Purpose/Objective: The aim of this study is to assess the stability of relative gold marker position due to deformation and marker migration for prostate cancer during the treatment course of image-guided VMAT external beam radiotherapy.

Materials and Methods: 30 patients with localized prostate cancer, who underwent primary IGRT with implanted gold markers (MPB Marker Kit 1.2x3mm, MPB Scherer Medizinprodukte GmbH, A-Krustetten), were chosen for this study. 27 patients had four and three patients had three implanted markers. The gold marker implantation was carried out one week before the planning CT. The IGRT was carried out with kV-CBCT and orthogonal kV-Imaging (OBI Varian Medical Systems, Palo Alto CA). For this study 739 orthogonal kV-image pairs were evaluated: between 9 and 32 kV image pairs were evaluated per patient. The images were segmented with an edge algorithm (MATLAB R2013a, MathWorks). The centroid of the gold marker was identified to evaluate the gold marker position. The inter-marker distances were determined and compared to those identified in the planning CT.

Results: The median marker distance was 23.9 ± 9.7 mm (SD). The marker distance varied from 5.5 to 45.7 mm. For 21 patients the marker distance variations remained under 3 mm. For five patients marker distance variations between 3 and 4 mm were identified. The variation exceeded 4 mm for four patients. For one of them the variation seemed to be the result of either prostate deformation related to organ filling in the planning CT or gold marker migration after the planning CT. In this case the mean distance variation between two markers was 5.7 ± 0.5 mm (SD). Overall 640 of 739 IGRT sessions showed deviations in marker distance variation below 3 mm. 67 distance variations were between 3 and 4 mm. In 32 IGRT sessions the inter-marker distance exceeded 4 mm.

Conclusions: In most cases the gold marker distance variation seems to be smaller than 3 mm, so that a good image matching can be achieved. If the variation exceeds 3 mm the matching might become more difficult. For patients with larger variation it should be determined if the change is the result of gold marker migration. Furthermore, if necessary, a new planning CT should be performed and the PTV margins appropriately adapted.
Purpose/Objective: The MacroMedics Double Shell Positioning System (DSPS) is a new fixation system for cranial radiotherapy (RT). It consists of a mouldable mask in combination with an also individually moulded head rest. In this study we compare the setup accuracy and stability of patient positioning using the DSPS versus an in-house 3-point mask solution.

Materials and Methods: In 20 patients receiving cranial RT extra conebeam computed tomographies (CBCT) were acquired to calculate the geometrical setup uncertainties (mean-of-means (µ), systematic (Σ) and random (σ) errors). 10 stereotactic brain RT patients were immobilized using an in-house 3-point mask solution, a 3-point mask with integrated dental fixation (bite). While the 3-point masks were moulded, the patients were asked to bite on a wooden spatula through the mask to improve the fixation of the upper jaw and prevent pitch. During each of their 3 RT fractions, 3 CBCTs were acquired. The first CBCT was used for positioning, the second CBCT was acquired in the treatment position just prior to irradiation, and the third CBCT was acquired directly after treatment. The errors of the interfraction motion (registration of the 1st CBCT and the planning CT) represent a situation in which no setup correction is applied. The residual errors (registration of the 2nd CBCT and the planning CT) are the uncertainties after application of the setup correction. The intrafraction motion is the movement during the actual treatment between the 2nd and 3rd CBCT. 10 palliative cranial RT patients were immobilized using the DSPS, again with bite. These patients received 5 or 10 RT fractions. During 5 of these fractions extra CBCTs were acquired analogue to the previous group. The geometrical uncertainties were calculated as described by Van Herk (Sem. Rad. Oncol. 14(1) 2004: 52-64).

Results: The setup errors for both fixation systems are shown in the table. Almost all the systematic and random errors are smaller for the DSPS system, only the random pitch angle error of the residual error is larger. Yet only half of all the errors in the mean-of-means decreases when the DSPS is used. In particular the longitudinal shift, roll and again the pitch worsen for both the interfraction motion as well as for the residual error. Nevertheless, after setup correction the mean-of-means is at acceptable sub-mm level.

Conclusions: The fixation with the in-house 3-point mask solution is already quite satisfactory. Yet the DSPS seems promising to be able to give even better fixation. For each group 20 more patients will be included in the study to investigate the uncertainties further and to enlarge the sample size. In particular reasons for the current increase in error of the mean-of-means should be verified, like a possible learning curve in moulding and using the DSPS.

EP-1507
Automated transfer of absolute couch coordinates to the R&V system to prevent gross set-up incidents
E.J.L. Brunenberg¹, M. Luesink², E. Van der Wal³, H. Huizenga¹, K.L. Pasma²
¹Radboud University Medical Center, Radiation Oncology, Nijmegen, The Netherlands
²Institute for Radiation Oncology Arnhem, Physics Department, Arnhem, The Netherlands

Purpose/Objective: With patient positioning using skin marks, set-up errors during the first fraction can go undetected, since the expected couch coordinates are not known in the Record and Verify (R&V) system. In our clinic, treating 2500 patients per year, a few times a year an incorrect isocenter is used, e.g. due to selection of skin marks from an old or other plan. Even in-room imaging cannot fully prevent such incidents. We therefore propose an automated workflow that transfers the absolute couch coordinates and site-specific tolerance table from the CT via the Treatment Planning System (TPS) to the R&V system, causing an interlock when the patient is positioned incorrectly.

Materials and Methods: Crucial for this workflow was the installation of the same long-extension universal couch tops (UCT LE, Civco) on our CT and Linacs. With immobilization devices patients can then be positioned identically on all systems. We recalibrated all couch pedestals, using the couch top indices as a reference, to ensure identical absolute coordinates for each Linac. Furthermore, we implemented an