Data Collection & Analysis at SESAME

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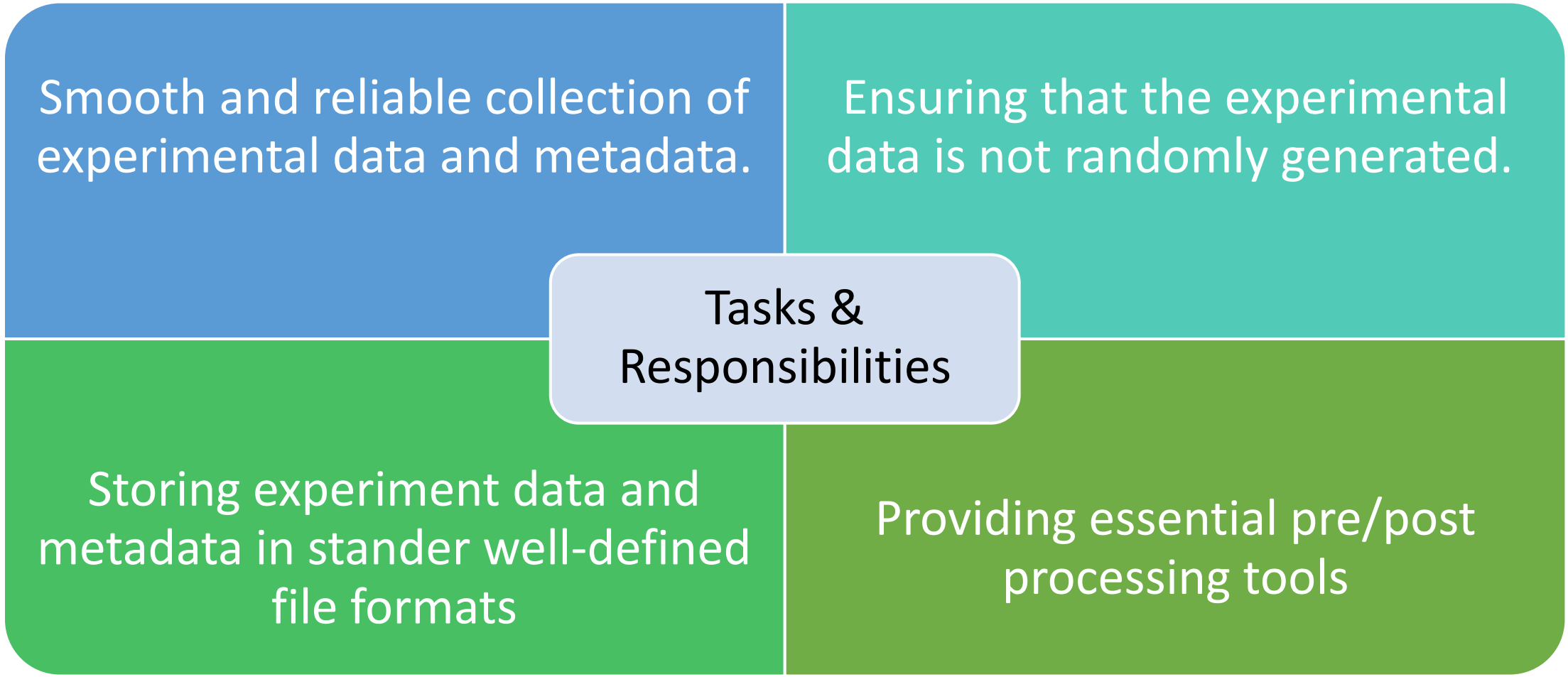
Data Collection and Analysis (DCA) Team

- Team role was activated late 2020 / beginning 2021. Before activation, experimental data collection were handled by beamline scientists, control and computing engineers.

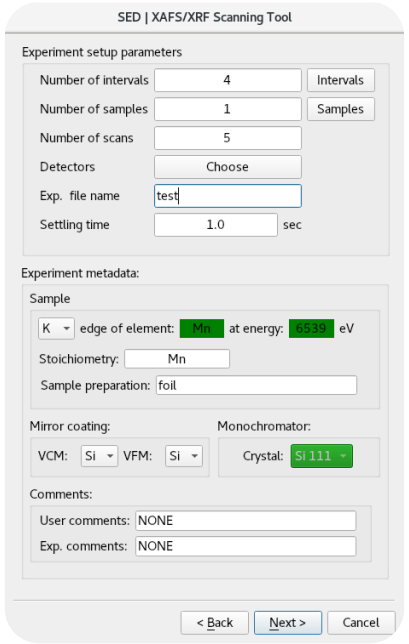


DCA | Mission & Responsibility

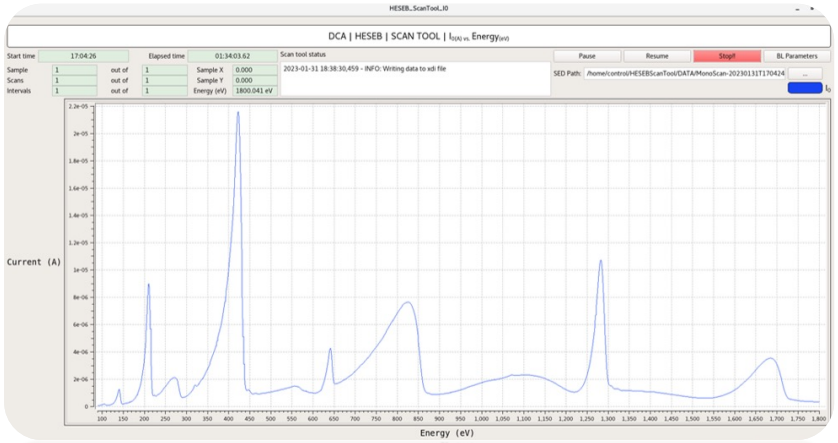
SESAME

Data Collection and Analysis team is:

- responsible for providing the essential pre-processing and post-processing tools that are needed to make the data ready for users and scientists to start their own analysis.



UI scanning tool



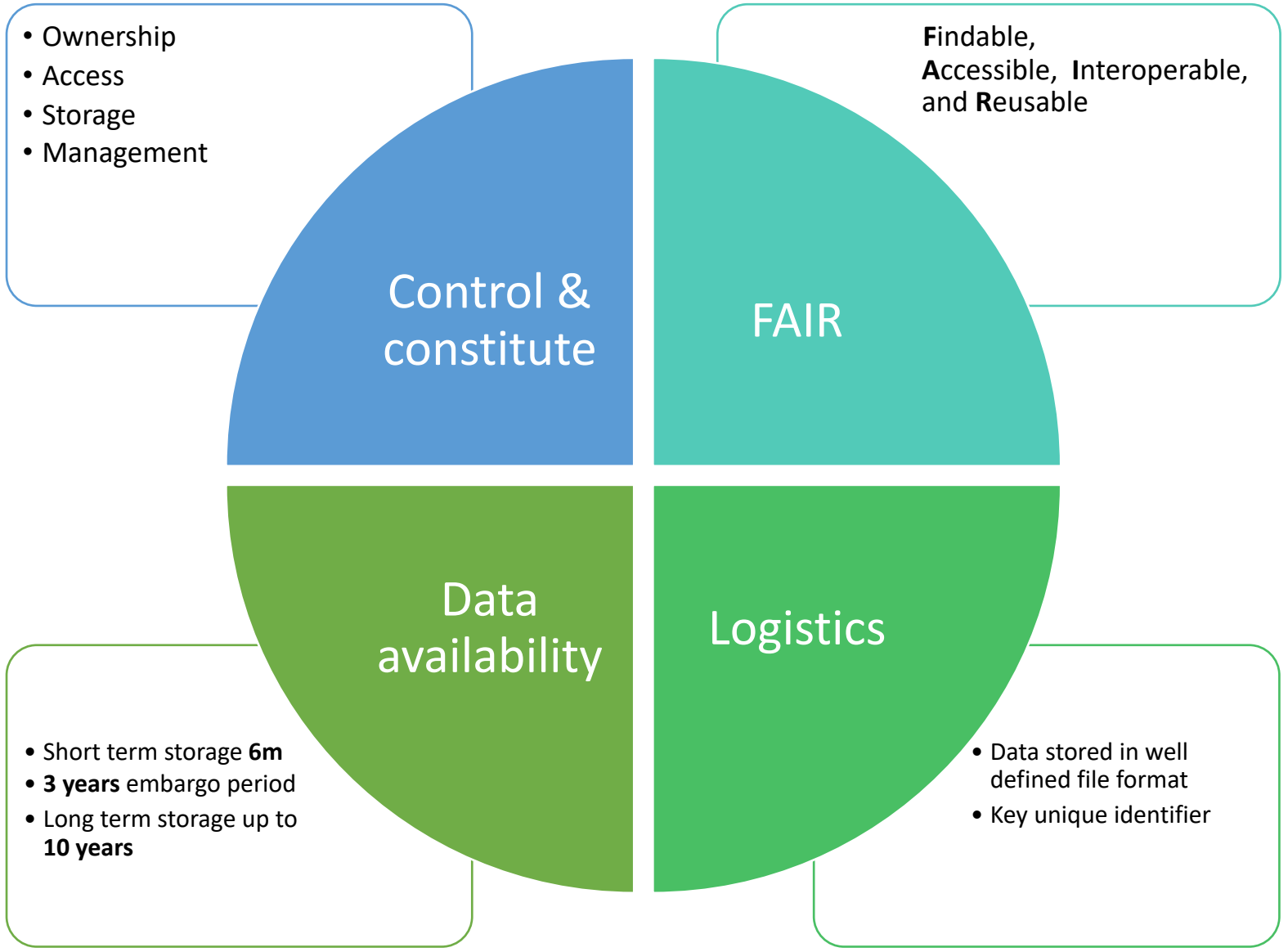
Live data plotting

SESAME Experimental Data Management Policy vs standardization

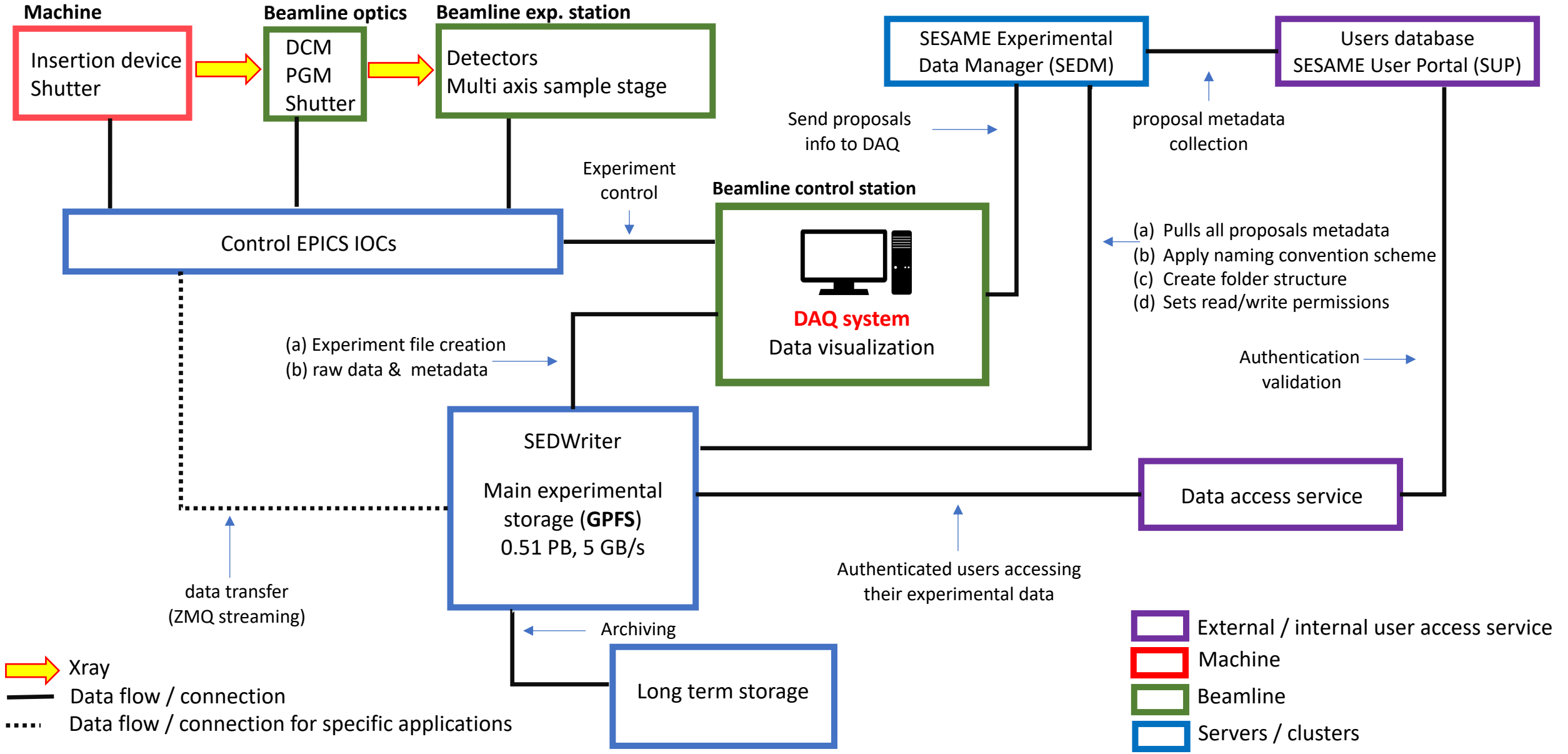
The data policy is a deliverable of the H2020 BEATS project. It is harmonised based on the ESRF and PaNData data policy frameworks.

The intention behind the policy is to apply it on all experimental data.

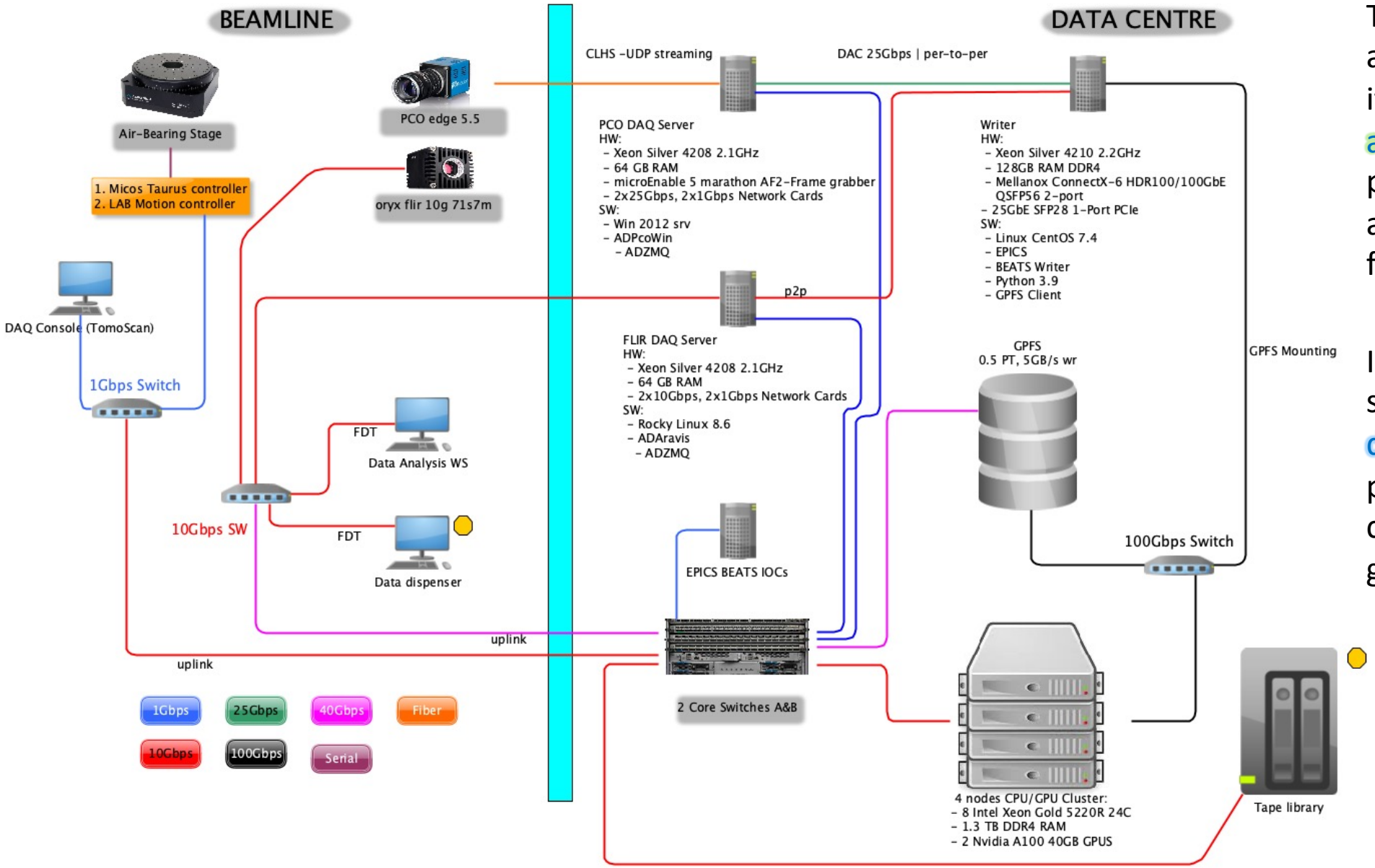
We have started implementing the data policy …. not easy job but we are progressing…



DAQ General Pipeline



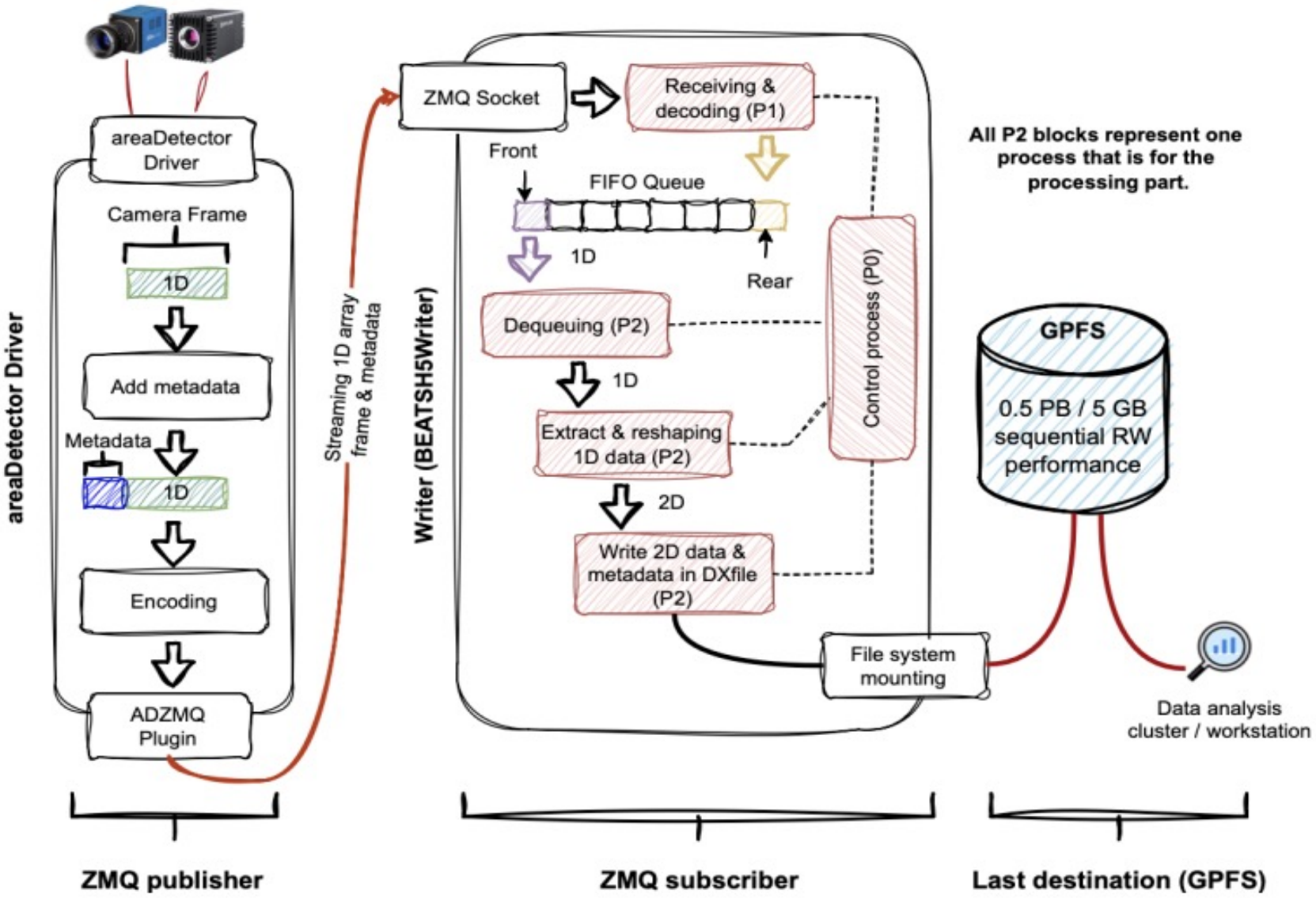
BEATS | DAQ | Pipeline | Current Setup



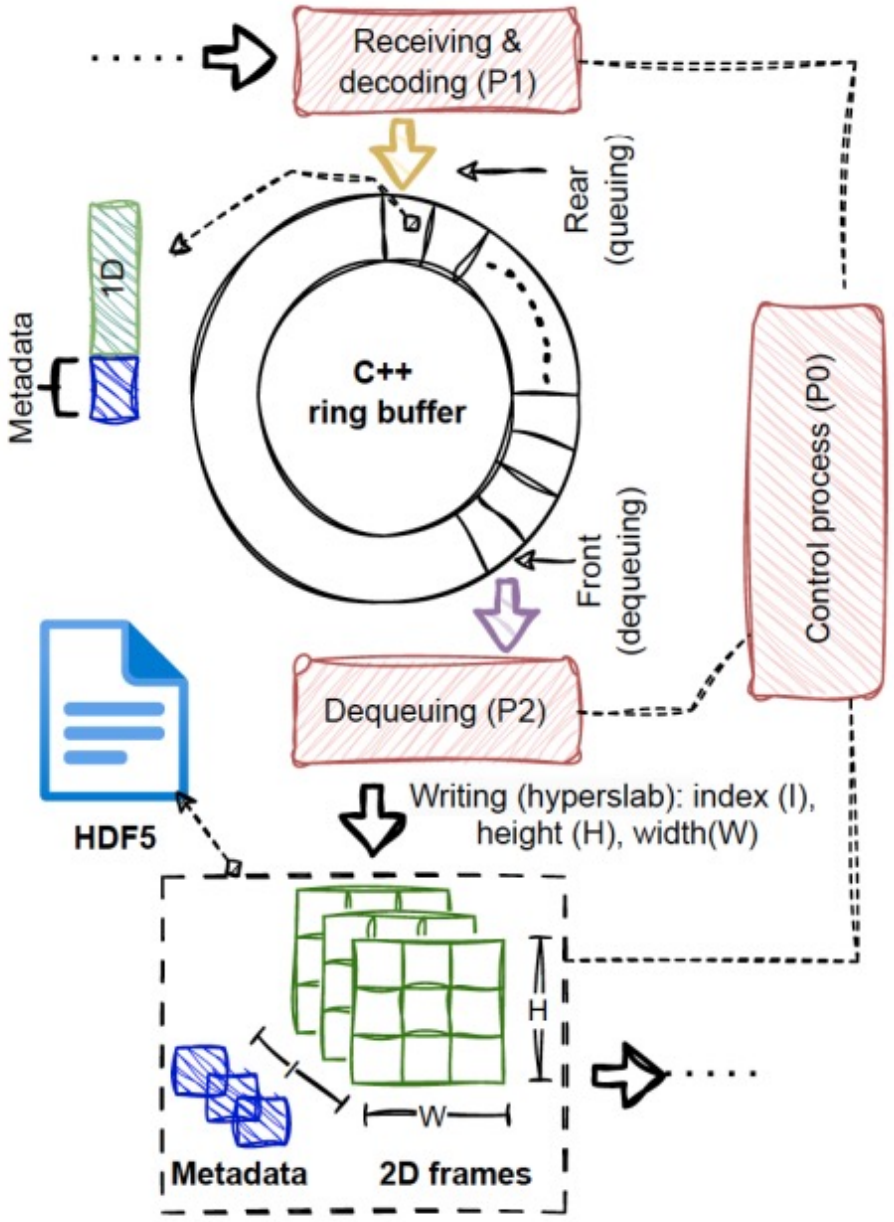
The pipline is not a copy of any partner's setup, instead it is a result of discussing and validating with project partniers mainly ESRF, PSI and CyI as well as other facilities (APS and Max IV)

Implemeinting the pipline started in mid 2021 on a dedecated testing bench prepared by Gianluca, control, motion and DCA groups.

BEATS | DAQ | BEATSH5WRITER | Block Diagram



BEATS | DAQ | BEATSH5WRITER | C++ Implementation




```
std::vector<std::unique_ptr<std::pair
<std::string, std::vector<size_t>>>>;
```

std::vector<size_t>

- stores camera frames, which are constructed in two dimensions

std::unique_ptr

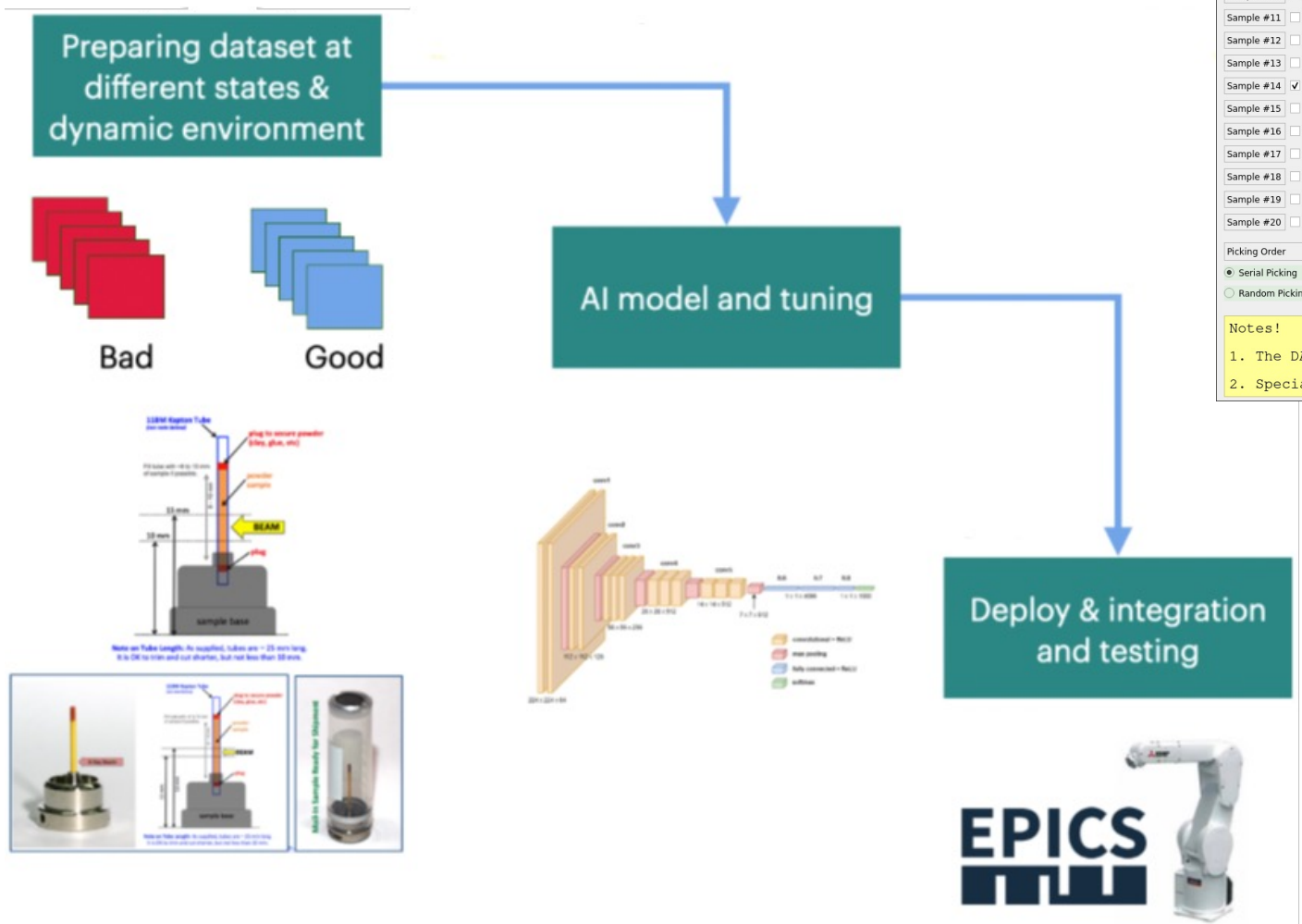
- manage dynamically allocated buffer elements by enforcing exclusive ownership and enabling safe transfer of frames between receiving and processing threads

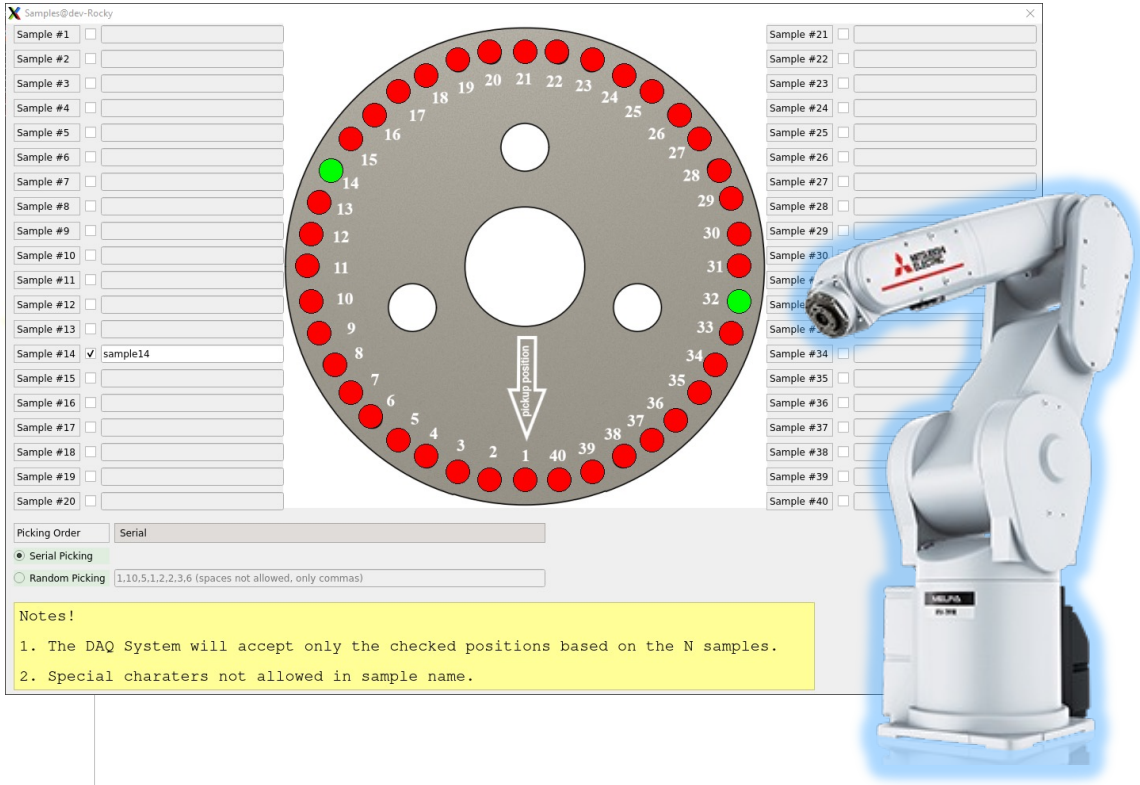
std::pair

- bundle both the camera frame and its metadata into a single entity data structure

DCA & Control | Ongoing Projects | Robot Integration

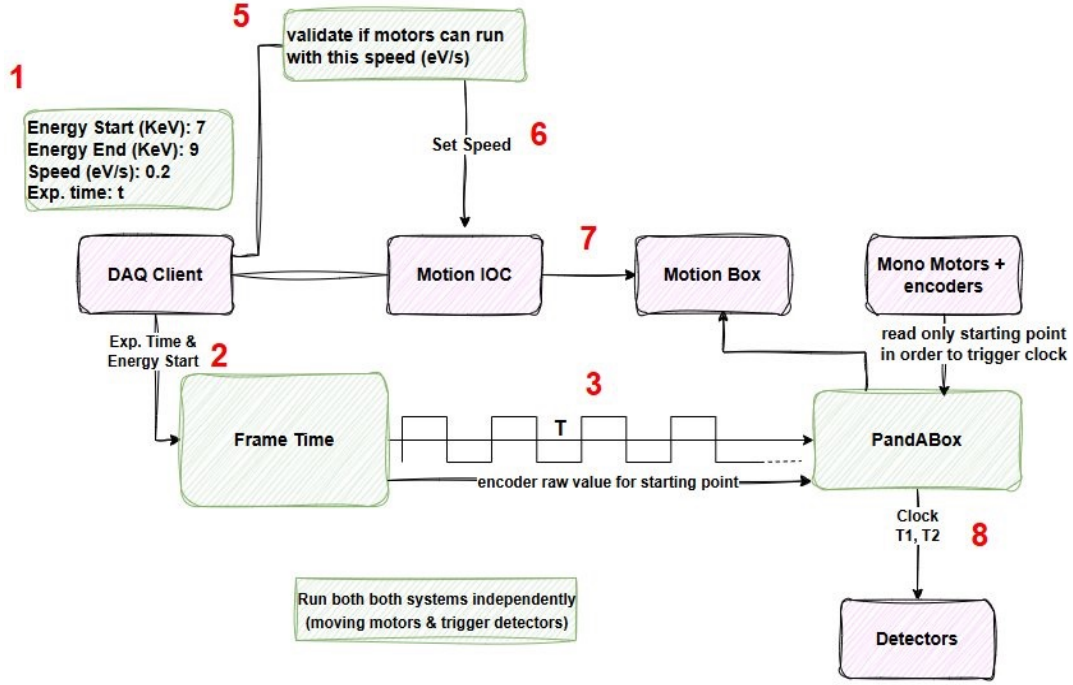
"AI-based Robotic Arm Vision System" project aims to integrate a camera-based object detection system powered by AI.

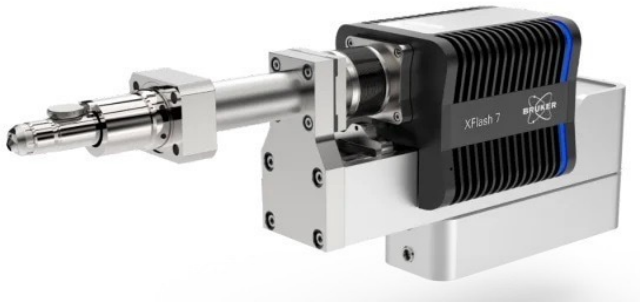




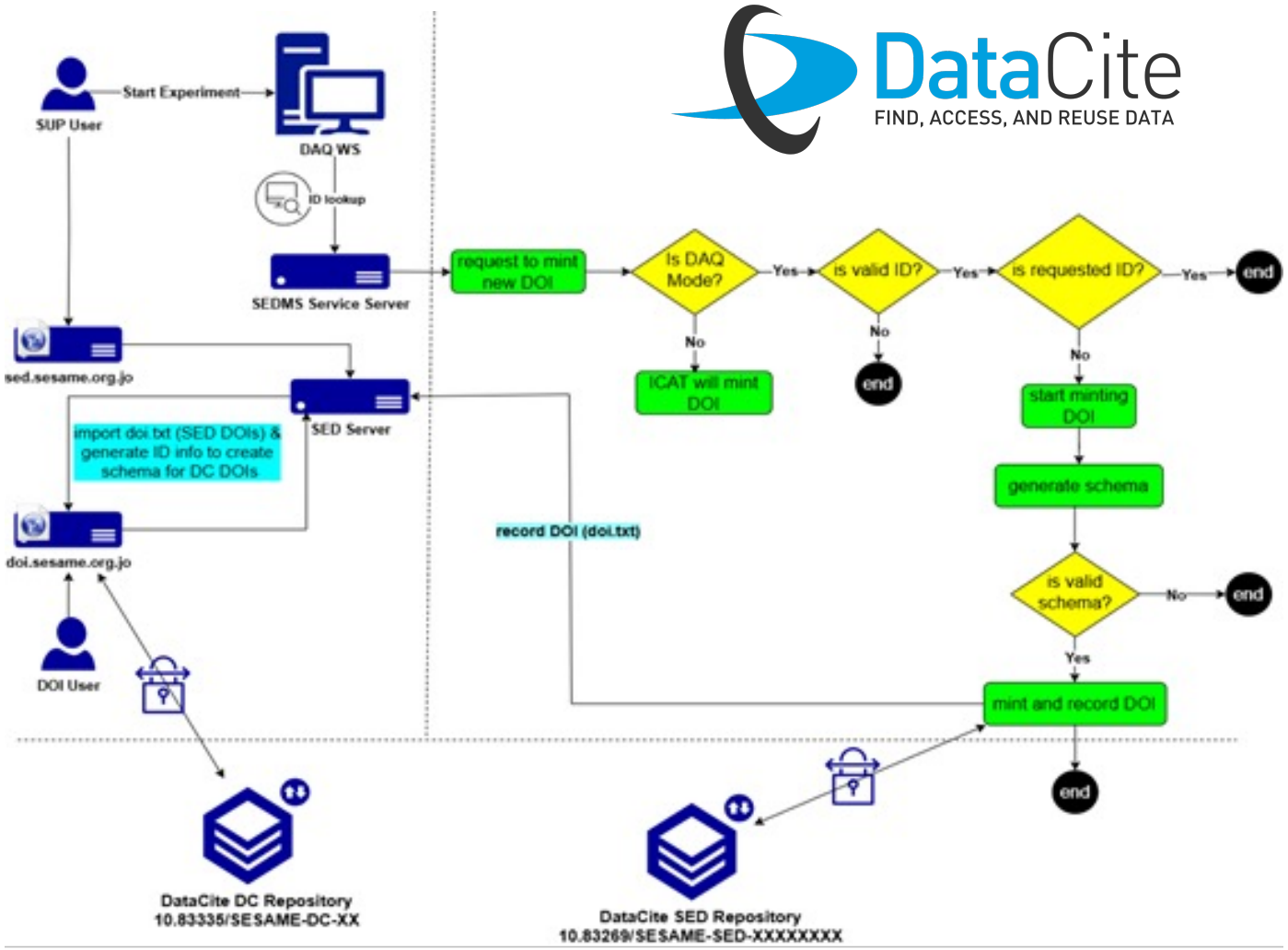
- Enhance Sample Identification
- Integrate with Existing Systems
- Boost Operational Safety

DAQ | Ongoing Projects | PandABox Integration for Soft X-ray Beamline





DCA & Computing | Ongoing Projects | DOI Minting at SESAME



As part of SESAME's commitment to improving data accessibility, traceability, and recognition for scientific contributions, we have successfully implemented a DOI (Digital Object Identifier) minting service.

This project enables SESAME users to assign DOIs to their datasets directly through the SESAME Data Portal (SED) and make those datasets publicly discoverable via a dedicated landing page system.

AI-Based Collision Avoidance System for Motion Stages in Synchrotron Beamlines

Synchrotron beamlines often utilize multiple high-precision motion stages (e.g., sample stages, detector arms, slit systems) operating in close proximity. Coordinated movement of these stages is essential to avoid mechanical collisions that could cause equipment damage. Traditional solutions rely on predefined motion constraints or hard-coded interlocks, which can be inflexible and limited in dynamic, complex configurations.

An ***AI-driven collision avoidance system*** offers an adaptive and intelligent approach to predict and prevent collisions in real-time.

Thanks

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