AbstractID: 13649 Title: System for Treating Tumors with Necrotic Cores: Modeling and Experimental Results

Purpose:
Our goal was to develop and refine a method that can target a periphery of the tumor with central necrosis. By translation of a collimated source off-axis it is possible to deliver an eccentric cylindrical 'mantle'. Overall requirements to target the necrotic center are decreased resulting in a dose savings to the sensitive normal tissue that surrounds the tumor that would normally be in the path when using techniques as 3DCRT. For radiation therapy planning, we applied DCE-MRI to evaluate the vascular supply to the interior as an indicator to locate the locality of the necrotic core.

Method and Materials:
We evaluated through experimentation and Monte Carlo simulation using *MCNPx*. For empirical validation, we applied a 40 kVp, 20W source for 30 seconds. The X-ray tube to lead slit = 36 inches, X-ray tube to center-of-object = 39.5 inches and X-ray tube-to-detector surface = 44.75 inches (for demonstration purposes of the technology only)

Results:
We were able to achieve interrater reliability in spatial locality comparisons from 80.4%, decreasing to 41.3% on a series of MCNP models
and experiments. Regions of does were highly dependent on beam collimation and beam focusing. Monte Carlo modeling could be used to enhance targeting.

Conclusion:
Multi-source and off-axis Radiation Therapy Methods have a potential to reduce dose in targets particularly if necrotic cores can be localized. Agreement between experimental results and Monte Carlo Simulation provide ample information for planning. Such techniques have a future with advancing technologies such as Multileaf collimator which can enhance localization potential. Offsetting and multiple sources (not necessary, but can provide additional speed to the therapy) are used not only to spare dose to the center but reduce the dose in the path of the radiation that inefficiently may target regions of necrosis, as seen with such techniques as 3DCRT.