AbstractID: 10927 Title: Quality Assurance of Proton Range Compensators by CT scanning

Purpose:
Patient specific range compensators (RCs) are required in passively scattered proton therapy. Conventionally, quality assurance (QA) of RC is performed by either a visual inspection or spot check of thicknesses for some drill points (e.g. 4). A more comprehensive QA of RCs is needed for precise delivery of proton beams. The purpose of this study was to develop a QA procedure by use of computed tomography (CT).

Method and Materials:
For the procedure, one or more range compensators would be scanned with a CT scanner. Software was developed to automatically segment the range compensator on CT images and calculate the thickness matrix for the RC. The CT-scanned RC thickness matrix was then compared to the expected one, which was reconstructed from the DICOM ION Radiotherapy Plan exported from a proton treatment planning system. The actual milling tool size and shape were taken into account when the RC was reconstructed. The scanned RC thickness matrix was automatically aligned to the planned RC matrix. In addition to comparing the physical thickness of the RC, we also verified the water equivalence thickness of the range compensator based on the CT scan. This would allow us to detect possible impurities or other defects of the RC. As part of the validation, we tested not only an unaltered RC, but RC that was damaged or altered post-construction.

Results:
We developed software to process the scanned CT images of the RC and reconstruct the planned RC from the radiation therapy treatment plan. We compared both the physical thickness and water equivalent thickness between the scanned RC and planned RC to quality assurance the manufacturing of the RC. Our process was able to detect deviations of less than 2 mm.

Conclusion:
We have developed a procedure to efficiently and comprehensively QA the RC.