

LEGEND Author List: August 23, 2023

N. Abgrall,¹ N. Ackermann,² M. Agostini,³ A. Alexander,³ C. Andreoiu,⁴ G.R. Araujo,⁵ M. Atzori Corona,⁶ F.T. Avignone III,^{7,8} M. Babicz,⁵ W. Bae,⁹ A. Bakalyarov,¹⁰ M. Balata,¹¹ I. Barabanov,¹² A.S. Barabash,¹⁰ P.S. Barbeau,^{13,14} C.J. Barton,¹⁶ L. Baudis,⁵ C. Bauer,² V. Belov,²⁵ E. Bernieri,¹⁶ L. Bezrukov,¹² K.H. Bhimani,^{17,14} V. Biancacci,^{33,11} E. Blalock,^{20,14} A. Bolozdynya,²¹ W.M. Bonivento,⁶ S. Borden,²² G. Borghi,²³ B. Bos,^{17,14} E. Bossio,²⁵ A. Boston,²⁶ V. Bothe,² R. Bouabid,^{13,14} R. Brugnera,^{18,19} N. Burlac,¹⁶ M. Busch,^{13,14} D. Butta,²³ M. Cadeddu,⁶ A. Caldwell,²⁷ S. Calgaro,^{18,19} S. Capra,⁴² N. Cargioli,⁶ M.C. Carminati,²³ R.M.D. Carney,¹ C. Cattadori,²⁹ Y.-D. Chan,¹ S.Y. Cheng,²² A. Chernogorov,¹⁰ P.-J. Chiu,⁵ C.D. Christofferson,³⁰ P.-H. Chu,³¹ M. Clark,^{17,14} V. Cocco,⁶ J.A. Colon Rivera,^{13,14} T. Comellato,²⁵ R.J. Cooper,¹ I.A. Costa,¹⁶ V. D'Andrea,¹⁶ R. Deckert,²⁵ J.A. Detwiler,²² A. Di Giacinto,¹¹ N. Di Marco,^{33,11} J. Dobson,^{3,*} K.-M. Dong,¹⁵ A. Drobizhev,¹ G. Duran,^{17,14} Yu. Efremenko,³⁴ S.R. Elliott,³¹ E. Engelhardt,^{17,14} S. Enomoto,²² E. Esch,⁴⁹ M.T. Febbraro,⁸ F. Ferella,¹¹ D.E. Fields,²⁸ C. Fiorini,²³ M. Fomina,³⁷ H. Fox,³⁸ N. Fuad,³⁶ F. Gabriele,⁶ D. Gahan,⁶ R. Gala,^{20,14} C. Galbiati,³⁹ A. Galindo-Uribarri,⁸ A. Gangapshev,¹² P. Garca Abia,⁴⁰ A. Garfagnini,^{18,19} S. Gazzana,^{11,41} A. Geraci,⁴² C. Ghiano,¹¹ S. Giri,^{17,14} D. Gnani,¹ M. Gold,²⁸ C. Gooch,²⁷ G. Grünauer,⁴⁹ C.R. Grace,¹ M.P. Green,^{20,14,8} G.F. Grinyer,⁴⁴ A. Grobov,¹⁰ J. Gruszko,^{17,14} I. Guinn,⁸ V.E. Guisepe,⁸ V. Gurentsov,¹² Y. Gurov,³⁷ K. Gusev,^{37,25} B. Hackett,²⁷ D.X. Haddock,²⁸ F. Hagemann,²⁷ M. Haranczyk,⁴⁵ C.R. Haufe,^{17,14} C. Hayward,³⁸ C. Heckmayer,⁴⁹ F. Henkes,²⁵ R. Henning,^{17,14} J. Herrera,^{20,14} D. Hervas Aguilar,^{17,14} J. Hinton,² R. Hodak,³⁵ H. Hoffmann,⁴⁶ W. Hofmann,² D. Huff,⁴⁷ M. Hult,⁴⁸ Aldo Ianni,¹¹ Andrea Ianni,³⁹ C.J. Jillings,^{56,57} J. Jochum,⁴⁹ R. Jones,³⁸ D. Judson,²⁶ M. Junker,¹¹ J. Kaizer,⁵⁰ V. Kazalov,¹² H. Khushbakht,⁴⁹ M. Kidd,⁵¹ T. Kihm,² K. Kilgus,⁴⁹ A. Klimenko,³⁷ K.T. Knöpfle,² I. Kochanek,¹¹ S.I. Konovalov,¹⁰ I. Kontul',⁵⁰ L.L. Kormos,³⁸ V.N. Kornoukhov,²¹ P. Krause,²⁵ H. Krishnamoorthy,⁸ J. Kumar,⁴⁹ V.V. Kuzminov,¹² J.M. López-Castaño,⁸ M. Labiche,²⁴ K. Lang,⁹ M. Laubenstein,¹¹ E. León,^{17,14} B. Lehnert,¹ A. Leonhardt,²⁵ N. Levashko,¹⁰ A. Li,^{17,14} M. Lindner,² I. Lippi,¹⁹ J. Liu,¹⁵ A. Lubashevskiy,³⁷ B. Lubsandorzhev,¹² N. Lusardi,⁴² Y. Müller,⁵ C. Macolino,^{32,11} B. Majorovits,²⁷ F. Mamedov,³⁵ W. Maneschg,² G. Marshall,³ R.D. Martin,⁵² E.L. Martin,^{17,14} R. Massarczyk,³¹ A. Mazumdar,³¹ A. Mehta,²⁶ D.-M. Mei,¹⁵ S.P. Meireles,^{32,11} S. Mertens,²⁵ E. Miller,²² M. Misiaszek,⁴⁵ I. Mizra,³⁴ E. Mondragon,²⁵ M. Morella,^{33,11} B. Morgan,⁵³ T. Mroz,⁴⁵ D. Muenstermann,³⁸ C.J. Nave,²² I. Nemchenok,³⁷ M. Neuberger,²⁵ J. Newby,⁸ G. Orebi Gann,^{1,54} P. Organtini,³⁹ F. Paissan,¹⁶ V. Palusova,³⁵ P. Papadakis,²⁴ L. Papp,²⁵ L.S. Paudel,¹⁵ K. Pelczar,⁴⁸ J. Perez Perez,⁴⁵ L. Pertoldi,^{25,19} V. Pesudo,⁴⁰ W. Pettus,³⁶ F. Piastra,⁵ M. Pichotta,⁴⁶ P. Piseri,⁴² A.W.P. Poon,¹ S. Pordes,³⁹ P.P. Povinec,⁵⁰ A. Pullia,⁴² W.S. Quinn,³ D.C. Radford,⁸ Y.A. Ramachers,⁵³ A. Ramirez,⁴⁷ L. Rauscher,⁴⁹ A. Razeto,¹¹ M. Redchuk,¹⁹ A.L. Reine,^{17,14} A. Renshaw,⁴⁷ S. Riboldi,⁴² K. Rielage,³¹ L. Romero,⁴⁰ C. Romo-Luque,³¹ N. Rossi,¹¹ S. Rozov,³⁷ T.C. Ruland,⁸ N. Rumyantseva,^{25,37} J. Runge,^{13,14} R. Saakyan,³ S. Sailer,² G. Salamanna,¹⁶ F. Salamida,^{32,11} G. Saleh,^{18,19} D.J. Salvat,³⁶ V. Sandukovsky,³⁷ R. Santorelli,⁴⁰ C. Savarese,³⁹ S. Schönert,²⁵ A.-K. Schültz,¹ D.C. Schaper,³¹ S.J. Schleich,³⁶ J. Schreiner,² O. Schulz,²⁷ M. Schwarz,²⁵ B. Schwingenheuer,² C. Seibt,⁴⁶ O. Selivanenko,¹² E. Shevchik,³⁷ M. Shirchenko,³⁷ Y. Shitov,³⁷ H. Simgen,² F. Simkovic,³⁵ M. Skorokhvatov,¹⁰ A. Smolnikov,³⁷ J.A. Solomon,^{17,14} G. Song,²² A.C. Sousa,³⁰ R. Stefanizzi,⁶ I. Stekl,³⁵ A. Steri,⁶ T. Stezelberger,^{1,49} M. Stommel,⁵⁹ S.A. Sullivan,² R.R. Sumathi,⁴³ K. Szczepaniewicz,⁴⁵ L. Taffarello,¹⁹ D. Tagnani,¹⁶ R. Tayloe,³⁶ D. Tedeschi,⁷ T.N. Thorpe,³¹ S. Torres-Lara,⁴⁷ R. Tousif,²⁸ V. Tretyak,³⁷ M. Turqueti,¹ E.E. Van Nieuwenhuizen,^{13,14} R.L. Varner,⁸ L. Varriano,²² S. Vasilyev,³⁷ A. Veresnikova,¹² K. Vetter,^{1,58} C. Vignoli,¹¹ C. Vogl,²⁵ K. von Sturm,^{18,19} A. Warren,¹⁵ D. Waters,³ S.L. Watkins,³¹ C. Wiesinger,²⁵ J.F. Wilkerson,^{17,14,8} M. Willers,²⁵ C. Wiseman,²² M. Wojcik,⁴⁵ D. Xu,³ E. Yakushev,³⁷ T. Ye,⁵² C.-H. Yu,⁸ V. Yumatov,¹⁰ N. Zaretski,¹⁰ I. Zhitnikov,³⁷ D. Zinatulina,³⁷ K. Zuber,⁴⁶ and G. Zuzel⁴⁵

(LEGEND Collaboration)

¹*Institute for Nuclear and Particle Astrophysics and Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA*

²*Max-Planck-Institut für Kernphysik, Heidelberg, 69117, Germany*

³*University College London, London, WC1E 6BT, United Kingdom*

⁴*Department of Chemistry, Simon Fraser University, Burnaby, British Columbia, V5A 1S6, Canada*

⁵*Physik-Institut, University of Zürich, Zürich, 8057, Switzerland*

⁶*Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Cagliari, Italy*

⁷*Department of Physics and Astronomy, University of South Carolina, Columbia, SC 29208, USA*

⁸*Oak Ridge National Laboratory, Oak Ridge, TN 37830, USA*

⁹*Department of Physics, University of Texas at Austin, Austin, TX 78712, USA*

- ¹⁰ National Research Centre “Kurchatov Institute”, Moscow, 123098, Russia
- ¹¹ Istituto Nazionale di Fisica Nucleare, Laboratori Nazionali del Gran Sasso, I-67100 Assergi (AQ), Italy
- ¹² Institute for Nuclear Research of the Russian Academy of Sciences, Moscow, 119991, Russia
- ¹³ Department of Physics, Duke University, Durham, NC 27708, USA
- ¹⁴ Triangle Universities Nuclear Laboratory, Durham, NC 27708, USA
- ¹⁵ Department of Physics, University of South Dakota, Vermillion, SD 57069, USA
- ¹⁶ Roma Tre University and INFN Roma Tre, Rome, I-00146, Italy
- ¹⁷ Department of Physics and Astronomy, University of North Carolina, Chapel Hill, NC 27514, USA
- ¹⁸ Dipartimento di Fisica e Astronomia dell’Università di Padova, 35121, Italy
- ¹⁹ Padova Istituto Nazionale di Fisica Nucleare, Padova, 35131, Italy
- ²⁰ Department of Physics, North Carolina State University, Raleigh, NC 27607, USA
- ²¹ National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), 115409 Moscow, Russia
- ²² Center for Experimental Nuclear Physics and Astrophysics, and
Department of Physics, University of Washington, Seattle, WA 98195, USA
- ²³ Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria Sezione di Elettronica, Milano, 20133, Italy
- ²⁴ Science and Technology Facilities Council (STFC) Daresbury Laboratory, Daresbury, Cheshire, WA4 4AD, UK
- ²⁵ Department of Physics, TUM School of Natural Sciences, Technische
Universität München, 85748 Garching b. München, Germany
- ²⁶ University of Liverpool, Liverpool, L69 3BX, United Kingdom
- ²⁷ Max-Planck-Institut für Physik, München, 80805, Germany
- ²⁸ Department of Physics and Astronomy, University of New Mexico, Albuquerque, NM 87131, USA
- ²⁹ Istituto Nazionale di Fisica Nucleare, Milano Bicocca, Milano, 20126, Italy
- ³⁰ South Dakota Mines, Rapid City, SD, 57701, USA
- ³¹ Los Alamos National Laboratory, Los Alamos, NM 87545, USA
- ³² Department of Physical and Chemical Sciences University of L’Aquila, L’Aquila, 67100, Italy
- ³³ Gran Sasso Science Institute, L’Aquila, 67100, Italy
- ³⁴ Department of Physics and Astronomy, University of Tennessee, Knoxville, TN 37916, USA
- ³⁵ Czech Technical University, Institute of Experimental and Applied Physics, CZ-12800 Prague, Czech Republic
- ³⁶ Center for Exploration of Energy and Matter, and Department of Physics, Indiana University, Bloomington, IN 47405, USA
- ³⁷ Joint Institute for Nuclear Research, Dubna, 141890, Russia
- ³⁸ Department of Physics, Lancaster University, Lancaster, LA1 4YW, United Kingdom
- ³⁹ Physics Department, Princeton University, Princeton, NJ 08544, USA
- ⁴⁰ Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, Madrid, 28040, Spain
- ⁴¹ Istituto Nazionale di Fisica Nucleare, Laboratori Nazionali di Frascati, I-00044 Frascati (RM), Italy
- ⁴² Milano Univ. and Milano Istituto Nazionale di Fisica Nucleare, Milano, 20054, Italy
- ⁴³ Leibniz-Institut für Kristallzüchtung, Berlin, D-12489, Germany
- ⁴⁴ Department of Physics, University of Regina, Regina, Saskatchewan, SK S4S 0A2, Canada
- ⁴⁵ M. Smoluchowski Institute of Physics, Jagiellonian University, Cracow, 31-007, Poland
- ⁴⁶ Technische Universität Dresden, Dresden, 01069, Germany
- ⁴⁷ Department of Physics, University of Houston, Houston, TX 77204, USA
- ⁴⁸ European Commission, Joint Research Centre, Directorate for Nuclear Safety & Security, Geel, 2440, Belgium
- ⁴⁹ University Tübingen, Tübingen, 55411, Germany
- ⁵⁰ Department of Nuclear Physics and Biophysics, Comenius University, Bratislava, SK-84248, Slovakia
- ⁵¹ Tennessee Tech University, Cookeville, TN 38505, USA
- ⁵² Department of Physics, Engineering Physics & Astronomy, Queen’s University, Kingston, Ontario, K7L 3N6, Canada
- ⁵³ Department of Physics, University of Warwick, Coventry, CV4 7AL, United Kingdom
- ⁵⁴ Department of Physics, University of California, Berkeley, CA, 94720, USA
- ⁵⁵ Leibniz-Institute of Polymer Research Dresden e.V., Dresden, 01069, Germany
- ⁵⁶ SNOLAB, Creighton Mine #9, Sudbury, ON P3Y 1N2, Canada
- ⁵⁷ School of Natural Sciences, Laurentian University, Sudbury, P3E 2C6, Canada
- ⁵⁸ Department of Nuclear Engineering, University of California, Berkeley, CA, 94720, USA
- ⁵⁹ Leibniz-Institut für Polymerforschung Dresden e.V., Dresden, D-01069, Germany

* Permanent Address: Kings College London, London, United Kingdom