Non-diffractive Acoustic Radiation Force Push Sequences for Shear Wave Viscoelastography

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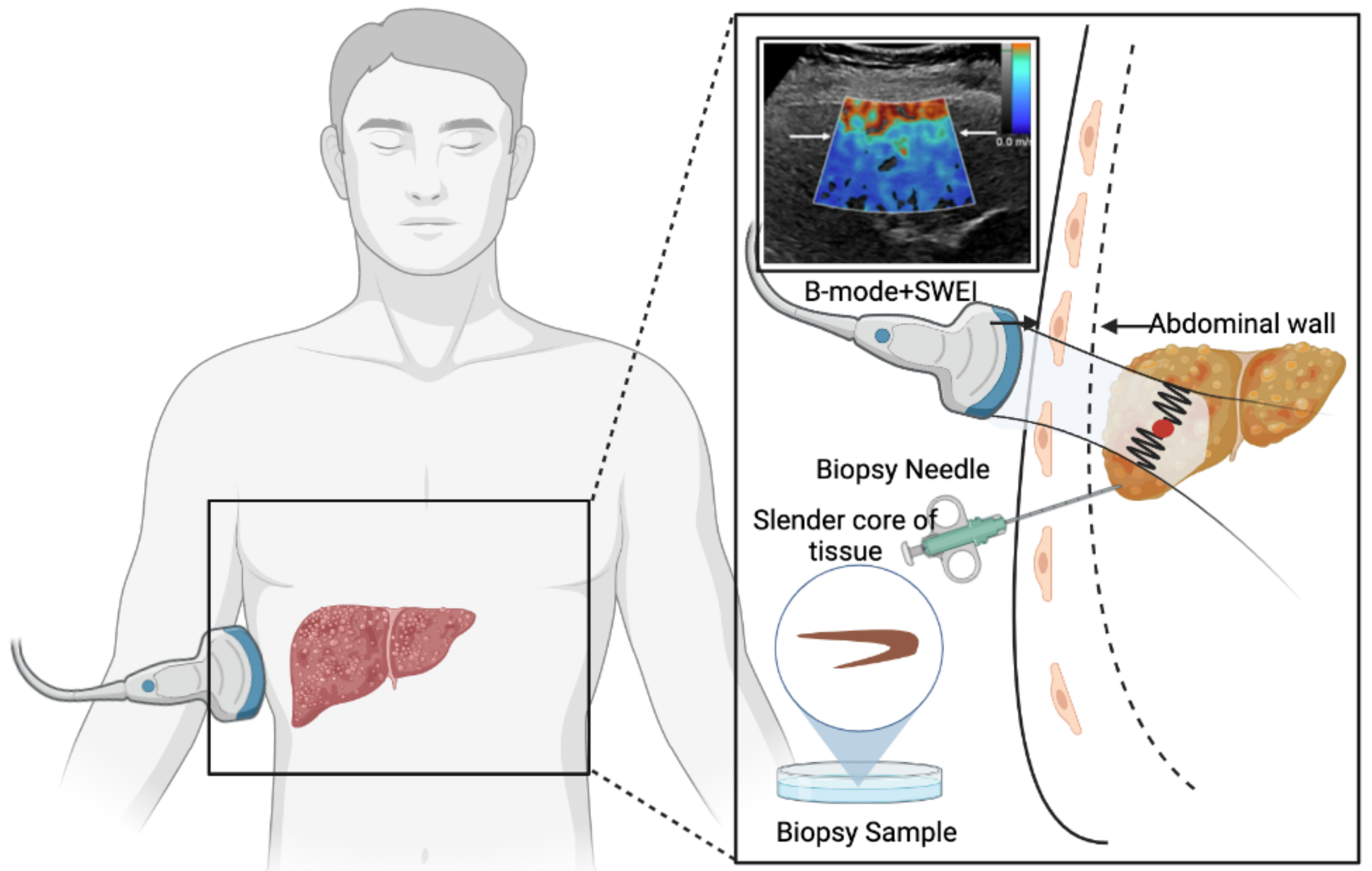
Clinical Relevance



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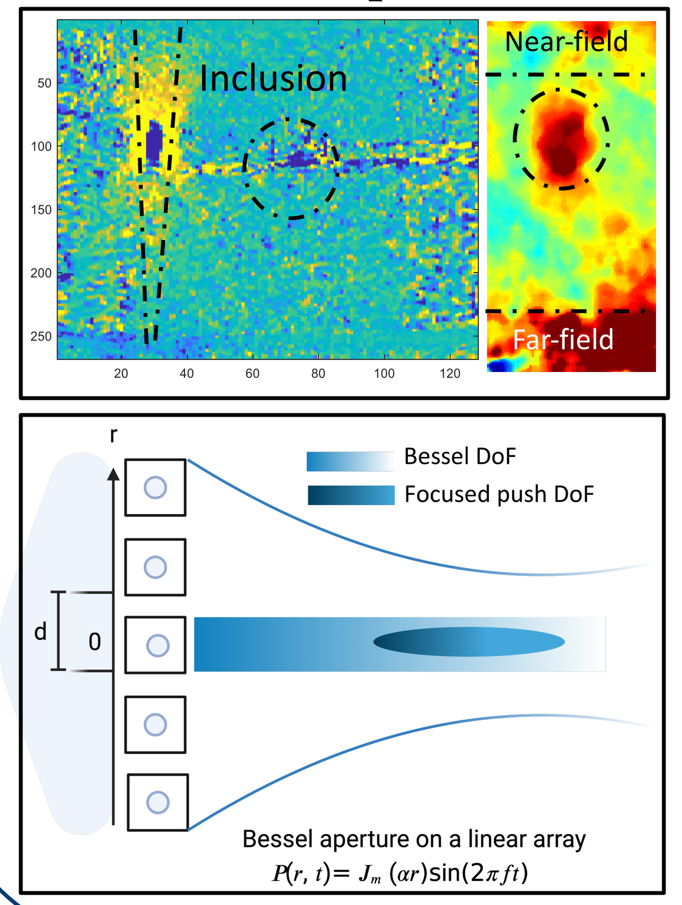
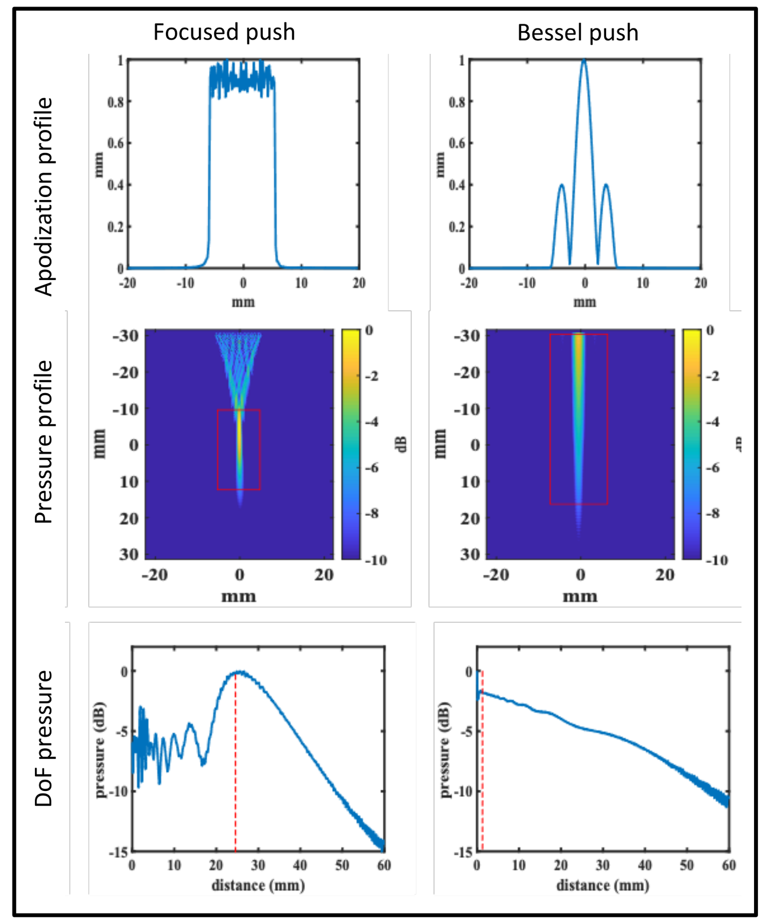
- Chronic liver disease affects 5% of the US population, induces liver fibrosis, and must be regularly monitored for progression.
- Fibrosis leads to increased tissue stiffness thus, amenable to elastographic analysis.

Bessel Apodized Aperture Imaging

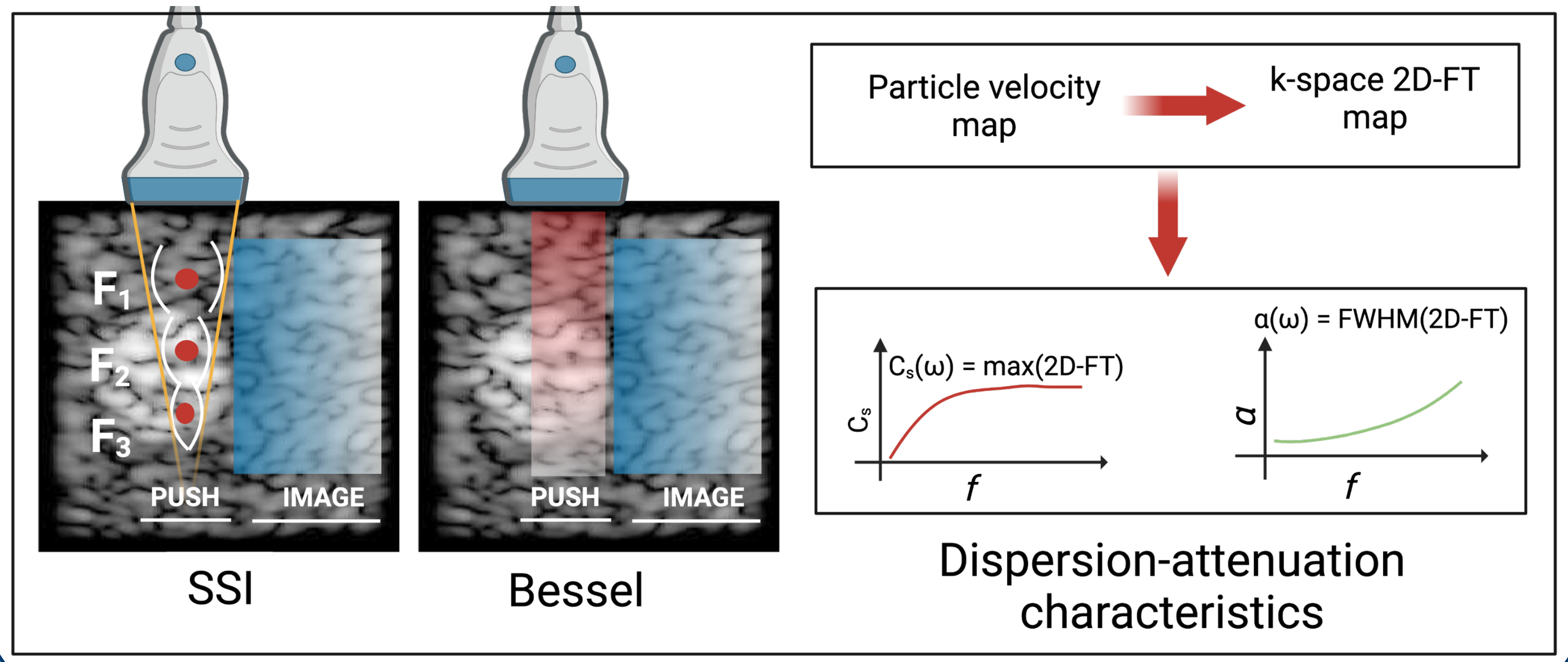
Focused beams cause diffractive near-field scattering and diminished depth-of-field



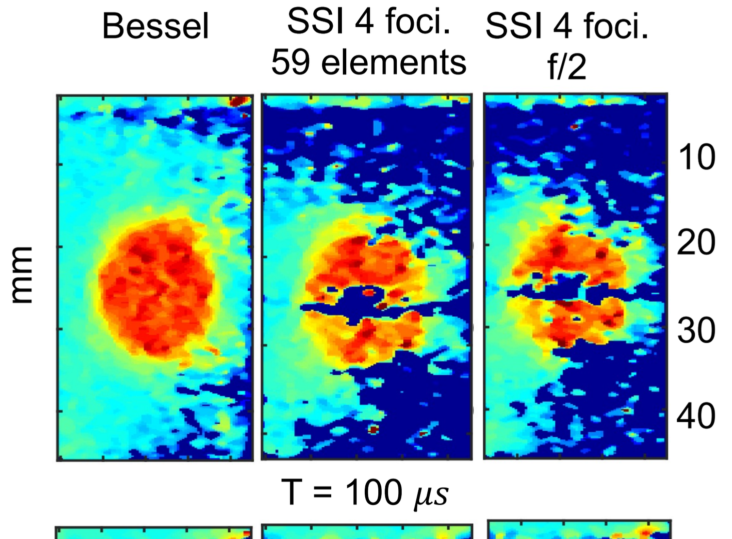
Beam-intensity profiles of focused and Bessel ARF



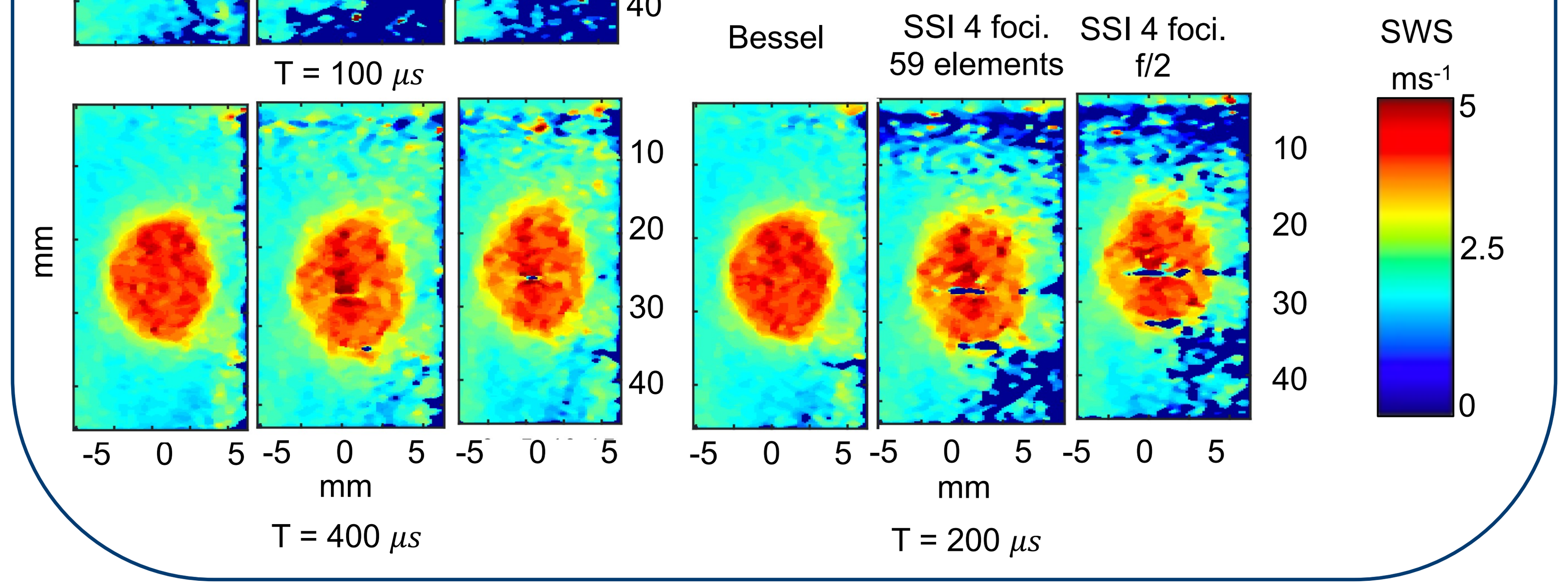
Ultrasound guided Viscoelasticity Reconstruction



Group-speed (c_g) Reconstructions of *in-vitro* Focal Lesions



Elastograms of Bessel (α = 1000), SSI 59 elements (18.2 mm) 4 foci, and SSI f/2 4 foci, with same voltage (38V), with matched total push time but different transmitted energy.



Acknowledgements

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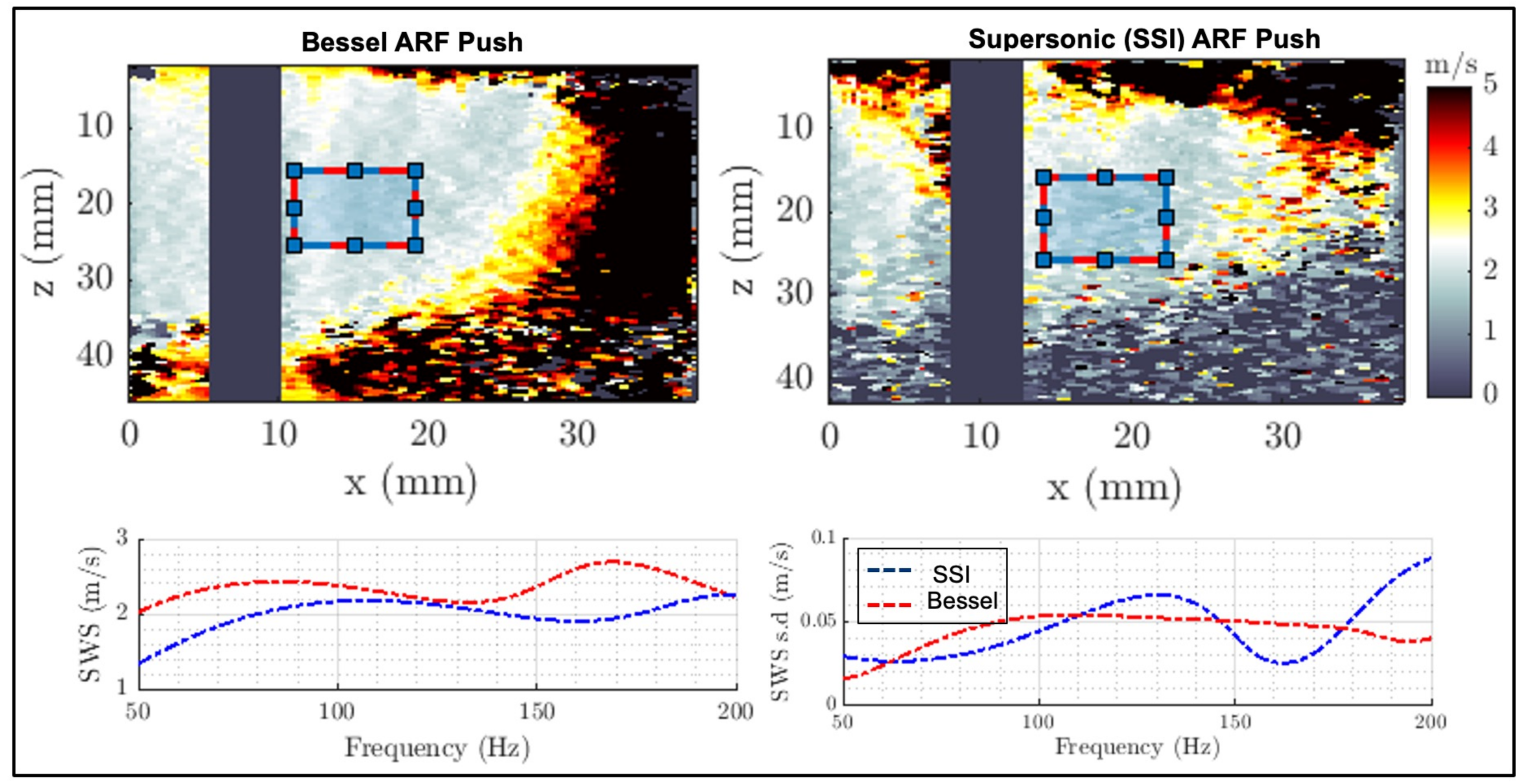
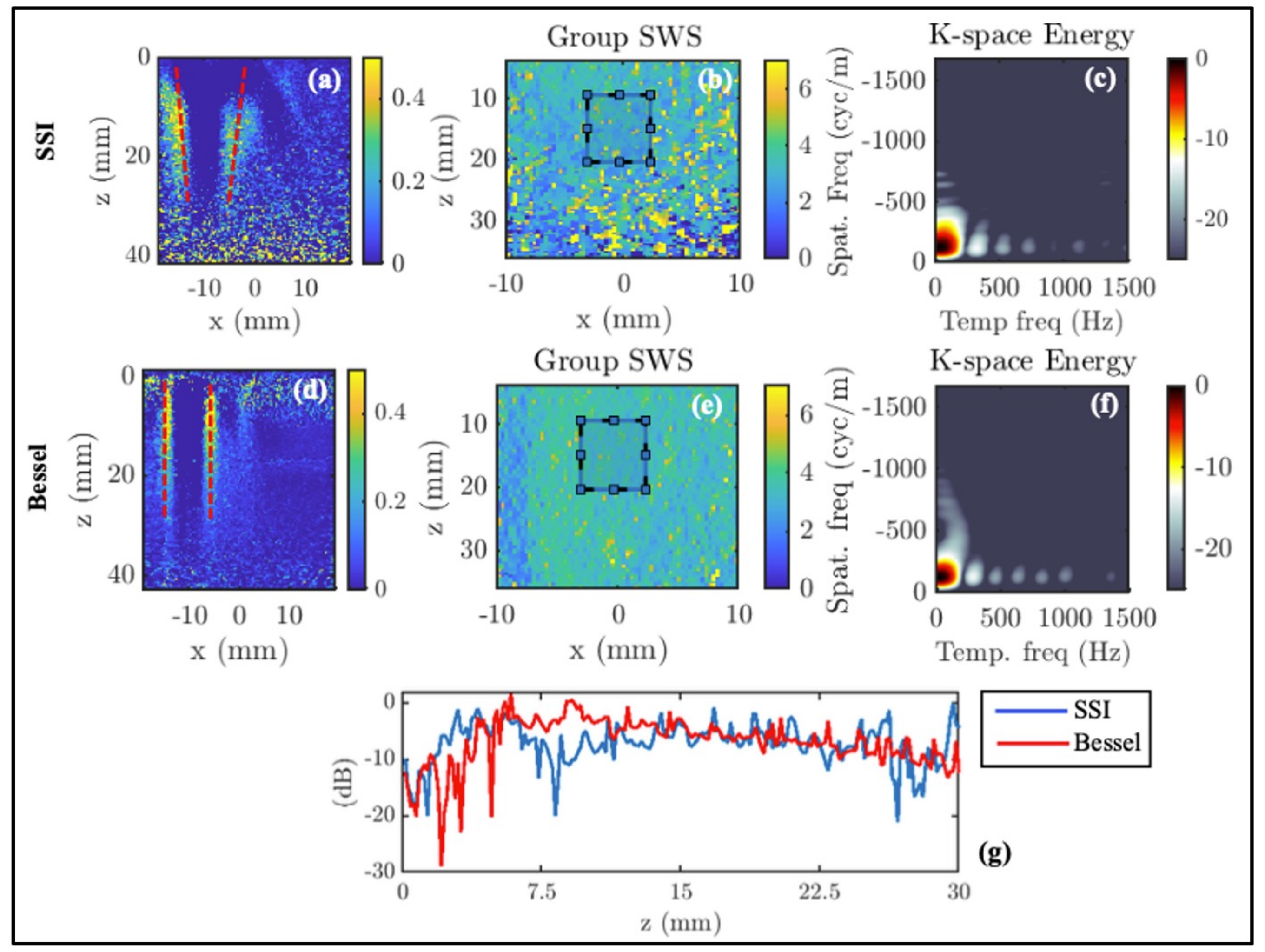
CENTRE for INTEGRATED RESEARCH COMPUTING

Phase-speed (c_{ph}) Reconstructions of Homogenous Phantoms



Mean and deviation of phase velocity reconstructions with Bessel apodized ARF pushes versus SSI. (a) and (b) show the selected10×10 mm region-of-interest (ROI) for the dispersion analysis. Panel (c) and (d) represent the mean and s.d of SWS (m.s^{-1}) across the frequency range of (50-400 Hz) within the ROI



Performance of Bessel apodized ARF pushes versus SSI in fractional bandwidth (FBW) improvement. Panels (a) through (c) show the K-space for SSI push (4 foci: 10, 20, 30 and40 mm). (d) through (e) represent the same, for the Bessel apodized push beam (focus: 32 mm).

Key Take-aways

Bessel apodized ARF beams improved:

- Reconstructions at greater depth-of-field and present less near-field diffractions.
- Fractional band-width (FBW) performance in viscous mediums.
- Dispersion-attenuation reconstructions over extended frequency range compared to Super-sonic Shear Imaging (SSI).