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Muon-based measurements and searches with the CMS detector in Run 3 and towards the HL-LHC

The excellent muon reconstruction, identification, and triggering capabilities of the CMS detector play a central role in a broad range of measurements and searches at the LHC. Final states containing one or more muons provide clean experimental signatures, high trigger efficiency, and precise momentum measurements over a wide kinematic range, enabling both precision studies of Standard Model processes and sensitive probes of physics beyond the Standard Model.

This contribution reviews recent CMS results exploiting muon final states, including precision measurements of electroweak and heavy-flavour processes, studies of Higgs boson properties, and searches for new phenomena. Prospects for future measurements and searches at the High-Luminosity LHC are also discussed, highlighting the key role of the upgraded muon detector in extending the discovery reach of the CMS experiment.

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