AbstractID: 4524 Title: PlanCheck: A system for routine clinical comparison of IMRT treatment plans with Monte Carlo recalculations

Purpose:
Current IMRT QA methods are cumbersome and are not comprehensive. The purpose of the PlanCheck dose recalculation system is to provide independent verification that MLC leaf-sequences generated by commercial treatment planning system will result in an acceptable dose.

Method and Materials:
The PlanCheck Beam Commissioning process was developed for medical linear accelerators and includes modeling of the photon energy spectra, off–axis softening, electron contamination, flattening filter and penumbra blurring. The Monte Carlo beam parameters are derived by fitting treatment planning dose in water and to the measured dose. The system will regenerate the dose for each treatment and for the whole planned dose utilizing the Monte Carlo engine based on beam sequence DICOM/RTOG information imported into PlanCheck. The comparison metrics, including dose-volume histogram comparisons, report the validation quality and dose agreement.

Results:
Monte Carlo commissioning was tested for Varian Linear Accelerator (Clinac 2100) for 2x2 cm^2, 5x5 cm^2, 10x10 cm^2 and 20x20 cm^2 open fields in water for 6MV, 10MV and 18MV photon beam. The profiles and comparison results show good agreement for Eclipse (Varian) open field dose in water. The IMRT treatment plans from systems such as XiO (CMS), Eclipse (Varian) and Pinnacle (Phillips) were tested with Plancheck for dose agreement with Monte Carlo Dose and found to show adequate agreement.

Conclusion:
PlanCheck Monte Carlo calculations shows good overall agreement with treatment planning results except for regions with complex heterogeneities. Sun Nuclear Corporation is currently developing this product for intensive commercial use. The system dose engine is currently in process of integration with a 64-bit/16-node calculation cluster, which we expect will make the typical IMRT plan calculation time 30 minutes or less for the total planned 3D dose.

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