

Optical Stimulation and Recording Acquisition Software

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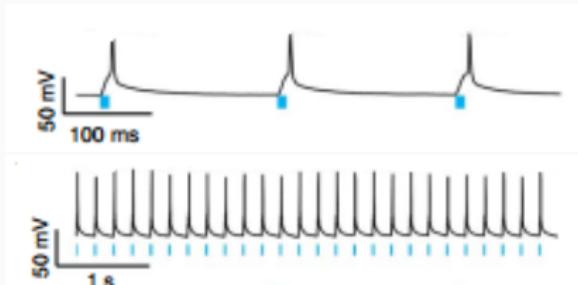
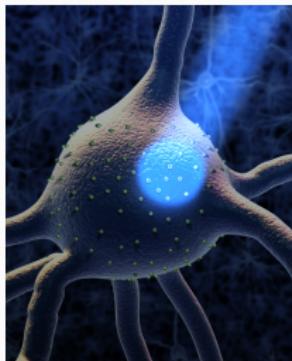
October 29, 2020

New York University, Reyes Lab

Background

Optical stimulation

Controlling brain activity with light : Optogenetics

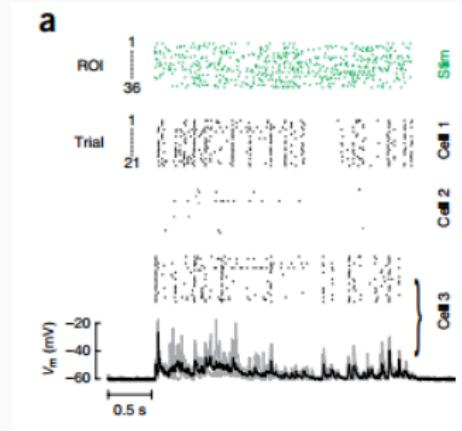
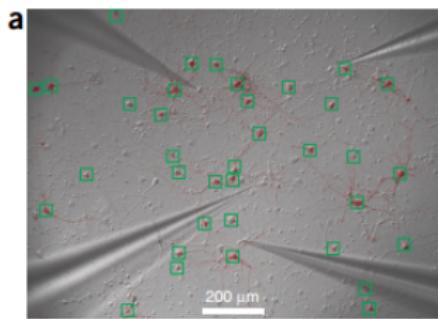


Boyden et al. 2005 Millisecond-timescale, genetically targeted optical control of neural activity.

Hochbaum et al. 2014 All-optical electrophysiology in mammalian neurons using engineered microbial rhodopsins.

Optical stimulation

Controlling brain activity with light : Optogenetics

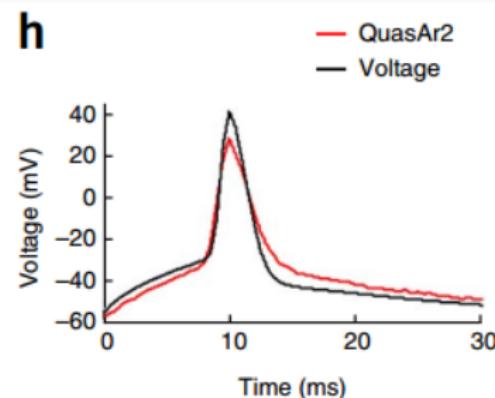
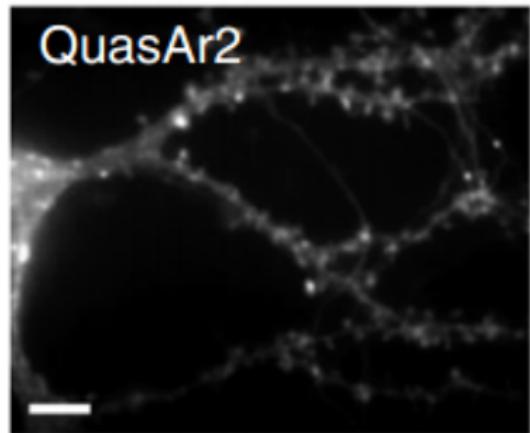


2 major drawbacks :

- Invasive : kills the cells after a short time
- Limited bandwidth : maximal 12-16 parallel recordings

Optical recording

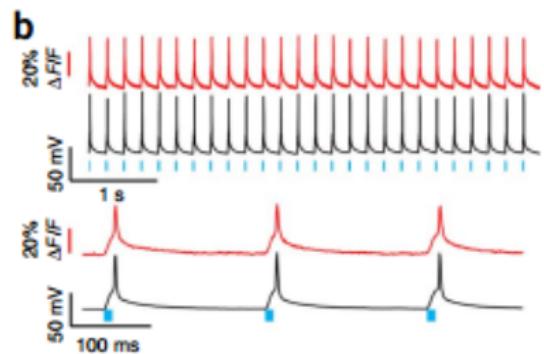
Imaging brain activity with light : Optical imaging



Hochbaum et al. 2014 All-optical electrophysiology in mammalian neurons using engineered microbial rhodopsins.

Whole Optical electrophysiology

Combining optical recording and optical stimulation



- Can record many more cells at once
- Not invasive

Has other limitations among them requires multiple pieces of equipments to work

Whole Optical electrophysiology

Hardware requirements:

- High frame rate camera recording at least at 500Hz
- Laser for the voltage reporter visualization
- Digital Light Processor for patterned optogenetic stimulation
- Microscope with moveable stage
- Classical electrophysiology equipment

Optical Stimulation and Recording Acquisition Software

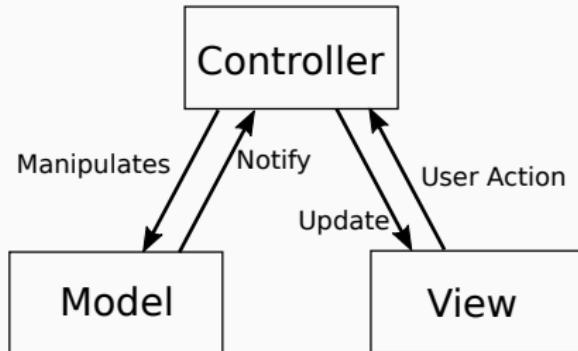
Python and MVC pattern

Why Python ?

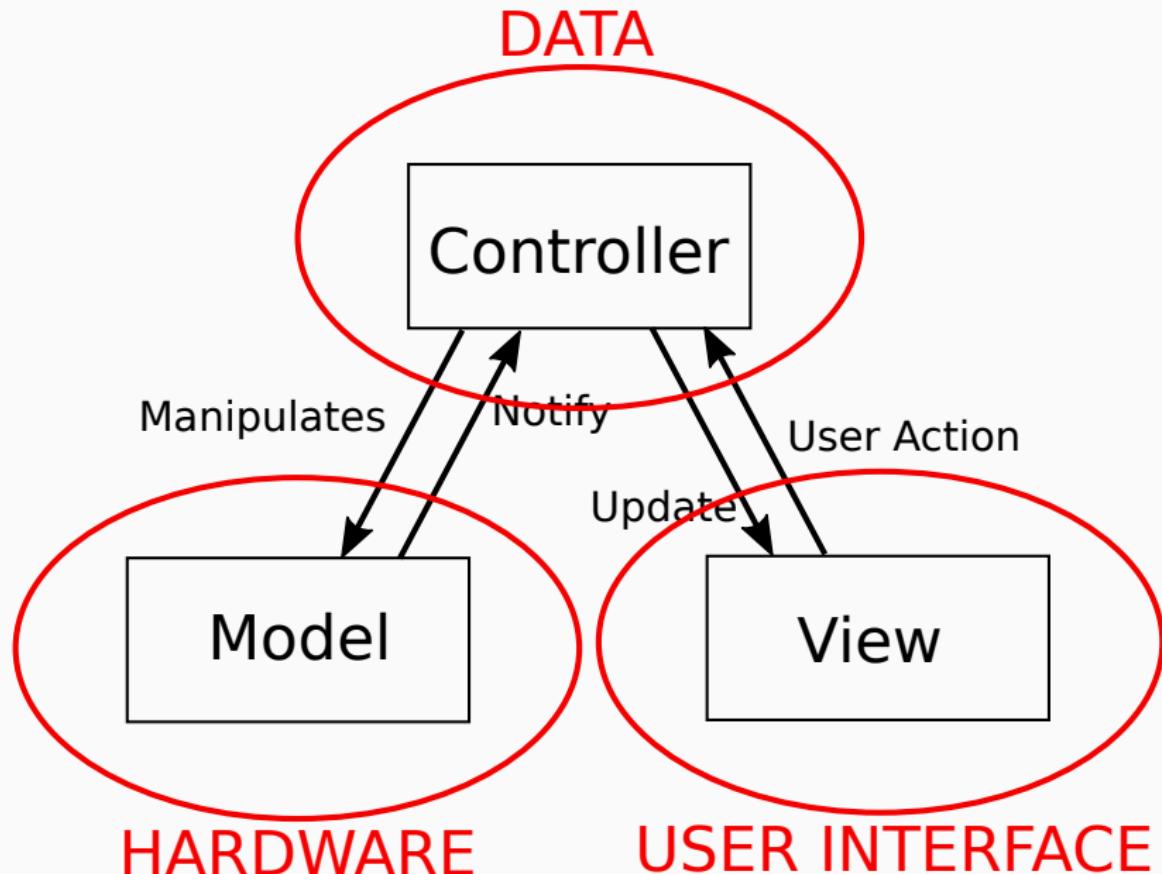
- Rich ecosystem for software development and scientific computing
- Large and expanding user base
- Free and Open-Source

Model-View-Controller approach

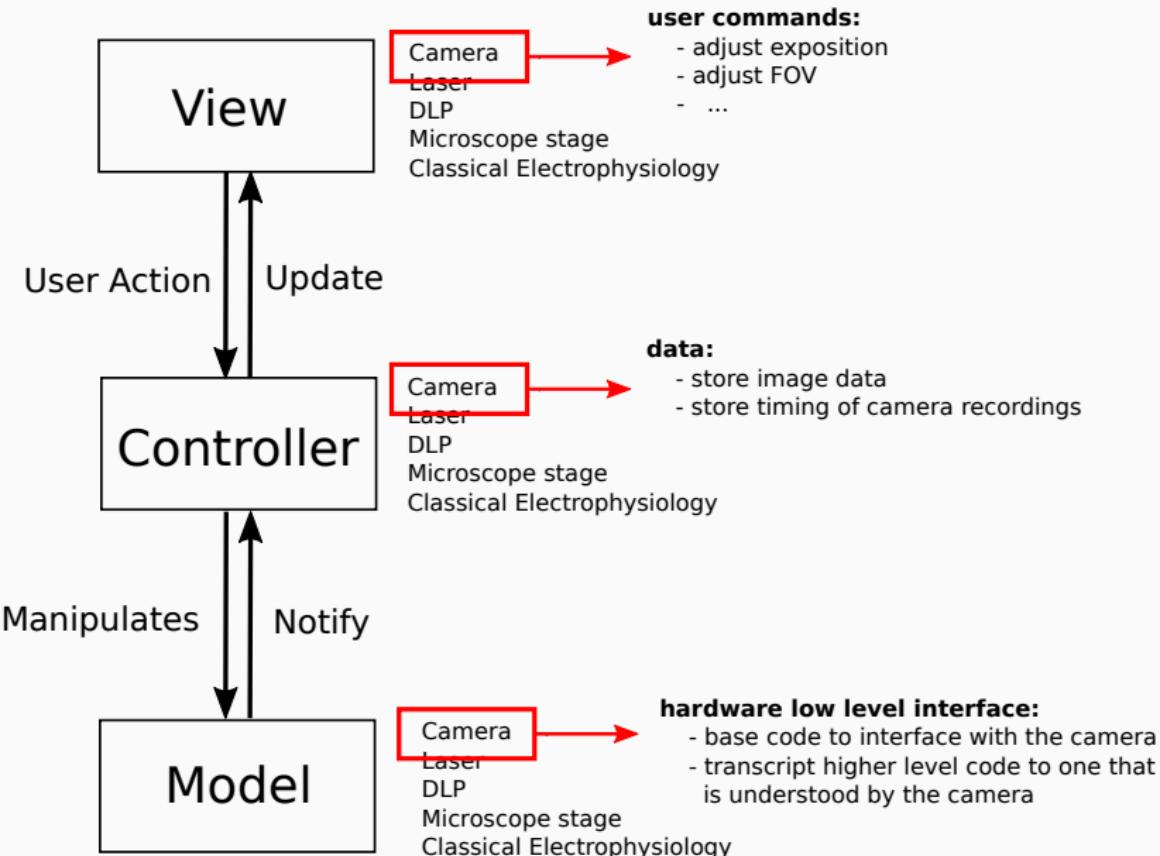
- Components independence



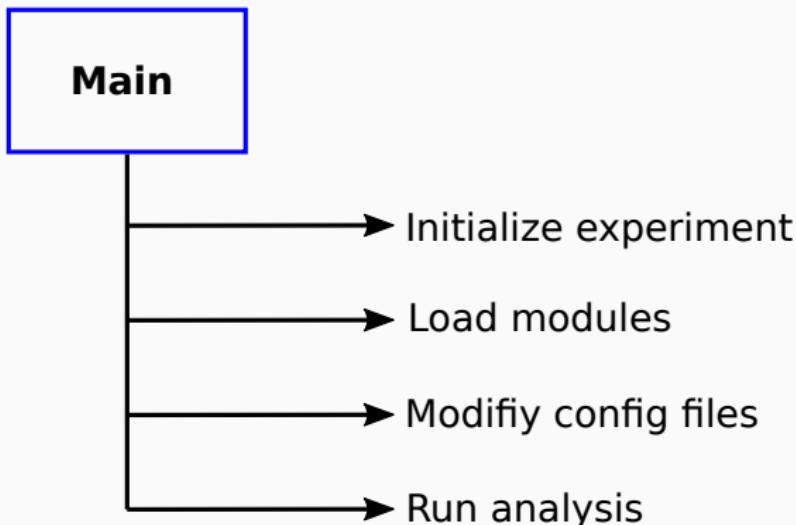
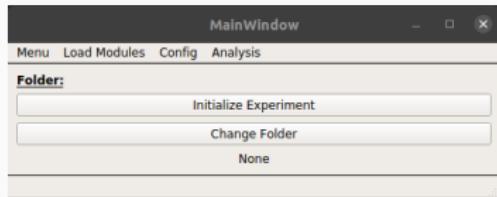
Python and MVC pattern



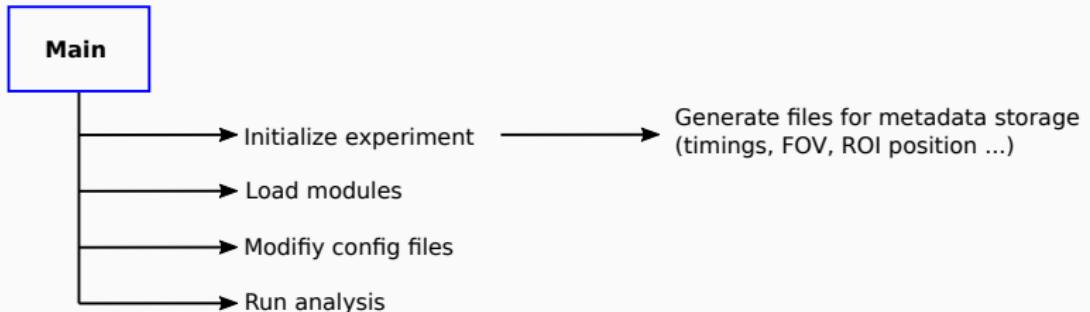
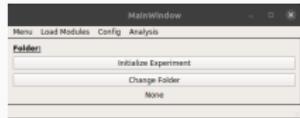
Python and MVC pattern



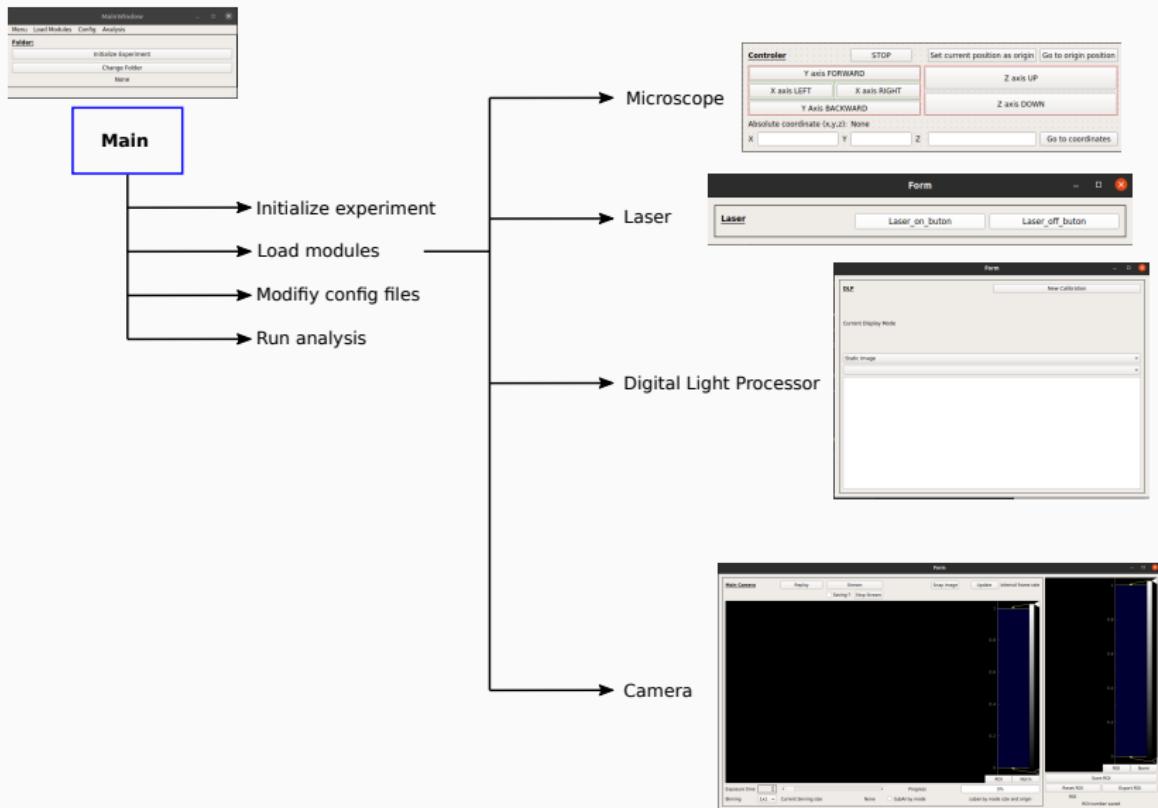
Software flow diagramm



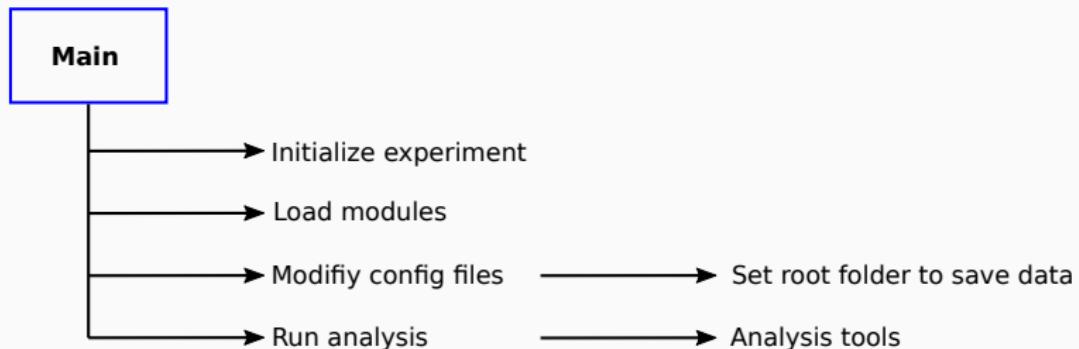
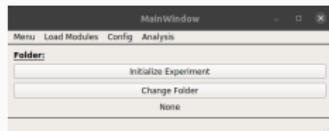
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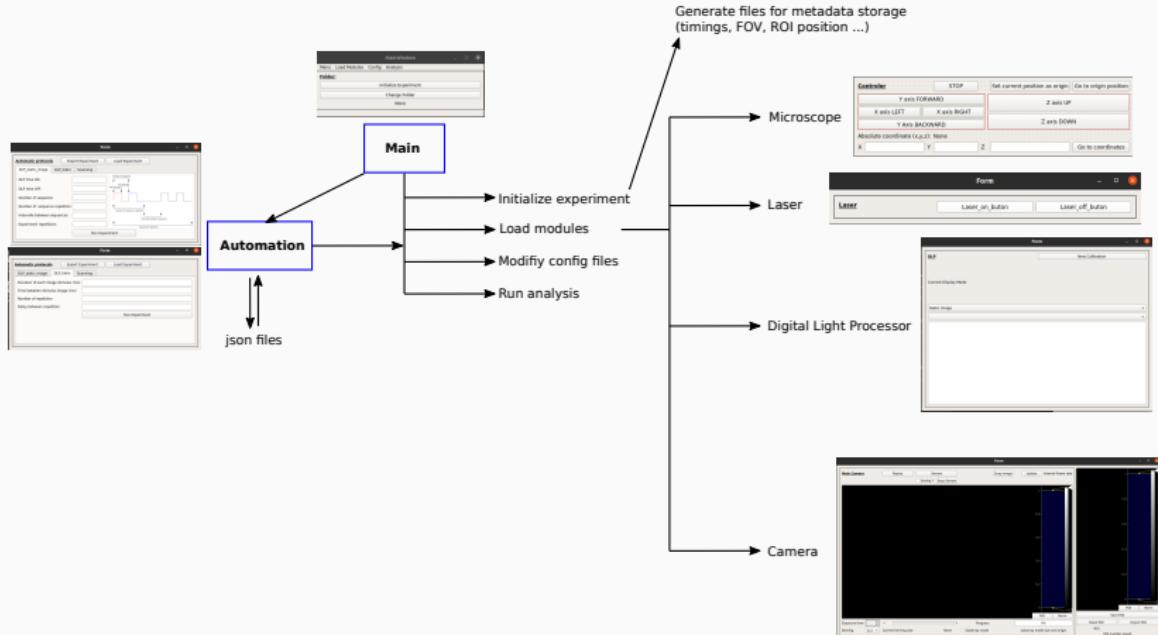
Software flow diagramm



Software flow diagramm



Software flow diagramm

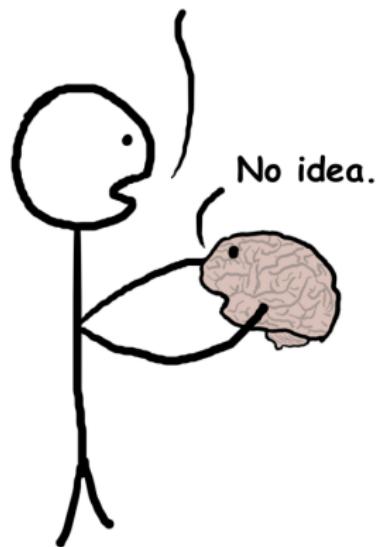


Thanks



Questions

How do you work?



No idea.

