

Lucy 3D QA Phantom

Background information

The Lucy 3D QA Phantom is a spherical polystyrene phantom that is designed to assist medical physicists with "End-to-end" testing of a stereotactic radiosurgery program or verification of a patient's treatment plan prior to delivery. The phantom is comprised of two hemispheres that accommodate several inserts used to test the various aspects of a stereotactic radiosurgery procedure. Details on the phantom and inserts can be found in the attached references.

Research Goals

- Familiarize team members with the Lucy 3D QA Phantom and the associated inserts
- Review the specifications and use of competitor products such as the Stereophan (Sun Nuclear, <http://www.sunnuclear.com/medphys/machineqa/stereophan/stereophan.asp>) and STEEV (CIRS, <http://www.cirsinc.com/products/all/104/steev-stereotactic-end-to-end-brverification-phantom-patient/>). Address any competitive design advantages and assess whether features should be added/modified to the Lucy 3D QA Phantom.

- Draft an improved design for the Lucy 3D QA Phantom as a continuation of the previous semesters work (listed from high to low priority):

1.) Using the proposed threaded design, determine an optimal location for a cut plane in Lucy to easily access the cavity which holds the inserts.

2.) Expand the "small" region of interest/active area current used to house inserts during use. Note that the diameter of existing Lucy is based on the head size of the researcher who originally developed the phantom (14 cm in diameter). Explore a change of diameter and the added costs/benefits of a larger phantom.

3.) In conjunction with a larger region of interest (above), determine if any inserts can be combined as to allow users to accomplish more than one test during a single setup.

4.) Only one orientation for ionization chamber measurements is allowed right now. With complex plans and advanced treatment modalities, additional chamber orientations are desirable (see sketch)

Deliverables

- Initial product design proposal
- Prototyping if possible
- Final product proposal (presentation and paper)

References

R. Ramani, A.W. Lightstone, D.L.D. Mason, and P.F. O'Brien, "The Use of Radiochromic Film in Treatment and Verification of Dynamic Radiosurgery", Medical Physics 21(3), 389 (1994)

"Stereotactic Treatment Verification with the Lucy 3D QA Phantom", Standard Imaging Tech Note, 2007

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