



Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	CNRS 03	
Project title:	Upgrade of the pulse-tube dilution refrigerator used for the optimisation of particle detectors operated in the Gran Sasso underground laboratory	
Project acronym:	Como	
Lead scientist: ¹	Title:	Professor
	First name:	Andrea
	Last name:	Giuliani
	Birth date:	12 March 1961
	Passport number:	IC: AR1503022
	Research status/Position:	Professor
	New User: ²	Yes
	Scientific Field:	Bolometric detection of particles and neutrino physics
	Home institution:	University of Insubria
	Is your home institution MICROKELVIN partner?	No
	Business address:	Department of Physics and Mathematics
	Street:	Via Valleggio 11
	PO Box:	
	City:	Como
	Zip/Postal Code:	I-22100
	Country:	Italy
	Telephone:	+39 031 238 6217
	Fax:	+39 031 238 6209
	E-mail:	andrea.giuliani@mib.infn.it
	Curriculum vitae (18 lines max): Andrea Giuliani was born in Milano (Italy) in 1961. He graduated from the University of Milan in 1985, with a pioneer work on bolometers performed at CERN. After earning his Ph.D. in Milano with a research activity on low temperature detectors for weak interactions, conducted partially at CERN and in Milano, he worked in Milano initially (since 1990) as a University Researcher and then (since 1997) as a Senior Researcher of INFN (Italian Institute of Nuclear Physics). In 1999, he was appointed Associate Professor at Como (University of Insubria). Expert in bolometric detection of particles and in crucial aspects of neutrino physics, he gave several invited talks about low temperature detectors of radiation and neutrino physics at international conferences. Andrea Giuliani has given determinant contributions to the development of a new class of particle detectors (bolometers). He is and was involved in experiments in non accelerator particle physics (in particular, neutrinoless double beta decay and direct measurement of the neutrino mass) at Gran Sasso Underground Laboratories, in Milano and in the Como cryogenics laboratory. At the University of Insubria, he is responsible for a cryogenic laboratory for the development of bolometers, to be used not only in neutrino physics but also for astrophysical and technological applications.	
	Five most recent publications:	
	1) C. Arnaboldi, ... A. Giuliani, ... et al. (the Cuoricino Collaboration) RESULTS FROM THE CUORICINO 2b0n-DECAY EXPERIMENT Phys. Rev. C, Vol. 78, p. 035502 (2008)	
	2) E. Pasca, M. Barucci, A. Giuliani, E. Olivieri, L. Risegari, G. Ventura BOLOMETERS IN MAGNETIC FIELD: USE OF NTD Ge SENSORS Nuclear Instruments & Methods In Physics Research, vol. A 575, pp. 433-438 (2007)	

¹ The lead scientist indicated here is expected to participate in the campaign as a user of the infrastructure.

² Indicate 'Yes' only if the user has never visited the infrastructure before this specific project, otherwise write 'No'.

	3) C. Arnaboldi, G. Benedek, C. Brofferio, S. Capelli, F. Capozzi, O. Cremonesi, A. Filipponi, E. Fiorini, A. Giuliani, A. Monfardini, A. Nucciotti, M. Pavan, M. Pedretti, G. Pessina, S. Pirro, E. Previtali, M. Sisti MEASUREMENT OF THE p TO s WAVE BRANCHING RATIO OF ^{187}Re BETA DECAY FROM BETA ENVIRONMENTAL FINE STRUCTURE Physical Review Letters, vol. 96, pp. 042503-1-042503-4 (2006)		
	4) C. Arnaboldi, ..., A. Giuliani,... et al., (the Cuoricino Collaboration) NEW LIMIT ON THE NEUTRINOLESS BETA BETA DECAY OF Te-130 Phys. Rev. Lett. 95, 142501 (2005)		
	5) L. Foggetta, A. Giuliani, C. Nones, M. Pedretti, S. Sangiorgio SURFACE-SENSITIVE MACROBOLOMETERS FOR THE IDENTIFICATION OF EXTERNAL CHARGED PARTICLES Appl. Phys. Lett. 86, 134106 (2005)		
<u>Other participating scientists:</u> ³	Name:	Position:	New User: ²
	1- Foggetta, Luca	University Researcher	yes
	2-		
	3-		

³ Please list all participating user group members. Expand the table, if necessary.

2. Project Information

Name of host infrastructure:	Institut Néel, CNRS, Grenoble (MICROKELVIN-Grenoble)		
Access provider / Infrastructure Director:	Name: H. Godfrin	E-mail address: henri.godfrin@grenoble.cnrs.fr	
Planned project dates:	Start date:	01/11/2009	Completion date: 31/01/2010
Project description (12 lines max):			
<p>Our team is presently involved in the Project CUORE, investigating the neutrinoless Double Beta Decay of the isotope Te-130 in an experiment located in the Gran Sasso underground laboratory. This rare nuclear process is of crucial importance for neutrino physics, since it can determine the mass of this particle and ascertain its nature (Dirac or Majorana fermion). For this purpose, very low temperature bolometers are used. They consist of 760 g TeO₂ crystals, cooled down to temperatures of the order of 10 mK. In this temperature range, the energy resolution is 4 keV FWHM in the relevant energy range. Several key parameters influence the quality of the system: the minimum temperature, the consumption of cryogenic fluids, and the refrigerator cooling time. Our present refrigerator, used to prepare prototypes of the final detectors operating in Gran Sasso, is a commercial system, designed by CNRS-Grenoble ten years ago and manufactured by Air Liquide. Pre-cooling of the dilution refrigerator unit is achieved by means of a pulse-tube cryocooler. This "cryogen-free" machine is particularly adapted to Underground laboratories, where helium supply is limited or expensive. The performance of the dilution refrigerator is essential in order to achieve the best sensitivity of the bolometers in the field of Particle detection. For this reason, we would like to benefit from the latest improvements of this very low temperature technology, through the Grenoble TA2 facility of the FRP7 Microkelvin Infrastructure.</p>			
Scientific objectives of the project (12 lines max):			
<p>The main objective is simply to optimise the bolometric detector. This requires several technical objectives to be met:</p> <ul style="list-style-type: none">- 1) to reduce the minimum temperature of the system well below 10 mK- 2) to optimise the condensation stage in order to reduce the mixture condensation time- 3) to determine the optimum working parameters for the dilution unit			
Technical description of work to be performed (20 lines max):			
<p>- The Como cryostat is similar to the PT-DR machine designed and built at the CNRS Microkelvin facility at CNRS-Grenoble. Our refrigerator will be shipped to Grenoble, where the condensation stage and the heat exchangers will be upgraded. This operation requires specific know-how, techniques and tools available there.</p> <p>- One of us (Luca Foggetta) will conduct the necessary operations in Grenoble, under the supervision of A. Giuliani, and the expert assistance of the Microkelvin CNRS-Grenoble facility local contacts: H. Godfrin, C. Gianèse and A. Sultan.</p> <p>- The performance of the system will be tested in Grenoble (pre-cooling time, condensation time, very low temperature cooling time, cooling power as a function of ³He flow rate, determination of the optimum circulation conditions. It will then be tested by our group in the Insubria cryogenics laboratory in Como.</p> <p>- The time involved for the tests by Luca Foggetta in Grenoble is estimated to one month, in two periods of 2 weeks, between November 2009 and January 2010. A short visit of A. Giuliani is foreseen during this period.</p> <p>- The cost of transportation of the equipment, as well as that of building parts (if needed), will be covered by the University of Insubria. The Microkelvin facility, in turn, will provide the support in personnel needed within this project without charge, thanks to the Microkelvin program to open very low temperatures to neighbouring fields, in this case, Particle detectors Physics.</p>			

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If yes, please specify:
Is this proposal submitted to any funding programmes? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If yes, please specify:

The completed Application Form should be submitted to MICROKELVIN Management Office
(leena.meilahti@tkk.fi, fax +358-9-4512969)