welcome to the
European Microkelvin Collaboration

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.

► **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:	AALTO17	
Project Title:	**Microkelvin experimental platform**	
Lead scientist:[1]	**Title:**	Dr
	First name:	Jan
	Last name:	Nyeki
	Home institution:	Royal Holloway, University of London
	Birth date:	06/08/58
	Passport number:	
	Research status/Position:	Senior Research Officer
	New User:[2]	Yes
	Scientific Field:	Quantum Fluids and Solids
	Home institution:	Royal Holloway, University of London
	Is your home institution MICROKELVIN partner?	Yes
	Business address:	Department of Physics Royal Holloway University of London (RHUL)
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[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'.

2. Project information

Please, give a brief description of project objectives: (250 words max)	At the London Low Temperature Laboratory, RHUL, we are creating a facility to widen access of the scientific community to microkelvin experimental range, a key objective of the Mictokelvin Collaboration. Our aim is to provide access to external academic (UK, EU and international) and industrial users to the microkelvin (sub-dilution refrigerator base temperature) in magnetic fields up to 9T. This will contribute to the opening up of this temperature regime to new research users from a widened community, including nanophysics, semiconductor physics, strongly correlated materials. This project is funded by a £0.8m infrastructure grant and involves a collaboration with Oxford Instruments. At Royal Holloway, using our cryogenic engineering expertise, we have designed and manufactured a new microkelvin experimental platform based on a copper demagnetization stage. In order to achieve an optimal performance of the system at very low temperatures, a special heat treatment of those copper parts was crucial. The copper demagnetisation stage itself was approx 500 mm long and weighted approx 5.5 kg. It was imperative to heat treat it in vertical position in order to prevent deformation under its own weight at high temperatures. The microkelvin experimental plate was, on the other hand, heat treated while keeping the furnace in horizontal position. The Aalto Low Temperature Laboratory had available infrastructure (a custom built quartz tube vacuum furnace) and local expertise from similar tasks carried out previously there. The furnace was large enough to accommodate the parts and to perform required heat treatment procedures.
Technical description of work performed: (250 words max)	Two copper parts of the new microkelvin experimental platform were manufactured at Royal Holloway and heat treated at Aalto. The furnace at Aalto university had been working for more than a decade time in horizontal position only. It has had an option to work in vertical position as well. However, a hardware upgrade was necessary. Project itself was divided into three phases: During first visit a set of new radiation baffles, support structure for heat treatment in vertical position and loading mechanism for heavy objects were designed. All parts necessary for the furnace upgrade were manufactured at Aalto. During the second visit the experimental plate was annealed in horizontal position. After that the furnace was erected into a vertical position and refurbished with the new support structure and radiation baffles. Several test runs were performed at high temperatures in order to clean the new struc-

	tures and to tune parameters of the annealing process. RRR of test samples was measured following each run. As last, the demagnetisation stage itself was loaded into the furnace and annealed. During the final visit the RRR of test samples from stage anneal were measured. The demagnetisation stage was cleaned from unexpected surface residuum in the upper part. Both heat treated parts were transported back to Royal Holloway.
Project achievements (and difficulties encountered)**:**[5] (250 words max)	Two copper parts of the newly built microkelvin experimental platform were manufactured at Royal Holloway and heat treated at Aalto: a) the copper demagnetisation stage was annealed for 17 hours in vacuum immediately followed by 10 hour long anneal in 1.5 mbar air atmosphere, both at 800^{o}C. Target Residual Resistivity Ratio for this process was RRR ~ 500. Measurement on test pieces returned RRR=545±100. b) the microkelvin experimental plate was annealed for 42 hours in vacuum immediately followed by 28 hour long anneal in 1.5 mbar air atmosphere, both at 850^{o}C. Target Residual Resistivity Ratio for this process was RRR > 1000. Measurement on test pieces returned RRR=3870±100. As part of the project the existing infrastructure at Aalto (a quartz tube vacuum furnace) had been upgraded. This will be beneficial for other users in the future.
Expected publications and dates:	This work supports the construction of a new ultralow temperature facility, and is expected to lead to publications within the time frame of the Microkelvin project.
Submission date of user group questionnaire:	12/12/2011

Completed Project Reports should be returned to MICROKELVIN Management Office (laitila@neuro.hut.fi, Fax: +358 9 47022969).