\[
\frac{\Phi(x)}{\Phi(0)} = \frac{\int_0^E U(x, E) \left( \frac{dE}{d\Phi} \right) E \cdot dE}{\int_0^E U(0, E) \left( \frac{dE}{d\Phi} \right) E \cdot dE}
\]

The method was validated for the beam qualities in Table 1 in the single-projection radiographic imaging mode as well as the full CBCT image acquisition. Computed dose was compared to ion chamber measurements in a homogeneous and a heterogeneous block phantom for the radiographic imaging mode and in a cylindrical acrylic phantom for CBCT. The heterogeneous phantom comprises tissue, bone and lung-equivalent materials. Preliminary validation was done using ultra sensitive MCP-N type LiF TLDs in the anthropomorphic RANDO™ phantom. Previous work conducted at our institution had confirmed that the response of this type of TLD is not as energy-dependent as the standard MTS-N type TLDs.

Results: The agreement in the homogeneous block phantom was typically 1-2% and 4% at worst. Similar results were obtained in the heterogeneous phantom for beams using a half bow tie filter, but for the full bow tie filter measurements were 8-10% lower than computation in the central axis of the beam in bone. However, agreement in the rest of the profile in bone and lung was typically 1-2%. In the cylindrical acrylic phantom seen in Fig.1, the agreement between relative dose measurement and computation was within 4% of local dose for all beam modalities save for some in high-gradient regions. The agreement between computational measurements was better in low-gradient regions. While only a single imaging modality was tested in the anthropomorphic geometry, the agreement was within experimental uncertainty.

Conclusions: We have validated a kV x-ray dose computation method (kVDosCalc) and our kV x-ray simplified beam model derived from only experimentally measured quantities. The agreement was excellent (2-4%) in the homogeneous geometries, and generally good for heterogeneous and anthropomorphic geometries. This represents a crucial step toward our goal to develop a tool for the routine patient-specific computation of absorbed dose from CBCT procedures.

References:
M. Essers

PO-0805

Combining VMAT and breath hold to reduce heart and lung dose for locoregional treatment of left-sided breast cancer

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Conclusions: RapidArc® leads to a slight further improvement in heart dose, as well as a reduction of the dose to the contralateral breast, we conclude that both of the groups included variety of different size patients. The improvements for dose calculation accuracy when using the soft tissue conversion instead of setting all soft tissues as water equivalent, but having bones converted with the same technique, were up to over 1 percentage unit (with obese patients).

| 3D-CRT | RapidArc
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FB</td>
<td>vmDIBH/FB</td>
</tr>
<tr>
<td>Heart V20 (%)</td>
<td>8.7</td>
</tr>
<tr>
<td>V5 (%)</td>
<td>40.5</td>
</tr>
<tr>
<td>Mean (Gy)</td>
<td>9.6</td>
</tr>
<tr>
<td>Lung V20 (%)</td>
<td>16.9</td>
</tr>
<tr>
<td>V5 (%)</td>
<td>36.4</td>
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<tr>
<td>Mean (Gy)</td>
<td>8.1</td>
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<tr>
<td>CL breast/V20 (%)</td>
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<tr>
<td>V5(%)</td>
<td>0.8</td>
</tr>
<tr>
<td>Mean (Gy)</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Conclusions: RapidArc® plans are superior compared to 3D-CRT for dose homogeneity to the PTV, heart dose and V20 and mean dose on the lung. This goes at the expense of a slightly increased dose to the contralateral breast. We confirm a decrease in heart dose using vmDIBH combined with 3D-CRT. Since the addition of vmDIBH to RapidArc® leads to a slight further improvement in heart dose, as well as a reduction of the dose to the contralateral breast, we conclude that the combination of RapidArc® and vmDIBH is a promising technique for locoregional RT for left sided breast cancer patients.

Conclusions: Our results indicate that both techniques are able to produce plans with a good coverage of PTVs and an acceptable sparing of the contralateral parotid gland for OCP, despite a slight advantage of RA for dosimetric analysis of PTV. In addition, the NTID was significantly lower with RA. However, the clinical benefit of these dosimetric advantages needs further investigation.

Conclusions: This study indicates that it is possible to construct pseudo-CT images by converting the MRI intensity values into electron density values in pelvis, and to use these images for accurate MRI-based prostate RTP. The examinations illustrated that by including the heterogeneous soft tissues into the pseudo-CT images the dose calculation accuracy can be improved especially with obese patients.

**Materials and Methods:**

1. Seventeen randomly chosen patients were set either into a data collection group (10 patients) or into a test group so that both of the groups included variety of different size patients. The standard CT image HUs and the MRI intensity values were analyzed for pelvic soft tissues of each data collection patient. By using the collected data a threshold based segmentation method was constructed to convert the soft tissues such as fat, muscle and urine, from MRI intensity values into HUs. For the bones our previously published2 conversion model was utilized with minor adjustments. The soft tissue HUs in the created pseudo-CT image of each test group patient were compared to the HUs in the standard CT image. Moreover, the dose distributions in the pseudo-CT images were compared to those in the CT images by using a 7-field IMRT plan.

2. The major challenge for MRI-based RTP is the lack of electron density information in the images. This research aimed to convert the T1/T2-weighted MRI intensity values into electron density values in pelvis, and to enable accurate MRI-based RTP for prostate cancer patients.

**Materials and Methods:**

- Eclipse TPS (version 10.0) was used to compute IMRS plans for 20 cases of small brain lesions (range: 0.5 to 18.3 cc). Two different models of MLC (Varian) were configured in Eclipse for a Varian Clinac 2100 CD: one with standard 5 mm leaf width (‘STD’) and the other with 2.5 mm leaf width (‘HD’). For each patient, two IMRS plans were created using the same beam arrangement, same constraints during the optimization process, same number of optimization cycles, same dose calculation algorithm (AAA, 1 mm calculation grid size), and same dose prescription (99% of the target volume receiving 12 Gy or more (V12) and 4) normal tissue volume (NTD) receiving the 50%, 70% and 90% of prescription dose (NTD50, NTD70, NTD90).

**Purpose/Objective:**

- To compare two models of multileaf collimators (MLCs) with different leaf width for the treatment of intracranial lesions using intensity modulated radiosurgery (IMRS) technique.

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