

AbstractID: 13466 Title: Surface dose investigation for open and wedge fields: measurements vs. Monte Carlo

Purpose: To accurately predict the surface doses of radiation fields commonly used in breast cancer radiotherapy using Monte Carlo simulations.

Method and Materials: Monte Carlo simulations were carried out using the EGSnrc/BEAMnrc Monte Carlo code on a computing cluster. A Varian 21iXs linear accelerator was modeled using BEAMnrc. Characteristic beam data for the 6MV x-ray beam on this linear accelerator was measured using an ionisation chamber for different beam sizes (5×5 to 15×15 cm²) and various static field arrangements. Monte Carlo calculated doses were verified by comparing dose distributions with measured data including depth doses and profiles of the open fields. The verified Monte Carlo data were then used to model various beam setups and the corresponding surface doses. Surface doses were also calculated in the Eclipse treatment planning system using the Pencil Beam Convolution algorithm.

Results: Measured and Monte Carlo calculated depth doses agreed to within 2% for all field sizes and shapes, except within the first 2 mm depth from the surface where differences of up to 30% are found with measured data being consistently higher. The dose profiles agree to within 2.5%, however, relatively large systematic differences (up to 6%) were found at the edge of the fields. These differences tend to increase with field size. Largest difference in surface dose is found to be more than 5% after the over-response chamber reading correction. Treatment planning system calculated surface doses were systematically over predicted compared to our Monte Carlo data for all field sizes and shapes by more than 10%.

Conclusion: Our results confirm there are significant uncertainties in predicted and measured skin doses for breast cancer radiotherapy as compared to Monte Carlo calculations. This suggests that clinical dose measurements and/or treatment planning system alone may be inadequate for assessing the possible risk of adverse skin reactions.