AbstractID: 12715 Title: Evaluating Dynamic Magnetic Resonance Imaging using a New Design of Phantom: Validation with Fast Megavoltage Fluoroscopic Imaging

Purpose: To devlope a reliable and economic phantom for motion management study and investigate its feasibility in evaluating dynamic MRI.

Method and Materials: Experiments was performed using an in-house developed phantom that consists of a platform, a low-elastic thread and a motion phantom driven by a motor in various modes. A small cylinder object was placed on the platform as an imaging object. The design allows metallic motor to be away from the MRI scanner and thereby immunizes the interferences between them. To test its reproducibility, the phantom was setup separately for three times and imaged using fluoroscopy with the same motion mode with an amplitude of 18mm and a period of 5 seconds. An EPID detector was used for fluoroscopy with a high temporal resolution (8 frames/second). Because of free of distortion and fast imaging, fluoroscopy is considered as reference. After this, the phantom was tested with MRI and fluoroscopy with five different motion modes, each with a different period from 4-6 seconds and amplitude from 16-20mm. MR images were acquired on a 1.5T GE scanner with the sequence of FIESTA. (flip angle 50^{o}, matrix 198x128, FOV 30cm, TR 3.2ms, TE 1.0ms, slice thickness 5mm, 2.5 frames/second).

Results: The reproducibility test shows consistent agreement among the three measurements. A quantitative analysis yields an average standard deviation (SD) of trajectory profiles of 0.28mm, ~1.5% of the amplitude. Comparison between MRI and fluoroscopy for five different modes shows that the trajectory profiles by MRI are generally consistent with references. The discrepancies measured by average SDs are from 0.31-0.5mm, relatively small compared with amplitudes from 16-20mm.

Conclusion: A reliable and economic motion phantom is developed and successfully used to evaluate dynamic MRI. As a general tool, the phantom can be used to assess motion management of other modalities including 4DCT and PET.