Multiple Imaging Modality Isocentricity Phantom

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Introduction

To develop a fast and simple means of cross-testing the isocentricity of four systems, cone beam CT (CBCT) and on, on-board imaging (OBI), optical guidance, and in-room lasers. We have employed a prototype of the new Standard Imaging's MIMI (Multi Imaging Modality Isocentricity) phantom. In addition we are using Varian's iX linac with CBCT, OBI, and Varian's optical guidance system with passive fiducials. The OBI portion was done using megavoltage electronic portal imaging with OBI software.

Goal

- The goal is to integrate the QA of optical guidance, CBCT, OBI, and in-room lasers.
- This test can be for quick and routine weekly or monthly checks of these systems.
- We have placed a passive fiducial localizer with four infrared light reflecting markers on top of the MIMI phantom to test the optic guidance system.
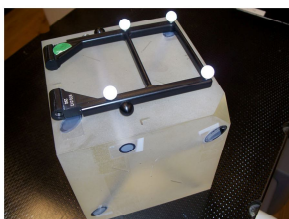
Method

- An axial CT scan of of the MIMI with the localizer secured on top of the phantom was obtained.
- CT scan was transferred to ADAC Pinnacle v8.0m and a simple plan generated with the isocenter in middle of the phantom and the rods in the MIMI outlined.
- ADAC plan transferred to the optical guidance control computer and the fiducials were registered.
- CBCT field and OBI fields were setup in Aria 8.1
- The calibration of the optical guidance system was verified with respect to in-room lasers.
- The phantom was aligned to isocenter using the optical guidance readout.
- The MIMI is sitting on top of the 2D-head holder--so that rotational adjusts around the sup-inf axis and the left-right axis can be made.
- Then orthogonal MV OBI images were acquired and a 2D/2D Match was performed.
- Then a CBCT was acquired and a manual match was performed.
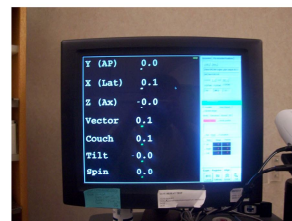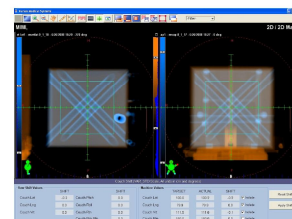
MIMI Phantom
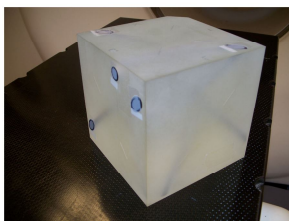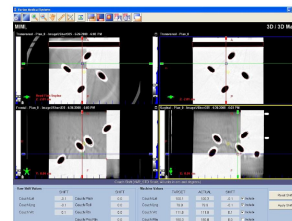

MIMI with localizer

MIMI Phantom on Linac
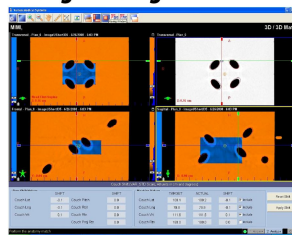

Optic Guidance Alignment

MV OBI Alignment

CBCT Alignment

Using Moving Window Tool

Results

The four methods agreed to within 1 mm or less in any one direction. The results are based on CBCT and/or OBI alignment. Thus, after optic guidance alignment and laser check, CBCT and OBI align to the below results.

Results taken over 10 measurements show the following shifts

Lat	Lng	Vrt	Couch Rotation
-0.1	-0.1	0.1	0.0
-0.1	-0.1	0.1	0.0
-0.1	-0.1	0.0	0.0
0.0	-0.1	0.0	0.0
-0.1	0.0	0.0	0.0
-0.1	-0.1	0.1	0.0
0.1	0.1	-0.1	0.0
-0.1	-0.1	0.1	0.0
-0.1	-0.1	0.1	0.0
-0.1	-0.1	0.0	0.0

Conclusions

This is a simple and effective means of integrated QA for optical guidance, CBCT, OBI, and lasers. This is not a complete QA of any one of these systems but could be part of the arsenal for quick and routine QA checks to ensure coincidence between the different isocenter locations predicted by each of these localization systems. The MIMI is just as effective if optic guidance is not present. The production phantom employs many BB's located strategically which aids in alignment.