welcome to the European Microkelvin Collaboration

Application Form for MICROKELVIN Transnational Access Project

1. General Information

Project number:	**AALTO 41**	
Project Title:	**SQUID-based NMR spectrometer for a rotating nuclear demagnetization cryostat (ROTA)**	
Lead scientist:[1]	**Title:**	Dr.
	First name:	Joern
	Last name:	Beyer
	Home institution:	Physikalisch-Technische Bundesanstalt (PTB)
Host scientist:[2]	**Title:**	Dr.
	First name:	Vladislav
	Last name:	Zavjalov
	Home institution:	Aalto University
Project scientist:[3]	**Title:**	Dr.
	First name:	Joern
	Last name:	Beyer
	Scientific Field:	
	Home institution:	Physikalisch-Technische Bundesanstalt (PTB)
	Is your home institution MICROKELVIN partner?	Yes
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	E-mail:	joern.beyer@ptb.de
	Curriculum vitae (18 lines max): - physicist, Dipl.-Phys. degree received in 1994, doctorate degree received in 2001 from Humboldt-University, Berlin - joined PTB in 1995 - 2001 - 2003 guest researcher at NIST Quantum Devices Group - 2005 guest researcher at NASA Goddard Space Flight Center, Microcalorimeter Group - since 2009 head of PTB working group "Cryosensors" - research interests: development of SQUID-sensors for precision electro-magnetic measurements, SQUID-based low-temperature thermometers, superconducting radiation detectors	
	Five most recent publications:	
	1- *Reference measurements of SQUID-based magnetic-field fluctuation thermometers,* J Beyer, M Schmidt, J Engert, S AliValiollahi and H J Barthelmess, Supercond. Sci. Technol. (2013) Vol.26, 065010	

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

[2] The host scientist is supervising the work of the visiting project scientist at the infrastructure.

[3] The project scientist is the person who will be visiting the infrastructure.

	2- *Two-stage transition edge sensor,* J. Beyer, L. Ferrari, *Supercond. Sci. Technol.* ***24*** *(2011) 085005*		
	3- *Transition edge sensor series array bolometer,* J. Beyer, Supercond. Sci. Technol. 23 (2010) 105019		
	4- *A SQUID multiplexer with superconducting-to-normalconducting switches,* J. Beyer, D. Drung, Supercond. Sci. Technol. **21** (2008) 105022		
	5- *SQUID series array dc current sensor*, J. Beyer, D. Drung, Supercond. Sci. Technol. 21 (2008) 095012		
Other participating scientists:[4]	**Name:**	**Position:**	**New User:**
	1- Thomas Schurig		
	2- Jost Engert		

2. Project Information

Name of host infrastructure:				
Access provider / Infrastructure Director:	**Name:** Vladimir Eltsov		**E-mail address:** ve@boojum.hut.fi	
Planned project dates:	**Start date:**	1/9/2013	**Completion date:**	8/9/2013

Project description (12 lines max):

The purpose of this project is to build and test a new high-precision SQUID-based NMR spectrometer for the ROTA cryostat (which is used for measurements on rotating superfluid 3He). For this spectrometer we will use a SQUID amplifier developed in PTB. The high signal sensitivity of this device will bring us the following advantages, compared to the current setup with a high Q LC resonator coupled to a liquid-helium-temperature MOSFET preamplifier :

- Larger NMR frequency range. It will become possible to avoid a highly tuned resonant circuit, tuned to some fixed frequency, and thus i twill become possible to perform measurements over a larger range of frequencies.

- Possibility to use much smaller NMR signal coils and thus improve spatial resolution.

- Overall better signal/noise ratio in all measurements.

Scientific objectives of the project (12 lines max):

Current research on the ROTA cryostat includes studies of energy dissipation in superfluid 3He-B in the presence of vortices. Recent results on spin relaxation show that the relaxation time has a non-trivial dependence on the NMR frequency: relaxation displays regular dissipation peaks with approximately 1.5 kHz period.

Theoretical investigations let us believe that this behaviour can provide information about the spectrum of quasiparticles bound to vortex cores. To verify this explanation we need to cover a much larger frequency range than is possible now. The interpretation of the experimental data is also complicated by the contribution of vortices with slightly differing properties in the non-uniform conditions of our experiment.

High spatial resolution of the NMR spectrometer will be useful for building an NMR microscope which can be used to resolve individual vortices and textural point defects.

Technical description of work to be performed (20 lines max):

We have constructed a SQUID test setup which can be run at 4.2 K temperature. First we plan to observe NMR in 3He gas in this setup and the study spectrometer properties in various conditions including both CW and pulsed NMR in a wide frequency range. We also plan to discuss the design of 100 μm-size micro-coils for single-vortex detection.

[4] Please list all participating user group members. Expand the table, if necessary.

3. Joint Proposals / Funding

Is this project in collaboration with other (concurrent) projects at the infrastructure? Yes
If yes, please specify: The development of contactless high-sensitivity low-noise measurement techniques in Joint Research Acitivity package JRA4

Is this proposal submitted to any funding programmes?	**No**
If yes, please specify:	

The completed Application Form should be submitted to MICROKELVIN Management Office (**Sari.Laitila@aalto.fi**, fax +358-9-47022969)