yaq - Yet Another Acquisition

A modular approach to spectroscopy software and instrumentation

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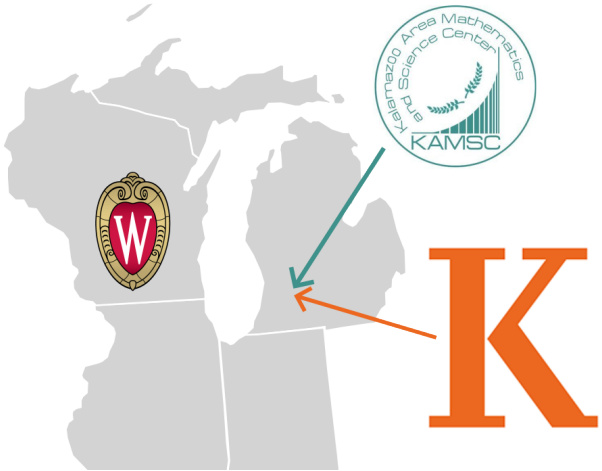
Where I'm from



Where I'm going

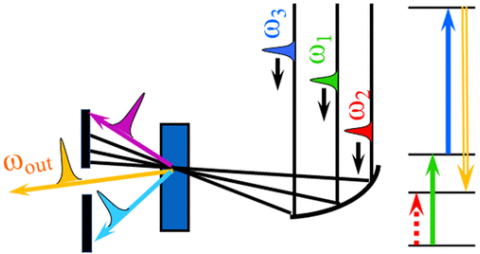
matplotlib

NASA

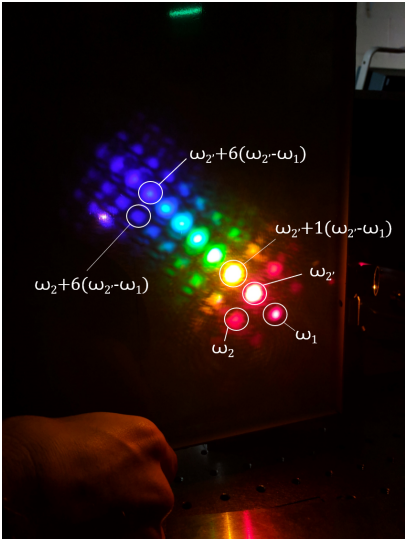
NUMFOCUS

OPEN CODE = BETTER SCIENCE

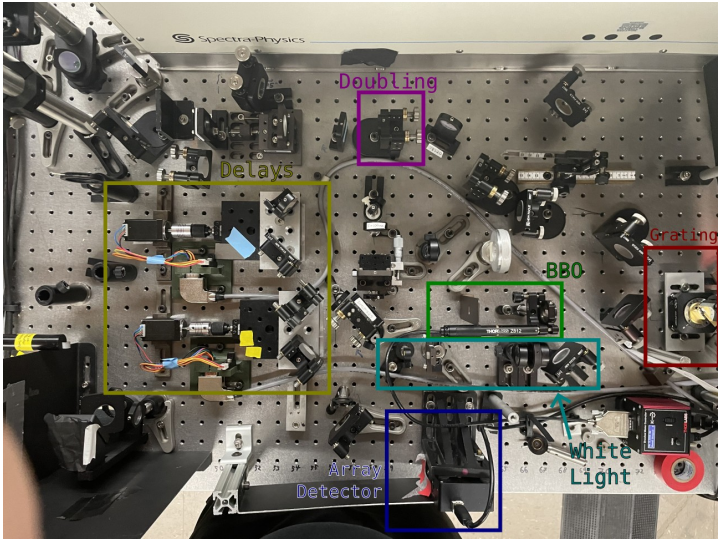
Coherent Multidimensional Spectroscopy (CMDS)



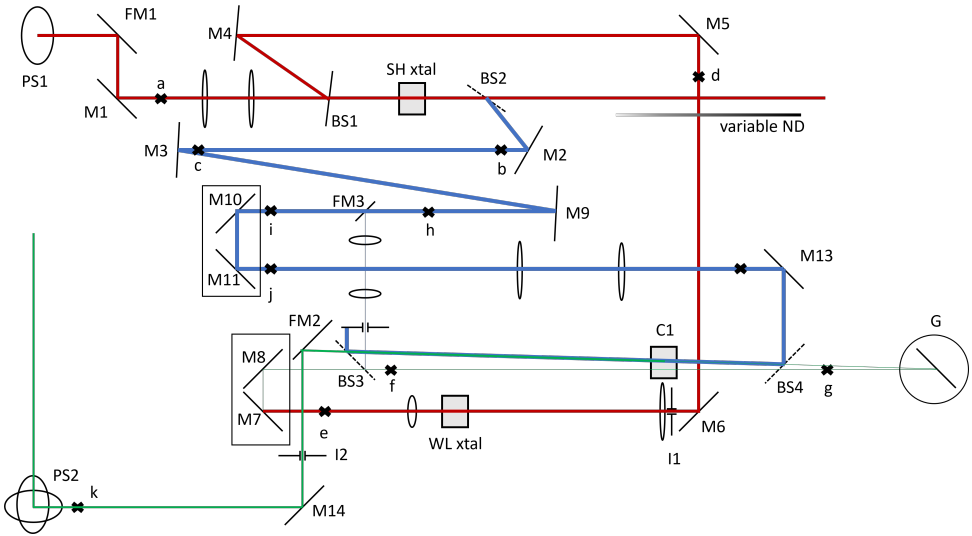
Source:
10.1021/acs.analchem.0c01662



OPA400: photo



OPA400: schematic



Monolithic Approach

A single application which does:

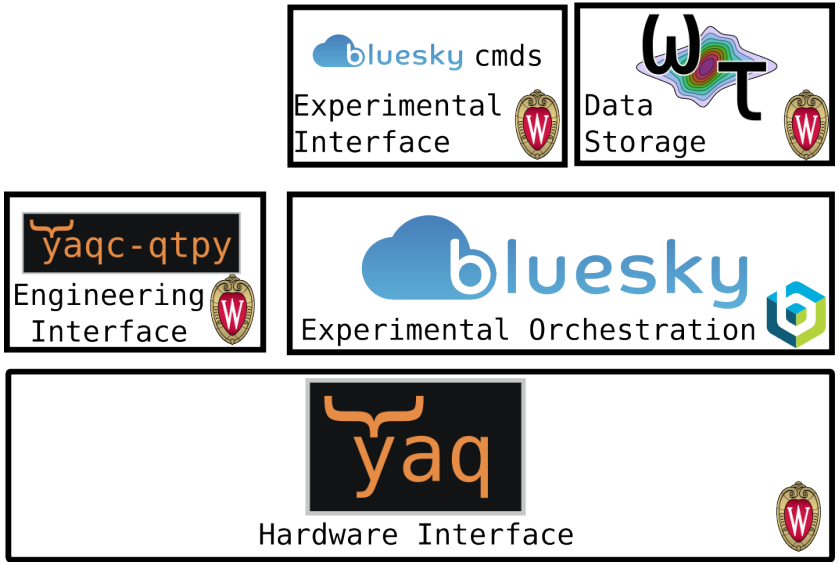
- Direct hardware communication
- Engineering tasks to prepare for experiments
- Experimental orchestration
- Graphical User Interface
- Data recording
- Data work-up

Monolithic Approach

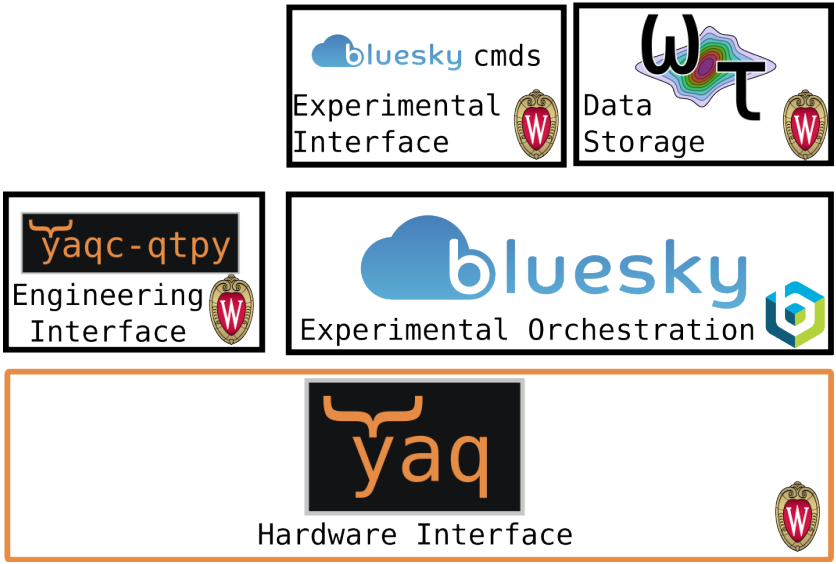
Problems:

- Systems are tightly coupled
- All hardware “speak” different “languages”
- Adding or changing hardware is arduous
- Often limited to one instrument/experiment
- Bugs unrelated to measurement cause measurement to stop

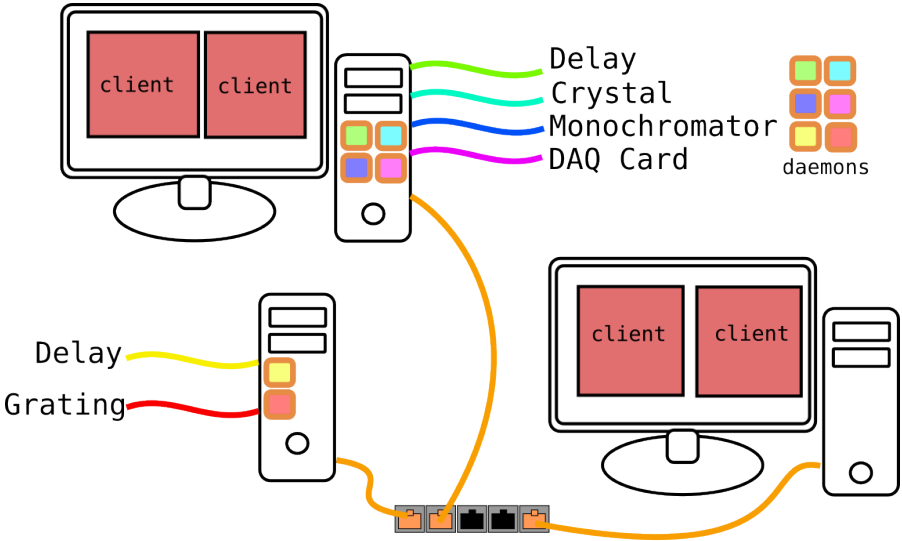
Modular Approach



Modular Approach: yaq



Daemons for hardware



Daemon: small background application which performs a single task

Protocol

Each yaq daemon provides a protocol:

- Self Describing
- Built on Apache Avro Remote Procedure Call
- Shared Traits for similar functionality

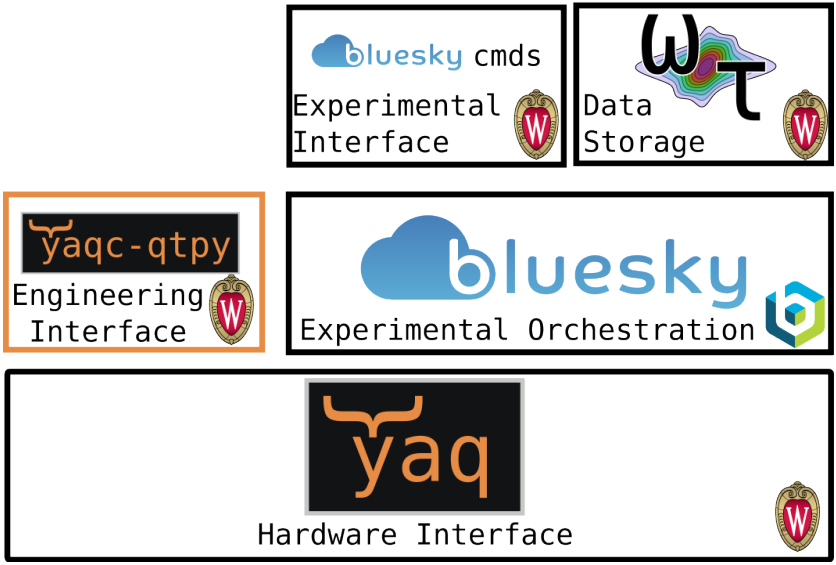
yaqc and scripts

We provide a generic client written for Python: yaqc

yaqc dynamically generates python methods from the protocol

Simple Python scripts are an easy entry to using yaq

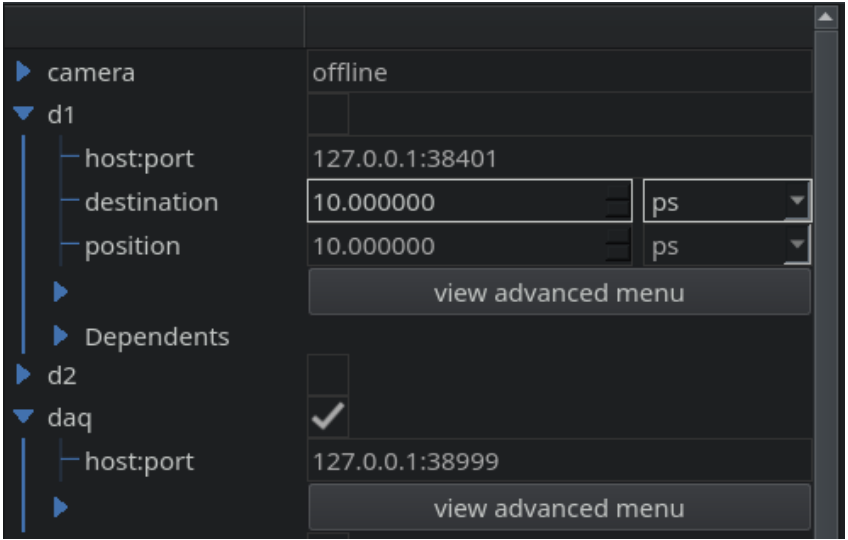
Modular Approach: yaqc-qtpy



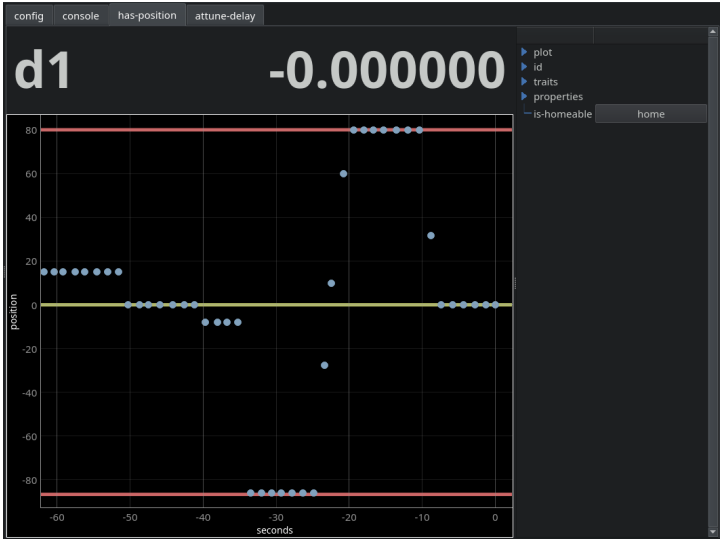
yaqc-qtpy


yaqc-qtpy
camera
offline
d1
d2
daq
nd1
nd2
w1
w1_shutter
w2
wa
wm
Hidden

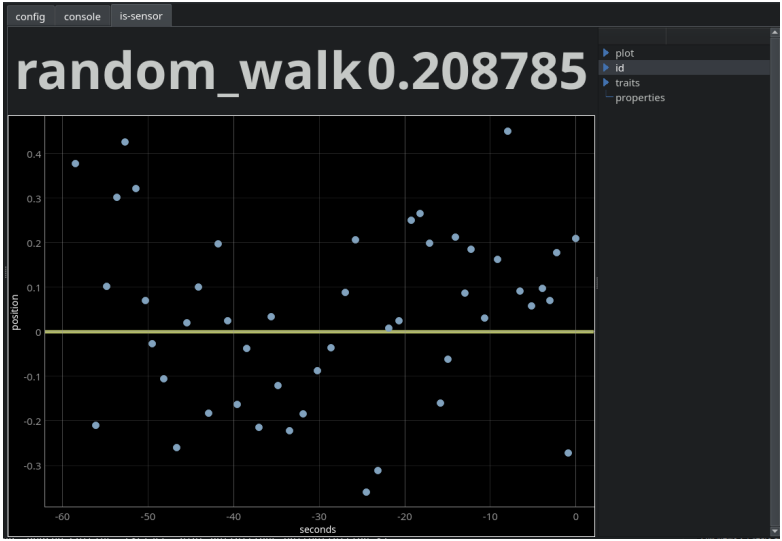
yaqc-qtpy: sidebar



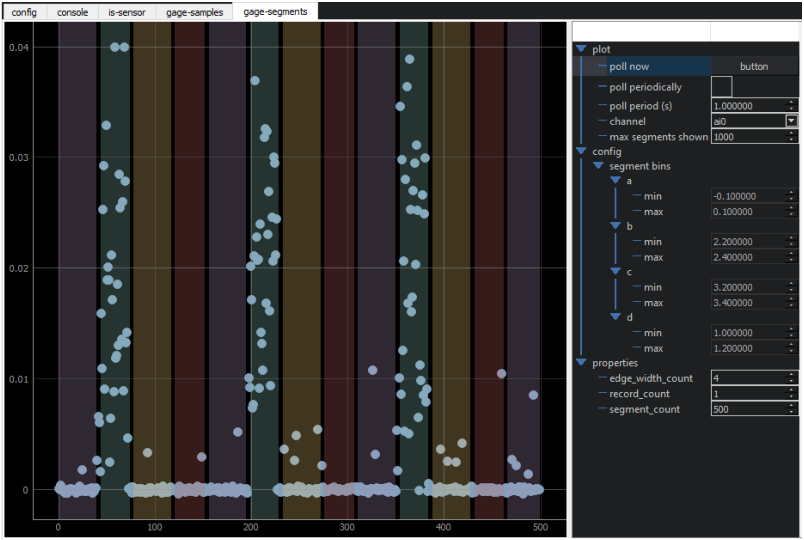
yaqc-qtpy: has-position



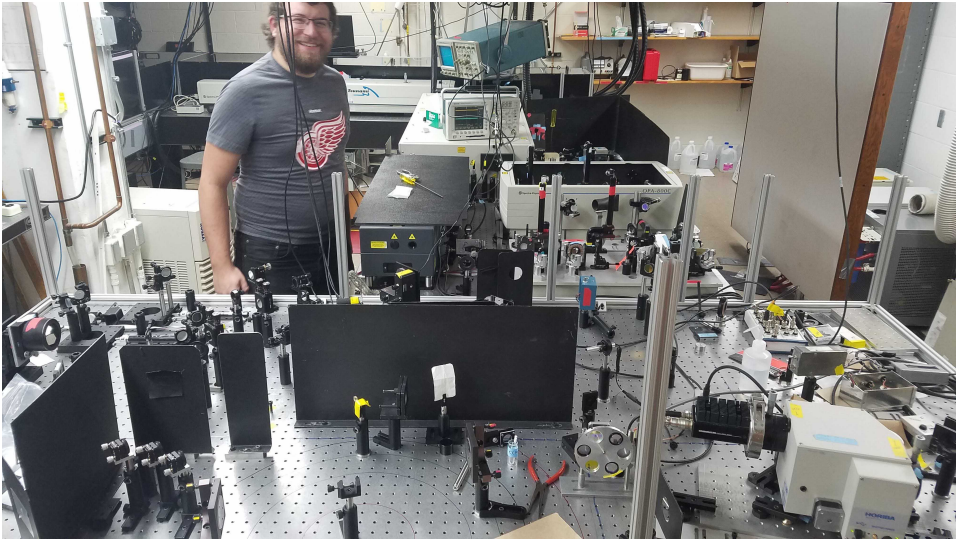
yaqc-qtpy: is-sensor



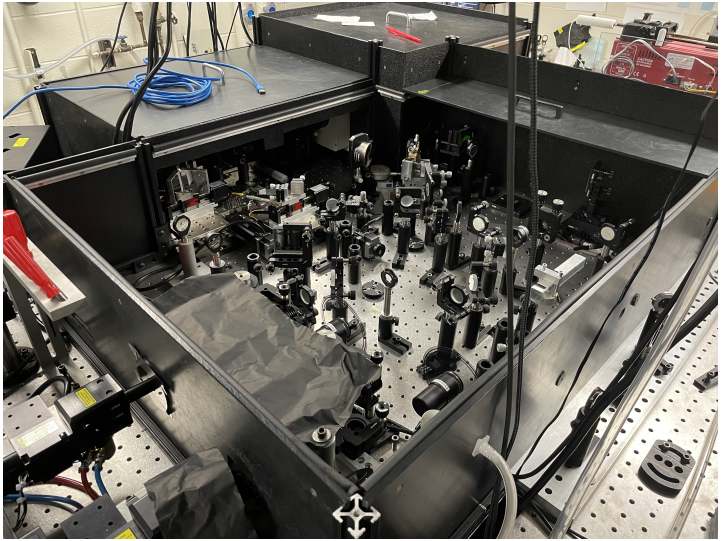
yaqc-qtpy: plugins



Wright Group

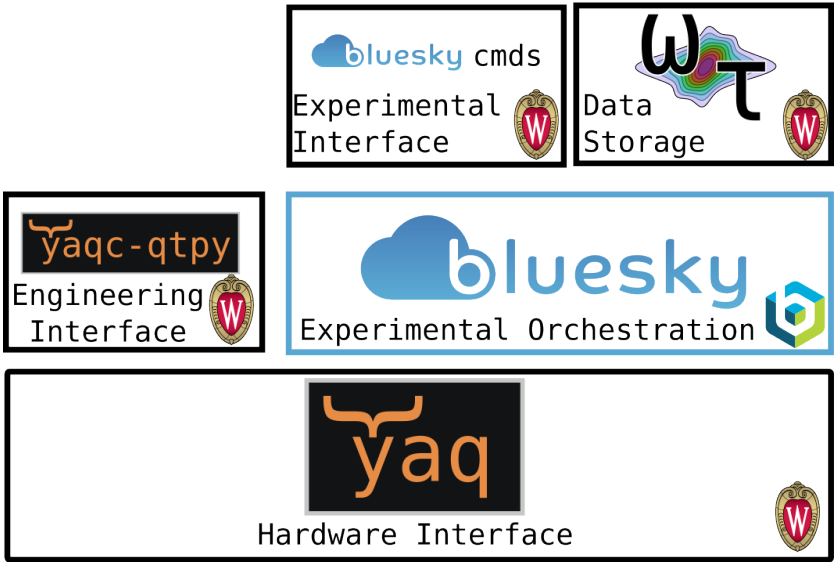


Waldo



Outside of the Wright Group

Modular Approach: Bluesky



The Bluesky Project

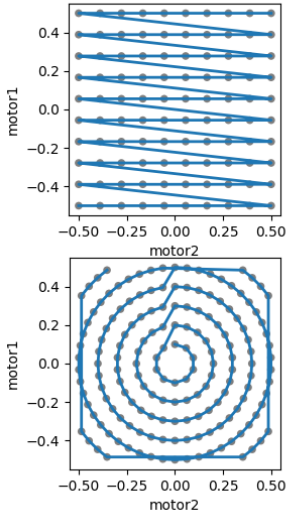
bluesky

Brookhaven National Laboratory

The Run Engine and Plans

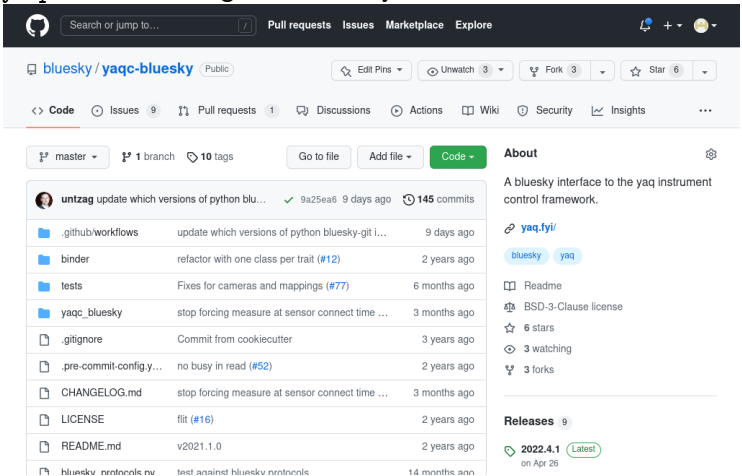
Steps for collecting a single point:

- `set` motors to correct positions
- `wait` for motion to complete
- `trigger` reading of sensors
- `wait` for sensors complete measurement
- `read` sensors and motors
- `save` data



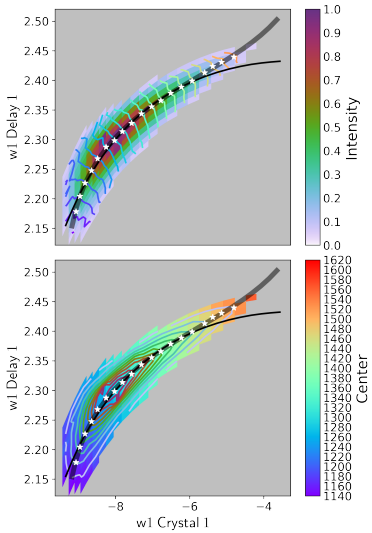
yaqc-bluesky

Translate yaq into something that Bluesky can use.

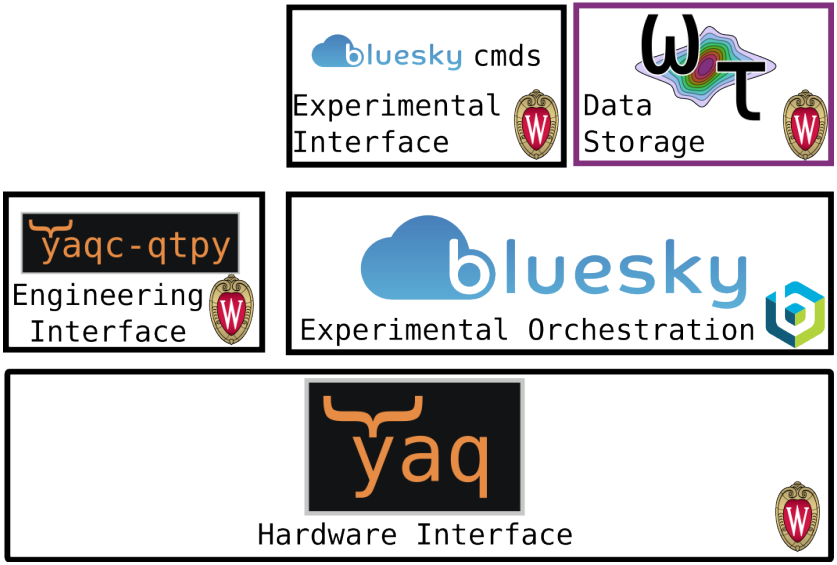


wright-plans

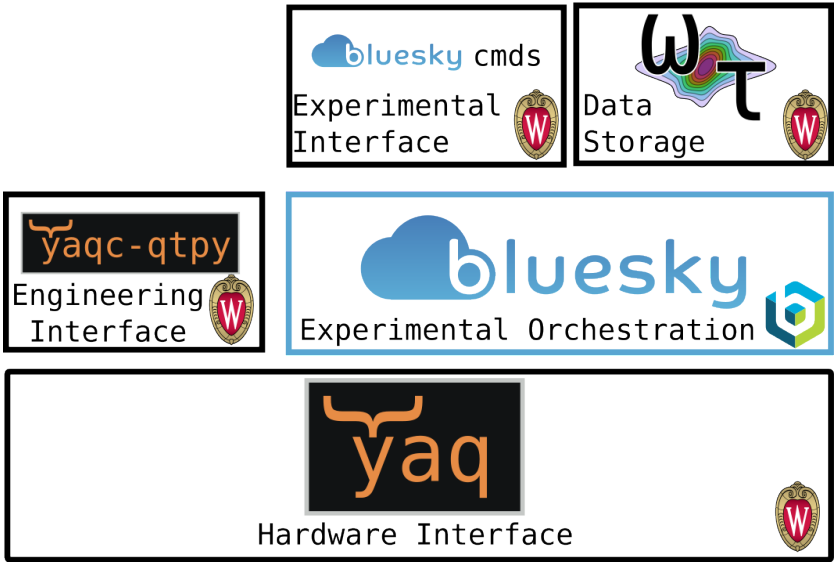
- Versions of built-in plans
  - Units support
  - "Constants"
- Plans for performing tuning operations



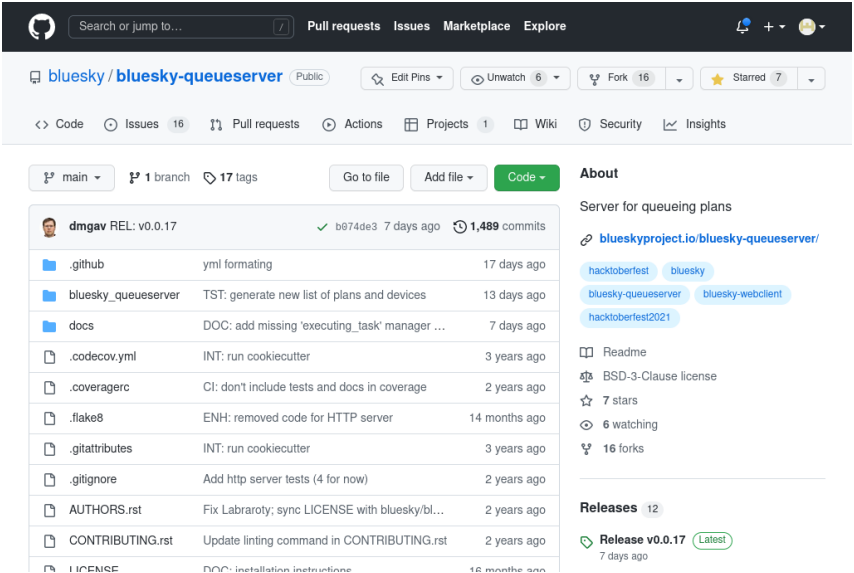
Modular Approach: WrightTools



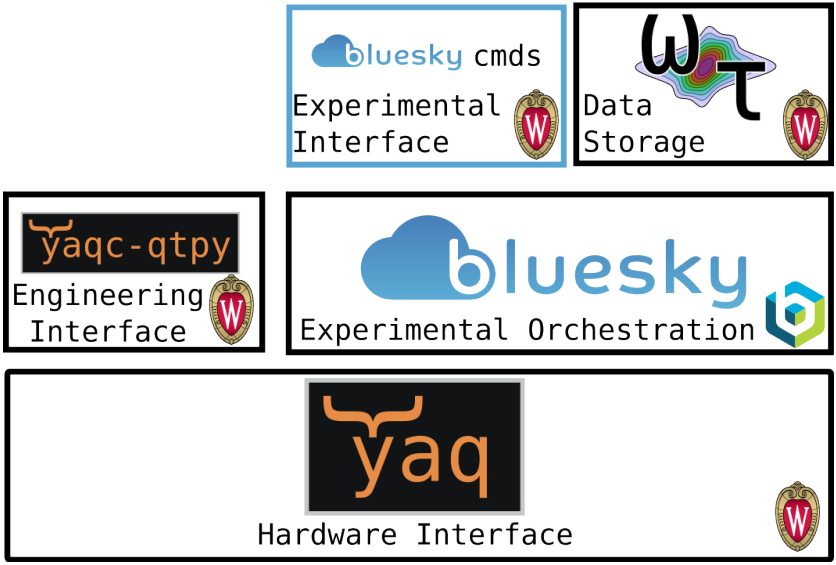
Modular Approach: Bluesky



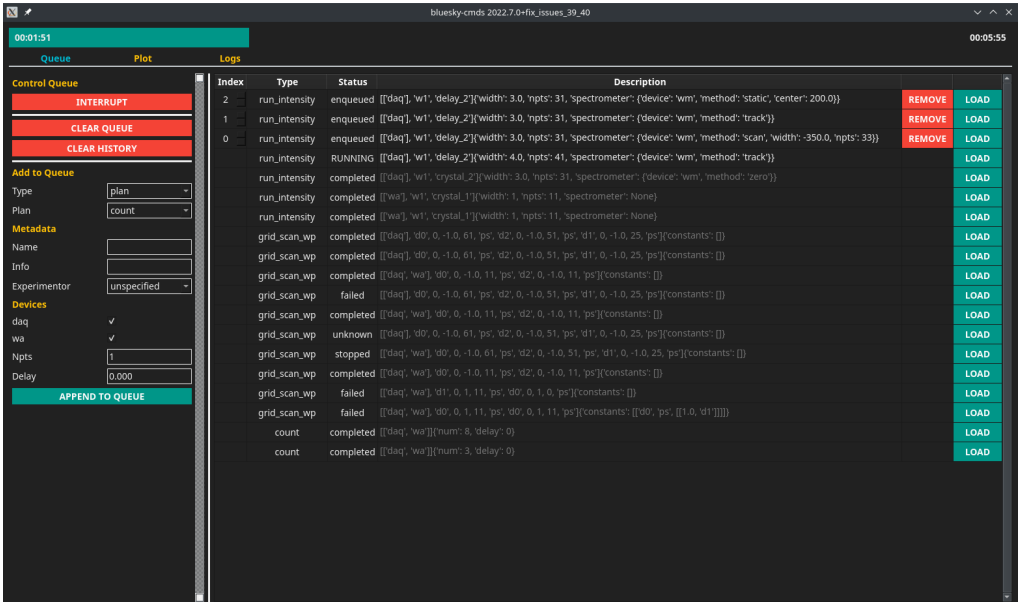
Bluesky-Queueserver



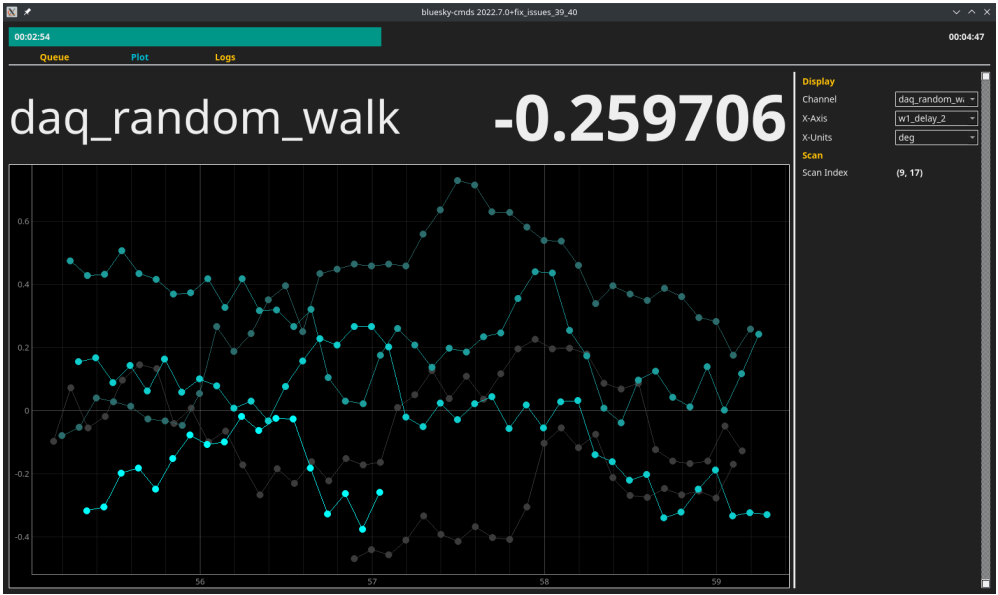
Modular Approach: Experimental GUI



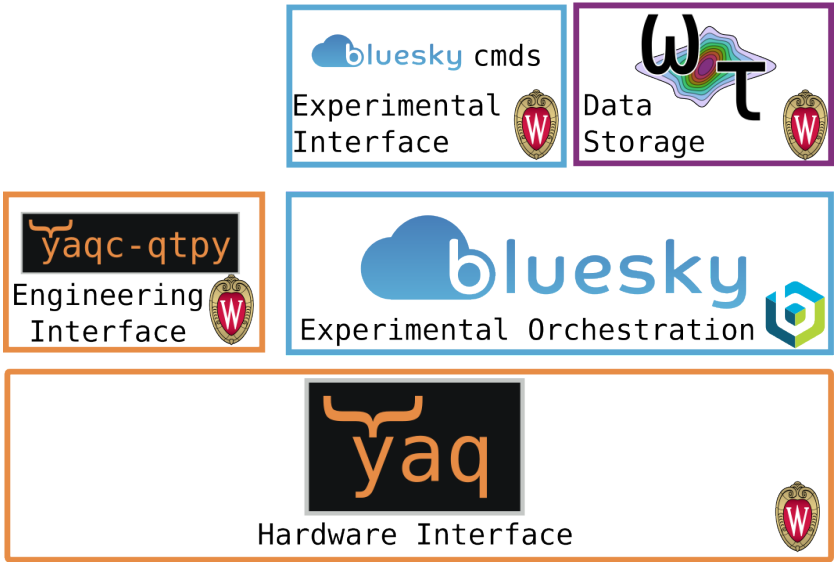
bluesky-cmds: queue



bluesky-cmds: plot



Conclusions



Acknowledgments

Wright Group

- Dan Kohler
- Skye Kain
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- Darien Morrow
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- Peter Cruz Parrilla
- Ryan McDonnell
- James Harris
- (and more...)

Bluesky Community

- Tom Caswell
- Dan Allen
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- Pete Jemian
- Zach Lentz
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- Dylan McReynolds
- Tom Cobb
- Callum Forrester
- Clinton Roy
- Abby Giles
- Juan Marulanda
- Juliane Reinhardt
- Ken Lauer
- Rober Tang-Kong
- Antoine Wojdyla
- (and more...)

Committee

- John Wright
- Bob Hamers
- Blaise Thompson
- Clark Landis
- Etienne Garand

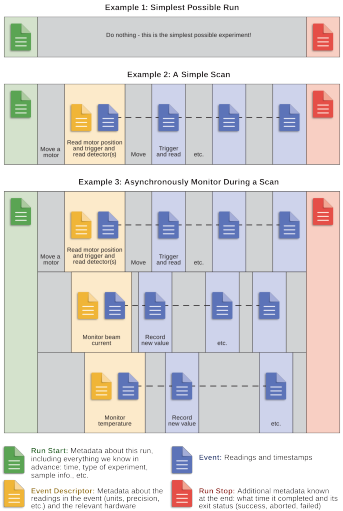
UW-Madison Chemistry Department

- Rob McClain
- Steve Myers

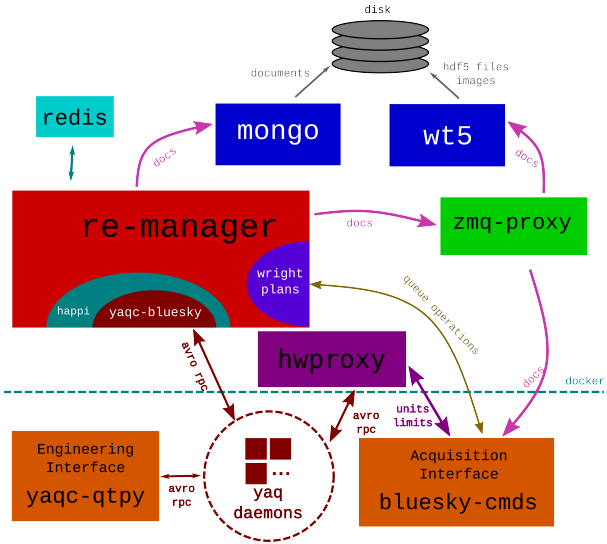
Open Source Maintainers

Friends and family

The Event Model



Bluesky In A Box



OPA400: control box