

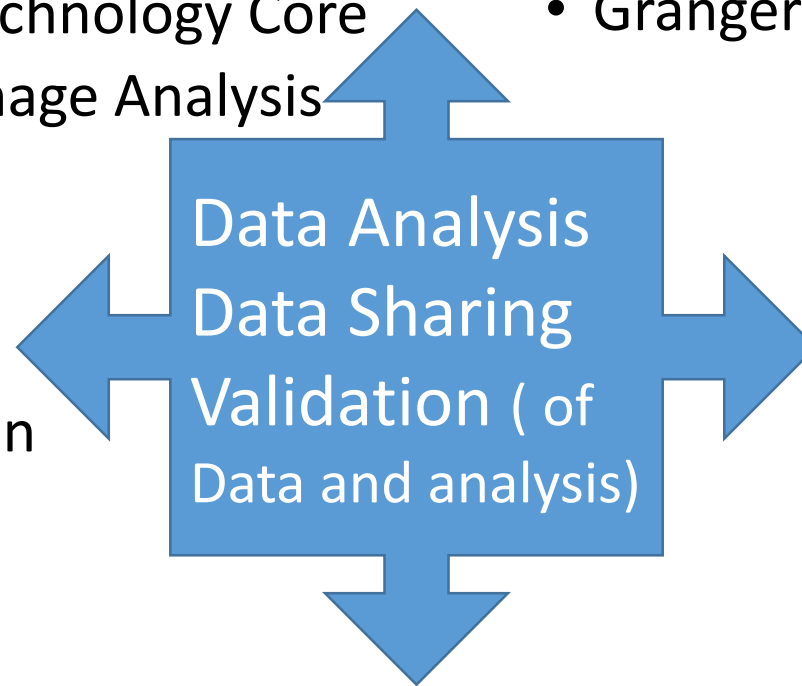
# U19 SENSATION Data Science Core (Maunsell, PI, Losert, Core Lead)

## **Data Science & Technology**

- Wolfgang Losert
  - Technology Core
  - Image Analysis
- Behtash Babadi
  - Granger Causality

## **Theory**

- Stefano Panzeri
  - Intersection Information
- Dante Chialvo
  - Criticality



## **Experiment**

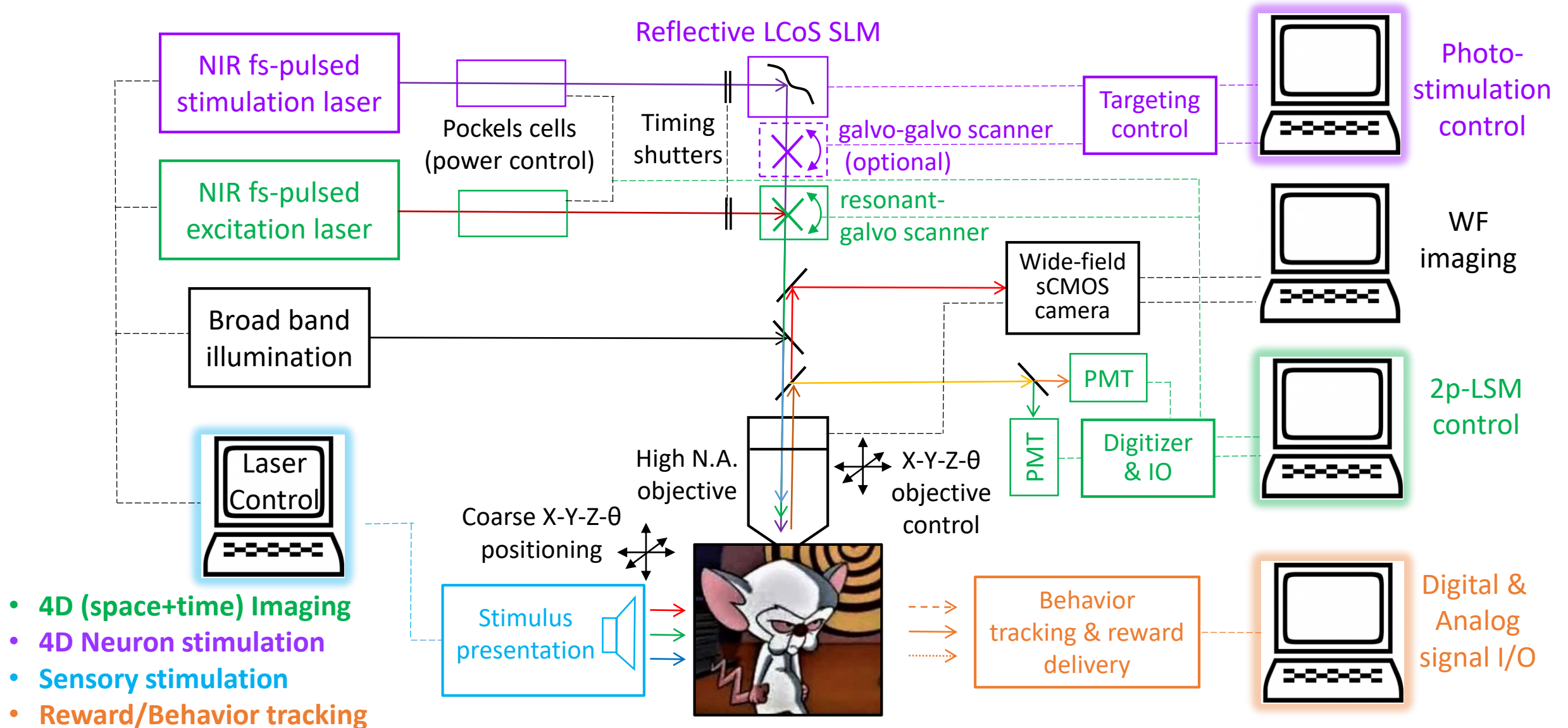
- Staff in Center Labs of:
  - Maunsell
  - Kanold
  - Plenz
  - Histed
  - Fellin
  - Losert
  - Rinberg
  - Shoham

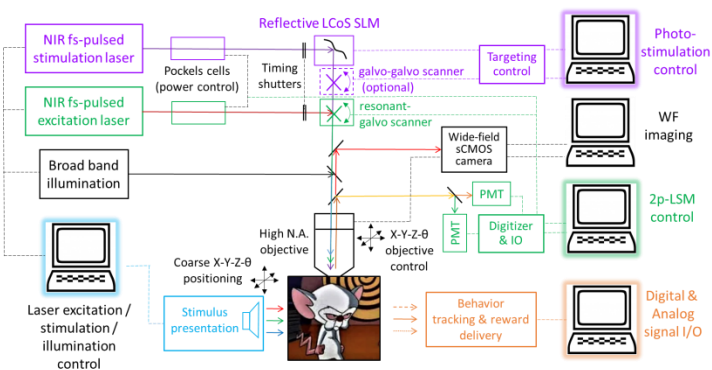
## **Systems Software Engineering**

- Madeline Diep and Gudjon Magnusson, Fraunhofer CESE

# U19: Holographic Stimulation of Sensory Systems

## *Integrating Data Science and Technology*



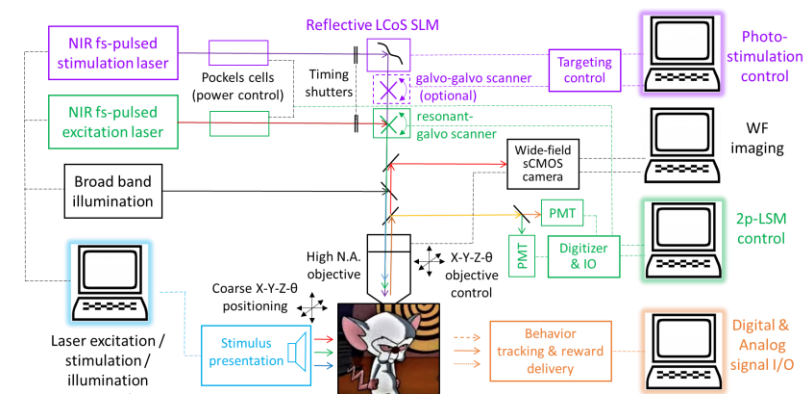


UMD

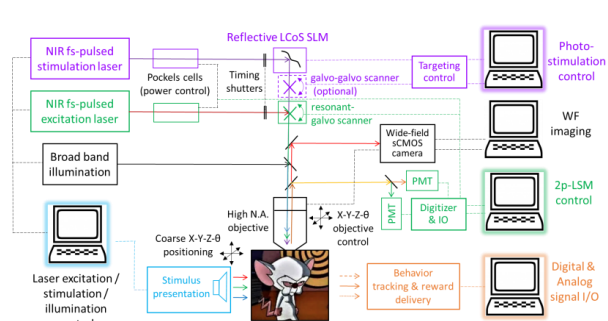
Different Hardware  
Different Metadata  
Different Analysis Software

# Many Sites

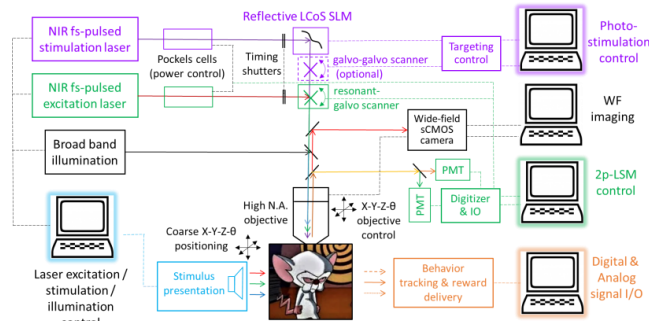
## Data & Analysis Tools



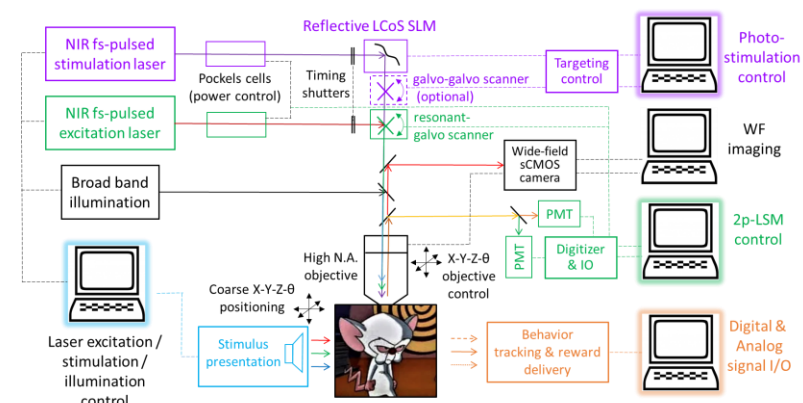
NIH



NYU



Chicago

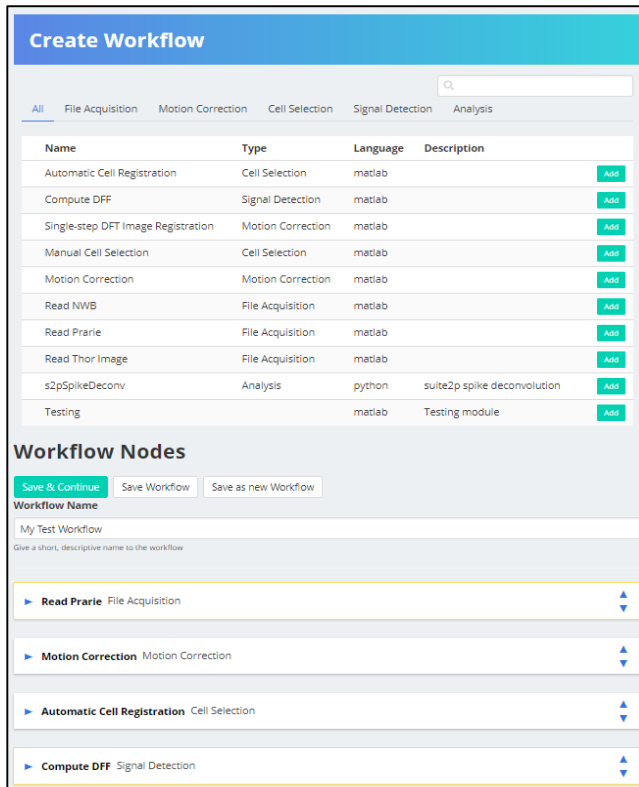


Italy

# Shared Software and Data Analysis Platform

Fraunhofer CESE leads development

## BRAIN Platform GUI: *Manage, Share & Validate Workflow*



**Create Workflow**

All File Acquisition Motion Correction Cell Selection Signal Detection Analysis

Name	Type	Language	Description	
Automatic Cell Registration	Cell Selection	matlab		Add
Compute DFF	Signal Detection	matlab		Add
Single-step DFT Image Registration	Motion Correction	matlab		Add
Manual Cell Selection	Cell Selection	matlab		Add
Motion Correction	Motion Correction	matlab		Add
Read NWB	File Acquisition	matlab		Add
Read Prairie	File Acquisition	matlab		Add
Read Thor Image	File Acquisition	matlab		Add
s2pSpikeDeconv	Analysis	python	suite2p spike deconvolution	Add
Testing		matlab	Testing module	Add

**Workflow Nodes**

Save & Continue Save Workflow Save as new Workflow

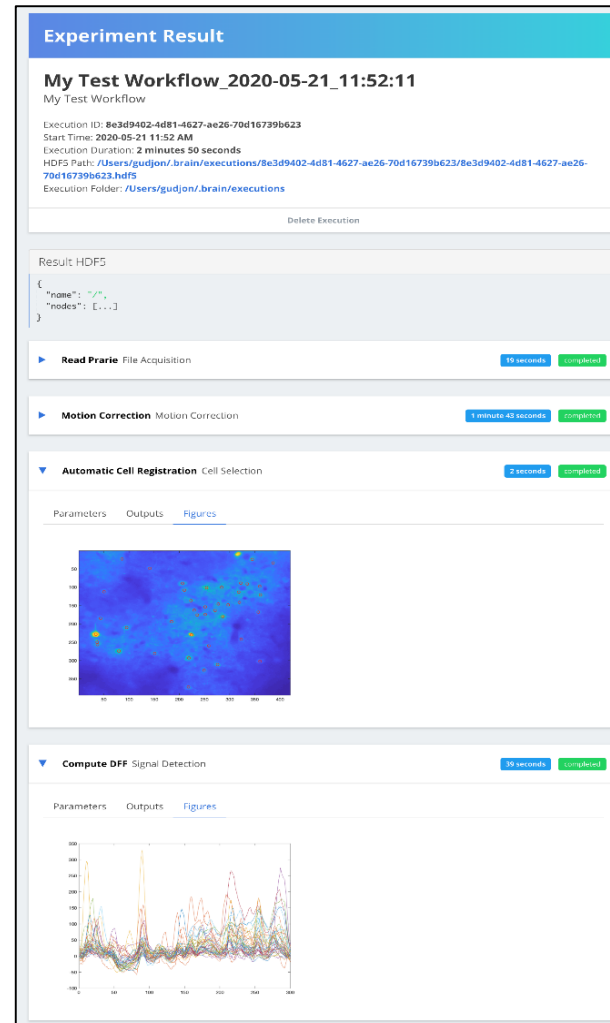
Workflow Name

My Test Workflow

Give a short, descriptive name to the workflow

- Read Prairie File Acquisition
- Motion Correction Motion Correction
- Automatic Cell Registration Cell Selection
- Compute DFF Signal Detection

Workflow is created using a combination of any modules. A number of modules already available in the platform.



**Experiment Result**

**My Test Workflow\_2020-05-21\_11:52:11**  
My Test Workflow

Execution ID: 8e3d9402-4d81-4627-ae26-70d16739b623  
Start Time: 2020-05-21 11:52 AM  
Execution Duration: 2 minutes 50 seconds  
HDF5 Path: /Users/gudjon/.brain/executions/8e3d9402-4d81-4627-ae26-70d16739b623.hdf5  
Execution Folder: /Users/gudjon/.brain/executions

Delete Execution

Result HDF5

```
{  
  "name": "Automatic Cell Registration",  
  "nodes": [...]  
}
```

Read Prairie File Acquisition 10 seconds completed

Motion Correction Motion Correction 1 minute 42 seconds completed

Automatic Cell Registration Cell Selection 2 seconds completed

Parameters Outputs Figures

Heatmap visualization of cell selection results.

Compute DFF Signal Detection 30 seconds completed

Parameters Outputs Figures

Line plot visualization of signal detection results.

Streamlines the process of **collaborating and sharing** data, algorithms and analysis pipelines

### Key Features

Adaptive workflow management: **Integrates** multiple open source and custom built calcium imaging modules in **multiple languages**

**Create** custom modules or **browse** from library of community-created modules

**Interface with cloud storage** to manage contents

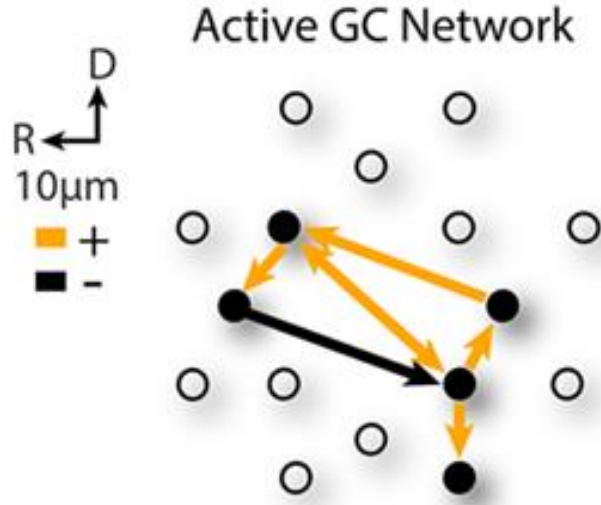
**HDF5-based file system** (enable NWB)

Track workflow **execution data, module configuration, and result** for **reproducibility**

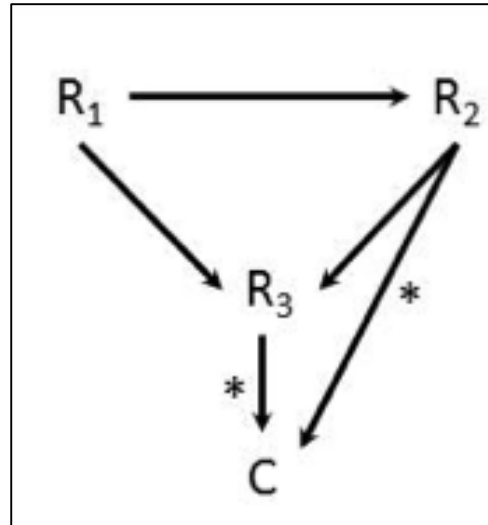
# Theory Guided Experiment Design

- Integrate multiple approaches to analysis of experimental data

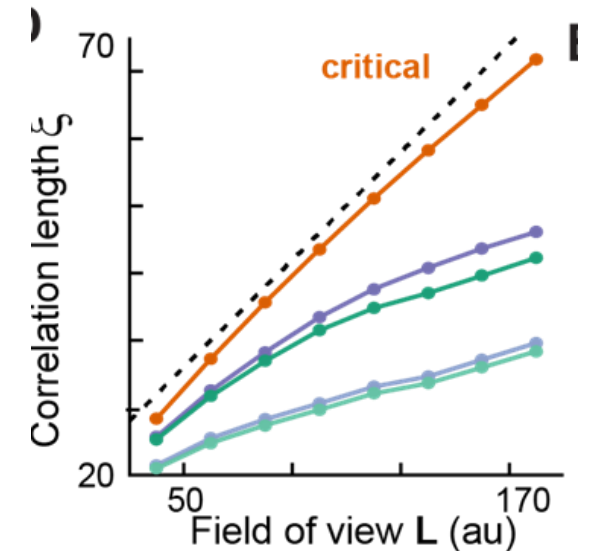
Babadi: Granger Causality (GC)



Panzeri: Intersection Information (II)



Chialvo: Criticality



**Ongoing:**

- Integrating GC and II Analyses.
- Computational Speedup, Real Time Analysis of Imaging Data





# Core Activities

## Data Science Hackathons:

Students/Postdocs working on Ca data shared their analysis workflow with each other and systems software engineers and theory groups

## Data Sharing:

AWS

NwB Hackathon Participation



May 2019



Dec 2019