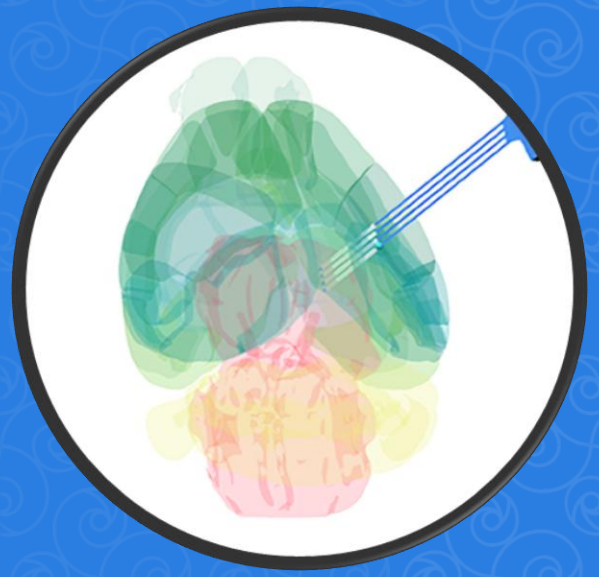
ALLEN INSTITUTE *for*
NEURAL DYNAMICS

# PINPOINT

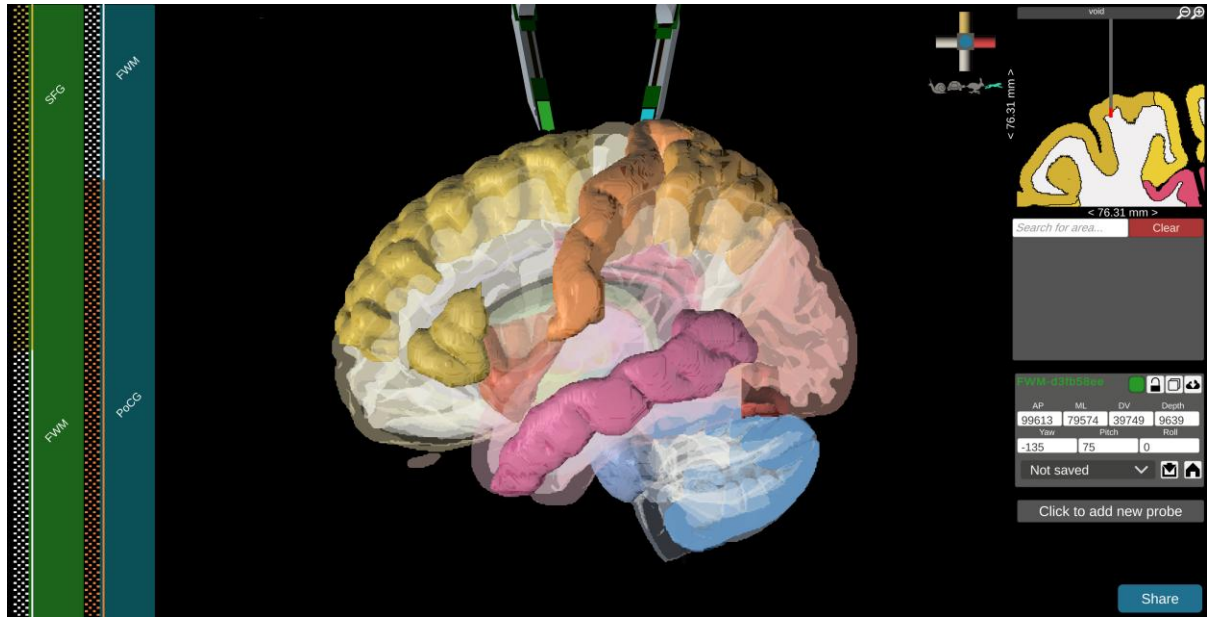


UNITY FOR HUMANITY 2025 PITCH DECK

# What is Pinpoint?

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

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




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

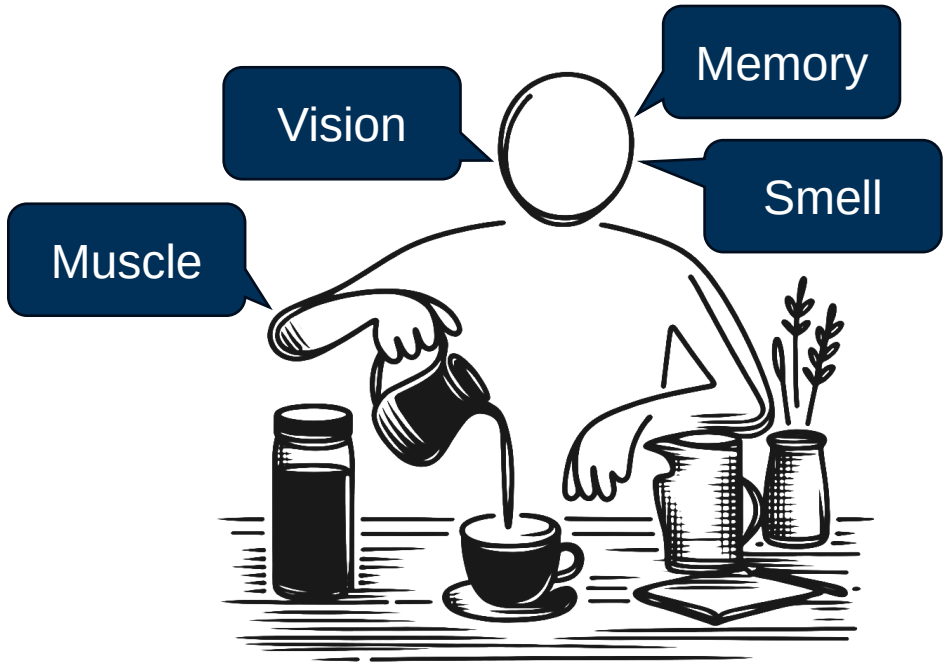
Expand access to **large-scale** neuroscience research by offering **free**, **web-based** tools for experiment planning, execution, and **education**.

# 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?

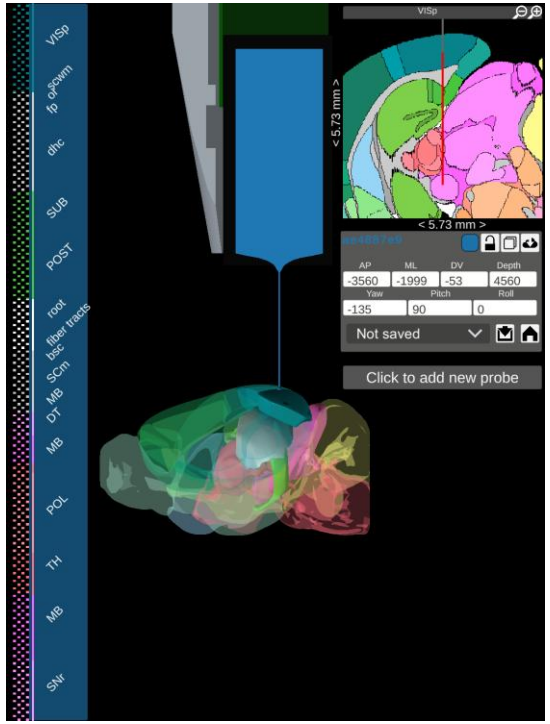
**Human behavior engages multiple regions of the brain…**




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

# What can Pinpoint do today?

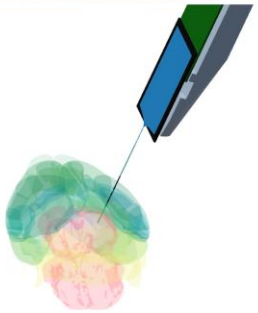
**Intuitive 3D planning with in-depth surgical information.**




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

Robotic manipulator →

Following a plan defined in Pinpoint →



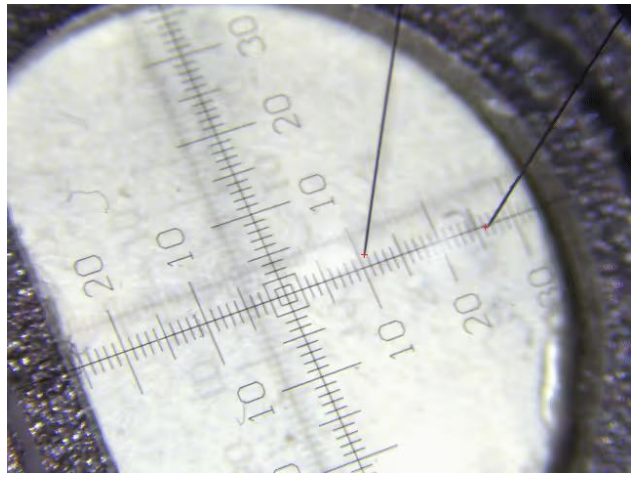
# The Future is Fully Automated.

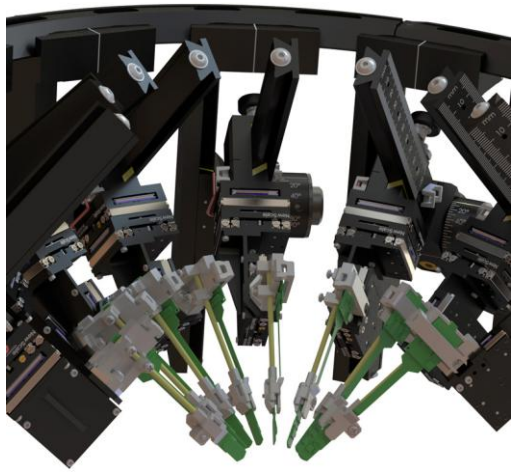
Automated surgeries **reduce human error** and **increase efficiency**, enabling neuroscientists to **scale up their work to the whole brain**, unlocking studies and surgeries previously deemed impossible.

# 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.



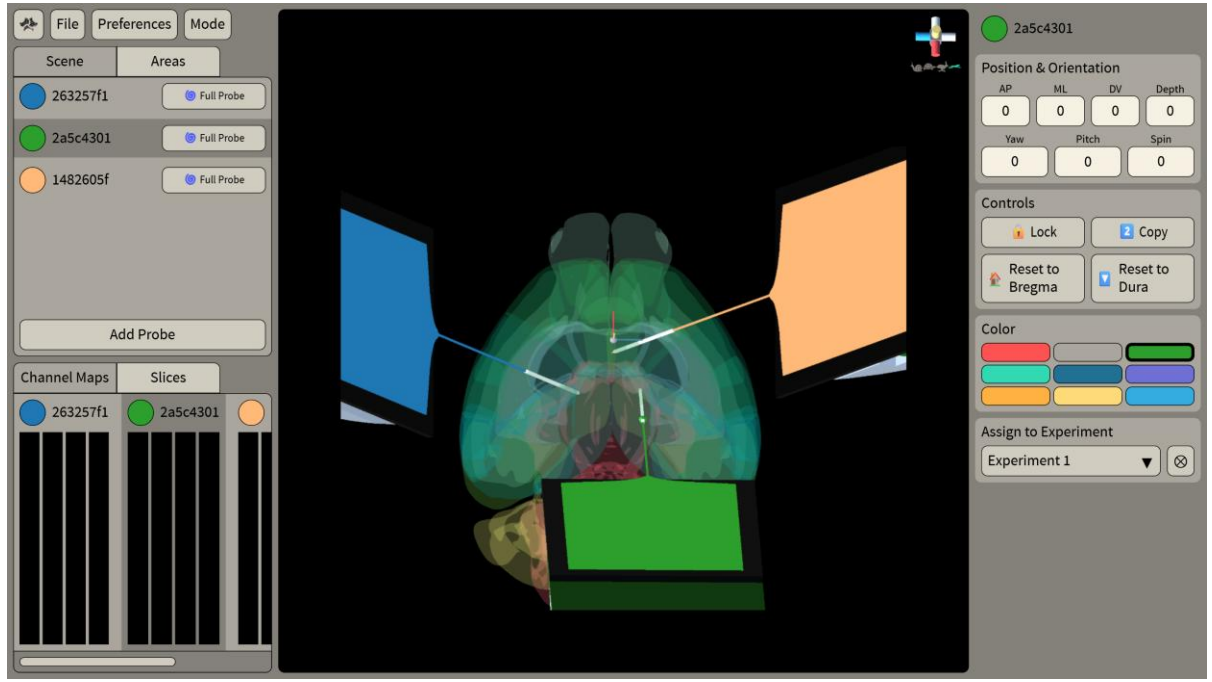


*(Right)* Parallax computer vision tracking system (probe tips marked with red crosses).
*(Left)* New Scale MPM rig.

# Aim 1: Automation (cont.)

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

Change the **interaction paradigm** for neuroscience tools, **emphasizing 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.

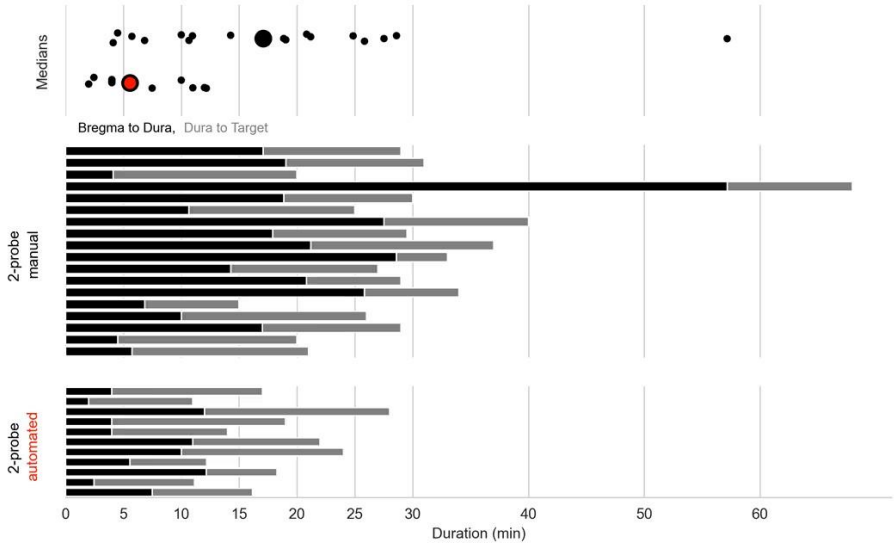
Share our work at **conferences and workshops**, and integrate them into the **classroom** for the next generation. Feedback from community use and user studies drive our development plan.

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 takes 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 one year. |
| 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**
University of Washington
Computer Science ('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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**Contacts:**
daniel.birman@alleninsitute.org
kjy5@uw.edu

# Usage Guide

This deck template was last updated December 2018.

- This PowerPoint deck offers an expanded selection of slide types which can be added using the same look and feel.
- To insert new slides, instead of copying and pasting existing slides from the deck, click on the **New Slide** drop down menu and select preferred layout.
- To change the layout of an existing slide select from the **Layout** tab
- When duplicating a slide with existing text and/or photos in the deck:
  - Copy your selected slide by right-clicking or using “Ctrl + C”
  - When pasting, use **Keep Source Formatting** as your paste option to ensure design or layout is not altered.

# Color Palette

## PowerPoint Palette

R=0 G=48 B=87

R=42 G=125 B=225

R=29 G=134 B=73

R=255 G=183 B=27

R=124 G=125 B=127

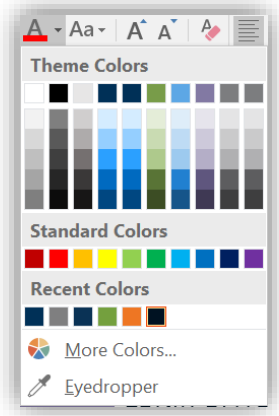
## Neutral Colors

R=0 G=0 B=0

R=64 G=85 B=100

R=231 G=230 B=230

Use a mixture of warm and cool colors from the palette to balance the look and feel of the deck. The brand colors are programmed into the default theme colors. Additional colors can be added manually under **More Colors**.




Copy is a darker shade of gray (R=0, G=18, B=34) and hyperlinks are preset to blue: alleninstitute.org

# Titles (40 pt.)

- This is the general content slide (24 pt.)
  - Bullet style and layouts are preset, but can be changed under the bullet drop down menu. Avoid going beyond tertiary bullets unless absolutely necessary (24 pt.)
    - General copy is in the gray, but **highlight key words** in bold and color as needed (20 pt.)