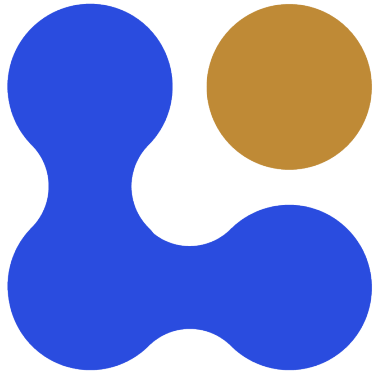
FAIR Research Data –
Generation, Handling and Analysis within the FAIRmat Infrastructure

16:00 Experimental research data as a FAIR resource: Introduction and the FAIRmat approach	Heiko B. Weber
16:30 Harmonization concepts for experimental research data: NOMAD and NeXus	Sandor Brockhauser
17:00 How to build FAIR data pipelines for photoemission spectroscopy	Florian Dobener
17:30 Easy access to FAIR data generation for custom-built experiments with NOMAD CAMELS	Alexander Fuchs
18:00 Questions, answers and discussions	



NOMAD CAMELS

Easy access to FAIR data generation for custom-built experiments with NOMAD CAMELS

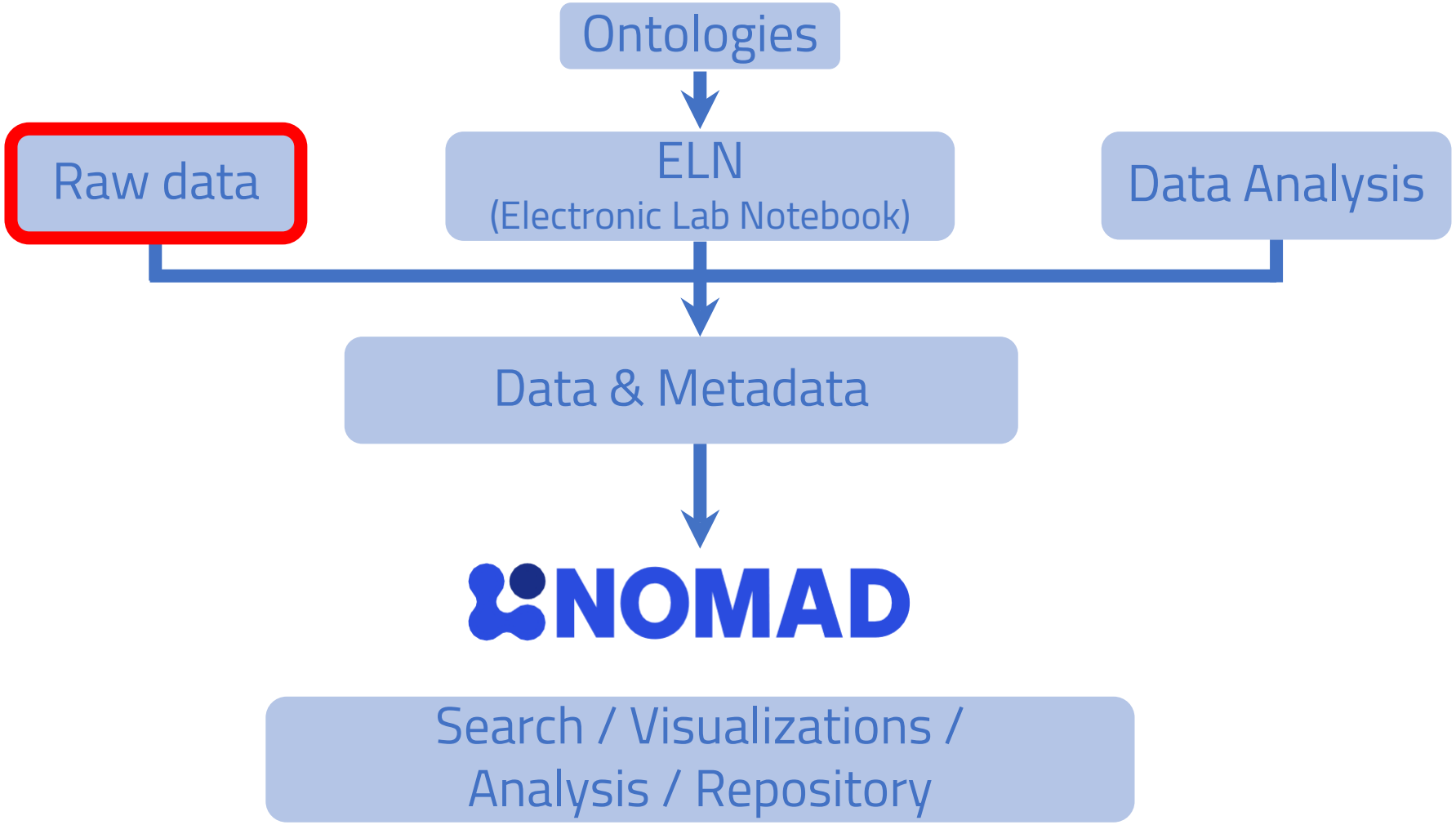
DPG

Berlin, 2024

FAIRmat

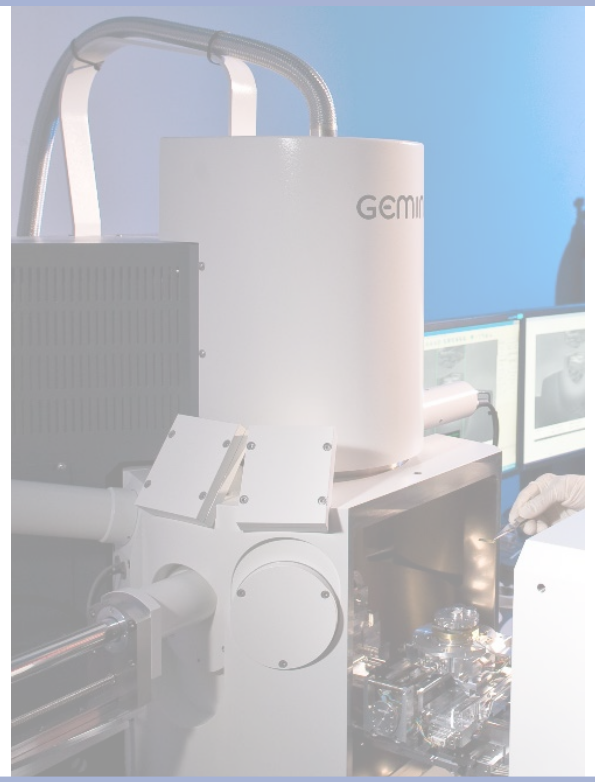
Where does FAIR data come from?

FAIR Data Origins ?



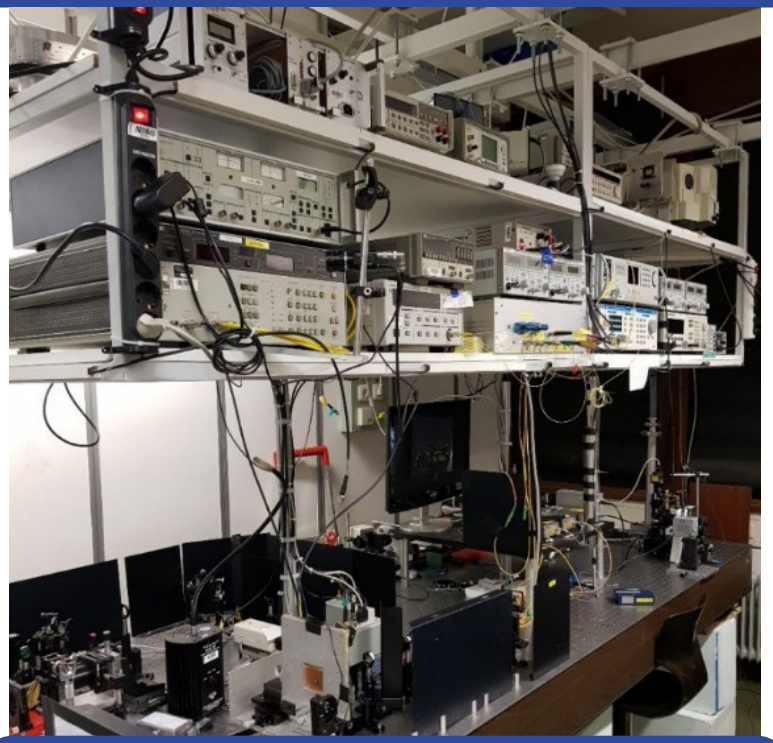
Two kinds of Experiments

Commercial integrated systems



Vendor-provided measurement software → standard data

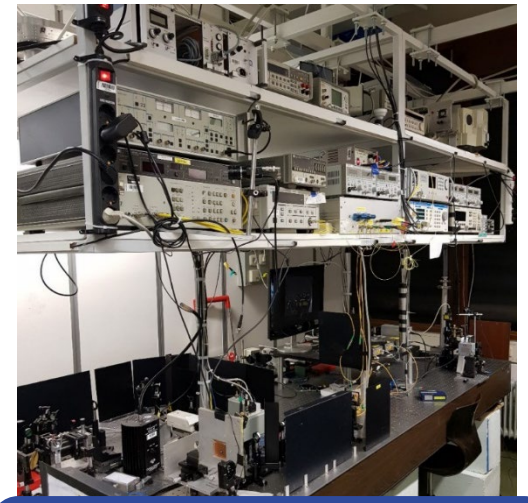
Specialized custom experiments



No standard control → No standard data

FAIR Data Origins ?

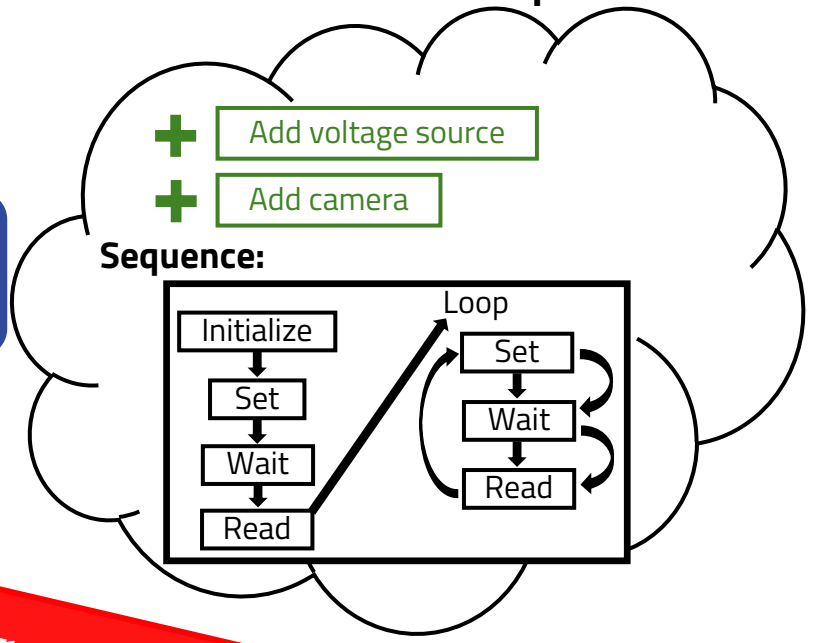
Specialized Experiments



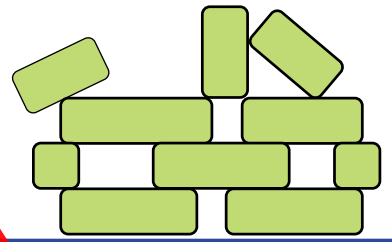
Specialized ad-hoc experimental setup

Code some piece of measurement software

New measurement protocol



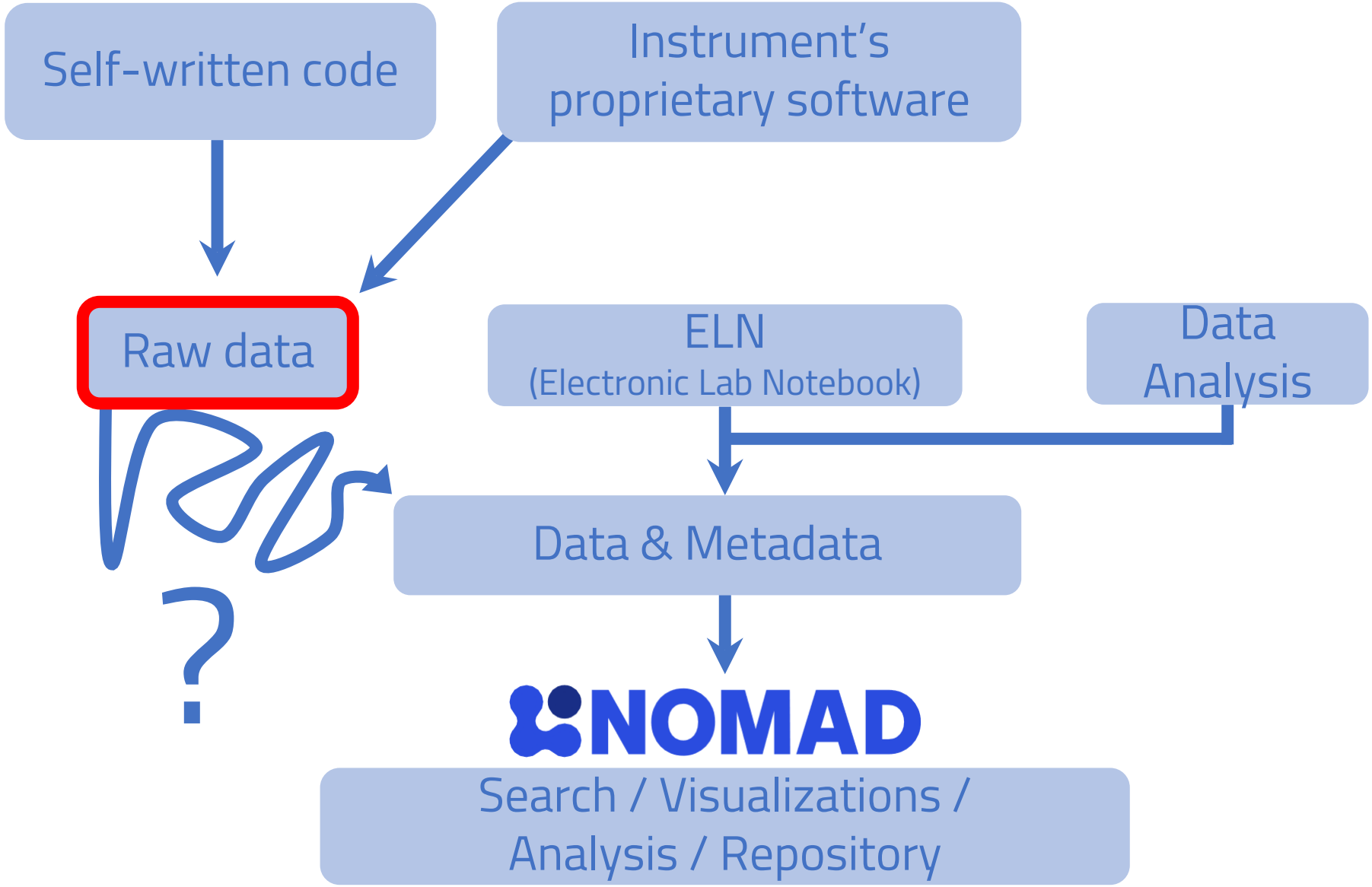
- Programming skills required
- High hurdle for implementation of new measurement protocols
- Redundant software development



not FAIR

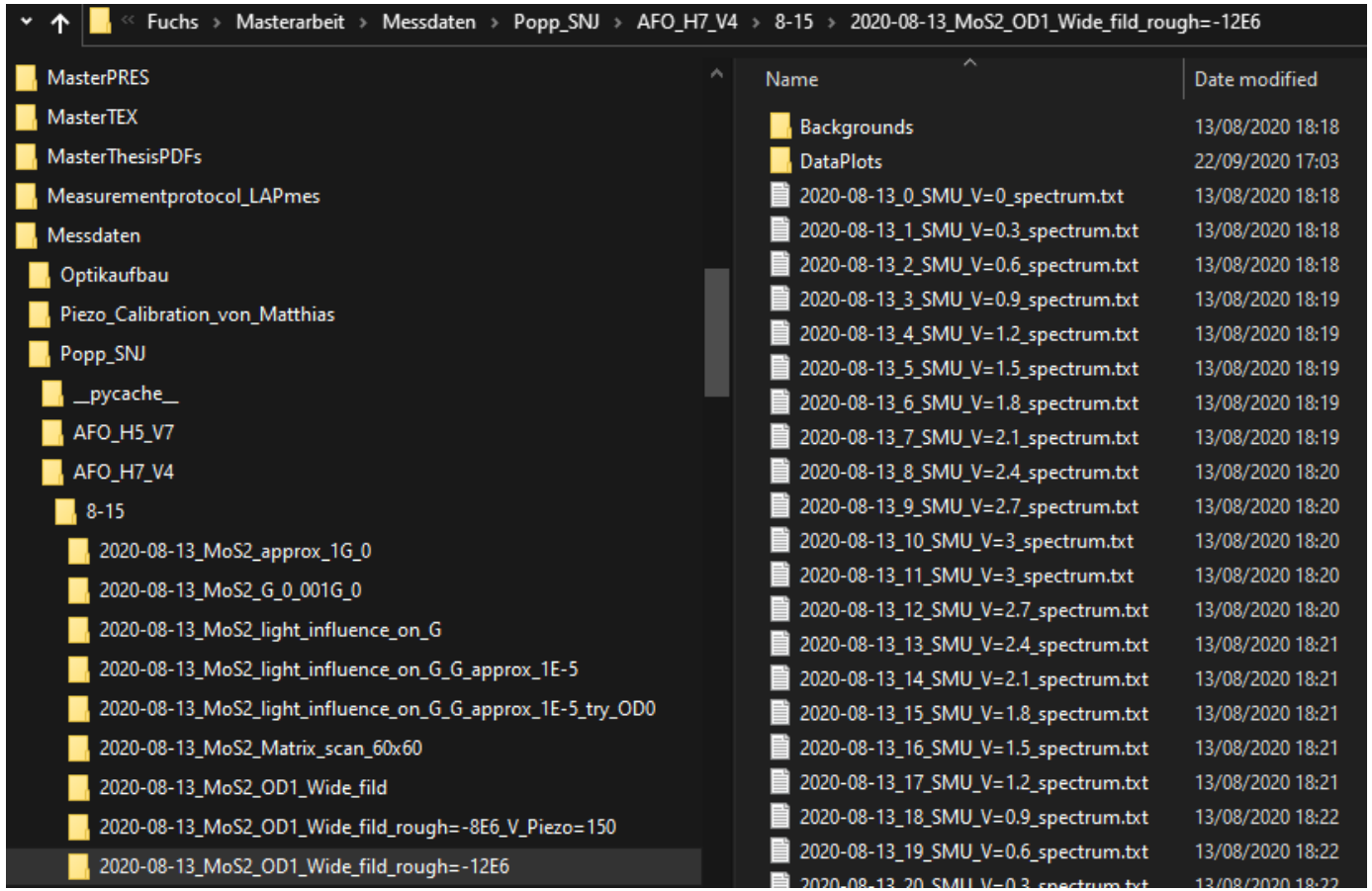
Raw data,
no or (little) metadata,
heterogeneous data format

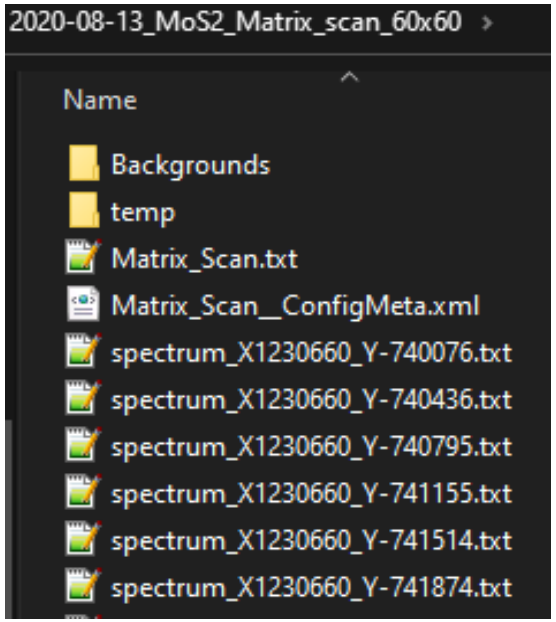
FAIR Data Origins ?

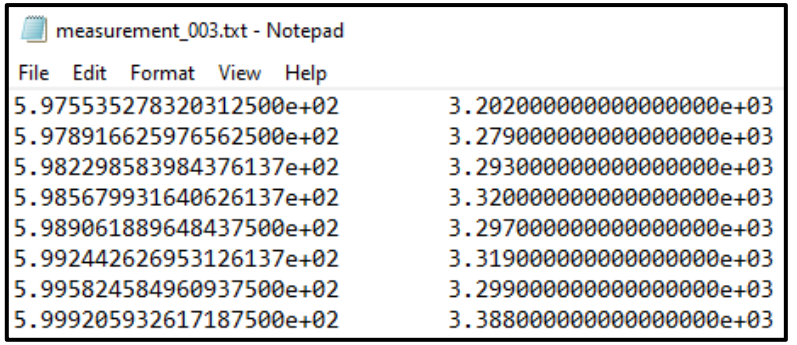


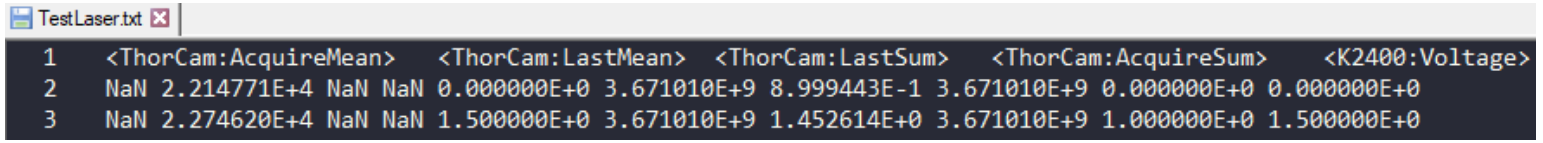
Data Realities

Data Structures









Our Approach

NOMAD CAMELS

Control Application for Measurements, Experiments and Laboratory Systems

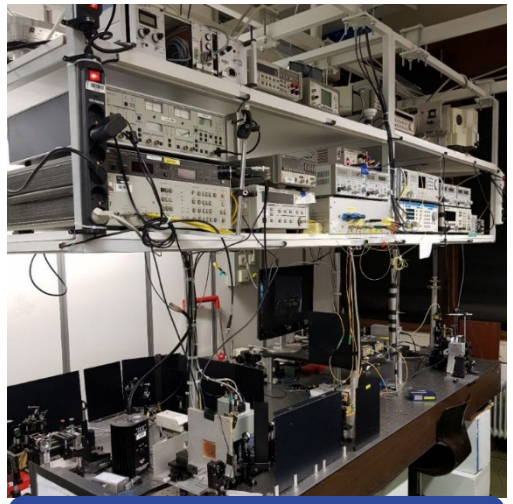
Your Simple Path to FAIR Experimental Data

Fuchs et al., (2024). NOMAD CAMELS: Configurable Application for Measurements, Experiments and Laboratory Systems. Journal of Open Source Software, 9(95), 6371, https://doi.org/10.21105/joss.06371

JOSS 10.21105/joss.06371

Concept

CAMELS Concept

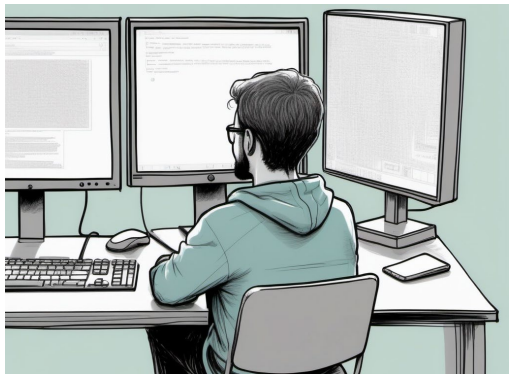


Experimental setup

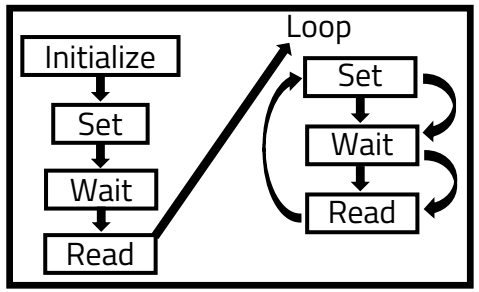
Communication:

CAMELS

GUI

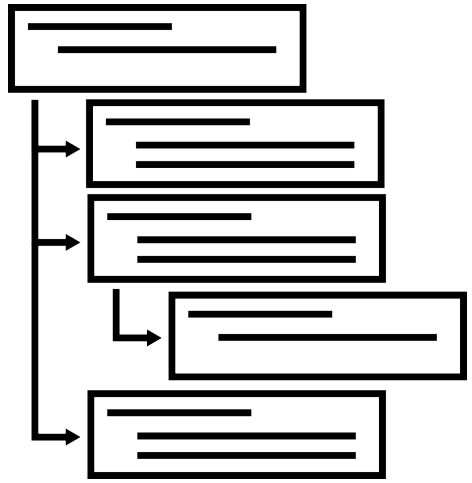


User



Configuration

Measurement protocol w. abstracted commands



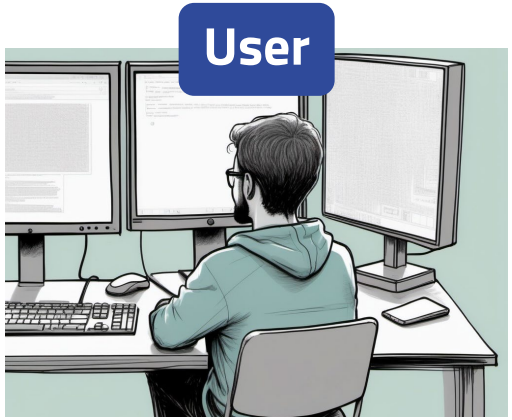
- Fast configuration of measurement protocols
- No programming skills required

FAIR data

- Raw data
- Metadata incl. devices, settings, protocol, …
- Structured data format (HDF5)

Research data management

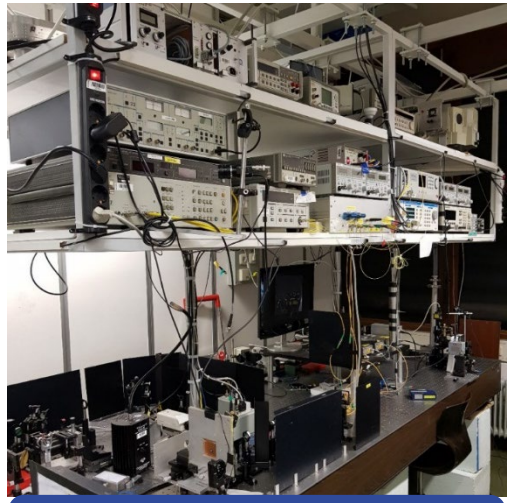
RDM Workflow



CAMELS

1 Configure

2 Measure



Experimental setup

3 Save

Data

4 Upload

NOMAD

Repository

eLabFTW

optional

5 Connect

Connect to ELN entries

Features

Features

Open source GitHub

Easy implementation & Quickly usable

Stand-alone Python code

Complete metadata

Large-scale & Local systems

EPICS

RDM workflow

eLabFTW

NOMAD

Basic Usage of CAMELS

Goal

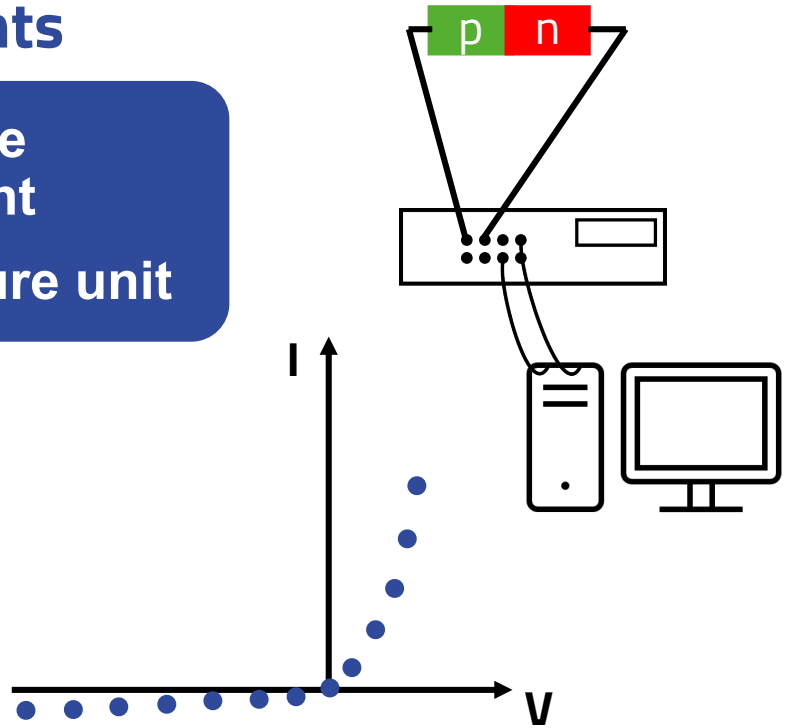
Measure current-voltage characteristics of a p-n diode

What do we need?

Instruments

- Setting voltage reading current

→ Source measure unit



Software

- Visualization
- Data recording
- Fitting

Basic Usage of CAMELS

Goal

Create 2D map of measurements

What do we need?

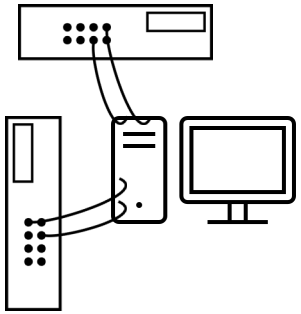
Instruments

- Setting & reading stage x- and y-axis

→ Motor & controls

- Reading a detector

→ Detector



Software

- Visualization
- Data recording

Goals and Benefits

Why CAMELS?

Easy to use

- Low threshold entry to device communication
- Save time communicating with devices
- Automatically upload data

Open Source & Community Driven

- Drivers written by & for the community

FAIR Data

- Standardized data formats
- Rich metadata

Customizable

- Setup consisting of several measurement instruments
- Allows dynamic changes of the measurement setup
- Multiple use-cases for a single setup

Thank you for your attention

Current users

DLR

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ikz

Documentation
fau-lap.github.io/NOMAD-CAMELS

Code
github.com/FAU-LAP/NOMAD-CAMELS