

19.2 fb<sup>-1</sup> (8 TeV)

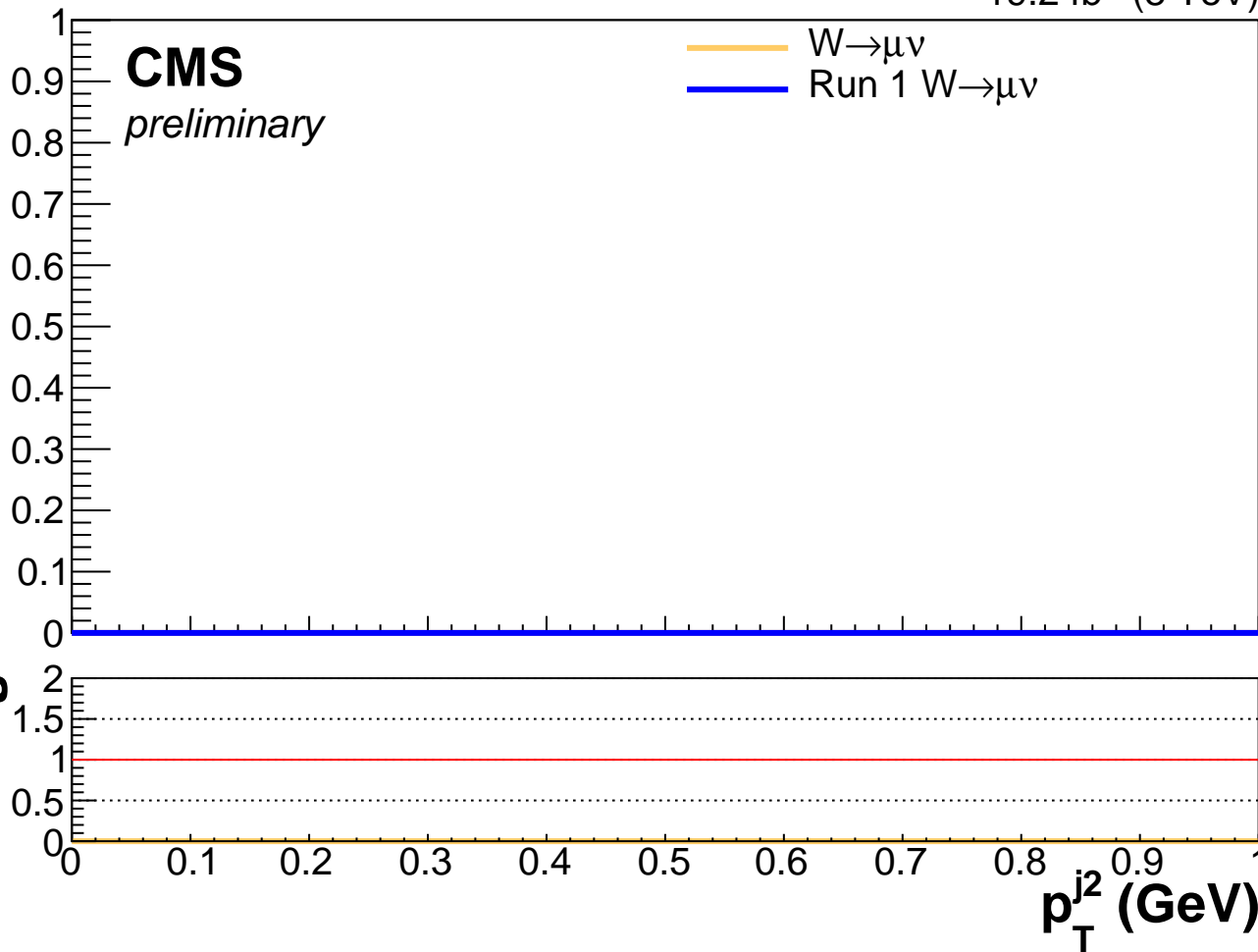
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

$p_T^{j2}$  (GeV)



19.2 fb<sup>-1</sup> (8 TeV)

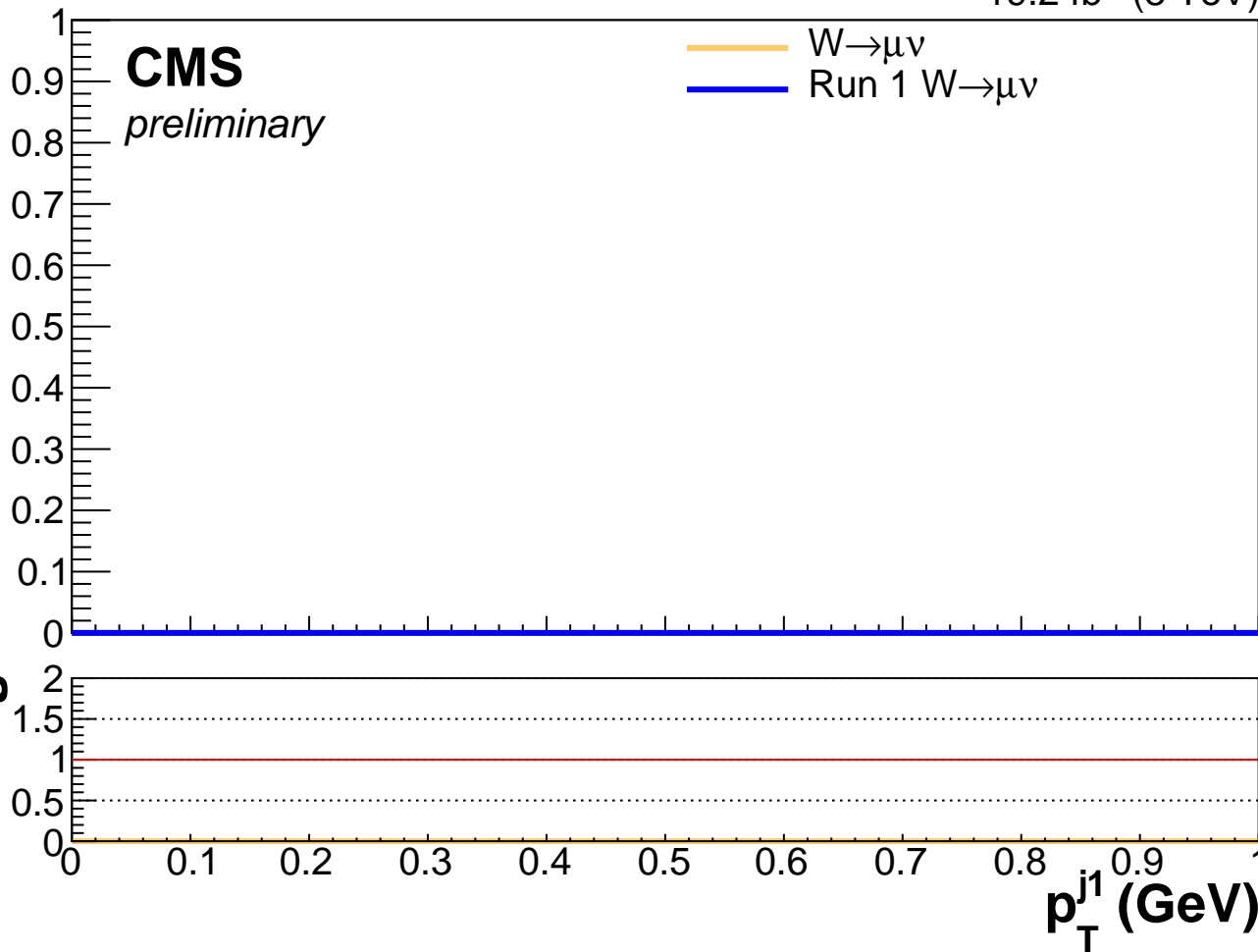
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

$p_T^{j1}$  (GeV)



19.2 fb<sup>-1</sup> (8 TeV)

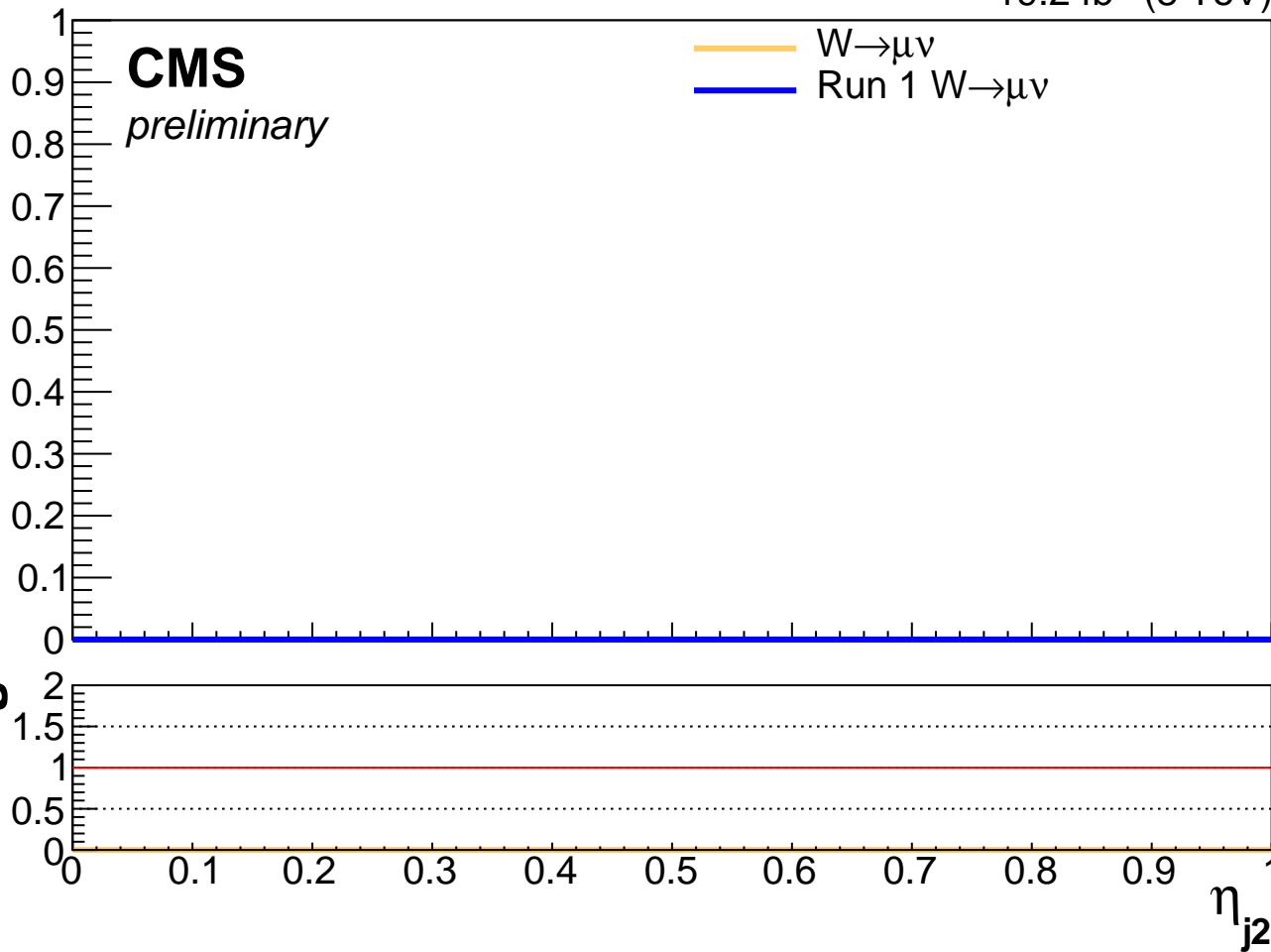
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

$\eta_{j2}$



19.2 fb<sup>-1</sup> (8 TeV)

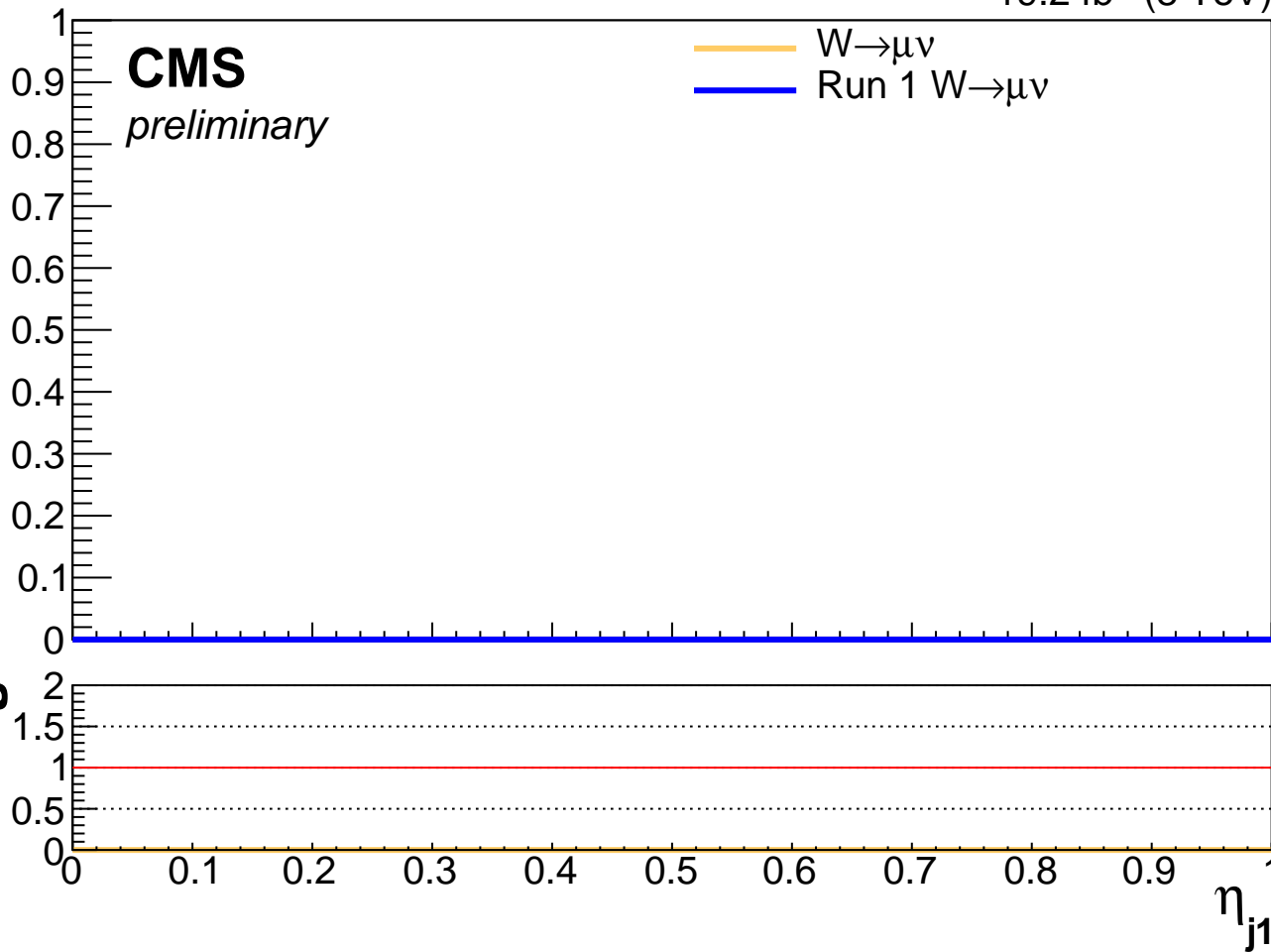
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

$\eta_{j1}$



19.2 fb<sup>-1</sup> (8 TeV)

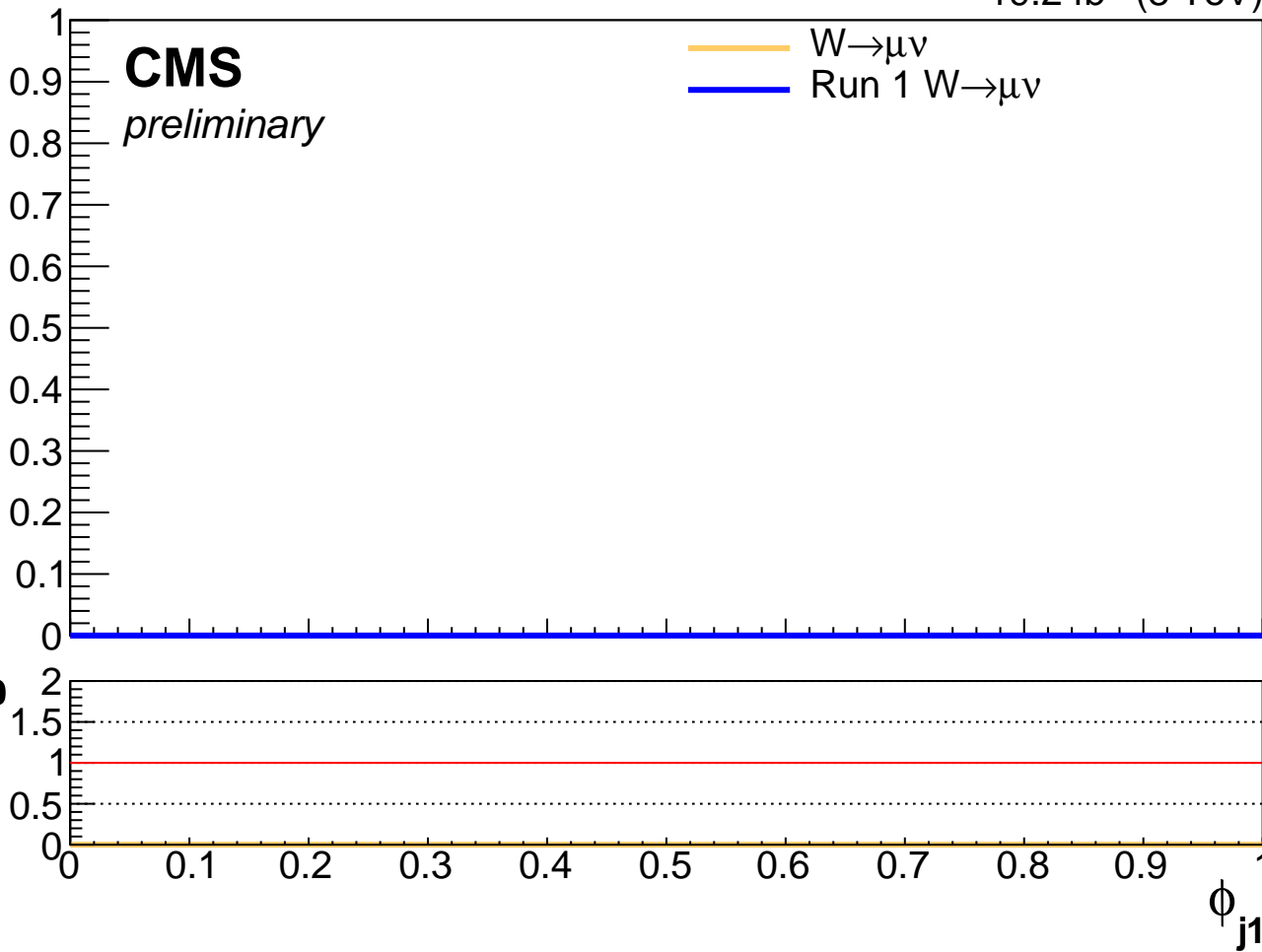
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

$\phi_{j1}$



19.2 fb<sup>-1</sup> (8 TeV)

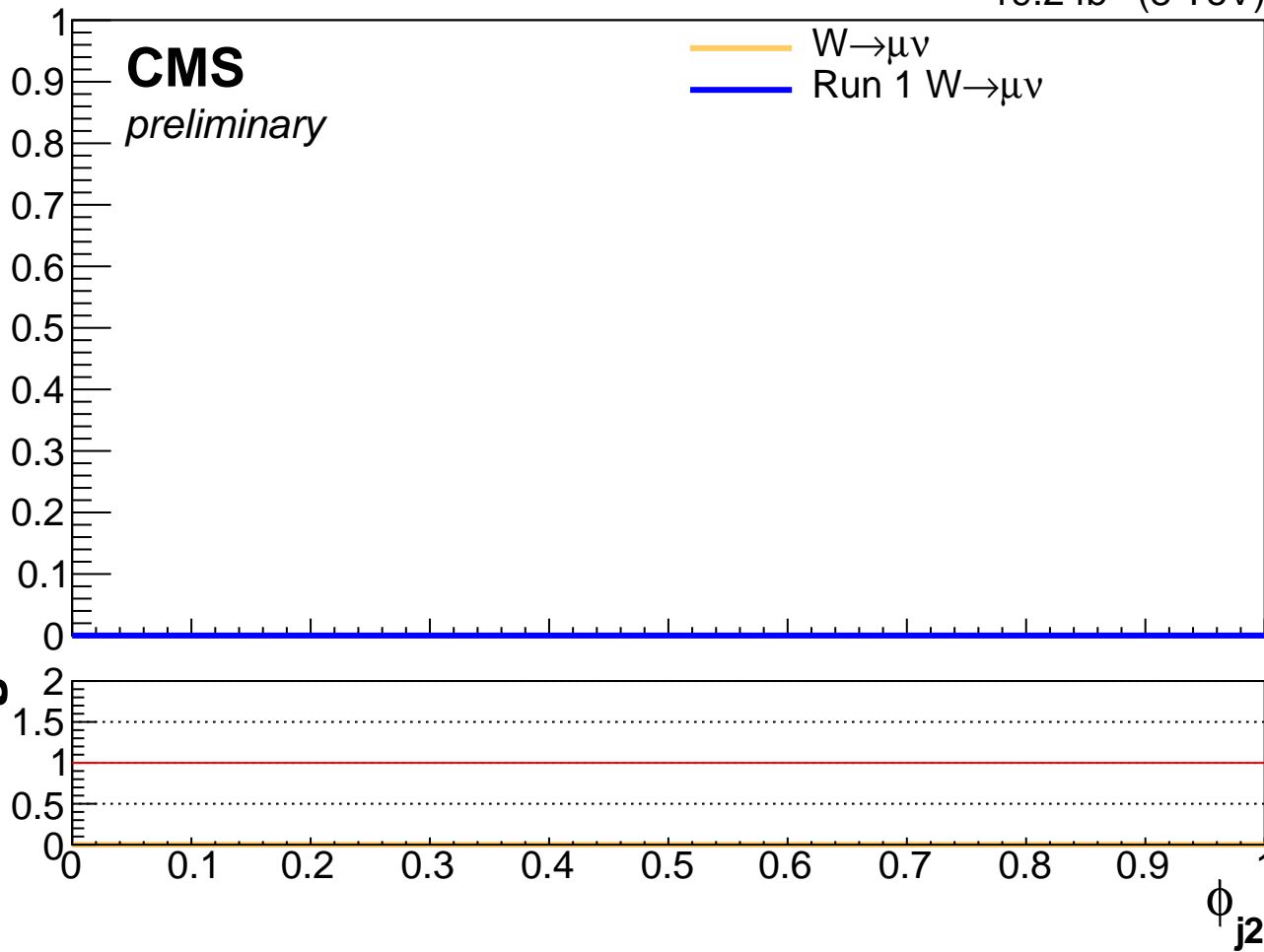
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

$\phi_{j2}$



19.2 fb<sup>-1</sup> (8 TeV)

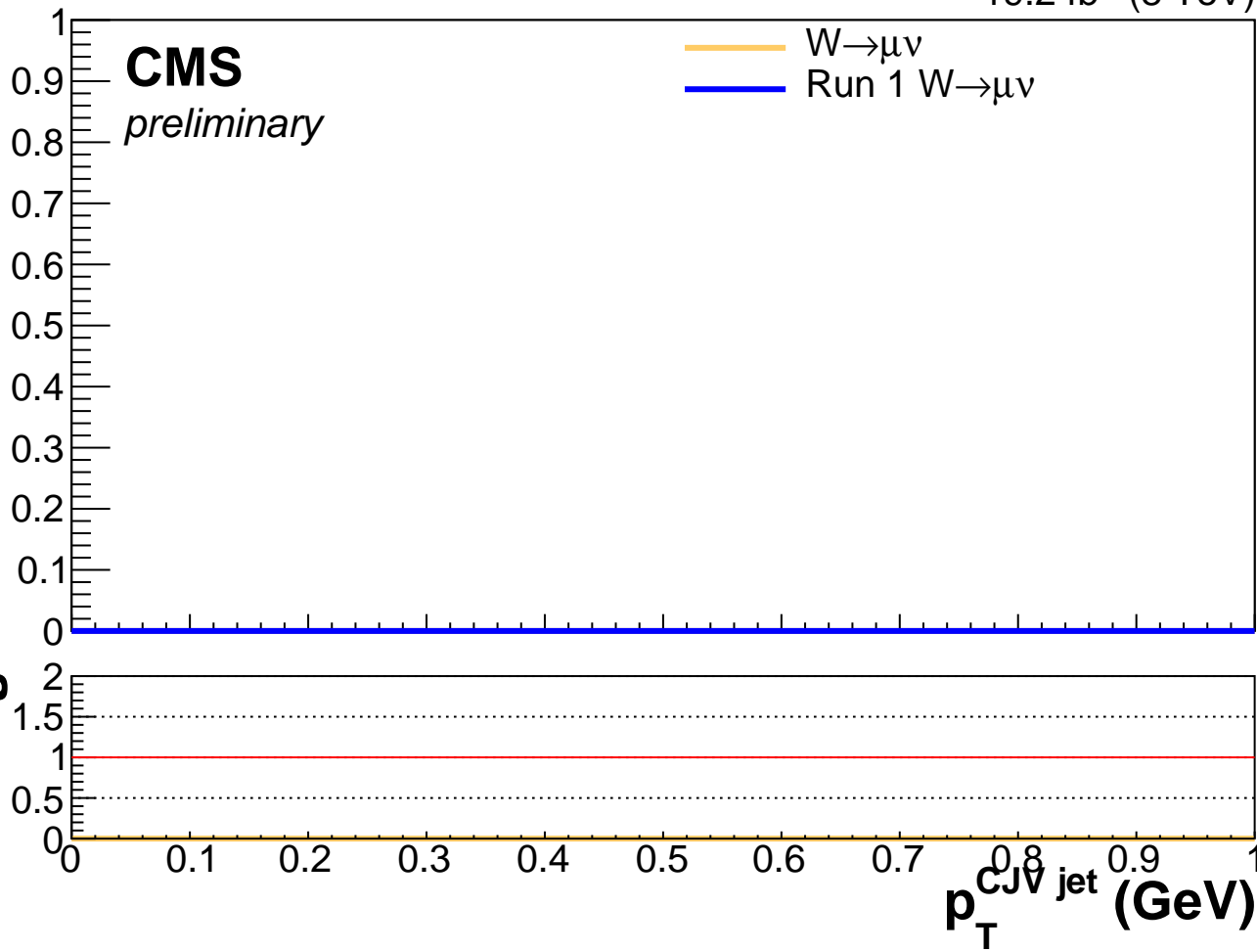
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

$p_{\text{T}}^{\text{CJ, jet}}$  (GeV)



19.2 fb<sup>-1</sup> (8 TeV)

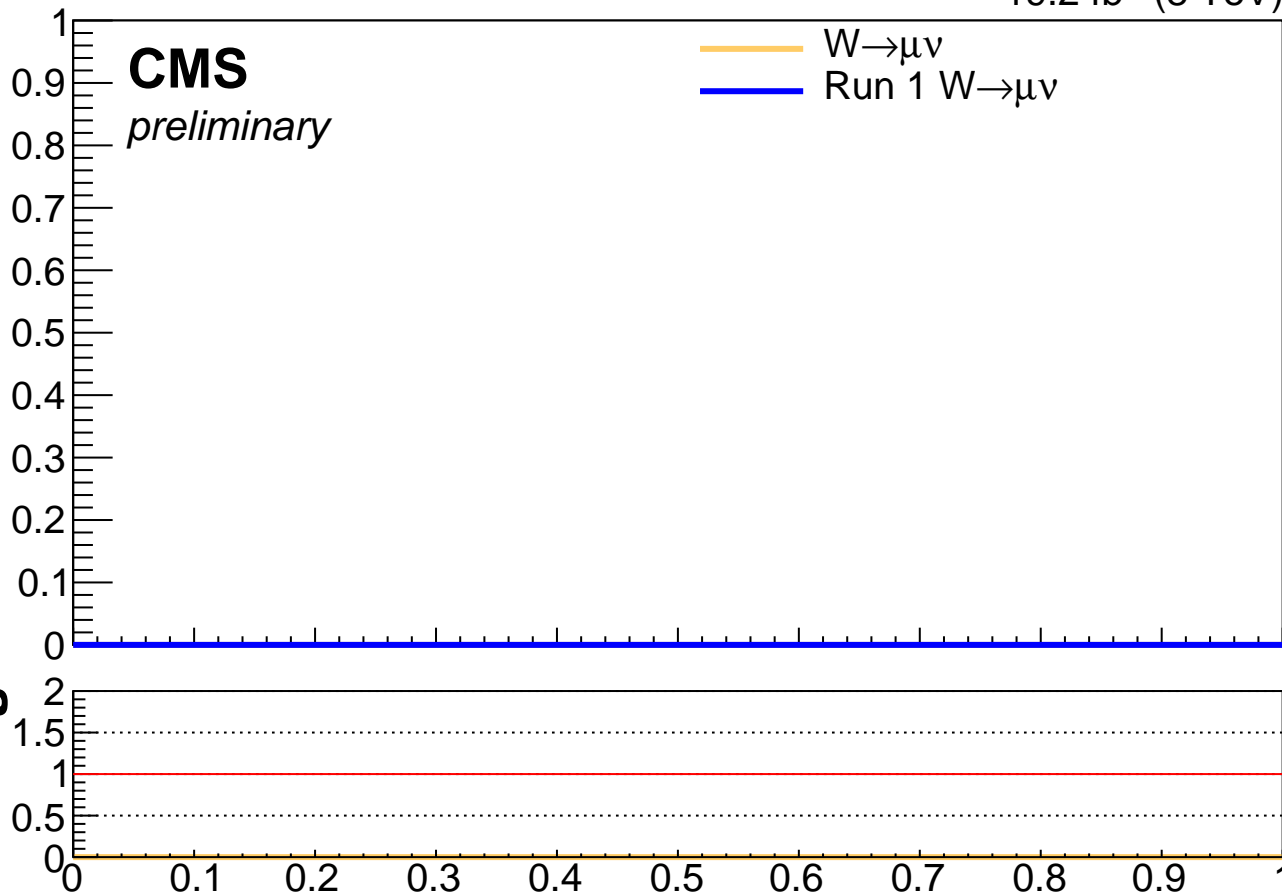
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**Missing transverse energy (GeV)**





19.2 fb<sup>-1</sup> (8 TeV)

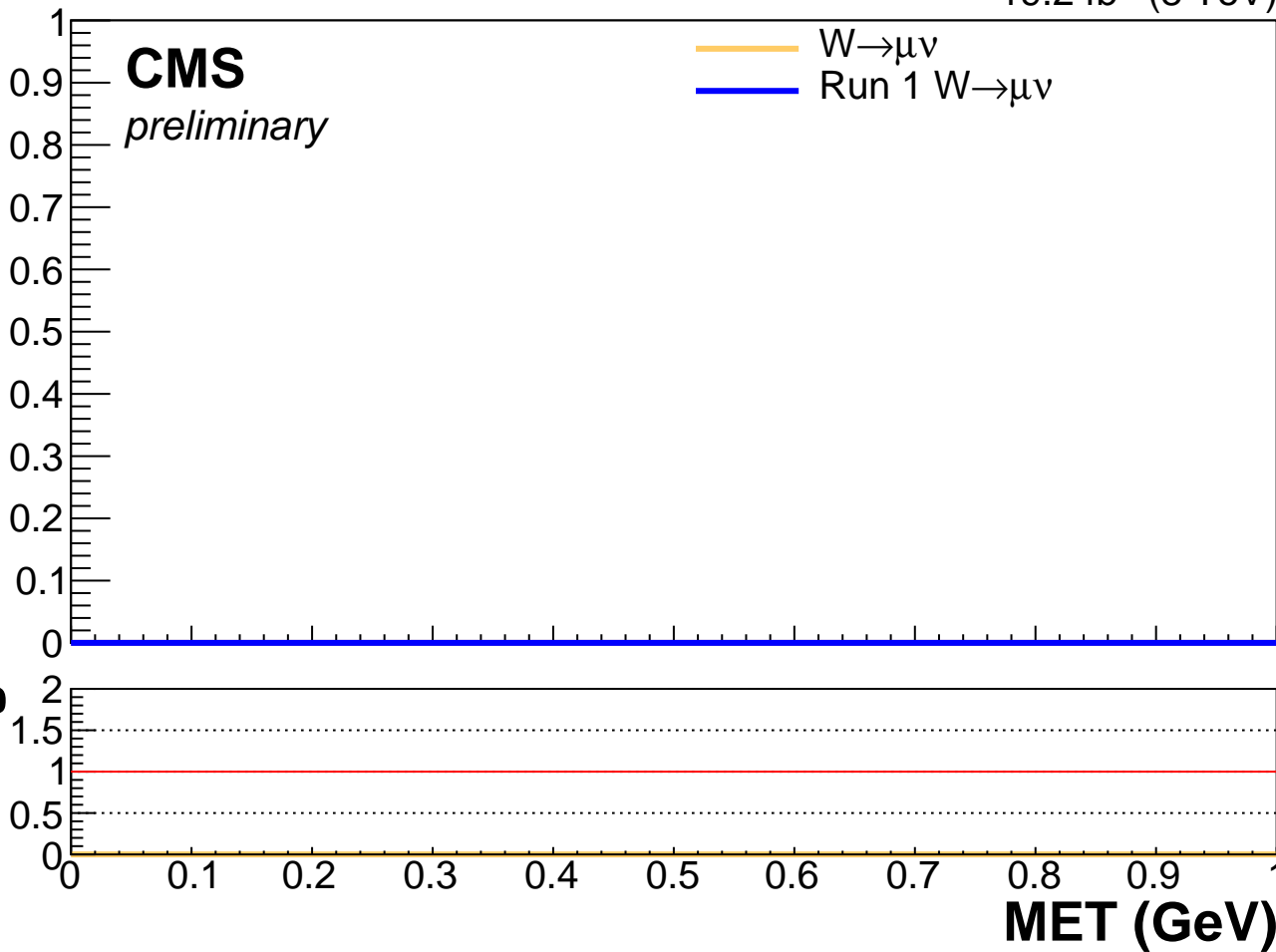
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**MET (GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

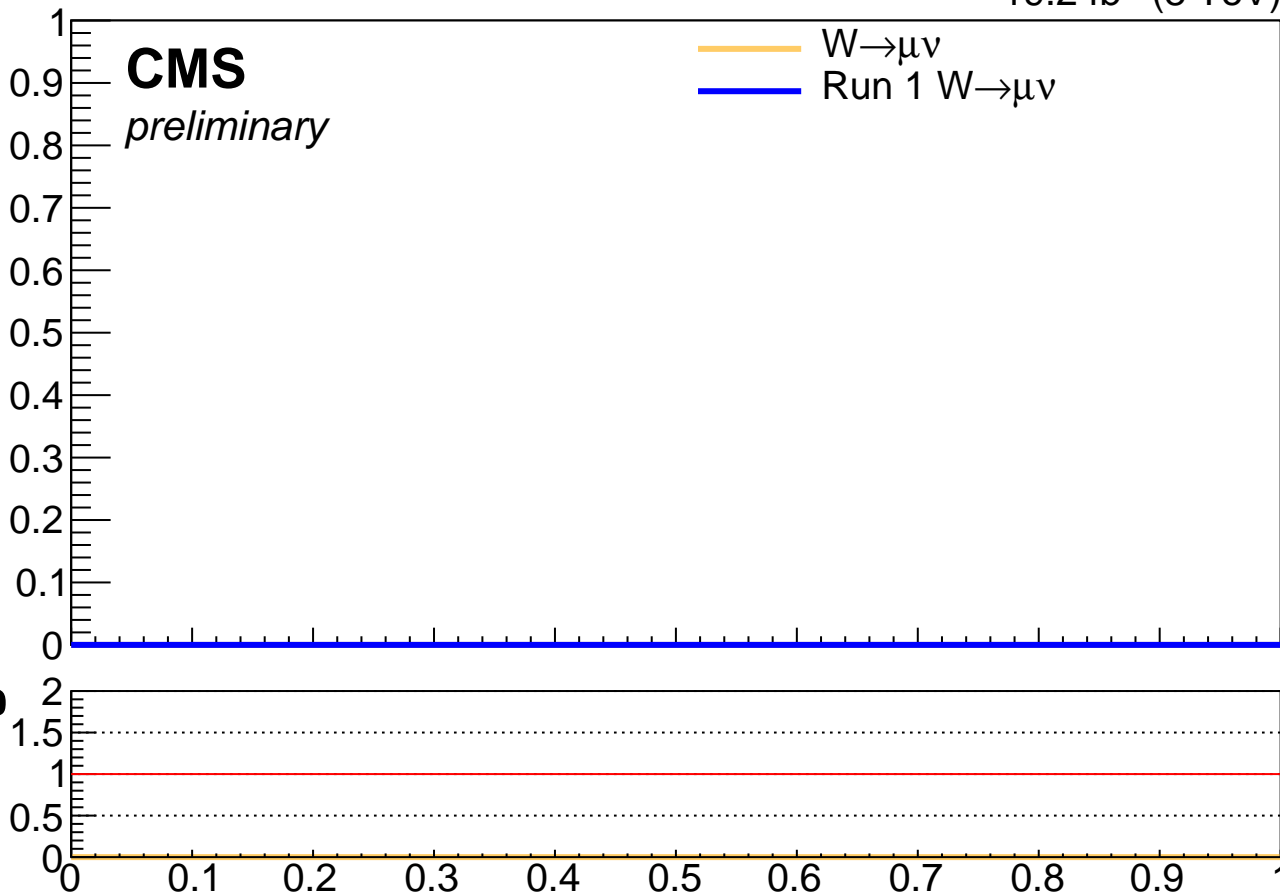
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**L1MET (GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

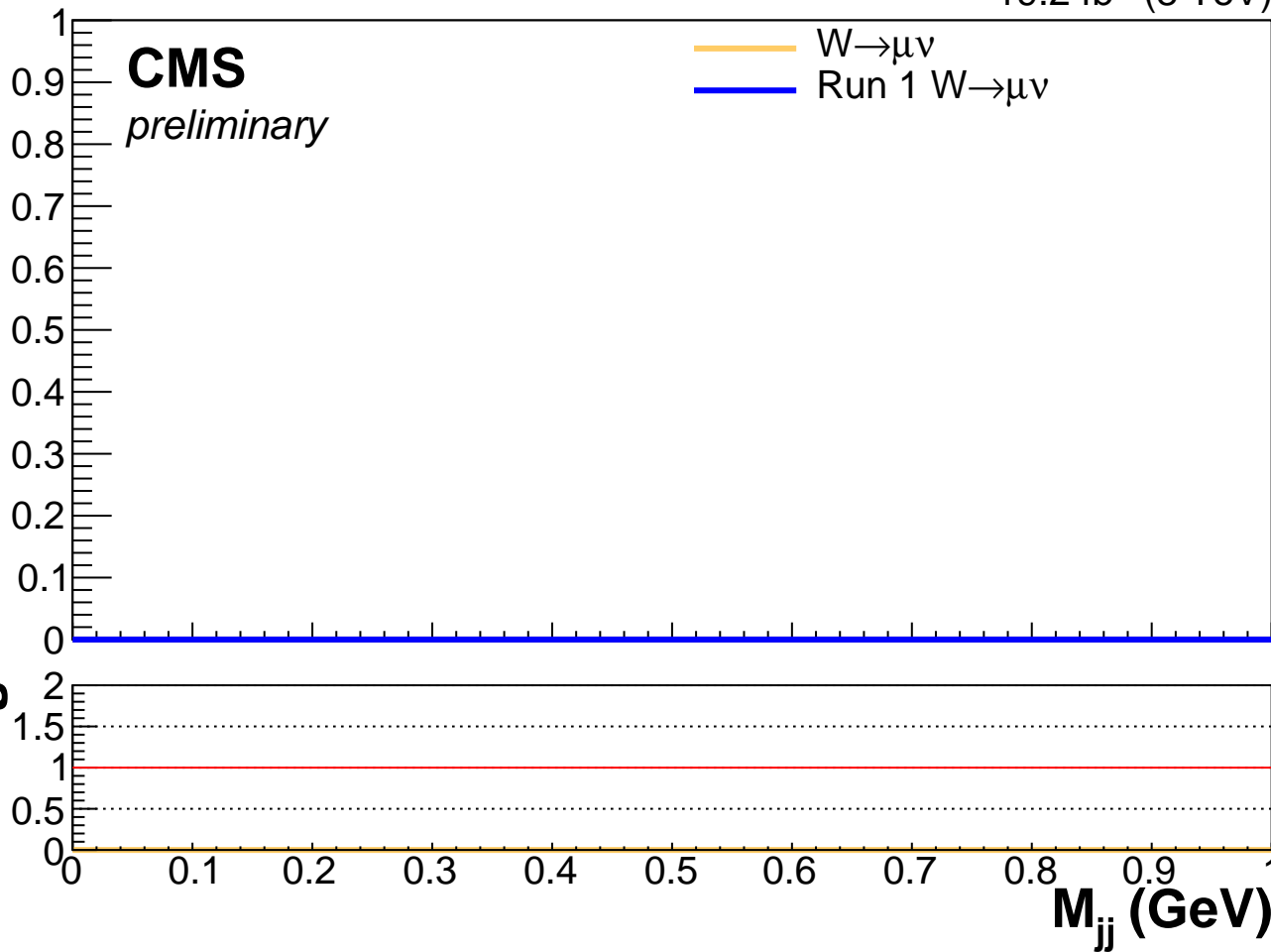
**CMS**

*preliminary*

—  $W \rightarrow \mu\nu$   
— Run 1  $W \rightarrow \mu\nu$

**Data/Bkg**

**$M_{jj}$  (GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

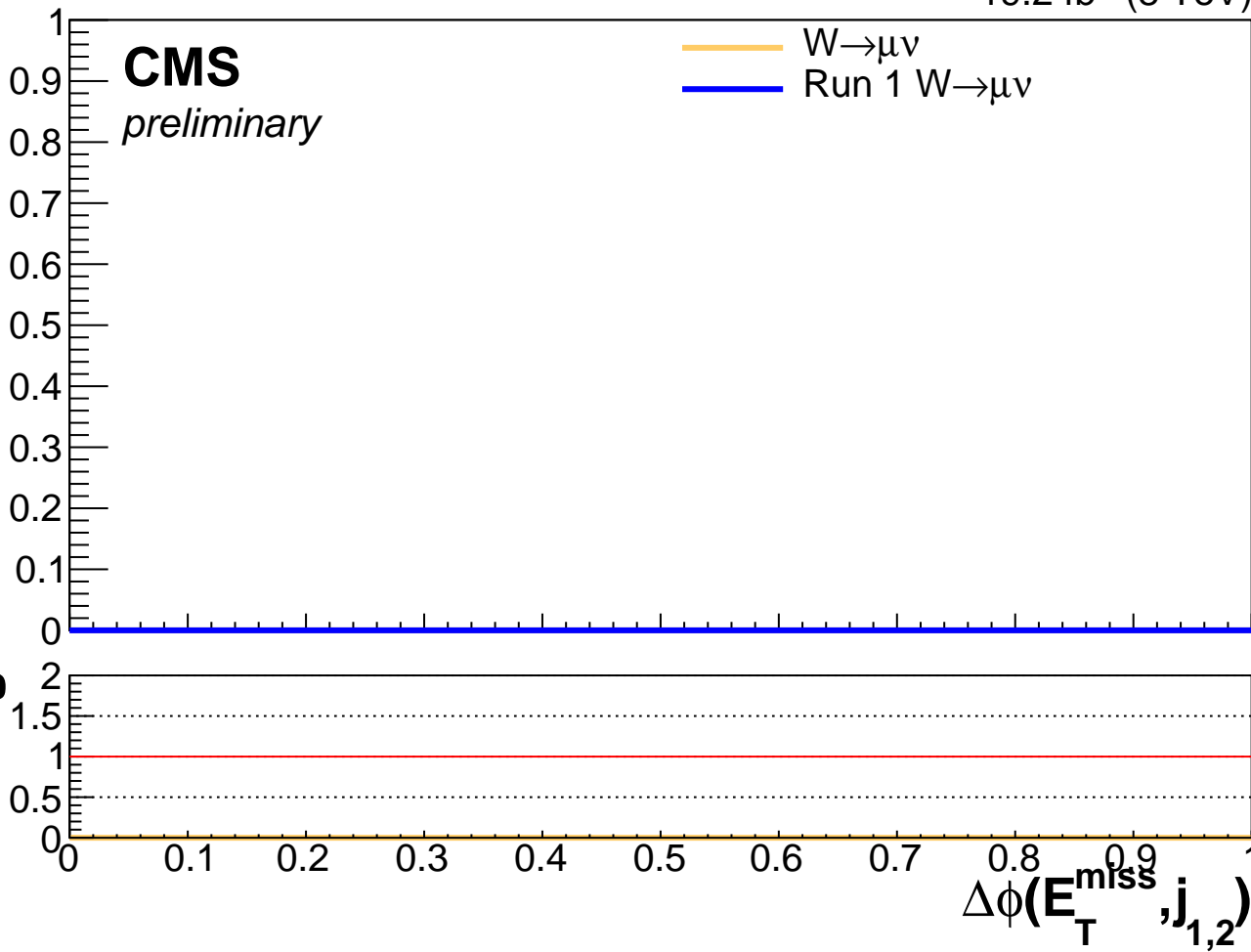
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

$\Delta\phi(E_T^{\text{miss}}, j_{1,2})$



19.2 fb<sup>-1</sup> (8 TeV)

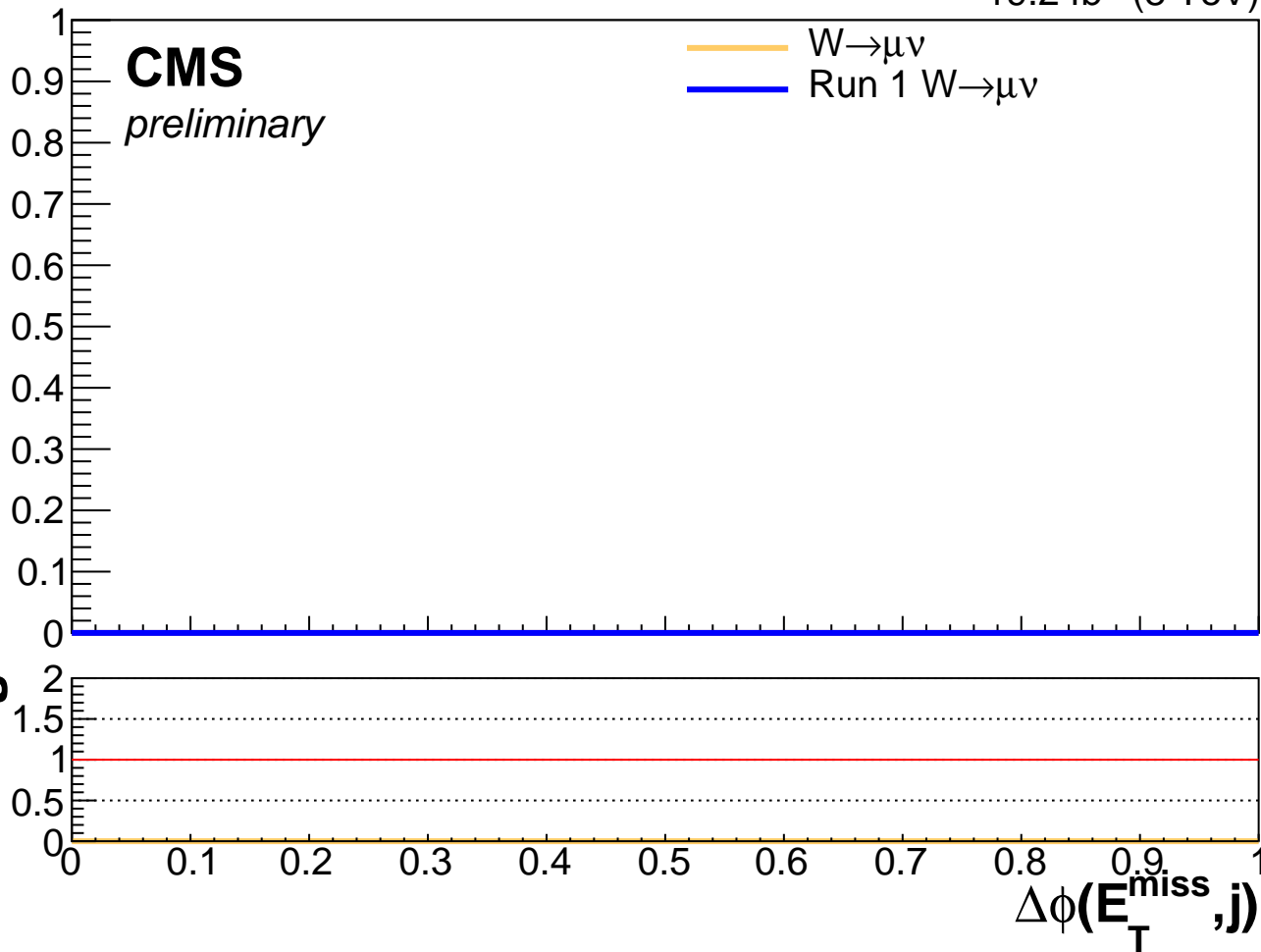
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

$\Delta\phi(\mathbf{E}_T^{\text{miss}}, \mathbf{j})$



19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

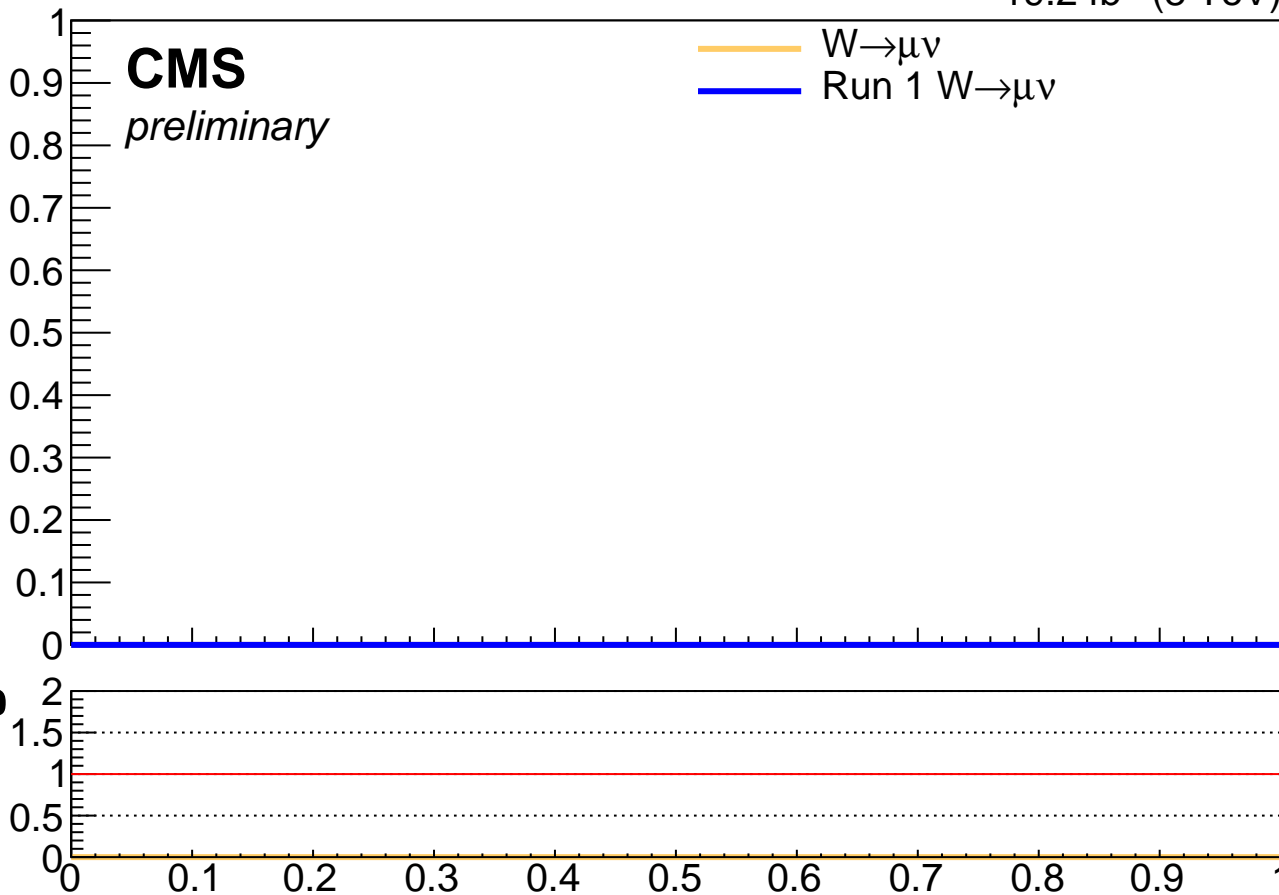
*preliminary*

—  $W \rightarrow \mu \nu$

— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**S**



19.2 fb<sup>-1</sup> (8 TeV)

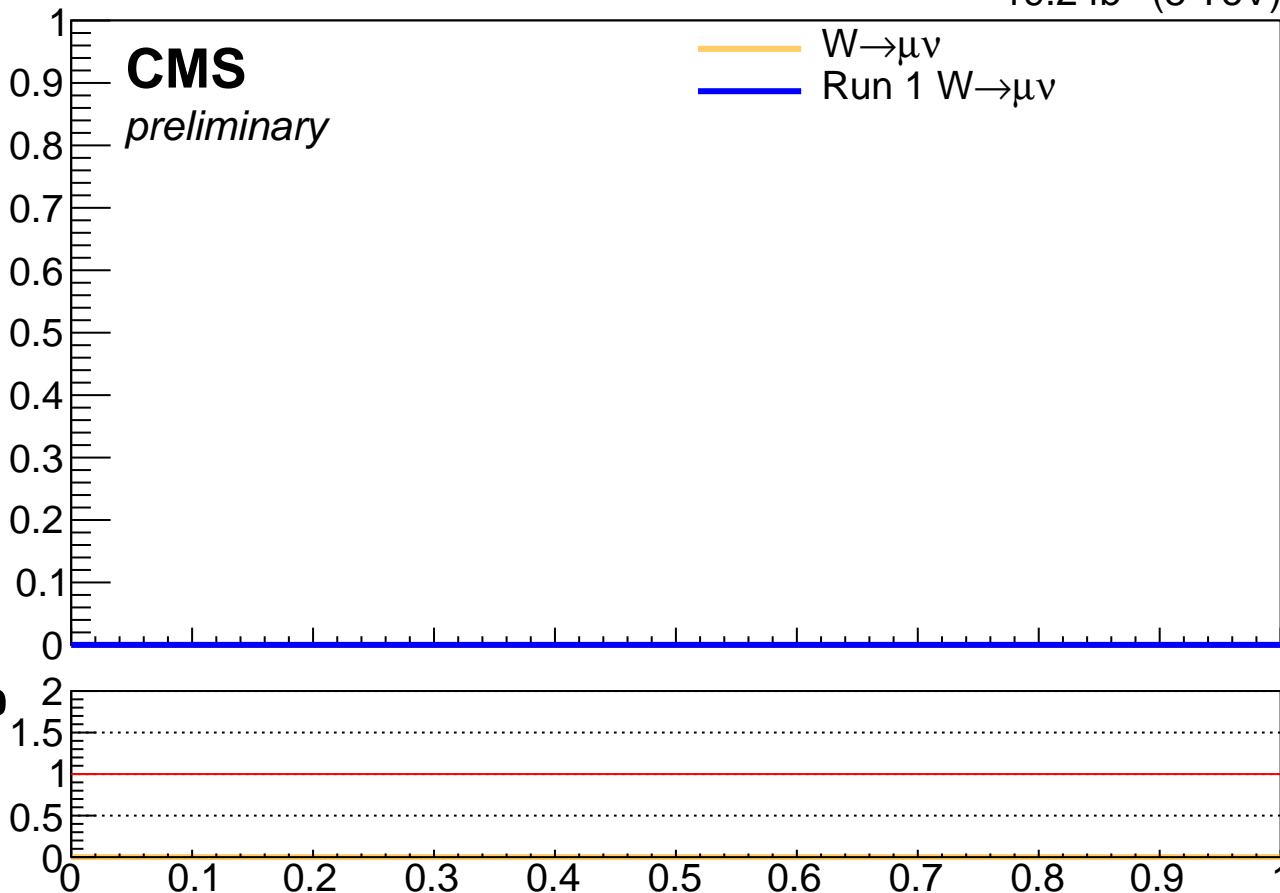
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**Run 1 S**



19.2 fb<sup>-1</sup> (8 TeV)

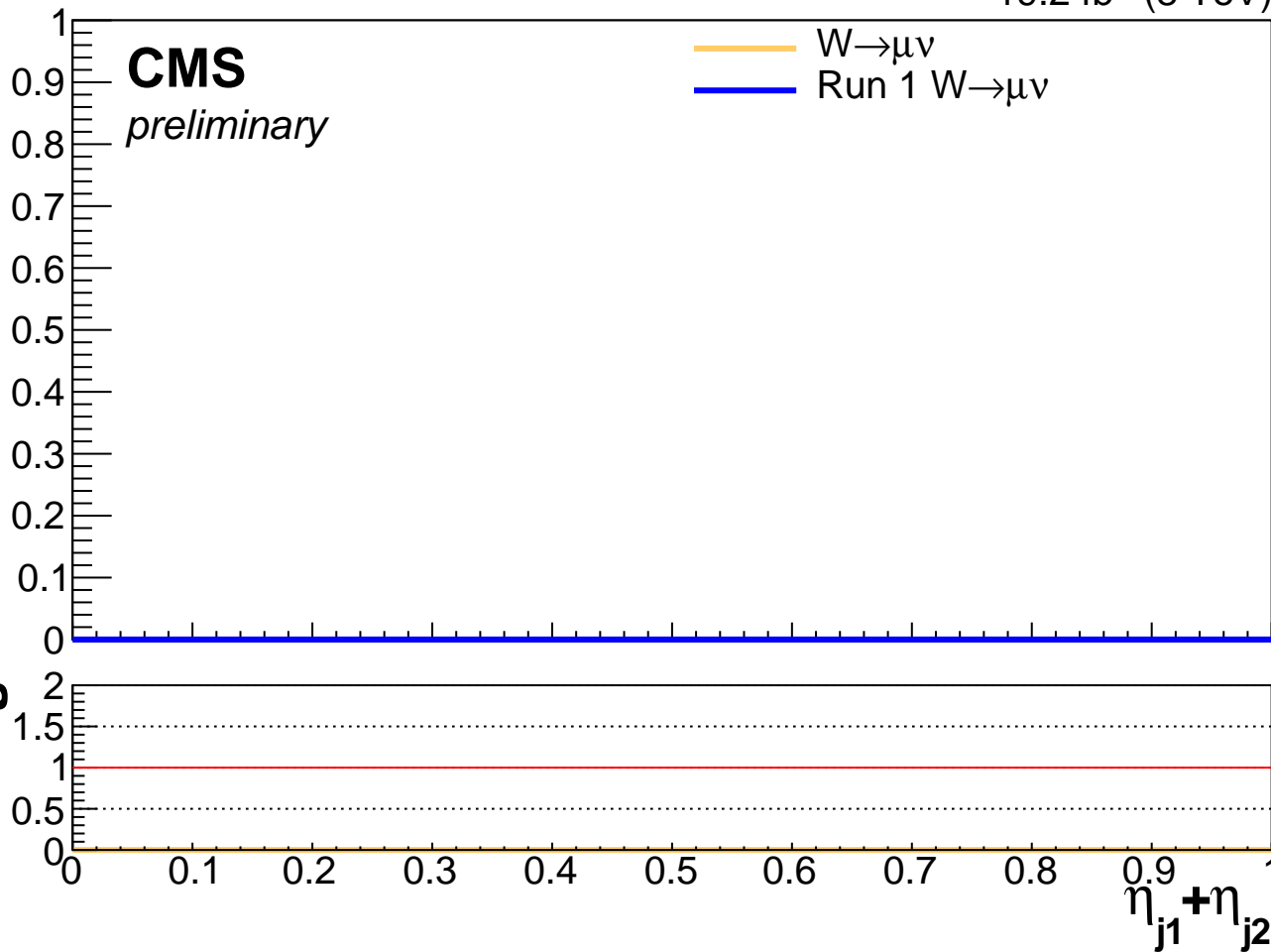
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

$\eta_{j1} + \eta_{j2}$





19.2 fb<sup>-1</sup> (8 TeV)

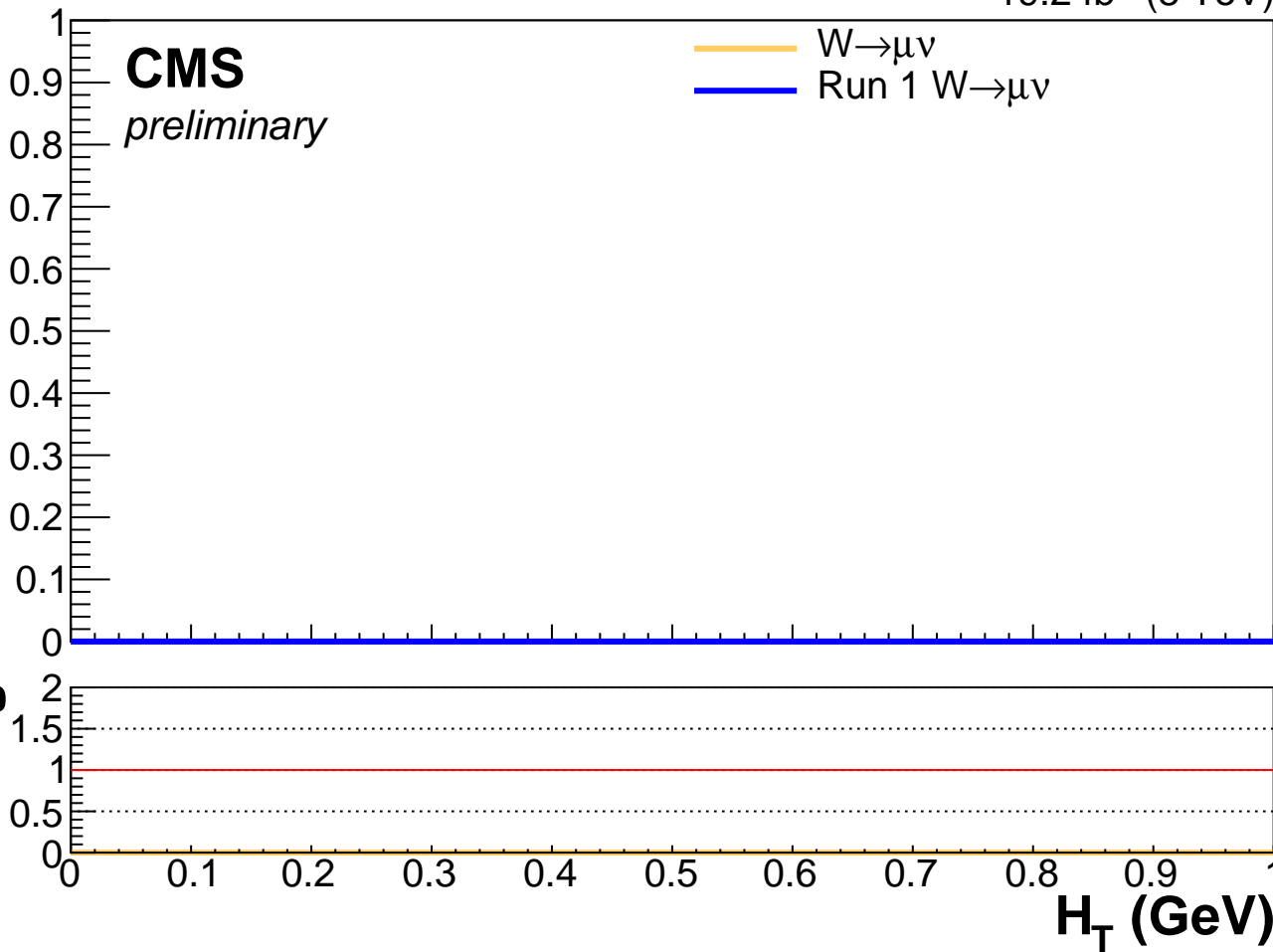
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**H<sub>T</sub> (GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

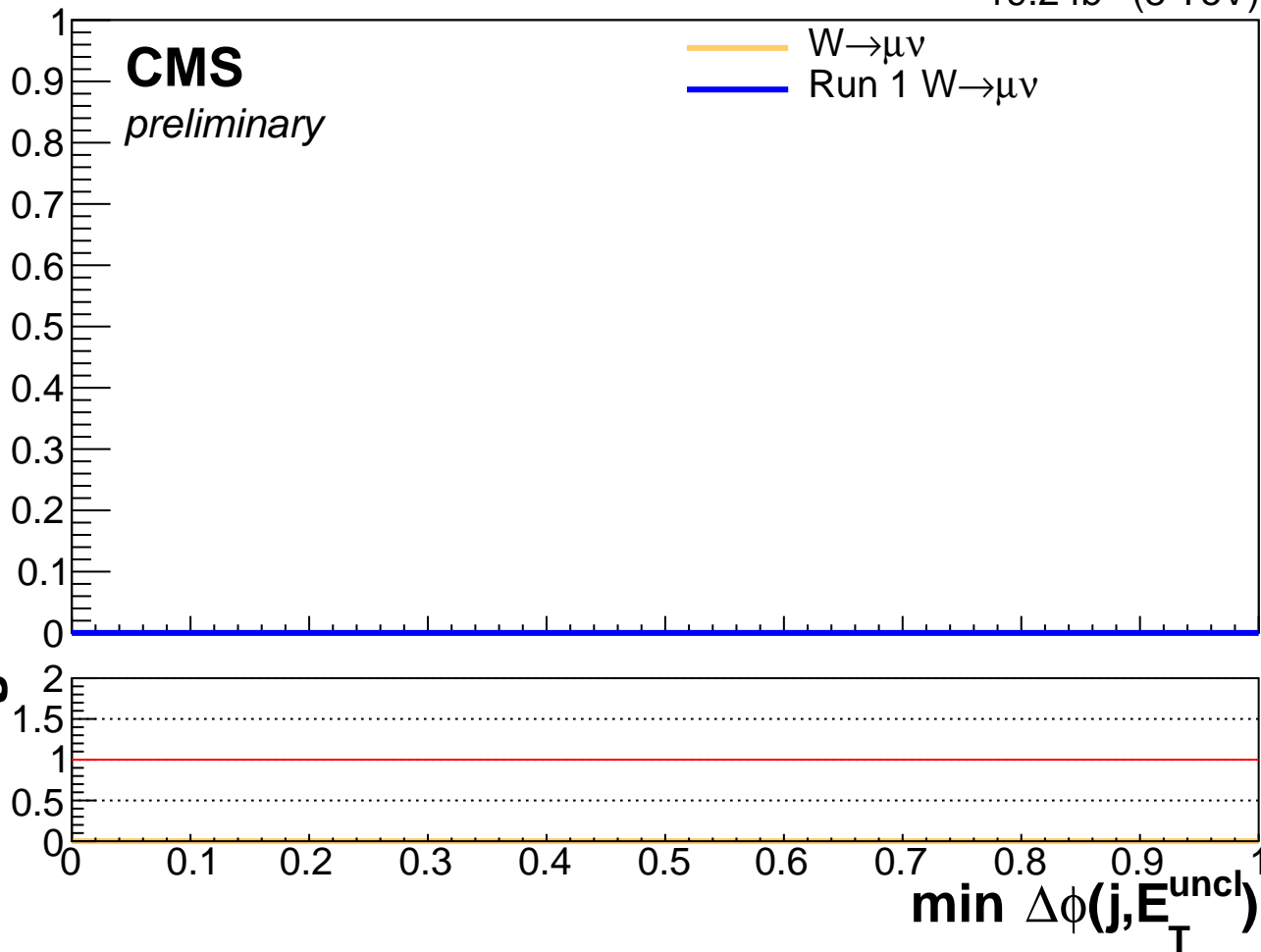
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**min  $\Delta\phi(j, E_T^{\text{uncl}})$**



19.2 fb<sup>-1</sup> (8 TeV)

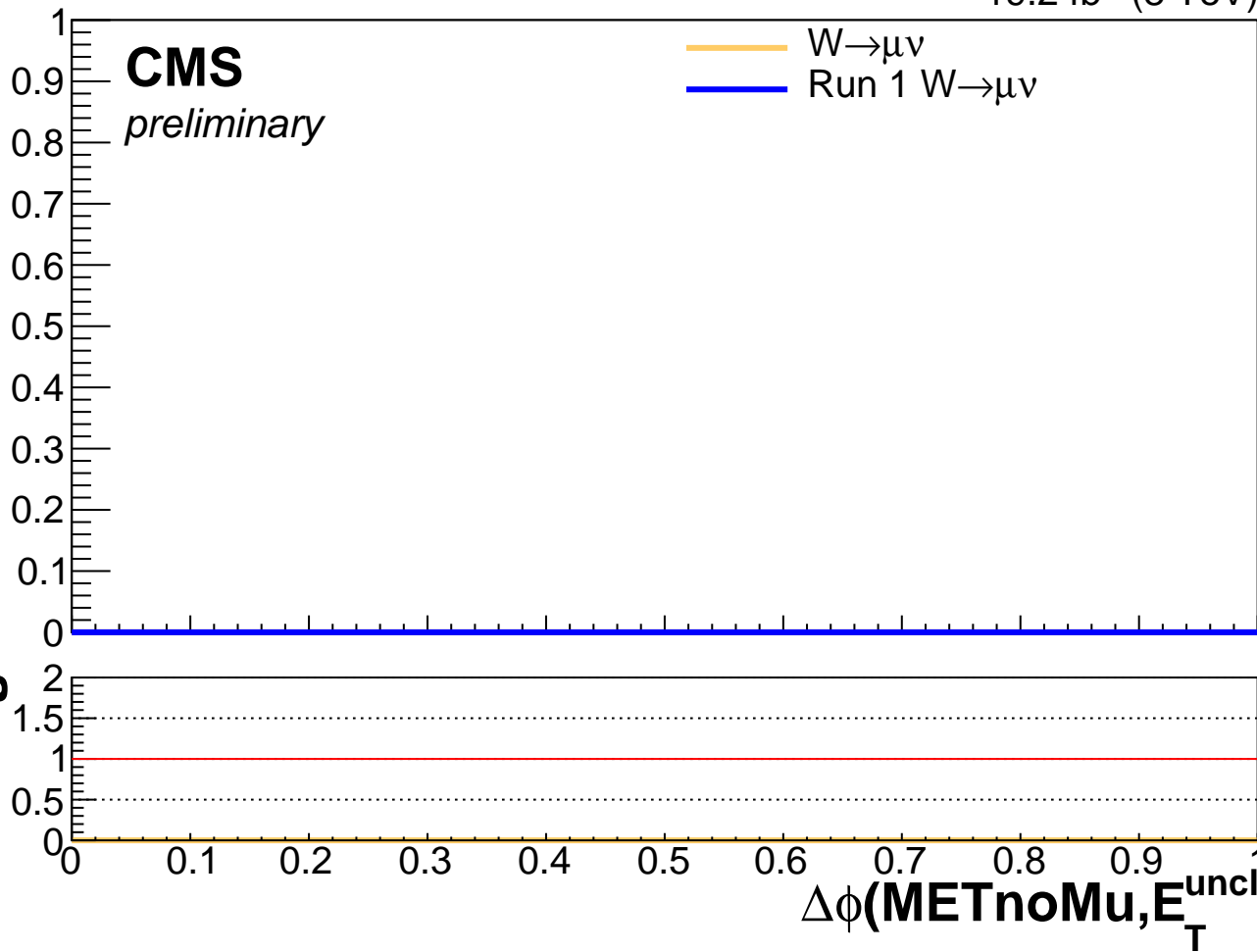
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

$\Delta\phi(\text{METnoMu}, E_T^{\text{uncl}})$



19.2 fb<sup>-1</sup> (8 TeV)

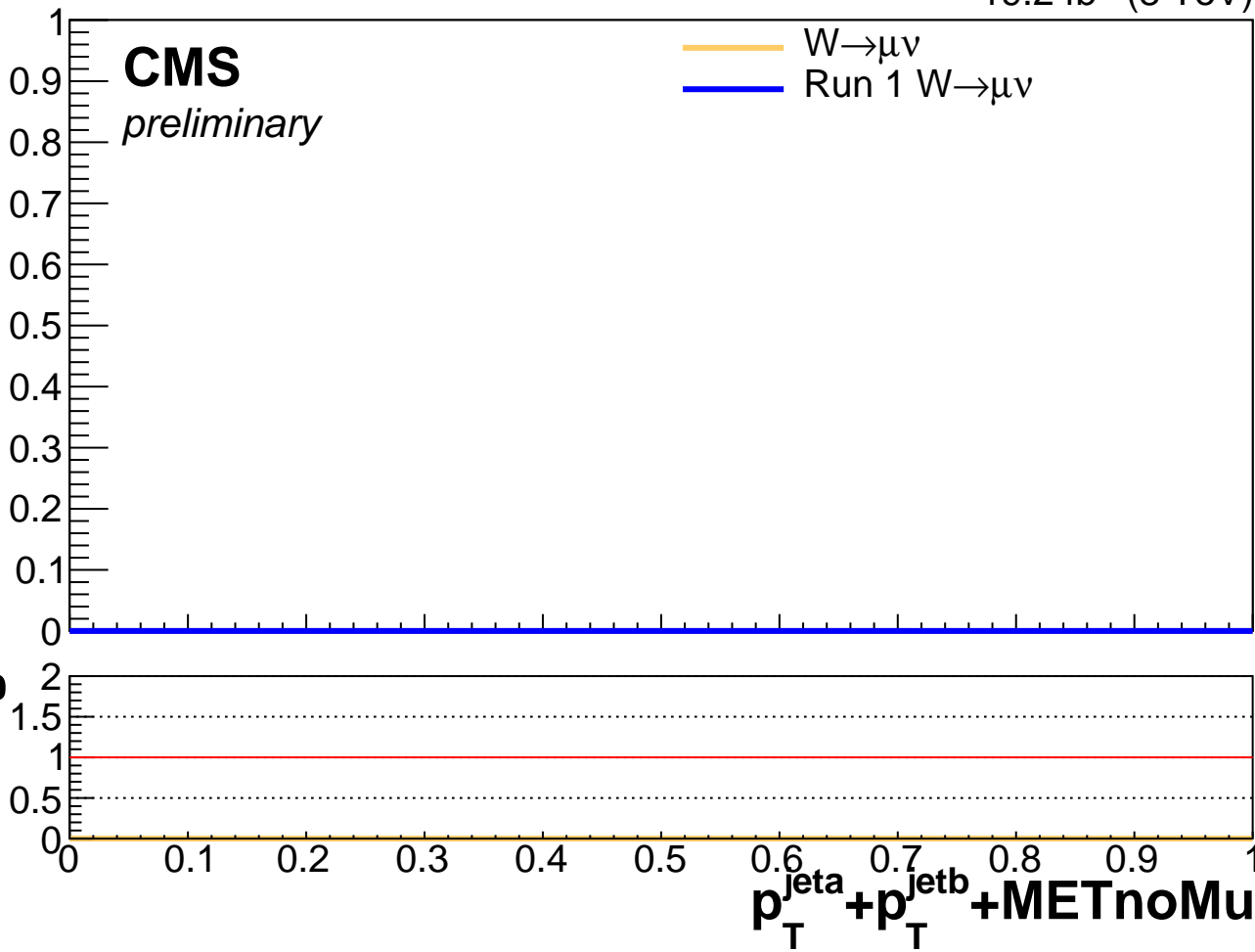
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**$p_T^{\text{jeta}} + p_T^{\text{jetb}} + \text{MET}_{\text{noMu}}$**



19.2 fb<sup>-1</sup> (8 TeV)

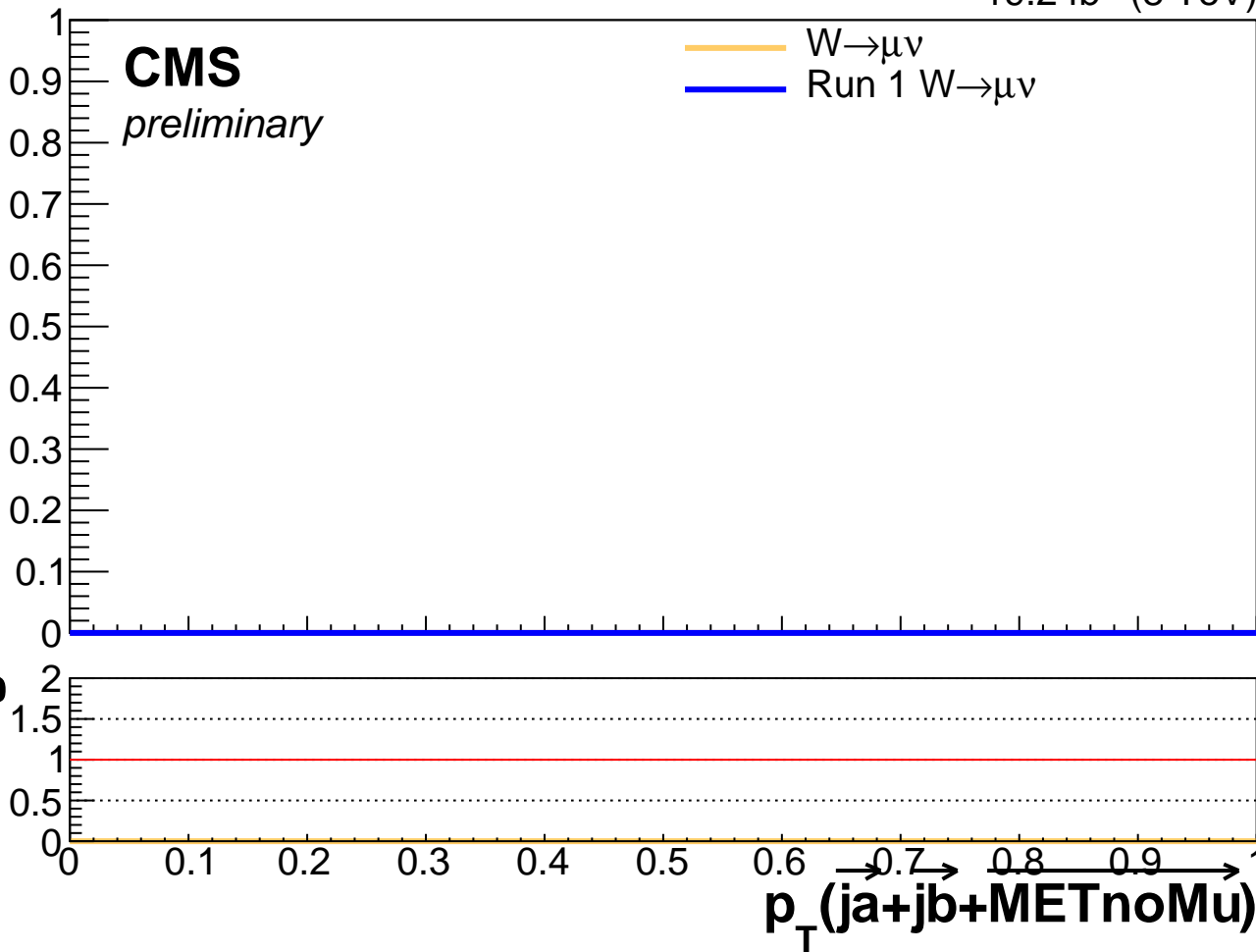
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**$p_T(ja+jb+METnoMu)$**



19.2 fb<sup>-1</sup> (8 TeV)

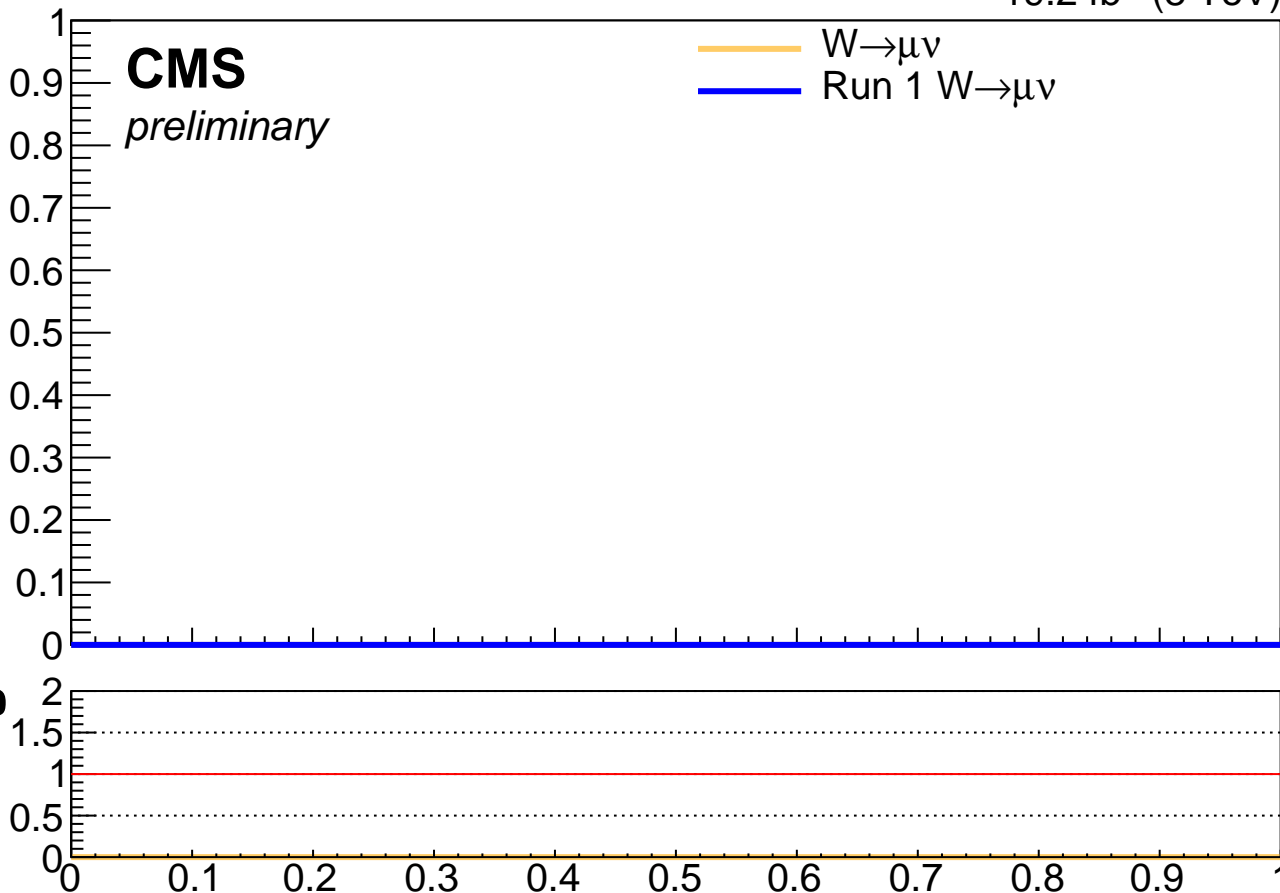
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**CJV jets (30 GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

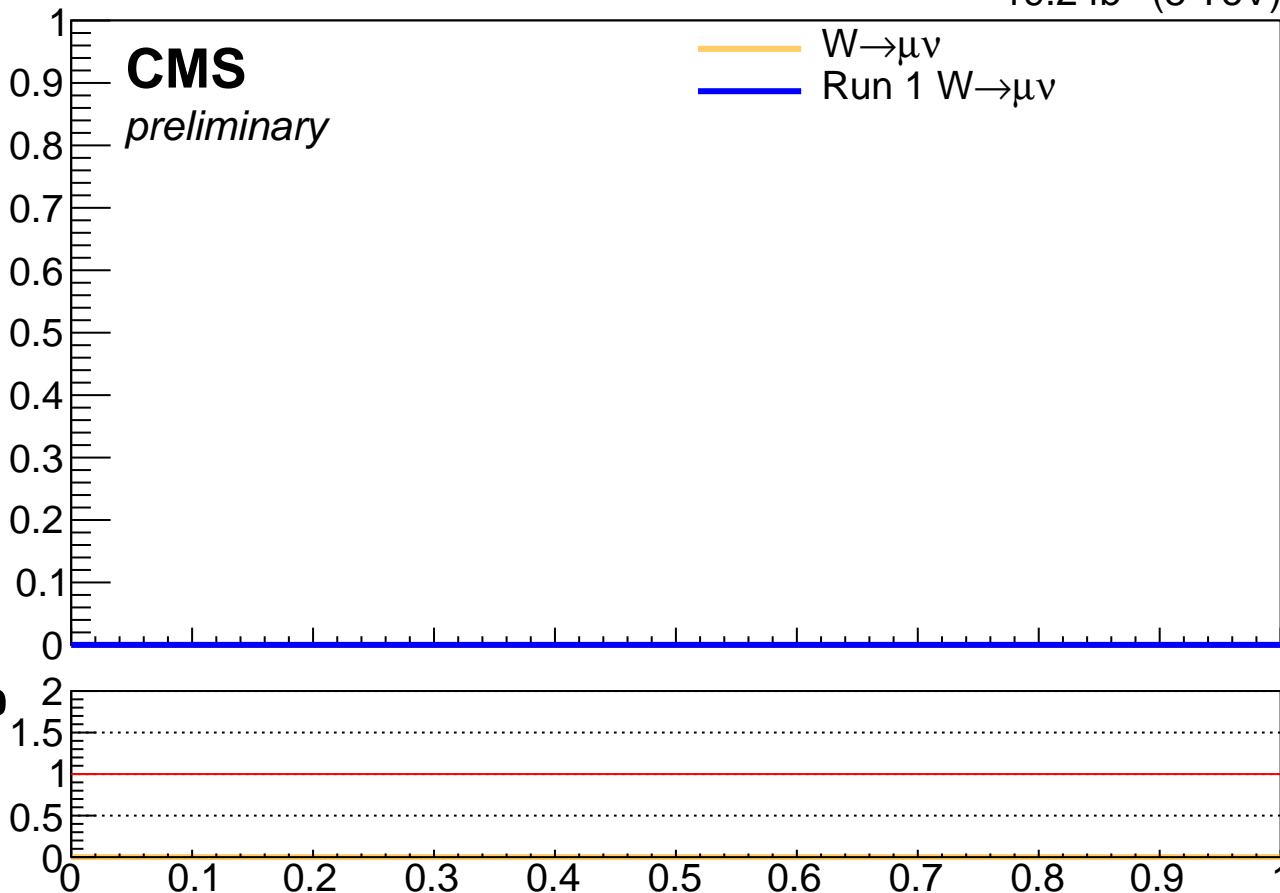
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**CJV jets (20 GeV EB, 30 GeV EE)**



19.2 fb<sup>-1</sup> (8 TeV)

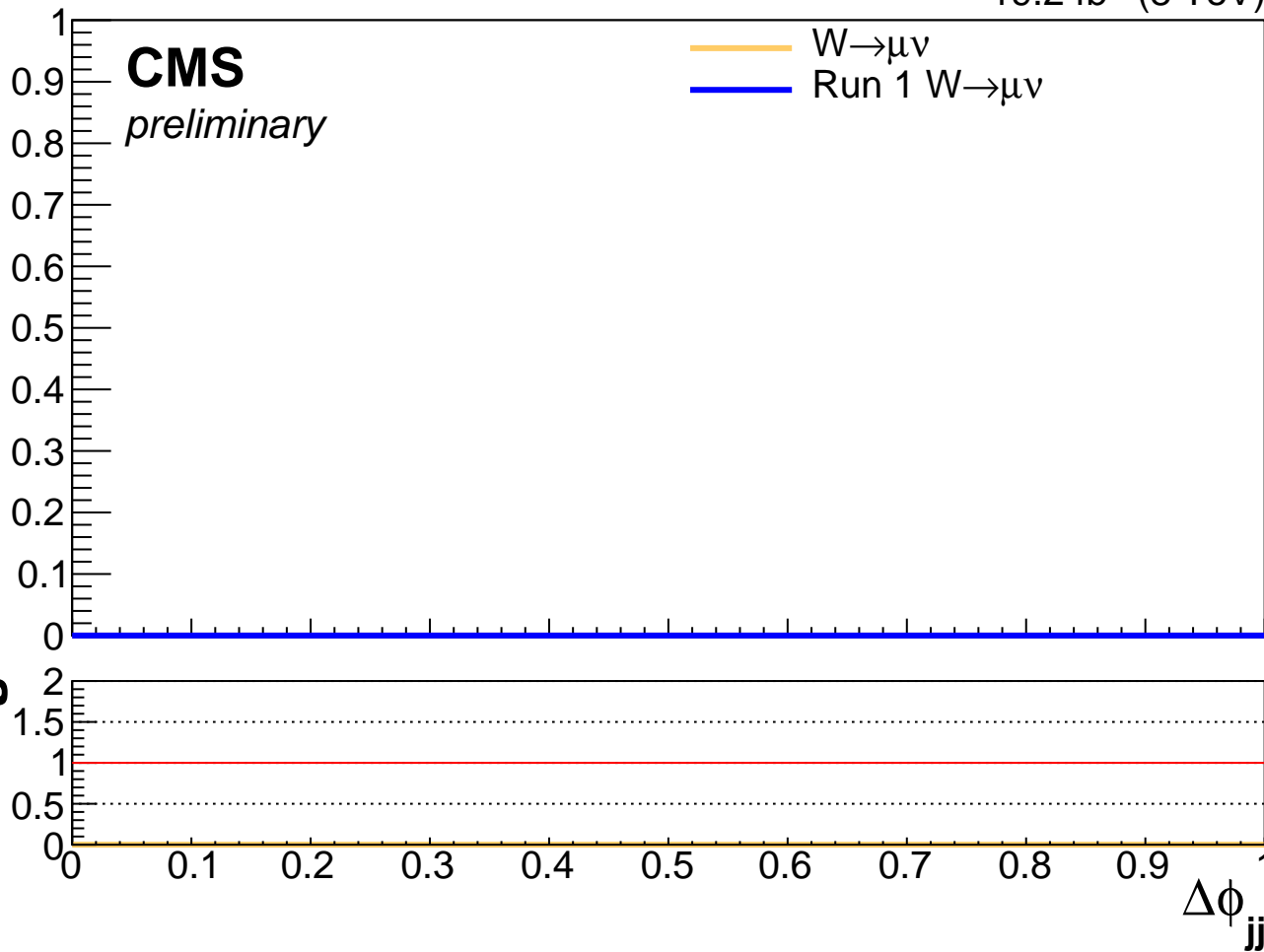
**CMS**

*preliminary*

—  $W \rightarrow \mu\nu$   
— Run 1  $W \rightarrow \mu\nu$

Data/Bkg

$\Delta\phi_{jj}$





19.2 fb<sup>-1</sup> (8 TeV)

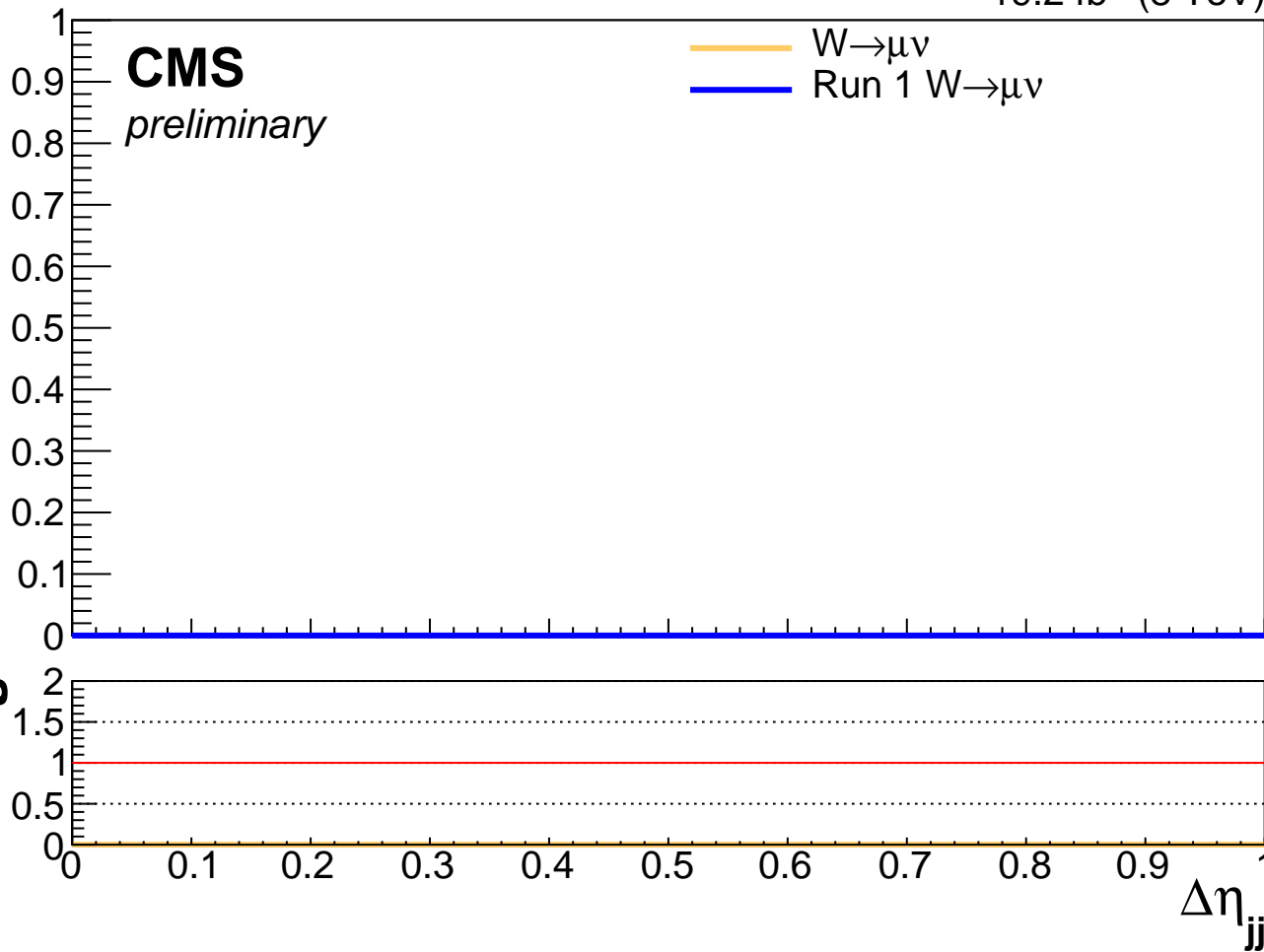
**CMS**

*preliminary*

—  $W \rightarrow \mu\nu$   
— Run 1  $W \rightarrow \mu\nu$

Data/Bkg

$\Delta\eta_{jj}$



19.2 fb<sup>-1</sup> (8 TeV)

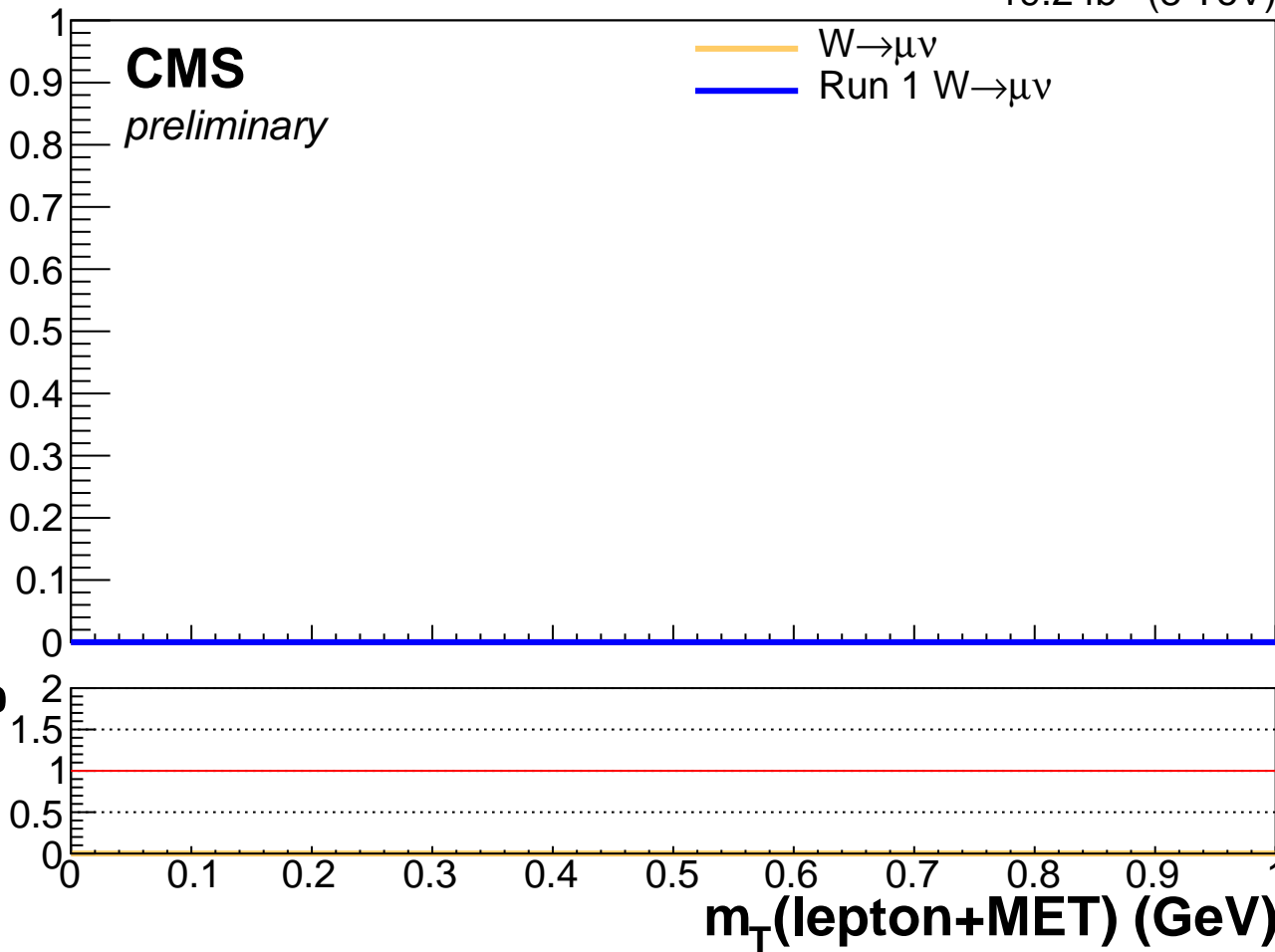
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**$m_T(\text{lepton}+\text{MET})$  (GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

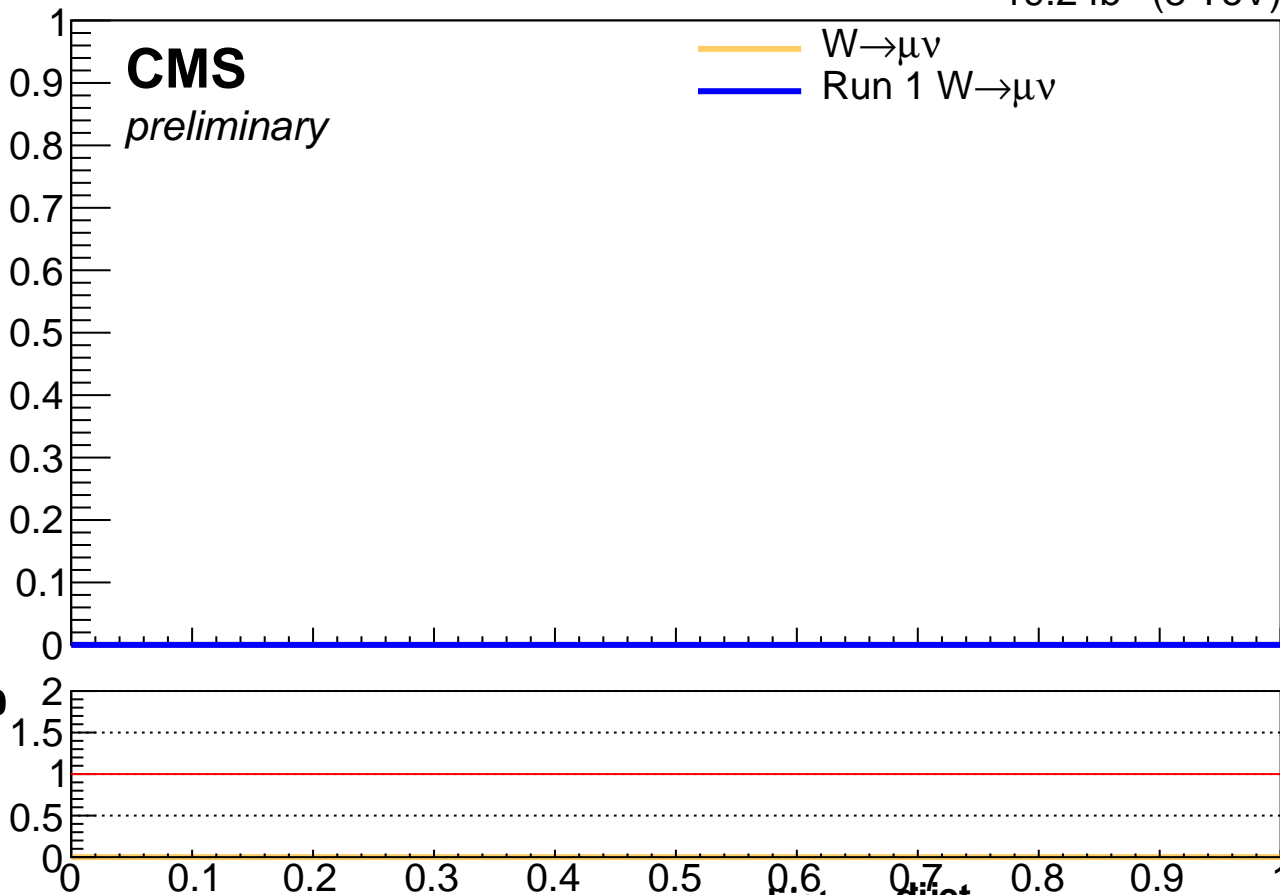
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

$p_T^{\text{dijet}} / (p_T^{\text{dijet}} + \text{MET}_{\text{noMu}})$



19.2 fb<sup>-1</sup> (8 TeV)

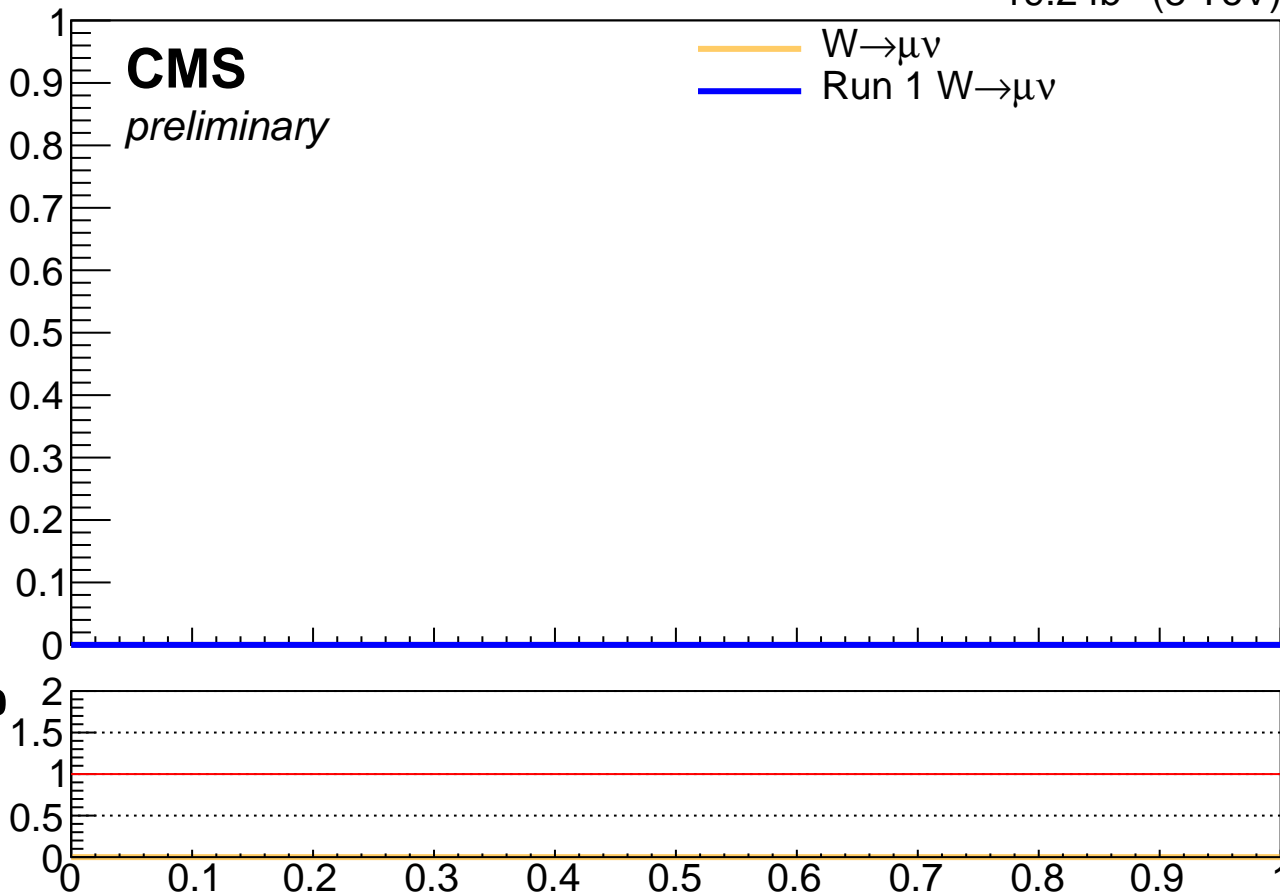
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**Jet 1 CSV**



19.2 fb<sup>-1</sup> (8 TeV)

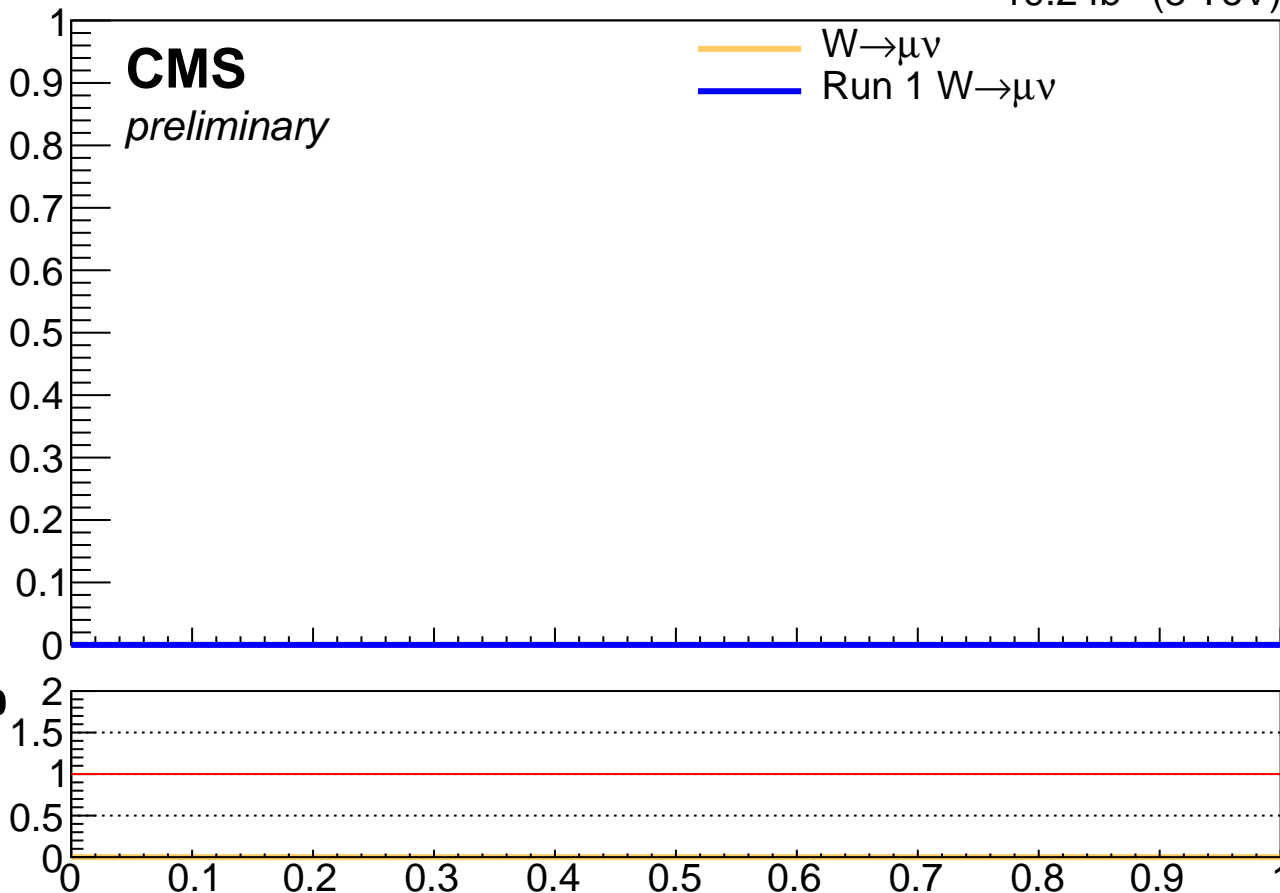
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**Jet 2 CSV**



19.2 fb<sup>-1</sup> (8 TeV)

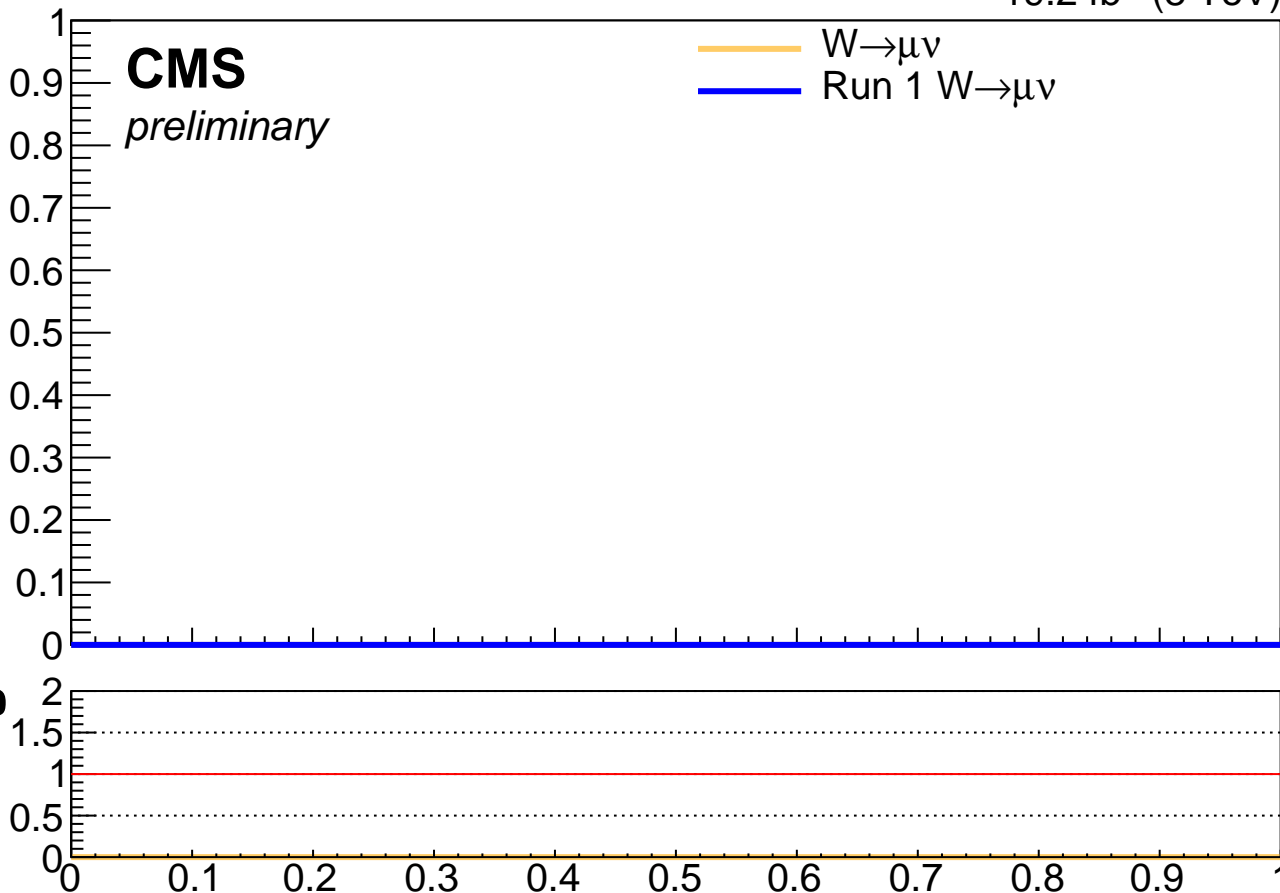
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**Jet 3 CSV**



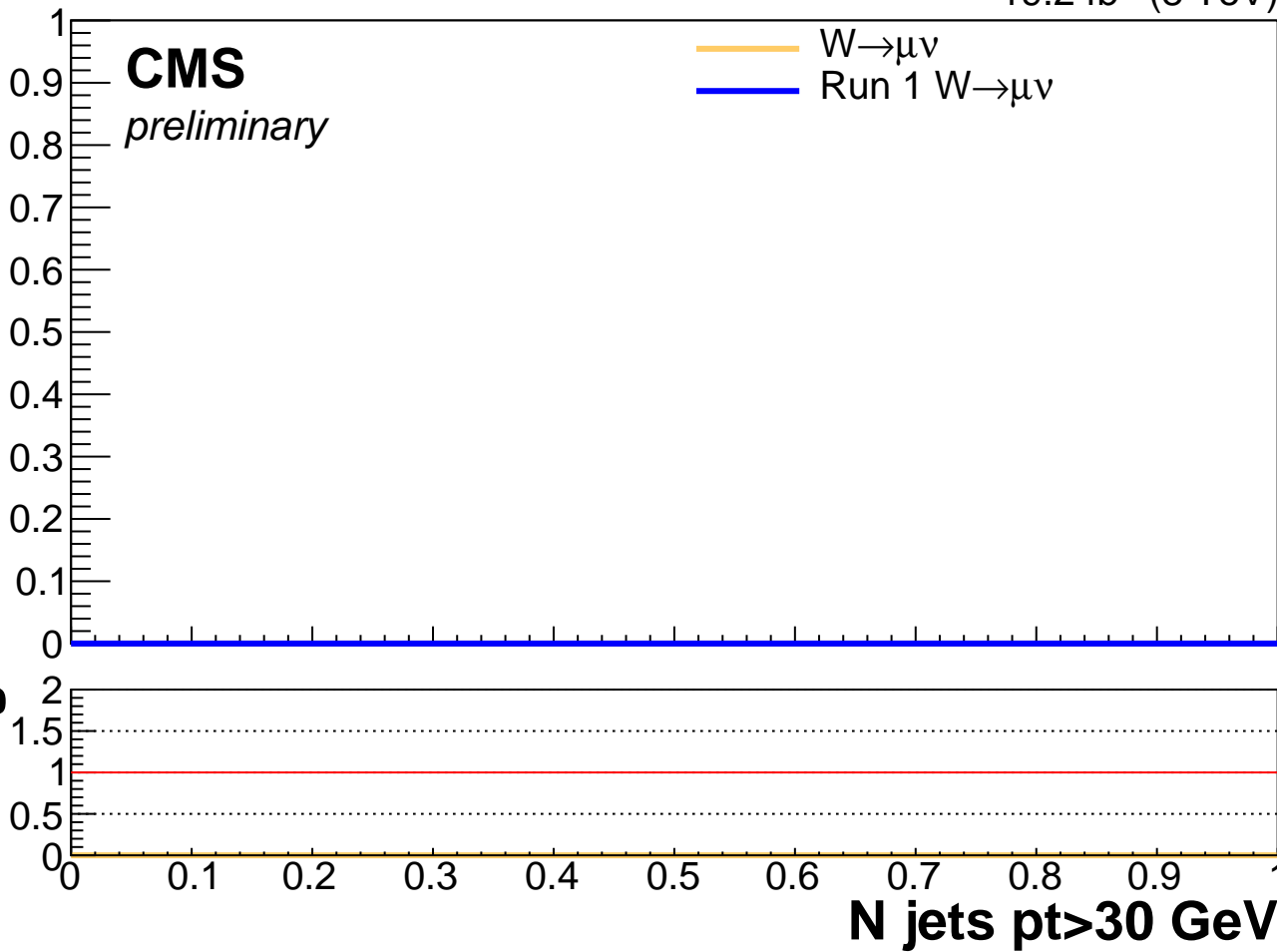
19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**



19.2 fb<sup>-1</sup> (8 TeV)

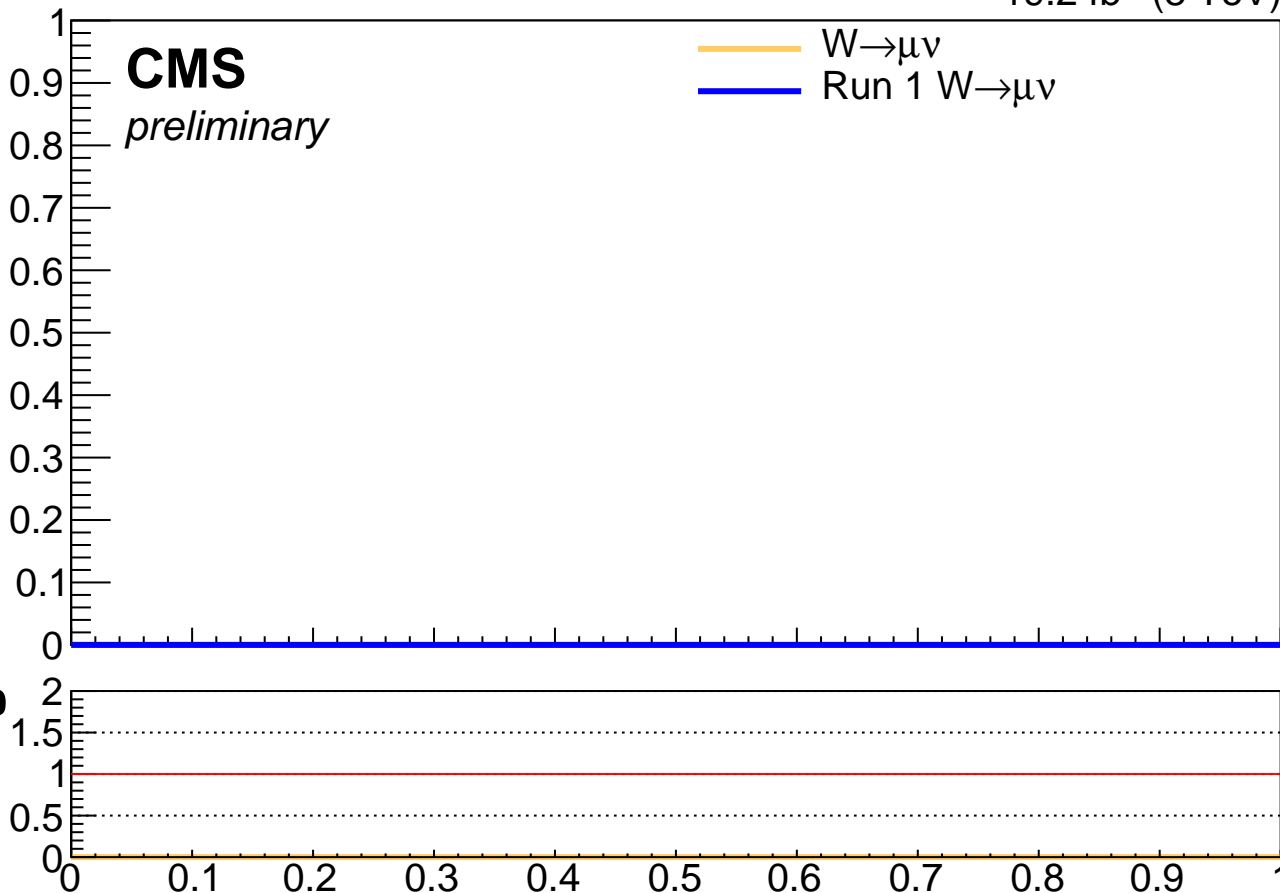
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**N jets pt>15 GeV**





19.2 fb<sup>-1</sup> (8 TeV)

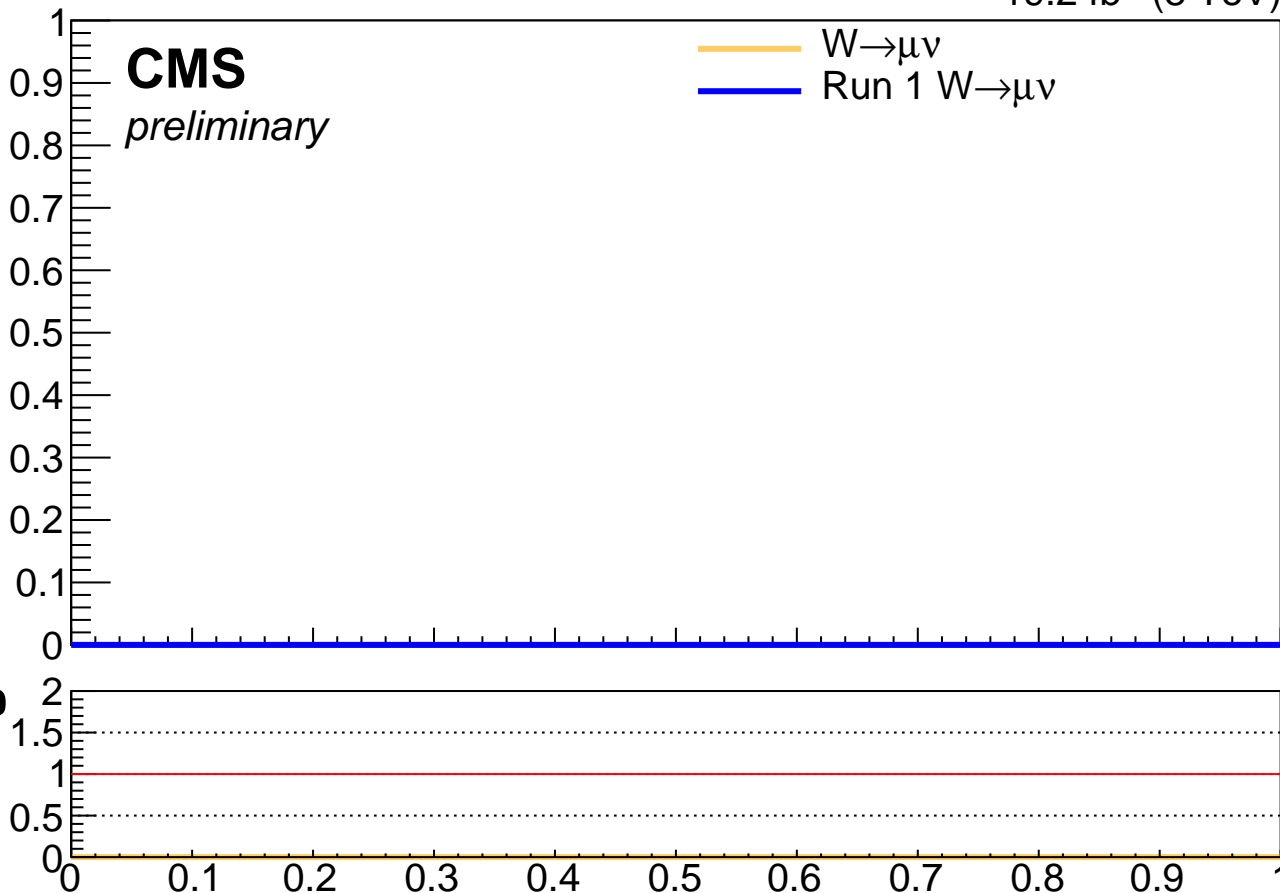
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**Central tag jet  $\eta$**



19.2 fb<sup>-1</sup> (8 TeV)

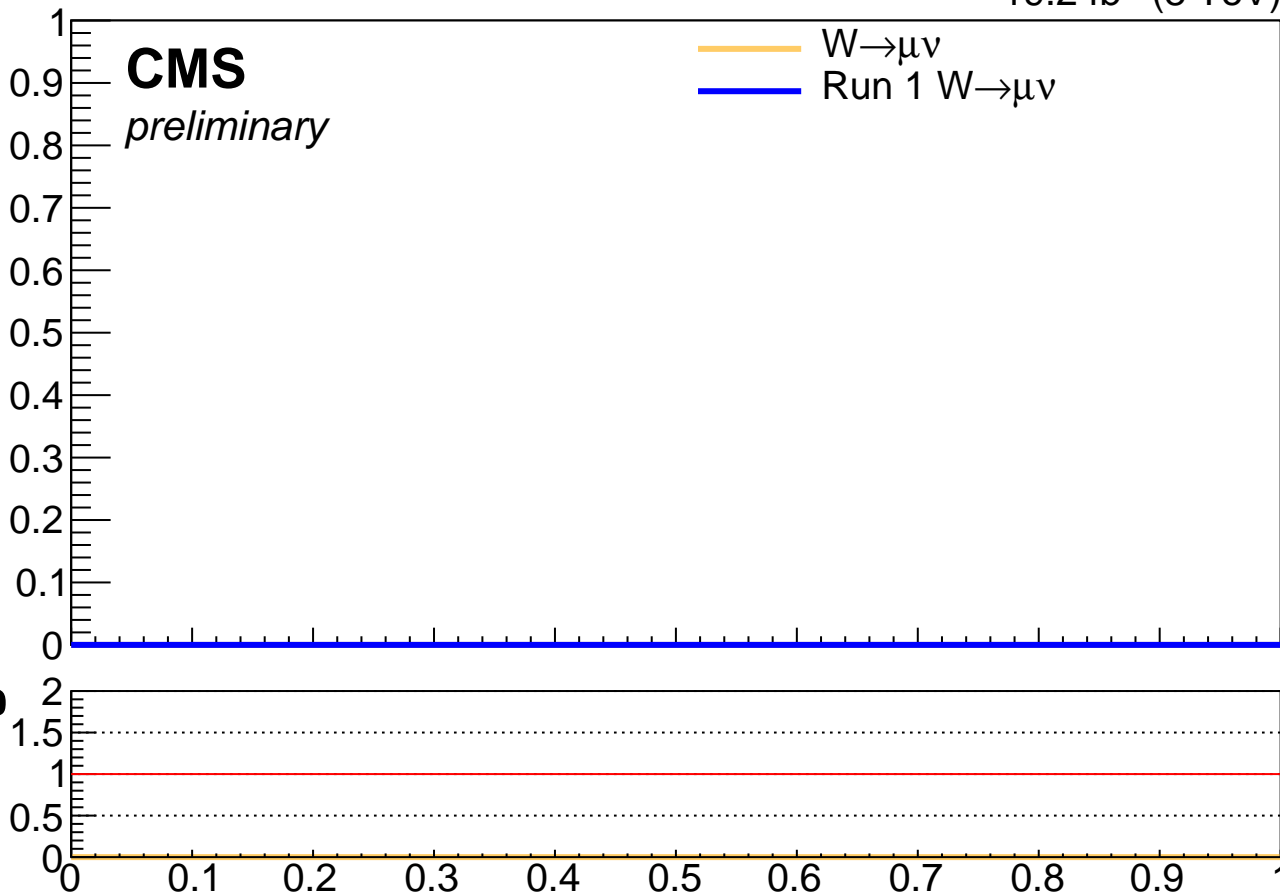
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**Forward tag jet  $\eta$**



19.2 fb<sup>-1</sup> (8 TeV)

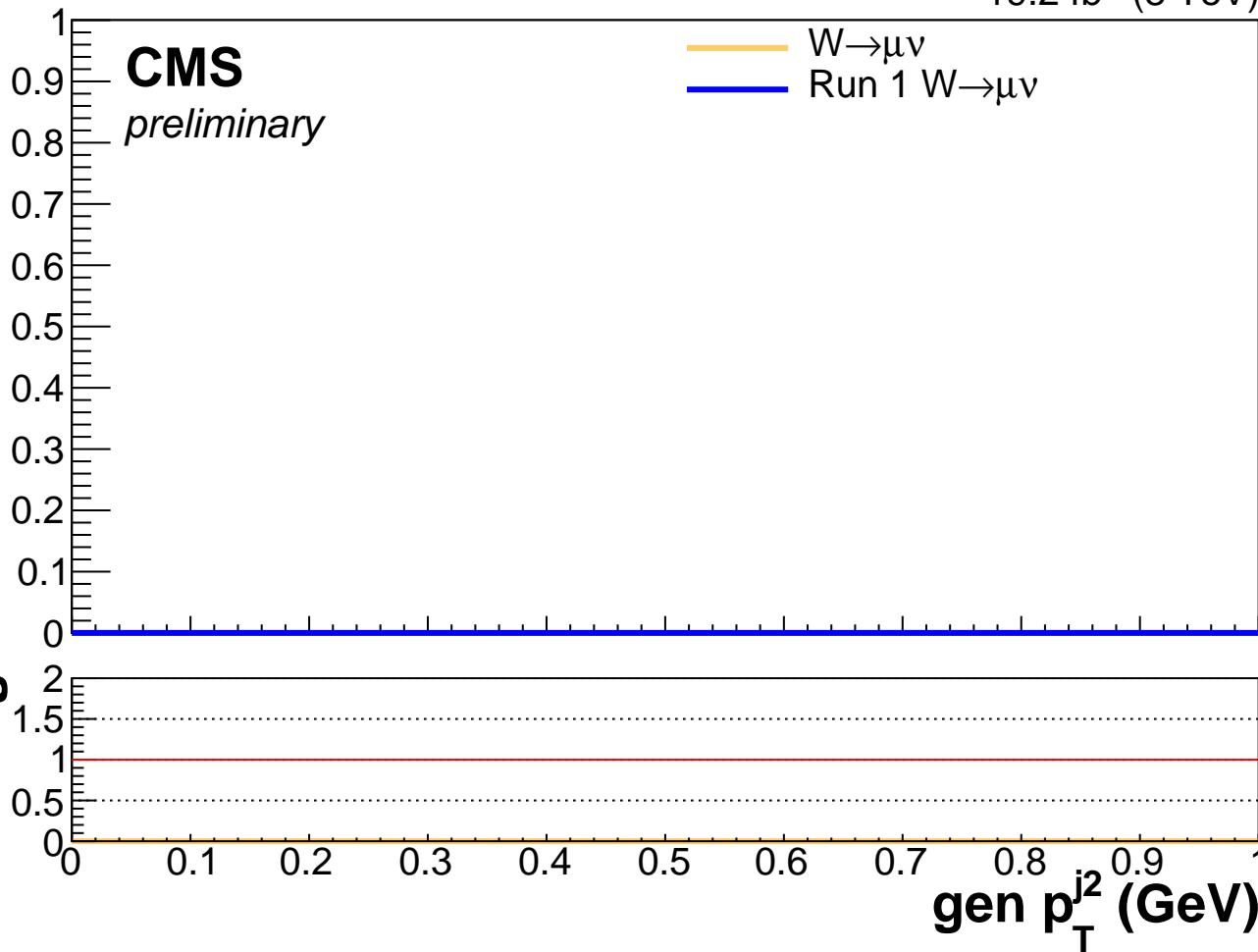
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**gen  $p_T^{j2}$  (GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

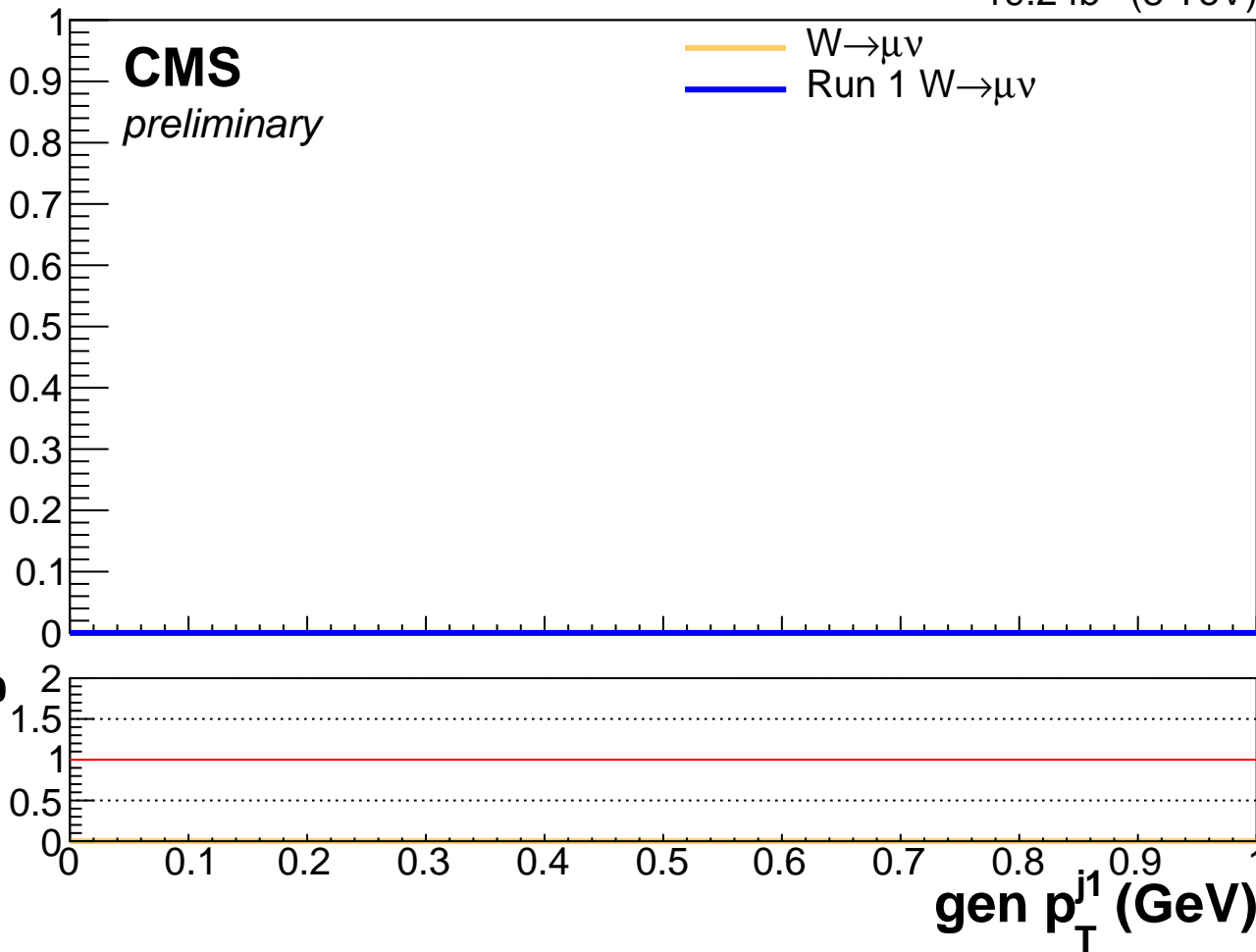
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**gen  $p_T^{j1}$  (GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

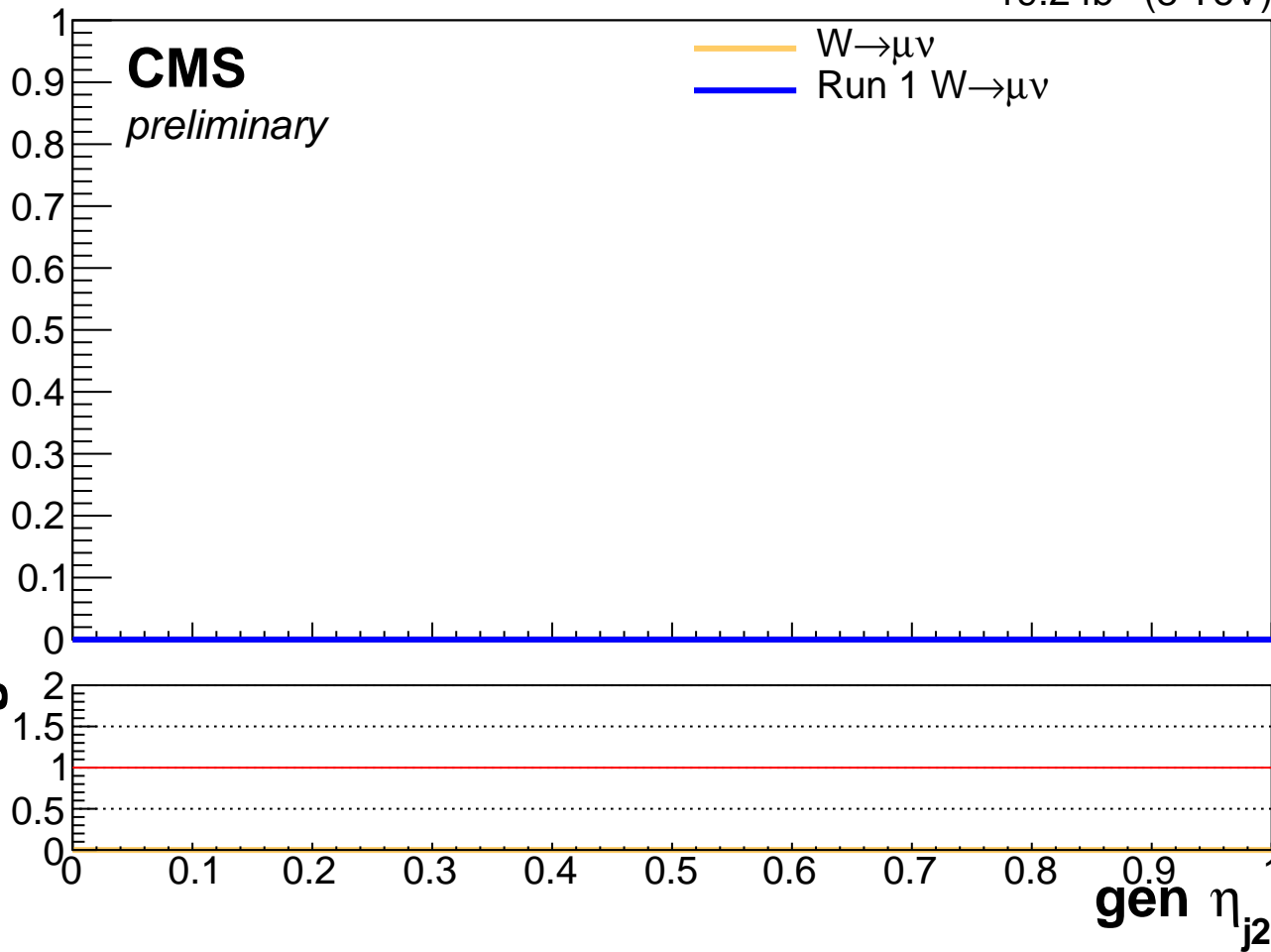
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**gen  $\eta_{j2}$**



19.2 fb<sup>-1</sup> (8 TeV)

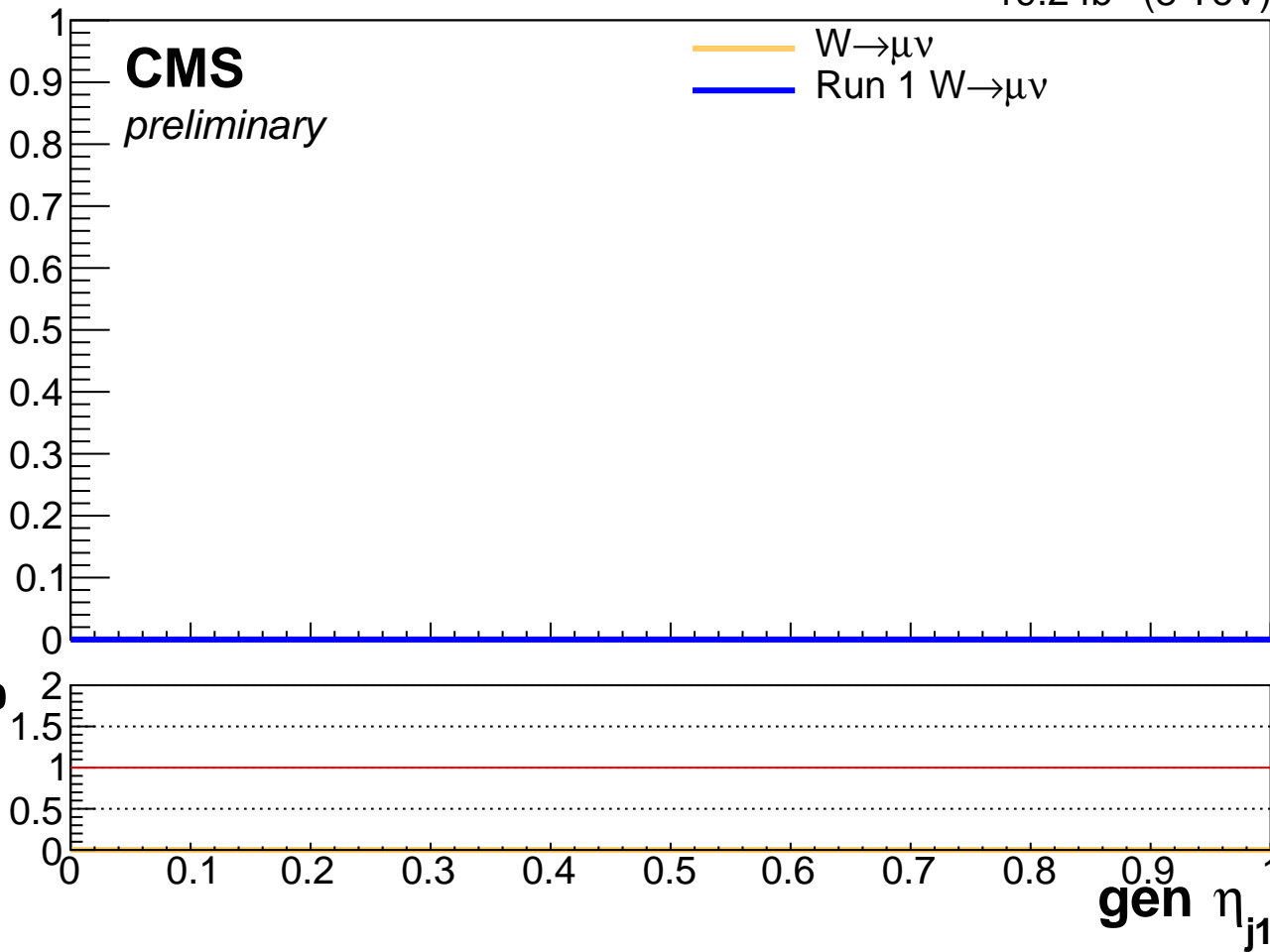
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**gen  $\eta_{j1}$**



19.2 fb<sup>-1</sup> (8 TeV)

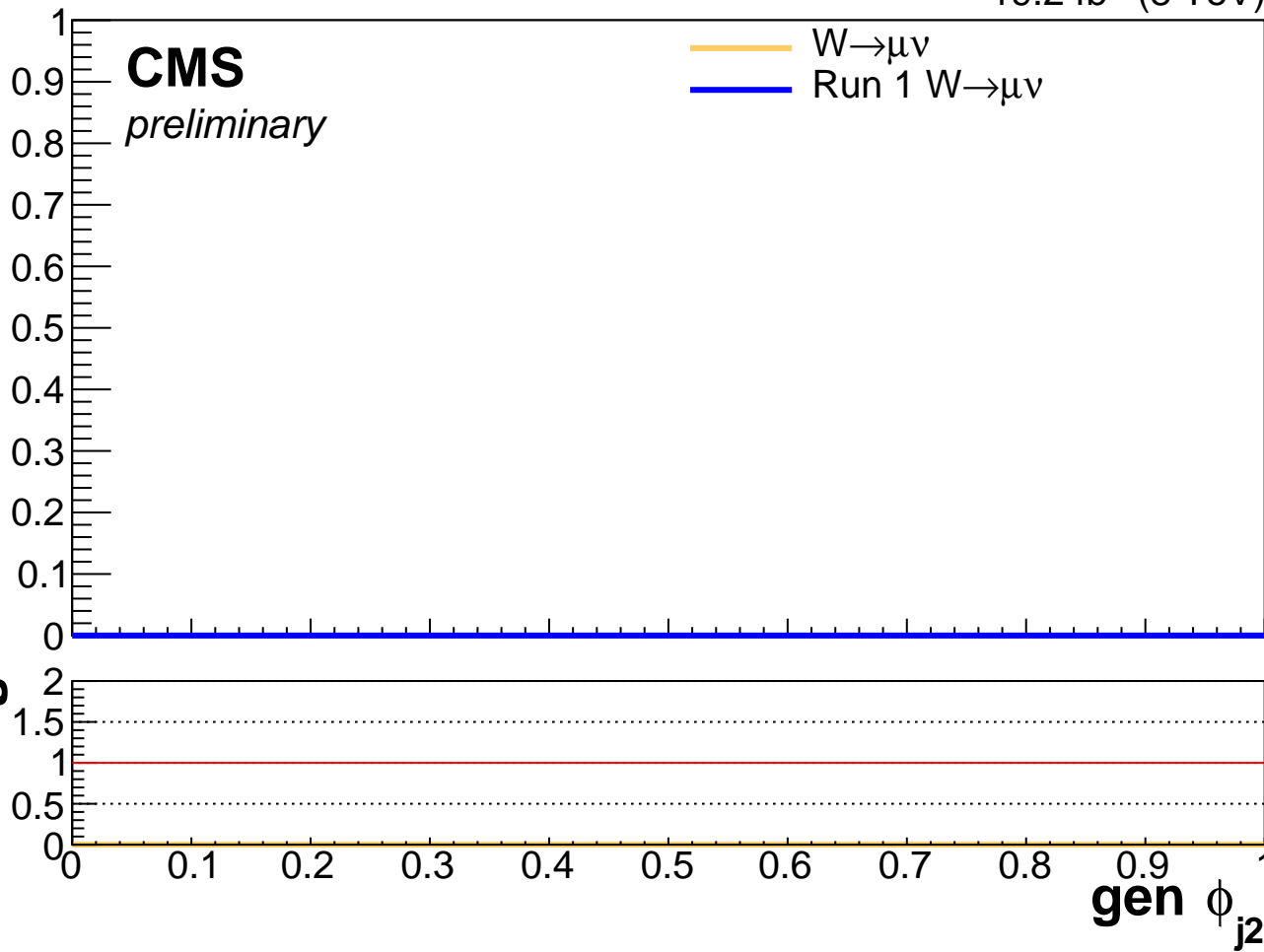
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

gen  $\phi_{j2}$



19.2 fb<sup>-1</sup> (8 TeV)

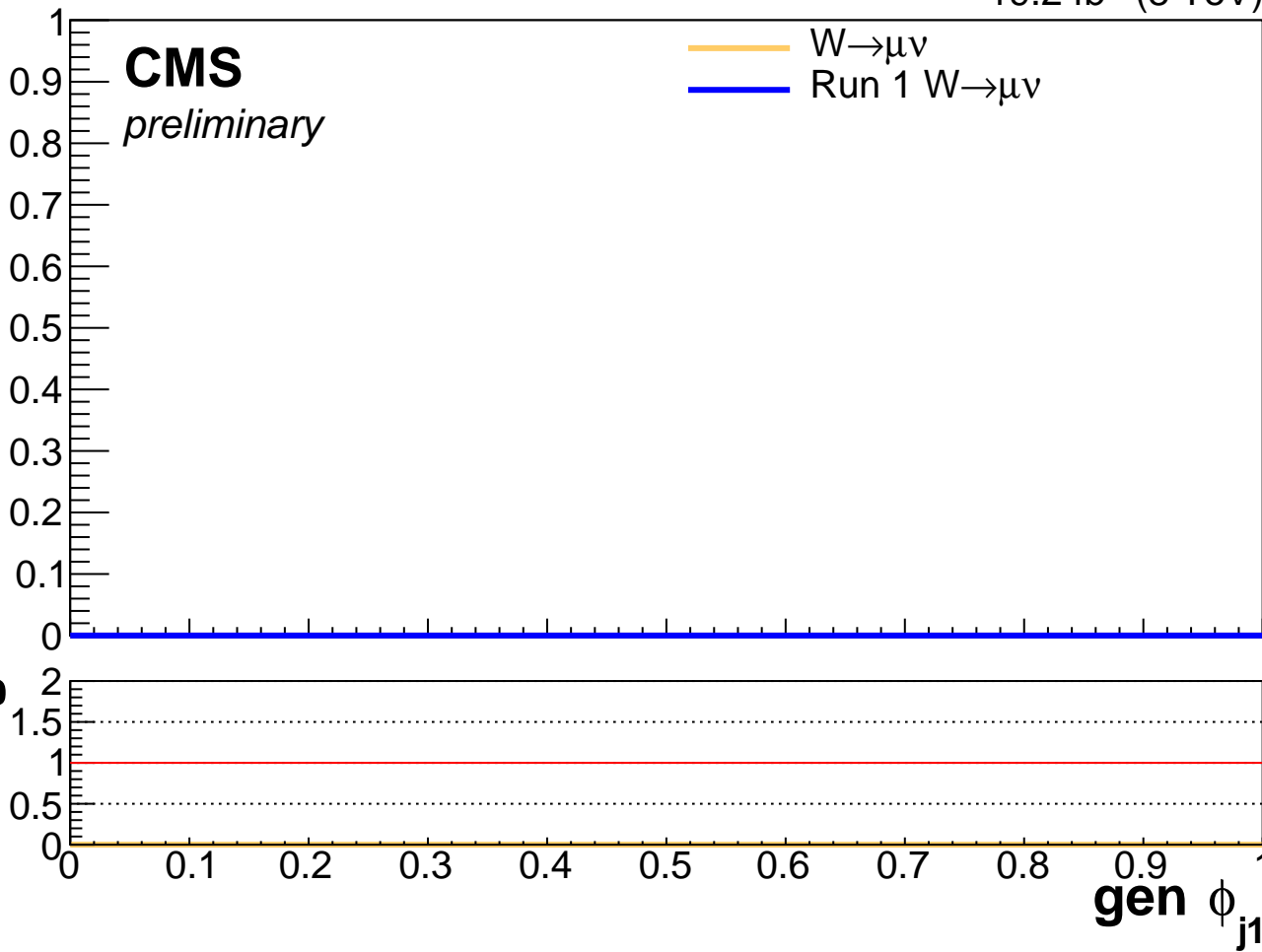
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

gen  $\phi_{j1}$





19.2 fb<sup>-1</sup> (8 TeV)

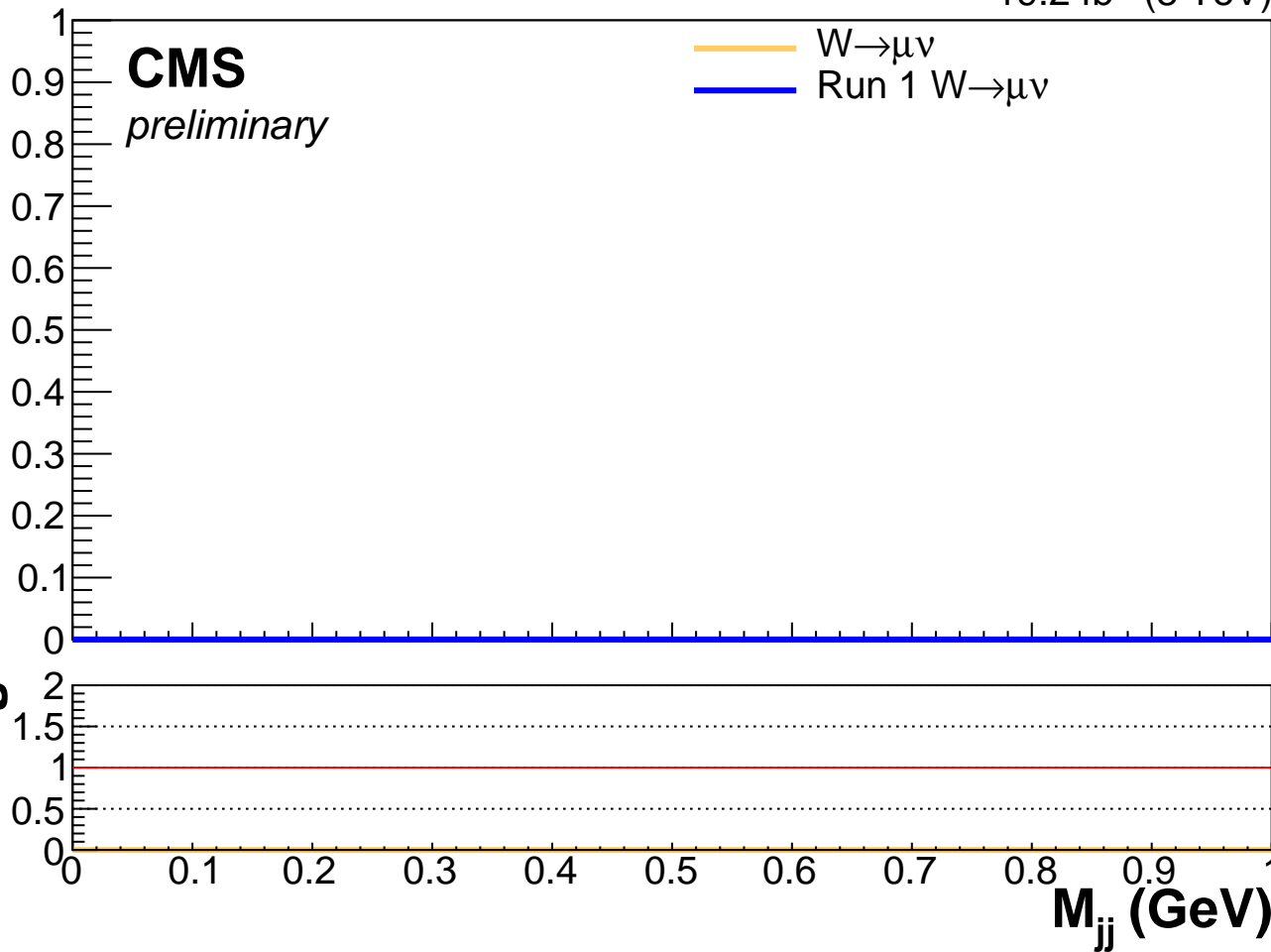
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**$M_{jj}$  (GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

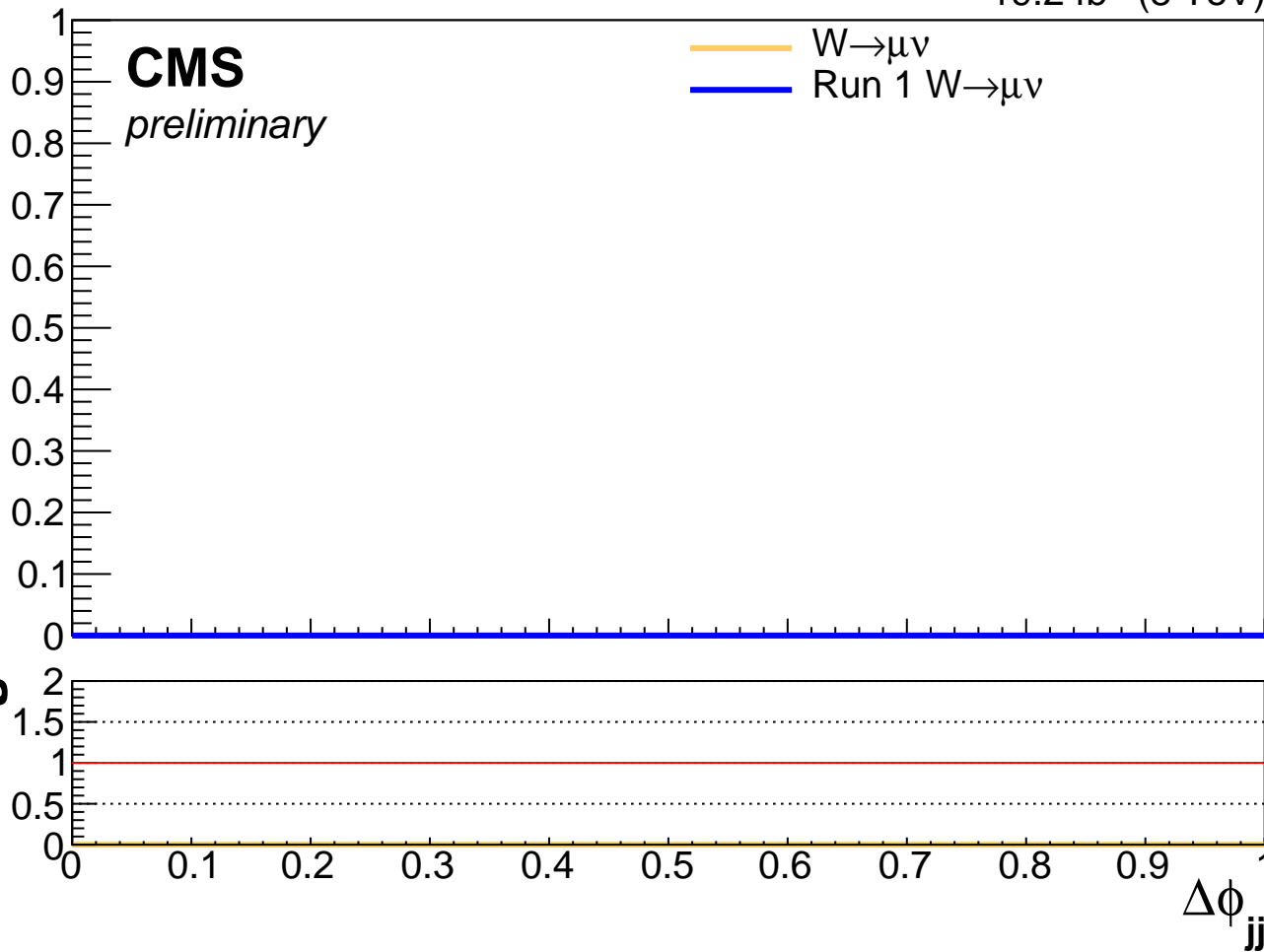
**CMS**

*preliminary*

—  $W \rightarrow \mu\nu$   
— Run 1  $W \rightarrow \mu\nu$

Data/Bkg

$\Delta\phi_{jj}$



19.2 fb<sup>-1</sup> (8 TeV)

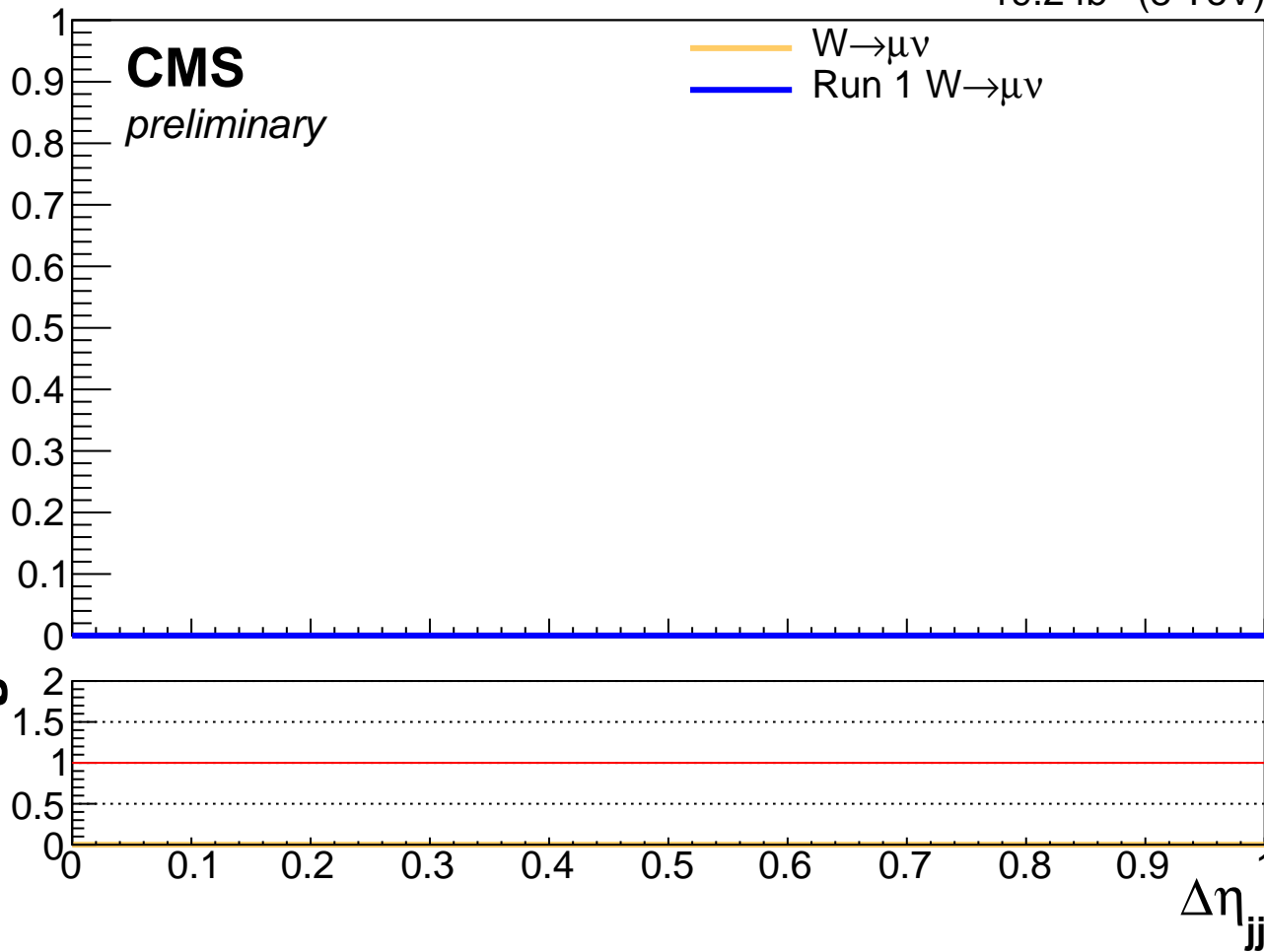
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

$\Delta\eta_{jj}$



19.2 fb<sup>-1</sup> (8 TeV)

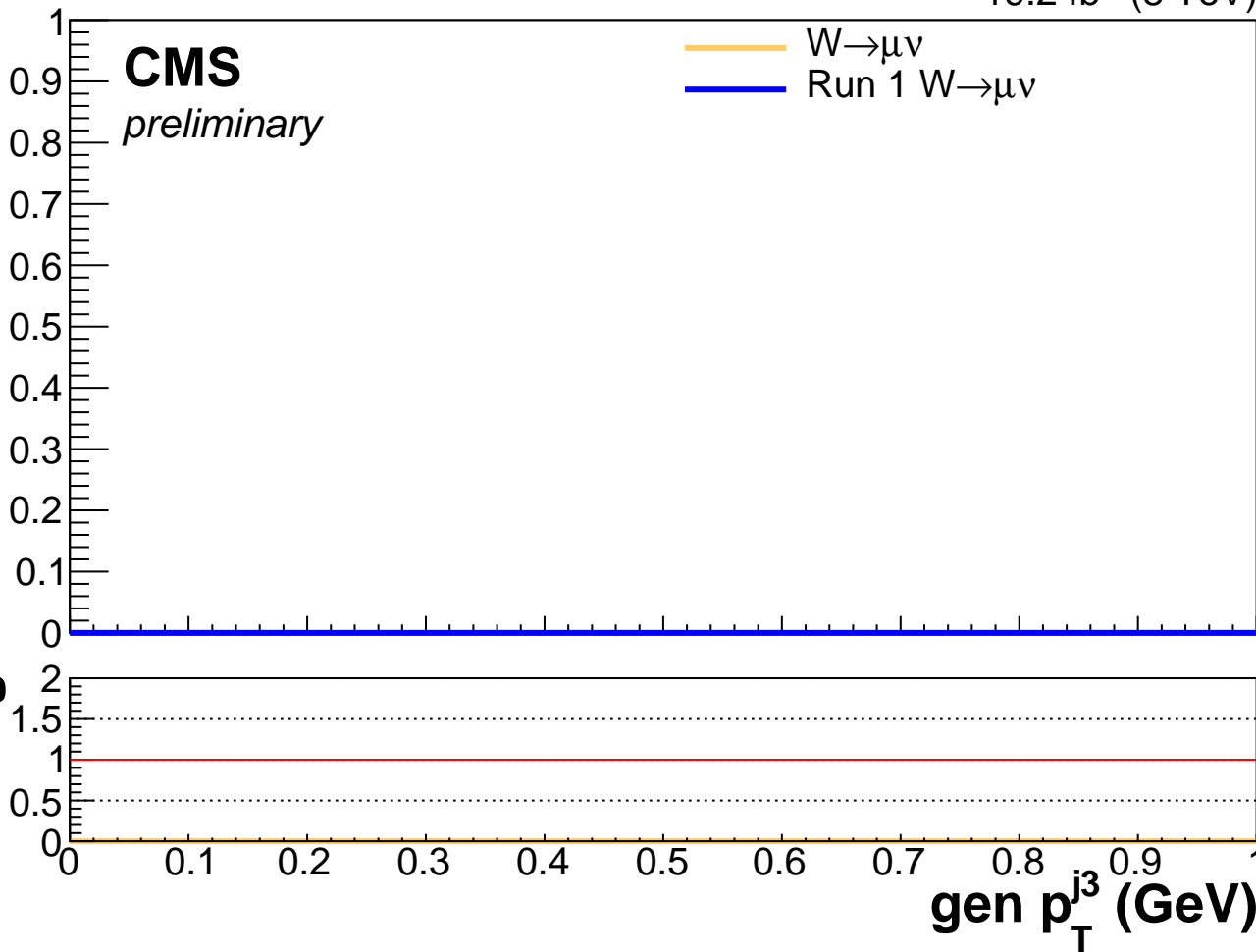
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**gen  $p_T^{j3}$  (GeV)**



19.2 fb<sup>-1</sup> (8 TeV)

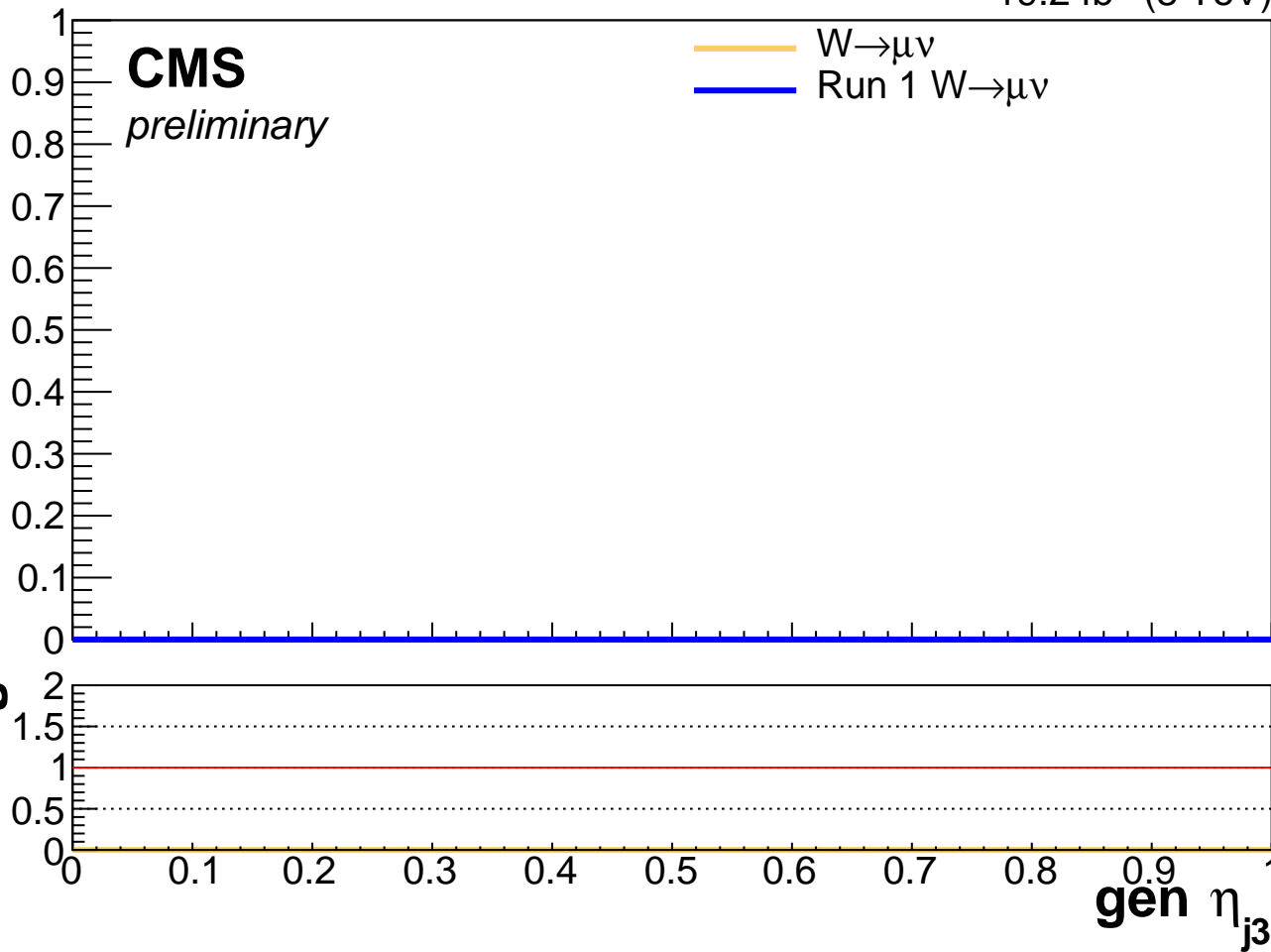
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

**gen  $\eta_{j3}$**



19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$

Data/Bkg

gen  $\phi_{j3}$

