data set approach, with the dose distribution calculated with the treatment planning system used in that centre.

Results: The gathering of IC and EPID datasets on a large variety of Elekta linacs went smoothly. For each linac/energy combination, a universal dataset was derived from similar linacs. This universal dataset was combined with only three measurements for each specific linac/energy combination: one IC measurement at the isocentre of a 20 cm thick phantom, and two EPID images, with and without the phantom in the beam. Preliminary validation results for 5 linac/energy combinations and a set of square fields (3x3 to 22x22 cm²) using the universal dataset, showed deviations of the dose at the isocentre varying between -0.5% and +1.5%. Gamma analysis (3%/3mm) yielded values for the mean gamma, near-maximum gamma and gamma pass rate varying between 0.26-0.37, 0.67-1.04 and 96.5%-100.0%, respectively. These results are comparable to data obtained by a reconstruction from EPID measurements based on a full commissioning process in those centres.

Conclusions: A generic set of EPID dosimetry model parameters has been derived for a variety of Elekta linac/energy combinations. Customizing the universal dataset in combination with 3 measurements instead of performing full commissioning decreases the amount of work needed to commission an EPID for dosimetry purposes by about 90% without a noticeable loss of accuracy.

PO-0835
Modelling the dosimetric effects of tumor motion due to respiration
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Purpose/Objective: The goal of the retrospectively performed dose distribution simulations was to justify the concept of validating conformal versus intensity-modulated approach in the treatment of non-small cell lung cancer (NSCLC) patient. The insight into the difference between the actual (affected by respiratory motion) and planned dose distributions for both clinical target volume (CTV) and organs at risk (OARs) was provided.

Materials and Methods: To test the influence of the respiratory motion on the dose distribution, for 10 patients representative for the spectrum of tumor sizes and locations, treated in free-breathing conditions (our standard institutional technique), 2 plans were prepared: with three-dimensional conformal (3D-CRT) and sliding window intensity-modulated radiation therapy (IMRT) techniques. For each of the field angles considered, the motion kernel (derived from the literature data) was generated to simulate tumor motion trajectories, with the largest amplitude in cranio-caudal direction of 4 mm, 6 mm and 8 mm respectively. While the robotic platform MotionSim XY/4D with 2D diode array MapCHECK 2 (Sun Nuclear, USA) on it repeatedly cycled through the motion trajectory, radiation was delivered starting at a random point. The measurements' results determined the agreement between the planned and measured doses within CTV and OARs. The evaluation of plan delivery was based on the Gamma Index (γ) with 3-mm criteria of distance to agreement (DTA) and 3% dose difference (ΔD).

Results: No statistically significant differences were found between the motion patterns with the smallest amplitudes for CTV in 3DCRT plans. The differences were found for the 8-mm amplitude when it was compared both to static conditions and 4-mm amplitude. For IMRT the significant differences between 0 mm vs. 6 mm, 0 mm vs. 8 mm and 4 mm vs. 8 mm were found. According to the analysis performed for OARs, the motion impact on delivered vs. planned doses had less effect for esophagus and spinal cord. The only OARs for which the observed differences were comparable was heart.

For maximal amplitudes of breathing trajectory below 4 mm the disagreement between planned and delivered dose distribution could be neglected. Whereas respiratory motion with amplitude above 5 mm, especially for IMRT, led to significant changes in delivered dose distribution.

Conclusions: 3DCRT is safe in a greater range of respiratory movements amplitudes. For patients with large tumor sizes or due to inability of achieving proper 3DCRT dose distribution coming from tumor and OARs close proximity, the IMRT affords possibilities for further optimizing the therapeutic ratio. Statically planned IMRT dose distribution could lead to tumor underdosage due to interplay effect (intra-fractional motion with respect to the movement of MLC). It is therefore important to verify the amplitude of individual patient breathing motion trajectory.

PO-0836
Dose sensitivity in the craniospinal IMRT junction region to positional and dose error
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Purpose/Objective: Craniospinal irradiation (CSI) using multiple isocenter intensity modulated radiation therapy (IMRT) allows for homogeneous dose distribution throughout the target and the dose distribution is conformed tightly around the target volume, reducing unnecessary dose to the organs-at-risk. The technique utilizes a combination of complicated field segments and there are sections of the treatment volume (junction) that are treated by fields from multiple isocenters. Small isocenter positional variations and dose changes in the junction regions may be unavoidable throughout the fractionated treatment. Dose sensitivity in the CSI IMRT junction region to positional and dose variations is tested using a diode array.

Materials and Methods: Ten CSI patients were planned with a 3-isocenter (cranial, upper and lower spine) IMRT technique using Pinnacle treatment planning system v9.2. The plans were prescribed to 36 Gy in 20 fractions. All beams were optimized simultaneously with a high weight placed on the target volume with lower weight placed on the other objectives. The isocenters were placed 25-27 cm away from each other. The IMRT plans were then recalculated and measured on a MapCHECK diode array placed in the upper/lower spine overlap region. >95% of measured to planned dose to the MapCHECK diodes with a γ-index <1 for 3% dose difference and 3mm distance-to-agreement was deemed clinically acceptable.

To test the sensitivity of junction region to positional and dose variations, the following changes were made to the plan
and recalculated plans were compared to the MapCHECK measured data as described in the previous section.
1) 3mm shift in all translational directions to lower spine isocenter,  
2) ±3% and ±5% changes to overall number of monitor units (MU), and  
3) ±20MU change in a single beam (upper spine gantry 215°).

**Results:** Table 1 shows the results of all the recalculated plans, with introduced changes as described in the above section, tested against the initial, correctly measured MapCHECK test. Figure 1 shows the graph representation of the deviations from the 3%/3mm γ-analysis (our centre’s clinical standard test) for the plans with the changes introduced. The planned to measured dose compared using the γ-analysis is relatively insensitive to 3mm positional variations to lower spine isocenter as only a slightly lower than the initial percent pass rates are observed. This indicates that 3mm positional variations in fields do not cause large changes in the dose distribution due to high segment modulation. However, the 3%/3mm γ-analysis was more sensitive dose changes as overall ±3% in MU and changes of ±20MU in one field shows a greater change than positional variations.

**Conclusions:** For multiple isocenter CSI, a small variation in isocenter position is unavoidable throughout the fractionated treatment. The results in this study indicate that 3mm positional changes in one isocenter with respect to the other may not cause detrimental changes in dose distribution. However, the measurements were sensitive to changes in overall dose and in a single field dose.

**PO-0837**

3D dose verification of VMAT lung SBRT using Mobius3D  
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**Purpose/Objective:** Mobius3D (Mobius Medical Systems, Houston, TX, USA) is QA software performing 3D treatment plan verification. Mobius3D (M3D) uses a collapsed-cone algorithm for dose calculations which makes it suitable for a wide range of treatment technics. After sending the CTdataset, RTplan, RTstructure and RTdose from the treatment planning system (TPS) the system starts calculating automatically. Results are available in PDF and include 3D gamma evaluation, dose volume histogram (DVH) and region of interest (ROI) overview.

In our clinic standard pretreatment QA is performed with a 2D ionization chamber array placed in a phantom. Gamma evaluation of the composite dose is performed in one plane. The minimum pass rate for a treatment plan verification to be acceptable is 95%.

The treatment plan verification with Mobius3D is compared with the standard pretreatment QA. Goal is to obtain a more efficient procedure of verifying VMAT lung SBRT plans without compromising on accuracy.

**Materials and Methods:** Twenty five VMAT lung Stereotactic Body Radiation Therapy (SBRT) plans were randomly selected in the TPS (Pinnacle v9.2, Philips Healthcare, Best, The Netherlands). The absolute pretreatment measurements were performed with a 2D ionization chamber array (Octavius II, PTW, Freiburg, Germany) in a phantom and compared with the planar dose of the recomputed treatment plan on the scanned phantom. The detector array has a density override, as recommended by the manufacturer. If necessary the isocenter is moved to achieve a high dose area in the detector array plane. The gamma evaluation of the measurements are performed with in-house developed software.

The CTdataset, RTplan, RTstructure and RTdose of both the original plan and the recalculated phantom plan are send to Mobius3D. The stereotactic approach requires a tight margin, the distance to agreement criterion is set to 2 mm. The dose difference is set to 3% if a homogeneous phantom is used and 5% for calculations on a heterogeneous CT set. In all cases, the gamma evaluation dose threshold is set to 30%.

The gamma pass rates of the three situations are evaluated as well as the difference between the mean internal target volume (ITV) dose calculated by the TPS and by Mobius3D.

**Results:** The gamma pass distribution per pass rate interval for 25 treatment plans is shown in the figure.