

AbstractID: 9575 Title: Intrafraction set-up variability in SBRT patients monitored by IR optical localizer and kV X-ray images

**Purpose:** To investigate intrafraction setup variability in high precision stereotactic body radiotherapy (SBRT) by means of integrated infra-red optical localization and stereoscopic kV X-ray imaging.

**Method and Materials:** We analyzed data coming from 24 patients treated with SBRT. Patient setup was realized through the ExacTrac X-ray 6D system (BrainLAB, Germany), consisting of 2 infra-red TV cameras for external fiducial localization and 2 couples of X-ray source-detectors for image registration. Before irradiation, patients were pre-aligned relying on optical marker localization. Subsequently, patient position was refined through the automatic matching of X-ray images to digitally reconstructed radiographs (DRR, 3 mm CT slice thickness), providing 6 corrective parameters that were automatically applied using a robotic couch. The 3D position of the external configuration of control points was detected and stored before (*PREmk*) and after (*POSTmk*) the irradiation fraction. A final set of stereoscopic images was acquired and registered to DRR at the end of the treatment, relying on bony anatomy, thus obtaining 6 verification parameters (*VP\_post*). Patient intrafraction motion was evaluated by comparing *PREmk* with *POSTmk* (optical measurement). Moreover *VP\_post* parameters were applied to *POSTmk* thus defining a new configuration of control points (*POSTmk-Xray*) that was compared to *PREmk* (X-ray measurement).

**Results:** According to the optical measurement, intrafraction motion measured on external fiducials was  $0.61 \pm 0.53$  mm (median $\pm$ quartile). The X-ray measurement overestimated intrafraction motion up to  $2.05 \pm 1.8$  mm. The latero-lateral direction resulted more sensitive to residual errors in X-ray measurement ( $0.34 \pm 2.88$  mm, mean $\pm$ std).

**Conclusion:** Intrafraction motion, as monitored by the optical system, is not significant. When relying on X-ray imaging registration, larger motion may be measured because of inherent limitations in DRR cranio-caudal resolution and digital X-ray image noise. Such results lead to further questions in assessing the accuracy of X-ray based setup when integration with optical patient localization is not taken into account.