

W Mass Measurement in CEPC

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EW Meeting

May 07, 2018



- **Sample information**
- **Event selections**
- **Make ratio histograms between ud, us, cs, cd (in W) and uu, dd, ss, cc, bb (in Z),
in the region of peaks.**
- **Currently work for additional lepton veto**

$\sqrt{s} = 250 \text{ GeV}$	$e^+e^- \rightarrow ZZ \rightarrow \nu\nu qq$	$e^+e^- \rightarrow WW \rightarrow \mu\nu qq$
Total # of event I have	1772775 $\approx 1.7 \times 10^6$	11176194 $\approx 11 \times 10^6$
Effective Luminosity [ab^{-1}]	11.75 ab^{-1}	10.6 ab^{-1}

My calculation:

$ee \rightarrow ZZ \rightarrow \nu\nu qq: \mathcal{L} \times XS \times \text{Br}[Z \rightarrow \nu\nu] \times \text{Br}[Z \rightarrow q\bar{q}]$

$$11.75 (\text{ab}^{-1}) \times 1033380 (\text{ab}) \times 20\% \times 70\% = 1699910$$

$ee \rightarrow WW \rightarrow \mu\nu qq: \mathcal{L} \times XS \times \text{Br}[W \rightarrow \mu\nu] \times \text{Br}[W \rightarrow q\bar{q}]$

$$10.6 (\text{ab}^{-1}) \times 15483950 (\text{ab}) \times 10\% \times 67\% = 10996701$$

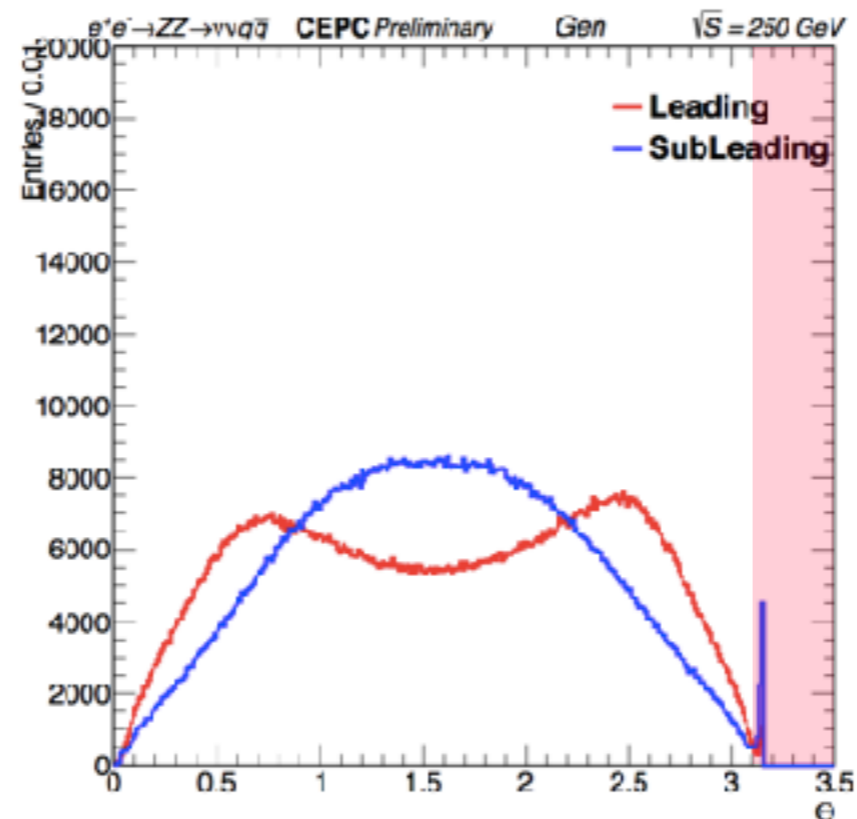
$\sqrt{s} = 250 \text{ GeV}$	$e^+e^- \rightarrow ZZ$	$e^+e^- \rightarrow WW$
XS [fb]	1033.38	15483.95

Reference:

Xiv: Physics cross sections and event generation of $e^+ e^-$ annihilations at the CEPC

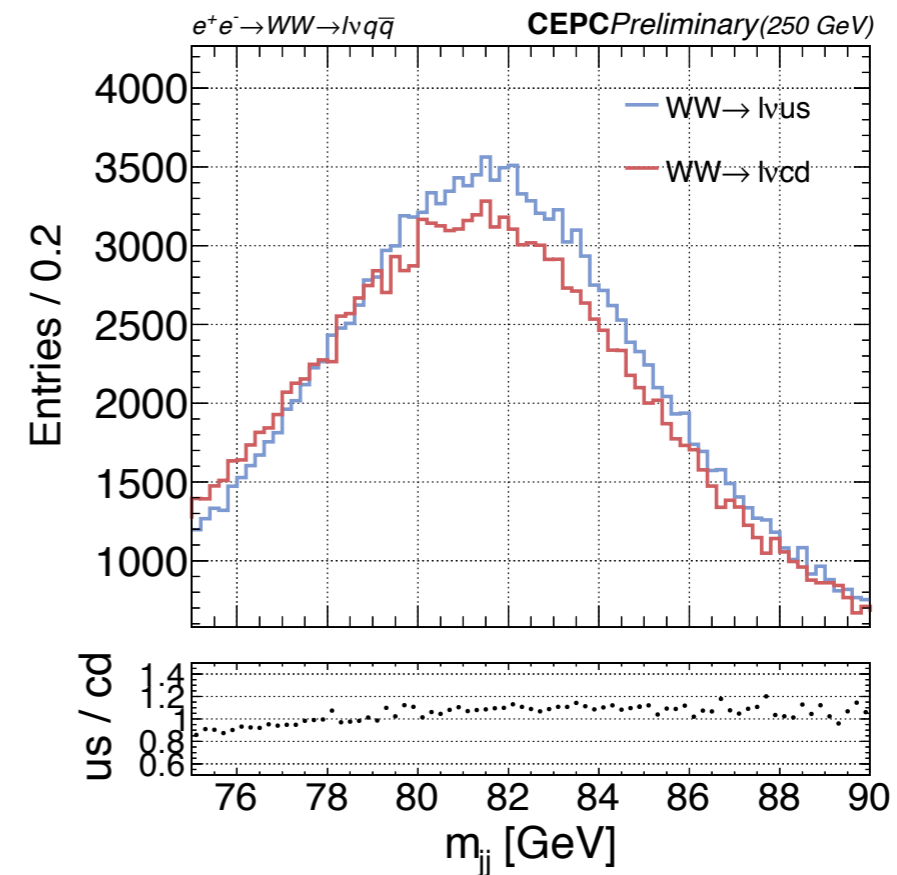
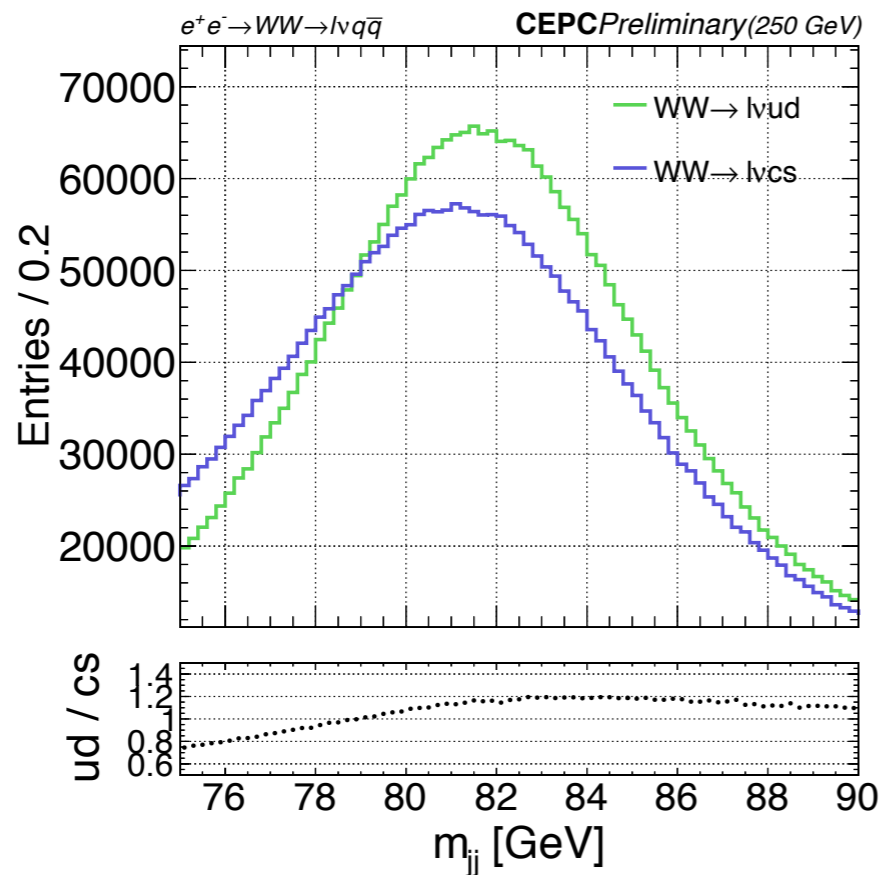
- Except the basic particle selection (e.g. $E > 1 \text{ GeV}$), there are no required criteria.
- There is only one selection in my analysis, Gen jet theta < 3.1 . Its selection efficiency is about 99%.

	$e^+e^- \rightarrow ZZ \rightarrow \nu\nu q\bar{q}$	$e^+e^- \rightarrow WW \rightarrow \nu q\bar{q}$
Gen jet theta < 3.1	✓	✗

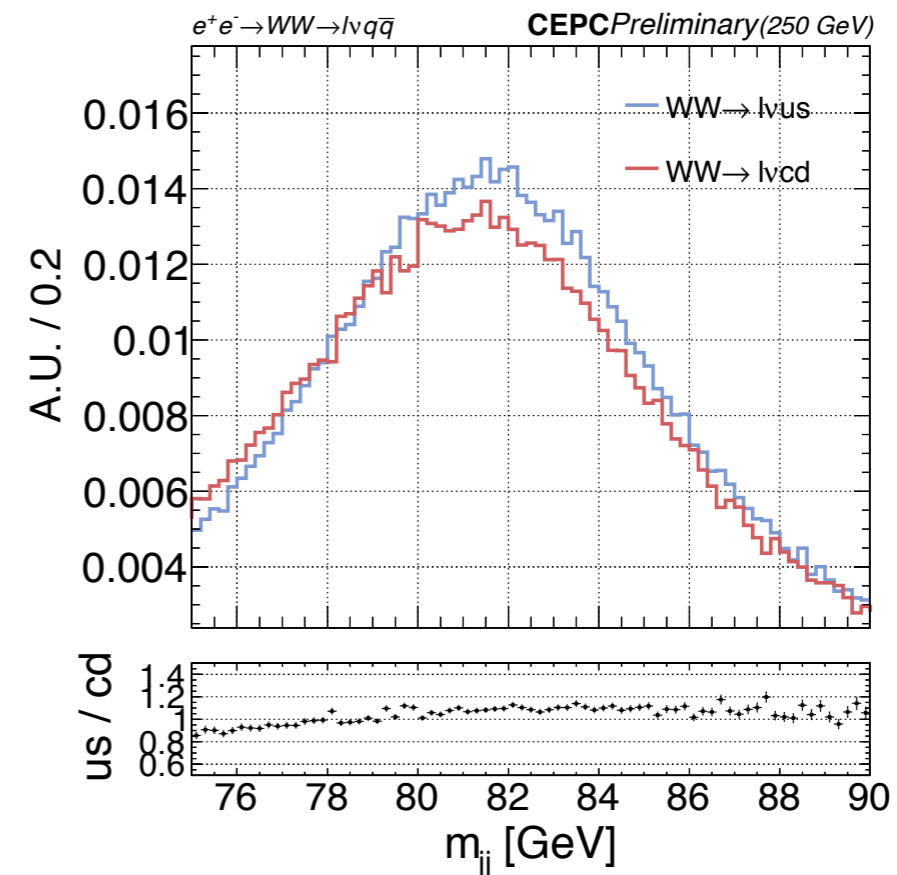
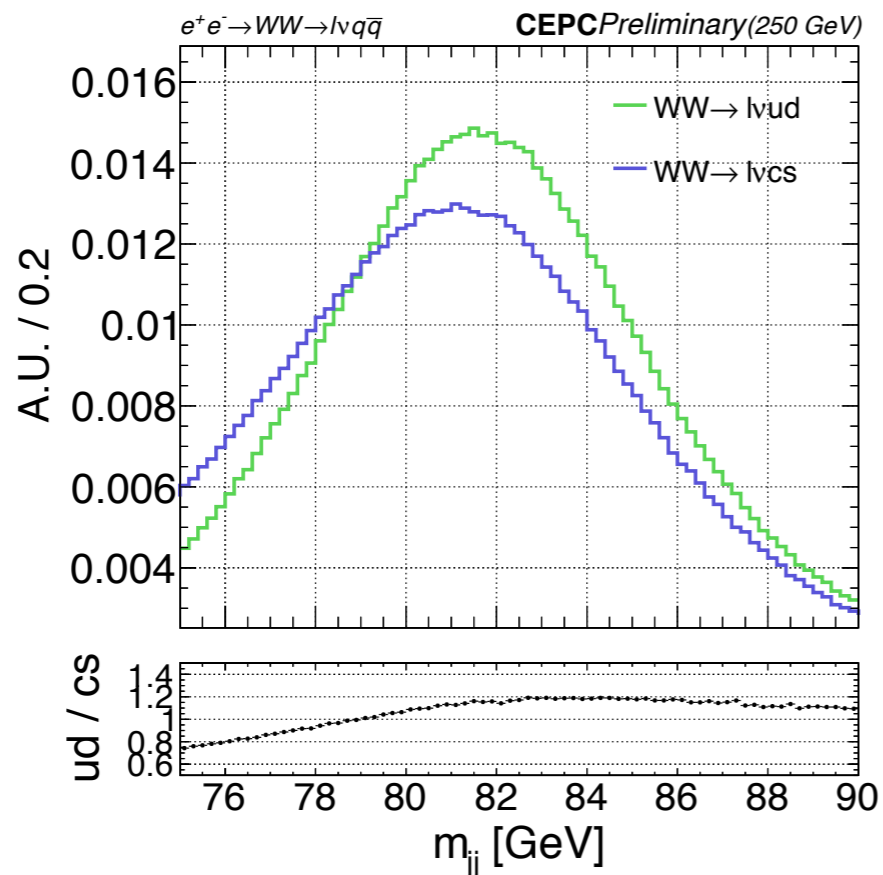


Ratio between different categories

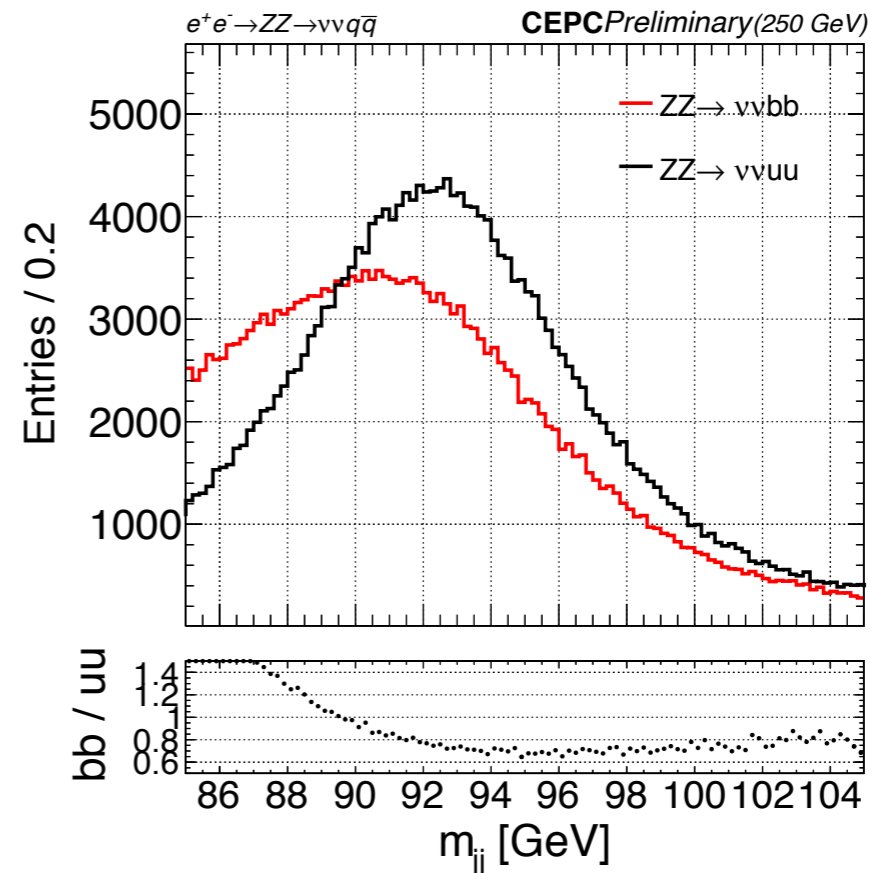
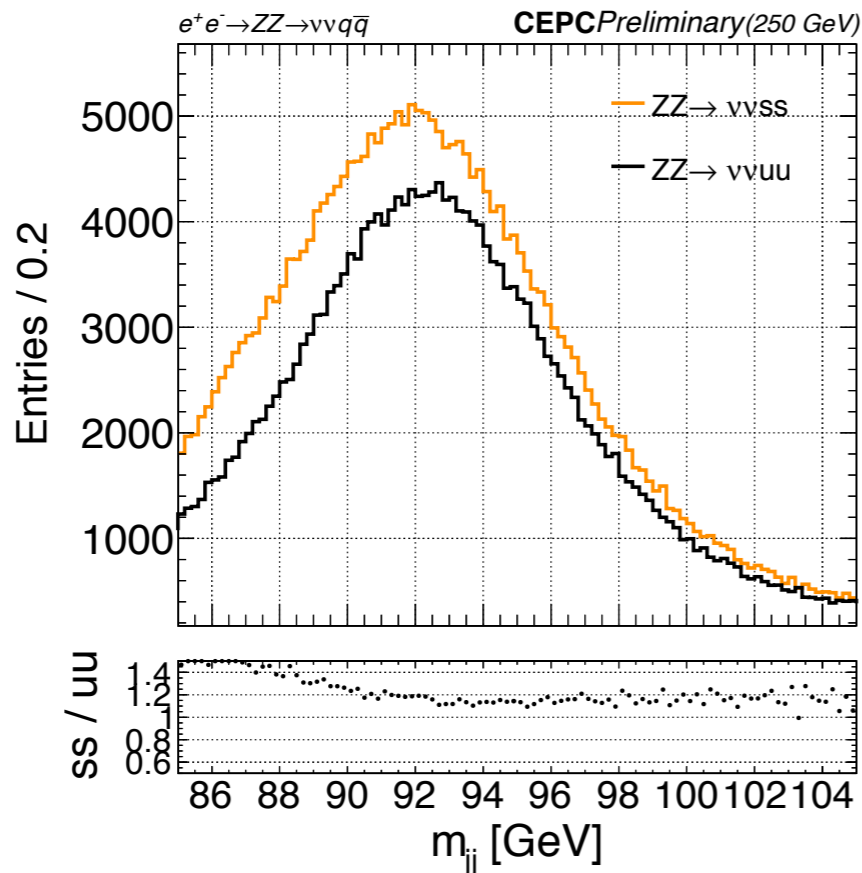
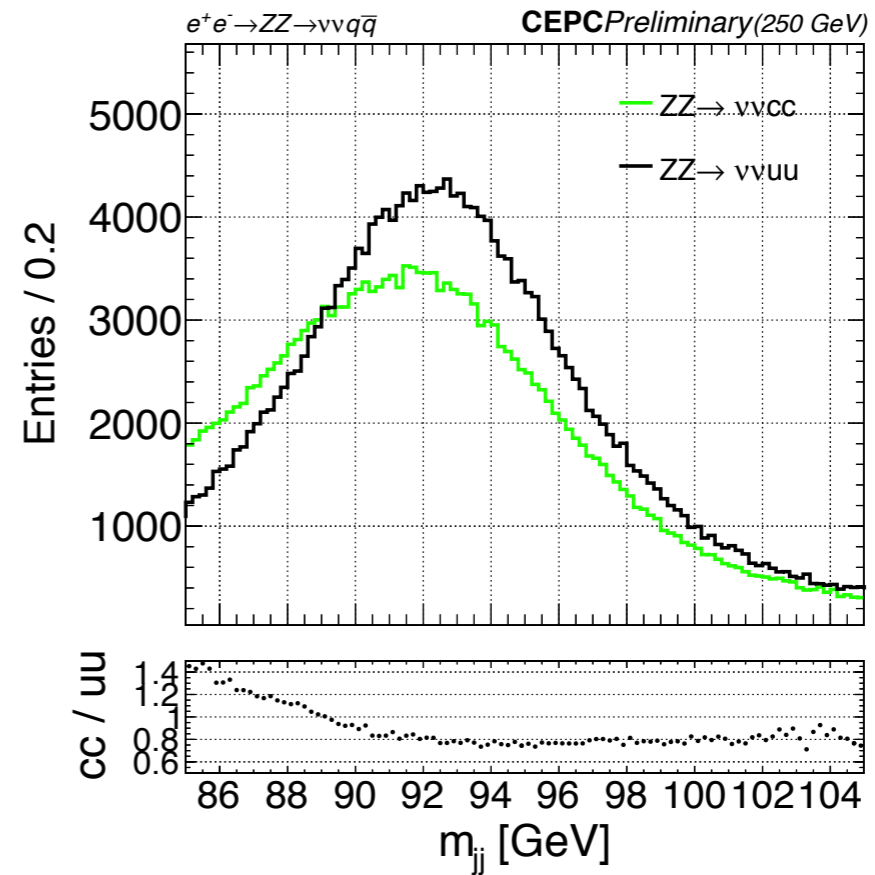
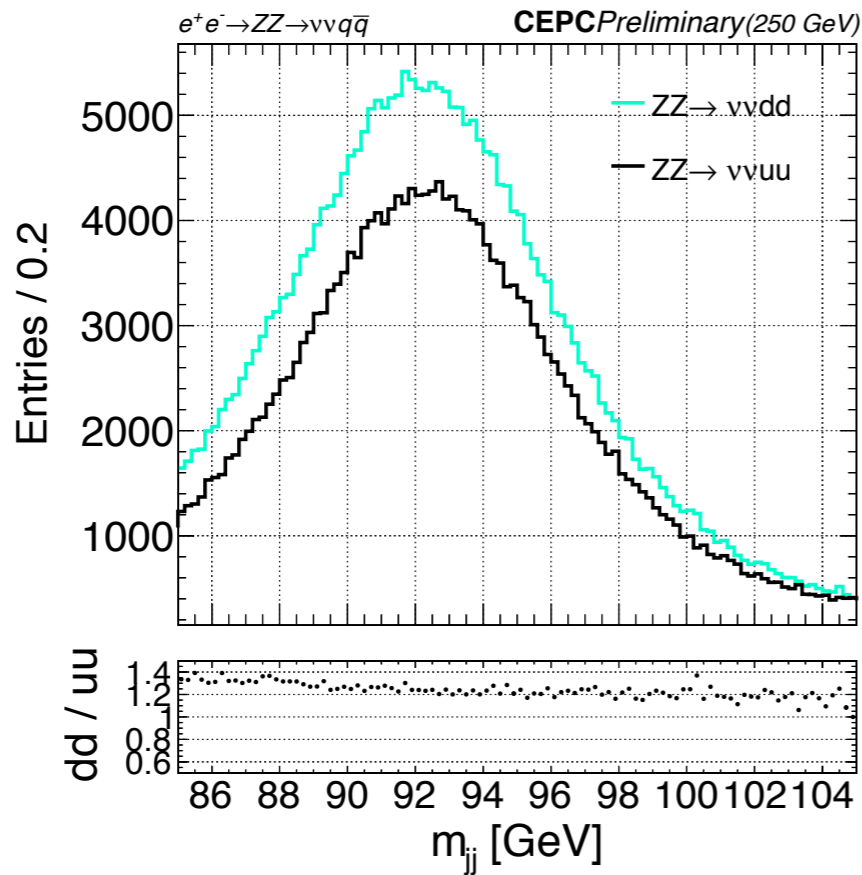
Nominal

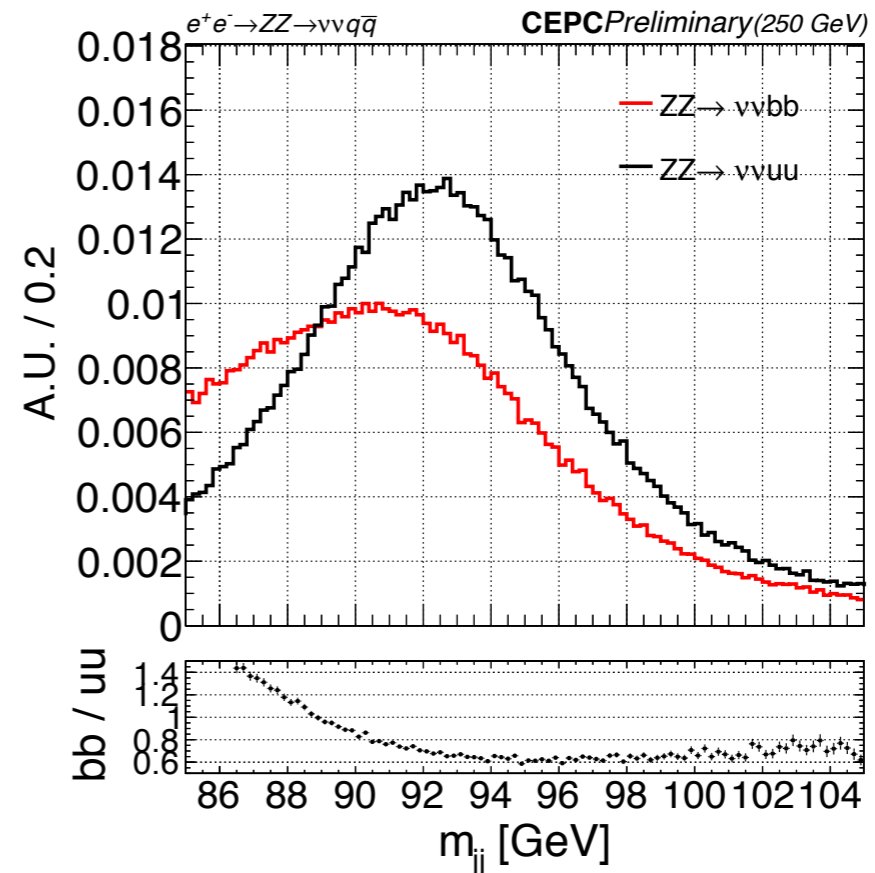
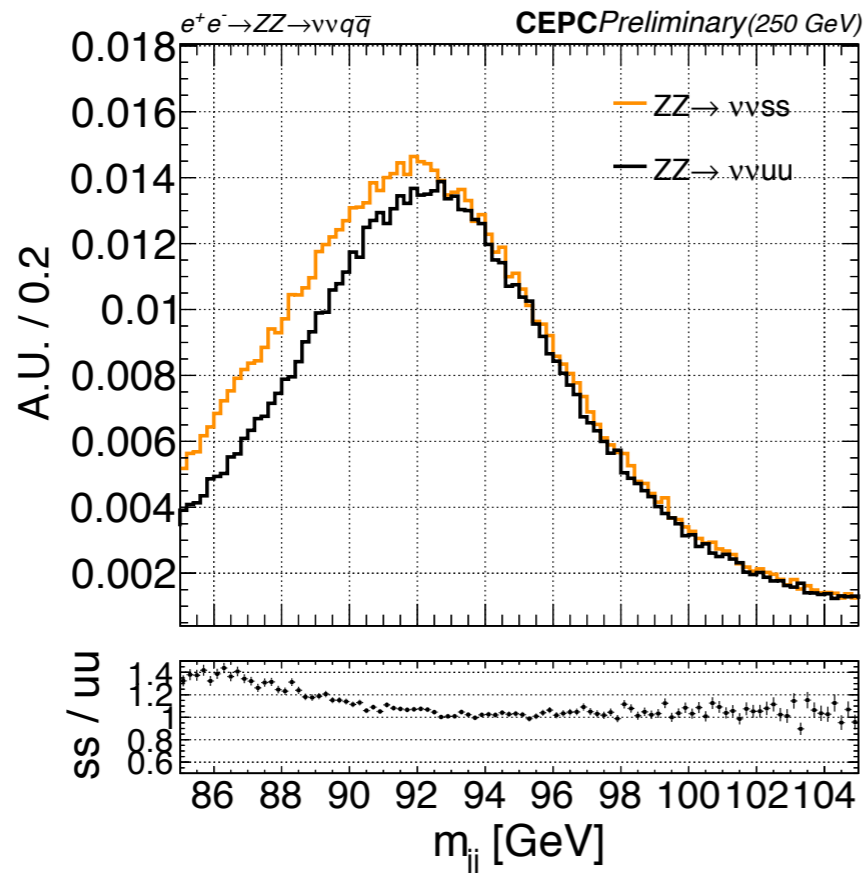
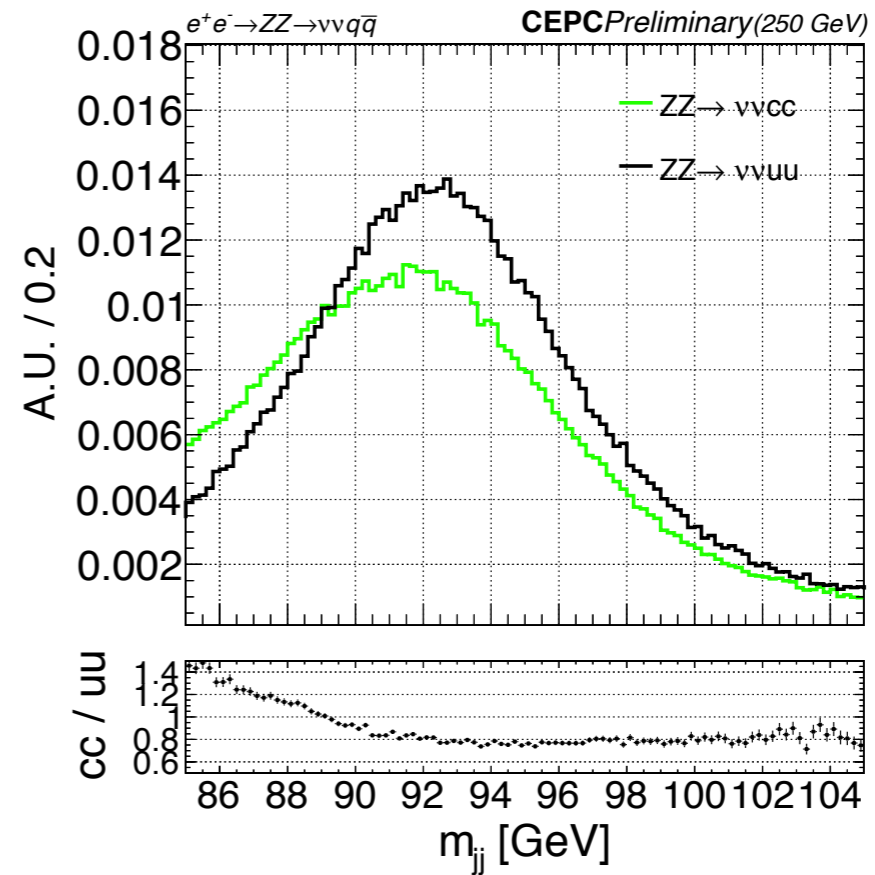
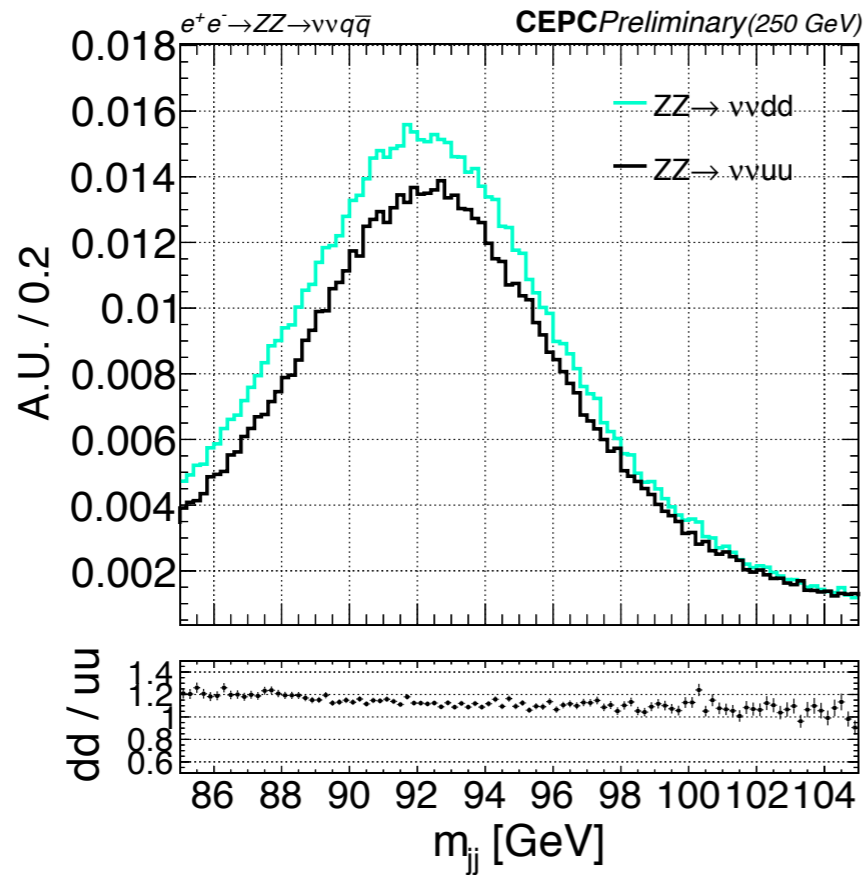


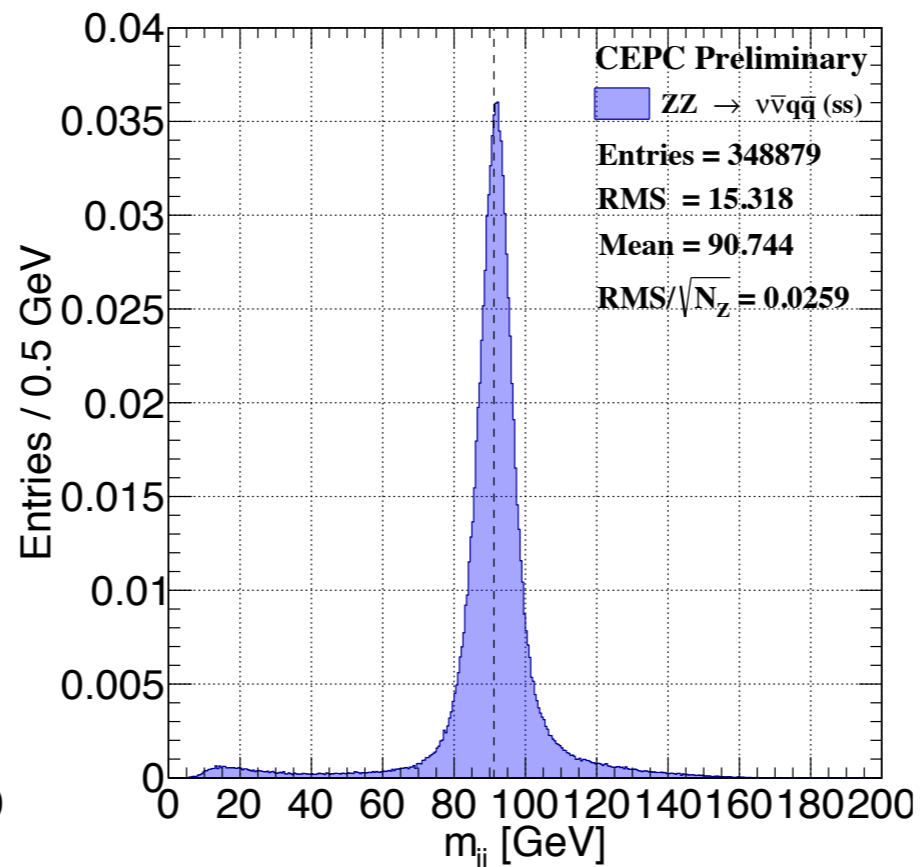
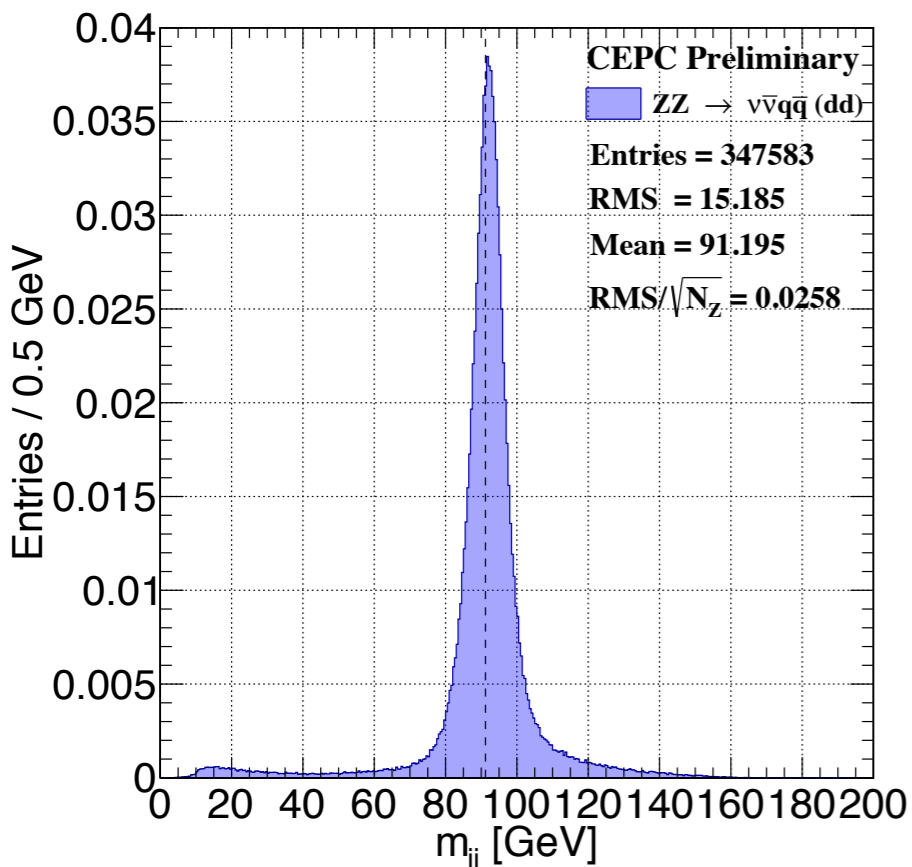
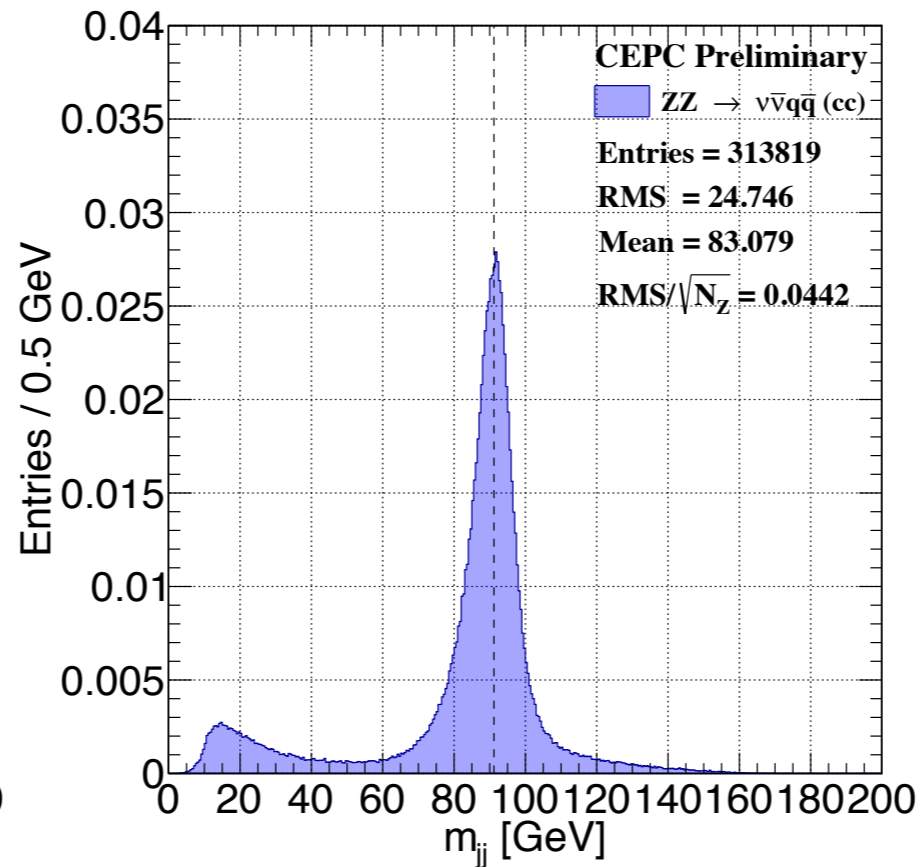
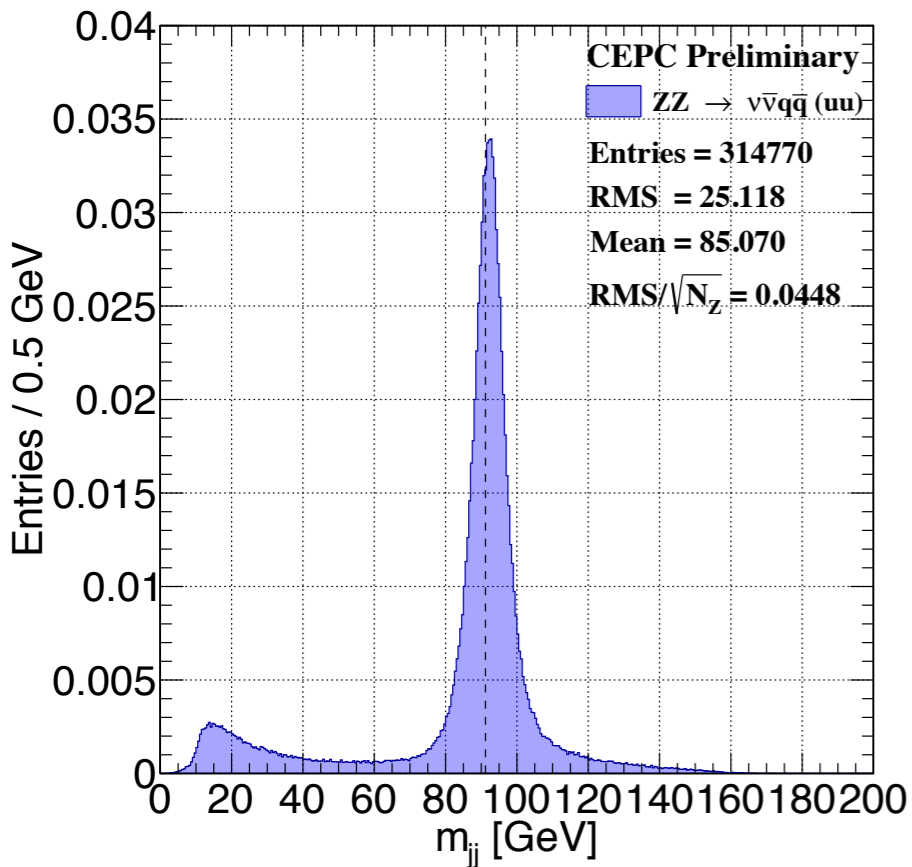
Normalized



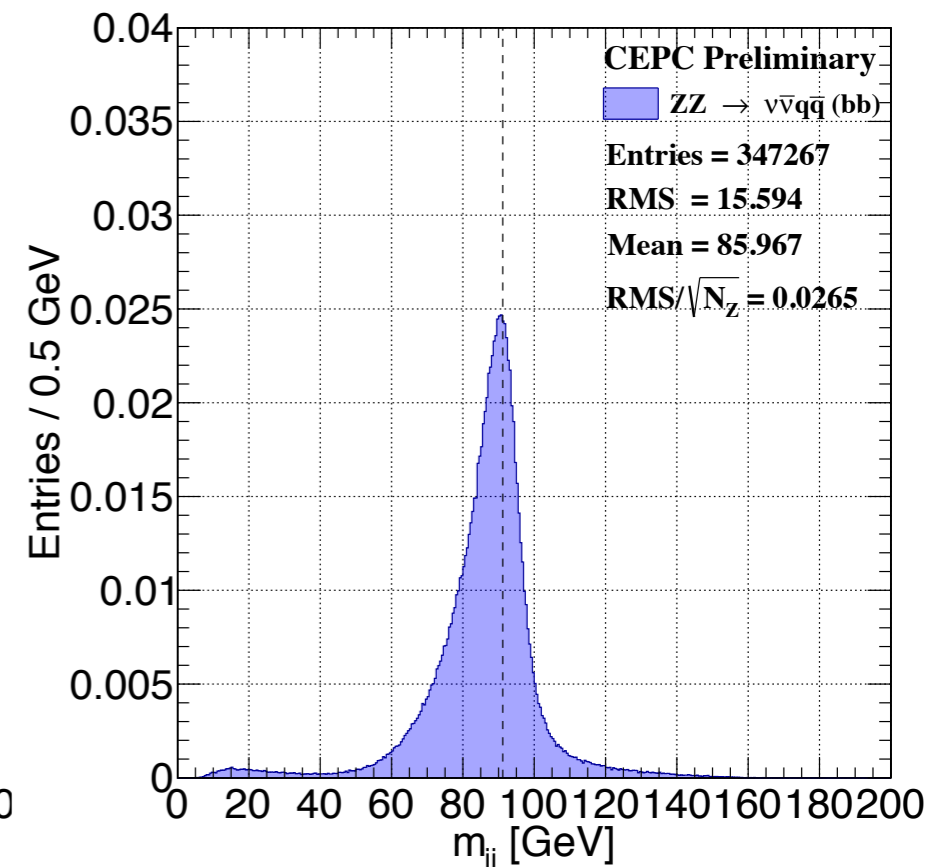
(Nominal) Ratio between different categories



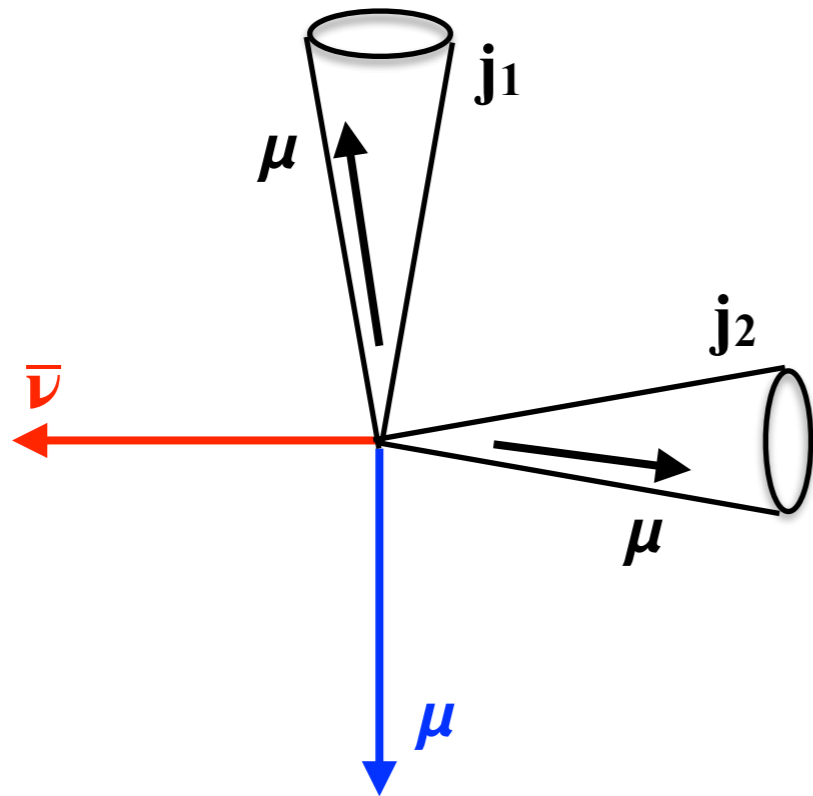




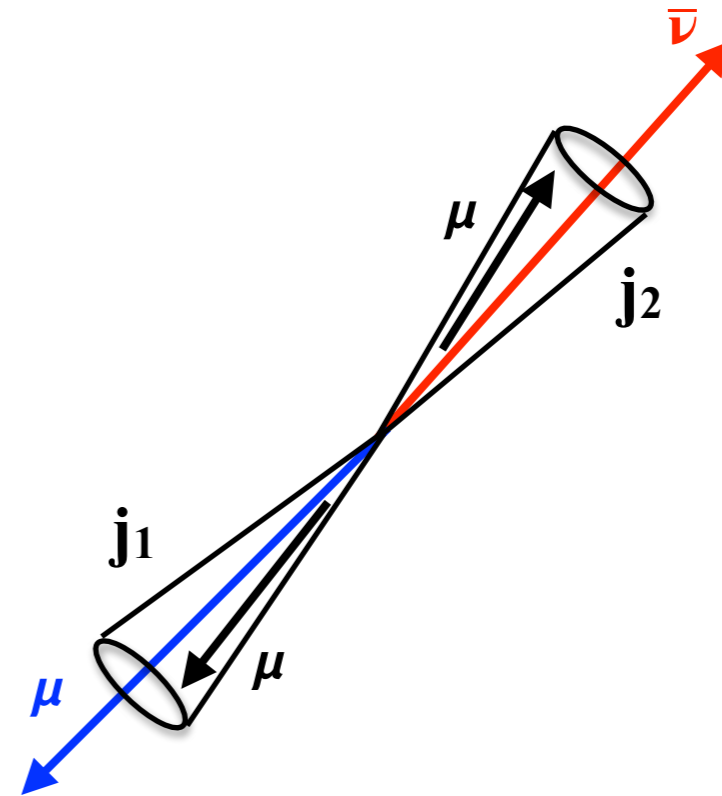
- Calculate the value event-by-event.
- Up-type quarks have higher probability decay from γ^* .
- c- and b- quark have worse resolution.
- Why there is a peak on the low mass region?



Condition1

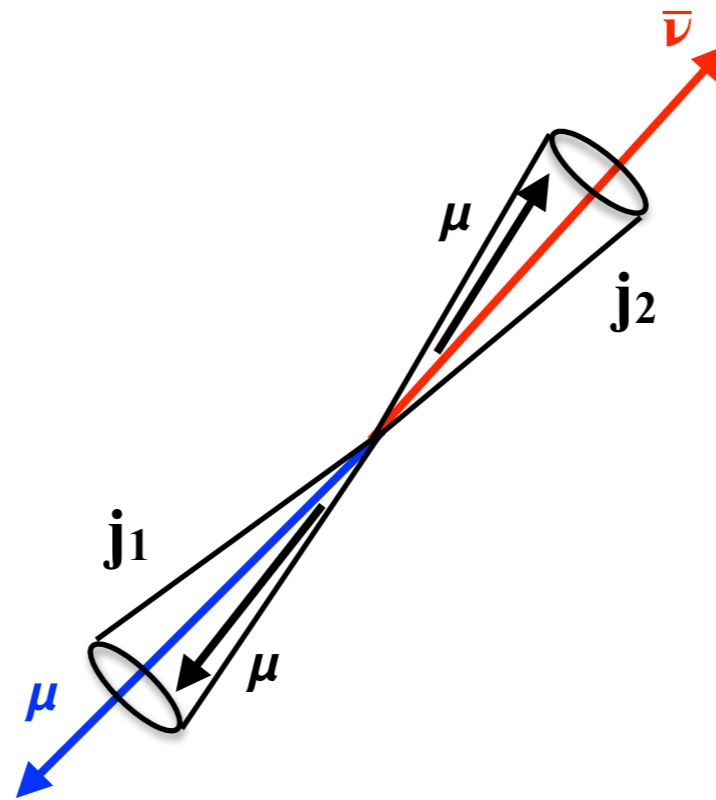


Condition2



- Our goal is to remove the blue muon in condition2.
- If calculate the missing p_T in a event, these two conditions have same missing p_T .
But if we calculate the missing p_T just in the jet, two conditions may have different missing p_T .

Condition2



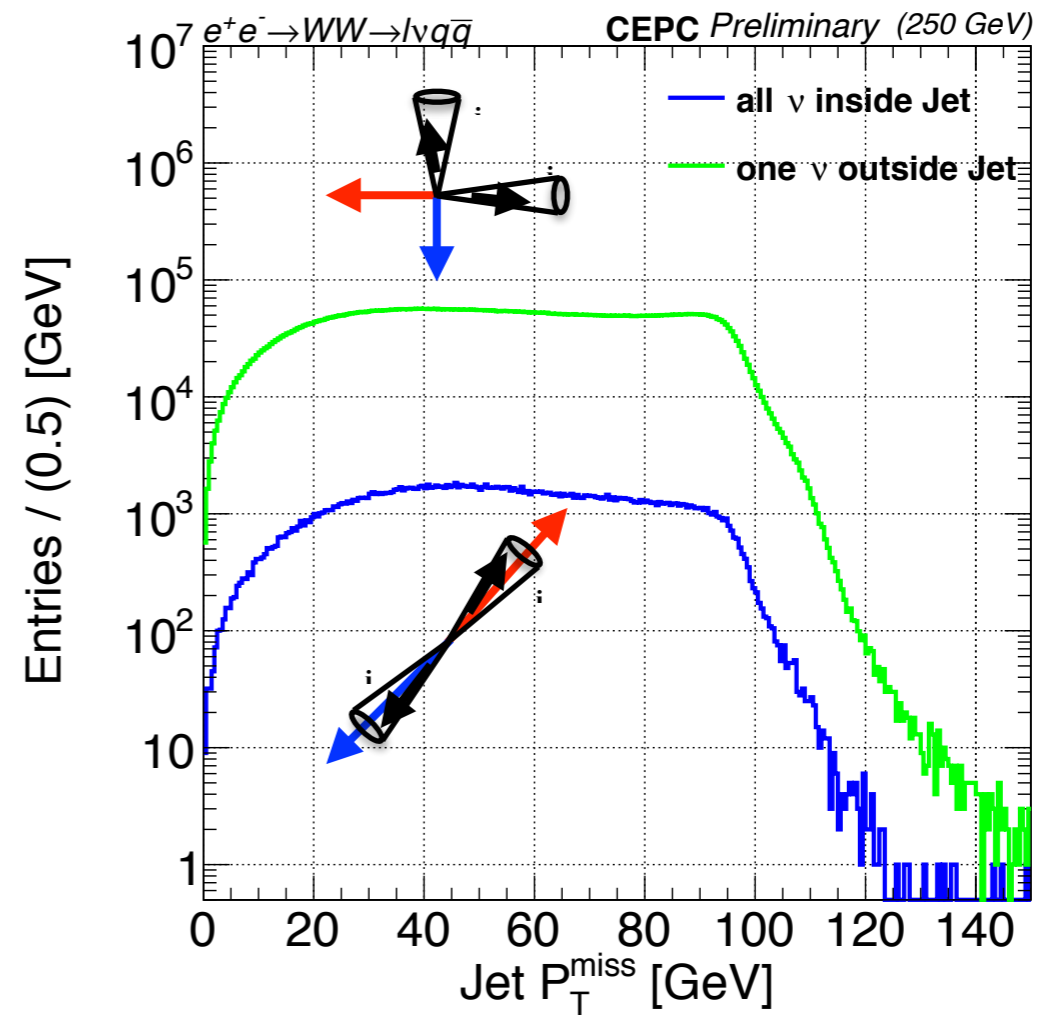
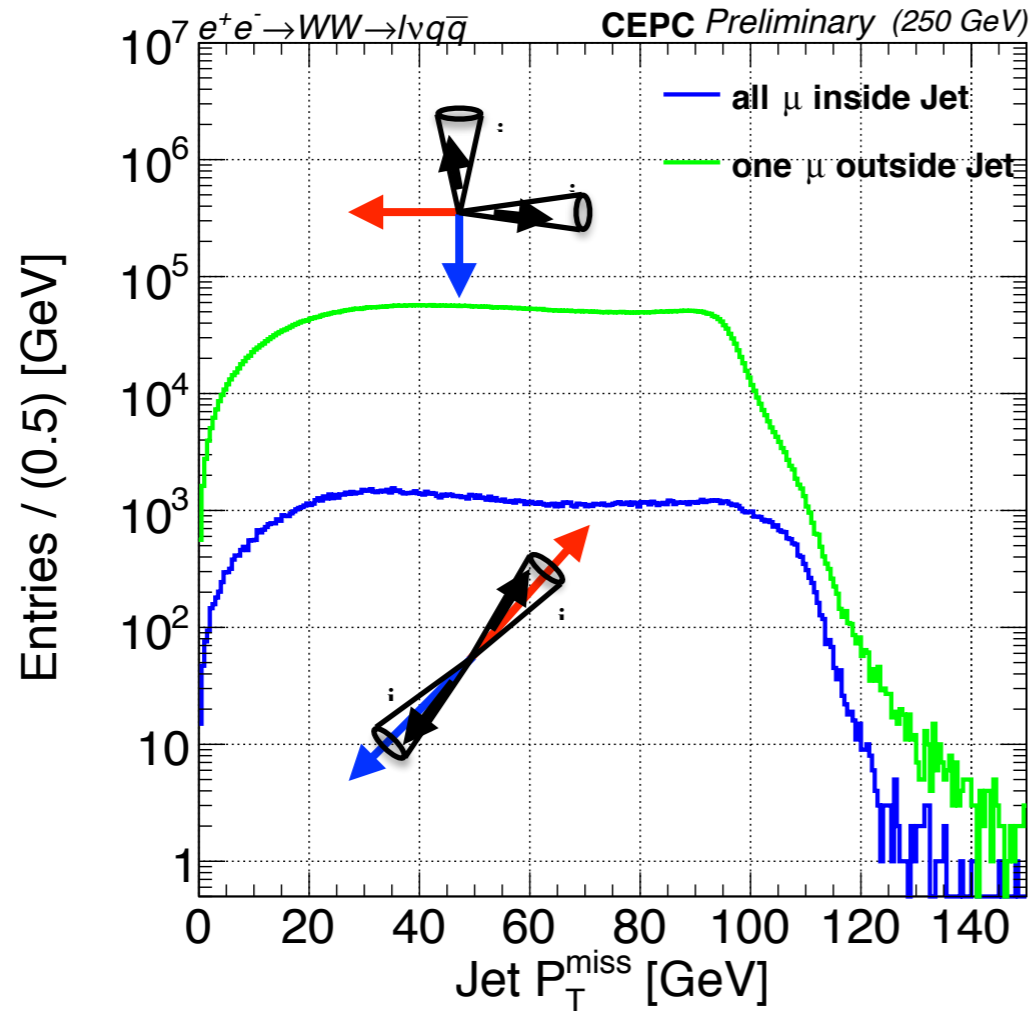
Different quantity of these two muons:

■ Muon $p_T \Leftrightarrow \text{ISO}/(\text{Muon } p_T)$

■ SIP, D0, DZ

The same quantity of these two muons:

■ $\Delta\phi(\mu, P_T^{\text{miss}})$



- There is no shape different in the jet missing p_T distribution.
- The condition2 only 1% of total number of event.

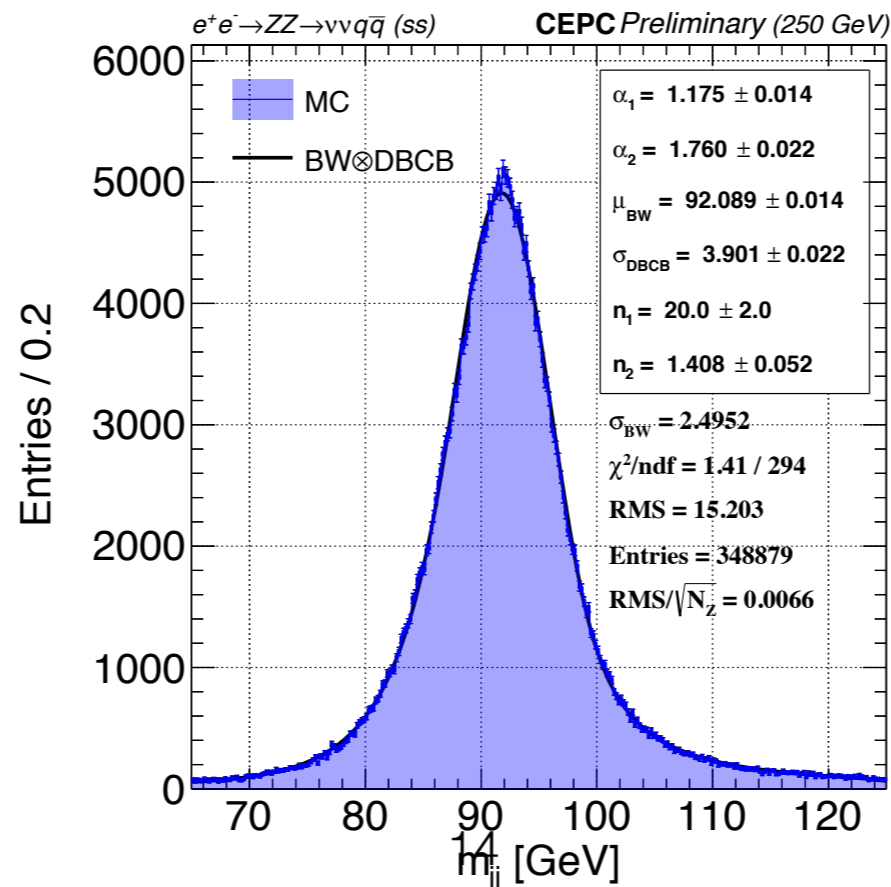
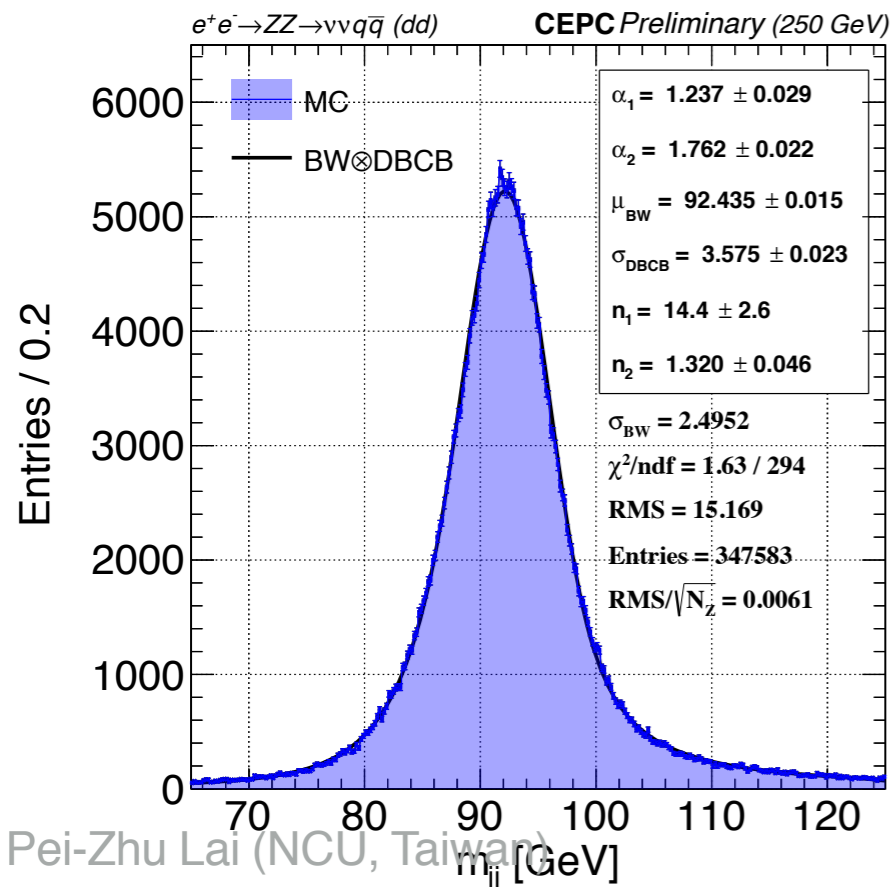
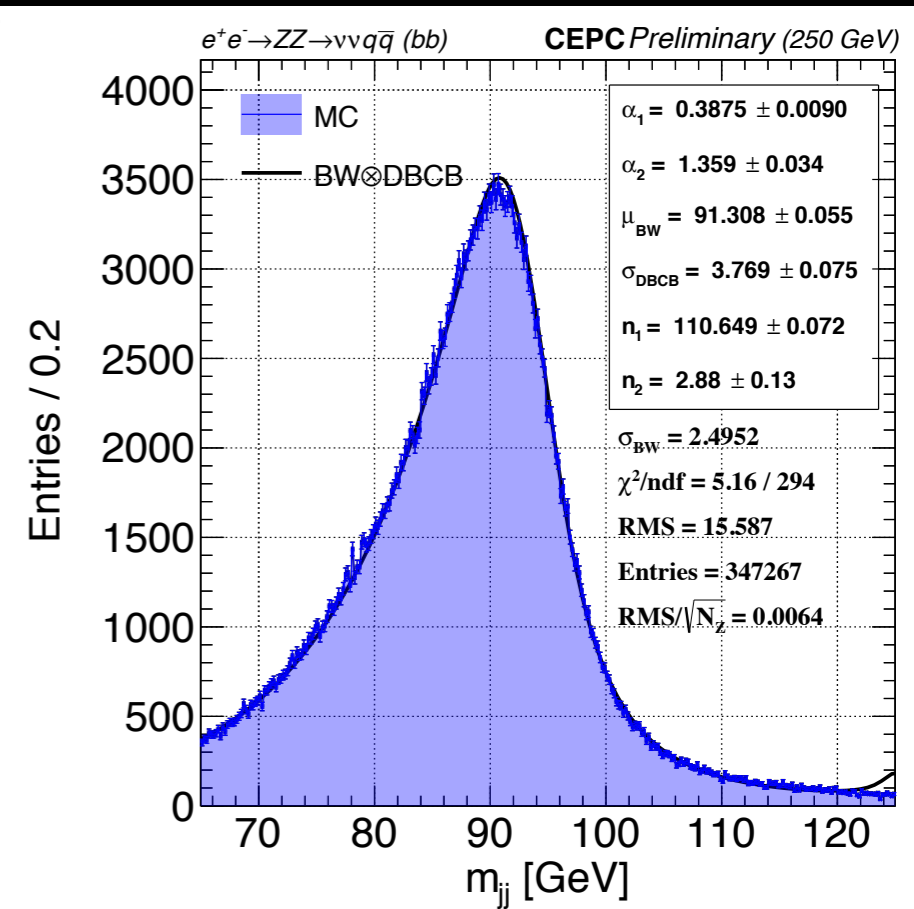
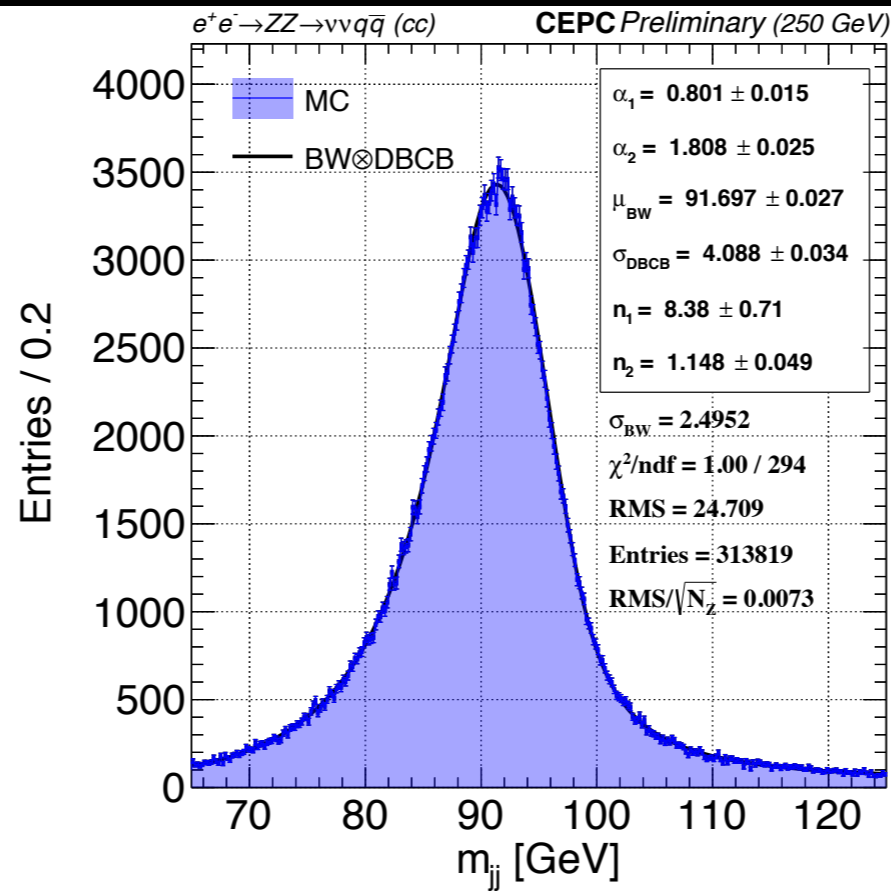
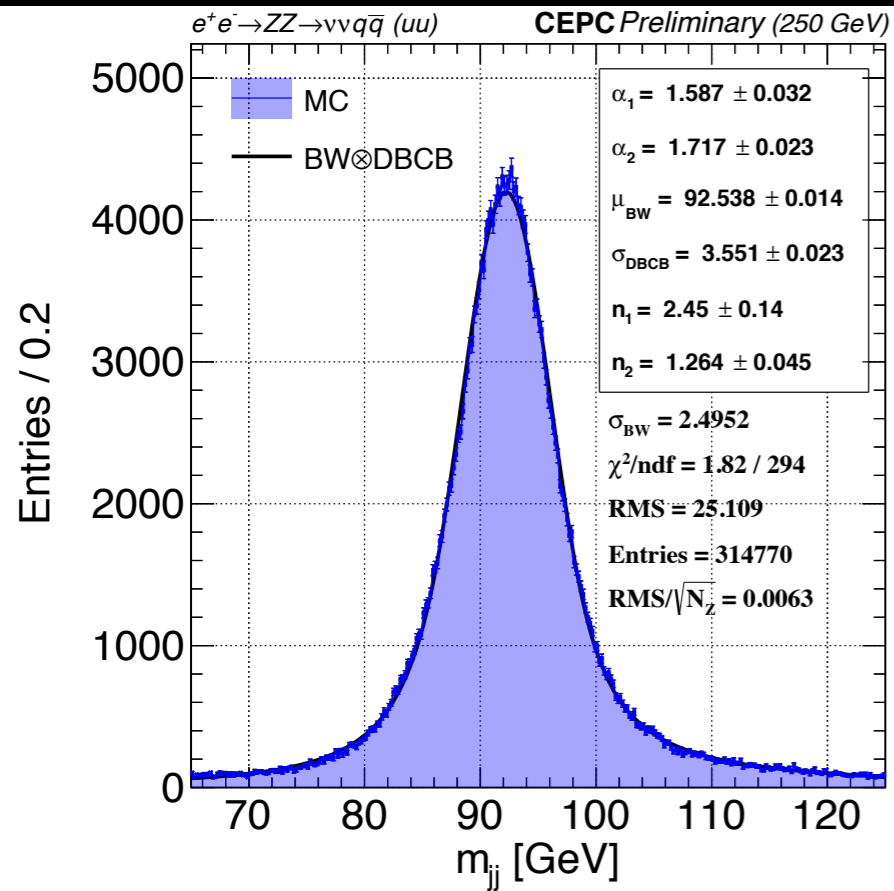
- Different flavor category of jet has different invariant mass. It is not caused by fitting.
- I am working on additional lepton problem.

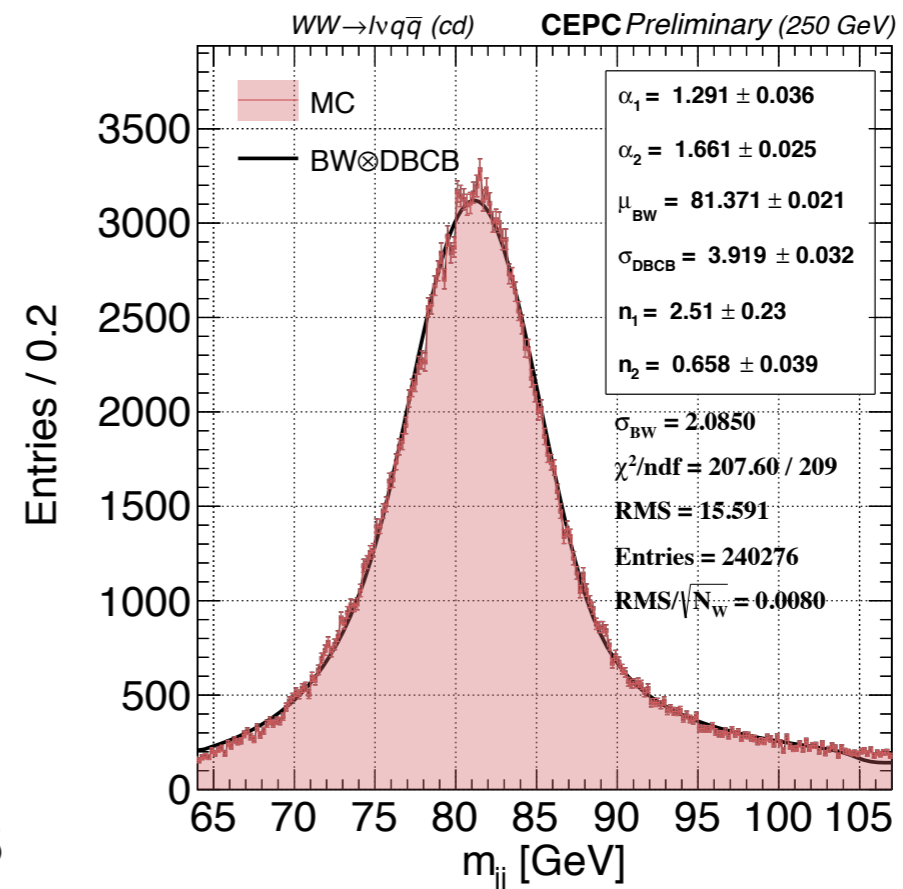
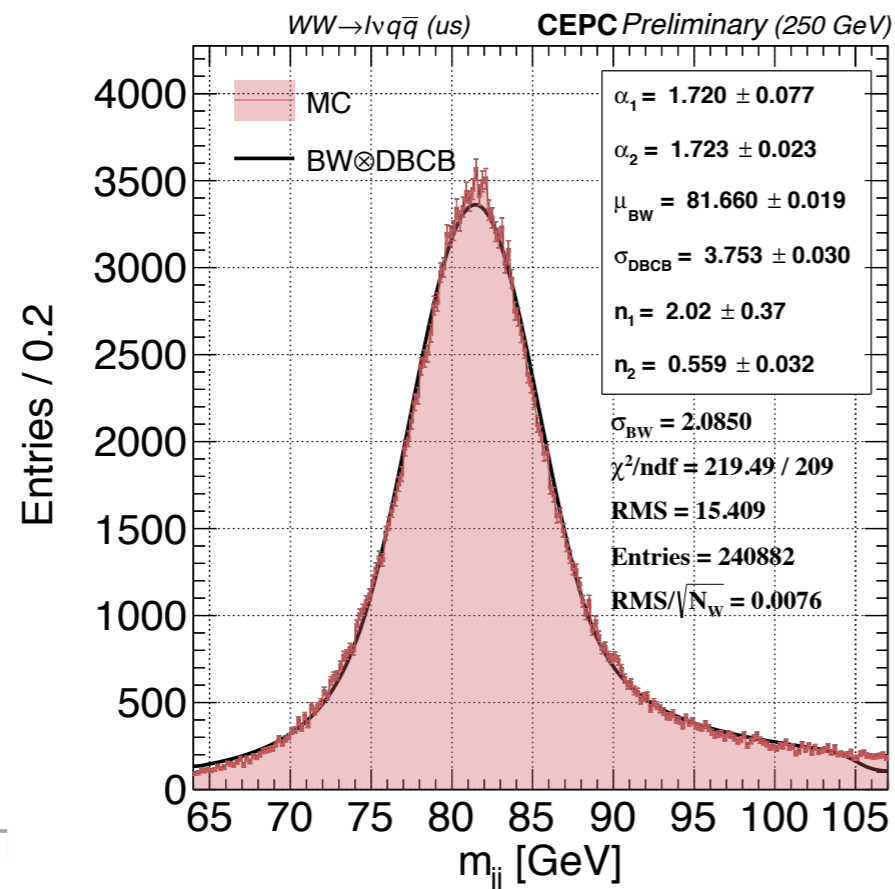
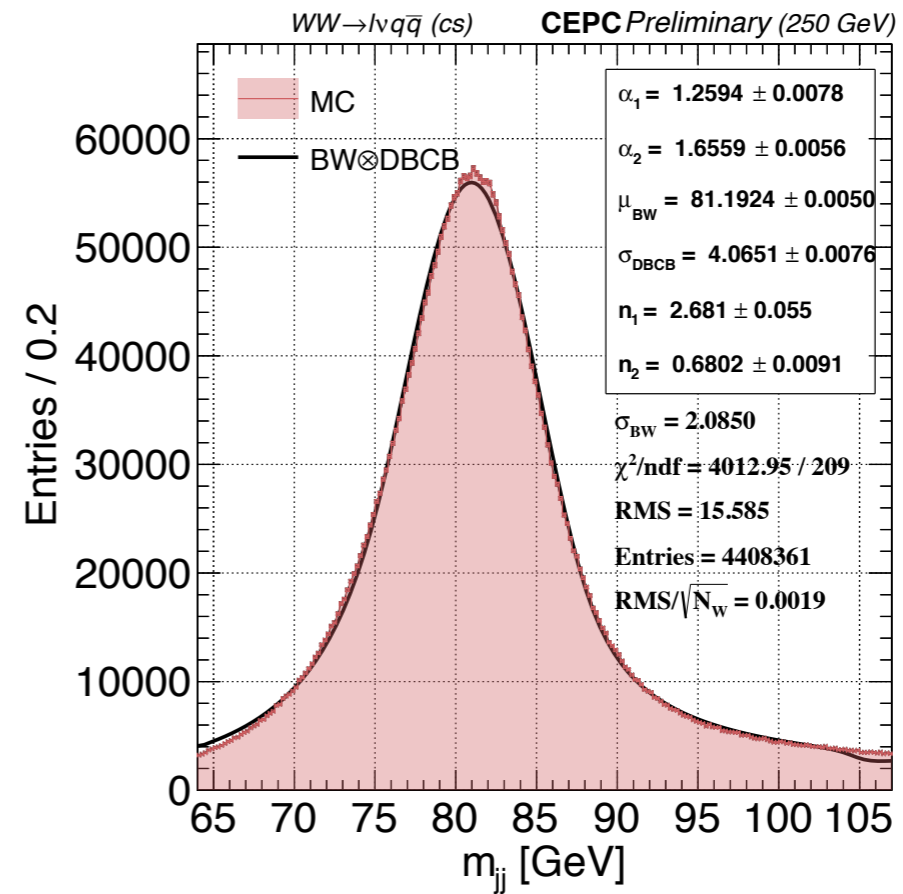
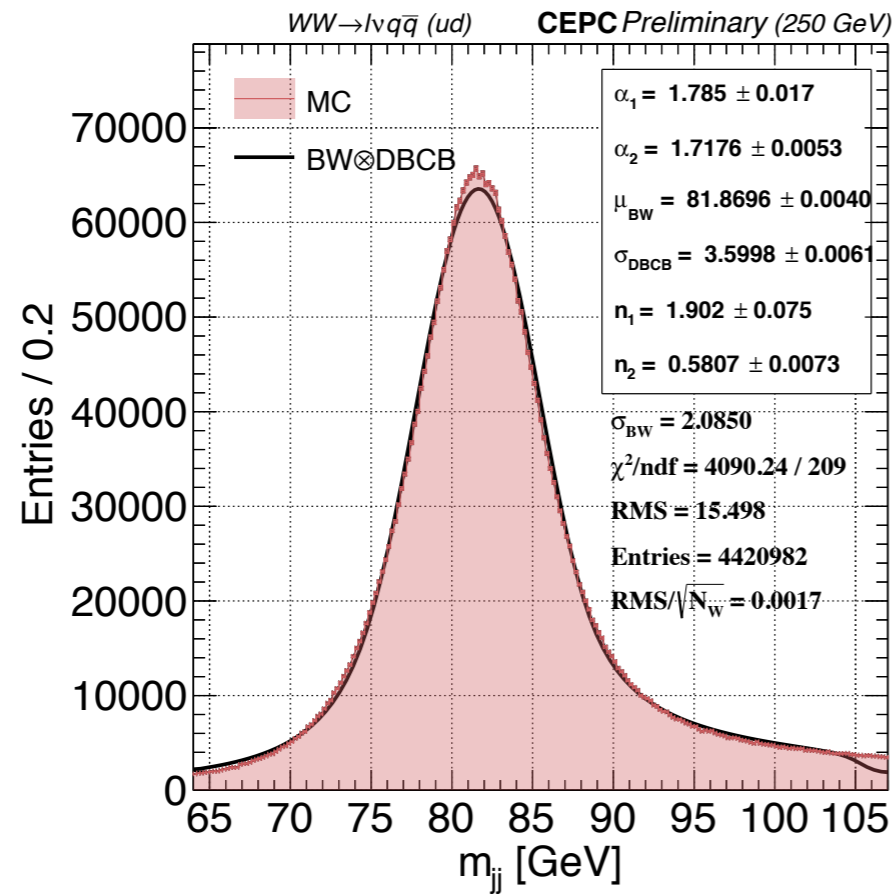
I summarized the dijet invariant mass from ZZ and WW processes in back up again.
Maybe it is help for Maarten.



Back up

Dijet Invariant Mass (Z)





- **Use the another sample to study JER and JES**
- **My data-driven calibration**
- **The different calibration comparison (Nominal, Global calibration, JES calibration which is studied by MC, data-driven calibration)**

- **From Maarten:**
 - **Try to veto muon in the reco jet and gen jet in WW process.**
 - **Compatibility between the reco mass and the truth mass.**
Study both m_{jj} and m_{vis} in particle flow object list and truth particle list (veto muon in W) and then M_{reco}/M_{truth} . (Normally, now should find comparable M_{reco}/M_{truth} ratios in both cases.)