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**Title:** “Low field MRI: hardware, data acquisition, image processing, sustainability and in vivo applications”

**Abstract:** Commercial magnetic resonance imaging (MRI) systems cost millions of pounds to purchase, require large electromagnetically shielded spaces to house, are extremely expensive to maintain and require highly trained technicians to operate. These factors together means that their distribution is confined to centrally-located medical centres in large towns and cities. Globally over 70% of the world’s population has absolutely no access to MRI, and clinical conditions which could benefit from even very simple scans cannot be treated. In the financially developed world, although MRI is diagnostically very important, the high cost and fixed nature prohibits any type of role in widespread health screening, for example. The magnetic fields typically used are very high, which means that there are severe contraindications so that, for example, MRI cannot currently be used in the emergency room. From the considerations above it is clear that if low-field MRI could be made more portable, accessible and sustainable then it would open up new opportunities in both developed and developing countries.

Rather than designing a highly sophisticated and expensive piece of equipment that can be used for all types of scanning, we use the philosophy of tailored design, such that we can design much more inexpensive systems for specific medical applications. Thus rather than one large MRI, the model is similar to having tens of different mobile ultrasound machines in a medical facility. In order to achieve portability, we design systems that use thousands of very small low-cost permanent magnets, arranged in designs which have no fringe field and therefore very easy siting requirements. The low magnetic fields allow scanning of patients with implants, and the scanner could potentially be transported on an ambulance for differentiation of hemorrhagic or ischemic stroke, for example.

This talk will cover aspects of magnet, gradient and RF coil design for low fields (~50 mT) , as well as corrections for gradient- and B0-distortions, and present the latest in vivo results as well as an outlook on future developments.