Magnetic Resonance Imaging: Characterization of gradient non-linearities on clinical MRI scanners.

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Project type: Experimental.
Main goal: To characterize the actual gradient ampltudes as function of position in two different 3 Tesla clinical MRI scanners at St.Olavs Hospital.

The background for this project is as follows:

1. It is becoming increasingly popular to use the absolute value of the apparent water-self-diffusion coefficient (ADC) in living tissue as measured by MRI for diagnostic purposes.
2. The measurement of ADC assumes perfectly linear magnetic field gradients inside the MRI scanner. However, in reality these gradients are not linear, they usually fall off towards the outer parts of the field-of-view. This leads to a systematic underestimation of ADC towards the edges of the image, as illustrated in figure 1.

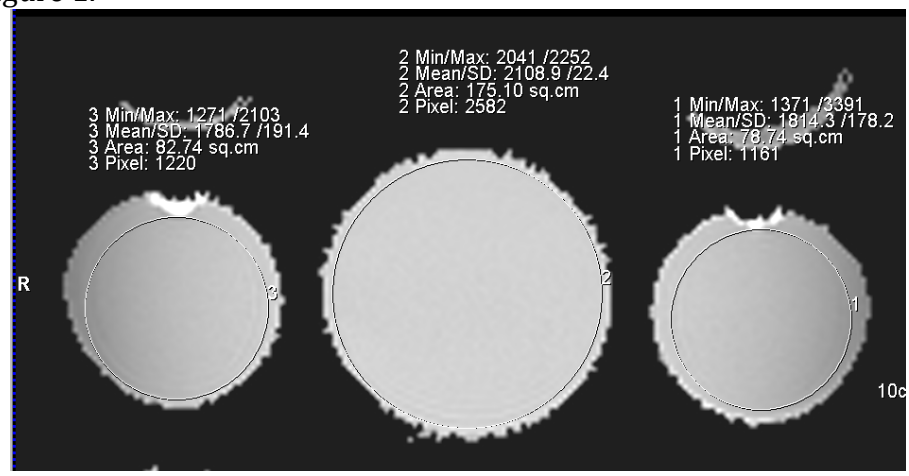

Figure 1. Example image of three water bottles with position-dependent variation in the apparent diffusion coefficient ADC (see min/max and mean values for the three ROIs, ADC in units of 10^{-3} $\mu m^2/s$). (Image: P.E.Goa).

Project description:

- The student will plan and perform the measurements required to characterize the actual gradient x-, y- and z- amplitude as function of position in two different scanners; Siemens 3T Prisma and Siemens 3T Skyra.
- The student will analyze the data and create maps of the scaling factor between true and the nominal gradient amplitude.
- The student will use the results to correct measurements of ADC both in water phantoms and in patients.