

Measurement of the background in the NEMO 3 double beta decay experiment

Argyriades J., Arnold R., Augier C., Baker J., Barabash A.S., Bongrand M., Broudin-Bay G., Brudanin V.B., Caffrey A.J., Chapon A., Chauveau E., Daraktchieva Z., Durand D., Egorov V.G., Fatemi-Ghomi N., Flack R., Freshville A., Guillon B., Hubert Ph., Jullian S., Kauer M., King S., Kochetov O.I., Konovalov S.I., Kovalenko V.E., Lalanne D., Lang K., Lemiere Y., Lutter G., Mamedov F., Marquet Ch., Martin-Albo J., Mauger F., Nachab A., Nasteva I., Nemchenok I.B., Nguyen C.H., Nova F., Novella P., Ohsumi H., Pahlka R.B., Perrot F., Piquemal F., Reyss J.L., Ricol J.S., Saakyan R., Sarazin X., Simard L., Shitov Yu.A., Smolnikov A.A., Snow S., Soldner-Rembold S., Stekl I., Sutton C.S., Szklarz G., Thomas J., Timkin V.V., Tretyak V.I., Tretyak V.I., Umatov V.I., Vala L., Vanyushin I.A., Vasiliev V.A., Vorobel V., Vylov Ts.

LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France; IPHC, Université de Strasbourg, CNRS/IN2P3, F-67037 Strasbourg, France; INL, Idaho Falls, ID 83415, United States; Institute of Theoretical and Experimental Physics, 117259 Moscow, Russian Federation; Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France; CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France; Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation; University of Manchester, M13 9PL Manchester, United Kingdom; IEAP, Czech Technical University in Prague, CZ-12800 Prague, Czech Republic; University College London, WC1E 6BT London, United Kingdom; University of Texas at Austin, Austin, TX 78712-0264, United States; LPC Caen, ENSICAEN, Université de Caen, F-14032 Caen, France; Universitat Autònoma de Barcelona, Spain; IFIC, CSIS - Universidad de Valencia, Valencia, Spain; Saga University, Saga, 840-8502, Japan; LSCE, CNRS, F-91190 Gif-sur-Yvette, France; MHC, South Hadley, Massachusetts, MA 01075, United States; Charles University in Prague, Faculty of Mathematics and Physics, CZ-12116 Prague, Czech Republic; INR, MSP 03680 Kyiv, Ukraine; Hanoi University of Sciences, Hanoi, Viet Nam

Abstract: In the double beta decay experiment NEMO 3 a precise knowledge of the background in the signal region is of outstanding importance. This article presents the methods used in NEMO 3 to evaluate the backgrounds resulting from most if not all possible origins. It also illustrates the power of the combined tracking-calorimetry technique used in the experiment. © 2009 Elsevier B.V.

Author Keywords: Background; Double beta decay; Low radioactivity; NEMO; Radon

Index Keywords: Background; Double beta decay; Low radioactivity; NEMO; Radiation; Radioactivity; Radon; Experiments

Year: 2009

Source title: Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment

Volume: 606

Issue: 3

Page : 449-465

Cited by: 10

Link: [Scopus Link](#)

Correspondence Address: Tretyak, V.I.; IPHC, Université de Strasbourg, CNRS/IN2P3, F-67037 Strasbourg, France; email: tretyak@jinr.ru

ISSN: 1689002

CODEN: NIMAE

DOI: 10.1016/j.nima.2009.04.011

Language of Original Document: English

Abbreviated Source Title: Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment

Document Type: Article

Source: Scopus

Authors with affiliations:

- Argyriades, J., LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France
- Arnold, R., IPHC, Université de Strasbourg, CNRS/IN2P3, F-67037 Strasbourg, France
- Augier, C., LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France
- Baker, J., INL, Idaho Falls, ID 83415, United States
- Barabash, A.S., Institute of Theoretical and Experimental Physics, 117259 Moscow, Russian Federation
- Bongrand, M., LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France
- Broudin-Bay, G., LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France
- Brudanin, V.B., Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation
- Caffrey, A.J., INL, Idaho Falls, ID 83415, United States
- Chapon, A., LPC Caen, ENSICAEN, Université de Caen, F-14032 Caen, France
- Chauveau, E., Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France
- Daraktchieva, Z., University College London, WC1E 6BT London, United Kingdom
- Durand, D., LPC Caen, ENSICAEN, Université de Caen, F-14032 Caen, France
- Egorov, V.G., Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation
- Fatemi-Ghomi, N., University of Manchester, M13 9PL Manchester, United Kingdom
- Flack, R., University College London, WC1E 6BT London, United Kingdom
- Freshville, A., University College London, WC1E 6BT London, United Kingdom
- Guillon, B., LPC Caen, ENSICAEN, Université de Caen, F-14032 Caen, France
- Hubert, Ph., Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France
- Jullian, S., LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France
- Kauer, M., University College London, WC1E 6BT London, United Kingdom
- King, S., University College London, WC1E 6BT London, United Kingdom
- Kochetov, O.I., Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation
- Konovalov, S.I., Institute of Theoretical and Experimental Physics, 117259 Moscow, Russian Federation
- Kovalenko, V.E., IPHC, Université de Strasbourg, CNRS/IN2P3, F-67037 Strasbourg, France, Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation

- Lalanne, D., LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France
- Lang, K., University of Texas at Austin, Austin, TX 78712-0264, United States
- Lemièrre, Y., LPC Caen, ENSICAEN, Université de Caen, F-14032 Caen, France
- Lutter, G., Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France
- Mamedov, F., IEAP, Czech Technical University in Prague, CZ-12800 Prague, Czech Republic
- Marquet, Ch., Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France
- Martin-Albo, J., IFIC, CSIS - Universidad de Valencia, Valencia, Spain
- Mauger, F., LPC Caen, ENSICAEN, Université de Caen, F-14032 Caen, France
- Nachab, A., Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France
- Nasteva, I., University of Manchester, M13 9PL Manchester, United Kingdom
- Nemchenok, I.B., Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation
- Nguyen, C.H., Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, Hanoi University of Sciences, Hanoi, Viet Nam
- Nova, F., Universitat Autònoma de Barcelona, Spain
- Novella, P., IFIC, CSIS - Universidad de Valencia, Valencia, Spain
- Ohsumi, H., Saga University, Saga, 840-8502, Japan
- Pahlka, R.B., University of Texas at Austin, Austin, TX 78712-0264, United States
- Perrot, F., Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France
- Piquemal, F., Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France
- Reyss, J.L., LSCE, CNRS, F-91190 Gif-sur-Yvette, France
- Ricol, J.S., Université de Bordeaux, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France, CNRS/IN2P3, Centre d'Etudes Nucléaires de Bordeaux Gradignan, UMR 5797, F-33175 Gradignan, France
- Saakyan, R., University College London, WC1E 6BT London, United Kingdom
- Sarazin, X., LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France
- Simard, L., LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France
- Shitov, Yu.A., Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation
- Smolnikov, A.A., Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation
- Snow, S., University of Manchester, M13 9PL Manchester, United Kingdom
- Söldner-Rembold, S., University of Manchester, M13 9PL Manchester, United Kingdom
- Štekl, I., IEAP, Czech Technical University in Prague, CZ-12800 Prague, Czech Republic
- Sutton, C.S., MHC, South Hadley, Massachusetts, MA 01075, United States
- Szklarz, G., LAL, Université Paris-Sud, CNRS/IN2P3, F-91405 Orsay, France
- Thomas, J., University College London, WC1E 6BT London, United Kingdom
- Timkin, V.V., Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation
- Tretyak, V.I., IPHC, Université de Strasbourg, CNRS/IN2P3, F-67037 Strasbourg, France, Joint Institute for Nuclear Research,

141980 Dubna, Russian Federation

- Tretyak, V.I., INR, MSP 03680 Kyiv, Ukraine
- Umatov, V.I., Institute of Theoretical and Experimental Physics, 117259 Moscow, Russian Federation
- Vála, L., IEAP, Czech Technical University in Prague, CZ-12800 Prague, Czech Republic
- Vanyushin, I.A., Institute of Theoretical and Experimental Physics, 117259 Moscow, Russian Federation
- Vasiliev, V.A., University College London, WC1E 6BT London, United Kingdom
- Vorobel, V., Charles University in Prague, Faculty of Mathematics and Physics, CZ-12116 Prague, Czech Republic
- Vylov, Ts., Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation

References:

- Arnold, R., NEMO Collaboration (2005) Nucl. Instr. and Meth. A, 536, p. 79
- Arnold, R., NEMO Collaboration (2005) Phys. Rev. Lett, 95, p. 182302
- Arnold, R., NEMO Collaboration (2006) Nucl. Phys. A, 765, p. 483
- Arnold, R., NEMO Collaboration (2007) Nucl. Phys. A, 781, p. 209
- Firestone, R.B., (1998) Table of Isotopes, , 8th ed, Wiley, NY
- Frey, G., Hoke, P.K., Stukel, J.J., (1981) Science, 211, p. 480
- Busigin, A., (1981) Health Phys., 40, p. 333
- Wellisch, E.M., (1913) Philos. Mag., 26, p. 623
- Renoux, A., (1965) Etudes des ions radioactifs de l'atmosphère, pp. R-2771. , thèse de doctorat, Université de Fac-Science, Rapport CEA, Paris, France
- Porstendörfer, J., Mercer, T.T., (1979) Health Phys., 37, p. 191
- Arnold, R., Tretyak, V.I., (1997) The NEMO 3 simulation program, NEMO 3 internal, , note IReS-1/97, Strasbourg
- (1995) CERN Program Library Long Writeup W5013, , http://wwwasdoc.web.cern.ch/wwwasdoc/geant_html3/geantall.html, GEANT Detector Description and Simulation Tool
- Ponkratenko, O.A., Tretyak, V.I., Zdesenko, Yu.G., (2000) Phys. Atom. Nucl., 63, p. 1282
- Akovali, Y.A., (1995) Nucl. Data Sheets, 76, p. 127
- Ohsumi, H., NEMO Collaboration (2002) Nucl. Instr. and Meth. A, 482, p. 832
- Arpesella, C., (1992) Nucl. Phys. B (Proc. Suppl.), 28 A, p. 420
- Marquet, C., NEMO Collaboration (2001) Nucl. Instr. and Meth. A, 457, p. 487
- Chasal, V., (1998) Astroparticle Phys., 9, p. 163
- Be, M.M., (2005) Proceedings of the International Conference on Advances in Liquid Scintillation Spectrometry, , Katowice, 17-21 October
- H. Behrens, L. Szybisz, Phys. Data 6-1 (1976)