



A quick study of $W(\rightarrow ev) + jj$ events: reconstructed m_{jj} distribution

Kalanand Mishra
Fermilab



Candidate events selection

◆ $W \rightarrow e\nu$ reconstruction

- GsfElectron passing tight WP70 criteria, $E_T > 25$ GeV
- W transverse mass: $m_T > 50$ GeV
- PF MET > 25 GeV
- Z veto

◆ Require two PF jets in the event

- each jet with corrected $p_T > 20$ GeV and $|\eta| < 2.4$
- $|\cos\theta^*| < 0.4$, $|\Delta\phi(\text{jet1}, \text{jet2})| > 1.5$
- $|\Delta\phi(\text{jet1}, \text{MET})| > 0.6$
- $|\Delta\phi(W, W) - \pi| < 0.2$
- No b-tagged jets

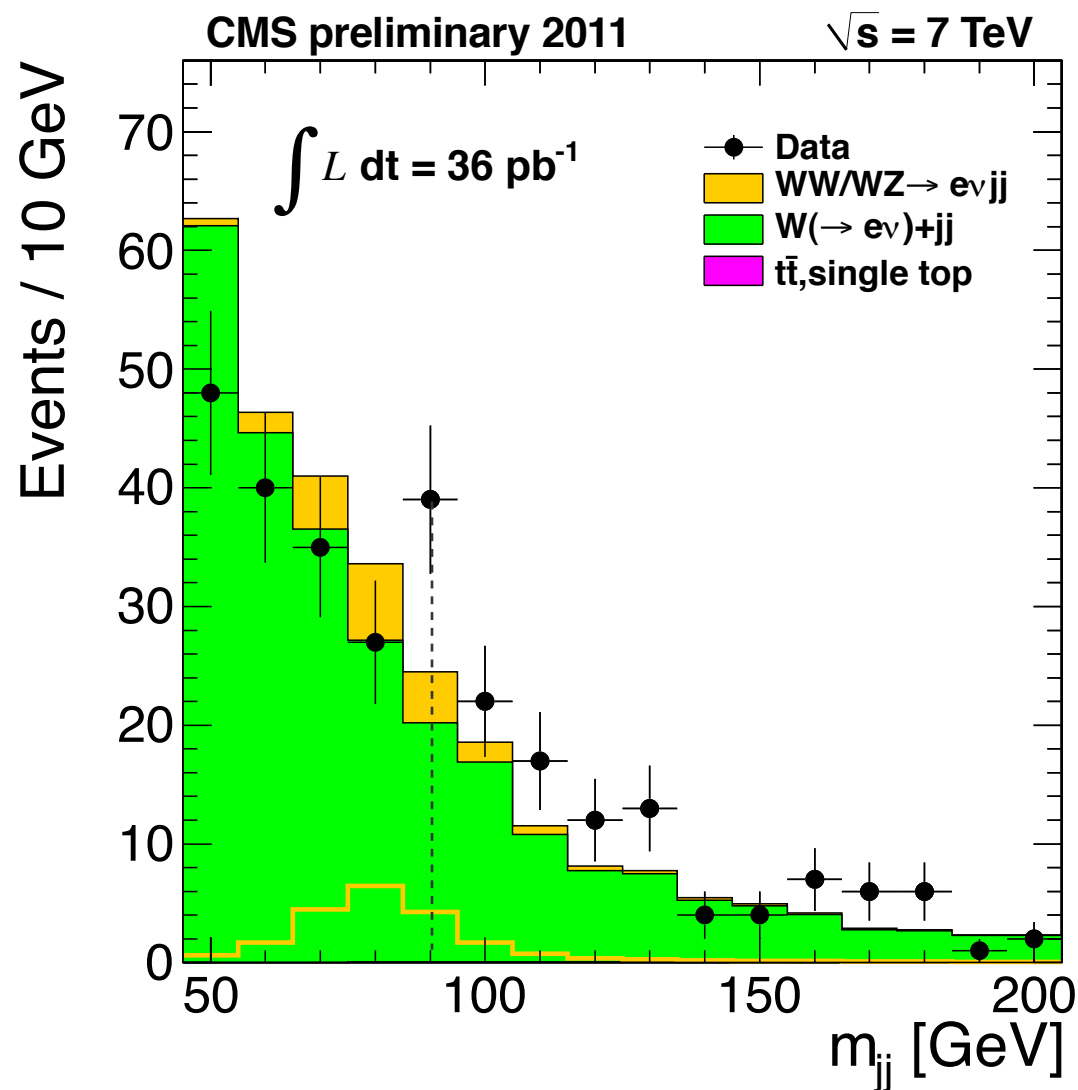
Apply standard
“L2 L3” correction
and “residual
correction” in data

Using 36 pb^{-1} data from 2010 run

- Start with ~ 92000 $W(\rightarrow e\nu) + N$ jets (where $N \geq 2$) events where $p_T^{\text{jet}} > 20$ GeV
- 260 events pass the above-listed $W+jj$ criteria

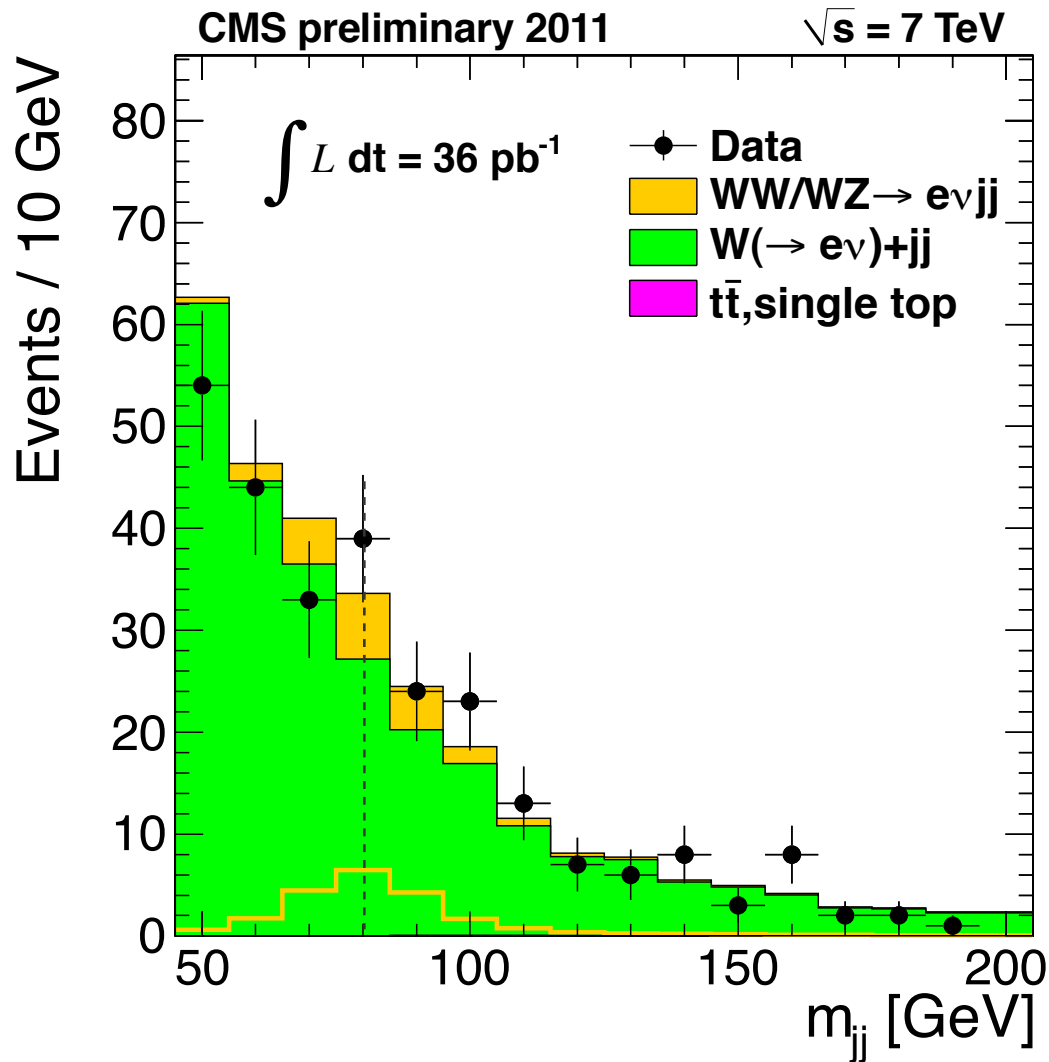
MC: $W+\text{jets}$: Madgraph, Top: Powheg, $WW+WZ$: Pythia
(all with pileup conditions observed in 2010 data)

m_{jj} distribution for W+jj events



- See clear W bump
- The bump is shifted right
- Need to adjust the JES to get the W peak at right place

m_{jj} distribution for $W+jj$ events



Had to adjust JES by -10%

observed events in data = 267

MC predicts:

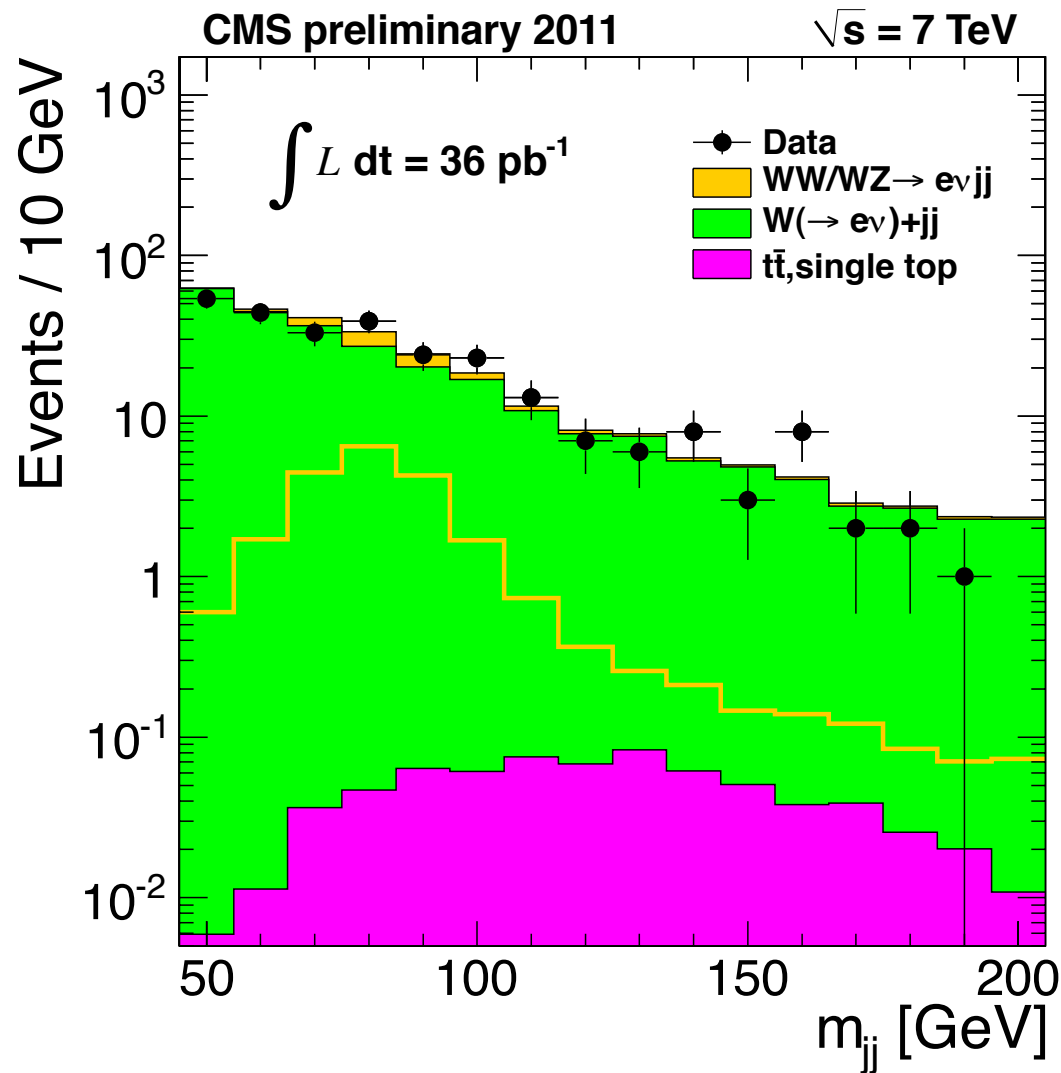
$W+jj = 257$

$T\bar{t}$ bar, single top = 0.7

$WW + WZ = 21$

LogY version of this plot
on next slide $\Rightarrow \Rightarrow \Rightarrow \Rightarrow$

m_{jj} distribution for $W+jj$ events



observed events in data = 267

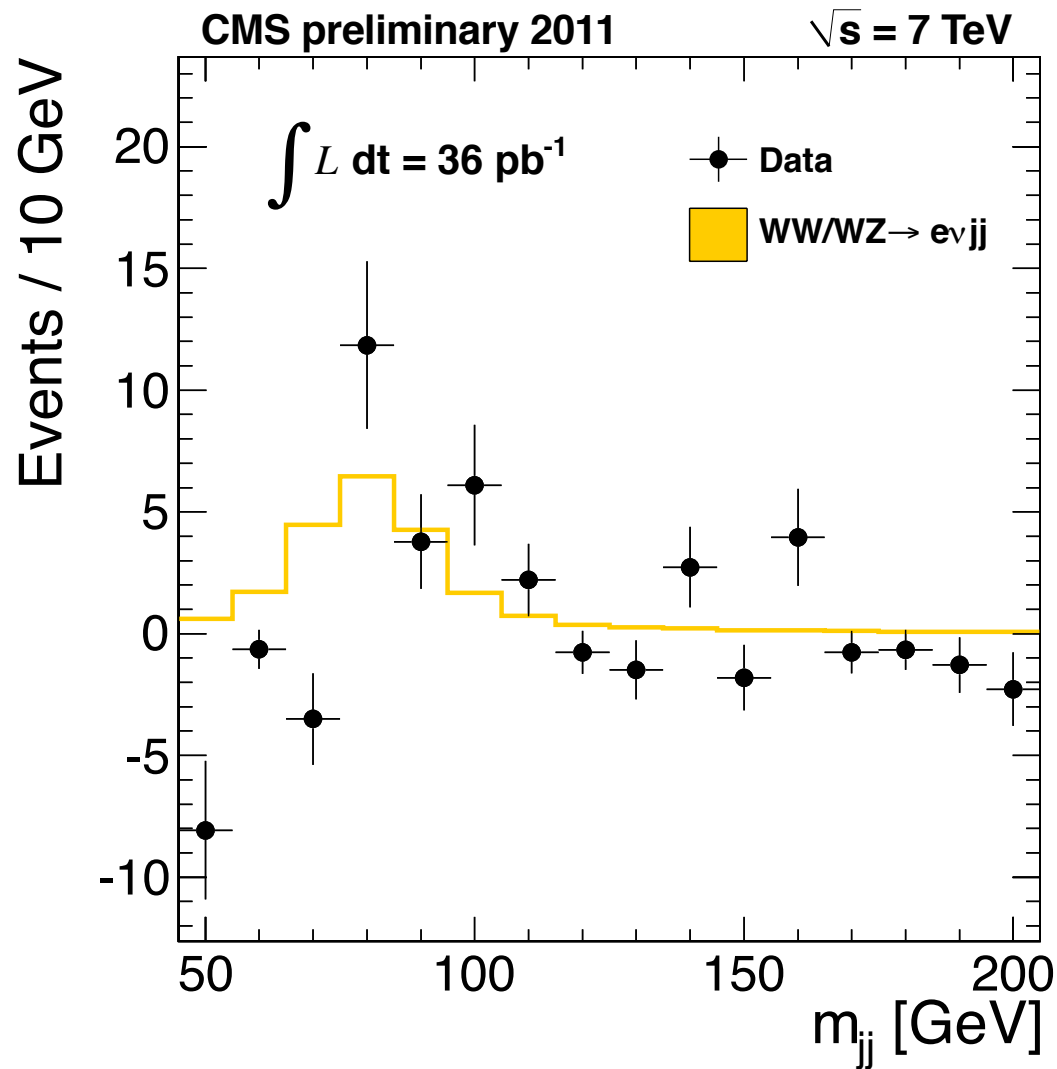
MC predicts:

$W+jj = 257$

$T\bar{t}$ bar, single top = 0.7

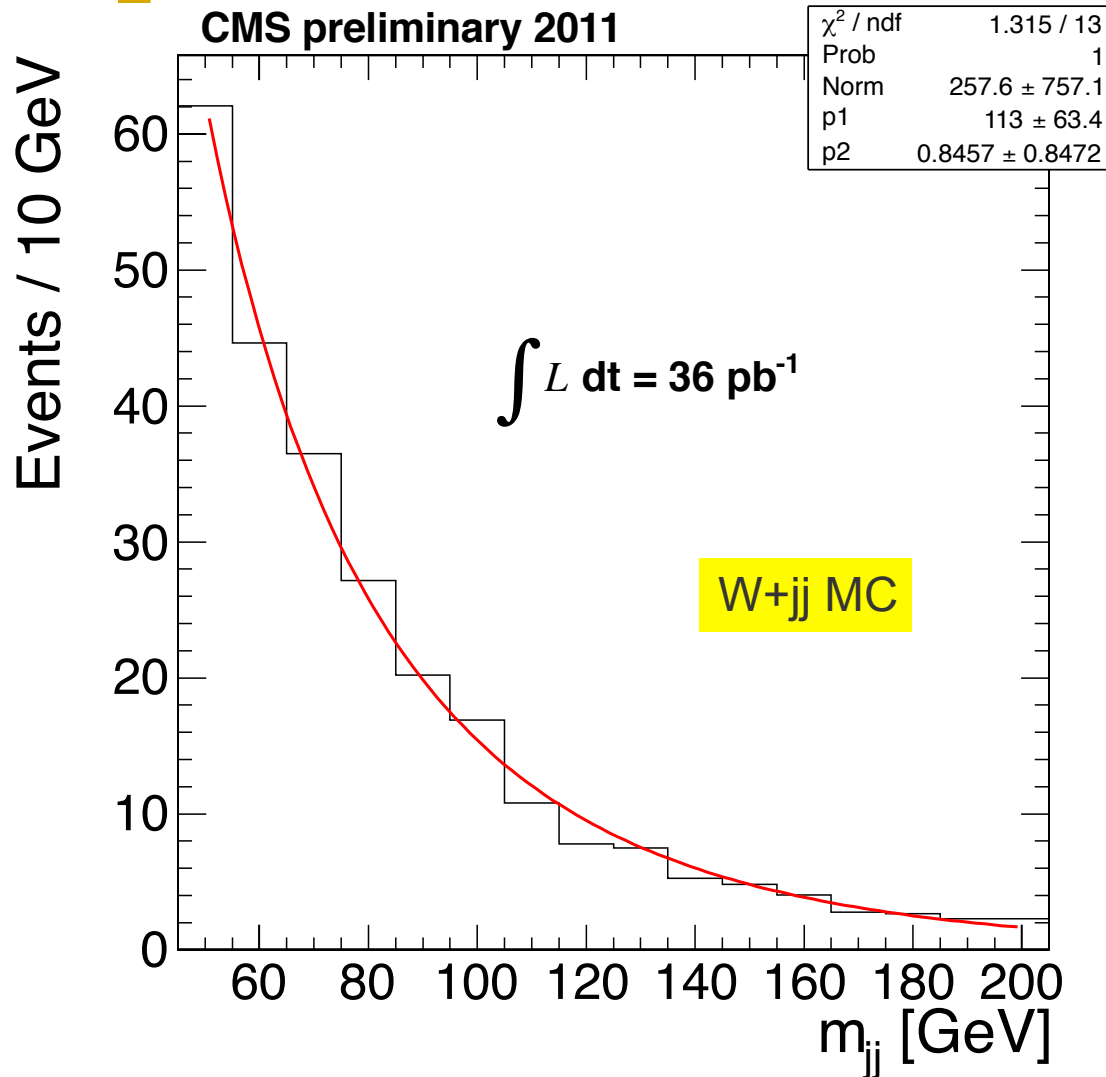
$WW + WZ = 21$

m_{jj} distribution after background subtraction



Error bar on data shows statistical uncertainty.

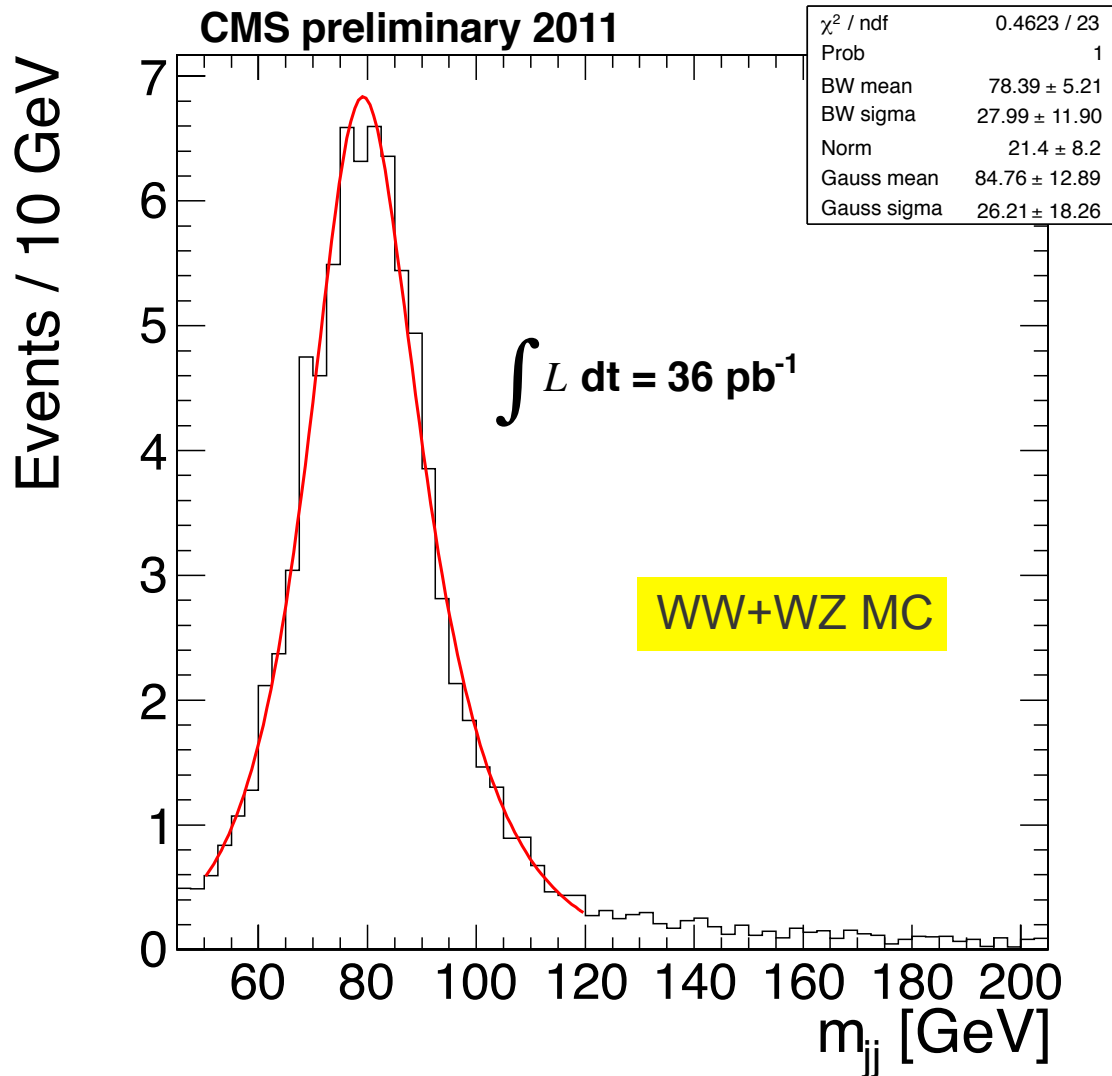
Shape parametrization for W+jj



The spectrum is well modeled by a power law modified by (1-x) term for PDF:

$$\text{Norm.} \cdot (1-x)^{p1} / x^{p2}$$

Shape parametrization for WW

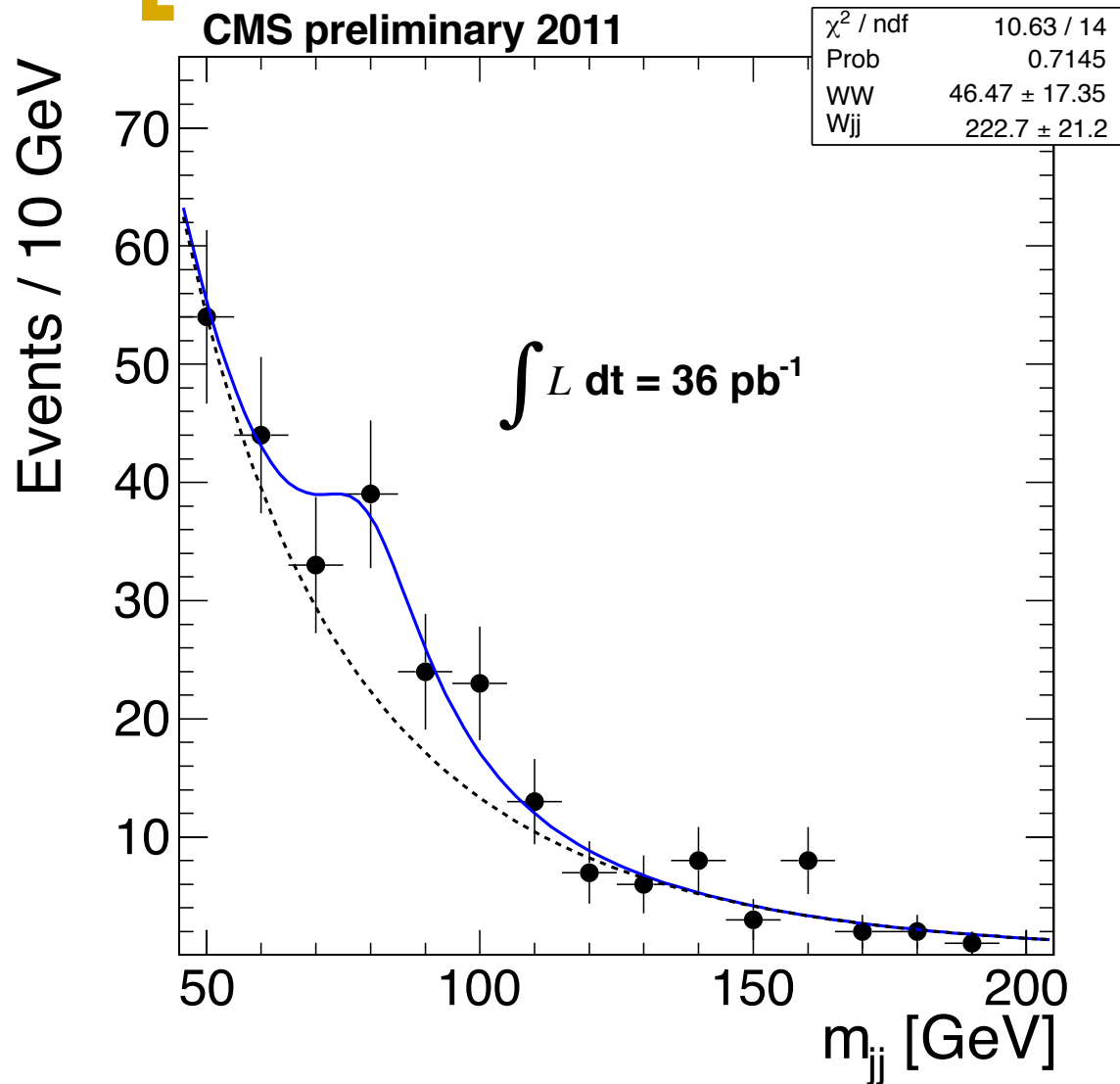


The spectrum is well modeled by Breit-Wigner x Gaussian:

Norm x Breit-Wigner x Gaussian



Fit to the data



Fix the shape derived from MC. Then fit for the normalization. We get:

WW + WZ yield = 46 ± 17
W+jets yield = 223 ± 21

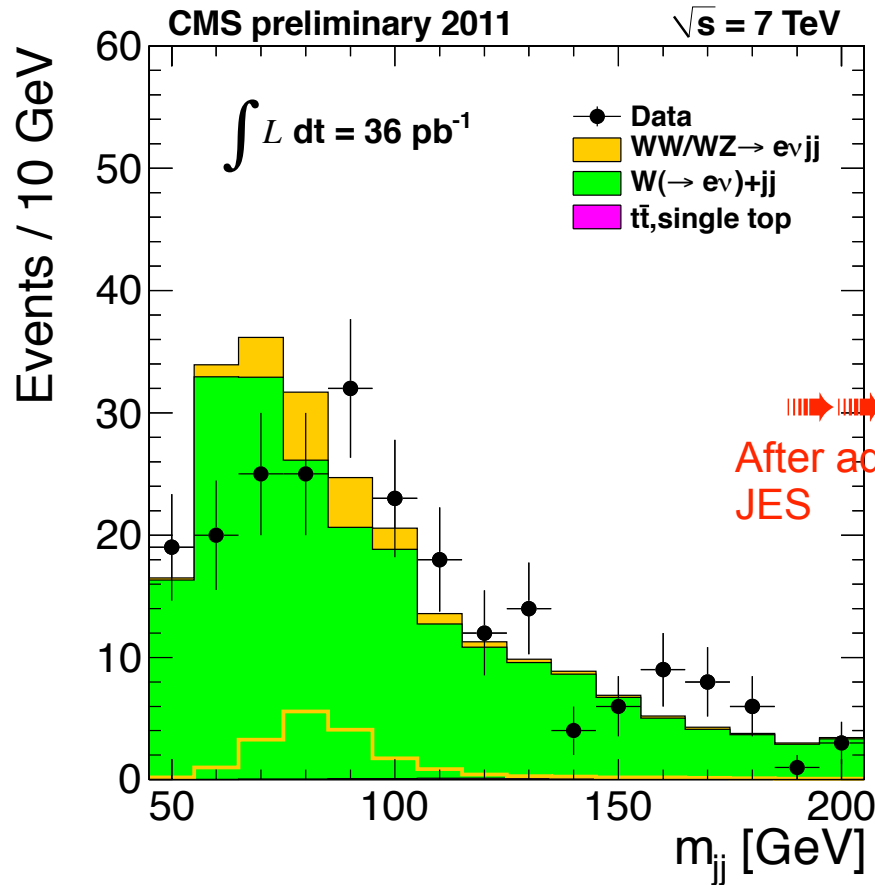
MC prediction was:

WW + WZ yield = 21
W+jets yield = 257

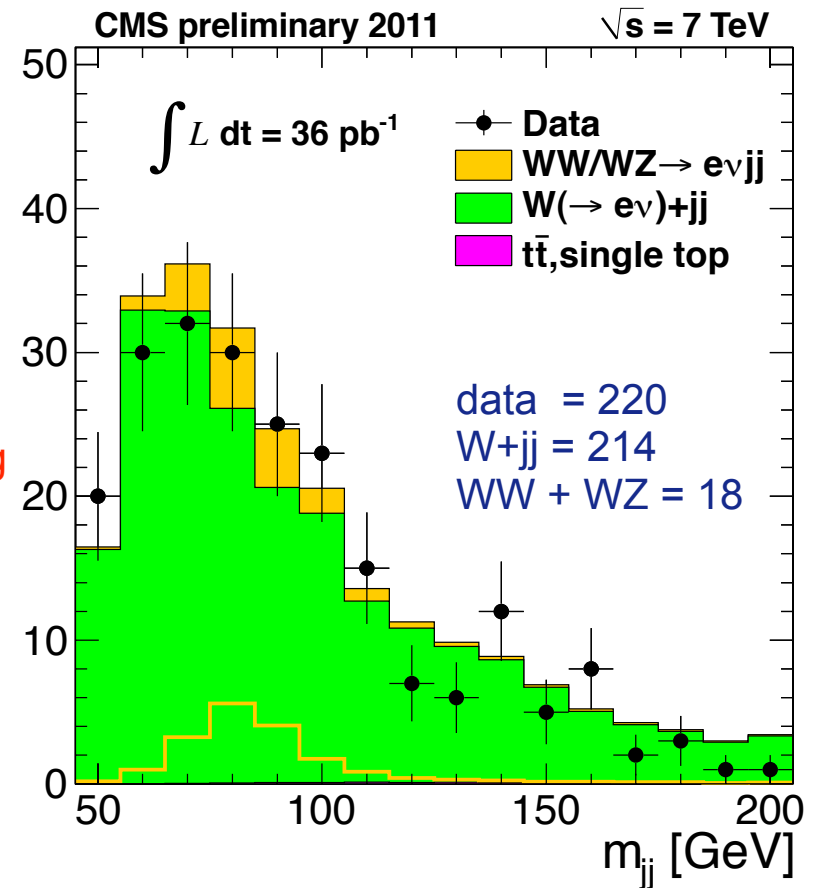
m_{jj} distribution with higher jet p_T threshold



jet $p_T > 25$ GeV



After adjusting
JES

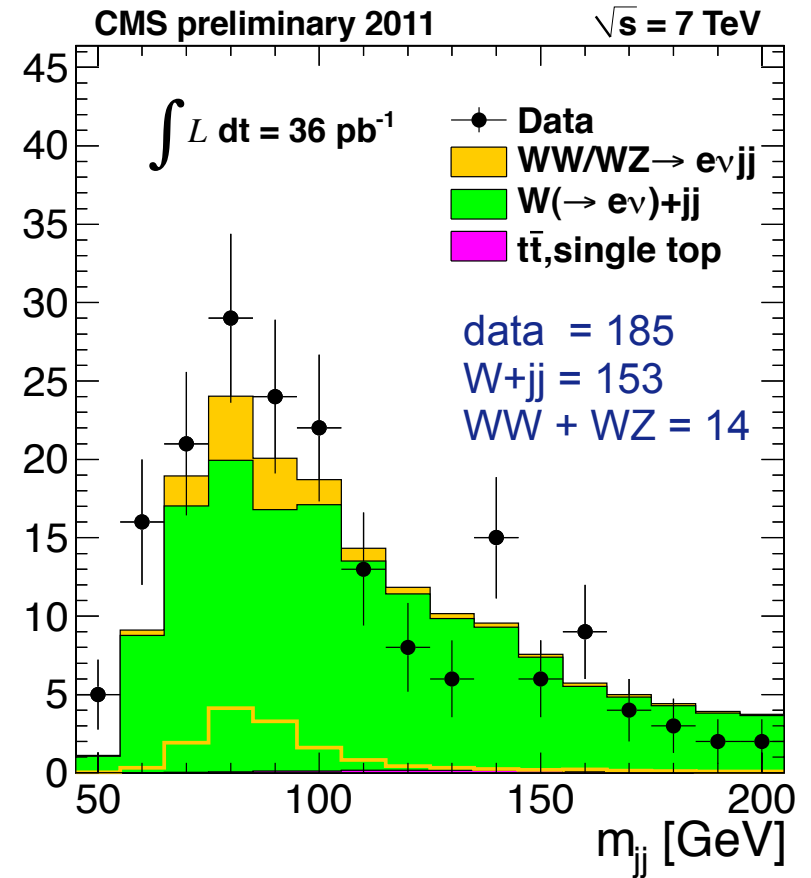
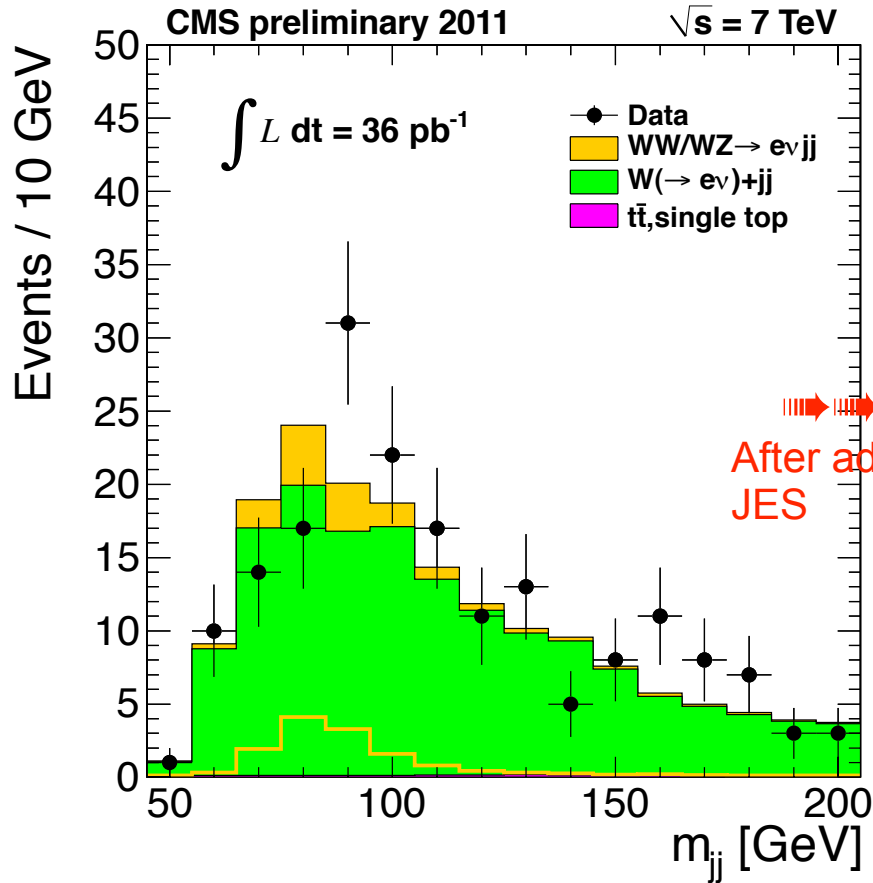


W+ jj and WW are peaking close to each other. It is harder to discriminate between their shape. The absolute number of W+ jj has gone down though.

m_{jj} distribution with higher jet p_T threshold



jet $p_T > 30$ GeV



W+jj and WW are peaking essentially at the same place.