



NUMEN

**Determining the Nuclear Matrix Elements of Neutrinoless Double
Beta Decays by Heavy-Ion Double Charge Exchange Reactions**

Organization (January 2021)

Spokespersons: F. Cappuzzello (cappuzzello@lns.infn.it) and C. Agodi (agodi@lns.infn.it)

Participants

C. Agodi¹, C. Altana¹, J.I. Bellone¹, S. Brasolin², G.A. Brischetto^{1,3}, O. Brunasso², M.P. Bussa^{2,4}, S. Calabrese¹, L. Calabretta¹, D. Calvo², L. Campajola^{5,6}, V. Capirossi^{2,7}, F. Cappuzzello^{1,3}, D. Carbone¹, M. Cavallaro¹, S. Ciociola^{2,10}, I. Ciraldo^{1,3}, M. Colonna¹, M. Cutuli^{1,3}, F. Delaunay^{1,8}, F. Dumitrache², C. Ferraresi^{2,9}, P. Finocchiaro¹, M. Fisichella¹, A. Foti¹⁰, S. Gallian², D. Gambacurta¹, E.M. Gandolfo^{5,6}, F. Iazzi^{2,7}, L. La Faiuci^{1,3}, G. Lanzalone^{1,12}, A. Lavagno^{2,7}, F. La Via¹³, P. Mereu², L. Neri¹, L. Pandola¹, F. Pinna^{2,7}, D. Rosato^{2,9}, A.D. Russo¹, G. Russo^{3,10}, E. Santopinto¹¹, D. Sartirana², O. Sgouros¹, V. Soukeras¹, A. Spatafora^{1,3}, D. Torresi¹, S. Tudisco¹, R.I.M. Vsevolodovna¹¹

¹ *Istituto Nazionale di Fisica Nucleare, Laboratori Nazionali del Sud, Italy*

² *Istituto Nazionale di Fisica Nucleare, Sezione di Torino, Italy*

³ *Dipartimento di Fisica e Astronomia "Ettore Majorana", Università di Catania, Italy*

⁴ *Dipartimento di Fisica, Università di Torino, Italy*

⁵ *Dipartimento di Fisica, Università di Napoli Federico II, Italy*

⁶ *Istituto Nazionale di Fisica Nucleare, Sezione di Napoli, Italy*

⁷ *DISAT, Politecnico di Torino, Italy*

⁸ *LPC Caen, Normandie Université, ENSICAEN, UNICAEN, CNRS/INP3, France*

⁹ *DIMEAS, Politecnico di Torino, Italy*

¹⁰ *Istituto Nazionale di Fisica Nucleare, Sezione di Catania, Italy*

¹¹ *Istituto Nazionale di Fisica Nucleare, Sezione di Genova, Italy*

¹² *Università degli Studi di Enna "Kore", Italy*

¹³ *CNR-IMM, Sezione di Catania, Italy*

S. Burrello¹⁴

¹⁴ *IPN Orsay, IN2P3-CNRS, France*

L.H. Avanzi¹⁵, E.N. Cardozo¹⁶, K.M. Costa¹⁵, J.L. Ferreira¹⁶, R. Linares¹⁶, J. Lubian¹⁶, N.H. Medina¹⁷, D.R. Mendes Junior¹⁶, M. Morales¹⁸, J.R.B. Oliveira¹⁷, T.M. Santarelli¹⁵, R.B.B. Santos¹⁵, M.A. Guazzelli¹⁵, V.A.B. Zagatto¹⁶

¹⁵ *Centro Universitario FEI Sao Bernardo do Campo, Brazil*

¹⁶ *Instituto de Fisica, Universidade Federal Fluminense, Brazil*

¹⁷ *Instituto de Fisica, Universidade de Sao Paulo, Brazil*

¹⁸ *Instituto de Pesquisas Energeticas e Nucleares IPEN/CNEN, Brazil*

S. Koulouris¹⁹, A. Pakou²⁰, G. Souliotis¹⁹

¹⁹ *Department of Chemistry, National and Kapodistrian University of Athens, Greece*

²⁰ *Department of Physics and HINP, University of Ioannina, Greece*

L. Acosta²¹, P. Amador-Valenzuela²², R. Bijker²³, E.R. Chávez Lomelí²¹, H. Garcia-Tecocoatzi²³, A. Huerta Hernandez²¹, D.J. Marín-Lámbarri²¹, V.R. Sharma²¹, H. Vargas Hernandez²¹

²¹ *Instituto de Física, Universidad Nacional Autónoma de México, Mexico*

²² *Instituto Nacional de Investigaciones Nucleares, Mexico*

²³ *Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México, Mexico*

H. Lenske²⁴, J. Isaak²⁵, N. Pietralla²⁵, V. Werner²⁵

²⁴ *Department of Physics, University of Giessen, Germany*

²⁵ *Institut für Kernphysik, Technische Universität Darmstadt, Germany*

I. Boztosun²⁶, H. Dapo²⁷, C. Eke²⁶, S. Firat²⁶, A. Hacisalihoglu²⁸, Y. Kucuk²⁶, S.O. Solakci²⁶, A. Yildirim²⁶

²⁶ *Department of Physics, Akdeniz University, Turkey*

²⁷ *Ankara University, Institute of Accelerator Technologies, Turkey*

²⁸ *Institute of Natural Sciences, Karadeniz Teknik University, Turkey*

N. Auerbach²⁹

²⁹ *School of Physics and Astronomy, Tel Aviv University, Israel*

J.A. Lay³⁰

³⁰ *Departamento de FAMN, University of Seville, Spain*

H. Petrascu³¹

³¹ *Department of Nuclear Physics, Horia Hubulei National Institute of Physics and Nuclear Engineering, IFIN-HH, Romania*

J. Ferretti³², J. Kotila³²

³² *University of Jyväskylä, Finland*

P. Adsley^{33,34}, H. Jivan^{33,34}, R. Neveling³⁴, L. Pellegrini^{33,34}

³³ *School of Physics, University of the Witwatersrand, Johannesburg, South Africa*

³⁴ *iThemba Laboratory for Accelerator Based Sciences, Faure, Cape Town, South Africa*

NUMEN sub-projects

NUMEN PROJECTS	COORDINATOR COMPONENTS	FORESEEN ACTIVITY
SPOKESPERSON	F.Cappuzzello, C.Agodi	Scientific responsibility; Interface with the external; NP coordination activities; Coordinating resources and collaborations; MAGNEX upgrade
CROSS SECTION DATA	M.Cavallaro <i>L.Acosta, P.Adsley, C.Agodi, C.Altana, P.Amador-Valenzuela, I.Boztosun, G.A.Brischetto, S.Calabrese, D.Calvo, L.Campajola, F.Cappuzzello, D.Carbone, M.Cavallaro, E.R.Chávez Lomeli, I.Cirald, M.Cutuli, F.Delaunay, H.Dapo, C.Eke, P.Finocchiaro, S.Firat, M.Fisichella, A.Foti, M.A.Guazzelli, A.Hacisalihoglu, S.Koulouris, L.La Fauci, H.Jivan, R.Linares, N.H.Medina, R.Neveling, J.R.B.Oliveira, A.Pakou, L.Pandola, L.Pellegri, H.Petrascu, G.Russo, O.Sgouros, S.O.Solakci, V.Soukeras, G.Souliotis, A.Spatafora, D.Torresi, S.Tudisco, A.Yildirim, V.A.B.Zagatto</i>	Experiment set up; Facility optimization; Experiment shifts; Data taking
DATA REDUCTION	D.Carbone, R.Linares <i>C.Agodi, P.Amador-Valenzuela, G.A.Brischetto, S.Calabrese, F.Cappuzzello, D.Carbone, M.Cavallaro, I.Cirald, M.Cutuli, S.Firat, M.Fisichella, A.Hacisalihoglu, L.La Fauci, R.Linares, O.Sgouros, V.Soukeras, A.Spatafora, V.A.B.Zagatto</i>	Extraction of energy spectra and absolute cross sections
FPD GAS TRACKER	D.Torresi <i>L.Acosta, P.Adsley, C.Agodi, I.Boztosun, G.A.Brischetto, L.Campajola, F.Cappuzzello, M.Cavallaro, E.R.Chávez Lomeli, I.Cirald, H.Dapo, M. Fisichella, E.M.Gandolfo, A.Huerta, H.Jivan, Y.Kucuk, D.Marin-Lambarri, L.Neri, R.Neveling, L.Pellegri, H.Petrascu, V.Sharma,</i>	Design, building and test of the gas prototype and of the final tracker ^{a)}

	<i>A.Spatafora, D.Torresi, H.Vargas, A.Yildirim</i>	
FPD PID SYSTEM	S.Tudisco, D.Carbone, P.Finocchiaro <i>C.Agodi, C.Altana, G.A.Brischetto, S.Calabrese, L.Campajola, F.Cappuzzello, D.Carbone, M.Cavallaro, P.Finocchiaro, E.M.Gandolfo, G.Lanzalone, F.La Via, O.Sgouros, V.Soukeras, A.Spatafora, S.Tudisco</i>	Building prototypes and tests with SiC technology; Study of CsI technology for NUMEN PID; Construction of crystals and assembly with suitable read-out systems; Project of final detectors; Building of the final detector; b), c)
GAMMA ARRAY	J.R.B.Oliveira, P.Finocchiaro <i>C.Agodi, I.Boztosun, L.Campajola, F.Cappuzzello, E.M.Gandolfo, J.Isaak, R.Linares, N.H.Medina, D.R.MendesJunior, M.Morales, J.R.B.Oliveira, L.Pellegrini, S.O.Solakci, V.Werner, A.Yildirim,</i>	Choice of the scintillator; Building prototypes; Test of prototypes; Design of the final detector
THEORETICAL MODELS	M.Colonna, E.Santopinto <i>N.Auerbach, J.I.Bellone, R.Bijker, I.Boztosun, S. Burrello, E.N.Cardozo, M.Colonna, D.Gambacurta, J.L.Ferreira, J.Ferretti, H.Garcia-Tecocoatzi, J.Kotila, Y.Kucuk, A.Lavagno, J.A.Lay, H.Lenske, J.Lubian, G.Russo, E.Santopinto, R.B.B.Santos, R.I.M.Vsevolodovna</i>	Folding of nuclear structure and reaction models; Development of microscopic DCE theory; Extraction of matrix elements from DCE cross sections d)
HIGH INTENSITY BEAM MANAGEMENT	L.Calabretta <i>L.Calabretta, L.Campajola, D.Carbone, M.Cavallaro, A.D.Russo</i>	Beam transport line; beam dump
IT SYSTEM	L.Pandola <i>I.Boztosun, G.A.Brischetto, S.Calabrese, L.Campajola, E.M.Gandolfo, M.Morales, J.R.B.Oliveira, L.Pandola, O.Sgouros, V.Soukeras</i>	DAQ; Computation; Simulations; Storage; Web management
TARGETS	F.Iazzi <i>L.Acosta, C.Agodi, L.H.Avanzi, O.Brunasso, D.Calvo, V.Capirossi, F.Cappuzzello, M.Cavallaro, E.Chavez Lomeli, K.M.Costa, F.Delaunay, M.Fisichella, S.Gallian, M.A.Guazzelli, A.Huerta Hernandez, F.Iazzi, A.Lavagno, D.J.Marin Lambarri, N.H.Medina, J.R.B.Oliveira, F.Pinna,</i>	Target system design and production; Radiation damage study; Cooling system design; Study of dissipation; Deposition techniques

	<i>T.M.Santarelli, R.B.B.Santos, V.Sharma, D.Torresi, H.Vargas Hernandez</i>	
INTEGRATION (transversal sub-project)	D.Calvo <i>C.Agodi, S.Brasolin, M.P.Bussa, D.Calvo, L. Calabretta, D.Carbone, F.Cappuzzello, M.Cavallaro, S.Ciociola, F.Dumitrache, C.Ferraresi, P.Mereu, J.R.B.Oliveira, H.Petrascu, D.Rosato, D.Sartirana</i>	Mechanical integration of devices; Design and construction of vacuum chambers;
ELECTRONICS (transversal sub-project)	P.Finocchiaro <i>M.A.Guazzelli, N.H.Medina, M.Morales, J.R.B.Oliveira, L.Pandola, R.B.B.Santos, V.Soukeras, D.Torresi</i>	Front-end electronics; Readout electronics; Data acquisition

a) Collaboration with W. Mittig, M. Cortesi and D. Bazin (MSU).

b) Synergy with INFN CALL SICILIA.

c) Collaboration with G. Cosentino (INFN-LNS), A. Pappalardo (IFIN).

d) Collaboration with R.A. Broglia (Niels Bohr Institute Copenhagen), O. Civitarese (La Plata University), A. Gargano (INFN-Na), G. De Gregorio (INFN-Na), G. Potel (MSU).

Technical Board (TB)

COMPONENTS	FORESEEN ACTIVITY
F.Cappuzzello, C.Agodi <i>C.Agodi, L.Calabretta, D.Calvo, F.Cappuzzello, D.Carbone, M.Cavallaro, M.Colonna, P.Finocchiaro, F.Iazzi, R.Linares, J.R.B.Oliveira, L.Pandola, E.Santopinto, D.Torresi, S.Tudisco</i>	Sub-projects coordination activities; Publications management; Conferences management

Publication Committee (PC)

COMPONENTS	FORESEEN ACTIVITY
<i>D.Calvo, D. Carbone, S. Tudisco</i>	Publications management

Speaker Committee (SC)

COMPONENTS	FORESEEN ACTIVITY
<i>M. Cavallaro, M. Colonna, J.R.B. Oliveira, L. Pandola</i>	Conferences management

Project management Committee (PM)

COMPONENTS	FORESEEN ACTIVITY
<i>C. Agodi, D. Calvo, M. Cavallaro, P. Finocchiaro</i>	Risk assessment strategies, time schedule optimization, project control, communication