AbstractID: 5712 Title: Impact of Hardware Errors and Patient Movement on Standardized MR QA Tests for Noncartesian Pulse Sequences: Are these Standard QA Tests Sufficient ?

Purpose: The American College of Radiology (ACR) phantom was designed during a stage when most pulse sequences were rectilinear. Noncartesian trajectories (including Projection Reconstruction and Spiral imaging) are becoming more widely available on most standard clinical scanners. Our goal was to assess if either 1) ACR quality assurance (QA) tests, 2) Root Mean Square Error (RMSE), or 3) by Visual Inspection, or a combination of the above methods would adequately assess the types of image artifacts associated with these radial methods.

Method and Materials: Simulation in Matlab and C was written to reconstruct ACR phantom images using projection and spiral methods. Additive and multiplicative phase distortions and as well as center of k-space misregistration artifacts were introduced to test their impact on phantom images for both reconstruction methods. Additional artifacts of gradient delay, amplitude modulation and miscalibration of gradient amplitude were tested for spiral reconstruction. Images were then evaluated using the above mentioned techniques.

Results: Gradient delay, miscalibration of gradient modulation and k-space center misregistration affected all tests. However, the ACR QA test did not effectively demonstrate the influence of certain artifacts (phase distortion artifacts and ghosting) in projection and spiral reconstructed images. RSME was effective for most tests in determining the overall severity (i.e. larger RMSE demonstrates more artifacts). However, RMSE was not useful for assessing phase distortion.

Conclusions: We noted that for specific artifacts, QA and RMSE tests were not sufficient alone. Visual inspection is time consuming, but is not necessarily a true objective test of performance as ACR QA. A compendium of noncartesian induced hardware artifacts was generated for Physicist Referral and we believe a combination of all above methods 1) ACR QA, 2) RMSE and Visual Inspection would be the appropriate test for validating scanner performance.