ICALEPCS 2019
17th Biennial International Conference on
Accelerator and Large Experimental Physics

Beamline experiments with BLISS @ ESRF

presented by Matias Guijarro - BLISS team

Beamline Control Unit / Software Group

ESRF, Grenoble, France

ESRF Extremely Brilliant Source (EBS) update program

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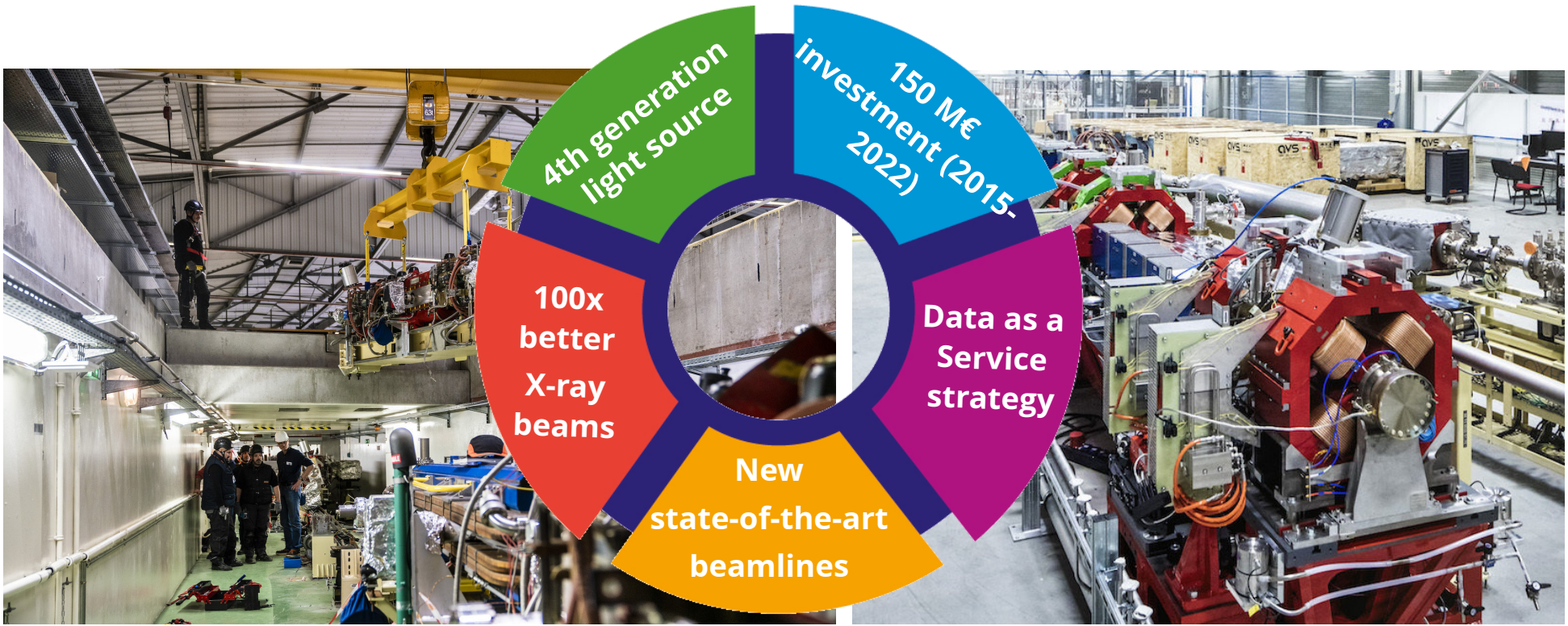

ESRF-EBS

Beamline Instrumentation Support Software

BLISS project goals

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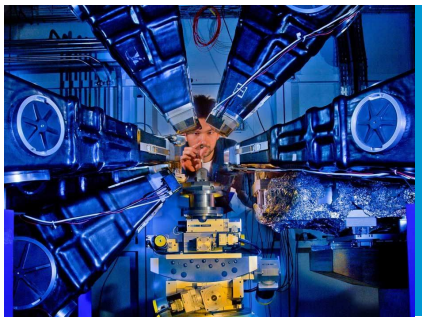
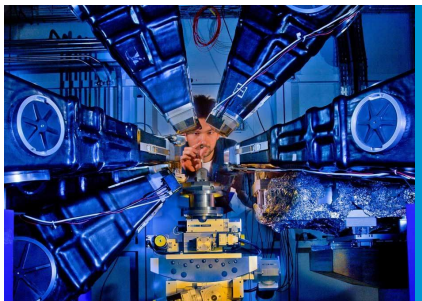


State-of-the-art beamline control

Advanced scans, Trajectories,

Data management

BLISS project goals



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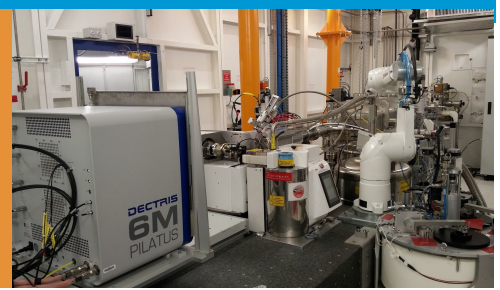
Configuration, Command Line Interface, Live Data Display



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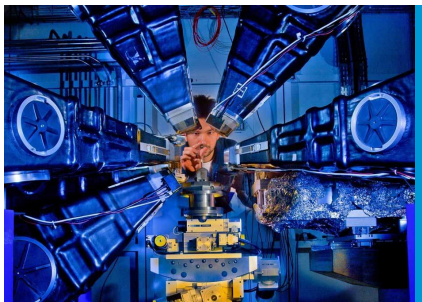

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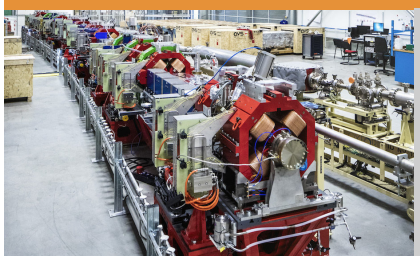
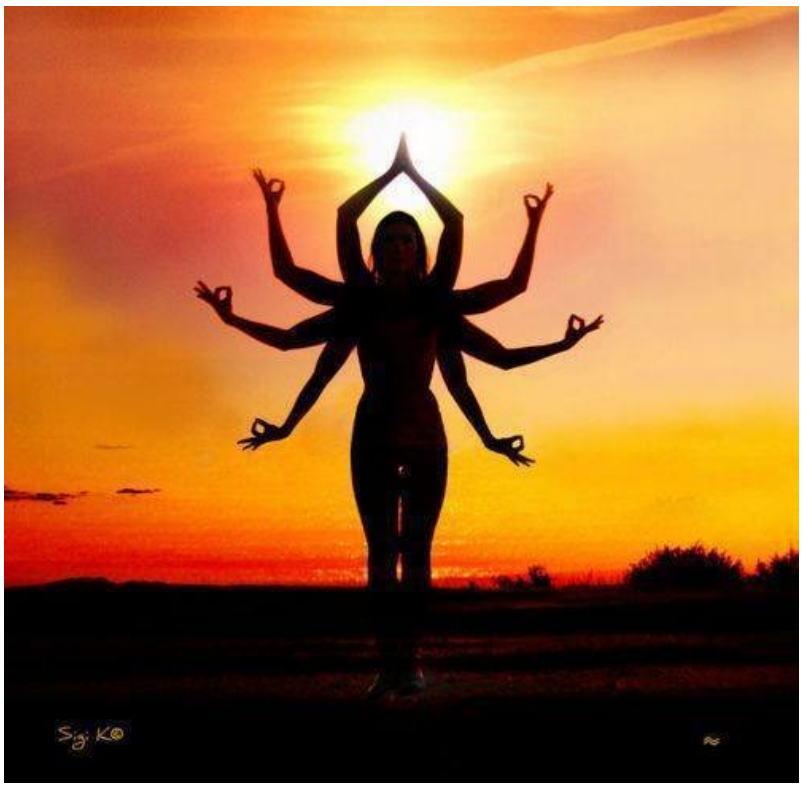


Ready for new challenges

Online data analysis, live feedback, extensibility of the system

ESRF-EBS

BLISS philosophy



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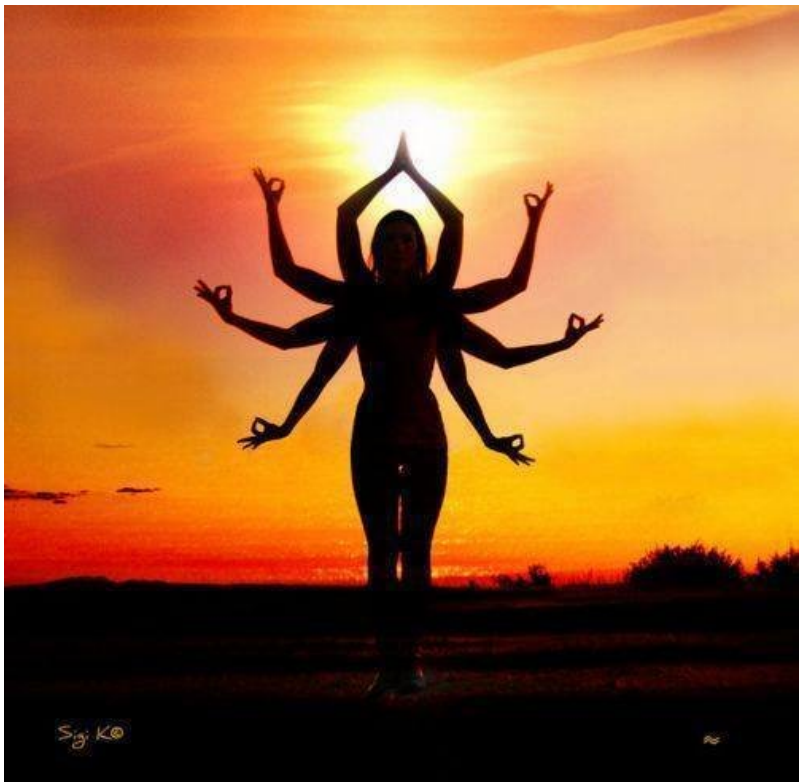
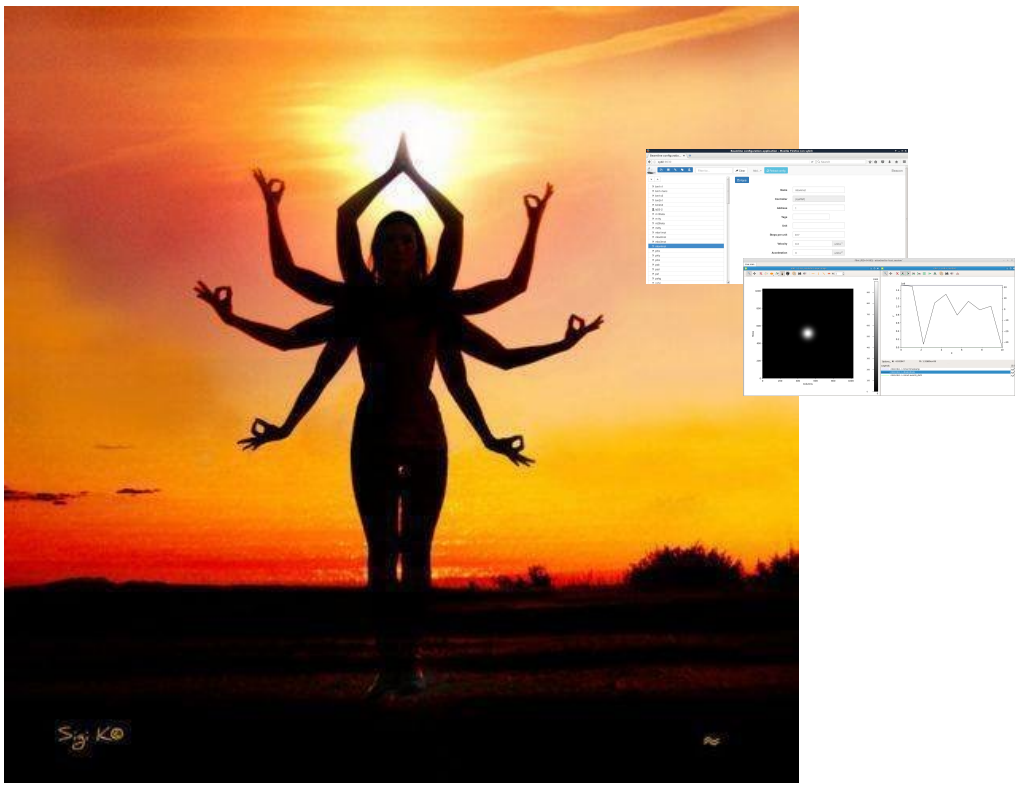


Python (3.7=>) everywhere

BLISS philosophy



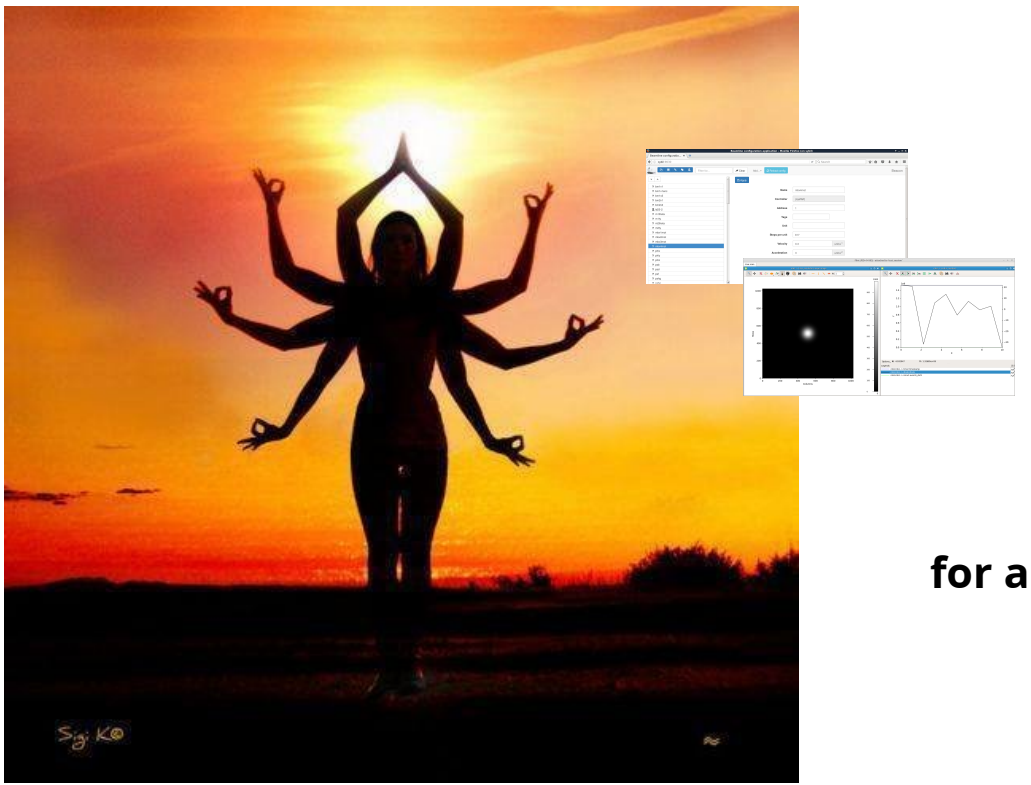
Python (3.7=>) everywhere

Software library first,

with a set of tools built upon

- Command Line Interface
- Configuration application
- Online visualization

BLISS philosophy



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To provide a generic scan engine
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Software library first,
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- Command Line Interface
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To provide a generic scan engine
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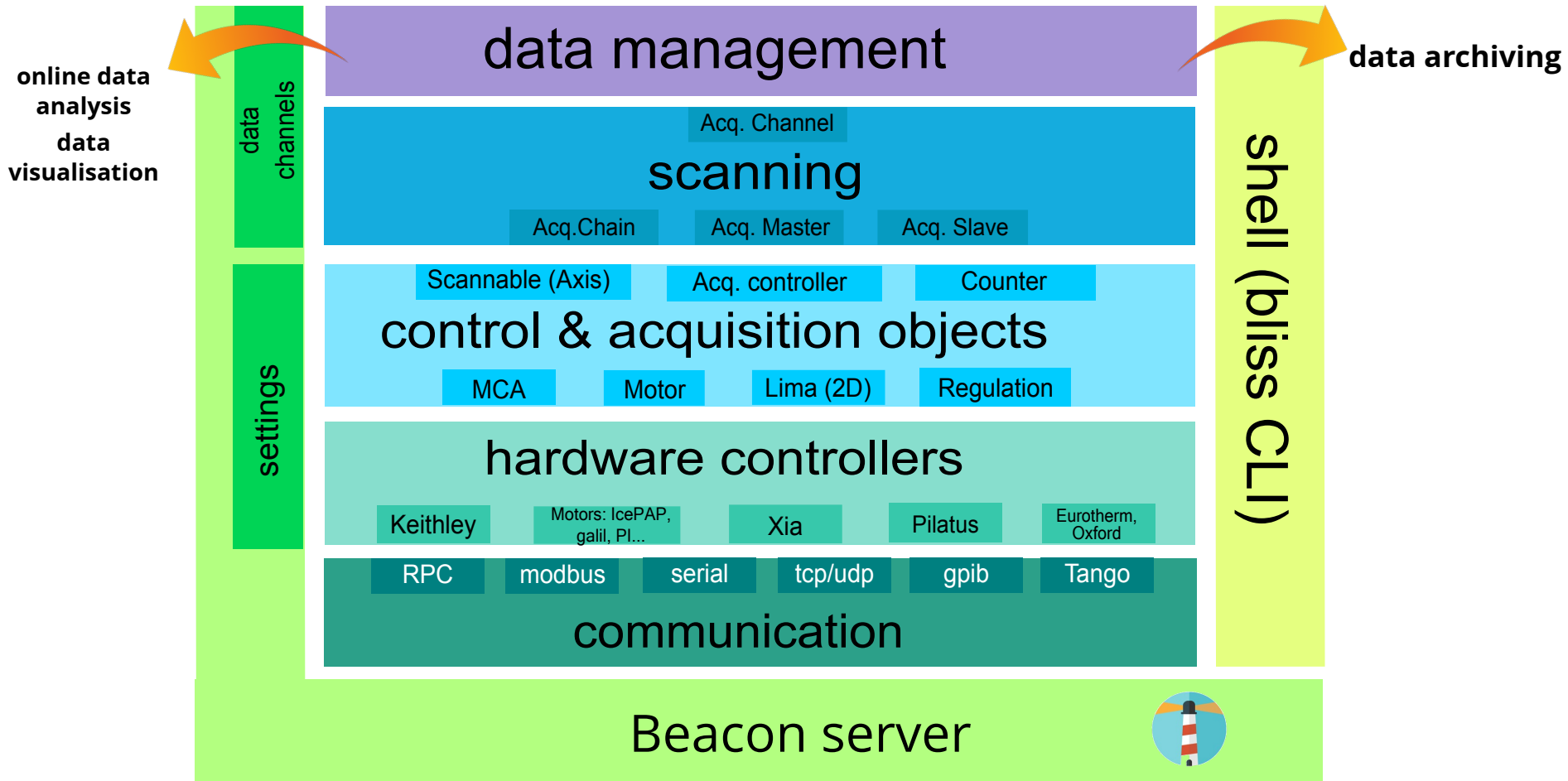
Producer/Consumer model for Data Management,
to decouple acquisition and data storage

BLISS modular architecture



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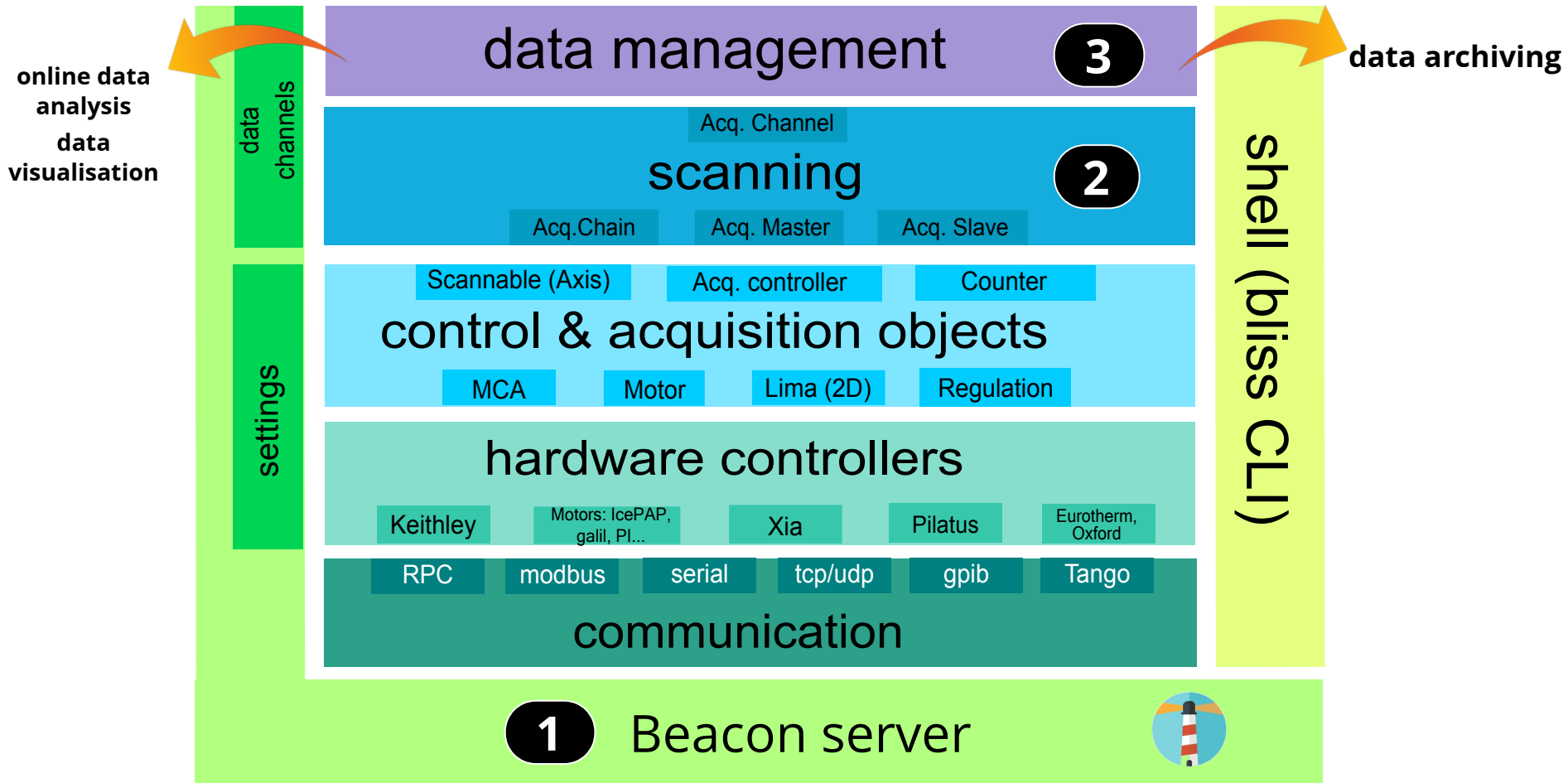


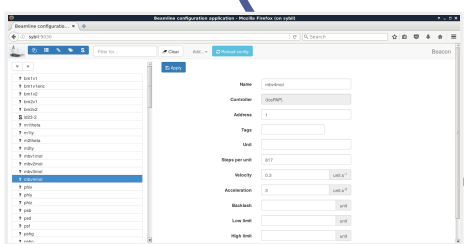
1 Beacon server

Devices & sequences configuration in YAML format

configuration

User sessions to group beamline devices for an experiment,

Python **setup file**



Web interface for configuration editing

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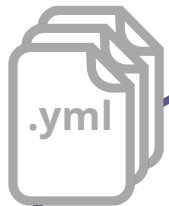

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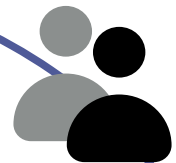

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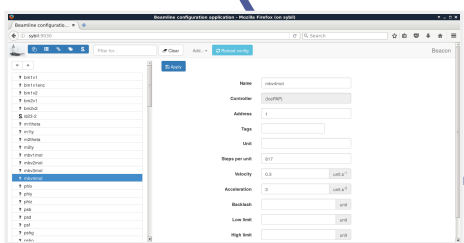


Web interface for configuration editing

Can **replace TANGO DB**

to have all beamline configuration at the same place

1 Beacon server

Devices & sequences configuration in YAML format

.yml

User sessions to group beamline devices for an experiment,

Python **setup file**

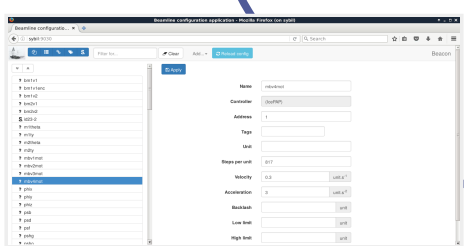
configuration

+ services based on

redis

Message broker: data channels, distributed lock

Persistent settings cache



Web interface for configuration editing

Transient data store

TANGO

Can **replace TANGO DB**

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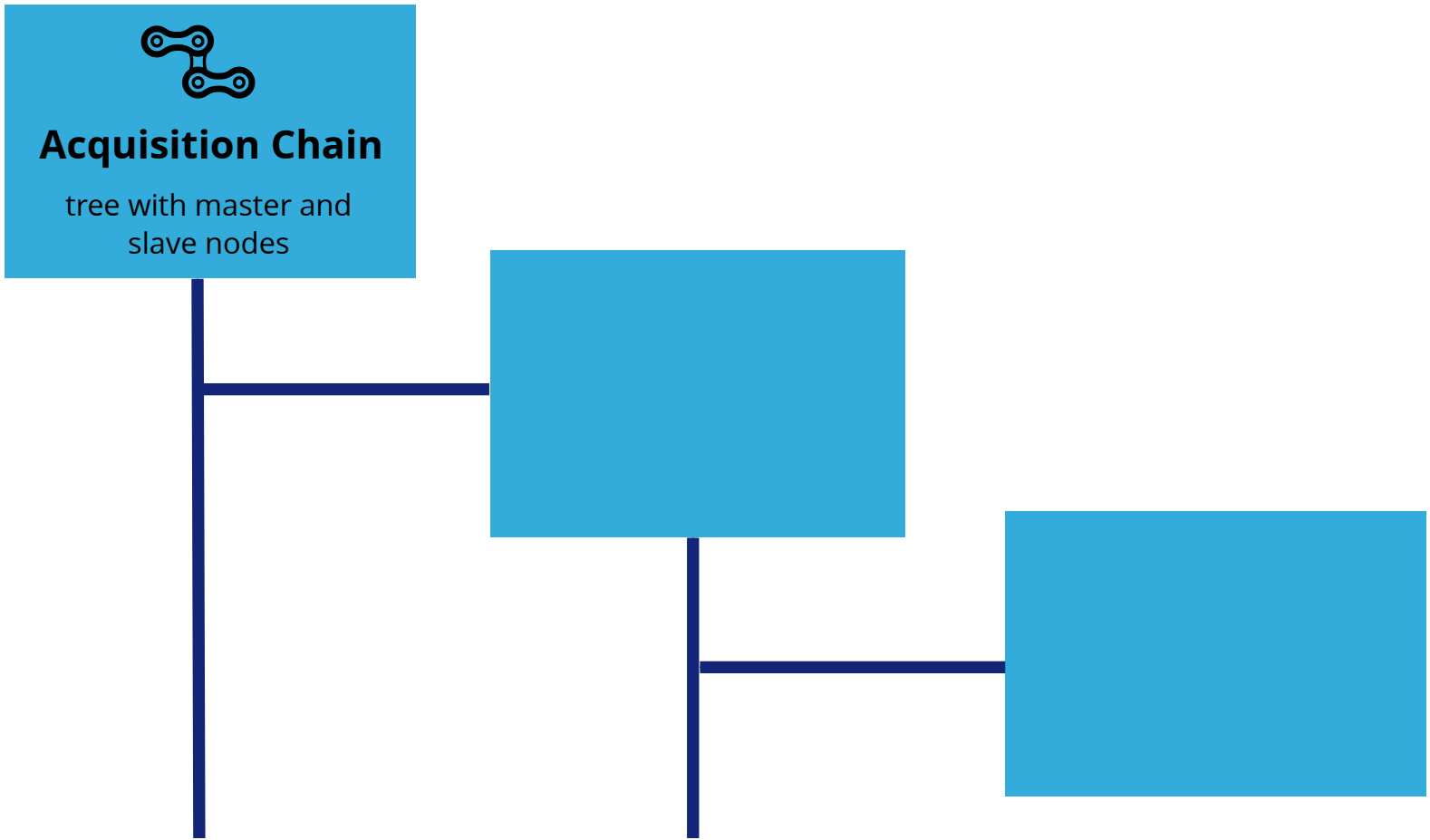
2 BLISS scan engine

2 BLISS scan framework



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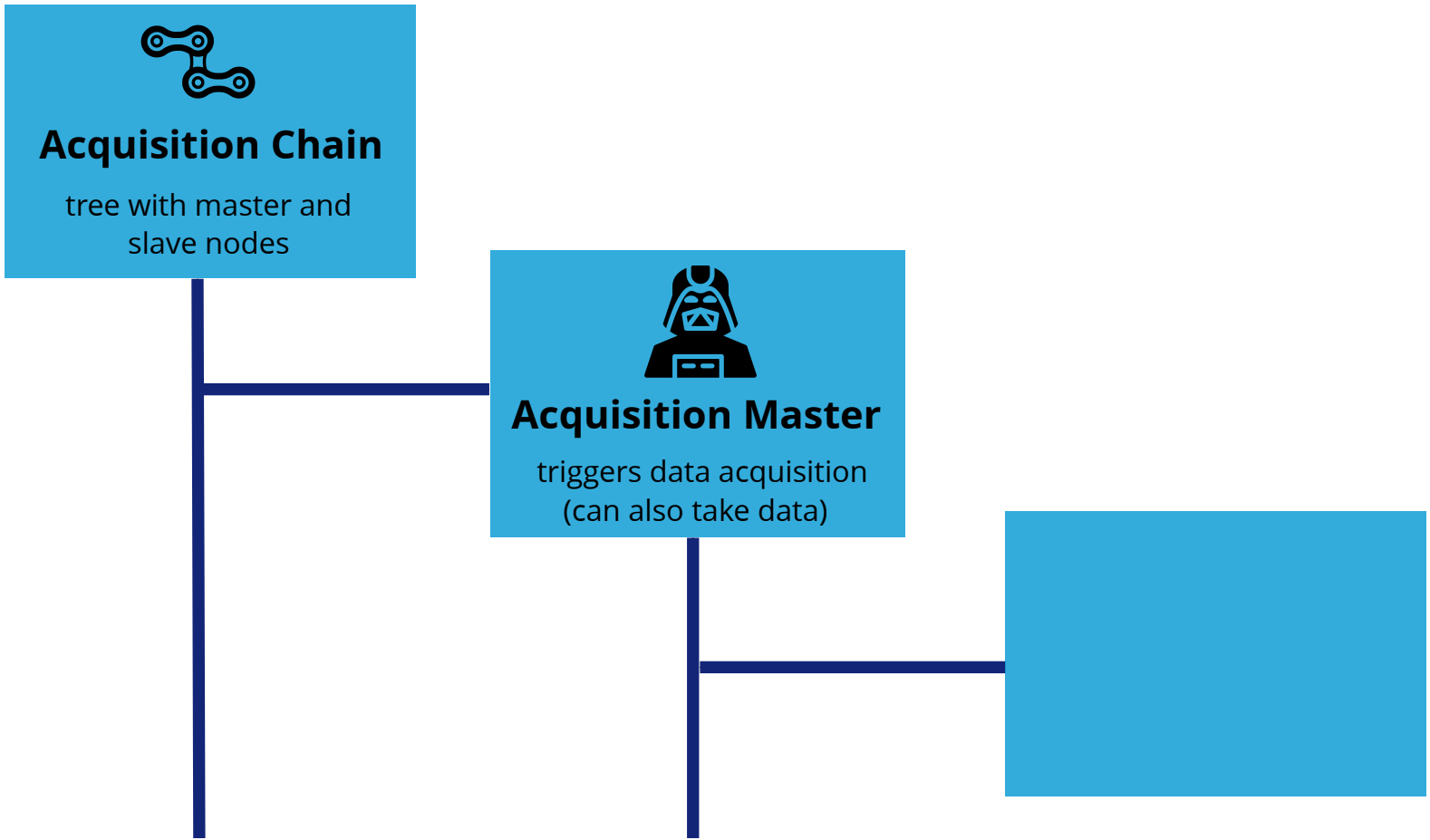

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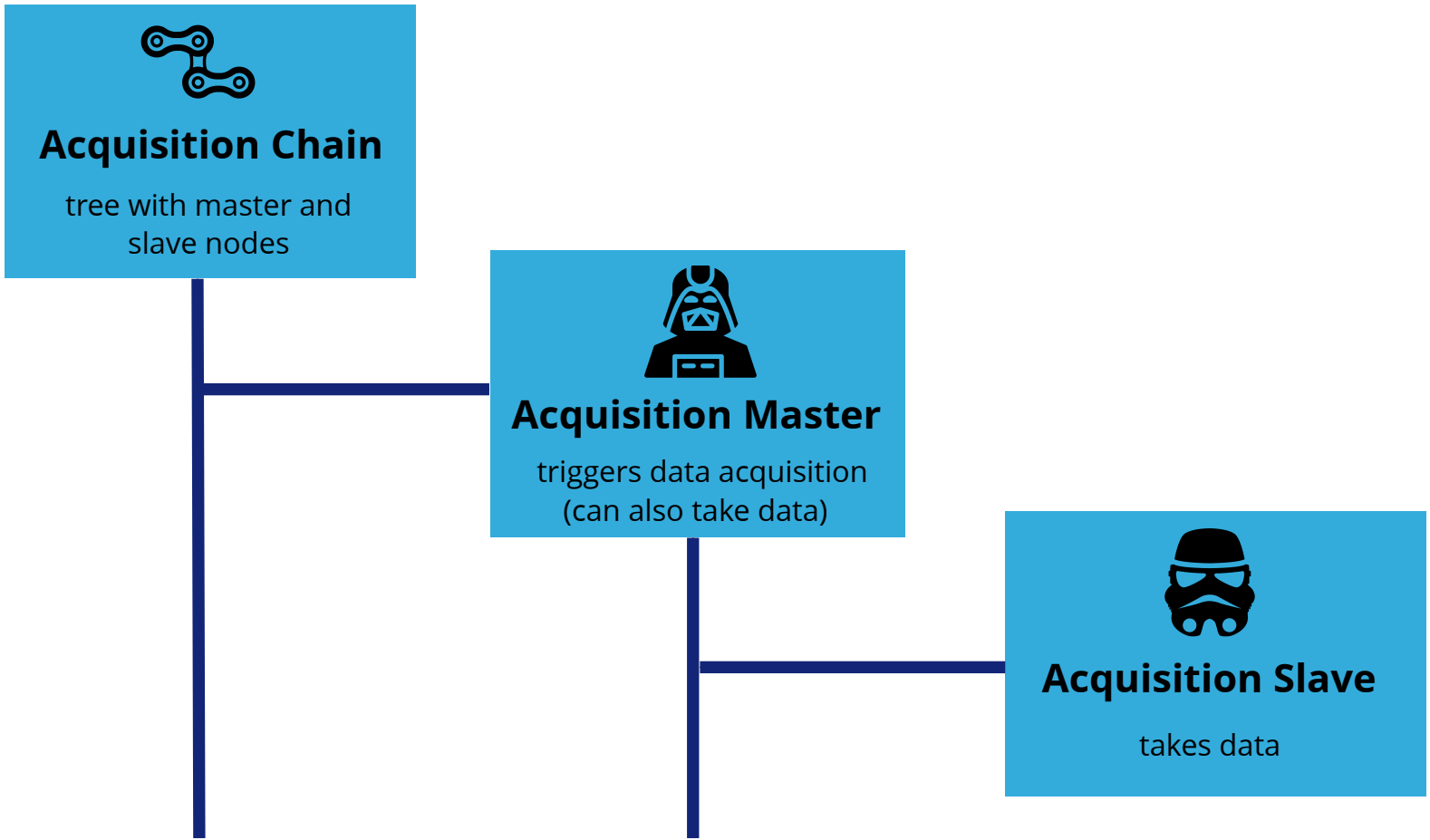

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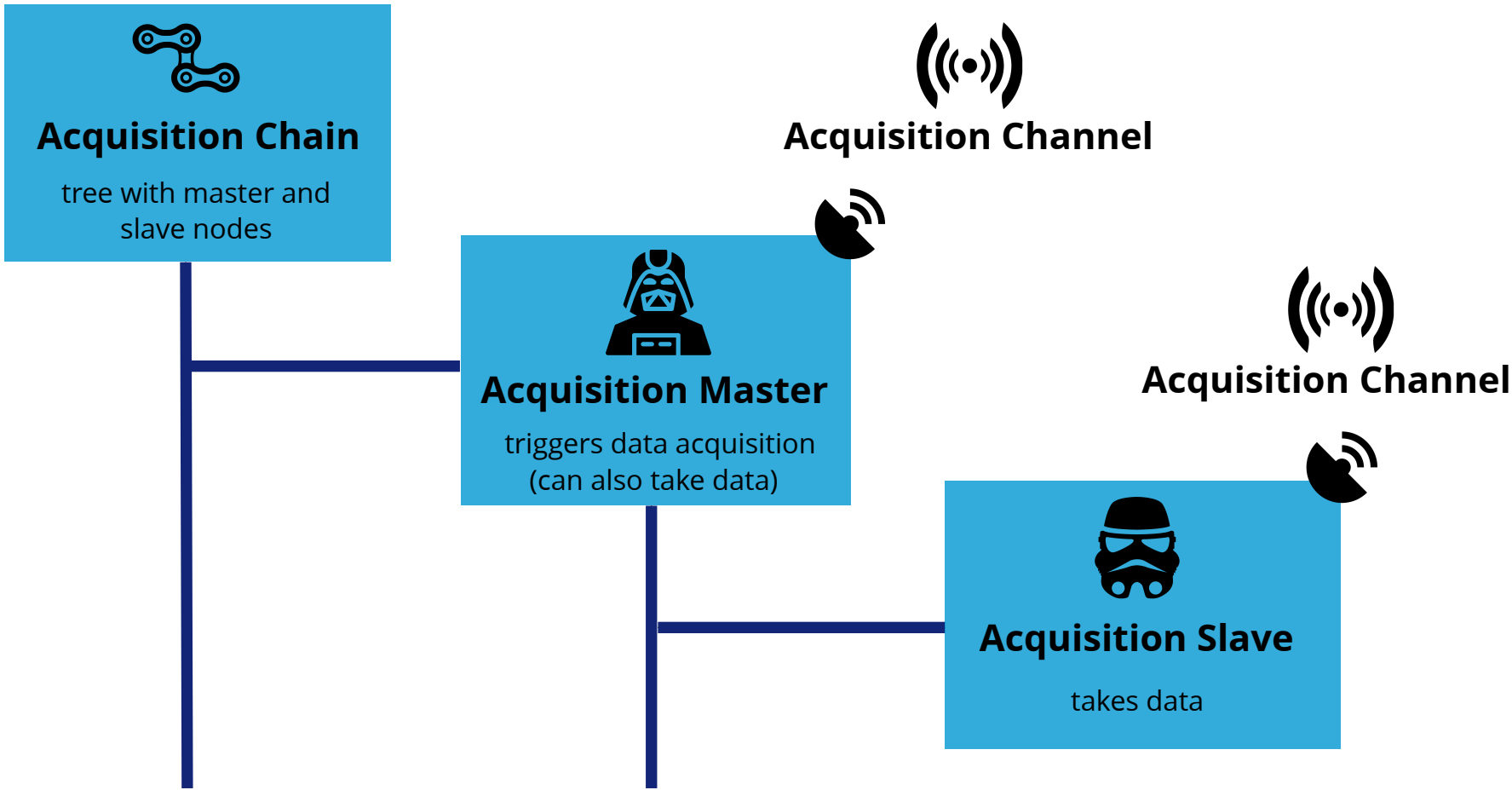
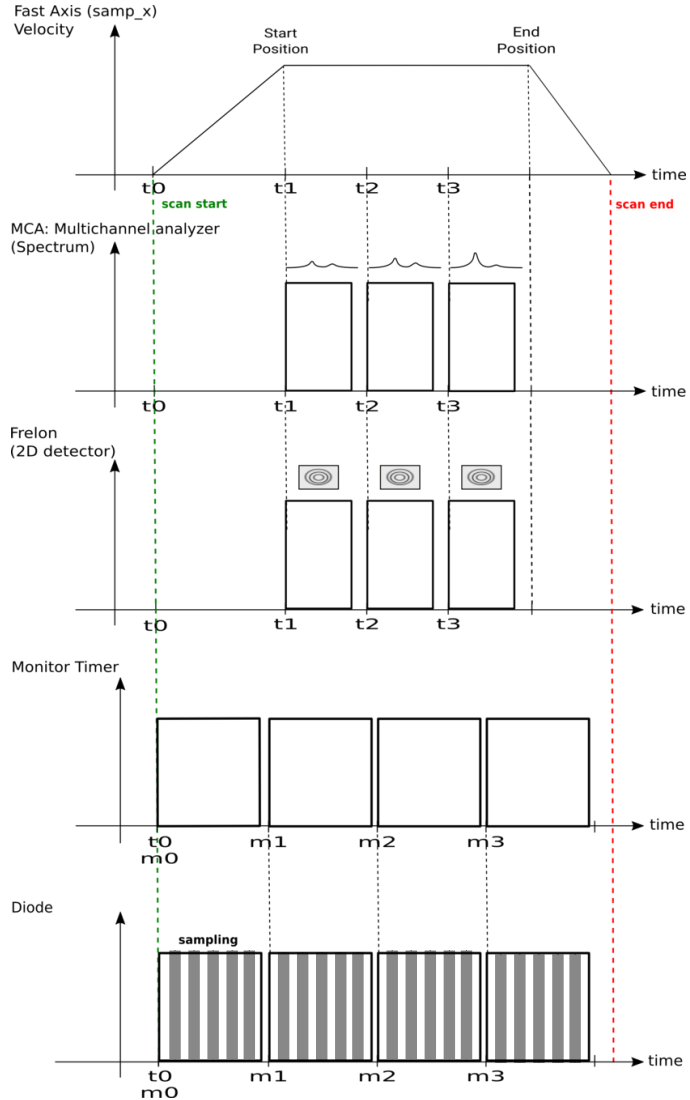


2 BLISS scan example

Continuous scan with a motor triggering MCA and 2D detector acquisition, while a timer triggers diode readings

- Timer
  - Keithley
    - scalar
- Motor:samp_x
  - MCA
    - spectrum
  - Lima
    - image

```python
def cscan(motor, start, stop, npoints, time):
    # create a new chain
    chain = AcquisitionChain(parallel_prepare=True)
    # create the monitor timer
    # npoints == 0 mean infinite
    monitor_timer = SoftwareTimerMaster(1., name="monitor_timer",
                                        npoints=0)
    # create acquisition device for the monitor diode
    diode_device = SamplingCounterAcquisitionDevice(diode1,
                                                    count_time=1.,
                                                    npoints=0)
    # Associate them in the chain
    chain.add(monitor_timer, diode_device)
    # Now the fast acquisition
    # create a motor master for a position trigger
    master = SoftwarePositionTriggerMaster(motor, start, stop, npoints,
                                           time=time)
    # The spectrum device MCA
    mca_acq = McaAcquisitionDevice(mca, npoints=npoints,
                                   trigger_mode=McaAcquisitionDevice.GATE,
                                   counters=list(mca.counters))
    chain.add(master, mca_acq)
    # The Image detector
    lima_master = LimaAcquisitionMaster(frelon,
         acq_nb_frames=npoints, acq_trigger_mode='EXTERNAL_GATE')
    lima_master.add_counter(frelon.image)
    chain.add(master, lima_master)
    # Finally build the scan and run it.
    scan = Scan(chain,name='cscan')
    scan.run()
    return scan
```



3 BLISS online data publishing

While a scan is running, **data is published** to the redis database provided by Beacon 

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- scalar values are **stored directly**
- bigger data (images, spectra) is **just referenced**
- configurable time to live (TTL)

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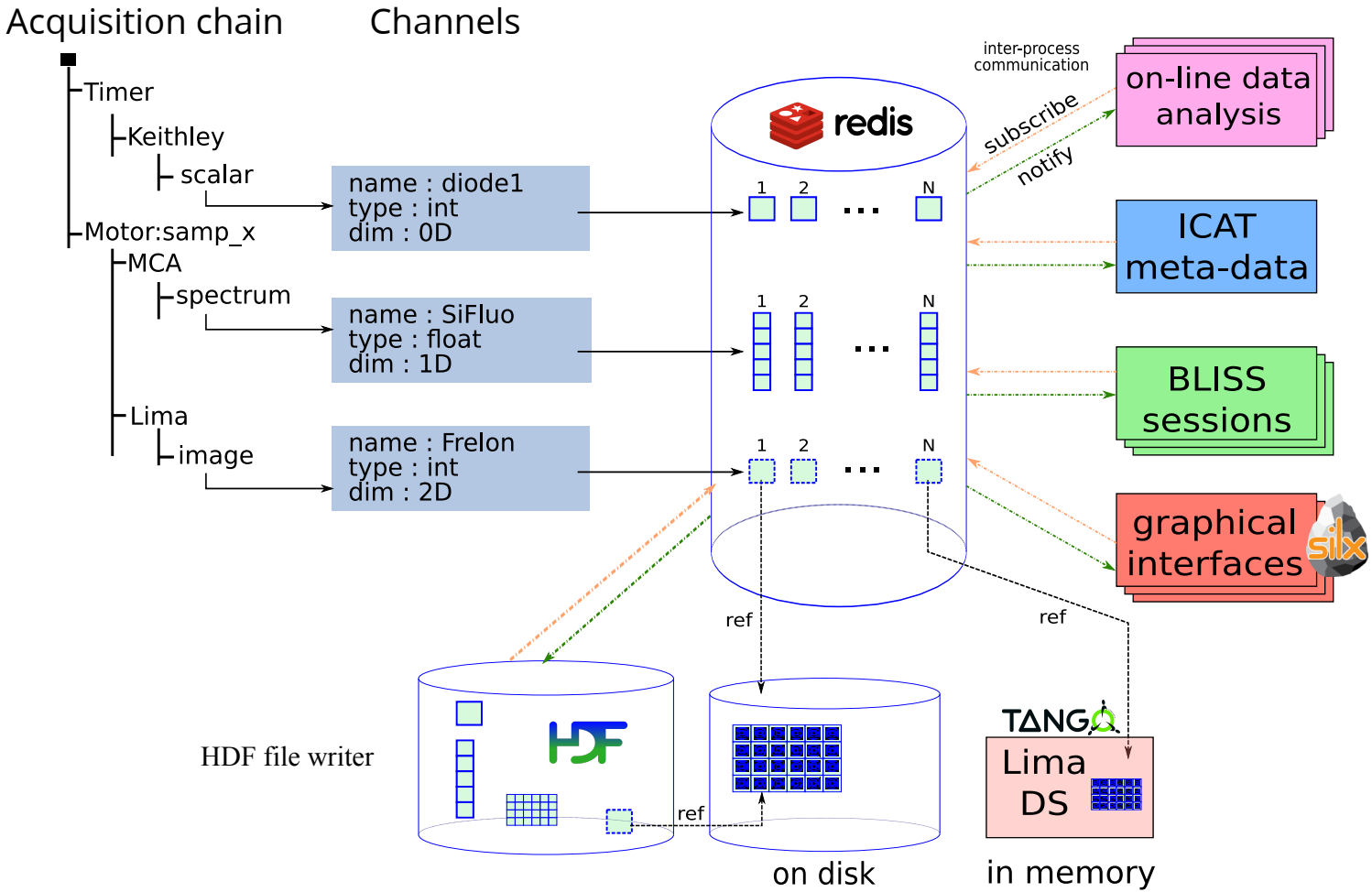
Any external process can access redis data to perform **online data analysis** or **live feedback** for example

3 BLISS scan data flow



BLISS development

BLISS development methodology

backlog

(tasks)

new features

bug fixes

BLISS development methodology

Kanban

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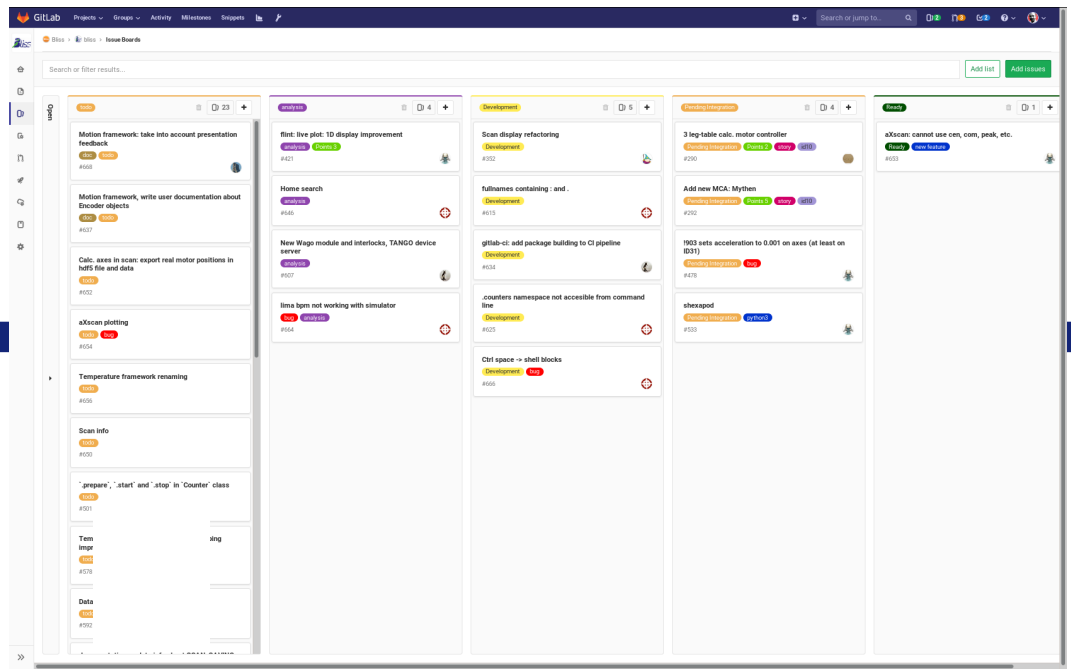

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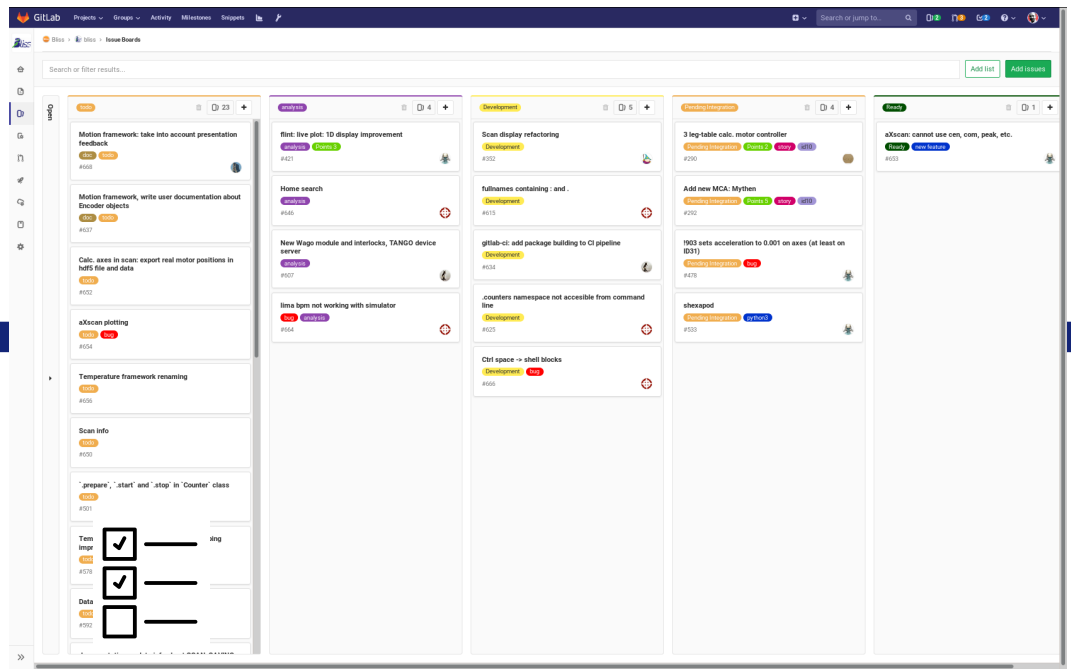

Prioritized

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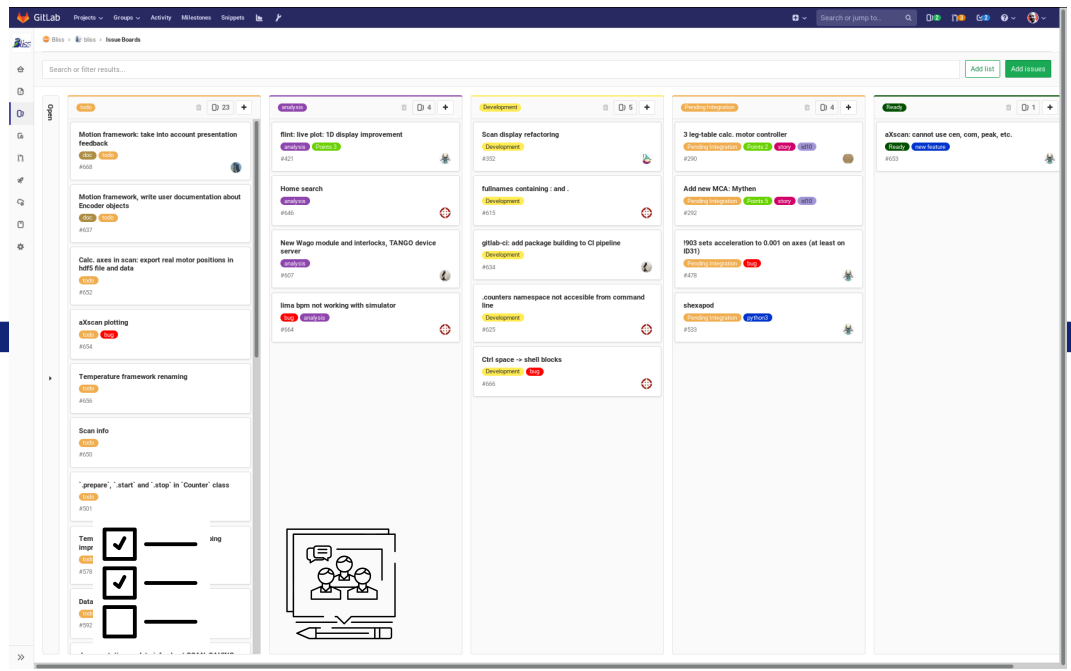

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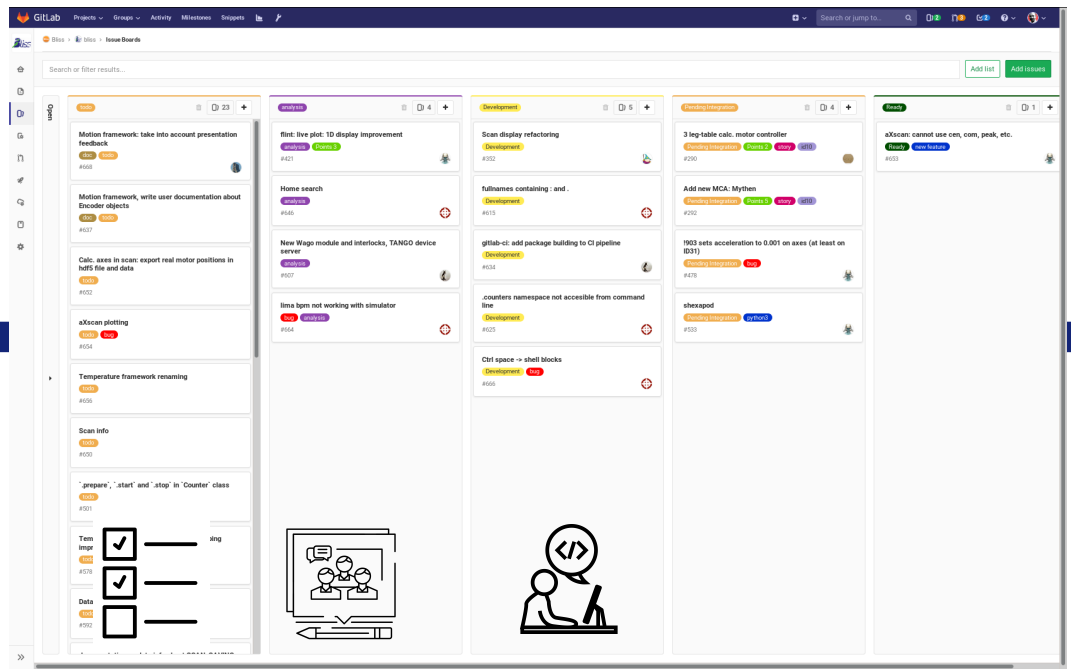

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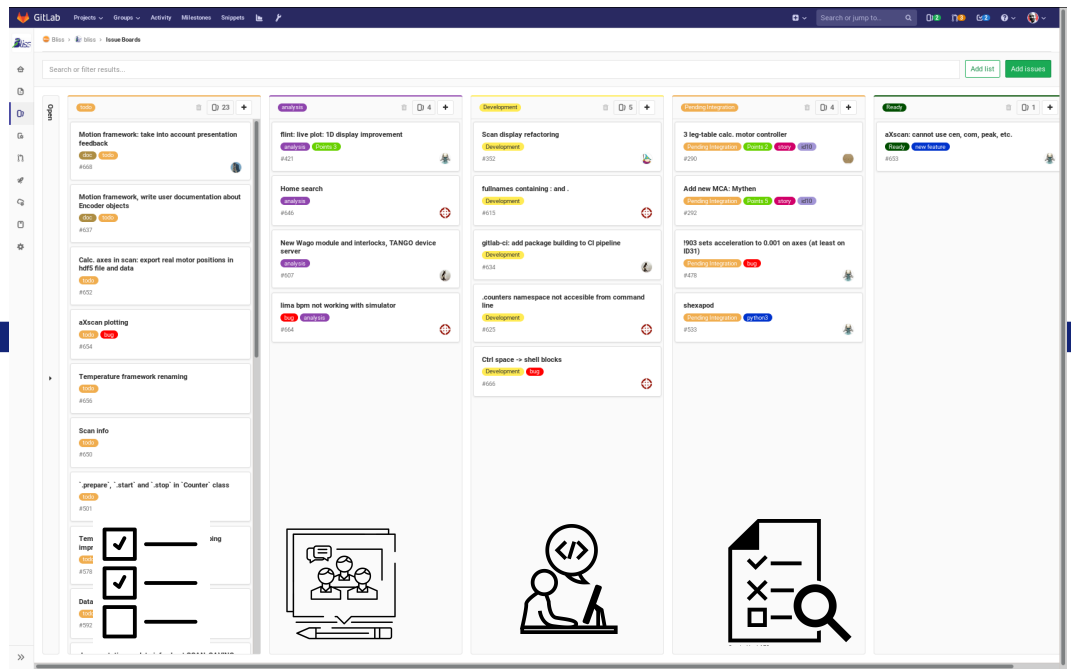

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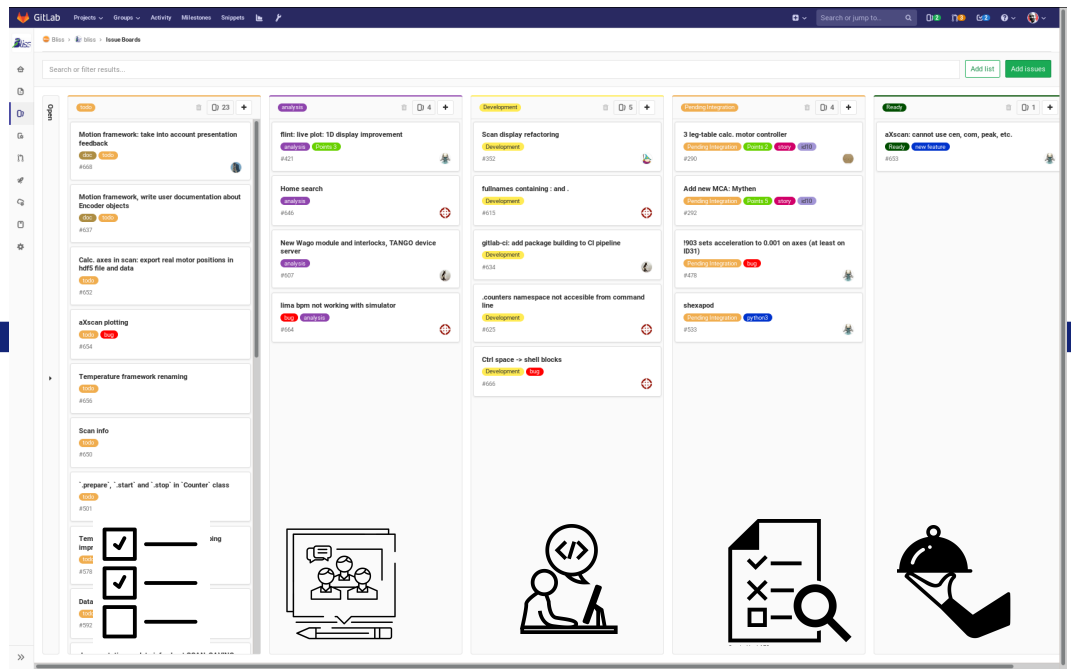

Prioritized todo

Analysis phase

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Integration tests

Ready to merge

new features

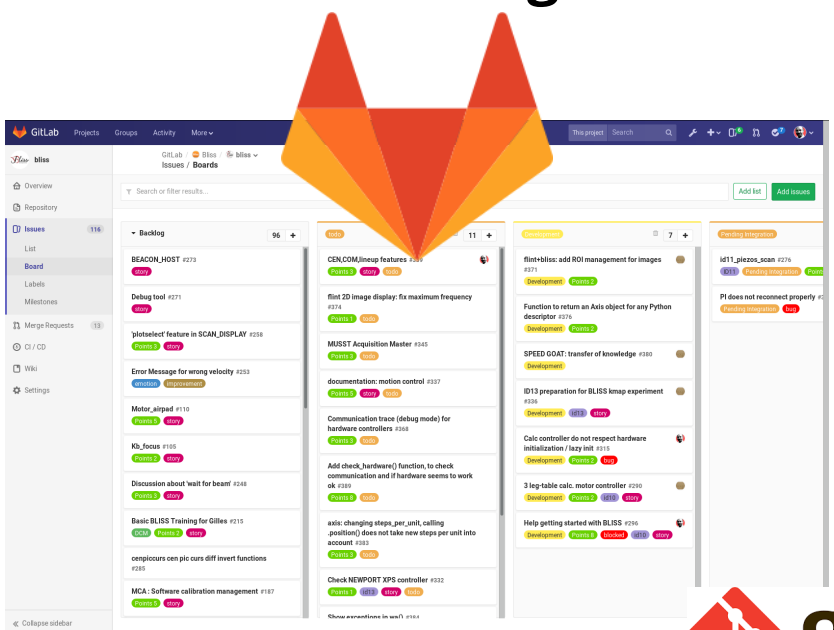
bug fixes

BLISS project development tools

Issues list, Kanban board, wiki, and more on ESRF-hosted gitlab

Continuous Integration:

gitlab-ci



pytest

Documentation:

MkDocs

Deployment:

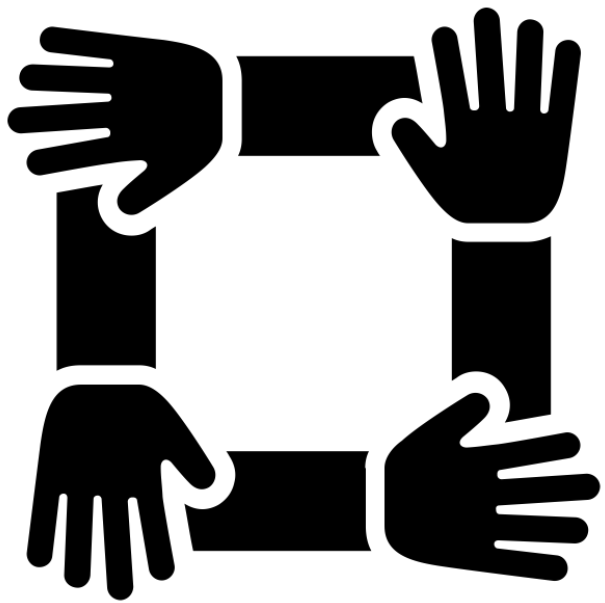
ANSIBLE

CONDA

git

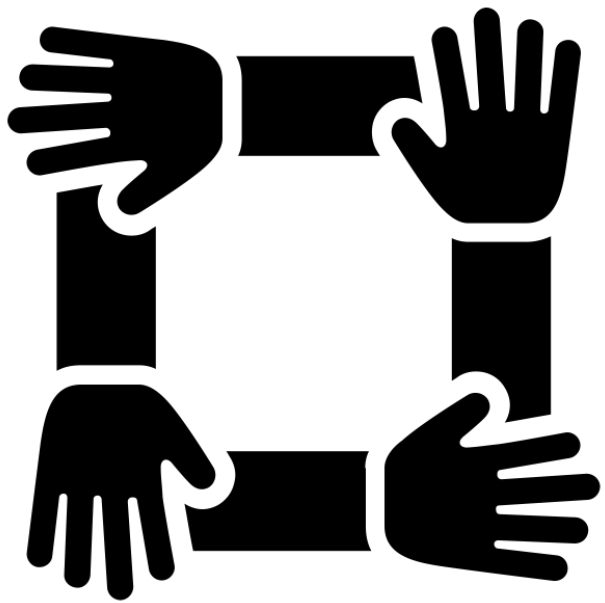
Code formatting: Black

Sharing knowledge within the BLISS team



Sharing knowledge within the BLISS team

Daily stand-ups



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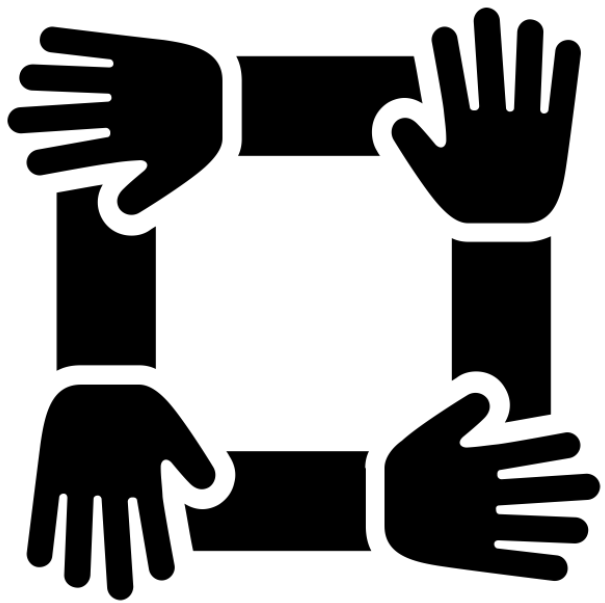

"Stop and Solve" meetings

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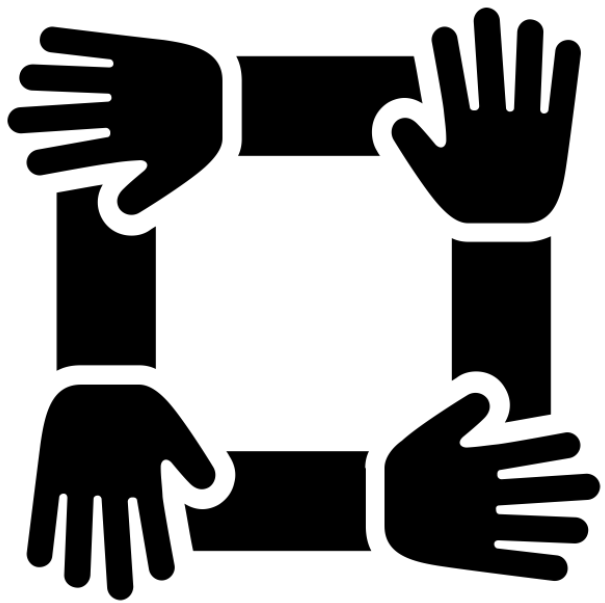

"Stop and Solve" meetings

Pair programming

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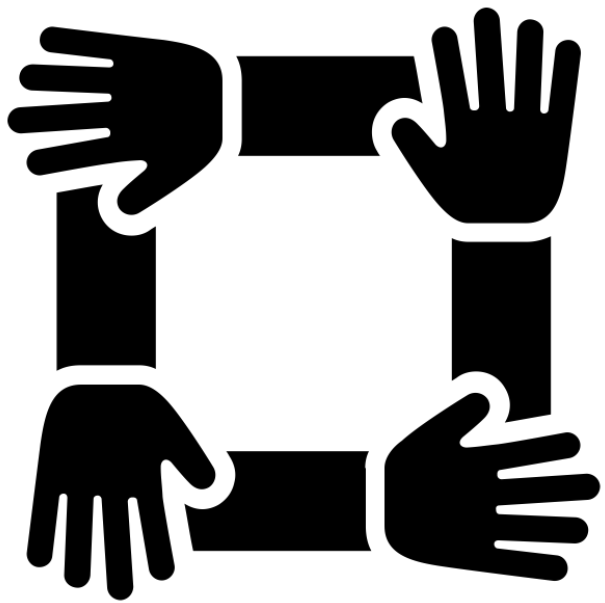

"Stop and Solve" meetings

Pair programming

Guidelines, good practices
(very useful for newcomers)

BLISS team ensures Quality Assurance

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Automatic tests pipeline
(980+ tests)

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Only merge code with
documentation

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Systematic code
review

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Only merge code with documentation

Systematic code review

Integration tests on beamlines (real hardware)

Dealing with the technical debt

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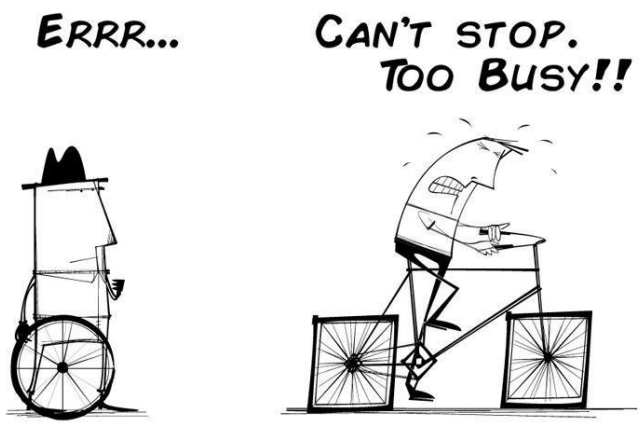
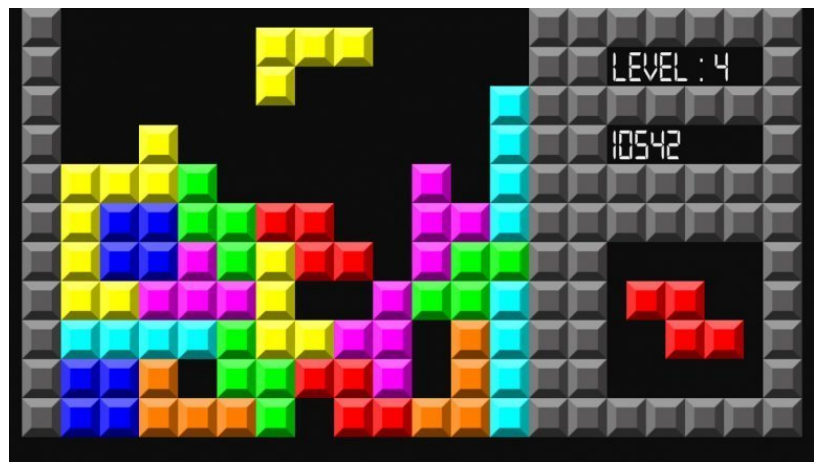
Technical debt = Tetris game
(you can't win)





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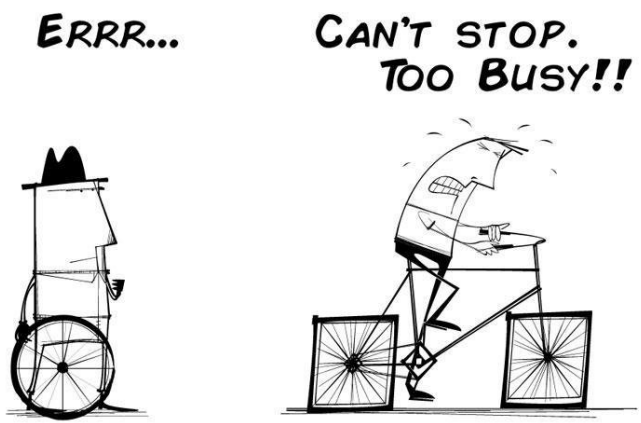
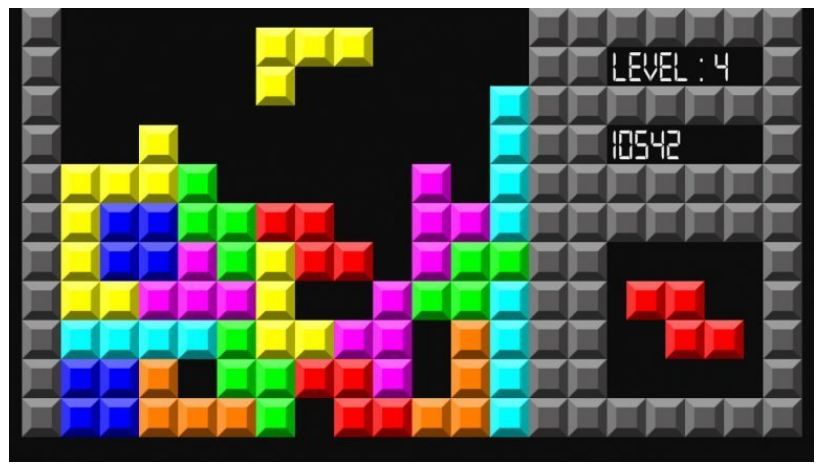
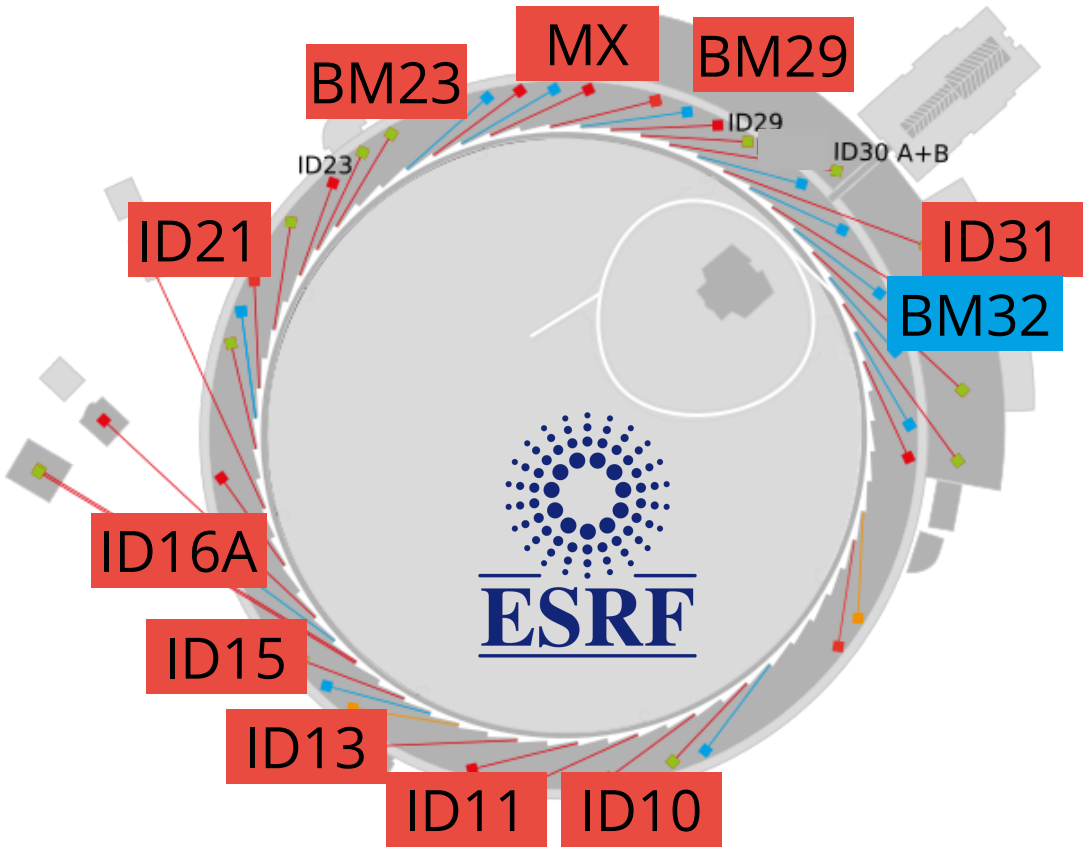
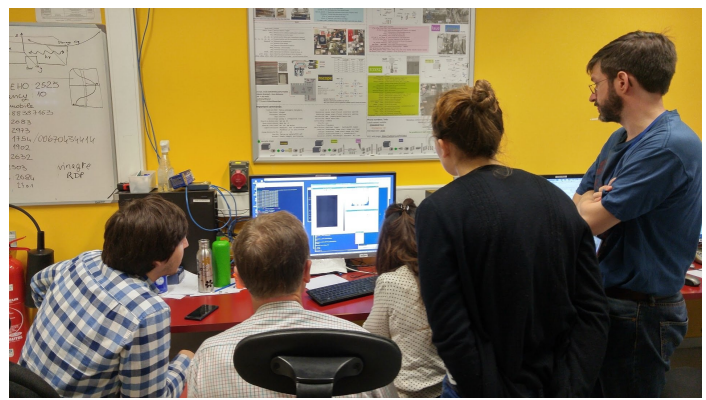




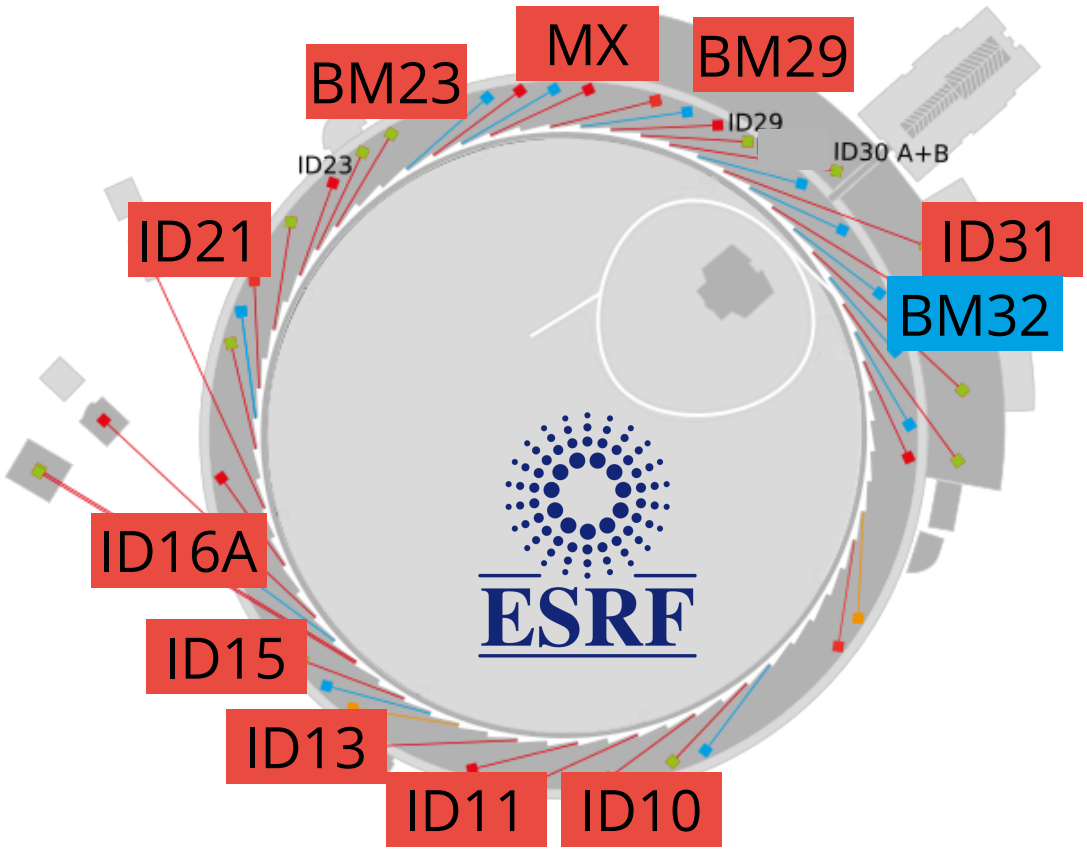
Refactoring helps to fill the holes,
but with time penalty

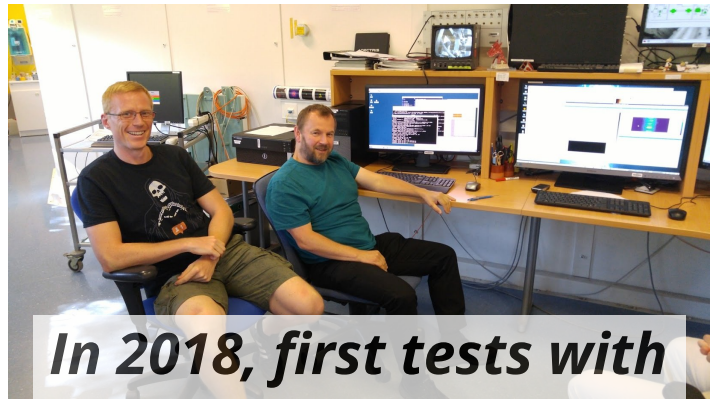
BLISS deployment (2020)





BLISS deployment (2020)





In 2018, first tests with users: MX, ID10, ID11, ID13, ID31

Conclusion

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BLISS is the new Python-based DAQ and experiments control system

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BLISS is being designed for the needs of the EBS beamlines

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Half of the beamlines are being converted to BLISS during the EBS shutdown (2019-2020)

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Would be happy to start collaborations around BLISS with interested people

Acknowledgements

head of Software Group: **A. Gotz,** *head of BCU:* **J. Meyer**

BLISS Core Development team

From left to right:

B. Formet (CEA), **M. Guijarro,**

P. Pancino, L. Pithan,

P. Guillou,

S. Petitdemange,

C. Guilloud

Beamline Operation team

A. Beteva, G. Berruyer, **L. Claustre**, S. Fisher, A. Homs, R. Homs, M-C. Lagier, A. Mauro, C. Muzelle, S. Ohlsson, M. Oscarsson, E. Papillon, F. Sever, V. Valls, H. Witsch