

Evidence for the Higgs Boson Decay to a Z Boson and a Photon at the LHCG. Aad *et al.**

(ATLAS and CMS Collaborations)



(Received 8 September 2023; accepted 27 November 2023; published 11 January 2024)

The first evidence for the Higgs boson decay to a Z boson and a photon is presented, with a statistical significance of 3.4 standard deviations. The result is derived from a combined analysis of the searches performed by the ATLAS and CMS Collaborations with proton-proton collision datasets collected at the CERN Large Hadron Collider (LHC) from 2015 to 2018. These correspond to integrated luminosities of around 140 fb^{-1} for each experiment, at a center-of-mass energy of 13 TeV. The measured signal yield is 2.2 ± 0.7 times the standard model prediction, and agrees with the theoretical expectation within 1.9 standard deviations.

DOI: [10.1103/PhysRevLett.132.021803](https://doi.org/10.1103/PhysRevLett.132.021803)

Since the discovery of the Higgs boson [1–3] by the ATLAS [4] and CMS [5] Collaborations in 2012, a detailed program of measurements [6–8] has confirmed its couplings and other properties to be mostly consistent with those predicted by the standard model (SM). However, there are several rare Higgs boson decay channels, including $H \rightarrow Z\gamma$ [9–11], that have not been observed. These channels provide probes for possible contributions arising from physics beyond the SM (BSM physics). During LHC Run 2 (2015–2018), large data samples of proton-proton collisions at $\sqrt{s} = 13 \text{ TeV}$ were collected by the two experiments, improving the sensitivity to such decays.

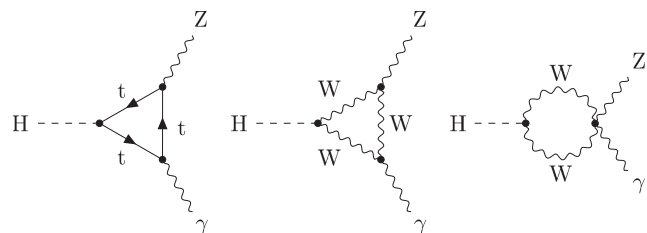
In the SM, the $H \rightarrow Z\gamma$ decay is expected to have a relatively small branching fraction of $(1.5 \pm 0.1) \times 10^{-3}$ for a Higgs boson mass (m_H) close to 125 GeV [12,13]. As the $H \rightarrow Z\gamma$ decay occurs via loop diagrams, with examples given in Fig. 1, it is sensitive to modifications in several BSM scenarios that would cause the branching fraction to be enhanced compared with the SM value. Examples include models where the Higgs boson is a composite state [14], a pseudo Nambu-Goldstone boson [15], or a neutral scalar originating from a different source [16,17]. Branching fractions deviating from the SM value are also expected for models with additional colorless charged scalars, leptons, or vector bosons that couple to the Higgs boson, because of their contributions via loop corrections [18–20].

This Letter reports the first evidence for $H \rightarrow Z\gamma$ decay obtained from a combination of ATLAS [21] and CMS [22]

searches for this channel. The analyses are based on the Run 2 datasets collected by the ATLAS and CMS experiments, corresponding to integrated luminosities of 139 and 138 fb^{-1} , respectively, at a center-of-mass energy of 13 TeV. Previous $H \rightarrow Z\gamma$ searches by the ATLAS and CMS Collaborations used the datasets collected at $\sqrt{s} = 7$ and 8 TeV, and partial datasets collected at $\sqrt{s} = 13 \text{ TeV}$ [23–25].

The ATLAS detector [4] is a multipurpose particle detector with cylindrical geometry. It consists of an inner tracking detector surrounded by a thin superconducting solenoid providing a 2 T axial magnetic field, electromagnetic and hadronic sampling calorimeters, and a muon spectrometer with three toroidal superconducting magnets, providing nearly 4π coverage in solid angle. The CMS apparatus [5] is a nearly hermetic, multipurpose detector. Contained within a 3.8 T superconducting solenoid are an all-silicon inner tracker, a crystal electromagnetic calorimeter, and a brass-scintillator hadron calorimeter. Gas-ionization muon detectors are embedded in the flux-return yoke outside the solenoid.

The ATLAS and CMS $H \rightarrow Z\gamma$ analyses share many features. In both, the Z boson is reconstructed through its decays into electron or muon pairs ($Z \rightarrow \ell^+\ell^-$, $\ell = e$ or μ), requiring a dilepton mass above 50 GeV. The leptons provide a clean signature and ensure a high trigger

FIG. 1. Examples of Feynman diagrams for $H \rightarrow Z\gamma$ decay.

*Full author list given at the end of the Letter.

Published by the American Physical Society under the terms of the [Creative Commons Attribution 4.0 International](https://creativecommons.org/licenses/by/4.0/) license. Further distribution of this work must maintain attribution to the author(s) and the published article's title, journal citation, and DOI. Funded by SCOAP³.

efficiency and good invariant mass resolution for the final-state products of the Higgs boson decay. The photon candidate is reconstructed from energy clusters in the electromagnetic calorimeters. It must satisfy identification criteria and be isolated from other event activity. The dominant backgrounds arise from Drell-Yan production in association with a photon or a jet misidentified as a photon. In both analyses, the production of the SM Higgs boson signal is modeled with the POWHEG BOX v2 Monte Carlo event generator [26–31].

After the reconstruction and selection of $H \rightarrow Z\gamma$ candidate events, the signal is identified as a narrow resonant peak at m_H in the $Z\gamma$ invariant mass ($m_{Z\gamma}$) distribution, calculated as the invariant mass of the $\ell^+\ell^-\gamma$ system. The $m_{Z\gamma}$ resolution is improved by dedicated final-state radiation corrections to the momenta of muons with nearby photons, and via kinematic fits for the dilepton mass of the Z boson candidate using a Breit-Wigner line shape to model the Z boson resonance, convolved with a Gaussian response function for the leptons [32,33]. The resulting $m_{Z\gamma}$ resolution is 1.4–2 GeV, depending on the final state and event topology.

To enhance the sensitivity, both analyses assign events to categories with different signal-to-background ratios by exploiting the kinematic features of different Higgs boson production modes. The ATLAS analysis assigns each event to one of six categories, including a category targeting the vector-boson fusion (VBF) topology, which requires the presence of at least two jets and a selection on the output score of a dedicated boosted decision tree (BDT). The remaining five categories target other Higgs boson production modes, which are defined with different lepton flavors and kinematic properties of the momentum of the $Z\gamma$ system transverse to the beam direction [34].

The CMS analysis assigns each event to one of eight categories, including a category with additional leptons targeting the production of Higgs bosons associated with either a weak vector boson or a top quark pair, and three categories defined by the output score of a dedicated BDT targeting the VBF topology. The other four categories are defined by the output score of another BDT exploiting the differences between the kinematic properties of $H \rightarrow Z\gamma$ signal events and background events.

Simultaneous signal-plus-background fits across the analysis categories are performed to the $Z\gamma$ invariant mass distribution, with analytic signal and background functions. The signal models are from Crystal Ball [35] and Gaussian functions, and the background models are based on exponential functions, power law functions, Laurent series, and Bernstein polynomials. Experimental and theoretical uncertainties affecting the expected number of signal events, the shape of the $Z\gamma$ invariant mass distribution from the $H \rightarrow Z\gamma$ signal process, and the background models are considered as constrained nuisance parameters. The Higgs boson production cross sections and $H \rightarrow Z\gamma$

branching fraction used to normalize the signal are common to both experiments. In both analyses, the parameters of the analytic background functions are determined from the data. Both the ATLAS and CMS analyses measure the signal strength (μ) defined as the ratio of the Higgs boson production cross section times $H \rightarrow Z\gamma$ branching fraction to the SM prediction.

The statistical treatment of the data is based on the standard LHC data modeling and handling toolkits: RooFit [36], RooStats [37], and HistFactory [38]. The confidence intervals of the signal strength are determined via the profile-likelihood-ratio test statistic [39]. The likelihood function used to define the test statistic is the product of the likelihood functions of the ATLAS and CMS analyses, adapted to have common constraint terms for the nuisance parameters representing the correlated uncertainties. The main differences between the likelihood functions of the two analyses are the background models. In each category of the ATLAS analysis, the chosen background model is the one that minimizes the presence of “spurious” signal, i.e., the extracted signal yields in signal-plus-background fits to background-only templates of $m_{Z\gamma}$ [1]. The spurious-signal yield is introduced as an additional nuisance parameter in the likelihood function, which modifies the expected signal yield. In the CMS analysis, a discrete profiling method [40] is used to determine the background model directly in the fit to the data. For each category, this method introduces an additional discrete nuisance parameter that selects the best background model among a large set of alternative models. The discrete nuisance parameter is profiled in the final fit.

The experimental uncertainties from the ATLAS and CMS analyses are considered uncorrelated. While some components of the experimental systematic uncertainties could be correlated due to the similar simulation software and calibration techniques, these are expected to be much smaller than the uncorrelated components. Among the theoretical uncertainty sources, the one associated with missing higher orders in the perturbative calculations of the gluon-gluon fusion cross section (renormalization and factorization scale uncertainties) [41–43], and the ones in the $H \rightarrow Z\gamma$ branching fraction prediction [13] are correlated. In the CMS analysis, a small number of modifications are made to facilitate the combination. In particular, for consistency, the scale and branching fraction uncertainties are reevaluated. These changes have a minor impact on the CMS result. In the ATLAS analysis, the decomposition of the scale uncertainties in terms of independent sources is modified, which has a negligible impact on the observed signal strength. The uncertainties associated with missing higher orders in the calculations for the other Higgs boson production modes, with the choice of parton distribution functions (PDFs) [44,45], with the value of the strong-force coupling constant (α_s), and with the modeling of the underlying event and parton shower are not correlated because of their different implementations in the two

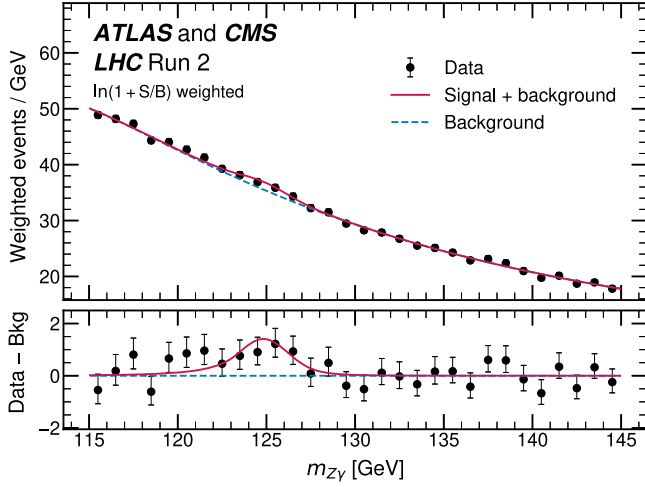


FIG. 2. The $Z\gamma$ invariant mass distribution. Events from all categories in the ATLAS and CMS analyses are shown. As different ranges in $m_{Z\gamma}$ are used in the two analyses, only the common subrange is visualized here. The data (points with error bars) in each category are weighted by $\ln(1 + S/B)$, where S and B are the observed signal and background yields in that category, in the 120–130 GeV interval. The S and B values are derived from the fit to data. The error bars are invisible because of their small values. The fitted signal-plus-background (background) probability density functions (pdfs) in each category are also weighted in the same way and summed, and represented by a red solid (blue dashed) line. The lower panel shows the background-subtracted results with the same data and pdfs.

analyses. However, approximate correlation strategies were investigated for the integrated luminosity [46–50], scale, and PDF uncertainties; they are found to have a negligible impact and are not adopted in the following results. One difference between the ATLAS and CMS analyses is the assumed value of m_H taken to be 125.09 GeV [51] in the former and 125.38 GeV [52] in the latter. The results of the combination are determined for both m_H values, and the different mass assumptions have a negligible impact within the precision reported in this Letter.

The $Z\gamma$ invariant mass distribution observed in data is shown in Fig. 2. To demonstrate the sensitivity of this likelihood analysis, the events in each category are weighted by $\ln(1 + S/B)$, where S and B are the observed signal and background yields in that category in the range $120 < m_{Z\gamma} < 130$ GeV, as determined by the minimization of the test statistic. The negative log-likelihood ratio as a function of the signal strength is shown in Fig. 3. The observed (expected) signal strength at the 68% confidence level is $\mu = 2.0^{+1.0}_{-0.9}$ (1.0 ± 0.9) for the ATLAS analysis, $\mu = 2.4^{+1.0}_{-0.9}$ ($1.0^{+1.0}_{-0.9}$) for the CMS analysis, and $\mu = 2.2 \pm 0.6(\text{stat})^{+0.3}_{-0.2}(\text{syst}) = 2.2 \pm 0.7$ [$1.0 \pm 0.6(\text{stat}) \pm 0.2(\text{syst}) = 1.0 \pm 0.6$] for their combination. Expressed in standard deviations σ , the observed (expected) local significance, with respect to the $\mu = 0$ hypothesis of no $H \rightarrow Z\gamma$ signal, is 2.2σ (1.2σ) for the ATLAS analysis,

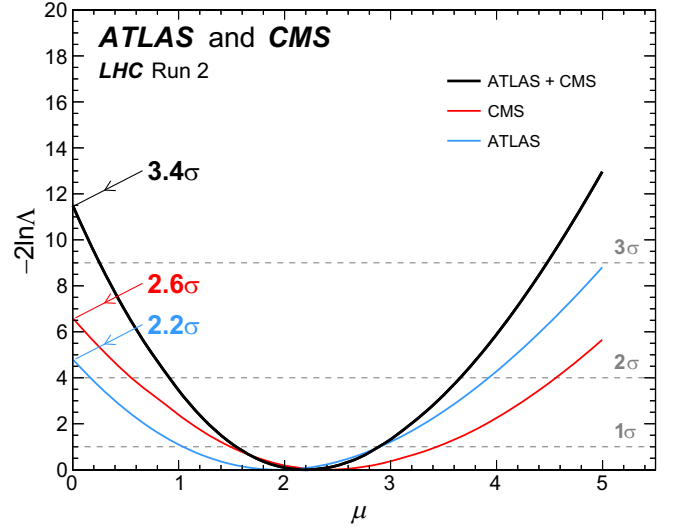


FIG. 3. The negative profile log-likelihood test statistic, where Λ represents the likelihood ratio as a function of the signal strength μ derived from the ATLAS data (blue line), the CMS data (red line), and the combined result (black line). The different Higgs boson masses assumed by ATLAS and CMS have a negligible impact on the results.

2.6σ (1.1σ) for the CMS analysis, and 3.4σ (1.6σ) for their combination. The uncertainties in the $H \rightarrow Z\gamma$ branching fraction and the background modeling are the largest systematic uncertainties. Assuming SM Higgs boson production cross sections, the measured branching fraction for $H \rightarrow Z\gamma$ decay is $(3.4 \pm 1.1) \times 10^{-3}$. In contrast to the signal strength measurement, the uncertainty in the SM branching fraction prediction is not included in this fit. The uncertainties in the results are dominated by the statistical fluctuations of data.

The combined result is compatible with the measured signal strengths from individual categories with a p -value greater than 12%. The p -value for compatibility with the SM hypothesis ($\mu = 1$) is about 6%, and the observed local significance with respect to the SM is 1.9σ . The goodness of fit of the model to the data is evaluated with a likelihood-ratio test [53], and has a p -value greater than 90%. Tabulated results are provided in the HEPData record for this analysis [54].

In summary, a combined analysis of ATLAS and CMS searches for the Higgs boson decay to a Z boson and a photon, where the Z boson decays into an electron or muon pair, is presented. The results are based on the 13 TeV proton-proton collision data recorded by the ATLAS and CMS experiments at the CERN LHC, amounting to integrated luminosities of 139 and 138 fb^{-1} , respectively. Evidence for $H \rightarrow Z\gamma$ decay is established, with an observed significance of 3.4 standard deviations. The observed signal yield is 2.2 ± 0.7 times the SM prediction. The measured $H \rightarrow Z\gamma$ branching fraction is $(3.4 \pm 1.1) \times 10^{-3}$. The result agrees with the SM prediction within 1.9 standard deviations.

ATLAS thanks CERN for the very successful operation of the LHC, as well as the support staff from our institutions without whom ATLAS could not be operated efficiently. ATLAS acknowledges the support of ANPCyT, Argentina; YerPhI, Armenia; ARC, Australia; BMWFW and FWF, Austria; ANAS, Azerbaijan; CNPq and FAPESP, Brazil; NSERC, NRC, and CFI, Canada; CERN; ANID, Chile; CAS, MOST, and NSFC, China; Minciencias, Colombia; MEYS CR, Czech Republic; DNRF and DNSRC, Denmark; IN2P3-CNRS and CEA-DRF/IRFU, France; SRNSFG, Georgia; BMBF, HGF, and MPG, Germany; GSRI, Greece; RGC and Hong Kong SAR, China; ISF and Benoziyo Center, Israel; INFN, Italy; MEXT and JSPS, Japan; CNRST, Morocco; NWO, Netherlands; RCN, Norway; MEiN, Poland; FCT, Portugal; MNE/IFA, Romania; MESTD, Serbia; MSSR, Slovakia; ARRS and MIZŠ, Slovenia; DSI/NRF, South Africa; MICINN, Spain; SRC and Wallenberg Foundation, Sweden; SERI, SNSF, and Cantons of Bern and Geneva, Switzerland; MOST, Taiwan; TENMAK, Türkiye; STFC, United Kingdom; DOE and NSF, USA. In addition, individual groups and members have received support from BCKDF, CANARIE, Compute Canada and CRC, Canada; PRIMUS 21/SCI/017 and UNCE SCI/013, Czech Republic; COST, ERC, ERDF, Horizon 2020, ICSC-NextGenerationEU, and Marie Skłodowska-Curie Actions, European Union; Investissements d'Avenir Labex, Investissements d'Avenir Idex, and ANR, France; DFG and AvH Foundation, Germany; Herakleitos, Thales, and Aristeia programs co-financed by EU-ESF and the Greek NSRF, Greece; BSF-NSF and MINERVA, Israel; Norwegian Financial Mechanism 2014–2021, Norway; NCN and NAWA, Poland; La Caixa Banking Foundation, CERCA Programme Generalitat de Catalunya, and PROMETEO and GenT Programmes Generalitat Valenciana, Spain; Göran Gustafssons Stiftelse, Sweden; The Royal Society and Leverhulme Trust, United Kingdom. The crucial computing support from all WLCG partners is acknowledged gratefully, in particular from CERN, the ATLAS Tier-1 facilities at TRIUMF (Canada), NDGF (Denmark, Norway, Sweden), CC-IN2P3 (France), KIT/GridKA (Germany), INFN-CNAF (Italy), NL-T1 (Netherlands), PIC (Spain), ASGC (Taiwan), RAL (UK) and BNL (USA), the Tier-2 facilities worldwide, and large non-WLCG resource providers. Major contributors of computing resources are listed in Ref. [55]. CMS congratulates our colleagues in the CERN accelerator departments for the excellent performance of the LHC and thank the technical and administrative staffs at CERN and at other CMS institutes for their contributions to the success of the CMS effort. In addition, we gratefully acknowledge the computing centers and personnel of the Worldwide LHC Computing Grid and other centers for delivering so effectively the computing infrastructure essential to our analyses. Finally, we acknowledge the enduring support for

the construction and operation of the LHC, the CMS detector, and the supporting computing infrastructure provided by the following funding agencies: SC (Armenia), BMBWF and FWF (Austria); FNRS and FWO (Belgium); CNPq, CAPES, FAPERJ, FAPERGS, and FAPESP (Brazil); MES and BNSF (Bulgaria); CERN; CAS, FRFCU, MOST, and NSFC (China); Ministerio de Ciencia, Tecnología e Innovación (MINCIENCIAS) (Colombia); MSES and CSF (Croatia); RIF (Cyprus); SENESCYT (Ecuador); MoER, ERC PUT, and ERDF (Estonia); Academy of Finland, MEC, and HIP (Finland); CEA and CNRS/IN2P3 (France); BMBF, DFG, and HGF (Germany); General Secretariat for Research and Innovation (GSRI) (Greece); NKFIH (Hungary); DAE and DST (India); IPM (Iran); SFI (Ireland); INFN (Italy); MSIP and NRF (Republic of Korea); MES (Latvia); LAS (Lithuania); MOE and UM (Malaysia); BUAP, CINVESTAV, CONACYT, LNS, SEP, and UASLP-FAI (Mexico); MOS (Montenegro); MBIE (New Zealand); PAEC (Pakistan); MES and NSC (Poland); FCT (Portugal); Ministry of Education, Science and Technological Development (MESTD) (Serbia); MCIN/AEI and PCTI (Spain); MOSTR (Sri Lanka); Swiss Funding Agencies (Switzerland); MST (Taipei); MHESI and NSTDA (Thailand); TUBITAK and TENMAK (Turkey); NASU (Ukraine); STFC (United Kingdom); DOE and NSF (USA).

-
- [1] ATLAS Collaboration, Observation of a new particle in the search for the standard model Higgs boson with the ATLAS detector at the LHC, *Phys. Lett. B* **716**, 1 (2012).
 - [2] CMS Collaboration, Observation of a new boson at a mass of 125 GeV with the CMS experiment at the LHC, *Phys. Lett. B* **716**, 30 (2012).
 - [3] CMS Collaboration, Observation of a new boson with mass near 125 GeV in pp collisions at $\sqrt{s} = 7$ and 8 TeV, *J. High Energy Phys.* **06** (2013) 081.
 - [4] ATLAS Collaboration, The ATLAS experiment at the CERN Large Hadron Collider, *J. Instrum.* **3**, S08003 (2008).
 - [5] CMS Collaboration, The CMS experiment at the CERN LHC, *J. Instrum.* **3**, S08004 (2008).
 - [6] ATLAS and CMS Collaborations, Measurements of the Higgs boson production and decay rates and constraints on its couplings from a combined ATLAS and CMS analysis of the LHC pp collision data at $\sqrt{s} = 7$ and 8 TeV, *J. High Energy Phys.* **08** (2016) 045.
 - [7] ATLAS Collaboration, A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery, *Nature (London)* **607**, 52 (2022).
 - [8] CMS Collaboration, A portrait of the Higgs boson by the CMS experiment ten years after the discovery, *Nature (London)* **607**, 60 (2022).
 - [9] R. Cahn, M. Chanowitz, and N. Fleishon, Higgs particle production by $Z \rightarrow H\gamma$, *Phys. Lett.* **82B**, 113 (1979).
 - [10] L. Bergstrom and G. Hulth, Induced Higgs couplings to neutral bosons in e^+e^- collisions, *Nucl. Phys.* **B259**, 137 (1985).

- [11] M. Spira, A. Djouadi, and P. Zerwas, QCD corrections to the $HZ\gamma$ coupling, *Phys. Lett. B* **276**, 350 (1992).
- [12] A. Djouadi, J. Kalinowski, and M. Spira, HDECAY: A program for Higgs boson decays in the standard model and its supersymmetric extension, *Comput. Phys. Commun.* **108**, 56 (1998).
- [13] D. de Florian *et al.*, Handbook of LHC Higgs cross sections: 4. Deciphering the nature of the Higgs sector, [10.23731/CYRM-2017-002](#) (2017).
- [14] A. Azatov, R. Contino, A. Di Iura, and J. Galloway, New prospects for Higgs compositeness in $h \rightarrow Z\gamma$, *Phys. Rev. D* **88**, 075019 (2013).
- [15] Q.-H. Cao, L.-X. Xu, B. Yan, and S.-h. Zhu, Signature of pseudo Nambu-Goldstone Higgs boson in its decay, *Phys. Lett. B* **789**, 233 (2019).
- [16] I. Low, J. Lykken, and G. Shaughnessy, Singlet scalars as Higgs imposters at the Large Hadron Collider, *Phys. Rev. D* **84**, 035027 (2011).
- [17] I. Low, J. Lykken, and G. Shaughnessy, Have we observed the Higgs (imposter)?, *Phys. Rev. D* **86**, 093012 (2012).
- [18] M. Carena, I. Low, and C. E. Wagner, Implications of a modified Higgs to diphoton decay width, *J. High Energy Phys.* **08** (2012) 060.
- [19] C.-W. Chiang and K. Yagyu, Higgs boson decays to $\gamma\gamma$ and $Z\gamma$ in models with Higgs extensions, *Phys. Rev. D* **87**, 033003 (2013).
- [20] C.-S. Chen, C.-Q. Geng, D. Huang, and L.-H. Tsai, New scalar contributions to $h \rightarrow Z\gamma$, *Phys. Rev. D* **87**, 075019 (2013).
- [21] ATLAS Collaboration, A search for the $Z\gamma$ decay mode of the Higgs boson in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector, *Phys. Lett. B* **809**, 135754 (2020).
- [22] CMS Collaboration, Search for Higgs boson decays to a Z boson and a photon in proton-proton collisions at $\sqrt{s} = 13$ TeV, *J. High Energy Phys.* **05** (2023) 233.
- [23] ATLAS Collaboration, Search for Higgs boson decays to a photon and a Z boson in pp collisions at $\sqrt{s} = 7$ and 8 TeV with the ATLAS detector, *Phys. Lett. B* **732**, 8 (2014).
- [24] CMS Collaboration, Search for a Higgs boson decaying into a Z and a photon in pp collisions at $\sqrt{s} = 7$ and 8 TeV, *Phys. Lett. B* **726**, 587 (2013).
- [25] CMS Collaboration, Search for the decay of a Higgs boson in the $\ell\ell\gamma$ channel in proton-proton collisions at $\sqrt{s} = 13$ TeV, *J. High Energy Phys.* **11** (2018) 152.
- [26] P. Nason and C. Oleari, NLO Higgs boson production via vector-boson fusion matched with shower in POWHEG, *J. High Energy Phys.* **02** (2010) 037.
- [27] S. Alioli, P. Nason, C. Oleari, and E. Re, A general framework for implementing NLO calculations in shower Monte Carlo programs: The POWHEG BOX, *J. High Energy Phys.* **06** (2010) 043.
- [28] P. Nason, A new method for combining NLO QCD with shower Monte Carlo algorithms, *J. High Energy Phys.* **11** (2004) 040.
- [29] S. Frixione, P. Nason, and C. Oleari, Matching NLO QCD computations with parton shower simulations: The POWHAG method, *J. High Energy Phys.* **11** (2007) 070.
- [30] H. B. Hartanto, B. Jäger, L. Reina, and D. Wackerroth, Higgs boson production in association with top quarks in the POWHEG BOX, *Phys. Rev. D* **91**, 094003 (2015).
- [31] S. Alioli, P. Nason, C. Oleari, and E. Re, NLO Higgs boson production via gluon fusion matched with shower in POWHEG, *J. High Energy Phys.* **04** (2009) 002.
- [32] ATLAS Collaboration, Measurements of Higgs boson production and couplings in the four-lepton channel in pp collisions at center-of-mass energies of 7 and 8 TeV with the ATLAS detector, *Phys. Rev. D* **91**, 012006 (2015).
- [33] CMS Collaboration, Measurements of properties of the Higgs boson decaying into the four-lepton final state in pp collisions at $\sqrt{s} = 13$ TeV, *J. High Energy Phys.* **11** (2017) 047.
- [34] M. Vesterinen and T. Wyatt, A novel technique for studying the Z boson transverse momentum distribution at hadron colliders, *Nucl. Instrum. Methods Phys. Res., Sect. A* **602**, 432 (2009).
- [35] M. Oreglia, A study of the reactions $\psi' \rightarrow \gamma\gamma\psi$, 1980, <https://www.slac.stanford.edu/cgi-wrap/getdoc/slac-r-236.pdf>.
- [36] W. Verkerke and D. Kirkby, The RooFit toolkit for data modeling, [arXiv:physics/0306116](#).
- [37] L. Moneta *et al.*, The RooStats project, *Proc. Sci. ACAT2010* (2010) 057.
- [38] K. Cranmer, G. Lewis, L. Moneta, A. Shibata, and W. Verkerke, HistFactory: A tool for creating statistical models for use with RooFit and RooStats, Report No. CERN-OPEN-2012-016, 2012, <https://cds.cern.ch/record/1456844>.
- [39] G. Cowan, K. Cranmer, E. Gross, and O. Vitells, Asymptotic formulae for likelihood-based tests of new physics, *Eur. Phys. J. C* **71**, 1554 (2011); **73**, 2501(E) (2013).
- [40] P. Dauncey, M. Kenzie, N. Wardle, and G. Davies, Handling uncertainties in background shapes: The discrete profiling method, *J. Instrum.* **10**, P04015 (2015).
- [41] I. W. Stewart and F. J. Tackmann, Theory uncertainties for Higgs and other searches using jet bins, *Phys. Rev. D* **85**, 034011 (2012).
- [42] S. Gangal and F. J. Tackmann, Next-to-leading-order uncertainties in Higgs + 2 jets from gluon fusion, *Phys. Rev. D* **87**, 093008 (2013).
- [43] M. Grazzini and H. Sargsyan, Heavy-quark mass effects in Higgs boson production at the LHC, *J. High Energy Phys.* **09** (2013) 129.
- [44] A. Martin, W. Stirling, R. Thorne, and G. Watt, Parton distributions for the LHC, *Eur. Phys. J. C* **63**, 189 (2009).
- [45] J. Butterworth *et al.*, PDF4LHC recommendations for LHC Run II, *J. Phys. G* **43**, 023001 (2016).
- [46] ATLAS Collaboration, Luminosity determination in pp collisions at $\sqrt{s} = 13$ TeV using the ATLAS detector at the LHC, Report No. ATLAS-CONF-2019-021, 2019, <https://cds.cern.ch/record/2677054>.
- [47] G. Avoni *et al.*, The new LUCID-2 detector for luminosity measurement and monitoring in ATLAS, *J. Instrum.* **13**, P07017 (2018).
- [48] CMS Collaboration, Precision luminosity measurement in proton-proton collisions at $\sqrt{s} = 13$ TeV in 2015 and 2016 at CMS, *Eur. Phys. J. C* **81**, 800 (2021).
- [49] CMS Collaboration, CMS luminosity measurement for the 2017 data-taking period at $\sqrt{s} = 13$ TeV, Report No. CMS-PAS-LUM-17-004, 2018, <https://cds.cern.ch/record/2621960>.
- [50] CMS Collaboration, CMS luminosity measurement for the 2018 data-taking period at $\sqrt{s} = 13$ TeV, Report No. CMS-PAS-LUM-18-002, 2019, <https://cds.cern.ch/record/2676164>.

- [51] ATLAS and CMS Collaborations, Combined measurement of the Higgs boson mass in pp collisions at $\sqrt{s} = 7$ and 8 TeV with the ATLAS and CMS experiments, *Phys. Rev. Lett.* **114**, 191803 (2015).
- [52] CMS Collaboration, A measurement of the Higgs boson mass in the diphoton decay channel, *Phys. Lett. B* **805**, 135425 (2020).
- [53] S. Baker and R.D. Cousins, Clarification of the use of chi square and likelihood functions in fits to histograms, *Nucl. Instrum. Methods* **221**, 437 (1984).
- [54] ATLAS and CMS Collaborations, HEPData record for this analysis, 2023, [10.17182/hepdata.142406](https://cds.cern.ch/record/142406).
- [55] ATLAS Collaboration, ATLAS computing acknowledgements, Report No. ATL-SOFT-PUB-2023-001, 2023, <https://cds.cern.ch/record/2869272>.

G. Aad¹⁰², B. Abbott¹²⁰, K. Abeling⁵⁵, N. J. Abicht⁴⁹, S. H. Abidi²⁹, A. Aboulhorma^{35e}, H. Abramowicz¹⁵¹, H. Abreu¹⁵⁰, Y. Abulaiti¹¹⁷, B. S. Acharya^{69a,69b}, C. Adam Bourdarios⁴, L. Adamczyk^{86a}, L. Adamek¹⁵⁵, S. V. Addepalli²⁶, M. J. Addison¹⁰¹, J. Adelman¹¹⁵, A. Adiguzel^{21c}, T. Adye¹³⁴, A. A. Affolder¹³⁶, Y. Afik³⁶, M. N. Agaras¹³, J. Agarwala^{73a,73b}, A. Aggarwal¹⁰⁰, C. Agheorghiesei^{27c}, A. Ahmad³⁶, F. Ahmadov^{38,c}, W. S. Ahmed¹⁰⁴, S. Ahuja⁹⁵, X. Ai^{62a}, G. Aielli^{76a,76b}, A. Aikot¹⁶³, M. Ait Tamlihat^{35e}, B. Aitbenchikh^{35a}, I. Aizenberg¹⁶⁹, M. Akbiyik¹⁰⁰, T. P. A. Åkesson⁹⁸, A. V. Akimov³⁷, D. Akiyama¹⁶⁸, N. N. Akolkar²⁴, K. Al Khoury⁴¹, G. L. Alberghi^{23b}, J. Albert¹⁶⁵, P. Albicocco⁵³, G. L. Albouy⁶⁰, S. Alderweireldt⁵², M. Aleksa³⁶, I. N. Aleksandrov³⁸, C. Alexa^{27b}, T. Alexopoulos¹⁰, F. Alfonsi^{23b}, M. Algren⁵⁶, M. Alhroob¹²⁰, B. Ali¹³², H. M. J. Ali⁹¹, S. Ali¹⁴⁸, S. W. Alibocus⁹², M. Aliev¹⁴⁵, G. Alimonti^{71a}, W. Alkakh⁵⁵, C. Allaire⁶⁶, B. M. M. Allbrooke¹⁴⁶, J. F. Allen⁵², C. A. Allendes Flores^{137f}, P. P. Allport²⁰, A. Aloisio^{72a,72b}, F. Alonso⁹⁰, C. Alpigiani¹³⁸, M. Alvarez Estevez⁹⁹, A. Alvarez Fernandez¹⁰⁰, M. Alves Cardoso⁵⁶, M. G. Alviggi^{72a,72b}, M. Aly¹⁰¹, Y. Amaral Coutinho^{83b}, A. Ambler¹⁰⁴, C. Amelung³⁶, M. Ameri¹⁰¹, C. G. Ames¹⁰⁹, D. Amidei¹⁰⁶, S. P. Amor Dos Santos^{130a}, K. R. Amos¹⁶³, V. Ananiev¹²⁵, C. Anastopoulos¹³⁹, T. Andeen¹¹, J. K. Anders³⁶, S. Y. Andrean^{47a,47b}, A. Andreazza^{71a,71b}, S. Angelidakis⁹, A. Angerami^{41,d}, A. V. Anisenkov³⁷, A. Annovi^{74a}, C. Antel⁵⁶, M. T. Anthony¹³⁹, E. Antipov¹⁴⁵, M. Antonelli⁵³, F. Anulli^{75a}, M. Aoki⁸⁴, T. Aoki¹⁵³, J. A. Aparisi Pozo¹⁶³, M. A. Aparo¹⁴⁶, L. Aperio Bella⁴⁸, C. Appelt¹⁸, A. Apyan²⁶, N. Aranzabal³⁶, C. Arcangeletti⁵³, A. T. H. Arce⁵¹, E. Arena⁹², J-F. Arguin¹⁰⁸, S. Argyropoulos⁵⁴, J.-H. Arling⁴⁸, O. Arnaez⁴, H. Arnold¹¹⁴, G. Artoni^{75a,75b}, H. Asada¹¹¹, K. Asai¹¹⁸, S. Asai¹⁵³, N. A. Asbah⁶¹, J. Assahsah^{35d}, K. Assamagan²⁹, R. Astalos^{28a}, S. Atashi¹⁶⁰, R. J. Atkin^{33a}, M. Atkinson¹⁶², H. Atmani^{35f}, P. A. Atlasiddha¹⁰⁶, K. Augsten¹³², S. Auricchio^{72a,72b}, A. D. Auriol²⁰, V. A. Austrup¹⁰¹, G. Avolio³⁶, K. Axiotis⁵⁶, G. Azuelos^{108,e}, D. Babal^{28b}, H. Bachacou¹³⁵, K. Bachas^{152,f}, A. Bachi³⁴, F. Backman^{47a,47b}, A. Badea⁶¹, P. Bagnaia^{75a,75b}, M. Bahmani¹⁸, A. J. Bailey¹⁶³, V. R. Bailey¹⁶², J. T. Baines¹³⁴, L. Baines⁹⁴, C. Bakalis¹⁰, O. K. Baker¹⁷², E. Bakos¹⁵, D. Bakshi Gupta⁸, V. Balakrishnan¹²⁰, R. Balasubramanian¹¹⁴, E. M. Baldin³⁷, P. Balek^{86a}, E. Ballabene^{23b,23a}, F. Balli¹³⁵, L. M. Baltes^{63a}, W. K. Balunas³², J. Balz¹⁰⁰, E. Banas⁸⁷, M. Bandieramonte¹²⁹, A. Bandyopadhyay²⁴, S. Bansal²⁴, L. Barak¹⁵¹, M. Barakat⁴⁸, E. L. Barberio¹⁰⁵, D. Barberis^{57b,57a}, M. Barbero¹⁰², M. Z. Barel¹¹⁴, K. N. Barends^{33a}, T. Barillari¹¹⁰, M-S. Barisits³⁶, T. Barklow¹⁴³, P. Baron¹²², D. A. Baron Moreno¹⁰¹, A. Baroncelli^{62a}, G. Barone²⁹, A. J. Barr¹²⁶, J. D. Barr⁹⁶, L. Barranco Navarro^{47a,47b}, F. Barreiro⁹⁹, J. Barreiro Guimarães da Costa^{14a}, U. Barron¹⁵¹, M. G. Barros Teixeira^{130a}, S. Barsov³⁷, F. Bartels^{63a}, R. Bartoldus¹⁴³, A. E. Barton⁹¹, P. Bartos^{28a}, A. Basan¹⁰⁰, M. Baselga⁴⁹, A. Bassalat^{66,g}, M. J. Basso^{156a}, C. R. Basson¹⁰¹, R. L. Bates⁵⁹, S. Batlamous^{35e}, J. R. Batley³², B. Batool¹⁴¹, M. Battaglia¹³⁶, D. Battulga¹⁸, M. Bauce^{75a,75b}, M. Bauer³⁶, P. Bauer²⁴, L. T. Bazzano Hurrell³⁰, J. B. Beacham⁵¹, T. Beau¹²⁷, P. H. Beauchemin¹⁵⁸, F. Becherer⁵⁴, P. Bechtel²⁴, H. P. Beck^{19,h}, K. Becker¹⁶⁷, A. J. Beddall⁸², V. A. Bednyakov³⁸, C. P. Bee¹⁴⁵, L. J. Beemster¹⁵, T. A. Beermann³⁶, M. Begalli^{83d}, M. Begel²⁹, A. Behera¹⁴⁵, J. K. Behr⁴⁸, J. F. Beirer⁵⁵, F. Beisiegel²⁴, M. Belfkir¹⁵⁹, G. Bella¹⁵¹, L. Bellagamba^{23b}, A. Bellerive³⁴, P. Bellos²⁰, K. Beloborodov³⁷, D. Benckekroun^{35a}, F. Bendebba^{35a}, Y. Benhammou¹⁵¹, M. Benoit²⁹, J. R. Bensinger²⁶, S. Bentvelsen¹¹⁴, L. Beresford⁴⁸, M. Beretta⁵³, E. Bergeas Kuutmann¹⁶¹, N. Berger⁴, B. Bergmann¹³², J. Beringer^{17a}, G. Bernardi⁵, C. Bernius¹⁴³, F. U. Bernlochner²⁴, F. Bernon^{36,102}, T. Berry⁹⁵, P. Berta¹³³, A. Berthold⁵⁰, I. A. Bertram⁹¹, S. Bethke¹¹⁰, A. Betti^{75a,75b}, A. J. Bevan⁹⁴, N. K. Bhalla⁵⁴, M. Bhamjee^{33c}, S. Bhatta¹⁴⁵, D. S. Bhattacharya¹⁶⁶, P. Bhattarai¹⁴³, V. S. Bhopatkar¹²¹, R. Bi^{29,i}

- R. M. Bianchi¹²⁹ G. Bianco^{23b,23a} O. Biebel¹⁰⁹ R. Bielski¹²³ M. Biglietti^{77a} M. Bindl⁵⁵ A. Bingul^{21b}
C. Bini^{75a,75b} A. Biondini⁹² C. J. Birch-sykes¹⁰¹ G. A. Bird^{20,134} M. Birman¹⁶⁹ M. Biros¹³³ S. Biryukov¹⁴⁶
T. Bisanz⁴⁹ E. Bisceglie^{43b,43a} J. P. Biswal¹³⁴ D. Biswas¹⁴¹ A. Bitadze¹⁰¹ K. Bjørke¹²⁵ I. Bloch⁴⁸
C. Blocker²⁶ A. Blue⁵⁹ U. Blumenschein⁹⁴ J. Blumenthal¹⁰⁰ G. J. Bobbink¹¹⁴ V. S. Bobrovnikov³⁷
M. Boehler⁵⁴ B. Boehm¹⁶⁶ D. Bogavac³⁶ A. G. Bogdanchikov³⁷ C. Bohm^{47a} V. Boisvert⁹⁵ P. Bokan⁴⁸
T. Bold^{86a} M. Bomben⁵ M. Bona⁹⁴ M. Boonekamp¹³⁵ C. D. Booth⁹⁵ A. G. Borbély⁵⁹ I. S. Bordulev³⁷
H. M. Borecka-Bielska¹⁰⁸ G. Borissov⁹¹ D. Bortoletto¹²⁶ D. Boscherini^{23b} M. Bosman¹³ J. D. Bossio Sola³⁶
K. Bouaouda^{35a} N. Bouchhar¹⁶³ J. Boudreau¹²⁹ E. V. Bouhova-Thacker⁹¹ D. Boumediene⁴⁰ R. Bouquet⁵
A. Boveia¹¹⁹ J. Boyd³⁶ D. Boye²⁹ I. R. Boyko³⁸ J. Bracinik²⁰ N. Brahimi^{62d} G. Brandt¹⁷¹ O. Brandt³²
F. Braren⁴⁸ B. Brau¹⁰³ J. E. Brau¹²³ R. Brenner¹⁶⁹ L. Brenner¹¹⁴ R. Brenner¹⁶¹ S. Bressler¹⁶⁹ D. Britton⁵⁹
D. Britzger¹¹⁰ I. Brock²⁴ G. Brooijmans⁴¹ W. K. Brooks^{137f} E. Brost²⁹ L. M. Brown¹⁶⁵ L. E. Bruce⁶¹
T. L. Bruckler¹²⁶ P. A. Bruckman de Renstrom⁸⁷ B. Brüers⁴⁸ A. Bruni^{23b} G. Bruni^{23b} M. Bruschi^{23b}
N. Bruscino^{75a,75b} T. Buanes¹⁶ Q. Buat¹³⁸ D. Buchin¹¹⁰ A. G. Buckley⁵⁹ O. Bulekov³⁷ B. A. Bullard¹⁴³
S. Burdin⁹² C. D. Burgard⁴⁹ A. M. Burger⁴⁰ B. Burghgrave⁸ O. Burlayenko⁵⁴ J. T. P. Burr³² C. D. Burton¹¹
J. C. Burzynski¹⁴² E. L. Busch⁴¹ V. Büscher¹⁰⁰ P. J. Bussey⁵⁹ J. M. Butler²⁵ C. M. Buttar⁵⁹
J. M. Butterworth⁹⁶ W. Buttinger¹³⁴ C. J. Buxo Vazquez¹⁰⁷ A. R. Buzykaev³⁷ S. Cabrera Urbán¹⁶³
L. Cadamuro⁶⁶ D. Caforio⁵⁸ H. Cai¹²⁹ Y. Cai^{14a,14e} V. M. M. Cairo³⁶ O. Cakir^{3a} N. Calace³⁶ P. Calafiura^{17a}
G. Calderini¹²⁷ P. Calfayan⁶⁸ G. Callea⁵⁹ L. P. Caloba^{83b} D. Calvet⁴⁰ S. Calvet⁴⁰ T. P. Calvet¹⁰²
M. Calvetti^{74a,74b} R. Camacho Toro¹²⁷ S. Camarda³⁶ D. Camarero Munoz²⁶ P. Camarri^{76a,76b}
M. T. Camerlingo^{72a,72b} D. Cameron³⁶ C. Camincher¹⁶⁵ M. Campanelli⁹⁶ A. Camplani⁴² V. Canale^{72a,72b}
A. Canesse¹⁰⁴ J. Cantero¹⁶³ Y. Cao¹⁶² F. Capocasa²⁶ M. Capua^{43b,43a} A. Carbone^{71a,71b} R. Cardarelli^{76a}
J. C. J. Cardenas⁸ F. Cardillo¹⁶³ T. Carli³⁶ G. Carlino^{72a} J. I. Carlotto¹³ B. T. Carlson^{129j}
E. M. Carlson^{165,156a} L. Carminati^{71a,71b} A. Carnelli¹³⁵ M. Carnesale^{75a,75b} S. Caron¹¹³ E. Carquin^{137f}
S. Carrá^{71a,71b} G. Carratta^{23b,23a} F. Carrio Argos^{33g} J. W. S. Carter¹⁵⁵ T. M. Carter⁵² M. P. Casado^{13,k}
M. Caspar⁴⁸ E. G. Castiglia¹⁷² F. L. Castillo⁴ L. Castillo Garcia¹³ V. Castillo Gimenez¹⁶³ N. F. Castro^{130a,130e}
A. Catinaccio³⁶ J. R. Catmore¹²⁵ V. Cavaliere²⁹ N. Cavalli^{23b,23a} V. Cavasinni^{74a,74b} Y. C. Cekmecelioglu⁴⁸
E. Celebi^{21a} F. Celli¹²⁶ M. S. Centonze^{70a,70b} V. Cepaitis⁵⁶ K. Cerny¹²² A. S. Cerqueira^{83a} A. Cerri¹⁴⁶
L. Cerrito^{76a,76b} F. Cerutti^{17a} B. Cervato¹⁴¹ A. Cervelli^{23b} G. Cesarini⁵³ S. A. Cetin⁸² Z. Chadi^{35a}
D. Chakraborty¹¹⁵ J. Chan¹⁷⁰ W. Y. Chan¹⁵³ J. D. Chapman³² E. Chapon¹³⁵ B. Chargeishvili^{149b}
D. G. Charlton²⁰ T. P. Charman⁹⁴ M. Chatterjee¹⁹ C. Chauhan¹³³ S. Chekanov⁶ S. V. Chekulaev^{156a}
G. A. Chelkov^{38,1} A. Chen¹⁰⁶ B. Chen¹⁵¹ B. Chen¹⁶⁵ H. Chen^{14c} H. Chen²⁹ J. Chen^{62c} J. Chen¹⁴²
M. Chen¹²⁶ S. Chen¹⁵³ S. J. Chen^{14c} X. Chen^{62c,135} X. Chen^{14b,m} Y. Chen^{62a} C. L. Cheng¹⁷⁰
H. C. Cheng^{64a} S. Cheong¹⁴³ A. Cheplakov³⁸ E. Cheremushkina⁴⁸ E. Cherepanova¹¹⁴
R. Cherkaoui El Moursli^{35e} E. Cheu⁷ K. Cheung⁶⁵ L. Chevalier¹³⁵ V. Chiarella⁵³ G. Chiarelli^{74a}
N. Chiedde¹⁰² G. Chiodini^{70a} A. S. Chisholm²⁰ A. Chitan^{27b} M. Chitishvili¹⁶³ M. V. Chizhov³⁸ K. Choi¹¹
A. R. Chomont^{75a,75b} Y. Chou¹⁰³ E. Y. S. Chow¹¹⁴ T. Chowdhury^{33g} K. L. Chu¹⁶⁹ M. C. Chu^{64a} X. Chu^{14a,14e}
J. Chudoba¹³¹ J. J. Chwastowski⁸⁷ D. Cieri¹¹⁰ K. M. Ciesla^{86a} V. Cindro⁹³ A. Ciocio^{17a} F. Ciotto^{72a,72b}
Z. H. Citron^{169,n} M. Citterio^{71a} D. A. Ciubotaru^{27b} B. M. Ciungu¹⁵⁵ A. Clark⁵⁶ P. J. Clark⁵²
J. M. Clavijo Columbie⁴⁸ S. E. Clawson⁴⁸ C. Clement^{47a,47b} J. Clercx⁴⁸ L. Clissa^{23b,23a} Y. Coadou¹⁰²
M. Cobal^{69a,69c} A. Cocco^{57b} R. F. Coelho Barrue^{130a} R. Coelho Lopes De Sa¹⁰³ S. Coelli^{71a} H. Cohen¹⁵¹
A. E. C. Coimbra^{71a,71b} B. Cole⁴¹ J. Collot⁶⁰ P. Conde Muiño^{130a,130g} M. P. Connell^{33c} S. H. Connell^{33c}
I. A. Connelly⁵⁹ E. I. Conroy¹²⁶ F. Conventi^{72a,o} H. G. Cooke²⁰ A. M. Cooper-Sarkar¹²⁶
A. Cordeiro Oudot Choi¹²⁷ F. Cormier¹⁶⁴ L. D. Corpe⁴⁰ M. Corradi^{75a,75b} F. Corriveau^{104,p}
A. Cortes-Gonzalez¹⁸ M. J. Costa¹⁶³ F. Costanza⁴ D. Costanzo¹³⁹ B. M. Cote¹¹⁹ G. Cowan⁹⁵ K. Cranmer¹⁷⁰
D. Cremonini^{23b,23a} S. Crépe-Renaudin⁶⁰ F. Crescioli¹²⁷ M. Cristinziani¹⁴¹ M. Cristoforetti^{78a,78b} V. Croft¹¹⁴
J. E. Crosby¹²¹ G. Crosetti^{43b,43a} A. Cueto⁹⁹ T. Cuhadar Donszelmann¹⁶⁰ H. Cui^{14a,14e} Z. Cui⁷
W. R. Cunningham⁵⁹ F. Curcio^{43b,43a} P. Czodrowski³⁶ M. M. Czurylo^{63b}
M. J. Da Cunha Sargedas De Sousa^{57b,57a} J. V. Da Fonseca Pinto^{83b} C. Da Via¹⁰¹ W. Dabrowski^{86a} T. Dado⁴⁹
S. Dahbi^{33g} T. Dai¹⁰⁶ D. Dal Santo¹⁹ C. Dallapiccola¹⁰³ M. Dam⁴² G. D'amen²⁹ V. D'Amico¹⁰⁹

J. Damp¹⁰⁰ J. R. Dandoy¹²⁸ M. F. Daneri³⁰ M. Danninger¹⁴² V. Dao³⁶ G. Darbo^{57b} S. Darmora⁶
S. J. Das^{29,i} S. D'Auria^{71a,71b} C. David^{156b} T. Davidek¹³³ B. Davis-Purcell³⁴ I. Dawson⁹⁴ H. A. Day-hall¹³²
K. De⁸ R. De Asmundis^{72a} N. De Biase⁴⁸ S. De Castro^{23b,23a} N. De Groot¹¹³ P. de Jong¹¹⁴ H. De la Torre¹¹⁵
A. De Maria^{14c} A. De Salvo^{75a} U. De Sanctis^{76a,76b} A. De Santo¹⁴⁶ J. B. De Vivie De Regie⁶⁰ D. V. Dedovich³⁸
J. Degens¹¹⁴ A. M. Deiana⁴⁴ F. Del Corso^{23b,23a} J. Del Peso⁹⁹ F. Del Rio^{63a} F. Deliot¹³⁵ C. M. Delitzsch⁴⁹
M. Della Pietra^{72a,72b} D. Della Volpe⁵⁶ A. Dell'Acqua³⁶ L. Dell'Asta^{71a,71b} M. Delmastro⁴ P. A. Delsart⁶⁰
S. Demers¹⁷² M. Demichev³⁸ S. P. Denisov³⁷ L. D'Eramo⁴⁰ D. Derendarz⁸⁷ F. Derue¹²⁷ P. Dervan⁹²
K. Desch²⁴ C. Deutsch²⁴ F. A. Di Bello^{57b,57a} A. Di Ciaccio^{76a,76b} L. Di Ciaccio⁴ A. Di Domenico^{75a,75b}
C. Di Donato^{72a,72b} A. Di Girolamo³⁶ G. Di Gregorio³⁶ A. Di Luca^{78a,78b} B. Di Micco^{77a,77b} R. Di Nardo^{77a,77b}
C. Diaconu¹⁰² M. Diamantopoulou³⁴ F. A. Dias¹¹⁴ T. Dias Do Vale¹⁴² M. A. Diaz^{137a,137b} F. G. Diaz Capriles²⁴
M. Didenko¹⁶³ E. B. Diehl¹⁰⁶ L. Diehl⁵⁴ S. Díez Cornell⁴⁸ C. Diez Pardos¹⁴¹ C. Dimitriadi^{161,24,161}
A. Dimitrievska^{17a} J. Dingfelder²⁴ I-M. Dinu^{27b} S. J. Dittmeier^{63b} F. Dittus³⁶ F. Djama¹⁰² T. Djobava^{149b}
J. I. Djuvsland¹⁶ C. Doglioni^{101,98} A. Dohnalova^{28a} J. Dolejsi¹³³ Z. Dolezal¹³³ K. M. Dona³⁹
M. Donadelli^{83c} B. Dong¹⁰⁷ J. Donini⁴⁰ A. D'Onofrio^{77a,77b} M. D'Onofrio⁹² J. Dopke¹³⁴ A. Doria^{72a}
N. Dos Santos Fernandes^{130a} P. Dougan¹⁰¹ M. T. Dova⁹⁰ A. T. Doyle⁵⁹ M. A. Draguet¹²⁶ E. Dreyer¹⁶⁹
I. Drivas-koulouris¹⁰ M. Drnevich¹¹⁷ A. S. Drobac¹⁵⁸ M. Drozdova⁵⁶ D. Du^{62a} T. A. du Pree¹¹⁴ F. Dubinin³⁷
M. Dubovsky^{28a} E. Duchovni¹⁶⁹ G. Duckeck¹⁰⁹ O. A. Ducu^{27b} D. Duda⁵² A. Dudarev³⁶ E. R. Duden²⁶
M. D'uffizi¹⁰¹ L. Duflot⁶⁶ M. Dührssen³⁶ C. Dülken¹⁷¹ A. E. Dumitriu^{27b} M. Dunford^{63a} S. Dungs⁴⁹
K. Dunne^{47a,47b} A. Duperrin¹⁰² H. Duran Yildiz^{3a} M. Düren⁵⁸ A. Durglishvili^{149b} B. L. Dwyer¹¹⁵
G. I. Dyckes^{17a} M. Dyndal^{86a} S. Dysch¹⁰¹ B. S. Dziedzic⁸⁷ Z. O. Earnshaw¹⁴⁶ G. H. Eberwein¹²⁶
B. Eckerova^{28a} S. Eggebrecht⁵⁵ E. Egidio Purcino De Souza¹²⁷ L. F. Ehrke⁵⁶ G. Eigen¹⁶ K. Einsweiler^{17a}
T. Ekelof¹⁶¹ P. A. Ekman⁹⁸ S. El Farkh^{35b} Y. El Ghazali^{35b} H. El Jarrari^{35e,148} A. El Moussaouy¹⁰⁸
V. Ellajosyula¹⁶¹ M. Ellert¹⁶¹ F. Ellinghaus¹⁷¹ A. A. Elliot⁹⁴ N. Ellis³⁶ J. Elmsheuser²⁹ M. Elsing³⁶
D. Emeliyanov¹³⁴ Y. Enari¹⁵³ I. Ene^{17a} S. Epari¹³ J. Erdmann⁴⁹ P. A. Erland⁸⁷ M. Errenst¹⁷¹ M. Escalier⁶⁶
C. Escobar¹⁶³ E. Etzion¹⁵¹ G. Evans^{130a} H. Evans⁶⁸ L. S. Evans⁹⁵ M. O. Evans¹⁴⁶ A. Ezhilov³⁷
S. Ezzarqtouni^{35a} F. Fabbri⁵⁹ L. Fabbri^{23b,23a} G. Facini⁹⁶ V. Fadeyev¹³⁶ R. M. Fakhrutdinov³⁷ S. Falciano^{75a}
L. F. Falda Ulhoa Coelho³⁶ P. J. Falke²⁴ J. Faltova¹³³ C. Fan¹⁶² Y. Fan^{14a} Y. Fang^{14a,14e} M. Fanti^{71a,71b}
M. Faraj^{69a,69b} Z. Farazpay⁹⁷ A. Farbin⁸ A. Farilla^{77a} T. Farooque¹⁰⁷ S. M. Farrington⁵² F. Fassi^{35e}
D. Fassouliotis⁹ M. Faucci Giannelli^{76a,76b} W. J. Fawcett³² L. Fayard⁶⁶ P. Federic¹³³ P. Federicova¹³¹
O. L. Fedin^{37,1} G. Fedotov³⁷ M. Feickert¹⁷⁰ L. Feligioni¹⁰² D. E. Fellers¹²³ C. Feng^{62b} M. Feng^{14b}
Z. Feng¹¹⁴ M. J. Fenton¹⁶⁰ A. B. Fenyuk³⁷ L. Ferencz⁴⁸ R. A. M. Ferguson⁹¹ S. I. Fernandez Luengo^{137f}
P. Fernandez Martinez¹³ M. J. V. Fernoux¹⁰² J. Ferrando⁴⁸ A. Ferrari¹⁶¹ P. Ferrari^{114,113} R. Ferrari^{73a}
D. Ferrere⁵⁶ C. Ferretti¹⁰⁶ F. Fiedler¹⁰⁰ P. Fiedler¹³² A. Filipčič⁹³ E. K. Filmer¹ F. Filthaut¹¹³
M. C. N. Fiolhais^{130a,130c,q} L. Fiorini¹⁶³ W. C. Fisher¹⁰⁷ T. Fitschen¹⁰¹ P. M. Fitzhugh¹³⁵ I. Fleck¹⁴¹
P. Fleischmann¹⁰⁶ T. Flick¹⁷¹ M. Flores^{33d,r} L. R. Flores Castillo^{64a} L. Flores Sanz De Acedo³⁶
F. M. Follega^{78a,78b} N. Fomin¹⁶ J. H. Foo¹⁵⁵ B. C. Forland⁶⁸ A. Formica¹³⁵ A. C. Forti¹⁰¹ E. Fortin³⁶
A. W. Fortman⁶¹ M. G. Foti^{17a} L. Fountas^{9,s} D. Fournier⁶⁶ H. Fox⁹¹ P. Francavilla^{74a,74b} S. Francescato⁶¹
S. Franchellucci⁵⁶ M. Franchini^{23b,23a} S. Franchino^{63a} D. Francis³⁶ L. Franco¹¹³ V. Franco Lima³⁶
L. Franconi⁴⁸ M. Franklin⁶¹ G. Frattari²⁶ A. C. Freegard⁹⁴ W. S. Freund^{83b} Y. Y. Frid¹⁵¹ J. Friend⁵⁹
N. Fritzsche⁵⁰ A. Froch⁵⁴ D. Froidevaux³⁶ J. A. Frost¹²⁶ Y. Fu^{62a} M. Fujimoto^{118,t} E. Fullana Torregrosa^{163,a}
K. Y. Fung^{64a} E. Furtado De Simas Filho^{83b} M. Furukawa¹⁵³ J. Fuster¹⁶³ A. Gabrielli^{23b,23a} A. Gabrielli¹⁵⁵
P. Gadow³⁶ G. Gagliardi^{57b,57a} L. G. Gagnon^{17a} E. J. Gallas¹²⁶ B. J. Gallop¹³⁴ K. K. Gan¹¹⁹ S. Ganguly¹⁵³
J. Gao^{62a} Y. Gao⁵² F. M. Garay Walls^{137a,137b} B. Garcia^{29,i} C. García¹⁶³ A. Garcia Alonso¹¹⁴
A. G. Garcia Caffaro¹⁷² J. E. García Navarro¹⁶³ M. Garcia-Sciveres^{17a} G. L. Gardner¹²⁸ R. W. Gardner³⁹
N. Garelli¹⁵⁸ D. Garg⁸⁰ R. B. Garg^{143,u} J. M. Gargan⁵² C. A. Garner¹⁵⁵ C. M. Garvey^{33a} S. J. Gasiorowski¹³⁸
P. Gaspar^{83b} G. Gaudio^{73a} V. Gautam¹³ P. Gauzzi^{75a,75b} I. L. Gavrilenko³⁷ A. Gavriluk³⁷ C. Gay¹⁶⁴
G. Gaycken⁴⁸ E. N. Gazis¹⁰ A. A. Geanta^{27b} C. M. Gee¹³⁶ C. Gemme^{57b} M. H. Genest⁶⁰ S. Gentile^{75a,75b}
A. D. Gentry¹¹² S. George⁹⁵ W. F. George²⁰ T. Gerialis⁴⁶ P. Gessinger-Befurt³⁶ M. E. Geyik¹⁷¹ M. Ghani¹⁶⁷
M. Ghneimat¹⁴¹ K. Ghorbanian⁹⁴ A. Ghosal¹⁴¹ A. Ghosh¹⁶⁰ A. Ghosh⁷ B. Giacobbe^{23b} S. Giagu^{75a,75b}

- T. Giani¹¹⁴ P. Giannetti^{74a} A. Giannini^{62a} S. M. Gibson⁹⁵ M. Gignac¹³⁶ D. T. Gil^{86b} A. K. Gilbert^{86a}
 B. J. Gilbert⁴¹ D. Gillberg³⁴ G. Gilles¹¹⁴ N. E. K. Gillwald⁴⁸ L. Ginabat¹²⁷ D. M. Gingrich^{2,e}
 M. P. Giordani^{69a,69c} P. F. Giraud¹³⁵ G. Giugliarelli^{69a,69c} D. Giugni^{71a} F. Giuli³⁶ I. Gkialas^{9,s}
 L. K. Gladilin³⁷ C. Glasman⁹⁹ G. R. Gledhill¹²³ G. Glemža⁴⁸ M. Glisic¹²³ I. Gnesi^{43b,v} Y. Go^{29,i}
 M. Goblirsch-Kolb³⁶ B. Gocke⁴⁹ D. Godin¹⁰⁸ B. Gokturk^{21a} S. Goldfarb¹⁰⁵ T. Golling⁵⁶ M. G. D. Gololo^{33g}
 D. Golubkov³⁷ J. P. Gombas¹⁰⁷ A. Gomes¹²⁰ G. Gomes Da Silva¹⁴¹ A. J. Gomez Delegido¹⁶³
 R. Gonçalves^{130a,130c} G. Gonella¹²³ L. Gonella²⁰ A. Gongadze^{149c} F. Gonnella²⁰ J. L. Gonski⁴¹
 R. Y. González Andana⁵² S. González de la Hoz¹⁶³ S. Gonzalez Fernandez¹³ R. Gonzalez Lopez⁹²
 C. Gonzalez Renteria^{17a} M. V. Gonzalez Rodrigues⁴⁸ R. Gonzalez Suarez¹⁶¹ S. Gonzalez-Sevilla⁵⁶
 G. R. Gonzalvo Rodriguez¹⁶³ L. Goossens³⁶ B. Gorini³⁶ E. Gorini^{70a,70b} A. Gorišek⁹³ T. C. Gosart¹²⁸
 A. T. Goshaw⁵¹ M. I. Gostkin³⁸ S. Goswami¹²¹ C. A. Gottardo³⁶ S. A. Gotz¹⁰⁹ M. Goughri^{35b}
 V. Goumarre⁴⁸ A. G. Goussiou¹³⁸ N. Govender^{33c} I. Grabowska-Bold^{86a} K. Graham³⁴ E. Gramstad¹²⁵
 S. Grancagnolo^{70a,70b} M. Grandi¹⁴⁶ C. M. Grant^{1,135} P. M. Gravila^{27f} F. G. Gravili^{70a,70b} H. M. Gray^{17a}
 M. Greco^{70a,70b} C. Greife²⁴ I. M. Gregor⁴⁸ P. Grenier¹⁴³ S. G. Grewe¹¹⁰ C. Grieco¹³ A. A. Grillo¹³⁶
 K. Grimm³¹ S. Grinstein^{13,w} J.-F. Grivaz⁶⁶ E. Gross¹⁶⁹ J. Grosse-Knetter⁵⁵ C. Grud¹⁰⁶ J. C. Grundy¹²⁶
 L. Guan¹⁰⁶ W. Guan²⁹ C. Gubbels¹⁶⁴ J. G. R. Guerrero Rojas¹⁶³ G. Guerrieri^{69a,69c} F. Guescini¹¹⁰
 R. Gugel¹⁰⁰ J. A. M. Guhit¹⁰⁶ A. Guida¹⁸ T. Guillemin⁴ E. Guilloton^{167,134} S. Guindon³⁶ F. Guo^{14a,14e}
 J. Guo^{62c} L. Guo⁴⁸ Y. Guo¹⁰⁶ R. Gupta⁴⁸ S. Gurbuz²⁴ S. S. Gurdasani⁵⁴ G. Gustavino³⁶ M. Guth⁵⁶
 P. Gutierrez¹²⁰ L. F. Gutierrez Zagazeta¹²⁸ C. Gutschow⁹⁶ C. Gwenlan¹²⁶ C. B. Gwilliam⁹² E. S. Haaland¹²⁵
 A. Haas¹¹⁷ M. Habedank⁴⁸ C. Haber^{17a} H. K. Hadavand⁸ A. Hadeef¹⁰⁰ S. Hadzic¹¹⁰ J. J. Hahn¹⁴¹
 E. H. Haines⁹⁶ M. Haleem¹⁶⁶ J. Haley¹²¹ J. J. Hall¹³⁹ G. D. Hallowell¹⁰² L. Halser¹⁹ K. Hamano¹⁶⁵
 M. Hamer²⁴ G. N. Hamity⁵² E. J. Hampshire⁹⁵ J. Han^{62b} K. Han^{62a} L. Han^{14c} L. Han^{62a} S. Han^{17a}
 Y. F. Han¹⁵⁵ K. Hanagaki⁸⁴ M. Hance¹³⁶ D. A. Hangal^{41,d} H. Hanif¹⁴² M. D. Hank¹²⁸ R. Hankache¹⁰¹
 J. B. Hansen⁴² J. D. Hansen⁴² P. H. Hansen⁴² K. Hara¹⁵⁷ D. Harada⁵⁶ T. Harenberg¹⁷¹ S. Harkusha³⁷
 M. L. Harris¹⁰³ Y. T. Harris¹²⁶ J. Harrison¹³ N. M. Harrison¹¹⁹ P. F. Harrison¹⁶⁷ N. M. Hartman¹¹⁰
 N. M. Hartmann¹⁰⁹ Y. Hasegawa¹⁴⁰ R. Hauser¹⁰⁷ C. M. Hawkes²⁰ R. J. Hawkings³⁶ Y. Hayashi¹⁵³
 S. Hayashida¹¹¹ D. Hayden¹⁰⁷ C. Hayes¹⁰⁶ R. L. Hayes¹¹⁴ C. P. Hays¹²⁶ J. M. Hays⁹⁴ H. S. Hayward⁹²
 F. He^{62a} M. He^{14a,14e} Y. He¹⁵⁴ Y. He⁴⁸ N. B. Heatley⁹⁴ V. Hedberg⁹⁸ A. L. Heggelund¹²⁵ N. D. Hehir⁹⁴
 C. Heidegger⁵⁴ K. K. Heidegger⁵⁴ W. D. Heidorn⁸¹ J. Heilman³⁴ S. Heim⁴⁸ T. Heim^{17a} J. G. Heinlein¹²⁸
 J. J. Heinrich¹²³ L. Heinrich^{110,x} J. Hejbal¹³¹ L. Helary⁴⁸ A. Held¹⁷⁰ S. Hellesund¹⁶ C. M. Helling¹⁶⁴
 S. Hellman^{47a,47b} R. C. W. Henderson⁹¹ L. Henkelmann³² A. M. Henriques Correia³⁶ H. Herde⁹⁸
 Y. Hernández Jiménez¹⁴⁵ L. M. Herrmann²⁴ T. Herrmann⁵⁰ G. Herten⁵⁴ R. Hertenberger¹⁰⁹ L. Hervas³⁶
 M. E. Hespington¹⁰⁰ N. P. Hessey^{156a} H. Hibi⁸⁵ E. Hill¹⁵⁵ S. J. Hillier²⁰ J. R. Hinds¹⁰⁷ F. Hinterkeuser²⁴
 M. Hirose¹²⁴ S. Hirose¹⁵⁷ D. Hirschbuehl¹⁷¹ T. G. Hitchings¹⁰¹ B. Hiti⁹³ J. Hobbs¹⁴⁵ R. Hobincu^{27e}
 N. Hod¹⁶⁹ M. C. Hodgkinson¹³⁹ B. H. Hodgkinson³² A. Hoecker³⁶ J. Hofer⁴⁸ T. Holm²⁴ M. Holzbock¹¹⁰
 L. B. A. H. Hommels³² B. P. Honan¹⁰¹ J. Hong^{62c} T. M. Hong¹²⁹ B. H. Hooberman¹⁶² W. H. Hopkins⁶
 Y. Horii¹¹¹ S. Hou¹⁴⁸ A. S. Howard⁹³ J. Howarth⁵⁹ J. Hoya⁶ M. Hrabovsky¹²² A. Hrynevich⁴⁸
 T. Hryn'ova⁴ P. J. Hsu⁶⁵ S.-C. Hsu¹³⁸ Q. Hu^{62a} Y. F. Hu^{14a,14e} S. Huang^{64b} X. Huang^{14c} Y. Huang¹³⁹
 Y. Huang^{14a} Z. Huang¹⁰¹ Z. Hubacek¹³² M. Huebner²⁴ F. Huegging²⁴ T. B. Huffman¹²⁶ C. A. Hugli⁴⁸
 M. Huhtinen³⁶ S. K. Huiberts¹⁶ R. Hulsken¹⁰⁴ N. Huseynov^{12,1} J. Huston¹⁰⁷ J. Huth⁶¹ R. Hyneman¹⁴³
 G. Iacobucci⁵⁶ G. Iakovidis²⁹ I. Ibragimov¹⁴¹ L. Iconomidou-Fayard⁶⁶ P. Iengo^{72a,72b} R. Iguchi¹⁵³
 T. Iizawa¹²⁶ Y. Ikegami⁸⁴ N. Ilic¹⁵⁵ H. Imam^{35a} M. Ince Lezki⁵⁶ T. Ingebrechtsen Carlson^{47a,47b}
 G. Introzzi^{73a,73b} M. Iodice^{77a} V. Ippolito^{75a,75b} R. K. Irwin⁹² M. Ishino¹⁵³ W. Islam¹⁷⁰ C. Issever^{18,48}
 S. Istin^{21a,y} H. Ito¹⁶⁸ J. M. Iturbe Ponce^{64a} R. Iuppa^{78a,78b} A. Ivina¹⁶⁹ J. M. Izen⁴⁵ V. Izzo^{72a} P. Jacka^{131,132}
 P. Jackson¹ R. M. Jacobs⁴⁸ B. P. Jaeger¹⁴² C. S. Jagfeld¹⁰⁹ G. Jain^{156a} P. Jain⁵⁴ G. Jäkel¹⁷¹ K. Jakobs⁵⁴
 T. Jakoubek¹⁶⁹ J. Jamieson⁵⁹ K. W. Janas^{86a} M. Javurkova¹⁰³ F. Jeanneau¹³⁵ L. Jeanty¹²³ J. Jejelava^{149a,z}
 P. Jenni^{54,aa} C. E. Jessiman³⁴ S. Jézéquel⁴ C. Jia^{62b} J. Jia¹⁴⁵ X. Jia⁶¹ X. Jia^{14a,14e} Z. Jia^{14c} Y. Jiang^{62a}
 S. Jiggins⁴⁸ J. Jimenez Pena¹³ S. Jin^{14c} A. Jinaru^{27b} O. Jinnouchi¹⁵⁴ P. Johansson¹³⁹ K. A. Johns⁷
 J. W. Johnson¹³⁶ D. M. Jones³² E. Jones⁴⁸ P. Jones³² R. W. L. Jones⁹¹ T. J. Jones⁹² H. L. Joos^{55,36}

- R. Joshi¹¹⁹, J. Jovicevic¹⁵, X. Ju^{17a}, J. J. Junggeburth¹⁰³, T. Junkermann^{63a}, A. Juste Rozas^{13,w}, M. K. Juzek⁸⁷,
 S. Kabana^{137e}, A. Kaczmarzka⁸⁷, M. Kado¹¹⁰, H. Kagan¹¹⁹, M. Kagan¹⁴³, A. Kahn⁴¹, A. Kahn¹²⁸, C. Kahra¹⁰⁰,
 T. Kaji¹⁵³, E. Kajomovitz¹⁵⁰, N. Kakati¹⁶⁹, I. Kalaitzidou⁵⁴, C. W. Kalderon²⁹, A. Kamenshchikov¹⁵⁵,
 N. J. Kang¹³⁶, D. Kar^{33g}, K. Karava¹²⁶, M. J. Kareem^{156b}, E. Karentzos⁵⁴, I. Karkanas¹⁵², O. Karkout¹¹⁴,
 S. N. Karpov³⁸, Z. M. Karpova³⁸, V. Kartvelishvili⁹¹, A. N. Karyukhin³⁷, E. Kasimi¹⁵², J. Katzy⁴⁸, S. Kaur³⁴,
 K. Kawade¹⁴⁰, M. P. Kawale¹²⁰, C. Kawamoto⁸⁸, T. Kawamoto¹³⁵, E. F. Kay³⁶, F. I. Kaya¹⁵⁸, S. Kazakos¹⁰⁷,
 V. F. Kazanin³⁷, Y. Ke¹⁴⁵, J. M. Keaveney^{33a}, R. Keeler¹⁶⁵, G. V. Kehris⁶¹, J. S. Keller³⁴, A. S. Kelly⁹⁶,
 J. J. Kempster¹⁴⁶, K. E. Kennedy⁴¹, P. D. Kennedy¹⁰⁰, O. Kepka¹³¹, B. P. Kerridge¹⁶⁷, S. Kersten¹⁷¹,
 B. P. Kerševan⁹³, S. Keshri⁶⁶, L. Keszeghova^{28a}, S. Ketabchi Haghighat¹⁵⁵, M. Khandoga¹²⁷, A. Khanov¹²¹,
 A. G. Kharlamov³⁷, T. Kharlamova³⁷, E. E. Khoda¹³⁸, M. Kholodenko³⁷, T. J. Khoo¹⁸, G. Khorauli¹⁶⁶,
 J. Khubua^{149b}, Y. A. R. Khwaira⁶⁶, A. Kilgallon¹²³, D. W. Kim^{47a,47b}, Y. K. Kim³⁹, N. Kimura⁹⁶,
 M. K. Kingston⁵⁵, A. Kirchhoff⁵⁵, C. Kirfel²⁴, F. Kirfel²⁴, J. Kirk¹³⁴, A. E. Kiryunin¹¹⁰, C. Kitsaki¹⁰,
 O. Kivernyk²⁴, M. Klassen^{63a}, C. Klein³⁴, L. Klein¹⁶⁶, M. H. Klein¹⁰⁶, M. Klein⁹², S. B. Klein⁵⁶, U. Klein⁹²,
 P. Klimek³⁶, A. Klimentov²⁹, T. Klioutchnikova³⁶, P. Kluit¹¹⁴, S. Kluth¹¹⁰, E. Kneringer⁷⁹, T. M. Knight¹⁵⁵,
 A. Knue⁴⁹, R. Kobayashi⁸⁸, D. Kobylanskii¹⁶⁹, S. F. Koch¹²⁶, M. Kocian¹⁴³, P. Kodyš¹³³, D. M. Koeck¹²³,
 P. T. Koenig²⁴, T. Koffas³⁴, M. Kolb¹³⁵, I. Koletsou⁴, T. Komarek¹²², K. Köneke⁵⁴, A. X. Y. Kong¹,
 T. Kono¹¹⁸, N. Konstantinidis⁹⁶, B. Konya⁹⁸, R. Kopeliansky⁶⁸, S. Koperny^{86a}, K. Korcyl⁸⁷, K. Kordas^{152,bb},
 G. Koren¹⁵¹, A. Korn⁹⁶, S. Korn⁵⁵, I. Korolkov¹³, N. Korotkova³⁷, B. Kortman¹¹⁴, O. Kortner¹¹⁰,
 S. Kortner¹¹⁰, W. H. Kostecka¹¹⁵, V. V. Kostyukhin¹⁴¹, A. Kotskechagia¹³⁵, A. Kotwal⁵¹, A. Koulouris³⁶,
 A. Kourkouveli-Charalampidi^{73a,73b}, C. Kourkouvelis⁹, E. Kourlitis^{110,x}, O. Kovanda¹⁴⁶, R. Kowalewski¹⁶⁵,
 W. Kozanecki¹³⁵, A. S. Kozhin³⁷, V. A. Kramarenko³⁷, G. Kramberger⁹³, P. Kramer¹⁰⁰, M. W. Krasny¹²⁷,
 A. Krasznahorkay³⁶, J. W. Kraus¹⁷¹, J. A. Kremer⁴⁸, T. Kresse⁵⁰, J. Kretschmar⁹², K. Kreul¹⁸, P. Krieger¹⁵⁵,
 S. Krishnamurthy¹⁰³, M. Krivos¹³³, K. Krizka²⁰, K. Kroeninger⁴⁹, H. Kroha¹¹⁰, J. Kroll¹³¹, J. Kroll¹²⁸,
 K. S. Krowpman¹⁰⁷, U. Kruchonak³⁸, H. Krüger²⁴, N. Krumnack⁸¹, M. C. Kruse⁵¹, J. A. Krzysiak⁸⁷,
 O. Kuchinskaia³⁷, S. Kuday^{3a}, S. Kuehn³⁶, R. Kuesters⁵⁴, T. Kuhl⁴⁸, V. Kukhtin³⁷, Y. Kulchitsky^{37,1},
 S. Kuleshov^{137d,137b}, M. Kumar^{33g}, N. Kumari⁴⁸, A. Kupco¹³¹, T. Kupfer⁴⁹, A. Kupich³⁷, O. Kuprash⁵⁴,
 H. Kurashige⁸⁵, L. L. Kurchaninov^{156a}, O. Kurdysh⁶⁶, Y. A. Kurochkin³⁷, A. Kurova³⁷, M. Kuze¹⁵⁴,
 A. K. Kvam¹⁰³, J. Kvita¹²², T. Kwan¹⁰⁴, N. G. Kyriacou¹⁰⁶, L. A. O. Laatu¹⁰², C. Lacasta¹⁶³, F. Lacava^{75a,75b},
 H. Lacker¹⁸, D. Lacour¹²⁷, N. N. Lad⁹⁶, E. Ladygin³⁸, B. Laforge¹²⁷, T. Lagouri^{137e}, F. Z. Lahbabi^{35a}, S. Lai⁵⁵,
 I. K. Lakomic^{86a}, N. Lalloue⁶⁰, J. E. Lambert¹⁶⁵, S. Lammers⁶⁸, W. Lampl⁷, C. Lampoudis^{152,bb},
 A. N. Lancaster¹¹⁵, E. Lançon²⁹, U. Landgraf⁵⁴, M. P. J. Landon⁹⁴, V. S. Lang⁵⁴, R. J. Langenberg¹⁰³,
 O. K. B. Langrekken¹²⁵, A. J. Lankford¹⁶⁰, F. Lanni³⁶, K. Lantzsch²⁴, A. Lanza^{73a}, A. Lapertosa^{57b,57a},
 J. F. Laporte¹³⁵, T. Lari^{71a}, F. Lasagni Manghi^{23b}, M. Lassnig³⁶, V. Latonova¹³¹, A. Laudrain¹⁰⁰, A. Laurier¹⁵⁰,
 S. D. Lawlor¹³⁹, Z. Lawrence¹⁰¹, M. Lazzaroni^{71a,71b}, B. Le¹⁰¹, E. M. Le Boulicaut⁵¹, B. Leban⁹³, A. Lebedev⁸¹,
 M. LeBlanc¹⁰¹, F. Ledroit-Guillon⁶⁰, A. C. A. Lee⁹⁶, S. C. Lee¹⁴⁸, S. Lee^{47a,47b}, T. F. Lee⁹², L. L. Leeuw^{33c},
 H. P. Lefebvre⁹⁵, M. Lefebvre¹⁶⁵, C. Leggett^{17a}, G. Lehmann Miotto³⁶, M. Leigh⁵⁶, W. A. Leight¹⁰³,
 W. Leinonen¹¹³, A. Leisos^{152,cc}, M. A. L. Leite^{83c}, C. E. Leitgeb⁴⁸, R. Leitner¹³³, K. J. C. Leney⁴⁴, T. Lenz²⁴,
 S. Leone^{74a}, C. Leonidopoulos⁵², A. Leopold¹⁴⁴, C. Leroy¹⁰⁸, R. Les¹⁰⁷, C. G. Lester³², M. Levchenko³⁷,
 J. Levêque⁴, D. Levin¹⁰⁶, L. J. Levinson¹⁶⁹, M. P. Lewicki⁸⁷, D. J. Lewis⁴, A. Li⁵, B. Li^{62b}, C. Li^{62a}, C.-Q. Li^{62c},
 H. Li^{62a}, H. Li^{62b}, H. Li^{14c}, H. Li^{14b}, H. Li^{62b}, K. Li¹³⁸, L. Li^{62c}, M. Li^{14a,14e}, Q. Y. Li^{62a}, S. Li^{14a,14e},
 S. Li^{62d,62c,dd}, T. Li⁵, X. Li¹⁰⁴, Z. Li¹²⁶, Z. Li¹⁰⁴, Z. Li⁹², Z. Li^{14a,14e}, S. Liang^{14a,14e}, Z. Liang^{14a},
 M. Liberatore¹³⁵, B. Liberti^{76a}, K. Lie^{64c}, J. Lieber Marin^{83b}, H. Lien⁶⁸, K. Lin¹⁰⁷, R. E. Lindley⁷,
 J. H. Lindon², E. Lipeles¹²⁸, A. Lipniacka¹⁶, A. Lister¹⁶⁴, J. D. Little⁴, B. Liu^{14a}, B. X. Liu¹⁴², D. Liu^{62d,62c},
 J. B. Liu^{62a}, J. K. K. Liu³², K. Liu^{62d,62c}, M. Liu^{62a}, M. Y. Liu^{62a}, P. Liu^{14a}, Q. Liu^{62d,138,62c}, X. Liu^{62a},
 Y. Liu^{14d,14e}, Y. L. Liu^{62b}, Y. W. Liu^{62a}, J. Llorente Merino¹⁴², S. L. Lloyd⁹⁴, E. M. Lobodzinska⁴⁸, P. Loch⁷,
 S. Loffredo^{76a,76b}, T. Lohse¹⁸, K. Lohwasser¹³⁹, E. Loiacono⁴⁸, M. Lokajicek^{131,a}, J. D. Lomas²⁰, J. D. Long¹⁶²,
 I. Longarini¹⁶⁰, L. Longo^{70a,70b}, R. Longo¹⁶², I. Lopez Paz⁶⁷, A. Lopez Solis⁴⁸, J. Lorenz¹⁰⁹,
 N. Lorenzo Martinez⁴, A. M. Lory¹⁰⁹, G. Löschcke Centeno¹⁴⁶, O. Loseva³⁷, X. Lou^{47a,47b}, X. Lou^{14a,14e},
 A. Lounis⁶⁶, J. Love⁶, P. A. Love⁹¹, G. Lu^{14a,14e}, M. Lu⁸⁰, S. Lu¹²⁸, Y. J. Lu⁶⁵, H. J. Lubatti¹³⁸, C. Luci^{75a,75b}

- F. L. Lucio Alves^{14c}, A. Lucotte⁶⁰, F. Luehring⁶⁸, I. Luise¹⁴⁵, O. Lukianchuk⁶⁶, O. Lundberg¹⁴⁴,
 B. Lund-Jensen¹⁴⁴, N. A. Luongo¹²³, M. S. Lutz¹⁵¹, A. B. Lux²⁵, D. Lynn²⁹, H. Lyons⁹², R. Lysak¹³¹,
 E. Lytken⁹⁸, V. Lyubushkin³⁸, T. Lyubushkina³⁸, M. M. Lyukova¹⁴⁵, H. Ma²⁹, K. Ma^{62a}, L. L. Ma^{62b}, Y. Ma¹²¹,
 D. M. Mac Donell¹⁶⁵, G. Maccarrone⁵³, J. C. MacDonald¹⁰⁰, P. C. Machado De Abreu Farias^{83b}, R. Madar⁴⁰,
 W. F. Mader⁵⁰, T. Madula⁹⁶, J. Maeda⁸⁵, T. Maeno²⁹, H. Maguire¹³⁹, V. Maiboroda¹³⁵, A. Maio^{130a,130b,130d},
 K. Maj^{86a}, O. Majersky⁴⁸, S. Majewski¹²³, N. Makovec⁶⁶, V. Maksimovic¹⁵, B. Malaescu¹²⁷, Pa. Malecki⁸⁷,
 V. P. Maleev³⁷, F. Malek⁶⁰, M. Mali⁹³, D. Malito⁹⁵, U. Mallik⁸⁰, S. Maltezos¹⁰, S. Malyukov³⁸, J. Mamuzic¹³,
 G. Mancini⁵³, G. Manco^{73a,73b}, J. P. Mandalia⁹⁴, I. Mandić⁹³, L. Manhaes de Andrade Filho^{83a}, I. M. Maniatis¹⁶⁹,
 J. Manjarres Ramos^{102,ee}, D. C. Mankad¹⁶⁹, A. Mann¹⁰⁹, B. Mansoulie¹³⁵, S. Manzoni³⁶, A. Marantis^{152,cc},
 G. Marchiori⁵, M. Marcisovsky¹³¹, C. Marcon^{71a,71b}, M. Marinescu²⁰, M. Marjanovic¹²⁰, E. J. Marshall⁹¹,
 Z. Marshall^{17a}, S. Marti-Garcia¹⁶³, T. A. Martin¹⁶⁷, V. J. Martin⁵², B. Martin dit Latour¹⁶, L. Martinelli^{75a,75b},
 M. Martinez^{13,w}, P. Martinez Agullo¹⁶³, V. I. Martinez Outschoorn¹⁰³, P. Martinez Suarez¹³, S. Martin-Haugh¹³⁴,
 V. S. Martoiu^{27b}, A. C. Martyniuk⁹⁶, A. Marzin³⁶, D. Mascione^{78a,78b}, L. Masetti¹⁰⁰, T. Mashimo¹⁵³, J. Masik¹⁰¹,
 A. L. Maslennikov³⁷, L. Massa^{23b}, P. Massarotti^{72a,72b}, P. Mastrandrea^{74a,74b}, A. Mastroberardino^{43b,43a},
 T. Masubuchi¹⁵³, T. Mathisen¹⁶¹, J. Matousek¹³³, N. Matsuzawa¹⁵³, J. Maurer^{27b}, B. Maček⁹³, D. A. Maximov³⁷,
 R. Mazini¹⁴⁸, I. Maznas¹⁵², M. Mazza¹⁰⁷, S. M. Mazza¹³⁶, E. Mazzeo^{71a,71b}, C. Mc Ginn²⁹, J. P. Mc Gowan¹⁰⁴,
 S. P. Mc Kee¹⁰⁶, E. F. McDonald¹⁰⁵, A. E. McDougall¹¹⁴, J. A. Mcfayden¹⁴⁶, R. P. McGovern¹²⁸,
 G. Mchedlidze^{149b}, R. P. Mckenzie^{33g}, T. C. McLachlan⁴⁸, D. J. McLaughlin⁹⁶, S. J. McMahon¹³⁴,
 C. M. Mcpartland⁹², R. A. McPherson^{165,p}, S. Mehlhase¹⁰⁹, A. Mehta⁹², D. Melini¹⁵⁰, B. R. Mellado Garcia^{33g},
 A. H. Melo⁵⁵, F. Meloni⁴⁸, A. M. Mendes Jacques Da Costa¹⁰¹, H. Y. Meng¹⁵⁵, L. Meng⁹¹, S. Menke¹¹⁰,
 M. Mentink³⁶, E. Meoni^{43b,43a}, C. Merlassino¹²⁶, L. Merola^{72a,72b}, C. Meroni^{71a,71b}, G. Merz¹⁰⁶, O. Meshkov³⁷,
 J. Metcalfe⁶, A. S. Mete⁶, C. Meyer⁶⁸, J-P. Meyer¹³⁵, R. P. Middleton¹³⁴, L. Mijović⁵², G. Mikenberg¹⁶⁹,
 M. Mikesikova¹³¹, M. Mikuž⁹³, H. Mildner¹⁰⁰, A. Milic³⁶, C. D. Milke⁴⁴, D. W. Miller³⁹, L. S. Miller³⁴,
 A. Milov¹⁶⁹, D. A. Milstead^{47a,47b}, T. Min^{14c}, A. A. Minaenko³⁷, I. A. Minashvili^{149b}, L. Mince⁵⁹, A. I. Mincer¹¹⁷,
 B. Mindur^{86a}, M. Mineev³⁸, Y. Mino⁸⁸, L. M. Mir¹³, M. Miralles Lopez¹⁶³, M. Mironova^{17a}, A. Mishima¹⁵³,
 M. C. Missio¹¹³, A. Mitra¹⁶⁷, V. A. Mitsou¹⁶³, Y. Mitsumori¹¹¹, O. Miu¹⁵⁵, P. S. Miyagawa⁹⁴, T. Mkrtchyan^{63a},
 M. Mlinarevic⁹⁶, T. Mlinarevic⁹⁶, M. Mlynarikova³⁶, S. Mobius¹⁹, P. Moder⁴⁸, P. Mogg¹⁰⁹,
 A. F. Mohammed^{14a,14e}, S. Mohapatra⁴¹, G. Mokgatitwane^{33g}, L. Moleri¹⁶⁹, B. Mondal¹⁴¹, S. Mondal¹³²,
 K. Mönig⁴⁸, E. Monnier¹⁰², L. Monsonis Romero¹⁶³, J. Montejo Berlingen¹³, M. Montella¹¹⁹, F. Montekali^{77a,77b},
 F. Monticelli⁹⁰, S. Monzani^{69a,69c}, N. Morange⁶⁶, A. L. Moreira De Carvalho^{130a}, M. Moreno Llácer¹⁶³,
 C. Moreno Martinez⁵⁶, P. Morettini^{57b}, S. Morgenstern³⁶, M. Morii⁶¹, M. Morinaga¹⁵³, A. K. Morley³⁶,
 F. Morodei^{75a,75b}, L. Morvaj³⁶, P. Moschovakos³⁶, B. Moser³⁶, M. Mosidze^{149b}, T. Moskalets⁵⁴, P. Moskvitina¹¹³,
 J. Moss^{31,ff}, E. J. W. Moyse¹⁰³, O. Mtintsilana^{33g}, S. Muanza¹⁰², J. Mueller¹²⁹, D. Muenstermann⁹¹, R. Müller¹⁹,
 G. A. Mullier¹⁶¹, A. J. Mullin³², J. J. Mullin¹²⁸, D. P. Mungo¹⁵⁵, D. Munoz Perez¹⁶³, F. J. Munoz Sanchez¹⁰¹,
 M. Murin¹⁰¹, W. J. Murray^{167,134}, A. Murrone^{71a,71b}, J. M. Muse¹²⁰, M. Muškinja^{17a}, C. Mwewa²⁹,
 A. G. Myagkov^{37,1}, A. J. Myers⁸, A. A. Myers¹²⁹, G. Myers⁶⁸, M. Myska¹³², B. P. Nachman^{17a}, O. Nackenhorst⁴⁹,
 A. Nag⁵⁰, K. Nagai¹²⁶, K. Nagano⁸⁴, J. L. Nagle^{29,i}, E. Nagy¹⁰², A. M. Nairz³⁶, Y. Nakahama⁸⁴,
 K. Nakamura⁸⁴, K. Nakkalil⁵, H. Nanjo¹²⁴, R. Narayan⁴⁴, E. A. Narayanan¹¹², I. Naryshkin³⁷, M. Naseri³⁴,
 S. Nasri¹⁵⁹, C. Nass²⁴, G. Navarro^{22a}, J. Navarro-Gonzalez¹⁶³, R. Nayak¹⁵¹, A. Nayaz¹⁸, P. Y. Nechaeva³⁷,
 F. Nechansky⁴⁸, L. Nedic¹²⁶, T. J. Neep²⁰, A. Negri^{73a,73b}, M. Negrini^{23b}, C. Nellist¹¹⁴, C. Nelson¹⁰⁴,
 K. Nelson¹⁰⁶, S. Nemecek¹³¹, M. Nessi^{36,gg}, M. S. Neubauer¹⁶², F. Neuhaus¹⁰⁰, J. Neundorff⁴⁸, R. Newhouse¹⁶⁴,
 P. R. Newman²⁰, C. W. Ng¹²⁹, Y. W. Y. Ng⁴⁸, B. Ngair^{35e}, H. D. N. Nguyen¹⁰⁸, R. B. Nickerson¹²⁶,
 R. Nicolaidou¹³⁵, J. Nielsen¹³⁶, M. Niemeyer⁵⁵, J. Niermann^{55,36}, N. Nikiforou³⁶, V. Nikolaenko^{37,1},
 I. Nikolic-Audit¹²⁷, K. Nikolopoulos²⁰, P. Nilsson²⁹, I. Nince⁴⁸, H. R. Nindhito⁵⁶, G. Ninio¹⁵¹, A. Nisati^{75a},
 N. Nishu², R. Nisius¹¹⁰, J-E. Nitschke⁵⁰, E. K. Nkadimeng^{33g}, T. Nobe¹⁵³, D. L. Noel³², T. Nommensen¹⁴⁷,
 M. B. Norfolk¹³⁹, R. R. B. Norisam⁹⁶, B. J. Norman³⁴, J. Novak⁹³, T. Novak⁴⁸, L. Novotny¹³², R. Novotny¹¹²,
 L. Nozka¹²², K. Ntekas¹⁶⁰, N. M. J. Nunes De Moura Junior^{83b}, E. Nurse⁹⁶, J. Ocariz¹²⁷, A. Ochi⁸⁵, I. Ochoa^{130a},
 S. Oerdek⁴⁸, J. T. Offermann³⁹, A. Ogrodnik¹³³, A. Oh¹⁰¹, C. C. Ohm¹⁴⁴, H. Oide⁸⁴, R. Oishi¹⁵³,
 M. L. Ojeda⁴⁸, M. W. O'Keefe⁹², Y. Okumura¹⁵³, L. F. Oleiro Seabra^{130a}, S. A. Olivares Pino^{137d}

- D. Oliveira Damazio²⁹ D. Oliveira Goncalves^{83a} J. L. Oliver¹⁶⁰ A. Olszewski⁸⁷ Ö. O. Öncel⁵⁴ A. P. O'Neill¹⁹
A. Onofre^{130a,130e} P. U. E. Onyisi¹¹ M. J. Oreglia³⁹ G. E. Orellana⁹⁰ D. Orestano^{77a,77b} N. Orlando¹³
R. S. Orr¹⁵⁵ V. O'Shea⁵⁹ L. M. Osojnak¹²⁸ R. Ospanov^{62a} G. Otero y Garzon³⁰ H. Otono⁸⁹ P. S. Ott^{63a}
G. J. Ottino^{17a} M. Ouchrif^{35d} J. Ouellette²⁹ F. Ould-Saada¹²⁵ M. Owen⁵⁹ R. E. Owen¹³⁴ K. Y. Oyulmaz^{21a}
V. E. Ozcan^{21a} N. Ozturk⁸ S. Ozturk⁸² H. A. Pacey¹²⁶ A. Pacheco Pages¹³ C. Padilla Aranda¹³
G. Padovano^{75a,75b} S. Pagan Griso^{17a} G. Palacino⁶⁸ A. Palazzo^{70a,70b} S. Palestini³⁶ J. Pan¹⁷² T. Pan^{64a}
D. K. Panchal¹¹ C. E. Pandini¹¹⁴ J. G. Panduro Vazquez⁹⁵ H. D. Pandya¹ H. Pang^{14b} P. Pani⁴⁸
G. Panizzo^{69a,69c} L. Paolozzi⁵⁶ C. Papadatos¹⁰⁸ S. Parajuli⁴⁴ A. Paramonov⁶ C. Paraskevopoulos¹⁰
D. Paredes Hernandez^{64b} T. H. Park¹⁵⁵ M. A. Parker³² F. Parodi^{57b,57a} E. W. Parrish¹¹⁵ V. A. Parrish⁵²
J. A. Parsons⁴¹ U. Parzefall⁵⁴ B. Pascual Dias¹⁰⁸ L. Pascual Dominguez¹⁵¹ E. Pasqualucci^{75a} S. Passaggio^{57b}
F. Pastore⁹⁵ P. Pasuwan^{47a,47b} P. Patel⁸⁷ U. M. Patel⁵¹ J. R. Pater¹⁰¹ T. Pauly³⁶ J. Pearkes¹⁴³
M. Pedersen¹²⁵ R. Pedro^{130a} S. V. Peleganchuk³⁷ O. Penc³⁶ E. A. Pender⁵² H. Peng^{62a} K. E. Penski¹⁰⁹
M. Penzin³⁷ B. S. Peralva^{83d} A. P. Pereira Peixoto⁶⁰ L. Pereira Sanchez^{47a,47b} D. V. Perepelitsa^{29,i}
E. Perez Codina^{156a} M. Perganti¹⁰ L. Perini^{71a,71b,a} H. Pernegger³⁶ O. Perrin⁴⁰ K. Peters⁴⁸ R. F. Y. Peters¹⁰¹
B. A. Petersen³⁶ T. C. Petersen⁴² E. Petit¹⁰² V. Petousis¹³² C. Petridou^{152,bb} A. Petrukhin¹⁴¹ M. Pettee^{17a}
N. E. Pettersson³⁶ A. Petukhov³⁷ K. Petukhova¹³³ R. Pezoa^{137f} L. Pezzotti³⁶ G. Pezzullo¹⁷² T. M. Pham¹⁷⁰
T. Pham¹⁰⁵ P. W. Phillips¹³⁴ G. Piacquadio¹⁴⁵ E. Pianori^{17a} F. Piazza^{71a,71b} R. Piegaia³⁰ D. Pietreanu^{27b}
A. D. Pilkington¹⁰¹ M. Pinamonti^{69a,69c} J. L. Pinfold² B. C. Pinheiro Pereira^{130a} A. E. Pinto Pinoargote^{100,135}
L. Pintucci^{69a,69c} K. M. Piper¹⁴⁶ A. Pirttikoski⁵⁶ D. A. Pizzi³⁴ L. Pizzimento^{64b} A. Pizzini¹¹⁴ M.-A. Pleier²⁹
V. Plesanovs⁵⁴ V. Pleskot¹³³ E. Plotnikova³⁸ G. Poddar⁴ R. Poettgen⁹⁸ L. Poggioli¹²⁷ I. Pokharel⁵⁵
S. Polacek¹³³ G. Polesello^{73a} A. Poley^{142,156a} R. Polifka¹³² A. Polini^{23b} C. S. Pollard¹⁶⁷ Z. B. Pollock¹¹⁹
V. Polychronakos²⁹ E. Pompa Pacchi^{75a,75b} D. Ponomarenko¹¹³ L. Pontecorvo³⁶ S. Popa^{27a}
G. A. Popeneciu^{27d} A. Poreba³⁶ D. M. Portillo Quintero^{156a} S. Pospisil¹³² M. A. Postill¹³⁹ P. Postolache^{27c}
K. Potamianos¹⁶⁷ P. A. Potepa^{86a} I. N. Potrap³⁸ C. J. Potter³² H. Potti¹ T. Poulsen⁴⁸ J. Poveda¹⁶³
M. E. Pozo Astigarraga³⁶ A. Prades Ibanez¹⁶³ J. Pretel⁵⁴ D. Price¹⁰¹ M. Primavera^{70a} M. A. Principe Martin⁹⁹
R. Privara¹²² T. Procter⁵⁹ M. L. Proffitt¹³⁸ N. Proklova¹²⁸ K. Prokofiev^{64c} G. Proto¹¹⁰ S. Protopopescu²⁹
J. Proudfoot⁶ M. Przybycien^{86a} W. W. Przygoda^{86b} J. E. Puddefoot¹³⁹ D. Pudzha³⁷ D. Pyatiizbyantseva³⁷
J. Qian¹⁰⁶ D. Qichen¹⁰¹ Y. Qin¹⁰¹ T. Qiu⁵² A. Quadt⁵⁵ M. Queitsch-Maitland¹⁰¹ G. Quetant⁵⁶
R. P. Quinn¹⁶⁴ G. Rabanal Bolanos⁶¹ D. Rafanoharana⁵⁴ F. Ragusa^{71a,71b} J. L. Rainbolt³⁹ J. A. Raine⁵⁶
S. Rajagopalan²⁹ E. Ramakoti³⁷ K. Ran^{48,14e} N. P. Rapheeha^{33g} H. Rasheed^{27b} V. Raskina¹²⁷
D. F. Rassloff^{63a} S. Rave¹⁰⁰ B. Ravina⁵⁵ I. Ravinovich¹⁶⁹ M. Raymond³⁶ A. L. Read¹²⁵ N. P. Radioff¹³⁹
D. M. Rebuzzi^{73a,73b} G. Redlinger²⁹ A. S. Reed¹¹⁰ K. Reeves²⁶ J. A. Reidelsturz¹⁷¹ D. Reikher¹⁵¹ A. Rej¹⁴¹
C. Rembser³⁶ A. Renardi⁴⁸ M. Renda^{27b} M. B. Rendel¹¹⁰ F. Renner⁴⁸ A. G. Rennie¹⁶⁰ A. L. Rescia⁴⁸
S. Resconi^{71a} M. Ressegotti^{57b,57a} S. Rettie³⁶ J. G. Reyes Rivera¹⁰⁷ E. Reynolds^{17a} O. L. Rezanova³⁷
P. Reznicek¹³³ N. Ribaric⁹¹ E. Ricci^{78a,78b} R. Richter¹¹⁰ S. Richter^{47a,47b} E. Richter-Was^{86b} M. Ridel¹²⁷
S. Ridouani^{35d} P. Rieck¹¹⁷ P. Riedler³⁶ E. M. Riefel^{47a,47b} M. Rijssenbeek¹⁴⁵ A. Rimoldi^{73a,73b} M. Rimoldi⁴⁸
L. Rinaldi^{23b,23a} T. T. Rinn²⁹ M. P. Rinnagel¹⁰⁹ G. Ripellino¹⁶¹ I. Riu¹³ P. Rivadeneira⁴⁸
J. C. Rivera Vergara¹⁶⁵ F. Rizatdinova¹²¹ E. Rizvi⁹⁴ B. A. Roberts¹⁶⁷ B. R. Roberts^{17a} S. H. Robertson^{104,p}
D. Robinson³² C. M. Robles Gajardo^{137f} M. Robles Manzano¹⁰⁰ A. Robson⁵⁹ A. Rocchi^{76a,76b} C. Roda^{74a,74b}
S. Rodriguez Bosca^{63a} Y. Rodriguez Garcia^{22a} A. Rodriguez Rodriguez⁵⁴ A. M. Rodríguez Vera^{156b} S. Roe³⁶
J. T. Roemer¹⁶⁰ A. R. Roepe-Gier¹³⁶ J. Roggel¹⁷¹ O. Røhne¹²⁵ R. A. Rojas¹⁰³ C. P. A. Roland⁶⁸ J. Roloff²⁹
A. Romaniouk³⁷ E. Romano^{73a,73b} M. Romano^{23b} A. C. Romero Hernandez¹⁶² N. Rompotis⁹² L. Roos¹²⁷
S. Rosati^{75a} B. J. Rosser³⁹ E. Rossi¹²⁶ E. Rossi^{72a,72b} L. P. Rossi^{57b} L. Rossini⁵⁴ R. Rosten¹¹⁹
M. Rotaru^{27b} B. Rottler⁵⁴ C. Rougier^{102,ee} D. Rousseau⁶⁶ D. Rouso³² A. Roy¹⁶² S. Roy-Garand¹⁵⁵
A. Rozanov¹⁰² Y. Rozen¹⁵⁰ X. Ruan^{33g} A. Rubio Jimenez¹⁶³ A. J. Ruby⁹² V. H. Ruelas Rivera¹⁸
T. A. Ruggeri¹ A. Ruggiero¹²⁶ A. Ruiz-Martinez¹⁶³ A. Rummler³⁶ Z. Rurikova⁵⁴ N. A. Rusakovich³⁸
H. L. Russell¹⁶⁵ G. Russo^{75a,75b} J. P. Rutherford⁷ S. Rutherford Colmenares³² K. Rybacki⁹¹ M. Rybar¹³³
E. B. Rye¹²⁵ A. Ryzhov⁴⁴ J. A. Sabater Iglesias⁵⁶ P. Sabatini¹⁶³ L. Sabetta^{75a,75b} H. F.-W. Sadrozinski¹³⁶
F. Safai Tehrani^{75a} B. Safarzadeh Samani¹³⁴ M. Safdari¹⁴³ S. Saha¹⁶⁵ M. Sahinsoy¹¹⁰ M. Saimpert¹³⁵

M. Saito¹⁵³, T. Saito¹⁵³, D. Salamani³⁶, A. Salnikov¹⁴³, J. Salt¹⁶³, A. Salvador Salas¹³, D. Salvatore^{43b,43a},
 F. Salvatore¹⁴⁶, A. Salzburger³⁶, D. Sammel⁵⁴, D. Sampsonidis^{152,bb}, D. Sampsonidou¹²³, J. Sánchez¹⁶³,
 A. Sanchez Pineda⁴, V. Sanchez Sebastian¹⁶³, H. Sandaker¹²⁵, C. O. Sander⁴⁸, J. A. Sandesara¹⁰³, M. Sandhoff¹⁷¹,
 C. Sandoval^{22b}, D. P. C. Sankey¹³⁴, T. Sano⁸⁸, A. Sansoni⁵³, L. Santi^{75a,75b}, C. Santoni⁴⁰, H. Santos^{130a,130b},
 S. N. Santpur^{17a}, A. Santra¹⁶⁹, K. A. Saoucha^{116b}, J. G. Saraiva^{130a,130d}, J. Sardain⁷, O. Sasaki⁸⁴, K. Sato¹⁵⁷,
 C. Sauer^{63b}, F. Sauerburger⁵⁴, E. Sauvan⁴, P. Savard^{155,e}, R. Sawada¹⁵³, C. Sawyer¹³⁴, L. Sawyer⁹⁷,
 I. Sayago Galvan¹⁶³, C. Sbarra^{23b}, A. Sbrizzi^{23b,23a}, T. Scanlon⁹⁶, J. Schaarschmidt¹³⁸, P. Schacht¹¹⁰,
 U. Schäfer¹⁰⁰, A. C. Schaffer^{66,44}, D. Schaile¹⁰⁹, R. D. Schamberger¹⁴⁵, C. Scharf¹⁸, M. M. Schefer¹⁹,
 V. A. Schegelsky³⁷, D. Scheirich¹³³, F. Schenck¹⁸, M. Schernau¹⁶⁰, C. Scheulen⁵⁵, C. Schiavi^{57b,57a},
 E. J. Schioppa^{70a,70b}, M. Schioppa^{43b,43a}, B. Schlag^{143,u}, K. E. Schleicher⁵⁴, S. Schlenker³⁶, J. Schmeing¹⁷¹,
 M. A. Schmidt¹⁷¹, K. Schmieden¹⁰⁰, C. Schmitt¹⁰⁰, S. Schmitt⁴⁸, L. Schoeffel¹³⁵, A. Schoening^{63b},
 P. G. Scholer⁵⁴, E. Schopf¹²⁶, M. Schott¹⁰⁰, J. Schovancova³⁶, S. Schramm⁵⁶, F. Schroeder¹⁷¹, T. Schroer⁵⁶,
 H-C. Schultz-Coulon^{63a}, M. Schumacher⁵⁴, B. A. Schumm¹³⁶, Ph. Schune¹³⁵, A. J. Schuy¹³⁸, H. R. Schwartz¹³⁶,
 A. Schwartzman¹⁴³, T. A. Schwarz¹⁰⁶, Ph. Schwemling¹³⁵, R. Schwienhorst¹⁰⁷, A. Sciandra¹³⁶, G. Sciolla²⁶,
 F. Scuri^{74a}, C. D. Sebastiani⁹², K. Sedlaczek¹¹⁵, P. Seema¹⁸, S. C. Seidel¹¹², A. Seiden¹³⁶, B. D. Seidlitz⁴¹,
 C. Seitz⁴⁸, J. M. Seixas^{83b}, G. Sekhniaidze^{72a}, S. J. Sekula⁴⁴, L. Selem⁶⁰, N. Semprini-Cesari^{23b,23a},
 D. Sengupta⁵⁶, V. Senthikumar¹⁶³, L. Serin⁶⁶, L. Serkin^{69a,69b}, M. Sessa^{76a,76b}, H. Severini¹²⁰, F. Sforza^{57b,57a},
 A. Sfyrila⁵⁶, E. Shabalina⁵⁵, R. Shaheen¹⁴⁴, J. D. Shahinian¹²⁸, D. Shaked Renous¹⁶⁹, L. Y. Shan^{14a},
 M. Shapiro^{17a}, A. Sharma³⁶, A. S. Sharma¹⁶⁴, P. Sharma⁸⁰, S. Sharma⁴⁸, P. B. Shatalov³⁷, K. Shaw¹⁴⁶,
 S. M. Shaw¹⁰¹, A. Shcherbakova³⁷, Q. Shen^{62c,5}, P. Sherwood⁹⁶, L. Shi⁹⁶, X. Shi^{14a}, C. O. Shimmmin¹⁷²,
 J. D. Shinner⁹⁵, I. P. J. Shipsey¹²⁶, S. Shirabe^{56,gg}, M. Shiyakova^{38,hh}, J. Shlomi¹⁶⁹, M. J. Shochet³⁹, J. Shojaii¹⁰⁵,
 D. R. Shope¹²⁵, B. Shrestha¹²⁰, S. Shrestha^{119,ii}, E. M. Shrif^{33g}, M. J. Shroff¹⁶⁵, P. Sicho¹³¹, A. M. Sickles¹⁶²,
 E. Sideras Haddad^{33g}, A. Sidoti^{23b}, F. Siegert⁵⁰, Dj. Sijacki¹⁵, R. Sikora^{86a}, F. Sili⁹⁰, J. M. Silva²⁰,
 M. V. Silva Oliveira²⁹, S. B. Silverstein^{47a}, S. Simion⁶⁶, R. Simoniello³⁶, E. L. Simpson⁵⁹, H. Simpson¹⁴⁶,
 L. R. Simpson¹⁰⁶, N. D. Simpson⁹⁸, S. Simsek⁸², S. Sindhu⁵⁵, P. Sinervo¹⁵⁵, S. Singh¹⁵⁵, S. Sinha⁴⁸, S. Sinha¹⁰¹,
 M. Sioli^{23b,23a}, I. Siral³⁶, E. Sitnikova⁴⁸, S. Yu. Sivoklov^{37,a}, J. Sjölin^{47a,47b}, A. Skaf⁵⁵, E. Skorda²⁰,
 P. Skubic¹²⁰, M. Slawinska⁸⁷, V. Smakhtin¹⁶⁹, B. H. Smart¹³⁴, J. Smiesko³⁶, S. Yu. Smirnov³⁷, Y. Smirnov³⁷,
 L. N. Smirnova^{37,1}, O. Smirnova⁹⁸, A. C. Smith⁴¹, E. A. Smith³⁹, H. A. Smith¹²⁶, J. L. Smith⁹², R. Smith¹⁴³,
 M. Smizanska⁹¹, K. Smolek¹³², A. A. Snesarev³⁷, S. R. Snider¹⁵⁵, H. L. Snoek¹¹⁴, S. Snyder²⁹, R. Sobie^{165,p},
 A. Soffer¹⁵¹, C. A. Solans Sanchez³⁶, E. Yu. Soldatov³⁷, U. Soldevila¹⁶³, A. A. Solodkov³⁷, S. Solomon²⁶,
 A. Soloshenko³⁸, K. Solovieva⁵⁴, O. V. Solovyanov⁴⁰, V. Solovyev³⁷, P. Sommer³⁶, A. Sonay¹³, W. Y. Song^{156b},
 J. M. Sonneveld¹¹⁴, A. Sopczak¹³², A. L. Sopio⁹⁶, F. Sopkova^{28b}, I. R. Sotarriva Alvarez¹⁵⁴, V. Sothilingam^{63a},
 S. Sottocornola⁶⁸, R. Soualah^{116b}, Z. Soumami^{35e}, D. South⁴⁸, N. Soybelman¹⁶⁹, S. Spagnolo^{70a,70b},
 M. Spalla¹¹⁰, D. Sperlich⁵⁴, G. Spigo³⁶, S. Spinali⁹¹, D. P. Spiteri⁵⁹, M. Spousta¹³³, E. J. Staats³⁴,
 A. Stabile^{71a,71b}, R. Stamen^{63a}, A. Stampekis²⁰, M. Standke²⁴, E. Stanecka⁸⁷, M. V. Stange⁵⁰, B. Stanislaus^{17a},
 M. M. Stanitzki⁴⁸, B. Stapf⁴⁸, E. A. Starchenko³⁷, G. H. Stark¹³⁶, J. Stark^{102,ee}, D. M. Starko^{156b}, P. Staroba¹³¹,
 P. Starovoitov^{63a}, S. Stärz¹⁰⁴, R. Staszewski⁸⁷, G. Stavropoulos⁴⁶, J. Steentoft¹⁶¹, P. Steinberg²⁹,
 B. Stelzer^{142,156a}, H. J. Stelzer¹²⁹, O. Stelzer-Chilton^{156a}, H. Stenzel⁵⁸, T. J. Stevenson¹⁴⁶, G. A. Stewart³⁶,
 J. R. Stewart¹²¹, M. C. Stockton³⁶, G. Stoicea^{27b}, M. Stolarski^{130a}, S. Stonjek¹¹⁰, A. Straessner⁵⁰,
 J. Strandberg¹⁴⁴, S. Strandberg^{47a,47b}, M. Stratmann¹⁷¹, M. Strauss¹²⁰, T. Streblor¹⁰², P. Strizenec^{28b},
 R. Ströhmer¹⁶⁶, D. M. Strom¹²³, L. R. Strom⁴⁸, R. Stroynowski⁴⁴, A. Strubig^{47a,47b}, S. A. Stucci²⁹, B. Stugu¹⁶,
 J. Stupak¹²⁰, N. A. Styles⁴⁸, D. Su¹⁴³, S. Su^{62a}, W. Su^{62d}, X. Su^{62a,66}, K. Sugizaki¹⁵³, V. V. Sulini³⁷,
 M. J. Sullivan⁹², D. M. S. Sultan^{78a,78b}, L. Sultanaliyeva³⁷, S. Sultansoy^{3b}, T. Sumida⁸⁸, S. Sun¹⁰⁶, S. Sun¹⁷⁰,
 O. Sunneborn Gudnadottir¹⁶¹, N. Sur¹⁰², M. R. Sutton¹⁴⁶, H. Suzuki¹⁵⁷, M. Svatos¹³¹, M. Swiatlowski^{156a},
 T. Swirski¹⁶⁶, I. Sykora^{28a}, M. Sykora¹³³, T. Sykora¹³³, D. Ta¹⁰⁰, K. Tackmann^{48,jj}, A. Taffard¹⁶⁰,
 R. Tahirout^{156a}, J. S. Tafoya Vargas⁶⁶, E. P. Takeva⁵², Y. Takubo⁸⁴, M. Talby¹⁰², A. A. Talyshev³⁷, K. C. Tam^{64b},
 N. M. Tamir¹⁵¹, A. Tanaka¹⁵³, J. Tanaka¹⁵³, R. Tanaka⁶⁶, M. Tanasini^{57b,57a}, Z. Tao¹⁶⁴, S. Tapia Araya^{137f},
 S. Tapprogge¹⁰⁰, A. Tarek Abouelfadl Mohamed¹⁰⁷, S. Tarem¹⁵⁰, K. Tariq^{14a}, G. Tarna^{102,27b}, G. F. Tartarelli^{71a},
 P. Tas¹³³, M. Tasevsky¹³¹, E. Tassi^{43b,43a}, A. C. Tate¹⁶², G. Tateno¹⁵³, Y. Tayalati^{35e,kk}, G. N. Taylor¹⁰⁵

- W. Taylor^{156b}, H. Teagle⁹², A. S. Tee¹⁷⁰, R. Teixeira De Lima¹⁴³, P. Teixeira-Dias⁹⁵, J. J. Teoh¹⁵⁵, K. Terashi¹⁵³, J. Terron⁹⁹, S. Terzo¹³, M. Testa⁵³, R. J. Teuscher^{155,p}, A. Thaler⁷⁹, O. Theiner⁵⁶, N. Themistokleous⁵², T. Theveniaux-Pelzer¹⁰², O. Thielmann¹⁷¹, D. W. Thomas⁹⁵, J. P. Thomas²⁰, E. A. Thompson^{17a}, P. D. Thompson²⁰, E. Thomson¹²⁸, Y. Tian⁵⁵, V. Tikhomirov^{37,1}, Yu. A. Tikhonov³⁷, S. Timoshenko³⁷, D. Timoshyn¹³³, E. X. L. Ting¹, P. Tipton¹⁷², S. H. Tlou^{33g}, A. Tnourji⁴⁰, K. Todome¹⁵⁴, S. Todorova-Nova¹³³, S. Todt⁵⁰, M. Togawa⁸⁴, J. Tojo⁸⁹, S. Tokár^{28a}, K. Tokushuku⁸⁴, O. Toldaiev⁶⁸, R. Tombs³², M. Tomoto^{84,111}, L. Tompkins^{143,u}, K. W. Topolnicki^{86b}, E. Torrence¹²³, H. Torres^{102,ee}, E. Torró Pastor¹⁶³, M. Toscani³⁰, C. Toscirri³⁹, M. Tost¹¹, D. R. Tovey¹³⁹, A. Traet¹⁶, I. S. Trandafir^{27b}, T. Trefzger¹⁶⁶, A. Tricoli²⁹, I. M. Trigger^{156a}, S. Trincas-Duvoid¹²⁷, D. A. Trischuk²⁶, B. Trocmé⁶⁰, C. Troncon^{71a}, L. Truong^{33c}, M. Trzebinski⁸⁷, A. Trzupke⁸⁷, F. Tsai¹⁴⁵, M. Tsai¹⁰⁶, A. Tsiamis^{152,bb}, P. V. Tsiareshka³⁷, S. Tsigaridas^{156a}, A. Tsirigotis^{152,cc}, V. Tsiskaridze¹⁵⁵, E. G. Tskhadadze^{149a}, M. Tsopoulou^{152,bb}, Y. Tsujikawa⁸⁸, I. I. Tsukerman³⁷, V. Tsulaia^{17a}, S. Tsuno⁸⁴, O. Tsur¹⁵⁰, K. Tsurii¹¹⁸, D. Tsybychev¹⁴⁵, Y. Tu^{64b}, A. Tudorache^{27b}, V. Tudorache^{27b}, A. N. Tuna³⁶, S. Turchikhin^{57b,57a}, I. Turk Cakir^{3a}, R. Turra^{71a}, T. Turtuvshin^{38,11}, P. M. Tuts⁴¹, S. Tzamaras^{152,bb}, P. Tzanis¹⁰, E. Tzovara¹⁰⁰, F. Ukegawa¹⁵⁷, P. A. Ulloa Poblete^{137c,137b}, E. N. Umaka²⁹, G. Unal³⁶, M. Unal¹¹, A. Undrus²⁹, G. Unel¹⁶⁰, J. Urban^{28b}, P. Urquijo¹⁰⁵, G. Usai⁸, R. Ushioda¹⁵⁴, M. Usman¹⁰⁸, Z. Uysal^{21b}, L. Vacavant¹⁰², V. Vacek¹³², B. Vachon¹⁰⁴, K. O. H. Vadla¹²⁵, T. Vafeiadis³⁶, A. Vaitkus⁹⁶, C. Valderanis¹⁰⁹, E. Valdes Santurio^{47a,47b}, M. Valente^{156a}, S. Valentinetti^{23b,23a}, A. Valero¹⁶³, E. Valiente Moreno¹⁶³, A. Vallier^{102,ee}, J. A. Valls Ferrer¹⁶³, D. R. Van Arneeman¹¹⁴, T. R. Van Daalen¹³⁸, A. Van Der Graaf⁴⁹, P. Van Gemmeren⁶, M. Van Rijnbach^{125,36}, S. Van Stroud⁹⁶, I. Van Vulpen¹¹⁴, M. Vanadia^{76a,76b}, W. Vandelli³⁶, M. Vandenbroucke¹³⁵, E. R. Vandewall¹²¹, D. Vannicola¹⁵¹, L. Vannoli^{57b,57a}, R. Vari^{75a}, E. W. Varnes⁷, C. Varni^{17b}, T. Varol¹⁴⁸, D. Varouchas⁶⁶, L. Varriale¹⁶³, K. E. Varvell¹⁴⁷, M. E. Vasile^{27b}, L. Vaslin⁴⁰, G. A. Vazquez¹⁶⁵, A. Vasyukov³⁸, F. Vazeille⁴⁰, T. Vazquez Schroeder³⁶, J. Veatch³¹, V. Vecchio¹⁰¹, M. J. Veen¹⁰³, I. Veliscek¹²⁶, L. M. Veloce¹⁵⁵, F. Veloso^{130a,130c}, S. Veneziano^{75a}, A. Ventura^{70a,70b}, S. Ventura Gonzalez¹³⁵, A. Verbytskyi¹¹⁰, M. Verducci^{74a,74b}, C. Vergis²⁴, M. Verissimo De Araujo^{83b}, W. Verkerke¹¹⁴, J. C. Vermeulen¹¹⁴, C. Vernieri¹⁴³, M. Vessella¹⁰³, M. C. Vetterli^{142,e}, A. Vgenopoulos^{152,bb}, N. Viaux Maira^{137f}, T. Vickey¹³⁹, O. E. Vickey Boeriu¹³⁹, G. H. A. Viehhauser¹²⁶, L. Vigani^{63b}, M. Villa^{23b,23a}, M. Villaplana Perez¹⁶³, E. M. Villhauer⁵², E. Vilucchi⁵³, M. G. Vinciter³⁴, G. S. Virdee²⁰, A. Vishwakarma⁵², A. Visibile¹¹⁴, C. Vittori³⁶, I. Vivarelli¹⁴⁶, E. Voevodina¹¹⁰, F. Vogel¹⁰⁹, P. Vokac¹³², Yu. Volkotrub^{86a}, J. Von Ahnen⁴⁸, E. Von Toerne²⁴, B. Vormwald³⁶, V. Vorobel¹³³, K. Vorobev³⁷, M. Vos¹⁶³, K. Voss¹⁴¹, J. H. Vosseveld⁹², M. Vozak¹¹⁴, L. Vozdecky⁹⁴, N. Vranjes¹⁵, M. Vranjes Milosavljevic¹⁵, M. Vreeswijk¹¹⁴, R. Vuillermet³⁶, O. Vujinovic¹⁰⁰, I. Vukotic³⁹, S. Wada¹⁵⁷, C. Wagner¹⁰³, J. M. Wagner^{17a}, W. Wagner¹⁷¹, S. Wahdan¹⁷¹, H. Wahlberg⁹⁰, M. Wakida¹¹¹, J. Walder¹³⁴, R. Walker¹⁰⁹, W. Walkowiak¹⁴¹, A. Wall¹²⁸, T. Wamorkar⁶, A. Z. Wang¹⁷⁰, C. Wang¹⁰⁰, C. Wang^{62c}, H. Wang^{17a}, J. Wang^{64a}, R.-J. Wang¹⁰⁰, R. Wang⁶¹, R. Wang⁶, S. M. Wang¹⁴⁸, S. Wang^{62b}, T. Wang^{62a}, W. T. Wang⁸⁰, W. Wang^{14a}, X. Wang^{14c}, X. Wang¹⁶², X. Wang^{62c}, Y. Wang^{62d}, Y. Wang^{14c}, Z. Wang¹⁰⁶, Z. Wang^{62d,51,62c}, Z. Wang¹⁰⁶, A. Warburton¹⁰⁴, R. J. Ward²⁰, N. Warrack⁵⁹, A. T. Watson²⁰, H. Watson⁵⁹, M. F. Watson²⁰, E. Watton^{59,134}, G. Watts¹³⁸, B. M. Waugh⁹⁶, C. Weber²⁹, H. A. Weber¹⁸, M. S. Weber¹⁹, S. M. Weber^{63a}, C. Wei^{62a}, Y. Wei¹²⁶, A. R. Weidberg¹²⁶, E. J. Weik¹¹⁷, J. Weingarten⁴⁹, M. Weirich¹⁰⁰, C. Weiser⁵⁴, C. J. Wells⁴⁸, T. Wenaus²⁹, B. Wendland⁴⁹, T. Wengler³⁶, N. S. Wenke¹¹⁰, N. Wermes²⁴, M. Wessels^{63a}, A. M. Wharton⁹¹, A. S. White⁶¹, A. White⁸, M. J. White¹, D. Whiteson¹⁶⁰, L. Wickremasinghe¹²⁴, W. Wiedenmann¹⁷⁰, C. Wiel⁵⁰, M. WIELERS¹³⁴, C. Wigglesworth⁴², D. J. Wilbern¹²⁰, H. G. Wilkens³⁶, D. M. Williams⁴¹, H. H. Williams¹²⁸, S. Williams³², S. Willocq¹⁰³, B. J. Wilson¹⁰¹, P. J. Windischhofer³⁹, F. I. Winkel³⁰, F. Winklmeier¹²³, B. T. Winter⁵⁴, J. K. Winter¹⁰¹, M. Wittgen¹⁴³, M. Wobisch⁹⁷, Z. Wolffs¹¹⁴, J. Wollrath¹⁶⁰, M. W. Wolter⁸⁷, H. Wolters^{130a,130c}, A. F. Wongel⁴⁸, S. D. Worm⁴⁸, B. K. Wosiek⁸⁷, K. W. Woźniak⁸⁷, S. Wozniowski⁵⁵, K. Wraight⁵⁹, C. Wu²⁰, J. Wu^{14a,14e}, M. Wu^{64a}, M. Wu¹¹³, S. L. Wu¹⁷⁰, X. Wu⁵⁶, Y. Wu^{62a}, Z. Wu¹³⁵, J. Wuerzinger^{110,x}, T. R. Wyatt¹⁰¹, B. M. Wynne⁵², S. Xella⁴², L. Xia^{14c}, M. Xia^{14b}, J. Xiang^{64c}, M. Xie^{62a}, X. Xie^{62a}, S. Xin^{14a,14e}, A. Xiong¹²³, J. Xiong^{17a}, D. Xu^{14a}, H. Xu^{62a}, L. Xu^{62a}, R. Xu¹²⁸, T. Xu¹⁰⁶, Y. Xu^{14b}, Z. Xu⁵², Z. Xu^{14a}, Z. Xu^{14c}, B. Yabsley¹⁴⁷, S. Yacoob^{33a}, Y. Yamaguchi¹⁵⁴, E. Yamashita¹⁵³, H. Yamauchi¹⁵⁷, T. Yamazaki^{17a}, Y. Yamazaki⁸⁵, J. Yan^{62c}, S. Yan¹²⁶, Z. Yan²⁵, H. J. Yang^{62c,62d}, H. T. Yang^{62a}, S. Yang^{62a}

T. Yang^{64c}, X. Yang^{62a}, X. Yang^{14a}, Y. Yang⁴⁴, Y. Yang^{62a}, Z. Yang^{62a}, W.-M. Yao^{17a}, Y. C. Yap⁴⁸, H. Ye^{14c},
 H. Ye⁵⁵, J. Ye^{14a}, S. Ye²⁹, X. Ye^{62a}, Y. Yeh⁹⁶, I. Yeletsikh³⁸, B. K. Yeo^{17b}, M. R. Yexley⁹⁶, P. Yin⁴¹,
 K. Yorita¹⁶⁸, S. Younas^{27b}, C. J. S. Young³⁶, C. Young¹⁴³, C. Yu^{14a,14e,mm}, Y. Yu^{62a}, M. Yuan¹⁰⁶, R. Yuan^{62b},
 L. Yue⁹⁶, M. Zaazoua^{62a}, B. Zabinski⁸⁷, E. Zaid⁵², T. Zakareishvili^{149b}, N. Zakharchuk³⁴, S. Zambito⁵⁶,
 J. A. Zamora Saa^{137d,137b}, J. Zang¹⁵³, D. Zanzi⁵⁴, O. Zaplatilek¹³², C. Zeitnitz¹⁷¹, H. Zeng^{14a}, J. C. Zeng¹⁶²,
 D. T. Zenger Jr.²⁶, O. Zenin³⁷, T. Ženiš^{28a}, S. Zenz⁹⁴, S. Zerradi^{35a}, D. Zerwas⁶⁶, M. Zhai^{14a,14e}, B. Zhang^{14c},
 D. F. Zhang¹³⁹, J. Zhang^{62b}, J. Zhang⁶, K. Zhang^{14a,14e}, L. Zhang^{14c}, P. Zhang^{14a,14e}, R. Zhang¹⁷⁰, S. Zhang¹⁰⁶,
 T. Zhang¹⁵³, X. Zhang^{62c}, X. Zhang^{62b}, Y. Zhang^{62c,5}, Y. Zhang⁹⁶, Z. Zhang^{17a}, Z. Zhang⁶⁶, H. Zhao¹³⁸,
 P. Zhao⁵¹, T. Zhao^{62b}, Y. Zhao¹³⁶, Z. Zhao^{62a}, A. Zhemchugov³⁸, J. Zheng^{14c}, K. Zheng¹⁶², X. Zheng^{62a},
 Z. Zheng¹⁴³, D. Zhong¹⁶², B. Zhou¹⁰⁶, H. Zhou⁷, N. Zhou^{62c}, Y. Zhou⁷, C. G. Zhu^{62b}, J. Zhu¹⁰⁶, Y. Zhu^{62c},
 Y. Zhu^{62a}, X. Zhuang^{14a}, K. Zhukov³⁷, V. Zhulanov³⁷, N. I. Zimine³⁸, J. Zinsser^{63b}, M. Ziolkowski¹⁴¹,
 L. Živković¹⁵, A. Zoccoli^{23b,23a}, K. Zoch⁶¹, T. G. Zorbas¹³⁹, O. Zormpa⁴⁶, W. Zou⁴¹ and L. Zwalinski³⁶

(ATLAS Collaboration)

A. Hayrapetyan,¹ A. Tumasyan^{1,nn}, W. Adam², J. W. Andrejkovic², T. Bergauer², S. Chatterjee², K. Damanakis²,
 M. Dragicevic², A. Escalante Del Valle², P. S. Hussain², M. Jeitler^{2,oo}, N. Krammer², A. Li², D. Liko²,
 I. Mikulec², J. Schieck^{2,oo}, R. Schöfbeck², D. Schwarz², M. Sonawane², S. Templ², W. Waltenberger²,
 C.-E. Wulz^{2,oo}, M. R. Darwish^{3,pp}, T. Janssen³, P. Van Mechelen³, E. S. Bols⁴, J. D'Hondt⁴, S. Dansana⁴,
 A. De Moor⁴, M. Delcourt⁴, H. El Faham⁴, S. Lowette⁴, I. Makarenko⁴, D. Müller⁴, A. R. Sahasransu⁴,
 S. Tavernier⁴, M. Tytgat^{4,qq}, S. Van Putte⁴, D. Vannerom⁴, B. Clerbaux⁵, G. De Lentdecker⁵, L. Favart⁵,
 D. Hohov⁵, J. Jaramillo⁵, A. Khalilzadeh⁵, K. Lee⁵, M. Mahdavihorrani⁵, A. Malara⁵, S. Paredes⁵, L. Pétré⁵,
 N. Postiau⁵, L. Thomas⁵, M. Vanden Bemden⁵, C. Vander Velde⁵, P. Vanlaer⁵, M. De Coen⁶, D. Dobur⁶,
 Y. Hong⁶, J. Knolle⁶, L. Lambrecht⁶, G. Mestdach⁶, C. Rendón⁶, A. Samalan⁶, K. Skovpen⁶, N. Van Den Bossche⁶,
 L. Wezenbeek⁶, A. Benecke⁷, G. Bruno⁷, C. Caputo⁷, C. Delaere⁷, I. S. Donertas⁷, A. Giammanco⁷,
 K. Jaffel⁷, Sa. Jain⁷, V. Lemaître⁷, J. Lidrych⁷, P. Mastrapasqua⁷, K. Mondal⁷, T. T. Tran⁷, S. Wertz⁷,
 G. A. Alves⁸, E. Coelho⁸, C. Hensel⁸, T. Menezes De Oliveira⁸, A. Moraes⁸, P. Rebello Teles⁸, M. Soeiro⁸,
 W. L. Aldá Júnior⁹, M. Alves Gallo Pereira⁹, M. Barroso Ferreira Filho⁹, H. Brandao Malbouisson⁹, W. Carvalho⁹,
 J. Chinellato^{9,rr}, E. M. Da Costa⁹, G. G. Da Silva^{9,ss}, D. De Jesus Damiao⁹, S. Fonseca De Souza⁹, J. Martins^{9,tt},
 C. Mora Herrera⁹, K. Mota Amarilo⁹, L. Mundim⁹, H. Nogima⁹, A. Santoro⁹, A. Sznajder⁹, M. Thiel⁹,
 A. Vilela Pereira⁹, C. A. Bernardes^{10,ss}, L. Calligaris¹⁰, T.R. Fernandez Perez Tomei¹⁰, E. M. Gregores¹⁰,
 P. G. Mercadante¹⁰, S. F. Novaes¹⁰, B. Orzari¹⁰, Sandra S. Padula¹⁰, A. Aleksandrov¹¹, G. Antchev¹¹,
 R. Hadjiiska¹¹, P. Iaydjiev¹¹, M. Misheva¹¹, M. Shopova¹¹, G. Sultanov¹¹, A. Dimitrov¹², L. Litov¹²,
 B. Pavlov¹², P. Petkov¹², A. Petrov¹², E. Shumka¹², S. Keshri¹³, S. Thakur¹³, T. Cheng¹⁴, Q. Guo¹⁴,
 T. Javaid¹⁴, M. Mittal¹⁴, L. Yuan¹⁴, G. Bauer^{15,uu,vv}, Z. Hu¹⁵, J. Liu¹⁵, K. Yi^{15,uu,ww}, G. M. Chen^{16,xx},
 H. S. Chen^{16,xx}, M. Chen^{16,xx}, F. Iemmi¹⁶, C. H. Jiang¹⁶, A. Kapoor^{16,yy}, H. Liao¹⁶, Z.-A. Liu^{16,zz}, F. Monti¹⁶,
 M. A. Shahzad^{16,xx}, R. Sharma^{16,aaa}, J. N. Song^{16,zz}, J. Tao¹⁶, C. Wang^{16,xx}, J. Wang¹⁶, Z. Wang^{16,xx}, H. Zhang¹⁶,
 A. Agapitos¹⁷, Y. Ban¹⁷, A. Levin¹⁷, C. Li¹⁷, Q. Li¹⁷, Y. Mao¹⁷, S. J. Qian¹⁷, X. Sun¹⁷, D. Wang¹⁷, H. Yang¹⁷,
 L. Zhang¹⁷, M. Zhang¹⁷, C. Zhou¹⁷, Z. You¹⁸, N. Lu¹⁹, X. Gao^{20,bbb}, D. Leggat²⁰, H. Okawa²⁰, Y. Zhang²⁰,
 Z. Lin²¹, C. Lu²¹, M. Xiao²¹, C. Avila²², D. A. Barbosa Trujillo²², A. Cabrera²², C. Florez²², J. Fraga²²,
 J. A. Reyes Vega²², J. Mejia Guisao²³, F. Ramirez²³, M. Rodriguez²³, J. D. Ruiz Alvarez²³, D. Giljanovic²⁴,
 N. Godinovic²⁴, D. Lelas²⁴, A. Sculac²⁴, M. Kovac²⁵, T. Sculac²⁵, P. Bargassa²⁶, V. Brigljevic²⁶,
 B. K. Chitroda²⁶, D. Ferencek²⁶, S. Mishra²⁶, A. Starodumov^{26,ccc}, T. Susa²⁶, A. Attikis²⁷, K. Christoforou²⁷,
 S. Konstantinou²⁷, J. Mousa²⁷, C. Nicolaou²⁷, F. Ptochos²⁷, P. A. Razis²⁷, H. Rykaczewski²⁷, H. Saka²⁷,
 A. Stepennov²⁷, M. Finger²⁸, M. Finger Jr.²⁸, A. Kveton²⁸, E. Ayala²⁹, E. Carrera Jarrin³⁰, Y. Assran^{31,ddd,eee},
 S. Elgammal^{31,eee}, M. Abdullah Al-Mashad³², M. A. Mahmoud³², R. K. Dewanjee^{33,fff}, K. Ehataht³³, M. Kadastik³³,
 T. Lange³³, S. Nandan³³, C. Nielsen³³, J. Pata³³, M. Raidal³³, L. Tani³³, C. Veelken³³, H. Kirschenmann³⁴,
 K. Osterberg³⁴, M. Voutilainen³⁴, S. Bharthuar³⁵, E. Brücken³⁵, F. Garcia³⁵, J. Havukainen³⁵,
 K. T. S. Kallonen³⁵, R. Kinnunen³⁵, T. Lampén³⁵, K. Lassila-Perini³⁵, S. Lehti³⁵, T. Lindén³⁵, M. Lotti³⁵

- L. Martikainen³⁵, M. Myllymäki³⁵, M. m. Rantanen³⁵, H. Siikonen³⁵, E. Tuominen³⁵, J. Tuominiemi³⁵,
 P. Luukka³⁶, H. Petrow³⁶, T. Tuuva^{36,a}, M. Besancon³⁷, F. Couderc³⁷, M. Dejardin³⁷, D. Denegri³⁷, J. L. Faure³⁷,
 F. Ferri³⁷, S. Ganjour³⁷, P. Gras³⁷, G. Hamel de Monchenault³⁷, V. Lohezic³⁷, J. Malcles³⁷, J. Rander³⁷,
 A. Rosowsky³⁷, M. Ö. Sahin³⁷, A. Savoy-Navarro^{37,ggg}, P. Simkina³⁷, M. Titov³⁷, M. Tornago³⁷,
 C. Baldenegro Barrera³⁸, F. Beaudette³⁸, A. Buchot Perraguin³⁸, P. Busson³⁸, A. Cappati³⁸, C. Charlot³⁸,
 F. Damas³⁸, O. Davignon³⁸, A. De Wit³⁸, G. Falmagne³⁸, B. A. Fontana Santos Alves³⁸, S. Ghosh³⁸,
 A. Gilbert³⁸, R. Granier de Cassagnac³⁸, A. Hakimi³⁸, B. Harikrishnan³⁸, L. Kalipoliti³⁸, G. Liu³⁸, J. Motta³⁸,
 M. Nguyen³⁸, C. Ochando³⁸, L. Portales³⁸, R. Salerno³⁸, U. Sarkar³⁸, J. B. Sauvan³⁸, Y. Sirois³⁸,
 A. Tarabini³⁸, E. Vernazza³⁸, A. Zabi³⁸, A. Zghiche³⁸, J.-L. Agram^{39,hhh}, J. Andrea³⁹, D. Appar³⁹,
 D. Bloch³⁹, J.-M. Brom³⁹, E. C. Chabert³⁹, C. Collard³⁹, S. Falke³⁹, U. Goerlach³⁹, C. Grimault³⁹,
 R. Haeberle³⁹, A.-C. Le Bihan³⁹, G. Saha³⁹, M. A. Sessini³⁹, P. Van Hove³⁹, S. Beauceron⁴⁰, B. Blancon⁴⁰,
 G. Boudoul⁴⁰, N. Chanon⁴⁰, J. Choi⁴⁰, D. Contardo⁴⁰, P. Depasse⁴⁰, C. Dozen^{40,iii}, H. El Mamouni⁴⁰, J. Fay⁴⁰,
 S. Gascon⁴⁰, M. Gouzevitch⁴⁰, C. Greenberg⁴⁰, G. Grenier⁴⁰, B. Ille⁴⁰, I. B. Laktineh⁴⁰, M. Lethuillier⁴⁰,
 L. Mirabito⁴⁰, S. Perries⁴⁰, A. Purohit⁴⁰, M. Vander Donckt⁴⁰, P. Verdier⁴⁰, J. Xiao⁴⁰, I. Lomidze⁴¹,
 T. Toriashvili^{41,jjj}, Z. Tsamalaidze^{41,ccc}, V. Botta⁴², L. Feld⁴², K. Klein⁴², M. Lipinski⁴², D. Meuser⁴²,
 A. Pauls⁴², N. Röwert⁴², M. Teroerde⁴², S. Diekmann⁴³, A. Dodonova⁴³, N. Eich⁴³, D. Eliseev⁴³, F. Engelke⁴³,
 M. Erdmann⁴³, P. Fackeldey⁴³, B. Fischer⁴³, T. Hebbeker⁴³, K. Hoepfner⁴³, F. Ivone⁴³, A. Jung⁴³, M. y. Lee⁴³,
 L. Mastrolorenzo⁴³, M. Merschmeyer⁴³, A. Meyer⁴³, S. Mukherjee⁴³, D. Noll⁴³, A. Novak⁴³, F. Nowotny⁴³,
 A. Pozdnyakov⁴³, Y. Rath⁴³, W. Redjeb⁴³, F. Rehm⁴³, H. Reithler⁴³, V. Sarkisovi⁴³, A. Schmidt⁴³, A. Sharma⁴³,
 J. L. Spah⁴³, A. Stein⁴³, F. Torres Da Silva De Araujo^{43,kkk}, L. Vigilante⁴³, S. Wiedenbeck⁴³, S. Zaleski⁴³,
 C. Dziwok⁴⁴, G. Flügge⁴⁴, W. Haj Ahmad^{44,lll}, T. Kress⁴⁴, A. Nowack⁴⁴, O. Pooth⁴⁴, A. Stahl⁴⁴, T. Ziemons⁴⁴,
 A. Zotz⁴⁴, H. Aarup Petersen⁴⁵, M. Aldaya Martin⁴⁵, J. Alimena⁴⁵, S. Amoroso⁴⁵, Y. An⁴⁵, S. Baxter⁴⁵,
 M. Bayatmakou⁴⁵, H. Becerril Gonzalez⁴⁵, O. Behnke⁴⁵, A. Belvedere⁴⁵, S. Bhattacharya⁴⁵, F. Blekman^{45,mmm},
 K. Borras^{45,nnn}, D. Brunner⁴⁵, A. Campbell⁴⁵, A. Cardini⁴⁵, C. Cheng⁴⁵, F. Colombina⁴⁵,
 S. Consuegra Rodríguez⁴⁵, G. Correia Silva⁴⁵, M. De Silva⁴⁵, G. Eckerlin⁴⁵, D. Eckstein⁴⁵, L. I. Estevez Banos⁴⁵,
 O. Filatov⁴⁵, E. Gallo^{45,mmm}, A. Geiser⁴⁵, A. Giralddi⁴⁵, G. Greau⁴⁵, V. Guglielmi⁴⁵, M. Guthoff⁴⁵,
 A. Hinzmann⁴⁵, A. Jafari^{45,ooo}, L. Jeppe⁴⁵, N. Z. Jomhari⁴⁵, B. Kaech⁴⁵, M. Kasemann⁴⁵, H. Kaveh⁴⁵,
 C. Kleinwort⁴⁵, R. Kogler⁴⁵, M. Komm⁴⁵, D. Krücker⁴⁵, W. Lange⁴⁵, D. Leyva Pernia⁴⁵, K. Lipka^{45,ppp},
 W. Lohmann^{45,qqq}, R. Mankel⁴⁵, I.-A. Melzer-Pellmann⁴⁵, M. Mendizabal Morentin⁴⁵, J. Metwally⁴⁵,
 A. B. Meyer⁴⁵, G. Milella⁴⁵, A. Mussgiller⁴⁵, L. P. NAIR⁴⁵, A. Nürnberg⁴⁵, Y. Otard⁴⁵, J. Park⁴⁵,
 D. Pérez Adán⁴⁵, E. Ranken⁴⁵, A. Raspereza⁴⁵, B. Ribeiro Lopes⁴⁵, J. Rübenach⁴⁵, A. Saggio⁴⁵,
 M. Scham^{45,rrr,nnn}, S. Schnake^{45,nnn}, P. Schütze⁴⁵, C. Schwanenberger^{45,mmm}, D. Selivanova⁴⁵,
 M. Shchedrolosiev⁴⁵, R. E. Sosa Ricardo⁴⁵, D. Stafford⁴⁵, F. Vazzoler⁴⁵, A. Ventura Barroso⁴⁵, R. Walsh⁴⁵,
 Q. Wang⁴⁵, Y. Wen⁴⁵, K. Wichmann⁴⁵, L. Wiens^{45,nnn}, C. Wissing⁴⁵, Y. Yang⁴⁵, A. Zimermmne Castro Santos⁴⁵,
 A. Albrecht⁴⁶, S. Albrecht⁴⁶, M. Antonello⁴⁶, S. Bein⁴⁶, L. Benato⁴⁶, M. Bonanomi⁴⁶, P. Connor⁴⁶, M. Eich⁴⁶,
 K. El Morabit⁴⁶, Y. Fischer⁴⁶, A. Fröhlich⁴⁶, C. Garbers⁴⁶, E. Garutti⁴⁶, A. Grohsjean⁴⁶, M. Hajheidari⁴⁶,
 J. Haller⁴⁶, H. R. Jabusch⁴⁶, G. Kasieczka⁴⁶, P. Keicher⁴⁶, R. Klanner⁴⁶, W. Korcar⁴⁶, T. Kramer⁴⁶,
 V. Kutzner⁴⁶, F. Labe⁴⁶, J. Lange⁴⁶, A. Lobanov⁴⁶, C. Matthies⁴⁶, A. Mehta⁴⁶, L. Moureaux⁴⁶, M. Mrowietz⁴⁶,
 A. Nigamova⁴⁶, Y. Nissan⁴⁶, A. Paasch⁴⁶, K. J. Pena Rodriguez⁴⁶, T. Quadfasel⁴⁶, B. Raciti⁴⁶, M. Rieger⁴⁶,
 D. Savoie⁴⁶, J. Schindler⁴⁶, P. Schleper⁴⁶, M. Schröder⁴⁶, J. Schwandt⁴⁶, M. Sommerhalder⁴⁶, H. Stadie⁴⁶,
 G. Steinbrück⁴⁶, A. Tews⁴⁶, M. Wolf⁴⁶, S. Brommer⁴⁷, M. Burkart⁴⁷, E. Butz⁴⁷, T. Chwalek⁴⁷, A. Dierlamm⁴⁷,
 A. Droll⁴⁷, N. Faltermann⁴⁷, M. Giffels⁴⁷, A. Gottmann⁴⁷, F. Hartmann^{47,sss}, R. Hofsaess⁴⁷, M. Horzela⁴⁷,
 U. Husemann⁴⁷, J. Kieseler⁴⁷, M. Klute⁴⁷, R. Koppenhöfer⁴⁷, J. M. Lawhorn⁴⁷, M. Link⁴⁷, A. Lintuluoto⁴⁷,
 S. Maier⁴⁷, S. Mitra⁴⁷, M. Mormile⁴⁷, Th. Müller⁴⁷, M. Neukum⁴⁷, M. Oh⁴⁷, M. Presilla⁴⁷, G. Quast⁴⁷,
 K. Rabbertz⁴⁷, B. Regnery⁴⁷, N. Shadskiy⁴⁷, I. Shvetsov⁴⁷, H. J. Simonis⁴⁷, N. Trevisani⁴⁷, R. Ulrich⁴⁷,
 J. van der Linden⁴⁷, R. F. Von Cube⁴⁷, M. Wassmer⁴⁷, S. Wieland⁴⁷, F. Wittig⁴⁷, R. Wolf⁴⁷, S. Wunsch⁴⁷,
 X. Zuo⁴⁷, G. Anagnostou⁴⁸, P. Assiouras⁴⁸, G. Daskalakis⁴⁸, A. Kyriakis⁴⁸, A. Papadopoulos^{48,sss}, A. Stakia⁴⁸,
 P. Kontaxakis⁴⁹, G. Melachroinos⁴⁹, A. Panagiotou⁴⁹, I. Papavergou⁴⁹, I. Paraskevas⁴⁹, N. Saoulidou⁴⁹,
 K. Theofilatos⁴⁹, E. Tziaferi⁴⁹, K. Vellidis⁴⁹, I. Zisopoulos⁴⁹, G. Bakas⁵⁰, T. Chatzistavrou⁵⁰, G. Karapostoli⁵⁰

- K. Kousouris⁵⁰ I. Papakrivopoulos⁵⁰ E. Siamarkou⁵⁰ G. Tsipolitis⁵⁰ A. Zacharopoulou⁵⁰ K. Adamidis⁵¹
 I. Bestintzanos⁵¹ I. Evangelou⁵¹ C. Foudas⁵¹ P. Gianneios⁵¹ C. Kamtsikis⁵¹ P. Katsoulis⁵¹ P. Kokkas⁵¹
 P. G. Kosmoglou Kioseoglou⁵¹ N. Manthos⁵¹ I. Papadopoulos⁵¹ J. Strologas⁵¹ M. Csanád⁵² K. Farkas⁵²
 M. M. A. Gadallah^{52,ttt} Á. Kadlecsek⁵² P. Major⁵² K. Mandal⁵² G. Pásztor⁵² A. J. Rádl^{52,uuu} G. I. Veres⁵²
 M. Bartók^{53,vvv} C. Hajdu⁵³ D. Horvath^{53,www,xxx} F. Sikler⁵³ V. Veszpremi⁵³ P. Raics⁵⁴ B. Ujvari^{54,yyy}
 G. Zilizi⁵⁴ G. Bencze⁵⁵ S. Czellar⁵⁵ J. Karancsi^{55,vvv} J. Molnar⁵⁵ Z. Szillasi⁵⁵ T. Csorgo^{56,uuu} F. Nemes^{56,uuu}
 T. Novak⁵⁶ J. Babbar⁵⁷ S. Bansal⁵⁷ S. B. Beri⁵⁷ V. Bhatnagar⁵⁷ G. Chaudhary⁵⁷ S. Chauhan⁵⁷
 N. Dhingra^{57,zzz} A. Kaur⁵⁷ A. Kaur⁵⁷ H. Kaur⁵⁷ M. Kaur⁵⁷ S. Kumar⁵⁷ M. Meena⁵⁷ K. Sandeep⁵⁷
 T. Sheokand⁵⁷ J. B. Singh⁵⁷ A. Singla⁵⁷ A. Ahmed⁵⁸ A. Bhardwaj⁵⁸ A. Chhetri⁵⁸ B. C. Choudhary⁵⁸
 A. Kumar⁵⁸ M. Naimuddin⁵⁸ K. Ranjan⁵⁸ S. Saumya⁵⁸ S. Acharya^{59,aaaa} S. Baradia⁵⁹ S. Barman^{59,bbbb}
 S. Bhattacharya⁵⁹ D. Bhowmik⁵⁹ S. Dutta⁵⁹ S. Dutta⁵⁹ P. Palit⁵⁹ B. Sahu^{59,aaaa} S. Sarkar⁵⁹ M. M. Ameen⁶⁰
 P. K. Behera⁶⁰ S. C. Behera⁶⁰ S. Chatterjee⁶⁰ P. Jana⁶⁰ P. Kalbhor⁶⁰ J. R. Komaragiri^{60,cccc} D. Kumar^{60,cccc}
 L. Panwar^{60,cccc} R. Pradhan⁶⁰ P. R. Pujahari⁶⁰ N. R. Saha⁶⁰ A. Sharma⁶⁰ A. K. Sikdar⁶⁰ S. Verma⁶⁰
 T. Aziz⁶¹ I. Das⁶¹ S. Dugad⁶¹ M. Kumar⁶¹ G. B. Mohanty⁶¹ P. Suryadevara⁶¹ A. Bala⁶² S. Banerjee⁶²
 R. M. Chatterjee⁶² M. Guchait⁶² Sh. Jain⁶² S. Karmakar⁶² S. Kumar⁶² G. Majumder⁶² K. Mazumdar⁶²
 S. Mukherjee⁶² S. Parolia⁶² A. Thachayath⁶² S. Bahinipati^{63,dddd} A. K. Das⁶³ C. Kar⁶³ D. Maity^{63,eeee}
 P. Mal⁶³ T. Mishra⁶³ V. K. Muraleedharan Nair Bindhu^{63,eeee} K. Naskar^{63,eeee} A. Nayak^{63,eeee} P. Sadangi⁶³
 P. Saha⁶³ S. K. Swain⁶³ S. Varghese^{63,eeee} D. Vats^{63,eeee} A. Alpina⁶⁴ S. Dube⁶⁴ B. Gomber^{64,aaaa}
 B. Kansal⁶⁴ A. Laha⁶⁴ A. Rastogi⁶⁴ S. Sharma⁶⁴ H. Bakhshiansohi^{65,ffff} E. Khazaie^{65,gggg} M. Zeinali^{65,hhhh}
 S. Chenarani^{66,iiiii} S. M. Etesami⁶⁶ M. Khakzad⁶⁶ M. Mohammadi Najafabadi⁶⁶ M. Grunewald⁶⁷
 M. Abbrescia^{68a,68b} R. Aly^{68a,68c,iiiii} A. Colaleo^{68a,68b} D. Creanza^{68a,68c} B. D'Anzi^{68a,68b} N. De Filippis^{68a,68c}
 M. De Palma^{68a,68b} A. Di Florio^{68a,68c} W. Elmetenawee^{68a,68b,iiiii} L. Fiore^{68a} G. Iaselli^{68a,68c} M. Louka^{68a,68b}
 G. Maggi^{68a,68c} M. Maggi^{68a} I. Margjeka^{68a,68b} V. Mastrapasqua^{68a,68b} S. My^{68a,68b} S. Nuzzo^{68a,68b}
 A. Pellecchia^{68a,68b} A. Pompili^{68a,68b} G. Pugliese^{68a,68c} R. Radogna^{68a} G. Ramirez-Sanchez^{68a,68c} D. Ramos^{68a}
 A. Ranieri^{68a} L. Silvestris^{68a} F. M. Simone^{68a,68b} Ü. Sözbilir^{68a} A. Stamerra^{68a} R. Venditti^{68a}
 P. Verwilligen^{68a} A. Zaza^{68a,68b} G. Abbiendi^{69a} C. Battilana^{69a,69b} D. Bonacorsi^{69a,69b} L. Borgonovi^{69a}
 P. Capiluppi^{69a,69b} A. Castro^{69a,69b} F. R. Cavallo^{69a} M. Cuffiani^{69a,69b} G. M. Dallavalle^{69a} T. Diotalevi^{69a,69b}
 F. Fabbri^{69a} A. Fanfani^{69a,69b} D. Fasanella^{69a,69b} P. Giacomelli^{69a} L. Giommi^{69a,69b} C. Grandi^{69a}
 L. Guiducci^{69a,69b} S. Lo Meo^{69a,kkkk} L. Lunerti^{69a,69b} S. Marcellini^{69a} G. Masetti^{69a} F. L. Navarria^{69a,69b}
 A. Perrotta^{69a} F. Primavera^{69a,69b} A. M. Rossi^{69a,69b} T. Rovelli^{69a,69b} G. P. Siroli^{69a,69b} S. Costa^{70a,70b,llll}
 A. Di Mattia^{70a} R. Potenza^{70a,70b} A. Tricomi^{70a,70b,llll} C. Tuve^{70a,70b} G. Barbagli^{71a} G. Bardelli^{71a,71b}
 B. Camaiani^{71a,71b} A. Cassese^{71a} R. Ceccarelli^{71a} V. Ciulli^{71a,71b} C. Civinini^{71a} R. D'Alessandro^{71a,71b}
 E. Focardi^{71a,71b} T. Kello^{71a} G. Latino^{71a,71b} P. Lenzi^{71a,71b} M. Lizzo^{71a} M. Meschini^{71a} S. Paoletti^{71a}
 A. Papanastassiou^{71a,71b} G. Sguazzoni^{71a} L. Viliani^{71a} L. Benussi⁷² S. Bianco⁷² S. Meola^{72,mmmm} D. Piccolo⁷²
 P. Chatagnon^{73a} F. Ferro^{73a} E. Robutti^{73a} S. Tosi^{73a,73b} A. Benaglia^{74a} G. Boldrini^{74a,74b} F. Brivio^{74a}
 F. Ceteorelli^{74a} F. De Guio^{74a,74b} M. E. Dinardo^{74a,74b} P. Dini^{74a} S. Gennai^{74a} R. Gerosa^{74a,74b} A. Ghezzi^{74a,74b}
 P. Govoni^{74a,74b} L. Guzzi^{74a} M. T. Lucchini^{74a,74b} M. Malberti^{74a} S. Malvezzi^{74a} A. Massironi^{74a}
 D. Menasce^{74a} L. Moroni^{74a} M. Paganoni^{74a,74b} D. Pedrini^{74a} B. S. Pinolini^{74a} S. Ragazzi^{74a,74b}
 T. Tabarelli de Fatis^{74a,74b} D. Zuolo^{74a} S. Buontempo^{75a} A. Cagnotta^{75a,75b} F. Carnevali^{75a,75b} N. Cavallo^{75a,75c}
 A. De Iorio^{75a,75b} F. Fabozzi^{75a,75c} A. O. M. Iorio^{75a,75b} L. Lista^{75a,75b,nnnn} P. Paolucci^{75a,sss} B. Rossi^{75a}
 C. Sciacca^{75a,75b} R. Ardino^{76a} P. Azzi^{76a} N. Bacchetta^{76a,oooo} D. Bisello^{76a,76b} P. Bortignon^{76a}
 A. Bragagnolo^{76a,76b} R. Carlin^{76a,76b} P. Checchia^{76a} T. Dorigo^{76a} F. Gasparini^{76a,76b} U. Gasparini^{76a,76b}
 G. Grosso^{76a} L. Layer^{76a,pppp} E. Lusiani^{76a} M. Margoni^{76a,76b} A. T. Meneguzzo^{76a,76b} M. Migliorini^{76a,76b}
 J. Pazzini^{76a,76b} P. Ronchese^{76a,76b} R. Rossin^{76a,76b} F. Simonetto^{76a,76b} G. Strong^{76a} M. Tosi^{76a,76b}
 A. Triossi^{76a,76b} S. Ventura^{76a} H. Yarar^{76a,76b} M. Zanetti^{76a,76b} P. Zotto^{76a,76b} A. Zucchetta^{76a,76b}
 G. Zumerle^{76a,76b} S. Abu Zeid^{77a,qqqq} C. Aimè^{77a,77b} A. Braghieri^{77a} S. Calzaferri^{77a,77b} D. Fiorina^{77a,77b}
 P. Montagna^{77a,77b} V. Re^{77a} C. Riccardi^{77a,77b} P. Salvini^{77a} I. Vai^{77a,77b} P. Vitulo^{77a,77b} S. Ajmal^{78a,78b}
 P. Asenov^{78a,rrrr} G. M. Bilei^{78a} D. Ciangottini^{78a,78b} L. Fanò^{78a,78b} M. Magherini^{78a,78b} G. Mantovani^{78a,78b}
 V. Mariani^{78a,78b} M. Menichelli^{78a} F. Moscatelli^{78a,rrrr} A. Rossi^{78a,78b} A. Santocchia^{78a,78b} D. Spiga^{78a}

T. Tedeschi^{78a,78b} P. Azzurri^{79a} G. Bagliesi^{79a} R. Bhattacharya^{79a} L. Bianchini^{79a,79b} T. Boccali^{79a}
 E. Bossini^{79a} D. Bruschini^{79a,79c} R. Castaldi^{79a} M. A. Ciocci^{79a,79b} M. Cipriani^{79a,79b} V. D'Amante^{79a,79d}
 R. Dell'Orso^{79a} S. Donato^{79a} A. Giassi^{79a} F. Ligabue^{79a,79c} D. Matos Figueiredo^{79a} A. Messineo^{79a,79b}
 M. Musich^{79a,79b} F. Palla^{79a} A. Rizzi^{79a,79b} G. Rolandi^{79a,79c} S. Roy Chowdhury^{79a} T. Sarkar^{79a}
 A. Scribano^{79a} P. Spagnolo^{79a} R. Tenchini^{79a,79b} G. Tonelli^{79a,79b} N. Turini^{79a,79d} A. Venturi^{79a}
 P. G. Verdini^{79a} P. Barria^{80a} M. Campana^{80a,80b} F. Cavallari^{80a} L. Cunqueiro Mendez^{80a,80b} D. Del Re^{80a,80b}
 E. Di Marco^{80a} M. Diemoz^{80a} F. Errico^{80a,80b} E. Longo^{80a,80b} P. Meridiani^{80a} J. Mijuskovic^{80a,80b}
 G. Organtini^{80a,80b} F. Pandolfi^{80a} R. Paramatti^{80a,80b} C. Quaranta^{80a,80b} S. Rahatlou^{80a,80b} C. Rovelli^{80a}
 F. Santanastasio^{80a,80b} L. Soffi^{80a} N. Amapane^{81a,81b} R. Arcidiacono^{81a,81c} S. Argiro^{81a,81b} M. Arneodo^{81a,81c}
 N. Bartosik^{81a} R. Bellan^{81a,81b} A. Bellora^{81a,81b} C. Biino^{81a} N. Cartiglia^{81a} M. Costa^{81a,81b} R. Covarelli^{81a,81b}
 N. Demaria^{81a} L. Finco^{81a} M. Grippo^{81a,81b} B. Kiani^{81a,81b} F. Legger^{81a} F. Luongo^{81a,81b} C. Mariotti^{81a}
 S. Maselli^{81a} A. Mecca^{81a,81b} E. Migliore^{81a,81b} M. Monteno^{81a} R. Mulargia^{81a} M. M. Obertino^{81a,81b}
 G. Ortona^{81a} L. Pacher^{81a,81b} N. Pastrone^{81a} M. Pelliccioni^{81a} M. Ruspa^{81a,81c} F. Siviero^{81a,81b} V. Sola^{81a,81b}
 A. Solano^{81a,81b} D. Soldi^{81a,81b} A. Staiano^{81a} C. Tarricone^{81a,81b} D. Trocino^{81a} G. Umoret^{81a,81b}
 E. Vlasov^{81a,81b} S. Belforte^{82a} V. Candelise^{82a,82b} M. Casarsa^{82a} F. Cossutti^{82a} K. De Leo^{82a,82b}
 G. Della Ricca^{82a,82b} S. Dogra⁸³ J. Hong⁸³ C. Huh⁸³ B. Kim⁸³ D. H. Kim⁸³ J. Kim⁸³ H. Lee⁸³ S. W. Lee⁸³
 C. S. Moon⁸³ Y. D. Oh⁸³ M. S. Ryu⁸³ S. Sekmen⁸³ Y. C. Yang⁸³ M. S. Kim⁸⁴ G. Bak⁸⁵ P. Gwak⁸⁵
 H. Kim⁸⁵ D. H. Moon⁸⁵ E. Asilar⁸⁶ D. Kim⁸⁶ T. J. Kim⁸⁶ J. A. Merlin⁸⁶ S. Choi⁸⁷ S. Han⁸⁷ B. Hong⁸⁷
 K. Lee⁸⁷ K. S. Lee⁸⁷ S. Lee⁸⁷ J. Park⁸⁷ S. K. Park⁸⁷ J. Yoo⁸⁷ J. Goh⁸⁸ H. S. Kim⁸⁹ Y. Kim⁸⁹ S. Lee⁸⁹
 J. Almond⁹⁰ J. H. Bhyun⁹⁰ J. Choi⁹⁰ W. Jun⁹⁰ J. Kim⁹⁰ J. S. Kim⁹⁰ S. Ko⁹⁰ H. Kwon⁹⁰ H. Lee⁹⁰ J. Lee⁹⁰
 J. Lee⁹⁰ B. H. Oh⁹⁰ S. B. Oh⁹⁰ H. Seo⁹⁰ U. K. Yang⁹⁰ I. Yoon⁹⁰ W. Jang⁹¹ D. Y. Kang⁹¹ Y. Kang⁹¹
 S. Kim⁹¹ B. Ko⁹¹ J. S. H. Lee⁹¹ Y. Lee⁹¹ I. C. Park⁹¹ Y. Roh⁹¹ I. J. Watson⁹¹ S. Yang⁹¹ S. Ha⁹²
 H. D. Yoo⁹² M. Choi⁹³ M. R. Kim⁹³ H. Lee⁹³ Y. Lee⁹³ I. Yu⁹³ T. Beyrouthy⁹⁴ Y. Maghrbi⁹⁴ K. Dreimanis⁹⁵
 A. Gaile⁹⁵ G. Pikurs⁹⁵ A. Potrebko⁹⁵ M. Seidel⁹⁵ V. Veckalns^{95,ssss} N. R. Strautnieks⁹⁶ M. Ambrozis⁹⁷
 A. Juodagalvis⁹⁷ A. Rinkevicius⁹⁷ G. Tamulaitis⁹⁷ N. Bin Norjoharuddeen⁹⁸ I. Yusuff^{98,tttt} Z. Zolkapli⁹⁸
 J. F. Benitez⁹⁹ A. Castaneda Hernandez⁹⁹ H. A. Encinas Acosta⁹⁹ L. G. Gallegos Maríñez⁹⁹ M. León Coello⁹⁹
 J. A. Murillo Quijada⁹⁹ A. Sehrawat⁹⁹ L. Valencia Palomo⁹⁹ G. Ayala¹⁰⁰ H. Castilla-Valdez¹⁰⁰
 E. De La Cruz-Burelo¹⁰⁰ I. Heredia-De La Cruz^{100,uuuu} R. Lopez-Fernandez¹⁰⁰ C. A. Mondragon Herrera¹⁰⁰
 A. Sánchez Hernández¹⁰⁰ C. Oropeza Barrera¹⁰¹ M. Ramírez García¹⁰¹ I. Bautista¹⁰² I. Pedraza¹⁰²
 H. A. Salazar Ibarguen¹⁰² C. Uribe Estrada¹⁰² I. Bujanja¹⁰³ N. Raicevic¹⁰³ P. H. Butler¹⁰⁴ A. Ahmad¹⁰⁵
 M. I. Asghar¹⁰⁵ A. Awais¹⁰⁵ M. I. M. Awan¹⁰⁵ H. R. Hoorani¹⁰⁵ W. A. Khan¹⁰⁵ V. Avati¹⁰⁶ L. Grzanka¹⁰⁶
 M. Malawski¹⁰⁶ H. Bialkowska¹⁰⁷ M. Bluj¹⁰⁷ B. Boimska¹⁰⁷ M. Górski¹⁰⁷ M. Kazana¹⁰⁷ M. Szleper¹⁰⁷
 P. Zalewski¹⁰⁷ K. Bunkowski¹⁰⁸ K. Doroba¹⁰⁸ A. Kalinowski¹⁰⁸ M. Konecki¹⁰⁸ J. Krolikowski¹⁰⁸
 A. Muhammad¹⁰⁸ M. Araujo¹⁰⁹ D. Bastos¹⁰⁹ C. Beirão Da Cruz E Silva¹⁰⁹ A. Boletti¹⁰⁹ M. Bozzo¹⁰⁹
 T. Camporesi¹⁰⁹ G. Da Molin¹⁰⁹ P. Faccioli¹⁰⁹ M. Gallinaro¹⁰⁹ J. Hollar¹⁰⁹ N. Leonardo¹⁰⁹ T. Niknejad¹⁰⁹
 A. Petrilli¹⁰⁹ M. Pisano¹⁰⁹ J. Seixas¹⁰⁹ J. Varela¹⁰⁹ J. W. Wulff¹⁰⁹ P. Adzic¹¹⁰ P. Milenovic¹¹⁰
 M. Dordevic¹¹¹ J. Milosevic¹¹¹ V. Rekovic¹¹¹ M. Aguilar-Benitez¹¹² J. Alcaraz Maestre¹¹² Cristina F. Bedoya¹¹²
 M. Cepeda¹¹² M. Cerrada¹¹² N. Colino¹¹² B. De La Cruz¹¹² A. Delgado Peris¹¹² D. Fernández Del Val¹¹²
 J. P. Fernández Ramos¹¹² J. Flix¹¹² M. C. Fouz¹¹² O. Gonzalez Lopez¹¹² S. Goy Lopez¹¹² J. M. Hernandez¹¹²
 M. I. Josa¹¹² J. León Holgado¹¹² D. Moran¹¹² C. M. Morcillo Perez¹¹² Á. Navarro Tobar¹¹²
 C. Perez Dengra¹¹² A. Pérez-Calero Yzquierdo¹¹² J. Puerta Pelayo¹¹² I. Redondo¹¹² D. D. Redondo Ferrero¹¹²
 L. Romero¹¹² S. Sánchez Navas¹¹² L. Urda Gómez¹¹² J. Vazquez Escobar¹¹² C. Willmott¹¹² J. F. de Trocóniz¹¹³
 B. Alvarez Gonzalez¹¹⁴ J. Cuevas¹¹⁴ J. Fernandez Menendez¹¹⁴ S. Folgueras¹¹⁴ I. Gonzalez Caballero¹¹⁴
 J. R. González Fernández¹¹⁴ E. Palencia Cortezon¹¹⁴ C. Ramón Álvarez¹¹⁴ V. Rodríguez Bouza¹¹⁴
 A. Soto Rodríguez¹¹⁴ A. Trapote¹¹⁴ C. Vico Villalba¹¹⁴ P. Vischia¹¹⁴ S. Bhowmik¹¹⁵ S. Blanco Fernández¹¹⁵
 J. A. Brochero Cifuentes¹¹⁵ I. J. Cabrillo¹¹⁵ A. Calderon¹¹⁵ J. Duarte Campderros¹¹⁵ M. Fernandez¹¹⁵
 C. Fernandez Madrazo¹¹⁵ G. Gomez¹¹⁵ C. Lasaosa García¹¹⁵ C. Martinez Rivero¹¹⁵
 P. Martinez Ruiz del Arbol¹¹⁵ F. Matorras¹¹⁵ P. Matorras Cuevas¹¹⁵ E. Navarrete Ramos¹¹⁵ J. Piedra Gomez¹¹⁵
 L. Scodellaro¹¹⁵ I. Vila¹¹⁵ J. M. Vizán García¹¹⁵ M. K. Jayananda¹¹⁶ B. Kailasapathy^{116,vvvv}

- D. U. J. Sonnadara¹¹⁶ D. D. C. Wickramaratna¹¹⁶ W. G. D. Dharmaratna¹¹⁷ K. Liyanage¹¹⁷ N. Perera¹¹⁷
N. Wickramage¹¹⁷ D. Abbaneo¹¹⁸ C. Amendola¹¹⁸ E. Auffray¹¹⁸ G. Auzinger¹¹⁸ J. Baechler¹¹⁸ D. Barney¹¹⁸
A. Bermúdez Martínez¹¹⁸ M. Bianco¹¹⁸ B. Bilin¹¹⁸ A. A. Bin Anuar¹¹⁸ A. Bocci¹¹⁸ E. Brondolin¹¹⁸
C. Caillol¹¹⁸ G. Cerminara¹¹⁸ N. Chernyavskaya¹¹⁸ D. d'Enterria¹¹⁸ A. Dabrowski¹¹⁸ A. David¹¹⁸
A. De Roeck¹¹⁸ M. M. Defranchis¹¹⁸ M. Deile¹¹⁸ M. Dobson¹¹⁸ F. Fallavollita^{118,wwww} L. Forthomme¹¹⁸
G. Franzoni¹¹⁸ W. Funk¹¹⁸ S. Giani¹¹⁸ D. Gigi¹¹⁸ K. Gill¹¹⁸ F. Glege¹¹⁸ L. Gouskos¹¹⁸ M. Haranko¹¹⁸
J. Hegeman¹¹⁸ B. Huber¹¹⁸ V. Innocente¹¹⁸ T. James¹¹⁸ P. Janot¹¹⁸ S. Laurila¹¹⁸ P. Lecoq¹¹⁸ E. Leutgeb¹¹⁸
C. Lourenço¹¹⁸ B. Maier¹¹⁸ L. Malgeri¹¹⁸ M. Mannelli¹¹⁸ A. C. Marini¹¹⁸ M. Matthewman¹¹⁸ F. Meijers¹¹⁸
S. Mersi¹¹⁸ E. Meschi¹¹⁸ V. Milosevic¹¹⁸ F. Moortgat¹¹⁸ M. Mulders¹¹⁸ S. Orfanelli¹¹⁸ F. Pantaleo¹¹⁸
G. Petrucciani¹¹⁸ A. Pfeiffer¹¹⁸ M. Pierini¹¹⁸ D. Piparo¹¹⁸ H. Qu¹¹⁸ D. Rabady¹¹⁸ G. Reales Gutiérrez¹¹⁸
M. Rovere¹¹⁸ H. Sakulin¹¹⁸ S. Scarfi¹¹⁸ M. Selvaggi¹¹⁸ A. Sharma¹¹⁸ K. Shchelina¹¹⁸ P. Silva¹¹⁸
P. Sphicas^{118,xxxx} A. G. Stahl Leiton¹¹⁸ A. Steen¹¹⁸ S. Summers¹¹⁸ D. Treille¹¹⁸ P. Tropea¹¹⁸ A. Tsirou¹¹⁸
D. Walter¹¹⁸ J. Wanczyk^{118,yyyy} K. A. Wozniak^{118,zzzz} S. Wuchterl¹¹⁸ P. Zehetner¹¹⁸ P. Zejdl¹¹⁸
W. D. Zeuner¹¹⁸ T. Bevilacqua^{119,aaaa} L. Caminada^{119,aaaa} A. Ebrahimi¹¹⁹ W. Erdmann¹¹⁹ R. Horisberger¹¹⁹
Q. Ingram¹¹⁹ H. C. Kaestli¹¹⁹ D. Kotlinski¹¹⁹ C. Lange¹¹⁹ M. Missiroli^{119,aaaa} L. Noehte^{119,aaaa} T. Rohe¹¹⁹
T. K. Aarrestad¹²⁰ K. Androsov^{120,yyyy} M. Backhaus¹²⁰ A. Calandri¹²⁰ C. Cazzaniga¹²⁰ K. Datta¹²⁰
A. De Cosa¹²⁰ G. Dissertori¹²⁰ M. Dittmar¹²⁰ M. Donegà¹²⁰ F. Eble¹²⁰ M. Galli¹²⁰ K. Gedia¹²⁰
F. Glessgen¹²⁰ C. Grab¹²⁰ D. Hits¹²⁰ W. Lustermann¹²⁰ A.-M. Lyon¹²⁰ R. A. Manzoni¹²⁰ M. Marchegiani¹²⁰
L. Marchese¹²⁰ C. Martin Perez¹²⁰ A. Mascellani^{120,yyyy} F. Nessi-Tedaldi¹²⁰ F. Pauss¹²⁰ V. Perovic¹²⁰
S. Pigazzini¹²⁰ M. G. Ratti¹²⁰ M. Reichmann¹²⁰ C. Reissel¹²⁰ T. Reitenspiess¹²⁰ B. Ristic¹²⁰ F. Riti¹²⁰
D. Ruini¹²⁰ D. A. Sanz Becerra¹²⁰ R. Seidita¹²⁰ J. Steggemann^{120,yyyy} D. Valsecchi¹²⁰ R. Wallny¹²⁰
C. Amsler^{121,bbbb} P. Bärtschi¹²¹ C. Botta¹²¹ D. Brzhechko¹²¹ M. F. Canelli¹²¹ K. Cormier¹²¹ R. Del Burgo¹²¹
J. K. Heikkilä¹²¹ M. Huwiler¹²¹ W. Jin¹²¹ A. Jofrehei¹²¹ B. Kilminster¹²¹ S. Leontsinis¹²¹ S. P. Liehti¹²¹
A. Macchiolo¹²¹ P. Meiring¹²¹ V. M. Mikuni¹²¹ U. Molinatti¹²¹ I. Neutelings¹²¹ A. Reimers¹²¹ P. Robmann¹²¹
S. Sanchez Cruz¹²¹ K. Schweiger¹²¹ M. Senger¹²¹ Y. Takahashi¹²¹ R. Tramontano¹²¹ C. Adloff^{122,cccc}
C. M. Kuo¹²² W. Lin¹²² P. K. Rout¹²² P. C. Tiwari^{122,cccc} S. S. Yu¹²² L. Ceard¹²³ Y. Chao¹²³ K. F. Chen¹²³
P. s. Chen¹²³ Z. g. Chen¹²³ W.-S. Hou¹²³ T. h. Hsu¹²³ Y. w. Kao¹²³ R. Khurana¹²³ G. Kole¹²³ Y. y. Li¹²³
R.-S. Lu¹²³ E. Paganis¹²³ A. Psallidas¹²³ X. f. Su¹²³ J. Thomas-Wilsker¹²³ L. s. Tsai¹²³ H. y. Wu¹²³
E. Yazgan¹²³ C. Asawatangkuldee¹²⁴ N. Srimanobhas¹²⁴ V. Wachirapusanand¹²⁴ D. Agyel¹²⁵ F. Boran¹²⁵
Z. S. Demiroglu¹²⁵ F. Dolek¹²⁵ I. Dumanoglu^{125,dddd} E. Eskut¹²⁵ Y. Guler^{125,eeee} E. Gurpinar Guler^{125,eeee}
C. Isik¹²⁵ O. Kara¹²⁵ A. Kayis Topaksu¹²⁵ U. Kiminsu¹²⁵ G. Onengut¹²⁵ K. Ozdemir^{125,ffff} A. Polatoz¹²⁵
B. Tali^{125,gggg} U. G. Tok¹²⁵ S. Turkcpar¹²⁵ E. Uslan¹²⁵ I. S. Zorbakir¹²⁵ M. Yalvac^{126,hhhh} B. Akgun¹²⁷
I. O. Atakisi¹²⁷ E. Gülmez¹²⁷ M. Kaya^{127,iiiii} O. Kaya^{127,jjjj} S. Tekten^{127,kkkk} A. Cakir¹²⁸
K. Cankocak^{128,dddd,llll} Y. Komurcu¹²⁸ S. Sen^{128,mmmm} O. Aydilek¹²⁹ S. Cerci^{129,gggg} V. Epshteyn¹²⁹
B. Hacıahinoglu¹²⁹ I. Hos^{129,nnnn} B. Isildak^{129,oooo} B. Kaynak¹²⁹ S. Ozkorucuklu¹²⁹ O. Potok¹²⁹
H. Sert¹²⁹ C. Simsek¹²⁹ D. Sunar Cerci^{129,gggg} C. Zorbilmez¹²⁹ A. Boyaryntsev¹³⁰ B. Grynyov¹³⁰
L. Levchuk¹³¹ D. Anthony¹³² J. J. Brooke¹³² A. Bundock¹³² F. Bury¹³² E. Clement¹³² D. Cussans¹³²
H. Flacher¹³² M. Glowacki¹³² J. Goldstein¹³² H. F. Heath¹³² L. Kreczko¹³² B. Krikler¹³² S. Paramesvaran¹³²
S. Seif El Nasr-Storey¹³² V. J. Smith¹³² N. Stylianou^{132,pppp} K. Walkingshaw Pass¹³² R. White¹³² A. H. Ball¹³³
K. W. Bell¹³³ A. Belyaev^{133,qqqq} C. Brew¹³³ R. M. Brown¹³³ D. J. A. Cockerill¹³³ C. Cooke¹³³ K. V. Ellis¹³³
K. Harder¹³³ S. Harper¹³³ M.-L. Holmberg^{133,rrrr} J. Linacre¹³³ K. Manolopoulos¹³³ D. M. Newbold¹³³
E. Olaiya¹³³ D. Petyt¹³³ T. Reis¹³³ G. Salvi¹³³ T. Schuh¹³³ C. H. Shepherd-Themistocleous¹³³ I. R. Tomalin¹³³
T. Williams¹³³ R. Bainbridge¹³⁴ P. Bloch¹³⁴ C. E. Brown¹³⁴ O. Buchmuller¹³⁴ V. Cacchio¹³⁴
C. A. Carrillo Montoya¹³⁴ G. S. Chahal^{134,ssss} D. Colling¹³⁴ J. S. Dancu¹³⁴ P. Dauncey¹³⁴ G. Davies¹³⁴
J. Davies¹³⁴ M. Della Negra¹³⁴ S. Fayer¹³⁴ G. Fedi¹³⁴ G. Hall¹³⁴ M. H. Hassanshahi¹³⁴ A. Howard¹³⁴ G. Iles¹³⁴
M. Knight¹³⁴ J. Langford¹³⁴ L. Lyons¹³⁴ A.-M. Magnan¹³⁴ S. Malik¹³⁴ A. Martelli¹³⁴ M. Mieskolainen¹³⁴
J. Nash^{134,tttt} M. Pesaresi¹³⁴ B. C. Radburn-Smith¹³⁴ A. Richards¹³⁴ A. Rose¹³⁴ C. Seez¹³⁴ R. Shukla¹³⁴
A. Tapper¹³⁴ K. Uchida¹³⁴ G. P. Uttley¹³⁴ L. H. Vage¹³⁴ T. Virdee^{134,sss} M. Vojinovic¹³⁴ N. Wardle¹³⁴
D. Winterbottom¹³⁴ K. Coldham¹³⁵ J. E. Cole¹³⁵ A. Khan¹³⁵ P. Kyberd¹³⁵ I. D. Reid¹³⁵ S. Abdullin¹³⁶

- A. Brinkerhoff¹³⁶, B. Caraway¹³⁶, J. Dittmann¹³⁶, K. Hatakeyama¹³⁶, J. Hiltbrand¹³⁶, A. R. Kanuganti¹³⁶,
 B. McMaster¹³⁶, M. Saunders¹³⁶, S. Sawant¹³⁶, C. Sutantawibul¹³⁶, M. Toms^{136,ccc}, J. Wilson¹³⁶, R. Bartek¹³⁷,
 A. Dominguez¹³⁷, C. Huerta Escamilla¹³⁷, A. E. Simsek¹³⁷, R. Uniyal¹³⁷, A. M. Vargas Hernandez¹³⁷,
 R. Chudasama¹³⁸, S. I. Cooper¹³⁸, S. V. Gleyzer¹³⁸, C. U. Perez¹³⁸, P. Rumerio^{138,uuuuu}, E. Usai¹³⁸, C. West¹³⁸,
 R. Yi¹³⁸, A. Akpınar¹³⁹, A. Albert¹³⁹, D. Arcaro¹³⁹, C. Cosby¹³⁹, Z. Demiragli¹³⁹, C. Erice¹³⁹, E. Fontanesi¹³⁹,
 D. Gastler¹³⁹, S. Jeon¹³⁹, J. Rohlf¹³⁹, K. Salyer¹³⁹, D. Sperka¹³⁹, D. Spitzbart¹³⁹, I. Suarez¹³⁹, A. Tsatsos¹³⁹,
 S. Yuan¹³⁹, G. Benelli¹⁴⁰, X. Coubez^{140,nnn}, D. Cutts¹⁴⁰, M. Hadley¹⁴⁰, U. Heintz¹⁴⁰, J. M. Hogan^{140,vvvvv},
 T. Kwon¹⁴⁰, G. Landsberg¹⁴⁰, K. T. Lau¹⁴⁰, D. Li¹⁴⁰, J. Luo¹⁴⁰, S. Mondal¹⁴⁰, M. Narain^{140,a}, N. Pervan¹⁴⁰,
 S. Sagir^{140,wwwvvv}, F. Simpson¹⁴⁰, M. Stamenkovic¹⁴⁰, W. Y. Wong¹⁴⁰, X. Yan¹⁴⁰, W. Zhang¹⁴⁰, S. Abbott¹⁴¹,
 J. Bonilla¹⁴¹, C. Brainerd¹⁴¹, R. Breedon¹⁴¹, M. Calderon De La Barca Sanchez¹⁴¹, M. Chertok¹⁴¹, M. Citron¹⁴¹,
 J. Conway¹⁴¹, P. T. Cox¹⁴¹, R. Erbacher¹⁴¹, F. Jensen¹⁴¹, O. Kukral¹⁴¹, G. Mocellin¹⁴¹, M. Mulhearn¹⁴¹,
 D. Pellett¹⁴¹, W. Wei¹⁴¹, Y. Yao¹⁴¹, F. Zhang¹⁴¹, M. Bachtis¹⁴², R. Cousins¹⁴², A. Datta¹⁴², J. Hauser¹⁴²,
 M. Ignatenko¹⁴², M. A. Iqbal¹⁴², T. Lam¹⁴², E. Manca¹⁴², D. Saltzberg¹⁴², V. Valuev¹⁴², R. Clare¹⁴³,
 J. W. Gary¹⁴³, M. Gordon¹⁴³, G. Hanson¹⁴³, W. Si¹⁴³, S. Wimpenny^{143,a}, J. G. Branson¹⁴⁴, S. Cittolin¹⁴⁴,
 S. Cooperstein¹⁴⁴, D. Diaz¹⁴⁴, J. Duarte¹⁴⁴, L. Giannini¹⁴⁴, J. Guiang¹⁴⁴, R. Kansal¹⁴⁴, V. Krutelyov¹⁴⁴,
 R. Lee¹⁴⁴, J. Letts¹⁴⁴, M. Masciovecchio¹⁴⁴, F. Mokhtar¹⁴⁴, M. Pieri¹⁴⁴, M. Quinnan¹⁴⁴,
 B. V. Sathia Narayanan¹⁴⁴, V. Sharma¹⁴⁴, M. Tadel¹⁴⁴, E. Vourliotis¹⁴⁴, F. Würthwein¹⁴⁴, Y. Xiang¹⁴⁴,
 A. Yagil¹⁴⁴, A. Barzdukas¹⁴⁵, L. Brennan¹⁴⁵, C. Campagnari¹⁴⁵, G. Collura¹⁴⁵, A. Dorsett¹⁴⁵, J. Incandela¹⁴⁵,
 M. Kilpatrick¹⁴⁵, J. Kim¹⁴⁵, A. J. Li¹⁴⁵, P. Masterson¹⁴⁵, H. Mei¹⁴⁵, M. Oshiro¹⁴⁵, J. Richman¹⁴⁵, U. Sarica¹⁴⁵,
 R. Schmitz¹⁴⁵, F. Setti¹⁴⁵, J. Sheplock¹⁴⁵, D. Stuart¹⁴⁵, S. Wang¹⁴⁵, A. Bornheim¹⁴⁶, O. Cerri¹⁴⁶, A. Latorre¹⁴⁶,
 J. Mao¹⁴⁶, H. B. Newman¹⁴⁶, T. Q. Nguyen¹⁴⁶, M. Spiropulu¹⁴⁶, J. R. Vlimant¹⁴⁶, C. Wang¹⁴⁶, S. Xie¹⁴⁶,
 R. Y. Zhu¹⁴⁶, J. Alison¹⁴⁷, S. An¹⁴⁷, M. B. Andrews¹⁴⁷, P. Bryant¹⁴⁷, V. Dutta¹⁴⁷, T. Ferguson¹⁴⁷, A. Harilal¹⁴⁷,
 C. Liu¹⁴⁷, T. Mudholkar¹⁴⁷, S. Murthy¹⁴⁷, M. Paulini¹⁴⁷, A. Roberts¹⁴⁷, A. Sanchez¹⁴⁷, W. Terrill¹⁴⁷,
 J. P. Cumalat¹⁴⁸, W. T. Ford¹⁴⁸, A. Hassani¹⁴⁸, G. Karathanasis¹⁴⁸, E. MacDonald¹⁴⁸, N. Manganelli¹⁴⁸,
 F. Marini¹⁴⁸, A. Perloff¹⁴⁸, C. Savard¹⁴⁸, N. Schonbeck¹⁴⁸, K. Stenson¹⁴⁸, K. A. Ulmer¹⁴⁸, S. R. Wagner¹⁴⁸,
 N. Zipper¹⁴⁸, J. Alexander¹⁴⁹, S. Bright-Thonney¹⁴⁹, X. Chen¹⁴⁹, D. J. Cranshaw¹⁴⁹, J. Fan¹⁴⁹, X. Fan¹⁴⁹,
 D. Gadkari¹⁴⁹, S. Hogan¹⁴⁹, J. Monroy¹⁴⁹, J. R. Patterson¹⁴⁹, J. Reichert¹⁴⁹, M. Reid¹⁴⁹, A. Ryd¹⁴⁹, J. Thom¹⁴⁹,
 P. Wittich¹⁴⁹, R. Zou¹⁴⁹, M. Albrow¹⁵⁰, M. Alyari¹⁵⁰, O. Amram¹⁵⁰, G. Apollinari¹⁵⁰, A. Apresyan¹⁵⁰,
 L. A. T. Bauerdick¹⁵⁰, D. Berry¹⁵⁰, J. Berryhill¹⁵⁰, P. C. Bhat¹⁵⁰, K. Burkett¹⁵⁰, J. N. Butler¹⁵⁰, A. Canepa¹⁵⁰,
 G. B. Cerati¹⁵⁰, H. W. K. Cheung¹⁵⁰, F. Chlebana¹⁵⁰, G. Cummings¹⁵⁰, J. Dickinson¹⁵⁰, I. Dutta¹⁵⁰,
 V. D. Elvira¹⁵⁰, Y. Feng¹⁵⁰, J. Freeman¹⁵⁰, A. Gandrakota¹⁵⁰, Z. Gece¹⁵⁰, L. Gray¹⁵⁰, D. Green¹⁵⁰,
 A. Grummer¹⁵⁰, S. Grünendahl¹⁵⁰, D. Guerrero¹⁵⁰, O. Gutsche¹⁵⁰, R. M. Harris¹⁵⁰, R. Heller¹⁵⁰,
 T. C. Herwig¹⁵⁰, J. Hirschauer¹⁵⁰, L. Horyn¹⁵⁰, B. Jayatilaka¹⁵⁰, S. Jindariani¹⁵⁰, M. Johnson¹⁵⁰, U. Joshi¹⁵⁰,
 T. Klijnsma¹⁵⁰, B. Klima¹⁵⁰, K. H. M. Kwok¹⁵⁰, S. Lammel¹⁵⁰, D. Lincoln¹⁵⁰, R. Lipton¹⁵⁰, T. Liu¹⁵⁰,
 C. Madrid¹⁵⁰, K. Maeshima¹⁵⁰, C. Mantilla¹⁵⁰, D. Mason¹⁵⁰, P. McBride¹⁵⁰, P. Merkel¹⁵⁰, S. Mrenna¹⁵⁰,
 S. Nahn¹⁵⁰, J. Ngadiuba¹⁵⁰, D. Noonan¹⁵⁰, V. Papadimitriou¹⁵⁰, N. Pastika¹⁵⁰, K. Pedro¹⁵⁰, C. Pena^{150,xxxx},
 F. Ravera¹⁵⁰, A. Reinsvold Hall^{150,yyyyy}, L. Ristori¹⁵⁰, E. Sexton-Kennedy¹⁵⁰, N. Smith¹⁵⁰, A. Soha¹⁵⁰,
 L. Spiegel¹⁵⁰, S. Stoynev¹⁵⁰, J. Strait¹⁵⁰, L. Taylor¹⁵⁰, S. Tkaczyk¹⁵⁰, N. V. Tran¹⁵⁰, L. Uplegger¹⁵⁰,
 E. W. Vaandering¹⁵⁰, I. Zoi¹⁵⁰, C. Aruta¹⁵¹, P. Avery¹⁵¹, D. Bourilkov¹⁵¹, L. Cadamuro¹⁵¹, P. Chang¹⁵¹,
 V. Cherepanov¹⁵¹, R. D. Field¹⁵¹, E. Koenig¹⁵¹, M. Kolosova¹⁵¹, J. Konigsberg¹⁵¹, A. Korytov¹⁵¹, K. H. Lo¹⁵¹,
 K. Matchev¹⁵¹, N. Menendez¹⁵¹, G. Mitselmakher¹⁵¹, K. Mohrman¹⁵¹, A. Muthirakalayil Madhu¹⁵¹, N. Rawal¹⁵¹,
 D. Rosenzweig¹⁵¹, S. Rosenzweig¹⁵¹, K. Shi¹⁵¹, J. Wang¹⁵¹, T. Adams¹⁵², A. Al Kadhimi¹⁵², A. Askew¹⁵²,
 N. Bower¹⁵², R. Habibullah¹⁵², V. Hagopian¹⁵², R. Hashmi¹⁵², R. S. Kim¹⁵², S. Kim¹⁵², T. Kolberg¹⁵²,
 G. Martinez¹⁵², H. Prosper¹⁵², P. R. Prova¹⁵², O. Viazlo¹⁵², M. Wulansatiti¹⁵², R. Yohay¹⁵², J. Zhang¹⁵²,
 B. Alsufyani¹⁵³, M. M. Baarmand¹⁵³, S. Butalla¹⁵³, T. Elkafrawy^{153,qqqq}, M. Hohlmann¹⁵³, R. Kumar Verma¹⁵³,
 M. Rahmani¹⁵³, M. R. Adams¹⁵⁴, C. Bennett¹⁵⁴, R. Cavanaugh¹⁵⁴, S. Dittmer¹⁵⁴, R. Escobar Franco¹⁵⁴,
 O. Evdokimov¹⁵⁴, C. E. Gerber¹⁵⁴, D. J. Hofman¹⁵⁴, J. h. Lee¹⁵⁴, D. S. Lemos¹⁵⁴, A. H. Merrit¹⁵⁴, C. Mills¹⁵⁴,
 S. Nanda¹⁵⁴, G. Oh¹⁵⁴, B. Ozek¹⁵⁴, D. Pilipovic¹⁵⁴, T. Roy¹⁵⁴, S. Rudrabhatla¹⁵⁴, M. B. Tonjes¹⁵⁴,
 N. Varelas¹⁵⁴, X. Wang¹⁵⁴, Z. Ye¹⁵⁴, J. Yoo¹⁵⁴, M. Alhusseini¹⁵⁵, D. Blend¹⁵⁵, K. Dilsiz^{155,zzzzz}, L. Emediato¹⁵⁵

- G. Karaman¹⁵⁵ O. K. Köseyan¹⁵⁵ J.-P. Merlo¹⁵⁵ A. Mestvirishvili^{155,aaaaa} J. Nachtman¹⁵⁵ O. Neogi¹⁵⁵
 H. Ogul^{155,bbbbb} Y. Onel¹⁵⁵ A. Penzo¹⁵⁵ C. Snyder¹⁵⁵ E. Tiras^{155,ccccc} B. Blumenfeld¹⁵⁶ L. Corcodilos¹⁵⁶
 J. Davis¹⁵⁶ A. V. Gritsan¹⁵⁶ L. Kang¹⁵⁶ S. Kyriacou¹⁵⁶ P. Maksimovic¹⁵⁶ M. Roguljic¹⁵⁶ J. Roskes¹⁵⁶
 S. Sekhar¹⁵⁶ M. Swartz¹⁵⁶ T. Á. Vámi¹⁵⁶ A. Abreu¹⁵⁷ L. F. Alcerro Alcerro¹⁵⁷ J. Anguiano¹⁵⁷ P. Baringer¹⁵⁷
 A. Bean¹⁵⁷ Z. Flowers¹⁵⁷ D. Grove¹⁵⁷ J. King¹⁵⁷ G. Krintiras¹⁵⁷ M. Lazarovits¹⁵⁷ C. Le Mahieu¹⁵⁷
 C. Lindsey¹⁵⁷ J. Marquez¹⁵⁷ N. Minafra¹⁵⁷ M. Murray¹⁵⁷ M. Nickel¹⁵⁷ M. Pitt¹⁵⁷ S. Popescu^{157,ddddd}
 C. Rogan¹⁵⁷ C. Royon¹⁵⁷ R. Salvatico¹⁵⁷ S. Sanders¹⁵⁷ C. Smith¹⁵⁷ Q. Wang¹⁵⁷ G. Wilson¹⁵⁷
 B. Allmond¹⁵⁸ A. Ivanov¹⁵⁸ K. Kaadze¹⁵⁸ A. Kalogeropoulos¹⁵⁸ D. Kim¹⁵⁸ Y. Maravin¹⁵⁸ K. Nam¹⁵⁸
 J. Natoli¹⁵⁸ D. Roy¹⁵⁸ G. Sorrentino¹⁵⁸ F. Rebassoo¹⁵⁹ D. Wright¹⁵⁹ A. Baden¹⁶⁰ A. Belloni¹⁶⁰
 A. Bethani¹⁶⁰ Y. M. Chen¹⁶⁰ S. C. Eno¹⁶⁰ N. J. Hadley¹⁶⁰ S. Jabeen¹⁶⁰ R. G. Kellogg¹⁶⁰ T. Koeth¹⁶⁰
 Y. Lai¹⁶⁰ S. Lascio¹⁶⁰ A. C. Mignerey¹⁶⁰ S. Nabili¹⁶⁰ C. Palmer¹⁶⁰ C. Papageorgakis¹⁶⁰ M. M. Paranjpe¹⁶⁰
 L. Wang¹⁶⁰ J. Bendavid¹⁶¹ W. Busza¹⁶¹ I. A. Cali¹⁶¹ Y. Chen¹⁶¹ M. D'Alfonso¹⁶¹ J. Eysermans¹⁶¹
 C. Freer¹⁶¹ G. Gomez-Ceballos¹⁶¹ M. Goncharov¹⁶¹ P. Harris¹⁶¹ D. Hoang¹⁶¹ D. Kovalskyi¹⁶¹ J. Krupa¹⁶¹
 L. Lavezzo¹⁶¹ Y.-J. Lee¹⁶¹ K. Long¹⁶¹ C. Mironov¹⁶¹ C. Paus¹⁶¹ D. Rankin¹⁶¹ C. Roland¹⁶¹ G. Roland¹⁶¹
 S. Rothman¹⁶¹ Z. Shi¹⁶¹ G. S. F. Stephans¹⁶¹ J. Wang¹⁶¹ Z. Wang¹⁶¹ B. Wyslouch¹⁶¹ T. J. Yang¹⁶¹
 B. Crossman¹⁶² B. M. Joshi¹⁶² C. Kapsiak¹⁶² M. Krohn¹⁶² D. Mahon¹⁶² J. Mans¹⁶² B. Marzocchi¹⁶²
 S. Pandey¹⁶² M. Revering¹⁶² R. Rusack¹⁶² R. Saradhy¹⁶² N. Schroeder¹⁶² N. Strobbe¹⁶² M. A. Wadud¹⁶²
 L. M. Cremaldi¹⁶³ K. Bloom¹⁶⁴ M. Bryson¹⁶⁴ D. R. Claes¹⁶⁴ C. Fangmeier¹⁶⁴ F. Golf¹⁶⁴ G. Haza¹⁶⁴
 J. Hossain¹⁶⁴ C. Joo¹⁶⁴ I. Kravchenko¹⁶⁴ I. Reed¹⁶⁴ J. E. Siado¹⁶⁴ W. Tabb¹⁶⁴ A. Vagnerini¹⁶⁴
 A. Wightman¹⁶⁴ F. Yan¹⁶⁴ D. Yu¹⁶⁴ A. G. Zecchinelli¹⁶⁴ G. Agarwal¹⁶⁵ H. Bandyopadhyay¹⁶⁵ L. Hay¹⁶⁵
 I. Iashvili¹⁶⁵ A. Kharchilava¹⁶⁵ M. Morris¹⁶⁵ D. Nguyen¹⁶⁵ S. Rappoccio¹⁶⁵ H. Rejeb Sfar¹⁶⁵ A. Williams¹⁶⁵
 E. Barberis¹⁶⁶ Y. Haddad¹⁶⁶ Y. Han¹⁶⁶ A. Krishna¹⁶⁶ J. Li¹⁶⁶ M. Lu¹⁶⁶ G. Madigan¹⁶⁶ R. Mccarthy¹⁶⁶
 D. M. Morse¹⁶⁶ V. Nguyen¹⁶⁶ T. Orimoto¹⁶⁶ A. Parker¹⁶⁶ L. Skinnari¹⁶⁶ A. Tishelman-Charny¹⁶⁶
 B. Wang¹⁶⁶ D. Wood¹⁶⁶ S. Bhattacharya¹⁶⁷ J. Bueghly¹⁶⁷ Z. Chen¹⁶⁷ K. A. Hahn¹⁶⁷ Y. Liu¹⁶⁷ Y. Miao¹⁶⁷
 D. G. Monk¹⁶⁷ M. H. Schmitt¹⁶⁷ A. Taliencio¹⁶⁷ M. Velasco¹⁶⁷ R. Band¹⁶⁸ R. Bucci¹⁶⁸ S. Castells¹⁶⁸
 M. Cremonesi¹⁶⁸ A. Das¹⁶⁸ R. Goldouzian¹⁶⁸ M. Hildreth¹⁶⁸ K. W. Ho¹⁶⁸ K. Hurtado Anampa¹⁶⁸ T. Ivanov¹⁶⁸
 C. Jessop¹⁶⁸ K. Lannon¹⁶⁸ J. Lawrence¹⁶⁸ N. Loukas¹⁶⁸ L. Lutton¹⁶⁸ J. Mariano¹⁶⁸ N. Marinelli¹⁶⁸
 I. Mcalister¹⁶⁸ T. McCauley¹⁶⁸ C. Mcgrady¹⁶⁸ C. Moore¹⁶⁸ Y. Musienko^{168,ccc} H. Nelson¹⁶⁸ M. Osherson¹⁶⁸
 A. Piccinelli¹⁶⁸ R. Ruchti¹⁶⁸ A. Townsend¹⁶⁸ Y. Wan¹⁶⁸ M. Wayne¹⁶⁸ H. Yockey¹⁶⁸ M. Zarucki¹⁶⁸
 L. Zygala¹⁶⁸ A. Basnet¹⁶⁹ B. Bylsma¹⁶⁹ M. Carrigan¹⁶⁹ L. S. Durkin¹⁶⁹ C. Hill¹⁶⁹ M. Joyce¹⁶⁹
 A. Lesauvage¹⁶⁹ M. Nunez Ornelas¹⁶⁹ K. Wei¹⁶⁹ B. L. Winer¹⁶⁹ B. R. Yates¹⁶⁹ F. M. Addesa¹⁷⁰
 H. Bouchamaoui¹⁷⁰ P. Das¹⁷⁰ G. Dezoort¹⁷⁰ P. Elmer¹⁷⁰ A. Frankenthal¹⁷⁰ B. Greenberg¹⁷⁰ N. Haubrich¹⁷⁰
 S. Higginbotham¹⁷⁰ G. Kopp¹⁷⁰ S. Kwan¹⁷⁰ D. Lange¹⁷⁰ A. Loeliger¹⁷⁰ D. Marlow¹⁷⁰ I. Ojalvo¹⁷⁰
 J. Olsen¹⁷⁰ A. Shevelev¹⁷⁰ D. Stickland¹⁷⁰ C. Tully¹⁷⁰ S. Malik¹⁷¹ A. S. Bakshi¹⁷² V. E. Barnes¹⁷²
 S. Chandra¹⁷² R. Chawla¹⁷² S. Das¹⁷² A. Gu¹⁷² L. Gutay¹⁷² M. Jones¹⁷² A. W. Jung¹⁷² D. Kondratyev¹⁷²
 A. M. Koshy¹⁷² M. Liu¹⁷² G. Negro¹⁷² N. Neumeister¹⁷² G. Paspalaki¹⁷² S. Piperov¹⁷² V. Scheurer¹⁷²
 J. F. Schulte¹⁷² M. Stojanovic¹⁷² J. Thieman¹⁷² A. K. Viridi¹⁷² F. Wang¹⁷² W. Xie¹⁷² J. Dolen¹⁷³
 N. Parashar¹⁷³ A. Pathak¹⁷³ D. Acosta¹⁷⁴ A. Baty¹⁷⁴ T. Carnahan¹⁷⁴ K. M. Ecklund¹⁷⁴
 P. J. Fernández Manteca¹⁷⁴ S. Freed¹⁷⁴ P. Gardner¹⁷⁴ F. J. M. Geurts¹⁷⁴ A. Kumar¹⁷⁴ W. Li¹⁷⁴
 O. Miguel Colin¹⁷⁴ B. P. Padley¹⁷⁴ R. Redjimi¹⁷⁴ J. Rotter¹⁷⁴ E. Yigitbasi¹⁷⁴ Y. Zhang¹⁷⁴ A. Bodek¹⁷⁵
 P. de Barbaro¹⁷⁵ R. Demina¹⁷⁵ J. L. Dulemba¹⁷⁵ C. Fallon¹⁷⁵ A. Garcia-Bellido¹⁷⁵ O. Hindrichs¹⁷⁵
 A. Khukhunaishvili¹⁷⁵ P. Parygin^{175,ccc} E. Popova^{175,ccc} R. Taus¹⁷⁵ G. P. Van Onsem¹⁷⁵ K. Goulianos¹⁷⁶
 B. Chiarito¹⁷⁷ J. P. Chou¹⁷⁷ Y. Gershtein¹⁷⁷ E. Halkiadakis¹⁷⁷ A. Hart¹⁷⁷ M. Heindl¹⁷⁷ D. Jaroslawski¹⁷⁷
 O. Karacheban^{177,qqq} I. Laflotte¹⁷⁷ A. Lath¹⁷⁷ R. Montalvo¹⁷⁷ K. Nash¹⁷⁷ H. Routray¹⁷⁷ S. Salur¹⁷⁷
 S. Schnetzer¹⁷⁷ S. Somalwar¹⁷⁷ R. Stone¹⁷⁷ S. A. Thayil¹⁷⁷ S. Thomas¹⁷⁷ J. Vora¹⁷⁷ H. Wang¹⁷⁷ H. Acharya¹⁷⁸
 D. Ally¹⁷⁸ A. G. Delannoy¹⁷⁸ S. Fiorendi¹⁷⁸ T. Holmes¹⁷⁸ N. Karunarathna¹⁷⁸ L. Lee¹⁷⁸ E. Nibigira¹⁷⁸
 S. Spanier¹⁷⁸ D. Aebi¹⁷⁹ M. Ahmad¹⁷⁹ O. Bouhali^{179,eeeeee} M. Dalchenko¹⁷⁹ R. Eusebi¹⁷⁹ J. Gilmore¹⁷⁹
 T. Huang¹⁷⁹ T. Kamon^{179,fffff} H. Kim¹⁷⁹ S. Luo¹⁷⁹ S. Malhotra¹⁷⁹ R. Mueller¹⁷⁹ D. Overton¹⁷⁹
 D. Rathjens¹⁷⁹ A. Safonov¹⁷⁹ N. Akchurin¹⁸⁰ J. Damgov¹⁸⁰ V. Hegde¹⁸⁰ A. Hussain¹⁸⁰ Y. Kazhykarim¹⁸⁰

K. Lamichhane¹⁸⁰, S. W. Lee¹⁸⁰, A. Mankel¹⁸⁰, T. Mengke¹⁸⁰, S. Muthumuni¹⁸⁰, T. Peltola¹⁸⁰, I. Volobouev¹⁸⁰,
 A. Whitbeck¹⁸⁰, E. Appelt¹⁸¹, S. Greene¹⁸¹, A. Gurrola¹⁸¹, W. Johns¹⁸¹, R. Kunnawalkam Elayavalli¹⁸¹,
 A. Melo¹⁸¹, F. Romeo¹⁸¹, P. Sheldon¹⁸¹, S. Tuo¹⁸¹, J. Velkovska¹⁸¹, J. Viinikainen¹⁸¹, B. Cardwell¹⁸²,
 B. Cox¹⁸², J. Hakala¹⁸², R. Hirosky¹⁸², A. Ledovskoy¹⁸², C. Neu¹⁸², C. E. Perez Lara¹⁸², P. E. Karchin¹⁸³,
 A. Aravind¹⁸⁴, S. Banerjee¹⁸⁴, K. Black¹⁸⁴, T. Bose¹⁸⁴, S. Dasu¹⁸⁴, I. De Bruyn¹⁸⁴, P. Everaerts¹⁸⁴, C. Galloni¹⁸⁴,
 H. He¹⁸⁴, M. Herndon¹⁸⁴, A. Herve¹⁸⁴, C. K. Koraka¹⁸⁴, A. Lanaro¹⁸⁴, R. Loveless¹⁸⁴,
 J. Madhusudanan Sreekala¹⁸⁴, A. Mallampalli¹⁸⁴, A. Mohammadi¹⁸⁴, S. Mondal¹⁸⁴, G. Parida¹⁸⁴, D. Pinna¹⁸⁴,
 A. Savin¹⁸⁴, V. Shang¹⁸⁴, V. Sharma¹⁸⁴, W. H. Smith¹⁸⁴, D. Teague¹⁸⁴, H. F. Tsoi¹⁸⁴, W. Vetens¹⁸⁴, A. Warden¹⁸⁴,
 S. Afanasiev¹⁸⁵, V. Andreev¹⁸⁵, Yu. Andreev¹⁸⁵, T. Aushev¹⁸⁵, M. Azarkin¹⁸⁵, A. Babaev¹⁸⁵, A. Belyaev¹⁸⁵,
 V. Blinov^{185,ccc}, E. Boos¹⁸⁵, V. Borshch¹⁸⁵, D. Budkouski¹⁸⁵, V. Chekhovsky¹⁸⁵, R. Chistov^{185,ccc}, M. Danilov^{185,ccc},
 A. Dermenev¹⁸⁵, T. Dimova^{185,ccc}, D. Druzhkin^{185,ggggg}, M. Dubinin^{185,xxxxx}, L. Dudko¹⁸⁵, A. Ershov¹⁸⁵,
 G. Gavrilov¹⁸⁵, V. Gavrilov¹⁸⁵, S. Gninenko¹⁸⁵, V. Golovtsov¹⁸⁵, N. Golubev¹⁸⁵, I. Golutvin¹⁸⁵, I. Gorbunov¹⁸⁵,
 A. Gribushin¹⁸⁵, Y. Ivanov¹⁸⁵, V. Kachanov¹⁸⁵, L. Kardapoltsev^{185,ccc}, V. Karjavine¹⁸⁵, A. Karneyeu¹⁸⁵,
 V. Kim^{185,ccc}, M. Kirakosyan¹⁸⁵, D. Kirpichnikov¹⁸⁵, M. Kirsanov¹⁸⁵, V. Klyukhin¹⁸⁵, O. Kodolova^{185,hhhhh},
 D. Konstantinov¹⁸⁵, V. Korenkov¹⁸⁵, A. Kozyrev^{185,ccc}, N. Krasnikov¹⁸⁵, A. Lanev¹⁸⁵, P. Levchenko^{185,iiiiii},
 N. Lychkovskaya¹⁸⁵, V. Makarenko¹⁸⁵, A. Malakhov¹⁸⁵, V. Matveev^{185,ccc}, V. Murzin¹⁸⁵,
 A. Nikitenko^{185,jjjjj,hhhhh}, S. Obraztsov¹⁸⁵, V. Oreshkin¹⁸⁵, V. Palichik¹⁸⁵, V. Perelygin¹⁸⁵, S. Petrushanko¹⁸⁵,
 S. Polikarpov^{185,ccc}, V. Popov¹⁸⁵, O. Radchenko^{185,ccc}, M. Savina¹⁸⁵, V. Savrin¹⁸⁵, V. Shalaev¹⁸⁵, S. Shmatov¹⁸⁵,
 S. Shulha¹⁸⁵, Y. Skovpen^{185,ccc}, S. Slabospitskii¹⁸⁵, V. Smirnov¹⁸⁵, A. Snigirev¹⁸⁵, D. Sosnov¹⁸⁵, V. Sulimov¹⁸⁵,
 E. Tcherniaev¹⁸⁵, A. Terkulov¹⁸⁵, O. Teryaev¹⁸⁵, I. Tlisova¹⁸⁵, A. Toropin¹⁸⁵, L. Uvarov¹⁸⁵, A. Uzunian¹⁸⁵,
 A. Vorobyev^{185,a}, N. Voytishin¹⁸⁵, B. S. Yuldashev^{185,kkkkk}, A. Zarubin¹⁸⁵, I. Zhizhin¹⁸⁵ and A. Zhokin¹⁸⁵

(CMS Collaboration)

¹Department of Physics, University of Adelaide, Adelaide, Australia

²Department of Physics, University of Alberta, Edmonton, Alberta, Canada

^{3a}Department of Physics, Ankara University, Ankara, Türkiye

^{3b}Division of Physics, TOBB University of Economics and Technology, Ankara, Türkiye

⁴LAPP, Université Savoie Mont Blanc, CNRS/IN2P3, Annecy, France

⁵APC, Université Paris Cité, CNRS/IN2P3, Paris, France

⁶High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois, USA

⁷Department of Physics, University of Arizona, Tucson, Arizona, USA

⁸Department of Physics, University of Texas at Arlington, Arlington, Texas, USA

⁹Physics Department, National and Kapodistrian University of Athens, Athens, Greece

¹⁰Physics Department, National Technical University of Athens, Zografou, Greece

¹¹Department of Physics, University of Texas at Austin, Austin, Texas, USA

¹²Institute of Physics, Azerbaijan Academy of Sciences, Baku, Azerbaijan

¹³Institut de Física d'Altes Energies (IFAE), Barcelona Institute of Science and Technology, Barcelona, Spain

^{14a}Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China

^{14b}Physics Department, Tsinghua University, Beijing, China

^{14c}Department of Physics, Nanjing University, Nanjing, China

^{14d}School of Science, Shenzhen Campus of Sun Yat-sen University, China

^{14e}University of Chinese Academy of Science (UCAS), Beijing, China

¹⁵Institute of Physics, University of Belgrade, Belgrade, Serbia

¹⁶Department for Physics and Technology, University of Bergen, Bergen, Norway

^{17a}Physics Division, Lawrence Berkeley National Laboratory, Berkeley, California, USA

^{17b}University of California, Berkeley, California, USA

¹⁸Institut für Physik, Humboldt Universität zu Berlin, Berlin, Germany

¹⁹Albert Einstein Center for Fundamental Physics and Laboratory for High Energy Physics, University of Bern, Bern, Switzerland

²⁰School of Physics and Astronomy, University of Birmingham, Birmingham, United Kingdom

^{21a}Department of Physics, Bogazici University, Istanbul, Türkiye

^{21b}Department of Physics Engineering, Gaziantep University, Gaziantep, Türkiye

^{21c}Department of Physics, Istanbul University, Istanbul, Türkiye

- ^{22a}*Facultad de Ciencias y Centro de Investigaciones, Universidad Antonio Nariño, Bogotá, Colombia*
^{22b}*Departamento de Física, Universidad Nacional de Colombia, Bogotá, Colombia*
^{23a}*Dipartimento di Fisica e Astronomia A. Righi, Università di Bologna, Bologna, Italy*
^{23b}*INFN Sezione di Bologna, Italy*
²⁴*Physikalisches Institut, Universität Bonn, Bonn, Germany*
²⁵*Department of Physics, Boston University, Boston, Massachusetts, USA*
²⁶*Department of Physics, Brandeis University, Waltham, Massachusetts, USA*
^{27a}*Transilvania University of Brasov, Brasov, Romania*
^{27b}*Horia Hulubei National Institute of Physics and Nuclear Engineering, Bucharest, Romania*
^{27c}*Department of Physics, Alexandru Ioan Cuza University of Iasi, Iasi, Romania*
^{27d}*National Institute for Research and Development of Isotopic and Molecular Technologies, Physics Department, Cluj-Napoca, Romania*
^{27e}*University Politehnica Bucharest, Bucharest, Romania*
^{27f}*West University in Timisoara, Timisoara, Romania*
^{27g}*Faculty of Physics, University of Bucharest, Bucharest, Romania*
^{28a}*Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovak Republic*
^{28b}*Department of Subnuclear Physics, Institute of Experimental Physics of the Slovak Academy of Sciences, Kosice, Slovak Republic*
²⁹*Physics Department, Brookhaven National Laboratory, Upton, New York, USA*
³⁰*Universidad de Buenos Aires, Facultad de Ciencias Exactas y Naturales, Departamento de Física, y CONICET, Instituto de Física de Buenos Aires (IFIBA), Buenos Aires, Argentina*
³¹*California State University, California, USA*
³²*Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom*
^{33a}*Department of Physics, University of Cape Town, Cape Town, South Africa*
^{33b}*iThemba Labs, Western Cape, South Africa*
^{33c}*Department of Mechanical Engineering Science, University of Johannesburg, Johannesburg, South Africa*
^{33d}*National Institute of Physics, University of the Philippines Diliman (Philippines), Philippines*
^{33e}*University of South Africa, Department of Physics, Pretoria, South Africa*
^{33f}*University of Zululand, KwaDlangezwa, South Africa*
^{33g}*School of Physics, University of the Witwatersrand, Johannesburg, South Africa*
³⁴*Department of Physics, Carleton University, Ottawa, Ontario, Canada*
^{35a}*Faculté des Sciences Ain Chock, Réseau Universitaire de Physique des Hautes Energies—Université Hassan II, Casablanca, Morocco*
^{35b}*Faculté des Sciences, Université Ibn-Tofail, Kénitra, Morocco*
^{35c}*Faculté des Sciences Semlalia, Université Cadi Ayyad, LPHEA-Marrakech, Morocco*
^{35d}*LPMR, Faculté des Sciences, Université Mohamed Premier, Oujda, Morocco*
^{35e}*Faculté des sciences, Université Mohammed V, Rabat, Morocco*
^{35f}*Institute of Applied Physics, Mohammed VI Polytechnic University, Ben Guerir, Morocco*
³⁶*CERN, Geneva, Switzerland*
³⁷*Affiliated with an institute covered by a cooperation agreement with CERN*
³⁸*Affiliated with an international laboratory covered by a cooperation agreement with CERN*
³⁹*Enrico Fermi Institute, University of Chicago, Chicago, Illinois, USA*
⁴⁰*LPC, Université Clermont Auvergne, CNRS/IN2P3, Clermont-Ferrand, France*
⁴¹*Nevis Laboratory, Columbia University, Irvington, New York, USA*
⁴²*Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark*
^{43a}*Dipartimento di Fisica, Università della Calabria, Rende, Italy*
^{43b}*INFN Gruppo Collegato di Cosenza, Laboratori Nazionali di Frascati, Italy*
⁴⁴*Physics Department, Southern Methodist University, Dallas, Texas, USA*
⁴⁵*Physics Department, University of Texas at Dallas, Richardson, Texas, USA*
⁴⁶*National Centre for Scientific Research “Demokritos”, Agia Paraskevi, Greece*
^{47a}*Department of Physics, Stockholm University, Sweden*
^{47b}*Oskar Klein Centre, Stockholm, Sweden*
⁴⁸*Deutsches Elektronen-Synchrotron DESY, Hamburg and Zeuthen, Germany*
⁴⁹*Fakultät Physik, Technische Universität Dortmund, Dortmund, Germany*
⁵⁰*Institut für Kern- und Teilchenphysik, Technische Universität Dresden, Dresden, Germany*
⁵¹*Department of Physics, Duke University, Durham, North Carolina, USA*
⁵²*SUPA—School of Physics and Astronomy, University of Edinburgh, Edinburgh, United Kingdom*
⁵³*INFN e Laboratori Nazionali di Frascati, Frascati, Italy*
⁵⁴*Physikalisches Institut, Albert-Ludwigs-Universität Freiburg, Freiburg, Germany*
⁵⁵*II. Physikalisches Institut, Georg-August-Universität Göttingen, Göttingen, Germany*

- ⁵⁶*Département de Physique Nucléaire et Corpusculaire, Université de Genève, Genève, Switzerland*
^{57a}*Dipartimento di Fisica, Università di Genova, Genova, Italy*
^{57b}*INFN Sezione di Genova, Italy*
⁵⁸*II. Physikalisches Institut, Justus-Liebig-Universität Giessen, Giessen, Germany*
⁵⁹*SUPA—School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom*
⁶⁰*LPSC, Université Grenoble Alpes, CNRS/IN2P3, Grenoble INP, Grenoble, France*
⁶¹*Laboratory for Particle Physics and Cosmology, Harvard University, Cambridge, Massachusetts, USA*
^{62a}*Department of Modern Physics and State Key Laboratory of Particle Detection and Electronics, University of Science and Technology of China, Hefei, China*
^{62b}*Institute of Frontier and Interdisciplinary Science and Key Laboratory of Particle Physics and Particle Irradiation (MOE), Shandong University, Qingdao, China*
^{62c}*School of Physics and Astronomy, Shanghai Jiao Tong University, Key Laboratory for Particle Astrophysics and Cosmology (MOE), SKLPPC, Shanghai, China*
^{62d}*Tsung-Dao Lee Institute, Shanghai, China*
^{63a}*Kirchhoff-Institut für Physik, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany*
^{63b}*Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany*
^{64a}*Department of Physics, Chinese University of Hong Kong, Shatin, N.T., Hong Kong, China*
^{64b}*Department of Physics, University of Hong Kong, Hong Kong, China*
^{64c}*Department of Physics and Institute for Advanced Study, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, China*
⁶⁵*Department of Physics, National Tsing Hua University, Hsinchu, Taiwan*
⁶⁶*IJCLab, Université Paris-Saclay, CNRS/IN2P3, 91405, Orsay, France*
⁶⁷*Centro Nacional de Microelectrónica (IMB-CNM-CSIC), Barcelona, Spain*
⁶⁸*Department of Physics, Indiana University, Bloomington, Indiana, USA*
^{69a}*INFN Gruppo Collegato di Udine, Sezione di Trieste, Udine, Italy*
^{69b}*ICTP, Trieste, Italy*
^{69c}*Dipartimento Politecnico di Ingegneria e Architettura, Università di Udine, Udine, Italy*
^{70a}*INFN Sezione di Lecce, Italy*
^{70b}*Dipartimento di Matematica e Fisica, Università del Salento, Lecce, Italy*
^{71a}*INFN Sezione di Milano, Italy*
^{71b}*Dipartimento di Fisica, Università di Milano, Milano, Italy*
^{72a}*INFN Sezione di Napoli, Italy*
^{72b}*Dipartimento di Fisica, Università di Napoli, Napoli, Italy*
^{73a}*INFN Sezione di Pavia, Italy*
^{73b}*Dipartimento di Fisica, Università di Pavia, Pavia, Italy*
^{74a}*INFN Sezione di Pisa, Italy*
^{74b}*Dipartimento di Fisica E. Fermi, Università di Pisa, Pisa, Italy*
^{75a}*INFN Sezione di Roma, Italy*
^{75b}*Dipartimento di Fisica, Sapienza Università di Roma, Roma, Italy*
^{76a}*INFN Sezione di Roma Tor Vergata, Italy*
^{76b}*Dipartimento di Fisica, Università di Roma Tor Vergata, Roma, Italy*
^{77a}*INFN Sezione di Roma Tre, Italy*
^{77b}*Dipartimento di Matematica e Fisica, Università Roma Tre, Roma, Italy*
^{78a}*INFN-TIFPA, Italy*
^{78b}*Università degli Studi di Trento, Trento, Italy*
⁷⁹*Universität Innsbruck, Department of Astro and Particle Physics, Innsbruck, Austria*
⁸⁰*University of Iowa, Iowa City, Iowa, USA*
⁸¹*Department of Physics and Astronomy, Iowa State University, Ames, Iowa, USA*
⁸²*Istinye University, Sariyer, Istanbul, Türkiye*
^{83a}*Departamento de Engenharia Elétrica, Universidade Federal de Juiz de Fora (UFJF), Juiz de Fora, Brazil*
^{83b}*Universidade Federal do Rio De Janeiro COPPE/EE/IF, Rio de Janeiro, Brazil*
^{83c}*Instituto de Física, Universidade de São Paulo, São Paulo, Brazil*
^{83d}*Rio de Janeiro State University, Rio de Janeiro, Brazil*
⁸⁴*KEK, High Energy Accelerator Research Organization, Tsukuba, Japan*
⁸⁵*Graduate School of Science, Kobe University, Kobe, Japan*
^{86a}*AGH University of Krakow, Faculty of Physics and Applied Computer Science, Krakow, Poland*
^{86b}*Marian Smoluchowski Institute of Physics, Jagiellonian University, Krakow, Poland*
⁸⁷*Institute of Nuclear Physics Polish Academy of Sciences, Krakow, Poland*
⁸⁸*Faculty of Science, Kyoto University, Kyoto, Japan*
⁸⁹*Research Center for Advanced Particle Physics and Department of Physics, Kyushu University, Fukuoka, Japan*

- ⁹⁰*Instituto de Física La Plata, Universidad Nacional de La Plata and CONICET, La Plata, Argentina*
- ⁹¹*Physics Department, Lancaster University, Lancaster, United Kingdom*
- ⁹²*Oliver Lodge Laboratory, University of Liverpool, Liverpool, United Kingdom*
- ⁹³*Department of Experimental Particle Physics, Jožef Stefan Institute and Department of Physics, University of Ljubljana, Ljubljana, Slovenia*
- ⁹⁴*School of Physics and Astronomy, Queen Mary University of London, London, United Kingdom*
- ⁹⁵*Department of Physics, Royal Holloway University of London, Egham, United Kingdom*
- ⁹⁶*Department of Physics and Astronomy, University College London, London, United Kingdom*
- ⁹⁷*Louisiana Tech University, Ruston, Louisiana, USA*
- ⁹⁸*Fysiska institutionen, Lunds universitet, Lund, Sweden*
- ⁹⁹*Departamento de Física Teórica C-15 and CIAFF, Universidad Autónoma de Madrid, Madrid, Spain*
- ¹⁰⁰*Institut für Physik, Universität Mainz, Mainz, Germany*
- ¹⁰¹*School of Physics and Astronomy, University of Manchester, Manchester, United Kingdom*
- ¹⁰²*CPPM, Aix-Marseille Université, CNRS/IN2P3, Marseille, France*
- ¹⁰³*Department of Physics, University of Massachusetts, Amherst, Massachusetts, USA*
- ¹⁰⁴*Department of Physics, McGill University, Montreal, Québec, Canada*
- ¹⁰⁵*School of Physics, University of Melbourne, Victoria, Australia*
- ¹⁰⁶*Department of Physics, University of Michigan, Ann Arbor, Michigan, USA*
- ¹⁰⁷*Department of Physics and Astronomy, Michigan State University, East Lansing, Michigan, USA*
- ¹⁰⁸*Group of Particle Physics, University of Montreal, Montreal, Québec, Canada*
- ¹⁰⁹*Fakultät für Physik, Ludwig-Maximilians-Universität München, München, Germany*
- ¹¹⁰*Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München, Germany*
- ¹¹¹*Graduate School of Science and Kobayashi-Maskawa Institute, Nagoya University, Nagoya, Japan*
- ¹¹²*Department of Physics and Astronomy, University of New Mexico, Albuquerque, New Mexico, USA*
- ¹¹³*Institute for Mathematics, Astrophysics and Particle Physics, Radboud University/Nikhef, Nijmegen, Netherlands*
- ¹¹⁴*Nikhef National Institute for Subatomic Physics and University of Amsterdam, Amsterdam, Netherlands*
- ¹¹⁵*Department of Physics, Northern Illinois University, DeKalb, Illinois, USA*
- ^{116a}*New York University Abu Dhabi, Abu Dhabi, United Arab Emirates*
- ^{116b}*University of Sharjah, Sharjah, United Arab Emirates*
- ¹¹⁷*Department of Physics, New York University, New York, New York, USA*
- ¹¹⁸*Ochanomizu University, Otsuka, Bunkyo-ku, Tokyo, Japan*
- ¹¹⁹*Ohio State University, Columbus, Ohio, USA*
- ¹²⁰*Homer L. Dodge Department of Physics and Astronomy, University of Oklahoma, Norman, Oklahoma, USA*
- ¹²¹*Department of Physics, Oklahoma State University, Stillwater, Oklahoma, USA*
- ¹²²*Palacký University, Joint Laboratory of Optics, Olomouc, Czech Republic*
- ¹²³*Institute for Fundamental Science, University of Oregon, Eugene, Oregon, USA*
- ¹²⁴*Graduate School of Science, Osaka University, Osaka, Japan*
- ¹²⁵*Department of Physics, University of Oslo, Oslo, Norway*
- ¹²⁶*Department of Physics, Oxford University, Oxford, United Kingdom*
- ¹²⁷*LPNHE, Sorbonne Université, Université Paris Cité, CNRS/IN2P3, Paris, France*
- ¹²⁸*Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania, USA*
- ¹²⁹*Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, Pennsylvania, USA*
- ^{130a}*Laboratório de Instrumentação e Física Experimental de Partículas—LIP, Lisboa, Portugal*
- ^{130b}*Departamento de Física, Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal*
- ^{130c}*Departamento de Física, Universidade de Coimbra, Coimbra, Portugal*
- ^{130d}*Centro de Física Nuclear da Universidade de Lisboa, Lisboa, Portugal*
- ^{130e}*Departamento de Física, Universidade do Minho, Braga, Portugal*
- ^{130f}*Departamento de Física Teórica y del Cosmos, Universidad de Granada, Granada (Spain), Spain*
- ^{130g}*Departamento de Física, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal*
- ¹³¹*Institute of Physics of the Czech Academy of Sciences, Prague, Czech Republic*
- ¹³²*Czech Technical University in Prague, Prague, Czech Republic*
- ¹³³*Charles University, Faculty of Mathematics and Physics, Prague, Czech Republic*
- ¹³⁴*Particle Physics Department, Rutherford Appleton Laboratory, Didcot, United Kingdom*
- ¹³⁵*IRFU, CEA, Université Paris-Saclay, Gif-sur-Yvette, France*
- ¹³⁶*Santa Cruz Institute for Particle Physics, University of California Santa Cruz, Santa Cruz, California, USA*
- ^{137a}*Departamento de Física, Pontificia Universidad Católica de Chile, Santiago, Chile*
- ^{137b}*Millennium Institute for Subatomic physics at high energy frontier (SAPHIR), Santiago, Chile*
- ^{137c}*Instituto de Investigación Multidisciplinario en Ciencia y Tecnología, y Departamento de Física, Universidad de La Serena, Chile*
- ^{137d}*Universidad Andres Bello, Department of Physics, Santiago, Chile*
- ^{137e}*Instituto de Alta Investigación, Universidad de Tarapacá, Arica, Chile*

- ^{137f}*Departamento de Física, Universidad Técnica Federico Santa María, Valparaíso, Chile*
- ¹³⁸*Department of Physics, University of Washington, Seattle, Washington State, USA*
- ¹³⁹*Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom*
- ¹⁴⁰*Department of Physics, Shinshu University, Nagano, Japan*
- ¹⁴¹*Department Physik, Universität Siegen, Siegen, Germany*
- ¹⁴²*Department of Physics, Simon Fraser University, Burnaby, British Columbia, Canada*
- ¹⁴³*SLAC National Accelerator Laboratory, Stanford, California, USA*
- ¹⁴⁴*Department of Physics, Royal Institute of Technology, Stockholm, Sweden*
- ¹⁴⁵*Departments of Physics and Astronomy, Stony Brook University, Stony Brook, New York, USA*
- ¹⁴⁶*Department of Physics and Astronomy, University of Sussex, Brighton, United Kingdom*
- ¹⁴⁷*School of Physics, University of Sydney, Sydney, Australia*
- ¹⁴⁸*Institute of Physics, Academia Sinica, Taipei, Taiwan*
- ^{149a}*E. Andronikashvili Institute of Physics, Iv. Javakhishvili Tbilisi State University, Tbilisi, Georgia*
- ^{149b}*High Energy Physics Institute, Tbilisi State University, Tbilisi, Georgia*
- ^{149c}*University of Georgia, Tbilisi, Georgia*
- ¹⁵⁰*Department of Physics, Technion, Israel Institute of Technology, Haifa, Israel*
- ¹⁵¹*Raymond and Beverly Sackler School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel*
- ¹⁵²*Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece*
- ¹⁵³*International Center for Elementary Particle Physics and Department of Physics, University of Tokyo, Tokyo, Japan*
- ¹⁵⁴*Department of Physics, Tokyo Institute of Technology, Tokyo, Japan*
- ¹⁵⁵*Department of Physics, University of Toronto, Toronto, Ontario, Canada*
- ^{156a}*TRIUMF, Vancouver, British Columbia, Canada*
- ^{156b}*Department of Physics and Astronomy, York University, Toronto, Ontario, Canada*
- ¹⁵⁷*Division of Physics and Tomonaga Center for the History of the Universe, Faculty of Pure and Applied Sciences, University of Tsukuba, Tsukuba, Japan*
- ¹⁵⁸*Department of Physics and Astronomy, Tufts University, Medford, Massachusetts, USA*
- ¹⁵⁹*United Arab Emirates University, Al Ain, United Arab Emirates*
- ¹⁶⁰*Department of Physics and Astronomy, University of California Irvine, Irvine, California, USA*
- ¹⁶¹*Department of Physics and Astronomy, University of Uppsala, Uppsala, Sweden*
- ¹⁶²*Department of Physics, University of Illinois, Urbana, Illinois, USA*
- ¹⁶³*Instituto de Física Corpuscular (IFIC), Centro Mixto Universidad de Valencia—CSIC, Valencia, Spain*
- ¹⁶⁴*Department of Physics, University of British Columbia, Vancouver, British Columbia, Canada*
- ¹⁶⁵*Department of Physics and Astronomy, University of Victoria, Victoria, British Columbia, Canada*
- ¹⁶⁶*Fakultät für Physik und Astronomie, Julius-Maximilians-Universität Würzburg, Würzburg, Germany*
- ¹⁶⁷*Department of Physics, University of Warwick, Coventry, United Kingdom*
- ¹⁶⁸*Waseda University, Tokyo, Japan*
- ¹⁶⁹*Department of Particle Physics and Astrophysics, Weizmann Institute of Science, Rehovot, Israel*
- ¹⁷⁰*Department of Physics, University of Wisconsin, Madison, Wisconsin, USA*
- ¹⁷¹*Fakultät für Mathematik und Naturwissenschaften, Fachgruppe Physik, Bergische Universität Wuppertal, Wuppertal, Germany*
- ¹⁷²*Department of Physics, Yale University, New Haven, Connecticut, USA*
- ¹*Yerevan Physics Institute, Yerevan, Armenia*
- ²*Institut für Hochenergiephysik, Vienna, Austria*
- ³*Universiteit Antwerpen, Antwerpen, Belgium*
- ⁴*Vrije Universiteit Brussel, Brussel, Belgium*
- ⁵*Université Libre de Bruxelles, Bruxelles, Belgium*
- ⁶*Ghent University, Ghent, Belgium*
- ⁷*Université Catholique de Louvain, Louvain-la-Neuve, Belgium*
- ⁸*Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, Brazil*
- ⁹*Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil*
- ¹⁰*Universidade Estadual Paulista, Universidade Federal do ABC, São Paulo, Brazil*
- ¹¹*Institute for Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences, Sofia, Bulgaria*
- ¹²*University of Sofia, Sofia, Bulgaria*
- ¹³*Instituto De Alta Investigación, Universidad de Tarapacá, Casilla 7 D, Arica, Chile*
- ¹⁴*Beihang University, Beijing, China*
- ¹⁵*Department of Physics, Tsinghua University, Beijing, China*
- ¹⁶*Institute of High Energy Physics, Beijing, China*
- ¹⁷*State Key Laboratory of Nuclear Physics and Technology, Peking University, Beijing, China*
- ¹⁸*Sun Yat-Sen University, Guangzhou, China*

- ¹⁹University of Science and Technology of China, Hefei, China
- ²⁰Institute of Modern Physics and Key Laboratory of Nuclear Physics and Ion-beam Application (MOE)—Fudan University, Shanghai, China
- ²¹Zhejiang University, Hangzhou, Zhejiang, China
- ²²Universidad de Los Andes, Bogota, Colombia
- ²³Universidad de Antioquia, Medellin, Colombia
- ²⁴University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, Croatia
- ²⁵University of Split, Faculty of Science, Split, Croatia
- ²⁶Institute Rudjer Boskovic, Zagreb, Croatia
- ²⁷University of Cyprus, Nicosia, Cyprus
- ²⁸Charles University, Prague, Czech Republic
- ²⁹Escuela Politecnica Nacional, Quito, Ecuador
- ³⁰Universidad San Francisco de Quito, Quito, Ecuador
- ³¹Academy of Scientific Research and Technology of the Arab Republic of Egypt, Egyptian Network of High Energy Physics, Cairo, Egypt
- ³²Center for High Energy Physics (CHEP-FU), Fayoum University, El-Fayoum, Egypt
- ³³National Institute of Chemical Physics and Biophysics, Tallinn, Estonia
- ³⁴Department of Physics, University of Helsinki, Helsinki, Finland
- ³⁵Helsinki Institute of Physics, Helsinki, Finland
- ³⁶Lappeenranta-Lahti University of Technology, Lappeenranta, Finland
- ³⁷IRFU, CEA, Université Paris-Saclay, Gif-sur-Yvette, France
- ³⁸Laboratoire Leprince-Ringuet, CNRS/IN2P3, Ecole Polytechnique, Institut Polytechnique de Paris, Palaiseau, France
- ³⁹Université de Strasbourg, CNRS, IPHC UMR 7178, Strasbourg, France
- ⁴⁰Institut de Physique des 2 Infinis de Lyon (IP2I), Villeurbanne, France
- ⁴¹Georgian Technical University, Tbilisi, Georgia
- ⁴²RWTH Aachen University, I. Physikalisches Institut, Aachen, Germany
- ⁴³RWTH Aachen University, III. Physikalisches Institut A, Aachen, Germany
- ⁴⁴RWTH Aachen University, III. Physikalisches Institut B, Aachen, Germany
- ⁴⁵Deutsches Elektronen-Synchrotron, Hamburg, Germany
- ⁴⁶University of Hamburg, Hamburg, Germany
- ⁴⁷Karlsruher Institut fuer Technologie, Karlsruhe, Germany
- ⁴⁸Institute of Nuclear and Particle Physics (INPP), NCSR Demokritos, Aghia Paraskevi, Greece
- ⁴⁹National and Kapodistrian University of Athens, Athens, Greece
- ⁵⁰National Technical University of Athens, Athens, Greece
- ⁵¹University of Ioánnina, Ioánnina, Greece
- ⁵²MTA-ELTE Lendület CMS Particle and Nuclear Physics Group, Eötvös Loránd University, Budapest, Hungary
- ⁵³Wigner Research Centre for Physics, Budapest, Hungary
- ⁵⁴Faculty of Informatics, University of Debrecen, Debrecen, Hungary
- ⁵⁵Institute of Nuclear Research ATOMKI, Debrecen, Hungary
- ⁵⁶Karoly Robert Campus, MATE Institute of Technology, Gyongyos, Hungary
- ⁵⁷Panjab University, Chandigarh, India
- ⁵⁸University of Delhi, Delhi, India
- ⁵⁹Saha Institute of Nuclear Physics, HBNI, Kolkata, India
- ⁶⁰Indian Institute of Technology Madras, Madras, India
- ⁶¹Tata Institute of Fundamental Research-A, Mumbai, India
- ⁶²Tata Institute of Fundamental Research-B, Mumbai, India
- ⁶³National Institute of Science Education and Research, An OCC of Homi Bhabha National Institute, Bhubaneswar, Odisha, India
- ⁶⁴Indian Institute of Science Education and Research (IISER), Pune, India
- ⁶⁵Isfahan University of Technology, Isfahan, Iran
- ⁶⁶Institute for Research in Fundamental Sciences (IPM), Tehran, Iran
- ⁶⁷University College Dublin, Dublin, Ireland
- ^{68a}INFN Sezione di Bari, Bari, Italy
- ^{68b}Università di Bari, Bari, Italy
- ^{68c}Politecnico di Bari, Bari, Italy
- ^{69a}INFN Sezione di Bologna, Bologna, Italy
- ^{69b}Università di Bologna, Bologna, Italy
- ^{70a}INFN Sezione di Catania, Catania, Italy
- ^{70b}Università di Catania, Catania, Italy
- ^{71a}INFN Sezione di Firenze, Firenze, Italy
- ^{71b}Università di Firenze, Firenze, Italy

- ⁷²*INFN Laboratori Nazionali di Frascati, Frascati, Italy*
- ^{73a}*INFN Sezione di Genova, Genova, Italy*
- ^{73b}*Università di Genova, Genova, Italy*
- ^{74a}*INFN Sezione di Milano-Bicocca, Milano, Italy*
- ^{74b}*Università di Milano-Bicocca, Milano, Italy*
- ^{75a}*INFN Sezione di Napoli, Napoli, Italy*
- ^{75b}*Università di Napoli 'Federico II', Napoli, Italy*
- ^{75c}*Università della Basilicata, Potenza, Italy*
- ^{75d}*Università G. Marconi, Roma, Italy*
- ^{76a}*INFN Sezione di Padova, Padova, Italy*
- ^{76b}*Università di Padova, Padova, Italy*
- ^{76c}*Università di Trento, Trento, Italy*
- ^{77a}*INFN Sezione di Pavia, Pavia, Italy*
- ^{77b}*Università di Pavia, Pavia, Italy*
- ^{78a}*INFN Sezione di Perugia, Perugia, Italy*
- ^{78b}*Università di Perugia, Perugia, Italy*
- ^{79a}*INFN Sezione di Pisa, Pisa, Italy*
- ^{79b}*Università di Pisa, Pisa, Italy*
- ^{79c}*Scuola Normale Superiore di Pisa, Pisa, Italy*
- ^{79d}*Università di Siena, Siena, Italy*
- ^{80a}*INFN Sezione di Roma, Roma, Italy*
- ^{80b}*Sapienza Università di Roma, Roma, Italy*
- ^{81a}*INFN Sezione di Torino, Torino, Italy*
- ^{81b}*Università di Torino, Torino, Italy*
- ^{81c}*Università del Piemonte Orientale, Novara, Italy*
- ^{82a}*INFN Sezione di Trieste, Trieste, Italy*
- ^{82b}*Università di Trieste, Trieste, Italy*
- ⁸³*Kyungpook National University, Daegu, Korea*
- ⁸⁴*Department of Mathematics and Physics—GWNu, Gangneung, Korea*
- ⁸⁵*Chonnam National University, Institute for Universe and Elementary Particles, Kwangju, Korea*
- ⁸⁶*Hanyang University, Seoul, Korea*
- ⁸⁷*Korea University, Seoul, Korea*
- ⁸⁸*Kyung Hee University, Department of Physics, Seoul, Korea*
- ⁸⁹*Sejong University, Seoul, Korea*
- ⁹⁰*Seoul National University, Seoul, Korea*
- ⁹¹*University of Seoul, Seoul, Korea*
- ⁹²*Yonsei University, Department of Physics, Seoul, Korea*
- ⁹³*Sungkyunkwan University, Suwon, Korea*
- ⁹⁴*College of Engineering and Technology, American University of the Middle East (AUM), Dasman, Kuwait*
- ⁹⁵*Riga Technical University, Riga, Latvia*
- ⁹⁶*University of Latvia (LU), Riga, Latvia*
- ⁹⁷*Vilnius University, Vilnius, Lithuania*
- ⁹⁸*National Centre for Particle Physics, Universiti Malaya, Kuala Lumpur, Malaysia*
- ⁹⁹*Universidad de Sonora (UNISON), Hermosillo, Mexico*
- ¹⁰⁰*Centro de Investigación y de Estudios Avanzados del IPN, Mexico City, Mexico*
- ¹⁰¹*Universidad Iberoamericana, Mexico City, Mexico*
- ¹⁰²*Benemerita Universidad Autónoma de Puebla, Puebla, Mexico*
- ¹⁰³*University of Montenegro, Podgorica, Montenegro*
- ¹⁰⁴*University of Canterbury, Christchurch, New Zealand*
- ¹⁰⁵*National Centre for Physics, Quaid-I-Azam University, Islamabad, Pakistan*
- ¹⁰⁶*AGH University of Science and Technology Faculty of Computer Science, Electronics and Telecommunications, Krakow, Poland*
- ¹⁰⁷*National Centre for Nuclear Research, Swierk, Poland*
- ¹⁰⁸*Institute of Experimental Physics, Faculty of Physics, University of Warsaw, Warsaw, Poland*
- ¹⁰⁹*Laboratório de Instrumentação e Física Experimental de Partículas, Lisboa, Portugal*
- ¹¹⁰*Faculty of Physics, University of Belgrade, Belgrade, Serbia*
- ¹¹¹*VINCA Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia*
- ¹¹²*Centro de Investigaciones Energéticas Medioambientales y Tecnológicas (CIEMAT), Madrid, Spain*
- ¹¹³*Universidad Autónoma de Madrid, Madrid, Spain*
- ¹¹⁴*Universidad de Oviedo, Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias (ICTEA), Oviedo, Spain*
- ¹¹⁵*Instituto de Física de Cantabria (IFCA), CSIC-Universidad de Cantabria, Santander, Spain*

- ¹¹⁶*University of Colombo, Colombo, Sri Lanka*
- ¹¹⁷*University of Ruhuna, Department of Physics, Matara, Sri Lanka*
- ¹¹⁸*CERN, European Organization for Nuclear Research, Geneva, Switzerland*
- ¹¹⁹*Paul Scherrer Institut, Villigen, Switzerland*
- ¹²⁰*ETH Zurich—Institute for Particle Physics and Astrophysics (IPA), Zurich, Switzerland*
- ¹²¹*Universität Zürich, Zurich, Switzerland*
- ¹²²*National Central University, Chung-Li, Taiwan*
- ¹²³*National Taiwan University (NTU), Taipei, Taiwan*
- ¹²⁴*Chulalongkorn University, Faculty of Science, Department of Physics, Bangkok, Thailand*
- ¹²⁵*Çukurova University, Physics Department, Science and Art Faculty, Adana, Turkey*
- ¹²⁶*Middle East Technical University, Physics Department, Ankara, Turkey*
- ¹²⁷*Bogazici University, Istanbul, Turkey*
- ¹²⁸*Istanbul Technical University, Istanbul, Turkey*
- ¹²⁹*Istanbul University, Istanbul, Turkey*
- ¹³⁰*Institute for Scintillation Materials of National Academy of Science of Ukraine, Kharkiv, Ukraine*
- ¹³¹*National Science Centre, Kharkiv Institute of Physics and Technology, Kharkiv, Ukraine*
- ¹³²*University of Bristol, Bristol, United Kingdom*
- ¹³³*Rutherford Appleton Laboratory, Didcot, United Kingdom*
- ¹³⁴*Imperial College, London, United Kingdom*
- ¹³⁵*Brunel University, Uxbridge, United Kingdom*
- ¹³⁶*Baylor University, Waco, Texas, USA*
- ¹³⁷*Catholic University of America, Washington, DC, USA*
- ¹³⁸*The University of Alabama, Tuscaloosa, Alabama, USA*
- ¹³⁹*Boston University, Boston, Massachusetts, USA*
- ¹⁴⁰*Brown University, Providence, Rhode Island, USA*
- ¹⁴¹*University of California, Davis, Davis, California, USA*
- ¹⁴²*University of California, Los Angeles, California, USA*
- ¹⁴³*University of California, Riverside, Riverside, California, USA*
- ¹⁴⁴*University of California, San Diego, La Jolla, California, USA*
- ¹⁴⁵*University of California, Santa Barbara—Department of Physics, Santa Barbara, California, USA*
- ¹⁴⁶*California Institute of Technology, Pasadena, California, USA*
- ¹⁴⁷*Carnegie Mellon University, Pittsburgh, Pennsylvania, USA*
- ¹⁴⁸*University of Colorado Boulder, Boulder, Colorado, USA*
- ¹⁴⁹*Cornell University, Ithaca, New York, USA*
- ¹⁵⁰*Fermi National Accelerator Laboratory, Batavia, Illinois, USA*
- ¹⁵¹*University of Florida, Gainesville, Florida, USA*
- ¹⁵²*Florida State University, Tallahassee, Florida, USA*
- ¹⁵³*Florida Institute of Technology, Melbourne, Florida, USA*
- ¹⁵⁴*University of Illinois at Chicago (UIC), Chicago, Illinois, USA*
- ¹⁵⁵*The University of Iowa, Iowa City, Iowa, USA*
- ¹⁵⁶*Johns Hopkins University, Baltimore, Maryland, USA*
- ¹⁵⁷*The University of Kansas, Lawrence, Kansas, USA*
- ¹⁵⁸*Kansas State University, Manhattan, Kansas, USA*
- ¹⁵⁹*Lawrence Livermore National Laboratory, Livermore, California, USA*
- ¹⁶⁰*University of Maryland, College Park, Maryland, USA*
- ¹⁶¹*Massachusetts Institute of Technology, Cambridge, Massachusetts, USA*
- ¹⁶²*University of Minnesota, Minneapolis, Minnesota, USA*
- ¹⁶³*University of Mississippi, Oxford, Mississippi, USA*
- ¹⁶⁴*University of Nebraska-Lincoln, Lincoln, Nebraska, USA*
- ¹⁶⁵*State University of New York at Buffalo, Buffalo, New York, USA*
- ¹⁶⁶*Northeastern University, Boston, Massachusetts, USA*
- ¹⁶⁷*Northwestern University, Evanston, Illinois, USA*
- ¹⁶⁸*University of Notre Dame, Notre Dame, Indiana, USA*
- ¹⁶⁹*The Ohio State University, Columbus, Ohio, USA*
- ¹⁷⁰*Princeton University, Princeton, New Jersey, USA*
- ¹⁷¹*University of Puerto Rico, Mayaguez, Puerto Rico, USA*
- ¹⁷²*Purdue University, West Lafayette, Indiana, USA*
- ¹⁷³*Purdue University Northwest, Hammond, Indiana, USA*
- ¹⁷⁴*Rice University, Houston, Texas, USA*
- ¹⁷⁵*University of Rochester, Rochester, New York, USA*

- ¹⁷⁶*The Rockefeller University, New York, New York, USA*
¹⁷⁷*Rutgers, The State University of New Jersey, Piscataway, New Jersey, USA*
¹⁷⁸*University of Tennessee, Knoxville, Tennessee, USA*
¹⁷⁹*Texas A&M University, College Station, Texas, USA*
¹⁸⁰*Texas Tech University, Lubbock, Texas, USA*
¹⁸¹*Vanderbilt University, Nashville, Tennessee, USA*
¹⁸²*University of Virginia, Charlottesville, Virginia, USA*
¹⁸³*Wayne State University, Detroit, Michigan, USA*
¹⁸⁴*University of Wisconsin—Madison, Madison, Wisconsin, USA*
¹⁸⁵*An institute or international laboratory covered by a cooperation agreement with CERN*

^aDeceased.

^bAlso at Department of Physics, King's College London, London, United Kingdom.

^cAlso at Institute of Physics, Azerbaijan Academy of Sciences, Baku, Azerbaijan.

^dAlso at Lawrence Livermore National Laboratory, Livermore, USA.

^eAlso at TRIUMF, Vancouver, British Columbia, Canada.

^fAlso at Department of Physics, University of Thessaly, Greece.

^gAlso at An-Najah National University, Nablus, Palestine.

^hAlso at Department of Physics, University of Fribourg, Fribourg, Switzerland.

ⁱAlso at University of Colorado Boulder, Department of Physics, Colorado, USA.

^jAlso at Department of Physics, Westmont College, Santa Barbara, USA.

^kAlso at Departament de Física de la Universitat Autònoma de Barcelona, Barcelona, Spain.

^lAlso at Affiliated with an institute covered by a cooperation agreement with CERN.

^mAlso at The Collaborative Innovation Center of Quantum Matter (CICQM), Beijing, China.

ⁿAlso at Department of Physics, Ben Gurion University of the Negev, Beer Sheva, Israel.

^oAlso at Università di Napoli Parthenope, Napoli, Italy.

^pAlso at Institute of Particle Physics (IPP), Canada.

^qAlso at Borough of Manhattan Community College, City University of New York, New York, New York, USA.

^rAlso at National Institute of Physics, University of the Philippines Diliman (Philippines), Philippines.

^sAlso at Department of Financial and Management Engineering, University of the Aegean, Chios, Greece.

^tAlso at Ochanomizu University, Otsuka, Bunkyo-ku, Tokyo, Japan.

^uAlso at Department of Physics, Stanford University, Stanford, California, USA.

^vAlso at Centro Studi e Ricerche Enrico Fermi, Italy.

^wAlso at Institutio Catalana de Recerca i Estudis Avancats, ICREA, Barcelona, Spain.

^xAlso at Technical University of Munich, Munich, Germany.

^yAlso at Yeditepe University, Physics Department, Istanbul, Türkiye.

^zAlso at Institute of Theoretical Physics, Ilia State University, Tbilisi, Georgia.

^{aa}Also at CERN, Geneva, Switzerland.

^{bb}Also at Center for Interdisciplinary Research and Innovation (CIRI-AUTH), Thessaloniki, Greece.

^{cc}Also at Hellenic Open University, Patras, Greece.

^{dd}Also at Center for High Energy Physics, Peking University, China.

^{ee}Also at L2IT, Université de Toulouse, CNRS/IN2P3, UPS, Toulouse, France.

^{ff}Also at Department of Physics, California State University, Sacramento, USA.

^{gg}Also at Département de Physique Nucléaire et Corpusculaire, Université de Genève, Genève, Switzerland.

^{hh}Also at Institute for Nuclear Research and Nuclear Energy (INRNE) of the Bulgarian Academy of Sciences, Sofia, Bulgaria.

ⁱⁱAlso at Washington College, Chestertown, Maryland, USA.

^{jj}Also at Institut für Experimentalphysik, Universität Hamburg, Hamburg, Germany.

^{kk}Also at Institute of Applied Physics, Mohammed VI Polytechnic University, Ben Guerir, Morocco.

^{ll}Also at Institute of Physics and Technology, Ulaanbaatar, Mongolia.

^{mm}Also at University of Chinese Academy of Sciences (UCAS), Beijing, China.

ⁿⁿAlso at Yerevan State University, Yerevan, Armenia.

^{oo}Also at TU Wien, Vienna, Austria.

^{pp}Also at Institute of Basic and Applied Sciences, Faculty of Engineering, Arab Academy for Science, Technology and Maritime Transport, Alexandria, Egypt.

^{qq}Also at Ghent University, Ghent, Belgium.

^{rr}Also at Universidade Estadual de Campinas, Campinas, Brazil.

^{ss}Also at Federal University of Rio Grande do Sul, Porto Alegre, Brazil.

^{tt}Also at UFMS, Nova Andradina, Brazil.

^{uu}Also at Nanjing Normal University, Nanjing, China.

^{vv}Also at Henan Normal University, Xinxiang, China.

- ^{ww} Also at The University of Iowa, Iowa City, Iowa, USA.
- ^{xx} Also at University of Chinese Academy of Sciences, Beijing, China.
- ^{yy} Also at China Center of Advanced Science and Technology, Beijing, China.
- ^{zz} Also at University of Chinese Academy of Sciences, Beijing, China.
- ^{aaa} Also at China Spallation Neutron Source, Guangdong, China.
- ^{bbb} Also at Université Libre de Bruxelles, Bruxelles, Belgium.
- ^{ccc} Also at Another institute or international laboratory covered by a cooperation agreement with CERN.
- ^{ddd} Also at Suez University, Suez, Egypt.
- ^{eee} Also at British University in Egypt, Cairo, Egypt.
- ^{fff} Also at Birla Institute of Technology, Mesra, Mesra, India.
- ^{ggg} Also at Purdue University, West Lafayette, Indiana, USA.
- ^{hhh} Also at Université de Haute Alsace, Mulhouse, France.
- ⁱⁱⁱ Also at Department of Physics, Tsinghua University, Beijing, China.
- ^{jjj} Also at Tbilisi State University, Tbilisi, Georgia.
- ^{kkk} Also at The University of the State of Amazonas, Manaus, Brazil.
- ^{lll} Also at Erzincan Binali Yildirim University, Erzincan, Turkey.
- ^{mmm} Also at University of Hamburg, Hamburg, Germany.
- ⁿⁿⁿ Also at RWTH Aachen University, III. Physikalisches Institut A, Aachen, Germany.
- ^{ooo} Also at Isfahan University of Technology, Isfahan, Iran.
- ^{ppp} Also at Bergische University Wuppertal (BUW), Wuppertal, Germany.
- ^{qqq} Also at Brandenburg University of Technology, Cottbus, Germany.
- ^{rrr} Also at Forschungszentrum Jülich, Jülich, Germany.
- ^{sss} Also at CERN, European Organization for Nuclear Research, Geneva, Switzerland.
- ^{ttt} Also at Physics Department, Faculty of Science, Assiut University, Assiut, Egypt.
- ^{uuu} Also at Wigner Research Centre for Physics, Budapest, Hungary.
- ^{vvv} Also at Institute of Physics, University of Debrecen, Debrecen, Hungary.
- ^{www} Also at Institute of Nuclear Research ATOMKI, Debrecen, Hungary.
- ^{xxx} Also at Universitatea Babes-Bolyai—Facultatea de Fizica, Cluj-Napoca, Romania.
- ^{yyy} Also at Faculty of Informatics, University of Debrecen, Debrecen, Hungary.
- ^{zzz} Also at Punjab Agricultural University, Ludhiana, India.
- ^{aaaa} Also at University of Hyderabad, Hyderabad, India.
- ^{bbbb} Also at University of Visva-Bharati, Santiniketan, India.
- ^{cccc} Also at Indian Institute of Science (IISc), Bangalore, India.
- ^{dddd} Also at IIT Bhubaneswar, Bhubaneswar, India.
- ^{eeee} Also at Institute of Physics, Bhubaneswar, India.
- ^{fff} Also at Deutsches Elektronen-Synchrotron, Hamburg, Germany.
- ^{gggg} Also at Department of Physics, Isfahan University of Technology, Isfahan, Iran.
- ^{hhhh} Also at Sharif University of Technology, Tehran, Iran.
- ⁱⁱⁱⁱ Also at Department of Physics, University of Science and Technology of Mazandaran, Behshahr, Iran.
- ^{jjjj} Also at Helwan University, Cairo, Egypt.
- ^{kkkk} Also at Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Bologna, Italy.
- ^{llll} Also at Centro Siciliano di Fisica Nucleare e di Struttura Della Materia, Catania, Italy.
- ^{mmmm} Also at Università degli Studi Guglielmo Marconi, Roma, Italy.
- ⁿⁿⁿⁿ Also at Scuola Superiore Meridionale, Università di Napoli 'Federico II', Napoli, Italy.
- ^{oooo} Also at Fermi National Accelerator Laboratory, Batavia, Illinois, USA.
- ^{pppp} Also at Università di Napoli 'Federico II', Napoli, Italy.
- ^{qqqq} Also at Ain Shams University, Cairo, Egypt.
- ^{rrrr} Also at Consiglio Nazionale delle Ricerche—Istituto Officina dei Materiali, Perugia, Italy.
- ^{ssss} Also at Riga Technical University, Riga, Latvia.
- ^{tttt} Also at Department of Applied Physics, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Bangi, Malaysia.
- ^{uuuu} Also at Consejo Nacional de Ciencia y Tecnología, Mexico City, Mexico.
- ^{vvvv} Also at Trincomalee Campus, Eastern University, Sri Lanka, Nilaveli, Sri Lanka.
- ^{wwww} Also at INFN Sezione di Pavia, Università di Pavia, Pavia, Italy.
- ^{xxxx} Also at National and Kapodistrian University of Athens, Athens, Greece.
- ^{yyyy} Also at Ecole Polytechnique Fédérale Lausanne, Lausanne, Switzerland.
- ^{zzzz} Also at University of Vienna Faculty of Computer Science, Vienna, Austria.
- ^{aaaaa} Also at Universität Zürich, Zurich, Switzerland.
- ^{bbbbb} Also at Stefan Meyer Institute for Subatomic Physics, Vienna, Austria.
- ^{ccccc} Also at Laboratoire d'Annecy-le-Vieux de Physique des Particules, IN2P3-CNRS, Annecy-le-Vieux, France.
- ^{ddddd} Also at Near East University, Research Center of Experimental Health Science, Mersin, Turkey.

- ceeee Also at Konya Technical University, Konya, Turkey.
 fffff Also at Izmir Bakircay University, Izmir, Turkey.
 ggggg Also at Adiyaman University, Adiyaman, Turkey.
 hhhhh Also at Bozok Universitetsi Rektörlüğü, Yozgat, Turkey.
 iiiii Also at Marmara University, Istanbul, Turkey.
 jjjjj Also at Milli Savunma University, Istanbul, Turkey.
 kkkkk Also at Kafkas University, Kars, Turkey.
 lllll Also at stanbul Okan University, Istanbul, Turkey.
 mmmmm Also at Hacettepe University, Ankara, Turkey.
 nnnnn Also at Istanbul University—Cerrahpasa, Faculty of Engineering, Istanbul, Turkey.
 ooooo Also at Yildiz Technical University, Istanbul, Turkey.
 ppppp Also at Vrije Universiteit Brussel, Brussel, Belgium.
 qqqqq Also at School of Physics and Astronomy, University of Southampton, Southampton, United Kingdom.
 rrrrr Also at University of Bristol, Bristol, United Kingdom.
 sssss Also at IPPP Durham University, Durham, United Kingdom.
 ttttt Also at Monash University, Faculty of Science, Clayton, Australia.
 uuuuu Also at Università di Torino, Torino, Italy.
 vvvvv Also at Bethel University, St. Paul, Minnesota, USA.
 wwwww Also at Karamanoğlu Mehmetbey University, Karaman, Turkey.
 xxxxx Also at California Institute of Technology, Pasadena, California, USA.
 yyyyy Also at United States Naval Academy, Annapolis, Maryland, USA.
 zzzzz Also at Bingol University, Bingol, Turkey.
 aaaaaa Also at Georgian Technical University, Tbilisi, Georgia.
 bbbbbb Also at Sinop University, Sinop, Turkey.
 cccccc Also at Erciyes University, Kayseri, Turkey.
 ddddd Also at Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH), Bucharest, Romania.
 eeeee Also at Texas A&M University at Qatar, Doha, Qatar.
 fffff Also at Kyungpook National University, Daegu, Korea.
 ggggg Also at Universiteit Antwerpen, Antwerpen, Belgium.
 hhhhh Also at Yerevan Physics Institute, Yerevan, Armenia.
 iiiii Also at Northeastern University, Boston, Massachusetts, USA.
 jjjjj Also at Imperial College, London, United Kingdom.
 kkkkk Also at Institute of Nuclear Physics of the Uzbekistan Academy of Sciences, Tashkent, Uzbekistan.