AbstractID: 13311 Title: Development of A Computational Infrastructure for GPU-based Online Adaptive Radiation Therapy

Purpose: To develop a computational infrastructure to enable a streamlined clinical workflow for online adaptive radiation therapy (ART). **Method and Materials:** Our computational infrastructure consists of modules for deformable image registration based on the demons algorithm, and fluence map and direct aperture re-optimization based on finite size pencil beam dose calculation. These modules have been implemented on a graphics processing unit (GPU) platform. Around these highly efficient implementations we have built modules for DICOM file handling, and graphical user interface based on the Qt framework. Furthermore, we have built a communication infrastructure for web-based plan reviewing and approval using a PDA device such as the iPhone. **Results:** We measured a net re-planning computation time of <10 seconds for a 9-field prostate IMRT plan. A software infrastructure with a clean yet functional user interface has been built to seamlessly guide clinicians through the online re-planning process. **Conclusion:** We integrated new computational tools into real clinical environment. We achieved this in two ways. First, by turning prototype high performance codes into a product-alike software solution to be used by clinicians. Second, by developing a web-based communication infrastructure to allow faster treatment plan review and approval by attending.