AbstractID: 7671 Title: DPM and VMC++ Mont Carlo codes applied to heterogeneous media

**Purpose:**

Monte Carlo (MC) techniques are physically sound to provide accurate dose distributions. However, they take a large amount of CPU time compared to EGS4. Several fast MC algorithms have been developed, including VMC++ (Voxel Monte Carlo) and DPM (Dose Planning Method). For these fast MC codes, the simplifications of the underlying physics, variance reduction, and random number generation may not be equivalent. Moreover, implementation issues are complex and therefore testing and quality assurance is important. We compared these two codes as applied to heterogeneous media a quality assurance check.

**Methods and Materials:**

In this research, we conducted calculations for both codes on a standard open field water phantom, a water phantom with an air cavity, and a 5-beam conformal therapy plan computed based on a CT-scan of a heterogeneous anthropomorphic thorax phantom. The results were either compared with BEAM results, the Treatment Planning System (TPS; Pinnacle 7.6c), film or TLD measurements. The MC codes were integrated with CERR to facilitate CT-based calculations.

**Results:**

In the water phantom, for 6MV 5x5cm$^2$ field size at 100cm SSD, DPM and VMC++ agreed within 1%, except in the penumbra region. For 0.5x0.5cm$^2$ field size of the air cavity test, they differed at the interface of air and water. For the 5-beam 3D conformal plan on a thorax phantom, they agreed within 1% RMS ([STD of the difference larger than 5%Dmax]/Dmax); Most regions had a difference much less than 3% except at the buildup region for the two beams.

**Conclusions**

Carefully designed tests were conducted comparing DPM and VMC++. Water phantom results were almost identical. The air-cavity-heterogeneity results gave agreement within 1% except for the water-air-cavity interface. DPM appeared to be somewhat more sensitive to local material changes in the thorax phantom results.