

Compute4PUNCH & Storage4PUNCH: The Platforms for the analysis & Astronomical Data management

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Presented by

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PUNCH4NFDI

A Consortium in the NFDI

Nationale ForschungsDaten
Infrastruktur

P articles
U niverse
N uClei
C
H adrons

Particles, Universe,
NuClei and Hadrons
for the NFDI

A consortium in the NFDI.



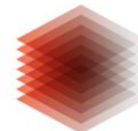
- FAIRification: data & workflows
- "big data" and "open data"
- heterogeneous data & infrastructures
- transfer of knowledge

Efficient usage of DATA and resources
with minimum technical barriers

Meet the team



UNIVERSITÄT
HEIDELBERG
ZUKUNFT
SEIT 1386



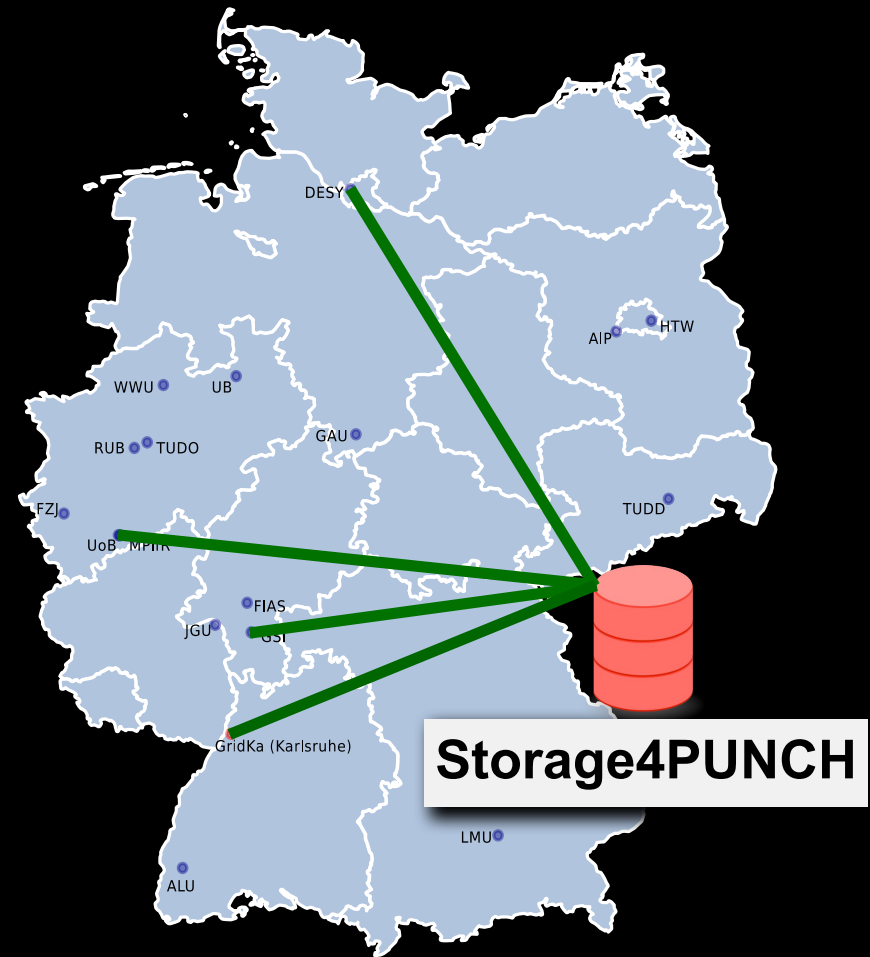
Storage4PUNCH

Integrated 4 Storage sites

Based on **two storage technologies**:

- **dCache** (@ DESY and KIT)
- **XrootD** (@ U Bonn and GSI)

Storage in PUNCH 1.0: ~ 4 PB



Compute4PUNCH

Dynamic integration of various heterogeneous compute resources

Acquire resources :

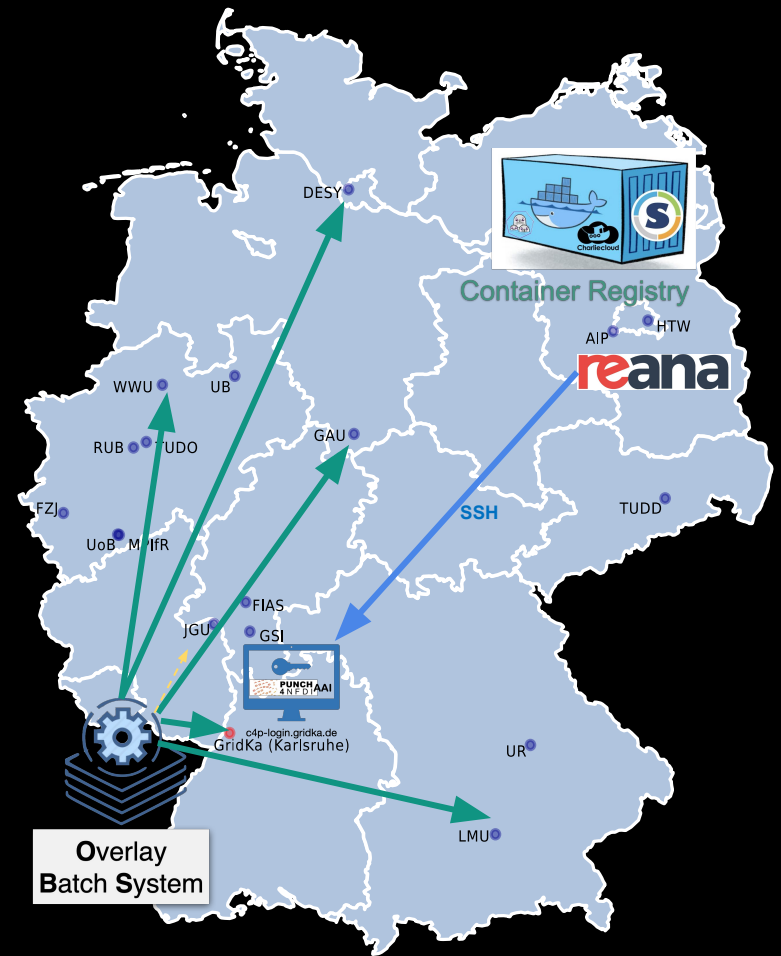
- dynamically by CoBalD/TARDIS

Integrated →

HTC, GPU, Kubernetes cluster (ReAna)

Container technology :

- software, modules, libraries encapsulated in a container; lightweight isolated environment



PUNCH-AAI

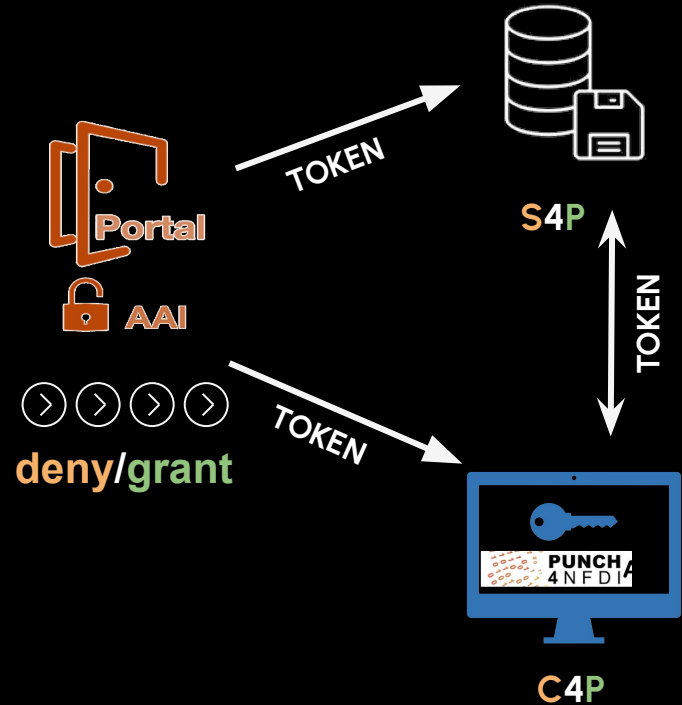
Authentication and Authorization Infrastructure

Authentication:

- ❖ to securely access distributed resources
- ❖ using existing institutional credentials
- ❖ a Single Sign-On mechanism

Based on Helmholtz AAI:

- implemented using the UNITY AAI toolkit
- provided by HIFIS





Storage4PUNCH



Container Registry



Overlay
Batch System

Compute4PUNCH



Storage4PUNCH



USER



Container Registry



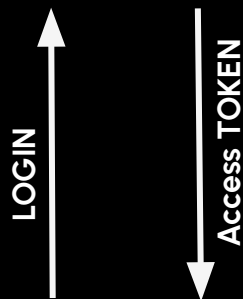
Compute4PUNCH



Overlay
Batch System



Storage4PUNCH



USER



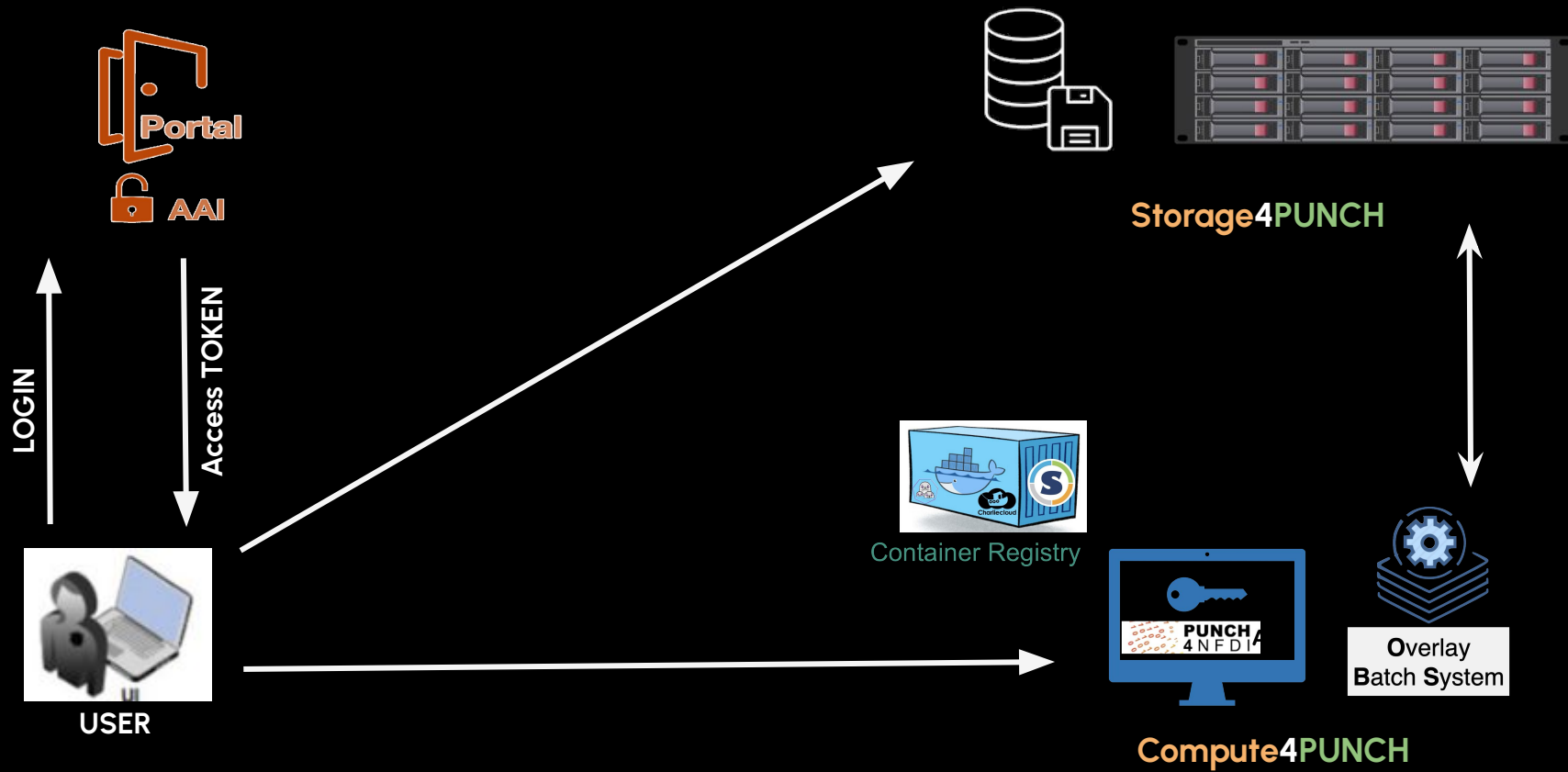
Container Registry



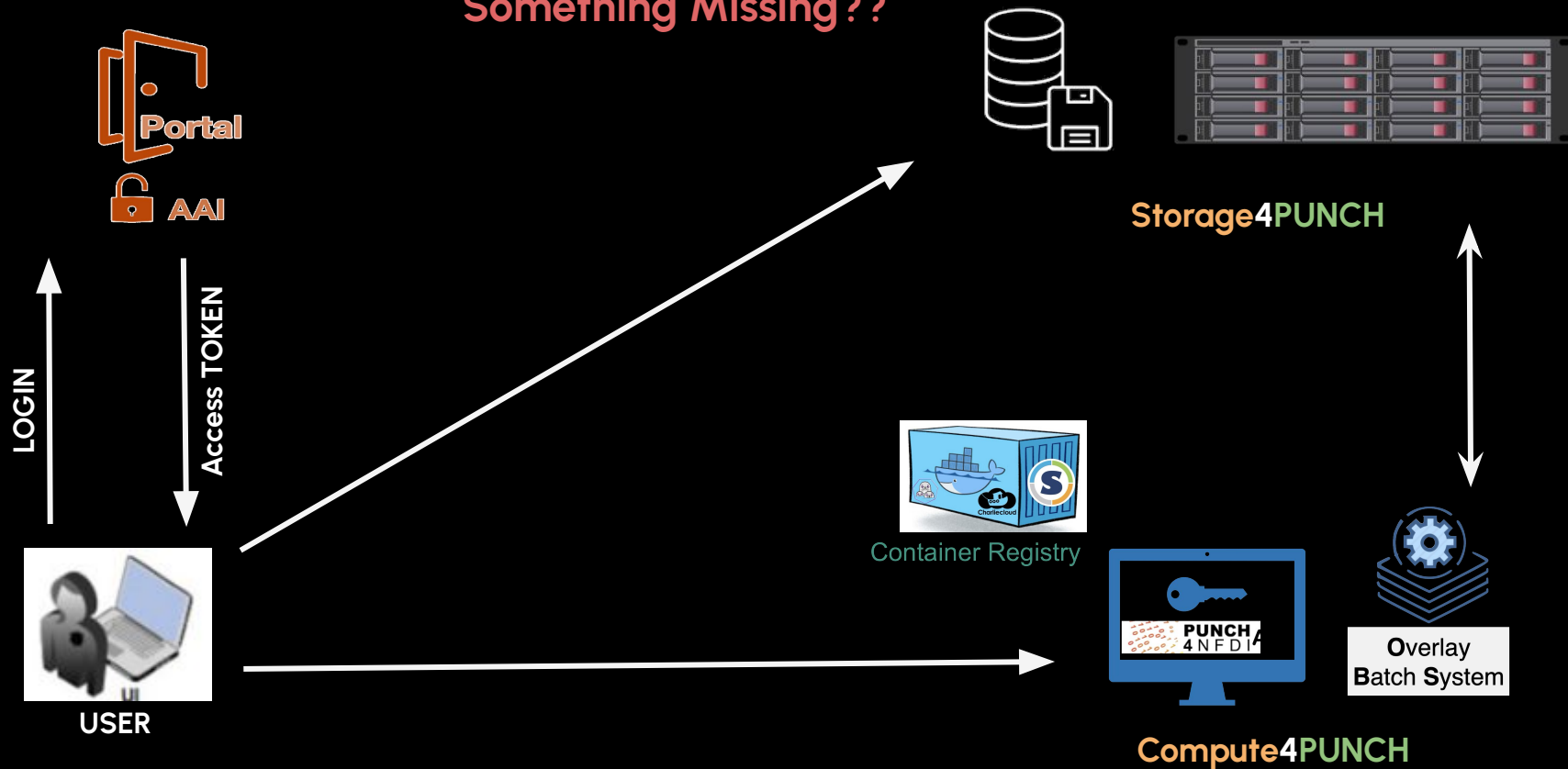
Compute4PUNCH

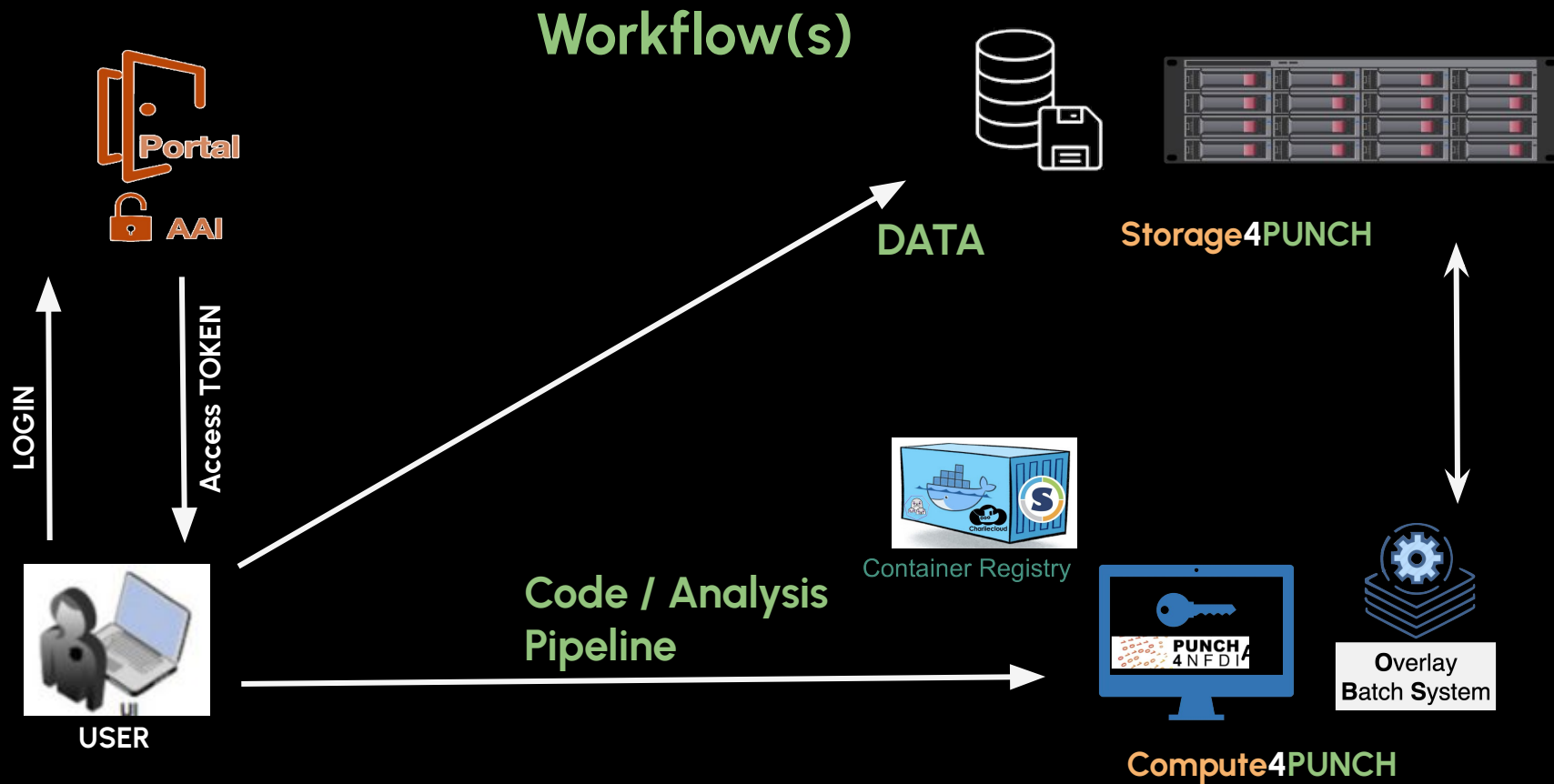


Overlay
Batch System



Something Missing??

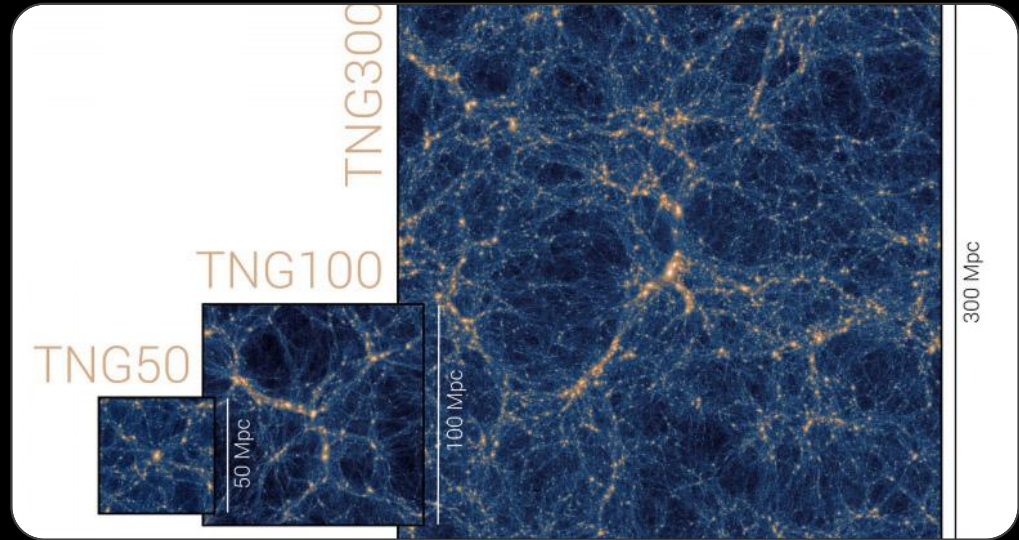
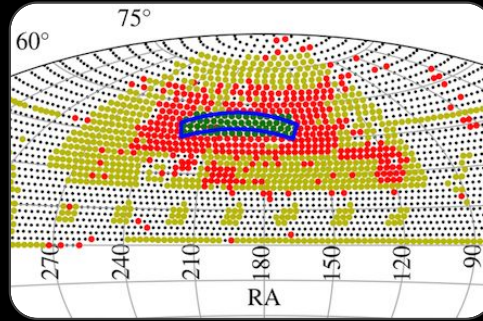




Large Astronomical Data

Various Radio Sky Surveys and Large Cosmological simulations are conducted in order to understand the formation history of the Universe

- This leads to significant amount of data ~ a few 10's of PB
 - ~ 500 GB to 1.5 TB / Snapshot
 - ~ 1.5 TB / observation hours (LOFAR)
 - ~ 2.5 TB / observation hours (MeerKAT)



Large Astronomical Data Projects

TNG Post-processing:

- Structure identification
- Volume rendering 3D maps of large structures
- Magnetic field structures in Galaxy clusters

MeerKAT Pulsar search:

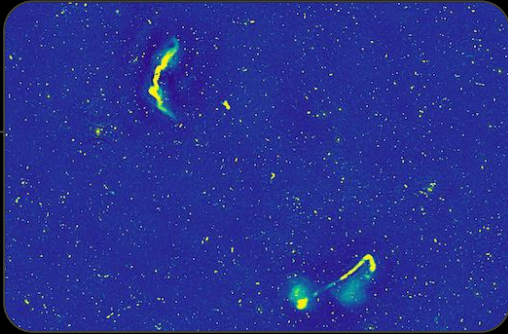
- Processing MeerKAT data
- Searching Pulsars in the field

LOFAR Deep Field Processing:

- Run initial calibration pipeline LINC
- Prepare data for further science analysis.

Demonstrator Workflows

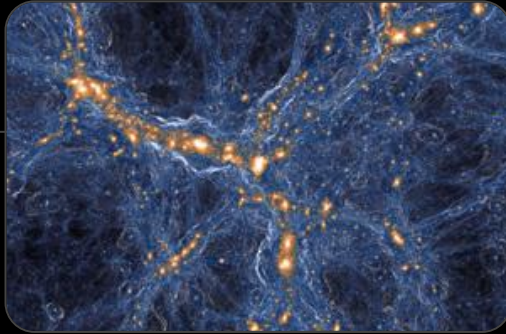
1



LoTSS data processing

- Initial **calibration pipeline**
- Processed **several pointing**
- **Calibration tables** for those pointings

2



Simulation Post-processing

- **Slice/Projection plots** of simulated fields
- **Derive new fields** using semi-analytical modelling
- Exploring **time-series possibility**

3



MeerKAT data processing

- Aiming for **pulsar search** (Ph.D. project)
- Onboarding in progress

DRP-Hub
Discover and manage research tools and workflows

Welcome back, prateek

NAVIGATION

- Dashboard
- Browse
- Bookmarks

TOOLS

- Open console

SECRETS & CONNECTIONS

- SSH Keys
- Git Config
- S3 Storage
- Reana
- C4P

Search: Search DRP cards...

Categories Tags Sort: Newest

24 DRPs available (12 public,12 internal,0 private)

CO CERN Open Data with C4P
by Elena Sacchi
hep

LHC example using C4P backend.

thc reana +2

FIAS 2026 Frankfurt
by Arman Khalatyan
general

FIAS 2026 Frankfurt PUNCH-2.0 Preparation Workshop

PUNCH2 FIAS

KT Key4hep tutorial
by Leonhard Reichenbach
hep

Key4hep recoil mass example on REANA
The [key4hep/edm4hep analysis tutorial]
(https://github.com/key4hep/key4hep-...)

Cosmology data analysis ex...
by Arman Khalatyan
astro

An example to render a slice from the Local Group from EDSM project: https://www.multidark.org/

cosmology

HM Halo Mass Distribution
by Harry Enke
astro

Halos are a result of cosmological simulations. (https://www.cosmosim.org/cms/data/halo-finders/). The workflow...

astronomy tap

SI StarHorse interactive
by Elena Sacchi
astro

This example makes use of StarHorse data (reading them from a public S3 bucket) to build an interactive session within a REANA...

python interactive

RE REANA Environments
by Elena Sacchi
general

Collection of ready to use environments (Docker images) with different libraries and scopes which can be included in a REANA...

reana tutorial +6

RT REANA Tutorials
by Elena Sacchi
general

Tutorials of different levels to get started with REANA and its many functionalities (including interactive sessions and more...

reana tutorial +1

● PUNCH4NFDI

* Credits: AIP, Arman et. al.
* https://drphub-p4n.aip.de/

■ Astro-CC EDP Forum

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Workflow imbedded

Findable

Data location &
retrieval process

● **F**indable

● **A**ccessible

Workflow imbedded

Data location &
retrieval process

Data on S4P :
TOKEN access

● Findable

● Accessible

● Interoperable

Workflow imbedded

Data location & retrieval process

Data on S4P :
TOKEN access

Code(s), input(s),
software, library,
modules, Containers

● **F**indable

● **A**ccessible

● **I**nteroperable

● **R**eusable

Workflow imbedded

Data location &
retrieval process

Data on S4P :
TOKEN access

Code(s), input(s),
software, library,
modules, Containers

Editable

C4P & S4P: Platform for data analysis & management

● Findable

● Accessible

● Interoperable

● Reusable

Workflow imbedded

Data location & retrieval process

Data on S4P :
TOKEN access

Code(s), input(s),
software, library,
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Editable

Thank you