**ABSTRACT SUBMISSION FORM**

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**PRESENTATION TITLE**

Coil-replacement shimming reduce inhomogeneity-induced artifacts in sodium imaging

**AUTHOR(S)**

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**ABSTRACT**

Coil-replacement shimming reduce inhomogeneity-induced artifacts in sodium imaging

**Purpose:**
The complementary physiological information provided by sodium (²³Na) MRI is promising for evaluation of radiation therapy (bioscale for cell viability). When only a single tuned ²³Na coil is available, a proton (¹H) coil is needed for B₀ shimming to reduce inhomogeneity-induced artifacts. Differences in coil geometry affect the accuracy of the shimming. Furthermore, due to the fast transverse relaxation of sodium, ultra-short Tₑ sequences have to be used. As these sequences are usually non-Cartesian sampled, blurring artifacts caused by B₀ inhomogeneity can occur. The importance of similar coil geometry was evaluated as well as the feasibility of B₀ inhomogeneity correction from field maps obtained from ²³Na scans.

**Materials & Methods:**
A single-tuned ²³Na birdcage coil was used for data acquisition while a ¹H phased array coil and a ¹H birdcage coil were used for shimming (twisted projection sequence, 7T human MRI, Siemens, Germany). The ¹H birdcage coil was designed specifically to be geometrically similar to the ²³Na coil for better shimming accuracy. However, the image quality is poor due to RF field inhomogeneity. A phantom with varying sodium concentration was scanned with the ²³Na coil with no shimming, shim settings derived from measurements using the ¹H birdcage coil and from the ¹H phased array coil, respectively. Field maps were calculated from data acquired with the ²³Na coil and used for B₀ correction of the images to reduce blurring.

**Results:**
There is a clear visible difference in fig. 1 between the images acquired without shimming (a) and the images where shim settings were used (b and c). The difference between the images acquired with shim settings from the birdcage coil (b) and the phased array coil (c) are a lot more subtle. Even though the
inhomogeneity-induced artifacts are reduced after shimming is used, there are some blurring artifacts indicated by white arrows. Apart from using shim values, the image in Fig. 1d has also been $B_0$ corrected with the field map calculated from phase images acquired with the $^{23}$Na coil. In this image, the blurring artifacts indicated by arrows, are reduced significantly.

![Figure 1](image_url)

**Figure 1:** (a) Sodium MRI of a phantom acquired with no previous shimming. Acquisition with shim settings from (b) the geometrically similar $^1$H birdcage coil which is not suitable for imaging at 7T and (c) the $^1$H phased array coil otherwise used for structural imaging (32ch Nova Medical). (d) Sodium image with shimming based on the phased array coil with additional $B_0$ correction

**Conclusions:**
When using a single-tuned $^{23}$Na coil it is crucial to obtain shim settings with a $^1$H coil first. We show in this study that the geometrical similarity of the $^{23}$Na and $^1$H coils is not critical for the reduction of the inhomogeneity-induced artifacts. This implies that if a $^1$H coil is used prior to the $^{23}$Na coil to get structural images, an additional coil change to get shim values from a coil geometrically similar to the $^{23}$Na coil is not critical. It has further been shown that it is possible to use field maps calculated from the $^{23}$Na phase images to further reduce the inhomogeneity-induced artifacts.