ESA Data Exploitation Platforms Accelerating Space and Navigation Science

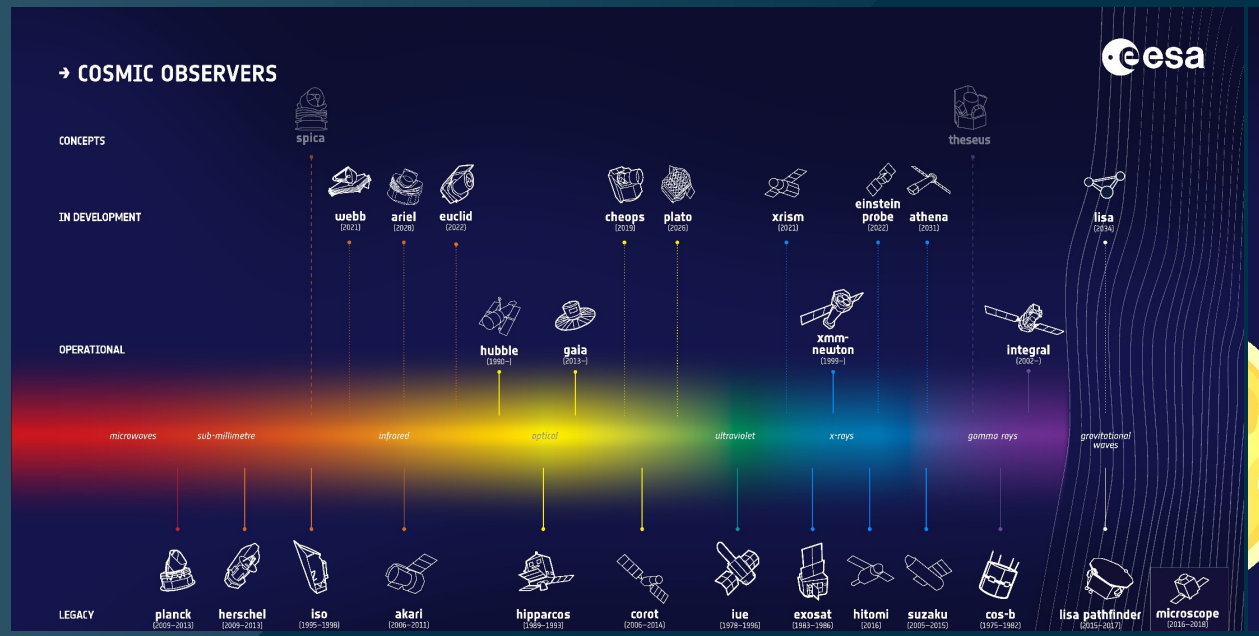
Vicente Navarro on behalf of the ESA Datalabs and GSSC teams

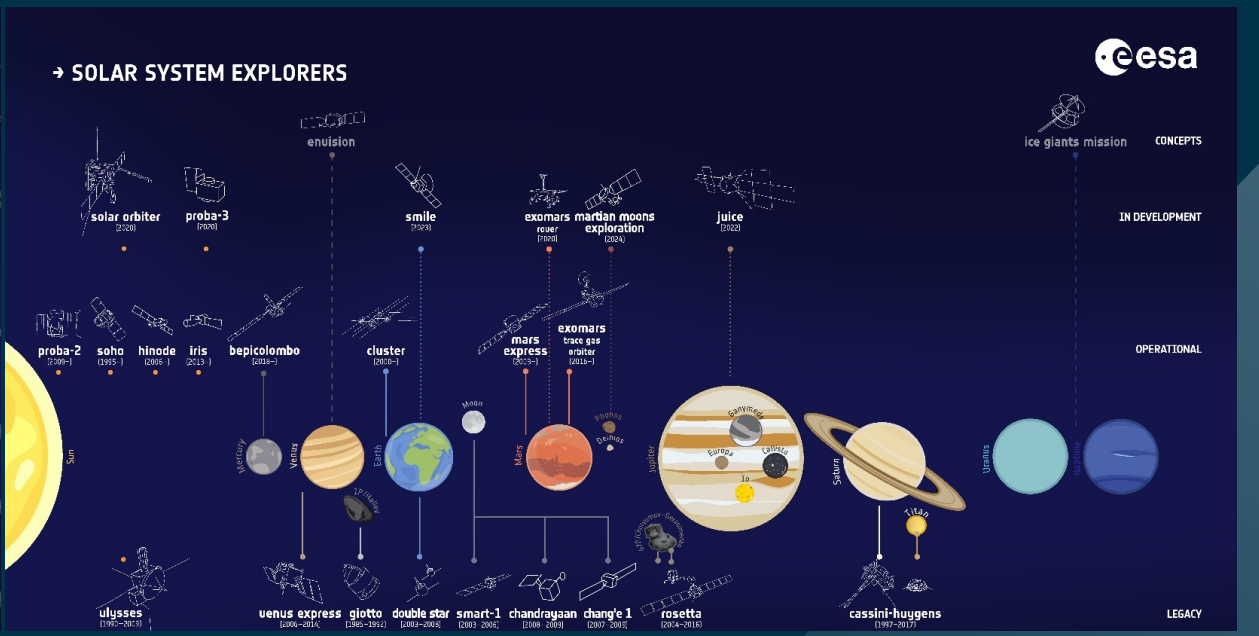
ESA / ESO Workshop SciOps 2022, 19.05.2021

@ivicentenavarro

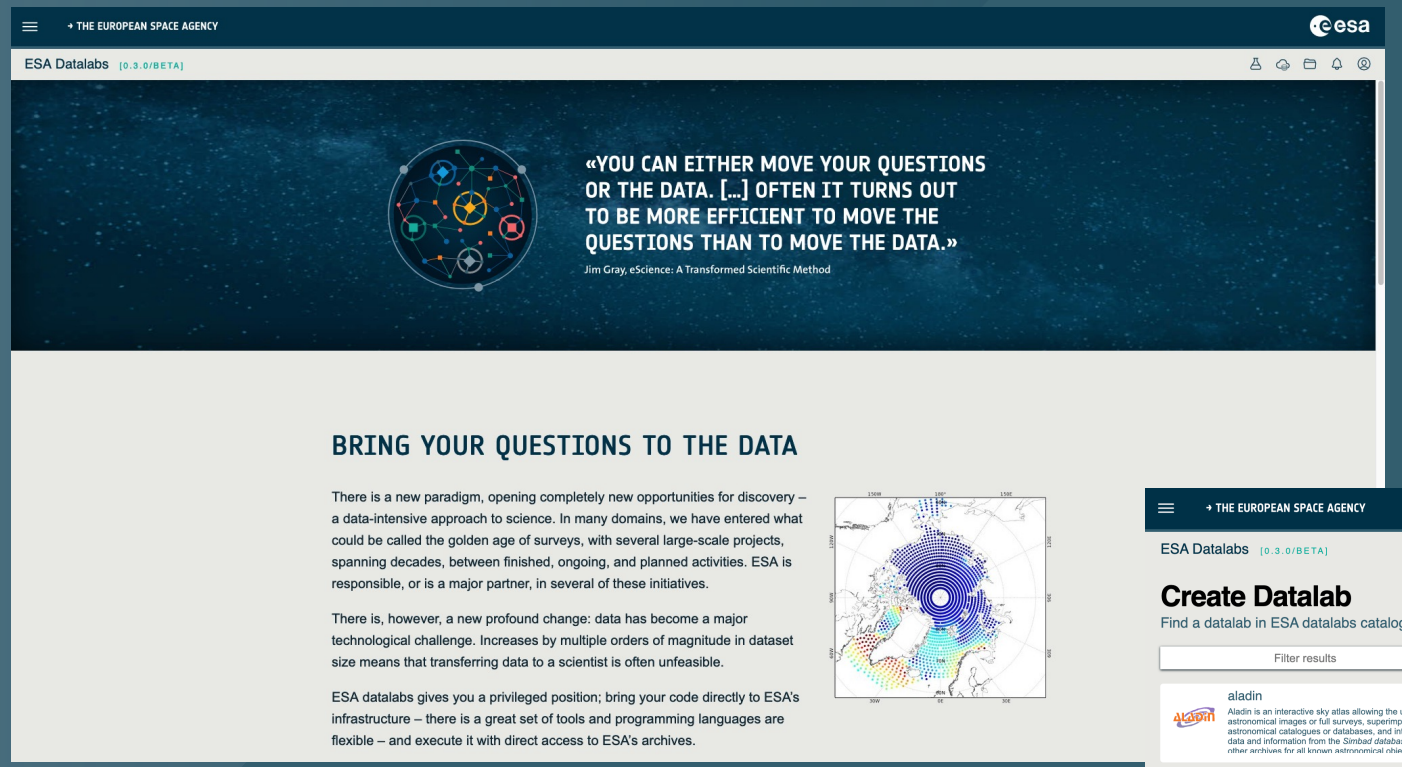
ESA UNCLASSIFIED – Releasable to the Public

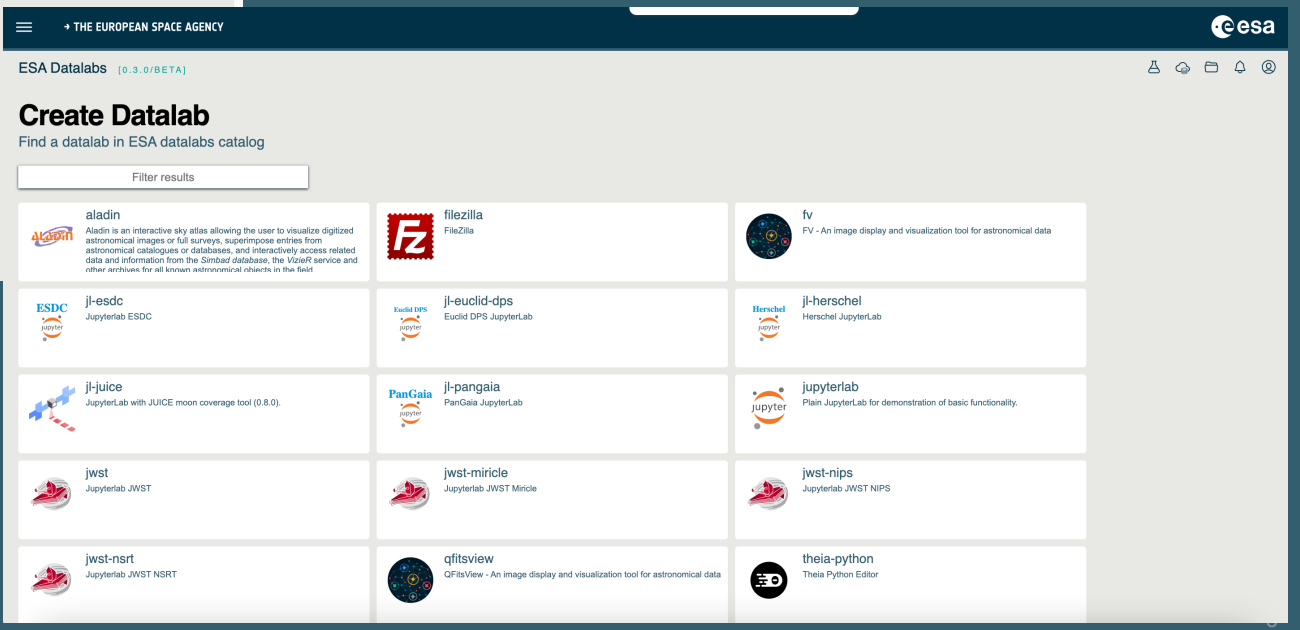
Space Science Context





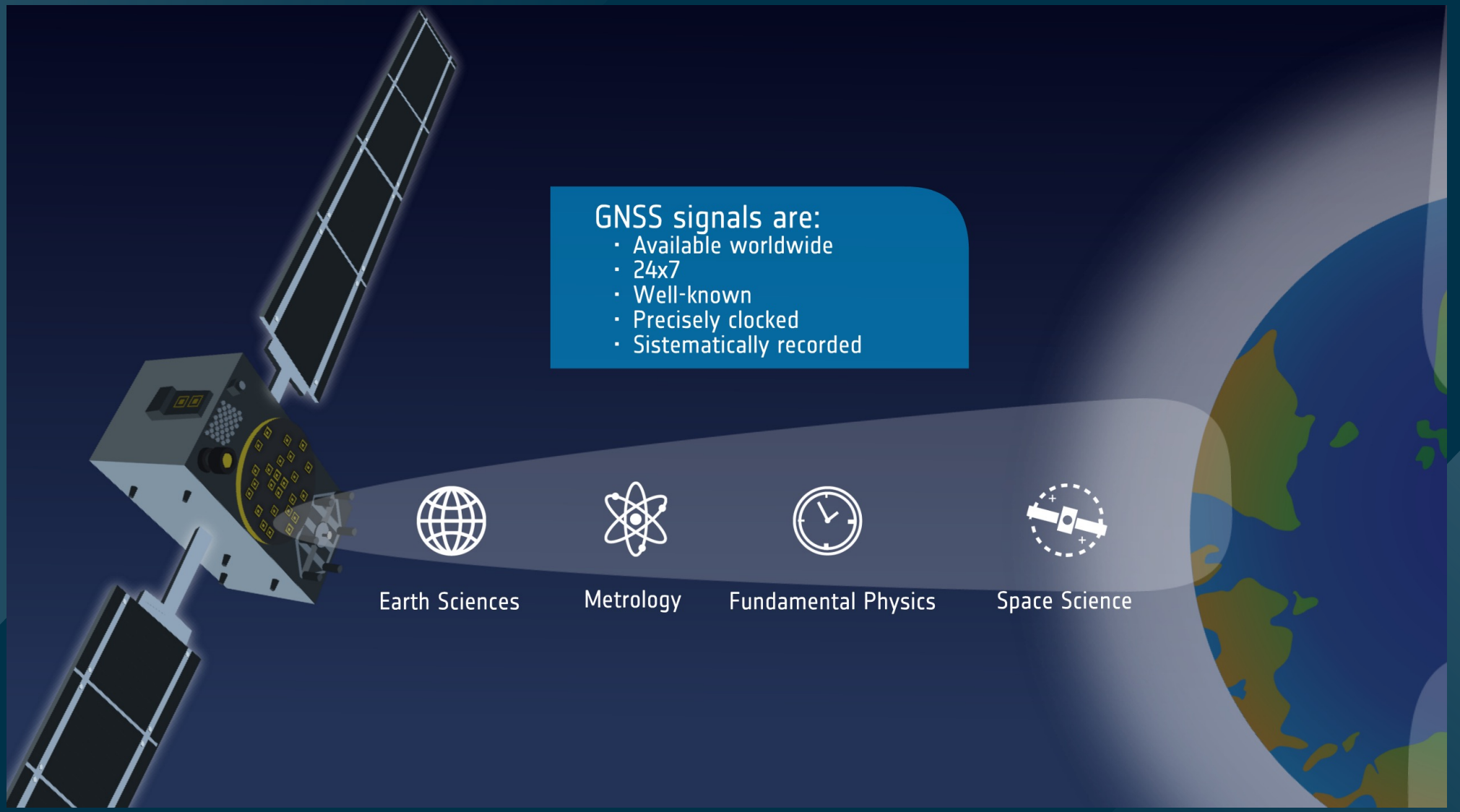
ESA Datalabs – Cross Domain Data Exploitation Platform



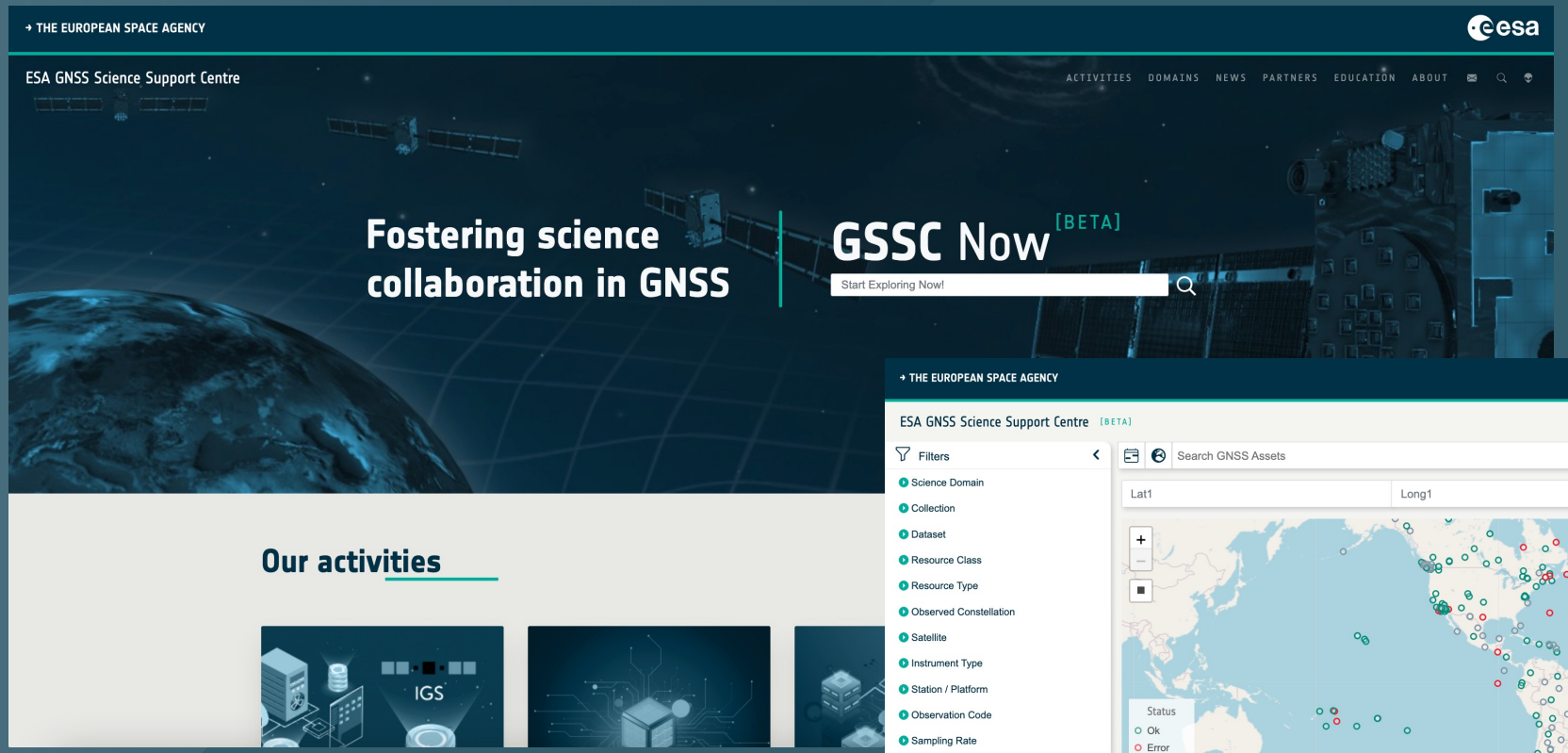


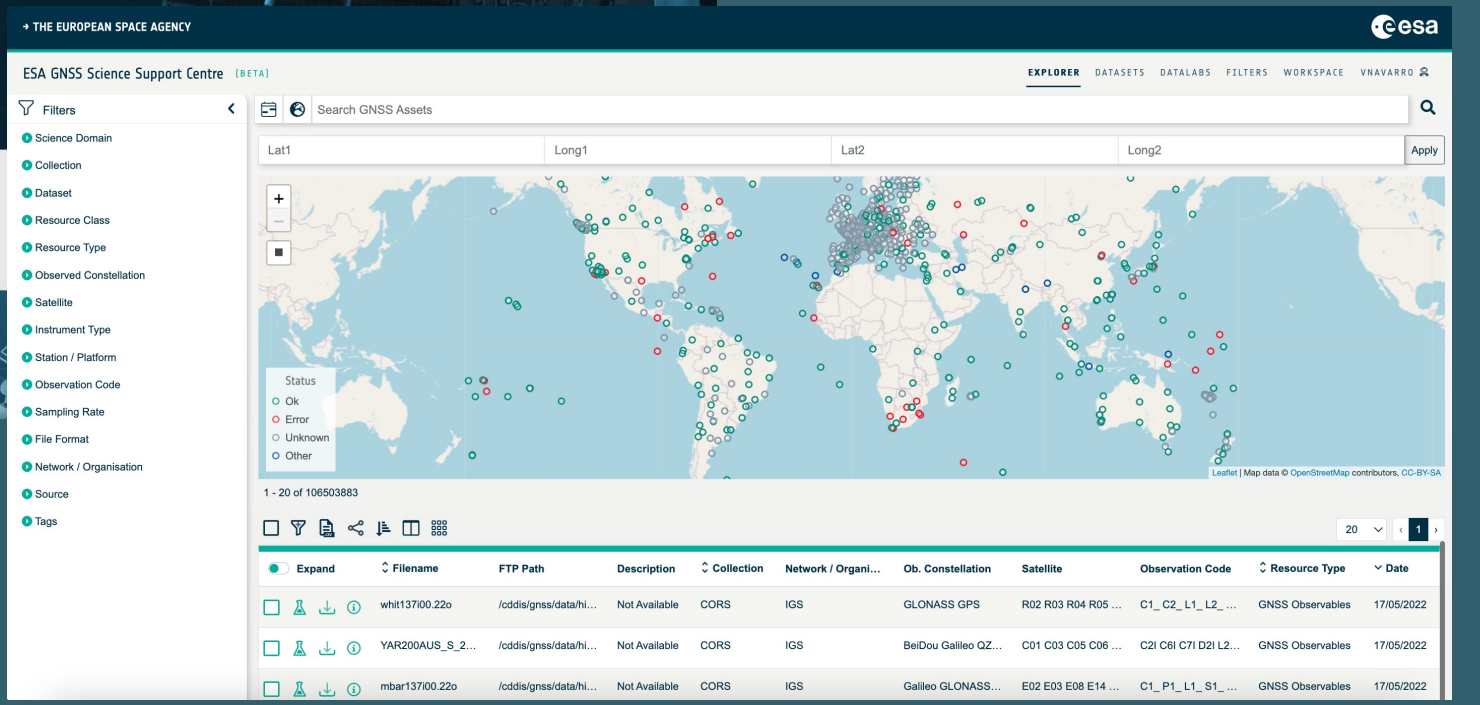
datalabs.esa.int

Navigation Science Context



GSSC Now – Vertical Data Exploitation Platform





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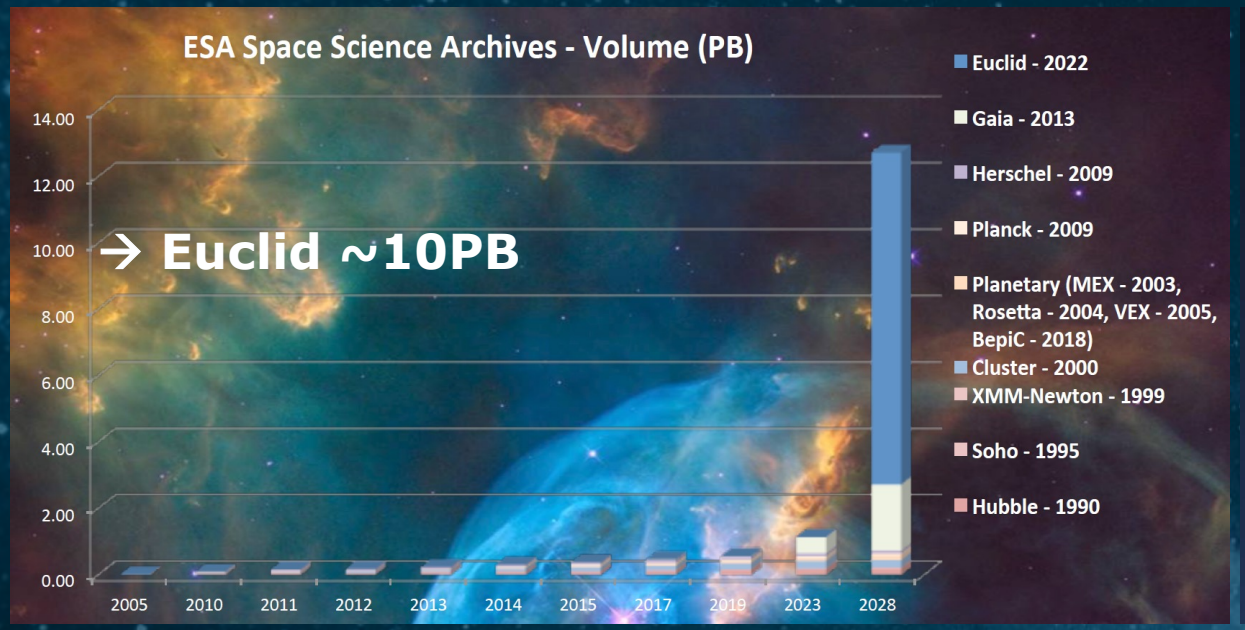
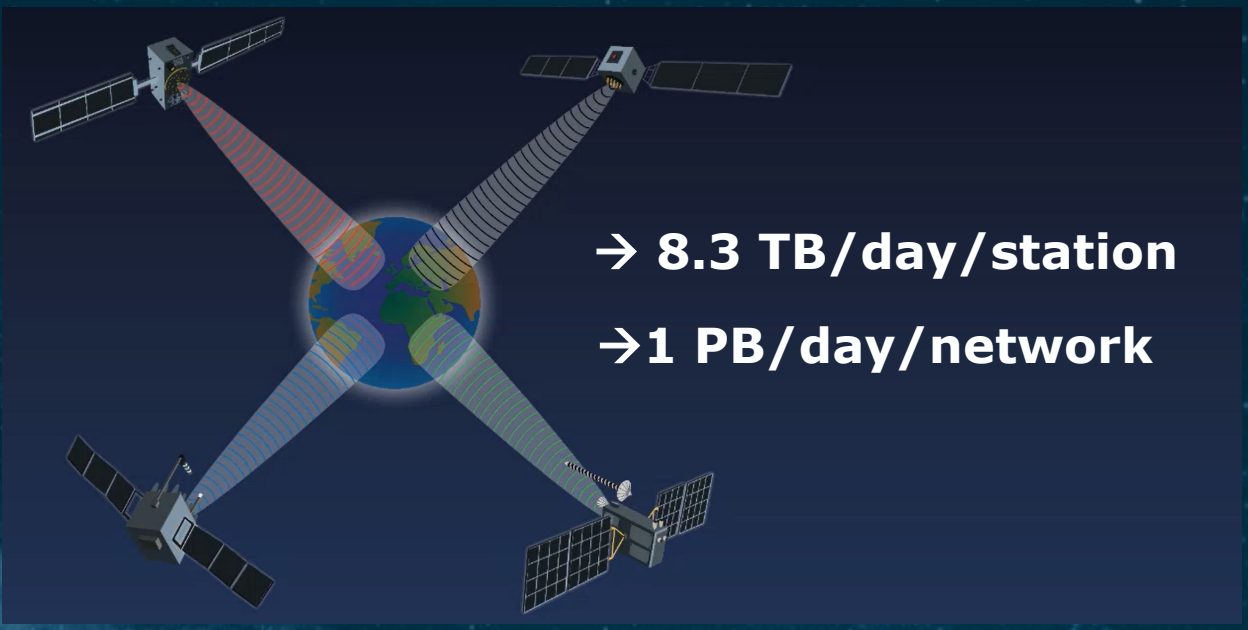
Data Access
Innovation

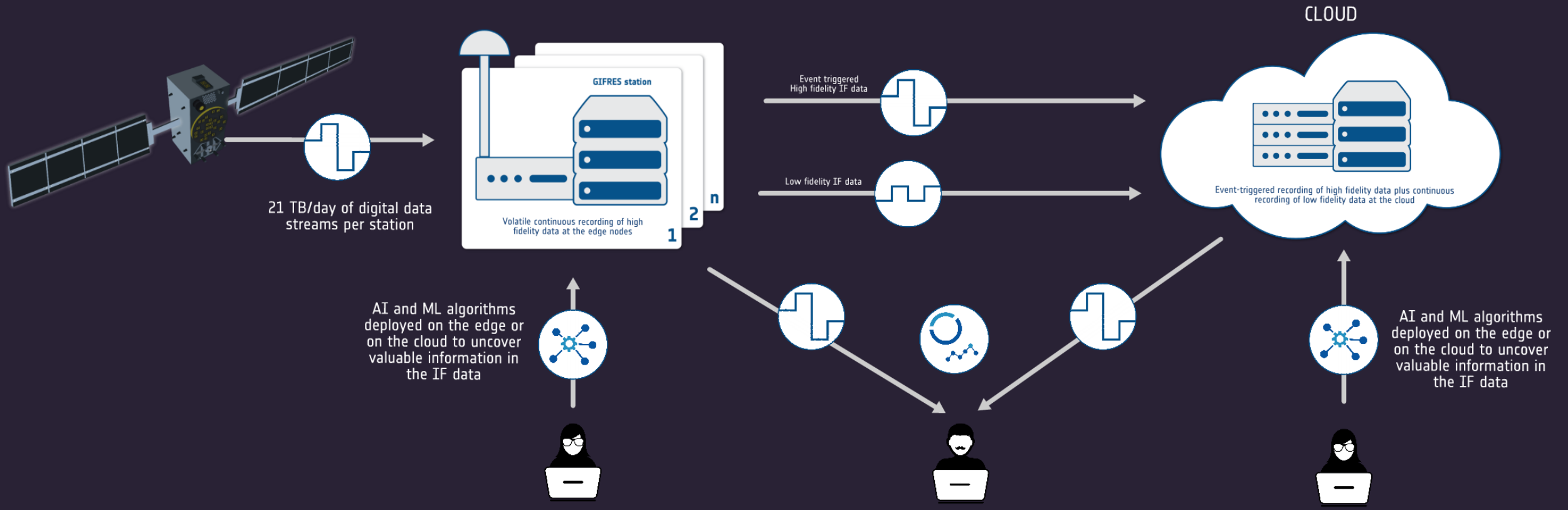
Data Exploitation Paradigm Shift



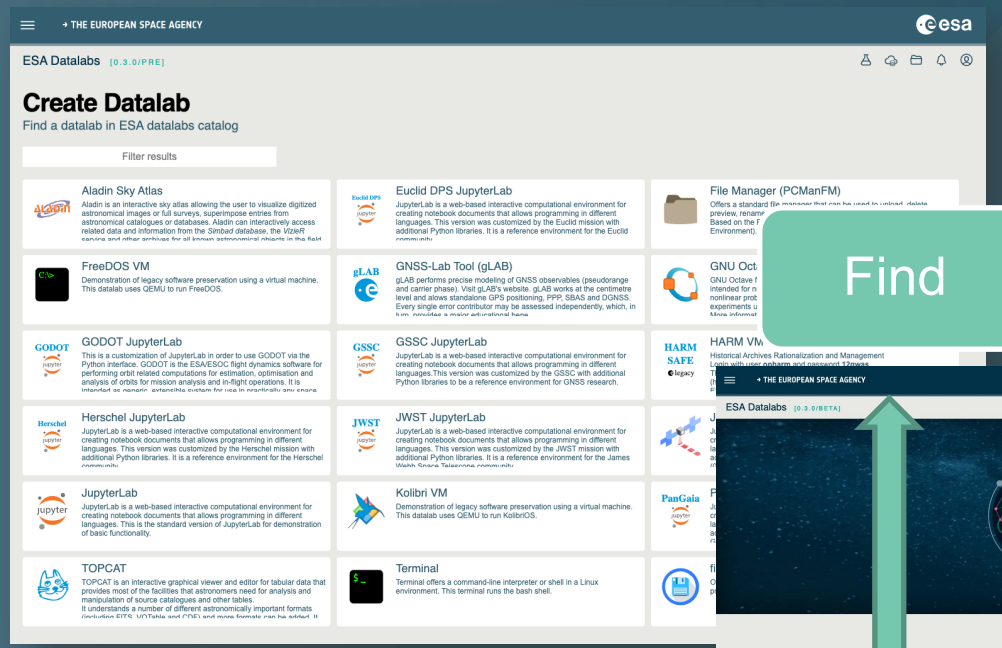


From *bring the data to the user*
To *bring the user to the data*

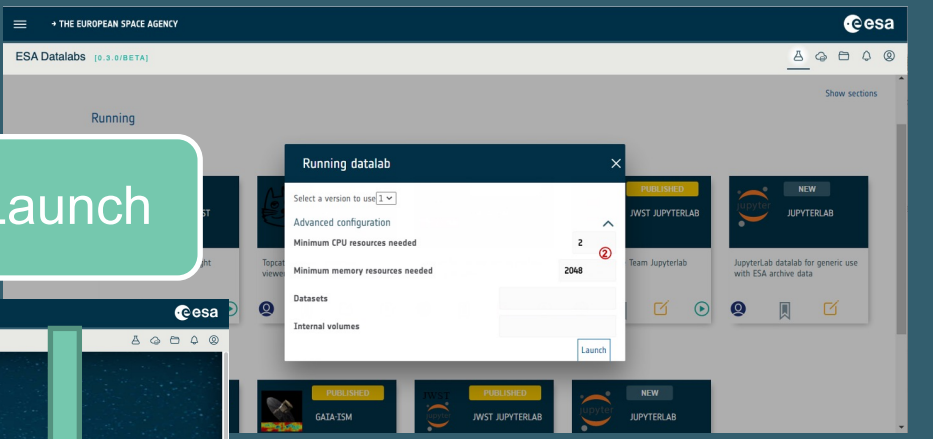
Edge Computing



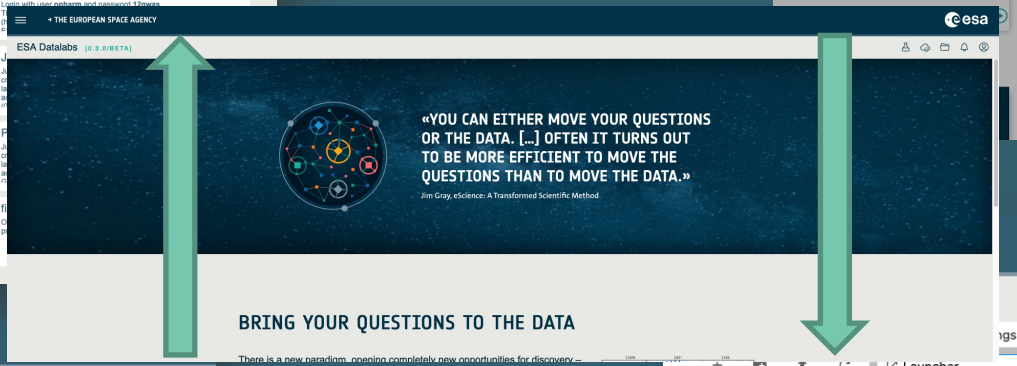
Datalabs – Standard Flow

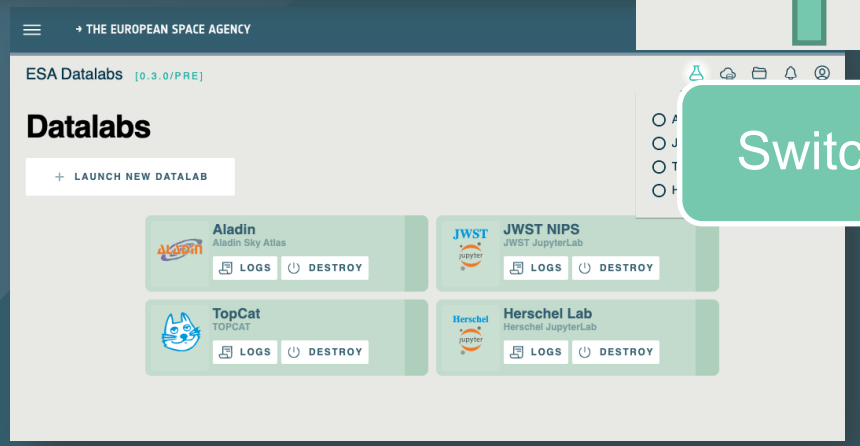


Find



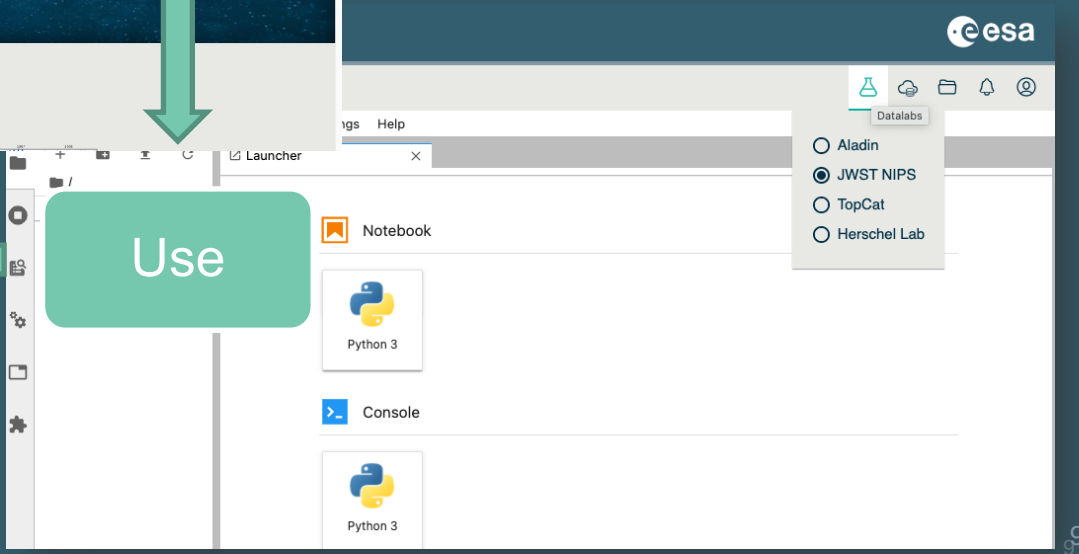
Launch





Switch

Use



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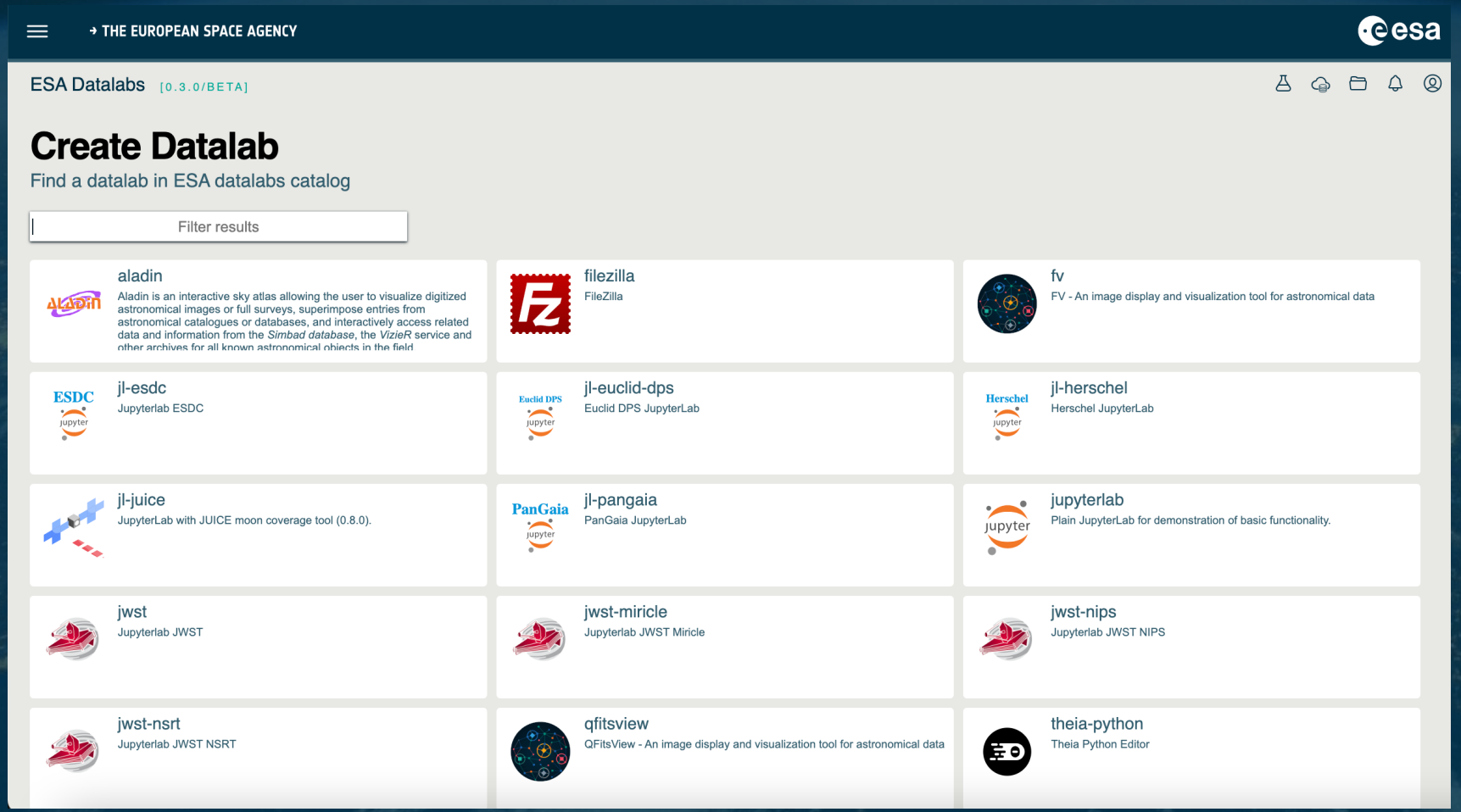
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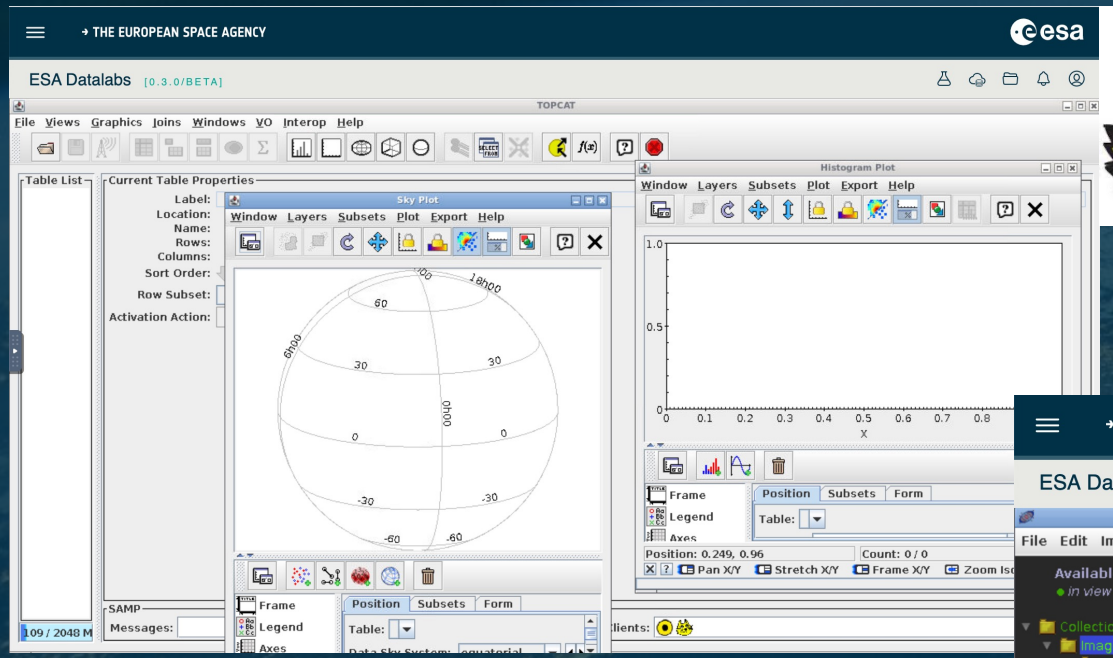
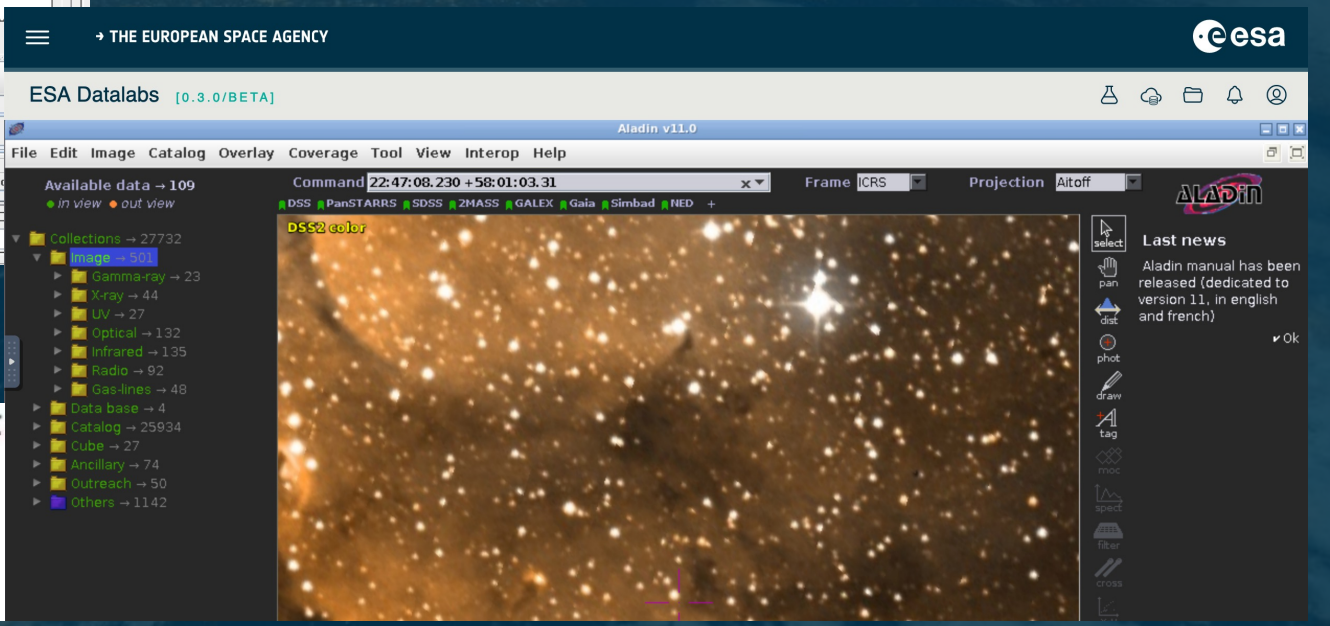
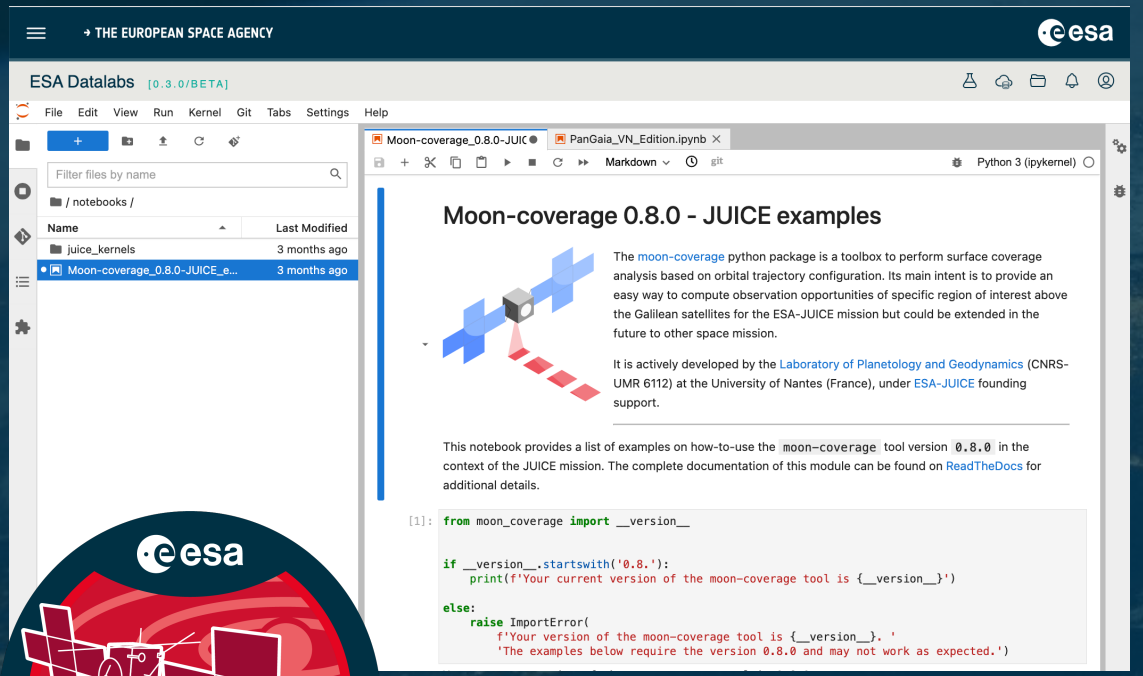
esa
ESA Datalabs [0.3.0/BETA]
Create Datalab
Find a datalab in ESA datalabs catalog
Filter results
aladin
Aladin is an interactive sky atlas allowing the user to visualize digitized astronomical images or full surveys, superimpose entries from astronomical catalogues or databases, and interactively access related data and information from the Simbad database, the VizieR service and
filezilla
FileZilla
fv
FV - An image display and visualization tool for astronomical data
jl-esdc
Jupyterlab ESDC
jl-euclid-dps
Euclid DPS JupyterLab
jl-herschel
Herschel JupyterLab
jl-juice
JupyterLab with JUICE moon coverage tool (0.8.0).
jl-pangaia
PanGaia JupyterLab
jupyterlab
Plain JupyterLab for demonstration of basic functionality.
jwst
Jupyterlab JWST
jwst-miricle
Jupyterlab JWST Miricle
jwst-nips
Jupyterlab JWST NIPS
jwst-nsrt
Jupyterlab JWST NSRT
qfitsview
QFitsView - An image display and visualization tool for astronomical data
theia-python
Theia Python Editor

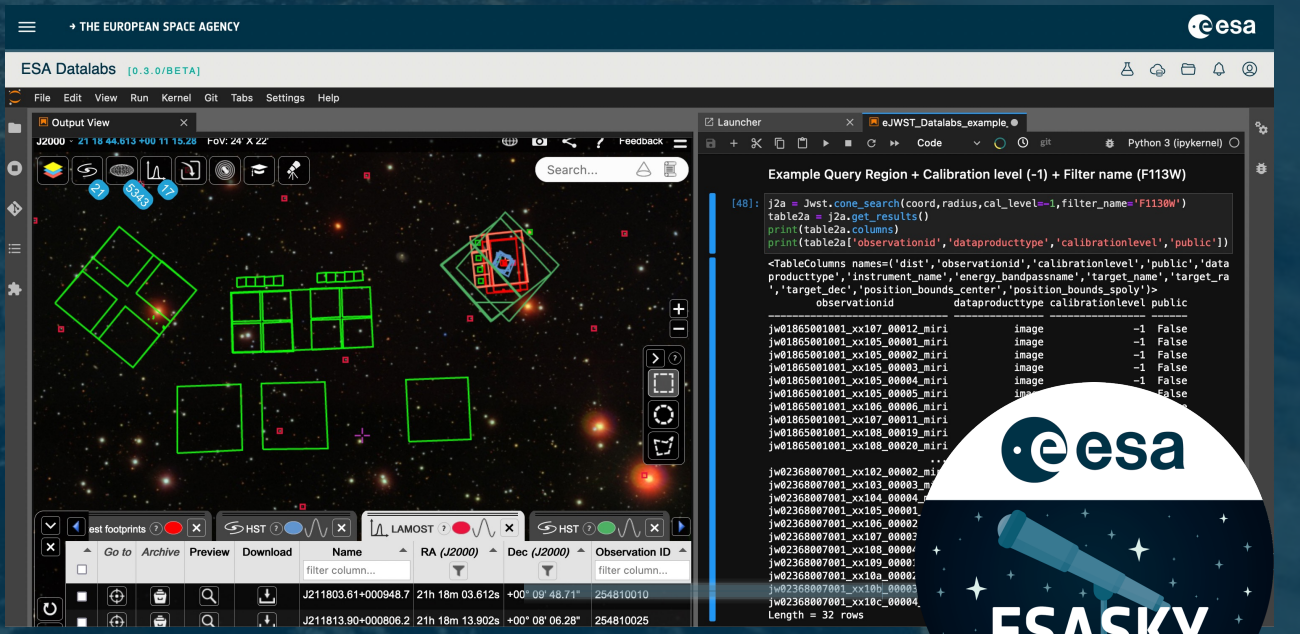
FIND – Desktop Apps



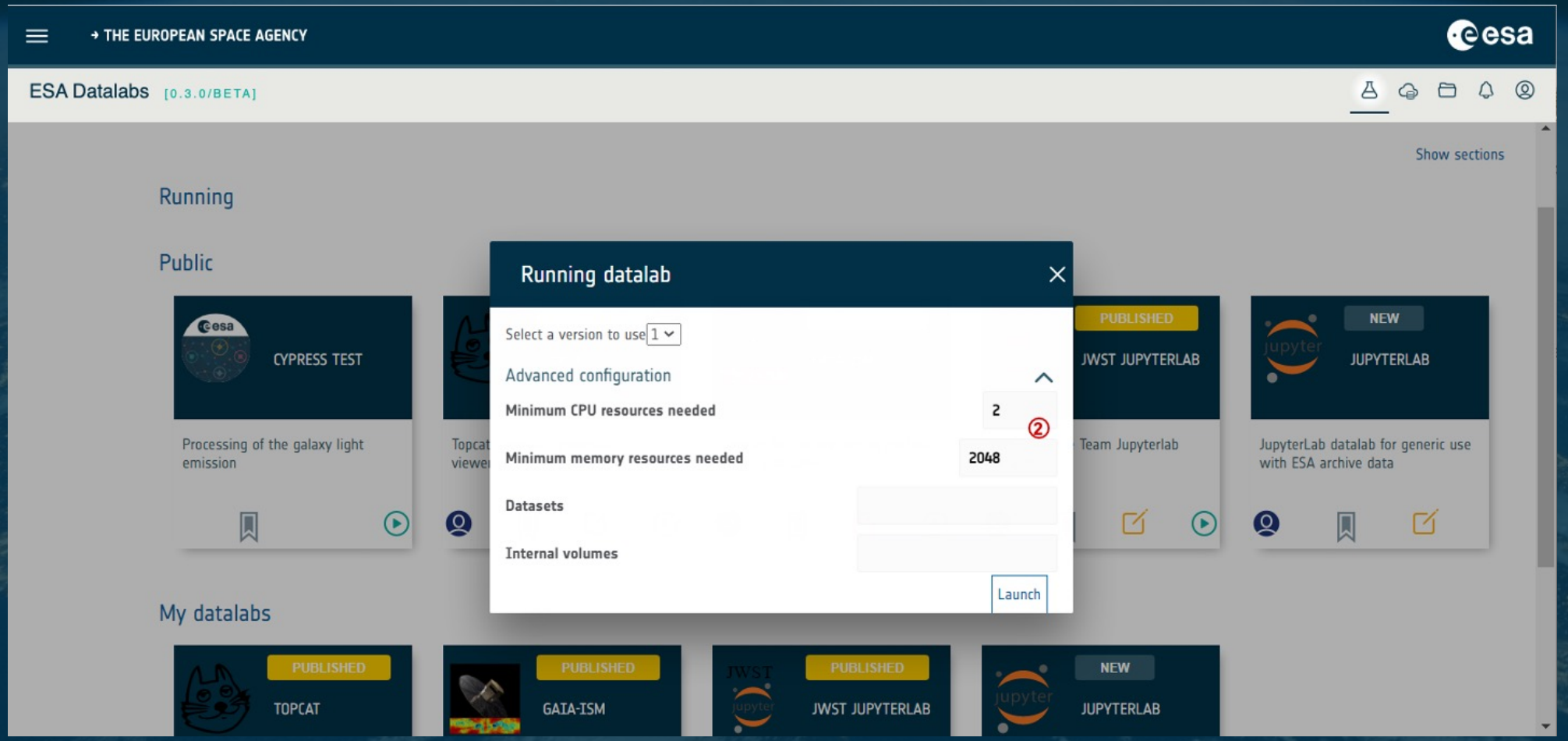


FIND – Web Apps (i.e. JupyterLab)





LAUNCH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esa
ESA Datalabs [0.3.0/BETA]
Show sections
Running
Public
CYPRESS TEST
Processing of the galaxy light emission
PUBLISHED
JWST JUPYTERLAB
Team Jupyterlab
NEW
JUPYTERLAB
JupyterLab datalab for generic use with ESA archive data
Running datalab
Select a version to use 1
Advanced configuration
Minimum CPU resources needed
2
Minimum memory resources needed
2048
Datasets
Internal volumes
Launch
My datalabs
PUBLISHED
TOPCAT
PUBLISHED
GAIA-ISM
PUBLISHED
JWST JUPYTERLAB
NEW
JUPYTERLAB

USE

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ESA Datalabs [0.3.0/BETA]

File Edit View Run Kernel Git Tabs Settings Help

Launcher | Moon-coverage_0.8.0-JUIC | PanGaia_VN_Edition.ipynb

Markdown | git | Python 3 (ipykernel)

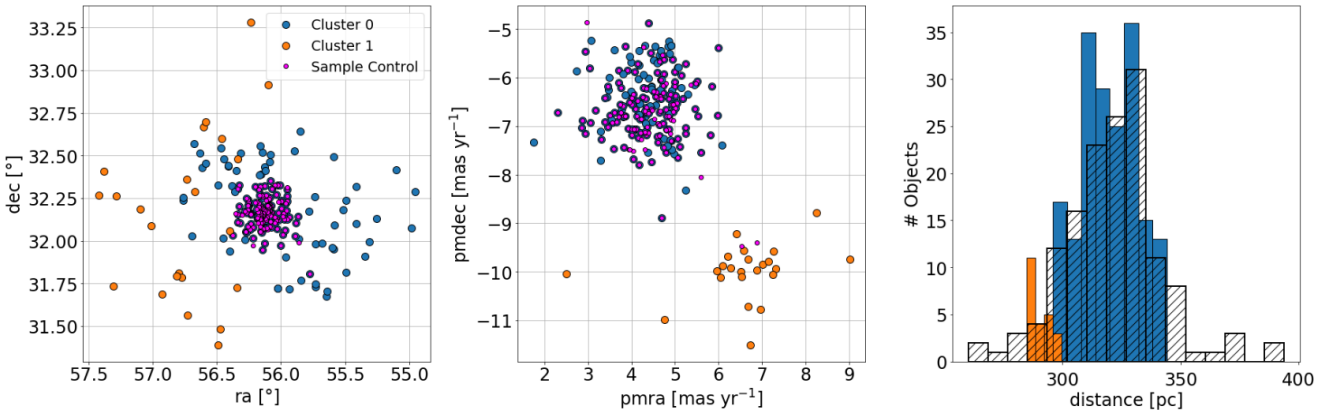
Filter files by name

/ my_workspace / My Notebooks /

Name	Last Modified
PanGaia_VN_Edition.ipy...	2 months ago
Untitled.ipynb	2 months ago

[11]:
```
# Show selected HDBSCAN results ========================
if step_4:
    data_clustering.run_hdbscan(probability = data_clustering.probability, min_samples = data_clustering.min_samples, verbose = True)
    if step_1:
        data_clustering.load_control_obj(control)
        data_clustering.compare_to_control()
    data_clustering.plot_clusters()
```

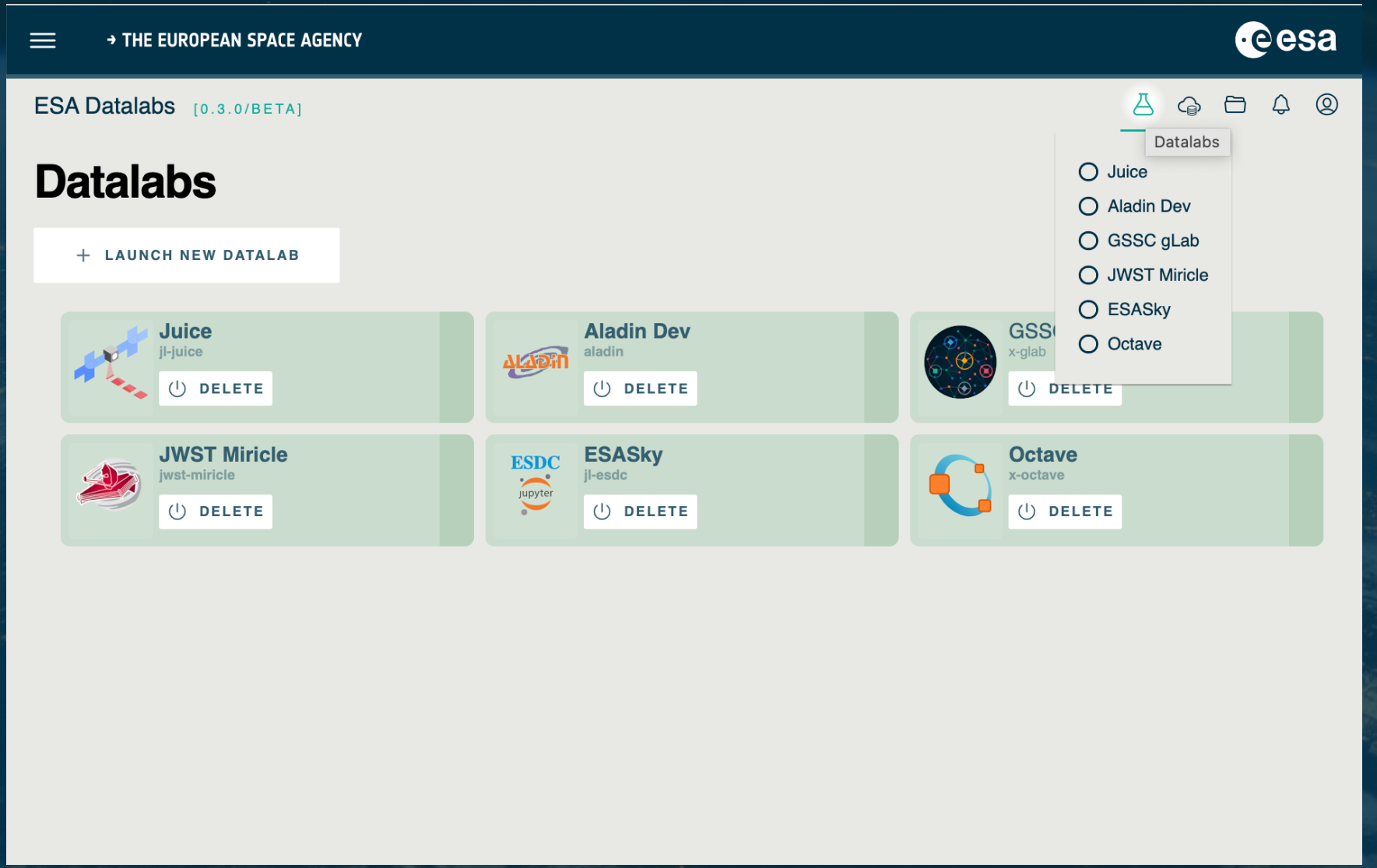
```
Insert min_Cluster_size: 20
mCls = 20; clusters = 2; N_members = [183, 23]

Cluster 0 contains   183 Elements, including 120 (83.3%) of the Control Sample
Cluster 1 contains    23 Elements, including 0 ( 0.0%) of the Control Sample
```




```
==================================================
PDF saved as: test_hdb_minsamp_1_prob_0.8_mCls_20.pdf
==================================================
```

Simple | 0 | 2 | Python 3 (ipykernel) | Idle | Mode: Command | Ln 1, Col 1 | PanGaia_VN_Edition.ipynb

SWITCH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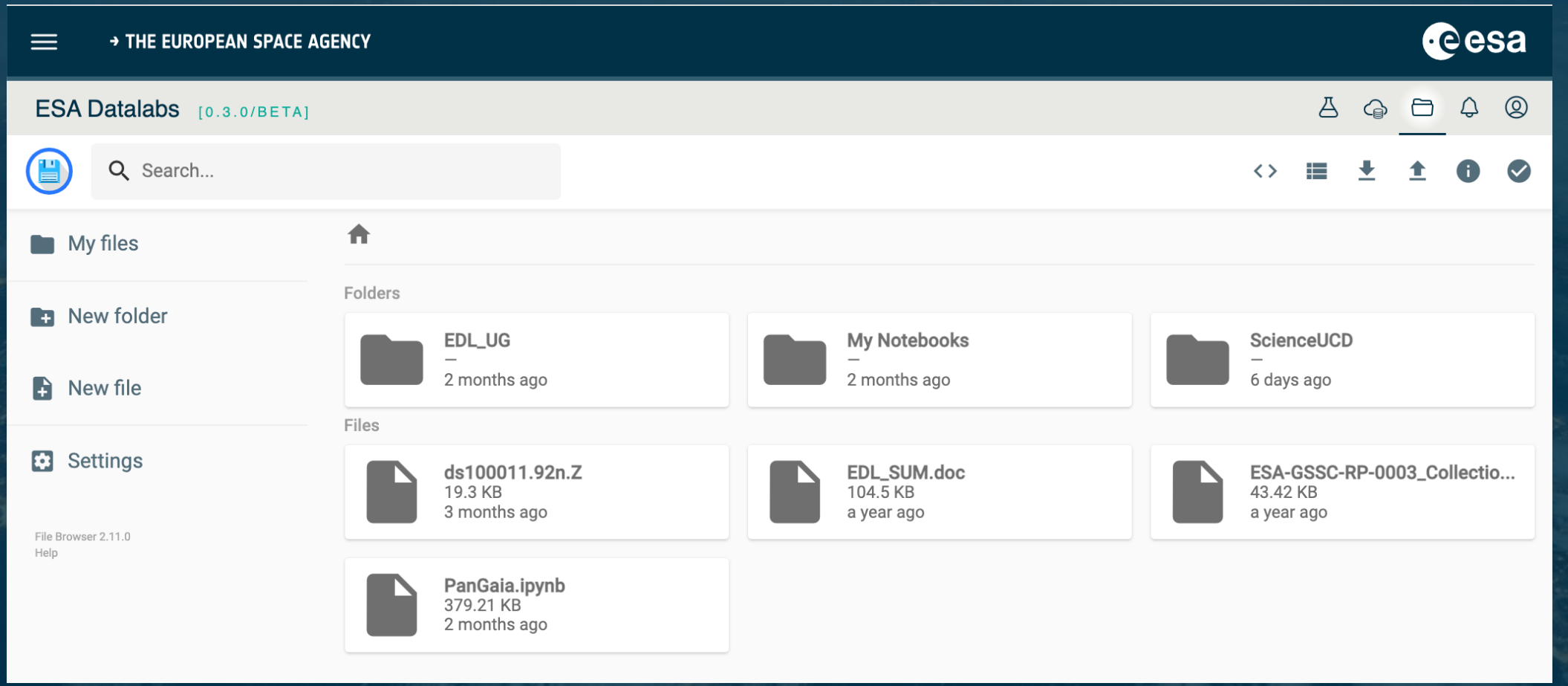
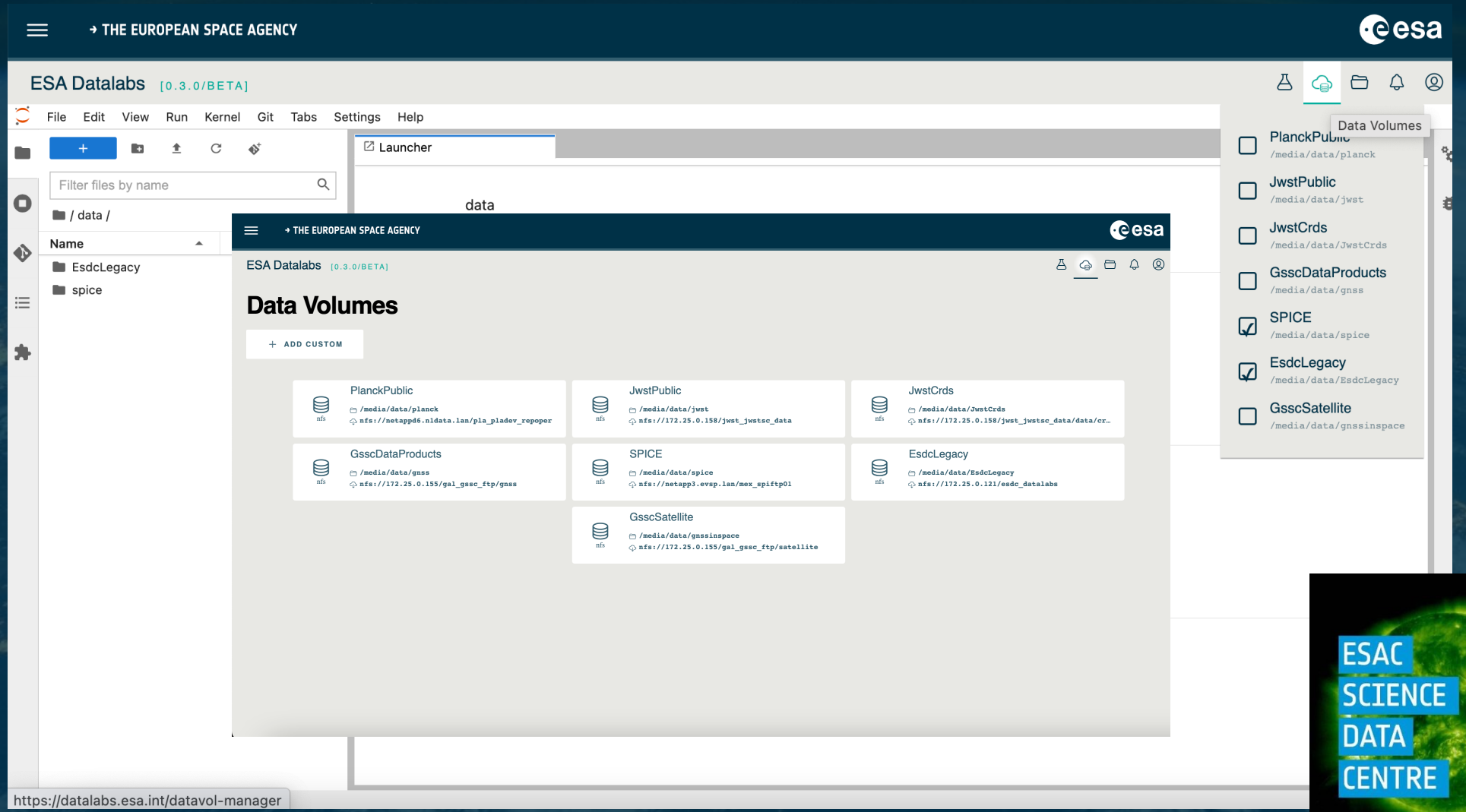
esa
ESA Datalabs [0.3.0/BETA]
Datalabs
Datalabs
Juice
Aladin Dev
GSSC gLab
JWST Miricle
ESASky
Octave
+ LAUNCH NEW DATALAB
Juice
jl-juice
DELETE
Aladin Dev
aladin
DELETE
GSS
x-glab
DELETE
JWST Miricle
jwst-miricle
DELETE
ESASky
jl-esdc
DELETE
Octave
x-octave
DELETE

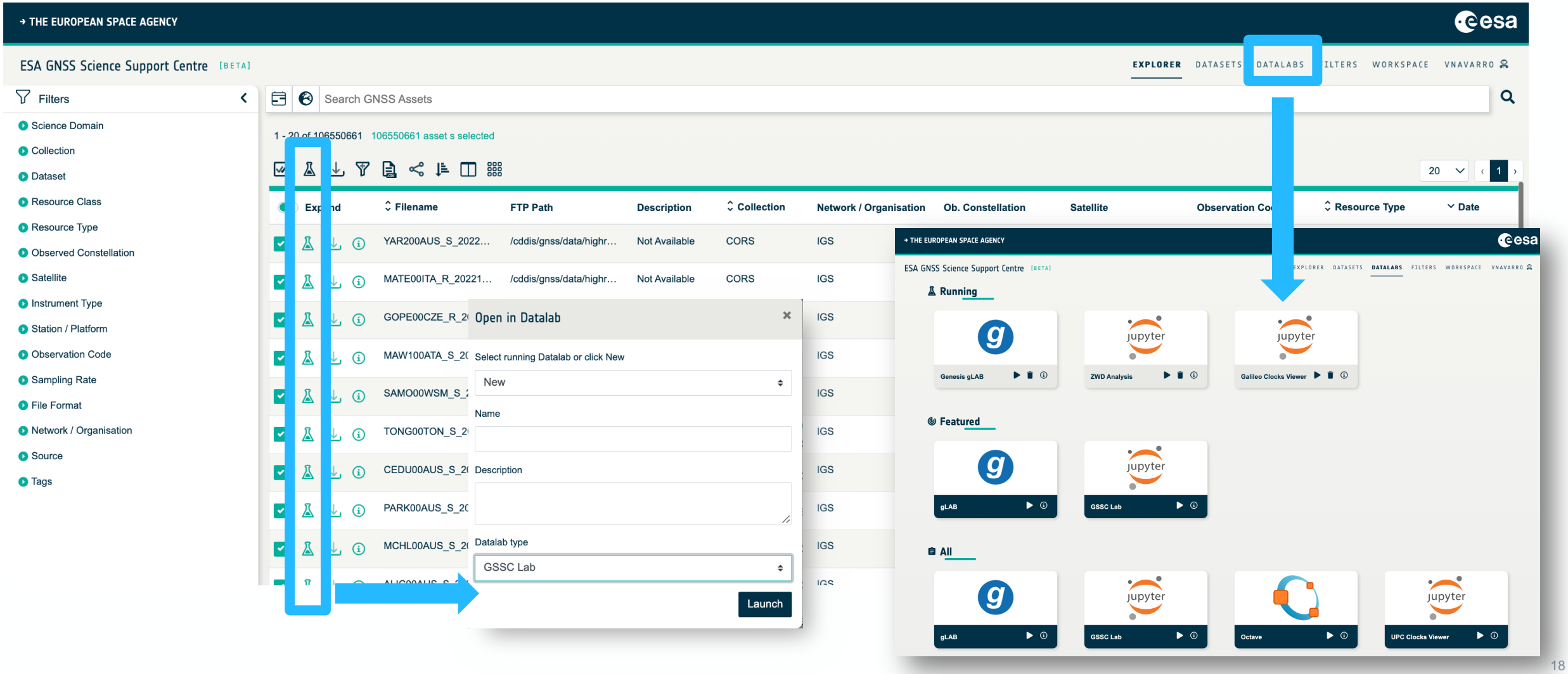
Personal Workspace



Data and Computing Colocation - Coarse Grain

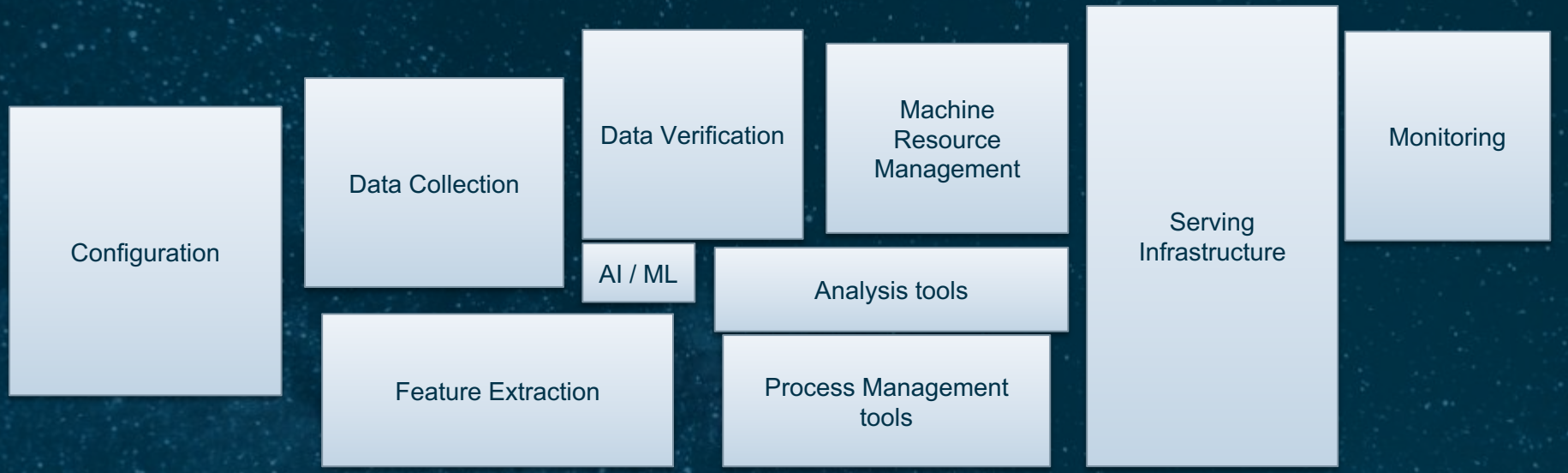


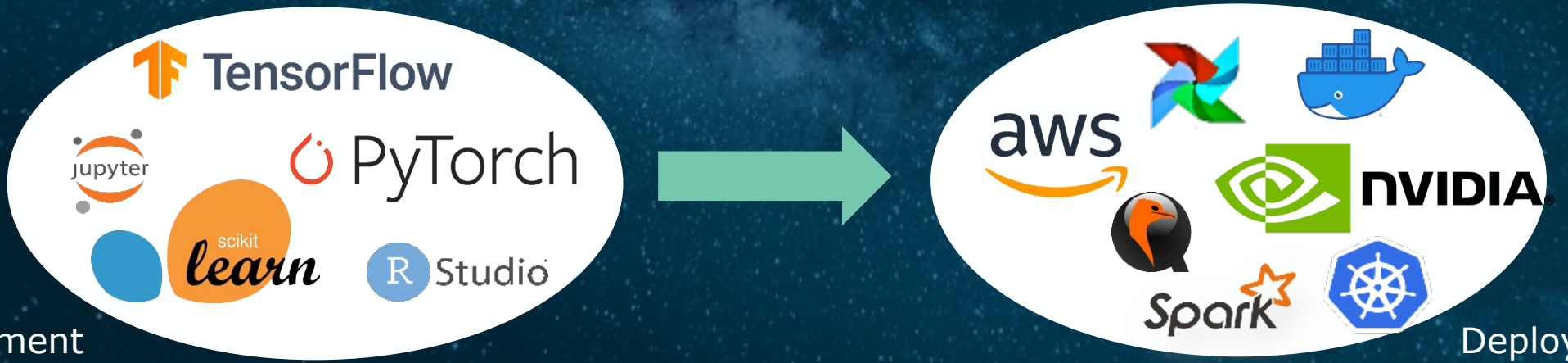
Data and Computing Colocation - Fine Grain



Data Processing Innovation

MLOps



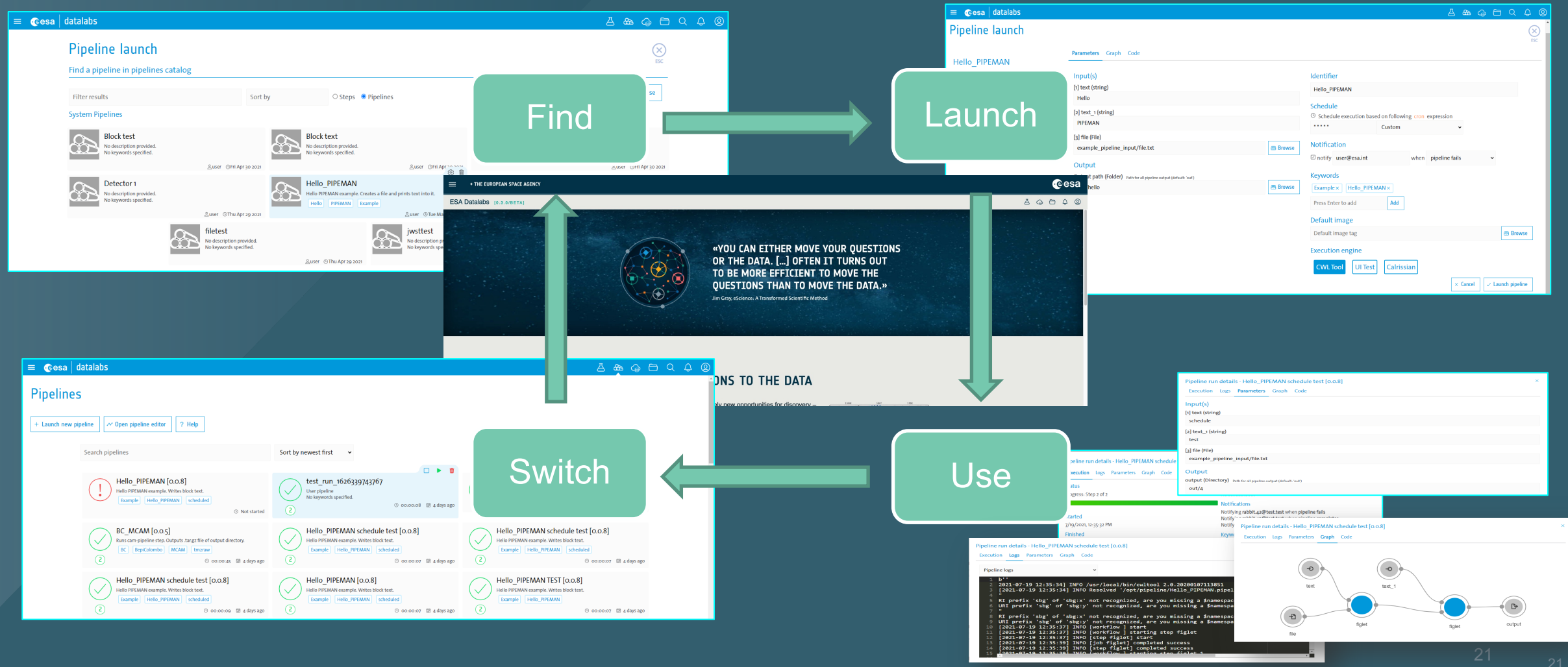


Model Development

Model Deployment

*Source: Hidden Technical Debt in Machine Learning Systems

Pipelines – Standard Flow



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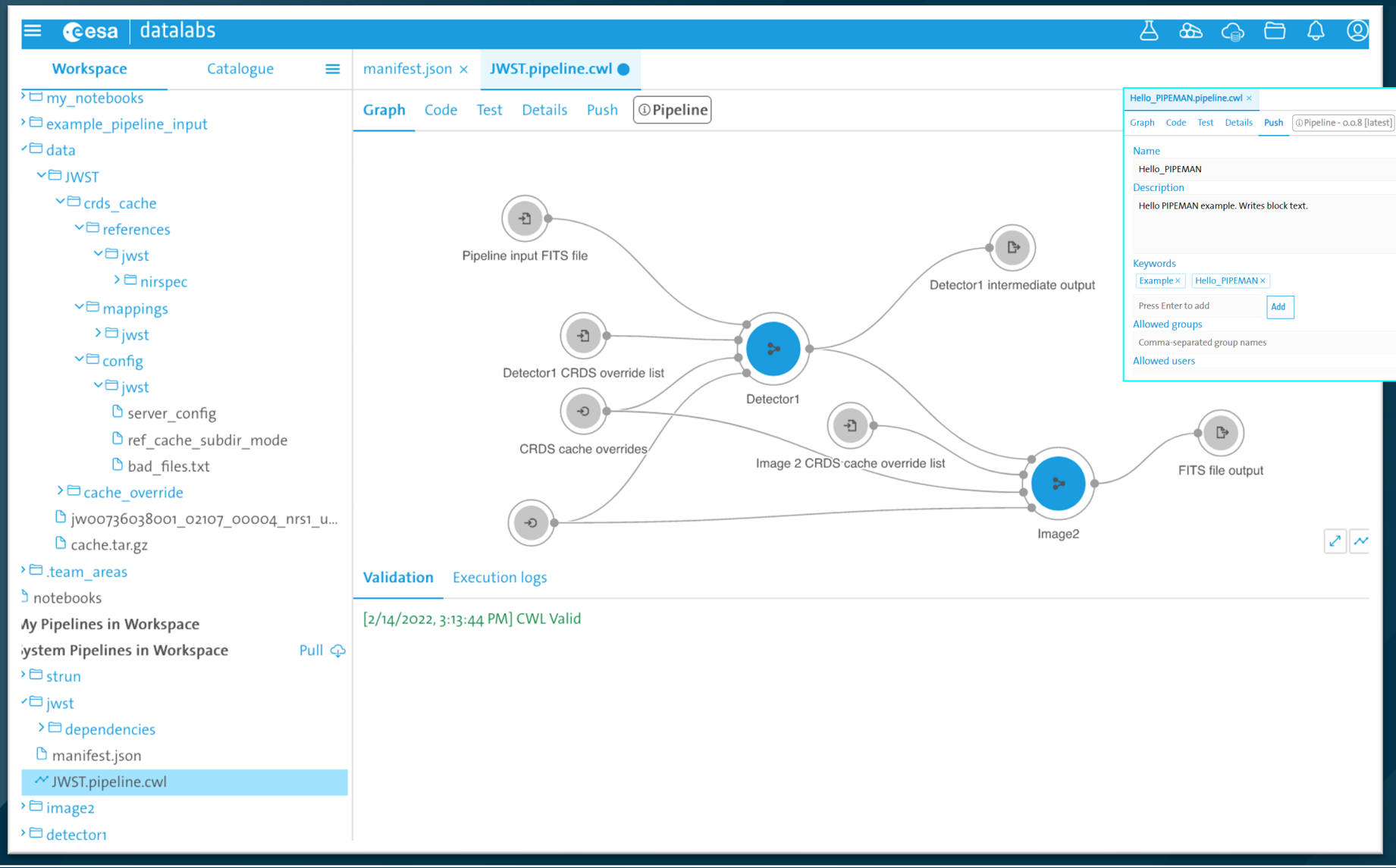
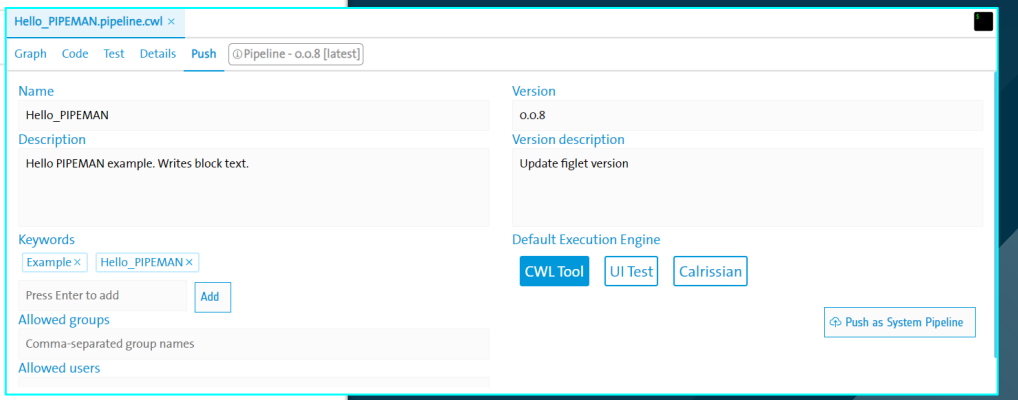
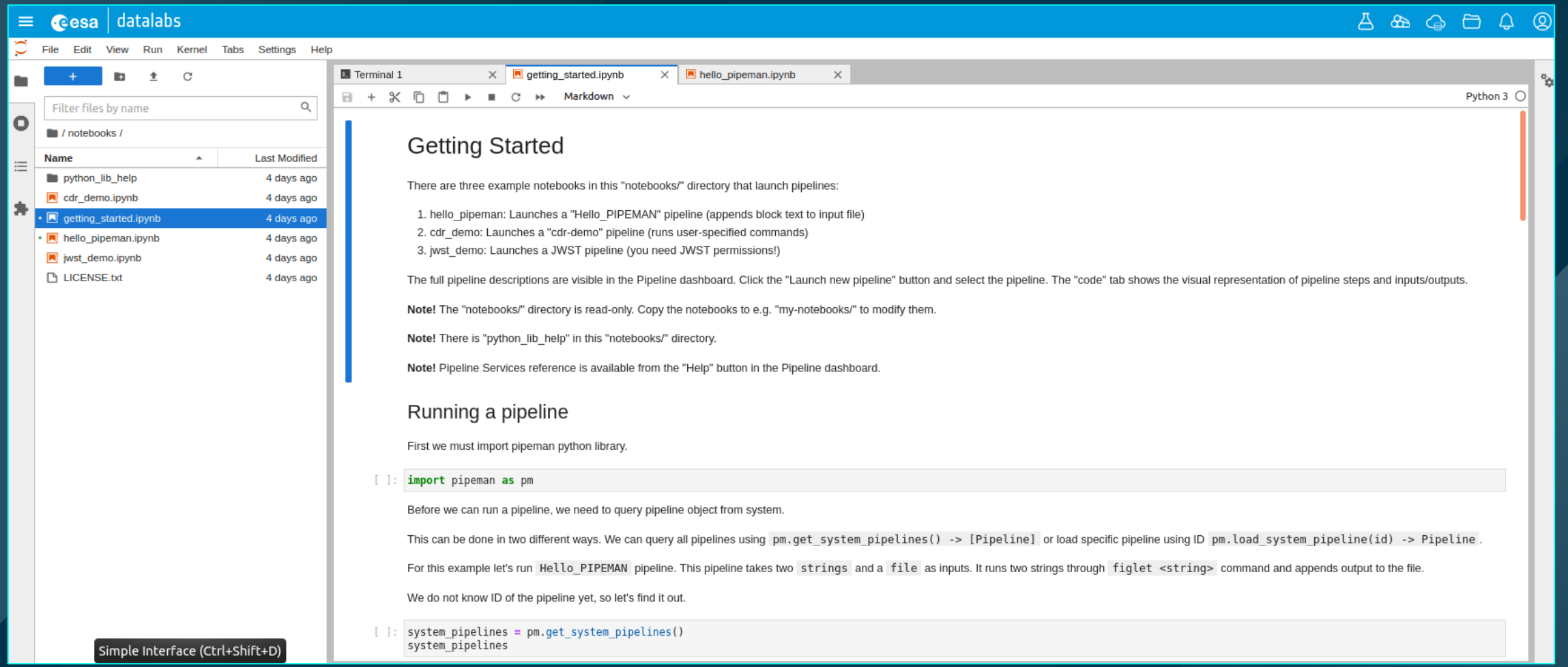
Pipeline Editor

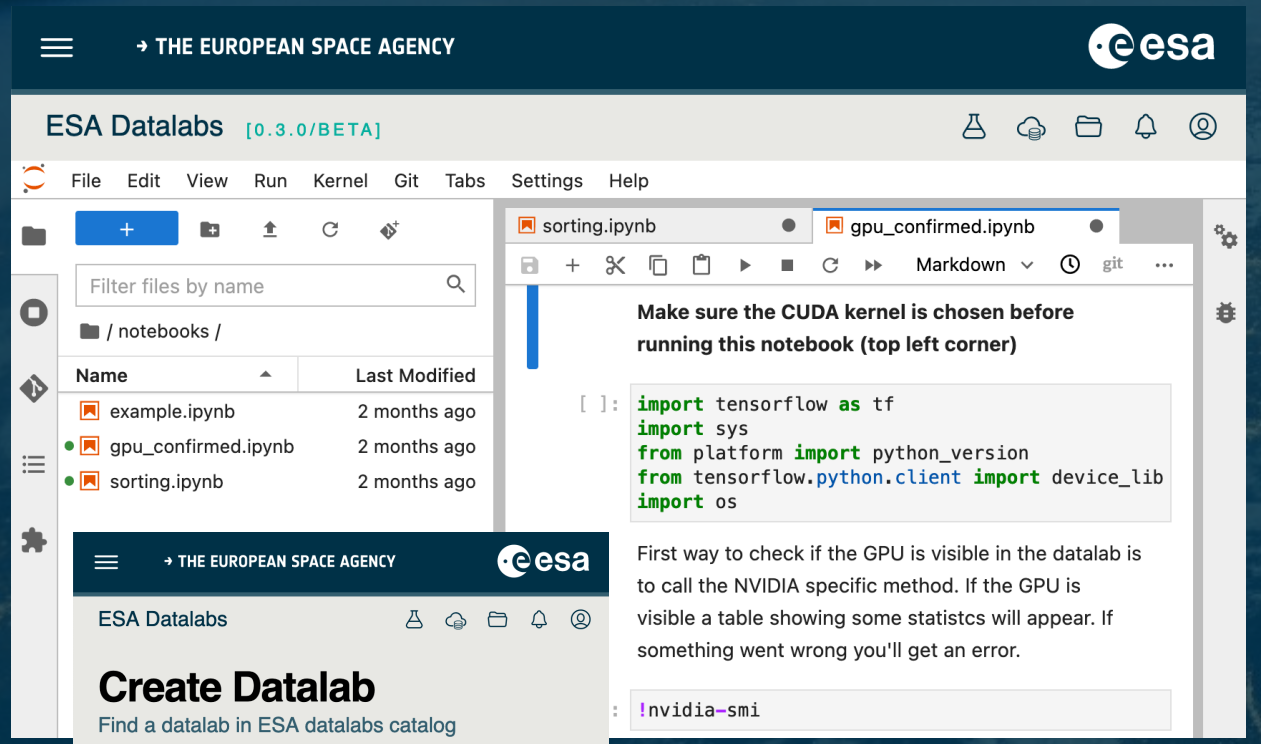


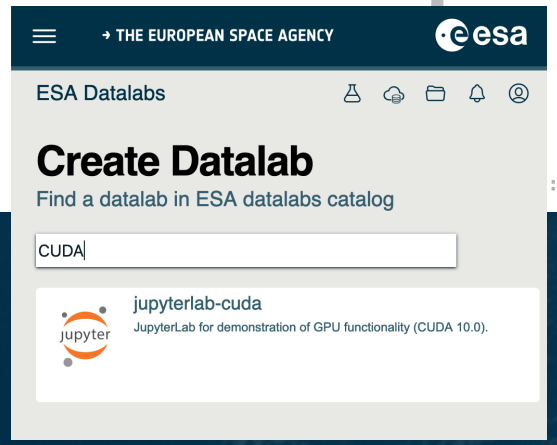


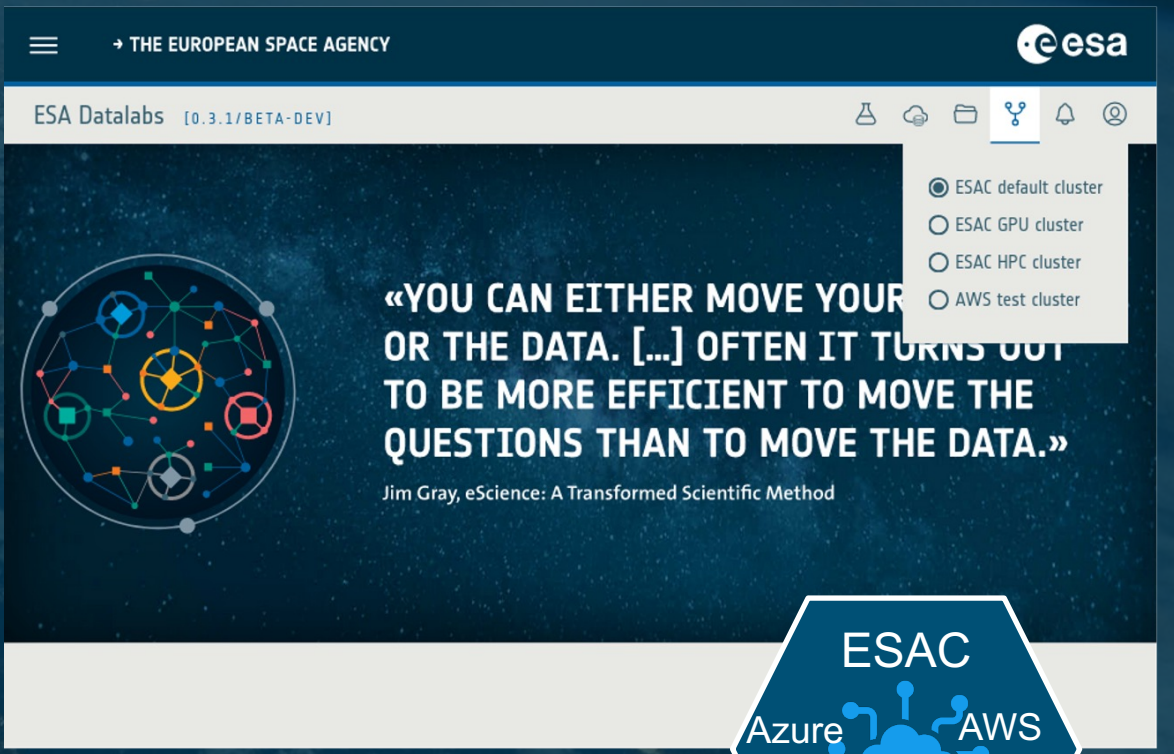
JupyterLab Pipeline Management



GPU Computing and Federated Scalability

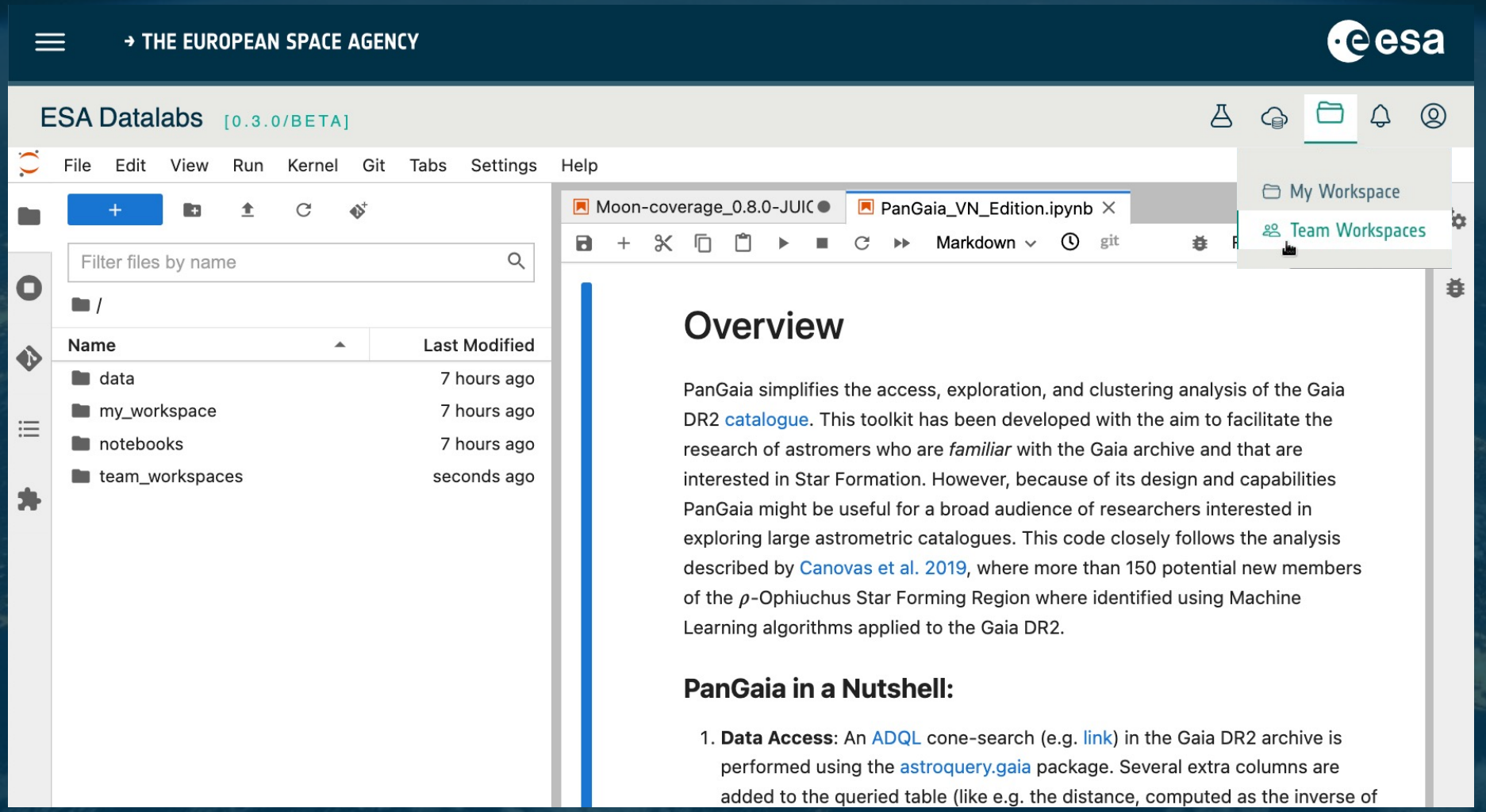




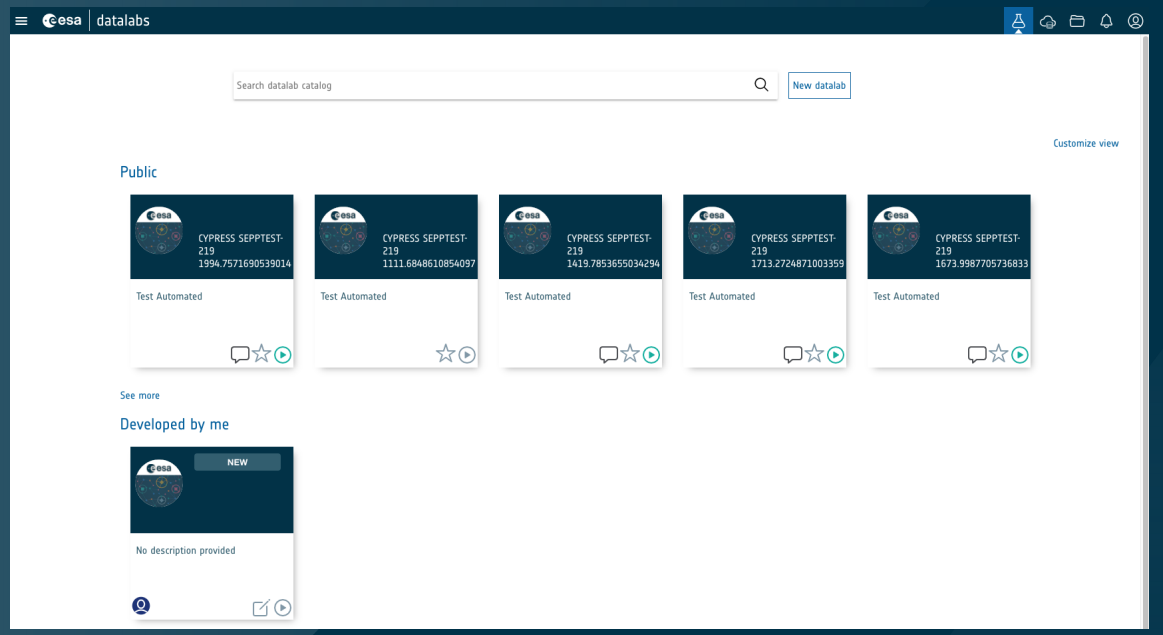


Collaborative Innovation

Data Centric Collaboration - Team Workspaces



Application Centric Collaboration - AppStore



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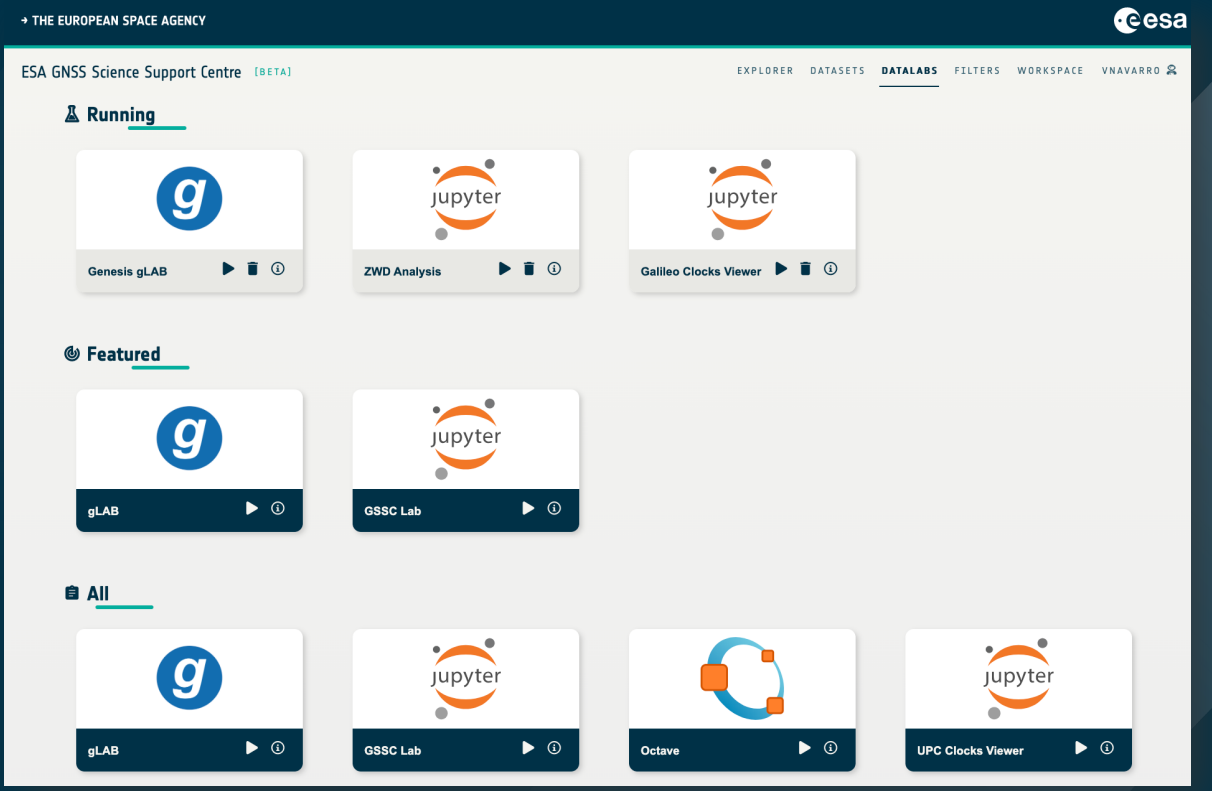
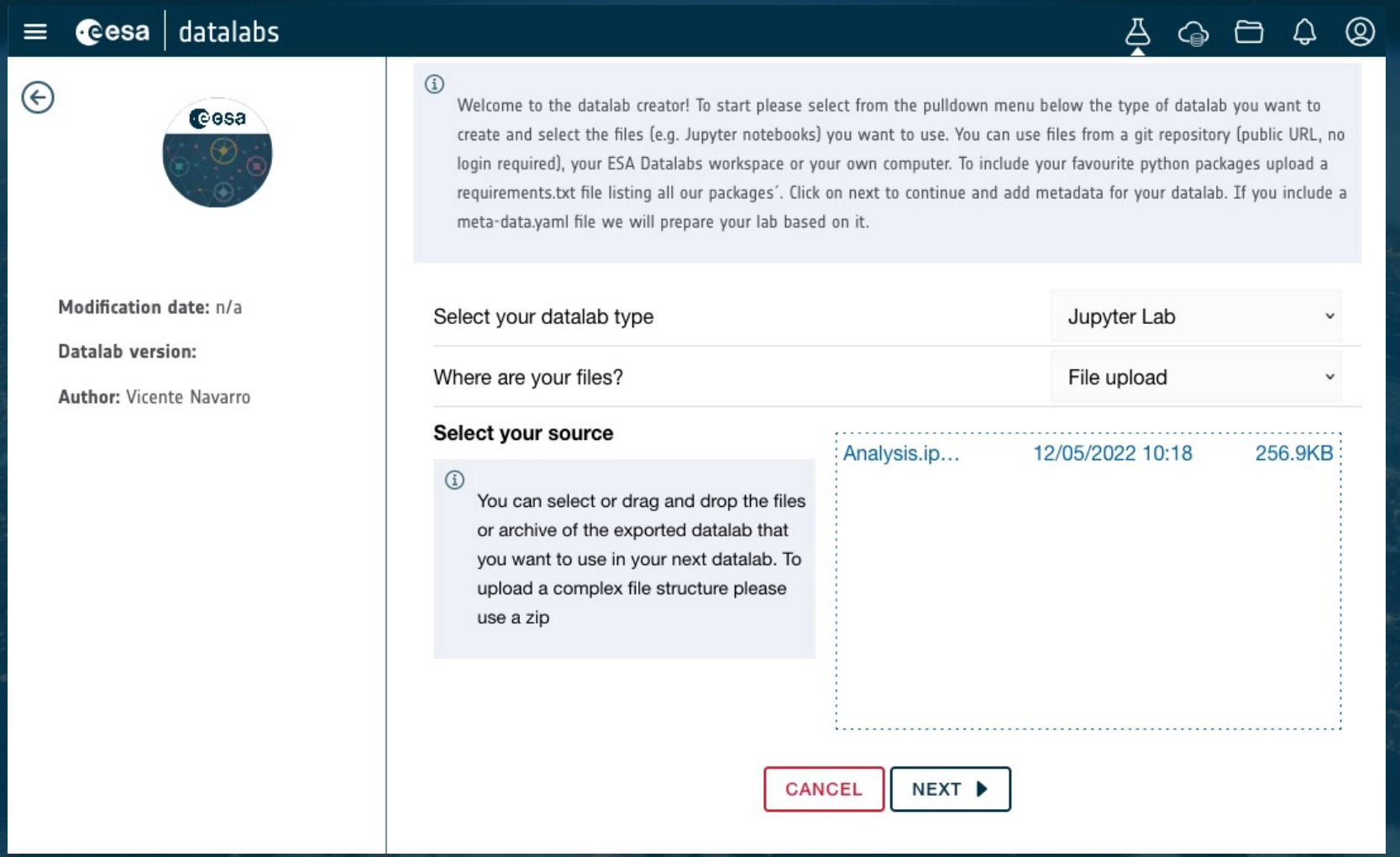
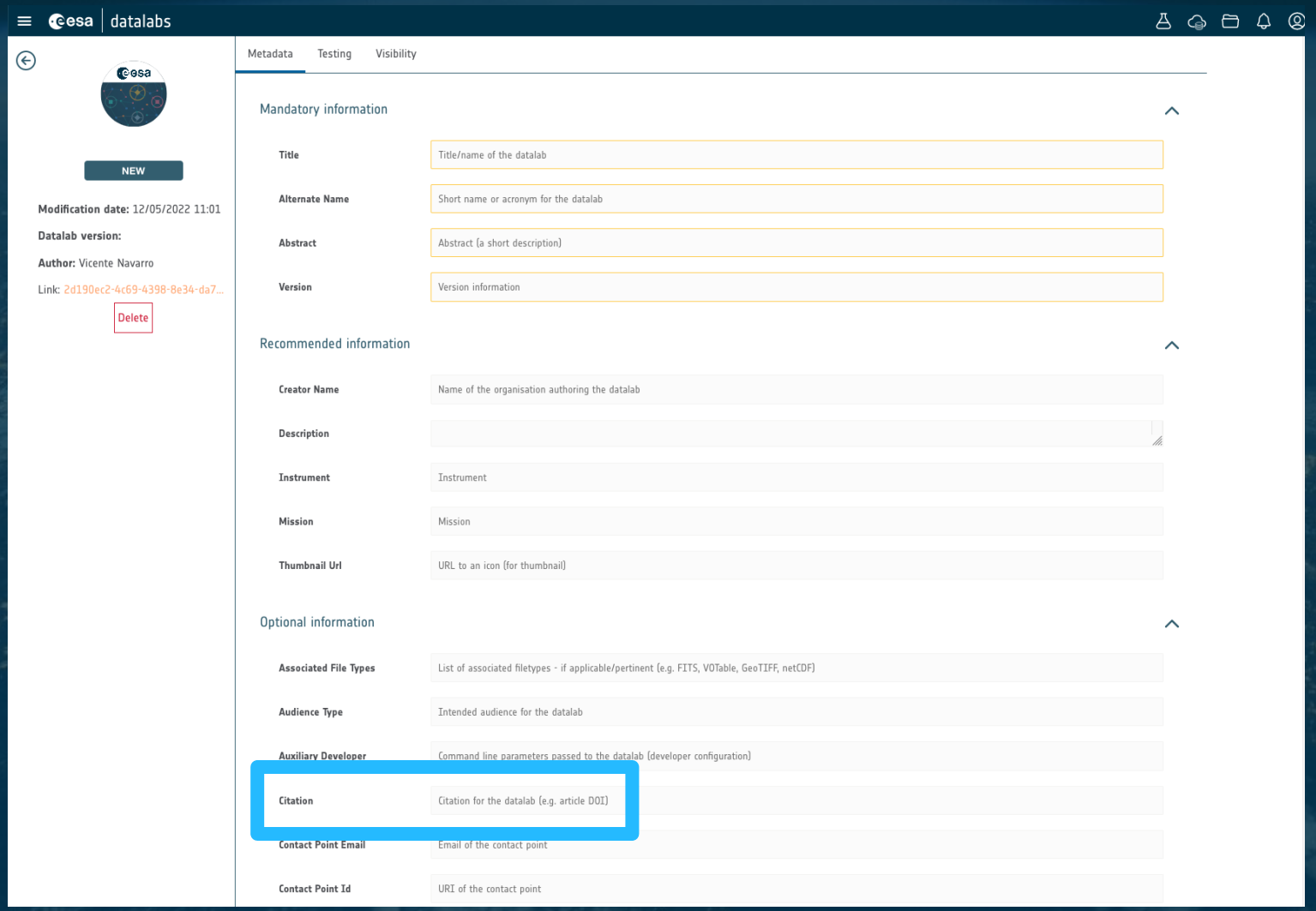


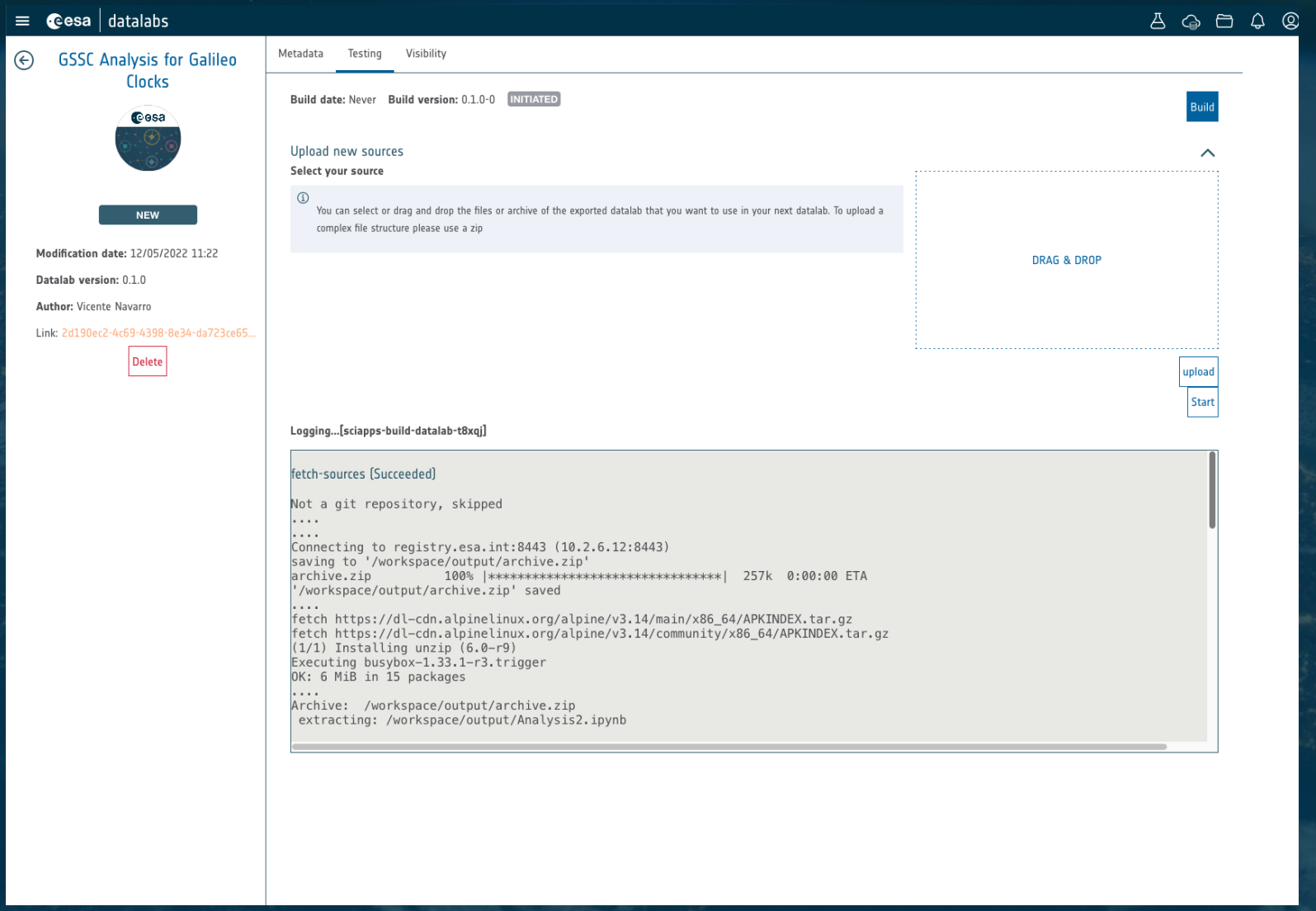
Datalabs Editor



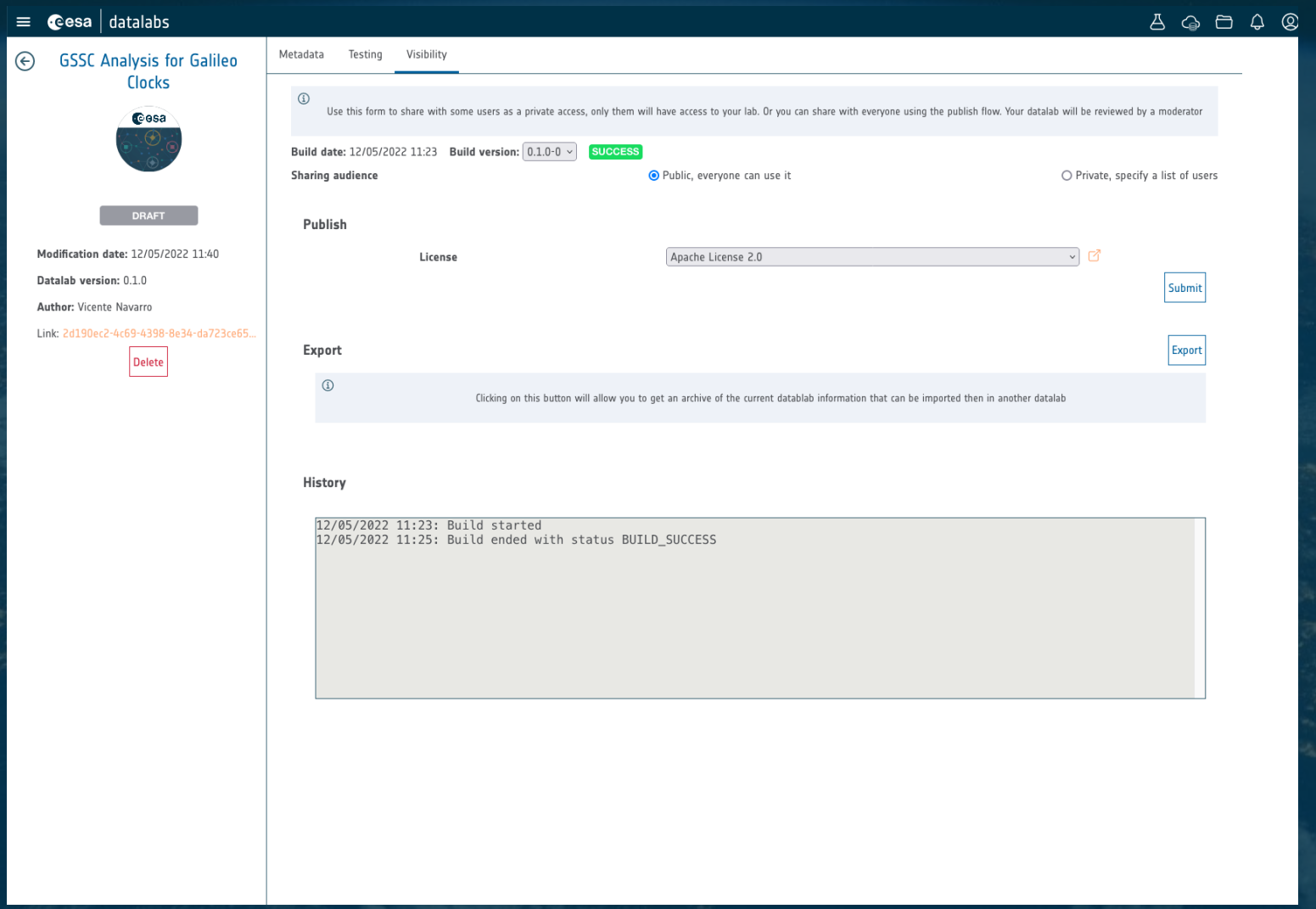
Datalabs Editor - Metadata



Datalabs Editor - Build



Datalabs Editor - Share



Take away messages

ESA Science strategy support

- Increased science return from its missions
- Increased science operations efficiency

Innovation traits

- Science data exploitation coupled with data
- Science pipelines for current and future needs
- Collaborative research & citizen science

Thank You!

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… special thanks to Sara del Rio, Marcos Lopez-Caniego, Filip Marinic, Anna Anku, Miguel Angel Diego

Industry Teams and User's Group (+50 members)