

AbstractID: 7658 Title: A Treatment Planning System (TPS) Independent Software for 4DCT Image Analysis

**Purpose:** To present standalone software that allows for transfer of treatment planning data from a treatment planning system (TPS) in DICOM-RT format to any user-defined image analysis platform. With this, several treatment planning tools have been developed outside of TPS for 4DCT analysis.

**Materials and method:** Treatment planning systems have been primarily viewed as dose calculation engines, and only recently have begun introducing rudimentary tools dealing with 4DCT and deformable image registration. Concurrently, there has been a proliferation of imaging software, either in public domain or user-written, for the new imaging paradigm offered by 4DCT to study organ deformation. There is a disconnect between available treatment planning tools and the state-of-art in image processing. While DICOM-RT standard allows, in theory, for a straightforward transfer of treatment planning data, the clinical experience is generally anything but this. Thus most radiotherapy clinics, without benefit of dedicated programming and imaging science teams and yet treating the majority of patients, are unable to realize the full potential offered by 4DCT or contribute valuable clinical experience. Using a simplified DICOM-RT export from TPS, we developed several treatment planning tools for enhanced visualization and image analysis of 4DCT data.

**Results:** Various tools for processing 4DCT data were developed: 1) autosegmentation of normal structures onto phased CTs using a reference 3D CT containing initial manual segmentations; 2) automatic generation of internal target volume (ITV); 3) target motion characterization using center-of-mass trajectories; 4) dose volume histograms based either on maximal target motion, or probability density function; and 5) visualization for studying goodness of registration.

**Conclusion:** Image analysis tools, which supplement available image visualization using software from CERR (Washington University, St. Louis) and RCET (University of Florida), for 4DCT were presented. This approach allows for rapid development and clinical implementation of state-of-art image analysis tools in treatment planning.