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Off-shell Higgs Couplings in $H^* \rightarrow ZZ \rightarrow \ell\nu\nu$

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We explore the new physics reach for the off-shell Higgs boson measurement in the $pp \rightarrow H^* \rightarrow Z(\ell^+\ell^-)Z(\nu\bar{\nu})$ channel at the high-luminosity LHC. The new physics sensitivity is parametrized in terms of the Higgs boson width, effective field theory framework, and a non-local Higgs-top coupling form factor. Adopting Machine-learning techniques, we demonstrate that the combination of a large signal rate and a precise phenomenological probe for the process energy scale, due to the transverse ZZ mass, leads to significant sensitivities beyond the existing results in the literature for the new physics scenarios considered.

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