

Cone beam calibration curves in dose calculations for a VMAT head and neck radiotherapy treatment

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INTRODUCTION

Cone beam computer tomography (CBCT) based dose calculation proved to be accurate for adaptive radiotherapy, despite the Hounsfield number (HU) inconsistency due to the beam scattering and beam hardening.

PURPOSE

Assessment of the differences between CT and CBCT based dose calculation for a volumetric modulated arc therapy (VMAT) treatment, using different calibration curves.

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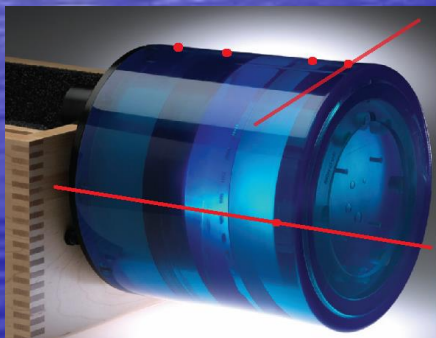
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METHODS

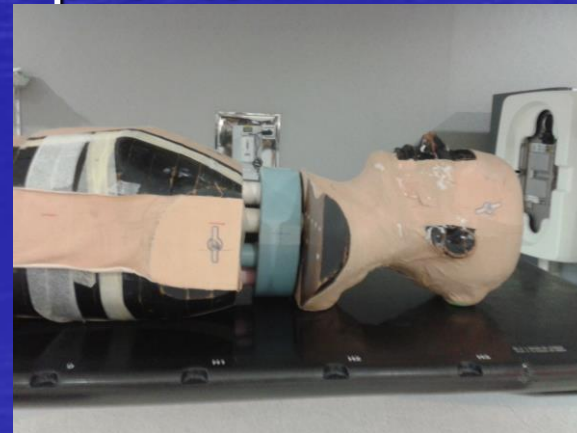
1. Calibration curves for CBCT Images

4 different calibration curves were obtained :

- Standard
- Varian CBCT calibration
- Measured with a CATPHAN 504 phantom
- Measured with a CIRS 062M phantom



CATPHAN 504



CIRS
+
Alderson
Randon

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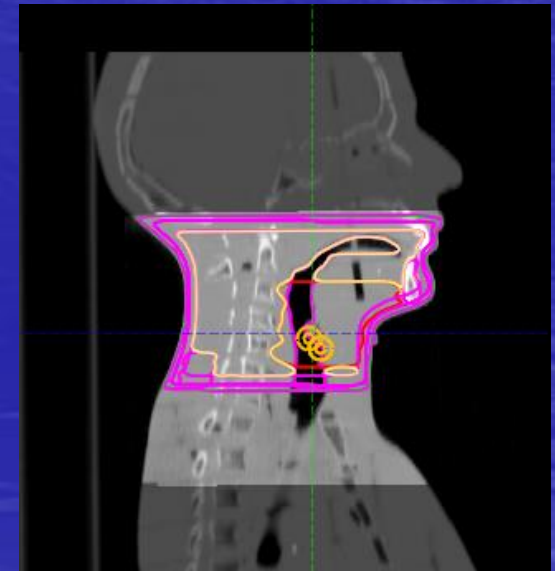
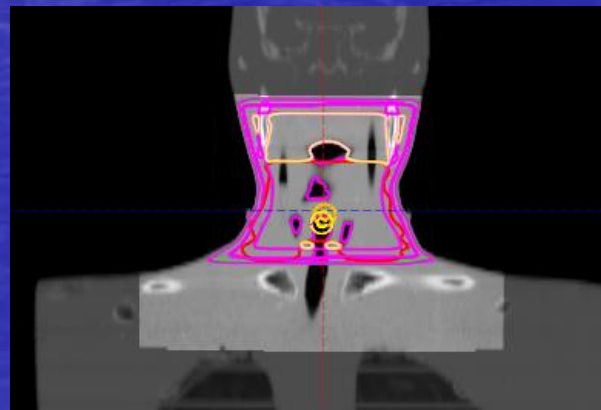
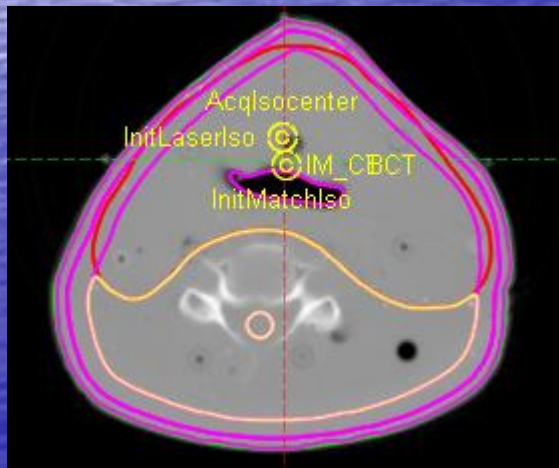
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2. CBCT/CT Images of an Alderson RANDO phantom

- ❑ CBCT images were obtained in a Varian`s On-Board Imager (v1.4), using a standard-dose head protocol.
- ❑ Planning CT images were obtained in a Toshiba Aquilion LB.



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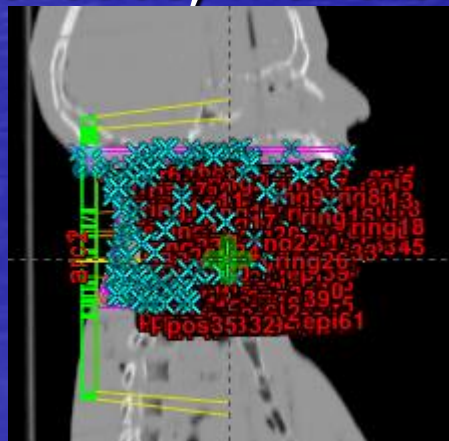
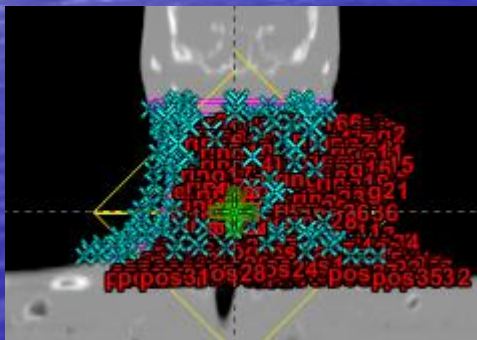
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3. Planning

- ❑ A VMAT plan has been calculated in Eclipse (v10) using all the different calibration curves.
- ❑ For each image, points were defined in different tissues (air, bone and soft tissue) and anatomical areas (PTV, spinal cord, parotids, mandible and oropharynx).



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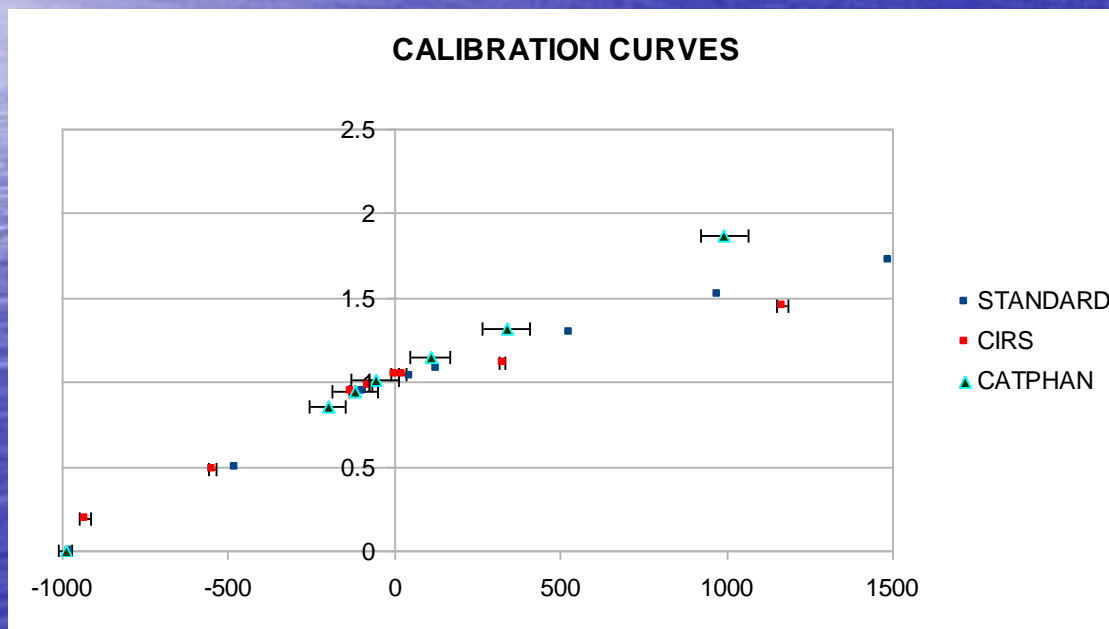
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RESULTS

1. Calibration curves for CBCT Images



Catphan-Teflon gets the biggest differences.

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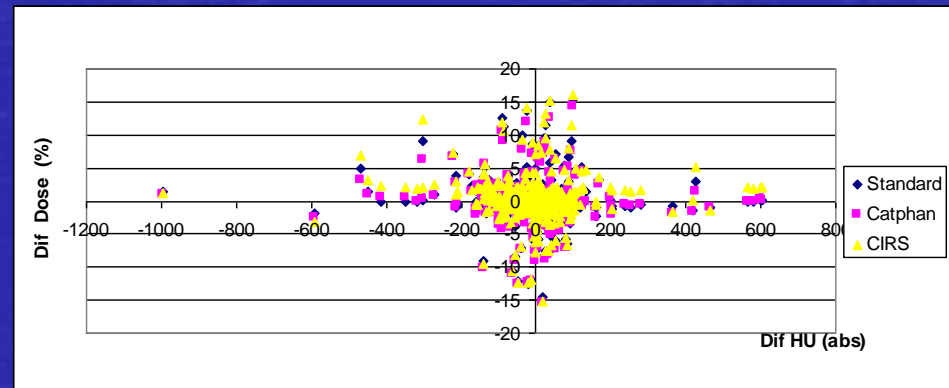
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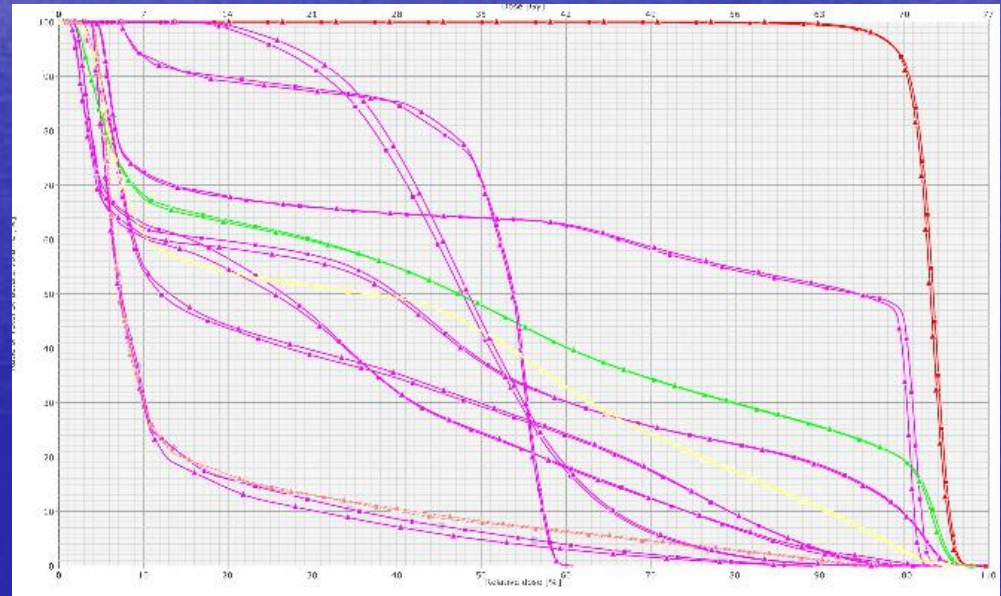
- The average difference in HU for the points analyzed was 5 HU (SD 147)
- The average dose differences were less than 2% for all calibration curves
- We found no relationship between differences in HU and doses.



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RESULTS

- All CBCT-DVHs were in excellent agreement with CT-DVHs.
- Minimum, maximum, mean and median doses agreed quite well (differences less than 2%).
- The smallest differences were obtained for the CIRS-calibration curves.



DVH CT-CBCT_cirs comparison for all the structures considered

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CONCLUSIONS

CBCT images for a head and neck treatment provide accurate dose calculation in adaptive radiotherapy in order to evaluate changes with the original treatment planning using the calibration curves analyzed.