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## New W Boson Decay Channel at the LHC

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We investigate the W boson's exotic decay channel,  $W \rightarrow \ell \ell \ell \nu$ , at the LHC. Although the four-body final states suppress the decay branching ratio, the large production of W bosons makes detecting and precisely measuring this decay probability entirely feasible.

Our simulation study indicates that this tiny branching ratio can be measured with sub-percent precision at the HL-LHC. This decay channel can also constrain Standard Model extensions. Using the  $L_{\mu} - L_{\tau}$  model as a benchmark, we find that the current bound on the gauge coupling for Z' mass in the range of [4, 75] GeV can significantly improve.

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