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Guest Editorial

New Developments in the Magnetic Particle Imaging Research Fields Instrumentation and Particle Synthesis

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Abstract

The first issue of the fourth volume of the International Journal on Magnetic Particle Imaging (IJMPI) includes 4 papers that were mostly presented in short format at the 8th International Workshop on Magnetic Particle Imaging in Hamburg. The papers cover the Magnetic Particle Imaging research areas application specific particle synthesis and instrumentation of imaging as well as spectroscopic devices.

Magnetic Particle Imaging (MPI) is a tomographic imaging method that allows to image the spatio-temporal distribution of magnetic nanoparticles [1]. During the last decade a variety of new developments for imaging devices, particle synthesis, particle characterization, image reconstruction and application validation has been presented [2].

The first issue of the fourth volume of the IJMPI contains 4 papers covering the MPI research areas application specific particle synthesis and instrumentation of imaging as well as spectroscopic devices.

In the field of application specific particle synthesis the authors of [3] present a SPION tracer optimized for the purpose of magnetic drug delivery that also can be used for hyperthermia and Magnetic Resonance Imaging. In the contribution it could be shown that the tracer also shows MPI signal within an imaging device although the nanoparticle structures are not ideal for imaging with MPI. This is an important step towards theranostics in MPI, which is a highly promising current research field [4, 5].

In the field of instrumentation this issue includes three different aspects ranging from a model for coil development [6] over a selection field setup for a single sided field free line (FFL) scanner [7] to the presentation of a complete working setup of a 3D spectrometer [8].

In [6] a method is presented to predict the impedance and homogeneity of a multi-layered coreless solenoid coil for different frequencies, using analytical formulas as well as finite element method data in combination with a SPICE circuit solver. The model is evaluated by building an optimized drive field generator for the use in a dual-frequency MPI scanner.

A next important step towards a single sided FFL scanner is made in [7], where a selection field setup build from permanent magnets is presented. Thus, the power consumption is reduced efficiently. A similar approach was already presented for the drive field setup in [9].

In [8] the first 3D Magnetic Particle Spectrometer (MPS) is presented including first measurement results. The detectable number of harmonics and mixing frequencies exceeds the usable frequency range in current MPI imaging systems. Thus, this MPS can be used to record 3D hybrid system matrices. In [10] it was already

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shown that hybrid system matrices can be measured fast and result in excellent image reconstruction results for 2D data.

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