**Docket #:** S23-120

# Smart Calibration Software for High-Precision Neural Implants

Researchers at Stanford have developed a smart calibration platform that allows neural implants to precisely target individual nerve cells, unlocking higher-resolution performance from next-generation medical devices.

Today's neural implants use arrays of small electrodes to electrically stimulate nerve cells. Devices that activate one electrode at a time lack the precision needed to reliably reach a single target cell without also triggering its neighbors. More precise stimulation is possible by passing current through multiple electrodes simultaneously, but identifying the best combination of currents to target a given neuron has historically been too complex and time-consuming for clinical use. Stanford's system solves this with an intelligent, self-guided approach that rapidly homes in on the right stimulation settings for each target cell, cutting configuration time to a clinically practical window.

The lead application is vision restoration. For patients blinded by macular degeneration or retinitis pigmentosa, retinal implants guided by this system could deliver sharper, more natural visual perception by activating the right cells at the right time. However, any neural interface application requiring precise targeting and using high-density multi-electrode arrays may benefit from the approach.

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**Stage of Development**: Research - in vitro

## Applications

- Retinal implants for restoring vision in patients with macular degeneration or retinitis pigmentosa
- Calibration software for any neural implant requiring precise, cellular-resolution targeting
- Research platforms for high-precision neuroscience studies

## Advantages

- More precise cell targeting than conventional single-electrode stimulation methods
- Faster calibration, cutting setup time to a clinically feasible window
- Compatible with existing neural implant hardware, lowering integration barriers

## Publications


- Vasireddy, P.K., Gogliettino, A.R., Brown, J.B., Vilkhu, R.S., Madugula, S.S., Phillips, A.J., Mitra, S., Hottowy, P., Sher, A., Litke, A., Shah, N.P., & Chichilnisky, E.J. (2023). Efficient Modeling and Calibration of Multi-Electrode Stimuli for Epiretinal Implants. IEEE NER 2023.
- Vasireddy P, Vilkhu R, Lotlikar A et al. Leveraging current steering and the biophysics of spike generation for cellular-resolution electrical stimulation of neurons. Cell Reports, 2026; 45


## Patents

- Published Application: 20240359009

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