the previously established correlation patterns, the measurement can be considered problematic, and the most probable parameter fingerprint can be determined by mixing the base fingerprints.

Results: Parameter fingerprints for the most frequent energies of Varian and Elekta linacs were generated and used to validate BBD. The method is very sensitive to problems with depth-dose curves (DDC), e.g. incorrect placement of the sensitive volume of the detector, spectral dependencies of the detector for large fields/large depths, partial-volume-, cable- and scatter-effects. Due to the virtually absent scatter in small fields, MC is the ideal method to augment and validate the self-consistency of small field dosimetry. The precision of error detection is in the range of 0.1 mm detector position shifts and 0.3% dose error, for DDC from 5x5 mm² to 400x400 mm². Output factor variations can be detected with a sensitivity of 0.2%, MLC positioning uncertainty with a sensitivity of 0.1 mm. Typical issues with detector types and accelerator models can be identified.

Conclusion: Monte-Carlo derived phase space abstractions can be used to validate the self-consistency and overall quality of base data measurements and thereby fill a gap in the quality assurance chain. Base data can be validated with an accuracy of 0.3%, being one order of magnitude better than potential experimental errors.

PO-0803

Validation of a pre-treatment delivery quality assurance method for the CyberKnife Synchrony System

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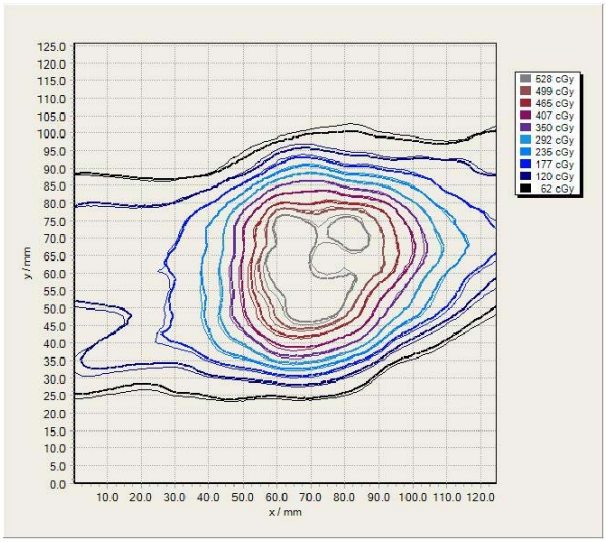
Purpose or Objective: To evaluate the accuracy of the CyberKnife Synchrony Respiratory Tracking System (RTS) and to validate a method for pre-treatment patient-specific delivery quality assurance (DQA).

Material and Methods: An EasyCube Phantom (Sun Nuclear), consisting of RW3 slabs, was mounted on the ExacTrac (ET) Gating Phantom (Brainlab), which can move along the superior-inferior axis of the patient to simulate a moving target. Eight fiducial markers were implanted in the EasyCube for the treatment set-up and for the tracking. A Gafchromic EBT3 film (Ashland) was positioned between two slabs of the EasyCube, while a PinPoint ionization chamber (PTW) was placed in an appropriate insert. The EBT3 films were calibrated with a 6MV beam (Trilogy, Varian) from 0 to 15 Gy and analysed with the multichannel film dosimetry performed by the FilmQA Pro software (Ashland). Our evaluation was performed in two steps: 1) the films were irradiated with single fields perpendicular to the EasyCube for several collimators (3 fixed collimators: 15, 30, 60mm; 3 IRIS openings: 20, 30 and 40mm) and in different dynamic conditions (e.g. motion amplitude of the ET Phantom from 8 to 28 mm). The delivered and planned dose distributions were compared with the gamma (γ) analysis method. The local γ passing rates (GP) were evaluated using 3 acceptance criteria, varying the local dose difference (LDD), the distance-to-agreement (DTA) and the dose threshold (TH): 3%/3mm TH=10%, 2%/2mm TH=30% and 3%/1mm TH=50%.Dynamic cases were also delivered with purposefully simulated errors (RTS switched off or low coverage of the respiratory correlation model). 2) The DQA plans of 6 clinical patients were delivered in different dynamic conditions, for a total of 19 cases. The measured and planned dose distributions were evaluated with the same γ-index criteria of step 1 and the measured PinPoint doses were compared with the planned mean doses in the sensitive volume of the chamber.



The test was considered passed if the 3 γ analysis criteria yielded a GP>90% or at least 2 criteria yielded a GP>90% and the PinPoint dose difference (ΔD) was <5.0%.

Results: The γ analysis of the collimators showed the need to use more γ-index criteria to detect the simulated errors. Only the stricter DTA criterion drastically failed the test, with GP<70%. All of the DQA plans passed the tests, both in static and dynamic conditions. The mean GP (±σ) were 95.5±5.2% (3%/3mm), 98.6±1.4% (2%/2mm) and 97.8±2.2% (3%/1mm).The mean ΔD was 2.9±1.8%. No significant differences were found between the static and the dynamic cases.

Conclusion: The presented method confirms the ability of the RTS, if used properly, to treat a moving target with great precision. Our pre-treatment patient-specific DQA method was robust, combining PinPoint dose measurements and an evaluation of dose distributions with EBT3 films. However, we found the need of a detailed study of each case, especially when one acceptance criterion does not satisfy the tolerance level.

PO-0804

Clinical applications of a Monte Carlo tool of a proton pencil beam scanning delivery system

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Purpose or Objective: Apply a validated Monte Carlo (MC) tool for independent dose calculation in proton PBS to 'patient specific' quality assurance (QA) tasks

Material and Methods: We had developedand validated a MC tool for independent dose calculation[1]. In this work weuse this code for:
- Recalculationof a clinically approved plan from the TPS, to evaluate the quality of our TPSsemi-analytical dose calculation algorithm at the level of the individualpatient
- Recalculationof a treatment session using the Log File coming from the Therapy ControlSystem (TCS), to evaluate differences in 3D dose distribution in patientanatomy taking into account the characteristics of spots (energy, position, MUetc.) as actually delivered by the machine
- Simulationof a 2D patient specific QA (2DQA).

This is aretrospective study on 10 patients done to evaluate the possibility ofsubstituting our actual 2DQA measurement process with a completely automatic andreliable MC based workflow. For each 2DQA TPS and MC dose distributionsrecalculated in water equivalent material, at different depths, were comparedwith measurements performed with an array of 1020 ionization chambers