Development of a Rat MCG System by Using High-T_c SQUID Magnetometers

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We have developed an MCG system by using a high-T_C SQUID magnetometer to measure magnetocardiograms of laboratory rats, aiming to applications for a basic physiological study on cardiac electrical activity. For the rat MCG system development, we fabricated narrow gap liquid nitrogen dewars, and table-top magnetically shielded box. Magnetic field noise of the high-T_C SQUID magnetometers measured in a magnetically shielded box was about 35 fT/Hz$^{1/2}$ with 1/*f* corner frequency of 3 Hz. Rats with weights of about 350g were anesthetized and fixed on wood table inside the shield box. The animal experiment was approved by the institutional animal care and use committee of KRISS. The SQUID sensor was put directly above the heart of a rat. The magnetic field signals induced from the cardiac electrical activity were recorded in the frequency range of 0.5 Hz to 200 Hz with 1260 sample/s. With the benefits of the narrow gap liquid nitrogen dewar, we could obtain strong *R*-peak signals of about 30 pT with well defined *P*-, *QRS*-, and *T*-wave complexes, and also well defined isoelectric *ST* segment from the averaged MCG signal of rats. In this pilot study, we measured and analyzed *QT* interval and prolongation from the MCG waveform signals for further studies of animal models of cardiac electrical activities those are well guided for clinics and industry by NIH and FDA.

Keywords : high-T_C SQUID, magnetocardiogram, laboratory animal, murine MCG