ESAP
ESFRI Science Analysis Platform

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From Science Gateways to Papers

Palermo, 22-26 May 2022

ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n° 824064.

Summary

- Brief EU ESCAPE projects description
  - introduction
  - partners
  - work program
- ESAP
  - in the project proposal
  - in the concrete design and development
  - current status

Funded by the European Union's
Horizon 2020 - Grant N° 824064

ESCAPE
European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures

ESCAPE aims to address the Open Science challenges in data accessibility shared by

- ESFRI facilities (SKA, CTA, KM3Net, EST, ELT, HL-LHC, FAIR)
- pan-European research infrastructures (CERN, ESO, JIVE)

both in astronomy and particle physics.

Goal: to make data and software open, accessible and interoperable in multi-messenger astronomy and accelerator-driven particle physics

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Use cases providers

ESFRI Research Infrastructures are
facilities, resources or services
identified by the European research communities,
based on the excellence of their scientific case and their maturity,
to conduct and to support top-level research activities in their domains.

Astrophysics

Cherenkov Telescope Array

Astrophysics

EGO-Virgo

Astrophysics

European Solar Telescope

Astrophysics

Rubin Observatory Legacy Survey of Space and Time (LSST)

Astrophysics

Square Kilometre Array

Astrophysics

Joint Institute for VLBI ERIC

Astrophysics

KM3NeT

Astrophysics

Extremely Large Telescope

Particle Physics

Facility for Antiproton and Ion Research

Particle Physics

High Luminosity LHC

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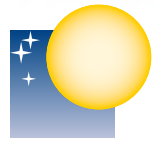
ESCAPE partners

Royal Observatory
of Belgium



Leibniz-Institut für
Astrophysik Potsdam

Netherlands Institute for Radio Astronomy

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ESCAPE technical Work Packages

- **Data Lake (DIOS: Data Infrastructure for Open Science):**

Build a scalable, federated, data infrastructure for open science for the ESFRI
Enable connection to compute and storage resources. [Rucio]

- **Software Repository (OSSR: Open-source Scientific Software and Service Repository):**

Open source scientific software and service repository. [Zenodo]

- **Virtual Observatory (CEVO: Connecting ESFRI projects to EOSC through VO framework):**

Extend FAIR standards, methods, tools of the Virtual Observatory;
demonstrate EOSC ability to include existing platforms [IVOA]

- **Citizen Science (ECO:Engagement and COmmunication):**

Open gateway for citizen science on ESCAPE data archives and ESFRI CS projects

- **Science Platforms (ESAP: ESFRI Science Analysis Platform):**

Flexible science platform to enable the analysis of open access data

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ESAP: ESFRI Science Analysis Platform in the EU ESCAPE project proposal

A high-performance, scalable science platform-service prototype

- to identify and stage existing data collections for analysis
- to run a wide-range of software tools and packages developed by the ESFRIs
- to allow researchers to bring their own custom workflows to the platform
- to take advantage of the underlying HPC and HTC computing infrastructure to execute those workflows
- to share results and workflows

tailored to the requirements of the ESFRI and other Research Infrastructures involved in the project

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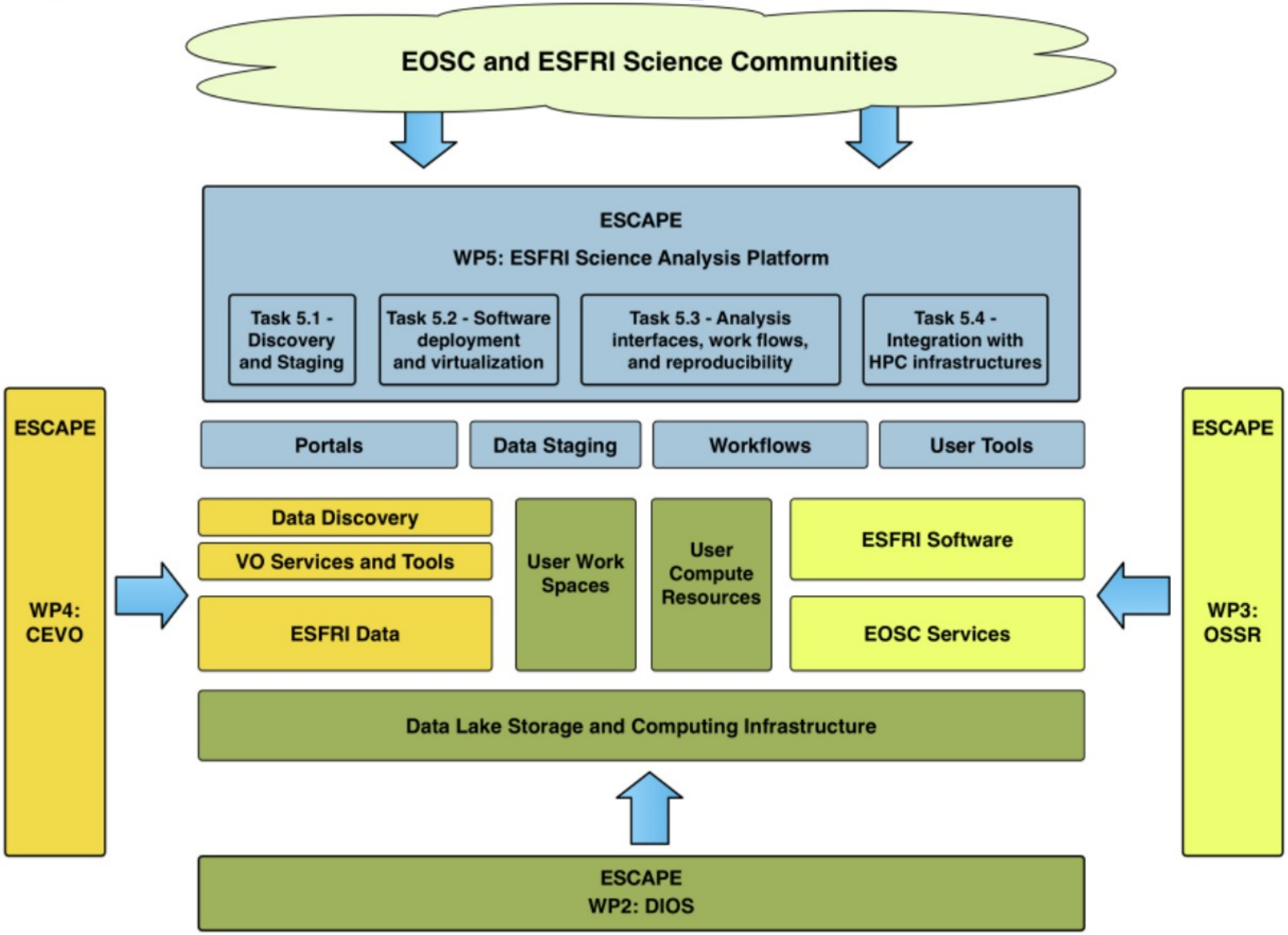
ESCAPE WP5 ESAP work program in a diagram



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ESAP: A platform... or a toolkit?

In the ESCAPE project ESAP is conceived as an integrated open science platform for data analysis

but ....

we are *not resourced* to build and maintain the great variety of available tools: Jupyter, batch computing services, desktop tools, etc. for common/EOSC access.

Many ESCAPE partner institutions do make available systems for testing, developing, and experimenting on.

ESAP is a *toolkit* for building "science platforms" which are customized to particular applications.

- At a variety of scales:
  - "Centralized ESAP", providing flexible and convenient access to a wide spectrum of ESCAPE services.
  - "Project ESAP", providing a way for individual infrastructures, projects, etc to quickly integrate diverse capabilities into a unified service offering.

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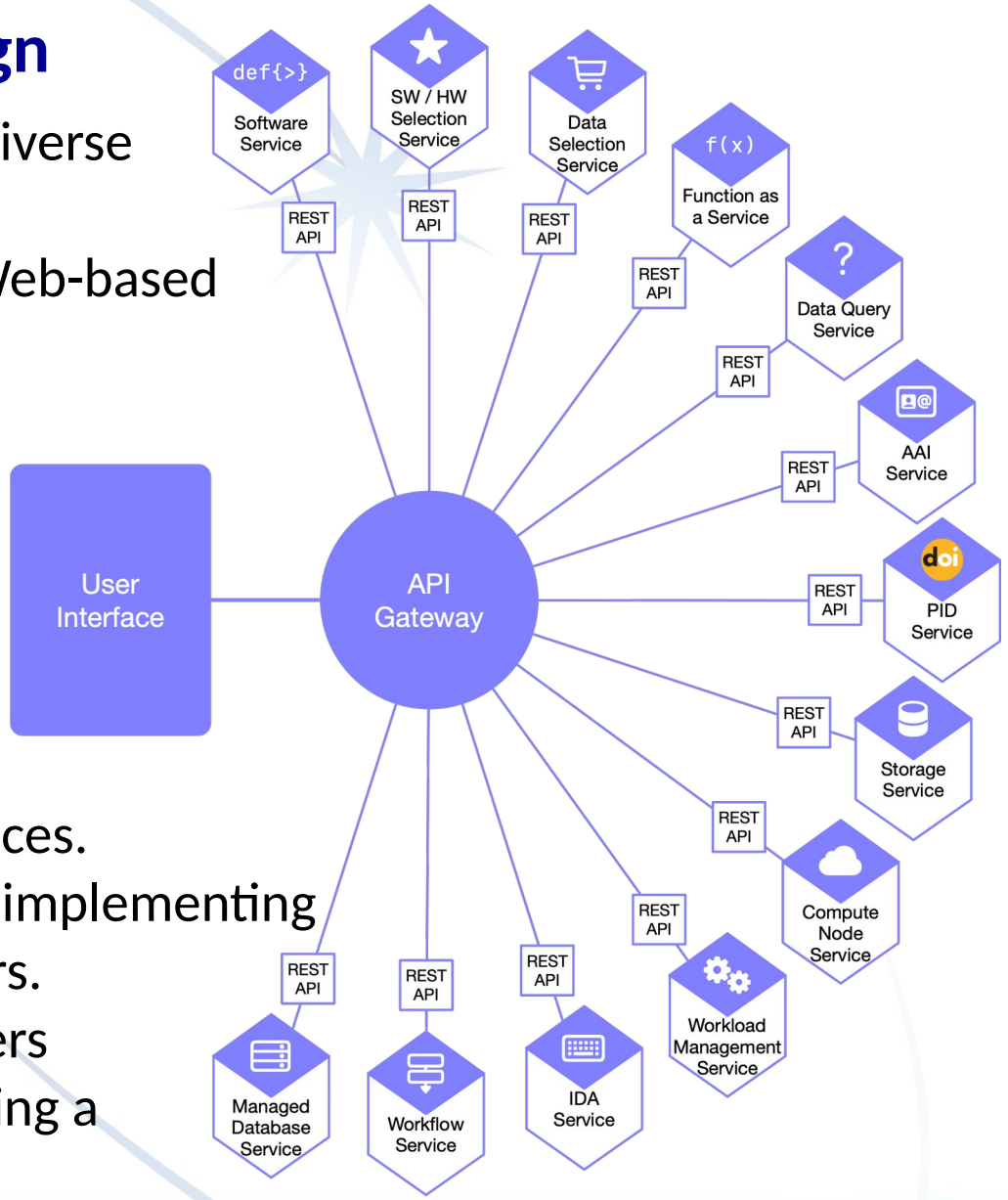
ESAP
Architectural Design

- ESAP is an integration point of diverse services from ESCAPE partners.
- The heart of the system is the Web-based *User Interface* and the *API Gateway*.
- The API Gateway modulates communication with a range of external services using REST APIs. A “service connector” system provides a standardized, plugin-based mechanism for integrating new services.
- It is possible to extend ESAP by implementing & integrating new service connectors.
- WP5 members and ESFRI partners collaborateon developing & integrating a variety of external services.



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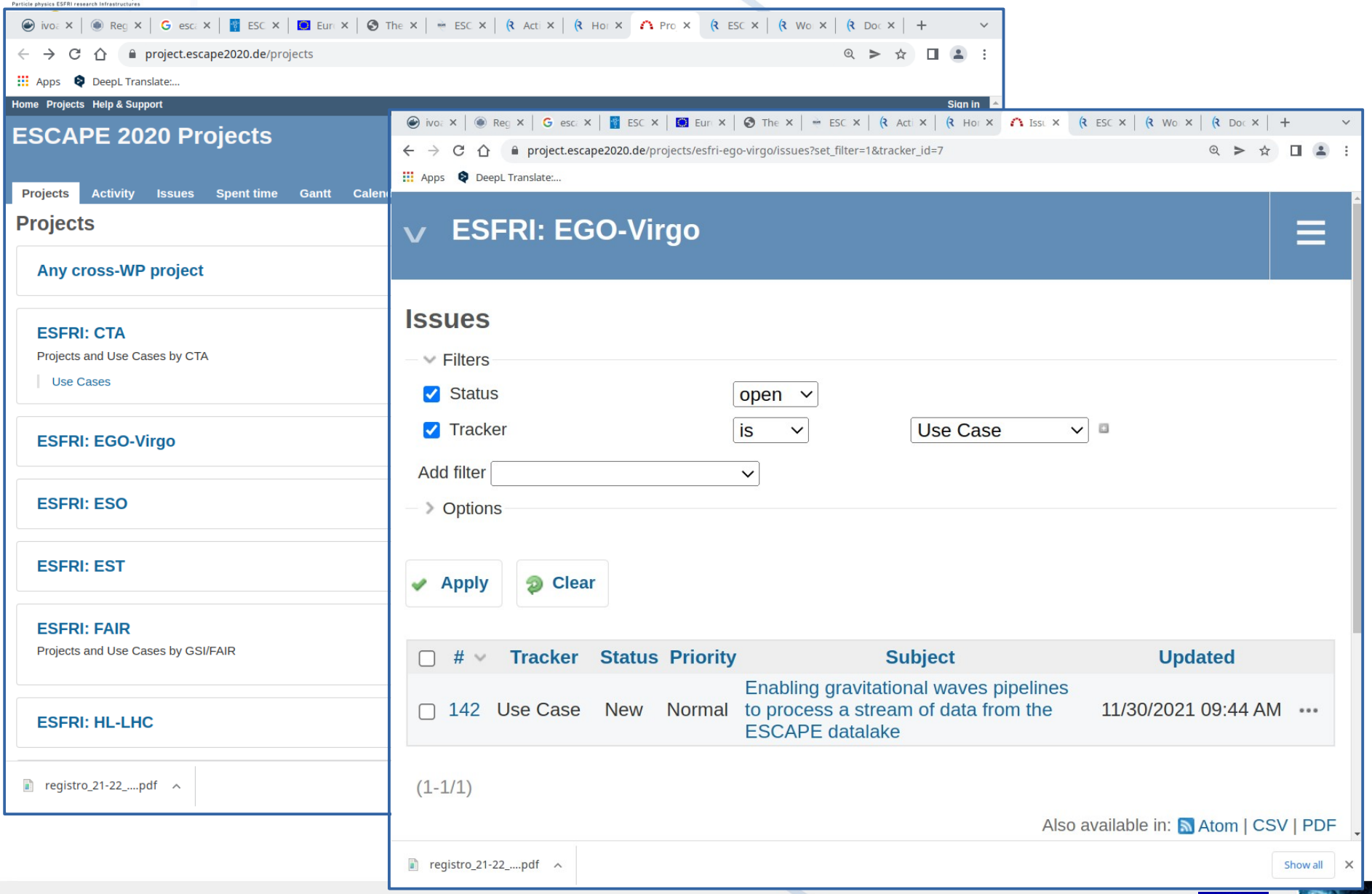
Use cases study



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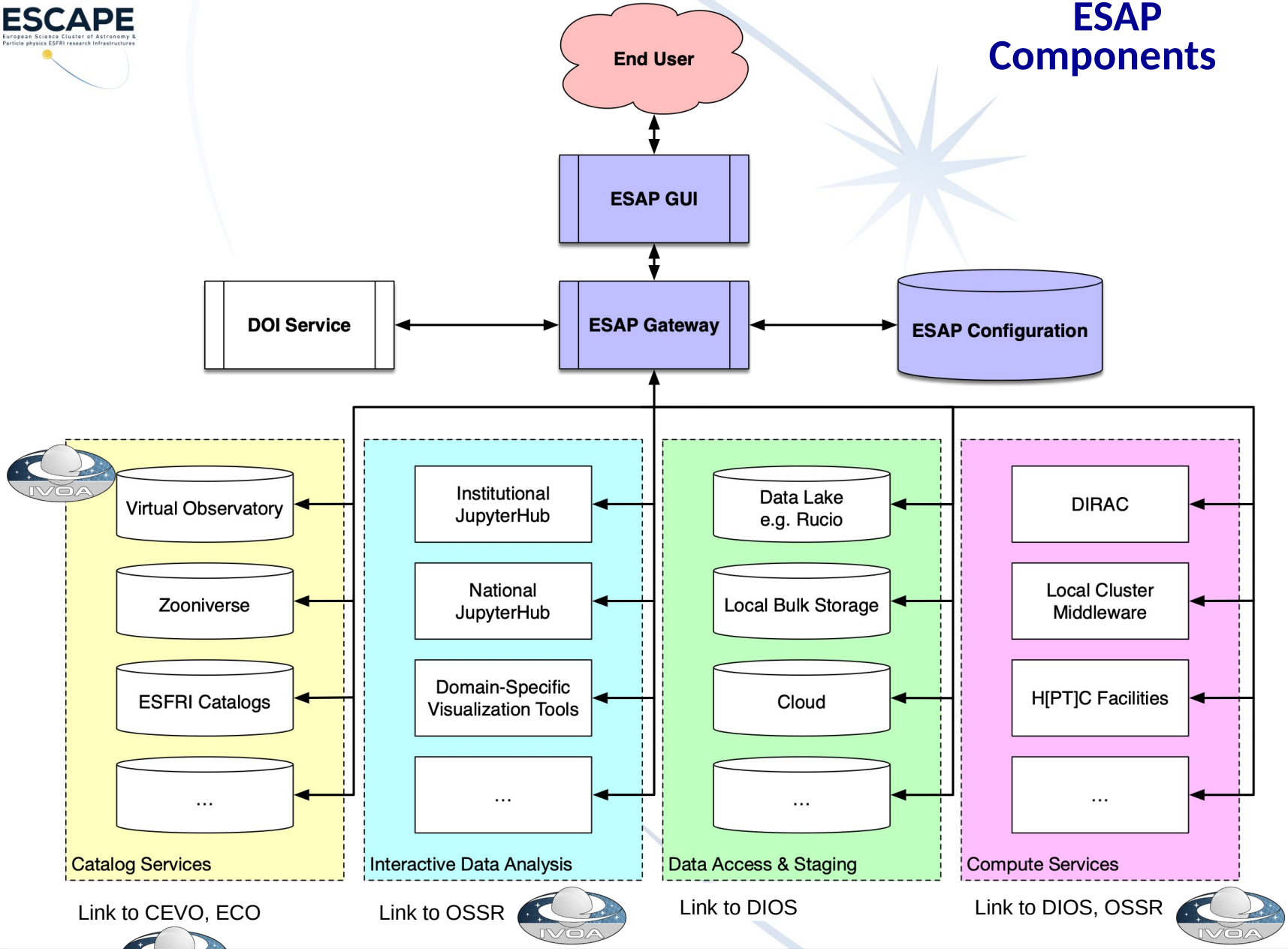
ESAP Components



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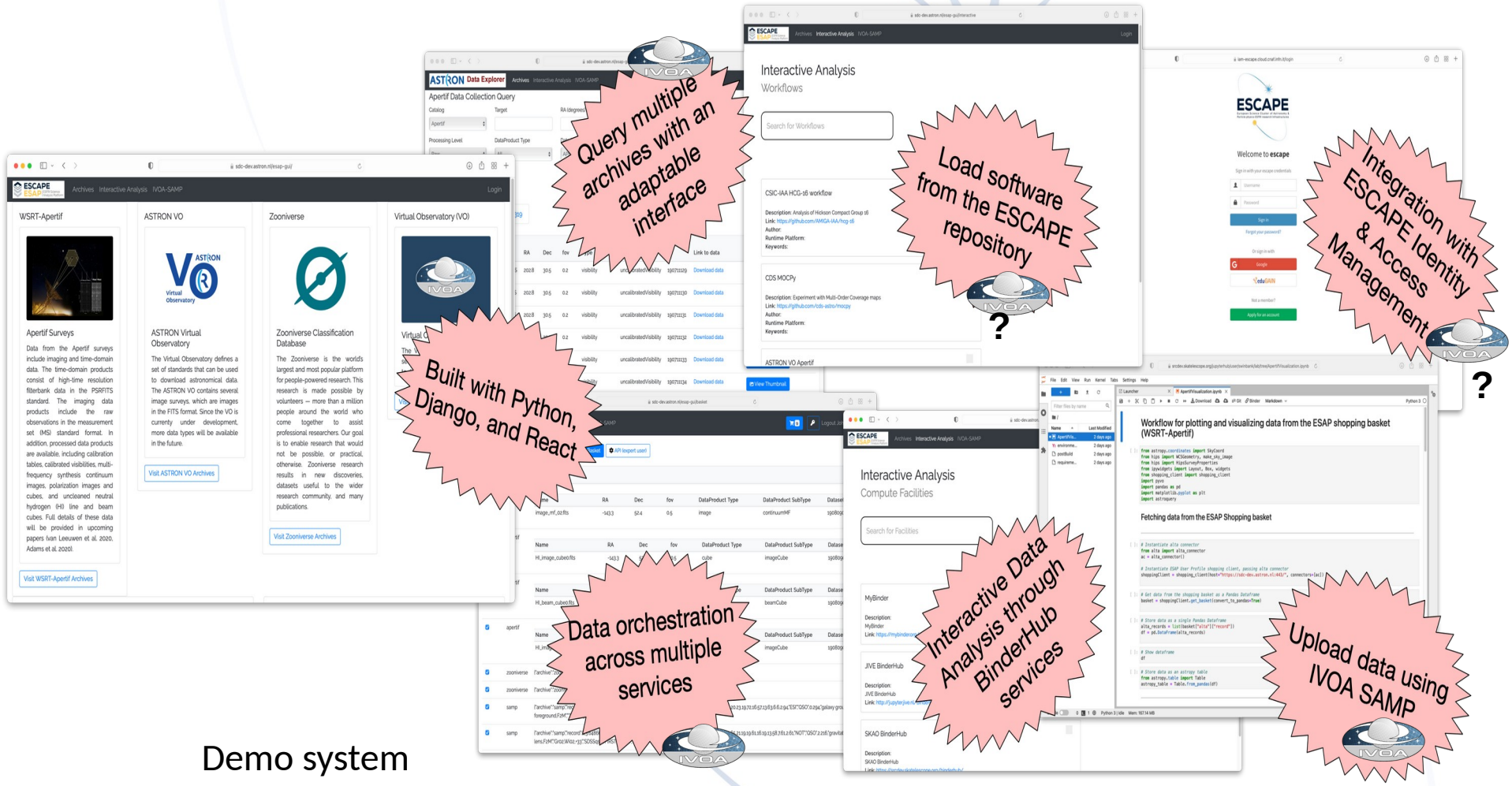
Current Status & Capabilities



Demo system

https://sdc-dev.astron.nl/esap-gui

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Current Status & Capabilities

ESAP-GUI — Mozilla Firefox

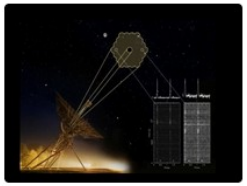
Google Traduttore | Inbox (3,817) - sara.bertoc | ESAP-GUI | PyVO.ipynb - JupyterLab | indigo iam - Google Search

https://sdc-dev.astron.nl/esap-gui/

Getting Started | Other Bookmarks

ESCAPE ESAP ESFRI Science Analysis Platform | Archives | Multi Query | Interactive Analysis | IVOA-SAMP | Login

WSRT-Apertif



Apertif Surveys

Data from the Apertif surveys include imaging and time-domain data. The time-domain products consist of high-time resolution filterbank data in the PSRFITS standard. The imaging data products include the raw observations in the measurement set (MS) standard format. In addition, processed data products are available, including calibration tables, calibrated visibilities, multi-frequency synthesis continuum images, polarization images and cubes, and uncleaned neutral hydrogen (HI) line and beam cubes. Full

ASTRON VO

ASTRON VO Virtual Observatory

ASTRON Virtual Observatory

The Virtual Observatory defines a set of standards that can be used to download astronomical data. The ASTRON VO contains several image surveys, which are images in the FITS format. Since the VO is currenty under development, more data types will be available in the future.

Visit ASTRON VO Archives

Zooniverse

Zooniverse Classification Database

The Zooniverse is the world's largest and most popular platform for people-powered research. This research is made possible by volunteers — more than a million people around the world who come together to assist professional researchers. Our goal is to enable research that would not be possible, or practical, otherwise. Zooniverse research results in new discoveries, datasets useful to the wider research community, and many publications.

Virtual Observatory (VO)

IVOA

Virtual Observatory (VO)

The Virtual Observatory defines a set of standards that can be used to download astronomical data.

Visit Virtual Observatory (VO) Archives

RUCIO

SCIENTIFIC DATA MANAGEMENT RUCIO

Rucio

Built on more than a decade of experience, Rucio serves the data needs of modern scientific experiments. Large amounts of data, countless numbers of files, heterogeneous storage systems, globally distributed data centres, monitoring and analytics. All coming together in modular solution to fit your needs.

Visit RUCIO Archives

https://sdc-dev.astron.nl/esap-api/oidc/authenticate

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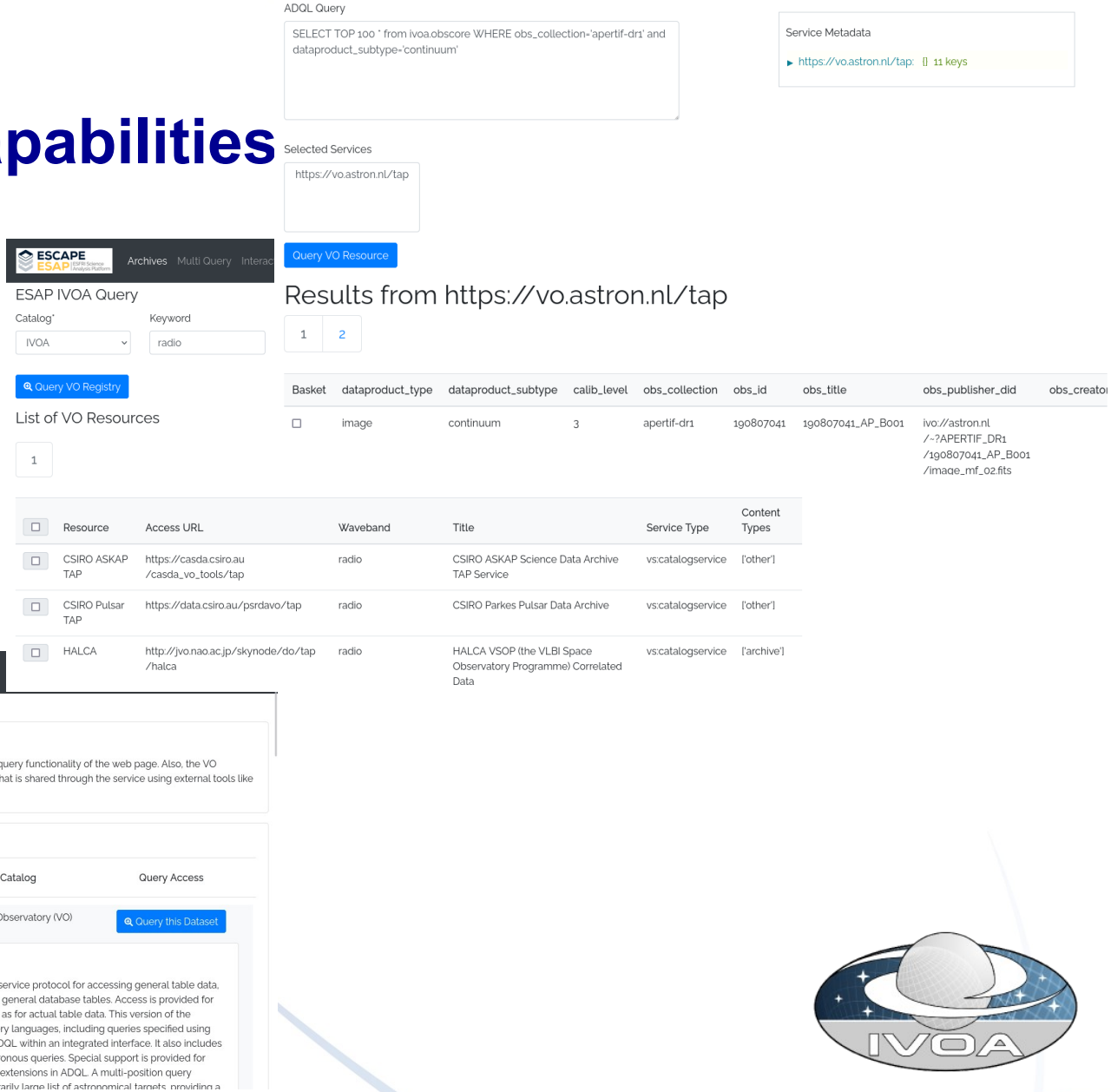
Existing Query Capabilities

ESAP can query the registry for services and data



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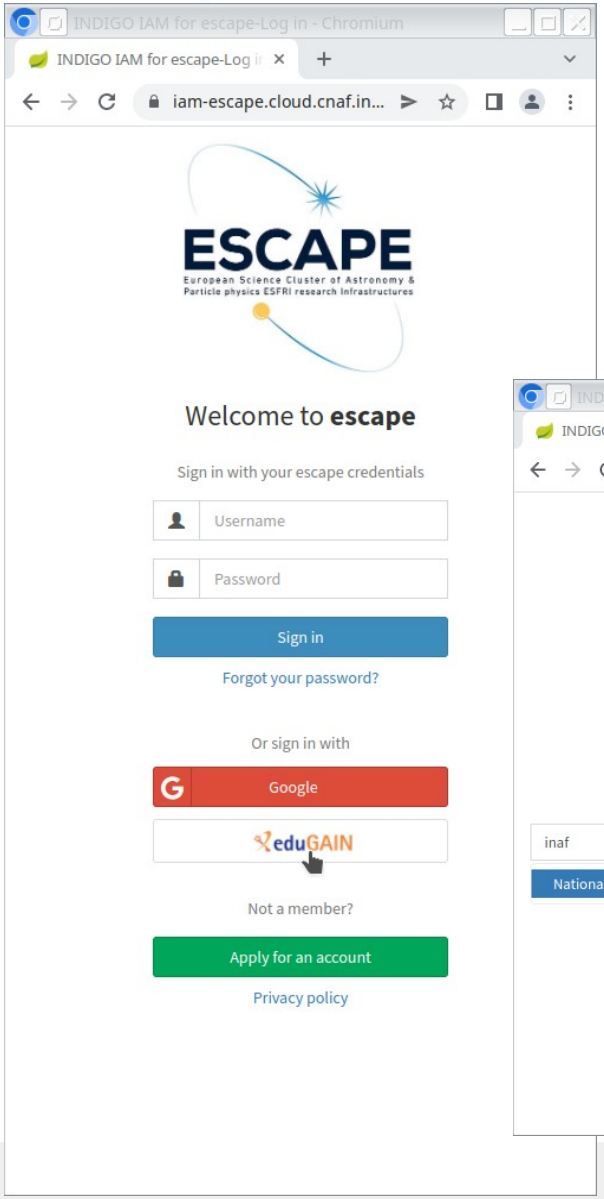
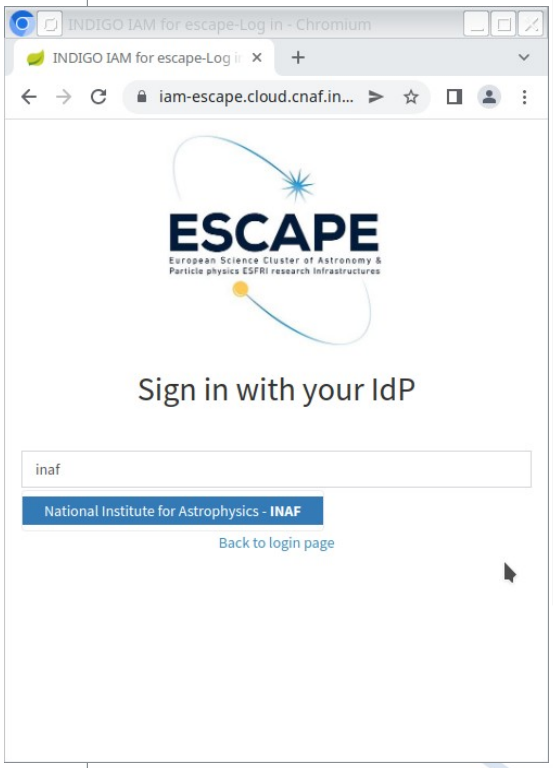
Authentication using IAM
INDIGO Identity and Access Management





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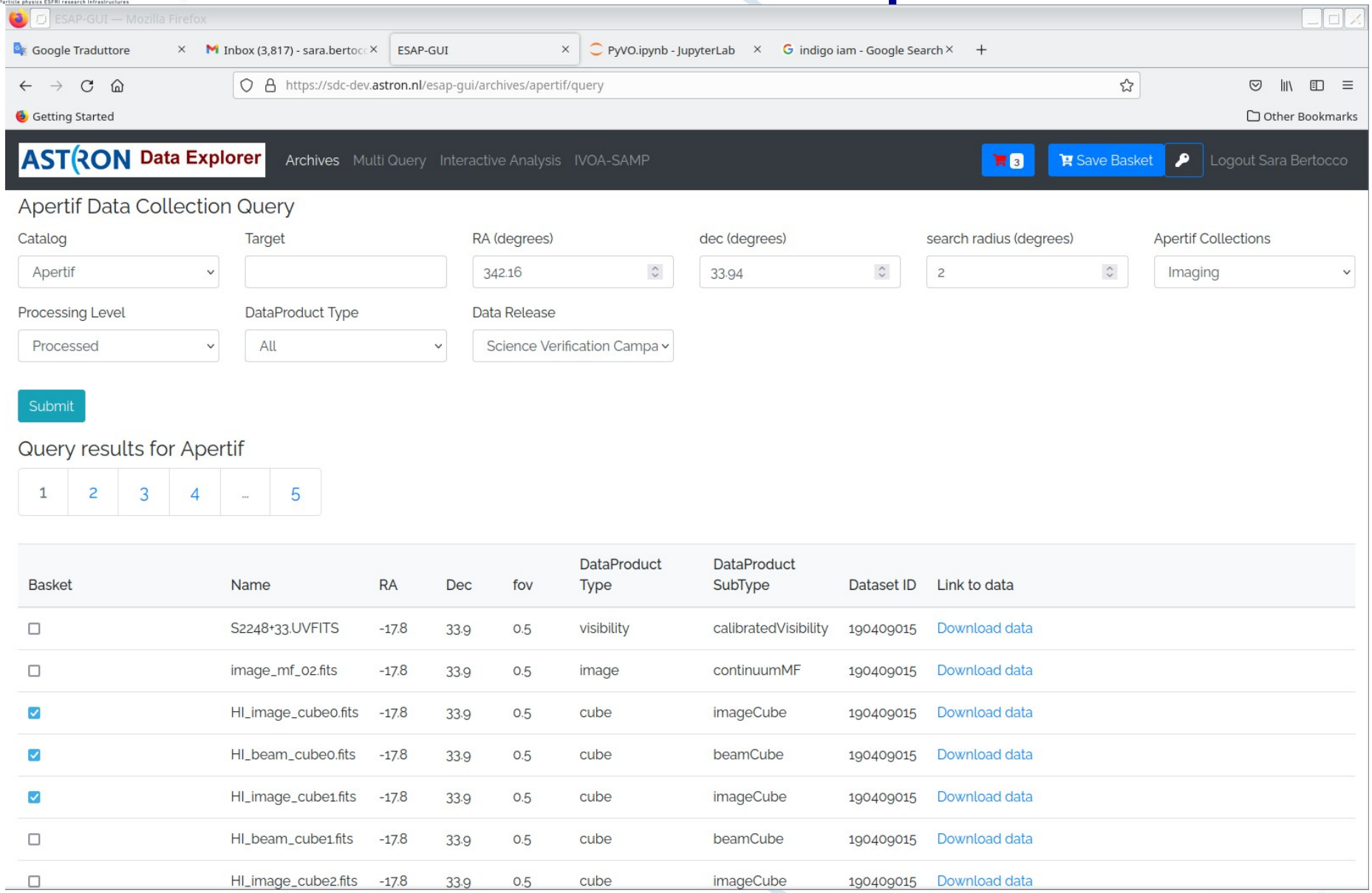
Authenticated user operations



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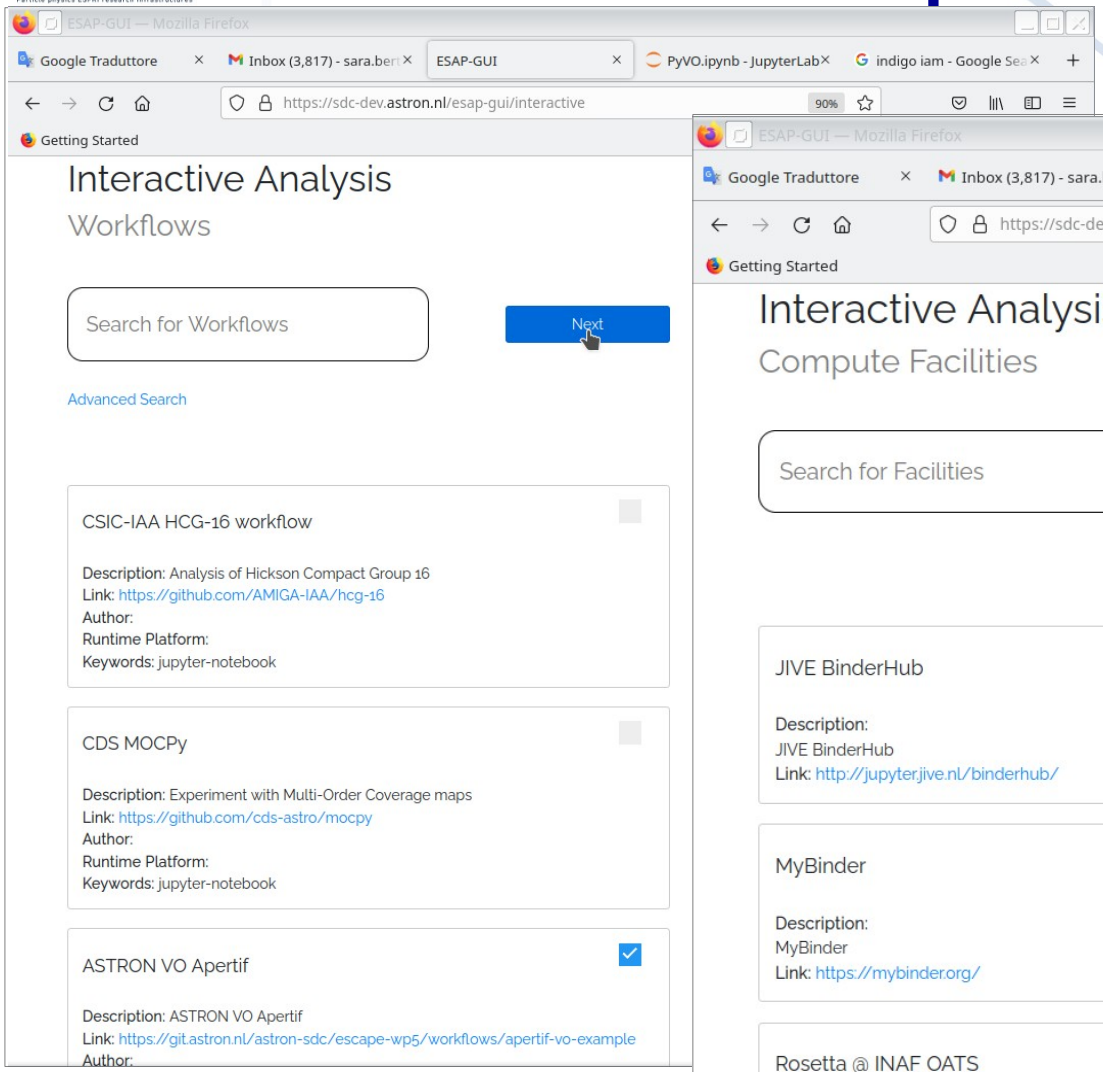
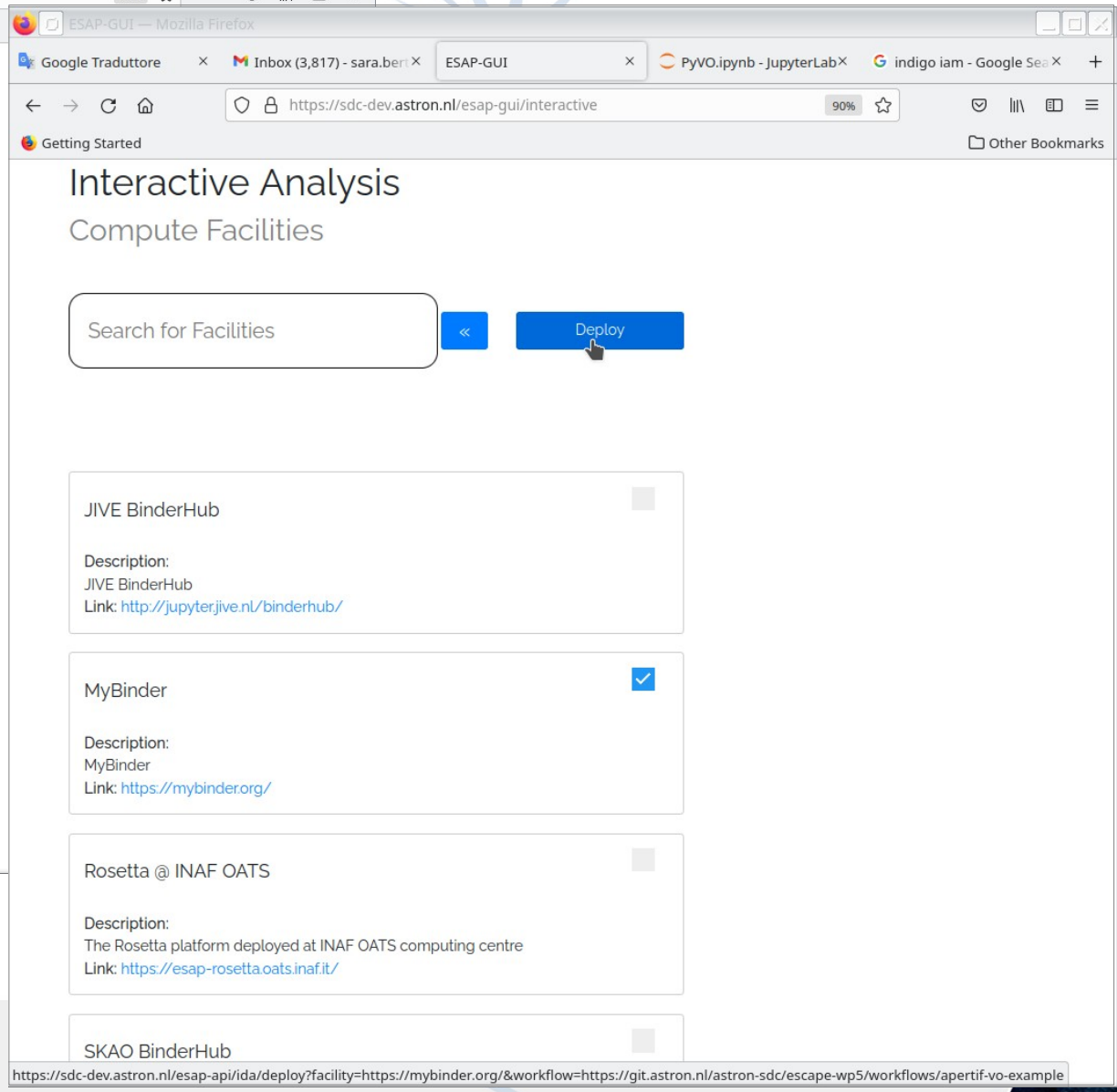
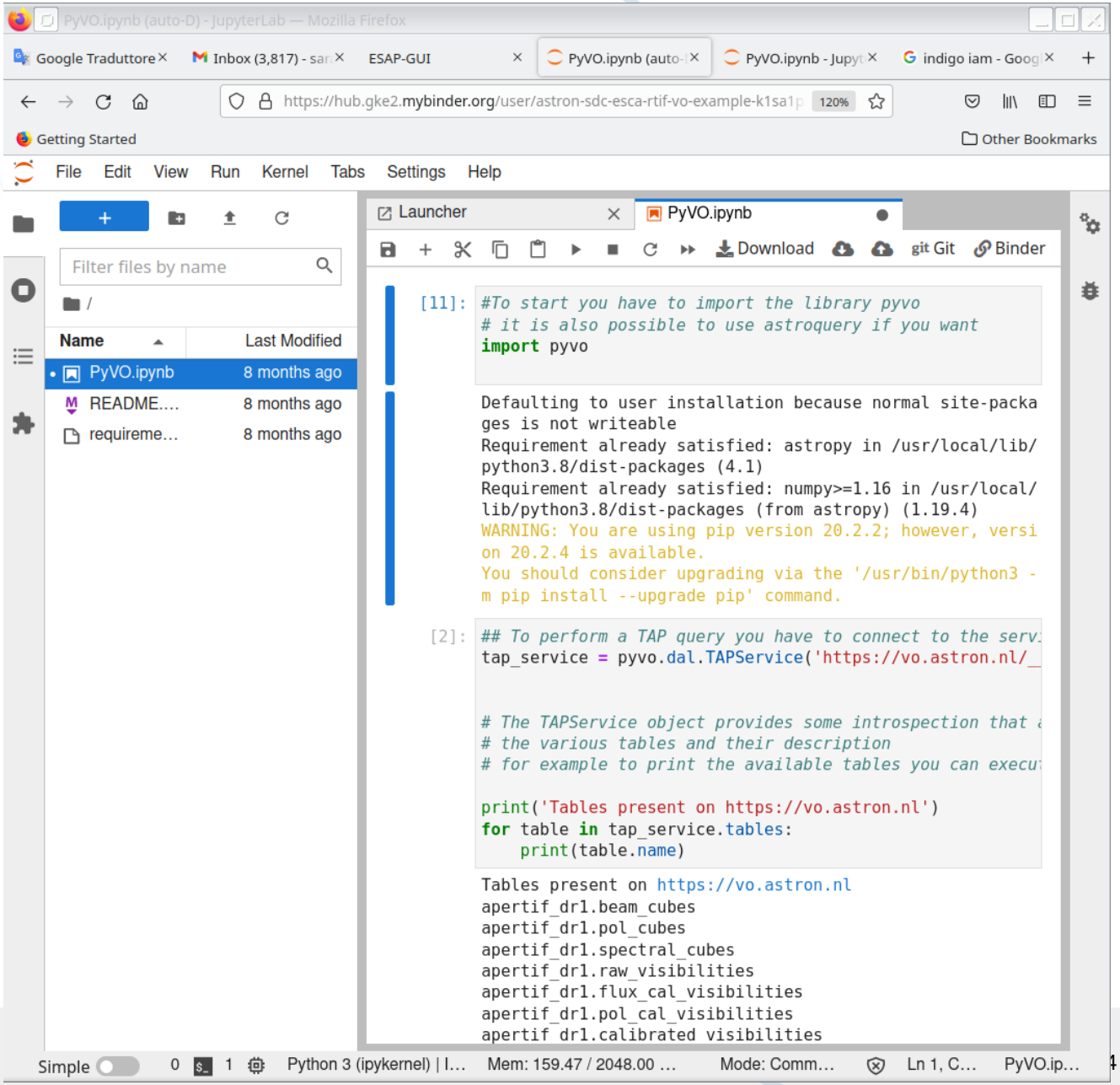
Workflows & computing facilities selection





Analysis facilities access



Work in progress

- Enlarge the supported computation facilities (EGI under investigation)

  Add workflows search capabilities through workflow metadata description (metadata needed)
- Add computation facility search (metadata needed)

  and
- Automate workflow upload and run in a computation facility through compute facility metadata description

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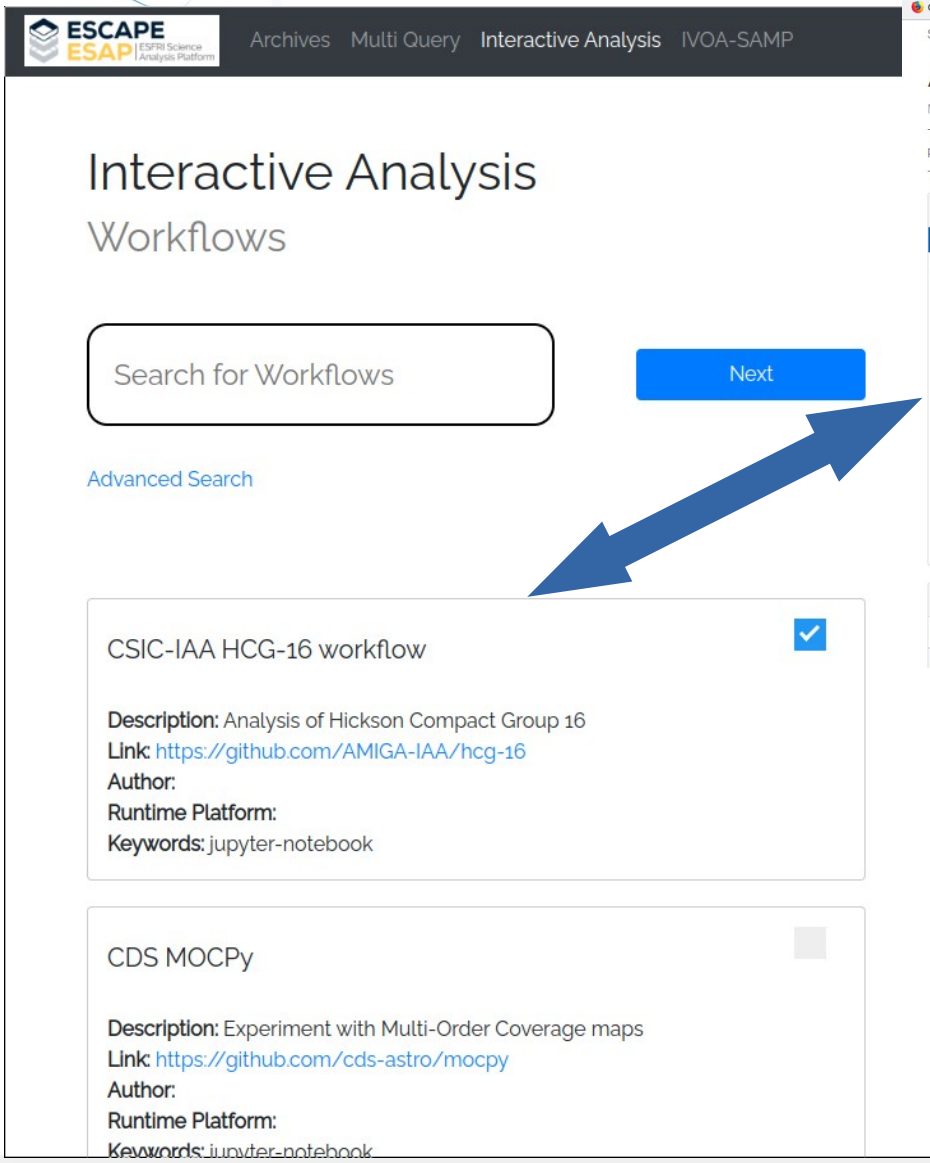
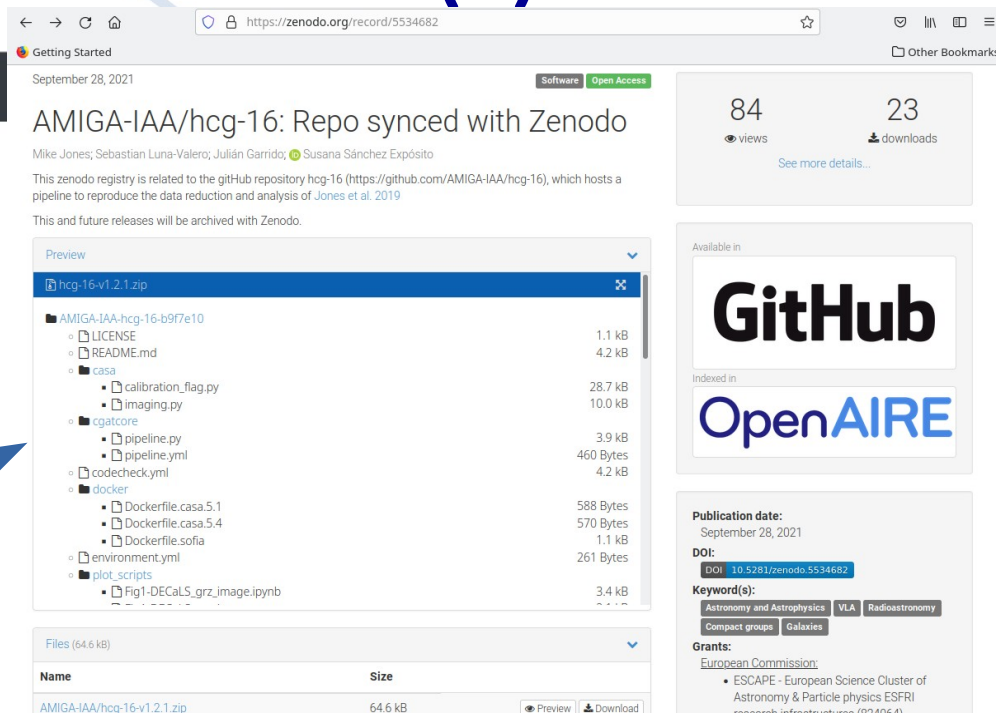
ESAP Software Execution (1)





Workflow metadata description needed:

- OSSR & CEVO working on it
  codemeta.json
  https://escape2020.pages.in2p3.fr/wp3/eossr/v0.4/metadata.html

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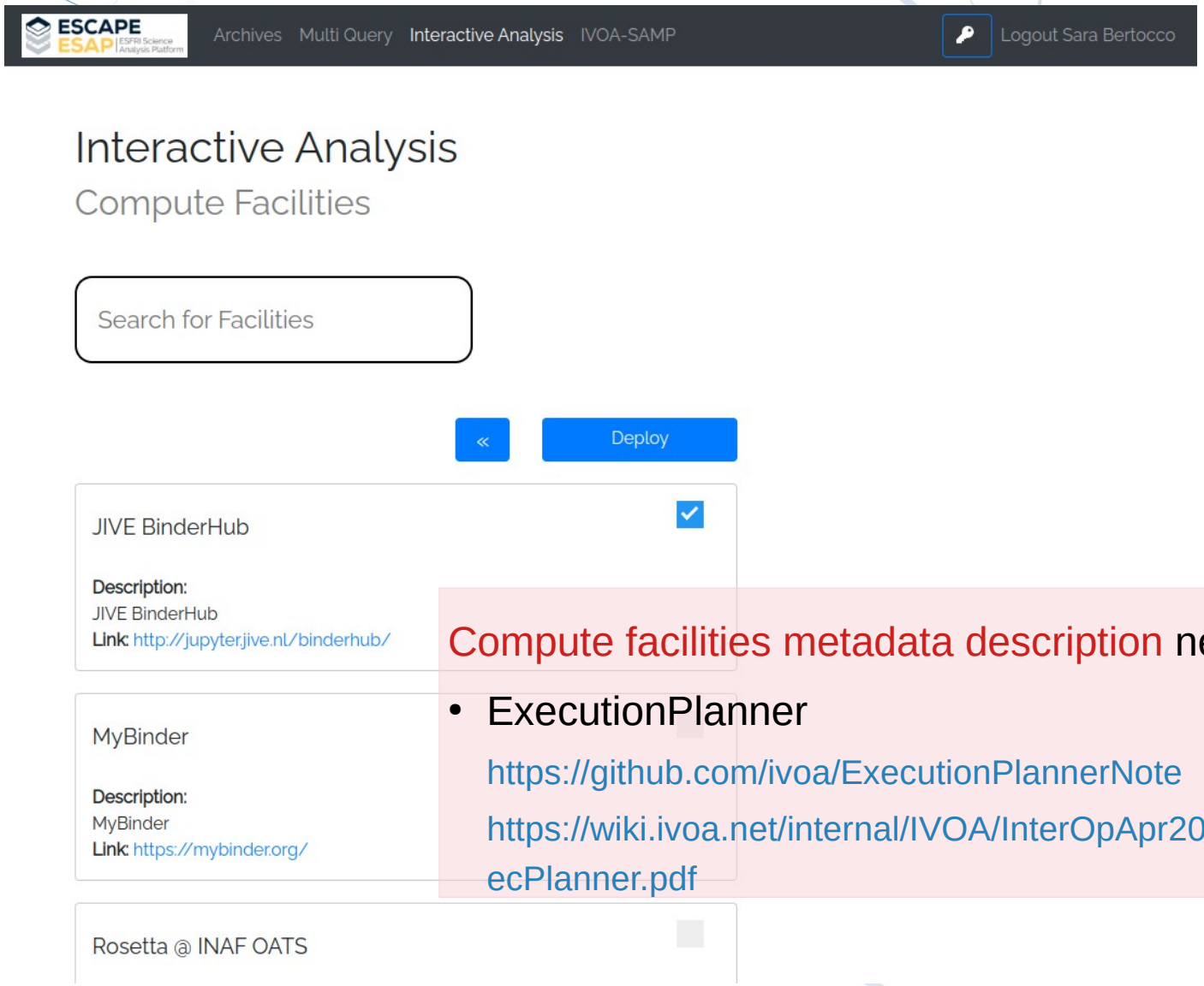
ESAP Software Execution (2)



Compute facilities metadata description needed:

- ExecutionPlanner
  https://github.com/ivoa/ExecutionPlannerNote
  https://wiki.ivoa.net/internal/IVOA/InterOpApr2022GWS/20220426-ExecPlanner.pdf

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Acknoledgment

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Thank you !

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