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Exploring ^{10}B MRI at 11.74 T: Preliminary Results

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Boron-10 (10B) is the active isotope used in boron neutron capture therapy (BNCT); therefore, accurate quantification of its concentration and spatial distribution is essential. Direct MRI of 10B is challenging due to its low sensitivity. Ultra-high-field MRI systems (e.g., 11.74 T) provide increased signal-to-noise ratio and enable improved characterization of contrast mechanisms relevant to BNCT. In this study, we evaluate curve-fitting approaches to estimate boron concentration indirectly using proton (1H) imaging of phantoms containing boronophenylalanine (BPA), a 10B delivery agent.
- Gradient-echo images were acquired on an 11.74 T MRI system
- A phantom consisting of 15 containers with water–BPA mixtures at different concentrations (ppm) was prepared.

This study demonstrates the feasibility of indirectly estimating BPA concentration using proton-based T2* mapping at 11.74 T. The observed non-linear relationship indicates that the system does not follow a simple relaxation model, likely due to susceptibility and microstructural effects.

A dependence on T2* and BPA concentration can be observed. The curve fitting methods tested in this work are shown in Fig 2. Direct fitting between T2* and BPA yielded R^2=0.60, with limited discrimination at higher concentrations (≥100 ppm). Applying logarithmic scaling improved performance: fitting R2* versus BPA achieved R^2=0.84, while fitting in log–log space further improved the correlation to R^2=0.88. Logarithmic transformation of T2* effectively inverted the trend, improving separability and consistency with previous findings.

Although evaluated in simple phantoms, this approach shows potential for BNCT-related imaging, complementing direct 10B detection methods.

Keywords: *Ultra-high field, MRI, Boron, Curve fitting*