Measurements of the Nuclear Modification Factor for Jets in Pb + Pb Collisions at $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV with the ATLAS Detector

G. Aad *et al.**
(ATLAS Collaboration)
(Received 10 November 2014; published 20 February 2015)

Measurements of inclusive jet production are performed in pp and Pb + Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV with the ATLAS detector at the LHC, corresponding to integrated luminosities of 4.0 and 0.14 nb^{-1}, respectively. The jets are identified with the anti-k_t algorithm with $R = 0.4$, and the spectra are measured over the kinematic range of jet transverse momentum $32 < p_{\mathrm{T}} < 500$ GeV and absolute rapidity $|y| < 2.1$ and as a function of collision centrality. The nuclear modification factor R_{AA} is evaluated, and jets are found to be suppressed by approximately a factor of 2 in central collisions compared to pp collisions. The R_{AA} shows a slight increase with p_T and no significant variation with rapidity.

DOI: 10.1103/PhysRevLett.114.072302 PACS numbers: 25.75.−q

Relativistic heavy-ion collisions at the LHC produce a medium of strongly interacting nuclear matter composed of deconfined color charges [1–4]. Hard scattering processes occurring in these collisions produce high transverse momentum (p_T) partons that propagate through the medium and lose energy, resulting in the phenomenon of "jet quenching." The partonic energy loss can be probed through measurements of the suppression of jet production rates. The effects of energy loss have been observed through the suppression of single hadrons [5–11] and jets constructed from charged particles [12]. ATLAS has previously reported measurements with fully reconstructed jets [13] by comparing the jet yields in central collisions, where the colliding nuclei have a large overlap, to the yields in peripheral collisions. Those results indicate that the rate of jets in Pb + Pb collisions is suppressed by a factor of approximately 2 in central collisions relative to peripheral collisions. A more sensitive probe of energy loss is provided by measurements of the suppression relative to pp collisions, where there are no quenching effects.

The magnitude of the suppression is expected to depend on both the p_T dependence of the energy loss as well as the shape of the initial jet production p_T spectrum [1]. This spectrum becomes increasingly steep at larger values of the jet rapidity [14]. Thus, measurements of jet suppression for jets in different intervals of rapidity provide complementary information about the energy loss. Additionally, parton showers initiated by quarks may be quenched differently than gluons [15], and the fraction of quark-initiated jets is expected to increase with rapidity.

Hard scattering rates are enhanced in more central collisions; the larger overlap results in a higher integrated luminosity of partons able to participate in hard scattering processes, and these hard scattering rates are expected to be proportional to the nuclear overlap function T_{AA}. The suppression is quantified by the nuclear modification factor

$$R_{\mathrm{AA}} = \frac{\frac{1}{N_{\mathrm{evt}}}\frac{d^2N_{\mathrm{jet}}}{dp_T dy}\Big|_{\mathrm{central}}}{\langle T_{\mathrm{AA}}\rangle \frac{d^2\sigma^{pp}_{\mathrm{jet}}}{dp_T dy}}.$$

This Letter presents measurements of the inclusive jet R_{AA} in Pb + Pb collisions at a nucleon-nucleon center-of-mass energy of $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV. It utilizes Pb + Pb data collected during 2011 corresponding to an integrated luminosity of 0.14 nb^{-1} as well as data from pp collisions recorded during 2013 at the same center-of-mass energy corresponding to 4.0 pb^{-1}. Results are presented for jets reconstructed in the calorimeter with the anti-k_t jet-finding algorithm [16] with jet radius parameter $R = 0.4$. The contribution of the underlying event (UE) to each jet, assumed to be uncorrelated and additive, was subtracted on a per-jet basis.

The measurements presented here were performed with the ATLAS calorimeter, inner detector, trigger, and data acquisition systems [17,18]. The calorimeter system consists of a liquid argon (LAr) electromagnetic calorimeter ($|\eta| < 3.2$), a steel-scintillator sampling hadronic calorimeter ($|\eta| < 1.7$), a LAr hadronic calorimeter ($1.5 < |\eta| < 3.2$), and a forward calorimeter (FCal) ($3.2 < |\eta| < 4.9$). Charged-particle tracks were measured over the range $|\eta| < 2.5$ using the inner detector [19], which is composed of silicon pixel detectors in the innermost layers, followed by silicon microstrip detectors and a straw-tube transition-radiation tracker ($|\eta| < 2.0$), all immersed in a 2 T axial magnetic field. The zero-degree calorimeters

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

(ZDCs) are located symmetrically at $z = \pm 140$ m and cover $|\eta| > 8.3$. A ZDC coincidence trigger was defined by requiring a signal consistent with one or more neutrons in each of the calorimeters.

The pp events used in the analysis were selected using the ATLAS jet trigger [20] with multiple values of the trigger p_T thresholds. During pp data taking, the average number of pp interactions per bunch crossing (pile-up) varied from 0.3 to 0.6. The pp events were required to contain at least one primary vertex, reconstructed from at least two tracks, and jets originating from all such vertices were included in the cross section measurement.

Data from Pb + Pb collisions were recorded using either a minimum-bias trigger or a jet trigger. The minimum-bias trigger, formed from the logical OR of triggers based on a ZDC coincidence or total transverse energy in the event, is fully efficient in the range of centralities presented here. The jet trigger identified jets by applying the anti-k_t algorithm with $R = 0.2$ with a UE subtraction procedure similar to that applied in the off-line analysis. The jet trigger selected events having at least one jet with transverse energy $E_T > 20$ GeV at the electromagnetic scale [21]. Event selection and background rejection criteria were applied [22] yielding 53×10^6 and 14×10^6 events in the minimum-bias and jet-triggered samples, respectively.

The centrality of Pb + Pb collisions was characterized by $\Sigma E_T^{\mathrm{FCal}}$, the total transverse energy measured in the FCal [22]. The centrality intervals were defined according to successive percentiles of the $\Sigma E_T^{\mathrm{FCal}}$ distribution ordered from the most central (highest $\Sigma E_T^{\mathrm{FCal}}$) to the most peripheral collisions. A Glauber model analysis of the $\Sigma E_T^{\mathrm{FCal}}$ distribution was used to evaluate the $\langle T_{\mathrm{AA}} \rangle$ and the number of nucleons participating in the collision, $\langle N_{\mathrm{part}} \rangle$, in each centrality interval [22–24]. The centrality intervals used in this measurement are indicated in Table I along with the values of $\langle T_{\mathrm{AA}} \rangle$ and $\langle N_{\mathrm{part}} \rangle$ for those intervals.

TABLE I. The $\langle T_{\mathrm{AA}} \rangle$ and $\langle N_{\mathrm{part}} \rangle$ values and their uncertainties in each centrality bin.

Centrality (%)	$\langle T_{\mathrm{AA}} \rangle$ (mb^{-1})	$\langle N_{\mathrm{part}} \rangle$
0–10	23.45 ± 0.37	356.2 ± 2.5
10–20	14.43 ± 0.30	260.7 ± 3.6
20–30	8.73 ± 0.26	186.4 ± 3.9
30–40	5.04 ± 0.22	129.3 ± 3.8
40–50	2.7 ± 0.17	85.6 ± 3.6
50–60	1.33 ± 0.12	53.0 ± 3.1
60–70	0.59 ± 0.07	30.1 ± 2.5
70–80	0.24 ± 0.04	15.1 ± 1.7
0–1	29.04 ± 0.46	400.1 ± 1.3
1–5	25.62 ± 0.40	377.6 ± 2.2
5–10	20.59 ± 0.34	330.3 ± 3.0
60–80	0.41 ± 0.05	22.6 ± 2.1

The jet reconstruction and UE subtraction procedures described in Ref. [13] were applied to both pp and Pb + Pb data. The anti-k_t algorithm was applied to logical towers with segmentation $\Delta\eta \times \Delta\phi = 0.1 \times 0.1$ formed from energy deposits in the calorimeter. An iterative procedure was used to obtain an event-by-event estimate of the average η-dependent UE energy density while excluding actual jets from that estimate. The jet kinematics were obtained by subtracting the UE energy from the towers within the jet. Following reconstruction, the jet energies were corrected for the calorimeter energy response using the procedure described in Ref. [25].

In addition to the calorimetric jets, "track jets" were reconstructed by applying the anti-k_t algorithm with $R = 0.4$ to charged particles with $p_T > 4$ GeV. In the Pb + Pb analysis, the track jets were used in conjunction with electromagnetic clusters to exclude the contribution to the jet yield from UE fluctuations of soft particles incorrectly interpreted as calorimetric jets [13]. The jets were required to be within $\Delta R = \sqrt{(\Delta\eta)^2 + (\Delta\phi)^2} = 0.2$ of a track jet with $p_T > 7$ GeV or an electromagnetic cluster with $p_T > 8$ GeV.

The performance of the jet reconstruction in Pb + Pb collisions was evaluated using the GEANT4-simulated detector response [26,27] in a Monte Carlo (MC) sample of pp hard scattering events at $\sqrt{s} = 2.76$ TeV. The events were produced with the PYTHIA event generator [28] version 6.423 with parameters chosen according to the so-called AUET2B tune [29] and overlaid with minimum-bias Pb + Pb collisions recorded by ATLAS during the same data-taking period as the data used in the analysis. Thus, the MC sample contains a UE contribution that is identical in all respects to the data. A separate PYTHIA sample was produced for the analysis of the pp data with the detector simulation adjusted to match the conditions during the pp data taking including pile-up. Additional MC samples were used in evaluations of the jet energy scale (JES) uncertainty. The PYQUEN generator [30], which applies medium-induced energy loss to parton showers produced by PYTHIA, was used to generate a sample of jets with fragmentation functions that differ from those in the nominal PYTHIA sample in a fashion consistent with measurements of fragmentation functions in quenched jets [31–33].

The jet spectra, defined to be the average differential yield in a given p_T bin, were constructed from a mixture of minimum-bias (Pb + Pb only) and jet-triggered samples. In each p_T bin, the trigger with the most events and that was more than 99% efficient for that bin was used. The jet spectra were unfolded [13] to account for the p_T bin migration induced by the jet energy resolution (JER) using a method based on the singular value decomposition [34]. The effects of the JER, which receives contributions from both the detector response and UE fluctuations, were evaluated by applying the same procedure to the MC samples as was applied to the data and by matching the resulting reconstructed jets and "generator jets" that are reconstructed from final-state PYTHIA hadrons. For each pair, the p_T of the generator and reconstructed jets were used to populate a detector response matrix. Separate response matrices were obtained for each centrality interval.

The response matrix is generally diagonal, indicating that jets are likely to be reconstructed in the same p_T bin as the generator jets. The average p_T difference between reconstructed and generator jets is $\lesssim 1\%$, independent of centrality. However, the response distributions broaden at low p_T as the relative JER increases due to the larger UE fluctuations. At $p_T = 200$ GeV, the relative JER is approximately 10% and is independent of centrality. However, at $p_T = 40$ GeV, it varies from 20% to 40% between peripheral and central collisions. The unfolding is most sensitive in this region, and the range of jet p_T used in the unfolding was chosen separately in each centrality interval to be as low as possible while maintaining stability in the unfolding procedure. The statistical covariance of each unfolded spectrum was evaluated using the pseudoexperiment procedure described in Ref. [13]. Systematic uncertainties in the unfolding procedure were evaluated by varying the choice of regularization parameter used in the unfolding.

The effects of any inefficiency in the jet reconstruction, including inefficiency introduced by the UE jet rejection requirement, were corrected for by a multiplicative correction applied after unfolding. This factor, obtained from the MC sample, is unity for $p_T > 100$ GeV and reaches a maximum of 1.3 in the most central collisions at the lowest p_T. For values larger than unity, an uncertainty of 0.5% was assigned to this correction based on the comparison of the jet reconstruction efficiency with respect to track jets between the data and MC sample.

Uncertainties on the JER and JES have been evaluated using data-driven techniques in pp collisions [21,35]. A systematic uncertainty of 1.5% on the JES was assigned to account for potential differences, not described by the MC simulations, between the two data-taking periods. This value was obtained by comparing the calorimetric response with respect to the p_T of matched track jets in pp and peripheral Pb + Pb collisions.

A centrality-dependent uncertainty on the JES due to differences between pp and Pb + Pb in the partonic composition of jets and in their fragmentation was estimated with the PYQUEN sample. The jet response in that sample was found to differ by up to 1% from that in the PYTHIA sample. The magnitude of this variation was checked with a similar study using track jets to compare central and peripheral Pb + Pb data. The uncertainty was taken to be 1% in the most central collisions with the uncertainty decreasing in more peripheral collisions.

The impacts of the JER and JES uncertainties on the spectra were assessed by constructing new response matrices with a systematically varied relationship between the reconstructed and generator jet kinematics and repeating the unfolding. Correlations in the JES and JER uncertainties across the pp and Pb + Pb samples were accounted for in the propagation of the uncertainties to the R_{AA}.

Uncertainties on the T_{AA} and integrated luminosity affect the overall normalization of the yields and thus are independent of jet p_T and rapidity. The uncertainties on $\langle T_{AA} \rangle$ vary between 1% and 10% in the most central and peripheral collisions, respectively, with the full set of values given in Table I. The uncertainty on the integrated luminosity is estimated to be 3.1%. It is determined, following the same methodology as that detailed in Ref. [36], from a calibration of the luminosity scale derived from beam-separation scans performed during the 2.76 TeV operation of the LHC in 2013.

The total systematic uncertainty on the pp cross sections is dominated by the JES uncertainty, which is as large as 15%. For the Pb + Pb jet yields, this uncertainty is also dominant and in the most central collisions is 22%. In the R_{AA}, much of this uncertainty cancels. However, the dominant contribution is due to the JES in most centrality and rapidity intervals and is typically 10%. The uncertainties due to the unfolding are generally a few percent, but for some p_T values near the upper and lower limits included in the measurement the contributions from this source are as large as 15%. The contributions of the JER to the total uncertainty on R_{AA} are less than 3% except in the most central collisions at low p_T, where they are as large as 10%. In the most peripheral bins, the $\langle T_{AA} \rangle$

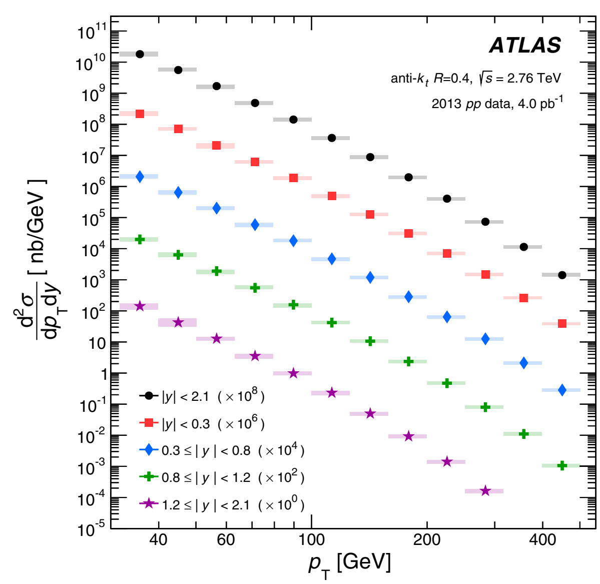

FIG. 1 (color online). The double differential jet cross section in pp collisions as a function of p_T in different rapidity bins (scaled by successive powers of 10^2). The statistical and systematic uncertainties are indicated by the error bars (too small to be seen on this scale) and shaded bands, respectively. The points and horizontal error bars indicate the p_T bin center and width, respectively.

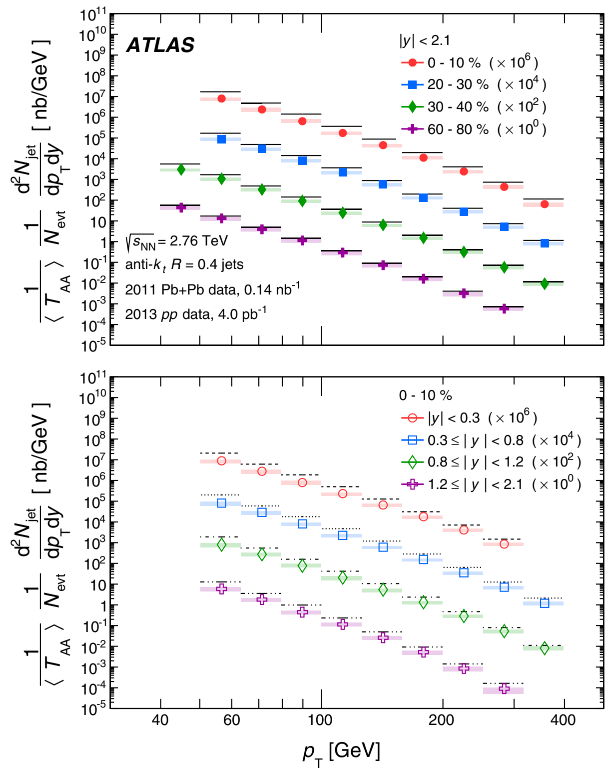

FIG. 2 (color online). The per-event jet yield in Pb + Pb collisions, multiplied by $1/\langle T_{\mathrm{AA}}\rangle$, as a function of p_T (scaled by successive powers of 10^2). The upper panel shows the 0–2.1 rapidity range in different centrality intervals. The lower panel shows the 0%–10% centrality interval in different rapidity ranges. The statistical and systematic uncertainties are indicated by the error bars (too small to be seen on this scale) and shaded bands, respectively. The points and horizontal error bars indicate the p_T bin center and width, respectively. The solid and dashed lines represent the pp jet cross section for the same rapidity interval scaled by the same factor.

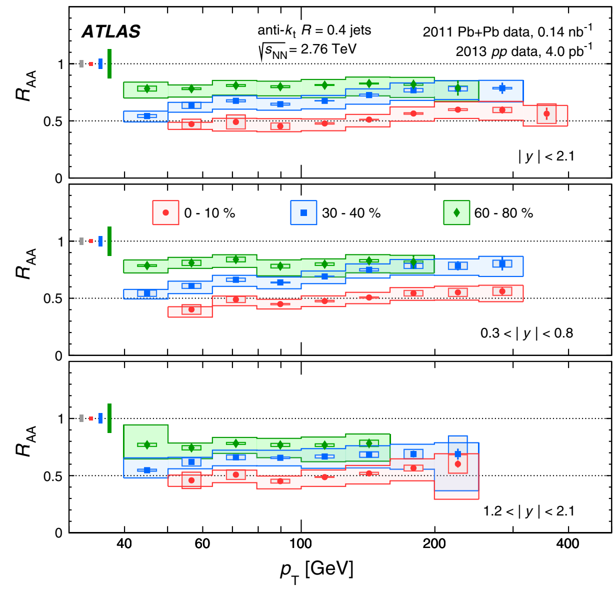

FIG. 3 (color online). Jet R_{AA} as a function of p_T in different centrality bins with each panel showing a different range in $|y|$. The fractional luminosity and $\langle T_{\mathrm{AA}}\rangle$ uncertainties are indicated separately as shaded boxes centered at one. The boxes, bands, and error bars indicate uncorrelated systematic, correlated systematic, and statistical uncertainties, respectively.

uncertainties that affect the overall normalization are the dominant contribution.

The pp differential jet cross sections are shown in Fig. 1 for the following absolute rapidity ranges: 0–0.3, 0.3–0.8, 0.8–1.2, 1.2–2.1, and 0–2.1. These results are consistent with a previous measurement with fewer events [37]. The differential per-event jet yield in Pb + Pb collisions, multiplied by $1/\langle T_{\mathrm{AA}}\rangle$, is shown in Fig. 2, in selected rapidity and centrality bins in the lower and upper panels, respectively. The dashed lines represent the pp jet cross sections for that same rapidity bin; the jet suppression is evidenced by the fact that the jet yields fall below these lines.

The jet R_{AA} as a function of p_T is shown in Fig. 3 for different ranges in collision centrality and jet rapidity. The R_{AA} is observed to increase weakly with p_T, except in the most peripheral collisions. In the 0%–10% and $|y| < 2.1$ centrality and rapidity intervals, which have the smallest statistical uncertainty, the R_{AA} is 0.47 at $p_T \sim 55$ GeV and rises to 0.56 at $p_T \sim 350$ GeV. These distributions were fit, accounting for the pointwise correlations in the uncertainties, to the functional form $a \ln(p_T) + b$. The slope parameter was found to be significantly above zero in all but the most peripheral collisions. The magnitude and weak increase of the R_{AA} in central collisions are described quantitatively by recent theoretical calculations [38,39]. The results of this measurement are consistent with

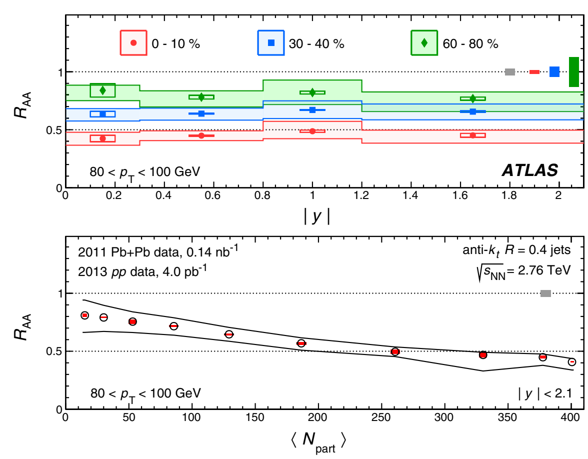

FIG. 4 (color online). The R_{AA} for jets with $80 < p_T < 100$ GeV as a function of $|y|$ for different centrality bins (top) and as a function of $\langle N_{\mathrm{part}}\rangle$ for the $|y| < 2.1$ range (bottom). The fractional luminosity and $\langle T_{\mathrm{AA}}\rangle$ uncertainties are indicated separately as shaded boxes centered at one. The boxes, bands, and error bars indicate uncorrelated systematic, correlated systematic, and statistical uncertainties, respectively.

measurements of the jet central-to-peripheral ratio [13], although in those measurements the uncertainties are too large to infer any significant p_T dependence.

The rapidity dependence of the R_{AA} is shown in the top panel of Fig. 4 for jets with $80 < p_T < 100$ GeV for three centrality bins. The R_{AA} shows no significant rapidity dependence over the p_T and rapidity ranges presented in this measurement. The $\langle N_{part} \rangle$ dependence is shown in the bottom panel of Fig. 4 for jets in the same p_T interval and with $|y| < 2.1$. The R_{AA} decreases smoothly from the most peripheral collisions (smallest $\langle N_{part} \rangle$ values) to central collisions, where it reaches a minimal value of approximately 0.4 in the most central 1% of collisions. A similar $\langle N_{part} \rangle$ dependence is observed for jets in different ranges of p_T and rapidity.

In summary, this Letter presents measurements of inclusive jet production in pp and Pb + Pb collisions over a wide range in p_T, rapidity, and centrality. The jet nuclear modification factor R_{AA} obtained from these measurements shows a weak rise with p_T, with a slope that varies with collision centrality. No significant slope is observed in the most peripheral collisions. The R_{AA} decreases gradually with increasing $\langle N_{part} \rangle$. At forward rapidity, the increasing steepness of the jet production spectrum is expected to result in more suppression of the jet yields. In this kinematic region, the production is increasingly dominated by quark jets, which may lose less energy than gluon jets [15]. The observed lack of rapidity dependence in the R_{AA} places constraints on relative energy loss for quark and gluon jets in theoretical descriptions of jet quenching.

We thank 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. We acknowledge the support of ANPCyT, Argentina; YerPhI, Armenia; ARC, Australia; BMWFW and FWF, Austria; ANAS, Azerbaijan; SSTC, Belarus; CNPq and FAPESP, Brazil; NSERC, NRC, and CFI, Canada; CERN; CONICYT, Chile; CAS, MOST, and NSFC, China; COLCIENCIAS, Colombia; MSMT CR, MPO CR, and VSC CR, Czech Republic; DNRF, DNSRC, and Lundbeck Foundation, Denmark; EPLANET, ERC, and NSRF, European Union; IN2P3-CNRS, CEA-DSM/IRFU, France; GNSF, Georgia; BMBF, DFG, HGF, MPG, and AvH Foundation, Germany; GSRT and NSRF, Greece; ISF, MINERVA, GIF, I-CORE, and Benoziyo Center, Israel; INFN, Italy; MEXT and JSPS, Japan; CNRST, Morocco; FOM and NWO, Netherlands; BRF and RCN, Norway; MNiSW and NCN, Poland; GRICES and FCT, Portugal; MNE/IFA, Romania; MES of Russia and ROSATOM, Russian Federation; JINR; MSTD, Serbia; MSSR, Slovakia; ARRS and MIZŠ, Slovenia; DST/NRF, South Africa; MINECO, Spain; SRC and Wallenberg Foundation, Sweden; SER, SNSF, and Cantons of Bern and Geneva, Switzerland; NSC, Taiwan; TAEK, Turkey; STFC, the Royal Society, and Leverhulme Trust, United Kingdom; DOE and NSF, United States of America. The crucial computing support from all WLCG partners is acknowledged gratefully, in particular, from CERN and the ATLAS Tier-1 facilities at TRIUMF (Canada), NDGF (Denmark, Norway, and Sweden), CC-IN2P3 (France), KIT/GridKA (Germany), INFN-CNAF (Italy), NL-T1 (Netherlands), PIC (Spain), ASGC (Taiwan), RAL (United Kingdom), and BNL (USA) and in the Tier-2 facilities worldwide.

[1] K. Adcox *et al.* (PHENIX Collaboration), Nucl. Phys. **A757**, 184 (2005).
[2] J. Adams *et al.* (STAR Collaboration), Nucl. Phys. **A757**, 102 (2005).
[3] B. Back *et al.* (PHOBOS Collaboration), Nucl. Phys. **A757**, 28 (2005).
[4] I. Arsene *et al.* (BRAHMS Collaboration), Nucl. Phys. **A757**, 1 (2005).
[5] S. Adler *et al.* (PHENIX Collaboration), Phys. Rev. Lett. **91**, 072301 (2003).
[6] J. Adams *et al.* (STAR Collaboration), Phys. Rev. Lett. **91**, 172302 (2003).
[7] I. Arsene *et al.* (BRAHMS Collaboration), Phys. Rev. Lett. **91**, 072305 (2003).
[8] B. Back *et al.* (PHOBOS Collaboration), Phys. Rev. Lett. **94**, 082304 (2005).
[9] CMS Collaboration, Eur. Phys. J. C **72**, 1945 (2012).
[10] K. Aamodt *et al.* (ALICE Collaboration), Phys. Lett. B **696**, 30 (2011).
[11] B. Abelev *et al.* (ALICE Collaboration), Phys. Lett. B **720**, 52 (2013).
[12] B. Abelev *et al.* (ALICE Collaboration), J. High Energy Phys. 03 (2014) 013.
[13] ATLAS Collaboration, Phys. Lett. B **719**, 220 (2013).
[14] ATLAS Collaboration, Phys. Rev. D **86**, 014022 (2012).
[15] R. Baier, D. Schiff, and B. Zakharov, Annu. Rev. Nucl. Part. Sci. **50**, 37 (2000).
[16] M. Cacciari, G. P. Salam, and G. Soyez, J. High Energy Phys. 04 (2008) 063.
[17] ATLAS uses a right-handed coordinate system with its origin at the nominal interaction point (IP) in the center of the detector and the z axis along the beam pipe. The x axis points from the IP to the center of the LHC ring, and the y axis points upward. Cylindrical coordinates (r, ϕ) are used in the transverse plane, ϕ being the azimuthal angle around the beam pipe. The pseudorapidity is defined in terms of the polar angle θ as $\eta = -\ln\tan(\theta/2)$.
[18] ATLAS Collaboration, JINST **3**, S08003 (2008).
[19] ATLAS Collaboration, Eur. Phys. J. C **70**, 787 (2010).
[20] ATLAS Collaboration, Eur. Phys. J. C **72**, 1849 (2012).
[21] ATLAS Collaboration, Eur. Phys. J. C **73**, 2304 (2013).
[22] ATLAS Collaboration, Phys. Lett. B **707**, 330 (2012).
[23] M. L. Miller, K. Reygers, S. J. Sanders, and P. Steinberg, Annu. Rev. Nucl. Part. Sci. **57**, 205 (2007).
[24] B. Alver, M. Baker, C. Loizides, and P. Steinberg, arXiv:0805.4411.

[25] ATLAS Collaboration, Eur. Phys. J. C **75**, 17 (2015).
[26] S. Agostinelli *et al.*, Nucl. Instrum. Methods Phys. Res., Sect. A **506**, 250 (2003).
[27] ATLAS Collaboration, Eur. Phys. J. C **70**, 823 (2010).
[28] T. Sjostrand, S. Mrenna, and P. Z. Skands, J. High Energy Phys. 05 (2006) 026.
[29] ATLAS Collaboration, Report No. ATL-PHYS-PUB-2011-009, 2011, http://cdsweb.cern.ch/record/1363300.
[30] I. Lokhtin and A. Snigirev, Eur. Phys. J. C **45**, 211 (2006).
[31] CMS Collaboration, J. High Energy Phys. 10 (2012) 087.
[32] CMS Collaboration, Phys. Rev. C **90**, 024908 (2014).
[33] ATLAS Collaboration, Phys. Lett. B **739**, 320 (2014).
[34] A. Höcker and V. Kartvelishvili, Nucl. Instrum. Methods Phys. Res., Sect. A **372**, 469 (1996).
[35] ATLAS Collaboration, Eur. Phys. J. C **73**, 2306 (2013).
[36] ATLAS Collaboration, Eur. Phys. J. C **73**, 2518 (2013).
[37] ATLAS Collaboration, Eur. Phys. J. C **73**, 2509 (2013).
[38] Y. He, I. Vitev, and B.-W. Zhang, Phys. Lett. B **713**, 224 (2012).
[39] Z.-B. Kang, R. Lashof-Regas, G. Ovanesyan, P. Saad, and I. Vitev, arXiv:1405.2612 [Phys. Rev. Lett (to be published)].

G. Aad,[84] B. Abbott,[112] J. Abdallah,[152] S. Abdel Khalek,[116] O. Abdinov,[11] R. Aben,[106] B. Abi,[113] M. Abolins,[89] O. S. AbouZeid,[159] H. Abramowicz,[154] H. Abreu,[153] R. Abreu,[30] Y. Abulaiti,[147a,147b] B. S. Acharya,[165a,165b,b] L. Adamczyk,[38a] D. L. Adams,[25] J. Adelman,[177] S. Adomeit,[99] T. Adye,[130] T. Agatonovic-Jovin,[13a] J. A. Aguilar-Saavedra,[125a,125f] M. Agustoni,[17] S. P. Ahlen,[22] F. Ahmadov,[64,c] G. Aielli,[134a,134b] H. Akerstedt,[147a,147b] T. P. A. Åkesson,[80] G. Akimoto,[156] A. V. Akimov,[95] G. L. Alberghi,[20a,20b] J. Albert,[170] S. Albrand,[55] M. J. Alconada Verzini,[70] M. Aleksa,[30] I. N. Aleksandrov,[64] C. Alexa,[26a] G. Alexander,[154] G. Alexandre,[49] T. Alexopoulos,[10] M. Alhroob,[165a,165c] G. Alimonti,[90a] L. Alio,[84] J. Alison,[31] B. M. M. Allbrooke,[18] L. J. Allison,[71] P. P. Allport,[73] J. Almond,[83] A. Aloisio,[103a,103b] A. Alonso,[36] F. Alonso,[70] C. Alpigiani,[75] A. Altheimer,[35] B. Alvarez Gonzalez,[89] M. G. Alviggi,[103a,103b] K. Amako,[65] Y. Amaral Coutinho,[24a] C. Amelung,[23] D. Amidei,[88] S. P. Amor Dos Santos,[125a,125c] A. Amorim,[125a,125b] S. Amoroso,[48] N. Amram,[154] G. Amundsen,[23] C. Anastopoulos,[140] L. S. Ancu,[49] N. Andari,[30] T. Andeen,[35] C. F. Anders,[58b] G. Anders,[30] K. J. Anderson,[31] A. Andreazza,[90a,90b] V. Andrei,[58a] X. S. Anduaga,[70] S. Angelidakis,[9] I. Angelozzi,[106] P. Anger,[44] A. Angerami,[35] F. Anghinolfi,[30] A. V. Anisenkov,[108] N. Anjos,[125a] A. Annovi,[47] A. Antonaki,[9] M. Antonelli,[47] A. Antonov,[97] J. Antos,[145b] F. Anulli,[133a] M. Aoki,[65] L. Aperio Bella,[18] R. Apolle,[119,d] G. Arabidze,[89] I. Aracena,[144] Y. Arai,[65] J. P. Araque,[125a] A. T. H. Arce,[45] J-F. Arguin,[94] S. Argyropoulos,[42] M. Arik,[19a] A. J. Armbruster,[30] O. Arnaez,[30] V. Arnal,[81] H. Arnold,[48] M. Arratia,[28] O. Arslan,[21] A. Artamonov,[96] G. Artoni,[23] S. Asai,[156] N. Asbah,[42] A. Ashkenazi,[154] B. Åsman,[147a,147b] L. Asquith,[6] K. Assamagan,[25] R. Astalos,[145a] M. Atkinson,[166] N. B. Atlay,[142] B. Auerbach,[6] K. Augsten,[127] M. Aurousseau,[146b] G. Avolio,[30] G. Azuelos,[94,e] Y. Azuma,[156] M. A. Baak,[30] A. E. Baas,[58a] C. Bacci,[135a,135b] H. Bachacou,[137] K. Bachas,[155] M. Backes,[30] M. Backhaus,[30] J. Backus Mayes,[144] E. Badescu,[26a] P. Bagiacchi,[133a,133b] P. Bagnaia,[133a,133b] Y. Bai,[33a] T. Bain,[35] J. T. Baines,[130] O. K. Baker,[177] P. Balek,[128] F. Balli,[137] E. Banas,[39] Sw. Banerjee,[174] A. A. E. Bannoura,[176] V. Bansal,[170] H. S. Bansil,[18] L. Barak,[173] S. P. Baranov,[95] E. L. Barberio,[87] D. Barberis,[50a,50b] M. Barbero,[84] T. Barillari,[100] M. Barisonzi,[176] T. Barklow,[144] N. Barlow,[28] B. M. Barnett,[130] R. M. Barnett,[15] Z. Barnovska,[5] A. Baroncelli,[135a] G. Barone,[49] A. J. Barr,[119] F. Barreiro,[81] J. Barreiro Guimarães da Costa,[57] R. Bartoldus,[144] A. E. Barton,[71] P. Bartos,[145a] V. Bartsch,[150] A. Bassalat,[116] A. Basye,[166] R. L. Bates,[53] J. R. Batley,[28] M. Battaglia,[138] M. Battistin,[30] F. Bauer,[137] H. S. Bawa,[144,f] M. D. Beattie,[71] T. Beau,[79] P. H. Beauchemin,[162] R. Beccherle,[123a,123b] P. Bechtle,[21] H. P. Beck,[17] K. Becker,[176] S. Becker,[99] M. Beckingham,[171] C. Becot,[116] A. J. Beddall,[19c] A. Beddall,[19c] S. Bedikian,[177] V. A. Bednyakov,[64] C. P. Bee,[149] L. J. Beemster,[106] T. A. Beermann,[176] M. Begel,[25] K. Behr,[119] C. Belanger-Champagne,[86] P. J. Bell,[49] W. H. Bell,[49] G. Bella,[154] L. Bellagamba,[20a] A. Bellerive,[29] M. Bellomo,[85] K. Belotskiy,[97] O. Beltramello,[30] O. Benary,[154] D. Benchekroun,[136a] K. Bendtz,[147a,147b] N. Benekos,[166] Y. Benhammou,[154] E. Benhar Noccioli,[49] J. A. Benitez Garcia,[160b] D. P. Benjamin,[45] J. R. Bensinger,[23] K. Benslama,[131] S. Bentvelsen,[106] D. Berge,[106] E. Bergeaas Kuutmann,[16] N. Berger,[5] F. Berghaus,[170] J. Beringer,[15] C. Bernard,[22] P. Bernat,[77] C. Bernius,[78] F. U. Bernlochner,[170] T. Berry,[76] P. Berta,[128] C. Bertella,[84] G. Bertoli,[147a,147b] F. Bertolucci,[123a,123b] C. Bertsche,[112] D. Bertsche,[112] M. I. Besana,[90a] G. J. Besjes,[105] O. Bessidskaia Bylund,[147a,147b] M. Bessner,[42] N. Besson,[137] C. Betancourt,[48] S. Bethke,[100] W. Bhimji,[46] R. M. Bianchi,[124] L. Bianchini,[23] M. Bianco,[30] O. Biebel,[99] S. P. Bieniek,[77] K. Bierwagen,[54] J. Biesiada,[15] M. Biglietti,[135a] J. Bilbao De Mendizabal,[49] H. Bilokon,[47] M. Bindi,[54] S. Binet,[116] A. Bingul,[19c] C. Bini,[133a,133b] C. W. Black,[151] J. E. Black,[144] K. M. Black,[22] D. Blackburn,[139] R. E. Blair,[6] J.-B. Blanchard,[137] T. Blazek,[145a] I. Bloch,[42] C. Blocker,[23] W. Blum,[82,a] U. Blumenschein,[54] G. J. Bobbink,[106] V. S. Bobrovnikov,[108] S. S. Bocchetta,[80]

A. Bocci,[45] C. Bock,[99] C. R. Boddy,[119] M. Boehler,[48] T. T. Boek,[176] J. A. Bogaerts,[30] A. G. Bogdanchikov,[108] A. Bogouch,[91,a] C. Bohm,[147a] J. Bohm,[126] V. Boisvert,[76] T. Bold,[38a] V. Boldea,[26a] A. S. Boldyrev,[98] M. Bomben,[79] M. Bona,[75] M. Boonekamp,[137] A. Borisov,[129] G. Borissov,[71] M. Borri,[83] S. Borroni,[42] J. Bortfeldt,[99] V. Bortolotto,[135a,135b] K. Bos,[106] D. Boscherini,[20a] M. Bosman,[12] H. Boterenbrood,[106] J. Boudreau,[124] J. Bouffard,[2] E. V. Bouhova-Thacker,[71] D. Boumediene,[34] C. Bourdarios,[116] N. Bousson,[113] S. Boutouil,[136d] A. Boveia,[31] J. Boyd,[30] I. R. Boyko,[64] J. Bracinik,[18] A. Brandt,[8] G. Brandt,[15] O. Brandt,[58a] U. Bratzler,[157] B. Brau,[85] J. E. Brau,[115] H. M. Braun,[176,a] S. F. Brazzale,[165a,165c] B. Brelier,[159] K. Brendlinger,[121] A. J. Brennan,[87] R. Brenner,[167] S. Bressler,[173] K. Bristow,[146c] T. M. Bristow,[46] D. Britton,[53] F. M. Brochu,[28] I. Brock,[21] R. Brock,[89] C. Bromberg,[89] J. Bronner,[100] G. Brooijmans,[35] T. Brooks,[76] W. K. Brooks,[32b] J. Brosamer,[15] E. Brost,[115] J. Brown,[55] P. A. Bruckman de Renstrom,[39] D. Bruncko,[145b] R. Bruneliere,[48] S. Brunet,[60] A. Bruni,[20a] G. Bruni,[20a] M. Bruschi,[20a] L. Bryngemark,[80] T. Buanes,[14] Q. Buat,[143] F. Bucci,[49] P. Buchholz,[142] R. M. Buckingham,[119] A. G. Buckley,[53] S. I. Buda,[26a] I. A. Budagov,[64] F. Buehrer,[48] L. Bugge,[118] M. K. Bugge,[118] O. Bulekov,[97] A. C. Bundock,[73] H. Burckhart,[30] S. Burdin,[73] B. Burghgrave,[107] S. Burke,[130] I. Burmeister,[43] E. Busato,[34] D. Büscher,[48] V. Büscher,[82] P. Bussey,[53] C. P. Buszello,[167] B. Butler,[57] J. M. Butler,[22] A. I. Butt,[3] C. M. Buttar,[53] J. M. Butterworth,[77] P. Butti,[106] W. Buttinger,[28] A. Buzatu,[53] M. Byszewski,[10] S. Cabrera Urbán,[168] D. Caforio,[20a,20b] O. Cakir,[4a] P. Calafiura,[15] A. Calandri,[137] G. Calderini,[79] P. Calfayan,[99] R. Calkins,[107] L. P. Caloba,[24a] D. Calvet,[34] S. Calvet,[34] R. Camacho Toro,[49] S. Camarda,[42] D. Cameron,[118] L. M. Caminada,[15] R. Caminal Armadans,[12] S. Campana,[30] M. Campanelli,[77] A. Campoverde,[149] V. Canale,[103a,103b] A. Canepa,[160a] M. Cano Bret,[75] J. Cantero,[81] R. Cantrill,[125a] T. Cao,[40] M. D. M. Capeans Garrido,[30] I. Caprini,[26a] M. Caprini,[26a] M. Capua,[37a,37b] R. Caputo,[82] R. Cardarelli,[134a] T. Carli,[30] G. Carlino,[103a] L. Carminati,[90a,90b] S. Caron,[105] E. Carquin,[32a] G. D. Carrillo-Montoya,[146c] J. R. Carter,[28] J. Carvalho,[125a,125c] D. Casadei,[77] M. P. Casado,[12] M. Casolino,[12] E. Castaneda-Miranda,[146b] A. Castelli,[106] V. Castillo Gimenez,[168] N. F. Castro,[125a] P. Catastini,[57] A. Catinaccio,[30] J. R. Catmore,[118] A. Cattai,[30] G. Cattani,[134a,134b] S. Caughron,[89] V. Cavaliere,[166] D. Cavalli,[90a] M. Cavalli-Sforza,[12] V. Cavasinni,[123a,123b] F. Ceradini,[135a,135b] B. C. Cerio,[45] K. Cerny,[128] A. S. Cerqueira,[24b] A. Cerri,[150] L. Cerrito,[75] F. Cerutti,[15] M. Cerv,[30] A. Cervelli,[17] S. A. Cetin,[19b] A. Chafaq,[136a] D. Chakraborty,[107] I. Chalupkova,[128] P. Chang,[166] B. Chapleau,[86] J. D. Chapman,[28] D. Charfeddine,[116] D. G. Charlton,[18] C. C. Chau,[159] C. A. Chavez Barajas,[150] S. Cheatham,[86] A. Chegwidden,[89] S. Chekanov,[6] S. V. Chekulaev,[160a] G. A. Chelkov,[64,g] M. A. Chelstowska,[88] C. Chen,[63] H. Chen,[25] K. Chen,[149] L. Chen,[33d,h] S. Chen,[33c] X. Chen,[146c] Y. Chen,[66] Y. Chen,[35] H. C. Cheng,[88] Y. Cheng,[31] A. Cheplakov,[64] R. Cherkaoui El Moursli,[136e] V. Chernyatin,[25,a] E. Cheu,[7] L. Chevalier,[137] V. Chiarella,[47] G. Chiefari,[103a,103b] J. T. Childers,[6] A. Chilingarov,[71] G. Chiodini,[72a] A. S. Chisholm,[18] R. T. Chislett,[77] A. Chitan,[26a] M. V. Chizhov,[64] S. Chouridou,[9] B. K. B. Chow,[99] D. Chromek-Burckhart,[30] M. L. Chu,[152] J. Chudoba,[126] J. J. Chwastowski,[39] L. Chytka,[114] G. Ciapetti,[133a,133b] A. K. Ciftci,[4a] R. Ciftci,[4a] D. Cinca,[53] V. Cindro,[74] A. Ciocio,[15] P. Cirkovic,[13b] Z. H. Citron,[173] M. Citterio,[90a] M. Ciubancan,[26a] A. Clark,[49] P. J. Clark,[46] R. N. Clarke,[15] W. Cleland,[124] J. C. Clemens,[84] C. Clement,[147a,147b] Y. Coadou,[84] M. Cobal,[165a,165c] A. Coccaro,[139] J. Cochran,[63] L. Coffey,[23] J. G. Cogan,[144] J. Coggeshall,[166] B. Cole,[35] S. Cole,[107] A. P. Colijn,[106] J. Collot,[55] T. Colombo,[58c] G. Colon,[85] G. Compostella,[100] P. Conde Muiño,[125a,125b] E. Coniavitis,[48] M. C. Conidi,[12] S. H. Connell,[146b] I. A. Connelly,[76] S. M. Consonni,[90a,90b] V. Consorti,[48] S. Constantinescu,[26a] C. Conta,[120a,120b] G. Conti,[57] F. Conventi,[103a,i] M. Cooke,[15] B. D. Cooper,[77] A. M. Cooper-Sarkar,[119] N. J. Cooper-Smith,[76] K. Copic,[15] T. Cornelissen,[176] M. Corradi,[20a] F. Corriveau,[86,j] A. Corso-Radu,[164] A. Cortes-Gonzalez,[12] G. Cortiana,[100] G. Costa,[90a] M. J. Costa,[168] D. Costanzo,[140] D. Côté,[8] G. Cottin,[28] G. Cowan,[76] B. E. Cox,[83] K. Cranmer,[109] G. Cree,[29] S. Crépé-Renaudin,[55] F. Crescioli,[79] W. A. Cribbs,[147a,147b] M. Crispin Ortuzar,[119] M. Cristinziani,[21] V. Croft,[105] G. Crosetti,[37a,37b] C.-M. Cuciuc,[26a] T. Cuhadar Donszelmann,[140] J. Cummings,[177] M. Curatolo,[47] C. Cuthbert,[151] H. Czirr,[142] P. Czodrowski,[3] Z. Czyczula,[177] S. D'Auria,[53] M. D'Onofrio,[73] M. J. Da Cunha Sargedas De Sousa,[125a,125b] C. Da Via,[83] W. Dabrowski,[38a] A. Dafinca,[119] T. Dai,[88] O. Dale,[14] F. Dallaire,[94] C. Dallapiccola,[85] M. Dam,[36] A. C. Daniells,[18] M. Dano Hoffmann,[137] V. Dao,[48] G. Darbo,[50a] S. Darmora,[8] J. A. Dassoulas,[42] A. Dattagupta,[60] W. Davey,[21] C. David,[170] T. Davidek,[128] E. Davies,[119,d] M. Davies,[154] O. Davignon,[79] A. R. Davison,[77] P. Davison,[77] Y. Davygora,[58a] E. Dawe,[143] I. Dawson,[140] R. K. Daya-Ishmukhametova,[85] K. De,[8] R. de Asmundis,[103a] S. De Castro,[20a,20b] S. De Cecco,[79] N. De Groot,[105] P. de Jong,[106] H. De la Torre,[81] F. De Lorenzi,[63] L. De Nooij,[106] D. De Pedis,[133a] A. De Salvo,[133a] U. De Sanctis,[165a,165b] A. De Santo,[150] J. B. De Vivie De Regie,[116] W. J. Dearnaley,[71] R. Debbe,[25] C. Debenedetti,[138] B. Dechenaux,[55] D. V. Dedovich,[64] I. Deigaard,[106] J. Del Peso,[81] T. Del Prete,[123a,123b] F. Deliot,[137] C. M. Delitzsch,[49] M. Deliyergiyev,[74] A. Dell'Acqua,[30] L. Dell'Asta,[22] M. Dell'Orso,[123a,123b] M. Della Pietra,[103a,i] D. della Volpe,[49] M. Delmastro,[5] P. A. Delsart,[55]

C. Deluca,[106] S. Demers,[177] M. Demichev,[64] A. Demilly,[79] S. P. Denisov,[129] D. Derendarz,[39] J. E. Derkaoui,[136d] F. Derue,[79] P. Dervan,[73] K. Desch,[21] C. Deterre,[42] P. O. Deviveiros,[106] A. Dewhurst,[130] S. Dhaliwal,[106] A. Di Ciaccio,[134a,134b] L. Di Ciaccio,[5] A. Di Domenico,[133a,133b] C. Di Donato,[103a,103b] A. Di Girolamo,[30] B. Di Girolamo,[30] A. Di Mattia,[153] B. Di Micco,[135a,135b] R. Di Nardo,[47] A. Di Simone,[48] R. Di Sipio,[20a,20b] D. Di Valentino,[29] F. A. Dias,[46] M. A. Diaz,[32a] E. B. Diehl,[88] J. Dietrich,[42] T. A. Dietzsch,[58a] S. Diglio,[84] A. Dimitrievska,[13a] J. Dingfelder,[21] C. Dionisi,[133a,133b] P. Dita,[26a] S. Dita,[26a] F. Dittus,[30] F. Djama,[84] T. Djobava,[51b] M. A. B. do Vale,[24c] A. Do Valle Wemans,[125a,125g] T. K. O. Doan,[5] D. Dobos,[30] C. Doglioni,[49] T. Doherty,[53] T. Dohmae,[156] J. Dolejsi,[128] Z. Dolezal,[128] B. A. Dolgoshein,[97,a] M. Donadelli,[24d] S. Donati,[123a,123b] P. Dondero,[120a,120b] J. Donini,[34] J. Dopke,[130] A. Doria,[103a] M. T. Dova,[70] A. T. Doyle,[53] M. Dris,[10] J. Dubbert,[88] S. Dube,[15] E. Dubreuil,[34] E. Duchovni,[173] G. Duckeck,[99] O. A. Ducu,[26a] D. Duda,[176] A. Dudarev,[30] F. Dudziak,[63] L. Duflot,[116] L. Duguid,[76] M. Dührssen,[30] M. Dunford,[58a] H. Duran Yildiz,[4a] M. Düren,[52] A. Durglishvili,[51b] M. Dwuznik,[38a] M. Dyndal,[38a] J. Ebke,[99] W. Edson,[2] N. C. Edwards,[46] W. Ehrenfeld,[21] T. Eifert,[144] G. Eigen,[14] K. Einsweiler,[15] T. Ekelof,[167] M. El Kacimi,[136c] M. Ellert,[167] S. Elles,[5] F. Ellinghaus,[82] N. Ellis,[30] J. Elmsheuser,[99] M. Elsing,[30] D. Emeliyanov,[130] Y. Enari,[156] O. C. Endner,[82] M. Endo,[117] R. Engelmann,[149] J. Erdmann,[177] A. Ereditato,[17] D. Eriksson,[147a] G. Ernis,[176] J. Ernst,[2] M. Ernst,[25] J. Ernwein,[137] D. Errede,[166] S. Errede,[166] E. Ertel,[82] M. Escalier,[116] H. Esch,[43] C. Escobar,[124] B. Esposito,[47] A. I. Etienvre,[137] E. Etzion,[154] H. Evans,[60] A. Ezhilov,[122] L. Fabbri,[20a,20b] G. Facini,[31] R. M. Fakhrutdinov,[129] S. Falciano,[133a] R. J. Falla,[77] J. Faltova,[128] Y. Fang,[33a] M. Fanti,[90a,90b] A. Farbin,[8] A. Farilla,[135a] T. Farooque,[12] S. Farrell,[15] S. M. Farrington,[171] P. Farthouat,[30] F. Fassi,[136e] P. Fassnacht,[30] D. Fassouliotis,[9] A. Favareto,[50a,50b] L. Fayard,[116] P. Federic,[145a] O. L. Fedin,[122,k] W. Fedorko,[169] M. Fehling-Kaschek,[48] S. Feigl,[30] L. Feligioni,[84] C. Feng,[33d] E. J. Feng,[6] H. Feng,[88] A. B. Fenyuk,[129] S. Fernandez Perez,[30] S. Ferrag,[53] J. Ferrando,[53] A. Ferrari,[167] P. Ferrari,[106] R. Ferrari,[120a] D. E. Ferreira de Lima,[53] A. Ferrer,[168] D. Ferrere,[49] C. Ferretti,[88] A. Ferretto Parodi,[50a,50b] M. Fiascaris,[31] F. Fiedler,[82] A. Filipčič,[74] M. Filipuzzi,[42] F. Filthaut,[105] M. Fincke-Keeler,[170] K. D. Finelli,[151] M. C. N. Fiolhais,[125a,125c] L. Fiorini,[168] A. Firan,[40] A. Fischer,[2] J. Fischer,[176] W. C. Fisher,[89] E. A. Fitzgerald,[23] M. Flechl,[48] I. Fleck,[142] P. Fleischmann,[88] S. Fleischmann,[176] G. T. Fletcher,[140] G. Fletcher,[75] T. Flick,[176] A. Floderus,[80] L. R. Flores Castillo,[174,l] A. C. Florez Bustos,[160b] M. J. Flowerdew,[100] A. Formica,[137] A. Forti,[83] D. Fortin,[160a] D. Fournier,[116] H. Fox,[71] S. Fracchia,[12] P. Francavilla,[79] M. Franchini,[20a,20b] S. Franchino,[30] D. Francis,[30] L. Franconi,[118] M. Franklin,[57] S. Franz,[61] M. Fraternali,[120a,120b] S. T. French,[28] C. Friedrich,[42] F. Friedrich,[44] D. Froidevaux,[30] J. A. Frost,[28] C. Fukunaga,[157] E. Fullana Torregrosa,[82] B. G. Fulsom,[144] J. Fuster,[168] C. Gabaldon,[55] O. Gabizon,[173] A. Gabrielli,[20a,20b] A. Gabrielli,[133a,133b] S. Gadatsch,[106] S. Gadomski,[49] G. Gagliardi,[50a,50b] P. Gagnon,[60] C. Galea,[105] B. Galhardo,[125a,125c] E. J. Gallas,[119] V. Gallo,[17] B. J. Gallop,[130] P. Gallus,[127] G. Galster,[36] K. K. Gan,[110] R. P. Gandrajula,[62] J. Gao,[33b,h] Y. S. Gao,[144,f] F. M. Garay Walls,[46] F. Garberson,[177] C. García,[168] J. E. García Navarro,[168] M. Garcia-Sciveres,[15] R. W. Gardner,[31] N. Garelli,[144] V. Garonne,[30] C. Gatti,[47] G. Gaudio,[120a] B. Gaur,[142] L. Gauthier,[94] P. Gauzzi,[133a,133b] I. L. Gavrilenko,[95] C. Gay,[169] G. Gaycken,[21] E. N. Gazis,[10] P. Ge,[33d] Z. Gecse,[169] C. N. P. Gee,[130] D. A. A. Geerts,[106] Ch. Geich-Gimbel,[21] K. Gellerstedt,[147a,147b] C. Gemme,[50a] A. Gemmell,[53] M. H. Genest,[55] S. Gentile,[133a,133b] M. George,[54] S. George,[76] D. Gerbaudo,[164] A. Gershon,[154] H. Ghazlane,[136b] N. Ghodbane,[34] B. Giacobbe,[20a] S. Giagu,[133a,133b] V. Giangiobbe,[12] P. Giannetti,[123a,123b] F. Gianotti,[30] B. Gibbard,[25] S. M. Gibson,[76] M. Gilchriese,[15] T. P. S. Gillam,[28] D. Gillberg,[30] G. Gilles,[34] D. M. Gingrich,[3,e] N. Giokaris,[9] M. P. Giordani,[165a,165c] R. Giordano,[103a,103b] F. M. Giorgi,[20a] F. M. Giorgi,[16] P. F. Giraud,[137] D. Giugni,[90a] C. Giuliani,[48] M. Giulini,[58b] B. K. Gjelsten,[118] S. Gkaitatzis,[155] I. Gkialas,[155,m] L. K. Gladilin,[98] C. Glasman,[81] J. Glatzer,[30] P. C. F. Glaysher,[46] A. Glazov,[42] G. L. Glonti,[64] M. Goblirsch-Kolb,[100] J. R. Goddard,[75] J. Godfrey,[143] J. Godlewski,[30] C. Goeringer,[82] S. Goldfarb,[88] T. Golling,[177] D. Golubkov,[129] A. Gomes,[125a,125b,125d] L. S. Gomez Fajardo,[42] R. Gonçalo,[125a] J. Goncalves Pinto Firmino Da Costa,[137] L. Gonella,[21] S. González de la Hoz,[168] G. Gonzalez Parra,[12] S. Gonzalez-Sevilla,[49] L. Goossens,[30] P. A. Gorbounov,[96] H. A. Gordon,[25] I. Gorelov,[104] B. Gorini,[30] E. Gorini,[72a,72b] A. Gorišek,[74] E. Gornicki,[39] A. T. Goshaw,[6] C. Gössling,[43] M. I. Gostkin,[64] M. Gouighri,[136a] D. Goujdami,[136c] M. P. Goulette,[49] A. G. Goussiou,[139] C. Goy,[5] S. Gozpinar,[23] H. M. X. Grabas,[137] L. Graber,[54] I. Grabowska-Bold,[38a] P. Grafström,[20a,20b] K-J. Grahn,[42] J. Gramling,[49] E. Gramstad,[118] S. Grancagnolo,[16] V. Grassi,[149] V. Gratchev,[122] H. M. Gray,[30] E. Graziani,[135a] O. G. Grebenyuk,[122] Z. D. Greenwood,[78,n] K. Gregersen,[77] I. M. Gregor,[42] P. Grenier,[144] J. Griffiths,[8] A. A. Grillo,[138] K. Grimm,[71] S. Grinstein,[12,o] Ph. Gris,[34] Y. V. Grishkevich,[98] J.-F. Grivaz,[116] J. P. Grohs,[44] A. Grohsjean,[42] E. Gross,[173] J. Grosse-Knetter,[54] G. C. Grossi,[134a,134b] J. Groth-Jensen,[173] Z. J. Grout,[150] L. Guan,[33b] F. Guescini,[49] D. Guest,[177] O. Gueta,[154] C. Guicheney,[34] E. Guido,[50a,50b] T. Guillemin,[116] S. Guindon,[2] U. Gul,[53] C. Gumpert,[44] J. Gunther,[127] J. Guo,[35] S. Gupta,[119] P. Gutierrez,[112] N. G. Gutierrez Ortiz,[53]

C. Gutschow,[77] N. Guttman,[154] C. Guyot,[137] C. Gwenlan,[119] C. B. Gwilliam,[73] A. Haas,[109] C. Haber,[15] H. K. Hadavand,[8] N. Haddad,[136e] P. Haefner,[21] S. Hageböck,[21] Z. Hajduk,[39] H. Hakobyan,[178] M. Haleem,[42] D. Hall,[119] G. Halladjian,[89] K. Hamacher,[176] P. Hamal,[114] K. Hamano,[170] M. Hamer,[54] A. Hamilton,[146a] S. Hamilton,[162] G. N. Hamity,[146c] P. G. Hamnett,[42] L. Han,[33b] K. Hanagaki,[117] K. Hanawa,[156] M. Hance,[15] P. Hanke,[58a] R. Hanna,[137] J. B. Hansen,[36] J. D. Hansen,[36] P. H. Hansen,[36] K. Hara,[161] A. S. Hard,[174] T. Harenberg,[176] F. Hariri,[116] S. Harkusha,[91] D. Harper,[88] R. D. Harrington,[46] O. M. Harris,[139] P. F. Harrison,[171] F. Hartjes,[106] M. Hasegawa,[66] S. Hasegawa,[102] Y. Hasegawa,[141] A. Hasib,[112] S. Hassani,[137] S. Haug,[17] M. Hauschild,[30] R. Hauser,[89] M. Havranek,[126] C. M. Hawkes,[18] R. J. Hawkings,[30] A. D. Hawkins,[80] T. Hayashi,[161] D. Hayden,[89] C. P. Hays,[119] H. S. Hayward,[73] S. J. Haywood,[130] S. J. Head,[18] T. Heck,[82] V. Hedberg,[80] L. Heelan,[8] S. Heim,[121] T. Heim,[176] B. Heinemann,[15] L. Heinrich,[109] J. Hejbal,[126] L. Helary,[22] C. Heller,[99] M. Heller,[30] S. Hellman,[147a,147b] D. Hellmich,[21] C. Helsens,[30] J. Henderson,[119] R. C. W. Henderson,[71] Y. Heng,[174] C. Hengler,[42] A. Henrichs,[177] A. M. Henriques Correia,[30] S. Henrot-Versille,[116] C. Hensel,[54] G. H. Herbert,[16] Y. Hernández Jiménez,[168] R. Herrberg-Schubert,[16] G. Herten,[48] R. Hertenberger,[99] L. Hervas,[30] G. G. Hesketh,[77] N. P. Hessey,[106] R. Hickling,[75] E. Higón-Rodriguez,[168] E. Hill,[170] J. C. Hill,[28] K. H. Hiller,[42] S. Hillert,[21] S. J. Hillier,[18] I. Hinchliffe,[15] E. Hines,[121] M. Hirose,[158] D. Hirschbuehl,[176] J. Hobbs,[149] N. Hod,[106] M. C. Hodgkinson,[140] P. Hodgson,[140] A. Hoecker,[30] M. R. Hoeferkamp,[104] F. Hoenig,[99] J. Hoffman,[40] D. Hoffmann,[84] J. I. Hofmann,[58a] M. Hohlfeld,[82] T. R. Holmes,[15] T. M. Hong,[121] L. Hooft van Huysduynen,[109] J-Y. Hostachy,[55] S. Hou,[152] A. Hoummada,[136a] J. Howard,[119] J. Howarth,[42] M. Hrabovsky,[114] I. Hristova,[16] J. Hrivnac,[116] T. Hryn'ova,[5] C. Hsu,[146c] P. J. Hsu,[82] S.-C. Hsu,[139] D. Hu,[35] X. Hu,[25] Y. Huang,[42] Z. Hubacek,[30] F. Hubaut,[84] F. Huegging,[21] T. B. Huffman,[119] E. W. Hughes,[35] G. Hughes,[71] M. Huhtinen,[30] T. A. Hülsing,[82] M. Hurwitz,[15] N. Huseynov,[64,c] J. Huston,[89] J. Huth,[57] G. Iacobucci,[49] G. Iakovidis,[10] I. Ibragimov,[142] L. Iconomidou-Fayard,[116] E. Ideal,[177] P. Iengo,[103a] O. Igonkina,[106] T. Iizawa,[172] Y. Ikegami,[65] K. Ikematsu,[142] M. Ikeno,[65] Y. Ilchenko,[31,p] D. Iliadis,[155] N. Ilic,[159] Y. Inamaru,[66] T. Ince,[100] P. Ioannou,[9] M. Iodice,[135a] K. Iordanidou,[9] V. Ippolito,[57] A. Irles Quiles,[168] C. Isaksson,[167] M. Ishino,[67] M. Ishitsuka,[158] R. Ishmukhametov,[110] C. Issever,[119] S. Istin,[19a] J. M. Iturbe Ponce,[83] R. Iuppa,[134a,134b] J. Ivarsson,[80] W. Iwanski,[39] H. Iwasaki,[65] J. M. Izen,[41] V. Izzo,[103a] B. Jackson,[121] M. Jackson,[73] P. Jackson,[1] M. R. Jaekel,[30] V. Jain,[2] K. Jakobs,[48] S. Jakobsen,[30] T. Jakoubek,[126] J. Jakubek,[127] D. O. Jamin,[152] D. K. Jana,[78] E. Jansen,[77] H. Jansen,[30] J. Janssen,[21] M. Janus,[171] G. Jarlskog,[80] N. Javadov,[64,c] T. Javůrek,[48] L. Jeanty,[15] J. Jejelava,[51a,q] G.-Y. Jeng,[151] D. Jennens,[87] P. Jenni,[48,r] J. Jentzsch,[43] C. Jeske,[171] S. Jézéquel,[5] H. Ji,[174] J. Jia,[149] Y. Jiang,[33b] M. Jimenez Belenguer,[42] S. Jin,[33a] A. Jinaru,[26a] O. Jinnouchi,[158] M. D. Joergensen,[36] K. E. Johansson,[147a,147b] P. Johansson,[140] K. A. Johns,[7] K. Jon-And,[147a,147b] G. Jones,[171] R. W. L. Jones,[71] T. J. Jones,[73] J. Jongmanns,[58a] P. M. Jorge,[125a,125b] K. D. Joshi,[83] J. Jovicevic,[148] X. Ju,[174] C. A. Jung,[43] R. M. Jungst,[30] P. Jussel,[61] A. Juste Rozas,[12,o] M. Kaci,[168] A. Kaczmarska,[39] M. Kado,[116] H. Kagan,[110] M. Kagan,[144] E. Kajomovitz,[45] C. W. Kalderon,[119] S. Kama,[40] A. Kamenshchikov,[129] N. Kanaya,[156] M. Kaneda,[30] S. Kaneti,[28] V. A. Kantserov,[97] J. Kanzaki,[65] B. Kaplan,[109] A. Kapliy,[31] D. Kar,[53] K. Karakostas,[10] N. Karastathis,[10] M. Karnevskiy,[82] S. N. Karpov,[64] Z. M. Karpova,[64] K. Karthik,[109] V. Kartvelishvili,[71] A. N. Karyukhin,[129] L. Kashif,[174] G. Kasieczka,[58b] R. D. Kass,[110] A. Kastanas,[14] Y. Kataoka,[156] A. Katre,[49] J. Katzy,[42] V. Kaushik,[7] K. Kawagoe,[69] T. Kawamoto,[156] G. Kawamura,[54] S. Kazama,[156] V. F. Kazanin,[108] M. Y. Kazarinov,[64] R. Keeler,[170] R. Kehoe,[40] M. Keil,[54] J. S. Keller,[42] J. J. Kempster,[76] H. Keoshkerian,[5] O. Kepka,[126] B. P. Kerševan,[74] S. Kersten,[176] K. Kessoku,[156] J. Keung,[159] F. Khalil-zada,[11] H. Khandanyan,[147a,147b] A. Khanov,[113] A. Khodinov,[97] A. Khomich,[58a] T. J. Khoo,[28] G. Khoriauli,[21] A. Khoroshilov,[176] V. Khovanskiy,[96] E. Khramov,[64] J. Khubua,[51b] H. Y. Kim,[8] H. Kim,[147a,147b] S. H. Kim,[161] N. Kimura,[172] O. Kind,[16] B. T. King,[73] M. King,[168] R. S. B. King,[119] S. B. King,[169] J. Kirk,[130] A. E. Kiryunin,[100] T. Kishimoto,[66] D. Kisielewska,[38a] F. Kiss,[48] T. Kittelmann,[124] K. Kiuchi,[161] E. Kladiva,[145b] M. Klein,[73] U. Klein,[73] K. Kleinknecht,[82] P. Klimek,[147a,147b] A. Klimentov,[25] R. Klingenberg,[43] J. A. Klinger,[83] T. Klioutchnikova,[30] P. F. Klok,[105] E.-E. Kluge,[58a] P. Kluit,[106] S. Kluth,[100] E. Kneringer,[61] E. B. F. G. Knoops,[84] A. Knue,[53] D. Kobayashi,[158] T. Kobayashi,[156] M. Kobel,[44] M. Kocian,[144] P. Kodys,[128] P. Koevesarki,[21] T. Koffas,[29] E. Koffeman,[106] L. A. Kogan,[119] S. Kohlmann,[176] Z. Kohout,[127] T. Kohriki,[65] T. Koi,[144] H. Kolanoski,[16] I. Koletsou,[5] J. Koll,[89] A. A. Komar,[95,a] Y. Komori,[156] T. Kondo,[65] N. Kondrashova,[42] K. Köneke,[48] A. C. König,[105] S. König,[82] T. Kono,[65,s] R. Konoplich,[109,t] N. Konstantinidis,[77] R. Kopeliansky,[153] S. Koperny,[38a] L. Köpke,[82] A. K. Kopp,[48] K. Korcyl,[39] K. Kordas,[155] A. Korn,[77] A. A. Korol,[108,u] I. Korolkov,[12] E. V. Korolkova,[140] V. A. Korotkov,[129] O. Kortner,[100] S. Kortner,[100] V. V. Kostyukhin,[21] V. M. Kotov,[64] A. Kotwal,[45] C. Kourkoumelis,[9] V. Kouskoura,[155] A. Koutsman,[160a] R. Kowalewski,[170] T. Z. Kowalski,[38a] W. Kozanecki,[137] A. S. Kozhin,[129] V. Kral,[127] V. A. Kramarenko,[98] G. Kramberger,[74] D. Krasnopevtsev,[97] M. W. Krasny,[79] A. Krasznahorkay,[30] J. K. Kraus,[21]

A. Kravchenko,[25] S. Kreiss,[109] M. Kretz,[58c] J. Kretzschmar,[73] K. Kreutzfeldt,[52] P. Krieger,[159] K. Kroeninger,[54] H. Kroha,[100] J. Kroll,[121] J. Kroseberg,[21] J. Krstic,[13a] U. Kruchonak,[64] H. Krüger,[21] T. Kruker,[17] N. Krumnack,[63] Z. V. Krumshteyn,[64] A. Kruse,[174] M. C. Kruse,[45] M. Kruskal,[22] T. Kubota,[87] S. Kuday,[4a] S. Kuehn,[48] A. Kugel,[58c] A. Kuhl,[138] T. Kuhl,[42] V. Kukhtin,[64] Y. Kulchitsky,[91] S. Kuleshov,[32b] M. Kuna,[133a,133b] J. Kunkle,[121] A. Kupco,[126] H. Kurashige,[66] Y. A. Kurochkin,[91] R. Kurumida,[66] V. Kus,[126] E. S. Kuwertz,[148] M. Kuze,[158] J. Kvita,[114] A. La Rosa,[49] L. La Rotonda,[37a,37b] C. Lacasta,[168] F. Lacava,[133a,133b] J. Lacey,[29] H. Lacker,[16] D. Lacour,[79] V. R. Lacuesta,[168] E. Ladygin,[64] R. Lafaye,[5] B. Laforge,[79] T. Lagouri,[177] S. Lai,[48] H. Laier,[58a] L. Lambourne,[77] S. Lammers,[60] C. L. Lampen,[7] W. Lampl,[7] E. Lançon,[137] U. Landgraf,[48] M. P. J. Landon,[75] V. S. Lang,[58a] A. J. Lankford,[164] F. Lanni,[25] K. Lantzsch,[30] S. Laplace,[79] C. Lapoire,[21] J. F. Laporte,[137] T. Lari,[90a] M. Lassnig,[30] P. Laurelli,[47] W. Lavrijsen,[15] A. T. Law,[138] P. Laycock,[73] O. Le Dortz,[79] E. Le Guirriec,[84] E. Le Menedeu,[12] T. LeCompte,[6] F. Ledroit-Guillon,[55] C. A. Lee,[152] H. Lee,[106] J. S. H. Lee,[117] S. C. Lee,[152] L. Lee,[177] G. Lefebvre,[79] M. Lefebvre,[170] F. Legger,[99] C. Leggett,[15] A. Lehan,[73] M. Lehmacher,[21] G. Lehmann Miotto,[30] X. Lei,[7] W. A. Leight,[29] A. Leisos,[155] A. G. Leister,[177] M. A. L. Leite,[24d] R. Leitner,[128] D. Lellouch,[173] B. Lemmer,[54] K. J. C. Leney,[77] T. Lenz,[21] G. Lenzen,[176] B. Lenzi,[30] R. Leone,[7] S. Leone,[123a,123b] K. Leonhardt,[44] C. Leonidopoulos,[46] S. Leontsinis,[10] C. Leroy,[94] C. G. Lester,[28] C. M. Lester,[121] M. Levchenko,[122] J. Levêque,[5] D. Levin,[88] L. J. Levinson,[173] M. Levy,[18] A. Lewis,[119] G. H. Lewis,[109] A. M. Leyko,[21] M. Leyton,[41] B. Li,[33b,v] B. Li,[84] H. Li,[149] H. L. Li,[31] L. Li,[45] L. Li,[33e] S. Li,[45] Y. Li,[33c,w] Z. Liang,[138] H. Liao,[34] B. Liberti,[134a] P. Lichard,[30] K. Lie,[166] J. Liebal,[21] W. Liebig,[14] C. Limbach,[21] A. Limosani,[87] S. C. Lin,[152,x] T. H. Lin,[82] F. Linde,[106] B. E. Lindquist,[149] J. T. Linnemann,[89] E. Lipeles,[121] A. Lipniacka,[14] M. Lisovyi,[42] T. M. Liss,[166] D. Lissauer,[25] A. Lister,[169] A. M. Litke,[138] B. Liu,[152] D. Liu,[152] J. B. Liu,[33b] K. Liu,[33b,y] L. Liu,[88] M. Liu,[45] M. Liu,[33b] Y. Liu,[33b] M. Livan,[120a,120b] S. S. A. Livermore,[119] A. Lleres,[55] J. Llorente Merino,[81] S. L. Lloyd,[75] F. Lo Sterzo,[152] E. Lobodzinska,[42] P. Loch,[7] W. S. Lockman,[138] T. Loddenkoetter,[21] F. K. Loebinger,[83] A. E. Loevschall-Jensen,[36] A. Loginov,[177] T. Lohse,[16] K. Lohwasser,[42] M. Lokajicek,[126] V. P. Lombardo,[5] B. A. Long,[22] J. D. Long,[88] R. E. Long,[71] L. Lopes,[125a] D. Lopez Mateos,[57] B. Lopez Paredes,[140] I. Lopez Paz,[12] J. Lorenz,[99] N. Lorenzo Martinez,[60] M. Losada,[163] P. Loscutoff,[15] X. Lou,[41] A. Lounis,[116] J. Love,[6] P. A. Love,[71] A. J. Lowe,[144,f] F. Lu,[33a] N. Lu,[88] H. J. Lubatti,[139] C. Luci,[133a,133b] A. Lucotte,[55] F. Luehring,[60] W. Lukas,[61] L. Luminari,[133a] O. Lundberg,[147a,147b] B. Lund-Jensen,[148] M. Lungwitz,[82] D. Lynn,[25] R. Lysak,[126] E. Lytken,[80] H. Ma,[25] L. L. Ma,[33d] G. Maccarrone,[47] A. Macchiolo,[100] J. Machado Miguens,[125a,125b] D. Macina,[30] D. Madaffari,[84] R. Madar,[48] H. J. Maddocks,[71] W. F. Mader,[44] A. Madsen,[167] M. Maeno,[8] T. Maeno,[25] E. Magradze,[54] K. Mahboubi,[48] J. Mahlstedt,[106] S. Mahmoud,[73] C. Maiani,[137] C. Maidantchik,[24a] A. A. Maier,[100] A. Maio,[125a,125b,125d] S. Majewski,[115] Y. Makida,[65] N. Makovec,[116] P. Mal,[137,z] B. Malaescu,[79] Pa. Malecki,[39] V. P. Maleev,[122] F. Malek,[55] U. Mallik,[62] D. Malon,[6] C. Malone,[144] S. Maltezos,[10] V. M. Malyshev,[108] S. Malyukov,[30] J. Mamuzic,[13b] B. Mandelli,[30] L. Mandelli,[90a] I. Mandić,[74] R. Mandrysch,[62] J. Maneira,[125a,125b] A. Manfredini,[100] L. Manhaes de Andrade Filho,[24b] J. A. Manjarres Ramos,[160b] A. Mann,[99] P. M. Manning,[138] A. Manousakis-Katsikakis,[9] B. Mansoulie,[137] R. Mantifel,[86] L. Mapelli,[30] L. March,[146c] J. F. Marchand,[29] G. Marchiori,[79] M. Marcisovsky,[126] C. P. Marino,[170] M. Marjanovic,[13a] C. N. Marques,[125a] F. Marroquim,[24a] S. P. Marsden,[83] Z. Marshall,[15] L. F. Marti,[17] S. Marti-Garcia,[168] B. Martin,[30] B. Martin,[89] T. A. Martin,[171] V. J. Martin,[46] B. Martin dit Latour,[14] H. Martinez,[137] M. Martinez,[12,o] S. Martin-Haugh,[130] A. C. Martyniuk,[77] M. Marx,[139] F. Marzano,[133a] A. Marzin,[30] L. Masetti,[82] T. Mashimo,[156] R. Mashinistov,[95] J. Masik,[83] A. L. Maslennikov,[108] I. Massa,[20a,20b] L. Massa,[20a,20b] N. Massol,[5] P. Mastrandrea,[149] A. Mastroberardino,[37a,37b] T. Masubuchi,[156] P. Mättig,[176] J. Mattmann,[82] J. Maurer,[26a] S. J. Maxfield,[73] D. A. Maximov,[108,u] R. Mazini,[152] L. Mazzaferro,[134a,134b] G. Mc Goldrick,[159] S. P. Mc Kee,[88] A. McCarn,[88] R. L. McCarthy,[149] T. G. McCarthy,[29] N. A. McCubbin,[130] K. W. McFarlane,[56,a] J. A. Mcfayden,[77] G. Mchedlidze,[54] S. J. McMahon,[130] R. A. McPherson,[170,j] A. Meade,[85] J. Mechnich,[106] M. Medinnis,[42] S. Meehan,[31] S. Mehlhase,[99] A. Mehta,[73] K. Meier,[58a] C. Meineck,[99] B. Meirose,[80] C. Melachrinos,[31] B. R. Mellado Garcia,[146c] F. Meloni,[17] A. Mengarelli,[20a,20b] S. Menke,[100] E. Meoni,[162] K. M. Mercurio,[57] S. Mergelmeyer,[21] N. Meric,[137] P. Mermod,[49] L. Merola,[103a,103b] C. Meroni,[90a] F. S. Merritt,[31] H. Merritt,[110] A. Messina,[30,aa] J. Metcalfe,[25] A. S. Mete,[164] C. Meyer,[82] C. Meyer,[121] J-P. Meyer,[137] J. Meyer,[30] R. P. Middleton,[130] S. Migas,[73] L. Mijović,[21] G. Mikenberg,[173] M. Mikestikova,[126] M. Mikuž,[74] A. Milic,[30] D. W. Miller,[31] C. Mills,[46] A. Milov,[173] D. A. Milstead,[147a,147b] D. Milstein,[173] A. A. Minaenko,[129] I. A. Minashvili,[64] A. I. Mincer,[109] B. Mindur,[38a] M. Mineev,[64] Y. Ming,[174] L. M. Mir,[12] G. Mirabelli,[133a] T. Mitani,[172] J. Mitrevski,[99] V. A. Mitsou,[168] S. Mitsui,[65] A. Miucci,[49] P. S. Miyagawa,[140] J. U. Mjörnmark,[80] T. Moa,[147a,147b] K. Mochizuki,[84] S. Mohapatra,[35] W. Mohr,[48] S. Molander,[147a,147b] R. Moles-Valls,[168] K. Mönig,[42] C. Monini,[55] J. Monk,[36] E. Monnier,[84] J. Montejo Berlingen,[12] F. Monticelli,[70] S. Monzani,[133a,133b] R. W. Moore,[3] A. Moraes,[53] N. Morange,[62]

D. Moreno,[82] M. Moreno Llácer,[54] P. Morettini,[50a] M. Morgenstern,[44] M. Morii,[57] S. Moritz,[82] A. K. Morley,[148] G. Mornacchi,[30] J. D. Morris,[75] L. Morvaj,[102] H. G. Moser,[100] M. Mosidze,[51b] J. Moss,[110] K. Motohashi,[158] R. Mount,[144] E. Mountricha,[25] S. V. Mouraviev,[95,a] E. J. W. Moyse,[85] S. Muanza,[84] R. D. Mudd,[18] F. Mueller,[58a] J. Mueller,[124] K. Mueller,[21] T. Mueller,[28] T. Mueller,[82] D. Muenstermann,[49] Y. Munwes,[154] J. A. Murillo Quijada,[18] W. J. Murray,[171,130] H. Musheghyan,[54] E. Musto,[153] A. G. Myagkov,[129,bb] M. Myska,[127] O. Nackenhorst,[54] J. Nadal,[54] K. Nagai,[61] R. Nagai,[158] Y. Nagai,[84] K. Nagano,[65] A. Nagarkar,[110] Y. Nagasaka,[59] M. Nagel,[100] A. M. Nairz,[30] Y. Nakahama,[30] K. Nakamura,[65] T. Nakamura,[156] I. Nakano,[111] H. Namasivayam,[41] G. Nanava,[21] R. Narayan,[58b] T. Nattermann,[21] T. Naumann,[42] G. Navarro,[163] R. Nayyar,[7] H. A. Neal,[88] P. Yu. Nechaeva,[95] T. J. Neep,[83] P. D. Nef,[144] A. Negri,[120a,120b] G. Negri,[30] M. Negrini,[20a] S. Nektarijevic,[49] A. Nelson,[164] T. K. Nelson,[144] S. Nemecek,[126] P. Nemethy,[109] A. A. Nepomuceno,[24a] M. Nessi,[30,cc] M. S. Neubauer,[166] M. Neumann,[176] R. M. Neves,[109] P. Nevski,[25] P. R. Newman,[18] D. H. Nguyen,[6] R. B. Nickerson,[119] R. Nicolaidou,[137] B. Nicquevert,[30] J. Nielsen,[138] N. Nikiforou,[35] A. Nikiforov,[16] V. Nikolaenko,[129,bb] I. Nikolic-Audit,[79] K. Nikolics,[49] K. Nikolopoulos,[18] P. Nilsson,[8] Y. Ninomiya,[156] A. Nisati,[133a] R. Nisius,[100] T. Nobe,[158] L. Nodulman,[6] M. Nomachi,[117] I. Nomidis,[29] S. Norberg,[112] M. Nordberg,[30] O. Novgorodova,[44] S. Nowak,[100] M. Nozaki,[65] L. Nozka,[114] K. Ntekas,[10] G. Nunes Hanninger,[87] T. Nunnemann,[99] E. Nurse,[77] F. Nuti,[87] B. J. O'Brien,[46] F. O'grady,[7] D. C. O'Neil,[143] V. O'Shea,[53] F. G. Oakham,[29,e] H. Oberlack,[100] T. Obermann,[21] J. Ocariz,[79] A. Ochi,[66] M. I. Ochoa,[77] S. Oda,[69] S. Odaka,[65] H. Ogren,[60] A. Oh,[83] S. H. Oh,[45] C. C. Ohm,[15] H. Ohman,[167] W. Okamura,[117] H. Okawa,[25] Y. Okumura,[31] T. Okuyama,[156] A. Olariu,[26a] A. G. Olchevski,[64] S. A. Olivares Pino,[46] D. Oliveira Damazio,[25] E. Oliver Garcia,[168] A. Olszewski,[39] J. Olszowska,[39] A. Onofre,[125a,125e] P. U. E. Onyisi,[31,p] C. J. Oram,[160a] M. J. Oreglia,[31] Y. Oren,[154] D. Orestano,[135a,135b] N. Orlando,[72a,72b] C. Oropeza Barrera,[53] R. S. Orr,[159] B. Osculati,[50a,50b] R. Ospanov,[121] G. Otero y Garzon,[27] H. Otono,[69] M. Ouchrif,[136d] E. A. Ouellette,[170] F. Ould-Saada,[118] A. Ouraou,[137] K. P. Oussoren,[106] Q. Ouyang,[33a] A. Ovcharova,[15] M. Owen,[83] V. E. Ozcan,[19a] N. Ozturk,[8] K. Pachal,[119] A. Pacheco Pages,[12] C. Padilla Aranda,[12] M. Pagáčová,[48] S. Pagan Griso,[15] E. Paganis,[140] C. Pahl,[100] F. Paige,[25] P. Pais,[85] K. Pajchel,[118] G. Palacino,[160b] S. Palestini,[30] M. Palka,[38b] D. Pallin,[34] A. Palma,[125a,125b] J. D. Palmer,[18] Y. B. Pan,[174] E. Panagiotopoulou,[10] J. G. Panduro Vazquez,[76] P. Pani,[106] N. Panikashvili,[88] S. Panitkin,[25] D. Pantea,[26a] L. Paolozzi,[134a,134b] Th. D. Papadopoulou,[10] K. Papageorgiou,[155,m] A. Paramonov,[6] D. Paredes Hernandez,[34] M. A. Parker,[28] F. Parodi,[50a,50b] J. A. Parsons,[35] U. Parzefall,[48] E. Pasqualucci,[133a] S. Passaggio,[50a] A. Passeri,[135a] F. Pastore,[135a,135b,a] Fr. Pastore,[76] G. Pásztor,[29] S. Pataraia,[176] N. D. Patel,[151] J. R. Pater,[83] S. Patricelli,[103a,103b] T. Pauly,[30] J. Pearce,[170] M. Pedersen,[118] S. Pedraza Lopez,[168] R. Pedro,[125a,125b] S. V. Peleganchuk,[108] D. Pelikan,[167] H. Peng,[33b] B. Penning,[31] J. Penwell,[60] D. V. Perepelitsa,[25] E. Perez Codina,[160a] M. T. Pérez García-Estañ,[168] V. Perez Reale,[35] L. Perini,[90a,90b] H. Pernegger,[30] R. Perrino,[72a] R. Peschke,[42] V. D. Peshekhonov,[64] K. Peters,[30] R. F. Y. Peters,[83] B. A. Petersen,[30] T. C. Petersen,[36] E. Petit,[42] A. Petridis,[147a,147b] C. Petridou,[155] E. Petrolo,[133a] F. Petrucci,[135a,135b] N. E. Pettersson,[158] R. Pezoa,[32b] P. W. Phillips,[130] G. Piacquadio,[144] E. Pianori,[171] A. Picazio,[49] E. Piccaro,[75] M. Piccinini,[20a,20b] R. Piegaia,[27] D. T. Pignotti,[110] J. E. Pilcher,[31] A. D. Pilkington,[77] J. Pina,[125a,125b,125d] M. Pinamonti,[165a,165c,dd] A. Pinder,[119] J. L. Pinfold,[3] A. Pingel,[36] B. Pinto,[125a] S. Pires,[79] M. Pitt,[173] C. Pizio,[90a,90b] L. Plazak,[145a] M.-A. Pleier,[25] V. Pleskot,[128] E. Plotnikova,[64] P. Plucinski,[147a,147b] S. Poddar,[58a] F. Podlyski,[34] R. Poettgen,[82] L. Poggioli,[116] D. Pohl,[21] M. Pohl,[49] G. Polesello,[120a] A. Policicchio,[37a,37b] R. Polifka,[159] A. Polini,[20a] C. S. Pollard,[45] V. Polychronakos,[25] K. Pommès,[30] L. Pontecorvo,[133a] B. G. Pope,[89] G. A. Popeneciu,[26b] D. S. Popovic,[13a] A. Poppleton,[30] X. Portell Bueso,[12] S. Pospisil,[127] K. Potamianos,[15] I. N. Potrap,[64] C. J. Potter,[150] C. T. Potter,[115] G. Poulard,[30] J. Poveda,[60] V. Pozdnyakov,[64] P. Pralavorio,[84] A. Pranko,[15] S. Prasad,[30] R. Pravahan,[8] S. Prell,[63] D. Price,[83] J. Price,[73] L. E. Price,[6] D. Prieur,[124] M. Primavera,[72a] M. Proissl,[46] K. Prokofiev,[47] F. Prokoshin,[32b] E. Protopapadaki,[137] S. Protopopescu,[25] J. Proudfoot,[6] M. Przybycien,[38a] H. Przysiezniak,[5] E. Ptacek,[115] D. Puddu,[135a,135b] E. Pueschel,[85] D. Puldon,[149] M. Purohit,[25,ee] P. Puzo,[116] J. Qian,[88] G. Qin,[53] Y. Qin,[83] A. Quadt,[54] D. R. Quarrie,[15] W. B. Quayle,[165a,165b] M. Queitsch-Maitland,[83] D. Quilty,[53] A. Qureshi,[160b] V. Radeka,[25] V. Radescu,[42] S. K. Radhakrishnan,[149] P. Radloff,[115] P. Rados,[87] F. Ragusa,[90a,90b] G. Rahal,[179] S. Rajagopalan,[25] M. Rammensee,[30] A. S. Randle-Conde,[40] C. Rangel-Smith,[167] K. Rao,[164] F. Rauscher,[99] T. C. Rave,[48] T. Ravenscroft,[53] M. Raymond,[30] A. L. Read,[118] N. P. Readioff,[73] D. M. Rebuzzi,[120a,120b] A. Redelbach,[175] G. Redlinger,[25] R. Reece,[138] K. Reeves,[41] L. Rehnisch,[16] H. Reisin,[27] M. Relich,[164] C. Rembser,[30] H. Ren,[33a] Z. L. Ren,[152] A. Renaud,[116] M. Rescigno,[133a] S. Resconi,[90a] O. L. Rezanova,[108,u] P. Reznicek,[128] R. Rezvani,[94] R. Richter,[100] M. Ridel,[79] P. Rieck,[16] J. Rieger,[54] M. Rijssenbeek,[149] A. Rimoldi,[120a,120b] L. Rinaldi,[20a] E. Ritsch,[61] I. Riu,[12] F. Rizatdinova,[113] E. Rizvi,[75] S. H. Robertson,[86,j] A. Robichaud-Veronneau,[86] D. Robinson,[28] J. E. M. Robinson,[83] A. Robson,[53] C. Roda,[123a,123b] L. Rodrigues,[30] S. Roe,[30]

O. Røhne,[118] S. Rolli,[162] A. Romaniouk,[97] M. Romano,[20a,20b] E. Romero Adam,[168] N. Rompotis,[139] M. Ronzani,[48] L. Roos,[79] E. Ros,[168] S. Rosati,[133a] K. Rosbach,[49] M. Rose,[76] P. Rose,[138] P. L. Rosendahl,[14] O. Rosenthal,[142] V. Rossetti,[147a,147b] E. Rossi,[103a,103b] L. P. Rossi,[50a] R. Rosten,[139] M. Rotaru,[26a] I. Roth,[173] J. Rothberg,[139] D. Rousseau,[116] C. R. Royon,[137] A. Rozanov,[84] Y. Rozen,[153] X. Ruan,[146c] F. Rubbo,[12] I. Rubinskiy,[42] V. I. Rud,[98] C. Rudolph,[44] M. S. Rudolph,[159] F. Rühr,[48] A. Ruiz-Martinez,[30] Z. Rurikova,[48] N. A. Rusakovich,[64] A. Ruschke,[99] J. P. Rutherfoord,[7] N. Ruthmann,[48] Y. F. Ryabov,[122] M. Rybar,[128] G. Rybkin,[116] N. C. Ryder,[119] A. F. Saavedra,[151] S. Sacerdoti,[27] A. Saddique,[3] I. Sadeh,[154] H. F-W. Sadrozinski,[138] R. Sadykov,[64] F. Safai Tehrani,[133a] H. Sakamoto,[156] Y. Sakurai,[172] G. Salamanna,[135a,135b] A. Salamon,[134a] M. Saleem,[112] D. Salek,[106] P. H. Sales De Bruin,[139] D. Salihagic,[100] A. Salnikov,[144] J. Salt,[168] D. Salvatore,[37a,37b] F. Salvatore,[150] A. Salvucci,[105] A. Salzburger,[30] D. Sampsonidis,[155] A. Sanchez,[103a,103b] J. Sánchez,[168] V. Sanchez Martinez,[168] H. Sandaker,[14] R. L. Sandbach,[75] H. G. Sander,[82] M. P. Sanders,[99] M. Sandhoff,[176] T. Sandoval,[28] C. Sandoval,[163] R. Sandstroem,[100] D. P. C. Sankey,[130] A. Sansoni,[47] C. Santoni,[34] R. Santonico,[134a,134b] H. Santos,[125a] I. Santoyo Castillo,[150] K. Sapp,[124] A. Sapronov,[64] J. G. Saraiva,[125a,125d] B. Sarrazin,[21] G. Sartisohn,[176] O. Sasaki,[65] Y. Sasaki,[156] G. Sauvage,[5,a] E. Sauvan,[5] P. Savard,[159,e] D. O. Savu,[30] C. Sawyer,[119] L. Sawyer,[78,n] D. H. Saxon,[53] J. Saxon,[121] C. Sbarra,[20a] A. Sbrizzi,[3] T. Scanlon,[77] D. A. Scannicchio,[164] M. Scarcella,[151] V. Scarfone,[37a,37b] J. Schaarschmidt,[173] P. Schacht,[100] D. Schaefer,[30] R. Schaefer,[42] S. Schaepe,[21] S. Schaetzel,[58b] U. Schäfer,[82] A. C. Schaffer,[116] D. Schaile,[99] R. D. Schamberger,[149] V. Scharf,[58a] V. A. Schegelsky,[122] D. Scheirich,[128] M. Schernau,[164] M. I. Scherzer,[35] C. Schiavi,[50a,50b] J. Schieck,[99] C. Schillo,[48] M. Schioppa,[37a,37b] S. Schlenker,[30] E. Schmidt,[48] K. Schmieden,[30] C. Schmitt,[82] S. Schmitt,[58b] B. Schneider,[17] Y. J. Schnellbach,[73] U. Schnoor,[44] L. Schoeffel,[137] A. Schoening,[58b] B. D. Schoenrock,[89] A. L. S. Schorlemmer,[54] M. Schott,[82] D. Schouten,[160a] J. Schovancova,[25] S. Schramm,[159] M. Schreyer,[175] C. Schroeder,[82] N. Schuh,[82] M. J. Schultens,[21] H.-C. Schultz-Coulon,[58a] H. Schulz,[16] M. Schumacher,[48] B. A. Schumm,[138] Ph. Schune,[137] C. Schwanenberger,[83] A. Schwartzman,[144] Ph. Schwegler,[100] Ph. Schwemling,[137] R. Schwienhorst,[89] J. Schwindling,[137] T. Schwindt,[21] M. Schwoerer,[5] F. G. Sciacca,[17] E. Scifo,[116] G. Sciolla,[23] W. G. Scott,[130] F. Scuri,[123a,123b] F. Scutti,[21] J. Searcy,[88] G. Sedov,[42] E. Sedykh,[122] S. C. Seidel,[104] A. Seiden,[138] F. Seifert,[127] J. M. Seixas,[24a] G. Sekhniaidze,[103a] S. J. Sekula,[40] K. E. Selbach,[46] D. M. Seliverstov,[122,a] G. Sellers,[73] N. Semprini-Cesari,[20a,20b] C. Serfon,[30] L. Serin,[116] L. Serkin,[54] T. Serre,[84] R. Seuster,[160a] H. Severini,[112] T. Sfiligoj,[74] F. Sforza,[100] A. Sfyrla,[30] E. Shabalina,[54] M. Shamim,[115] L. Y. Shan,[33a] R. Shang,[166] J. T. Shank,[22] M. Shapiro,[15] P. B. Shatalov,[96] K. Shaw,[165a,165b] C. Y. Shehu,[150] P. Sherwood,[77] L. Shi,[152,ff] S. Shimizu,[66] C. O. Shimmin,[164] M. Shimojima,[101] M. Shiyakova,[64] A. Shmeleva,[95] M. J. Shochet,[31] D. Short,[119] S. Shrestha,[63] E. Shulga,[97] M. A. Shupe,[7] S. Shushkevich,[42] P. Sicho,[126] O. Sidiropoulou,[155] D. Sidorov,[113] A. Sidoti,[133a] F. Siegert,[44] Dj. Sijacki,[13a] J. Silva,[125a,125d] Y. Silver,[154] D. Silverstein,[144] S. B. Silverstein,[147a] V. Simak,[127] O. Simard,[5] Lj. Simic,[13a] S. Simion,[116] E. Simioni,[82] B. Simmons,[77] R. Simoniello,[90a,90b] M. Simonyan,[36] P. Sinervo,[159] N. B. Sinev,[115] V. Sipica,[142] G. Siragusa,[175] A. Sircar,[78] A. N. Sisakyan,[64,a] S. Yu. Sivoklokov,[98] J. Sjölin,[147a,147b] T. B. Sjursen,[14] H. P. Skottowe,[57] K. Yu. Skovpen,[108] P. Skubic,[112] M. Slater,[18] T. Slavicek,[127] K. Sliwa,[162] V. Smakhtin,[173] B. H. Smart,[46] L. Smestad,[14] S. Yu. Smirnov,[97] Y. Smirnov,[97] L. N. Smirnova,[98,gg] O. Smirnova,[80] K. M. Smith,[53] M. Smizanska,[71] K. Smolek,[127] A. A. Snesarev,[95] G. Snidero,[75] S. Snyder,[25] R. Sobie,[170,j] F. Socher,[44] A. Soffer,[154] D. A. Soh,[152,ff] C. A. Solans,[30] M. Solar,[127] J. Solc,[127] E. Yu. Soldatov,[97] U. Soldevila,[168] A. A. Solodkov,[129] A. Soloshenko,[64] O. V. Solovyanov,[129] V. Solovyev,[122] P. Sommer,[48] H. Y. Song,[33b] N. Soni,[1] A. Sood,[15] A. Sopczak,[127] B. Sopko,[127] V. Sopko,[127] V. Sorin,[12] M. Sosebee,[8] R. Soualah,[165a,165c] P. Soueid,[94] A. M. Soukharev,[108] D. South,[42] S. Spagnolo,[72a,72b] F. Spanò,[76] W. R. Spearman,[57] F. Spettel,[100] R. Spighi,[20a] G. Spigo,[30] L. A. Spiller,[87] M. Spousta,[128] T. Spreitzer,[159] B. Spurlock,[8] R. D. St. Denis,[53,a] S. Staerz,[44] J. Stahlman,[121] R. Stamen,[58a] S. Stamm,[16] E. Stanecka,[39] R. W. Stanek,[6] C. Stanescu,[135a] M. Stanescu-Bellu,[42] M. M. Stanitzki,[42] S. Stapnes,[118] E. A. Starchenko,[129] J. Stark,[55] P. Staroba,[126] P. Starovoitov,[42] R. Staszewski,[39] P. Stavina,[145a,a] P. Steinberg,[25] B. Stelzer,[143] H. J. Stelzer,[30] O. Stelzer-Chilton,[160a] H. Stenzel,[52] S. Stern,[100] G. A. Stewart,[53] J. A. Stillings,[21] M. C. Stockton,[86] M. Stoebe,[86] G. Stoicea,[26a] P. Stolte,[54] S. Stonjek,[100] A. R. Stradling,[8] A. Straessner,[44] M. E. Stramaglia,[17] J. Strandberg,[148] S. Strandberg,[147a,147b] A. Strandlie,[118] E. Strauss,[144] M. Strauss,[112] P. Strizenec,[145b] R. Ströhmer,[175] D. M. Strom,[115] R. Stroynowski,[40] S. A. Stucci,[17] B. Stugu,[14] N. A. Styles,[42] D. Su,[144] J. Su,[124] R. Subramaniam,[78] A. Succurro,[12] Y. Sugaya,[117] C. Suhr,[107] M. Suk,[127] V. V. Sulin,[95] S. Sultansoy,[4c] T. Sumida,[67] S. Sun,[57] X. Sun,[33a] J. E. Sundermann,[48] K. Suruliz,[140] G. Susinno,[37a,37b] M. R. Sutton,[150] Y. Suzuki,[65] M. Svatos,[126] S. Swedish,[169] M. Swiatlowski,[144] I. Sykora,[145a] T. Sykora,[128] D. Ta,[89] C. Taccini,[135a,135b] K. Tackmann,[42] J. Taenzer,[159] A. Taffard,[164] R. Tafirout,[160a] N. Taiblum,[154] H. Takai,[25] R. Takashima,[68] H. Takeda,[66] T. Takeshita,[141] Y. Takubo,[65] M. Talby,[84] A. A. Talyshev,[108,u] J. Y. C. Tam,[175] K. G. Tan,[87] J. Tanaka,[156] R. Tanaka,[116]

S. Tanaka,[132] S. Tanaka,[65] A. J. Tanasijczuk,[143] B. B. Tannenwald,[110] N. Tannoury,[21] S. Tapprogge,[82] S. Tarem,[153] F. Tarrade,[29] G. F. Tartarelli,[90a] P. Tas,[128] M. Tasevsky,[126] T. Tashiro,[67] E. Tassi,[37a,37b] A. Tavares Delgado,[125a,125b] Y. Tayalati,[136d] F. E. Taylor,[93] G. N. Taylor,[87] W. Taylor,[160b] F. A. Teischinger,[30] M. Teixeira Dias Castanheira,[75] P. Teixeira-Dias,[76] K. K. Temming,[48] H. Ten Kate,[30] P. K. Teng,[152] J. J. Teoh,[117] S. Terada,[65] K. Terashi,[156] J. Terron,[81] S. Terzo,[100] M. Testa,[47] R. J. Teuscher,[159,j] J. Therhaag,[21] T. Theveneaux-Pelzer,[34] J. P. Thomas,[18] J. Thomas-Wilsker,[76] E. N. Thompson,[35] P. D. Thompson,[18] P. D. Thompson,[159] R. J. Thompson,[83] A. S. Thompson,[53] L. A. Thomsen,[36] E. Thomson,[121] M. Thomson,[28] W. M. Thong,[87] R. P. Thun,[88,a] F. Tian,[35] M. J. Tibbetts,[15] V. O. Tikhomirov,[95,hh] Yu. A. Tikhonov,[108,u] S. Timoshenko,[97] E. Tiouchichine,[84] P. Tipton,[177] S. Tisserant,[84] T. Todorov,[5] S. Todorova-Nova,[128] B. Toggerson,[7] J. Tojo,[69] S. Tokár,[145a] K. Tokushuku,[65] K. Tollefson,[89] L. Tomlinson,[83] M. Tomoto,[102] L. Tompkins,[31] K. Toms,[104] N. D. Topilin,[64] E. Torrence,[115] H. Torres,[143] E. Torró Pastor,[168] J. Toth,[84,ii] F. Touchard,[84] D. R. Tovey,[140] H. L. Tran,[116] T. Trefzger,[175] L. Tremblet,[30] A. Tricoli,[30] I. M. Trigger,[160a] S. Trincaz-Duvoid,[79] M. F. Tripiana,[12] W. Trischuk,[159] B. Trocmé,[55] C. Troncon,[90a] M. Trottier-McDonald,[143] M. Trovatelli,[135a,135b] P. True,[89] M. Trzebinski,[39] A. Trzupek,[39] C. Tsarouchas,[30] J. C-L. Tseng,[119] P. V. Tsiareshka,[91] D. Tsionou,[137] G. Tsipolitis,[10] N. Tsirintanis,[9] S. Tsiskaridze,[12] V. Tsiskaridze,[48] E. G. Tskhadadze,[51a] I. I. Tsukerman,[96] V. Tsulaia,[15] S. Tsuno,[65] D. Tsybychev,[149] A. Tudorache,[26a] V. Tudorache,[26a] A. N. Tuna,[121] S. A. Tupputi,[20a,20b] S. Turchikhin,[98,gg] D. Turecek,[127] I. Turk Cakir,[4d] R. Turra,[90a,90b] P. M. Tuts,[35] A. Tykhonov,[49] M. Tylmad,[147a,147b] M. Tyndel,[130] K. Uchida,[21] I. Ueda,[156] R. Ueno,[29] M. Ughetto,[84] M. Ugland,[14] M. Uhlenbrock,[21] F. Ukegawa,[161] G. Unal,[30] A. Undrus,[25] G. Unel,[164] F. C. Ungaro,[48] Y. Unno,[65] C. Unverdorben,[99] D. Urbaniec,[35] P. Urquijo,[87] G. Usai,[8] A. Usanova,[61] L. Vacavant,[84] V. Vacek,[127] B. Vachon,[86] N. Valencic,[106] S. Valentinetti,[20a,20b] A. Valero,[168] L. Valery,[34] S. Valkar,[128] E. Valladolid Gallego,[168] S. Vallecorsa,[49] J. A. Valls Ferrer,[168] W. Van Den Wollenberg,[106] P. C. Van Der Deijl,[106] R. van der Geer,[106] H. van der Graaf,[106] R. Van Der Leeuw,[106] D. van der Ster,[30] N. van Eldik,[30] P. van Gemmeren,[6] J. Van Nieuwkoop,[143] I. van Vulpen,[106] M. C. van Woerden,[30] M. Vanadia,[133a,133b] W. Vandelli,[30] R. Vanguri,[121] A. Vaniachine,[6] P. Vankov,[42] F. Vannucci,[79] G. Vardanyan,[178] R. Vari,[133a] E. W. Varnes,[7] T. Varol,[85] D. Varouchas,[79] A. Vartapetian,[8] K. E. Varvell,[151] F. Vazeille,[34] T. Vazquez Schroeder,[54] J. Veatch,[7] F. Veloso,[125a,125c] S. Veneziano,[133a] A. Ventura,[72a,72b] D. Ventura,[85] M. Venturi,[170] N. Venturi,[159] A. Venturini,[23] V. Vercesi,[120a] M. Verducci,[133a,133b] W. Verkerke,[106] J. C. Vermeulen,[106] A. Vest,[44] M. C. Vetterli,[143,e] O. Viazlo,[80] I. Vichou,[166] T. Vickey,[146c,jj] O. E. Vickey Boeriu,[146c] G. H. A. Viehhauser,[119] S. Viel,[169] R. Vigne,[30] M. Villa,[20a,20b] M. Villaplana Perez,[90a,90b] E. Vilucchi,[47] M. G. Vincter,[29] V. B. Vinogradov,[64] J. Virzi,[15] I. Vivarelli,[150] F. Vives Vaque,[3] S. Vlachos,[10] D. Vladoiu,[99] M. Vlasak,[127] A. Vogel,[21] M. Vogel,[32a] P. Vokac,[127] G. Volpi,[123a,123b] M. Volpi,[87] H. von der Schmitt,[100] H. von Radziewski,[48] E. von Toerne,[21] V. Vorobel,[128] K. Vorobev,[97] M. Vos,[168] R. Voss,[30] J. H. Vossebeld,[73] N. Vranjes,[137] M. Vranjes Milosavljevic,[106] V. Vrba,[126] M. Vreeswijk,[106] T. Vu Anh,[48] R. Vuillermet,[30] I. Vukotic,[31] Z. Vykydal,[127] P. Wagner,[21] W. Wagner,[176] H. Wahlberg,[70] S. Wahrmund,[44] J. Wakabayashi,[102] J. Walder,[71] R. Walker,[99] W. Walkowiak,[142] R. Wall,[177] P. Waller,[73] B. Walsh,[177] C. Wang,[152,kk] C. Wang,[45] F. Wang,[174] H. Wang,[15] H. Wang,[40] J. Wang,[42] J. Wang,[33a] K. Wang,[86] R. Wang,[104] S. M. Wang,[152] T. Wang,[21] X. Wang,[177] C. Wanotayaroj,[115] A. Warburton,[86] C. P. Ward,[28] D. R. Wardrope,[77] M. Warsinsky,[48] A. Washbrook,[46] C. Wasicki,[42] P. M. Watkins,[18] A. T. Watson,[18] I. J. Watson,[151] M. F. Watson,[18] G. Watts,[139] S. Watts,[83] B. M. Waugh,[77] S. Webb,[83] M. S. Weber,[17] S. W. Weber,[175] J. S. Webster,[31] A. R. Weidberg,[119] P. Weigell,[100] B. Weinert,[60] J. Weingarten,[54] C. Weiser,[48] H. Weits,[106] P. S. Wells,[30] T. Wenaus,[25] D. Wendland,[16] Z. Weng,[152,ff] T. Wengler,[30] S. Wenig,[30] N. Wermes,[21] M. Werner,[48] P. Werner,[30] M. Wessels,[58a] J. Wetter,[162] K. Whalen,[29] A. White,[8] M. J. White,[1] R. White,[32b] S. White,[123a,123b] D. Whiteson,[164] D. Wicke,[176] F. J. Wickens,[130] W. Wiedenmann,[174] M. Wielers,[130] P. Wienemann,[21] C. Wiglesworth,[36] L. A. M. Wiik-Fuchs,[21] P. A. Wijeratne,[77] A. Wildauer,[100] M. A. Wildt,[42,ll] H. G. Wilkens,[30] J. Z. Will,[99] H. H. Williams,[121] S. Williams,[28] C. Willis,[89] S. Willocq,[85] A. Wilson,[88] J. A. Wilson,[18] I. Wingerter-Seez,[5] F. Winklmeier,[115] B. T. Winter,[21] M. Wittgen,[144] T. Wittig,[43] J. Wittkowski,[99] S. J. Wollstadt,[82] M. W. Wolter,[39] H. Wolters,[125a,125c] B. K. Wosiek,[39] J. Wotschack,[30] M. J. Woudstra,[83] K. W. Wozniak,[39] M. Wright,[53] M. Wu,[55] S. L. Wu,[174] X. Wu,[49] Y. Wu,[88] E. Wulf,[35] T. R. Wyatt,[83] B. M. Wynne,[46] S. Xella,[36] M. Xiao,[137] D. Xu,[33a] L. Xu,[33b,mm] B. Yabsley,[151] S. Yacoob,[146b,nn] R. Yakabe,[66] M. Yamada,[65] H. Yamaguchi,[156] Y. Yamaguchi,[117] A. Yamamoto,[65] K. Yamamoto,[63] S. Yamamoto,[156] T. Yamamura,[156] T. Yamanaka,[156] K. Yamauchi,[102] Y. Yamazaki,[66] Z. Yan,[22] H. Yang,[33e] H. Yang,[174] U. K. Yang,[83] Y. Yang,[110] S. Yanush,[92] L. Yao,[33a] W-M. Yao,[15] Y. Yasu,[65] E. Yatsenko,[42] K. H. Yau Wong,[21] J. Ye,[40] S. Ye,[25] I. Yeletskikh,[64] A. L. Yen,[57] E. Yildirim,[42] M. Yilmaz,[4b] R. Yoosoofmiya,[124] K. Yorita,[172] R. Yoshida,[6] K. Yoshihara,[156] C. Young,[144] C. J. S. Young,[30] S. Youssef,[22] D. R. Yu,[15] J. Yu,[8] J. M. Yu,[88] J. Yu,[113] L. Yuan,[66] A. Yurkewicz,[107] I. Yusuff,[28,oo] B. Zabinski,[39] R. Zaidan,[62]

A. M. Zaitsev,[129,bb] A. Zaman,[149] S. Zambito,[23] L. Zanello,[133a,133b] D. Zanzi,[100] C. Zeitnitz,[176] M. Zeman,[127] A. Zemla,[38a] K. Zengel,[23] O. Zenin,[129] T. Ženiš,[145a] D. Zerwas,[116] G. Zevi della Porta,[57] D. Zhang,[88] F. Zhang,[174] H. Zhang,[89] J. Zhang,[6] L. Zhang,[152] X. Zhang,[33d] Z. Zhang,[116] Z. Zhao,[33b] A. Zhemchugov,[64] J. Zhong,[119] B. Zhou,[88] L. Zhou,[35] N. Zhou,[164] C. G. Zhu,[33d] H. Zhu,[33a] J. Zhu,[88] Y. Zhu,[33b] X. Zhuang,[33a] K. Zhukov,[95] A. Zibell,[175] D. Zieminska,[60] N. I. Zimine,[64] C. Zimmermann,[82] R. Zimmermann,[21] S. Zimmermann,[21] S. Zimmermann,[48] Z. Zinonos,[54] M. Ziolkowski,[142] G. Zobernig,[174] A. Zoccoli,[20a,20b] M. zur Nedden,[16] G. Zurzolo,[103a,103b] V. Zutshi,[107] and L. Zwalinski[30]

(ATLAS Collaboration)

[1]*Department of Physics, University of Adelaide, Adelaide, Australia*
[2]*Physics Department, SUNY Albany, Albany, New York, USA*
[3]*Department of Physics, University of Alberta, Edmonton, Alberta, Canada*
[4a]*Department of Physics, Ankara University, Ankara, Turkey*
[4b]*Department of Physics, Gazi University, Ankara, Turkey*
[4c]*Division of Physics, TOBB University of Economics and Technology, Ankara, Turkey*
[4d]*Turkish Atomic Energy Authority, Ankara, Turkey*
[5]*LAPP, CNRS/IN2P3 and Université de Savoie, Annecy-le-Vieux, France*
[6]*High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois, USA*
[7]*Department of Physics, University of Arizona, Tucson, Arizona, USA*
[8]*Department of Physics, The University of Texas at Arlington, Arlington, Texas, USA*
[9]*Physics Department, University of Athens, Athens, Greece*
[10]*Physics Department, National Technical University of Athens, Zografou, Greece*
[11]*Institute of Physics, Azerbaijan Academy of Sciences, Baku, Azerbaijan*
[12]*Institut de Física d'Altes Energies and Departament de Física de la Universitat Autònoma de Barcelona, Barcelona, Spain*
[13a]*Institute of Physics, University of Belgrade, Belgrade, Serbia*
[13b]*Vinca Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia*
[14]*Department for Physics and Technology, University of Bergen, Bergen, Norway*
[15]*Physics Division, Lawrence Berkeley National Laboratory and University of California, Berkeley, California, USA*
[16]*Department of Physics, Humboldt University, Berlin, Germany*
[17]*Albert Einstein Center for Fundamental Physics and Laboratory for High Energy Physics, University of Bern, Bern, Switzerland*
[18]*School of Physics and Astronomy, University of Birmingham, Birmingham, United Kingdom*
[19a]*Department of Physics, Bogazici University, Istanbul, Turkey*
[19b]*Department of Physics, Dogus University, Istanbul, Turkey*
[19c]*Department of Physics Engineering, Gaziantep University, Gaziantep, Turkey*
[20a]*INFN Sezione di Bologna, Italy*
[20b]*Dipartimento di Fisica e Astronomia, Università di Bologna, Bologna, Italy*
[21]*Physikalisches Institut, University of Bonn, Bonn, Germany*
[22]*Department of Physics, Boston University, Boston, Massachusetts, USA*
[23]*Department of Physics, Brandeis University, Waltham, Massachusetts, USA*
[24a]*Universidade Federal do Rio De Janeiro COPPE/EE/IF, Rio de Janeiro, Brazil*
[24b]*Federal University of Juiz de Fora (UFJF), Juiz de Fora, Brazil*
[24c]*Federal University of Sao Joao del Rei (UFSJ), Sao Joao del Rei, Brazil*
[24d]*Instituto de Fisica, Universidade de Sao Paulo, Sao Paulo, Brazil*
[25]*Physics Department, Brookhaven National Laboratory, Upton, New York, USA*
[26a]*National Institute of Physics and Nuclear Engineering, Bucharest, Romania*
[26b]*National Institute for Research and Development of Isotopic and Molecular Technologies, Physics Department, Cluj Napoca, Romania*
[26c]*University Politehnica Bucharest, Bucharest, Romania*
[26d]*West University in Timisoara, Timisoara, Romania*
[27]*Departamento de Física, Universidad de Buenos Aires, Buenos Aires, Argentina*
[28]*Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom*
[29]*Department of Physics, Carleton University, Ottawa, Ontario, Canada*
[30]*CERN, Geneva, Switzerland*
[31]*Enrico Fermi Institute, University of Chicago, Chicago, Illinois, USA*
[32a]*Departamento de Física, Pontificia Universidad Católica de Chile, Santiago, Chile*
[32b]*Departamento de Física, Universidad Técnica Federico Santa María, Valparaíso, Chile*
[33a]*Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China*
[33b]*Department of Modern Physics, University of Science and Technology of China, Anhui, China*

[33c]Department of Physics, Nanjing University, Jiangsu, China
[33d]School of Physics, Shandong University, Shandong, China
[33e]Physics Department, Shanghai Jiao Tong University, Shanghai, China
[34]Laboratoire de Physique Corpusculaire, Clermont Université and Université Blaise Pascal and CNRS/IN2P3, Clermont-Ferrand, France
[35]Nevis Laboratory, Columbia University, Irvington, New York, USA
[36]Niels Bohr Institute, University of Copenhagen, Kobenhavn, Denmark
[37a]INFN Gruppo Collegato di Cosenza, Laboratori Nazionali di Frascati, Italy
[37b]Dipartimento di Fisica, Università della Calabria, Rende, Italy
[38a]AGH University of Science and Technology, Faculty of Physics and Applied Computer Science, Krakow, Poland
[38b]Marian Smoluchowski Institute of Physics, Jagiellonian University, Krakow, Poland
[39]The Henryk Niewodniczanski Institute of Nuclear Physics, Polish Academy of Sciences, Krakow, Poland
[40]Physics Department, Southern Methodist University, Dallas, Texas, USA
[41]Physics Department, University of Texas at Dallas, Richardson, Texas, USA
[42]DESY, Hamburg and Zeuthen, Germany
[43]Institut für Experimentelle Physik IV, Technische Universität Dortmund, Dortmund, Germany
[44]Institut für Kern- und Teilchenphysik, Technische Universität Dresden, Dresden, Germany
[45]Department of Physics, Duke University, Durham, North Carolina, USA
[46]SUPA - School of Physics and Astronomy, University of Edinburgh, Edinburgh, United Kingdom
[47]INFN Laboratori Nazionali di Frascati, Frascati, Italy
[48]Fakultät für Mathematik und Physik, Albert-Ludwigs-Universität, Freiburg, Germany
[49]Section de Physique, Université de Genève, Geneva, Switzerland
[50a]INFN Sezione di Genova, Italy
[50b]Dipartimento di Fisica, Università di Genova, Genova, Italy
[51a]E. Andronikashvili Institute of Physics, Iv. Javakhishvili Tbilisi State University, Tbilisi, Georgia
[51b]High Energy Physics Institute, Tbilisi State University, Tbilisi, Georgia
[52]II Physikalisches Institut, Justus-Liebig-Universität Giessen, Giessen, Germany
[53]SUPA - School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom
[54]II Physikalisches Institut, Georg-August-Universität, Göttingen, Germany
[55]Laboratoire de Physique Subatomique et de Cosmologie, Université Grenoble-Alpes, CNRS/IN2P3, Grenoble, France
[56]Department of Physics, Hampton University, Hampton, Virginia, USA
[57]Laboratory for Particle Physics and Cosmology, Harvard University, Cambridge, Massachusetts, USA
[58a]Kirchhoff-Institut für Physik, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany
[58b]Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany
[58c]ZITI Institut für technische Informatik, Ruprecht-Karls-Universität Heidelberg, Mannheim, Germany
[59]Faculty of Applied Information Science, Hiroshima Institute of Technology, Hiroshima, Japan
[60]Department of Physics, Indiana University, Bloomington, Indiana, USA
[61]Institut für Astro- und Teilchenphysik, Leopold-Franzens-Universität, Innsbruck, Austria
[62]University of Iowa, Iowa City, Iowa, USA
[63]Department of Physics and Astronomy, Iowa State University, Ames, Iowa, USA
[64]Joint Institute for Nuclear Research, JINR Dubna, Dubna, Russia
[65]KEK, High Energy Accelerator Research Organization, Tsukuba, Japan
[66]Graduate School of Science, Kobe University, Kobe, Japan
[67]Faculty of Science, Kyoto University, Kyoto, Japan
[68]Kyoto University of Education, Kyoto, Japan
[69]Department of Physics, Kyushu University, Fukuoka, Japan
[70]Instituto de Física La Plata, Universidad Nacional de La Plata and CONICET, La Plata, Argentina
[71]Physics Department, Lancaster University, Lancaster, United Kingdom
[72a]INFN Sezione di Lecce, Italy
[72b]Dipartimento di Matematica e Fisica, Università del Salento, Lecce, Italy
[73]Oliver Lodge Laboratory, University of Liverpool, Liverpool, United Kingdom
[74]Department of Physics, Jožef Stefan Institute and University of Ljubljana, Ljubljana, Slovenia
[75]School of Physics and Astronomy, Queen Mary University of London, London, United Kingdom
[76]Department of Physics, Royal Holloway University of London, Surrey, United Kingdom
[77]Department of Physics and Astronomy, University College London, London, United Kingdom
[78]Louisiana Tech University, Ruston, Lousiana, USA
[79]Laboratoire de Physique Nucléaire et de Hautes Energies, UPMC and Université Paris-Diderot and CNRS/IN2P3, Paris, France
[80]Fysiska institutionen, Lunds universitet, Lund, Sweden
[81]Departamento de Fisica Teorica C-15, Universidad Autonoma de Madrid, Madrid, Spain
[82]Institut für Physik, Universität Mainz, Mainz, Germany

[83]School of Physics and Astronomy, University of Manchester, Manchester, United Kingdom
[84]CPPM, Aix-Marseille Université and CNRS/IN2P3, Marseille, France
[85]Department of Physics, University of Massachusetts, Amherst, Massachusetts, USA
[86]Department of Physics, McGill University, Montreal, Quebec, Canada
[87]School of Physics, University of Melbourne, Victoria, Australia
[88]Department of Physics, The University of Michigan, Ann Arbor, Michigan, USA
[89]Department of Physics and Astronomy, Michigan State University, East Lansing, Michigan, USA
[90a]INFN Sezione di Milano, Italy
[90b]Dipartimento di Fisica, Università di Milano, Milano, Italy
[91]B.I. Stepanov Institute of Physics, National Academy of Sciences of Belarus, Minsk, Republic of Belarus
[92]National Scientific and Educational Centre for Particle and High Energy Physics, Minsk, Republic of Belarus
[93]Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA
[94]Group of Particle Physics, University of Montreal, Montreal, Quebec, Canada
[95]P.N. Lebedev Institute of Physics, Academy of Sciences, Moscow, Russia
[96]Institute for Theoretical and Experimental Physics (ITEP), Moscow, Russia
[97]Moscow Engineering and Physics Institute (MEPhI), Moscow, Russia
[98]D.V. Skobeltsyn Institute of Nuclear Physics, M.V. Lomonosov Moscow State University, Moscow, Russia
[99]Fakultät für Physik, Ludwig-Maximilians-Universität München, München, Germany
[100]Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München, Germany
[101]Nagasaki Institute of Applied Science, Nagasaki, Japan
[102]Graduate School of Science and Kobayashi-Maskawa Institute, Nagoya University, Nagoya, Japan
[103a]INFN Sezione di Napoli, Italy
[103b]Dipartimento di Fisica, Università di Napoli, Napoli, Italy
[104]Department of Physics and Astronomy, University of New Mexico, Albuquerque, New Mexico, USA
[105]Institute for Mathematics, Astrophysics and Particle Physics, Radboud University Nijmegen/Nikhef, Nijmegen, Netherlands
[106]Nikhef National Institute for Subatomic Physics and University of Amsterdam, Amsterdam, Netherlands
[107]Department of Physics, Northern Illinois University, DeKalb, Illinois, USA
[108]Budker Institute of Nuclear Physics, SB RAS, Novosibirsk, Russia
[109]Department of Physics, New York University, New York, New York, USA
[110]Ohio State University, Columbus, Ohio, USA
[111]Faculty of Science, Okayama University, Okayama, Japan
[112]Homer L. Dodge Department of Physics and Astronomy, University of Oklahoma, Norman, Oklahoma, USA
[113]Department of Physics, Oklahoma State University, Stillwater, Oklahoma, USA
[114]Palacký University, RCPTM, Olomouc, Czech Republic
[115]Center for High Energy Physics, University of Oregon, Eugene, Oregon, USA
[116]LAL, Université Paris-Sud and CNRS/IN2P3, Orsay, France
[117]Graduate School of Science, Osaka University, Osaka, Japan
[118]Department of Physics, University of Oslo, Oslo, Norway
[119]Department of Physics, Oxford University, Oxford, United Kingdom
[120a]INFN Sezione di Pavia, Italy
[120b]Dipartimento di Fisica, Università di Pavia, Pavia, Italy
[121]Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania, USA
[122]Petersburg Nuclear Physics Institute, Gatchina, Russia
[123a]INFN Sezione di Pisa, Italy
[123b]Dipartimento di Fisica E. Fermi, Università di Pisa, Pisa, Italy
[124]Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, Pennsylvania, USA
[125a]Laboratorio de Instrumentacao e Fisica Experimental de Particulas-LIP, Lisboa, Portugal
[125b]Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal
[125c]Department of Physics, University of Coimbra, Coimbra, Portugal
[125d]Centro de Física Nuclear da Universidade de Lisboa, Lisboa, Portugal
[125e]Departamento de Fisica, Universidade do Minho, Braga, Portugal
[125f]Departamento de Fisica Teorica y del Cosmos and CAFPE, Universidad de Granada, Granada (Spain), Portugal
[125g]Dep Fisica and CEFITEC of Faculdade de Ciencias e Tecnologia, Universidade Nova de Lisboa, Caparica, Portugal
[126]Institute of Physics, Academy of Sciences of the Czech Republic, Praha, Czech Republic
[127]Czech Technical University in Prague, Praha, Czech Republic
[128]Faculty of Mathematics and Physics, Charles University in Prague, Praha, Czech Republic
[129]State Research Center Institute for High Energy Physics, Protvino, Russia
[130]Particle Physics Department, Rutherford Appleton Laboratory, Didcot, United Kingdom
[131]Physics Department, University of Regina, Regina, Saskatchewan, Canada
[132]Ritsumeikan University, Kusatsu, Shiga, Japan

[133a]*INFN Sezione di Roma, Italy*
[133b]*Dipartimento di Fisica, Sapienza Università di Roma, Roma, Italy*
[134a]*INFN Sezione di Roma Tor Vergata, Italy*
[134b]*Dipartimento di Fisica, Università di Roma Tor Vergata, Roma, Italy*
[135a]*INFN Sezione di Roma Tre, Italy*
[135b]*Dipartimento di Matematica e Fisica, Università Roma Tre, Roma, Italy*
[136a]*Faculté des Sciences Ain Chock, Réseau Universitaire de Physique des Hautes Energies - Université Hassan II, Casablanca, Morocco*
[136b]*Centre National de l'Energie des Sciences Techniques Nucleaires, Rabat, Morocco*
[136c]*Faculté des Sciences Semlalia, Université Cadi Ayyad, LPHEA-Marrakech, Morocco*
[136d]*Faculté des Sciences, Université Mohamed Premier and LPTPM, Oujda, Morocco*
[136e]*Faculté des sciences, Université Mohammed V-Agdal, Rabat, Morocco*
[137]*DSM/IRFU (Institut de Recherches sur les Lois Fondamentales de l'Univers), CEA Saclay (Commissariat à l'Energie Atomique et aux Energies Alternatives), Gif-sur-Yvette, France*
[138]*Santa Cruz Institute for Particle Physics, University of California Santa Cruz, Santa Cruz, California, USA*
[139]*Department of Physics, University of Washington, Seattle, Washington, USA*
[140]*Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom*
[141]*Department of Physics, Shinshu University, Nagano, Japan*
[142]*Fachbereich Physik, Universität Siegen, Siegen, Germany*
[143]*Department of Physics, Simon Fraser University, Burnaby, British Columbia, Canada*
[144]*SLAC National Accelerator Laboratory, Stanford, California, USA*
[145a]*Faculty of Mathematics, Physics & Informatics, Comenius University, Bratislava, Slovak Republic*
[145b]*Department of Subnuclear Physics, Institute of Experimental Physics of the Slovak Academy of Sciences, Kosice, Slovak Republic*
[146a]*Department of Physics, University of Cape Town, Cape Town, South Africa*
[146b]*Department of Physics, University of Johannesburg, Johannesburg, South Africa*
[146c]*School of Physics, University of the Witwatersrand, Johannesburg, South Africa*
[147a]*Department of Physics, Stockholm University, Sweden*
[147b]*The Oskar Klein Centre, Stockholm, Sweden*
[148]*Physics Department, Royal Institute of Technology, Stockholm, Sweden*
[149]*Departments of Physics & Astronomy and Chemistry, Stony Brook University, Stony Brook, New York, USA*
[150]*Department of Physics and Astronomy, University of Sussex, Brighton, United Kingdom*
[151]*School of Physics, University of Sydney, Sydney, Australia*
[152]*Institute of Physics, Academia Sinica, Taipei, Taiwan*
[153]*Department of Physics, Technion: Israel Institute of Technology, Haifa, Israel*
[154]*Raymond and Beverly Sackler School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel*
[155]*Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece*
[156]*International Center for Elementary Particle Physics and Department of Physics, The University of Tokyo, Tokyo, Japan*
[157]*Graduate School of Science and Technology, Tokyo Metropolitan University, Tokyo, Japan*
[158]*Department of Physics, Tokyo Institute of Technology, Tokyo, Japan*
[159]*Department of Physics, University of Toronto, Toronto, Ontario, Canada*
[160a]*TRIUMF, Vancouver, British Columbia, Canada*
[160b]*Department of Physics and Astronomy, York University, Toronto, Ontario, Canada*
[161]*Faculty of Pure and Applied Sciences, University of Tsukuba, Tsukuba, Japan*
[162]*Department of Physics and Astronomy, Tufts University, Medford, Massachusetts, USA*
[163]*Centro de Investigaciones, Universidad Antonio Narino, Bogota, Colombia*
[164]*Department of Physics and Astronomy, University of California Irvine, Irvine, California, USA*
[165a]*INFN Gruppo Collegato di Udine, Sezione di Trieste, Udine, Italy*
[165b]*ICTP, Trieste, Italy*
[165c]*Dipartimento di Chimica, Fisica e Ambiente, Università di Udine, Udine, Italy*
[166]*Department of Physics, University of Illinois, Urbana, Illinois, USA*
[167]*Department of Physics and Astronomy, University of Uppsala, Uppsala, Sweden*
[168]*Instituto de Física Corpuscular (IFIC) and Departamento de Física Atómica, Molecular y Nuclear and Departamento de Ingeniería Electrónica and Instituto de Microelectrónica de Barcelona (IMB-CNM), University of Valencia and CSIC, Valencia, Spain*
[169]*Department of Physics, University of British Columbia, Vancouver, British Columbia, Canada*
[170]*Department of Physics and Astronomy, University of Victoria, Victoria, British Columbia, Canada*
[171]*Department of Physics, University of Warwick, Coventry, United Kingdom*
[172]*Waseda University, Tokyo, Japan*
[173]*Department of Particle Physics, The Weizmann Institute of Science, Rehovot, Israel*
[174]*Department of Physics, University of Wisconsin, Madison, Wisconsin, USA*
[175]*Fakultät für Physik und Astronomie, Julius-Maximilians-Universität, Würzburg, Germany*

[176]*Fachbereich C Physik, Bergische Universität Wuppertal, Wuppertal, Germany*
[177]*Department of Physics, Yale University, New Haven, Connecticut, USA*
[178]*Yerevan Physics Institute, Yerevan, Armenia*
[179]*Centre de Calcul de l'Institut National de Physique Nucléaire et de Physique des Particules (IN2P3), Villeurbanne, France*

[a]Deceased.
[b]Also at Department of Physics, King's College London, London, United Kingdom.
[c]Also at Institute of Physics, Azerbaijan Academy of Sciences, Baku, Azerbaijan.
[d]Also at Particle Physics Department, Rutherford Appleton Laboratory, Didcot, United Kingdom.
[e]Also at TRIUMF, Vancouver, BC, Canada.
[f]Also at Department of Physics, California State University, Fresno, CA, USA.
[g]Also at Tomsk State University, Tomsk, Russia.
[h]Also at CPPM, Aix-Marseille Université and CNRS/IN2P3, Marseille, France.
[i]Also at Università di Napoli Parthenope, Napoli, Italy.
[j]Also at Institute of Particle Physics (IPP), Canada.
[k]Also at Department of Physics, St. Petersburg State Polytechnical University, St. Petersburg, Russia.
[l]Also at Chinese University of Hong Kong, China.
[m]Also at Department of Financial and Management Engineering, University of the Aegean, Chios, Greece.
[n]Also at Louisiana Tech University, Ruston, LA, USA.
[o]Also at Institucio Catalana de Recerca i Estudis Avancats, ICREA, Barcelona, Spain.
[p]Also at Department of Physics, The University of Texas at Austin, Austin, TX, USA.
[q]Also at Institute of Theoretical Physics, Ilia State University, Tbilisi, Georgia.
[r]Also at CERN, Geneva, Switzerland.
[s]Also at Ochadai Academic Production, Ochanomizu University, Tokyo, Japan.
[t]Also at Manhattan College, New York, NY, USA.
[u]Also at Novosibirsk State University, Novosibirsk, Russia.
[v]Also at Institute of Physics, Academia Sinica, Taipei, Taiwan.
[w]Also at LAL, Université Paris-Sud and CNRS/IN2P3, Orsay, France.
[x]Also at Academia Sinica Grid Computing, Institute of Physics, Academia Sinica, Taipei, Taiwan.
[y]Also at Laboratoire de Physique Nucléaire et de Hautes Energies, UPMC and Université Paris-Diderot and CNRS/IN2P3, Paris, France.
[z]Also at School of Physical Sciences, National Institute of Science Education and Research, Bhubaneswar, India.
[aa]Also at Dipartimento di Fisica, Sapienza Università di Roma, Roma, Italy.
[bb]Also at Moscow Institute of Physics and Technology State University, Dolgoprudny, Russia.
[cc]Also at Section de Physique, Université de Genève, Geneva, Switzerland.
[dd]Also at International School for Advanced Studies (SISSA), Trieste, Italy.
[ee]Also at Department of Physics and Astronomy, University of South Carolina, Columbia, SC, USA.
[ff]Also at School of Physics and Engineering, Sun Yat-sen University, Guangzhou, China.
[gg]Also at Faculty of Physics, M.V.Lomonosov Moscow State University, Moscow, Russia.
[hh]Also at Moscow Engineering and Physics Institute (MEPhI), Moscow, Russia.
[ii]Also at Institute for Particle and Nuclear Physics, Wigner Research Centre for Physics, Budapest, Hungary.
[jj]Also at Department of Physics, Oxford University, Oxford, United Kingdom.
[kk]Also at Department of Physics, Nanjing University, Jiangsu, China.
[ll]Also at Institut für Experimentalphysik, Universität Hamburg, Hamburg, Germany.
[mm]Also at Department of Physics, The University of Michigan, Ann Arbor, MI, USA.
[nn]Also at Discipline of Physics, University of KwaZulu-Natal, Durban, South Africa.
[oo]Also at University of Malaya, Department of Physics, Kuala Lumpur, Malaysia.