

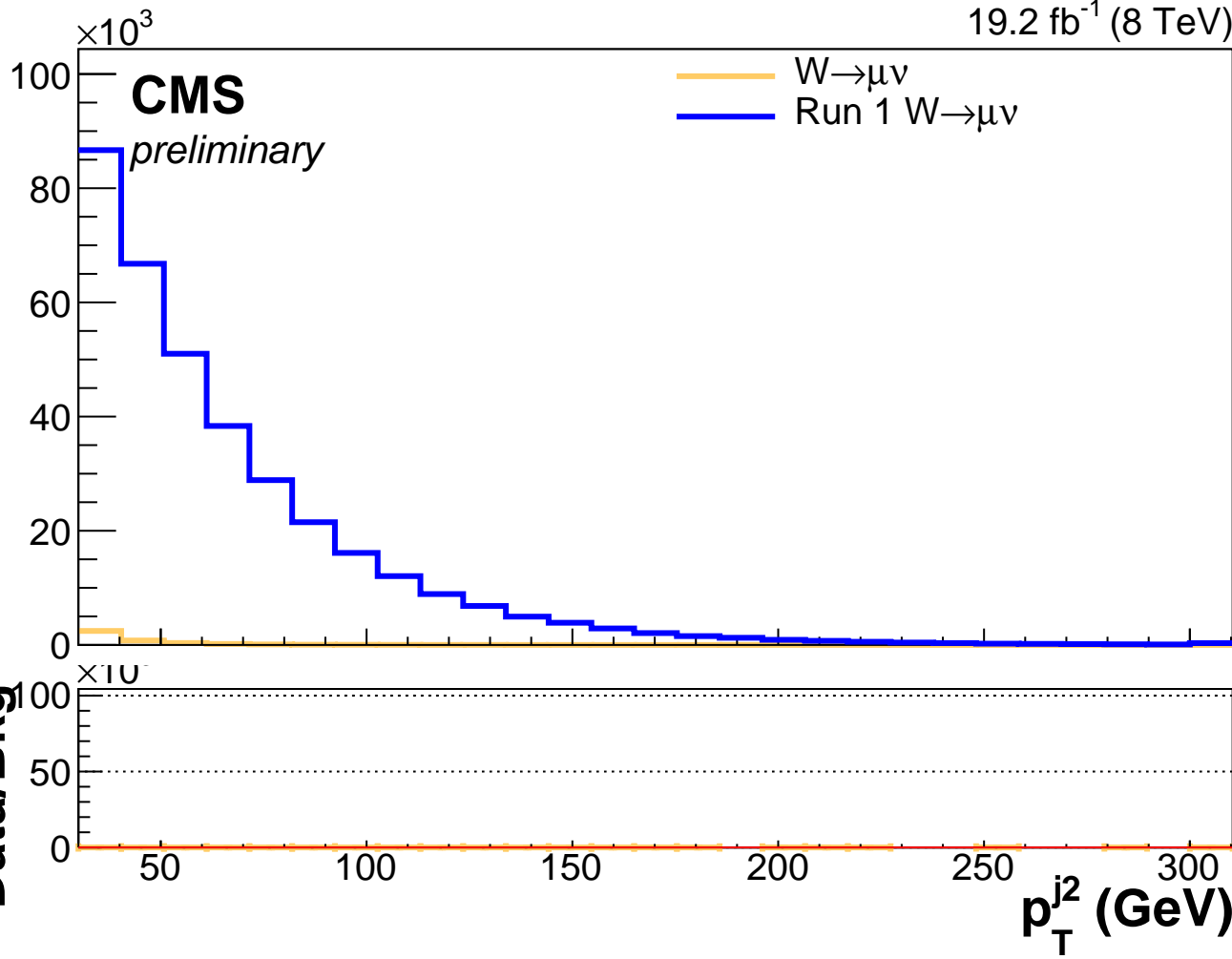
19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

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

**Data/Bkg**

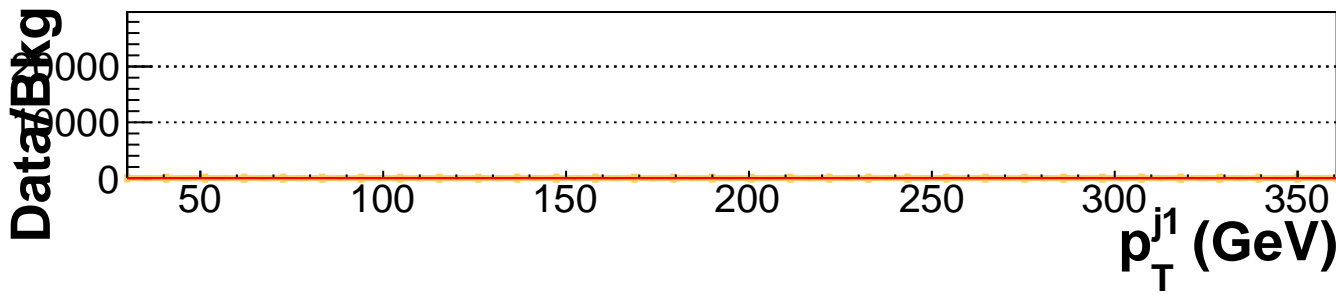
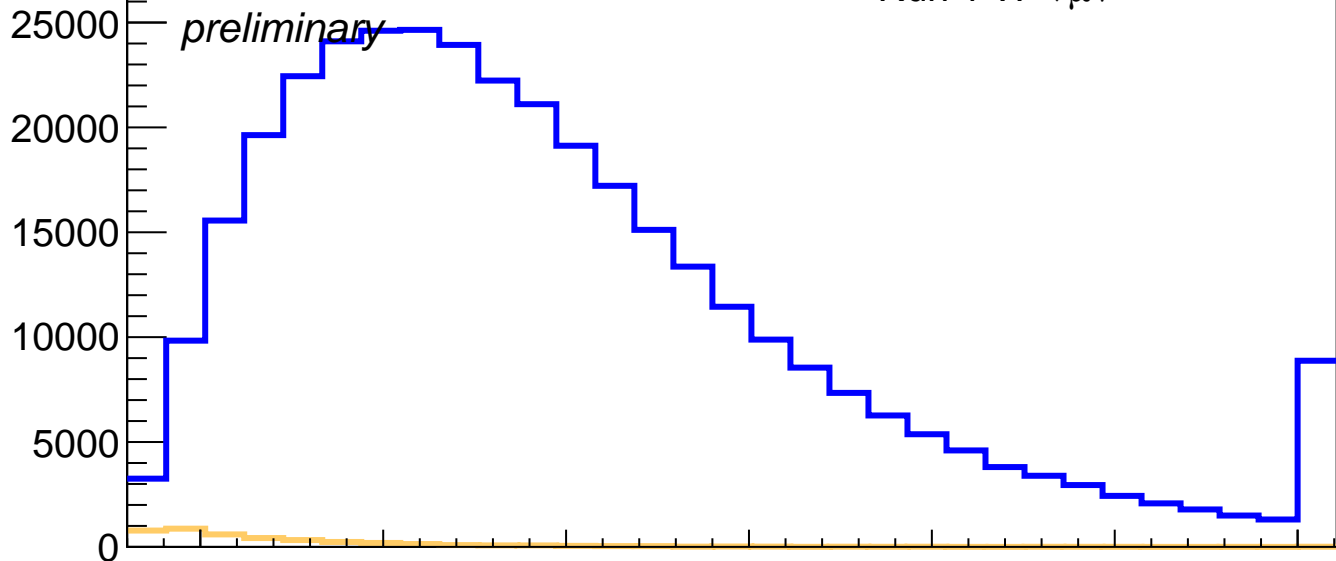


19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

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



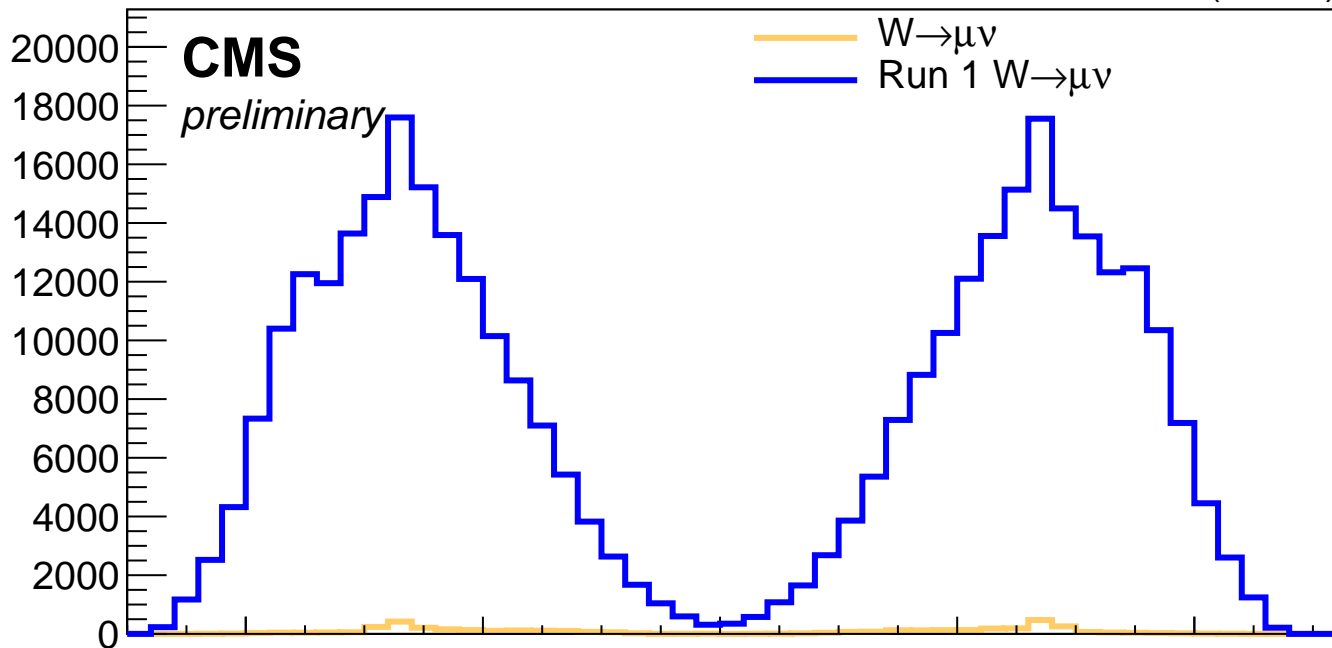
19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

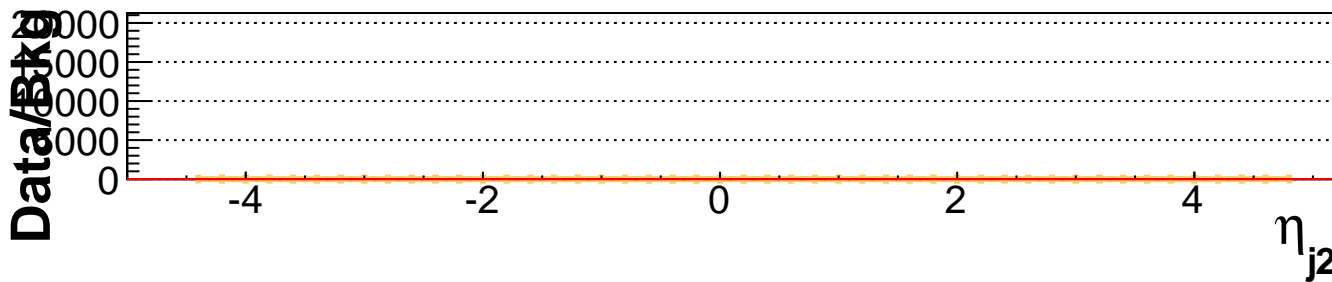
*preliminary*

—  $W \rightarrow \mu \nu$

— Run 1  $W \rightarrow \mu \nu$



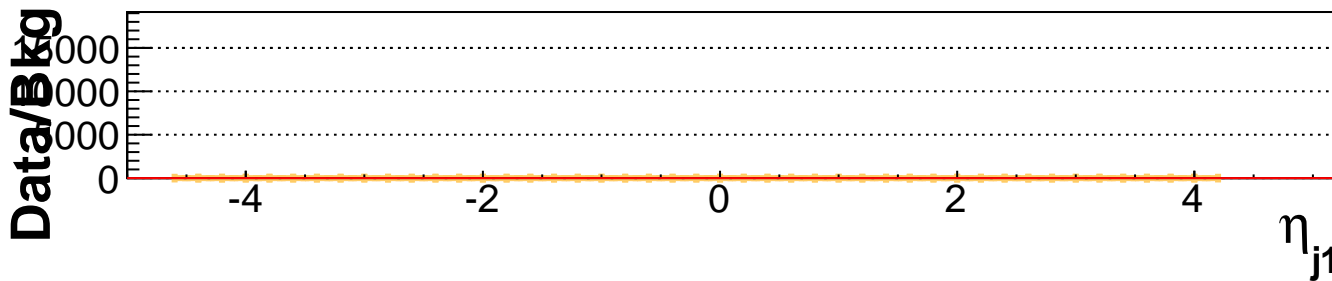
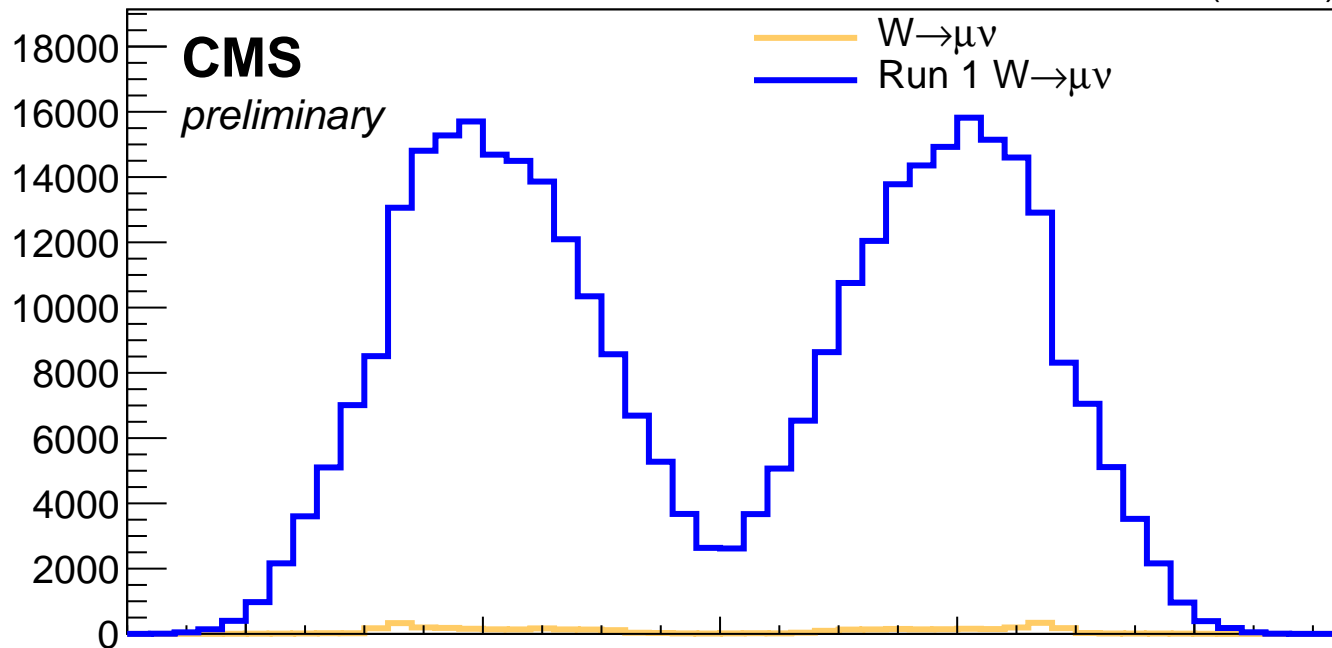
**Data/Bkg**



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

**CMS**  
*preliminary*

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



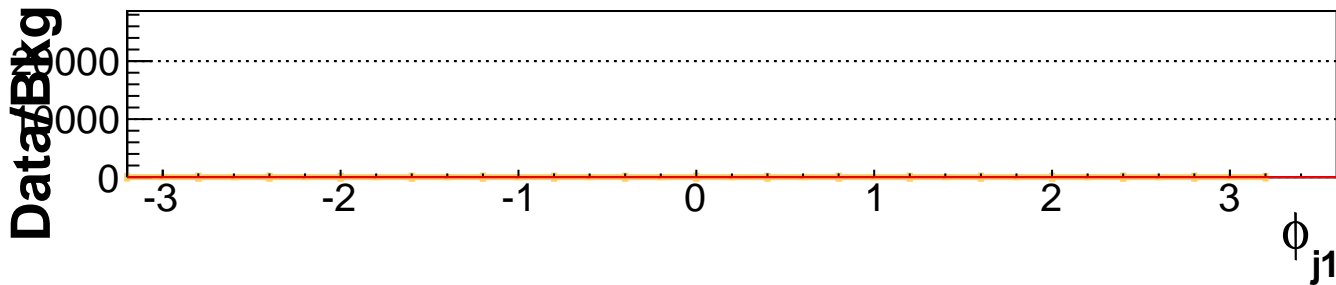
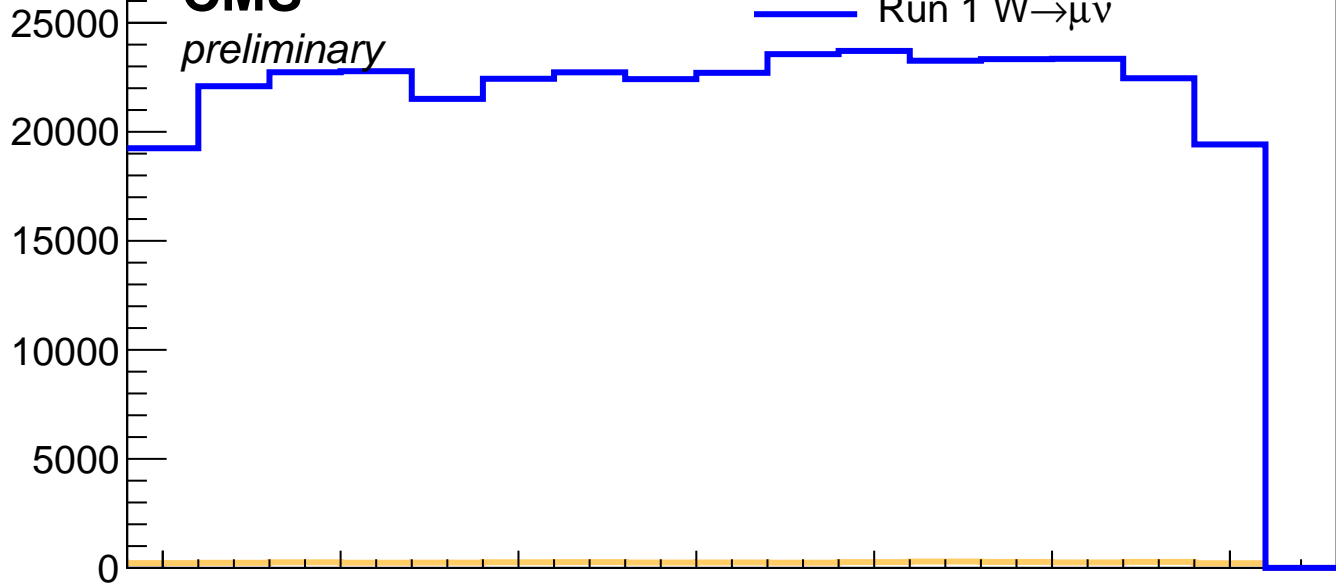
19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$

— Run 1  $W \rightarrow \mu \nu$



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

**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$

— Run 1  $W \rightarrow \mu \nu$

25000

20000

15000

10000

5000

0

**Data/Bkg**

10000

5000

0

-3

-2

-1

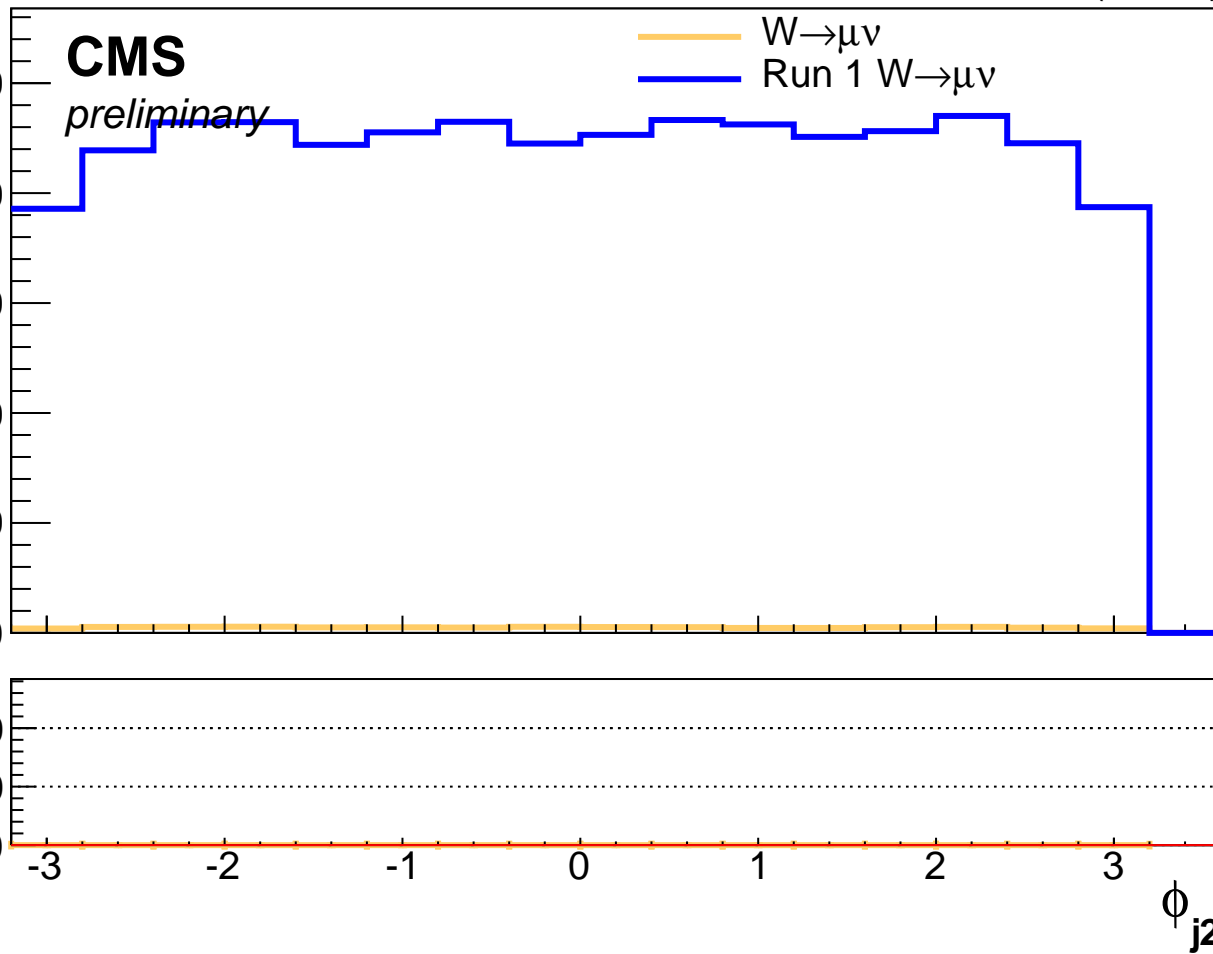
0

1

2

3

$\phi_{j2}$



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

**CMS**

*preliminary*

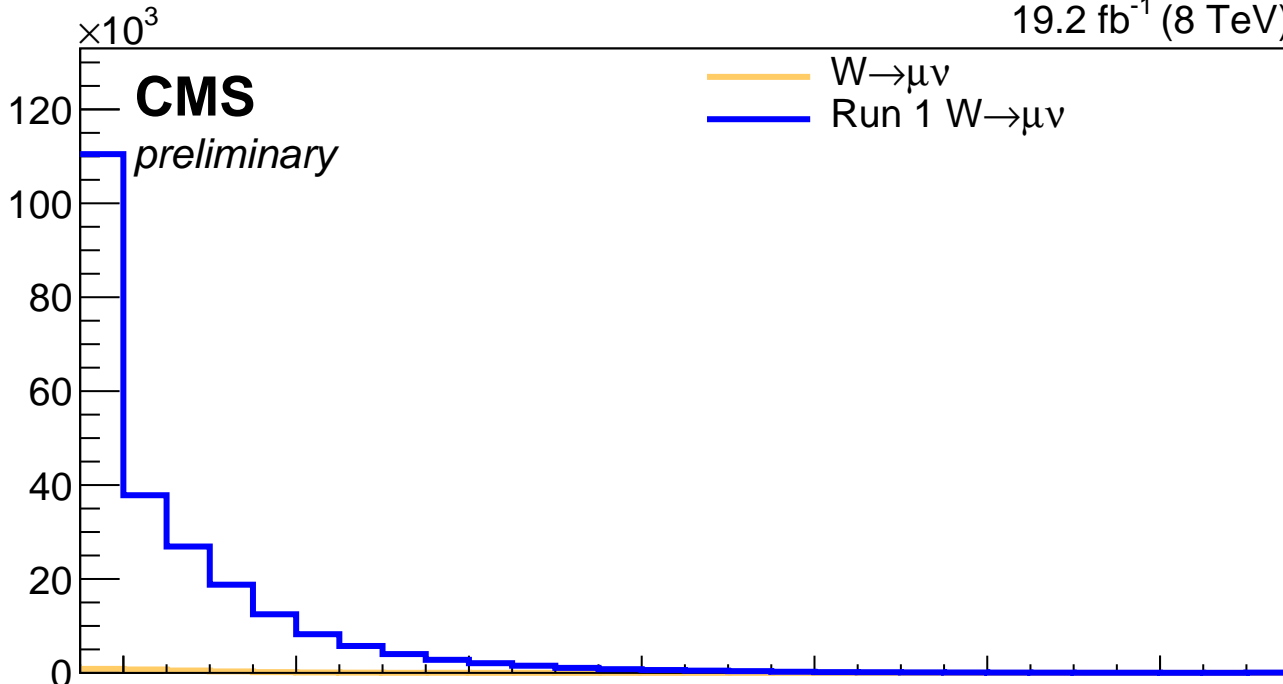
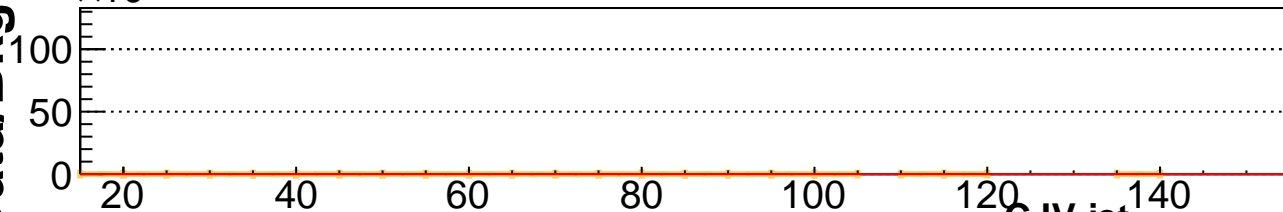
W→μν

Run 1 W→μν

**Data/Bkg**

×10<sup>-1</sup>

**p<sub>T</sub><sup>CJV jet</sup> (GeV)**



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

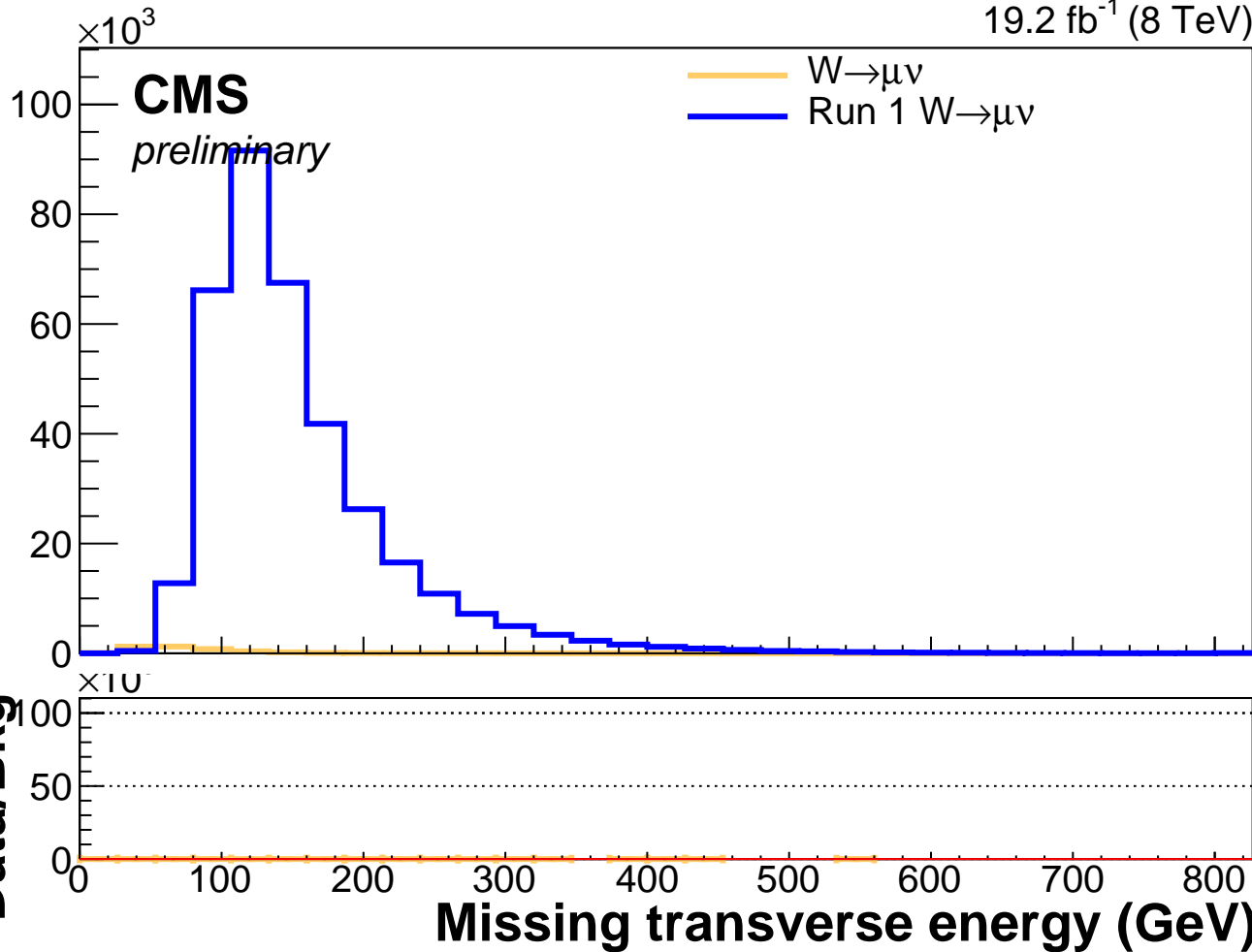
**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$

— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**



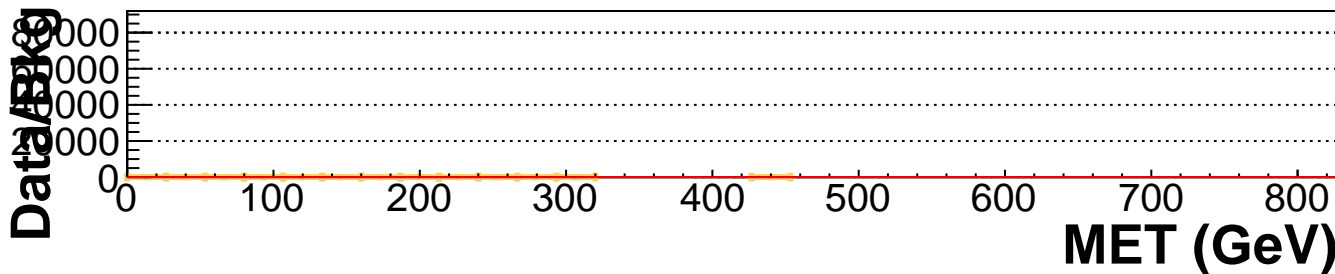
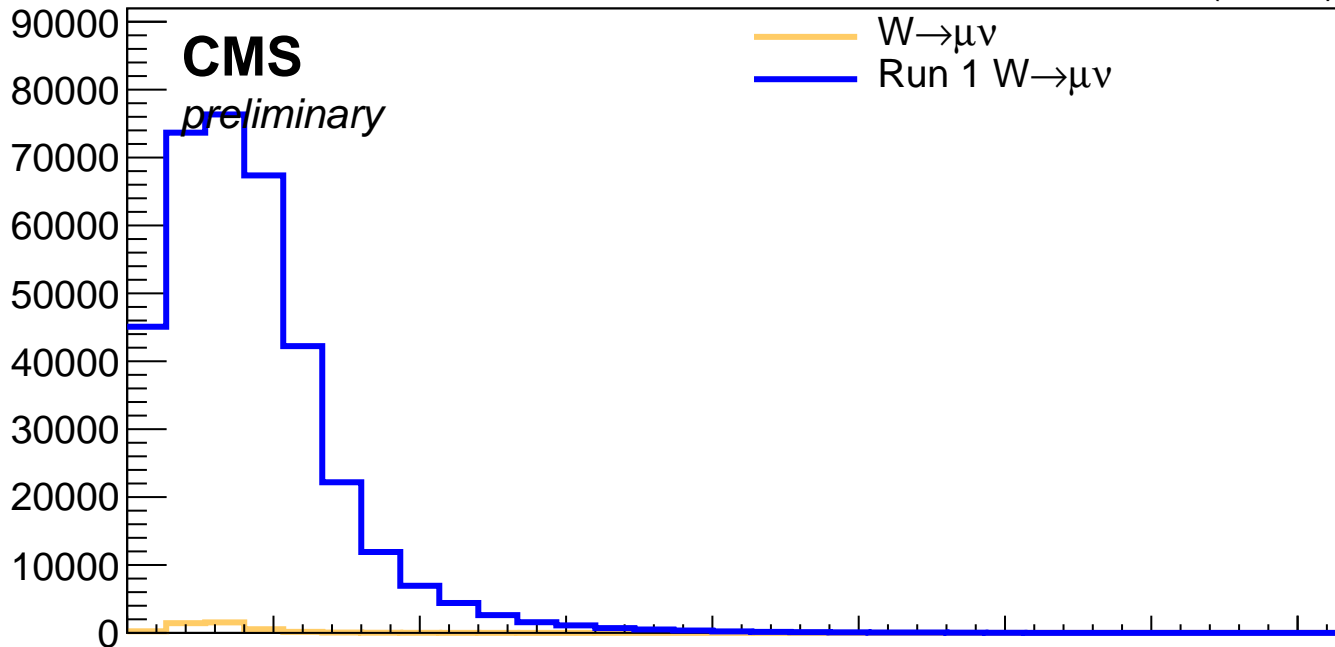


19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

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



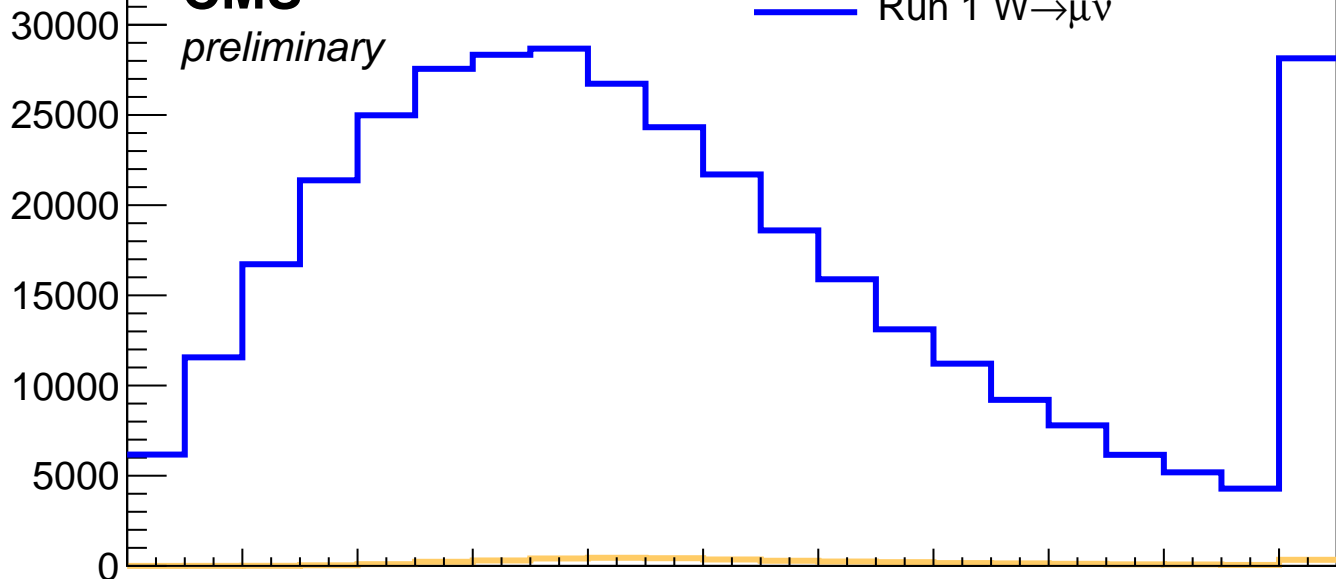
19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

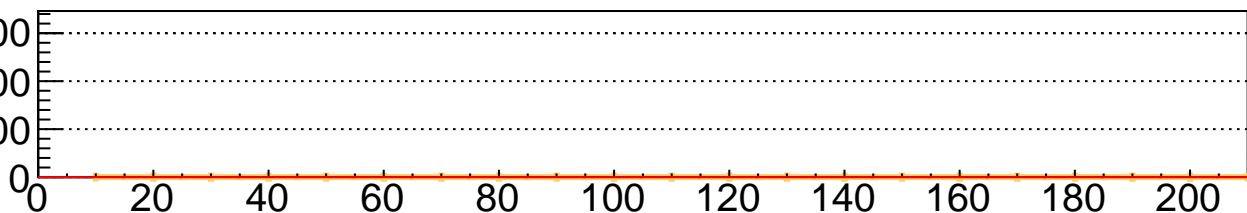
*preliminary*

W→μν

Run 1 W→μν



**Data/Bkg**



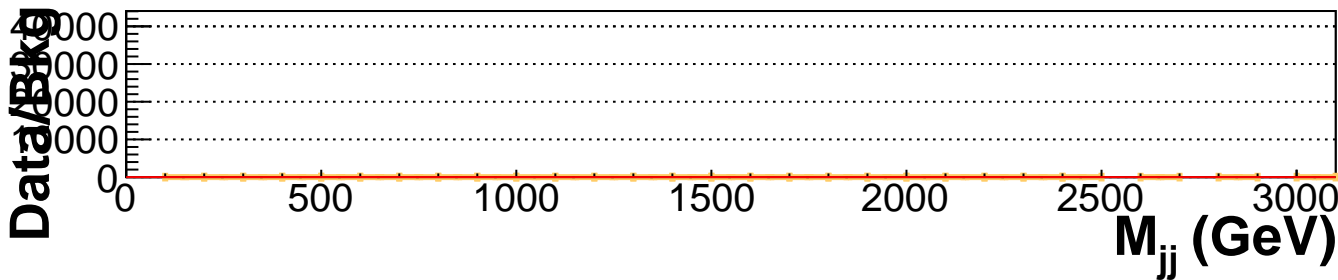
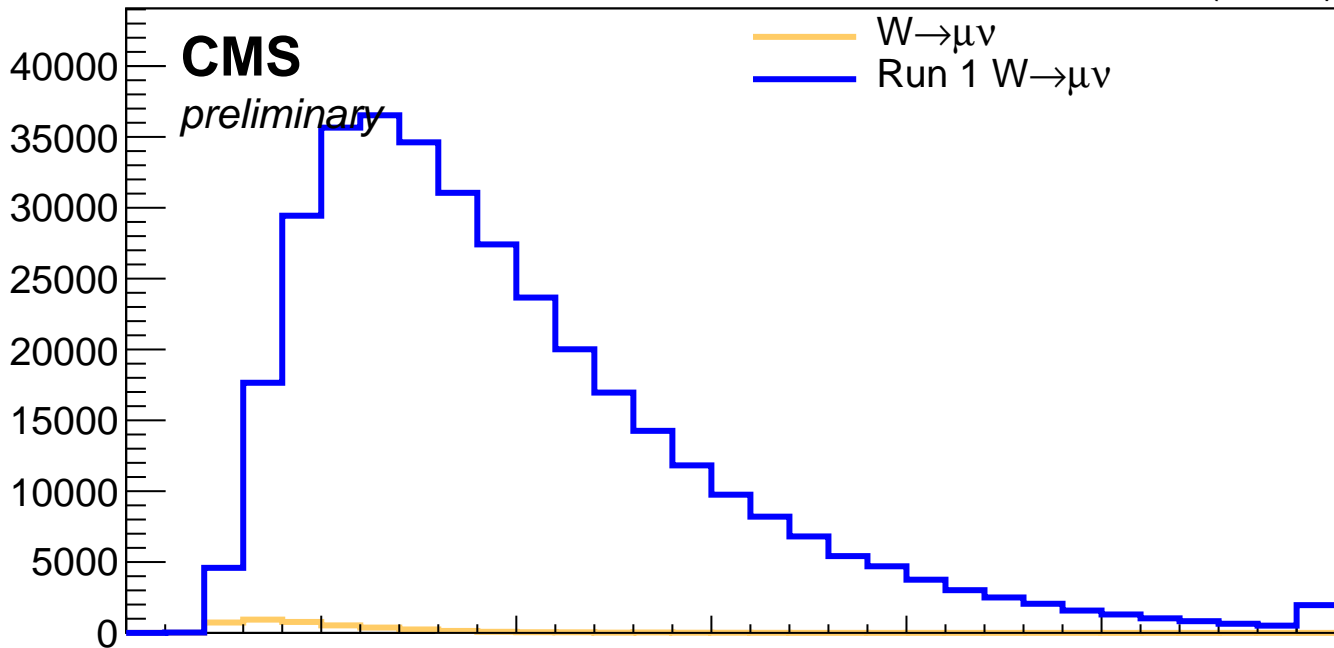
**L1MET (GeV)**

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

**CMS**

*preliminary*

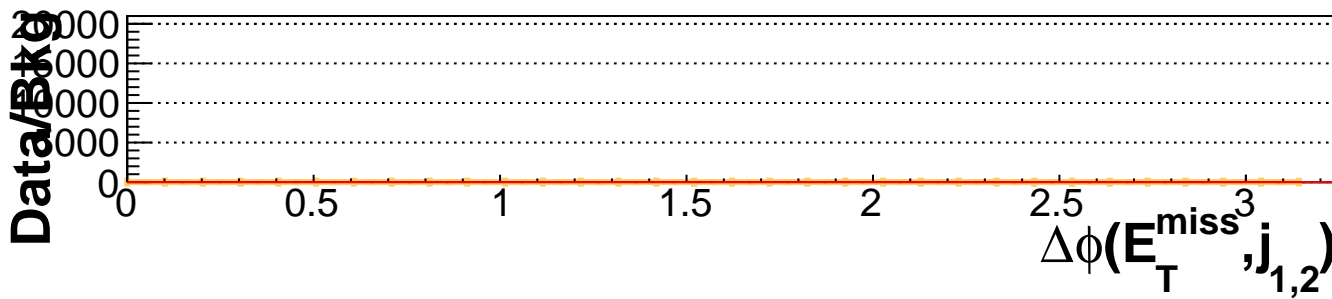
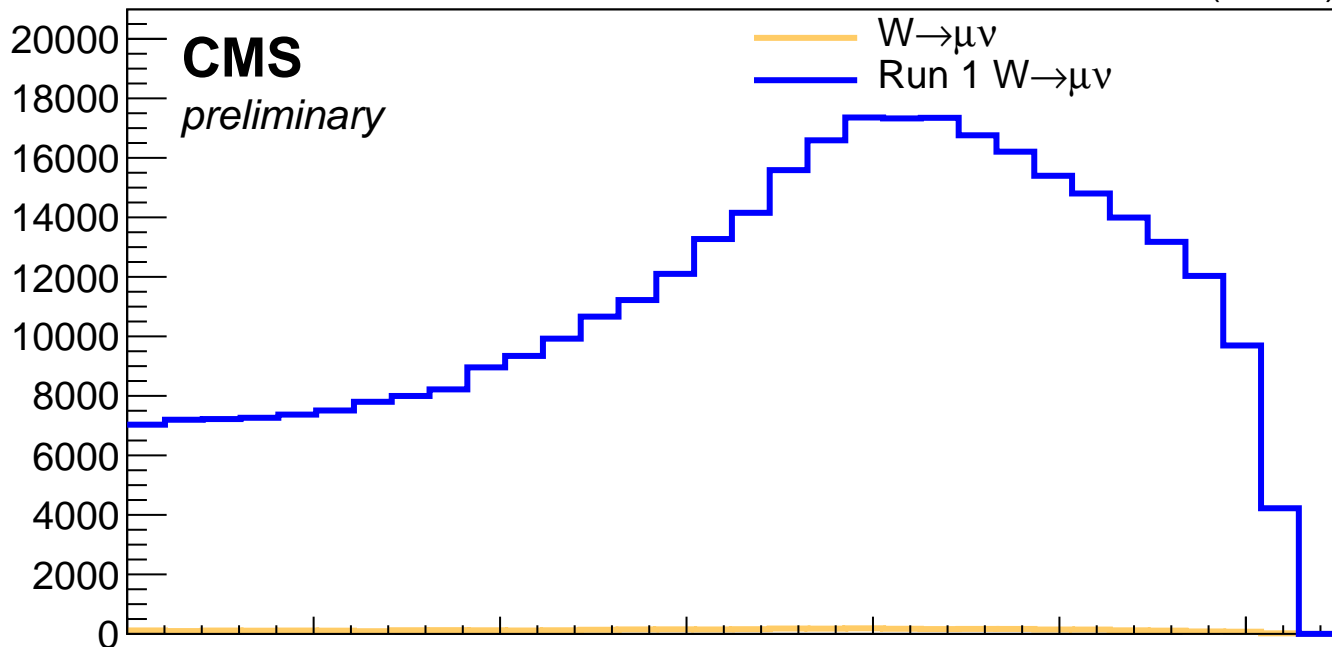
—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$



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

**CMS**  
*preliminary*

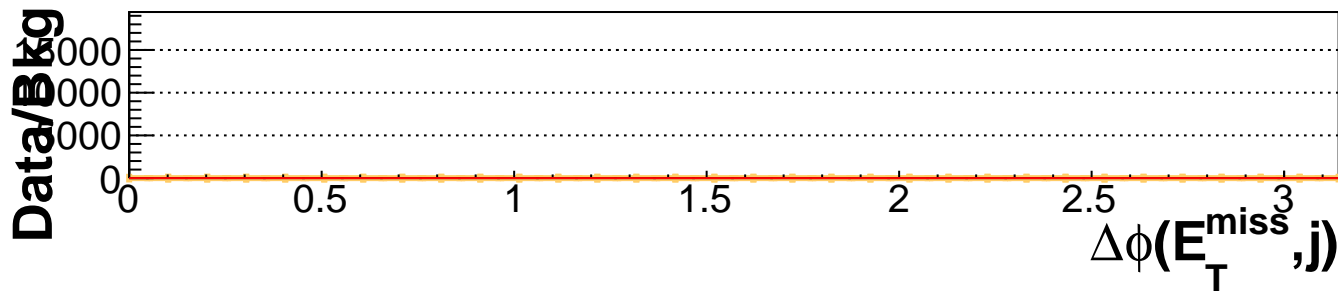
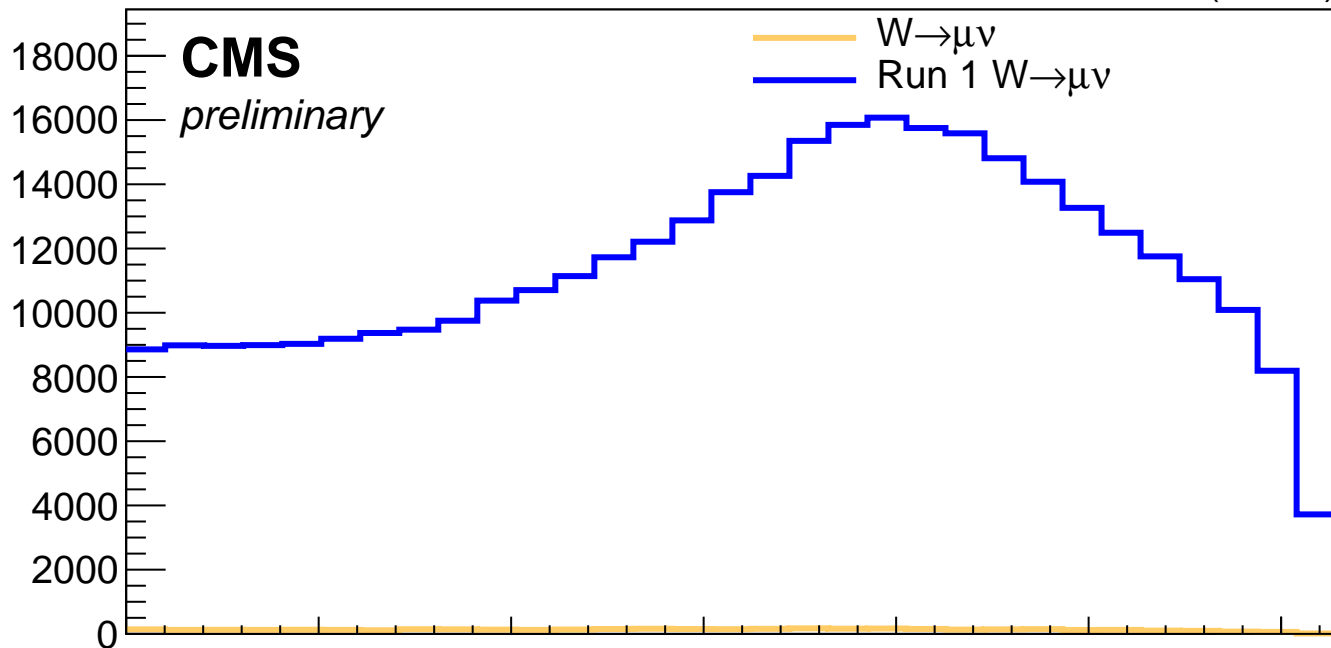
—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$



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

**CMS**  
*preliminary*

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



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

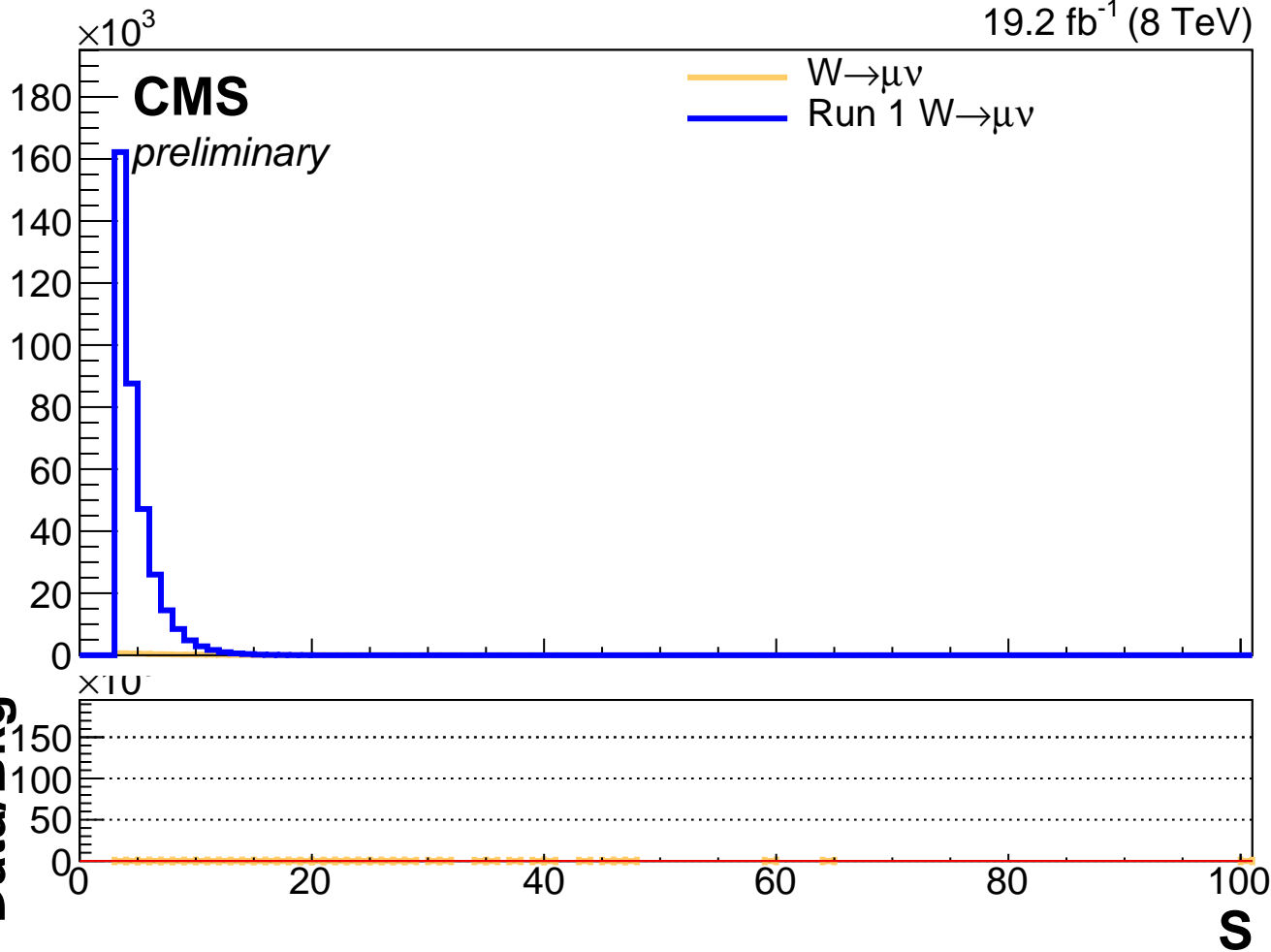
**CMS**

*preliminary*

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

**Data/Bkg**

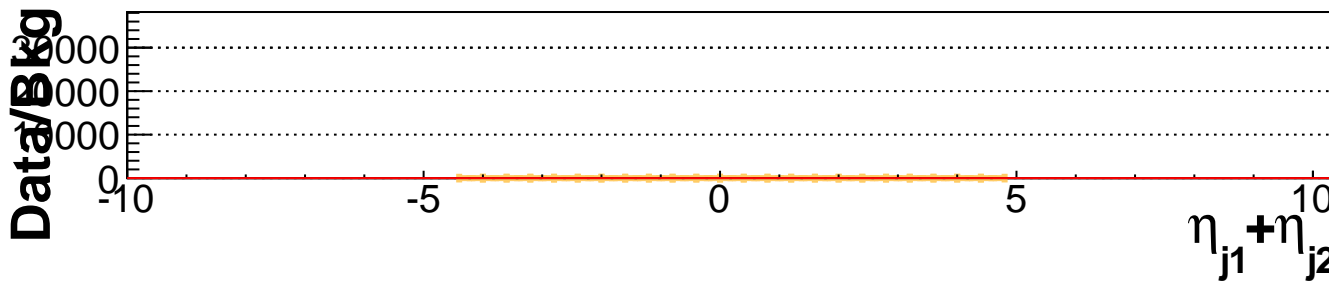
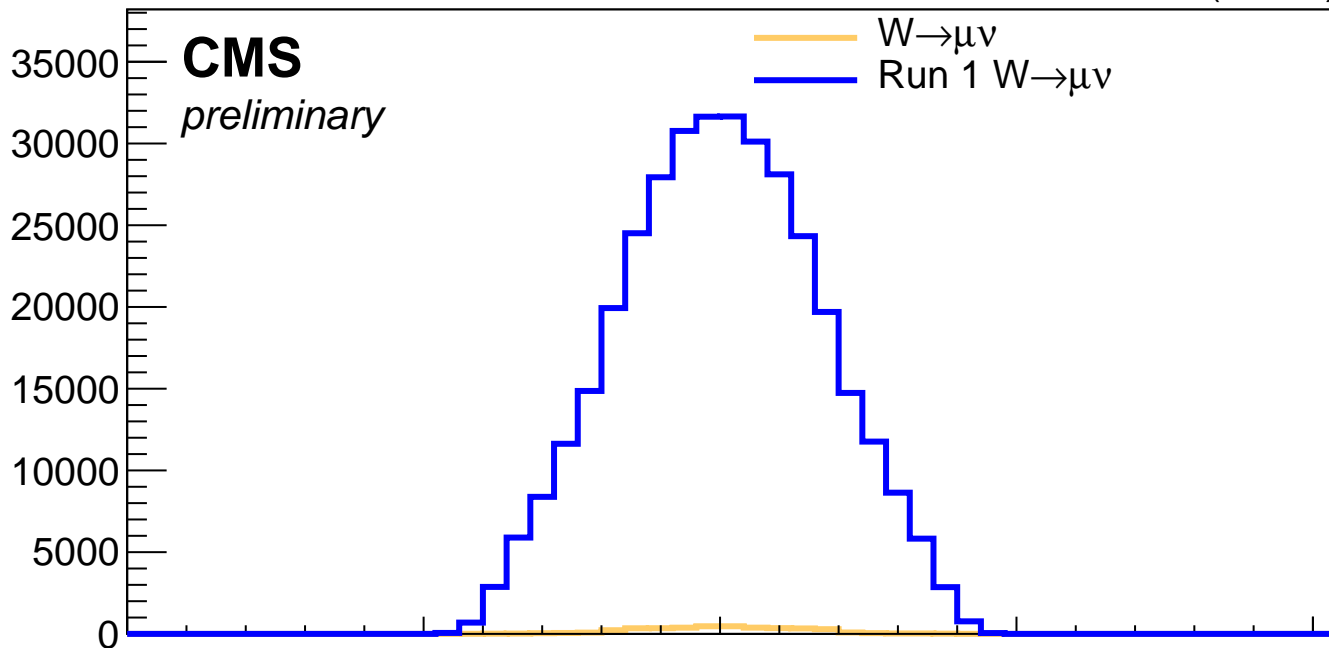
**S**



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

**CMS**  
*preliminary*

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

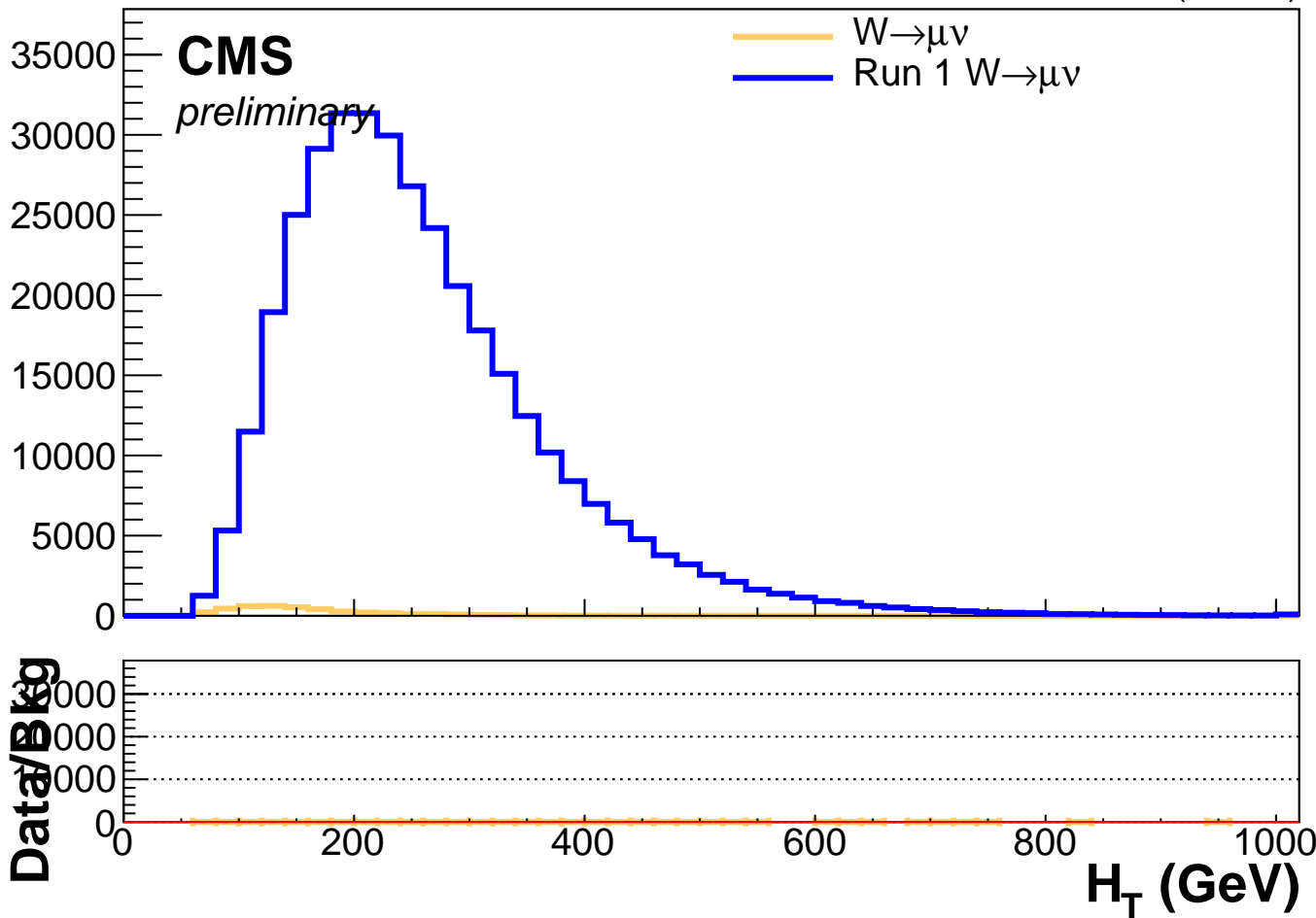


19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

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



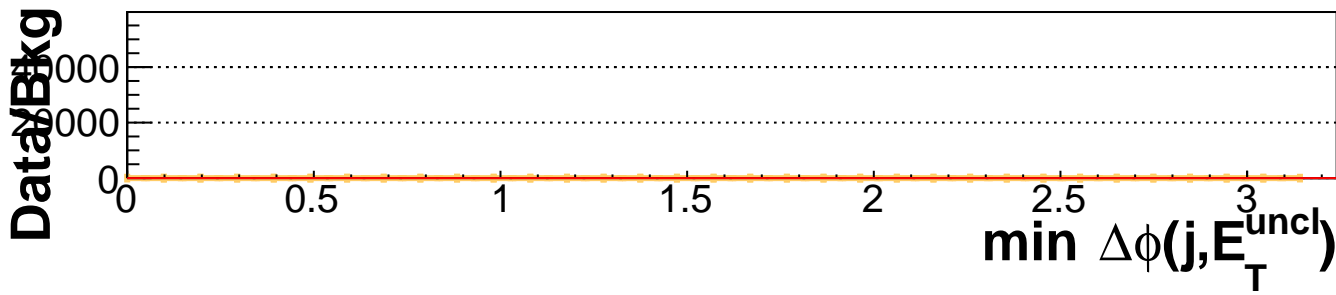
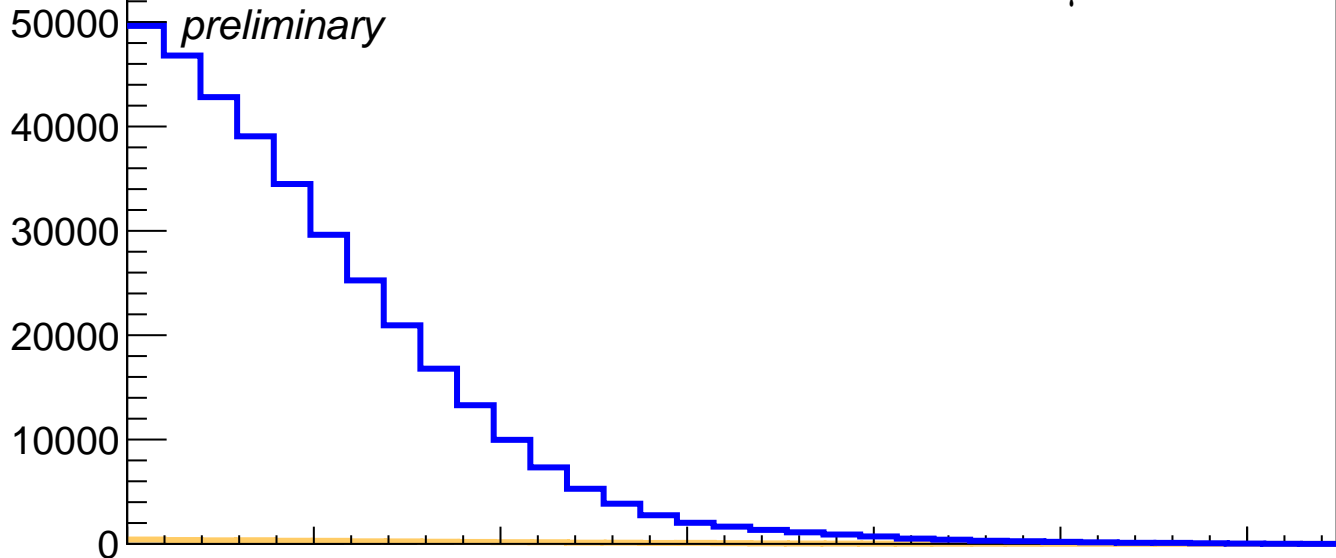


19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

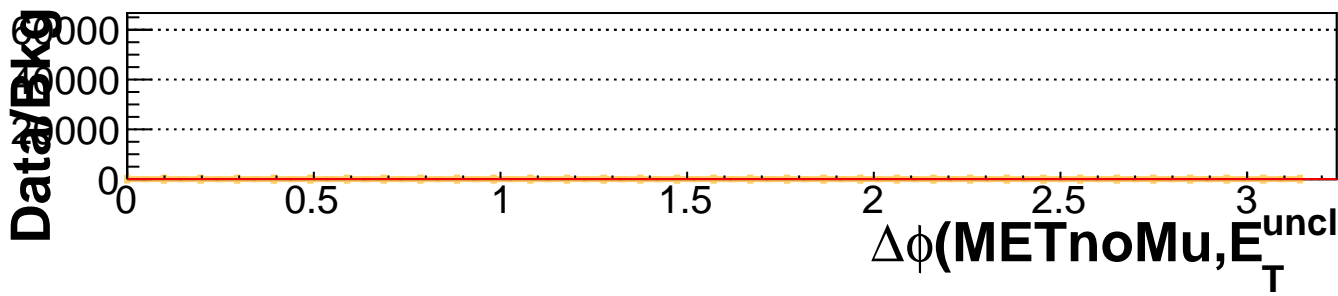
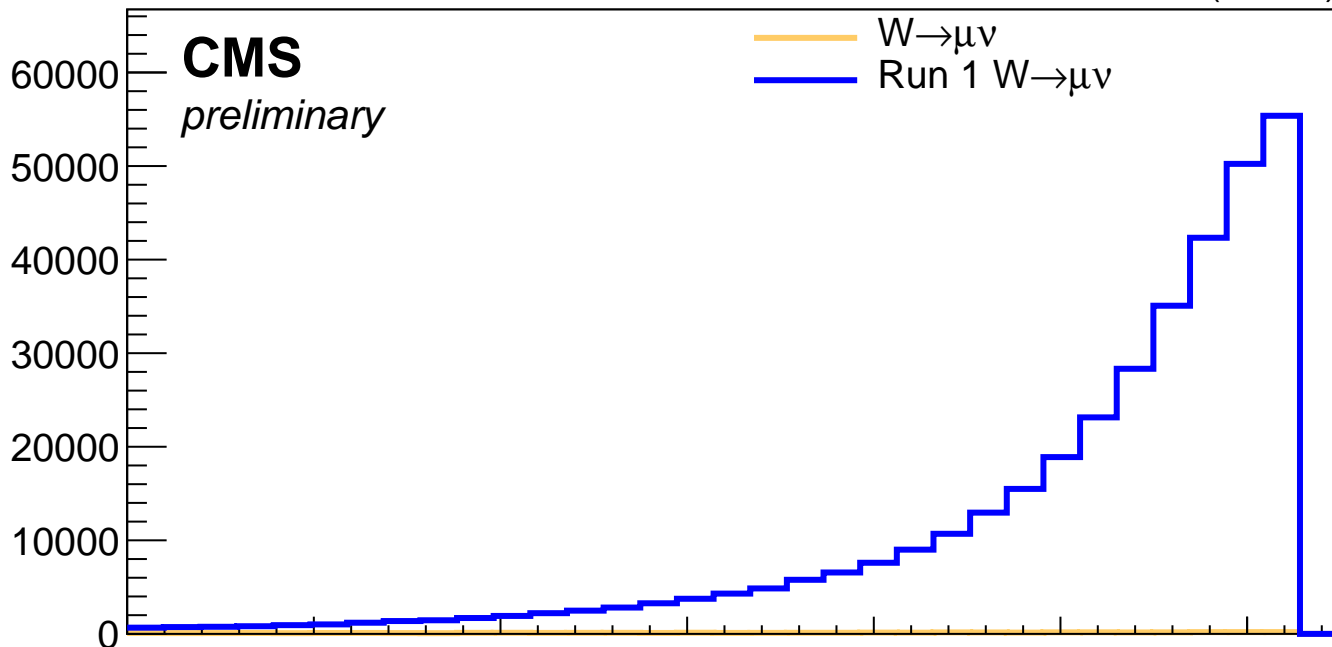
—  $W \rightarrow \mu \nu$   
— Run 1  $W \rightarrow \mu \nu$



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

**CMS**  
*preliminary*

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



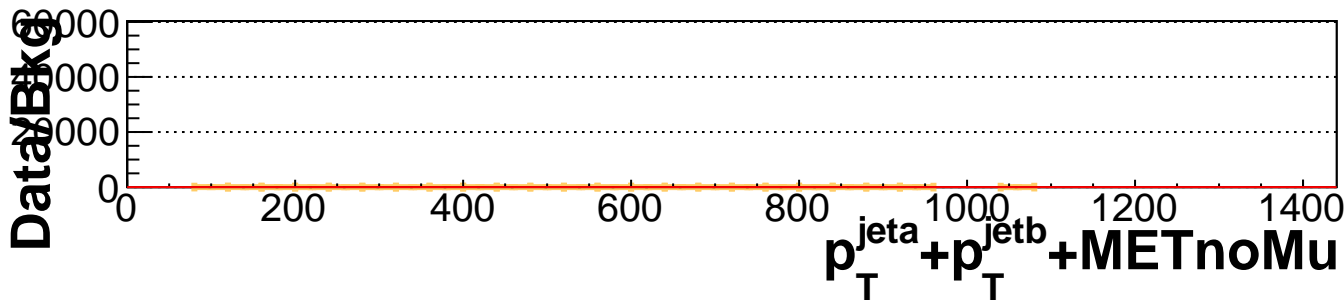
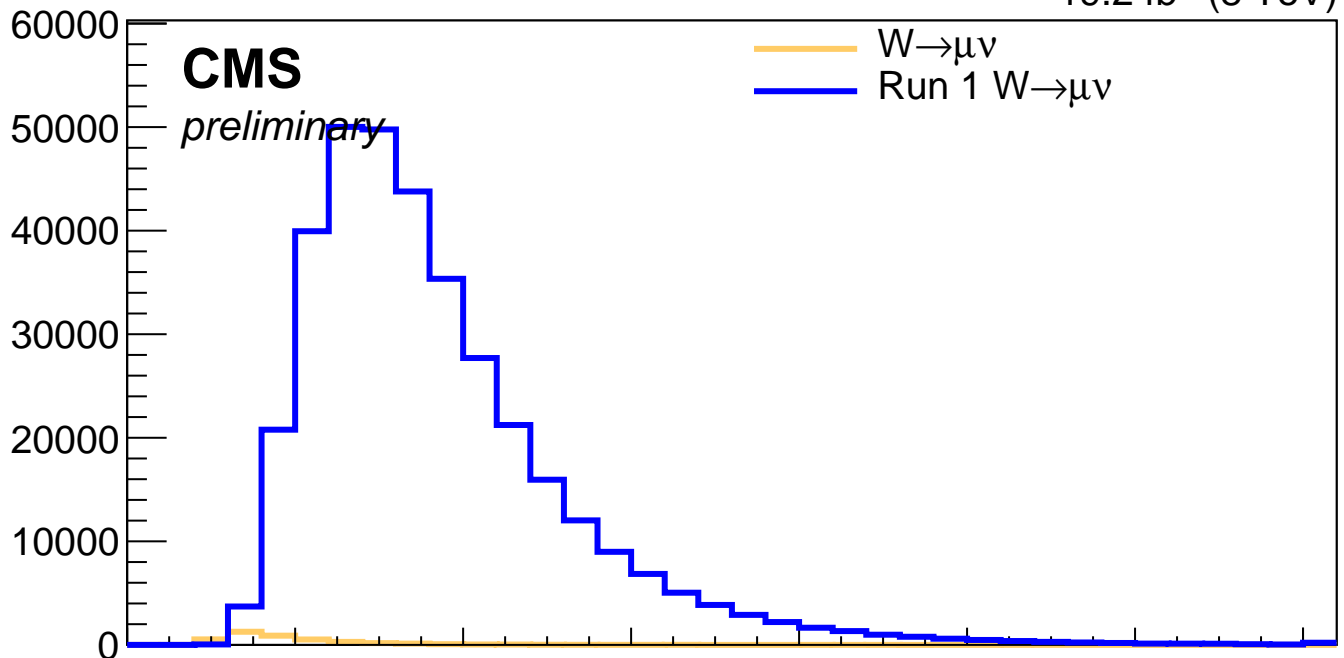
19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

—  $W \rightarrow \mu \nu$

— Run 1  $W \rightarrow \mu \nu$



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

**CMS**

*preliminary*

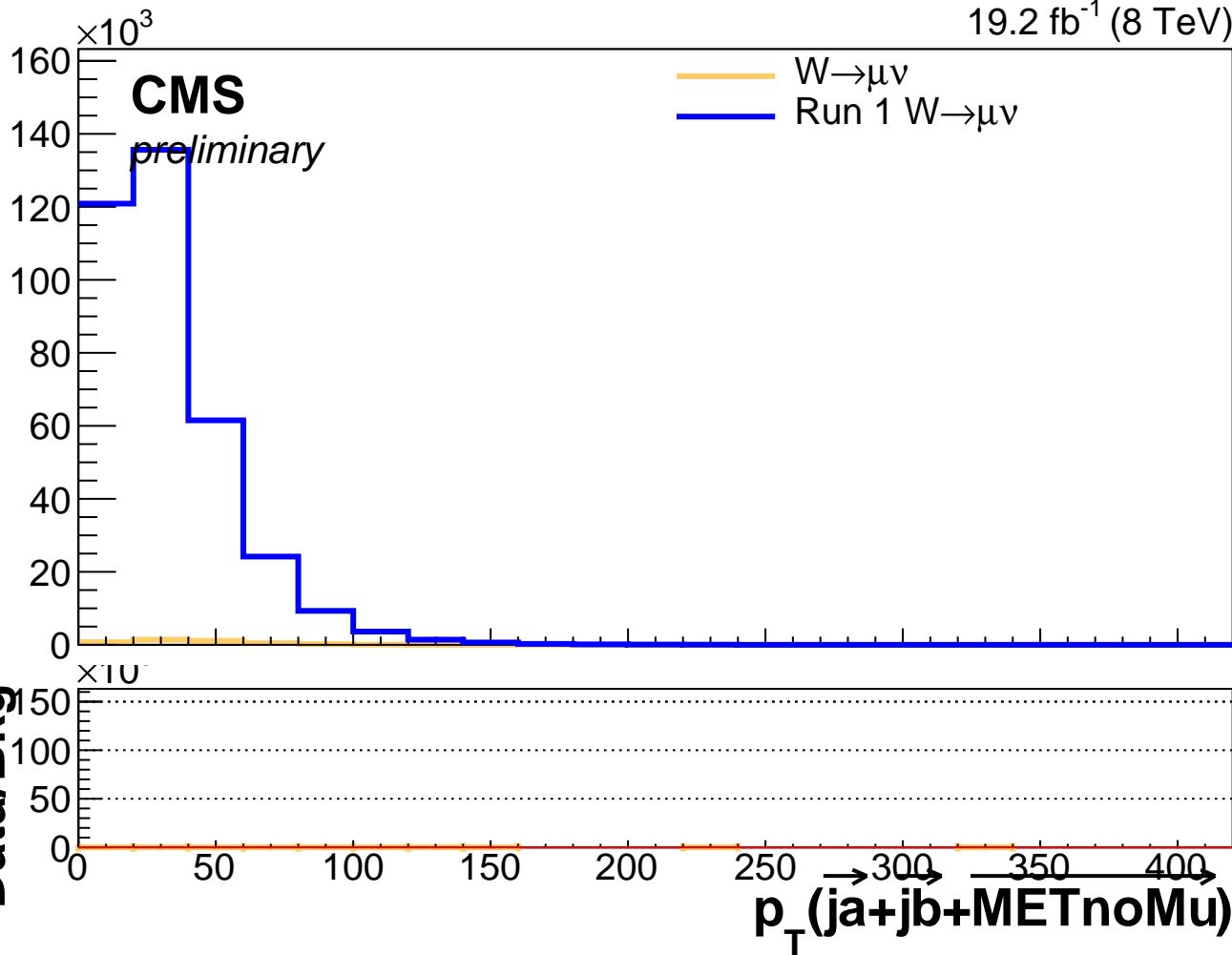
—  $W \rightarrow \mu \nu$

— Run 1  $W \rightarrow \mu \nu$

**Data/Bkg**

$\times 10^{-1}$

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



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

**CMS**

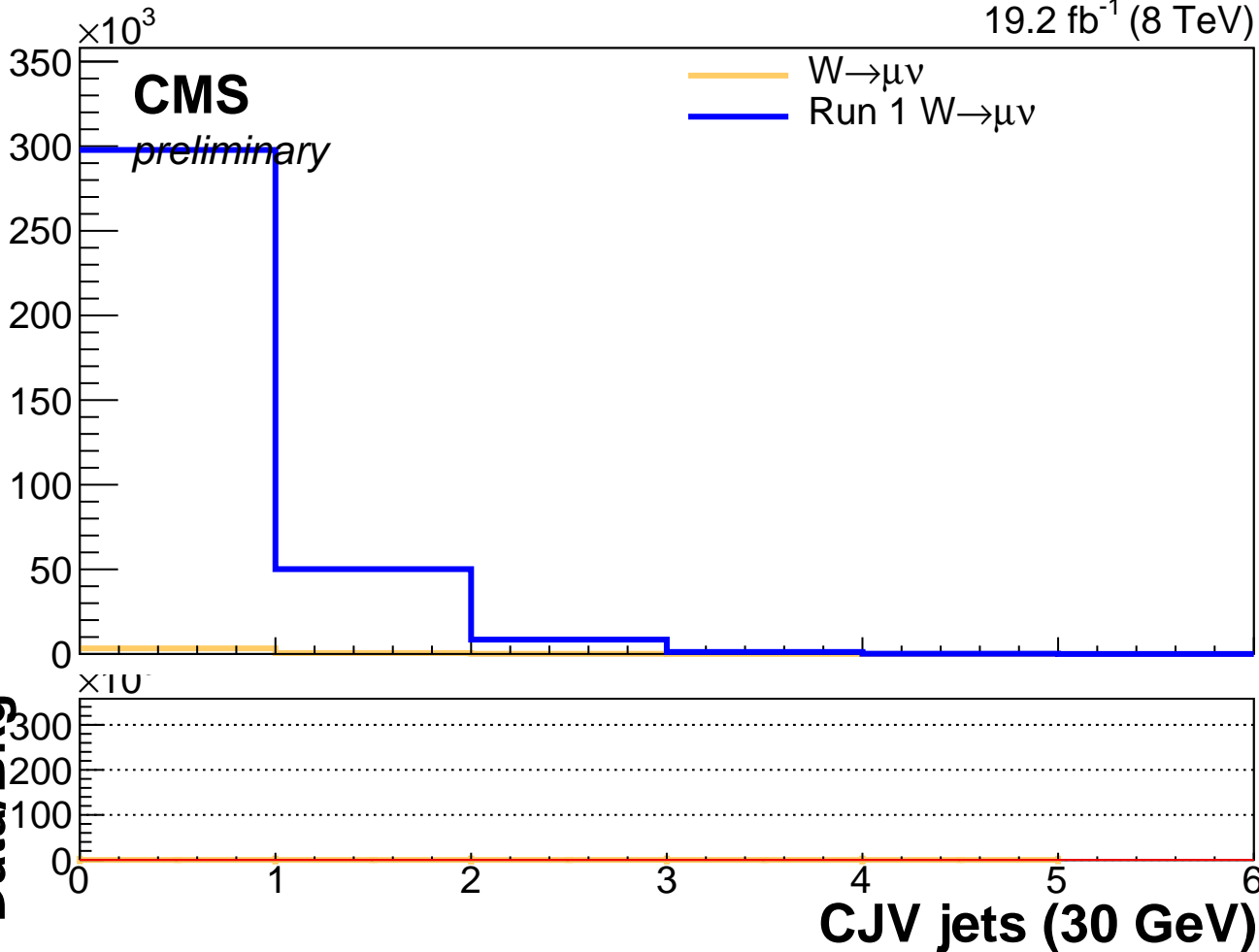
*preliminary*

W→μν

Run 1 W→μν

**Data/Bkg**

**CJV jets (30 GeV)**



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

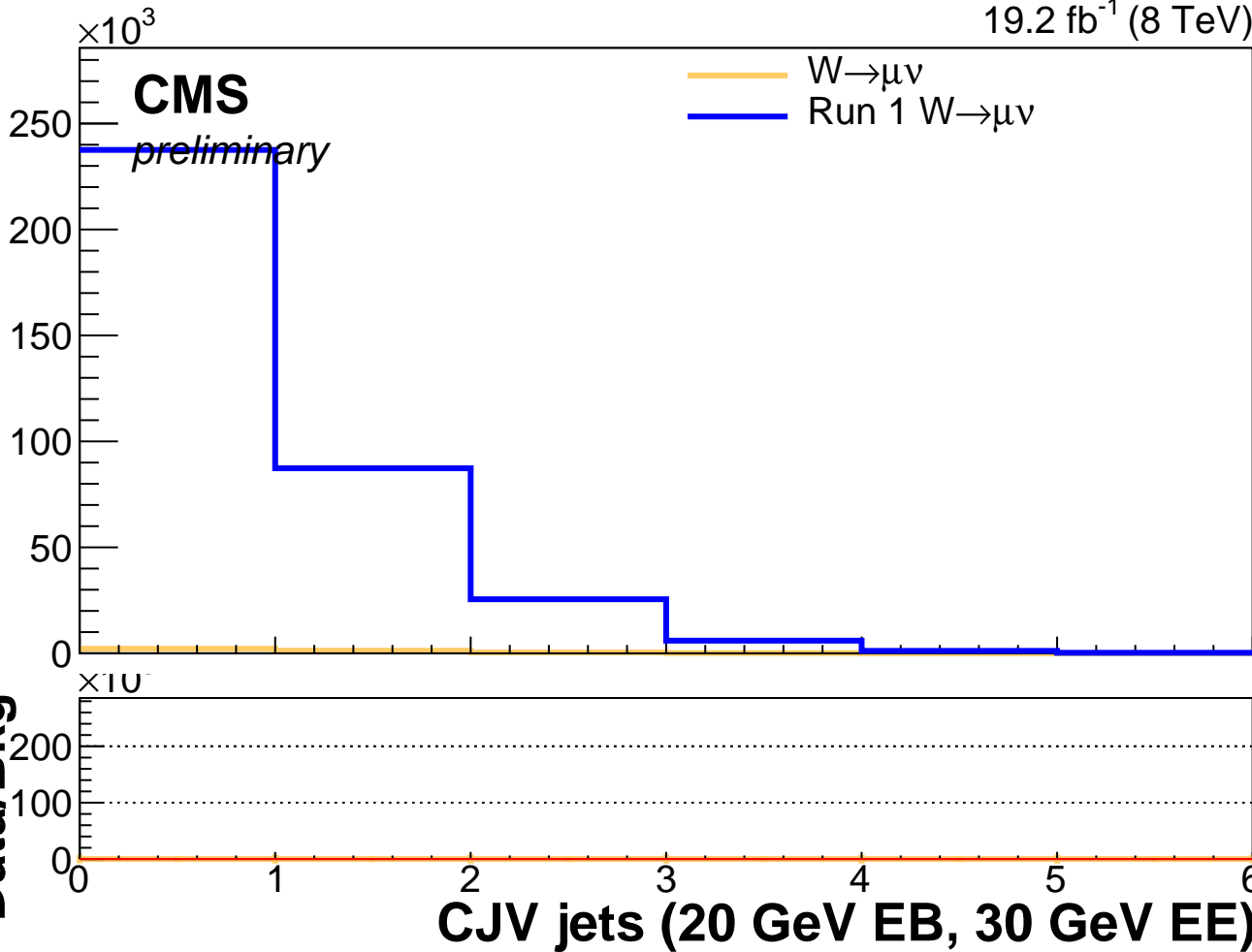
**CMS**

*preliminary*

— W→μν  
— Run 1 W→μν

**Data/Bkg**

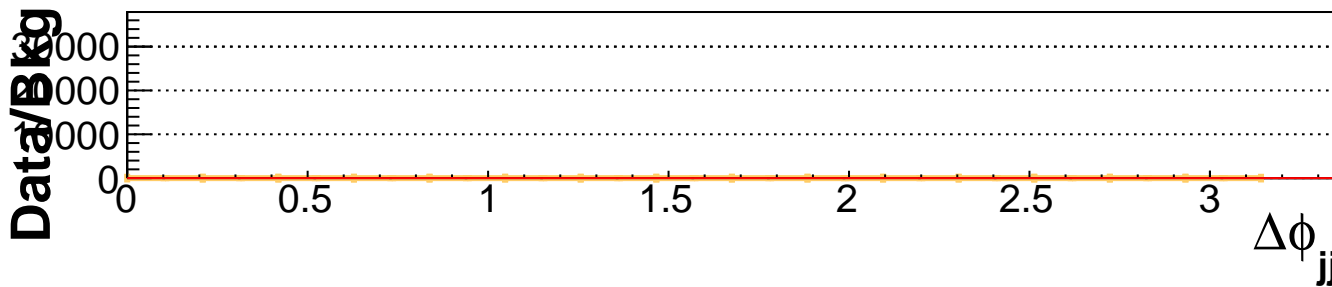
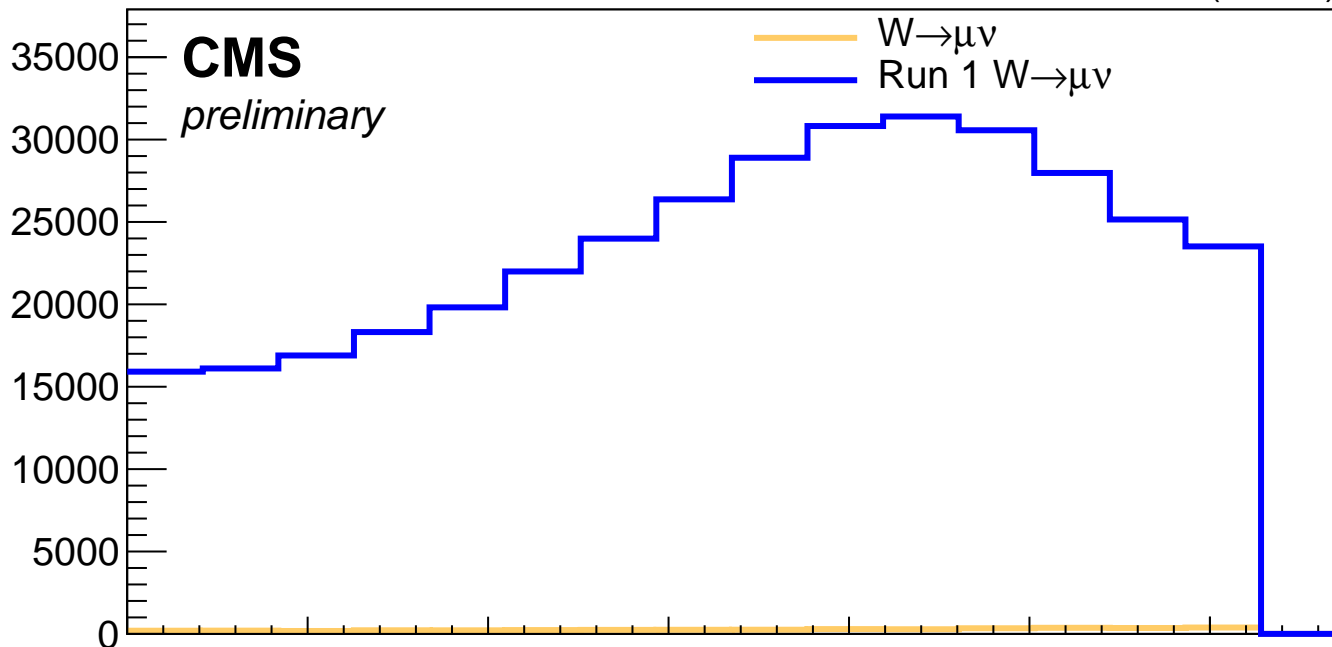
**CJV jets (20 GeV EB, 30 GeV EE)**



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

**CMS**  
*preliminary*

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

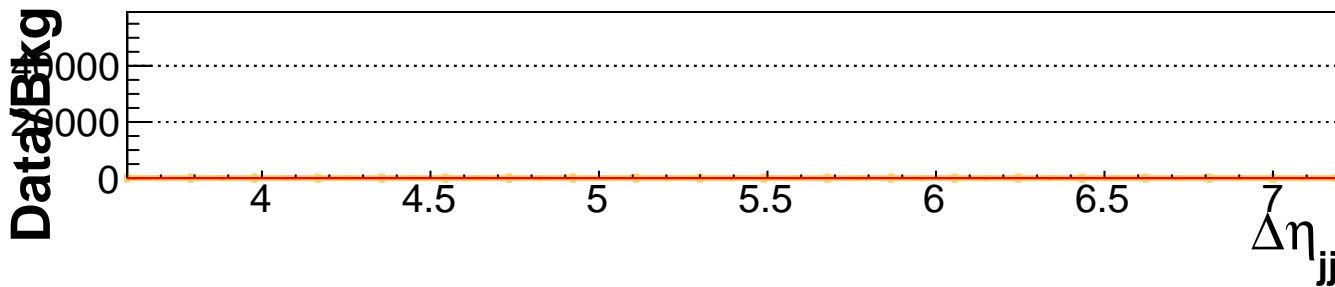
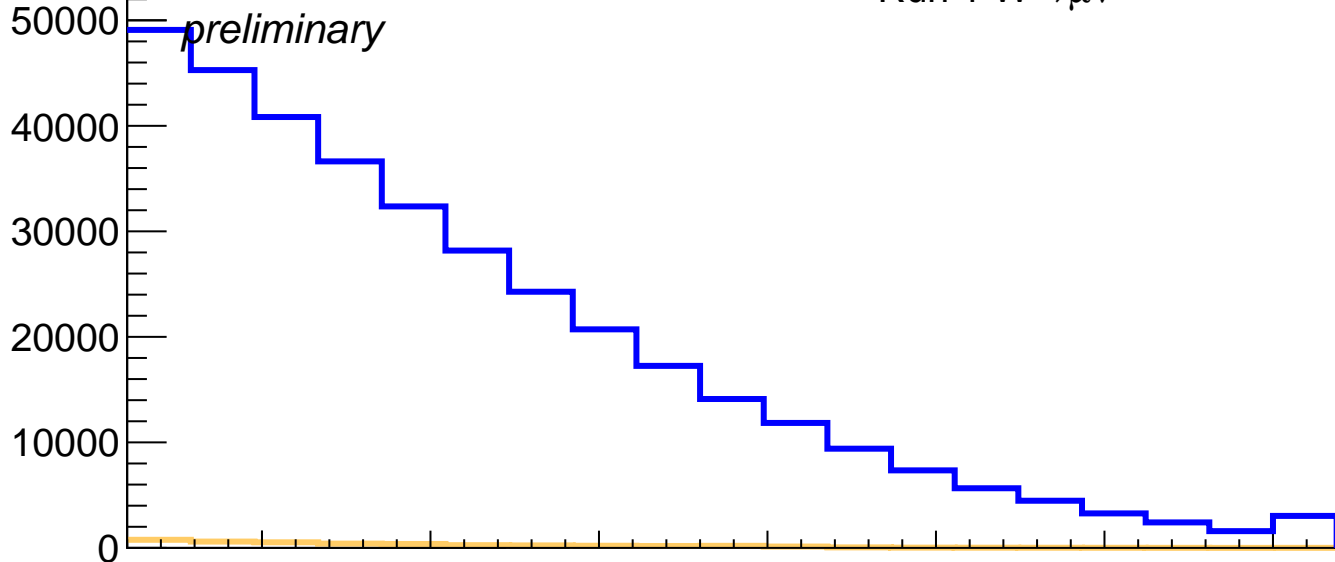


19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

*preliminary*

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





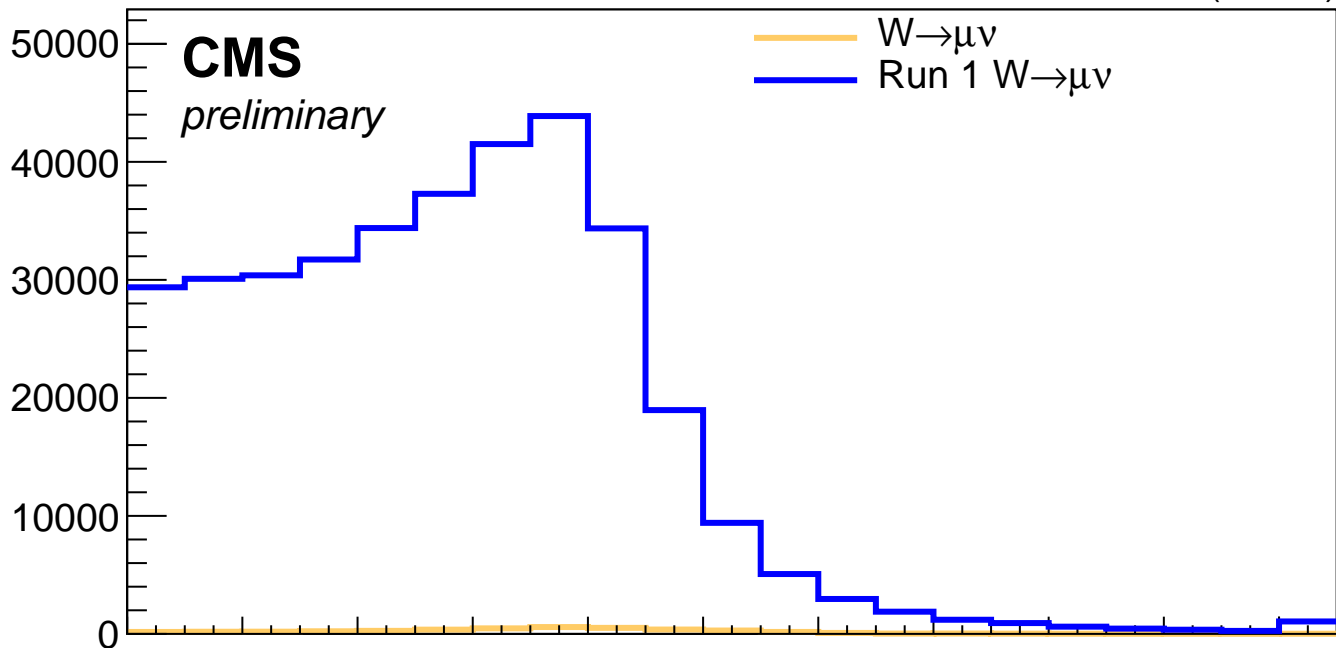
19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

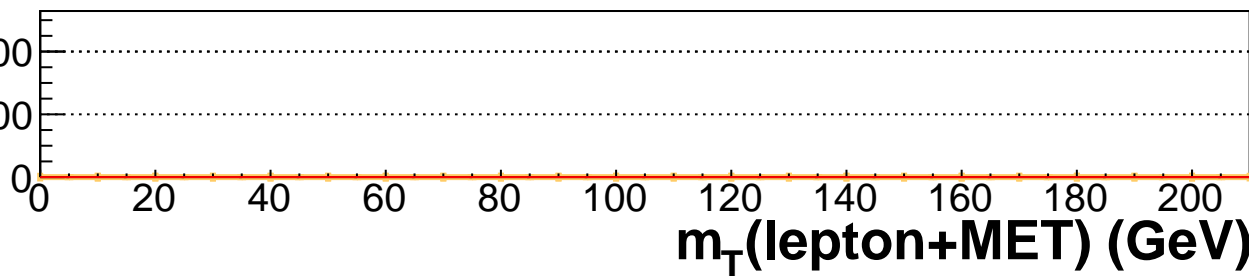
*preliminary*

— W→μν

— Run 1 W→μν



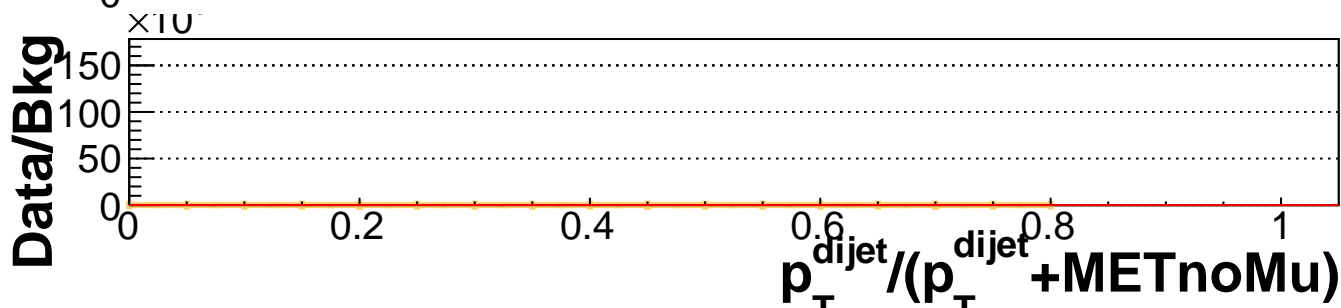
**Data/Bkg**



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

**CMS**  
*preliminary*

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



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

**CMS**

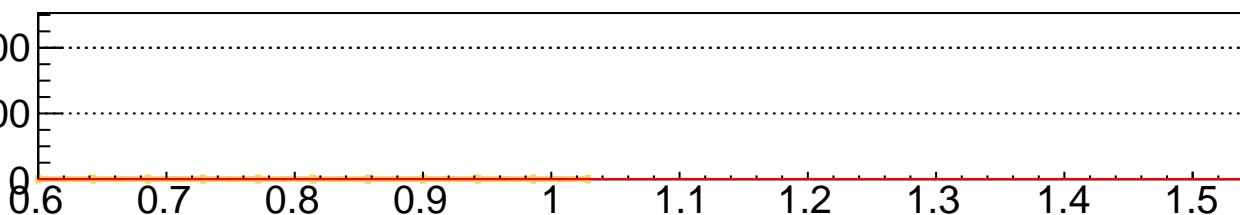
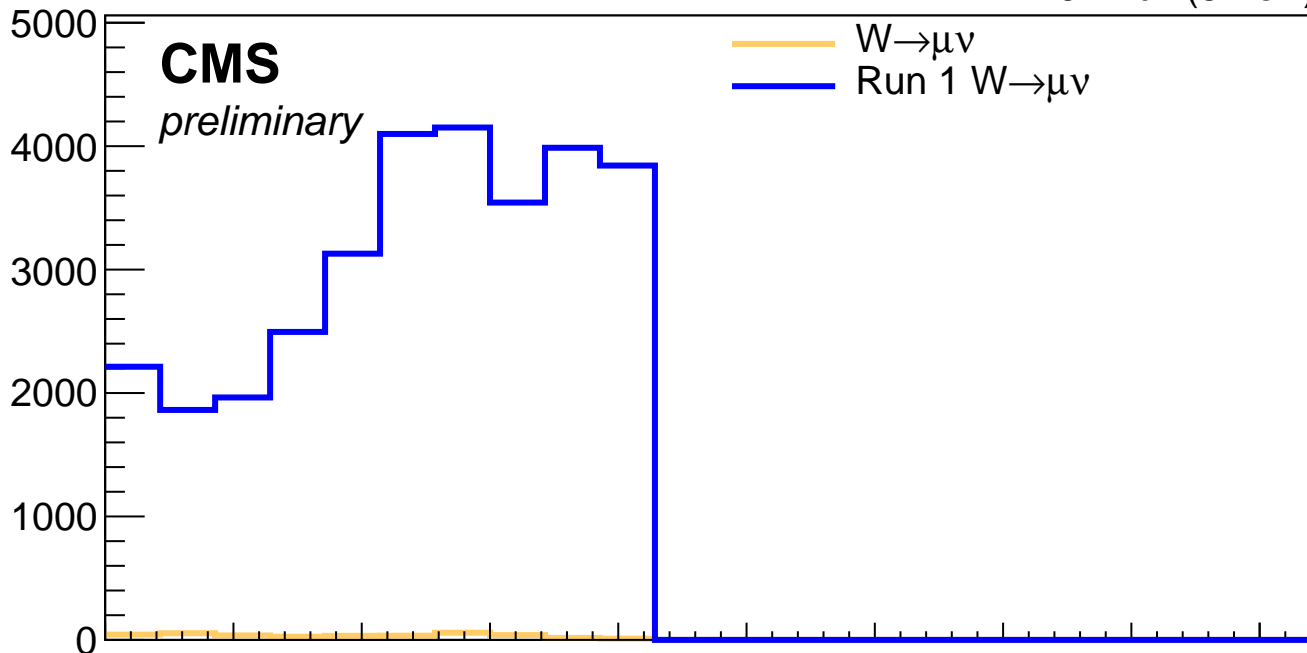
*preliminary*

— W→μν

— Run 1 W→μν

**Data/Bkg**

**Jet 1 CSV**



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

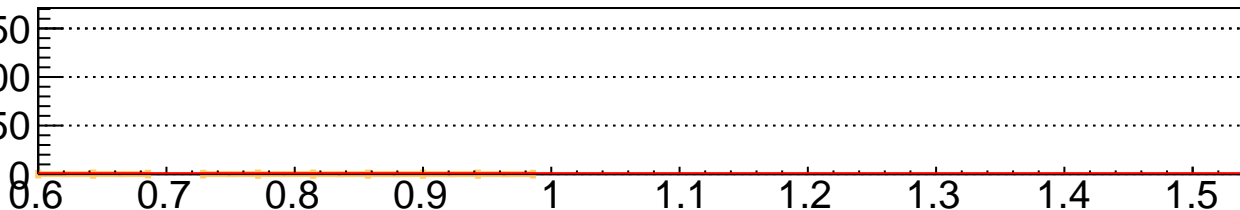
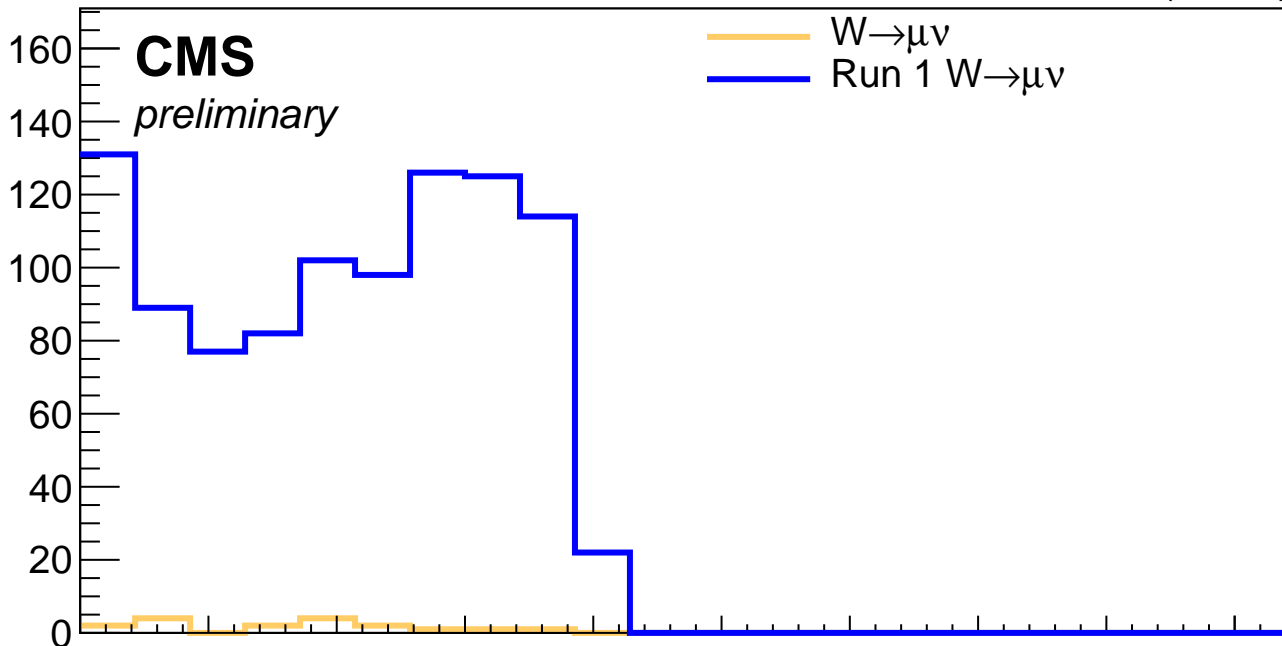
**CMS**

*preliminary*

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

**Data/Bkg**

**Jet 2 CSV**

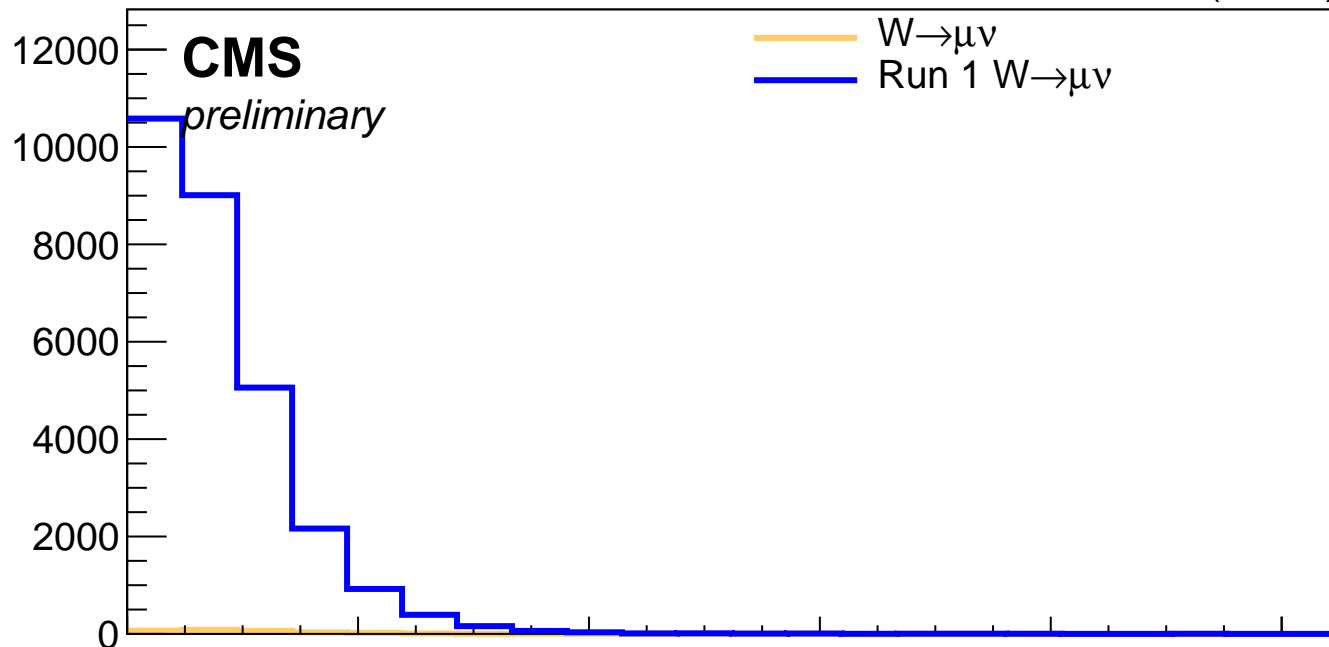


19.2 fb<sup>-1</sup> (8 TeV)

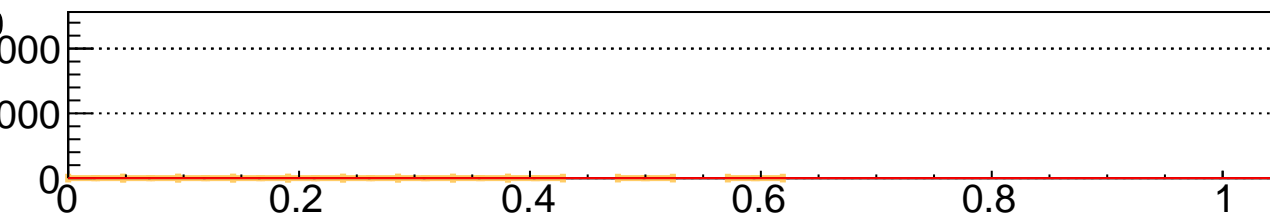
**CMS**

*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**

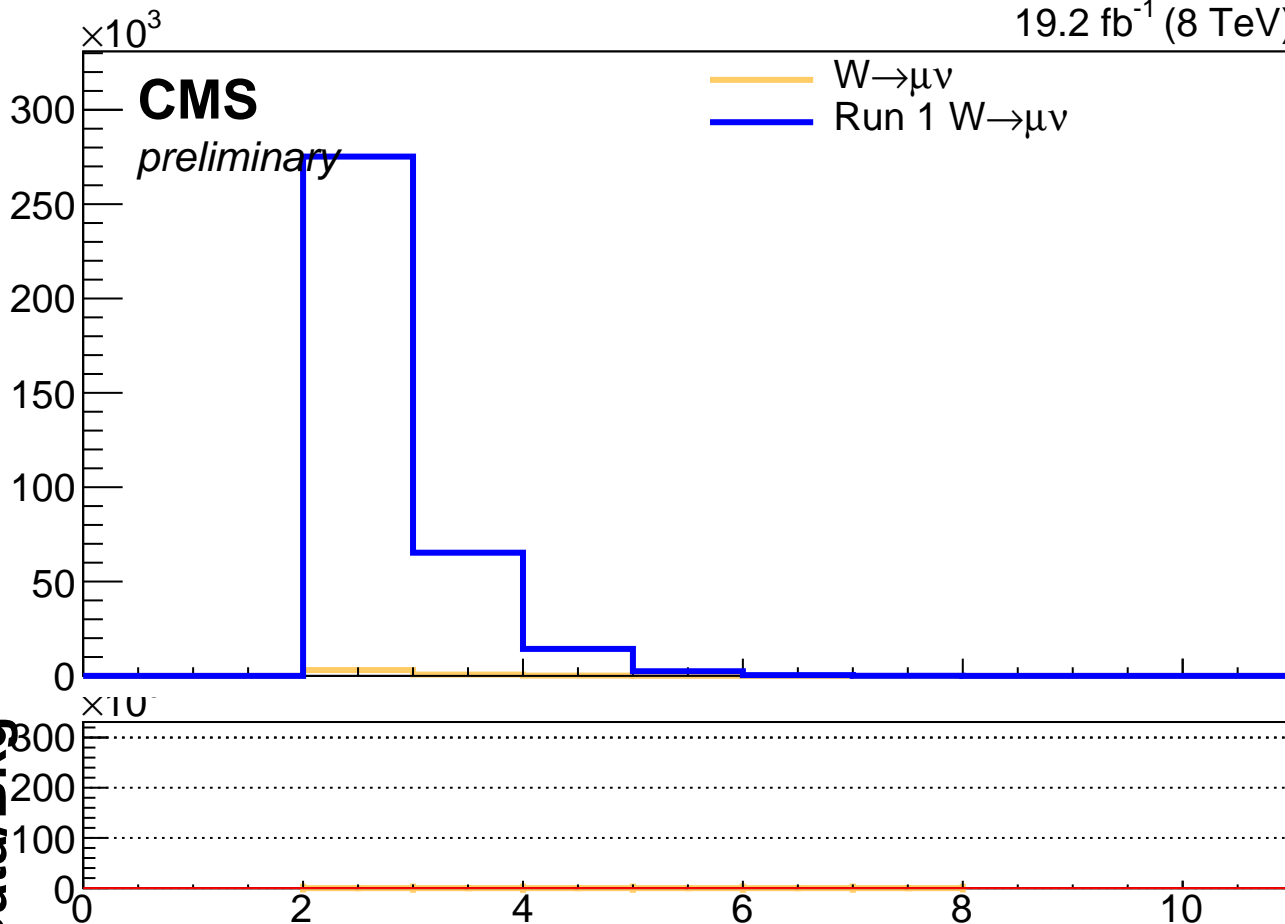
*preliminary*

W→μν

Run 1 W→μν

**Data/Bkg**

**N jets pt>30 GeV**



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

**CMS**

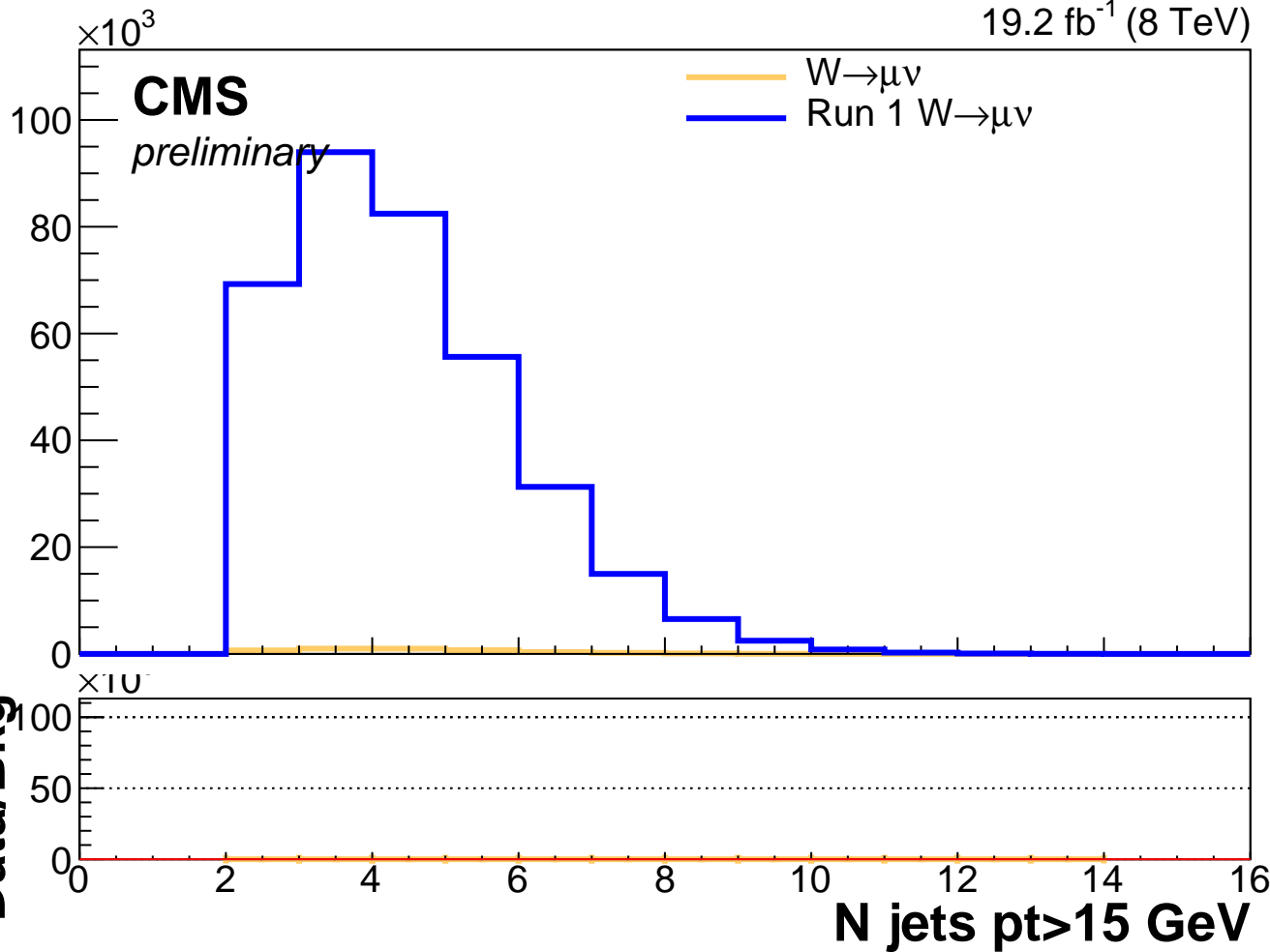
*preliminary*

W→μν

Run 1 W→μν

**Data/Bkg**

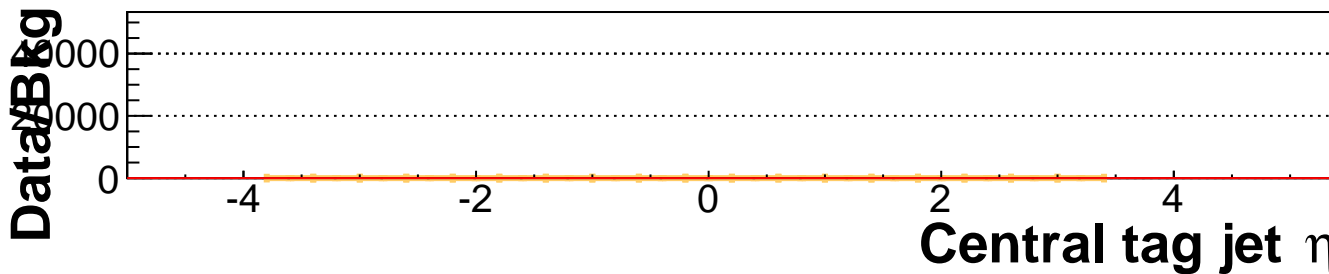
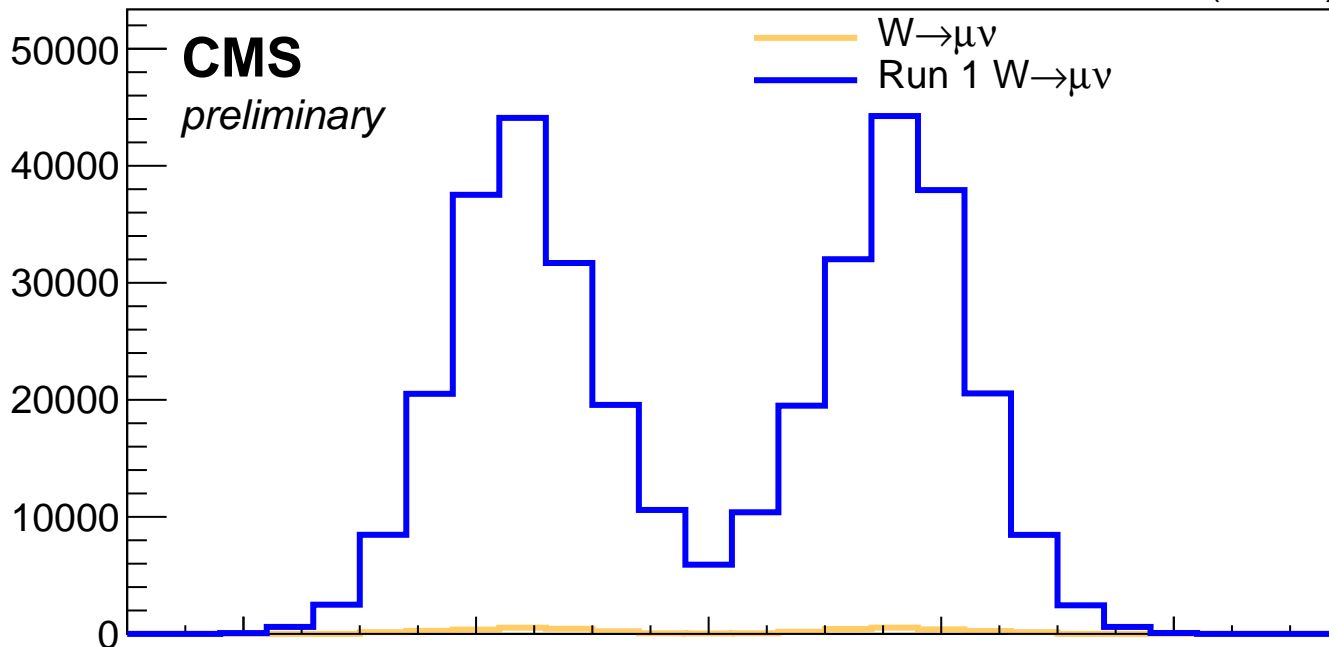
**N jets pt>15 GeV**



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

**CMS**  
*preliminary*

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





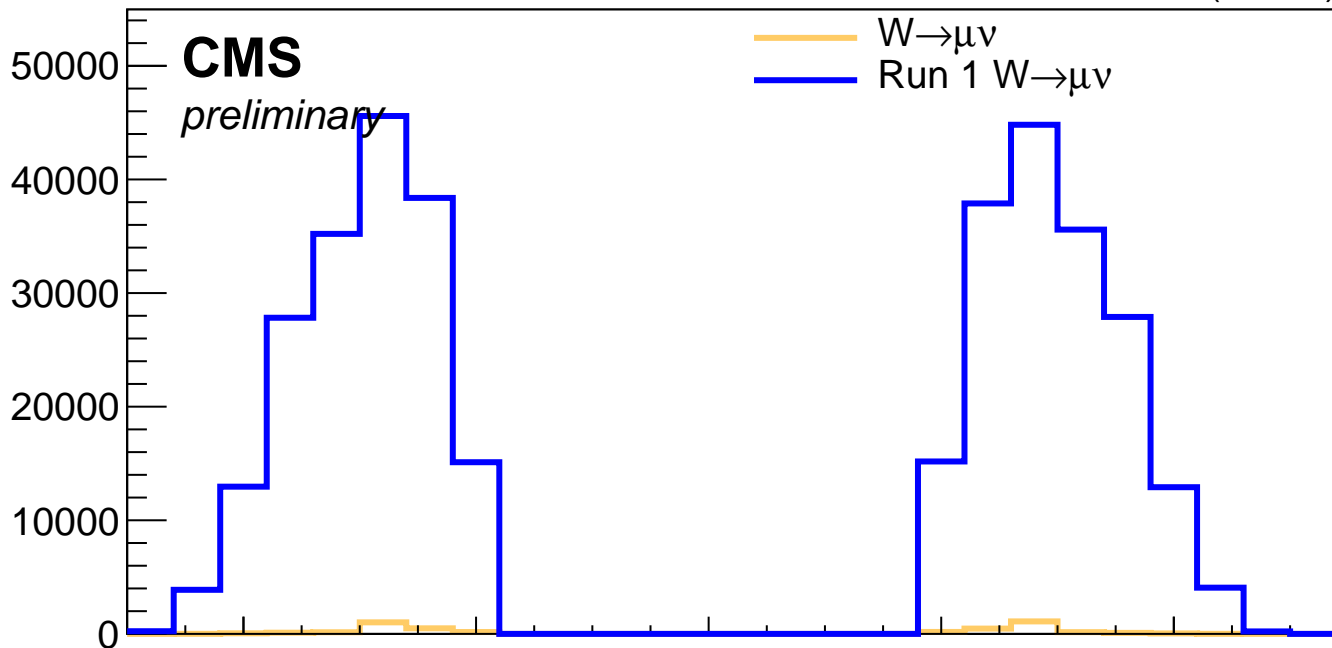
19.2 fb<sup>-1</sup> (8 TeV)

**CMS**

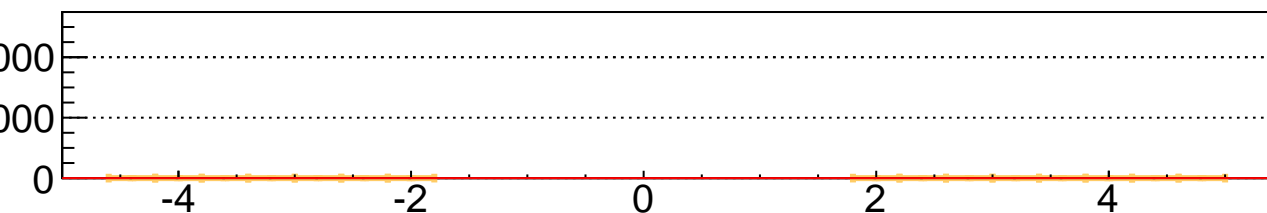
*preliminary*

— W→μν

— Run 1 W→μν



**Data/Bkg**



**Forward tag jet  $\eta$**