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# Evaluation of 4Pi Arc Positioning for Cranial VMAT SRS in Elements

B Loughery
*Beaumont Health*

C Knill
*Beaumont Health*

R Sandhu
*Beaumont Health*

L Lin
*Beaumont Health*

Z Seymour
*Beaumont Health*



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15.6.03) in 1mm grid. **Results:** For single-lesion plans, all the three QA devices showed good agreement. For example, an 8-arc SRS plan for a single lesion of 1.9cm had >97% passing rates (2%2mm, 10% threshold) in all devices measured. For multiple-lesion plans, PD overestimated predicted dose, but the same plans passed QA when measured by diode arrays. For example, an 8-arc SRS single-isocenter 3-target plan (PTV sizes = 1.4cm, 0.9cm, and 0.7cm) failed PD QA at 61.4% passing rate (2%2mm, 10% threshold), but had 98.0% and 99.3% passing rates with srsMapCHECK and MapCHECK3, respectively. Area of failing in PD was concentrated in low-to-mid dose regions, i.e., <60% dose level; passing rate increased to 90% if threshold for dose analysis was up to 50%. The data indicated PD might not accurately calculate dose from scatter, off-axial and/or small lesion size for multiple-lesion SRS. **Conclusion:** Portal dosimetry failed to verify single-isocenter multiple-lesion SRS plans. Its algorithm might be too simple to accurately model the actual dose in these regions. Diode array device is more appropriate for multiple-lesion plan verification.

**PO-GePV-T-386,** Cross-Validation of Patient Positioning Systems Using An Optical Surface Image Guidance Platform: D Pinkham[1*], S Hancock[2],(1) Yale University School of Medicine, New Haven, CT, (2) Southeast Health, Cape Girardeau, MO

**Purpose:** Treatment delivery machines in radiation therapy are often accompanied by several supporting/complimentary subsystems for patient positioning and monitoring. During stereotactic radiation therapy procedures, these can utilize both ionizing and non-ionizing radiation to ensure that radiation is delivered accurately, often with submillimeter precision. With so many technologies at the medical physicist's disposal, the purpose of this project is to illustrate ways that one of these technologies, optical surface image monitoring, can cross-validate the accuracy of other positioning/imaging subsystems during commissioning or routine QA**. Methods:** A surface image monitoring system (C-RAD) was used to cross-validate submillimeter offsets of a CBCT registration algorithm as well as the motions effected by a corresponding 6-DOF hexapod couch. This was studied in two independent scenarios: (1) During C-RAD system commissioning, two IGRT phantoms were initially aligned to their reference CT using the hexapod, and a reference surface was captured with C-RAD. Both were subsequently misaligned over a range of clinically-relevant translations and rotations (in isolation and in combination) using prescribed offsets input directly into the hexapod system. At each misalignment step a CBCT registration was repeated and 6-DOF offsets were recorded from both the XVI system and C-RAD. (2) During hexapod couch commissioning, a Winston-Lutz cube phantom was used to confirm a relative adjustment made to the couch base using simultaneous MV imaging and C-RAD monitoring. **Results:** C-RAD calculated offsets agreed with prescribed hexapod offsets with RMSE below 0.2 mm and 0.1 degrees. Similarly, C-RAD calculated offsets agreed with XVI calculated offsets with comparable RMSE. During table axis adjustment, C-RAD confirmed a 0.4mm lateral adjustment of the couch axis, agreeing with pre- and post- Winston lutz images within 0.1 mm**. Conclusion:** Surface imaging, if available, can be a versatile commissioning and QA tool for other positioning systems within the radiation treatment vault.

**PO-GePV-T-387,** Evaluation of 4Pi Arc Positioning for Cranial VMAT SRS in Elements: B Loughery*, C Knill, R Sandhu, L Lin, Z Seymour, Beaumont Hospital, Dearborn, MI

**Purpose:** Brainlab's Elements Cranial VMAT (CVMAT) v3.0 introduces a 4Pi optimization that includes automated gantry and couch positioning alongside collimator optimization. In contrast, v1.5 uses a fixed collimator angle and predefined templates for gantry and couch angles that are manually modified by the planner. This study evaluates the 4Pi generated plans for clinical acceptability in terms of plan quality and delivery accuracy on a VersaHD. **Methods:** We chose a recent sample of 9 clinical plans that represent our catalog of target locations, fractionation schemes, and target sizes. Cases were replanned in CVMAT v3.0 using 4Pi optimization. These plans were evaluated for target coverage using Inverse Paddick Conformity Index (ICI), normal tissue sparing using Gradient Index (GI), and maximum dose to the predefined "most important organ at risk." Plans were dosimetrically evaluated using a microdiamond detector and SRS Mapcheck in a StereoPHAN to evaluate deliverability. **Results:** All 4Pi generated plans were able to produce target dose metrics within clinical acceptable tolerances (ICIs < 1.3 and GIs < 4.5), while maintaining organ at risk doses within AAPM Task Group 101 tolerances. All fields had >95% gamma pass rates using 3%/1mm, 10% threshold, absolute dose. MicroDiamond measured doses were within 5% of predicted for all cases with an average absolute difference of 1.73%+/-1.69%. The largest dose discrepancy occurred as a microDiamond measured underdosing for the smallest target (<0.36cc, <11.0mm diameter). **Conclusion:** 4Pi automated couch, gantry, and collimator angle selection in CVMAT v3.0 simplifies beam setup while producing clinically acceptable plans. Initial deliverability of 4Pi plans has been verified. Work is ongoing to elucidate the source of dose discrepancies for small targets.

 