Efficient Accumulation of Antiprotons

- Article -

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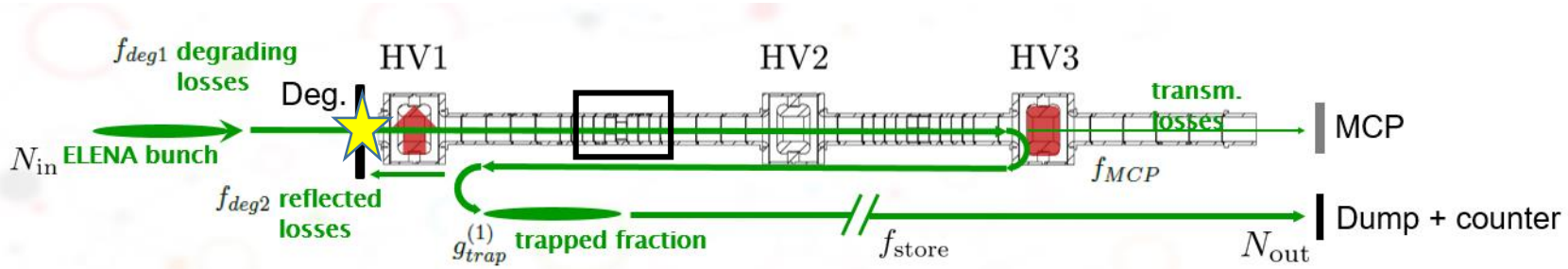
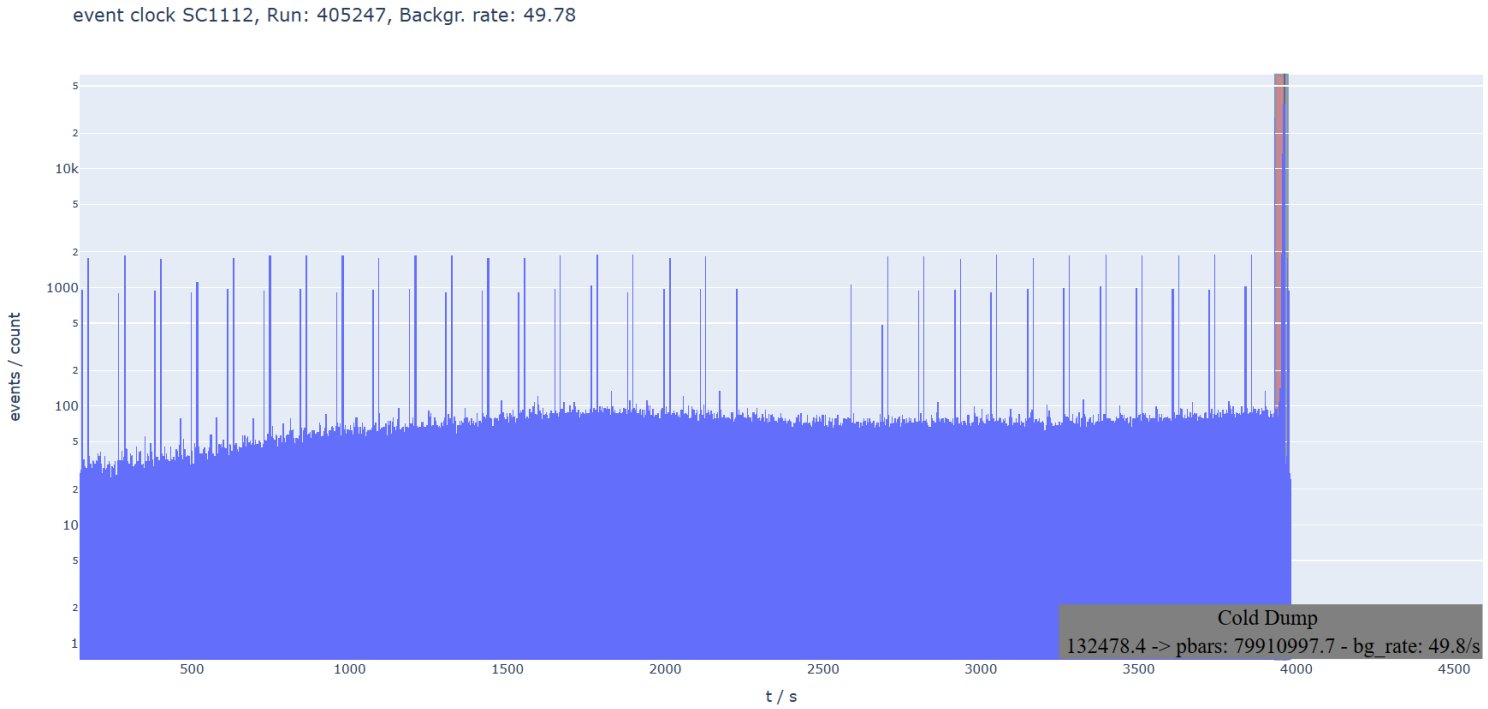
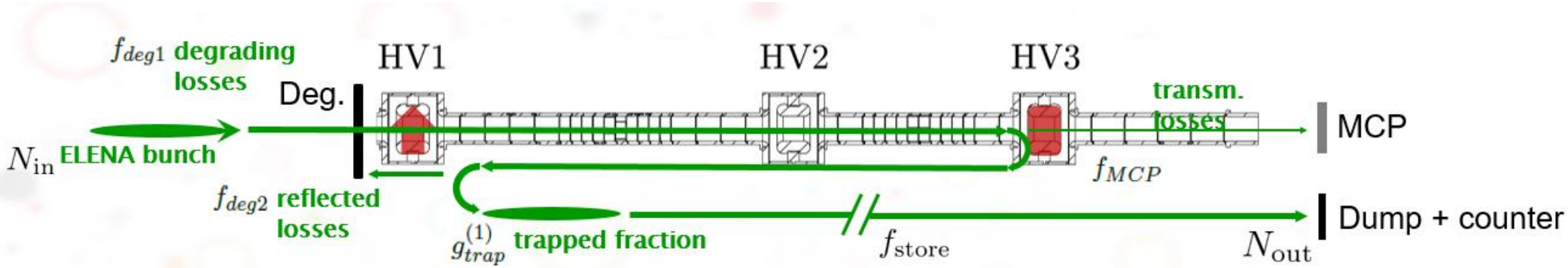
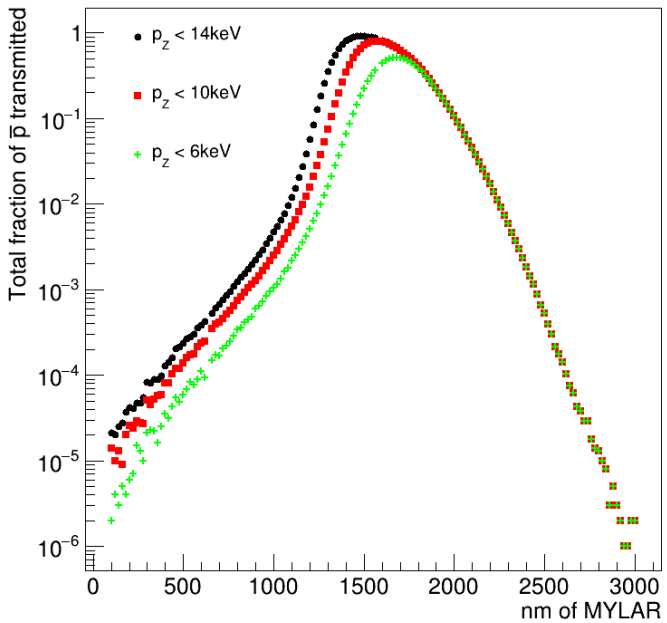


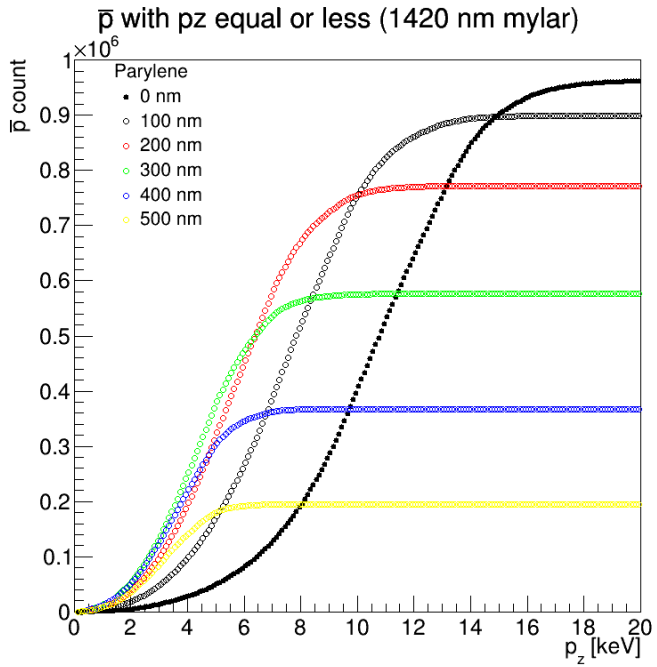
1. Catch
2. Hot Dump
3. Cool & Compress with RW
4. Accumulate in few eV trap

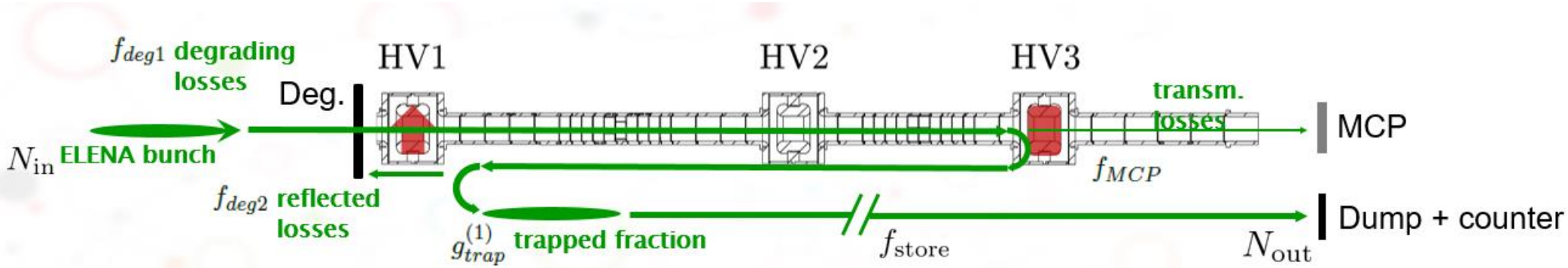


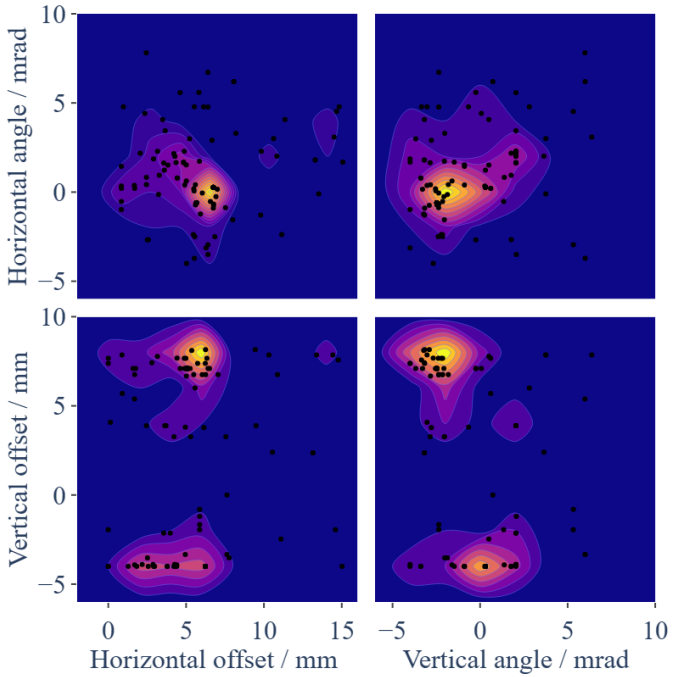


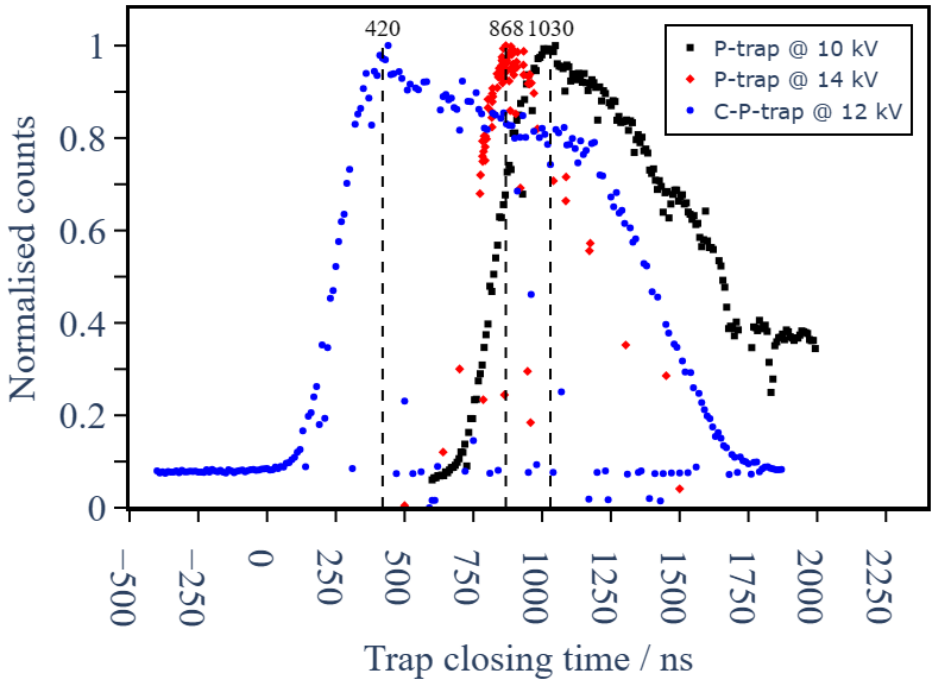
Trap efficiency

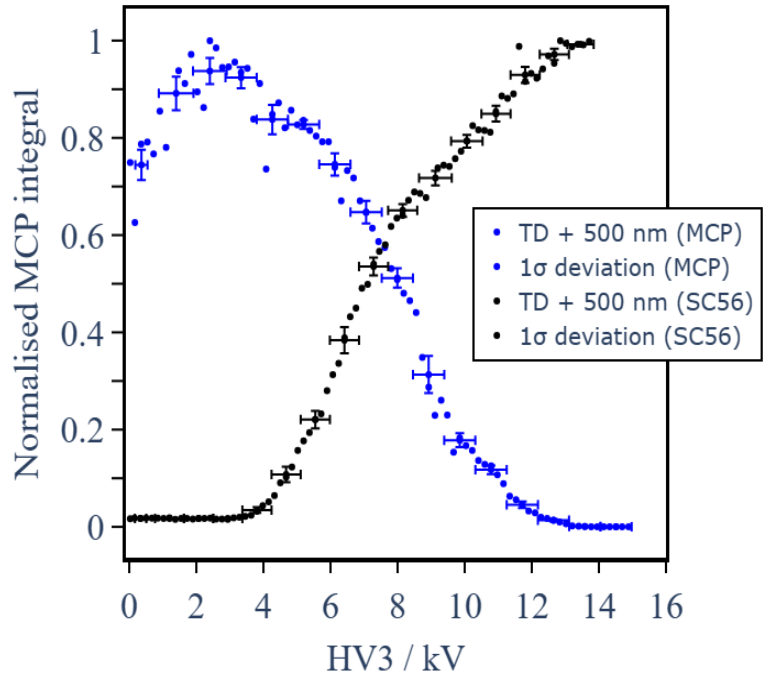





f_{deg1} degrading losses
Deg.
HV1
HV2
HV3
transm. losses
MCP
N_{in} ELENA bunch
f_{MCP}
f_{deg2} reflected losses
$g^{(1)}_{trap}$ trapped fraction
f_{store}
N_{out}
Dump + counter

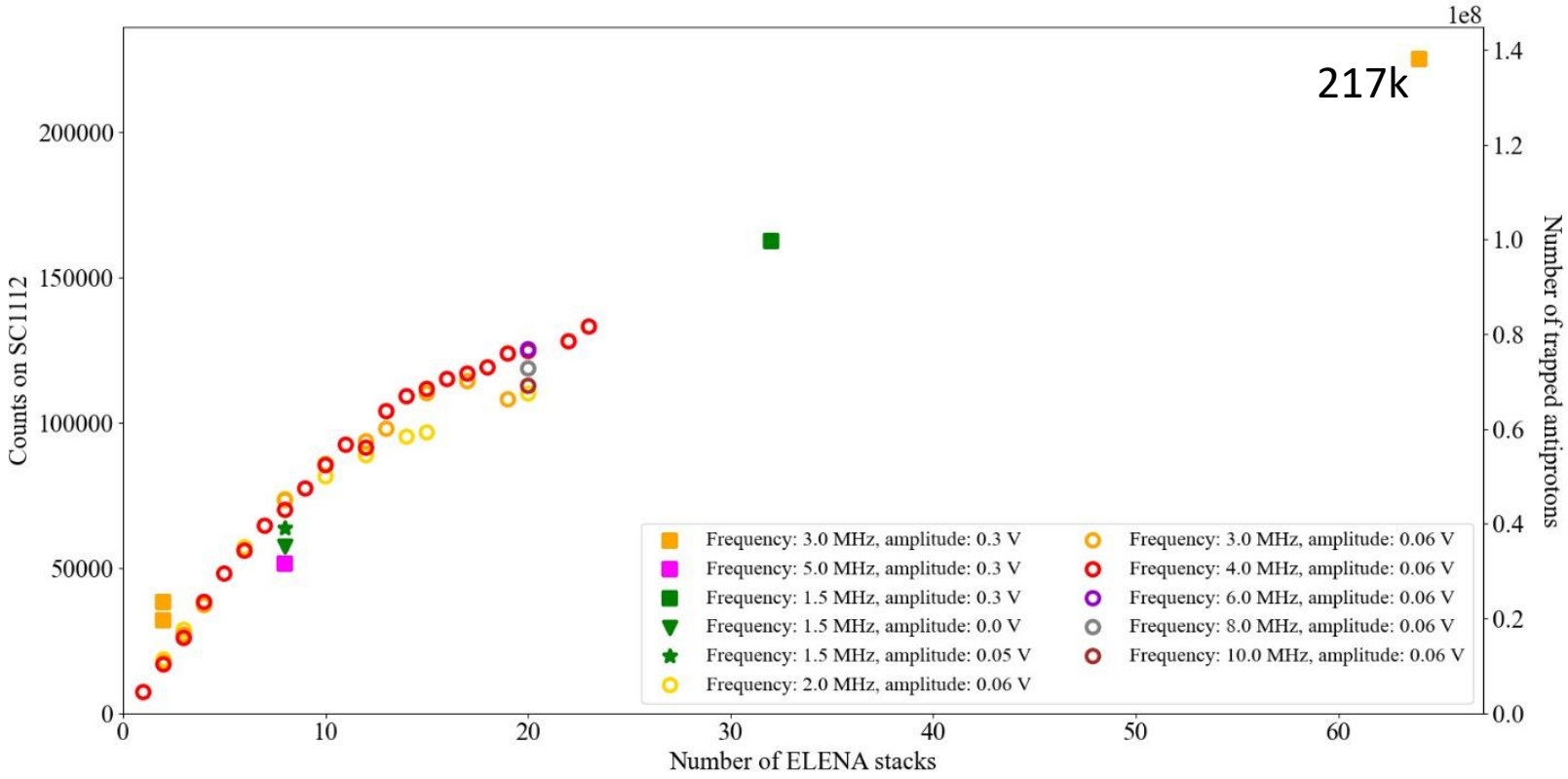

Horizontal angle / mrad
Vertical offset / mm
Horizontal offset / mm
Vertical angle / mrad


420
868
1030
P-trap @ 10 kV
P-trap @ 14 kV
C-P-trap @ 12 kV
Normalised counts
Trap closing time / ns


TD + 500 nm (MCP)
1σ deviation (MCP)
TD + 500 nm (SC56)
1σ deviation (SC56)
Normalised MCP integral
HV3 / kV

Efficient Antiproton Trapping

- Article -



SC1112 → SC12: x **???**

SC12 → #pbars: x 16.0

→ Currently investigating!

Efficient Antiproton Trapping

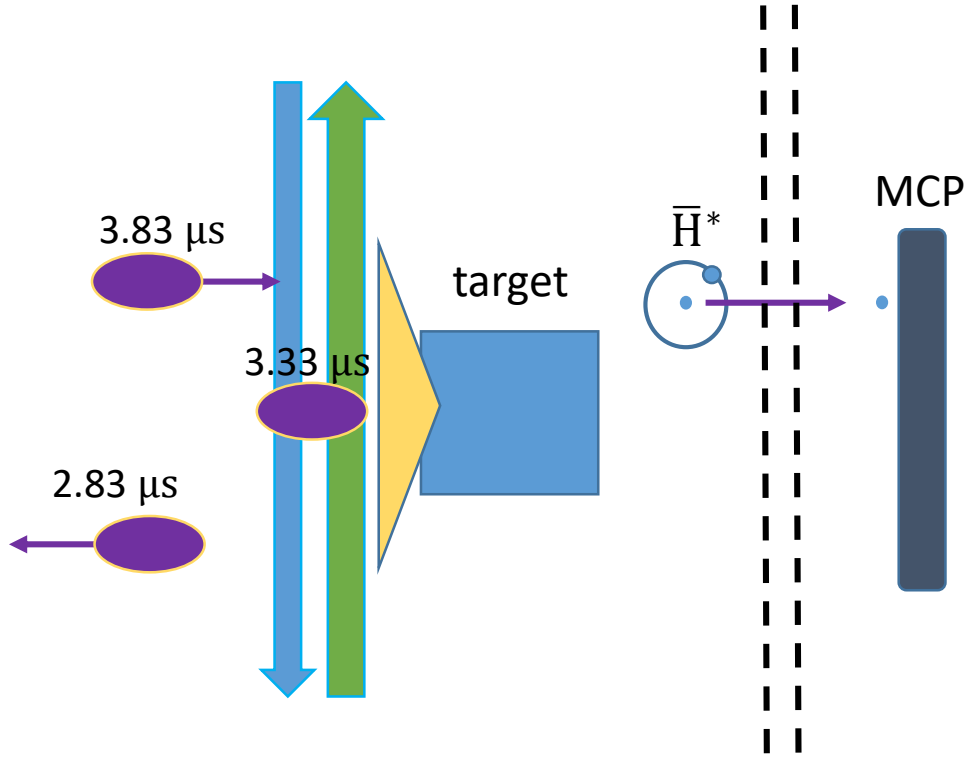
- Article -

Listen to a proper presentation by Saiva in the next Monday meeting!!!

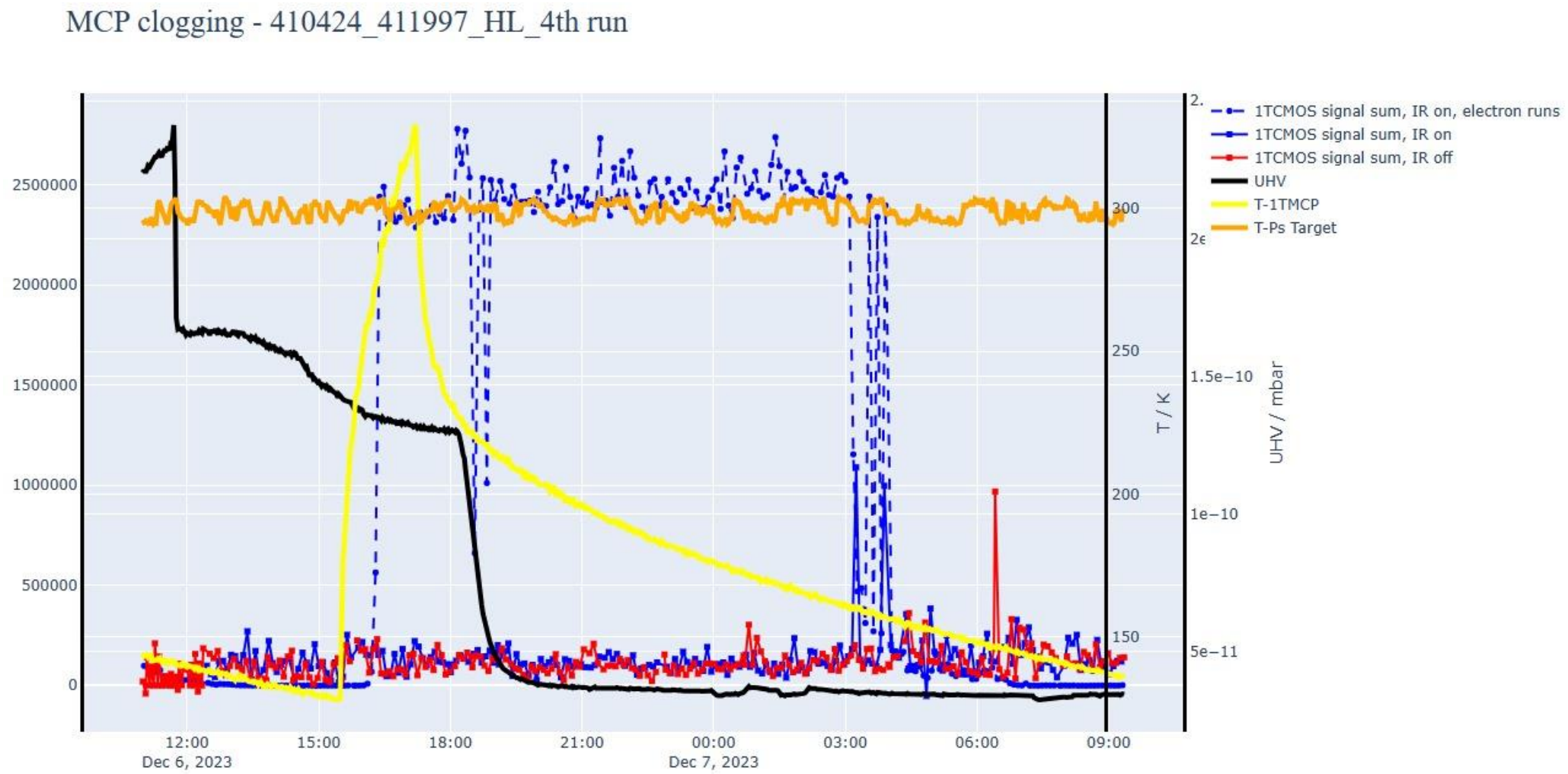
N x 4 measurement scheme of Hbar production

N x 4 scheme

IR	Positron-Pbar-Delay / µs
off	3.33
on	2.83
on	3.33
on	3.83



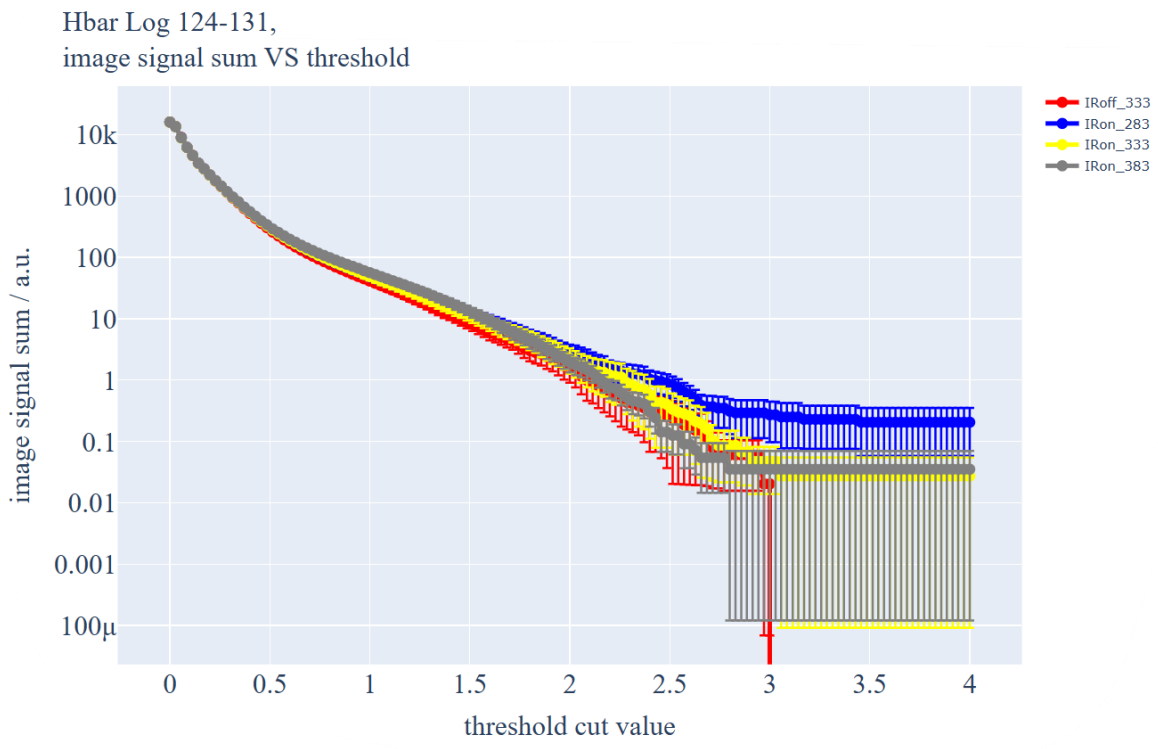
1TMCP “clogging like effect”



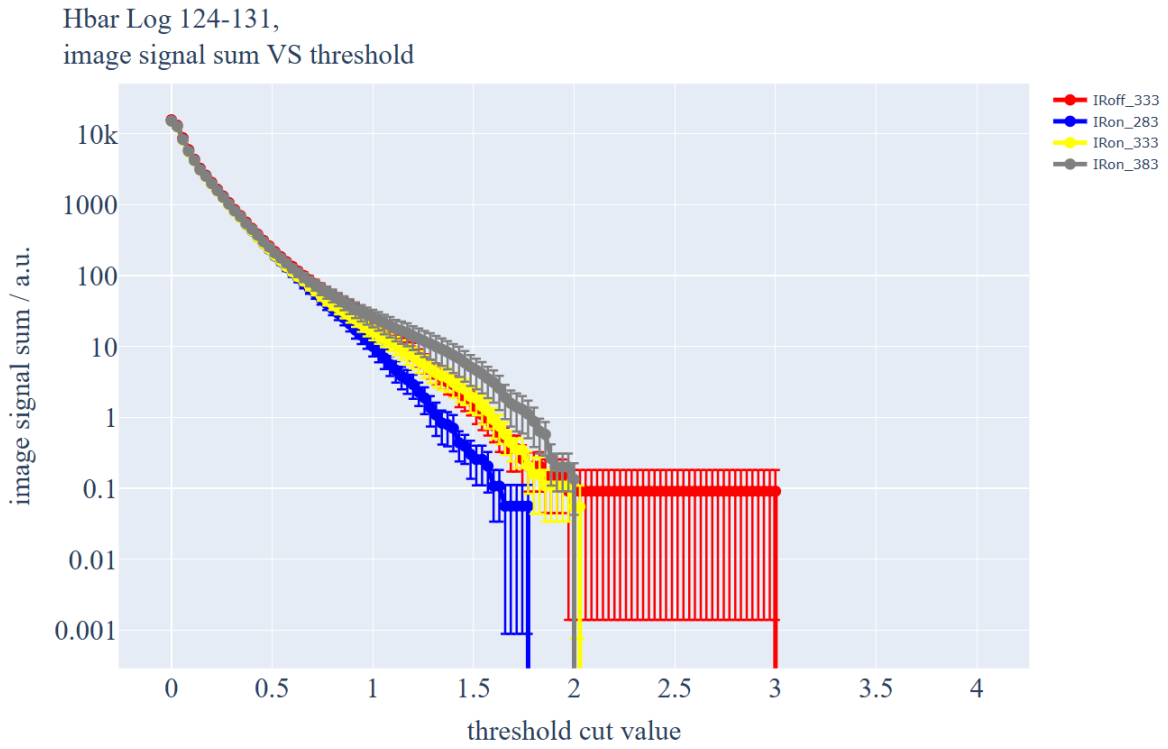
Peak finding of T-1TMCP

$\bar{H}$ formation

Nx4 measurement scheme,
All 600 runs



Inside golden window, 150 runs



ALPACA

-

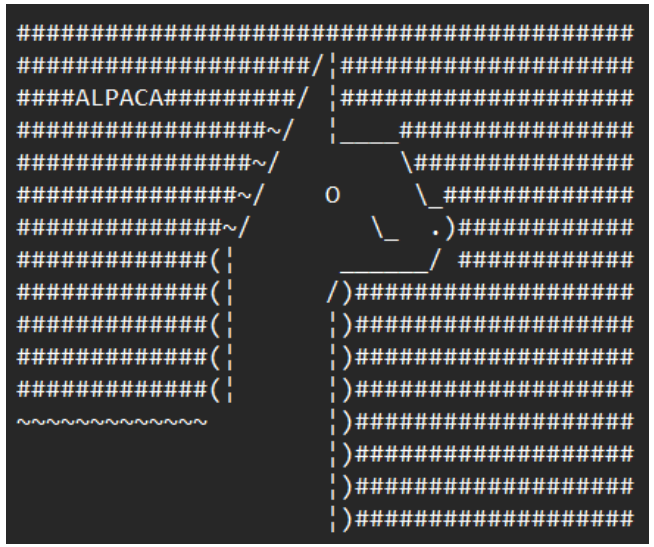
Status & Future

-

Status April 2024

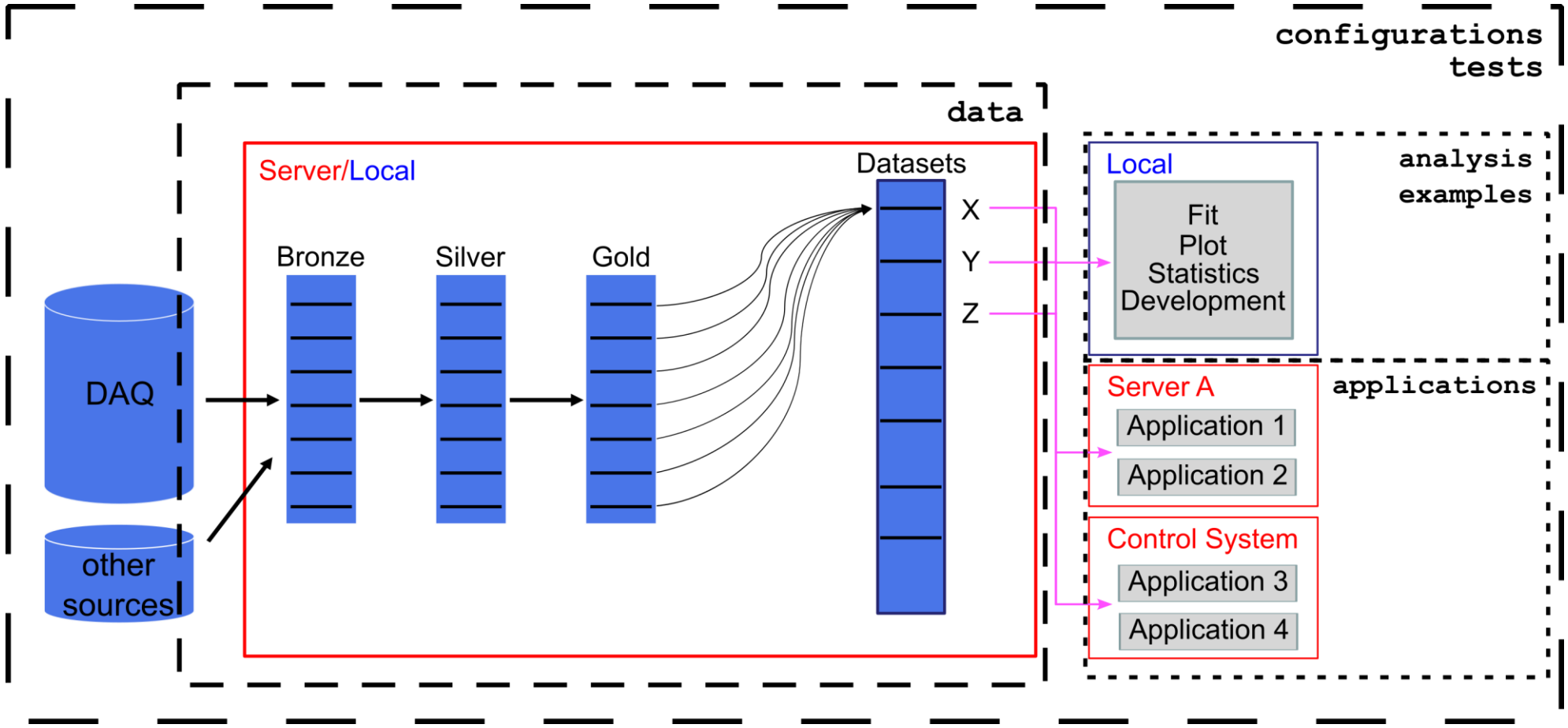
-

Tassilo Rauschendorfer

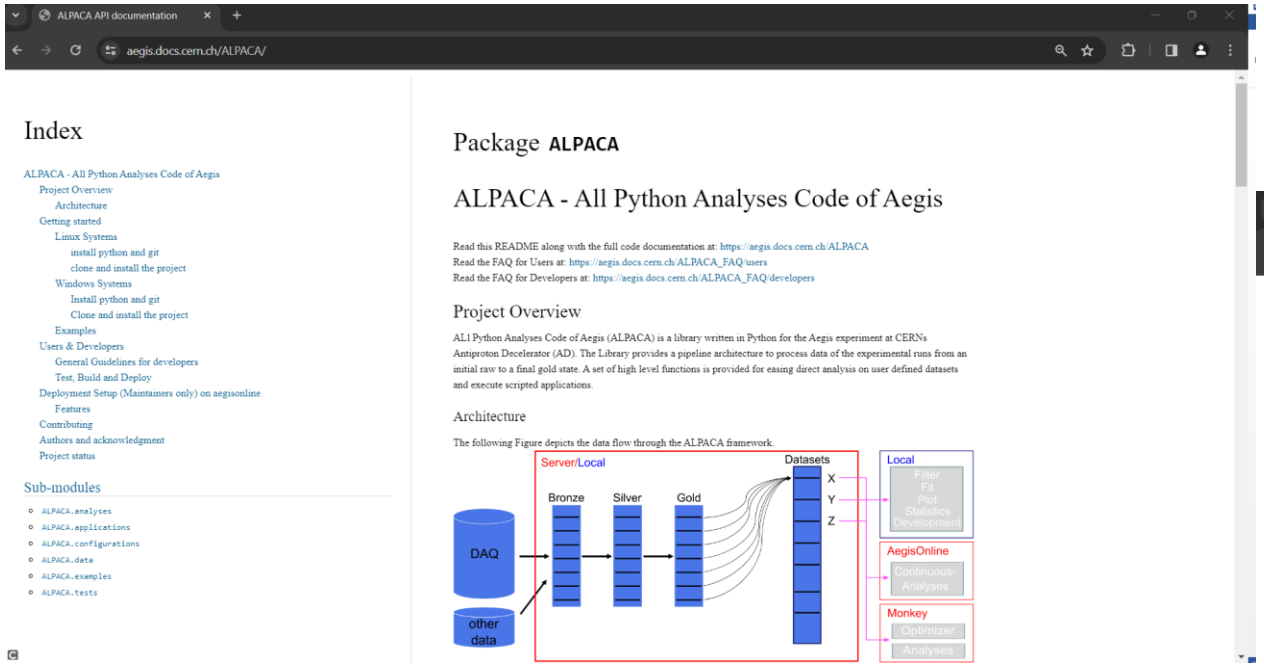


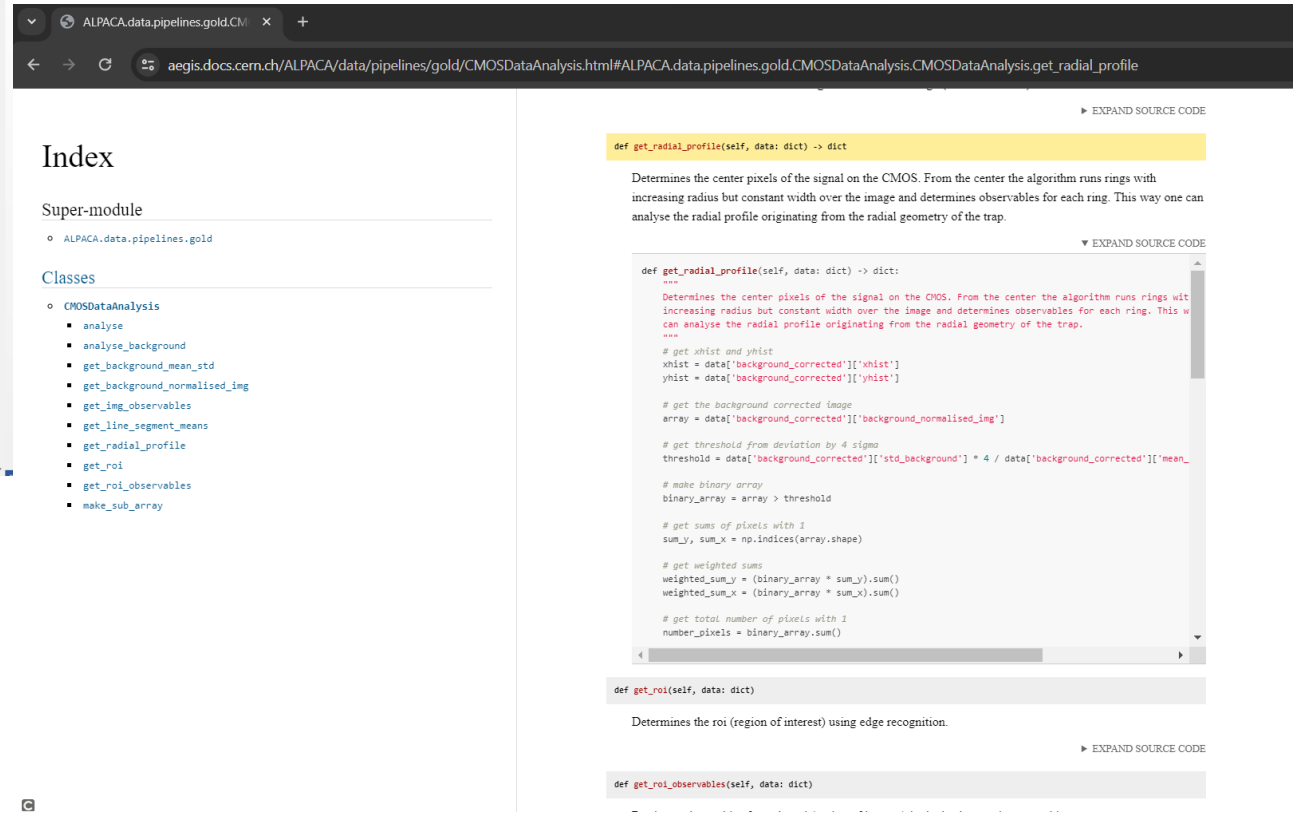
ALPACA – Architecture

(Scipy, Numpy, Plotly)

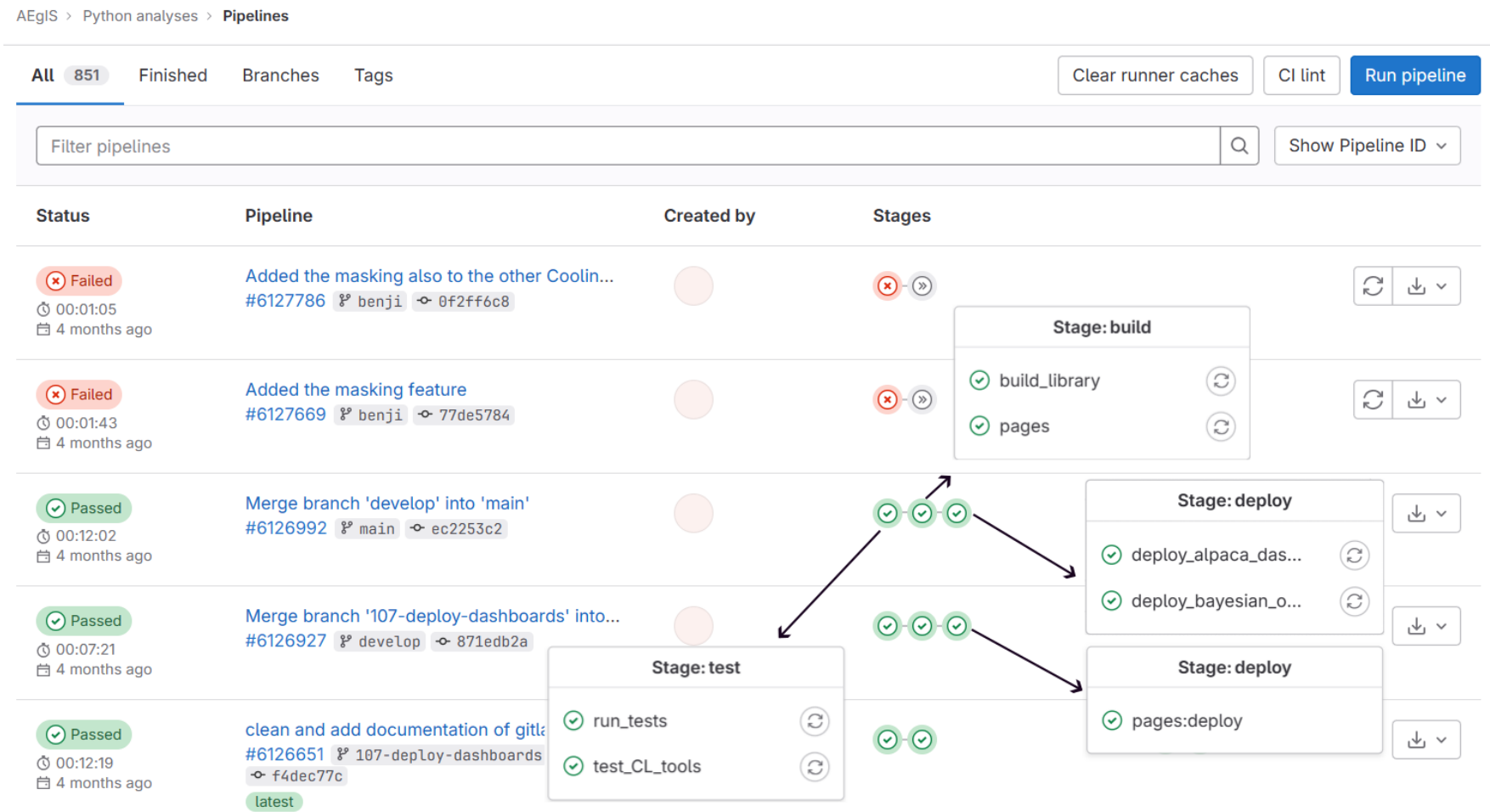


Documentation



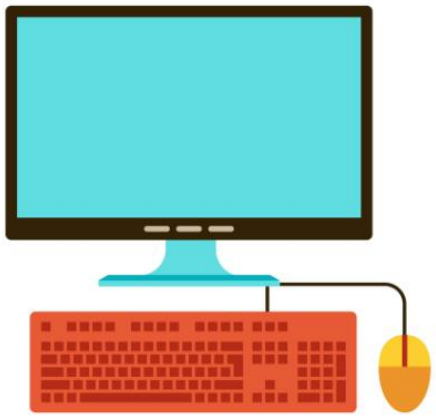


Continuous Integration – Continuous Deployment

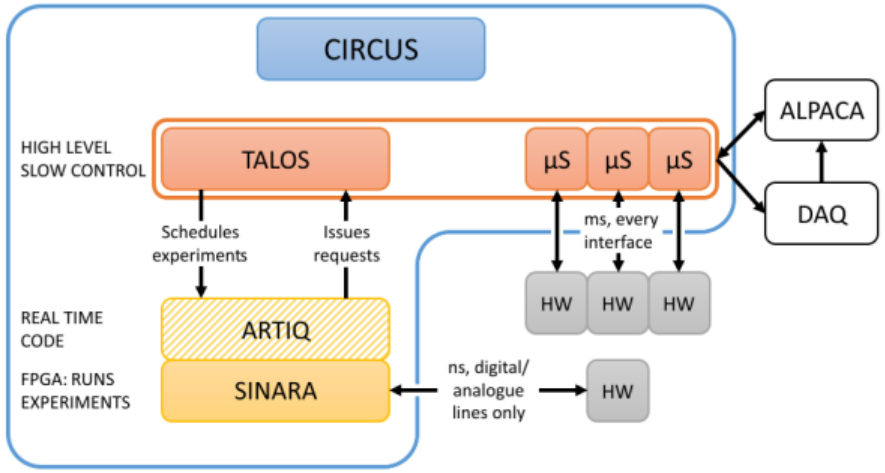


Where does the ALPACA currently live?

Personal Computers

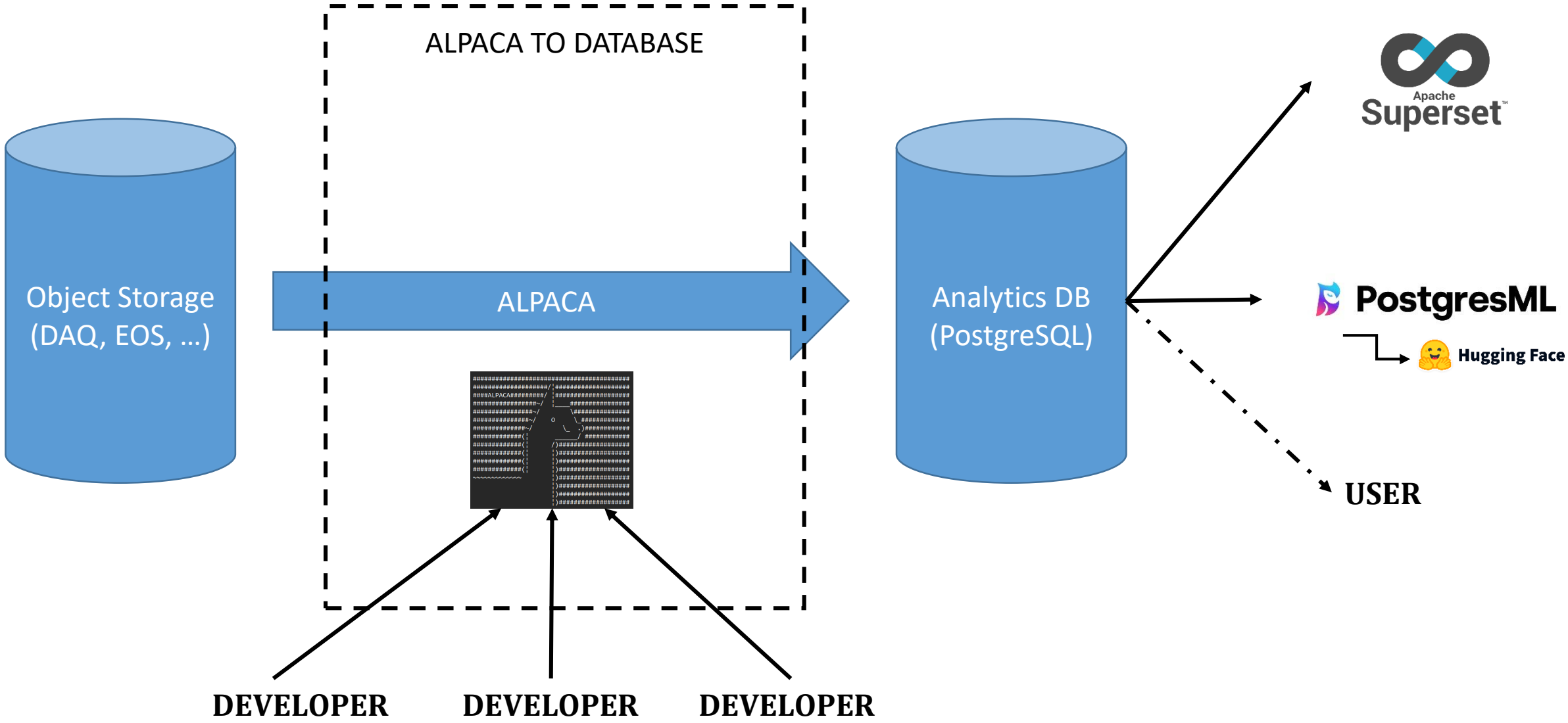


Aegis Control System

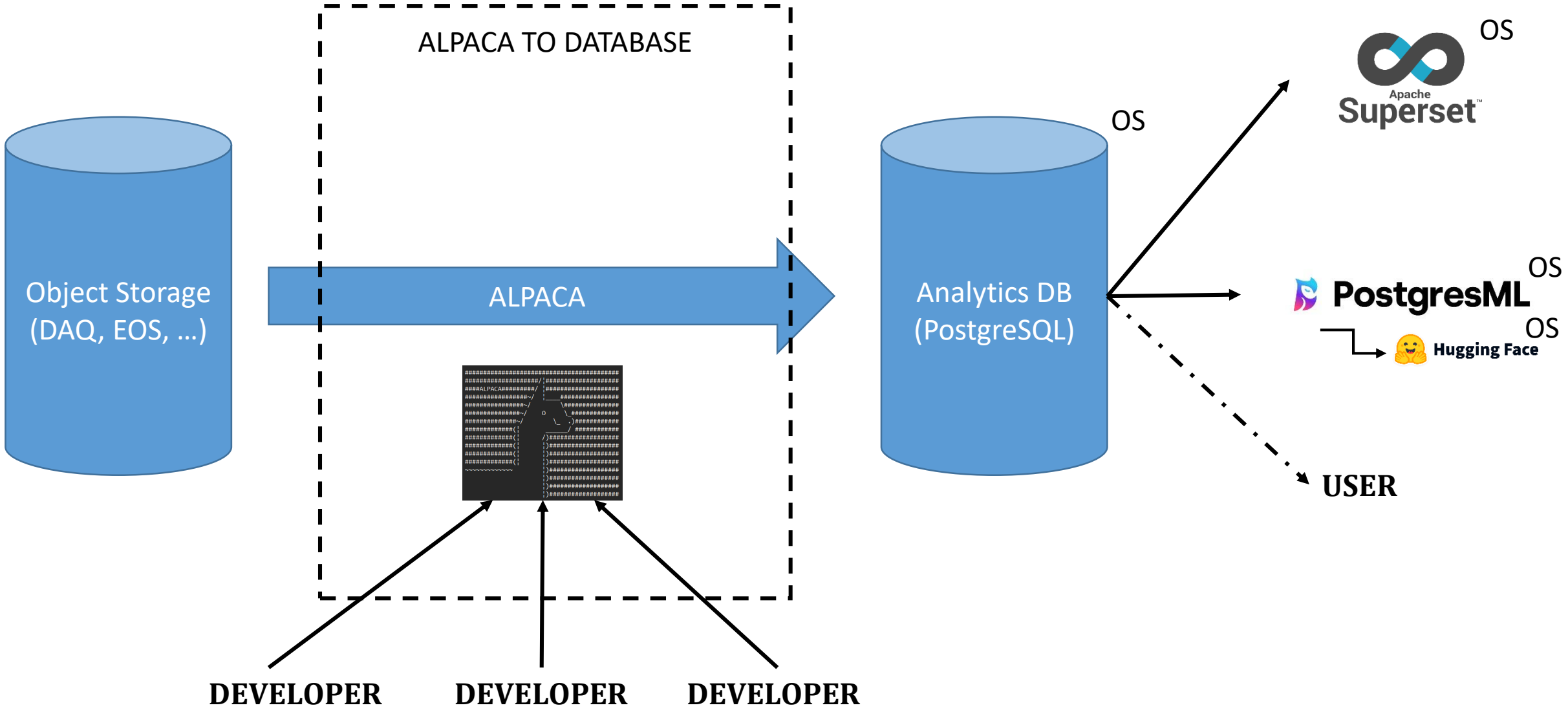


aegisonline

Full Stack Integration

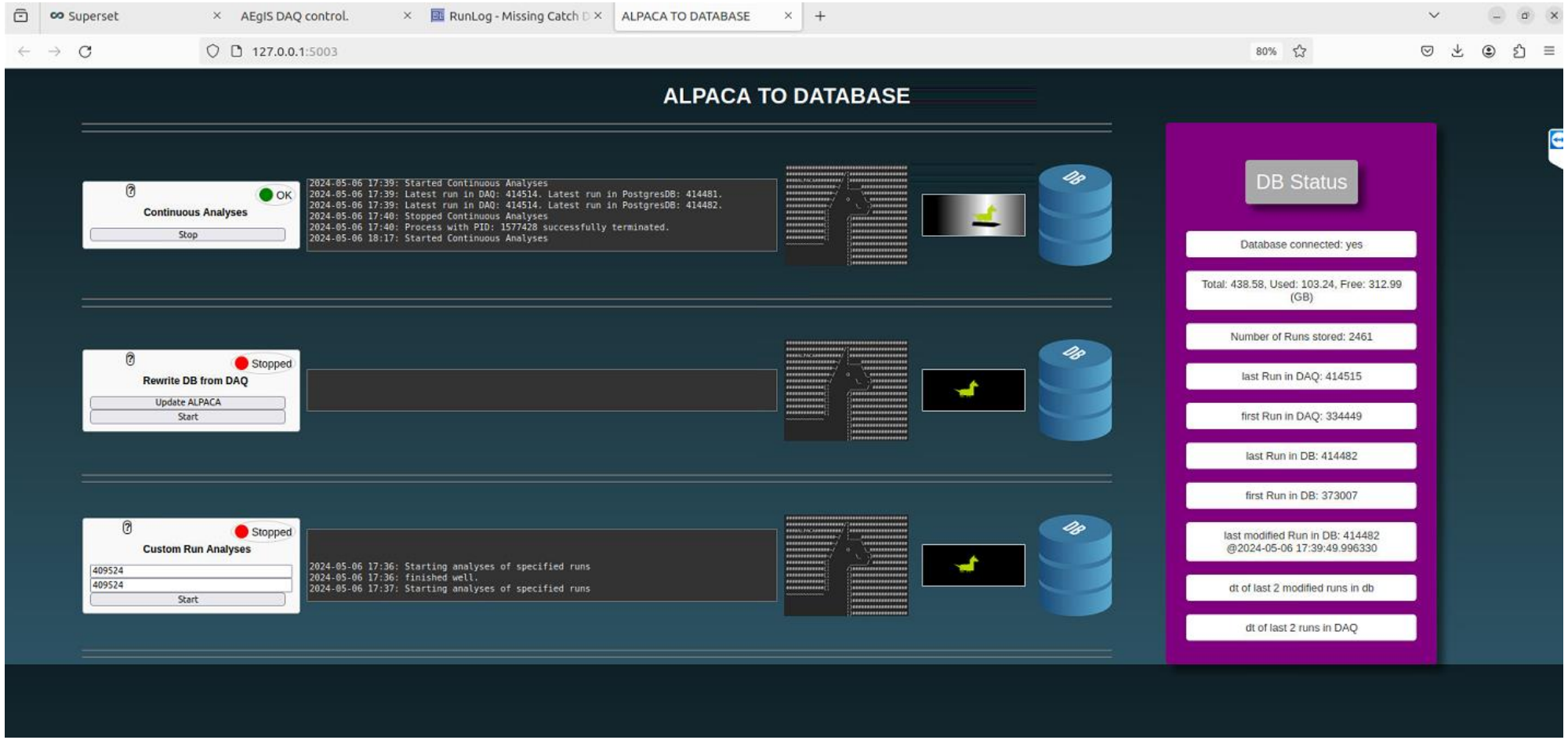


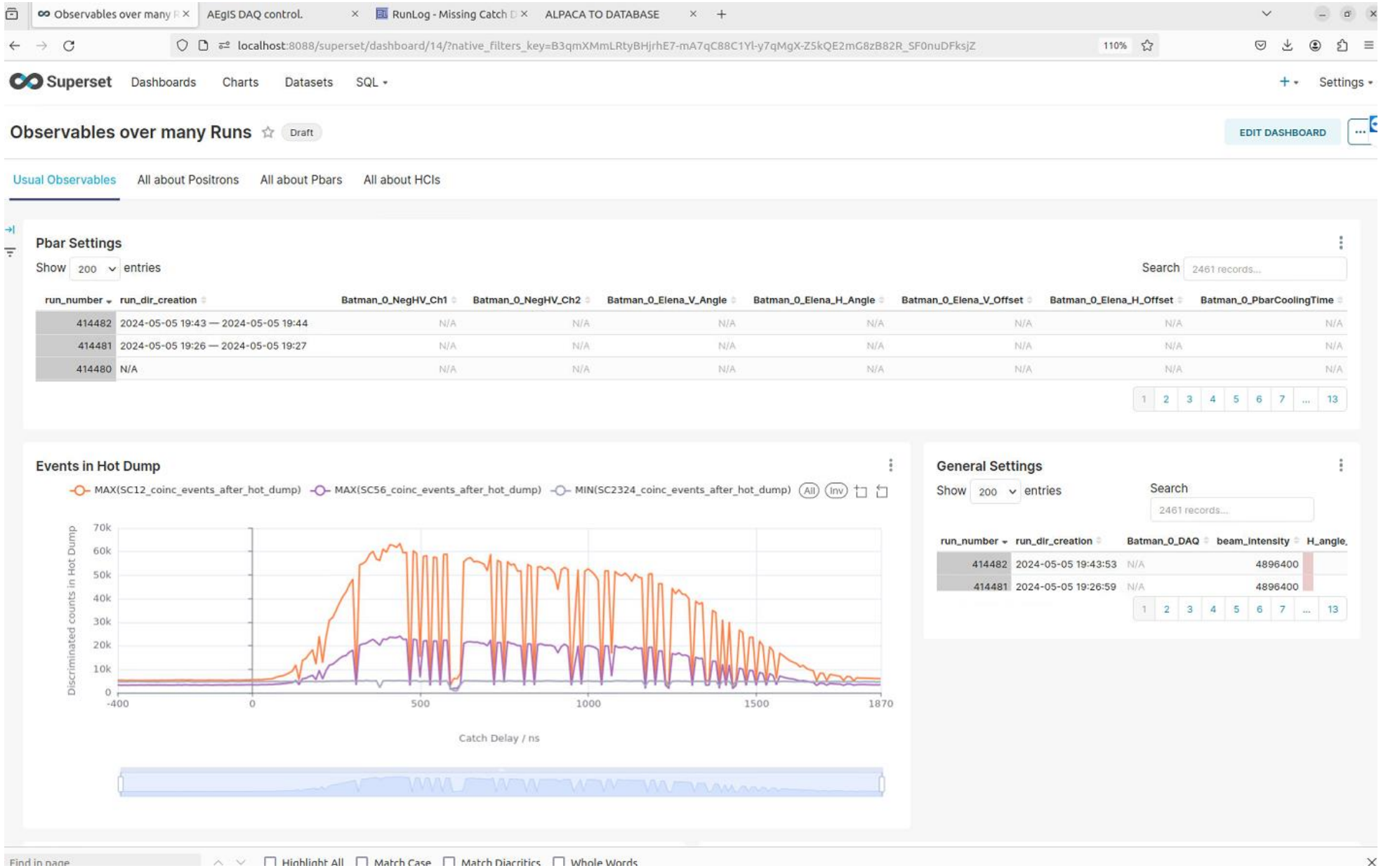
Full Stack Integration
- Powered by Open Source -



Alpaca to Database

(web app)




Observables over many
AEgIS DAQ control.
RunLog - Missing Catch
ALPACA TO DATABASE
localhost:8088/superset/dashboard/14/?native_filters_key=B3qmXMmLRtyBHjrhE7-mA7qC88C1Yl-y7qMgX-Z5kQE2mG8zB82R_SF0nuDFksjZ
110%
Superset
Dashboards
Charts
Datasets
SQL
Settings
Observables over many Runs
Draft
EDIT DASHBOARD
Usual Observables
All about Positrons
All about Pbars
All about HCIs
Pbar Settings
Show 200 entries
Search
2461 records...
run_number
run_dir_creation
Batman_0_NegHV_Ch1
Batman_0_NegHV_Ch2
Batman_0_Elena_V_Angle
Batman_0_Elena_H_Angle
Batman_0_Elena_V_Offset
Batman_0_Elena_H_Offset
Batman_0_PbarCoolingTime
414482
2024-05-05 19:43 — 2024-05-05 19:44
414481
2024-05-05 19:26 — 2024-05-05 19:27
414480
N/A
1 2 3 4 5 6 7 ... 13
Events in Hot Dump
MAX(SC12_coinc_events_after_hot_dump)
MAX(SC56_coinc_events_after_hot_dump)
MIN(SC2324_coinc_events_after_hot_dump)
All
Inv
Discriminated counts in Hot Dump
70k
60k
50k
40k
30k
20k
10k
0
-400
0
500
1000
1500
1870
Catch Delay / ns
General Settings
Show 200 entries
Search
2461 records...
run_number
run_dir_creation
Batman_0_DAQ
beam_intensity
H_angle
414482
2024-05-05 19:43:53
4896400
414481
2024-05-05 19:26:59
4896400
1 2 3 4 5 6 7 ... 13
Find in page
Highlight All
Match Case
Match Diacritics
Whole Words

Superset Dashboards Charts Datasets SQL + Settings

Specific Run ☆ Draft

EDIT DASHBOARD ...

Run Number

411999

Started run at

2023-12-07 09:24:28

Beam Intensity from elena

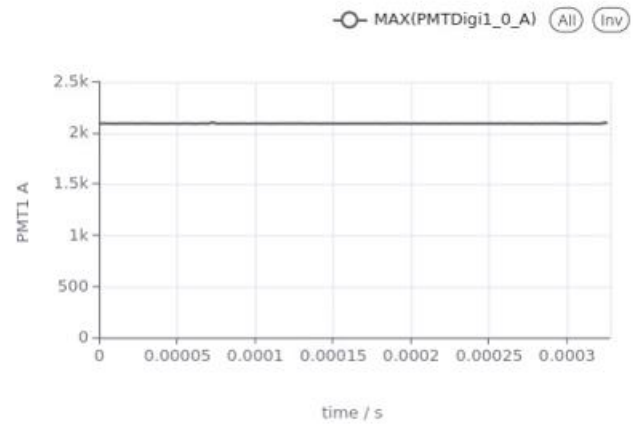
No data

No data after filtering or data is NULL for the latest time record

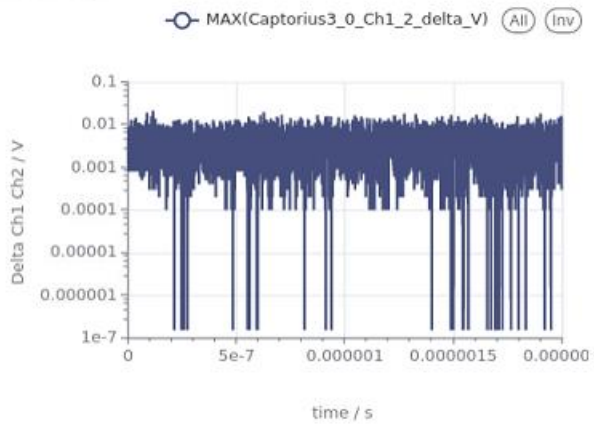
Metadata

MAX(Metadata_Intensity_ekspla)	MAX(Metadata_detuning_ekspla)	MAX(Metadata_delay_ekspla)	MAX(Metadata_Class)	MAX(Metadata_RealNoP)
N/A	N/A	N/A	N/A	N/A

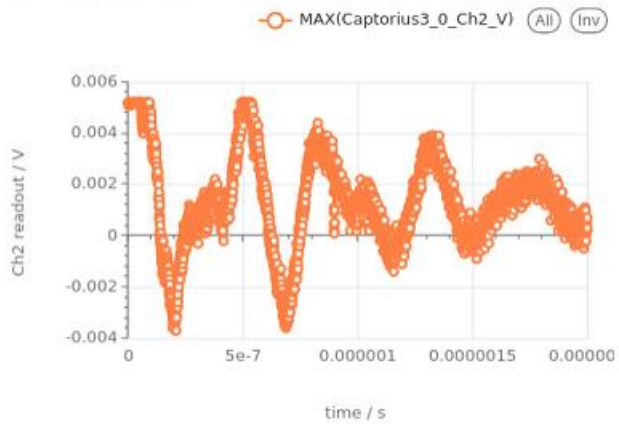
PMT1



Captorius3_Ch2_deltaV



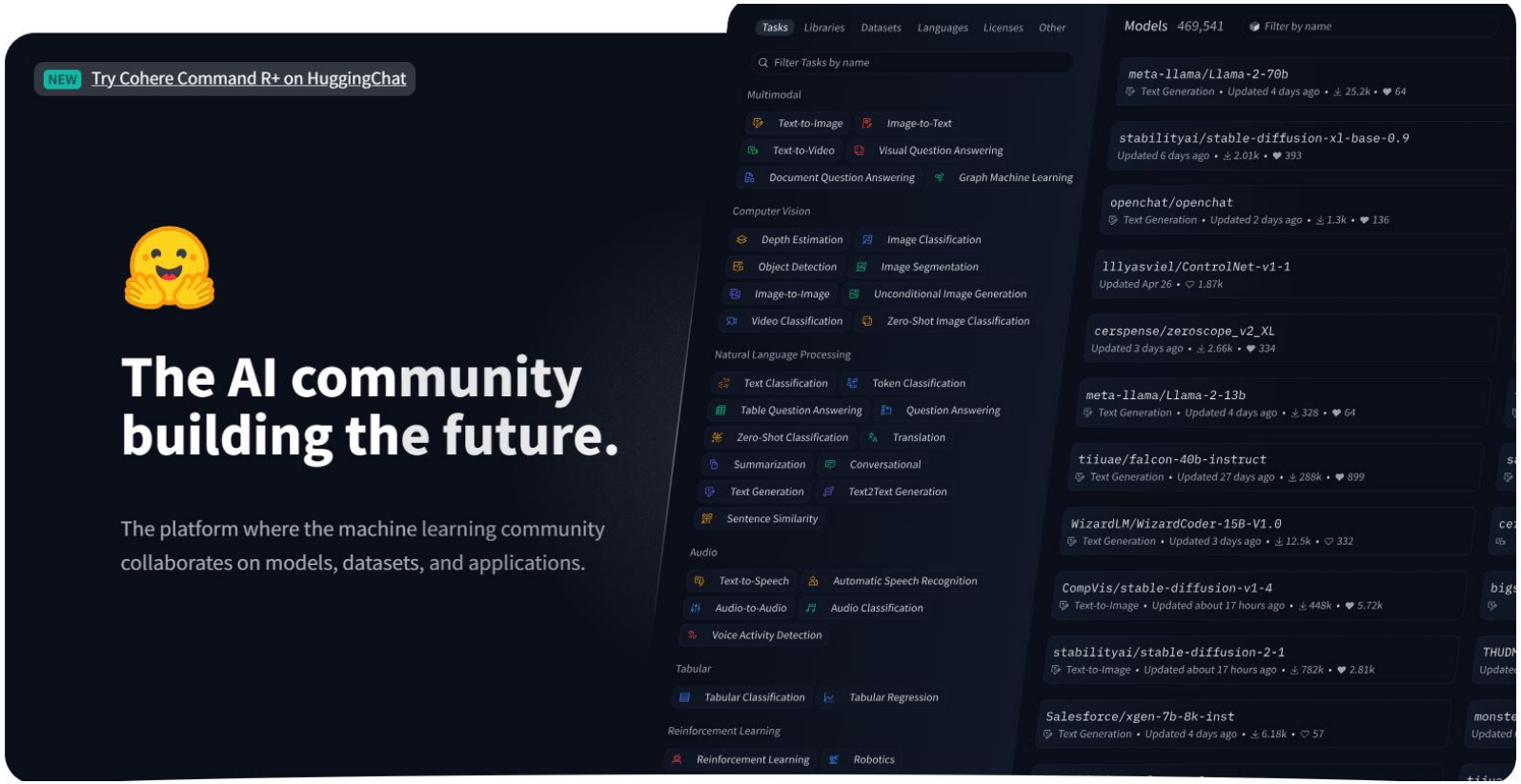
Captorius3_Ch2_readout



- A **no-code interface** for building charts quickly
- A powerful, web-based **SQL Editor** for advanced querying
- A **lightweight semantic layer**
- **Support for nearly any SQL** database or data engine
- wide array of **beautiful visualizations**
- **security roles and authentication**
- **API**

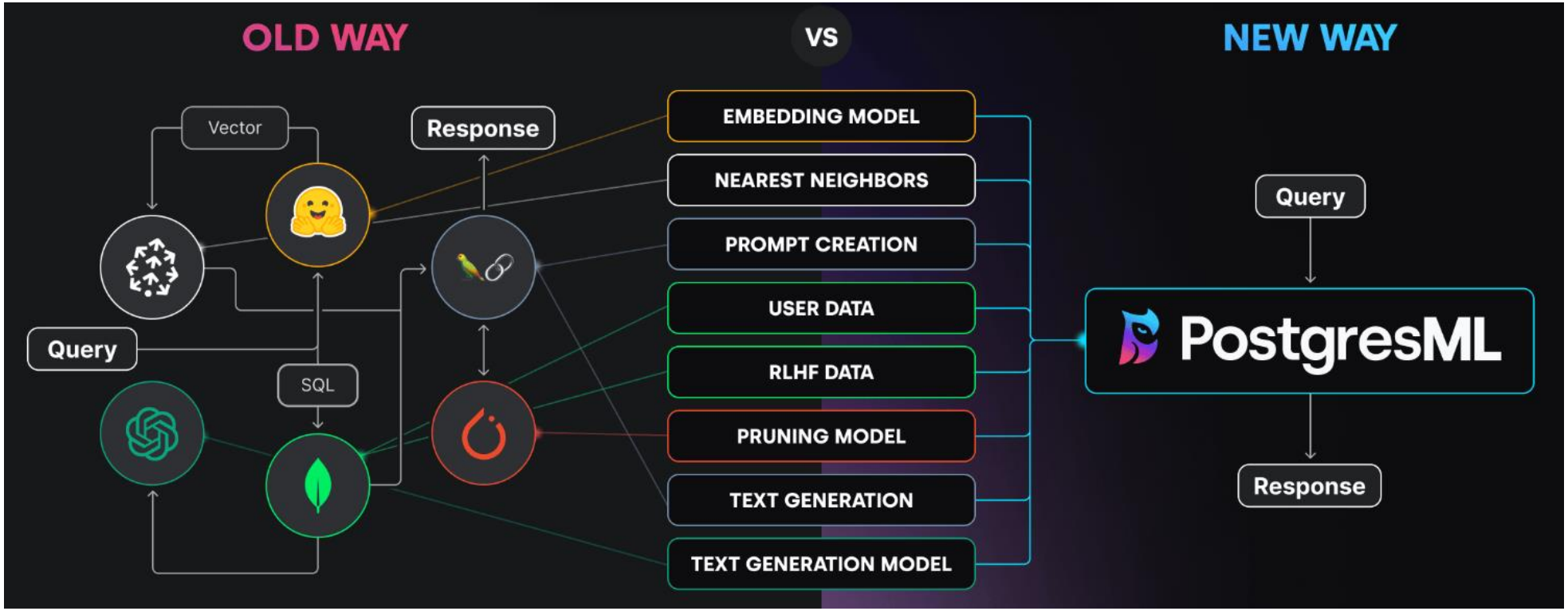
PostgresML

Hugging Face



- ML: More parameters → Better performance // Breakthrough of GPTs (LLNs)
- High economic pressure:
  - OpenAI (CS) → GPT4: 1.7T parameters 🫠
  - Meta & Google (OS) → Lama3: 8-70B parameters
  - ➢ Models bigger than data… → Bring them to the DB!

PostgresML



- PostgresML
  - Import data / Export models
  - Notebooks: ML with SQL
  - Full integration of Hugging Face
  - Training
  - Inference

SQL Extension

The SQL extension provides end-to-end ML & AI functionality from inference to deployment. It can be used in any combination to implement bespoke models across use cases.

AI

pgml.embed()

Generate high quality embeddings with faster end-to-end vector operations without an additional vector database.

pgml.transform()

Perform dozens of state-of-the-art natural language processing (NLP) tasks with thousands of models. Serve with the same Postgres infrastructure.

pgml.tune()

Fine tune open-source models on your own data.

ML

pgml.deploy()

Release trained models when ML quality metrics computed during training improve. Track model deployments over time and rollback if needed.

pgml.predict()

Batch predict from data in a table. Online predict with parameters passed in a query. Automatically reuse pre-processing steps from training.

pgml.train()

Pre-process and pull data to train a model using any of 50 different ML algorithms.

Via Notebooks

```
1
SELECT pgml.transform(
    'translation_en_to_fr',
    inputs => ARRAY[
        'Welcome to PostgresML!',
        'The next generation ML Database'
    ]
) AS french;
```

french
[{"translation_text":"Bienvenue à PostgresML!"},{"translation_text":"Base de données sur le ML de la prochaine génération"}]

3.057067s

Why interesting?

- Unique **Control System**
  - Code driven
  - Autonomous
  - Self-driven (closed feedback loops)
- Our Physics data
  - Sequential & iid
  - images, spectra, annihilation events
  - Raw & Analysed

- Research on ML in Physics of **high interest**

- specialised niche to study the intersection of ML/AI & low energy atomic physics, antimatter, plasma physics

What’s next?

Analytics Object Storage:

- Possible to store processed images
- Gravity Measurement with 6 GB images!

Superset:

- Opening up to outside CERN
- Access distribution (training)
- Upgrade to 4.0

PostgresML:

- Run models in DB
- Integrate Models from Hugging Face
- Deploy models
- Experiment the use-cases:
  - Coding
  - Analyses
  - Model Training not possible on aegisonline
    → More GPU power needed