

AbstractID: 8633 Title: Submillimeter XKnife end-to-end alignment accuracy using SAlinac and the Lucy phantom

**Purpose:**

To achieve submillimeter end-to-end alignment accuracy on a conventional linac with stereotactic cones using the Stereotactic Alignment for Linac (S. A. linac) system.

**Method and Materials:**

Previous conference publications have already shown that the SAlinac system can enable the user to align the Winston-Lutz radiopaque ball and the room lasers to within 0.2 mm of the isocenter. In this study, the Lucy phantom from Standard Imaging has been used to show that submillimeter end-to-end alignment accuracy can also be achieved with the SAlinac system. In the 20 years since the seminal paper by Winston and Lutz, we have not seen any other system that can achieve submillimeter end-to-end alignment accuracy on a conventional gantry mounted linear accelerator.

The SAlinac system captures live images of the laser targets with digital cameras and combines this information with analysis of the Winston-Lutz test to provide near-real time alignment advice. As the user repositions the Winston-Lutz ball, the room lasers, or the head frame, the SAlinac system continuously captures and processes live digital images to provide updated repositioning advice.

**Results:**

To prepare for this study, two years ago the SAlinac system was used to correct a 0.5 mm gantry skew on the Siemens Mevatron MXE2 at Christiana Hospital, and four months ago the ceiling and wall lasers were remounted to minimize laser divergence. In this study we CT scanned the Lucy phantom, generated a treatment plan, and delivered the plan to expose the Gafchromic film inside the phantom. The final end-to-end results were  $x=-0.73$ ,  $y=0.27$ ,  $z=-0.41$  mm, for a total 3D error of 0.87 mm.

**Conclusion:**

Submillimeter end-to-end alignment accuracy has been achieved - it is now the Submillimeter Knife (SKnife).