



# ESCAPE

European Science Cluster of Astronomy &  
Particle physics ESFRI research Infrastructures

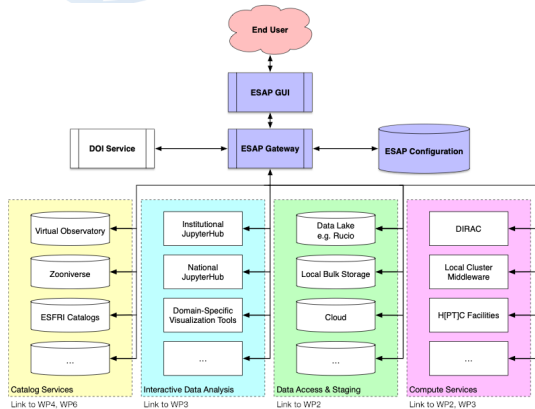
## ESAP Architecture

Klaas Kliffen - [kliffen@astron.nl](mailto:kliffen@astron.nl)

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ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures  
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under the Grant Agreement n°824064

- What is ESAP
- Components
  - ESAP GUI
  - API Gateway
  - Background workers
- Deployment



# What is ESAP

- A framework, tool box, extensible to fit needs
- Everything configurable
- Shopping basket
- Gateway to data (no data stored, only references)
- Common interface to different platforms



# ESAP Shopping basket



Archives Multi Query Interactive Analysis IVOA-SAMP



Logout Klaas Kliffen

## Data Shopping Basket

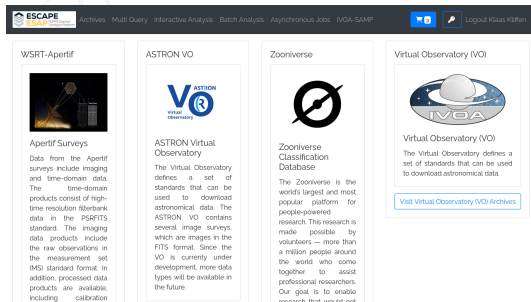
Empty Basket

API (expert user)

Basket	Source	Item	RA	Dec	fov	DataProduct Type	Calibration Level	Size
<input checked="" type="checkbox"/>	astron_vo	Collection						
		lotss-dr1	2277	52.5	4.2	image	3	87.4 MB
<input checked="" type="checkbox"/>	astron_vo	Collection						
		lotss-dr1	2277	52.5	4.2	image	3	786.3 MB
<input checked="" type="checkbox"/>	astron_vo	Collection						
		lotss-dr1	2277	52.5	4.2	image	3	87.4 MB
<input checked="" type="checkbox"/>	astron_vo	Collection						
		lotss-dr1	2277	52.5	4.2	image	3	786.3 MB



- React: single page JavaScript application
- Dataset Archives - Search
- IDA (shown in a later talk)
- Batch/Async (shown in a later talk)



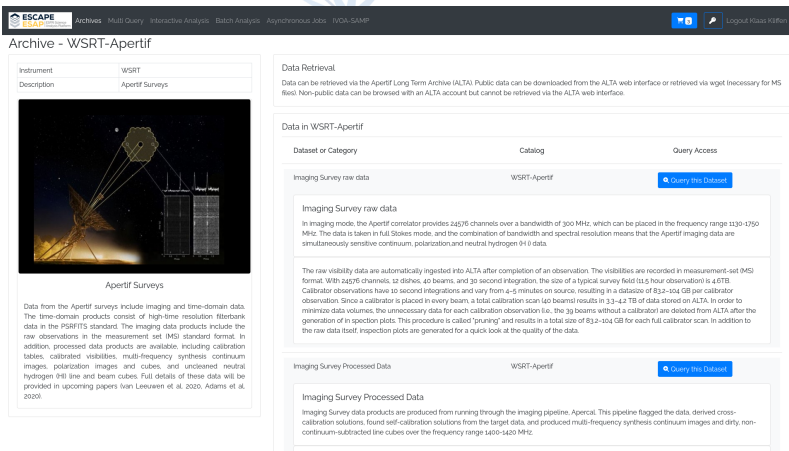
The screenshot shows a web interface for ESCAPE with a navigation bar at the top containing links for Archives, Multi Query, Interactive Analysis, Batch Analysis, Asynchronous Jobs, and IVOA-SAMP. There are also social media icons and a 'Logout Kees Kiften' link. Below the navigation bar are four service cards:

- WSRT-Apertif**: Features an image of a telescope. Text: "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 (MSI) standard format. In addition, processed data products are available, including calibration."
- ASTRON VO**: Features the ASTRON Virtual Observatory logo. Text: "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 currently under development, more data types will be available in the future."
- Zooniverse**: Features the Zooniverse logo. Text: "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."
- Virtual Observatory (VO)**: Features the IVOA logo. Text: "Virtual Observatory (VO). The Virtual Observatory defines a set of standards that can be used to download astronomical data." Below the text is a button labeled "Visit Virtual Observatory (VO) Archives".



# Components - GUI Dataset Hierarchy

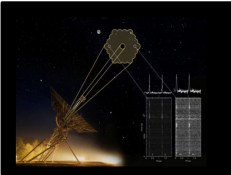
Archives breaks down into multiple Datasets



**ESCAPE** Archives Multi Query Interactive Analysis Batch Analysis Asynchronous Jobs NDA-SAMP Logout Klaus Knefl

## Archive - WSRT-Apertif

Instrument	WSRT
Description	Apertif Surveys



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 details of these data will be provided in upcoming papers (van Leeuwen et al. 2020, Adams et al. 2020).

### Data Retrieval

Data can be retrieved via the Apertif Long Term Archive (ALTA). Public data can be downloaded from the ALTA web interface or retrieved via wget (necessary for MS files). Non-public data can be browsed with an ALTA account but cannot be retrieved via the ALTA web interface.

### Data in WSRT-Apertif

Dataset or Category	Catalog	Query Access
Imaging Survey raw data	WSRT-Apertif	<a href="#">Query this Dataset</a>
Imaging Survey Processed Data	WSRT-Apertif	<a href="#">Query this Dataset</a>

**Imaging Survey raw data**

In imaging mode, the Apertif correlator provides 24576 channels over a bandwidth of 300 MHz, which can be placed in the frequency range 1130-1750 MHz. The data is taken in full Stokes mode, and the combination of bandwidth and spectral resolution means that the Apertif imaging data are simultaneously sensitive continuum, polarization, and neutral hydrogen (HI) data.

The raw visibility data are automatically ingested into ALTA after completion of an observation. The visibilities are recorded in measurement-set (MS) format. With 24576 channels, 12 dishes, 40 beams, and 30 second integration, the size of a typical survey field (11.5 hour observation) is 4.6TB. Calibrator observations have 10 second integrations and vary from 4-5 minutes on source, resulting in a dataset of 83.2-104 GB per calibrator observation. Since a calibrator is placed in every beam, a total calibrator scan (40 beams) results in 3.3-4.2 TB of data stored on ALTA. In order to minimize data volumes, the unnecessary data for each calibration observation (i.e. the 39 beams without a calibrator) are deleted from ALTA after the generation of inspection plots. This procedure is called "pruning" and results in a total size of 83.2-104 GB for each full calibrator scan. In addition to the raw data itself, inspection plots are generated for a quick look at the quality of the data.

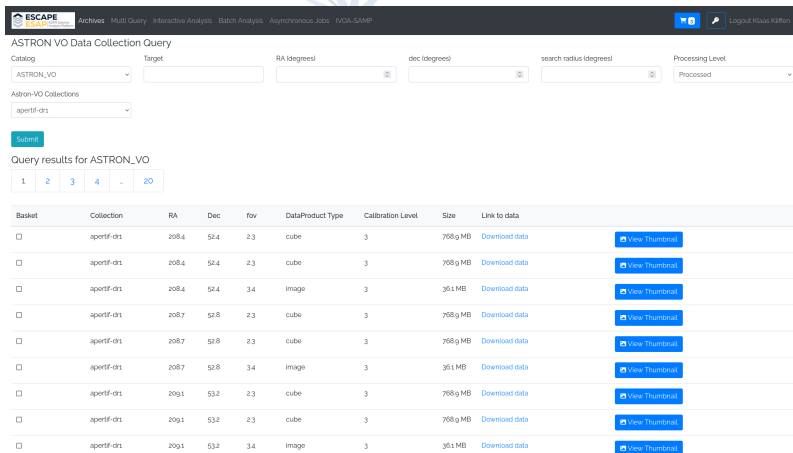
**Imaging Survey Processed Data**

Imaging Survey data products are produced from running through the imaging pipeline, Aperlcal. This pipeline flagged the data, derived cross-calibration solutions, found self-calibration solutions from the target data, and produced multi-frequency synthesis continuum images and dirty, non-continuum-subtracted line cubes over the frequency range 1400-1420 MHz.



# Components - Querying a dataset

- Configurable query fields
- Similar to VO UCD mapping of parameters
- Add to shopping basket



The screenshot shows the ESCAPE ASTRON VO Data Collection Query interface. At the top, there is a navigation bar with links for Archives, Multi Query, Interactive Analysis, Batch Analysis, Asynchronous Jobs, and MDA-SAMP. A user profile for 'Logout Klaus Keffen' is visible in the top right.

The main query form includes the following fields:

- Catalog:** A dropdown menu set to 'ASTRON\_VO'.
- Target:** An empty text input field.
- RA (degrees):** A text input field with a dropdown arrow.
- dec (degrees):** A text input field with a dropdown arrow.
- search radius (degrees):** A text input field with a dropdown arrow.
- Processing Level:** A dropdown menu set to 'Processed'.
- Astron-VO Collections:** A dropdown menu set to 'apertif-dr1'.

A blue 'Submit' button is located below the form. Below the form, the text 'Query results for ASTRON\_VO' is displayed, followed by a pagination control showing '1 2 3 4 - 20'.

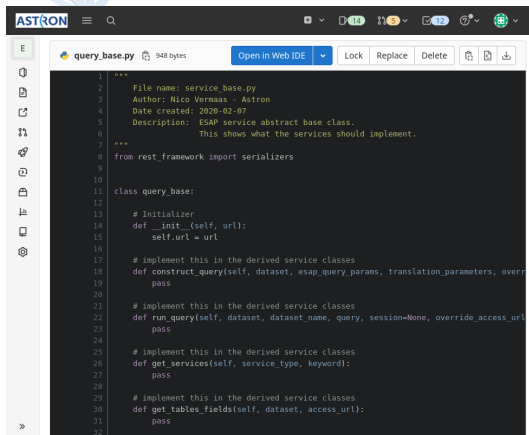
The results are presented in a table with the following columns: Basket, Collection, RA, Dec, fov, DataProduct Type, Calibration Level, Size, Link to data, and View Thumbnail. The table contains 9 rows of data, each with a checkbox in the 'Basket' column and a 'View Thumbnail' button in the last column.

Basket	Collection	RA	Dec	fov	DataProduct Type	Calibration Level	Size	Link to data	View Thumbnail
<input type="checkbox"/>	apertif-dr1	208.4	52.4	2.3	cube	3	768 g MB	<a href="#">Download data</a>	<a href="#">View Thumbnail</a>
<input type="checkbox"/>	apertif-dr1	208.4	52.4	2.3	cube	3	768 g MB	<a href="#">Download data</a>	<a href="#">View Thumbnail</a>
<input type="checkbox"/>	apertif-dr1	208.4	52.4	3.4	image	3	35.1 MB	<a href="#">Download data</a>	<a href="#">View Thumbnail</a>
<input type="checkbox"/>	apertif-dr1	208.7	52.8	2.3	cube	3	768 g MB	<a href="#">Download data</a>	<a href="#">View Thumbnail</a>
<input type="checkbox"/>	apertif-dr1	208.7	52.8	2.3	cube	3	768 g MB	<a href="#">Download data</a>	<a href="#">View Thumbnail</a>
<input type="checkbox"/>	apertif-dr1	208.7	52.8	3.4	image	3	35.1 MB	<a href="#">Download data</a>	<a href="#">View Thumbnail</a>
<input type="checkbox"/>	apertif-dr1	209.1	53.2	2.3	cube	3	768 g MB	<a href="#">Download data</a>	<a href="#">View Thumbnail</a>
<input type="checkbox"/>	apertif-dr1	209.1	53.2	2.3	cube	3	768 g MB	<a href="#">Download data</a>	<a href="#">View Thumbnail</a>
<input type="checkbox"/>	apertif-dr1	209.1	53.2	3.4	image	3	35.1 MB	<a href="#">Download data</a>	<a href="#">View Thumbnail</a>



# Components - API Gateway

- Django, Django REST Framework
- Queries per archive: service connectors
- PyVO (VO Standards)



The screenshot shows a code editor window titled 'query\_base.py' (948 bytes) with the following Python code:

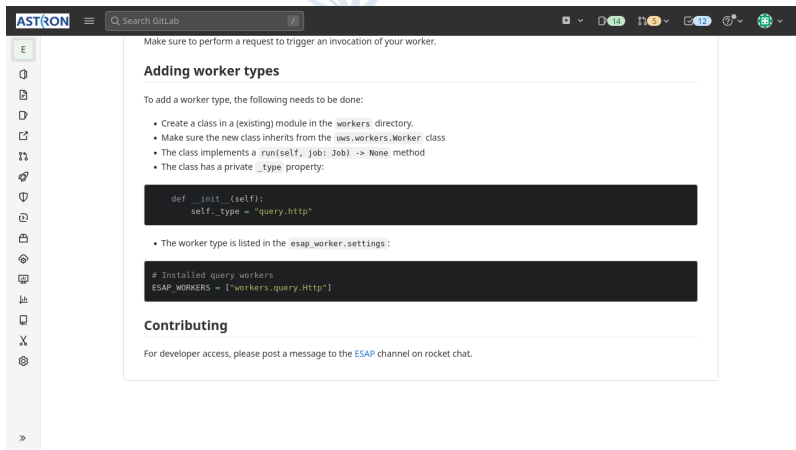
```
1 """
2     File name: service_base.py
3     Author: Nico Vermaas - Astron
4     Date created: 2020-02-07
5     Description: ESAP service abstract base class.
6                 This shows what the services should implement.
7 """
8 from rest_framework import serializers
9
10
11 class query_base:
12
13     # Initializer
14     def __init__(self, url):
15         self.url = url
16
17     # Implement this in the derived service classes
18     def construct_query(self, dataset, esap_query_params, translation_parameters, overr
19         pass
20
21     # Implement this in the derived service classes
22     def run_query(self, dataset, dataset_name, query, session=None, override_access_url
23         pass
24
25     # Implement this in the derived service classes
26     def get_services(self, service_type, keyword):
27         pass
28
29     # Implement this in the derived service classes
30     def get_tables_fields(self, dataset, access_url):
31         pass
32
```





# Components - Worker

- UWS (via django-uws)
- Celery Framework
- "Task routing"



ASTRON

Search GitLab

Make sure to perform a request to trigger an invocation of your worker.

## Adding worker types

To add a worker type, the following needs to be done:

- Create a class in a (existing) module in the `workers` directory.
- Make sure the new class inherits from the `uws.workers.Worker` class
- The class implements a `run(self, job: Job) -> None` method
- The class has a private `_type` property:

```
def __init__(self):  
    self._type = "query.http"
```

- The worker type is listed in the `esap_worker.settings`:

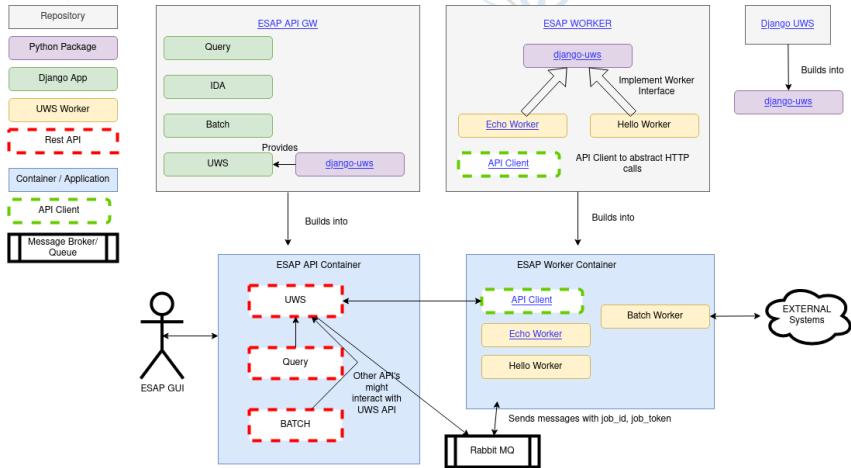
```
# Installed query workers  
ESAP_WORKERS = ["workers.query.Http"]
```

## Contributing

For developer access, please post a message to the [ESAP](#) channel on rocket chat.

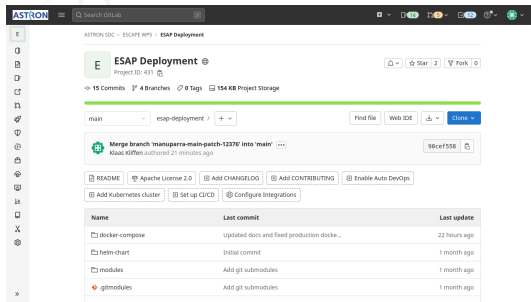


# Components - Worker implementation



# Deployment

- Main repository / eOSSR entry
- docker-compose
- Helm Chart (WIP)
- Another talk on deployment later today



ASTRON | Search GitHub

ASTRON-SDC > ESCAPE WPS > ESAP Deployment

## ESAP Deployment

Project ID: 431

15 Commits · 4 Branches · 0 Tags · 154 KB Project Storage

main · esap-deployment / +

Find file · Web IDE · Clone

Merge branch 'manuerra-main-patch-12276' into 'main'

90cef558

README · Apache License 2.0 · Add CHANGELOG · Add CONTRIBUTING · Enable Auto DevOps

Add Kubernetes cluster · Set up CI/CD · Configure Integrations

Name	Last commit	Last update
docker-compose	Updated docs and fixed production docke...	22 hours ago
helm-chart	Initial commit	1 month ago
modules	Add git submodules	1 month ago
.gitmodules	Add git submodules	1 month ago



A large, light blue starburst graphic is positioned in the upper right quadrant of the slide, partially overlapping a faint blue arc that curves across the top.

Thank you for your attention & any questions?



- Main repository:  
<https://git.astron.nl/astron-sdc/escape-wp5/esap-deployment>
- Documentation:  
<https://git.astron.nl/astron-sdc/escape-wp5/esap-api-gateway/-/wikis/home>
- UWS Specification:  
<https://www.ivoa.net/documents/UWS/20161024/REC-UWS-1.1-20161024.html>

