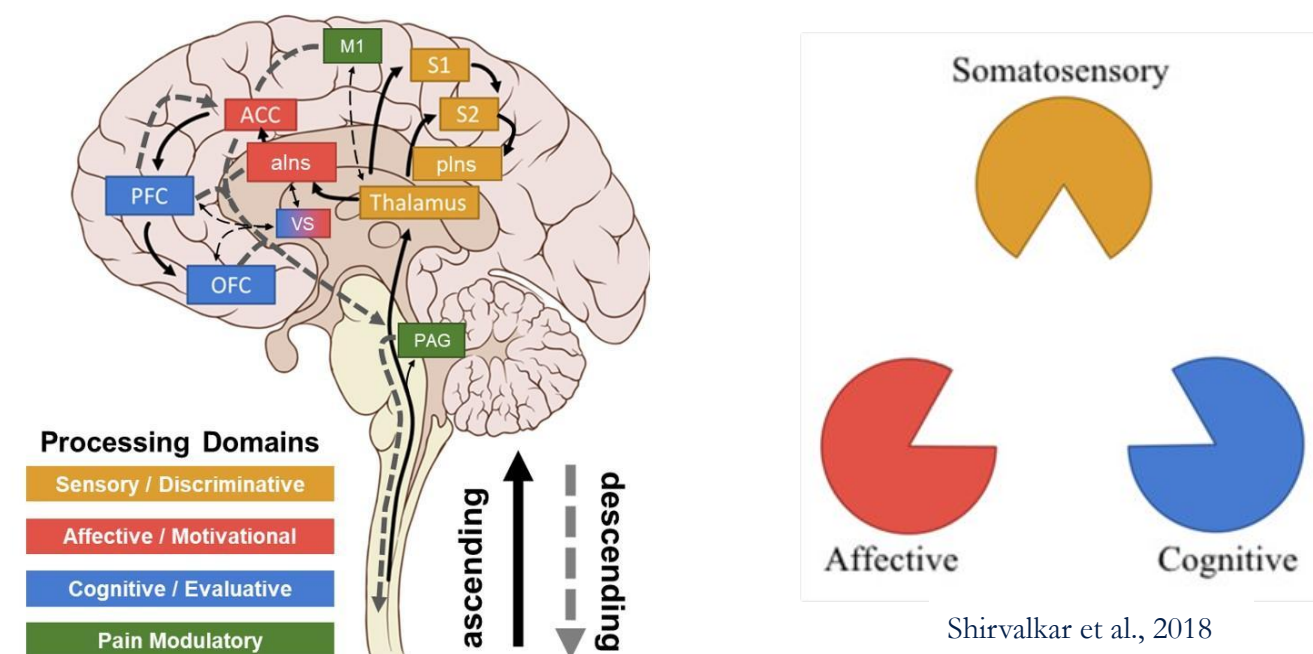
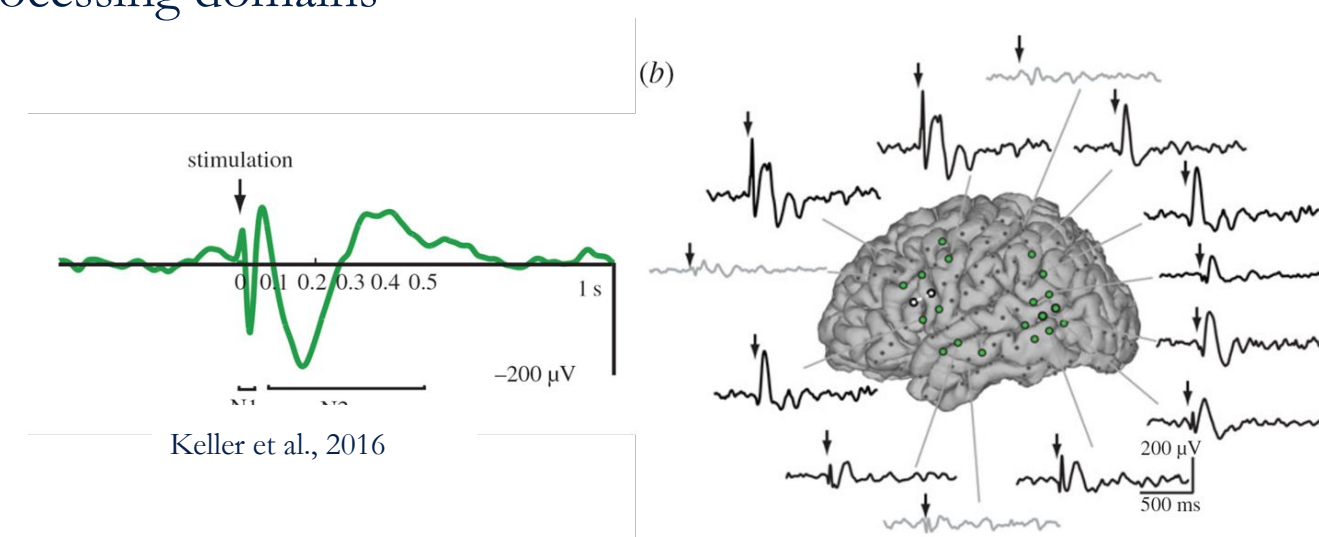


Background



Key regions in the pain matrix are connected in ascending and descending neural pathways, with chronic pain as an emergent entity comprised of somatosensory, affective, and cognitive psychological processing domains



Corticocortical evoked potentials (CCEPs) in response to single pulses of stimulation have been proposed as a measure of directional functional connectivity, but has yet to be investigated using stereoelectroencephalography and subcortical targets.

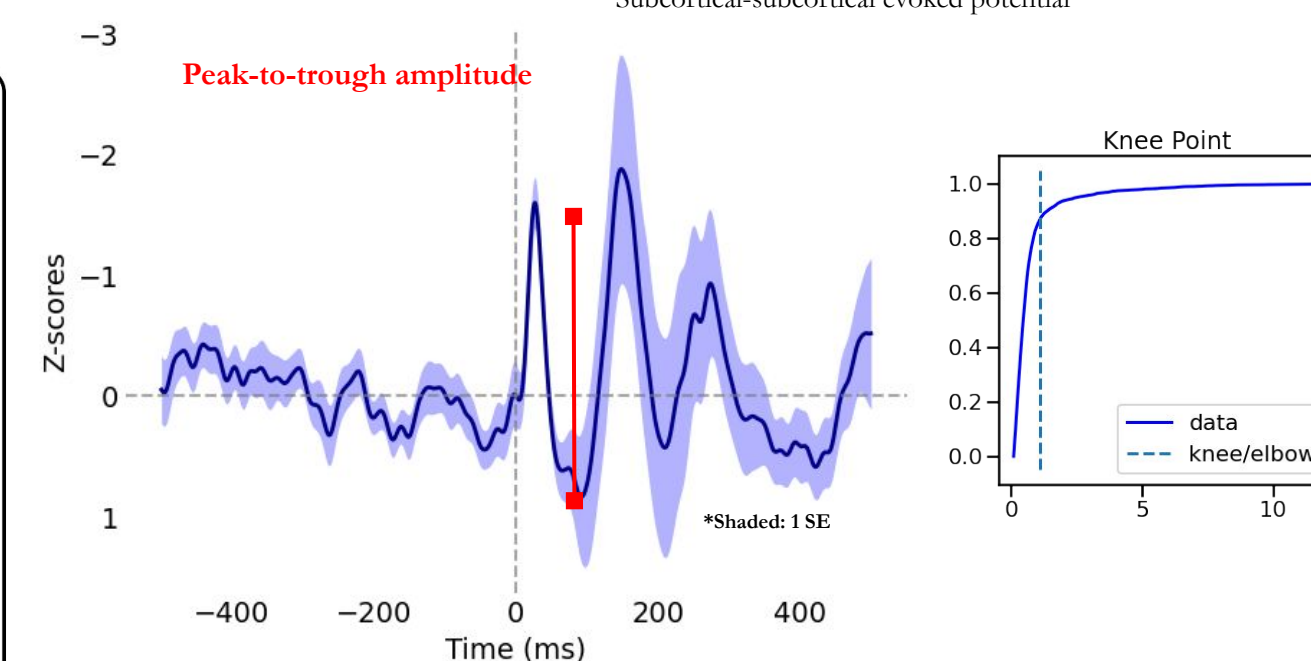
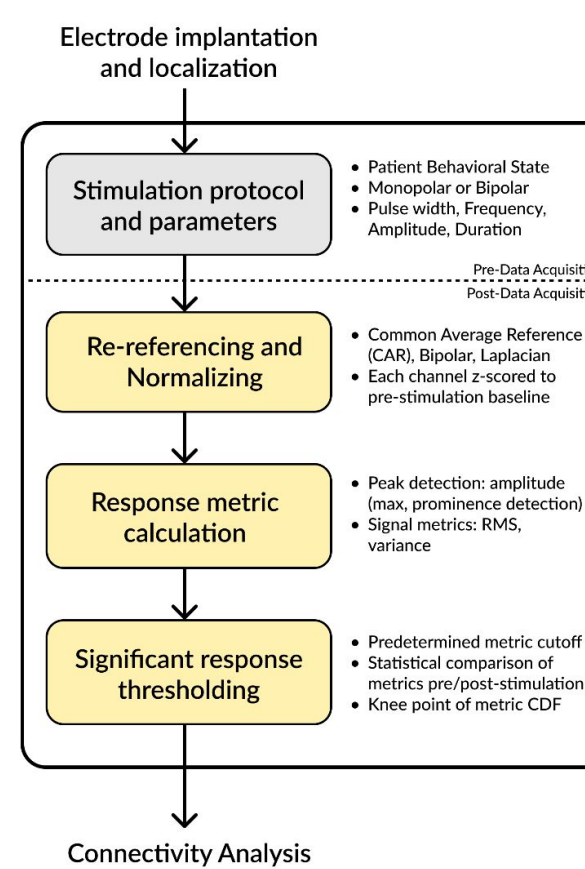
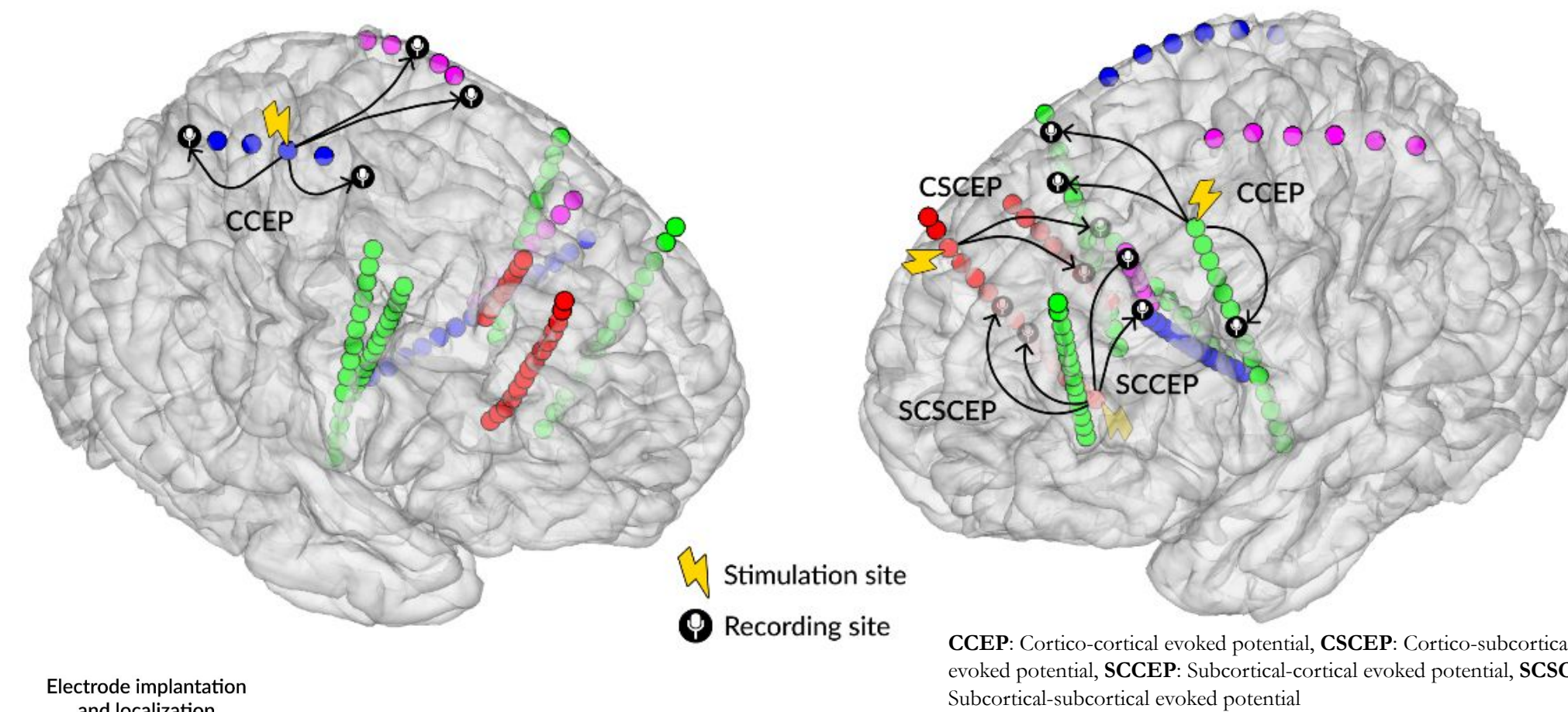
Objective

Network mapping is widely used in tumor and epileptic foci resection, but has never before been conducted in humans with chronic pain.

Hypothesis 1: Graph-based network interrogation with sEEG will reveal functional pain networks and identify effective DBS stimulation targets.

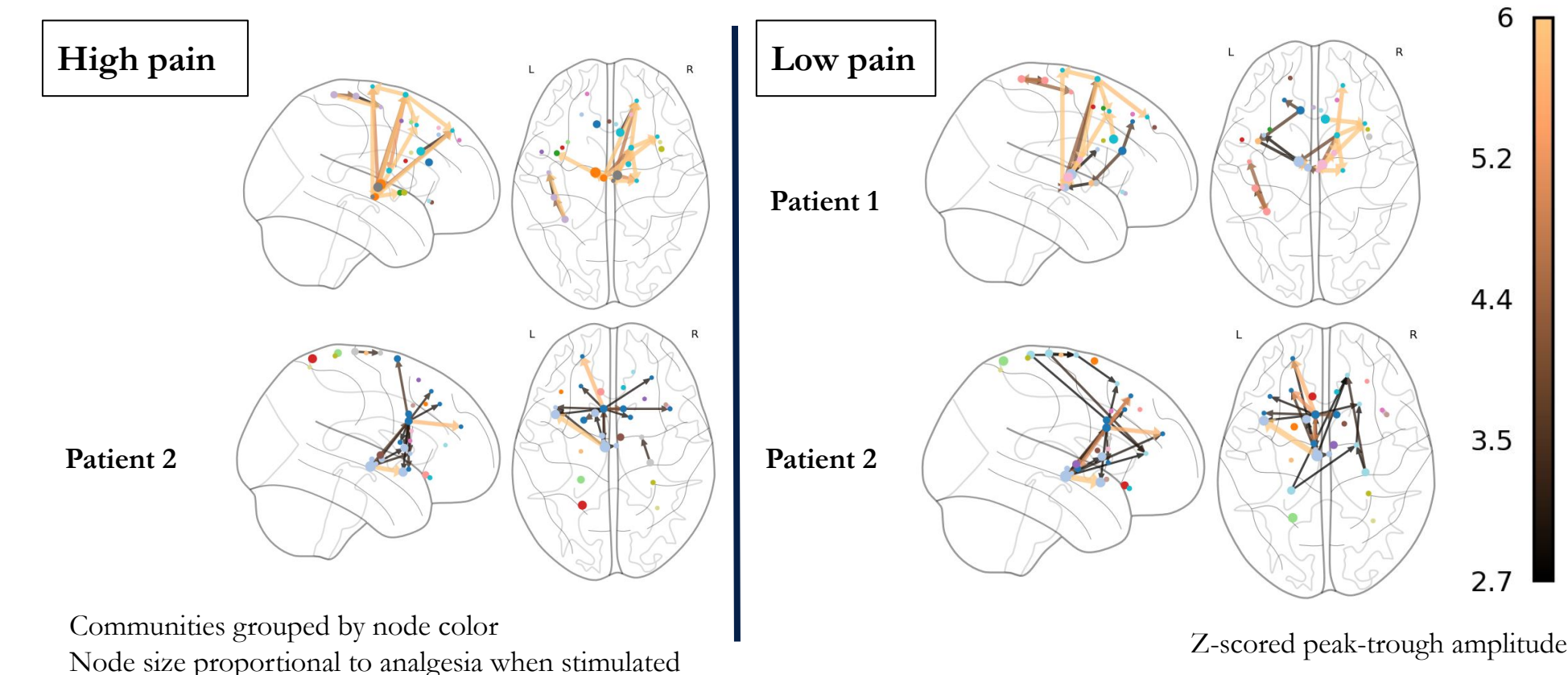
Hypothesis 2: High pain states will be associated with more disconnected network topologies than low pain states.

Methods



Stimulation parameters: 0.5Hz, 100μsec, 3-6mA, 25 pulses

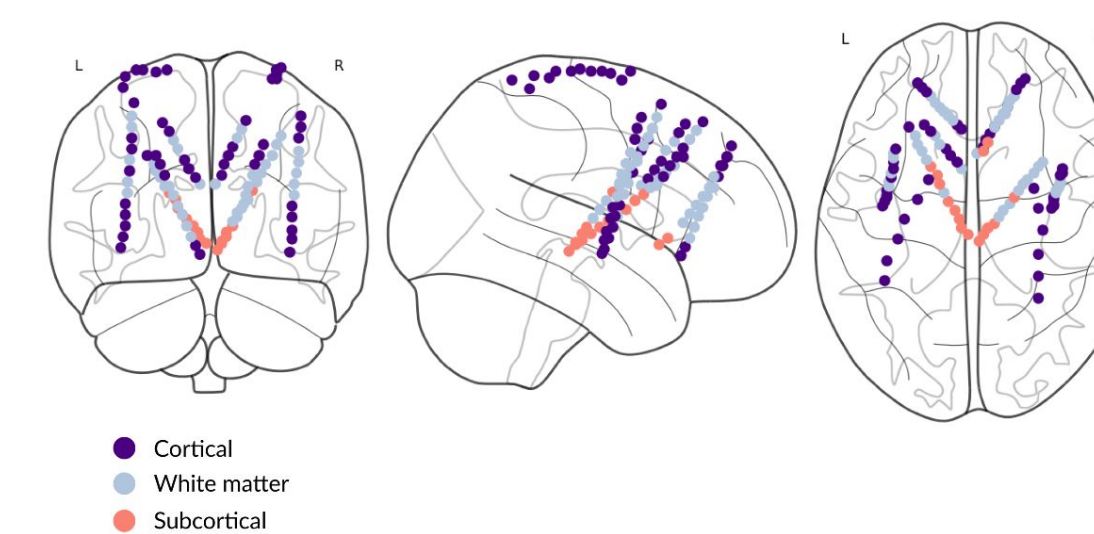
Results



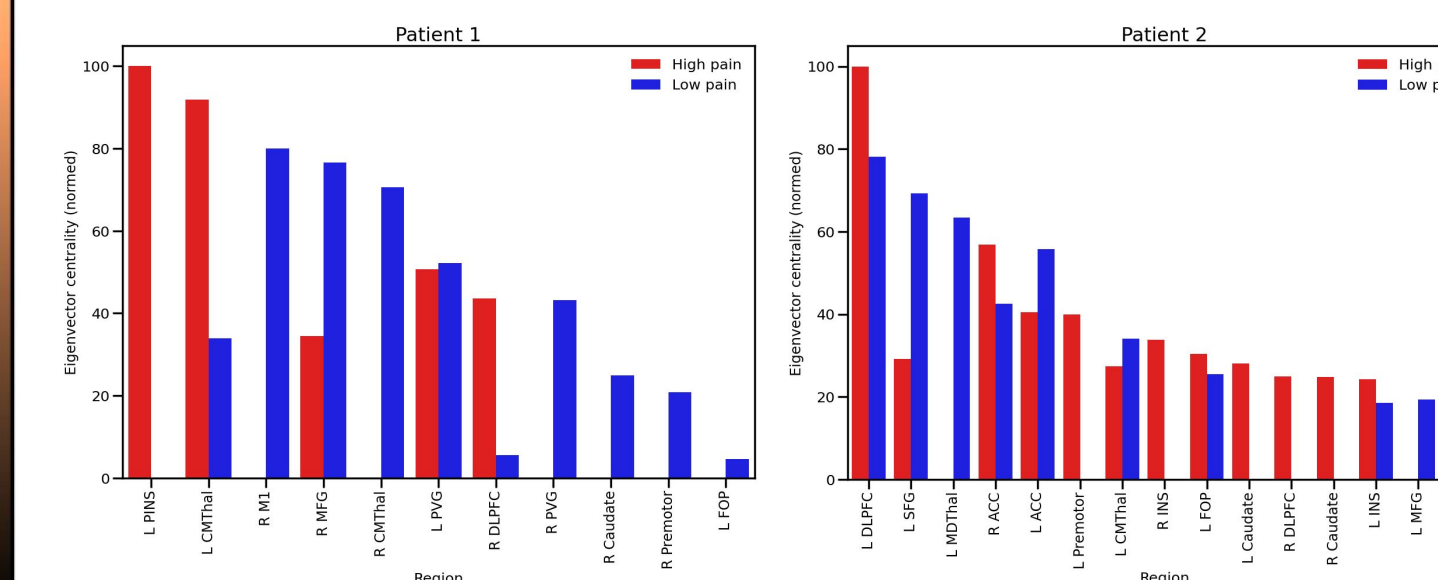
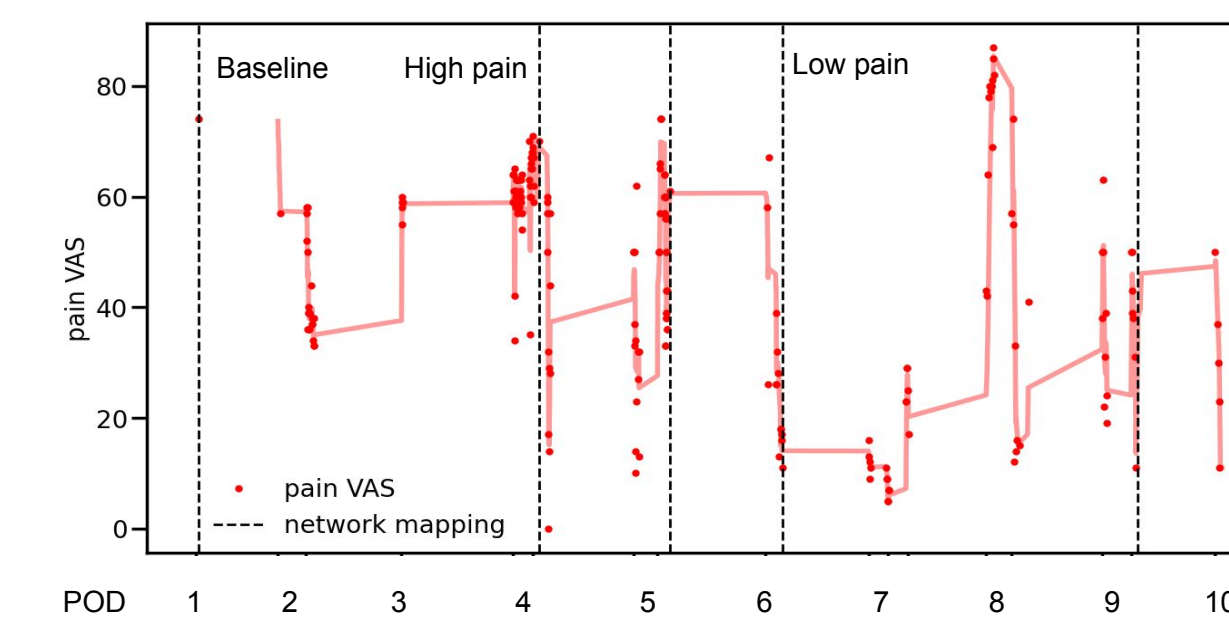
Five chronic neuropathic pain patients with **130-150 contacts** across **20+** brain regions.

Targets:

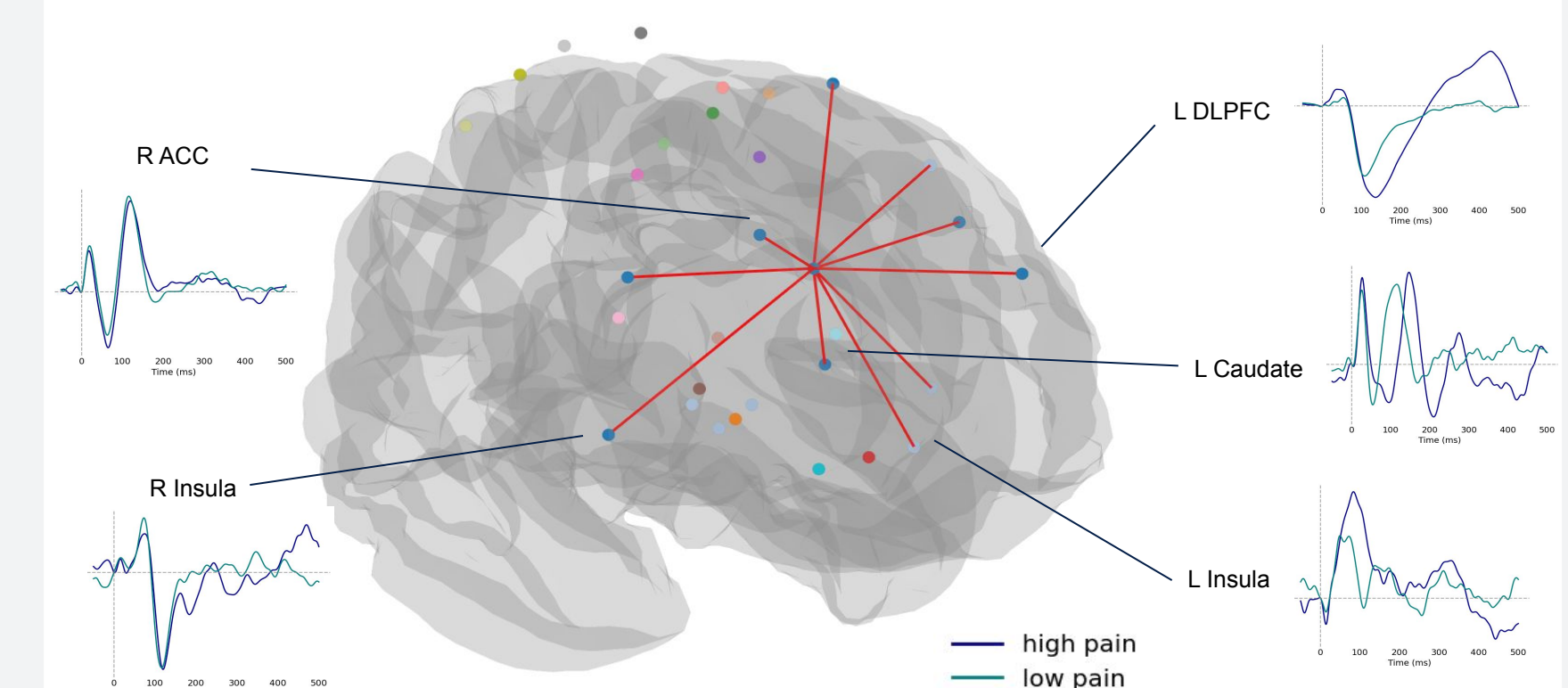
- Anterior cingulate cortex
- Subgenual cingulate cortex
- Medial prefrontal cortex
- Insula
- Thalamus (CM/MD nuclei)
- PAG/PVG
- M1/S1



Network mapping sessions are repeated in high and low pain states during a 10-day therapeutic trial.



Results (continued)



Stereo-EEG waveforms show regional differences in high versus low pain. Example shown in L ACC subnetwork in a representative patient.

Conclusions

- Single pulse network mapping enables functional pain network visualization
- sEEG waveforms show regional differences within patients in high vs. low pain states
- High amplitude potentials are consistent in high vs. low pain states, while low amplitude potentials demonstrate variability
- Community detection and graph centrality measures highlight functional remapping in high vs. low pain states and identifies key analgesic DBS targets for pain

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