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 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 cases were recalculated in water equivalent material, at different depths, were compared with measurements performed with an array of 1020 ionization chambers.

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 (±SD) were 95.5±5.2% (3%/3mm), 98.6±1.4% (2%/2mm) and 97.8±2.2% (3%/3mm). 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 developed and validated a MC tool for independent dose calculation in proton PBS to "patient specific" quality assurance (QA) tasks.