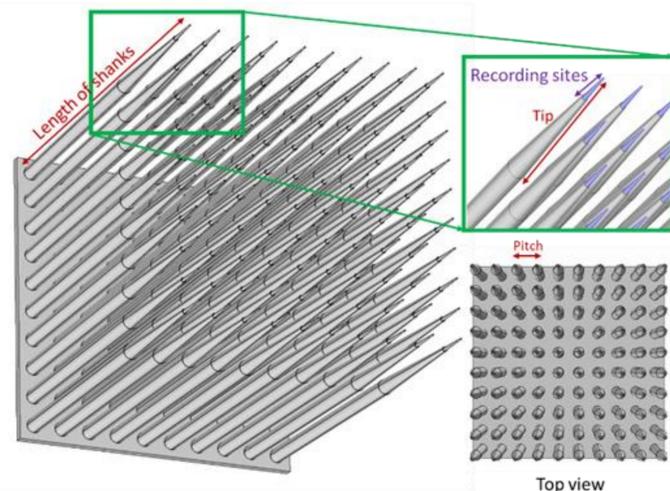
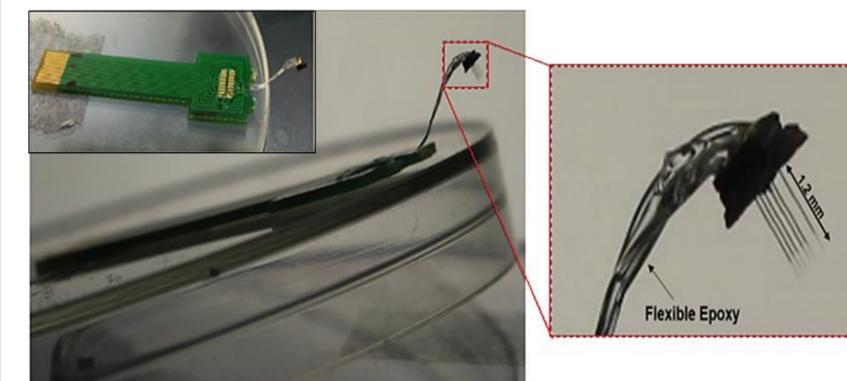
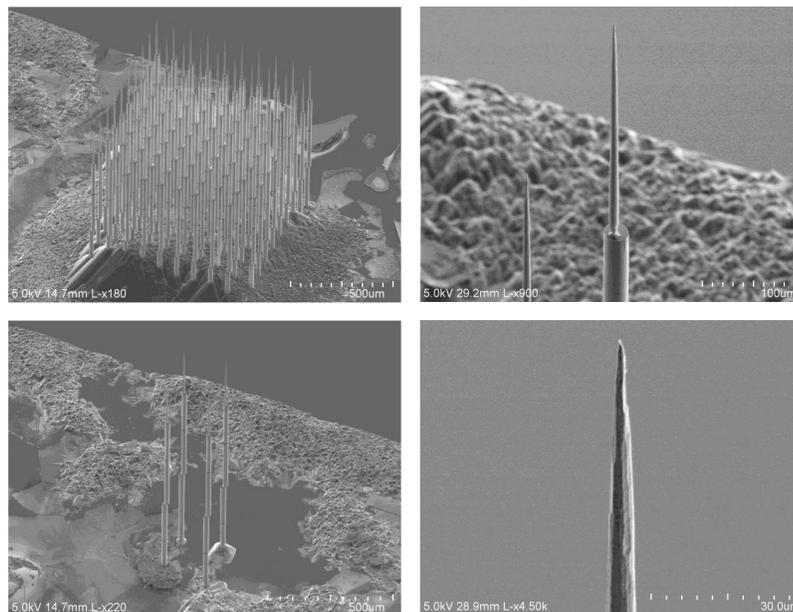


Objectives

- ✓ Scalable
- ✓ New generation of 3D arrays
- ✓ High-Density
- ✓ High-Electrode-Count (Thousands and eventually millions of needles)
- ✓ Silicon based
- ✓ Based on refilling deep ultra-high aspect-ratio holes in a Si substrate



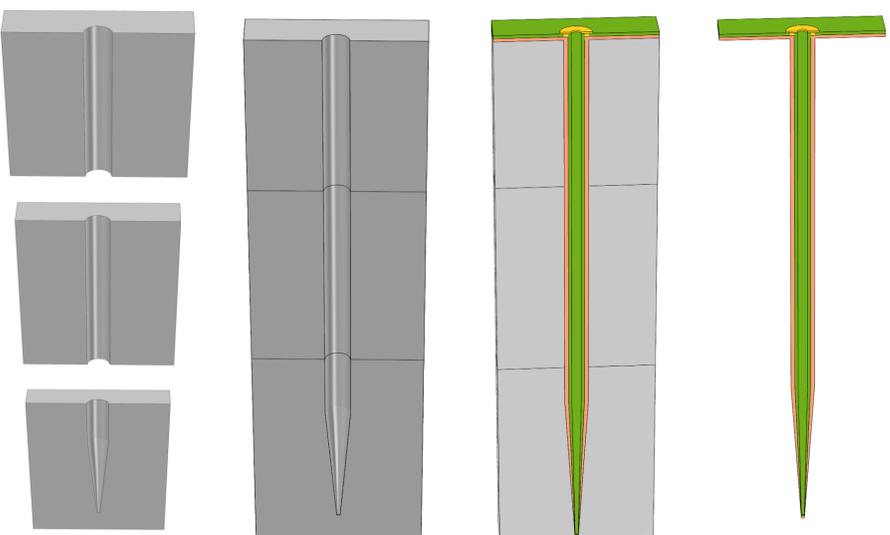
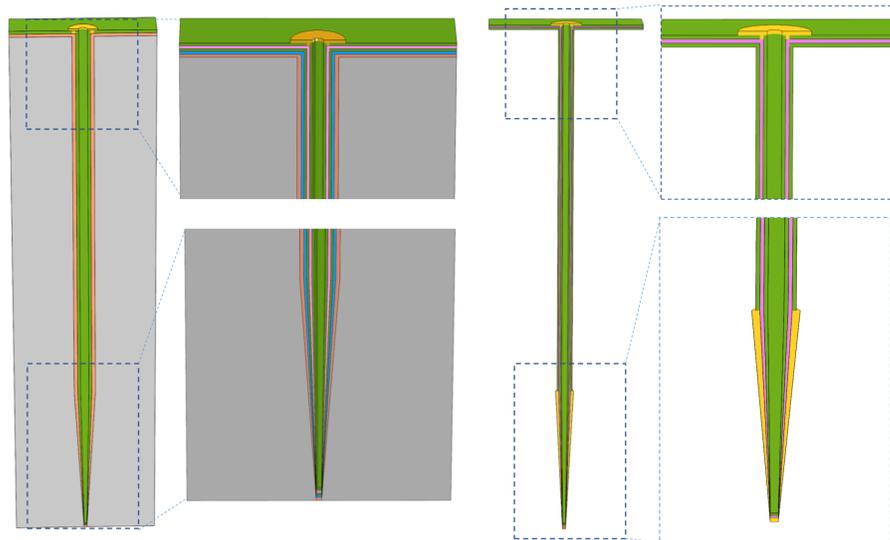
➤ SEM images show the fabricated mm-long electrodes using bonding-refilling technique.



➤ Acute *in vivo* testing and site impedance measurements

Fabrication

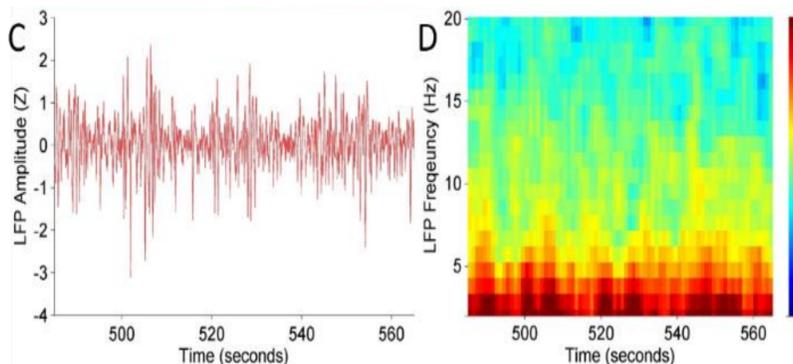
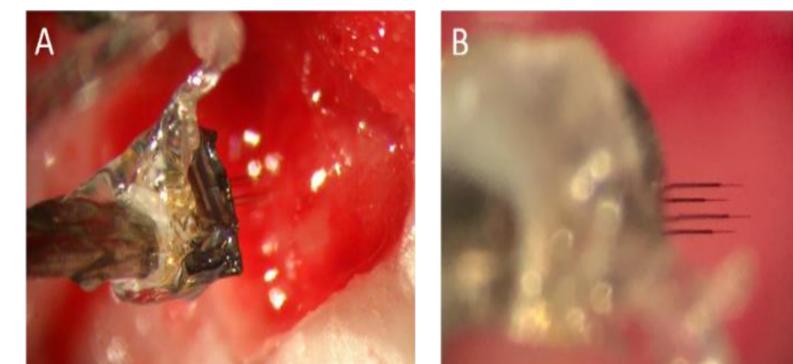
- ONO
- Poly-Si
- Sacrificial Poly-Si
- SiO₂
- Silicon Substrate



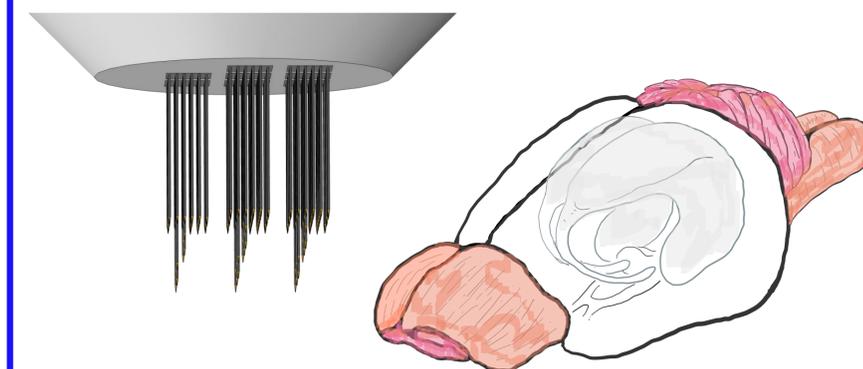
- DRIE <25μm diameter holes
- LPCVD Refilling
- Releasing in EDP
- Electrodes tip metallization

mm-length Arrays

- DRIE multiple wafers
- Wafer Bonding
- LPCVD Refilling
- Releasing in EDP
- Electrodes tip metallization



➤ The Local Field Potential (LFP) amplitude of the recorded signals from a rat under anesthesia



Conclusion

- Design and fabrication of an ultra-high-count customizable array of electrodes for mapping the functional neural circuitry
- High-density, large-count, 3D arrays of extremely fine needles with user-defined length, width, shape and tip profile
- Future work: Optimizing the fabrication technique to manufacture micro-probe arrays to improve the chronic stability