

Design of a 3D Printed Magnetic Particle Imaging Bed Insert for Multimodal Registration

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Magnetic particle imaging (MPI) generates signal from nonlinear magnetization of iron-oxide nanoparticles, giving background-free detection but no anatomical context, so registration to an anatomical modality is required. Conventional workflows either image fiducials alongside the subject, where spillover affects in vivo quantification [1,2], or acquire a fiducial-only registration scan. Fiducial preparation and placement must be consistent but are usually manual, introducing variability. Taped fiducials shift between studies and are confined to the bed surface, while distribution throughout the field of view would minimize registration error (Fig. 1A). We developed a 3D-printed clear resin insert seating reproducibly in the MPI mouse bed, holding four capillaries at CAD-defined positions spanning the FOV, including elevated positions above the bed floor. Fiducials contained 2 μL VivoTrax 1:1 (v/v) in Omnipaque, visible in MPI and CT (Fig. 1B). We evaluated agreement between MPI and CT mouse phantom [2] segmentations registered by taping and insert transforms (Fig. 1A).

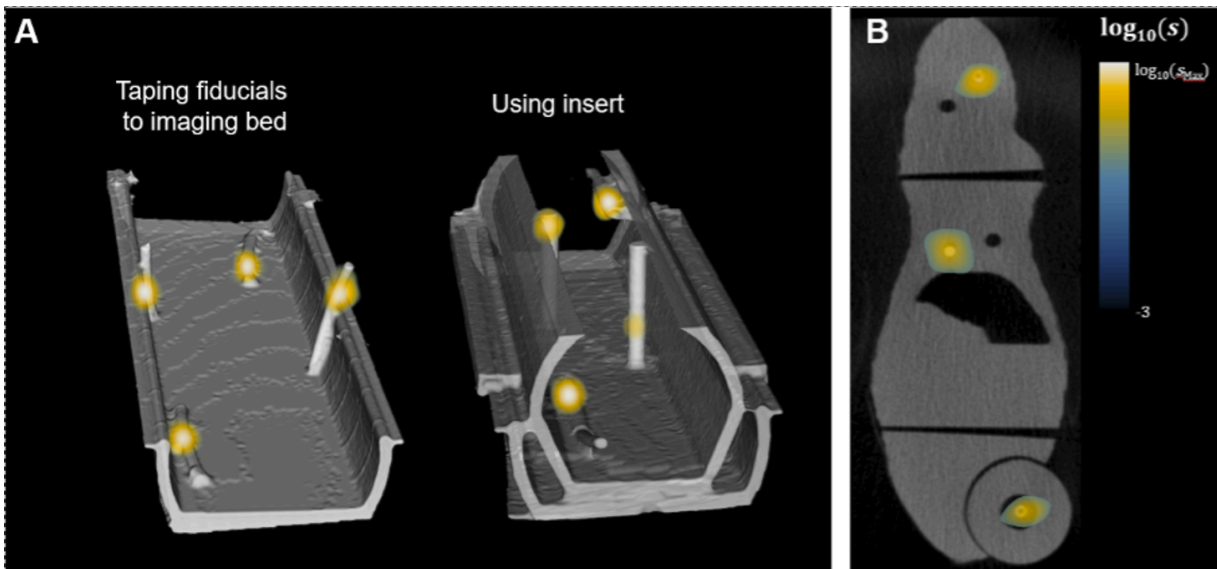


Fig. 1. (A) Taped vs. insert-mounted fiducials on the MPI bed. (B) Overlaid MPI/CT of a phantom, $\log_{10}$ signal scale.

Acknowledgements

This work was performed in the J. Crayton Pruitt Family Department of Biomedical Engineering at the University of Florida.

References

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