Appendix 1

M0 maps are visualized here for the digital phantom experiments. However, note that M0 maps were not analyzed in this work and were not considered as standard outputs of interest in this study. Nevertheless, anecdotal comparisons can be made between the reconstruction methods. As shown in *Figure S1*, the conventional MRF reconstruction tends to yield M0 maps with "noise spikes" that make consistent scaling difficult as data are reduced in number of frames. LR-MRF mitigates the noise spikes observed in MRF and has comparable intensity profiles across the different number of frames, but overall scaling is still not consistent. SuperMRF shows increasing M0 error at fewer frames, however the overall scaling and intensity profile is qualitatively consistent across the conditions. Similar trends can be observed in *Figure S2*; the degradations in SNR introduce more noise spikes in LR-MRF M0 maps and SuperMRF M0 maps are generally consistent across SNR levels but with increasing errors as SNR decreases.

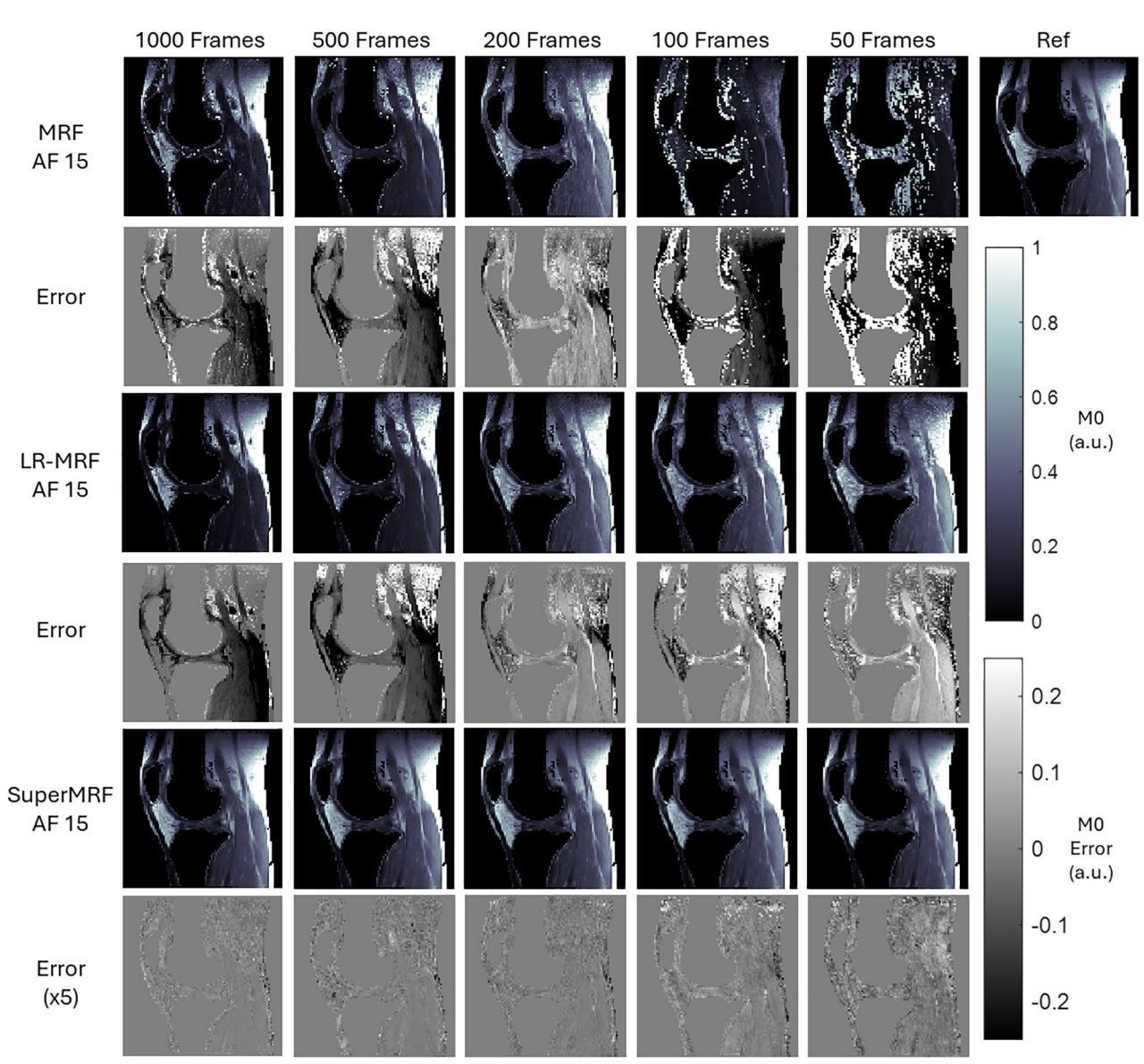

Figure S1 Traditional MRF, LR-MRF and SuperMRF for M0 mapping with the number of frames reducing from 1,000 to 50 and a fixed k-space acceleration factor (AF) of 15. M0 maps were normalized by scaling the image by the 95th percentile value to standardize the scaling while mitigating the effect of outlier values. Note that "spikes" in M0 values in MRF and LR-MRF that lead to differences in the M0 map as compared to reference that are particularly severe for MRF below 200 frames. SuperMRF more closely matches the reference M0 map with no apparent noise spikes.

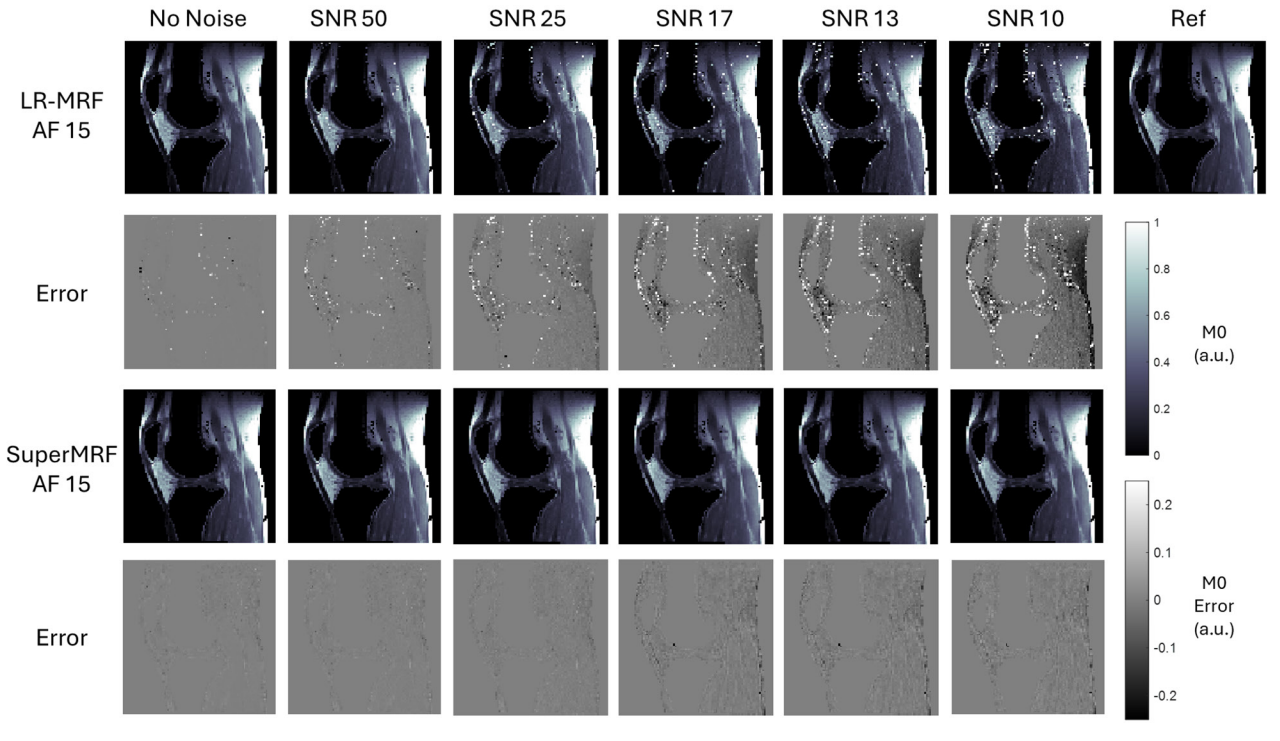

Figure S2 LR-MRF and SuperMRF noise robustness test for M0 mapping with 200 frames and an AF 15. M0 maps were normalized by scaling the image by the 95th percentile value to standardize the scaling while mitigating the effect of outlier values. As SNR degrades, noise spikes become more prevalent in the LR-MRF M0 maps. Overall, M0 maps from both methods have similar relative intensity profiles despite some differences in scaling and occurrence of noise-related spikes.

Prospective real-world data: Note that in the SuperMRF version used for processing of prospective real-world data, T1 and T2 maps were the standard outputs of processing. M0 maps were not generated and therefore could not be included in these supplemental materials. Evaluation of M0 maps from SuperMRF is needed to confirm generalizability of the reconstruction technique.

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