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CAPACITIES

# Report on the Transnational Access Activity carried out within MICROKELVIN

The eligibility of transnational access to a MICROKELVIN TA site implies the submission of the following:

## 1) The Certification of visit

The form "Certification of visit" must be completed and signed by the access provider in charge of the infrastructure and the leader of the project.

## 2) A TA project report

The form for the TA project report is contained within this document. It should be completed after project end by the group leader of the project. You must respect the limited number of words specified, longer descriptions will be rejected. Figures/tables may be attached at the end of the document. The document must be submitted in an editable format (doc, rtf).

## 3) A User group questionnaire

To enable the Commission to evaluate the Research Infrastructures Action, to monitor the individual contracts, and to improve the services provided to the scientific community, each project leader of a user-project supported under an EC Research Infrastructure contract is requested to complete a "user group questionnaire". The questionnaire must be submitted once by each user group to the Commission as soon as the experiments on the infrastructure come to end.

The user group questionnaire is not part of this document and must be completed on-line. It is accessible at:

http://cordis.europa.eu/fp7/capacities/questionnaire_en.html.

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► **Please note that any publications resulting from work carried out under the MICROKELVIN TA activity must acknowledge the support of the European Community:**

> **"The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 228464 (MICROKELVIN)."**

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# MICROKELVIN Transnational Access Project Report

## 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-Berlin) |
| **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 |
| | **Birth date:** | |
| | **Passport number:** | |
| | **Research status/Position:** | |
| | **New User:**[4] | |
| | **Scientific Field:** | |
| | **Home institution:** | Physikalisch-Technische Bundesanstalt (PTB) |
| | **Is your home institution MICROKELVIN partner?** | Yes |
| | **Business address:** | |
| | Street: | Abbestrasse 2-12 |
| | PO Box: | |
| | City: | Berlin |
| | Zip/Postal Code: | D-10587 |
| | Country: | Germany |
| | Telephone: | +49-(0)30-3481 7379 |
| | Fax: | +49-(0)30-3481 69 7379 |
| | E-mail: | joern.beyer@ptb.de |

[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.

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

## 2. Project information

| | |
|---|---|
| **Please, give a brief description of project objectives:** (250 words max) | The purpose of this project is to build and test a high-precision NMR spectrometer for the rotating nuclear demagnetization cryostat (known as the ROTA cryostat),which is used for measurements on rotating superfluid 3He. The spectrometer is based on a SQUID amplifier developed in PTB. The high signal sensitivity of this device will bring us the following advantages, compared to the current setup:<br>-- Larger NMR frequency range. It will become possible to work without a highly tuned resonant circuit at a fixed frequency, and thus it will become possible to perform measurements over a larger range of frequencies. This improvement will be useful for our current studies of energy dissipation in superfluid 3He-B in the presence of vortices, since measurements in a wide frequency range can provide information about the spectrum of quasiparticles bound to vortex cores.<br>-- Possibility to use much smaller NMR signal coils and thus improve spatial resolution. This can be useful for building an NMR microscope which can resolve individual vortices and textural point defects.<br>-- Overall better signal-to-noise ratio in all measurements. |
| **Technical description of work performed:** (250 words max) | The SQUID amplifier was tested at 4.2 K. A test setup was specially built for this purpose, based on the NMR measurement of 3He gas. The setup consists of a 40 mT NMR magnet, transmitter and receiver coils, and a sample container for the 3He gas. During the work we used the SQUID amplifier to measure the signal properties and noise sources in various experimental conditions. |
| **Project achievements** (and difficulties encountered)**:**[5] (250 words max) | We achieved quite good amplifier performance in the absence of a constant magnetic field which is needed for the NMR signal. We found that a difficulty in using the SQUID amplifier for NMR experiments, especially in CW mode, because of its high sensitivity to low-frequency noise which arises from noise and disturbances in the magnet current. For proper operation a good quality of current supply as well as mechanical rigidity of the magnet windings is needed. We also learned a few important things about electrical and magnetic shielding and mechanical design of the device. |
| **Expected publications and dates:** | The SQUID based NMR measurement will be used next for studying the relaxation properties of the low-temperature coherent trapped magnon modes as a function of frequency with a broad-band spectrometer. |
| **Submission date of user group questionnaire:** | 23 Sep, 2013 |

Completed Project Reports should be returned to MICROKELVIN Management Office

(Mari.Kaarni@aalto.fi, Fax: +358 9 47022969).

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# CERTIFICATION OF VISIT

## at MICROKELVIN Transnational Access Site

I herewith confirm that the following project was carried out at our Transnational Access Site

***O.V. Lounasmaa Laboratory – Low Temperature Section, Aalto University***

in the context of MICROKELVIN Transnational Access:

***SQUID-based NMR spectrometer for a rotating nuclear demagnetization cryostat***

The amount of access[1] delivered to the project group (project users) is as follows:

| | Participant name | Duration of stay (start – end date) | Amount of access[2] |
|---|---|---|---|
| **Project leader:** | Joern Beyer | 1 – 9 Sep, 2013 | 9 days |
| **Project user 1:** | Joern Beyer | | |
| **Project user 2:** | | | |
| **Project user ...:**[3] | | | |
| **Total amount of access delivered to project group:** | | | **9 days** |

Otaniemi 23 Sep, 2013

Location and date

Signature of access provider
**Dr. Vladislav Zavyalov**

Berlin 23 Sep, 2013

Location and date

Signature of project leader
**Dr. Joern Beyer**

Completed Certification of Visit should be returned to MICROKELVIN Management Office
(sari.laitila@aalto.fi, fax: +358 9 47022969 )

[1] TKK Helsinki, CNRS Crenoble, or Lancaster University

[2] The amount of access is defined as the time, in days, spent by the user at the infrastructure for this project, including weekends and public holidays (e.g., a scientist who spent 5 days at the infrastructure must indicate '5'). The total amount of access of the project group is the sum of access days of each project user.

[3] Please, expand if necessary.