

## AbstractID: 2767 Title: Incorporating Clinical Outcome Data into IMRT Inverse Planning

**Purpose:** To develop a biologically more sensible yet clinically practical framework for IMRT planning by incorporation of existing clinical endpoint data.

**Method:** To effectively integrate outcome data into inverse planning, two critical steps are (i) identifying the variable that characterizes the dose-volume status of an organ; and (ii) writing the objective function as a function of the variable with consideration of outcome data. The concept of effective volume is extended to the voxel domain for this purpose. For a dose-volume structure, the objective function depends not only the dose, but also its volumetric status. When compared with conventional quadratic function, the effect of the new scheme is to modulate the penalty distribution by applying more penalties on those high-dose voxels, and *vice versa*. The modulation is organ dependent and determined by the clinical outcome data. An iterative algorithm is used to optimize the system. The new formalism is applied to plan a head-and-neck case and a prostate case. The results are compared with that obtained using the quadratic objective function with DVH constraints.

**Results:** The technique provides clinically sensible ranking of competing IMRT plans. For parotid glands, for example, it yields the same score when the glands are irradiated 15Gy to 67%, or 30Gy to 30%, or 45Gy to 24% of the volume since they lead to the same outcome. On the contrary, the quadratic function yields different rankings for the three scenarios. Comparison with conventional technique indicated that, for the same target coverage, critical structure sparing is substantially improved for both cases.

**Conclusions:** A new penalty scheme, in which the voxels are penalized differentially according to clinical outcome data, is proposed. The sub-optimal performance of the current dose-based inverse planning can be substantially improved by considering outcome data.