



Search for the Higgs boson in the $H \rightarrow WW(*) \rightarrow l^+ \nu l^- \bar{\nu}$ decay channel in pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector

G. Aad, T. Beau, S. Bordini, G. Calderini, A. Camard, P. Cavalleri, E. Chareyre, S. de Cecco, F. Derue, D. Imbault, et al.

► To cite this version:

G. Aad, T. Beau, S. Bordini, G. Calderini, A. Camard, et al.. Search for the Higgs boson in the $H \rightarrow WW(*) \rightarrow l^+ \nu l^- \bar{\nu}$ decay channel in pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector. Physical Review Letters, 2012, 108, pp.111802. 10.1103/PhysRevLett.108.111802. in2p3-00651209

HAL Id: in2p3-00651209

<https://hal.in2p3.fr/in2p3-00651209>

Submitted on 21 Sep 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Search for the Higgs boson in the $H \rightarrow WW^{(*)} \rightarrow \ell^+ \nu \ell^- \bar{\nu}$ decay channel in pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector

The ATLAS Collaboration

A search for the Higgs boson has been performed in the $H \rightarrow WW^{(*)} \rightarrow \ell^+ \nu \ell^- \bar{\nu}$ channel ($\ell = e/\mu$) with an integrated luminosity of 2.05 fb^{-1} of pp collisions at $\sqrt{s} = 7$ TeV collected with the ATLAS detector at the Large Hadron Collider. No significant excess of events over the expected background is observed and limits on the Higgs boson production cross section are derived for a Higgs boson mass in the range $110 \text{ GeV} < m_H < 300 \text{ GeV}$. The observations exclude the presence of a Standard Model Higgs boson with a mass $145 < m_H < 206 \text{ GeV}$ at 95% confidence level.

PACS numbers: 12.15.Ji 14.80.Bn 13.87.Ce 14.70.Fm 14.70.Hp

The Standard Model of particle physics postulates the existence of a complex scalar doublet with a vacuum expectation value, which spontaneously breaks the electroweak symmetry, gives masses to all the massive elementary particles in the theory, and gives rise to a physical scalar known as the Higgs boson [1]. At the LHC, the Higgs boson is expected to be produced mainly through gluon fusion ($gg \rightarrow H$) [2] due to the large gluon density, although vector boson fusion ($qq \rightarrow qqH$) [3] is also important. Associated production of Higgs bosons (WH , ZH) also contributes more than 4% to the total rate for $m_H \leq 135 \text{ GeV}$ [4]. For $m_H \gtrsim 135 \text{ GeV}$, $H \rightarrow WW^{(*)}$ is the dominant decay mode of the Higgs boson. Direct searches at LEP and the Tevatron exclude a Standard Model Higgs boson with a mass $m_H < 114.4 \text{ GeV}$ or $156 \text{ GeV} < m_H < 177 \text{ GeV}$ [5] at 95% confidence level (CL). The search for $H \rightarrow ZZ \rightarrow \ell\ell\nu\nu$ at ATLAS excludes a Standard Model Higgs boson with a mass $340 < m_H < 450 \text{ GeV}$, while the search for $H \rightarrow ZZ \rightarrow 4\ell$ excludes $191 < m_H < 197 \text{ GeV}$, $199 < m_H < 200 \text{ GeV}$, and $214 < m_H < 224 \text{ GeV}$ [6].

This Letter reports the results of a search for the Higgs boson in the channel $H \rightarrow WW^{(*)} \rightarrow \ell^+ \nu \ell^- \bar{\nu}$ [7] ($\ell = e/\mu$, but including contributions from $\tau \rightarrow e/\mu$ decays) in 2.05 fb^{-1} of pp collisions at $\sqrt{s} = 7$ TeV recorded by the ATLAS detector during the LHC run of spring and summer 2011. As described in detail below, the search examines events containing two leptons and up to one jet. The main backgrounds are suppressed by cuts on angular distributions, invariant masses, and b -jet tagging information. The background normalization and composition is estimated in situ using several control samples defined by relaxing or reversing selection cuts. Similar searches were performed by CMS and ATLAS in 36 pb^{-1} [8] and 35 pb^{-1} [9], respectively. The ATLAS experiment [10] is a multipurpose particle physics detector with forward-backward symmetric cylindrical geometry allowing tracks within the pseudorapidity range $|\eta| < 2.5$ and energy deposits in calorimeters covering $|\eta| < 4.9$ to be recon-

structed. It is modeled using GEANT4 [11] and simulated events are reconstructed using the same software that is used to perform the reconstruction on data. The effects of multiple pp interactions (“in-time” pile-up) and residual energy deposits from neighboring bunch crossings (“out-of-time” pile-up) are modeled in the Monte Carlo (MC) samples by superimposing a number of simulated minimum-bias events on the simulated signal and background events. MC samples with different numbers of pile-up interactions are re-weighted to match the conditions observed in the present data: about 6 interactions per bunch crossing, with a 50 ns bunch spacing. The data used in this analysis were recorded during periods when all ATLAS sub-detectors were operating under nominal conditions. The events were triggered [12] by requiring the presence of a high- p_T electron or muon in the event.

Electron candidates are selected from clustered energy deposits in the electromagnetic (EM) calorimeter with an associated track reconstructed in the inner detector and are required to satisfy a stringent set of identification cuts [13] with an efficiency of 71% for electrons with transverse momentum $E_T > 20 \text{ GeV}$ and $|\eta| < 2.47$. Muons are reconstructed by combining tracks in the inner detector and muon spectrometer. The efficiency of this reconstruction is 92% for muons with $p_T > 20 \text{ GeV}$ and $|\eta| < 2.4$. Events are required to have a primary vertex with ≥ 3 tracks with $p_T > 0.4 \text{ GeV}$. For both electrons and muons, the track associated with the lepton candidate is required to be consistent with having been produced at the event’s primary vertex. Leptons are required to be isolated, satisfying stringent cuts on tracks and calorimeter depositions inside a cone $\Delta R = \sqrt{\Delta\phi^2 + \Delta\eta^2} < 0.2$ around the lepton candidate, where $\Delta\phi$ and $\Delta\eta$ are the transverse opening angle and pseudorapidity difference between the lepton and the track or energy deposit. The lepton reconstruction efficiencies are evaluated with tag-and-probe methods using $Z \rightarrow \ell\ell$, $J/\psi \rightarrow \ell\ell$, and $W \rightarrow \ell\nu$ events in data [14].

Jets are reconstructed from calibrated clusters using

TABLE I: The expected numbers of signal ($m_H = 150$ GeV) and background events after the requirements listed in the first column, as well as the observed numbers of events in data. All numbers are summed over lepton flavor.

$H + 0\text{-jet}$ Channel	Signal	WW	$W + \text{jets}$	$Z/\gamma^* + \text{jets}$	$t\bar{t}$	$tW/tb/tqb$	$WZ/ZZ/W\gamma$	Total Bkg.	Observed
Jet Veto	99 ± 21	524 ± 52	84 ± 41	174 ± 169	42 ± 14	32 ± 8	15 ± 4	872 ± 182	920
$p_T^{\ell\ell} > 30$ GeV	95 ± 20	467 ± 45	69 ± 34	30 ± 12	39 ± 14	29 ± 8	13 ± 4	648 ± 60	700
$m_{\ell\ell} < 50$ GeV	68 ± 15	118 ± 15	21 ± 8	13 ± 8	7 ± 4	5.8 ± 1.8	1.9 ± 0.6	166 ± 19	199
$\Delta\phi_{\ell\ell} < 1.3$	58 ± 13	91 ± 12	12 ± 5	9 ± 6	6 ± 3	5.8 ± 1.8	1.7 ± 0.6	125 ± 15	149
$0.75 m_H < m_T < m_H$	40 ± 9	52 ± 7	5 ± 2	2 ± 4	2.4 ± 1.6	1.5 ± 1.0	1.1 ± 0.5	63 ± 9	81
$H + 1\text{-jet}$ Channel	Signal	WW	$W + \text{jets}$	$Z/\gamma^* + \text{jets}$	$t\bar{t}$	$tW/tb/tqb$	$WZ/ZZ/W\gamma$	Total Bkg.	Observed
1 jet	50 ± 9	193 ± 20	38 ± 21	74 ± 65	473 ± 124	174 ± 26	14 ± 2	967 ± 145	952
$b\text{-jet veto}$	48 ± 9	188 ± 19	35 ± 19	73 ± 61	174 ± 49	66 ± 11	14 ± 2	549 ± 83	564
$ \mathbf{p}_T^{\text{tot}} < 30$ GeV	39 ± 7	154 ± 16	18 ± 9	38 ± 32	106 ± 30	50 ± 9	9.7 ± 1.5	376 ± 48	405
$Z \rightarrow \tau\tau$ veto	39 ± 7	150 ± 17	18 ± 8	34 ± 23	102 ± 23	48 ± 8	9 ± 2	361 ± 38	388
$m_{\ell\ell} < 50$ GeV	26 ± 6	33 ± 5	3.3 ± 1.4	8 ± 7	20 ± 7	11 ± 3	1.8 ± 0.5	77 ± 12	90
$\Delta\phi_{\ell\ell} < 1.3$	23 ± 5	25 ± 4	2.1 ± 1.0	4 ± 6	17 ± 6	9 ± 3	1.5 ± 0.4	60 ± 10	72
$0.75 m_H < m_T < m_H$	14 ± 3	12 ± 3	0.9 ± 0.4	1.3 ± 1.9	8 ± 2	4.0 ± 1.6	0.7 ± 0.3	28 ± 4	29
Control Regions	Signal	WW	$W + \text{jets}$	$Z/\gamma^* + \text{jets}$	$t\bar{t}$	$tW/tb/tqb$	$WZ/ZZ/W\gamma$	Total Bkg.	Observed
WW 0-jet ($m_H < 220$ GeV)	1.7 ± 0.4	223 ± 30	20 ± 15	6 ± 8	25 ± 10	15 ± 4	8 ± 3	296 ± 36	296
WW 0-jet ($m_H \geq 220$ GeV)	10 ± 2	173 ± 23	24 ± 12	13 ± 19	15 ± 6	8 ± 3	3.3 ± 0.6	236 ± 33	258
WW 1-jet ($m_H < 220$ GeV)	1.0 ± 0.3	76 ± 13	5 ± 3	5 ± 5	56 ± 14	23 ± 5	5.3 ± 1.4	171 ± 21	184
WW 1-jet ($m_H \geq 220$ GeV)	5.8 ± 1.5	51 ± 9	3.9 ± 1.8	10 ± 10	35 ± 9	18 ± 4	2.8 ± 0.6	120 ± 17	129
$t\bar{t}$ 1-jet	0.9 ± 0.3	3.9 ± 1.0	-	1 ± 17	184 ± 64	80 ± 19	0.2 ± 0.9	270 ± 69	249

the anti- k_t algorithm [15] with radius parameter $R = 0.4$. Jet energies are calibrated using E_T and η dependent correction factors based on MC simulation and validated by test beam and collision data studies [16]. They are required to have $E_T > 25$ GeV and $|\eta| < 4.5$. Jets are identified as having been produced by b quarks using an algorithm that combines information about the impact parameter significance of tracks in the jet and the topology of semi-leptonic b - and c -hadron decays [17]. The missing transverse momentum E_T^{miss} [18] is reconstructed from calibrated energy clusters in the calorimeters and the reconstructed momenta of the muons, which generally deposit only a small fraction of their energy in the calorimeters. The E_T^{miss} distribution in the presence of pile-up has been studied, and both E_T^{miss} as a function of the number of reconstructed primary vertices and E_T^{miss} as a function of the event's position in the bunch train are well-modeled by MC.

Exactly two opposite-sign lepton candidates (e or μ) with $p_T > 15$ GeV for muons or $E_T > 20$ GeV for electrons are required. The leading lepton must have transverse momentum > 25 GeV so the selected events have a high efficiency for the trigger selection.

After the selection of events with two leptons, the significant backgrounds are the Drell-Yan process, $t\bar{t}$ and single top ($tW/tb/tqb$), WW , other diboson processes ($WZ/ZZ/W\gamma$), and W +jets where a jet is misidentified as a lepton. In addition to data-driven validations of the background estimates discussed later, MC simulations of the signal and backgrounds are studied in detail. The $gg \rightarrow H$ and $qq \rightarrow qqH$ processes are modeled using POWHEG, with PYTHIA to handle the parton shower [19], and the $gg \rightarrow H$ Higgs boson p_T spectrum is reweighted

to agree with the prediction of Ref. [20]. PYTHIA is used to model WH/ZH production. Signal MC is generated in steps of 5 GeV for m_H below 200 GeV and in steps of 20 GeV for larger masses. Signal expectations for intermediate mass values are obtained by linear interpolation of the signal efficiency. The $t\bar{t}$, s -channel single top (tb), and $qq/qg \rightarrow WW/WZ/ZZ$ processes are generated with MC@NLO, t -channel and Wt single top with ACERMC (interfaced to the parton shower algorithm in PYTHIA), $gg \rightarrow WW$ with GG2WW interfaced to the parton shower algorithm in HERWIG [21], $W\gamma$ with MADGRAPH interfaced to PYTHIA, and W +jets and Z/γ^* +jets with ALPGEN interfaced to PYTHIA [22].

If the two leptons have different flavors, their invariant mass ($m_{\ell\ell}$) is required to be above 10 GeV. Otherwise, they must satisfy $m_{\ell\ell} > 15$ GeV and they must lie outside the region with $|m_{\ell\ell} - m_Z| < 15$ GeV to suppress backgrounds from Υ and Z production, respectively.

The quantity $E_{T,\text{rel}}^{\text{miss}}$ is defined as E_T^{miss} if the angle $\Delta\phi$ between the missing transverse momentum and the transverse momentum of the nearest lepton or jet is greater than $\pi/2$, or $E_T^{\text{miss}} \sin(\Delta\phi)$ otherwise. $E_{T,\text{rel}}^{\text{miss}}$ is less sensitive to the mismeasurement of a single lepton or jet than E_T^{miss} . To suppress backgrounds from multi-jet events and Drell-Yan production, it is required that $E_{T,\text{rel}}^{\text{miss}} > 40$ GeV if the two leptons have the same flavor, or $E_{T,\text{rel}}^{\text{miss}} > 25$ GeV if they have different flavor.

After these requirements, the data are separated into $H + 0\text{-jet}$ and $H + 1\text{-jet}$ [23] samples based on whether they have zero or exactly one jet. In the $H + 0\text{-jet}$ channel, the dilepton system is required to have a large transverse boost, $p_T^{\ell\ell} > 30$ GeV, to suppress backgrounds from

Z +jets and continuum WW production.

To suppress background from top-quark production, events in the $H + 1$ -jet channel are rejected if the jet is identified as the decay of a b -quark. These candidates are further required to have $|\mathbf{p}_T^{\text{tot}}| < 30$ GeV, where $\mathbf{p}_T^{\text{tot}}$ is the vector sum of the transverse momenta of the jet, the two leptons, and the E_T^{miss} vector. This latter selection suppresses events with significant hadronic activity that recoils against the $\mathbf{p}_T^{\text{tot}}$ system but does not leave high p_T jets in the detector. In the $H + 1$ -jet channel, the event is required to pass the $Z \rightarrow \tau\tau$ rejection cut used in the $H \rightarrow WW$ analysis of Ref. [24].

Top and WW backgrounds are suppressed by an upper bound on $m_{\ell\ell}$. Because the $m_{\ell\ell}$ distribution for the signal depends strongly on m_H , the chosen upper bound depends on the Higgs boson mass hypothesis. For $m_H < 170$ GeV, $m_{\ell\ell} < 50$ GeV is required, while for $170 \leq m_H < 220$ GeV, the cut is $m_{\ell\ell} < 65$ GeV. For $m_H \geq 220$ GeV, the requirement is $50 < m_{\ell\ell} < 180$ GeV.

For $m_H < 220$ GeV, an upper bound is imposed on the azimuthal angle between the two leptons to exploit differences in spin correlations between signal and background: $\Delta\phi_{\ell\ell} < 1.3$ for $m_H < 170$ GeV, or $\Delta\phi_{\ell\ell} < 1.8$ for $m_H < 220$ GeV. The final requirement uses the transverse mass m_T [25] which is defined as $(m_T)^2 = m_v^2 + 2(e_v|\mathbf{p}_{T,i}| - \mathbf{p}_{T,v} \cdot \mathbf{p}_{T,i})$, where the subscripts v and i denote the visible and invisible decay products and $e_v = \sqrt{\mathbf{p}_{T,v} \cdot \mathbf{p}_{T,v} + m_v^2}$ denotes the transverse energy. The transverse mass m_T is required to lie within $0.75m_H < m_T < m_H$ if $m_H < 220$ GeV or $0.6m_H < m_T < m_H$ otherwise. The upper bound on this window reduces the WW and top backgrounds and excludes regions of phase space where interference effects between the signal and the $gg \rightarrow WW$ background are large [26].

Table I shows the expected and observed event yields after these cuts. As described below, the W +jets background is entirely determined from data, whereas for the other processes the expectations are based on simulation, with $Z/\gamma^* + \text{jets}$, $t\bar{t}$, and $tW/tb/tqb$ corrected by scale factors derived from control samples. The uncertainties shown are the sum in quadrature of systematic uncertainties and statistical errors due to the finite number of MC events. Figure 1 shows the distributions of $m_{\ell\ell}$ and $\Delta\phi_{\ell\ell}$ before the final cut on $m_{\ell\ell}$, and the distribution of m_T after the cut on $\Delta\phi_{\ell\ell}$.

The background from W +jets events where one jet is misidentified as a lepton is estimated from data using a control sample where one of the two leptons satisfies a loosened set of identification and isolation criteria but not the full set of criteria normally used. The extrapolation from this control sample to the signal region is extracted from dijet events [27].

The Drell-Yan background is corrected for mis-modeling of the distribution of E_T^{miss} at high values based on the observed difference between the fraction of events passing the $E_{T,\text{rel}}^{\text{miss}} > 40$ GeV selection in data and MC

simulation for events with $m_{\ell\ell}$ within 10 GeV of the Z boson mass. The correction factors are all found to be between 0.8 and 0.9, which indicates that the background in the signal region is about 15% less than the MC estimates.

The WW and top backgrounds are normalized by a simultaneous fit to the numbers of observed events in the signal region and several control samples. A sample enriched in WW background is defined by removing the selections on m_T and $\Delta\phi_{\ell\ell}$ and changing the selection on $m_{\ell\ell}$. For $m_H < 220$ GeV, the cut is changed to $m_{\ell\ell} > 80$ GeV, while for $m_H > 220$ GeV, the control region is the union of the regions with $15 < m_{\ell\ell} < 50$ GeV and $m_{\ell\ell} > 180$ GeV. This control sample is studied separately for the $H + 0$ -jet channel and the $H + 1$ -jet channel, and the observed yields are consistent with expectations in both cases. The yields in these control regions, shown in Table I, are propagated to the signal region using scale factors computed with MC.

In the $H + 0$ -jet channel, the top-enriched control sample consists of the same preselected sample used in the rest of this analysis: events with two leptons and $E_{T,\text{rel}}^{\text{miss}}$. The scale factor used to propagate the $t\bar{t}$ yield from this sample to the signal region is estimated as the square of the efficiency for one top decay to survive the jet veto (estimated using another control sample, defined by the presence of an additional b -jet), with a correction computed using MC to account for the presence of single top [28]. A sample enriched in top background is defined for the $H + 1$ -jet channel by reversing the b -jet veto and removing the cuts on $\Delta\phi_{\ell\ell}$, $m_{\ell\ell}$, and m_T . The extrapolation to the signal region is done using a scale factor computed using MC. The control samples for top in the $H + 0$ -jet and $H + 1$ -jet channels also normalize the top contamination in the corresponding WW control regions. In both cases, the estimated top backgrounds are consistent with the expected yields in Table I.

The signal significance and limits on Higgs boson production are derived from a likelihood function that is the product of the Poisson probabilities of each of the lepton flavor and jet multiplicity yields for the signal selections, the $WW + 0$ -jet and $WW + 1$ -jet control regions, and top control region for the $H + 1$ -jet channel. The normalization of the signal, the WW cross sections for the $H + 0$ -jet and $H + 1$ -jet channels, and the top cross section for the $H + 1$ -jet channel are allowed to vary independently; the control regions included in the fit constrain all of these except the signal yield. All other components are normalized to their expectations scaled by nuisance parameters constrained by Gaussian terms that include the systematic uncertainties described below. The results from the control sample measurements for the top background in the $H + 0$ -jet channel and for the W +jets and Drell-Yan backgrounds everywhere are used as the expected values for the corresponding backgrounds in the fit. Since these contributions are small, the control samples themselves

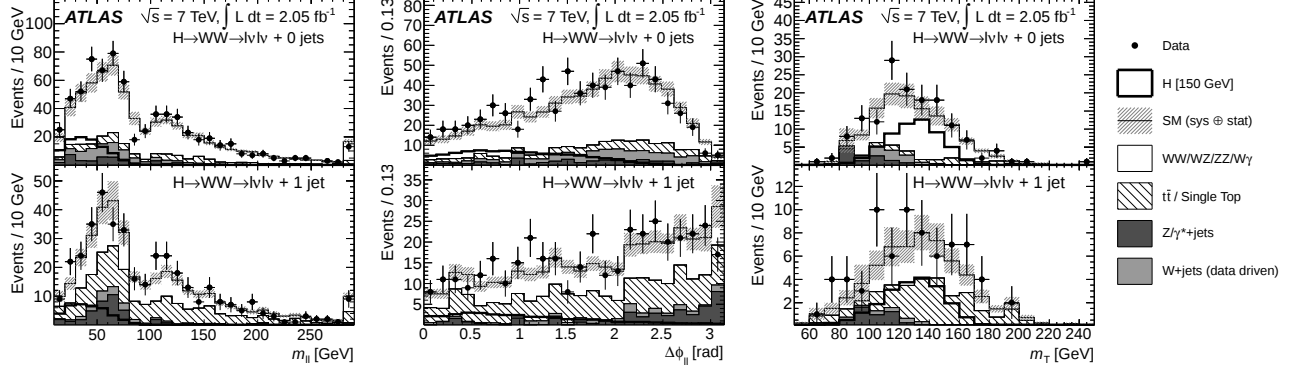


FIG. 1: Distributions of $m_{\ell\ell}$ (left), $\Delta\phi_{\ell\ell}$ (center), and m_T (right). The top row shows the selection for the $H + 0$ -jet channel and the bottom row for the $H + 1$ -jet channel. The left and central plots are shown after the p_T^{tot} selection for the $H + 0$ -jet channel and after the $|\mathbf{p}_T^{\text{tot}}|$ cut for the $H + 1$ -jet channel. For the rightmost plots, the distributions are shown after all the cuts for $m_H = 150$ GeV except the cut on m_T itself. The background distributions are stacked, so that the top of the diboson background coincides with the Standard Model (SM) line which includes the statistical and systematic uncertainties on the expectation in the absence of a signal. The expected signal for $m_H=150$ GeV is shown as a separate thicker line, and the final bin includes the overflow.

are not explicitly modeled in the fit as they are for top in the $H + 1$ -jet channel and for WW everywhere.

The systematic uncertainties include contributions from the 3.7% uncertainty in the luminosity [29], and from theoretical uncertainties, which are $-8/+12\%$ and $\pm 8\%$ from the QCD scale and 1% and 4% from the parton density functions, for $gg \rightarrow H$ and $qq \rightarrow qqH$ respectively. Additional theoretical uncertainties on the acceptance are assessed as described in Ref. [30]. In particular, the uncertainty in the assignment of events to jet multiplicity bins is included separately as an uncertainty on the cross section of each bin, calculated from the approximate 10% and 20% uncertainties of the inclusive 0-jet and 1-jet cross sections, respectively.

Several sources of measurement uncertainty are taken into account. The uncertainty on the jet energy scale is less than 10% on the global scale including flavor composition effects, with an additional uncertainty of up to 7% due to pile-up [16]. The electron and muon efficiencies are determined from samples of W and Z boson data with uncertainties of 2-5% and 0.3-1%, respectively, depending on $|\eta|$ and p_T . Uncertainties are $< 1\%$ and $< 0.1\%$, respectively, on the lepton energy scale and $< 0.6\%$ and $< 5\%$ on the resolution [14]. The uncertainties on the b -tagging efficiency and mistag rate are 6-15% and up to 21%, respectively [17]. A 13% uncertainty is applied to the energy scale for low- p_T depositions in the E_T^{miss} measurement. All these sources of detector uncertainty are propagated to the result by varying reconstructed quantities and observing the effect on the expected yields. For the WW background, the total (theoretical and experimental) uncertainty on the ratio of cross sections in the signal and control regions is 7.6% in the $H + 0$ -jet channel and 21% in the $H + 1$ -jet channel; for the top background

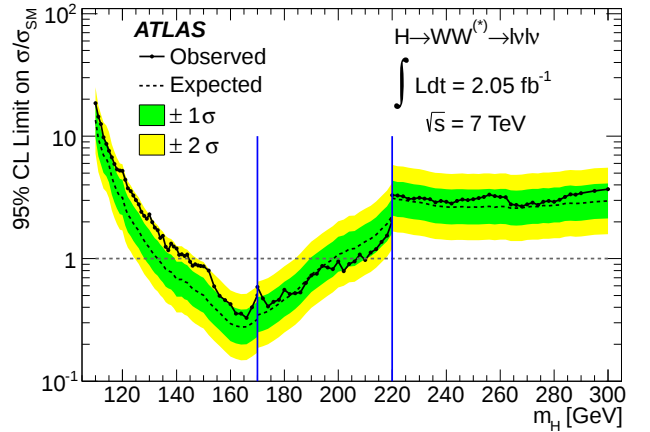


FIG. 2: The expected (dashed) and observed (solid) 95% CL upper limits on the cross section, normalized to the Standard Model cross section, as a function of the Higgs boson mass. Expected limits are given for the scenario where there is no signal. The vertical lines in the curves indicate the points where the selection cuts change, and the bands around the dashed line indicate the expected statistical fluctuations of the limit.

in $H + 1$ -jet the total for the extrapolation to the signal region is 38%, and 29% to the WW control region.

No significant excess of events is observed. The largest observed deviation from the expected background is 1.9σ . A 95% CL upper bound is set on the Higgs boson cross section as a function of m_H using the CL_s formalism [31]. Figure 2 shows the expected and observed limits. Discontinuities occur where the selection changes, since the signal regions there are less statistically correlated between adjacent masses. In the absence of a signal, one would expect to exclude a Standard Model Higgs boson

in the range $134 < m_H < 200$ GeV at the 95% CL. The Higgs boson mass interval excluded by the measurements presented in this Letter, $145 < m_H < 206$ GeV, is consistent with that expectation. This measurement excludes, at 95% CL, a larger part of the mass range favored by the electroweak fits than previous limits [32].

ACKNOWLEDGMENTS

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; BMWF, Austria; AHAS, 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; ARTEMIS, European Union; IN2P3-CNRS, CEA-DSM/IRFU, France; GNAS, Georgia; BMBF, DFG, HGF, MPG and AvH Foundation, Germany; GSRT, Greece; ISF, MINERVA, GIF, DIP and Benoziyo Center, Israel; INFN, Italy; MEXT and JSPS, Japan; CNRST, Morocco; FOM and NWO, Netherlands; RCN, Norway; MNiSW, Poland; GRICES and FCT, Portugal; MERYS (MECTS), Romania; MES of Russia and ROSATOM, Russian Federation; JINR; MSTĐ, Serbia; MSSR, Slovakia; ARRS and MVZT, Slovenia; DST/NRF, South Africa; MICINN, 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, Sweden), CC-IN2P3 (France), KIT/GridKA (Germany), INFN-CNAF (Italy), NL-T1 (Netherlands), PIC (Spain), ASGC (Taiwan), RAL (UK) and BNL (USA) and in the Tier-2 facilities worldwide.

[1] F. Englert and R. Brout, Phys. Rev. Lett. **13**, 321 (1964); P. W. Higgs, Phys. Rev. Lett. **13**, 508 (1964); G. S. Guralnik, C.R. Hagen and T.W.B. Kibble, Phys. Rev. Lett. **13**, 585 (1964).
[2] R. V. Harlander and W. B. Kilgore, Phys. Rev. Lett. **88**, 201801 (2002); C. Anastasiou and K. Melnikov, Nucl. Phys. **B646**, 220 (2002); V. Ravindran, J. Smith, and W. L. van Neerven, Nucl. Phys. **B665**, 325 (2003); S. Catani, D. de Florian, M. Grazzini, and P. Nason,

JHEP **07**, 028 (2003); C. Anastasiou, R. Boughezal, and F. Petriello, JHEP **04**, 003 (2009); D. de Florian and M. Grazzini, Phys. Lett. **B674**, 291 (2009); U. Aglietti, R. Bonciani, G. Degrossi, and A. Vicini, Phys. Lett. **B595**, 432 (2004); S. Actis, G. Passarino, C. Sturm, and S. Uccirati, Phys. Lett. **B670**, 12 (2008).
[3] P. Bolzoni, F. Maltoni, S.-O. Moch, and M. Zaro, Phys. Rev. Lett. **105**, 011801 (2010); M. Ciccolini, A. Denner, and S. Dittmaier, Phys. Rev. Lett. **99**, 161803 (2007); M. Ciccolini, A. Denner, and S. Dittmaier, Phys. Rev. **D77**, 013002 (2008).
[4] LHC Higgs Cross Section Working Group, S. Dittmaier, C. Mariotti, G. Passarino, and R. Tanaka (Eds.), CERN-2011-002 (CERN, Geneva, 2011), arXiv:1101.0593.
[5] The LEP Collaborations, Phys. Lett. **B565**, 61 (2003); The CDF and D0 Collaborations (2011), arXiv:1107.5518.
[6] The ATLAS Collaboration, Phys. Rev. Lett. **107**, 221802 (2011); Phys. Lett. **B705**, 435 (2011).
[7] M. Dittmar and H. Dreiner, Phys. Rev. **D55**, 167 (1997).
[8] The CMS Collaboration, Phys. Lett. **B699**, 25 (2011).
[9] The ATLAS Collaboration, Eur.Phys.J. **C71**, 1728 (2011).
[10] The ATLAS Collaboration, JINST **3**, S08003 (2008).
[11] S. Agostinelli et al., NIM A **506**, 250 (2003); The ATLAS Collaboration, Eur. Phys. J. **C70**, 823 (2010).
[12] The ATLAS Collaboration (2011), arXiv:1110.1530, submitted to EPJC.
[13] The ATLAS Collaboration, JHEP **12**, 060 (2010).
[14] The ATLAS Collaboration (2011), arXiv:1110.3174, submitted to EPJC.
[15] M. Cacciari, G. P. Salam, and G. Soyez, JHEP **04**, 063 (2008).
[16] The ATLAS Collaboration, ATLAS-CONF-2011-032, available at <http://cdsweb.cern.ch/record/1337782>.
[17] The ATLAS Collaboration, ATLAS-CONF-2011-102, available at <http://cdsweb.cern.ch/record/1369219>.
[18] The ATLAS Collaboration (2011), arXiv:1108.5602, submitted to EPJC.
[19] S. Alioli, P. Nason, C. Oleari, and E. Re, JHEP **0904**, 002 (2009); P. Nason and C. Oleari, JHEP **1002**, 037 (2010); T. Sjöstrand et al., JHEP **05**, 026 (2006).
[20] G. Bozzi, S. Catani, D. de Florian, and M. Grazzini, Nucl.Phys. **B737**, 73 (2006).
[21] S. Frixione and B. Webber, JHEP **0308**, 007 (2003); B. P. Kersevan and E. Richter-Was, arXiv:hep-ph/0405247 (2004); T. Binoth, M. Ciccolini, N. Kauer, and M. Krämer, JHEP **12**, 046 (2006); G. Corcella et al., JHEP **01**, 010 (2001).
[22] J. Alwall et al., JHEP **0709**, 028 (2007); M. L. Mangano et al., JHEP **07**, 001 (2003).
[23] B. Mellado, W. Quayle, and S. L. Wu, Phys. Rev. **D76**, 093007 (2007).
[24] S. Asai et al., Eur. Phys. J. **C32S2**, 19 (2004).
[25] A. J. Barr, B. Gripaios, and C. G. Lester, JHEP **07**, 072 (2009).
[26] J. M. Campbell, R. K. Ellis, and C. Williams, JHEP **10**, 005 (2011).
[27] The ATLAS Collaboration, Phys. Rev. Lett. **107**, 041802 (2011).
[28] B. Mellado, X. Ruan, and Z. Zhang, Phys. Rev. D **84**, 096005 (2011).
[29] The ATLAS Collaboration, Eur.Phys.J. **C71**, 1630 (2011); The ATLAS Collaboration, ATLAS-CONF-2011-

- 116, available at <http://cdsweb.cern.ch/record/1376384>.
- [30] The ATLAS and CMS Collaborations and the LHC Higgs Combination Group, ATL-PHYS-PUB-2011-011 and CMS NOTE-2011/005 (2011).
- [31] A. L. Read, *Journal of Physics G: Nuclear and Particle Physics* **28**, 2693 (2002); G. Cowan, K. Cranmer, E. Gross, and O. Vitells, *European Physical Journal C* **71**, 1554 (2011), 1007.1727.
- [32] The ALEPH, CDF, D0, DELPHI, L3, OPAL, and SLD Collaborations, the LEP and Tevatron Electroweak Working Groups, and the SLD Heavy Flavor Working Group (2010), arXiv:1012.2367.

The ATLAS Collaboration

G. Aad⁴⁸, B. Abbott¹¹⁰, J. Abdallah¹¹, A.A. Abdelalim⁴⁹, A. Abdesselam¹¹⁷, O. Abidinov¹⁰, B. Abi¹¹¹, M. Abolins⁸⁷, H. Abramowicz¹⁵², H. Abreu¹¹⁴, E. Acerbi^{88a,88b}, B.S. Acharya^{163a,163b}, L. Adamczyk³⁷, D.L. Adams²⁴, T.N. Addy⁵⁶, J. Adelman¹⁷⁴, M. Aderholz⁹⁸, S. Adomeit⁹⁷, P. Adragna⁷⁴, T. Adye¹²⁸, S. Aefsky²², J.A. Aguilar-Saavedra^{123b,a}, M. Aharrouche⁸⁰, S.P. Ahlen²¹, F. Ahles⁴⁸, A. Ahmad¹⁴⁷, M. Ahsan⁴⁰, G. Aielli^{132a,132b}, T. Akdogan^{18a}, T.P.A. Åkesson⁷⁸, G. Akimoto¹⁵⁴, A.V. Akimov⁹³, A. Akiyama⁶⁶, M.S. Alam¹, M.A. Alam⁷⁵, J. Albert¹⁶⁸, S. Albrand⁵⁵, M. Aleksa²⁹, I.N. Aleksandrov⁶⁴, F. Alessandria^{88a}, C. Alexa^{25a}, G. Alexander¹⁵², G. Alexandre⁴⁹, T. Alexopoulos⁹, M. Alhroob²⁰, M. Aliev¹⁵, G. Alimonti^{88a}, J. Alison¹¹⁹, M. Aliyev¹⁰, P.P. Allport⁷², S.E. Allwood-Spiers⁵³, J. Almond⁸¹, A. Aloisio^{101a,101b}, R. Alon¹⁷⁰, A. Alonso⁷⁸, B. Alvarez Gonzalez⁸⁷, M.G. Alviggi^{101a,101b}, K. Amako⁶⁵, P. Amaral²⁹, C. Amelung²², V.V. Ammosov¹²⁷, A. Amorim^{123a,b}, G. Amorós¹⁶⁶, N. Amram¹⁵², C. Anastopoulos²⁹, L.S. Ancu¹⁶, N. Andari¹¹⁴, T. Andeen³⁴, C.F. Anders²⁰, G. Anders^{58a}, K.J. Anderson³⁰, A. Andreazza^{88a,88b}, V. Andrei^{58a}, M-L. Andrieux⁵⁵, X.S. Anduaga⁶⁹, A. Angerami³⁴, F. Anghinolfi²⁹, A. Anisenkov¹⁰⁶, N. Anjos^{123a}, A. Annovi⁴⁷, A. Antonaki⁸, M. Antonelli⁴⁷, A. Antonov⁹⁵, J. Antos^{143b}, F. Anulli^{131a}, S. Aoun⁸², L. Aperio Bella⁴, R. Apolle^{117,c}, G. Arabidze⁸⁷, I. Aracena¹⁴², Y. Arai⁶⁵, A.T.H. Arce⁴⁴, J.P. Archambault²⁸, S. Arfaoui⁸², J-F. Arguin¹⁴, E. Arik^{18a,*}, M. Arik^{18a}, A.J. Armbruster⁸⁶, O. Arnaez⁸⁰, C. Arnault¹¹⁴, A. Artamonov⁹⁴, G. Artoni^{131a,131b}, D. Arutinov²⁰, S. Asai¹⁵⁴, R. Asfandiyarov¹⁷¹, S. Ask²⁷, B. Åsman^{145a,145b}, L. Asquith⁵, K. Assamagan²⁴, A. Astbury¹⁶⁸, A. Astvatsatourov⁵², B. Aubert⁴, E. Auge¹¹⁴, K. Augsten¹²⁶, M. Aourousseau^{144a}, G. Avolio¹⁶², R. Avramidou⁹, D. Axen¹⁶⁷, C. Ay⁵⁴, G. Azuelos^{92,d}, Y. Azuma¹⁵⁴, M.A. Baak²⁹, G. Baccaglioni^{88a}, C. Bacci^{133a,133b}, A.M. Bach¹⁴, H. Bachacou¹³⁵, K. Bachas²⁹, G. Bachy²⁹, M. Backes⁴⁹, M. Backhaus²⁰, E. Badescu^{25a}, P. Bagnaia^{131a,131b}, S. Bahinipati², Y. Bai^{32a}, D.C. Bailey¹⁵⁷, T. Bain¹⁵⁷, J.T. Baines¹²⁸, O.K. Baker¹⁷⁴, M.D. Baker²⁴, S. Baker⁷⁶, E. Banas³⁸, P. Banerjee⁹², Sw. Banerjee¹⁷¹, D. Banfi²⁹, A. Bangert¹⁴⁹, V. Bansal¹⁶⁸, H.S. Bansil¹⁷, L. Barak¹⁷⁰, S.P. Baranov⁹³, A. Barashkou⁶⁴, A. Barbaro Galtieri¹⁴, T. Barber⁴⁸, E.L. Barberio⁸⁵, D. Barberis^{50a,50b}, M. Barbero²⁰, D.Y. Bardin⁶⁴, T. Barillari⁹⁸, M. Barisonzi¹⁷³, T. Barklow¹⁴², N. Barlow²⁷, B.M. Barnett¹²⁸, R.M. Barnett¹⁴, A. Baroncelli^{133a}, G. Barone⁴⁹, A.J. Barr¹¹⁷, F. Barreiro⁷⁹, J. Barreiro Guimarães da Costa⁵⁷, P. Barrillon¹¹⁴, R. Bartoldus¹⁴², A.E. Barton⁷⁰, V. Bartsch¹⁴⁸, R.L. Bates⁵³, L. Batkova^{143a}, J.R. Batley²⁷, A. Battaglia¹⁶, M. Battistin²⁹, G. Battistoni^{88a}, F. Bauer¹³⁵, H.S. Bawa^{142,e}, S. Beale⁹⁷, B. Beare¹⁵⁷, T. Beau⁷⁷, P.H. Beauchemin¹⁶⁰, R. Beccherle^{50a}, P. Bechtel²⁰, H.P. Beck¹⁶, S. Becker⁹⁷, M. Beckingham¹³⁷, K.H. Becks¹⁷³, A.J. Beddall^{18c}, A. Beddall^{18c}, S. Bedikian¹⁷⁴, V.A. Bednyakov⁶⁴, C.P. Bee⁸², M. Begel²⁴, S. Behar Harpaz¹⁵¹, P.K. Behera⁶², M. Beimforde⁹⁸, C. Belanger-Champagne⁸⁴, P.J. Bell⁴⁹, W.H. Bell⁴⁹, G. Bella¹⁵², L. Bellagamba^{19a}, F. Bellina²⁹, M. Bellomo²⁹, A. Belloni⁵⁷, O. Beloborodova^{106,f}, K. Belotskiy⁹⁵, O. Beltramello²⁹, S. Ben Ami¹⁵¹, O. Benary¹⁵², D. Bencheikroun^{134a}, C. Benchouk⁸², M. Bendel⁸⁰, N. Benekos¹⁶⁴, Y. Benhammou¹⁵², J.A. Benitez Garcia^{158b}, D.P. Benjamin⁴⁴, M. Benoit¹¹⁴, J.R. Bensinger²², K. Benslama¹²⁹, S. Bentvelsen¹⁰⁴, D. Berge²⁹, E. Bergeas Kuutmann⁴¹, N. Berger⁴, F. Berghaus¹⁶⁸, E. Berglund¹⁰⁴, J. Beringer¹⁴, P. Bernat⁷⁶, R. Bernhard⁴⁸, C. Bernius²⁴, T. Berry⁷⁵, C. Bertella⁸², A. Bertin^{19a,19b}, F. Bertinelli²⁹, F. Bertolucci^{121a,121b}, M.I. Besana^{88a,88b}, N. Besson¹³⁵, S. Bethke⁹⁸, W. Bhimji⁴⁵, R.M. Bianchi²⁹, M. Bianco^{71a,71b}, O. Biebel⁹⁷, S.P. Bieniek⁷⁶, K. Bierwagen⁵⁴, J. Biesiada¹⁴, M. Biglietti^{133a}, H. Bilokon⁴⁷, M. Bindi^{19a,19b}, S. Binet¹¹⁴, A. Bingul^{18c}, C. Bini^{131a,131b}, C. Biscarat¹⁷⁶, U. Bitenc⁴⁸, K.M. Black²¹, R.E. Blair⁵, J.-B. Blanchard¹¹⁴, G. Blanchot²⁹, T. Blazek^{143a}, C. Blocker²², J. Blocki³⁸, A. Blondel⁴⁹, W. Blum⁸⁰, U. Blumenschein⁵⁴, G.J. Bobbink¹⁰⁴, V.B. Bobrovnikov¹⁰⁶, S.S. Bocchetta⁷⁸, A. Bocci⁴⁴, C.R. Boddy¹¹⁷, M. Boehler⁴¹, J. Boek¹⁷³, N. Boelaert³⁵, S. Böser⁷⁶, J.A. Bogaerts²⁹, A. Bogdanchikov¹⁰⁶, A. Bogouch^{89,*}, C. Bohm^{145a}, V. Boisvert⁷⁵, T. Bold³⁷, V. Boldea^{25a}, N.M. Bolnet¹³⁵, M. Bona⁷⁴, V.G. Bondarenko⁹⁵, M. Bondioli¹⁶², M. Boonekamp¹³⁵, G. Boorman⁷⁵, C.N. Booth¹³⁸, S. Bordon⁷⁷, C. Borer¹⁶, A. Borisov¹²⁷, G. Borissov⁷⁰, I. Borjanovic^{12a}, S. Borroni⁸⁶, K. Bos¹⁰⁴, D. Boscherini^{19a}, M. Bosman¹¹, H. Boterenbrood¹⁰⁴, D. Botterill¹²⁸, J. Bouchami⁹², J. Boudreau¹²², E.V. Bouhova-Thacker⁷⁰, C. Bourdarios¹¹⁴, N. Bousson⁸², A. Boveia³⁰, J. Boyd²⁹, I.R. Boyko⁶⁴, N.I. Bozhko¹²⁷, I. Bozovic-Jelisavcic^{12b}, J. Bracinik¹⁷, A. Braem²⁹, P. Branchini^{133a}, G.W. Brandenburg⁵⁷, A. Brandt⁷, G. Brandt¹¹⁷, O. Brandt⁵⁴, U. Bratzler¹⁵⁵, B. Brau⁸³, J.E. Brau¹¹³, H.M. Braun¹⁷³, B. Brelrier¹⁵⁷, J. Bremer²⁹, R. Brenner¹⁶⁵, S. Bressler¹⁷⁰, D. Breton¹¹⁴, D. Britton⁵³, F.M. Brochu²⁷, I. Brock²⁰, R. Brock⁸⁷, T.J. Brodbeck⁷⁰, E. Brodet¹⁵², F. Broggi^{88a}, C. Bromberg⁸⁷, J. Bronner⁹⁸, G. Brooijmans³⁴, W.K. Brooks^{31b}, G. Brown⁸¹, H. Brown⁷, P.A. Bruckman de Renstrom³⁸, D. Bruncko^{143b}, R. Bruneliere⁴⁸, S. Brunet⁶⁰, A. Bruni^{19a}, G. Bruni^{19a}, M. Bruschi^{19a}, T. Buanes¹³, Q. Buat⁵⁵, F. Bucci⁴⁹, J. Buchanan¹¹⁷, N.J. Buchanan², P. Buchholz¹⁴⁰, R.M. Buckingham¹¹⁷, A.G. Buckley⁴⁵, S.I. Buda^{25a}, I.A. Budagov⁶⁴, B. Budick¹⁰⁷, V. Büscher⁸⁰, L. Bugge¹¹⁶, D. Buira-Clark¹¹⁷, O. Bulekov⁹⁵, M. Bunse⁴², T. Buran¹¹⁶, H. Burckhart²⁹, S. Burdin⁷², T. Burgess¹³, S. Burke¹²⁸, E. Busato³³, P. Bussey⁵³, C.P. Buszello¹⁶⁵, F. Butin²⁹, B. Butler¹⁴², J.M. Butler²¹, C.M. Buttar⁵³, J.M. Butterworth⁷⁶, W. Buttinger²⁷, S. Cabrera Urbán¹⁶⁶,

D. Caforio^{19a,19b}, O. Cakir^{3a}, P. Calafiura¹⁴, G. Calderini⁷⁷, P. Calfayan⁹⁷, R. Calkins¹⁰⁵, L.P. Caloba^{23a}, R. Caloi^{131a,131b}, D. Calvet³³, S. Calvet³³, R. Camacho Toro³³, P. Camarri^{132a,132b}, M. Cambiaghi^{118a,118b}, D. Cameron¹¹⁶, L.M. Caminada¹⁴, S. Campana²⁹, M. Campanelli⁷⁶, V. Canale^{101a,101b}, F. Canelli^{30,g}, A. Canepa^{158a}, J. Cantero⁷⁹, L. Capasso^{101a,101b}, M.D.M. Capeans Garrido²⁹, I. Caprini^{25a}, M. Caprini^{25a}, D. Capriotti⁹⁸, M. Capua^{36a,36b}, R. Caputo⁸⁰, C. Caramarcu²⁴, R. Cardarelli^{132a}, T. Carli²⁹, G. Carlino^{101a}, L. Carminati^{88a,88b}, B. Caron⁸⁴, S. Caron⁴⁸, G.D. Carrillo Montoya¹⁷¹, A.A. Carter⁷⁴, J.R. Carter²⁷, J. Carvalho^{123a,h}, D. Casadei¹⁰⁷, M.P. Casado¹¹, M. Cascella^{121a,121b}, C. Caso^{50a,50b,*}, A.M. Castaneda Hernandez¹⁷¹, E. Castaneda-Miranda¹⁷¹, V. Castillo Gimenez¹⁶⁶, N.F. Castro^{123a}, G. Cataldi^{71a}, F. Cataneo²⁹, A. Catinaccio²⁹, J.R. Catmore²⁹, A. Cattai²⁹, G. Cattani^{132a,132b}, S. Caughron⁸⁷, D. Cauz^{163a,163c}, P. Cavalleri⁷⁷, D. Cavalli^{88a}, M. Cavalli-Sforza¹¹, V. Cavaşinni^{121a,121b}, F. Ceradini^{133a,133b}, A.S. Cerqueira^{23b}, A. Cerri²⁹, L. Cerrito⁷⁴, F. Cerutti⁴⁷, S.A. Cetin^{18b}, F. Cevenini^{101a,101b}, A. Chafaq^{134a}, D. Chakraborty¹⁰⁵, K. Chan², B. Chapleau⁸⁴, J.D. Chapman²⁷, J.W. Chapman⁸⁶, E. Chareyre⁷⁷, D.G. Charlton¹⁷, V. Chavda⁸¹, C.A. Chavez Barajas²⁹, S. Cheatham⁸⁴, S. Chekanov⁵, S.V. Chekulaev^{158a}, G.A. Chelkov⁶⁴, M.A. Chelstowska¹⁰³, C. Chen⁶³, H. Chen²⁴, S. Chen^{32c}, T. Chen^{32c}, X. Chen¹⁷¹, S. Cheng^{32a}, A. Cheplakov⁶⁴, V.F. Chepurinov⁶⁴, R. Cherkaoui El Moursli^{134e}, V. Chernyatin²⁴, E. Cheu⁶, S.L. Cheung¹⁵⁷, L. Chevalier¹³⁵, G. Chiefari^{101a,101b}, L. Chikovani^{51a}, J.T. Childers^{58a}, A. Chilingarov⁷⁰, G. Chiodini^{71a}, M.V. Chizhov⁶⁴, G. Choudalakis³⁰, S. Chouridou¹³⁶, I.A. Christidi⁷⁶, A. Christov⁴⁸, D. Chromek-Burckhart²⁹, M.L. Chu¹⁵⁰, J. Chudoba¹²⁴, G. Ciapetti^{131a,131b}, K. Ciba³⁷, A.K. Ciftci^{3a}, R. Ciftci^{3a}, D. Cinca³³, V. Cindro⁷³, M.D. Ciobotaru¹⁶², C. Ciocca^{19a}, A. Ciocio¹⁴, M. Cirilli⁸⁶, M. Citterio^{88a}, M. Ciubancan^{25a}, A. Clark⁴⁹, P.J. Clark⁴⁵, W. Cleland¹²², J.C. Clemens⁸², B. Clement⁵⁵, C. Clement^{145a,145b}, R.W. Clift¹²⁸, Y. Coadou⁸², M. Cobal^{163a,163c}, A. Cocco^{50a,50b}, J. Cochran⁶³, P. Coe¹¹⁷, J.G. Cogan¹⁴², J. Coggeshall¹⁶⁴, E. Cogneras¹⁷⁶, C.D. Cojocar²⁸, J. Colas⁴, A.P. Colijn¹⁰⁴, N.J. Collins¹⁷, C. Collins-Tooth⁵³, J. Collot⁵⁵, G. Colon⁸³, P. Conde Muño^{123a}, E. Coniavitis¹¹⁷, M.C. Conidi¹¹, M. Consonni¹⁰³, V. Consorti⁴⁸, S. Constantinescu^{25a}, C. Conta^{118a,118b}, F. Conventi^{101a,i}, J. Cook²⁹, M. Cooke¹⁴, B.D. Cooper⁷⁶, A.M. Cooper-Sarkar¹¹⁷, K. Copic¹⁴, T. Cornelissen¹⁷³, M. Corradi^{19a}, F. Corriveau^{84,j}, A. Cortes-Gonzalez¹⁶⁴, G. Cortiana⁹⁸, G. Costa^{88a}, M.J. Costa¹⁶⁶, D. Costanzo¹³⁸, T. Costin³⁰, D. Côté²⁹, R. Coura Torres^{23a}, L. Courneyea¹⁶⁸, G. Cowan⁷⁵, C. Cowden²⁷, B.E. Cox⁸¹, K. Cranmer¹⁰⁷, F. Crescioli^{121a,121b}, M. Cristinziani²⁰, G. Crosetti^{36a,36b}, R. Crupi^{71a,71b}, S. Crépe-Renaudin⁵⁵, C.-M. Cuciuc^{25a}, C. Cuenca Almenar¹⁷⁴, T. Cuhadar Donszelmann¹³⁸, M. Curatolo⁴⁷, C.J. Curtis¹⁷, C. Cuthbert¹⁴⁹, P. Cwetanski⁶⁰, H. Czirr¹⁴⁰, Z. Czyczula¹⁷⁴, S. D'Auria⁵³, M. D'Onofrio⁷², A. D'Orazio^{131a,131b}, P.V.M. Da Silva^{23a}, C. Da Via⁸¹, W. Dabrowski³⁷, T. Dai⁸⁶, C. Dallapiccola⁸³, M. Dam³⁵, M. Dameri^{50a,50b}, D.S. Damiani¹³⁶, H.O. Danielsson²⁹, D. Dannheim⁹⁸, V. Dao⁴⁹, G. Darbo^{50a}, G.L. Darlea^{25b}, C. Daum¹⁰⁴, W. Davey²⁰, T. Davidek¹²⁵, N. Davidson⁸⁵, R. Davidson⁷⁰, E. Davies^{117,c}, M. Davies⁹², A.R. Davison⁷⁶, Y. Davygora^{58a}, E. Dawe¹⁴¹, I. Dawson¹³⁸, J.W. Dawson^{5,*}, R.K. Daya-Ishmukhametova³⁹, K. De⁷, R. de Asmundis^{101a}, S. De Castro^{19a,19b}, P.E. De Castro Faria Salgado²⁴, S. De Cecco⁷⁷, J. de Graat⁹⁷, N. De Groot¹⁰³, P. de Jong¹⁰⁴, C. De La Taille¹¹⁴, H. De la Torre⁷⁹, B. De Lotto^{163a,163c}, L. de Mora⁷⁰, L. De Nooij¹⁰⁴, D. De Pedis^{131a}, A. De Salvo^{131a}, U. De Sanctis^{163a,163c}, A. De Santo¹⁴⁸, J.B. De Vivie De Regie¹¹⁴, S. Dean⁷⁶, W.J. Dearnaley⁷⁰, R. Debbé²⁴, C. Debenedetti⁴⁵, D.V. Dedovich⁶⁴, J. Degenhardt¹¹⁹, M. Dehchar¹¹⁷, C. Del Papa^{163a,163c}, J. Del Peso⁷⁹, T. Del Prete^{121a,121b}, T. Delemontex⁵⁵, M. Deliyergiyev⁷³, A. Dell'Acqua²⁹, L. Dell'Asta²¹, M. Della Pietra^{101a,i}, D. della Volpe^{101a,101b}, M. Delmastro⁴, N. Delruelle²⁹, P.A. Delsart⁵⁵, C. Deluca¹⁴⁷, S. Demers¹⁷⁴, M. Demichev⁶⁴, B. Demirköz^{11,k}, J. Deng¹⁶², S.P. Denisov¹²⁷, D. Derendarz³⁸, J.E. Derkaoui^{134d}, F. Derue⁷⁷, P. Dervan⁷², K. Desch²⁰, E. Devetak¹⁴⁷, P.O. Deviveiros¹⁵⁷, A. Dewhurst¹²⁸, B. DeWilde¹⁴⁷, S. Dhaliwal¹⁵⁷, R. Dhullipudi^{24,l}, A. Di Ciaccio^{132a,132b}, L. Di Ciaccio⁴, A. Di Girolamo²⁹, B. Di Girolamo²⁹, S. Di Luise^{133a,133b}, A. Di Mattia¹⁷¹, B. Di Micco²⁹, R. Di Nardo⁴⁷, A. Di Simone^{132a,132b}, R. Di Sipio^{19a,19b}, M.A. Diaz^{31a}, F. Diblen^{18c}, E.B. Diehl⁸⁶, J. Dietrich⁴¹, T.A. Dietzsch^{58a}, S. Diglio⁸⁵, K. Dindar Yagci³⁹, J. Dingfelder²⁰, C. Dionisi^{131a,131b}, P. Dita^{25a}, S. Dita^{25a}, F. Dittus²⁹, F. Djama⁸², T. Djobava^{51b}, M.A.B. do Vale^{23c}, A. Do Valle Wemans^{123a}, T.K.O. Doan⁴, M. Dobbs⁸⁴, R. Dobinson^{29,*}, D. Dobos²⁹, E. Dobson^{29,m}, J. Dodd³⁴, C. Doglioni¹¹⁷, T. Doherty⁵³, Y. Doi^{65,*}, J. Dolejsi¹²⁵, I. Dolenc⁷³, Z. Dolezal¹²⁵, B.A. Dolgoshein^{95,*}, T. Dohmae¹⁵⁴, M. Donadelli^{23d}, M. Donega¹¹⁹, J. Donini³³, J. Dopke²⁹, A. Doria^{101a}, A. Dos Anjos¹⁷¹, M. Dosil¹¹, A. Dotti^{121a,121b}, M.T. Dova⁶⁹, J.D. Dowell¹⁷, A.D. Doxiadis¹⁰⁴, A.T. Doyle⁵³, Z. Drasal¹²⁵, J. Drees¹⁷³, N. Dressnandt¹¹⁹, H. Drevermann²⁹, C. Driouichi³⁵, M. Dris⁹, J. Dubbert⁹⁸, S. Dube¹⁴, E. Duchovni¹⁷⁰, G. Duckeck⁹⁷, A. Dudarev²⁹, F. Dudziak⁶³, M. Dührssen²⁹, I.P. Duerdoth⁸¹, L. Duflot¹¹⁴, M.-A. Dufour⁸⁴, M. Dunford²⁹, H. Duran Yildiz^{3a}, R. Duxfield¹³⁸, M. Dwuznik³⁷, F. Dydak²⁹, M. Düren⁵², W.L. Ebenstein⁴⁴, J. Ebke⁹⁷, S. Eckweiler⁸⁰, K. Edmonds⁸⁰, C.A. Edwards⁷⁵, N.C. Edwards⁵³, W. Ehrenfeld⁴¹, T. Ehrich⁹⁸, T. Eifert²⁹, G. Eigen¹³, K. Einsweiler¹⁴, E. Eisenhandler⁷⁴, T. Ekelof¹⁶⁵, M. El Kacimi^{134c}, M. Ellert¹⁶⁵, S. Elles⁴, F. Ellinghaus⁸⁰, K. Ellis⁷⁴, N. Ellis²⁹, J. Elmsheuser⁹⁷, M. Elsing²⁹, D. Emelianov¹²⁸, R. Engelmann¹⁴⁷, A. Engl⁹⁷, B. Epp⁶¹, A. Eppig⁸⁶, J. Erdmann⁵⁴, A. Ereditato¹⁶, D. Eriksson^{145a}, J. Ernst¹, M. Ernst²⁴, J. Ernwein¹³⁵, D. Errede¹⁶⁴, S. Errede¹⁶⁴, E. Ertel⁸⁰, M. Escalier¹¹⁴,

C. Escobar¹²², X. Espinal Curull¹¹, B. Esposito⁴⁷, F. Etienne⁸², A.I. Etienne¹³⁵, E. Etzion¹⁵², D. Evangelakou⁵⁴, H. Evans⁶⁰, L. Fabbri^{19a,19b}, C. Fabre²⁹, R.M. Fakhrutdinov¹²⁷, S. Falciano^{131a}, Y. Fang¹⁷¹, M. Fanti^{88a,88b}, A. Farbin⁷, A. Farilla^{133a}, J. Farley¹⁴⁷, T. Farooque¹⁵⁷, S.M. Farrington¹¹⁷, P. Farthouat²⁹, P. Fassnacht²⁹, D. Fassouliotis⁸, B. Fatholahzadeh¹⁵⁷, A. Favaretto^{88a,88b}, L. Fayard¹¹⁴, S. Fazio^{36a,36b}, R. Febbraro³³, P. Federic^{143a}, O.L. Fedin¹²⁰, W. Fedorko⁸⁷, M. Fehling-Kaschek⁴⁸, L. Feligioni⁸², D. Fellmann⁵, C. Feng^{32d}, E.J. Feng³⁰, A.B. Fenyuk¹²⁷, J. Ferencei^{143b}, J. Ferland⁹², W. Fernando¹⁰⁸, S. Ferrag⁵³, J. Ferrando⁵³, V. Ferrara⁴¹, A. Ferrari¹⁶⁵, P. Ferrari¹⁰⁴, R. Ferrari^{118a}, A. Ferrer¹⁶⁶, M.L. Ferrer⁴⁷, D. Ferrere⁴⁹, C. Ferretti⁸⁶, A. Ferretto Parodi^{50a,50b}, M. Fiascaris³⁰, F. Fiedler⁸⁰, A. Filipčić⁷³, A. Filippas⁹, F. Filthaut¹⁰³, M. Fincke-Keeler¹⁶⁸, M.C.N. Fiolhais^{123a,h}, L. Fiorini¹⁶⁶, A. Firan³⁹, G. Fischer⁴¹, P. Fischer²⁰, M.J. Fisher¹⁰⁸, M. Flechl⁴⁸, I. Fleck¹⁴⁰, J. Fleckner⁸⁰, P. Fleischmann¹⁷², S. Fleischmann¹⁷³, T. Flick¹⁷³, L.R. Flores Castillo¹⁷¹, M.J. Flowerdew⁹⁸, M. Fokitis⁹, T. Fonseca Martin¹⁶, J. Fopma¹¹⁷, D.A. Forbush¹³⁷, A. Formica¹³⁵, A. Forti⁸¹, D. Fortin^{158a}, J.M. Foster⁸¹, D. Fournier¹¹⁴, A. Foussat²⁹, A.J. Fowler⁴⁴, K. Fowler¹³⁶, H. Fox⁷⁰, P. Francavilla^{121a,121b}, S. Franchino^{118a,118b}, D. Francis²⁹, T. Frank¹⁷⁰, M. Franklin⁵⁷, S. Franz²⁹, M. Fraternali^{118a,118b}, S. Fratina¹¹⁹, S.T. French²⁷, F. Friedrich⁴³, R. Froeschl²⁹, D. Froidevaux²⁹, J.A. Frost²⁷, C. Fukunaga¹⁵⁵, E. Fullana Torregrosa²⁹, J. Fuster¹⁶⁶, C. Gabaldon²⁹, O. Gabizon¹⁷⁰, T. Gadfort²⁴, S. Gadomski⁴⁹, G. Gagliardi^{50a,50b}, P. Gagnon⁶⁰, C. Galea⁹⁷, E.J. Gallas¹¹⁷, V. Gallo¹⁶, B.J. Gallop¹²⁸, P. Gallus¹²⁴, K.K. Gan¹⁰⁸, Y.S. Gao^{142,e}, V.A. Gapienko¹²⁷, A. Gaponenko¹⁴, F. Garberson¹⁷⁴, M. Garcia-Sciveres¹⁴, C. García¹⁶⁶, J.E. García Navarro¹⁶⁶, R.W. Gardner³⁰, N. Garelli²⁹, H. Garitaonandia¹⁰⁴, V. Garonne²⁹, J. Garvey¹⁷, C. Gatti⁴⁷, G. Gaudio^{118a}, O. Gaumer⁴⁹, B. Gaur¹⁴⁰, L. Gauthier¹³⁵, I.L. Gavrilenko⁹³, C. Gay¹⁶⁷, G. Gaycken²⁰, J-C. Gayde²⁹, E.N. Gazis⁹, P. Ge^{32d}, C.N.P. Gee¹²⁸, D.A.A. Geerts¹⁰⁴, Ch. Geich-Gimbel²⁰, K. Gellerstedt^{145a,145b}, C. Gemme^{50a}, A. Gemmell⁵³, M.H. Genest⁹⁷, S. Gentile^{131a,131b}, M. George⁵⁴, S. George⁷⁵, P. Gerlach¹⁷³, A. Gershon¹⁵², C. Geweniger^{58a}, H. Ghazlane^{134b}, N. Ghodbane³³, B. Giacobbe^{19a}, S. Giagu^{131a,131b}, V. Giakoumopoulou⁸, V. Giangiobbe¹¹, F. Gianotti²⁹, B. Gibbard²⁴, A. Gibson¹⁵⁷, S.M. Gibson²⁹, L.M. Gilbert¹¹⁷, V. Gilevsky⁹⁰, D. Gillberg²⁸, A.R. Gillman¹²⁸, D.M. Gingrich^{2,d}, J. Ginzburg¹⁵², N. Giokaris⁸, M.P. Giordani^{163c}, R. Giordano^{101a,101b}, F.M. Giorgi¹⁵, P. Giovannini⁹⁸, P.F. Giraud¹³⁵, D. Giugni^{88a}, M. Giunta⁹², P. Giusti^{19a}, B.K. Gjelsten¹¹⁶, L.K. Gladilin⁹⁶, C. Glasman⁷⁹, J. Glatzer⁴⁸, A. Glazov⁴¹, K.W. Glitza¹⁷³, G.L. Glonti⁶⁴, J. Godfrey¹⁴¹, J. Godlewski²⁹, M. Goebel⁴¹, T. Göpfert⁴³, C. Goeringer⁸⁰, C. Gössling⁴², T. Göttfert⁹⁸, S. Goldfarb⁸⁶, T. Golling¹⁷⁴, S.N. Golovnia¹²⁷, A. Gomes^{123a,b}, L.S. Gomez Fajardo⁴¹, R. Gonçalves⁷⁵, J. Goncalves Pinto Firmino Da Costa⁴¹, L. Gonella²⁰, A. Gonidec²⁹, S. Gonzalez¹⁷¹, S. González de la Hoz¹⁶⁶, G. Gonzalez Parra¹¹, M.L. Gonzalez Silva²⁶, S. Gonzalez-Sevilla⁴⁹, J.J. Goodson¹⁴⁷, L. Goossens²⁹, P.A. Gorbounov⁹⁴, H.A. Gordon²⁴, I. Gorelov¹⁰², G. Gorfine¹⁷³, B. Gorini²⁹, E. Gorini^{71a,71b}, A. Gorišek⁷³, E. Gornicki³⁸, S.A. Gorokhov¹²⁷, V.N. Goryachev¹²⁷, B. Gosdzik⁴¹, M. Gosselink¹⁰⁴, M.I. Gostkin⁶⁴, I. Gough Eschrich¹⁶², M. Goughri^{134a}, D. Goujdami^{134c}, M.P. Goulette⁴⁹, A.G. Goussiou¹³⁷, C. Goy⁴, S. Gozpınar²², I. Grabowska-Bold³⁷, P. Grafström²⁹, K-J. Grahm⁴¹, F. Grancagnolo^{71a}, S. Grancagnolo¹⁵, V. Grassi¹⁴⁷, V. Gratchev¹²⁰, N. Grau³⁴, H.M. Gray²⁹, J.A. Gray¹⁴⁷, E. Graziani^{133a}, O.G. Grebenyuk¹²⁰, T. Greenshaw⁷², Z.D. Greenwood^{24,l}, K. Gregersen³⁵, I.M. Gregor⁴¹, P. Grenier¹⁴², J. Griffiths¹³⁷, N. Grigalashvili⁶⁴, A.A. Grillo¹³⁶, S. Grinstein¹¹, Y.V. Grishkevich⁹⁶, J.-F. Grivaz¹¹⁴, M. Groh⁹⁸, E. Gross¹⁷⁰, J. Grosse-Knetter⁵⁴, J. Groth-Jensen¹⁷⁰, K. Grybel¹⁴⁰, V.J. Guarino⁵, D. Guest¹⁷⁴, C. Guicheney³³, A. Guida^{71a,71b}, S. Guindon⁵⁴, H. Guler^{84,n}, J. Gunther¹²⁴, B. Guo¹⁵⁷, J. Guo³⁴, A. Gupta³⁰, Y. Gusakov⁶⁴, V.N. Gushchin¹²⁷, A. Gutierrez⁹², P. Gutierrez¹¹⁰, N. Guttman¹⁵², O. Gutzwiller¹⁷¹, C. Guyot¹³⁵, C. Gwenlan¹¹⁷, C.B. Gwilliam⁷², A. Haas¹⁴², S. Haas²⁹, C. Haber¹⁴, H.K. Hadavand³⁹, D.R. Hadley¹⁷, P. Haefner⁹⁸, F. Hahn²⁹, S. Haider²⁹, Z. Hajduk³⁸, H. Hakobyan¹⁷⁵, D. Hall¹¹⁷, J. Haller⁵⁴, K. Hamacher¹⁷³, P. Hamal¹¹², M. Hamer⁵⁴, A. Hamilton^{144b,o}, S. Hamilton¹⁶⁰, H. Han^{32a}, L. Han^{32b}, K. Hanagaki¹¹⁵, K. Hanawa¹⁵⁹, M. Hance¹⁴, C. Handel⁸⁰, P. Hanke^{58a}, J.R. Hansen³⁵, J.B. Hansen³⁵, J.D. Hansen³⁵, P.H. Hansen³⁵, P. Hansson¹⁴², K. Hara¹⁵⁹, G.A. Hare¹³⁶, T. Harenberg¹⁷³, S. Harkusha⁸⁹, D. Harper⁸⁶, R.D. Harrington⁴⁵, O.M. Harris¹³⁷, K. Harrison¹⁷, J. Hartert⁴⁸, F. Hartjes¹⁰⁴, T. Haruyama⁶⁵, A. Harvey⁵⁶, S. Hasegawa¹⁰⁰, Y. Hasegawa¹³⁹, S. Hassani¹³⁵, M. Hatch²⁹, D. Hauff⁹⁸, S. Haug¹⁶, M. Hauschild²⁹, R. Hauser⁸⁷, M. Havranek²⁰, B.M. Hawes¹¹⁷, C.M. Hawkes¹⁷, R.J. Hawkings²⁹, D. Hawkins¹⁶², T. Hayakawa⁶⁶, T. Hayashi¹⁵⁹, D. Hayden⁷⁵, H.S. Hayward⁷², S.J. Haywood¹²⁸, E. Hazen²¹, M. He^{32d}, S.J. Head¹⁷, V. Hedberg⁷⁸, L. Heelan⁷, S. Heim⁸⁷, B. Heinemann¹⁴, S. Heisterkamp³⁵, L. Helary⁴, C. Heller⁹⁷, M. Heller²⁹, S. Hellman^{145a,145b}, D. Hellmich²⁰, C. Helsens¹¹, R.C.W. Henderson⁷⁰, M. Henke^{58a}, A. Henrichs⁵⁴, A.M. Henriques Correia²⁹, S. Henrot-Versille¹¹⁴, F. Henry-Couannier⁸², C. Hensel⁵⁴, T. Henß¹⁷³, C.M. Hernandez⁷, Y. Hernández Jiménez¹⁶⁶, R. Herrberg¹⁵, A.D. Hershenhorn¹⁵¹, G. Herten⁴⁸, R. Hertenberger⁹⁷, L. Hervas²⁹, N.P. Hessey¹⁰⁴, E. Higón-Rodríguez¹⁶⁶, D. Hill^{5,*}, J.C. Hill²⁷, N. Hill⁵, K.H. Hiller⁴¹, S. Hillert²⁰, S.J. Hillier¹⁷, I. Hinchliffe¹⁴, E. Hines¹¹⁹, M. Hirose¹¹⁵, F. Hirsch⁴², D. Hirschbuehl¹⁷³, J. Hobbs¹⁴⁷, N. Hod¹⁵², M.C. Hodgkinson¹³⁸, P. Hodgson¹³⁸, A. Hoecker²⁹, M.R. Hoefkamp¹⁰², J. Hoffman³⁹, D. Hoffmann⁸², M. Hohlfeld⁸⁰, M. Holder¹⁴⁰, S.O. Holmgren^{145a}, T. Holy¹²⁶, J.L. Holzbauer⁸⁷, Y. Homma⁶⁶, T.M. Hong¹¹⁹,

L. Hooft van Huysduynen¹⁰⁷, T. Horazdovsky¹²⁶, C. Horn¹⁴², S. Horner⁴⁸, J.-Y. Hostachy⁵⁵, S. Hou¹⁵⁰, M.A. Houlden⁷², A. Hoummada^{134a}, J. Howarth⁸¹, D.F. Howell¹¹⁷, I. Hristova¹⁵, J. Hrivnac¹¹⁴, I. Hruska¹²⁴, T. Hryn'ova⁴, P.J. Hsu⁸⁰, S.-C. Hsu¹⁴, G.S. Huang¹¹⁰, Z. Hubacek¹²⁶, F. Hubaut⁸², F. Huegging²⁰, T.B. Huffman¹¹⁷, E.W. Hughes³⁴, G. Hughes⁷⁰, R.E. Hughes-Jones⁸¹, M. Huhtinen²⁹, P. Hurst⁵⁷, M. Hurwitz¹⁴, U. Husemann⁴¹, N. Huseynov^{64,p}, J. Huston⁸⁷, J. Huth⁵⁷, G. Iacobucci⁴⁹, G. Iakovidis⁹, M. Ibbotson⁸¹, I. Ibragimov¹⁴⁰, R. Ichimiya⁶⁶, L. Iconomidou-Fayard¹¹⁴, J. Idarraga¹¹⁴, P. Iengo^{101a}, O. Igonkina¹⁰⁴, Y. Ikegami⁶⁵, M. Ikeno⁶⁵, Y. Ilchenko³⁹, D. Iliadis¹⁵³, N. Ilic¹⁵⁷, D. Imbault⁷⁷, M. Imori¹⁵⁴, T. Ince²⁰, J. Inigo-Golfín²⁹, P. Ioannou⁸, M. Iodice^{133a}, A. Irles Quiles¹⁶⁶, C. Isaksson¹⁶⁵, A. Ishikawa⁶⁶, M. Ishino⁶⁷, R. Ishmukhametov³⁹, C. Issever¹¹⁷, S. Istin^{18a}, A.V. Ivashin¹²⁷, W. Iwanski³⁸, H. Iwasaki⁶⁵, J.M. Izen⁴⁰, V. Izzo^{101a}, B. Jackson¹¹⁹, J.N. Jackson⁷², P. Jackson¹⁴², M.R. Jaekel²⁹, V. Jain⁶⁰, K. Jakobs⁴⁸, S. Jakobsen³⁵, J. Jakubek¹²⁶, D.K. Jana¹¹⁰, E. Jankowski¹⁵⁷, E. Jansen⁷⁶, H. Jansen²⁹, A. Jantsch⁹⁸, M. Janus²⁰, G. Jarlskog⁷⁸, L. Jeanty⁵⁷, K. Jelen³⁷, I. Jen-La Plante³⁰, P. Jenni²⁹, A. Jeremie⁴, P. Jez³⁵, S. Jézéquel⁴, M.K. Jha^{19a}, H. Ji¹⁷¹, W. Ji⁸⁰, J. Jia¹⁴⁷, Y. Jiang^{32b}, M. Jimenez Belenguer⁴¹, G. Jin^{32b}, S. Jin^{32a}, O. Jinnouchi¹⁵⁶, M.D. Joergensen³⁵, D. Joffe³⁹, L.G. Johansen¹³, M. Johansen^{145a,145b}, K.E. Johansson^{145a}, P. Johansson¹³⁸, S. Johnert⁴¹, K.A. Johns⁶, K. Jon-And^{145a,145b}, G. Jones⁸¹, R.W.L. Jones⁷⁰, T.W. Jones⁷⁶, T.J. Jones⁷², O. Jonsson²⁹, C. Joram²⁹, P.M. Jorge^{123a}, J. Joseph¹⁴, T. Jovin^{12b}, X. Ju¹⁷¹, C.A. Jung⁴², V. Juranek¹²⁴, P. Jussel⁶¹, A. Juste Rozas¹¹, V.V. Kabachenko¹²⁷, S. Kabana¹⁶, M. Kaci¹⁶⁶, A. Kaczmarek³⁸, P. Kadlecik³⁵, M. Kado¹¹⁴, H. Kagan¹⁰⁸, M. Kagan⁵⁷, S. Kaiser⁹⁸, E. Kajomovitz¹⁵¹, S. Kalinin¹⁷³, L.V. Kalinovskaya⁶⁴, S. Kama³⁹, N. Kanaya¹⁵⁴, M. Kameda²⁹, T. Kanno¹⁵⁶, V.A. Kantserov⁹⁵, J. Kanzaki⁶⁵, B. Kaplan¹⁷⁴, A. Kapliy³⁰, J. Kaplon²⁹, D. Kar⁴³, M. Karagounis²⁰, M. Karagoz¹¹⁷, M. Karneviskiy⁴¹, K. Karr⁵, V. Kartvelishvili⁷⁰, A.N. Karyukhin¹²⁷, L. Kashif¹⁷¹, G. Kasieczka^{58b}, R.D. Kass¹⁰⁸, A. Kastanas¹³, M. Kataoka⁴, Y. Kataoka¹⁵⁴, E. Katsoufis⁹, J. Katzy⁴¹, V. Kaushik⁶, K. Kawagoe⁶⁶, T. Kawamoto¹⁵⁴, G. Kawamura⁸⁰, M.S. Kayl¹⁰⁴, V.A. Kazanin¹⁰⁶, M.Y. Kazarinov⁶⁴, J.R. Keates⁸¹, R. Keeler¹⁶⁸, R. Kehoe³⁹, M. Keil⁵⁴, G.D. Kekelidze⁶⁴, J. Kennedy⁹⁷, C.J. Kenney¹⁴², M. Kenyon⁵³, O. Kepka¹²⁴, N. Kerschen²⁹, B.P. Kerševan⁷³, S. Kersten¹⁷³, K. Kessoku¹⁵⁴, J. Keung¹⁵⁷, F. Khalil-zada¹⁰, H. Khandanyan¹⁶⁴, A. Khanov¹¹¹, D. Kharchenko⁶⁴, A. Khodinov⁹⁵, A.G. Kholodenko¹²⁷, A. Khomich^{58a}, T.J. Khoo²⁷, G. Khoriali²⁰, A. Khoroshilov¹⁷³, N. Khovanskiy⁶⁴, V. Khovanskiy⁹⁴, E. Khramov⁶⁴, J. Khubua^{51b}, H. Kim^{145a,145b}, M.S. Kim², P.C. Kim¹⁴², S.H. Kim¹⁵⁹, N. Kimura¹⁶⁹, O. Kind¹⁵, B.T. King⁷², M. King⁶⁶, R.S.B. King¹¹⁷, J. Kirk¹²⁸, L.E. Kirsch²², A.E. Kiryunin⁹⁸, T. Kishimoto⁶⁶, D. Kisieleska³⁷, T. Kittelmann¹²², A.M. Kiver¹²⁷, E. Kladiwa^{143b}, J. Klaiber-Lodewigs⁴², M. Klein⁷², U. Klein⁷², K. Kleinknecht⁸⁰, M. Klemetti⁸⁴, A. Klier¹⁷⁰, A. Klimentov²⁴, R. Klingenberg⁴², E.B. Klinkby³⁵, T. Klioutchnikova²⁹, P.F. Klok¹⁰³, S. Klous¹⁰⁴, E.-E. Kluge^{58a}, T. Kluge⁷², P. Kluit¹⁰⁴, S. Kluth⁹⁸, N.S. Knecht¹⁵⁷, E. Kneringer⁶¹, J. Knobloch²⁹, E.B.F.G. Knoops⁸², A. Knue⁵⁴, B.R. Ko⁴⁴, T. Kobayashi¹⁵⁴, M. Kobel⁴³, M. Kocian¹⁴², P. Kodys¹²⁵, K. Köneke²⁹, A.C. König¹⁰³, S. Koenig⁸⁰, L. Köpke⁸⁰, F. Koetsveld¹⁰³, P. Koevesarki²⁰, T. Koffas²⁸, E. Koffeman¹⁰⁴, F. Kohn⁵⁴, Z. Kohout¹²⁶, T. Kohriki⁶⁵, T. Koi¹⁴², T. Kokott²⁰, G.M. Kolachev¹⁰⁶, H. Kolanoski¹⁵, V. Kolesnikov⁶⁴, I. Koletsou^{88a}, J. Koll⁸⁷, D. Kollar²⁹, M. Kollefath⁴⁸, S.D. Kolya⁸¹, A.A. Komar⁹³, Y. Komori¹⁵⁴, T. Kondo⁶⁵, T. Kono^{41,q}, A.I. Kononov⁴⁸, R. Konoplich^{107,r}, N. Konstantinidis⁷⁶, A. Kootz¹⁷³, S. Koperny³⁷, S.V. Kopikov¹²⁷, K. Korcyl³⁸, K. Kordas¹⁵³, V. Koreshev¹²⁷, A. Korn¹¹⁷, A. Korol¹⁰⁶, I. Korolkov¹¹, E.V. Korolkova¹³⁸, V.A. Korotkov¹²⁷, O. Kortner⁹⁸, S. Kortner⁹⁸, V.V. Kostyukhin²⁰, M.J. Kotamäki²⁹, S. Kotov⁹⁸, V.M. Kotov⁶⁴, A. Kotwal⁴⁴, C. Kourkoumelis⁸, V. Kouskoura¹⁵³, A. Koutsman^{158a}, R. Kowalewski¹⁶⁸, T.Z. Kowalski³⁷, W. Kozanecki¹³⁵, A.S. Kozhin¹²⁷, V. Kral¹²⁶, V.A. Kramarenko⁹⁶, G. Kramberger⁷³, M.W. Krasny⁷⁷, A. Krasznahorkay¹⁰⁷, J. Kraus⁸⁷, J.K. Kraus²⁰, A. Kreisel¹⁵², F. Krejci¹²⁶, J. Kretschmar⁷², N. Krieger⁵⁴, P. Krieger¹⁵⁷, K. Kroeninger⁵⁴, H. Kroha⁹⁸, J. Kroll¹¹⁹, J. Kroseberg²⁰, J. Krstic^{12a}, U. Kruchonak⁶⁴, H. Krüger²⁰, T. Kruker¹⁶, N. Krumnack⁶³, Z.V. Krumshteyn⁶⁴, A. Kruth²⁰, T. Kubota⁸⁵, S. Kuehn⁴⁸, A. Kugel^{58c}, T. Kuhl⁴¹, D. Kuhn⁶¹, V. Kukhtin⁶⁴, Y. Kulchitsky⁸⁹, S. Kuleshov^{31b}, C. Kummer⁹⁷, M. Kuna⁷⁷, N. Kundu¹¹⁷, J. Kunkle¹¹⁹, A. Kupco¹²⁴, H. Kurashige⁶⁶, M. Kurata¹⁵⁹, Y.A. Kurochkin⁸⁹, V. Kus¹²⁴, M. Kuze¹⁵⁶, J. Kvita¹⁴¹, R. Kwee¹⁵, A. La Rosa⁴⁹, L. La Rotonda^{36a,36b}, L. Labarga⁷⁹, J. Labbe⁴, S. Lablak^{134a}, C. Lacasta¹⁶⁶, F. Lacava^{131a,131b}, H. Lacker¹⁵, D. Lacour⁷⁷, V.R. Lacuesta¹⁶⁶, E. Ladygin⁶⁴, R. Lafaye⁴, B. Laforge⁷⁷, T. Lagouri⁷⁹, S. Lai⁴⁸, E. Laisne⁵⁵, M. Lamanna²⁹, C.L. Lampen⁶, W. Lampl⁶, E. Lancon¹³⁵, U. Landgraf⁴⁸, M.P.J. Landon⁷⁴, H. Landsman¹⁵¹, J.L. Lane⁸¹, C. Lange⁴¹, A.J. Lankford¹⁶², F. Lanni²⁴, K. Lantzsche¹⁷³, S. Laplace⁷⁷, C. Lapoire²⁰, J.F. Laporte¹³⁵, T. Lari^{88a}, A.V. Larionov¹²⁷, A. Lerner¹¹⁷, C. Lasseur²⁹, M. Lassnig²⁹, P. Laurelli⁴⁷, W. Lavrijsen¹⁴, P. Laycock⁷², A.B. Lazarev⁶⁴, O. Le Dortz⁷⁷, E. Le Guirriec⁸², C. Le Maner¹⁵⁷, E. Le Menedeu¹³⁵, C. Lebel⁹², T. LeCompte⁵, F. Ledroit-Guillon⁵⁵, H. Lee¹⁰⁴, J.S.H. Lee¹¹⁵, S.C. Lee¹⁵⁰, L. Lee¹⁷⁴, M. Lefebvre¹⁶⁸, M. Legendre¹³⁵, A. Leger⁴⁹, B.C. LeGeyt¹¹⁹, F. Legger⁹⁷, C. Leggett¹⁴, M. Lehmacher²⁰, G. Lehmann Miotto²⁹, X. Lei⁶, M.A.L. Leite^{23d}, R. Leitner¹²⁵, D. Lellouch¹⁷⁰, M. Leltchouk³⁴, B. Lemmer⁵⁴, V. Lendermann^{58a}, K.J.C. Leney^{144b}, T. Lenz¹⁰⁴, G. Lenzen¹⁷³, B. Lenzi²⁹, K. Leonhardt⁴³, S. Leontsinis⁹, C. Leroy⁹², J.-R. Lessard¹⁶⁸, J. Lesser^{145a}, C.G. Lester²⁷, A. Leung Fook Cheong¹⁷¹, J. Levêque⁴, D. Levin⁸⁶, L.J. Levinson¹⁷⁰, M.S. Levitski¹²⁷, A. Lewis¹¹⁷, G.H. Lewis¹⁰⁷,

A.M. Leyko²⁰, M. Leyton¹⁵, B. Li⁸², H. Li^{171,s}, S. Li^{32b,t}, X. Li⁸⁶, Z. Liang^{117,u}, H. Liao³³, B. Liberti^{132a}, P. Lichard²⁹, M. Lichtnecker⁹⁷, K. Lie¹⁶⁴, W. Liebig¹³, R. Lifshitz¹⁵¹, C. Limbach²⁰, A. Limosani⁸⁵, M. Limper⁶², S.C. Lin^{150,v}, F. Linde¹⁰⁴, J.T. Linnemann⁸⁷, E. Lipeles¹¹⁹, L. Lipinsky¹²⁴, A. Lipniacka¹³, T.M. Liss¹⁶⁴, D. Lissauer²⁴, A. Lister⁴⁹, A.M. Litke¹³⁶, C. Liu²⁸, D. Liu¹⁵⁰, H. Liu⁸⁶, J.B. Liu⁸⁶, M. Liu^{32b}, S. Liu², Y. Liu^{32b}, M. Livan^{118a,118b}, S.S.A. Livermore¹¹⁷, A. Lleres⁵⁵, J. Llorente Merino⁷⁹, S.L. Lloyd⁷⁴, E. Lobodzinska⁴¹, P. Loch⁶, W.S. Lockman¹³⁶, T. Loddenkoetter²⁰, F.K. Loebinger⁸¹, A. Loginov¹⁷⁴, C.W. Loh¹⁶⁷, T. Lohse¹⁵, K. Lohwasser⁴⁸, M. Lokajicek¹²⁴, J. Loken¹¹⁷, V.P. Lombardo⁴, R.E. Long⁷⁰, L. Lopes^{123a,b}, D. Lopez Mateos⁵⁷, J. Lorenz⁹⁷, M. Losada¹⁶¹, P. Loscutoff¹⁴, F. Lo Sterzo^{131a,131b}, M.J. Losty^{158a}, X. Lou⁴⁰, A. Lounis¹¹⁴, K.F. Loureiro¹⁶¹, J. Love²¹, P.A. Love⁷⁰, A.J. Lowe^{142,e}, F. Lu^{32a}, H.J. Lubatti¹³⁷, C. Luci^{131a,131b}, A. Lucotte⁵⁵, A. Ludwig⁴³, D. Ludwig⁴¹, I. Ludwig⁴⁸, J. Ludwig⁴⁸, F. Luehring⁶⁰, G. Luijckx¹⁰⁴, D. Lumb⁴⁸, L. Luminari^{131a}, E. Lund¹¹⁶, B. Lund-Jensen¹⁴⁶, B. Lundberg⁷⁸, J. Lundberg^{145a,145b}, J. Lundquist³⁵, M. Lungwitz⁸⁰, G. Lutz⁹⁸, D. Lynn²⁴, J. Lys¹⁴, E. Lytken⁷⁸, H. Ma²⁴, L.L. Ma¹⁷¹, J.A. Macana Goia⁹², G. Maccarrone⁴⁷, A. Macchiolo⁹⁸, B. Maček⁷³, J. Machado Miguens^{123a}, R. Mackeprang³⁵, R.J. Madaras¹⁴, W.F. Mader⁴³, R. Maenner^{58c}, T. Maeno²⁴, P. Mättig¹⁷³, S. Mättig⁴¹, L. Magnoni²⁹, E. Magradze⁵⁴, Y. Mahalalel¹⁵², K. Mahboubi⁴⁸, G. Mahout¹⁷, C. Maiani^{131a,131b}, C. Maidantchik^{23a}, A. Maio^{123a,b}, S. Majewski²⁴, Y. Makida⁶⁵, N. Makovec¹¹⁴, P. Mal¹³⁵, Pa. Malecki³⁸, P. Malecki³⁸, V.P. Maleev¹²⁰, F. Malek⁵⁵, U. Mallik⁶², D. Malon⁵, C. Malone¹⁴², S. Maltezos⁹, V. Malyshev¹⁰⁶, S. Malyukov²⁹, R. Mameghani⁹⁷, J. Mamuzic^{12b}, A. Manabe⁶⁵, L. Mandelli^{88a}, I. Mandić⁷³, R. Mandrysch¹⁵, J. Maneira^{123a}, P.S. Mangeard⁸⁷, I.D. Manjavidze⁶⁴, A. Mann⁵⁴, P.M. Manning¹³⁶, A. Manousakis-Katsikakis⁸, B. Mansoulie¹³⁵, A. Manz⁹⁸, A. Mapelli²⁹, L. Mapelli²⁹, L. March⁷⁹, J.F. Marchand²⁸, F. Marchese^{132a,132b}, G. Marchiori⁷⁷, M. Marcisovsky¹²⁴, A. Marin^{21,*}, C.P. Marino¹⁶⁸, F. Marroquim^{23a}, R. Marshall⁸¹, Z. Marshall²⁹, F.K. Martens¹⁵⁷, S. Marti-Garcia¹⁶⁶, A.J. Martin¹⁷⁴, B. Martin²⁹, B. Martin⁸⁷, F.F. Martin¹¹⁹, J.P. Martin⁹², Ph. Martin⁵⁵, T.A. Martin¹⁷, V.J. Martin⁴⁵, B. Martin dit Latour⁴⁹, S. Martin-Haugh¹⁴⁸, M. Martinez¹¹, V. Martinez Outschoorn⁵⁷, A.C. Martyniuk¹⁶⁸, M. Marx⁸¹, F. Marzano^{131a}, A. Marzin¹¹⁰, L. Masetti⁸⁰, T. Mashimo¹⁵⁴, R. Mashinistov⁹³, J. Masik⁸¹, A.L. Maslennikov¹⁰⁶, I. Massa^{19a,19b}, G. Massaro¹⁰⁴, N. Massol⁴, P. Mastrandrea^{131a,131b}, A. Mastroberardino^{36a,36b}, T. Masubuchi¹⁵⁴, M. Mathes²⁰, P. Matricon¹¹⁴, H. Matsumoto¹⁵⁴, T. Matsunaga¹⁵⁴, T. Matsushita⁶⁶, C. Mattravers^{117,c}, J.M. Maugain²⁹, J. Maurer⁸², S.J. Maxfield⁷², D.A. Maximov^{106,f}, E.N. May⁵, A. Mayne¹³⁸, R. Mazini¹⁵⁰, M. Mazur²⁰, M. Mazzanti^{88a}, E. Mazzoni^{121a,121b}, S.P. Mc Kee⁸⁶, A. McCarn¹⁶⁴, R.L. McCarthy¹⁴⁷, T.G. McCarthy²⁸, N.A. McCubbin¹²⁸, K.W. McFarlane⁵⁶, J.A. Mcfayden¹³⁸, H. McGlone⁵³, G. Mchedlidze^{51b}, R.A. McLaren²⁹, T. McLaughlan¹⁷, S.J. McMahon¹²⁸, R.A. McPherson^{168,j}, A. Meade⁸³, J. Mechnich¹⁰⁴, M. Mechtel¹⁷³, M. Medinnis⁴¹, R. Meera-Lebbai¹¹⁰, T. Meguro¹¹⁵, R. Mehdiyev⁹², S. Mehlhase³⁵, A. Mehta⁷², K. Meier^{58a}, B. Meirose⁷⁸, C. Melachrinou³⁰, B.R. Mellado Garcia¹⁷¹, L. Mendoza Navas¹⁶¹, Z. Meng^{150,s}, A. Mengarelli^{19a,19b}, S. Menke⁹⁸, C. Menot²⁹, E. Meoni¹¹, K.M. Mercurio⁵⁷, P. Mermoud⁴⁹, L. Merola^{101a,101b}, C. Meroni^{88a}, F.S. Merritt³⁰, A. Messina²⁹, J. Metcalfe¹⁰², A.S. Mete⁶³, C. Meyer⁸⁰, C. Meyer³⁰, J-P. Meyer¹³⁵, J. Meyer¹⁷², J. Meyer⁵⁴, T.C. Meyer²⁹, W.T. Meyer⁶³, J. Miao^{32d}, S. Michal²⁹, L. Micu^{25a}, R.P. Middleton¹²⁸, P. Miele²⁹, S. Migas⁷², L. Mijović⁴¹, G. Mikenberg¹⁷⁰, M. Mikestikova¹²⁴, M. Mikuz⁷³, D.W. Miller³⁰, R.J. Miller⁸⁷, W.J. Mills¹⁶⁷, C. Mills⁵⁷, A. Milov¹⁷⁰, D.A. Milstead^{145a,145b}, D. Milstein¹⁷⁰, A.A. Minaenko¹²⁷, M. Miñano Moya¹⁶⁶, I.A. Minashvili⁶⁴, A.I. Mincer¹⁰⁷, B. Mindur³⁷, M. Mineev⁶⁴, Y. Ming¹⁷¹, L.M. Mir¹¹, G. Mirabelli^{131a}, L. Miralles Verge¹¹, A. Misiejuk⁷⁵, J. Mitrevski¹³⁶, G.Y. Mitrofanov¹²⁷, V.A. Mitsou¹⁶⁶, S. Mitsui⁶⁵, P.S. Miyagawa¹³⁸, K. Miyazaki⁶⁶, J.U. Mjörnmark⁷⁸, T. Moa^{145a,145b}, P. Mockett¹³⁷, S. Moed⁵⁷, V. Moeller²⁷, K. Mönig⁴¹, N. Möser²⁰, S. Mohapatra¹⁴⁷, W. Mohr⁴⁸, S. Mohrdieck-Möck⁹⁸, A.M. Moiseev^{127,*}, R. Moles-Valls¹⁶⁶, J. Molina-Perez²⁹, J. Monk⁷⁶, E. Monnier⁸², S. Montesano^{88a,88b}, F. Monticelli⁶⁹, S. Monzani^{19a,19b}, R.W. Moore², G.F. Moorhead⁸⁵, C. Mora Herrera⁴⁹, A. Moraes⁵³, N. Morange¹³⁵, J. Morel⁵⁴, G. Morello^{36a,36b}, D. Moreno⁸⁰, M. Moreno Llácer¹⁶⁶, P. Morettini^{50a}, M. Morii⁵⁷, J. Morin⁷⁴, A.K. Morley²⁹, G. Mornacchi²⁹, S.V. Morozov⁹⁵, J.D. Morris⁷⁴, L. Morvaj¹⁰⁰, H.G. Moser⁹⁸, M. Mosidze^{51b}, J. Moss¹⁰⁸, R. Mount¹⁴², E. Mountricha^{9,w}, S.V. Mouraviev⁹³, E.J.W. Moyse⁸³, M. Mudrinic^{12b}, F. Mueller^{58a}, J. Mueller¹²², K. Mueller²⁰, T.A. Müller⁹⁷, T. Mueller⁸⁰, D. Muenstermann²⁹, A. Muir¹⁶⁷, Y. Munwes¹⁵², W.J. Murray¹²⁸, I. Mussche¹⁰⁴, E. Musto^{101a,101b}, A.G. Myagkov¹²⁷, M. Myska¹²⁴, J. Nadal¹¹, K. Nagai¹⁵⁹, K. Nagano⁶⁵, Y. Nagasaka⁵⁹, M. Nagel⁹⁸, A.M. Nairz²⁹, Y. Nakahama²⁹, K. Nakamura¹⁵⁴, T. Nakamura¹⁵⁴, I. Nakano¹⁰⁹, G. Nanava²⁰, A. Napier¹⁶⁰, M. Nash^{76,c}, N.R. Nation²¹, T. Nattermann²⁰, T. Naumann⁴¹, G. Navarro¹⁶¹, H.A. Neal⁸⁶, E. Nebot⁷⁹, P.Yu. Nechaeva⁹³, A. Negri^{118a,118b}, G. Negri²⁹, S. Nektarijevic⁴⁹, A. Nelson¹⁶², S. Nelson¹⁴², T.K. Nelson¹⁴², S. Nemecek¹²⁴, P. Nemethy¹⁰⁷, A.A. Nepomuceno^{23a}, M. Nessi^{29,x}, M.S. Neubauer¹⁶⁴, A. Neusiedl⁸⁰, R.M. Neves¹⁰⁷, P. Nevski²⁴, P.R. Newman¹⁷, V. Nguyen Thi Hong¹³⁵, R.B. Nickerson¹¹⁷, R. Nicolaidou¹³⁵, L. Nicolas¹³⁸, B. Nicquevert²⁹, F. Niedercorn¹¹⁴, J. Nielsen¹³⁶, T. Niinikoski²⁹, N. Nikiforou³⁴, A. Nikiforov¹⁵, V. Nikolaenko¹²⁷, K. Nikolaev⁶⁴, I. Nikolic-Audit⁷⁷, K. Nikolics⁴⁹, K. Nikolopoulos²⁴, H. Nilsen⁴⁸, P. Nilsson⁷, Y. Ninomiya¹⁵⁴, A. Nisati^{131a}, T. Nishiyama⁶⁶, R. Nisius⁹⁸, L. Nodulman⁵, M. Nomachi¹¹⁵, I. Nomidis¹⁵³, M. Nordberg²⁹, B. Nordkvist^{145a,145b},

P.R. Norton¹²⁸, J. Novakova¹²⁵, M. Nozaki⁶⁵, L. Nozka¹¹², I.M. Nugent^{158a}, A.-E. Nuncio-Quiroz²⁰, G. Nunes Hanninger⁸⁵, T. Nunnemann⁹⁷, E. Nurse⁷⁶, T. Nyman²⁹, B.J. O'Brien⁴⁵, S.W. O'Neale^{17,*}, D.C. O'Neil¹⁴¹, V. O'Shea⁵³, F.G. Oakham^{28,d}, H. Oberlack⁹⁸, J. Ocariz⁷⁷, A. Ochi⁶⁶, S. Oda¹⁵⁴, S. Odaka⁶⁵, J. Odier⁸², H. Ogren⁶⁰, A. Oh⁸¹, S.H. Oh⁴⁴, C.C. Ohm^{145a,145b}, T. Ohshima¹⁰⁰, H. Ohshita¹³⁹, S. Okada⁶⁶, H. Okawa¹⁶², Y. Okumura¹⁰⁰, T. Okuyama¹⁵⁴, A. Olariu^{25a}, M. Olcese^{50a}, A.G. Olchevski⁶⁴, M. Oliveira^{123a,h}, D. Oliveira Damazio²⁴, E. Oliver Garcia¹⁶⁶, D. Olivito¹¹⁹, A. Olszewski³⁸, J. Olszowska³⁸, C. Omachi⁶⁶, A. Onofre^{123a,y}, P.U.E. Onyisi³⁰, C.J. Oram^{158a}, M.J. Oreglia³⁰, Y. Oren¹⁵², D. Orestano^{133a,133b}, I. Orlov¹⁰⁶, C. Oropeza Barrera⁵³, R.S. Orr¹⁵⁷, B. Osculati^{50a,50b}, R. Ospanov¹¹⁹, C. Osuna¹¹, G. Otero y Garzon²⁶, J.P. Ottersbach¹⁰⁴, M. Ouchrif^{134d}, F. Ould-Saada¹¹⁶, A. Ouraou¹³⁵, Q. Ouyang^{32a}, A. Ovcharova¹⁴, M. Owen⁸¹, S. Owen¹³⁸, V.E. Ozcan^{18a}, N. Ozturk⁷, A. Pacheco Pages¹¹, C. Padilla Aranda¹¹, S. Pagan Griso¹⁴, E. Paganis¹³⁸, F. Paige²⁴, P. Pais⁸³, K. Pajchel¹¹⁶, G. Palacino^{158b}, C.P. Paleari⁶, S. Palestini²⁹, D. Pallin³³, A. Palma^{123a}, J.D. Palmer¹⁷, Y.B. Pan¹⁷¹, E. Panagiotopoulou⁹, B. Panes^{31a}, N. Panikashvili⁸⁶, S. Panitkin²⁴, D. Pantea^{25a}, M. Panuskova¹²⁴, V. Paolone¹²², A. Papadelis^{145a}, Th.D. Papadopoulos⁹, A. Paramonov⁵, W. Park^{24,z}, M.A. Parker²⁷, F. Parodi^{50a,50b}, J.A. Parsons³⁴, U. Parzefall⁴⁸, E. Pasqualucci^{131a}, A. Passeri^{133a}, F. Pastore^{133a,133b}, Fr. Pastore⁷⁵, G. Pásztor^{49,aa}, S. Pataria¹⁷³, N. Patel¹⁴⁹, J.R. Pater⁸¹, S. Patricelli^{101a,101b}, T. Pauly²⁹, M. Pecsny^{143a}, M.I. Pedraza Morales¹⁷¹, S.V. Peleganchuk¹⁰⁶, H. Peng^{32b}, R. Pengo²⁹, A. Penson³⁴, J. Penwell⁶⁰, M. Perantoni^{23a}, K. Perez^{34,ab}, T. Perez Cavalcanti⁴¹, E. Perez Codina¹¹, M.T. Pérez García-Estañ¹⁶⁶, V. Perez Reale³⁴, L. Perini^{88a,88b}, H. Pernegger²⁹, R. Perrino^{71a}, P. Perrodo⁴, S. Persema^{3a}, A. Perus¹¹⁴, V.D. Peshekhonov⁶⁴, B.A. Petersen²⁹, J. Petersen²⁹, T.C. Petersen³⁵, E. Petit⁴, A. Petridis¹⁵³, C. Petridou¹⁵³, E. Petrolo^{131a}, F. Petrucci^{133a,133b}, D. Petschull⁴¹, M. Petteni¹⁴¹, R. Pezoa^{31b}, A. Phan⁸⁵, P.W. Phillips¹²⁸, G. Piacquadio²⁹, E. Piccaro⁷⁴, M. Piccinini^{19a,19b}, S.M. Piec⁴¹, R. Piegaia²⁶, D.T. Pignotti¹⁰⁸, J.E. Pilcher³⁰, A.D. Pilkington⁸¹, J. Pina^{123a,b}, M. Pinamonti^{163a,163c}, A. Pinder¹¹⁷, J.L. Pinfeld², J. Ping^{32c}, B. Pinto^{123a,b}, O. Pirotte²⁹, C. Pizio^{88a,88b}, M. Plamondon¹⁶⁸, M.-A. Pleier²⁴, A.V. Pleskach¹²⁷, A. Poblaguev²⁴, S. Poddar^{58a}, F. Podlyski³³, L. Poggioli¹¹⁴, T. Poghosyan²⁰, M. Pohl⁴⁹, F. Polci⁵⁵, G. Polesello^{118a}, A. Policicchio^{36a,36b}, A. Polini^{19a}, J. Poll⁷⁴, V. Polychronakos²⁴, D.M. Pomarede¹³⁵, D. Pomeroy²², K. Pommès²⁹, L. Pontecorvo^{131a}, B.G. Pope⁸⁷, G.A. Popeneciu^{25a}, D.S. Popovic^{12a}, A. Poppleton²⁹, X. Portell Bueso²⁹, C. Posch²¹, G.E. Pospelov⁹⁸, S. Pospisil¹²⁶, I.N. Potrap⁹⁸, C.J. Potter¹⁴⁸, C.T. Potter¹¹³, G. Poulard²⁹, J. Poveda¹⁷¹, R. Prabhu⁷⁶, P. Pralavorio⁸², A. Pranko¹⁴, S. Prasad⁵⁷, R. Pravahan⁷, S. Prell⁶³, K. Pretzl¹⁶, L. Pribyl²⁹, D. Price⁶⁰, J. Price⁷², L.E. Price⁵, M.J. Price²⁹, D. Prieur¹²², M. Primavera^{71a}, K. Prokofiev¹⁰⁷, F. Prokoshin^{31b}, S. Protopopescu²⁴, J. Proudfoot⁵, X. Prudent⁴³, M. Przybycien³⁷, H. Przysiezniak⁴, S. Psoroulas²⁰, E. Ptacek¹¹³, E. Pueschel⁸³, J. Purdham⁸⁶, M. Purohit^{24,z}, P. Puze¹¹⁴, Y. Pylypchenko⁶², J. Qian⁸⁶, Z. Qian⁸², Z. Qin⁴¹, A. Quadt⁵⁴, D.R. Quarrie¹⁴, W.B. Quayle¹⁷¹, F. Quinonez^{31a}, M. Raas¹⁰³, V. Radescu^{58b}, B. Radics²⁰, T. Rador^{18a}, F. Ragusa^{88a,88b}, G. Rahal¹⁷⁶, A.M. Rahimi¹⁰⁸, D. Rahm²⁴, S. Rajagopalan²⁴, M. Rammensee⁴⁸, M. Rammes¹⁴⁰, M. Ramstedt^{145a,145b}, A.S. Randle-Conde³⁹, K. Randrianarivony²⁸, P.N. Ratoff⁷⁰, F. Rauscher⁹⁷, M. Raymond²⁹, A.L. Read¹¹⁶, D.M. Rebuzzi^{118a,118b}, A. Redelbach¹⁷², G. Redlinger²⁴, R. Reece¹¹⁹, K. Reeves⁴⁰, A. Reichold¹⁰⁴, E. Reinherz-Aronis¹⁵², A. Reinsch¹¹³, I. Reisinger⁴², D. Reljic^{12a}, C. Rembser²⁹, Z.L. Ren¹⁵⁰, A. Renaud¹¹⁴, P. Renkel³⁹, M. Rescigno^{131a}, S. Resconi^{88a}, B. Resende¹³⁵, P. Reznicek⁹⁷, R. Rezvani¹⁵⁷, A. Richards⁷⁶, R. Richter⁹⁸, E. Richter-Was^{4,ac}, M. Ridel⁷⁷, M. Rijpstra¹⁰⁴, M. Rijssenbeek¹⁴⁷, A. Rimoldi^{118a,118b}, L. Rinaldi^{19a}, R.R. Rios³⁹, I. Riu¹¹, G. Rivoltella^{88a,88b}, F. Rizatdinova¹¹¹, E. Rizvi⁷⁴, S.H. Robertson^{84,j}, A. Robichaud-Veronneau¹¹⁷, D. Robinson²⁷, J.E.M. Robinson⁷⁶, M. Robinson¹¹³, A. Robson⁵³, J.G. Rocha de Lima¹⁰⁵, C. Roda^{121a,121b}, D. Roda Dos Santos²⁹, S. Rodier⁷⁹, D. Rodriguez¹⁶¹, Y. Rodriguez Garcia¹⁶¹, A. Roe⁵⁴, S. Roe²⁹, O. Røhne¹¹⁶, V. Rojo¹, S. Rolli¹⁶⁰, A. Romaniouk⁹⁵, M. Romano^{19a,19b}, V.M. Romanov⁶⁴, G. Romeo²⁶, L. Roos⁷⁷, E. Ros¹⁶⁶, S. Rosati^{131a}, K. Rosbach⁴⁹, A. Rose¹⁴⁸, M. Rose⁷⁵, G.A. Rosenbaum¹⁵⁷, E.I. Rosenberg⁶³, P.L. Rosendahl¹³, O. Rosenthal¹⁴⁰, L. Rosselet⁴⁹, V. Rossetti¹¹, E. Rossi^{131a,131b}, L.P. Rossi^{50a}, M. Rotaru^{25a}, I. Roth¹⁷⁰, J. Rothberg¹³⁷, D. Rousseau¹¹⁴, C.R. Royon¹³⁵, A. Rozanov⁸², Y. Rozen¹⁵¹, X. Ruan^{114,ad}, I. Rubinskiy⁴¹, B. Ruckert⁹⁷, N. Ruckstuhl¹⁰⁴, V.I. Rud⁹⁶, C. Rudolph⁴³, G. Rudolph⁶¹, F. Rühr⁶, F. Ruggieri^{133a,133b}, A. Ruiz-Martinez⁶³, V. Rumiantsev^{90,*}, L. Rumyantsev⁶⁴, K. Runge⁴⁸, O. Runolfsson²⁰, Z. Rurikova⁴⁸, N.A. Rusakovich⁶⁴, D.R. Rust⁶⁰, J.P. Rutherford⁶, C. Ruwiedel¹⁴, P. Ruzicka¹²⁴, Y.F. Ryabov¹²⁰, V. Ryadovikov¹²⁷, P. Ryan⁸⁷, M. Rybar¹²⁵, G. Rybkin¹¹⁴, N.C. Ryder¹¹⁷, S. Rzaeva¹⁰, A.F. Saavedra¹⁴⁹, I. Sadeh¹⁵², H.F.W. Sadrozinski¹³⁶, R. Sadykov⁶⁴, F. Safai Tehrani^{131a}, H. Sakamoto¹⁵⁴, G. Salamanna⁷⁴, A. Salamon^{132a}, M. Saleem¹¹⁰, D. Salihagic⁹⁸, A. Salnikov¹⁴², J. Salt¹⁶⁶, B.M. Salvachua Ferrando⁵, D. Salvatore^{36a,36b}, F. Salvatore¹⁴⁸, A. Salvucci¹⁰³, A. Salzburger²⁹, D. Sampsonidis¹⁵³, B.H. Samset¹¹⁶, A. Sanchez^{101a,101b}, H. Sandaker¹³, H.G. Sander⁸⁰, M.P. Sanders⁹⁷, M. Sandhoff¹⁷³, T. Sandoval²⁷, C. Sandoval¹⁶¹, R. Sandstroem⁹⁸, S. Sandvoss¹⁷³, D.P.C. Sankey¹²⁸, A. Sansoni⁴⁷, C. Santamarina Rios⁸⁴, C. Santoni³³, R. Santonico^{132a,132b}, H. Santos^{123a}, J.G. Saraiva^{123a}, T. Sarangi¹⁷¹, E. Sarkisyan-Grinbaum⁷, F. Sarri^{121a,121b}, G. Sartisohn¹⁷³, O. Sasaki⁶⁵, N. Sasao⁶⁷, I. Satsounkevitch⁸⁹, G. Sauvage⁴, E. Sauvan⁴,

J.B. Sauvan¹¹⁴, P. Savard^{157,d}, V. Savinov¹²², D.O. Savu²⁹, L. Sawyer^{24,l}, D.H. Saxon⁵³, L.P. Says³³, C. Sbarra^{19a}, A. Sbrizzi^{19a,19b}, O. Scallan⁹², D.A. Scannicchio¹⁶², M. Scarcella¹⁴⁹, J. Schaarschmidt¹¹⁴, P. Schacht⁹⁸, U. Schäfer⁸⁰, S. Schaepe²⁰, S. Schaetzel^{58b}, A.C. Schaffer¹¹⁴, D. Schaile⁹⁷, R.D. Schamberger¹⁴⁷, A.G. Schamov¹⁰⁶, V. Scharf^{58a}, V.A. Schegelsky¹²⁰, D. Scheirich⁸⁶, M. Schernau¹⁶², M.I. Scherzer³⁴, C. Schiavi^{50a,50b}, J. Schieck⁹⁷, M. Schioppa^{36a,36b}, S. Schlenker²⁹, J.L. Schlereth⁵, E. Schmidt⁴⁸, K. Schmieden²⁰, C. Schmitt⁸⁰, S. Schmitt^{58b}, M. Schmitz²⁰, A. Schöning^{58b}, M. Schott²⁹, D. Schouten^{158a}, J. Schovancova¹²⁴, M. Schram⁸⁴, C. Schroeder⁸⁰, N. Schroer^{58c}, S. Schuh²⁹, G. Schuler²⁹, J. Schultes¹⁷³, H.-C. Schultz-Coulon^{58a}, H. Schulz¹⁵, J.W. Schumacher²⁰, M. Schumacher⁴⁸, B.A. Schumm¹³⁶, Ph. Schune¹³⁵, C. Schwanenberger⁸¹, A. Schwartzman¹⁴², Ph. Schwemling⁷⁷, R. Schwiehorst⁸⁷, R. Schwierz⁴³, J. Schwindling¹³⁵, T. Schwindt²⁰, M. Schwoerer⁴, W.G. Scott¹²⁸, J. Searcy¹¹³, G. Sedov⁴¹, E. Sedykh¹²⁰, E. Segura¹¹, S.C. Seidel¹⁰², A. Seiden¹³⁶, F. Seifert⁴³, J.M. Seixas^{23a}, G. Sekhniaidze^{101a}, D.M. Seliverstov¹²⁰, B. Sellden^{145a}, G. Sellers⁷², M. Seman^{143b}, N. Semprini-Cesari^{19a,19b}, C. Serfon⁹⁷, L. Serin¹¹⁴, R. Seuster⁹⁸, H. Severini¹¹⁰, M.E. Sevier⁸⁵, A. Sfyrila²⁹, E. Shabalina⁵⁴, M. Shamim¹¹³, L.Y. Shan^{32a}, J.T. Shank²¹, Q.T. Shao⁸⁵, M. Shapiro¹⁴, P.B. Shatalov⁹⁴, L. Shaver⁶, K. Shaw^{163a,163c}, D. Sherman¹⁷⁴, P. Sherwood⁷⁶, A. Shibata¹⁰⁷, H. Shichi¹⁰⁰, S. Shimizu²⁹, M. Shimojima⁹⁹, T. Shin⁵⁶, M. Shiyakova⁶⁴, A. Shmeleva⁹³, M.J. Shochet³⁰, D. Short¹¹⁷, S. Shrestha⁶³, M.A. Shupe⁶, P. Sicho¹²⁴, A. Sidoti^{131a}, A. Siebel¹⁷³, F. Siegert⁴⁸, Dj. Sijacki^{12a}, O. Silbert¹⁷⁰, J. Silva^{123a,b}, Y. Silver¹⁵², D. Silverstein¹⁴², S.B. Silverstein^{145a}, V. Simak¹²⁶, O. Simard¹³⁵, Lj. Simic^{12a}, S. Simion¹¹⁴, B. Simmons⁷⁶, M. Simonyan³⁵, P. Sinervo¹⁵⁷, N.B. Sinev¹¹³, V. Sipica¹⁴⁰, G. Siragusa¹⁷², A. Sircar²⁴, A.N. Sisakyan⁶⁴, S.Yu. Sivoklov⁹⁶, J. Sjölin^{145a,145b}, T.B. Sjursen¹³, L.A. Skinnari¹⁴, H.P. Skottowe⁵⁷, K. Skovpen¹⁰⁶, P. Skubic¹¹⁰, N. Skvorodnev²², M. Slater¹⁷, T. Slavicek¹²⁶, K. Sliwa¹⁶⁰, J. Sloper²⁹, V. Smakhtin¹⁷⁰, S.Yu. Smirnov⁹⁵, L.N. Smirnova⁹⁶, O. Smirnova⁷⁸, B.C. Smith⁵⁷, D. Smith¹⁴², K.M. Smith⁵³, M. Smizanska⁷⁰, K. Smolek¹²⁶, A.A. Snesarev⁹³, S.W. Snow⁸¹, J. Snow¹¹⁰, J. Snuverink¹⁰⁴, S. Snyder²⁴, M. Soares^{123a}, R. Sobie^{168,j}, J. Sodomka¹²⁶, A. Soffer¹⁵², C.A. Solans¹⁶⁶, M. Solar¹²⁶, J. Solc¹²⁶, E. Soldatov⁹⁵, U. Soldevila¹⁶⁶, E. Solfaroli Camillocci^{131a,131b}, A.A. Solodkov¹²⁷, O.V. Solovyanov¹²⁷, J. Sondericker²⁴, N. Soni², V. Sopko¹²⁶, B. Sopko¹²⁶, M. Sosebee⁷, R. Soualah^{163a,163c}, A. Soukharev¹⁰⁶, S. Spagnolo^{71a,71b}, F. Spanò⁷⁵, R. Spighi^{19a}, G. Spigo²⁹, F. Spila^{131a,131b}, R. Spiwoks²⁹, M. Spousta¹²⁵, T. Spreitzer¹⁵⁷, B. Spurlock⁷, R.D. St. Denis⁵³, T. Stahl¹⁴⁰, J. Stahlman¹¹⁹, R. Stamen^{58a}, E. Stanecka³⁸, R.W. Stanek⁵, C. Stanescu^{133a}, S. Stapnes¹¹⁶, E.A. Starchenko¹²⁷, J. Stark⁵⁵, P. Staroba¹²⁴, P. Starovoitov⁹⁰, A. Staude⁹⁷, P. Stavina^{143a}, G. Stavropoulos¹⁴, G. Steele⁵³, P. Steinbach⁴³, P. Steinberg²⁴, I. Stekl¹²⁶, B. Stelzer¹⁴¹, H.J. Stelzer⁸⁷, O. Stelzer-Chilton^{158a}, H. Stenzel⁵², S. Stern⁹⁸, K. Stevenson⁷⁴, G.A. Stewart²⁹, J.A. Stillings²⁰, M.C. Stockton²⁹, K. Stoerig⁴⁸, G. Stoicea^{25a}, S. Stonjek⁹⁸, P. Strachota¹²⁵, A.R. Stradling⁷, A. Straessner⁴³, J. Strandberg¹⁴⁶, S. Strandberg^{145a,145b}, A. Strandlie¹¹⁶, M. Strang¹⁰⁸, E. Strauss¹⁴², M. Strauss¹¹⁰, P. Strizenec^{143b}, R. Ströhmer¹⁷², D.M. Strom¹¹³, J.A. Strong^{75,*}, R. Stroynowski³⁹, J. Strube¹²⁸, B. Stugu¹³, I. Stumer^{24,*}, J. Stupak¹⁴⁷, P. Sturm¹⁷³, N.A. Styles⁴¹, D.A. Soh^{150,u}, D. Su¹⁴², H.S. Subramania², A. Succurro¹¹, Y. Sugaya¹¹⁵, T. Sugimoto¹⁰⁰, C. Suhr¹⁰⁵, K. Suita⁶⁶, M. Suk¹²⁵, V.V. Sulin⁹³, S. Sultansoy^{3d}, T. Sumida⁶⁷, X. Sun⁵⁵, J.E. Sundermann⁴⁸, K. Suruliz¹³⁸, S. Sushkov¹¹, G. Susinno^{36a,36b}, M.R. Sutton¹⁴⁸, Y. Suzuki⁶⁵, Y. Suzuki⁶⁶, M. Svatos¹²⁴, Yu.M. Sviridov¹²⁷, S. Swedish¹⁶⁷, I. Sykora^{143a}, T. Sykora¹²⁵, B. Szeless²⁹, J. Sánchez¹⁶⁶, D. Ta¹⁰⁴, K. Tackmann⁴¹, A. Taffard¹⁶², R. Tafirout^{158a}, N. Taiblum¹⁵², Y. Takahashi¹⁰⁰, H. Takai²⁴, R. Takashima⁶⁸, H. Takeda⁶⁶, T. Takeshita¹³⁹, M. Talby⁸², A. Talyshev^{106,f}, M.C. Tamsett²⁴, J. Tanaka¹⁵⁴, R. Tanaka¹¹⁴, S. Tanaka¹³⁰, S. Tanaka⁶⁵, Y. Tanaka⁹⁹, K. Tani⁶⁶, N. Tannoury⁸², G.P. Tappern²⁹, S. Tapprogge⁸⁰, D. Tardif¹⁵⁷, S. Tarem¹⁵¹, F. Tarrade²⁸, G.F. Tartarelli^{88a}, P. Tas¹²⁵, M. Tasevsky¹²⁴, E. Tassi^{36a,36b}, M. Tatarkhanov¹⁴, Y. Tayalati^{134d}, C. Taylor⁷⁶, F.E. Taylor⁹¹, G.N. Taylor⁸⁵, W. Taylor^{158b}, M. Teinturier¹¹⁴, M. Teixeira Dias Castanheira⁷⁴, P. Teixeira-Dias⁷⁵, K.K. Temming⁴⁸, H. Ten Kate²⁹, P.K. Teng¹⁵⁰, S. Terada⁶⁵, K. Terashi¹⁵⁴, J. Terron⁷⁹, M. Testa⁴⁷, R.J. Teuscher^{157,j}, J. Thadome¹⁷³, J. Therhaag²⁰, T. Theveneaux-Pelzer⁷⁷, M. Thioye¹⁷⁴, S. Thoma⁴⁸, J.P. Thomas¹⁷, E.N. Thompson³⁴, P.D. Thompson¹⁷, P.D. Thompson¹⁵⁷, A.S. Thompson⁵³, E. Thomson¹¹⁹, M. Thomson²⁷, R.P. Thun⁸⁶, F. Tian³⁴, M.J. Tibbetts¹⁴, T. Tic¹²⁴, V.O. Tikhomirov⁹³, Y.A. Tikhonov^{106,f}, S. Timoshenko⁹⁵, P. Tipton¹⁷⁴, F.J. Tique Aires Viegas²⁹, S. Tisserant⁸², B. Toczec³⁷, T. Todorov⁴, S. Todorova-Nova¹⁶⁰, B. Toggerson¹⁶², J. Tojo⁶⁵, S. Tokár^{143a}, K. Tokunaga⁶⁶, K. Tokushuku⁶⁵, K. Tollefson⁸⁷, M. Tomoto¹⁰⁰, L. Tompkins³⁰, K. Toms¹⁰², G. Tong^{32a}, A. Tonoyan¹³, C. Topfel¹⁶, N.D. Topilin⁶⁴, I. Torchiani²⁹, E. Torrence¹¹³, H. Torres⁷⁷, E. Torró Pastor¹⁶⁶, J. Toth^{82,aa}, F. Touchard⁸², D.R. Tovey¹³⁸, T. Trefzger¹⁷², L. Tremblet²⁹, A. Tricoli²⁹, I.M. Trigger^{158a}, S. Trincas-Duvoid⁷⁷, T.N. Trinh⁷⁷, M.F. Tripiana⁶⁹, W. Trischuk¹⁵⁷, A. Trivedi^{24,z}, B. Trocme⁵⁵, C. Troncon^{88a}, M. Trottier-McDonald¹⁴¹, M. Trzebinski³⁸, A. Trzupek³⁸, C. Tsarouchas²⁹, J.C.-L. Tseng¹¹⁷, M. Tsiakiris¹⁰⁴, P.V. Tsiareshka⁸⁹, D. Tsionou^{4,ae}, G. Tsipolitis⁹, V. Tsiskaridze⁴⁸, E.G. Tskhadadze^{51a}, I.I. Tsukerman⁹⁴, V. Tsulaia¹⁴, J.-W. Tsung²⁰, S. Tsuno⁶⁵, D. Tsybychev¹⁴⁷, A. Tua¹³⁸, A. Tudorache^{25a}, V. Tudorache^{25a}, J.M. Tuggle³⁰, M. Turala³⁸, D. Turecek¹²⁶, I. Turk Cakir^{3e}, E. Turlay¹⁰⁴, R. Turra^{88a,88b}, P.M. Tuts³⁴, A. Tykhonov⁷³, M. Tylmad^{145a,145b}, M. Tyndel¹²⁸, H. Tyrvalinen²⁹, G. Tzanakos⁸, K. Uchida²⁰, I. Ueda¹⁵⁴, R. Ueno²⁸, M. Ugland¹³,

M. Uhlenbrock²⁰, M. Uhrmacher⁵⁴, F. Ukegawa¹⁵⁹, G. Unal²⁹, D.G. Underwood⁵, A. Undrus²⁴, G. Unel¹⁶², Y. Unno⁶⁵, D. Urbaniec³⁴, G. Usai⁷, M. Uslenghi^{118a,118b}, L. Vacavant⁸², V. Vacek¹²⁶, B. Vachon⁸⁴, S. Vahsen¹⁴, J. Valenta¹²⁴, P. Valente^{131a}, S. Valentini^{19a,19b}, S. Valkar¹²⁵, E. Valladolid Gallego¹⁶⁶, S. Vallecorsa¹⁵¹, J.A. Valls Ferrer¹⁶⁶, H. van der Graaf¹⁰⁴, E. van der Kraaij¹⁰⁴, R. Van Der Leeuw¹⁰⁴, E. van der Poel¹⁰⁴, D. van der Ster²⁹, N. van Eldik⁸³, P. van Gemmeren⁵, Z. van Kesteren¹⁰⁴, I. van Vulpen¹⁰⁴, M. Vanadia⁹⁸, W. Vandelli²⁹, G. Vandoni²⁹, A. Vaniachine⁵, P. Vankov⁴¹, F. Vannucci⁷⁷, F. Varela Rodriguez²⁹, R. Vari^{131a}, E.W. Varnes⁶, D. Varouchas¹⁴, A. Vartapetian⁷, K.E. Varvell¹⁴⁹, V.I. Vassilakopoulos⁵⁶, F. Vazeille³³, G. Vegni^{88a,88b}, J.J. Veillet¹¹⁴, C. Vellidis⁸, F. Veloso^{123a}, R. Veness²⁹, S. Veneziano^{131a}, A. Ventura^{71a,71b}, D. Ventura¹³⁷, M. Venturi⁴⁸, N. Venturi¹⁵⁷, V. Vercesi^{118a}, M. Verducci¹³⁷, W. Verkerke¹⁰⁴, J.C. Vermeulen¹⁰⁴, A. Vest⁴³, M.C. Vetterli^{141,d}, I. Vichou¹⁶⁴, T. Vickey^{144b,af}, O.E. Vickey Boeriu^{144b}, G.H.A. Viehhauser¹¹⁷, S. Viel¹⁶⁷, M. Villa^{19a,19b}, M. Villaplana Perez¹⁶⁶, E. Vilucchi⁴⁷, M.G. Vinciter²⁸, E. Vinek²⁹, V.B. Vinogradov⁶⁴, M. Virchaux^{135,*}, J. Virzi¹⁴, O. Vitells¹⁷⁰, M. Viti⁴¹, I. Vivarelli⁴⁸, F. Vives Vaque², S. Vlachos⁹, D. Vladoiu⁹⁷, M. Vlasak¹²⁶, N. Vlasov²⁰, A. Vogel²⁰, P. Vokac¹²⁶, G. Volpi⁴⁷, M. Volpi⁸⁵, G. Volpini^{88a}, H. von der Schmitt⁹⁸, J. von Loeben⁹⁸, H. von Radziewski⁴⁸, E. von Toerne²⁰, V. Vorobel¹²⁵, A.P. Vorobiev¹²⁷, V. Vorwerk¹¹, M. Vos¹⁶⁶, R. Voss²⁹, T.T. Voss¹⁷³, J.H. Vossebeld⁷², N. Vranjes^{12a}, M. Vranjes Milosavljevic¹⁰⁴, V. Vrba¹²⁴, M. Vreeswijk¹⁰⁴, T. Vu Anh⁸⁰, R. Vuillermet²⁹, I. Vukotic¹¹⁴, W. Wagner¹⁷³, P. Wagner¹¹⁹, H. Wahlen¹⁷³, J. Wakabayashi¹⁰⁰, J. Walbersloh⁴², S. Walch⁸⁶, J. Walder⁷⁰, R. Walker⁹⁷, W. Walkowiak¹⁴⁰, R. Wall¹⁷⁴, P. Waller⁷², A. Walz⁴⁸, C. Wang⁴⁴, H. Wang¹⁷¹, H. Wang^{32b,ag}, J. Wang¹⁵⁰, J. Wang⁵⁵, J.C. Wang¹³⁷, R. Wang¹⁰², S.M. Wang¹⁵⁰, A. Warburton⁸⁴, C.P. Ward²⁷, M. Warsinsky⁴⁸, R. Wastie¹¹⁷, P.M. Watkins¹⁷, A.T. Watson¹⁷, I.J. Watson¹⁴⁹, M.F. Watson¹⁷, G. Watts¹³⁷, S. Watts⁸¹, A.T. Waugh¹⁴⁹, B.M. Waugh⁷⁶, J. Weber⁴², M. Weber¹²⁸, M.S. Weber¹⁶, P. Weber⁵⁴, A.R. Weidberg¹¹⁷, P. Weigell⁹⁸, J. Weingarten⁵⁴, C. Weiser⁴⁸, H. Wellenstein²², P.S. Wells²⁹, M. Wen⁴⁷, T. Wenaus²⁴, S. Wendler¹²², Z. Weng^{150,u}, T. Wengler²⁹, S. Wenig²⁹, N. Wermes²⁰, M. Werner⁴⁸, P. Werner²⁹, M. Werth¹⁶², M. Wessels^{58a}, C. Weydert⁵⁵, K. Whalen²⁸, S.J. Wheeler-Ellis¹⁶², S.P. Whitaker²¹, A. White⁷, M.J. White⁸⁵, S.R. Whitehead¹¹⁷, D. Whiteson¹⁶², D. Whittington⁶⁰, F. Wicek¹¹⁴, D. Wicke¹⁷³, F.J. Wickens¹²⁸, W. Wiedenmann¹⁷¹, M. Wielers¹²⁸, P. Wienemann²⁰, C. Wigglesworth⁷⁴, L.A.M. Wiik-Fuchs⁴⁸, P.A. Wijeratne⁷⁶, A. Wildauer¹⁶⁶, M.A. Wildt^{41,q}, I. Wilhelm¹²⁵, H.G. Wilkens²⁹, J.Z. Will⁹⁷, E. Williams³⁴, H.H. Williams¹¹⁹, W. Willis³⁴, S. Willocq⁸³, J.A. Wilson¹⁷, M.G. Wilson¹⁴², A. Wilson⁸⁶, I. Wingerter-Seez⁴, S. Winkelmann⁴⁸, F. Winklmeier²⁹, M. Wittgen¹⁴², M.W. Wolter³⁸, H. Wolters^{123a,h}, W.C. Wong⁴⁰, G. Wooden⁸⁶, B.K. Wosiek³⁸, J. Wotschack²⁹, M.J. Woudstra⁸³, K.W. Wozniak³⁸, K. Wraight⁵³, C. Wright⁵³, M. Wright⁵³, B. Wrona⁷², S.L. Wu¹⁷¹, X. Wu⁴⁹, Y. Wu^{32b,ah}, E. Wulf³⁴, R. Wunstorff⁴², B.M. Wynne⁴⁵, S. Xella³⁵, M. Xiao¹³⁵, S. Xie⁴⁸, Y. Xie^{32a}, C. Xu^{32b,w}, D. Xu¹³⁸, G. Xu^{32a}, B. Yabsley¹⁴⁹, S. Yacoub^{144b}, M. Yamada⁶⁵, H. Yamaguchi¹⁵⁴, A. Yamamoto⁶⁵, K. Yamamoto⁶³, S. Yamamoto¹⁵⁴, T. Yamamura¹⁵⁴, T. Yamanaka¹⁵⁴, J. Yamaoka⁴⁴, T. Yamazaki¹⁵⁴, Y. Yamazaki⁶⁶, Z. Yan²¹, H. Yang⁸⁶, U.K. Yang⁸¹, Y. Yang⁶⁰, Y. Yang^{32a}, Z. Yang^{145a,145b}, S. Yanush⁹⁰, Y. Yao¹⁴, Y. Yasu⁶⁵, G.V. Ybeles Smit¹²⁹, J. Ye³⁹, S. Ye²⁴, M. Yilmaz^{3c}, R. Yoosoofmiya¹²², K. Yorita¹⁶⁹, R. Yoshida⁵, K. Yoshihara¹⁵⁴, C. Young¹⁴², S. Youssef²¹, D. Yu²⁴, J. Yu⁷, J. Yu¹¹¹, L. Yuan^{32a,ai}, A. Yurkewicz¹⁰⁵, B. Zabinski³⁸, V.G. Zaets¹²⁷, R. Zaidan⁶², A.M. Zaitsev¹²⁷, Z. Zajacova²⁹, Yo.K. Zalite¹²⁰, L. Zanello^{131a,131b}, P. Zarzhitsky³⁹, A. Zaytsev¹⁰⁶, C. Zeitnitz¹⁷³, M. Zeller¹⁷⁴, M. Zeman¹²⁴, A. Zemla³⁸, C. Zendler²⁰, O. Zenin¹²⁷, T. Ženiš^{143a}, Z. Zinonos^{121a,121b}, S. Zenz¹⁴, D. Zerwas¹¹⁴, G. Zevi della Porta⁵⁷, Z. Zhan^{32d}, D. Zhang^{32b,ag}, H. Zhang⁸⁷, J. Zhang⁵, X. Zhang^{32d}, Z. Zhang¹¹⁴, L. Zhao¹⁰⁷, T. Zhao¹³⁷, Z. Zhao^{32b}, A. Zhemchugov⁶⁴, S. Zheng^{32a}, J. Zhong¹¹⁷, B. Zhou⁸⁶, N. Zhou¹⁶², Y. Zhou¹⁵⁰, C.G. Zhu^{32d}, H. Zhu⁴¹, J. Zhu⁸⁶, Y. Zhu^{32b}, X. Zhuang⁹⁷, V. Zhuravlov⁹⁸, D. Zieminska⁶⁰, R. Zimmermann²⁰, S. Zimmermann²⁰, S. Zimmermann⁴⁸, M. Ziolkowski¹⁴⁰, R. Zitoun⁴, L. Živković³⁴, V.V. Zmouchko^{127,*}, G. Zobernig¹⁷¹, A. Zoccoli^{19a,19b}, Y. Zolnierowski⁴, A. Zsenei²⁹, M. zur Nedden¹⁵, V. Zutshi¹⁰⁵, L. Zwalinski²⁹.

¹ University at Albany, Albany NY, United States of America

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

³ (a)Department of Physics, Ankara University, Ankara; (b)Department of Physics, Dumlupinar University, Kutahya;

(c)Department of Physics, Gazi University, Ankara; (d)Division of Physics, TOBB University of Economics and Technology, Ankara; (e)Turkish Atomic Energy Authority, Ankara, Turkey

⁴ LAPP, CNRS/IN2P3 and Université de Savoie, Annecy-le-Vieux, France

⁵ High Energy Physics Division, Argonne National Laboratory, Argonne IL, United States of America

⁶ Department of Physics, University of Arizona, Tucson AZ, United States of America

⁷ Department of Physics, The University of Texas at Arlington, Arlington TX, United States of America

⁸ Physics Department, University of Athens, Athens, Greece

⁹ Physics Department, National Technical University of Athens, Zografou, Greece

¹⁰ Institute of Physics, Azerbaijan Academy of Sciences, Baku, Azerbaijan

- ¹¹ Institut de Física d'Altes Energies and Departament de Física de la Universitat Autònoma de Barcelona and ICREA, Barcelona, Spain
- ¹² ^(a)Institute of Physics, University of Belgrade, Belgrade; ^(b)Vinca Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia
- ¹³ Department for Physics and Technology, University of Bergen, Bergen, Norway
- ¹⁴ Physics Division, Lawrence Berkeley National Laboratory and University of California, Berkeley CA, United States of America
- ¹⁵ Department of Physics, Humboldt University, Berlin, Germany
- ¹⁶ Albert Einstein Center for Fundamental Physics and Laboratory for High Energy Physics, University of Bern, Bern, Switzerland
- ¹⁷ School of Physics and Astronomy, University of Birmingham, Birmingham, United Kingdom
- ¹⁸ ^(a)Department of Physics, Bogazici University, Istanbul; ^(b)Division of Physics, Dogus University, Istanbul; ^(c)Department of Physics Engineering, Gaziantep University, Gaziantep; ^(d)Department of Physics, Istanbul Technical University, Istanbul, Turkey
- ¹⁹ ^(a)INFN Sezione di Bologna; ^(b)Dipartimento di Fisica, Università di Bologna, Bologna, Italy
- ²⁰ Physikalisches Institut, University of Bonn, Bonn, Germany
- ²¹ Department of Physics, Boston University, Boston MA, United States of America
- ²² Department of Physics, Brandeis University, Waltham MA, United States of America
- ²³ ^(a)Universidade Federal do Rio De Janeiro COPPE/EE/IF, Rio de Janeiro; ^(b)Federal University of Juiz de Fora (UFJF), Juiz de Fora; ^(c)Federal University of Sao Joao del Rei (UFSJ), Sao Joao del Rei; ^(d)Instituto de Fisica, Universidade de Sao Paulo, Sao Paulo, Brazil
- ²⁴ Physics Department, Brookhaven National Laboratory, Upton NY, United States of America
- ²⁵ ^(a)National Institute of Physics and Nuclear Engineering, Bucharest; ^(b)University Politehnica Bucharest, Bucharest; ^(c)West University in Timisoara, Timisoara, Romania
- ²⁶ Departamento de Física, Universidad de Buenos Aires, Buenos Aires, Argentina
- ²⁷ Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom
- ²⁸ Department of Physics, Carleton University, Ottawa ON, Canada
- ²⁹ CERN, Geneva, Switzerland
- ³⁰ Enrico Fermi Institute, University of Chicago, Chicago IL, United States of America
- ³¹ ^(a)Departamento de Física, Pontificia Universidad Católica de Chile, Santiago; ^(b)Departamento de Física, Universidad Técnica Federico Santa María, Valparaíso, Chile
- ³² ^(a)Institute of High Energy Physics, Chinese Academy of Sciences, Beijing; ^(b)Department of Modern Physics, University of Science and Technology of China, Anhui; ^(c)Department of Physics, Nanjing University, Jiangsu; ^(d)School of Physics, Shandong University, Shandong, China
- ³³ Laboratoire de Physique Corpusculaire, Clermont Université and Université Blaise Pascal and CNRS/IN2P3, Aubiere Cedex, France
- ³⁴ Nevis Laboratory, Columbia University, Irvington NY, United States of America
- ³⁵ Niels Bohr Institute, University of Copenhagen, Kobenhavn, Denmark
- ³⁶ ^(a)INFN Gruppo Collegato di Cosenza; ^(b)Dipartimento di Fisica, Università della Calabria, Arcavata di Rende, Italy
- ³⁷ AGH University of Science and Technology, Faculty of Physics and Applied Computer Science, Krakow, Poland
- ³⁸ The Henryk Niewodniczanski Institute of Nuclear Physics, Polish Academy of Sciences, Krakow, Poland
- ³⁹ Physics Department, Southern Methodist University, Dallas TX, United States of America
- ⁴⁰ Physics Department, University of Texas at Dallas, Richardson TX, United States of America
- ⁴¹ DESY, Hamburg and Zeuthen, Germany
- ⁴² Institut für Experimentelle Physik IV, Technische Universität Dortmund, Dortmund, Germany
- ⁴³ Institut für Kern- und Teilchenphysik, Technical University Dresden, Dresden, Germany
- ⁴⁴ Department of Physics, Duke University, Durham NC, United States of America
- ⁴⁵ SUPA - School of Physics and Astronomy, University of Edinburgh, Edinburgh, United Kingdom
- ⁴⁶ Fachhochschule Wiener Neustadt, Johannes Gutenbergstrasse 3 2700 Wiener Neustadt, Austria
- ⁴⁷ INFN Laboratori Nazionali di Frascati, Frascati, Italy
- ⁴⁸ Fakultät für Mathematik und Physik, Albert-Ludwigs-Universität, Freiburg i.Br., Germany
- ⁴⁹ Section de Physique, Université de Genève, Geneva, Switzerland
- ⁵⁰ ^(a)INFN Sezione di Genova; ^(b)Dipartimento di Fisica, Università di Genova, Genova, Italy
- ⁵¹ ^(a)E.Andronikashvili Institute of Physics, Tbilisi State University, Tbilisi; ^(b)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 Joseph Fourier and CNRS/IN2P3 and Institut National Polytechnique de Grenoble, Grenoble, France
⁵⁶ Department of Physics, Hampton University, Hampton VA, United States of America
⁵⁷ Laboratory for Particle Physics and Cosmology, Harvard University, Cambridge MA, United States of America
⁵⁸ ^(a)Kirchhoff-Institut für Physik, Ruprecht-Karls-Universität Heidelberg, Heidelberg; ^(b)Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Heidelberg; ^(c)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 IN, United States of America
⁶¹ Institut für Astro- und Teilchenphysik, Leopold-Franzens-Universität, Innsbruck, Austria
⁶² University of Iowa, Iowa City IA, United States of America
⁶³ Department of Physics and Astronomy, Iowa State University, Ames IA, United States of America
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 Instituto de Física La Plata, Universidad Nacional de La Plata and CONICET, La Plata, Argentina
⁷⁰ Physics Department, Lancaster University, Lancaster, United Kingdom
⁷¹ ^(a)INFN Sezione di Lecce; ^(b)Dipartimento di Fisica, Università del Salento, Lecce, Italy
⁷² Oliver Lodge Laboratory, University of Liverpool, Liverpool, United Kingdom
⁷³ Department of Physics, Jožef Stefan Institute and University of Ljubljana, Ljubljana, Slovenia
⁷⁴ School of Physics and Astronomy, Queen Mary University of London, London, United Kingdom
⁷⁵ Department of Physics, Royal Holloway University of London, Surrey, United Kingdom
⁷⁶ Department of Physics and Astronomy, University College London, London, United Kingdom
⁷⁷ Laboratoire de Physique Nucléaire et de Hautes Energies, UPMC and Université Paris-Diderot and CNRS/IN2P3, Paris, France
⁷⁸ Fysiska institutionen, Lunds universitet, Lund, Sweden
⁷⁹ Departamento de Física Teórica C-15, Universidad Autónoma de Madrid, Madrid, Spain
⁸⁰ Institut für Physik, Universität Mainz, Mainz, Germany
⁸¹ School of Physics and Astronomy, University of Manchester, Manchester, United Kingdom
⁸² CPPM, Aix-Marseille Université and CNRS/IN2P3, Marseille, France
⁸³ Department of Physics, University of Massachusetts, Amherst MA, United States of America
⁸⁴ Department of Physics, McGill University, Montreal QC, Canada
⁸⁵ School of Physics, University of Melbourne, Victoria, Australia
⁸⁶ Department of Physics, The University of Michigan, Ann Arbor MI, United States of America
⁸⁷ Department of Physics and Astronomy, Michigan State University, East Lansing MI, United States of America
⁸⁸ ^(a)INFN Sezione di Milano; ^(b)Dipartimento di Fisica, Università di Milano, Milano, Italy
⁸⁹ B.I. Stepanov Institute of Physics, National Academy of Sciences of Belarus, Minsk, Republic of Belarus
⁹⁰ National Scientific and Educational Centre for Particle and High Energy Physics, Minsk, Republic of Belarus
⁹¹ Department of Physics, Massachusetts Institute of Technology, Cambridge MA, United States of America
⁹² Group of Particle Physics, University of Montreal, Montreal QC, Canada
⁹³ P.N. Lebedev Institute of Physics, Academy of Sciences, Moscow, Russia
⁹⁴ Institute for Theoretical and Experimental Physics (ITEP), Moscow, Russia
⁹⁵ Moscow Engineering and Physics Institute (MEPhI), Moscow, Russia
⁹⁶ Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia
⁹⁷ Fakultät für Physik, Ludwig-Maximilians-Universität München, München, Germany
⁹⁸ Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München, Germany
⁹⁹ Nagasaki Institute of Applied Science, Nagasaki, Japan
¹⁰⁰ Graduate School of Science, Nagoya University, Nagoya, Japan
¹⁰¹ ^(a)INFN Sezione di Napoli; ^(b)Dipartimento di Scienze Fisiche, Università di Napoli, Napoli, Italy
¹⁰² Department of Physics and Astronomy, University of New Mexico, Albuquerque NM, United States of America
¹⁰³ Institute for Mathematics, Astrophysics and Particle Physics, Radboud University Nijmegen/Nikhef, Nijmegen,

Netherlands

- ¹⁰⁴ Nikhef National Institute for Subatomic Physics and University of Amsterdam, Amsterdam, Netherlands
- ¹⁰⁵ Department of Physics, Northern Illinois University, DeKalb IL, United States of America
- ¹⁰⁶ Budker Institute of Nuclear Physics, SB RAS, Novosibirsk, Russia
- ¹⁰⁷ Department of Physics, New York University, New York NY, United States of America
- ¹⁰⁸ Ohio State University, Columbus OH, United States of America
- ¹⁰⁹ Faculty of Science, Okayama University, Okayama, Japan
- ¹¹⁰ Homer L. Dodge Department of Physics and Astronomy, University of Oklahoma, Norman OK, United States of America
- ¹¹¹ Department of Physics, Oklahoma State University, Stillwater OK, United States of America
- ¹¹² Palacký University, RCPTM, Olomouc, Czech Republic
- ¹¹³ Center for High Energy Physics, University of Oregon, Eugene OR, United States of America
- ¹¹⁴ LAL, Univ. Paris-Sud and CNRS/IN2P3, Orsay, France
- ¹¹⁵ Graduate School of Science, Osaka University, Osaka, Japan
- ¹¹⁶ Department of Physics, University of Oslo, Oslo, Norway
- ¹¹⁷ Department of Physics, Oxford University, Oxford, United Kingdom
- ¹¹⁸ ^(a) INFN Sezione di Pavia; ^(b) Dipartimento di Fisica, Università di Pavia, Pavia, Italy
- ¹¹⁹ Department of Physics, University of Pennsylvania, Philadelphia PA, United States of America
- ¹²⁰ Petersburg Nuclear Physics Institute, Gatchina, Russia
- ¹²¹ ^(a) INFN Sezione di Pisa; ^(b) Dipartimento di Fisica E. Fermi, Università di Pisa, Pisa, Italy
- ¹²² Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh PA, United States of America
- ¹²³ ^(a) Laboratório de Instrumentação e Física Experimental de Partículas - LIP, Lisboa, Portugal; ^(b) Departamento de Física Teórica y del Cosmos and CAFPE, Universidad de Granada, Granada, Spain
- ¹²⁴ Institute of Physics, Academy of Sciences of the Czech Republic, Praha, Czech Republic
- ¹²⁵ Faculty of Mathematics and Physics, Charles University in Prague, Praha, Czech Republic
- ¹²⁶ Czech Technical University in Prague, Praha, Czech Republic
- ¹²⁷ State Research Center Institute for High Energy Physics, Protvino, Russia
- ¹²⁸ Particle Physics Department, Rutherford Appleton Laboratory, Didcot, United Kingdom
- ¹²⁹ Physics Department, University of Regina, Regina SK, Canada
- ¹³⁰ Ritsumeikan University, Kusatsu, Shiga, Japan
- ¹³¹ ^(a) INFN Sezione di Roma I; ^(b) Dipartimento di Fisica, Università La Sapienza, Roma, Italy
- ¹³² ^(a) INFN Sezione di Roma Tor Vergata; ^(b) Dipartimento di Fisica, Università di Roma Tor Vergata, Roma, Italy
- ¹³³ ^(a) INFN Sezione di Roma Tre; ^(b) Dipartimento di Fisica, Università Roma Tre, Roma, Italy
- ¹³⁴ ^(a) Faculté des Sciences Ain Chock, Réseau Universitaire de Physique des Hautes Energies - Université Hassan II, Casablanca; ^(b) Centre National de l'Energie des Sciences Techniques Nucleaires, Rabat; ^(c) Faculté des Sciences Semlalia, Université Cadi Ayyad, LPHEA-Marrakech; ^(d) Faculté des Sciences, Université Mohamed Premier and LPTPM, Oujda; ^(e) Faculté des Sciences, Université Mohammed V- Agdal, Rabat, Morocco
- ¹³⁵ DSM/IRFU (Institut de Recherches sur les Lois Fondamentales de l'Univers), CEA Saclay (Commissariat à l'Energie Atomique), Gif-sur-Yvette, France
- ¹³⁶ Santa Cruz Institute for Particle Physics, University of California Santa Cruz, Santa Cruz CA, United States of America
- ¹³⁷ Department of Physics, University of Washington, Seattle WA, United States of America
- ¹³⁸ Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom
- ¹³⁹ Department of Physics, Shinshu University, Nagano, Japan
- ¹⁴⁰ Fachbereich Physik, Universität Siegen, Siegen, Germany
- ¹⁴¹ Department of Physics, Simon Fraser University, Burnaby BC, Canada
- ¹⁴² SLAC National Accelerator Laboratory, Stanford CA, United States of America
- ¹⁴³ ^(a) Faculty of Mathematics, Physics & Informatics, Comenius University, Bratislava; ^(b) Department of Subnuclear Physics, Institute of Experimental Physics of the Slovak Academy of Sciences, Kosice, Slovak Republic
- ¹⁴⁴ ^(a) Department of Physics, University of Johannesburg, Johannesburg; ^(b) School of Physics, University of the Witwatersrand, Johannesburg, South Africa
- ¹⁴⁵ ^(a) Department of Physics, Stockholm University; ^(b) The Oskar Klein Centre, Stockholm, Sweden
- ¹⁴⁶ Physics Department, Royal Institute of Technology, Stockholm, Sweden
- ¹⁴⁷ Departments of Physics & Astronomy and Chemistry, Stony Brook University, Stony Brook NY, United States of America
- ¹⁴⁸ Department of Physics and Astronomy, University of Sussex, Brighton, United Kingdom

- ¹⁴⁹ School of Physics, University of Sydney, Sydney, Australia
- ¹⁵⁰ Institute of Physics, Academia Sinica, Taipei, Taiwan
- ¹⁵¹ Department of Physics, Technion: Israel Inst. of Technology, Haifa, Israel
- ¹⁵² Raymond and Beverly Sackler School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel
- ¹⁵³ Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece
- ¹⁵⁴ International Center for Elementary Particle Physics and Department of Physics, The University of Tokyo, Tokyo, Japan
- ¹⁵⁵ Graduate School of Science and Technology, Tokyo Metropolitan University, Tokyo, Japan
- ¹⁵⁶ Department of Physics, Tokyo Institute of Technology, Tokyo, Japan
- ¹⁵⁷ Department of Physics, University of Toronto, Toronto ON, Canada
- ¹⁵⁸ ^(a) TRIUMF, Vancouver BC; ^(b) Department of Physics and Astronomy, York University, Toronto ON, Canada
- ¹⁵⁹ Institute of Pure and Applied Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8571, Japan
- ¹⁶⁰ Science and Technology Center, Tufts University, Medford MA, United States of America
- ¹⁶¹ Centro de Investigaciones, Universidad Antonio Narino, Bogota, Colombia
- ¹⁶² Department of Physics and Astronomy, University of California Irvine, Irvine CA, United States of America
- ¹⁶³ ^(a) INFN Gruppo Collegato di Udine; ^(b) ICTP, Trieste; ^(c) Dipartimento di Chimica, Fisica e Ambiente, Università di Udine, Udine, Italy
- ¹⁶⁴ Department of Physics, University of Illinois, Urbana IL, United States of America
- ¹⁶⁵ Department of Physics and Astronomy, University of Uppsala, Uppsala, Sweden
- ¹⁶⁶ 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
- ¹⁶⁷ Department of Physics, University of British Columbia, Vancouver BC, Canada
- ¹⁶⁸ Department of Physics and Astronomy, University of Victoria, Victoria BC, Canada
- ¹⁶⁹ Waseda University, Tokyo, Japan
- ¹⁷⁰ Department of Particle Physics, The Weizmann Institute of Science, Rehovot, Israel
- ¹⁷¹ Department of Physics, University of Wisconsin, Madison WI, United States of America
- ¹⁷² Fakultät für Physik und Astronomie, Julius-Maximilians-Universität, Würzburg, Germany
- ¹⁷³ Fachbereich C Physik, Bergische Universität Wuppertal, Wuppertal, Germany
- ¹⁷⁴ Department of Physics, Yale University, New Haven CT, United States of America
- ¹⁷⁵ Yerevan Physics Institute, Yerevan, Armenia
- ¹⁷⁶ Domaine scientifique de la Doua, Centre de Calcul CNRS/IN2P3, Villeurbanne Cedex, France
- ^a Also at Laboratório de Instrumentação e Física Experimental de Partículas - LIP, Lisboa, Portugal
- ^b Also at Faculdade de Ciências and CFNUL, Universidade de Lisboa, Lisboa, Portugal
- ^c Also at Particle Physics Department, Rutherford Appleton Laboratory, Didcot, United Kingdom
- ^d Also at TRIUMF, Vancouver BC, Canada
- ^e Also at Department of Physics, California State University, Fresno CA, United States of America
- ^f Also at Novosibirsk State University, Novosibirsk, Russia
- ^g Also at Fermilab, Batavia IL, United States of America
- ^h Also at Department of Physics, University of Coimbra, Coimbra, Portugal
- ⁱ Also at Università di Napoli Parthenope, Napoli, Italy
- ^j Also at Institute of Particle Physics (IPP), Canada
- ^k Also at Department of Physics, Middle East Technical University, Ankara, Turkey
- ^l Also at Louisiana Tech University, Ruston LA, United States of America
- ^m Also at Department of Physics and Astronomy, University College London, London, United Kingdom
- ⁿ Also at Group of Particle Physics, University of Montreal, Montreal QC, Canada
- ^o Also at Department of Physics, University of Cape Town, Cape Town, South Africa
- ^p Also at Institute of Physics, Azerbaijan Academy of Sciences, Baku, Azerbaijan
- ^q Also at Institut für Experimentalphysik, Universität Hamburg, Hamburg, Germany
- ^r Also at Manhattan College, New York NY, United States of America
- ^s Also at School of Physics, Shandong University, Shandong, China
- ^t Also at CPPM, Aix-Marseille Université and CNRS/IN2P3, Marseille, France
- ^u Also at School of Physics and Engineering, Sun Yat-sen University, Guanzhou, China
- ^v Also at Academia Sinica Grid Computing, Institute of Physics, Academia Sinica, Taipei, Taiwan
- ^w Also at DSM/IRFU (Institut de Recherches sur les Lois Fondamentales de l'Univers), CEA Saclay (Commissariat à l'Energie Atomique), Gif-sur-Yvette, France

^x Also at Section de Physique, Université de Genève, Geneva, Switzerland

^y Also at Departamento de Fisica, Universidade de Minho, Braga, Portugal

^z Also at Department of Physics and Astronomy, University of South Carolina, Columbia SC, United States of America

^{aa} Also at Institute for Particle and Nuclear Physics, Wigner Research Centre for Physics, Budapest, Hungary

^{ab} Also at California Institute of Technology, Pasadena CA, United States of America

^{ac} Also at Institute of Physics, Jagiellonian University, Krakow, Poland

^{ad} Also at Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China

^{ae} Also at Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom

^{af} Also at Department of Physics, Oxford University, Oxford, United Kingdom

^{ag} Also at Institute of Physics, Academia Sinica, Taipei, Taiwan

^{ah} Also at Department of Physics, The University of Michigan, Ann Arbor MI, United States of America

^{ai} Also at Laboratoire de Physique Nucléaire et de Hautes Energies, UPMC and Université Paris-Diderot and CNRS/IN2P3, Paris, France

* Deceased