

# SELF-SUPERVISED ISOTROPIC SUPERRESOLUTION FETAL BRAIN MRI

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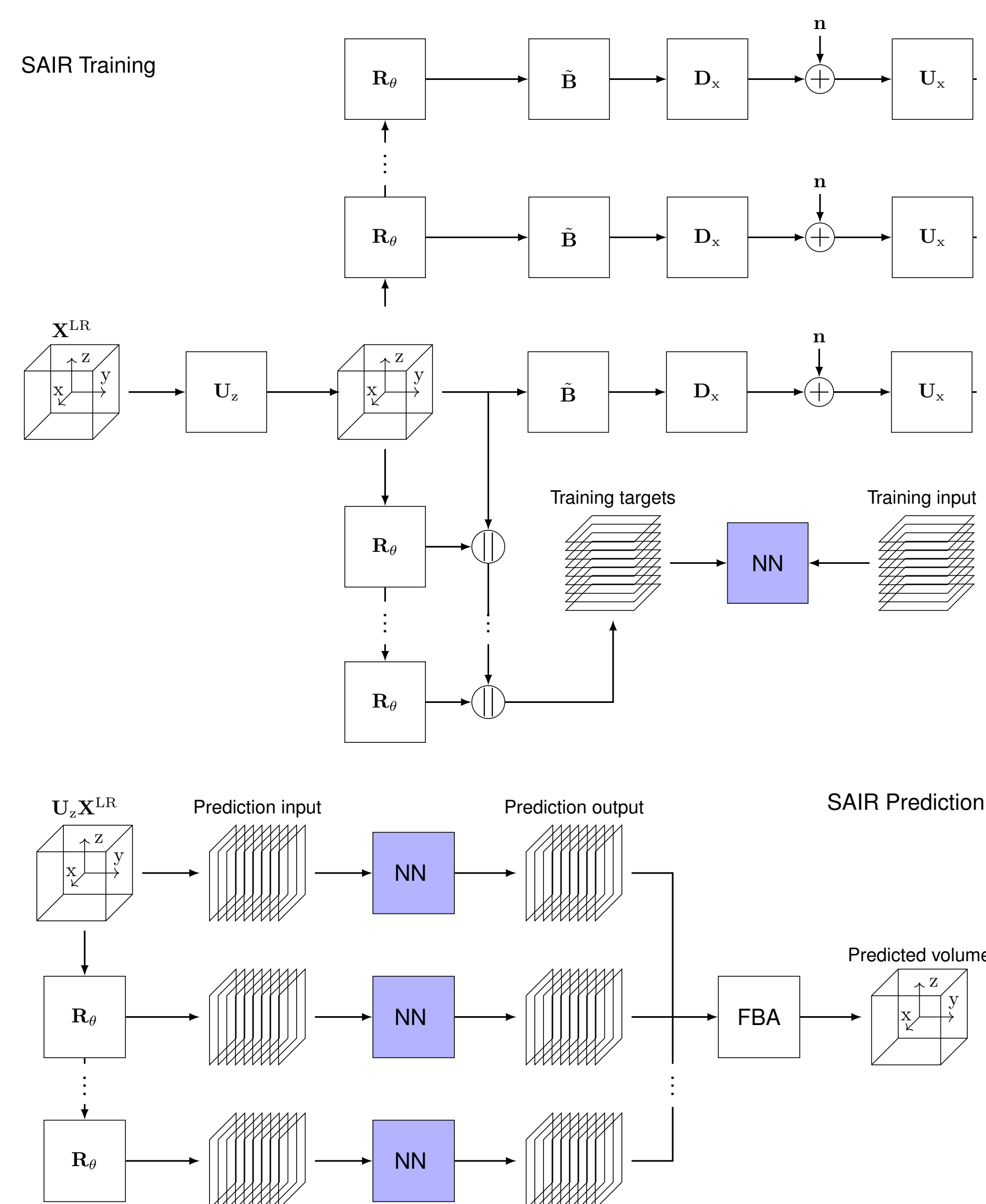
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## BACKGROUND

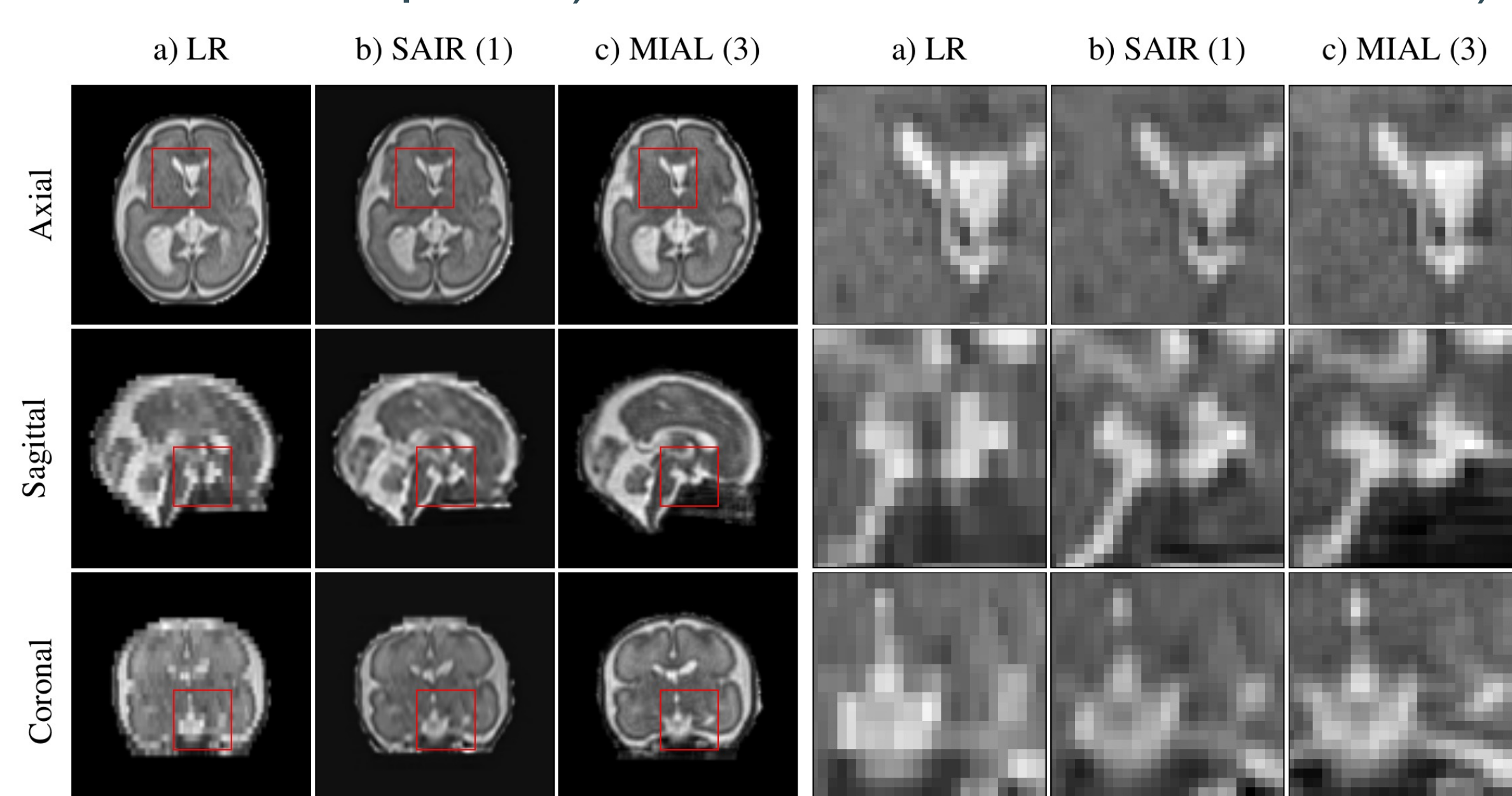
- T2w structural fetal brain MRI, complementary to ultrasound.
- Typically relies on *several* low-resolution (LR) non-isotropic orthogonal volumes. Extreme: single volume.
- Few volumes, strong regularization.
- Hard-to-get ground-truth data makes supervised learning challenging.

## SAIR

- Self-supervised, using the HR axis
- Simplified MRI model: convolution + downsampling
- Rotation for data augmentation
- Combination of several predictions from rotated data
- Fourier burst accumulation
- U-Net with skip connection (artifact removal)
- Very shallow: 1 encode/decode block, 32 channels, 7x7 kernels

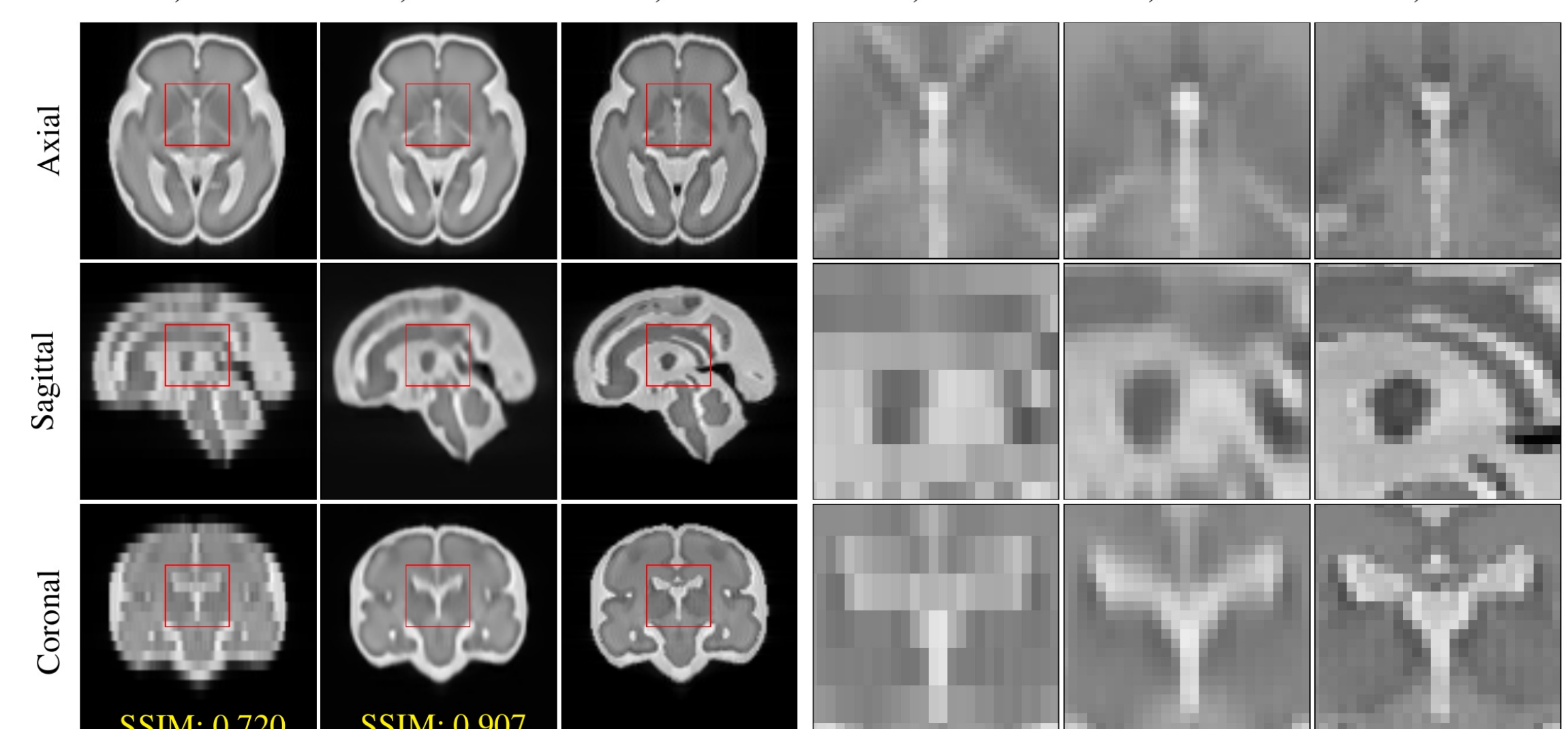
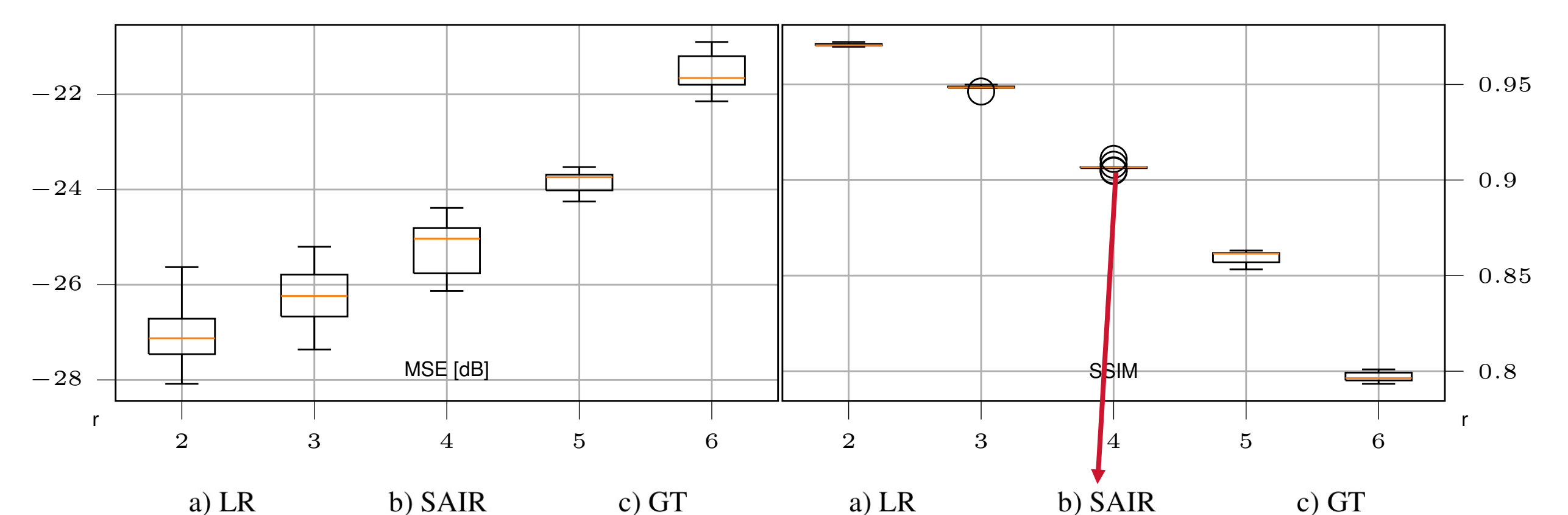


- Validation on clinical data with little motion (33 weeks GA, 1.5 T, normal development), 1.124 x 1.125 x 3.3 mm<sup>3</sup> voxels

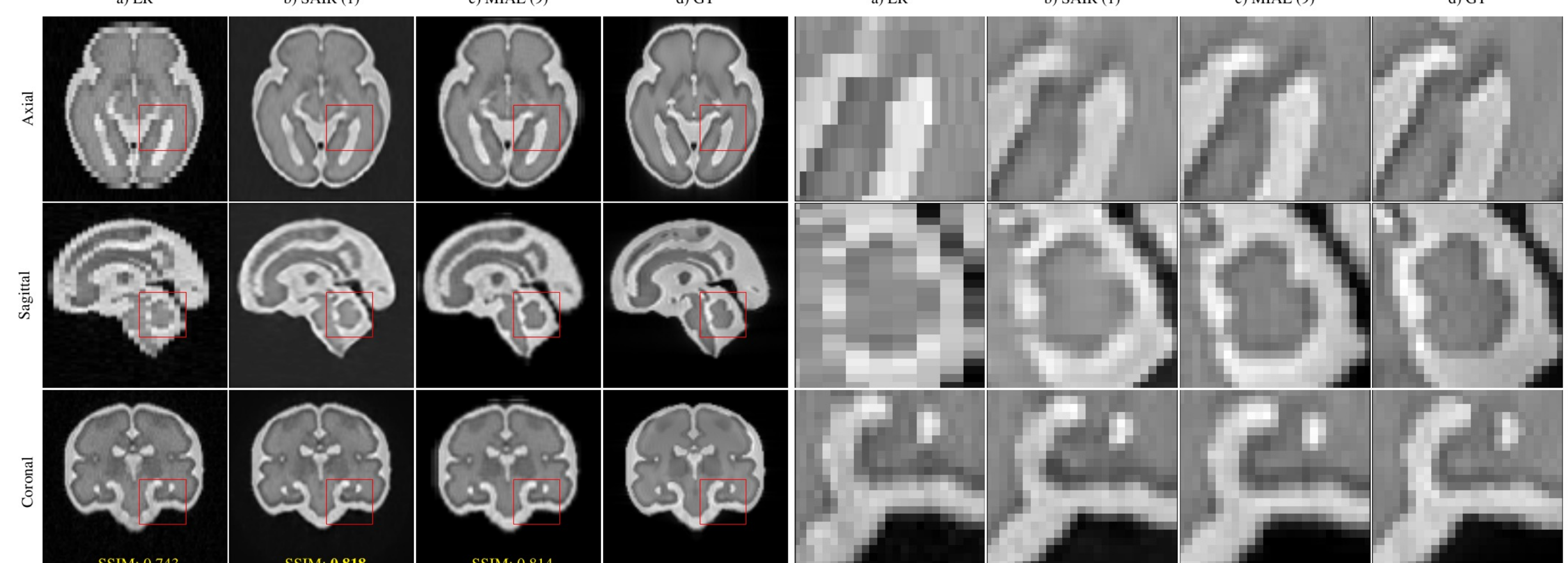
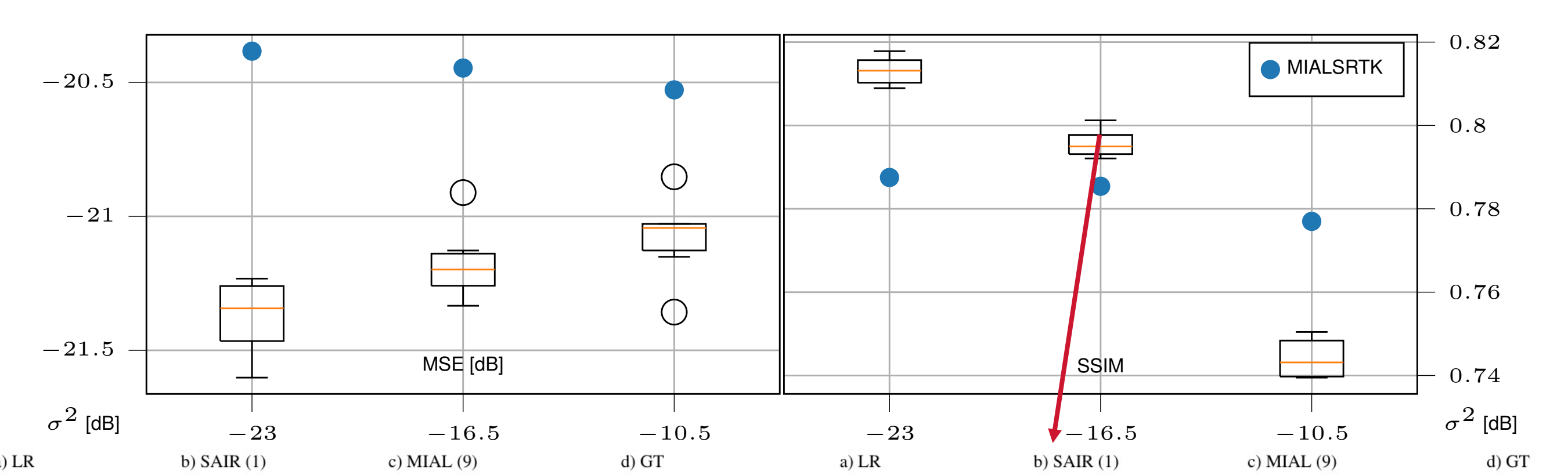


## RESULTS

- Validation with the simplified MRI model
- Analysis of the robustness w.r.t.  $r = \Delta z / \Delta x$



- Validation with the FaBiAN (realistic simulated fetal-brain MR)
- Analysis of the robustness w.r.t. the noise level



## CONCLUSION

- Comparable to multiple-volume on idealized settings.
- Directly usable within current pipelines (replacing interpolation).
- Promising for clinical translation (reduced acquisition time).

