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MRI Phantom for Determination of the Direction of Nerve Fibers in the Brain

Medical imaging is increasingly used to investigate the anatomical connectivity of the human brain prior to brain surgery. With this new method, it is possible to produce a phantom representing the fine structures of nerve tissue for the exact calibration of diffusion MRI devices to achieve a previously unreached representation of detail. This will open new possibilities for applications of MRI.

BACKGROUND

Despite increasing capabilities of imaging technologies, the exact representation of natural, highly complex brain structures in a quality required for brain surgery is still a challenge. Diffusion-weighted imaging (DWI) is a high potential technique for investigations of the anatomical connectivity of the human brain. However, phantoms for calibration and validation of such applications are not available due to the complexity and intricacy of the studied structures.

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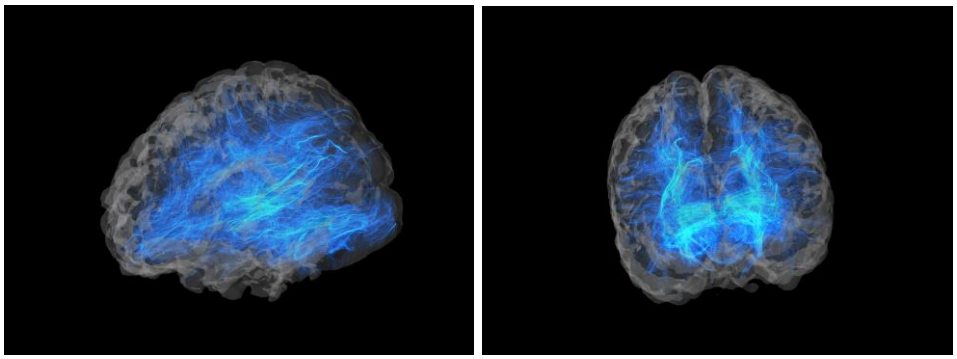
The diffusion phantoms presented here represent the fine structures of nerve tissue for the exact calibration of MRI devices to allow determination of the exact geometry and gradient of the fibers in various parts of the brain. The phantom design is characterized by small fiber diameter (close to the axon diameter), sharply bounded fiber walls to maximize the signal, crossing fiber layout with defined geometry for exact calibration.



Figures: Brain white matter fiber structure determined with Magnetic Resonance Imaging (MRI) using Diffusion Tensor Imaging (DTI)

ADVANTAGES

- First phantom prototypes were produced using a commercially available high-resolution 3D printer
- Hitherto unreached fiber geometries
- Validation data available

REFERENCE:
M030/2017

APPLICATIONS:
Calibration of MRI

DEVELOPMENT STATUS:
Prototype

KEYWORDS:
MRI, diffusion, imaging, phantom, brain, nerve fiber, tractography

IPR:
PCT Application

OPTIONS:
R&D - Cooperation
License agreement

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