Imperial College London

VBF Higgs to Invisible

W MC

Run 1 Reminder

- In run 1 we split $W \to \ell\nu$ samples by lepton at generator level
- $W \to \tau\nu$ events were classified according to τ decay:
  - e.g. $W \to \tau\nu \to \mu\nu\nu\nu$ put in muon category etc.
- Done by checking for status 3 lepton

Run 2

- No more status 3, approximately replaced by status 21-29
- In some cases status 21-29 particle replaced by status 1 or 2

W MC: replacing status 3

New strategy

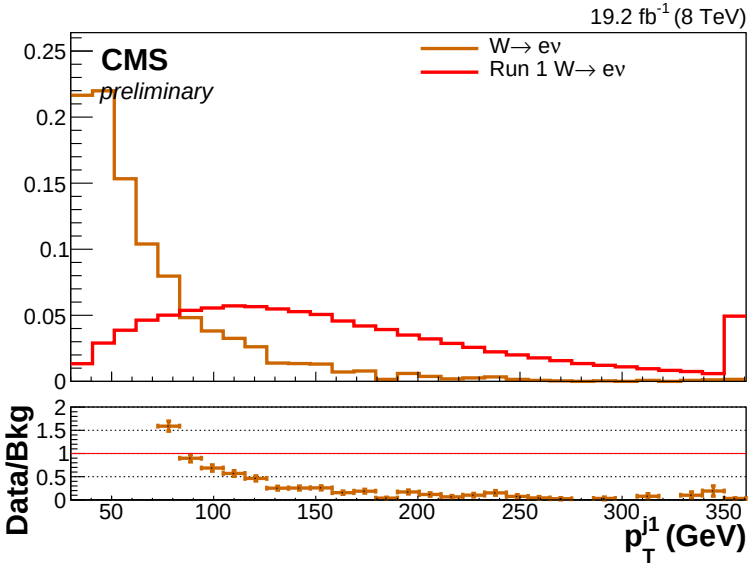
- Use list of W daughters to find lepton flavour
- If a τ is found check its daughters to determine τ decay
  - τ often radiates, need to check recursively until a decay is found

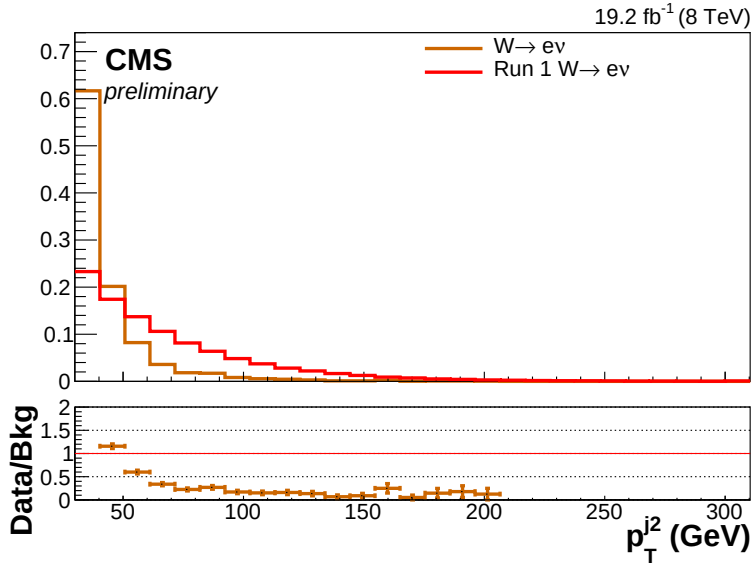
- Since yesterday bug identified, correctly classifies all events light trees made

W Comparison

- As recommended weights now removed to make it clearer if difference is from gen/reconstruction
- Distributions still normalised to 1
- Same set of plots as for QCD and signal included for reference
- Selection as for QCD is: $\eta_{j1} \cdot \eta_{j2} < 0$, $\eta_{j1} < 4.7$, $\eta_{j2} < 4.7$, $p_T^{j1} > 50\,\text{GeV}$, $p_T^{j2} > 40\,\text{GeV}$, $\Delta\eta_{jj} > 3.6$, $M_{jj} > 800\,\text{GeV}$, $MET > 90\,\text{GeV}$, $METsig > 3$.]
- As met significance is a different variable in runs 1 and 2 this may bias comparison
- Additionally to above cuts enu, munu and taunu categories applied

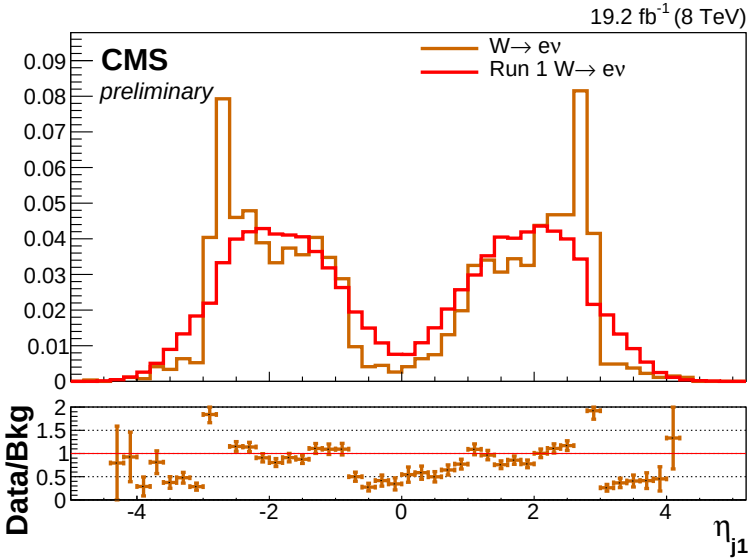
W enu Comparison: run 1 vs run 2: Jet p_T

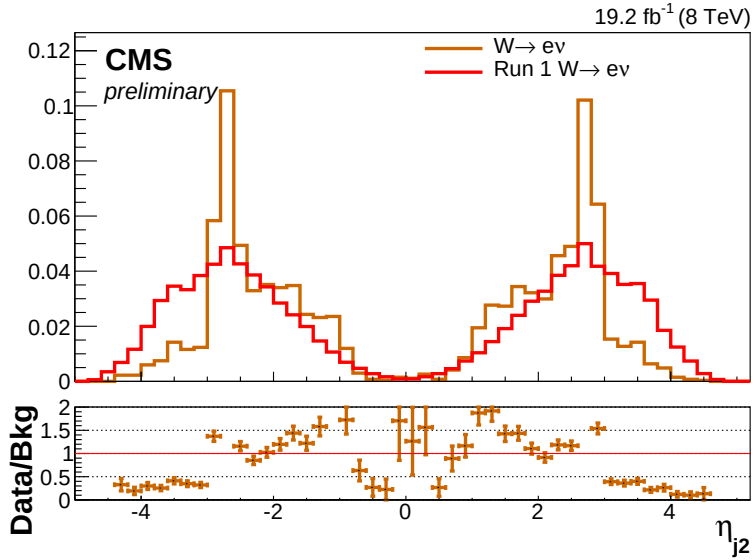




- Run 2 much lower could be due to met significance cut bias

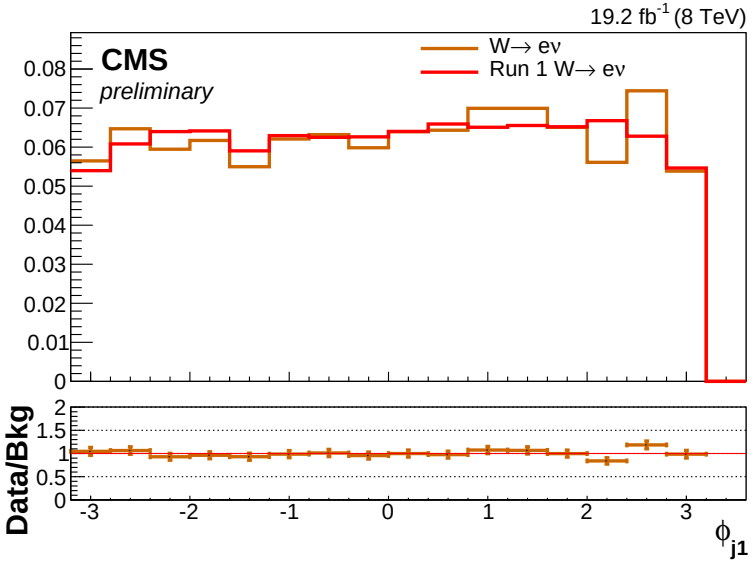
W enu Comparison: run 1 vs run 2: Jet η

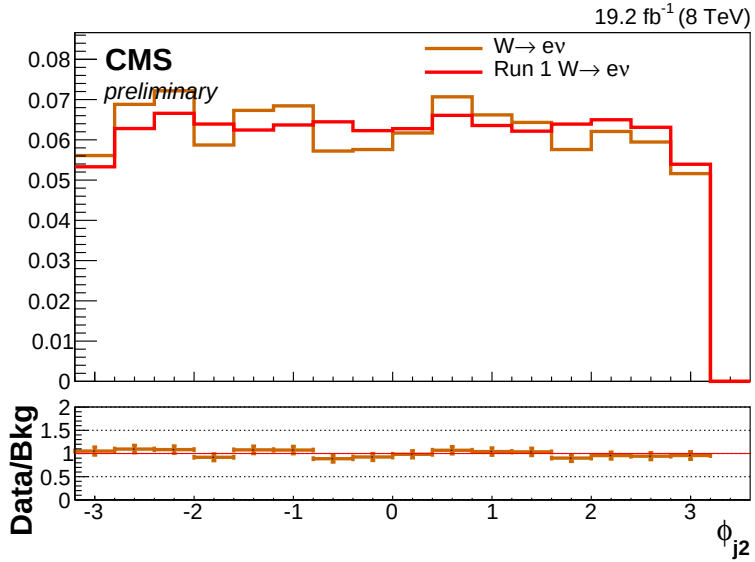




- Ears still apparent

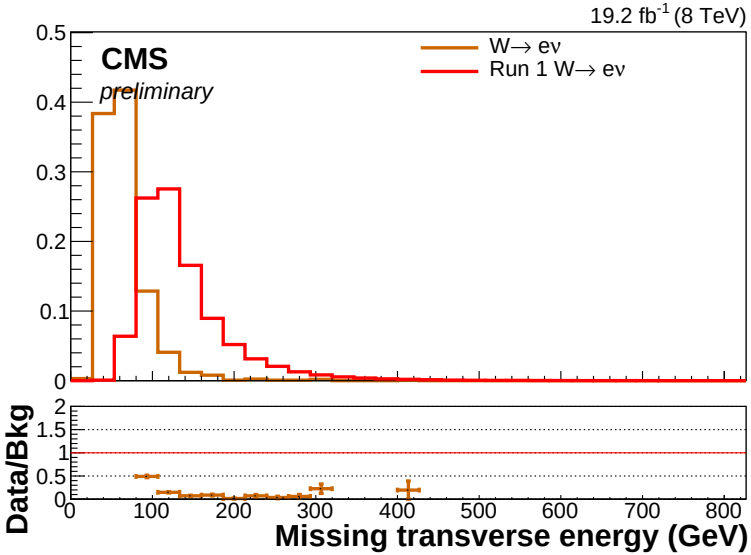
W enu Comparison: run 1 vs run 2: Jet ϕ

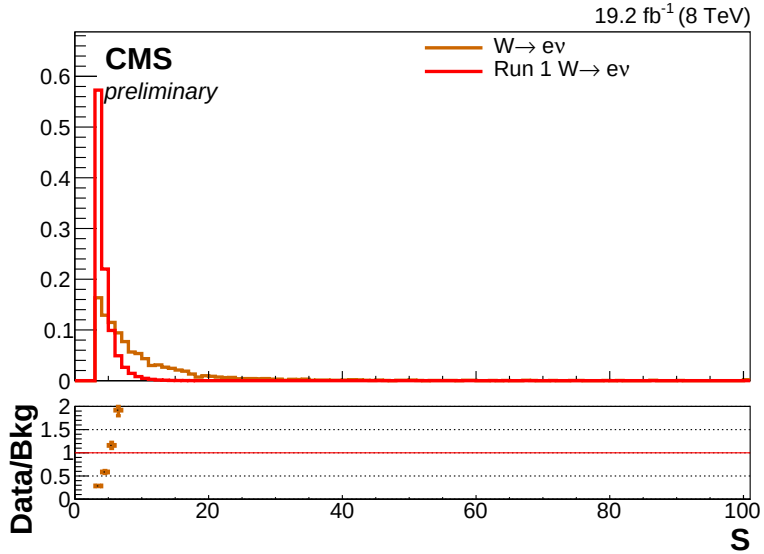




- ϕ distributions look similar within stat error

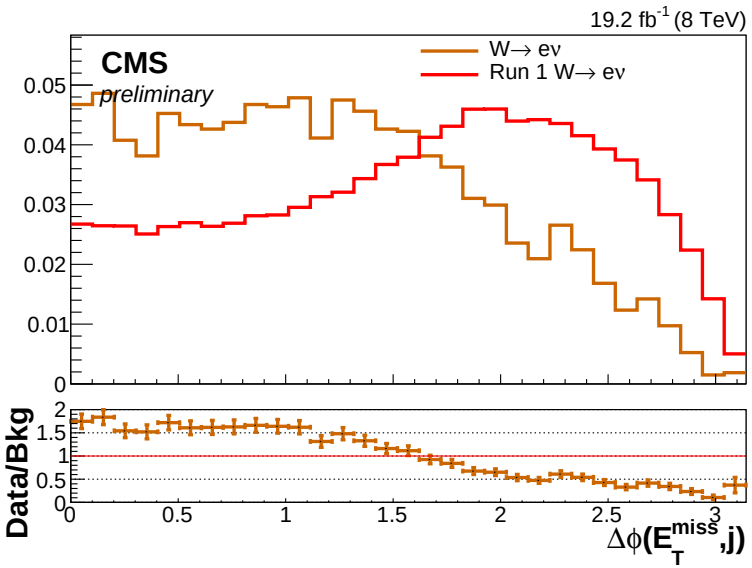
W enu Comparison: run 1 vs run 2: Met

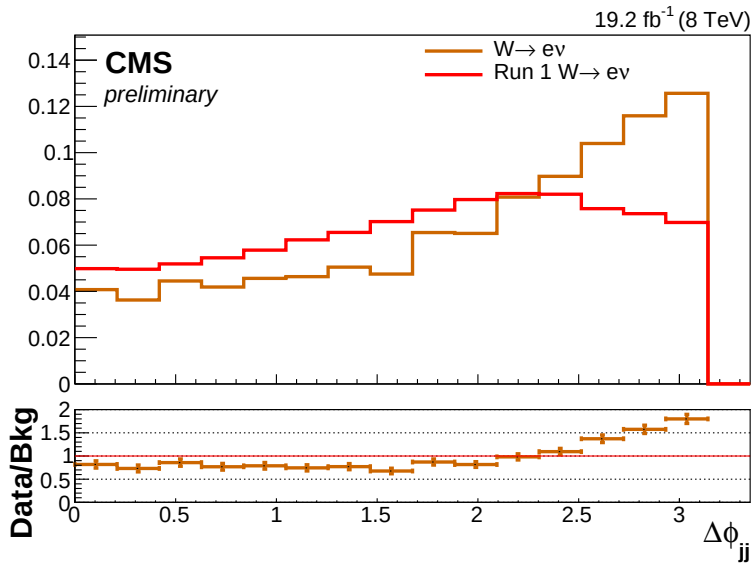




- Metnomu lower for run 2
- Met significance is a different variable in miniAOD to the one we used in run 1

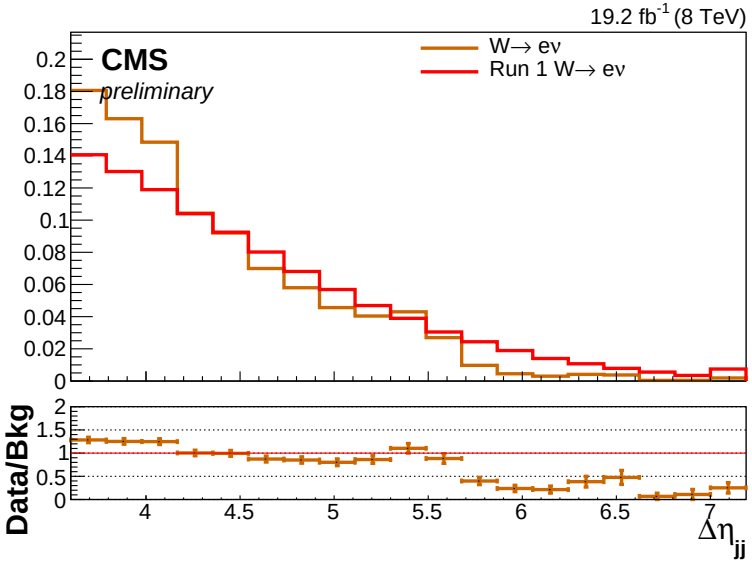
W enu Comparison: run 1 vs run 2: $\Delta\phi$ variables

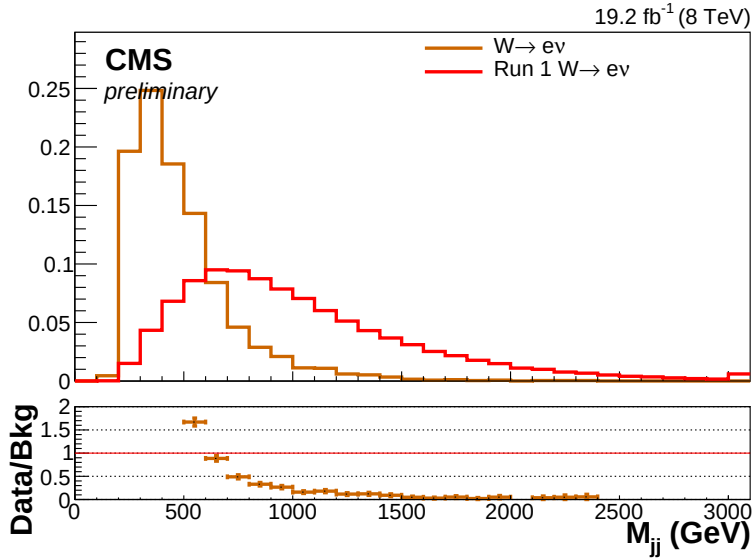




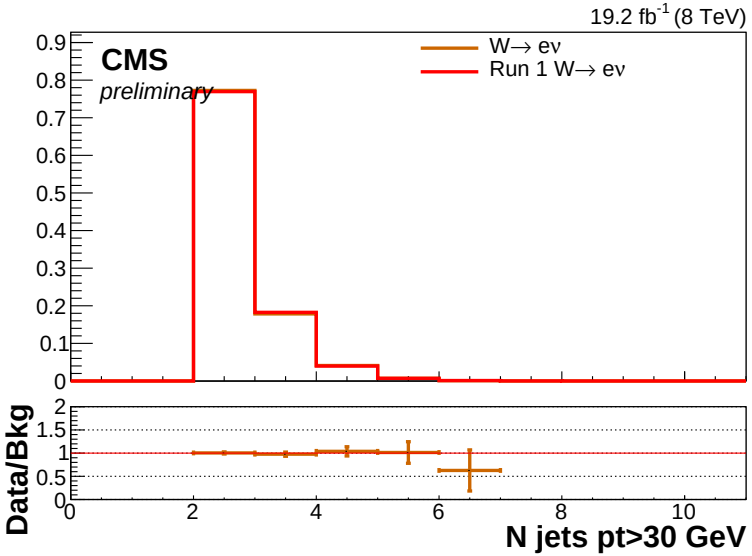
- Much more background like for run 2
  - could be due to met significance cut bias

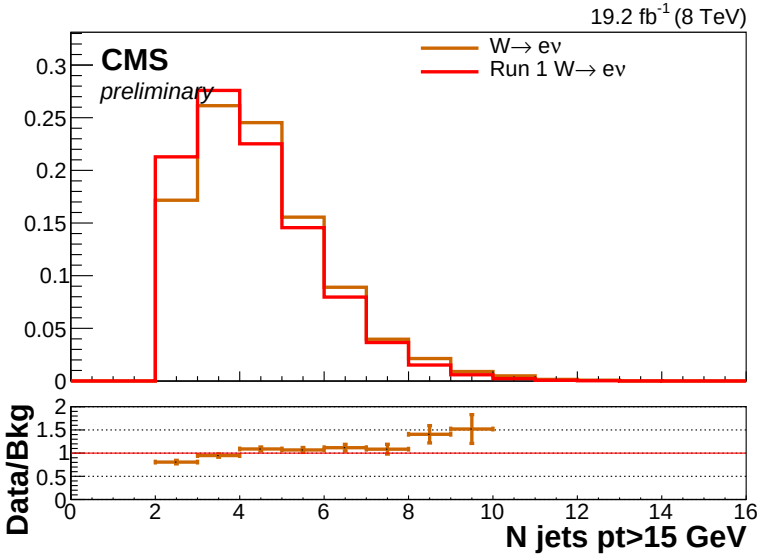
W enu Comparison: run 1 vs run 2: dijet variables



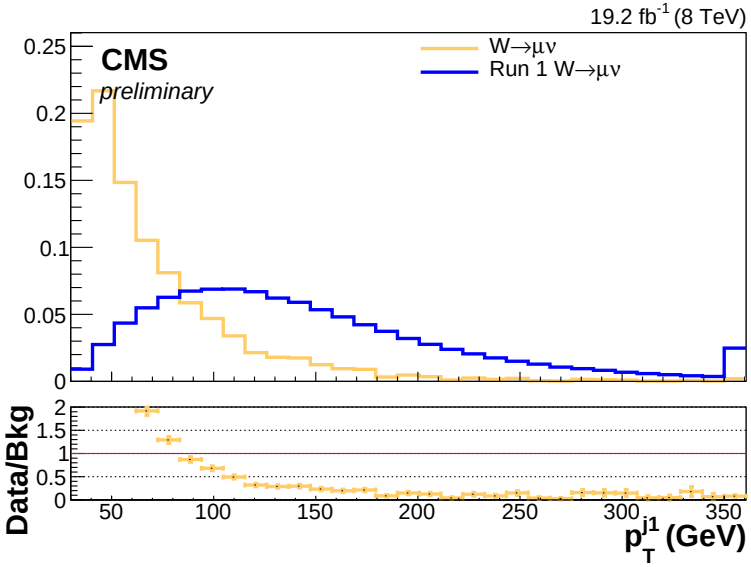


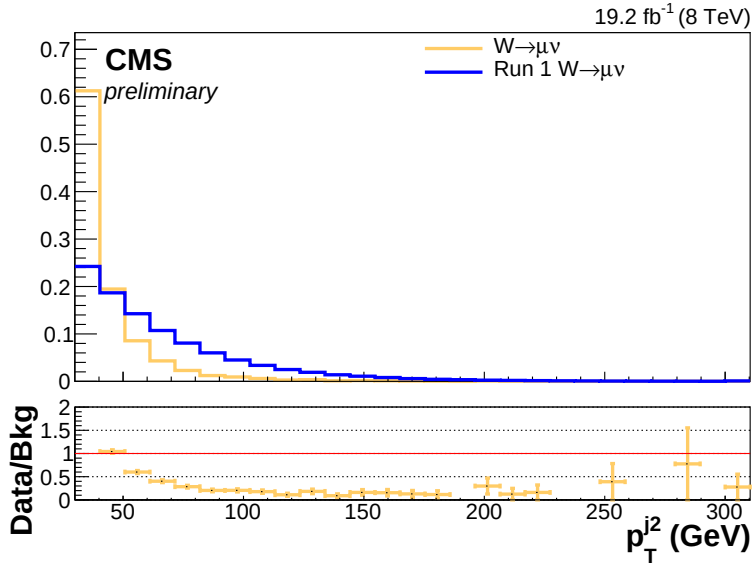
W enu Comparison: run 1 vs run 2: N jets





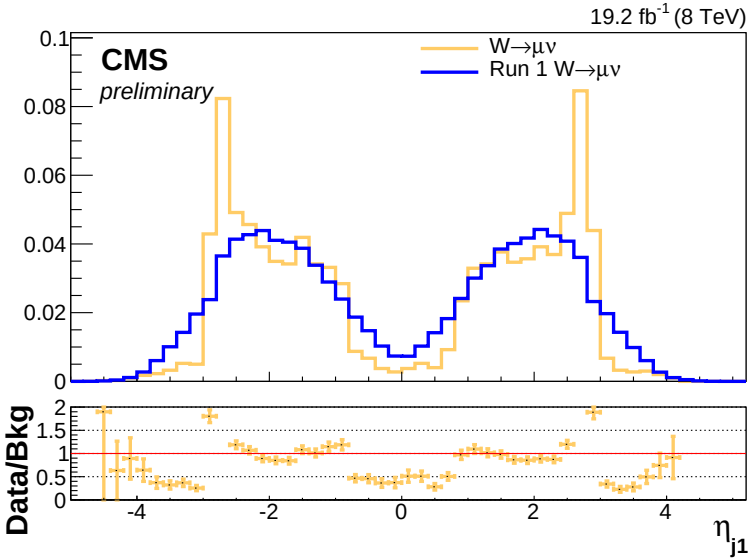
W munu Comparison: run 1 vs run 2: Jet p_T

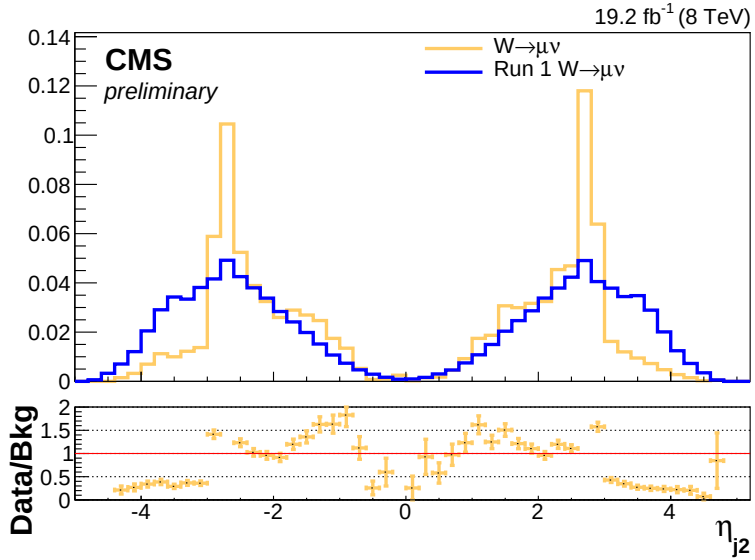




- Run 2 much lower could be due to met significance cut bias

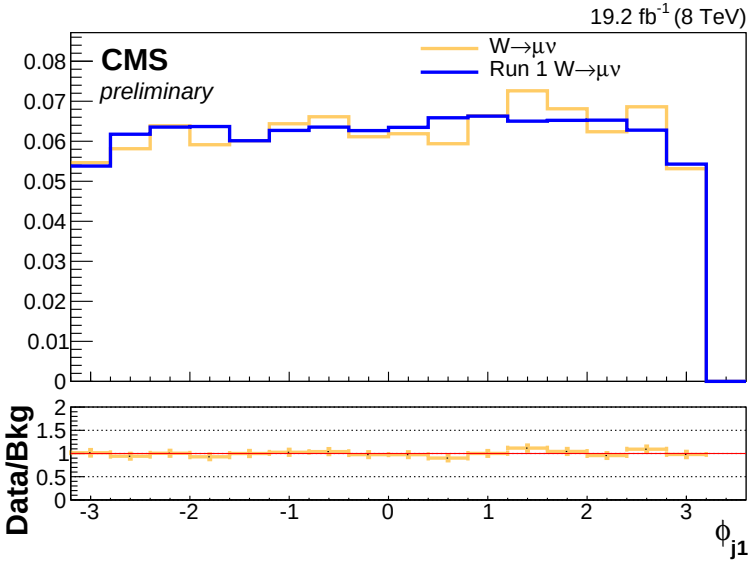
W munu Comparison: run 1 vs run 2: Jet η

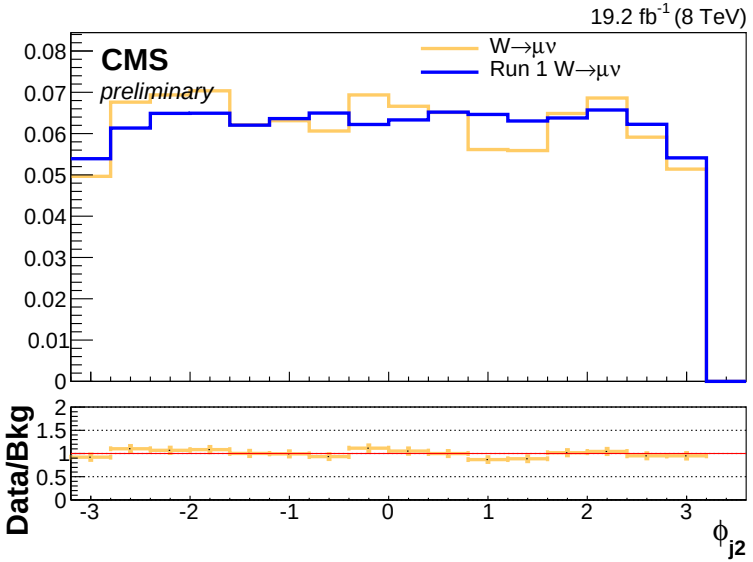




- Ears still apparent

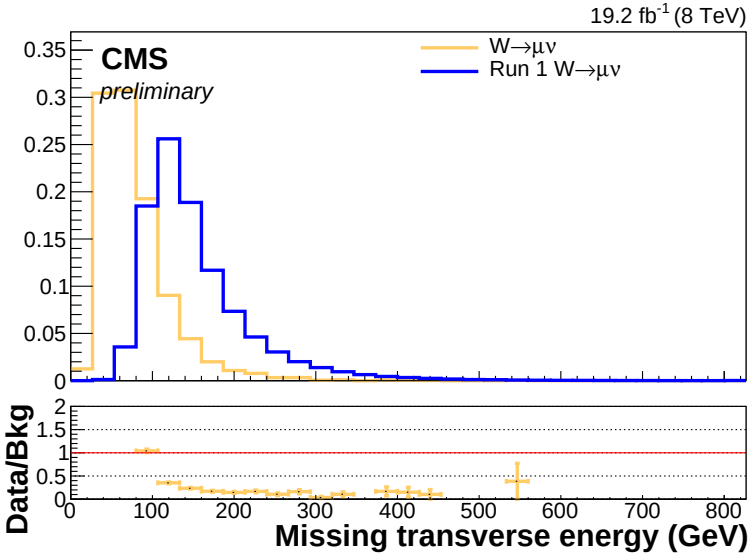
W munu Comparison: run 1 vs run 2: Jet ϕ

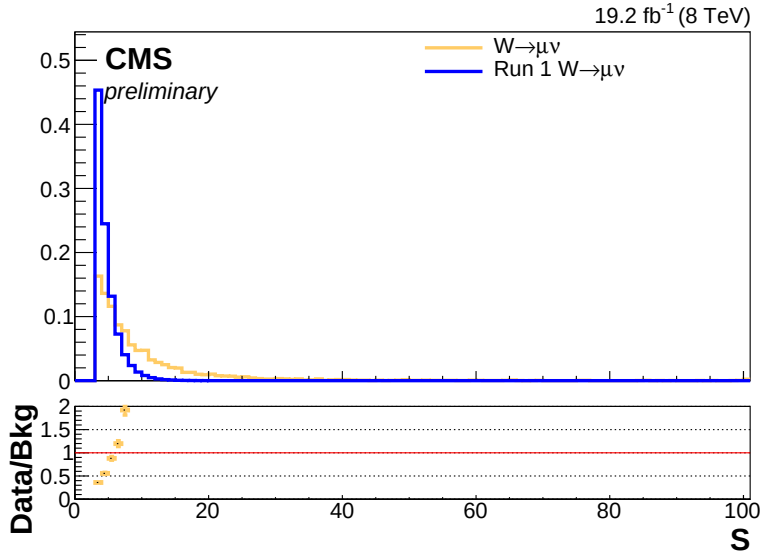




- ϕ distributions look similar within stat error

W munu Comparison: run 1 vs run 2: Met





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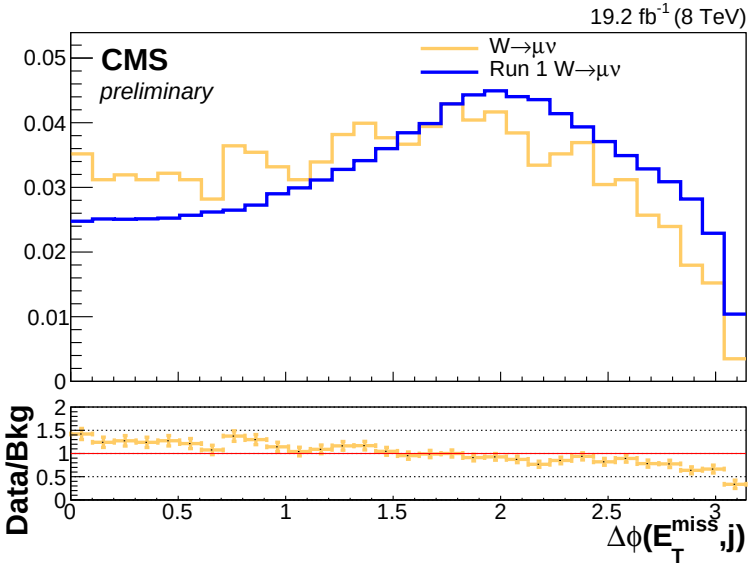
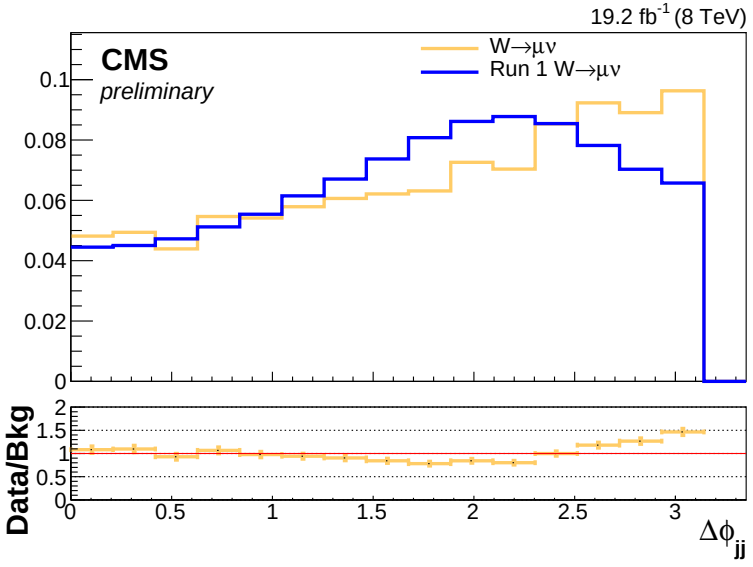
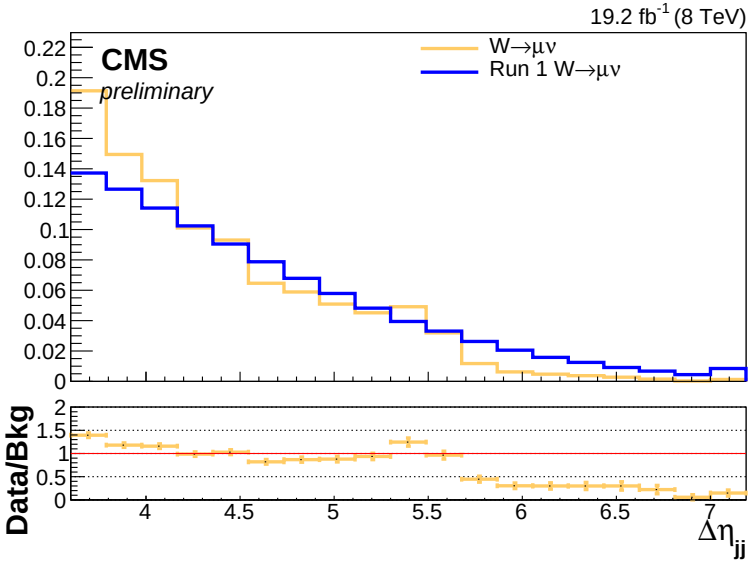
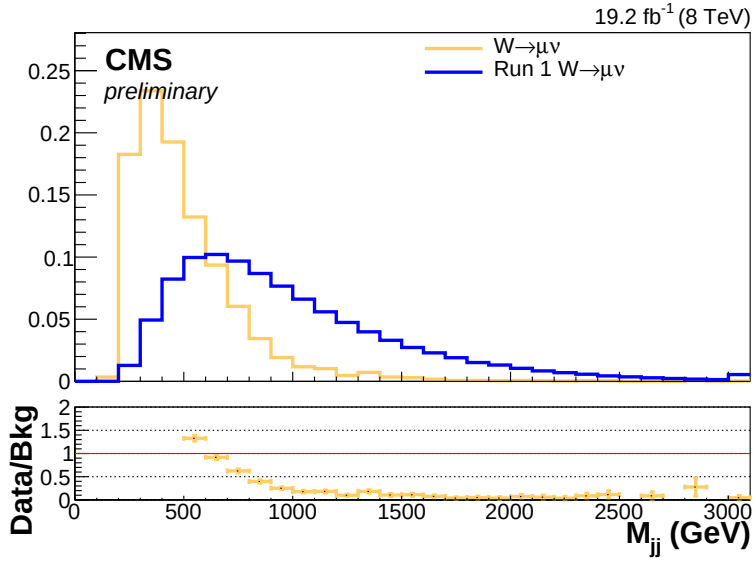




- Difference could be due to met significance bias

W munu Comparison: run 1 vs run 2: dijet variables





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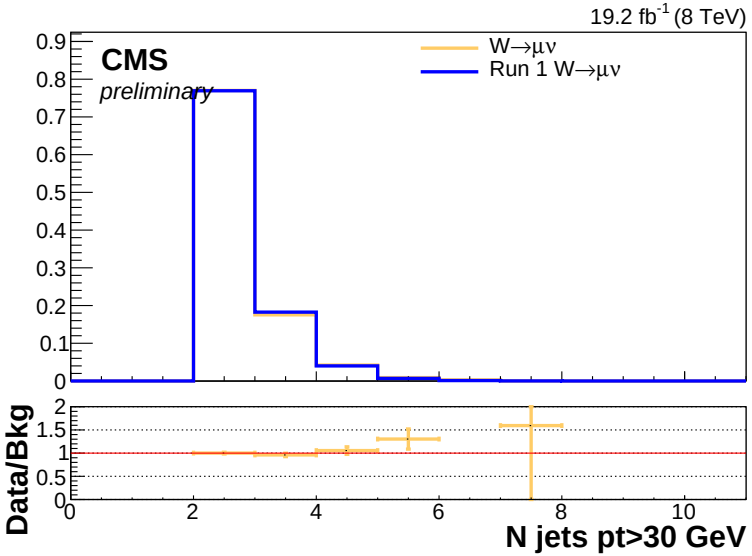
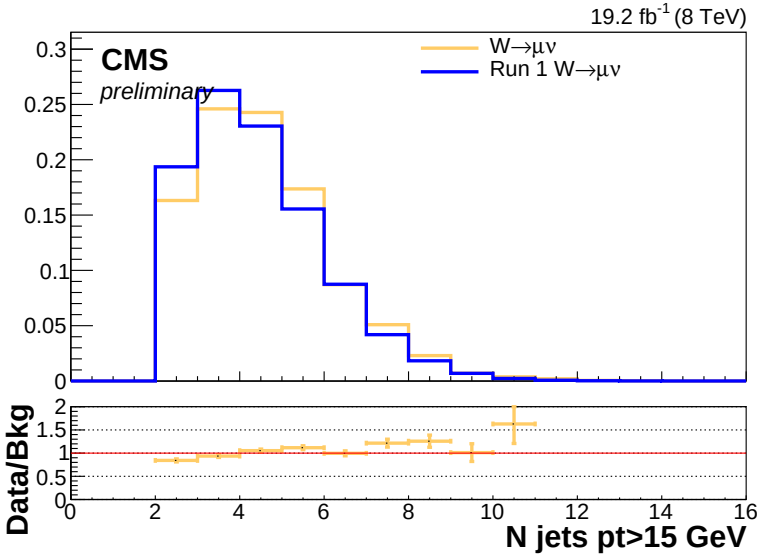
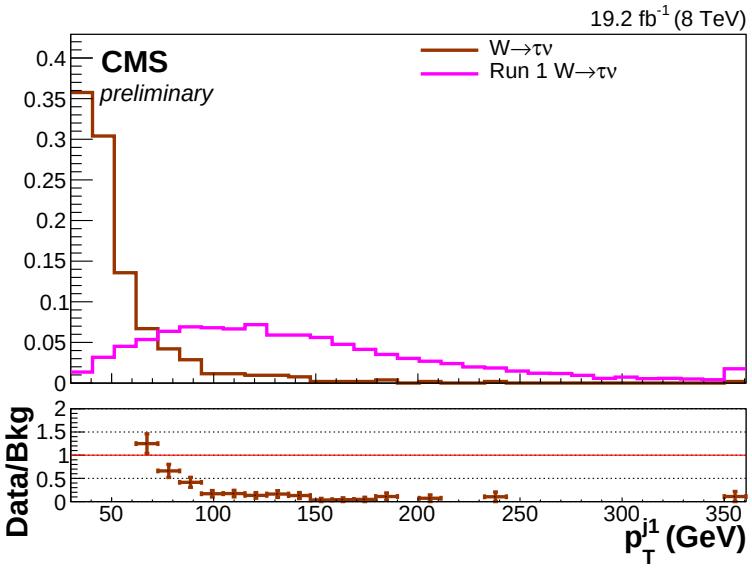
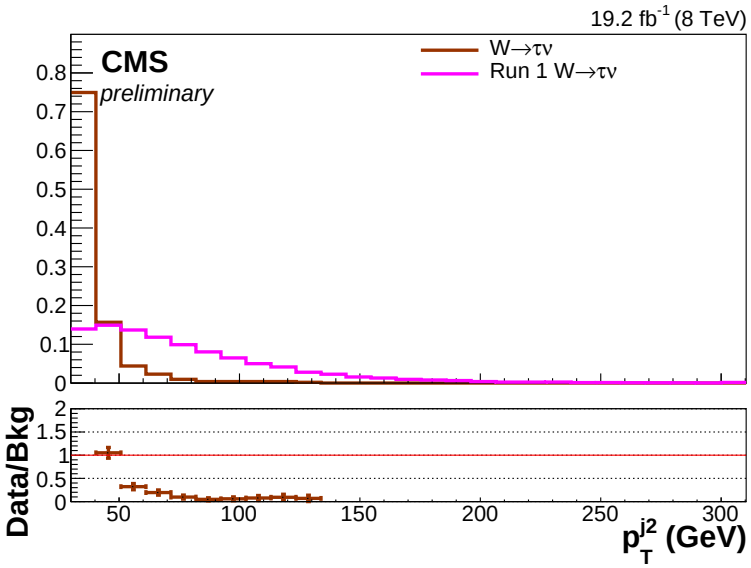
W munu Comparison: run 1 vs run 2: N jets





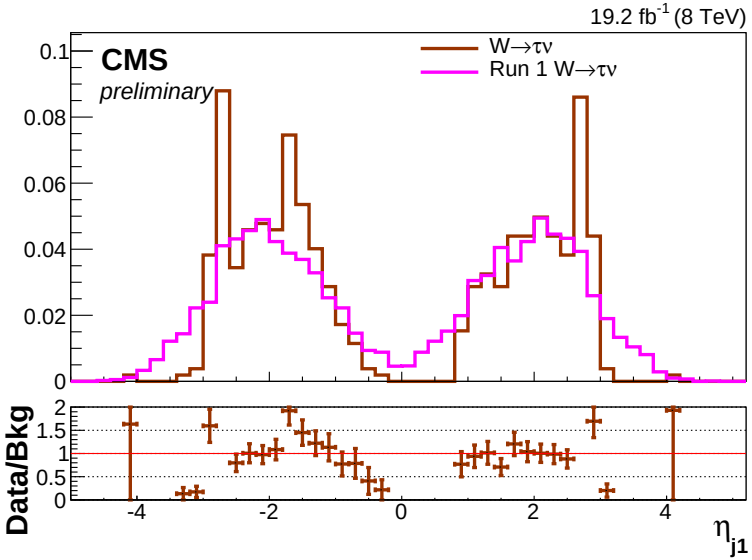
W taunu Comparison: run 1 vs run 2: Jet p_T

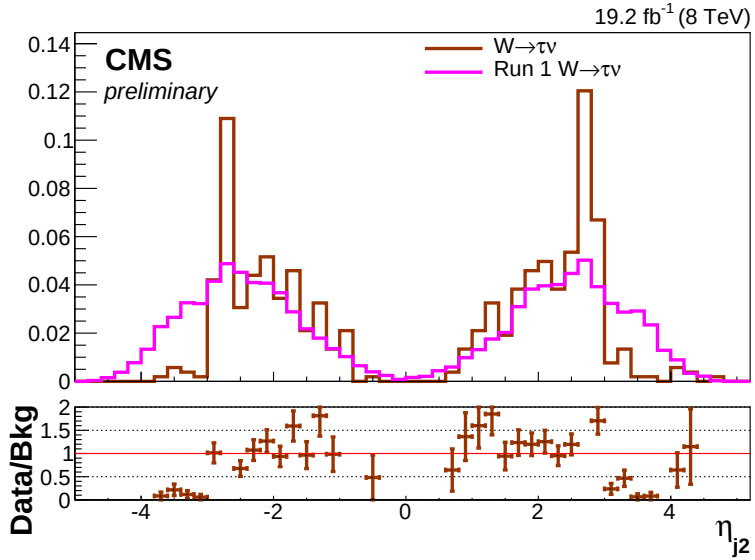




- Same as enu and munu

W taunu Comparison: run 1 vs run 2: Jet η





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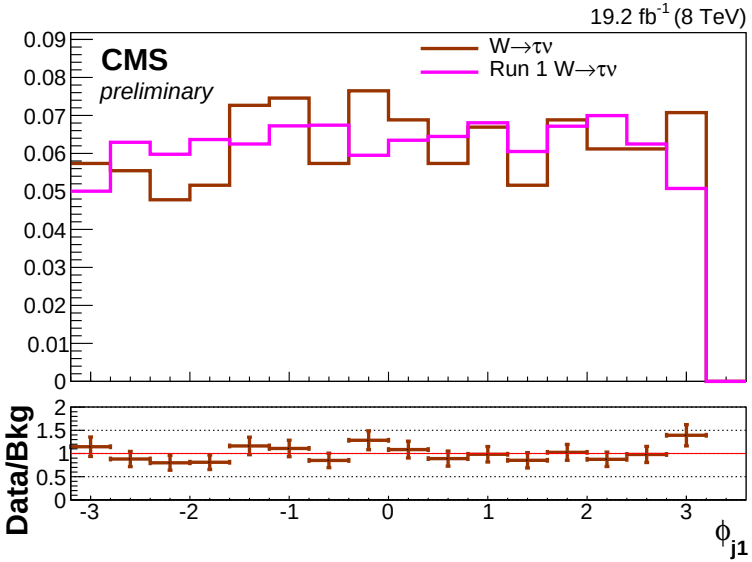
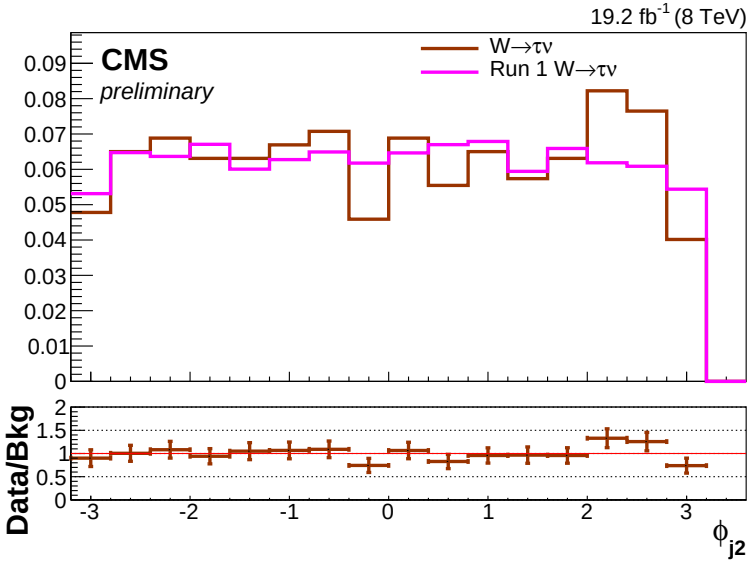
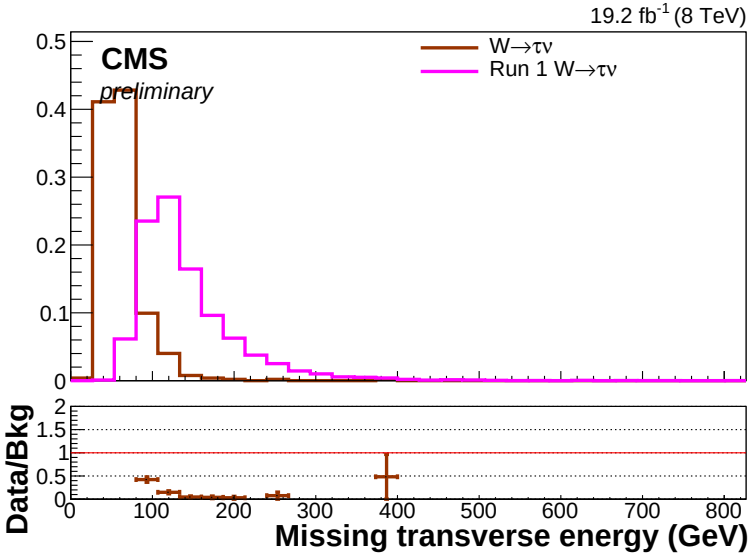
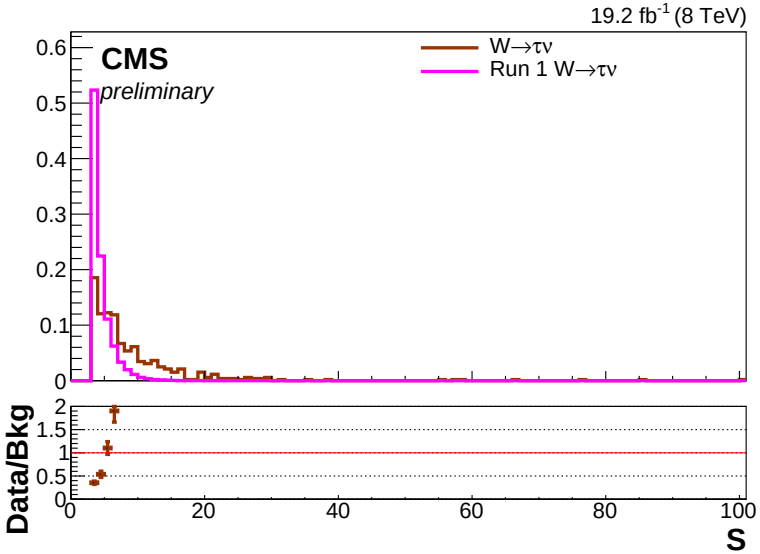




- ϕ distributions look similar within stat error

W taunu Comparison: run 1 vs run 2: Met





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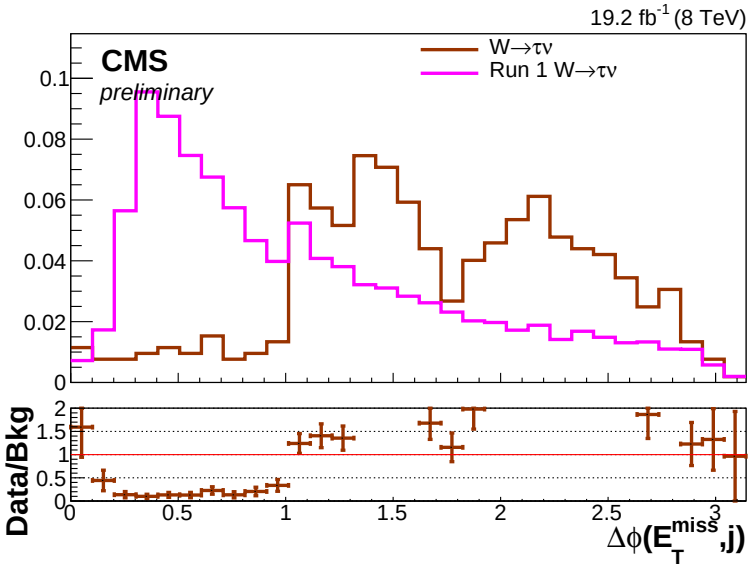
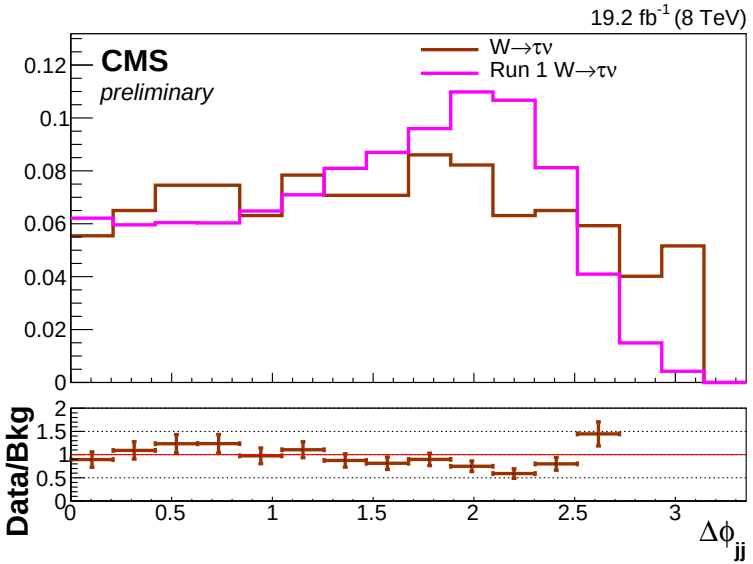
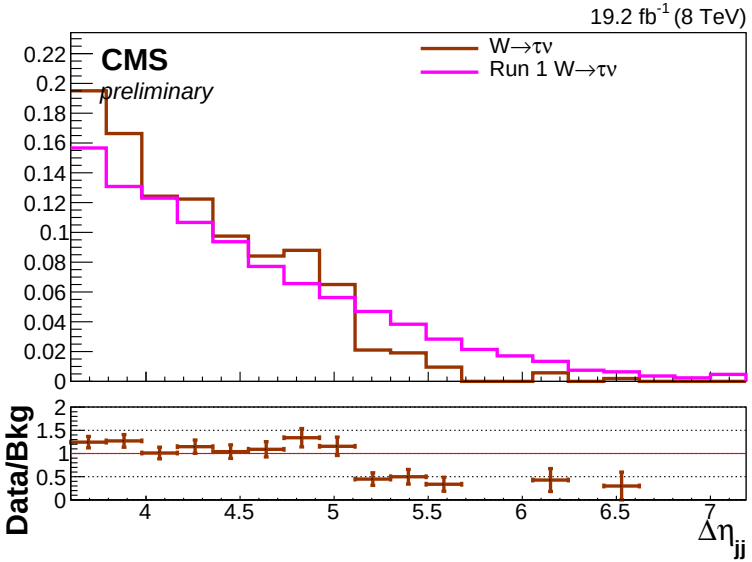
W taunu Comparison: run 1 vs run 2: $\Delta\phi$ variables

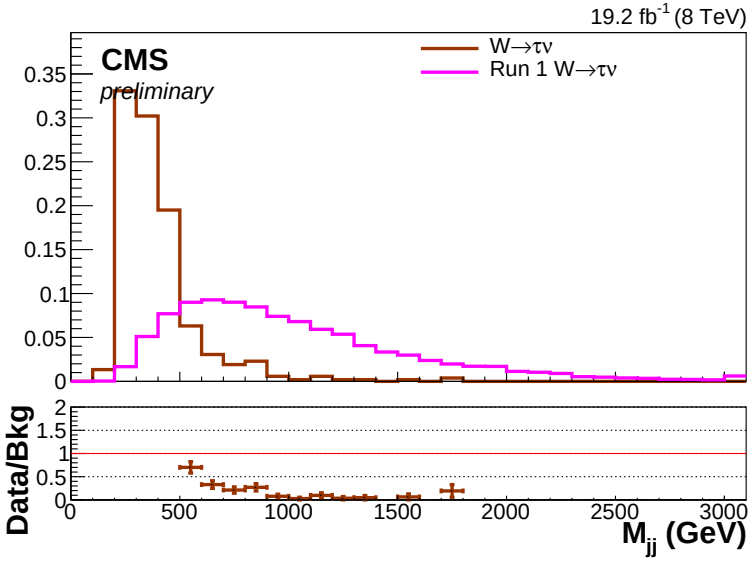




- Step effect in left plot due to cut on leading jets met dphi in tau category

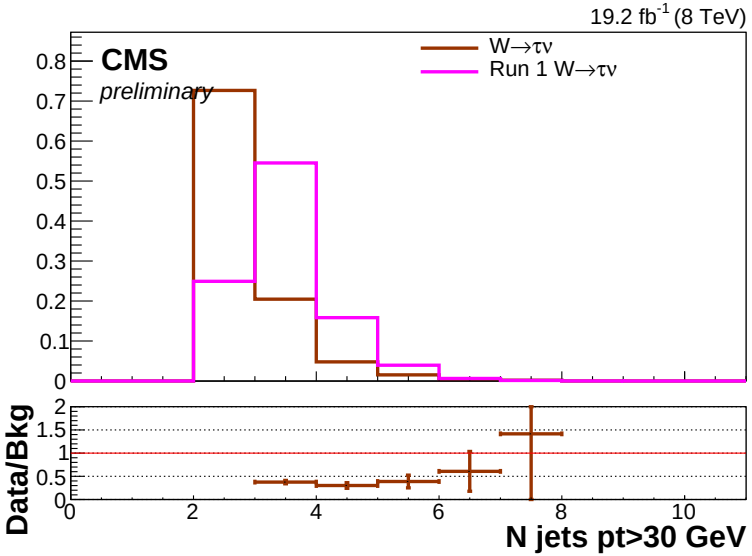
W taunu Comparison: run 1 vs run 2: dijet variables

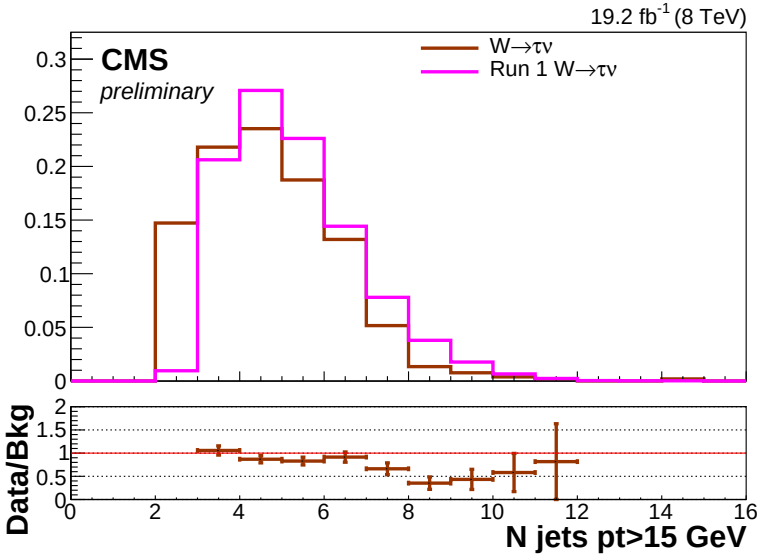




- Could be due to met significance cut

W Comparison: run 1 vs run 2: N jets





Summary

- W control plots produced
- Significant differences seen especially in p_T and MET
  - Could be due to looser cut on MET Sig. due to difference in variable definition from run 1 to run 2
  - Will reproduce old met significance variable to allow direct comparison
- Have installed Scorpion framework for phenomenology work with Bjoern
  - Next step implement $H \rightarrow inv$ analysis in scorpion

Backup