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LHC HIGGS CROSS SECTION WORKING GROUP\*

PUBLIC NOTE

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**Recommendations for the interpretation of LHC  
searches for  $H_5^0$ ,  $H_5^\pm$ , and  $H_5^{\pm\pm}$  in vector boson  
fusion with decays to vector boson pairs**

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## Abstract

We provide theory input for the interpretation of the LHC searches for the production of Higgs bosons  $H_5^0$ ,  $H_5^\pm$ , and  $H_5^{\pm\pm}$  that transform as a five-plet under the custodial symmetry. We choose as a benchmark the Georgi-Machacek model, in which isospin-triplet scalars are added to the Standard Model Higgs sector in such a way as to preserve custodial SU(2) symmetry. This leads to several interesting features, including a tree-level  $H_5^\pm W^\mp Z$  interaction,  $H_5^{\pm\pm}$  decays to like-sign  $W$  bosons, and  $H_5^0$  decays to  $W^+W^-$  and  $ZZ$  in a different ratio than appears in the Standard Model, while still satisfying experimental constraints on the electroweak  $\rho$  parameter. We provide cross sections for single production of all five scalars in vector boson fusion up to next-to-next-to-leading order in QCD for masses in the range 200–1000 GeV (200–2000 GeV) at the 8 TeV (13 TeV) LHC. We also provide tree-level decay widths for  $H_5^0 \rightarrow W^+W^-$  and  $ZZ$ ,  $H_5^\pm \rightarrow W^\pm Z$ , and  $H_5^{\pm\pm} \rightarrow W^\pm W^\pm$  for masses in the range 200–2000 GeV.