CDPP/AMDA Tool for Cassini & JUICE

Baptiste Cecconi (LESIA, Meudon), Nicolas André (IRAP, Toulouse)
& CDPP Science & Technical Teams

CDPP http://cdpp.cesr.fr/

- The french Space Plasma Datacenter

(director: Vincent Génot)

- Funded by CNES and CNRS
- Hosted at IRAP, Toulouse
- Data archives
- Added Value Services

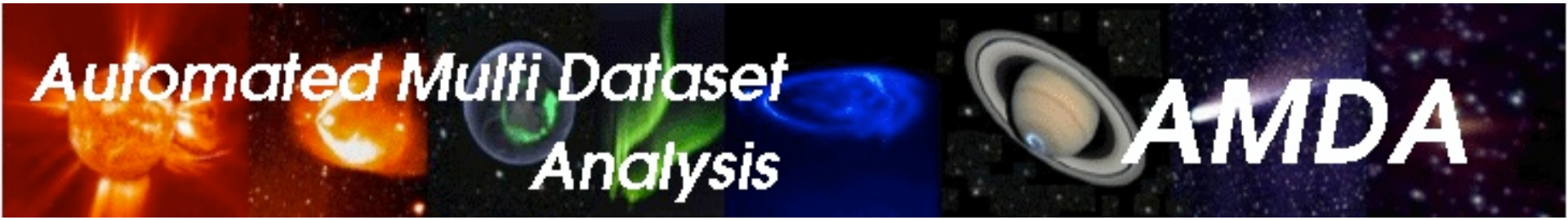
Rationale

- The growing amount and wealth of data available make it difficult for scientists to exploit data coming from many sources that can initially be **heterogeneous in their organization, description and format**.

- One of our objective is to provide **easy-to-use access to planetary plasma resources** from various **data archives**.

- One of our objective is to provide **Virtual Observatory tools** for the access of data, **combining as divergent data sources as feasible**.

AMDA Tool and Functionalities



http://cdpp-amda.cesr.fr/

Visualisation editor

Download data

Parameter editor

External data

Conditional search

Visual search

Time-Table manager

Web-based service Publicly available

Produces / exploits time-tables, catalogues

Transparent (automated) access to data

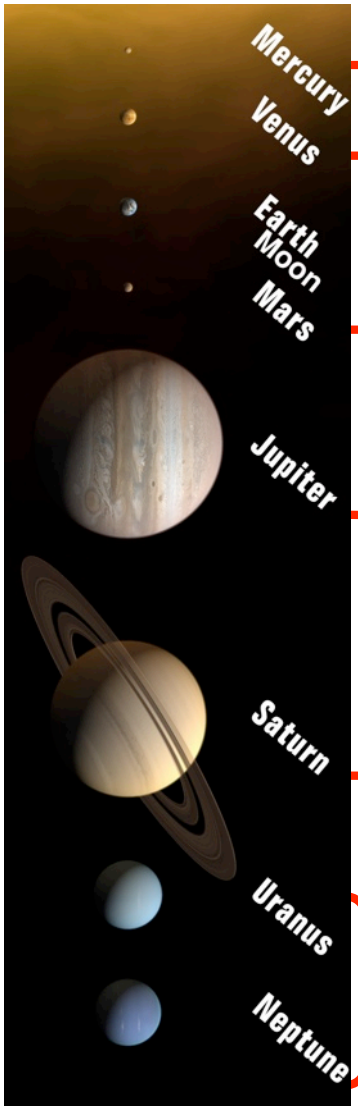
the user plays with parameters, not with files

Upload data

Catalogue Manager

Interoperability

New Planetary Plasma Datasets in AMDA



MESSENGER : Orbit, MAG, FIPS, EPPS + Mariner

VEX : Ephem, MAG, ELS, IMA + PVO

MGS : Orbit, Ephem, MAG, ER, Proxy

MEX : Orbit, Ephem, IMA, ELS, MARSIS

Galileo : Orbit, Ephem, MAG, PLS, PWS, EPD

Pioneer 10 & 11 : Orbit, MAG

Ulysses : Orbit, MAG, SWOOPS, URAP (QTN)

Voyager 1 & 2 : Orbit, MAG, PLS, PWS (fuh), PRA (LB+HB), LECP

Cassini : Orbit, Ephem, MAG, SKR longitude system, CAPS + MAPSKP (RPWS, CAPS, MIMI, MAG)

plasma moments from RPWS: LP + QTN + Sounder

Voyager 1 & 2 : Orbit, MAG

Remote access

Available, Coming soon, Future

Service(s) provided to the giant planet community

- Exploitation of Cassini Magnetosphere and Plasma Science
  - Large datasets available (2004-2017)
    - Need for statistical analysis
    - Need for conditional search (case studies)
    - Need for multi-instrument studies
  - Need for pluridisciplinary studies
    - E.g., Satellite science

- Preparation of Juno
  - Need for pluridisciplinary studies
    - E.g., Auroral science (magnetosphere/ionosphere coupling)

- Preparation of JUICE
  - Need for re-analysis of previous datasets
    - Mission preparation
    - Instrument preparation (CEPAGE consortium led by IRAP)

Cassini/Huygens datasets available in AMDA

Welcome to AMDA

cdpp-amda.cesr.fr/DDHTML/HTML/loginreq.php

foot entreprise 2013

CM-CIC cdpp-amda.cesr.fr

- AMDA
  - Cassini_Public
    - ephemeris
      - orbit_cassini@Iowa
      - ksm_cassini@Iowa
      - equatorial_cassini_Jupiter@Iowa
      - orbit_titan@Iowa
      - orbit_enceladus@Iowa
      - orbit_dione@Iowa
      - orbit_mimas@Iowa
      - orbit_rhea@Iowa
      - orbit_tethys@Iowa
    - RPWS
      - skr@LESIA
      - SLS4_Longitude_North@Iowa
      - SLS4_Longitude_South@Iowa
      - SKR_Phase_North_And_South@LESIA
    - MAG
    - CAPS
      - els@PDS
      - sng@PDS
      - actuator@PDS
  - Cassini_Private
    - LP
      - Ne_PROXY
      - Titan
  - Cassini_CAPS
  - Galileo
  - mSWiM_Saturn

Amda Data Info

Amda Data Info

cdpp-amda.cesr.fr/DDHTML/HELP/CassiniMag.html

Google

CM-CIC cdpp-amda.cesr.fr

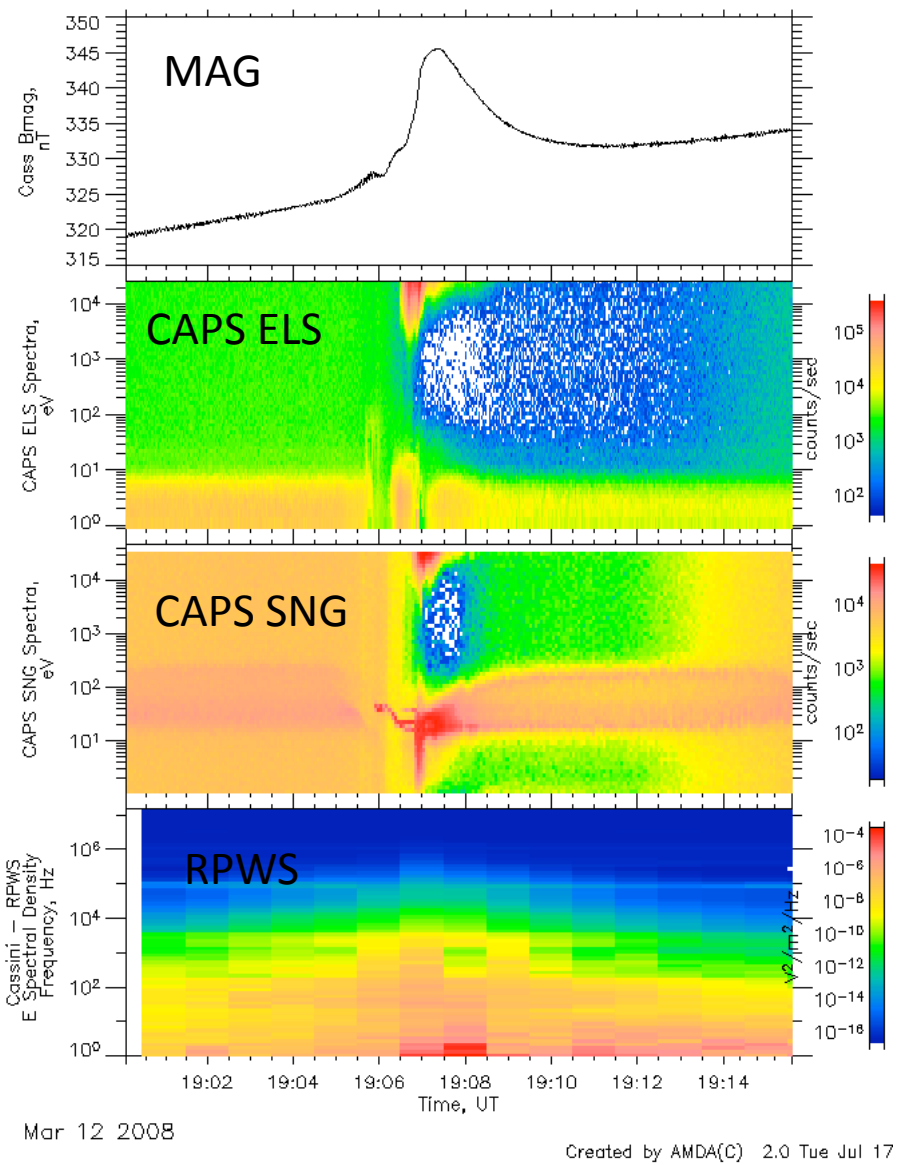
Cassini Magnetometer data at AMDA

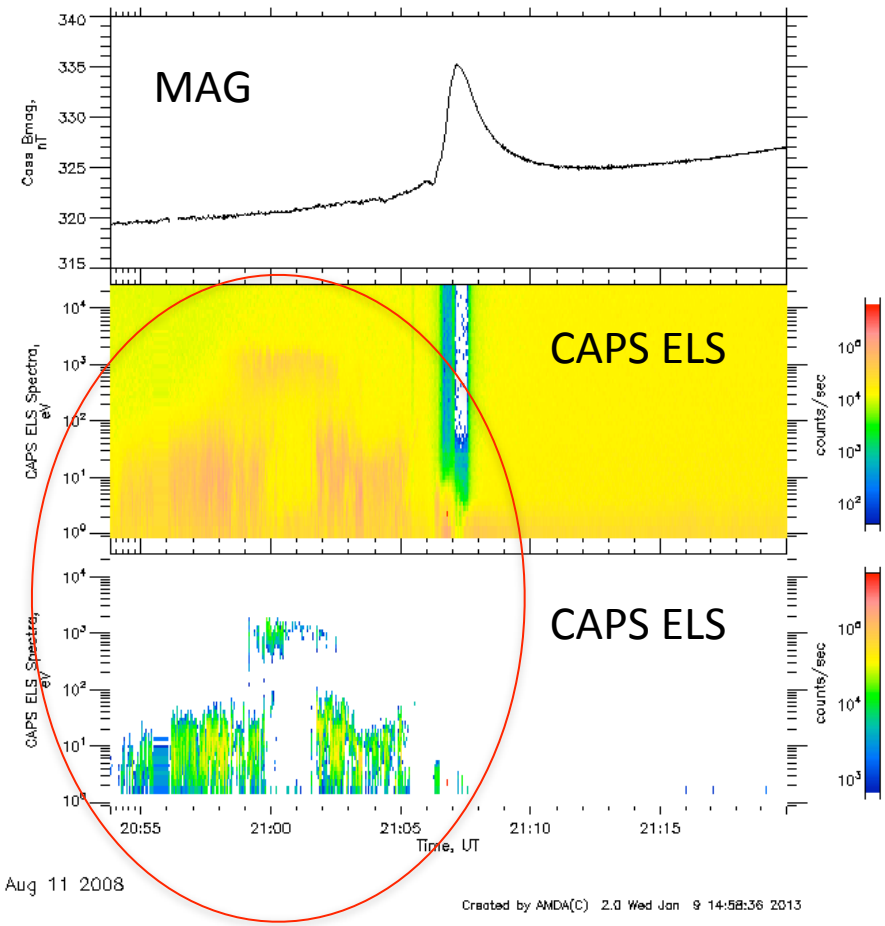
- Cassini Magnetometer data are taken from the PDS (Planetary Data System), site.
- Available coordinates :
  - **RTN** : R (radial component, Sun to the spacecraft), T (tangential component, parallel to the Solar Equatorial plane and perpendicular to R), and N (normal component, completes right handed set)
  - **KSM** : X (Saturn to Sun), Z (X-Z plane contains Saturn's centered magnetic dipole axis, M), and Y (completes right handed set)
  - **KSO** : X (Saturn to Sun), Z (parallel to Saturn's orbital plane upward normal), and Y (completes the right handed set)
  - **KRTP** : R (Saturn to spacecraft), Phi (parallel to Saturn's equator), and Theta (completes right handed set)

Source	Datasets	Status	Last Update
COMAG_4001	RTN_1sec - KSM_1sec - KSO_1sec - KRTP_1sec	Uncertified	2012-01-11
COMAG_4002	RTN_1min - KSM_1min - KSO_1min - KRTP_1min	Uncertified	2012-01-11
COMAG_3001	Jupiter_RTN	Uncertified	2012-01-11

Done

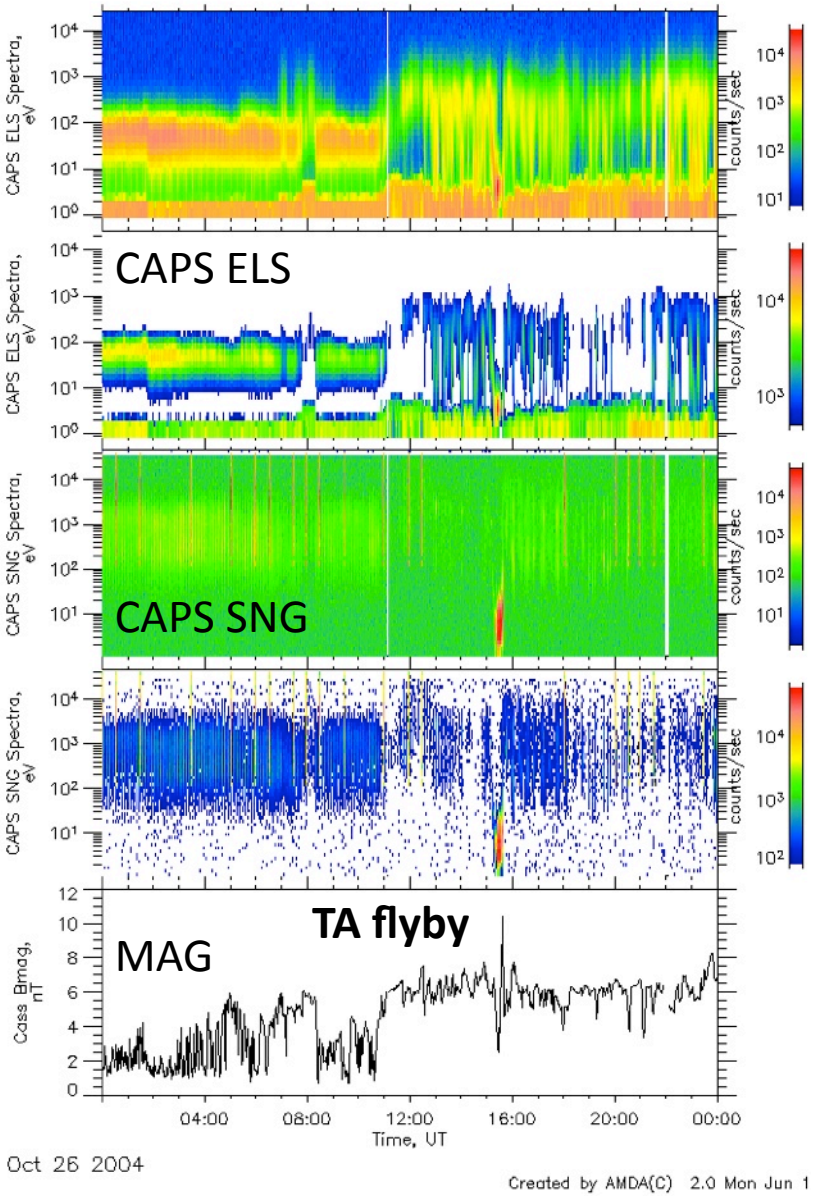
Illustration #1: 2 Enceladus flybys





With background subtraction !

Illustration #2: Titan TA flyby



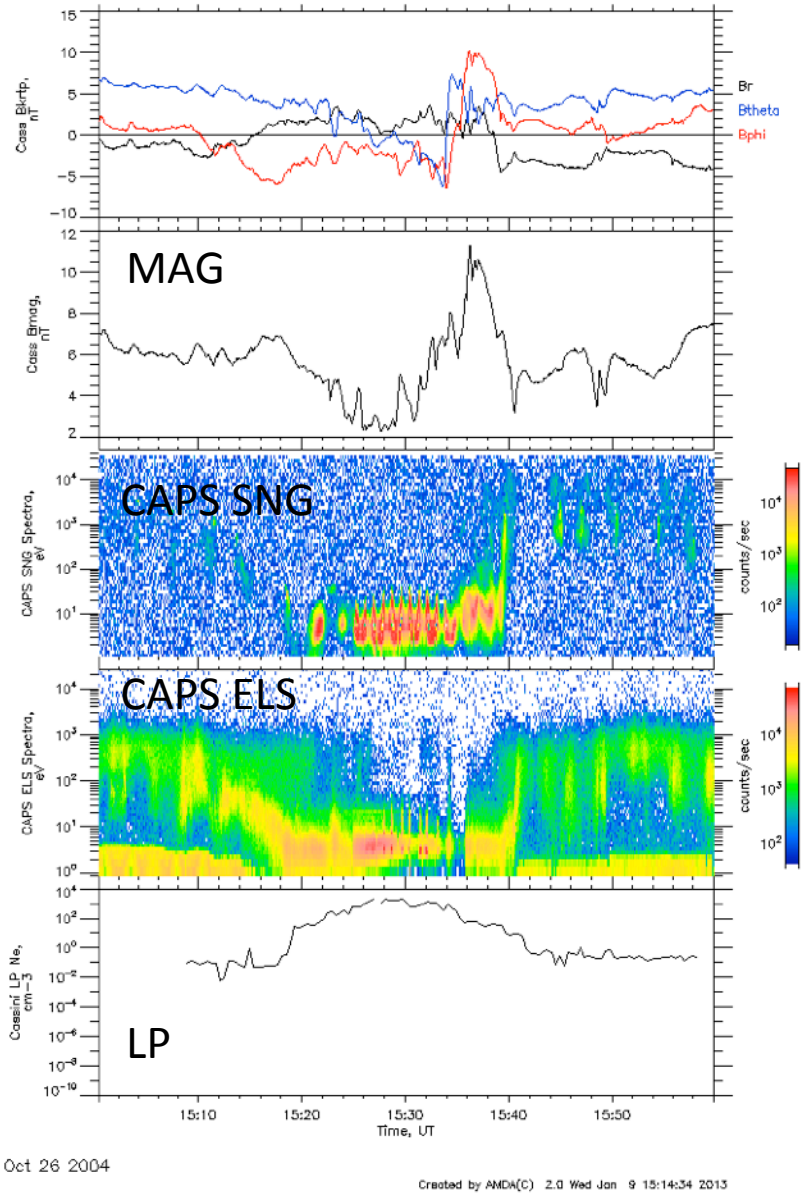
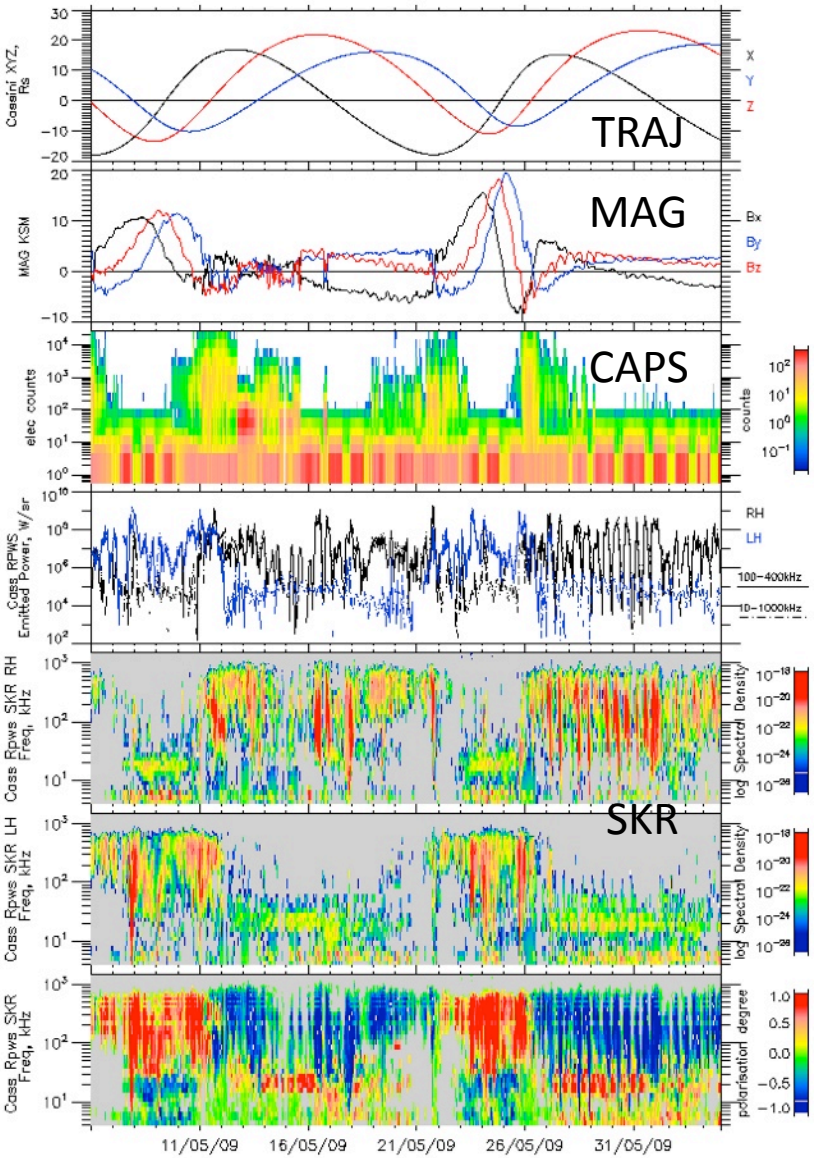


Illustration #3: Magnetosphere (2 Rev.)



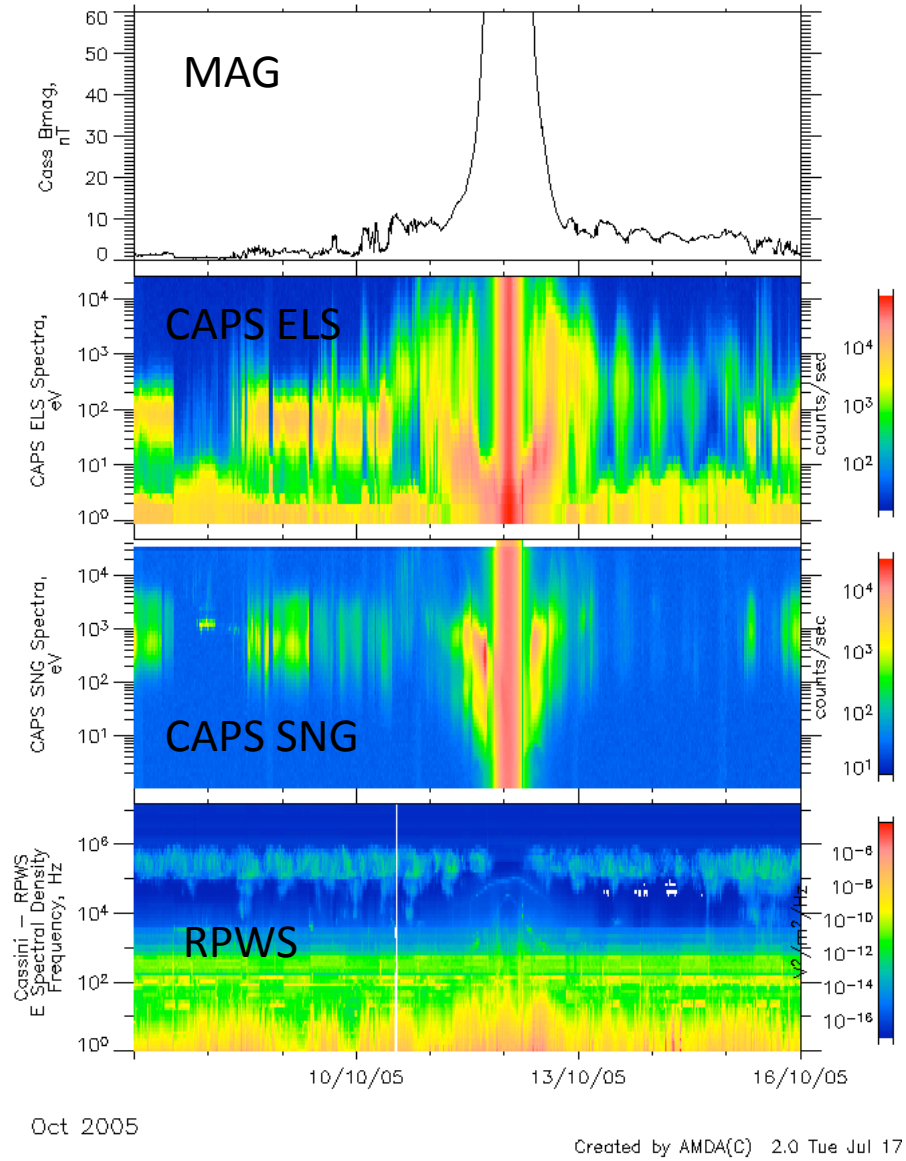
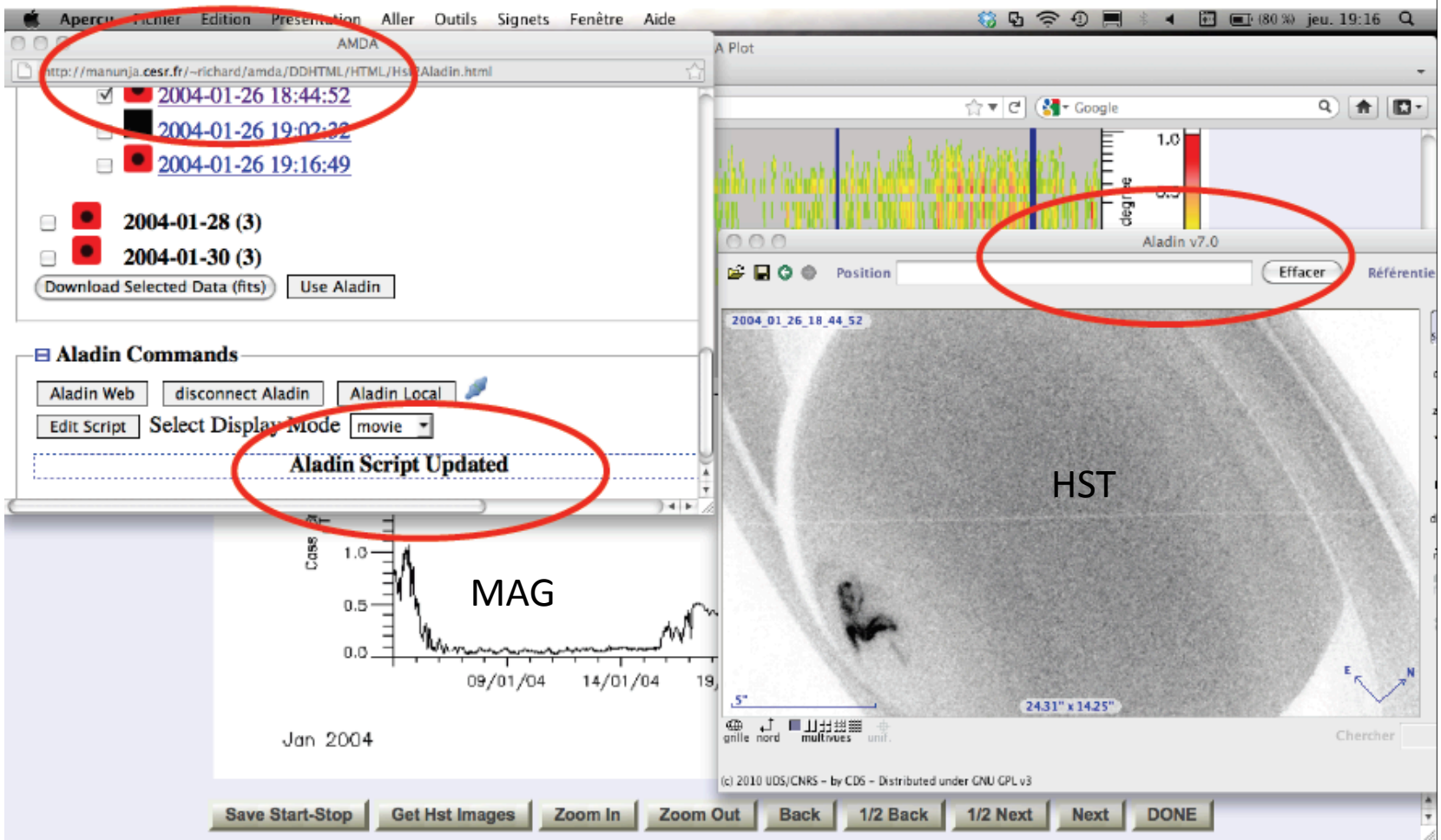
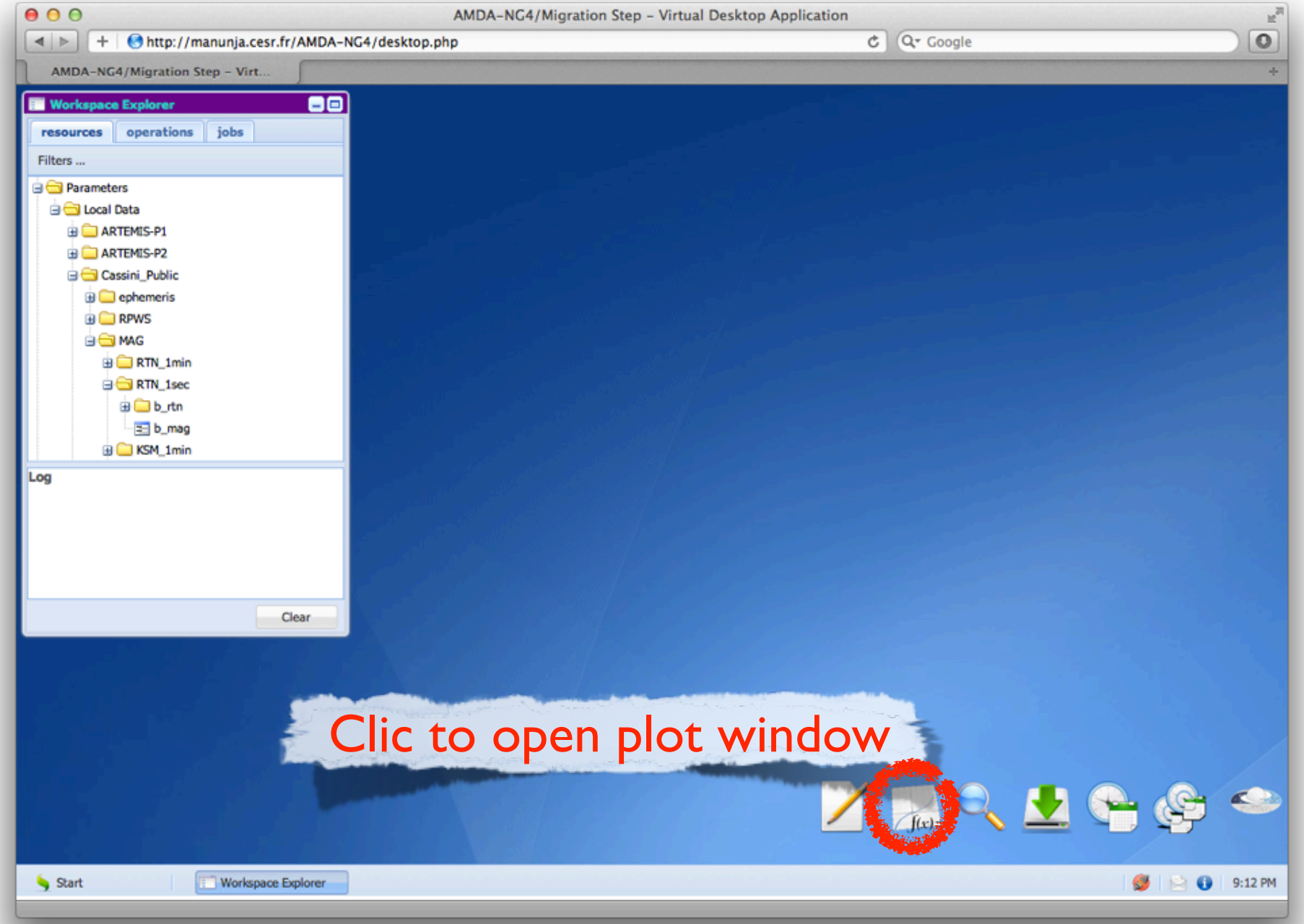
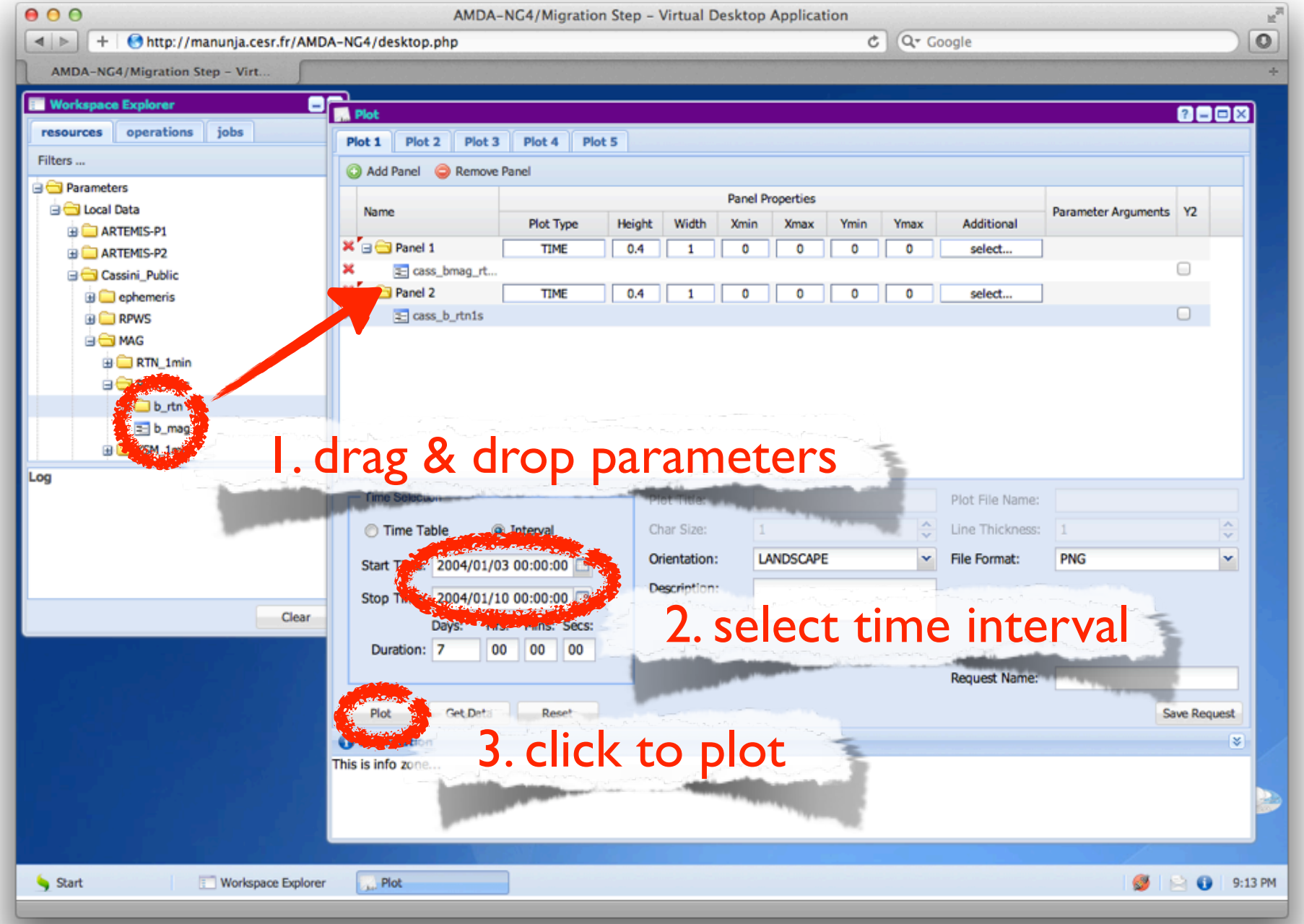


Illustration #4: Auroral campaign

AMDA/Aladin Connection




AMDA-NG4/Migration Step - Virtual Desktop Application
http://manunja.cesr.fr/AMDA-NG4/desktop.php
Google
AMDA-NG4/Migration Step - Virt...
Workspace Explorer
resources
operations
jobs
Filters ...
Parameters
Local Data
ARTEMIS-P1
ARTEMIS-P2
Cassini_Public
ephemeris
RPWS
MAG
RTN_1min
RTN_1sec
b_rtn
b_mag
KSM_1min
Log
Clear
Clic to open plot window
Start
Workspace Explorer
9:12 PM


AMDA-NG4/Migration Step - Virtual Desktop Application
http://manunja.cesr.fr/AMDA-NG4/desktop.php
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Filters ...
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ARTEMIS-P1
ARTEMIS-P2
Cassini_Public
ephemeris
RPWS
MAG
RTN_1min
b_rtn
b_mag
Log
Clear
Plot
Plot 1
Plot 2
Plot 3
Plot 4
Plot 5
Add Panel
Remove Panel
Name
Panel Properties
Plot Type
Height
Width
Xmin
Xmax
Ymin
Ymax
Additional
Parameter Arguments
Y2
Panel 1
TIME
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Panel 2
cass_b_rtn1s
1. drag & drop parameters
Time Table
Interval
Start Time:
2004/01/03 00:00:00
Stop Time:
2004/01/10 00:00:00
Days:
Hrs:
Mins:
Secs:
Duration:
7
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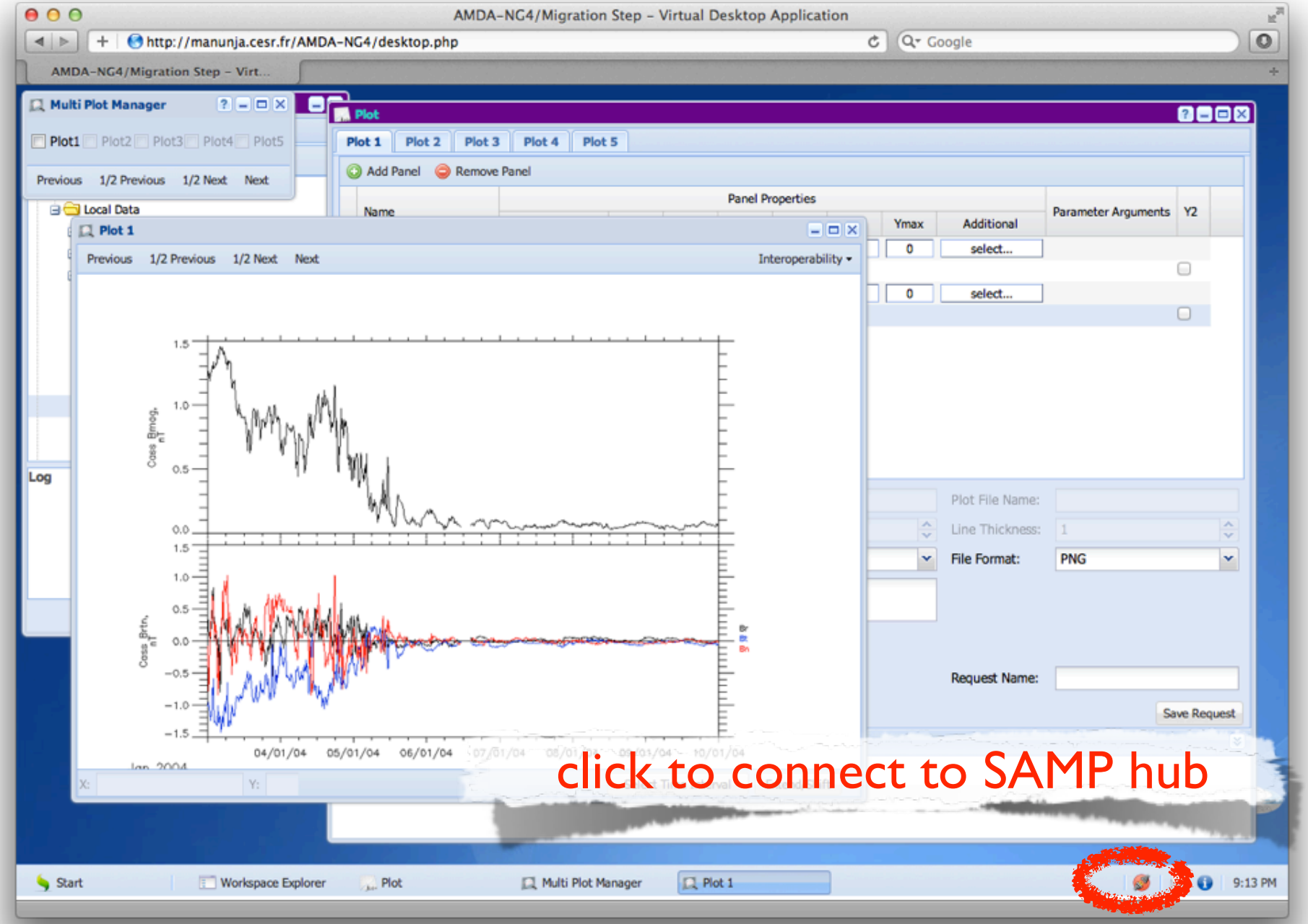
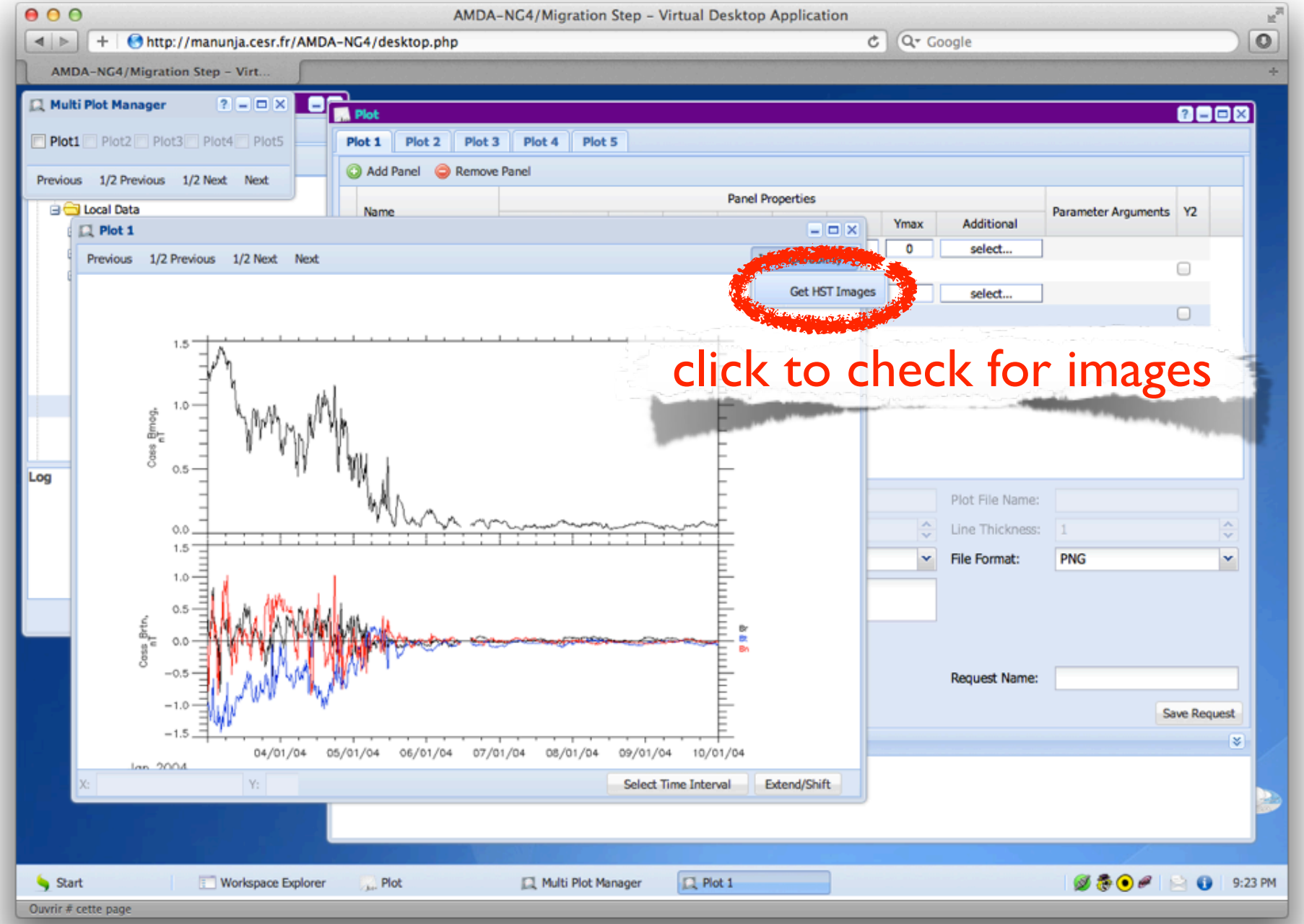
2. select time interval
Plot File Name:
Char Size:
Line Thickness:
Orientation:
LANDSCAPE
File Format:
PNG
Description:
Request Name:
Plot
Get Data
Reset
Save Request
This is info zone...
3. click to plot
Start
Workspace Explorer
Plot
9:13 PM



click to connect to SAMP hub


AMDA-NG4/Migration Step - Virtual Desktop Application
http://manunja.cesr.fr/AMDA-NG4/desktop.php
Google
AMDA-NG4/Migration Step - Virt...
Multi Plot Manager
Plot1 Plot2 Plot3 Plot4 Plot5
Previous 1/2 Previous 1/2 Next Next
Local Data
Log
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Plot 1 Plot 2 Plot 3 Plot 4 Plot 5
Add Panel
Remove Panel
Panel Properties
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Parameter Arguments
Y2
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Get HST Images
click to check for images
Plot File Name:
Line Thickness:
File Format:
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Save Request
Plot 1
Previous 1/2 Previous 1/2 Next Next
Cass_Bmag, nT
Cass_Brtn, nT
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Select Time Interval
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Start
Workspace Explorer
Plot
Multi Plot Manager
Plot 1
9:23 PM
Ouvrir # cette page

AMDA-NG4/Migration Step – Virtual Desktop Application

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Google

AMDA-NG4/Migration Step – Virt...

Multi Plot Manager

Plot1 Plot2 Plot3 Plot4 Plot5

Previous 1/2 Previous 1/2 Next Next

Local Data

Log

Plot

Plot 1 Plot 2 Plot 3 Plot 4 Plot 5

Add Panel Remove Panel

Panel Properties

Name Ymax Additional Parameter Arguments Y2

0 select...

Plot 1

Previous 1/2 Previous 1/2 Next Next

Hst

Time Selection

Start Time: 2004/01/03 00:00:00

Stop Time: 2004/01/10 00:00:00

Days: Hrs: Mins: Secs:

Duration: 0007 00 00 00

Delta T: 0 minute(s)

Extend ... left right both

Shift ... left right

Image Selection

Collapse all Expand all Select all Unselect all

Images

Refresh Load preview Download selection

Interoperability with Aladin

Display Mode: Send to Web Send to SAMP

click to get image list

File Name:

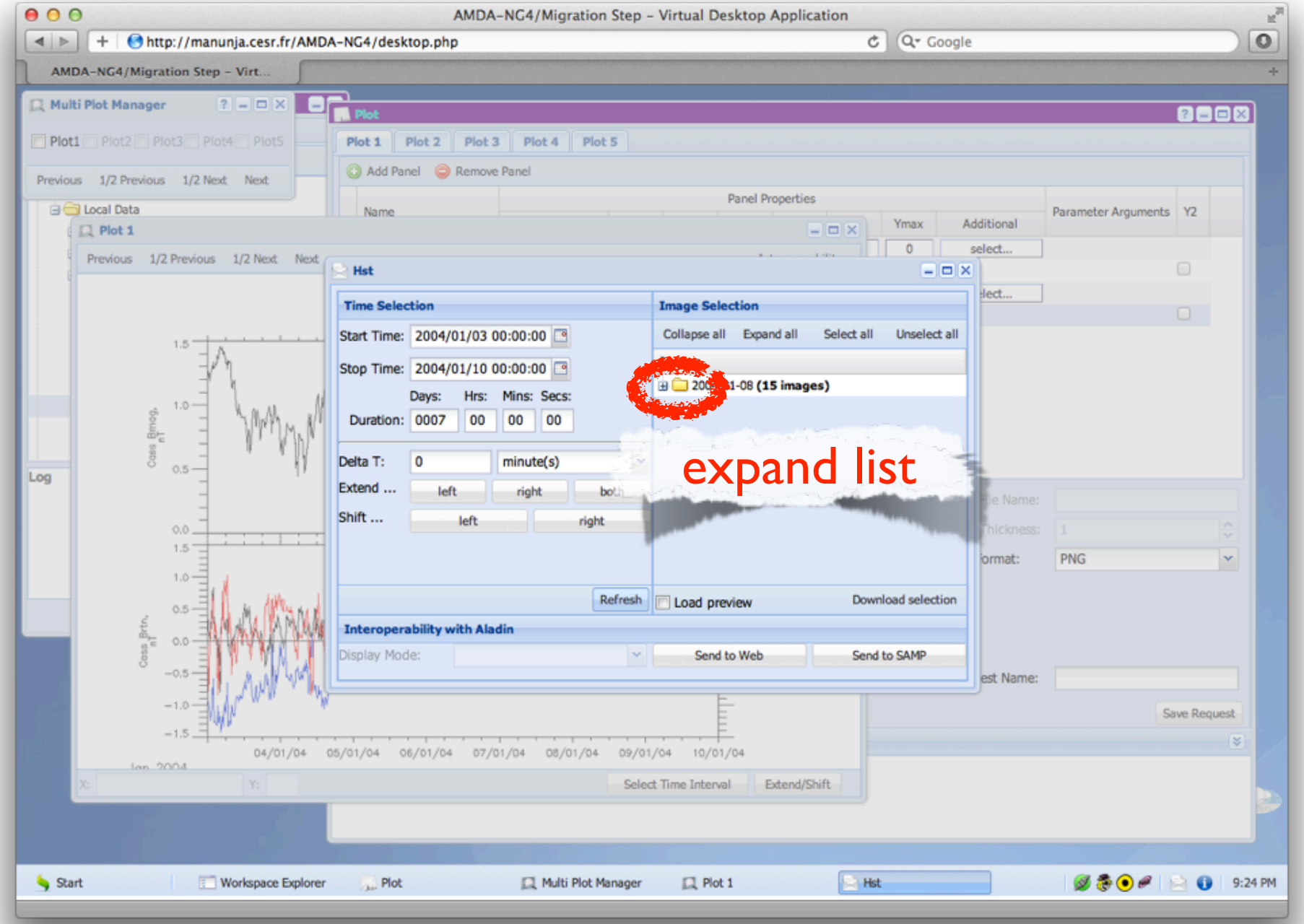
Thickness: 1

Format: PNG

Save Request

Select Time Interval Extend/Shift

Start Workspace Explorer Plot Multi Plot Manager Plot 1 Hst 9:24 PM


AMDA-NG4/Migration Step - Virtual Desktop Application
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Refresh
Image Selection
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(15 images)
expand list
Load preview
Download selection
Interoperability with Aladin
Display Mode:
Send to Web
Send to SAMP
Save Request
Select Time Interval
Extend/Shift
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Workspace Explorer
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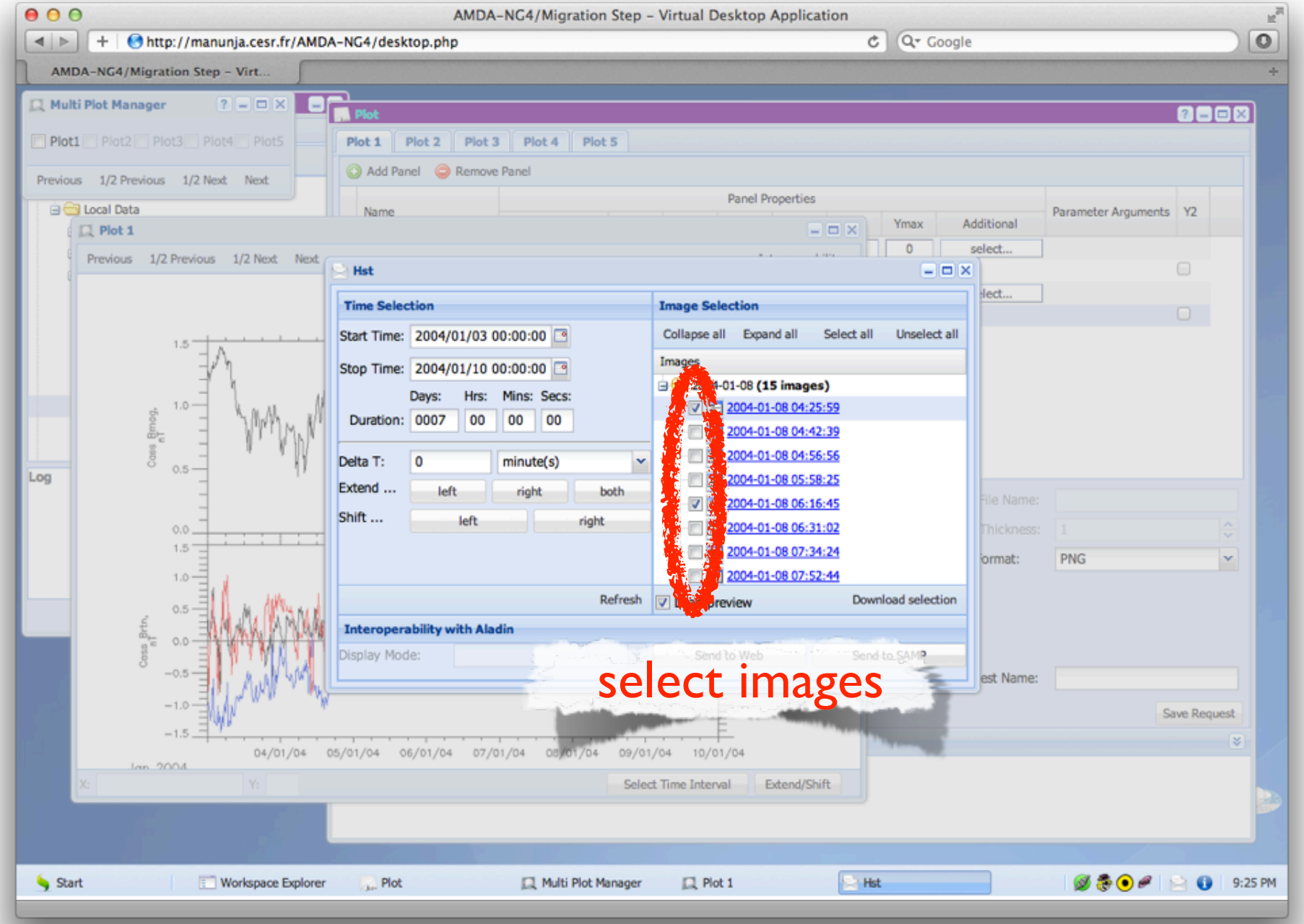
Multi Plot Manager
Plot 1
Hst
9:24 PM


AMDA-NG4/Migration Step - Virtual Desktop Application
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Google
AMDA-NG4/Migration Step - Virt...
Multi Plot Manager
Plot1 Plot2 Plot3 Plot4 Plot5
Previous 1/2 Previous 1/2 Next Next
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Plot 1 Plot 2 Plot 3 Plot 4 Plot 5
Add Panel
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Parameter Arguments
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Plot 1
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Time Selection
Start Time: 2004/01/03 00:00:00
Stop Time: 2004/01/10 00:00:00
Days: Hrs: Mins: Secs:
Duration: 0007 00 00 00
Delta T: 0 minute(s)
Extend ... left right both
Shift ... left right
Refresh
Image Selection
Collapse all Expand all Select all Unselect all
Images
(15 images)
2004-01-08 04:25:59
2004-01-08 04:42:39
2004-01-08 04:56:56
2004-01-08 05:58:25
2004-01-08 06:16:45
2004-01-08 06:31:02
2004-01-08 07:34:24
2004-01-08 07:52:44
Download selection
Interoperability with Aladin
Display Mode:
Send to Web
Send to SAMP
select images
Log
Select Time Interval
Extend/Shift
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PNG
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Workspace Explorer
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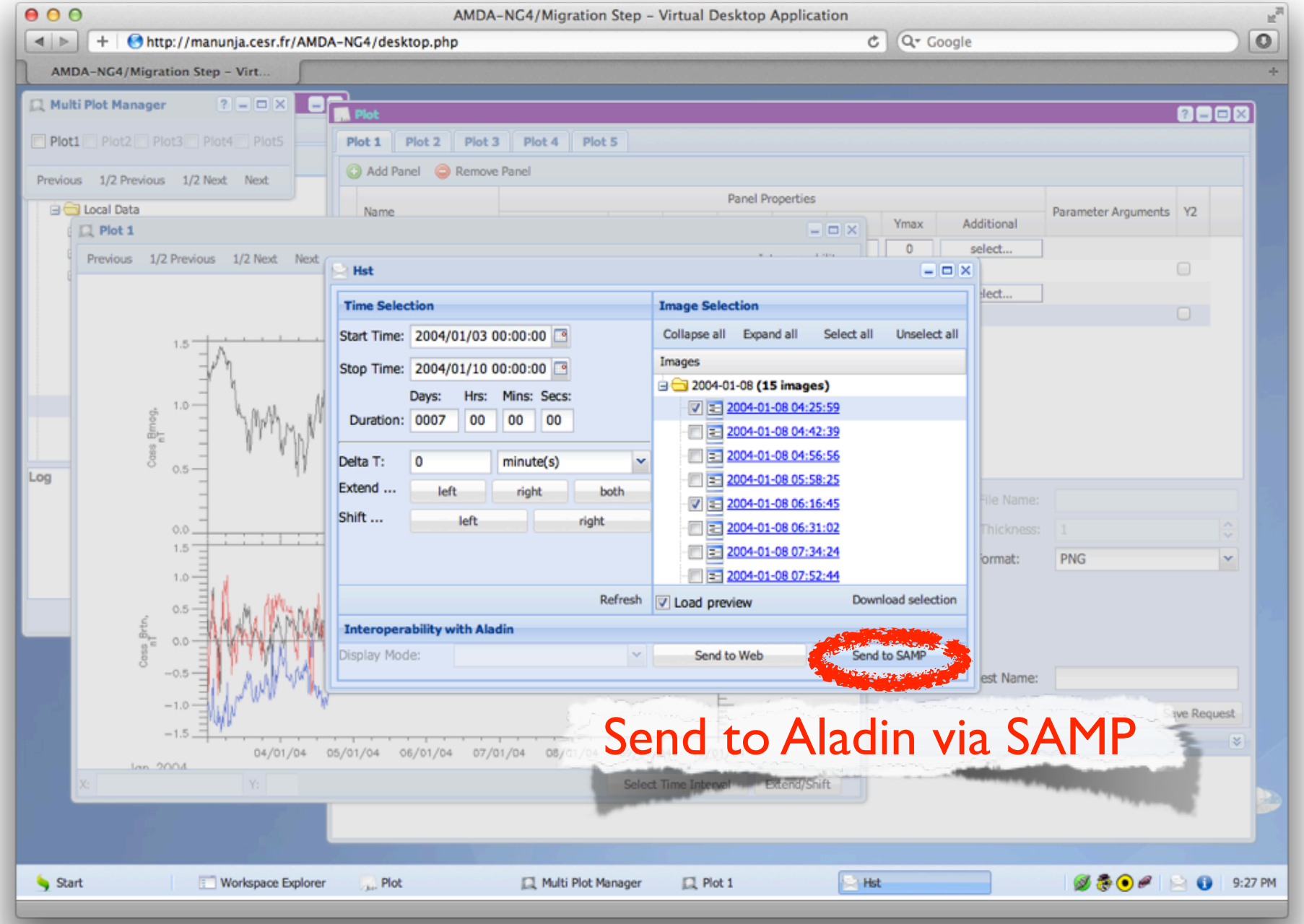
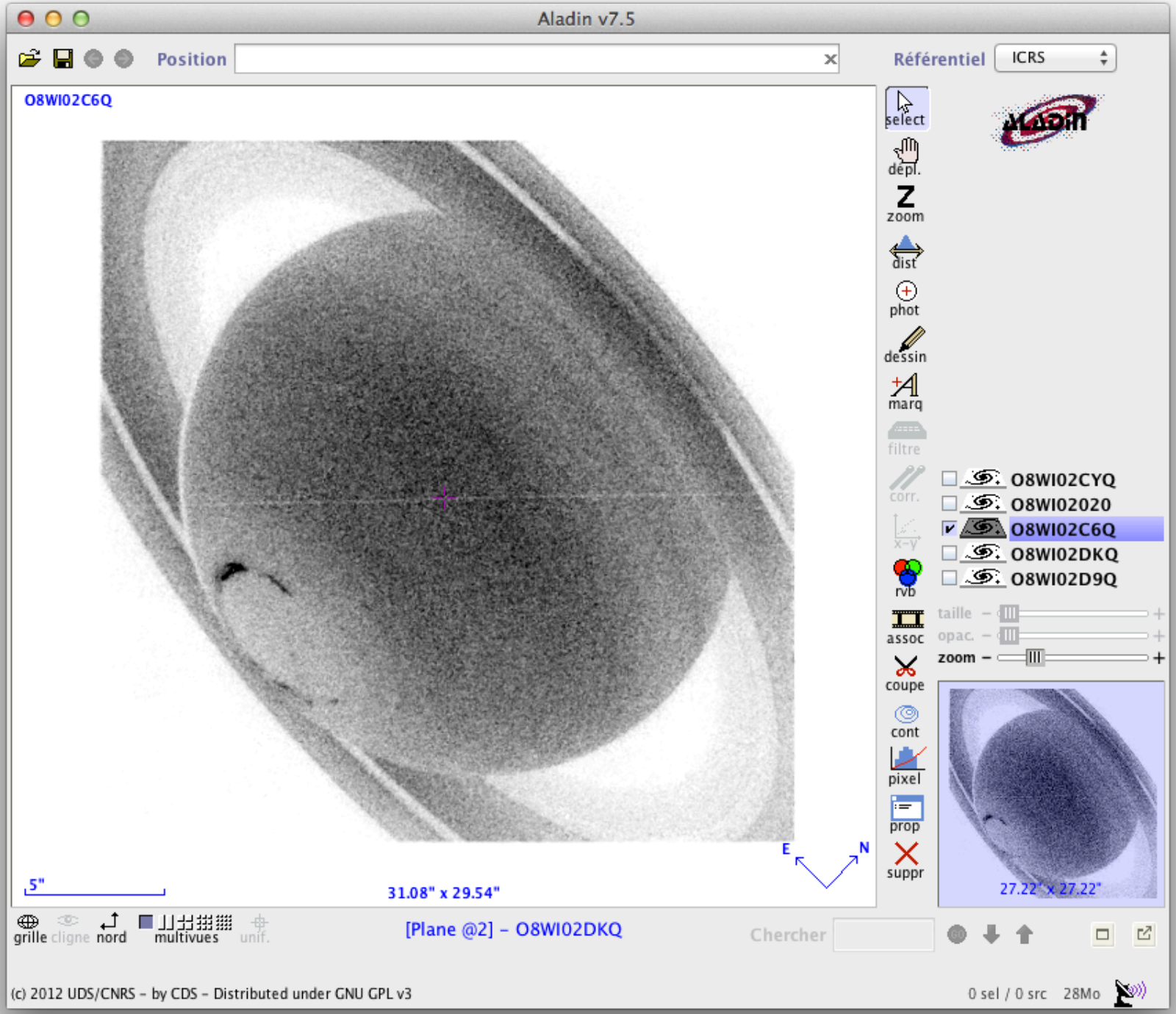
Plot 1
Hst
9:25 PM



Send to Aladin via SAMP


Aladin v7.5
Position
Référentiel
ICRS
O8WI02C6Q
select
dépl.
zoom
dist
phot
dessin
marq
filtre
corr.
x-y
rvb
assoc
coupe
cont
pixel
prop
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O8WI02DKQ
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[Plane @2] - O8WI02DKQ
Chercher
(c) 2012 UDS/CNRS - by CDS - Distributed under GNU GPL v3
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28Mo

Jupiter datasets available in AMDA

Welcome to AMDA | AMDA Plot

cdpp-amda.cesr.fr/DDHTML/HTML/loginreq.php

CM-CIC cdpp-amda.cesr.fr

- Galileo
  - ephemeris
    - Callisto@Iowa
    - Ganymede@Iowa
    - Io@Iowa
    - Europa@Iowa
  - orbit
    - orbit_Galileo@PDS
    - jse_Galileo@PDS
    - flybys_Callisto@PDS
    - flybys_Ganymede@PDS
    - flybys_Io@PDS
    - flybys_Europa@PDS
    - orbit_Burst@PDS
  - attitude
  - mag
    - Callisto@PDS
    - Ganymede@PDS
    - Io@PDS
    - Europa@PDS
    - Burst@PDS
    - Magnetosphere@PDS
  - PLS
  - PWS
    - Summary_MAG@PDS
    - Summary_ELEC@PDS
    - HighRes_MAG@PDS
    - HighRes_ELEC@PDS
  - models
    - mag@Khurana
    - mag@ONERA
- mSWiM_Saturn
- mSWiM_Jupiter
- Voyager_1

Amda Data Info

cdpp-amda.cesr.fr/DDHTML/HELP/GIIPLS.html

CM-CIC cdpp-amda.cesr.fr

Galileo Plasma Science data at AMDA

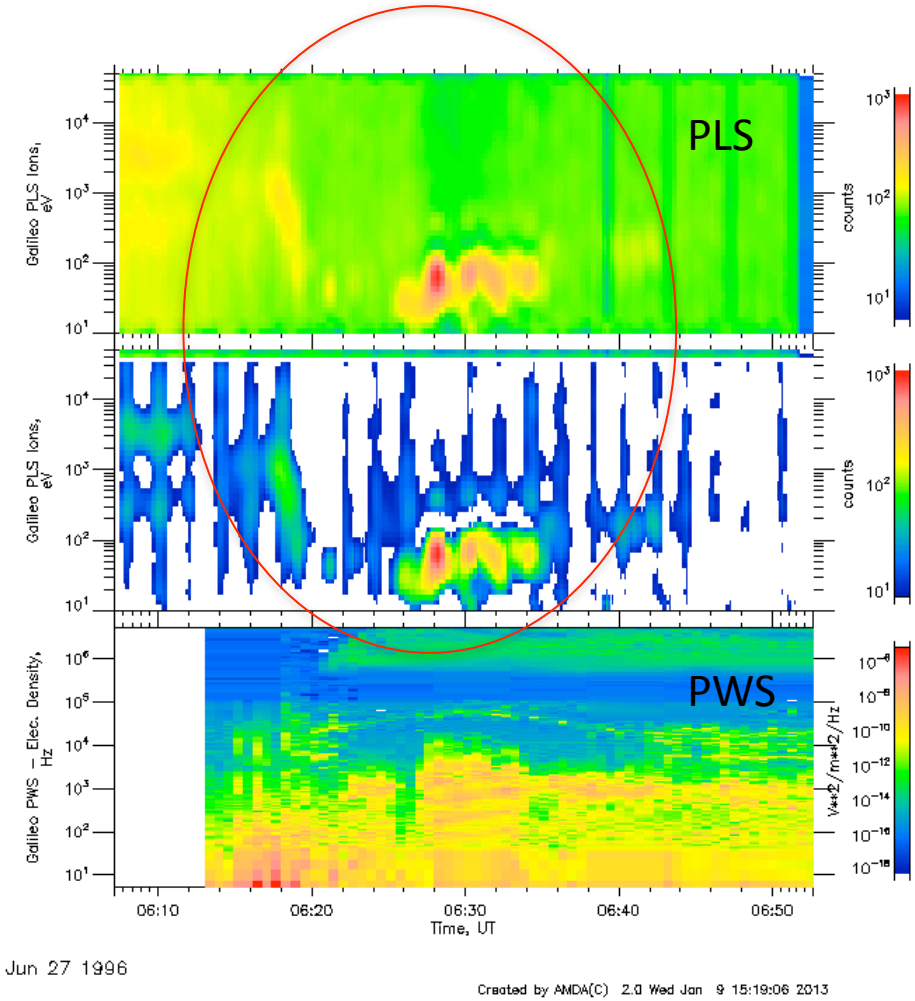
- Galileo Plasma Science data are taken from the PDS (Planetary Data System), site.
- **Magnetosphere dataset** corresponds to data acquired by the Galileo Orbiter during the magnetospheric survey portion of the mission. More information here
- **Burst dataset** corresponds to high time resolution data acquired by the Galileo Orbiter. It includes only non-flyby data. More information here
- **Callisto, Ganymede, Io, Europa datasets** corresponds to high time resolution data acquired by the Galileo Orbiter. It includes only corresponding satellite flybys. More information here
- **Moments dataset** corresponds to Galileo plasma moments (ion density, temperature, velocity) derived from the real-time science (RTS) data acquired by the instrument (inside of 30Rj).
- Parameter plotting arguments:
  - **backgrdChan** : substraction of background noise defined by a channel index
  - **backgrdVal** : substraction of background noise defined by a constant value
  - **minCount** : count data must be greater or egal than minCount to be plot
  - **minCount** : count data must be lower or egal than maxCount to be plot
  - **channel** : plot a specific channel index
-

Sources	Datasets	Status	Last Update
GOPLS_5101 GOPLS_5102 GOPLS_5103 GOPLS_5104 GOPLS_5105	Burst, Satellites	Certified	2011-11-28
GOMW_5001 GOMW_5002 GOMW_5003 GOMW_5004 GOMW_5005	Magnetosphere	Certified	2011-11-28
GOPLS_9003	Moments	Certified	2011-11-28

- Acknowledgments

ACE 0 Save and Apply To Plot

Illustration #1: Ganymede flybys



With background subtraction !

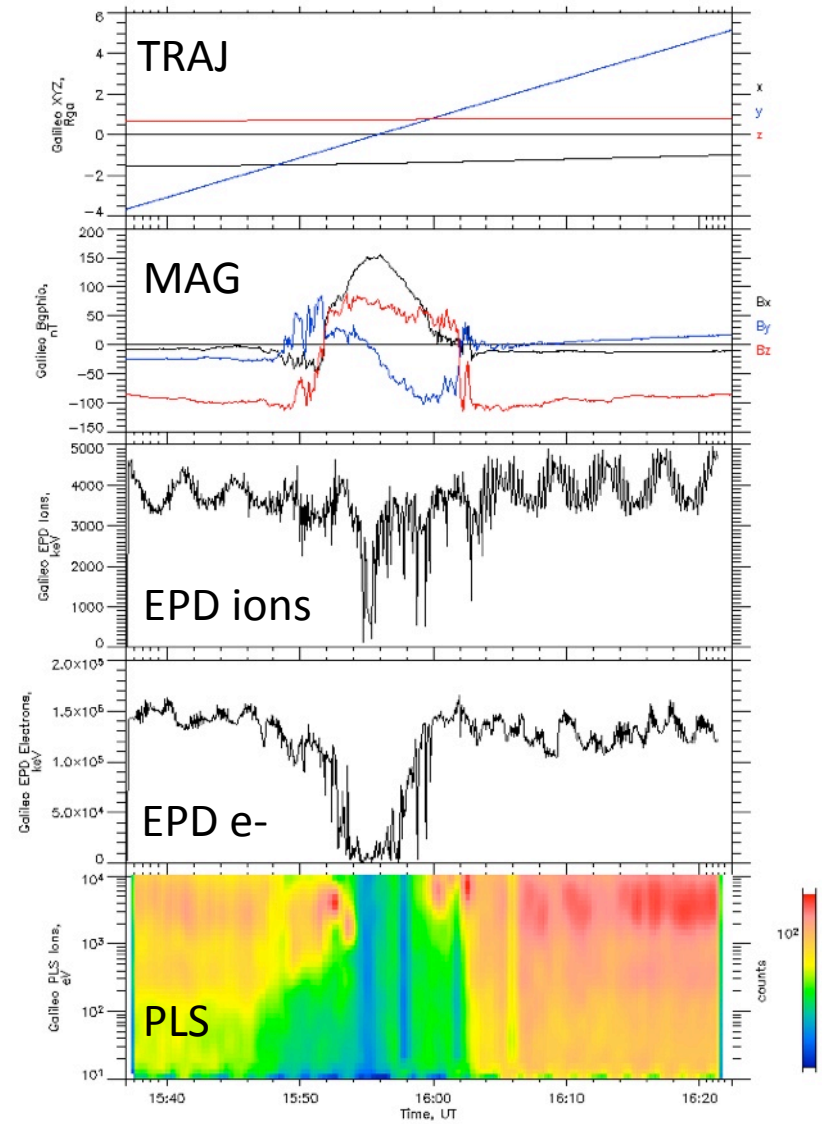
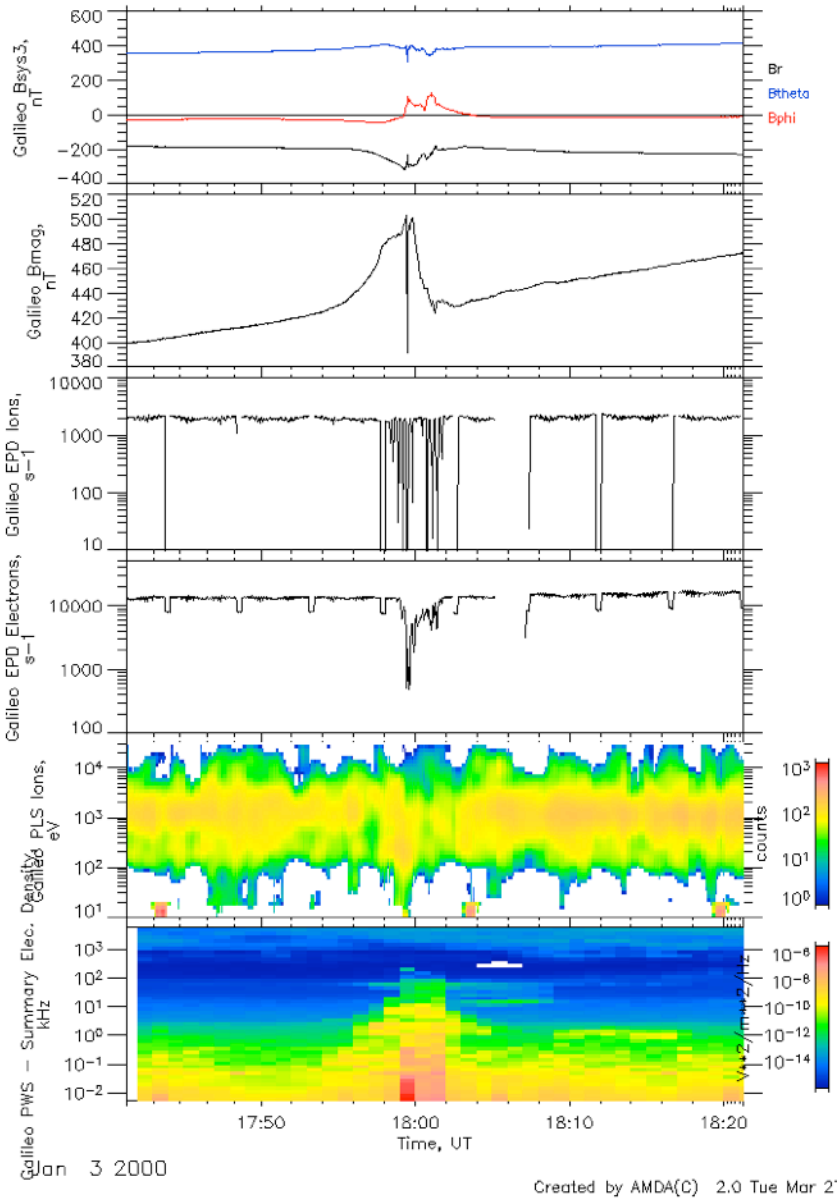


Illustration #2: Europa & Callisto flyby



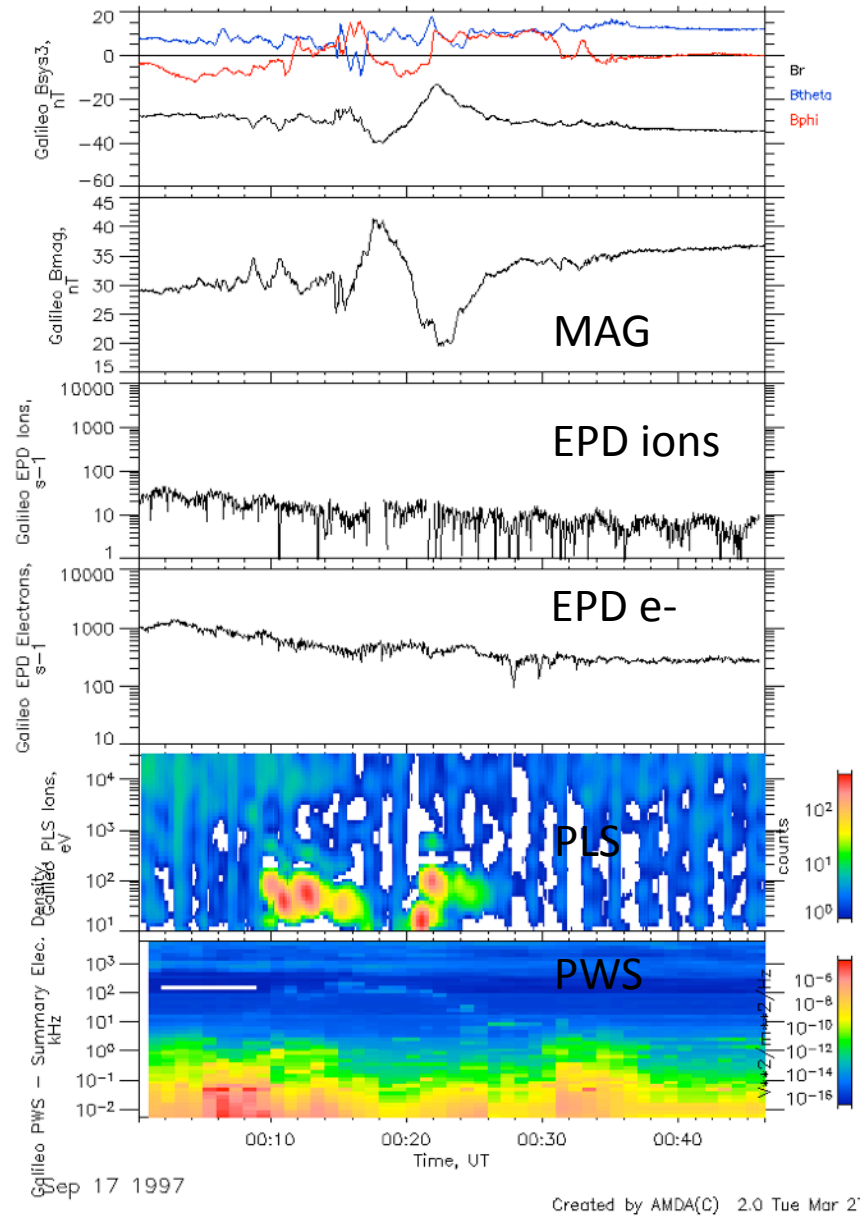
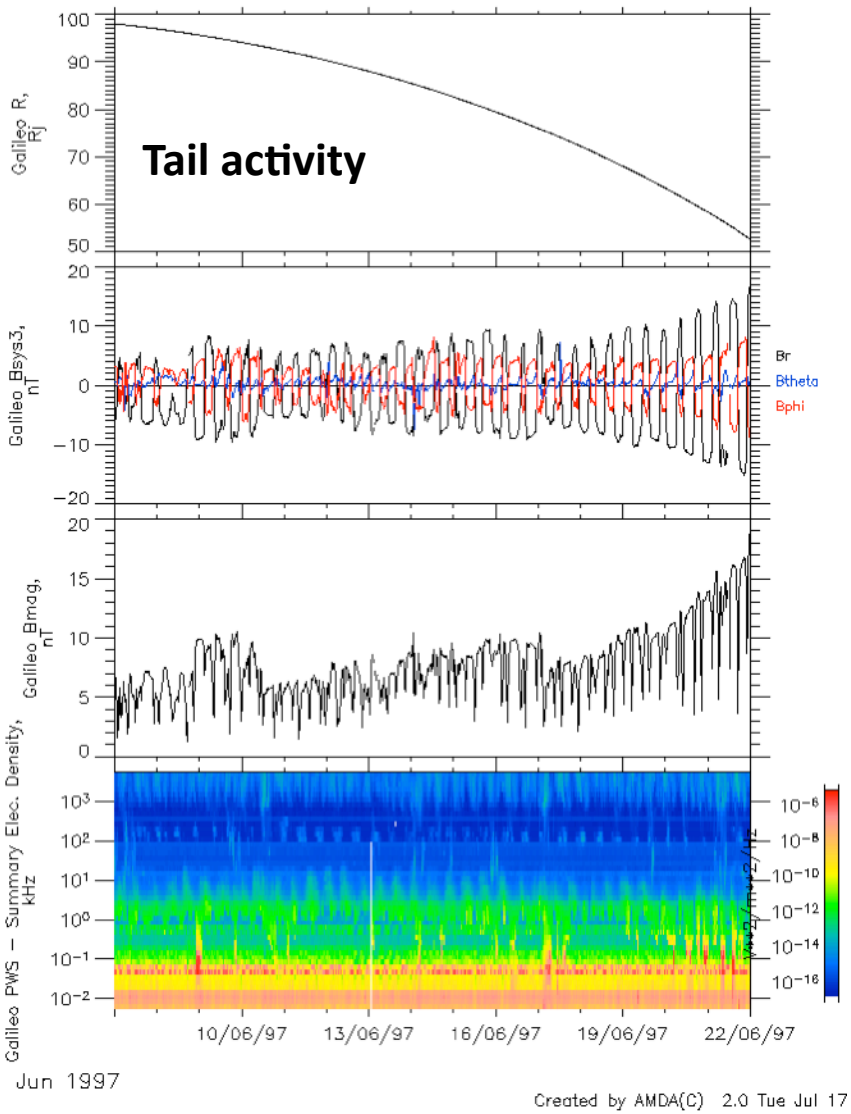


Illustration #3: Magnetosphere



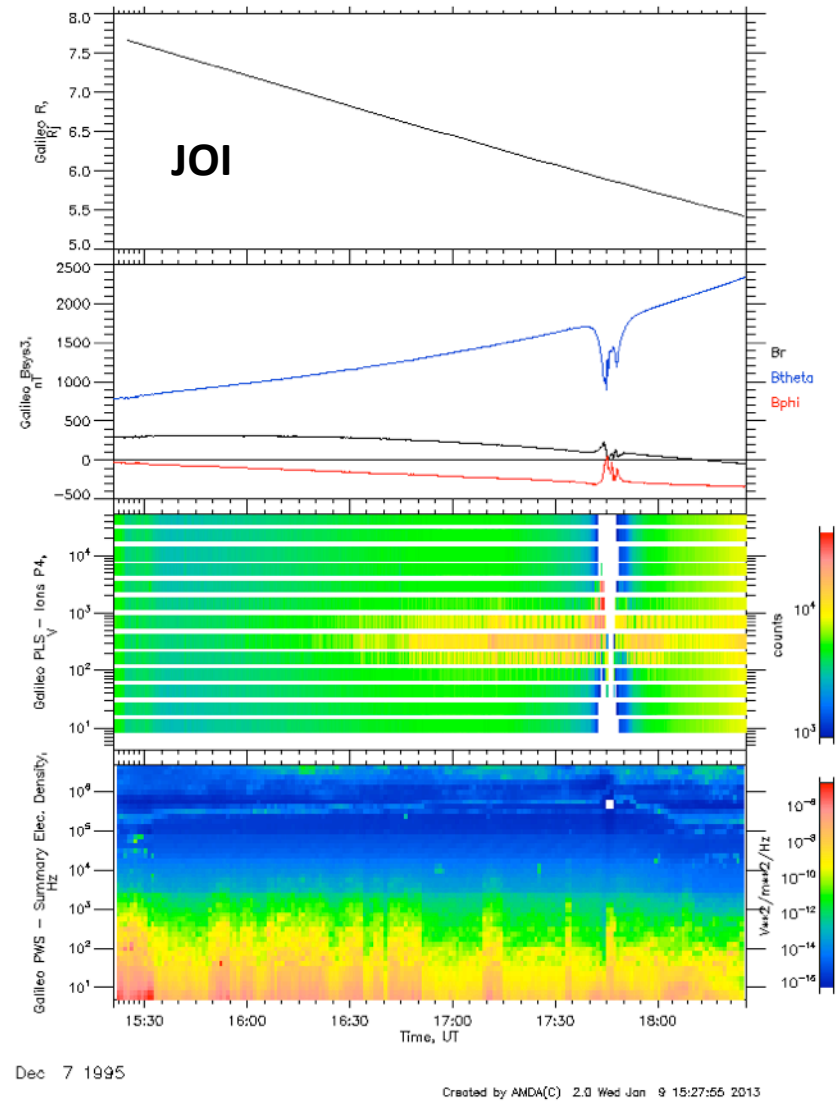


Illustration #4: Auroral campaign

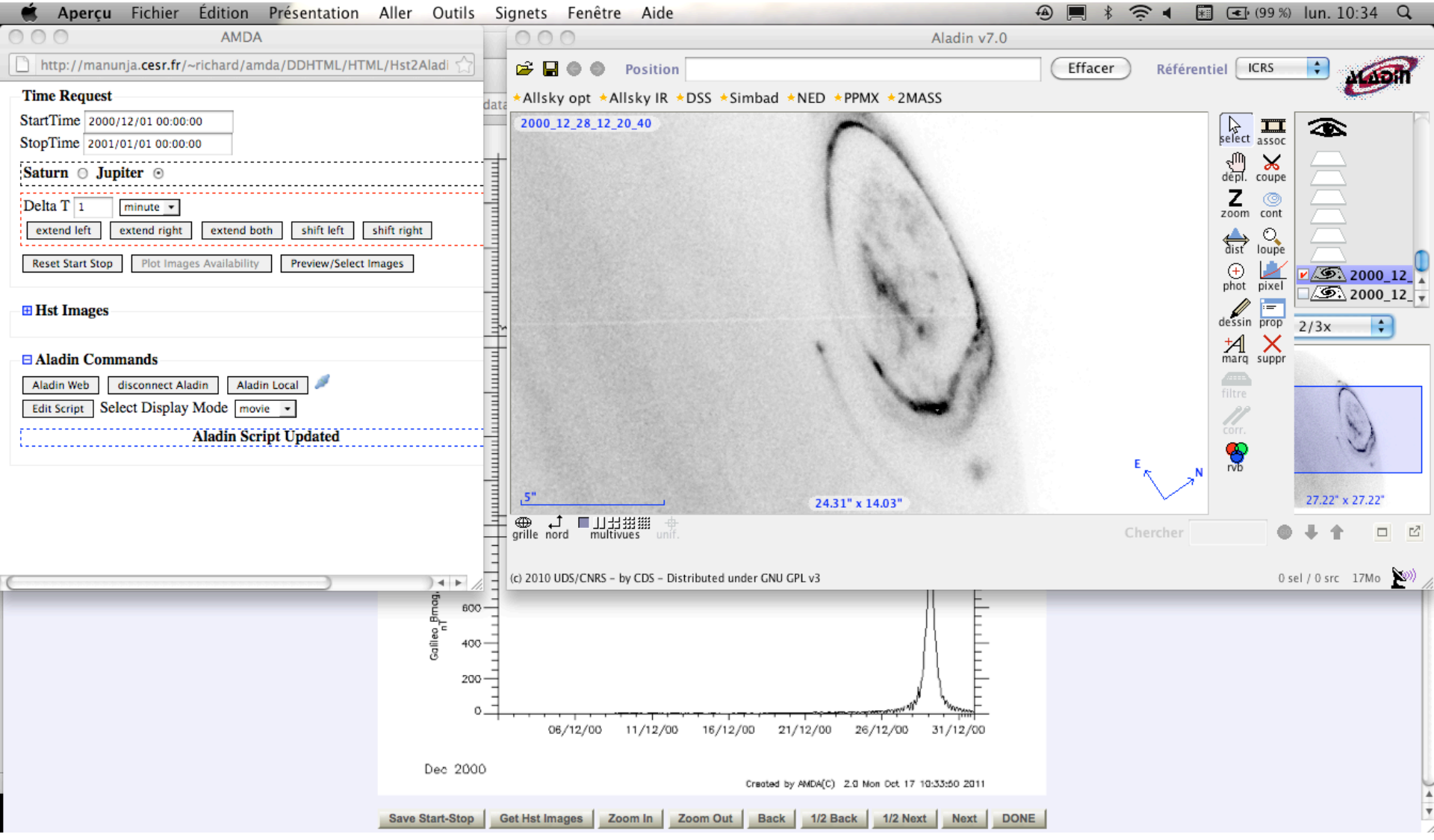
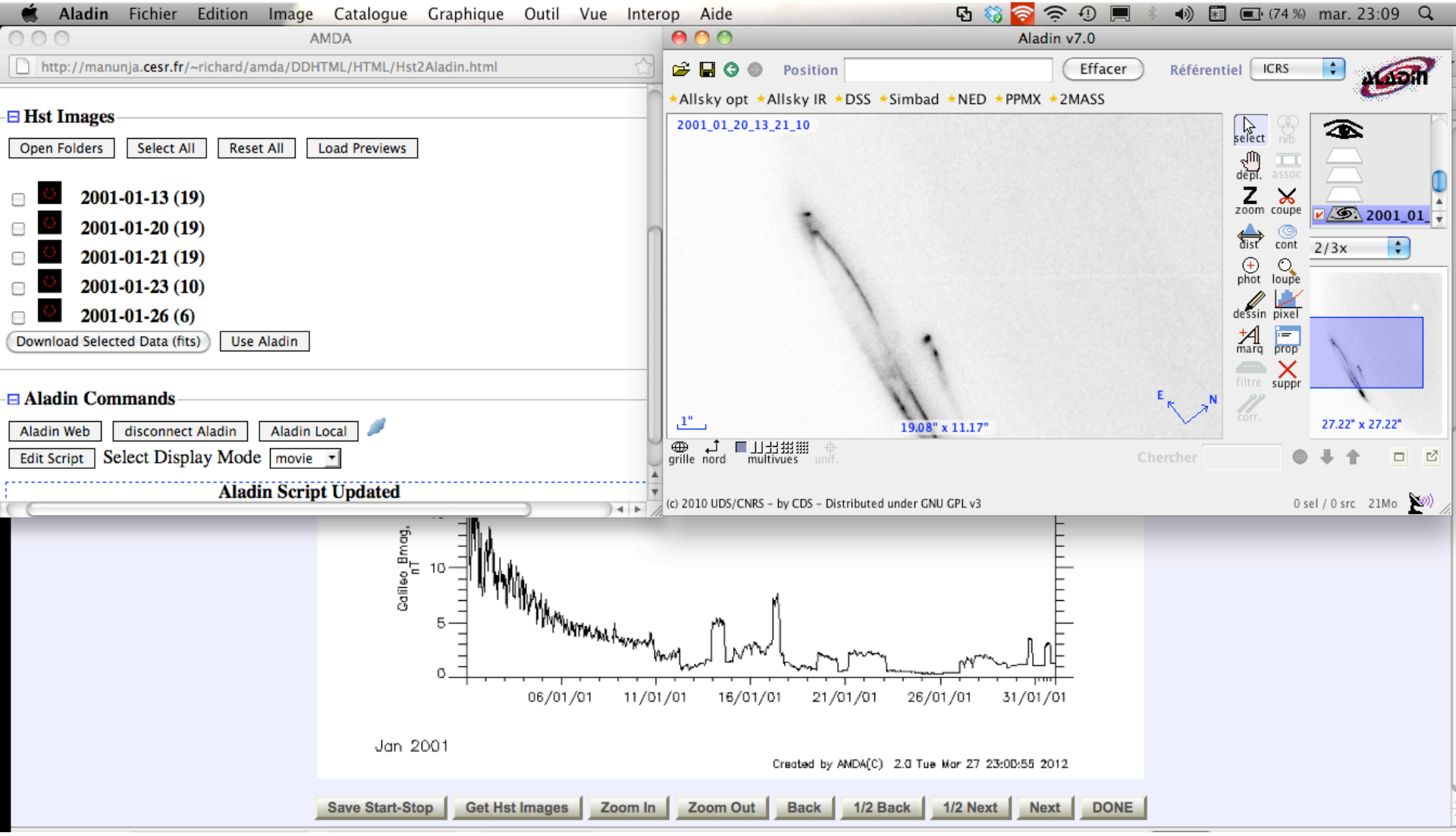
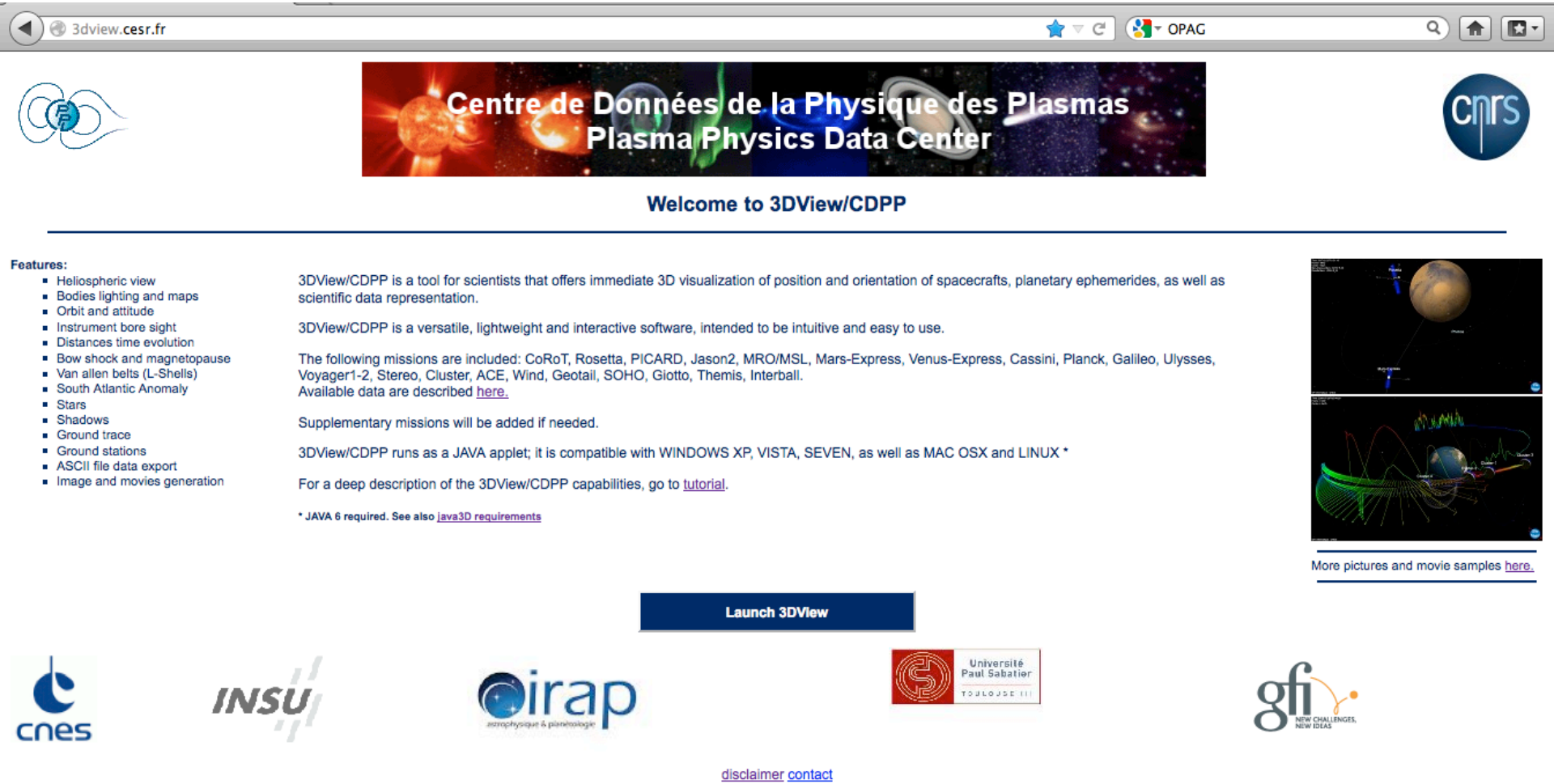


Illustration #4: Auroral campaign



3DView/CDPP Tool

http://3dview.cesr.fr/



3DView/CDPP is a tool for scientists that offers immediate 3D visualization of position and orientation of spacecraft, planetary ephemeris, as well as scientific data representation.

Illustration #1: Earth

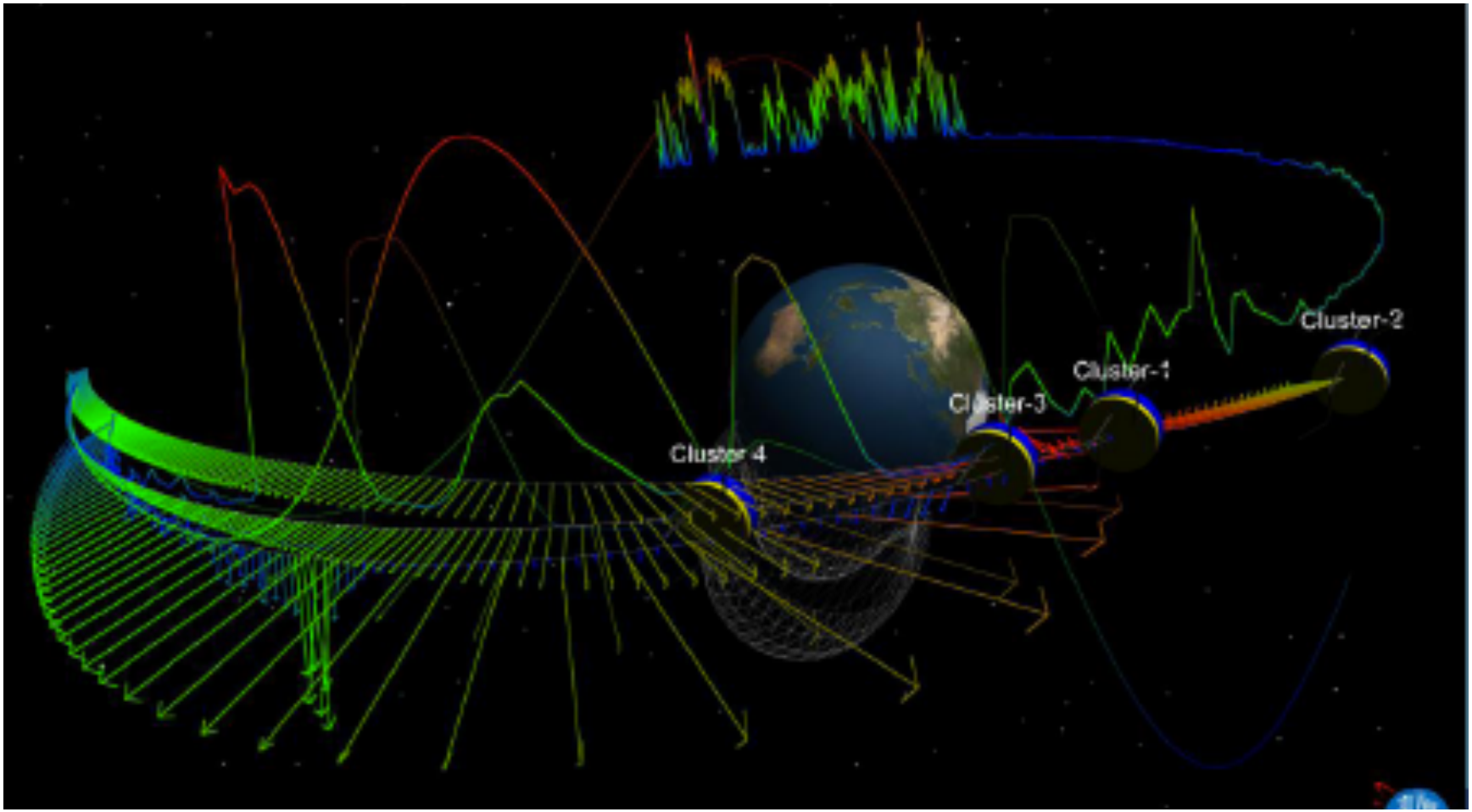
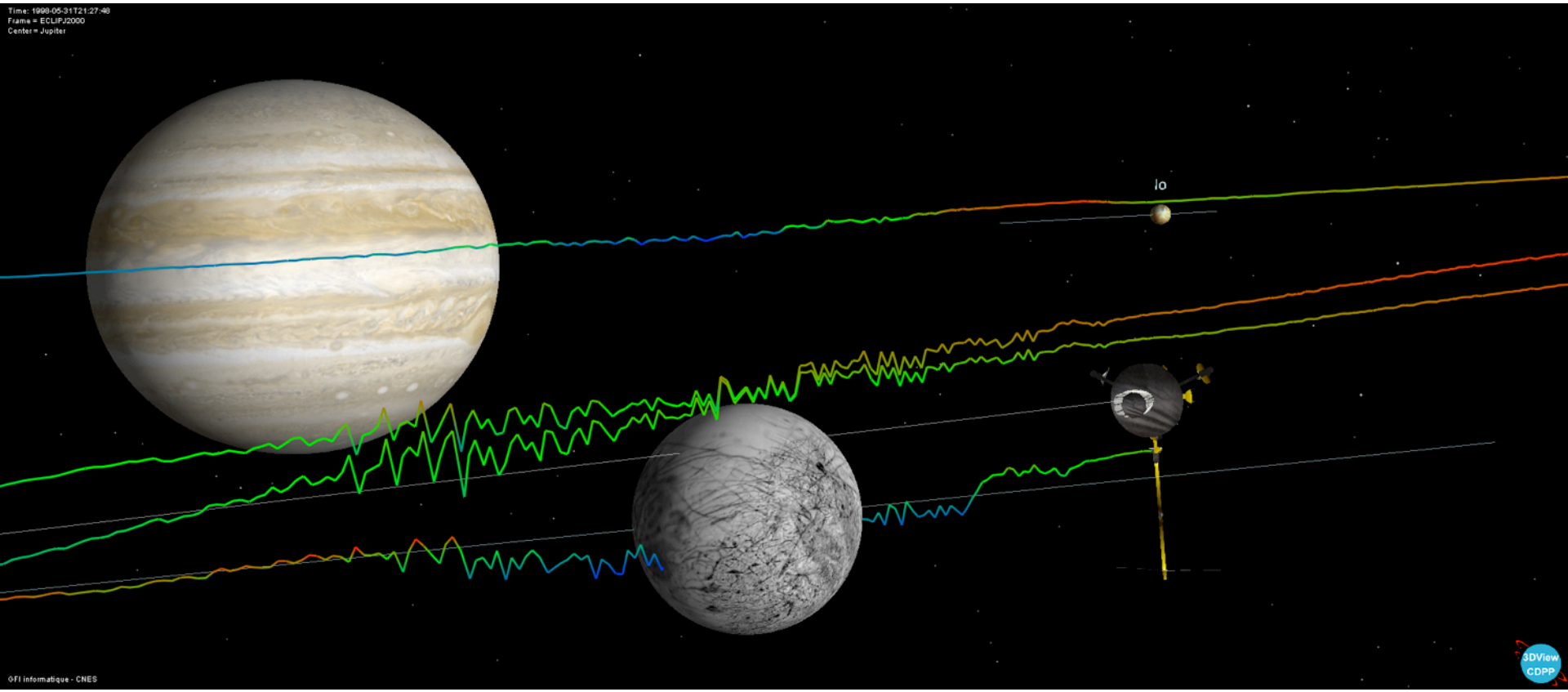


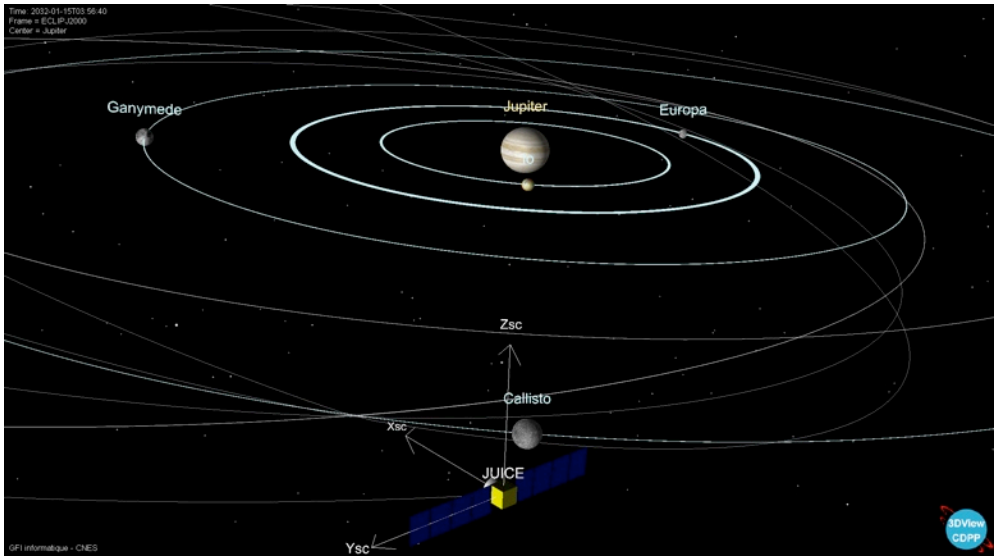
Illustration #2: Galileo

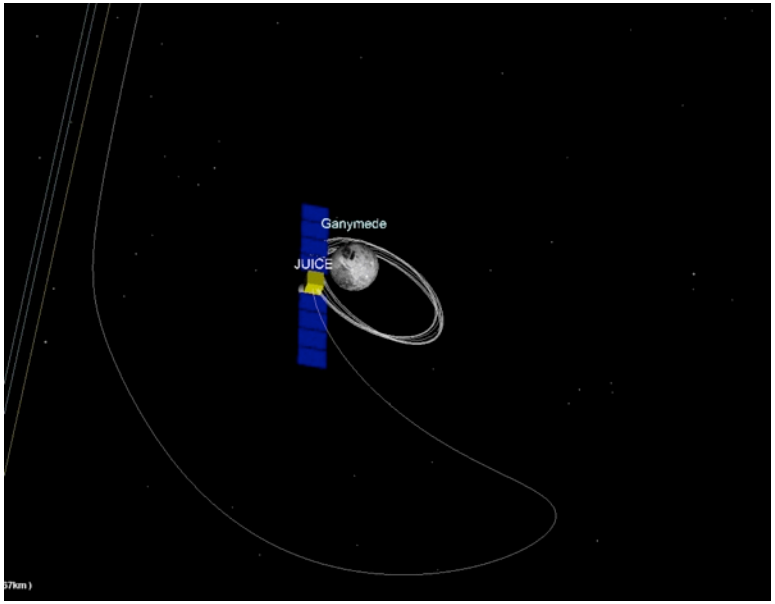


Visualization of Galileo EPD (energetic particle) data during 1 Europa flyby

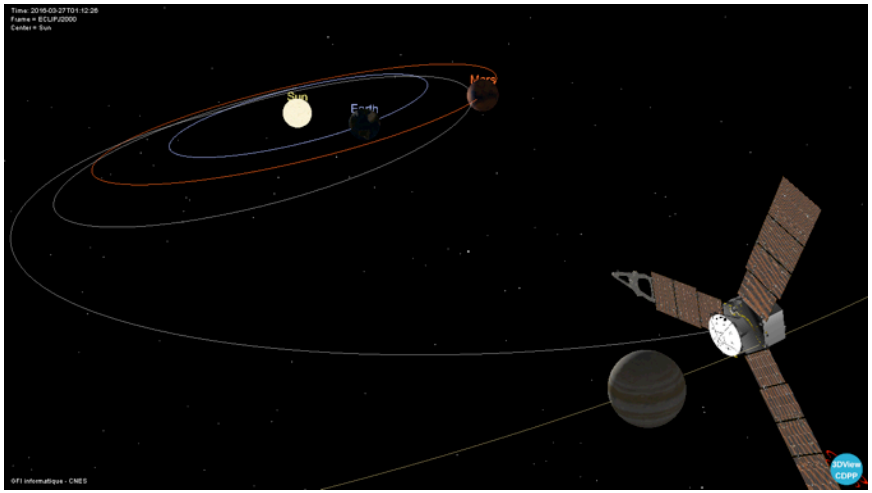
Illustration #3: JUICE

JUICE trajectory/ephemeris has been implemented in CDPP/3DView plasma





(JUNO also)



Perspectives

- Cassini MAPS datasets included in the CDPP/AMDA tool. Enhancing science return to the potential benefit of the broader science community.
- A Jupiter database including all publicly available magnetospheric and plasma data from previous missions to Jupiter has been built in the CDPP/AMDA (Automated Multi-Dataset Analysis) tool. This tool can be used to re-analyze past datasets (including Galileo) in order to prepare and optimize proposed JUICE instrumentation to the potential benefit of the JUICE teams and the broader science community.
- The 3DView/CDPP Tool can be used to visualize JUICE mission phases as well as prepare science mode operation plans, and will be regularly updated as the mission progresses to the potential benefit of the JUICE teams and the broader science community.
- AMDA/Aladin interoperable connection has been developed. This enables in-situ/remote auroral studies at giant planets. The service has been buiklt around HST datasets and will be adapted to spacecraft imagers/spectrometers (e.g., UVIS). This will be adapted in preparation of Juno.

Links

- http://cdpp.cesr.fr/

- http://cdpp-amda.cesr.fr/DDHTML/index.html
- http://3dview.cesr.fr/

- http://europlanet-plasmanode.oeaw.ac.at/