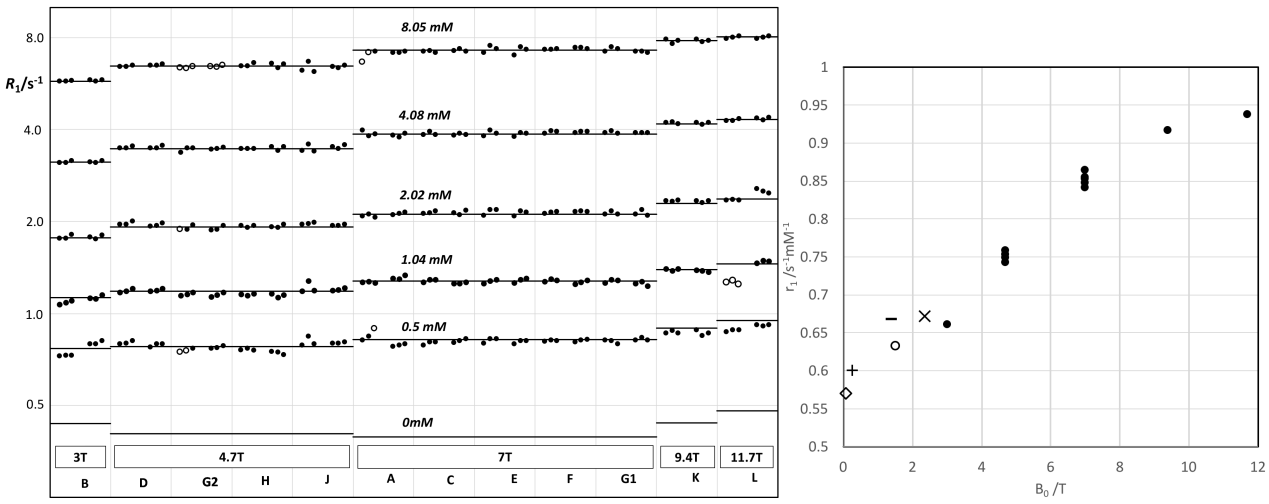
Accuracy, repeatability, and reproducibility of R_1 in 12 small-animal MRI systems.

JC Waterton[a,b], CDG Hines[c], PD Hockings[d,e], I Laitinen[f], S Ziemian[g], S Campbell[h], M Gottschalk[i], C Green[g], M Haase[h], K Hoffmann[f], H-P Juretschke[f,1], S Koehler[j], W Lloyd[b], Y Luo[k], I Mahmutovic Persson[i], JPB O'Connor[b], LE Olsson[i], GJM Parker[a,b], K Pindoria[h], JE Schneider[l], D Steinmann[f], K Strobel[j], I Teh[l], A Veltien[M], X Zhang[k], G Schütz[g]
[a]Bioxydyn, [b]U. of Manchester, [c]Merck, [d]Antaros, [e]Chalmers U. of Technology, [f]Sanofi-Aventis, [g]Bayer, [h]GSK, [i]Lund U., [j]Bruker, [k]Abbvie, [l]U. of Leeds, [m]Radboud U. ([1]former)
on behalf of the TRISTAN consortium www.imi-tristan.eu

Background: Many translational MR biomarkers derive from measurements of the longitudinal relaxation rate R_1, but evidence for between-site reproducibility of R_1 in small-animal MRI is lacking.
Objective: To assess R_1 repeatability and multi-site reproducibility in phantoms for preclinical MRI.
Methods: R_1 was measured by saturation recovery in 2% agarose phantoms with five nickel chloride concentrations in 12 magnets at 5 field strengths in 11 centres on two different occasions within 1-13 days. R_1 was analysed in three different regions of interest, giving 360 measurements in total. Root-mean-square repeatability and reproducibility coefficients of variation were calculated. Relaxivities were calculated.
Results: Day-to-day repeatability (N=180 regions of interest) was 2.3%. Between-centre reproducibility (N=9 centres) was 1.4%. The relaxivity of aqueous Ni^{2+} in 2% agarose varied between 0.66 $s^{-1}mM^{-1}$ at 3T and 0.94 $s^{-1}mM^{-1}$ at 11.7T.



Figures. Left: R_1 measurements (log axis) for each of centres A-L. Each centre made measurements on five 2% agarose phantoms with different Ni^{2+} concentrations. The 30 horizontal lines represent R_1 values calculated from the field-dependent relaxivities. There are two groups of three data points for each phantom at each centre representing, respectively, days 1 and 2, and RoIs at three spatial locations. Open symbols: data points with fit error >5%. **Right**: [Ni^{2+}] relaxivities in 2% agarose against B_0. Circles: this work. Other symbols: **-**, parameter c_1 in [1]. **+**, figure 1 in [2]. **×**, figure 4 in [3]. **◇,** figure 2 in [4].

References: [1] Captur G, et al. *J Cardiovasc Magn Reson* 2016;**18**:1–20. [2] Christoffersson J O, et al. *Acta Radiol* 1991;**32**:426–31.[3] Kraft KA, et al. *Magn Reson Med* 1987;**5**:555–62. [4] Howe FA. *Magn Reson Imaging* 1988;**6**:263–70.
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