H->WW branch ratio measurement with e⁺e⁻->ZH->vvqqqq

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Introduction

- Based on MC sample of 5000 fb^{-1} at 250GeV, Branch ratio measurement of H->WW has been performed under full simulation at CEPC.

- There are 50 different channels according to the particles in final state.

| W boson decay \ Z boson decay	ee	μμ	ττ	νν	qq
$WW^* \to e\nu e\nu$	95	88	88	603	1836
$WW^* \to \mu\nu\mu\nu$	93	87	87	593	1808
$WW^* \to e\nu\mu\nu$	188	175	175	1206	3644
$WW^* \to e\nu\tau\nu$	201	187	188	1281	3901
$WW^* \to \mu\nu\tau\nu$	200	186	186	1271	3872
$WW^* \to \tau\nu\tau\nu$	107	99	99	681	2072
$WW^* \to e\nu qq$	1196	1112	1114	7589	23112
$WW^* \to \mu\nu qq$	1187	1104	1105	7530	22939
$WW^* \to \tau\nu qq$	1271	1182	1183	8066	24558
$WW^* \to qqqq$	3764	3502	3506	23884	72735

MC sample

- There are 2 kinds of samples of signal (nnH) corresponding to 3.5Tesla and 3.0Tesla respectively.

- Detector model are cepc_v1 (3.5Tesla) and cepc_v4 (3.0Tesla) simulated by Geant4.

- Object reconstruction is done using the particle flow algorithm, Arbor.

- Charged particles identification is performed by LICH.

- The ee-k_t algorithm is used for jet clustering.

- Performance of b-tagging is given by LCFIPlus package.
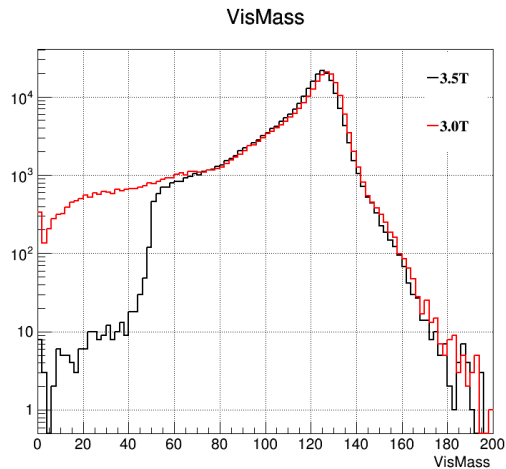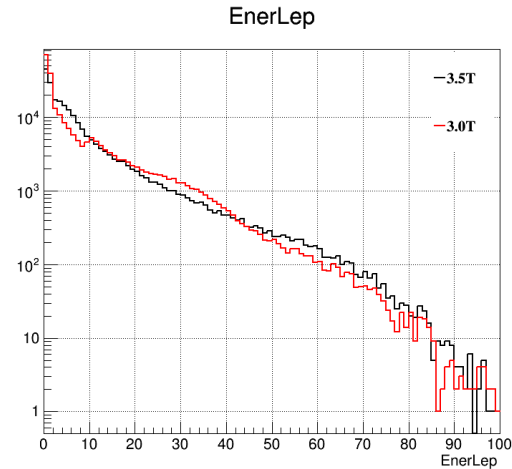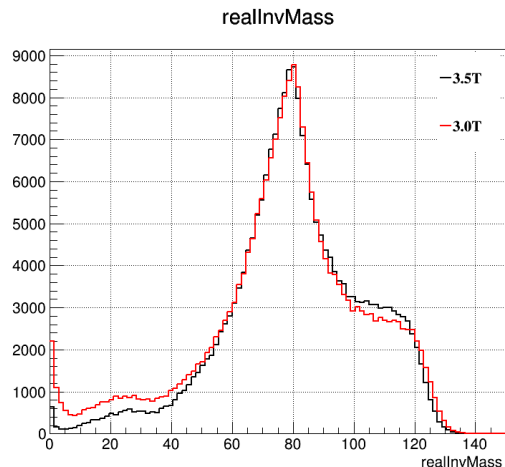
Variable comparison between 3.5T and 3.0T

missing mass
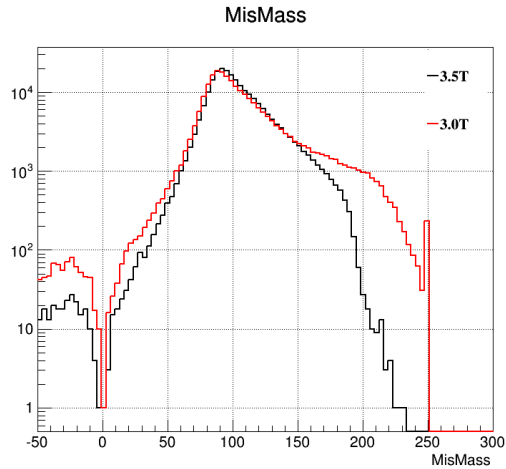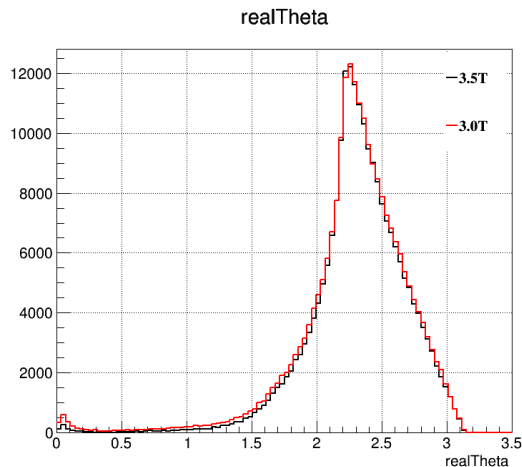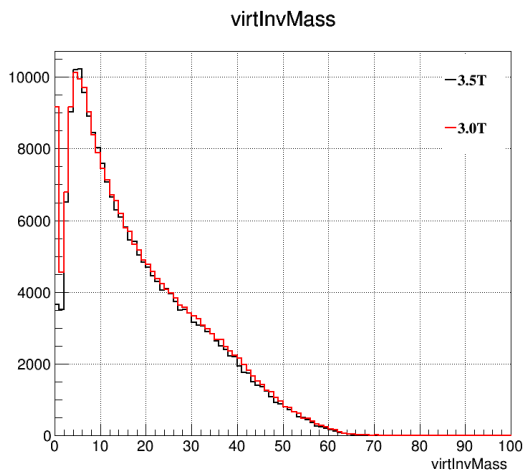
missing energy
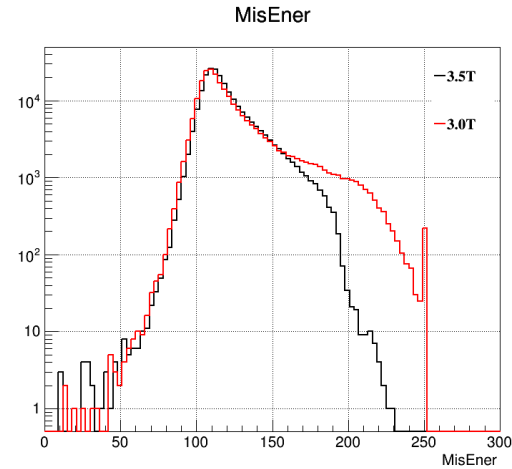
visible mass
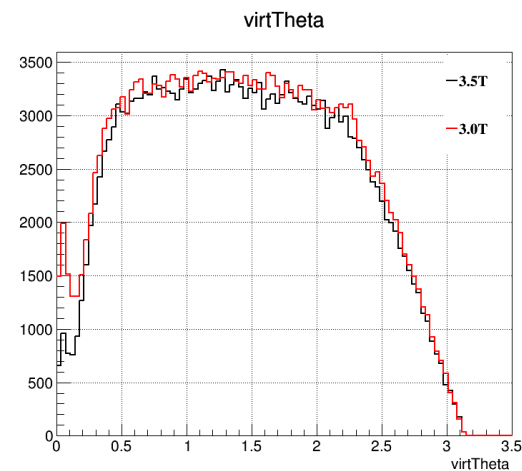
lepton energy

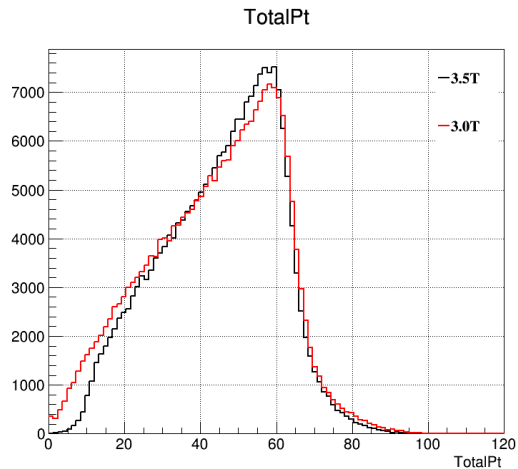invariant mass from on-shell W decay

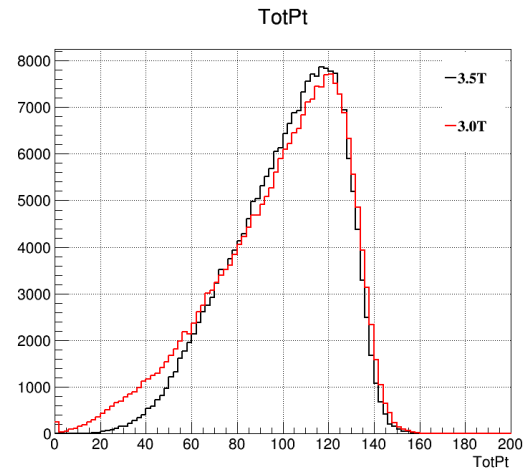theta of on-shell W decay

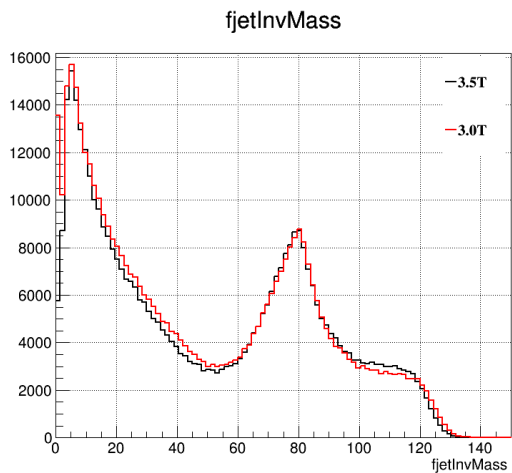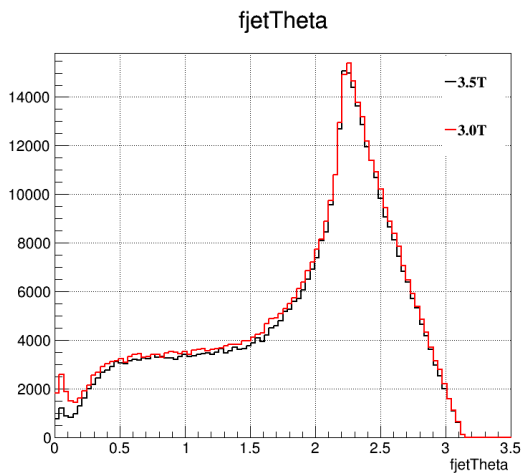invariant mass from off-shell W decay
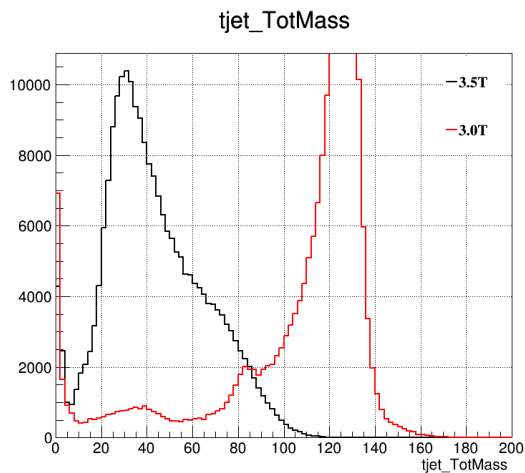
theta of off-shell W decay
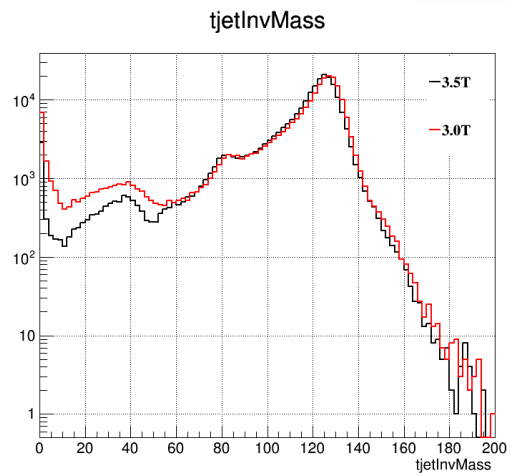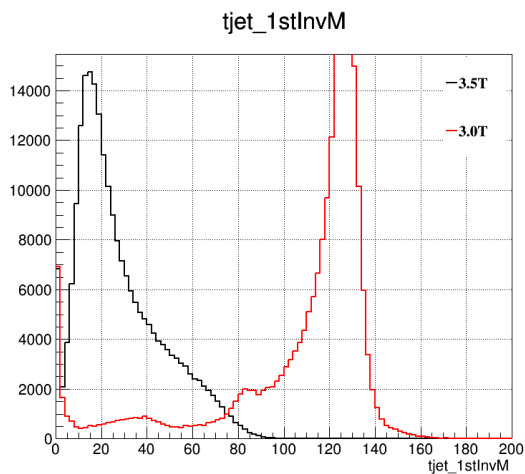
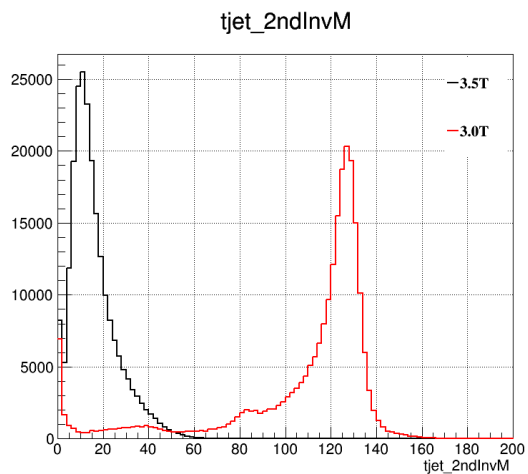total visible p_T

total p_T

4 jet invariant mass

4 jet theta

tjet_TotMass

2 jet total mass

tjetInvMass

2 jet invariant mass

tjet_1stInvM

2 jet invariant mass of the first pair
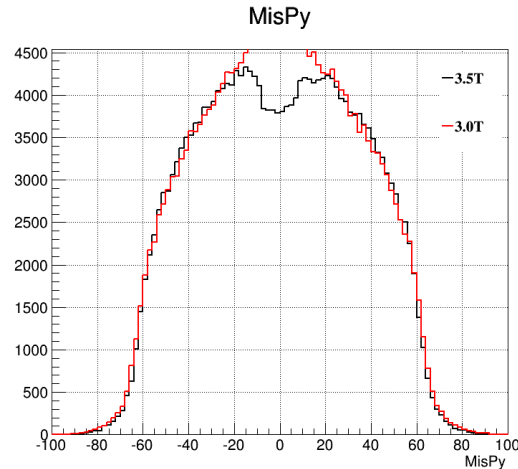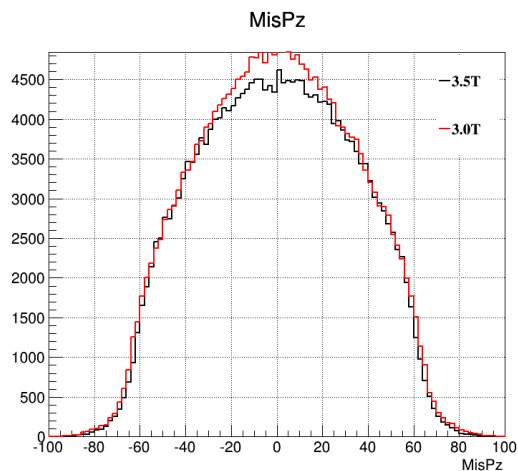
tjet_2ndInvM

2 jet invariant mass of the second pair

missing p_x
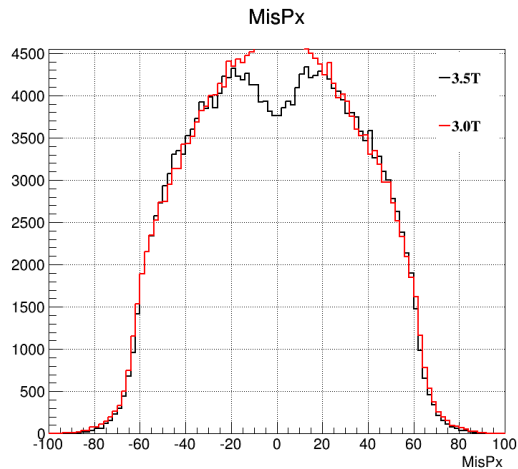
missing p_y

missing p_z

cos angle
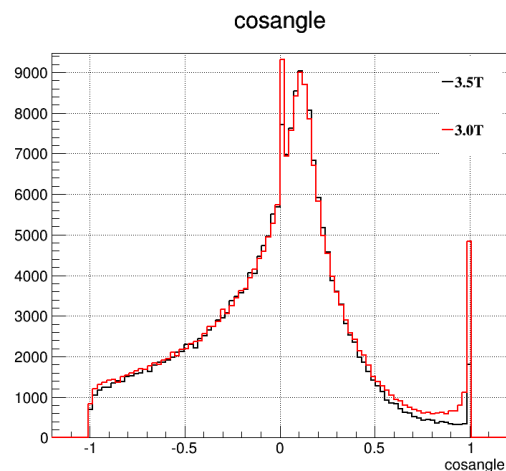
Results after event selection

Category	Signal	ZH background	SM background
Total	23938	208200	21314314
Validation of pre-selection	20405	143765	3166923
$N_{Particle}^{Tot} > 20$	19681	124112	537839
$Btag < 0.9$	19349	28857	477099
$Cos\theta_{2\,jets} > 0.87$	19298	28673	433563
$\Sigma|M_{Inv}^{2jet}| > 50$ GeV	18621	14793	309919
$Y_{34} > 0.005$	15183	6919	122866
Combined Variable	9022	3075	38226

backup

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Statistical results
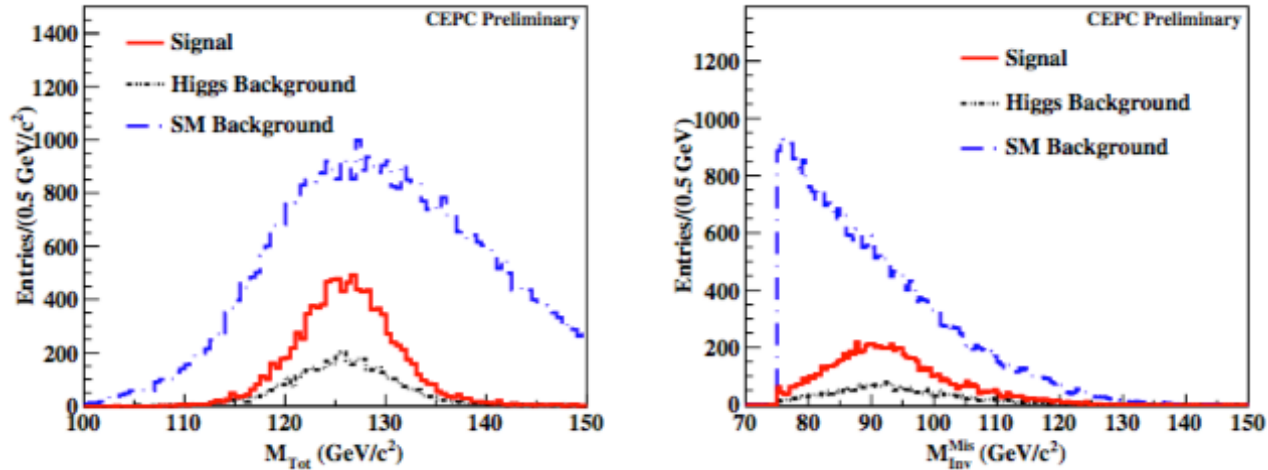
Visible mass and missing mass after the event selection.

- The final number of signal is 9022±224, corresponding to signal efficiency 37.8%.
- Expected sensitivity:

$$Accu. = \frac{\sqrt{S + B}}{S} = 2.5\%.$$