**PRESENTATION TITLE**
Zero TE based pseudo CT conversion for Head and Neck: from feasibility to a Radiation Therapy workflow-friendly solution

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**ABSTRACT**

**Purpose:** An MR-only Radiation Therapy (RT) Planning solution is very appealing for both the exquisite soft tissue contrast provided by MR compared to CT as well as for the workflow simplification gained by using a single imaging system for both tumor delineation and dose calculation. Major issues currently being addressed are the pseudo-CT conversion and the geometric accuracy of the chosen MR sequences. Another issue in the MR-only workflow is the ability of selecting appropriate coils. Surface coil may lead to sensitivity gaps dependent on placement and channel selection and they may be impractical or even incompatible with RT fixation devices. Body coil provides instead repeatable and uniform coil sensitivity which allow the use of RT fixation at the known expense of a reduced SNR.

Zero Echo Time (ZTE) MR imaging was recently demonstrated suitable for both Attenuation Correction in PET/MR and for pseudo-CT conversion for Head and Neck applications, both in terms of dosimetric and geometric accuracy [1], using a high SNR surface coil. Here we demonstrate ZTE based derivation of pseudo-CT using a body coil for an optimal MR-only workflow. Despite a lower SNR, the body coil enables patient positioning in the MRI with the RT fixation devices, while preserving the image quality and reproducibility needed for pseudo-CT conversion.

**Materials & Methods:**
The method was tested on N=5 volunteers for different resolutions.
A 3-tesla GE SIGNA MR scanner (GE Healthcare, Chicago, IL) and body coil were used for ZTE data acquisition at three different resolution (2.4, 2 and 1.5 mm isotropic resolution). A GEM head and neck (HNU) array coil (GE Healthcare, Chicago, IL) was used on one of the volunteer as reference.

ZTE data were processed with both a threshold-based pixel-wise conversion method [2] and with a Deep Learning (DL) method [3].

**Results:** In Figure 1 the raw images acquired with the GEM HNU coil used for reference is shown in the left top row. On the right top row, the ZTE raw images from the body coil are shown. At the bottom, the pseudo-CT converted data for the GEM HNU coil on the left and for the body coil on the right are illustrated. A 3D rendering of the bone is also shown for both coils. The body coil on the right provides uniform
coverage (i.e. similar to the GEM HNU coil on the left) at the cost of a slightly reduced SNR which however does not significantly impact the pseudo-CT result.  

**Conclusions:** We have optimized a body coil protocol for pseudo-CT conversion which gives comparable results to the high SNR GEM HNU coil. We have demonstrated the pseudo-CT for different resolutions, including 1.5 mm isotropic resolution for both pixel-wise and DL conversion methods. These results indicate that the body coil can be used allowing for all required fixation devices for an optimized MR-only based RTP workflow. This workflow is also compatible with any additional surface coil the users may choose for the preferred sequence for tumor delineation.

![Figure 1](image1.png)

**Figure 1:** Left: HNU coil ZTE raw images (top), 3D bone rendering (left) and pseudo CT conversion (bottom) for the high-resolution protocol (1.5 mm isotropic). Right: Corresponding Body coil ZTE results.

References: