

AbstractID: 11589 Title: Head leakage, collimator scatter, and patient scatter contributions to out-of-field dose

Purpose:

Head leakage, collimator scatter, and patient scatter all contribute to dose outside of the treatment field during radiation therapy, which may lead to sequelae such as second cancers. In order to minimize out-of-field dose, it is essential to quantify the sources of this undesired radiation, particularly in the era of evolving radiation therapy.

Method and Materials:

The out-of-field dose was calculated with a previously benchmarked model of a Varian 2100 linac that was equipped with a 120 leaf MLC and was developed in MCNPX. The total out-of-field dose was calculated as a function of distance from the field edge for different field sizes, treatment energy, and linac configurations. In particular, the impact of removing the MLC, removing the flattening filter, and modulating the treatment field (IMRT) were evaluated. For each field and linac configuration, the head leakage, collimator scatter, and patient scatter components were resolved by repeating simulations but eliminating particles either leaving the MLC opening (thereby isolating for head leakage), or entering the phantom within the primary field (thereby isolating for head leakage plus collimator scatter).

Results:

In general, patient scatter dominated within ~20 cm of the treatment field, while head leakage dominated at distances beyond ~20 cm from the field edge. Collimator scatter typically made up 20% of the out-of-field dose, regardless of distance from the field edge. Removal of the MLC increased head leakage, while removal of the flattening filter decreased head leakage and collimator scatter, but increased patient scatter. Field modulation increased head leakage and collimator scatter, while patient scatter was unchanged.

Conclusion:

Different linear accelerator configurations changed the relative importance of head leakage, collimator scatter, and patient scatter contributions to the out-of-field dose. These differences should be considered when evaluating the out-of-field dose and techniques to reduce the out-of-field dose.