BMR -- Performance of 25.3.0

- Perform BMR study in $ZH \to \nu\nu + gg/bb/cc/uu/dd/ss$ with $\sqrt{s} = 240\mathrm{GeV}/c^2$
- Comparisons without/with event cleaning under $|\cos\theta_{\mathrm{jet}}| < 0.85$

Case	process	$ZH \to \nu\nu gg$	$ZH \to \nu\nu bb$	$ZH \to \nu\nu cc$	$ZH \to \nu\nu uu$	$ZH \to \nu\nu dd$	$ZH \to \nu\nu ss$
Physical level	BMR/%	3.87 ± 0.01	4.37 ± 0.03	4.09 ± 0.02	3.82 ± 0.01	3.97 ± 0.01	4.33 ± 0.01
	Efficiency/%	74.4	74.5	74.8	74.9	74.8	74.8
Detector level	BMR/%	3.82 ± 0.01	3.70 ± 0.01	3.92 ± 0.01	3.80 ± 0.01	3.94 ± 0.01	4.30 ± 0.01
	Efficiency/%	66.7	28.4	49.1	71.2	70.8	70.9

  - Event cleaning: $\Sigma|Pt_{\mathrm{ISR}}| < 1\mathrm{GeV}/c \& \Sigma|Pt_{\nu}| < 1\mathrm{GeV}/c$
  - Before event cleaning, BMR ranges from 3.87% to 4.33%
  - After event cleaning, BMR ranges from 3.70% to 4.30%
- Samples generated under CEPCSW_tdr25.3.0
  - /cefs/higgs/maxiaotian/25.3.0/CEPCSW/Analysis/EvtClass/sample
  - /cefs/higgs/zhangkl/Production/2503

BMR -- Performance of 25.1.0

- Perform BMR study in $ZH \to \nu\nu + gg/bb/cc/uu/dd/ss$ with $\sqrt{s} = 240\mathrm{GeV}/c^2$
- Comparisons without/with event cleaning under $|\cos\theta_{\mathrm{jet}}| < 0.85$

Case	process	$ZH \to \nu\nu gg$	$ZH \to \nu\nu bb$	$ZH \to \nu\nu cc$	$ZH \to \nu\nu uu$	$ZH \to \nu\nu dd$	$ZH \to \nu\nu ss$
Physical level	BMR/%	4.00 ± 0.01	4.36 ± 0.03	4.16 ± 0.03	3.79 ± 0.01	3.97 ± 0.01	4.44 ± 0.01
	Efficiency/%	73.3	73.7	74.0	74.2	74.1	74.1
Detector level	BMR/%	3.95 ± 0.01	3.74 ± 0.02	4.01 ± 0.01	3.77 ± 0.01	3.95 ± 0.01	4.40 ± 0.01
	Efficiency/%	65.7	28.1	48.6	70.3	70.1	70.2

  - Event cleaning: $\Sigma|Pt_{\mathrm{ISR}}| < 1\mathrm{GeV}/c \& \Sigma|Pt_{\nu}| < 1\mathrm{GeV}/c$
  - Before event cleaning, BMR ranges from 3.79% to 4.44%
  - After event cleaning, BMR ranges from 3.74% to 4.40%
- Samples generated under CEPCSW_tdr25.1.0
  - /cefs/higgs/maxiaotian/25.1.0/CEPCSW/jet/4ML/fit
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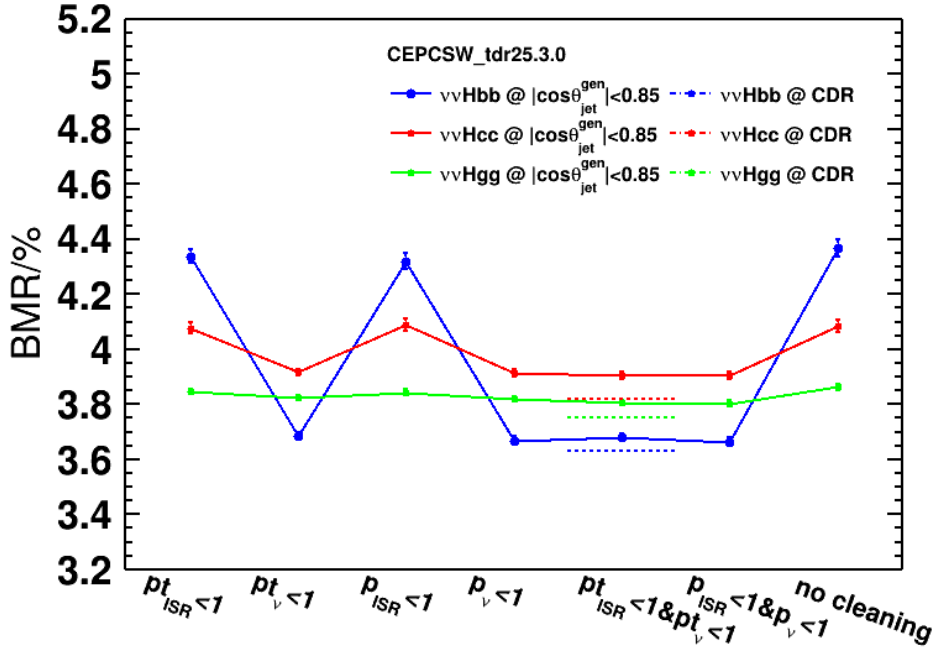
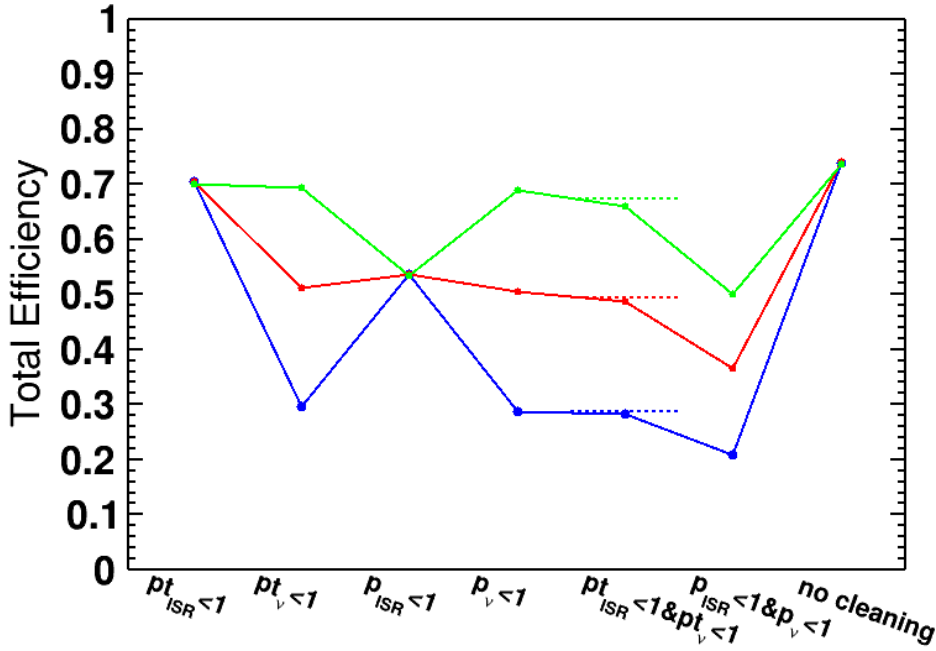
BMR -- Performance of 25.3.0





Current result – efficiency consistent with CDR, BMR 0.07%/0.10%/0.07% higher

Table 1. Event cumulative efficiency for Higgs boson exclusive decay at the CEPC with $\sqrt{s} = 240$ GeV.

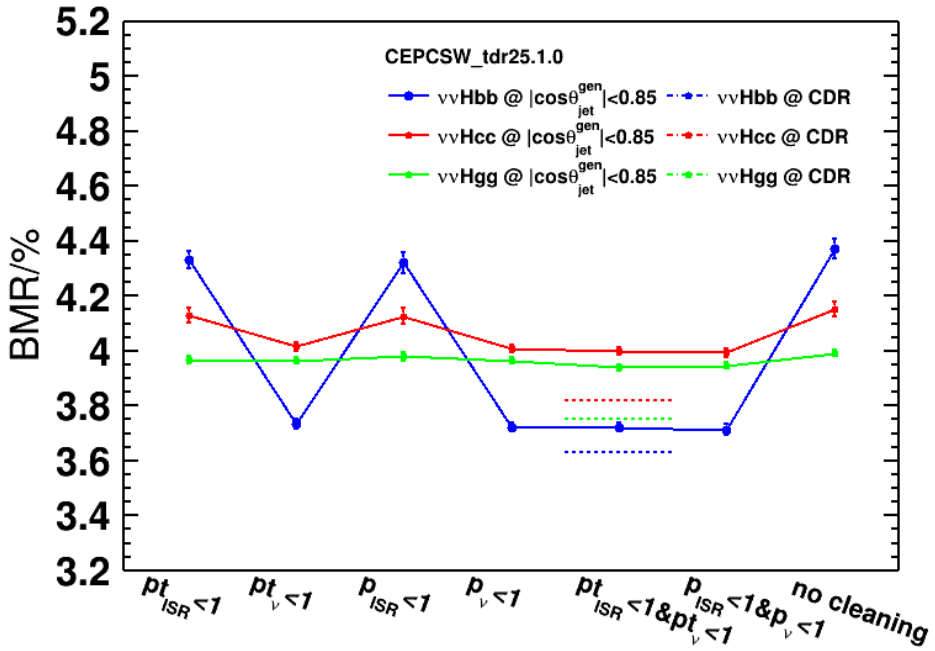
	gg(%)	bb(%)	cc(%)	WW^*(%)	ZZ^* (%)
Pt_ISR < 1 GeV	95.15	95.37	95.30	95.16	95.24
Pt_neutrino < 1 GeV	89.33	39.04	66.36	37.46	41.39
|Cos(Theta_Jet)| < 0.85	67.30	28.65	49.31	–	–

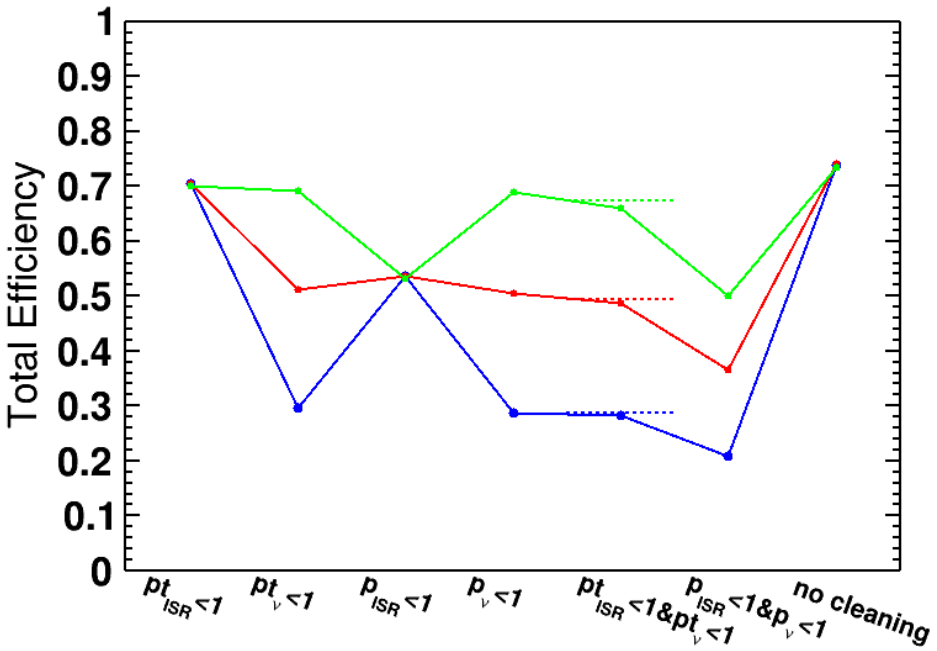
Table 3. Higgs boson mass resolution (sigma/Mean) for different decay modes with jets as final state particles, after event cleaning.

$H \to bb$	$H \to cc$	$H \to gg$	$H \to WW^*$	$H \to ZZ^*$
3.63%	3.82%	3.75%	3.81%	3.74%

CDR reference

BMR -- Performance of 25.1.0





Current result – efficiency consistent with CDR, BMR 0.11%/0.19%/0.20% higher

Table 1. Event cumulative efficiency for Higgs boson exclusive decay at the CEPC with $\sqrt{s} = 240$ GeV.

	gg(%)	bb(%)	cc(%)	WW^*(%)	ZZ^* (%)
Pt_ISR < 1 GeV	95.15	95.37	95.30	95.16	95.24
Pt_neutrino < 1 GeV	89.33	39.04	66.36	37.46	41.39
|Cos(Theta_Jet)| < 0.85	67.30	28.65	49.31	–	–

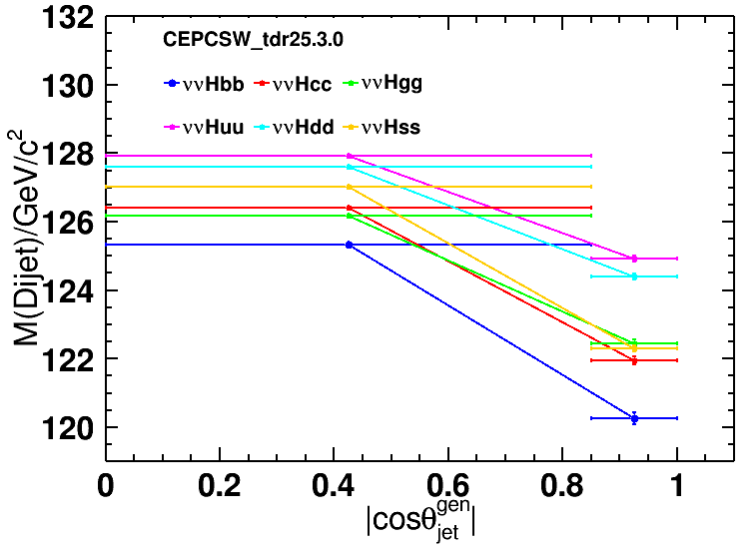
Table 3. Higgs boson mass resolution (sigma/Mean) for different decay modes with jets as final state particles, after event cleaning.

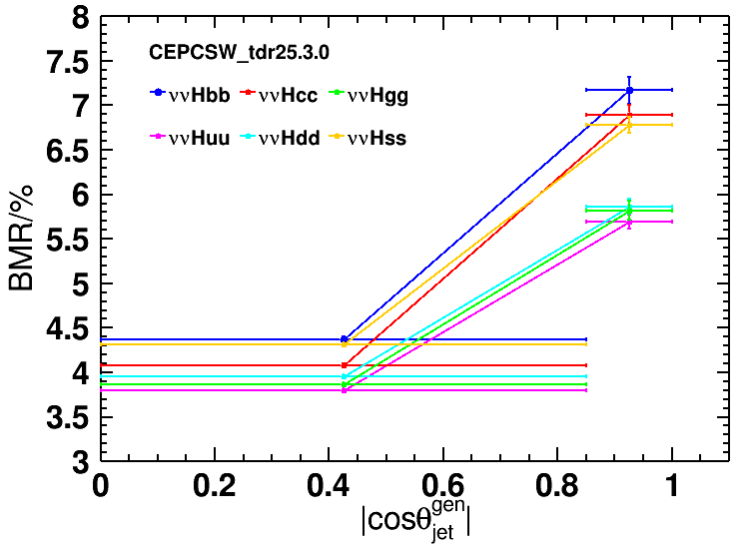
$H \to bb$	$H \to cc$	$H \to gg$	$H \to WW^*$	$H \to ZZ^*$
3.63%	3.82%	3.75%	3.81%	3.74%

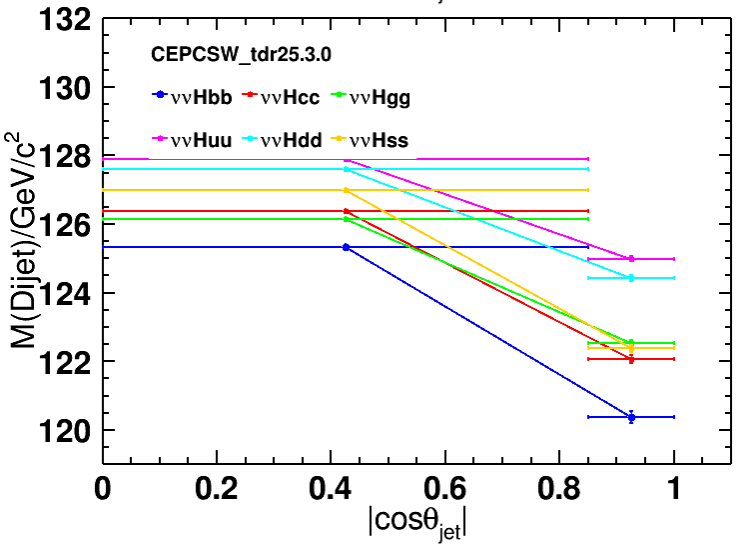
CDR reference

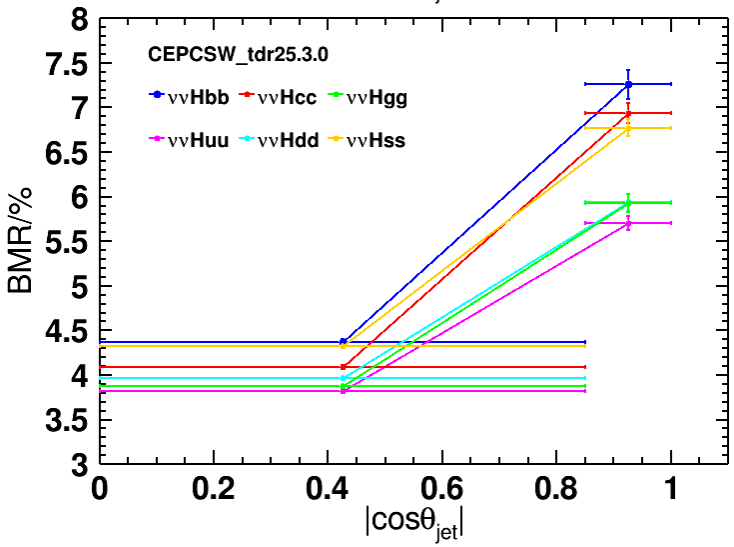
25.3.0

Dijet mass and BMR of barrel and endcap



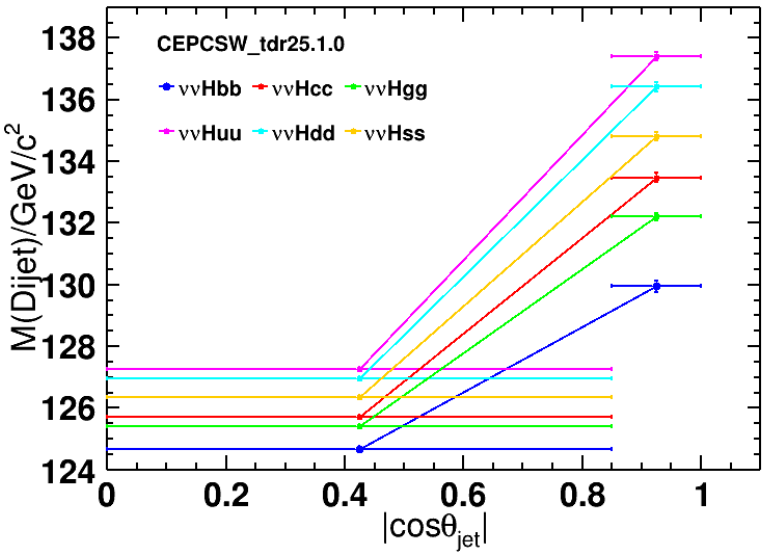


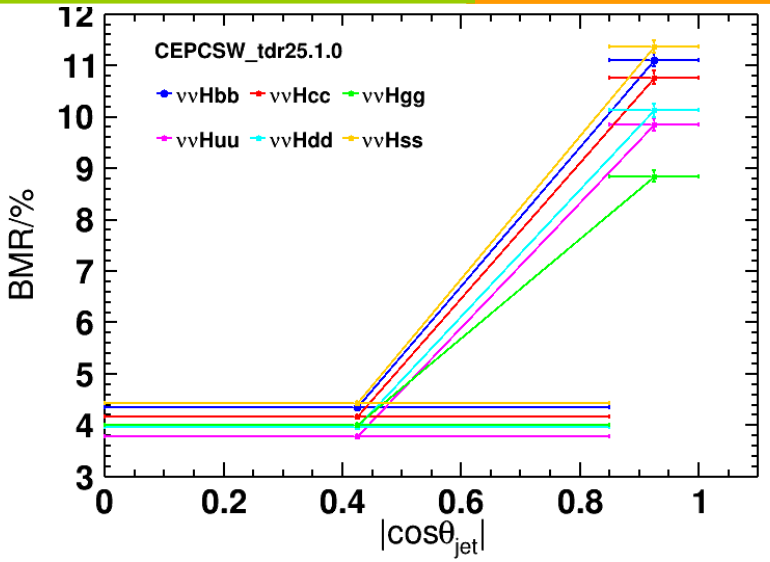


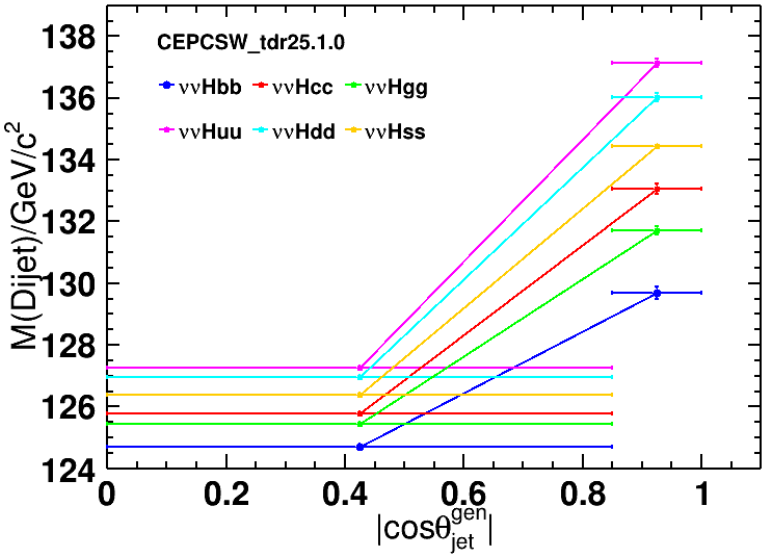


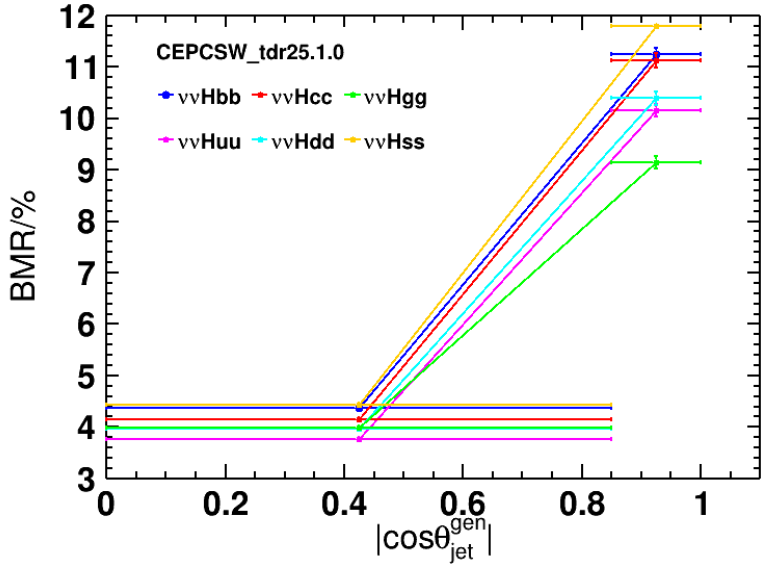
25.1.0

Dijet mass and BMR of barrel and endcap



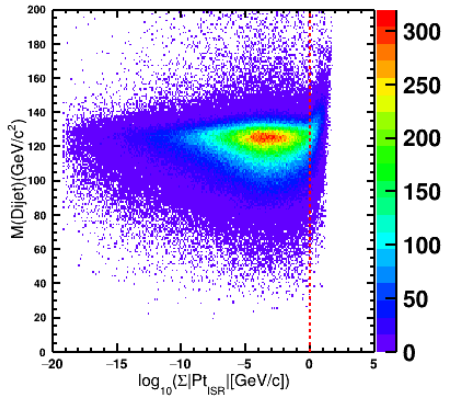


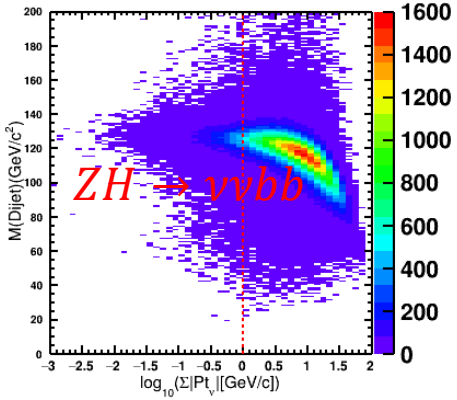


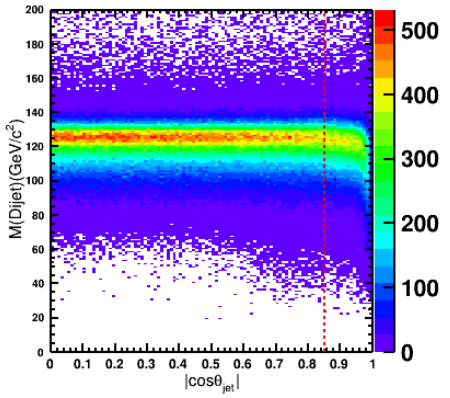


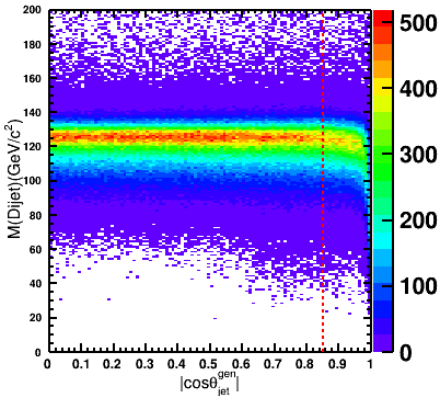
Backup

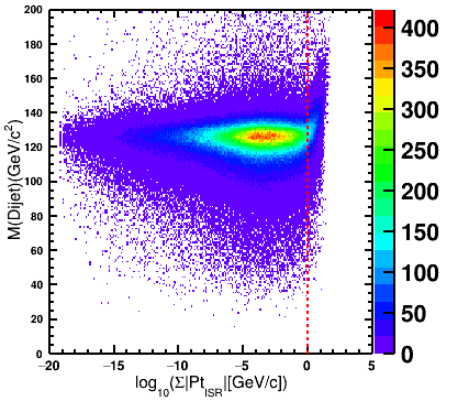
Distributions of 25.3.0

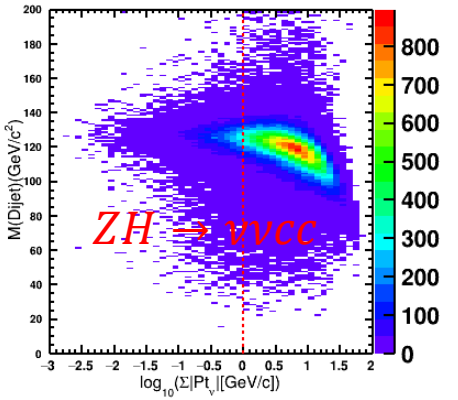


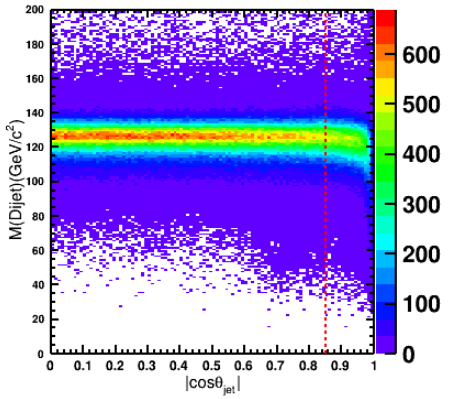


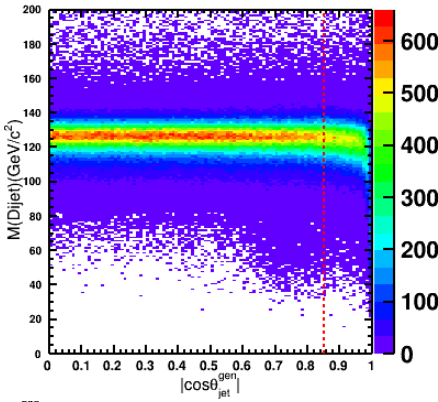


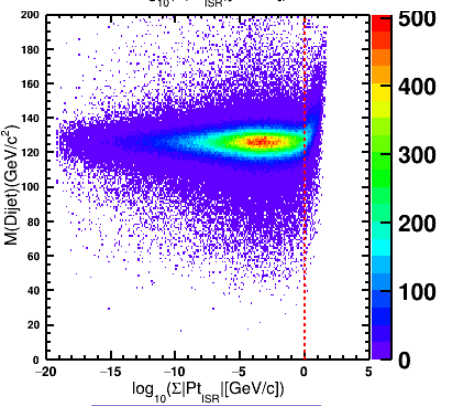


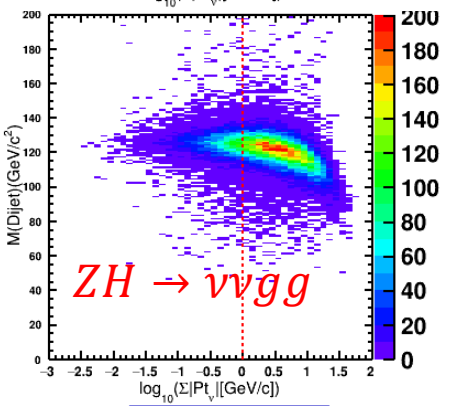


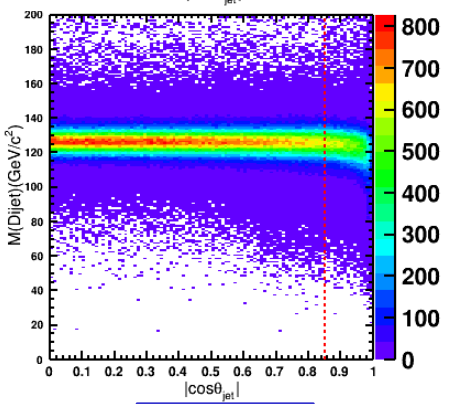


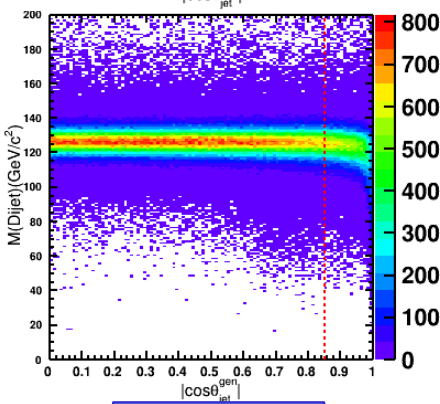












$\lg|\Sigma Pt_{\mathrm{ISR}}|$

$\lg\Sigma|Pt_{\nu}|$

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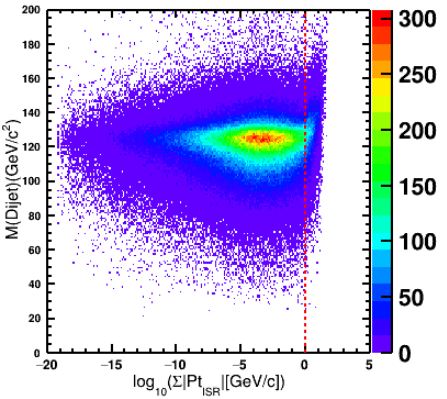
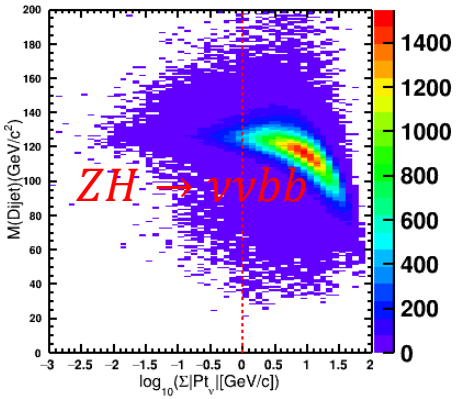
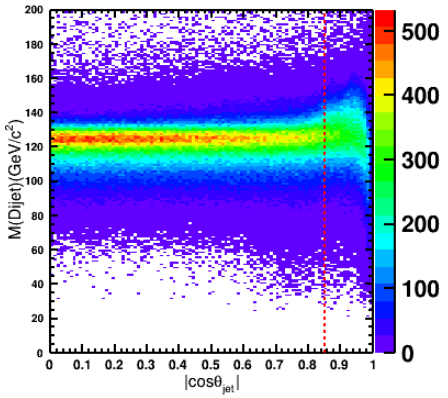
$|\cos\theta_{\mathrm{jet}}|$

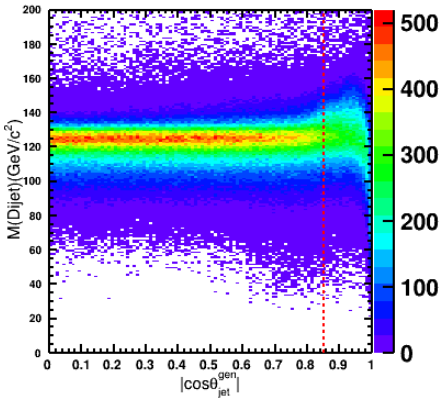
$|\cos\theta_{\mathrm{jet}}^{\mathrm{gen}}|$

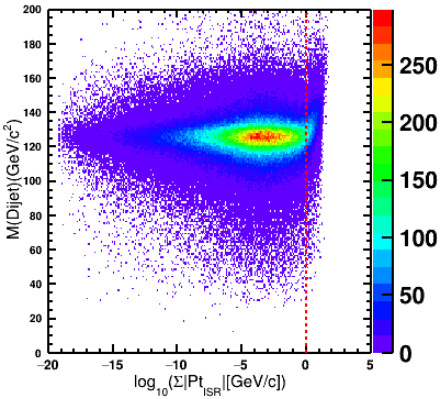
Distributions of 25.1.0

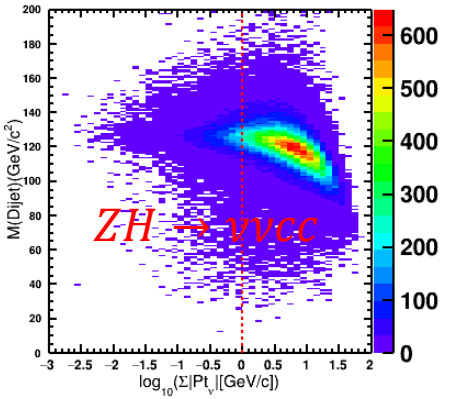


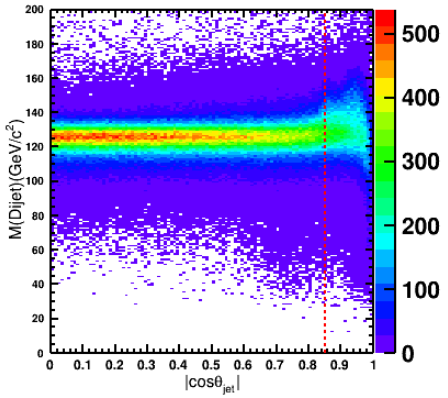


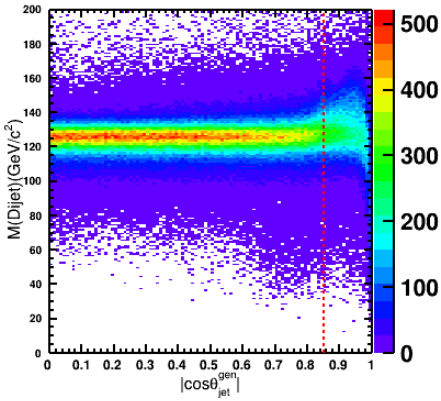


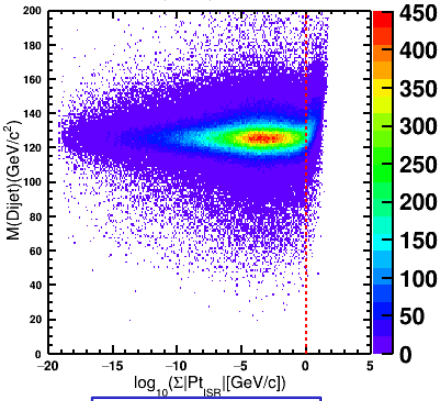


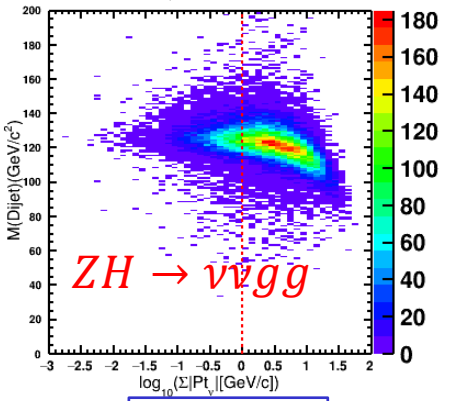


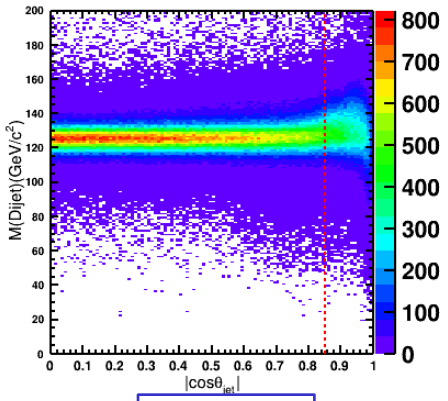


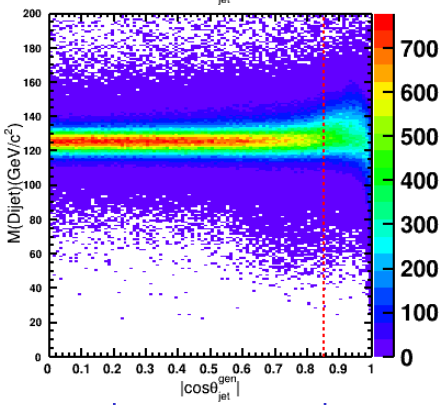












$\lg|\Sigma Pt_{\mathrm{ISR}}|$

$\lg\Sigma|Pt_{\nu}|$

$|\cos\theta_{\mathrm{jet}}|$

$|\cos\theta_{\mathrm{jet}}^{\mathrm{gen}}|$

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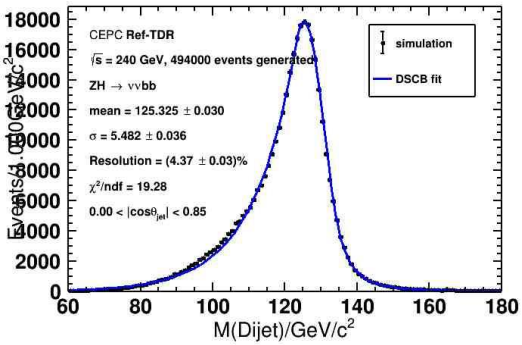
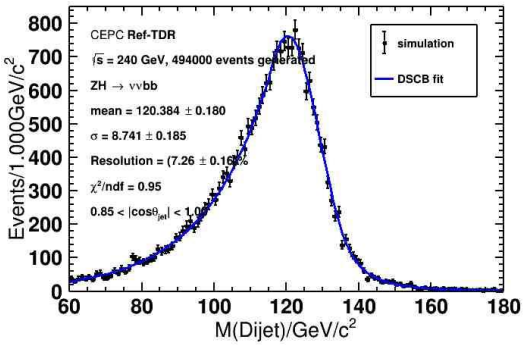
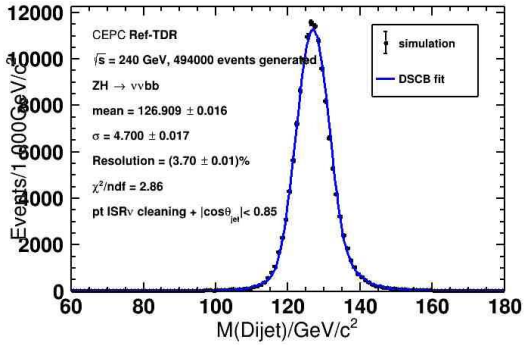
25.3.0

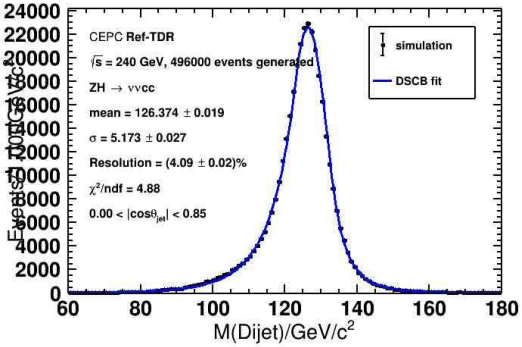
Fit result at barrel/endcap/barrel cleaning

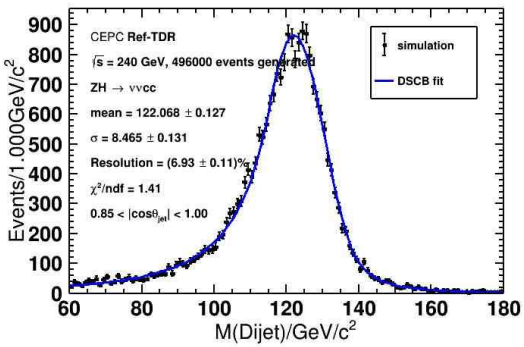


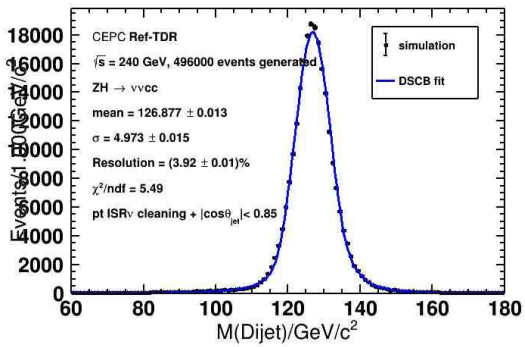




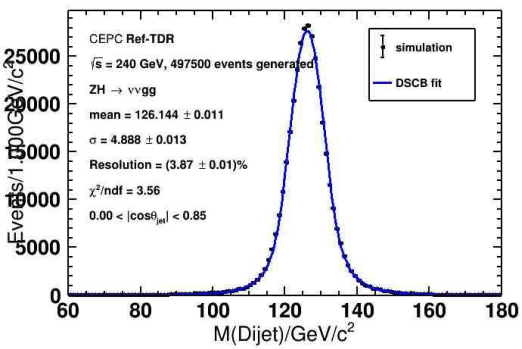
$ZH \to \nu\nu bb$

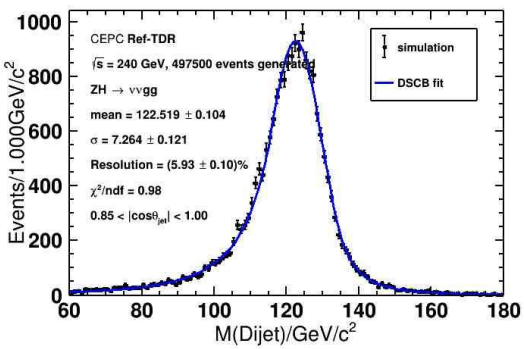


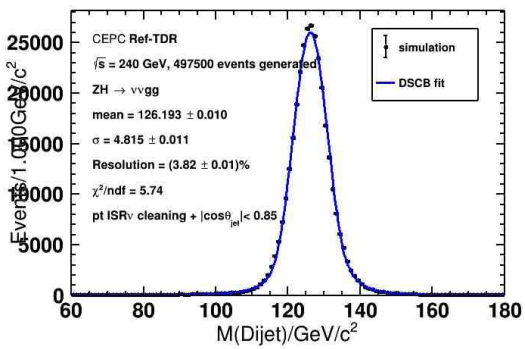




$ZH \to \nu\nu cc$



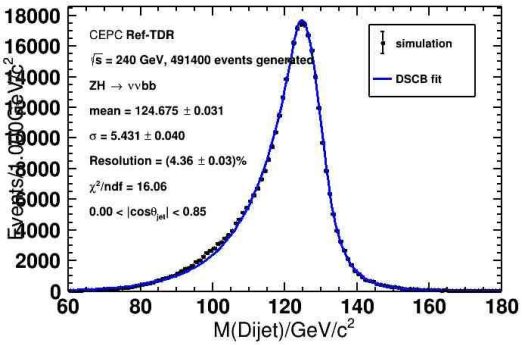


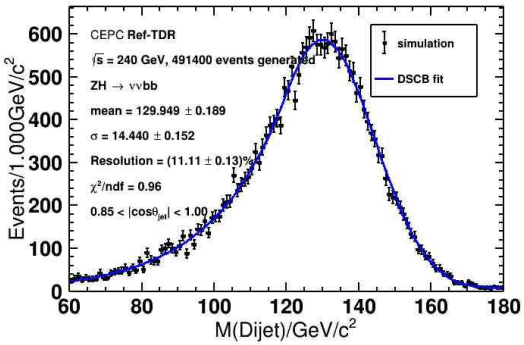


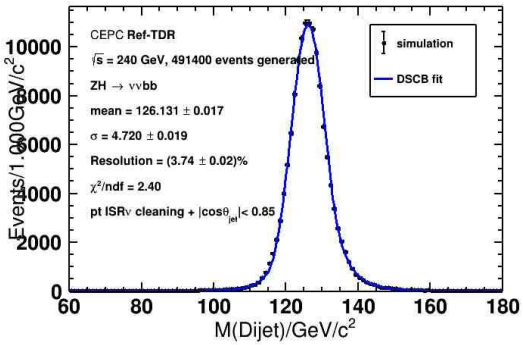
$ZH \to \nu\nu gg$

25.1.0

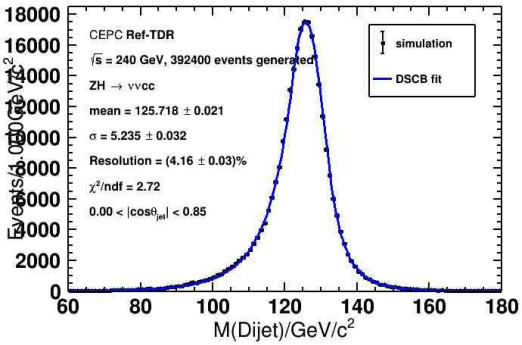
Fit result at barrel/endcap/barrel cleaning

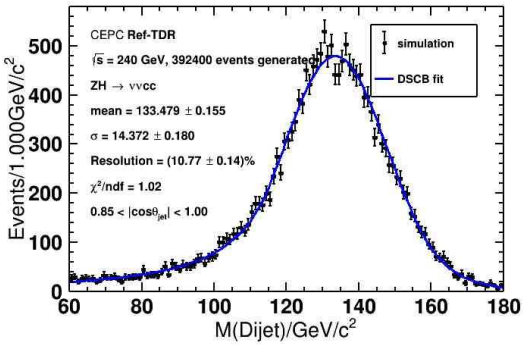


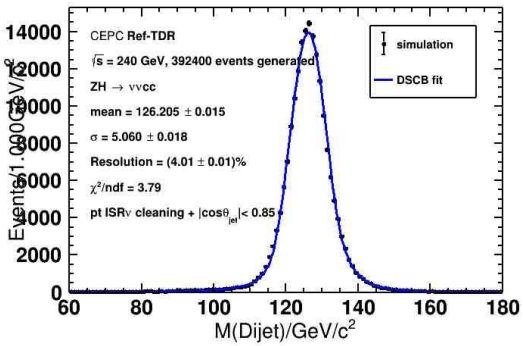




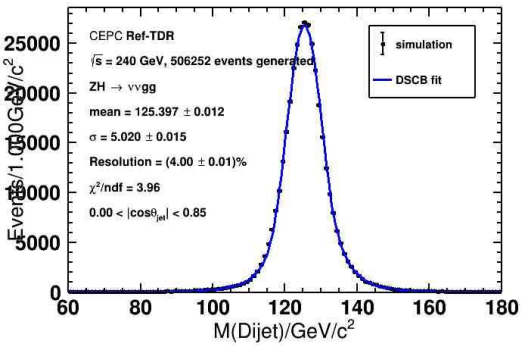
$ZH \to \nu\nu bb$

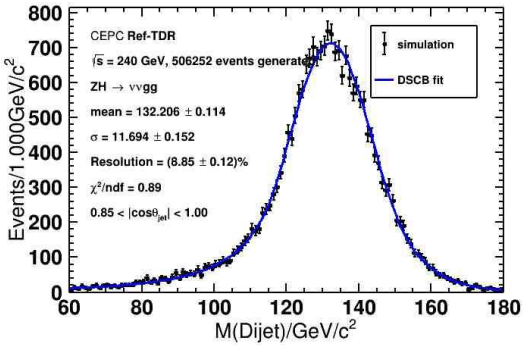


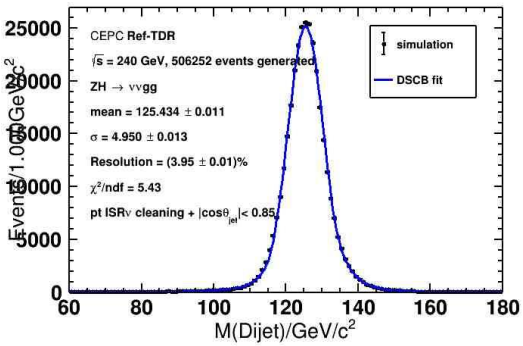




$ZH \to \nu\nu cc$







$ZH \to \nu\nu gg$