

Higgs boson CP properties at CEPC

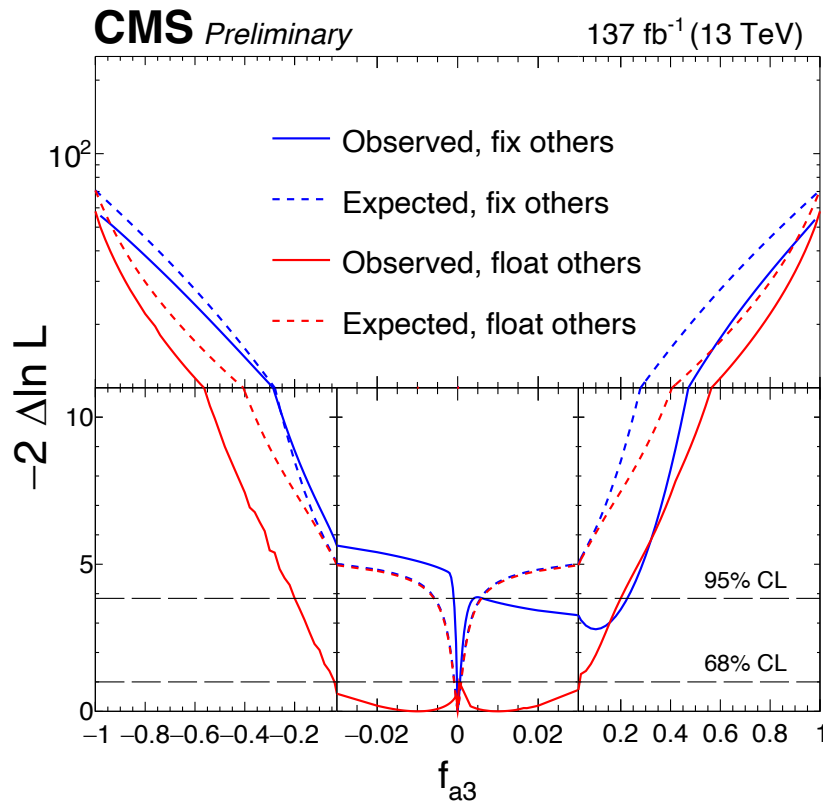
Meng Xiao (ZJU) Xin Shi (IHEP)

Yanxi Gu (UCSD) Mengyao Liu (SDU)

Measurements of HZZ anomalous coupling

- Will measure a_2 , a_3 , κ_1 in the following expressions

$$A(\text{HVV}) = \frac{1}{v} \left[a_1^{\text{VV}} + \frac{\kappa_1^{\text{VV}} q_{V1}^2 + \kappa_2^{\text{VV}} q_{V2}^2}{(\Lambda_1^{\text{VV}})^2} + \frac{\kappa_3^{\text{VV}} (q_{V1} + q_{V2})^2}{(\Lambda_Q^{\text{VV}})^2} \right] m_{V1}^2 \epsilon_{V1}^* \epsilon_{V2}^* \\ + \frac{1}{v} a_2^{\text{VV}} f_{\mu\nu}^{*(1)} f^{*(2),\mu\nu} + \frac{1}{v} a_3^{\text{VV}} f_{\mu\nu}^{*(1)} \tilde{f}^{*(2),\mu\nu},$$

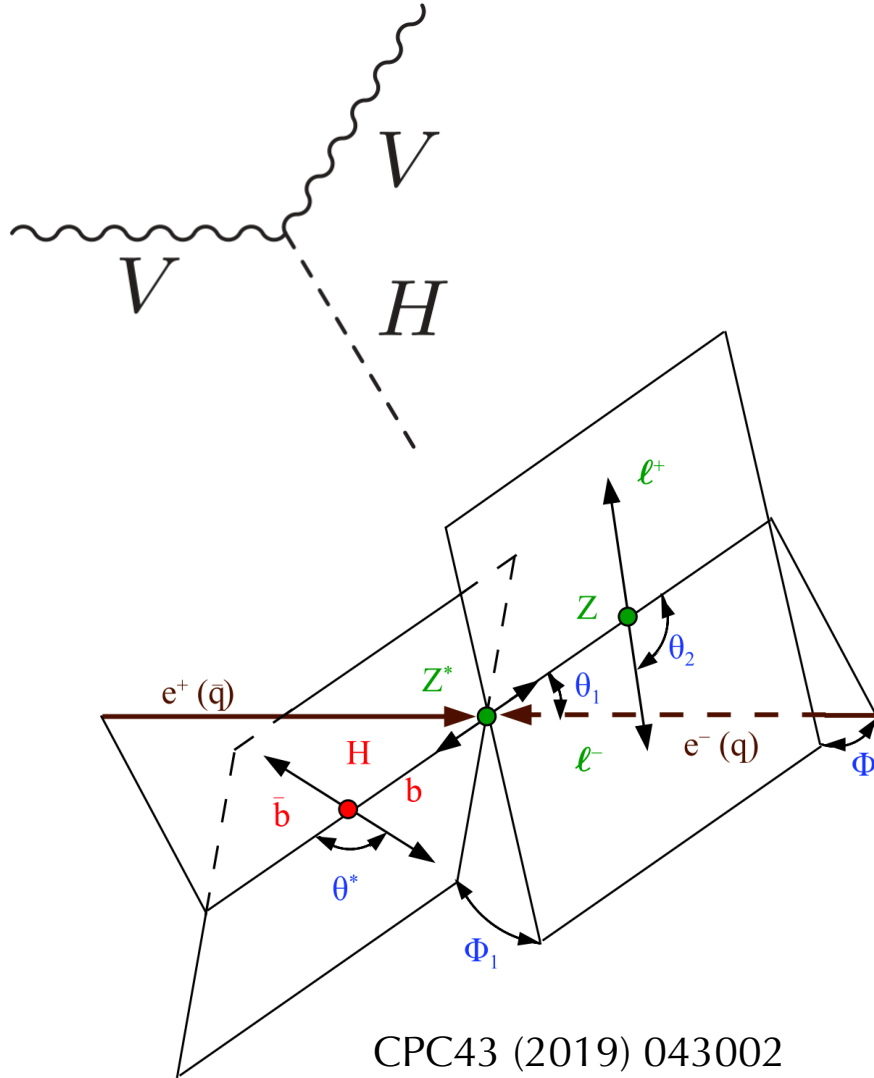


Latest result from CMS
CMS-PAS-HIG-19-009

Measurements of HZZ anomalous coupling

- Using $ee \rightarrow ZH$ to measure HZZ anomalous couplings
 - Earlier studies done in $(2l)(bb)$ final state, only sensitive to production vertex ZH
- Plan to explore $ZH \rightarrow 2l4q$ final state, $(2l)(2q)(2q)$, $(2q)(2l)(2q)$
 - Sensitive to both production and decay HZZ vertex
 - Measure anomalous couplings at two distinct Q^2 (250 & 125 GeV), not possible at the LHC
 - Will be sensitive to different phase spaces
 - Very rich kinematics (angles, invariant masses) sensitive to anomalous couplings
 - Relatively high BR , clean environment in CEPC, impossible final state at LHC

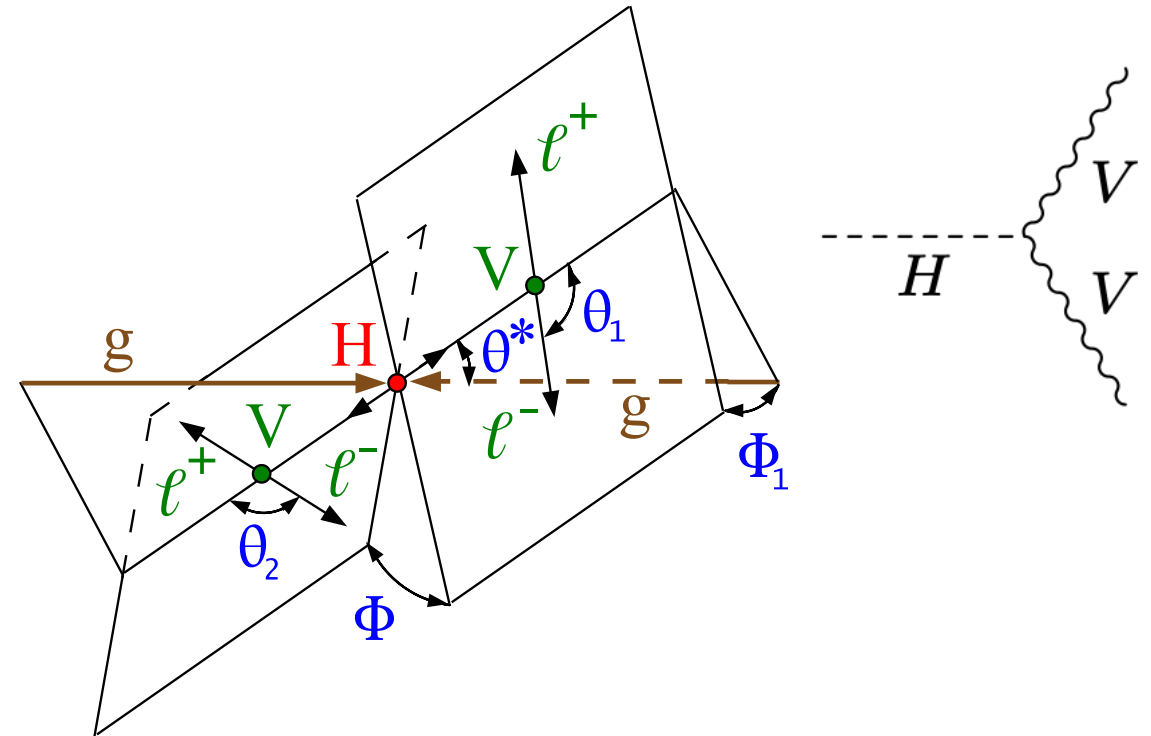
Angular Distributions



$$A(X_{J=0} \rightarrow VV)$$

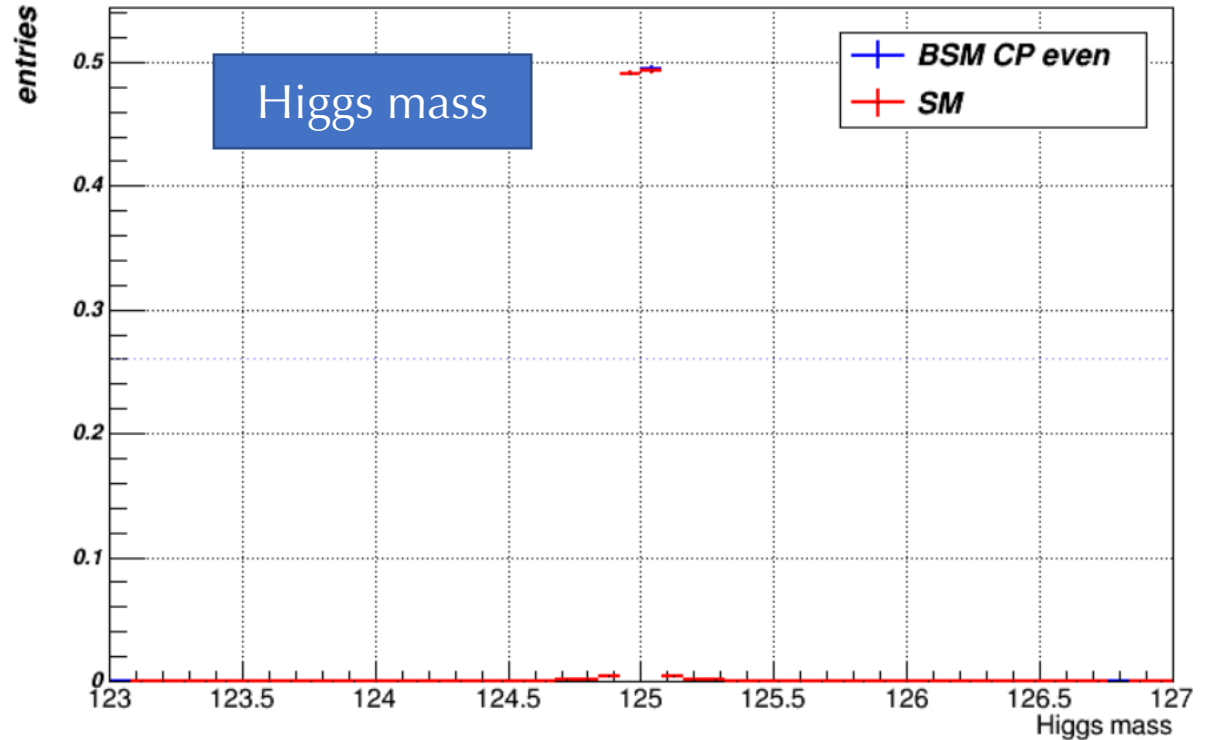
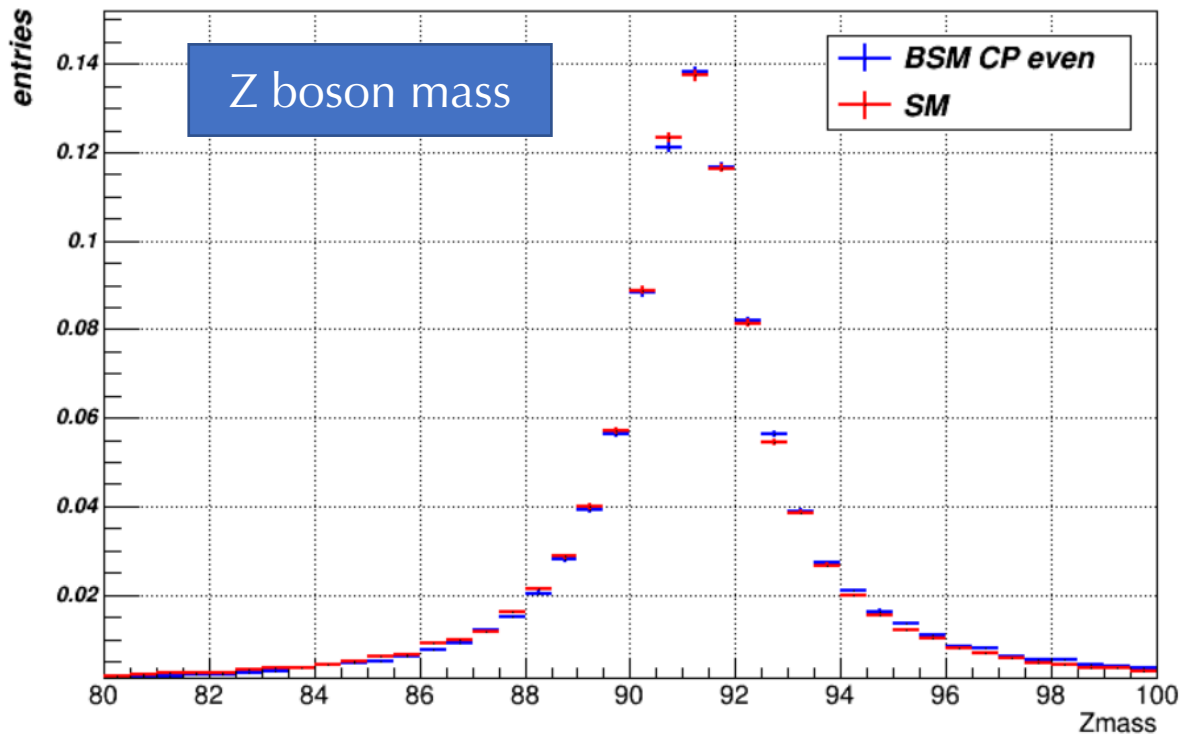
PRD 89, 035007 (2014)

$$= \frac{1}{v} (g_1 m_V^2 \epsilon_1^* \epsilon_2^* + g_2 f_{\mu\nu}^{*(1)} f^{*(2),\mu\nu} + g_4 f_{\mu\nu}^{*(1)} \tilde{f}^{*(2),\mu\nu})$$



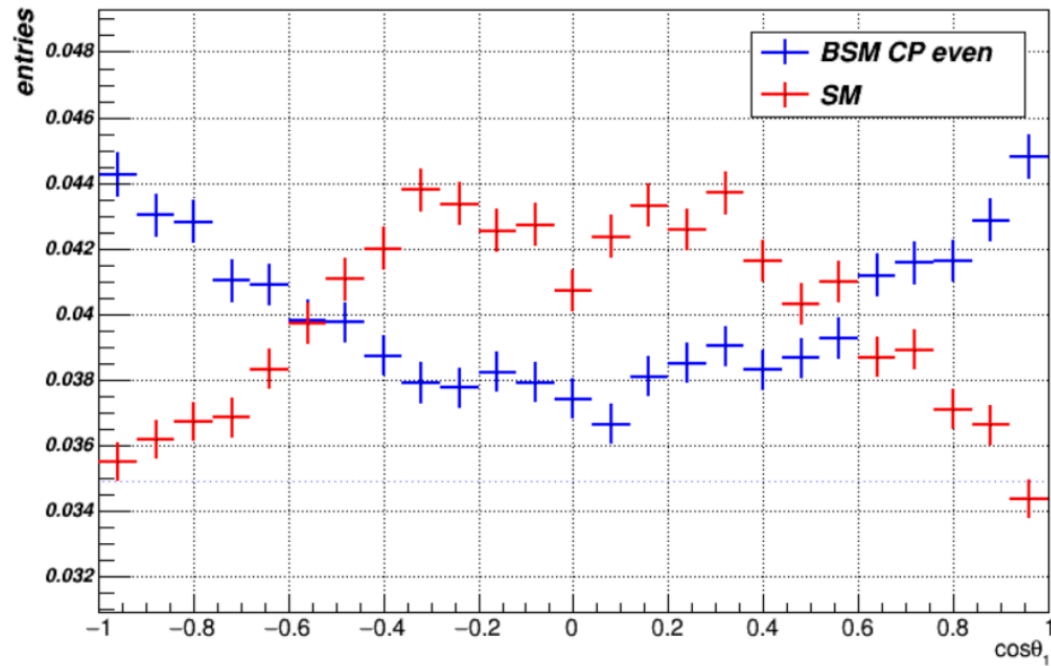
Current Status

- Presented in the EF01 Working group meeting
<https://indico.fnal.gov/event/45835/> (2020.10.22)
- Used JHU generator for $ee \rightarrow Z(\mu\mu)H(bb)$
- 10k events for SM and BSM CP even

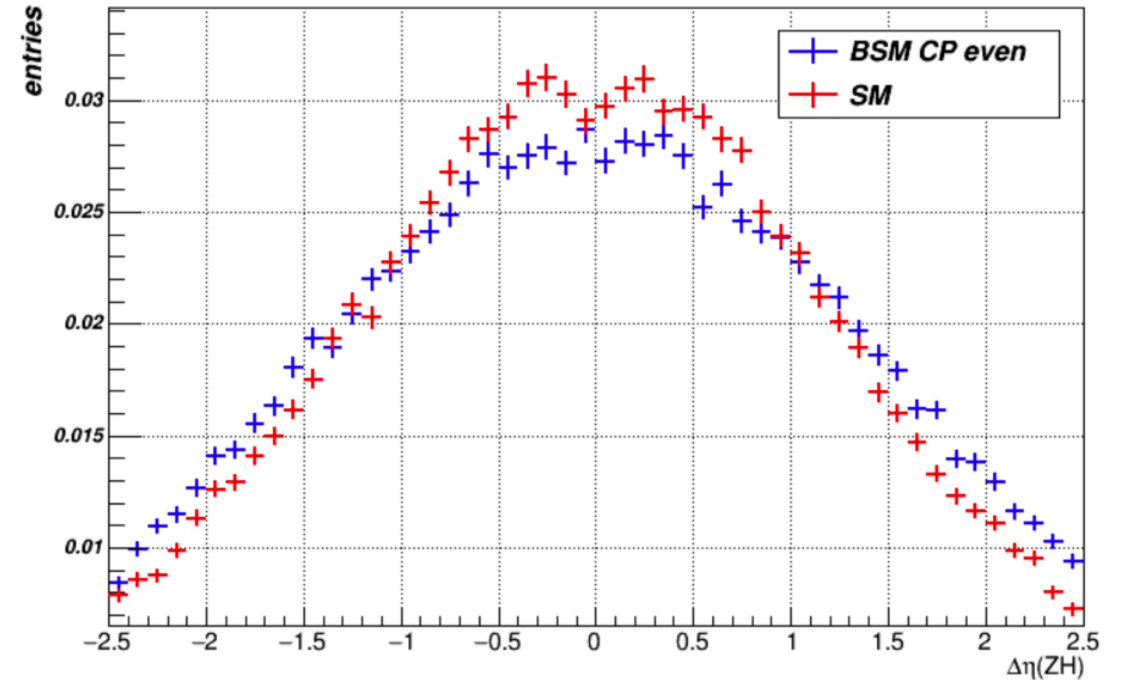


Angulars distribution

$\cos\theta_1$



$\Delta\eta(\text{ZH})$



Summary and Plan

- Higgs CP Properties can be studied on CEPC with unique features
- Team has been formed to study the HZZ anomalous coupling
- Started with the JHU generator
- Plan for snowmass:
 - Investigate both ZH and $H \rightarrow ZZ$ vertices for different Q^2