OAK RIDGE National Laboratory

Python 'IOC'

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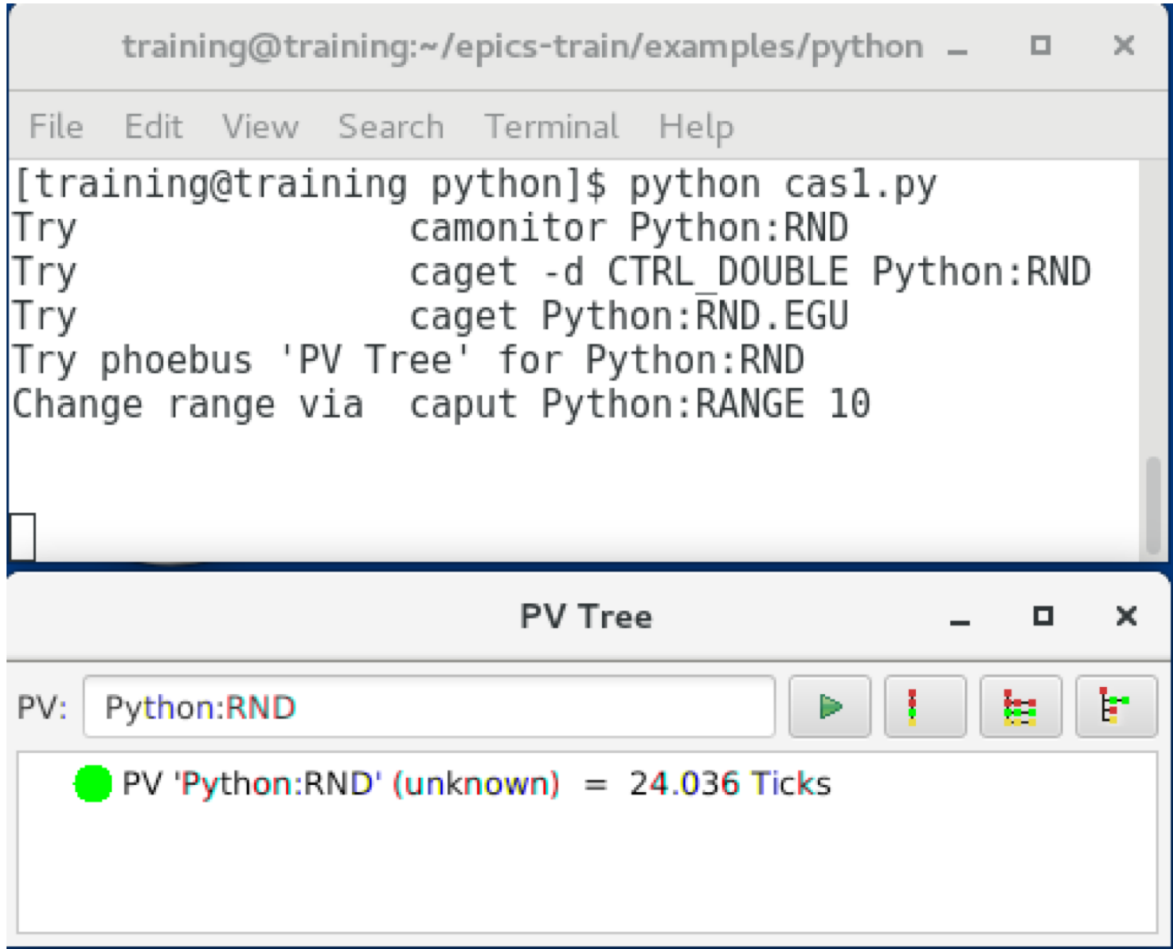
https://github.com/paulscherrerinstitute/pcaspy

CA Server library for python

```
cd ~/epics-train/examples/python

python cas1.py
```



More Examples

- PV supporting put-callback

```
python cas2.py
```

- CA Client as well as CA server

```
python cas3.py
```

For more, see pcaspy documentation: Access security, data types, ..

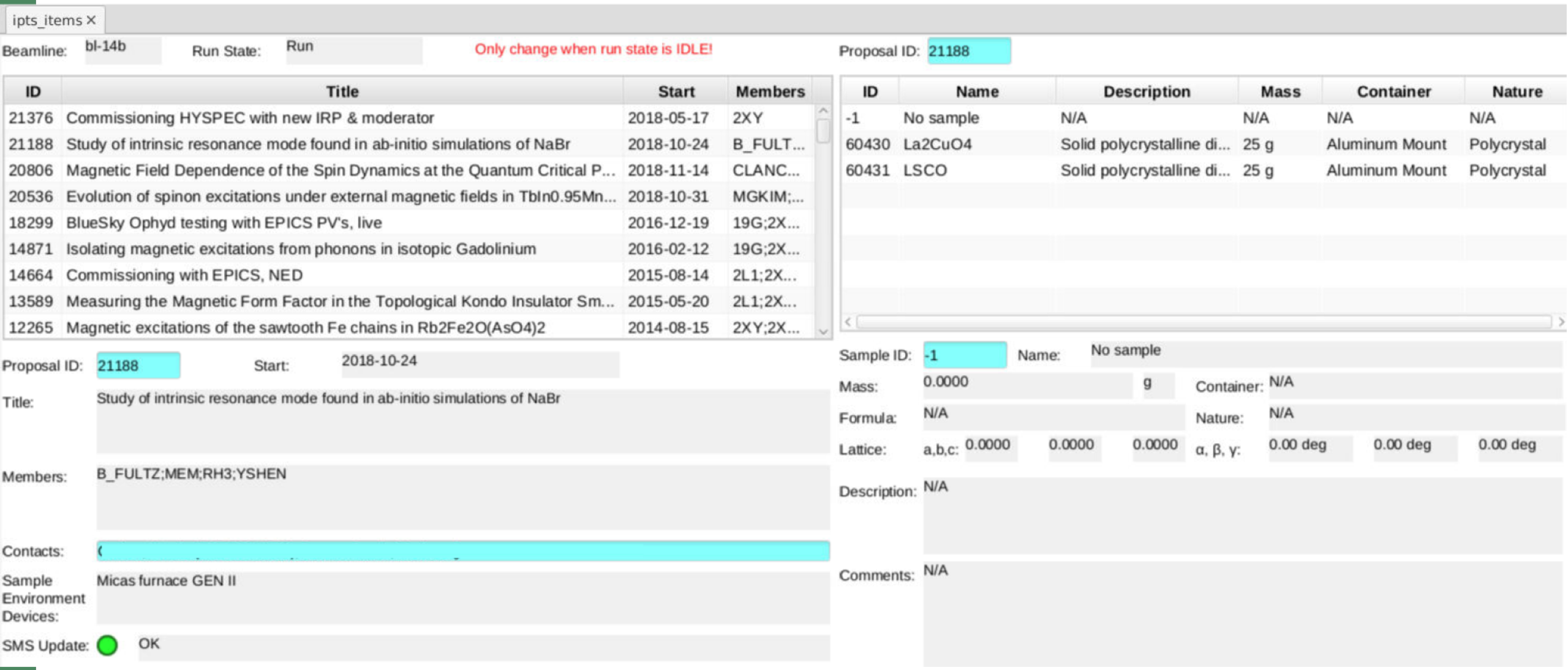
Caveats

- CA server, no records
  - No xxx.RTYP, .EGU, .SCAN, …
- No Autosave
  - DIY
- No shell with ‘dbl’, ‘dbpr’, ‘casr’
  - DIY

Use Cases

- Number Crunching
  - Numpy instead of CALC record
- Outside Data Source
  - Access web services, relational databases, .. and serve results
- Existing Python code
  - Turn script into IOC

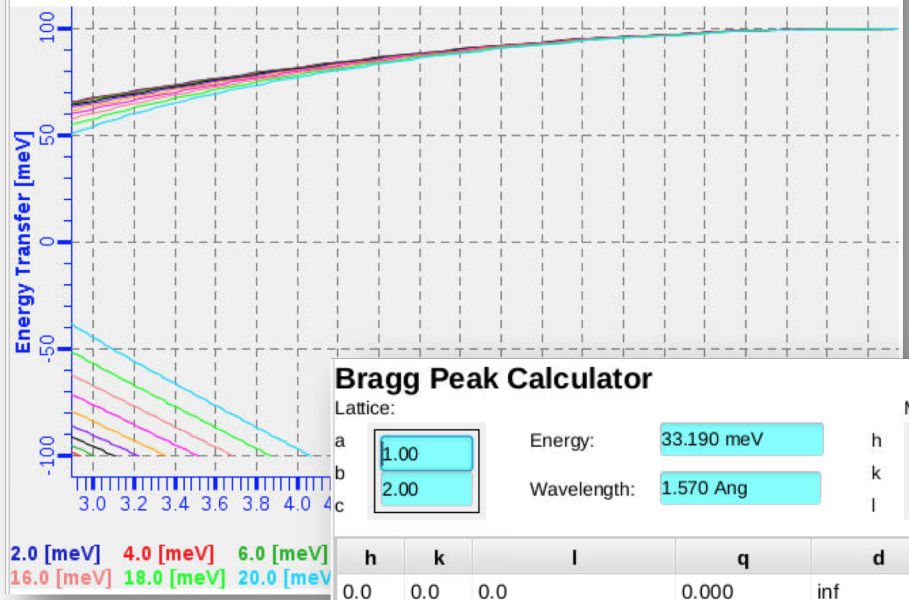
Example: Proposal Database



Example: Computations

Powder Planning Tool

Energy: 100.000 meV
Scattering Angle min: 2.000 deg
Wavelength: 0.904 Ang
Scattering Angle max: 20.000 deg
Calculate



Bragg Peak Calculator

Lattice: a 1.00, b 2.00, c
Energy: 33.190 meV
Wavelength: 1.570 Ang
Maximum Values: h 3.00, k 3.00, l
Calculate

h	k	l	q	d	2 theta [deg]
0.0	0.0	0.0	0.000	inf	0.000
0.0	0.0	1.0	0.000	inf	0.000
0.0	0.0	2.0	0.000	inf	0.000
0.0	1.0	0.0	0.000	inf	0.000
0.0	1.0	1.0	0.000	inf	0.000
0.0	1.0	2.0	0.000	inf	0.000
0.0	2.0	0.0	6.283	1.000	103.441
0.0	2.0	1.0	6.283	1.000	103.441
0.0	2.0	2.0	6.283	1.000	103.441
1.0	0.0	0.0	6.283	1.000	103.441
1.0	0.0	1.0	6.283	1.000	103.441
1.0	0.0	2.0	6.283	1.000	103.441
1.0	1.0	0.0	6.283	1.000	103.441
1.0	1.0	1.0	6.283	1.000	103.441
1.0	1.0	2.0	6.283	1.000	103.441

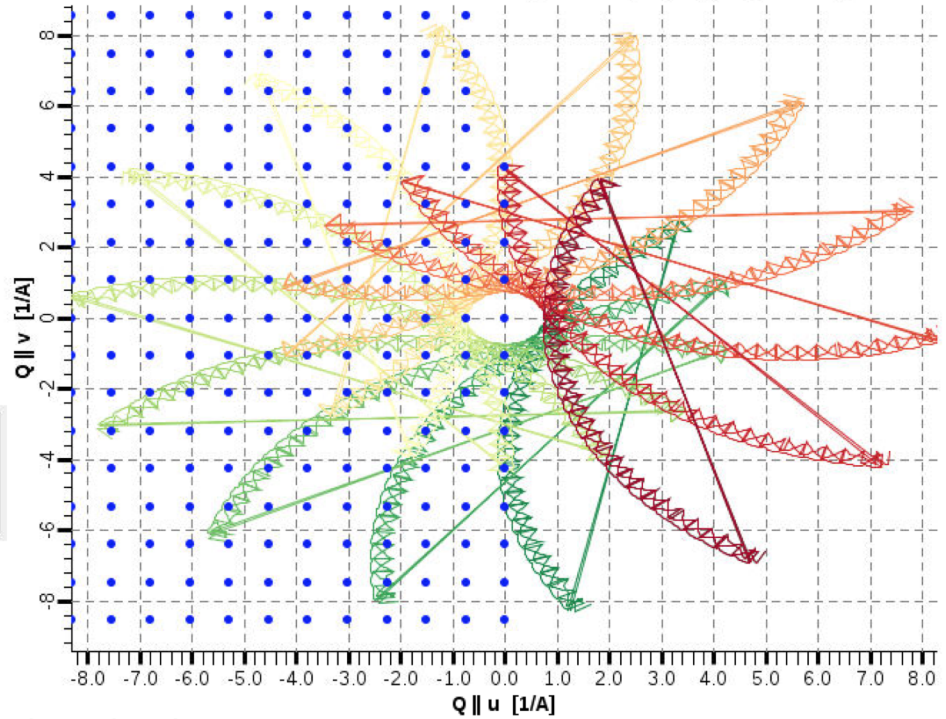
Single Crystal Planner

Energy: 160.000 meV
Energy transfer: 25.000 meV
Sample Rotation Angle min: 0.000 deg
Sample Rotation Angle max: 360.000 deg
Sample Rotation Step: 2.000 deg
Calculate
Create Scan
Tab.Scan
(updates tmp/crystal_plan_scan.csv)

Lattice Parameters [A]: 8.32, 8.32, 8.32

Lattice Angles [deg]: 90.00, 90.00, 90.00

Vectors u, v: 1.00, -0.00, 0.00 / 0.00, 1.00, 1.00



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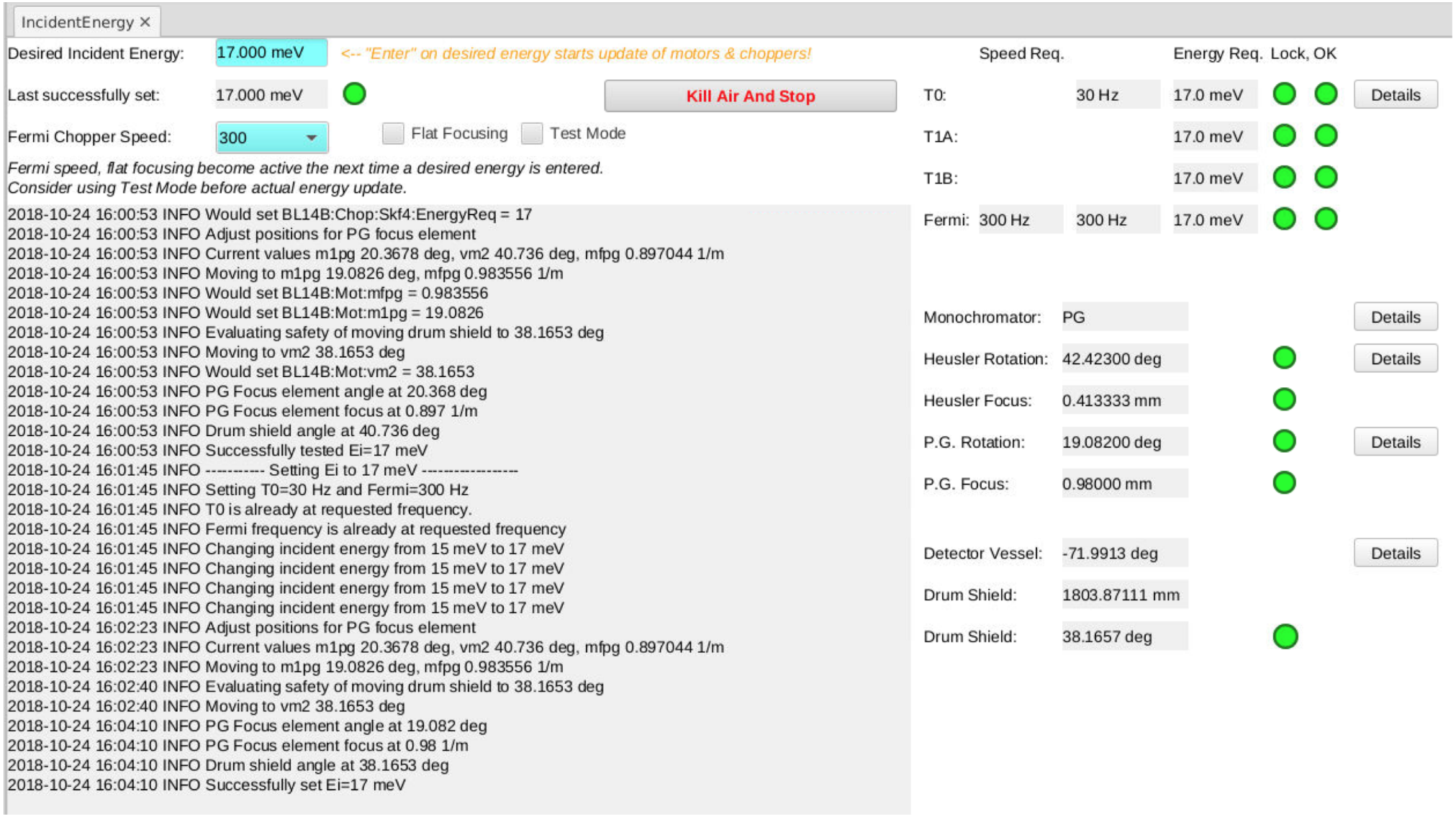
Energy Adjustment



- Could use sequencer, but had existing python code

What if data is “Table” or Structure?

Channel Access can only handle scalar or arrays of number & string

h	k	l	q	d	2 theta [deg]
0.0	0.0	0.0	0.000	inf	0.000
0.0	0.0	1.0	0.000	inf	0.000
0.0	0.0	2.0	0.000	inf	0.000
0.0	1.0	0.0	0.000	inf	0.000
0.0	1.0	1.0	0.000	inf	0.000
0.0	1.0	2.0	0.000	inf	0.000
0.0	2.0	0.0	6.283	1.000	103.441
0.0	2.0	1.0	6.283	1.000	103.441
0.0	2.0	2.0	6.283	1.000	103.441

1. On server side (pcaspy), ‘pickle’ python data into CA byte waveform
2. On client side (CS-Studio), read byte waveform PV in display script, ‘unpickle’, then display in table or …

Handling Table, Structure

h	k	l	q	d	2 theta [deg]
0.0	0.0	0.0	0.000	inf	0.000
0.0	0.0	1.0	0.000	inf	0.000
0.0	0.0	2.0	0.000	inf	0.000
0.0	1.0	0.0	0.000	inf	0.000
0.0	1.0	1.0	0.000	inf	0.000
0.0	1.0	2.0	0.000	inf	0.000
0.0	2.0	0.0	6.283	1.000	103.441
0.0	2.0	1.0	6.283	1.000	103.441
0.0	2.0	2.0	6.283	1.000	103.441

Yes, pickled byte waveform is a hack

- Requires scripts
- Only works with python as server & client

pvAccess can handle custom structures

- Better for server side
- Client likely needs more than dump of structure;
  Will still require script for user-friendly display.

Summary

Python with CA server & client libs can act as IOC

- Great tool to have
- Doesn't replace all IOCs