



# H-VV CP Violation Measurement Update

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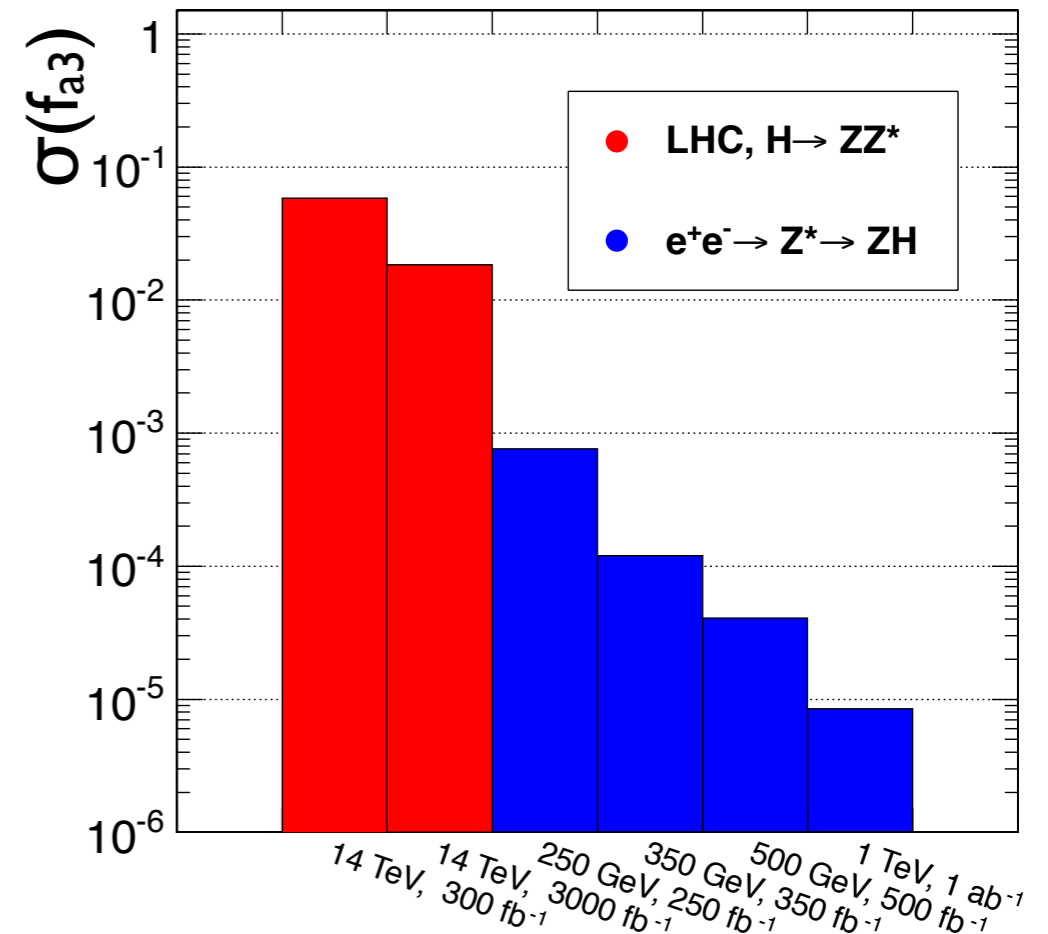
Snowmass Meeting in Higgs group, Minneapolis, August 2nd, 2013

# Update in $e^+e^-$ Collider Experiments

- Compare to last update from A. Whitbeck in Seattle <http://goo.gl/XZXdL>
  - Extend the studies for 350 GeV and 1 TeV
  - Use MC simulated events in the pseudo-experiments
- Significant improvement in  $e^+e^-$  collider experiments compared to LHC
  - Presented at EPS by Yanyan Gao: <http://goo.gl/oalvdQ>
    - In the LHC analysis, explore only the decay kinematics of  $X \rightarrow ZZ \rightarrow 4l$

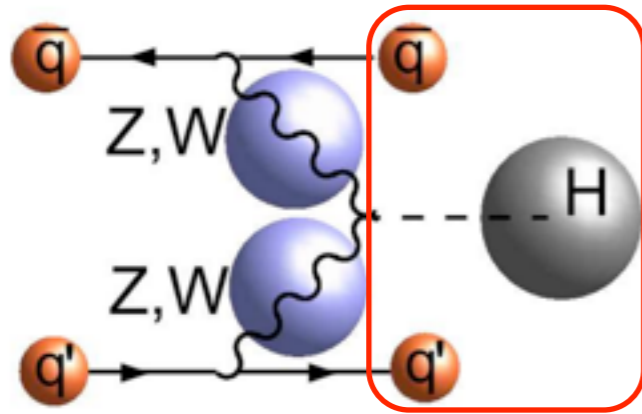
## CP violation $\sim 3\sigma$ discovery potential

	$\sqrt{s}$ (Lumi)	$f_3$	$f_{a3}$	$\sigma(f_{a3})$
LHC $X \rightarrow ZZ(4l)$	14TeV(300/fb)	0.18	0.18	0.06
	14TeV(3000/fb)	0.06	0.06	0.02
$e^+e^- \rightarrow Z^* \rightarrow Z(l\bar{l})X(bb)$	250GeV(250/fb)	0.1	2.10E-03	7.00E-04
	350GeV(350/fb)	0.1	3.36E-04	1.12E-04
	500GeV(500/fb)	0.1	1.05E-04	3.90E-05
	1TeV(1000/fb)	0.1	1.95E-05	7.22E-06

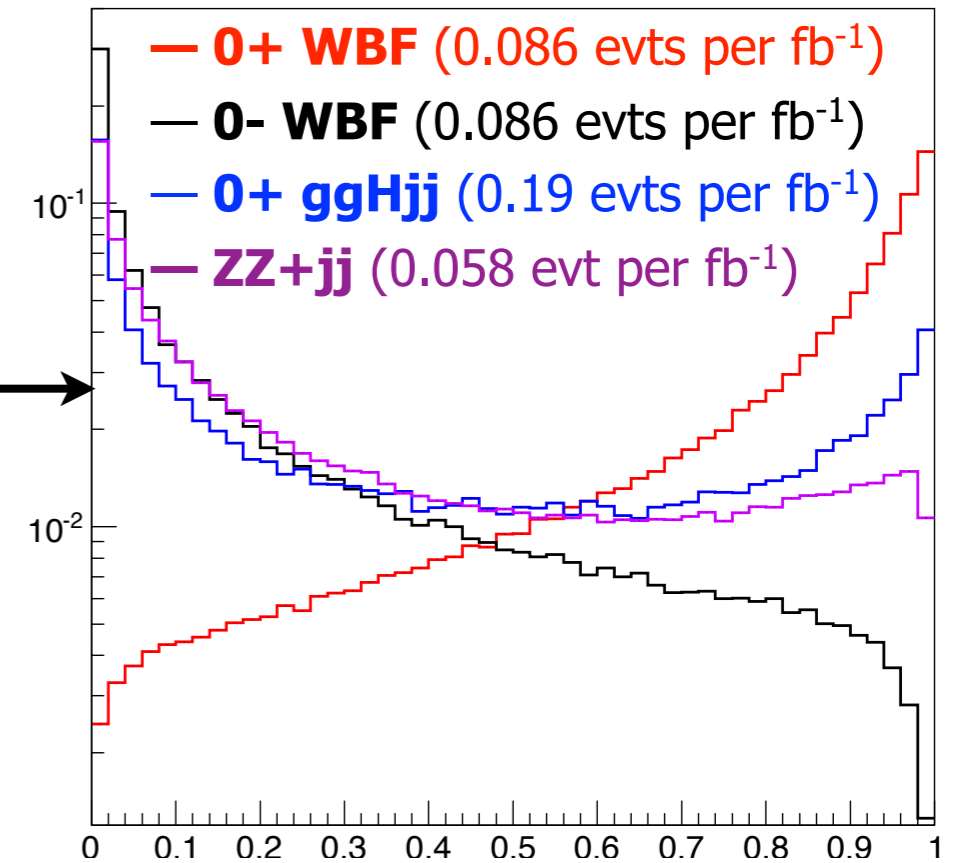


# Development on the $pp \rightarrow H$ in WBF Channel

- Significant boost in relative 0-/0+ cross-section due to the off-shell-ness of the W/Z-boson



$$D_{0-}^{WBF} = \left[ 1 + \frac{P_{0-}^{WBF}}{P_{0+}^{WBF}} \right]^{-1}$$



- ME based on VBF jets and Higgs 4-momenta
  - Method can be used for any VBF production
  - Preliminary study uses the VBF  $H \rightarrow ZZ \rightarrow 4l$

## CP violation $\sim 3\sigma$ discovery potential

	$\sqrt{s}$ (Lumi)	$f_3$	$f_{a3}$	$\sigma(f_{a3})$
LHC $X \rightarrow ZZ(4l)$	300/fb	0.18	0.18	0.06
	3000/fb	0.06	0.06	0.02
LHC VBF $\rightarrow X$ $\rightarrow ZZ(4l)$	300/fb (jet pt > 30)	0.5	0.0084	0.003
	3000/fb (jet pt > 30)	0.15	0.0015	0.0005
	3000/fb (jet pt > 50)	0.5	0.0049	0.0015

