

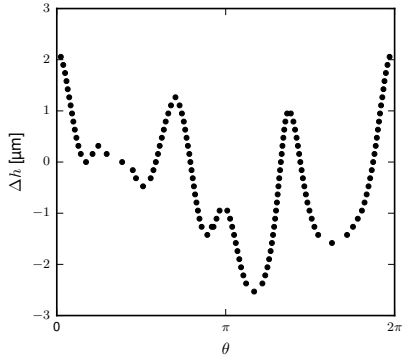
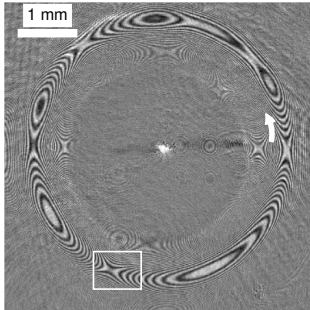
Matplotlib and Scientific Visualization

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Who am I?

- ▶ Trained as a physicist
 - ▶ Jamming + dynamics of Leidenfrost drops with Nagel and Gardel at UChicago



Who am I?

- ▶ Trained as a physicist
 - ▶ Jamming + dynamics of Leidenfrost drops with Nagel and Gardel at UChicago
- ▶ Currently in Data Science and System Integration program at NSLS-II
- ▶ Current Project Lead of Matplotlib

matplotlib

 **bluesky**

Acknowledgments

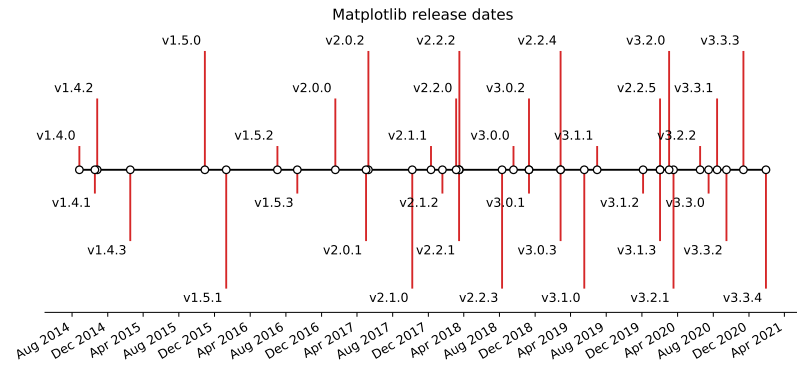
- ▶ John Hunter (1968-2012)
- ▶ Michael Droettboom
- ▶ The whole Matplotlib development team
 - ▶ Over 1,250+ have contributed code, many more in bug reports, feature requests, and user support
- ▶ Dora Caswell

Recent funding from Chan Zuckerberg Initiative (2020-present)

Matplotlib

...is a comprehensive library for creating static, animated, and interactive visualizations in Python.

- ▶ Widely used through out science
 - ▶ over 10% of arXiv has at least one Matplotlib figure (as of 2018)
 - ▶ estimated over 1M users
- ▶ Continuously developed for past 19 years
 - ▶ first commit in 2003, initial work in 2001-2002



What is visualization for?

1. Exploratory data analysis

- ▶ just get the data on the screen in a way *you* can understand as fast as you can
- ▶ `matplotlib.pyplot`
- ▶ `seaborn`
- ▶ plotting methods on data structures (e.g. `obj.plot(...)`)

2. Paper figures

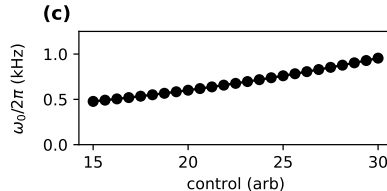
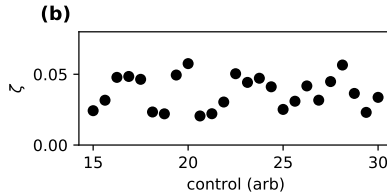
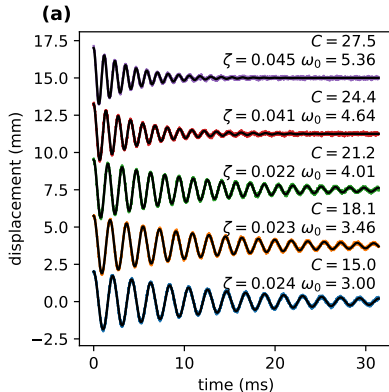
- ▶ need to be *just right*

3. Part of a standard (interactive) workflow

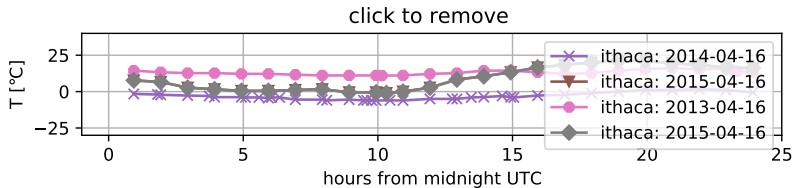
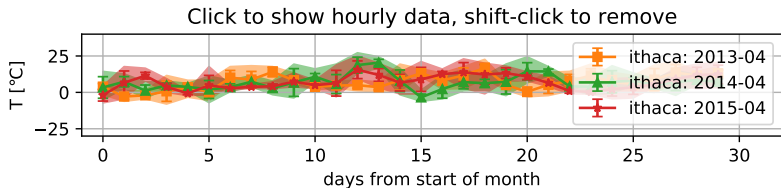
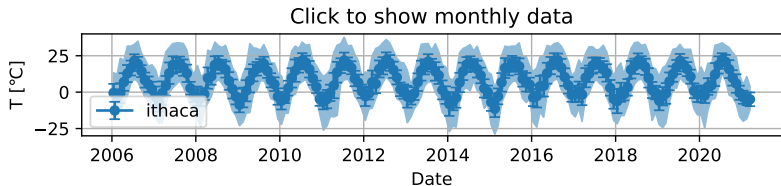
- ▶ repeatedly visualize data with same data-structure

Case Study: Paper Figure

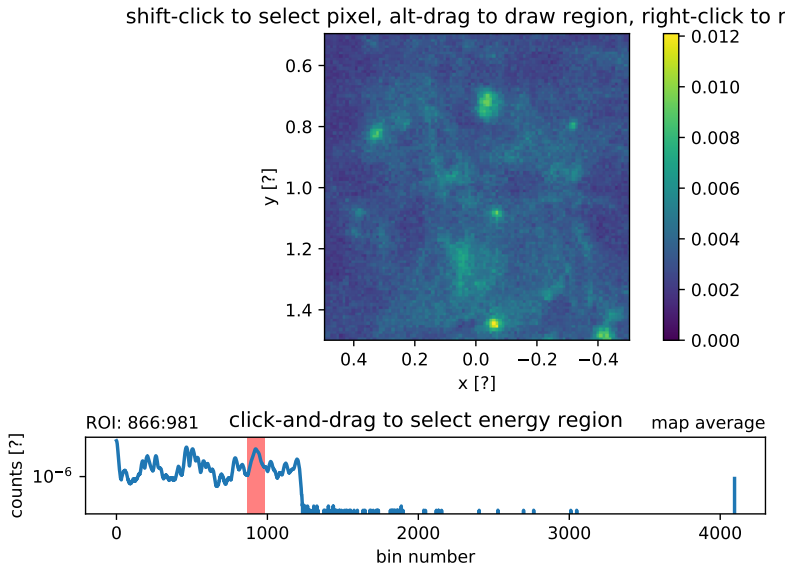
- ▶ Assume:
 - ▶ you have fabricated 25 cantilevers
 - ▶ Varied something (called 'control') in fabrication
- ▶ Experiment:
 - ▶ displace away from equilibrium position by some amount
 - ▶ release at $t=0$ and watch vibrations ring down



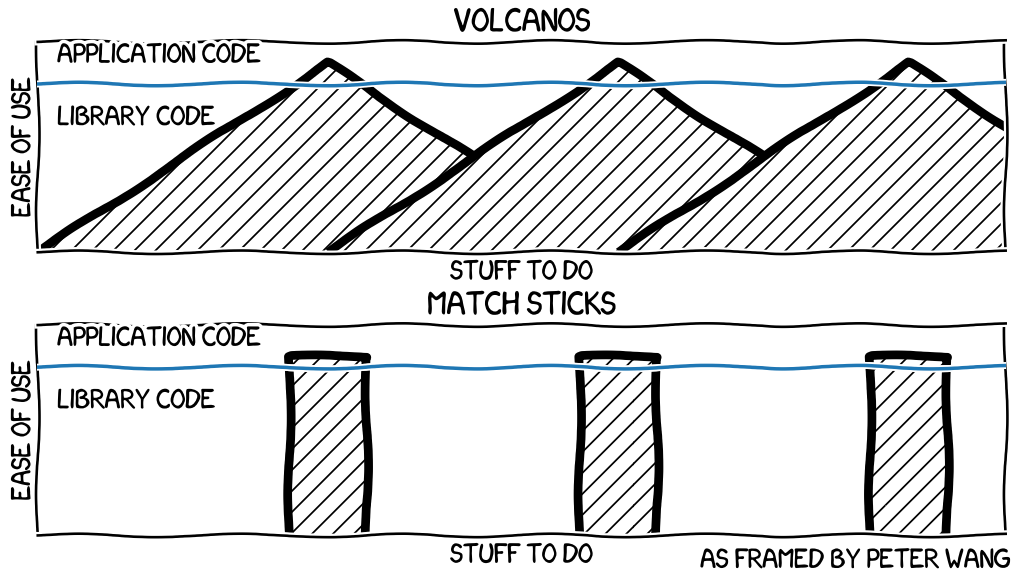
Interactive application (temperature)



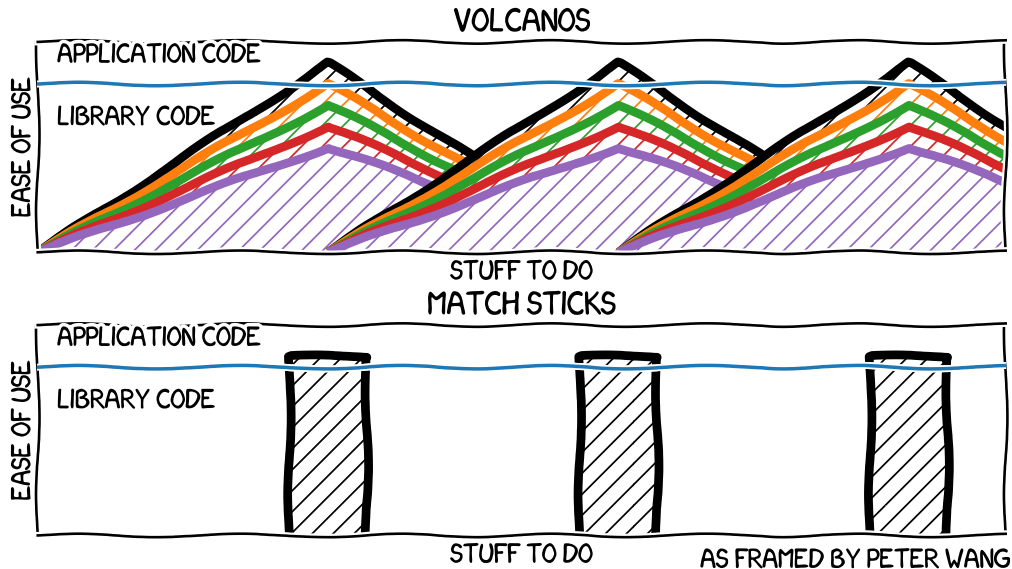
Interactive applications (x-ray fluorescence map)



Iterative software development



Iterative software development



Future Work

- ▶ On going incremental improvements, bug fixes, and maintenance
- ▶ Improvements to Figure and Axes layout tooling (Jody Klymak)
- ▶ Re-designing Matplotlib's internal data model (Hannah Aizenman)

Resources

This material: https://github.com/tacaswell/2021-03_APS

- ▶ docs: <https://matplotlib.org/stable>
- ▶ cheatsheets: <https://github.com/matplotlib/cheatsheets>
- ▶ chat: <https://gitter.im/matplotlib>
- ▶ forum: <https://discourse.matplotlib.org>
- ▶ tutorials: https://github.com/matplotlib/interactive_tutorial,
<https://github.com/matplotlib/AnatomyOfMatplotlib>
<https://github.com/matplotlib/GettingStarted>
- ▶ Interactive Applications Using Matplotlib, Benjamin V. Root (2015)
- ▶ domain-specific libraries
- ▶ Building a maintainable plotting library (PyData NYC 2019)
<https://youtu.be/NV4Y75ZUDJA>
- ▶ Separation Of Scales (PyData Global 2020) <https://youtu.be/P85UIuMovnI>