

EXPERIMENTAL DATA TAKING AND MANAGEMENT: THE UPGRADE PROCESS AT BESSY II AND HZB

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Will Smith et al

Experiment
Control
BESSY II Upgrade

CONTENT

Path Towards 4th Gen BESSY III

FAIR Data

Historical Challenges at HZB

Bluesky at BESSY II

ROCK-IT Demonstrator

Remote Operando Controlled Knowledge-driven, IT-based project



BESSY II recently celebrated its 25th anniversary

BESSY III

4th Gen Soft X-Ray Light Source

Embedded in a campus in Berlin-Adlershof and Science Region

A Materials Discovery Facility

Pre CDR complete. TDR to be started by 2026

Operational some time in the late 2030's

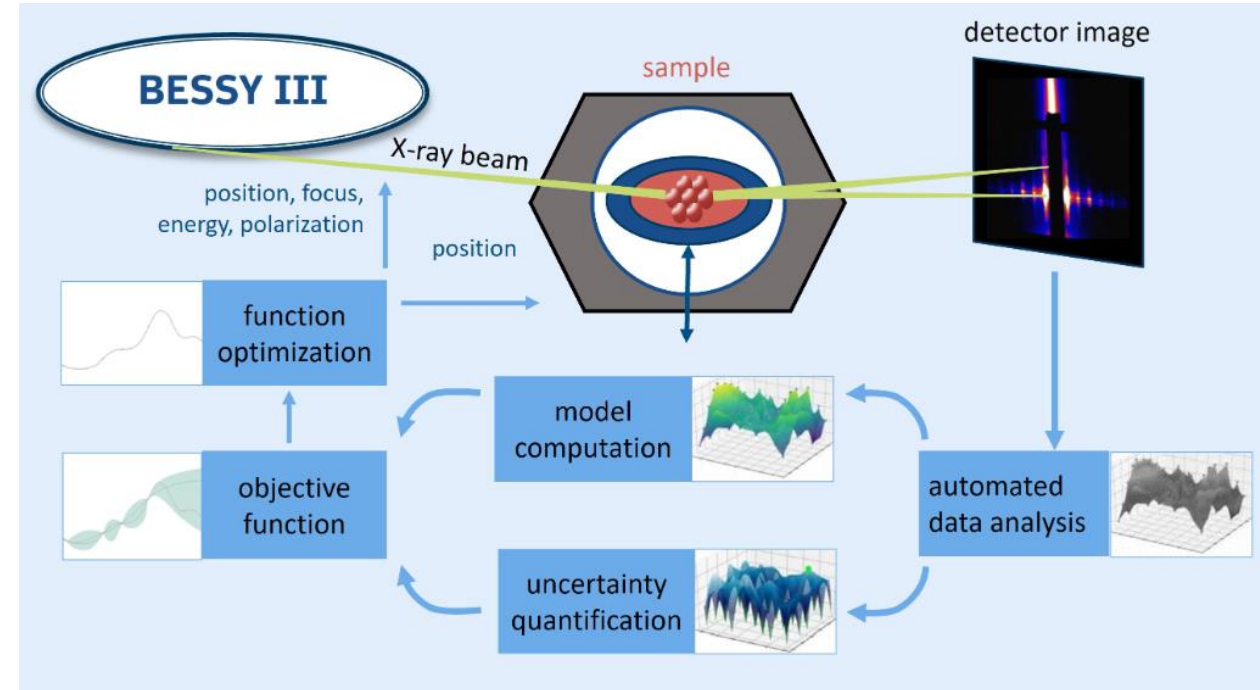


DIGITALISATION

Automated and Remote

Smart and Autonomous

Data Quality and Quantity



BESSY II +

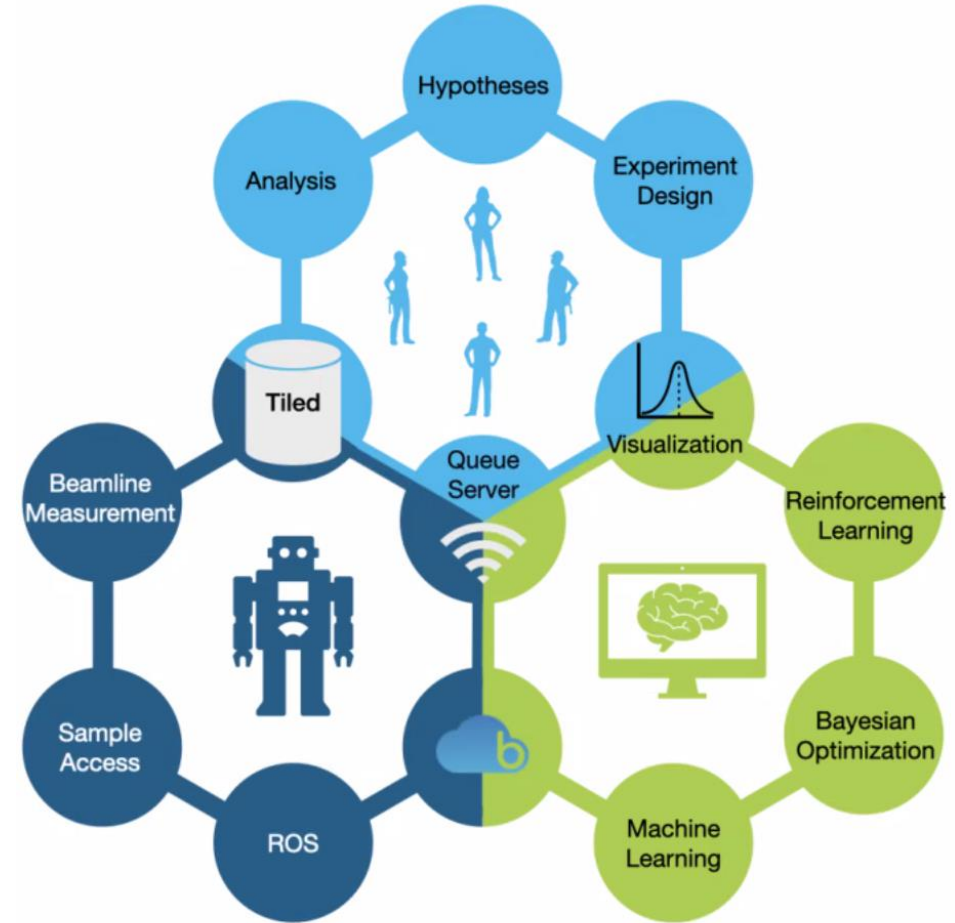
A stepping stone

Operando Experiments

Enabling remote access to experiments and data

Increasing efficiency and throughput

Acquire FAIR Scientific Data



from P. M. Maffettone *et al.* APS UM 2022

OBLIGATION AND OPPORTUNITY

We are publicly funded. We want to give back to the people who support us

Offers exciting opportunities to use data in ways not previously thought of



Findable



Accessible



Interoperable



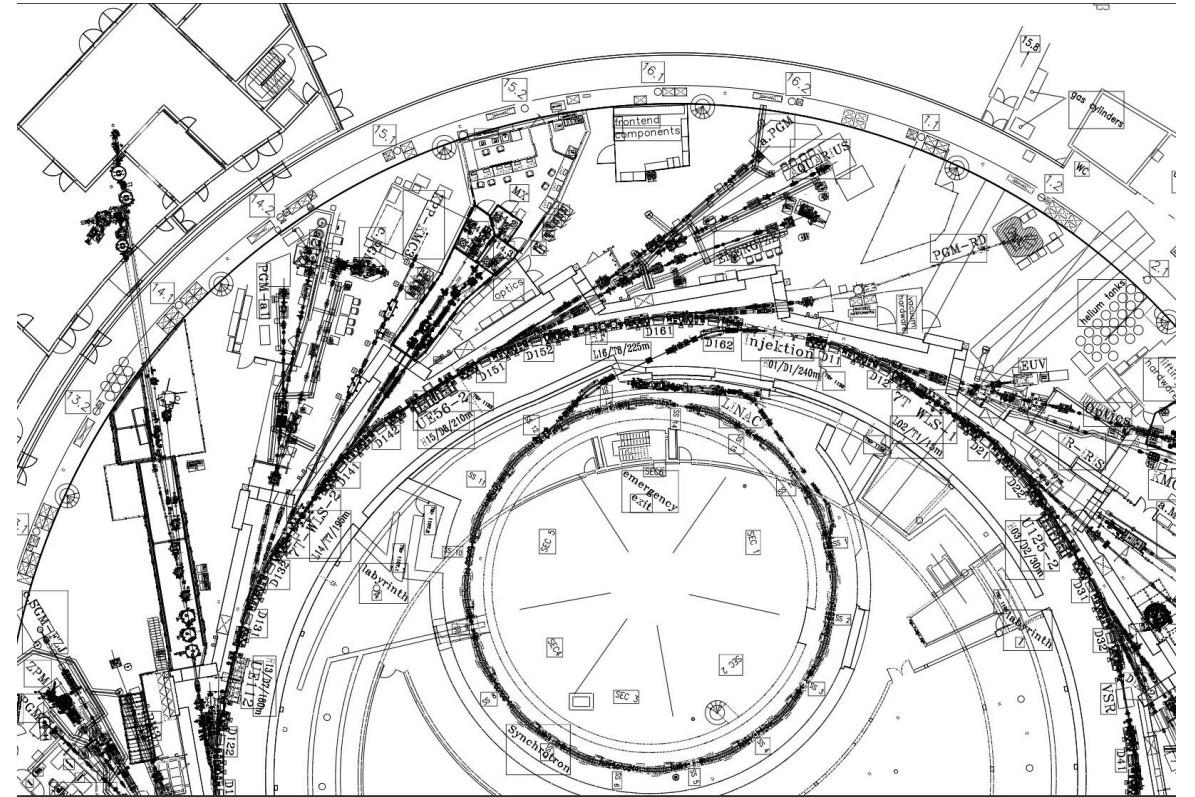
Reusable

HISTORICAL CHALLENGES AT HZB

Only the accelerator uses a consistent control architecture

Lack of central steering and understaffing of experimental control support

Many different individual solutions around the hall. Spec, Igor, EPICS, Tango, bash scripts, pShell, Bluesky...



BESSY II, the most extensive used soft x-ray light source. Around 50 instruments share beamlines and source points at 16 segments of the 240 m storage ring.

2019 PROPOSALS

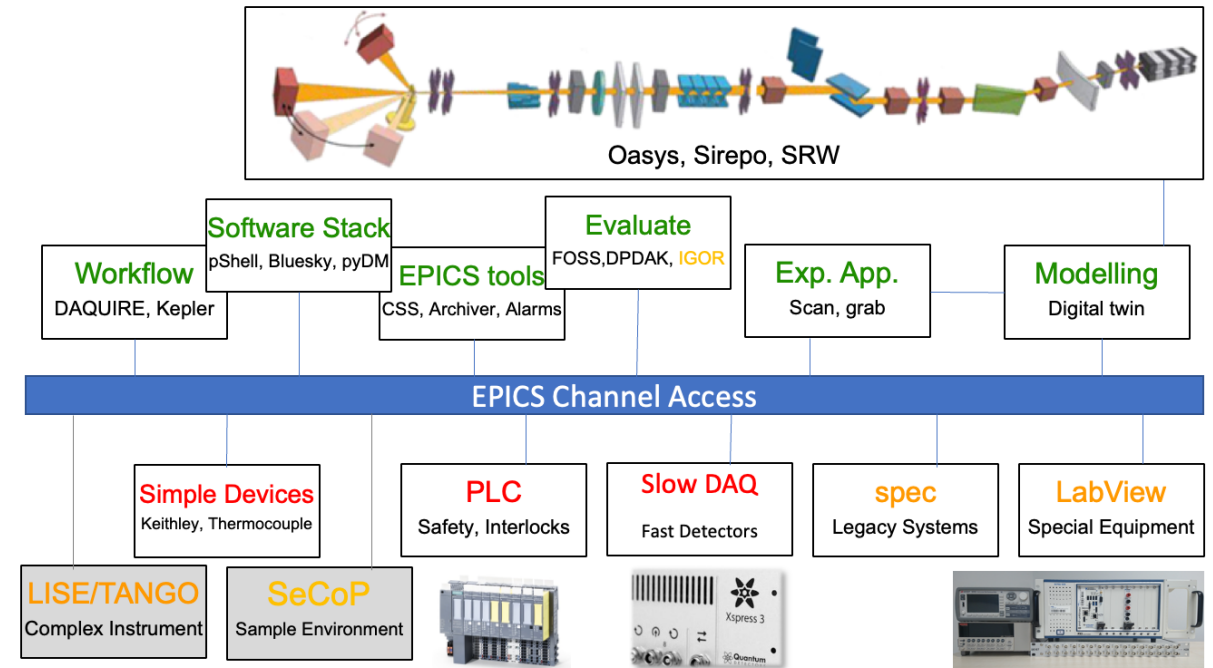
Use EPICS for distributed control system

Standardize on an experiment orchestration tool

Enable machine learning for beamlines and experiments

Develop digital twins for beamlines

Make data FAIR

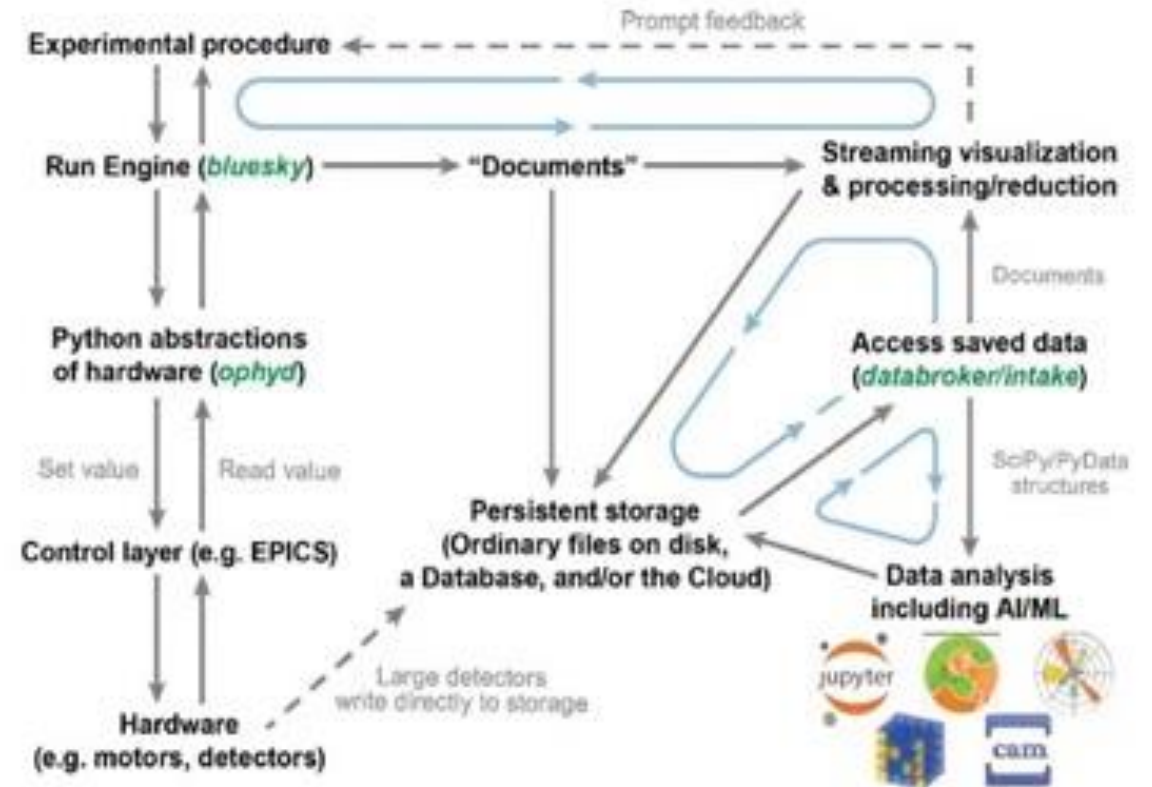


ADOPTION OF BLUESKY

A tool for orchestrating experiments

A series of useful independent python packages

A growing and extremely responsive international collaboration



<https://blueskyproject.io/>

ADOPTION OF BLUESKY

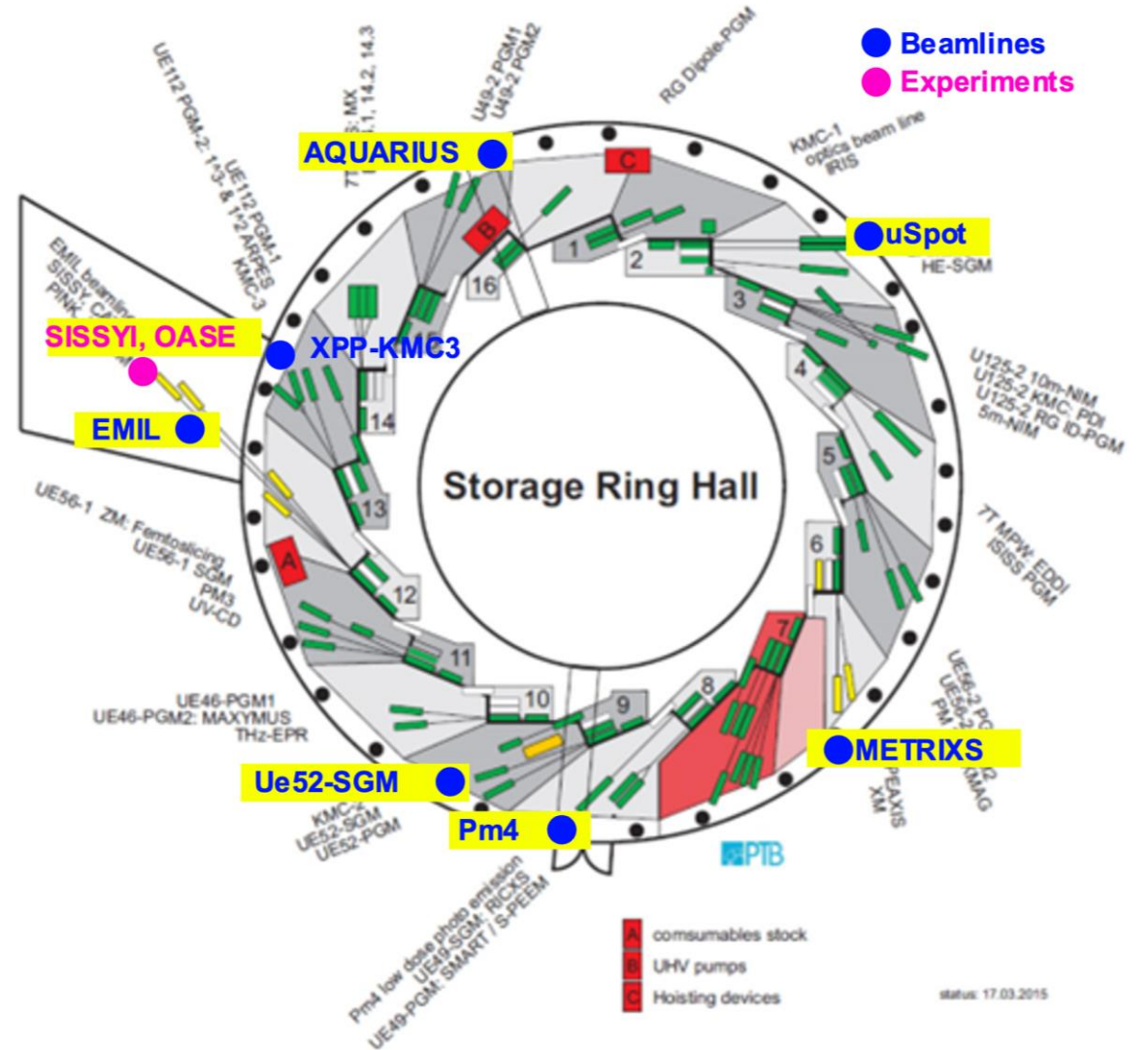
8 Beamlines

4 Experiments

Accelerator Commissioning

Undulator Commissioning

Motion Control Labs



BLUESKY COMMUNITY

NSLS-II, APS, ALS, LCLS, ANSTO, DLS, HZB, FHI, PSI, HZDR, HEPS...

Smaller labs, universities (Madison WI)

Public Mattermost chat, very responsive and with broad expertise

Regular Community Calls

Project Advisory Board

Technical Steering Committee

<https://github.com/bluesky/governance/tree/main>

HZB CONTRIBUTIONS

TUPDP014 A Web client GUI to the Bluesky Queueserver (*Huiling He*)

THMBCM010 Integrating SECoP into Ophyd V2 (*Peter Wegmann*)

THMBCM018 Interacting with digital twins using Bluesky (*Simone Vadilonga*)

The screenshot displays the Bluesky web client interface. The top-left panel shows the 'Status' as 'idle'. The 'RE Manager' panel displays system status: 'Queue is running? Running Plan: NO', 'RE State: idle', 'Queue LOOP mode: OFF', 'Manager State: idle', 'Queue STOP pending: NO', 'Items in queue: 0', and 'Items in history: 4'. The 'Console' panel shows a log of events, including 'new item to the queue ...', 'bluesky_queueserver.manager.manager] Item added: success=False item_type='plan' name='count' qsize=None.', and 'bluesky_queueserver.manager.manager] Adding new item to the queue ...'. The 'Plan Editor' panel allows selecting a plan (currently 'count') and editing parameters like 'detectors', 'det', 'num', 'delay', 'per_shot', 'mtd', and 'Add to Queue'. The 'Queue List' panel shows a list of items in the queue, including 'count' and 'scan' with their respective IDs and actions. The 'Plan History' panel shows a table of completed plans. The 'Plot Data' panel displays a graph of a parabolic curve.

Actions	Result	Plan	Args
completed		count	[[{"det1": "det2"}]]
completed		scan	[[{"det1": "det2"}, {"motor": 1.1, 1.0}]]

ROCK-IT

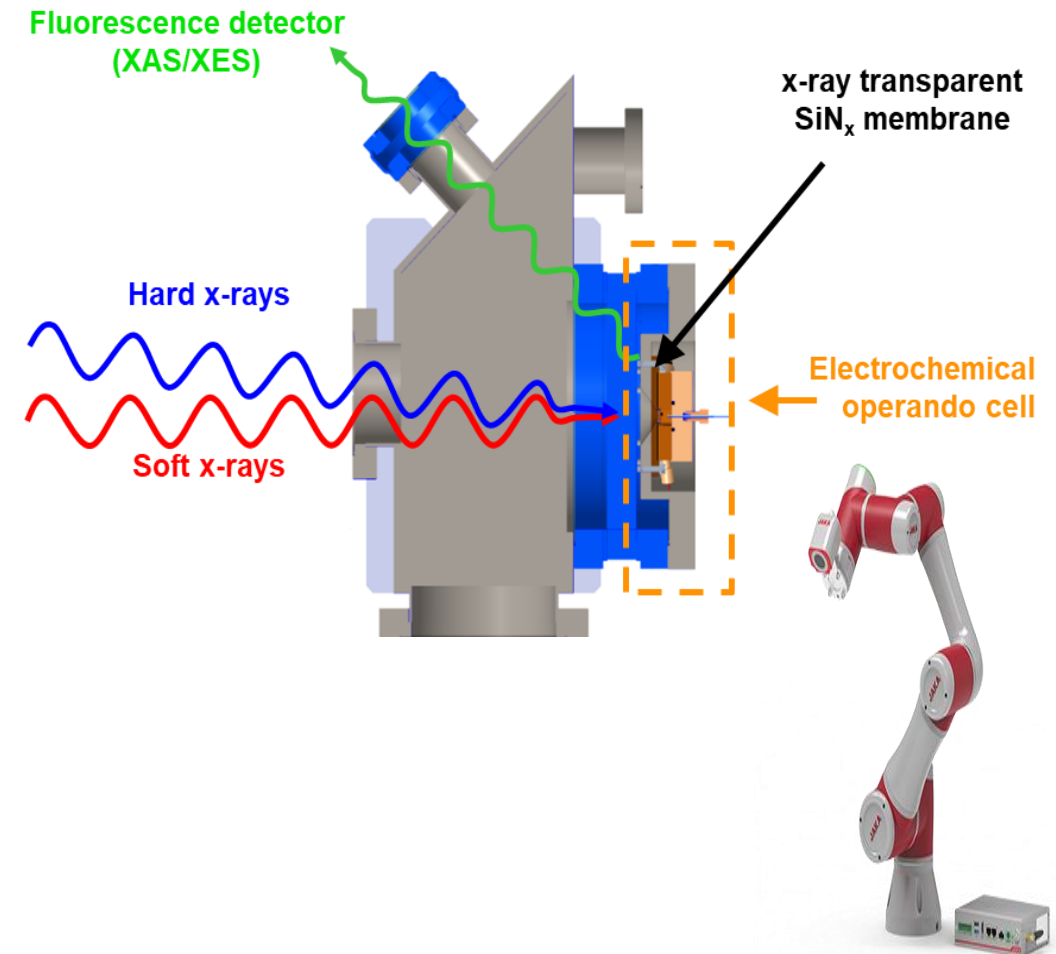
Provides a common goal and shared forces from member institutes

Automation of Operando Catalysis Experiments

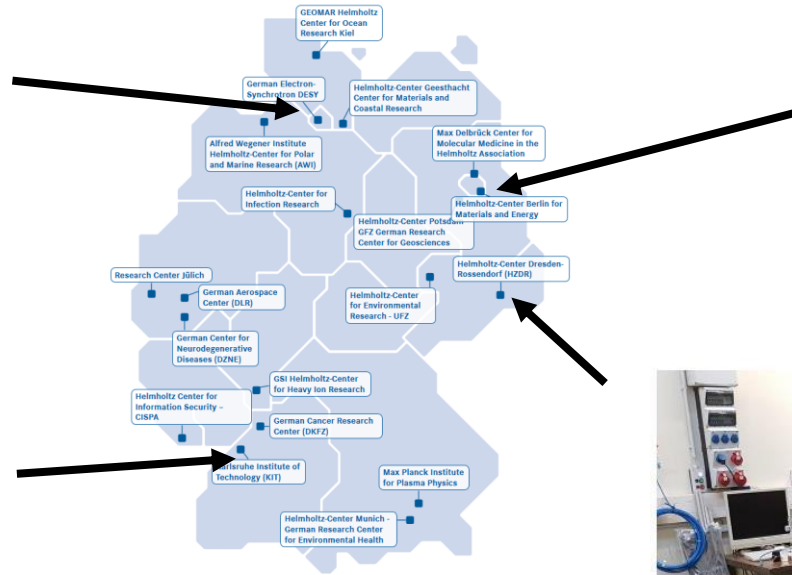
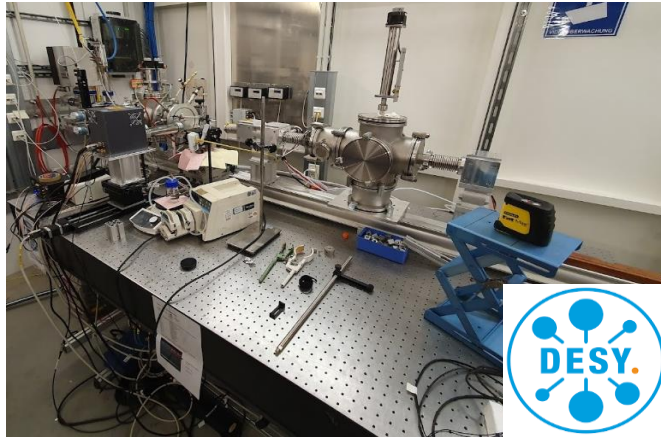
Remote Access to Experiment and Data

Integration of challenging sample environment

Integrating ML tools



A COLLABORATION



THE ELEPHANT IN THE ROOM



SUMMARY

BESSY III 4th Gen Light Source

FAIR Data obligations are also an opportunity

Grassroots activity led to standardization on EPICS and Bluesky

ROCK-IT demonstrator

Hack provides an opportunity!



THANKS FOR YOUR ATTENTION!