COMPASS database (CDB)

Data files

(netCDF)

METADATA database (SQL)
- shot record
- signal type
- signal data record
  - path to data file
- acquisition signal → named signal mapping
- …

Shot 21554

◀◀ 21553	21555 ▶▶	Collected Channels	Postprocessing	View in logbook	Go to record:	21554	Go

Time	2021-08-03 16:12:41 (4 years ago)
Number of Signals	1794

Only signals collected in this shot are shown here. Can be grouped by hardware attachments, by data sources, or displayed all for easy s

Signals   All   **By Data Sources**   By Hardware

	Generic signal	Computer	Board	Channel
ATCA_1 (9)	laser_1_triggers	atca2	4	1
BOLOMETRY (3)	laser_2_triggers	atca2	4	2
DTACQ196 (234)	laser_3_triggers	atca2	4	3
DTACQ216 (83)	laser_4_triggers	atca2	4	4
EFIT (94)	ne			
EFIT_LEGACY (44)	ne_avg			
	ne_avg_efit			
HYDRAULICS (25)	ne_avg_err			
IRCAM (4)	ne_err			
	pe			
MAGNETICS (11)	pe_err			
MAGNETICS_RAW (370)	psi_n			
	R_midplane			
MARTE (201)	Te			
MICROWAVES (6)	te_avg			
NEUTRON (4)	Te_err			

NFS
(shared filesystem)

SQL query

CDB client (python, Matlab, …)

User has data
(xarray.Dataset, …)

IMAS (in)compatibility:

Flat primary data structure in CDB
= one N-dimensional array *(think numpy)*

i.e. CDB cannot trivially/cleanly contain hierarchical IDS structures (nested arrays)

IPP   COMPASS
INSTITUTE OF PLASMA PHYSICS ASCR

COMPASS (was in operation 2011-2021)

- Experimental data stored in COMPASS database (CDB)
- Data provided in two stages:
  - Currently in development Python mapping library using `yaml/json` description of the CDB → IMAS mapping.
  - COMPASS UDA plugin wrap the library and serve the data over UDA server.

- Device name: **COMPASS**

COMPASS (was in operation 2011-2021)
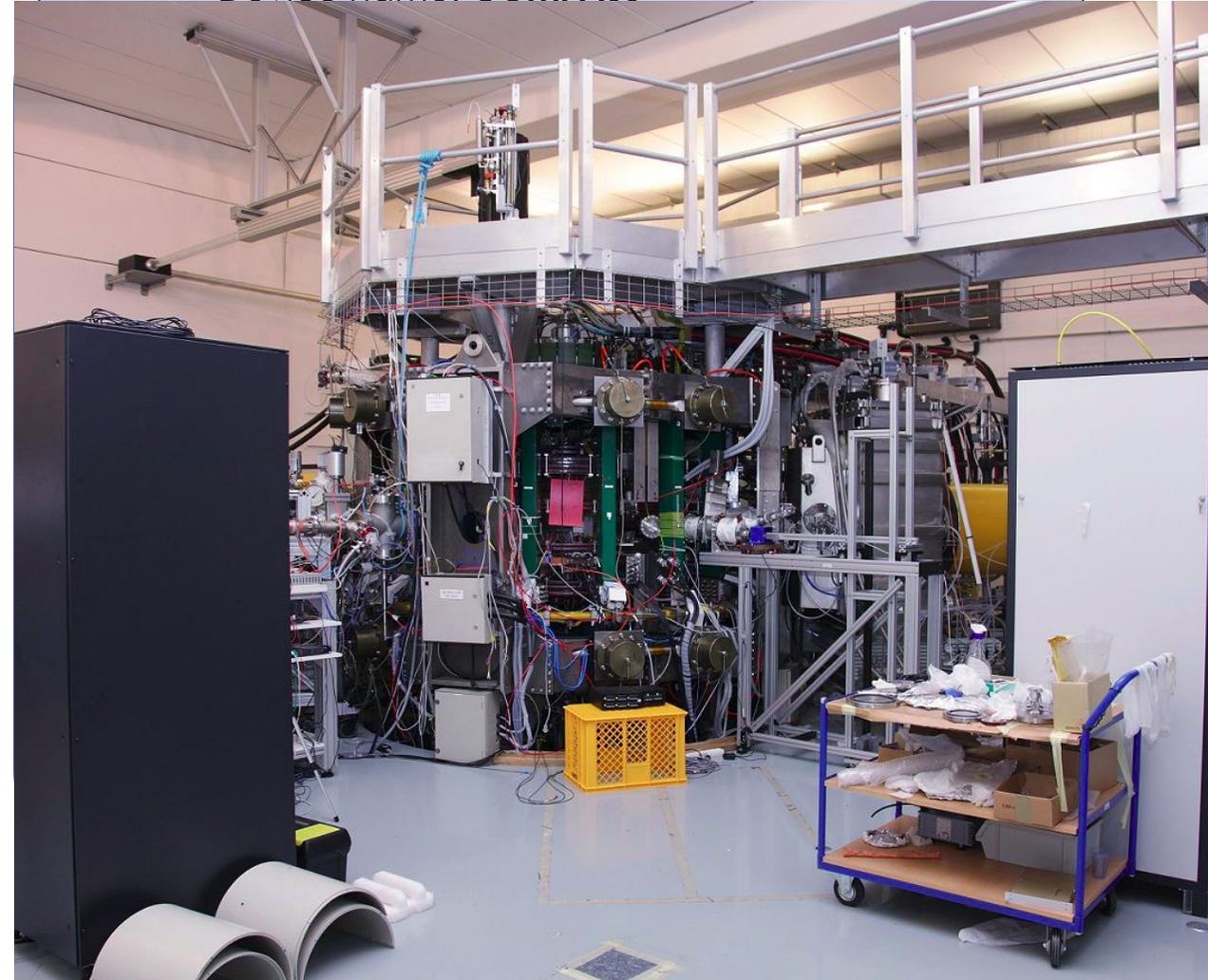
- Experimental data stored in COMPASS database (CDB)
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  - COMPASS UDA plugin wrap the library and serve the data over UDA server.

- Device name: **COMPASS**
- Native data format/data access library: **pyCDB**
- Contact persons (name + email) for IMAS / Data mapping: N/A, **Lukas Kripner** (kripner@ipp.cas.cz), **David Tskhakaya** (tskhakaya@ipp.cas.cz)
- List of IDS with mapped data (+ DD version): **ids_summary (DD v3)** (just few fields)
- How the mapping is done: **custom IMAS mapper / custom UDA plugin**
- Pulses (or ranges of) being mapped: **single pulse for testing (may be extended in the future)**
- Applications that are using the mapped IMAS data: **None**
- Data access policy (contact + collaboration + possibility to share test data): **None – to be established**
- Plans over the coming year: **To be established**

COMPASS Upgrade

- Design/construction ⇒ No experimental data

- IMAS representation of the machine in progress
  (coils, wall, diagnostics, …)
  - following the design process (variants, revisions, …)
  - kept in sync for pulse design, flight simulator

- DD v3 (migration to DD v4 should be ok)

- Device name: **COMPASS Upgrade**

COMPASS Upgrade

- Design/construction ⇒ No experimental data

- IMAS representation of the machine in progress (coils, wall, diagnostics, …)
  - following the design process (variants, revisions, …)
  - kept in sync for pulse design, flight simulator
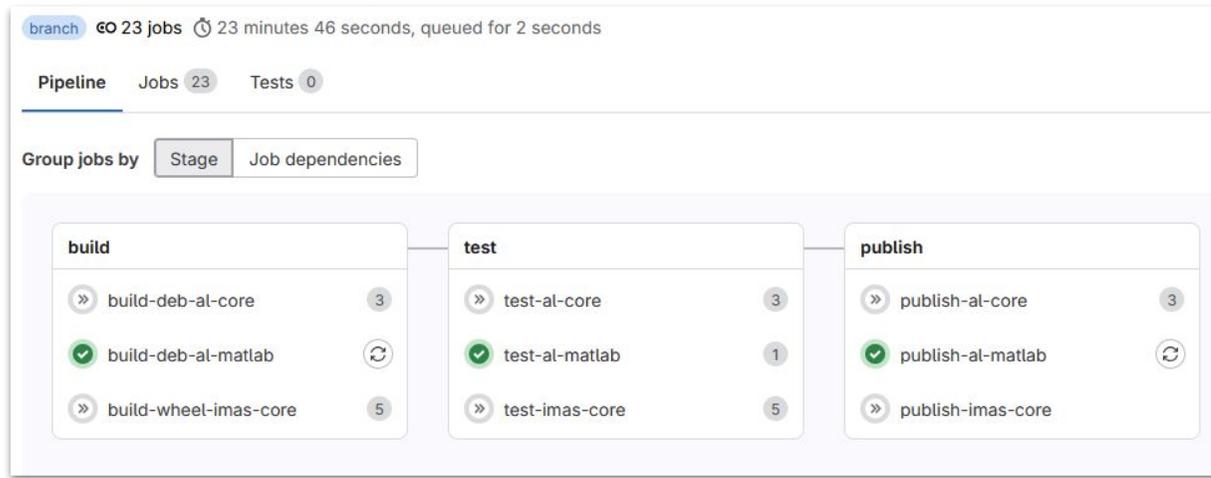
- DD v3 (migration to DD v4 should be ok)
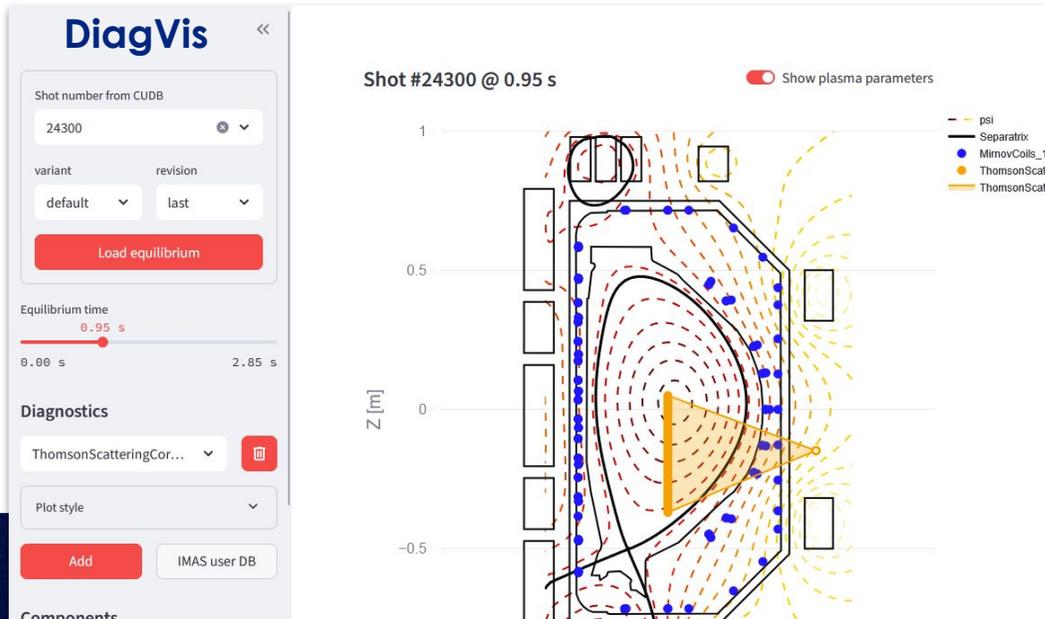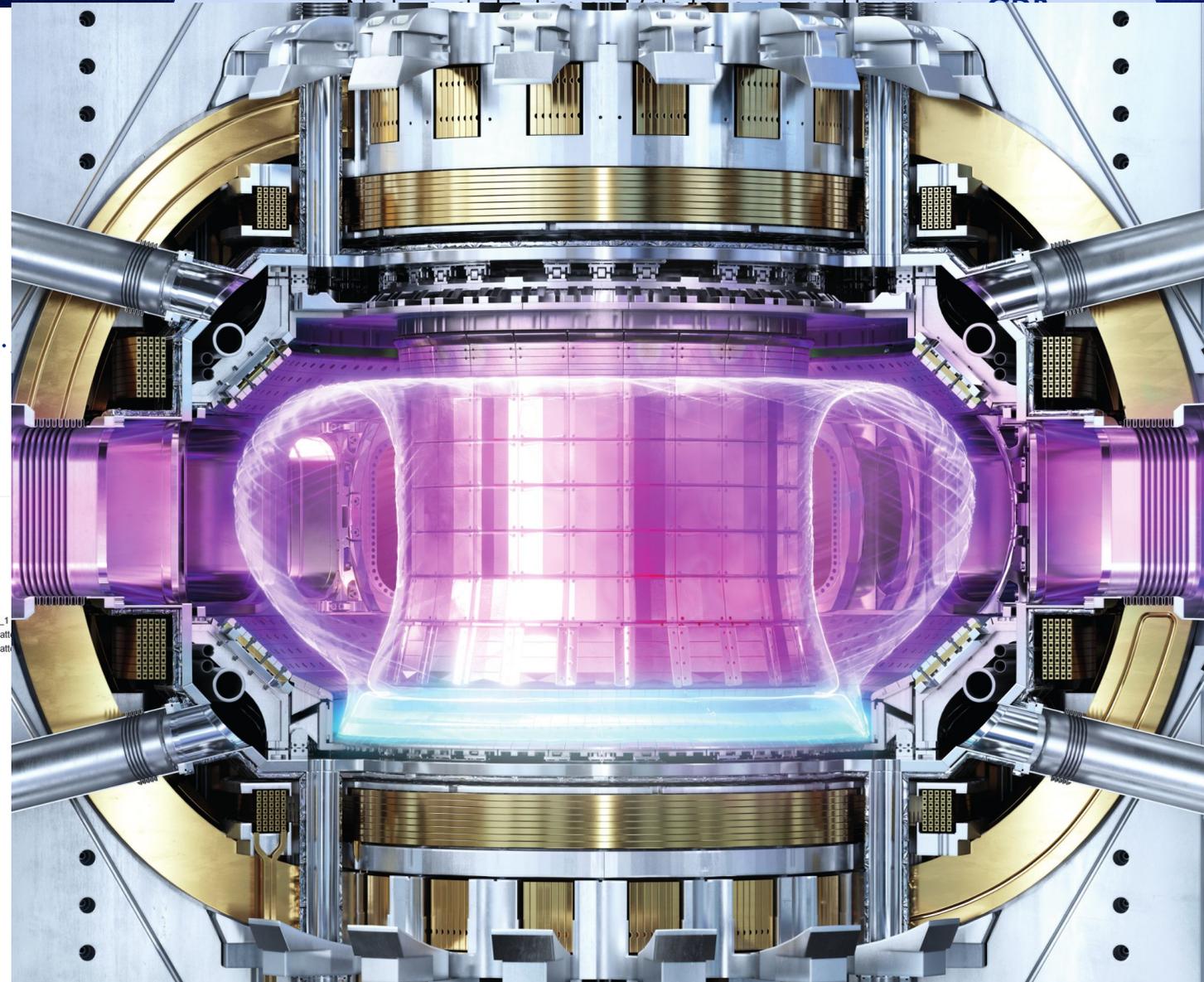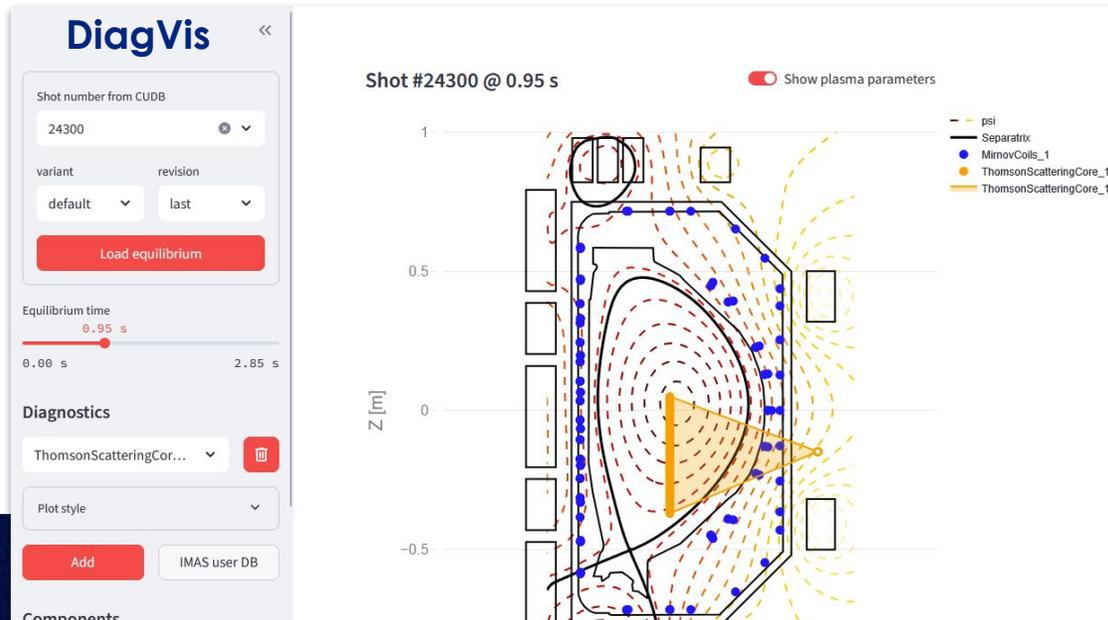
- Device name: **COMPASS Upgrade**
- Native data format/data access library: **pyCDB**
- Contact persons (name + email) for IMAS / Data mapping: **Jan Hečko** (hecko@ipp.cas.cz), **Lukas Kripner** (kripner@ipp.cas.cz), **David Tskhakaya** (tskhakaya@ipp.cas.cz)
- List of IDS with mapped data (+ DD version): **wall, magnetics, pf_active, pf_passive, langmuir_probes, thomson_scattering**
- How the mapping is done: **custom IMAS mapper / custom UDA plugin**
- Pulses (or ranges of) being mapped: **single pulse for testing (may be extended in the future)**
- Applications that are using the mapped IMAS data: **diagvis (Streamlit diagnostics and equilibrium visualization application)**
- Data access policy (contact + collaboration + possibility to share test data): **None – to be established**
- Plans over the coming year: **To be established**

Deployment of AL on COMPASS servers

Access Layer

- Building linux packages (**.deb**) in GitLab pipeline
  - (probably) could set up **.rpm** for RHEL, too
- Using native CMake tools (extending CMake config for AL)

Packages used in

- directly on servers for all users
- to build docker images with tools using IMAS
  - (e.g. for visualization web-applications)
- easily deployable anywhere else

Backend for AL-Core (our needs)

- HDF5
- UDA

Limitations

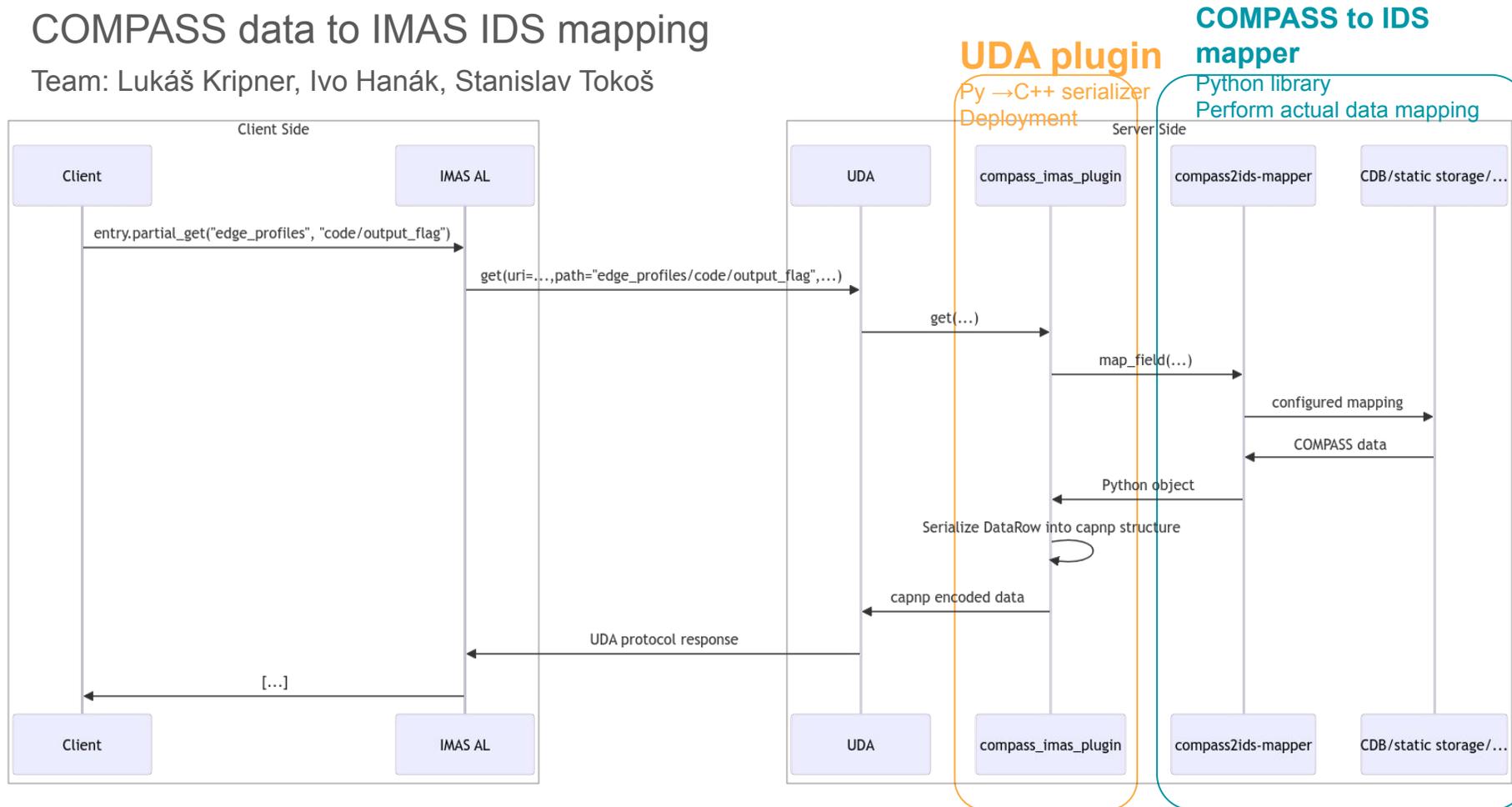- some adjustments needed for the AL CMake config (to cleanly handle the package hierarchy)

BACKUP

COMPASS data to IMAS IDS mapping

Team: Lukáš Kripner, Ivo Hanák, Stanislav Tokoš

UDA plugin
Py →C++ serializer
Deployment

COMPASS to IDS mapper
Python library
Perform actual data mapping

Disclaimer: The proposed architecture is in its early stages and may be subject to change.

COMPASS IDS plugin

- Developed with best practices:
  - continuous testing
  - continuous deployment as:
    - docker image or deb package
- Deployment version:
  - Depends only on open-source packages (e.g. UDA server)
- Testing version:
  - Utilizes Python IMAS AL for end-to-end testing
- Python to C++ serialization
  - Python facilitates easier development of future mappings
- Mapping process
  - Actual mapping performed by the `COMPASS to IDS mapper` library.
- First deployment of testing COMPASS UDA server:
  - Limited to selected IP addresses
  - Scheduled for the end of September 2024
- Next steps:
  - complete COMPASS mapping schema
  - Secure UDA server:
    - Consider using only SSL and/or OAuth2 for authentication.
  - Deploy a second instance with COMPASS-U synthetic data, followed by experimental data when they become available.

COMPASS to IDS mapper

- Standalone Python Library
  - Relies solely on open-source dependencies (e.g., OMAS)
  - Optionally supports closed-source backend libraries (e.g., IMAS)
- Uses json/yaml configuration files for mapping specification
- Mapping Capabilities:
  - Supports mapping to various data sources:
    - COMPASS database (CDB) [1]
    - Static files (e.g., HDF5, netCDF, CSV)
  - Future enhancement: machine description will be sourced from the machine description server
  - Aggregations:
    - For example, summary IDS fields require resampling of the time axis to unify data from various sources
- Direct mapping of both: single IDS field and whole IDS entry
- Core `Abstract mapper` provide with functions: `map_ids`, `map_leaf` for flexible mapping

[1] J. Urban, et al.: *Integrated data acquisition, storage, retrieval and processing using the COMPASS DataBase (CDB)*, Fus. Eng. and Design, **89** (5), 2014

```
{
"entry": "summary",
"time axis": "time",
"time_factor": 1e-3,
"resampling_method": "interp1d",
"resampling args": {                                    {
    "freq": 1e4                                               "dataset": "MAGNETICS_RAW",
},                                                            "fields": [
"fields_or_datasets": [                                          {
    {                                                                "source":
        "dataset": "EFIT",                             "diamagnetic_loop_1_1_RAW",
        "fields": [                                                  "target":
            {                                          "global quantities.v_loop",
                "source": "li",                                  },
                "target": "global_quantities            ...
            },...]},                                       ]}}]
```

Useful links

- [Indigo page](#)
- [Preparation document](#)