

AbstractID: 4753 Title: Performance of the Nucletron Simulix Evolution flat-plate imaging system and CBCT

**Purpose:** To characterize the performance of the flat-plate imaging system available on a commercial radiotherapy simulator, to describe some of its clinical limitations and to present preliminary results when used in cone-beam CT mode. **Method and Materials:** Measurements were performed on the Nucletron Simulix Evolution simulator installed at our institution. The Simulix Evolution is equipped with a 40 cm x 40 cm flat-panel detector. Low contrast measurements were performed with a CDRAD contrast-detail phantom at the center of varying-thickness slabs of water-equivalent material. Cone-beam CT (CBCT) images were obtained with the AAPM CT and with a 20-cm diameter water phantoms. **Results:** The Simulix Evolution performs digital fluoroscopy at a fixed rate of 3 frames/sec. There is no digital radiography mode available currently. In fluoroscopy, two automatic brightness settings are available (ABS1 and ABS2). Entrance skin exposure levels at time of acceptance exceeded 15 R/min. Contrast-detail measurements with 10-cm and 20-cm water-equivalent phantoms demonstrated that the grid has limited clinical utility since the large air gap present reduces the impact of scatter. Removing the grid reduces patient exposure by a factor of 2. Note that the grid is not used in CBCT. Evaluation of the CBCT mode demonstrated that the system does not currently meet the HU uniformity target of  $\pm 75$  HU for water set by the manufacturer. Ring artifacts are also present and compromise clinical utility. Images and clinical examples will be presented. **Conclusion:** Lack of a digital radiography mode limits the clinical utility of the Simulix Evolution. With optimization, the system can be operated with clinically-acceptable fluoroscopy images at exposures below 5 R/min. Cone-beam CT image quality is currently compromised by the presence of ring artifacts and by poor HU uniformity and low-contrast discrimination.