

Introduction

- ▶ Sodium is the key component of cellular homeostasis.
- ▶ Clinical Potentials : Subtle pathophysiologic changes can be detected in sodium imaging in early stage of the various diseases.
- ▶ Previous uniformity correction method works well but takes much time. For example, 20 min for 2mm iso-cubic voxel images.
- ▶ We present upgraded uniformity correction technique which reduces scan time significantly but provides higher SNR uniform image.

Materials and Methods

- ▶ System Info : All the images are acquired using a MAGNETOM Terra 7T MR system (Siemens Healthcare, Erlangen, Germany) located at the Hale Building for Transformative Medicine using a dual tuned (¹H/²³Na) birdcage head coil (RAPID Biomedical, Rimpar, Germany) with 32 additionally integrated receive-only array elements for ²³Na MRI.
- ▶ Sequence : UTE_3D Sequence. TR/TE: 12.8/0.27, FA: 25.
- ▶ Previous method calculates a sensitivity map from the low pass filtered volume and array coil images. To obtain the uniformity corrected image, it multiplies the sensitivity map to the array coil image. (Fig. 1) This method works well but takes twice the scan time for a uniformity corrected image.
- ▶ To reduce the scan time and increase SNR in the volume coil image, we obtained lower resolution images instead of low pass filtered image and performed uniformity correction. (Fig. 2,3)
- ▶ To match the image matrix size, lower resolution images were linearly interpolated. We measured line profiles from the center slice of the in vivo images using Matlab and custom image analysis scripts to confirm the uniformity correction effect.

Results

- ▶ The lower resolution images were less noisy (Fig. 2) while preserving overall anatomic morphology. The uniformity correction results with lower resolution images show almost identical results with high resolution one (Fig. 3).
- ▶ Using the 4mm iso-cubic resolution volume coil images, we could obtain 2mm and 3mm iso-cubic voxel total sodium concentration (TSC) map within 12 min 30s and 6min 30s, respectively (Fig. 4).

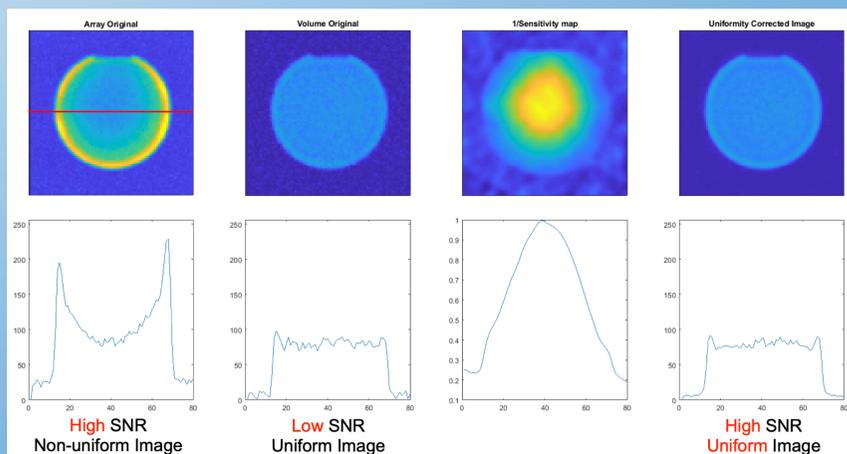


Fig 1. Uniformity Correction Method

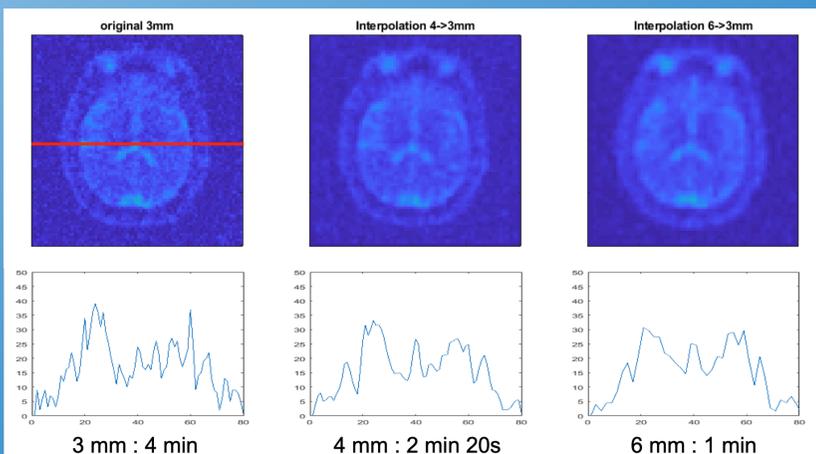


Fig 2. Volume Coil Images with Various Resolution

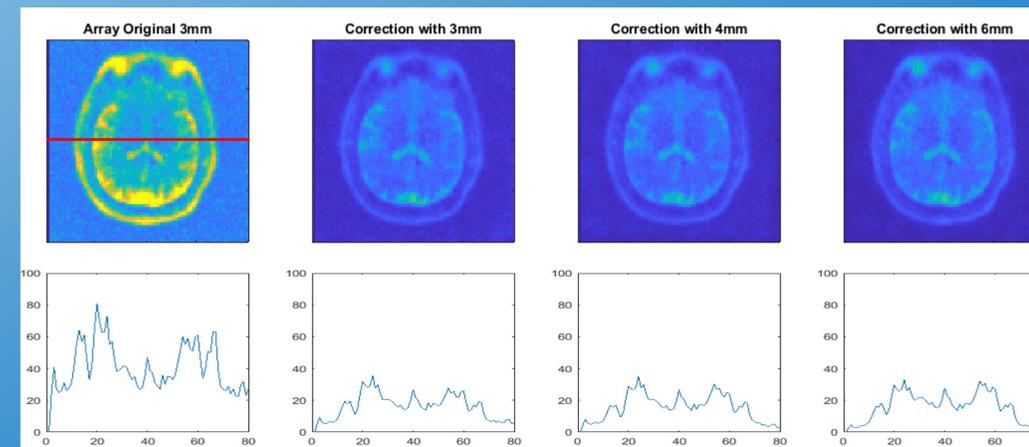


Fig 3. Uniformity Correction with Various Resolution Volume Coil Images

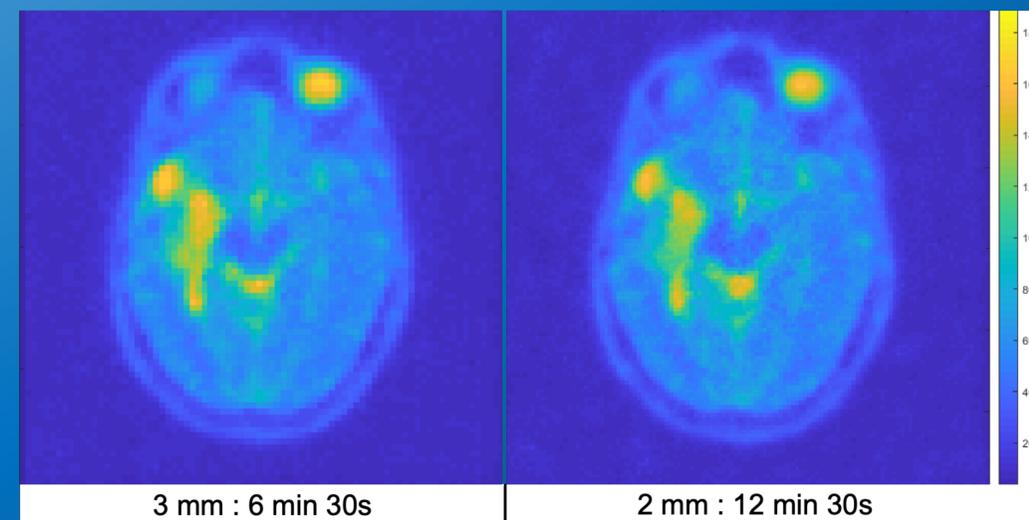


Fig 4. Patient Total Sodium Concentration Map (mM)

Conclusions

- ▶ We demonstrated the feasibility of using lower resolution volume coil images for uniformity correction.
- ▶ It provides similar uniformity correction results when we compare with high resolution data while reducing scan time about 40%.
- ▶ Our approach can be applied to patient ²³Na scan practically.