A Quasar phantom (Modus Medical Systems) with moving inserts was used to investigate the effect of motion on CBCT image quality. A systematic pattern of motion artefacts was revealed. Artefacts (created by a high density object moving along the axis perpendicular to the slice) were assessed in an axial slice. Circular profiles were used to quantify the artefacts on the three systems.

Clinical image quality was assessed through a qualitative study where two experienced observers independently scored 24 randomly selected clinical thoracic CBCT scans (8 per system). CBCT images were viewed alongside the planning CT scan, with the PTV outline being the only visible delineated structure. Scoring was based on a five point scale and reflected the image quality for matching purposes, the clinical task. Eight anatomical regions, sharpness, contrast, impact of artefacts, and the overall image quality were scored. Comments were also recorded.

Results: Quantitative assessment using the Catphan revealed no differences between systems that was deemed significant. The variation in magnitude of the streaking artefacts in the Quasar phantom was found to depend on scan time, but not on the system, as shown in Table 1.

<table>
<thead>
<tr>
<th>System</th>
<th>Scan protocol</th>
<th>Scan time (s)</th>
<th>Max Peak - Min Trough</th>
</tr>
</thead>
<tbody>
<tr>
<td>TrueBeam OBI</td>
<td>Thorax</td>
<td>60</td>
<td>215.0</td>
</tr>
<tr>
<td>TrueBeam OBI</td>
<td>Thorax 2min</td>
<td>120</td>
<td>130.4</td>
</tr>
<tr>
<td>TrueBeam OBI</td>
<td>Thorax 4min</td>
<td>180</td>
<td>97.2</td>
</tr>
<tr>
<td>Trilogy OBI</td>
<td>Thorax</td>
<td>60</td>
<td>223.2</td>
</tr>
<tr>
<td>XVI</td>
<td>Lung</td>
<td>96</td>
<td>207.3</td>
</tr>
<tr>
<td>XVI</td>
<td>Oesophagus</td>
<td>120</td>
<td>135.7</td>
</tr>
</tbody>
</table>

The Mann-Whitney test was applied to each observer’s scores for each metric of the clinical image analysis. No significant (p<0.05) differences between any systems for any metric for either user were detected.

Conclusion: Investigations to date indicate no significant difference between the systems assessed. Image quality must allow matching of the CBCT to CT with confidence. Staff were thus reassured that all systems were assessed as “acceptable” (mean score of 3) for most metrics. It was felt that patient size was often the cause of particularly good or poor scores; therefore improvement of patient size dependent protocols is identified as a key area of future work.

EP-1910
Evaluation of diffusion-weighted imaging properties of a RT-specific positioning solution for PET/MR
R. Winter1, S. Leibfarth1, H. Schmidt2, N. Schwenzer2, D. Zips3, D. Thorwarth1
1University Hospital Tübingen, Section for Biomedical Physics, Tübingen, Germany
2University Hospital Tübingen, Diagnostic and Interventional Radiology, Tübingen, Germany
Purpose or Objective: PET/MRI may be highly beneficial for radiotherapy planning (RTP) in head and neck (HN) cancer in terms of increased accuracy in target volume definition (TVD) and integration of functional tissue properties. As the integration of imaging data into RTP requires co-registration, PET/MR examination in RT treatment position is favorable. Therefore, we propose a solution using a dedicated hardware setup.

Moreover, accuracy of TVD depends on the spatial accuracy of the imaging data. Since diffusion-weighted MR imaging (DWI) based on echo planar imaging (EPI) is prone to spatial inaccuracy, the aim of this study was to evaluate the quality of DWI with RT scan setup using dedicated distortion correction.

Material and Methods: The RT hardware setup consists of a flat table overlay and two coil holders for flexible body matrix coils (Siemens mMR), in addition to an in-house designed overlay add-on for RT mask fixation (cf. Fig1). The evaluation of DWI quality using the RT setup was based on MR-only scans of n=3 healthy volunteers. Each time, two scans were performed: (I) using the RT setup with a pair of 6-channel flexible RF coils, (II) a reference scan, using a standard 16-channel HN coil. The protocol included T2w SPACE, T2w TSE, and DWI (b = 150 and 800 s/mm²).

DWI data was collected with reversed phase encode blips in order to use a correction method for susceptibility-induced distortions as implemented in the open source toolkit FSL. The geometric accuracy of DWI was assessed on a ROI basis by comparing pairwise distortion corrected and uncorrected b150 images to T2w images. Four ROIs were placed in submandibular glands and cervical spine. In addition to spatial distances between ROI centers, the Dice similarity index (DSI) was calculated to assess ROI similarity.

Furthermore, ADC values derived from ROIs of the corrected b150 images were compared between RT and reference scans. One set of DW images acquired with RT setup had to be excluded from analysis due to strong MR image artifacts.

Results: DWI suffered from geometric distortions with both scan setups but correction with FSL led to significantly reduced effects. These were of the same order as differences in ROI delineation between T2w images due to minor involuntary patient motion. The average displacements of the ROIs' centers of mass between DW and T2w images were 4.6±2.3 mm / 5.9±3.4 mm (RT / REF) and 1.0±0.4 mm / 1.5±0.9 mm for standard DWI and distortion corrected DWI, respectively (cf. Fig2 A). Fig2 B presents the average DSI per ROI pair: 0.4±0.1 / 0.4±0.2 (RT / REF) and 0.8±0 / 0.7±0.1, accordingly.

ADC values differed by 7±14% on average comparing the RT with the standard coil setup.

Conclusion: The presented PET/MR hardware solution for HN imaging enables for RT-specific patient positioning. Using dedicated correction methods, spatial distortions in DWI can be significantly reduced allowing for accurate usage of DWI in RTP. ADC values of distortion corrected maps of the RT scan setup were found to be adequate.

Purpose or Objective: New treatment modalities are developed with the aim of escalating tumor absorbed dose...