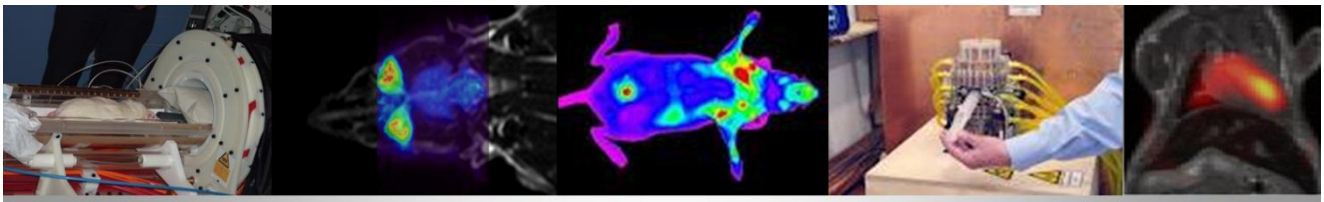


The department of **"Physics of Molecular Imaging Systems"** (**PMI**) is exploring future molecular imaging technologies. The research areas range from new detector concepts, simulations, hardware prototypes, high speed data processing, image reconstruction algorithms to applications. Our group consists of students and researchers from different disciplines: physics, engineering, computer science, and medicine. PMI (faculties of Physics and Medicine) is part of a large international network with a close link to industry, especially Philips Research.

Referenceless MR thermometry to monitor tissue heating

MRI thermometry

MR thermometry is based on the proton resonance frequency shift with temperature. It provides a non-invasive and accurate means of determining the temperature shift within a 2D or 3D region of interest in the body [1]. In interventional radiology, MR thermometry is used for the control of MR-guided minimal invasive treatments such as HIFU or laser ablation.

In its standard form, MR thermometry measures the phase shift due to heating with respect to a baseline phase image. An improved version of MR thermometry is called the "referenceless" method [2]: The need for a baseline image is eliminated by fitting a background phase to each measurement. This method is therefore more stable with respect to motion artifacts and the constant phase drift of the MRI scanner.

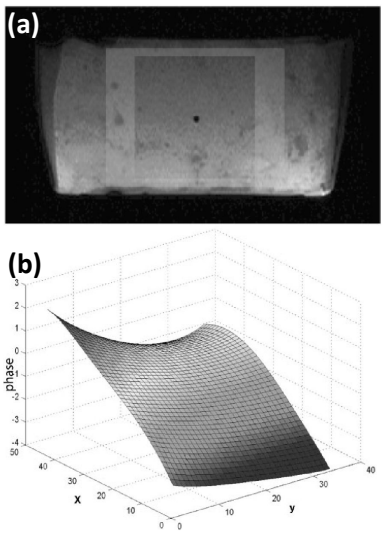
The AdapTT project

AdapTT (Adaptive thermal therapies in oncology care) is a PHILIPS project which aims to plan and optimize radiofrequency ablation therapy outcomes by numerical means. The numerical models demand for reliable experimental validation methods such as MR thermometry.

Your thesis

After understanding the basics of MRI physics and MRI thermometry, it is your task to set up a referenceless MR thermometry data treatment method as described in [2]. Therefore, you will be provided with a thermometry test data set from a phantom experiment. You will compare the result of the referenceless method to the standard baseline subtraction and thereby validate your data treatment method. In a second step, the referenceless method could be applied to a "real" MR HIFU dataset. If you are in addition interested in the MRI measurement itself, we are having access to a clinical Philips 3T Achieva scanner.

We are looking for a highly motivated student with an interest in MRI physics and improving data treatment methods. Programming skills in QT/C++ are advantageous.



(a) Magnitude image showing a frame region of interest. To the frame ROI, a polynomial background phase (b) is fitted and subtracted from the corresponding phase image. (figures cf. [2])

Literature:

[1] Rieke et al: MR Thermometry. Journal of Magnetic Resonance Imaging, 27:376–390 (2008)

[2] Rieke et al: Referenceless PRF Shift Thermometry. Magnetic Resonance in Medicine 51:1223–1231 (2004)

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