AbstractID: 10319 Title: Dosimetric Impact of Rotational Setup Error in Stereotactic Body Frame Radiation Therapy (SBRT)

Purpose: SBRT uses specialized fixation devices to achieve high dose gradient with minimal margin, however setup errors cannot be totally eliminated. The dosimetric impact of rotational setup error is investigated in the context if translational shifts can compensate for it. **Methods and Materials:** To simulate patient rotational setup errors, CT images of a phantom and actual clinical SBRT cases (liver: n=3, lung: n=3) were rotated around the body center using an in-house image processing toolkit. The dosimetric impact of uncorrected roll was quantified by comparing the recalculated dose distribution to the original plan. Manual translational registration was then performed to match the target volumes on the rotated images to the original datasets to simulate translational correction. The original plan was then recalculated using the corrected CT datasets and the resultant dose distributions compared to the original ones. **Results:** The simulated rotation of phantom results in reduced dose-volume coverage of CTV and PTV. While minimal for rotations <3 degrees, CTV coverage decreased sharply for larger rotation. For all clinical cases, a 3-degree rotation resulted in less than 5% reduction in the CTV volume covered by 90% prescribed dose (CTV_{90}). A larger rotation led to significant dose reduction in tumor targets as well as dose changes to critical organs (OAR). Manual translational registration resulted in good recovery of both CTV_{90} and PTV_{80}. However, increased dose to OAR was observed in some cases where the selection of beam angle was close to the OAR. **Conclusion**: It is concluded that uncorrected rotational setup error larger than 3 degree could cause significant dose changes to tumor targets and OAR. Image guided translational correction can compensate for rotational setup errors. Despite the improvement of CTV matching, caution needs to be paid regarding dose increase to OAR when large rotation angle is corrected.