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Constraint on Higgs boson total width using off-shell production in the ZZ decay

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We constrain the total Higgs boson width using off-shell production and decay to four leptons, 4ℓ , or two leptons plus two neutrinos, $2\ell 2\nu$, with $\ell=e,\mu$. The analysis is based on the data collected in 2011 and 2012 by the CMS experiment at the LHC, corresponding to integrated luminosities of $calL = 19.7 fb^{-1}$ and $calL = 5.1 fb^{-1}$ at center-of-mass energies of $\sqrt{s}=8$ TeV and $\sqrt{s}=7$ TeV respectively. The 4ℓ analysis uses the ZZ invariant mass distribution as well as a matrix element likelihood discriminant to separate the ZZ components originating from gluon- and quark-initiated processes. The $2\ell 2\nu$ analysis relies on the transverse mass or missing transverse energy distributions in jet categories. An unbinned maximum-likelihood fit of the above distributions, combined with the 4ℓ measurement near the resonance peak, leads to an upper limit on the Higgs boson width of $\Gamma < 17$ MeV at the 95% confidence level. This result considerably improves over previous experimental constraints from the measurement near the resonance peak.

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