Physics at the LHC

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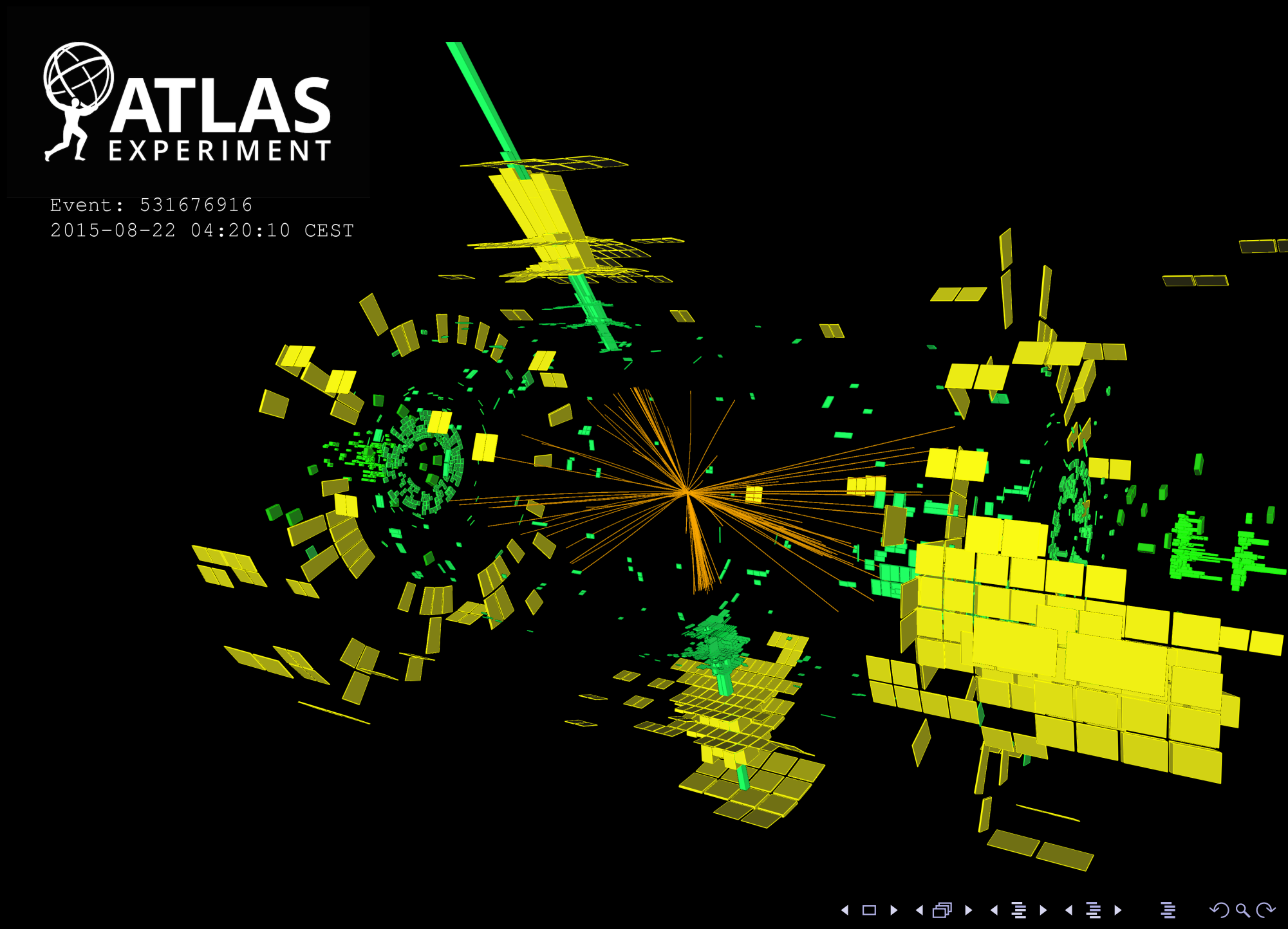
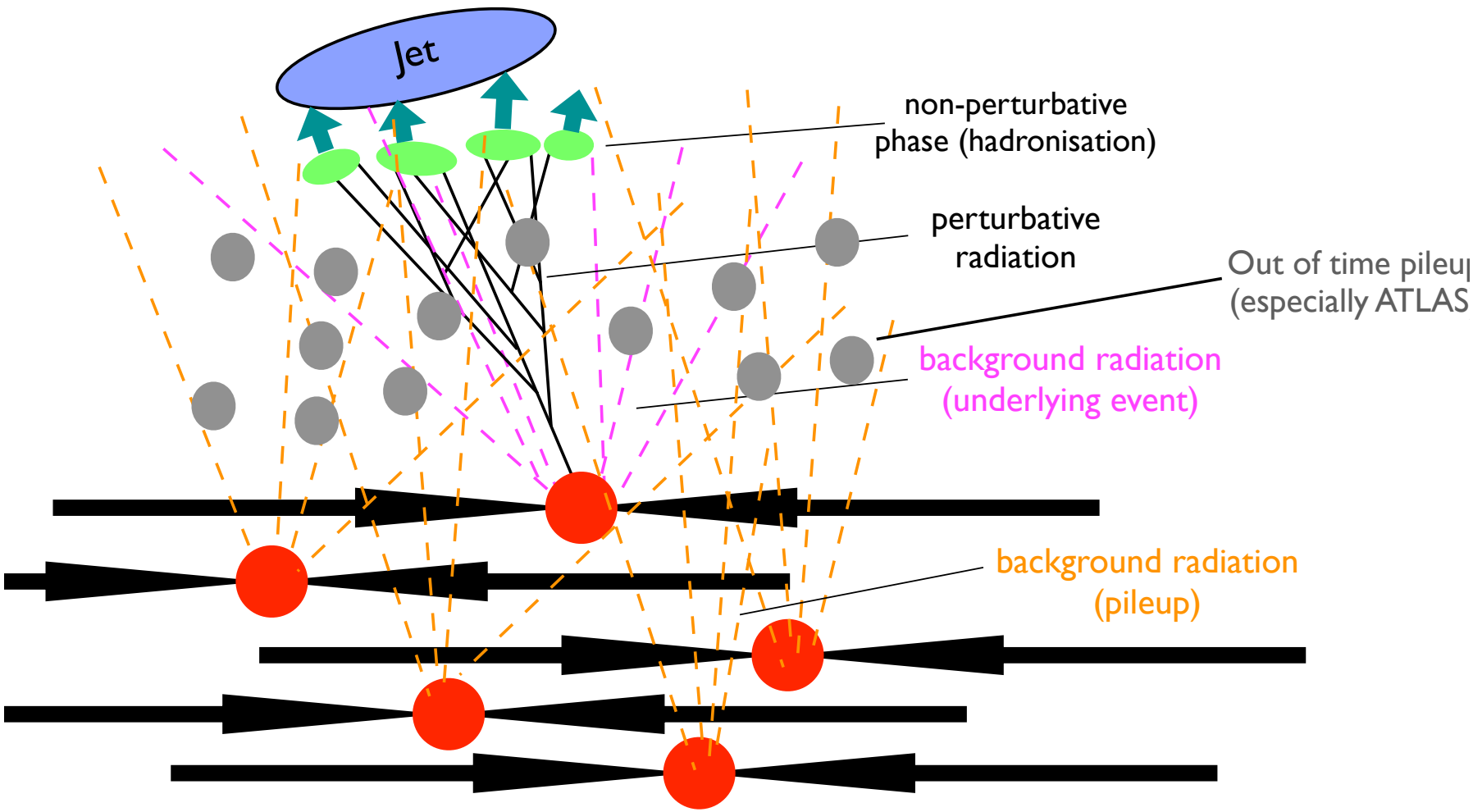
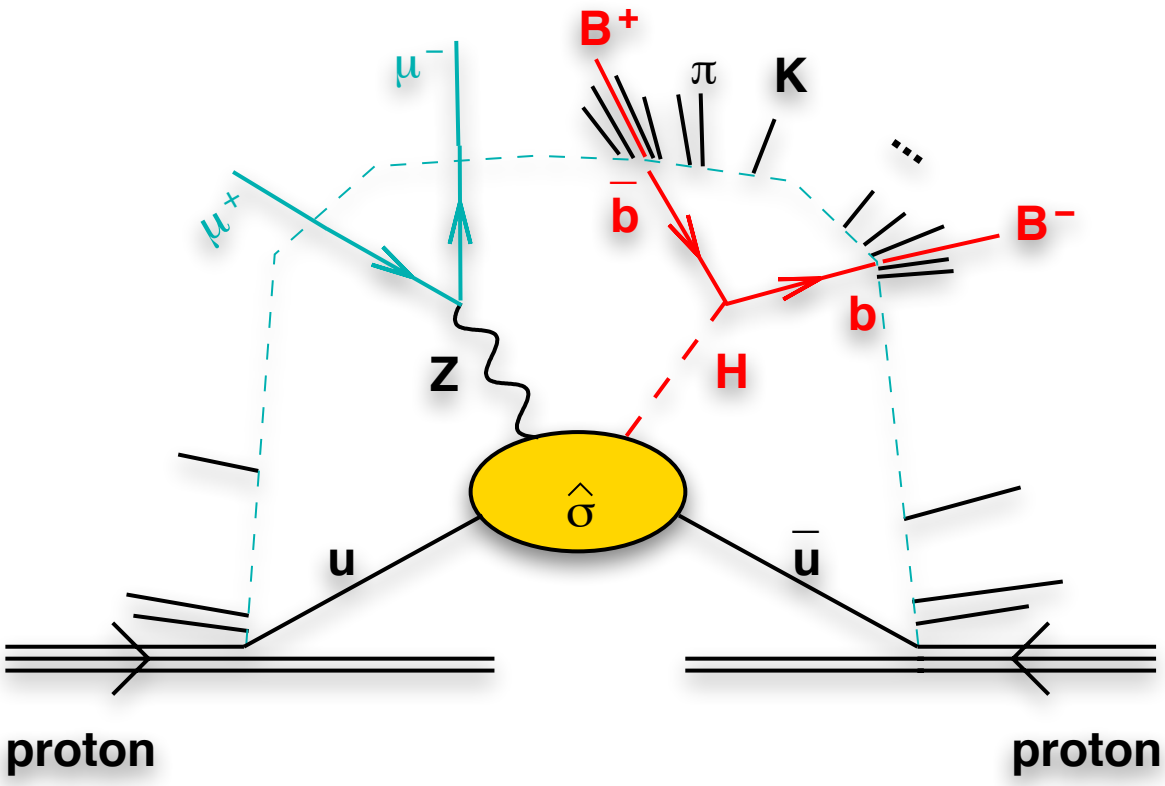
November 15, 2021


ATLAS
EXPERIMENT
Event: 531676916
2015-08-22 04:20:10 CEST

Very realistic picture of proton-proton collisions

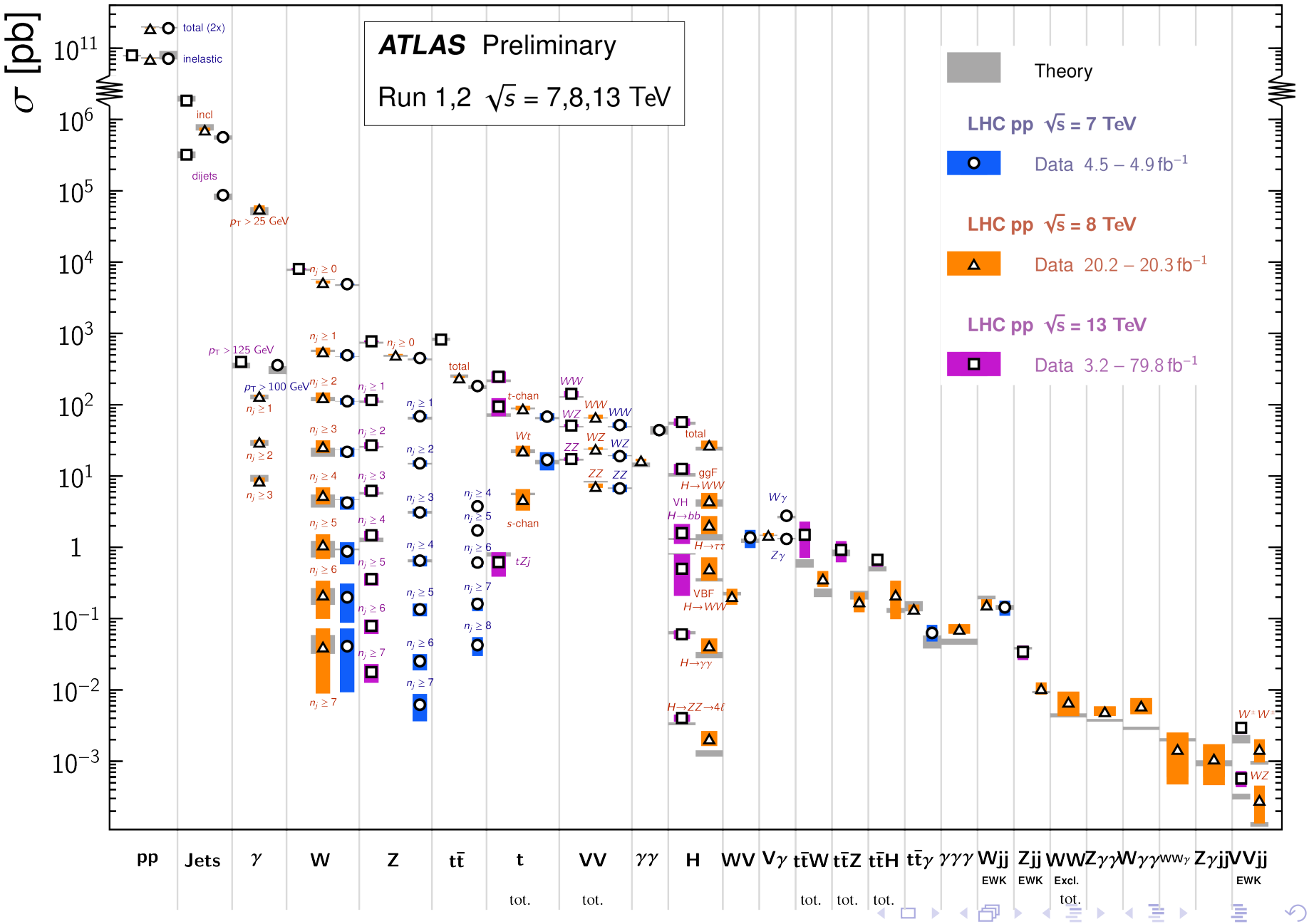


Proton-proton collisions : final state truth at the particle-level

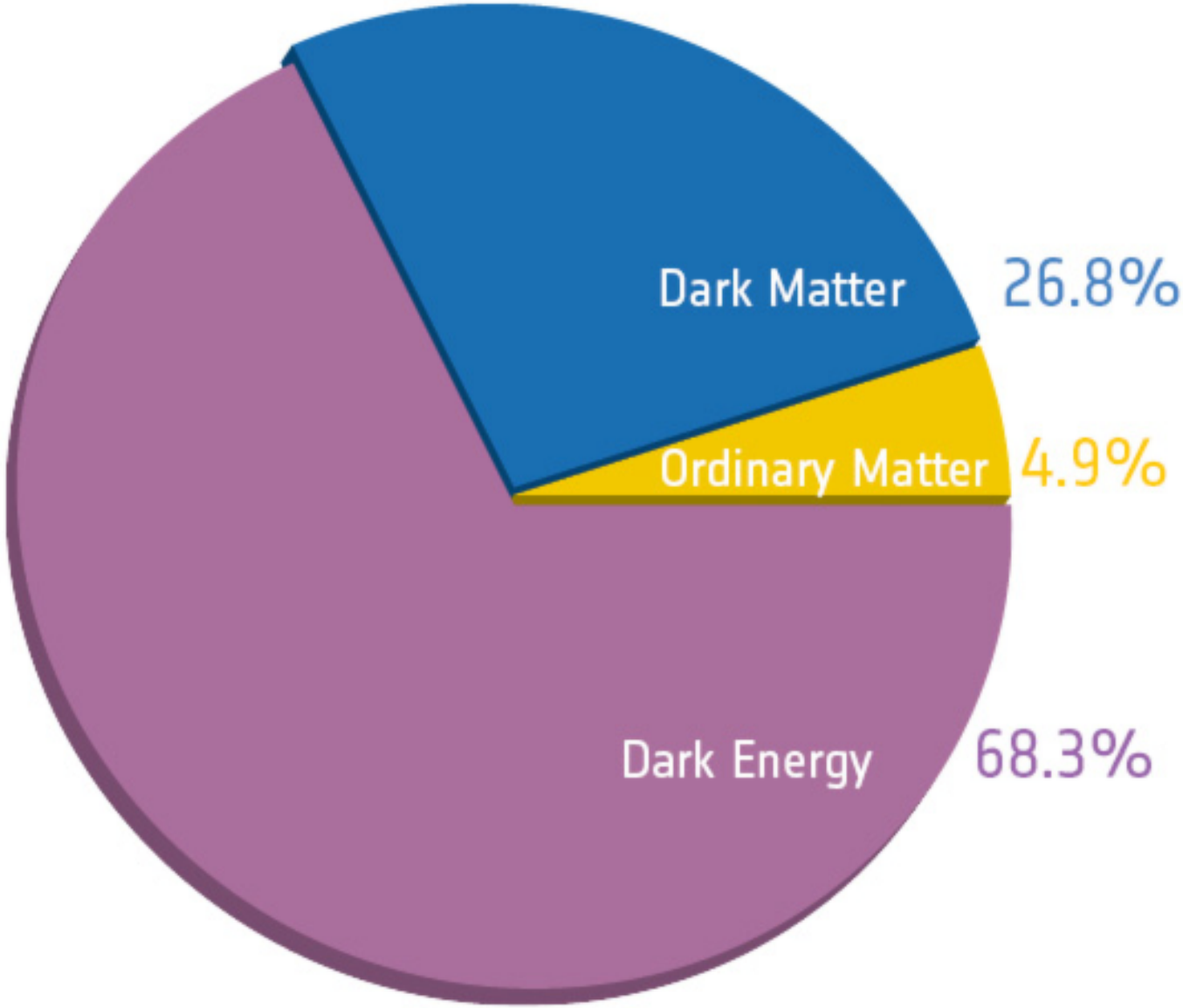


Standard Model Production Cross Section Measurements

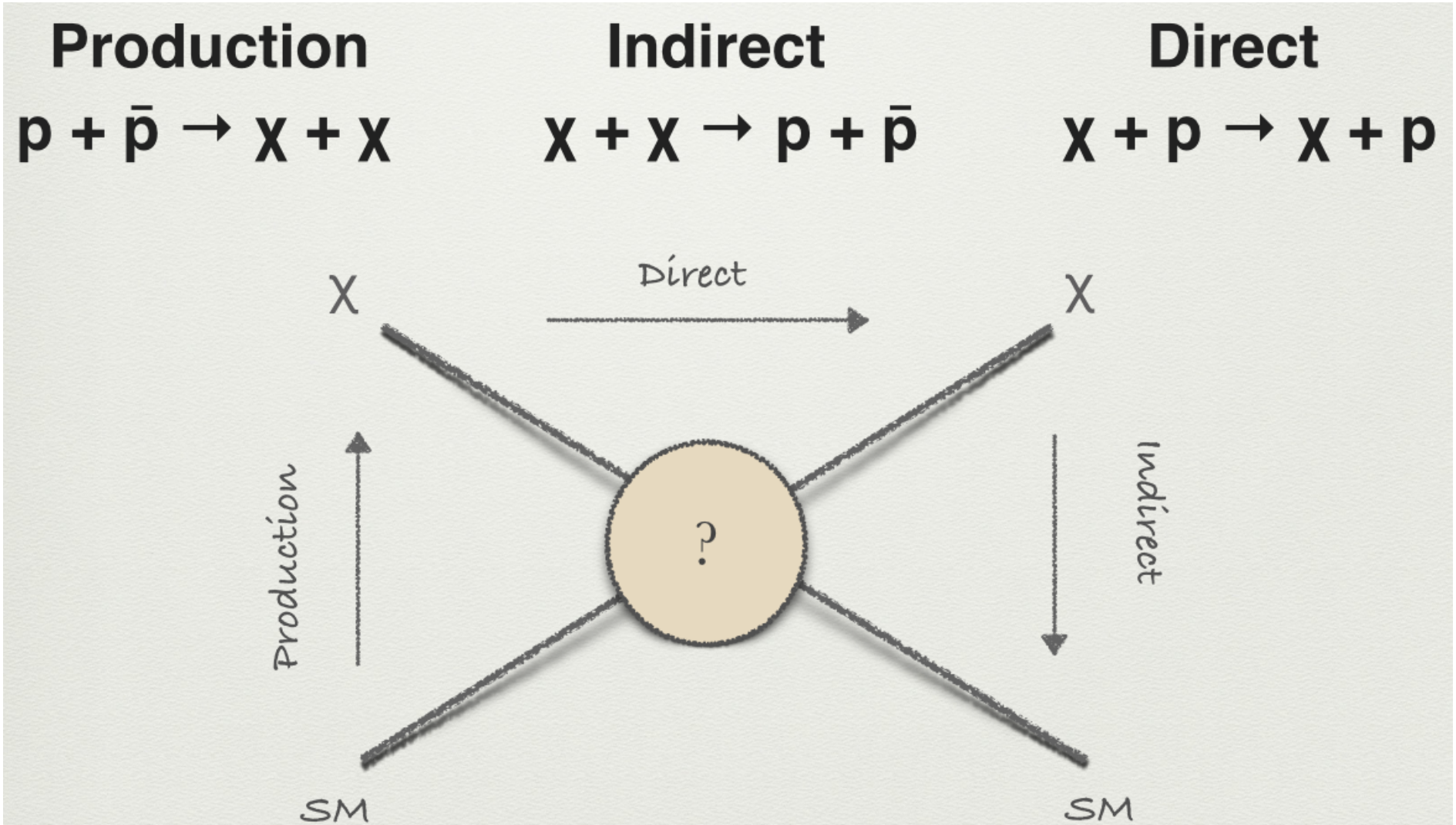
Status: July 2018



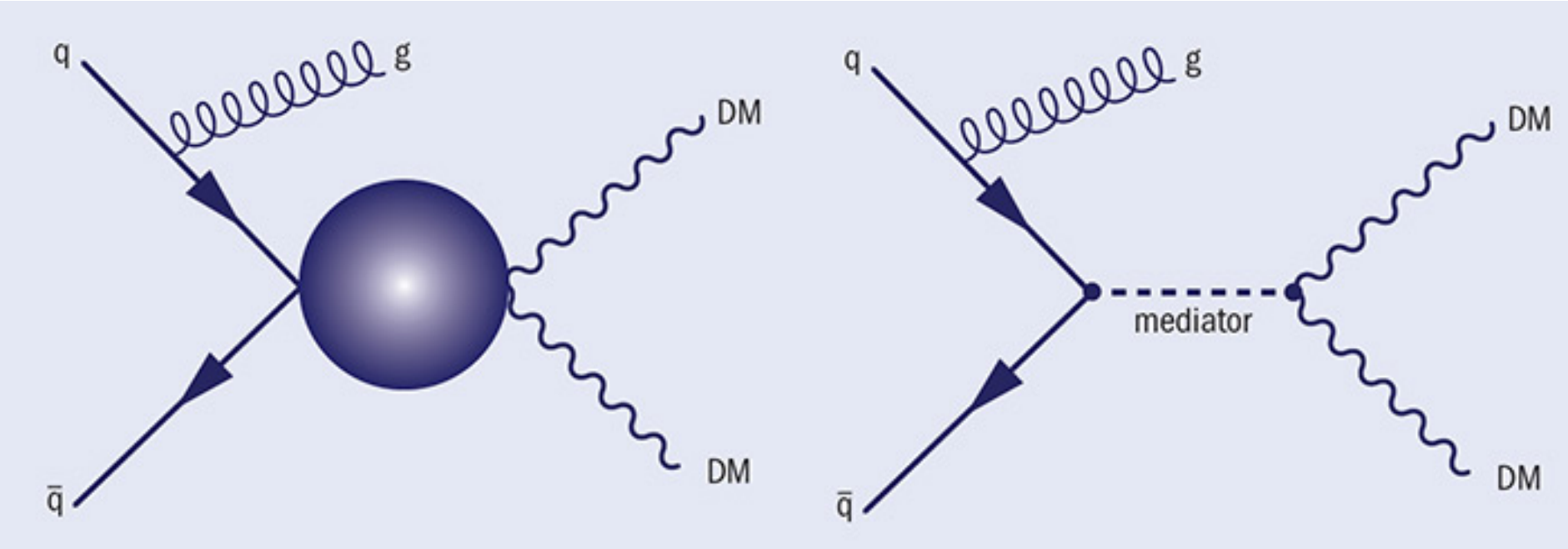
Universe pie chart



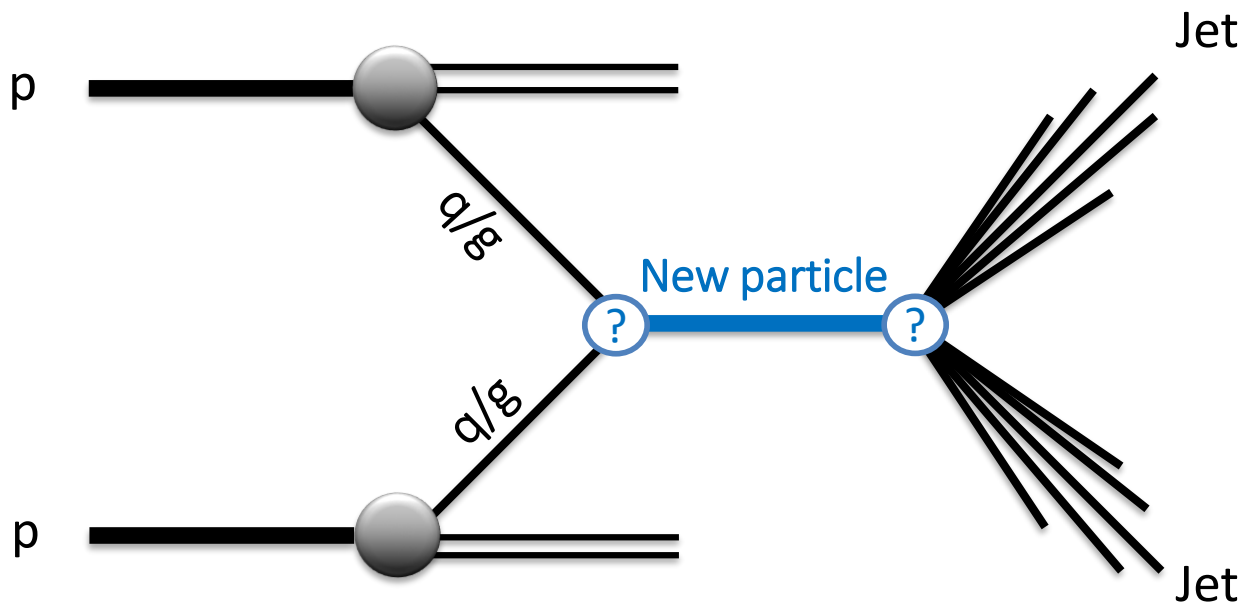
Dark Matter production mechanisms



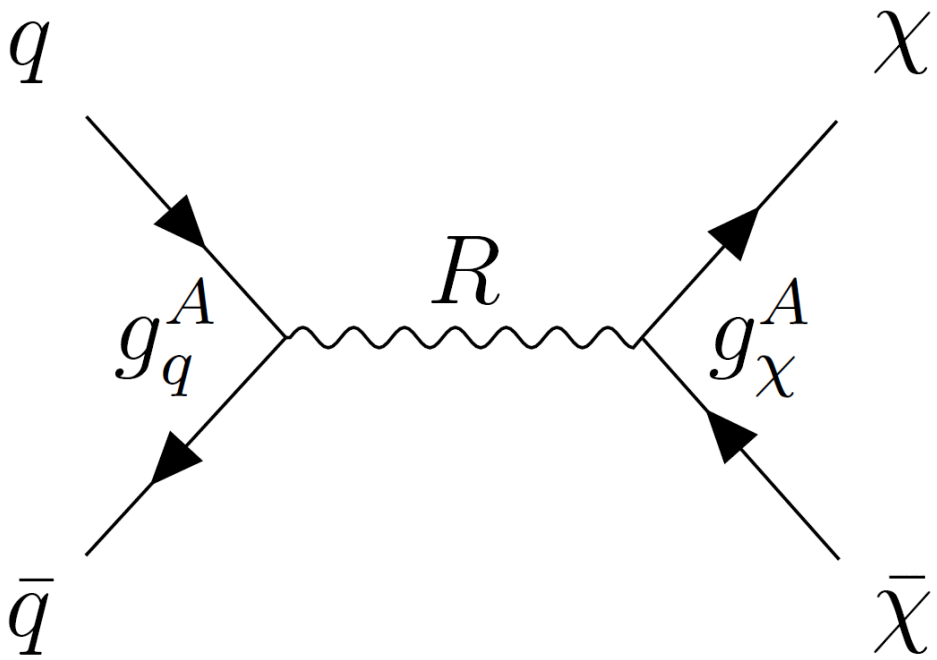
Dark Matter production at a collider : MET+X



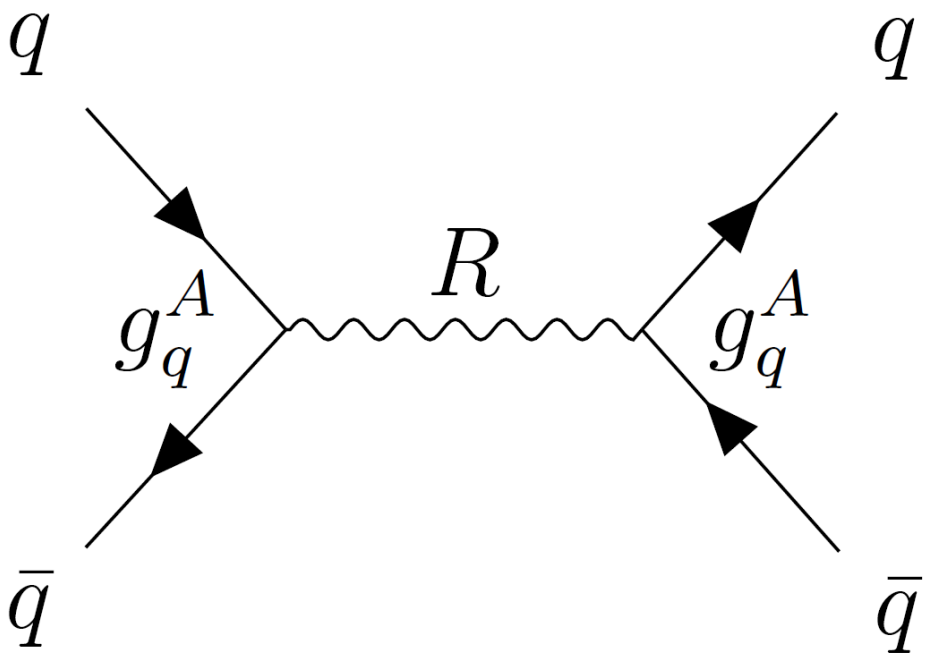
Dijets : the most inclusive signature



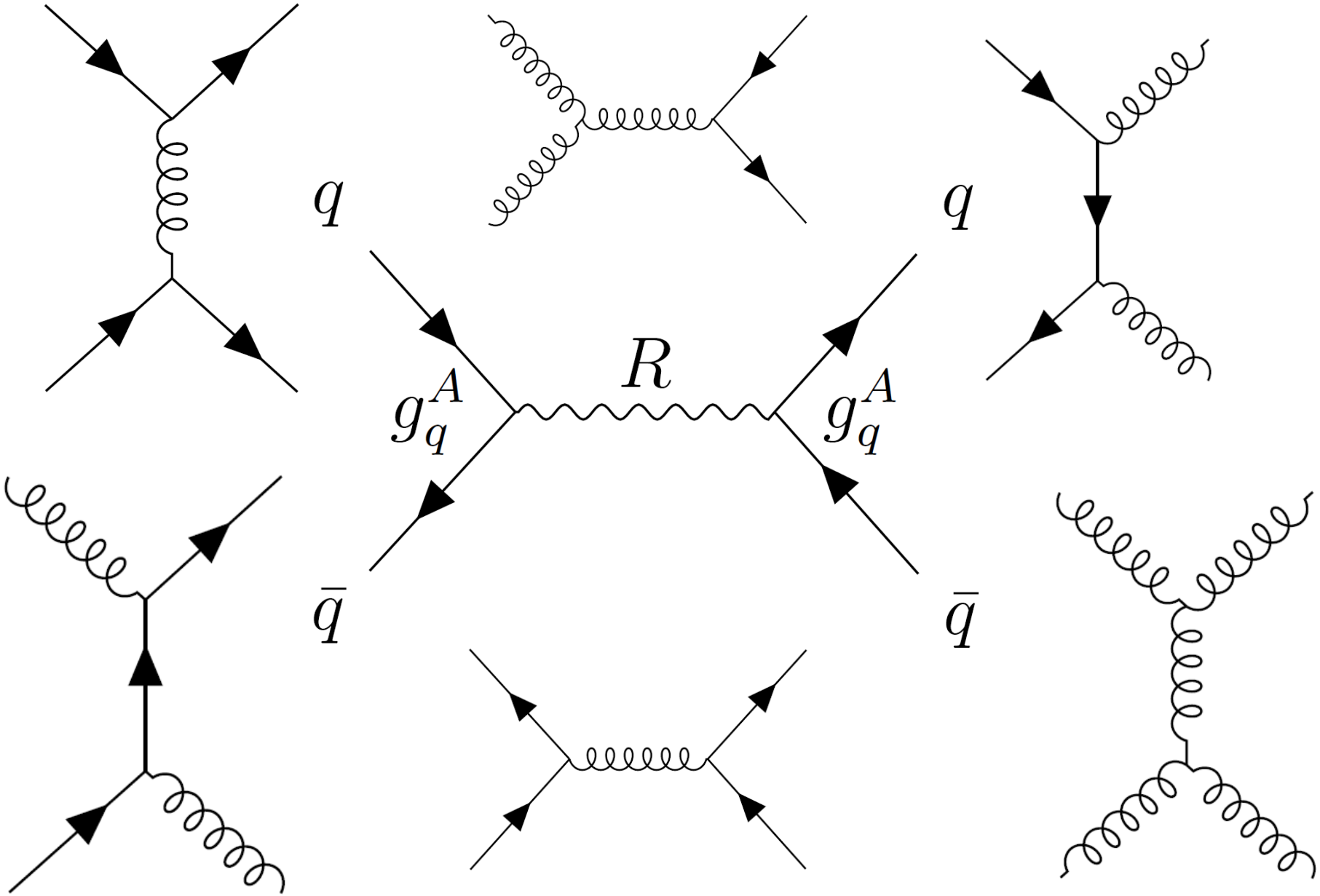
Dijets : the most inclusive signature



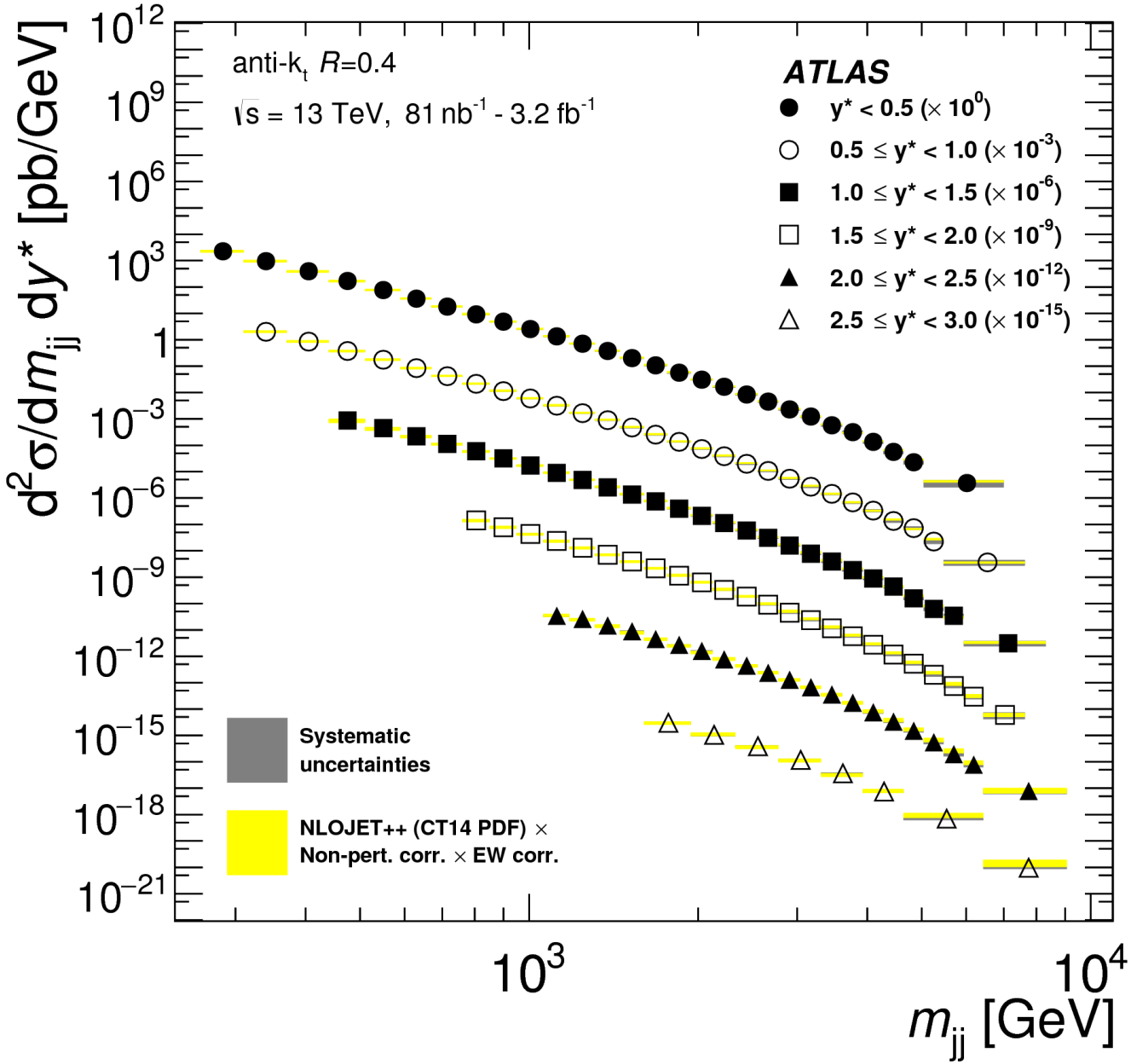
Dijets : the most inclusive signature



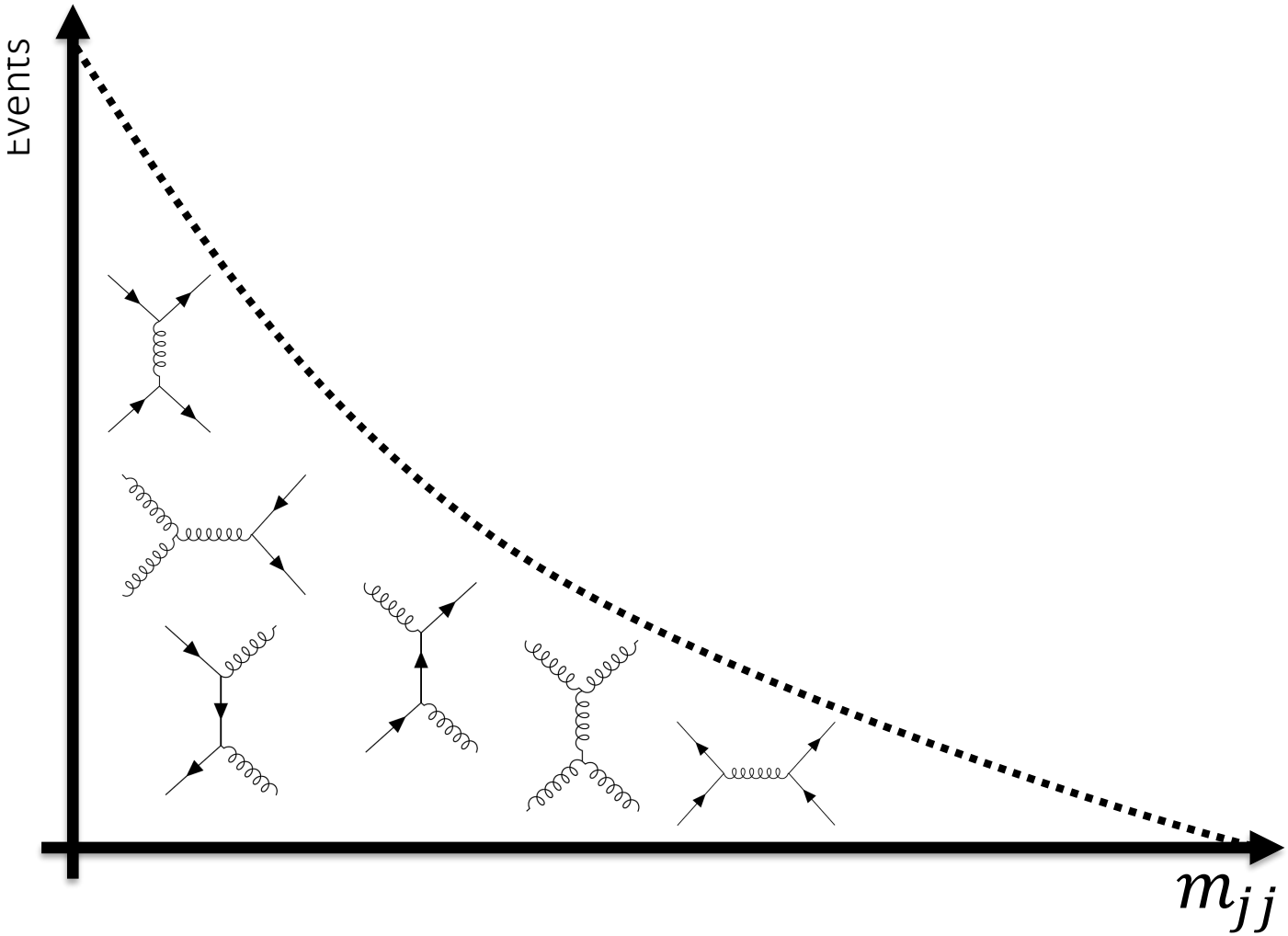
Dijets : the most inclusive signature



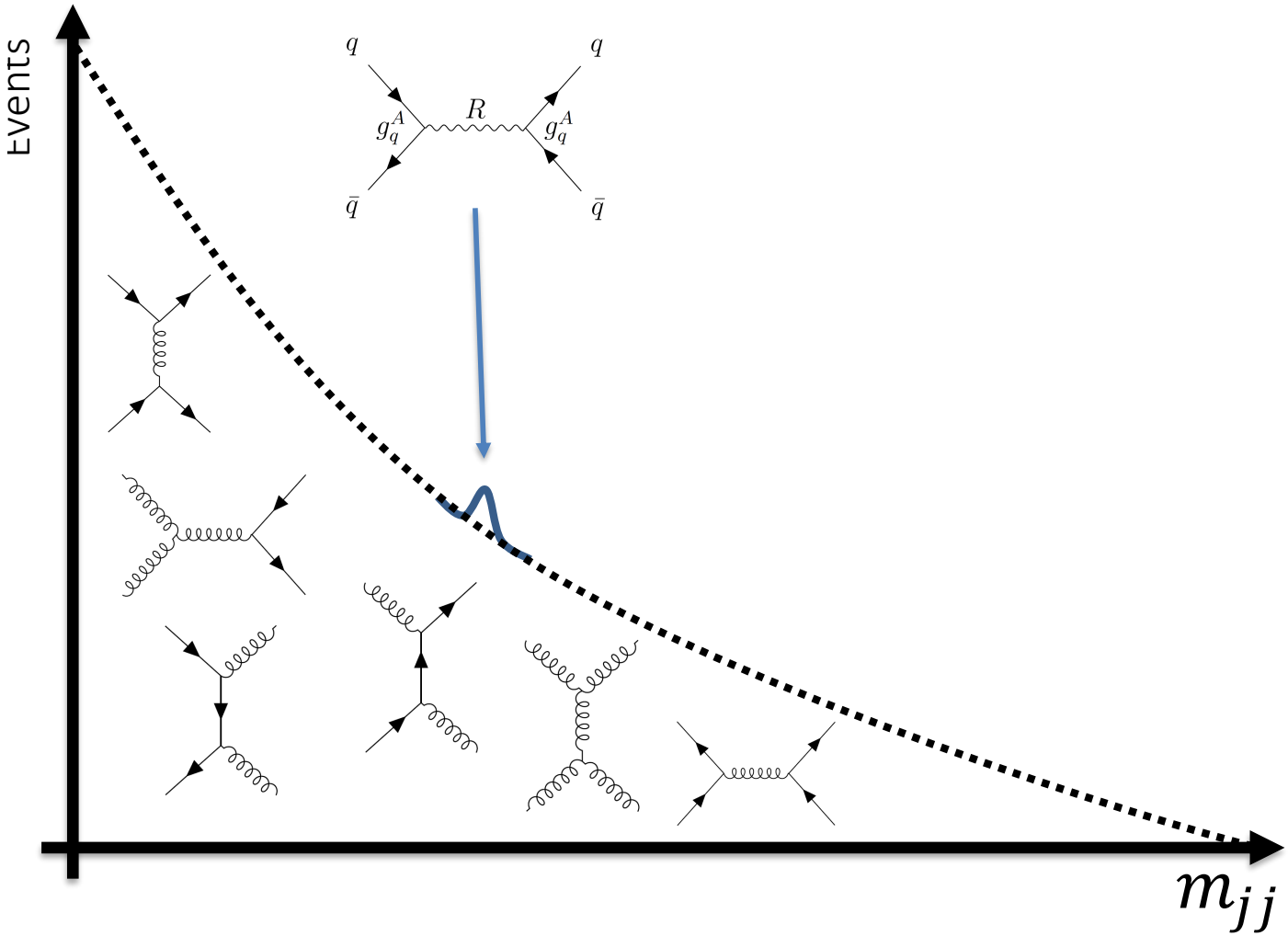
Standard Model Dijets



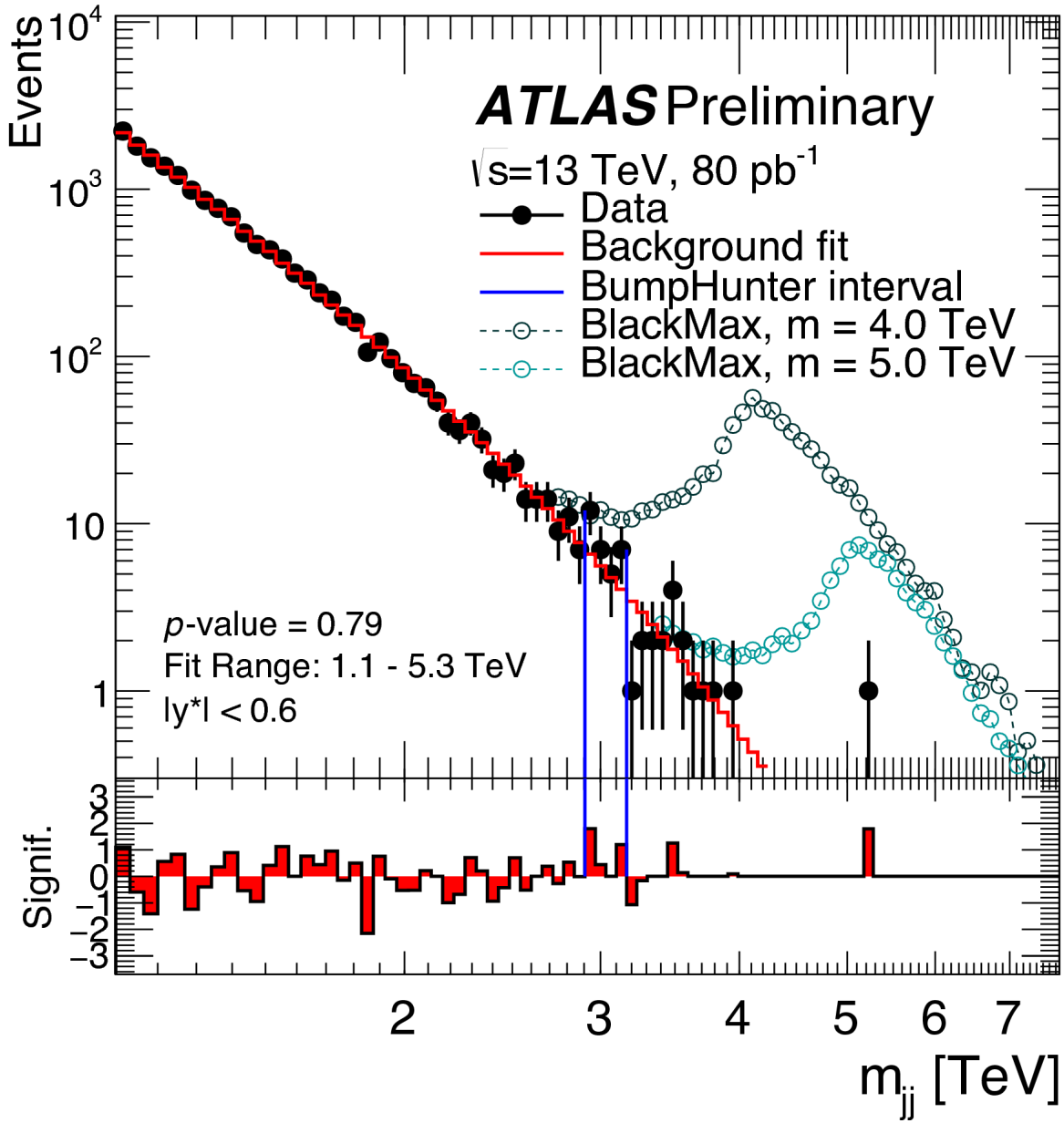
Dijets : spectrum



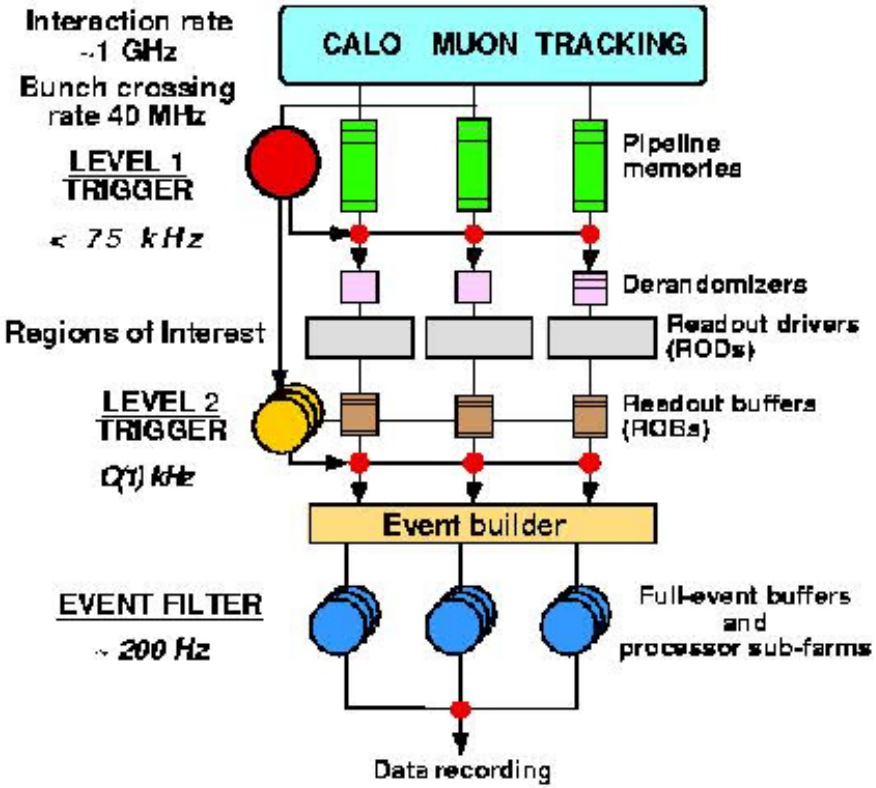
Dijets : spectrum in the presence of New Physics

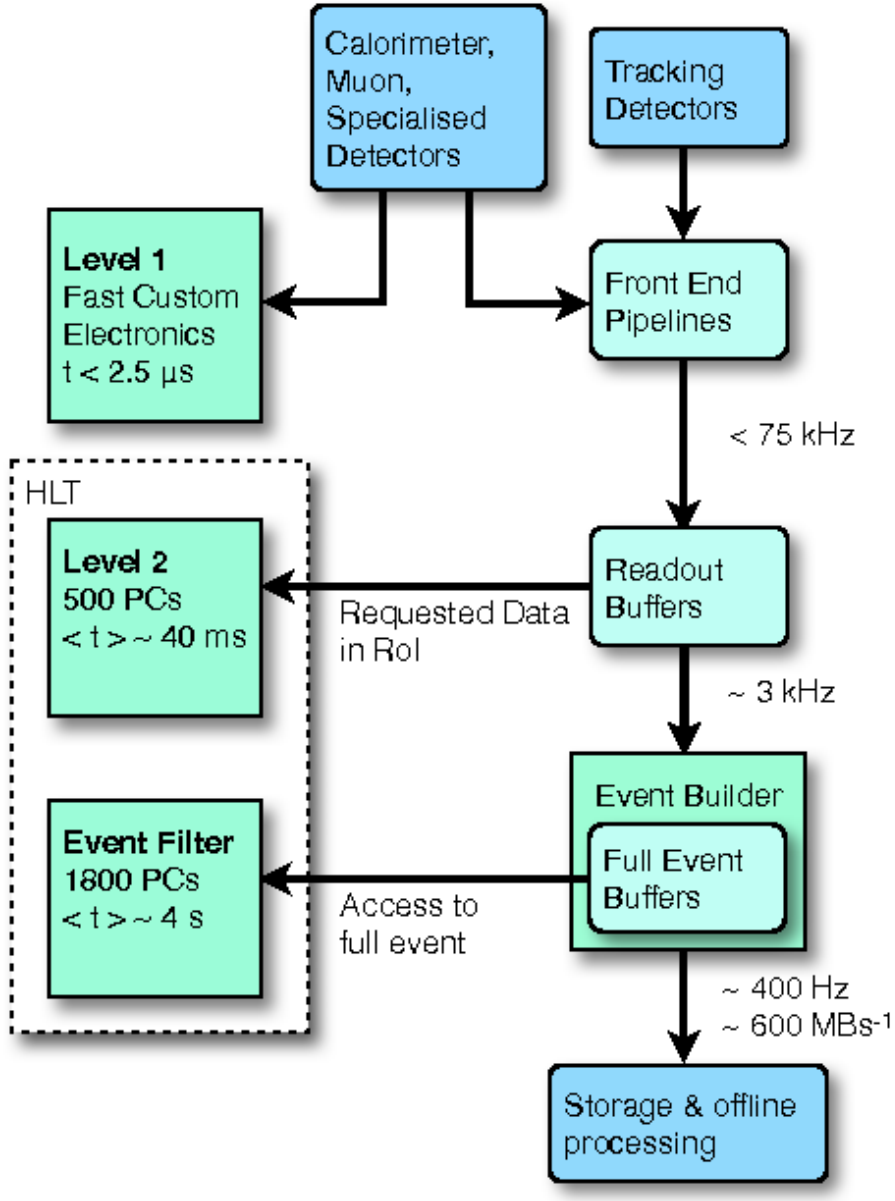


High-mass dijets

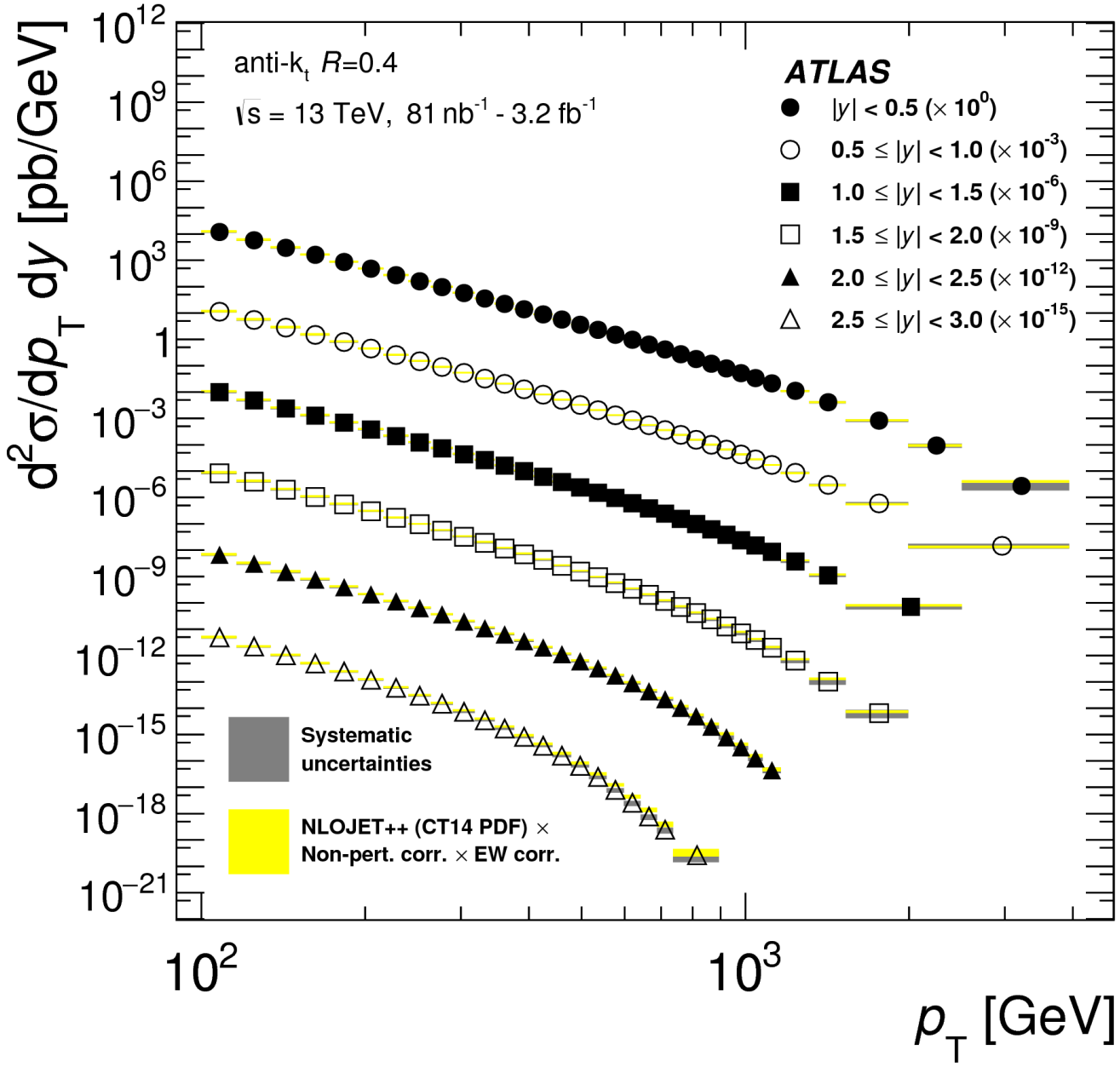


Trigger system

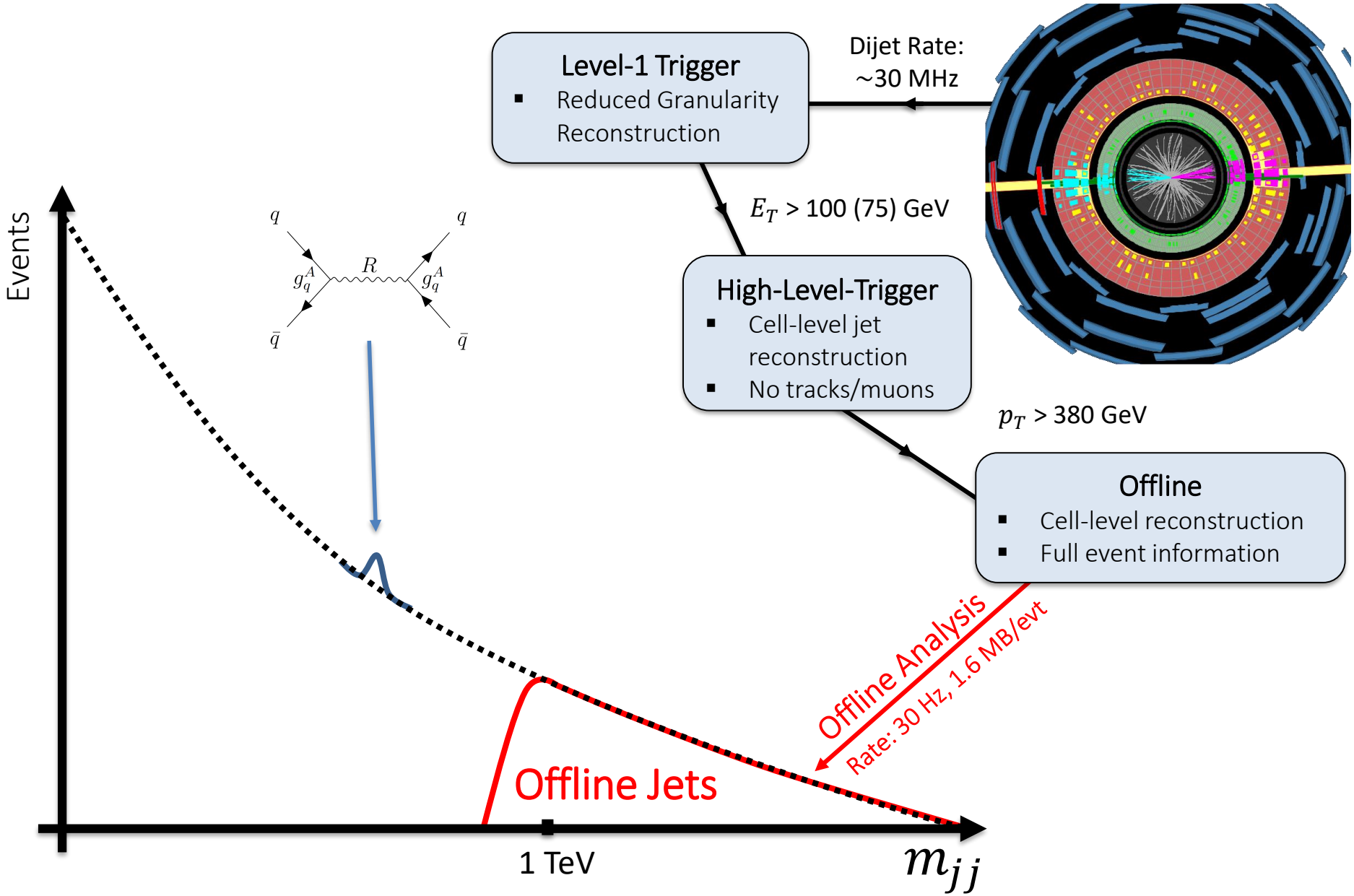




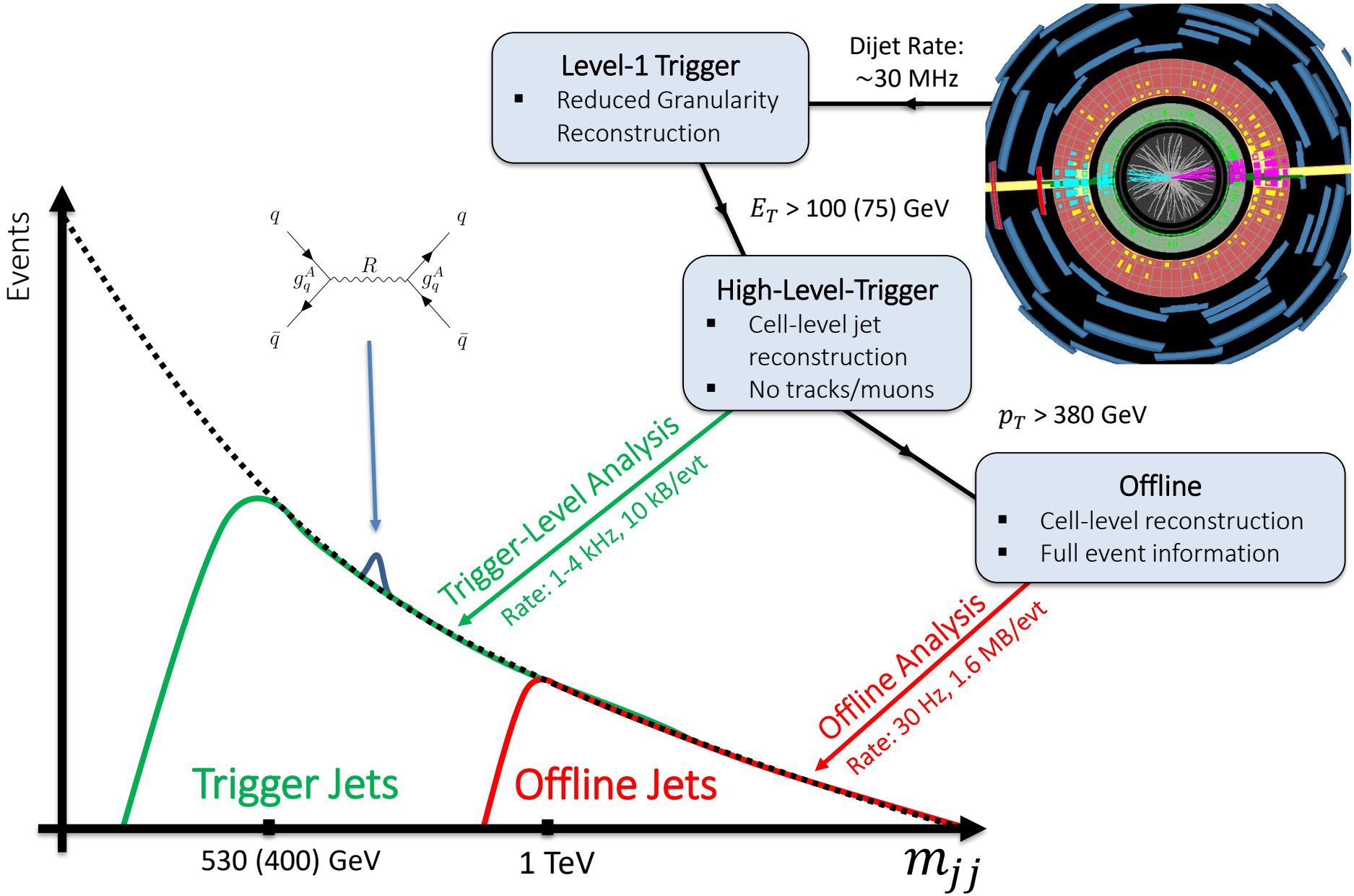
Inclusive jets



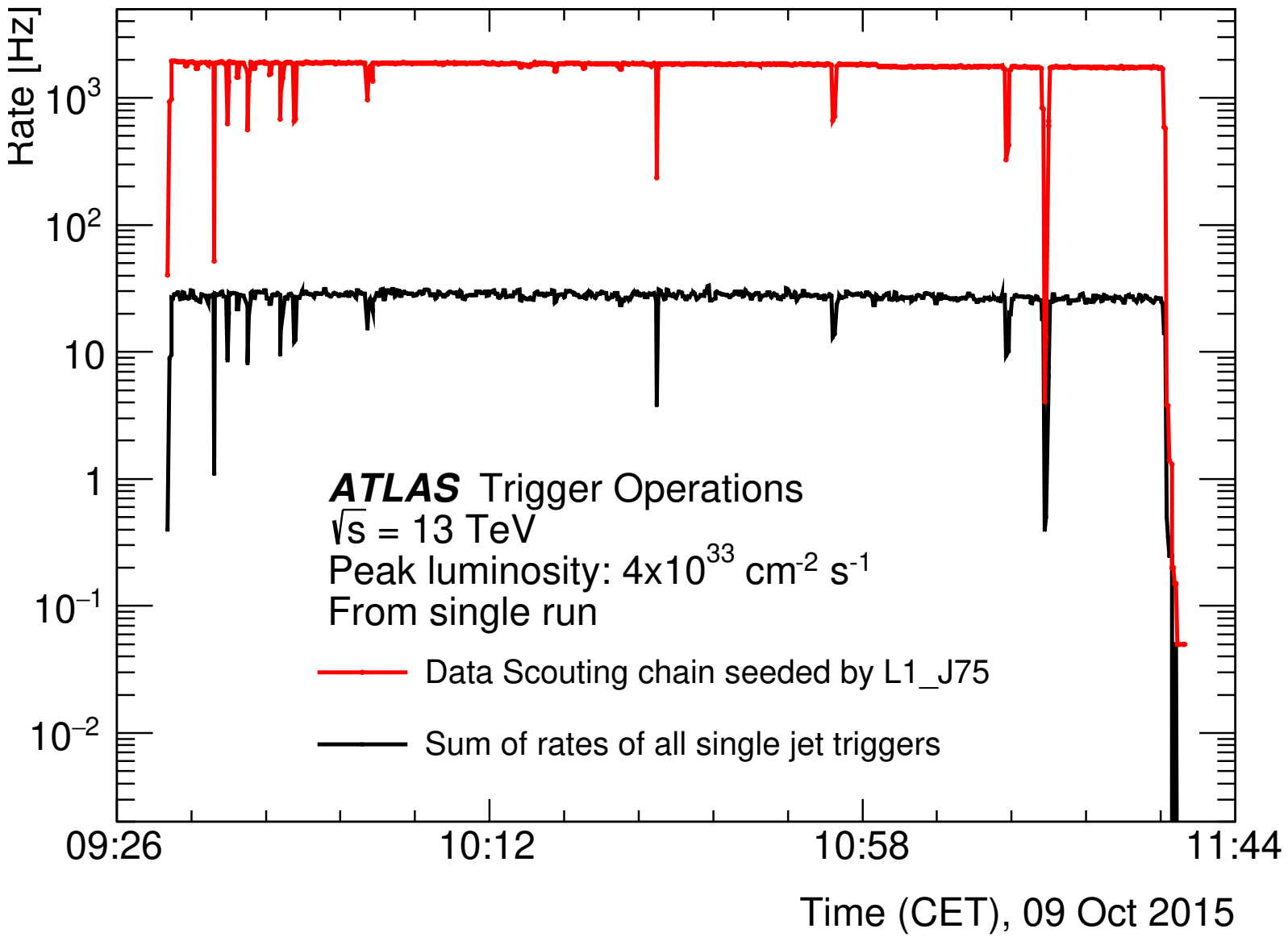
Dijets : TLA spectrum



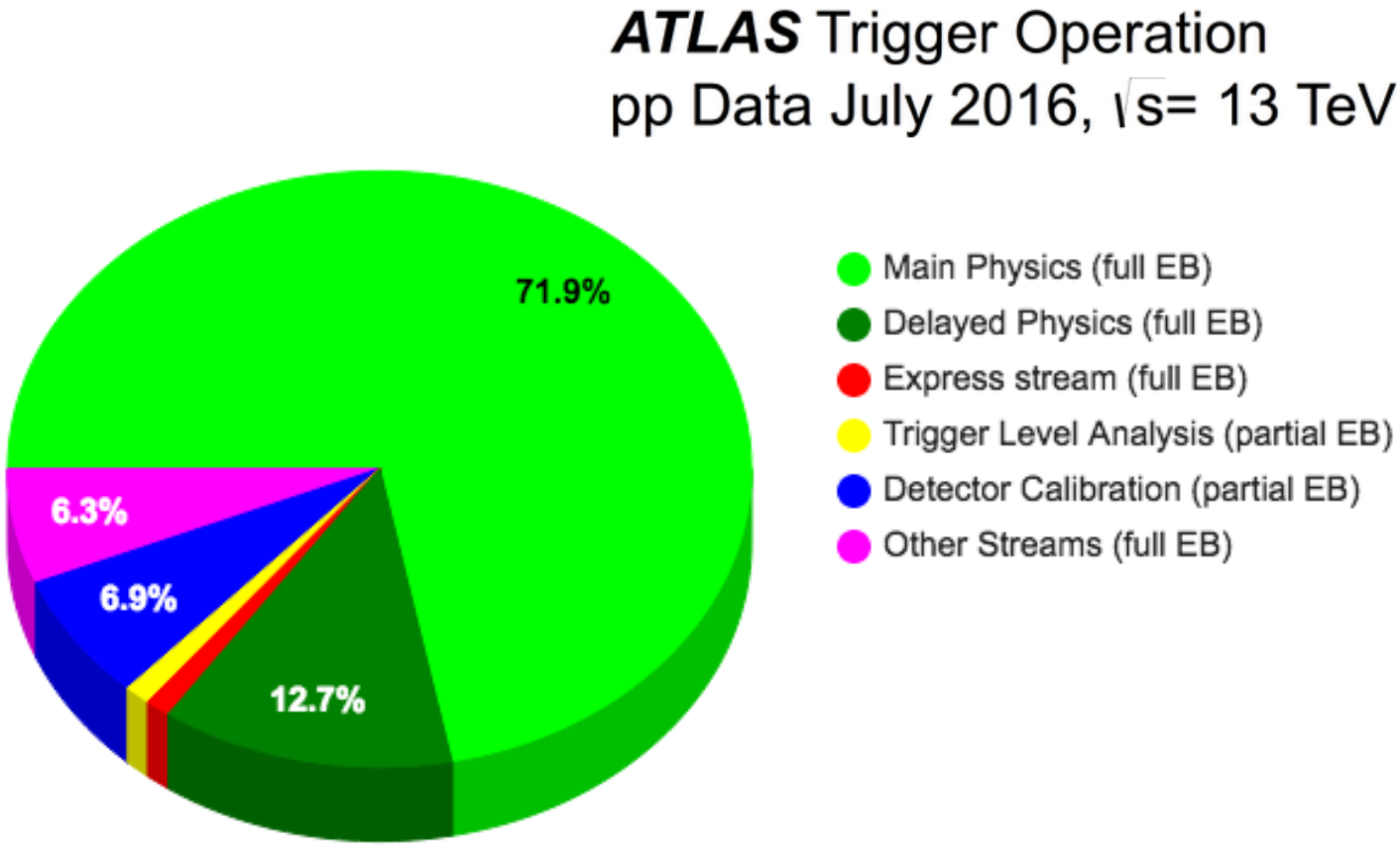
Dijets : TLA spectrum



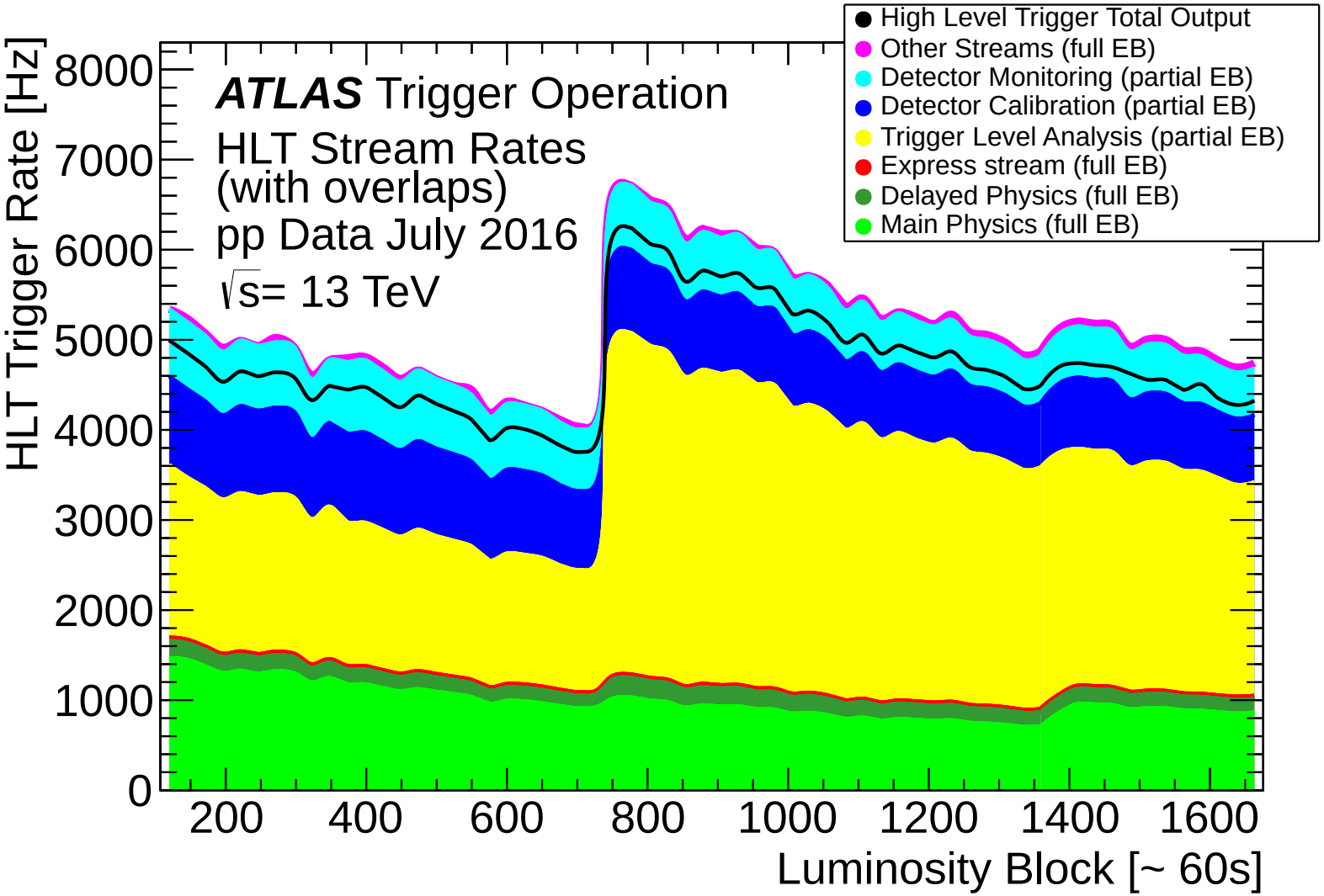
TLA : data scouting



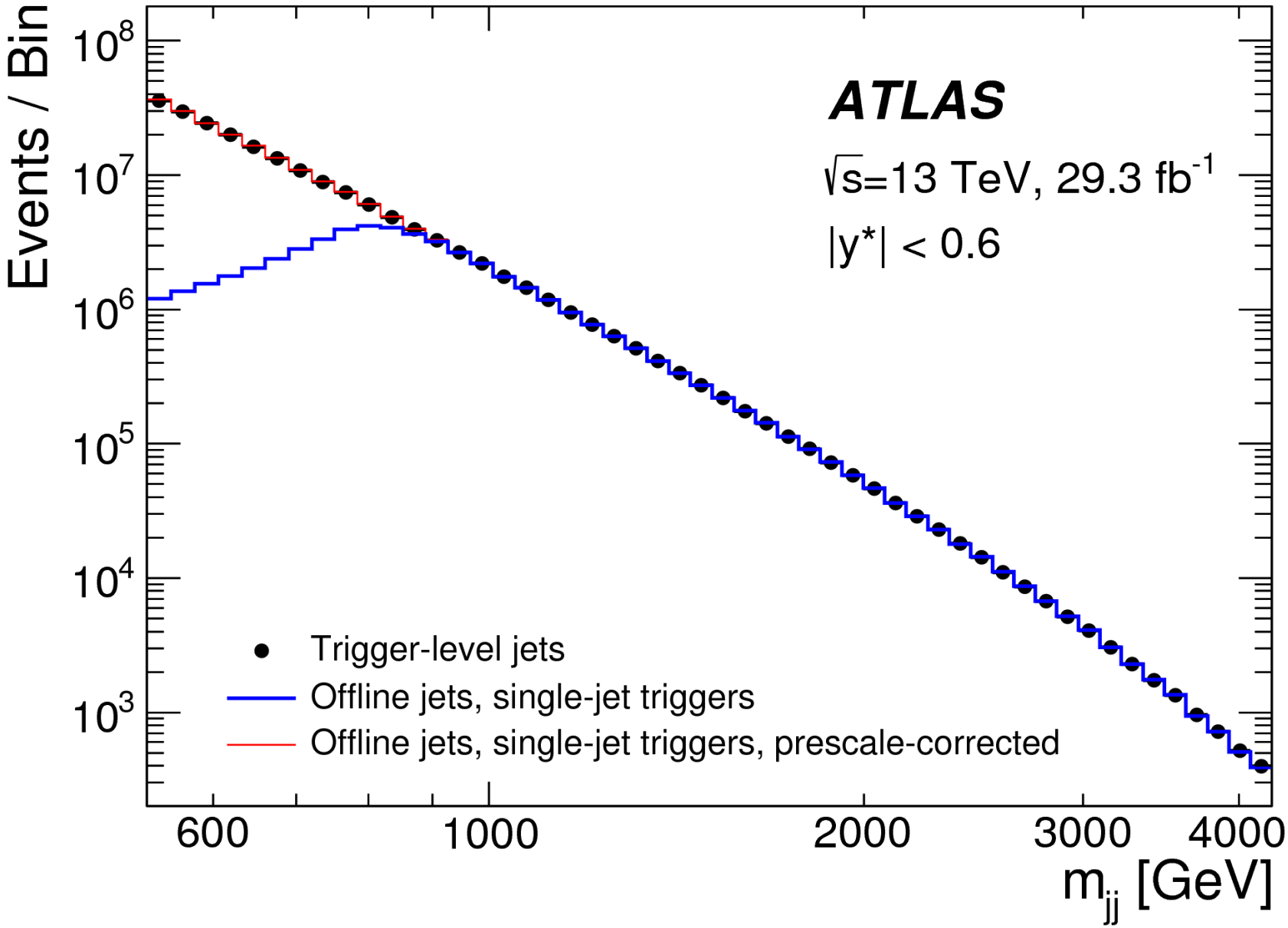
TLA : data scouting



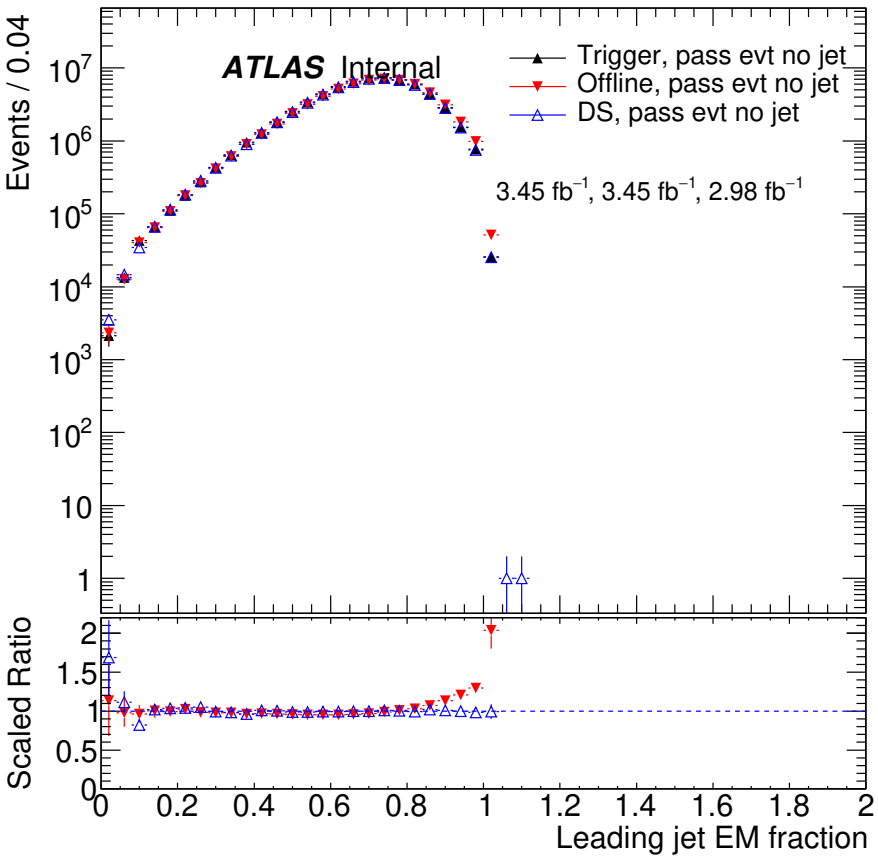
TLA : data scouting

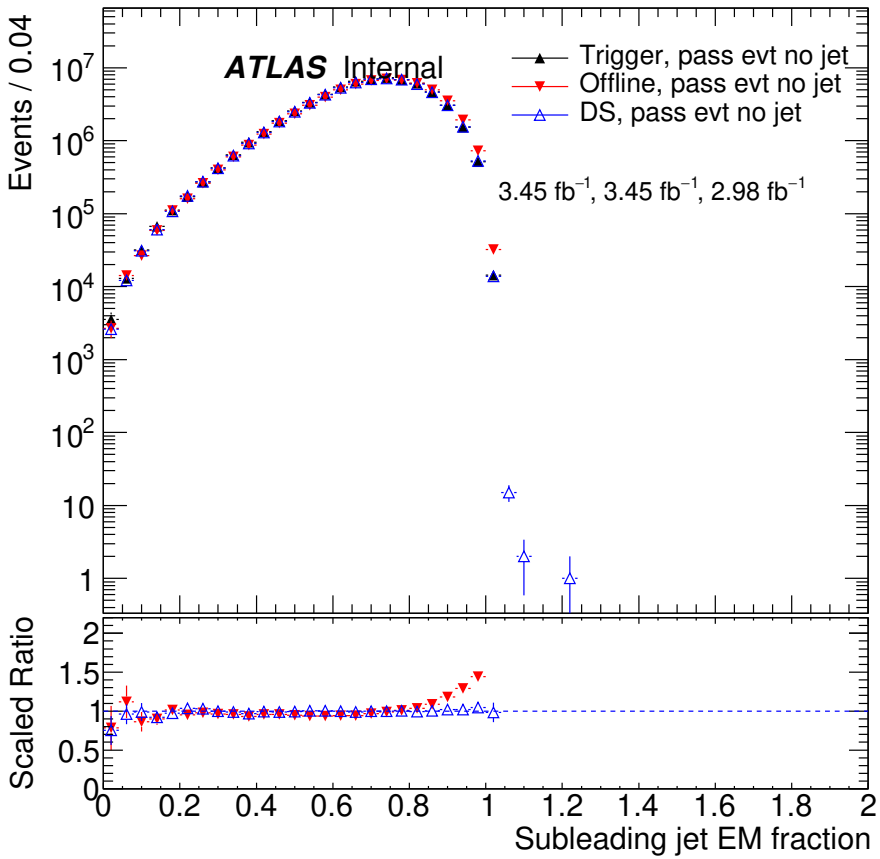


TLA Dijets : gain in statistics in the low m_{jj}

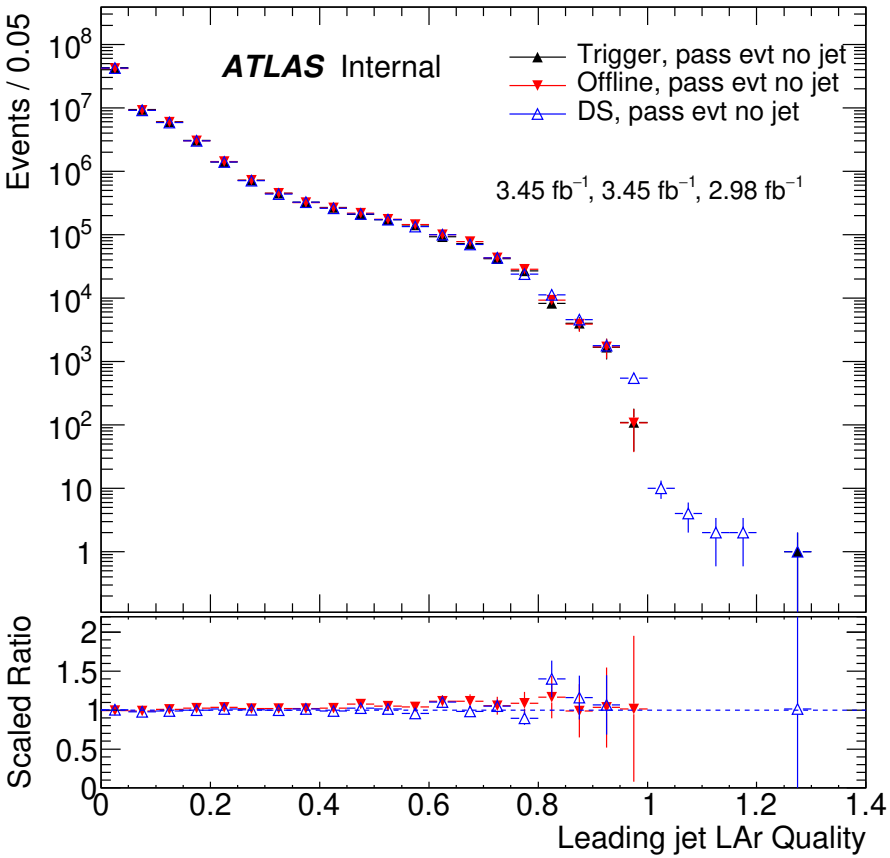


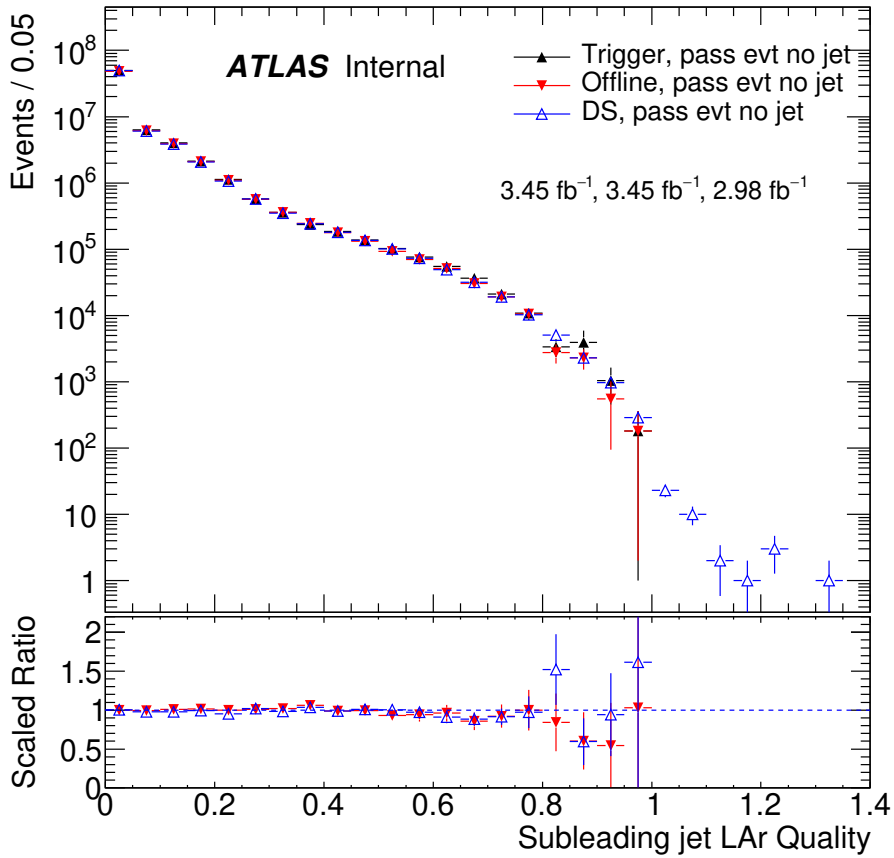
TLA Dijets : quality of reconstruction $EM_{fraction}$



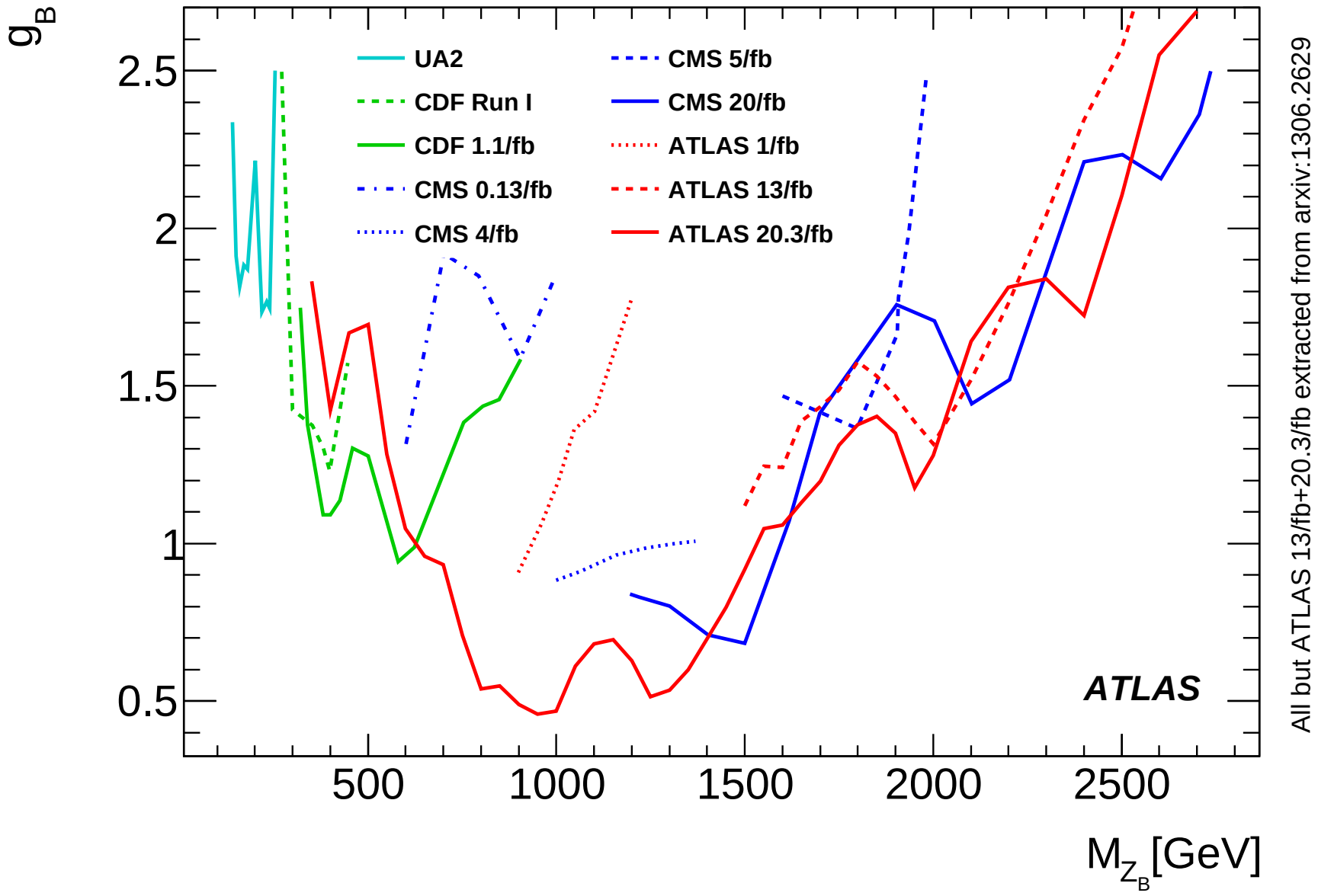


TLA Dijets : quality of reconstruction $\text{LAr}_{\text{Quality}}$





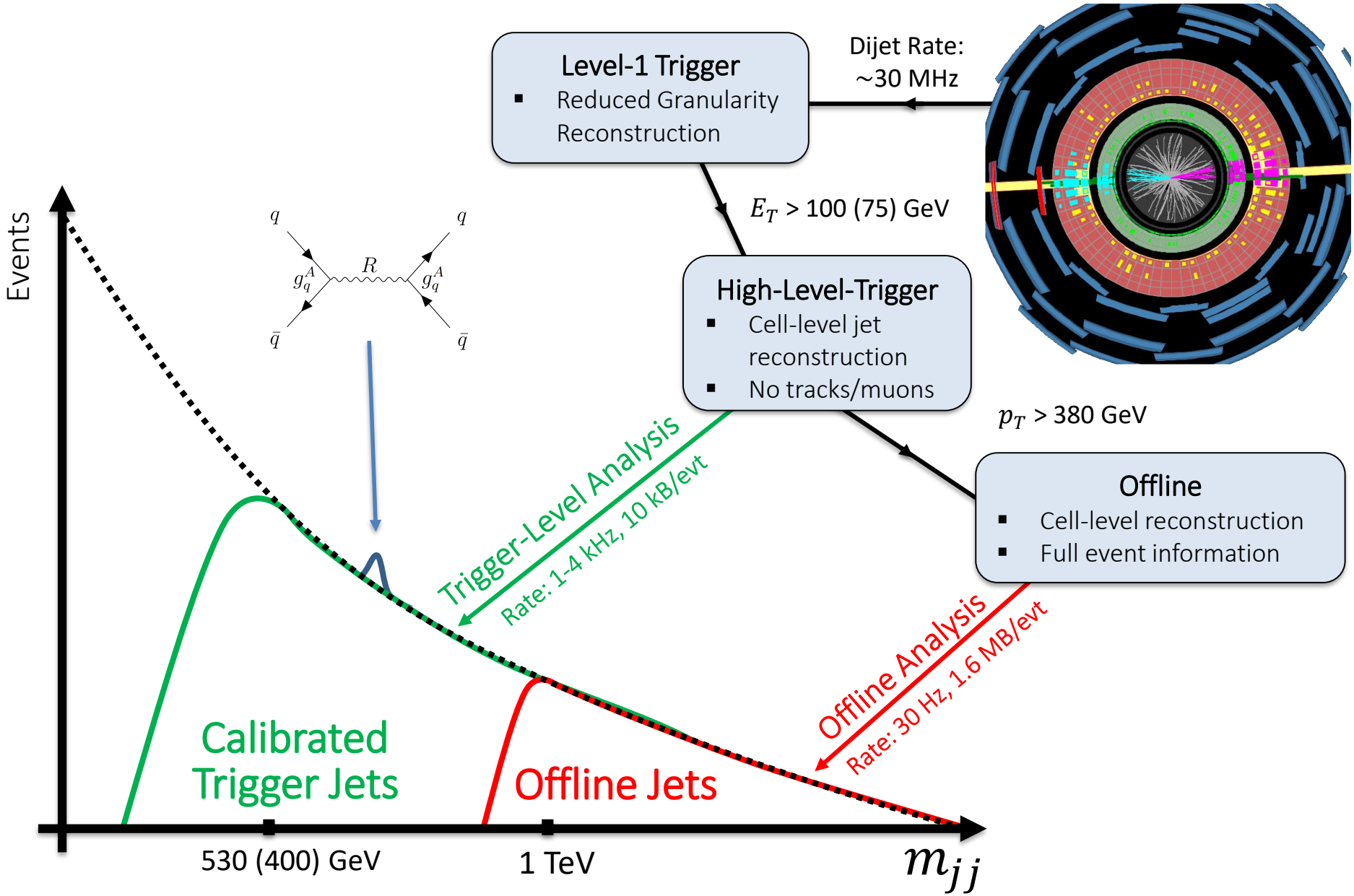
TLA motivation



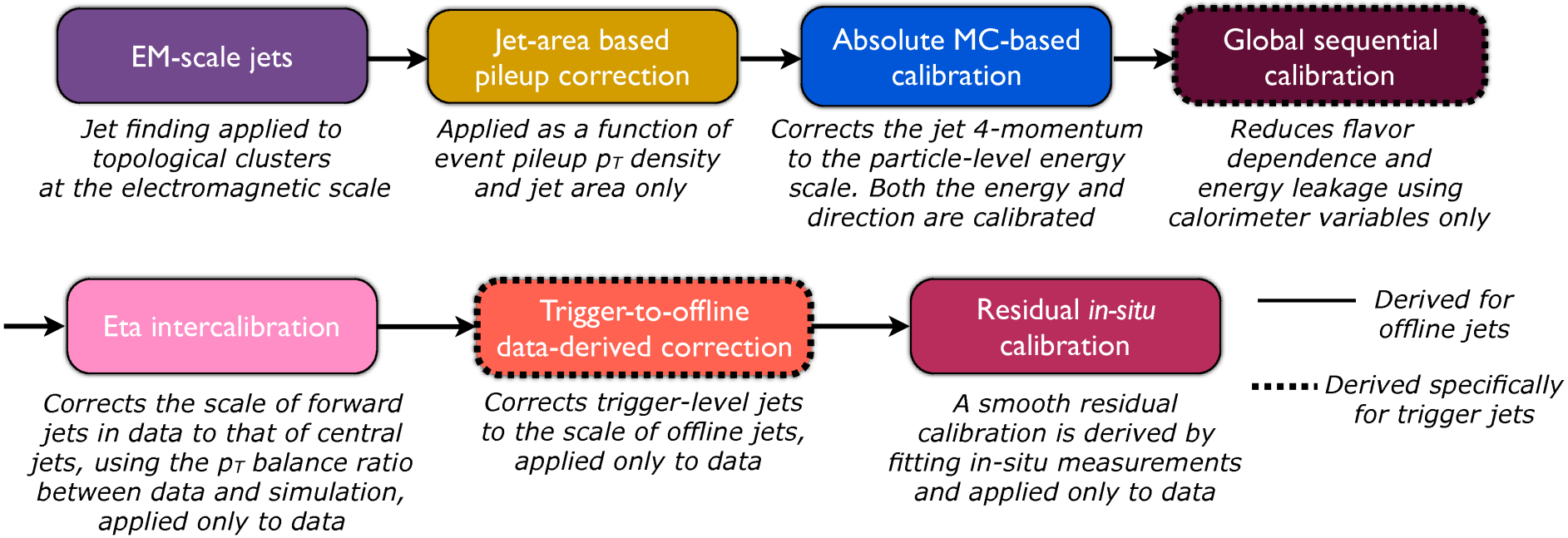
TLA Dijets event selection

Selection criteria	Number of events passing cut
Generated events	18000
$p_{\mathrm{T,lead}} > 220$ GeV && $p_{\mathrm{T,sublead}} > 85$ GeV	13178
$\lvert\eta_{\mathrm{lead}}\rvert$ <2.8 && $\lvert\eta_{\mathrm{sublead}}\rvert$ <2.8	13033
$\lvert y^*\rvert < 0.6$	8376
$m_{jj} > 531$	7291
$p_{\mathrm{T,lead}} > 185$ GeV && $p_{\mathrm{T,sublead}} > 85$ GeV	14739
$\lvert\eta_{\mathrm{lead}}\rvert$ <2.8 && $\lvert\eta_{\mathrm{sublead}}\rvert$ <2.8	14492
$\lvert y^*\rvert < 0.3$	4491
$m_{jj} > 400$	4311

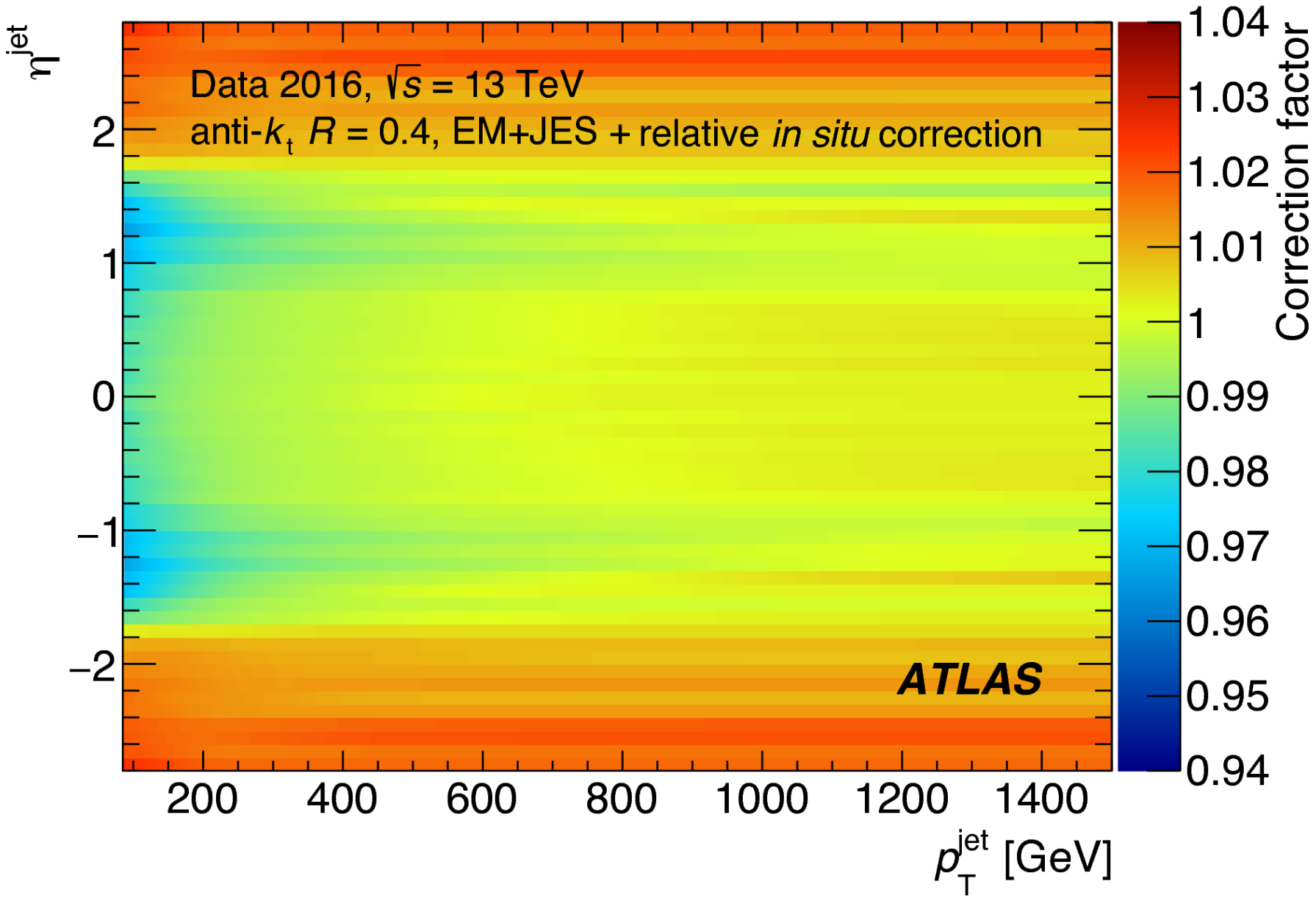
Dijets : TLA final spectrum



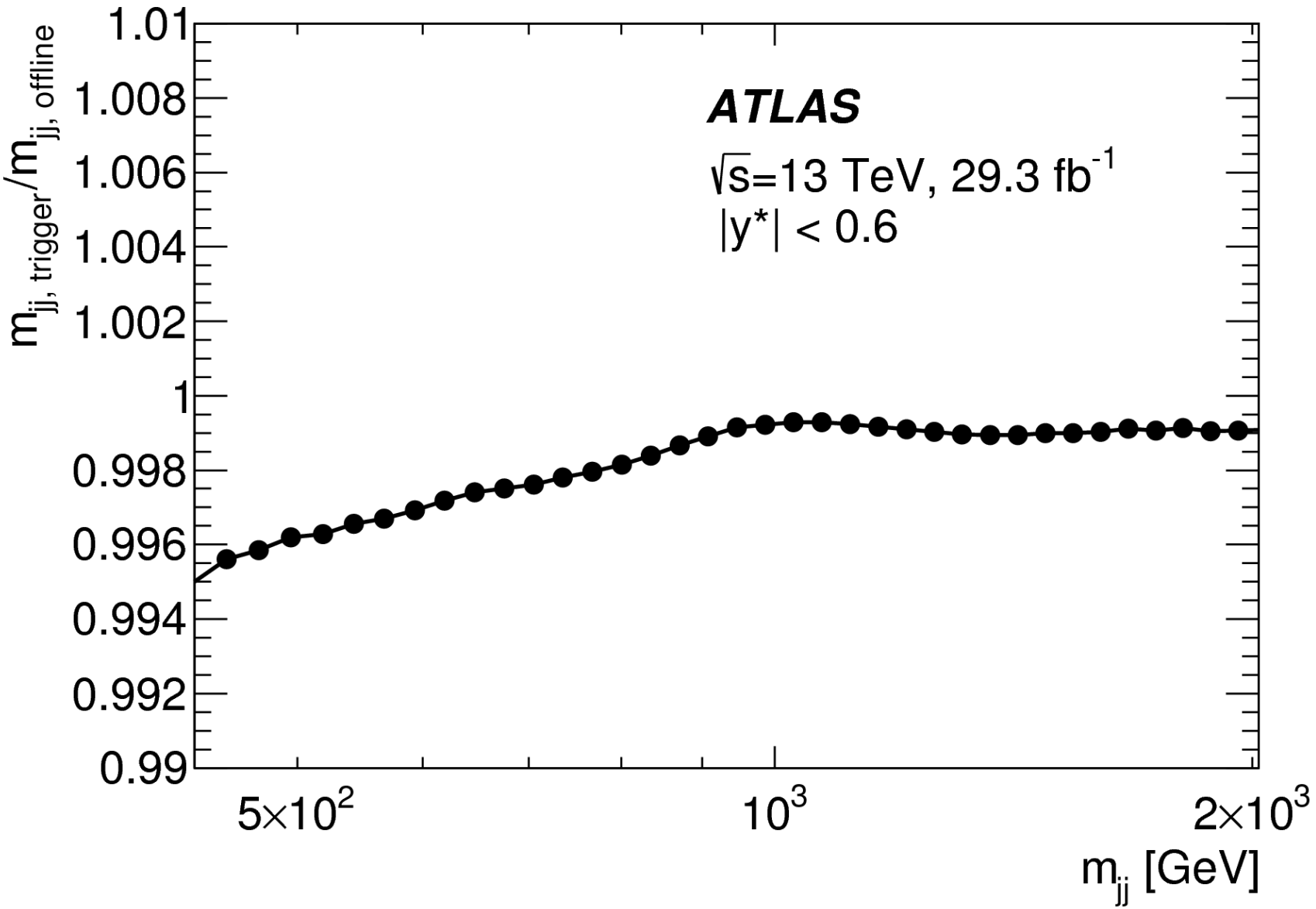
TLA Final Calibration



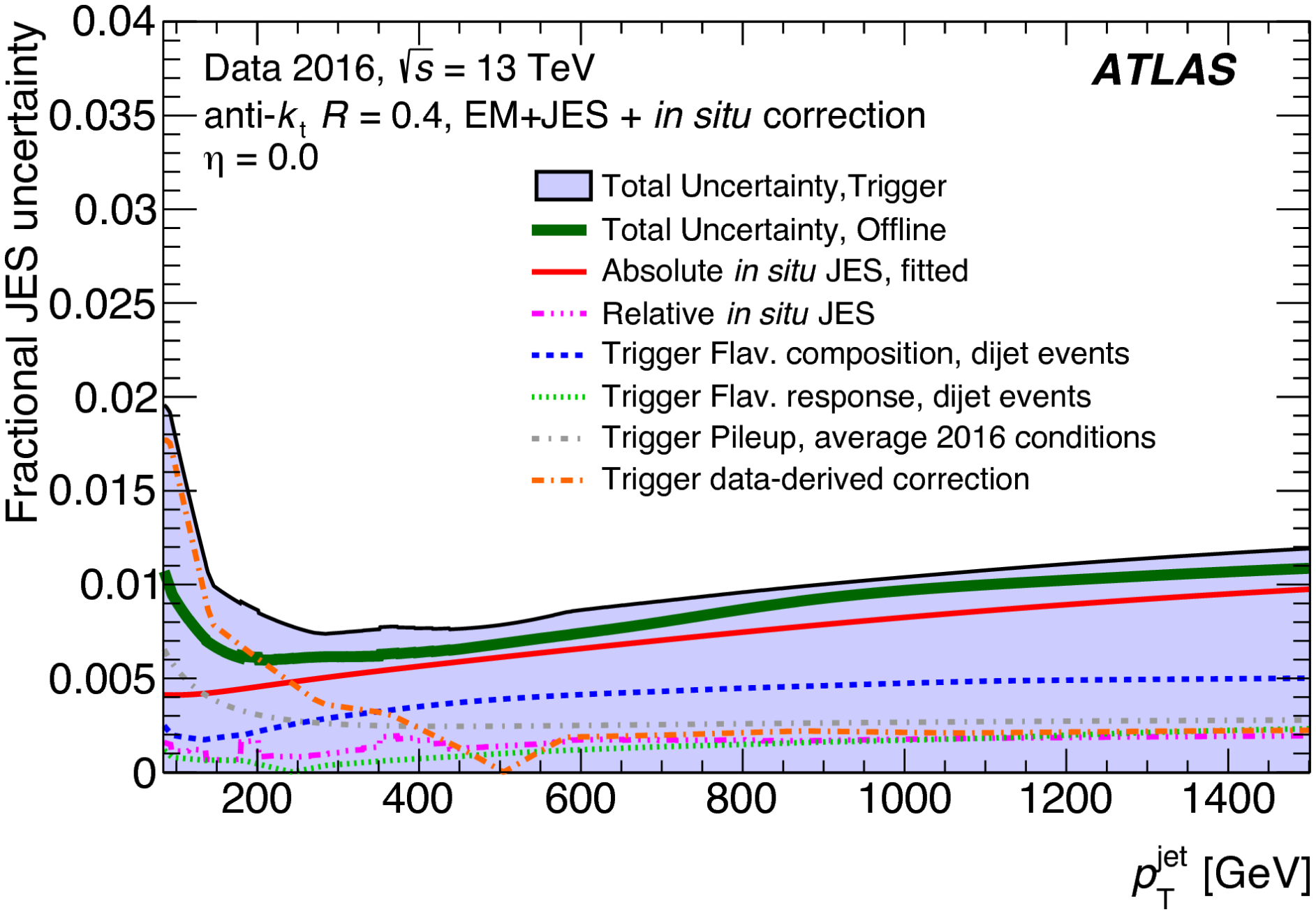
TLA Cross-Calibration



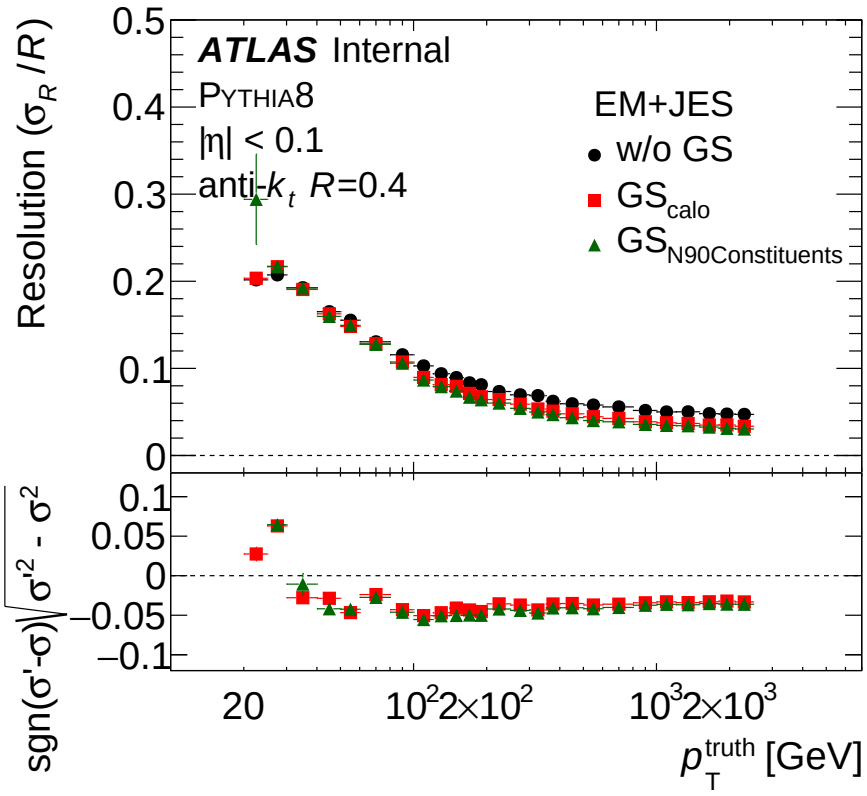
TLA Calibration Closure

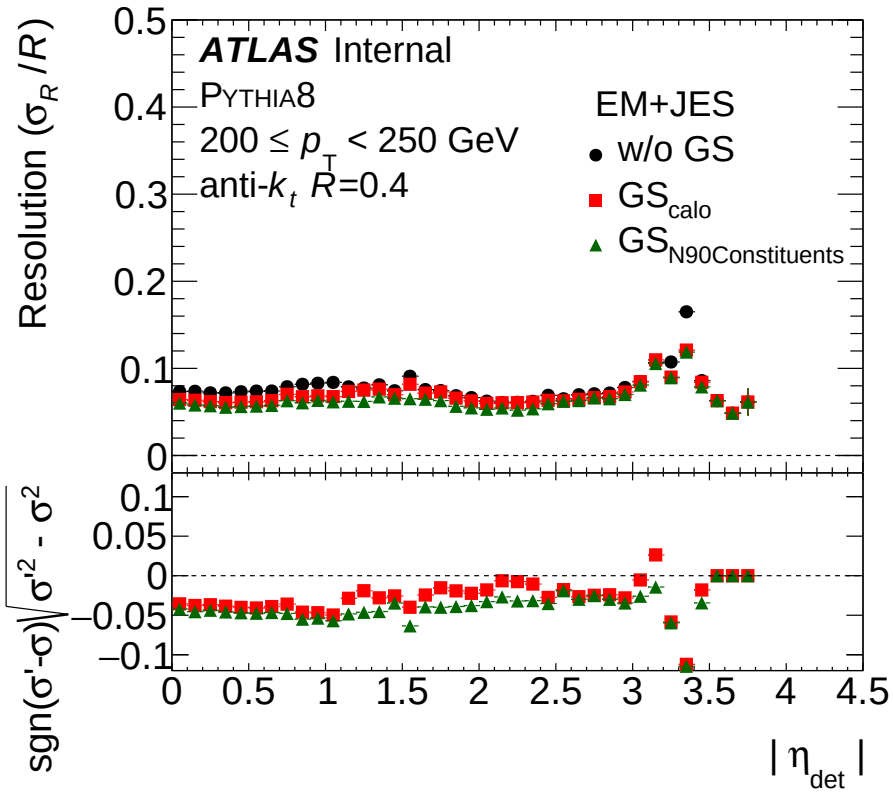


TLA Calibration Precision

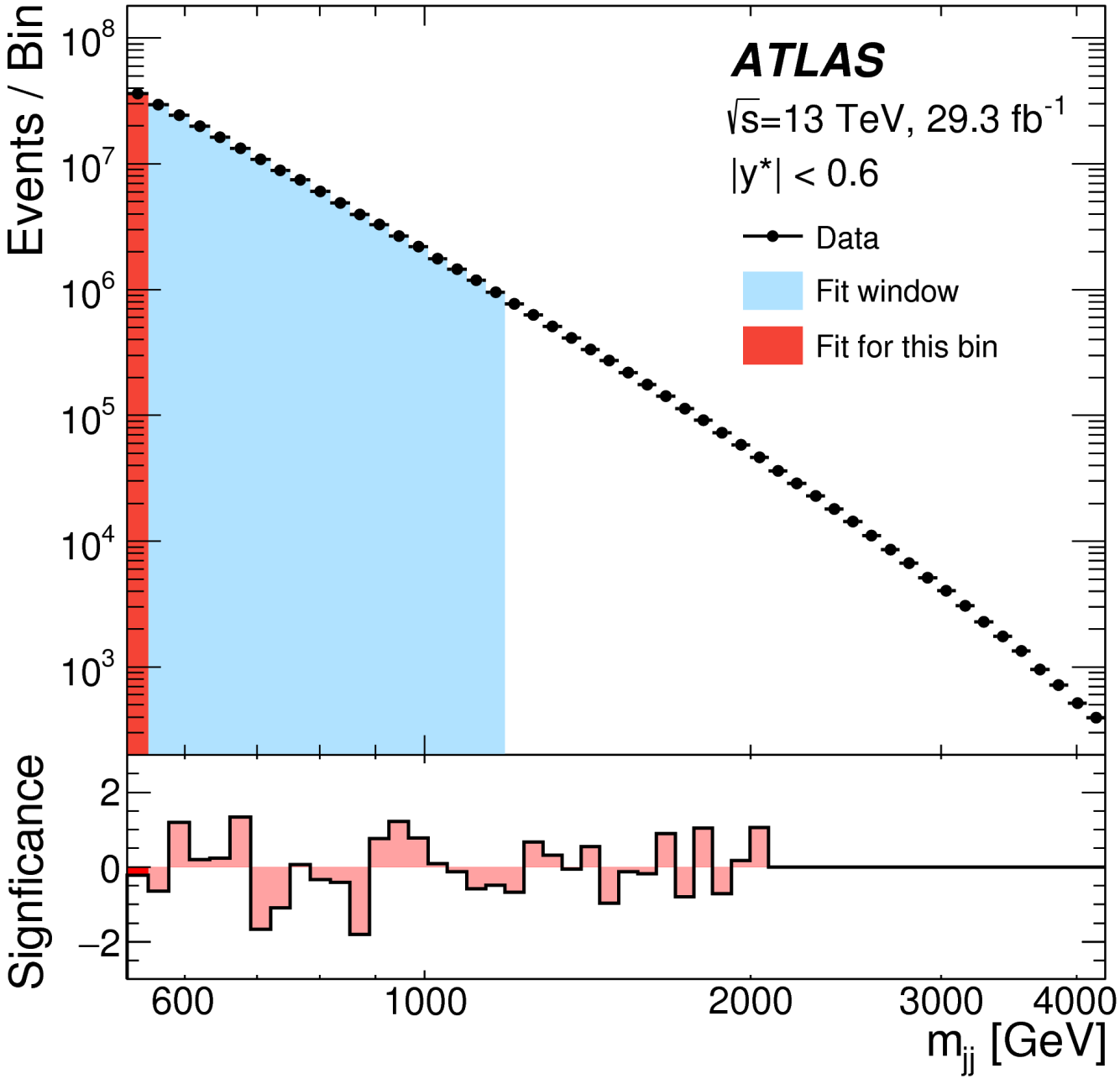


TLA jet resolution

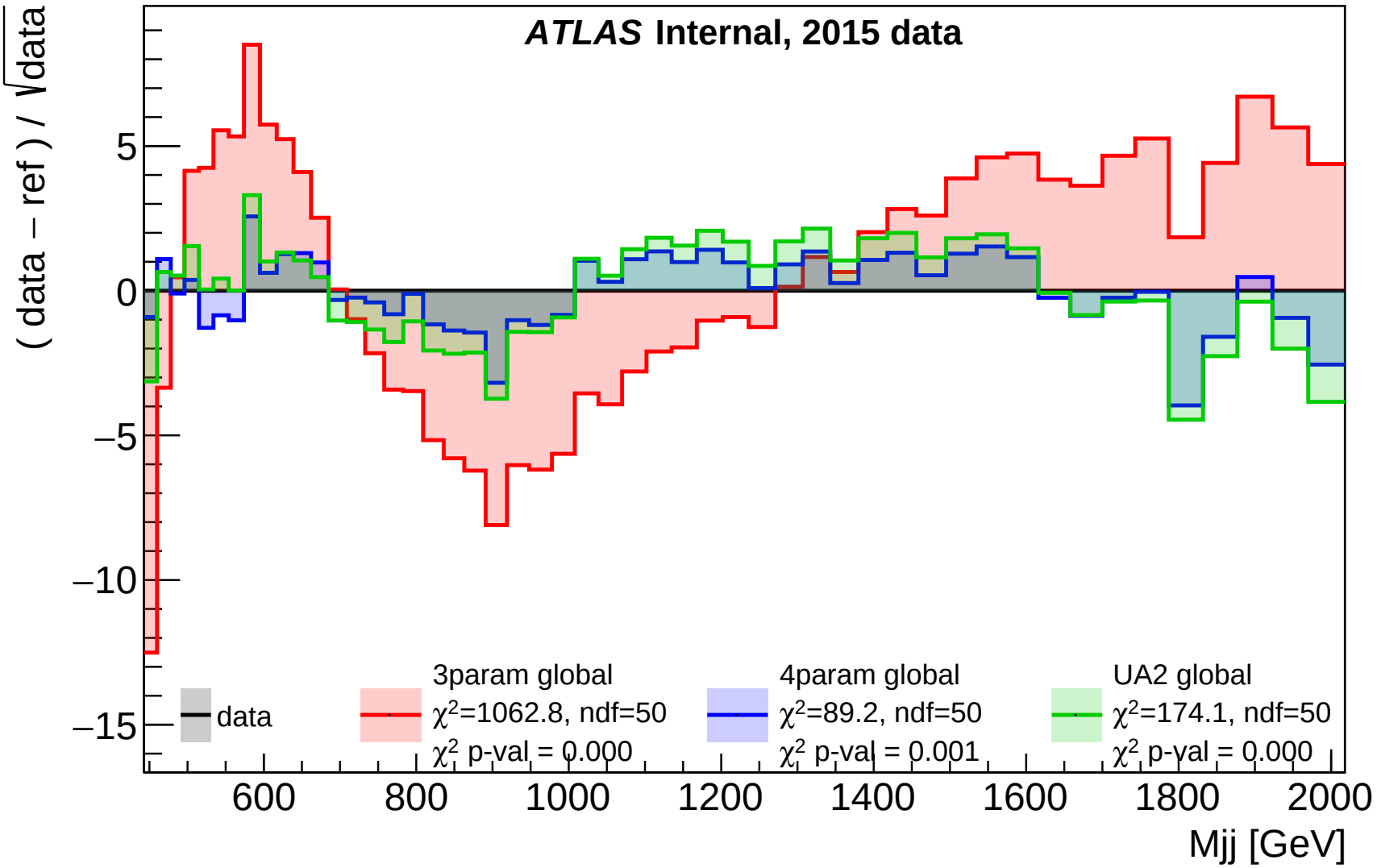




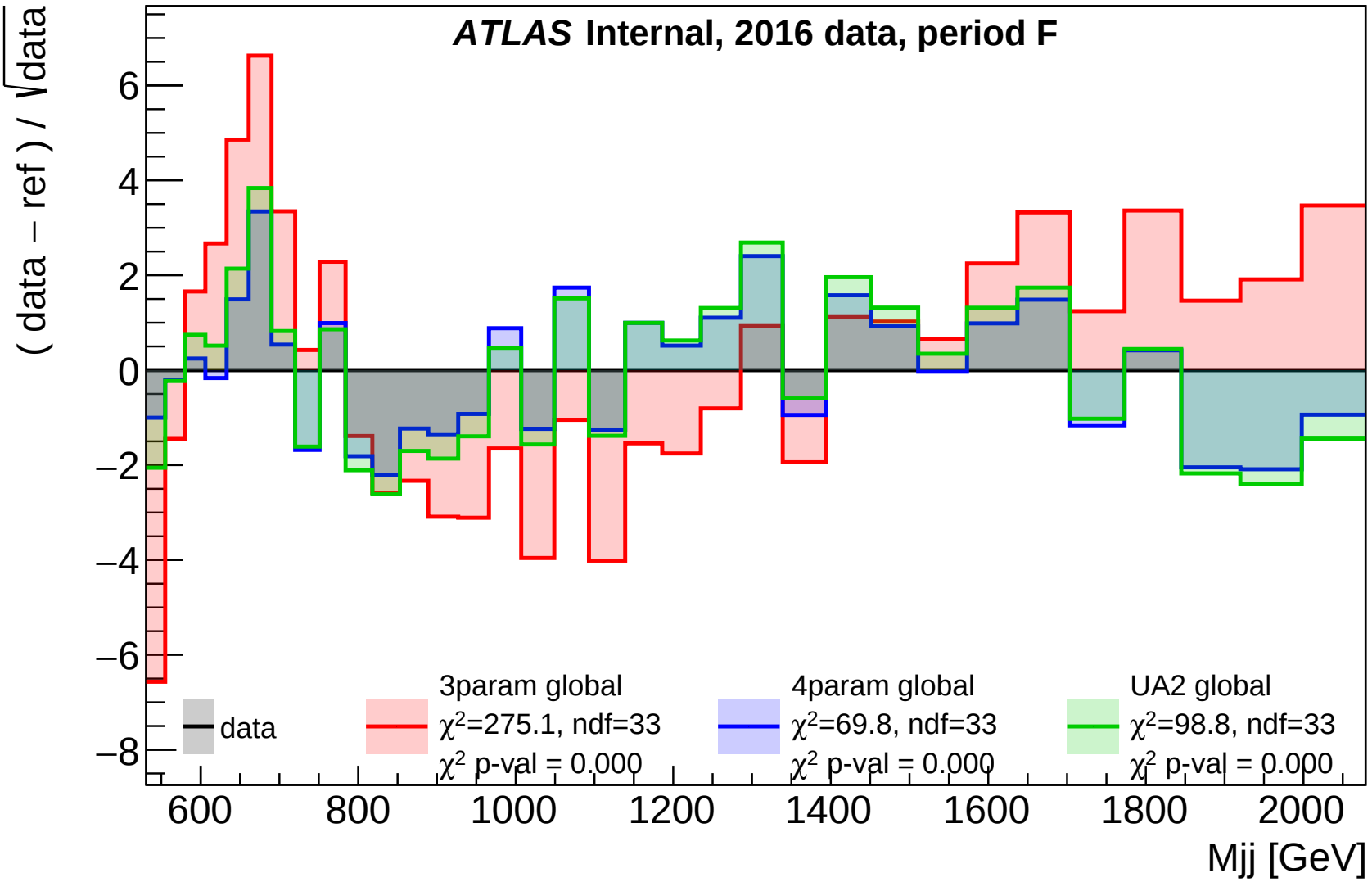
TLA SWIFT fit



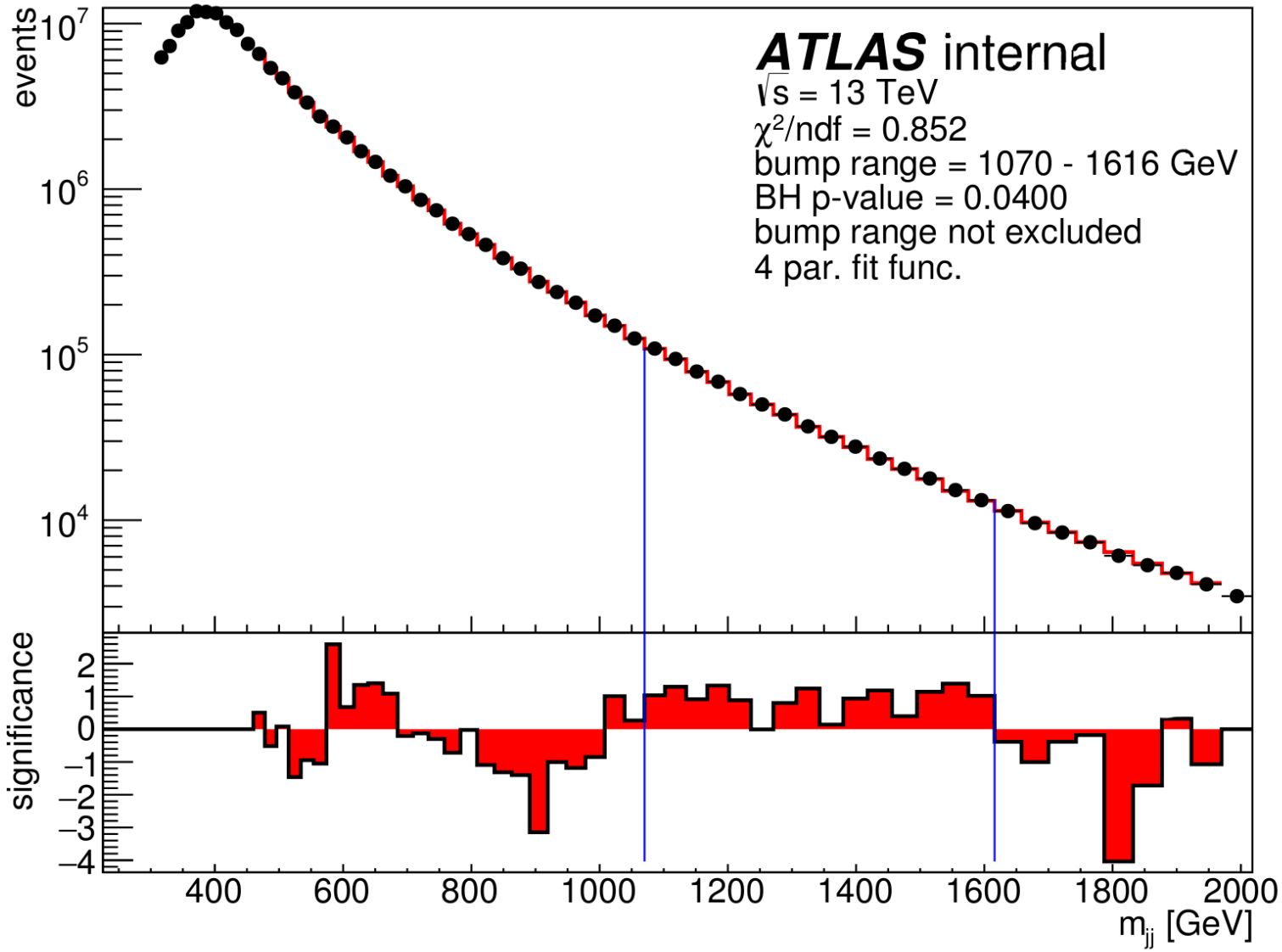
TLA fit. Why SWIFT?



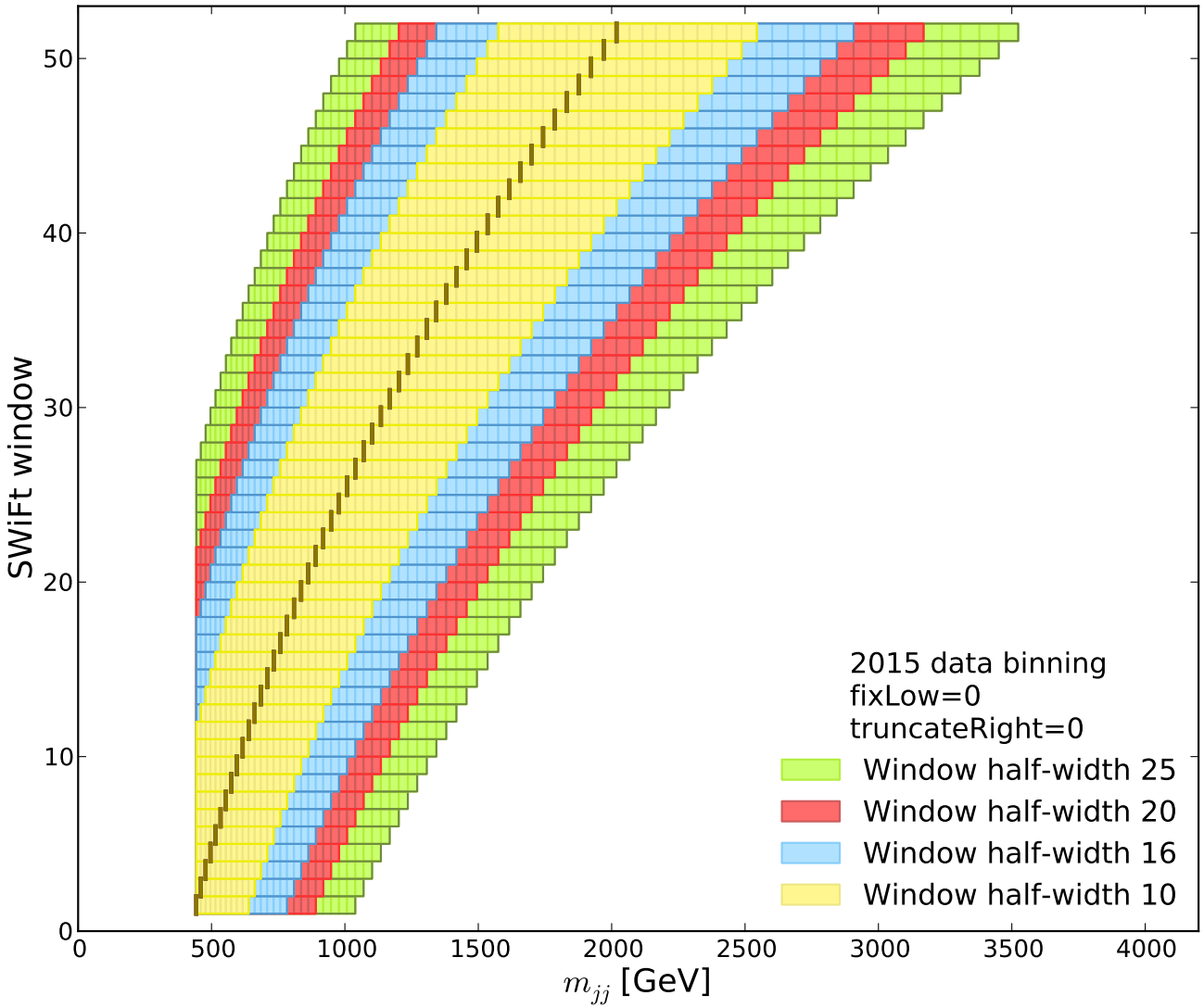
TLA fit. Why SWIFT?



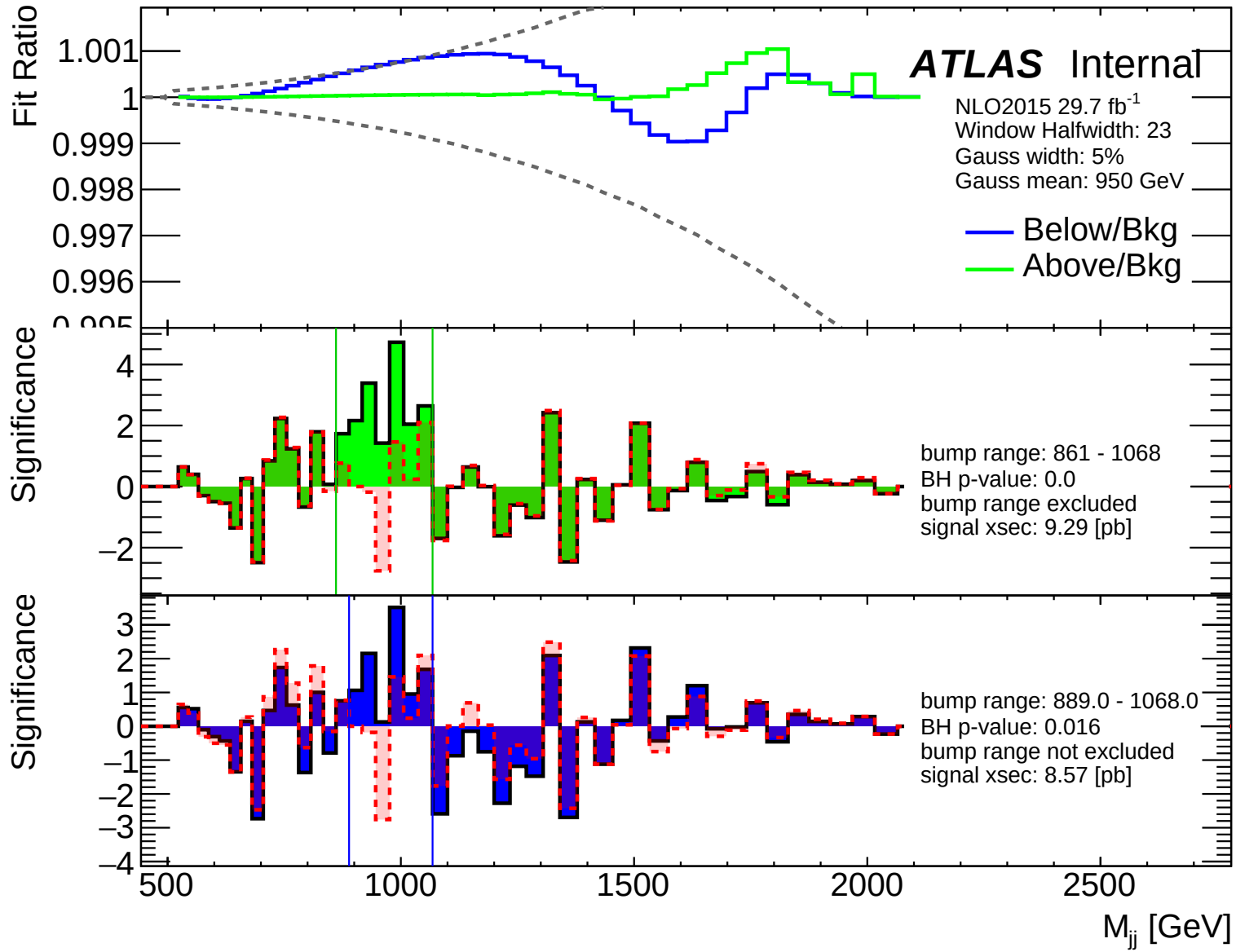
TLA SWIFT fit: test run



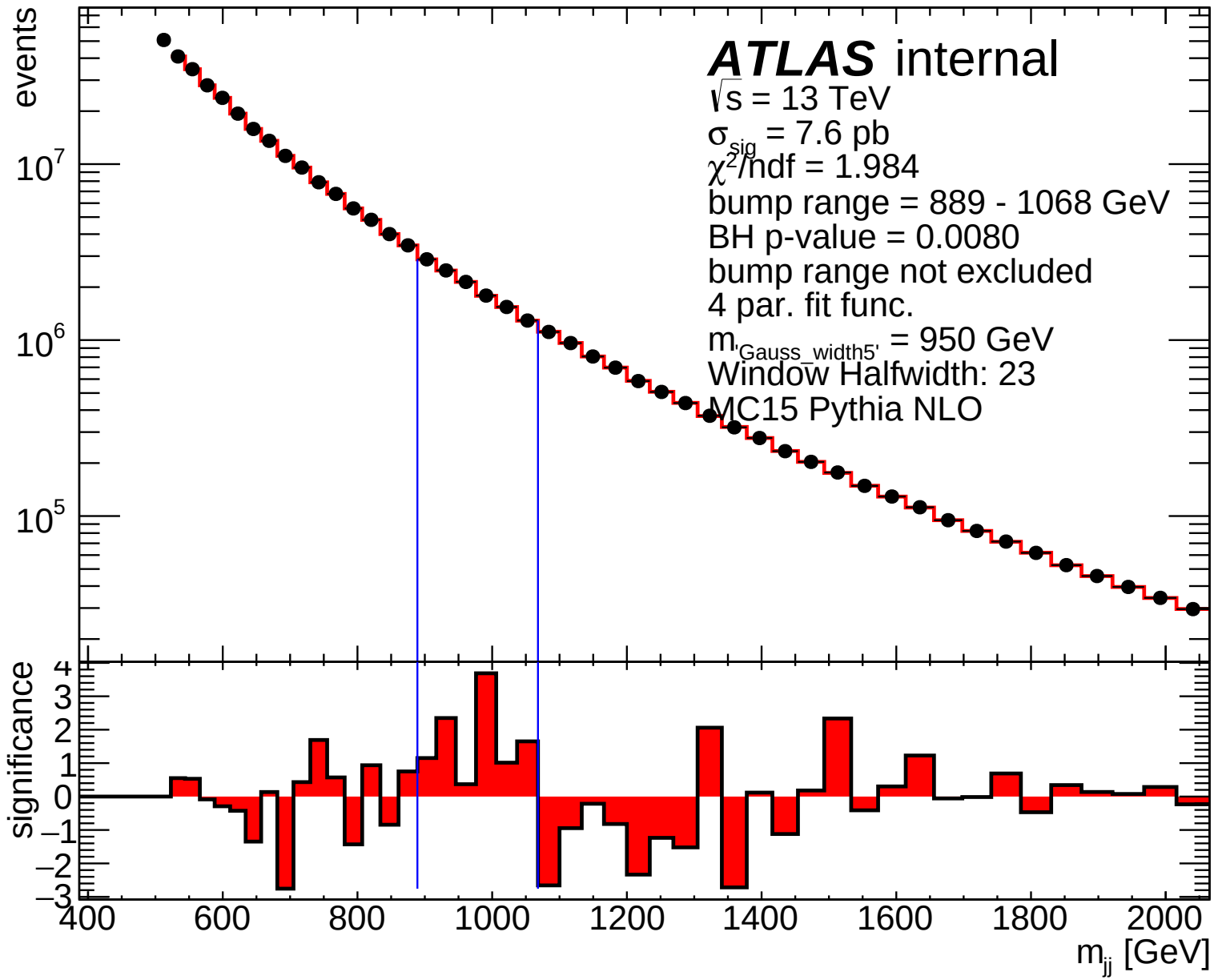
TLA SWIFT fit. Binning



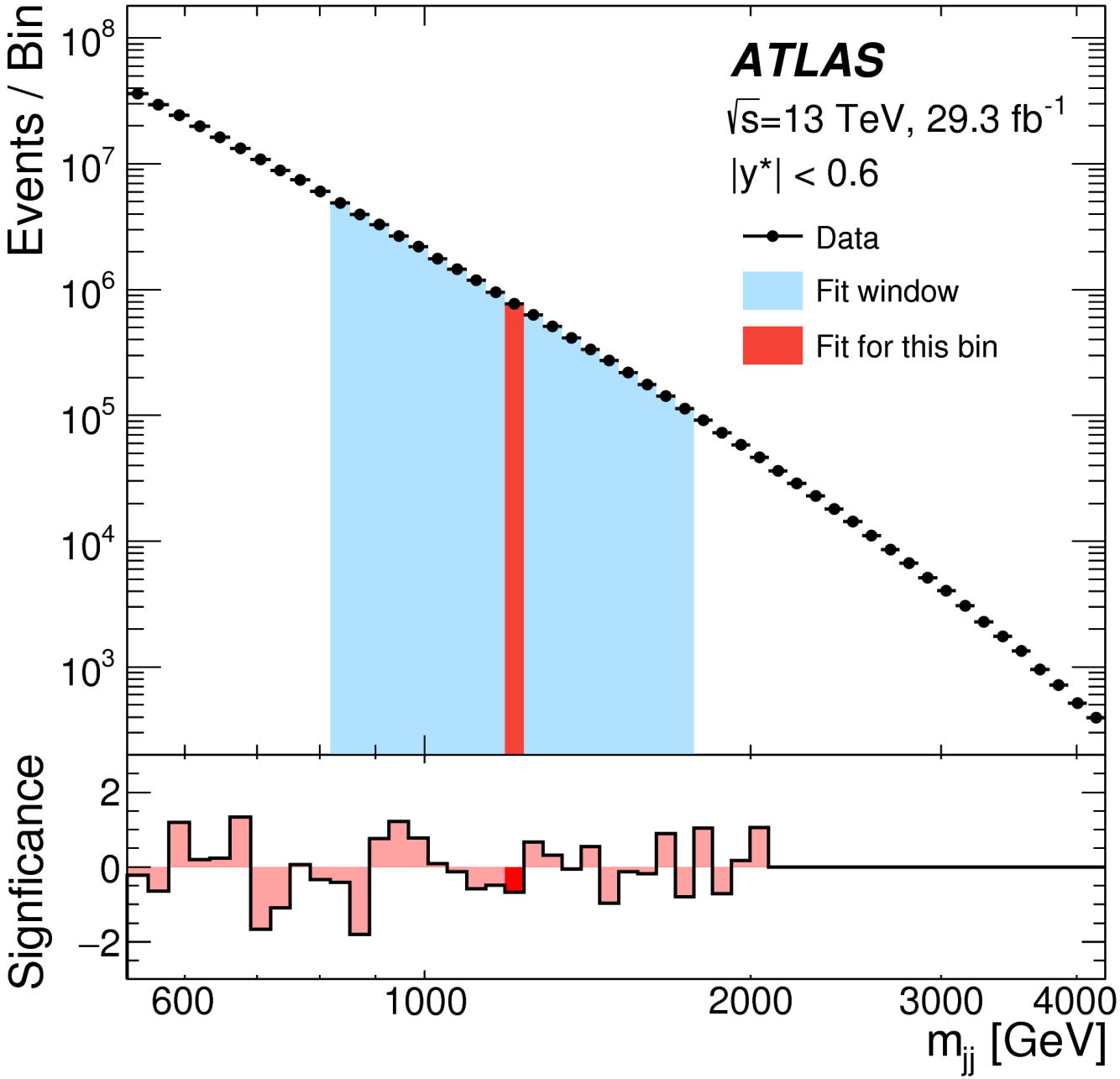
TLA Signal injection



TLA Signal injection

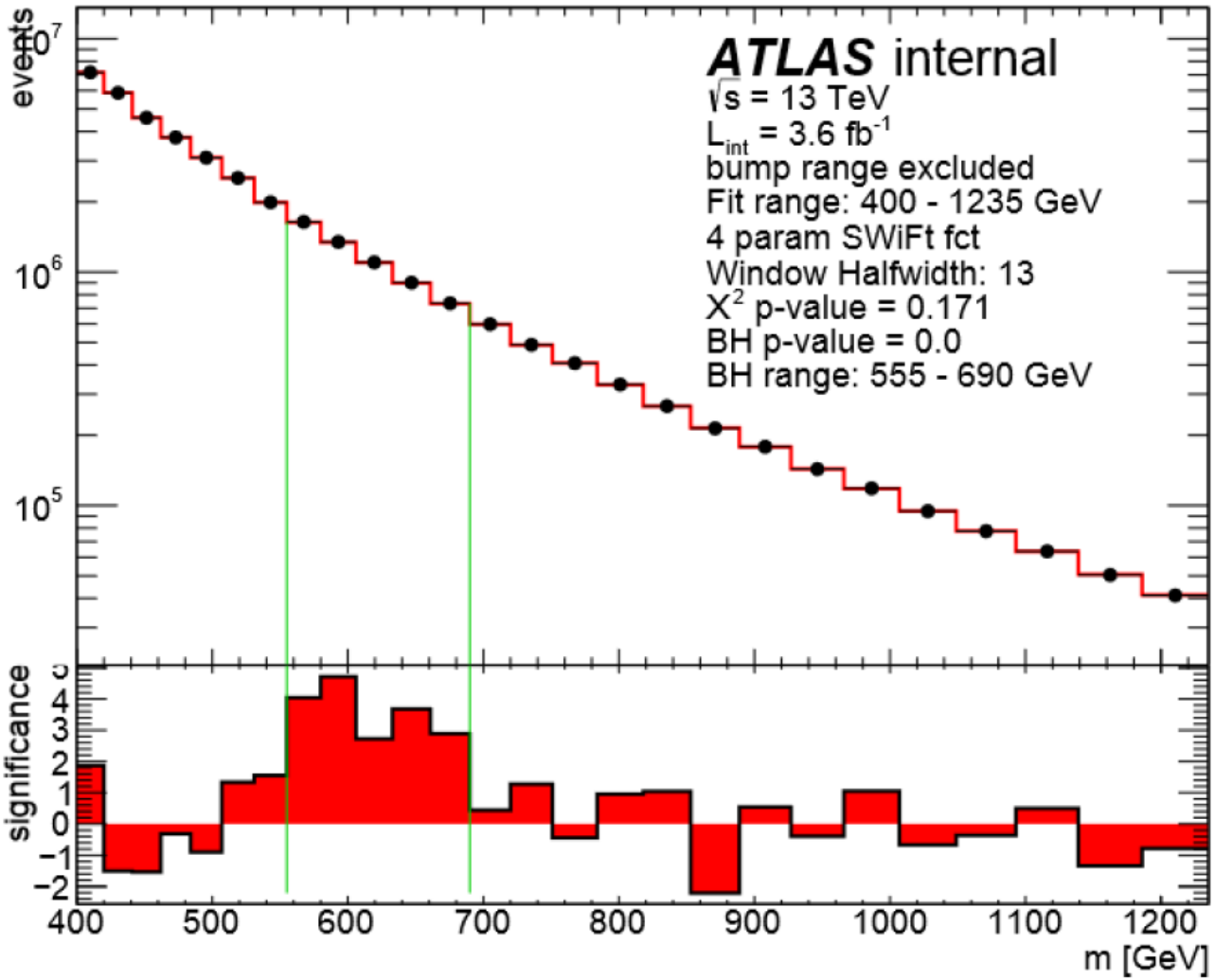


TLA SWIFT fit

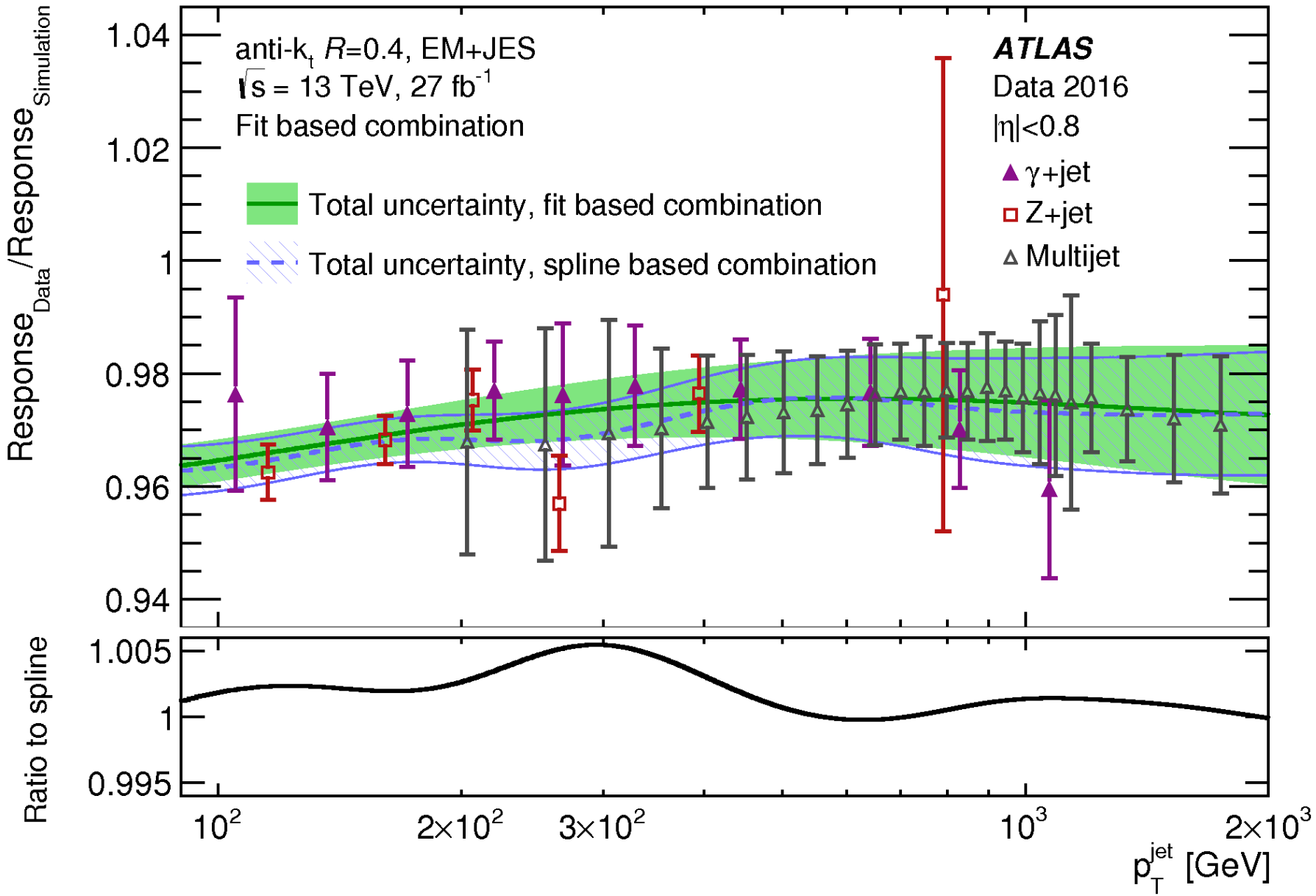


TLA First search result

Unblinding excess:



TLA Final Calibration



TLA Final Calibration Issue

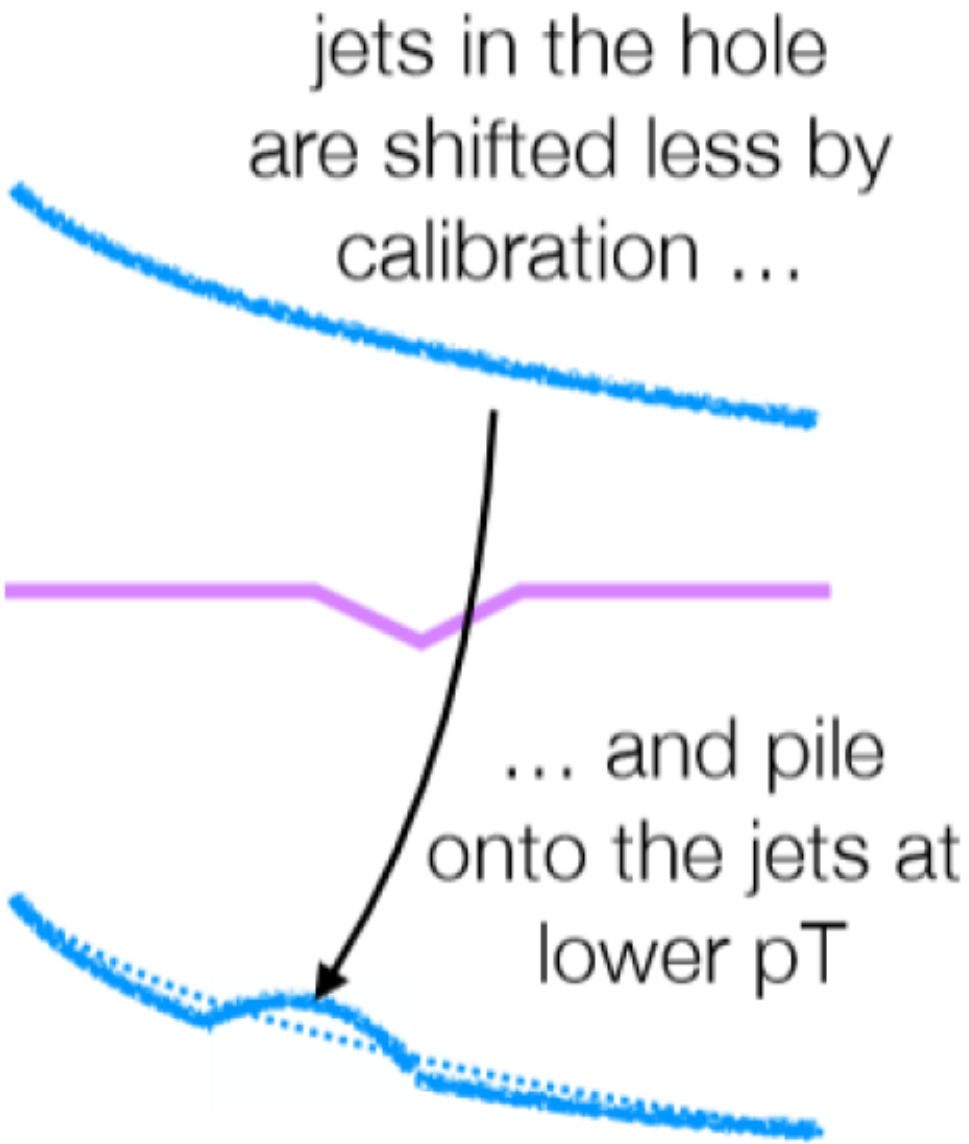
raw jets

x

calibration curve

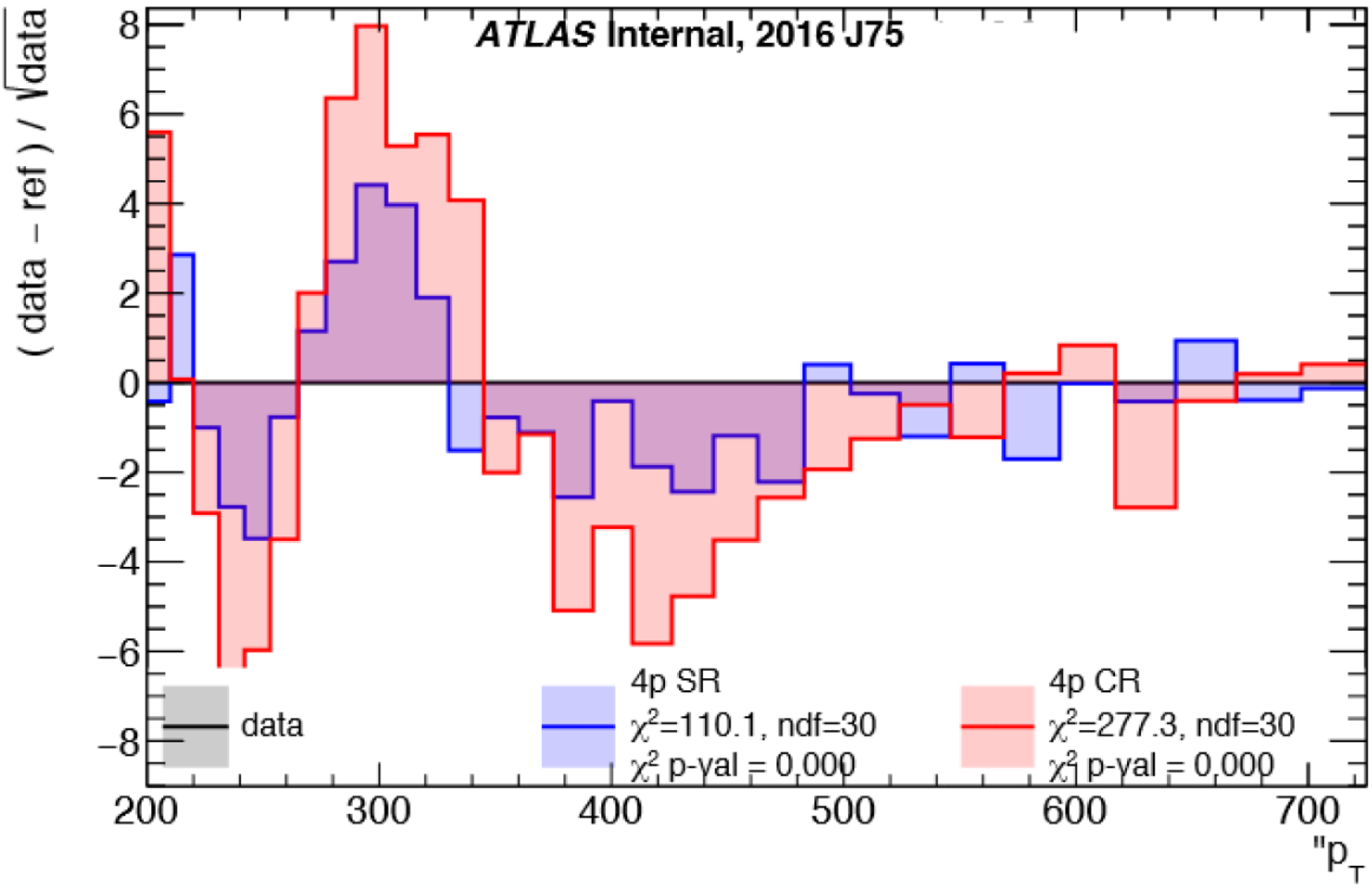
=

bumpy!



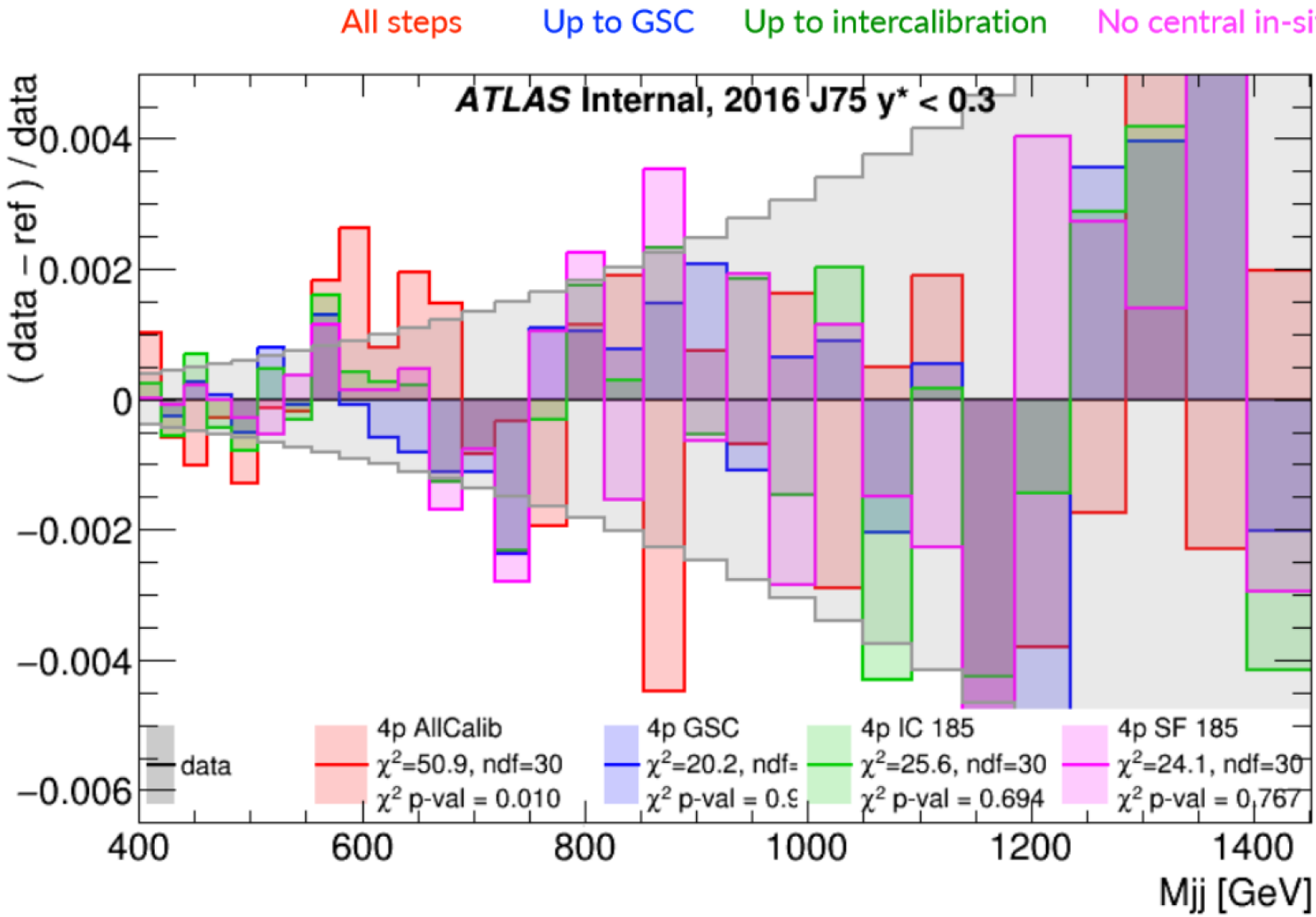
TLA calibration p_T tests

- ”CalibrationBump” should also appear in pT spectrum
- Position of ”CalibrationBump” should be independent of y^*

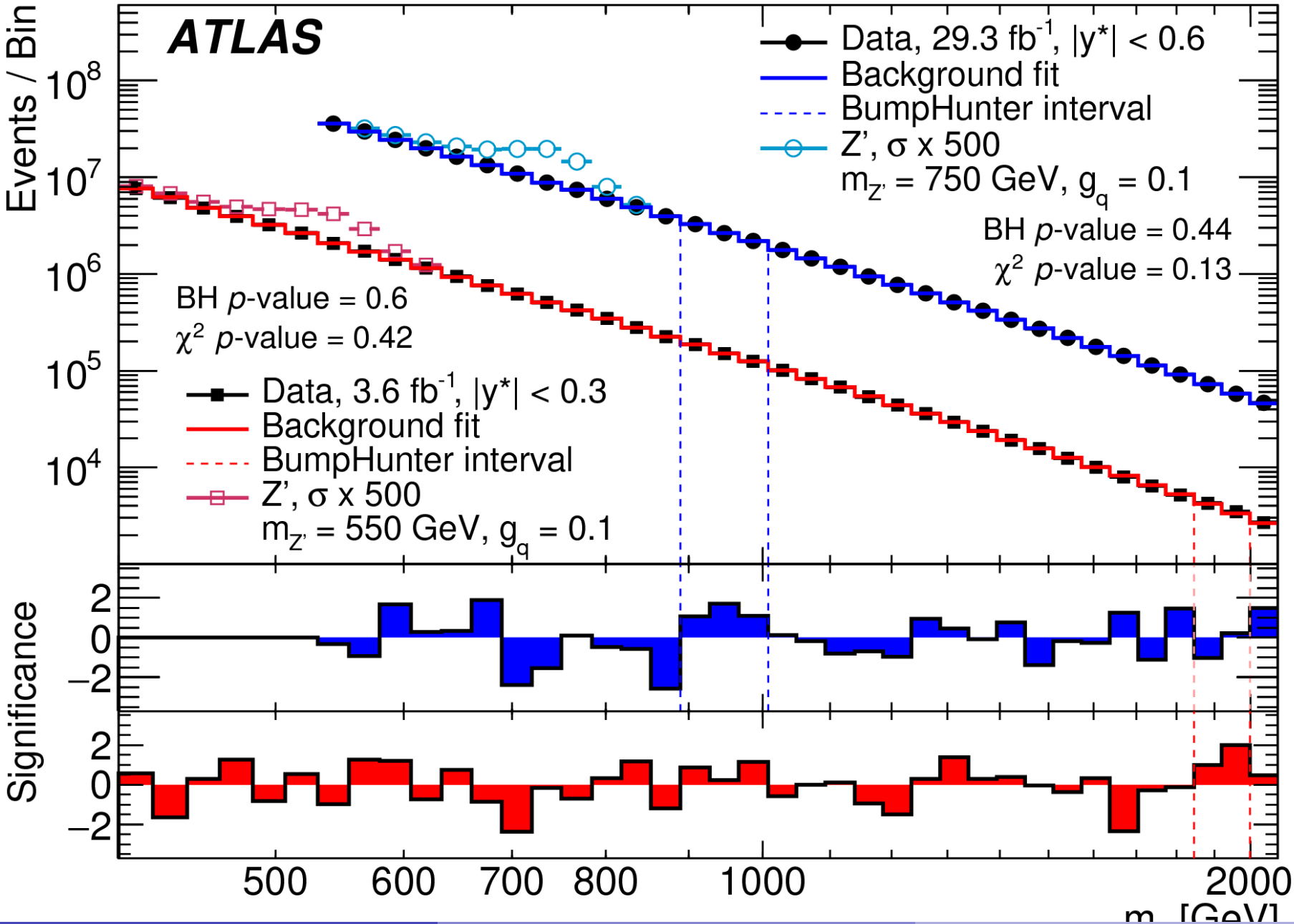


- Excess in data is consistent with a bump caused by calibration

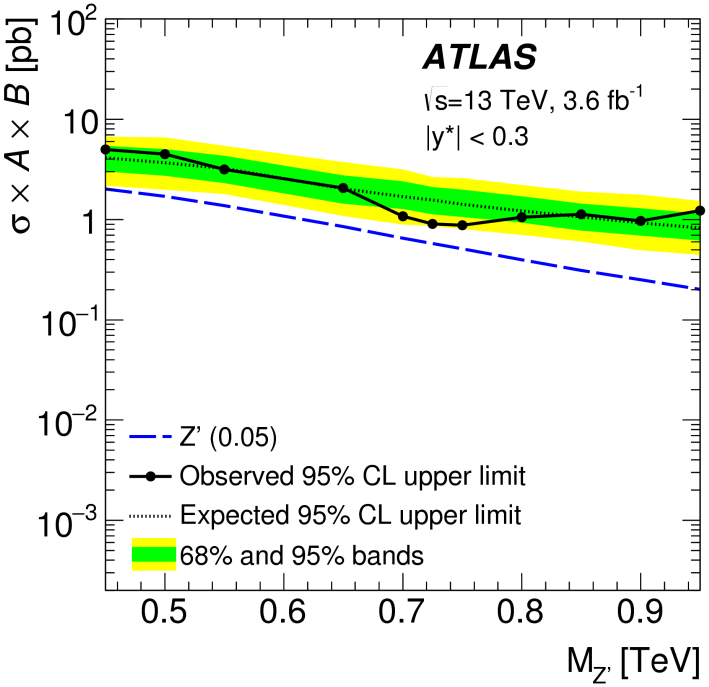
TLA calibration extensive tests

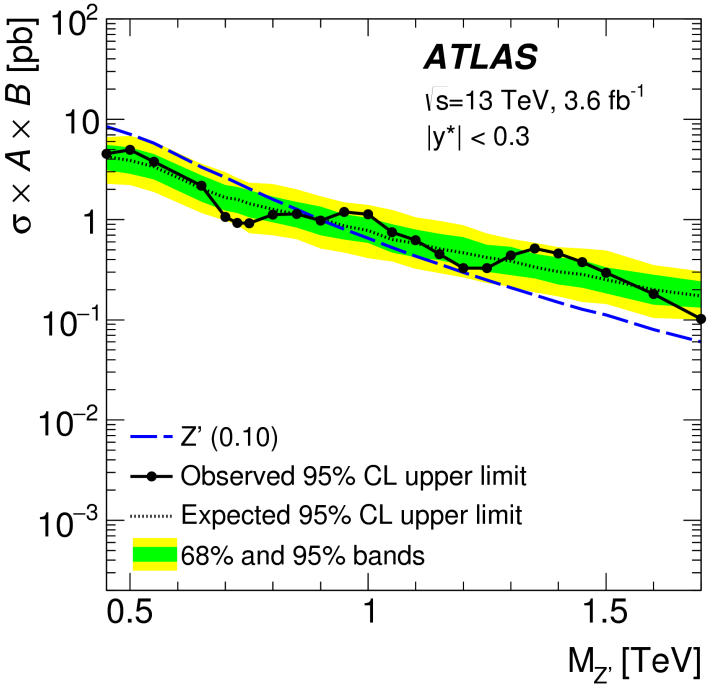


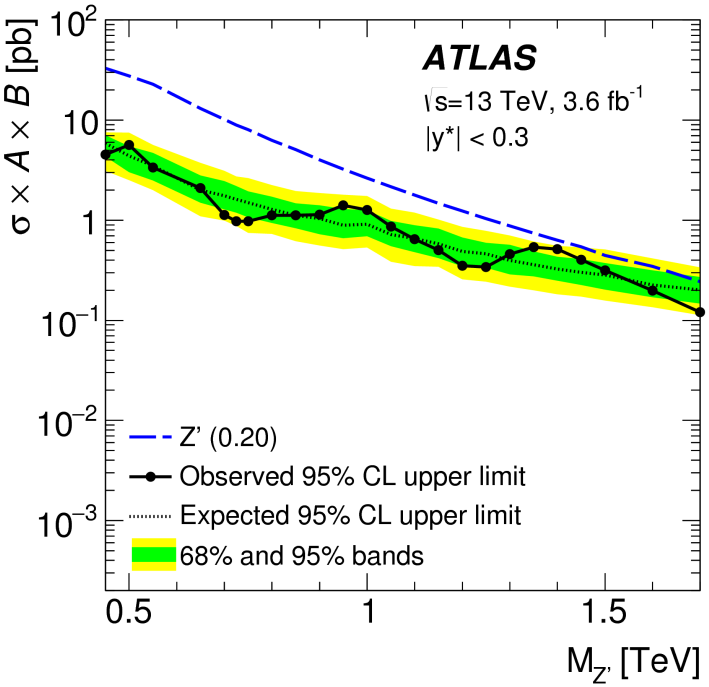
TLA Spectrum

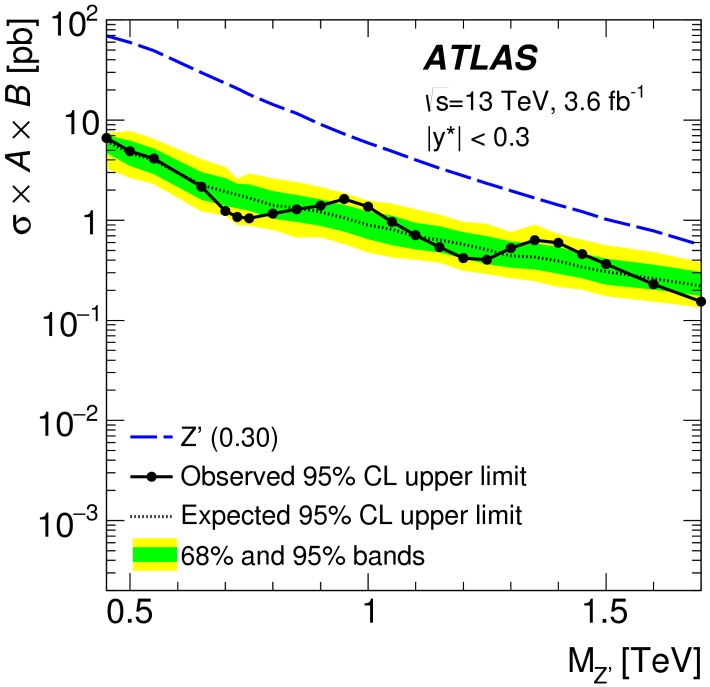


Limits

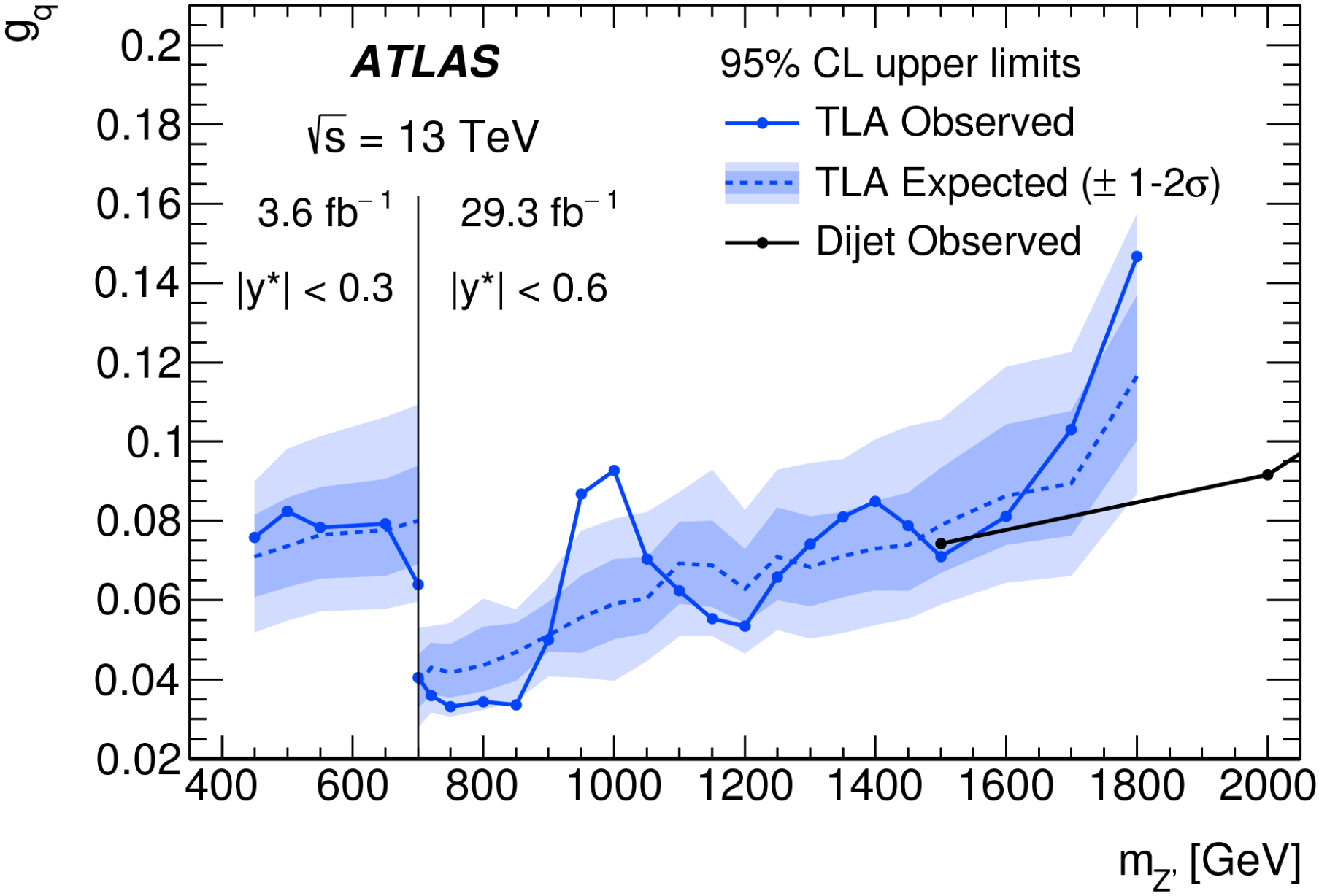

ATLAS
√s=13 TeV, 3.6 fb-1
|y*| < 0.3
σ × A × B [pb]
Z' (0.05)
Observed 95% CL upper limit
Expected 95% CL upper limit
68% and 95% bands
MZ' [TeV]


ATLAS
√s=13 TeV, 3.6 fb-1
|y*| < 0.3
σ × A × B [pb]
Z' (0.10)
Observed 95% CL upper limit
Expected 95% CL upper limit
68% and 95% bands
MZ' [TeV]

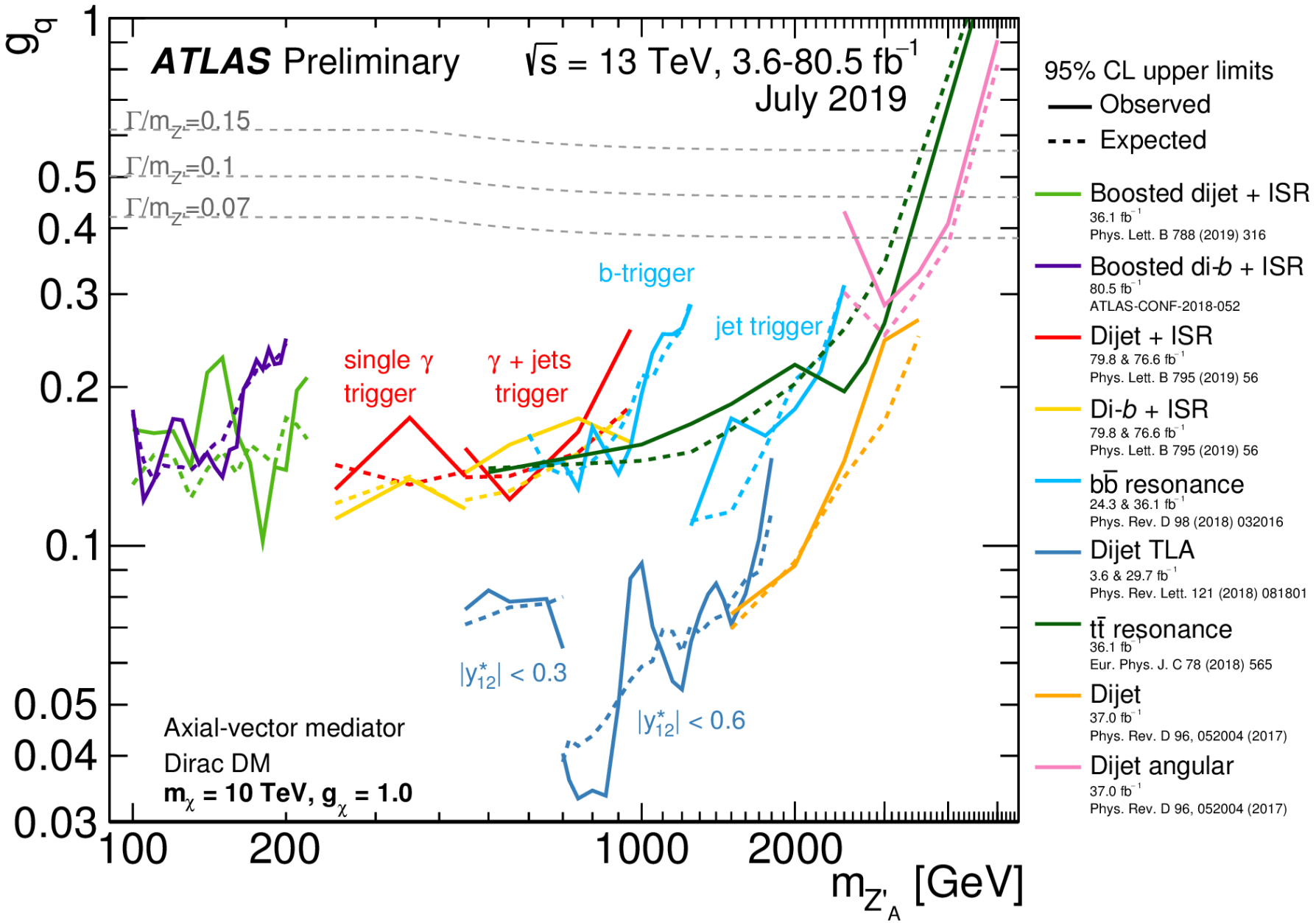

ATLAS
√s=13 TeV, 3.6 fb-1
|y*| < 0.3
σ × A × B [pb]
Z' (0.20)
Observed 95% CL upper limit
Expected 95% CL upper limit
68% and 95% bands
MZ' [TeV]


ATLAS
√s=13 TeV, 3.6 fb-1
|y*| < 0.3
σ × A × B [pb]
Z' (0.30)
Observed 95% CL upper limit
Expected 95% CL upper limit
68% and 95% bands
MZ' [TeV]

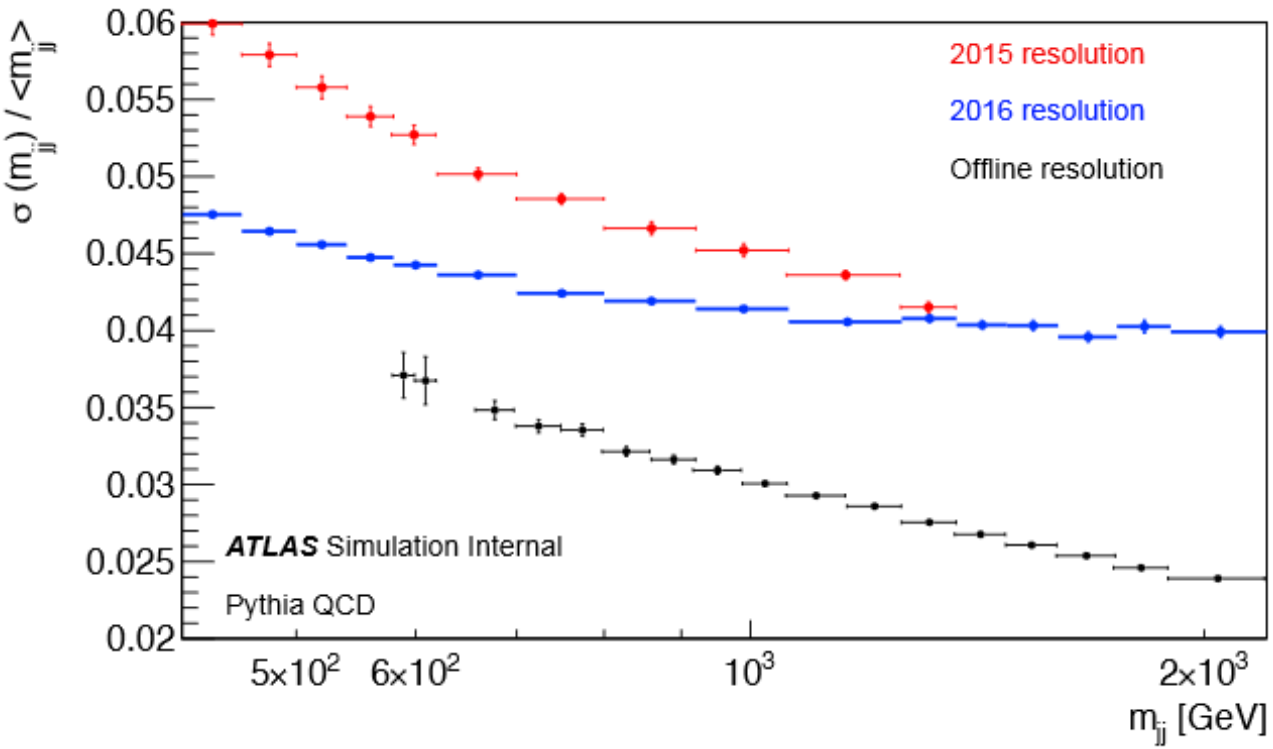
TLA final result



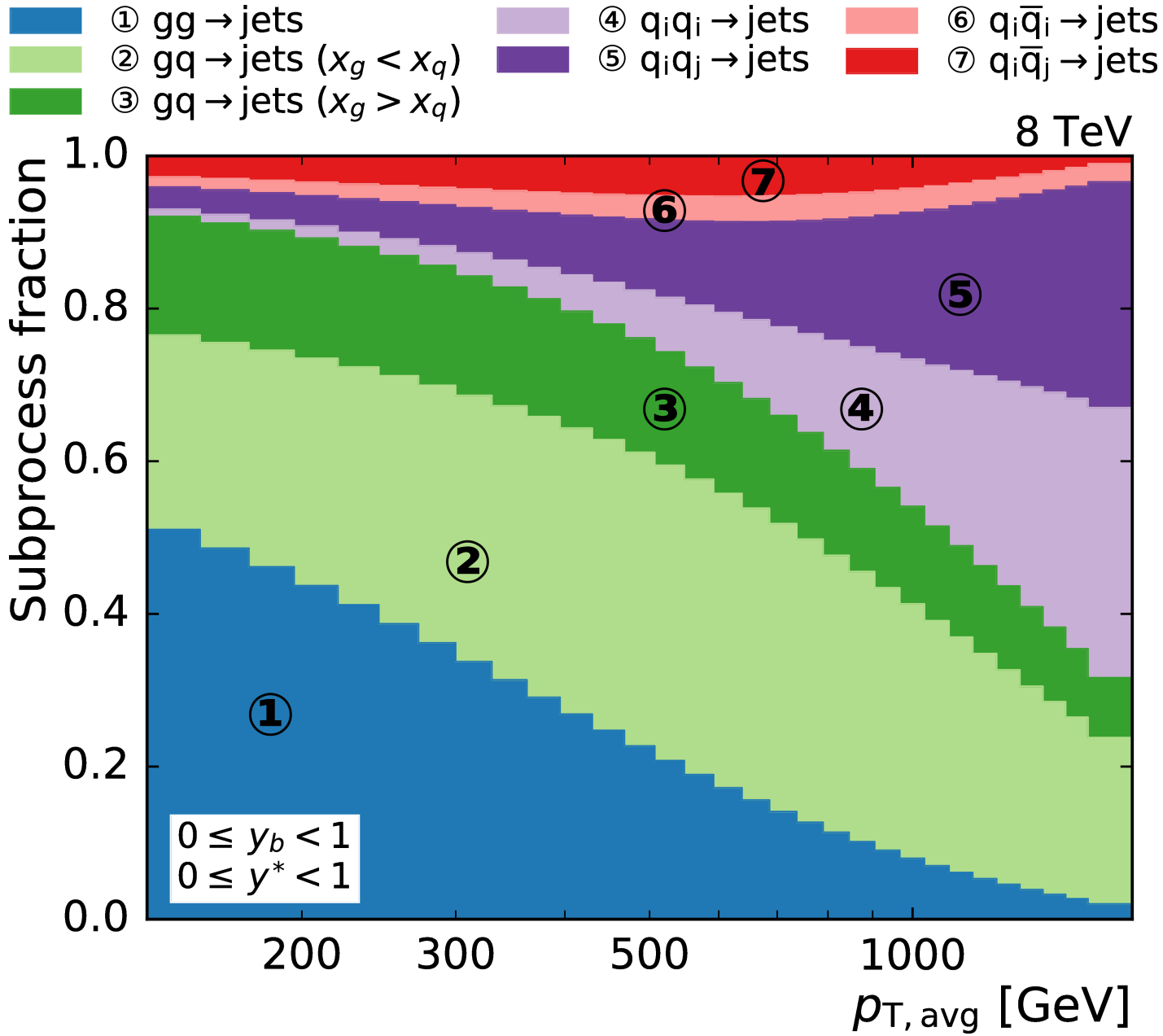
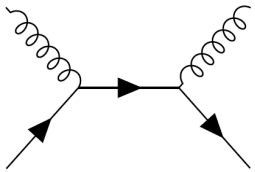
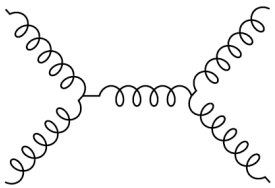
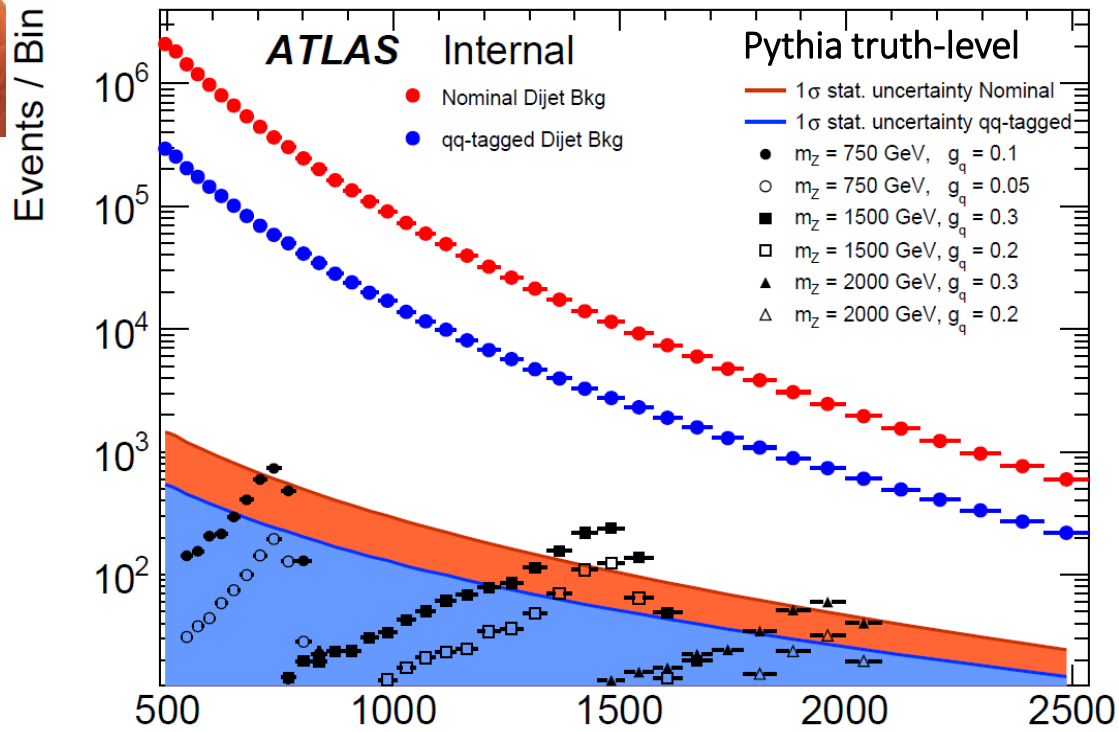
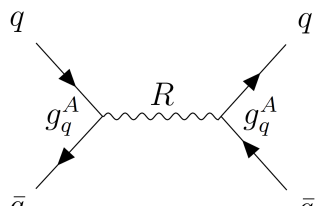
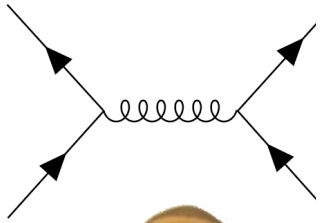
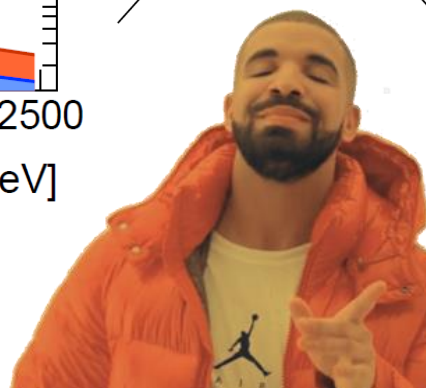
All dijet searches



TLA Low m_{jj} future



jet-jet events : initial-state flavour composition



TLA Low m_{jj} future