# MENTO: Automated data processing pipelines

**Fast analysis feedback for users at PETRA-III**

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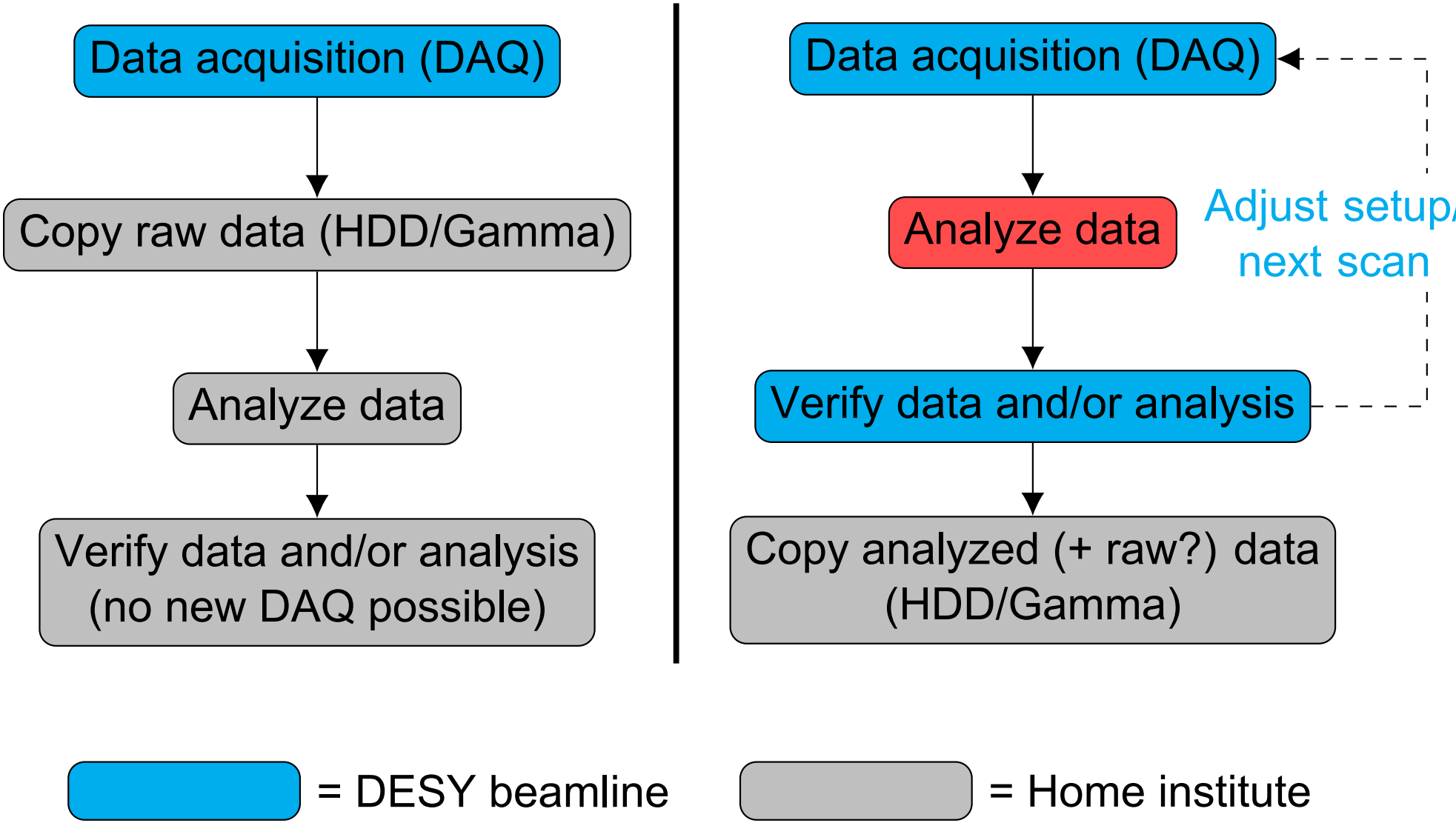
# User workflow: Old vs New

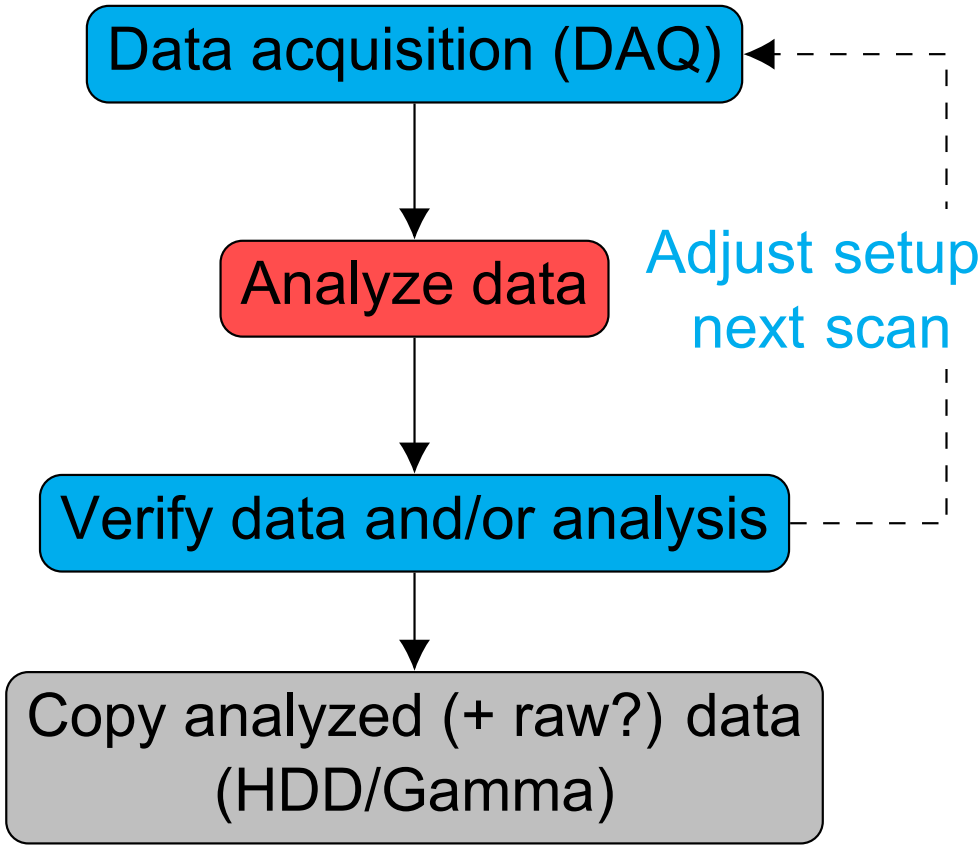


# MENTO: what, how, why

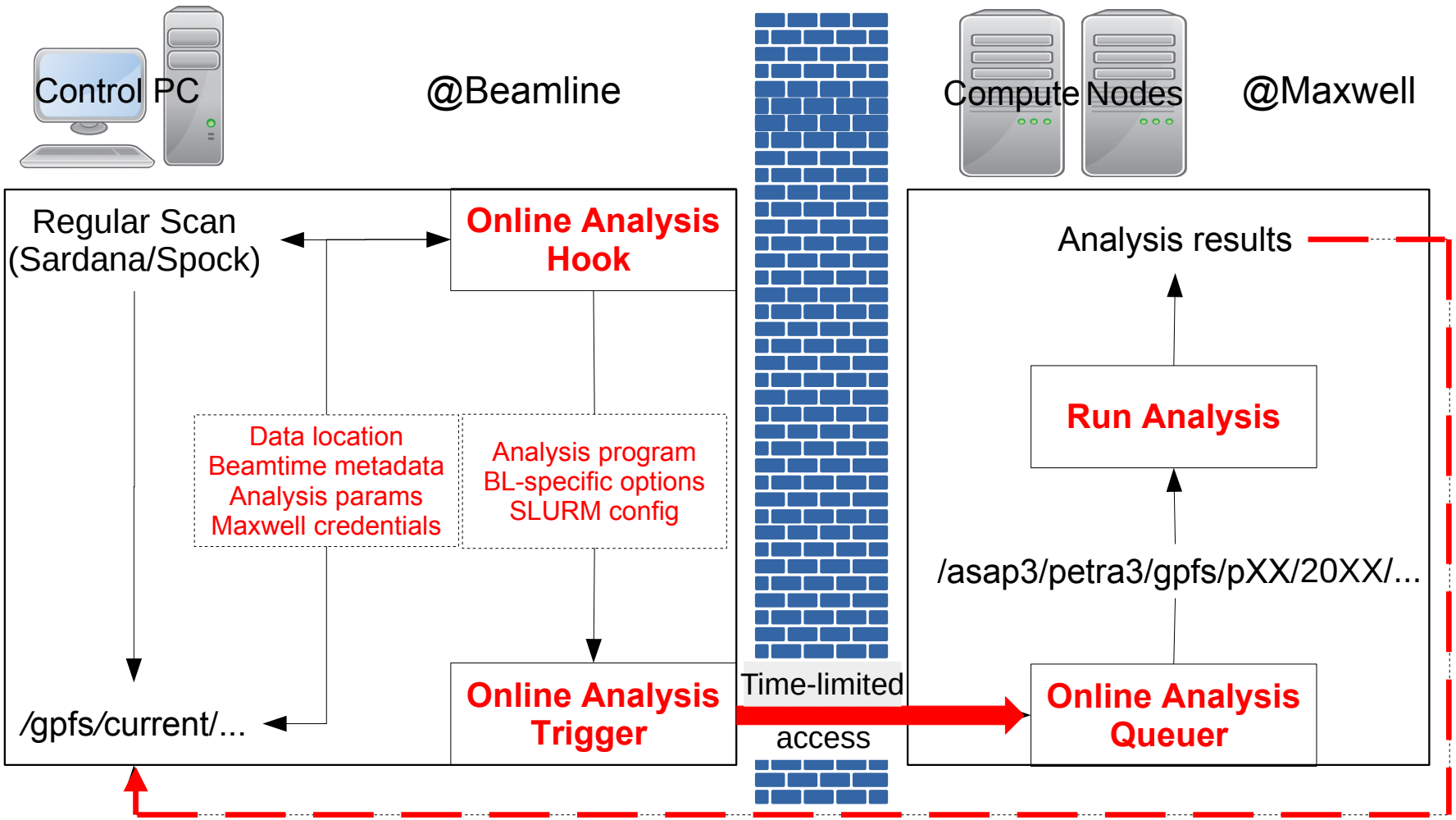
**What** Python plugin

**How** Trigger analysis from within controls s/w during DAQ

**Why**
1. Make analyzing data easy
2. Make ‘boring bits’ invisible



# From beamline to HPC nodes



# MENTO: easy for the user

MENTO
=
DAQ connector
+
Online trigger
+
Process queuer
+
Program runner

```
# my-DAQ-macro.py

import mento

# take data...

my_processing = mento.Trigger(SLURM)

my_processing.run(analysis_program,
                  analysis_params)

# analysis triggered
# on remote HPC resource
```

# MENTO @PETRA-III

## Mixed bag of use cases

| | P10: XPCS | P11: MX |
|---|---|---|
| Controls | Standard<br>Tango/Sardana | Custom<br>‘Crystal Control’ |
| Analysis | Custom<br>‘PLUG2’, GPU | Standard<br>XDS pipeline, CPU |
| Computing | Standard<br>DESY HPC pool | Custom<br>Dedicated nodes |
| Visualizing | Local<br>MATLAB / Qt+Silx | Remote<br>HTML webpages |

# DAQ + analysis together

IPython: raw/SPOCK

File Edit View Search Terminal Help

```
].fio (fio)
Scan #3 started
 #Pt No   exp_dmy01   e2_t02     udio      cbs1      apd      ipetra     mhz1    cbs1_ll   cbs1_ul
dt
Triggering online analysis
   0          0        0.01       4         0         0       100.34     9999       0         0      4.4
9648
Triggering online analysis
   1         0.1       0.01      3.5        0         0      100.237     9999       0         0      8.0
7033
Triggering online analysis
   2         0.2       0.01       4         0         0      100.135    10000       0         0      11.
7363
Triggering online analysis
   3         0.3       0.01      3.5        0         0      100.033    10000       0         0       15
.497
Triggering online analysis
   4         0.4       0.01       4         0         0      99.9545    10000       0         0      19.
2608
Triggering online analysis
   5         0.5       0.01       4         0         0      100.811    10000       0         0      22.
9741
Triggering online analysis
   6         0.6       0.01       4         0         0       100.87     9999       0         0      26.
3028
Triggering online analysis
   7         0.7       0.01       4         0         0      100.767    10000       0         0      30.
5762
Triggering online analysis
   8         0.8       0.01       4         0         0      100.689     9999       0         0      34.
3077
Triggering online analysis
   9         0.9       0.01       4         0         0      100.587     9999       0         0       37
.839
Triggering online analysis
   10         1        0.01      3.5        0         0      100.485     9999       1         1      41.
5993
Triggering online analysis
   11        1.1       0.01      3.5        0         0      100.406     9999       0         0      45.
3512
Triggering online analysis
   12        1.2       0.01       4         0         0      100.304    10000       0         0      48.
9822
Triggering online analysis
```

Maxwell node

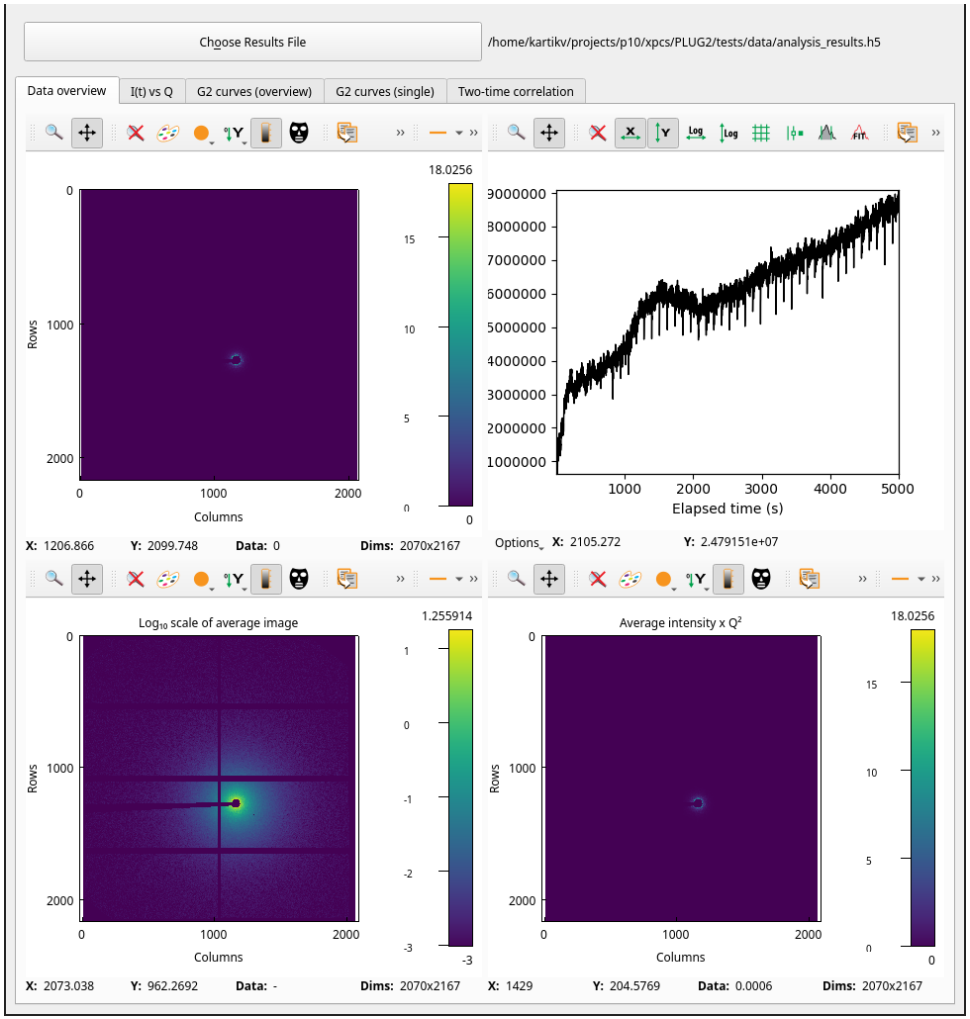
File Edit View Search Terminal Help

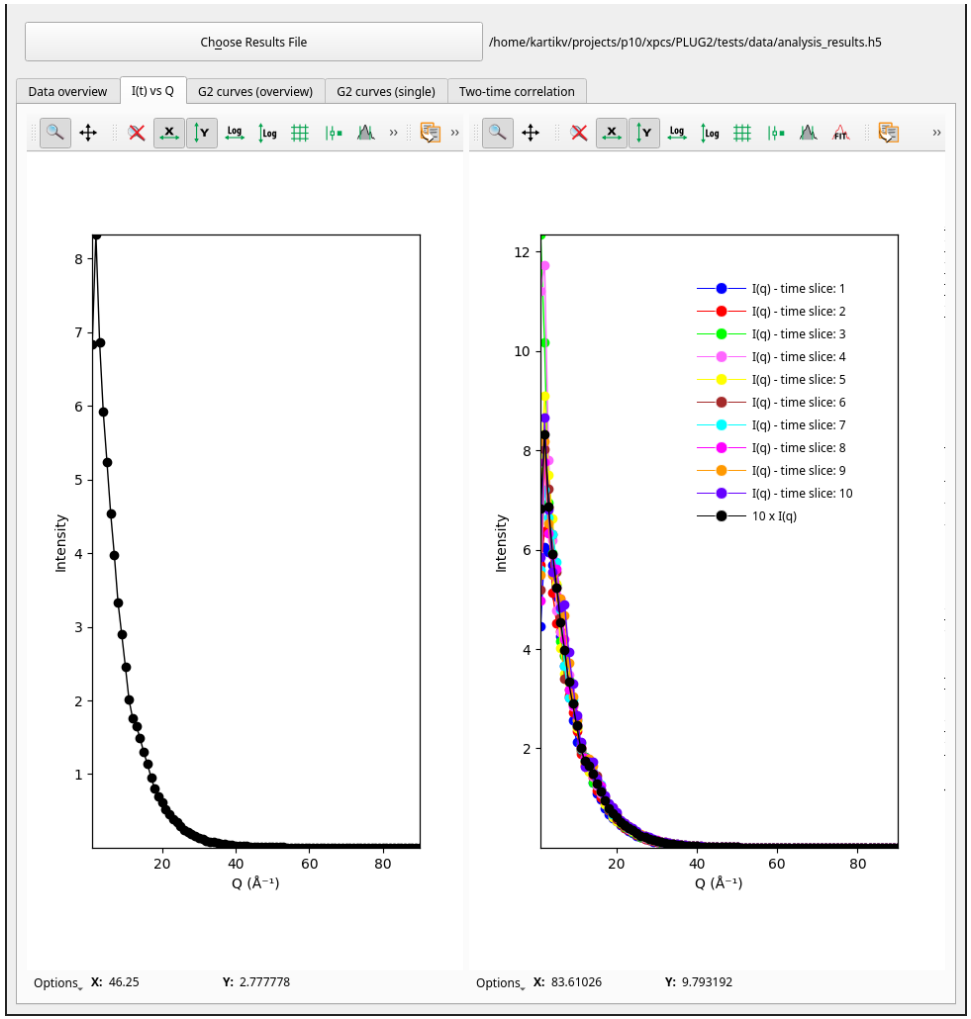
```
 1  [||||||||||100.0%]   11 [||||||||||100.0%]   21 [              0.0%]   31 [|             0
 2  [||||||||||100.0%]   12 [||||||||||100.0%]   22 [|             2.6%]   32 [              0
 3  [             0.0%]   13 [||||||||||100.0%]   23 [||||||||||100.0%]   33 [              0
 4  [|            0.7%]   14 [|             0.7%]   24 [||           5.9%]   34 [|             3
 5  [|            0.7%]   15 [||||||||||100.0%]   25 [||           3.9%]   35 [              0
 6  [||||||||||100.0%]   16 [|            0.6%]   26 [             0.0%]   36 [||||||||||100
 7  [             0.0%]   17 [||           3.2%]   27 [||||||||||100.0%]   37 [||            3
 8  [             0.0%]   18 [||||||||||100.0%]   28 [||||||||||100.0%]   38 [|             1
 9  [||||||||||100.0%]   19 [||||||||||100.0%]   29 [              0.0%]   39 [              0
 10 [             0.0%]   20 [||||||||||100.0%]   30 [||||||||||100.0%]   40 [              0
 Mem[||||||||                         78.8G/504G]   Tasks: 124, 927 thr; 17 running
 Swp[                                   0K/4.00G]   Load average: 6.84 1.83 0.84
                                                    Uptime: 56 days, 18:54:21

  PID USER      S CPU% MEM%   TIME+  Command
28847 bttest01  R 100.  0.1  0:43.28 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29398 bttest01  R 100.  0.1  0:24.08 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29198 bttest01  R 100.  0.1  0:32.18 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29001 bttest01  R 100.  0.1  0:38.27 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
28345 bttest01  R 100.  0.1  1:01.42 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
28645 bttest01  R 100.  0.1  0:50.11 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29494 bttest01  R 100.  0.1  0:21.11 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
28544 bttest01  R 100.  0.1  0:52.35 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29097 bttest01  R 99.7  0.1  0:35.22 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29820 bttest01  R 99.7  0.1  0:10.28 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
28749 bttest01  R 99.7  0.1  0:46.30 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29301 bttest01  R 99.7  0.1  0:28.12 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29688 bttest01  R 99.7  0.1  0:14.04 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29916 bttest01  R 99.7  0.1  0:05.96 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
29590 bttest01  R 99.7  0.1  0:17.02 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
28448 bttest01  R 99.7  0.1  0:58.41 /gpfs/petra3/scratch/oatest/testprograms/frameloopg2calc_l
21509 bttest01  R  2.0  0.0  0:36.36 htop -u bttest01
29185 bttest01  S  0.0  0.0  0:00.06 slurmstepd: [1890862.batch]
29186 bttest01  S  0.0  0.0  0:00.01 slurmstepd: [1890862.batch]
12171 bttest01  S  0.0  0.0  0:00.28 sshd: bttest01@pts/3
 9828 bttest01  S  0.0  0.0  0:00.16 -zsh
12612 bttest01  S  0.0  0.0  0:00.16 -zsh
12611 bttest01  S  0.0  0.0  0:10.65 sshd: bttest01@pts/1
 9821 bttest01  S  0.0  0.0  0:00.01 sshd: bttest01@pts/0
10997 bttest01  S  0.0  0.0  0:00.00 /bin/bash /var/spool/slurmd/job1867163/slurm_script
10998 bttest01  S  0.0  0.0  0:00.00 sleep 14d
11625 bttest01  S  0.0  0.0  0:00.24 sshd: bttest01@pts/2
11626 bttest01  S  0.0  0.0  0:00.61 -zsh
```

Beamline control terminal

Remote HPC node

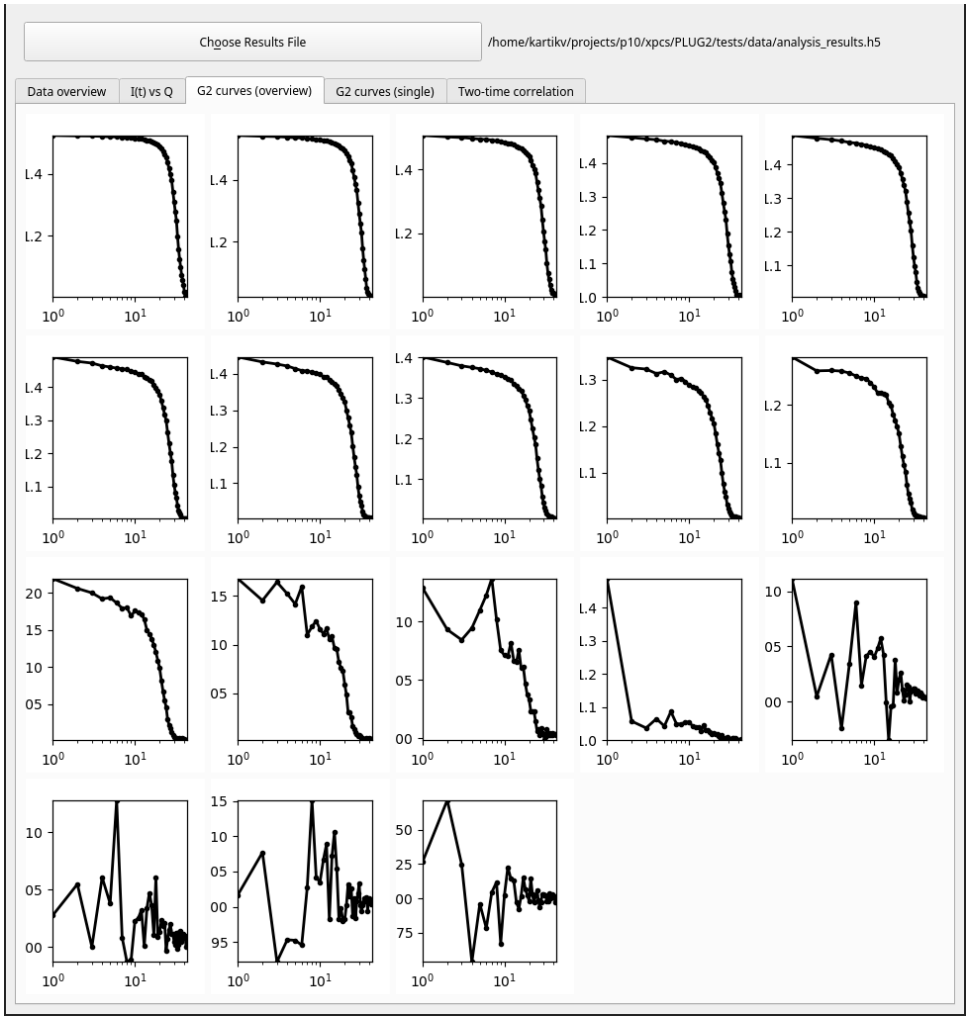
# Near real-time feedback (@P10)

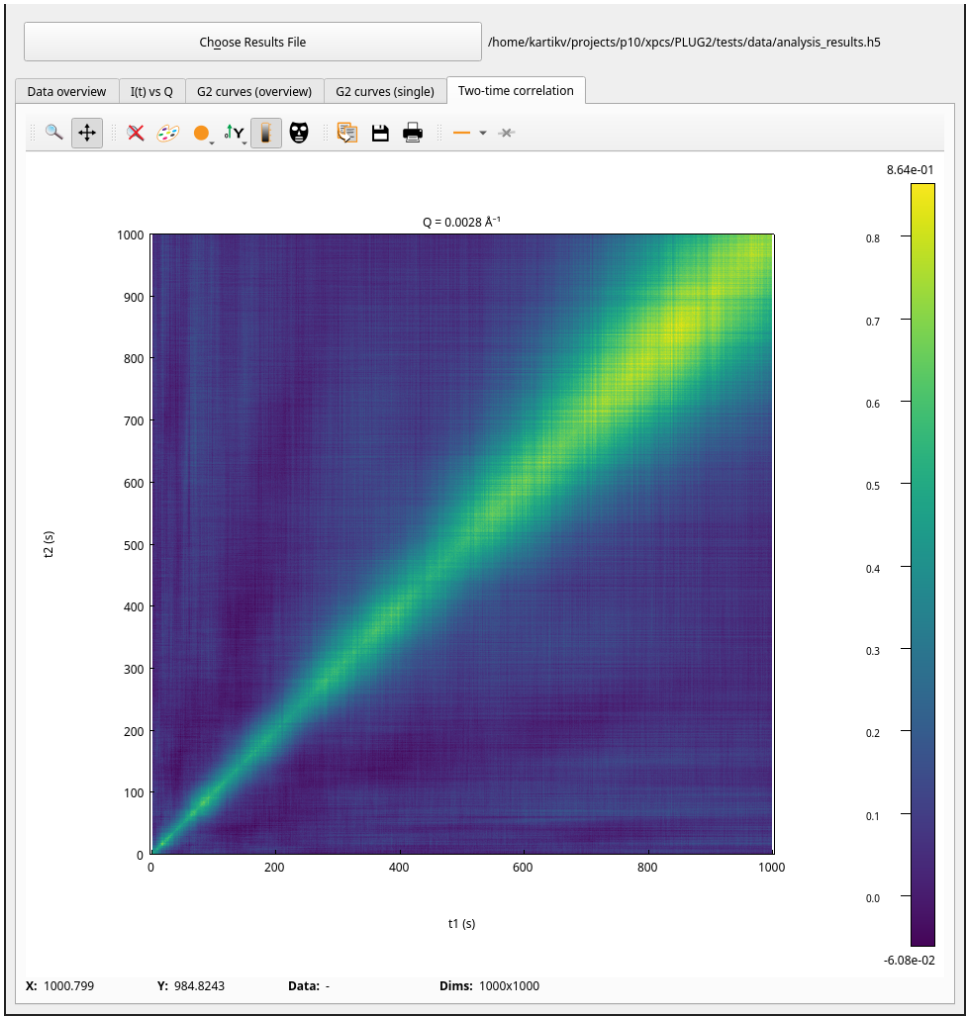



Data fidelity checks

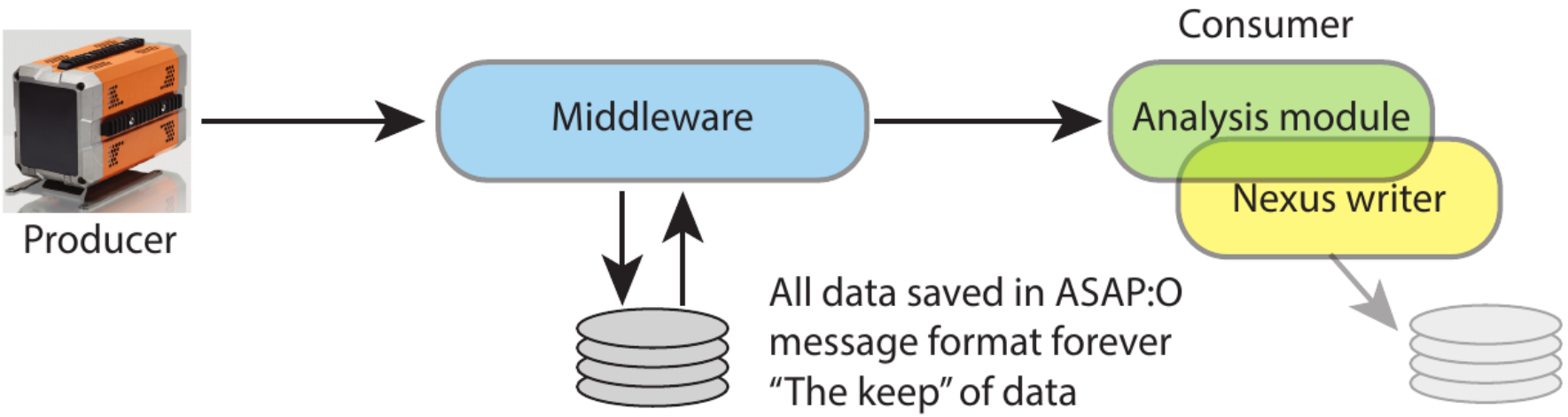
# Near real-time feedback (@P10)




Multiple analyses

# Next steps: streaming analysis




DESY in-house data streaming framework

# Future directions

1. Integrate with DESY data streaming framework
2. Have easy visualizers for results
   - directly at beamline or remote/web access to HPC nodes
3. “Replay button” to quickly redo analysis with different params
   - cheap if we are fast enough
   - may not need to store raw data long-term

`MENTO` (+ data streaming)

$\Downarrow$

BUGS

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`MENTO` (+ data streaming)

+

Discussions, collaborations, ideas this week

$\Downarrow$

NOBUGS

Fin.

Questions?

https://gitlab.desy.de/fs-sc/mento

More questions? Get in touch!

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