

AbstractID: 6446 Title: Analytical Image Guided Radiotherapy for Head and Neck

Purpose: Present a general cost-effective robust clinical process that can analytically evaluate and correct patient setup error for head and neck radiotherapy by comparing orthogonal megavoltage portal images (PI) with corresponding digitally reconstructed radiographs (DRR).

Method and Materials: Adobe Photoshop CS2 is used to interactively segment images. Scripts are available to automate many steps, including image enhancement. MATLAB is a software package with many features for rapid matrix computations and image analysis. The closest point distance (CPD) for each PI point to a DRR point forms a set of homologous points. The translation T that aligns the PI to the DRR is equal to the difference in centers of mass. The original PI points are transformed and the process repeated with an Iterative Closest Point (ICP) algorithm. Analytical results are displayed as a cumulative histogram of the percentage of points exceeding CPD. The total area Σ under the histogram is a general error metric. A color coded image is provided to display the anatomical location of the PI points with respect to the DRR and their CPD.

Results: The ICP algorithm always converged. The integral Σ was consistently lower for the *analytical*IGRT, with a mean reduction of 16%. The process was tested retrospectively by three users. Typical user dependence was below 0.5 mm. The time for segmentation of two images and computations was under ten minutes. The process has been integrated with a Visual Basic Toolbox that guides the user through the required all the steps from importing the daily Portal Image, segmentation, computing the translation, and printing a standard report.

Conclusion: Inexpensive commercial software has been shown to be useful for on line *analytical*IGRT. The process developed is robust, consistently better than IGRT, provides documented error metrics, and can be customized by the user for individual applications.