

## Measurement of Fetal Magnetocardiography Signals Using an Axial First-order SQUID Gradiometer System

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We have fabricated a low-noise 61-channel axial type first order gradiometer system for measuring fetal magnetocardiography (MCG) signals. Superconducting quantum interference device (SQUID) sensor was based on double relaxation oscillation SQUID (DROS) for detecting biomagnetic signal, such as MCG, magnetoencephalogram (MEG) and fetal-MCG. The SQUID sensor detected axial component of fetal MCG signal. The pickup coil of SQUID sensor was wound with 120  $\mu\text{m}$  NbTi wire on bobbin (20 mm diameter) and was a first order gradiometer to reject the environment noise. The sensors have low white noise about  $3\text{fT}/\text{Hz}^{1/2}$  at 100 Hz, averagely. The fetal MCG was measured from 24~36 weeks fetus in a magnetically shielded room (MSR) with 35 dB, 80 dB shielding factor at each of 0.1 Hz and 100Hz (comparatively mild shielding). The MCG signal contained maternal and fetal MCG. Fetal MCG could be distinguished comparatively easily from maternal MCG by using independent component analysis (ICA) filter. In addition, we could observe T peak clearly as well as QRS wave. It may be useful to detect fetal cardiac diseases.

Keywords: SQUID, MSR, fetal MCG, ICA filter