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Observation of proton-tagged, central (semi)exclusive production of high-mass lepton pairs in pp collisions at 13 TeV with the CMS-TOTEM precision proton spectrometer

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Abstract

The process $pp \rightarrow p(l^+l^-)p(l^*l^-)$, with l^+l^- a muon or an electron pair produced at midrapidity with mass larger than 110 GeV, has been observed for the first time at the LHC in pp collisions at $\sqrt{s} = 13$ TeV. One of the two scattered protons is measured in the CMS-TOTEM precision proton spectrometer (CT-PPS), which operated for the first time in 2016. The second proton either remains intact or is excited and then dissociates into a low-mass state p^* , which is undetected. The measurement is based on an integrated luminosity of 9.4 fb⁻¹ collected during standard, high-luminosity LHC operation. A total of 12 $\mu^+\mu^-$ and 8 e^+e^- pairs with $m(l^+l^-) > 110$ GeV, and matching forward proton kinematics, are observed, with expected backgrounds of 1.49 \pm 0.07 (stat) \pm 0.53 (syst) and 2.36 \pm 0.09 (stat) \pm 0.47 (syst), respectively. This corresponds to an excess of more than five standard deviations over the expected background. The present result constitutes the first observation of proton-tagged gamma gamma collisions at the electroweak scale. This measurement also demonstrates that CT-PPS performs according to the design specifications.

Keywords

Author Keywords: Forward physics; Hadron-Hadron scattering (experiments); Photon production; proton-proton scattering

KeyWords Plus: LHC; DETECTORS

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