# Recovery of intensity at the sub-FOV interfaces in continuously moving table MRI

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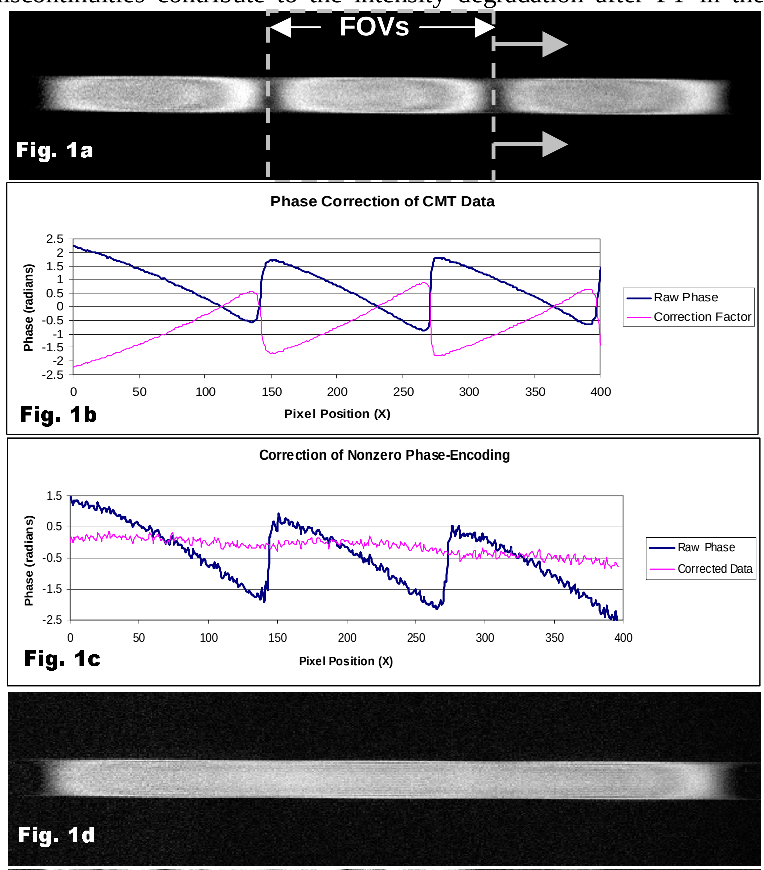
## Introduction

Extended-FOV continuously moving table (CMT) MRI allows a net longitudinal FOV many times longer than the region of magnet homogeneity and magnetic field gradient linearity (1). The sub-FOV is defined as the longitudinal length sampled in an individual readout. Falloff of intensity has been observed at the region where two abutting sub-FOVs join. These positions correspond to the interfaces between consecutive samples of the central $k_Y$-$k_Z$ phase encodes. The intensity falloff is caused by the phase difference of the leading edge of hybrid space data of one sample of a phase encode with the trailing edge of the same phase encode from the next sub-FOV.

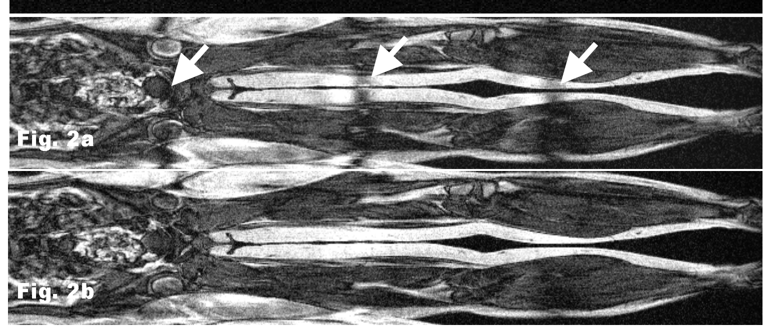
## Methods

Figure 1a is a single slice from a 3D image of a phantom showing the artifact and the outline of the acquired 28 cm. sub-FOV. In moving table as well as stationary MRI acquisitions, images will have some phase accumulation in the complex data along the readout direction. The phase accumulation can be sampled from hybrid space data (FT in readout direction only) at the center of k-space in $k_Y$ and $k_Z$. This phase accumulation is graphed in Figure 1b (blue line) for three sub-FOVs along the table motion direction (X). Note the phase discontinuity at the sub-FOV interfaces. These discontinuities contribute to the intensity degradation after FT in the remaining $k_Y$ and $k_Z$ directions. This pattern is retained for higher k-space views. For example the blue line in Fig. 1c is the phase for the 3D view $k_Y$=0.25 cm$^{-1}$, $k_Z$=0.167 cm$^{-1}$. As can be seen this sawtooth pattern again dominates the phase. This is observed throughout the non-zero k-space views. Careful shimming has been found to partially correct the artifact, but the image results are unsatisfactory. Because the hybrid space data has already been FTed along X we can manipulate the phase to eliminate this sawtooth pattern as long as we apply the same correction to all the $k_Y$, $k_Z$ data for that X position. The purple line of Fig 1b shows that correction function. Note that it is simply the negative of the measured phase and has magnitude = 1.0.




## Results

This correction produces hybrid space data with exactly zero phase at the center of $k_Y$, $k_Z$ (not shown). In Fig. 1c the purple line shows the same $k_Y,k_Z \neq 0$ view as the blue line but after application of the correction factor in Fig 1b. Note that the sawtooth discontinuity is eliminated, but the phase information required to reconstruct the data is preserved. Fig. 1d is an image reconstructed using the same data as Fig. 1a but after phase correction of all the views. Note that the magnitude falloffs have been eliminated and the image of the agar phantom is homogeneous throughout. Fig. 2a is a four sub-FOV in-vivo image with these intensity dropouts visible (arrows). Fig. 2b is the same data with correction applied.




## Conclusion

We have presented a phase correction method for CMT imaging which eliminates the volume-dependent phase accumulation and thus the phase discontinuities in the data prior to reconstruction. The correction appears to be independent of view order. No additional measurements are required, as the correction factor is the inverse of the phase of the central k-space views.

## References

1. Kruger, DG, et al., Magn Res Med, 2002. **47**: p. 224-231.