

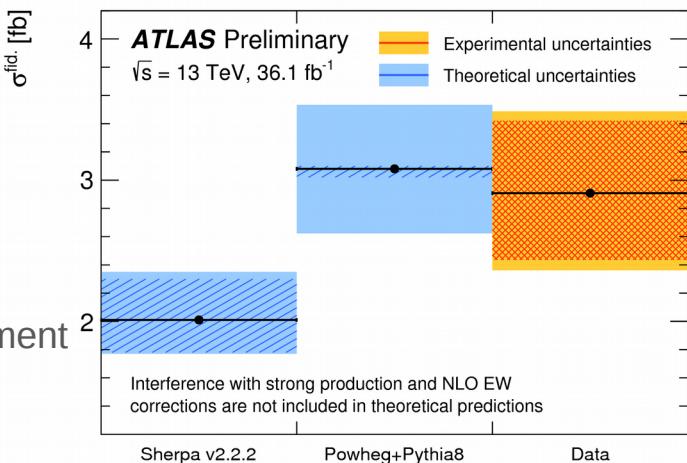
# LHC-EWWG: Comparison of WZ / ssWW VBS MCs

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A first look - 13th May 2019

# General Setup

- Multiboson and VBS/VBF processes entering precision area
  - But are we able to keep up with theorists?
- VBS extracted using fits → signal strength based on **SM MC predictions**
  - But which? Potentially large differences
  - Different interference / NLO EW correction treatments
- But how different are CMS/ATLAS?
  - Step 1: Compare MC predictions (shower, color-flow, tuning)
    - Easier: Compare MC using RIVET
    - Evaluate data difference w/o adapting measurement
  - Step 2: Compare data
    - Needs to extrapolate in same phase space



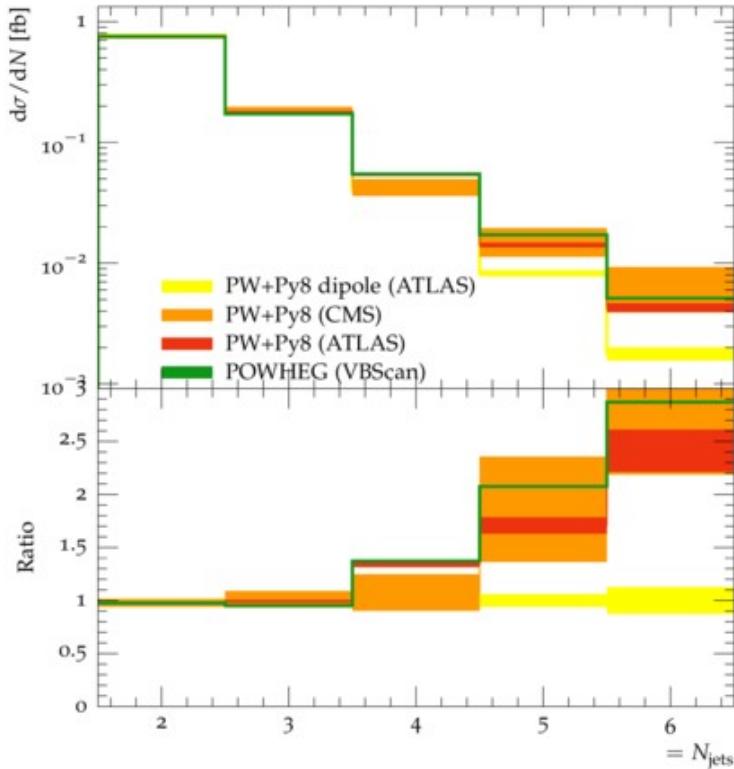
# Comparisons ssWW and WZ-VBS: Codes used

- First ATLAS/CMS multiboson comparisons
  - VBS WZ: <https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/STDM-2017-23/>  
<https://arxiv.org/abs/1901.04060>
  - ssWW: <https://arxiv.org/pdf/1709.05822>  
<https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2018-030/>  
Updated ATLAS MC configurations:  
<https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PUBNOTES/ATL-PHYS-PUB-2019-004/>
- Comparisons using RIVET (<https://rivet.hepforge.org/>)
  - Based on public codes of general VBS phase spaces:
    - VBS WZ: Les Houches Study (Kenneth Long, <https://arxiv.org/abs/1803.07977>)
    - ssWW: VBScan theory comparison (<https://arxiv.org/abs/1803.07943>)
  - Gathered here: <https://gitlab.cern.ch/lhcewkg/lhcewkg-multiboson/mc-comparison>
  - Added Control Regions, including documentation
  - Example from TOP WG: <https://cds.cern.ch/record/2676661>

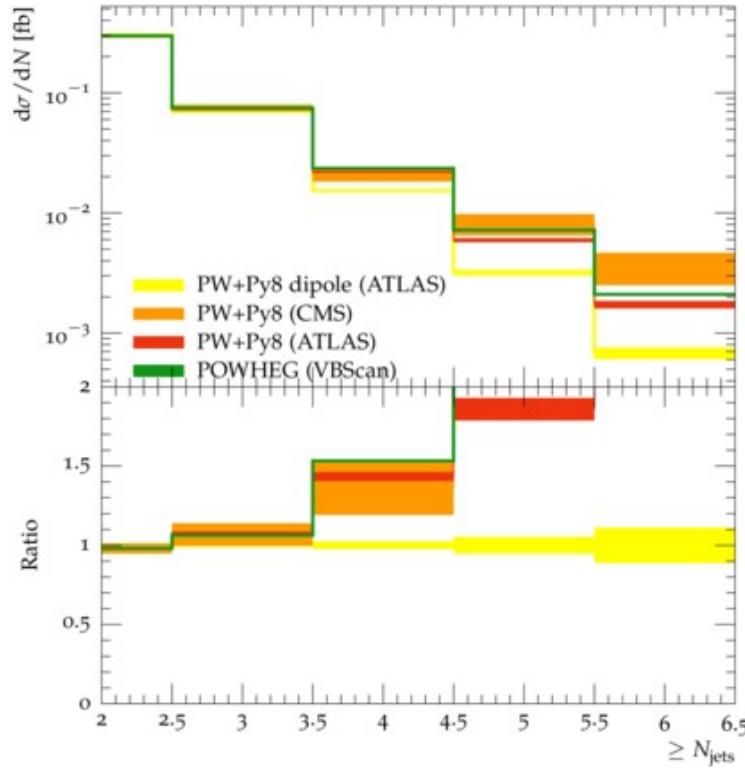
# First glance: ssWW

- Cuts: e-mu final state **only**
  - Above 20 GeV , within eta<2.5
  - For any object  $dR > 0.3$
  - $\text{MET}>40 \text{ GeV}$ ,  $pT(\text{jet}) > 30 \text{ GeV}$ ,
  - $\Delta\eta_{jj} > 2.5$ ,  $M_{jj} > 200 \text{ GeV}$
- Few general points:
  - Mismatch xsec unit (CMS) vs (ATLAS) (scale CMS by Scale=0.001) ?
  - Cross section comparison problematic → no k-factors, mismatch ee,mm,em,me ? (e.g. VBScan yoda contains perhaps only 1 flavour)
  - Chase up plain xsec or not? (probably cited in papers)
  - Only normalized comparisons in the following

# ssWW : Number of jets

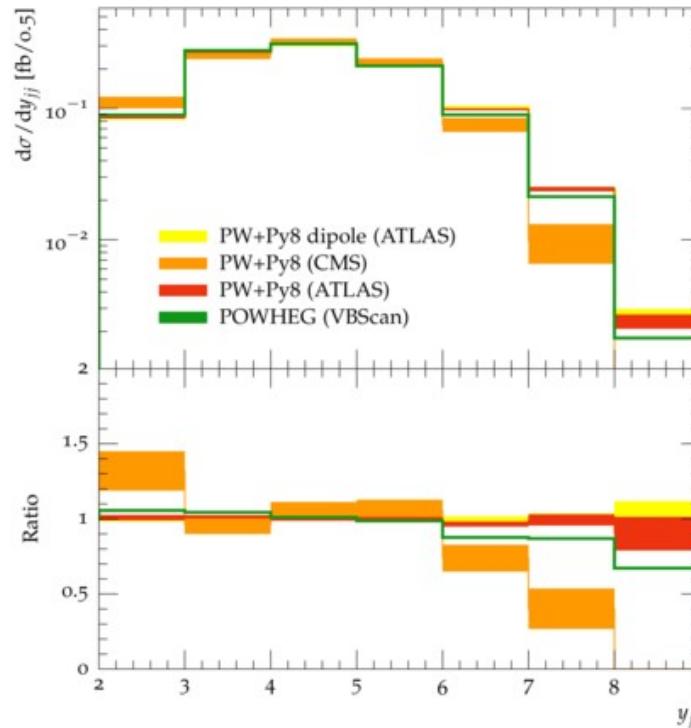
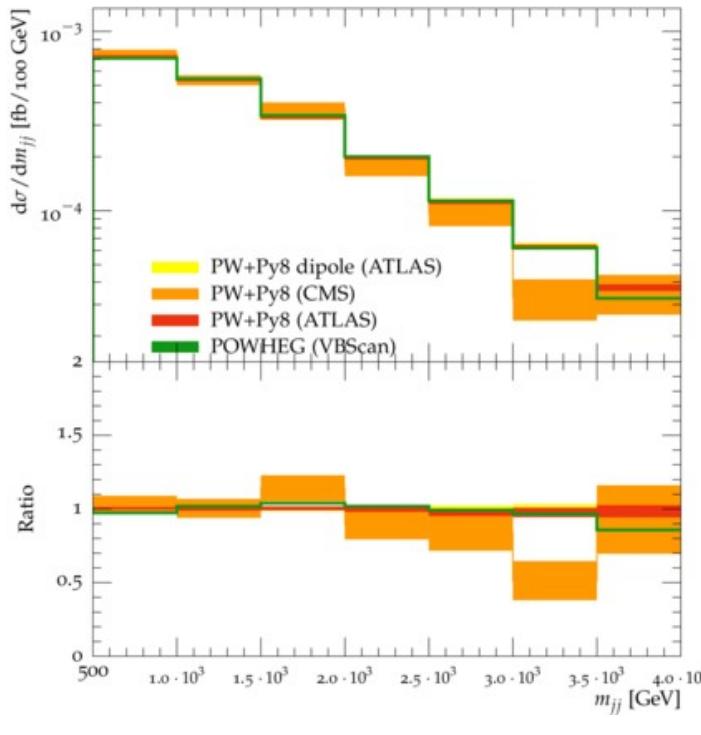


**Consistent pictures for all samples, except for the dipole model which has less jets**

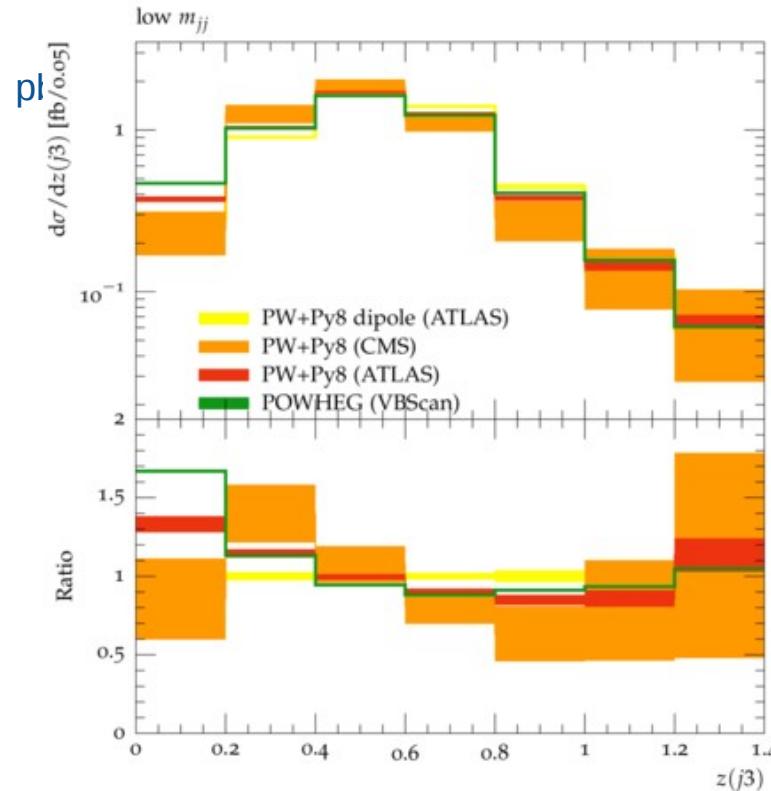
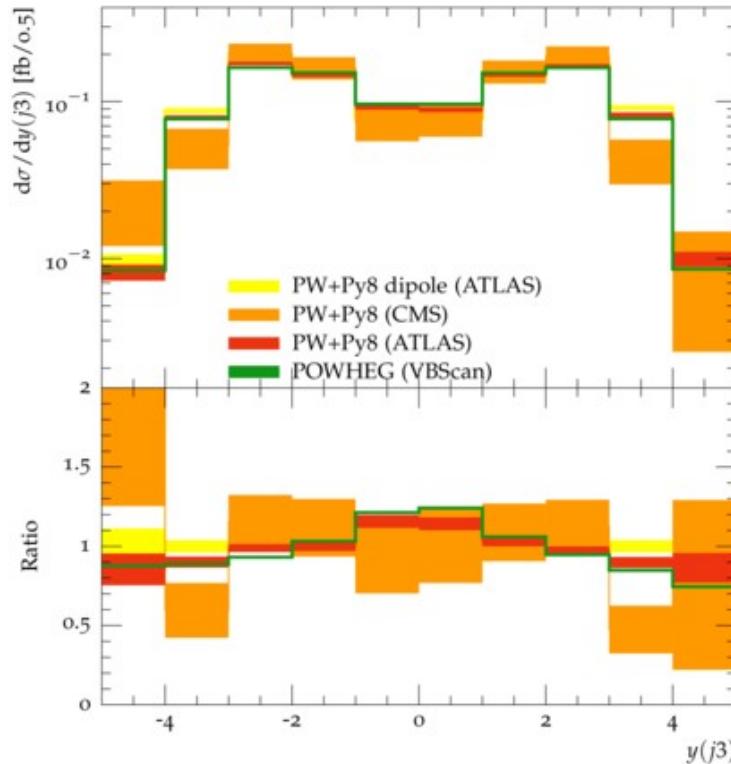


# ssWW : m<sub>jj</sub> and Delta\_y<sub>jj</sub>

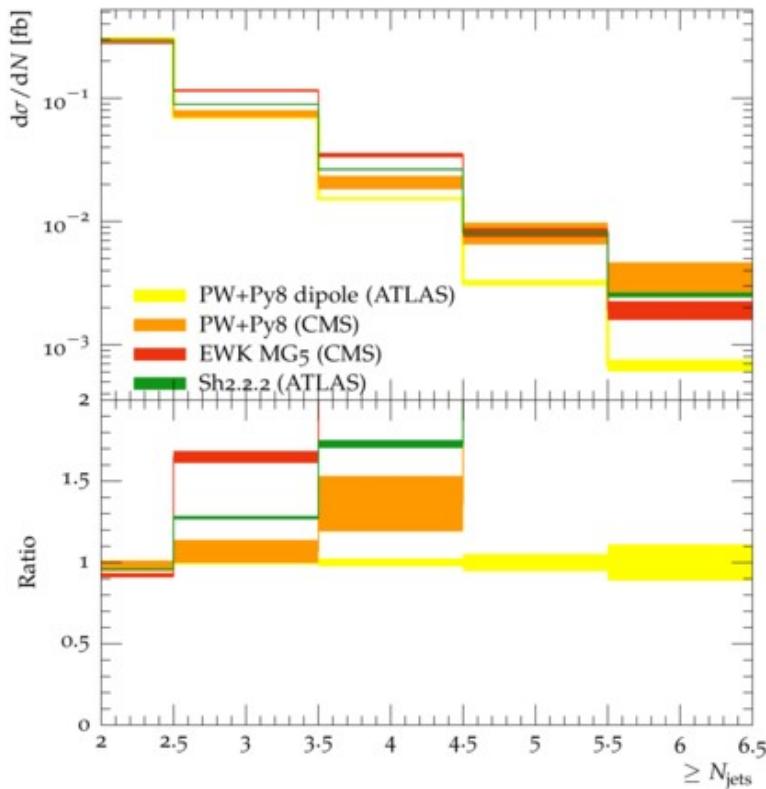
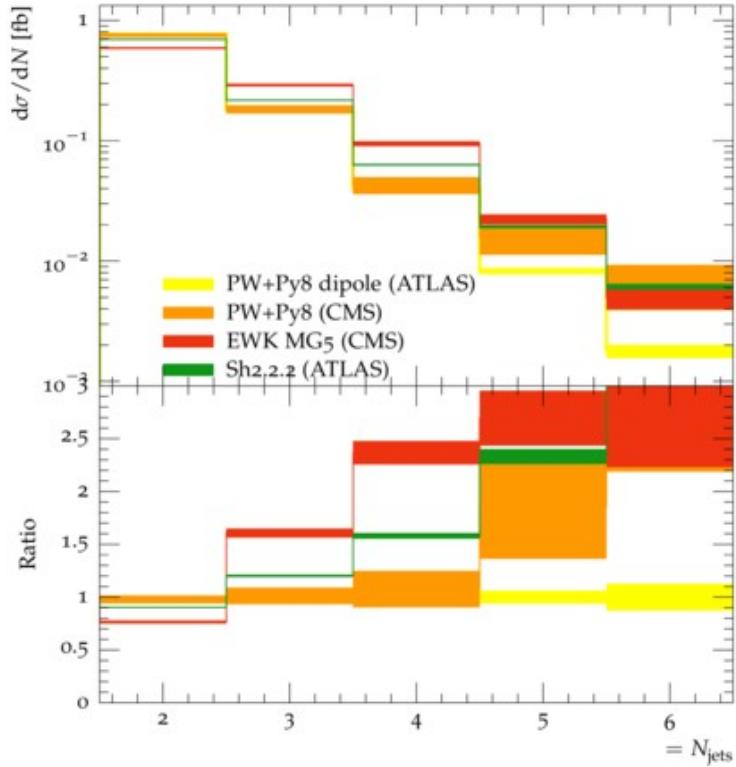
**ATLAS and CMS PW+P8 look a bit different,  
but in this comparison it could also be  
attributed to statistics**



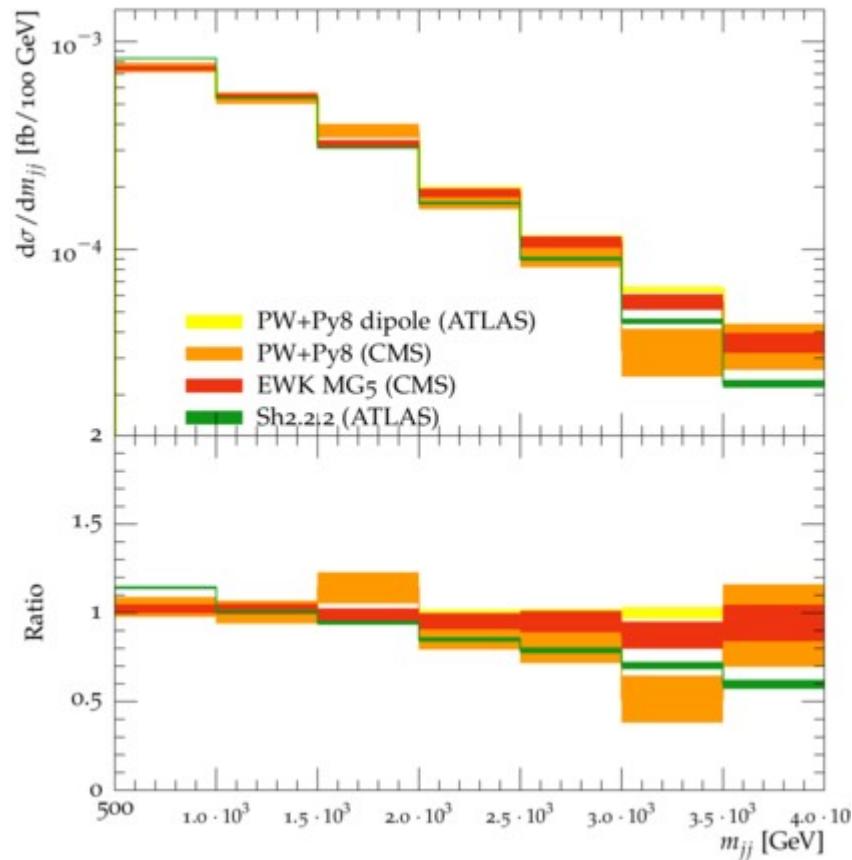
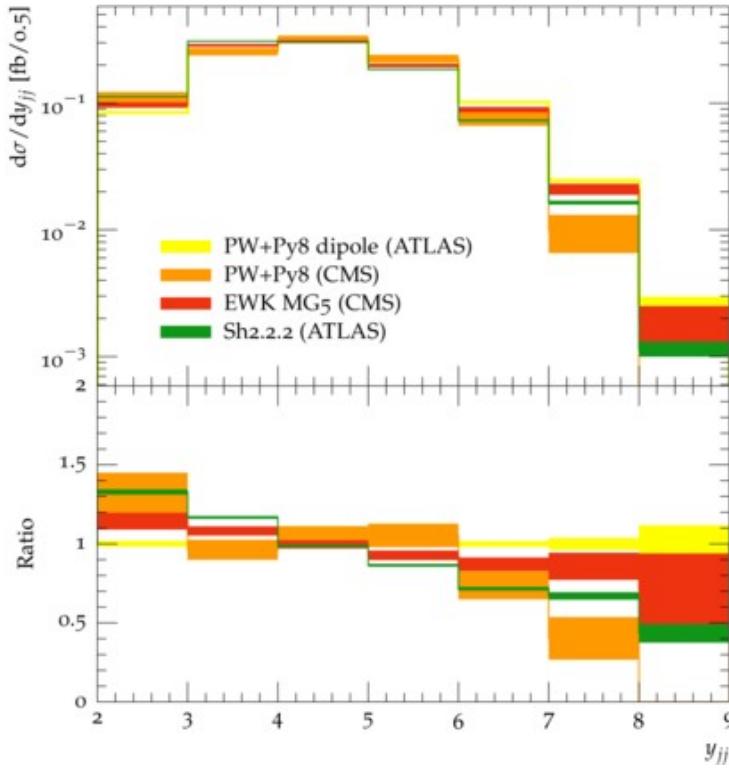
# Centrality of the 3rd jet



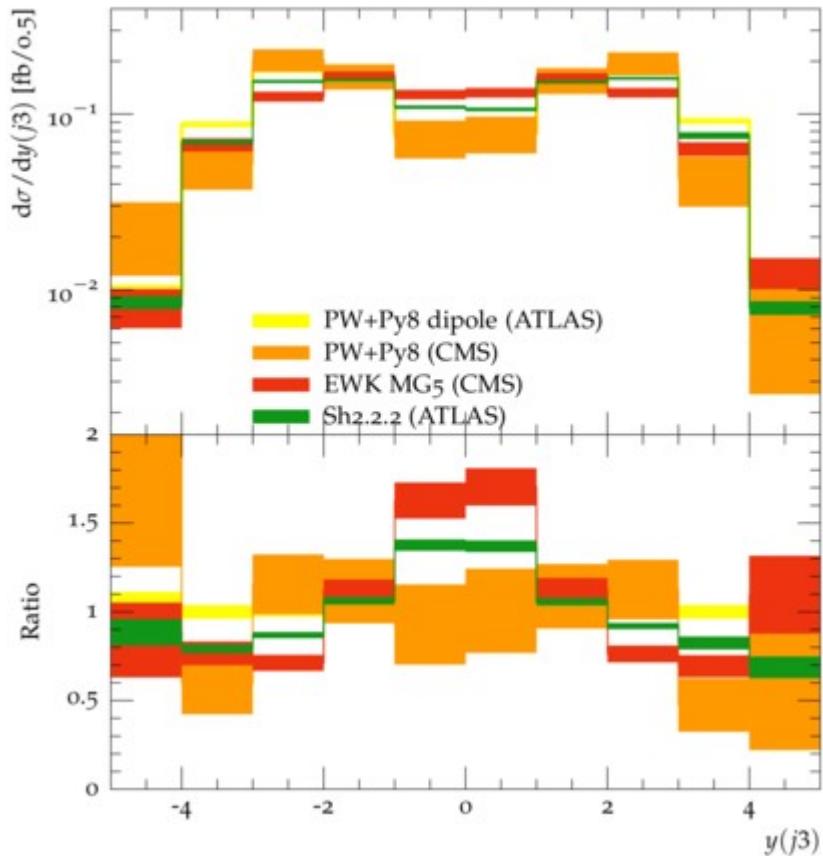
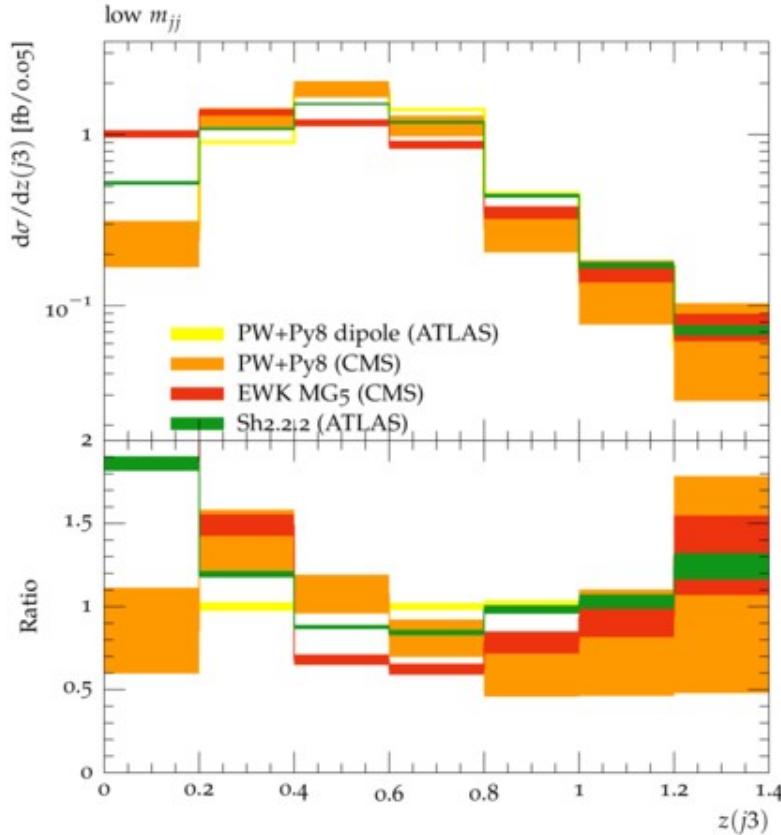
# ssWW: Nominal samples



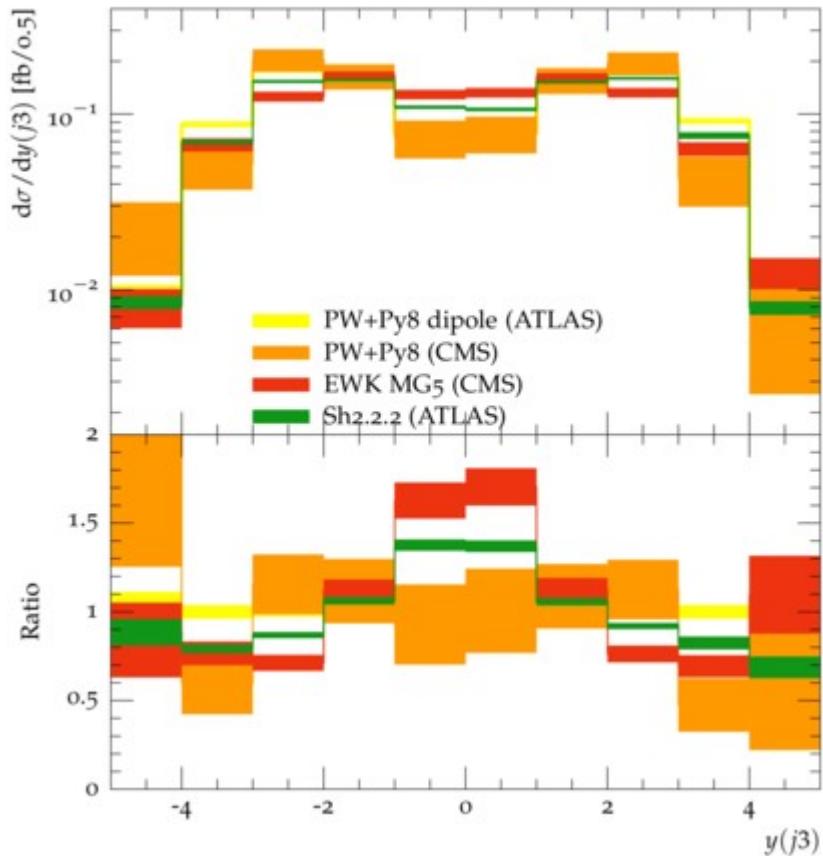
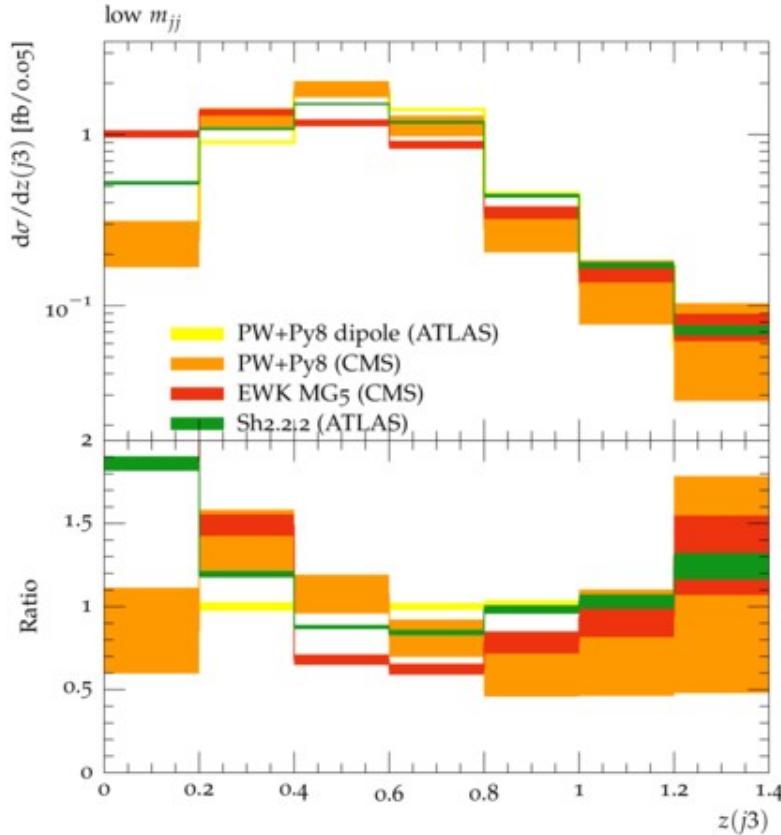
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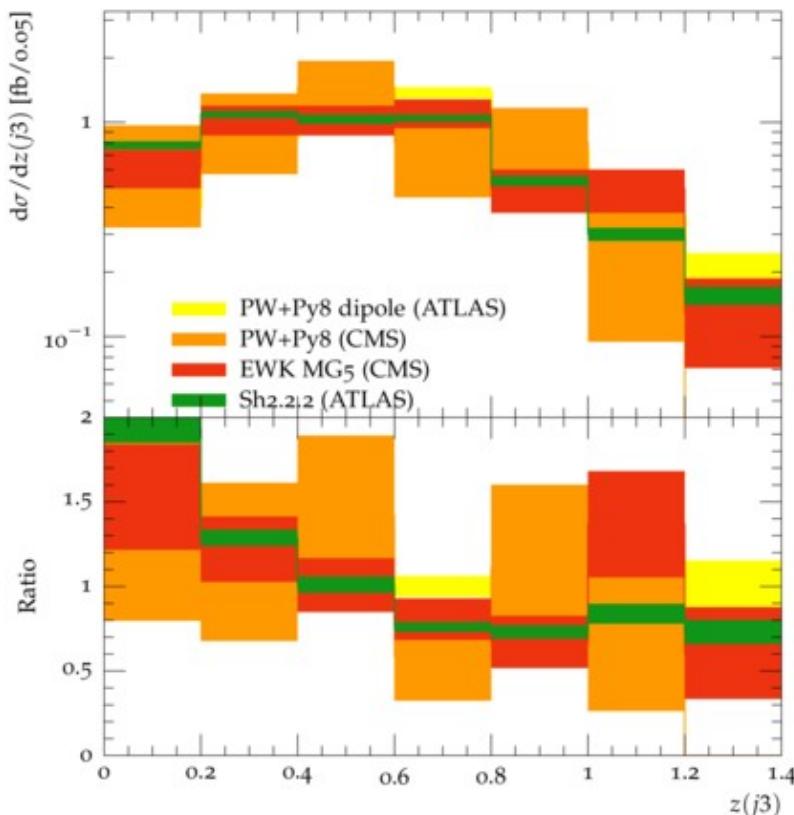
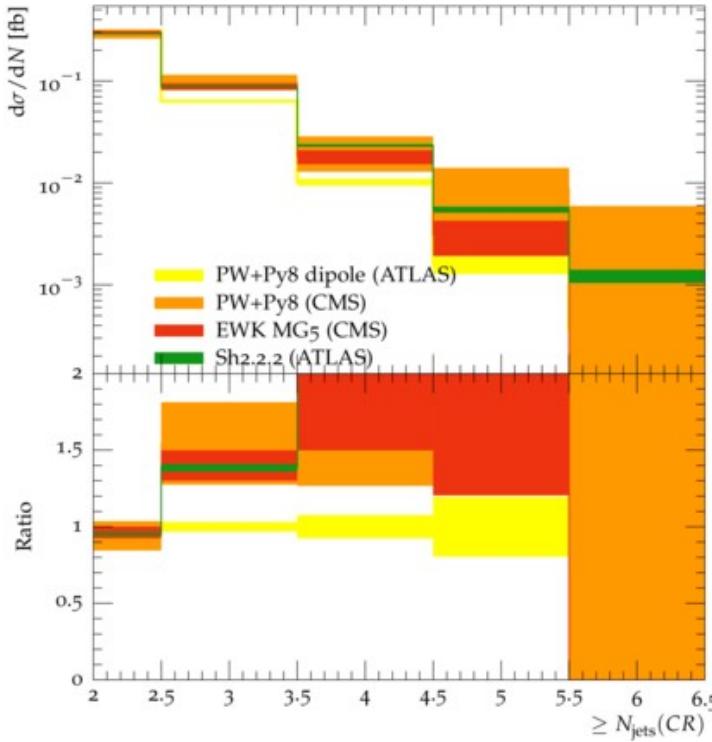
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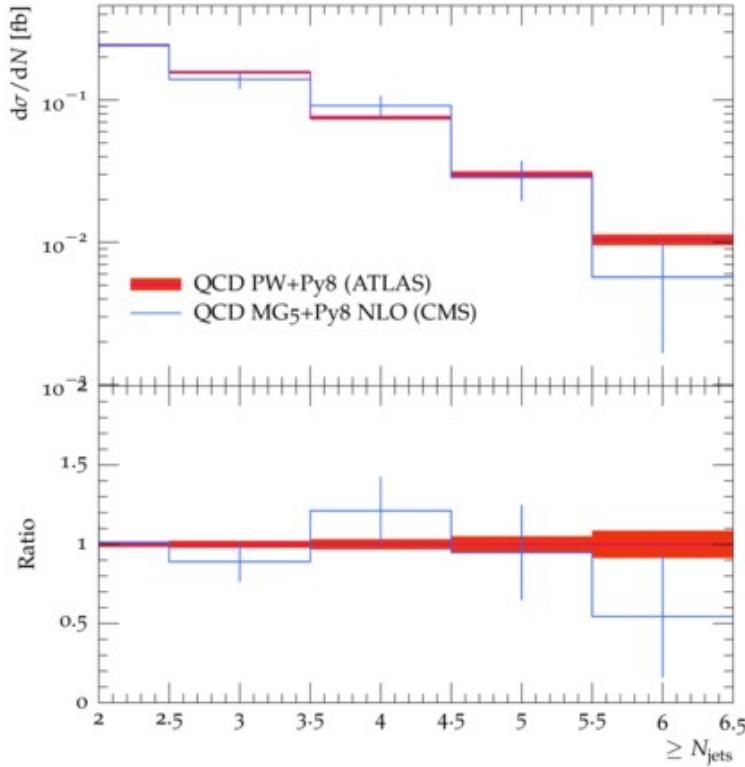
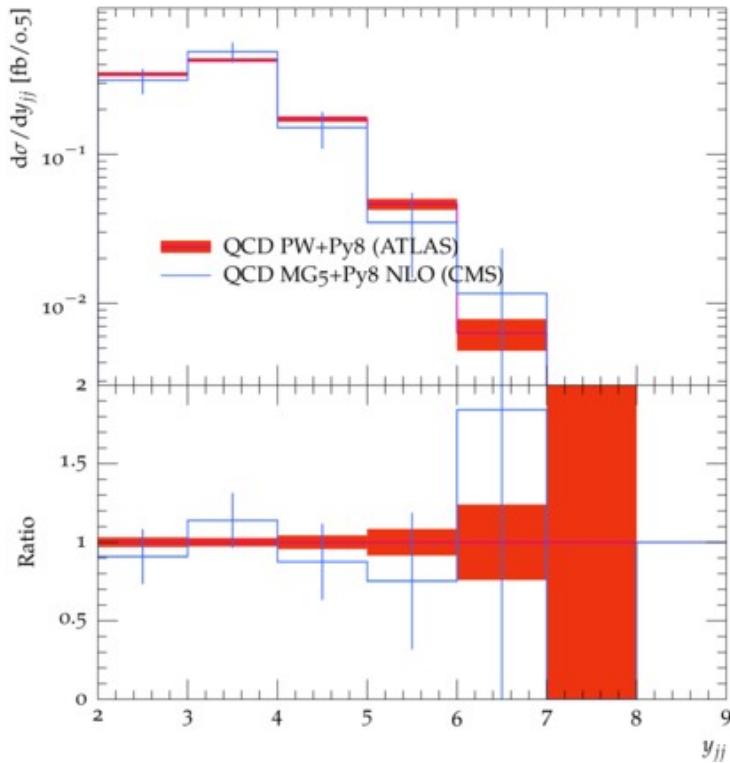
# ssWW: Nominal samples



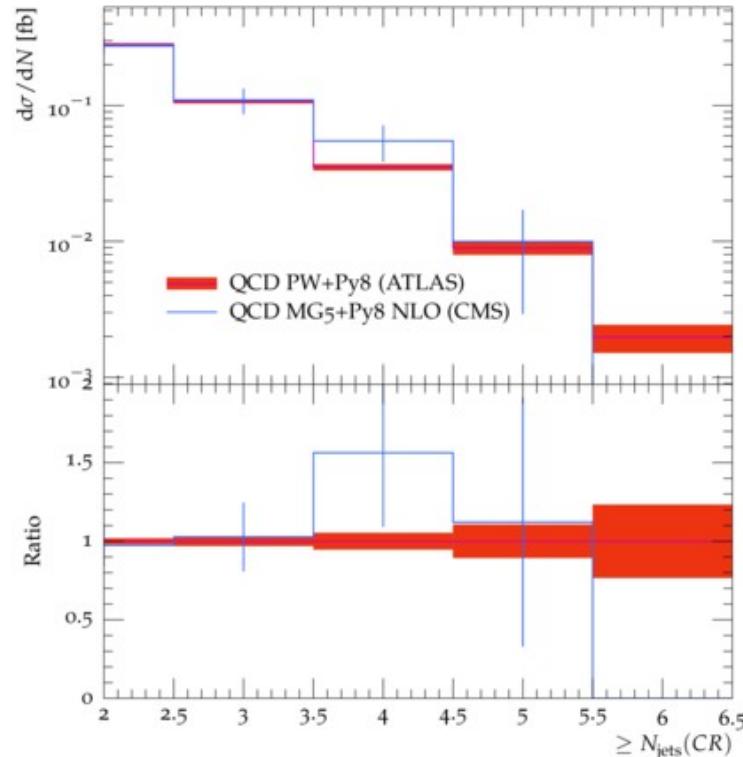
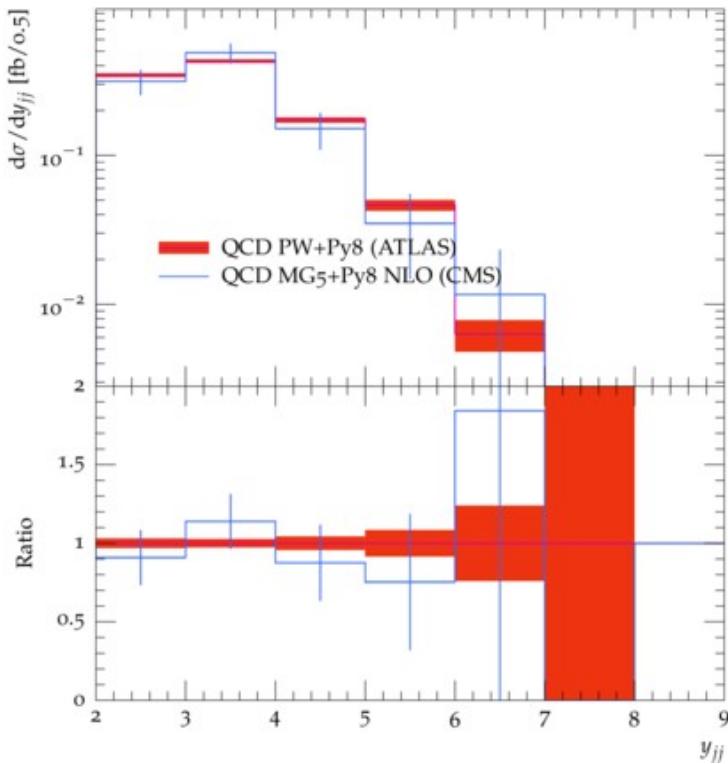
# SsWW-CR: Nominal samples



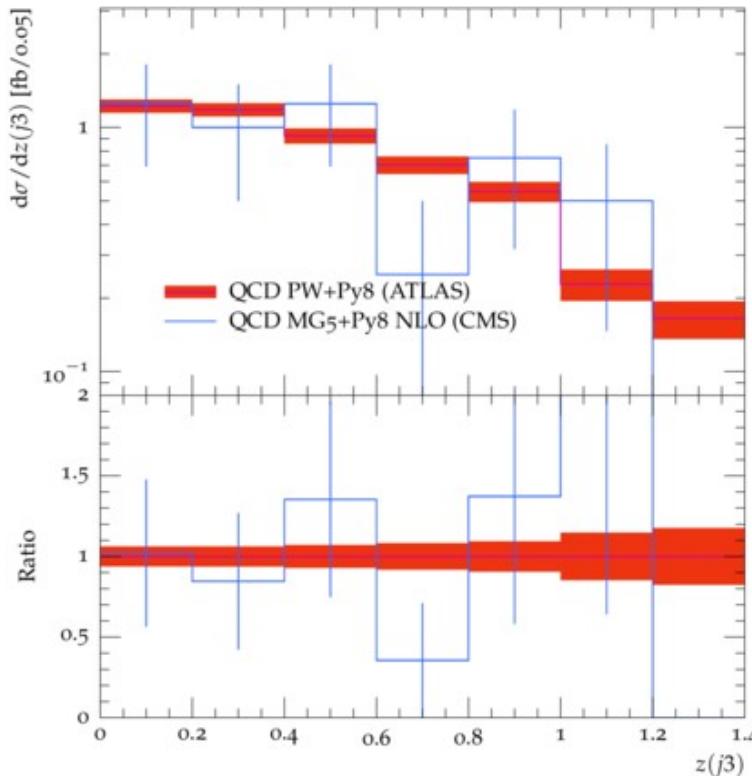
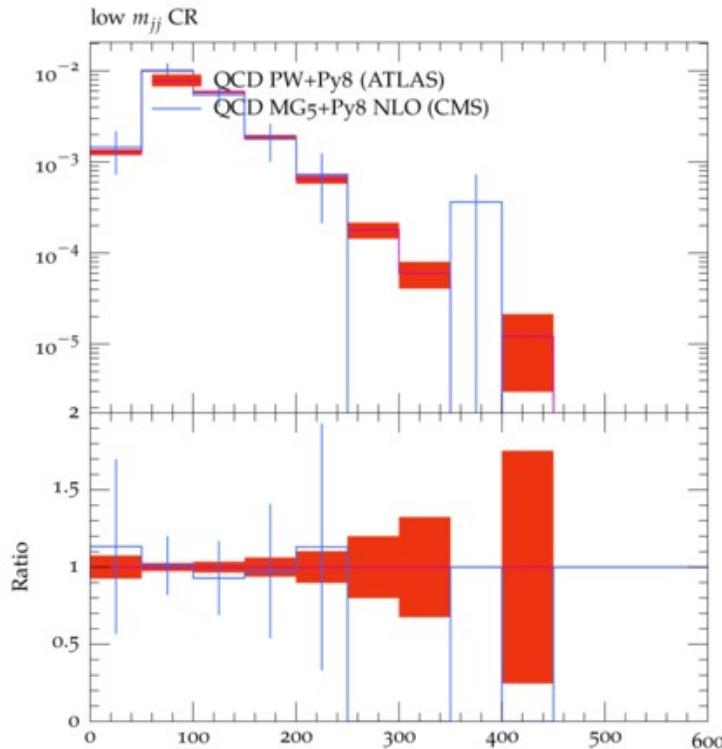
# S<sub>s</sub>WW-CR: QCD samples



# S<sub>s</sub>WW-CR: QCD samples



# S<sub>s</sub>WW-CR: QCD samples



# Conclusions

- Still quite low statistics
  - Any way to increase for CMS?
- Otherwise agreement is not bad
- How was observed vs. expected evaluated in CMS?