AbstractID: 1319 Title: Progress towards a microRT small animal conformal irradiator

The recent development of small-animal imaging hardware has provided functional imaging researchers with extraordinary tools for preclinical studies. However, radiation oncology studies, either tumor response or normal organ response, have been hampered by the lack of a tool for the precise irradiation of small animals. A conformal small animal irradiator based on teletherapy is proposed that will provide customized dose distributions that enable the investigator to limit confounding side-effects and obtain more quantitative response results. The irradiator uses a small, high-activity ^{192}Ir source. Measurement-validated Monte Carlo dose distribution simulations have been conducted to aid in the optimization of the irradiator design. Dose rates in excess of 1 Gy min^{-1} at 1.0 cm target depths are shown to be possible using a 120 Ci source, providing adequately steep penumbra and low irradiation levels outside the irradiated fields. The source will be produced using an existing high-flux research reactor. The depth-dose distribution is due primarily to the inverse-square law, so the source-to-target distance (STD) has a profound effect on the depth dose. Three-dimensional dose calculations indicate that the ratio of doses at depth to superficial doses can be made similar to human irradiation using megavoltage accelerators, indicating that the tissue sparing gained with 3D human treatment planning is possible with this device. For example, for a 2.5 cm diameter animal cross-section, the STD that provides the equivalent scaled depth-dose behavior to a 25 cm human diameter is 5.2 cm, well within the maximum practical STD.