Simulation and comparison of coils for Hyperpolarized 13C MRS cardiac metabolism studies in pigs - DTU Orbit (08/11/2017)

Simulation and comparison of coils for Hyperpolarized 13C MRS cardiac metabolism studies in pigs

Hyperpolarized 13C Magnetic Resonance represents a promising modality for in vivo spectroscopy since it provides a unique opportunity for the non-invasive assessment of regional cardiac metabolism. Although it represents a powerful tool for the study of the heart physiology in pig models, by permitting metabolic activity mapping, a number of technological problems still limit this technology and need innovative solutions such as the design of suitable radiofrequency (RF) coils, capable to provide a large sensitivity region. This work describes the simulation and the comparison of different 13C coil configurations, constituted by various arrangement of circular, butterfly and birdcage coils designed for hyperpolarized studies of pig heart with a clinical 3T scanner. The coils characterization is performed by developing a Signal-to-Noise Ratio (SNR) model, previously validated with experimental results, for coils performance evaluation in terms of coil resistance, sampleinduced resistance and magnetic field pattern. In particular, coil resistances were calculated from Ohm's law, while magnetic field patterns and sample induced resistances were calculated using a numerical Finite-Difference Time-Domain (FDTD) algorithm. Theoretical SNR-vs-depth profiles were calculated for each coil configuration. We believe the paper could be interesting for graduate students and researchers in the field of magnetic resonance coil design and development, especially for 13C studies.

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