



Invention Available for Licensing **Advanced Imaging**

Title: *Novel scanners for Magnetic Particle Imaging*

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Inventors: *Alexey Tonyushkin, Ph.D.*

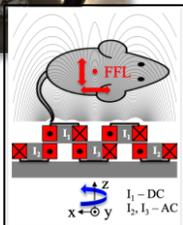
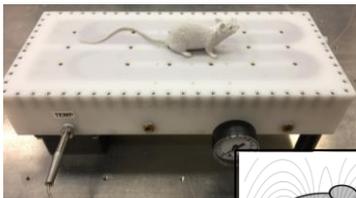
- Applications:**
- Full-body or body parts scanning for research and preclinical use
 - Breast cancer screening, cardiovascular imaging, brain angiography
 - Non-medical imaging applications include material science, geological surveys

- Benefits:**
- Improved signal-to-noise (SNR) ratio, leading to significant cost savings
 - Sufficiently deep penetration of the magnetic field to allow imaging of human organs
 - Non-invasive imaging without use of radioisotopes or toxic tracers

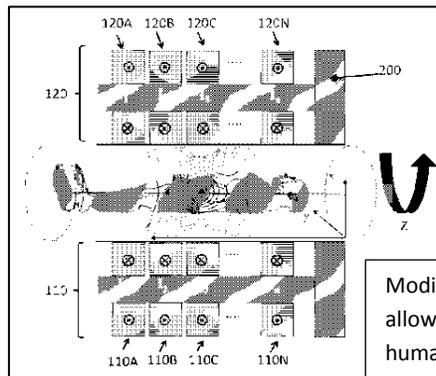
Technology Description: Magnetic Particle Imaging (MPI) is a reconstructive imaging method, like CT or MRI. It utilizes various magnets, which can generate a static magnetic gradient field, often called the selection field, with a field-free region (FFR) at the center of the scanner. The magnets are surrounded by the oscillating coils, which generate a drive field, which moves the FFR along a predetermined trajectory throughout a volume of scanning. To scan an object such as an animal or human body, a contrast agent containing magnetic nanoparticles, i.e., superparamagnetic iron oxide (SPIO), must be injected into the bloodstream prior to the scan. As the FFR moves along the desired trajectory, the receive coils detect the changed magnetization of the SPIOs caused by the changing magnetic field, with high sensitivity and zero background from the surrounding tissues.

This invention provides modified scanner geometries to improve existing MPI systems. In particular, the geometry of the selection coils, for the first time, allows translation of the MPI technology to image *in vivo* parts of the human body. In another embodiment, the invention allows for the magnetic field to be generated on a single side rather than surrounding the object to be scanned. The invention is expected to be particularly useful for breast cancer screening and interventional procedures.

Patent and Publication Status: UMass Boston has filed [U.S. and European patent applications](#) on this invention, and the U.S. application has been allowed. The research underlying the invention has been published in several papers, including A. Tonyushkin, [IEEE Trans. Magnetics, 53\(9\):5300506 \(2017\)](#); A. Tonyushkin, [Intl J. Magn. Particle Imaging, 3\(1\):1703009 \(2017\)](#); and G. Rudd, A. Tonyushkin, [Intl J. Magn. Particle Imaging, 4\(1\):1809001 \(2018\)](#).



“Single-Side” embodiment of the invention.



Modified coil geometry to allow *in vivo* imaging of the human body

For more information:
 David J. Glass, Ph.D.
 University of Massachusetts
 Boston
 Office: 617-287-5710
 Cell: 617-653-9945
david.glass@umb.edu