the available photon energies in our TrueBeam: 6MV, 15MV, 6MV FFF and 10MV FFF. Geometrical checks were measured only for the 6MV beam.

Results: In all our measurements we found that the results were within the established tolerances. The value of the isocenter’s size is, in our case, 0.27 mm, very close to that obtained by Clivio et al. for the same energy, 0.34 mm. The values of the 6MV beam center shift, MV imager projection offset and absolute gantry positioning are the same that the ones obtained in the mentioned study: 0.04 mm, 0.17 mm and -0.09° respectively. For that same energy the offset of the collimator rotation is, in our case, 0.15°, while the one reported in the study is 0.17°, and the kV imager projection offset, 0.24 mm versus 0.32 mm. The output change in our TrueBeam varies from -0.58% for the 10MV FFF beam to -0.50% for the 6MV beam. In the study these values range from 0.06% for their 15 MV beam to 0.24% for their 6MV FFF beam.

Conclusion: Our TrueBeam MPC results were compared with those obtained by Clivio et al. at their institution. They show great agreement with those reported in their study. We have established MPC tool measurements as part of our routine daily QA.

EP-1531 Comprehensive commissioning and QA of the new version upgrade of treatment planning system
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Purpose or Objective: To evaluate the dosimetric and optimization algorithm accuracy of a newly released version 13.5 of the Eclipse treatment planning system (TPS) prior to upgrade, utilizing the recently published AAPM Medical Physics Practice Guideline (MPPG), “Commissioning and QA of treatment planning dose calculations”.

Material and Method: Eclipse V13.5 includes many novel features, such as contouring tool enhancements, streamlined 4D CT contouring, new physical materials for the AcurosXB (AXB) dose algorithm, and faster optimization engines. MPPG phantom tests were performed to validate both static and dynamic beams in both homo- and hetero- generous material. Additionally, 54 patient plans were re-calculated in V13.5 with the same beam parameters, monitor units, and dose algorithms in order to examine algorithm difference. A dose-difference plan was created by subtracting the dose calculated in V13.5 from V11 and evaluated in 3D dose display. Those re-calculated patient plans included a variety of treatment sites, energies, and techniques. However, the new Photon Optimizer (PO) algorithm was developed in V13.5 to replace the previous Dose Volume Optimizer (DVO) in IMRT and Progressive Resolution Optimizer (PRO) in VMAT. In order to compare the PO and DVO/PRO optimizers, 25 IMRT/VMAT clinical plans were re-optimized with PO using the same objectives, prescriptions, and number of iterations. The plan quality and optimization time were examined.

Results: Dose differences for all clinical cases and MPPG phantom tests in-field and in homogeneous areas, were within 1% and 3% for photon and electron plans, respectively. Although the beam models were not re-commissioned in V13.5, the dosimetric leaf gap (DLG) value was modified and the new physical material was added in AXB; as a result the dose differences correspond to differences in the dose algorithms. Therefore, at field edges and heterogeneity interfaces, maximum dose differences increased to 3% and 6% for photons and electrons, respectively. Dose calculated using AXB was found to be 3% less at the lung interface and inside the lung in V13.5 compared to dose calculated in V11, but no dose difference calculated using AAA was seen. PO could optimize plans 20-30% faster than DVO/PRO. For most cases, no significant difference was noted.

Conclusion: Commissioning and QA of new TPS version is essential prior to clinical release. The tests suggested by MPPG provide an excellent framework for this work, particularly when combined with additional clinical cases. Dose differences noted were chiefly located at beam edges, possibly due to modified DLG values, and in heterogeneous materials and interfaces using AXB, potentially due to differences in material specification. The PO improved optimization efficiency in all cases and MU economy and dose conformity in some SBRTs, with no reduction in plan quality.

EP-1532 Reliability of the Machine Performance Check application for TrueBeam STx Linac
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Purpose or Objective: Machine Performance Check (MPC) is an application to verify geometry and beam performances of Truebeam STx, through automated checks. In this study, MPC tests were analysed using all photon beam energies of our Truebeam STx, comparing whenever possible with external independent checks.

Material and Methods: The Machine Performance Check (MPC) is a new Truebeam STx major mode, designed to evaluate the machines geometric performance. Data acquisition comprises a series of 39 images acquired with IsoCal Phantom & with particular MLC pattern settings. MPC performs geometric and dosimetric checks. The geometric checks intend to test the treatment isocenter size and its coincidence with imaging devices, the positioning accuracy of the imaging systems, collimator, gantry, jaws, MLC leaves & the couch position. The dosimetric checks refer to a reference MV image and give the beam output, uniformity and center change relative to the reference. MPC data were acquired during one month on different consecutive days. For most of the MPC checks, an independent control has been performed at the same time of the acquisition of the MPC to evaluate the agreement of the two methods. For the independent checks, phantoms and detectors available & used routinely in the department were used. The Daily QA3 was used to check the beam constancy. The first acquisition, acquired at the same time as the MPC baseline, was used as reference. Also weekly output was performed as per TRS 398 protocol on water phantom using FC 65 chamber to compared with the MPC and Daily QA3 output.

Results: Treatment isocenter was between 0.39 ± 0.02 mm with MPC, compared to 0.5 ± 0.01 mm for 6 MV with the Winston-Lutz test. Coincidence of kV and MV imaging isocenters was within 0.26 ± 0.05 and 0.25 ± 0.06 mm, respectively (0.5 ± 0.1 mm with external tests). Positioning accuracy of MLC was within 0.5 mm; accuracy of jaws was 0.12 ± 0.02, 0.14 ± 0.03, −0.77 ± 0.08, 0.11 ± 0.04 mm for X1, X2, Y1, Y2 jaws, respectively, with MPC. Dosimetric tests: the output stability relative to the baseline for 6 MV, 10 MV, X2, Y1, Y2 jaws, respectively, with MPC. Dosimetric tests: the output stability relative to the baseline for 6 MV, 10 MV, X2, Y1, Y2 jaws, respectively, with MPC. Dosimetric tests: the output stability relative to the baseline for 6 MV, 10 MV, X2, Y1, Y2 jaws, respectively, with MPC.

Conclusion: MPC is a useful tool for QA of Truebeam STx systems and its automation makes it highly efficient for testing both geometric and dosimetric aspects of the machine. Overall, the ability of the MPC to monitor linac output stability was comparable to that of ionization chamber-based measurements.

Sensitivity of ArcCheck system to setup error using Perfect Pitch 6D couch

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Purpose or Objective: The purpose of this study is to evaluate the sensitivity of ArcCheck 3D diode array to setup error for patient-specific quality assurance (QA) of volumetric-modulated arc therapy (VMAT). Translational setup errors of ± 1, 2 & 3 mm in the RL, SI & AP directions & rotational setup errors of ± 0.5°, 1° & 1.5° in the pitch, roll & yaw directions were set up in ArcCheck for 6 patients. The pass rate of γ analysis was computed by comparing the calculated & measured dose distributions using 3%/3 mm, criteria.

Material and Methods: Six VMAT plans for various sites were selected for this study. The VMAT plans were designed using Eclipse v13 treatment planning system. The ArcCheck Dosimetry system consists of 1386 diodes, embedded in the cylindrical wall of the phantom with 10 mm spacing. All tests were carried out using an Truebeam STx accelerator with a high definition MLC. CBCTs were acquired for all the setup. Registration between the reference CT and CBCT was carried out automatically using an inbuilt rigid registration method. The ArcCheck phantom was translated in the right-left (RL), anterior-posterior (AP), and superior-inferior (SI) directions by ± 1, 2 & 3 mm respectively and rotated in the pitch, roll, and yaw directions by ± 0.5°, 1° & 1.5° using the 60 treatment couch. To validate the accuracy of perfect pitch couch for rotation, smart tool digital level was placed on couch to confirm the rotation introduced in phantom. Each patient plan was separately delivered on the phantom for dose verification in total, 37 measurements (1 without positional error, 18 with translational errors, 18 with rotational errors) were performed for each patient. The pass rate of γ analysis was computed by comparing the calculated and measured dose distributions using 3%/3 mm, criteria respectively.

Results: When the translational setup errors are ± 1, 2 & 3 mm, respectively, the pass rates of γ analysis with the 3%/3 mm criteria decreased by a maximum of 1.7%, 8.4%, and 11.0% in RL direction; 2.5%, 7.4%, and 12% in the SI direction & 2.0%, 7.5%, and 10.5% in the AP direction. When the rotational setup errors were ± 0.5°, 1° & 1.5°, respectively, the pass rates of γ analysis with the 3%/3 mm criteria decreased by a maximum of 3.5%, 5% & 12% in the pitch direction; 3.2% 6% & 15.2% in the roll direction, 3.5%, 8% & 18% in the yaw direction.

Conclusion: In this study, ArcCheck diode array showed high sensitivity to rotational setup errors. ArcCheck 3D diode array is capable of detecting an setup error in order of 1 mm/0.5°.

EP-1534
Dosimetric impact of the QFix kVue Calypso couch top and the electromagnetic array with photon beams

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Conclusion: In this study, ArcCheck diode array showed high sensitivity to rotational setup errors. ArcCheck 3D diode array is capable of detecting an setup error in order of 1 mm/0.5°.