AbstractID: 5715 Title: High Dose Rate Mode Linear Accelerator Based Stereotactic Radiosurgery and Image Guided Radiation Therapy

Introduction
In order to improve the standard linear accelerator's ability to address the demands of intracranial and extracranial stereotactic radiosurgery as well as for image-guided and intensity modulated radiotherapy, a high dose rate output accelerator was developed. The objective of this study was to assess the device performance and compare it to standard accelerators.

Materials and Methods
The 6 MV x-ray beam of a Siemens Oncor linac was modified by removing the flattening filter, enabling dose rates to reach 1000 MU per minute. Ion chambers, diodes, and film dosimeters were used to assess monitor chamber behavior, energy, and dose profile characteristics. Treatment time required for radiosurgery treatments in 40 patients was measured.

Results
Even at this high dose rate, the linac dosimetry system remains robust; constancy, linearity, and beam energy remain within 1% for 3 to 1000 MU. Measurements at incrementally reduced dose rates (1000 to 300 in 100 MU increments) showed the output calibration to fall from 1.000 cGy/MU to 0.994 cGy/MU, with an average value of 0.997 cGy/MU. Over this range of dose rates the beam energy held consistent, with the ratio of percent depth dose values within 0.5%. Dose profiles for larger field sizes are not flat, but they are radially symmetric and as such able to be modeled by a treatment planning system. Radiosurgery treatment times, computed here as the beginning of x-ray delivery until the end of treatment, were reduced to an average of 2 minutes and 18 seconds per arc, or 11 minutes 27 seconds per isocenter.

Conclusions
Even at this high dose rate, the linac dosimetry system remains robust. Because stereotactic IGRT can require significantly longer times for treatment delivery, the advantages of the high dose rate design should be pursued.