

Various ways to access the CSA

3rd IHDEA meeting, NASA/GSFC
17 October 2019

A. Masson, ESDC Heliophysics archives science Lead

1. Cluster Science Archive web application: Shock physics science case
2. Distribution functions
3. Different formats
4. Wget, IDL, Matlab, Python
5. Data Streaming

CSA Web GUI:











<https://csa.esac.esa.int/>



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Cluster Science Archive

CSA 2.4.1



WELCOME TO THE CLUSTER SCIENCE ARCHIVE

The Cluster Science Archive provides access to all science and support data of the ongoing Cluster (2000-) and Double Star (2004-2008) missions.

For each instrument on these missions, detailed documentation is available. Users are warmly invited to read the PI recommendations provided in the User Guide and Calibration Report of each instrument.

LATEST NEWS

Release csa-2.4.1

-Qtran has been rolled back instead of SPARTA in this patch release to convert CEF files to CDF. Differences in the way the data are stored in the CDF files have been indeed found when converting 2D and 3D datasets by Qtran vs. SPARTA. SPARTA will be deployed again in the near future, once fixed.

2019-09-04 12:40:00 CSA Team

[SEARCH](#) [GRAPHS](#) [QUICKLOOKS](#) [INVENTORY](#) [DISTRIBUTION FUNCTIONS](#) [DOCUMENTATION](#) [COMMAND LINE](#) [CONTACT](#)

Basic dataset search



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Cluster Science Archive

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Mission ☒ Cluster ☒ DoubleStar

DATA SEARCH

Time (begin/end) -

Duration Days Hours Minutes

CLUSTER MISSION EXPERIMENTS

All

- ASPOC active spacecraft potential control
- CIS ion spectrometer
- DWP wave-particle correlator
- EDI electron drift instrument
- EFW electric field double probe antenna
- FGM fluxgate magnetometer
- PEACE electron spectrometer
- RAPID energetic electron and ion spectrometer
- STAFF search coil magnetometer and spectrum analyzer
- WBD radio receiver - electric field waveforms
- WHISPER relaxation sounder
- Auxiliary, MAARBLE and ECLAT support data
- CAL Cross calibration products

DOUBLE STAR MISSION EXPERIMENTS

All

- ASPOC spacecraft potential control experiment
- FGM fluxgate magnetometer
- HEED high energy electron detector
- HIA ion spectrometer
- HID high energy heavy ion detector
- PEACE electron spectrometer
- STAFF/DWP search coil magnetometer / wave-particle experiment
- Auxiliary and support data

NEW FEATURE

3x faster to make
inventory queries

Results + new features



NEW FEATURES

- Experiments in tabs
- New ordering and grouping of datasets

Cluster Science Archive
CSA 2.4.1

Data Request #1 x Data Request #2 x

Time (begin/end)
2001-02-01T00:00:00Z - 2017-01-01T00:00:00Z

Duration
0 Days 0 Hours 0 Minutes

☐ Short List CEF All

CLUSTER

ASP CIS DWP EDI EFW FGM PEA RAP STA WBD WHI AUX CAL

CIS ION SPECTROMETER

SCIENCE

MOMENTS

PITCH ANGLE

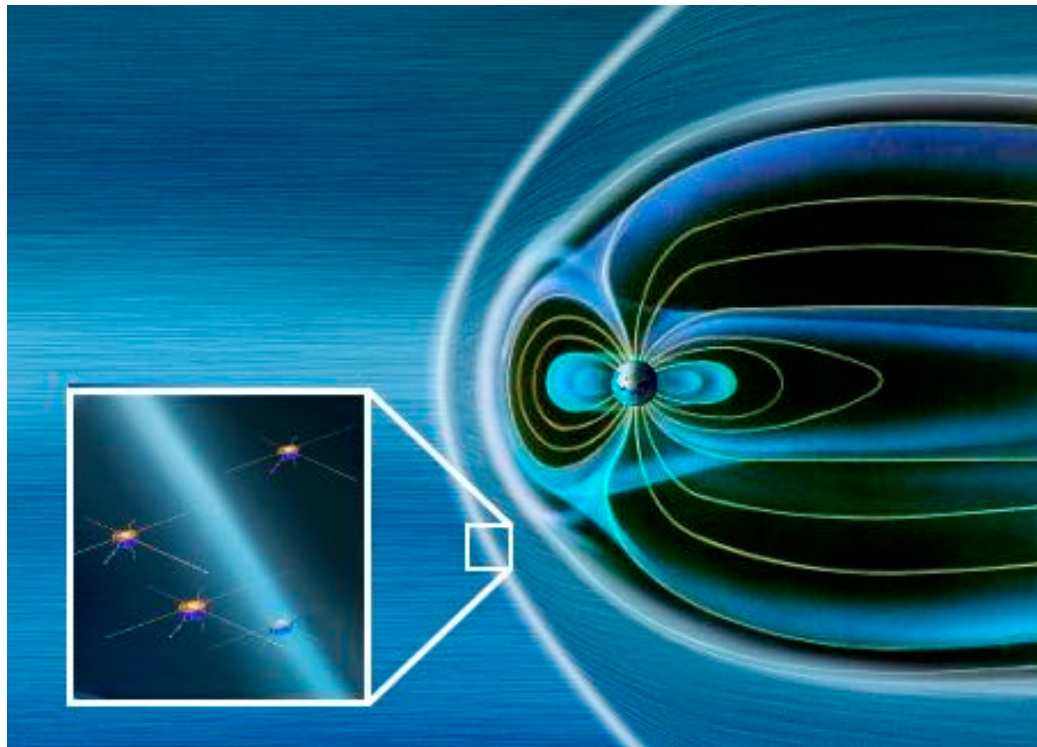
PARTICLE DISTRIBUTION

ANCILLARY

GRAPHICAL

1. Cluster science archive

Science case on shock physics



83 quicklook plots (orbit long, 6h, PI plots)



EUROPEAN SPACE AGENCY SCIENCE & TECHNOLOGY AMASSON

Cluster Science Archive

CSA 2.4.1

DATA SEARCH

2005-01-09T18:00:00Z

Transversal type: ☒ Plot ☐ Time

Plots: 1

Size: 1.0

Cluster DoubleStar

AUX & ECLAT **CIS** **Cross Calibration** **DWP** **EDI** **EFW** **RAPID** **STAFF** **WBD** **WHISPER**

C1	C2	C3	C4	All	Interval	Product Name
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	6 hour	6-hr CAA Summary Plot (Overview)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	6 hour	6-hr CAA Summary Plot (Fields)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	6 hour	6-hr CAA Summary Plot (Particles1)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	6 hour	6-hr CAA Summary Plot (Particles2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1 orbit	Orbit CAA Summary Plot (Overview)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1 orbit	Orbit CAA Summary Plot (Fields)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1 orbit	Orbit CAA Summary Plot (Particles1)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1 orbit	Orbit CAA Summary Plot (Particles2)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1 orbit	Orbit Summary Plot (Overview)
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	1 orbit	Orbit Summary Plot (Fields)

QUICKLOOK DATASET DETAILS

2005-01-09T18:00:00Z / 2005-01-09T00:00:00Z

Pre-generated plots (1h, 6h, 1day)



Cluster Science Archive

CSA 2.4.1



KEY GRAPHICAL PRODUCTS

Time granularity ☐ 1 day ☐ 6 hours ☒ 1 hour ☐ On demand

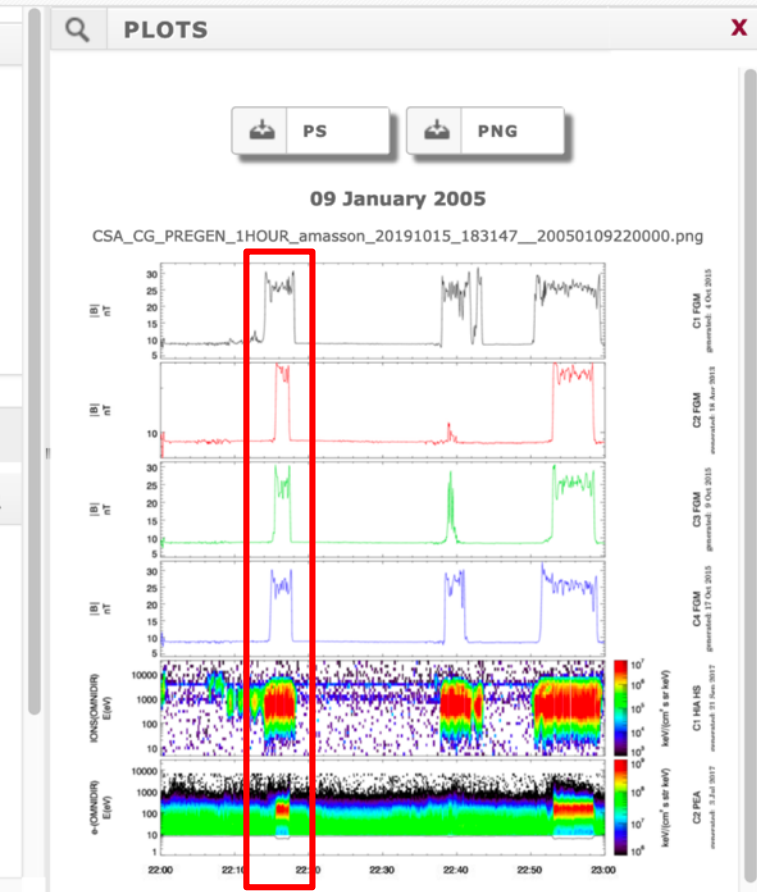
Time (begin/end) 2005-01-09T22:00:00Z - 2005-01-09T23:00:00Z

Duration 0 Days 1 Hours 0 Minutes

Clear Plot

Cluster DoubleStar

ASPOC	AUX	CIS	DWP	EDI	EFW	FGM	PEACE	RAPID	STAFF	WBD	WHISPER
C1	C2	C3	C4	All	Product Name						
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		MAGNETIC FIELD - X COMPONENT IN GSE						
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		MAGNETIC FIELD - Y COMPONENT IN GSE						
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		MAGNETIC FIELD - Z COMPONENT IN GSE						
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>		MAGNETIC FIELD - TOTAL FIELD						
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		MAGNETIC FIELD - AZIMUTHAL COMPONENT IN GSE						
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		MAGNETIC FIELD - POLAR COMPONENT IN GSE						
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		CAVEATS -- On Demand only						



On-demand plotting



Cluster Science Archive

CSA 2.4.1



KEY GRAPHICAL PRODUCTS

Time granularity ☐ 1 day ☐ 6 hours ☐ 1 hour ☒ On demand

Time (begin/end)

2005-01-09T22:13:00Z



- 2005-01-09T22:17:00Z



Duration

0

0

4

Days

Hours

Minutes



Clear



Plot



Cluster DoubleStar

ASPOC AUX CIS DWP EDI EFW FGM PEACE RAPID STAFF WBD WHISPER

C1	C2	C3	C4	All	Product Name
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	MAGNETIC FIELD - X COMPONENT IN GSE
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	MAGNETIC FIELD - Y COMPONENT IN GSE
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	MAGNETIC FIELD - Z COMPONENT IN GSE
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	MAGNETIC FIELD - TOTAL FIELD
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	MAGNETIC FIELD - AZIMUTHAL COMPONENT IN GSE
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	MAGNETIC FIELD - POLAR COMPONENT IN GSE
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	CAVEATS -- On Demand only
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	DATA GAPS -- On Demand only
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	VALIDATION GAPS -- On Demand only

Q PLOTS



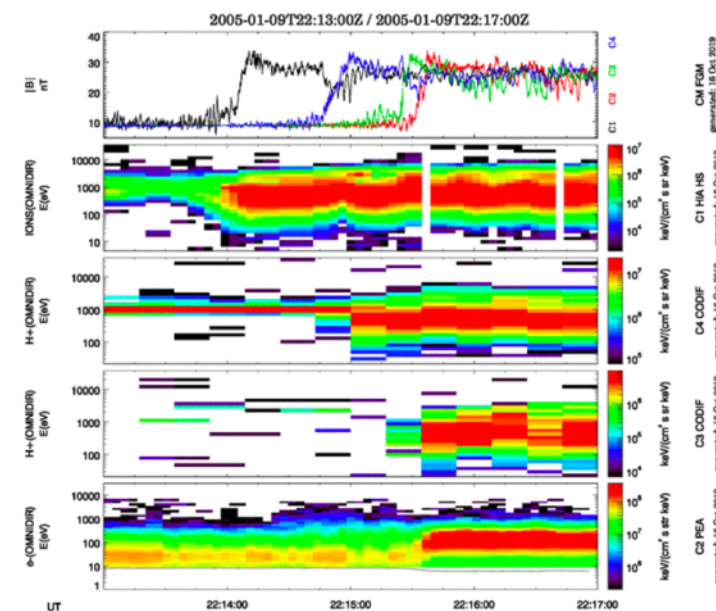
PS



CEF



CL.CG.ONDMD_20050109221300_20050109221700_V20191016003015_00.gif



1. Cluster science archive

Science case on shock physics



PHYSICAL REVIEW LETTERS

Images

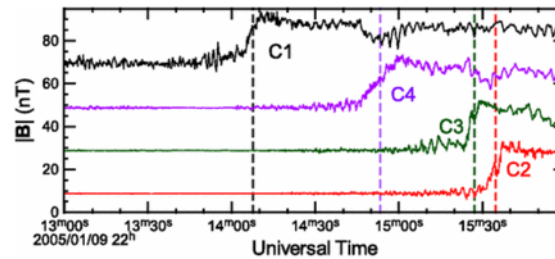
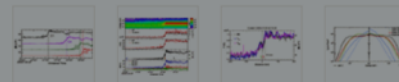


Figure 1

Magnetic field data at a crossing of the Earth's bow shock by the 4 Cluster spacecraft on 9 Jan. 2005. Traces have been shifted by 20 nT for clarity. The dashed lines show the times of the steep ramp.

Reuse & Permissions

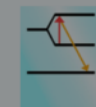
strongly influencing the efficiency of shocks as cosmic ray accelerators.



Received 29 June 2011

DOI: <https://doi.org/10.1103/PhysRevLett.107.215002>

PHYSICAL
REVIEW
JOURNALS 125
YEARS



1947: Lamb shift
is discovered

1. Cluster science archive

Science case on shock physics



PHYSICAL REVIEW LETTERS

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Electron Temperature Gradient Scale at Collisionless Shocks

Steven J. Schwartz, Edmund Henley, Jeremy Mitchell, and Vladimir Krasnoselskikh
Phys. Rev. Lett. **107**, 215002 – Published 14 November 2011

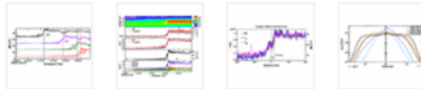
More

Article References Citing Articles (32) PDF HTML Export Citation

>

ABSTRACT

Shock waves are ubiquitous in space and astrophysics. They transform directed flow energy into thermal energy and accelerate energetic particles. The energy repartition is a multiscale process related to the spatial and temporal structure of the electromagnetic fields within the shock layer. While large scale features of ion heating are known, the electron heating and smaller scale fields remain poorly understood. We determine for the first time the scale of the electron temperature gradient via electron distributions measured *in situ* by the Cluster spacecraft. Half of the electron heating coincides with a narrow layer several electron inertial lengths (c/ω_{pe}) thick. Consequently, the nonlinear steepening is limited by wave dispersion. The dc electric field must also vary over these small scales, strongly influencing the efficiency of shocks as cosmic ray accelerators.




Received 29 June 2011

Issue

Vol. 107, Iss. 21 — 18 November 2011

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PHYSICAL REVIEW JOURNALS 125 YEARS

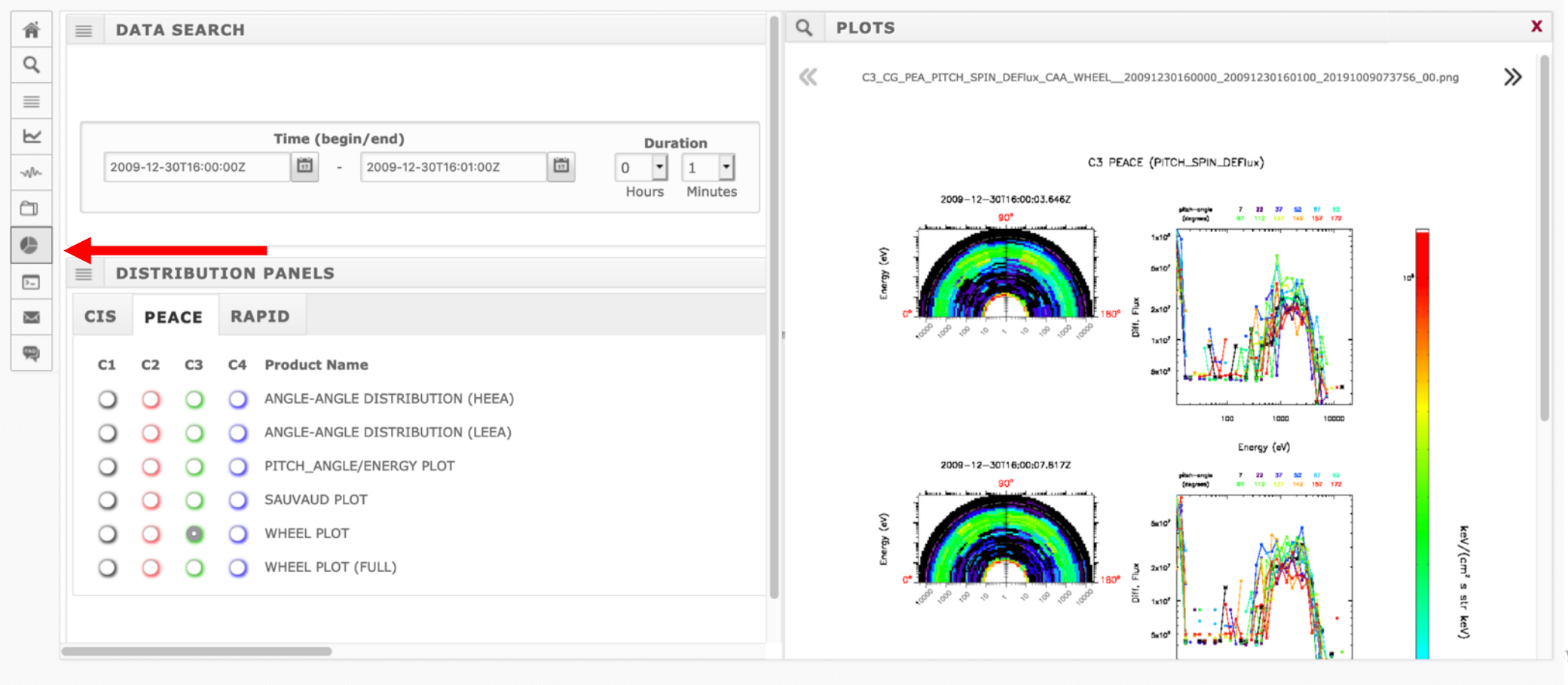
 1947: Lamb shift is discovered

2. Distribution functions



Cluster Science Archive

CSA 2.4.1



3. Different data formats



Cluster Science Archive
CSA 2.4.1

Data Request #1 x

Time (begin/end)
2017-10-05T00:00:00Z - 2018-10-06T00:00:00Z

Duration
0 Days 0 Hours 0 Minutes

☐ Short List CEF All

CLUSTER

FGM **PEA** **W**

FGM FLUXG

SCIENCE

ANCILLARY

4. Rest API: <https://csa.esac.esa.int/csa/aio/>

Cluster Science Archive

CSA 2.4.1



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LATEST NEWS

Next release csa-2.5

- Option to download CDF ISTP compliant files

2019-09-15 23:30:00 CSA Team

 **SEARCH**

 **GRAPHS**

 **QUICKLOOKS**

 **INVENTORY**

 **DISTRIBUTION
FUNCTIONS**

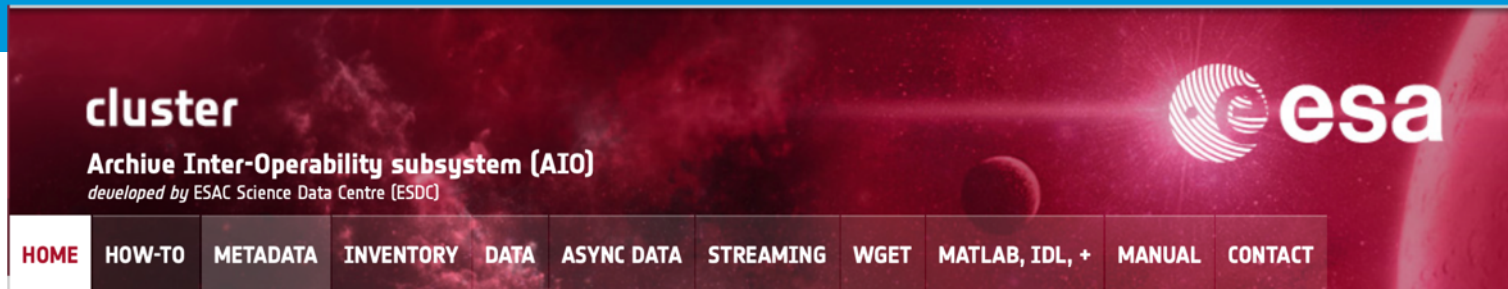
 **DOCUMENTATION**

 **COMMAND LINE**

 **CONTACT**



4. Rest API: <https://csa.esac.esa.int/csa/aio/>



cluster

Archive Inter-Operability subsystem (AIO)
developed by ESAC Science Data Centre (ESDC)

HOME HOW-TO METADATA INVENTORY DATA ASYNC DATA STREAMING WGET MATLAB, IDL, + MANUAL CONTACT

Cluster Resources

- Cluster Science Archive
- Mission Home
- Mission Overview
- Space Science - Cluster
- Multimedia Gallery
- For Kids

Other Solar-based Archives

- Ulysses Final Archive
- Soho Science Archive

CLUSTER ARCHIVE INTER-OPERABILITY SUBSYSTEM (CAIO)

The CAIO (Cluster Science Archive Inter-Operability Subsystem) is an alternative way to access the Cluster Science Archive (CSA) content through HTTPS requests. This subsystem shares the core system of the standard [CSA graphical user interface](#) java application, but it is called using scripts, application code, command line tools or just a browser.

Data retrieval can be handled in three different ways depending on what is wanted:

- A [Synchronous Data request](#) allows the user to download data from the archive that fulfill certain search criteria, up to a total (compressed) limit of 1GB. The files are assembled on our server, and then downloaded as soon as it's ready.
- An [Asynchronous Data Request](#) allows the user to download more data up to a total (compressed) limit of 50GB. The files are assembled on our server and an email will be sent to the user when the package is ready for download.
- A [Streaming Data Request](#) allows the user to download just one CEF file but start receiving it immediately. This might be useful for visualisation packages.

Metadata requests can be used for information about data:

- Dataset and File Search allows the user to discover datasets and files that fulfill certain search criteria.

ESA LATEST NEWS

4. Rest API: <https://csa.esac.esa.int/csa/aio/>

IDL

Below you can find two IDL routines developed by Andrew Walsh, that use the CAIO to download data directly from IDL. They work with Linux, Mac and Windows enabling login ([csa_login.pro](#)) and product actions ([csa_product.pro](#)). The error handling will be improved in the near future, together with the actions for unpacking the downloaded tar files.

Important note: If you have IDL with an older version than 8.4, these programs may not work and display an error message as follows:

```
% Loaded DLM: URL.
% IDLNETURL::GET: CCurlException: Error: Http Get Request Failed. Error = SSL certificate problem:
self signed certificate in certificate chain, Curl Error Code = 60..
% Execution halted at: CSA_LOGIN
```

To quickly solve this issue:

- in the login script ([csa_login.pro](#)), please add `csa_login_obj->SetProperty, ssl_verify_peer = 0`
- in the product script ([csa_product.pro](#)), please add `csa_product_obj->SetProperty, ssl_verify_peer = 0`

Alternatively, please have a look here [here](#).

```
function csa_login,user,pass

;Function that logs in to the CSA AIO system.
;Parameters:
;   USER: String containing your RSSD LDAP user identifier
;   PASS: String containing your RSSD LDAP password
;
;Return Value:
;   If login is successful, returns a string containing a JSESSIONID cookie
;   If login is unsuccessful, returns 0
;
;Example:
```

PYTHON

This section of code, in Python 3, will allow you to do the same as the previous scripts: download a selection of data and uncompress the package.

```
from requests import get # to make GET request
import tarfile

def download(url, params, file_name):
    # open in binary mode
    with open(file_name, "wb") as file:
        # get request
        response = get(url, params=params)
        # write to file
        file.write(response.content)

myurl = 'https://csa.esac.esa.int/csa/aio/product-action'
query_specs = {'DATASET_ID': 'C1_CP_FGM_SPIN',
               'START_DATE': '2003-03-03T12:00:00Z',
               'END_DATE': '2003-03-04T12:00:00Z',
               'DELIVERY_FORMAT': 'CEF',
               'NON_BROWSER': '1',
               'DELIVERY_INTERVAL': 'hourly',
               'CSACOOKIE': ''}

download(myurl, query_specs, '20160616test.tar.gz')

with tarfile.open("20160616test.tar.gz") as tar:
    tarname = tar.getnames()
    tar.extractall()
```


5. Rest API: <https://csa.esac.esa.int/csa/aio/>

cluster

Archive Inter-Operability subsystem (AIO)
developed by ESAC Science Data Centre (ESDC)

HOME HOW-TO METADATA INVENTORY DATA ASYNC DATA **STREAMING** WGET MATLAB, IDL, + MANUAL

Cluster Resources

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- Multimedia Gallery
- For Kids

Other Solar-based Archives

- Ulysses Final Archive
- Soho Science Archive

STREAMING DATA REQUESTS

Data streaming allows a faster delivery of the data. It enables immediate streaming of one dataset to (instead of a file package being created on the CSA server and then sent). However, the following con

- Only CEF products can be downloaded using these requests
- Only one dataset can be requested
- Only one file is delivered for the time period requested, i.e. delivery interval option is not available
- Header only cannot be requested
- If the internet connection is broken before file download has completed, the request must be made whole file

PRODUCT REQUESTS

Table 8: Streami

PARAMETER NAME(S)	DESCRIPTION	MANDATORY
DATASET_ID	Unique identifier of the dataset whose data we want to retrieve. Please note that wild cards ("*") are NOT allowed	YES



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irfu / irfu-matlab

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Matlab routines to work with space data, particularly with MMS and Cluster/CAA data. Also some general plasma routines.

8,115 commits

13 branches

63 releases

21 contributors

Branch: master

New pull request

Find file

Clone or download

thomas-nilsson-irfu New irfu-matlab v1.15.0

Latest commit f98b8a6 9 days ago

+local	Some more minor checkcode() corrections..	2 years ago
+lp	Some more minor checkcode() corrections..	2 years ago
+maarble	Some more minor checkcode() corrections..	2 years ago
+model	Some more moves to HTTPS	2 years ago