

**Purpose:** To assess the feasibility and benefits of replacing patient specific QA measurements and back-up MU calculations with Monte Carlo based dose calculations for improved plan verification in radiation therapy.

**Methods:** An in-house Monte Carlo based planning system (MMCTP) has been clinically implemented at McGill University. Over 50 patient plans have been recalculated on the system by both dosimetrists and physicists. Initial plans chosen for recalculation were head and neck IMRT and lung SBRT plans, where simple monitor unit calculators and measurements in water equivalent phantoms are often insufficient to show agreement of the planned and delivered doses within 5%.

**Results:** MMCTP was found to be easy to use by both dosimetrists and physicists. Eighteen head and neck IMRT plans were recalculated by a dosimetrist and over 35 lung SBRT plans have been calculated by the physics staff. As no effort was spent in implementing fast MC engines, the calculation time is long but all mechanical operations, i.e., the transfer of the plans from the clinical treatment planning system to the MMCTP system and starting the calculation, take only a few minutes. Differences between MMCTP and the clinical TPS (Varian Eclipse, AAA) were small in terms of dose delivered to the PTV for the head and neck IMRT group but differences of greater than 5% were seen among the lung SBRT group. For both groups, the largest differences were seen for anatomy close to the skin and near air cavities.

**Conclusions:** Verifying the delivery accuracy of complex treatment plans can be challenging. Current techniques requiring recalculation and measurement of plans in uniform phantoms are cumbersome and do not take into account the patient specific heterogeneity effects. The MMCTP treatment planning system requires minimal physics resources and likely introduces a more comprehensive method of evaluating calculation accuracy throughout the treatment volume.