bluesky

Bluesky ‘Remote’ Developments

Stuart Campbell

5 Light Source (5LS) Remote Experiment Forum Series

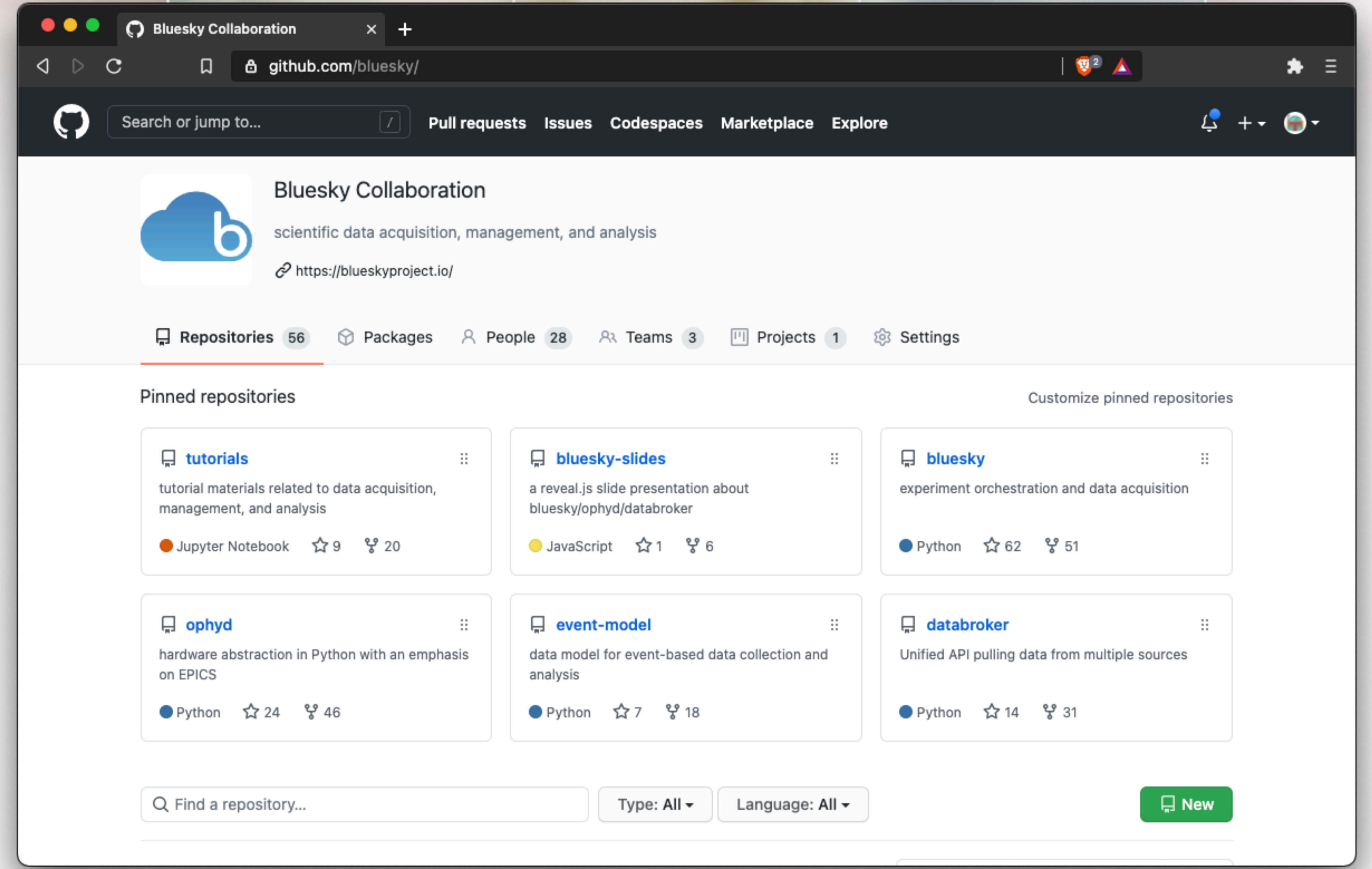
16th December 2020

U.S. DEPARTMENT OF ENERGY | Office of Science

BROOKHAVEN NATIONAL LABORATORY

Public Apology

I will be skipping **a lot** of details and work that is being done in these slides in favour of being brief and allowing more time for discussions



Bluesky Collaboration

scientific data acquisition, management, and analysis

https://blueskyproject.io/

Pinned repositories

tutorials
tutorial materials related to data acquisition, management, and analysis
● Jupyter Notebook ☆ 9 ⑂ 20

bluesky-slides
a reveal.js slide presentation about bluesky/ophyd/databroker
● JavaScript ☆ 1 ⑂ 6

bluesky
experiment orchestration and data acquisition
● Python ☆ 62 ⑂ 51

ophyd
hardware abstraction in Python with an emphasis on EPICS
● Python ☆ 24 ⑂ 46

event-model
data model for event-based data collection and analysis
● Python ☆ 7 ⑂ 18

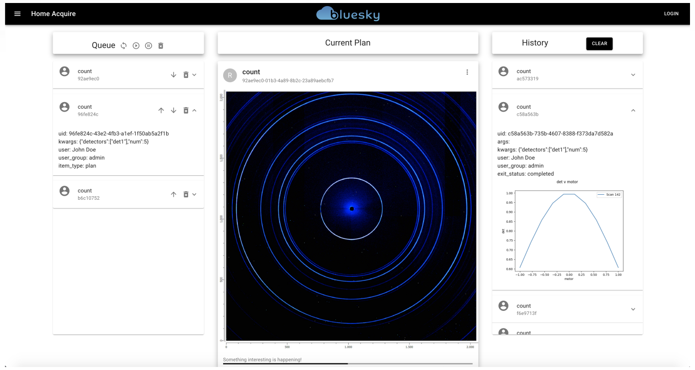
databroker
Unified API pulling data from multiple sources
● Python ☆ 14 ⑂ 31

Bluesky ’Remote’ Development Process

- Adopted an agile development model based on a series of Minimal Viable Product (MVP) milestones.
- Assumption is that all code produced is ‘research’ code.
- Allows experimentation on interfaces (both GUI and API) to see what works in practice.
- Perform real world testing on beamlines as soon as makes sense.

What are we working on ?

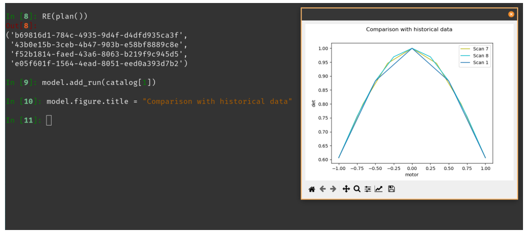
- Run Engine as a Service
- Bluesky Queuing System
- Central infrastructure improvements
- API for ‘facility’
- Web based Data Acquisition Interfaces
- Common Widgets Libraries
- Unified model/plotting framework
- Building containers/pods for everything
- Integration and development of business systems, databases, LIMS, …
- … lots of other things (too many to mention here)



uid: 96fe824c-43e2-4fb3-a1ef-1f50ab5a2f1b
kwargs: {"detectors":["det1"],"num":5}
user: John Doe
user_group: admin
item_type: plan

uid: c58a563b-735b-4607-8388-f373da7d582a
args:
kwargs: {"detectors":["det1"],"num":5}
user: John Doe
user_group: admin
exit_status: completed

Something interesting is happening!

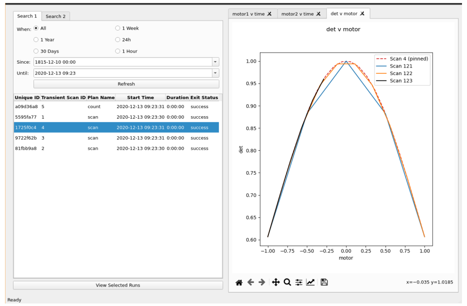


```
In [8]: RE(plan())
Out[8]:
('b69816d1-784c-4935-9d4f-d4dfd935ca3f',
 '43b0e15b-3ceb-4b47-903b-e58bf8889c8e',
 'f52b1814-faed-43a6-8063-b219f9c945d5',
 'e05f601f-1564-4ead-8051-eed0a393d7b2')

In [9]: model.add_run(catalog[1])

In [10]: model.figure.title = "Comparison with historical data"

In [11]: 
```



When: ● All ○ 1 Week
○ 1 Year ○ 24h
○ 30 Days ○ 1 Hour
Since: 1815-12-10 00:00
Until: 2020-12-13 09:23

Unique ID	Transient Scan ID	Plan Name	Start Time	Duration	Exit Status
a09d36a8	5	count	2020-12-13 09:23:31	0:00:00	success
5595fa77	1	scan	2020-12-13 09:23:30	0:00:00	success
1725f0c4	4	scan	2020-12-13 09:23:31	0:00:00	success
9722f62b	3	scan	2020-12-13 09:23:31	0:00:00	success
81fbb9a8	2	scan	2020-12-13 09:23:30	0:00:00	success

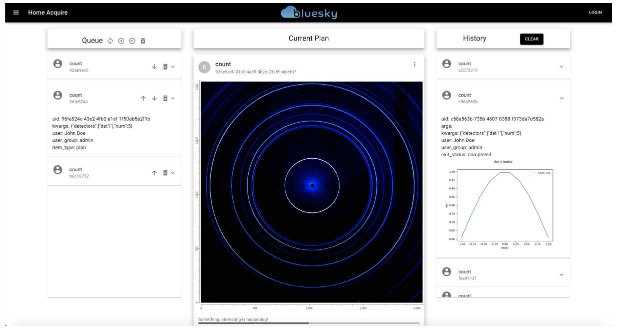
x=−0.035 y=1.0185

Ready

Where are we headed ?

Remote User Interactions

Data Acquisition


Home Acquire

bluesky

LOGIN

Queue

count
92ae9ec0

count
96fe824c

uid: 96fe824c-43e2-4fb3-a1ef-1f50ab5a2f1b
kwargs: {"detectors":["det1"],"num":5}
user: John Doe
user_group: admin
item_type: plan

count
b6c10752

Current Plan

count
92ae9ec0-01b3-4a89-8b2c-23a89aebcfb7

Something interesting is happening!

History CLEAR

count
ac573319

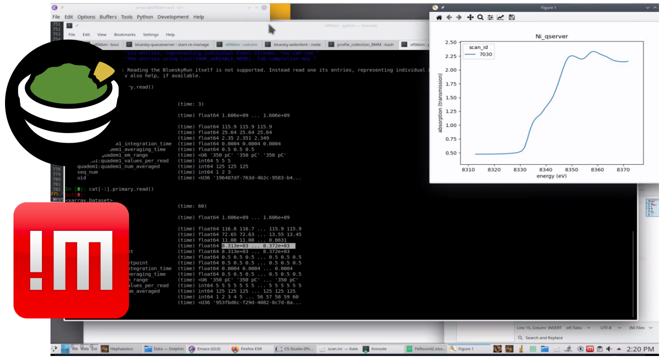
count
c58a563b

uid: c58a563b-735b-4607-8388-f373da7d582a
args:
kwargs: {"detectors":["det1"],"num":5}
user: John Doe
user_group: admin
exit_status: completed

count
f6e9713f

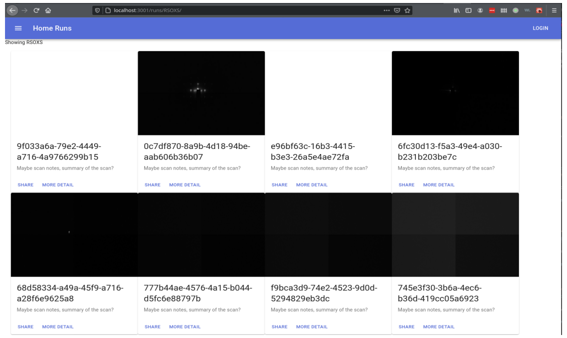
count

bluesky webapp


File Edit Options Buffers Tools Python Development Help
Ni_qserver
scan_id
7030
absorption (transmission)
energy (eV)

Remote Desktops

Data Access


localhost:3001/runs/RSOXS/

Home Runs

LOGIN

Showing RSOXS

9f033a6a-79e2-4449-a716-4a9766299b15
Maybe scan notes, summary of the scan?
SHARE MORE DETAIL

0c7df870-8a9b-4d18-94be-aab606b36b07
Maybe scan notes, summary of the scan?
SHARE MORE DETAIL

e96bf63c-16b3-4415-b3e3-26a5e4ae72fa
Maybe scan notes, summary of the scan?
SHARE MORE DETAIL

6fc30d13-f5a3-49e4-a030-b231b203be7c
Maybe scan notes, summary of the scan?
SHARE MORE DETAIL

68d58334-a49a-45f9-a716-a28f6e9625a8
Maybe scan notes, summary of the scan?
SHARE MORE DETAIL

777b44ae-4576-4a15-b044-d5fc6e88797b
Maybe scan notes, summary of the scan?
SHARE MORE DETAIL

f9bca3d9-74e2-4523-9d0d-5294829eb3dc
Maybe scan notes, summary of the scan?
SHARE MORE DETAIL

745e3f30-3b6a-4ec6-b36d-419cc05a6923
Maybe scan notes, summary of the scan?
SHARE MORE DETAIL

databroker webapp

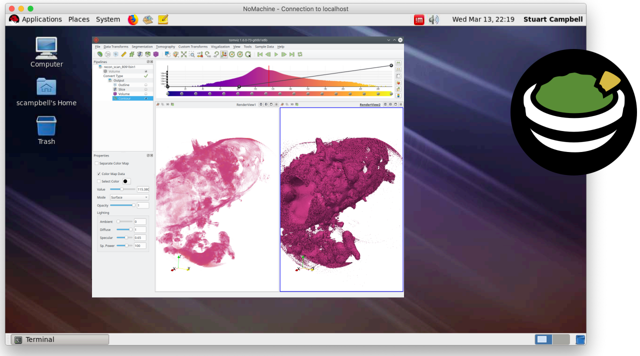
globus online

BNL BOX

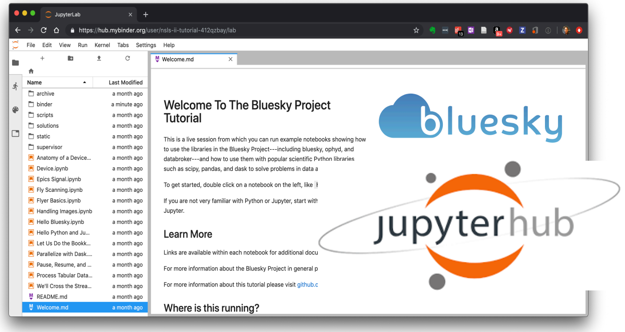
MINIO

Data Transfer Nodes
& push to cloud services

Data Analysis



Remote Desktops


JupyterLab
https://hub.mybinder.org/user/nsls-ii-tutorial-412qzbay/lab
File Edit View Run Kernel Tabs Settings Help
Welcome.md
bluesky
jupyterhub

Name	Last Modified
archive	a month ago
binder	a minute ago
scripts	a month ago
solutions	a month ago
static	a month ago
supervisor	a month ago
Anatomy of a Device...	a month ago
Device.ipynb	a month ago
Epics Signal.ipynb	a month ago
Fly Scanning.ipynb	a month ago
Flyer Basics.ipynb	a month ago
Handling Images.ipynb	a month ago
Hello Bluesky.ipynb	a month ago
Hello Python and Ju...	a month ago
Let Us Do the Bookk...	a month ago
Parallelize with Dask....	a month ago
Pause, Resume, and ...	a month ago
Process Tabular Data...	a month ago
We'll Cross the Strea...	a month ago
README.md	a month ago
Welcome.md	a month ago

Welcome To The Bluesky Project Tutorial

This is a live session from which you can run example notebooks showing how to use the libraries in the Bluesky Project---including bluesky, ophyd, and databroker---and how to use them with popular scientific Python libraries such as scipy, pandas, and dask to solve problems in data a

To get started, double click on a notebook on the left, like

If you are not very familiar with Python or Jupyter, start with Jupyter.

Learn More

Links are available within each notebook for additional docu

For more information about the Bluesky Project in general p

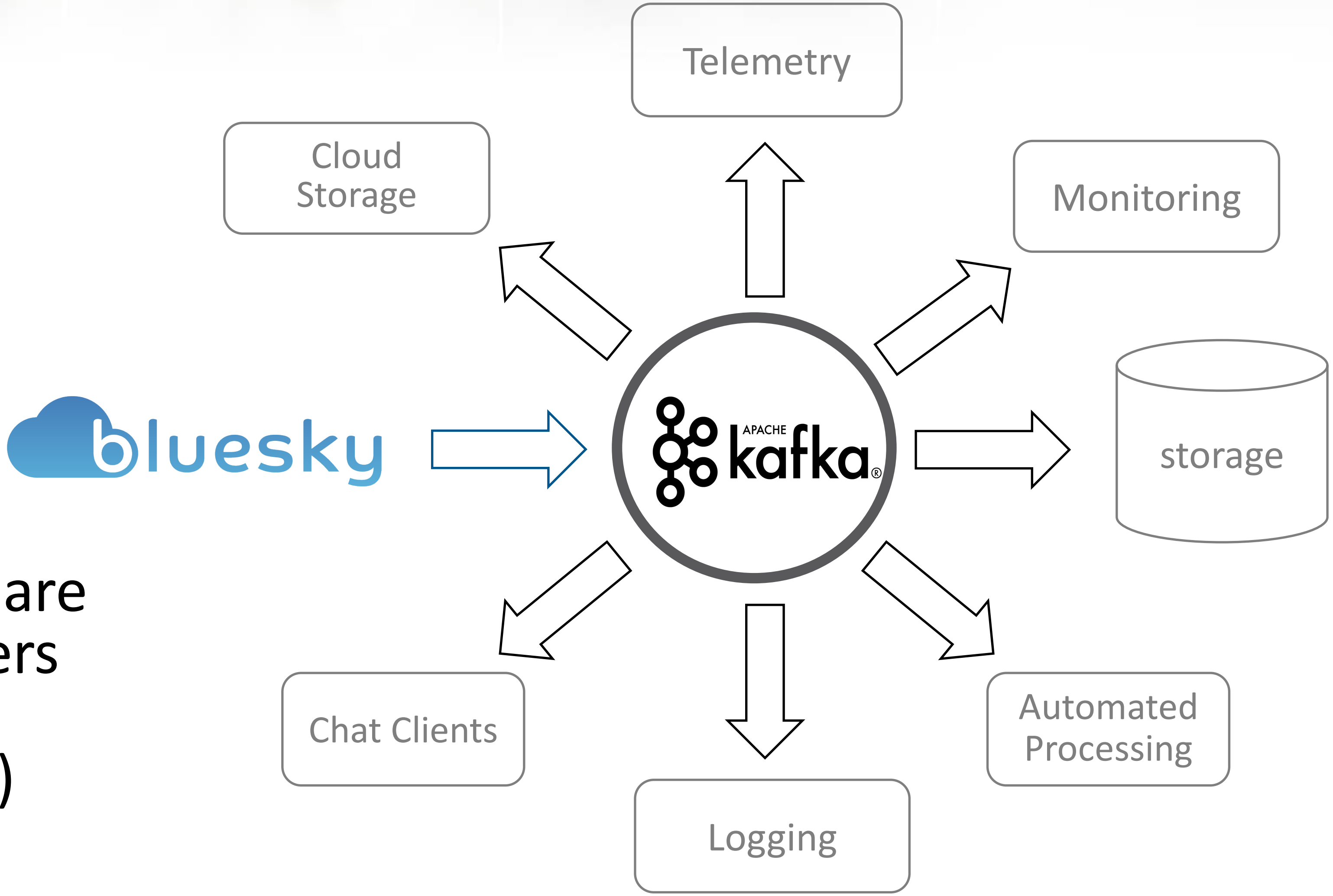
For more information about this tutorial please visit github.c

Where is this running?

Jupyter

Automated processing

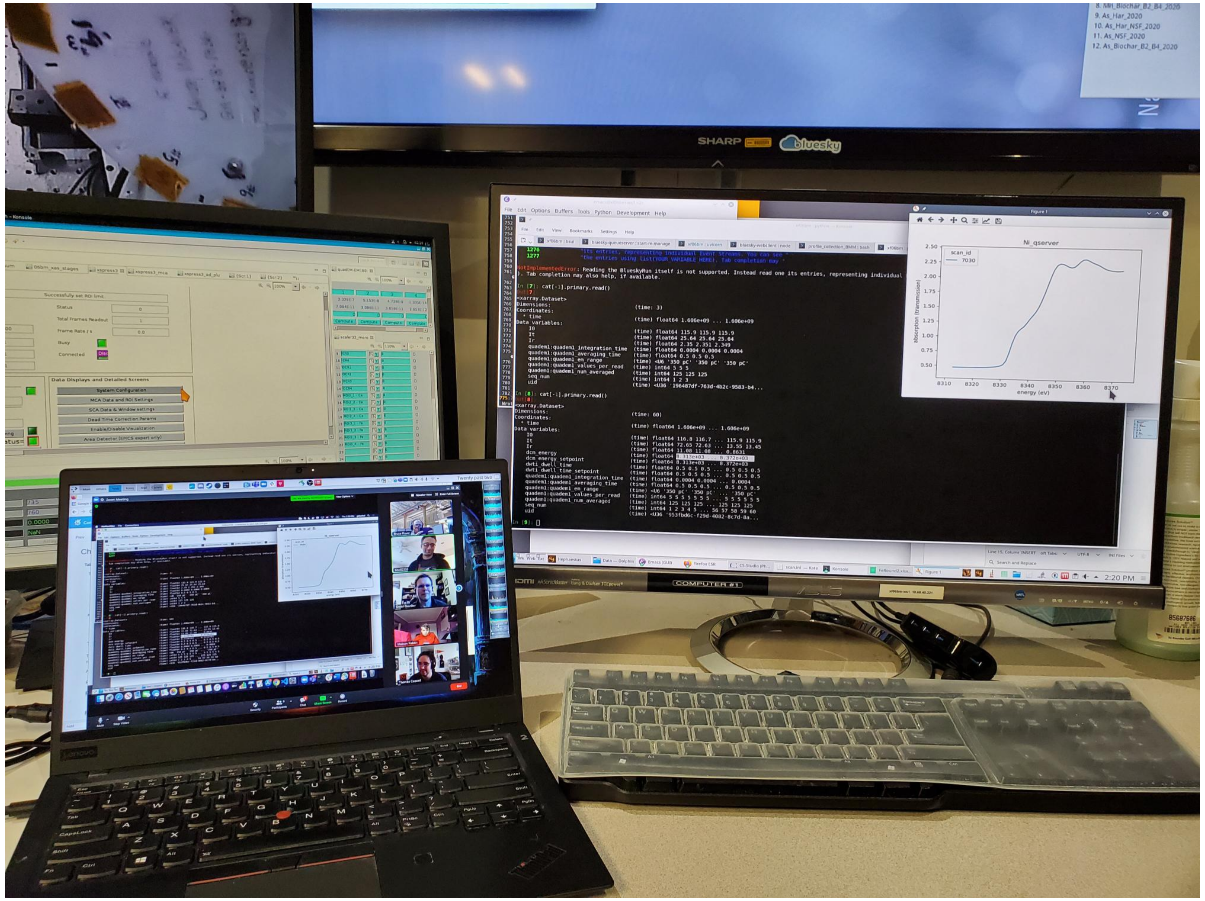
- Streaming data into message bus
- Consumers listen to stream
- Full data and metadata are available to all consumers (either directly in messages, or via an API)



Testing on BMM Beamline

Bluesky in a browser

Wednesday, November 19 – Thursday, November 20
First demonstration of the BlueSky QueueServer



I worked with:

- Dmitri
- Garrett
- Tom
- Maksim
- Marcus

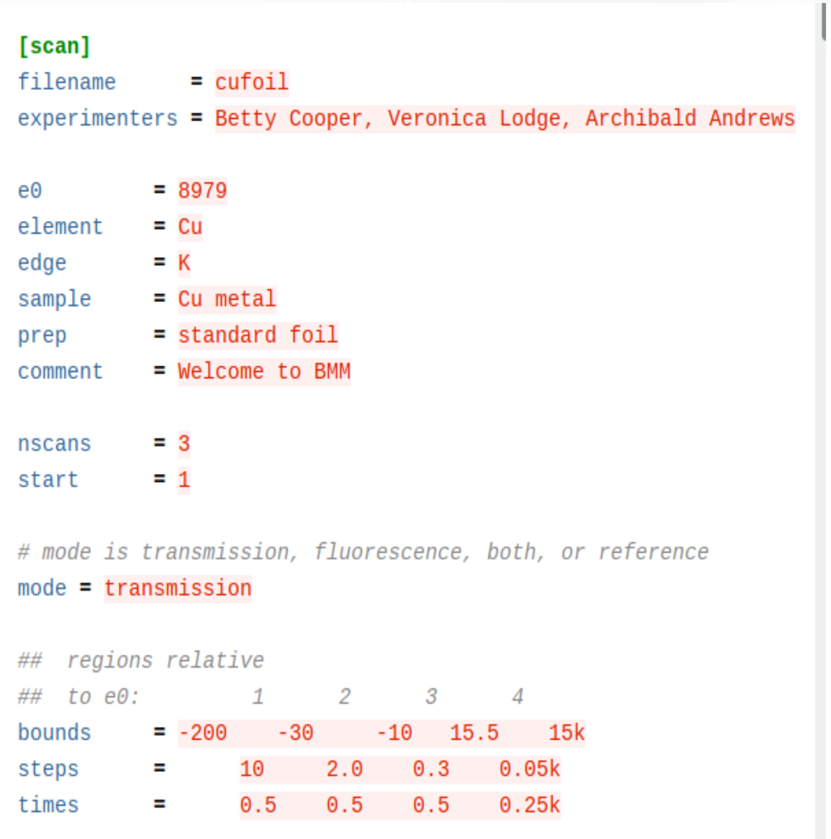
On Wednesday, we did simple plans, e.g. `count()` and `mv()`

On Thursday, we ran my complicated `xafs()` plan.

Thanks for Bruce Ravel for allowing me to shameless steal this slide

BMM’s xafs() plan

QueueServer is a work in progress. Here is Marcus’ prototype UI for Bruce’s xafs() plan:



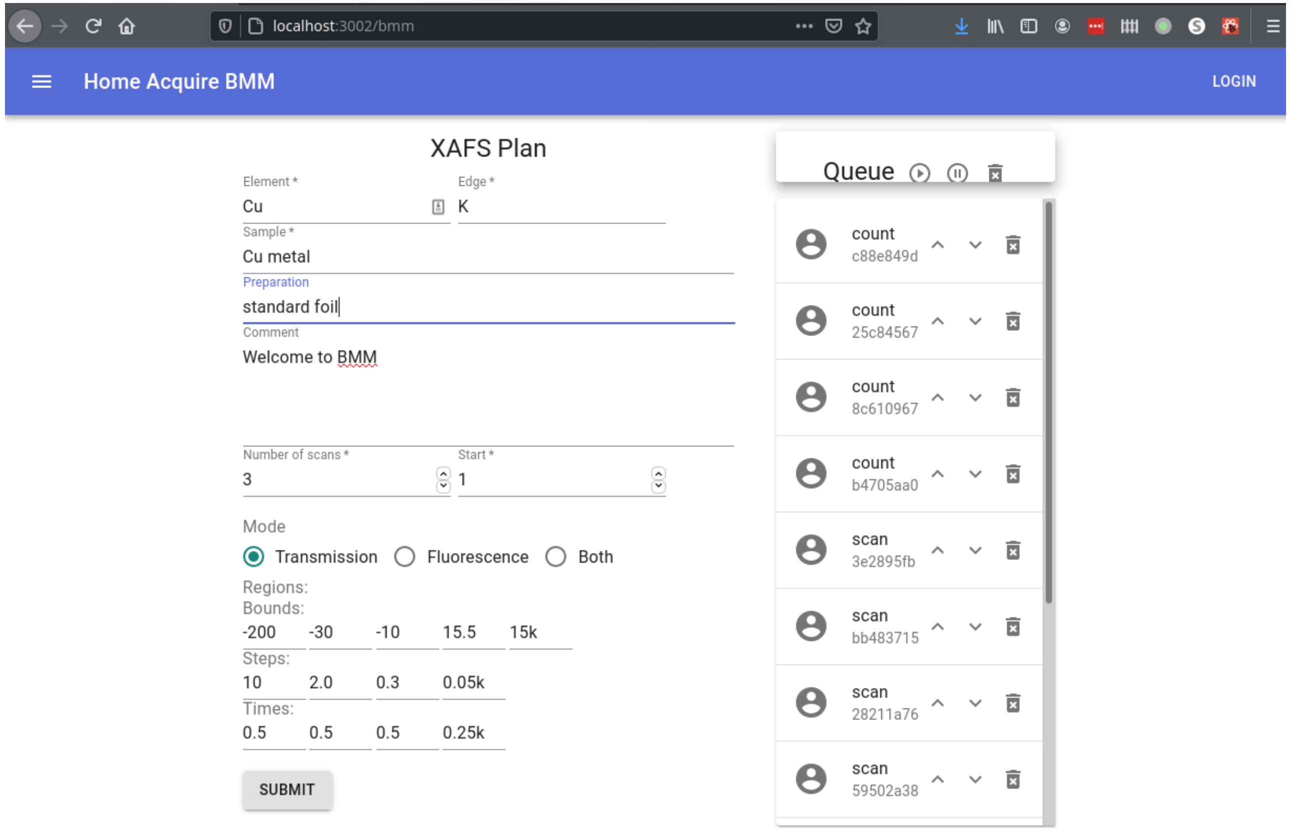
```
[scan]
filename     = cufoil
experimenters = Betty Cooper, Veronica Lodge, Archibald Andrews

e0          = 8979
element     = Cu
edge        = K
sample      = Cu metal
prep        = standard foil
comment     = Welcome to BMM

nscans      = 3
start       = 1

# mode is transmission, fluorescence, both, or reference
mode = transmission

##  regions relative
##  to e0:        1      2      3      4
bounds      = -200    -30     -10   15.5    15k
steps       =      10     2.0    0.3    0.05k
times       =      0.5    0.5    0.5    0.25k
```



XAFS Plan

Element * Cu

Edge * K

Sample * Cu metal

Preparation standard foil

Comment Welcome to BMM

Number of scans * 3

Start * 1

Mode

● Transmission ○ Fluorescence ○ Both

Regions:

Bounds:				
-200	-30	-10	15.5	15k
Steps:				
10	2.0	0.3	0.05k	
Times:				
0.5	0.5	0.5	0.25k	

SUBMIT

Queue

- count c88e849d
- count 25c84567
- count 8c610967
- count b4705aa0
- scan 3e2895fb
- scan bb483715
- scan 28211a76
- scan 59502a38

Thanks for Bruce Ravel for allowing me to shameless steal this slide

Thank you