Update on EXO-12-050 (AN-13-010):

Search in Dijet Angular Distributions for Quark Compositeness

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Recap (01/10/13): Data Distributions

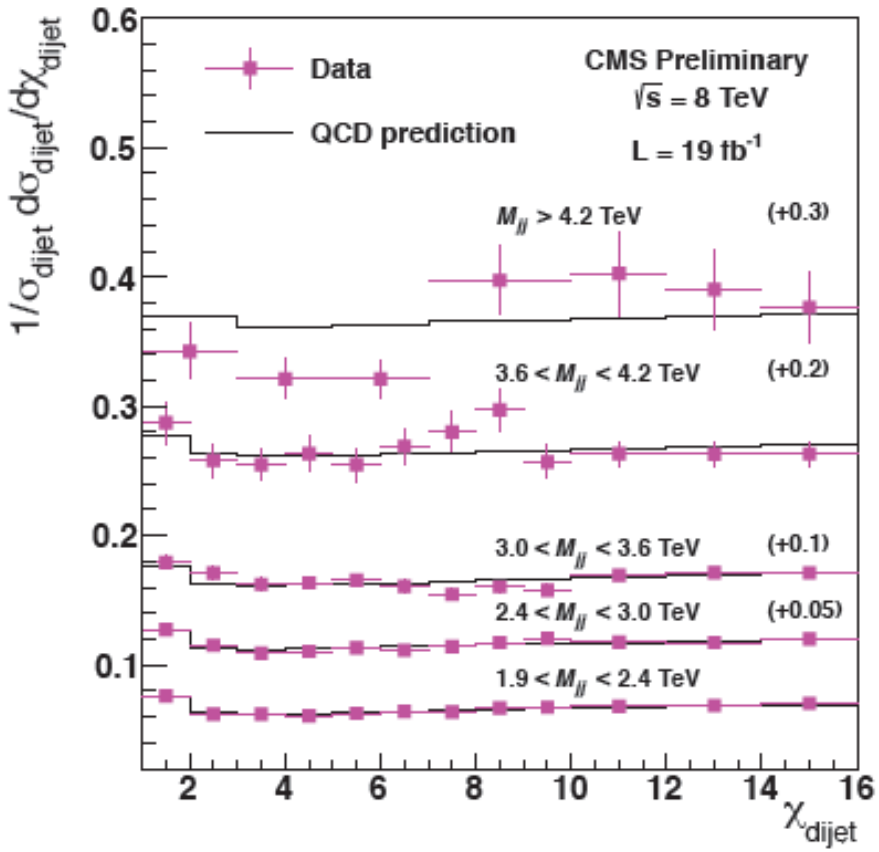
Last update: Jan 10, 2013
Link: https://indico.cern.ch/getFile.py/access?contribId=6&resId=0&materialId=slides&confId=226174

- Caveats:
  - No new unfolding corrections yet
  - No systematic uncertainties yet

❑ After adding new data and updating the JEC, chi distributions agree well with NLO QCD predictions below 4.2TeV

❑ We observe a downward fluctuation in the highest mass bin (like in the previous 2 papers but at higher masses)

❑ The full dataset with the latest JEC shows no hint of a contact interaction

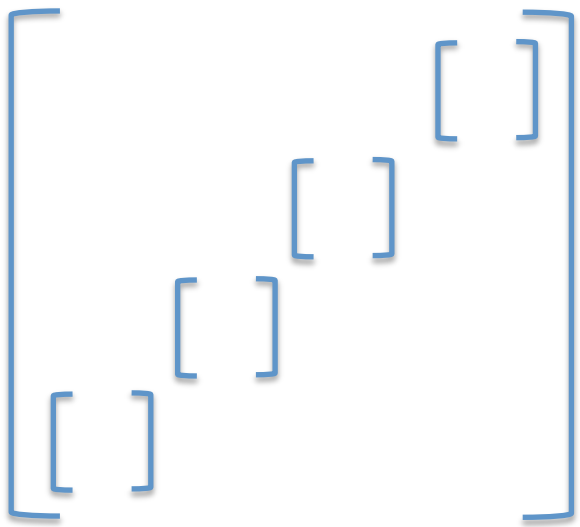


Recap (01/10/13): Things to do

- Missing pieces of the analysis:
- ❑ Scan highest mass events and lowest chi events
- ❑ Check the impact of pile-up
- ❑ Theory uncertainties
- ❑ **Derive unfolding matrix JER-smeared QCD MC** ⇨ *today*
- ❑ Proper unfolding (move away from bin-by-bin)
- ❑ Limits on extra dimension models
- ❑ Fill AN+PAS

Deriving the Unfolding matrix

- Deriving unfolding matrix for this analysis is not straight forward
- As the analysis involves measuring Chi in different mass bins
- The mass points move from one bin to the other when smearing is applied
- So need to construct a supermatrix with submatrices in it



(something similar to what was done for the azimuthal correlation analysis with SVD Unfolding)

bin-by-bin Unfolding for Chi

- As a first step – we first tested the available JER parameters (official twiki) and performed a bin-by-bin unfolding test for Chi analysis
- This is what will be shown today

- First I tried the default Crystal-ball fit following the twiki:

https://twiki.cern.ch/twiki/bin/view/CMSPublic/SWGuideJetResolution

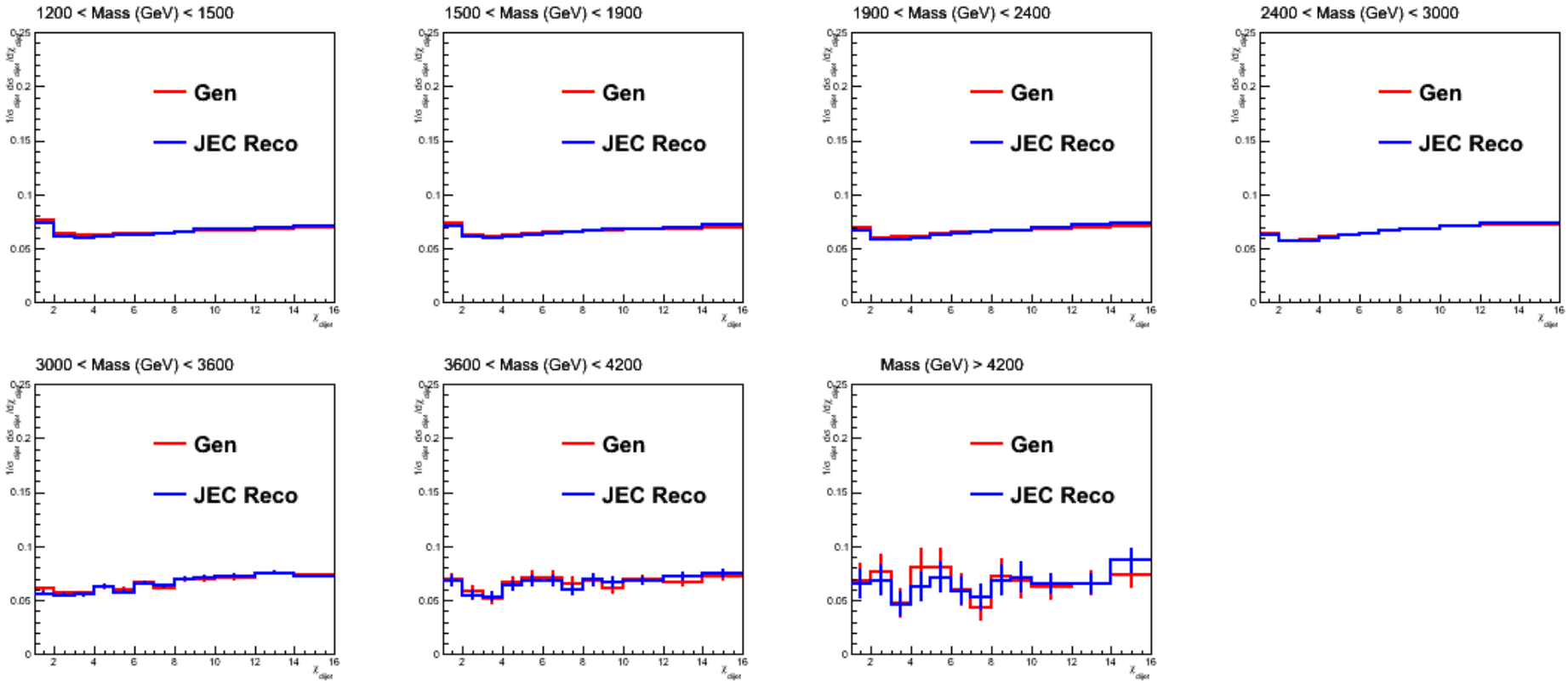
- I used the QCDHT samples:

/QCD_HT-**250To500**_TuneZ2star_8TeV-madgraph-pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/
/QCD_HT-**500To1000**_TuneZ2star_8TeV-madgraph-pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/
/QCD_HT-**1000ToInf**_TuneZ2star_8TeV-madgraph-pythia6/Summer12_DR53X-PU_S10_START53_V7A-v1/

- JEC used: 53X

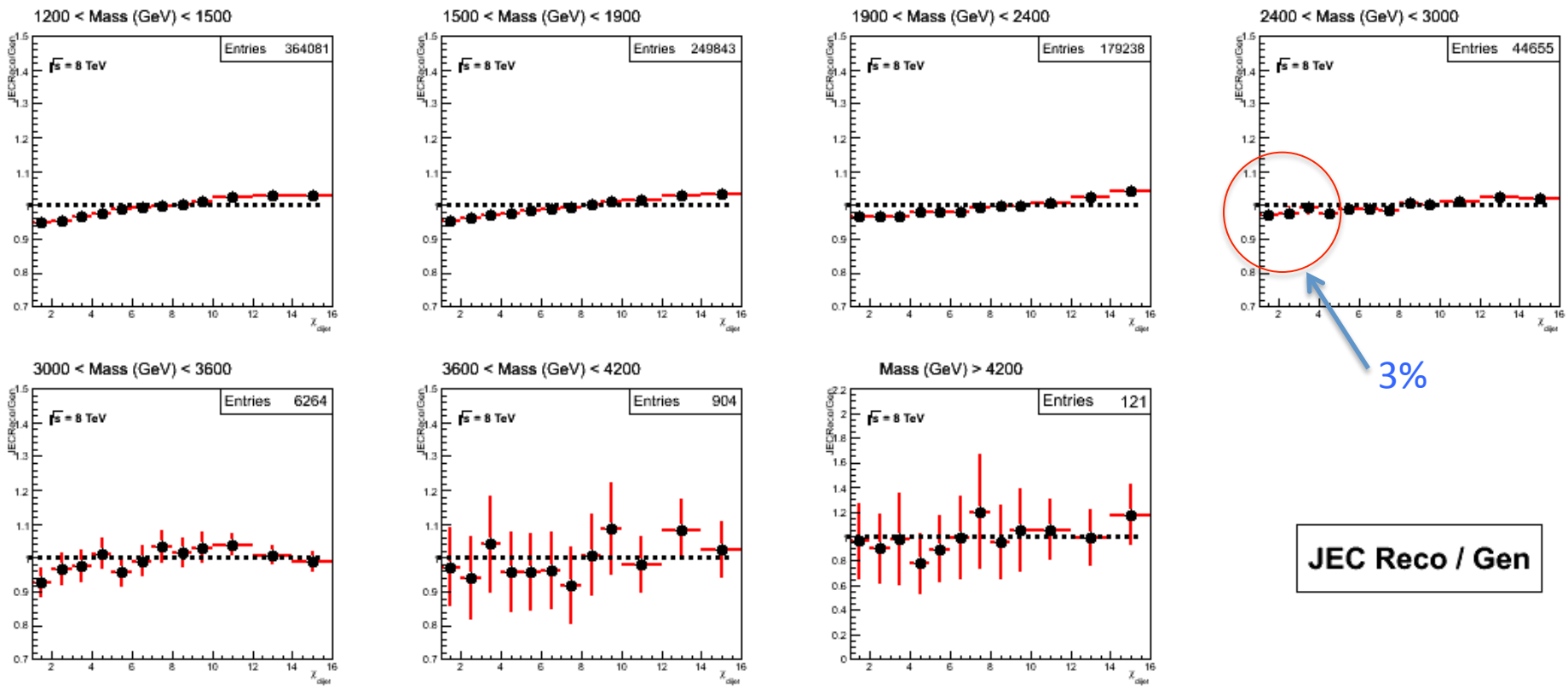
Gen vs JEC Reco

QCDHT250+QCDHT500+QCDHT1000 sample



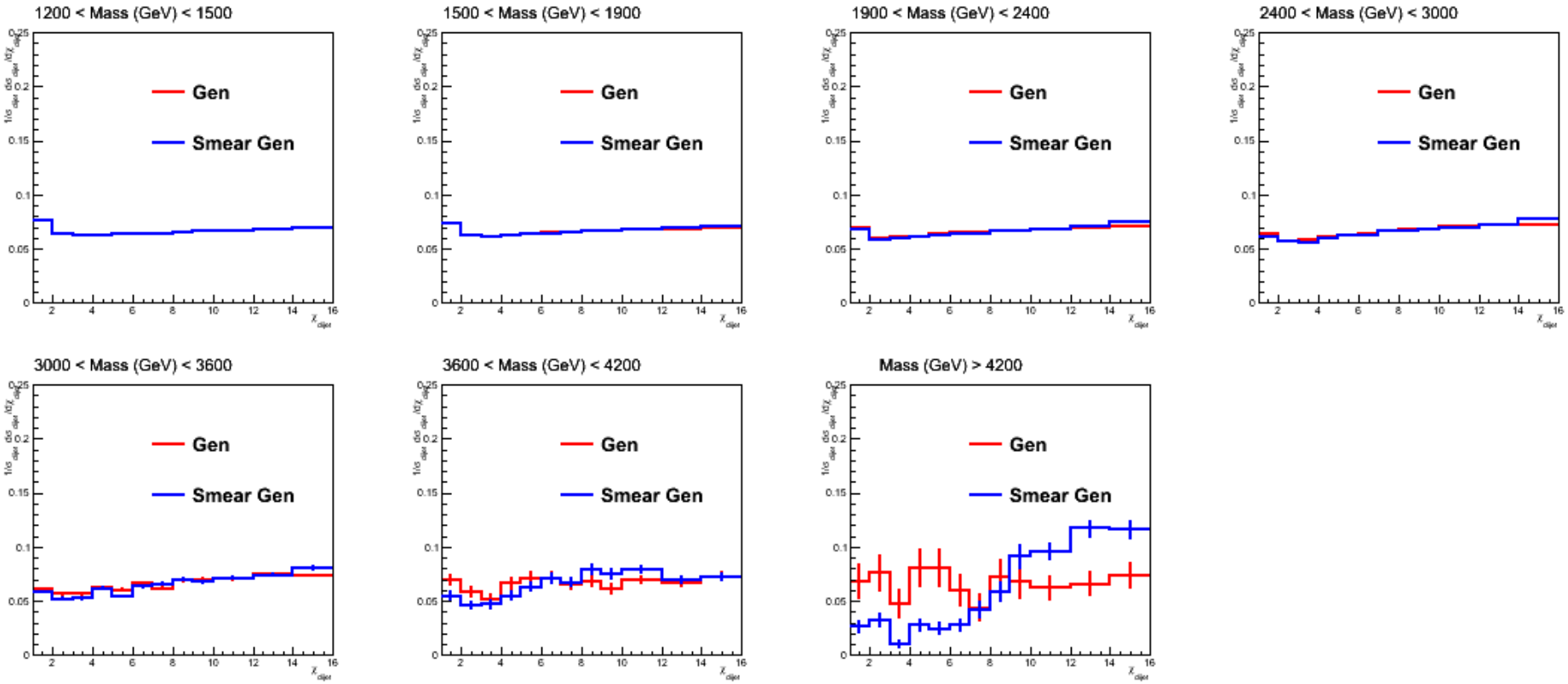
JEC Reco / Gen

QCDHT250+QCDHT500+QCDHT1000 sample



Gen vs smeared Gen

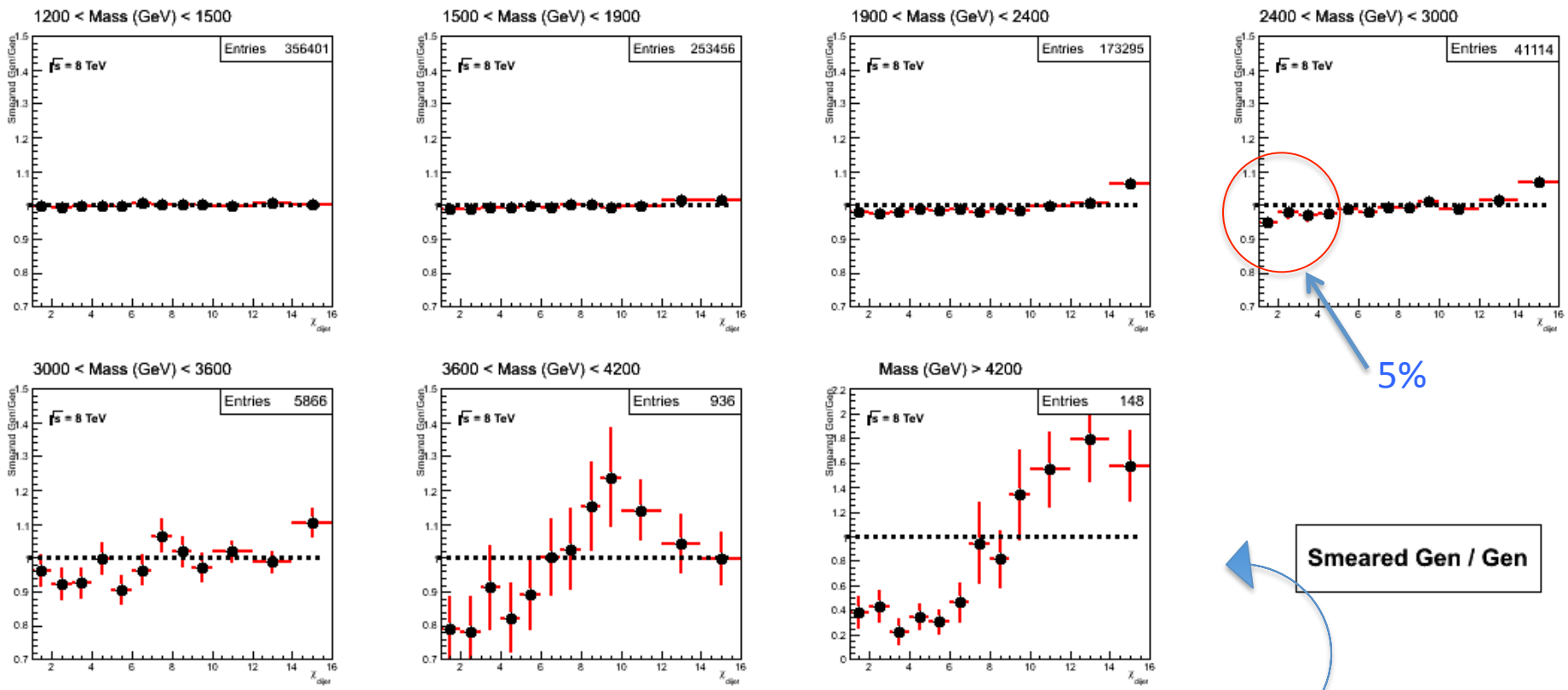
QCDHT250+QCDHT500+QCDHT1000 sample



- Smearing with Gaussian+tail was not doing a good job at high tails.

Smeared Gen / Gen

QCDHT250+QCDHT500+QCDHT1000 sample



- Smearing with Gaussian+tail was not doing a good job at high tails.

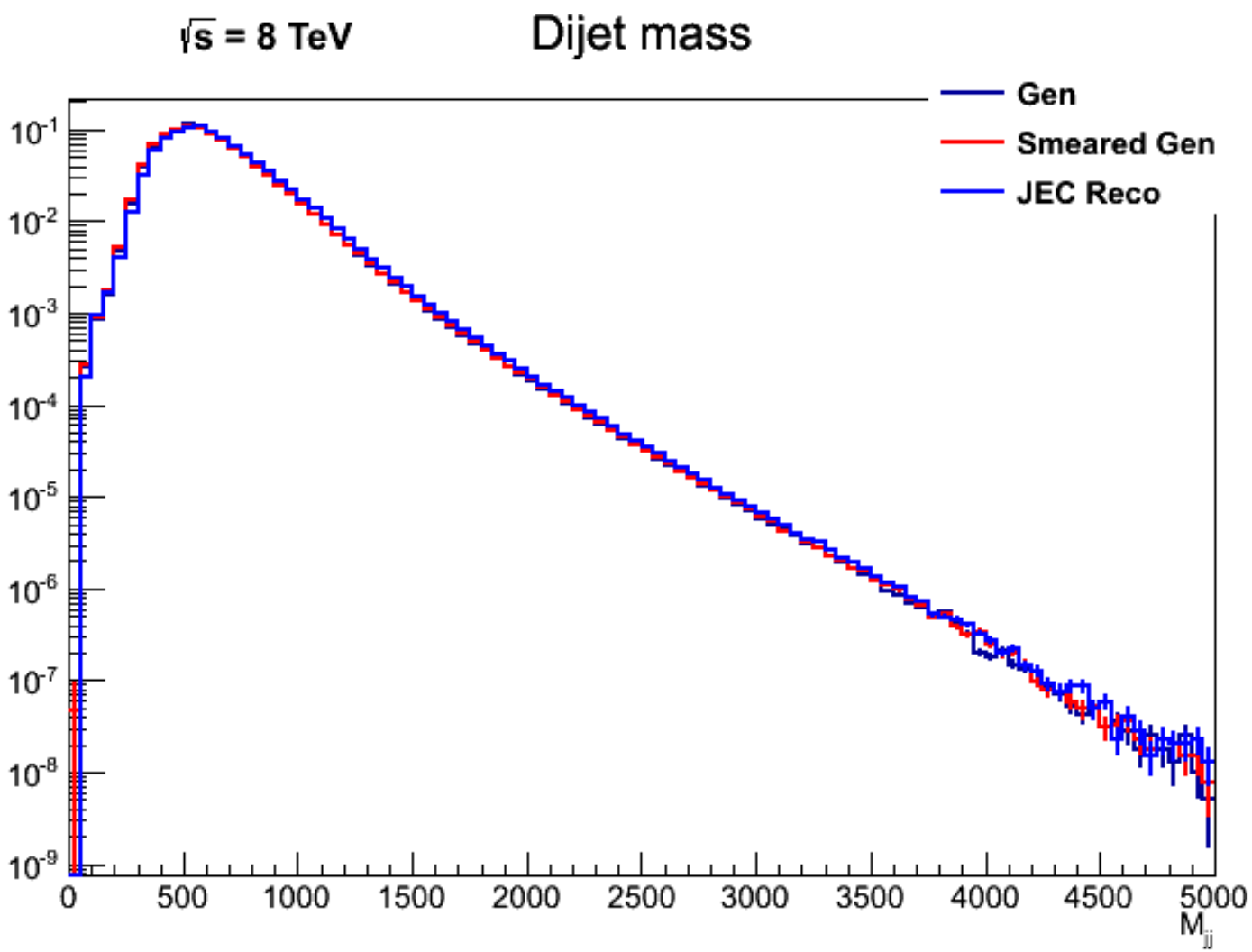
Smearing with Gaussian with MC/data scale factors

- The smearing factors used so far were derived from MC. In addition data/MC scale factors for the resolution are available for the Gaussian core resolution:
  https://twiki.cern.ch/twiki/bin/view/CMS/JetResolution

eta bin	Data/MC Ratio (factor +-stat. +syst.- syst.)
0.0–0.5	1.052+-0.012+0.062-0.061
0.5–1.1	1.057+-0.012+0.056-0.055
1.1–1.7	1.096+-0.017+0.063-0.062
1.7–2.3	1.134+-0.035+0.087-0.085
2.3–5.0	1.288+-0.127+0.155-0.153

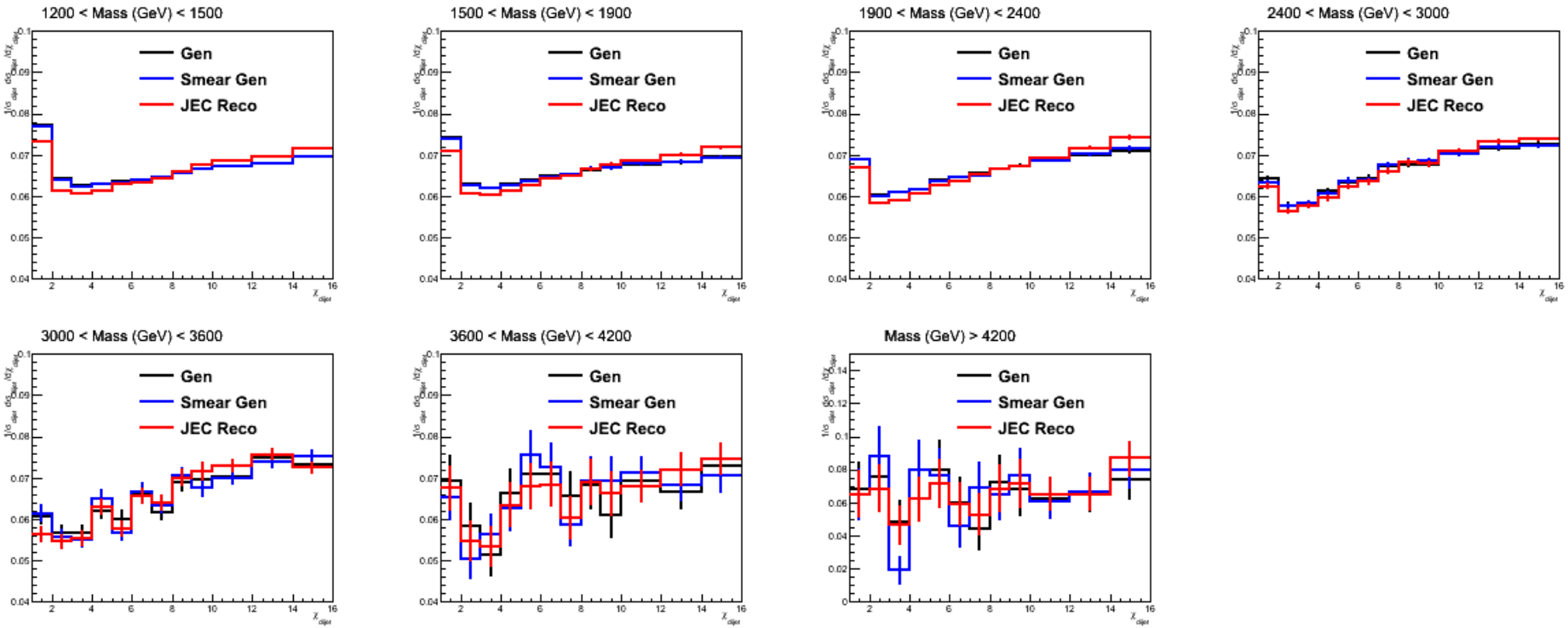
- Used Gaussian-only Smearing, where the width of the Gaussian was modified according to the data/MC scale factors for the resolution

Dijet Mass


√s = 8 TeV
Dijet mass
Gen
Smeared Gen
JEC Reco
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-8
10^-9
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
M_jj

Gen / JEC Reco / Smeared Gen

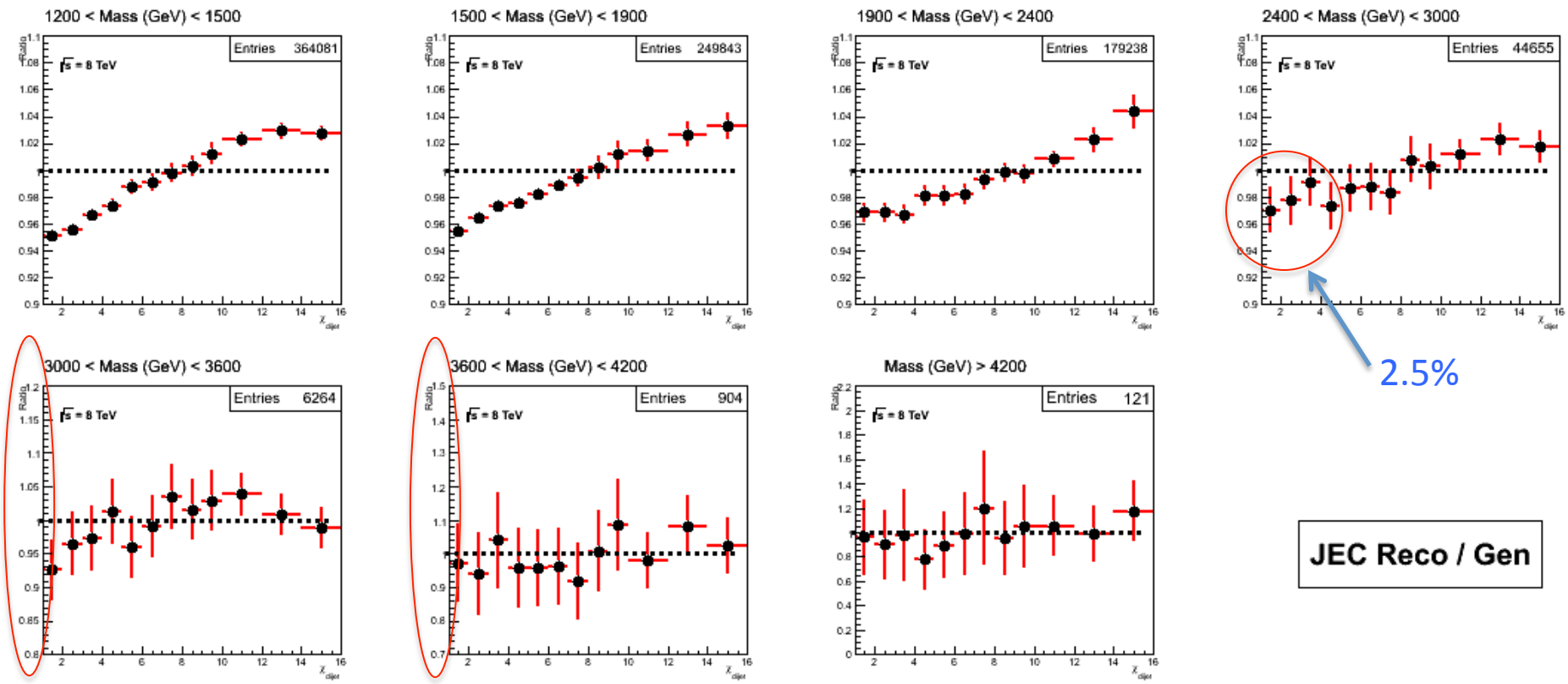
- I overlay the distributions : Y-axis range are different in the last two mass bins



- Here the smearing is Gaussian-only (with mc/data scale factors)

JEC Reco / Gen (zoomed in version of slide 3)

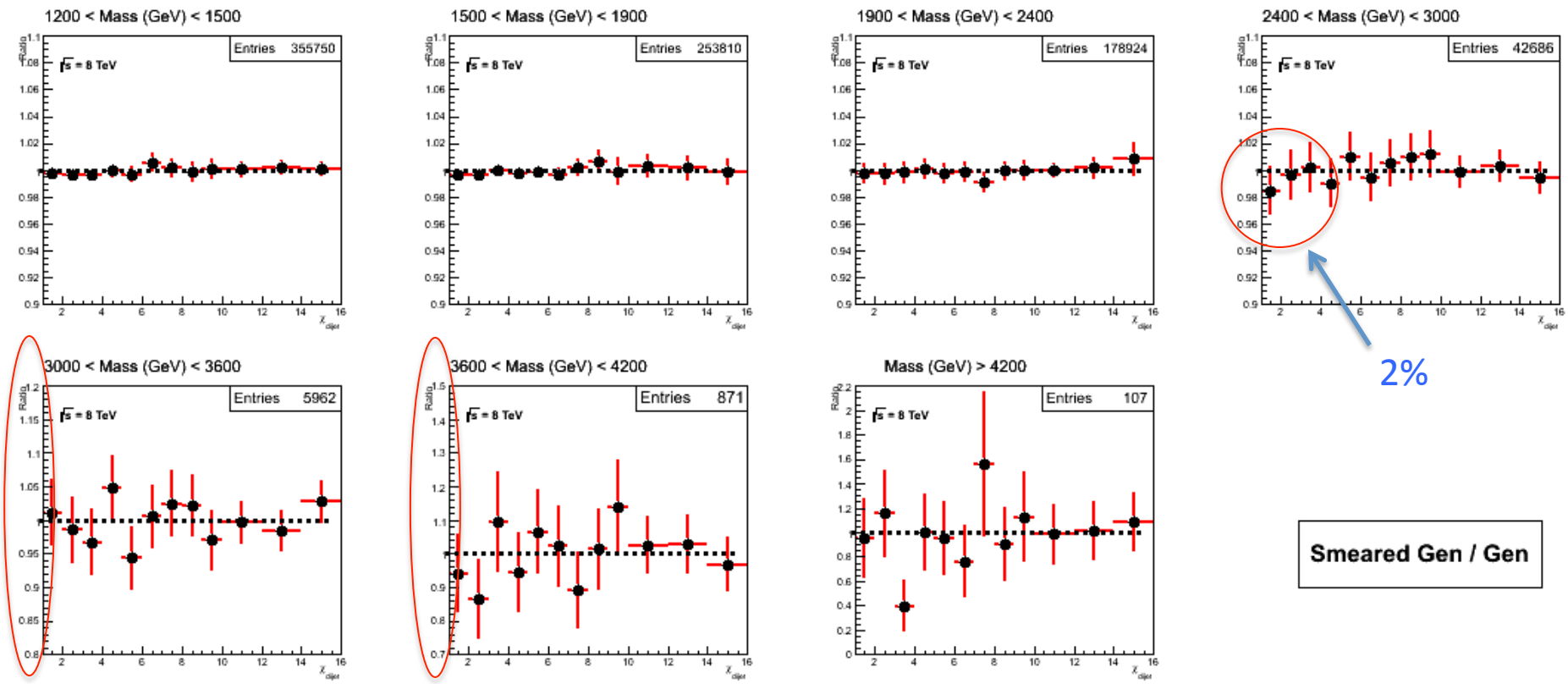
NB: y-axis has been zoomed for first 5 mass bins



JEC Reco / Gen

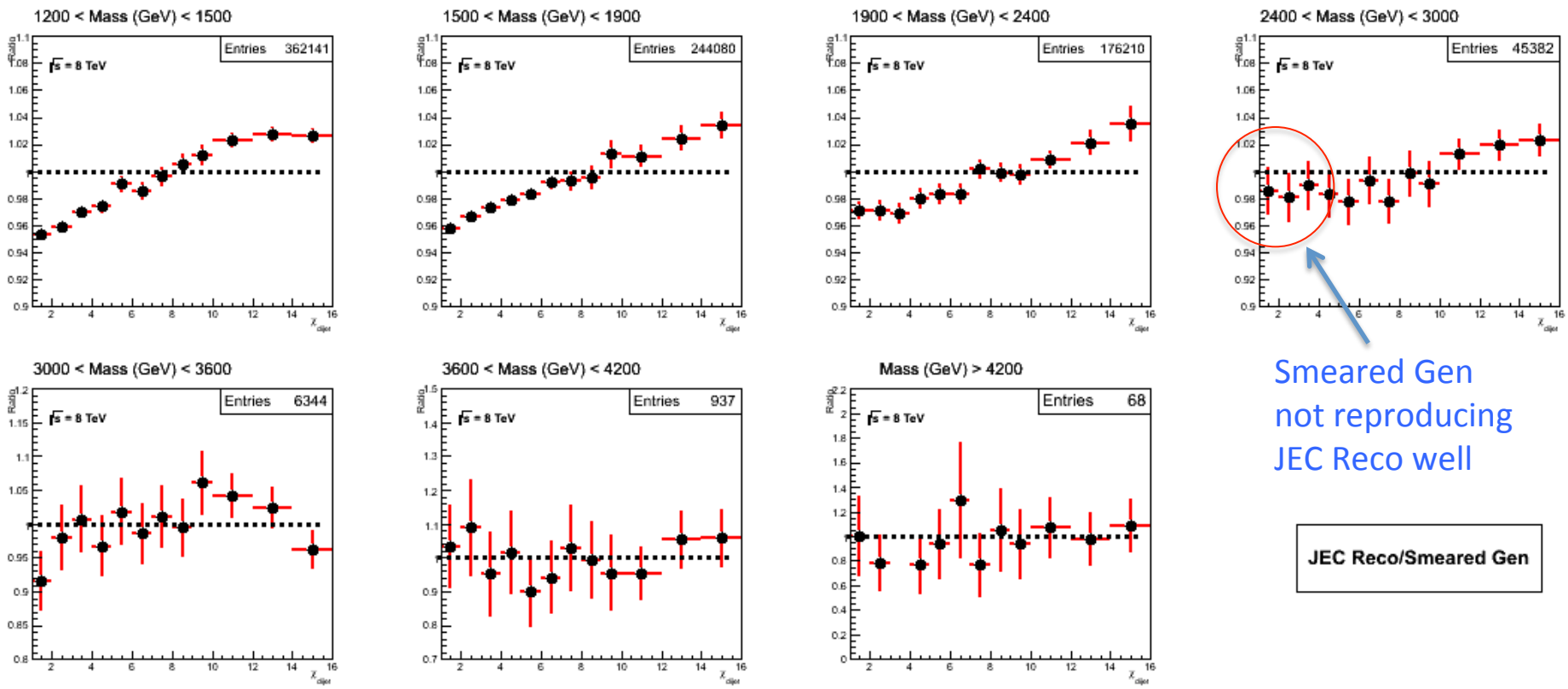
Smeared Gen / Gen

NB: y-axis has been zoomed for first 5 mass bins



Looks like these Gaussian-only smearing with scale factors still not reproducing it well.

JEC Reco / Smeared Gen



Smeared Gen not reproducing JEC Reco well

JEC Reco/Smeared Gen

Coming up: Constructing Response matrix

- We use the official RooUnfold package for performing the Unfolding with the SVD method.

placeholder

Summary

- We have started to look into the unfolding issues (MC level)
- Preliminary bin-by-bin unfolding with official (old) recipe does not reproduce the reconstructed (Fullsim) distributions
- Have consulted with the Inclusive jet analyzers and suggestions from them are being looked into
- The outstanding items are as follows:
  - Check the impact of pile-up
  - Theory uncertainties
  - Scan highest mass events and lowest chi events
  - Limits on extra dimension models
  - Fill AN+PAS