

## AbstractID: 9050 Title: Skeletal dosimetry in cone beam computed tomography

**Purpose:** In a recent publication, Ding et al [Med.Phys.35,(2008)1135]demonstrated that the dose in patient bony anatomy during a typical cone beam computed tomography (CBCT) scan is up to 3-4 times higher than that in soft tissues. The purpose of this investigation is to determine the dose to red bone marrow (RBM) and bone surface cells (BSC), identified by the ICRP as the two organs at risk in the skeleton.

**Method and Materials:** The FAX06/MAX06 EGSnrc-based code provides the ability to compute whole organ doses, including BSC and RBM doses, in a voxelized representation of a female/male body including micro-structural information for the spongiosa obtained from micro-CT images. The code is modified to permit the computation of spatial dose distributions and to allow the use of phase space files from BEAMnrc simulations to be employed as sources. A typical head-and-neck CBCT scan from a Varian Trilogy linac is investigated.

**Results:** The average RBM dose in the FAX06 phantom is found to be 4.6 cGy, *i.e.*, about 30% lower than the average dose in soft tissues such as the brain (6 cGy) and the eye lens (6.4 cGy), although a small fraction of the bone marrow (7%) receives doses in excess of 10 cGy. Due to the close BSC proximity to trabecular bone, the average BSC dose (11.2 cGy) is about 80% higher than the dose to soft tissue. The dose in about 15% of the BSC volume exceeds 15 cGy.

**Conclusion:** The dose delivered to BSC and a small fraction of the RBM in typical head-and-neck CBCT scans is significantly higher than the dose in soft tissues. Repeated CBCT scans may therefore increase the risk of bone malformation and may cause growth issues in pediatric radiotherapy patients.