AbstractID: 6481 Title: Designing an optimum IMRT verification system

Purpose: A verification system must be integrated into the clinical environment for a quality-assurance measurement of each plan. As a Monte Carlo dose kernel is commercially available for IMRT planning, the development of a sophisticated IMRT verification system is absolutely necessary for inhomogeneity corrections which are not possible with a homogeneous phantom. **Method and Materials:** We designed a cylindrical head and neck phantom to verify the accuracy of the IMRT planning. The head and neck regions include the organs at risk (OARs) such as parotid glands, spinal cord, brainstem, and mandible which are often situated in the vicinity of the target. The cylinder dimension is similar to the human head and neck dimension. OARs and target are designed as slabs for easy insertion in the cylinder. Ionization chamber holders are inserted in OARs and target volume. This heterogeneous phantom was CT scanned, and the PMCEPT, an in-house Monte Carlo code, was applied to calculate the depth dose profiles for the phantom. **Results:** We manufactured materials similar to a typical patient's critical organs and target, and inserted them into the PMMA cylindrical phantom. For the Monte Carlo calculations, the measured CT numbers for each material were converted into mass densities and chemical compositions. Using the PMCEPT code, we computed dose distributions, and confirmed an electronic nonequilibrium at medium interfaces, in agreement with the measured PDD curves. **Conclusion:** We developed a heterogeneous phantom for routine IMRT dose verification. We evaluated optimum design parameters for the phantom using experiments and Monte Carlo simulations. We found that the PMCEPT code could accurately predict the dose in the heterogeneous phantom within 2 % error. Thus, our IMRT verification system is suitable for the sophisticated verification of routine individual patient IMRT plan, which will promote the quality of radiotherapy treatment. Supported by Com2Mac-MOST-KOSEF.