AbstractID: 3467 Title: Performance Evaluation of Magnetic Field Homogeneity in MRI

Purpose: Poor main (B_o) magnetic field homogeneity (MFH) leads to artifacts in MR images. The ACR MRI QC Manual mandates annual checks of MFH, suggesting tests using spectral line widths (FWHM) and phase-difference ($\Delta\phi$)maps. A new method for determining MFH is proposed and compared with standard methods using three different phantoms.

Method and Materials: Small receiver bandwidth (BW) in the presence of poor MFH leads to geometric distortions because gradients are reduced to the level of the B_o inhomogeneities. The proposed bandwidth-difference (ΔBW) method compares the distortion for small and large BW acquisitions to determine the MFH. Data were acquired using a 3T system and FFE pulse sequence scanned twice with BW's of 50 Hz and 501Hz, respectively. MFH was measured from the shift of landmarks between the two BW acquisitions. Data were compared with data from the FWHM and $\Delta\phi$ methods.

Results: Measured FWHM = 0.06 ppm@13.5cm DSV for the manufacturer's phantom, 0.27 ppm over the 19cm(diam) $\times$ 15cm(length) ACR phantom and 0.07ppm@27.9cm DSV in our spherical homogeneity phantom. The $\Delta\phi$ images showed pronounced areas of poor MFH near the corners of the ACR phantom, which were not evident in the other phantoms. The ΔBW method could not be used in phantoms without landmarks, but in the ACR phantom MFH was measured to be 0.43 ppm in the axial direction and 0.86 ppm in the saggital direction. In the spherical phantom ΔBW measurements show MFH=0.16 ppm@15.3 cm DSV to 0.32 ppm@18.83cm DSV.

Conclusions: Spectral line width measurements of MFH on spherical phantoms can be useful however the acquired data are only for one DSV. The ΔBW method produces measurements of MFH at various DSV values that can be obtained from a single set of phantom images.