AbstractID: 9933 Title: Image Registration Solves Everything?

Ongoing developments in multimodality and 4D imaging technologies are providing opportunities to improve tumor localization and patient modeling for treatment planning and to reduce setup variations and margins for treatment delivery. Proper use of these technologies can provide greater sparing of dose to normal tissues and permit safer escalation of tumor doses. Imaging techniques are also being developed to help predict response to treatment during therapy when interventions and adaptations are still possible. The explosive growth in imaging technology has been followed by growth of technologies to manage the plethora of data now being generated.

One key technology is image registration, which can be thought of as producing the "glue" to allow quantitative integration of anatomic, functional and dosimetric information from different imaging studies. Indeed, most modern imaging workstations, treatment planning systems and even treatment delivery systems now provide tools for image registration and data integration. These tools range in sophistication from simple manual registration involving just a few degrees of freedom (DOF) to fully automated registration techniques which produce deformation fields at the resolution of the image data.

Unfortunately, widespread use of these techniques for all but simple situations has been impeded by lack of more realistic models which can accommodate processes *other than just deformations* such as tissue loss, gain, and sliding. The situation is also complicated by the realization that the optimal number of DOF and other registration parameters vary from tissue to tissue; using too few or too many DOF or inappropriate parameters can cause inaccurate or unphysical results. Fortunately, developments aimed at overcoming these obstacles continue to emerge and will pave the way to broader clinical use of image registration. These developments as well some of the remaining hurdles will be discussed.