Title: High-Tc DC SQUIDs for magnetoencephalography

Presentation Time: Thursday, Oct 11, 2012, 9:00 AM -10:30 AM

Authors: **M.I. Faley**[1], U. Poppe[1], R.E. Dunin-Borkowski[1], M. Schiek[1], F. Boers[1], H. Chocholacs[1], J. Dammers[1], E. Eich[1], N.J. Shah[1], A. Ermakov[2], V.Y. Slobodchikov[2], Y.V. Maslennikov[2], V.P. Koshelets[2];
[1]Forschungszentrum Juelich GmbH, Juelich, Germany, [2]The Kotel'nikov Institute of Radio Engineering & Electronics RAS, Moscow, Russian Federation.

Keyword: ++16 – SQUID designs and applications

Abstract: Whole-head magnetoencephalography (MEG) systems are based on low-Tc (LTc) superconducting quantum interference devices (SQUIDs), which rely on liquid helium. In contrast, high-Tc (HTc) DC SQUIDs are cooled by cheap and easy-to-handle liquid nitrogen. Besides the unlimited availability and the low cost of liquid nitrogen, the major advantage of HTc SQUIDs is that they can be placed closer to magnetic sources when compared to LTc SQUIDs. The problem, however, is to reduce the intrinsic noise of HTc SQUIDs down to 10 fT/rt(Hz) at 77 K, as required for MEG. Here, we introduce home-built multilayer HTc SQUID magnetometers that have a magnetic field resolution of 4 fT/rt(Hz) at 77 K. We demonstrate results from MEG measurements obtained using our HTc SQUIDs and a commercial LTc system for neuromagnetic brain responses recorded from one volunteer subjected to auditory stimuli. The low intrinsic noise of the HTc SQUIDs and the closer distance to the cortex result in a signal-to-noise ratio that is comparable to commercial LTc MEG systems. Our results confirm the feasibility of using HTc SQUIDs for neuromagnetic measurements and open the way for upgrading MEG systems using HTc SQUIDs. This technology promises to make MEG systems independent of helium and more user-friendly. It would also reduce running costs, which in turn hamper the widespread utilization of MEG systems in clinical practice and research.