

# Improving the Safety and Efficiency of Head Imaging with High-Field MR

**Robert Kosior, PhD**

*Post-doctoral fellow, Madrid-MIT M+Visión Consortium  
Massachusetts Institute of Technology, Cambridge, MA, USA  
Universidad Rey Juan Carlos, Madrid, Spain*



**27 February 2012  
HSC 1405B**

This collaborative project is motivated by the need to improve the efficiency of ultra-high field magnetic resonance (MR) systems (e.g., 7-T systems) for imaging patients with neurological diseases such as multiple sclerosis (MS). 7-T MR systems reveal MS lesions with greater sensitivity than lower-field MR system and thus show promise for improving the diagnosis, and the monitoring of the therapeutic efficacy in clinical trials. However, the specific absorption rate (SAR) or the power deposited in patients may cause unsafe tissue heating, which poses a significant safety constraint that limits the implementation of ultra-high field MR systems. To address this problem, the project comprises the investigation into and development of methods to reduce the level of SAR caused by standard MR pulse sequences to enable their efficient usage at 7-T.

One easy but inefficient way to manage SAR is to increase the acquisition time to lower the overall absorption rate. A more sophisticated approach involves the use of a parallel transmission (multi-channel drive) array for greater control over the radiofrequency (RF) field. With a parallel array, field homogeneity can be improved with a concomitant reduction in local SAR. A multi-channel array also allows for targeted reduction of SAR in specific regions. We are implementing a method at 7-T to direct the electric field (Eryaman Y et al. MRM, 2011) for achieving low-SAR zones. With this approach, low-SAR zones are directed at SAR-sensitive regions, or other hot spots identified through simulation. The robustness of this method will be tested with industry-standard phantoms and multi-compartment anthropomorphic phantom experiments. Developing this approach comprises a key objective towards improving a 7-T MR clinical protocol used to study diseases such as MS.

