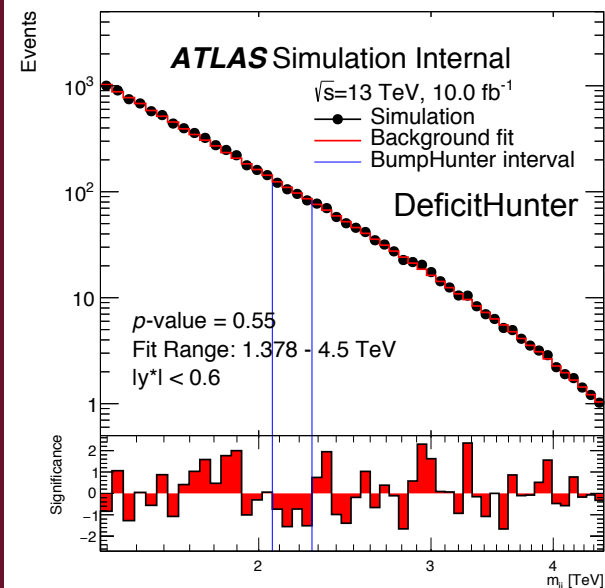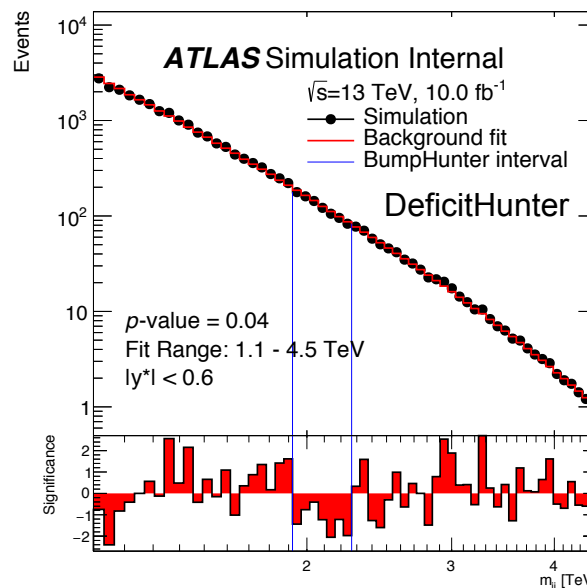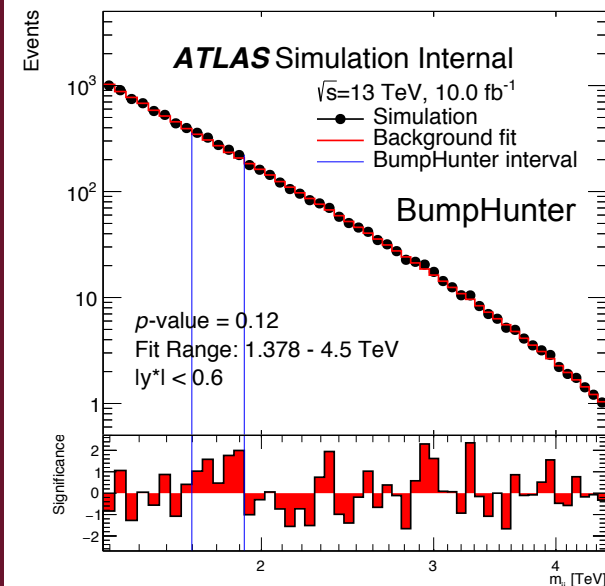
- **Confirm that fits discrepancies are not significantly occurring**
  - Fit discrepancy = A difference in shape between fitting function and background shape
  - Fit discrepancy may hide true signal or create fake signal

- **Test fit function by performing fits to background only data-set**
  - Use MC for representative background only data-set
  - Create data-like distributions by applying poisson fluctuations
  - Study fit quality - BH p-value, Chi2 p-value, Deficit Hunter p-value
  - Search for evidence of spurious signal

We want data-like distributions, poisson fluctuations applied to precise background estimate
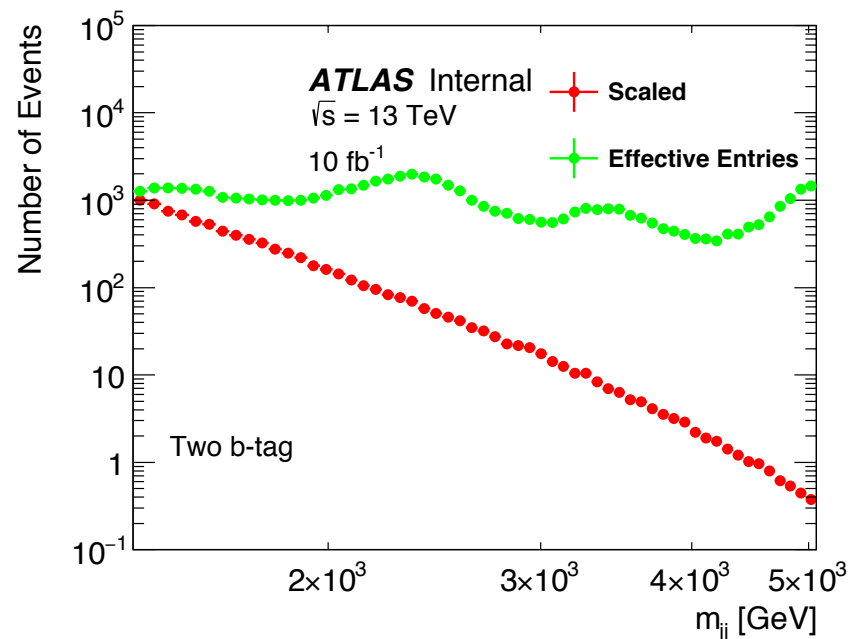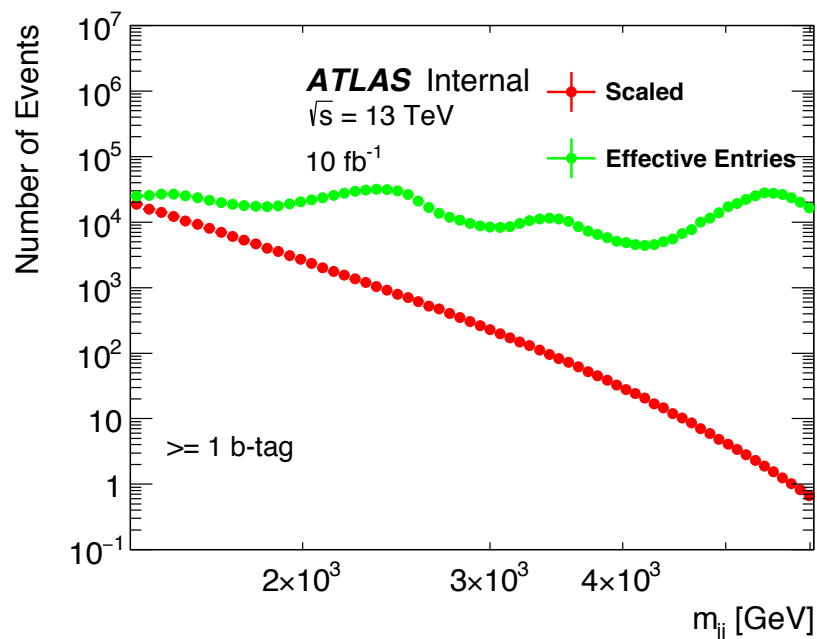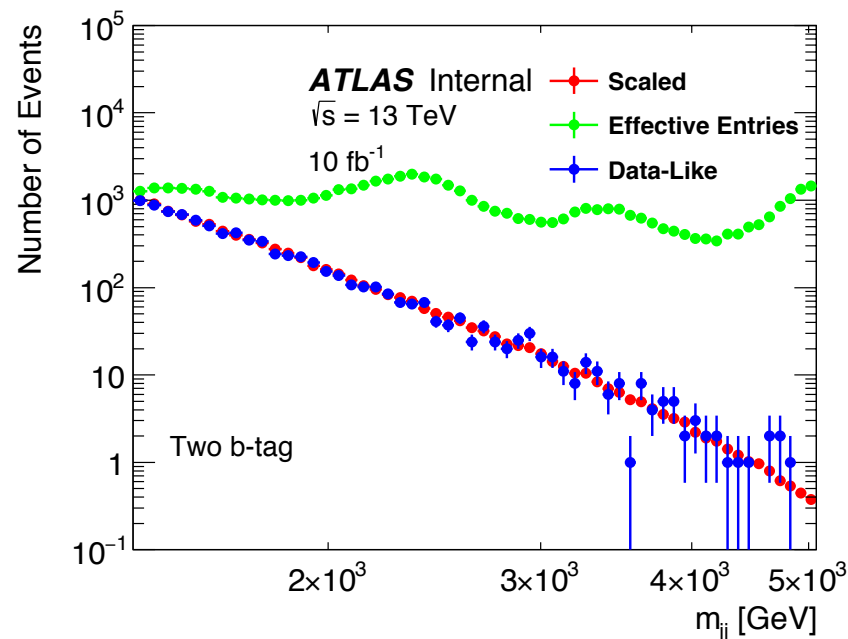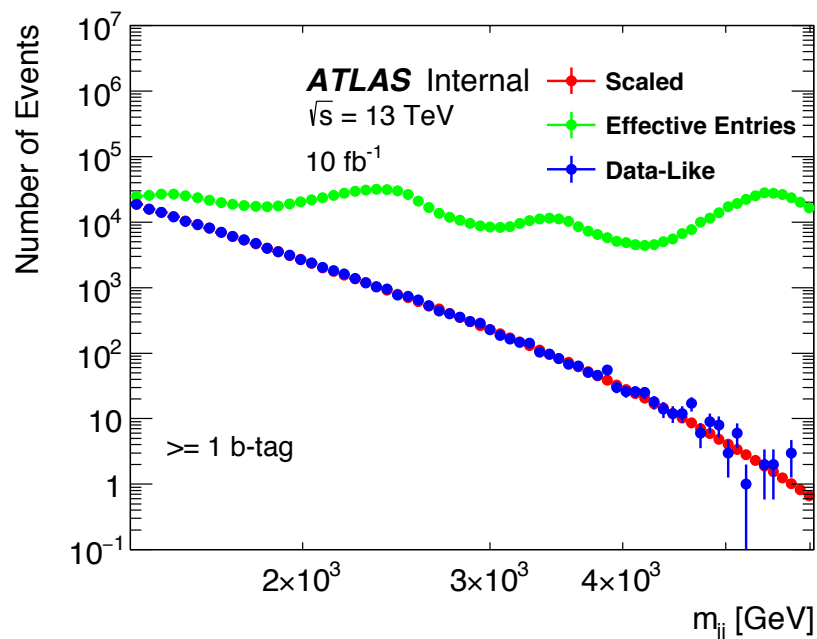

Where Effective Entries > Scaled: We have enough stats for fit tests
- Know expected entry more precisely than data

We want data-like distributions, poisson fluctuations applied to precise background estimate

Where Effective Entries > Scaled: We have enough stats for fit tests
- Know expected entry more precisely than data

Make Data-Like distributions by applying random Poisson fluctuations
- Shown is one particular set of random fluctuations.
- We can fit to the data-like distributions

Many different data-like distributions can be made with different fluctuations
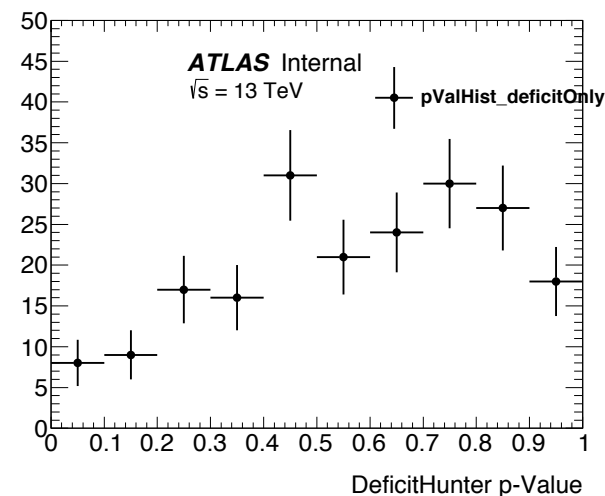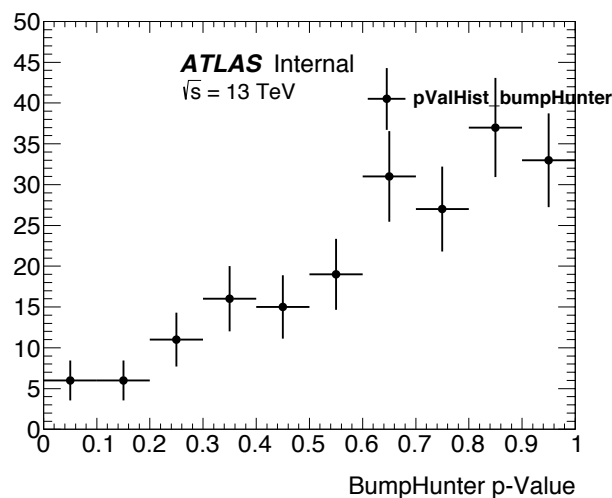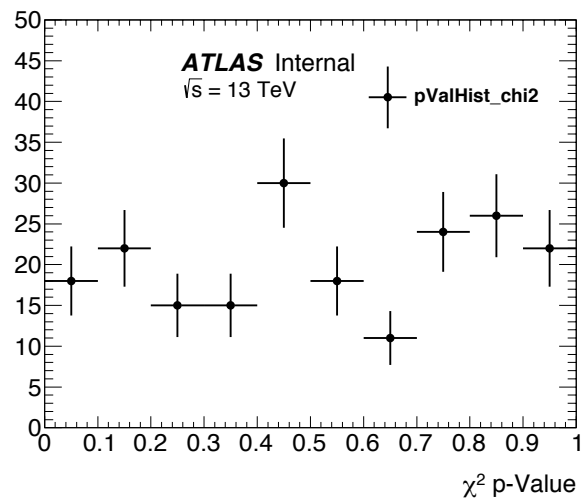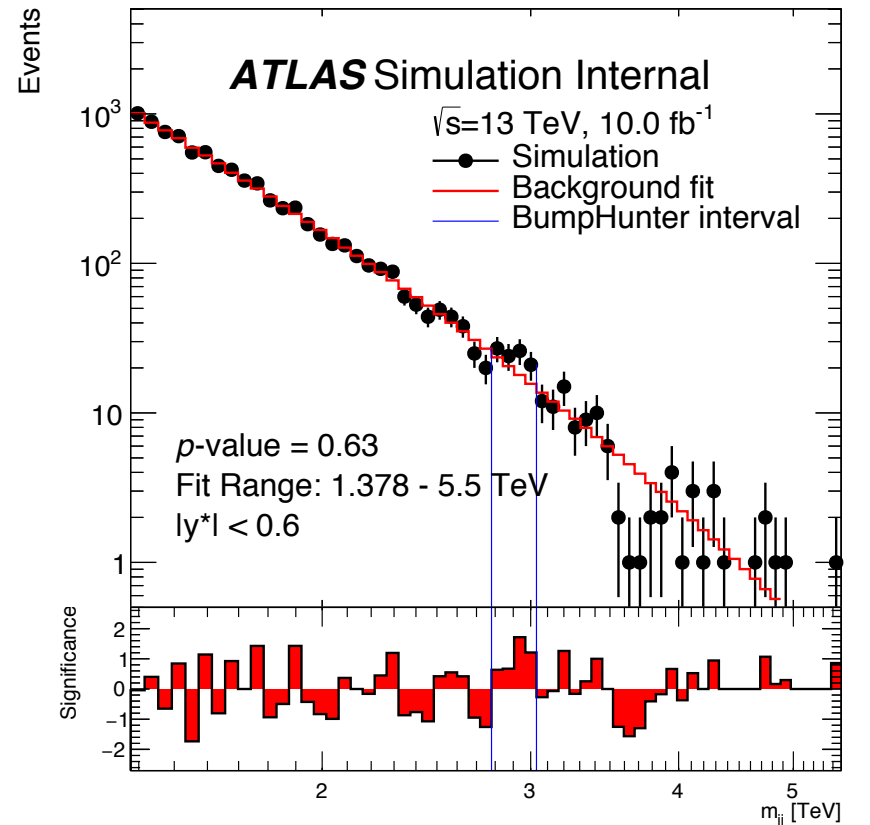- Gives us a global study of our fitting procedure

>= 1 b-tag category
4 para fit function

Data-like background only distributions
- Taken from MC scaled to 10 ifb
- Apply poison fluctuations
- 200 different fluctuations

Fit Range: 1378 - End of Data

2 b-tag category
4 para fit function

Data-like background only distributions
- Taken from MC scaled to 10 ifb
- Apply poison fluctuations
- 200 different fluctuations

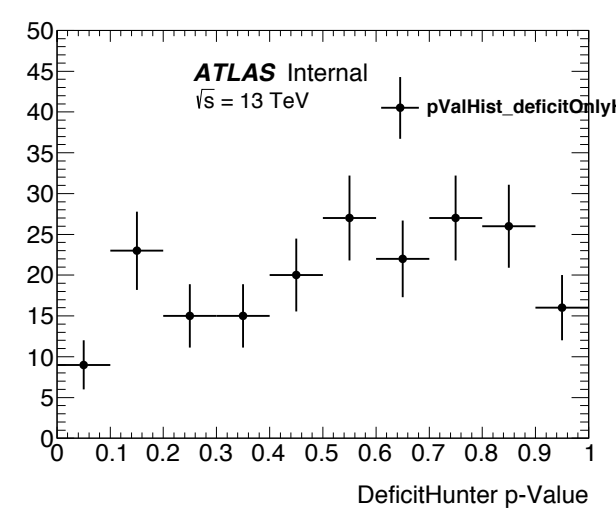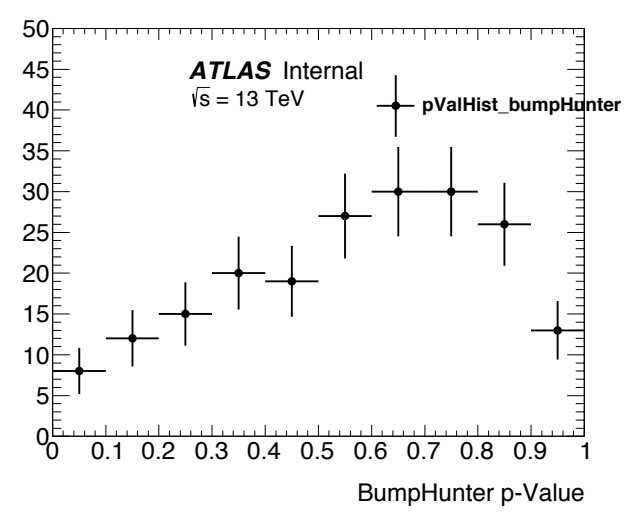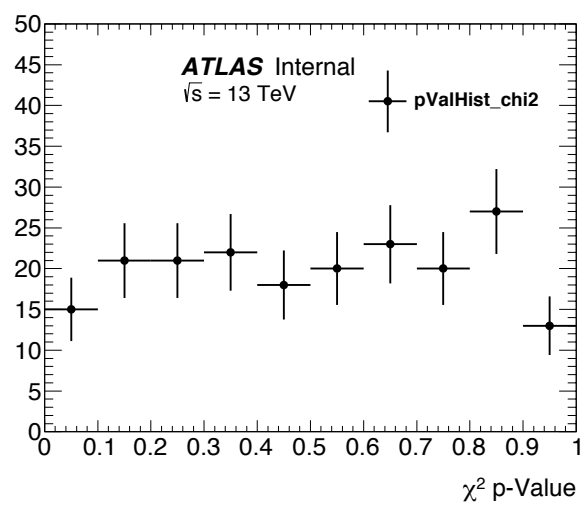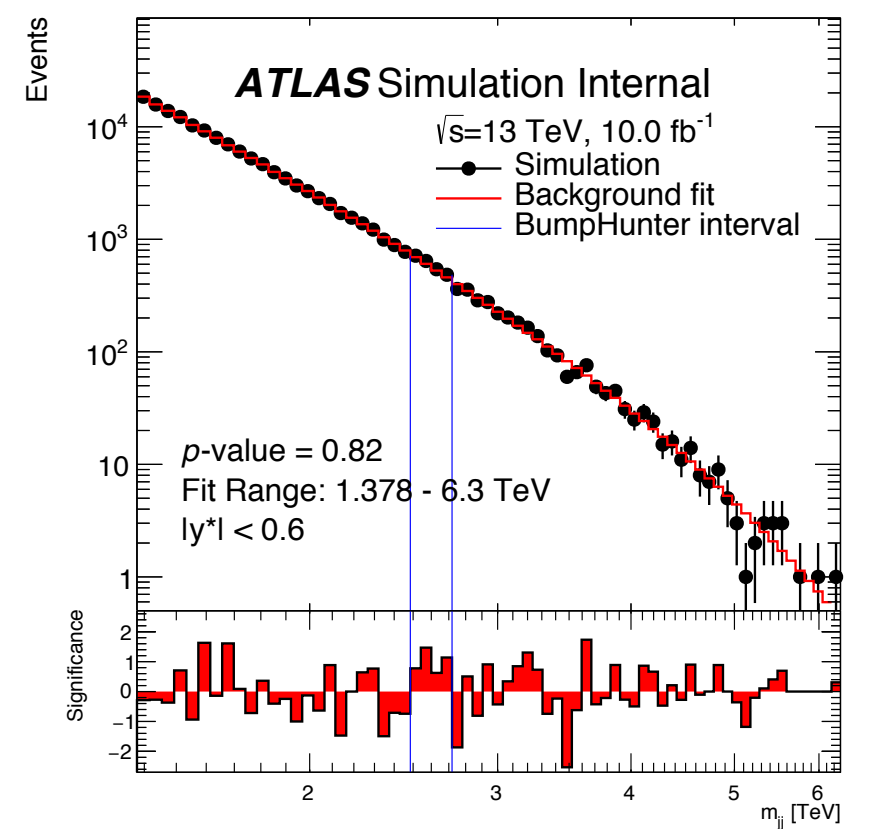Fit Range: 1378 - End of Data

ATLAS Simulation Internal

$\sqrt{s}$=13 TeV, 10.0 fb^{-1}

— Simulation
— Background fit
— BumpHunter interval

p-value = 0.82
Fit Range: 1.378 - 6.3 TeV
|y*| < 0.6

Events

Significance

m_{jj} [TeV]

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

pValHist_chi2

χ^2 p-Value

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

pValHist_bumpHunter

BumpHunter p-Value

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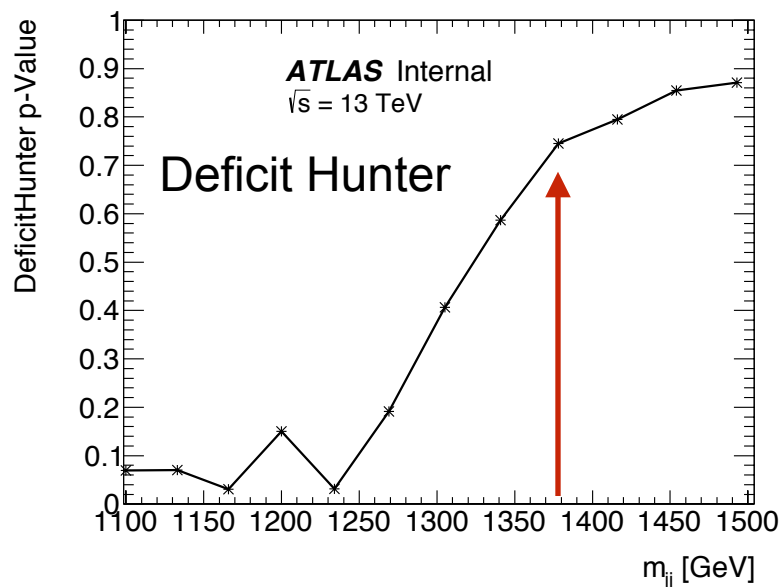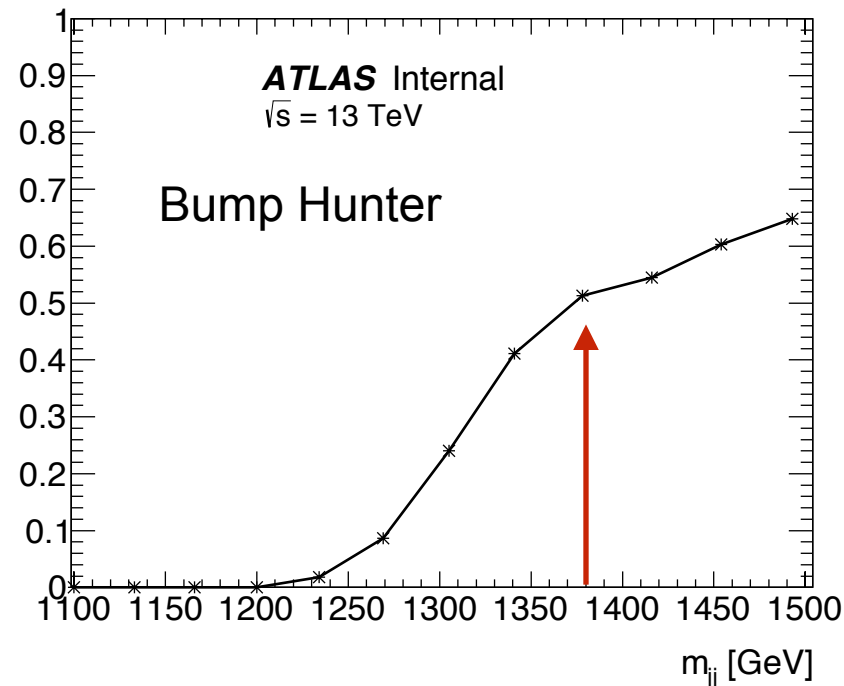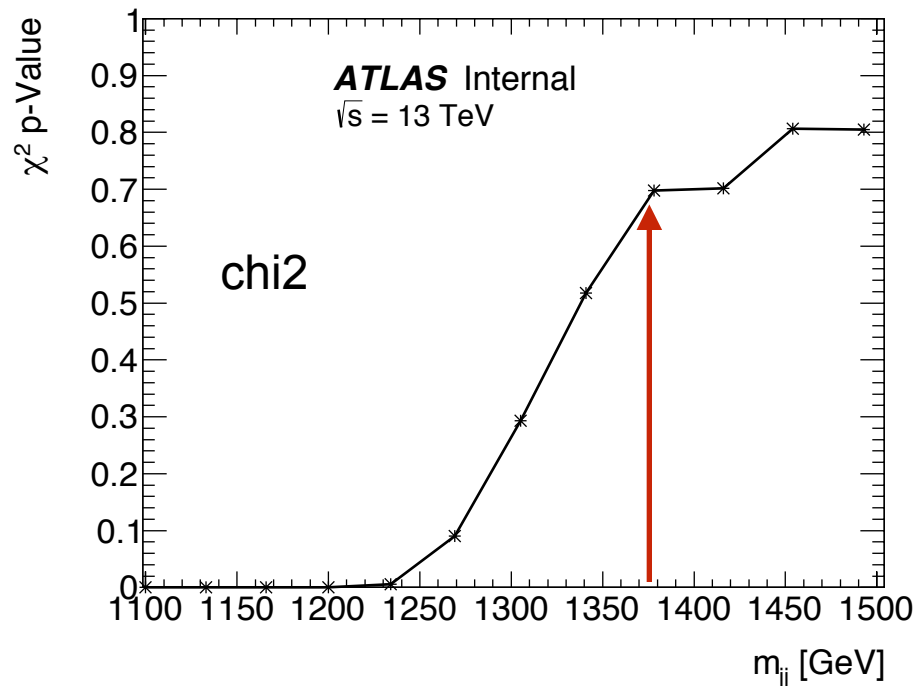$\sqrt{s}$ = 13 TeV

pValHist_deficitOnly

DeficitHunter p-Value

- **MC - 2016071̲3̲**

=> Fixed b-tagging

=> New scale factors

- **>= 1 b-tag category**
 - **chi2 and bH p-value plateau @ mjj > 1378 GeV**
 - No spurious signal, mjj > 1378 GeV

- **2 b-tag category**
 - chi2 and bH p-value stable @ mjj > 1378 GeV
 - No spurious signal, mjj > 1.378 TeV

- **Updating INT note now!!**

Backup

MC - 20160713
5 parameter fit function
Inclusive 1 b-tag category
Short @ 10 fib (cut off at 1 event)

Plateau at 1378 GeV
- Shows that mjj > 1378 GeV
  is a stable fitting region

Event Selection

Pythia8EvtGen MC Di-Jet Sample
- **HLT_j380**
- 2016 MC
- di-b-jet Ntuple production

Scale to 10ifb
- Will update for final lumi

- **Standard Dijet Resonance Cuts**
  - Leading Jet pT > 430 GeV
  - Sublead Jet pT > 60 GeV
  - $|y^*| < 0.6$
  - mjj > 1100 GeV

- **MV2c10**
  - Using fixed cut 85% for both jets
  - mbb_fix_8585
  - mbj_inc_fix_8585