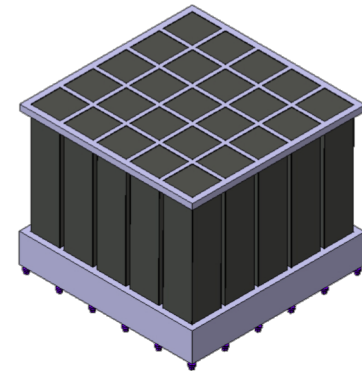
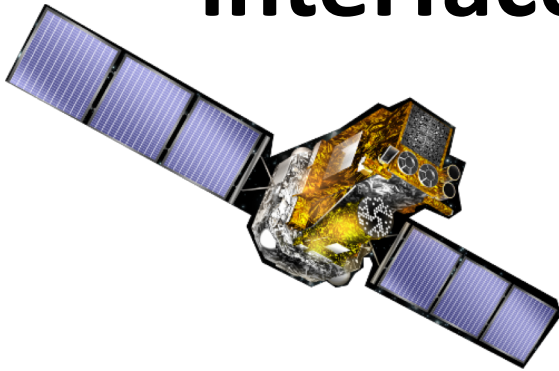


Online Data analysis (ODA) interface for INTEGRAL and Polar



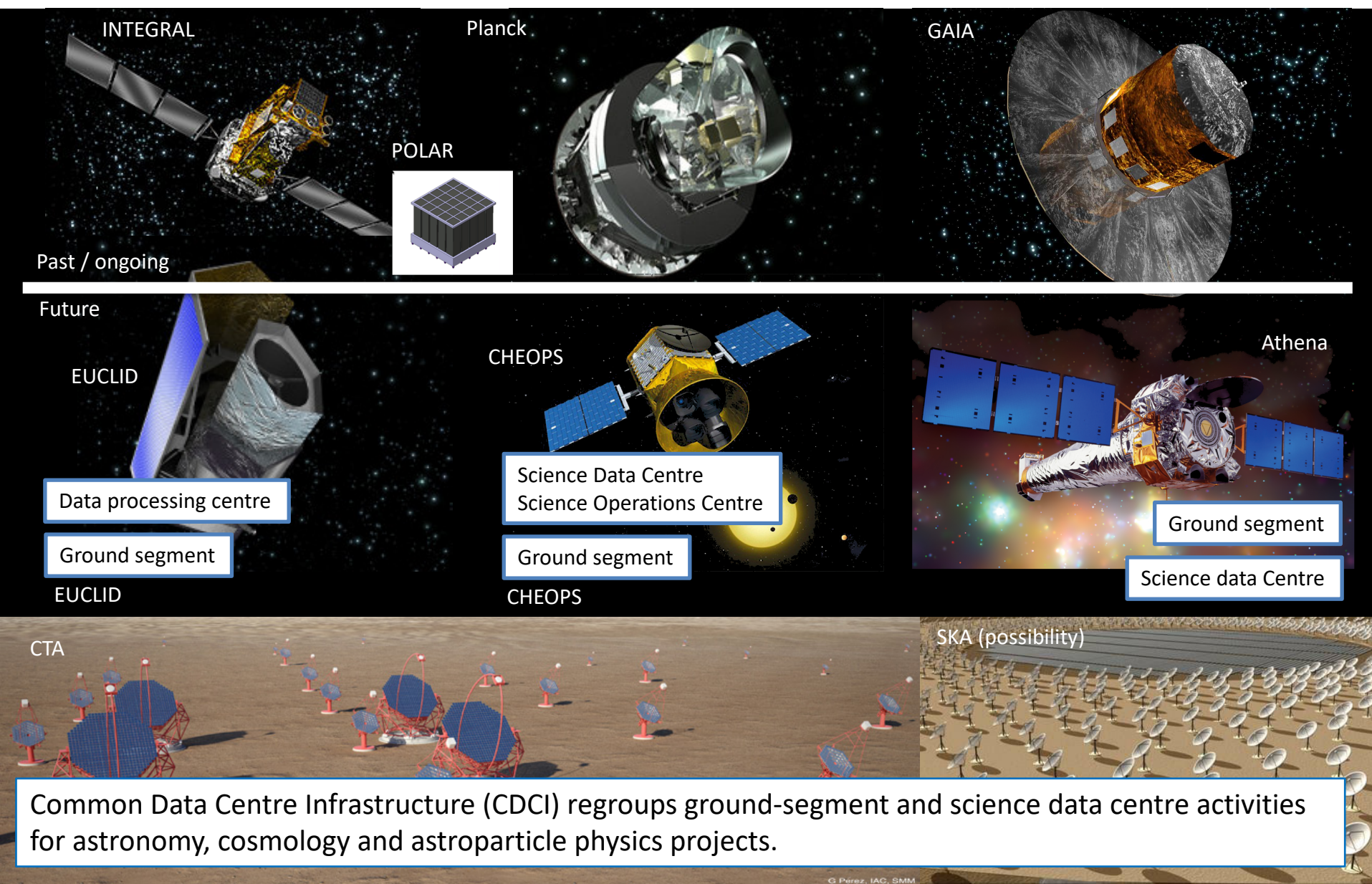
Carlo Ferrigno on behalf of

Andrii Neronov, Mohamed Maharga, Andrea Tramacere, Volodymyr Savchenko,

University of Geneva

Common Data Centre Infrastructure

for astronomy, astroparticle physics and cosmology at the University of Geneva



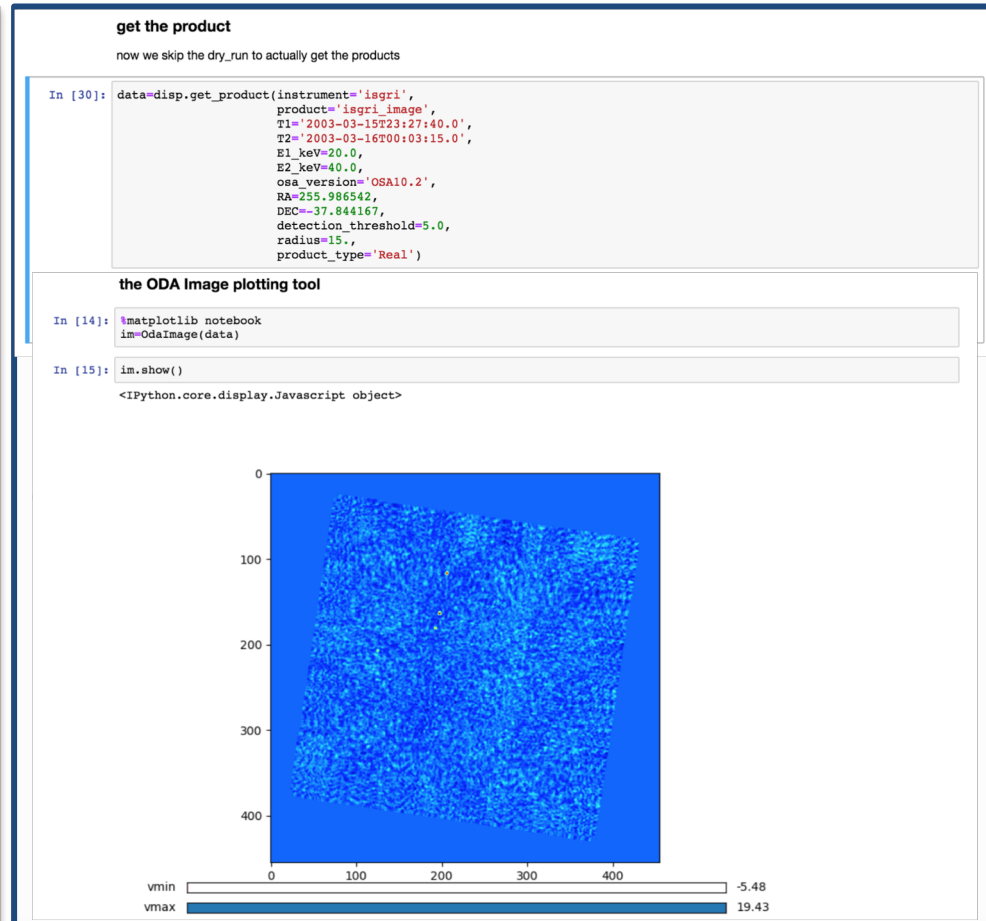
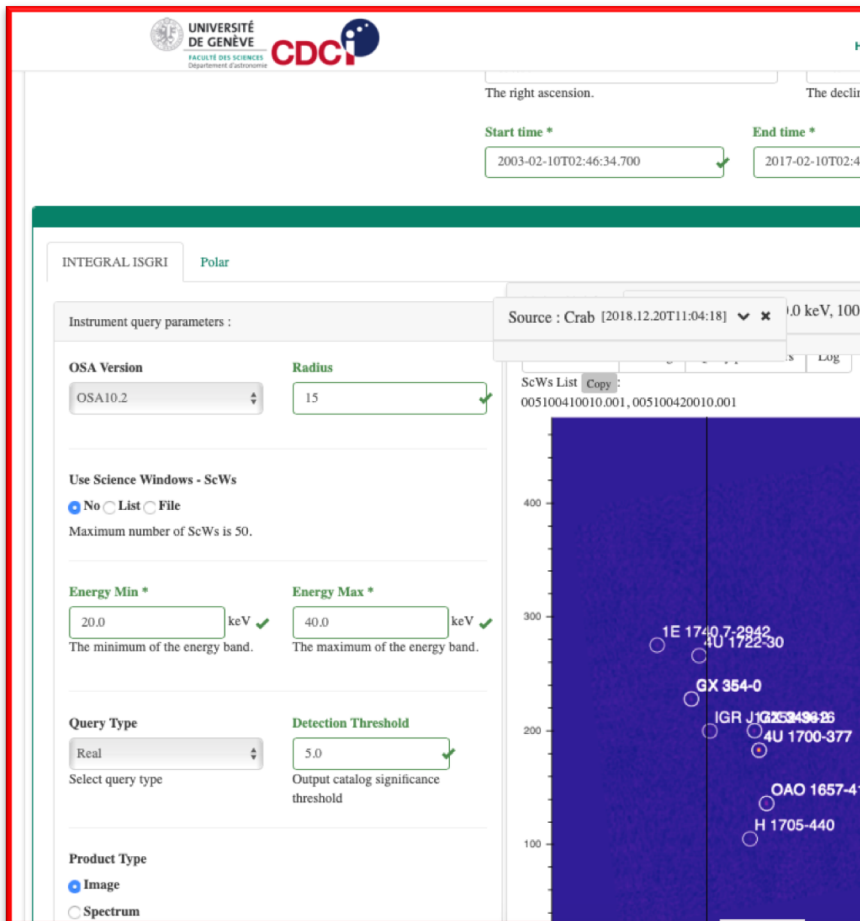
Data analysis in the multi-messenger astronomy era

- Multi-messenger approach requires efficient combination of data from different telescopes and astronomical messenger detectors.
- Long-term preservation of data analysis capability is essential
- This combination could be facilitated by availability of open access telescope data
..... **and data analysis tools**

Data analysis services

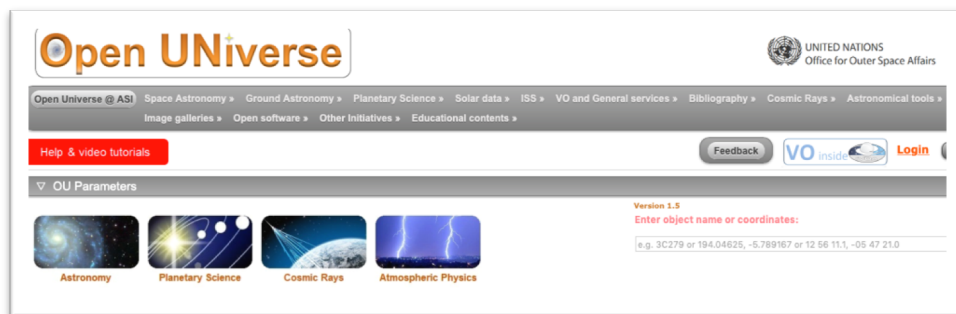
Data analysis of telescopes and astronomical messenger detectors could now be done on remotely via dedicated services accessible via

- Web interface (in a browser)
- Application Programming interface (API) from e.g. Jupyter notebooks



On a diffuse path ...

Efficient and easy-to-access exploitation of data is a common and recognized challenge



Common Data Centre Infrastructure basic services

www.astro.unige.ch/cdci

The screenshot shows the CDCI website header with the University of Geneva logo and navigation links: HOME, PROJECTS, DATA ANALYSIS, SOFTWARE, DATA, TEAM, and CONTACT US. The 'DATA' link is highlighted with a blue box. Below the header, a banner features images of astronomical missions: INTEGRAL, CTA, EUCLID, Polar, CHEOPS, and ATHENA. Two white boxes with blue borders are overlaid on the banner: 'On-the-fly data analysis' and 'Data archives access'. Below the banner, text describes the infrastructure's services: support for data centre / ground segment projects; long-term preservation of astronomical data and data analysis tools of past missions / projects; Multi-mission astronomical data archives, public data access, data analysis system; and Reusability of public data sets / reproducibility of scientific results. At the bottom, a 'Contact Us' section provides the address and phone number.

UNIVERSITÉ DE GENÈVE
FACULTÉ DES SCIENCES
Département d'astronomie

CDCI Astronomy
Astroparticle
Cosmology

Sign in Search

HOME PROJECTS DATA ANALYSIS SOFTWARE DATA TEAM CONTACT US

On-the-fly data analysis

Data archives access

INTEGRAL

CTA

EUCLID

Polar

CHEOPS

ATHENA

A common infrastructure for all projects / missions :
- Data sets and software reusability
- Optimal resources management
- Know-how development and preservation

Support for data centre / ground segment projects;
Long-term preservation of astronomical data and data analysis tools of past missions / projects;
Multi-mission astronomical data archives, public data access, data analysis system;
Reusability of public data sets / reproducibility of scientific results.

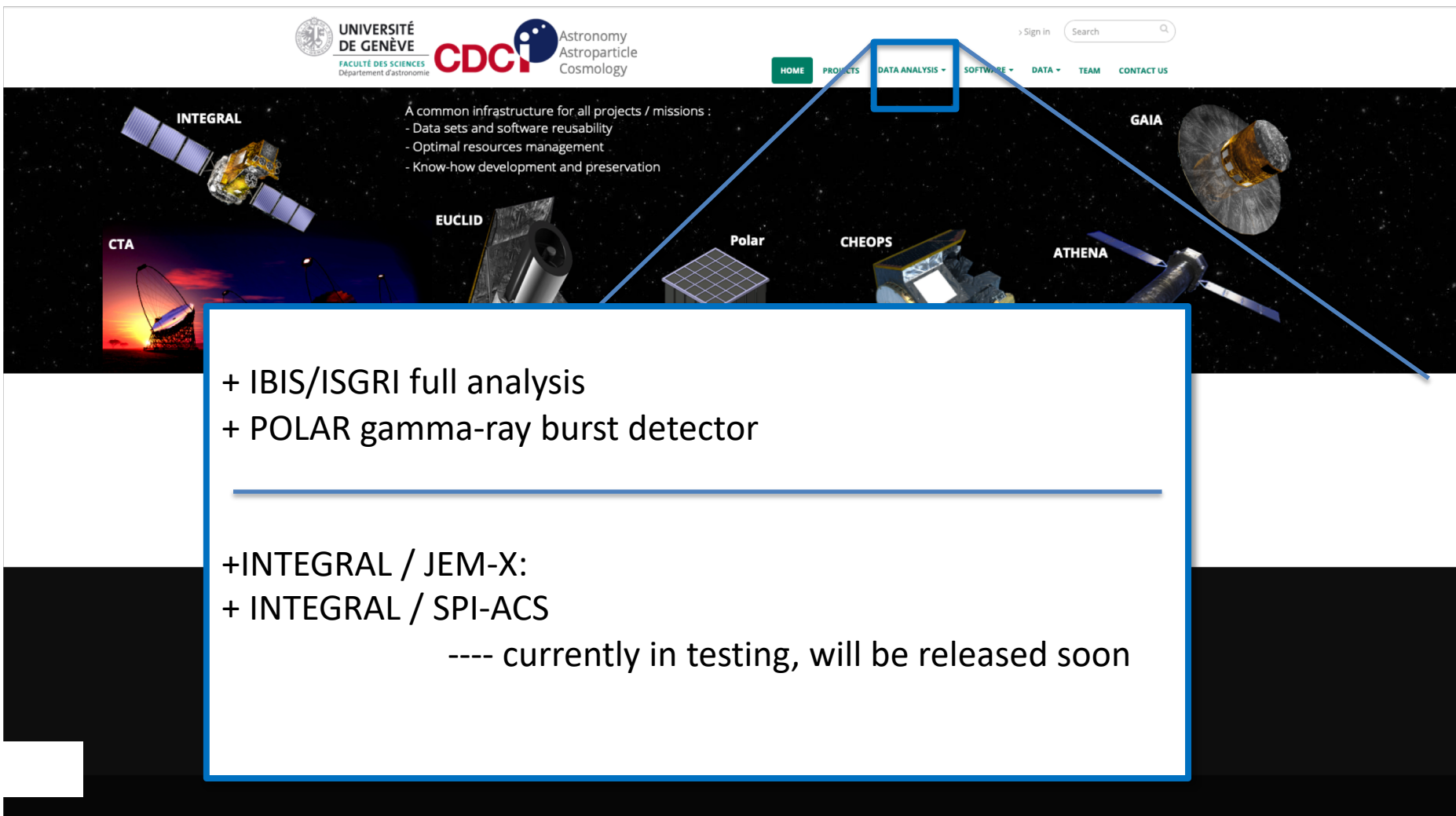
Contact Us

Address:
Chemin d'Ecogia 16
CH-1290 Versoix
Switzerland

Phone: +41 22 379 2 100

CDCI is developing a system **for long-term preservation of data and data analysis tools** for associated projects. The same system will also serve an **“added value” multi-project data archive**.

Online Data Analysis (astrooda) interface for INTEGRAL and Polar

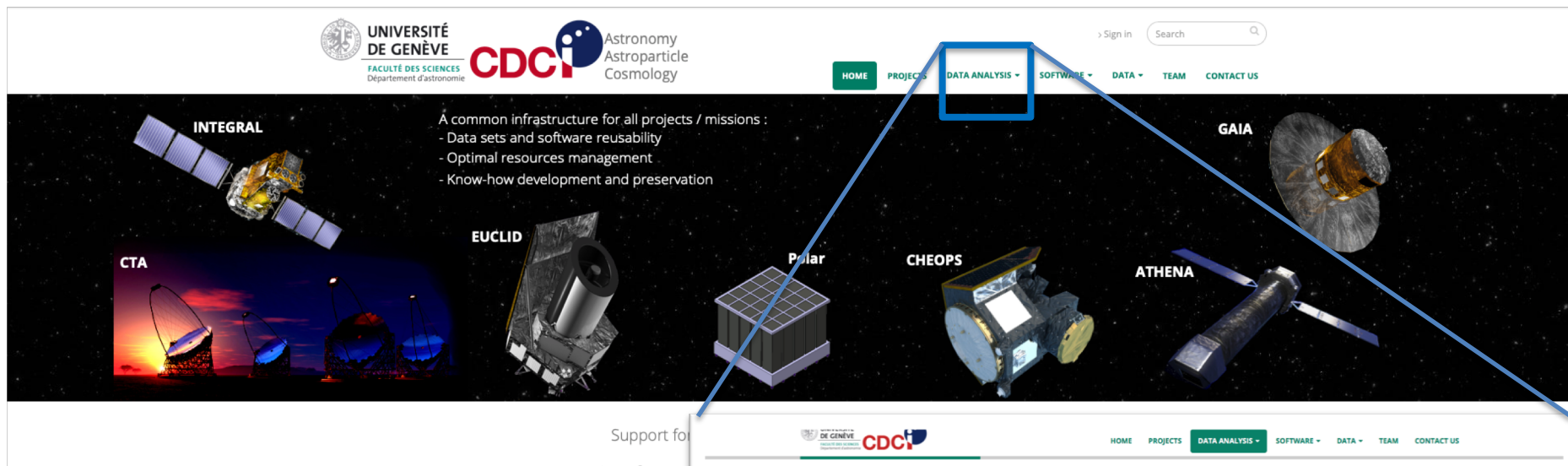


The screenshot shows the astrooda website header with logos for the University of Geneva, CDCI, and Astronomy Astroparticle Cosmology. A navigation bar includes links for HOME, PROJECTS, DATA ANALYSIS (highlighted with a blue box), SOFTWARE, DATA, TEAM, and CONTACT US. Below the navigation bar, a banner features images of various space missions: INTEGRAL, CTA, EUCLID, Polar, CHEOPS, ATHENA, and GAIA. A central text block states: 'A common infrastructure for all projects / missions :
- Data sets and software reusability
- Optimal resources management
- Know-how development and preservation'.

+ IBIS/ISGRI full analysis
+ POLAR gamma-ray burst detector

+ INTEGRAL / JEM-X:
+ INTEGRAL / SPI-ACS
---- currently in testing, will be released soon

Online Data Analysis (astrooda) interface



Web interface for online data analysis:

- imaging
- spectra
- lightcurves

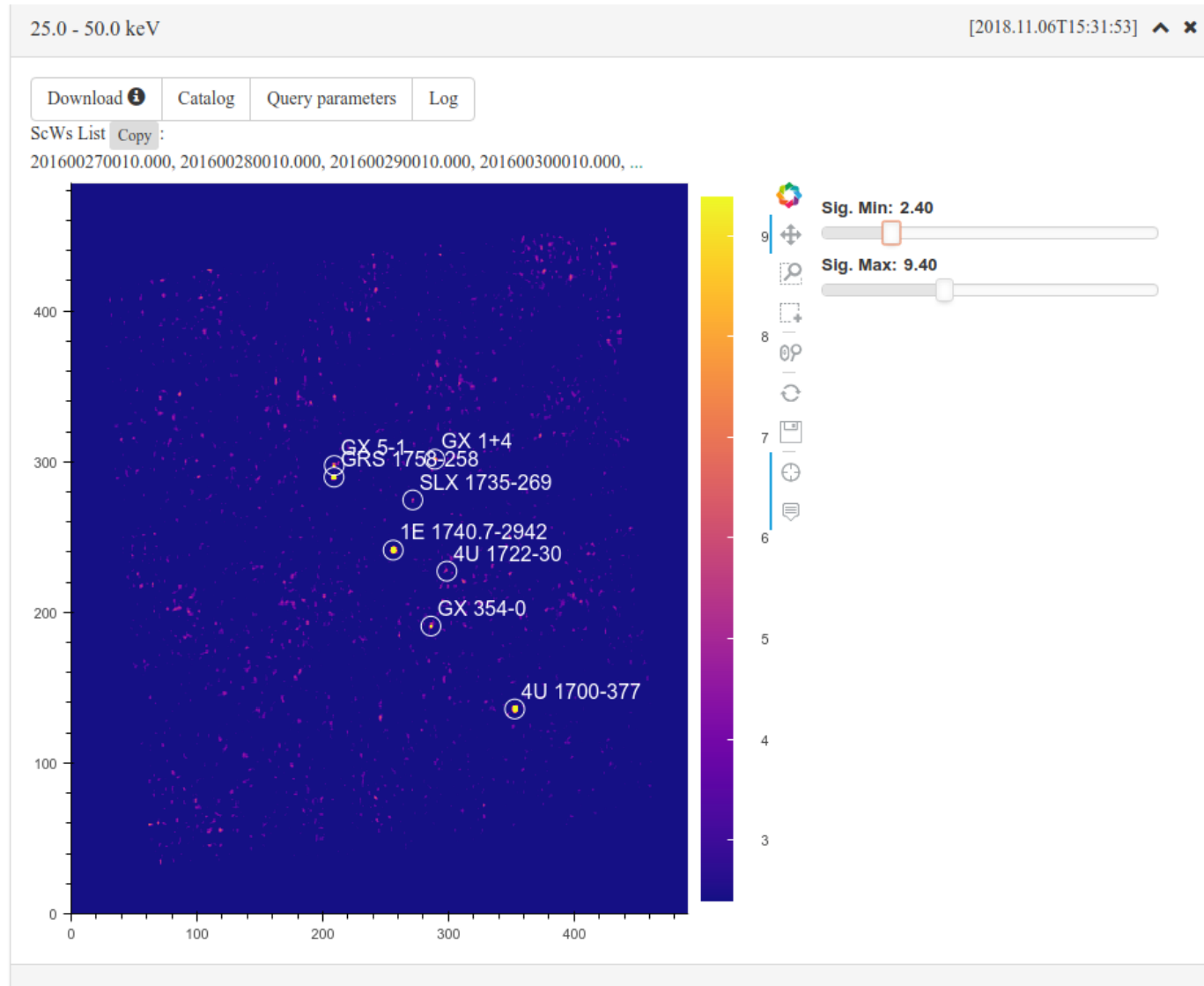
Offline Science Analysis (10.2 and 11.0)
running in Docker containers deployable
at CDCI “on-demand”

Only 50 science windows for run (to be
improved in future)

This image shows the detailed web interface for online data analysis. It features a session ID at the top. The main section contains input fields for object information: Object name (4U 1700-377), RA (257.815417), Dec (-41.593417), Start time (2003-03-15T23:27:40.0), End time (2003-03-16T00:03:15.0), and Time unit (ISC). A 'Resolve' button is next to the object name field. Below this, there are tabs for 'INTEGRAL ISGRI', 'INTEGRAL JEM-X', and 'MOCK instrument'. The 'INTEGRAL ISGRI' tab is active, showing 'Instrument query parameters' with a 'Radius' field set to 25, a 'Use Science Windows - ScWs' section with radio buttons for 'No', 'List', and 'File' (where 'List' is selected), and 'Energy Min' and 'Energy Max' fields. A 'Help' link is visible in the top right corner.

Imaging

- Possible to make images in one energy range
- Interactive imaging display



A central role for the catalog

- Easy handling of source catalog.
- You can delete, add sources found from imaging
- You can load a catalog from a file.

Source : Sgr a* - Image catalog

Select all Deselect all New Edit Delete

Showing 1 to 8 of 8 entries

Search:

| | src names | significance | ra | dec | NEW SOURCE | ISGRI FLAG | FLAG | ERR RAD |
|--------------------------|----------------|--------------|----------|----------|------------|------------|------|---------|
| <input type="checkbox"/> | 1E 1740.7-2942 | 39.7975 | 265.9794 | -29.7482 | 0 | 2 | 0 | 0.0000 |
| <input type="checkbox"/> | 4U 1700-377 | 31.1975 | 255.9964 | -37.8460 | 0 | 2 | 0 | 0.0003 |
| <input type="checkbox"/> | 4U 1722-30 | 5.4710 | 261.8883 | -30.8019 | 0 | 2 | 0 | 0.0003 |
| <input type="checkbox"/> | GRS 1758-258 | 27.0265 | 270.3057 | -25.7378 | 0 | 2 | 0 | 0.0003 |
| <input type="checkbox"/> | GX 1+4 | 8.6322 | 263.0458 | -24.7477 | 0 | 2 | 0 | 0.0003 |
| <input type="checkbox"/> | GX 354-0 | 10.7631 | 262.9798 | -33.8281 | 0 | 2 | 0 | 0.0003 |
| <input type="checkbox"/> | GX 5-1 | 9.7901 | 270.2689 | -25.1035 | 0 | 2 | 0 | 0.0008 |
| <input type="checkbox"/> | SLX 1735-269 | 6.0459 | 264.5713 | -26.9941 | 0 | 2 | 0 | 0.0002 |

Show 25 entries

Previous 1 Next

Use catalog

Spectra and online fitting

- From the catalog, you get all spectra simultaneously at full 256 channel resolution
- Fit individual spectra using Xspec and download files in fits format

Processing ...

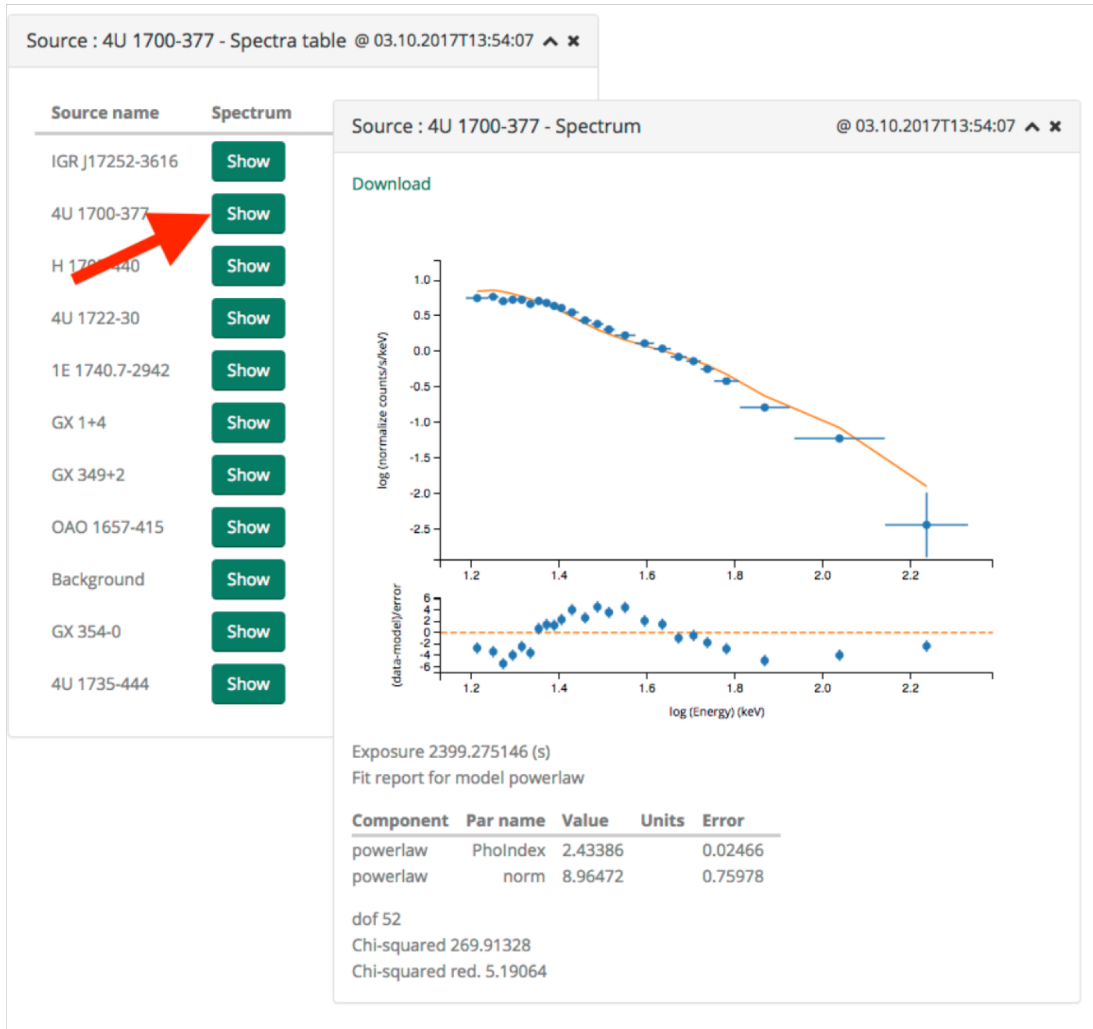
Session : 2a10871c8d4db1429e62d218acd7b2d1 | Job Id : -7594506992834016721

2018.11.06T15:48:58 Status : ready

| Data unit | | ISGRI_SpectraSum | ii_spectra_extract | ii_skyimage | iiis_gti | iiis_dead | ISGRIEvents |
|-----------|------------------|------------------|--------------------|-------------|----------|-----------|-------------|
| 001 | 201600270010.000 | | | | | | |
| 002 | 201600280010.000 | | | | | | |
| 003 | 201600290010.000 | | | | | | |
| 004 | 201600300010.000 | | | | | | |
| 005 | 201600310010.000 | | | | | | |
| 006 | 201600320010.000 | | | | | | |

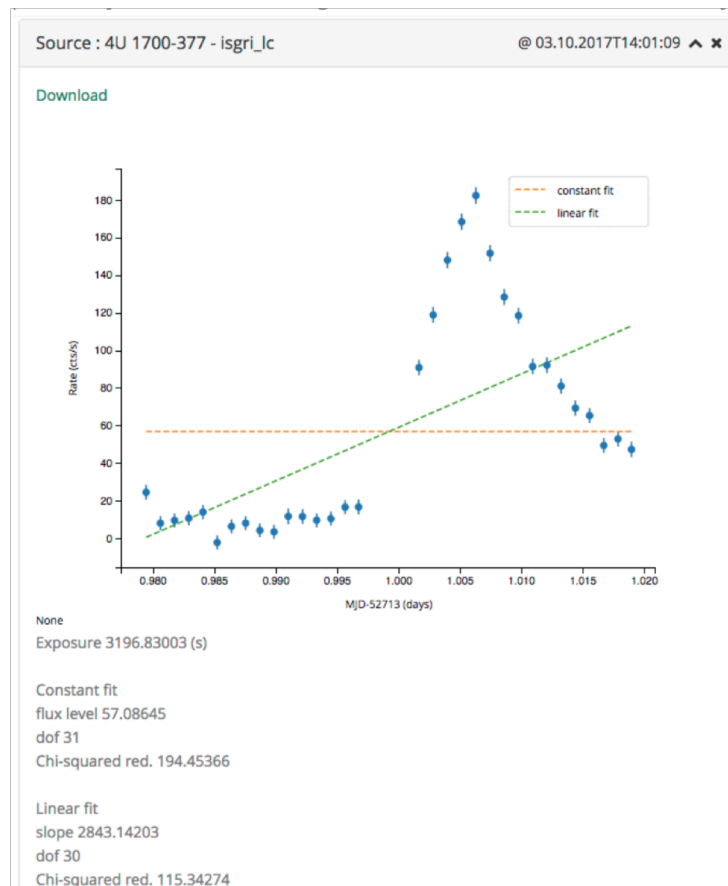
2018.11.06T15:49:56 done

[More details >](#)



Light curves

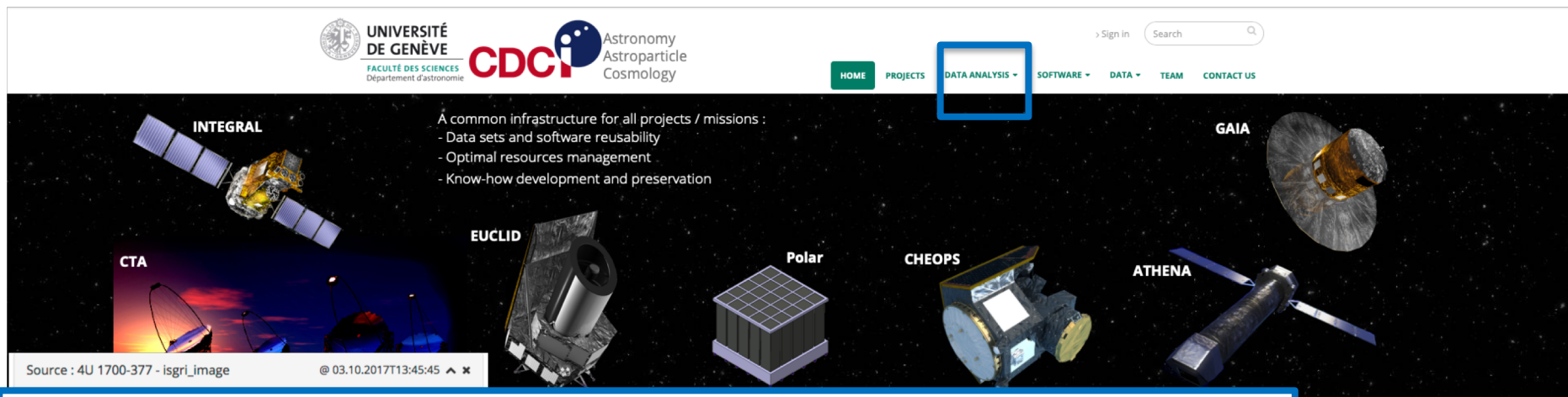
- From the catalog, you can create light curves with time bins larger than 10 seconds and display them individually
- Downloaded light curves in OGIP format



Reproducible and storable

- The system is built with internal cache to save intermediate products.
- The second time you make the same query, results are almost instantaneous.
- Backend can be deployed virtually anywhere, because it is based on a scalable virtual cluster, which runs science windows in parallel.

Online Data Analysis (astrooda) interface potential



Container-based data servers for online data analysis extensible to other projects (GAIA, Euclid....) and for the multi-wavelength / multi-messenger post-processing of data from different telescopes (e.g. for the transient analysis) could be added at next development stages.

Online data analysis system will be used to foster “reproducible science”:

- data analysis executable on-the-fly e.g. from links in research publications
- data analysis executable on-the-fly integrated through API into any user-defined multi-instrument analysis workflows (e.g. Jupyter notebooks)

Container-based approach is suitable as technology of choice for long-term preservation of entire data analysis systems.

Legacy online catalog of most popular requests and transients...

[Home](#) [Data](#)

INTEGRAL Transients

| Time | Class | Instrument | |
|--|--|--|--------------------------------------|
| <input type="text" value="Is not empty (NOT NULL)"/> | <input type="text" value="Is one of"/> | <input type="text" value="Is one of"/> | <input type="button" value="Apply"/> |
| | <div>FRB GW Neutrino</div> | <div>INTEGRAL ISGRI INTEGRAL JEMX INTEGRAL SPI-ACS</div> | |
| Name | Instrument | Class | Time |
| GW150914 | INTEGRAL ISGRI | GW | 2015-09-14T09:50:45.000000 |
| GW151226 | INTEGRAL ISGRI | GW | 2015-12-26T03:38:53.000000 |
| GW170104 | INTEGRAL ISGRI | GW | 2017-01-04T10:11:58.000000 |
| GW170608 | INTEGRAL ISGRI | GW | 2017-06-08T02:01:16.000000 |
| GW170814 | INTEGRAL ISGRI | GW | 2017-08-14T10:30:43.000000 |
| GW170817 | INTEGRAL ISGRI | GW | 2017-08-17T12:41:04.000000 |
| LVT151012 | INTEGRAL ISGRI | GW | 2015-10-12T09:54:43.000000 |

- We aim at populating dynamically a catalog of most important online analyses for legacy.

Instrument:

INTEGRAL ISGRI

Class:

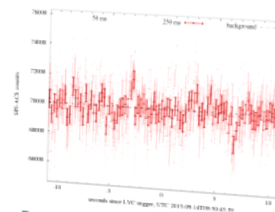
GW

Time:

2017-08-17T12:41:04.000000

Light curves:

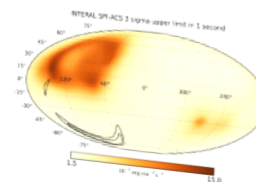
GW170817 light curve



[Read more](#)

All sky images:

GW170817 all-sky image



[Read more](#)

Localization summaries:

GW170817 localization summary