the target registration, and we used the Dice similarity coefficient to classify the registration quality. A secondary aim was to find a FRE-cutoff value that indicates a good MR-CT-fusion. A third aim was to see if there was an additional gain using 4 versus 3 gold fiducials in a rigid registration of the MR- and CT-series.
Materials and Methods: Retrospectively we analysed 18 prostate patients treated with curative radiotherapy up to 78 Gy. All patients had 3 or 4 gold fiducials implanted in the prostate. All patients had performed MR-series within 1 hour after the CT-series, and the two series were fused through a rigid registration procedure in the dose planning system Oncentra (Elekta). Migration of the fiducials and deformation of the prostate can lead to an increased FRE. We simulated a systematic displacement of the most cranial fiducial. This influenced the fusion of CT- and MR-series, and the FRE and Dice similarity coefficients were compared. We simulated a systematic displacement in the X- and Y- direction of the fiducial of up to 4 mm. We also calculated a value that classified the spread of the fiducials in the prostate. The value is calculated from the sum of the distances between all the fiducials divided by the sum of the maximum distance between all the fiducials if they were located on the prostate wall.
Results: We found that the spread of the fiducials is very important. A small FRE-value from fiducials that are closely spaced can hide a large target registration error. We found that a spread of the fiducials with a value of 0.6 of the maximum possible spread of fiducials in the prostate is a cut-off value that can be used to indicate that a small FRE correlates well with a good target registration. We found a clear indication that 4 fiducials give a better target registration than 3 fiducials even when they indicate the same fiducial registration error. 4 fiducials are more robust when it comes to errors from migration of the fiducials and deformation of the prostate.
Conclusions: It is vital that the 4 fiducials implanted are well-spread in the prostate. A small FRE-value does not necessarily indicate a good target registration, and the FRE-value should be used in coherence with a value that indicates the spread of the fiducials. 4 fiducials are superior to 3 fiducials in most cases.

POSTER: PHYSICS TRACK: IMPLEMENTATION OF TECHNOLOGY, TECHNIQUES, CLINICAL PROTOCOLS OR TRIALS

PO-0877
QA for radiation therapy in a prospective head & neck study: Outcome impact of ICRs performed by the EORTC QART program
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Purpose/Objective: Quality assurance for radiotherapy (QART) aims to improve patient outcome in Head and Neck (H&N) cancer patient included in prospective studies. Three levels of QART were proposed: center's Facility Questionnaire and External Review Dosimetry Assessment with Dummy runs (QA level II), prospective Individual Case Reviews (ICRs) for 15% of patients (QA level III) and prospective ICRs for all patients (QA level IV). The purpose of this study is to assess the outcome impact (QAOI) and cost-effectiveness (QACEA) of the three levels of QART program, for H&N cancer patient included in the EORTC 22071-24071 protocol.
Materials and Methods: The non-activated phase III of postoperative chemo-radiotherapy with EGFR inhibition would have included 600 patients in 15 European centers. The study primary endpoint was local-tumor control on a two years follow-up, expressed as life-years without relapse. The follow-up of patients was modeled using a multi-state model. Parameters of the model were derived from EORTC studies, TROG 0202 and RTOG 0525 prospective studies. Simulations were performed with a probabilistic sensitivity analysis. Results for each QART level were expressed as percentage of mortality and local failure on 2 years, and in survival times and life-days without relapse on 2 years.
Results: For the QAOI, the estimated incremental percentage of local failure was -2.1% [95%CI: -5.9; -1.8], -4.9% [95%CI: -8.3; -1.5] and -2.7% [95%CI: -4.6; -1.4], for an increase QART level from II to III, II to IV and III to IV, respectively. The estimated incremental survival times was 8 days [95%CI: -7; 24], 18 days [95%CI: 4; 34], and 10 days [95%CI: 4; 18], for an increase QART level from II to III, II to IV and III to IV, respectively. The QACEA will be detailed during the congress.
Conclusions: Patient treated with an increase QART level were significantly less likely to recur locally.

PO-0878
Analysis of class solutions for 6MV and 6MV flattening filter free VMAT for stereotactic ablative lung radiotherapy
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Purpose/Objective: Hypofractionated stereotactic ablative radiotherapy (SABR) for small volume lung tumours precisely delivers ablative doses using multiple fixed gantry angle beams or volumetric arc therapy (VMAT). The high dose per fraction can result in significant delivery times and flattening filter free (FFF) beams delivered at much higher dose rates may be advantageous. A study at our institution compared dose distributions and delivery accuracy of one and two arc VMAT plans created with standard and FFF beams to determine appropriate planning class solutions and verification methods for lung SABR treatments.
Materials and Methods: Treatment plans were prepared on suitable lung datasets for SABR deliveries of 54Gy in 3 fractions. One and two arc VMAT plans were optimised and calculated for standard 6MV beams (600MU/min) and 6MV FFF beams (1400MU/min). Analysis of the resulting dose distributions included conformity index and organ at risk (OAR) doses. Deliveries were verified by in-phantom point dose measurements and fluence measurements in 2 dose planes using a 2D ion chamber array.
Results: Plans comprised a single 360° arc or two co-planar 195°arcs orientated to avoid the contra-lateral lung. All resulting dose distributions satisfied pre-defined dose and dose volume constraints when using the same optimisation objectives and priorities regardless of energy or beam arrangement. There was a slight improvement in conformity index with the FFF energy. The two arc technique resulted in lower mean and maximum doses to the contra-lateral lung however there was no significant difference in V20Gy and V12.5Gy for the combined lung. Total beam on time was approximately 5.6 minutes for 6MV and 2.5 minutes for 6MV FFF. Target volume point dose measurements in geometrical and semi-anatomical phantoms were within 2.5% of calculated for all deliveries. Measured point doses outside the target volumes were up to 6.5% different to calculated however dose gradients in these low dose regions may have contributed to the higher discrepancies. Fluence measurements with a 2D ion chamber array showed 100% of points within the 3%/3mm dose difference / distance to agreement threshold for points above 20% of the maximum dose.
Conclusions: Class solutions for one and two arc VMAT deliveries resulting in acceptable dose distributions for SABR lung treatments can be achieved with 6MV and 6MV FFF beams. Analysis of the resultant dose distributions showed no significant differences between plans. There was good agreement between planned and delivered point doses within the target volumes and OARs and between planned and delivered fluence regardless of beam orientation or energy. FFF deliveries are significantly faster than standard which may improve the patient experience. The choice of single arc or two arc plans is dependant on isocentre position in order to avoid collision as the gantry rotates around the patient.

PO-0879
Preliminary results of an online patient in-vivo dosimetry protocol to monitor anterior rectal wall dose in real time
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Purpose/Objective: To assess the accuracy of plastic scintillation detectors (PSDs) for real time in-vivo measurement of the dose to the anterior rectal wall for IMRT and to determine the clinical utility of daily monitoring of rectal dose for prostate cancer patients.
Materials and Methods: 58 in-vivo measurements were performed during prostate IMRT for the 1st two patients of an IRB approved protocol. During each monitored fraction two PSDs were attached to the anterior surface of an endorectal balloon to monitor the dose delivered to the rectal wall. The balloon was inserted into the patient