

MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITÀ E DELLA RICERCA
DIREZIONE GENERALE RICERCA
PROGETTO DI RICERCA - MODELLO B
BANDO FIRB - PROGRAMMA "FUTURO IN RICERCA"

Anno 2008 - Protocollo: RBFR086WNU_001

Linea d'intervento 2

1 - Associated Investigator of the Research Unit Program

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2 - Research Unit Description and Duties

The Research Unit is composed by physicists and personnel of the INFN Section of Ferrara. The external personnel provides the connection with the foreign research Institutions involved in the proposed research program.

The members of the Research Unit are actively involved in experiments with polarized gas targets. The physical topics of interest are broad and range from the spin structure of the nucleon to the low energy interactions between polarized light nuclei. The skills of the Unit cover all the requirements needed to organize such kind of experiments. The Research Unit has recognized experience for either the technology involved or the data analysis, as testified by the number of responsibilities covered in the framework of International collaborations.

Marco Contalbrigo is currently covering responsibilities in both data analysis and hardware in different experiments and International laboratories (data taking and analysis for the HERMES experiment at DESY, Hamburg, experimental proposals with the CLAS detector at Jefferson Lab, Newport, USA, simulations for the experiments at COSY, Juelich, propaedeutic for the PAX project). In particular:

*) he was responsible of the inclusive analyses based on data with longitudinally polarized target and is now the responsible of the analyses with transversely polarized target for the high-energy experiment HERMES at DESY, Hamburg; the experiment investigates the spin structure of the nucleon from deep inelastic scattering (DIS) of 27 GeV polarized electrons (positrons) off polarized nucleons;

*) he is spokesperson of one approved experiment in Hall-B of Jefferson Lab, USA for the study of spin-orbit effects into the nucleon by DIS with 12 GeV polarized electrons;

*) he is co-responsible for the silicon detector of the PAX project. He has studied, through Monte Carlo simulations, the configuration of the detector for the experiments dedicated to test the polarization of antiproton beams. He is currently responsible for the set up of a test laboratory for the silicon detectors in Ferrara.

The responsible of the Electronic Service of the INFN Section of Ferrara is a member of the Research Unit. Among his activities related to this project is the development of a high precision trigger board with programmable delays for the PAX experiment. The board is conceived in such a way to manage simultaneously the signal from 4 double-faced silicon strip detectors, is very flexible in the management of the timing of the 8 signals and in the trigger logic, allowing the self-trigger of the silicon detector.

The responsible for the Mechanical Service of the INFN Section of Ferrara is a member of the Research Unit. Among his activities related to this proposal are the design of storage cells for polarized gas (to be located internally to the storage ring beam lines) and simulations of thermal and mechanical stress of silicon detectors. In particular he is doing thermal simulations for the PAX detector and for the gigatracker of the NA62 experiment at CERN. He has designed the storage cell for the HERMES target and is currently designing the storage cell for the PAX target. The cell becomes part of the beam pipe and has therefore to fulfil very stringent quality standards concerning the hardness from thermal stress and electrical continuity of the vacuum beam line in order to reduce the background radiofrequencies. The walls of the cell are extremely thin (75 micron for Aluminium down to 5 micron for Teflon) in order to reduce the effects of energy loss and multiple scattering on the particles.

The foreign collaborators are also active in this field of research. They will provide a beam of polarized ions and a polarimeter for the measure of the polarization. The Italian personnel contributes with the fulfilment of the interaction point between ion and atomic beams, where the fusion reaction occurs, and of the silicon detector for the detection of the reaction products.

The interaction point requires magnetic fields to maintain the polarization and possibly the use of a storage cell to increase the target density.

The silicon detector will allow the tracking and the identification of the various isotopes through the analysis of the kinetic and deposited energy of the particles. The detector will be self-triggering. It will be operated in vacuum in order to allow the detection of low energy particles. The detector geometry is relatively simple since one silicon layer is enough to stop the nuclei and measure their energy. The crucial point is to minimize the material budget before detection. The interaction point between ion and atomic beam can be assumed to be point-like. Having only two particles in the final state, the angle and energy measurement of only one particle are enough to define completely the reaction kinematic.

The readout electronics and the preamplifiers will be in vacuo. This requires the design of a dedicated cooling system and the introduction of proper screens to reduce the thermal stress of the detector. These devices must not affect the quality of the vacuum in the beam line. The front-end electronic is developed at Juelich for PAX experiment together with the read-out (Vertex board) and corresponding LVDS control system. The Italian personnel is currently involved in the development of the controlling software. Once completed, the full read-out chain would be used for this project.

The technological skills of the Research Unit are fundamental to ensure the realization of a well-functioning interaction point completed with the detector of reaction

products.

The first year of activity will be dedicated to feasibility studies and simulations of the interactions in order to optimize the experimental set-up. This will allow to define the characteristics of the silicon detector and to start the purchase tender.

During the second year of activity the required material will be purchased and installed and the first quality tests will be performed.

In the third year the whole apparatus will be shipped to the Gatchina laboratory and the first runs of measures will be performed to characterize the two beams quality and polarization.

The fourth year will be dedicated to the continuation of the measurements, the data analysis and the publication of the results.

The purchase of consumable material, which cannot be lent from the equipment of the Unit, is foreseen. In particular this concerns: silicon detectors and electronic boards at the end of the current R&D; moreover various mechanical components, supports and cooling systems for the detectors, vacuum devices (flanges, feed-through and measuring devices) and electronic boards (trigger boards). Part of the durable material, i.e. scattering chamber and the relative vacuum system, power supply and read-out electronics, can be lent (at zero cost for the project) from the silicon detectors test laboratory in preparation in Ferrara. This reflects in a sizable reduction of the total cost of the Research Unit activity.

3 - ERC (European Research Council) research fields

PE Mathematics, physical sciences, information and communication, engineering, universe and earth sciences

PE2 Fundamental constituents of matter: high energy, particle, nuclear, plasma, atomic, molecular, gas, and optical physics

PE2_4 Nuclear physics

PE7 Universe science: astro-physics/chemistry/biology/geology; solar system; stellar, galactic and extragalactic astronomy, cosmology; space science, instrumentation

PE7_14 Cosmology

PE2 Fundamental constituents of matter: high energy, particle, nuclear, plasma, atomic, molecular, gas, and optical physics

PE2_5 Gas and plasma physics

4 - Scientific Curriculum of the Associated Investigator of the Research Unit Program

Marco Contalbrigo was born in 07/12/1971. He graduated in Physics in 1996 at University of Padova with the thesis: "Search for tau neutrinos in the neutrino beam of SPS at CERN".

In 1997 was awarded with the prize "Prof. Italo Filosofo" by the Istituto Veneto di Science, Lettere ed Arti for the best thesis in Physics at University of Padova and received an INFN fellowship for postgraduate students in sub-nuclear experimental physics. In 2001 he got the PhD in Physics at University of Ferrara with the thesis: "Precise measurement of the $KL \rightarrow \pi^0 gg$ decay". He got post-docs positions from 2001 to 2005 at University of Perugia and University of Ferrara. Since 2005 he is INFN researcher at the Ferrara Section of INFN.

He is author of 80 publications on International journals with referee and has published several works on proceedings of International conferences.

Brief summary of his scientific activity:

Marco Contalbrigo is involved in the experimental and phenomenological study of the fundamental interactions of elementary particles.

He began his scientific activity in the field of electro-weak physics with cosmological implications at the NOMAD experiment (CERN, Geneva), searching evidences of neutrino oscillations in the range of large masses, and at NA48 (CERN, Geneva), for the study of CP violation in the neutral kaon sector.

After the PhD he began to work in the field of spin physics and nucleon structure. He is a member of the HERMES collaboration (DESY, Hamburg) and has actively contributed to the study of spin dependent partonic functions of the nucleon. In particular he has coordinated the inclusive analyses and is currently coordinator of the analyses on the transverse spin effects.

He is among the proponents of the PAX experiment for the physics of polarized antiprotons. He is deputy-responsible for the silicon tracking detector for the experiments on the polarization of antiproton beams.

He is promoter of precision measurements of spin effects in deep-inelastic scattering at Jefferson Lab (Newport News, VA, USA) and is spokesperson of one of the experiments recently approved.

He contributes to the technological development of nuclear polarized gas targets in collaboration with the SpinLab laboratory at University of Ferrara.

He has presented his results in a number of International conferences. The most recent contributions are listed below:

- *) "Detectors at storage rings" at STORI05, May 2005, Juelich-Bonn;
- *) "The PAX Polarized Antiproton eXperiment" at Transversity 2005, September 2005, Como;
- *) "Investigation of the Nucleon Spin Structure at HERMES with longitudinally polarized targets" and "Antiproton--Proton Scattering Experiments with Polarization" at Spin-05, October 2005, Dubna, Russia;
- *) "The PAX Polarized Antiproton eXperiment" at the XLIV International Winter Meeting on Nuclear Physics, January 2006, Bormio;
- *) "PAX project at FAIR" at the Caucasian-German School and Workshop on Hadron Physics, September 2006, Tbilisi, Georgia;
- *) "Measurement of Transverse Asymmetries from Interference Fragmentation at HERMES" at SPIN 2006, October 2006, Kyoto, Giappone;
- *) "Spin Physics at HERMES" at QCD@work 2007, June 2007, Martina Franca;
- *) "The status of the PAX project at FAIR" at the The 6th Cirum-Pan-Pacific Symposium on High Energy Spin Physics, July 2007, Vancouver, Canada;
- *) "Transverse Spin Physics at HERMES" at SPIN 2008, October 2008, Charlottesville - VA, USA.

He is among the organizers and editors of the following conferences held in Ferrara: QCD-N02, April 2002 and Transversity 2008, May 2008.

5 - Most significant scientific publications of the Associated Investigator of the Research Unit Program

n°	Publication
1.	M. Stancari, L. Barion, M. Capiluppi, G. Ciullo, CONTALBRIGO M., P.F. Dalpiaz, A. Drago, P. Lenisa, M. Statera, E. Steffens, M. Wang (2008). Low conductance injection tubes for storage cell targets. NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH. SECTION A, ACCELERATORS, SPECTROMETERS, DETECTORS AND ASSOCIATED EQUIPMENT, vol. 594; p. 126-131, ISSN: 0168-9002, doi: 10.1016/j.nima.2008.06019

2. M. Stancari, L. Barion, C. Bonomo, M. Capiluppi, CONTALBRIGO M., G. Ciullo, P. F. Dalpiaz, F. Giordano, P. Lenisa, L. Pappalardo, M. Statera, M. Wang (2007). The Impact of Dissociator Cooling on the Beam Intensity and Velocity in the SpinLab ABS. In: Proceedings of the 17th International Spin Physics Symposium. Kyoto (Japan), 2007AIP, vol. 915, p. 992-995
3. M. Statera, M. Stancari, M. Capiluppi, G. Ciullo, CONTALBRIGO M., P.F. Dalpiaz, F. Giordano, P. Lenisa, M. Wang (2005). A high intensity Superconducting atomic beam source. IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, vol. 15; p. 1164-1166, ISSN: 1051-8223
4. S.N. Atutov, L. Barion, G. Ciullo, CONTALBRIGO M., P.F. Dalpiaz, F. Giordano, P. Lenisa, M. Stancari, M. Statera, L. Tomassetti, M. Wang (2005). Optical spectrometer for measuring the ratio of atomic hydrogen and molecular hydrogen in an ABS. In: 16th international spin physics symposium (SPIN2004). Trieste, 10/10/2004-16/10/2004, Toh tuck Link: World Scientific, p. 820-823
5. M. Stancari, G. Ciullo, S. Atutov, L. Barion, M. Capiluppi, CONTALBRIGO M., P.F. Dalpiaz, F. Giordano, P. Lenisa, M. Statera, M. Wang (2005). Estimates of intra-beam scattering in atomic beam sources. In: 16th international spin physics symposium (SPIN2004). Trieste, 10/10/2004-16/10/2004, Toh Tuk Link: World Scientific Publishing, p. 779-782
6. M. Statera, M. Stancari, V. Carasitti, G. Ciullo, F. Evangelisti, CONTALBRIGO M., P.F. Dalpiaz, P. Lenisa (2006). A Test Bench for Small Multipolar Magnets for a High-Intensity Superconducting Atomic Beam Source. IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, vol. 16; p. 297-300, ISSN: 1051-8223
7. M. Statera, M. Capiluppi, G. Ciullo, CONTALBRIGO M., P.F. Dalpiaz, P. Lenisa, M. Stancari (2007). The Field Mapping at Low Temperature of a NbTi Setupole. In: CRYOPRAGUE 2006 PROCEEDINGS OF ICMC '06, TWENTY FIRST INTERNATIONAL CRYOGENIC ENGINEERING CONFERENCE AND 9TH CRYOGENICS. PRAGA, 17/07/2006 - 21/07/2006, Praga: ICARIS Ltd, vol. 2, p. 199-202
8. CONTALBRIGO M. (2005). Detectors for storage rings. In: Nuclear physics at storage rings. Juelich, 23-26 May 2005, BONN, p. 373-380
9. RATHMANN F, LENISA P, STEFFENS E, CONTALBRIGO M., P. FERRETTI DALPIAZ, KACHARAVA A, LEHRACH A, LORENTZ B, MAIER R, PRASUHN D, STROHER H (2005). A method to polarize stored antiprotons to a high degree. PHYSICAL REVIEW LETTERS, vol. 94; p. 014801-1-014801-4, ISSN: 0031-9007
10. V. Barone, B.-Q. Ma, K. Goeke, A. Metz, P. Schweitzer J. Bisplinghoff, P.D. Eversheim, F. Hinterberger, U.-G. Meissner, H. Rohdjes, A. Sibirtsev, C. Montag, W. Vogelsang, U. D'Alesio, F. Murgia, N. Buttmore, A. Efremov, O. Teryaev, S. Dymov, N. Kadagidze, V. Komarov, A. Kulikov, V. Kurbatov, V. Leontiev, G. Macharashvili, S. Merzliakov, I. Meshkov, V. Serdjuk, A. Sidorin, A. Smirnov, E. Syresin, S. Trusov, Y. Uzikov, A. Volkov, N. Zhuravlev, O. Ivanov, V. Krivokhizhin, G. Meshcheryakov, A. Nagaytsev, V. Peshekhonov, A. Savin, B. Shaikhatdenov, O. Shevchenko, G. Yarygin, W. Eyrich, A. Kacharava, B. Krauss, A. Lehmann, D. Reggiani, K. Rith, R. Seidel, E. Steffens, F. Stinzing, P. Tait, S. Yaschenko, M. Capiluppi, G. Ciullo, CONTALBRIGO M., A. Drago, P. Ferretti-Dalpiaz, F. Giordano, P. Lenisa, L. Pappalardo, G. Stancari, M. Stancari, M. Statera, E. Avetisyan, N. Bianchi, E. De Sanctis, P. Di Nezza, A. Fantoni, C. Hadjidakis, D. Hasch, M. Mirazita, V. Muccifora, F. Ronchetti, P. Rossi, S. Barsov, S. Belostotski, O. Grebenyuk, K. Grigoriev, A. Izotov, A. Jgoun, P. Kravtsov, S. Manaenkov, M. Mikirtychiants, S. Mikirtychiants, O. Miklukho, Y. Naryshkin, A. Vassiliev, A. Zhdanov, D. Ryckbosch, Y. Jiang, H.J. Lu, W.G. Ma, J. Shen, Y.X. Ye, Z.J. Yin, Y.M. Zhang, D. Chladze, R. Gebel, R. Engels, O. Felden, J. Haidenbauer, C. Hanhart, M. Hartmann, I. Keshelashvili, S. Krewald, A. Lehrach, B. Lorentz, S. Martin, U.G. Meissner, N. Nikolaev, D. Prasuhn, F. Rathmann, R. vSchleichert, H. Seyfarth, H. Stroher, D. Bruncko, J. Ferencei, J. Musinsky, J. Urban, C. Wiedner, C. Coriano, M. Guzzi, T. Wise, P. Ratcliffe, V. Baru, A. Gasparyan, V. Grishina, L. Kondratyuk, A. Kudriavtsev, A. Bagulya, E. Devitsin, Y. Kozlov, A. Terkulov, M. Zavertiaev, A. Bogdanov, S. Nurusev, V. Okorokov, M. Runtzo, M. Strikhanov, Y. Shatunov, B. Pire, N. Belikov, B. Chujko, Y. Kharlov, V. Korotkov, V. Medvedev, A. Mysnik, A. Prudkoglyad, P. Semenov, S. Troshin, M. Ukhonov, B. Chladze, N. Lomidze, A. Machavariani, M. Nioradze, T. Sakhelashvili, M- Tabidze, I. Trekov, L. Kurdadze, G. Tsirekidze, M. Anselmino, M. Boglione, A. Prokudin, P. Thorngren-Engblom, S. Liuti, W.... (2005). Antiproton-proton scattering experiments with polarization., p. -, High Energy Physics Experiment (hep-ex/0505054).
The document describes the physics case of the PAX experiment using polarized antiprotons, which has recently been proposed for the new Facility for A
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6 - Personnel of the Research Unit

6.1 - Research Unit Personnel

Personnel of the Institution of the Associated Investigator

n°	Surname	Name	Dipartimento/Istituto/ Divisione/Settore	Degree	Typology	Months/ man	Cost
1.	CONTALBRIGO	Marco		Ricercatore	Tempo Indeterminato	16	55.635
2.	COTTA RAMUSINO	Angelo		Primo tecnologo	Tempo Indeterminato	8	0
3.	CARASSITI	Vittore		Dirigente tecnologo	Tempo Indeterminato	12	0
	TOTAL					36	55.635

Other Universities Personnel

n°	Surname	Name	Institution	Dipartimento/Istituto/ Divisione/Settore	Degree	Typology	Months/ man	Cost
	TOTAL						0	0

Other Organisations Personnel

n°	Surname	Name	Institution	Dipartimento/Istituto/ Divisione/Settore	Degree	Typology	Months/ man	Cost
1.	ENGELS	Ralf	KP Forschungszentrum Juelich		Ricercatore	Tempo Indeterminato	12	0
2.	KRAVTSOV	Peter	Petersburg Nuclear Physics Institute Academy of Sciences		Ricercatore	Tempo Indeterminato	16	0
3.	VASILYEV	Alexander	Petersburg Nuclear Physics Institute Academy of Sciences		Direttore di Istituto di EPR	Tempo Indeterminato	12	0
	TOTAL						40	0

6.2 - Personnel - Paid with other funds and occasionally used in the Research Project

n°	Surname	Name	University	Department/Institute	Degree	Months/ man
	TOTAL					0

6.3 - Personnel to be hired

n°	Degree	Typology	Months/ man	Cost
1.	<i>Assegno</i>	<i>assegno di ricerca</i>	11	24.400
2.	<i>Assegno</i>	<i>assegno di ricerca</i>	11	24.400
TOTAL			22	48.800

6.4 - Young Researchers contracts (C.1) and/or International Well Know Researchers contracts (C.2) to be used in this Research Project

n°	Degree	Typology	Months/ man	Cost
TOTAL			0	0

7 - Total Months/man dedicated to this Program

	Number	Months/ man	Cost
Non Fixed-term personnel (A.1.1)	6	76	55.635
Fixed-term personnel	0	0	0
Non dependent personnel costs	2	22	48.800
Young Researchers contracts	0	0	0
International Well Know Researchers contracts	0	0	0

8 - Description of equipments for this Research Program

n°	Year of acquisition	Description (Italian)	Description (English)	Estimated value	Percentage of use for the proposed activities
1.	2010	<i>Rivelatori al silicio</i>	<i>Silicon detectors</i>	25000	100%
2.	2011	<i>Scheda di trigger ad 8 canali</i>	<i>8 channel trigger board</i>	1800	100%
3.	2011	<i>crate per alimentazioni con interlock completo</i>	<i>crate for power supplis with full interlock system</i>	8500	30%
4.	2011	<i>alimentatori HV per i rivelatori al silicio</i>	<i>HV power supply for silicon</i>	2500	50%
5.	2011	<i>alimentatore LV per elettronica di lettura</i>	<i>LV power supply for DAQ</i>	4200	50%

9 - Total cost of the Research Unit Program

Cost item	Cost	Description (English)
Personnel Costs (A.1.1)	55.635	<i>Cost of the contract for the Coordinator normalized to twelve months of effective time spent into the project</i>
Personnel Costs (A.1.2)	0	
Non dependent personnel costs (A.2)	48.800	<i>Annual grant for specific research items</i>

General costs	62.661	<i>Spese generali direttamente imputabili all'attività di ricerca (obbligatoriamente nella misura forfettizzata del 60% del costo del personale di cui alle voci A e C)</i>
At least Three-year contracts (young-researchers) and International Well-Known researchers	0	
Well-known specialists costs	0	
Equipments costs	32.700	<i>Silicon detectors. Trigger board. Power supply boards for the silicon detector + DAQ and corresponding crate with full interlock functionality.</i>
Travels & Subsistence cost	18.990	<i>Missions abroad for scientific collaboration, installation and data-taking shifts.</i>
Consulting costs		
Other costs		
TOTAL	218.786	

10 - Incidence on the total cost of the Program

Insert the percentage 33%

11 - Financial overview of the Research Unit

	Grant requested	Own funds	TOTAL
Research activities cost	153.150	65.636	218.786
At least Three-years contracts cost (young researchers)	0		0
Contracts cost (well-known specialists)	0		0
Total cost of the Program	153.150	65.636	218.786

12 - English language knowledge

I certify that I have a good knowledge of English language: YES

13 - Availability of own funds is confirmed

Availability of own funds is confirmed : YES

14 - Project activities location

I certify that I will complete my activity at the institution indicated in point 1: YES

Si ricorda che il cofinanziamento a carico del proponente deve essere pari al 30% del costo complessivo della proposta progettuale, detratti i costi dei contratti triennali per giovani ricercatori e per ricercatori di chiara fama, che sono finanziati al 100%.

I dati contenuti nella domanda di finanziamento sono trattati esclusivamente per lo svolgimento delle funzioni istituzionali del MIUR. Incaricato del trattamento è il CINECA- Dipartimento Servizi per il MIUR. La consultazione è altresì riservata al MIUR - D.G. della Ricerca -- Ufficio IV, alla Commissione FIRB e ai referee scientifici. Il MIUR potrà anche procedere alla diffusione dei principali dati economici e scientifici relativi ai progetti finanziati. Responsabile del procedimento è il dirigente dell'ufficio IV della D.G. della Ricerca del MIUR.

Firma

Data..... (inserita dal sistema al termine della redazione della domanda)