

Methods for Measuring Sub-Surface Skin Displacement during Ultrasound Mid-Air Haptic Stimulation

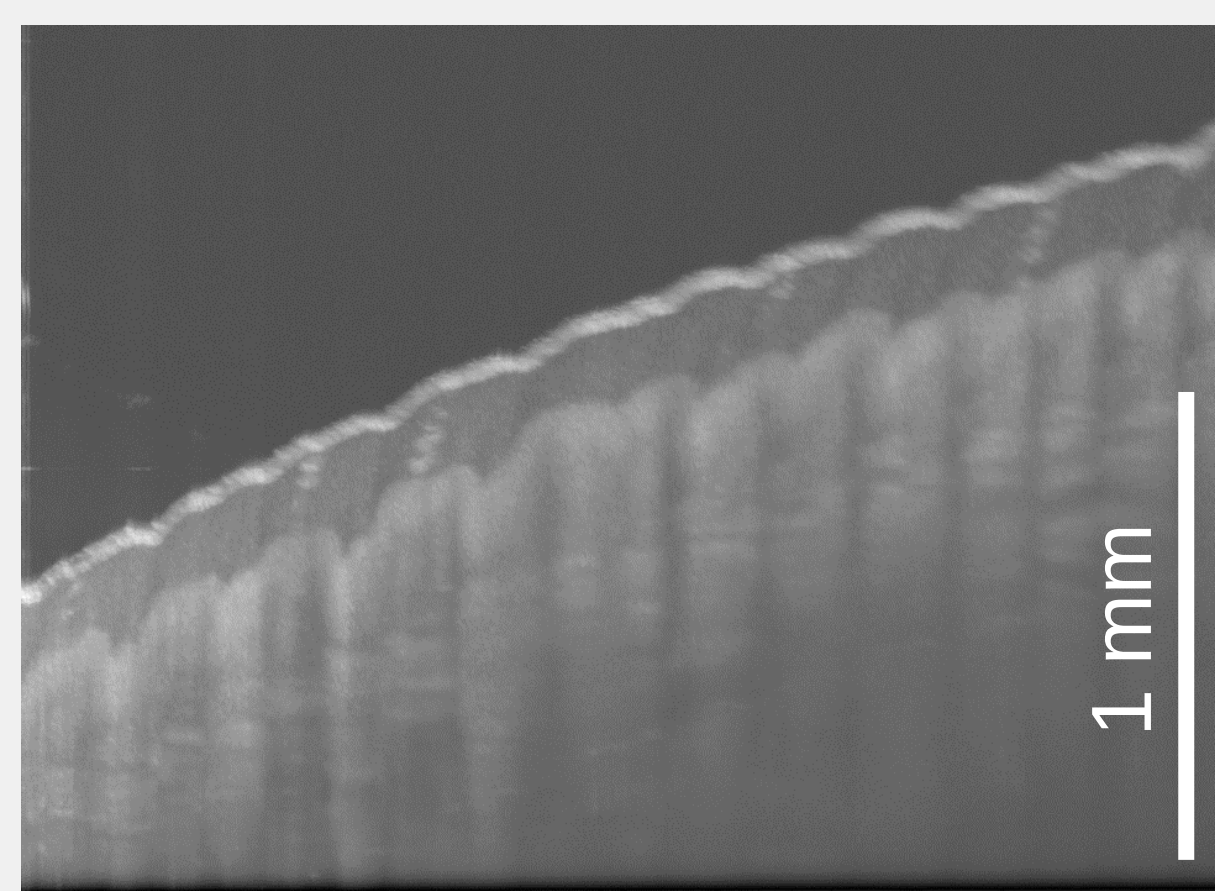
CONTEXT



Source: [Long et al., 2014]

Ultrasound mid-air haptic (UMH) interfaces generate points of high acoustic pressure at a distance by focusing ultrasound waves.

The focal point's position (STM) or amplitude (AM) is then modulated to deliver tactile stimulation.



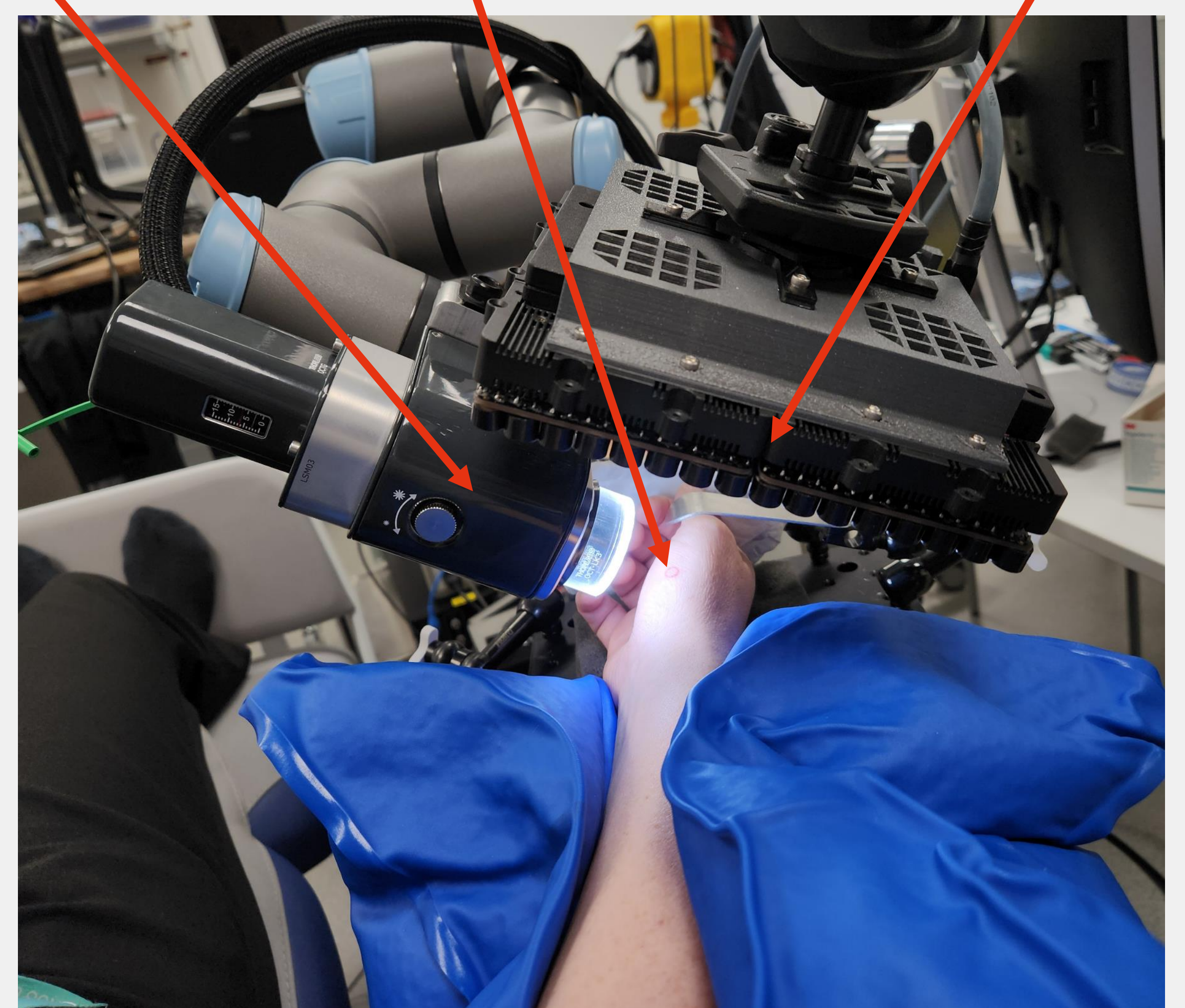
OCT morphological image of a fingerpad

Optical Coherence Tomography (OCT) is a sub-surface skin imaging technique relying on the analysis of the interference pattern created from an infrared beam targeted at the skin. It can be used to measure skin displacement over time.

SETUP

Motivations: understanding the skin layer's response to UMH stimulation

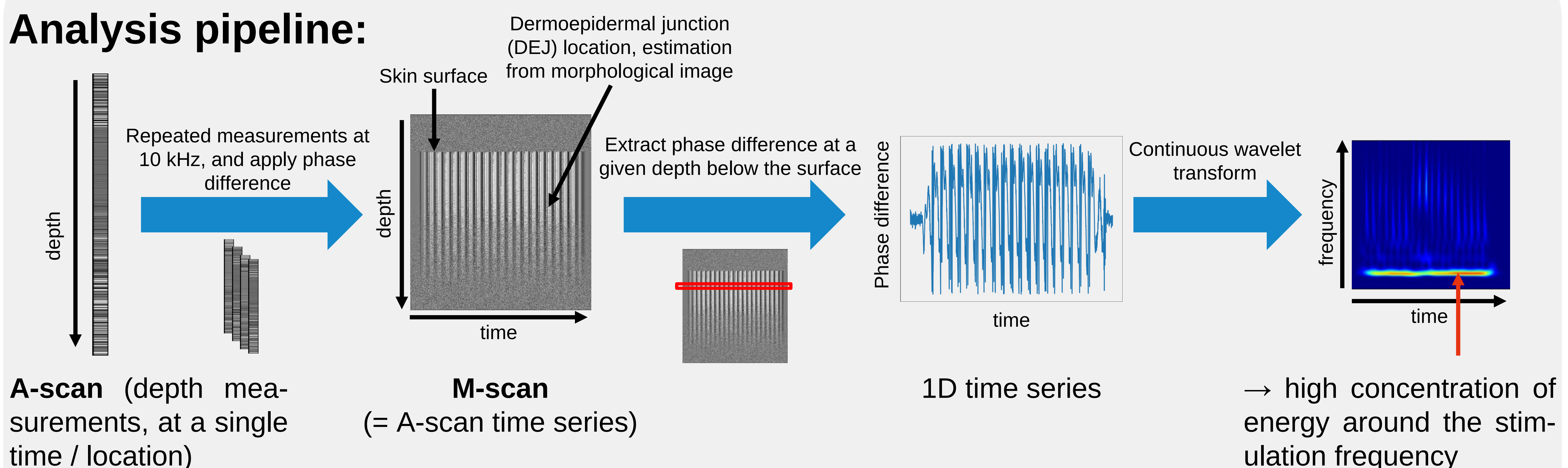
OCT Target point UMH Interface



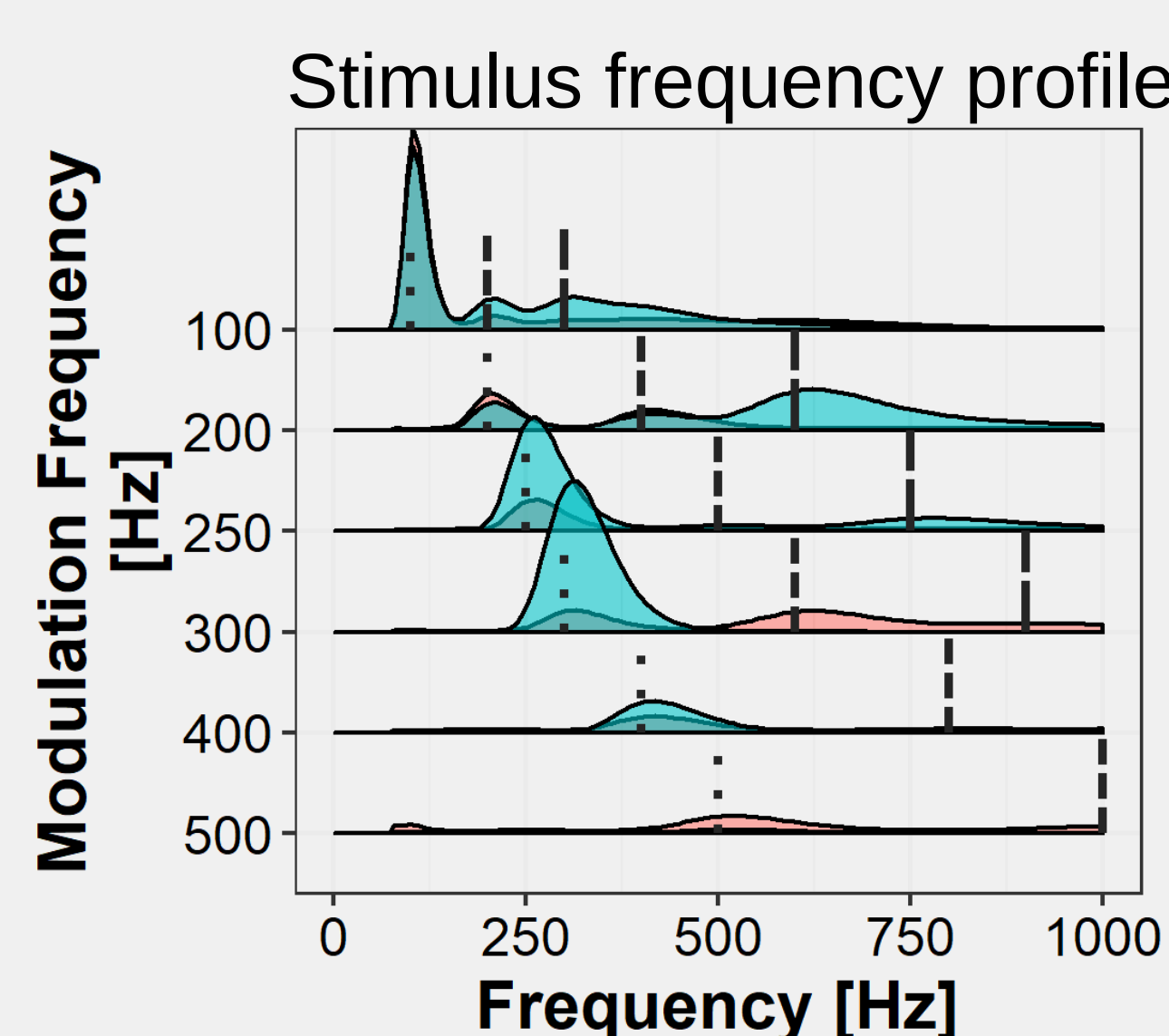
Result: synchronized UMH stimulation and OCT recording at a given location

ANALYSIS

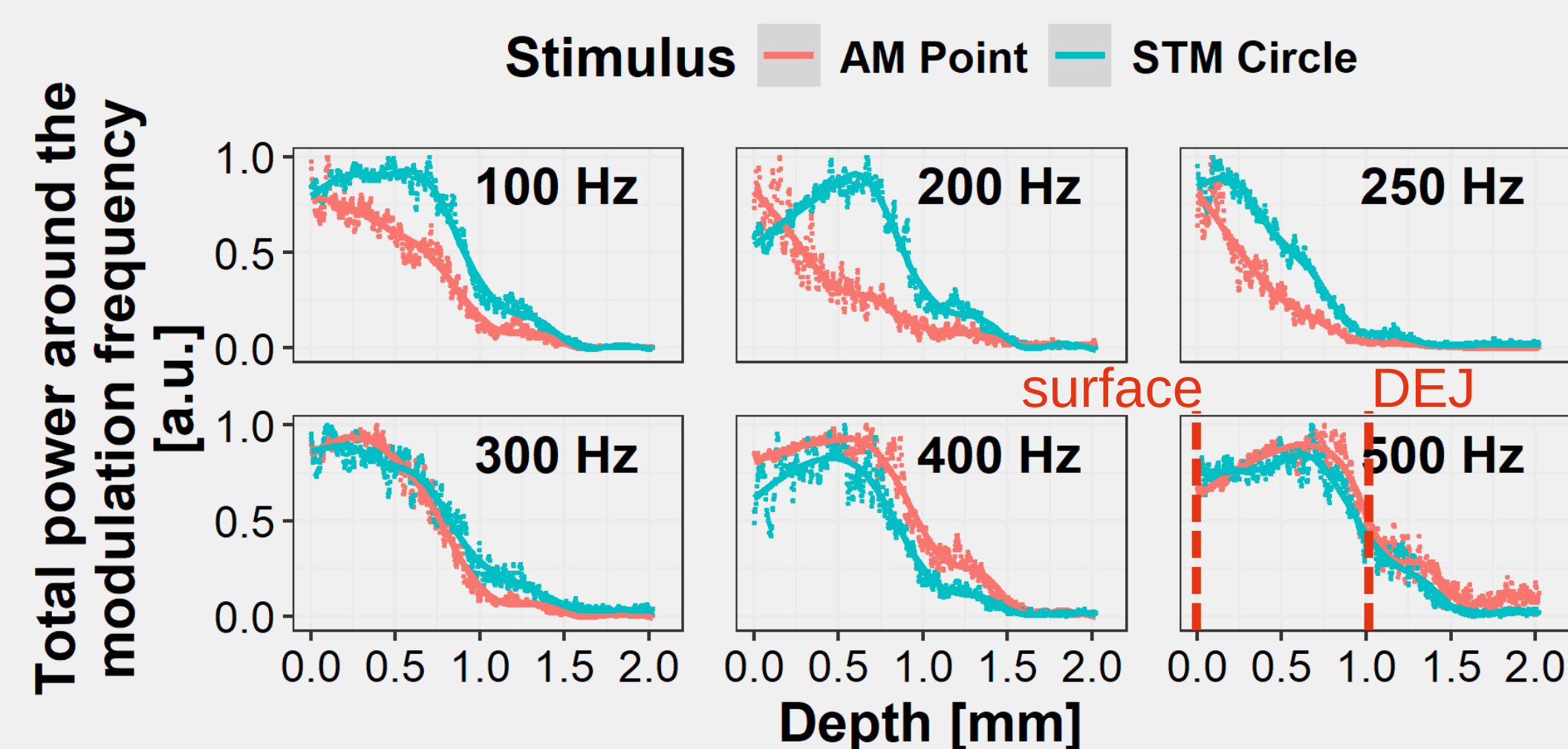
Analysis pipeline:



Resulting quantitative measurements:



- Energy is spread across harmonics
- Frequency-dependant response



- Non-linear decay with depth
- Similar profiles between AM and STM
- **Take-away:** different stimuli seem to carry energy to the deeper tissues differently

Future Work: gather more data to quantitatively evaluate these effects

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