Eur. Phys. J. C (2012) 72:2040
DOI 10.1140/epjc/s10052-012-2040-z

THE EUROPEAN
PHYSICAL JOURNAL C

Regular Article - Experimental Physics

Search for lepton flavour violation in the $e\mu$ continuum with the ATLAS detector in $\sqrt{s}=7$ TeV pp collisions at the LHC

The ATLAS Collaboration[⋆]
CERN, 1211 Geneva 23, Switzerland

Received: 3 May 2012 / Published online: 14 June 2012

Abstract This paper presents a search for the t-channel exchange of an R-parity violating scalar top quark ($\tilde{t}$) in the $e^{\pm}\mu^{\mp}$ continuum using 2.1 fb^{-1} of data collected by the ATLAS detector in $\sqrt{s}=7$ TeV pp collisions at the Large Hadron Collider. Data are found to be consistent with the expectation from the Standard Model backgrounds. Limits on R-parity-violating couplings at 95 % C.L. are calculated as a function of the scalar top mass ($m_{\tilde{t}}$). The upper limits on the production cross section for $pp \to e\mu X$, through the t-channel exchange of a scalar top quark, ranges from 170 fb for $m_{\tilde{t}}=95$ GeV to 30 fb for $m_{\tilde{t}}=1000$ GeV.

1 Introduction

In the Standard Model (SM), direct production of $e^{\pm}\mu^{\mp}$ ($e\mu$) pairs is forbidden in pp collisions due to lepton flavour conservation. However, in many extensions of the SM, lepton flavour violation (LFV) is permitted. In particular, R-parity-violating (RPV) supersymmetric (SUSY) models, LFV leptoquarks, and models with additional gauge symmetry allow LFV. Previous searches by the CDF, D0, and ATLAS Collaborations [1–7] have focused on resonant production of a heavy neutral particle which decays into an $e\mu$ pair and have set limits on these models. In addition to resonant $e\mu$ production, RPV SUSY models also allow for LFV interactions through the t-channel exchange of a scalar quark. The corresponding Lagrangian term for these RPV processes [8] is $\mathcal{W}=-\lambda'_{ijk}\tilde{u}_j\bar{d}_k\ell_i$, where $\tilde{u}$ denotes the up-type squark field, d is the down-type quark field, ℓ represents the lepton field, and λ' is the coupling at the production vertex. The indices i, j, k refer to fermion generations. This superpotential couples an up-type squark to a down-type quark and a lepton, allowing for production of $e\mu$ pairs through the t-channel exchange of an up-type squark. This paper presents a search for this process in the $e\mu$ continuum using 2.1 fb^{-1} of pp collision data at $\sqrt{s}=7$ TeV collected by the ATLAS detector at the Large Hadron Collider (LHC).

The cross section for this process is expected to be dominated by the lightest up-type squark, which is taken to be the scalar top quark ($\tilde{t}$) in this analysis. The Feynman diagram for the dominant process, $d\bar{d} \to e^{-}\mu^{+}$ through the t-channel exchange of a $\tilde{t}$, is shown in Fig. 1. The leading-order (LO) partonic differential cross section is calculated as $d\hat{\sigma}/d\hat{t}=|\lambda'_{131}\lambda'_{231}|^2\hat{t}^2/[64N_c\pi\hat{s}^2(\hat{t}-m^2_{\tilde{t}})^2]$, where $\hat{s}$ and $\hat{t}$ are the usual Mandelstam variables in the $d\bar{d}$ centre-of-mass frame, $N_c=3$ is the colour factor, $m_{\tilde{t}}$ is the scalar top mass, and λ'_{131} (λ'_{231}) is the coupling for the vertex $d\tilde{t}e^{-}$ ($\mu^{+}\tilde{t}\bar{d}$). The process where the final state leptons have opposite charges to those in Fig. 1 has the same cross section. Diagrams with the d and $\bar{d}$ independently replaced by s and $\bar{s}$ quarks are also allowed. The form of the cross section for these diagrams is the same, but the indices on the λ' couplings are different. In the case of $s\bar{s} \to \mu^{\pm}e^{\mp}$, the cross section depends on $|\lambda'_{132}\lambda'_{232}|$. For $d\bar{s} \to \mu^{+}e^{-}$ and $s\bar{d} \to \mu^{-}e^{+}$, the cross section depends on $|\lambda'_{131}\lambda'_{232}|$. Lastly, diagrams with $s\bar{d} \to \mu^{+}e^{-}$ and $d\bar{s} \to \mu^{-}e^{+}$ depend on $|\lambda'_{231}\lambda'_{132}|$.

Strong limits on RPV couplings have been obtained from low-energy searches [9, 10], such as $\mu \to e\gamma$, $\mu-e$ conversion on nuclei and $Z \to e\mu$, where superparticles appear in the intermediate state, often in loops. The presence of multiple interfering amplitudes makes the extraction of limits difficult, and it is usually assumed that a single product of couplings dominates. The interference of different diagrams could weaken the limits on a specific product of couplings. Also, these limits depend on unknown superparticle masses (including ones other than the scalar top), sometimes in a complex manner.

The HERA experiments searched for an LFV leptoquark in the process $ep \to \mu X$ [11, 12]. These studies also place limits on a potential RPV scalar top. At lower masses (less than about 300 GeV), there would be copious s-channel production, and placing limits on specific couplings depends on

---

[⋆] e-mail: atlas.publications@cern.ch

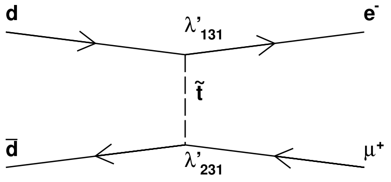


Fig. 1 The Feynman diagram for $d\bar{d} \to e^-\mu^+$ production through the t-channel exchange of a scalar top quark

assumptions about the stop decays. At higher masses, the HERA searches are sensitive to u-channel exchange, which can be directly compared to this analysis. The sensitivity of the measurement in this paper is slightly better than at HERA for masses above about 300 GeV. The HERA experiments also searched for scalar top production in both the RPV and gauge boson decay channels [13, 14]. Such searches assumed the RPV coupling involved in the scalar top production, λ'_{131}, to be dominant and cannot be directly compared with the results of this paper.

Direct searches at hadron colliders and at HERA for lepton-flavour-conserving scalar leptoquarks [15–24] are also relevant to the search here. The interpretation of such results as limits on a scalar top depends, as for the LFV leptoquarks, on the decay branching ratios to the leptons and quarks and hence on assumptions about the other possible decays. Present limits on such leptoquarks at the scalar top masses considered here do not preclude the signal sought in this analysis.

The limits on the couplings associated with the $d\bar{s}$ and $s\bar{d}$ processes are two orders of magnitude lower than those for the $d\bar{d}$ and $s\bar{s}$ couplings [9]. Therefore dominance by same flavour quark scattering processes is assumed in this analysis. As a result, the production cross section for $pp \to e\mu X$, due to the t-channel exchange of a scalar top quark, depends on λ'_{131}, λ'_{231}, λ'_{132}, λ'_{232}, and $m_{\tilde{t}}$.

2 Detector and data sample

The ATLAS detector [25] is a multi-purpose particle detector with a forward-backward symmetric cylindrical geometry and almost 4π coverage in solid angle.[1] The inner tracking detector (ID) covers $|\eta| < 2.5$ in pseudorapidity η and consists of a silicon pixel detector, a silicon microstrip detector, and a transition radiation tracker. The ID is surrounded by a thin superconducting solenoid providing a 2 T magnetic field and by a hermetic calorimeter system, which provides three-dimensional reconstruction of particle showers up to $|\eta| = 4.9$. The muon spectrometer (MS) is based on one barrel and two endcap air-core toroids, each consisting of eight superconducting coils arranged symmetrically in azimuth around the calorimeter. Three layers of precision tracking stations, consisting of drift tubes and cathode strip chambers, allow precise muon momentum measurement up to $|\eta| = 2.7$. Resistive plate and thin-gap chambers provide muon triggering capability up to $|\eta| = 2.4$.

The pp collision data used in this analysis were recorded between March and August 2011 at a centre-of-mass energy of 7 TeV. After applying data quality requirements, the total integrated luminosity of the dataset used in this analysis is $2.08 \pm 0.08\ \text{fb}^{-1}$ [26, 27]. Events are required to satisfy one of the single-lepton (e or μ) triggers. For electrons, the threshold on the transverse energy (E_T) is 20 GeV or 22 GeV depending on run periods, and for muons the threshold on the transverse momentum (E_T) is 18 GeV.

3 Event preselection

The event preselection requires a primary vertex with at least three associated tracks with $p_\text{T} > 0.5$ GeV and exactly one electron and one muon of opposite charge. Electron candidates are selected from clustered energy deposits in the electromagnetic calorimeter with an associated track reconstructed in the ID. They are required to have $E_\text{T} > 25$ GeV and to lie inside the pseudorapidity regions $|\eta| < 1.37$ or $1.52 < |\eta| < 2.47$. Electrons are further required to satisfy a stringent set of identification requirements based on the calorimeter shower shape, track quality and track matching with the calorimeter energy cluster, referred to as 'tight' in Ref. [28]. Muons are reconstructed by combining tracks in the ID and MS with $p_\text{T} > 25$ GeV and $|\eta| < 2.4$. Electrons are rejected if they are located within a cone of $\Delta R = \sqrt{(\Delta\eta)^2 + (\Delta\phi)^2} = 0.2$ around a muon, where $\Delta\eta$ and $\Delta\phi$ are the pseudorapidity and azimuthal opening angle difference between the electron and muon.

To suppress backgrounds from W/Z+jets and multijets, isolation requirements on tracks and calorimeter deposits are applied to the leptons. The scalar sum of the transverse momenta of tracks within a cone of $\Delta R = 0.2$ around the lepton must be less than 10 % of the lepton's p_T. Similarly, the transverse energy in the calorimeter within a cone of $\Delta R = 0.2$ around the lepton are required to be less than 15 % of the lepton's transverse energy. Corrections are applied to account for energy leakage and energy deposition inside the isolation cone due to additional pp collisions.

Jets are reconstructed from calibrated clusters using the anti-k_t algorithm [29] with a radius parameter of 0.4. Jet energies are calibrated using E_T- and η-dependent correction

---

[1] ATLAS uses a right-handed coordinate system with its origin at the nominal interaction point (IP) in the centre of the detector and the z-axis along the beam pipe. The x-axis points from the IP to the centre of the LHC ring, and the y-axis points upward. Cylindrical coordinates (r, ϕ) are used in the transverse plane, ϕ being the azimuthal angle around the beam pipe. The pseudorapidity is defined in terms of the polar angle θ as $\eta = -\ln\tan(\theta/2)$.

factors based on Monte Carlo (MC) simulation and validated by test beam and collision data studies [30]. Only jets with $p_T > 30$ GeV and $|\eta| < 2.5$ are considered. If such a jet and an electron lie within $\Delta R = 0.2$ of each other, the jet is discarded.

The measurement of missing transverse momentum [31] (E_T^{miss}) is based on the transverse momenta of the electron and muon candidates, all jets, and all energy clusters with $|\eta| < 4.5$ not associated to such objects.

4 Background and simulation

The SM processes that can produce an $e\mu$ signature are predominantly $t\bar{t}$, $Z/\gamma^* \to \tau\tau$, diboson, single top, W/Z+jets, $W/Z + \gamma$ and multijet events. All of these processes, except W/Z+jets and multijet production, are estimated using Monte Carlo samples generated at $\sqrt{s} = 7$ TeV followed by a detailed GEANT4-based [32] simulation of the ATLAS detector [33]. To improve the agreement between data and simulation, selection efficiencies are measured in both data and simulation, and correction factors are applied to the simulation. Furthermore, the simulation is tuned to reproduce the calorimeter energy and the muon momentum scale and resolution. Top production is generated with MC@NLO [34–36] for $t\bar{t}$ and single top, the Drell–Yan process is generated with PYTHIA [37], and the diboson processes are generated with HERWIG [38, 39]. The $W/Z + \gamma$ background comes from the $W(\to \mu\nu)\gamma$ and $Z(\to \mu\mu)\gamma$ processes, which is estimated using events generated with MADGRAPH [40]. The simulation samples are normalized to cross sections with higher-order corrections applied.

The $\tilde{t}$ signal samples are produced with the PYTHIA event generator [37] with $|\lambda'_{131}\lambda'_{231}| = |\lambda'_{132}\lambda'_{232}| = 0.05$ and the value of $m_{\tilde{t}}$ is varied from 95 GeV, which is the most stringent limit from previous experiments [41], to 1000 GeV. The central CTEQ6L1 [42] parton distribution function (PDF) set is used. The LO cross section is 580 fb for $m_{\tilde{t}} = 95$ GeV and 0.33 fb for $m_{\tilde{t}} = 1000$ GeV.

5 Data analysis

The production of W/Z+jets and multijets can give rise to backgrounds due to jets misidentified as leptons or non-prompt leptons from heavy-quark decays in jets. These sources are referred to as fake background and are estimated from data. A looser lepton quality selection (called 'loose' lepton here) is defined for each lepton type in addition to the default tight quality selection. For loose muons, both the calorimeter and the track isolation requirements are removed. For loose electrons, the 'loose' electron identification criteria as defined in Ref. [28] are used and the isolation requirements are also removed. The fake background is determined by weighting the events in the loose lepton sample by the likelihood that the event came from processes with at least one misidentified or non-prompt lepton. These weights are obtained by solving a 4 × 4 matrix equation, constructed from the E_T- or p_T-dependent probabilities for a prompt or fake/non-prompt lepton that passes the loose lepton requirement to also pass the tight lepton requirement. More details about the 4 × 4 matrix method are given in Ref. [7].

The middle column of Table 1 gives the number of events in the data and the estimated background contributions with their total uncertainties after the event preselection. A total of 5387 $e\mu$ candidates are observed with 5300 ± 400 events expected from SM processes. The number of expected signal events is shown for $m_{\tilde{t}} = 95, 250, 500$, and 1000 GeV, assuming $|\lambda'_{131}\lambda'_{231}| = |\lambda'_{132}\lambda'_{232}| = 0.05$. Figure 2 shows the comparison between data and the expected SM background for the dilepton invariant mass ($m_{e\mu}$), their azimuthal opening angle ($\Delta\phi_{e\mu}$), E_T^{miss} and the number of jets. A good description of the data by the expected SM background is observed.

To increase the signal purity, the preselected events are required to have zero jets, $m_{e\mu} > 100$ GeV, $\Delta\phi_{e\mu} > 3.0$ rad and $E_T^{\text{miss}} < 25$ GeV. This selection was optimized using the signal sample with $m_{\tilde{t}} = 95$ GeV which is the most demanding in terms of signal-to-background ratio when setting limits. After applying the full selection, 39 events are observed with 44 ± 6 SM events expected. A breakdown of the SM background composition is given in the last column

Table 1 Number of events observed in data, the estimated backgrounds, and expected number of signal events, assuming $|\lambda'_{131}\lambda'_{231}| = |\lambda'_{132}\lambda'_{232}| = 0.05$, with their combined systematic and statistical uncertainties for the preselected sample and the final selected sample. The number of signal and background events has been rounded

Process	Preselection	Final selection
WW	640 ± 50	23.4 ± 3.3
$Z/\gamma^* \to \tau\tau$	1210 ± 110	10 ± 4
Fake Background	290 ± 40	9.6 ± 1.9
WZ	36 ± 4	0.76 ± 0.31
$t\bar{t}$	2800 ± 400	0.25 ± 0.17
Single top	270 ± 40	0.22 ± 0.20
$W/Z + \gamma$	20 ± 7	0.04 ± 0.04
ZZ	4.0 ± 0.4	0.042 ± 0.028
Total background	5300 ± 400	44 ± 6
Data	5387	39
Signal ($m_{\tilde{t}} = 95$ GeV)	240 ± 15	67 ± 5
Signal ($m_{\tilde{t}} = 250$ GeV)	23.7 ± 1.4	9.3 ± 0.6
Signal ($m_{\tilde{t}} = 500$ GeV)	3.05 ± 0.18	1.28 ± 0.08
Signal ($m_{\tilde{t}} = 1000$ GeV)	0.305 ± 0.018	0.124 ± 0.008

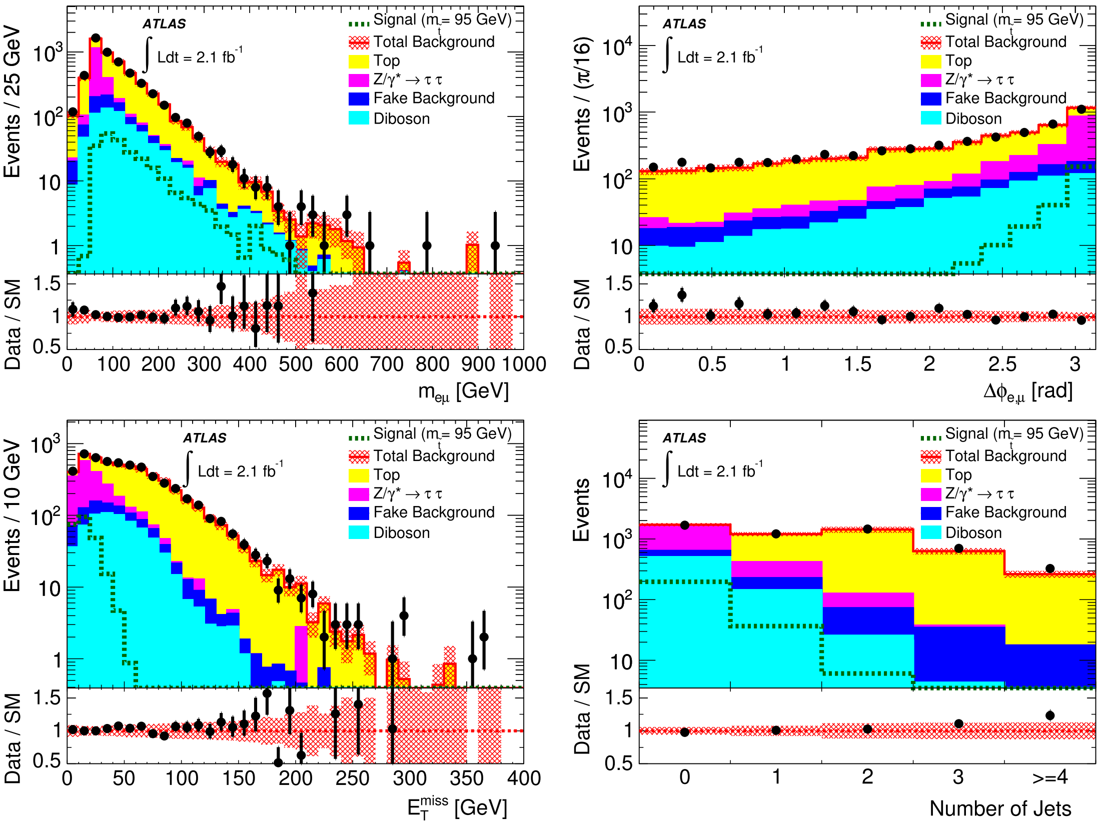


Fig. 2 Observed distributions of dilepton invariant mass ($m_{e\mu}$), dilepton azimuthal opening angle ($\Delta\phi_{e\mu}$), $E_{\mathrm{T}}^{\mathrm{miss}}$ and number of jets after object selection ('preselection'). The expected SM contributions, obtained as described in the text, with combined statistical and systematic uncertainties, are shown. In addition, the expected signal for $m_{\tilde{t}} = 95$ GeV is overlaid. For each case, a plot of the ratio of observed events to the expected background is shown. The error bars on these points represent the statistical errors on the data points and the *hashed boxes* represent the total error (statistical and systematic) on the expected background

of Table 1. In order of importance, the dominant contributions stem from WW, τ-pair and fake background. The $m_{e\mu}$ distribution of the selected events is shown in Fig. 3.

Systematic uncertainties on the SM background estimation arise from uncertainties in the estimation of the fake background (15 %), the integrated luminosity (3.7 %), and lepton trigger, reconstruction and identification efficiencies (1–2 %). Uncertainties from lepton energy/momentum scale and resolution (0.5–1 %), $E_{\mathrm{T}}^{\mathrm{miss}}$ modelling (12 %), and jet energy scale and resolution [43] (3.6 %) are also included. The SM background uncertainty in the shape of the $m_{e\mu}$ distribution used to extract the signal is estimated by comparing the default WW distribution generated with HERWIG [38, 39] to those obtained with ALPGEN [44] (interfaced with JIMMY [45]) and SHERPA [46]. A 13 % uncertainty is assigned. The uncertainties on the $t\bar{t}$ and single-top cross sections are 10 % [47] and 9 % [48], respectively. The theoretical uncertainties assigned to the $W/Z+\gamma$, $Z/\gamma^* \to \tau\tau$, WW, WZ, and ZZ cross sections are 10 %, 5 %, 7 %, 7 %, and 5 % respectively; these arise from the choice of PDFs, the factorization and renormalization scale dependence, and α_s variations.

6 Limit setting

Since no excess is observed in data, the $m_{e\mu}$ distribution in Fig. 3, with a single bin for $m_{e\mu} > 400$ GeV to reduce sensitivity to statistical fluctuations, is used to set limits on the production cross section of $e\mu$ pairs through t-channel exchange of $\tilde{t}$ in RPV SUSY models. A modified frequentist approach, using a binned log-likelihood ratio (LLR) of the signal-plus-background hypothesis to the background only hypothesis [49], is used to set the 95 % confidence level (CL) upper limits. Confidence levels, CL_{s+b} and CL_b, are defined by integrating the normalized probability distribution of LLR values from the observed LLR value to infinity for the two hypotheses. Since no data excess is observed, the production cross section is excluded at 95 % CL when $1 - \mathrm{CL}_{s+b}/\mathrm{CL}_b = 0.95$. The limits take into account systematic uncertainties by convolving the Poisson probability distributions for signal and background with the probability distributions for the corresponding uncertainty, which are assumed to be Gaussian.

The upper limit on the production cross section for $pp \to e\mu X$ through the t-channel exchange of a $\tilde{t}$ at 95 %

CL is shown in Fig. 4(a). For a $\tilde{t}$ with mass of 95 GeV (1000 GeV), the limit on the production cross section is 170 (30) fb which is in agreement with the expected limit of 180^{+80}_{-60} (30^{+11}_{-10}) fb. The theoretical cross section for $|\lambda'_{131}\lambda'_{231}| = |\lambda'_{132}\lambda'_{232}| = 0.05$ is also shown to illustrate the sensitivity.

The fraction of events produced by the $d\bar{d} \to e\mu$ ($s\bar{s} \to e\mu$) process is predicted to be $f_{d\bar{d}} = 0.72$ ($f_{s\bar{s}} = 0.28$) using the PYTHIA generator with the central CTEQ6L1 PDF set and with $m_{\tilde{t}} = 95$ GeV. The cross section for the signal process is hence proportional to the PDF-weighted sum of the RPV couplings, which is $f_{d\bar{d}} \times |\lambda'_{131}\lambda'_{231}|^2 + f_{s\bar{s}} \times |\lambda'_{132}\lambda'_{232}|^2$. The cross section limits set above can be interpreted as a limit on the plane spanned by the sum of couplings and $m_{\tilde{t}}$. The resulting two-dimensional 95 % confidence limit is shown in Fig. 4(b).

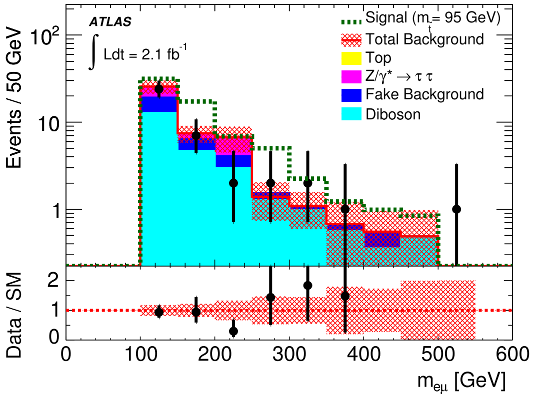


Fig. 3 The observed $m_{e\mu}$ distribution after applying all selection criteria. The expected SM contributions, obtained as described in the text, with combined statistical and systematic uncertainties, are shown. In addition, the expected signal for $m_{\tilde{t}} = 95$ GeV is overlaid. Finally, a plot of the ratio of observed events to the expected background is shown. The error bars on these points represent the statistical errors on the data points and the *hashed boxes* represent the total error (statistical and systematic) on the expected background

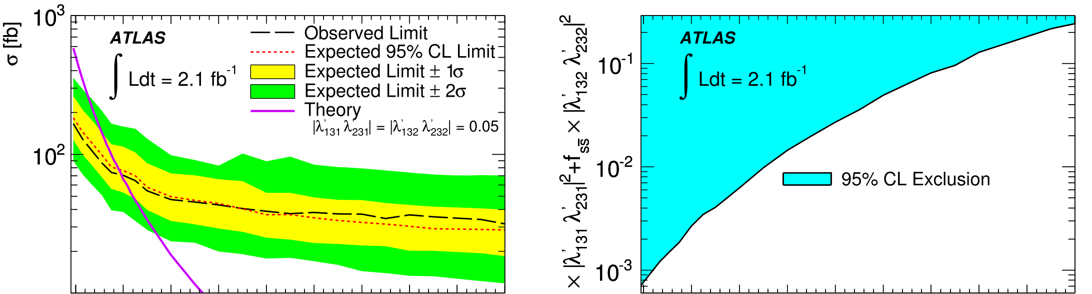
Assuming the equality of all couplings considered in this analysis ($\lambda'_{i3j} = \lambda'_{131} = \lambda'_{231} = \lambda'_{132} = \lambda'_{232}$), it is possible to compare this result with the one obtained by H1 for masses higher than the centre-of-mass collision energy of 319 GeV available at HERA. For example, at $m_{\tilde{t}} = 400$ (1000) GeV this analysis sets limits on a single coupling, λ'_{i3j}, of 0.35 (0.70), compared to the limits set by H1 experiment, which are 0.38 (0.95) [11].

7 Conclusion

This paper presents a search for LFV interactions in the $e\mu$ continuum, as modelled by the t-channel exchange of a scalar top quark, using 2.1 fb^{-1} of data collected by the ATLAS detector in $\sqrt{s} = 7$ TeV pp collisions at the LHC. The data are found to be consistent with the SM predictions. Upper limits are set on the production cross section for $pp \to e\mu X$ through the t-channel exchange of a $\tilde{t}$. A two dimensional limit in the plane of the weighted sum of couplings vs $m_{\tilde{t}}$ is also obtained.

Acknowledgements 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; ANAS, Azerbaijan; SSTC, Belarus; CNPq and FAPESP, Brazil; NSERC, NRC and CFI, Canada; CERN; CONICYT, Chile; CAS, MOST and NSFC, China; COLCIENCIAS, Colombia; MSMT CR, MPO CR and VSC CR, Czech Republic; DNRF, DNSRC and Lundbeck Foundation, Denmark; EPLANET and ERC, 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; MSTD, Serbia; MSSR, Slovakia; ARRS and MVZT, Slovenia; DST/NRF, South Africa; MICINN, Spain; SRC and Wallenberg Foundation, Sweden; SER, SNSF and



(a) (b)

Fig. 4 (**a**) The observed 95 % CL upper limits on $\sigma(pp \to e\mu)$ through the t-channel exchange of a scalar top quark as a function of $m_{\tilde{t}}$. The expected limits are also shown together with the ±1 and ±2 standard deviation uncertainty bands. The theoretical cross section for $|\lambda'_{131}\lambda'_{231}| = |\lambda'_{132}\lambda'_{232}| = 0.05$ is also shown. (**b**) Excluded region for the PDF weighted sum of couplings ($f_{d\bar{d}} \times |\lambda'_{131}\lambda'_{231}|^2 + f_{s\bar{s}} \times |\lambda'_{132}\lambda'_{232}|^2$) as a function of $m_{\tilde{t}}$

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.

References

1. A. Abulencia et al. (CDF Collaboration), Phys. Rev. Lett. **91**, 171602 (2003). arXiv:hep-ex/0307012 [hep-ex]
2. A. Abulencia et al. (CDF Collaboration), Phys. Rev. Lett. **98**, 131804 (2008). arXiv:0706.4448 [hep-ex]
3. A. Abulencia et al. (CDF Collaboration), Phys. Rev. Lett. **105**, 191801 (2010). arXiv:1004.3042 [hep-ex]
4. V.M. Abazov et al. (D0 Collaboration), Phys. Rev. Lett. **100**, 241803 (2008). arXiv:0711.3207 [hep-ex]
5. V.M. Abazov et al. (D0 Collaboration), Phys. Rev. Lett. **105**, 191802 (2010). arXiv:1007.4835 [hep-ex]
6. ATLAS Collaboration, Phys. Rev. Lett. **106**, 251801 (2011). arXiv:1103.5559 [hep-ex]
7. ATLAS Collaboration, Eur. Phys. J. C **71**, 1809 (2011). arXiv:1109.3089 [hep-ex]
8. Y.B. Sun et al., Commun. Theor. Phys. **44**, 107 (2005). arXiv:hep-ph/0412205
9. M. Chemtob, Prog. Part. Nucl. Phys. **54**, 71 (2005). arXiv:hep-ph/0406029
10. R. Barbier et al., Phys. Rep. **420**, 1 (2005). arXiv:hep-ph/0406039
11. F.D. Aaron et al. (H1 Collaboration), Phys. Lett. B **701**, 20 (2011). arXiv:1103.4938 [hep-ex]
12. S. Chekanov et al. (Zeus Collaboration), Eur. Phys. J. C **44**, 463 (2005). arXiv:hep-ex/0501070
13. S. Chekanov et al. (Zeus Collaboration), Eur. Phys. J. C **50**, 269 (2007). arXiv:hep-ex/0611018
14. F.D. Aaron et al. (H1 Collaboration), Eur. Phys. J. C **71**, 1572 (2011). arXiv:1011.6359 [hep-ex]
15. S. Chekanov, et al. (Zeus Collaboration), Phys. Rev. D **68**, 052004 (2003). arXiv:hep-ex/0304008 [hep-ex]
16. A. Abulencia et al. (CDF Collaboration), Phys. Rev. D **72**, 051107 (2005). arXiv:hep-ex/0506074 [hep-ex]
17. A. Abulencia et al. (CDF Collaboration), Phys. Rev. D **73**, 051102 (2006). arXiv:hep-ex/0512055 [hep-ex]
18. F.D. Aaron et al. (H1 Collaboration), Phys. Lett. B **704**, 388 (2011). arXiv:1107.3716 [hep-ex]
19. V.M. Abazov et al. (D0 Collaboration), Phys. Lett. B **671**, 224 (2009). arXiv:0808.4023 [hep-ex]
20. V.M. Abazov et al., (D0 Collaboration), Phys. Lett. B **681**, 224 (2009). arXiv:0907.1048 [hep-ex]
21. ATLAS Collaboration, Phys. Lett. B **709**, 158 (2012). arXiv:1112.4828 [hep-ex]
22. CMS Collaboration, Phys. Rev. Lett. **106**, 201802 (2011). arXiv:1012.4031 [hep-ex]
23. CMS Collaboration, Phys. Rev. Lett. **106**, 201803 (2011). arXiv:1012.4033 [hep-ex]
24. ATLAS Collaboration, Eur. Phys. J. C **72**, 1909 (2012). arXiv:1203.3172 [hep-ex]
25. ATLAS Collaboration, J. Instrum. **3**, S08003 (2008)
26. ATLAS Collaboration, ATLAS-CONF-2011-116 (2011)
27. ATLAS Collaboration, Eur. Phys. J. C **71**, 1630 (2011). arXiv:1101.2185 [hep-ex]
28. ATLAS Collaboration, Eur. Phys. J. C **72**, 1909 (2012). arXiv:1110.3174 [hep-ex]
29. M. Cacciari, G.P. Salam, G. Soyez, J. High Energy Phys. **04**, 063 (2008). arXiv:0802.1189 [hep-ph]
30. The ATLAS Collaboration, ATLAS-CONF-2011-032 (2011)
31. ATLAS Collaboration, Eur. Phys. J. C **72**, 1844 (2012). arXiv:1108.5602 [hep-ph]
32. S. Agostinelli et al. (GEANT4 Collaboration), Nucl. Instrum. Methods A **506**, 250 (2003)
33. ATLAS Collaboration, Eur. Phys. J. C **70**, 823 (2010). arXiv:1005.4568 [hep-ph]
34. S. Frixione, B.R. Webber, J. High Energy Phys. **0206**, 029 (2002). arXiv:hep-ph/0204244
35. S. Frixione, E. Laenen, P. Motylinski, J. High Energy Phys. **0603**, 092 (2006). arXiv:hep-ph/0512250
36. S. Frixione et al., J. High Energy Phys. **0807**, 029 (2008). arXiv:0805.3067 [hep-ph]
37. T. Sjostrand, S. Mrenna, P.Z. Skands, J. High Energy Phys. **05**, 026 (2006). arXiv:hep-ph/0603175. The scalar top mass is assumed to be 95 GeV and version 6.421 is used
38. G. Marchesini et al., Comput. Phys. Commun. **67**, 465 (1992)
39. G. Corcella et al., J. High Energy Phys. **01**, 010 (2001). arXiv:0805.3067 [hep-ph]
40. J. Alwall et al., J. High Energy Phys. **0709**, 028 (2007). arXiv:0706.2334 [hep-ph]
41. G. Abbiendi et al. (OPAL Collaboration), Phys. Lett. B **545**, 272 (2002). arXiv:hep-ex/0209026v1
42. J. Pumplin et al., J. High Energy Phys. **07**, 012 (2002). arXiv:hep-ph/0201195
43. ATLAS Collaboration, arXiv:1112.6426 [hep-ex], submitted to Eur. Phys. J. C.
44. M.L. Mangano et al., J. High Energy Phys. **07**, 001 (2003). arXiv:hep-ph/0206293
45. J.M. Butterworth et al., Z. Phys. C **72**, 637 (1996). arXiv:hep-ph/9601371
46. T. Gleisberg et al., J. High Energy Phys. **02**, 007 (2009). arXiv:0811.4622 [hep-ph]
47. S. Moch, P. Uwer, Nucl. Phys. Proc. Suppl. **183**, 7580 (2008). arXiv:0807.2794 [hep-ph]
48. N. Kidonakis, Phys. Rev. D **83**, 091503 (2011). arXiv:1103.2792 [hep-ph]
49. A.L. Read, J. Phys. G **28**, 2693 (2002)

The ATLAS Collaboration

G. Aad[48], B. Abbott[111], J. Abdallah[11], A.A. Abdelalim[49], A. Abdesselam[118], O. Abdinov[10], B. Abi[112], M. Abolins[88], H. Abramowicz[153], H. Abreu[115], E. Acerbi[89a,89b], B.S. Acharya[164a,164b], D.L. Adams[24], T.N. Addy[56], J. Adelman[176], S. Adomeit[98], P. Adragna[75], T. Adye[129], S. Aefsky[22], J.A. Aguilar-Saavedra[124b,a], M. Aharrouche[81], S.P. Ahlen[21], F. Ahles[48], A. Ahmad[148], M. Ahsan[40], G. Aielli[133a,133b], T. Akdogan[18a], T.P.A. Åkesson[79], G. Akimoto[155], A.V. Akimov[94], A. Akiyama[66], A. Aktas[48], M.S. Alam[1], M.A. Alam[76], S. Albrand[55], M. Aleksa[29], I.N. Aleksandrov[64], M. Aleppo[89a,89b], F. Alessandria[89a], C. Alexa[25a], G. Alexander[153], G. Alexandre[49], T. Alexopoulos[9], M. Alhroob[20], M. Aliev[15], G. Alimonti[89a], J. Alison[120], M. Aliyev[10], P.P. Allport[73], S.E. Allwood-Spiers[53], J. Almond[82], A. Aloisio[102a,102b], R. Alon[172], A. Alonso[79], M.G. Alviggi[102a,102b], K. Amako[65], C. Amelung[22], V.V. Ammosov[128], A. Amorim[124a,b], G. Amorós[167], N. Amram[153], C. Anastopoulos[139], T. Andeen[34], C.F. Anders[20], K.J. Anderson[30], A. Andreazza[89a,89b], V. Andrei[58a], X.S. Anduaga[70], A. Angerami[34], F. Anghinolfi[29], N. Anjos[124a], A. Annovi[47], A. Antonaki[8], M. Antonelli[47], S. Antonelli[19a,19b], A. Antonov[96], J. Antos[144b], F. Anulli[132a], S. Aoun[83], L. Aperio Bella[4], R. Apolle[118,c], G. Arabidze[88], I. Aracena[143], Y. Arai[65], A.T.H. Arce[44], J.P. Archambault[28], S. Arfaoui[29,d], J-F. Arguin[14], E. Arik[18a,*], M. Arik[18a], A.J. Armbruster[87], O. Arnaez[81], C. Arnault[115], A. Artamonov[95], G. Artoni[132a,132b], D. Arutinov[20], M. Asai[143], S. Asai[155], R. Asfandiyarov[173], S. Ask[27], B. Åsman[146a,146b], D. Asner[28], L. Asquith[5], K. Assamagan[24], A. Astbury[169], A. Astvatsatourov[52], G. Atoian[176], B. Aubert[4], E. Auge[115], K. Augsten[127], M. Aurousseau[145a], N. Austin[73], G. Avolio[163], R. Avramidou[9], D. Axen[168], G. Azuelos[93,e], Y. Azuma[155], M.A. Baak[29], G. Baccaglioni[89a], C. Bacci[134a,134b], A.M. Bach[14], H. Bachacou[136], K. Bachas[29], G. Bachy[29], M. Backes[49], M. Backhaus[20], E. Badescu[25a], P. Bagnaia[132a,132b], S. Bahinipati[2], Y. Bai[32a], D.C. Bailey[158], T. Bain[158], J.T. Baines[129], O.K. Baker[176], M.D. Baker[24], S. Baker[77], F. Baltasar Dos Santos Pedrosa[29], E. Banas[38], P. Banerjee[93], Sw. Banerjee[169], D. Banfi[29], A. Bangert[137], V. Bansal[169], H.S. Bansil[17], L. Barak[172], S.P. Baranov[94], A. Barbaro Galtieri[14], T. Barber[48], E.L. Barberio[86], D. Barberis[50a,50b], M. Barbero[20], D.Y. Bardin[64], T. Barillari[99], M. Barisonzi[175], T. Barklow[143], N. Barlow[27], B.M. Barnett[129], R.M. Barnett[14], A. Baroncelli[134a], A.J. Barr[118], F. Barreiro[80], J. Barreiro Guimarães da Costa[57], P. Barrillon[115], R. Bartoldus[143], A.E. Barton[71], D. Bartsch[20], V. Bartsch[149], R.L. Bates[53], L. Batkova[144a], J.R. Batley[27], A. Battaglia[16], M. Battistin[29], G. Battistoni[89a], F. Bauer[136], H.S. Bawa[143,f], B. Beare[158], T. Beau[78], P.H. Beauchemin[118], R. Beccherle[50a], P. Bechtle[41], G.A. Beck[75], H.P. Beck[16], M. Beckingham[48], K.H. Becks[175], A.J. Beddall[18c], A. Beddall[18c], S. Bedikian[176], V.A. Bednyakov[64], C.P. Bee[83], M. Begel[24], S. Behar Harpaz[152], P.K. Behera[62], M. Beimforde[99], C. Belanger-Champagne[166], P.J. Bell[49], W.H. Bell[49], G. Bella[153], L. Bellagamba[19a], F. Bellina[29], G. Bellomo[89a,89b], M. Bellomo[119a], A. Belloni[57], O. Beloborodova[107,g], K. Belotskiy[96], O. Beltramello[29], S. Ben Ami[152], O. Benary[153], D. Benchekroun[135a], C. Benchouk[83], M. Bendel[81], B.H. Benedict[163], N. Benekos[165], Y. Benhammou[153], D.P. Benjamin[44], M. Benoit[115], J.R. Bensinger[22], K. Benslama[130], S. Bentvelsen[105], M. Beretta[47], D. Berge[29], E. Bergeaas Kuutmann[41], N. Berger[4], F. Berghaus[169], E. Berglund[49], J. Beringer[14], K. Bernardet[83], P. Bernat[77], R. Bernhard[48], C. Bernius[24], T. Berry[76], A. Bertin[19a,19b], F. Bertolucci[122a,122b], M.I. Besana[89a,89b], N. Besson[136], S. Bethke[99], W. Bhimji[45], R.M. Bianchi[29], M. Bianco[72a,72b], O. Biebel[98], S.P. Bieniek[77], J. Biesiada[14], M. Biglietti[134a], H. Bilokon[47], M. Bindi[19a,19b], S. Binet[115], A. Bingul[18c], C. Bini[132a,132b], C. Biscarat[178], U. Bitenc[48], K.M. Black[21], R.E. Blair[5], J.-B. Blanchard[115], G. Blanchot[29], C. Blocker[22], J. Blocki[38], A. Blondel[49], W. Blum[81], U. Blumenschein[54], G.J. Bobbink[105], V.B. Bobrovnikov[107], S.S. Bocchetta[79], A. Bocci[44], C.R. Boddy[118], M. Boehler[41], J. Boek[175], N. Boelaert[35], S. Böser[77], J.A. Bogaerts[29], A. Bogdanchikov[107], A. Bogouch[90,*], C. Bohm[146a], V. Boisvert[76], T. Bold[163,h], V. Boldea[25a], M. Bona[75], M. Bondioli[163], M. Boonekamp[136], G. Boorman[76], C.N. Booth[139], P. Booth[139], S. Bordoni[78], C. Borer[16], A. Borisov[128], G. Borissov[71], I. Borjanovic[12a], S. Borroni[132a,132b], K. Bos[105], D. Boscherini[19a], M. Bosman[11], H. Boterenbrood[105], D. Botterill[129], J. Bouchami[93], J. Boudreau[123], E.V. Bouhova-Thacker[71], C. Boulahouache[123], C. Bourdarios[115], N. Bousson[83], A. Boveia[30], J. Boyd[29], I.R. Boyko[64], N.I. Bozhko[128], I. Bozovic-Jelisavcic[12b], J. Bracinik[17], A. Braem[29], E. Brambilla[72a,72b], P. Branchini[134a], A. Brandt[7], G. Brandt[15], O. Brandt[54], U. Bratzler[156], B. Brau[84], J.E. Brau[114], H.M. Braun[175], B. Brelier[158], J. Bremer[29], R. Brenner[166], S. Bressler[152], D. Breton[115], N.D. Brett[118], P.G. Bright-Thomas[17], D. Britton[53], F.M. Brochu[27], I. Brock[20], R. Brock[88], E. Brodet[153], F. Broggi[89a], C. Bromberg[88], G. Brooijmans[34], W.K. Brooks[31b], G. Brown[82], E. Brubaker[30], P.A. Bruckman de Renstrom[38], D. Bruncko[144b], R. Bruneliere[48], S. Brunet[60], A. Bruni[19a], G. Bruni[19a], M. Bruschi[19a], T. Buanes[13], F. Bucci[49], J. Buchanan[118], N.J. Buchanan[2], P. Buchholz[141], R.M. Buckingham[118], A.G. Buckley[45], S.I. Buda[25a], I.A. Budagov[64], B. Budick[108], V. Büscher[81], L. Bugge[117], D. Buira-Clark[118], E.J. Buis[105], O. Bulekov[96], M. Bunse[42], T. Buran[117], H. Burckhart[29], S. Burdin[73], T. Burgess[13], S. Burke[129], E. Busato[33], P. Bussey[53], C.P. Buszello[166], B. Butler[143], J.M. Butler[21], C.M. Buttar[53], J.M. Butterworth[77], W. Buttinger[27], T. Byatt[77], J. Caballero[24], S. Cabrera Urbán[167], M. Caccia[89a,89b], D. Caforio[19a,19b], O. Cakir[3a], P. Calafiura[14], G. Calderini[78], P. Calfayan[98], R. Calkins[106], L.P. Caloba[23a], R. Caloi[132a,132b], D. Calvet[33], S. Calvet[33], R. Camacho Toro[33], A. Camard[78], P. Camarri[133a,133b], D. Cameron[117], J. Cammin[20], S. Campana[29], M. Campanelli[77], V. Canale[102a,102b], F. Canelli[30,i],

A. Canepa[159a], J. Cantero[80], L. Capasso[102a,102b], M.D.M. Capeans Garrido[29], I. Caprini[25a], M. Caprini[25a], D. Capriotti[99], M. Capua[36a,36b], R. Caputo[148], C. Caramarcu[24], R. Cardarelli[133a], T. Carli[29], G. Carlino[102a], L. Carminati[89a,89b], B. Caron[159a], S. Caron[48], C. Carpentieri[48], G.D. Carrillo Montoya[173], A.A. Carter[75], J.R. Carter[27], J. Carvalho[124a,j], D. Casadei[108], M.P. Casado[11], M. Cascella[122a,122b], C. Caso[50a,50b,*], A.M. Castaneda Hernandez[173,k], E. Castaneda-Miranda[173], V. Castillo Gimenez[167], N.F. Castro[124a], G. Cataldi[72a], F. Cataneo[29], A. Catinaccio[29], J.R. Catmore[71], A. Cattai[29], G. Cattani[133a,133b], S. Caughron[88], A. Cavallari[132a,132b], P. Cavalleri[78], D. Cavalli[89a], M. Cavalli-Sforza[11], V. Cavasinni[122a,122b], A. Cazzato[72a,72b], F. Ceradini[134a,134b], A.S. Cerqueira[23a], A. Cerri[29], L. Cerrito[75], F. Cerutti[47], S.A. Cetin[18b], A. Chafaq[135a], D. Chakraborty[106], K. Chan[2], B. Chapleau[85], J.D. Chapman[27], J.W. Chapman[87], E. Chareyre[78], D.G. Charlton[17], V. Chavda[82], S. Cheatham[71], S. Chekanov[5], S.V. Chekulaev[159a], G.A. Chelkov[64], M.A. Chelstowska[104], C. Chen[63], H. Chen[24], L. Chen[2], S. Chen[32c], X. Chen[173], A. Cheplakov[64], R. Cherkaoui El Moursli[135e], V. Chernyatin[24], E. Cheu[6], S.L. Cheung[158], L. Chevalier[136], G. Chiefari[102a,102b], L. Chikovani[51a], J.T. Childers[58a], A. Chilingarov[71], G. Chiodini[72a], M.V. Chizhov[64], G. Choudalakis[30], S. Chouridou[137], I.A. Christidi[77], A. Christov[48], D. Chromek-Burckhart[29], M.L. Chu[151], J. Chudoba[125], G. Ciapetti[132a,132b], K. Ciba[37], A.K. Ciftci[3a], R. Ciftci[3a], D. Cinca[33], V. Cindro[74], M.D. Ciobotaru[163], C. Ciocca[19a], A. Ciocio[14], M. Cirilli[87], M. Citterio[89a], M. Ciubancan[25a], A. Clark[49], P.J. Clark[45], W. Cleland[123], J.C. Clemens[83], B. Clement[55], C. Clement[146a,146b], R.W. Clifft[129], Y. Coadou[83], M. Cobal[164a,164c], A. Coccaro[50a,50b], J. Cochran[63], P. Coe[118], S. Coelli[89a], J.G. Cogan[143], J. Coggeshall[165], E. Cogneras[178], C.D. Cojocaru[28], J. Colas[4], A.P. Colijn[105], C. Collard[115], N.J. Collins[17], C. Collins-Tooth[53], J. Collot[55], G. Colon[84], R. Coluccia[72a,72b], G. Comune[88], P. Conde Muiño[124a], E. Coniavitis[118], M.C. Conidi[11], M. Consonni[104], S. Constantinescu[25a], C. Conta[119a,119b], F. Conventi[102a,l], M. Cooke[14], B.D. Cooper[77], A.M. Cooper-Sarkar[118], K. Copic[34], T. Cornelissen[50a,50b], M. Corradi[19a], F. Corriveau[85,m], A. Corso-Radu[163], A. Cortes-Gonzalez[165], G. Cortiana[99], G. Costa[89a], M.J. Costa[167], D. Costanzo[139], T. Costin[30], D. Côté[29], R. Coura Torres[23a], L. Courneyea[169], G. Cowan[76], C. Cowden[27], B.E. Cox[82], K. Cranmer[108], J. Cranshaw[5], F. Crescioli[122a,122b], M. Cristinziani[20], G. Crosetti[36a,36b], R. Crupi[72a,72b], S. Crépé-Renaudin[55], C. Cuenca Almenar[176], T. Cuhadar Donszelmann[139], S. Cuneo[50a,50b], M. Curatolo[47], C.J. Curtis[17], P. Cwetanski[60], H. Czirr[141], Z. Czyczula[117], S. D'Auria[53], M. D'Onofrio[73], A. D'Orazio[132a,132b], A. Da Rocha Gesualdi Mello[23a], C. Da Via[82], W. Dabrowski[37], A. Dahlhoff[48], T. Dai[87], C. Dallapiccola[84], C.H. Daly[138], M. Dam[35], M. Dameri[50a,50b], D.S. Damiani[137], H.O. Danielsson[29], R. Dankers[105], D. Dannheim[99], V. Dao[49], G. Darbo[50a], G.L. Darlea[25b], C. Daum[105], J.P. Dauvergne[29], W. Davey[86], T. Davidek[126], N. Davidson[86], R. Davidson[71], M. Davies[93], A.R. Davison[77], E. Dawe[142], I. Dawson[139], R.K. Daya-Ishmukhametova[39], K. De[7], R. de Asmundis[102a], S. De Castro[19a,19b], P.E. De Castro Faria Salgado[24], S. De Cecco[78], J. de Graat[98], N. De Groot[104], P. de Jong[105], C. De La Taille[115], H. De la Torre[80], L. de Mora[71], L. De Nooij[105], M. De Oliveira Branco[29], D. De Pedis[132a], P. de Saintignon[55], A. De Salvo[132a], U. De Sanctis[164a,164c], A. De Santo[149], J.B. De Vivie De Regie[115], S. Dean[77], D.V. Dedovich[64], J. Degenhardt[120], M. Dehchar[118], M. Deile[98], C. Del Papa[164a,164c], J. Del Peso[80], T. Del Prete[122a,122b], A. Dell'Acqua[29], L. Dell'Asta[89a,89b], M. Della Pietra[102a,l], D. della Volpe[102a,102b], M. Delmastro[29], P. Delpierre[83], P.A. Delsart[55], C. Deluca[148], S. Demers[176], M. Demichev[64], B. Demirkoz[11,n], J. Deng[163], W. Deng[24], S.P. Denisov[128], D. Derendarz[38], J.E. Derkaoui[135d], F. Derue[78], P. Dervan[73], K. Desch[20], E. Devetak[148], P.O. Deviveiros[158], A. Dewhurst[129], B. DeWilde[148], S. Dhaliwal[158], R. Dhullipudi[24,o], A. Di Ciaccio[133a,133b], L. Di Ciaccio[4], A. Di Girolamo[29], B. Di Girolamo[29], S. Di Luise[134a,134b], A. Di Mattia[88], B. Di Micco[29], R. Di Nardo[133a,133b], A. Di Simone[133a,133b], R. Di Sipio[19a,19b], M.A. Diaz[31a], F. Diblen[18c], E.B. Diehl[87], H. Dietl[99], J. Dietrich[48], T.A. Dietzsch[58a], S. Diglio[115], K. Dindar Yagci[39], J. Dingfelder[20], C. Dionisi[132a,132b], P. Dita[25a], S. Dita[25a], F. Dittus[29], F. Djama[83], R. Djilkibaev[108], T. Djobava[51b], M.A.B. do Vale[23a], A. Do Valle Wemans[124a,p], T.K.O. Doan[4], M. Dobbs[85], R. Dobinson[29,*], D. Dobos[42], E. Dobson[29,q], M. Dobson[163], J. Dodd[34], O.B. Dogan[18a,*], C. Doglioni[118], T. Doherty[53], Y. Doi[65,*], J. Dolejsi[126], I. Dolenc[74], Z. Dolezal[126], B.A. Dolgoshein[96,*], T. Dohmae[155], M. Donadelli[23d], M. Donega[120], J. Donini[55], J. Dopke[29], A. Doria[102a], A. Dos Anjos[173], A. Dotti[122a,122b], M.T. Dova[70], J.D. Dowell[17], A.D. Doxiadis[105], A.T. Doyle[53], Z. Drasal[126], J. Drees[175], H. Drevermann[29], M. Dris[9], J.G. Drohan[77], J. Dubbert[99], T. Dubbs[137], S. Dube[14], E. Duchovni[172], G. Duckeck[98], A. Dudarev[29], F. Dudziak[63], M. Dührssen[29], I.P. Duerdoth[82], L. Duflot[115], M-A. Dufour[85], M. Dunford[29], H. Duran Yildiz[3a], R. Duxfield[139], M. Dwuznik[37], F. Dydak[29], D. Dzahini[55], M. Düren[52], J. Ebke[98], S. Eckert[48], S. Eckweiler[81], K. Edmonds[81], C.A. Edwards[76], I. Efthymiopoulos[49], K. Egorov[60], W. Ehrenfeld[41], T. Ehrich[99], T. Eifert[29], G. Eigen[13], K. Einsweiler[14], E. Eisenhandler[75], T. Ekelof[166], M. El Kacimi[4], M. Ellert[166], S. Elles[4], F. Ellinghaus[81], K. Ellis[75], N. Ellis[29], J. Elmsheuser[98], M. Elsing[29], R. Ely[14], D. Emeliyanov[129], R. Engelmann[148], A. Engl[98], B. Epp[61], A. Eppig[87], J. Erdmann[54], A. Ereditato[16], D. Eriksson[146a], J. Ernst[1], M. Ernst[24], J. Ernwein[136], D. Errede[165], S. Errede[165], E. Ertel[81], M. Escalier[115], C. Escobar[167], X. Espinal Curull[11], B. Esposito[47], F. Etienne[83], A.I. Etienvre[136], E. Etzion[153], D. Evangelakou[54], H. Evans[60], L. Fabbri[19a,19b], C. Fabre[29], K. Facius[35], R.M. Fakhrutdinov[128], S. Falciano[132a], A.C. Falou[115], Y. Fang[173], M. Fanti[89a,89b], A. Farbin[7], A. Farilla[134a], J. Farley[148], T. Farooque[158], S.M. Farrington[118], P. Farthouat[29], D. Fasching[173], P. Fassnacht[29], D. Fassouliotis[8], B. Fatholahzadeh[158], A. Favareto[89a,89b], L. Fayard[115], S. Fazio[36a,36b], R. Febbraro[33], P. Federic[144a], O.L. Fedin[121], I. Fedorko[29], W. Fedorko[88], M. Fehling-Kaschek[48],

L. Feligioni[83], D. Fellmann[5], C.U. Felzmann[86], C. Feng[32d], E.J. Feng[30], A.B. Fenyuk[128], J. Ferencei[144b], B. Fernandes[124a,b], W. Fernando[109], S. Ferrag[53], J. Ferrando[118], V. Ferrara[41], A. Ferrari[166], P. Ferrari[105], R. Ferrari[119a], A. Ferrer[167], M.L. Ferrer[47], D. Ferrere[49], C. Ferretti[87], A. Ferretto Parodi[50a,50b], M. Fiascaris[30], F. Fiedler[81], A. Filipčič[74], A. Filippas[9], F. Filthaut[104], M. Fincke-Keeler[169], M.C.N. Fiolhais[124a,j], L. Fiorini[11], A. Firan[39], G. Fischer[41], P. Fischer[20], M.J. Fisher[109], S.M. Fisher[129], J. Flammer[29], M. Flechl[48], I. Fleck[141], J. Fleckner[81], P. Fleischmann[174], S. Fleischmann[175], T. Flick[175], L.R. Flores Castillo[173], M.J. Flowerdew[99], F. Föhlisch[58a], T. Fonseca Martin[16], J. Fopma[118], A. Formica[136], A. Forti[82], D. Fortin[159a], D. Fournier[115], A.J. Fowler[44], K. Fowler[137], H. Fox[71], P. Francavilla[122a,122b], S. Franchino[119a,119b], D. Francis[29], T. Frank[172], M. Franklin[57], S. Franz[29], M. Fraternali[119a,119b], S. Fratina[120], J. Freestone[82], S.T. French[27], R. Froeschl[29], D. Froidevaux[29], J.A. Frost[27], C. Fukunaga[156], E. Fullana Torregrosa[29], J. Fuster[167], C. Gabaldon[29], O. Gabizon[172], T. Gadfort[24], S. Gadomski[49], G. Gagliardi[50a,50b], P. Gagnon[60], C. Galea[98], E.J. Gallas[118], M.V. Gallas[29], V. Gallo[16], B.J. Gallop[129], P. Gallus[125], E. Galyaev[40], K.K. Gan[109], Y.S. Gao[143,f], A. Gaponenko[14], F. Garberson[176], M. Garcia-Sciveres[14], C. García[167], J.E. García Navarro[49], R.W. Gardner[30], N. Garelli[29], H. Garitaonandia[105], V. Garonne[29], J. Garvey[17], C. Gatti[47], G. Gaudio[119a], O. Gaumer[49], B. Gaur[141], L. Gauthier[136], P. Gauzzi[132a,132b], I.L. Gavrilenko[94], C. Gay[168], G. Gaycken[20], E.N. Gazis[9], P. Ge[32d], C.N.P. Gee[129], D.A.A. Geerts[105], Ch. Geich-Gimbel[20], K. Gellerstedt[146a,146b], C. Gemme[50a], A. Gemmell[53], M.H. Genest[98], S. Gentile[132a,132b], M. George[54], S. George[76], P. Gerlach[175], A. Gershon[153], C. Geweniger[58a], H. Ghazlane[135b], N. Ghodbane[33], B. Giacobbe[19a], S. Giagu[132a,132b], V. Giakoumopoulou[8], V. Giangiobbe[122a,122b], F. Gianotti[29], B. Gibbard[24], A. Gibson[158], S.M. Gibson[29], G.F. Gieraltowski[5], M. Gilchriese[14], D. Gillberg[28], A.R. Gillman[129], D.M. Gingrich[2,e], J. Ginzburg[153], N. Giokaris[8], M.P. Giordani[164c], R. Giordano[102a,102b], F.M. Giorgi[15], P. Giovannini[99], P.F. Giraud[136], D. Giugni[89a], P. Giusti[19a], B.K. Gjelsten[117], L.K. Gladilin[97], C. Glasman[80], J. Glatzer[48], A. Glazov[41], K.W. Glitza[175], G.L. Glonti[64], J. Godfrey[142], J. Godlewski[29], M. Goebel[41], T. Göpfert[43], C. Goeringer[81], C. Gössling[42], T. Göttfert[99], S. Goldfarb[87], D. Goldin[39], T. Golling[176], S.N. Golovnia[128], A. Gomes[124a,b], L.S. Gomez Fajardo[41], R. Gonçalo[76], J. Goncalves Pinto Firmino Da Costa[41], L. Gonella[20], S. Gonzalez[173], S. González de la Hoz[167], M.L. Gonzalez Silva[26], S. Gonzalez-Sevilla[49], J.J. Goodson[148], L. Goossens[29], P.A. Gorbounov[95], H.A. Gordon[24], I. Gorelov[103], G. Gorfine[175], B. Gorini[29], E. Gorini[72a,72b], A. Gorišek[74], E. Gornicki[38], S.A. Gorokhov[128], B. Gosdzik[41], M. Gosselink[105], M.I. Gostkin[64], M. Gouanère[4], I. Gough Eschrich[163], M. Gouighri[135a], D. Goujdami[135a], M.P. Goulette[49], A.G. Goussiou[138], C. Goy[4], I. Grabowska-Bold[163,h], V. Grabski[177], P. Grafström[29], C. Grah[175], K-J. Grahn[147], F. Grancagnolo[72a], S. Grancagnolo[15], V. Grassi[148], V. Gratchev[121], N. Grau[34], H.M. Gray[29], J.A. Gray[148], E. Graziani[134a], O.G. Grebenyuk[121], B. Green[76], D. Greenfield[129], T. Greenshaw[73], Z.D. Greenwood[24,o], I.M. Gregor[41], P. Grenier[143], E. Griesmayer[46], J. Griffiths[138], N. Grigalashvili[64], A.A. Grillo[137], S. Grinstein[11], Y.V. Grishkevich[97], J.-F. Grivaz[115], J. Grognuz[29], M. Groh[99], E. Gross[172], J. Grosse-Knetter[54], J. Groth-Jensen[79], M. Gruwe[29], K. Grybel[141], D. Guest[176], C. Guicheney[33], A. Guida[72a,72b], S. Guindon[54], H. Guler[85,r], J. Gunther[125], B. Guo[158], J. Guo[34], Y. Gusakov[64], V.N. Gushchin[128], A. Gutierrez[93], P. Gutierrez[111], N. Guttman[153], O. Gutzwiller[173], C. Guyot[136], C. Gwenlan[118], C.B. Gwilliam[73], A. Haas[143], S. Haas[29], C. Haber[14], H.K. Hadavand[39], D.R. Hadley[17], P. Haefner[99], F. Hahn[29], S. Haider[29], Z. Hajduk[38], H. Hakobyan[177], J. Haller[54], K. Hamacher[175], P. Hamal[113], A. Hamilton[49], S. Hamilton[161], L. Han[32b], K. Hanagaki[116], M. Hance[120], C. Handel[81], P. Hanke[58a], C.J. Hansen[166], J.R. Hansen[35], J.B. Hansen[35], J.D. Hansen[35], P.H. Hansen[35], P. Hansson[143], K. Hara[160], G.A. Hare[137], T. Harenberg[175], D. Harper[87], R.D. Harrington[21], O.M. Harris[138], K. Harrison[17], J. Hartert[48], F. Hartjes[105], T. Haruyama[65], A. Harvey[56], S. Hasegawa[101], Y. Hasegawa[140], S. Hassani[136], S. Haug[16], M. Hauschild[29], R. Hauser[88], M. Havranek[20], B.M. Hawes[118], C.M. Hawkes[17], R.J. Hawkings[29], D. Hawkins[163], T. Hayakawa[66], D. Hayden[76], H.S. Hayward[73], S.J. Haywood[129], M. He[32d], S.J. Head[17], V. Hedberg[79], L. Heelan[7], S. Heim[88], B. Heinemann[14], S. Heisterkamp[35], L. Helary[4], M. Heldmann[48], M. Heller[29], S. Hellman[146a,146b], C. Helsens[11], T. Hemperek[20], R.C.W. Henderson[71], M. Henke[58a], A. Henrichs[54], A.M. Henriques Correia[29], S. Henrot-Versille[115], F. Henry-Couannier[83], C. Hensel[54], T. Henß[175], Y. Hernández Jiménez[167], R. Herrberg[15], A.D. Hershenhorn[152], G. Herten[48], R. Hertenberger[98], L. Hervas[29], N.P. Hessey[105], A. Hidvegi[146a], E. Higón-Rodriguez[167], J.C. Hill[27], K.H. Hiller[41], S. Hillert[20], S.J. Hillier[17], I. Hinchliffe[14], E. Hines[120], M. Hirose[116], F. Hirsch[42], D. Hirschbuehl[175], J. Hobbs[148], N. Hod[153], M.C. Hodgkinson[139], P. Hodgson[139], A. Hoecker[29], M.R. Hoeferkamp[103], J. Hoffman[39], D. Hoffmann[83], M. Hohlfeld[81], M. Holder[141], A. Holmes[118], S.O. Holmgren[146a], T. Holy[127], J.L. Holzbauer[88], Y. Homma[66], L. Hooft van Huysduynen[108], T. Horazdovsky[127], C. Horn[143], S. Horner[48], K. Horton[118], J-Y. Hostachy[55], T. Hott[99], S. Hou[151], A. Hoummada[135a], J. Howarth[82], I. Hristova[15], J. Hrivnac[115], I. Hruska[125], T. Hryn'ova[4], P.J. Hsu[176], S.-C. Hsu[14], G.S. Huang[111], Z. Hubacek[127], F. Hubaut[83], F. Huegging[20], T.B. Huffman[118], E.W. Hughes[34], G. Hughes[71], M. Huhtinen[29], M. Hurwitz[14], U. Husemann[41], N. Huseynov[64,s], J. Huston[88], J. Huth[57], G. Iacobucci[102a], G. Iakovidis[9], M. Ibbotson[82], I. Ibragimov[141], R. Ichimiya[66], L. Iconomidou-Fayard[115], J. Idarraga[115], M. Idzik[37], P. Iengo[102a], O. Igonkina[105], Y. Ikegami[65], M. Ikeno[65], Y. Ilchenko[39], D. Iliadis[154], D. Imbault[78], M. Imhaeuser[175], T. Ince[20], J. Inigo-Golfin[29], P. Ioannou[8], M. Iodice[134a], G. Ionescu[4], A. Irles Quiles[167], K. Ishii[65], A. Ishikawa[66], M. Ishino[65], R. Ishmukhametov[39],

C. Issever[118], S. Istin[18a], Y. Itoh[101], A.V. Ivashin[128], W. Iwanski[38], H. Iwasaki[65], J.M. Izen[40], V. Izzo[102a], B. Jackson[120], J.N. Jackson[73], P. Jackson[143], M.R. Jaekel[29], V. Jain[60], K. Jakobs[48], S. Jakobsen[35], J. Jakubek[127], D.K. Jana[111], E. Jankowski[158], E. Jansen[77], A. Jantsch[99], M. Janus[20], G. Jarlskog[79], L. Jeanty[57], I. Jen-La Plante[30], P. Jenni[29], A. Jeremie[4], P. Jež[35], S. Jézéquel[4], M.K. Jha[19a], H. Ji[173], W. Ji[81], J. Jia[148], Y. Jiang[32b], M. Jimenez Belenguer[41], S. Jin[32a], O. Jinnouchi[157], M.D. Joergensen[35], D. Joffe[39], L.G. Johansen[13], M. Johansen[146a,146b], K.E. Johansson[146a], P. Johansson[139], S. Johnert[41], K.A. Johns[6], K. Jon-And[146a,146b], G. Jones[82], R.W.L. Jones[71], T.J. Jones[73], C. Joram[29], P.M. Jorge[124a], J. Joseph[14], X. Ju[130], V. Juranek[125], P. Jussel[61], S. Kabana[16], M. Kaci[167], A. Kaczmarska[38], P. Kadlecik[35], M. Kado[115], H. Kagan[109], M. Kagan[57], S. Kaiser[99], E. Kajomovitz[152], S. Kalinin[175], L.V. Kalinovskaya[64], S. Kama[39], N. Kanaya[155], M. Kaneda[155], T. Kanno[157], V.A. Kantserov[96], J. Kanzaki[65], B. Kaplan[176], A. Kapliy[30], J. Kaplon[29], D. Kar[43], M. Karagounis[20], M. Karagoz[118], M. Karnevskiy[41], K. Karr[5], V. Kartvelishvili[71], A.N. Karyukhin[128], L. Kashif[173], A. Kasmi[39], R.D. Kass[109], A. Kastanas[13], M. Kataoka[4], Y. Kataoka[155], E. Katsoufis[9], J. Katzy[41], V. Kaushik[6], K. Kawagoe[66], T. Kawamoto[155], G. Kawamura[81], M.S. Kayl[105], V.A. Kazanin[107], M.Y. Kazarinov[64], S.I. Kazi[86], J.R. Keates[82], R. Keeler[169], R. Kehoe[39], M. Keil[54], G.D. Kekelidze[64], M. Kelly[82], J. Kennedy[98], C.J. Kenney[143], M. Kenyon[53], O. Kepka[125], N. Kerschen[29], B.P. Kerševan[74], S. Kersten[175], K. Kessoku[155], C. Ketterer[48], F. Khalil-zada[10], H. Khandanyan[165], A. Khanov[112], D. Kharchenko[64], A. Khodinov[96], A. Khomich[58a], T.J. Khoo[27], G. Khoriauli[20], V. Khovanskiy[95], E. Khramov[64], J. Khubua[51b], G. Kilvington[76], H. Kim[7], M.S. Kim[2], P.C. Kim[143], S.H. Kim[160], N. Kimura[171], O. Kind[15], B.T. King[73], M. King[66], R.S.B. King[118], J. Kirk[129], G.P. Kirsch[118], L.E. Kirsch[22], A.E. Kiryunin[99], D. Kisielewska[37], T. Kittelmann[123], A.M. Kiver[128], H. Kiyamura[66], E. Kladiva[144b], J. Klaiber-Lodewigs[42], M. Klein[73], U. Klein[73], K. Kleinknecht[81], M. Klemetti[85], A. Klier[172], A. Klimentov[24], R. Klingenberg[42], E.B. Klinkby[35], T. Klioutchnikova[29], P.F. Klok[104], S. Klous[105], E.-E. Kluge[58a], T. Kluge[73], P. Kluit[105], S. Kluth[99], N.S. Knecht[158], E. Kneringer[61], E.B.F.G. Knoops[83], A. Knue[54], B.R. Ko[44], T. Kobayashi[155], M. Kobel[43], B. Koblitz[29], M. Kocian[143], A. Kocnar[113], P. Kodys[126], K. Köneke[29], A.C. König[104], S. Koenig[81], S. König[48], L. Köpke[81], F. Koetsveld[104], P. Koevesarki[20], T. Koffas[29], E. Koffeman[105], F. Kohn[54], Z. Kohout[127], T. Kohriki[65], T. Koi[143], G.M. Kolachev[107], H. Kolanoski[15], V. Kolesnikov[64], I. Koletsou[89a], J. Koll[88], D. Kollar[29], M. Kollefrath[48], S.D. Kolya[82], A.A. Komar[94], J.R. Komaragiri[142], T. Kondo[65], T. Kono[41,t], A.I. Kononov[48], R. Konoplich[108,u], N. Konstantinidis[77], A. Kootz[175], S. Koperny[37], S.V. Kopikov[128], K. Korcyl[38], K. Kordas[154], A. Korn[14], A. Korol[107], I. Korolkov[11], E.V. Korolkova[139], V.A. Korotkov[128], O. Kortner[99], S. Kortner[99], V.V. Kostyukhin[20], S. Kotov[99], V.M. Kotov[64], C. Kourkoumelis[8], V. Kouskoura[154], A. Koutsman[105], R. Kowalewski[169], H. Kowalski[41], T.Z. Kowalski[37], W. Kozanecki[136], A.S. Kozhin[128], V. Kral[127], V.A. Kramarenko[97], G. Kramberger[74], O. Krasel[42], M.W. Krasny[78], A. Krasznahorkay[108], J. Kraus[88], A. Kreisel[153], F. Krejci[127], J. Kretzschmar[73], N. Krieger[54], P. Krieger[158], K. Kroeninger[54], H. Kroha[99], J. Kroll[120], J. Kroseberg[20], J. Krstic[12a], U. Kruchonak[64], H. Krüger[20], Z.V. Krumshteyn[64], A. Kruth[20], T. Kubota[155], S. Kuehn[48], A. Kugel[58c], T. Kuhl[175], D. Kuhn[61], V. Kukhtin[64], Y. Kulchitsky[90], S. Kuleshov[31b], C. Kummer[98], M. Kuna[78], N. Kundu[118], J. Kunkle[120], A. Kupco[125], H. Kurashige[66], M. Kurata[160], Y.A. Kurochkin[90], V. Kus[125], W. Kuykendall[138], M. Kuze[157], P. Kuzhir[91], O. Kvasnicka[125], J. Kvita[29], R. Kwee[15], A. La Rosa[29], L. La Rotonda[36a,36b], L. Labarga[80], J. Labbe[4], S. Lablak[135a], C. Lacasta[167], F. Lacava[132a,132b], H. Lacker[15], D. Lacour[78], V.R. Lacuesta[167], E. Ladygin[64], R. Lafaye[4], B. Laforge[78], T. Lagouri[80], S. Lai[48], E. Laisne[55], M. Lamanna[29], C.L. Lampen[6], W. Lampl[6], E. Lancon[136], U. Landgraf[48], M.P.J. Landon[75], H. Landsman[152], J.L. Lane[82], C. Lange[41], A.J. Lankford[163], F. Lanni[24], K. Lantzsch[175], A. Lanza[119a], V.V. Lapin[128,*], S. Laplace[78], C. Lapoire[20], J.F. Laporte[136], T. Lari[89a], A. Larner[118], M. Lassnig[29], W. Lau[118], P. Laurelli[47], A. Lavorato[118], W. Lavrijsen[14], P. Laycock[73], A. Lazzaro[89a,89b], O. Le Dortz[78], E. Le Guirriec[83], C. Le Maner[158], E. Le Menedeu[136], M. Leahu[29], A. Lebedev[63], T. LeCompte[5], F. Ledroit-Guillon[55], H. Lee[105], J.S.H. Lee[150], S.C. Lee[151], L. Lee[176], M. Lefebvre[169], M. Legendre[136], B.C. LeGeyt[120], F. Legger[98], C. Leggett[14], M. Lehmacher[20], G. Lehmann Miotto[29], X. Lei[6], M.A.L. Leite[23d], R. Leitner[126], D. Lellouch[172], V. Lendermann[58a], K.J.C. Leney[145b], T. Lenz[175], G. Lenzen[175], B. Lenzi[136], K. Leonhardt[43], S. Leontsinis[9], C. Leroy[93], J-R. Lessard[169], J. Lesser[146a], C.G. Lester[27], A. Leung Fook Cheong[173], J. Levêque[4], D. Levin[87], L.J. Levinson[172], M. Lewandowska[21], G.H. Lewis[108], M. Leyton[15], B. Li[83], H. Li[173,v], S. Li[32b,d], X. Li[87], Z. Liang[39], Z. Liang[118,w], B. Liberti[133a], P. Lichard[29], M. Lichtnecker[98], K. Lie[165], W. Liebig[13], R. Lifshitz[152], C. Limbach[20], A. Limosani[86], M. Limper[62], S.C. Lin[151,x], F. Linde[105], J.T. Linnemann[88], E. Lipeles[120], L. Lipinsky[125], A. Lipniacka[13], T.M. Liss[165], D. Lissauer[24], A. Lister[49], A.M. Litke[137], C. Liu[28], D. Liu[151,v], H. Liu[87], J.B. Liu[87], M. Liu[32b], S. Liu[2], Y. Liu[32b], M. Livan[119a,119b], S.S.A. Livermore[118], A. Lleres[55], S.L. Lloyd[75], E. Lobodzinska[41], P. Loch[6], W.S. Lockman[137], S. Lockwitz[176], T. Loddenkoetter[20], F.K. Loebinger[82], A. Loginov[176], C.W. Loh[168], T. Lohse[15], K. Lohwasser[48], M. Lokajicek[125], V.P. Lombardo[89a], R.E. Long[71], L. Lopes[124a,b], D. Lopez Mateos[34,y], M. Losada[162], P. Loscutoff[14], F. Lo Sterzo[132a,132b], M.J. Losty[159a], X. Lou[40], A. Lounis[115], K.F. Loureiro[162], J. Love[21], P.A. Love[71], A.J. Lowe[143,f], F. Lu[32a], J. Lu[2], L. Lu[39], H.J. Lubatti[138], C. Luci[132a,132b], A. Lucotte[55], A. Ludwig[43], D. Ludwig[41], I. Ludwig[48], J. Ludwig[48], F. Luehring[60], G. Luijckx[105], D. Lumb[48], L. Luminari[132a], E. Lund[117], B. Lund-Jensen[147], B. Lundberg[79], J. Lundberg[146a,146b], J. Lundquist[35], M. Lungwitz[81], A. Lupi[122a,122b], D. Lynn[24], J. Lys[14], E. Lytken[79], H. Ma[24], L.L. Ma[173], J.A. Macana Goia[93], G. Maccarrone[47], A. Macchiolo[99], B. Maček[74], J. Machado Miguens[124a], R. Mackeprang[35], R.J. Madaras[14], W.F. Mader[43], R. Maenner[58c], T. Maeno[24], P. Mättig[175], S. Mättig[41], P.J. Magalhaes Martins[124a,j], L. Magnoni[29], E. Magradze[51b], C.A. Magrath[104], Y. Mahalalel[153], K. Mahboubi[48], G. Mahout[17], C. Maiani[132a,132b], C. Maidantchik[23a], A. Maio[124a,b], S. Majewski[24], Y. Makida[65], N. Makovec[115], P. Mal[6], Pa. Malecki[38], P. Malecki[38], V.P. Maleev[121], F. Malek[55], U. Mallik[62], D. Malon[5], S. Maltezos[9], V. Malyshev[107], S. Malyukov[29], R. Mameghani[98], J. Mamuzic[12b], A. Manabe[65], L. Mandelli[89a], I. Mandić[74], R. Mandrysch[15], J. Maneira[124a], P.S. Mangeard[88], A. Mann[54], P.M. Manning[137], A. Manousakis-Katsikakis[8], B. Mansoulie[136], A. Mapelli[29], L. Mapelli[29], L. March[80], J.F. Marchand[29], F. Marchese[133a,133b], M. Marchesotti[29], G. Marchiori[78], M. Marcisovsky[125], A. Marin[21,*], C.P. Marino[60], F. Marroquim[23a], Z. Marshall[29], F.K. Martens[158], S. Marti-Garcia[167], A.J. Martin[75], B. Martin[29], B. Martin[88], F.F. Martin[120], J.P. Martin[93], T.A. Martin[17], B. Martin dit Latour[49], M. Martinez[11], V. Martinez Outschoorn[57], A.C. Martyniuk[82], M. Marx[82], F. Marzano[132a], A. Marzin[111], L. Masetti[81], T. Mashimo[155], R. Mashinistov[94], J. Masik[82], A.L. Maslennikov[107], M. Maß[42], I. Massa[19a,19b], G. Massaro[105], N. Massol[4], A. Mastroberardino[36a,36b], T. Masubuchi[155], M. Mathes[20], P. Matricon[115], H. Matsumoto[155], H. Matsunaga[155], T. Matsushita[66], C. Mattravers[118,c], S.J. Maxfield[73], D.A. Maximov[107,g], A. Mayne[139], R. Mazini[151], M. Mazur[20], M. Mazzanti[89a], E. Mazzoni[122a,122b], S.P. Mc Kee[87], A. McCarn[165], R.L. McCarthy[148], T.G. McCarthy[28], N.A. McCubbin[129], K.W. McFarlane[56], J.A. Mcfayden[139], H. McGlone[53], G. Mchedlidze[51b], T. Mclaughlan[17], S.J. McMahon[129], R.A. McPherson[169,m], A. Meade[84], J. Mechnich[105], M. Mechtel[175], M. Medinnis[41], R. Meera-Lebbai[111], T. Meguro[116], R. Mehdiyev[93], S. Mehlhase[35], A. Mehta[73], K. Meier[58a], J. Meinhardt[48], B. Meirose[79], C. Melachrinos[30], B.R. Mellado Garcia[173], L. Mendoza Navas[162], Z. Meng[151,v], A. Mengarelli[19a,19b], S. Menke[99], E. Meoni[11], K.M. Mercurio[57], P. Mermod[118], L. Merola[102a,102b], C. Meroni[89a], F.S. Merritt[30], A. Messina[29,z], J. Metcalfe[103], A.S. Mete[63], S. Meuser[20], C. Meyer[81], J-P. Meyer[136], J. Meyer[174], J. Meyer[54], T.C. Meyer[29], W.T. Meyer[63], J. Miao[32d], S. Michal[29], L. Micu[25a], R.P. Middleton[129], P. Miele[29], S. Migas[73], L. Mijović[41], G. Mikenberg[172], M. Mikestikova[125], B. Mikulec[49], M. Mikuž[74], D.W. Miller[143], R.J. Miller[88], W.J. Mills[168], C. Mills[57], A. Milov[172], D.A. Milstead[146a,146b], D. Milstein[172], A.A. Minaenko[128], M. Miñano Moya[167], I.A. Minashvili[64], A.I. Mincer[108], B. Mindur[37], M. Mineev[64], Y. Ming[130], L.M. Mir[11], G. Mirabelli[132a], S. Misawa[24], A. Misiejuk[76], J. Mitrevski[137], V.A. Mitsou[167], S. Mitsui[65], P.S. Miyagawa[82], K. Miyazaki[66], J.U. Mjörnmark[79], T. Moa[146a,146b], S. Moed[57], V. Moeller[27], K. Mönig[41], N. Möser[20], S. Mohapatra[148], B. Mohn[13], W. Mohr[48], A.M. Moisseev[128,*], R. Moles-Valls[167], J. Molina-Perez[29], L. Moneta[49], J. Monk[77], E. Monnier[83], S. Montesano[89a,89b], F. Monticelli[70], S. Monzani[19a,19b], R.W. Moore[2], G.F. Moorhead[86], C. Mora Herrera[49], A. Moraes[53], A. Morais[124a,b], N. Morange[136], J. Morel[54], G. Morello[36a,36b], D. Moreno[81], M. Moreno Llácer[167], P. Morettini[50a], M. Morii[57], J. Morin[75], Y. Morita[65], A.K. Morley[29], G. Mornacchi[29], MC Morone[49], J.D. Morris[75], H.G. Moser[99], M. Mosidze[51b], J. Moss[109], R. Mount[143], E. Mountricha[9], S.V. Mouraviev[94], E.J.W. Moyse[84], M. Mudrinic[12b], F. Mueller[58a], J. Mueller[123], K. Mueller[20], T.A. Müller[98], D. Muenstermann[29], A. Muijs[105], A. Muir[168], Y. Munwes[153], K. Murakami[65], W.J. Murray[129], I. Mussche[105], E. Musto[102a,102b], A.G. Myagkov[128], M. Myska[125], J. Nadal[11], K. Nagai[160], K. Nagano[65], Y. Nagasaka[59], A.M. Nairz[29], Y. Nakahama[115], K. Nakamura[155], I. Nakano[110], G. Nanava[20], A. Napier[161], M. Nash[77,c], N.R. Nation[21], T. Nattermann[20], T. Naumann[41], G. Navarro[162], S.K. Nderitu[85], H.A. Neal[87], E. Nebot[80], P.Yu. Nechaeva[94], A. Negri[119a,119b], G. Negri[29], S. Nektarijevic[49], A. Nelson[63], S. Nelson[143], T.K. Nelson[143], S. Nemecek[125], P. Nemethy[108], A.A. Nepomuceno[23a], M. Nessi[29,aa], S.Y. Nesterov[121], M.S. Neubauer[165], A. Neusiedl[81], R.M. Neves[108], P. Nevski[24], P.R. Newman[17], R.B. Nickerson[118], R. Nicolaidou[136], L. Nicolas[139], G. Nicoletti[47], B. Nicquevert[29], F. Niedercorn[115], J. Nielsen[137], A. Nikiforov[15], V. Nikolaenko[128], I. Nikolic-Audit[78], K. Nikolopoulos[24], H. Nilsen[48], P. Nilsson[7], Y. Ninomiya[155], A. Nisati[132a], T. Nishiyama[66], R. Nisius[99], L. Nodulman[5], M. Nomachi[116], I. Nomidis[154], H. Nomoto[155], M. Nordberg[29], B. Nordkvist[146a,146b], P.R. Norton[129], D. Notz[41], J. Novakova[126], M. Nozaki[65], M. Nožička[41], L. Nozka[113], I.M. Nugent[159a], A.-E. Nuncio-Quiroz[20], G. Nunes Hanninger[20], T. Nunnemann[98], E. Nurse[77], T. Nyman[29], B.J. O'Brien[45], S.W. O'Neale[17,*], D.C. O'Neil[142], V. O'Shea[53], F.G. Oakham[28,e], H. Oberlack[99], J. Ocariz[78], A. Ochi[66], S. Oda[155], S. Odaka[65], J. Odier[83], H. Ogren[60], A. Oh[82], S.H. Oh[44], C.C. Ohm[146a,146b], T. Ohshima[101], T.K. Ohska[65], S. Okada[66], H. Okawa[163], Y. Okumura[101], T. Okuyama[155], A.G. Olchevski[64], M. Oliveira[124a,j], D. Oliveira Damazio[24], E. Oliver Garcia[167], D. Olivito[120], A. Olszewski[38], J. Olszowska[38], C. Omachi[66], A. Onofre[124a,ab], P.U.E. Onyisi[30], C.J. Oram[159a], G. Ordonez[104], M.J. Oreglia[30], F. Orellana[49], Y. Oren[153], D. Orestano[134a,134b], I. Orlov[107], C. Oropeza Barrera[53], R.S. Orr[158], E.O. Ortega[130], B. Osculati[50a,50b], R. Ospanov[120], C. Osuna[11], G. Otero y Garzon[26], J.P. Ottersbach[105], M. Ouchrif[135d], F. Ould-Saada[117], A. Ouraou[136], Q. Ouyang[32a], M. Owen[82], S. Owen[139], O.K. Øye[13], V.E. Ozcan[18a], N. Ozturk[7], A. Pacheco Pages[11], C. Padilla Aranda[11], E. Paganis[139], F. Paige[24], K. Pajchel[117], S. Palestini[29], D. Pallin[33], A. Palma[124a], J.D. Palmer[17], Y.B. Pan[173], E. Panagiotopoulou[9], B. Panes[31a], N. Panikashvili[87], S. Panitkin[24], D. Pantea[25a], M. Panuskova[125], V. Paolone[123], A. Paoloni[133a,133b], A. Papadelis[146a], Th.D. Papadopoulou[9], A. Paramonov[5], W. Park[24,ac], M.A. Parker[27], F. Parodi[50a,50b], J.A. Parsons[34], U. Parzefall[48], E. Pasqualucci[132a], A. Passeri[134a], F. Pastore[134a,134b], Fr. Pastore[29], G. Pásztor[49,ad], S. Pataraia[173], N. Patel[150], J.R. Pater[82], S. Patricelli[102a,102b], T. Pauly[29], M. Pecsy[144a], M.I. Pedraza

Morales[173], S.V. Peleganchuk[107], H. Peng[173], R. Pengo[29], A. Penson[34], J. Penwell[60], M. Perantoni[23a], K. Perez[34,y], T. Perez Cavalcanti[41], E. Perez Codina[11], M.T. Pérez García-Estañ[167], V. Perez Reale[34], I. Peric[20], L. Perini[89a,89b], H. Pernegger[29], R. Perrino[72a], P. Perrodo[4], S. Persembe[3a], A. Perus[115], V.D. Peshekhonov[64], O. Peters[105], B.A. Petersen[29], J. Petersen[29], T.C. Petersen[35], E. Petit[83], A. Petridis[154], C. Petridou[154], E. Petrolo[132a], F. Petrucci[134a,134b], D. Petschull[41], M. Petteni[142], R. Pezoa[31b], B. Pfeifer[48], A. Phan[86], A.W. Phillips[27], P.W. Phillips[129], G. Piacquadio[29], E. Piccaro[75], M. Piccinini[19a,19b], A. Pickford[53], S.M. Piec[41], R. Piegaia[26], J.E. Pilcher[30], A.D. Pilkington[82], J. Pina[124a,b], M. Pinamonti[164a,164c], A. Pinder[118], J.L. Pinfold[2], B. Pinto[124a,b], O. Pirotte[29], C. Pizio[89a,89b], R. Placakyte[41], M. Plamondon[169], W.G. Plano[82], M.-A. Pleier[24], A. Poblaguev[24], S. Poddar[58a], F. Podlyski[33], L. Poggioli[115], T. Poghosyan[20], M. Pohl[49], F. Polci[55], G. Polesello[119a], A. Policicchio[138], A. Polini[19a], J. Poll[75], V. Polychronakos[24], D.M. Pomarede[136], D. Pomeroy[22], K. Pommès[29], L. Pontecorvo[132a], B.G. Pope[88], G.A. Popeneciu[25a], D.S. Popovic[12a], A. Poppleton[29], X. Portell Bueso[29], R. Porter[163], G.E. Pospelov[99], S. Pospisil[127], M. Potekhin[24], I.N. Potrap[99], C.J. Potter[149], C.T. Potter[114], K.P. Potter[82], G. Poulard[29], J. Poveda[173], R. Prabhu[77], P. Pralavorio[83], S. Prasad[57], R. Pravahan[7], S. Prell[63], K. Pretzl[16], L. Pribyl[29], D. Price[60], L.E. Price[5], P.M. Prichard[73], D. Prieur[123], M. Primavera[72a], K. Prokofiev[108], F. Prokoshin[31b], S. Protopopescu[24], J. Proudfoot[5], X. Prudent[43], H. Przysiezniak[4], S. Psoroulas[20], E. Ptacek[114], J. Purdham[87], M. Purohit[24,ac], P. Puzo[115], Y. Pylypchenko[117], J. Qian[87], W. Qian[129], Z. Qin[41], A. Quadt[54], D.R. Quarrie[14], W.B. Quayle[173], F. Quinonez[31a], M. Raas[104], V. Radeka[24], V. Radescu[58b], B. Radics[20], T. Rador[18a], F. Ragusa[89a,89b], G. Rahal[178], A.M. Rahimi[109], D. Rahm[24], S. Rajagopalan[24], S. Rajek[42], M. Rammensee[48], M. Rammes[141], M. Ramstedt[146a,146b], K. Randrianarivony[28], F. Rauscher[98], E. Rauter[99], M. Raymond[29], A.L. Read[117], D.M. Rebuzzi[119a,119b], A. Redelbach[174], G. Redlinger[24], R. Reece[120], K. Reeves[40], E. Reinherz-Aronis[153], A. Reinsch[114], I. Reisinger[42], D. Reljic[12a], C. Rembser[29], Z.L. Ren[151], A. Renaud[115], P. Renkel[39], B. Rensch[35], S. Rescia[24], M. Rescigno[132a], S. Resconi[89a], B. Resende[136], P. Reznicek[98], R. Rezvani[158], A. Richards[77], R. Richter[99], E. Richter-Was[38,ae], M. Ridel[78], S. Rieke[81], M. Rijpstra[105], M. Rijssenbeek[148], A. Rimoldi[119a,119b], L. Rinaldi[19a], R.R. Rios[39], I. Riu[11], G. Rivoltella[89a,89b], F. Rizatdinova[112], E. Rizvi[75], S.H. Robertson[85,m], A. Robichaud-Veronneau[49], D. Robinson[27], J.E.M. Robinson[77], M. Robinson[114], A. Robson[53], J.G. Rocha de Lima[106], C. Roda[122a,122b], D. Roda Dos Santos[29], S. Rodier[80], D. Rodriguez[162], Y. Rodriguez Garcia[15], A. Roe[54], S. Roe[29], O. Røhne[117], V. Rojo[1], S. Rolli[161], A. Romaniouk[96], G. Romeo[26], D. Romero Maltrana[31a], L. Roos[78], E. Ros[167], S. Rosati[132a], M. Rose[76], G.A. Rosenbaum[158], E.I. Rosenberg[63], P.L. Rosendahl[13], L. Rosselet[49], V. Rossetti[11], E. Rossi[102a,102b], L.P. Rossi[50a], L. Rossi[89a,89b], M. Rotaru[25a], I. Roth[172], J. Rothberg[138], I. Rottländer[20], D. Rousseau[115], C.R. Royon[136], A. Rozanov[83], Y. Rozen[152], X. Ruan[115,af], I. Rubinskiy[41], B. Ruckert[98], N. Ruckstuhl[105], V.I. Rud[97], G. Rudolph[61], F. Rühr[6], F. Ruggieri[134a,134b], A. Ruiz-Martinez[63], E. Rulikowska-Zarebska[37], V. Rumiantsev[91,*], L. Rumyantsev[64], K. Runge[48], O. Runolfsson[20], Z. Rurikova[48], N.A. Rusakovich[64], D.R. Rust[60], J.P. Rutherfoord[6], C. Ruwiedel[14], P. Ruzicka[125], Y.F. Ryabov[121], P. Ryan[88], M. Rybar[126], G. Rybkin[115], N.C. Ryder[118], S. Rzaeva[10], A.F. Saavedra[150], I. Sadeh[153], H.F-W. Sadrozinski[137], R. Sadykov[64], F. Safai Tehrani[132a], H. Sakamoto[155], G. Salamanna[105], A. Salamon[133a], M. Saleem[111], D. Salihagic[99], A. Salnikov[143], J. Salt[167], B.M. Salvachua Ferrando[5], D. Salvatore[36a,36b], F. Salvatore[149], A. Salvucci[104], A. Salzburger[29], D. Sampsonidis[154], B.H. Samset[117], H. Sandaker[13], H.G. Sander[81], M.P. Sanders[98], M. Sandhoff[175], P. Sandhu[158], T. Sandoval[27], R. Sandstroem[105], S. Sandvoss[175], D.P.C. Sankey[129], A. Sansoni[47], C. Santamarina Rios[85], C. Santoni[33], R. Santonico[133a,133b], H. Santos[124a], J.G. Saraiva[124a], T. Sarangi[173], E. Sarkisyan-Grinbaum[7], F. Sarri[122a,122b], G. Sartisohn[175], O. Sasaki[65], N. Sasao[67], I. Satsounkevitch[90], G. Sauvage[4], J.B. Sauvan[115], P. Savard[158,e], A.Y. Savine[6], V. Savinov[123], D.O. Savu[29], P. Savva[9], L. Sawyer[24,o], D.H. Saxon[53], C. Sbarra[19a], A. Sbrizzi[19a,19b], O. Scallon[93], D.A. Scannicchio[163], J. Schaarschmidt[115], P. Schacht[99], U. Schäfer[81], S. Schaepe[20], S. Schaetzel[58b], A.C. Schaffer[115], D. Schaile[98], R.D. Schamberger[148], A.G. Schamov[107], V. Scharf[58a], V.A. Schegelsky[121], D. Scheirich[87], M. Schernau[163], M.I. Scherzer[14], C. Schiavi[50a,50b], J. Schieck[98], M. Schioppa[36a,36b], S. Schlenker[29], E. Schmidt[48], M.P. Schmidt[176,*], K. Schmieden[20], C. Schmitt[81], M. Schmitz[20], A. Schöning[58b], M. Schott[29], D. Schouten[142], J. Schovancova[125], M. Schram[85], C. Schroeder[81], N. Schroer[58c], S. Schuh[29], J. Schultes[175], H.-C. Schultz-Coulon[58a], H. Schulz[15], J.W. Schumacher[20], M. Schumacher[48], B.A. Schumm[137], Ph. Schune[136], C. Schwanenberger[82], A. Schwartzman[143], Ph. Schwemling[78], R. Schwienhorst[88], R. Schwierz[43], J. Schwindling[136], W.G. Scott[129], J. Searcy[114], E. Sedykh[121], S.C. Seidel[103], A. Seiden[137], F. Seifert[43], J.M. Seixas[23a], G. Sekhniaidze[102a], D.M. Seliverstov[121], B. Sellden[146a], G. Sellers[73], M. Seman[144b], N. Semprini-Cesari[19a,19b], C. Serfon[98], L. Serin[115], R. Seuster[99], H. Severini[111], A. Sfyrla[29], E. Shabalina[54], M. Shamim[114], L.Y. Shan[32a], J.T. Shank[21], Q.T. Shao[86], M. Shapiro[14], P.B. Shatalov[95], C. Shaw[53], K. Shaw[164a,164c], D. Sherman[176], P. Sherwood[77], A. Shibata[108], S. Shimizu[29], M. Shimojima[100], T. Shin[56], A. Shmeleva[94], M.J. Shochet[30], D. Short[118], M.A. Shupe[6], P. Sicho[125], A. Sidoti[132a], A. Siebel[175], F. Siegert[48], J. Siegrist[14], Dj. Sijacki[12a], O. Silbert[172], J. Silva[124a,b], Y. Silver[153], D. Silverstein[143], S.B. Silverstein[146a], V. Simak[127], O. Simard[136], Lj. Simic[12a], S. Simion[115], B. Simmons[77], M. Simonyan[35], P. Sinervo[158], N.B. Sinev[114], V. Sipica[141], G. Siragusa[81], A.N. Sisakyan[64], S.Yu. Sivoklokov[97], J. Sjölin[146a,146b], T.B. Sjursen[13], L.A. Skinnari[14], K. Skovpen[107], P. Skubic[111], M. Slater[17], T. Slavicek[127], K. Sliwa[161], T.J. Sloan[71],

V. Smakhtin[172], S.Yu. Smirnov[96], Y. Smirnov[24], L.N. Smirnova[97], O. Smirnova[79], B.C. Smith[57], D. Smith[143], K.M. Smith[53], M. Smizanska[71], K. Smolek[127], A.A. Snesarev[94], S.W. Snow[82], J. Snow[111], J. Snuverink[105], S. Snyder[24], M. Soares[124a], R. Sobie[169,m], J. Sodomka[127], A. Soffer[153], C.A. Solans[167], M. Solar[127], J. Solc[127], E.Yu. Soldatov[96], U. Soldevila[167], E. Solfaroli Camillocci[132a,132b], A.A. Solodkov[128], O.V. Solovyanov[128], J. Sondericker[24], N. Soni[2], V. Sopko[127], B. Sopko[127], M. Sorbi[89a,89b], M. Sosebee[7], A. Soukharev[107], S. Spagnolo[72a,72b], F. Spanò[34], R. Spighi[19a], G. Spigo[29], F. Spila[132a,132b], E. Spiriti[134a], R. Spiwoks[29], M. Spousta[126], T. Spreitzer[158], B. Spurlock[7], R.D. St. Denis[53], T. Stahl[141], J. Stahlman[120], R. Stamen[58a], E. Stanecka[29], R.W. Stanek[5], C. Stanescu[134a], S. Stapnes[117], E.A. Starchenko[128], J. Stark[55], P. Staroba[125], P. Starovoitov[91], A. Staude[98], P. Stavina[144a], G. Stavropoulos[14], G. Steele[53], P. Steinbach[43], P. Steinberg[24], I. Stekl[127], B. Stelzer[142], H.J. Stelzer[88], O. Stelzer-Chilton[159a], H. Stenzel[52], K. Stevenson[75], G.A. Stewart[53], J.A. Stillings[20], T. Stockmanns[20], M.C. Stockton[29], K. Stoerig[48], G. Stoicea[25a], S. Stonjek[99], P. Strachota[126], A.R. Stradling[7], A. Straessner[43], J. Strandberg[147], S. Strandberg[146a,146b], A. Strandlie[117], M. Strang[109], E. Strauss[143], M. Strauss[111], P. Strizenec[144b], R. Ströhmer[174], D.M. Strom[114], J.A. Strong[76,*], R. Stroynowski[39], J. Strube[129], B. Stugu[13], I. Stumer[24,*], J. Stupak[148], P. Sturm[175], D.A. Soh[151,w], D. Su[143], HS. Subramania[2], Y. Sugaya[116], T. Sugimoto[101], C. Suhr[106], K. Suita[66], M. Suk[126], V.V. Sulin[94], S. Sultansoy[3d], T. Sumida[29], X. Sun[55], J.E. Sundermann[48], K. Suruliz[164a,164b], G. Susinno[36a,36b], M.R. Sutton[139], Y. Suzuki[65], S. Swedish[168], I. Sykora[144a], T. Sykora[126], J. Sánchez[167], D. Ta[105], K. Tackmann[29], A. Taffard[163], R. Tafirout[159a], A. Taga[117], N. Taiblum[153], Y. Takahashi[101], H. Takai[24], R. Takashima[68], H. Takeda[66], T. Takeshita[140], M. Talby[83], A. Talyshev[107,g], M.C. Tamsett[24], J. Tanaka[155], R. Tanaka[115], S. Tanaka[131], S. Tanaka[65], K. Tani[66], N. Tannoury[83], S. Tapprogge[81], D. Tardif[158], S. Tarem[152], F. Tarrade[24], G.F. Tartarelli[89a], P. Tas[126], M. Tasevsky[125], E. Tassi[36a,36b], M. Tatarkhanov[14], Y. Tayalati[135d], C. Taylor[77], F.E. Taylor[92], G.N. Taylor[86], W. Taylor[159b], M. Teixeira Dias Castanheira[75], P. Teixeira-Dias[76], K.K. Temming[48], H. Ten Kate[29], P.K. Teng[151], S. Terada[65], K. Terashi[155], J. Terron[80], M. Terwort[41,t], M. Testa[47], R.J. Teuscher[158,m], C.M. Tevlin[82], J. Therhaag[20], T. Theveneaux-Pelzer[78], M. Thioye[176], S. Thoma[48], J.P. Thomas[17], E.N. Thompson[84], P.D. Thompson[17], P.D. Thompson[158], R.J. Thompson[82], A.S. Thompson[53], E. Thomson[120], M. Thomson[27], R.P. Thun[87], T. Tic[125], V.O. Tikhomirov[94], Y.A. Tikhonov[107,g], C.J.W.P. Timmermans[104], P. Tipton[176], F.J. Tique Aires Viegas[29], S. Tisserant[83], T. Todorov[4], S. Todorova-Nova[161], B. Toggerson[163], J. Tojo[65], S. Tokár[144a], K. Tokunaga[66], K. Tokushuku[65], K. Tollefson[88], M. Tomoto[101], L. Tompkins[14], K. Toms[103], A. Tonazzo[134a,134b], A. Tonoyan[13], C. Topfel[16], N.D. Topilin[64], I. Torchiani[29], E. Torrence[114], E. Torró Pastor[167], J. Toth[83,ad], F. Touchard[83], D.R. Tovey[139], D. Traynor[75], T. Trefzger[174], J. Treis[20], L. Tremblet[29], A. Tricoli[29], I.M. Trigger[159a], S. Trincaz-Duvoid[78], T.N. Trinh[78], M.F. Tripiana[70], W. Trischuk[158], A. Trivedi[24,ac], B. Trocmé[55], C. Troncon[89a], M. Trottier-McDonald[142], A. Trzupek[38], C. Tsarouchas[29], J.C-L. Tseng[118], M. Tsiakiris[105], P.V. Tsiareshka[90], D. Tsionou[4,ag], G. Tsipolitis[9], V. Tsiskaridze[48], E.G. Tskhadadze[51a], I.I. Tsukerman[95], V. Tsulaia[123], J.-W. Tsung[20], S. Tsuno[65], D. Tsybychev[148], A. Tua[139], J.M. Tuggle[30], M. Turala[38], D. Turecek[127], I. Turk Cakir[3e], E. Turlay[105], R. Turra[89a,89b], P.M. Tuts[34], M.S. Twomey[138], A. Tykhonov[74], M. Tylmad[146a,146b], M. Tyndel[129], D. Typaldos[17], H. Tyrvainen[29], G. Tzanakos[8], K. Uchida[20], I. Ueda[155], R. Ueno[28], M. Ugland[13], M. Uhlenbrock[20], M. Uhrmacher[54], F. Ukegawa[160], G. Unal[29], A. Undrus[24], G. Unel[163], Y. Unno[65], D. Urbaniec[34], E. Urkovsky[153], P. Urrejola[31a], G. Usai[7], M. Uslenghi[119a,119b], L. Vacavant[83], V. Vacek[127], B. Vachon[85], S. Vahsen[14], C. Valderanis[99], J. Valenta[125], P. Valente[132a], S. Valentinetti[19a,19b], S. Valkar[126], E. Valladolid Gallego[167], S. Vallecorsa[152], J.A. Valls Ferrer[167], H. van der Graaf[105], E. van der Kraaij[105], R. Van Der Leeuw[105], E. van der Poel[105], D. van der Ster[29], B. Van Eijk[105], N. van Eldik[84], P. van Gemmeren[5], I. van Vulpen[105], W. Vandelli[29], A. Vaniachine[5], P. Vankov[41], F. Vannucci[78], R. Vari[132a], E.W. Varnes[6], D. Varouchas[14], A. Vartapetian[7], K.E. Varvell[150], V.I. Vassilakopoulos[56], F. Vazeille[33], G. Vegni[89a,89b], J.J. Veillet[115], F. Veloso[124a], R. Veness[29], S. Veneziano[132a], A. Ventura[72a,72b], D. Ventura[138], M. Venturi[48], N. Venturi[16], V. Vercesi[119a], M. Verducci[138], W. Verkerke[105], J.C. Vermeulen[105], A. Vest[43], M.C. Vetterli[142,e], I. Vichou[165], T. Vickey[145b,ah], G.H.A. Viehhauser[118], S. Viel[168], M. Villa[19a,19b], E.G. Villani[129], M. Villaplana Perez[167], E. Vilucchi[47], M.G. Vincter[28], E. Vinek[29], V.B. Vinogradov[64], M. Virchaux[136,*], S. Viret[33], J. Virzi[14], A. Vitale[19a,19b], O. Vitells[172], M. Viti[41], I. Vivarelli[48], F. Vives Vaque[11], S. Vlachos[9], M. Vlasak[127], N. Vlasov[20], A. Vogel[20], P. Vokac[127], G. Volpi[47], M. Volpi[11], G. Volpini[89a], H. von der Schmitt[99], J. von Loeben[99], H. von Radziewski[48], E. von Toerne[20], V. Vorobel[126], V. Vorwerk[11], M. Vos[167], R. Voss[29], T.T. Voss[175], J.H. Vossebeld[73], A.S. Vovenko[128], N. Vranjes[12a], M. Vranjes Milosavljevic[12a], V. Vrba[125], M. Vreeswijk[105], T. Vu Anh[81], R. Vuillermet[29], I. Vukotic[115], W. Wagner[175], P. Wagner[120], H. Wahlen[175], J. Wakabayashi[101], J. Walbersloh[42], S. Walch[87], J. Walder[71], R. Walker[98], W. Walkowiak[141], R. Wall[176], P. Waller[73], C. Wang[44], H. Wang[173], J. Wang[151], J. Wang[32d], R. Wang[103], S.M. Wang[151], A. Warburton[85], C.P. Ward[27], M. Warsinsky[48], R. Wastie[118], P.M. Watkins[17], A.T. Watson[17], M.F. Watson[17], G. Watts[138], S. Watts[82], A.T. Waugh[150], B.M. Waugh[77], J. Weber[42], M. Weber[129], M.S. Weber[16], P. Weber[54], A.R. Weidberg[118], P. Weigell[99], J. Weingarten[54], C. Weiser[48], H. Wellenstein[22], P.S. Wells[29], M. Wen[47], T. Wenaus[24], S. Wendler[123], Z. Weng[151,w], T. Wengler[29], S. Wenig[29], N. Wermes[20], M. Werner[48], P. Werner[29], M. Werth[163], U. Werthenbach[141], M. Wessels[58a], K. Whalen[28], S.J. Wheeler-Ellis[163], A. White[7], M.J. White[86], S. White[24], S.R. Whitehead[118], D. Whiteson[163], D. Whittington[60], F. Wicek[115], D. Wicke[175], F.J. Wickens[129], W. Wiedenmann[173], M. Wielers[129],

P. Wienemann[20], L.A.M. Wiik-Fuchs[48], P.A. Wijeratne[77], A. Wildauer[167], M.A. Wildt[41,t], I. Wilhelm[126], H.G. Wilkens[29], J.Z. Will[98], E. Williams[34], H.H. Williams[120], W. Willis[34], S. Willocq[84], J.A. Wilson[17], M.G. Wilson[143], A. Wilson[87], I. Wingerter-Seez[4], S. Winkelmann[48], F. Winklmeier[29], M. Wittgen[143], M.W. Wolter[38], H. Wolters[124a,j], G. Wooden[118], B.K. Wosiek[38], J. Wotschack[29], M.J. Woudstra[84], K. Wraight[53], C. Wright[53], D. Wright[143], B. Wrona[73], S.L. Wu[173], X. Wu[49], Y. Wu[32b,ai], E. Wulf[34], B.M. Wynne[45], L. Xaplanteris[9], S. Xella[35], S. Xie[48], C. Xu[32b,aj], D. Xu[139], B. Yabsley[150], M. Yamada[65], A. Yamamoto[65], K. Yamamoto[63], S. Yamamoto[155], T. Yamamura[155], J. Yamaoka[44], T. Yamazaki[155], Y. Yamazaki[66], Z. Yan[21], H. Yang[87], U.K. Yang[82], Y. Yang[60], Z. Yang[146a,146b], S. Yanush[91], W-M. Yao[14], Y. Yao[14], Y. Yasu[65], G.V. Ybeles Smit[130], J. Ye[39], S. Ye[24], M. Yilmaz[3c], R. Yoosoofmiya[123], K. Yorita[171], R. Yoshida[5], C. Young[143], S. Youssef[21], D. Yu[24], J. Yu[7], J. Yu[32c,aj], L. Yuan[32a,ak], A. Yurkewicz[148], R. Zaidan[62], A.M. Zaitsev[128], Z. Zajacova[29], Yo.K. Zalite[121], L. Zanello[132a,132b], P. Zarzhitsky[39], A. Zaytsev[107], C. Zeitnitz[175], M. Zeller[176], P.F. Zema[29], A. Zemla[38], C. Zendler[20], A.V. Zenin[128], O. Zenin[128], T. Ženiš[144a], Z. Zinonos[122a,122b], S. Zenz[14], D. Zerwas[115], G. Zevi della Porta[57], Z. Zhan[32d], D. Zhang[32b,al], H. Zhang[88], J. Zhang[5], Q. Zhang[5], X. Zhang[32d], Z. Zhang[115], L. Zhao[108], T. Zhao[138], Z. Zhao[32b], A. Zhemchugov[64], J. Zhong[151,am], B. Zhou[87], N. Zhou[163], Y. Zhou[151], C.G. Zhu[32d], H. Zhu[41], Y. Zhu[173], X. Zhuang[98], V. Zhuravlov[99], D. Zieminska[60], B. Zilka[144a], R. Zimmermann[20], S. Zimmermann[20], S. Zimmermann[48], M. Ziolkowski[141], R. Zitoun[4], L. Živković[34], V.V. Zmouchko[128,*], G. Zobernig[173], A. Zoccoli[19a,19b], Y. Zolnierowski[4], A. Zsenei[29], M. zur Nedden[15], V. Zutshi[106], L. Zwalinski[29]

[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 Fisica, 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] Department of Physics, Kyushu University, Fukuoka, Japan
[70] Instituto de Física La Plata, Universidad Nacional de La Plata and CONICET, La Plata, Argentina
[71] Physics Department, Lancaster University, Lancaster, United Kingdom

[72] (a)INFN Sezione di Lecce; (b)Dipartimento di Matematica e Fisica, Università del Salento, Lecce, Italy
[73] Oliver Lodge Laboratory, University of Liverpool, Liverpool, United Kingdom
[74] Department of Physics, Jožef Stefan Institute and University of Ljubljana, Ljubljana, Slovenia
[75] School of Physics and Astronomy, Queen Mary University of London, London, United Kingdom
[76] Department of Physics, Royal Holloway University of London, Surrey, United Kingdom
[77] Department of Physics and Astronomy, University College London, London, United Kingdom
[78] Laboratoire de Physique Nucléaire et de Hautes Energies, UPMC and Université Paris-Diderot and CNRS/IN2P3, Paris, France
[79] Fysiska institutionen, Lunds universitet, Lund, Sweden
[80] Departamento de Fisica Teorica C-15, Universidad Autonoma de Madrid, Madrid, Spain
[81] Institut für Physik, Universität Mainz, Mainz, Germany
[82] School of Physics and Astronomy, University of Manchester, Manchester, United Kingdom
[83] CPPM, Aix-Marseille Université and CNRS/IN2P3, Marseille, France
[84] Department of Physics, University of Massachusetts, Amherst MA, United States of America
[85] Department of Physics, McGill University, Montreal QC, Canada
[86] School of Physics, University of Melbourne, Victoria, Australia
[87] Department of Physics, The University of Michigan, Ann Arbor MI, United States of America
[88] Department of Physics and Astronomy, Michigan State University, East Lansing MI, United States of America
[89] (a)INFN Sezione di Milano; (b)Dipartimento di Fisica, Università di Milano, Milano, Italy
[90] B.I. Stepanov Institute of Physics, National Academy of Sciences of Belarus, Minsk, Republic of Belarus
[91] National Scientific and Educational Centre for Particle and High Energy Physics, Minsk, Republic of Belarus
[92] Department of Physics, Massachusetts Institute of Technology, Cambridge MA, United States of America
[93] Group of Particle Physics, University of Montreal, Montreal QC, Canada
[94] P.N. Lebedev Institute of Physics, Academy of Sciences, Moscow, Russia
[95] Institute for Theoretical and Experimental Physics (ITEP), Moscow, Russia
[96] Moscow Engineering and Physics Institute (MEPhI), Moscow, Russia
[97] Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia
[98] Fakultät für Physik, Ludwig-Maximilians-Universität München, München, Germany
[99] Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München, Germany
[100] Nagasaki Institute of Applied Science, Nagasaki, Japan
[101] Graduate School of Science, Nagoya University, Nagoya, Japan
[102] (a)INFN Sezione di Napoli; (b)Dipartimento di Scienze Fisiche, Università di Napoli, Napoli, Italy
[103] Department of Physics and Astronomy, University of New Mexico, Albuquerque NM, United States of America
[104] Institute for Mathematics, Astrophysics and Particle Physics, Radboud University Nijmegen/Nikhef, Nijmegen, Netherlands
[105] Nikhef National Institute for Subatomic Physics and University of Amsterdam, Amsterdam, Netherlands
[106] Department of Physics, Northern Illinois University, DeKalb IL, United States of America
[107] Budker Institute of Nuclear Physics, SB RAS, Novosibirsk, Russia
[108] Department of Physics, New York University, New York NY, United States of America
[109] Ohio State University, Columbus OH, United States of America
[110] Faculty of Science, Okayama University, Okayama, Japan
[111] Homer L. Dodge Department of Physics and Astronomy, University of Oklahoma, Norman OK, United States of America
[112] Department of Physics, Oklahoma State University, Stillwater OK, United States of America
[113] Palacký University, RCPTM, Olomouc, Czech Republic
[114] Center for High Energy Physics, University of Oregon, Eugene OR, United States of America
[115] LAL, Univ. Paris-Sud and CNRS/IN2P3, Orsay, France
[116] Graduate School of Science, Osaka University, Osaka, Japan
[117] Department of Physics, University of Oslo, Oslo, Norway
[118] Department of Physics, Oxford University, Oxford, United Kingdom
[119] (a)INFN Sezione di Pavia; (b)Dipartimento di Fisica, Università di Pavia, Pavia, Italy
[120] Department of Physics, University of Pennsylvania, Philadelphia PA, United States of America
[121] Petersburg Nuclear Physics Institute, Gatchina, Russia

[122] (a) INFN Sezione di Pisa; (b) Dipartimento di Fisica E. Fermi, Università di Pisa, Pisa, Italy
[123] Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh PA, United States of America
[124] (a) Laboratorio de Instrumentacao e Fisica Experimental de Particulas - LIP, Lisboa, Portugal; (b) Departamento de Fisica Teorica y del Cosmos and CAFPE, Universidad de Granada, Granada, Spain
[125] Institute of Physics, Academy of Sciences of the Czech Republic, Praha, Czech Republic
[126] Faculty of Mathematics and Physics, Charles University in Prague, Praha, Czech Republic
[127] Czech Technical University in Prague, Praha, Czech Republic
[128] State Research Center Institute for High Energy Physics, Protvino, Russia
[129] Particle Physics Department, Rutherford Appleton Laboratory, Didcot, United Kingdom
[130] Physics Department, University of Regina, Regina SK, Canada
[131] Ritsumeikan University, Kusatsu, Shiga, Japan
[132] (a) INFN Sezione di Roma I; (b) Dipartimento di Fisica, Università La Sapienza, Roma, Italy
[133] (a) INFN Sezione di Roma Tor Vergata; (b) Dipartimento di Fisica, Università di Roma Tor Vergata, Roma, Italy
[134] (a) INFN Sezione di Roma Tre; (b) Dipartimento di Fisica, Università Roma Tre, Roma, Italy
[135] (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
[136] DSM/IRFU (Institut de Recherches sur les Lois Fondamentales de l’Univers), CEA Saclay (Commissariat a l’Energie Atomique), Gif-sur-Yvette, France
[137] Santa Cruz Institute for Particle Physics, University of California Santa Cruz, Santa Cruz CA, United States of America
[138] Department of Physics, University of Washington, Seattle WA, United States of America
[139] Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom
[140] Department of Physics, Shinshu University, Nagano, Japan
[141] Fachbereich Physik, Universität Siegen, Siegen, Germany
[142] Department of Physics, Simon Fraser University, Burnaby BC, Canada
[143] SLAC National Accelerator Laboratory, Stanford CA, United States of America
[144] (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
[145] (a) Department of Physics, University of Johannesburg, Johannesburg; (b) School of Physics, University of the Witwatersrand, Johannesburg, South Africa
[146] (a) Department of Physics, Stockholm University; (b) The Oskar Klein Centre, Stockholm, Sweden
[147] Physics Department, Royal Institute of Technology, Stockholm, Sweden
[148] Departments of Physics & Astronomy and Chemistry, Stony Brook University, Stony Brook NY, United States of America
[149] Department of Physics and Astronomy, University of Sussex, Brighton, United Kingdom
[150] School of Physics, University of Sydney, Sydney, Australia
[151] Institute of Physics, Academia Sinica, Taipei, Taiwan
[152] Department of Physics, Technion: Israel Institute of Technology, Haifa, Israel
[153] Raymond and Beverly Sackler School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel
[154] Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece
[155] International Center for Elementary Particle Physics and Department of Physics, The University of Tokyo, Tokyo, Japan
[156] Graduate School of Science and Technology, Tokyo Metropolitan University, Tokyo, Japan
[157] Department of Physics, Tokyo Institute of Technology, Tokyo, Japan
[158] Department of Physics, University of Toronto, Toronto ON, Canada
[159] (a) TRIUMF, Vancouver BC; (b) Department of Physics and Astronomy, York University, Toronto ON, Canada
[160] Institute of Pure and Applied Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8571, Japan
[161] Science and Technology Center, Tufts University, Medford MA, United States of America
[162] Centro de Investigaciones, Universidad Antonio Narino, Bogota, Colombia
[163] Department of Physics and Astronomy, University of California Irvine, Irvine CA, United States of America
[164] (a) INFN Gruppo Collegato di Udine, Udine; (b) ICTP, Trieste; (c) Dipartimento di Chimica, Fisica e Ambiente, Università di Udine, Udine, Italy
[165] Department of Physics, University of Illinois, Urbana IL, United States of America

[166] Department of Physics and Astronomy, University of Uppsala, Uppsala, Sweden
[167] 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
[168] Department of Physics, University of British Columbia, Vancouver BC, Canada
[169] Department of Physics and Astronomy, University of Victoria, Victoria BC, Canada
[170] Department of Physics, University of Warwick, Coventry, United Kingdom
[171] Waseda University, Tokyo, Japan
[172] Department of Particle Physics, The Weizmann Institute of Science, Rehovot, Israel
[173] Department of Physics, University of Wisconsin, Madison WI, United States of America
[174] Fakultät für Physik und Astronomie, Julius-Maximilians-Universität, Würzburg, Germany
[175] Fachbereich C Physik, Bergische Universität Wuppertal, Wuppertal, Germany
[176] Department of Physics, Yale University, New Haven CT, United States of America
[177] Yerevan Physics Institute, Yerevan, Armenia
[178] Domaine scientifique de la Doua, Centre de Calcul CNRS/IN2P3, Villeurbanne Cedex, France
[a] Also at Laboratorio de Instrumentacao e Fisica Experimental de Particulas - LIP, Lisboa, Portugal
[b] Also at Faculdade de Ciencias and CFNUL, Universidade de Lisboa, Lisboa, Portugal
[c] Also at Particle Physics Department, Rutherford Appleton Laboratory, Didcot, United Kingdom
[d] Also at CPPM, Aix-Marseille Université and CNRS/IN2P3, Marseille, France
[e] Also at TRIUMF, Vancouver BC, Canada
[f] Also at Department of Physics, California State University, Fresno CA, United States of America
[g] Also at Novosibirsk State University, Novosibirsk, Russia
[h] Also at AGH University of Science and Technology, Faculty of Physics and Applied Computer Science, Krakow, Poland
[i] Also at Fermilab, Batavia IL, United States of America
[j] Also at Department of Physics, University of Coimbra, Coimbra, Portugal
[k] Also at Department of Physics, UASLP, San Luis Potosi, Mexico
[l] Also at Università di Napoli Parthenope, Napoli, Italy
[m] Also at Institute of Particle Physics (IPP), Canada
[n] Also at Department of Physics, Middle East Technical University, Ankara, Turkey
[o] Also at Louisiana Tech University, Ruston LA, United States of America
[p] Also at Dep Fisica and CEFITEC of Faculdade de Ciencias e Tecnologia, Universidade Nova de Lisboa, Caparica, Portugal
[q] Also at Department of Physics and Astronomy, University College London, London, United Kingdom
[r] Also at Group of Particle Physics, University of Montreal, Montreal QC, Canada
[s] Also at Institute of Physics, Azerbaijan Academy of Sciences, Baku, Azerbaijan
[t] Also at Institut für Experimentalphysik, Universität Hamburg, Hamburg, Germany
[u] Also at Manhattan College, New York NY, United States of America
[v] Also at School of Physics, Shandong University, Shandong, China
[w] Also at School of Physics and Engineering, Sun Yat-sen University, Guanzhou, China
[x] Also at Academia Sinica Grid Computing, Institute of Physics, Academia Sinica, Taipei, Taiwan
[y] Also at California Institute of Technology, Pasadena CA, United States of America
[z] Also at Dipartimento di Fisica, Università La Sapienza, Roma, Italy
[aa] Also at Section de Physique, Université de Genève, Geneva, Switzerland
[ab] Also at Departamento de Fisica, Universidade de Minho, Braga, Portugal
[ac] Also at Department of Physics and Astronomy, University of South Carolina, Columbia SC, United States of America
[ad] Also at Institute for Particle and Nuclear Physics, Wigner Research Centre for Physics, Budapest, Hungary
[ae] Also at Institute of Physics, Jagiellonian University, Krakow, Poland
[af] Also at Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China
[ag] Also at Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom
[ah] Also at Department of Physics, Oxford University, Oxford, United Kingdom
[ai] Also at Department of Physics, The University of Michigan, Ann Arbor MI, United States of America
[aj] Also at DSM/IRFU (Institut de Recherches sur les Lois Fondamentales de l'Univers), CEA Saclay (Commissariat a l'Energie Atomique), Gif-sur-Yvette, France

[ak] Also at Laboratoire de Physique Nucléaire et de Hautes Energies, UPMC and Université Paris-Diderot and CNRS/IN2P3, Paris, France
[al] Also at Institute of Physics, Academia Sinica, Taipei, Taiwan
[am] Also at Department of Physics, Nanjing University, Jiangsu, China
[*] Deceased