

Application for Round-3 QIBA Project Funding

Title of Proposal: DCE-MRI Phantom Study to Evaluate the Impact of Parallel Imaging and B1 Inhomogeneities at Different MR Field Strengths of 1.0T, 1.5T, and 3.0T		
QIBA Committee/Subgroup: MR / PDF-MRI		
Task Number(s) which this project addresses: 1a, 1b, 1c, 1d		
<b>Project Coordinator or Lead Investigator Information:</b>		
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Amount Requested:		

## Introduction

Dynamic contrast enhanced (DCE) MRI allows the assessment of tumor perfusion and vessel permeability and represents the most widely used preclinical and clinical research approach in this area. Recently, the QIBA PDF-MRI Technical Committee released the DCE-MRI profile v1 for image acquisition and analysis with a proposed within-subject coefficient of variation of 20% at 1.5 Tesla. However, the impact of parallel imaging and B1 field inhomogeneities for T1 mapping is still not completely investigated, particularly at higher field strengths, like imaging of prostate cancer at 3.0 Tesla. Commonly used DCE-MRI protocols and software do not include parallel imaging and/or B1 field inhomogeneity correction for improved T1 mapping.

## Project description

For this project, we are planning to acquire T1 maps using the variable flip angle technique and the QIBA DCE-MRI phantom (MD Anderson Cancer Center) at 1.0 Tesla (Philips Panorama), 1.5 Tesla (Philips Achieva), and 3.0 Tesla (Philips Achieva) at the University Hospital Cologne (Germany). The DCE-MRI phantom will be scanned using the Q-body coil and surface coil with and without parallel imaging. The MR protocol will be remeasured after repositioning of the phantom and the surface coil. B1 maps will be acquired to correct for the flip angle on a pixel-by-pixel basis. MR data will be exported as PAR/REC and DICOM, and provided for an open image archive. T1 maps will be calculated by using the Philips permeability software (Version 5.2, based on PAR/REC) with and without B1 correction. The measured T1 data of the various imaging techniques and field strengths, as well as the T1 mapping with and without B1 correction, will be used to measure the individual and population biases, and the reproducibility coefficient (RDC); 95% Confidence Intervals (CIs) will be constructed. The bias and precision of the imaging techniques will be compared using repeated

measures analysis and various component analysis, respectively. DICOM data will also be analyzed by using DynaLab software (Fraunhofer MEVIS, Germany). Moreover, for analysis of variance across different MR scanners, the QIBA DCE-MRI phantom will be also measured at 1.5 Tesla and 3.0 Tesla MR scanners from Siemens (Fraunhofer Institute Bremen and University Hospital Freiburg, Germany) and GE (MGH and University of Wisconsin, USA). Corresponding Philips, Siemens, and GE DICOM data will be compared by using DynaLab software (Fraunhofer MEVIS, Bremen).