



UKE Paper of the Month Mai 2019

Human-sized magnetic particle imaging for brain applications

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ABSTRACT: Determining the brain perfusion is an important task for diagnosis of vascular diseases such as occlusions and intracerebral hemorrhage. Even after successful diagnosis, there is a high risk of restenosis or rebleeding such that patients need intense attention in the days after treatment. Within this work, we present a diagnostic tomographic imager that allows access to brain perfusion quantitatively in short intervals. The device is based on the magnetic particle imaging technology and is designed for human scale. It is highly sensitive and allows the detection of an iron concentration of $263 \text{ pmol}_{\text{Fe}} \text{ ml}^{-1}$, which is one of the lowest iron concentrations imaged by MPI so far. The imager is self-shielded and can be used in unshielded environments such as intensive care units. In combination with the low technical requirements this opens up a variety of medical applications and would allow monitoring of stroke on intensive care units.

STATEMENT: *In this work we showed that MPI is capable of addressing an unmet need within the intensive care units for stroke patients. The next step is to develop the system further to enable measurements on living suspects like large animals. Besides this important factor it is also the first MPI device addressed for human brain imaging and thus a major step both from the medical and the engineering point of view.*

BACKGROUND: The work was performed at the Section for Biomedical Imaging in the group of author Prof. Tobias Knopp who holds a professorship at UKE since 2014. Dr.-Ing. Matthias Gräser joined the group in 2017 and started the project in april 2017. Both have strong research interests in the field of Magnetic Particle Imaging, Tobias Knopp with a special focus on signal processing and image reconstruction while Matthias Gräser focusses on instrumentation and sensitivity improvements.