# NICOS Update

## Spectroscopy STAP

MATT CLARKE (ECDC)

# Agenda

1. Background
2. Architecture
3. ESS Specific
4. Instrument Specific
5. YMIR
6. BIFROST
7. What next?

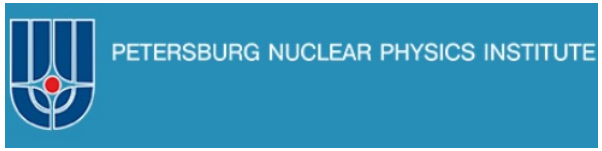
# Background

- Developed for FRM II (MLZ) in Munich
  - Started ~2002, developed for specific beamlines
  - Modernisation project started in 2009
  - Decision made to use it on all beamlines (2013)
- ESS and SINQ joined the collaboration ~2016
  - Survey of existing control systems such as IBEX, SICS, Bluesky, Sardar
- Deployed at V20 for ESS tests
  - Choppers, SANS, …
- Deployed at Utgård for integrating SE
- YMIR
  - Motion, scanning, light tomo
- BIFROST, ESTIA and ODIN

# Facilities


BRIN
batan


PAUL SCHERRER INSTITUT
PSI


PETERSBURG NUCLEAR PHYSICS INSTITUTE


MGML


MLZ
Heinz Maier-Leibnitz Zentrum


INL
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ENTERING

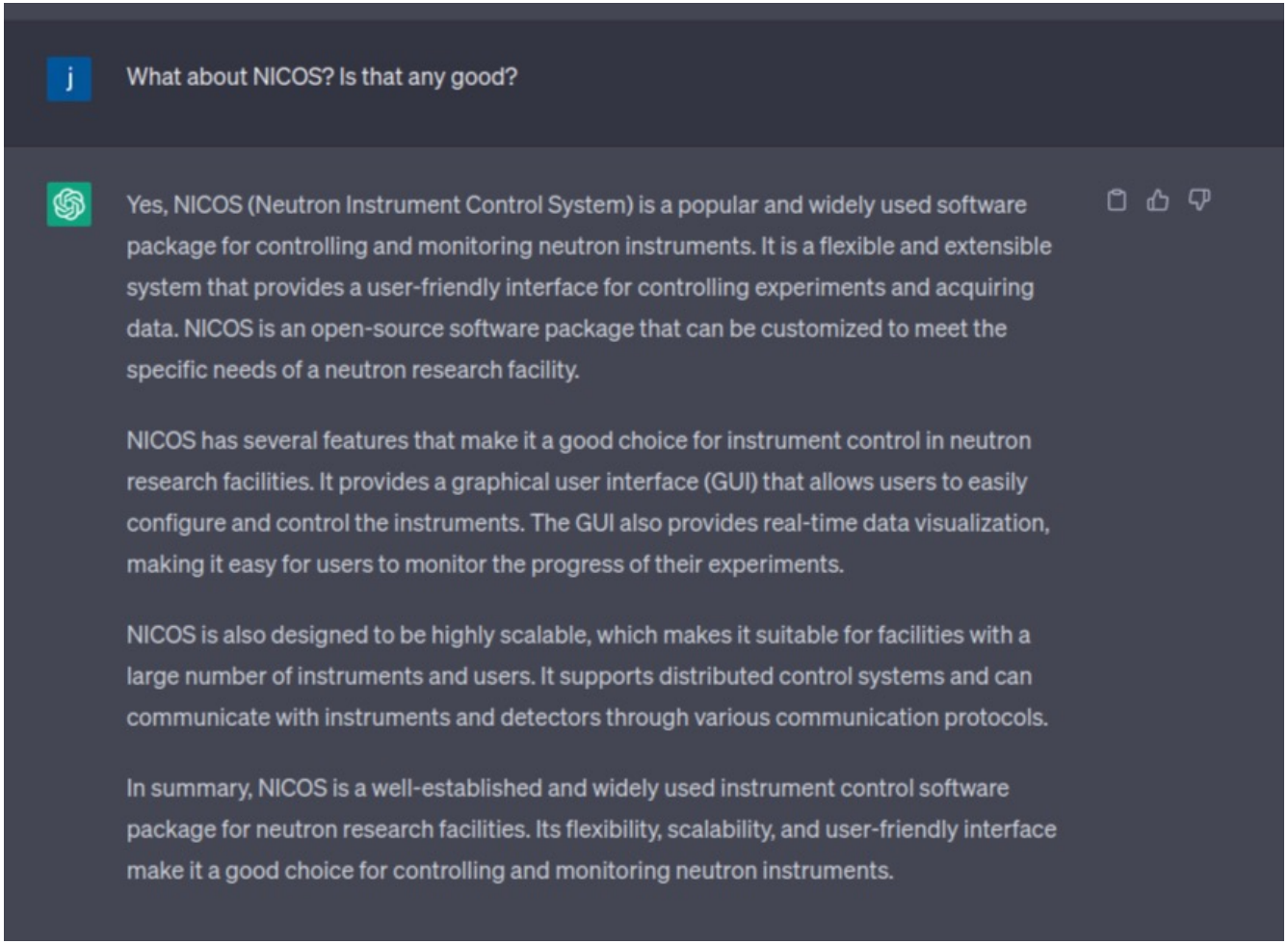

LAHN
LABORATORIO ARGENTINO
DE HACES DE NEUTRONES


TU
WIEN
TECHNISCHE
UNIVERSITÄT
WIEN
Vienna University of Technology


ISIS Neutron and
Muon Source

*

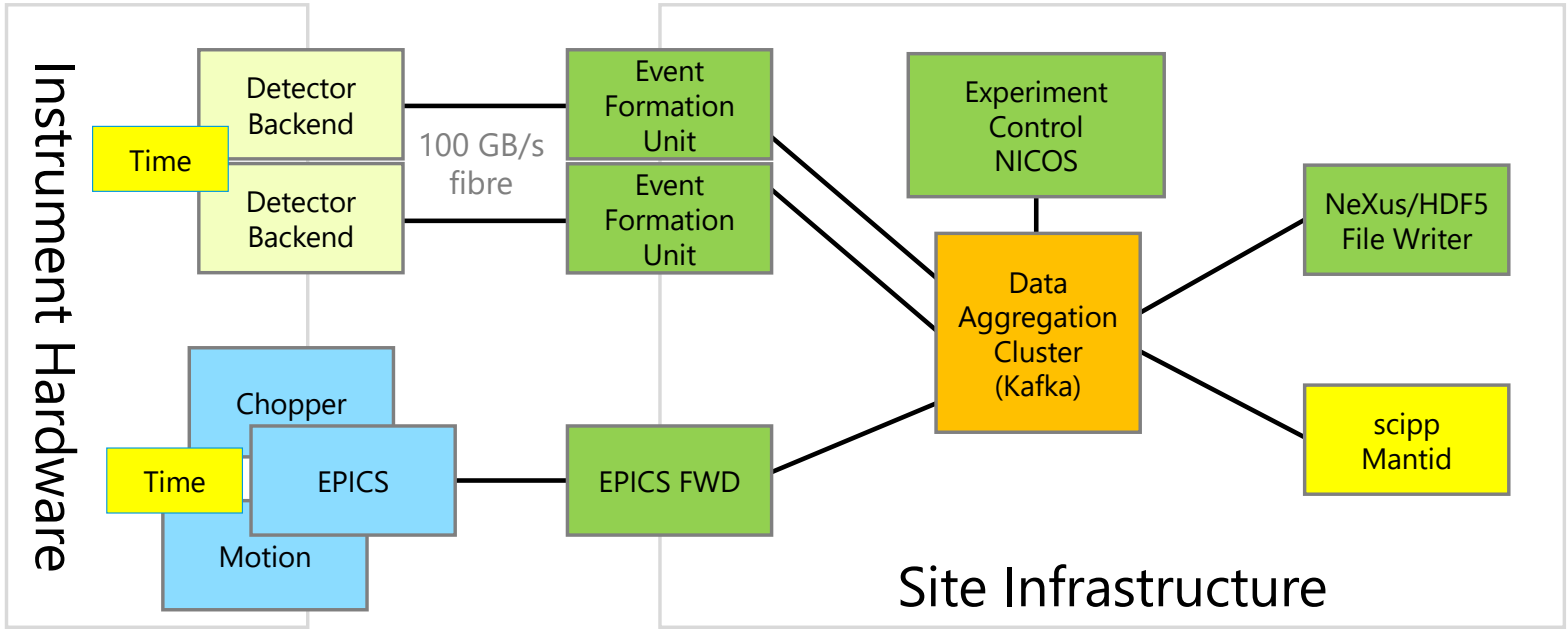
# Why NICOS?


j
What about NICOS? Is that any good?
Yes, NICOS (Neutron Instrument Control System) is a popular and widely used software package for controlling and monitoring neutron instruments. It is a flexible and extensible system that provides a user-friendly interface for controlling experiments and acquiring data. NICOS is an open-source software package that can be customized to meet the specific needs of a neutron research facility.
NICOS has several features that make it a good choice for instrument control in neutron research facilities. It provides a graphical user interface (GUI) that allows users to easily configure and control the instruments. The GUI also provides real-time data visualization, making it easy for users to monitor the progress of their experiments.
NICOS is also designed to be highly scalable, which makes it suitable for facilities with a large number of instruments and users. It supports distributed control systems and can communicate with instruments and detectors through various communication protocols.
In summary, NICOS is a well-established and widely used instrument control software package for neutron research facilities. Its flexibility, scalability, and user-friendly interface make it a good choice for controlling and monitoring neutron instruments.

# Architecture

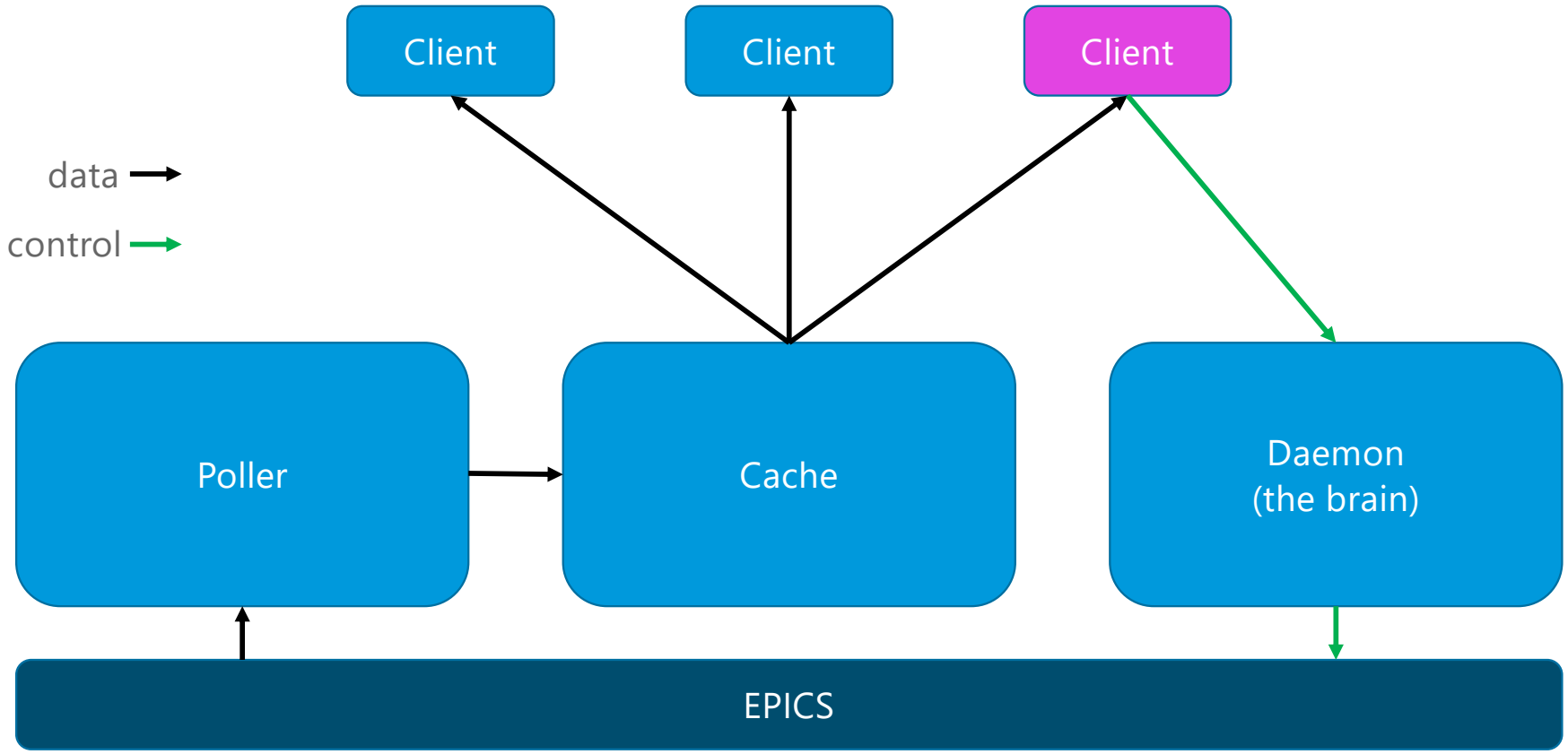
# Architecture

## ECDC

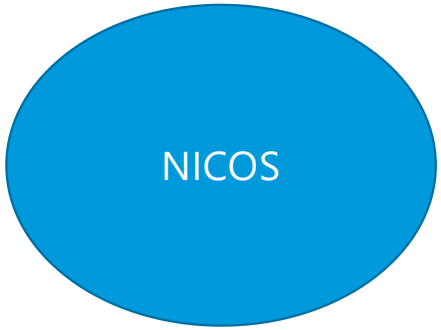


# Architecture

## NICOS

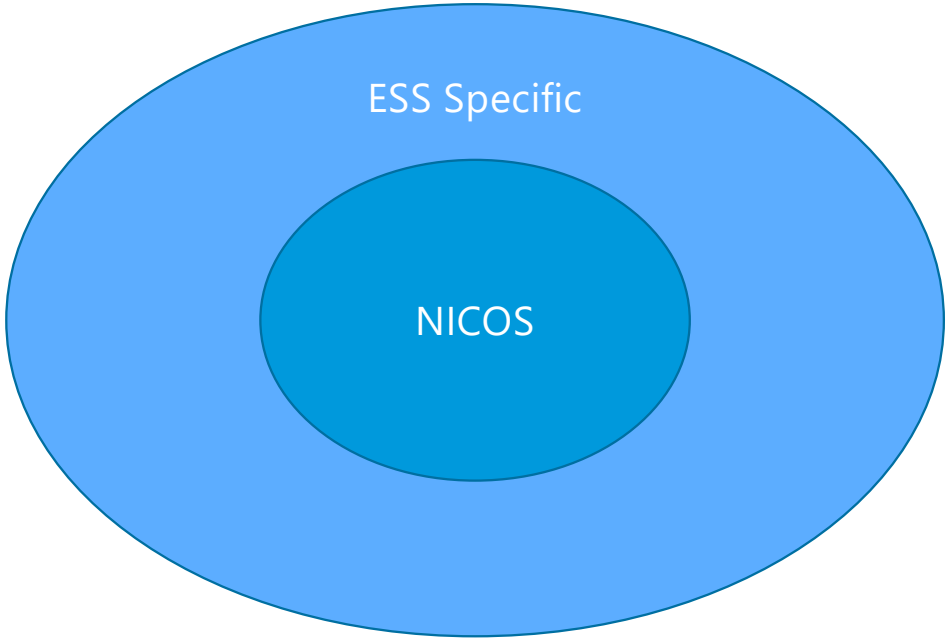


# Core Functionality



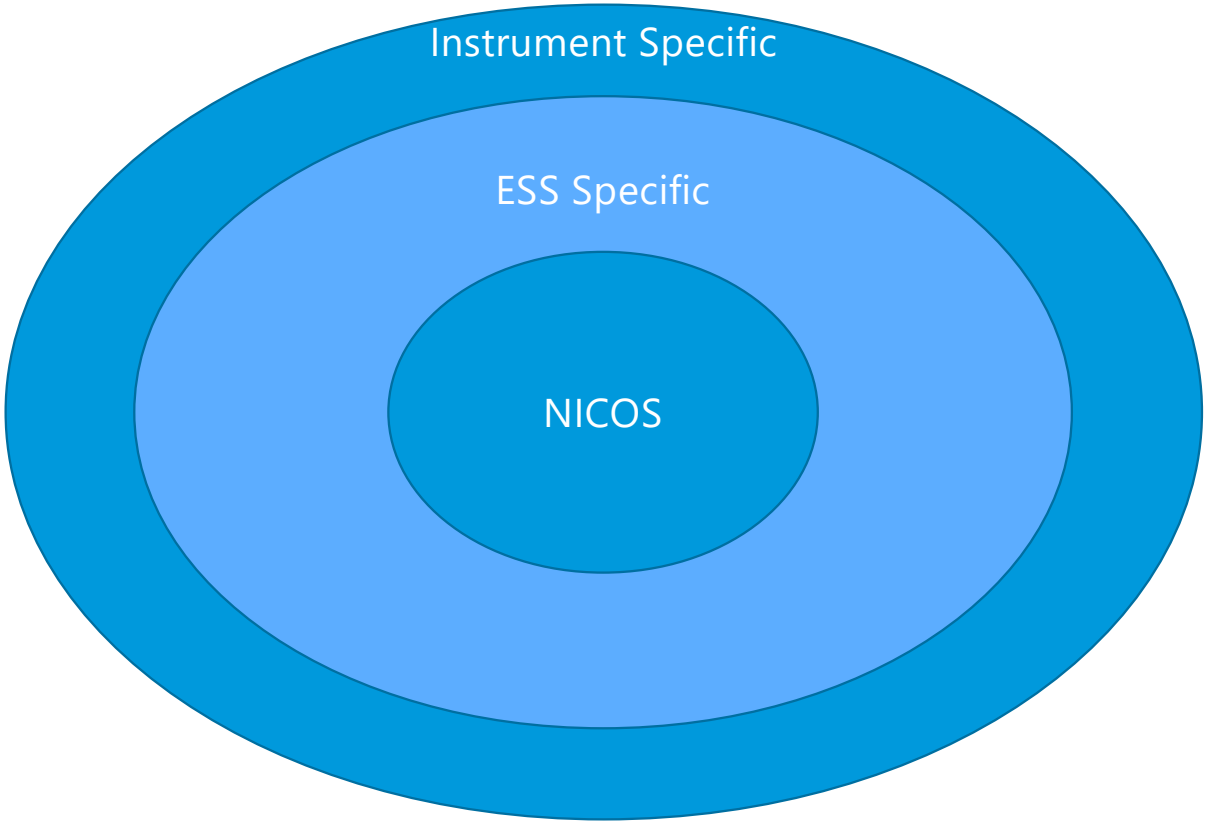

- Poller
- Cache
- Daemon
- Architecture
- Device hierarchy
- …

# ESS Specific




- EPICS support
  - Monitors
- Data files
  - Kafka file-writer
- ESS proposal system
- flowui
- Live display
- Graylog
- Common devices
- …

# Instrument Specific




- Special devices
- Custom commands
- Scripts
- GUI widgets
- …

# ESS Specific

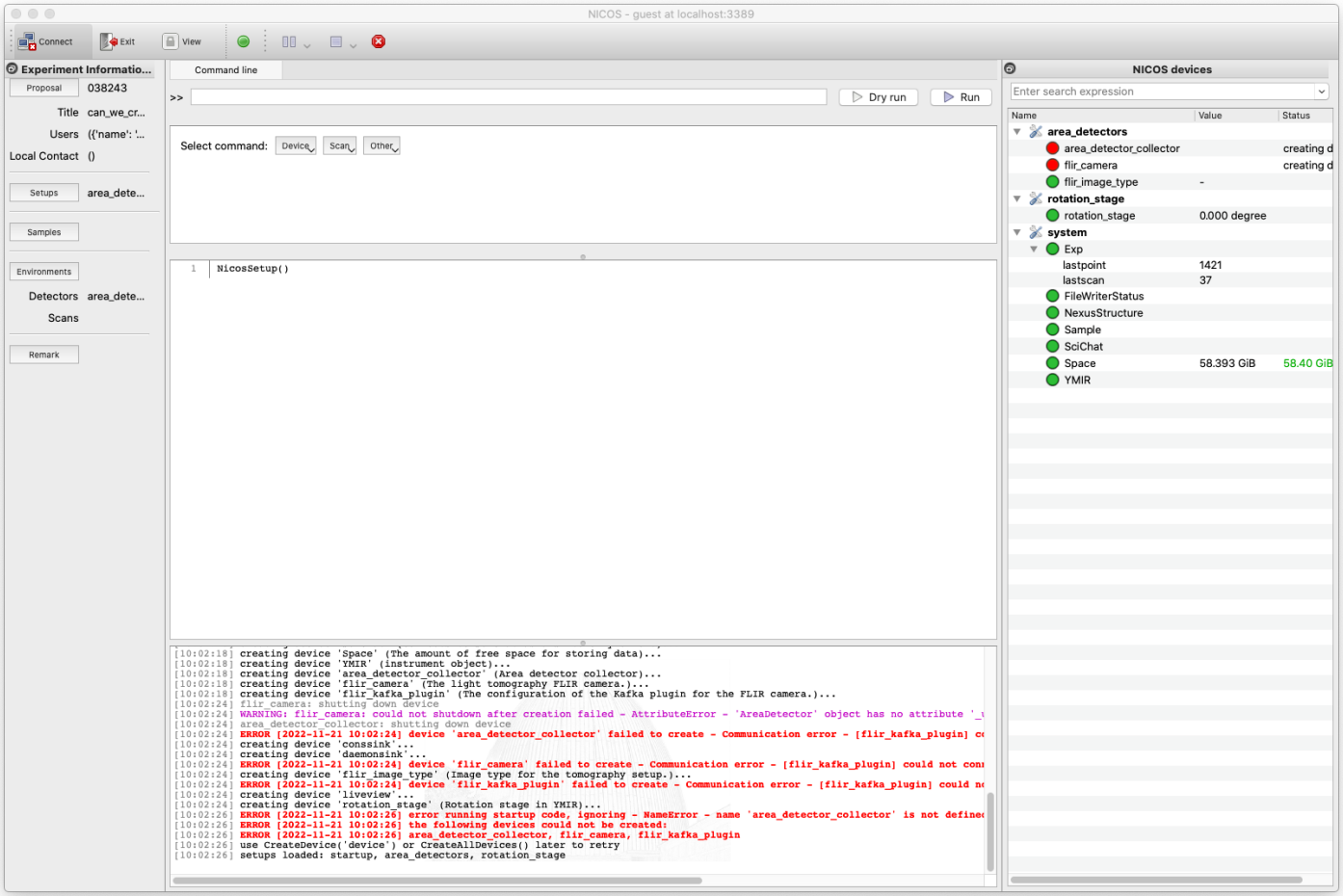
# ESS Specific

## Common across all instruments

- EPICS support
- Filewriter configuration and control
- Proposal system
- Common devices
  - Choppers
  - Motors
- flowui 
- …

# NICOS GUI

## Win95?



# NICOS GUI

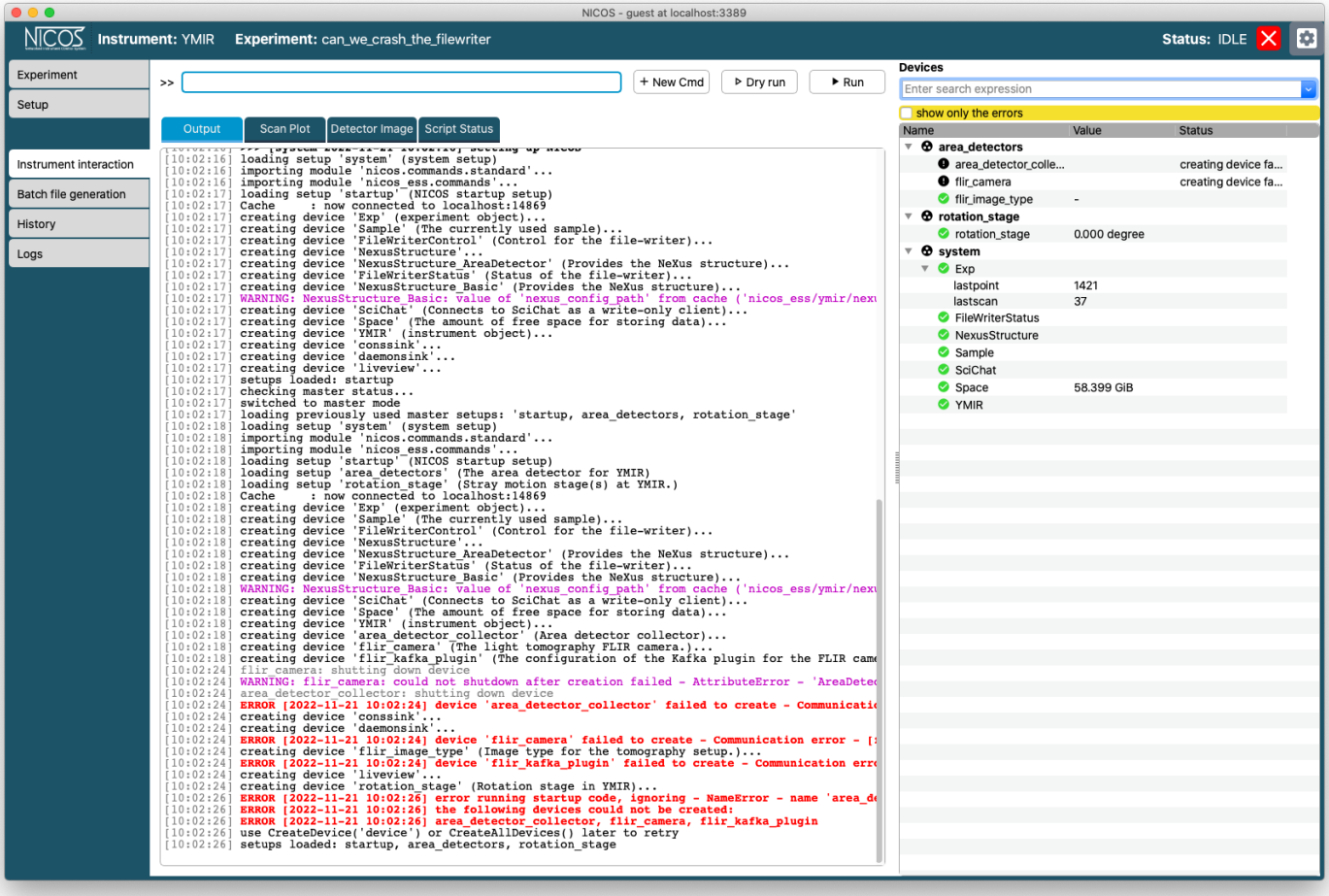
## Ask the experts

- User Journey
  - who they are; skills and background
  - what are their goals
  - what annoys them
- Workflow
  - from start to finish
- Interaction
  - how things do things in the GUI
- Perceptual
  - how things look and behaviour. E.g. buttons, icons, etc.
  - subconscious clues
  - visual impairments


https://www.designpsykologi.dk/

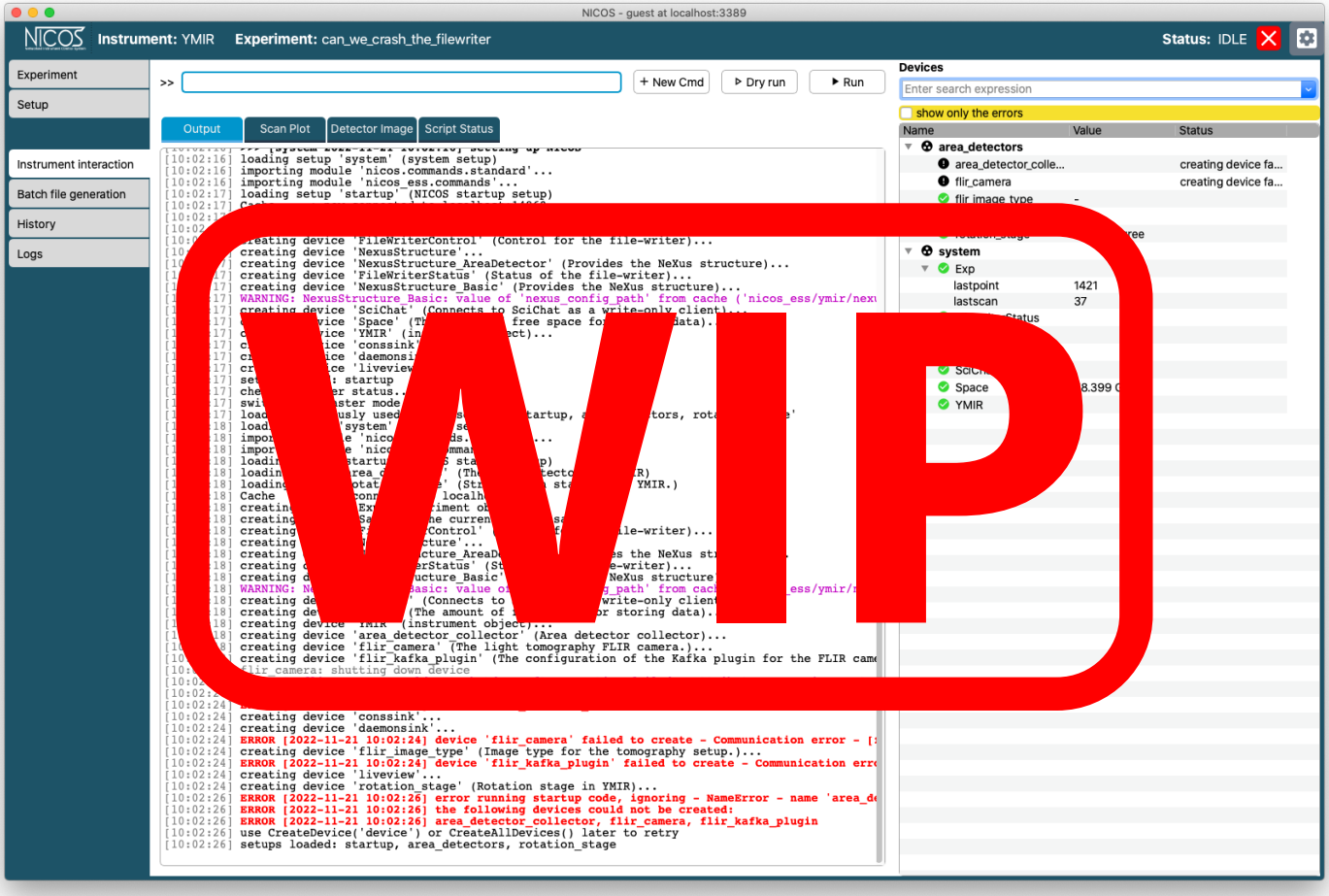
# NICOS flowui

## WinXP?



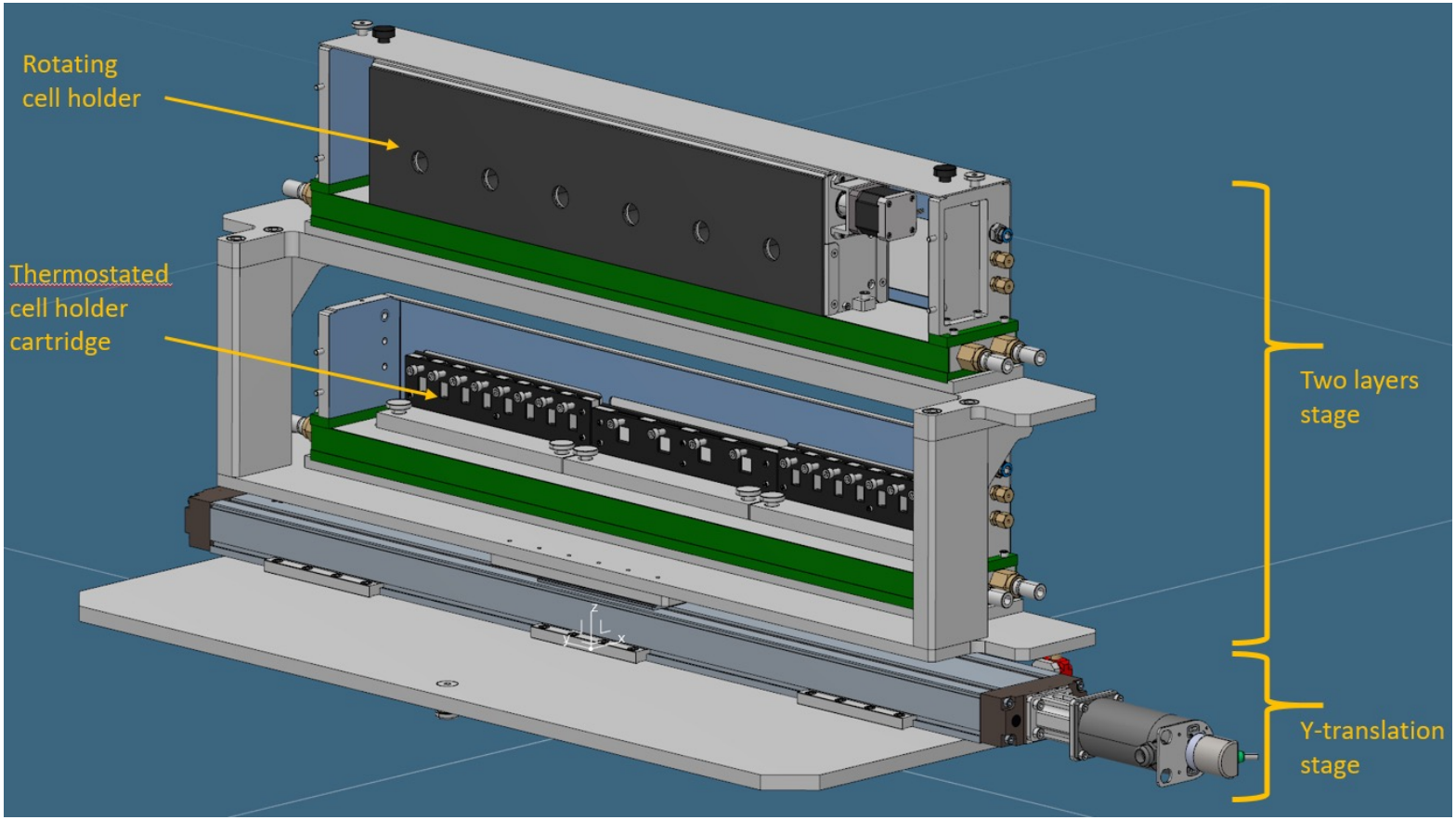
# NICOS flowui

## WinXP?



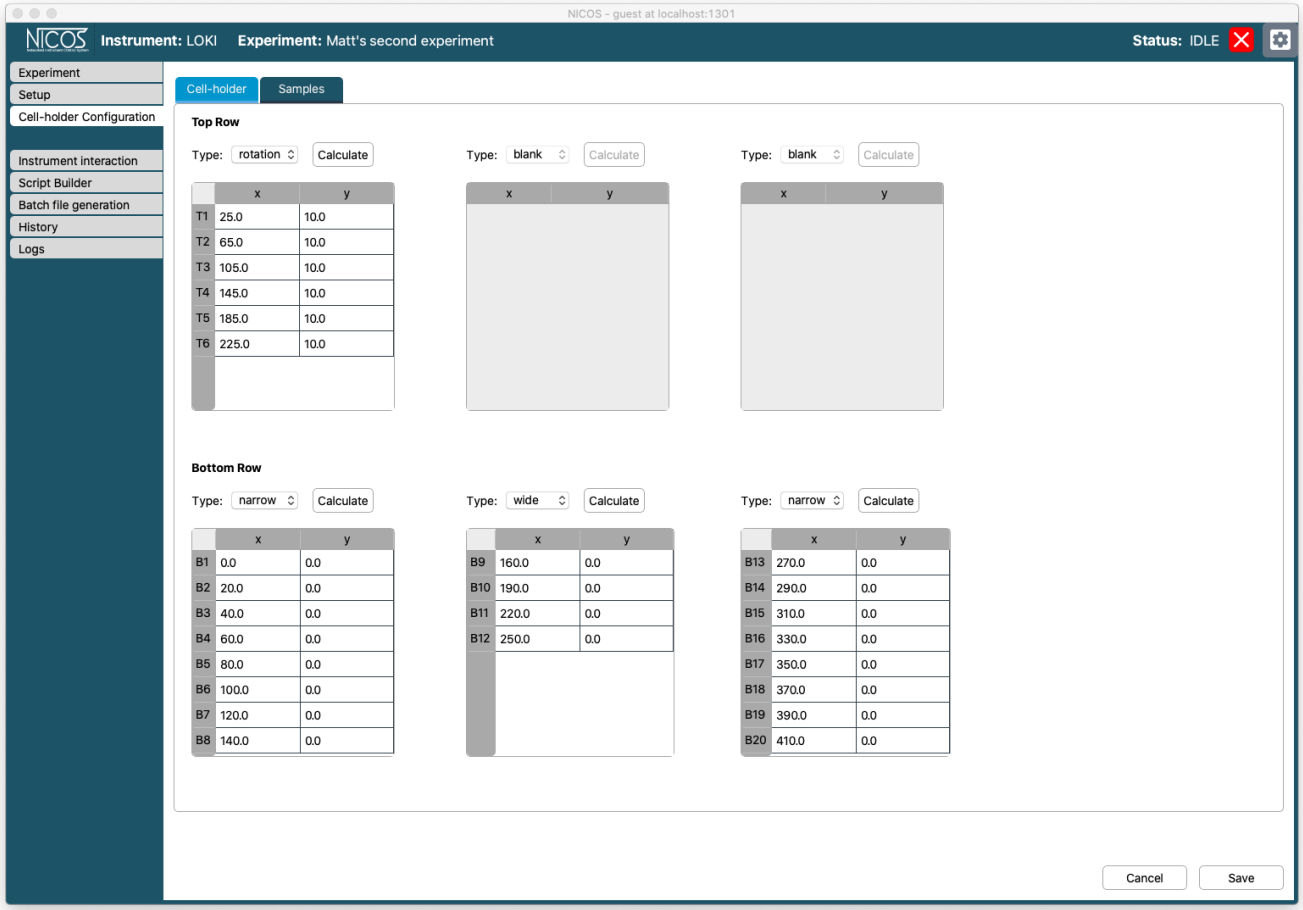
# Instrument Specific

# LoKI Cell-holder



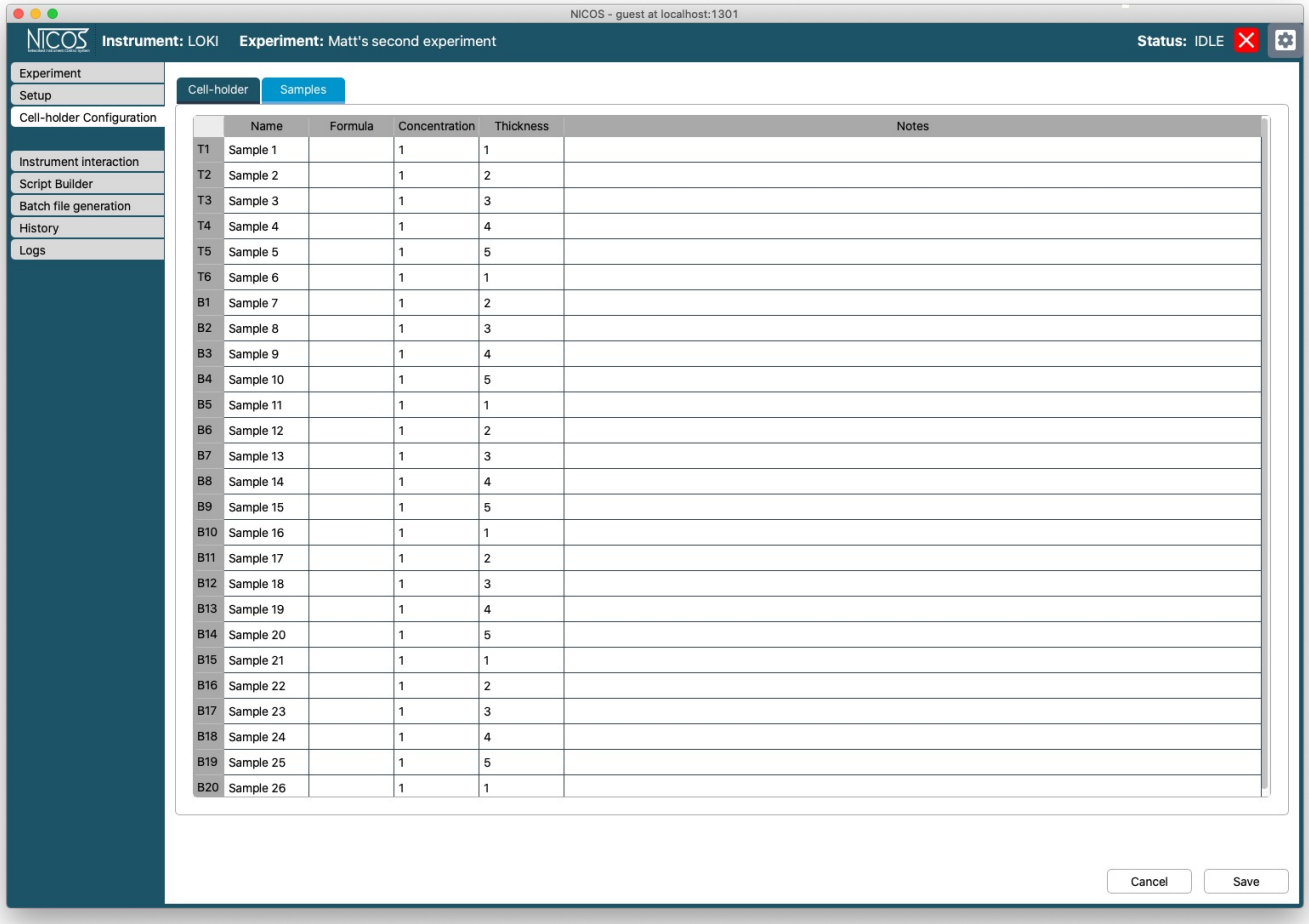
# LoKI Cell-holder

## Configure



# LoKI Cell-holder

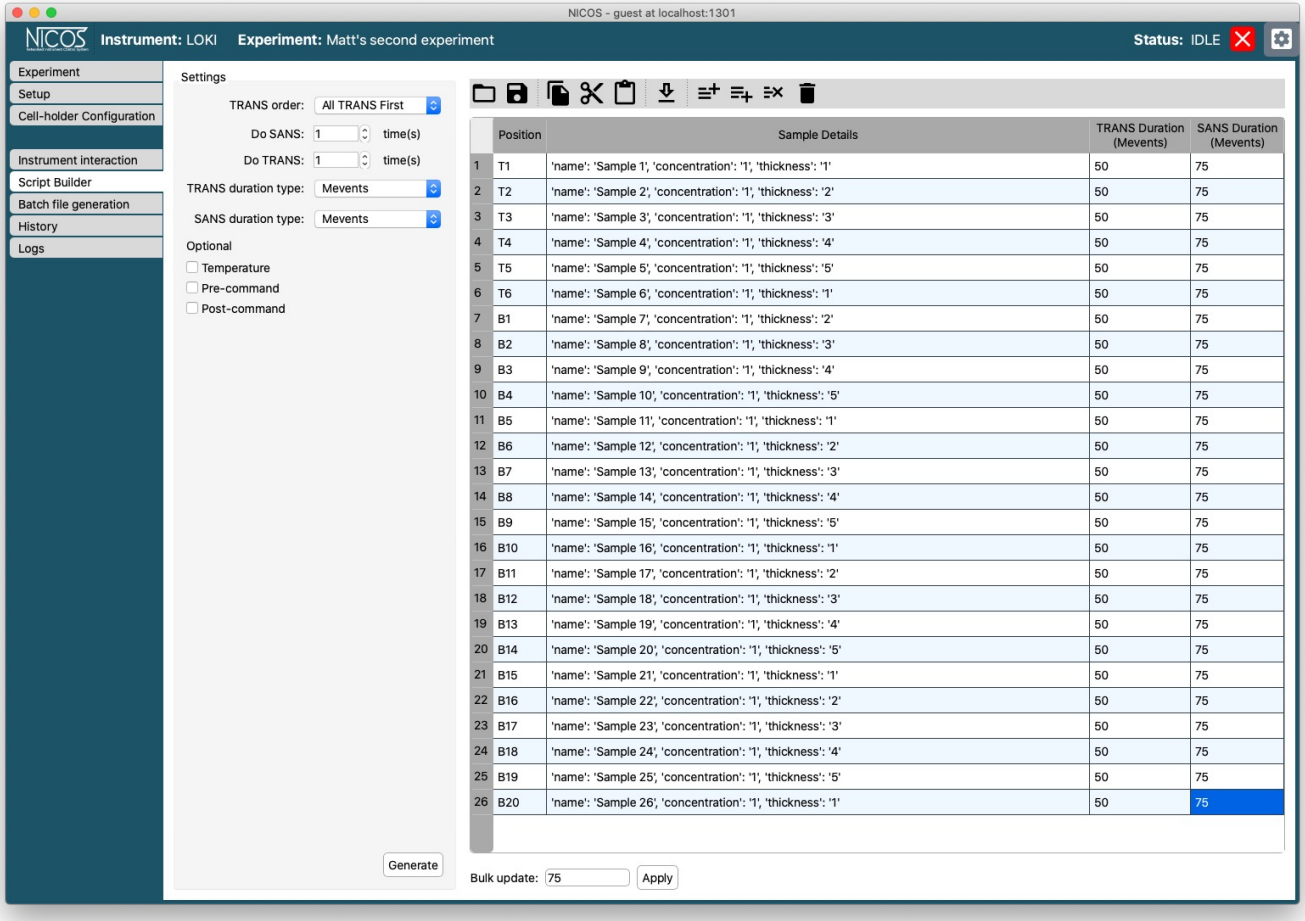
## Samples




| | Name | Formula | Concentration | Thickness | Notes |
|---|---|---|---|---|---|
| T1 | Sample 1 | | 1 | 1 | |
| T2 | Sample 2 | | 1 | 2 | |
| T3 | Sample 3 | | 1 | 3 | |
| T4 | Sample 4 | | 1 | 4 | |
| T5 | Sample 5 | | 1 | 5 | |
| T6 | Sample 6 | | 1 | 1 | |
| B1 | Sample 7 | | 1 | 2 | |
| B2 | Sample 8 | | 1 | 3 | |
| B3 | Sample 9 | | 1 | 4 | |
| B4 | Sample 10 | | 1 | 5 | |
| B5 | Sample 11 | | 1 | 1 | |
| B6 | Sample 12 | | 1 | 2 | |
| B7 | Sample 13 | | 1 | 3 | |
| B8 | Sample 14 | | 1 | 4 | |
| B9 | Sample 15 | | 1 | 5 | |
| B10 | Sample 16 | | 1 | 1 | |
| B11 | Sample 17 | | 1 | 2 | |
| B12 | Sample 18 | | 1 | 3 | |
| B13 | Sample 19 | | 1 | 4 | |
| B14 | Sample 20 | | 1 | 5 | |
| B15 | Sample 21 | | 1 | 1 | |
| B16 | Sample 22 | | 1 | 2 | |
| B17 | Sample 23 | | 1 | 3 | |
| B18 | Sample 24 | | 1 | 4 | |
| B19 | Sample 25 | | 1 | 5 | |
| B20 | Sample 26 | | 1 | 1 | |

# LoKI Cell-holder

## Script generator

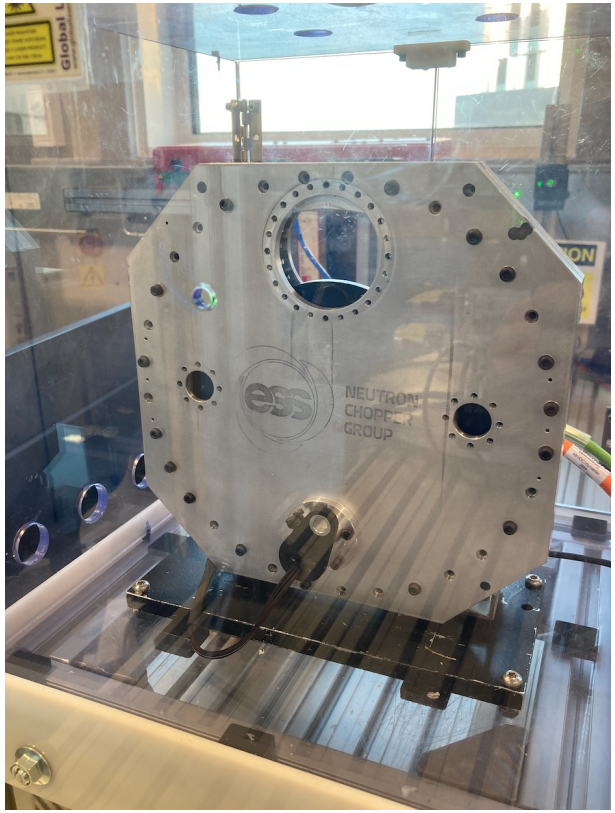


# YMIR

# Integration Platform (Instrument) YMIR in B02

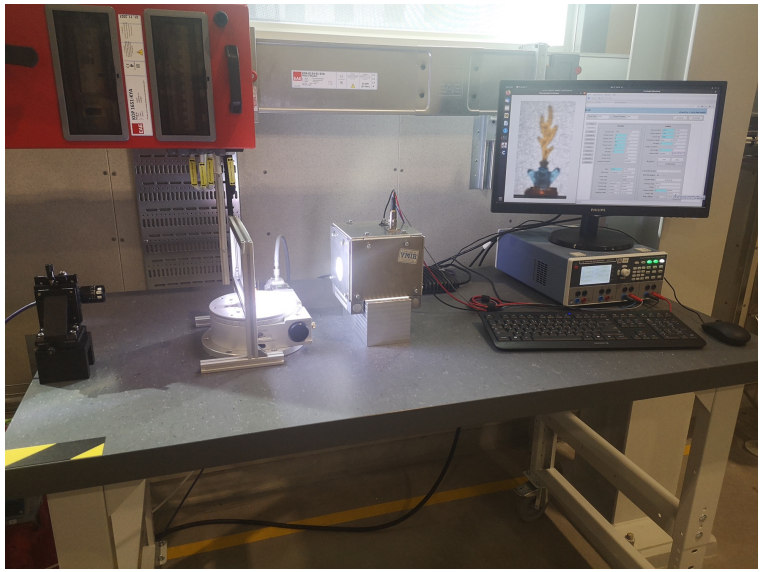
# Mini-chopper and laser scanning

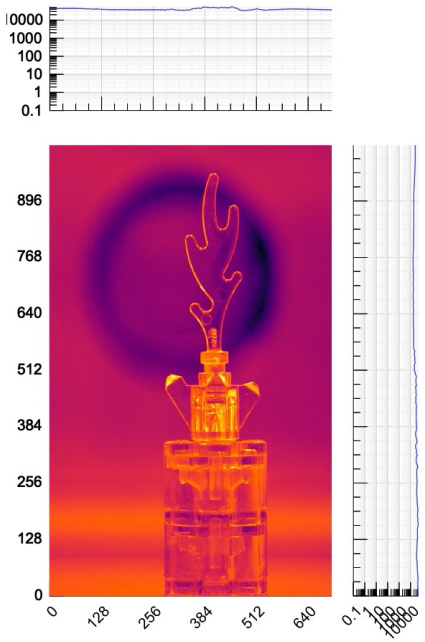
## Like a real chopper only smaller




# Light Tomography

## ~= to a real experiment

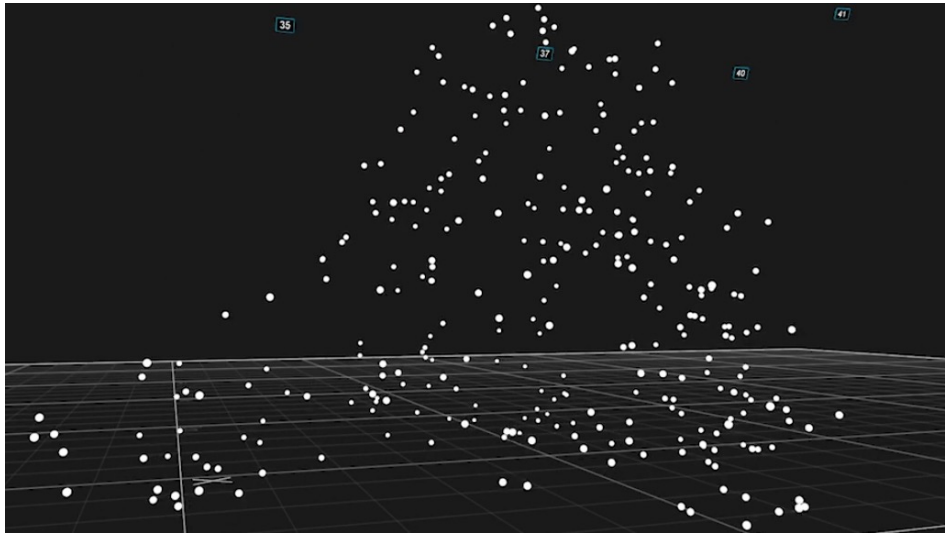





- Integrating different cameras
  - EPICS
  - NICOS
- Sending images to Kafka
- Writing image data to NeXus
- Real infrastructure
  - Networking (Lund & DMSC)
  - Servers
  - Timing system
  - SciCat
- Rotation stage integration
  - 0 to 360, -180 to 180 or -∞ to ∞?

# ODIN Metrology

## OptiTrack Motive




# BIFROST

# Bandwidth Choppers

Thursday, January 19th

**Markus Olsson** 8:53 AM
Hi Matt, I'm available but I also have some visitors from Hungary that may arrive soon.

For how long do you need to rotate the chopper and what data do you need?

**Matt Clarke (he/him)** 8:55 AM
if everything works then 10 minutes or so

I'm just setting up

**Markus Olsson** 8:56 AM
Everything will work, it's chopper controls team you are working with

😂

**Matt Clarke (he/him)** 9:02 AM
Okay, let's try it. Can I start the choppers?

# Bandwidth Choppers

## Controlled through NICOS

**Experiment Control and Data Curation**

**First data collected from an ESS instrument!**

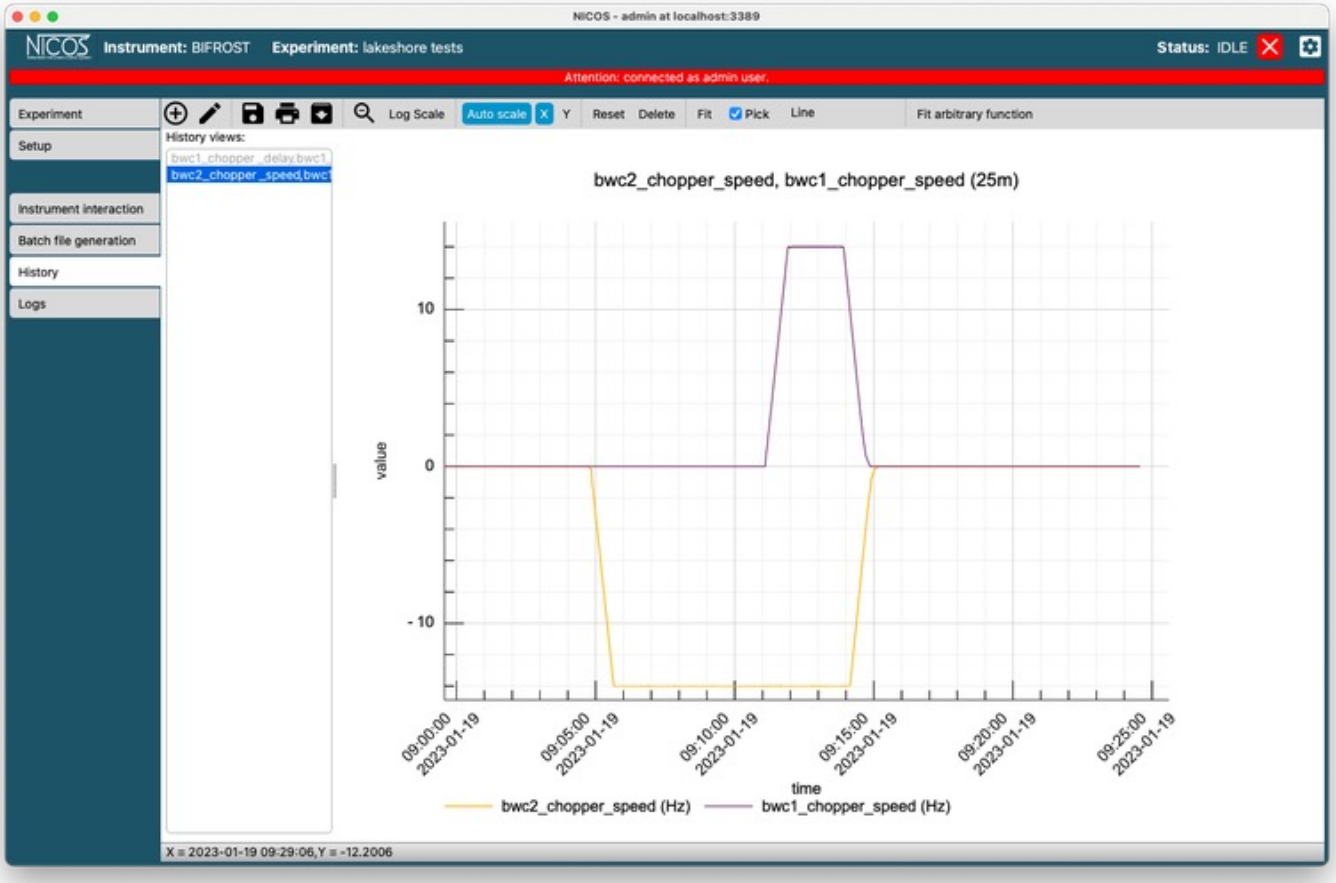
Through the joint effort by teams from NSS, DMSC and ICS commissioning data from the commissioned BIFROST bandwidth chopper has been collected, using the full ESS controls, data acquisition and data curation pipeline.

The bandwidth choppers' operation was controlled with the NICOS experiment control software, which will be used for future user operations.

Data from the chopper status and performance was recorded using the infrastructure in the ESS server hall in the Central Utility Building. The automatic migration of the files to the DMSC data storage in Copenhagen is also in place.

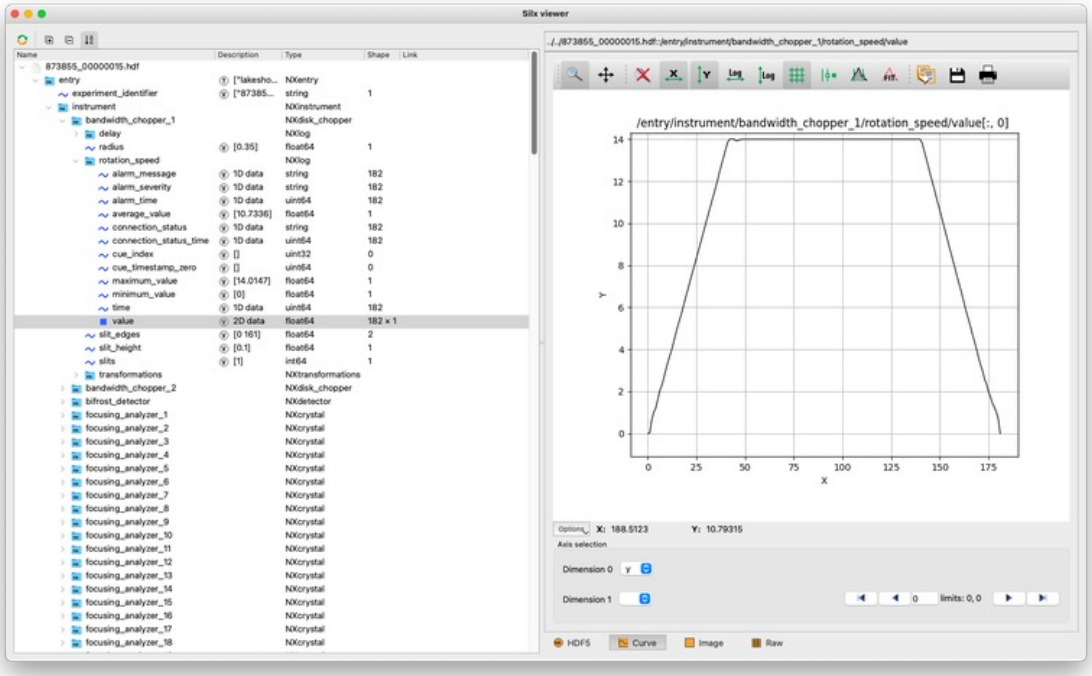
The data is being ingested into the data catalogue to make datasets findable, which is a crucial part of the scientific workflow for the future scientists.

Anders Pettersson (ECDC) and Nicklas Holmberg (ICS) at the BIFROST chopper in E02.

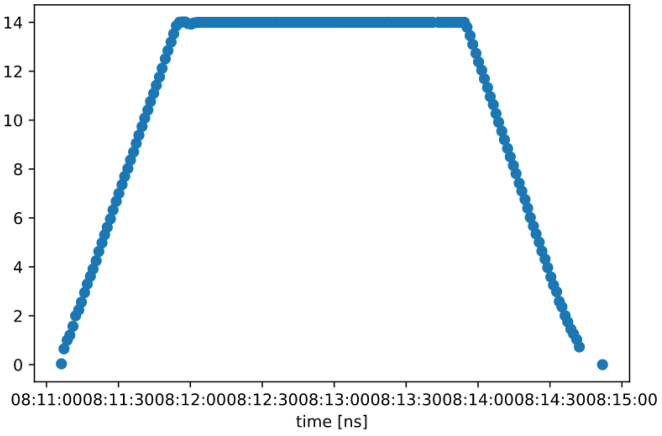


# Bandwidth Choppers

## NeXus file and SCIPP




```
: c1 = dg['entry']['instrument']['bandwidth_chopper_1']
  c1['rotation_speed'][1:].plot()
```



# Lakeshore temperature controller

## Second data

**Experiment Control and Data Curation**

**First data collected from an ESS instrument!**

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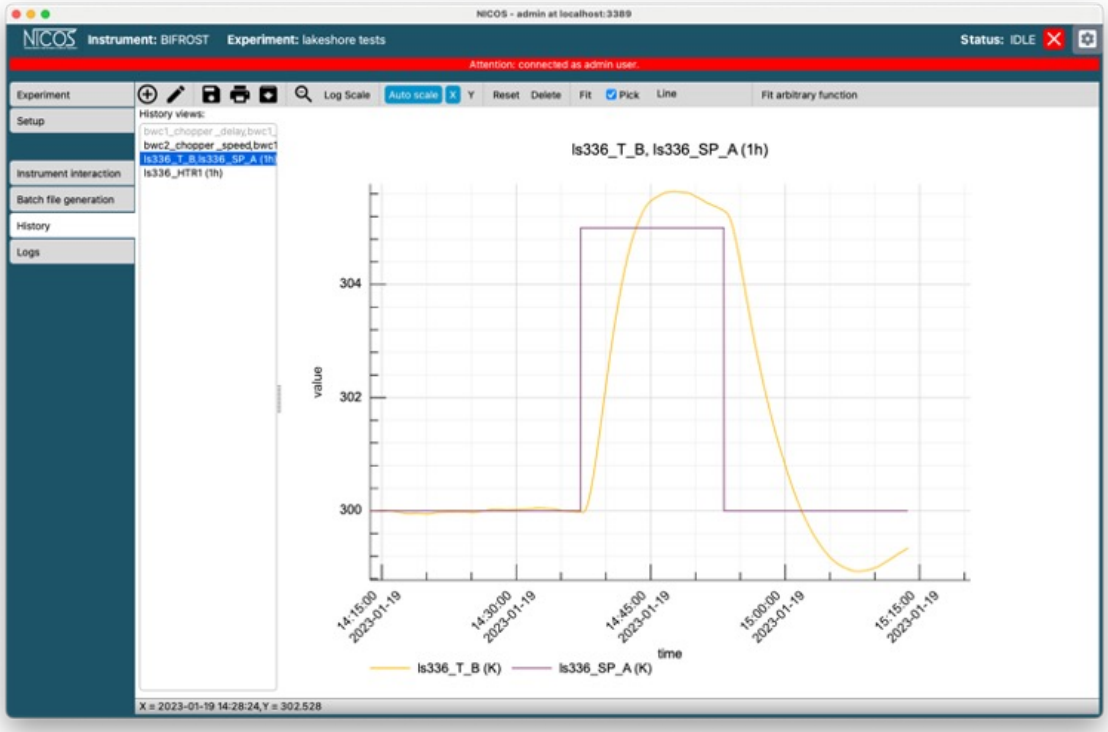


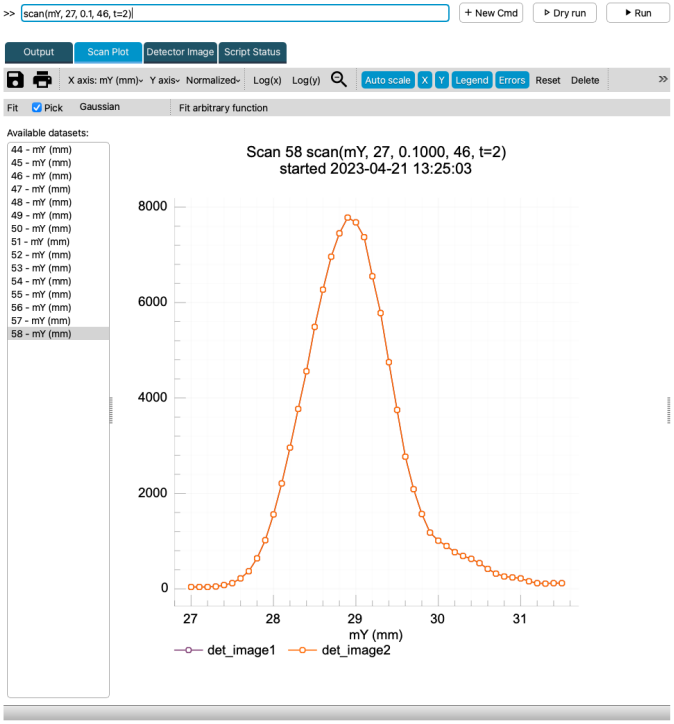
# NICOS Baseline

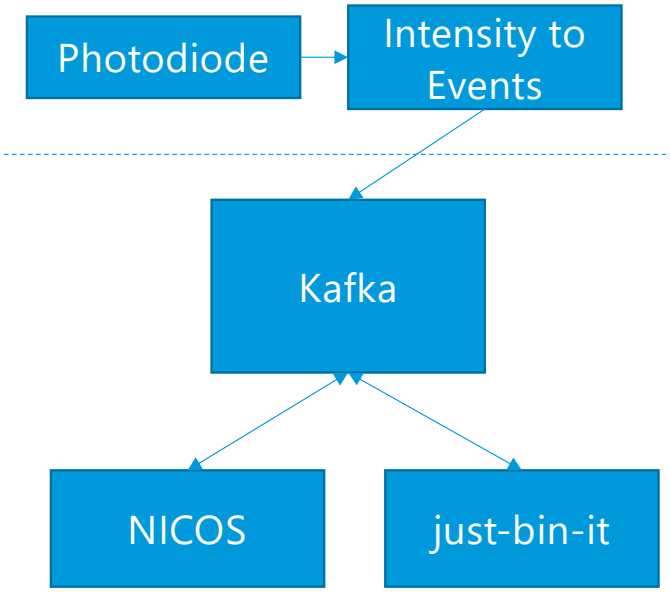
A first pass on an instrument to see what additional functionality is required:

- NICOS demonstration at YMIR
- Discussion of instrument specifics
- Tasks created in ECDC JIRA


# 1-D Monitor Data vs Something

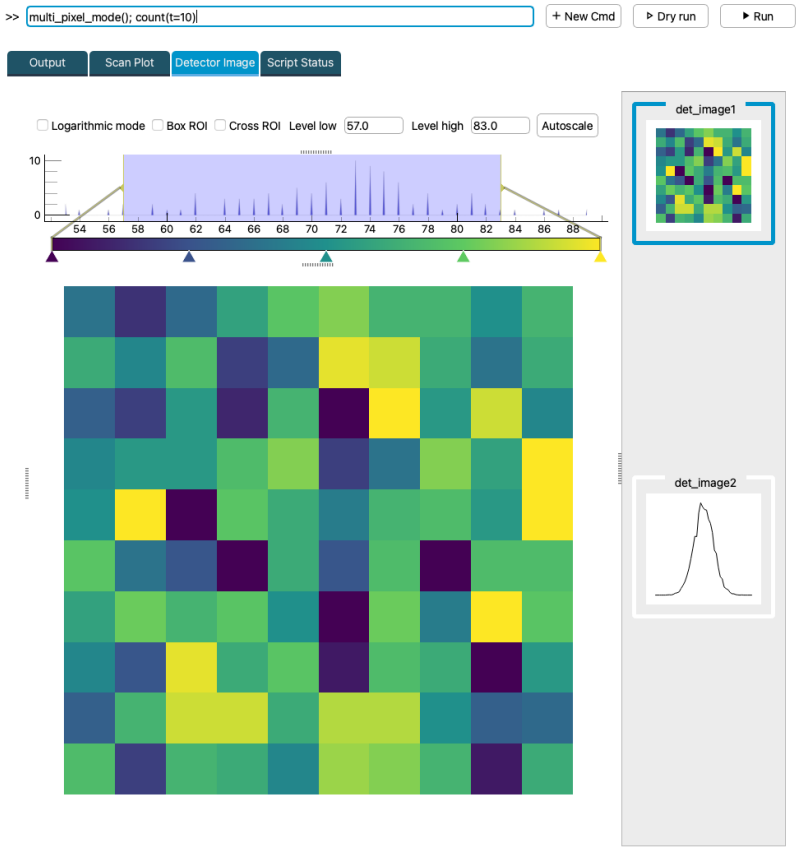
## Angle, x, y, z, etc.

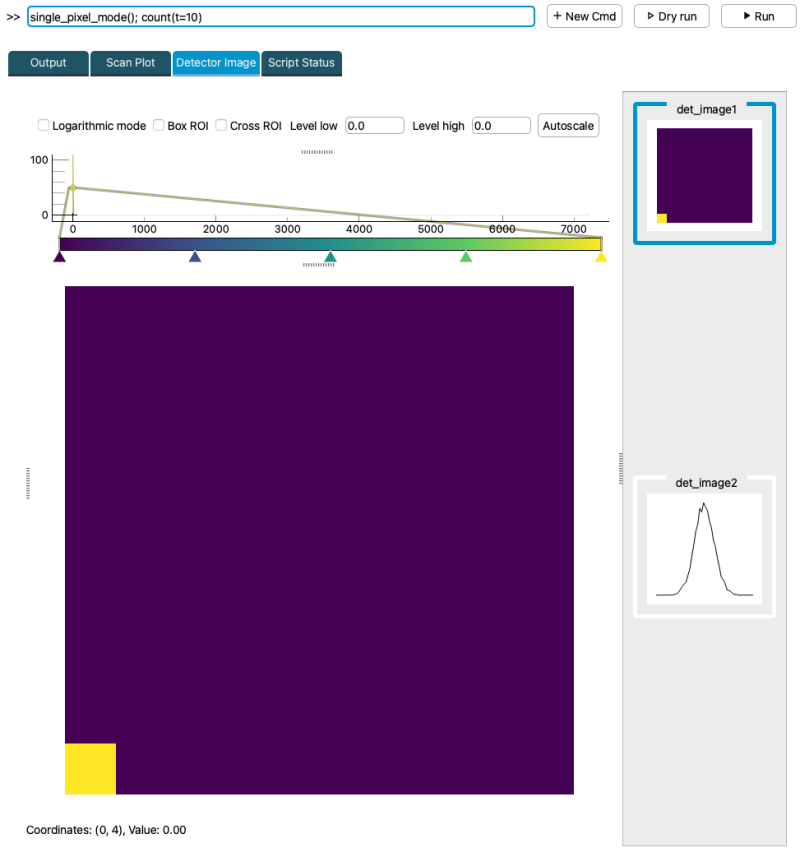


# Two Mode Monitor

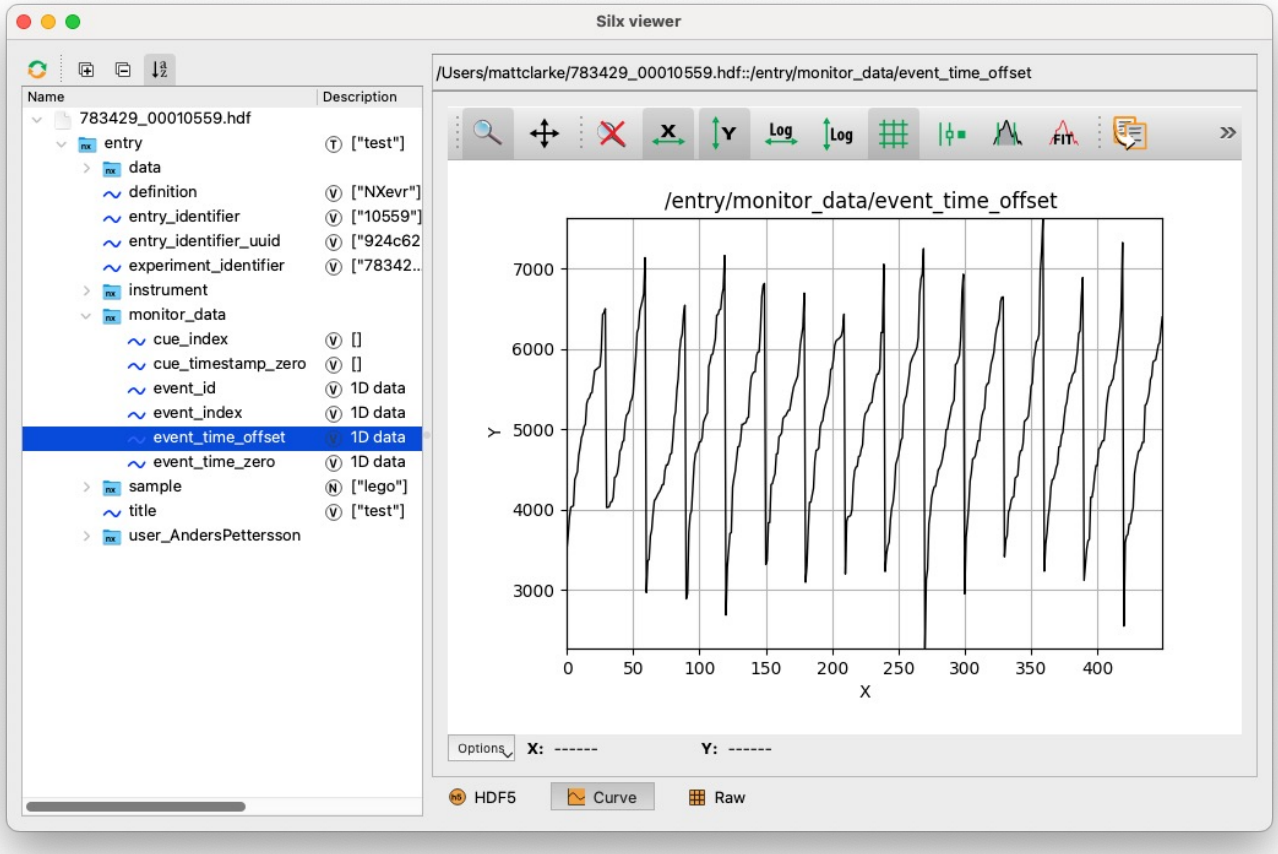
## Position sensitive and single pixel modes



# Two Mode Monitor

## In the NeXus file



# What Next?

# What Next?

- Instrument specific baselines continue
  - Current: ODIN and BIFROST
  - Next: ?
- Cold commissioning
  - Revisiting/refining the baselines