

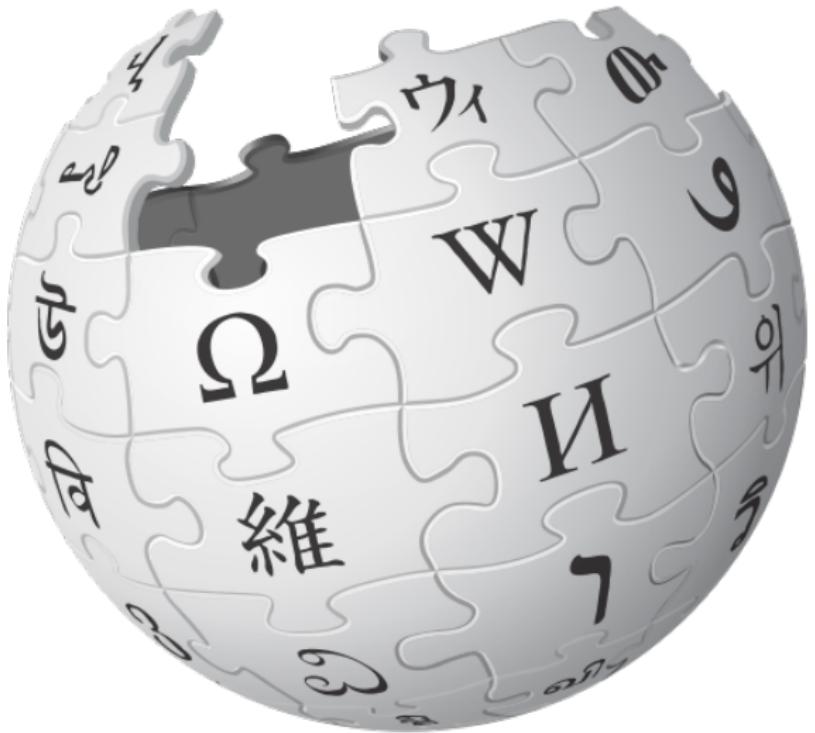
Getting Started Workshop: The Fragile Families Challenge

Matthew J. Salganik, Ian Lundberg, Sara S. McLanahan,
and we hope you

Department of Sociology, Office of Population Research, &
Center for Research on Child Wellbeing, Princeton University

June 23, 2017
Summer Institute in Computational Social Science

This research is supported by the Russell Sage Foundation. We are grateful to the members of the Board of Advisors of the Fragile Families Challenge: Jeanne Brooks-Gunn, Irwin Garfinkel, Moritz Hardt, Nicholas Lemann, Karen Levy, Sara McLanahan, Arvind Narayanan, Matthew Salganik, & Duncan Watts. Source for these slides: www.github.com/fragilefamilieschallenge.



Initial sequencing and analysis of the human genome

International Human Genome Sequencing Consortium*

** A partial list of authors appears on the opposite page. Affiliations are listed at the end of the paper.*

<http://dx.doi.org/10.1038/35057062>

Genome Sequencing Centres (Listed in order of total genomic sequence contributed, with a partial list of personnel. A full list of contributors at each centre is available as Supplementary Information.)

Whitehead Institute for Biomedical Research, Center for Genome Research: Eric S. Lander¹, Lauren M. Linton¹, Bruce Birren¹, Chad Nusbaum¹, Michael C. Zody¹, Jennifer Baldwin¹, Keri Devon¹, Ken Dewar¹, Michael Doyle¹, William FitzHugh¹, Roel Funke¹, Diane Gage¹, Katrina Harris¹, Andrew Heaford¹, John Howland¹, Lisa Kann¹, Jessica Lebocky¹, Rosie LeVine¹, Paul McEwan¹, Kevin McKernan¹, James Melkman¹, Jill P. Mesirov¹, Cher Miranda¹, William Morris¹, Jerome Naylor¹, Christine Raymond¹, Mark Roselli¹, Ralph Santos¹, Andrew Sheridan¹, Carrie Sougnez¹, Nicole Stange-Thomann¹, Nikola Stejanovic¹, Aravind Subramanian¹, & Dudley Wymant¹

The Sanger Centre: Jane Rogers², John Sulston², Rachael Ainscough², Stephan Beck², David Bentley², John Burton², Christopher Cleef², Nigel Carter², Alan Coulson², Rebecca Deadman², Panos Deloukas², Andrew Dunham², Ian Dunham², Richard Durbin², Lisa French², Darren Graffham², Simon Gregory², Tim Hubbard², Sean Humphray², Adrienne Hunt², Matthew Jones², Christine Lloyd², Amanda McMurray², Lucy Matthews², Simon Mercer², Sarah Milne², James C. Mullikin², Andrew Mungall², Robert Plumb², Mark Ross², Ratna Showker², & Sarah Sims²

Washington University Genome Sequencing Center: Robert H. Waterston³, Richard K. Wilson³, LaDeana W. Hillier³, John D. McPherson³, Marco A. Marra³, Elaine R. Mardis³, Lucinda A. Fulton³, Asil T. Chinwalla³, Kymberlie H. Pepin³, Warren R. Gish³, Stephanie L. Chissoe³, Michael C. Wendt³, Kim D. Delehaunty³, Tracie L. Miner³, Andrew Delehaunty³, Jason B. Kramer³, Lisa L. Cook³, Robert S. Fulton³, Douglas L. Johnson³, Patrick J. Minx³ & Sandra W. Clifton³

US DOE Joint Genome Institute: Trevor Hawkins⁴, Elbert Branscomb⁴, Paul Detrixie⁴, Paul Richardson⁴, Sarah Wenning⁴, Tom Slezk⁴, Norman Doggett⁴, Jan-Fang Cheng⁴, Anne Olsen⁴, Susan Lucas⁴, Christopher Ekin⁴, Edward Überbacher⁴ & Marvin Frazier⁴

Baylor College of Medicine Human Genome Sequencing Center: Richard A. Gibbs⁵, Donna M. Muzny⁵, Steven E. Scherer⁵, John B. Bouck⁵, Erica J. Sodergren⁵, Kim C. Worley⁵, Catherine M. Rives⁵, James H. Gorrell⁵, Michael L. Metzker⁵, Susan L. Nayor⁵, Raju S. Kucherlapati⁵, David L. Nelson⁵, & George M. Weinstock⁵

RIKEN Genomic Sciences Center: Yoshiyuki Sakai⁶, Asoo Fujiyama⁶, Masaharu Hattori⁶, Tetsushi Yada⁶, Atsushi Toyoda⁶, Takehiko Itoh⁶, Chiharu Kawabe⁶, Hiromi Watabayashi⁶, Yasutomo Totoku⁶ & Todd Taylor⁶

Genoscope and CNRS UMR-8030: Jean Weissenbach⁷, Roland Hellier⁷, William Saurin⁷, Francois Arigonave⁷, Philippe Brotte⁷, Thomas Brule⁷, Eric Pelletier⁷, Catherine Robert⁷ & Patrick Wincker⁷

GTC Sequencing Center: Douglas R. Smith¹¹, Lynn Doucette-Stamm¹¹, Marc Rubenfield¹¹, Keith Weinstock¹¹, Hong Mei Lee¹¹ & JoAnne Dubois¹¹

Department of Genome Analysis, Institute of Molecular

Biotechnology: André Rosenthal¹², Matthias Platzer¹², Gerald Nyakatura¹², Stefan Taudien¹² & Andreas Rump¹²

Beijing Genomics Institute/Human Genome Center: Huanning Yang¹³, Jun Yu¹³, Jian Wang¹³, Guyang Huang¹⁴ & Jun Gu¹⁵

Multimegapbase Sequencing Center, The Institute for Systems Biology: Leroy Hood¹⁶, Lee Rowen¹⁶, Anup Madan¹⁶ & Shizhen Qin¹⁶

Stanford Genome Technology Center: Ronald W. Davis¹⁷, Nancy A. Federspil¹⁷, A. Pla Abols¹⁷ & Michael J. Proctor¹⁷

Stanford Human Genome Center: Richard M. Myers¹⁸, Jeremy Schmutz¹⁸, Mark Dickson¹⁸, Jane Grimwood¹⁸ & David R. Cox¹⁸

University of Washington Genome Center: Maynard V. Olson¹⁹, Rajinder Kaul¹⁹ & Christopher Raymond¹⁹

Department of Molecular Biology, Keio University School of Medicine: Nobuyoshi Shimizu²⁰, Kazuhiko Kawasaki²⁰ & Shinsei Minoshima²⁰

University of Texas Southwestern Medical Center at Dallas: Glen A. Evans²¹, Maria Athanasiou²¹ & Roger Schultz²¹

University of Oklahoma's Advanced Center for Genome Technology: Bruce A. Roe²², Feng Chen²² & Huaiqin Pan²²

Max Planck Institute for Molecular Genetics: Juliane Ramser²³, Hans Lehrach²³ & Richard Reinhardt²³

Cold Spring Harbor Laboratory, Lita Annenberg Hazen Genome Center: W. Richard McCombie²⁴, Melissa de la Bastide²⁴ & Neillay Dedhia²⁴

GBF—German Research Centre for Biotechnology: Helmut Blöcker²⁵, Klaus Hornischek²⁵ & Gabriele Nordiek²⁵

*** Genome Analysis Group (listed in alphabetical order, also includes individuals listed under other headings):**

Richa Agrawala²⁶, L. Aravind²⁶, Jeffrey A. Bailey²⁷, Alex Bateman²⁷, Serafin Batzoglou²⁸, Ewan Birney²⁹, Peer Bork^{28,30}, Daniel G. Brown²⁷, Christopher B. Burge²⁷, Lorenzo Cerutti²⁸, Hsiao-Chuan Chen²⁶, Deanna Church²⁶, Michele Clamp²⁷, Richard R. Coply²⁸, Tobias Doers²⁸, Sean R. Eddy²⁷, Evan E. Echler²⁸, Terrence S. Furey²⁷, James Galagan²⁷, James G. R. Gilbert²⁶, Cyrus Harmon²⁷, Yoshihiko Hayashizaki²⁸, David Haussler²⁷, Henning Hermjakob²⁸, Karsten Hockamp²⁷, Wonhee Jang²⁶, L. Steven Johnson²⁸, Thomas A. Jones²⁸, Simon Kasai²⁸, Arik Kasprzyk²⁹, Scott Kennedy²⁹, W. James Kent²⁸, Paul Kiths²⁸, Eugene V. Koonin²⁸, Ian Korf²⁷, David Kulp²⁸, Doron Lancet²⁸, Todd M. Lowy²⁸, Aofe McLysaght²⁷, Tarjei Mikkelsen²⁸, John V. Moran²⁸, Nicola Mulder²⁸, Victor J. Pollara²⁸, Chris P. Ponting²⁸, Greg Schuler²⁸, Jörg Schütz²⁸, Guy Slater²⁸, Arfan A. Smit²⁸, Ella Stupka²⁸, Joseph Szustakowski²⁸, Danielle Thierry-Mieg²⁸, Jean Thierry-Mieg²⁸, Lukas Wagner²⁸, John Wallis²⁸, Raymond Wheeler²⁸, Alan Williams²⁸, Yuli I. Wolf²⁸, Kenneth H. Wolfe²⁸, Shiaw-Pyn Yang²⁸ & Ru-Fang Yeh²⁸

Scientific management: National Human Genome Research Institute, US National Institutes of Health: Francis Collins³¹, Mark S. Guyer³¹, Jane Peterson³¹, Adam Fleischman³², Kris A. Wetterstrand³²; Office of Science, US Department of Energy: Aristides Patrinos³³; The Wellcome Trust: Michael J. Morgan³⁴



Combined Measurement of the Higgs Boson Mass in pp Collisions at $\sqrt{s} = 7$ and 8 TeV with the ATLAS and CMS Experiments

G. Aad *et al.*^{*}

(ATLAS Collaboration)[†]

(CMS Collaboration)[†]

(Received 25 March 2015; published 14 May 2015)

<https://doi.org/10.1103/PhysRevLett.114.191803>

- Conference for Computing in High-Energy and Nuclear Physics (CHeP03), 2003, CHeP-2003-MOLT007, arXiv: physics/0306116.
- [28] L. Moneta, K. Belasco, K.S. Cranmer, A. Lazzaro, D. Piparo, G. Schott, W. Verkerke, and M. Wolf, The ROOSTAT Project, in Proceedings of the 13th International Workshop on Advanced Computing and Analysis Techniques in Physics Research (ACAT2010) (SISSA, 2010), Phys. Sci., ACAT2010 (2010) 057 [arXiv:1009.1003].
- [29] K. Cranmer, O. Lewis, L. Moneta, A. Shihab, and W. Verkerke (ROOT), "HISTFACTORY: A tool for creating statistical models for use with ROOFIT and ROOSTAT," Tech. Rep. CERN-OPEN-2012-016, 2012 (http://cds.cern.ch/record/1456844).
- [30] ATLAS Collaboration, Electron and photon energy calibration with the ATLAS detector using LHC Run 1 data, Eur. Phys. J. C **74**, 3071 (2014).
- [31] ATLAS Collaboration, Measurement of the muon reconstruction performance of the ATLAS detector using 2011 and 2012 LHC proton-proton collision data, Eur. Phys. J. C **74**, 3130 (2014).
- [32] CMS Collaboration, Performance of CMS muon reconstruction in pp collision events at $\sqrt{s} = 7$ TeV, J. Instrum. **7**, P10002 (2012).
- [33] CMS Collaboration, Performance of electron reconstruction and selection with the CMS detector in proton-proton collisions at $\sqrt{s} = 8$ TeV, arXiv:1502.02701 [J. Instrum. (to be published)].
- [34] CMS Collaboration, Performance of photon reconstruction and identification with the CMS detector in proton-proton collisions at $\sqrt{s} = 8$ TeV, arXiv:1502.02702.
- [35] P.D. Dauncey, M. McKenzie, N. Waddington, and G.J. Davies, Handling uncertainty in background shapes: The discrete profiling method, J. Instrum. **10**, P04015 (2015).
- [36] ALEPH, DELPHI, L3, OPAL, SLD Collaborations, LEP Electroweak Working Group, and SLD Electroweak and Heavy Flavour Groups, Precision electroweak measurements on the Z resonance, Phys. Rep. **427**, 257 (2006).
- [37] ATLAS Collaboration, Observation and measurement of Higgs boson decays to WW^* with the ATLAS detector, arXiv:1412.2641 [Phys. Rev. D (to be published)].
- [38] ATLAS Collaboration, Evidence for the Higgs-boson Yukawa coupling to tau leptons with the ATLAS detector, J. High Energy Phys. 04 (2015) 117.
- [39] CMS Collaboration, Measurement of Higgs boson production and properties in the WW decay channel with leptonic final states, J. High Energy Phys. 01 (2014) 096.
- [40] CMS Collaboration, Evidence for the 125 GeV Higgs boson decaying to a pair of τ leptons, J. High Energy Phys. 05 (2014) 104.

-
- G. Aad,^{85,f} B. Abbott,^{113,f} J. Abdallah,^{151,f} O. Abdinov,^{11,f} R. Aben,^{107,f} M. Abolins,^{30,f} O. S. AbuZeid,^{158,f}
 H. Abramowicz,^{153,f} H. Abreu,^{152,f} R. Abreu,^{30,f} Y. Aloulabi,^{146a,146b,f} B. S. Acharya,^{164a,164b,f} L. Adamczyk,^{38a,f}
 D. L. Adams,^{25,f} J. Adelman,^{108,f} S. Adomeit,^{100,f} T. Adey,^{131,f} A. A. Afzaldeh,^{34,f} T. Agathonovic-Jovin,^{13,f}
 J. A. Aguilar-Sauvage,^{125a,126a,f} S. P. Ahlen,^{22,f} F. Ahmadov,^{65,f} G. Aielli,^{135a,135b,f} H. Akersdottir,^{146a,146b,f}
 T.P.A. Åkesson,^{41,f} G. Akimoto,^{155,f} A. V. Akimov,^{96,f} G. L. Alberghi,^{20a,20b,f} J. Albert,^{109,f} S. Albrand,^{25,f}
 M. J. Alconada Verzini,^{71,f} M. Aleksić,^{30,f} I.N. Aleksandrov,^{65,f} C. Alexa,^{26a,f} G. Alexander,^{153,f} T. Alexopoulos,^{10,f}
 M. Althroop,^{153,f} G. Altimonti,^{91a,f} L. Alio,^{85,f} J. Alison,^{31,f} S. P. Alkire,^{35,f} B. M. M. Allbrooke,^{18,f} P. P. Alport,^{74,f}
 A. Aloisio,^{104a,106b,f} A. Alonso,^{36,f} F. Alonso,^{71,f} C. Alpigiani,^{76,f} A. Altheimer,^{35,f} B. Alvarez Gonzalez,^{30,f}
 D. Álvarez Piqueras,^{36,f} M. G. Alvigi,^{104a,104b,f} B. T. Amadio,^{15,f} K. Amako,^{66,f} Y. Amaral Coutinho,^{24a,f} C. Ameling,^{23,f}
 D. Amidei,^{90,f} S. P. Amor Dos Santos,^{126a,126c,f} A. Amorim,^{126a,126b,f} S. Amoroso,^{48,f} N. Amram,^{153,f} G. Amundsen,^{23,f}
 C. Anastopoulos,^{139,f} L. S. Anzu,^{49,f} N. Andari,^{30,f} T. Andeen,^{35,f} C. F. Anders,^{58b,f} G. Anders,^{30,f} J. K. Anders,^{74,f}
 K.J. Anderson,^{47,f} A. Andreazza,^{14a,b,f} V. Andrei,^{58a,f} S. Angelidakis,^{9,f} I. Angelozzi,^{107,f} J. Anger,^{44,f} A. Angerami,^{35,f}
 F. Anghinolfi,^{30,f} A. V. Anisimov,^{109,f} N. Anjos,^{12,f} A. Annovi,^{124a,124b,f} M. Antonelli,^{47,f} A. Antonov,^{98,f} J. Antos,^{140b,f}
 F. Anulli,^{132a,f} M. Aoki,^{56,f} L. Aperio Bella,^{18,f} G. Arabidez,^{90,f} Y. Araújo,^{66,f} J. P. Araújo,^{126a,f} A. T. H. Arce,^{45,f}
 F. A. Ardhu,^{71,f} J.-F. Arguin,^{95,f} S. Argyropoulos,^{42,f} M. Arik,^{104,f} A.J. Armbruster,^{30,f} O. Arnaez,^{30,f} V. Arnal,^{82,f}
 H. Arnold,^{46,f} M. Arratia,^{85,f} O. Arslan,^{21,f} A. Artamonov,^{49,f} G. Artoni,^{23,f} S. Asai,^{155,f} N. Asbah,^{42,f} A. Ashkenazi,^{153,f}
 B. Åsman,^{146a,146b,f} L. Asquith,^{149,f} K. Assamagan,^{25,f} R. Astalos,^{144a,f} M. Atkinson,^{163,f} N. B. Atlay,^{141,f} B. Auermann,^{6,f}
 K. Augsten,^{128,f} M. Auroousseau,^{145b,f} G. Avolio,^{30,f} B. Axen,^{15,f} M. K. Ayoub,^{117,f} G. Azuelos,^{95,f} M. A. Baak,^{30,f}
 E. A. Baas,^{58a,f} C. Bacci,^{134a,134b,f} H. Bachacou,^{136,f} K. Baches,^{154,f} M. Backes,^{30,f} M. Backhaus,^{30,f} E. Badescu,^{26a,f}
 P. Bagiacchi,^{148,f} P. Bagnaia,^{132a,132b,f} Y. Bai,^{23a,f} T. Bain,^{35,f} J. T. Barnes,^{131,f} O. K. Baker,^{176,f} B. Balem,^{129,f}
 T. Balest,^{148,f} F. Balli,^{84,f} E. Banza,^{29,f} S. Van Banerjea,^{175,f} A. E. Barnousha,^{175,f} H. S. Bansil,^{18,f} L. Barak,^{30,f}
 S. P. Baranov,^{96,f} E.L. Barberio,^{88,f} D. Barberis,^{84,f} M. Barbero,^{85,f} T. Barillari,^{101,f} M. Barisonzi,^{164a,164b,f}
 T. Barklow,^{143,f} N. Barklow,^{28,f} S.L. Barnes,^{84,f} B.M. Barnes,^{131,f} R. M. Barnett,^{15,f} Z. Barnowska,^{8,f} A. Baroncelli,^{134a,f}
 G. Barone,^{49,f} A. J. Barr,^{120,f} F. Barreiro,^{82,f} J. Barreiro Guimaraes da Costa,^{37,f} R. Bartoldus,^{143,f} A. E. Barton,^{72,f}

- P. Bartos,^{144a,†} A. Bassalat,^{117,‡} A. Basye,^{165,‡} R. L. Bates,^{53,‡} S. J. Batista,^{158,‡} J. R. Batley,^{28,‡} M. Battaglia,^{137,‡}
 M. Baute,^{132a,132b,‡} F. Bauer,^{116,‡} H. S. Bawa,^{145,‡} J. B. Beacham,^{112,‡} M. D. Beattie,^{72,‡} T. Beau,^{161,‡} P. H. Beauchemin,^{161,‡}
 R. Beccerelle,^{126a,126b,‡} P. Bechtle,^{21,‡} H. P. Beck,^{17,‡} K. Becker,^{120,‡} M. Becker,^{83,‡} S. Becker,^{100,‡} M. Beckingham,^{270,‡}
 C. Becot,^{117,‡} A. J. Beddall,^{92,‡} A. Beddall,^{196,‡} V. A. Bednyakov,^{65,‡} C. P. Bee,^{148,‡} L. J. Beemster,^{107,‡} T. A. Beermann,^{175,‡}
 M. Begel,^{25,‡} J. K. Behr,^{120,‡} C. Belanger-Champagne,^{87,‡} W. H. Bell,^{49,‡} G. Bella,^{153,‡} L. Bellagamba,^{20a,‡} A. Bellerive,^{29,‡}
 M. Bellomo,^{19,‡} K. Belotsky,^{9,‡} O. Beltramello,^{30,‡} O. Benary,^{153,‡} D. Benchekroun,^{100,‡} M. Bender,^{100,‡}
 K. Bendy,^{246a,146b,‡} N. Benekos,^{101,‡} Y. Benhammou,^{153,‡} E. Benhar Noccioli,^{49,‡} J. A. Benitez Garcia,^{159,‡}
 D. P. Benjamin,^{45,‡} J. R. Bensinger,^{23,‡} S. Bentvelsen,^{107,‡} L. Beresford,^{120,‡} M. Beretta,^{47,‡} D. Berge,^{107,‡}
 E. Berghea Kuutmann,^{116,‡} N. Berger,^{5,‡} F. Berghaus,^{108,‡} J. Beringer,^{15,‡} C. Bernard,^{22,‡} N. R. Bernard,^{86,‡} C. Berniu,^{110,‡}
 F. U. Berlnochler,^{21,‡} T. Berry,^{7,‡} P. Beta,^{120,‡} C. Bertella,^{83,‡} G. Bertelli,^{146a,146b,‡} F. Bertolucci,^{125a,126b,‡} C. Berutsche,^{113,‡}
 D. Berutsche,^{113,‡} M. I. Besana,^{91,‡} G. J. Besjes,^{106,‡} O. Bessidokhai Bylund,^{146a,146b,‡} N. Besson,^{30,‡}
 C. Betancourt,^{48,‡} S. Bethke,^{101,‡} A. J. Bevan,^{76,‡} W. Bhimji,^{46,‡} R. M. Bianchi,^{125,‡} L. Bianchini,^{23,‡} M. Bianco,^{30,‡}
 O. Biebel,^{101,‡} S. P. Bienniek,^{143,‡} M. Biglietti,^{134,‡} J. Bibao De Mendizábal,^{60,‡} H. Bilokon,^{67,‡} M. Bindl,^{54,‡} S. Binet,^{117,‡}
 A. Biebel,^{193,‡} C. Bini,^{132a,132b,‡} C. Black,^{150,‡} J. Blaak,^{13,‡} M. Black,^{22,‡} D. Blackburn,^{138,‡} R. E. Blair,^{6,‡}
 J.-B. Blanchard,^{136,‡} J. E. Blanco,^{77,‡} T. Blazek,^{144,‡} I. Bloch,^{42,‡} C. Blocker,^{23,‡} W. Blum,^{83,‡} U. Blumenschein,^{54,‡}
 G. J. Bobbink,^{107,‡} V. S. Bobrovnikov,^{109,‡} S. S. Bocchetta,^{81,‡} A. Bocci,^{145,‡} C. Bock,^{100,‡} M. Boehler,^{48,‡} J. A. Bogaerts,^{30,‡}
 A. G. Bogodanchikov,^{108,‡} C. Bohm,^{164,‡} V. Botvits,^{77,‡} T. Böld,^{30,‡} W. Boldea,^{26a,‡} A. S. Boldyrev,^{99,‡} M. Bombe,^{80,‡}
 M. Bona,^{95,‡} M. Boonekamp,^{130,‡} A. Borisov,^{170,‡} G. Borisov,^{72,‡} S. Borroni,^{42,‡} J. Borfeldt,^{105,‡} V. Bortolotto,^{60a-60c,‡}
 K. Bos,^{107,‡} D. Boscherini,^{20a,‡} M. Bosman,^{12,‡} J. Bourdaud,^{125,‡} J. Bouffard,^{2,‡} E. V. Bouhouva-Thacker,^{72,‡}
 D. Boumediene,^{34,‡} C. Bourdarios,^{117,‡} N. Boussoin,^{144,‡} A. Boveia,^{30,‡} J. Boyd,^{30,‡} I. R. Boyke,^{65,‡} I. Bozic,^{13,‡}
 J. Braciukin,^{11,‡} A. Brandt,^{4,‡} G. Brandt,^{54,‡} O. Brandt,^{156,‡} U. Bratzler,^{156,‡} B. Brau,^{46,‡} J. E. Brau,^{116,‡} H. M. Braun,^{173a,‡}
 S. F. Brazzale,^{164a,164b,‡} K. Brendlinger,^{122,‡} A. J. Brennan,^{88,‡} L. Brenner,^{107,‡} R. Brenner,^{166,‡} S. Bressler,^{172,‡}
 K. Bristow,^{145,‡} T. M. Bristow,^{46,‡} D. Britton,^{53,‡} D. Britzger,^{42,‡} F. M. Brochu,^{26,‡} I. Brock,^{21,‡} R. Brock,^{90,‡} J. Bronner,^{101,‡}
 G. Brooijmans,^{35,‡} T. Brooks,^{77,‡} W. K. Brooks,^{10,‡} J. Brosamer,^{15,‡} E. Brost,^{136,‡} J. Brown,^{55,‡}
 P. A. Bruckman de Renstrom,^{39,‡} D. Bruncko,^{144b,‡} R. Bruniere,^{46,‡} A. Brunni,^{26a,‡} G. Bruni,^{26a,‡} M. Bruschi,^{20a,‡}
 L. Bryngemark,^{48,‡} T. Buanes,^{14,‡} Q. Buaat,^{142,‡} P. Bucholz,^{141,‡} A. G. Buckley,^{53,‡} S. L. Buda,^{26a,‡} I. A. Budagov,^{65,‡}
 F. Buehrer,^{48,‡} L. Buggy,^{119,‡} M. K. Buggy,^{119,‡} O. Bulekov,^{48,‡} D. Bullock,^{5,‡} H. Burckhardt,^{30,‡} S. Burdin,^{53,‡}
 B. Burghgraeve,^{108,‡} S. Burke,^{131,‡} I. Burmeister,^{43,‡} E. Busato,^{34,‡} D. Büscher,^{48,‡} V. Büscher,^{93,‡} P. Bussey,^{53,‡}
 P. C. Buszello,^{164,‡} J. M. Butler,^{22,‡} A. I. Butt,^{3,‡} C. M. Buttar,^{53,‡} J. M. Butterworth,^{76,‡} P. Buttli,^{107,‡} W. Buttinger,^{28,‡}
 A. Butazu,^{53,‡} V. Buzkaykae,^{109,‡} S. Cabrera Urbán,^{107,‡} D. Caforio,^{128,‡} V. M. Cairo,^{37a,37b,‡} O. Cakir,^{46,‡} P. Calafuria,^{15,‡}
 A. Calandri,^{136,‡} G. Calderini,^{101,‡} P. Calfayan,^{100,‡} L. P. Caloba,^{24‡} D. Calver,^{34,‡} R. Camacho Toro,^{31,‡}
 S. Camarda,^{42,‡} P. Camarri,^{133a,133b,‡} D. Cameron,^{119,‡} L. M. Caminada,^{15,‡} R. Caminada Armadans,^{12,‡} S. Campana,^{8,‡}
 M. Campanelli,^{78,‡} A. Campanvere,^{148,‡} V. Canale,^{104a,104b,‡} A. Canepa,^{104,‡} M. Canete Beri,^{76,‡} J. Cantero,^{42,‡}
 R. Cantrell,^{126a,‡} T. Cao,^{40,‡} M. D. M. Capaenos Garrido,^{30,‡} I. Caprini,^{26a,‡} M. Caprini,^{26a,‡} M. Capua,^{37a,37b,‡} R. Caputo,^{83,‡}
 R. Cardarelli,^{133a,‡} T. Carli,^{30,‡} G. Carino,^{104a,‡} L. Carmatin,^{91a,91b,‡} S. Caron,^{106,‡} E. Carquin,^{32a,‡} G. D. Carrillo-Montoya,^{8,‡}
 J. R. Carter,^{28,‡} J. Carvalho,^{126a,126b,‡} D. Casader,^{78,‡} M. P. Casado,^{12,‡} M. Casolino,^{12,‡} E. Castaneda-Miranda,^{149b,‡}
 A. Castelli,^{107,‡} V. Castillo Giménez,^{107,‡} N. F. Castro,^{123,‡} P. Catastini,^{59,‡} A. Catimacco,^{30,‡} J. R. Catmore,^{119,‡}
 A. Cattai,^{30,‡} J. Cauldon,^{83,‡} V. Cavaliere,^{165,‡} M. Cavalli,^{27a,‡} M. Cavalli-Sforza,^{12,‡} V. Cavasinni,^{124a,124b,‡}
 F. Ceradini,^{134a,134b,‡} B. C. Cerio,^{45,‡} K. Cerny,^{129,‡} A. S. Cerqueira,^{24b,‡} A. Cerni,^{149,‡} L. Cerrito,^{76,‡} F. Cerutti,^{15,‡} M. Cerv,^{30,‡}
 A. Cervelli,^{27,‡} S. A. Cetin,^{136,‡} A. Chafaq,^{135a,‡} D. Chakraborty,^{108,‡} I. Chalupkova,^{128,‡} P. Chang,^{165,‡} B. Chapleau,^{87,‡}
 J. D. Chapman,^{28,‡} D. G. Charlton,^{183,‡} C. C. Chan,^{128,‡} C. A. Chavez Barajas,^{149,‡} S. Cheatham,^{132,‡} A. Chegwidden,^{90,‡}
 S. Chekanov,^{6,‡} S. V. Chekuliev,^{159a,‡} G. A. Chelkov,^{65,‡} M. A. Chelstowska,^{99,‡} C. Chen,^{64,‡} H. Chen,^{25,‡} K. Chen,^{148,‡}
 L. Chen,^{33a,‡} S. Chen,^{33c,‡} Y. Chen,^{67,‡} H. C. Cheng,^{90,‡} Y. Cheng,^{31,‡} A. Cheplakov,^{65,‡} E. Cheremushkina,^{130,‡}
 R. Cherkouai El Mousli,^{135c,‡} V. Chernyatin,^{25,‡} E. Cheu,^{7,‡} L. Chevalier,^{136,‡} V. Chiarella,^{47,‡} J. T. Childers,^{6,‡}
 G. Chiodini,^{73,‡} A. S. Chisholm,^{18,‡} R. T. Chislett,^{78,‡} A. Chitan,^{26a,‡} M. V. Chizhov,^{65,‡} K. Choi,^{41,‡} S. Chouridou,^{9,‡}
 B. K. B. Chow,^{200,‡} V. Christodoulou,^{78,‡} D. Chromek-Burckhardt,^{30,‡} M. L. Chu,^{131,‡} J. Chudoba,^{127,‡} A. J. Chujnowski,^{87,‡}
 J. J. Chwastowski,^{39,‡} L. Chytka,^{115,‡} G. Ciapetti,^{132a,132b,‡} A. Ciftci,^{46,‡} D. Cinca,^{53,‡} V. Cindro,^{75,‡} I. A. Ciocara,^{21,‡}
 A. Ciocoi,^{15,‡} Z. H. Citron,^{172,‡} M. Ciubancan,^{26a,‡} A. Clark,^{40,‡} B. L. Clark,^{37,‡} P. J. Clark,^{46,‡} R. N. Clarke,^{15,‡}
 W. Cleland,^{125,‡} C. Clement,^{146a,146b,‡} Y. Coadou,^{85,‡} M. Cobal,^{164a,164c,‡} A. Coccaro,^{138,‡} J. Cochran,^{64,‡} L. Coffey,^{23,‡}

- J. G. Cogan,^{143,t} B. Cole,^{35,t} S. Cole,^{108,t} A. P. Colijn,^{107,t} J. Collot,^{55,t} T. Colombo,^{58c,f} G. Compastella,^{101,t}
 P. Conde Muñoz,^{126a,126b,t} E. Conivatis,^{48,t} S. H. Connell,^{148b,t} L. A. Connolly,^{17,t} S. M. Consonni,^{92a,b,t} V. Consorti,^{48,t}
 S. Constantinescu,^{26a,t} C. Conta,^{123a,123b,t} G. Conti,^{30,t} F. Conventi,^{104a,t} M. Cooke,^{15,t} B. D. Cooper,^{78,t}
 A. M. Cooper-Sarkar,^{120,t} T. Cornelissen,^{175,t} M. Corradi,^{20,t} F. Corriveau,^{87,t} A. Corso-Radu,^{103,t} A. Cortes-Gonzalez,^{12,t}
 G. Cortiana,^{101,t} G. Costa,^{91a,t} M. J. Costa,^{107,t} D. Costanzo,^{139,t} D. Côte,^{8,t} G. Cottin,^{28,t} G. Cowan,^{77,t} B. E. Cox,^{84,t}
 K. Cranmer,^{110,t} G. Cree,^{29,t} S. Crépel-Renaudin,^{46,t} F. Crescioli,^{40,t} W. A. Cribbs,^{146a,146b,t} M. Crispin Ortuzar,^{120,t}
 M. Cristinziani,^{21,t} V. Croft,^{106,t} G. Crosetti,^{27a,27b,t} T. Cuhadar Donszelmann,^{139,t} J. Cummings,^{176,t} M. Curatolo,^{47,t}
 C. Cuthbert,^{150,t} H. Czaj,^{141,t} P. Czodrowski,^{3,t} S. D'Auria,^{53,t} M. D'Onofrio,^{74,t}
 M. J. Da Cunha Sargedas De Sousa,^{123a,123b,t} C. Da Via,^{84,t} W. Dabrowski,^{38a,t} A. Dafinac,^{120,t} T. Dai,^{99,t} O. Dale,^{14,t}
 F. Dallaire,^{6,t} C. Dellapiccola,^{36,t} M. Dam,^{36,t} R. J. Dandoy,^{31,t} N. P. Pang,^{48,t} A. C. Daniels,^{18,t} M. Danninger,^{166,t}
 M. Dano Hoffmann,^{136,t} V. Dav,^{48,t} G. Darbo,^{50a,t} S. Darmora,^{8,t} J. Dassoulas,^{3,t} A. Datta Gupta,^{61,t} W. Davy,^{21,t}
 C. David,^{109,t} T. Davidek,^{129,t} E. Davies,^{53,t} M. Davies,^{153,t} P. Davison,^{78,t} Y. Davygora,^{58,t} E. Dawe,^{88,t} I. Dawson,^{139,t}
 R. K. Daya-Ishumkhametova,^{96,t} K. De,^{8,t} R. De Asmundis,^{104a,t} D. De Castro,^{20a,20b,t} S. De Cecco,^{80,t} N. De Groot,^{106,t}
 P. de Jong,^{107,t} H. De la Torre,^{82,t} F. De Lorenzi,^{64,t} L. De Nooit,^{107,t} D. De Pepe,^{132a,t} A. De Salvo,^{122a,t} U. De Sanctis,^{149,t}
 A. De Santo,^{149,t} J. B. De Vivie De Regie,^{117,t} W. J. Deamey,^{149,t} R. Debbe,^{25,t} C. Debenedetti,^{137,t} D. V. Dedovich,^{65,t}
 I. Deigaard,^{107,t} J. Del Peso,^{82,t} T. Del Prete,^{124a,124b,t} D. Delgove,^{117,t} F. Delion,^{116,t} C. M. Delitschz,^{49,t} M. Deliyergiyev,^{75,t}
 A. Dell'Acqua,^{30,t} L. Dell'asta,^{22,t} M. Dello Russo,^{124a,124b,t} M. Della Pietra,^{30a,30b,t} D. della Volpe,^{49,t} M. Delmastro,^{5,t}
 P. A. Delsart,^{55,t} C. Deluca,^{107,t} D. A. DeMarco,^{158,t} S. Demers,^{176,t} M. Demichev,^{85,t} A. Demilly,^{80,t} S. P. Denisov,^{130,t}
 D. Derendza,^{39,t} J. E. Derkaoui,^{155,t} F. Derue,^{80,t} P. Dervan,^{34,t} K. Desch,^{21,t} C. Deterre,^{42,t} P. O. Deviereiros,^{30,t}
 A. Dewhurst,^{131,t} S. Dhaliwal,^{107,t} A. Di Ciaccio,^{133a,133b,t} L. Di Ciazzo,^{5,t} A. Di Domenico,^{132a,132b,t} C. Di Donato,^{104a,104b,t}
 A. Di Girolamo,^{30,t} B. Di Girolamo,^{30,t} A. Di Mattia,^{152,t} B. Di Micco,^{152,t} R. Di Nardo,^{47,t} A. Di Simone,^{48,t}
 R. Di Sipio,^{158,t} D. Di Valentino,^{29,t} C. Diaconi,^{83,t} M. Diamond,^{138,t} F. A. Dias,^{46,t} M. A. Diaz,^{32a,t} E. B. Diehl,^{99,t}
 J. Dietrich,^{16,t} S. Diglio,^{85,t} A. Dimitrijevska,^{13,t} J. Dijngfelder,^{21,t} P. Dita,^{26a,t} S. Dittus,^{20,t} F. Dittus,^{30,t} F. Djama,^{85,t}
 T. Djobava,^{51b,t} J. I. Djuvland,^{58a,t} M. A. B. do Vale,^{24c,t} D. Dobos,^{30,t} M. Dobre,^{26a,t} C. Doglioni,^{49,t} T. Dolhmae,^{155,t}
 J. Dolejši,^{129,t} Z. Doležal,^{129b,t} B. A. Dolgoshein,^{98a,t} M. Donadelli,^{24d,t} S. Donati,^{124a,124b,t} P. Dondero,^{121a,121b,t}
 J. Donini,^{34,t} J. Dopke,^{131,t} A. Doris,^{104a,t} M. T. Dova,^{71,t} A. T. Doyle,^{33,t} E. Drechsler,^{84,t} M. Dris,^{10,t} E. Dubreuil,^{34,t}
 E. Duchovn,^{172,t} G. Duckeck,^{100,t} O. A. Duda,^{20a,20b,t} D. Duda,^{175,t} A. Dularayev,^{30,t} L. Duflo,^{117,t} L. Duguid,^{77,t}
 M. Dührssen,^{30,t} M. Dunford,^{58a,t} H. Duran Yıldız,^{46,t} M. Dürren,^{52,t} A. Durgishvili,^{51b,t} D. Duschinger,^{44,t} M. Dyndal,^{38a,t}
 C. Eckardt,^{42,t} K. M. Ecker,^{201,t} R. C. Edgar,^{98,t} W. Edson,^{96,t} N. C. Edwards,^{17,t} W. Ehrenfeld,^{21,t} T. Elifert,^{30,t} G. Eigen,^{14,t}
 K. Einsweiler,^{15,t} T. Ekelof,^{166,t} M. El Kacimi,^{135,t} M. Ellert,^{166,t} S. Elles,^{8,t} F. Ellinghaus,^{83,t} A. A. Elliott,^{169,t} N. Ellis,^{30,t}
 J. Elmsheuser,^{100,t} M. Eising,^{30,t} D. Emelyanov,^{131,t} Y. Enari,^{155,t} O. C. Endner,^{33,t} M. Endo,^{118,t} R. Engelmann,^{148,t}
 J. Erdmann,^{43,t} A. Ereditato,^{175,t} G. Ernis,^{175,t} J. Ernst,^{2,t} M. Ernst,^{25,t} S. Errede,^{165,t} E. Ertel,^{83,t} M. Escalier,^{117,t} H. Esch,^{43,t}
 J. Erdmann,^{125,t} B. Esposito,^{47,t} A. I. Etienne,^{136,t} E. Etzion,^{133,t} H. Evans,^{64,t} A. Ezhilov,^{123,t} L. Fabriti,^{20a,20b,t} G. Facini,^{31,t}
 C. Escobar,^{125,t} B. Espósito,^{47,t} A. I. Etienne,^{136,t} E. Etzion,^{133,t} H. Evans,^{64,t} A. Ezhilov,^{123,t} L. Fabriti,^{20a,20b,t} G. Facini,^{31,t}
 R. M. Fakhruddinov,^{130,t} S. Falcondo,^{132,t} R. J. Falla,^{78,t} J. Fallota,^{120,t} Y. Fang,^{33,t} M. Fanti,^{91a,91b,t} A. Farbin,^{8,t}
 A. Farilla,^{134a,t} T. Farooque,^{12,t} S. Farrell,^{15,t} S. M. Farrington,^{170,t} P. Farthouat,^{30,t} F. Fassa,^{135a,t} P. Fasnacht,^{30,t}
 D. Fassouliots,^{9,t} M. Faucci Giannelli,^{73,t} A. Favaro,^{17,t} L. Fayard,^{117,t} P. Federic,^{144a,t} O. L. Fedin,^{123a,t}
 W. Fedorko,^{168,t} S. Feigl,^{30,t} L. Feligioni,^{83,t} C. Feng,^{334,t} E. J. Feng,^{6,t} H. Feng,^{99,t} A. B. Fenyuk,^{130,t}
 P. Fernandez Martinez,^{167,t} S. Fernandez Perez,^{30,t} S. Ferrap,^{33,t} J. Ferrando,^{33,t} A. Ferrari,^{166,t} P. Ferrari,^{107,t} R. Ferrari,^{123a,t}
 D. E. Ferreira de Lima,^{53,t} A. Ferreir,^{167,t} D. Ferreira,^{49,t} C. Ferretti,^{89,t} A. Ferretto Parodi,^{30a,30b,t} M. Fiascaris,^{31,t}
 F. Fiedler,^{83,t} A. Filipic,^{25,t} M. Filipuzzi,^{42,t} F. Filthaut,^{108,t} M. Fincke-Kehler,^{160,t} K. D. Finelli,^{130,t}
 M. C. N. Fiolhas,^{126a,126b,t} L. Fiorini,^{167,t} A. Firan,^{49,t} A. Fischer,^{2,t} C. Fischer,^{12,t} J. Fischer,^{175,t} W. C. Fisher,^{90,t}
 E. A. Fitzgerald,^{23,t} M. Flechi,^{48,t} I. Fleck,^{141,t} G. Fleischmann,^{89,t} S. Fleischmann,^{173,t} G. T. Fletcher,^{139,t} G. Fletcher,^{76,t}
 T. Flick,^{175,t} A. Floderus,^{81,t} L. R. Flores Castillo,^{60a,t} M. J. Flowerdew,^{108,t} A. Formica,^{136,t} A. Forti,^{84,t} D. Fournier,^{117,t}
 H. Fox,^{72,t} S. Fracchia,^{12,t} P. Francavilla,^{170,t} M. Franchini,^{20a,20b,t} D. Francis,^{30,t} L. Franconi,^{138,t} M. Franklin,^{57,t}
 M. Fraternali,^{123a,123b,t} D. Freeborn,^{78,t} S. French,^{28,t} F. Friedrich,^{44,t} D. Froidevaux,^{30,t} J. A. Frost,^{120,t} C. Fukunaga,^{156,t}
 E. Fullana Torregrosa,^{83,t} B. G. Fulson,^{143,t} J. Fuller,^{167,t} C. Gabaldon,^{55,t} O. Gabizon,^{175,t} A. Gabrielli,^{20a,20b,t}
 A. Gabrielli,^{132a,132b,t} S. Gadatsch,^{107,t} S. Gadomski,^{49,t} G. Gagliardi,^{50a,50b,t} P. Gagnon,^{61,t} C. Galea,^{106,t}
 B. Galhardo,^{126a,126b,t} E. J. Gallas,^{131,t} B. J. Gallop,^{128,t} P. Gallus,^{36,t} G. Galster,^{36,t} K. K. Gan,^{111,t} J. Gao,^{33b,85,t} Y. Gao,^{46,t}
 Y. S. Gao,^{143,t} F. M. Gray Walls,^{46,t} F. Garberson,^{176,t} C. Garcia,^{167,t} J. E. Garcia Navarro,^{167,t} M. Garcia-Sciveres,^{15,t}

- R. W. Gardner,^{31,t} N. Garelli,^{143,t} V. Garonne,^{119,t} C. Gatti,^{47,t} A. Gaudiello,^{50,50h,t} G. Gaudio,^{121a,t} B. Gaur,^{141,t}
 L. Gauthier,^{95,t} P. Gauzzi,^{132a,132b,t} I. L. Gavrilenko,^{96,t} C. Gay,^{168,t} G. Gaycken,^{21,t} E. N. Gazis,^{167,t} P. Ge,^{33d,t} Z. Gece,^{168,t}
 C. N. P. Gee,^{131,t} D. A. A. Geerts,^{107,t} Ch. Geich-Gimbel,^{21,t} M. P. Geisler,^{58a,t} C. Gemme,^{50,t} M. H. Genes,^{25,t}
 S. Gentile,^{132a,132b,t} M. George,^{54,t} S. George,^{77,t} D. Gerbaudo,^{163,t} A. Gershon,^{153,t} H. Ghazlane,^{135b,t} B. Giacobbe,^{20a,t}
 S. Giagu,^{132a,132b,t} V. Giangiobbe,^{12,t} P. Giannetti,^{124a,124b,t} B. Gibbard,^{25,t} S. M. Gibson,^{77,t} M. Gilchristre,^{15,t}
 T. P. S. Gillam,^{28,t} D. Gillberg,^{30,t} G. Gilles,^{34,t} D. M. Gingrich,^{46,t} N. Kokaris,^{94,t} M. M. Giordani,^{164a,164b,t} F. M. Giorgi,^{20a,t}
 F. M. Giorgi,^{76,t} P. F. Giraud,^{136,t} P. Giromini,^{47,t} D. Giugni,^{91,t} C. Giuliani,^{48,t} M. Giulini,^{58b,t} B. K. Gjelsten,^{119,t}
 S. Gkaitatzis,^{154,t} I. Gkikas,^{154,t} E. L. Gkougkousis,^{117,t} L. K. Gladin,^{99,t} C. Glasman,^{39,t} J. Glatzer,^{30,t}
 P. C. F. Glasher,^{46,t} A. Glazov,^{12,t} M. Goblerski-Kolb,^{103,t} J. R. Goddard,^{76,t} J. Godlewski,^{39,t} S. Goldfarb,^{89,t}
 T. Golling,^{97,t} D. Golubkov,^{130,t} A. Gomes,^{128a,128b,128d,t} R. Gonçalo,^{126b,t} J. Goncalves Pinto Firmino Da Costa,^{136,t}
 L. Gonella,^{21,t} S. González de la Hoz,^{107,t} G. González Parra,^{12,t} S. Gonzalez-Sevilla,^{49,t} L. Goossens,^{30,t}
 P. A. Gorbounov,^{97,t} H. A. Gordon,^{25,t} I. Gorelov,^{105,t} B. Gorini,^{30,t} E. Gorini,^{73a,73b,t} A. Gorisek,^{75,t} E. Gornicki,^{30,t}
 A. T. Goshaw,^{45,t} M. I. Gostkin,^{65,t} D. Gougamli,^{135c,t} A. Goussiou,^{138,t} N. Govender,^{146b,t}
 H. M. X. Grabas,^{137,t} L. Graber,^{24,t} I. Grabowska-Bold,^{38a,t} P. Grafström,^{20a,20b,t} K. J. Grahn,^{42,t} J. Gramling,^{49,t}
 E. Gramstad,^{119,t} S. Grancagnolo,^{168,t} V. Grassi,^{148,t} V. Gratchev,^{123,t} H. M. Gray,^{30,t} E. Graziani,^{134a,t} Z. D. Greenwood,^{29a,t}
 K. Gregersen,^{78,t} I. M. Gregor,^{42,t} P. Grenier,^{143,t} J. Griffiths,^{8,t} A. M. Grillo,^{137,t} K. Grimm,^{72,t} S. Grinstein,^{12,t}
 Ph. Gris,^{34,t} J.-F. Grivaz,^{117,t} J. P. Grohs,^{64,t} A. Grohsjean,^{42,t} E. Gross,^{172,t} J. Gross-Kneitter,^{54,t} G. C. Grossi,^{79,t}
 Z. J. Grout,^{140,t} L. Guan,^{33b,t} J. Guenther,^{128,t} F. Guescini,^{40,t} D. Guest,^{176,t} O. Gueta,^{153,t} E. Guido,^{50a,50b,t} T. Guillemin,^{117,t}
 S. Guindon,^{21,t} U. Gul,^{53,t} C. Guelpert,^{44,t} J. Guo,^{33a,t} S. Gupta,^{120,t} P. Gutierrez,^{113,t} N. G. Gutierrez Ortiz,^{53,t}
 C. Gutschow,^{44,t} C. Guyot,^{136,t} C. Gwenlan,^{120,t} C. B. Gwilliam,^{74,t} A. Haas,^{110,t} C. Habes,^{15,t} H. K. Hadavand,^{8,t}
 N. Haddad,^{135,t} P. Haeferl,^{21,t} S. Hageböck,^{21,t} Z. Hajduk,^{30,t} H. Habokyan,^{171,t} M. Haleem,^{42,t} J. Haley,^{114,t} D. Hall,^{120,t}
 G. Halladjian,^{90,t} G. D. Hellwell,^{85,t} K. Hamacher,^{175,t} P. Hamal,^{115,t} K. Hanama,^{109,t} M. Hamer,^{54,t} A. Hamilton,^{143a,t}
 G. N. Hamity,^{145,t} P. G. Hamnett,^{42,t} L. Han,^{33b,t} K. Hanagaki,^{118,t} K. Hanawa,^{155,t} M. Hance,^{15,t} P. Hanke,^{58a,t}
 R. Hanna,^{136,t} J. B. Hansen,^{36,t} M. C. Hansen,^{36,t} P. H. Hansen,^{36,t} K. Hara,^{168,t} A. S. Hard,^{173,t}
 T. Harenberg,^{175,t} F. Hariri,^{117,t} S. Harksuka,^{92,t} R. D. Harrington,^{46,t} P. F. Harrison,^{170,t} R. Hartjes,^{107,t} M. Hasegawa,^{67,t}
 S. Hasegawa,^{103,t} R. Hashi,^{113,t} S. Hassani,^{136,t} S. Hauge,^{17,t} R. Hauser,^{90,t} L. Hauswald,^{44,t}
 M. Havranek,^{127,t} C. M. Hawkes,^{18,t} R. J. Hawkings,^{30,t} A. D. Hawkins,^{81,t} T. Hayashi,^{165,t} D. Hayden,^{90,t} C. P. Hays,^{120,t}
 J. M. Hayes,^{76,t} H. S. Hayward,^{74,t} S. J. Haywood,^{151,t} S. J. Head,^{18,t} T. Heck,^{83,t} V. Hedberg,^{81,t} L. Heelan,^{8,t} S. Hein,^{122,t}
 T. Heim,^{176,t} B. Heinemann,^{145,t} L. Heinrich,^{167,t} J. Hejbal,^{121,t} L. Helary,^{22,t} J. Hellman,^{240a,240b,t} D. Hellmich,^{21,t}
 C. Helsens,^{30,t} J. Henderson,^{120,t} R. C. W. Hendersson,^{72,t} Y. Heng,^{173,t} C. Henglert,^{42,t} A. Henrichs,^{176,t}
 A. M. Henriques Correia,^{30,t} S. Hentrot-Versille,^{117,t} G. H. Herberth,^{16,t} Y. Hernández Jiménez,^{167,t} R. Herberg-Schubert,^{16,t}
 G. Herten,^{48,t} R. Hertenberger,^{100,t} L. Hervas,^{30,t} G. G. Hesketh,^{78,t} N. P. Hessey,^{107,t} J. W. Hetherly,^{40,t} R. Hickling,^{76,t}
 E. Higón-Rodríguez,^{167,t} E. Hill,^{160,t} J. C. Hill,^{26,t} K. H. Hiller,^{42,t} S. J. Hillier,^{178,t} I. Hincliffe,^{123,t} E. Hines,^{122,t}
 R. R. Hinman,^{15,t} M. Hirose,^{157,t} D. Hirschbuehl,^{175,t} J. Hobbs,^{148,t} N. Hod,^{107,t} M. C. Hodgkinson,^{130,t} P. Hodgson,^{139,t}
 A. Hoecker,^{30,t} M. R. Hoefkerkamp,^{105,t} F. Hoenig,^{100,t} M. Hofhield,^{83,t} D. Hohn,^{21,t} T. R. Holmes,^{15,t} T. M. Hong,^{122,t}
 L. Hoof van Huysduyven,^{110,t} W. H. Hopkins,^{116,t} Y. Horai,^{30,t} A. J. Horton,^{142,t} J.-Y. Hostachy,^{58,t} S. Hou,^{151,t}
 A. Hoomanidis,^{135,t} J. Howard,^{128,t} M. Hrabovsky,^{115,t} I. Hristova,^{86,t} J. Hirvonen,^{117,t} T. Hrynová,^{5,t}
 A. Hrynevych,^{93,t} C. Hsu,^{146c,t} P. J. Hsu,^{151,t} S.-C. Hsu,^{138,t} D. Hu,^{25,t} Q. Hu,^{33b,t} X. Hu,^{90,t} Y. Huang,^{42,t} Z. Hubacek,^{30,t}
 F. Hubaut,^{85,t} F. Huegging,^{21,t} T. B. Huffman,^{120,t} E. W. Hughes,^{35,t} G. Hughes,^{72,t} M. Huhtinen,^{30,t} T. A. Hülsing,^{93,t}
 N. Huseynov,^{65,t} J. Huston,^{90,t} J. Jhut,^{27,t} G. Iacobucci,^{40,t} G. Iakovovidis,^{23,t} I. Ibragimov,^{141,t} L. Iconomou-Fayard,^{117,t}
 E. Ideal,^{178,t} Z. Idrisi,^{135,t} P. Iengo,^{30,t} O. Igonkina,^{107,t} T. Izawa,^{171,t} Y. Ikegami,^{96,t} K. Ikematsu,^{141,t} M. Ikeno,^{96,t}
 Y. Ilchenko,^{67,t} D. Iliadis,^{154,t} N. Ilie,^{143,t} Y. Inamaru,^{67,t} T. Ince,^{101,t} P. Ioannou,^{9,t} M. Iodice,^{134a,t} K. Iordanou,^{35,t}
 V. Ippolito,^{37,t} A. Irles Quiceno,^{167,t} C. Isaksson,^{166,t} M. Ishino,^{68,t} M. Ishitsuka,^{157,t} R. Ishumkhamedov,^{111,t} C. Issever,^{120,t}
 S. Istin,^{104,t} J. M. Iturbe Ponce,^{84,t} R. Juppa,^{133a,133b,t} J. Ivansson,^{81,t} W. Iwanski,^{39,t} H. Iwasaki,^{66,t} J. M. Izen,^{41,t}
 V. Izzo,^{104,t} S. Jabbar,^{74,t} B. Jackson,^{122,t} D. O. Jamín,^{151,t} D. K. Jana,^{79,t} V. Jain,^{21,t} K. Jakobs,^{28,t}
 J. Jakobson,^{30,t} T. Jakoubek,^{127,t} J. Jakubek,^{128,t} D. O. Jamín,^{151,t} D. K. Jana,^{79,t} E. Jansen,^{78,t} R. W. Jansky,^{62,t}
 J. Janssen,^{21,t} M. Janus,^{170,t} G. Jarlskog,^{81,t} N. Javadov,^{65,t} T. Javurek,^{48,t} L. Jeanty,^{15,t} J. Jejelava,^{51a,t} G. Y. Jeng,^{150,t}
 D. Jennens,^{88,t} P. Jenni,^{48,t} J. Jentsch,^{43,t} C. Jeske,^{130,t} S. Jézquel,^{8,t} H. Ji,^{173,t} J. Jia,^{148,t} Y. Jiang,^{33b,t} S. Jiggins,^{78,t}
 J. Jimenez Pena,^{167,t} S. Jin,^{33a,t} A. Jinaru,^{26a,t} O. Jinnouchi,^{157,t} M. D. Joergenson,^{36,t} P. Johansson,^{139,t} K. A. Johns,^{7,t}

- K. Jon-And^{146a,146b,†} G. Jones^{170,†} R. W. L. Jones^{72,†} T. J. Jones^{74,†} Johnnemann,^{58a,†} P. M. Jorge,^{126a,126b,†} K. D. Joshi,^{84,†} J. Jovicic^{139a,†} X. Ju,^{73,†} C. A. Jung,^{75,†} P. Jussel,^{62,†} A. Juste Rozas,^{12,†} M. Kaci,^{26,†} A. Kaczmarśka,^{36,†} M. Kado,^{117,†} H. Kagan,^{171,†} M. Kagan,^{143,†} S. J. Kahn,^{83,†} E. Kajomovitz,^{65,†} C. W. Kalderon,^{120,†} S. Kama,^{103,†} A. Kamenshchikov,^{130,†} N. Kanaya,^{155,†} M. Kaneda,^{30,†} S. Kaneti,^{28,†} V. A. Kantsarov,^{98,†} J. Kanzaki,^{66,†} B. Kaplan,^{110,†} A. Kaplyi,^{31,†} D. Kar,^{53,†} K. Karakostas,^{10,†} A. Karamaoun,^{3,†} N. Karastathis,^{10,107,†} M. J. Karem,^{54,†} M. Karnevskyi,^{83,†} S. N. Karpov,^{65,†} Z. M. Karpova,^{40,†} K. Kartik,^{180,†} V. Kartvelishvili,^{72,†} A. N. Karyukhin,^{138,†} L. Kashif,^{173,†} R. D. Kass,^{21,†} A. Kastanas,^{14,†} Y. Kataoka,^{155,†} A. Katre,^{49,†} J. Katzy,^{42,†} K. Kawago,^{70,†} T. Kawamoto,^{25,†} G. Kawamura,^{54,†} S. Kazama,^{155,†} V. F. Kazanin,^{109,†,4,†} M. Y. Kazanin,^{55,†} R. Keefer,^{169,†} R. Kehoe,^{40,†} J. S. Keller,^{42,†} J. J. Kempster,^{77,†} H. Keoshkerian,^{84,†} O. Kepka,^{127,†} B. P. Kersevan,^{31,†} S. Kersten,^{178,†} R. A. Keyes,^{87,†} F. Khalil-zada,^{11,†} H. Khandamany,^{146a,146b,†} A. Khanov,^{114,†} G. A. Kharlamov,^{209,†,4,†} T. J. Kho,^{208,†} V. Khovansky,^{97,†} E. Khramov,^{65,†} J. Khubua,^{51,†,7} H. Y. Kim,^{8,†} H. Kim,^{146a,146b,†} S. H. Kim,^{103,†} Y. Kim,^{31,†} N. Kimura,^{154,†} O. M. Kind,^{16,†} B. T. King,^{74,†} M. King,^{167,†} R. S. B. King,^{120,†} S. B. King,^{158,†} J. Kirk,^{131,†} A. E. Kiryunin,^{107,†} T. Kishimoto,^{67,†} D. Kisielewska,^{184,†} F. Kiss,^{46,†} K. Kiuchi,^{165,†} O. Kivemyk,^{136,†} E. Kladiva,^{144,†} M. H. Klein,^{58,†} M. Klein,^{74,†} E. Klein,^{74,†} K. Kleintnech,^{83,†} P. Klimek,^{146a,146b,†} A. Klimentov,^{25,†} E. Klingenberg,^{43,†} A. Klinger,^{80,†} T. Klužníckimova,^{30,†} E.-E. Kluge,^{50,†,7} P. Kluit,^{107,†} S. Kluth,^{101,†} E. Knerner,^{82,†} E. B. F. Knops,^{33,†} A. Knu^e,^{83,†} A. Kobayashi,^{153,†} D. Kobayashi,^{157,†} T. Kobayashi,^{155,†} M. Kobel,^{44,†} M. Kocian,^{143,†} P. Kodys,^{129,†} T. Koffas,^{29,†} E. Koffman,^{107,†} T. Kohout,^{128,†} T. Kohrik,^{66,†} T. Koi,^{143,†} H. Kolanski,^{5,†} I. Koletsou,^{5,†} A. A. Komar,^{96,†,7} Y. Komori,^{155,†} T. Kondo,^{66,†} R. Kopeliansky,^{152,†} S. Koperny,^{36,†} L. Köpke,^{83,†} A. K. Kopp,^{48,†} K. Korycyl,^{39,†} K. Kordas,^{154,†} A. Korn,^{78,†} N. Kondrashova,^{42,†} K. Koneček,^{4,†} A. C. König,^{106,†} S. König,^{83,†} T. Kono,^{66,†} R. Konoplich,^{110,†,7} N. Konstantinidis,^{78,†} R. Kopeliansky,^{152,†} S. Koperny,^{36,†} L. Köpke,^{83,†} A. K. Kopp,^{48,†} K. Korycyl,^{39,†} K. Kordas,^{154,†} A. Korn,^{78,†} A. A. Korol,^{109,†} I. Korolov,^{12,†} E. V. Korolkova,^{139,†} O. Koterm,^{100,†} S. Kortmer,^{101,†} T. Kosel,^{129,†} V. V. Kostyukhin,^{21,†} V. M. Kotov,^{63,†} A. Kotwal,^{45,†} A. Kourkoumelis-Charalampidi,^{154,†} C. Kourkoumelis,^{9,†} V. Kouskoura,^{24,†} A. Koutsman,^{159,†} R. Kowalewski,^{30,†} T. Z. Kowalski,^{26,†} W. Kozanecki,^{156,†} A. S. Kozhin,^{130,†} V. A. Kramarenko,^{99,†} G. Kramberger,^{73,†} D. Krasnopevts,^{78,†} A. Krasznahorkay,^{30,†} J. K. Kraus,^{21,†} A. Kravchenko,^{25,†} S. Kreiss,^{110,†} M. Kretz,^{96,†} J. Kretzschmar,^{74,†} K. Kreutzfeldt,^{52,†} P. Krieger,^{158,†} K. Krizka,^{31,†} K. Kroeninger,^{43,†} H. Krohn,^{101,†} J. Kroll,^{122,†} J. Kruseberg,^{17,†} J. Krstic,^{13,†} U. Kruchonak,^{65,†} H. Krüger,^{41,†} N. Krummack,^{64,†} Z. V. Krumshteyn,^{65,†} A. Kruse,^{173,†} M. C. Kruse,^{45,†} M. Kruskal,^{22,†} T. Kubota,^{78,†} H. Kucuk,^{82,†} S. Kuday,^{46,†} S. Kuehn,^{48,†} A. Kugel,^{58c,†} F. Kuger,^{174,†} A. Kuhl,^{137,†} T. Kuhl,^{42,†} V. Kukhlin,^{65,†} Y. Kulchitsky,^{92,†} S. Kuleshov,^{32,†} M. Kunz,^{132a,132b,†} T. Kunigo,^{68,†} A. Kupco,^{127,†} H. Kurashige,^{47,†} Y. A. Kurochkin,^{92,†} R. Kurumida,^{67,†} V. Kus,^{127,†} E. S. Kuwertz,^{160,†} M. Kuze,^{157,†} J. Kvita,^{115,†} T. Kwan,^{168,†} D. Kyriazopoulos,^{138,†} A. La Rosa,^{98,†} J. L. La Rosa Navarro,^{24d,†} L. La Rotonda,^{97a,97b,†} C. Lacasta,^{167,†} F. Lacava,^{132a,132b,†} J. Lacey,^{29,†} H. Lackey,^{16,†} D. Lacomur,^{80,†} V. R. Lacuesta,^{167,†} E. Ladypin,^{65,†} R. Lafaye,^{5,†} B. Laforge,^{80,†} T. Lagouri,^{37,†} S. Lai,^{48,†} L. Lamboume,^{78,†} S. Lammers,^{61,†} C. L. Lampen,^{7,†} W. Lampl,^{7,†} E. Lançon,^{136,†} U. Landgraf,^{48,†} M. P. J. Landon,^{76,†} V. S. Lang,^{58a,†} C. J. Lange,^{12,†} A. J. Lankford,^{163,†} F. Lanni,^{25,†} K. Lantzsch,^{3,†} S. Laplace,^{60,†} C. Lapoire,^{136,†} J. F. Laporte,^{136,†} T. Lari,^{36,†} F. Lasagab Manghi,^{20a,20b,†} M. Lassnig,^{90,†} P. Laurelli,^{47,†} W. Lavrijsen,^{15,†} A. T. Law,^{137,†} P. Laycock,^{74,†} O. Le Dortz,^{81,†} E. Le Guirice,^{45,†} E. Le Meneude,^{12,†} M. LeBlanc,^{169,†} T. LeCompte,^{6,†} L. Ledroit-Guillon,^{55,†} S. C. Lee,^{144b,†} S. C. Lee,^{151,†} L. Lee,^{1,†} G. Lefebvre,^{80,†} M. Lefebvre,^{109,†} F. Legger,^{100,†} C. Leggett,^{15,†} A. Lehau,^{74,†} G. Lehmann Miotti,^{30,†} X. Lei,^{7,†} W. A. Leigh,^{29,†} A. Leisos,^{154,†} A. G. Leister,^{176,†} M. A. L. Leite,^{24d,†} R. Leitner,^{120,†} D. Lellouch,^{172,†} B. Lemmer,^{54,†} K. J. C. Lenev,^{76,†} T. Lenz,^{21,†} B. Lenzi,^{20,†} R. Leone,^{7,†} S. Leone,^{126,126b,†} C. Leonidopoulos,^{46,†} S. Leontsinis,^{10,†} C. Leroy,^{95,†} C. G. Lester,^{28,†} M. Levchenko,^{123,†} J. Leveque,^{5,†} D. Levin,^{80,†} L. J. Levinson,^{172,†} M. Levy,^{18,†} A. Lewis,^{120,†} A. M. Leyko,^{21,†} M. Leyton,^{41,†} B. Li,^{133a,†} H. Li,^{148,†} H. L. Li,^{31,†} L. Li,^{45,†} L. Li,^{33c,†} S. Li,^{45,†} Y. Li,^{133c,†} Z. Liang,^{17,†} H. Liao,^{34,†} B. Liberti,^{133a,†} A. Libloug,^{158,†} P. Lichard,^{30,†} K. Lie,^{165,†} J. Liebal,^{21,†} W. Liebig,^{14,†} C. Limbach,^{21,†} A. Limosani,^{130,†} S. C. Lin,^{151,†} T. H. Lin,^{131,†} F. Linde,^{107,†} B. E. Lindquist,^{148,†} J. T. Linnemann,^{90,†} E. Lipelies,^{122,†} A. Lipniacka,^{14,†} M. Lisoviy,^{26b,†} T. M. Liss,^{165,†} D. Lissauer,^{25,†} A. Lister,^{168,†} M. A. Litke,^{157,†} B. Liu,^{151,†} D. Liu,^{151,†} J. Liu,^{85,†} J. B. Liu,^{133b,†} K. Liu,^{165,†} L. Liu,^{165,†} M. Liu,^{145,†} M. Liu,^{33b,†} Y. Liu,^{33b,†} M. Livian,^{121a,121b,†} A. Lleres,^{55,†} J. Llorente Merino,^{84,†} E. Lobodzinska,^{42,†} F. Loch,^{7,†} W. S. Lockman,^{137,†} F. Loebinger,^{84,†} A. E. Lovelschal-Jensen,^{36,†} A. Loginov,^{176,†} T. Lohse,^{16,†} K. Lohwasser,^{42,†} M. Lokajicek,^{127,†} B. A. Long,^{22,†} J. D. Long,^{80,†} R. E. Long,^{72,†} C. A.Looper,^{111,†} L. Lopez,^{126a,†} D. Lopez Mateos,^{57,†} B. Lopez Paredes,^{139,†} I. Lopez Paz,^{12,†} J. Lorenz,^{100,†} N. Lorenzo Martinez,^{61,†} M. Losada,^{162,†} P. Loscufoff,^{15,†} P. J. Lösel,^{100,†} X. Lou,^{33a,†} A. Louinis,^{117,†} J. Love,^{8,†} P. A. Love,^{72,†} N. Lu,^{98,†} H. J. Lubat,^{138,†} C. Luci,^{132a,132b,†} A. Lucotte,^{55,†} F. Luehring,^{61,†}

- W. Lukas,^{62,†} L. Luminari,^{132a,b} O. Lundberg,^{146a,146b,†} B. Lund-Jensen,^{147,†} D. Lynn,^{25,†} R. Lysak,^{127,†} E. Lytken,^{81,†}
 H. Ma,^{25,†} L. L. Ma,^{20,†} G. Maccarone,^{47,†} A. Macchione,^{106,†} C. M. Macdonald,^{139,†} J. Machado-Migues,^{122,123b,†}
 D. Macina,^{30,†} D. Madaffari,^{85,†} R. Madar,^{34,†} H. J. Maddocks,^{72,†} W. F. Mader,^{44,†} A. Madsen,^{106,†} S. Maeland,^{14,†}
 T. Maeno,^{25,†} A. Maevskiy,^{99,†} E. Magradze,^{54,†} K. Mahboubi,^{48,†} J. Mahstedt,^{107,†} C. Maiani,^{136,†} C. Maidantchik,^{24a,†}
 A. A. Maier,^{101,†} T. Maier,^{100,†} A. Maior,^{128a,128b,128d,†} S. Majewski,^{98,†} Y. Makide,^{68,†} N. Makovec,^{80,†}
 P. Malecki,^{39,†} V. Maleev,^{20,†} F. Malek,^{55,†} U. Mallik,^{63,†} D. Malon,^{6,†} C. Malone,^{143,†} S. Maltezos,^{10,†}
 V. M. Malyshev,^{109,†} S. Malyukov,^{20,†} J. Mamuzic,^{42,†} G. Mancini,^{47,†} B. Mandelli,^{30,†} L. Mandelli,^{91a,†} I. Mandic,^{75,†}
 R. Mandrysch,^{61,†} J. Manreira,^{126a,126b,†} A. Manfredini,^{101,†} L. Manhaes de Andrade Filho,^{126,†} J. Manjares Ramos,^{150b,†}
 A. Mann,^{108,†} P. M. Manning,^{137,†} A. Manousakis-Katsikakis,^{9,†} B. Mansouli,^{136,†} R. Mantel,^{83,†} M. Mantouani,^{54,†}
 L. Mapelli,^{30,†} L. March,^{145,†} G. Marchiori,^{103,†} M. Marcusi,^{127,†} C. Marta,^{109,†} M. Marano,^{109,†} M. Marjanovic,^{13,†} F. Marroquin,^{24a,†}
 S. P. Marsden,^{44,†} Z. Marshall,^{15,†} F. L. Marti,^{17,†} S. Marti-Garcia,^{106,†} B. Martin,^{90,†} T. A. Martin,^{170,†} V. J. Martin,^{46,†}
 B. Martin dit Latour,^{14,†} M. Martinez,^{12,†} S. Martin-Haque,^{131,†} V. S. Martoiu,^{26a,†} A. C. Martyniuk,^{78,†} M. Marx,^{138,†}
 F. Marzano,^{132a,†} A. Marzin,^{96,†} L. Masetti,^{83,†} T. Mashimo,^{155,†} R. Mashinistov,^{96,†} J. Masis,^{84,†} A. L. Maslenikov,^{109,†}
 I. Massa,^{20a,20b,†} L. Massa,^{99,†} N. Massol,^{5,†} P. Mastandrea,^{148,†} A. Mastrobardino,^{37a,37b,†} T. Matsubashi,^{155,†}
 P. Mättig,^{175,†} J. Mattmann,^{83,†} J. Maure,^{20a,†} S. J. Maxfield,^{74,†} D. A. Maximov,^{109,†} R. Mazini,^{151,†} S. M. Mazza,^{91a,91b,†}
 L. Mazzaferro,^{132a,132b,†} G. Mc Goldrick,^{158,†} S. P. Mc Kee,^{49,†} A. Mc Cann,^{89,†} R. L. McCarthy,^{148,†} T. G. McCarthy,^{29,†}
 N. A. McCubbin,^{131,†} K. W. McFarlane,^{56,†} J. A. McFayden,^{78,†} G. McHedlidze,^{54,†} S. J. McMahon,^{131,†}
 R. A. McPherson,^{208,†} M. Medimis,^{42,†} S. Meehan,^{85,†} S. Melihase,^{200,†} A. Mehta,^{74,†} K. Meier,^{58a,†} C. Meineck,^{100,†}
 B. Meirois,^{41,†} B. R. Mellado Garcia,^{145,†} F. Meloni,^{17,†} A. Mengarelli,^{21a,21b,†} S. Menke,^{101,†} E. Meoni,^{161,†}
 K. M. Mercurio,^{57,†} S. Mergelman,^{21,†} P. Memrod,^{49,†} L. Merolla,^{104a,104b,†} C. Meromi,^{91a,†} F. S. Merritt,^{31,†}
 A. Messina,^{132a,132b,†} J. Metcalfe,^{25,†} A. S. Mete,^{163,†} C. Meyer,^{81,†} J. P. Meyer,^{154,†} J. Meyer,^{107,†}
 R. P. Middleton,^{131,†} S. Miglioranzi,^{164,164c,†} L. Mijović,^{71,†} G. Mikenberg,^{172,†} N. Miketstikova,^{127,†} M. Mikusz,^{75,†}
 M. Milesi,^{88,†} A. Milic,^{30,†} D. W. Miller,^{31,†} C. Mills,^{46,†} A. Milov,^{172,†} D. A. Milstead,^{146a,146b,†} A. A. Minenko,^{130,†}
 Y. Minami,^{155,†} I. A. Minashvili,^{85,†} A. I. Mincer,^{110,†} B. Mindur,^{38a,†} M. Mineev,^{65,†} Y. Ming,^{173,†} L. M. Mir,^{12,†}
 T. Mitani,^{171,†} J. Mitrevski,^{100,†} V. A. Mitsou,^{167,†} A. Miucci,^{95,†} P. S. Miyagawa,^{139,†} J. U. Mjörmark,^{84,†} T. Moa,^{146b,†}
 K. Mochizuki,^{85,†} S. Mohapatra,^{25,†} W. Mohr,^{48,†} S. Molander,^{146a,146b,†} R. Moles-Valls,^{107,†} K. Möng,^{42,†} C. Monini,^{55,†}
 J. Monk,^{36,†} E. Monnier,^{83,†} J. Montejo Berlingen,^{12,†} F. Monticelli,^{71,†} S. Monzani,^{132a,132b,†} R. W. Moore,^{3,†}
 N. Morano,^{117,†} D. Moreno,^{162,†} M. Moreno Llacer,^{54,†} P. Morettini,^{50a,†} M. Morgenstern,^{44,†} M. Mori,^{57,†}
 M. Morinaga,^{135,†} V. Moritsub,^{119,†} S. Moritz,^{83,†} A. K. Morley,^{147,†} G. Moronaci,^{36,†} J. D. Morris,^{76,†} S. S. Mortensen,^{36,†}
 A. Morton,^{51,†} L. Morvaj,^{103,†} M. Mosidze,^{31b,†} J. Moss,^{111,†} K. Motohashi,^{157,†} R. Mount,^{143,†} E. Mountricha,^{25,†}
 S. V. Mouravious,^{96,†} E. J. W. Moyse,^{86,†} S. Muanza,^{85,†} R. D. Mudd,^{18,†} F. Mueller,^{101,†} J. Mueller,^{123,†} K. Mueller,^{21,†}
 R. S. P. Mueller,^{108,†} T. Mueller,^{28,†} D. Muenstermann,^{40,†} P. Mullen,^{53,†} Y. Munwes,^{153,†} J. A. Murillo Quijada,^{54,†}
 W. J. Murray,^{170,171,†} H. Musheghyan,^{85,†} E. Musto,^{162,†} A. G. Myagkov,^{130a,130b,†} M. Myska,^{128,†} O. Nackenhorst,^{54,†}
 J. Nadai,^{54,†} K. Nagai,^{120,†} R. Nagai,^{157,†} Y. Nagai,^{45,†} K. Nagano,^{66,†} A. Nagarkar,^{111,†} Y. Nagasaki,^{99,†} K. Nagata,^{160,†}
 M. Nagel,^{101,†} E. Nagy,^{85,†} A. M. Nairz,^{30,†} Y. Nakahama,^{30,†} K. Nakamura,^{66,†} T. Nakamura,^{155,†} I. Nakano,^{112,†}
 H. Namasyanayam,^{41,†} R. F. Narango Garcia,^{31,†} R. Narayan,^{31,†} T. Naumann,^{42,†} G. Navarro,^{162,†} R. Nayyar,^{7,†} H. A. Neal,^{89,†}
 P. Yu. Nechaeva,^{96,†} T. J. Neep,^{64,†} P. D. Neff,^{145,†} A. Negri,^{121a,121b,†} M. Negriini,^{200,†} S. Nektarievic,^{106,†} C. Nellist,^{117,†}
 A. Nelson,^{163,†} Nemecek,^{177,†} P. Nemethy,^{110,†} A. A. Nepomuceno,^{24a,†} M. Nessi,^{30a,c,†} M. S. Neuhaber,^{165,†}
 M. Neumann,^{175,†} R. M. Neves,^{110,†} P. Newski,^{25,†} P. R. Newman,^{18,†} D. H. Nguyen,^{61,†} R. B. Nickerson,^{120,†}
 R. Nicolaïdou,^{136,†} B. Nicquevert,^{30,†} J. Nielsen,^{137,†} N. Nikiforou,^{153,†} N. Nikiforou,^{16,†} V. Nikolaenko,^{130,13b,†}
 I. Nikolic-Audit,^{80,†} K. Niklopoulos,^{18,†} J. Nilsen,^{119,†} P. Nilsson,^{25,†} Y. Ninomiya,^{155,†} A. Nisiati,^{132a,†} R. Nisius,^{101,†}
 T. Nobe,^{157,†} M. Nomachi,^{118,†} I. Nomidis,^{20,†} T. Nooney,^{76,†} S. Norberg,^{113,†} M. Nordberg,^{30,†} O. Novgorodova,^{44,†}
 S. Nowak,^{101,†} M. Nowak,^{66,†} L. Nozka,^{115,†} K. Niekras,^{10,†} G. Nunes Haminger,^{88,†} T. Nunnemann,^{100,†} E. Nurse,^{78,†}
 F. Nutt,^{88,†} B. J. O'Brien,^{46,†} F. O'Grady,^{7,†} D. C. O'Neill,^{142,†} V. O'Shea,^{53,†} F. G. Oakham,^{20,6,†} H. Oberlack,^{108,†}
 T. Obermann,^{21,†} J. Ocariz,^{18,†} A. Ochi,^{167,†} L. Ochoa,^{76,†} P. J. Ochoa-Ricoux,^{32a,†} S. Oda,^{70,†} S. Oda,^{68,†} H. Ogren,^{61,†}
 A. Oh,^{84,†} S. H. Oh,^{30,†} C. O. Ohm,^{166,†} H. Ohide,^{30,†} W. Okamura,^{218,†} H. Okawa,^{200,†} Y. Okumura,^{31,†}
 T. Okuyama,^{155,†} A. Olarin,^{26a,†} S. A. Olivares Pino,^{46,†} D. Oliveira Damazio,^{25,†} E. Oliver Garcia,^{167,†} A. Olszewski,^{39,†}
 J. Olszowska,^{134a,134b,†} A. Onofre,^{31,†} P. U. E. Onyisi,^{31,†} C. J. Oram,^{159a,†} M. J. Oreglia,^{31,†} Y. Oren,^{153,†}
 D. Orestano,^{134a,134b,†} N. Orlando,^{154,†} C. Oropeza Barrera,^{33,†} R. S. Orr,^{158,†} B. Osculati,^{30a,50b,†} R. Ospanol,^{39,†}

- G. Otero y Garzon,^{27,†} H. Otomo,^{70,‡} M. Ouchrif,^{135,§} E. A. Ouellette,^{169,†} F. Ould-Saada,^{119,‡} A. Ouraou,^{136,‡} K. P. Ouusoren,^{107,‡} Q. Ouyang,^{33,‡} A. Ovcharov,^{14,§} M. Owen,^{18,‡} R. E. Owen,^{18,‡} V. E. Ozcan,^{16,‡} N. Ozturk,^{8,‡} K. Pachal,^{142,‡} A. Pacheco Pages,^{12,‡} C. Padilla Aranda,^{12,‡} M. Palagacica,^{48,‡} S. Pagan Griso,^{15,‡} E. Paganis,^{130,‡} C. Pahl,^{101,‡} F. Paige,^{25,‡} P. Pais,^{86,‡} K. Pajchel,^{119,‡} G. Palacino,^{150,§} S. Palestini,^{30,‡} M. Palka,^{38,‡} D. Pallin,^{24,‡} A. Palma,^{126a,126b,‡} Y. B. Pan,^{173,‡} E. Panagiopoulou,^{10,‡} C. E. Pandini,^{80,‡} J. G. Panduro Vazquez,^{77,‡} P. Pani,^{146a,146b,‡} S. Panitkin,^{25,‡} D. Pantea,^{26a,‡} L. Paoletti,^{49,‡} Th.D. Papadopoulos,^{101,‡} K. Papageorgiou,^{184,‡} A. Paramonov,^{6,‡} D. Paredes Hernandez,^{154,‡} M. A. Parker,^{28,‡} K. A. Parker,^{130,‡} F. Parodi,^{50a,50b,‡} J. A. Parsons,^{35,‡} U. Parzefall,^{46,‡} E. Pasqualucci,^{132a,‡} S. Passaggio,^{20a,‡} F. Pastore,^{134a,134b,‡} Fr. Pastore,^{77,‡} G. Pásztor,^{29,‡} S. Pataraia,^{175,‡} N. D. Patel,^{150,‡} J. R. Pater,^{94,‡} T. Pauri,^{30,‡} J. Pearce,^{169,‡} B. Pearson,^{113,‡} L. E. Pedersen,^{36,‡} M. Pedersen,^{189,‡} S. Pedraza Lopez,^{167,‡} R. Pedro,^{126a,126b,‡} S. V. Peleganchuk,^{108,‡} D. Pelikan,^{196,‡} H. Peng,^{108,‡} B. Penning,^{31,‡} J. Penwell,^{26,‡} P. Perellesta,^{25,‡} E. Perez Codina,^{159,‡} M. T. Pérez García-Estate,^{167,‡} L. Perini,^{91a,91b,‡} H. Permegger,^{30,‡} S. Perrella,^{104a,104b,‡} R. Peschke,^{42,‡} V. D. Peschekhonov,^{65,‡} K. Peters,^{30,‡} R. F. Y. Peters,^{84,‡} B. A. Petersen,^{134a,134b,‡} T. C. Petersen,^{36,‡} E. Petit,^{42,‡} A. Petridis,^{146a,146b,‡} C. Petridou,^{154,‡} E. Petrolo,^{132a,‡} F. Petrucci,^{18,‡} E. N. Pettersson,^{187,‡} R. Pezoa,^{32b,‡} P. W. Phillips,^{131,‡} G. Picciadio,^{143,‡} E. Pianori,^{170,‡} A. Picazio,^{49,‡} E. Piccaro,^{16,‡} M. Piccinini,^{20a,20b,‡} M. A. Pickett,^{126,‡} R. Piegaia,^{27,‡} D. T. Pignotti,^{111,‡} J. E. Pilcher,^{31,‡} A. D. Pilkington,^{84,‡} J. Pina,^{126a,126b,126d,‡} M. Pinamonti,^{164a,164c,48,‡} J. L. Pinfol,^{37,‡} A. Pingel,^{36,‡} B. Pinto,^{126a,‡} S. Pires,^{80,‡} M. Pitt,^{172,‡} C. Pizio,^{91a,91b,‡} L. Plazak,^{144a,‡} M.-A. Pleier,^{28,‡} V. Plesko,^{129,‡} D. P. Plotnikova,^{65,‡} P. Plucinski,^{146a,146b,‡} D. Pluth,^{64,‡} R. Poettgen,^{83,‡} L. Poglioni,^{117,‡} D. Polh,^{21,‡} G. Pollesello,^{121,‡} A. Pollicicchio,^{19,‡} R. Polifka,^{158,‡} A. Polini,^{26b,‡} C. S. Pollard,^{53,‡} V. Polychronakos,^{25,‡} K. Pommeis,^{30,‡} I. Pontecorvo,^{132a,‡} B. G. Pope,^{90,‡} G. A. Popenciu,^{21b,‡} D. S. Popovic,^{13,‡} A. Popleton,^{30,‡} S. Pospisil,^{128,‡} K. Potamianos,^{15,‡} I. N. Potrat,^{65,‡} C. J. Potter,^{149,‡} C. T. Potter,^{116,‡} G. Poulard,^{53,‡} J. J. Poveda,^{74a,‡} V. Pozdnjakov,^{65,‡} P. Pralavorio,^{85,‡} A. Pranko,^{15,‡} S. Prasad,^{30,‡} S. Prell,^{64,‡} D. Price,^{94,‡} L. Price,^{6,‡} M. Primavera,^{74a,‡} S. Prince,^{65,‡} M. Proissl,^{46,‡} K. Prokofiev,^{16,‡} F. Prokoshin,^{37b,‡} E. Protopapadaki,^{136,‡} S. Protopopescu,^{25,‡} J. Proudfoot,^{6,‡} M. Przybycien,^{38a,‡} J. Ptacek,^{116,‡} D. Puddu,^{134a,134b,‡} E. Pueschl,^{66,‡} D. Puldton,^{148,‡} M. Purnohi,^{84,‡} P. Puzzo,^{117,‡} J. Qian,^{90,‡} G. Qin,^{53,‡} Y. Qin,^{94,‡} A. Quadt,^{34,‡} D. R. Quarrie,^{15,‡} W. B. Quayle,^{16,‡} M. Queitsch-Maitland,^{64,‡} D. Quilty,^{53,‡} S. Radduin,^{119,‡} V. Radeka,^{25,‡} V. Radescu,^{42,‡} S. K. Radhakrishnan,^{148,‡} P. Radloff,^{116,‡} P. Rados,^{83,‡} F. Ragusa,^{91a,91b,‡} G. Rahal,^{178,‡} S. Rajagopalan,^{25,‡} M. Rammenhoven,^{30,‡} C. Rangel-Smith,^{81,‡} F. Rauscher,^{100,‡} S. Rave,^{83,‡} T. Ravencroft,^{53,‡} M. Raymond,^{30,‡} A. L. Read,^{119,‡} N. P. Readoff,^{24,‡} D. M. Rebuzzi,^{121a,121b,‡} A. Redelbach,^{174,‡} G. Redlinger,^{25,‡} R. Reece,^{137,‡} K. Reeves,^{41,‡} L. Rehmsch,^{16,‡} H. Reisin,^{27,‡} M. Relich,^{163,‡} C. Rembser,^{30,‡} H. Ren,^{35a,‡} A. Renaud,^{117,‡} M. Rescigno,^{132a,‡} S. Resconi,^{91a,‡} O. L. Rezanova,^{109,‡} P. Reznickz,^{123,‡} R. Rezvani,^{95,‡} R. Richter,^{88,‡} S. Richter,^{78,‡} E. Richter-Was,^{88,‡} O. Ricken,^{21,‡} M. Ridel,^{80,‡} P. Rieck,^{16,‡} C. J. Riegel,^{175,‡} J. Rieger,^{54,‡} M. Rijssenbeek,^{148,‡} A. Rimoldi,^{121a,121b,‡} L. Rinaldi,^{175,‡} B. Ristic,^{49,‡} E. Ritsch,^{62,‡} I. Riu,^{12,‡} F. Rizatdinova,^{114,‡} E. Rizvi,^{76,‡} S. H. Robertson,^{87,‡} A. Robichaud-Veronneau,^{87,‡} D. Robinson,^{28,‡} J. E. M. Robinson,^{84,‡} A. Robson,^{53,‡} C. Roda,^{124a,124b,‡} S. Roe,^{30,‡} O. Roßnhe,^{119,‡} S. Rolli,^{161,‡} A. Romanik,^{96,‡} M. Romano,^{80,‡} S. M. Romano Saez,^{34,‡} E. Romere Adam,^{167,‡} N. Rompotis,^{136,‡} M. Ronzani,^{48,‡} L. Roos,^{20,‡} E. Ros,^{167,‡} S. Rosati,^{112,‡} K. Rosbach,^{46,‡} P. Rose,^{137,‡} P. L. Rosendahl,^{147,‡} O. Rosenthal,^{141,‡} V. Rossetti,^{146a,146b,‡} E. Rossi,^{104a,104b,‡} L. P. Rossi,^{50a,‡} R. Rosten,^{138,‡} M. Rotaru,^{26a,‡} I. Roth,^{172,‡} J. Rothberg,^{138,‡} D. Rousseau,^{117,‡} C. R. Royon,^{136,‡} A. Rozanov,^{85,‡} Y. Rozen,^{152,‡} X. Ruan,^{145c,‡} F. Rubbo,^{143,‡} I. Rubinsky,^{42,‡} V. I. Rud,^{99,‡} C. Rudolph,^{44,‡} M. S. Rudolph,^{158,‡} F. Rühr,^{48,‡} A. Ruiz-Martinez,^{30,‡} Z. Runikova,^{48,‡} N. A. Rusakovitch,^{65,‡} A. Ruschke,^{100,‡} H. L. Russell,^{138,‡} J. P. Rutherford,^{7,‡} N. Ruthmann,^{48,‡} F. Y. Ryabov,^{123,‡} M. Rybar,^{129,‡} G. Rybkina,^{117,‡} N. C. Ryder,^{120,‡} A. F. Saavedra,^{150,‡} G. Sabato,^{107,‡} S. Sacerdoti,^{27,‡} A. Sadidze,^{14,‡} H. F.-W. Sadrozinski,^{137,‡} R. Sadykov,^{65,‡} F. Safai Tehrani,^{132a,‡} M. Samipert,^{136,‡} H. Sakamoto,^{155,‡} Y. Sakurai,^{171,‡} G. Salamanna,^{134a,134b,‡} A. Salamon,^{133a,‡} M. Saleem,^{113,‡} D. Salek,^{107,‡} P. H. Sales De Bruin,^{158,‡} D. Salihagic,^{101,‡} A. Salimov,^{143,‡} J. Salt,^{167,‡} D. Salvatore,^{170a,170b,‡} F. Salvatore,^{140,‡} A. Salvucci,^{106,‡} A. Salzburger,^{154,‡} D. Sampsonidis,^{154,‡} A. Sanchez,^{104a,104b,‡} J. Sanchez,^{167,‡} V. Sanchez Martinez,^{167,‡} H. Sandaker,^{4,‡} R. L. Sandbach,^{76,‡} H. G. Sander,^{83,‡} M. P. Sanders,^{100,‡} M. Sandhoff,^{175,‡} C. Sandoval,^{162,‡} R. Sandstrom,^{101,‡} D. P. C. Sankey,^{131,‡} M. Sammizo,^{50a,50b,‡} A. Sansoni,^{47,‡} C. Santoni,^{34,‡} R. Santonicio,^{133a,133b,‡} H. Santos,^{126a,‡} L. Santoyo Castillo,^{149,‡} K. Sapp,^{125,‡} A. Sapromov,^{65,‡} J. G. Sarava,^{126a,126b,‡} B. Sarrazinot,^{21,‡} O. Sasaki,^{66,‡} Y. Sasaki,^{155,‡} K. Satoh,^{160,‡} G. Sauvage,^{5,‡} E. Sauvan,^{5,‡} G. Savage,^{77,‡} P. Savard,^{128,‡} C. Sawyer,^{120,‡} L. Sawyer,^{70,‡} J. Saxon,^{31,‡} C. Sharra,^{20a,‡} A. Shazzi,^{172,‡} T. Scanlon,^{78,‡} D. A. Scannicchio,^{83,‡} M. Scarcella,^{150,‡} V. Scarfone,^{37a,37b,‡} J. Schaarschmidt,^{172,‡} P. Schacht,^{101,‡} D. Schaefer,^{30,‡} R. Schaefer,^{42,‡} J. Schaeffer,^{83,‡} S. Schaepe,^{21,‡} S. Schatzel,^{50b,‡} U. Schäfer,^{83,‡} A. C. Schaffer,^{117,‡} D. Schala,^{100,‡} R. D. Schamberger,^{140,‡} V. Scharf,^{90a,‡}

- V. A. Schegelsky,^{128,†} D. Scheirich,^{129,†} M. Schernau,^{163,‡} C. Schiavi,^{50a,50b,‡} C. Schillo,^{48,†} M. Schioppa,^{37a,37b,†}
 S. Schlenker,^{30,‡} E. Schmidt,^{48,†} K. Schmieden,^{30,‡} C. Schmitt,^{48,†} S. Schmitt,^{42,†} B. Schneider,^{189a,†}
 Y. J. Schnellbach,^{74,†} U. Schoonroek,^{44,†} L. Schoofel,^{136,†} A. Schoening,^{20b,†} B. D. Schoenrock,^{90,†} E. Schopf,^{21,†}
 A. L. S. Schorlemmer,^{54,†} M. Schott,^{83,†} D. Schouten,^{159a,†} J. Schovancova,^{8,†} S. Schramm,^{158,†} M. Schreyer,^{174,†}
 C. Schroeder,^{83,†} N. Schuh,^{83,†} M. J. Schulmes,^{21,†} H.-C. Schultz-Coulon,^{98,†} H. Schulz,^{16,†} M. Schumacher,^{48,†}
 B. A. Schumann,^{137,†} Ph. Schune,^{136,†} C. Schwanenberger,^{48,†} A. Schwartzman,^{143,†} T. A. Schwarz,^{90,†} Ph. Schwegler,^{101,†}
 Ph. Schwemling,^{136,†} R. Schwienhorst,^{90,†} J. Schwindig,^{136,†} T. Schwindt,^{21,†} M. Schwoerer,^{5,†} F. G. Sciacca,^{47,†}
 E. Seifo,^{117,†} G. Sciolta,^{23,†} F. Scuri,^{21,†} E. Seuti,^{21,†} J. Seucy,^{89,†} G. Sedov,^{42,†} E. Sedykh,^{93,†} P. Seema,^{21,†}
 S. C. Seidel,^{103,†} A. Seiden,^{137,†} F. Seifert,^{128,†} J. M. Sexias,^{24a,†} G. Sekhniaidze,^{83,†} K. Sekhon,^{89,†} S. J. Sekula,^{40,†}
 K. E. Selbach,^{46,†} D. M. Silverman,^{123,8,†} N. Semprini-Cesari,^{20a,20b,†} C. Serfon,^{30,†} L. Serin,^{117,†} L. Serkin,^{164,164b,†}
 T. Serre,^{85,†} M. Sessa,^{134,134b,†} R. Seuster,^{159a,†} H. Severini,^{113,†} T. Stijlgoij,^{75,†} F. Sforza,^{101,†} A. Sfyrla,^{20,†} E. Shabalina,^{54,†}
 M. Shamini,^{116,†} L. Y. Shan,^{33a,†} R. Shang,^{165,†} J. T. Shank,^{22,†} M. Shapiro,^{15,†} P. B. Shatalov,^{140,†} K. Shaw,^{164a,164b,†}
 S. M. Shaw,^{84,†} A. Scherbakov,^{140a,140b,†} C. Y. Shehu,^{140,†} P. Sherwood,^{78,†} L. Shi,^{131,131b,†} S. Shimizu,^{63,†} C. O. Shimmin,^{163,†}
 M. Shimojima,^{102,†} M. Shiyakova,^{65,†} A. Shmeleva,^{96,†} D. Shoalahe Saadi,^{42,†} M. J. Shochet,^{71,†} S. Shojaii,^{91,91b,†}
 S. Shrestha,^{111,†} E. Shulgina,^{96,†} M. A. Shupe,^{7,†} S. Shushkevich,^{42,†} P. Sicho,^{127,†} O. Sidiropolou,^{174,†} D. Sidorov,^{134,†}
 A. Sidoti,^{20a,20b,†} F. Siegert,^{44,†} D. Sijacki,^{13,†} J. Silva,^{126a,126d,†} Y. Silver,^{153,†} S. B. Silverstein,^{146a,†} V. Simak,^{128,†}
 O. Simard,^{83,†} Lj. Simic,^{13,†} S. Simon,^{117,†} E. Simioni,^{83,†} B. Simmonis,^{46,†} D. Simon,^{34,†} R. Simonello,^{91a,91b,†} P. Sinervo,^{158,†}
 N. B. Sinev,^{116,†} G. Siragusa,^{174,†} A. Sisakyan,^{85,†} S. Yu. Sivoklokov,^{90,†} J. Sjolin,^{146a,146b,†} T. B. Bjursen,^{14,†}
 M. B. Skinner,^{72,†} H. P. Skottowe,^{37,†} P. Skubic,^{118,†} M. Slater,^{18,†} T. Slavicek,^{128,†} M. Slawinska,^{107,†} K. Sliwa,^{161,†}
 V. Smakhtin,^{172,†} B. H. Smart,^{46,†} L. Smestad,^{14,†} S. Yu. Smirnov,^{98,†} Y. Smirnov,^{88,†} L. N. Smirnova,^{99,99b,†} O. Smirnova,^{81,†}
 M. N. K. Smith,^{35,†} R. W. Smith,^{35,†} M. Smizanska,^{72,†} K. Smolek,^{126,†} A. A. Smesarev,^{43,†} G. Smidero,^{26,†} S. Snyder,^{98,†}
 R. Sobie,^{109,109,†} F. Socher,^{44,†} A. Sofner,^{133,†} D. A. Soh,^{151,151,†} C. A. Solans,^{93,†} M. Solar,^{128,†} J. Solc,^{128,†} E. Yu. Soldatov,^{98,†}
 U. Soldevila,^{167,†} A. A. Solodkov,^{130,†} A. Soloshenko,^{65,†} O. V. Solovyanov,^{130,†} V. Solov'yev,^{123,†} P. Sommer,^{48,†}
 H. Y. Song,^{93,†} N. Soni,^{1,†} A. Sood,^{15,†} A. Sopeck,^{128,†} B. Sopko,^{128,†} V. Sorin,^{12,†} D. Sosa,^{58b,†}
 M. M.索塞比,^{43,†} C. L. Sotiriopoulou,^{126a,126b,†} P. Soualah,^{164,164c,†} P. Souseid,^{83,†} A. M. Soukharev,^{109,109,†} D. South,^{42,†}
 B. C. Sowden,^{77,†} S. Spagnolo,^{77a,77b,†} M. Spalla,^{124a,124b,†} F. Spanò,^{77,†} W. R. Spearman,^{77,†} F. Spettel,^{101,†} R. Spighi,^{20a,†}
 G. Spiga,^{30,†} L. A. Spiller,^{88,†} M. Spousa,^{129,†} T. Spritzer,^{158,†} R. D. St. Denz,^{53,53,†} S. Staerz,^{44,†} J. Stahlin,^{119,†}
 R. Stamen,^{58,†} S. Stamm,^{16,†} E. Staneecka,^{49,†} C. Stanescu,^{134,8,†} M. Stanescu-Bellu,^{42,†} M. M. Stanizki,^{42,†} S. Stappnes,^{25,†}
 E. A. Starchenko,^{130,†} J. Stark,^{53,†} P. Staroba,^{127,†} P. Starovitz,^{42,†} R. Staszewski,^{90,†} P. Stavina,^{146a,146b,†} P. Steinberg,^{25,†}
 B. Stelzer,^{142,†} H. J. Stelzer,^{103,†} O. Stielzer-Chilton,^{159a,†} P. Soualah,^{164,164c,†} S. Stern,^{20,†} G. A. Stewart,^{53,†} J. A. Stillings,^{21,†}
 M. C. Stockton,^{87,†} M. Stoebe,^{47,†} G. Stoica,^{26a,†} P. Stoltz,^{54,†} S. Stojanek,^{201,†} A. R. Stradling,^{8,†} A. Straessner,^{34,†}
 M. E. Stramaglia,^{17,†} J. Strandberg,^{147,†} S. Strandberg,^{146a,146b,†} A. Strandlie,^{119,†} E. Strauss,^{113,†} M. Strauss,^{113,†}
 P. Strizelecki,^{144,†} R. Ströhmer,^{143,†} D. M. Strom,^{116,†} J. Stroykowski,^{40,†} A. Strubig,^{108,†} S. A. Stucci,^{13,†} B. Stugu,^{14,†}
 N. A. Styles,^{42,†} D. Su,^{143,†} J. Sun,^{125,†} R. Subramanian,^{79,†} A. Sucurro,^{12,†} Y. Sugaya,^{118,†} C. Suhr,^{108,†} M. Suk,^{128,†}
 V. V. Sulim,^{96,†} S. T. Sun,^{4c,†} T. Sumida,^{68,†} S. Sun,^{57,†} X. Sun,^{33a,†} J. E. Sundermann,^{48,†} K. Suruliz,^{149,†}
 G. Susimmo,^{37a,37b,†} M. R. Sutton,^{149,†} S. Suzuki,^{66,†} Y. Suzuki,^{66,†} M. Svatos,^{127,†} S. Swedish,^{168,†} M. Swiatlowski,^{143,8,†}
 I. Sykora,^{144a,†} I. Sykora,^{129,7,†} D. Ta,^{90,†} C. Tacconi,^{134a,134b,†} K. Tackmann,^{42,†} J. Taenzer,^{158,†} A. Taffard,^{163,8,†} R. Tarifour,^{159a,†}
 N. Taihiumi,^{153,†} H. Takai,^{25,†} T. Takashima,^{69,†} H. Takeda,^{87,†} T. Takeishi,^{140,†} Y. Takubo,^{66,†} M. Talby,^{83,†}
 A. A. Talyshev,^{109,109,†} J. Y. C. Tan,^{174,†} K. G. Tan,^{38,†} J. Tanaka,^{158,†} R. Tanaka,^{117,†} S. Tanaka,^{66,†} B. B. Tannenwald,^{111,†}
 N. Tamoury,^{23,†} S. Tapprogue,^{83,†} S. Tarem,^{152,†} F. Tarrade,^{29,†} G. F. Tartarelli,^{21a,†} P. Tas,^{128,†} M. Tasevsky,^{127,†}
 T. Tashiro,^{16,†} E. Tassi,^{37a,37b,†} A. Tavares Delgado,^{126a,126b,†} Y. Tayalati,^{135d,†} F. E. Taylor,^{94,†} G. N. Taylor,^{88,†} W. Taylor,^{159b,†}
 F. A. Teischinger,^{30,†} M. Teixeira Dias Castanheira,^{76,†} P. Teixeira-Dias,^{77,†} K. K. Temming,^{48,†} H. Ten Kate,^{30,†}
 P. K. Teng,^{151,†} J. J. Teoh,^{118,†} F. Tepel,^{178,†} S. Terada,^{66,†} K. Terashi,^{155,†} J. Terron,^{82,†} S. Terzo,^{101,†} M. Testa,^{47,†}
 R. J. Teuscher,^{158,158,†} J. Therhaag,^{21,†} T. Theveneau-Pelzer,^{34,†} J. Thomas,^{18,†} J. J. Thomas-Wilsker,^{77,†} E. N. Thompson,^{35,†}
 P. D. Thompson,^{18,†} R. J. Thompson,^{84,†} A. S. Thompson,^{53,53,†} A. S. Thomasen,^{122,†} E. Thomson,^{122,†} M. Thomson,^{26,†}
 R. P. Thun,^{30,8,†} M. J. Tibbets,^{25,†} E. Tiece Torres,^{85,†} S. Tokimori,^{96,96b,†} Yu. A. Tikhonov,^{109,109,†} S. Timoshenko,^{98,†}
 E. Tiouchichine,^{85,†} P. Tipton,^{176,†} S. Tisserant,^{85,†} T. Todorov,^{53,†} S. Todorova-Nova,^{120,†} J. Tojo,^{70,†} S. Tokář,^{144a,†}
 K. Tokushuku,^{66,†} K. Tolleson,^{90,†} E. Tolley,^{57,†} L. Tomlinson,^{84,†} M. Tomoto,^{103,†} L. Tompkins,^{143,143b,†} K. Toms,^{105,†}
 E. Torrence,^{116,†} H. Torres,^{142,†} E. Torrò Pastor,^{167,†} J. Toth,^{85,85,†} F. Touchard,^{85,†} D. R. Tovey,^{139,†} T. Trefzger,^{174,†}

- L. Tremblet,^{30,†} A. Tricoli,^{30,‡} I. M. Trigger,^{159a,§} S. Trincaz-Duvord,^{30,||} M. F. Tripiana,^{12,†} W. Trischuk,^{158,¶} B. Trocmé,^{55,¶} C. Troncon,^{94,¶} M. Trottier-McDonald,^{12,†} M. Trouvaille,^{12a,13a,¶} P. True,^{90,‡} L. Truong,^{164,164c,¶} M. Trzebinski,^{99,¶} A. Trzupek,^{30,‡} C. Tsarouchas,^{30,‡} J.-C.-L. Tseng,^{120,‡} P. V. Tsiareska,^{92,‡} D. Tsionis,^{154,‡} G. Tsipoliti,^{10,§} N. Tsiririanitis,^{9,‡} S. Tsikaridze,^{12,†} V. Tsikaridze,^{48,‡} E. G. Tskhadadze,^{51,‡} I. I. Tsukerman,^{97,‡} V. Tsulai,^{15,‡} S. Tsuno,^{66,‡} D. Tyshychev,^{148,‡} A. Tudorache,^{26a,†} V. Tudorache,^{26a,†} A. N. Tuna,^{20a,†} S. A. Tuppur,^{20a,20b,†} S. Turchikhin,^{99,¶} D. Turecek,^{128,‡} R. Turra,^{91a,91b,†} A. J. Turvey,^{40,‡} P. M. Tuts,^{14,‡} A. Tykhonov,^{95,†} M. Tymiad,^{148a,148b,†} M. Tyndel,^{131,†} I. Ueda,^{155,‡} R. Ueno,^{20,‡} M. Ughetto,^{140a,140b,†} M. Uglan,^{14,‡} M. Uhlenbroek,^{21,‡} F. Ukegawa,^{160,‡} G. Unal,^{30,‡} A. Undrus,^{25,‡} G. Unel,^{48,‡} F. C. Ungaro,^{48,‡} Y. Unno,^{66,‡} C. Unverdorben,^{100,‡} J. Urban,^{140b,†} P. Usquijo,^{88,‡} P. Uriegola,^{83,‡} G. Usaï,^{83,‡} A. Usanova,^{62,‡} L. Vacavant,^{48,‡} V. Vacek,^{120,‡} B. Vachon,^{87,‡} C. Valkeronis,^{9,‡} N. Valencic,^{9,‡} S. Valentim,^{20a,20b,†} A. Valero,^{167,‡} L. Valery,^{12,‡} S. Valkar,^{129,‡} E. Valladolid Gallego,^{167,‡} S. Vallecorta,^{49,‡} J. A. Valls Ferre,^{197,‡} W. Van Den Wollenberg,^{107,‡} P. C. Van Der Deijl,^{107,‡} R. van der Geer,^{107,‡} H. van der Graaf,^{107,‡} R. Van Der Leeuw,^{107,‡} N. van Eldik,^{152,‡} P. van Gemmeren,^{6,‡} J. Van Nieuwkoop,^{142,‡} I. van Vulpen,^{107,‡} M. C. van Woerden,^{38,‡} M. Vanadia,^{132a,132b,†} W. Vandael,^{30,‡} R. Vanguri,^{122,‡} A. Vaniacchine,^{6,‡} F. Vannucci,^{80,‡} G. Vardanyan,^{347,‡} R. Varri,^{132,‡} E. W. Varner,^{7,‡} T. Varol,^{40,‡} R. Varouchas,^{80,‡} A. Varnapetian,^{8,‡} K. E. Varvel,^{150,‡} F. Vazeille,^{347,‡} T. Vazquez Schroeder,^{87,‡} J. Veatch,^{7,‡} L. M. Veloci,^{158,‡} F. Veloso,^{126a,126b,†} T. Velz,^{21,‡} S. Veneziano,^{132a,‡} A. Ventura,^{73a,73b,‡} D. Ventura,^{86,‡} M. Venturi,^{169,‡} N. Venturi,^{158,‡} A. Venturini,^{23,‡} V. Vercesi,^{121a,‡} M. Verducci,^{132a,132b,‡} W. Verkerke,^{107,‡} J. C. Vermeulen,^{107,‡} A. Vest,^{44,‡} M. C. Vetterli,^{142,‡} O. Viazlo,^{81,‡} I. Ichou,^{185,‡} T. Vickey,^{139,‡} O. E. Vickey Boeriu,^{139,‡} G. H. A. Viehhauser,^{120,‡} S. Viel,^{15,‡} R. Vigne,^{30,‡} M. Villa,^{20a,20b,†} M. Villaplana Perez,^{91a,91b,‡} E. Vilucchi,^{47,‡} M. G. Vinctor,^{29,‡} V. B. Vinogradov,^{65,‡} I. Vivarelli,^{140,‡} F. Vives Vaque,^{3,‡} S. Vlachos,^{10,‡} D. Vladou,^{100,‡} M. Vlasak,^{128,‡} M. Vogel,^{128,‡} P. Vokac,^{128,‡} M. Volpi,^{88,‡} H. von der Schmitz,^{101,‡} H. von Radziewski,^{48,‡} E. von Toerne,^{27,‡} K. Vorobel,^{28,‡} M. Vos,^{30,‡} R. Voss,^{74,‡} N. Vranjes,^{31,‡} J. H. Vossebeld,^{74,‡} N. Vranjes,^{31,‡} M. Vranjes Milosavljevic,^{13,‡} V. Vrba,^{127,‡} M. Vreeswijk,^{107,‡} R. Vuillermet,^{30,‡} L. Vukotic,^{31,‡} Z. Vykydal,^{128,‡} P. Wagner,^{21,‡} W. Wagner,^{175,‡} H. Wahlberg,^{71,‡} S. Wahrund,^{44,‡} J. Wakabayashi,^{103,‡} J. Walker,^{72,‡} R. Walker,^{108,‡} W. Walkowiak,^{141,‡} C. Wang,^{33c,‡} F. Wang,^{173,‡} H. Wang,^{15,‡} L. Wang,^{40,‡} J. Wang,^{42,‡} J. Wang,^{33a,‡} K. Wang,^{37,‡} R. Wang,^{6,‡} S. M. Wang,^{151,‡} T. Wang,^{21,‡} X. Wang,^{27b,‡} C. Wanotayaroj,^{116,‡} A. Warburton,^{87,‡} C. P. Ward,^{26,‡} D. R. Wardrobe,^{76,‡} M. Warsinsky,^{48,‡} A. Washbrook,^{46,‡} C. Wasicki,^{42,‡} P. M. Watson,^{18,‡} L. J. Watson,^{150,‡} M. F. Watson,^{18,‡} G. Watts,^{128,‡} S. Watts,^{84,‡} B. M. Waugh,^{84,‡} S. Webb,^{84,‡} M. S. Weber,^{84,‡} S. W. Webber,^{174,‡} J. S. Webster,^{31,‡} A. R. Weidberg,^{120,‡} B. Weinert,^{61,‡} J. Weingarten,^{54,‡} C. Weiser,^{48,‡} H. Weiss,^{107,‡} P. S. Wells,^{30,‡} T. Wenaus,^{28,‡} T. Wengler,^{30,‡} S. Wenzl,^{30,‡} N. Wermes,^{21,‡} M. Werner,^{40,‡} P. Werner,^{30,‡} M. Wessels,^{20a,‡} J. Wetter,^{84,‡} K. Whalen,^{29,‡} A. M. Wharton,^{72,‡} A. White,^{8,‡} M. J. White,^{12,‡} R. White,^{32b,‡} S. White,^{124a,124b,†} D. Whiteson,^{165,‡} F. J. Wickens,^{131,‡} W. Wiedemann,^{173,‡} M. Wieler,^{131,‡} P. Wienemann,^{21,‡} C. Wiglesworth,^{36,‡} L. A. M. Wiik-Fuchs,^{21,‡} A. Wildauer,^{101,‡} H. G. Wilkens,^{30,‡} H. H. Williams,^{122,‡} S. Williams,^{107,‡} C. Willis,^{90,‡} S. Willcoq,^{88,‡} A. Wilson,^{89,‡} J. A. Wilson,^{18,‡} I. Wingerter-Seetz,^{5,‡} F. Winklmeier,^{116,‡} B. T. Winter,^{21,‡} M. Wittgen,^{144,‡} J. Wittkowski,^{100,‡} S. J. Wolffstadt,^{83,‡} M. W. Wolter,^{98,‡} H. Wolters,^{120a,120c,‡} B. K. Wosiak,^{39,‡} J. Wotschack,^{30,‡} M. J. Woudstra,^{84,‡} K. W. Woźniak,^{98,‡} M. Wu,^{55,‡} M. Wu,^{21,‡} S. L. Wu,^{273,‡} X. Wu,^{49,‡} Y. Wu,^{89,‡} T. R. Wyatt,^{84,‡} B. M. Wynne,^{66,‡} S. K. Xella,^{36,‡} D. Xu,^{33a,‡} L. Xu,^{33b,‡} B. Yabsley,^{150,‡} S. Yacoob,^{148,‡} Y. Yakabe,^{67,‡} M. Yamada,^{66,‡} Y. Yamaguchi,^{118,‡} A. Yamamoto,^{66,‡} S. Yamamoto,^{155,‡} T. Yamashita,^{155,‡} K. Yamanchi,^{103,‡} Y. Yamazaki,^{67,‡} Z. Yan,^{22,‡} H. Yang,^{3,‡} H. Yang,^{173,‡} Y. Yang,^{151,‡} L. Yao,^{36a,‡} W.-M. Yao,^{15,‡} Y. Yao,^{66,‡} E. Yatsenko,^{5,‡} K. Hay,Wong,^{21,‡} J. Ye,^{40,‡} S. Ye,^{23,‡} I. Yetleksiz,^{65,‡} A. L. Yen,^{37,‡} E. Yıldırım,^{42,‡} K. Yorita,^{171,‡} R. Yoshida,^{6,‡} K. Yoshihara,^{122,‡} C. Young,^{143,‡} C. J. S. Young,^{30,‡} S. Yousell,^{22,‡} D. R. Yu,^{15,‡} J. Yu,^{8,‡} J. M. Yu,^{89,‡} J. Yu,^{114,‡} L. Yuan,^{67,‡} A. Yurkewicz,^{108,‡} I. Yusoff,^{28,‡} B. Zabinsk,^{19,‡} R. Zaidan,^{63,‡} A. M. Zaitsev,^{130,3b,‡} J. Zalewicka,^{84,‡} A. Zaman,^{148,‡} S. Zamitbo,^{57,‡} L. Zanello,^{132a,132b,‡} D. Zanzi,^{98,‡} C. Zeitlin,^{175,‡} M. Zeman,^{128,‡} A. Zemla,^{38a,‡} K. Zengel,^{23,‡} O. Zenin,^{130,‡} T. Ženčík,^{144,‡} D. Žerwas,^{177,‡} D. Zhang,^{103,‡} F. Zhang,^{173,‡} L. Zhang,^{6,‡} L. Zhang,^{48,‡} R. Zhang,^{30,‡} X. Zhang,^{33d,‡} Z. Zhang,^{117,‡} X. Zhao,^{40,‡} Y. Zhao,^{33a,17,‡} Z. Zhao,^{33b,‡} A. Zhembegov,^{65,‡} J. Zhong,^{120,‡} B. Zhou,^{80,‡} C. Zhou,^{45,‡} L. Zhou,^{35,‡} L. Zhou,^{40,‡} N. Zhou,^{163,‡} C. G. Zhu,^{33d,‡} H. Zhu,^{33a,‡} J. Zhu,^{89,‡} Y. Zhu,^{33b,‡} X. Zhuang,^{33a,‡} K. Zhukov,^{96,‡} A. Zibell,^{174,‡} D. Ziemińska,^{61,‡} N. I. Zimine,^{65,‡} C. Zimmermann,^{83,‡} S. Zimmermann,^{84,‡} M. Zinser,^{83,‡} M. Ziolkowski,^{141,‡} L. Živković,^{173,‡} G. Zobemig,^{179,‡} M. Zuccoli,^{20a,20b,†} M. zur Nedden,^{16,‡} G. Zarzolo,^{104a,104b,†} L. Zwalski,^{30,‡} V. Khachatryan,^{173,‡} A. M. Sirunyan,^{170,‡} A. Tumasyan,^{170,‡} W. Adam,^{180,‡} E. Asilar,^{180,‡} T. Bergauer,^{180,‡} J. Brandstötter,^{180,‡} E. Brondolin,^{180,‡} M. Dragicevic,^{180,‡} J. Erő,^{180,‡} M. Flechi,^{180,‡} M. Friedl,^{180,‡} R. Fröhwith,^{180,‡} V. M. Ghete,^{180,‡} C. Hartl,^{180,‡} N. Hörmann,^{174,‡} J. Huubec,^{180,‡} M. Jeitler,^{180,‡} A. König,^{180,‡}

- M. Krammer,^{180,mn,2} L. Krätschmer,^{180,2} D. Liko,^{180,2} T. Matsushita,^{180,2} I. Mikulec,^{180,2} D. Rabady,^{180,mn,2} B. Rahbaran,^{180,2} H. Rohringer,^{180,2} J. Schieck,^{180,mn,2} R. Schönbeck,^{180,2} J. Strauss,^{180,2} W. Treberer-Treberspurg,^{180,2} W. Waltenberger,^{180,2} C.-E. Wulz,^{180,mn,2} V. Mossolov,^{182,2} N. Shumeiko,^{182,2} J. Suarez Gonzalez,^{182,2} S. Alderweireldt,^{182,2} T. Cornelis,^{182,2} E. A. De Wolf,^{182,2} X. Janssen,^{182,2} A. Knutsson,^{182,2} J. Lauwers,^{182,2} S. Luyckx,^{182,2} S. Ochesanu,^{182,2} R. Rougny,^{182,2} M. Van De Klaender,^{182,2} H. Van Haevermaet,^{182,2} P. Van Mechelen,^{182,2} N. Van Remortel,^{182,2} A. Van Spilbeeck,^{182,2} S. Abu Zeid,^{183,2} F. Blekman,^{183,2} D. Hondt,^{183,2} N. Daci,^{183,2} I. De Bruyn,^{183,2} K. Deroover,^{183,2} N. Heracleous,^{183,2} J. Keaveney,^{183,2} S. Lowette,^{183,2} L. Moreels,^{183,2} A. Olbrechts,^{183,2} Q. Python,^{183,2} D. Strom,^{183,2} S. Tavernier,^{183,2} W. Van Doninck,^{183,2} P. Van Mulders,^{183,2} G. P. Van Onsem,^{183,2} J. Van Parjs,^{183,2} P. Barria,^{184,2} C. Caillol,^{184,2} B. Clerbaux,^{184,2} G. De Lentdecker,^{184,2} H. Delannoy,^{184,2} D. Dobur,^{184,2} G. Fasnacht,^{184,2} L. Favart,^{184,2} A. P. R. Gay,^{184,2} A. Grebenyuk,^{184,2} T. Lenzi,^{184,2} A. Léonard,^{184,2} T. Maerschalk,^{184,2} M. Mohammadi,^{184,2} L. Perni,^{184,2} A. Randle-conde,^{184,2} T. Reis,^{184,2} T. Seva,^{184,2} L. Thomas,^{184,2} C. Vander Velde,^{184,2} P. Vanhae,^{184,2} J. Wang,^{184,2} R. Yonamine,^{184,2} F. Zenoni,^{184,2} F. Zhang,^{184,2} K. Beernaert,^{185,2} L. Benucci,^{185,2} A. Cimmino,^{185,2} S. Crucy,^{185,2} A. Fagot,^{185,2} G. Garcia,^{185,2} M. Gui,^{185,2} J. Mccartin,^{185,2} A. Ocampo Rios,^{185,2} D. Poyraz,^{185,2} D. Ryckbosch,^{185,2} S. Salva Gibala,^{185,2} M. Sigamani,^{185,2} N. Strobbe,^{185,2} M. Tytgat,^{185,2} W. Van Diressche,^{185,2} E. Yazgan,^{185,2} N. Zaganidis,^{185,2} S. Basegmez,^{186,mn,2} C. Beluffi,^{186,mn,2} O. Bondu,^{186,2} G. Bruno,^{186,2} R. Castello,^{186,2} A. Caudron,^{186,2} L. Ceard,^{186,2} G. G. Da Silveira,^{186,2} C. Delaere,^{186,2} D. Favart,^{186,2} L. Forthomme,^{186,2} A. Giannamico,^{186,2} J. Hollar,^{186,2} A. Jafari,^{186,2} P. Jez,^{186,2} M. Komm,^{186,2} V. Lemaitre,^{186,2} A. Mertens,^{186,2} C. Nuttens,^{186,2} L. Perni,^{186,2} A. Pin,^{186,2} K. Piotrkowski,^{186,2} A. Popov,^{186,2} L. Quertenmont,^{186,2} M. Selvaggi,^{186,2} M. Vidal Marono,^{186,2} N. Bely,^{187,2} T. Caeberg,^{187,2} G. H. Hammad,^{187,2} W. L. Aldá Junior,^{187,2} G. A. Alves,^{187,2} L. Brito,^{187,2} M. Corre Martins Junior,^{188,2} T. Dos Reis Martins,^{188,2} C. Hensel,^{188,2} C. Mora Herrera,^{188,2} A. Morais,^{188,2} M. E. Pot,^{188,2} P. Rebello Teles,^{188,2} E. Belchior Batista Das Chagas,^{189,2} W. Carvalho,^{189,2} J. Chinellato,^{189,2} A. Custodio,^{189,2} E. M. Da Costa,^{189,2} D. De Jesus Damiao,^{189,2} C. D. Oliveira Martins,^{189,2} S. Fonseca De Souza,^{189,2} L. M. Huertas Guativa,^{189,2} H. Malbouisson,^{189,2} D. Matos Figueiredo,^{189,2} L. Mundini,^{189,2} H. Nogima,^{189,2} W. L. Prado Da Silva,^{189,2} A. Santoro,^{189,2} A. Sznaider,^{189,2} E. J. Tonelli Mangano,^{189,2} A. Vilela Pereira,^{189,2} S. Ahuja,^{189,2} C. A. Bernardes,^{189,2} A. De Souza Santos,^{189,2} S. Dogra,^{189,2} T. R. Fernandez Perez Tomei,^{189,2} E. M. Gregores,^{189,2} G. Mercadante,^{189,2} S. Moon,^{189,2} S. F. Novais,^{189,2} Sandra S. Padula,^{189,2} D. Romero Abad,^{189,2} J. C. Ruiz Vargas,^{189,2} A. Aleksandrov,^{191,2} V. Genchev,^{191,2} R. Hadjiska,^{191,2} P. Iaydjiev,^{191,2} A. Marinov,^{191,2} S. Piperov,^{191,2} M. Rodozov,^{191,2} S. Stoykova,^{191,2} G. Sultanov,^{191,2} M. Utovata,^{191,2} A. Dimitrov,^{192,2} I. Glushkov,^{192,2} L. Litov,^{192,2} B. Pavlov,^{192,2} P. Petkov,^{192,2} M. Ahmad,^{193,2} J. G. Bian,^{193,2} G. M. Chen,^{193,2} H. S. Chen,^{193,2} M. Chen,^{193,2} T. Cheng,^{193,2} R. Du,^{193,2} C. H. Jiang,^{193,2} R. Pestina,^{193,2} F. Romeo,^{193,2} S. M. Shahaeen,^{193,2} J. Tao,^{193,2} C. Wang,^{193,2} Z. Wang,^{193,2} H. Zhang,^{193,2} C. Asawatangtrakuldej,^{194,2} Y. Ban,^{194,2} G. Chen,^{194,2} Q. Li,^{194,2} J. Liu,^{194,2} Y. Mao,^{194,2} S. J. Qian,^{194,2} D. Wang,^{194,2} M. Wang,^{194,2} Q. Wang,^{194,2} Z. Xu,^{194,2} D. Yang,^{194,2} Z. Zhang,^{194,2} W. Zou,^{194,2} C. Avila,^{195,2} A. Cabrera,^{195,2} L. F. Chaparro Sierra,^{195,2} C. Florez,^{195,2} J. P. Gomez,^{195,2} B. Gomez Moreno,^{195,2} J. C. Sanabria,^{195,2} N. Godinovic,^{196,2} D. Lelas,^{196,2} D. Polic,^{196,2} I. Pujak,^{196,2} Z. Antonovic,^{197,2} M. Kovac,^{197,2} V. Brigljevic,^{197,2} K. Kadija,^{197,2} J. Luetic,^{198,2} L. Sudic,^{198,2} A. Attikis,^{199,2} G. Mavromanolakis,^{199,2} J. Mousa,^{199,2} C. Nicolaou,^{199,2} F. Ptochos,^{199,2} P. A. Razis,^{199,2} H. Rykaczewski,^{199,2} M. Bodlak,^{200,2} M. Finger,^{200,2} M. Finger Jr.,^{200,2} A. Ali,^{201,2} R. Aly,^{201,2} S. Aly,^{201,2} Y. Assran,^{201,2} A. Ellithi Kamel,^{201,2} A. Lotfy,^{201,2} M. A. Mahmoud,^{201,2} R. Masod,^{201,2} A. Radi,^{201,2} Y. Assran,^{201,2} A. Ellithi Kamel,^{202,2} M. Alridal,^{202,2} A. Tiko,^{202,2} C. Veelken,^{202,2} P. Eerola,^{202,2} B. Calpas,^{202,2} M. Kadastik,^{202,2} M. Murumura,^{202,2} M. Raidal,^{202,2} A. Tiko,^{202,2} C. Veelken,^{202,2} J. Pekkanen,^{203,2} M. Voutilainen,^{203,2} J. Härkönen,^{204,2} V. Karimäki,^{204,2} R. Kinnunen,^{204,2} T. Lampén,^{204,2} K. Lassila-Perrin,^{204,2} S. Lehti,^{204,2} T. Lindén,^{204,2} P. Luukka,^{204,2} T. Mäenpää,^{204,2} T. Peltola,^{204,2} E. Tuominen,^{204,2} J. Tuominen,^{204,2} E. Tuominen,^{204,2} E. Tuominen,^{204,2} E. Tuominen,^{204,2} T. Wendland,^{204,2} J. Talvitie,^{205,2} T. Tuuva,^{205,2} M. Besancon,^{205,2} F. Couderc,^{205,2} M. Dejardin,^{206,2} D. Denegri,^{206,2} B. Fabro,^{206,2} J. L. Faure,^{206,2} C. Favaro,^{206,2} F. Ferri,^{206,2} S. Ganjour,^{206,2} A. Givernau,^{206,2} P. Gras,^{206,2} G. Hamel de Monchenault,^{206,2} P. Jarry,^{206,2} E. Locci,^{206,2} M. Machet,^{206,2} J. Malcles,^{206,2} J. Rander,^{206,2} A. Rosowsky,^{207,2} M. Titov,^{207,2} A. Zghiche,^{207,2} S. Baffioni,^{207,2} F. Beaudelet,^{207,2} P. Bussion,^{207,2} L. Cadamuro,^{207,2} E. Chapon,^{207,2} T. Charlot,^{207,2} T. Dahms,^{207,2} P. Davignon,^{207,2} N. Filipovic,^{207,2} A. Florent,^{207,2} R. Granier de Cassagnac,^{207,2} S. Lisiak,^{207,2} L. Mastrolenzio,^{207,2} P. Miné,^{207,2} I. N. Narango,^{207,2} M. Nguyen,^{207,2} C. Ochando,^{207,2} G. Ortona,^{207,2} P. Paganini,^{207,2} R. Regnard,^{207,2} R. Salerno,^{207,2} J. B. Sauvan,^{207,2} Y. Sirois,^{207,2} T. Streblér,^{207,2} Y. Yilmaz,^{207,2} A. Zabi,^{207,2} J.-L. Agram,^{208,2} J. Andrea,^{208,2} A. Aubin,^{208,2} D. Bloch,^{208,2} J.-M. Brom,^{208,2} M. Buttignol,^{208,2} E. C. Chabert,^{208,2} N. Chanon,^{208,2} C. Collard,^{208,2} E. Conte,^{208,2} J.-C. Fontaine,^{208,2} D. Gelé,^{208,2}

- U. Goerlach,^{208,1} C. Goetzmann,^{208,1} A.-C. Le Bihan,^{208,1} J. A. Merlin,^{208,1} K. Skovpen,^{208,1} P. Van Hove,^{208,1}
 S. Gadrat,^{209,1} S. Beauregard,^{209,1} C. Bermet,^{210,1} G. Bouroud,^{210,1} E. Bouvier,^{210,1} S. Brochet,^{210,1} C. A. Carrillo Montoya,^{210,1}
 J. Chassera,^{210,1} R. Chierici,^{210,1} D. Contardo,^{210,1} B. Courbon,^{210,1} P. Depasse,^{210,1} H. El Mamouni,^{210,1} J. Fan,^{210,1}
 J. Fay,^{210,1} S. Gascon,^{210,1} M. Gouzevitch,^{210,1} B. Ille,^{210,1} L. B. Laktine,^{210,1} M. Lethuillier,^{210,1} L. Mirabito,^{210,1}
 A. L. Pequegnat,^{210,1} S. Perries,^{210,1} J. D. Ruiz Alvarez,^{210,1} D. Sabes,^{210,2} L. Sgandurra,^{210,2} V. Sordini,^{210,2}
 M. Vander Donckt,^{210,1} P. Verdin,^{210,1} S. Viret,^{210,1} X. Xiao,^{210,2} Z. Tsamalaidze,^{211,1} C. Autermann,^{212,1} S. Beranek,^{212,1}
 M. Bontenackels,^{212,1} M. Edelhoff,^{212,1} L. Feld,^{212,1} A. Heister,^{212,1} M. K. Kiesel,^{212,1} K. Klein,^{212,1} M. Lipinski,^{212,1}
 A. Ostapchuk,^{212,1} M. Preuter,^{212,1} F. Raupach,^{212,1} J. Sammet,^{212,1} S. Schael,^{212,1} J. F. Schultz,^{212,1} T. Verlage,^{212,1}
 H. Weber,^{212,1} B. Wittmer,^{212,1} V. Zhukov,^{212,1} M. Ata,^{213,1} M. Brodski,^{213,1} E. Dietz-Laursonn,^{213,1} D. Duchardt,^{213,1}
 M. Endres,^{213,1} M. Erdmann,^{213,1} S. Erdweg,^{213,1} T. Esch,^{213,1} R. Fischer,^{213,1} A. Güth,^{213,1} T. Hebbeker,^{213,1}
 C. Heidemann,^{213,1} K. Hoepfner,^{213,1} D. Klingebiel,^{213,1} S. Knutzen,^{213,1} P. Kreuzer,^{213,1} M. Merschmeyer,^{213,1} A. Meyer,^{213,1}
 P. Millet,^{213,1} M. Olschewski,^{213,1} K. Padeken,^{213,1} P. Papacz,^{213,1} T. Pook,^{213,1} M. Radziej,^{213,1} H. Reithler,^{213,1}
 M. Rieger,^{213,1} F. Scheuch,^{213,1} L. Sonnenschein,^{213,1} D. Teysier,^{213,1} S. Thüer,^{213,1} V. Cherepanov,^{214,1} Y. Erdogan,^{214,1}
 G. Flügge,^{214,1} H. Geenen,^{214,1} M. Geisler,^{214,1} W. Ha Ahmad,^{214,1} F. Hoehe,^{214,1} B. Kargoll,^{214,1} T. Kress,^{214,1}
 Y. Kuessel,^{214,1} A. Künsken,^{214,1} J. Lingemann,^{214,1} A. Nehrkorn,^{214,1} A. Nowack,^{214,1} I. M. Nugent,^{214,1} C. Pistone,^{214,1}
 A. Pooth,^{214,1} A. Stahl,^{214,1} M. Aldaya Martin,^{215,1} I. Asin,^{215,1} N. Bartosik,^{215,1} O. Behnke,^{215,1} U. Behrens,^{215,1}
 A. J. Bell,^{215,1} K. Borras,^{215,1} A. Burgmeier,^{215,1} A. Cakir,^{215,1} L. Calligaris,^{215,1} A. Campbell,^{215,1} S. Choudhury,^{215,1}
 F. Costanza,^{215,1} C. Diez Pardos,^{215,1} G. Dolinsky,^{215,1} S. Dooling,^{215,1} T. Dorland,^{215,1} G. Eckerlin,^{215,1} D. Eckstein,^{215,1}
 T. Eichhorn,^{215,1} G. Flucke,^{215,1} E. Gallo,^{215,1} J. Garay Garcia,^{215,1} A. Geise,^{215,1} A. Gitzho,^{215,1} P. Gunnellini,^{215,1}
 J. Haas,^{215,1} M. Hempel,^{215,1} K. Kieseler,^{215,1} C. Kleinwort,^{215,1} I. Korol,^{215,1} W. Lange,^{215,1} J. Leonard,^{215,1} K. Lipka,^{215,1} A. Lobanova,^{215,1}
 W. Lohmann,^{215,1} R. Mankel,^{215,1} I. Marfin,^{215,1} I.-A. Melzer-Pellmann,^{215,1} A. B. Meyer,^{215,1} G. Mittag,^{215,1}
 J. Mnich,^{215,1} A. Mussigller,^{215,1} S. Naumann-Emme,^{215,1} A. Nayak,^{215,1} E. Ntomari,^{215,1} H. Perrey,^{215,1} D. Pitzl,^{215,1}
 R. Placakyte,^{215,1} A. Raspereza,^{215,1} P. M. Ribeiro Cipriano,^{215,1} B. Roland,^{215,1} M. O. Sahin,^{215,1} J. Salfeld-Nebgen,^{215,1}
 P. Saxena,^{215,1} T. Schoerner-Sadenius,^{215,1} M. Schröder,^{215,1} C. Seitz,^{215,1} S. Spannagel,^{215,1} K. D. Trippkewitz,^{215,1}
 C. Wissing,^{215,1} V. Blobel,^{216,1} Centis Vignali,^{216,1} A. Draeger,^{216,1} J. Erflie,^{216,1} E. Garutti,^{216,1} K. Goebel,^{216,1}
 D. Gonzalez,^{216,1} M. Görner,^{216,1} J. Haller,^{216,1} M. Hoffmann,^{216,1} R. Höing,^{216,1} A. Junkes,^{216,1} R. Klanner,^{216,1}
 R. Kogler,^{216,1} T. Lapsien,^{216,1} T. Lenz,^{216,1} I. Marchesini,^{216,1} D. Marconi,^{216,1} D. Nowatschin,^{216,1} J. Ott,^{216,1}
 F. Pantaleo,^{216,1} T. Peiffer,^{216,1} A. Perieanu,^{216,1} N. Pletsch,^{216,1} J. Poehlsen,^{216,1} D. Rathjens,^{216,1} C. Sander,^{216,1}
 H. Schettler,^{216,1} P. Schleper,^{216,1} E. Schlieckau,^{216,1} A. Schmidt,^{216,1} J. Schwandt,^{216,1} M. Seidel,^{216,1} V. Sola,^{216,1}
 H. Stadie,^{216,1} G. Steinbrück,^{216,1} H. Tholen,^{216,1} D. Treonelle,^{216,1} E. Usai,^{216,1} L. Vanelder,^{216,1} A. Vanhofer,^{216,1}
 M. Akbyiyik,^{217,1} C. Amstutz,^{217,1} C. Barth,^{217,1} C. Baus,^{217,1} J. Berger,^{217,1} C. Beskidt,^{217,1} C. Böser,^{217,1} E. Butz,^{217,1}
 R. Casprt,^{217,1} T. Chwalek,^{217,1} F. Colombo,^{217,1} W. De Boer,^{217,1} A. Desroclos,^{217,1} A. Dierlamm,^{217,1} R. Eber,^{217,1}
 M. Feindt,^{217,1} S. Fink,^{217,1} M. Fischer,^{217,1} F. French,^{217,1} B. Freund,^{217,1} R. Friese,^{217,1} D. Funka,^{217,1} M. Giffels,^{217,1}
 A. Gilbert,^{217,1} D. Haitz,^{217,1} T. Harbaum,^{217,1} M. A. Harrendorf,^{217,1} F. Hartmann,^{217,1} U. Husemann,^{217,1} F. Kassel,^{217,1}
 I. Katkov,^{217,1} A. Kormayer,^{217,1} S. Kudella,^{217,1} P. Lobelle Pardo,^{217,1} B. Maier,^{217,1} H. Mildner,^{217,1} M. U. Mozer,^{217,1}
 T. Müller,^{217,1} Th. Müller,^{217,1} M. Plagge,^{217,1} M. Printz,^{217,1} G. Quast,^{217,1} K. Rabbertz,^{217,1} S. Röcker,^{217,1} F. Roscher,^{217,1}
 I. Shvetsov,^{217,1} G. Sieber,^{217,1} H. J. Simonis,^{217,1} F. M. Stober,^{217,1} R. Ulrich,^{217,1} J. Wagner-Kuhr,^{217,1} S. Wayand,^{217,1}
 T. Weiler,^{217,1} S. Williamson,^{217,1} C. Wöhrmann,^{217,1} R. Wolf,^{217,1} G. Agnostoni,^{218,1} G. Daskalakis,^{218,1} T. Gerald,^{218,1}
 V. A. Giakoumopoulou,^{218,1} A. Kyriakis,^{218,1} D. Loukas,^{218,1} A. Markou,^{218,1} A. Psallidas,^{218,1} I. Topsis-Giotis,^{218,1}
 A. Agapitos,^{219,1} S. Kesiosoglou,^{219,1} A. Panagioutou,^{219,1} N. Saoulidou,^{219,1} E. Tzafiri,^{219,1} I. Evangelou,^{219,1} G. Flouris,^{219,1}
 C. Fouad,^{220,1} P. Kokkas,^{220,1} N. Loukas,^{220,1} N. Manthos,^{220,1} I. Papadopoulos,^{220,1} E. Paradas,^{220,1} J. Strologas,^{220,1}
 G. Bencze,^{221,1} C. Hajdu,^{221,1} A. Hazi,^{221,1} P. Hidas,^{221,1} D. Horvath,^{221,1} F. Sikler,^{221,1} V. Veszpremi,^{221,1}
 G. Vesztrombi,^{221,1} A. J. Zsigmond,^{221,1} N. Beni,^{222,1} S. Czelarz,^{222,1} J. Karancsi,^{222,1} J. Molnar,^{222,1} Z. Szillas,^{222,1}
 M. Bartok,^{223,1} A. Makovec,^{223,1} P. Raics,^{223,1} Z. L. Trocsanyi,^{223,1} B. Ujvari,^{223,1} P. Mal,^{224,1} K. Mandal,^{224,1} N. Sahoo,^{224,1}
 S. K. Swain,^{224,1} S. Bansals,^{224,1} S. B. Beri,^{224,1} B. Bhattacharjee,^{224,1} A. Chawla,^{224,1} R. Gupta,^{224,1} U. Bhawandeep,^{224,1}
 A. K. Kalsi,^{225,1} A. Kaur,^{225,1} M. Kaur,^{225,1} R. Kumar,^{225,1} A. Mehta,^{225,1} M. Mittal,^{225,1} N. Nishu,^{225,1} J. B. Singh,^{225,1}
 G. Walia,^{226,1} Ashok Kumar,^{226,1} Arun Kumar,^{226,1} A. Bhardwaj,^{226,1} B. C. Choudhary,^{226,1} R. B. Garg,^{226,1} A. Kumar,^{226,1}
 S. Malhotra,^{226,1} M. Naimuddin,^{226,1} K. Ranjan,^{226,1} R. Sharma,^{226,1} S. Banerjee,^{227,1} S. Bhattacharya,^{227,1}

- K. Chatterjee,^{227,1} S. Dey,^{227,1} S. Dutta,^{227,1} Sa. Jain,^{227,1} Sh. Jain,^{227,1} R. Khurana,^{227,1} N. Majumdar,^{227,1} A. Modak,^{227,1} K. Mondal,^{227,1} S. Mukherjee,^{227,1} S. Mukhopadhyay,^{227,1} A. Roy,^{227,1} D. Roy,^{227,1} S. Roy,^{227,1} S. Sarkar,^{227,1} M. Sharan,^{227,1} A. Abdulsalam,^{228,1} R. Chudasma,^{228,1} V. Jha,^{228,1} V. Kumar,^{228,1} A. K. Mohanty,^{228,1} L. M. Pant,^{228,1} P. Shukla,^{228,1} A. Topkar,^{228,1} T. Aziz,^{229,1} S. Banerjee,^{229,1} S. Bhownik,^{229,1} R. M. Chatterjee,^{229,1} R. K. Dewanjee,^{229,1} S. Dugad,^{229,1} S. Ganguly,^{229,1} S. Ghosh,^{229,1} M. Guchait,^{229,1} A. Guru,^{229,1} G. Kole,^{229,1} S. Kumar,^{229,1} E. Mahakud,^{229,1} M. Maiti,^{229,1} G. Majumder,^{229,1} K. Mazumdar,^{229,1} S. Mitra,^{229,1} G. B. Mohanty,^{229,1} B. Parida,^{229,1} T. Sarkar,^{229,1} K. Sudhakar,^{229,1} N. Sutar,^{229,1} B. Sutar,^{229,1} N. Wickramage,^{229,1} S. Sharma,^{230,1} H. Bakshiansohi,^{231,1} H. Behnamian,^{231,1} S. M. Etesami,^{231,1} A. Fahim,^{231,1} R. Goldouzian,^{231,1} M. Khakzaei,^{231,1} M. Mohammadi Najafabadi,^{231,1} M. Naseri,^{231,1} S. Pakiniai Mehdibadi,^{231,1} F. Rezaei Hosseiniabadi,^{231,1} B. Safarzadeh,^{231,1} M. Zeinali,^{232,1} M. Felcini,^{232,1} G. Grunewald,^{232,1} M. Abbrescia,^{233a,233b,1} C. Calabria,^{233a,233b,1} C. Caputo,^{233a,233b,1} S. S. Chhibra,^{233a,233b,1} A. Colaleo,^{233a,233b,1} D. Creanza,^{233a,233b,1} L. Cristella,^{233a,233b,1} N. De Filippi,^{233a,233b,1} M. De Palma,^{233a,233b,1} L. Fiori,^{233a,233b,1} G. Iaselli,^{233a,233b,1} G. Maggi,^{233a,233b,1} M. Maggi,^{233a,233b,1} G. Minicello,^{233a,233b,1} S. Mylva,^{233a,233b,1} S. Nuzzo,^{233a,233b,1} A. Pompli,^{233a,233b,1} G. Pugliese,^{233a,233b,1} R. Radogna,^{233a,233b,1} A. Ranieri,^{233a,233b,1} L. Silvestri,^{233a,233b,1} R. Venditti,^{233a,233b,1} P. Verwilligen,^{233a,233b,1} G. Abbiendi,^{234a,234b,1} C. Battilana,^{234a,234b,1} A. Cenvenuti,^{234a,234b,1} D. Bonacorsi,^{234a,234b,1} R. Bribaart-Giacomelli,^{234a,234b,1} L. Brigliadori,^{234a,234b,1} R. Campanini,^{234a,234b,1} P. Capiluppi,^{234a,234b,1} A. Castro,^{234a,234b,1} F. R. Cavallo,^{234a,234b,1} G. Codispoti,^{234a,234b,1} M. Cuffiani,^{234a,234b,1} G. M. Dallavalle,^{234a,234b,1} F. Fabbri,^{234a,234b,1} A. Fanfani,^{234a,234b,1} D. Fasanella,^{234a,234b,1} P. Giacomelli,^{234a,234b,1} C. Grandi,^{234a,234b,1} L. Guiducci,^{234a,234b,1} S. Marcelli,^{234a,234b,1} A. Montanari,^{234a,234b,1} F. L. Navaria,^{234a,234b,1} A. Perrotta,^{234a,234b,1} A. M. Rossi,^{234a,234b,1} C. Rovelli,^{234a,234b,1} G. P. Siroli,^{234a,234b,1} N. Tosi,^{234a,234b,1} R. Travaglini,^{234a,234b,1} G. Cappello,^{235a,235b,1} M. Chiorboli,^{235a,235b,1} S. Costa,^{235a,235b,1} F. Giordano,^{235a,235b,1} R. Potenza,^{235a,235b,1} A. Tricomi,^{236a,236b,1} G. Barbagli,^{236a,236b,1} V. Ciulli,^{236a,236b,1} C. Civinini,^{236a,236b,1} R. D'Alessandro,^{236a,236b,1} E. Focardi,^{236a,236b,1} S. Gonzi,^{236a,236b,1} V. Giorni,^{236a,236b,1} P. Lenzi,^{236a,236b,1} M. Meschini,^{236a,236b,1} S. Paoletti,^{236a,236b,1} G. Sguazzoni,^{236a,236b,1} A. Tropiano,^{237,1} L. Viliani,^{236a,236b,1} L. Benussi,^{237,1} S. Bianco,^{237,1} F. Fabri,^{237,1} D. Piccolo,^{237,1} V. Calvelli,^{238a,238b,1} F. Ferro,^{238a,238b,1} M. Lo Vetere,^{238a,238b,1} E. Robutti,^{238a,238b,1} S. Tosi,^{238a,238b,1} M. E. Di Marzo,^{239a,239b,1} S. Fiorendi,^{239a,239b,1} S. Gennari,^{239a,239b,1} R. Gerosa,^{239a,239b,1} A. Ghezzi,^{239a,239b,1} P. Govoni,^{239a,239b,1} S. Malvezzi,^{239a,239b,1} R. A. Manzoni,^{239a,239b,1} B. Marzocchi,^{239a,239b,1} D. Menasse,^{239a,239b,1} L. Moroni,^{239a,239b,1} M. Pagani,^{239a,239b,1} D. Pedrini,^{239a,239b,1} S. Ragazzi,^{239a,239b,1} N. Redaelli,^{239a,239b,1} T. Tabarelli de Fatis,^{239a,239b,1} S. Buontempo,^{239a,239b,1} N. Cavallo,^{240a,240b,1} S. Di Guida,^{240a,240b,1} M. Esposito,^{240a,240b,1} F. Fabozzi,^{240a,240b,1} A. O. M. Iorio,^{240a,240b,1} G. Lanza,^{240a,240b,1} L. Lista,^{240a,240b,1} S. Meola,^{240a,240b,1} M. Merola,^{240a,240b,1} F. Paolucci,^{240a,240b,1} C. Sciacca,^{240a,240b,1} F. Thyssen,^{240a,240b,1} P. Azzi,^{241a,241b,1} N. Bacchetta,^{241a,241b,1} D. Bisello,^{241a,241b,1} J. Branca,^{241a,241b,1} R. Carlisi,^{241a,241b,1} A. Carvalho Antunes De Oliveira,^{241a,241b,1} P. Checchia,^{241a,241b,1} M. Dall'Osso,^{241a,241b,1} T. Dorigo,^{241a,241b,1} U. Dosselli,^{241a,241b,1} F. Gasparini,^{241a,241b,1} U. Gasparini,^{241a,241b,1} A. Gozzelino,^{241a,241b,1} K. Kanishchev,^{241a,241b,1} S. Lacaprara,^{241a,241b,1} M. Margoni,^{241a,241b,1} A. T. Meneguzzo,^{241a,241b,1} J. Pazzini,^{241a,241b,1} N. Pozzobon,^{241a,241b,1} P. Ronchese,^{241a,241b,1} F. Simonetto,^{241a,241b,1} E. Torassa,^{241a,241b,1} M. Tosi,^{241a,241b,1} M. Zanetti,^{241a,241b,1} P. Zotto,^{241a,241b,1} A. Zucchetta,^{241a,241b,1} G. Zumerle,^{241a,241b,1} A. Braghieri,^{242a,242b,1} M. Gabusi,^{242a,242b,1} A. Magnani,^{242a,242b,1} S. P. Ratti,^{242a,242b,1} V. Re,^{242,1} C. Riccardi,^{242a,242b,1} P. Salvini,^{242a,242b,1} I. Vai,^{242,1} P. Vitali,^{242a,242b,1} L. Alunni Solestizi,^{243a,243b,1} M. Biasini,^{243a,243b,1} G. M. Bilen,^{243a,243b,1} D. Ciangottini,^{243a,243b,1} L. Fanò,^{243a,243b,1} P. Lericcà,^{243a,243b,1} G. Mantovani,^{243a,243b,1} M. Menichelli,^{243a,243b,1} A. Saha,^{243a,243b,1} A. Santoccia,^{243a,243b,1} A. Spiezia,^{243a,243b,1} K. Androssov,^{244a,244b,1} P. Azzurri,^{244a,244b,1} G. Baglisi,^{244a,244b,1} J. Bernardi,^{244a,244b,1} T. Boccali,^{244a,244b,1} G. Broccolo,^{244a,244b,1} R. Castaldi,^{244a,244b,1} M. A. Ciocci,^{244a,244b,1} R. Dell'Orso,^{244a,244b,1} S. Donato,^{244a,244b,1} G. Fedi,^{244a,244b,1} L. Fou,^{244a,244b,1} A. Giassi,^{244a,244b,1} M. T. Grippo,^{244a,244b,1} F. Ligabue,^{244a,244b,1} T. Lomtadze,^{244a,244b,1} L. Martin,^{244a,244b,1} A. Messineo,^{244a,244b,1} F. Palla,^{244a,244b,1} A. Rizzi,^{244a,244b,1} A. Savoy-Navarro,^{244a,244b,1} A. T. Serban,^{244a,244b,1} P. Spagnolo,^{244a,244b,1} P. Squillacioti,^{244a,244b,1} R. Tenchini,^{244a,244b,1} G. Tonelli,^{244a,244b,1} A. Venturi,^{244a,244b,1} P. G. Verdini,^{244a,244b,1} L. Barone,^{245a,245b,1} F. Cavallari,^{245a,245b,1} G. D'imperio,^{245a,245b,1} D. Re,^{245a,245b,1} M. Diemoz,^{245a,245b,1} S. Gelli,^{245a,245b,1} C. Jorda,^{245a,245b,1} E. Longo,^{245a,245b,1} F. Margaroli,^{245a,245b,1} P. Meridiani,^{245a,245b,1} F. Michelini,^{245a,245b,1} G. Organini,^{245a,245b,1} R. Paramatti,^{245a,245b,1} F. Pretiato,^{245a,245b,1} S. Rahatlou,^{245a,245b,1} C. Rovelli,^{245a,245b,1} F. Santanastasio,^{245a,245b,1} E. Traczyk,^{245a,245b,1} N. Amapane,^{246a,246b,1} R. Arcidiacono,^{246a,246b,1} C. Rovelli,^{246a,246b,1} F. Santanastasio,^{246a,246b,1} R. Bellan,^{246a,246b,1} C. Biino,^{246a,246b,1} N. Cartiglia,^{246a,246b,1} M. Costa,^{246a,246b,1} R. Covarelli,^{246a,246b,1} A. Degana,^{246a,246b,1} N. Demaria,^{246a,246b,1} L. Finco,^{246a,246b,1} B. Kiani,^{246a,246b,1} C. Mariotti,^{246a,246b,1} S. Maselli,^{246a,246b,1} E. Migliore,^{246a,246b,1} V. Monaco,^{246a,246b,1} E. Montel,^{246a,246b,1} M. Musich,^{246a,246b,1} M. Obertino,^{246a,246b,1} L. Pacher,^{246a,246b,1} N. Pastore,^{246a,246b,1} M. Pelliccioni,^{246a,246b,1} G. L. Pinna Angioni,^{246a,246b,1}

- F. Ravera,^{246a,246b,1} A. Romero,^{246a,246b,1} M. Ruspa,^{246a,246c,1} R. Sacchi,^{246a,246b,1} A. Solano,^{246a,246b,1} A. Staiano,^{246a,1} U. Tamponi,^{246a,2,1} S. Belforte,^{247a,1} V. Candelsei,^{247a,1} M. Casarsa,^{247a,1} F. Cossutti,^{247a,2,1} G. Della Ricca,^{247a,247b,1} B. Gibbo,^{247a,2} C. La Licata,^{247a,247b,1} M. Marone,^{247a,247b,1} A. Schizzi,^{247a,247b,1} T. Umer,^{247a,247b,1} A. Zanetti,^{247a,1} S. Chang,^{248,1} A. Kropivnitskaya,^{248,1} S. K. Nam,^{248,1} D. H. Kim,^{249,1} G. N. Kim,^{249,1} M. S. Kim,^{249,1} D. J. Kong,^{249,1} S. Lee,^{249,1} Y. D. Oh,^{249,1} A. Sakharov,^{249,1} D. C. Son,^{249,1} J. A. Brochero Cifuentes,^{250,1} H. Kim,^{250,1} T. J. Kim,^{250,1} M. S. Ryu,^{250,1} S. Song,^{251,1} S. Choi,^{252,1} Y. Go,^{252,1} D. Gyun,^{252,1} B. Hong,^{252,1} M. Jo,^{252,1} H. Kim,^{252,1} Y. Kim,^{252,1} B. Lee,^{252,1} K. S. Lee,^{252,1} S. Lee,^{252,1} S. K. Park,^{252,1} Y. Roh,^{252,1} H. D. Yoo,^{253,1} M. Choi,^{254,1} J. H. Kim,^{254,1} J. S. H. Lee,^{254,1} I. C. Park,^{254,1} G. Ryu,^{254,1} Y. Choi,^{255,1} Y. K. Choi,^{255,1} J. Goh,^{255,1} D. Kim,^{255,1} E. Kwon,^{255,1} J. Lee,^{255,1} I. Yu,^{255,1} A. Juodagalvis,^{256,1} J. Vaikus,^{256,1} Z. A. Ibrahim,^{257,1} J. R. Komaragiri,^{257,1} M. A. B. Md Ali,^{257,1} F. Mohamad Idris,^{257,1} W. A. T. Wan Abdullah,^{257,1} E. Casimiro Linares,^{258,1} H. Castilla-Valdez,^{258,1} E. De La Cruz-Burelo,^{258,1} I. Heredia-de La Cruz,^{258,1} A. Hernandez-Almada,^{258,1} R. Lopez-Fernandez,^{258,1} A. Sanchez-Hernandez,^{258,1} S. Carrillo Moreno,^{259,1} F. Vazquez Valencia,^{259,1} S. Carpintero,^{260,1} I. Pedraza,^{260,1} H. A. Salazar Ibarague,^{260,1} A. Morelos Pineda,^{261,1} D. Krofcheck,^{262,1} P. H. Butler,^{263,1} S. Reucroft,^{263,1} A. Ahmad,^{264,1} M. Ahmad,^{264,1} Q. Hassan,^{264,1} H. R. Hoornai,^{264,1} W. A. Khan,^{264,1} T. Khurshid,^{264,1} M. Shoab,^{264,1} H. Bialkowska,^{265,1} M. Blin,^{265,1} B. Boimska,^{265,1} T. Fruehoebs,^{265,1} M. Gorski,^{265,1} M. Kazana,^{265,1} K. Nawrocki,^{265,1} K. Romanowska-Rybinska,^{265,1} M. Szleper,^{265,1} P. Zalewski,^{265,1} G. Brona,^{266,1} K. Bunkowski,^{266,1} K. Doroba,^{266,1} A. Kalinowski,^{266,1} M. Konecki,^{266,1} J. Krolikowski,^{266,1} M. Misura,^{266,1} M. Olszewski,^{266,1} M. Walczak,^{266,1} P. Bargassa,^{267,1} C. Beirão da Cruz e Silva,^{267,1} A. Di Francesco,^{267,1} P. Faccioli,^{267,1} P. G. Ferreira Parracho,^{267,1} M. Gallinaro,^{267,1} L. Lloret Iglesias,^{267,1} F. Nguyen,^{267,1} J. Rodriguez Antunes,^{267,1} J. Seixas,^{267,1} O. Toldaiay,^{267,1} D. Vadruccio,^{267,1} J. Varela,^{267,1} P. Vischia,^{267,1} S. Afamiasiev,^{268,1} P. Buning,^{268,1} M. Gavrilenko,^{268,1} I. Golutvin,^{268,1} I. Gorbovich,^{268,1} A. Kamenev,^{268,1} V. Karjavin,^{268,1} V. Komoplyanikov,^{268,1} A. Lanev,^{268,1} A. Malakhov,^{268,1} V. Matveev,^{268,1} P. Moisenko,^{268,1} V. Palichik,^{268,1} V. Perelygin,^{268,1} S. Shmatov,^{268,1} S. Shulha,^{268,1} N. Skatchkov,^{268,1} V. Smirnov,^{268,1} T. Torishiashvili,^{268,1} A. Zarubin,^{268,1} V. Golovtsov,^{269,1} Y. Ivanov,^{269,1} V. Kim,^{269,1} E. Kuznetsova,^{269,1} P. Levchenko,^{269,1} V. Murzin,^{269,1} V. Oreshkin,^{269,1} I. Smirnov,^{269,1} V. Sulimov,^{269,1} L. Uvarov,^{269,1} S. Savilov,^{269,1} A. Vorobьев,^{270,1} Yu. Andreev,^{270,1} A. Dermenev,^{270,1} S. Gminienko,^{270,1} N. Golubev,^{270,1} A. Kameyev,^{270,1} M. Kirsanov,^{270,1} N. Krasnikov,^{270,1} A. Pashenkov,^{270,1} D. Tilov,^{270,1} A. Toropin,^{270,1} V. Epishyn,^{271,1} V. Gavrilov,^{271,1} N. Lychkovskaya,^{271,1} V. Popov,^{271,1} I. Pozdnyakov,^{271,1} G. Safronov,^{271,1} A. Spiridonov,^{271,1} E. Vlason,^{271,1} A. Zhokin,^{271,1} V. Andreev,^{272,1} M. Azarkin,^{272,1} I. Dremin,^{272,1} M. Kirakosyan,^{272,1} A. Leonidov,^{272,1} G. Mesyats,^{272,1} S. V. Rusakov,^{272,1} A. Vinogradov,^{272,1} A. Baskakov,^{273,1} A. Belyaev,^{273,1} E. Boos,^{273,1} V. Bunichev,^{273,1} M. Dubinin,^{273,1} L. Dudko,^{273,1} A. Ershov,^{273,1} A. Grishubin,^{273,1} V. Klyukhin,^{273,1} O. Kodolova,^{273,1} I. Likholtin,^{273,1} I. Myagkov,^{273,1} S. Obraztsov,^{273,1} S. Petrushanko,^{273,1} V. Savrin,^{273,1} I. Azhgirey,^{274,1} I. Bayshev,^{274,1} S. Bitoukov,^{274,1} V. Kachanov,^{274,1} A. Kalinin,^{274,1} D. Konstantinov,^{274,1} V. Krychkine,^{274,1} V. Petrov,^{274,1} R. Rytin,^{274,1} A. Sobol,^{274,1} L. Touarchanovich,^{274,1} S. Troshin,^{274,1} N. Tyurin,^{274,1} A. Uzunian,^{274,1} A. Volkov,^{274,1} P. Adzie,^{274,1} M. Ekmekci,^{274,1} J. Milosevic,^{274,1} V. Rekovic,^{274,1} J. Alcaraz Maestre,^{276,1} E. Calvo,^{276,1} M. Cerrada,^{276,1} M. Chamizo Llatas,^{276,1} N. Colino,^{276,1} B. De La Cruz,^{276,1} A. Delgado Peris,^{276,1} D. Dominguez Vázquez,^{276,1} A. Escalante Del Valle,^{276,1} C. Fernandez Bedoya,^{276,1} J. P. Fernández Ramos,^{276,1} J. Fliz,^{276,1} M. C. Fouz,^{276,1} P. Garcia-Abia,^{276,1} O. González Lopez,^{276,1} S. Goy Lopez,^{276,1} J. M. Hernández,^{276,1} M. I. Josa,^{276,1} E. Navarro De Martino,^{276,1} P. Pérez-Calero Yzquierdo,^{276,1} J. Puerta Pelayo,^{276,1} A. Quintario Olmeda,^{276,1} I. Redondo,^{276,1} L. Romero,^{276,1} M. S. Soares,^{276,1} C. Albjar,^{277,1} J. F. P. Trocóniz,^{277,1} M. Missiroli,^{277,1} D. Moran,^{277,1} H. Brun,^{278,1} J. Cuevas,^{278,1} J. Fernández Menéndez,^{278,1} S. Folgueras,^{278,1} I. Gonzalez Caballero,^{278,1} E. Palencia Cortezon,^{278,1} J. M. Vizan García,^{278,1} I. J. Cabrillo,^{278,1} A. Calderon,^{278,1} J. R. Castilleiras De Saa,^{279,1} J. Duarte Campderros,^{279,1} M. Fernandez,^{279,1} G. Gomez,^{279,1} A. Graziano,^{279,1} A. Lopez Virtu,^{279,1} J. Marco,^{279,1} R. Marco,^{279,1} C. Martinez Rivero,^{279,1} F. J. Munoz Sanchez,^{279,1} J. Piedra Gomez,^{279,1} T. Rodrigo,^{279,1} A. Y. Rodriguez-Marrero,^{279,1} A. Ruiz-Jimeno,^{279,1} L. Scodellaro,^{279,1} I. Vilà,^{279,1} R. Vilar Cortabarri,^{279,1} D. Abbaneo,^{280,1} E. Auffray,^{280,1} G. Auzinger,^{280,1} M. Bachtis,^{280,1} P. Baillon,^{280,1} A. H. Ball,^{280,1} D. Barney,^{280,1} A. Benaglia,^{280,1} J. Bensdorff,^{280,1} J. F. Benitez,^{280,1} G. M. Berruti,^{280,1} P. Bloch,^{280,1} A. Bocci,^{280,1} A. Bonato,^{280,1} C. Botti,^{280,1} H. Breuval,^{280,1} T. Camporesi,^{280,1} G. Cerninaria,^{280,1} S. Colafranceschi,^{280,2} M. D'Alfonso,^{280,1} D. d'Enterria,^{280,1} A. Dabrowski,^{280,1} V. Duponte,^{280,1} A. David,^{280,1} M. De Gruttola,^{280,1} F. De Gui,^{280,1} A. De Roeck,^{280,1} S. De Visscher,^{280,1} E. Di Marco,^{280,1} M. Dobson,^{280,1} M. Dordevic,^{280,1} T. du Pree,^{280,1} N. Dupont-Sagorin,^{280,1} A. Elliott-Peisert,^{280,1} G. Franzoni,^{280,1} W. Funk,^{280,1} D. Gigi,^{280,1} K. Gill,^{280,1} D. Giordano,^{280,1}

- M. Girone,^{280,1} F. Glege,^{280,1} R. Guida,^{280,1} S. Gundacker,^{280,1} M. Guthoff,^{280,1} J. Hammer,^{280,1} M. Hansen,^{280,1} P. Harris,^{280,1} J. Hegeman,^{280,1} V. Innocente,^{280,1} P. Janot,^{280,1} H. Kirschennmann,^{280,1} K. Kousours,^{280,1} J. Krajcicar,^{280,1} P. Lecoq,^{280,1} C. Lourenco,^{280,1} M. T. Lucchini,^{280,1} N. Magni,^{280,1} L. Malgeri,^{280,1} M. Mannelli,^{280,1} J. Marrouche,^{280,1} A. Martelli,^{280,1} L. Masetti,^{280,1} F. Meijers,^{280,1} S. Mersi,^{280,1} E. Meschi,^{280,1} F. Moortgat,^{280,1} S. Morovic,^{280,1} M. Mulders,^{280,1} M. V. Nemallapudi,^{280,1} H. Neugebauer,^{280,1} S. Orfanelli,^{280,1} L. Orsini,^{280,1} L. Pape,^{280,1} E. Perez,^{280,1} A. Petrelli,^{280,1} G. Petrucciani,^{280,1} A. Pfeiffer,^{280,1} D. Piparo,^{280,1} A. Racz,^{280,1} G. Rolandi,^{280,1} M. Rovere,^{280,1} M. Ruan,^{280,1} H. Sakulin,^{280,1} C. Schäfer,^{280,1} C. Schwick,^{280,1} A. Sharma,^{280,1} P. Silva,^{280,1} M. Simon,^{280,1} P. Spighi,^{280,1} D. Spiga,^{280,1} J. Stegemann,^{280,1} B. Stieger,^{280,1} M. Stoye,^{280,1} Y. Takahashi,^{280,1} D. Treille,^{280,1} A. Tsirou,^{280,1} G. I. Veres,^{280,1} N. Wardle,^{280,1} H. K. Wöhri,^{280,1} A. Zagozdzinska,^{280,1} W. D. Zeuner,^{280,1} W. Bertl,^{280,1} K. Deiters,^{280,1} W. Erdmann,^{280,1} Horisberger,^{280,1} H. C. Kaestli,^{280,1} D. Kotlinski,^{280,1} U. Langenegg,^{280,1} T. Rohr,^{280,1} F. Bachmaier,^{280,1} L. Biati,^{280,1} L. Bianchini,^{280,1} M. A. Buchmann,^{280,1} B. Casal,^{280,1} G. Dissertori,^{280,1} M. Dittmar,^{280,1} M. Donega,^{280,1} M. Dünnser,^{280,1} P. Eller,^{280,1} C. Grab,^{280,1} C. Heidegger,^{280,1} D. Hits,^{280,1} J. Hoss,^{280,1} G. Kasieczka,^{280,1} W. Lustermann,^{280,1} B. Mangano,^{280,1} A. C. Marini,^{280,1} M. Marionneau,^{280,1} P. Martinez Ruiz del Arbol,^{280,1} B. Masciovecchio,^{280,1} D. Meister,^{280,1} P. Musella,^{280,1} F. Nessi-Tedaldi,^{280,1} F. Pandolfi,^{280,1} J. Pata,^{280,1} F. Pauss,^{280,1} L. Perrozzi,^{280,1} M. Peruzzo,^{280,1} M. Quittman,^{280,1} M. Rossini,^{280,1} A. Starodumov,^{280,1} M. Tahakoshi,^{280,1} V. R. Tavolari,^{280,1} K. Theofilatos,^{280,1} R. Wallny,^{280,1} H. A. Weber,^{280,1} T. K. Arrestadt,^{280,1} C. Amsler,^{280,1} M. F. Canelli,^{280,1} V. Chiochia,^{280,1} A. De Rosa,^{280,1} C. Galloni,^{280,1} A. Hinzmam,^{280,1} T. Hreus,^{280,1} B. Kilminster,^{280,1} C. Lange,^{280,1} J. Ngaduba,^{280,1} D. Pinna,^{280,1} H. Doan,^{280,1} F. J. Ronca,^{280,1} D. Salemi,^{280,1} S. Taromi,^{280,1} Y. Yang,^{280,1} M. Cardaci,^{280,1} K. H. Chen,^{280,1} T. H. Doan,^{280,1} C. Ferro,^{280,1} M. Konyushikhin,^{280,1} C. M. Ku,^{280,1} W. Lin,^{280,1} Y. J. Lu,^{280,1} R. Volpe,^{280,1} S. S. Yu,^{280,1} P. Chang,^{280,1} Y. H. Chang,^{280,1} Y. W. Chang,^{280,1} Y. Chao,^{280,1} K. Chen,^{280,1} P. H. Chen,^{280,1} C. Dietz,^{280,1} F. Fiori,^{280,1} U. Grunbler,^{280,1} W.-S. Hou,^{280,1} Y. Hsiung,^{280,1} Y. F. Liu,^{280,1} R.-S. Lu,^{280,1} M. Mifiana Moya,^{280,1} E. Petrucco,^{280,1} J. F. Tsai,^{280,1} Y. M. Tzeng,^{280,1} R. Wilken,^{280,1} B. Asavapibhop,^{280,1} K. Kovitavong,^{280,1} G. Singh,^{280,1} N. Sriwanobhas,^{280,1} N. Suwonjandee,^{280,1} A. Adiguzel,^{280,1} S. Cerci,^{280,1} C. Dozen,^{280,1} S. Girgis,^{280,1} G. Golokub,^{280,1} Y. Guler,^{280,1} E. Gurpinar,^{280,1} I. Hos,^{280,1} E. E. Kangal,^{280,1} A. Kayis Topaksu,^{280,1} G. Onengu,^{280,1} K. Ozdemir,^{280,1} S. Ozturk,^{280,1} B. Tali,^{280,1} H. Topakli,^{280,1} M. Vergili,^{280,1} C. Zorbuluc,^{280,1} I. V. Akin,^{280,1} B. Bilin,^{280,1} S. Bilmis,^{280,1} B. Isildak,^{280,1} G. Karapinar,^{280,1} U. E. Surat,^{280,1} M. Yalimzac,^{280,1} M. Zeyrek,^{280,1} E. A. Albayrak,^{280,1} E. Gülmek,^{280,1} M. Kaya,^{280,1} O. Kaya,^{280,1} T. Yetkin,^{280,1} K. Cankocak,^{280,1} S. Sen,^{280,1} F. I. Vardarli,^{280,1} B. Grynyov,^{280,1} L. Levchuk,^{280,1} P. Sorokin,^{280,1} R. Aggleton,^{280,1} F. Ball,^{280,1} L. Beck,^{280,1} J. J. Brooke,^{280,1} E. Clement,^{280,1} D. Cussans,^{280,1} H. Flacher,^{280,1} J. Goldstein,^{280,1} M. Grimes,^{280,1} G. P. Heath,^{280,1} H. F. Heath,^{280,1} A. Poll,^{280,1} T. Sakuma,^{280,1} C. Lucas,^{280,1} Z. Meng,^{280,1} D. M. Newbold,^{280,1} S. Paramesvaran,^{280,1} A. P. Poll,^{280,1} T. Sakuma,^{280,1} S. Seif El Nasr-storey,^{280,1} S. Senkin,^{280,1} D. Smith,^{280,1} V. J. Smith,^{280,1} K. W. Bell,^{280,1} A. Belyaev,^{280,1} C. Brew,^{280,1} R. M. Brown,^{280,1} D. J. A. Cockrel,^{280,1} J. A. Coughlan,^{280,1} K. Harder,^{280,1} S. Harper,^{280,1} E. Olaiya,^{280,1} D. Petly,^{280,1} C. H. Shepherd-Themistocleous,^{280,1} A. Thea,^{280,1} I. R. Tomalin,^{280,1} T. Williams,^{280,1} W. J. Womersley,^{280,1} S. D. Worm,^{280,1} M. Barber,^{280,1} R. Bainbridge,^{280,1} O. Buchmuller,^{280,1} A. Bundock,^{280,1} D. Burton,^{280,1} S. Casasso,^{280,1} M. Citron,^{280,1} D. Colling,^{280,1} L. Corpe,^{280,1} N. Cripps,^{280,1} P. Dauncey,^{280,1} G. Davies,^{280,1} A. De Wit,^{280,1} M. Delta Negra,^{280,1} P. Dunne,^{280,1} A. Elwood,^{280,1} W. Ferguson,^{280,1} J. Fulcher,^{280,1} D. Futyan,^{280,1} G. Hall,^{280,1} G. Iles,^{280,1} G. Kurapostoli,^{280,1} M. Kenzie,^{280,1} R. Lane,^{280,1} R. Lucas,^{280,1} L. Lyons,^{280,1} A.-M. Magnan,^{280,1} S. Malik,^{280,1} J. Nash,^{280,1} A. Nikitenko,^{280,1} J. Pela,^{280,1} M. Pesaresi,^{280,1} K. Petridis,^{280,1} D. M. Raymond,^{280,1} A. Richards,^{280,1} A. Rose,^{280,1} C. Seez,^{280,1} P. Sharp,^{280,1} A. Tapper,^{280,1} K. Uchida,^{280,1} M. Vazquez Acosta,^{280,1} T. Verdec,^{280,1} S. C. Zenz,^{280,1} J. E. Cole,^{280,1} R. Hobson,^{280,1} A. Khan,^{280,1} P. Kyberd,^{280,1} D. Leggett,^{280,1} D. Leslie,^{280,1} I. D. Reid,^{280,1} P. Symonds,^{280,1} L. Teodorescu,^{280,1} M. Turner,^{280,1} A. Borzou,^{280,1} J. Dittmar,^{280,1} K. Hatakeyama,^{280,1} A. Kasmi,^{280,1} H. Liu,^{280,1} N. Pastika,^{280,1} O. Charaf,^{280,1} S. J. Cooper,^{280,1} C. H. Henderson,^{280,1} P. Rumerio,^{280,1} A. Avetisyan,^{280,1} T. Bose,^{280,1} C. Fantasia,^{280,1} D. Gaster,^{280,1} P. Lawson,^{280,1} D. Rankin,^{280,1} C. Richardson,^{280,1} J. Rohl,^{280,1} J. St. John,^{280,1} L. Sulak,^{280,1} D. Zou,^{280,1} J. Alimeni,^{280,1} E. Berry,^{280,1} S. Bhattacharya,^{280,1} D. Cutts,^{280,1} N. Dhingra,^{280,1} A. Ferapontov,^{280,1} A. Garabedian,^{280,1} U. Heintz,^{280,1} E. Laird,^{280,1} G. Lansberg,^{280,1} Z. Mao,^{280,1} M. Narain,^{280,1} S. Sagiv,^{280,1} T. Senthuprasadar,^{280,1} R. Breedon,^{280,1} G. Breto,^{280,1} M. Calderon De La Barca Sanchez,^{280,1} S. Chauhan,^{280,1} M. Chertok,^{280,1} J. Conway,^{280,1} R. Conway,^{280,1} P. T. Cox,^{280,1} R. Erbacher,^{280,1} M. Gardner,^{280,1} W. Ko,^{280,1} R. Lander,^{280,1} M. Mulhearn,^{280,1} D. Pellett,^{280,1} J. Pilot,^{280,1} F. Ricci-Tam,^{280,1} S. Shalhout,^{280,1} J. Smith,^{280,1} M. Squires,^{280,1} D. Stolp,^{280,1} M. Tripathi,^{280,1}

- S. Wilbur,^{301,1} R. Yohay,^{301,1} R. Cousins,^{302,1} P. Everaerts,^{302,1} C. Farrell,^{302,1} J. Hauser,^{302,1} M. Ignatenko,^{302,1} G. Rakness,^{302,1} D. Saltzberg,^{302,1} E. Takasugi,^{302,1} V. Valusek,^{302,1} M. Weber,^{302,1} K. Burt,^{303,1} R. Clare,^{303,1} J. Ellison,^{303,1} J. W. Gary,^{303,1} G. Hansson,^{303,1} J. Heilmann,^{303,1} M. Iovva Rikova,^{303,1} P. Janard,^{303,1} E. Kennedy,^{303,1} F. Lacroix,^{303,1} O. R. Long,^{303,1} A. Luthra,^{303,1} M. Malberti,^{303,1} M. Olmedo Negrete,^{303,1} A. Shrimivas,^{303,1} S. Sumowidagdo,^{303,1} H. Wei,^{303,1} S. Wimpenny,^{303,1} J. G. Branson,^{304,1} G. B. Cerati,^{304,1} S. Cittolin,^{304,1} R. T. D'Agnolet,^{304,1} A. Holzner,^{304,1} R. Kelley,^{304,1} D. Klein,^{304,1} J. Letts,^{304,1} I. Macneill,^{304,1} D. Olivito,^{304,1} S. Padhi,^{304,1} M. Pieri,^{304,1} M. Sani,^{304,1} V. Sharma,^{304,1} S. Simon,^{304,1} M. Tadel,^{304,1} Y. Tu,^{304,1} A. Vartak,^{304,1} S. Wasserbaech,^{304,1} C. Welke,^{304,1} F. Würthwein,^{304,1} A. Yagita,^{304,1} G. Zevi Delta Porta,^{304,1} D. Barge,^{305,1} J. Bradmiller-Feld,^{305,1} C. Campagnari,^{305,1} A. Dishaw,^{305,1} V. Dutta,^{305,1} K. Flowers,^{305,1} M. Franco Sevilla,^{305,1} P. Geffert,^{305,1} C. George,^{305,1} F. Golf,^{305,1} L. Gouskos,^{305,1} J. Gran,^{305,1} J. Incandela,^{305,1} C. Justus,^{305,1} N. Mccoll,^{305,1} S. D. Mullin,^{305,1} J. Richman,^{305,1} D. Stuart,^{305,1} I. Suarez,^{305,1} W. To,^{305,1} C. West,^{305,1} J. Yoo,^{305,1} D. Anderson,^{306,1} A. Apresyan,^{306,1} A. Bornheim,^{306,1} J. Bunn,^{306,1} Y. Chen,^{306,1} J. Duarte,^{306,1} A. Mott,^{306,1} H. B. Newman,^{306,1} C. Penna,^{306,1} M. Pierini,^{306,1} M. Spiropulu,^{306,1} J. R. Litzmark,^{307,1} S. Xie,^{306,1} R. Y. Zhu,^{306,1} V. Azzolini,^{307,1} A. Calamia,^{307,1} B. Carlson,^{307,1} T. Ferguson,^{307,1} Y. Iiyama,^{307,1} P. Xenitidis,^{307,1} J. Russ,^{307,1} M. Sun,^{307,1} H. Vogel,^{307,1} J. P. Cumalat,^{308,1} W. T. Ford,^{308,1} A. Gaz,^{308,1} F. Jensen,^{308,1} A. Johnson,^{308,1} M. Krohn,^{308,1} T. Mulholland,^{308,1} U. Nauenberg,^{308,1} J. G. Smith,^{308,1} K. Stenson,^{308,1} S. R. Wagner,^{308,1} J. Alexander,^{309,1} A. Chatterjee,^{309,1} J. Chaves,^{309,1} J. Chu,^{309,1} S. Dittmer,^{309,1} N. Eggert,^{309,1} N. Mirman,^{309,1} G. Nicolas Kaufman,^{309,1} J. R. Patterson,^{309,1} A. Rinkevicius,^{309,1} A. Ryd,^{309,1} L. Skinnari,^{309,1} L. Sofoff,^{309,1} W. Sun,^{309,1} S. Tan,^{309,1} W. D. Teo,^{309,1} J. Thom,^{309,1} J. Thompson,^{309,1} J. Tucker,^{309,1} Y. Weng,^{309,1} P. Witlich,^{309,1} S. Abdullah,^{310,1} M. Albrow,^{310,1} J. Anderson,^{310,1} G. Apollinaris,^{310,1} L. A. T. Bauerdick,^{310,1} A. Beretvas,^{310,1} J. Berryhill,^{310,1} P. C. Bhattacharya,^{310,1} G. Bella,^{310,1} K. Burkett,^{310,1} J. N. Butler,^{310,1} H. W. K. Cheung,^{310,1} F. Cilebana,^{310,1} S. Chang,^{310,1} V. D. Elvira,^{310,1} I. Fisk,^{310,1} J. Freeman,^{310,1} E. Gottschalk,^{310,1} L. Gray,^{310,1} D. Green,^{310,1} S. Grinstein,^{310,1} O. Gutsche,^{310,1} J. Hanlon,^{310,1} D. Hare,^{310,1} R. M. Harris,^{310,1} J. Hirschauer,^{310,1} B. Hooberman,^{310,1} Z. Hu,^{310,1} S. Jindariani,^{310,1} M. Johnson,^{310,1} U. Joshi,^{310,1} A. W. Jung,^{310,1} B. Klima,^{310,1} B. Kreis,^{310,1} S. Kwan,^{310,1} S. Lammer,^{310,1} J. Linacre,^{310,1} D. Lincoln,^{310,1} T. Liu,^{310,1} R. Lopes De Sa,^{310,1} J. Lykken,^{310,1} K. Maeshima,^{310,1} J. M. Marrapino,^{310,1} V. I. Martinez,^{310,1} Outschorn,^{310,1} S. Maruyama,^{310,1} D. Mason,^{310,1} P. McBride,^{310,1} P. Merkel,^{310,1} K. Mishra,^{310,1} S. Mirena,^{310,1} S. Nahm,^{310,1} C. Newman-Holmes,^{310,1} V. O'Dell,^{310,1} O. Prokofyev,^{310,1} E. Sexton-Kennedy,^{310,1} A. Soha,^{310,1} W. J. Spalding,^{310,1} L. Spiegel,^{310,1} L. Taylor,^{310,1} S. Tkaczyk,^{310,1} N. V. Tran,^{310,1} L. Uplegger,^{310,1} E. W. Vaandering,^{310,1} C. Vernieri,^{310,1} M. Verzocchi,^{310,1} R. Vidal,^{310,1} A. Whitehead,^{310,1} F. Yang,^{310,1} H. Yin,^{310,1} D. Acosta,^{310,1} P. Avery,^{311,1} P. Bortignon,^{311,1} A. Carnei,^{311,1} M. Carver,^{311,1} D. Curry,^{311,1} S. Das,^{311,1} G. P. Di Giovanni,^{311,1} R. D. Field,^{311,1} P. Fisher,^{311,1} L. K. Furic,^{311,1} J. Hugon,^{311,1} J. Konigsberg,^{311,1} A. Korytov,^{311,1} J. F. Low,^{311,1} P. Ma,^{311,1} K. Matchev,^{311,1} H. Mei,^{311,1} P. Milennovic,^{311,1} G. Mitselmanker,^{311,1} L. Muniz,^{311,1} D. Rank,^{311,1} L. Shchukina,^{311,1} G. Martinez,^{311,1} M. Snowball,^{311,1} D. Sperka,^{311,1} S. J. Wang,^{311,1} J. Yeltos,^{311,1} S. Hewamanage,^{311,1} S. Linn,^{311,1} P. Markowitz,^{311,1} K. Martinec,^{311,1} L. J. Rodriguez,^{311,1} A. Ackert,^{311,1} R. Adams,^{311,1} T. Adams,^{311,1} A. Askew,^{311,1} J. Bochenek,^{311,1} B. Diamond,^{311,1} J. Haas,^{311,1} S. Hapogian,^{311,1} V. Hapogian,^{311,1} K. F. Johnson,^{311,1} A. Khatiwada,^{311,1} H. Prosper,^{311,1} V. Veeraraghavan,^{311,1} M. Weinberg,^{311,1} V. Bhopatkar,^{311,1} M. Hohlmann,^{311,1} H. Kalakachy,^{311,1} D. Mareska-paleck,^{311,1} T. Roy,^{311,1} F. Yumiceva,^{311,1} M. R. Adams,^{311,1} A. Gapanavich,^{311,1} D. Berry,^{311,1} R. R. Betts,^{311,1} I. Bucimski,^{311,1} R. Cavanagh,^{311,1} O. Evdokimov,^{311,1} L. Gauthier,^{311,1} C. E. Gerber,^{311,1} D. J. Hofman,^{311,1} P. Kurt,^{311,1} C. O'Brien,^{311,1} D. J. Sandoval Gonzalez,^{311,1} C. Silkworth,^{311,1} P. Turner,^{311,1} N. Varelas,^{311,1} Z. Wu,^{311,1} M. Zakaria,^{311,1} B. Bilki,^{311,1} W. Clara,^{311,1} K. Dilisiz,^{311,1} S. Durgut,^{311,1} P. R. Gundrajuja,^{311,1} M. Haytmiradov,^{311,1} V. Khristenko,^{311,1} J.-P. Merlo,^{311,1} H. Memerkaya,^{311,1} A. Mestvirishvili,^{311,1} J. Moeller,^{311,1} J. Nachtmann,^{311,1} H. Ogul,^{311,1} Y. Onel,^{311,1} F. Ozok,^{311,1} A. Penzo,^{311,1} C. Snyder,^{311,1} P. Tan,^{311,1} E. Tiras,^{311,1} J. Wetzel,^{311,1} K. Yu,^{311,1} I. Anderson,^{311,1} B. A. Barnett,^{311,1} B. Blumenfeld,^{311,1} D. Fehling,^{311,1} L. Feng,^{311,1} A. V. Grishan,^{311,1} P. Makrisovic,^{311,1} C. Martin,^{311,1} K. Nash,^{311,1} M. Osterson,^{311,1} M. Swartz,^{311,1} M. Xiao,^{311,1} Y. Xin,^{311,1} P. Baringer,^{311,1} A. Bean,^{311,1} G. Benelli,^{311,1} C. Bruner,^{311,1} J. Gray,^{311,1} R. P. Kenny III,^{311,1} D. Majumder,^{311,1} M. Malek,^{311,1} M. Murray,^{311,1} D. Noonan,^{311,1} S. Sanders,^{311,1} R. Stringer,^{311,1} Q. Wang,^{311,1} J. S. Wood,^{311,1} I. Chakaberia,^{311,1} A. Ivanov,^{311,1} K. Kaadze,^{311,1} S. Khalil,^{311,1} M. Makouski,^{311,1} Y. Maravin,^{311,1} L. K. Saini,^{311,1} N. Skhirtladze,^{311,1} I. Svintradze,^{311,1} S. Toda,^{311,1} D. Lange,^{311,1} F. Rebassoo,^{311,1} D. Wright,^{311,1} C. Anelli,^{311,1} S. Baden,^{311,1} O. Baron,^{311,1} A. Belloni,^{311,1} B. Calvert,^{311,1} S. C. Eno,^{311,1} C. Ferraioli,^{311,1} J. A. Gomez,^{311,1} N. J. Hadley,^{311,1} S. Jabeen,^{311,1} R. G. Kellogg,^{311,1} T. Kolberg,^{311,1} J. Kunkle,^{311,1} Y. Lu,^{311,1}

- A. C. Mignerey,^{321,1} K. Pedro,^{321,1} Y. H. Shin,^{321,1} A. Skuja,^{321,1} M. B. Tonjes,^{321,1} S. C. Tonwar,^{321,1} A. Apyan,^{322,1} R. Barberi,^{322,1} A. Baty,^{322,1} K. Bierwagen,^{322,1} S. Brandt,^{322,1} W. Buszka,^{322,1} I. A. Cali,^{322,1} L. Di Matteo,^{322,1} G. Gomez Ceballos,^{322,1} M. Goncharov,^{322,1} D. Gulhan,^{322,1} G. M. Innocenti,^{322,1} M. Klute,^{322,1} D. Kovalsky,^{322,1} Y. S. Lai,^{322,1} Y.-J. Lee,^{322,1} A. Levin,^{322,1} P. D. Luckey,^{322,1} C. Mcginn,^{322,1} X. Niu,^{322,1} C. Paus,^{322,1} D. Ralph,^{322,1} C. Roland,^{322,1} G. Roland,^{322,1} G. S. F. Stephens,^{322,1} K. Sumorok,^{322,1} M. Varma,^{322,1} D. Velicanu,^{322,1} J. Veverka,^{322,1} J. Wang,^{322,1} T. W. Wang,^{322,1} B. Wyslouch,^{322,1} M. Yang,^{322,1} V. Zhukova,^{322,1} B. Dahmes,^{323,1} A. Finkel,^{323,1} A. Gude,^{323,1} P. Hansen,^{323,1} S. Kalafut,^{323,1} S. C. Kao,^{323,1} K. Klapoetke,^{323,1} Y. Kubota,^{323,1} Z. Lesko,^{323,1} J. Mans,^{323,1} S. Nourbakhsh,^{323,1} N. Rückstuhl,^{323,1} R. Rusack,^{323,1} N. Tambe,^{323,1} J. Turkevitch,^{323,1} J. G. Acosta,^{324,1} S. Oliveros,^{324,1} E. Avdeeva,^{325,1} K. Bloom,^{325,1} S. Bose,^{325,1} D. R. Claes,^{325,1} A. Dominguez,^{325,1} C. Fangmeier,^{325,1} R. Gonzalez Suarez,^{325,1} K. Kamaleddin,^{325,1} J. Keller,^{325,1} D. Knowlton,^{325,1} I. Kravchenko,^{325,1} J. Lazo-Flores,^{325,1} F. Meier,^{325,1} J. Monroe,^{325,1} F. Ratnikow,^{326,1} J. E. Siado,^{326,1} G. R. Snow,^{326,1} M. Alyari,^{326,1} J. Dolen,^{326,1} J. George,^{326,1} A. Godshalk,^{326,1} I. Iashvili,^{326,1} J. Kaisen,^{326,1} A. Kharchilava,^{326,1} A. Kumar,^{326,1} S. Rappoccio,^{326,1} G. Alversen,^{327,1} E. Barbeis,^{327,1} D. Baumgartel,^{327,1} M. Chasco,^{327,1} A. Hortingtham,^{327,1} A. Massironi,^{327,1} D. M. Morse,^{327,1} D. Nash,^{327,1} T. Orimoto,^{327,1} R. Teixeira De Lima,^{327,1} D. Trocino,^{327,1} R.-J. Wang,^{327,1} D. Wood,^{327,1} J. Zhang,^{327,1} K. A. Hahn,^{328,1} A. Kubik,^{328,1} N. Mucia,^{328,1} N. Odell,^{328,1} B. Pollack,^{328,1} A. Poznyakov,^{328,1} M. Schmitt,^{328,1} S. Stoynev,^{328,1} K. Sung,^{328,1} M. Trovato,^{328,1} M. Velasco,^{328,1} S. Won,^{328,1} A. Brinkerhoff,^{329,1} N. Dev,^{329,1} M. Hildreth,^{329,1} C. Jessop,^{329,1} D. J. Karmgard,^{329,1} N. Kellams,^{329,1} K. Lamont,^{329,1} S. Lynch,^{329,1} N. Marinelli,^{329,1} F. Meng,^{329,1} C. Mueller,^{329,1} Y. Musienko,^{329,1} T. Pearson,^{329,1} M. Planer,^{329,1} R. Ruchti,^{329,1} S. Smith,^{329,1} N. Valla,^{329,1} M. Wayne,^{329,1} M. Wolf,^{329,1} A. Woodard,^{330,1} L. Antonelli,^{330,1} J. Brinson,^{330,1} B. Bylsma,^{330,1} L. S. Durkin,^{330,1} S. Flowers,^{330,1} A. Hart,^{330,1} C. Hill,^{330,1} R. Hughes,^{330,1} K. Kotov,^{330,1} T. Y. Liang,^{330,1} B. Liu,^{330,1} W. Luo,^{330,1} D. Puigh,^{330,1} M. Rodenburg,^{330,1} B. L. Winer,^{330,1} H. W. Wilson,^{330,1} O. Driga,^{331,1} P. Elmer,^{331,1} J. Hardenberg,^{331,1} P. Hebdon,^{331,1} S. A. Koay,^{331,1} P. Lujan,^{331,1} D. Marlow,^{331,1} T. Medvedeva,^{331,1} M. Mooney,^{331,1} J. Olsen,^{331,1} C. Palmer,^{331,1} P. Piroue,^{331,1} X. Quan,^{331,1} H. Saka,^{331,1} D. Stickland,^{331,1} C. Tully,^{331,1} J. S. Werner,^{331,1} A. Zuranski,^{331,1} V. E. Barnes,^{332,1} D. Benedetti,^{332,1} D. Bortoletto,^{332,1} L. Gutay,^{332,1} K. Jha,^{332,1} M. Jones,^{332,1} K. Jung,^{332,1} M. Kress,^{332,1} N. Leonardo,^{332,1} D. H. Miller,^{332,1} N. Neumeister,^{332,1} F. Primavera,^{332,1} B. C. Radburn-Smith,^{332,1} X. Shi,^{332,1} J. Shipsey,^{332,1} D. Silver,^{332,1} J. Sun,^{332,1} A. Svatikovsky,^{332,1} F. Wang,^{332,1} W. Xie,^{332,1} L. Xu,^{332,1} J. Zablocki,^{332,1} J. Stupak,^{333,1} A. Adair,^{334,1} B. Akgun,^{334,1} Z. Chen,^{334,1} K. M. Ecklund,^{334,1} F. J. M. Geurts,^{334,1} M. Guibal,^{334,1} W. Li,^{334,1} B. Michlin,^{334,1} M. Northup,^{334,1} B. P. Padley,^{334,1} R. Redjimi,^{334,1} J. Roberts,^{334,1} J. Rorie,^{334,1} Z. Tu,^{334,1} J. Zabel,^{334,1} B. Beitchart,^{335,1} A. Bodek,^{335,1} P. Barbour,^{335,1} R. Demina,^{335,1} Y. Eshaq,^{335,1} T. Ferbel,^{335,1} M. Galanti,^{335,1} A. Garcia-Bellido,^{335,1} P. Goldenzweig,^{335,1} J. Han,^{335,1} A. Harel,^{335,1} O. Hindrichs,^{335,1} S. Khukhunashvili,^{335,1} G. Petrillo,^{335,1} M. Verzetti,^{335,1} L. Demortier,^{336,1} S. Arora,^{337,1} A. Barker,^{337,1} J. P. Chou,^{337,1} C. Contreras-Campana,^{337,1} E. Contreras-Campana,^{337,1} D. Duggan,^{337,1} D. Ferencz,^{337,1} Y. Gershtein,^{337,1} R. Gray,^{337,1} E. Halkiadakis,^{337,1} D. Hidas,^{337,1} E. Hughes,^{337,1} S. Kaplan,^{337,1} R. Kumawalkam-Elayavalli,^{337,1} A. Lath,^{337,1} S. Panwalker,^{337,1} M. Park,^{337,1} S. Salur,^{337,1} S. Schnetzer,^{337,1} D. Shefield,^{337,1} S. Somalwar,^{337,1} R. Stone,^{337,1} S. Thomas,^{337,1} P. Thomassen,^{337,1} M. Walker,^{337,1} M. Woerner,^{338,1} G. Riley,^{338,1} K. Rose,^{338,1} S. Spanier,^{338,1} A. York,^{338,1} O. Bouhal,^{339,1} A. Castaneda Hernandez,^{339,1} M. Dalchenko,^{339,1} M. De Mattia,^{339,1} A. Delgado,^{339,1} S. Dildick,^{339,1} R. Eusebi,^{339,1} W. Flanagan,^{339,1} J. Gilmore,^{339,1} T. Kamon,^{339,1} V. Krutelyov,^{339,1} S. Montalvo,^{339,1} R. Mueller,^{339,1} I. Ospisken,^{339,1} Y. Pakhotin,^{339,1} R. Patel,^{339,1} A. Perloff,^{339,1} J. Roe,^{339,1} A. Rose,^{339,1} A. Safonov,^{339,1} A. Tatarinov,^{339,1} K. A. Ulmer,^{339,1} N. Akchurin,^{340,1} C. Cowden,^{340,1} J. Damgov,^{340,1} C. Dragoiu,^{340,1} P. R. Duderio,^{340,1} J. Falkner,^{340,1} S. Kunori,^{340,1} K. Lamichhane,^{340,1} S. W. Lee,^{340,1} T. Libeiro,^{340,1} S. Undleeb,^{340,1} I. Volobouev,^{340,1} E. Appel,^{341,1} A. G. Delanomy,^{341,1} S. Greene,^{341,1} A. Gurrola,^{341,1} R. Janjan,^{341,1} W. Johns,^{341,1} C. Maguire,^{341,1} Y. Mao,^{341,1} A. Melo,^{341,1} P. Sheldon,^{341,1} B. Snook,^{341,1} S. Tuo,^{341,1} J. Velkovska,^{341,1} Q. Xu,^{341,1} M. W. Arenton,^{342,1} S. Boule,^{342,1} B. Cox,^{342,1} B. Francis,^{342,1} J. Goodell,^{342,1} R. Hirosky,^{342,1} A. Ledovskoy,^{342,1} H. Li,^{342,1} C. Lin,^{342,1} C. Neu,^{342,1} E. Wolfe,^{342,1} J. Wood,^{342,1} F. Xia,^{342,1} C. Clarke,^{342,1} R. Harr,^{342,1} P. E. Karchin,^{343,1} C. Kottachchi Kankanaage Don,^{343,1} P. Lamichhane,^{343,1} J. Sturdy,^{343,1} D. A. Belknapp,^{344,1} D. Carlsmith,^{344,1} M. Cepeda,^{344,1} A. Christian,^{344,1} S. Daus,^{344,1} J. Dodd,^{344,1} S. Duric,^{344,1} E. Fries,^{344,1} B. Gomber,^{344,1} R. Hall-Wilton,^{344,1} M. Herndon,^{344,1} A. Hervé,^{344,1} P. Klabbens,^{344,1} A. Lanaro,^{344,1} A. Levine,^{344,1} K. Long,^{344,1} R. Loveless,^{344,1} A. Mohapatra,^{344,1} I. Ojalvo,^{344,1} T. Perry,^{344,1} G. A. Pierro,^{344,1} G. Polese,^{344,1} L. Ross,^{344,1} T. Ruggles,^{344,1} T. Sarangi,^{344,1} A. Savin,^{344,1} A. Sharma,^{344,1} N. Smith,^{344,1} W. H. Smith,^{344,1} D. Taylor,^{344,1} and N. Woods^{344,1}

(ATLAS Collaboration)[†]
(CMS Collaboration)[‡]

- ¹Department of Physics, University of Adelaide, Adelaide, Australia
²Physics Department, SUNY Albany, Albany, New York, USA
³Department of Physics, University of Alberta, Edmonton, Alberta, Canada
⁴Department of Physics, Ankara University, Ankara, Turkey
⁵Istanbul Aydin University, Istanbul, Turkey
⁶Division of Physics, TOBB University of Economics and Technology, Ankara, Turkey
⁷LAPP, CNRS/IN2P3 and Université Savoie Mont Blanc, Annecy-le-Vieux, France
⁸High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois, USA
⁹Department of Physics, University of Arizona, Tucson, Arizona, USA
¹⁰Department of Physics, The University of Texas at Arlington, Arlington, Texas, USA
¹¹Physics Department, University of Athens, Athens, Greece
¹²Physics Department, National Technical University of Athens, Zografou, Greece
¹³Institut of Physics, Azerbaijan Academy of Sciences, Baku, Azerbaijan
¹⁴Institut de Física d'Altes Energies and Departament de Física de la Universitat Autònoma de Barcelona, Barcelona, Spain
¹⁵Institute of Physics, University of Belgrade, Belgrade, Serbia
¹⁶Department for Physics and Technology, University of Bergen, Bergen, Norway
¹⁷Albert Einstein Center for Fundamental Physics and Laboratory for High Energy Physics, University of Bern, Bern, Switzerland
¹⁸School of Physics and Astronomy, University of Birmingham, Birmingham, United Kingdom
¹⁹Department of Physics, Bogaziçi University, Istanbul, Turkey
²⁰Department of Physics, Dogus University, Istanbul, Turkey
²¹Department of Physics Engineering, Gaziantepe University, Gaziantepe, Turkey
²²INFN Sezione di Bologna, Bologna, Italy
²³Dipartimento di Fisica e Astronomia, Università di Bologna, Bologna, Italy
²⁴Physikalisches Institut, University of Bonn, Bonn, Germany
²⁵Department of Physics, Boston University, Boston, Massachusetts, USA
²⁶Department of Physics, Brandeis University, Waltham, Massachusetts, USA
²⁷Universidade Federal do Rio De Janeiro COPPE/EEB, Rio de Janeiro, Brazil
²⁸Electrical Circuits Department, Federal University of Juiz de Fora (UFJF), Juiz de Fora, Brazil
²⁹Federal University of Sao Joao del Rei (UFSJ), Sao Joao del Rei, Brazil
³⁰Instituto de Física, Universidade de São Paulo, São Paulo, Brazil
³¹Physics Department, Brookhaven National Laboratory, Upton, New York, USA
³²National Institute of Physics and Nuclear Engineering, Bucharest, Romania
³³National Institute for Research and Development of Isotopic and Molecular Technologies, Physics Department, Cluj Napoca, Romania
³⁴University Politehnica Bucharest, Bucharest, Romania
³⁵West University in Timisoara, Timisoara, Romania
³⁶Departamento de Física, Universidad de Buenos Aires, Buenos Aires, Argentina
³⁷Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom
³⁸Department of Physics, Carleton University, Ottawa, Ontario, Canada
³⁹CERN, Geneva, Switzerland
⁴⁰Enrico Fermi Institute, University of Chicago, Chicago, Illinois, USA
⁴¹Departamento de Física, Pontificia Universidad Católica de Chile, Santiago, Chile
⁴²Departamento de Física, Universidad Técnica Federico Santa María, Valparaíso, Chile
⁴³Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China
⁴⁴Department of Modern Physics, University of Science and Technology of China, Anhui, China
⁴⁵Department of Physics, Nanjing University, Jiangsu, China
⁴⁶School of Physics, Shandong University, Shandong, China
⁴⁷Department of Physics and Astronomy, Shanghai Key Laboratory for Particle Physics and Cosmology, Shanghai Jiao Tong University, Shanghai, China
⁴⁸Physics Department, Tsinghua University, Beijing 100084, China
⁴⁹Laboratoire de Physique Corpusculaire, Clermont Université and Université Blaise Pascal and CNRS/IN2P3, Clermont-Ferrand, France
⁵⁰Nevis Laboratory, Columbia University, Irvington, New York, USA
⁵¹Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark

- ^{37a}INFN Gruppo Collegato di Cosenza, Laboratori Nazionali di Frascati, Frascati, Italy
^{37b}Dipartimento di Fisica, Università della Calabria, Rende, Italy
- ^{38a}AGH University of Science and Technology, Faculty of Physics and Applied Computer Science, Krakow, Poland
^{38b}Marian Smoluchowski Institute of Physics, Jagiellonian University, Krakow, Poland
³⁹Institute of Nuclear Physics Polish Academy of Sciences, Krakow, Poland
⁴⁰Physics Department, Southern Methodist University, Dallas, Texas, USA
⁴¹Physics Department, University of Texas at Dallas, Richardson, Texas, USA
⁴²DESY, Hamburg, Hamburg, Germany
⁴³Institut für Experimentelle Physik IV, Technische Universität Dortmund, Dortmund, Germany
⁴⁴Institut für Kern- und Teilchenphysik, Technische Universität Dresden, Dresden, Germany
⁴⁵Department of Physics, Duke University, Durham, North Carolina, USA
⁴⁶SUPA-School of Physics and Astronomy, University of Edinburgh, Edinburgh, United Kingdom
⁴⁷INFN Laboratori Nazionali di Frascati, Frascati, Italy
⁴⁸Fakultät für Mathematik und Physik, Albert-Ludwigs-Universität Freiburg, Freiburg, Germany
⁴⁹Section de Physique, Université de Genève, Geneva, Switzerland
⁵⁰INFN Sezione di Genova, Genova, Italy
^{51b}Dipartimento di Fisica, Università di Genova, Genova, Italy
^{51c}E. Andronikashvili Institute of Physics, I. Javakhishvili Tbilisi State University, Tbilisi, Georgia
^{51d}High Energy Physics Institute, Tbilisi State University, Tbilisi, Georgia
⁵²H Physikalisches Institut, Justus-Liebig-Universität Giessen, Giessen, Germany
⁵³SUPA-School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom
⁵⁴H Physikalisches Institut, Georg-August-Universität, Göttingen, Germany
⁵⁵Laboratoire de Physique Subatomique et de Cosmologie, Université Grenoble-Alpes, CNRS/IN2P3, Grenoble, France
⁵⁶Department of Physics, Hampton University, Hampton, Virginia, USA
⁵⁷Laboratory for Particle Physics and Cosmology, Harvard University, Cambridge, Massachusetts, USA
⁵⁸Kirchhoff-Institut für Physik, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany
⁵⁹Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany
^{59c}ZITI Institut für technische Informatik, Ruprecht-Karls-Universität Heidelberg, Mannheim, Germany
⁶⁰Faculty of Applied Information Science, Hiroshima Institute of Technology, Hiroshima, Japan
⁶¹Department of Physics, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, China
⁶²Department of Physics, The University of Hong Kong, Hong Kong, China
⁶³Department of Physics, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, China
⁶⁴Department of Physics, Indiana University, Bloomington, Indiana, USA
⁶⁵Institut für Astro- und Teilchenphysik, Leopold-Franzens-Universität, Innsbruck, Austria
⁶⁶University of Iowa, Iowa City, Iowa, USA
⁶⁷Department of Physics and Astronomy, Iowa State University, Ames, Iowa, USA
⁶⁸Joint Institute for Nuclear Research, JINR Dubna, Dubna, Russia
⁶⁹KEK, High Energy Accelerator Research Organization, Tsukuba, Japan
⁷⁰Graduate School of Science, Kobe University, Kobe, Japan
⁷¹Faculty of Science, Kyoto University, Kyoto, Japan
⁷²Kyoto University of Education, Kyoto, Japan
⁷³Department of Physics, Kyushu University, Fukuoka, Japan
⁷⁴Instituto de Física La Plata, Universidad Nacional de La Plata and CONICET, La Plata, Argentina
⁷⁵Physics Department, Lancaster University, Lancaster, United Kingdom
⁷⁶INFN Sezione di Lecce, Lecce, Italy
^{77b}Dipartimento di Matematica e Fisica, Università del Salento, Lecce, Italy
⁷⁸Oliver Lodge Laboratory, University of Liverpool, Liverpool, United Kingdom
⁷⁹Department of Physics, Jošef Stefan Institute and University of Ljubljana, Ljubljana, Slovenia
^{79c}School of Physics and Astronomy, Queen Mary University of London, London, United Kingdom
^{79d}Department of Physics, Royal Holloway University of London, Surrey, United Kingdom
^{79e}Department of Physics and Astronomy, University College London, London, United Kingdom
⁸⁰Louisiana Tech University, Ruston, Louisiana, USA
^{80c}Laboratoire de Physique Nucléaire et de Hautes Energies, UPMC and Université Paris-Diderot and CNRS/IN2P3, Paris, France
⁸¹Fysiska institutionen, Lund universitet, Lund, Sweden
⁸²Departamento de Física Teórica C-15, Universidad Autónoma de Madrid, Madrid, Spain
⁸³Institut für Physik, Universität Mainz, Mainz, Germany
⁸⁴School of Physics and Astronomy, University of Manchester, Manchester, United Kingdom
⁸⁵CPPM, Aix-Marseille Université and CNRS/IN2P3, Marseille, France
⁸⁶Department of Physics, University of Massachusetts, Amherst, Massachusetts, USA
⁸⁷Department of Physics, McGill University, Montreal, Quebec, Canada

- ³³School of Physics, University of Melbourne, Victoria, Australia
³⁰Department of Physics, The University of Michigan, Ann Arbor, Michigan, USA
³¹Department of Physics and Astronomy, Michigan State University, East Lansing, Michigan, USA
³²Dipartimento di Fisica, Università di Milano, Milano, Italy
³³B.I. Stepanov Institute of Physics, National Academy of Sciences of Belarus, Minsk, Republic of Belarus
³⁴National Scientific and Educational Centre for Particle and High Energy Physics, Minsk, Republic of Belarus
³⁵Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA
³⁶Group of Particle Physics, University of Montreal, Montreal, Quebec, Canada
³⁷P.N. Lebedev Institute of Physics, Academy of Sciences, Moscow, Russia
³⁸Institute for Theoretical and Experimental Physics (ITEP), Moscow, Russia
³⁹National Research Nuclear University MEPhI, Moscow, Russia
⁴⁰Skobeltsyn Institute of Nuclear Physics, M.V. Lomonosov Moscow State University, Moscow, Russia
⁴¹Fakultät für Physik, Ludwig-Maximilians-Universität München, München, Germany
⁴²Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München, Germany
⁴³Nagasaki Institute of Applied Science, Nagasaki, Japan
⁴⁴Graduate School of Science and Kobayashi-Maskawa Institute, Nagoya University, Nagoya, Japan
⁴⁵INFN Sezione di Napoli, Napoli, Italy
⁴⁶Dipartimento di Fisica, Università di Napoli, Napoli, Italy
⁴⁷Department of Physics and Astronomy, University of New Mexico, Albuquerque, New Mexico, USA
⁴⁸Institute for Mathematics, Astrophysics and Particle Physics, Radboud University Nijmegen/Nikhef, Nijmegen, Netherlands
⁴⁹Nikhef National Institute for Subatomic Physics and University of Amsterdam, Amsterdam, Netherlands
⁵⁰Department of Physics, Northern Illinois University, DeKalb, Illinois, USA
⁵¹Budker Institute of Nuclear Physics, SB RAS, Novosibirsk, Russia
⁵²Department of Physics, New York University, New York, New York, USA
⁵³The Ohio State University, Columbus, Ohio, USA
⁵⁴Faculty of Science, Okayama University, Okayama, Japan
⁵⁵Homer L. Dodge Department of Physics and Astronomy, University of Oklahoma, Norman, Oklahoma, USA
⁵⁶Department of Physics, Oklahoma State University, Stillwater, Oklahoma, USA
⁵⁷Faculty of Mathematics, University of Paderborn, Paderborn, Germany
⁵⁸Center for High Energy Physics, University of Oregon, Eugene, Oregon, USA
⁵⁹LAL, Université Paris-Sud and CNRS/IN2P3, Orsay, France
⁶⁰Graduate School of Science, Osaka University, Osaka, Japan
⁶¹Department of Physics, University of Oslo, Oslo, Norway
⁶²Department of Physics, Oxford University, Oxford, United Kingdom
⁶³INFN Sezione di Pavia, Pavia, Italy
⁶⁴Dipartimento di Fisica, Università di Pavia, Pavia, Italy
⁶⁵Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania, USA
⁶⁶National Research Centre "Kurchatov Institute" B.P.Konstantinov Petersburg Nuclear Physics Institute, St. Petersburg, Russia
⁶⁷INFN Sezione di Pisa, Pisa, Italy
⁶⁸Dipartimento di Fisica E. Fermi, Università di Pisa, Pisa, Italy
⁶⁹Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, Pennsylvania, USA
⁷⁰Laboratorio de Instrumentación e Física Experimental de Partículas-LIP, Lisboa, Portugal
⁷¹Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal
⁷²Department of Physics, University of Coimbra, Coimbra, Portugal
⁷³Centro de Física Nuclear da Universidade de Lisboa, Lisboa, Portugal
⁷⁴Departamento de Física, Universidade do Minho, Braga, Portugal
⁷⁵Departamento de Física Teórica y del Cosmos and CAFPE, Universidad de Granada, Granada (Spain), Portugal
⁷⁶Dep. Física and CEFITEC of Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Caparica, Portugal
⁷⁷Institute of Physics, Academy of Sciences of the Czech Republic, Praha, Czech Republic
⁷⁸Czech Technical University in Prague, Praha, Czech Republic
⁷⁹Faculty of Mathematics and Physics, Charles University in Prague, Praha, Czech Republic
⁸⁰State Research Center Institute for High Energy Physics, Protvino, Russia
⁸¹Particle Physics Department, Rutherford Appleton Laboratory, Didcot, United Kingdom
⁸²INFN Sezione di Roma, Roma, Italy
⁸³Dipartimento di Fisica, Sapienza Università di Roma, Roma, Italy
⁸⁴INFN Sezione di Roma Tor Vergata, Roma, Italy
⁸⁵Dipartimento di Fisica, Università di Roma Tor Vergata, Roma, Italy
⁸⁶INFN Sezione di Roma Tre, Roma, Italy
⁸⁷Dipartimento di Matematica e Fisica, Università Roma Tre, Roma, Italy

- ^{135a}Faculté des Sciences Ain Chock, Réseau Universitaire de Physique des Hautes Energies-Université Hassan II, Casablanca, Morocco
- ^{135b}Centre National de l'Energie des Sciences Techniques Nucléaires, Rabat, Morocco
- ^{135c}Faculté des Sciences Semlalia, Université Cadi Ayyad, LPHEA-Marrakech, Morocco
- ^{135d}Faculté des Sciences, Université Mohamed Premier et LPTPM, Oujda, Morocco
- ^{135e}Faculté des sciences, Université Mohammed V-Agdal, Rabat, Morocco
- ¹³⁶DSM/IRFU (Institut de Recherches sur les Lois Fondamentales de l'Univers), CEA Saclay (Commissariat à l'Energie Atomique et aux Energies Alternatives), Gif-sur-Yvette, France
- ¹³⁷Santa Cruz Institute for Particle Physics, University of California, Santa Cruz, Santa Cruz, California, USA
- ¹³⁸Department of Physics, University of Washington, Seattle, Washington, USA
- ¹³⁹Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom
- ¹⁴⁰Department of Physics, Shinshu University, Nagano, Japan
- ¹⁴¹Fachbereich Physik, Universität Siegen, Siegen, Germany
- ¹⁴²Department of Physics, Simon Fraser University, Burnaby, British Columbia, Canada
- ¹⁴³SLAC National Accelerator Laboratory, Stanford, California, USA
- ¹⁴⁴Faculty of Mathematics, Physics & Informatics, Comenius University, Bratislava, Slovak Republic
- ¹⁴⁵Department of Subnuclear Physics, Institute of Experimental Physics of the Slovak Academy of Sciences, Košice, Slovak Republic
- ¹⁴⁶Department of Physics, University of Cape Town, Cape Town, South Africa
- ¹⁴⁷Department of Physics, University of Johannesburg, Johannesburg, South Africa
- ¹⁴⁸School of Physics, University of the Witwatersrand, Johannesburg, South Africa
- ¹⁴⁹Department of Physics, Stockholm University, Sweden
- ¹⁵⁰The Oskar Klein Centre, Stockholm, Sweden
- ¹⁵¹Physics Department, Royal Institute of Technology, Stockholm, Sweden
- ¹⁵²Departments of Physics & Astronomy, Stony Brook University, Stony Brook, New York, USA
- ¹⁵³Department of Physics and Astronomy, University of Sussex, Brighton, United Kingdom
- ¹⁵⁴School of Physics, University of Sydney, Sydney, Australia
- ¹⁵⁵Institute of Physics, Academia Sinica, Taipei, Taiwan
- ¹⁵⁶Department of Physics, Technion - Israel Institute of Technology, Haifa, Israel
- ¹⁵⁷Raymond and Beverly Sackler School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel
- ¹⁵⁸Department of Physics, Aristotle University of Thessaloniki, Thessaloniki, Greece
- ¹⁵⁹International Center for Elementary Particle Physics and Department of Physics, The University of Tokyo, Tokyo, Japan
- ¹⁶⁰Graduate School of Science and Technology, Tokyo Metropolitan University, Tokyo, Japan
- ¹⁶¹Department of Physics, Tokyo Institute of Technology, Tokyo, Japan
- ¹⁶²Department of Physics, University of Toronto, Toronto, Ontario, Canada
- ¹⁶³TRIUMF, Vancouver, British Columbia, Canada
- ¹⁶⁴Department of Physics and Astronomy, York University, Toronto, Ontario, Canada
- ¹⁶⁵Faculty of Pure and Applied Sciences, University of Tsukuba, Tsukuba, Japan
- ¹⁶⁶Department of Physics and Astronomy, Tufts University, Medford, Massachusetts, USA
- ¹⁶⁷Centro de Investigaciones, Universidad Antonio Narino, Bogota, Colombia
- ¹⁶⁸Department of Physics and Astronomy, University of California Irvine, Irvine, California, USA
- ¹⁶⁹INFN Gruppo Collegato di Udine, Sezione di Trieste, Udine, Italy
- ¹⁷⁰ICTP, Trieste, Italy
- ¹⁷¹Dipartimento di Chimica, Fisica e Ambiente, Università di Udine, Udine, Italy
- ¹⁷²Department of Physics, University of Illinois, Urbana, Illinois, USA
- ¹⁷³Department of Physics and Astronomy, University of Uppsala, Uppsala, Sweden
- ¹⁷⁴Department of Physics, University of British Columbia, Vancouver, British Columbia, Canada
- ¹⁷⁵Department of Physics and Astronomy, University of Victoria, Victoria, British Columbia, Canada
- ¹⁷⁶Department of Physics, University of Warwick, Coventry, United Kingdom
- ¹⁷⁷Waseda University, Tokyo, Japan
- ¹⁷⁸Department of Particle Physics, The Weizmann Institute of Science, Rehovot, Israel
- ¹⁷⁹Department of Physics, University of Wisconsin, Madison, Wisconsin, USA
- ¹⁸⁰Fakultät für Physik und Astronomie, Julius-Maximilians-Universität, Würzburg, Germany
- ¹⁸¹Fachbereich C Physics, Bergische Universität Wuppertal, Wuppertal, Germany
- ¹⁸²Department of Physics, Yale University, New Haven, Connecticut, USA
- ¹⁸³Yerevan Physics Institute, Yerevan, Armenia
- ¹⁸⁴Centre de Calcul de l'Institut National de Physique Nucléaire et de Physique des Particules (IN2P3), Villeurbanne, France
- ¹⁸⁵Yerevan Physics Institute, Yerevan, Armenia
- ¹⁸⁶Institut für Hochenergiephysik der OeAW, Wien, Austria

- ¹⁸¹National Centre for Particle and High Energy Physics, Minsk, Belarus
¹⁸²Universiteit Antwerpen, Antwerpen, Belgium
¹⁸³Vrije Universiteit Brussel, Brussel, Belgium
¹⁸⁴Université Libre de Bruxelles, Bruxelles, Belgium
¹⁸⁵Ghent University, Ghent, Belgium
¹⁸⁶Université Catholique de Louvain, Louvain-la-Neuve, Belgium
¹⁸⁷Université de Montréal, Montréal, Québec, Canada
¹⁸⁸Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro, Brazil
¹⁸⁹Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil
^{190a}Universidade Estadual Paulista, São Paulo, Brazil
^{190b}Universidade Federal do ABC, São Paulo, Brazil
¹⁹¹Institute for Nuclear Research and Nuclear Energy, Sofia, Bulgaria
¹⁹²University of Sofia, Sofia, Bulgaria
¹⁹³Institute of High Energy Physics, Beijing, China
¹⁹⁴State Key Laboratory of Nuclear Physics and Technology, Peking University, Beijing, China
¹⁹⁵Universidad de Los Andes, Bogotá, Colombia
¹⁹⁶University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, Croatia
¹⁹⁷University of Split, Faculty of Science, Split, Croatia
¹⁹⁸Institute Rudjer Bosković, Zagreb, Croatia
¹⁹⁹University of Cyprus, Nicosia, Cyprus
²⁰⁰Charles University, Prague, Czech Republic
²⁰¹Academy of Scientific Research and Technology of the Arab Republic of Egypt, Egyptian Network of High Energy Physics, Cairo, Egypt
²⁰²National Institute of Chemical Physics and Biophysics, Tallinn, Estonia
²⁰³Department of Physics, University of Helsinki, Helsinki, Finland
²⁰⁴Helsinki Institute of Physics, Helsinki, Finland
²⁰⁵Lappeenranta University of Technology, Lappeenranta, Finland
²⁰⁶DSM/IRFU, CEA/Saclay, Gif-sur-Yvette, France
²⁰⁷Laboratoire Leprince-Ringuet, Ecole Polytechnique IN2P3-CNRS, Palaiseau, France
²⁰⁸Institut Pluridisciplinaire Hubert Curien, Université de Strasbourg, Université de Haute Alsace Mulhouse, CNRS/IN2P3, Strasbourg, France
²⁰⁹Centre de Calcul de l'Institut National de Physique Nucléaire et de Physique des Particules, CNRS/IN2P3, Villeurbanne, France
²¹⁰Université de Lyon, Université Claude Bernard Lyon 1, CNRS-IN2P3, Institut de Physique Nucléaire de Lyon, Villeurbanne, France
²¹¹Institute of High Energy Physics and Informationization, Tbilisi State University, Tbilisi, Georgia
²¹²RWTH Aachen University, I. Physikalisches Institut, Aachen, Germany
²¹³RWTH Aachen University, III. Physikalisches Institut A, Aachen, Germany
²¹⁴RWTH Aachen University, III. Physikalisches Institut B, Aachen, Germany
²¹⁵Deutsches Elektronen-Synchrotron, Hamburg, Germany
²¹⁶University of Hamburg, Hamburg, Germany
²¹⁷Institut für Experimentelle Kernphysik, Karlsruhe, Germany
²¹⁸Institute of Nuclear and Particle Physics (INPP), NCSR Demokritos, Aghia Paraskevi, Greece
²¹⁹University of Athens, Athens, Greece
²²⁰University of Ioannina, Ioannina, Greece
²²¹Wigner Research Centre for Physics, Budapest, Hungary
²²²Institute of Nuclear Research ATOMKI, Debrecen, Hungary
²²³University of Debrecen, Debrecen, Hungary
²²⁴National Institute of Science Education and Research, Bhubaneswar, India
²²⁵Panjab University, Chandigarh, India
²²⁶University of Delhi, Delhi, India
²²⁷Saha Institute of Nuclear Physics, Kolkata, India
²²⁸Bhabha Atomic Research Centre, Mumbai, India
²²⁹Tata Institute of Fundamental Research, Mumbai, India
²³⁰Indian Institute of Science Education and Research (IISER), Pune, India
²³¹Institute for Research in Fundamental Sciences (IPM), Tehran, Iran
²³²University College Dublin, Dublin, Ireland
²³³INFN Sezione di Bari, Bari, Italy
²³⁴Università di Bari, Bari, Italy
²³⁵Politecnico di Bari, Bari, Italy
²³⁶INFN Sezione di Bologna, Bologna, Italy
²³⁷Università di Bologna, Bologna, Italy

- ²³⁵*INFN Sezione di Catania, Catania, Italy*
²³⁶*Università di Catania, Catania, Italy*
²³⁷*CSEPNM, Catania, Italy*
²³⁸*INFN Sezione di Firenze, Firenze, Italy*
²³⁹*Università di Firenze, Firenze, Italy*
²⁴⁰*INFN Laboratori Nazionali di Frascati, Frascati, Italy*
²⁴¹*INFN Sezione di Genova, Genova, Italy*
²⁴²*Università di Genova, Genova, Italy*
²⁴³*INFN Sezione di Milano-Bicocca, Milano, Italy*
²⁴⁴*Università di Milano-Bicocca, Milano, Italy*
²⁴⁵*INFN Sezione di Napoli, Napoli, Italy*
²⁴⁶*Università di Napoli "Federico II," Napoli, Italy*
²⁴⁷*Università della Basilicata, Roma, Italy*
²⁴⁸*Università G. Marconi, Roma, Italy*
²⁴⁹*INFN Sezione di Padova, Padova, Italy*
²⁵⁰*Università di Padova, Padova, Italy*
²⁵¹*INFN Sezione di Trento, Trento, Italy*
²⁵²*Università di Trieste, Trieste, Italy*
²⁵³*INFN Sezione di Pavia, Pavia, Italy*
²⁵⁴*Università di Pavia, Pavia, Italy*
²⁵⁵*INFN Sezione di Perugia, Perugia, Italy*
²⁵⁶*Università di Perugia, Perugia, Italy*
²⁵⁷*INFN Sezione di Pisa, Pisa, Italy*
²⁵⁸*Università di Pisa, Pisa, Italy*
²⁵⁹*Scuola Normale Superiore di Pisa, Pisa, Italy*
²⁶⁰*INFN Sezione di Roma, Roma, Italy*
²⁶¹*Università di Roma, Roma, Italy*
²⁶²*INFN Sezione di Torino, Novara, Italy*
²⁶³*Università di Torino, Novara, Italy*
²⁶⁴*Università del Piemonte Orientale, Novara, Italy*
²⁶⁵*INFN Sezione di Trieste, Trieste, Italy*
²⁶⁶*Università di Trieste, Trieste, Italy*
²⁶⁷*Kangwon National University, Chunchon, Korea*
²⁶⁸*Kyungpook National University, Daegu, Korea*
²⁶⁹*Chonnam National University, Jeonju, Korea*
²⁷⁰*Chonbuk National University, Jeonju, Korea*
²⁷¹*Chonnam National University, Institute for Universe and Elementary Particles, Kwangju, Korea*
²⁷²*Korea University, Seoul, Korea*
²⁷³*Seoul National University, Seoul, Korea*
²⁷⁴*University of Seoul, Seoul, Korea*
²⁷⁵*Sungkyunkwan University, Suwon, Korea*
²⁷⁶*Vilnius University, Vilnius, Lithuania*
²⁷⁷*National Centre for Particle Physics, Universiti Malaya, Kuala Lumpur, Malaysia*
²⁷⁸*Centro de Investigación y de Estudios Avanzados del IPN, Mexico City, Mexico*
²⁷⁹*Universidad Iberoamericana, Mexico City, Mexico*
²⁸⁰*Benedictine Universidad Autónoma de Puebla, Puebla, Mexico*
²⁸¹*Universidad Autónoma de San Luis Potosí, San Luis Potosí, Mexico*
²⁸²*University of Auckland, Auckland, New Zealand*
²⁸³*University of Canterbury, Christchurch, New Zealand*
²⁸⁴*National Centre for Physics, Quaid-I-Azam University, Islamabad, Pakistan*
²⁸⁵*National Centre for Nuclear Research, Swierk, Poland*
²⁸⁶*Institute of Experimental Physics, Faculty of Physics, University of Warsaw, Warsaw, Poland*
²⁸⁷*Laboratório de Instrumentação e Física Experimental de Partículas, Lisboa, Portugal*
²⁸⁸*Joint Institute for Nuclear Research, Dubna, Russia*
²⁸⁹*Petersburg Nuclear Physics Institute, Gatchina (St. Petersburg), Russia*
²⁹⁰*Institute for Nuclear Research, Moscow, Russia*
²⁹¹*Institute for Theoretical and Experimental Physics, Moscow, Russia*
²⁹²*P.N. Lebedev Physical Institute, Moscow, Russia*
²⁹³*Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia*
²⁹⁴*State Research Center of Russian Federation, Institute for High Energy Physics, Protvino, Russia*
²⁹⁵*University of Belgrade, Faculty of Physics and Vinca Institute of Nuclear Sciences, Belgrade, Serbia*
²⁹⁶*Centro de Investigaciones Energéticas Medioambientales y Tecnológicas (CIEMAT), Madrid, Spain*

- ²⁷⁷Universidad Autónoma de Madrid, Madrid, Spain
²⁷⁸Universidad de Oviedo, Oviedo, Spain
²⁷⁹Instituto de Física de Cantabria (IFCA), CSIC-Universidad de Cantabria, Santander, Spain
²⁸⁰CERN, European Organization for Nuclear Research, Geneva, Switzerland
²⁸¹Scherrer Institut, Villigen, Switzerland
²⁸²Institute for Particle Physics, ETH Zurich, Zurich, Switzerland
²⁸³Universität Zürich, Zurich, Switzerland
²⁸⁴National Central University, Chung-Li, Taiwan
²⁸⁵National Taiwan University (NTU), Taipei, Taiwan
²⁸⁶Chulalongkorn University, Faculty of Science, Department of Physics, Bangkok, Thailand
²⁸⁸Middle East Technical University, Physics Department, Ankara, Turkey
²⁸⁹Bogazici University, Istanbul, Turkey
²⁹⁰Istanbul Technical University, Istanbul, Turkey
²⁹¹Institute for Scintillation Materials of National Academy of Science of Ukraine, Kharkov, Ukraine
²⁹²National Scientific Center, Kharkov Institute of Physics and Technology, Kharkov, Ukraine
²⁹³University of Bristol, Bristol, United Kingdom
²⁹⁴Rutherford Appleton Laboratory, Didcot, United Kingdom
²⁹⁵Imperial College, London, United Kingdom
²⁹⁶Brunei University, Uxbridge, United Kingdom
²⁹⁷Baylor University, Waco, Texas, USA
²⁹⁸The University of Alabama, Tuscaloosa, Alabama, USA
²⁹⁹Boston University, Boston, Massachusetts, USA
³⁰⁰Brown University, Providence, Rhode Island, USA
³⁰¹University of California, Davis, Davis, California, USA
³⁰²University of California, Los Angeles, Los Angeles, California, USA
³⁰³University of California, Riverside, Riverside, California, USA
³⁰⁴University of California, San Diego, La Jolla, California, USA
³⁰⁵University of California, Santa Barbara, Santa Barbara, California, USA
³⁰⁶California Institute of Technology, Pasadena, California, USA
³⁰⁷Carnegie Mellon University, Pittsburgh, Pennsylvania, USA
³⁰⁸University of Colorado at Boulder, Boulder, Colorado, USA
³⁰⁹Cornell University, Ithaca, New York, USA
³¹⁰Fermi National Accelerator Laboratory, Batavia, Illinois, USA
³¹¹University of Florida, Gainesville, Florida, USA
³¹²Florida International University, Miami, Florida, USA
³¹³Florida State University, Tallahassee, Florida, USA
³¹⁴Florida Institute of Technology, Melbourne, Florida, USA
³¹⁵University of Illinois at Chicago (UIC), Chicago, Illinois, USA
³¹⁶The University of Iowa, Iowa City, Iowa, USA
³¹⁷Johns Hopkins University, Baltimore, Maryland, USA
³¹⁸The University of Kansas, Lawrence, Kansas, USA
³¹⁹Kansas State University, Manhattan, Kansas, USA
³²⁰Lawrence Livermore National Laboratory, Livermore, California, USA
³²¹University of Maryland, College Park, Maryland, USA
³²²Massachusetts Institute of Technology, Cambridge, Massachusetts, USA
³²³University of Minnesota, Minneapolis, Minnesota, USA
³²⁴University of Mississippi, Oxford, Mississippi, USA
³²⁵University of Nebraska-Lincoln, Lincoln, Nebraska, USA
³²⁶State University of New York at Buffalo, Buffalo, New York, USA
³²⁷Northeastern University, Boston, Massachusetts, USA
³²⁸Northwestern University, Evanston, Illinois, USA
³²⁹University of Notre Dame, Notre Dame, Indiana, USA
³³⁰The Ohio State University, Columbus, Ohio, USA
³³¹Princeton University, Princeton, New Jersey, USA
³³²Purdue University, West Lafayette, Indiana, USA
³³³Purdue University Calumet, Hammond, Indiana, USA
³³⁴Rice University, Houston, Texas, USA
³³⁵University of Rochester, Rochester, New York, USA
³³⁶The Rockefeller University, New York, New York, USA

- ³³⁷Rutgers, The State University of New Jersey, Piscataway, New Jersey, USA
³³⁸University of Tennessee, Knoxville, Tennessee, USA
³³⁹Texas A&M University, College Station, Maryland, USA
³⁴⁰Texas Tech University, Lubbock, Texas, USA
³⁴¹Vanderbilt University, Nashville, Tennessee, USA
³⁴²University of Virginia, Charlottesville, Virginia, USA
³⁴³Wayne State University, Detroit, Michigan, USA
³⁴⁴University of Wisconsin, Madison, Wisconsin, USA

^bDeceased.

- ^bAlso at Department of Physics, King's College London, London, United Kingdom.
^bAlso at Institute of Physics, Azerbaijan Academy of Sciences, Baku, Azerbaijan.
^bAlso at Novosibirsk State University, Novosibirsk, Russia.
^bAlso at TRIUMF, Vancouver, BC, Canada.
^bAlso at Department of Physics, California State University, Fresno, CA, USA.
^bAlso at Department of Physics, University of Fribourg, Fribourg, Switzerland.
^bAlso at Departamento de Física e Astronomia, Faculdade de Ciências, Universidade do Porto, Portugal.
^bAlso at Tomsk State University, Tomsk, Russia.
^bAlso at CPPM, Aix-Marseille Université and CNRS/IN2P3, Marseille, France.
^bAlso at Università di Napoli Parthenope, Napoli, Italy.
^bAlso at Institute of Particle Physics (IPP), Canada.
^bAlso at Particle Physics Department, Rutherford Appleton Laboratory, Didcot, United Kingdom.
^bAlso at Department of Physics, St. Petersburg State Polytechnical University, St. Petersburg, Russia.
^bAlso at Louisiana Tech University, Ruston, LA, USA.
^bAlso at Institut Català de Recerca i Estudis Avançats, ICREA, Barcelona, Spain.
^bAlso at Department of Physics, National Tsing Hua University, Taiwan.
^bAlso at Department of Physics, The University of Texas at Austin, Austin, TX, USA.
^bAlso at Institute of Theoretical Physics, Ila State University, Tbilisi, Georgia.
^bAlso at CERN, Geneva, Switzerland.
^bAlso at Georgian Technical University (GTU), Tbilisi, Georgia.
^bAlso at Ochanomizu Academic Production, Ochanomizu University, Tokyo, Japan.
^bAlso at Manhattan College, New York, NY, USA.
^bAlso at Institute of Physics, Academia Sinica, Taipei, Taiwan.
^bAlso at LAL, Université Paris-Sud and CNRS/IN2P3, Orsay, France.
^bAlso at Academia Sinica Grid Computing, Institute of Physics, Academia Sinica, Taipei, Taiwan.
^bAlso at School of Physics, Shandong University, Shandong, China.
^bAlso at Moscow Institute of Physics and Technology State University, Dolgoprudny, Russia.
^bAlso at Section de Physique, Université de Genève, Geneva, Switzerland.
^bAlso at International School for Advanced Studies (SISSA), Trieste, Italy.
^bAlso at Department of Physics and Astronomy, University of South Carolina, Columbia, SC, USA.
^bAlso at School of Physics and Engineering, Sun Yat-sen University, Guangzhou, China.
^bAlso at Faculty of Physics, M.V.Lomonosov Moscow State University, Moscow, Russia.
^bAlso at National Research Nuclear University MEPhI, Moscow, Russia.
^bAlso at Department of Physics, Stanford University, Stanford, CA, USA.
^bAlso at Institute for Particle and Nuclear Physics, Wigner Research Centre for Physics, Budapest, Hungary.
^bAlso at Department of Physics, The University of Michigan, Ann Arbor, MI, USA.
^bAlso at Discipline of Physics, University of KwaZulu-Natal, Durban, South Africa.
^bAlso at University of Malaya, Department of Physics, Kuala Lumpur, Malaysia.
^bAlso at Vienna University of Technology, Vienna, Austria.
^bAlso at CERN, European Organization for Nuclear Research, Geneva, Switzerland.
^bAlso at State Key Laboratory of Nuclear Physics and Technology, Peking University, Beijing, China.
^bAlso at Institut Pluridisciplinaire Hubert Curien, Université de Strasbourg, Université de Haute Alsace Mulhouse, CNRS/IN2P3, Strasbourg, France.
^bAlso at National Institute of Chemical Physics and Biophysics, Tallinn, Estonia.
^bAlso at Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia.
^bAlso at Universidade Estadual de Campinas, Campinas, Brazil.
^bAlso at Centre National de la Recherche Scientifique (CNRS)-IN2P3, Paris, France.
^bAlso at Laboratoire Leprince-Ringuet, Ecole Polytechnique, IN2P3-CNRS, Palaiseau, France.
^bAlso at Joint Institute for Nuclear Research, Dubna, Russia.
^bAlso at Ain Shams University, Cairo, Egypt.

- ³⁷Also at British University in Egypt, Cairo, Egypt.
³⁸Also at Helwan University, Cairo, Egypt.
³⁹Also at Suez University, Suez, Egypt.
⁴⁰Also at Cairo University, Cairo, Egypt.
⁴¹Also at Fayoum University, El-Fayoum, Egypt.
⁴²Also at Université de Haute Alsace, Mulhouse, France.
⁴³Also at Brandenburg University of Technology, Cottbus, Germany.
⁴⁴Also at Institute of Nuclear Research ATOMKI, Debrecen, Hungary.
⁴⁵Also at Eötvös Loránd University, Budapest, Hungary.
⁴⁶Also at University of Debrecen, Debrecen, Hungary.
⁴⁷Also at Wigner Research Centre for Physics, Budapest, Hungary.
⁴⁸Also at University of Visva-Bharati, Santiniketan, India.
⁴⁹Also at King Abdulaziz University, Jeddah, Saudi Arabia.
⁵⁰Also at University of Ruhuna, Matara, Sri Lanka.
⁵¹Also at Isfahan University of Technology, Isfahan, Iran.
⁵²Also at University of Tehran, Department of Engineering Science, Tehran, Iran.
⁵³Also at Plasma Physics Research Center, Science and Research Branch, Islamic Azad University, Tehran, Iran.
⁵⁴Also at Università degli Studi di Siena, Siena, Italy.
⁵⁵Also at Purdue University, West Lafayette, IN, USA.
⁵⁶Also at International Islamic University of Malaysia, Kuala Lumpur, Malaysia.
⁵⁷Also at Consejo Nacional de Ciencia y Tecnología, Mexico, Mexico.
⁵⁸Also at Institute for Nuclear Research, Moscow, Russia.
⁵⁹Also at Institute of High Energy Physics and Informatization, Tbilisi State University, Tbilisi, Georgia.
⁶⁰Also at St. Petersburg State Polytechnical University, St. Petersburg, Russia.
⁶¹Also at National Research Nuclear University "Moscow Engineering Physics Institute" (MEPhI), Moscow, Russia.
⁶²Also at California Institute of Technology, Pasadena, CA, USA.
⁶³Also at Faculty of Physics, University of Belgrade, Belgrade, Serbia.
⁶⁴Also at Facoltà di Ingegneria, Università di Roma, Roma, Italy.
⁶⁵Also at National Technical University of Athens, Athens, Greece.
⁶⁶Also at Scuola Normale e Sezione dell'INFN, Pisa, Italy.
⁶⁷Also at University of Athens, Athens, Greece.
⁶⁸Also at Warsaw University of Technology, Institute of Electronic Systems, Warsaw, Poland.
⁶⁹Also at Institute for Theoretical and Experimental Physics, Moscow, Russia.
⁷⁰Also at Albert Einstein Center for Fundamental Physics, Bern, Switzerland.
⁷¹Also at Adiyaman University, Adiyaman, Turkey.
⁷²Also at Mersin University, Mersin, Turkey.
⁷³Also at Cag University, Mersin, Turkey.
⁷⁴Also at Piri Reis University, İstanbul, Turkey.
⁷⁵Also at Gaziosmanpasa University, Tokat, Turkey.
⁷⁶Also at Ozyegin University, Istanbul, Turkey.
⁷⁷Also at Izmir Institute of Technology, Izmir, Turkey.
⁷⁸Also at Mimar Sinan University, İstanbul, İstanbul, Turkey.
⁷⁹Also at Marmara University, İstanbul, Turkey.
⁸⁰Also at Yildiz Technical University, İstanbul, Turkey.
⁸¹Also at Hacettepe University, Ankara, Turkey.
⁸²Also at Rutherford Appleton Laboratory, Didcot, United Kingdom.
⁸³Also at School of Physics and Astronomy, University of Southampton, Southampton, United Kingdom.
⁸⁴Also at Instituto de Astrofísica de Canarias, La Laguna, Spain.
⁸⁵Also at Utah Valley University, Orem, UT, USA.
⁸⁶Also at University of Belgrade, Faculty of Physics and Vinca Institute of Nuclear Sciences, Belgrade, Serbia.
⁸⁷Also at Argonne National Laboratory, Argonne, IL, USA.
⁸⁸Also at Erzincan University, Erzincan, Turkey.
⁸⁹Also at Texas A&M University at Qatar, Doha, Qatar.
⁹⁰Also at Kyungpook National University, Daegu, Korea.

Fragile Families Challenge

Fragile Families Challenge

A scientific mass collaboration combining

Fragile Families Challenge

A scientific mass collaboration combining

- ▶ predictive modeling,

Fragile Families Challenge

A scientific mass collaboration combining

- ▶ predictive modeling,
- ▶ causal inference,

Fragile Families Challenge

A scientific mass collaboration combining

- ▶ predictive modeling,
- ▶ causal inference,
- ▶ and qualitative interviews

Fragile Families Challenge

A scientific mass collaboration combining

- ▶ predictive modeling,
- ▶ causal inference,
- ▶ and qualitative interviews

to improve the lives of disadvantaged children in the US.

FF Fragile Families

& Child Wellbeing Study
PRINCETON | COLUMBIA



- ▶ Birth cohort panel study
- ▶ ≈ 5,000 children born in 20 U.S. cities
- ▶ Oversample of non-marital births
- ▶ Followed from birth through age 15

Key research question: What can be done to improve the life chances of disadvantaged children?

Hundreds of papers and dozens of dissertations

<http://crcw.princeton.edu/publications/publications.asp>

Social Scientists ←→ Data Scientists

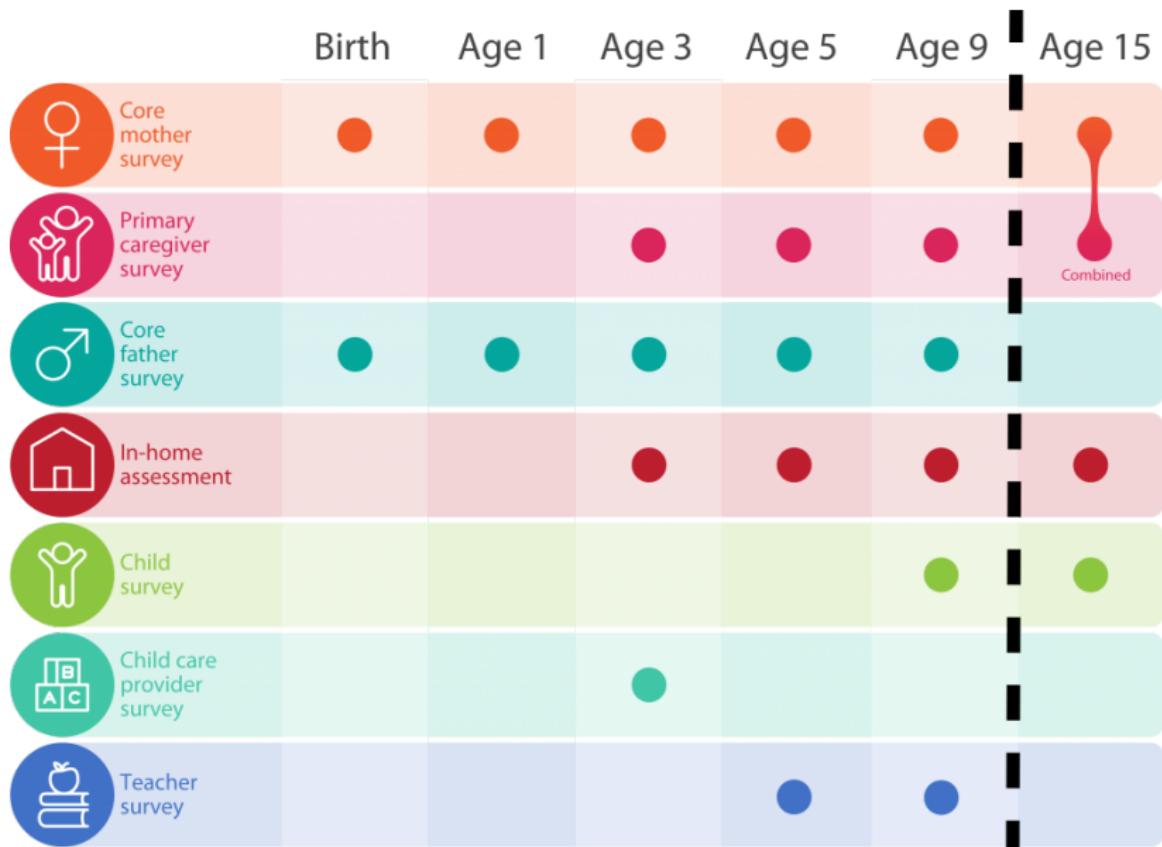
Social Scientists \longleftrightarrow Data Scientists

$$\hat{\beta} \quad \& \quad \hat{y}$$

Mullainathan and Spiess (2017):

<http://dx.doi.org/10.1257/jep.31.2.87>

	Birth	Age 1	Age 3	Age 5	Age 9
 Core mother survey	●	●	●	●	●
 Primary caregiver survey			●	●	●
 Core father survey	●	●	●	●	●
 In-home assessment			●	●	●
 Child survey					●
 Child care provider survey			●		
 Teacher survey				●	●



5,000 families

Birth to age 9
12,000 features

Age 15
1,500 features

5,000 families

Birth to age 9
12,000 features

Age 15
6 key outcomes



Continuous outcomes:

- ▶ GPA
- ▶ Grit
- ▶ Material hardship

Binary outcomes:

- ▶ Housing eviction
- ▶ Layoff of a caregiver
- ▶ Job training for a caregiver

Fragile Families Challenge:

1. common task method

Fragile Families Challenge:

1. common task method
2. use submissions to do cool stuff

Common task method

- ▶ common data
- ▶ common metric
- ▶ evaluation on held-out test data

“secret sauce” of machine learning (Donoho 2015)

$$\hat{y} = \hat{f}_1(x)$$

$$\hat{y} = \hat{f}_2(x)$$

$$\hat{y} = \hat{f}_3(x)$$

$$\begin{aligned}\hat{y} &= \hat{f}_1(x) \\ \hat{y} &= \hat{f}_2(x) \\ \hat{y} &= \hat{f}_3(x)\end{aligned}$$

Community model

$$\hat{f}_c\left(\hat{f}_1(x), \hat{f}_2(x), \hat{f}_3(x)\right)$$

$$\hat{y} = \hat{f}_1(x)$$

$$\hat{y} = \hat{f}_2(x)$$

$$\hat{y} = \hat{f}_3(x)$$

Community model

$$\hat{w}_1\hat{f}_1(x) + \hat{w}_2\hat{f}_2(x) + \hat{w}_3\hat{f}_3(x)$$

What's so special about this community model?

Use community model to

- ▶ look for “dark matter”
- ▶ estimate causal effects

Use community model to

- ▶ look for “dark matter”¹
- ▶ estimate causal effects

¹Learn more at

<http://www.fragilefamilieschallenge.org/unmeasured-factors/>

Most social science models have poor predictive performance.
Why?

Most social science models have poor predictive performance.
Why?

- ▶ poor measurement

Most social science models have poor predictive performance.
Why?

- ▶ poor measurement
- ▶ wrong functional form

Most social science models have poor predictive performance.
Why?

- ▶ poor measurement
- ▶ wrong functional form
- ▶ “dark matter”

Look for dark matter:

- ▶ Interview kids and families that are beating the odds (and not)

Look for dark matter:

- ▶ Interview kids and families that are beating the odds (and not)
- ▶ Three continuous outcomes: GPA, Material Hardship, Grit

Look for dark matter:

- ▶ Interview kids and families that are beating the odds (and not)
- ▶ Three continuous outcomes: GPA, Material Hardship, Grit
- ▶ Machine learning in the service of in-depth interviews

Use community model to

- ▶ look for “dark matter”
 - ▶ estimate causal effects

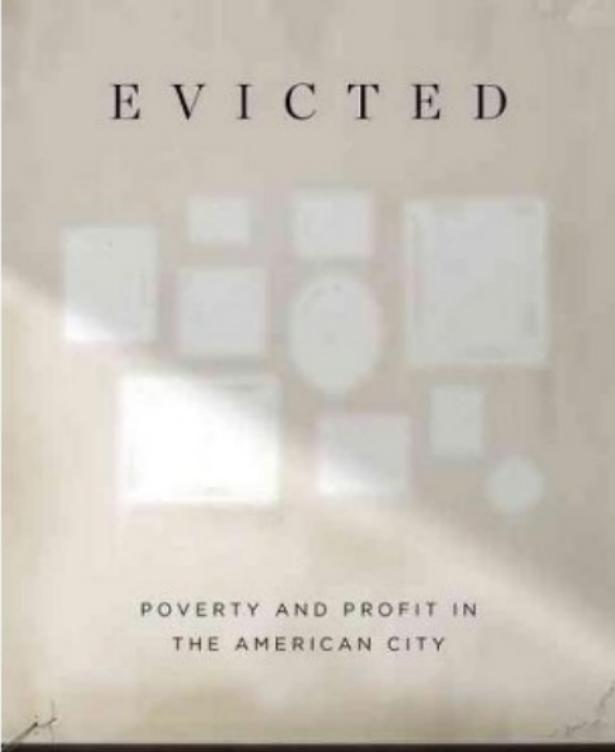
Use community model to

- ▶ look for “dark matter”
- ▶ estimate causal effects²

²Learn more at

<http://www.fragilefamilieschallenge.org/causal-inference/>

E V I C T E D

A very faint, blurry photograph of a living room interior serves as the background for the book cover. It shows a sofa, a chair, and some decorative items on a shelf.

POVERTY AND PROFIT IN
THE AMERICAN CITY

MATTHEW DESMOND

Does eviction **cause** children's outcomes to be worse?

Does eviction **cause** children's outcomes to be worse?

Or is eviction just **associated with** worse outcomes because those who are evicted are already disadvantaged in other ways?

Causal inference from observational data is hard but important

Causal inference from observational data is hard but important

- ▶ Community model produces propensity scores that can be used for matching (for example)

Causal inference from observational data is hard but important

- ▶ Community model produces propensity scores that can be used for matching (for example)
- ▶ Sensitivity analysis

Causal inference from observational data is hard but important

- ▶ Community model produces propensity scores that can be used for matching (for example)
- ▶ Sensitivity analysis
- ▶ In-depth interviews to check assumption of selection on observables

Causal inference from observational data is hard but important

- ▶ Community model produces propensity scores that can be used for matching (for example)
- ▶ Sensitivity analysis
- ▶ In-depth interviews to check assumption of selection on observables
- ▶ Talk to Ian if you want to discuss causal inference in more detail

Use community model to

- ▶ look for “dark matter”
- ▶ estimate causal effects

To enable future research,
at the end of the Challenge,
we will **open-source** all submitted
predictions, code, and narrative explanations.

To enable future research,
at the end of the Challenge,
we will **open-source** all submitted
predictions, code, and narrative explanations.

Some participants have **already** provided
open source examples submissions!

[http://github.com/fragilefamilieschallenge/
open-source-submissions](http://github.com/fragilefamilieschallenge/open-source-submissions)

How to participate

www.fragilefamilieschallenge.org

Introducing the outcome variables

GPA³

³Learn more at <http://www.fragilefamilieschallenge.org/gpa/>

GPA³

How do kids beat the odds academically?

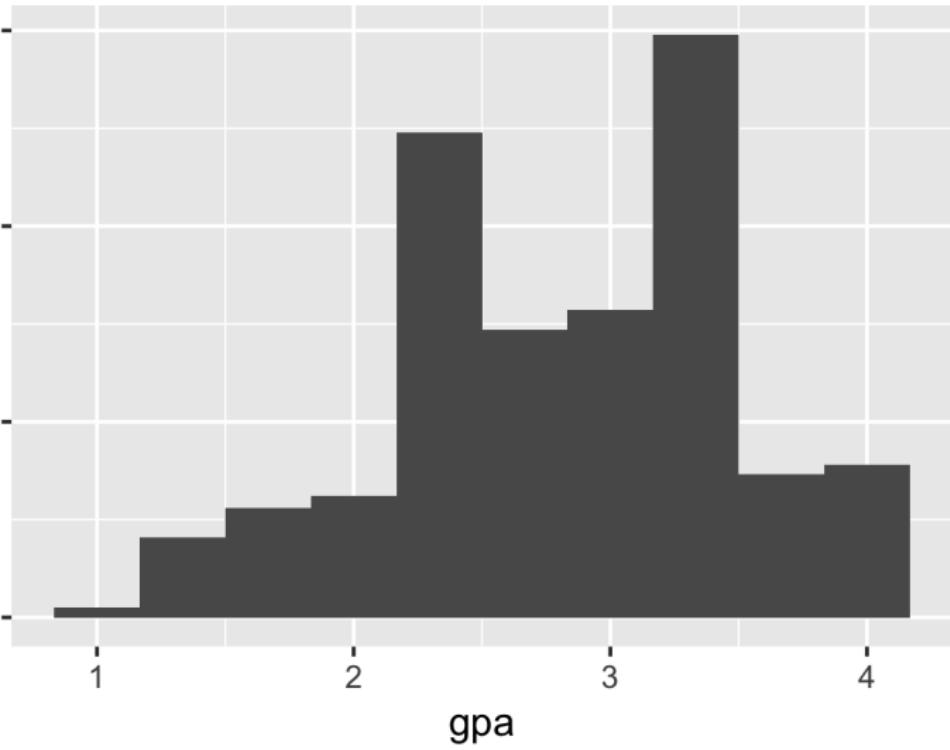
³Learn more at <http://www.fragilefamilieschallenge.org/gpa/>

GPA⁴

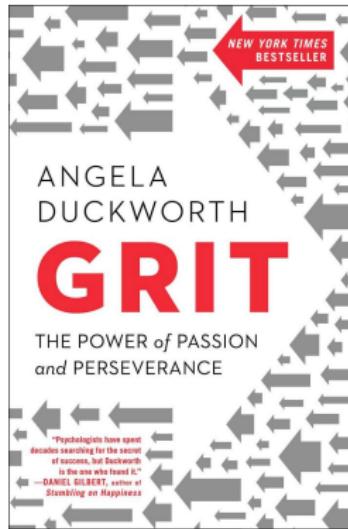
B20. At the {most recent grading period/last grading period in the spring} what was your grade in ...

	A	B	C	D OR LOWE R	NO GRADE OR PASS/FAIL	REF	DK	N/A HOMESCHOoled
B20A English or language arts? ..	1	2	3	4	5	-1	-2	7 → GO TO B22A
B20B Math?	1	2	3	4	5	-1	-2	7 → GO TO B22A
B20C History or social studies? ..	1	2	3	4	5	-1	-2	7 → GO TO B22A
B20D Science?	1	2	3	4	5	-1	-2	7 → GO TO B22A

⁴This variable is reverse-coded in the data file so that higher values represent higher GPAs.

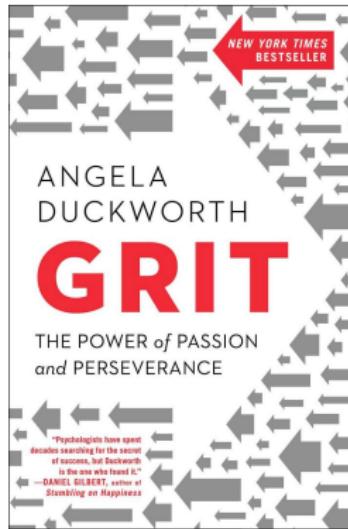


“Grit” predicts success, possibly more than IQ.⁵



⁵Learn more at <http://www.fragilefamilieschallenge.org/grit/>

“Grit” predicts success, possibly more than IQ.⁵



What makes some kids gritty?

⁵Learn more at <http://www.fragilefamilieschallenge.org/grit/>

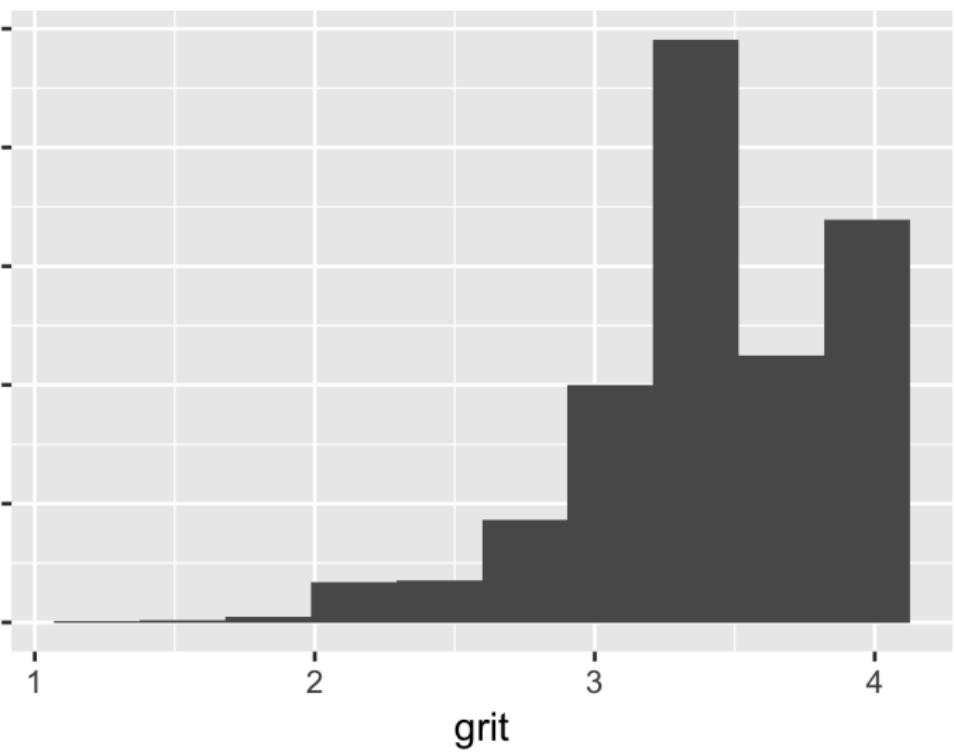
Grit⁶

- D2. Thinking about how you have behaved or felt during the past four weeks, please tell me whether you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the following statements.

PROBE: Thinking about the past four weeks, do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with this statement?

	STRONGLY AGREE	SOMEWHAT AGREE	SOMEWHAT DISAGREE	STRONGLY DISAGREE	REF	DK
D2I. I keep at my schoolwork until I am done with it.....	1	2	3	4	-1	-2
D2K. Once I make a plan to get something done, I stick to it.....	1	2	3	4	-1	-2
D2M. I finish whatever I begin.....	1	2	3	4	-1	-2
D2V. I am a hard worker	1	2	3	4	-1	-2

⁶This variable is reverse-coded in the data file so that higher values represent more grit.



Material hardship⁷

⁷Learn more at

<http://www.fragilefamilieschallenge.org/material-hardship/>

Material hardship⁷

What unmeasured predictors are associated with families unexpectedly escaping severe deprivation?

⁷Learn more at

<http://www.fragilefamilieschallenge.org/material-hardship/>

Material hardship⁷

What unmeasured predictors are associated with families unexpectedly escaping severe deprivation?

What sends families unexpectedly into deep poverty?

⁷Learn more at

<http://www.fragilefamilieschallenge.org/material-hardship/>

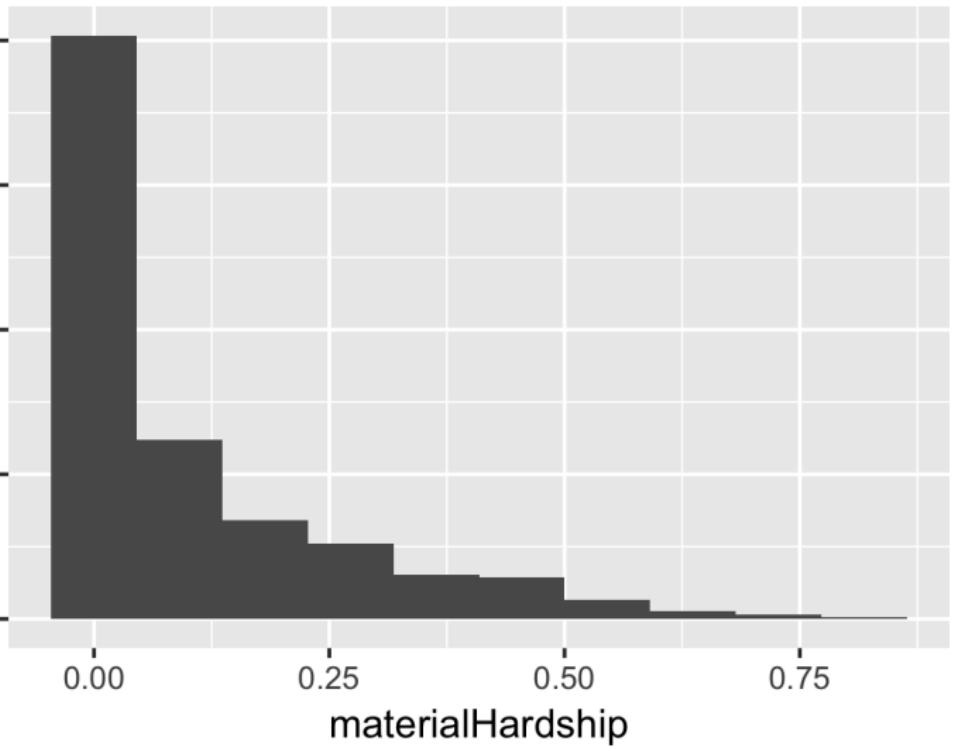
Material hardship

We are also interested in some of the problems that families face making ends meet. In the past twelve months, did you do any of the following because there wasn't enough money?

		YES	NO	REF	DK
J37.	In the past twelve months, did you receive free food or meals?	1	2	-1	-2
J38.	In the past twelve months, were you ever hungry, but didn't eat because you couldn't afford enough food?	1	2	-1	-2
J39.	In the past twelve months, did you ever not pay the full amount of rent or mortgage payments?	1	2	-1	-2
J40.	In the past twelve months, were you evicted from your home or apartment for not paying the rent or mortgage?	1	2	-1	-2
J41.	In the past twelve months, did you not pay the full amount of gas, oil, or electricity bill?	1	2	-1	-2
J42.	In the past twelve months, was your gas or electric services ever turned off, or the heating oil company did not deliver oil, because there wasn't enough money to pay the bills?	1	2	-1	-2
J43.	In the past twelve months, did you borrow money from friends or family to help pay bills?	1	2	-1	-2
J44.	In the past twelve months, did you move in with other people even for a little while because of financial problems?	1	2	-1	-2

Material hardship

J45.	In the past twelve months, did you stay at a shelter, in an abandoned building, an automobile or any other place not meant for regular housing, even for one night?	1	2	-1	-2
J46.	In the past twelve months, was there anyone in your household who needed to see a doctor or go to the hospital but couldn't go because of the cost?	1	2	-1	-2
J47.	In the past twelve months, was your telephone service (mobile or land line) cancelled or disconnected by the telephone company because there wasn't enough money to pay the bill?	1	2	-1	-2



Eviction⁸

⁸Learn more at <http://www.fragilefamilieschallenge.org/eviction/>

⁹Note: You will just create propensity scores for eviction given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Eviction⁸

Does housing eviction **cause** worse outcomes as kids transition to adulthood?⁹

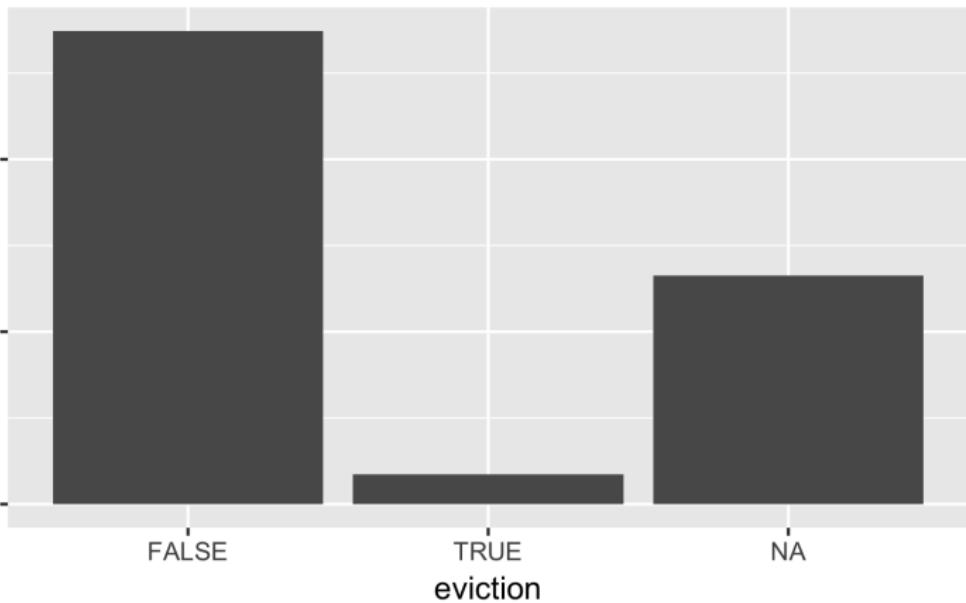
⁸Learn more at <http://www.fragilefamilieschallenge.org/eviction/>

⁹Note: You will just create propensity scores for eviction given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Eviction

J51. Since {MONTH AND YEAR COHORT CITY FIELDDED IN YR 9}, were you evicted from your home or apartment for not paying the rent or mortgage?

YES	1
NO	2
REFUSED	-1
DON'T KNOW	-2



Caregiver layoff¹⁰

¹⁰Learn more at <http://www.fragilefamilieschallenge.org/layoff/>

¹¹Note: You will just create propensity scores for caregiver layoff given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Caregiver layoff¹⁰

Does layoff of a caregiver **cause** collateral damage for kids?¹¹

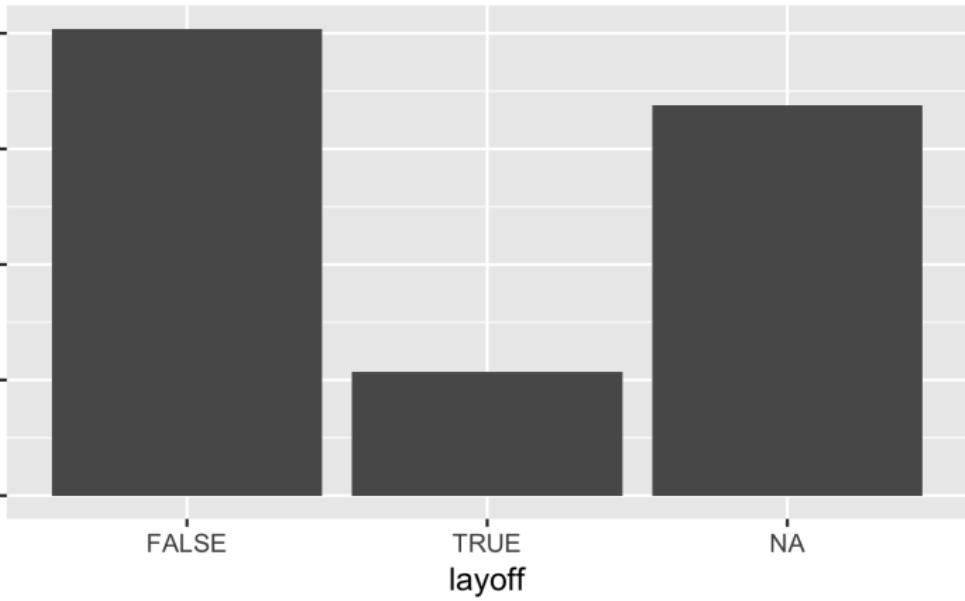
¹⁰Learn more at <http://www.fragilefamilieschallenge.org/layoff/>

¹¹Note: You will just create propensity scores for caregiver layoff given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Caregiver layoff

K13. Since {MONTH AND YEAR COHORT CITY FIELDDED IN YR 9}, have you been laid off from your employer for any time?

- | | |
|------------------|----|
| YES | 1 |
| NO..... | 2 |
| REFUSED..... | -1 |
| DON'T KNOW | -2 |



Job training¹²

¹²Learn more at

<http://www.fragilefamilieschallenge.org/job-training/>

¹³Note: You will just create propensity scores for job training given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Job training¹²

Does job training for a caregiver **cause** collateral benefits for children?¹³

¹²Learn more at

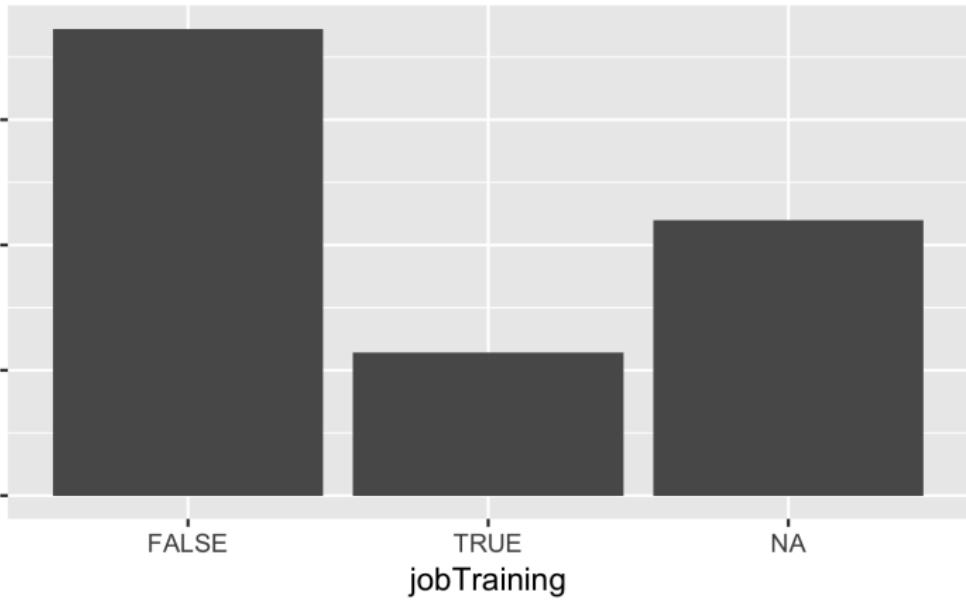
<http://www.fragilefamilieschallenge.org/job-training/>

¹³Note: You will just create propensity scores for job training given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Caregiver job training

K4. Since {MONTH AND YEAR COHORT CITY FIELDDED IN YR 9}, have you taken any classes to improve your job skills, such as computer training or literacy classes?

- | | |
|-----------------|-----|
| YES | .1 |
| NO..... | .2 |
| REFUSED..... | -.1 |
| DON'T KNOW..... | -.2 |



Introducing the documentation

How do I know what the variables are?

- ▶ Blog post: <http://www.fragilefamilieschallenge.org/survey-documentation/>
- ▶ Fragile Families and Child Wellbeing Study website:
<http://www.fragilefamilies.princeton.edu/>

FF Fragile Families & Child Wellbeing Study PRINCETON | COLUMBIA



Search... 

Home

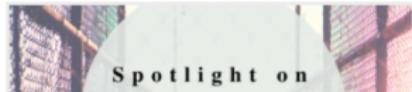
About

People

Publications

Data and Documentation

Contact



Spotlight on

Spotlight on FFCWS and Incarceration
Research

Recent publications using the Fragile Families & Child
Wellbeing Study provide a broader understanding of the effects

General Documentation

Baseline

Year 1

[Links to](#)

Year 3

[documentation
for each wave](#)

Year 5

Year 9

Year 15

FAQ

Data and Documentation

Data

Data are free to download from Princeton University's [Office of Population Research \(OPR\) data archive](#).

Currently, there are five waves of publicly available data including baseline and Year 1, Year 3, Year 5, and Year 9 follow-ups. In order to protect the confidentiality of survey respondents, geographic identifiers, medical records data, contextual data (i.e., census tract characteristics), macroeconomic indicators, and genetic biomarkers are not available in the public use data files. Researchers may apply for these data via a [restricted use contract](#).

Documentation

General Documentation

Baseline

Year 1

Year 3

Year 5

Year 9

Year 15

FAQ

Data Alerts

Contract Data

Year 9

The Year 9 follow-up wave of data collection took place from 2007 to 2010, which makes the data useful for researchers interested in the effects of the Great Recession on children and families. It is different from previous waves because the home visit was integral to the wave procedures. In previous waves, we conducted core interviews before proceeding to the in-home components. At year 9, our initial interview was with the child's primary caregiver (usually the mother) and we scheduled a home visit at the time of that initial interview. As part of the home visit, we interviewed focal children for the first time. We attempted teacher surveys through the mail. Similar to previous waves, we have core interviews with mothers and fathers. Restricted Data at this wave include [census tract characteristics](#) of mother and father residences, [macroeconomic indicators](#), administrative data on children's [school characteristics](#), and [genetic](#) data from saliva samples from the mother and focal child.

PRIMARY CAREGIVER

[Primary Caregiver Survey](#)

[Primary Caregiver Self-Administered](#)

SCALES

[Scales documentation](#)

MOTHER

[Questionnaire](#)

[Codebook](#)

**Each survey has
a questionnaire
and
a codebook**

FATHER

[Questionnaire](#)

[Codebook](#)

CHILD

[Child Survey](#)

[Home Visit Workbook](#)

[Interviewer Observations](#)

[Codebook](#)

TEACHER

[Questionnaire](#)

[Codebook](#)

Questionnaire:

BOX A3A2

IF PCG=BIOFATHER IN THE PCG IDENTIFIER IN THE SCREENER,
GO TO A3C.

ELSE IF PCG= NON-PARENT AND RELATIONSHIP = MATERNAL
GRANDPARENT(S), PATERNAL GRANDPARENT(S), OTHER
RELATIVES OR FRIEND IN THE PCG IDENTIFIER IN THE
SCREENER, GO TO A3B1A.

ELSE IF PCG=NON-PARENT AND RELATIONSHIP=FOSTER CARE
IN THE PCG IDENTIFIER IN THE SCREENER, GO TO A3B.

ELSE IF PCG=NON-PARENT AND RELATIONSHIP = OTHER,
SPECIFY IN THE PCG IDENTIFIER IN THE SCREENER, GO TO
A3B1A.

ELSE IF PCG= "NOT MOTHER" IN THE PCG IDENTIFIER GO TO
A3D.

A3B. Are {CHILD}'s foster parents related to you?

YES	1
NO	2
REFUSED.....	-1
DON'T KNOW.....	-2

In the corresponding codebook, we see the count of respondents who gave each answer:

```
m5a3b                                         A1B. Child's foster parents related to you

type: numeric (byte)
label: BM_72F

range: [-9,2]                               units: 1
unique values: 5                           missing : 0/4898

tabulation: Freq.   Numeric  Label
            1383      -9  -9 Not in wave
            3499      -6  -6 Skip
              6      -3  -3 Missing
              1      -2  -2 Don't know
              9       2     2 no
```

In the corresponding codebook, we see the count of respondents who gave each answer:

```
m5a3b                                         A1B. Child's foster parents related to you

type: numeric (byte)
label: BM_72F

range: [-9,2]                               units: 1
unique values: 5                           missing : 0/4898

tabulation: Freq.   Numeric  Label
            1383      -9    -9 Not in wave
            3499      -6    -6 Skip
              6      -3    -3 Missing
              1      -2    -2 Don't know
              9       2      2 no
```

Things to note here:

In the corresponding codebook, we see the count of respondents who gave each answer:

```
m5a3b                                         A3B. Child's foster parents related to you

type: numeric (byte)
label: BM_72F

range: [-9,2]                               units: 1
unique values: 5                           missing : 0/4898

tabulation: Freq.   Numeric  Label
            1383      -9    -9 Not in wave
            3499      -6    -6 Skip
              6      -3    -3 Missing
              1      -2    -2 Don't know
              9       2      2 no
```

Things to note here:

- ▶ The question referred to in the questionnaire as A3B is called m5a3b in the codebook.

In the corresponding codebook, we see the count of respondents who gave each answer:

```
m5a3b                                         A3B. Child's foster parents related to you

type: numeric (byte)
label: BM_72F

range: [-9,2]                               units: 1
unique values: 5                           missing : 0/4898

tabulation: Freq.   Numeric  Label
            1383     -9    -9 Not in wave
            3499     -6    -6 Skip
              6     -3    -3 Missing
              1     -2    -2 Don't know
              9      2      2 no
```

Things to note here:

- ▶ The question referred to in the questionnaire as A3B is called m5a3b in the codebook.
- ▶ There are missing codes.

The general structure of the variable names is

[prefix for questionnaire type][wave number][question number]

Variable prefixes¹⁴

Common prefixes:

Prefix	Meaning
m	Mother
f	Father
h or hv	Home visit
p	Primary caregiver
k	Kid (interview with the child)
kind_	Kindergarten teacher
t	Teacher
ffcc_[something]	Child care surveys. For a full list of the [something] see this documentation .

¹⁴For more info, see

<http://www.fragilefamilieschallenge.org/survey-documentation/>

Constructed variables

- ▶ Some variables are **constructed** from several questions.
- ▶ These tend to be important.
- ▶ These variables add the additional prefix **c** to the front of the variable name.
- ▶ For instance, cm1ethrace indicates constructed mother's wave 1 race/ethnicity.

Wave numbers \neq child ages

Wave number	Approximate child age
1	0, often called “baseline”
2	1
3	3
4	5
5	9

Common missing codes¹⁵

- ▶ -9 Not in wave - Did not participate in survey/data collection component
- ▶ -6 Valid skip - Intentionally not asked question; question does not apply to respondent or response known based on prior information.
- ▶ -2 Don't know - Respondent asked question; responded "Don't Know".
- ▶ -1 Refuse - Respondent asked question; refused to answer question
- ▶ NA also used occasionally

¹⁵For more complete list and explanation, see
<http://www.fragilefamilieschallenge.org/missing-data/>

Challenge-specific documentation and support

- ▶ Greg Gundersen API:

[http://www.fragilefamilieschallenge.org/
machine-readable-fragile-families-codebook/](http://www.fragilefamilieschallenge.org/machine-readable-fragile-families-codebook/)

Challenge-specific documentation and support

- ▶ Greg Gundersen API:
[http://www.fragilefamilieschallenge.org/
machine-readable-fragile-families-codebook/](http://www.fragilefamilieschallenge.org/machine-readable-fragile-families-codebook/)
- ▶ Aarshay Jain, Bindia Kalra, and Keerti Agrawal Constructed variables data dictionary: <http://www.fragilefamilieschallenge.org/c-dictionary/>

Challenge-specific documentation and support

- ▶ Greg Gundersen API:
[http://www.fragilefamilieschallenge.org/
machine-readable-fragile-families-codebook/](http://www.fragilefamilieschallenge.org/machine-readable-fragile-families-codebook/)
- ▶ Aarshay Jain, Bindia Kalra, and Keerti Agrawal Constructed variables data dictionary: <http://www.fragilefamilieschallenge.org/c-dictionary/>
- ▶ Dawn Koffman, parsed csv file: [https://github.com/
fragilefamilieschallenge/codebook-support](https://github.com/fragilefamilieschallenge/codebook-support)

Challenge-specific documentation and support

- ▶ Greg Gundersen API:
[http://www.fragilefamilieschallenge.org/
machine-readable-fragile-families-codebook/](http://www.fragilefamilieschallenge.org/machine-readable-fragile-families-codebook/)
- ▶ Aarshay Jain, Bindia Kalra, and Keerti Agrawal Constructed variables data dictionary: <http://www.fragilefamilieschallenge.org/c-dictionary/>
- ▶ Dawn Koffman, parsed csv file: [https://github.com/
fragilefamilieschallenge/codebook-support](https://github.com/fragilefamilieschallenge/codebook-support)
- ▶ Jeremy Freese stata support: [https://github.com/
fragilefamilieschallenge/stata-support](https://github.com/fragilefamilieschallenge/stata-support)

Challenge-specific documentation and support

- ▶ Greg Gundersen API:
[http://www.fragilefamilieschallenge.org/
machine-readable-fragile-families-codebook/](http://www.fragilefamilieschallenge.org/machine-readable-fragile-families-codebook/)
- ▶ Aarshay Jain, Bindia Kalra, and Keerti Agrawal Constructed variables data dictionary: <http://www.fragilefamilieschallenge.org/c-dictionary/>
- ▶ Dawn Koffman, parsed csv file: [https://github.com/
fragilefamilieschallenge/codebook-support](https://github.com/fragilefamilieschallenge/codebook-support)
- ▶ Jeremy Freese stata support: [https://github.com/
fragilefamilieschallenge/stata-support](https://github.com/fragilefamilieschallenge/stata-support)
- ▶ Steve McKay R support: <https://github.com/fragilefamilieschallenge/r-support>

Getting the data

1. Apply (<http://www.fragilefamilieschallenge.org/apply/>)
2. Complete terms and conditions

Building a submission

Submissions include:

1. Predictions
2. Code
3. Narrative explanation

Submission preparation instructions:

www.fragilefamilieschallenge.org/upload-your-contribution/

Get on the leaderboard

codalab.fragilefamilieschallenge.org

← → ⌂ codalab.fragilefamilieschallenge.org/#results

Fragile Families Help Sign Up Sign In

Download CSV

Results							
#	User	GPA ▲	Grit ▲	Material hardship ▲	Eviction ▲	Layoff ▲	Job training ▲
1	wjlei1990	0.36854 (1)	0.21896 (3)	0.02436 (1)	0.05341 (7)	0.17435 (5)	0.20224 (3)
2	OldDriverffc	0.37099 (2)	0.22979 (18)	0.02471 (2)	0.05341 (7)	0.17435 (5)	0.20224 (3)
3	yjpeng	0.37120 (3)	0.21759 (2)	0.02493 (3)	0.05223 (2)	0.17048 (1)	0.20169 (2)
4	hamidrezaomidvar	0.37136 (4)	0.22191 (13)	0.02523 (5)	0.05227 (3)	0.18784 (7)	0.21409 (7)
5	t.f.schaffner	0.37143 (5)	0.21755 (1)	0.02499 (4)	0.05660 (8)	0.22453 (9)	0.27736 (9)
6	andrewor	0.37143 (5)	0.21755 (1)	0.02499 (4)	0.06038 (10)	0.26792 (13)	0.30755 (13)
7	pc12	0.37583 (6)	6.18762 (29)	0.03536 (24)	0.94340 (18)	0.77547 (19)	0.72264 (18)
8	mannyg	0.37789 (7)	0.21997 (7)	0.02880 (17)	0.05341 (7)	0.17435 (5)	0.20224 (3)
9	ppz	0.37810 (8)	0.23896 (19)	0.02859 (14)	0.12830 (16)	0.30755 (15)	0.36981 (16)
10	lazs	0.38407 (9)	0.22054 (9)	0.02877 (16)	0.05660 (8)	0.22453 (9)	0.27736 (9)
11	miloyola	0.38644 (10)	0.21969 (4)	0.02880 (17)	0.05341 (7)	0.17435 (5)	0.20224 (3)
12	agalle	0.38846 (11)	0.22137 (11)	0.02740 (8)	0.05341 (7)	0.17435 (5)	0.20224 (3)
13	weggert	0.38868 (12)	0.24682 (21)	0.02546 (6)	0.05660 (8)	0.24528 (12)	0.29245 (11)
14	jeremyfreese	0.39077 (13)	0.22060 (10)	0.02803 (12)	0.05295 (5)	0.17379 (4)	0.20132 (1)

Powered by Codalab v0.1.1

Why participate?

Why participate?

- ▶ care about the goals of the project

Why participate?

- ▶ care about the goals of the project
- ▶ learn new skills

Why participate?

- ▶ care about the goals of the project
- ▶ learn new skills
- ▶ win prizes (<http://www.fragilefamilieschallenge.org/#prizes>)

Why participate?

- ▶ care about the goals of the project
- ▶ learn new skills
- ▶ win prizes (<http://www.fragilefamilieschallenge.org/#prizes>)
- ▶ publish papers: 1) mass collaboration paper and 2) special issue of *Socius* (<http://www.fragilefamilieschallenge.org/call-for-papers-special-issue-of-socius-about-the-fragile-families-challenge/>)

Why participate?

- ▶ care about the goals of the project
- ▶ learn new skills
- ▶ win prizes (<http://www.fragilefamilieschallenge.org/#prizes>)
- ▶ publish papers: 1) mass collaboration paper and 2) special issue of *Socius* (<http://www.fragilefamilieschallenge.org/call-for-papers-special-issue-of-socius-about-the-fragile-families-challenge/>)
- ▶ have fun

Timeline:

- ▶ August 1: Deadline to submit to the Challenge
- ▶ October 1: Deadline to submit to the Special Issue of *Socius*
- ▶ Fall: Scientific workshop at Princeton

Advice

Get started with the constructed variables

- ▶ blog post:

<http://www.fragilefamilieschallenge.org/quick-start/>

- ▶ Aarshay Jain, Bindia Kalra, and Keerti Agrawal Constructed variables data dictionary:

<http://www.fragilefamilieschallenge.org/c-dictionary/>

Leverage the hundreds of papers already written
with this data by domain experts

Published Articles

Authors	Date	Title / Link
Brianne Pragg, Chris Knoester	Forthcoming	"Parental Leave Use Among Disadvantaged Fathers" <i>Journal of Family Issues</i> .
Jessica Hardie, Kristin Turney	Forthcoming	"The Intergenerational Consequences of Parental Health Limitations" <i>Journal of Marriage and Family</i> .
Robin Hognas, Heidi Williams	Forthcoming	"Maternal Kinship Involvement and Father Identity in Fragile Families" <i>Journal of Family and Economic Issues</i> .
Manuel Jiménez, Roy Wade, Ofira Schwartz-Soicher, Yong Lin, Nancy Reichman	Forthcoming	"Adverse Childhood Experiences and ADHD Diagnosis at Age 9 in a National Urban Sample" <i>Academic Pediatrics</i> .
Samara Gunter	Forthcoming	"Dynamics of Urban Informal Labor Supply in the United States" <i>Social Science Quarterly</i> .
Juan Shao-Chiu, Heather Washington, Megan Kurlychek	Forthcoming	"Breaking the Intergenerational Cycle: Partner violence, child-parent attachment, and children's aggressive behaviors" <i>Journal of Interpersonal Violence</i> .
Youngmin Yi, Kristin Turney, Christopher Wildeman	Forthcoming	"Mental Health Among Jail and Prison Inmates" <i>American Journal of Men's Health</i> .
Michael McFarland, Sara McLanahan, Bridget Goosby, Nancy Reichman	Forthcoming	"Grandparents' Education and Infant Health: Pathways Across Generations" <i>Journal of Marriage and Family</i> .
Christian King	Forthcoming	"Food Insecurity and Housing Instability in Vulnerable Families" <i>Review of Economics of the Household</i> .
Wan-Yi Chen, Yookyong Lee	Forthcoming	"The Impact of Community Violence, Personal Victimization, and Paternal Support on Maternal Harsh Parenting" <i>Journal of Community Psychology</i> .
Marcia Carlson, Alicia VanOrman	Forthcoming	"Trajectories of relationship supportiveness after childbirth: Does marriage matter?" <i>Social Science Research</i> .
Jared Durtschi, Kristy Soloski, Jonathan Kimmes	Forthcoming	"The Dyadic Effects of Supportive Coparenting and Parental Stress on Relationship Quality Across the Transition to Parenthood" <i>Journal of Marital and Family Therapy</i> .
Anne Martin, Rebecca Ryan, Elizabeth Riina, Jeannie Brooks-Gunn	Forthcoming	"Coreidential Father Transitions and Biological Parents' Coparenting Quality in Early and Middle Childhood" <i>Journal of Family Issues</i> .
Lawrence Berger, Sarah Font, Kristen Slack, Jane Waldfogel	Forthcoming	"Income and child maltreatment in unmarried families: evidence from the earned income tax credit" <i>Review of Economics of the Household</i> .
Sung-Bong Cho, Ming Cui, Amy Claridge	Forthcoming	"Cohabiting parents' marriage plans and marriage realization: Gender differences, couple agreement, and longitudinal effects" <i>Journal of Social and Personal Relationships</i> .
M. Blake Berryhill	Forthcoming	"Single mothers' home-based school involvement: a longitudinal analysis" <i>Journal of Family Studies</i> .
Colin Flood, Karen Sheehan, Marie Crandall	Forthcoming	"Predictors of Emergency Department Utilization Among Children in Vulnerable Families" <i>Pediatric Emergency Care</i> .
Sarah James, Lauren Hale	Forthcoming	"Sleep Duration and Child Well-Being: A Nonlinear Association" <i>Journal of Clinical Child & Adolescent Psychology</i> .

Paula Fomby	Forthcoming	"Motherhood in Complex Families" <i>Journal of Family Issues</i>
Glenn Walters	Forthcoming	"Parent and Child Reports of Animal Cruelty and their Correlations with Parent and Child Reports of Child Delinquency" <i>Psychology, Crime & Law</i>
Cong Zhang, Catherine Cubbin, Qinying Ci	Forthcoming	"Parenting stress and mother-child playful interaction: the role of emotional support" <i>Journal of Family Studies</i>
Kei Nomaguchi, Susan Brown, Tanya M. Leyman	Forthcoming	"Fathers' Participation in Parenting and Maternal Parenting Stress: Variation by Relationship Status" <i>Journal of Family Issues</i>
Tenah Hunt, Lawrence Berger, Kristen Slack	Forthcoming	"Adverse childhood experiences and behavioral problems in middle childhood" <i>Child Abuse & Neglect</i>
Jessica Su, Rachel Dunifon	Forthcoming	"Nonstandard Work Schedules and Private Safety Nets Among Working Mothers" <i>Journal of Marriage and Family</i>
Jay Fagan, Mollie Cherson	Forthcoming	"Maternal Gatekeeping: The Associations Among Facilitation, Encouragement, and Low-Income Fathers' Engagement With Young Children" <i>Journal of Family Issues</i>
Branden McLeod	Forthcoming	"Paternal dimensions and complexities: Understanding the relationships between parental dyads and fathers' involvement among Black fathers with criminal records" <i>Journal of Family Social Work</i>
M. Blake Berryhill, Jared Durtschi	Forthcoming	"Understanding Single Mothers' Parenting Stress Trajectories" <i>Marriage & Family Review</i>
Robert Morris	2017	* Mitigating the Effects of Parental Incarceration through Social Intervention: A Longitudinal and Comparative Analysis of the Efficacy of Big Brothers Big Sisters" <i>Journal of Applied Social Science</i> , 11(1): 25 - 47.
Melissa Radey	2017	"Unmarried Mothers' Postnatal School Enrollment: The Role and Intersection of Demographic and Socioeconomic Characteristics" <i>Journal of Social Service Research</i> , 43(1): 115-128.
Paula Fomby, Cynthia Osborne	2017	"Family Instability, Multipartner Fertility, and Behavior in Middle Childhood" <i>Journal of Marriage and Family</i> , 79(1): 75-93.
Kei Nomaguchi, Wendi Johnson, Mallory Minter, Lindsey Aldrich	2017	"Clarifying the Association Between Mother-Father Relationship Aggression and Parenting" <i>Journal of Marriage and Family</i> , 79(1): 161-178.
Kristen Sobba, Brenda Prochaska, Emily Berthelot	2017	"Maternal incarceration penalty: an examination of the effect of maternal conviction and incarceration on childhood delinquency" <i>Journal of Criminal Psychology</i> , 7(1): 29 - 46.
Kimberly Turner, Maureen Waller	2017	"Indebted Relationships: Child Support Arrears and Nonresident Fathers' Involvement With Children" <i>Journal of Marriage and Family</i> , 79(1): 24-43.
Amelia Branigan	2017	"(How) Does Obesity Harm Academic Performance? (How) Does Obesity Harm Academic Performance? Stratification at the Intersection of Race, Sex, and Body Size in Elementary and High School" <i>Sociology of Education</i> , 90(1): 25-46.
Lauren McClain, Susan Brown	2017	"The Roles of Fathers' Involvement and Coparenting in Relationship Quality among Cohabiting and Married Parents" <i>Sex Roles</i> , 76(5): 334-345.
Robyn Powell, Susan Parish	2017	"Behavioural and cognitive outcomes in young children of mothers with intellectual impairments" <i>Journal of Intellectual Disability Research</i> , 61(1): 50-61.

William Schneider, Jane Waldfogel, Jeanne Brooks-Gunn	2017	"The Great Recession and risk for child abuse and neglect" <i>Children and Youth Services Review</i> , 72: 71-81.
Kristin Turney	2017	"The Unequal Consequences of Mass Incarceration for Children" <i>Demography</i> , 54: 1.
Raymond Petren	2017	"Paternal Multiple Partner Fertility and Environmental Chaos Among Unmarried Nonresident Fathers" <i>Journal of Social Service Research</i> , 43(1): 100-114.
Christian King	2017	"Soft drink consumption and child behaviour problems: the role of food insecurity and sleep patterns" <i>Public Health Nutrition</i> , 20(2): 266-273.
Marcia Carlson, Alicia VanOrman, Kimberly Turner	2017	"Fathers' Investments of Money and Time Across Residential Contexts" <i>Journal of Marriage and Family</i> , 79(1): 10-23.
Niel Wilmot, Kim Dauner	2017	"Examination of the influence of social capital on depression in fragile families" <i>Journal of Epidemiology and Community Health</i> , 71(3): 296-302.
Cole Ratcliffe, Aaron Norton, Jared Durtschi	2016	"Early Romantic Relationships Linked With Improved Child Behavior 8 Years Later" <i>Journal of Family Issues</i> , 37(5): 717-735.
Kei Nomaguchi, Wendi Johnson	2016	"Parenting Stress among Low-Income and Working-Class Fathers: The Role of Employment" <i>Journal of Family Issues</i> , 37(11): 1535-1557.
Robin Högnäs, Jason Thomas	2016	"Birds of a Feather Have Babies Together? Family Structure Homogamy and Union Stability Among Cohabiting Parents" <i>Journal of Family Issues</i> , 37(1): 29-52.
Anna Haskins	2016	"Beyond Boys' Bad Behavior: Paternal Incarceration and Cognitive Development in Middle Childhood" <i>Social Forces</i> , 95(2): 861-892.
Tammy Chang, Michelle Moniz, Melissa Piegle, Ananda Sen, Matthew Davis, Caroline Richardson	2016	"Characteristics of Adolescents at Risk for Excess Weight Gain During Pregnancy" <i>Obstetrics & Gynecology</i> , 127.
Anthony Isacco, Richard Hofscher, Sonia Molloy	2016	"An Examination of Fathers' Mental Health Help Seeking: A Brief Report" <i>American Journal of Men's Health</i> , 10(6): NP33-NP38.
Deadric Williams, Jacob Cheadle	2016	"Economic Hardship, Parents' Depression, and Relationship Distress among Couples With Young Children" <i>Society and Mental Health</i> , 6(2): 73-89.
Erin Fletcher	2016	"Match Quality and Maternal Investments in Children" <i>Review of Economics of the Household</i> , 14(1): 83-102.
Amanda Geller, Kate Jaeger, Garrett Pace	2016	"Surveys, Records, and the Study of Incarceration in Families" <i>Annals of the American Academy of Political and Social Sciences</i> , 665(1): 22-43.
Christopher Wildeman, Kristin Turney, Youngmin Yi	2016	"Paternal Incarceration and Family Functioning: Variation Across Federal, State, and Local Facilities" <i>The ANNALS of the American Academy of Political and Social Science</i> , 665(1): 80-97.
Hope Corman, Marah Curtis, Kelly Noonan, Nancy Reichman	2016	"Maternal Depression as a Risk Factor for Children's Inadequate Housing Conditions" <i>Social Science and Medicine</i> , 149: 76-83.
Manuel Jimenez, Roy Wade, Yong Lin, Lesley Morrow, Nancy Reichman	2016	"Adverse Experiences in Early Childhood and Kindergarten Outcomes" <i>Pediatrics</i> , 137(2): 1-9.
Cedric Taylor, Dilshani Sarathchandra	2016	"Migrant Selectivity or Cultural Buffering? Investigating the Black Immigrant Health Advantage in Low Birth Weight" <i>Journal of Immigrant and Minority Health</i> , 18(2): 390-396.
Robyn Powell, Susan Parish, Ilhom Akobirshoev	2016	"Health of Young Children Whose Mothers Have Intellectual Disability" <i>American Journal on Intellectual and Developmental Disabilities</i> , 121(4): 281-294.

Kristin Turney, Daniel Schneider	2016	"Incarceration and Household Asset Ownership" <i>Demography</i> , 53(6): 2075-2103.
Yiwen Cao, Kathryn Maguire-Jack	2016	"Interactions with community members and institutions: Preventive pathways for child maltreatment" <i>Child Abuse & Neglect</i> , 62: 111-121.
William Schneider	2016	"Relationship Transitions and the Risk for Child Maltreatment" <i>Demography</i> , 53(6): 1771-1800.
Louis Donnelly, Sara McLanahan, Jeanne Brooks-Gunn, Irwin Garfinkel, Brandon Wagner, Wade Jacobsen, Sarah Gold, Lauren Gaydosh	2016	"Cohesive Neighborhoods Where Social Expectations Are Shared May Have Positive Impact On Adolescent Mental Health" <i>Health Affairs</i> , 35(11): 2083-2091.
M. Blake Berryhill	2016	"Mothers' Parenting Stress and Engagement: Mediating Role of Parental Competence" <i>Marriage & Family Review</i> , 52(5): 461-480.
Tyrone Cheng, Celia Lo	2016	"Racial Disparities in Children's Health: A Longitudinal Analysis of Mothers Based on the Multiple Disadvantage Model" <i>Journal of Community Health</i> , 41(4): 753-760.
Daniel Schneider, Kristen Harknett, Sara McLanahan	2016	"Intimate Partner Violence in the Great Recession" <i>Demography</i> , 53(2): 471-505.
Ashley Munger, Sandra Hofferth, Stephanie Grutzmacher	2016	"The Role of the Supplemental Nutrition Assistance Program in the Relationship Between Food Insecurity and Probability of Maternal Depression" <i>Journal of Hunger & Environmental Nutrition</i> , 11(2): 147-161.
Edward Vargas, Maureen Pirog	2016	"Mixed-Status Families and WIC Uptake: The Effects of Risk of Deportation on Program Use" <i>Social Science Quarterly</i> , 97(3): 555-572.
Lanlan Xu, Maureen Pirog, Edward Vargas	2016	"Child support and mixed-status families: an analysis using the Fragile Families and Child Wellbeing Study" <i>Social Science Research</i> , 60: 249-265.
Angela Rachidi	2016	"Child care assistance and nonstandard work schedules" <i>Children and Youth Services Review</i> , 65: 104-111.
Todd Jensen, Garrett Pace	2016	"Stepfather Involvement and Stepfather-Child Relationship Quality: Race and Parental Marital Status as Moderators" <i>Journal of Marital and Family Therapy</i> , 42(4): 659-672.
Jessica Lucero, Sojung Lim, Anna Maria Santiago	2016	"Changes in Economic Hardship and Intimate Partner Violence: A Family Stress Framework" <i>Journal of Family and Economic Issues</i> , 37(3): 395-406.
Richard Petts	2016	"Religious homogamy, race/ethnicity, and parents' relationship stability" <i>Sociological Focus</i> , 49(3): 163-179.
Rachel Razza, Anne Martin, Jeanne Brooks-Gunn	2016	"Links Between Motor Control and Classroom Behaviors: Moderation by Low Birth Weight" <i>Journal of Child and Family Studies</i> , 25(8): 2423-2434.
Kari Adamsons, Kay Pasley	2016	"Parents' Fathering Identity Standards and Later Father Involvement" <i>Journal of Family Issues</i> , 37(2): 221-244.
Joy Piontak	2016	"Household Composition and Maternal Depression: Examining the Role of Multigenerational Households" <i>Journal of Family Issues</i> , 37(7): 947-969.
Natasha Pilkauskas, Jane Waldfogel, Jeanne Brooks-Gunn	2016	"Maternal labor force participation and differences by education in an urban birth cohort study - 1998-2010" <i>Demographic Research</i> , 34(14): 407-420.
Natasha Pilkauskas, Rachel Dunifon	2016	"Understanding Grandfamilies: Characteristics of Grandparents, Nonresident Parents, and Children" <i>Journal of Marriage and Family</i> , 78(3): 623-633.

Robynn Cox, Sally Wallace	2016	"Identifying the link between food security and incarceration" <i>Southern Economic Journal</i> , 82(4): 1062-1077.
Sarah Halpern-Meekin, Kristin Turney	2016	"Relationship Churning and Parenting Stress Among Mothers and Fathers" <i>Journal of Marriage and Family</i> , 78(3): 715-729.
Tracey Woodard, Jennifer Copp	2016	"Maternal incarceration and children's delinquent involvement: The role of sibling relationships" <i>Children and Youth Services Review</i> , 70: 340-348.
Inna Altschul, Shawna Lee, Elizabeth Gershoff	2016	"Hugs, Not Hits: Warmth and Spanking as Predictors of Child Social Competence" <i>Journal of Marriage and Family</i> , 78(3): 695-714.
Tianca Crocker, Yolanda Padilla	2016	"Living On the Edge: Access to Liquid Assets as a Determinant of Unmarried Urban Mothers' Life Satisfaction" <i>Families in Society: The Journal of Contemporary Social Services</i> , 97(2): 132-141.
Lucy Markson, Michael Lamb, Friedrich Losel	2016	"The impact of contextual family risks on prisoners' children's behavioural outcomes and the potential protective role of family functioning moderators" <i>European Journal of Developmental Psychology</i> , 13(3): 325-340.
Julie Ma	2016	"Neighborhood and parenting both matter: The role of neighborhood collective efficacy and maternal spanking in early behavior problems" <i>Children and Youth Services Review</i> , 70: 250-260.
Brenden Beck, Anthony Buttaro, Mary Clare Lennon	2016	"Home moves and child wellbeing in the first five years of life in the United States" <i>Longitudinal and Life Course Studies: International Journal</i> , 7(3).

<http://crcw.princeton.edu/publications/publications.asp>

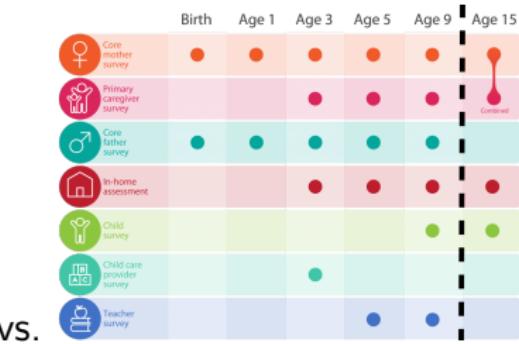
Use the structure in the data

5,000 families

Birth to age 9
12,000 features



Age 15
6 key outcomes



“human-assisted automatic feature selection”

Beware of rare outcomes (imbalanced data)

Beware of missing data

www.fragilefamilieschallenge.org

Questions?

- ▶ Email: fragilefamilieschallenge@gmail.com
- ▶ Blog: www.fragilefamilieschallenge.org/blog-posts/
- ▶ Github: www.github.com/fragilefamilieschallenge
- ▶ Forum: codalab.fragilefamilieschallenge.org