

Performance study -- BMR

❖ Perform BMR study in $ZH \rightarrow \nu\nu + gg/bb/cc/uu/dd/ss$

❖ Comparisons between tdr24.9.1 and tdr24.10.0 $|\cos\theta_{jet}| < 0.7 \& Match \& \Delta R < 0.6$

Release	process	$ZH \rightarrow \nu gg$	$ZH \rightarrow \nu bb$	$ZH \rightarrow \nu cc$	$ZH \rightarrow \nu uu$	$ZH \rightarrow \nu dd$	$ZH \rightarrow \nu ss$
CEPCSW_tdr24.9.1	BMR	$(5.28 \pm 0.19)\%$	$(7.00 \pm 0.34)\%$	$(6.32 \pm 0.20)\%$	$(5.39 \pm 0.16)\%$	$(4.93 \pm 0.18)\%$	$(5.45 \pm 0.22)\%$
	Efficiency	0.50	0.50	0.52	0.54	0.51	0.52
CEPCSW_tdr24.10.0	BMR	$(4.98 \pm 0.03)\%$	$(6.48 \pm 0.06)\%$	$(5.64 \pm 0.03)\%$	$(4.85 \pm 0.02)\%$	$(4.94 \pm 0.04)\%$	$(5.56 \pm 0.02)\%$
	Efficiency	0.57	0.56	0.57	0.57	0.57	0.56

- BMR improves generally
- Efficiency improves -- change of the reference point to IP

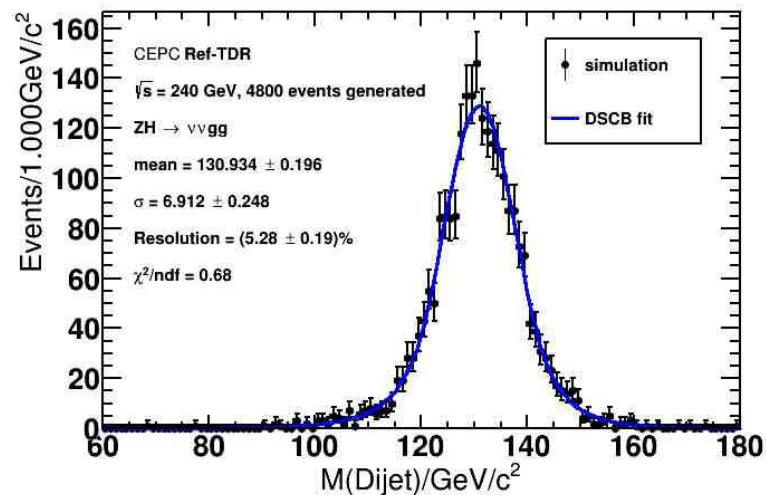
❖ Correct $ZH \rightarrow \nu bb$ and $ZH \rightarrow \nu cc$ samples used in CEPCSW_tdr24.9.1

- Samples used (see in backup)

❖ Distributions of leakage energy to explain the low tail in $ZH \rightarrow \nu bb$

- More neutrinos from H take more energy away

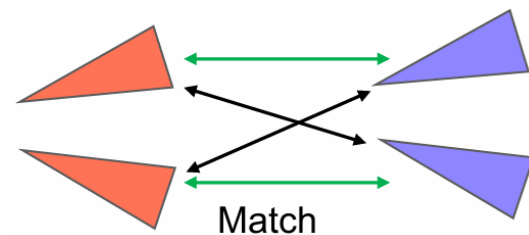
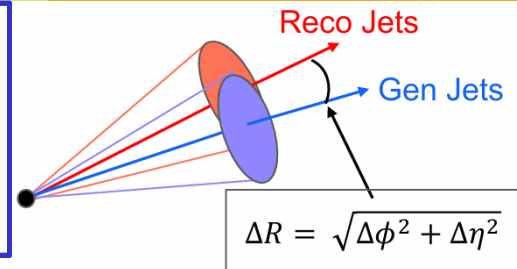
Performance study -- BMR



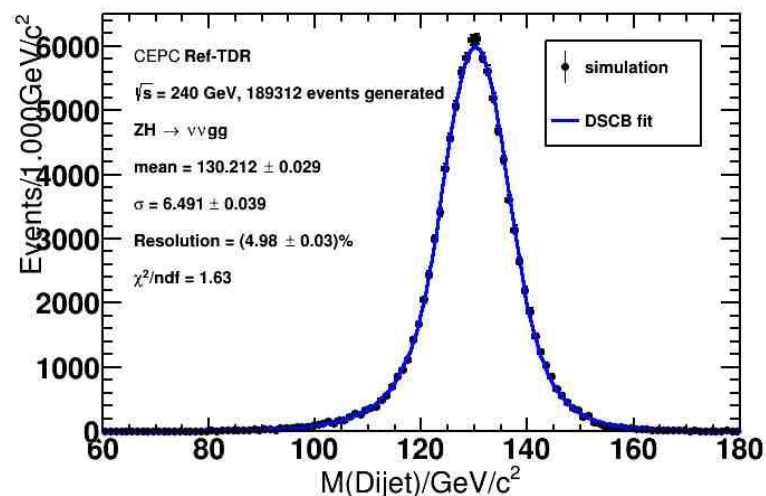
$ZH \rightarrow vv\bar{g}g$
CEPCSW_tdr24.9.1
 $m_H = 130.934 \pm 0.196$
Resolution $(5.28 \pm 0.19)\%$

Efficiency cutflow

$ \cos\theta_{jet} < 0.7$	0.541
Match & $\Delta R < 0.6$	0.499
Fit region	0.498



From Zebing

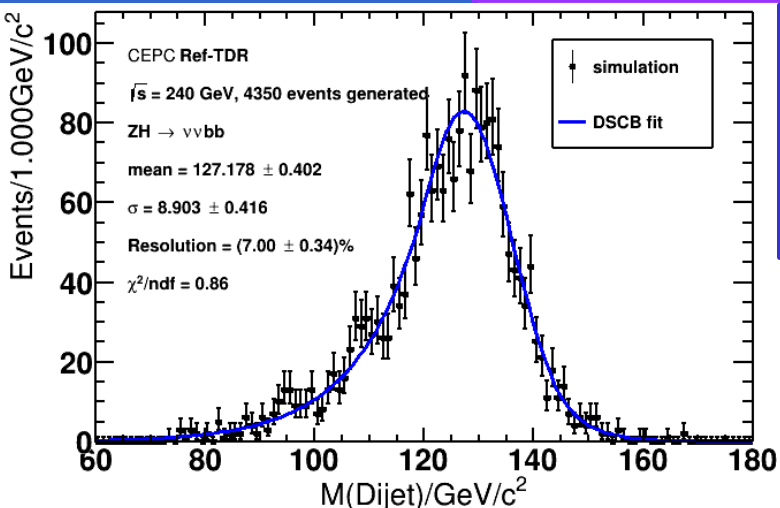


$ZH \rightarrow vv\bar{g}g$
CEPCSW_tdr24.10.0
 $m_H = 130.212 \pm 0.029$
Resolution $(4.98 \pm 0.03)\%$

Efficiency cutflow

$ \cos\theta_{jet} < 0.7$	0.592
Match & $\Delta R < 0.6$	0.566
Fit region	0.565

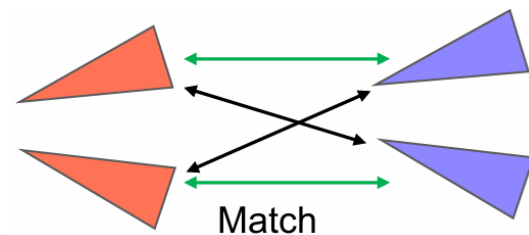
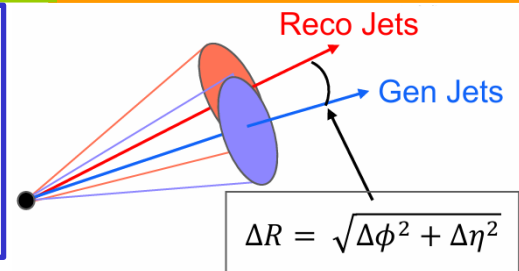
Performance study -- BMR



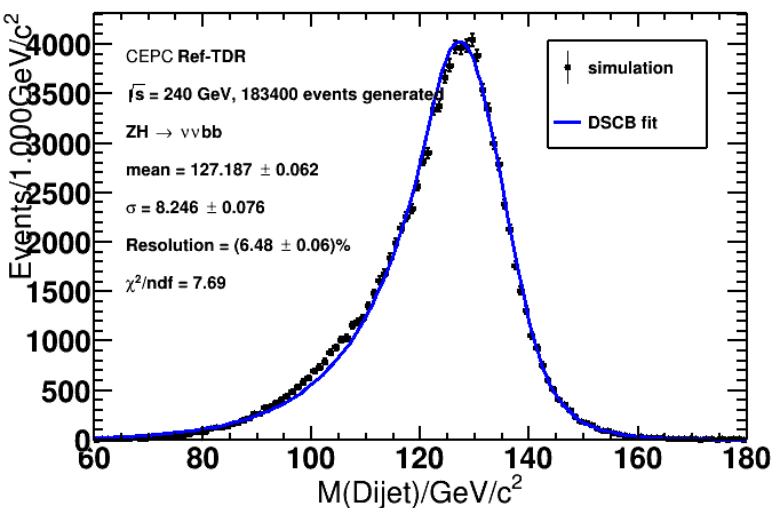
$ZH \rightarrow vvbb$
CEPCSW_tdr24.9.1
 $m_H = 127.178 \pm 0.402$
Resolution $(7.00 \pm 0.34)\%$

Efficiency cutflow

$ \cos\theta_{jet} < 0.7$	0.516
Match & $\Delta R < 0.6$	0.499
Fit region	0.498



From Zebing

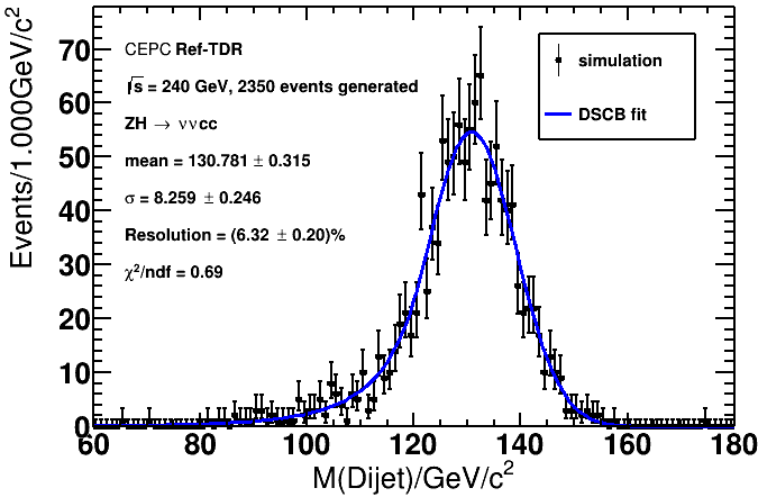


$ZH \rightarrow vvbb$
CEPCSW_tdr24.10.0
 $m_H = 127.187 \pm 0.062$
Resolution $(6.48 \pm 0.06)\%$

Efficiency cutflow

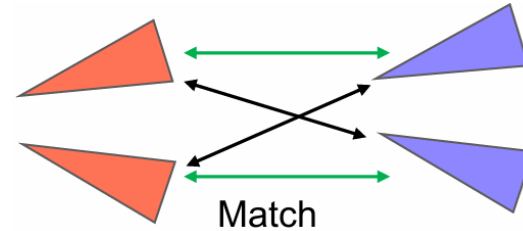
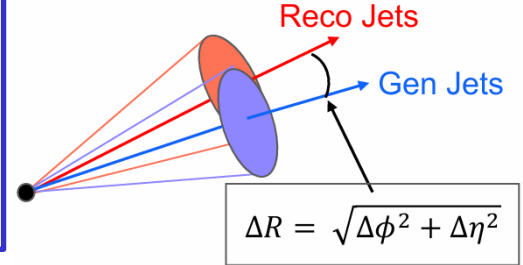
$ \cos\theta_{jet} < 0.7$	0.577
Match & $\Delta R < 0.6$	0.564
Fit region	0.563

Performance study -- BMR

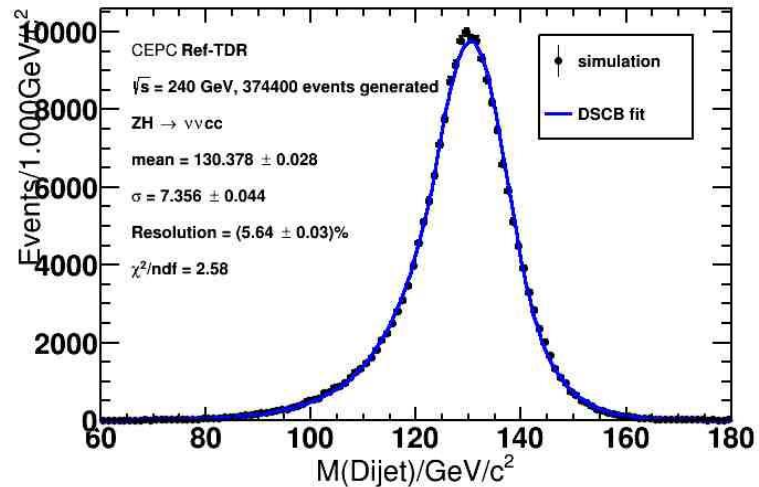


$ZH \rightarrow \nu\bar{\nu}cc$
CEPCSW_tdr24.9.1
 $m_H = 130.781 \pm 0.315$
Resolution $(6.32 \pm 0.20)\%$

Efficiency cutflow	
$ \cos\theta_{jet} < 0.7$	0.540
Match & $\Delta R < 0.6$	0.521
Fit region	0.521



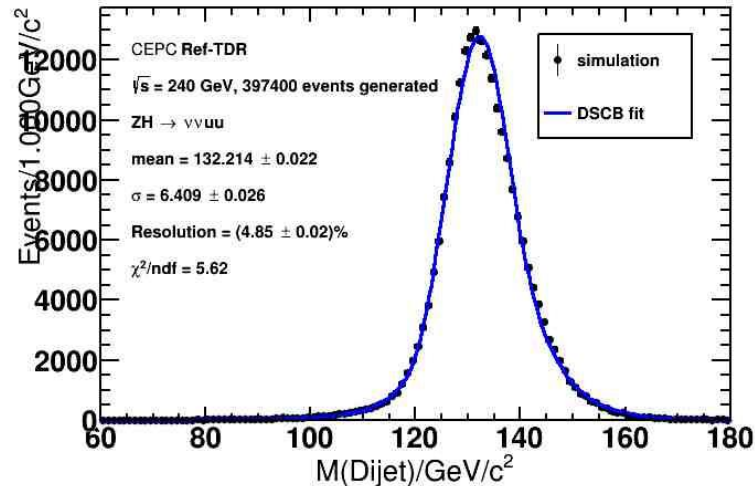
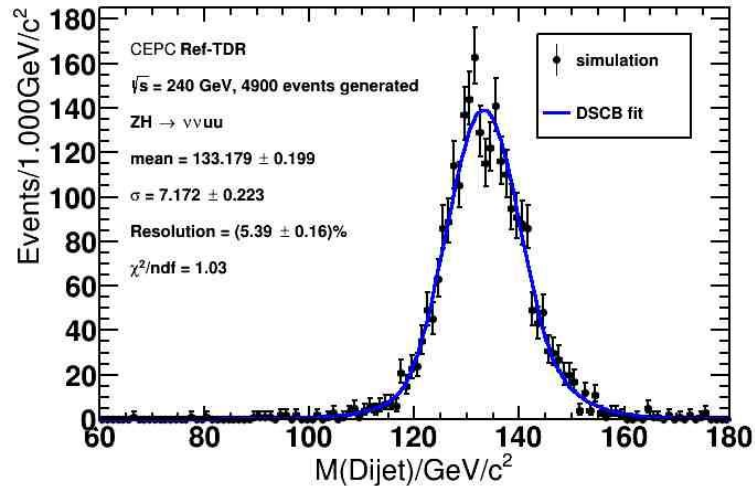
From Zebing



$ZH \rightarrow \nu\bar{\nu}cc$
CEPCSW_tdr24.10.0
 $m_H = 130.378 \pm 0.028$
Resolution $(5.64 \pm 0.03)\%$

Efficiency cutflow	
$ \cos\theta_{jet} < 0.7$	0.581
Match & $\Delta R < 0.6$	0.568
Fit region	0.567

Performance study -- BMR

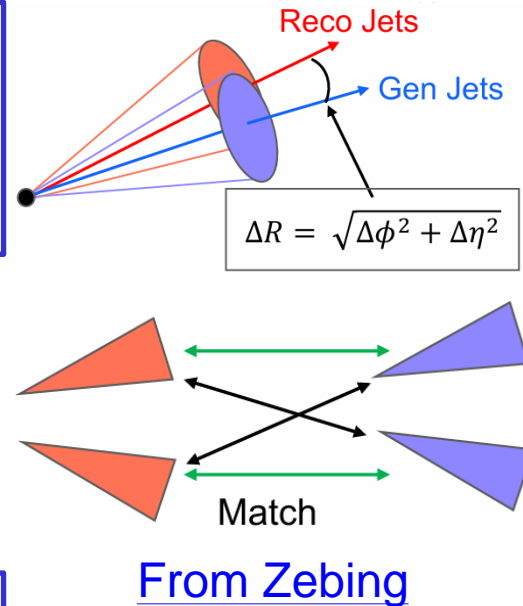


$ZH \rightarrow vvuu$
 CEPCSW_tdr24.9.1
 $m_H = 133.179 \pm 0.199$
 Resolution $(5.39 \pm 0.16)\%$

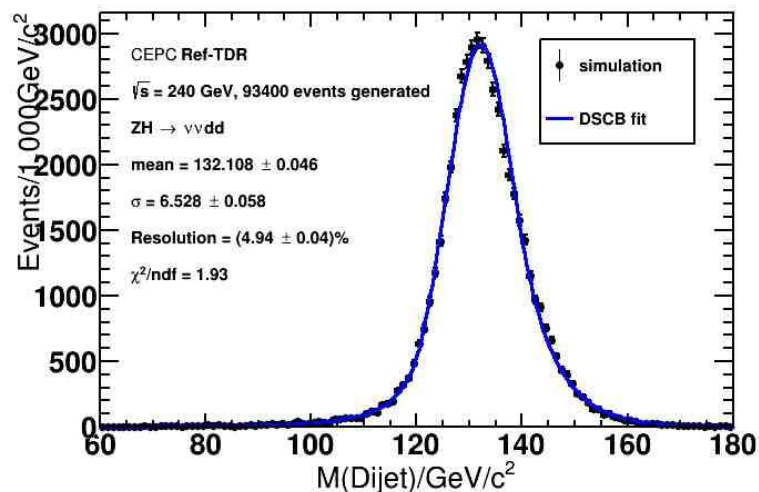
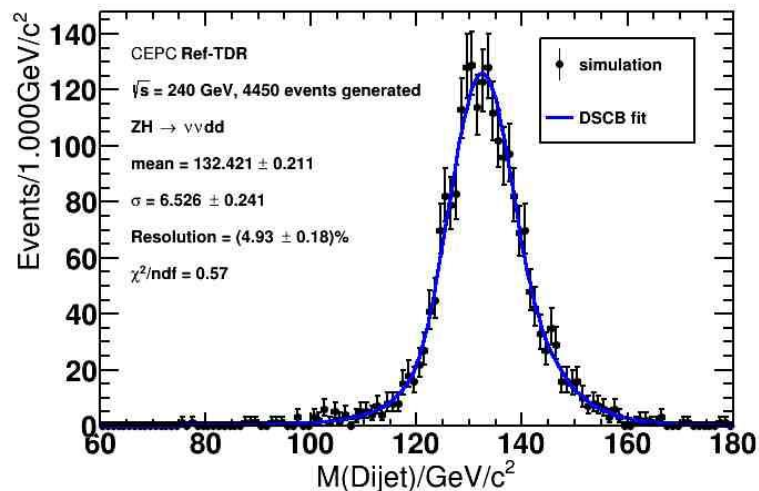
Efficiency cutflow	
$ \cos\theta_{jet} < 0.7$	0.553
Match & $\Delta R < 0.6$	0.537
Fit region	0.535

$ZH \rightarrow vvuu$
 CEPCSW_tdr24.10.0
 $m_H = 132.214 \pm 0.022$
 Resolution $(4.85 \pm 0.02)\%$

Efficiency cutflow	
$ \cos\theta_{jet} < 0.7$	0.584
Match & $\Delta R < 0.6$	0.572
Fit region	0.570



Performance study -- BMR



$ZH \rightarrow vvdd$
CEPCSW_tdr24.9.1
 $m_H = 132.421 \pm 0.211$
Resolution $(4.93 \pm 0.18)\%$

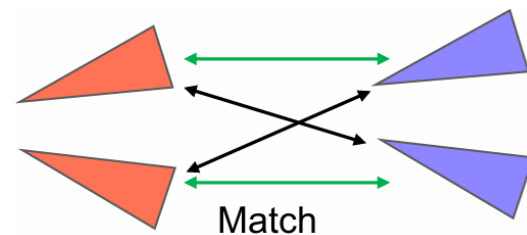
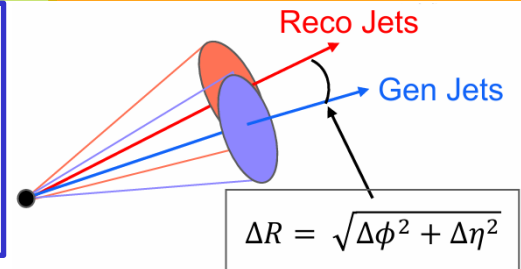
Efficiency cutflow

$ \cos\theta_{jet} < 0.7$	0.536
Match & $\Delta R < 0.6$	0.515
Fit region	0.514

$ZH \rightarrow vvdd$
CEPCSW_tdr24.10.0
 $m_H = 132.108 \pm 0.046$
Resolution $(4.94 \pm 0.04)\%$

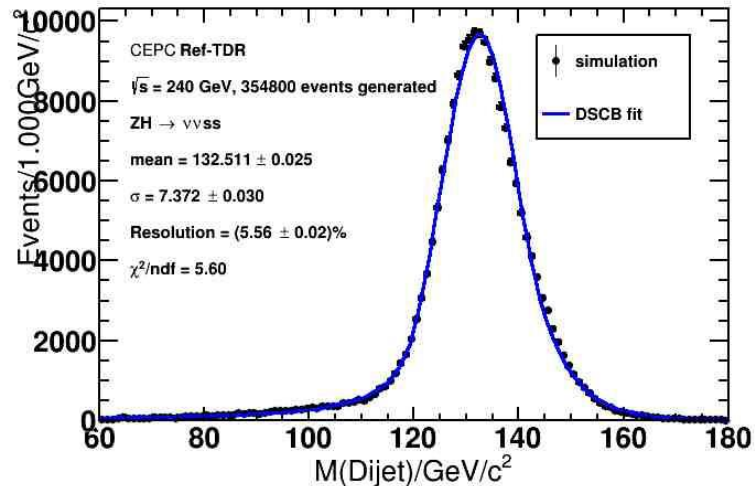
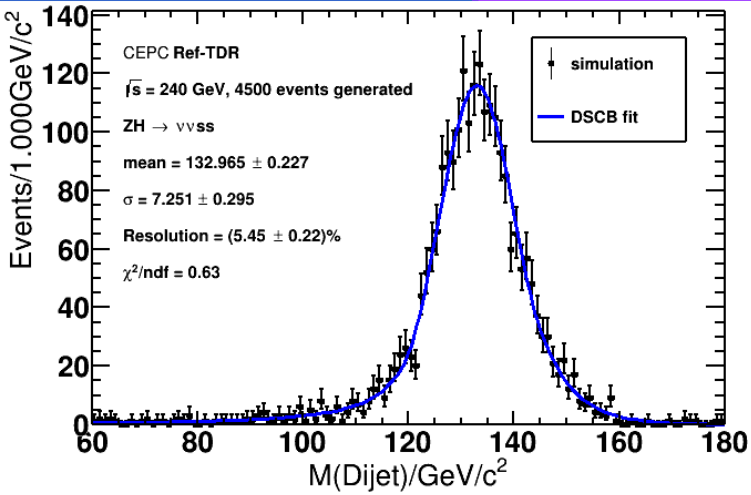
Efficiency cutflow

$ \cos\theta_{jet} < 0.7$	0.582
Match & $\Delta R < 0.6$	0.568
Fit region	0.567



From Zeping

Performance study -- BMR

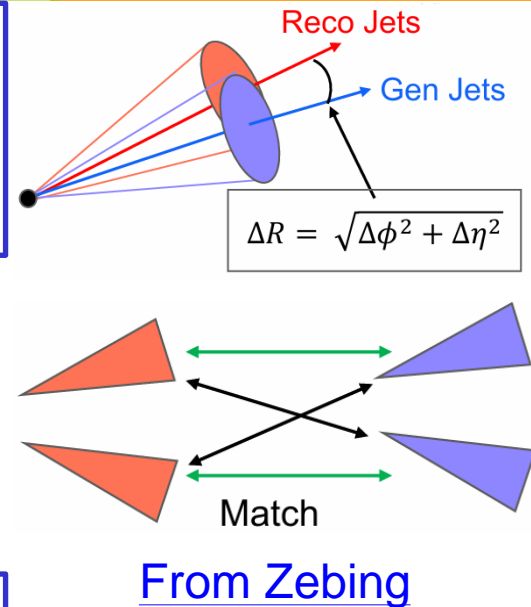


$ZH \rightarrow vvss$
CEPCSW_tdr24.9.1
 $m_H = 132.965 \pm 0.227$
 Resolution $(5.45 \pm 0.22)\%$

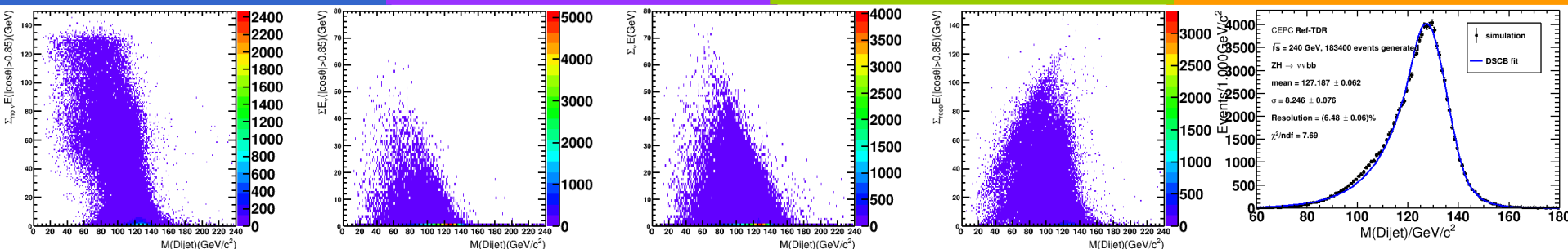
Efficiency cutflow	
$ \cos\theta_{jet} < 0.7$	0.547
Match & $\Delta R < 0.6$	0.527
Fit region	0.524

$ZH \rightarrow vvss$
CEPCSW_tdr24.10.0
 $m_H = 132.511 \pm 0.025$
 Resolution $(5.56 \pm 0.02)\%$

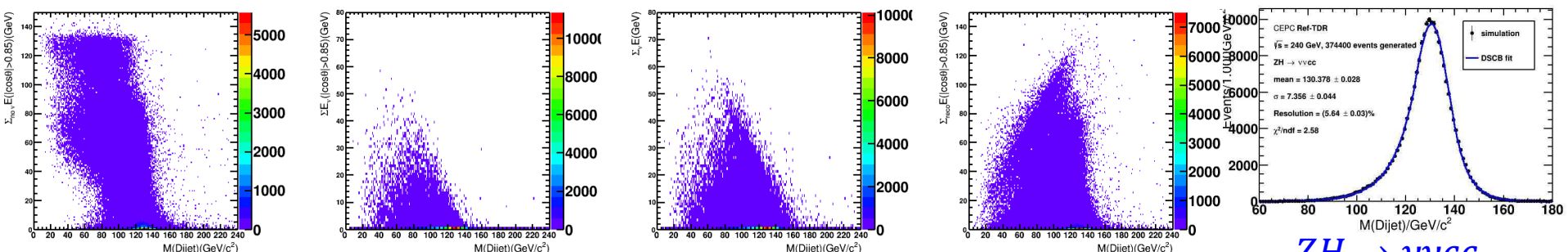
Efficiency cutflow	
$ \cos\theta_{jet} < 0.7$	0.580
Match & $\Delta R < 0.6$	0.565
Fit region	0.563



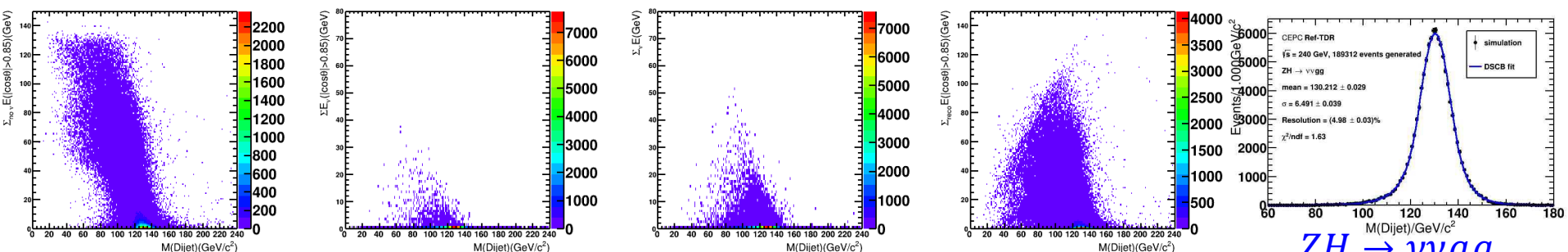
Distributions of energy leakage vs M(dijet) of 24.10.0



ZH \rightarrow $\nu\nu b\bar{b}$



ZH \rightarrow $\nu\nu c\bar{c}$



ZH \rightarrow $\nu\nu g\bar{g}$

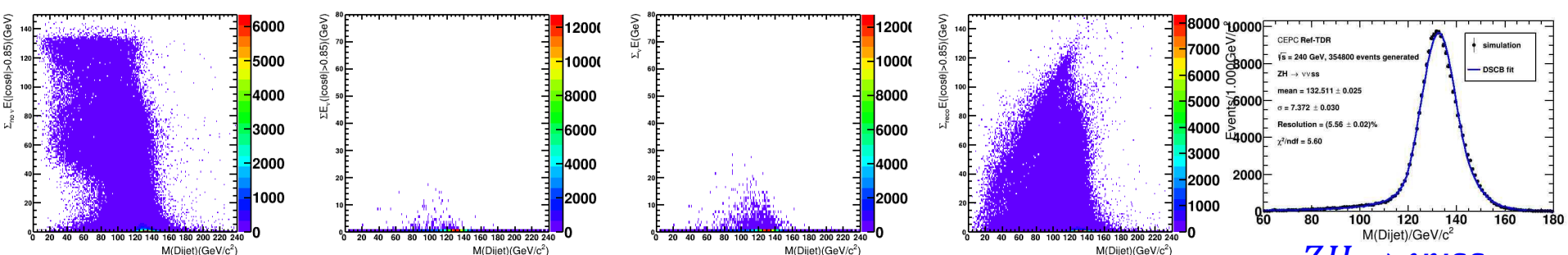
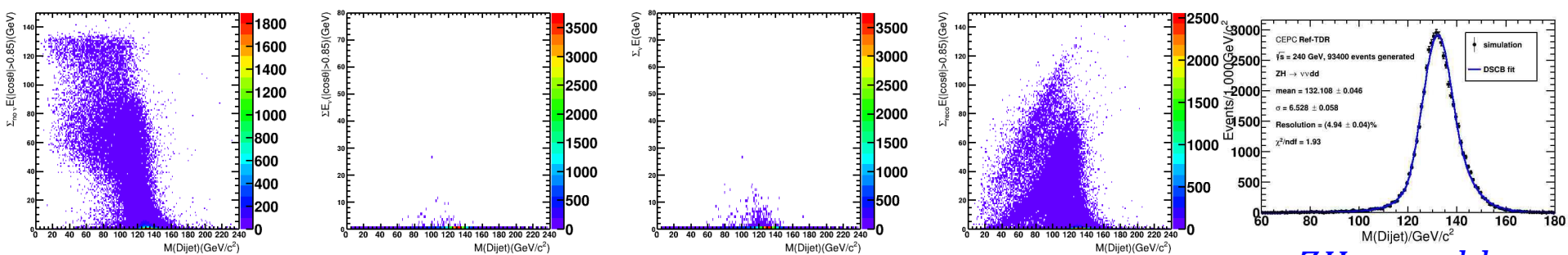
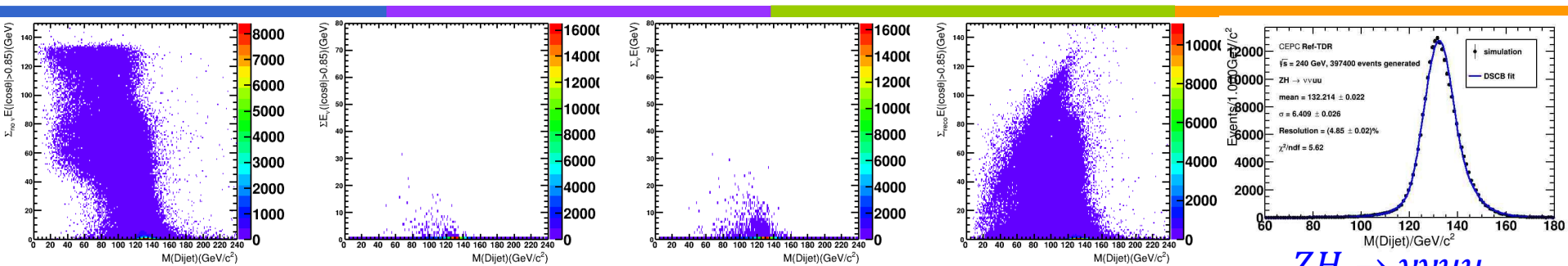
$$\sum_{\neq \nu} E_{\text{truth}}(|\cos\theta| > 0.85)$$

$$\sum_{\nu} E_{\text{truth}}(|\cos\theta| > 0.85)$$

$$\sum_{\nu} E_{\text{truth}}$$

$$\sum E_{\text{rec}}(|\cos\theta| > 0.85)$$

Distributions of energy leakage vs M(dijet) of 24.10.0



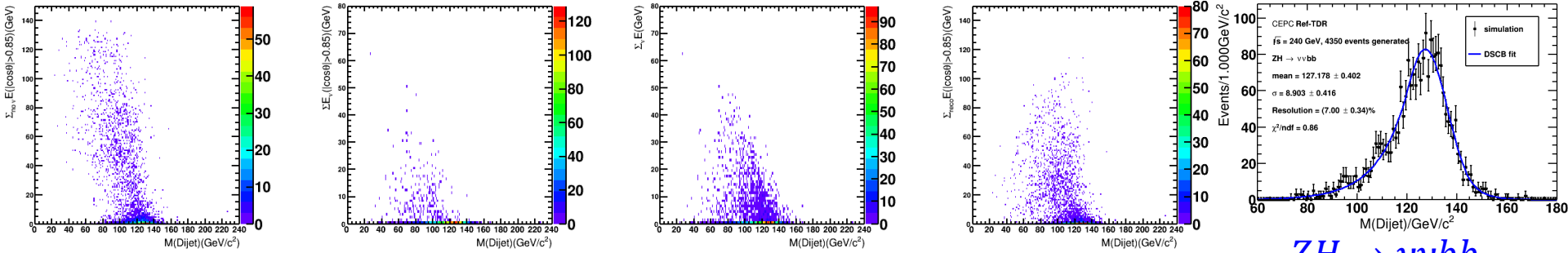
$$\sum_{\nu} E_{\text{truth}}(|\cos\theta| > 0.85)$$

$$\sum_{\nu} E_{\text{truth}}(|\cos\theta| > 0.85)$$

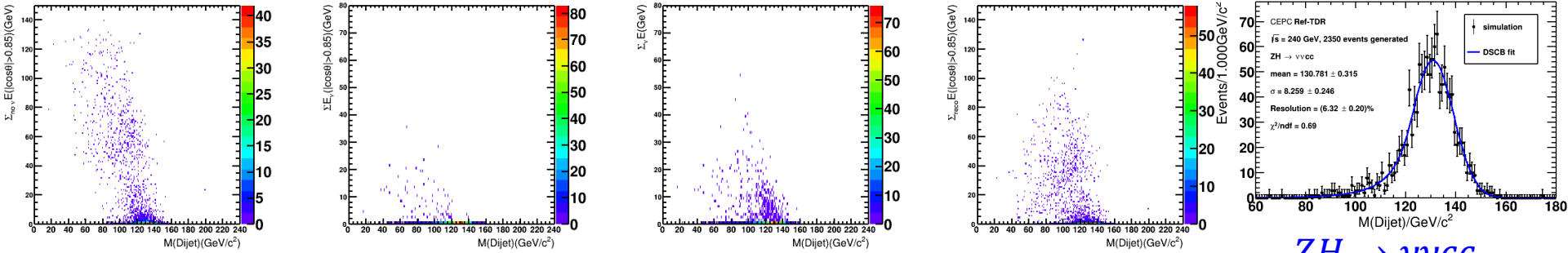
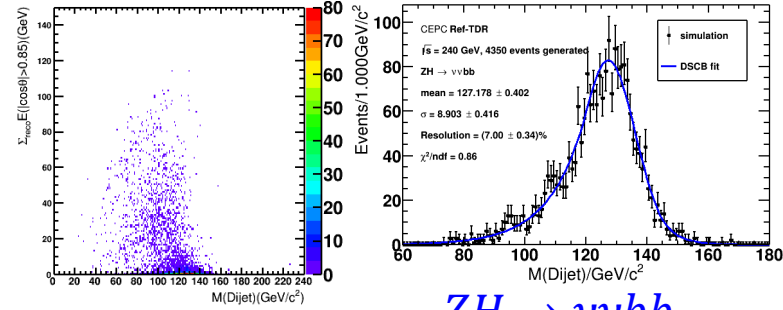
$$\sum_{\nu} E_{\text{truth}}$$

$$\sum E_{\text{rec}}(|\cos\theta| > 0.85)$$

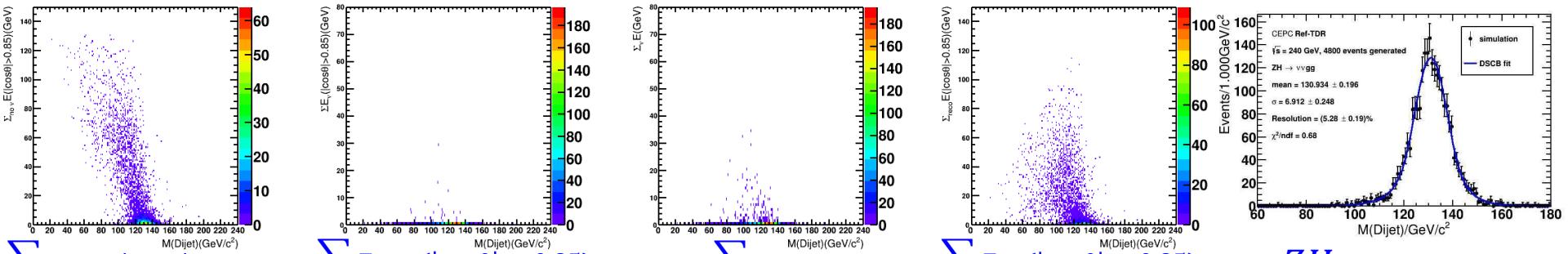
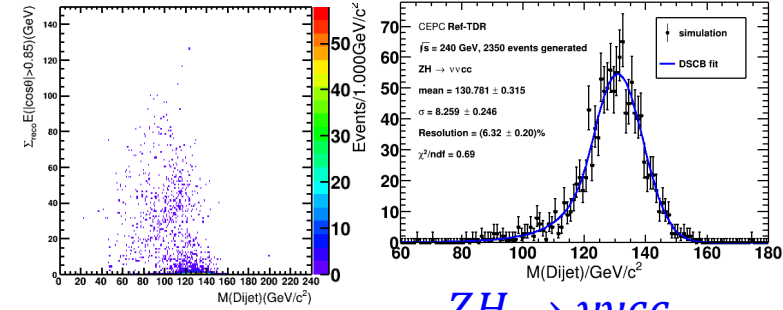
Distributions of energy leakage vs M(dijet) of 24.9.1



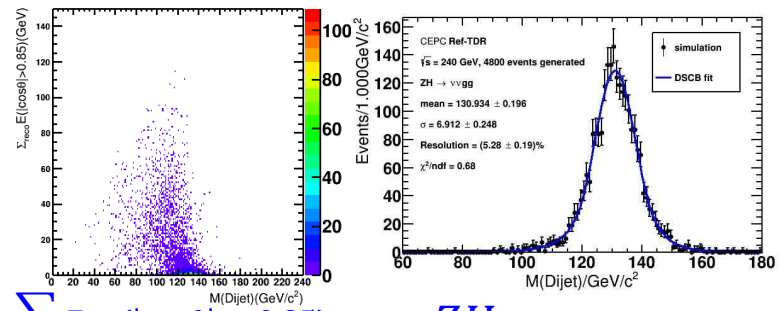
$ZH \rightarrow \nu\nu bb$



$ZH \rightarrow \nu\nu cc$



$ZH \rightarrow \nu\nu gg$



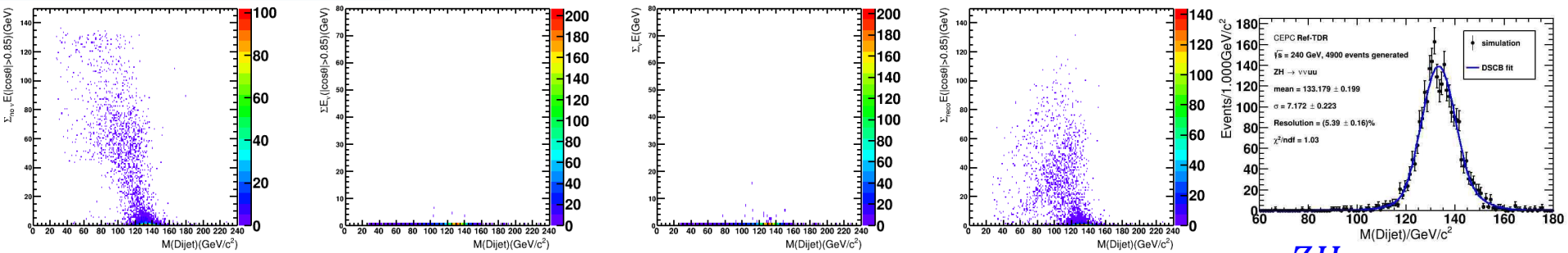
$$\sum_{\neq \nu} E_{\text{leak}}(|\cos\theta| > 0.85)$$

$$\sum_{\nu} E_{\text{leak}}(|\cos\theta| > 0.85)$$

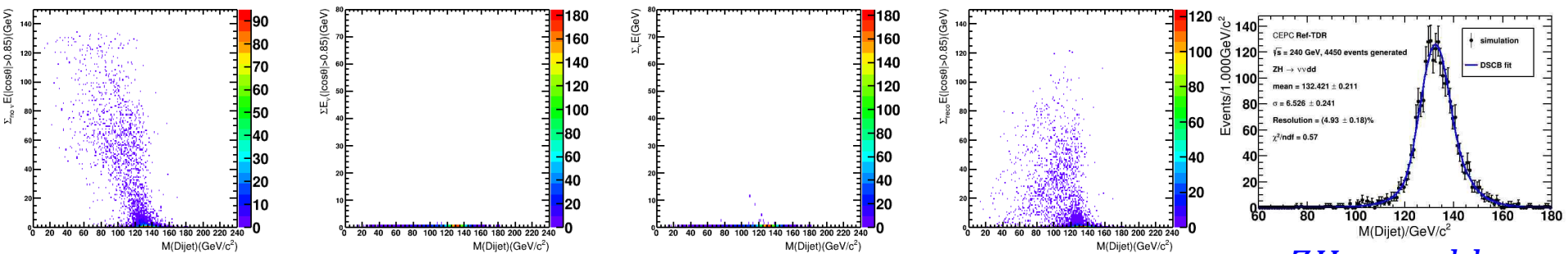
$$\sum_{\nu} E_{\text{leak}}$$

$$\sum E_{\text{rec}}(|\cos\theta| > 0.85)$$

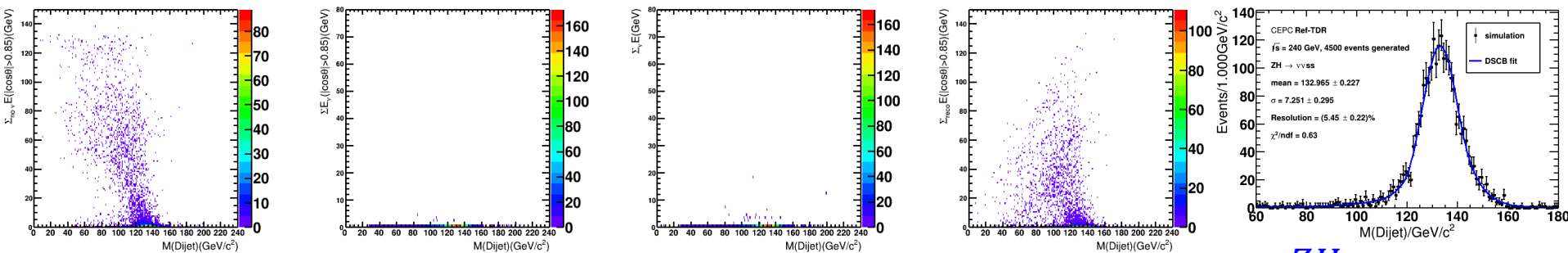
Distributions of energy leakage vs M(dijet) of 24.9.1



ZH \rightarrow $\nu\nu u\bar{u}$



ZH \rightarrow $\nu\nu d\bar{d}$



ZH \rightarrow $\nu\nu s\bar{s}$

$$\sum_{\neq \nu} E_{\text{truth}}(|\cos\theta| > 0.85)$$

$$\sum_{\nu} E_{\text{truth}}(|\cos\theta| > 0.85)$$

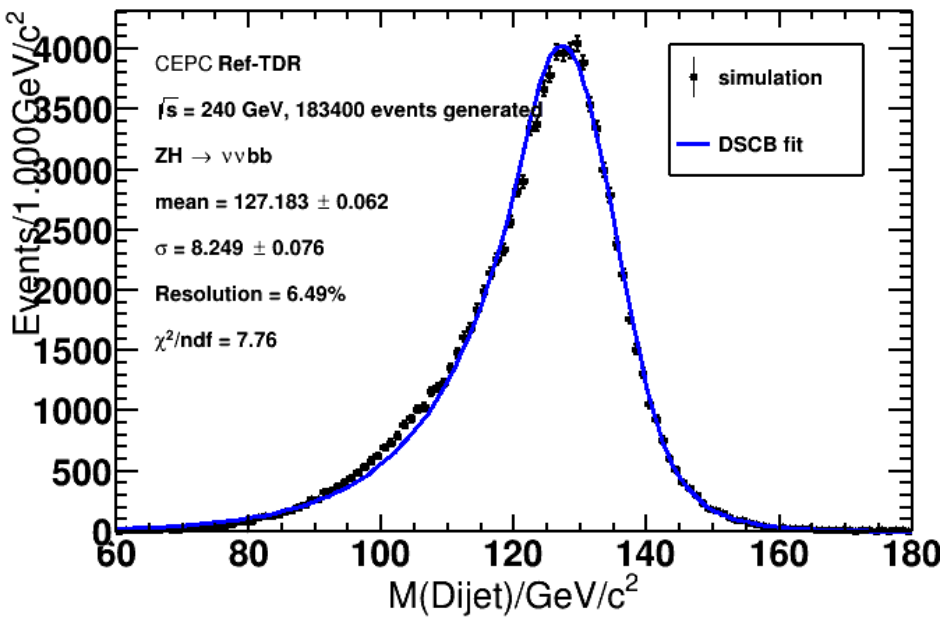
$$\sum_{\nu} E_{\text{truth}}$$

$$\sum E_{\text{rec}}(|\cos\theta| > 0.85)$$

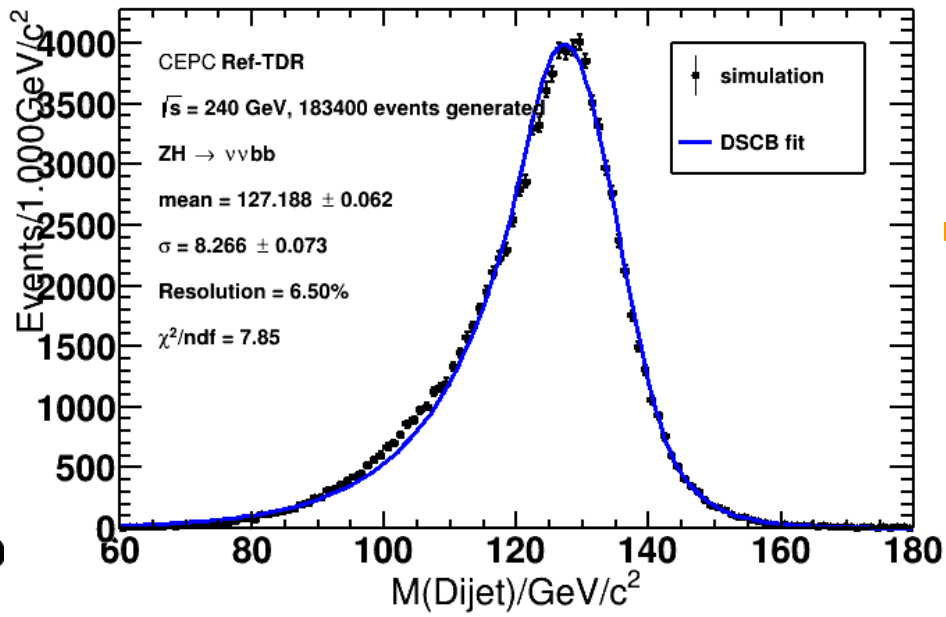
Back up

❖ Samples used:

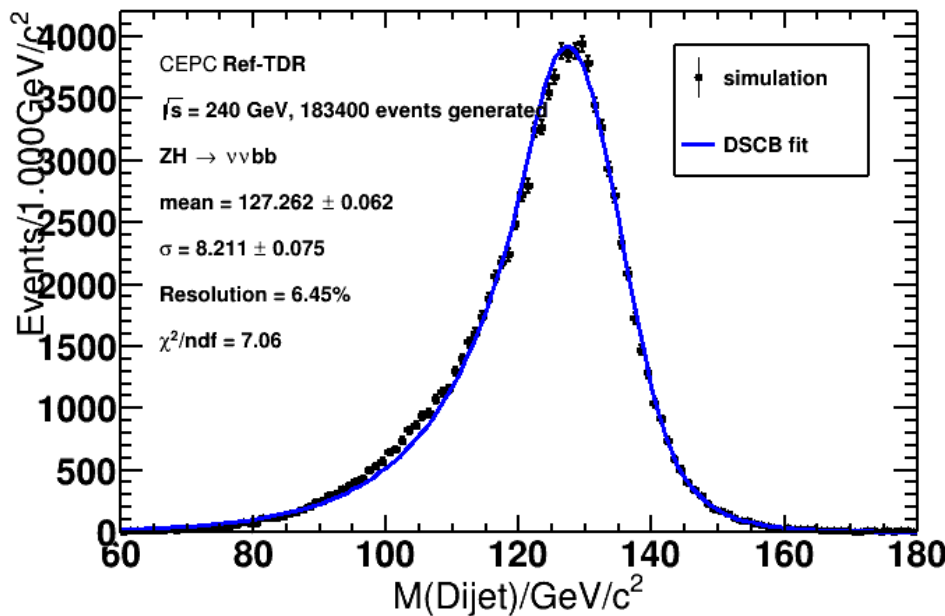
- Generator1: /cefs/higgs/zhuyf/workspace/whizard360/WhizardAis/data/higgs/E240.Pn2n2h_uu.e0.p0.whizard195/
- Generator2: /cefs/data/stdhep/CEPC240/higgs/update_from_LiangHao_1M/data/E240.Pnnh_*/
- /cefs/higgs/maxiaotian/CEPCSW/sample/24.9.1/
 - gen_Rec_E240_nnHgg_5000.root, gen_Rec_E240_nnHbb_5000.root, gen_Rec_E240_nnHcc_5000.root
 - gen_Rec_E240_nnHuu_5000.root, gen_Rec_E240_nnHdd_5000.root, gen_Rec_E240_nnHss_5000.root
- /cefs/higgs/zhangkl/Production/
 - E240_nnHgg/ -> /cefs/higgs/maxiaotian/CEPCSW/sample/Jets_E240_nnHgg.root
 - E240_nnHbb_1105v2/ -> /cefs/higgs/maxiaotian/CEPCSW/sample/Jets_E240_nnHbb.root
 - E240_nnHcc/ -> /cefs/higgs/maxiaotian/CEPCSW/sample/Jets_E240_nnHcc.root
 - E240_nnHuu/ -> /cefs/higgs/maxiaotian/CEPCSW/sample/Jets_E240_nnHuu.root
 - E240_nnHddv2/ -> /cefs/higgs/maxiaotian/CEPCSW/sample/Jets_E240_nnHdd.root
 - E240_nnHss/ -> /cefs/higgs/maxiaotian/CEPCSW/sample/Jets_E240_nnHss.root



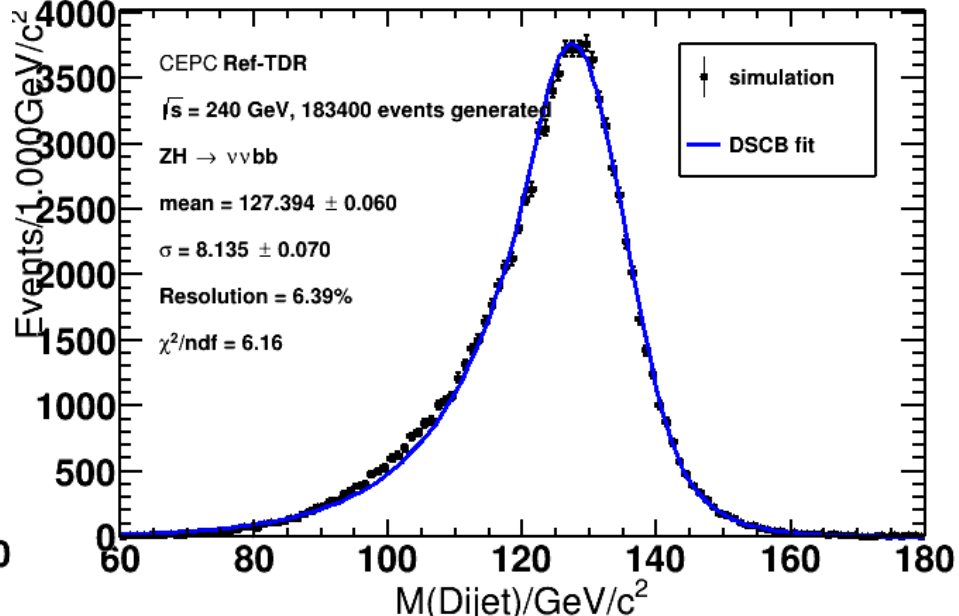
Match $\&\Delta R < 0.6$



Match $\&\Delta R < 0.4$



Match $\&\Delta R < 0.3$



Match $\&\Delta R < 0.2$