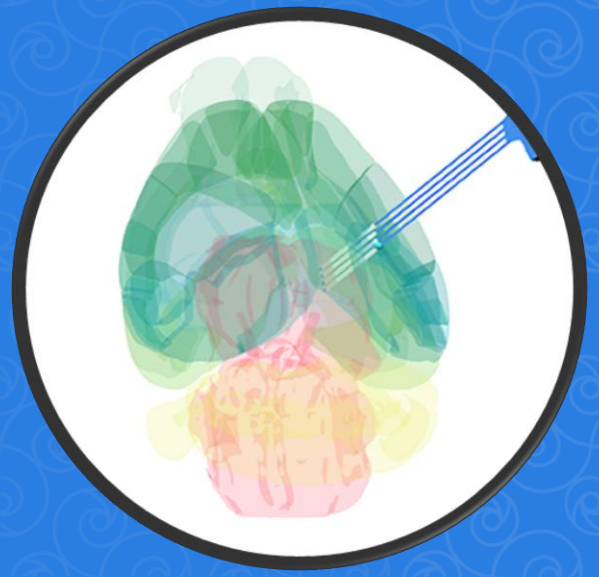
ALLEN INSTITUTE *for*
NEURAL DYNAMICS

# PINPOINT



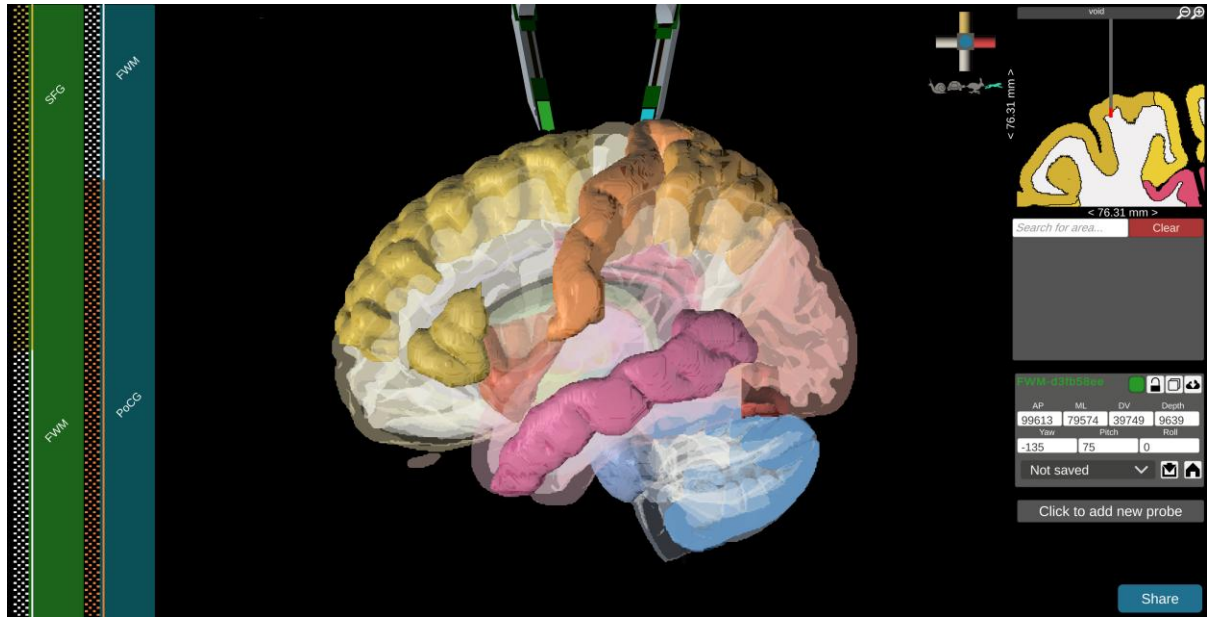
UNITY FOR HUMANITY 2025 PITCH DECK

# What is Pinpoint?

**Interactive 3D visualization and automation tools for neuroscience research and neurosurgery**

Available for **free** on the **web**, **desktop**, and **handheld consoles**

**Demo Video:**
https://youtu.be/io03ATeKapc




Human brain atlas with Neuropixel electrophysiology probes.

# Our Goals with this Grant

## Automation

Develop an automated platform for **reproducible** neurosurgical procedures, reducing variability and improving the **efficiency** of experimental workflows.

## Expand Access

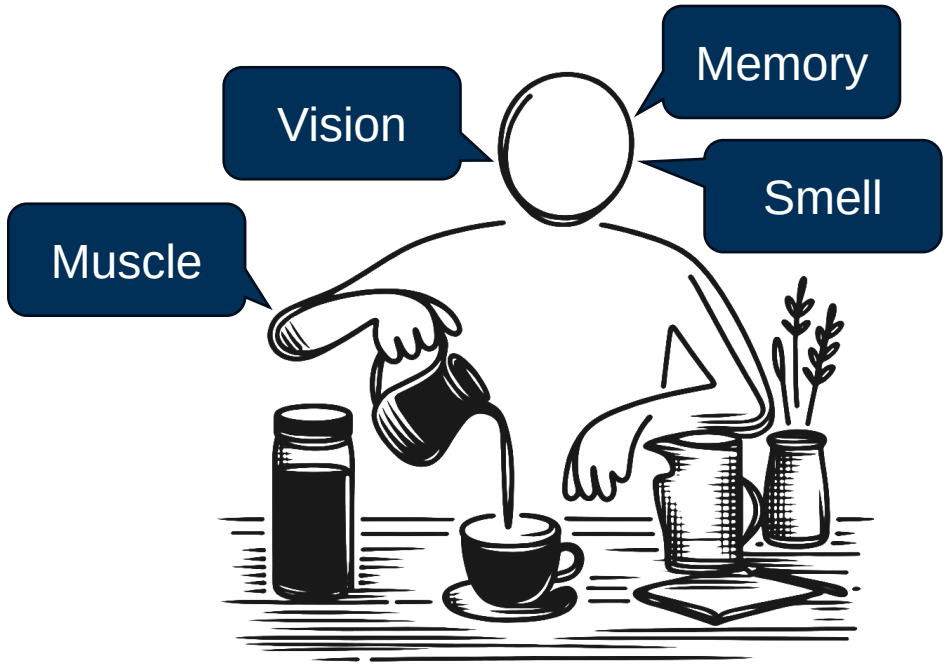
Expand access to **large-scale** neuroscience research by offering **free**, **web-based** tools for experiment planning, execution, and **education**.

# Modern neuroscientists need tools to study the whole brain.

Neuroscientists now recognize that **neurodegenerative diseases**, such as Parkinson's and Alzheimer's, affect the entire brain. Understanding these disorders and the **large-scale complex circuits** they impact requires techniques that scale up to measure neural activity **across the whole brain**.

# Why do we need new tools?

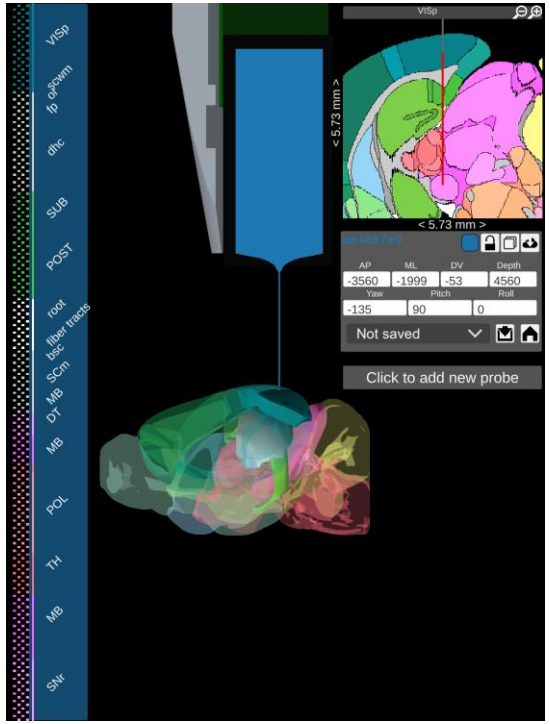
**Human behavior engages multiple regions of the brain…**




**… but current tools only help with studying individual regions.**

# What can Pinpoint do today?

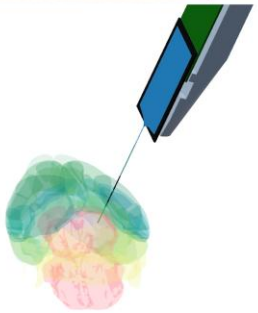
**Intuitive 3D planning with in-depth surgical information.**




**Repeatable surgeries with researcher-assisted robotics.**

Robotic manipulator →

Following a plan defined in Pinpoint →



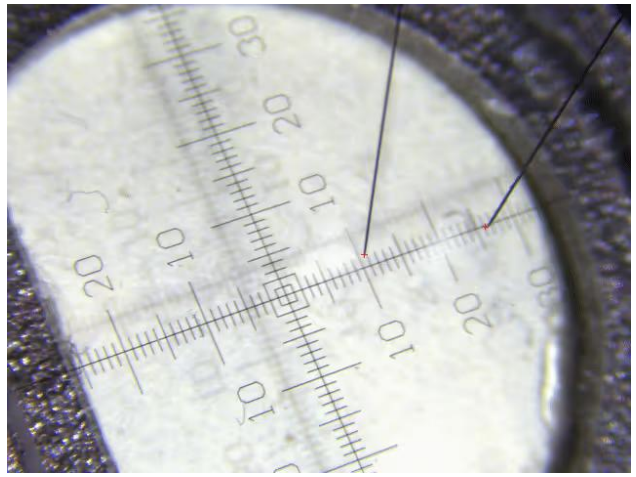
# The Future is Fully Automated.

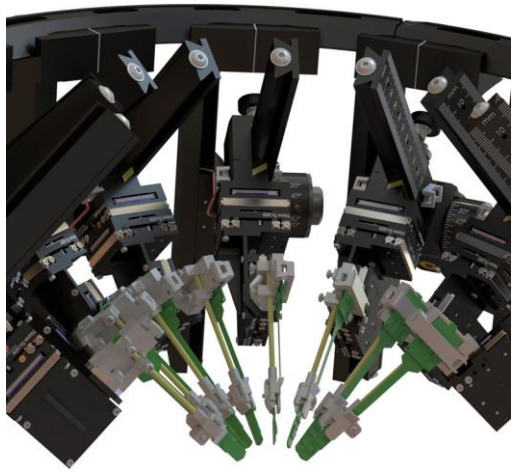
Automated surgeries **reduce human error** and **increase efficiency**, enabling neuroscientists to **scale up their work to the whole brain**, unlocking studies and surgeries previously deemed impossible.

# Aim 1: Automation

**We will develop computer vision assisted systems to enable unattended surgery.**

This will **reduce human error** and enable **scalable parallelization** of surgery procedures, required for working with the whole brain.



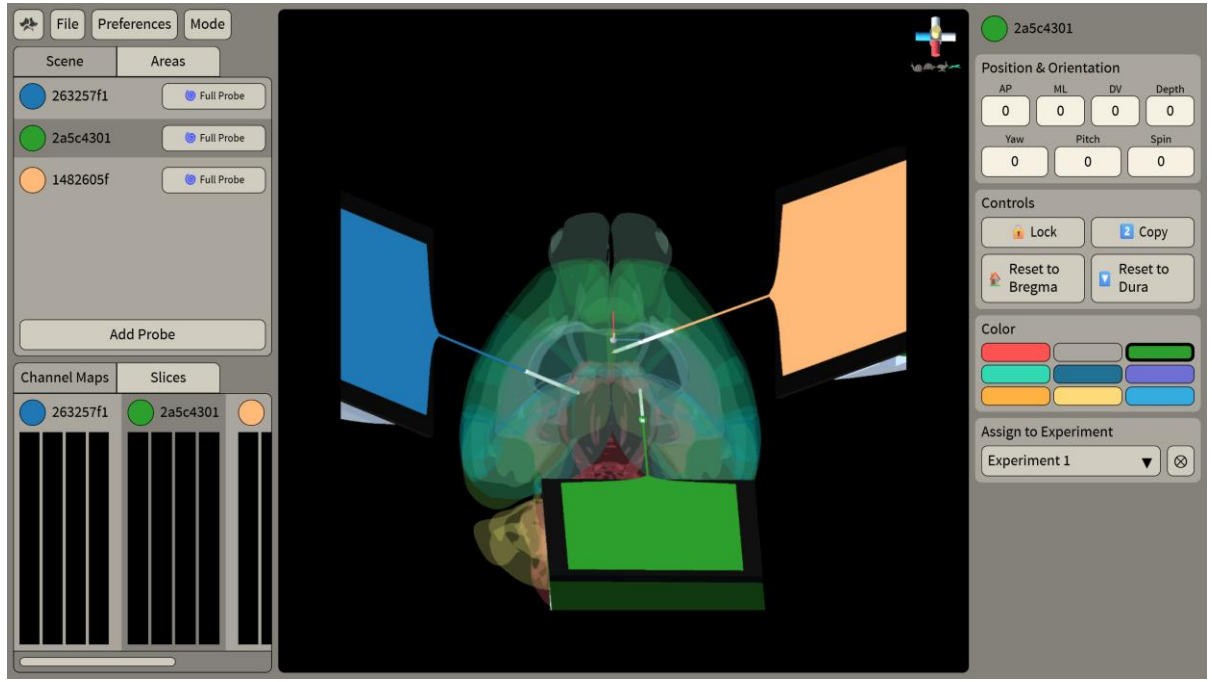


*(Right)* Parallax computer vision tracking system (probe tips marked with red crosses).
*(Left)* New Scale MPM rig.

# Aim 1: Automation (cont.)

**Develop intuitive interfaces to plan and automate unattended surgeries.**

Change the **interaction paradigm** for neuroscience tools, emphasizing **digital twinning** and **robotic automation.**




Planned future interface for Pinpoint (using UI Toolkit).

# Aim 2: Expanding Access

## Bring our free, web-based tools for experiments, surgeries, and education to the community.

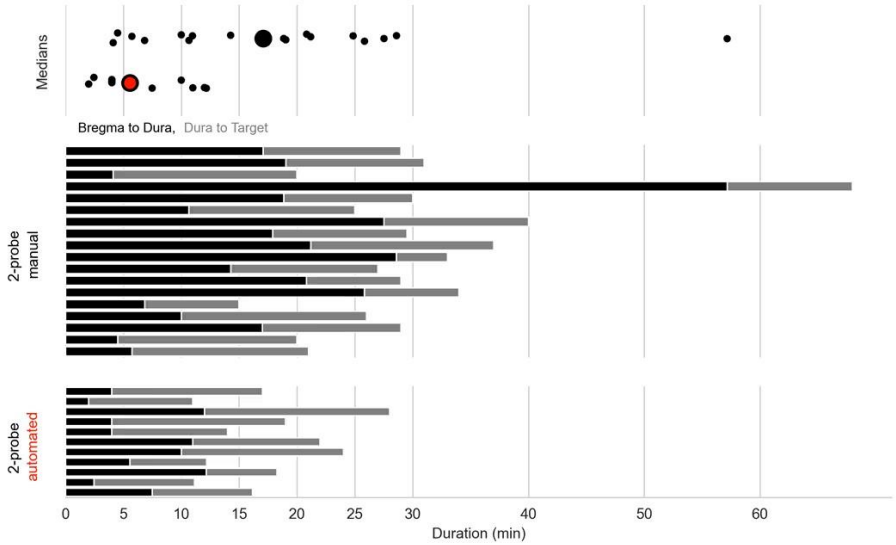
Share our work at **conferences and workshops** and integrate them into the **classroom** for the next generation. Feedback from community use and user studies drive our development plan.

Dr. Birman teaching Pinpoint to researchers at the Allen Institute 2024 Neuropixels and OpenScope Workshop.

# How much does automation help?

Using data from experiments in rodents:

- One probe takes about 15 minutes to implant.
- Manually, this process **scales linearly**: two probes take 30 minutes, etc.
- With automation, the process is **parallelized:** any number of probes can be inserted in the same time window.
- *In our data:* the median implant time for **automation** (red dot) is significantly lower than **manual implants** (black dot).




Electrophysiology setup timing in a rodent neuroscience research lab.

# Pinpoint's Impact


Improve surgery ethics and safety by **reducing human error** through automation. **Enables whole-brain studies** essential for addressing neurodegenerative diseases.


Open-source, web-based system **democratizes access** to cutting-edge neuroscience tools for education. The project has also fostered software engineering **research for undergraduates**.


Introduces **advanced robotics** and computer vision techniques to neurosurgery. These will **boost the efficiency and reproducibility** of smaller-scale operations as well.

# Project Timeline

| | 2025 Summer | 2025 Fall | 2025 Winter | 2026 Spring | 2026 Summer |
|---|---|---|---|---|---|
| Automation system | | | | | |
| UI and hardware integration | | | | | |
| Scientific outreach (conferences) | | | | | |
| Education outreach | | | | | |
| Evaluation and Adjustments | | | | | |

# Grant Budget Allocation

We are requesting **$100,000**

| | Item | Description |
|---|---|---|
| 70% | Software Development | DB working at 15% effort KJY at 50% effort for the duration of the project. |
| 30% | Support and Outreach | Running workshops through the Allen Institute, collaborating with researchers at universities and industry partners, publishing papers, and presenting at conferences. |

# Sponsors and Grants Who Have Funded Us

Washington Research Foundation

≈$50,000 post-doctorate and undergraduate fellowship

INTERNATIONAL BRAIN LABORATORY

≈$50,000 with Simons Foundation

SIMONS FOUNDATION

$11,500 through the Shenoy Undergraduate Research Fellowship

NIH National Institutes of Health
The BRAIN Initiative®

≈$20,000

UNIVERSITY of WASHINGTON

$10,000 through the Mary Gates Undergraduate Research Scholarship

# We are the Virtual Brain Lab

**Daniel Birman, PhD**
Software Engineer
Allen Institute for Neural Dynamics

**Kenneth J. Yang**
Computer Science
University of Washington (‘25)

- We develop 3D visualization tools for experimenting with, exploring, and simulating brains.
- All projects are open-source on GitHub.
- We foster undergraduate research:

Kenneth Yang, Jasmine Schoch, Qiqi Liang, Selina Li, Kai Nylund

# THANK YOU

**Product Website:**
https://pinpoint.virtualbrainlab.org

**Our Websites:**
https://virtualbrainlab.org
https://www.allenneuraldynamics.org/

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