AbstractID: 6419 Title: Qualifying Magnetic Moments in Small Cylindrical Objects by Complex Sum Method

Purpose: Our ultimate goal is to quantify magnetic moments of small cylindrical objects *in-vivo* from MR images, without any a priori information. We want to achieve this goal with the complex sum method [1,2].

Methods: Simulation procedures and the experimental setups were described in [1]. The magnetic moment is defined as $p = 0.5\gamma\Delta\chi B_o TEa^2$. The magnetic moment of an object is proportional to the phase values around the object in MR phase images. Three concentric circles were chosen on a phase image with radii R_1, R_2 and R_3. In the simulations, if the magnetic moment is known in advance, the phase values around the object can be used to determine the radii, using formulas in [3]. Each radius has to be larger than the size of the phase aliasing area[2]. Knowing the radii can be used to determine the magnetic moment of the object [2]. We also study the uncertainties of the magnetic moment with the presence of both systematic and thermal noises through error propagation methods. A gel image is also analyzed.

Results: For the uncertainty studies, we found that the phase combination $(\varphi_1,\varphi_2,\varphi_3)=(3,2,1)$, in units of radians, leads to an uncertainty of the magnetic moment within 3% of the expected moment, which seems to be the lowest uncertainty. Using this phase combination and the known magnetic moment -5.78 ppm-mm^2 from gel data [1], we were able to determine those three radii and then solve the magnetic moment between the gel-air interface. The result is -5.53 ppm-mm^2 which is within 5% uncertainty of the expected value.

Conclusions: We have shown that the current method is feasible of extracting the magnetic moment of a small cylindrical object within good accuracy.

[1] Cheng et. al, *MRI*, 2007, in press.
[2] Hsieh et. al, ISMRM, 2007 in press.
[3] Haacke et. al, MRI, 1999.