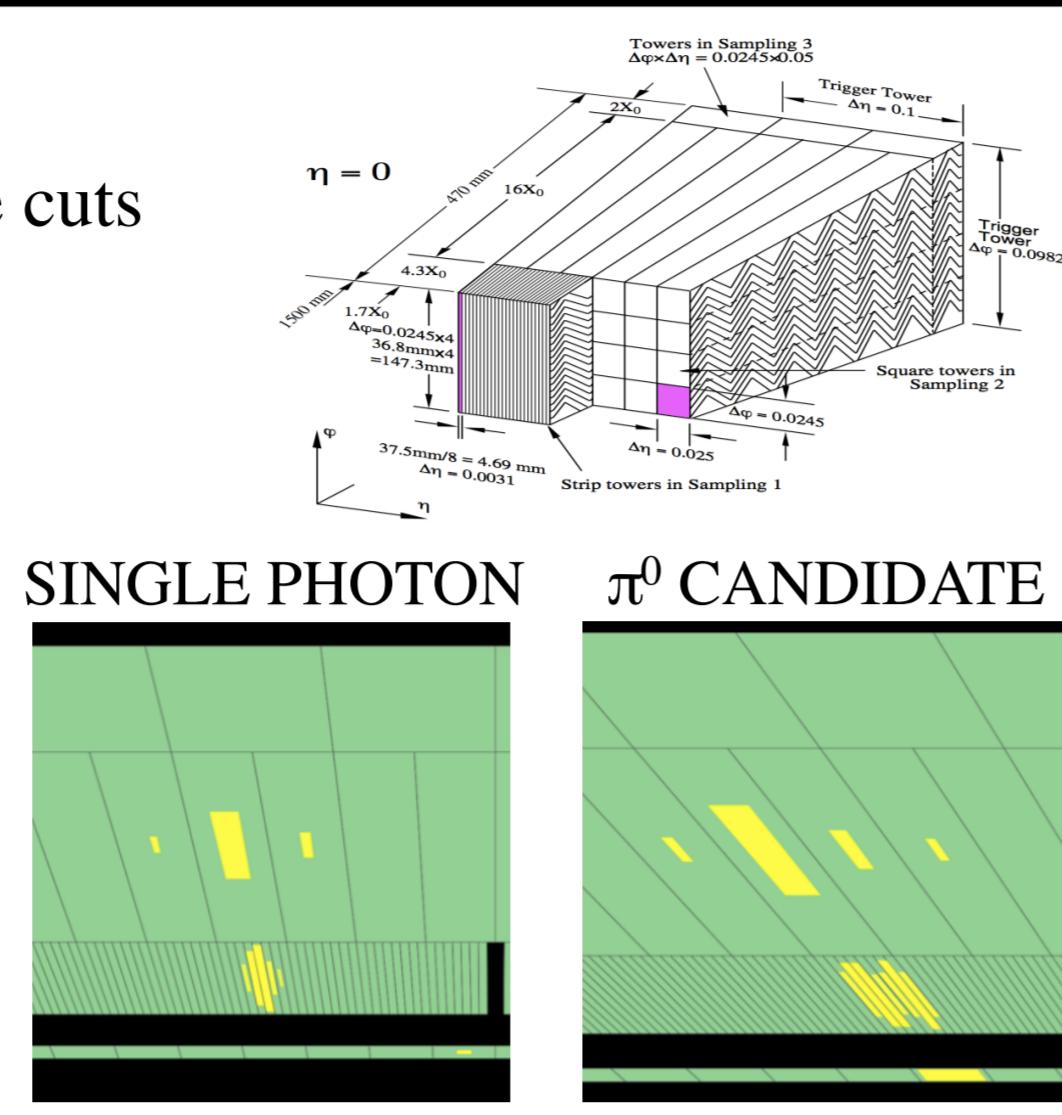
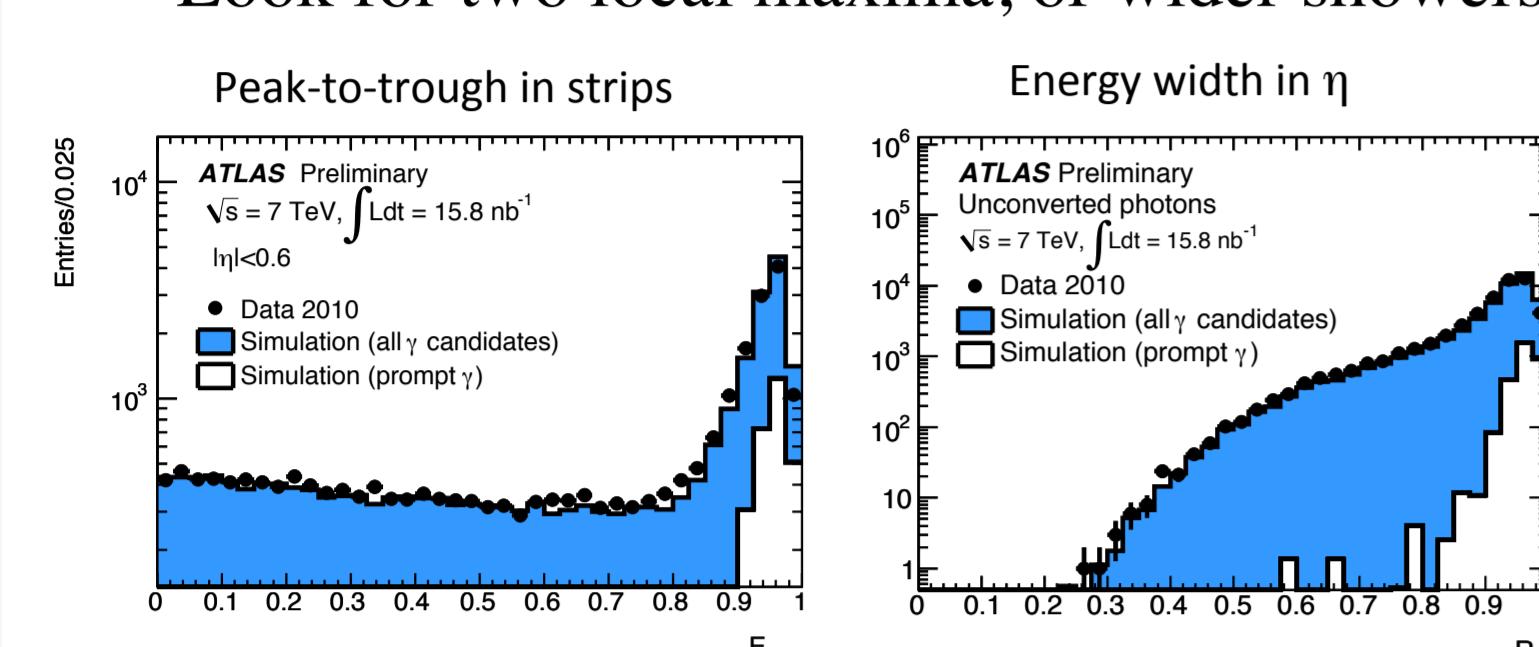


# Measurements of isolated prompt photons in pp collisions with the ATLAS detector

Martin Tripiana (IFLP-CONICET) on behalf of the ATLAS collaboration

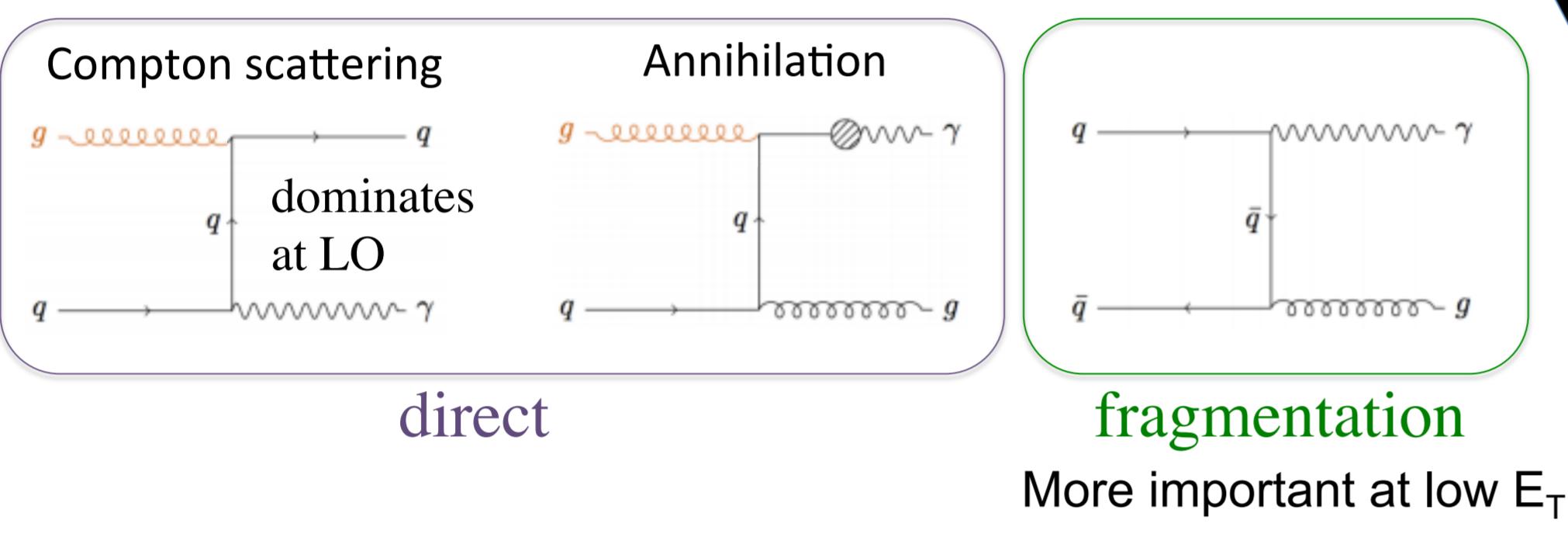
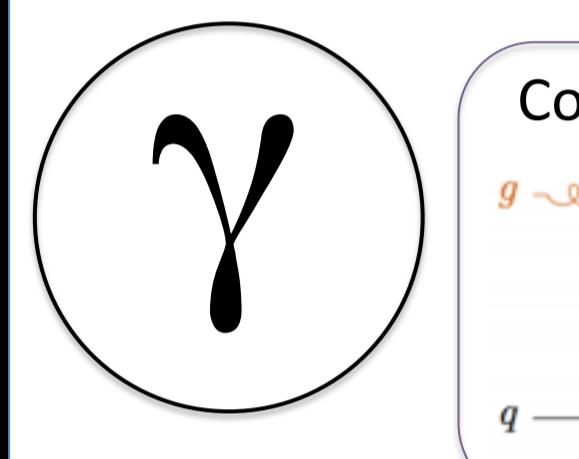
## Reconstruction and identification

- The layer 2 (primary calorimeter sampling layer) shower shape cuts require compact clusters consistent with single photons:
  - Energy distribution : width in  $\eta$  ( $R_\eta$ ) and  $\phi$  ( $R_\phi$ )
    - Leakage into hadronic calorimeter
- The layer 1 strips allow increased discrimination of single photons from  $\pi^0$ 's
  - Look for two local maxima, or wider showers in  $\eta$  or  $\phi$



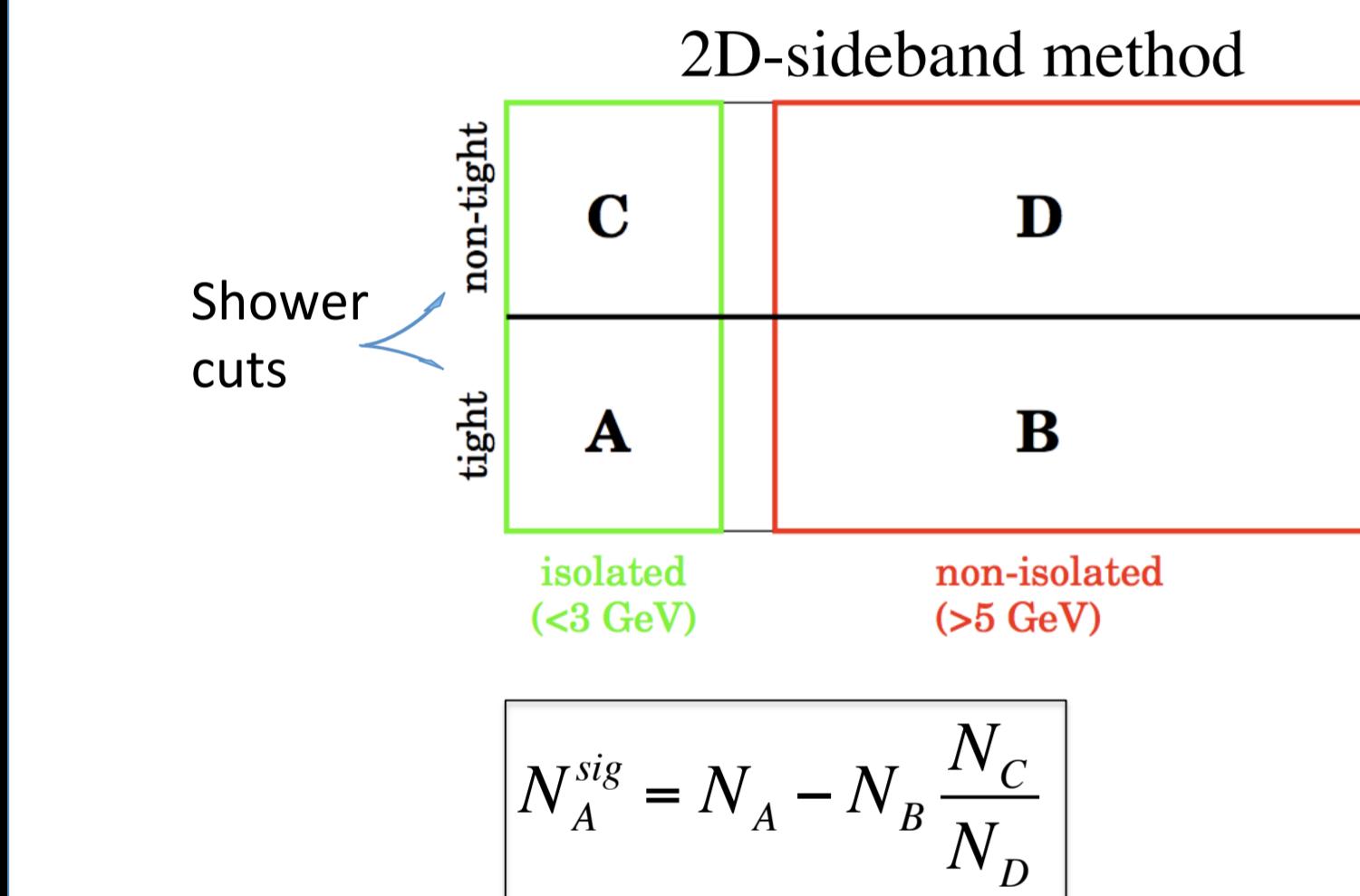
**Identification Efficiency** from Monte Carlo corrected for data/MC discrepancies in shower shape modeling.

$$\Delta\mu_{DV}^s = \langle DV_{data}^s \rangle - \langle DV_{MC}^s \rangle$$



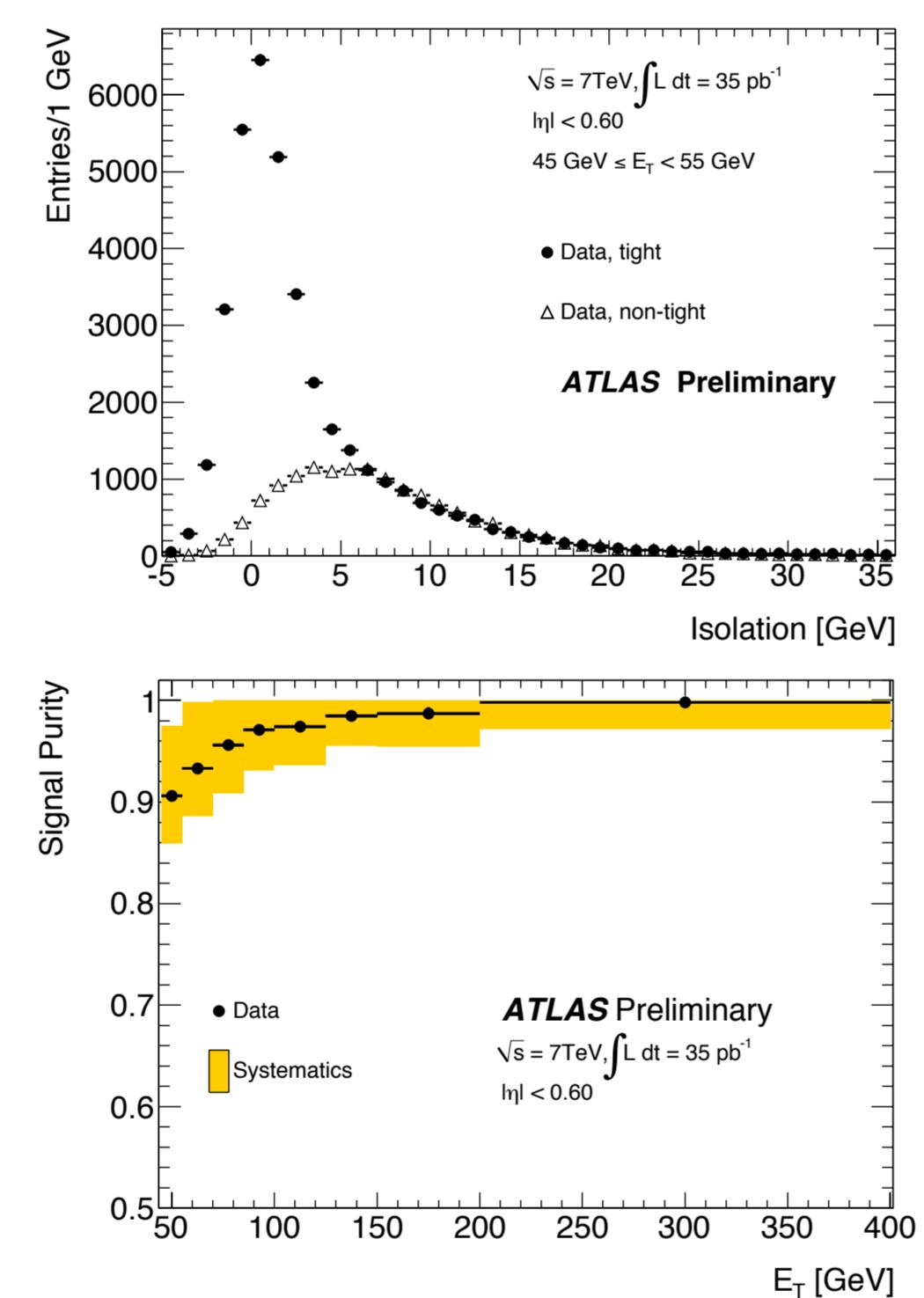
- test of perturbative QCD predictions (no complications due to jet related uncertainties)
- dominant process involves gluons in the initial state → probe the gluon content of the proton

## Background estimation

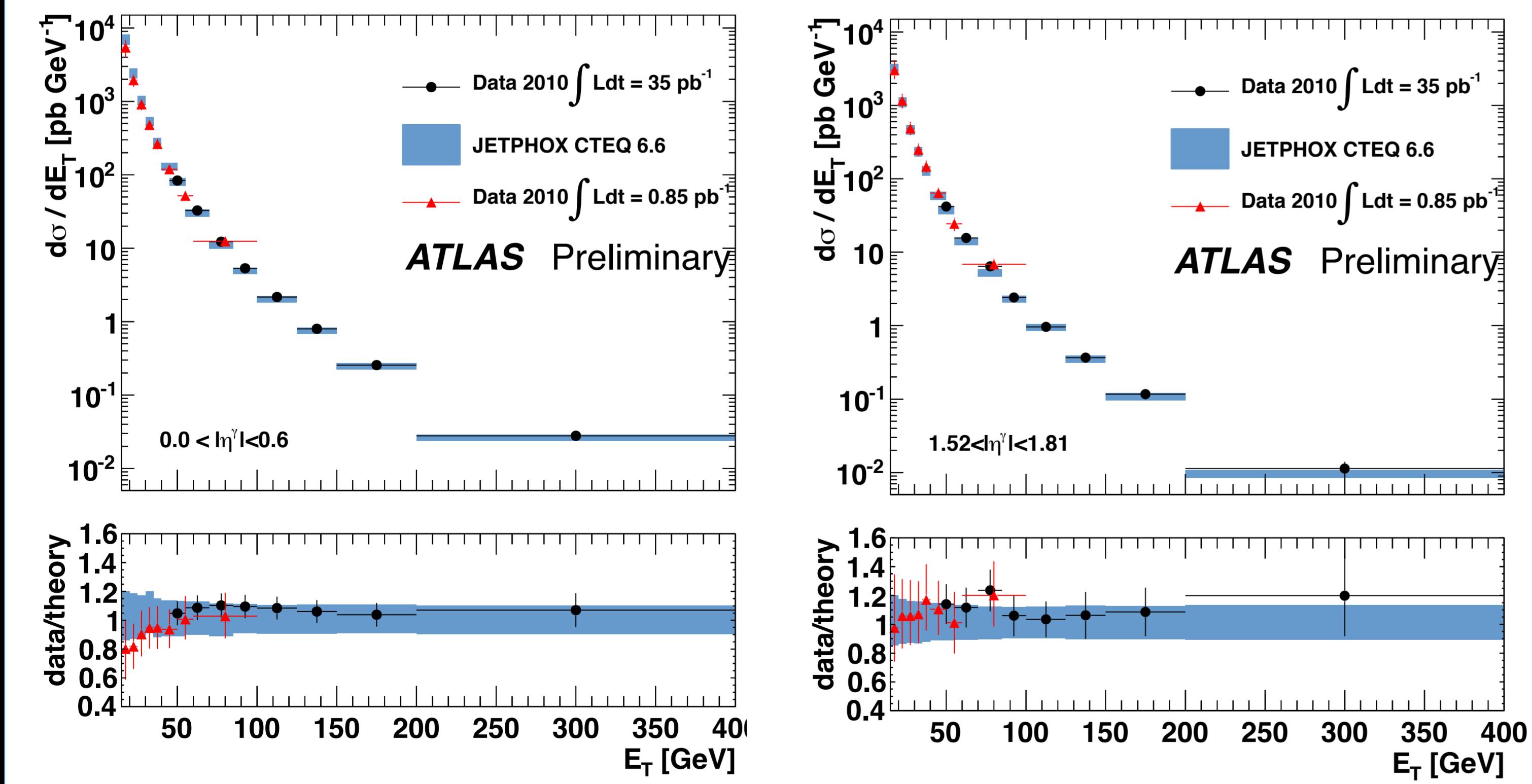


- Assumes
  - Small leakage of signal in control regions
  - Negligible correlation between identification and isolation variables

- Background isolation profile directly from data
  - Revert some ID cuts
  - Strips not strongly correlated to isolation



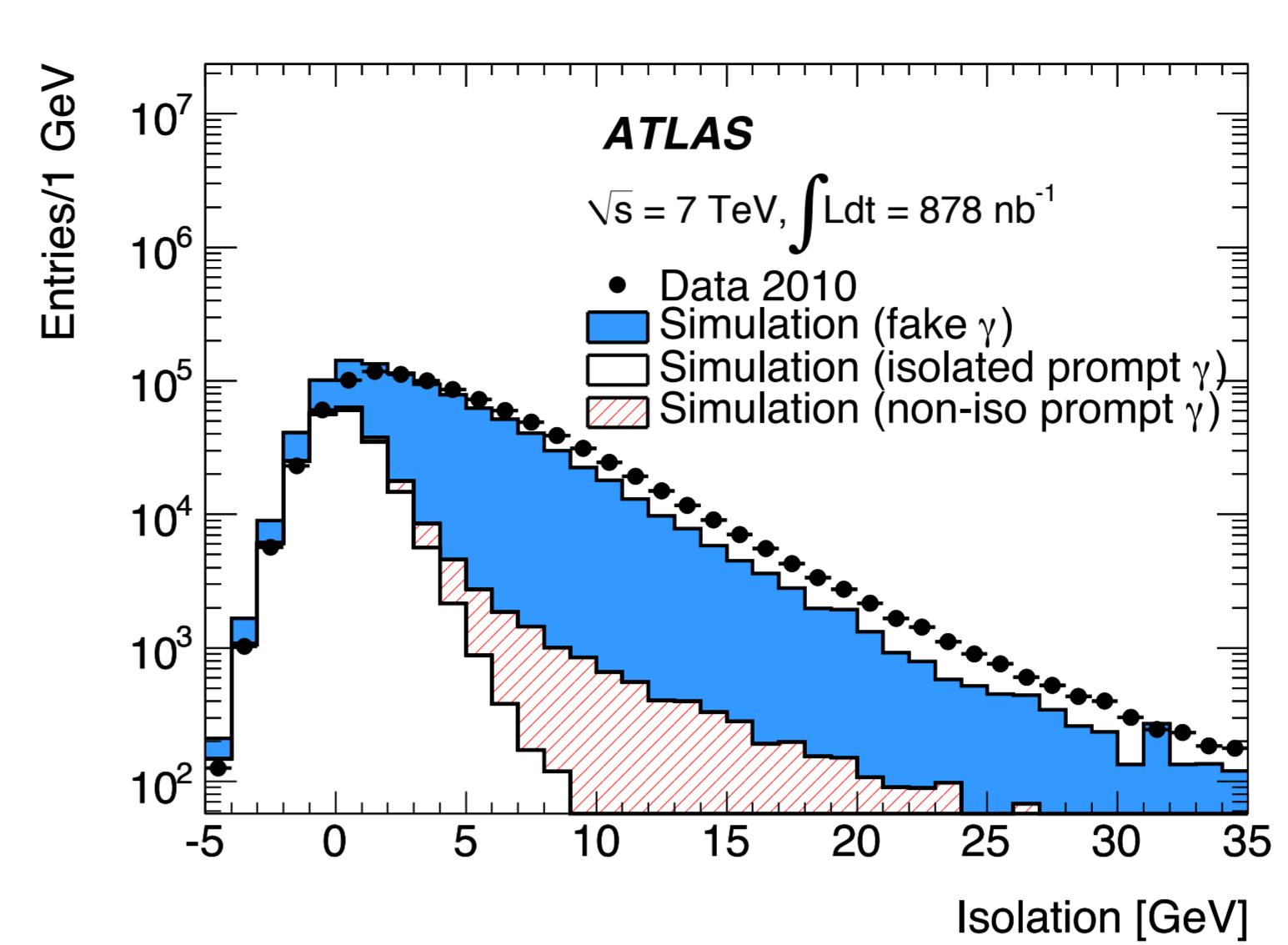
## Results



- Results systematically limited across full ET range
- The two measurements are consistent in the overlapping ET,  $\eta$  bins
- Data/(NLO pQCD) comparison:
  - experimental uncertainty comparable to theoretical one
  - good agreement with NLO pQCD above  $\sim 35$  GeV
  - disagreement (ratio data/theory < 1) at lower  $E_T$

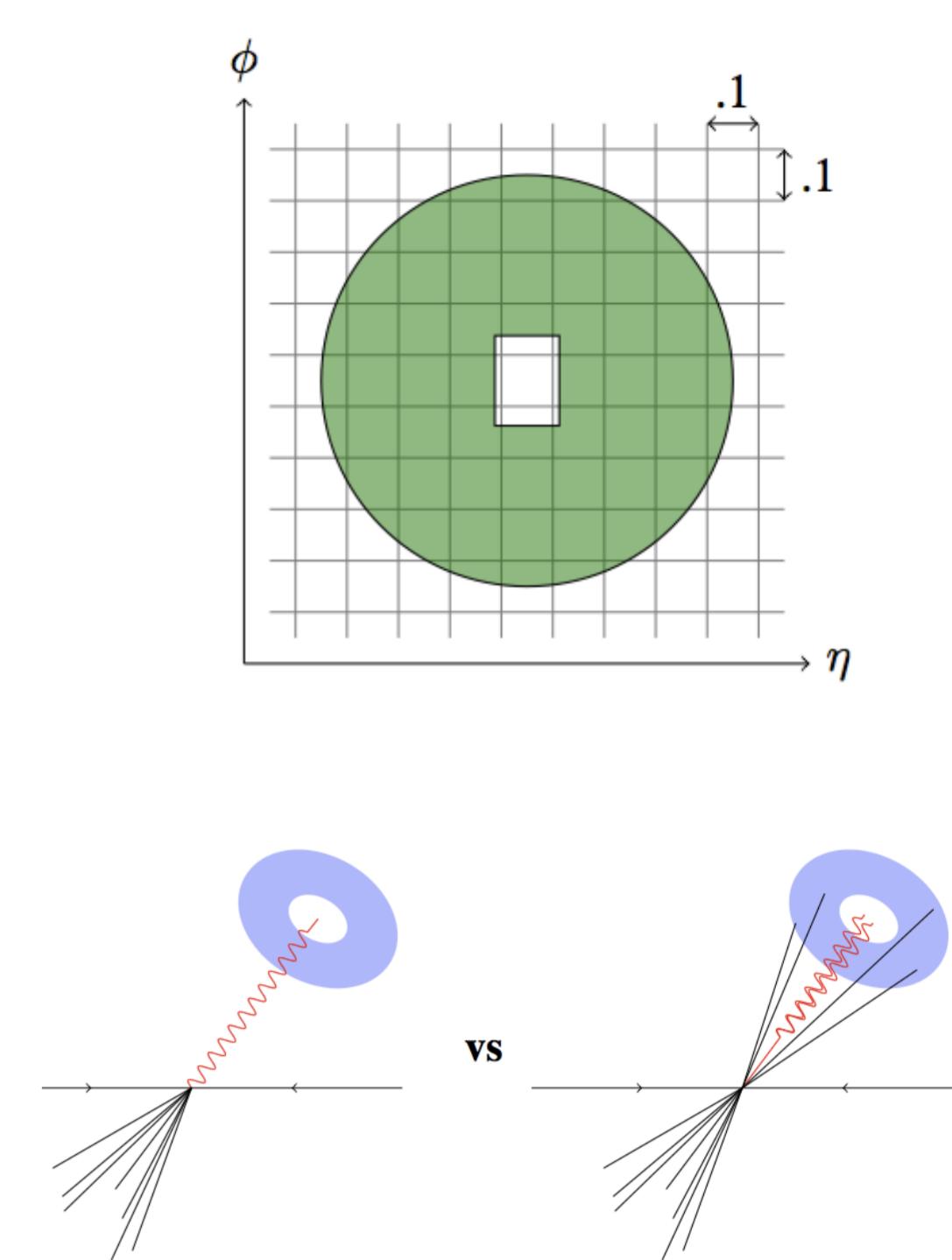
## References

## Isolation

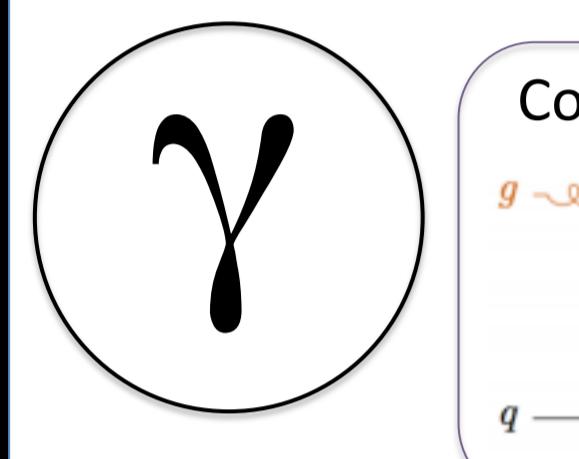


Sum of cells outside of  $5 \times 7$  central core:

$$\Delta R = \sqrt{\Delta\varphi^2 + \Delta\eta^2} < 0.4$$



- Corrected for out-of-core leakage
- Corrected to account for non-perturbative effects
  - Take median jet-energy density to be representative of the ambient energy in the event . (Cacciari et al. <http://arxiv.org/abs/0912.4926>)

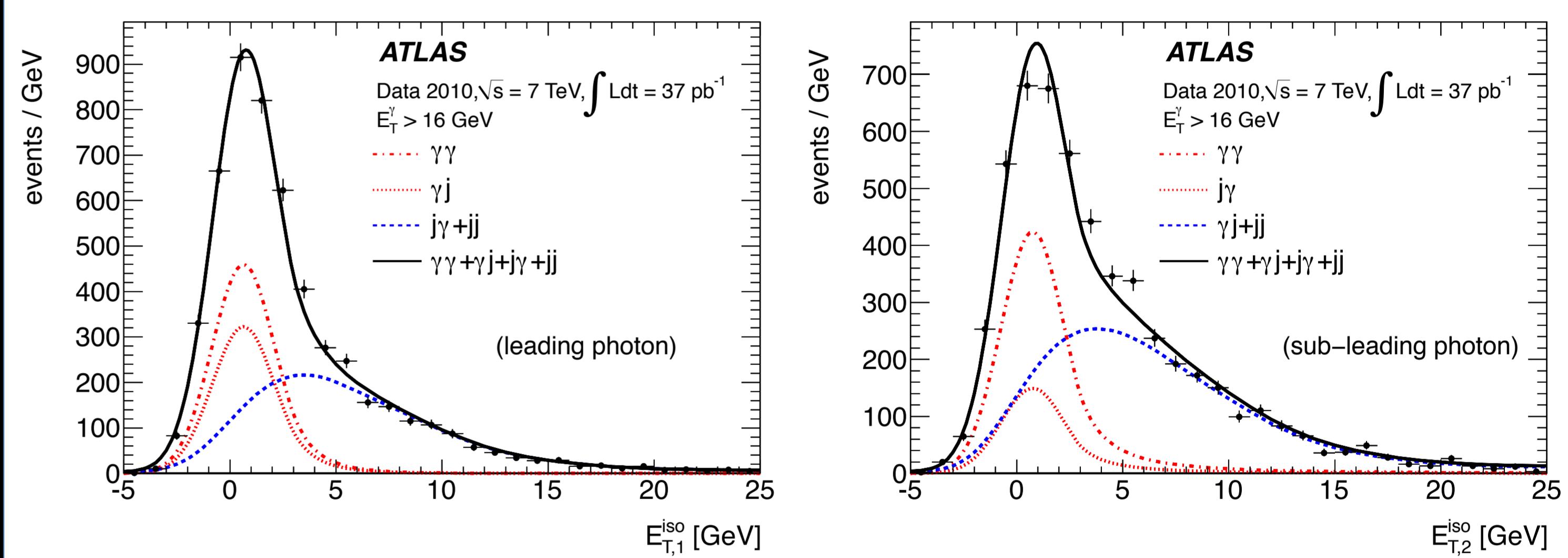


## Background estimation

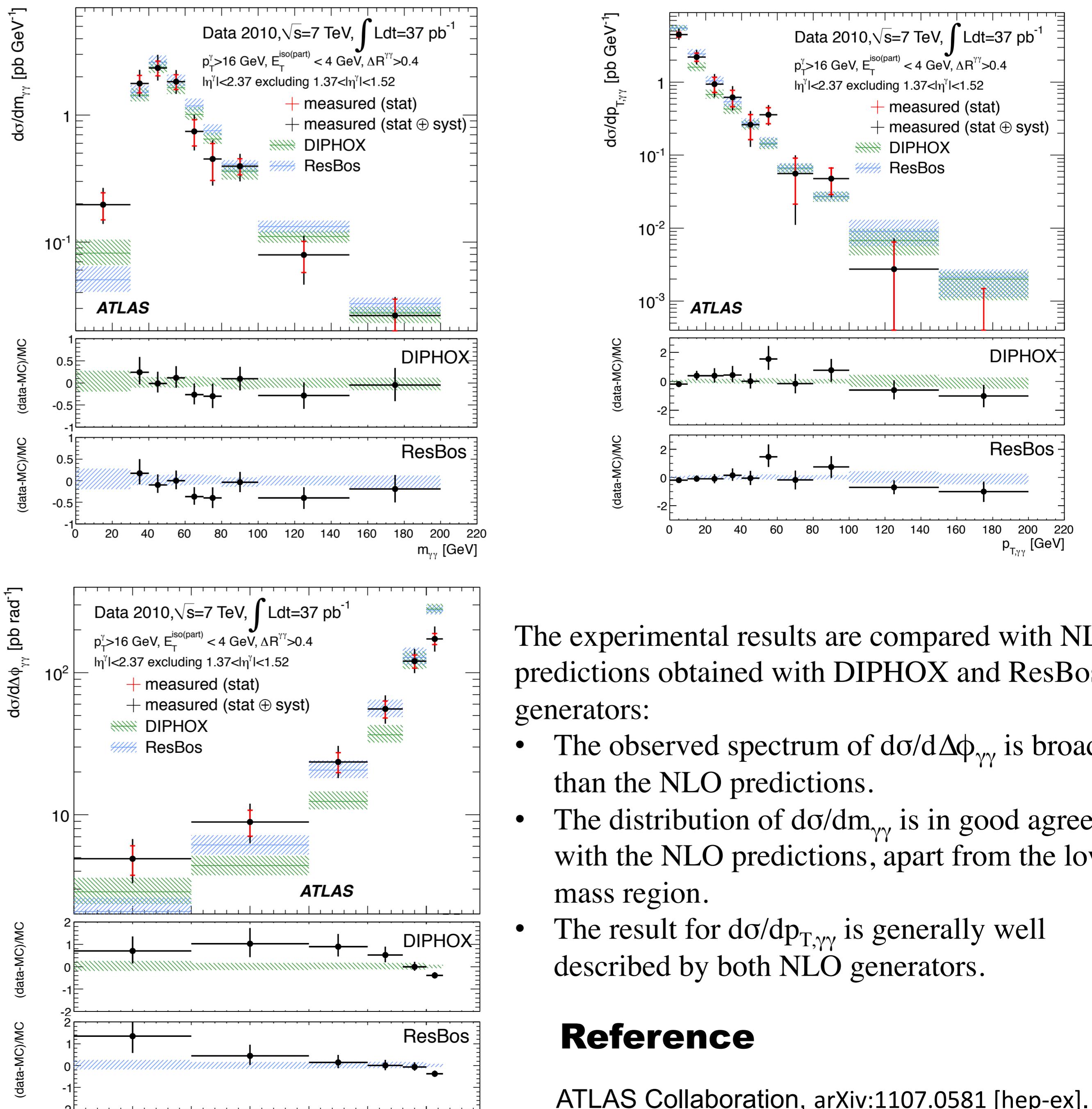
- the  $\Delta\phi$  separation between the  $\gamma$ 's is sensitive to the way the double fragmentation is modelled
- the balanced back to back case ( $\Delta\phi \sim \pi$  and small total PT) is sensitive to the soft gluon emission
- di-photon signature appears in some *new physics* processes

## Background estimation

- isolation templates for  $\gamma\gamma$ ,  $\gamma$ -jet and jet-jet events are built from data (using electrons and background *enriched* samples)
- the sample decomposition comes from a maximum likelihood fit



## Results



The experimental results are compared with NLO predictions obtained with DIPHOX and ResBos generators:

- The observed spectrum of  $d\sigma/d\Delta\phi_{\gamma\gamma}$  is broader than the NLO predictions.
- The distribution of  $d\sigma/dm_{\gamma\gamma}$  is in good agreement with the NLO predictions, apart from the low mass region.
- The result for  $d\sigma/dp_T^{gamma\gamma}$  is generally well described by both NLO generators.

## Reference