

# High-Resolution Laser-Assisted Magnetic Nanoparticle Imaging Using a High- $T_C$ SQUID Magnetometer

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**Abstract**—A new type of magnetic nanoparticle imaging (MPI) system has been proposed and developed. The spatial resolution of MPI systems is generally determined and limited by the size of the magnetic sensors used and the magnetic properties of the nanoparticles detected. Here, high-resolution imaging of magnetic particles was realized by combining the MPI system with a high- $T_C$  SQUID magnetometer and laser scanning system. The spatial resolution of this system was not determined by the properties of the magnetic nanoparticles but was determined by the laser spot size focused on samples. Thus, the higher spatial resolution imparted by conventional MPI systems could be expected. As a demonstration of the imaging system, two cylindrical containers filled with magnetic particles solutions were fabricated and measured. Although the containers were spaced only 2 mm apart, they could be clearly distinguished by the obtained signals. A knife-edge analysis was also applied to the obtained signals, and the spatial resolution of our system was estimated to be approximately 0.9 mm.

**Index Terms**—Biomagnetics, high-resolution imaging, magnetic particles, measurement by laser beam, SQUID.

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