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Volume 2018, Issue 7, 1 July 2018, Article number 153Observation 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 (Article) [\(Open Access\)](#)Sirunyan, A.M.^a, Tumasyan, A.^a, Adam, W.^b, Ambrogi, F.^b, Asilar, E.^b, Bergauer, T.^b, Brandstetter, J.^b, Brondolin, E.^b, Dragicevic, M.^b, Erö, J.^b, Escalante Del Valle, A.^b, Flechl, M.^b, Friedl, M.^b, Frühwirth, R.^{b,gr}, Gheze, V.M.^b, Grossmann, J.^b, Hrubec, J.^b, Jeitler, M.^{b,gr}, König, A.^b, Krammer, N.^b, Krätschmer, I.^b, ...[View additional authors](#) [v](#)^aYerevan Physics Institute, Yerevan, Armenia^bInstitut für Hochenergiephysik, Wien, Austria^cInstitute for Nuclear Problems, Minsk, Belarus[View additional affiliations](#) [v](#)

Abstract

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The process $pp \rightarrow p\ell^+\ell^-p^{(*)}$, with $\ell^+\ell^-$ 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 $m(\ell^+\ell^-) > 110$ GeV, and matching forward proton kinematics, are observed, with expected backgrounds of 1.49 ± 0.07 (stat) ± 0.53 (syst) and 2.36 ± 0.09 (stat) ± 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 $\Upsilon\Upsilon$ collisions at the electroweak scale. This measurement also demonstrates that CT-PPS performs according to the design specifications. [Figure not available: see fulltext.]. © 2018, The Author(s).

SciVal Topic Prominence [i](#)Topic: [production](#) | [protons](#) | [central exclusive](#)Prominence percentile: 87.102 [i](#)

Author keywords

[Forward physics](#) [Hadron-Hadron scattering \(experiments\)](#) [Photon production](#) [proton-proton scattering](#)

Funding details

Funding sponsor Funding number

NK 101438,EFOP-3.6.1-16-2016-00001

Fonds Wetenschappelijk Onderzoek

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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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