EE events

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(With inputs from many people)

High mass diphoton meeting

March 24, 2016

Outline

- EE tension
- Purity
- Kinematics

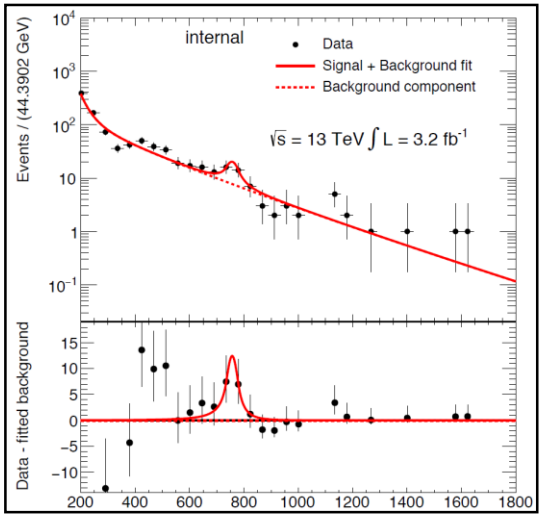
Observed significances

Exotics

Selection	obs. Z (σ)	exp. Z (σ)
Barrel-Barrel	3.9	5.3
Barrel-Endcap/Endcap-Barrel	0.3	1.8
Endcap-Endcap	3.3	0.3

Exotics +TightIso

Selection	obs. Z (σ)	exp. Z (σ)
Barrel-Barrel	1.5	2.7
Barrel-Endcap/Endcap-Barrel	2.2	1.3
Endcap-Endcap	0.6	0.6

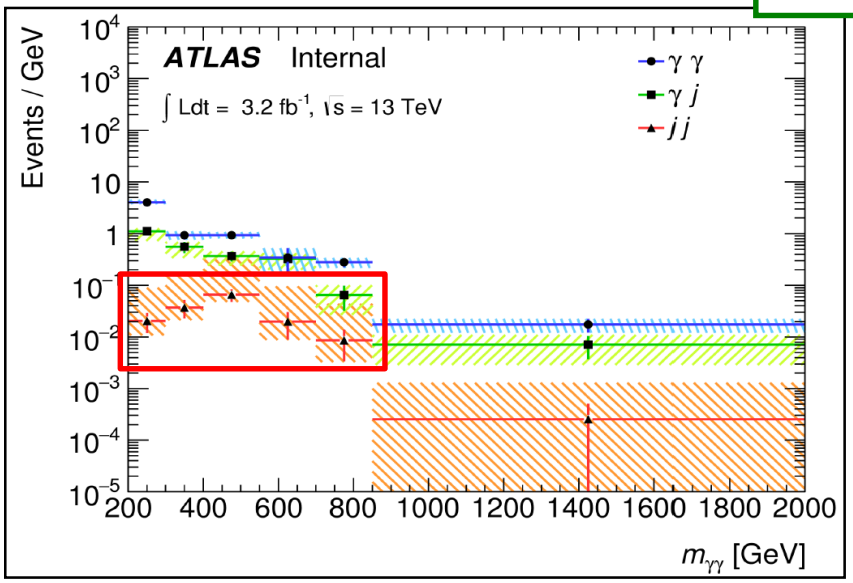


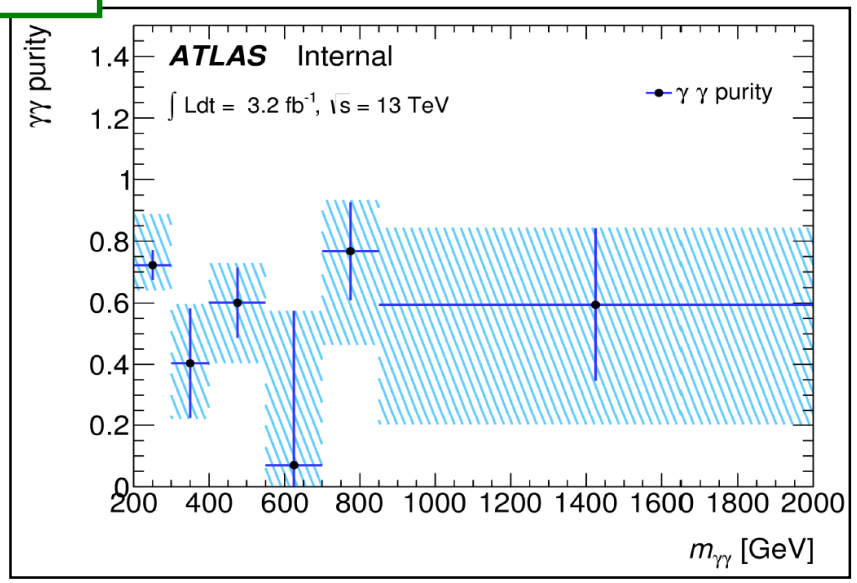
- N.B. 1: done for a scalar signal model but similar behaviour observed for a graviton signal model.
- N.B. 2: distribution of the Z values between categories more relevant than the absolute values due to the procedure used.
- N.B. 3: scalar selection not discussed at all (2 EE events in 700-850).

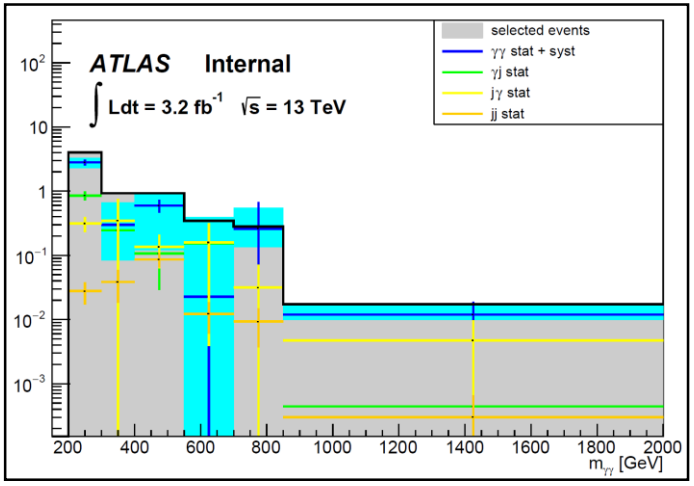
- 3 σ tension for the EE category with loose isolation.
- The tension observed in this category completely disappears when going to tight isolation.

Purity (1/2)

Looselso



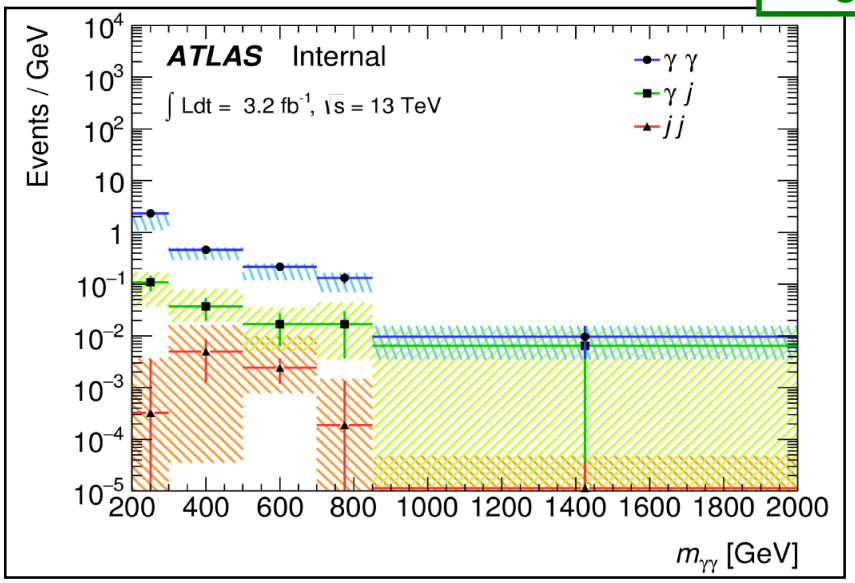


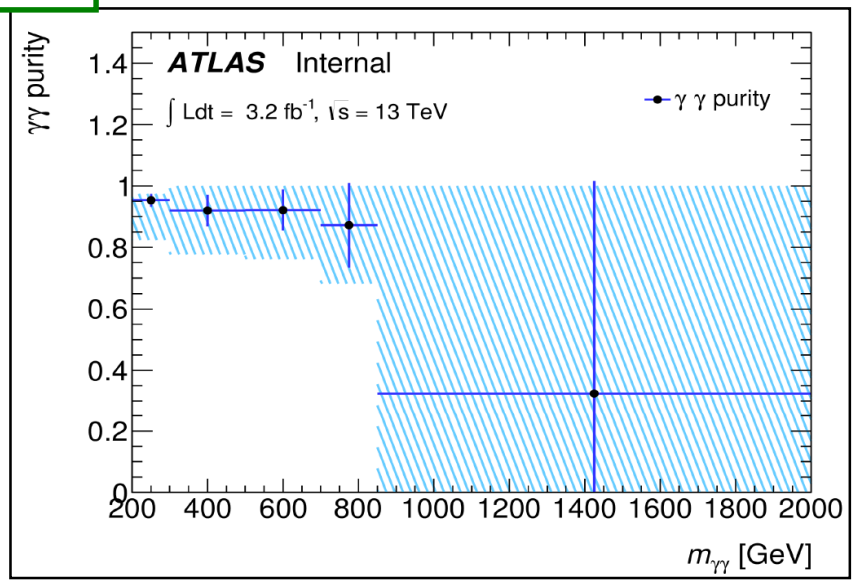


- Striking distribution of the jet-jet contribution.
- Despite the large uncertainties, quite clear decrease of the purity in the region 300-700 GeV.

Purity (2/2)

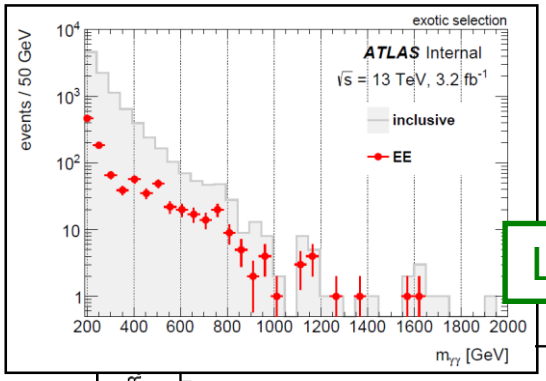
TightIso



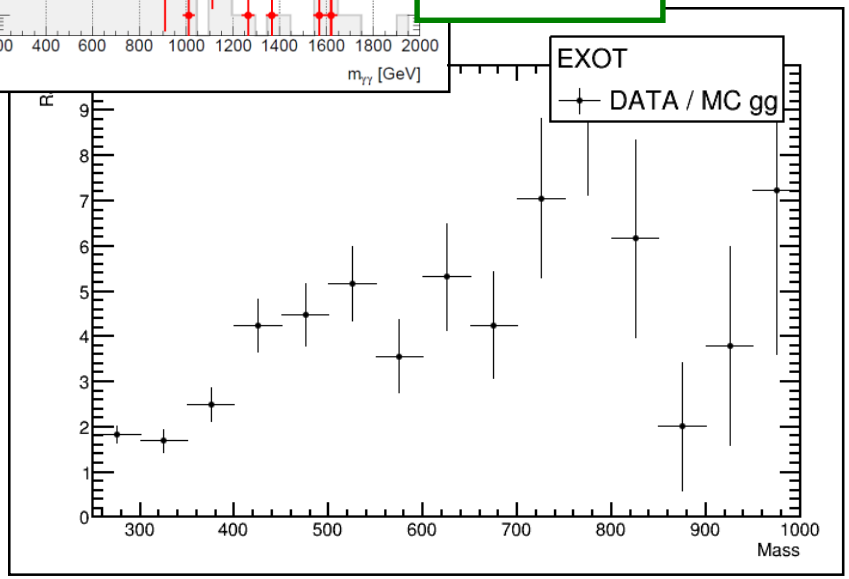


- Jet-jet contribution decreased by a factor ~10.
- Purity above 80% in all the mass range.

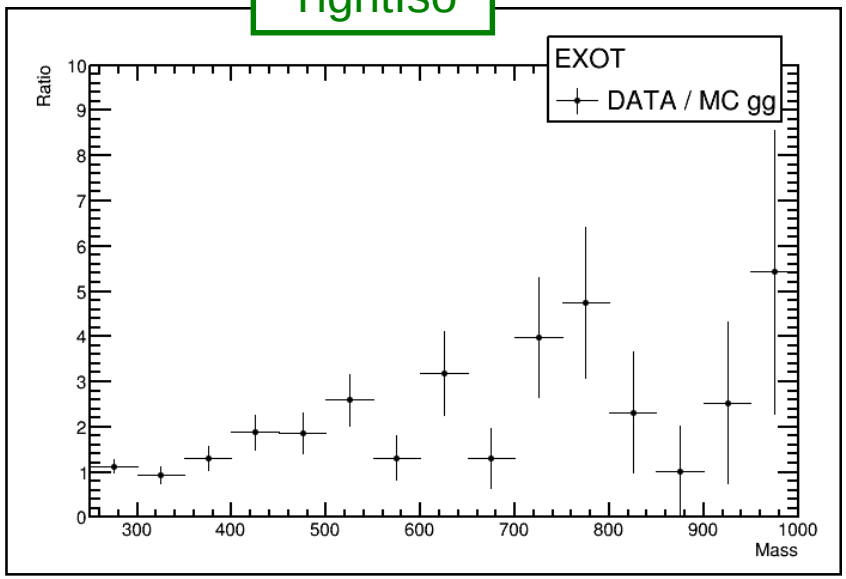
Mass shapes: comparison to MC gg



LooseIso



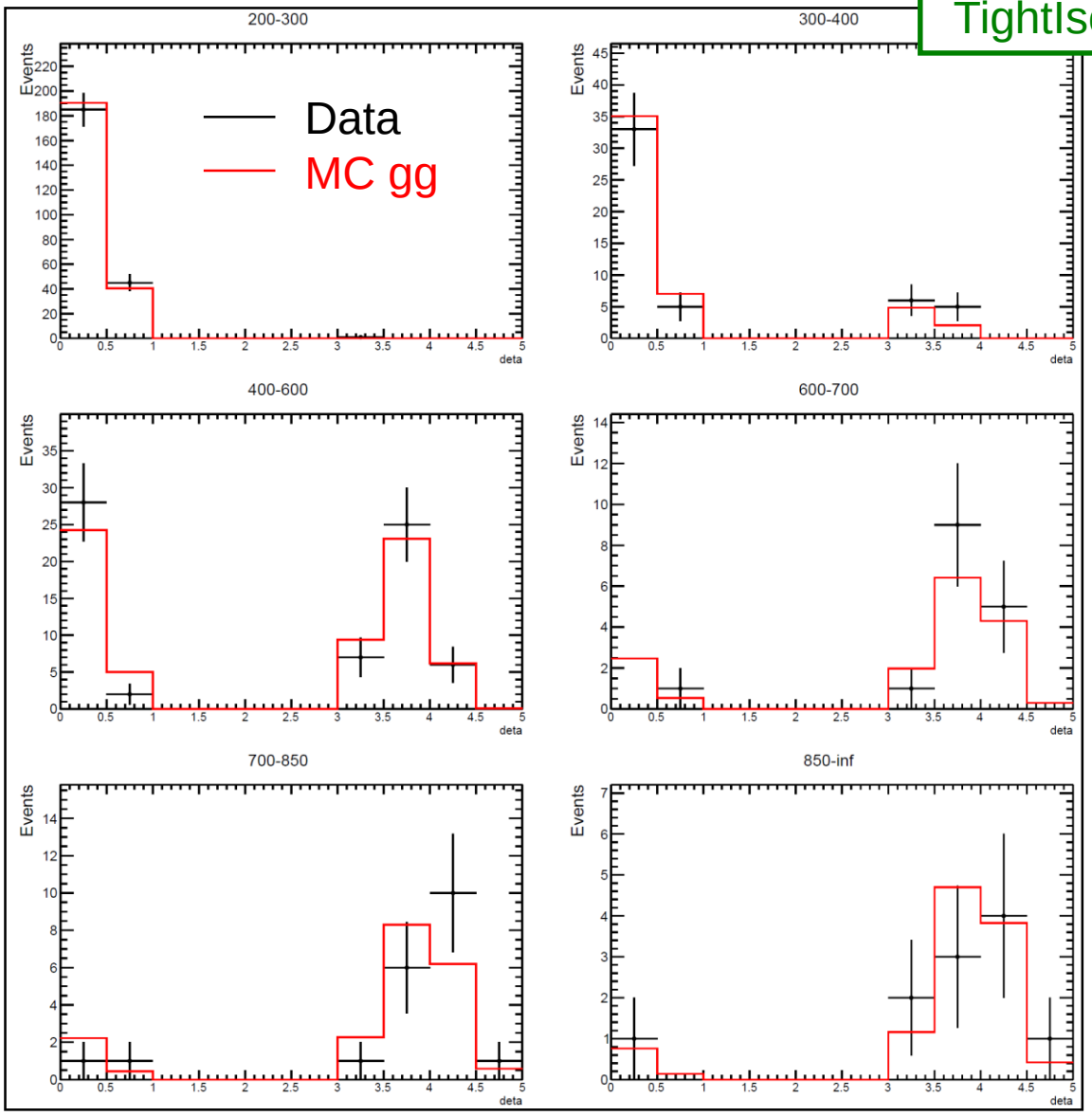
TightIso



- Very strong slope in the LooseIso case
- Slope reduced in the TightIso case, but still clearly there, while the purity is >80%: physics modeling issue with Sherpa?

Δη in mass bins (1/2)

TightIso

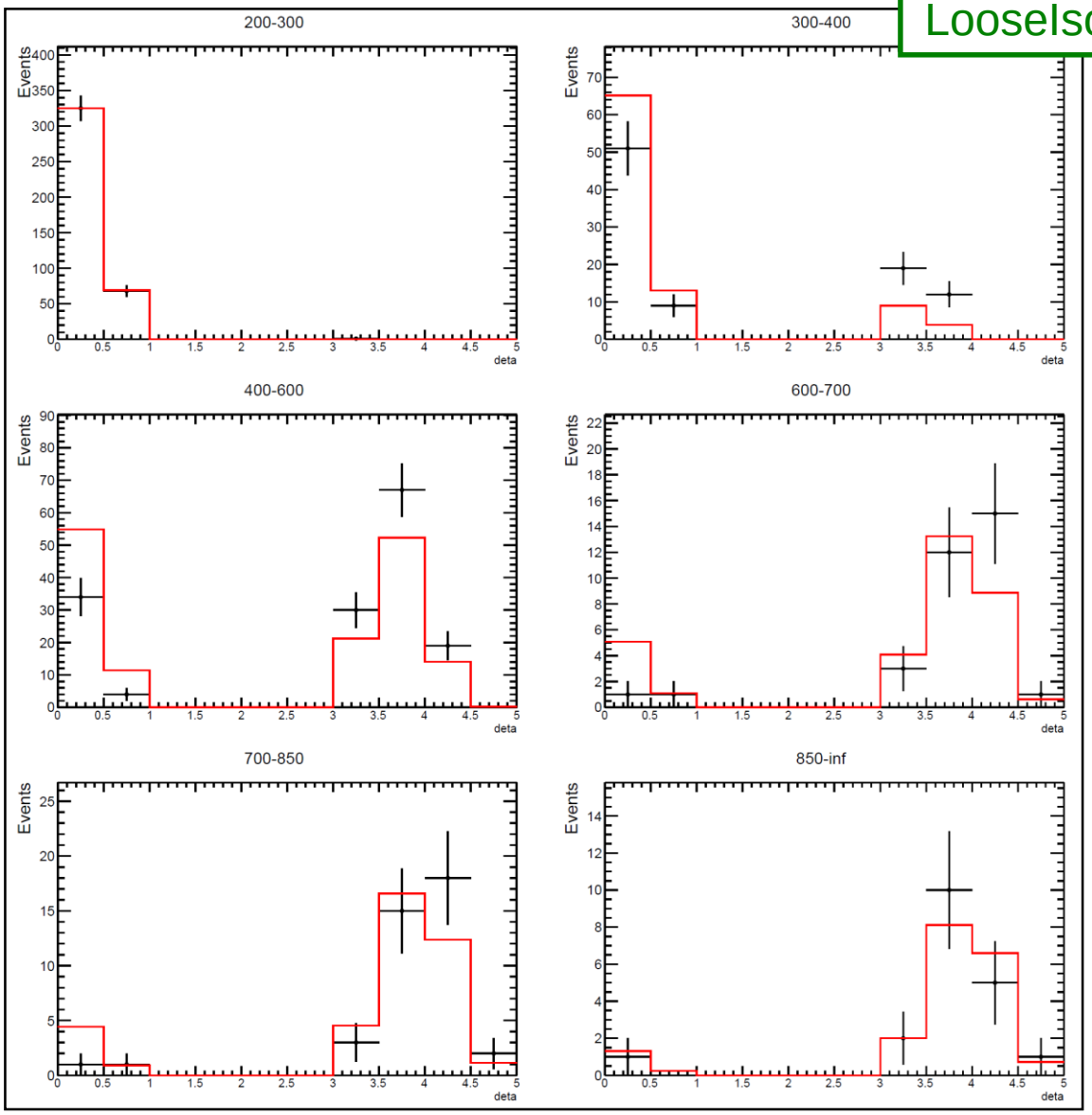


- The two populations correspond to the events with photons in same/opposite endcaps.

- Good description by Sherpa.

Δη in mass bins (1/2)

Looselso

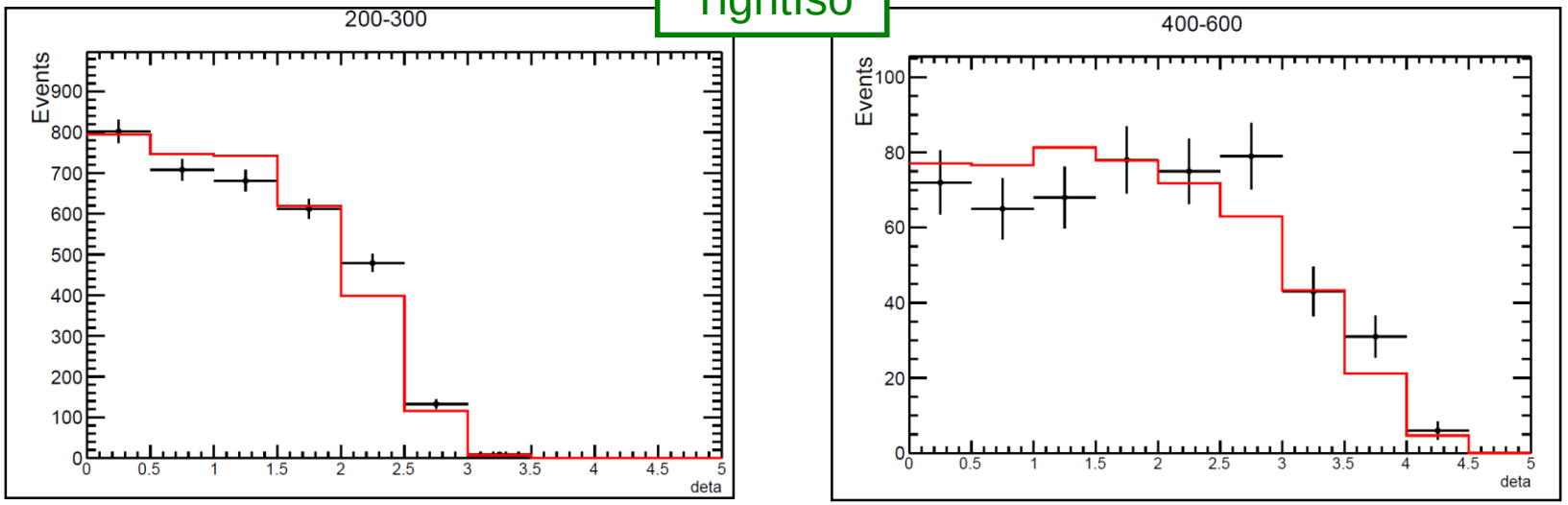


- Much higher fraction of high-Δη events in data in the 300-700 GeV region.

- Fraction in correct agreement in the excess region.

Δη modeling (inclusive case)

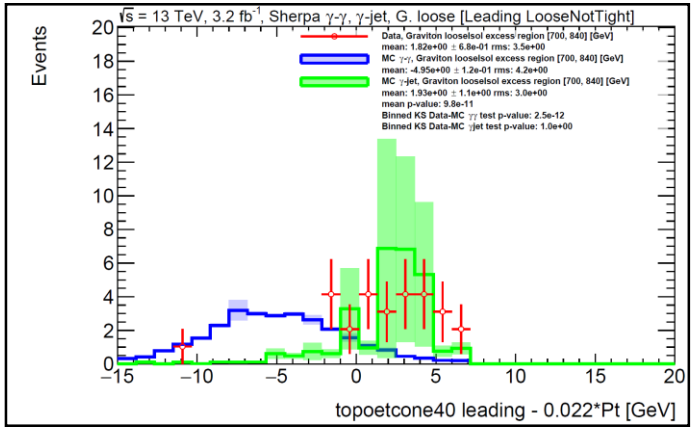
TightIso

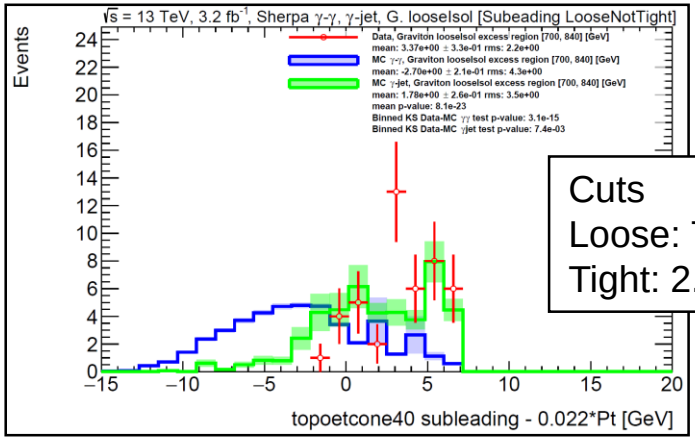


- Bad modeling of Δη observed in the 200-600 GeV range, while the purity is >90%.
- It may be interesting to:
  - look at the distribution of gamma-jet events from control regions
  - see the impact on MC of a Δη reweighting (increase of the high Δη contribution) on the mass shape.

Modeling of gamma-jet events from control regions (1/2)

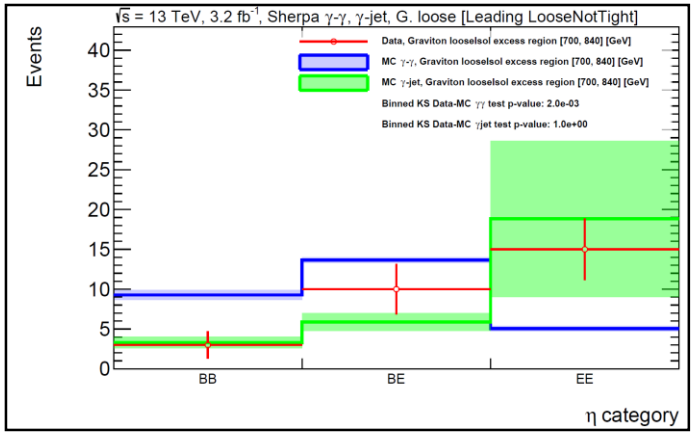
Select loose-not-tight ID photons (loose isolation applied) to define gamma-jet dominated control regions and compare to gamma-jet MC.

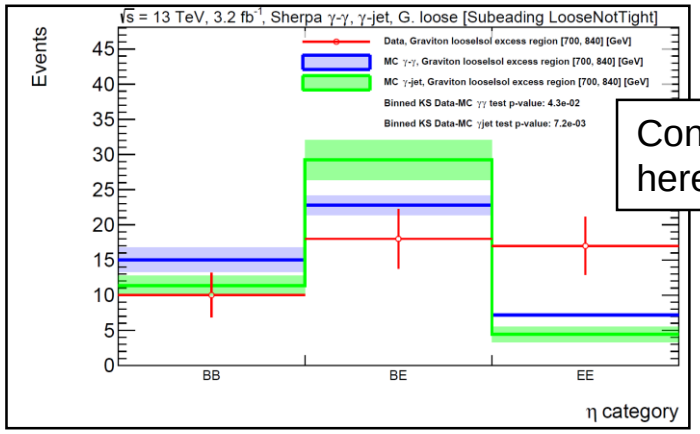




Cuts
Loose: 7 GeV
Tight: 2.45 GeV

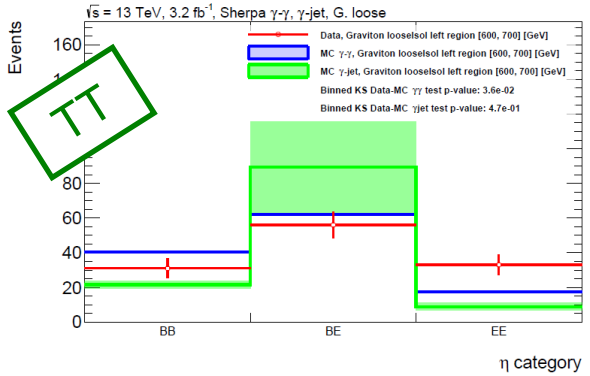
Use these control regions to look at the η-category distribution in the signal region.

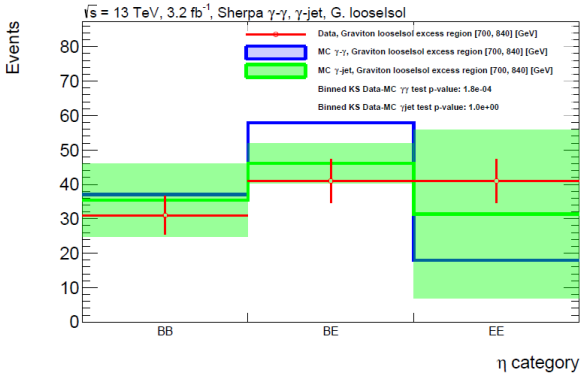


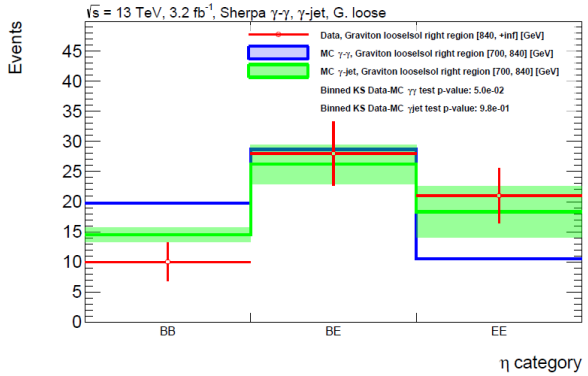


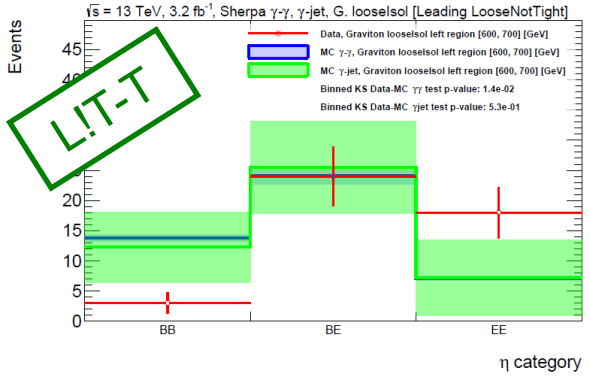
Control regions here.

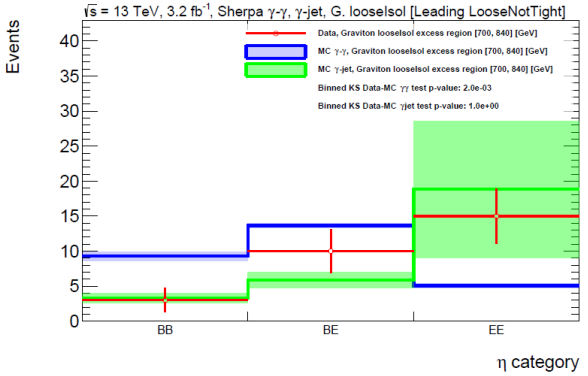
Modeling of gamma-jet events from control regions (2/2)

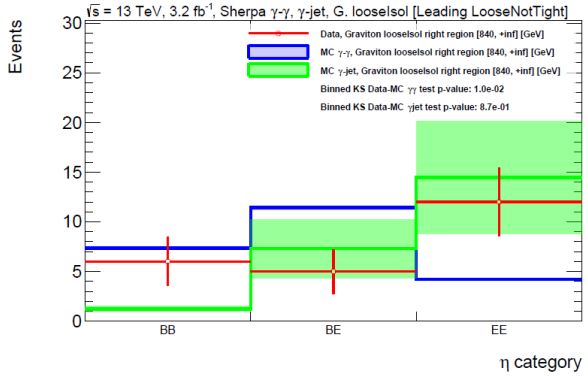


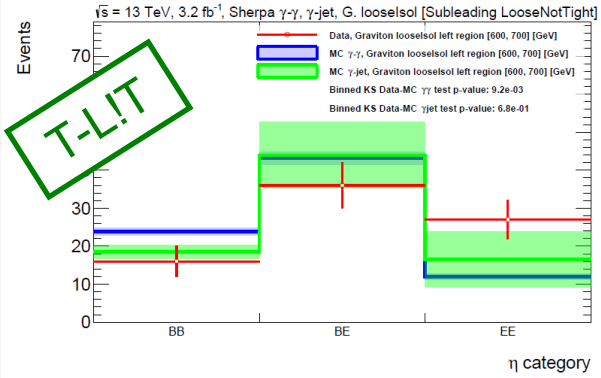


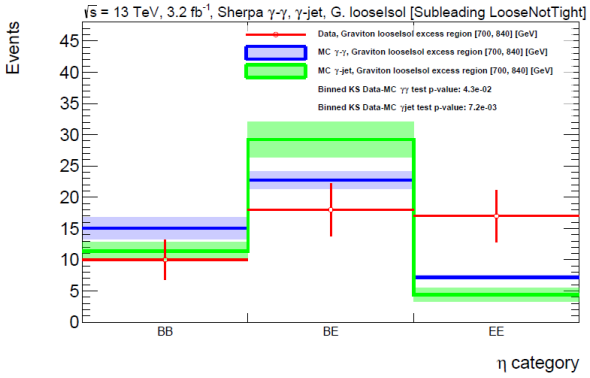


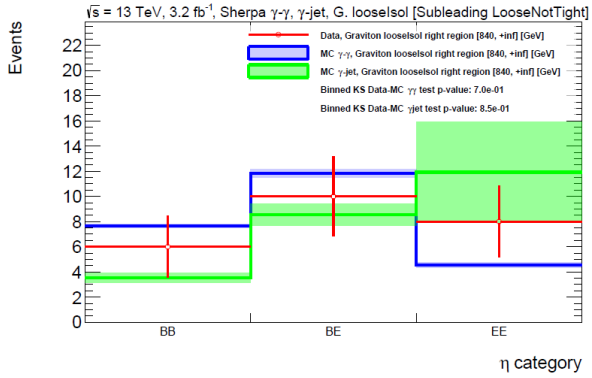












Studies of grey photons

- Look at the shower shapes of the grey photons (passing loose isolation but failing tight isolation) in EE events.

➔ Repeat the study already done in the crosschecks note, but restricting to EE events.

➔ Is the jet rejection in the EC at high p_T under control?

- To do:

- Start inclusively (in p_T) and look in p_T bins (as statistics allows).
- Correlations with the conversion status?