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Title: MRI-informed electrical impedance tomography from phantom to thorax

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Body: Electrical impedance tomography (EIT) has the potential to provide non-invasive, high temporal resolution, long term lung function monitoring. We present an instrument capable of volumetric data acquisition applied to a male torso, show an MRI-informed reconstruction, and correspondence of EIT measurements with high resolution MRI.

EIT data were acquired using two planes of 16 electrodes on the Manchester fEITER system, a BS EN 60601-1:2006 compliant system, followed by MRI acquired using fast field echo on a 1.5 T Philips Achieva. The data were coaligned using the open source medical image platform 3D-Slicer. Figure 1(a)-(c) shows an MRI axial slice of the torso, coalignment with EIT, and EIT alone. The system acquired volume data using 32 electrodes in two planes. The EIT was reconstructed using a torso boundary-only model derived from the MRI. This should produce a more faithful reconstruction than a generic model, allowing investigation of sensitivity of EIT measurements using increasingly precise models. At 100 fps, the EIT provides excellent temporal resolution. For example, it shows different temporal sequences of lung ventilation (dorsal versus ventral) within the breathing cycle for an upright subject as compared with supine. Current analyses of EIT data for lung function monitoring use sub-cycle statistics and time differentials; the (minimum) 3-fold increase in frame rate provided by fEITER will improve these methods substantially.