

# **Unbinned fit in $Z\gamma$ boosted analysis**

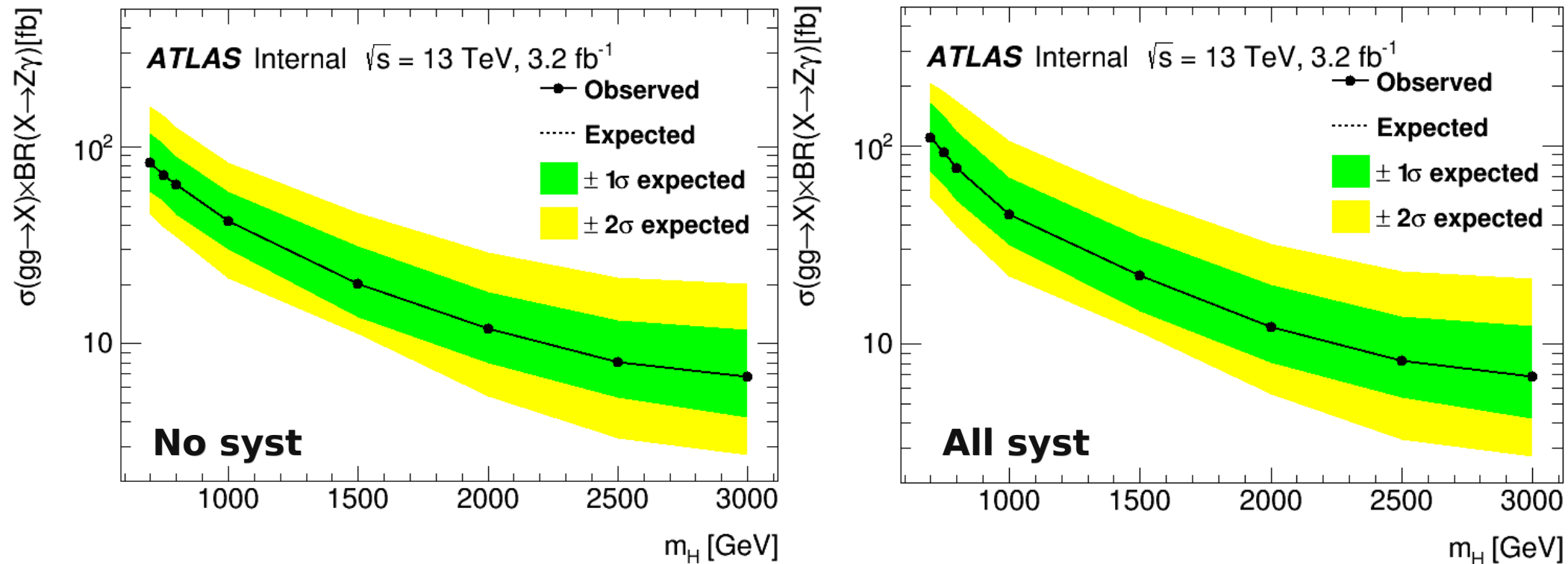
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IHEP  
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# Upper limits (expectation only)

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- Expected limits only from unbinned fit



Observed in these plots are set to expected

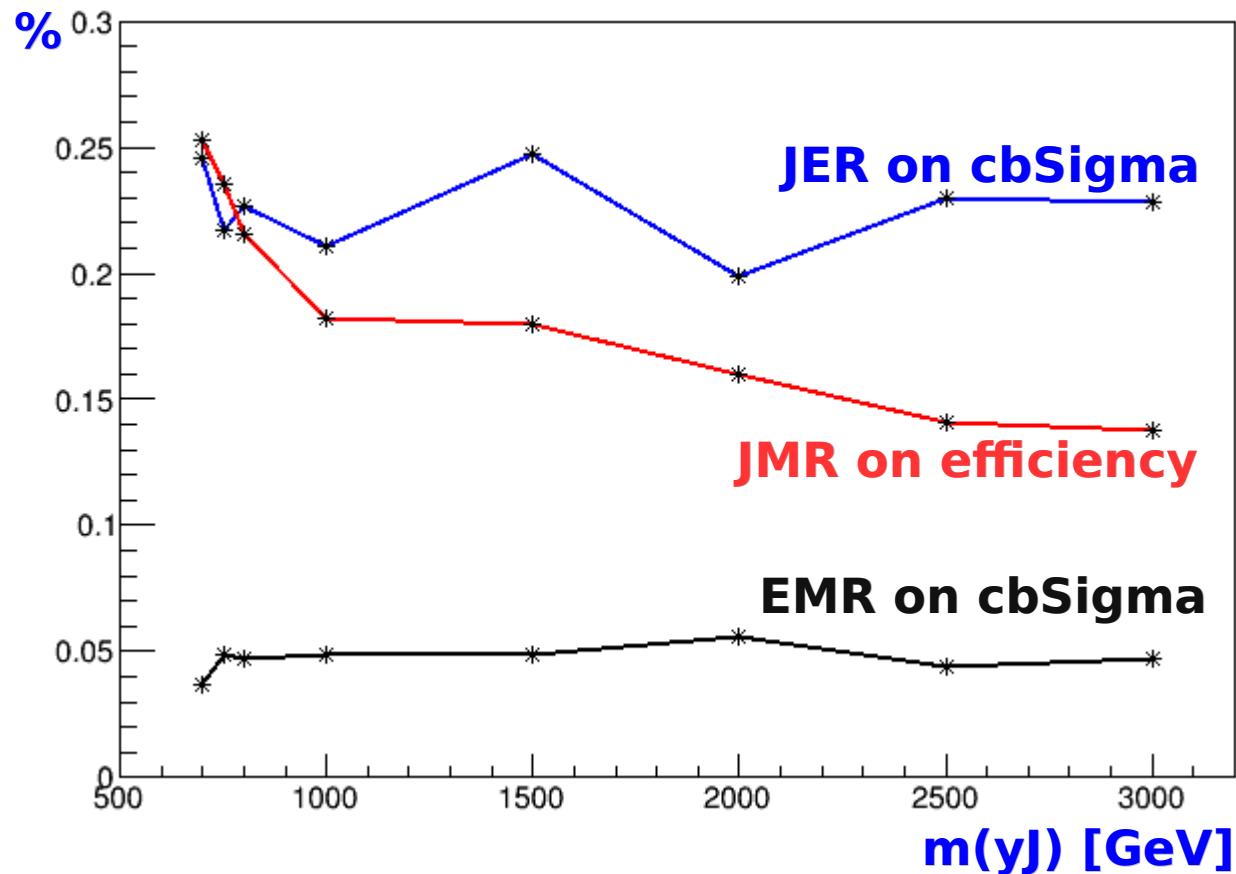
# Add systematic uncertainties

- Based on signal template generation script from Zhijun, I added to signal modeling several systematic uncertainties
  - JER, affects cbSigma
  - EMR, affects cbSigma
  - EM, affects cbMu
  - JES, affects cbMu
  - JMR, affects signal efficiency

$$f(m(\gamma J)) = f_{CB} CB(m(\gamma J); \mu, \sigma_{CB}, \alpha_{CB}, N_{CB}) + (1 - f_{CB}) Gauss(m(\gamma J); \mu, k\sigma_{CB})$$

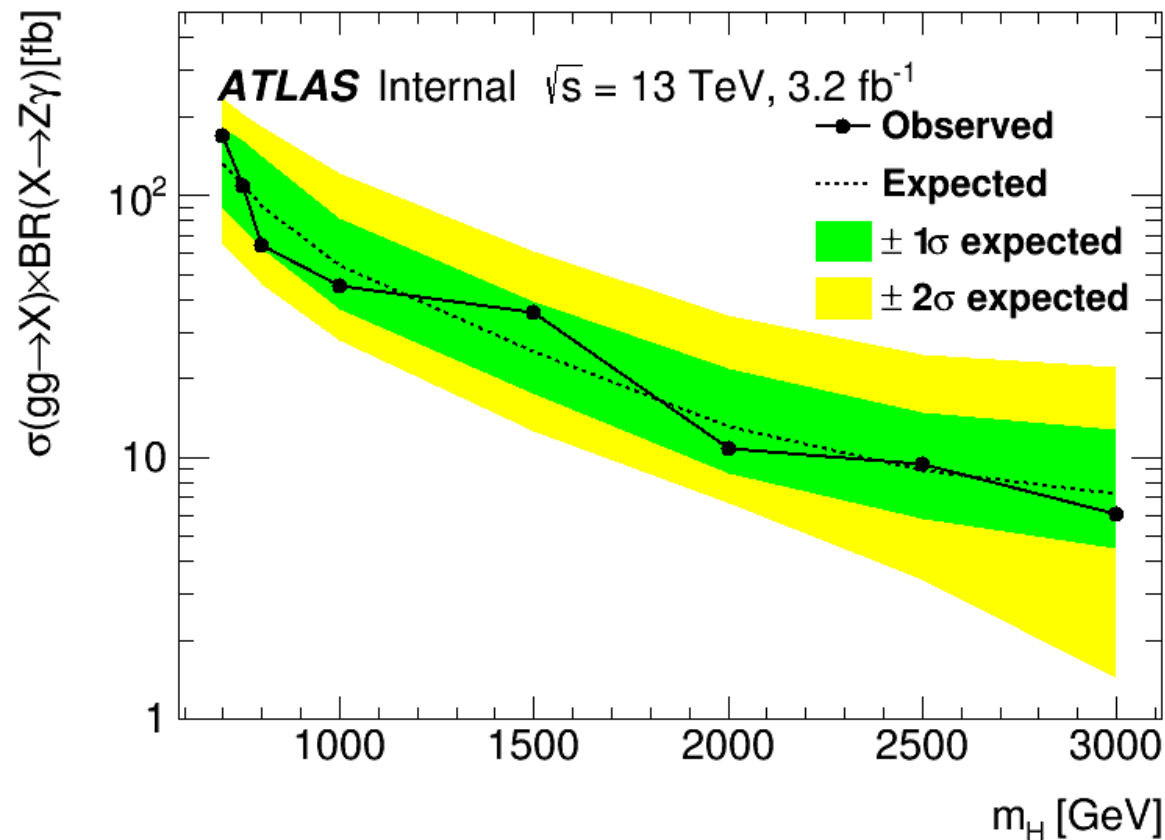
# Uncertainty inputs

- The rate/resolution uncertainties due to major sources of systematics

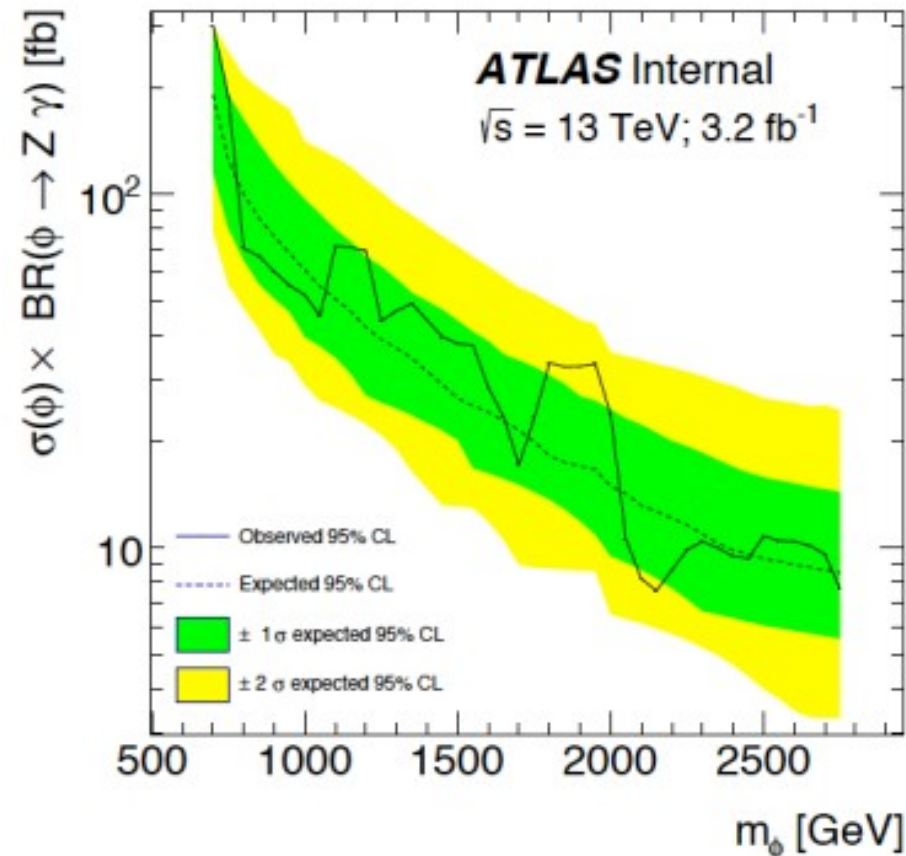


# Upper limits (obs)

- Compared to binned fit



**Unbinned fit**

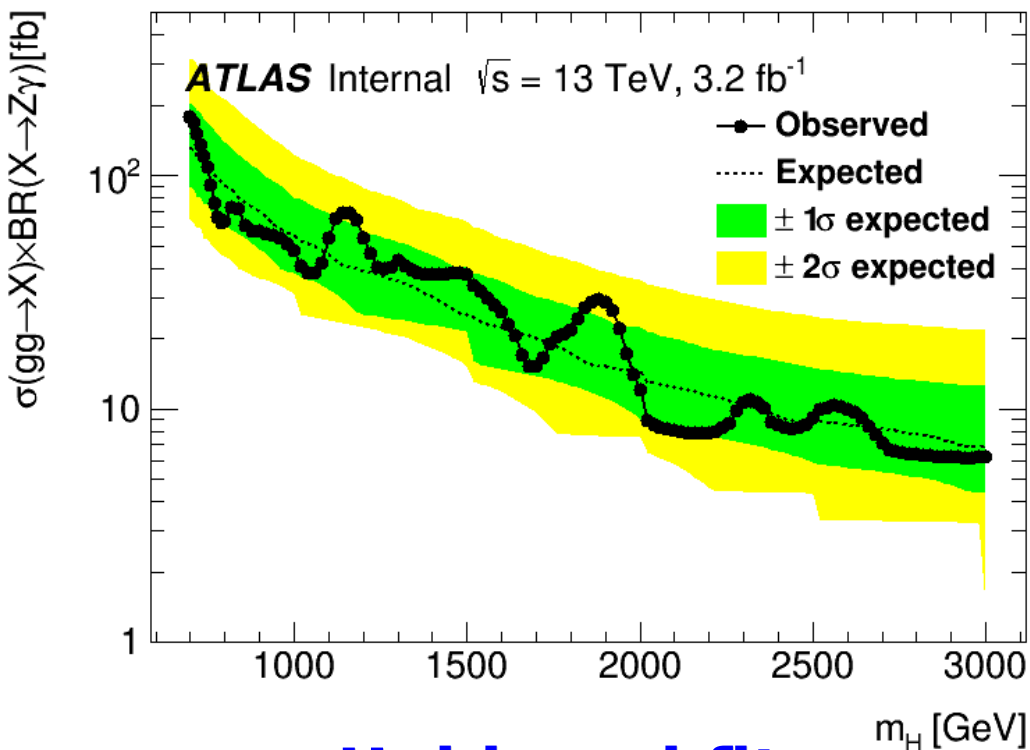
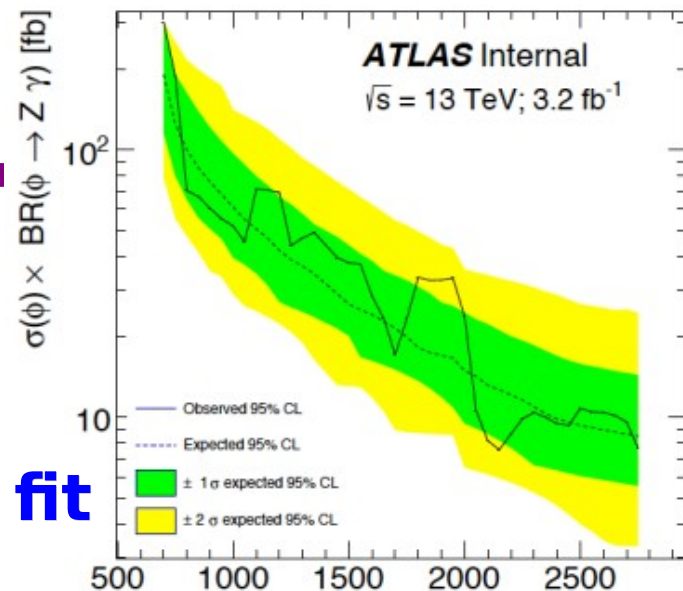


**Binned fit**

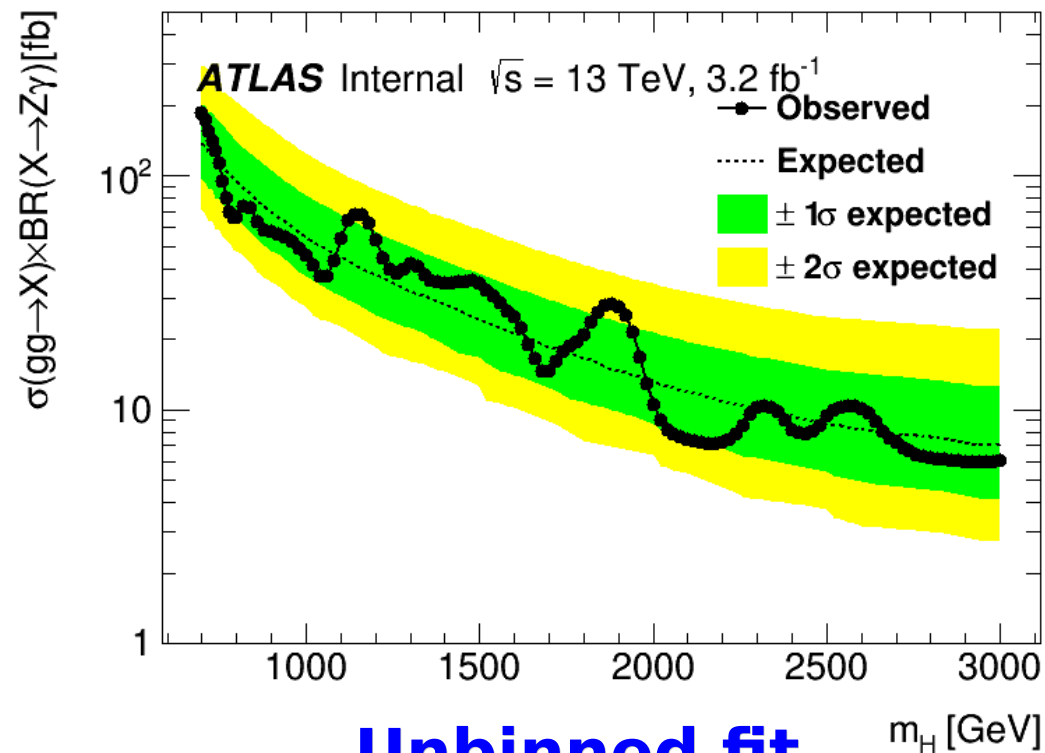
# Finer steps

- 10-GeV step from 700 to 800
- 20-GeV step from 800 to 3000
- With an update in systematics

**Binned fit**



**Unbinned fit**



**Unbinned fit**

**Updated with more syst  
 Finer scanning grid along mu**

# Updated systematic uncertainties

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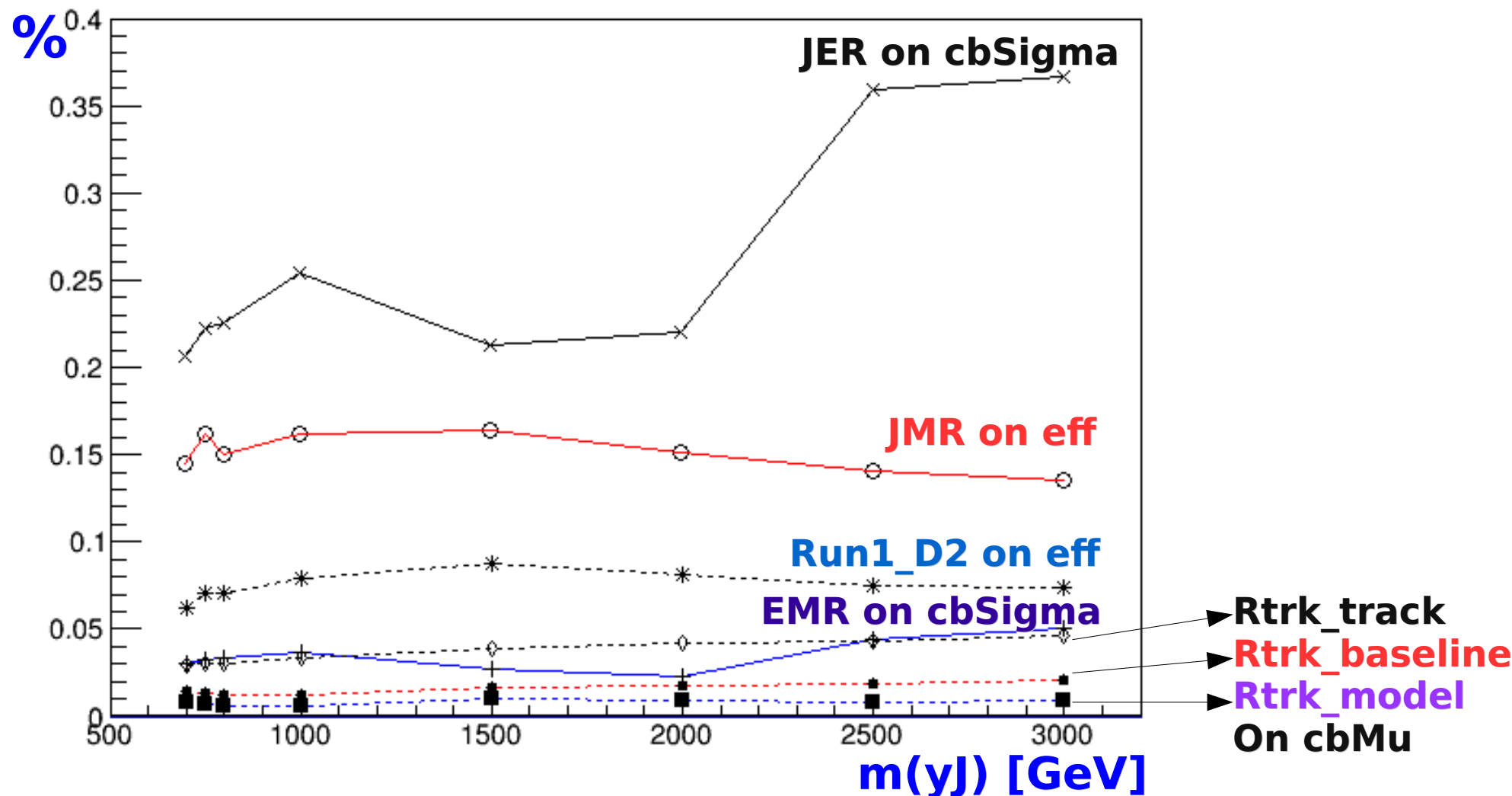
- Based on a new signal template generation script from Zhijun, I **updated** to signal modeling several systematic uncertainties
  - // dJER affects: cbSigma
  - // dEMR affects: cbSigma
  - // dEM affects cbMu
  - // dJES affects cbMu [deleted]
  - // dRtrk\_baseline affects cbMu // newly added
  - // dRtrk\_model affects cbMu // newly added
  - // dRtrk\_track affects cbMu // newly added
  - // dJMR affects Acc
  - // dRun1\_D2 affects Acc // newly added

$$f(m(\gamma J)) = f_{CB} CB(m(\gamma J); \mu, \sigma_{CB}, \alpha_{CB}, N_{CB})$$

$$\text{Signal model} + (1 - f_{CB}) Gauss(m(\gamma J); \mu, k\sigma_{CB})$$

# Updated uncertainty inputs

- The updated rate/resolution uncertainties due to major sources of systematics



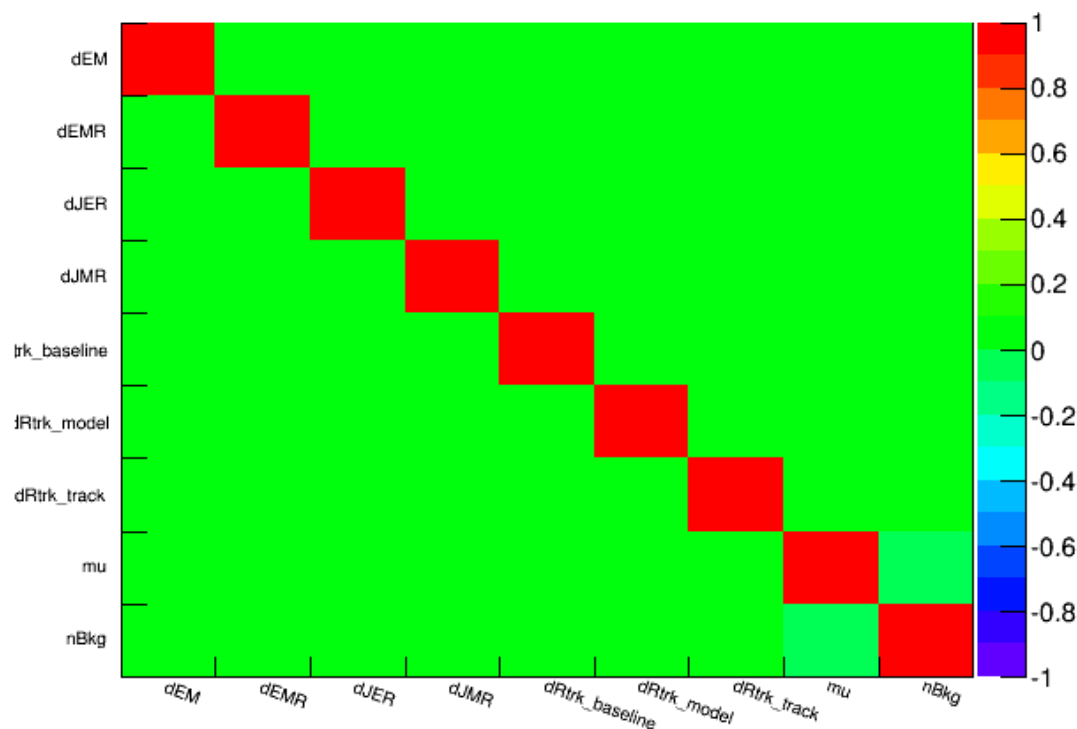


# Checks on nuis [pseudodata]

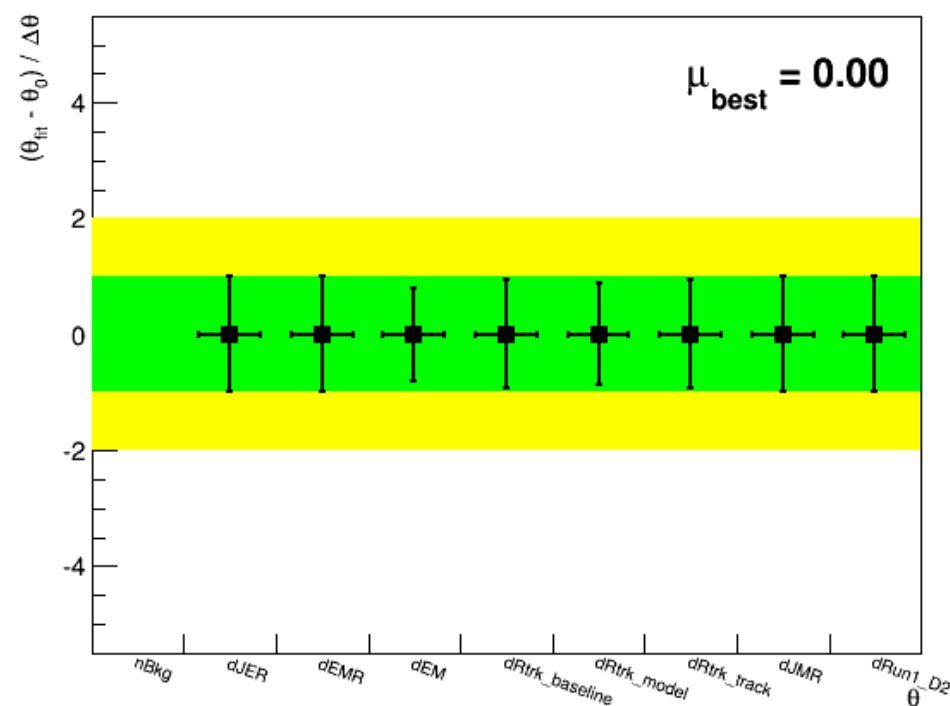
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- Check correlation & pull
- Plots are made with 750GeV and pseudodata

| Floating Parameter | InitialValue | FinalValue +/-  | Error    |
|--------------------|--------------|-----------------|----------|
| dEM                | 0.0000e+00   | 2.3733e-04 +/-  | 7.99e-01 |
| dEMR               | 0.0000e+00   | 6.9817e-09 +/-  | 9.93e-01 |
| dJER               | 0.0000e+00   | 4.8449e-08 +/-  | 9.93e-01 |
| dJMR               | 0.0000e+00   | -6.4316e-08 +/- | 9.93e-01 |
| dRtrk_baseline     | 0.0000e+00   | 8.6017e-05 +/-  | 9.38e-01 |
| dRtrk_model        | 0.0000e+00   | 1.6300e-04 +/-  | 8.77e-01 |
| dRtrk_track        | 0.0000e+00   | 8.8806e-05 +/-  | 9.36e-01 |
| mu                 | 0.0000e+00   | 7.2873e-06 +/-  | 4.33e+02 |
| nBkg               | 4.2570e+02   | 4.2570e+02 +/-  | 2.06e+01 |



No large correlations

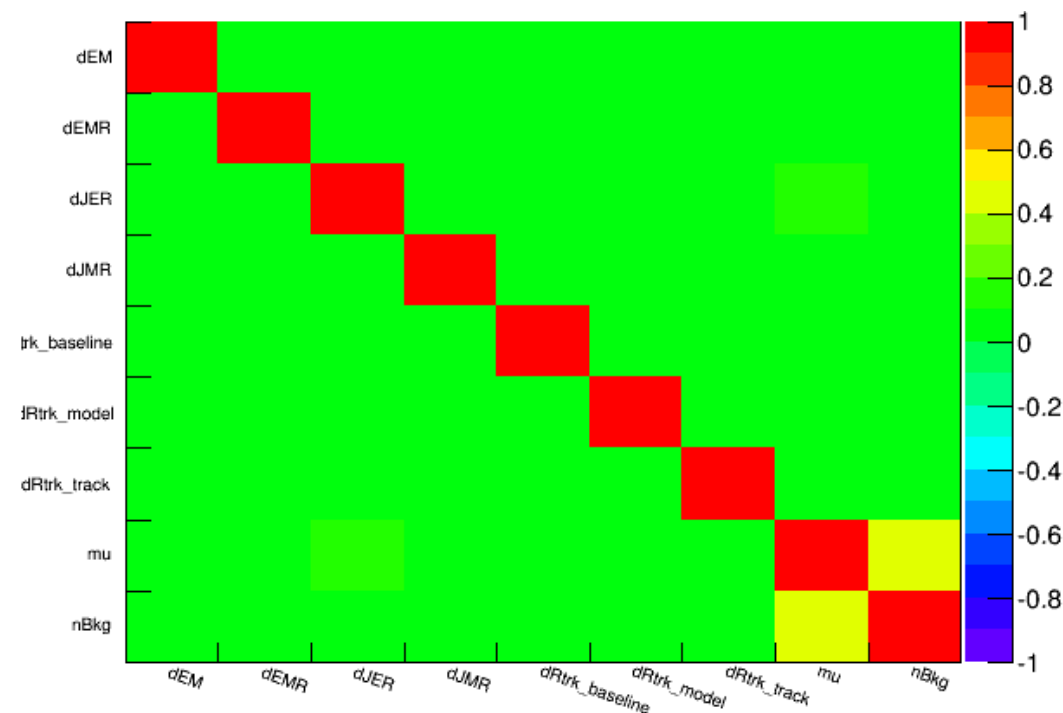


No pull seems strange

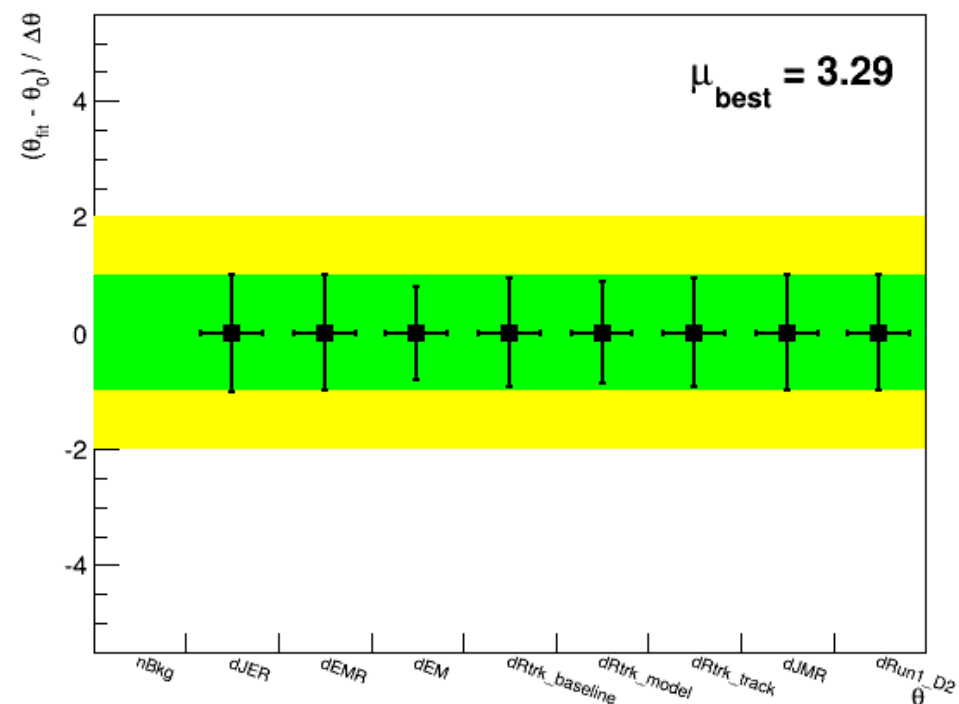
# Checks on nuis [obsdata]

- Check correlation & pull
- Plots are made with 750GeV and obsdata

| Floating Parameter | InitialValue | FinalValue +/-  | Error    |
|--------------------|--------------|-----------------|----------|
| dEM                | 0.0000e+00   | 6.0090e-04 +/-  | 7.99e-01 |
| dEMR               | 0.0000e+00   | -1.6193e-03 +/- | 9.94e-01 |
| dJER               | 0.0000e+00   | -1.1247e-02 +/- | 1.01e+00 |
| dJMR               | 0.0000e+00   | -2.5393e-04 +/- | 9.93e-01 |
| dRtrk_baseline     | 0.0000e+00   | 1.8012e-04 +/-  | 9.38e-01 |
| dRtrk_model        | 0.0000e+00   | 3.8175e-04 +/-  | 8.77e-01 |
| dRtrk_track        | 0.0000e+00   | 1.6012e-04 +/-  | 9.36e-01 |
| mu                 | 0.0000e+00   | 3.2914e+00 +/-  | 3.54e+02 |
| nBkg               | 4.2570e+02   | 6.1512e+02 +/-  | 2.83e+01 |



No large correlations



No pull seems strange