

Training sessions by EuroPlaNet H2020/VESPA

OVERVIEW

- On line tutorials
- VESPA Training sessions at EPSC and EGU
- Two examples of tutorial:
 - MGS data with LatHyS/AMDA/TopCat
 - CRISM data with TopCat/Aladin/TAPHandle
- Future plans with Python ...
- Conclusion

VESPA online tutorials

- Use cases with various software tools
 - CDPP AMDA , 3DView (Planetary data analysis and visualization)
 - LathyS from LATMOS (simulations)
 - TopCat, Aladin

with the EPN-TAP protocol (mostly version 2)
- Official VESPA Web page:
<http://www.europlanet-vespa.eu/tutos.shtml>
- Project Web page:
<https://voparis-confluence.obspm.fr/display/VES/va-t6-tutorials>
- GitHUB
 - Tutorials are written with Markdown
 - With simply a link on the Project Web page

VESPA tutorials

Text + images

- Aladin & planetary surfaces
- APIS
- CRISM cubes in TOPCAT and Aladin
- Atmospheric profiles
- Connection of HELIO with AMDA and 3Dview
- Exoplanets
- ExPRES
- EPN-TAP services: Using TopCat as a client
- EPN-TAP services: VIRTIS-VENUS EXPRESS
- Cassini Titan fly-by
- Magnetospheric region identification with AMDA and TopCat
- Mars Global Surveyor plasma data compared with models

+ **IMPEX tutorials** : compare planetary observations with simulations

Video tutorials

Tracking asteroids, Auroral processes on Saturn, Analysing Pluto's surface ...

Training sessions in conferences

- **Bi annual training sessions**

Organized on a regular basis at the two main conferences for the solar and planetary sciences community

- European Geophysical Union (EGU) April
- European Planetary Sciences Congress (EPSC) September/October

With the aims of

- Showcase the VESPA infrastructure
- Train the community
- Get new users
- Collect feedback

- Need to better advertise the sessions to increase the audience (about 10 at EGU2016, 12 at EPSC/DPS, only 1 at EGU 2017)

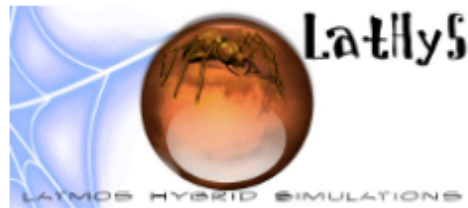
Tutorial example 1


Mars Global Surveyor plasma data compared with HYBRID simulations using AMDA

Data analysis and Visualization tools : AMDA, TopCat
LATMOS simulation results database : LatHyS

The screenshot displays the LatHyS web interface. On the left, a 'Data tree' shows a hierarchy: Mars > Simulations > LatHyS_Mars_14_01_13@Latmos_Hybrid_Simulation_Data > 2DCuts. Annotations include 'Activate SAMP' pointing to a 'SAMP' button, 'Data Product' pointing to the '2DCuts' folder, and 'Sim. Product' pointing to a group of folders including 'MagneticField', 'Mag/2D/XY', 'Mag/2D/XZ', and 'Mag/2D/YZ'. At the bottom left, a 'Filter' button is annotated with 'Filter the catalog (not yet active)'. The main content area is divided into two columns. The left column contains 'Data Information' (Mag/2D/XY), 'Product Type' (2DCuts), 'MeasurementType' (MagneticField), and 'Contents' (TotalMagneticField, MagneticField). Below this are 'Download file' and 'Send' buttons, with 'Send to TopCat' written below. The right column contains 'Run Information' (LatHyS_Mars_14_01_13), 'Simulated Region' (Mars), 'Reference Frame' (MSO, Cartesian), 'Domain' (x, y, z coordinates), 'Cell size' (82.8 km), 'Sub Solar Longitude' (90.00°), 'Solar wind properties' (IMF value, cone angle, IMF, Density, Velocity, Solar UV Flux), and a list of 'Solar wind populations' and 'Ionosphere populations'. The bottom of the interface shows a 'Catalog' section with a 'Filter' button.


Data and Run information



Data tree: 

- Mars
 - Simulations
 - LatHyS_Mars_14_01_13@Latmos_Hybrid_Simulation_I
 - LatHyS_Mars_13_02_13@Latmos_Hybrid_Simulation_I
 - LatHyS_Mars_18_01_13@Latmos_Hybrid_Simulation_I
 - 3DCubes
 - 2DCuts
 - LatHyS_Mars_23_01_13@Latmos_Hybrid_Simulation_I
 - LatHyS_Mars_27_01_13@Latmos_Hybrid_Simulation_I
 - LatHyS_Mars_03_01_14@Latmos_Hybrid_Simulation_I
 - LatHyS_Mars_09_01_14@Latmos_Hybrid_Simulation_I
 - Spacecraft
 - Mercury
 - Ganymede

Run Information:


LatHyS_Mars_18_01_13 

Simulated Region: Mars

Reference Frame: MSO, Cartesian

Domain: $x \in [-7180.1, 9389.4]$ km
 $y \in [-15879.1, 15934.3]$ km
 $z \in [-15879.1, 15934.3]$ km


Cell size: 82.8 82.8 82.8 km

Sub Solar Longitude: 0.00° 

Solar wind properties:

IMF value: 3.001 nT

IMF cone angle: 122.8°

IMF: (-1.63, 2.52, 0.00) nT 

Density: 2.84E+00 cm⁻³

Velocity: 485.00 km/s

Solar UV Flux @ 10.7: 236.00

Solar wind populations:

Ionosphere populations:

Exosphere populations:

Choosing one Martian simulation :

LatHyS catalog propose the main characteristic of the simulation - The ResourceID (Name) :

LatHyS_Mars-18_01_13@...

- IMF values : (-1.63, 2.52, 0.0) nT
- Sub Solar Longitude : 0 degree (main crustal field on the nightside)

Searching MGS data with similar IMF properties

Open AMDA

<http://amda.cdpp.eu>

Amda
Versatile web tool for
Space Physics

MULTI DATASET VISUALISATION
AND DOWNLOAD

VISUAL AND AUTOMATED EVENT
SEARCH AND DATA MINING

CATALOGUE GENERATION
AND EXPLOITATION

REMOTE ACCESS TO DATA,
MODEL AND IMAGE CENTRES
VIA VO TOOLS AND
STANDARDS

CDPP

- First visit, demo tour
- Rules of the road
- modolo
-
- Login
- Register
- Contact us

Announcements

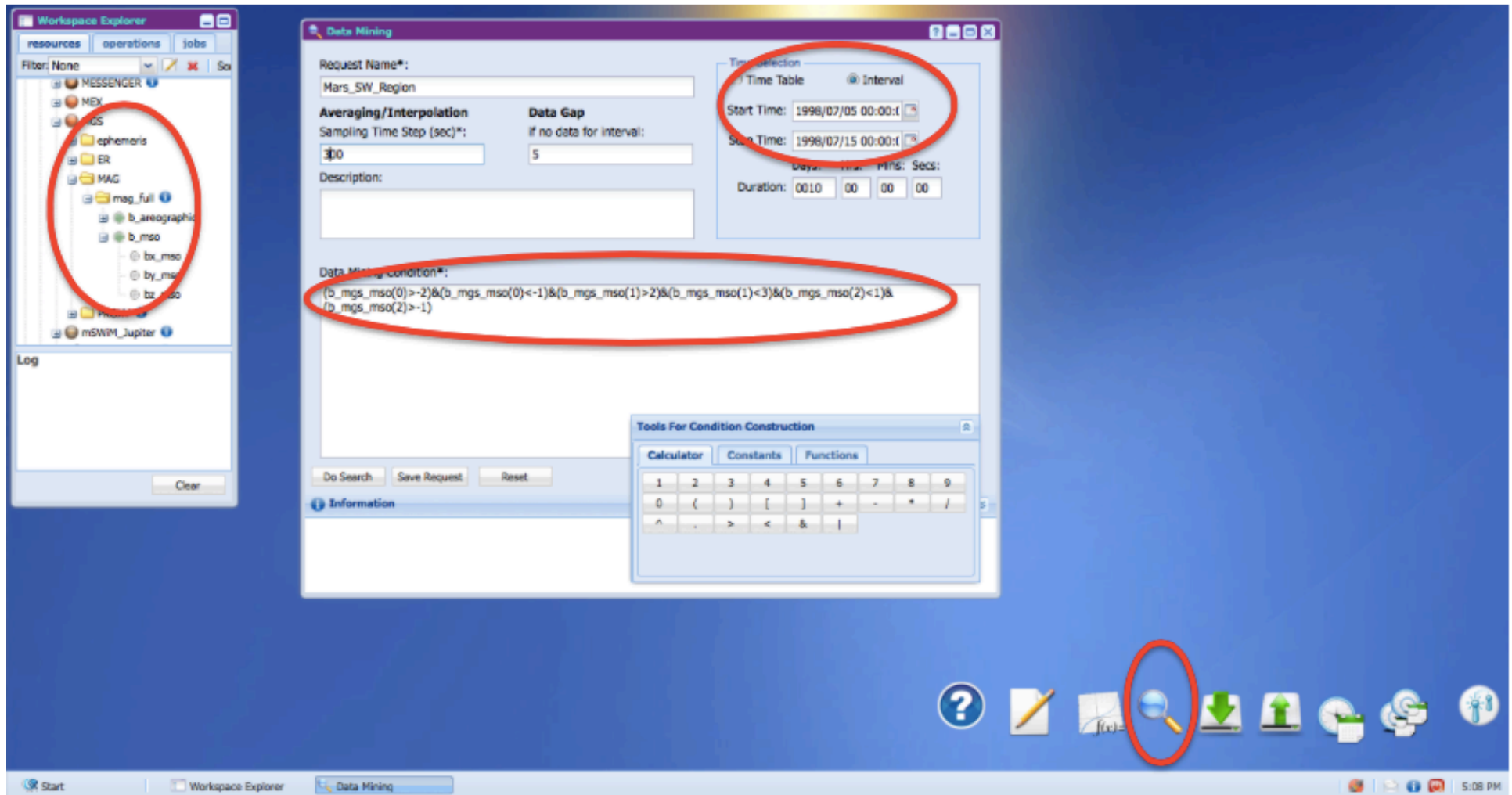
10/04/2014
New AMDA Release V1.3

13/02/2014
New data : ACE MAG and SWEPM
"real time" from NOAA

28/11/2013
The new AMDA is officially launched !

irap CNRS CNES Observatoire Université Toulouse III Paul Sabatier Observatoire Midi-Pyrénées Europlanet HELIO mAx

Report the conditions found in LathyS to AMDA
Simulations IMF values $-2 < B_x < -1$ $2 < B_y < 3$ $-1 < B_z < 1$
Set *sampling* and *time span*



The result is an Event (Time) Table

Create a new parameter : Total B field

The screenshot displays two windows from a software application. The top window, titled "Manage Time Tables", shows details for a table named "Mars_SW_Region". It includes a description with parameters like "Time_Step: 300.0s" and "Start_Time: 1998-07-05T00:00:00". A table on the right lists intervals with columns for Start Time, Stop Time, and Duration (min). The bottom window, titled "Create/modify parameters", is used to define a new parameter named "btot_mgs". It shows the "Construct Parameter*" field containing the formula $\text{sqrt}(b_mgs_mso(0)^2 + b_mgs_mso(1)^2 + b_mgs_mso(2)^2)$. A "Tools For Parameter Construction" panel with a calculator interface is also visible.

Manage Time Tables

Name*: Mars_SW_Region
Creation date: 2014/04/16 17:20:33 Intervals: 0
Description: job_31702
AMDA Search: Time_Step: 300.0s;
Data_absence_Is_gap_for_gaps > 5
Data_Sampling_Times; Start_Time: 1998-07-05T00:00:00
Time_Interval: 0010d00h00m
Operation log:
Operations on Intervals
Extend 360 min Shift -180 min
Apply Undo
Merge intervals Statistical info
Save Reset Share

	Start Time	Stop Time	Duration (min)
NEW	1998-07-11T19:31:00	1998-07-11T19:36:00	5.00
NEW	1998-07-11T19:46:00	1998-07-11T19:51:00	5.00
NEW	1998-07-11T22:46:00	1998-07-11T23:01:00	15.00
NEW	1998-07-11T23:51:00	1998-07-12T00:06:10	15.17
NEW	1998-07-13T06:31:20	1998-07-13T06:36:20	5.00
NEW	1998-07-13T09:21:20	1998-07-13T09:41:20	20.00
NEW	1998-07-13T20:56:20	1998-07-13T21:06:20	10.00

Create/modify parameters

Parameter Name*: btot_mgs
Time Step (sec)*: 1
Units: nT
Y Title for Plot: undefined
Description: undefined
Construct Parameter*:
 $\text{sqrt}(b_mgs_mso(0)^2 + b_mgs_mso(1)^2 + b_mgs_mso(2)^2)$
Save Reset

Tools For Parameter Construction

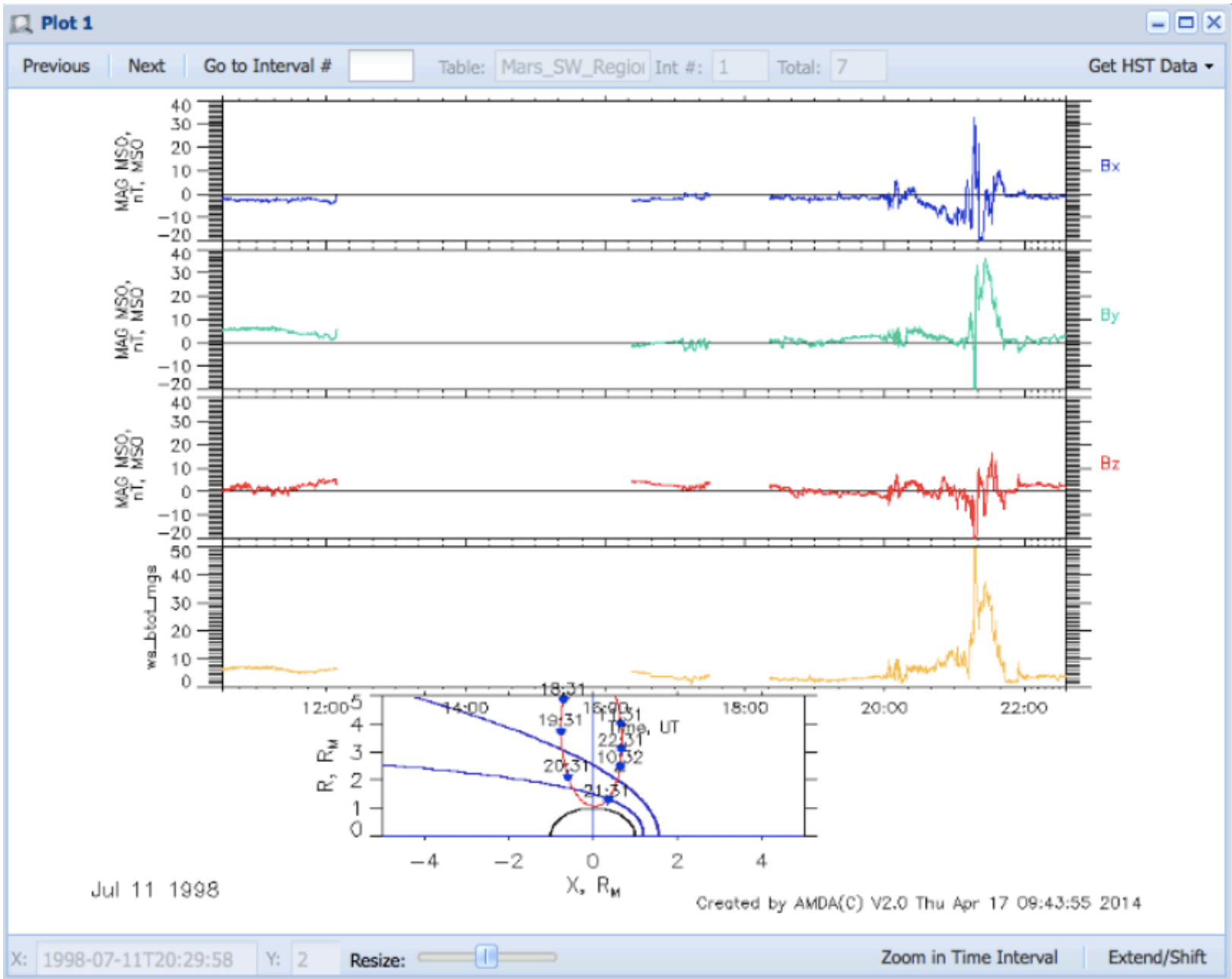
Calculator Constants Functions
1 2 3 4 5 6 7 8 9
0 () [] + - * /
^ . > < & |

Plot : select Data and Event Table

Choose one colour per component

The screenshot displays the Plot Manager interface with the following components:

- Workspace Explorer:** A tree view on the left showing a hierarchy of resources. The 'mso' folder is circled in red, containing sub-items like 'polar_areographic', 'xyz_mso', 'b_areographic', and 'b_mso'.
- Plot Manager Table:** A table with 5 columns: Name, Plot Type, Height, Width, Xmin, Xmax, Ymin, Ymax, and Additional. It lists five panels, each with a 'TIME' plot type and various coordinate ranges. The 'Additional' column contains 'select...' buttons.
- Time Selection:** A section with radio buttons for 'Time Table' (selected) and 'Interval'. Below it, a list box shows '1 Mars_SW_Region' circled in red.
- Plot Properties:** Fields for 'Plot Title', 'Char Size' (1.3), 'Orientation' (LANDSCAPE), and 'Description'.
- Plot File Settings:** Fields for 'Plot File Name', 'Line Thickness' (1), 'File Format' (PNG), and 'Points per Plot' (3000).
- Request Name:** A field for 'Request Name' with a 'Save Request' button.
- Buttons:** 'Plot', 'Get Data', and 'Reset' buttons are located at the bottom.
- Information:** A small icon of a document with a graph and the equation $f(x)=$ is circled in red at the bottom right.



Add now the simulation results to the plot

The screenshot shows a software interface with two main panes: a Workspace Explorer on the left and a Plot Manager on the right.

Workspace Explorer: Displays a hierarchical tree structure under 'resources'. The path is: Remote Data (Simulations) > MODELS@LATMOS > impex://LATMOS/Hybrid > LatHyS_Mars_18_01_13 > MagneticField > Mag/3D > MagneticField. Under 'MagneticField', there are radio buttons for Bx, By, Bz, and |B|.

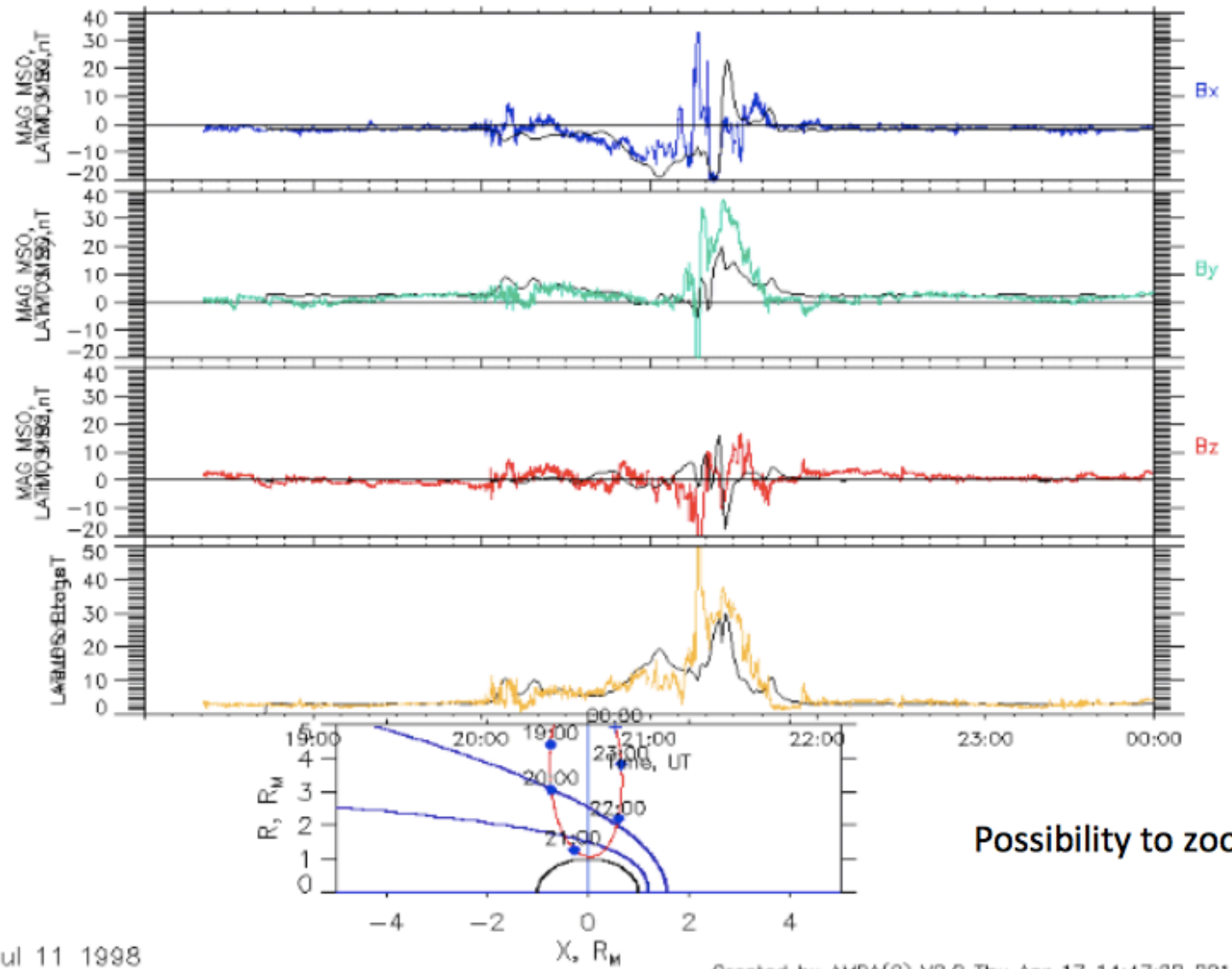
Plot Manager: Contains a table of panels and a configuration section for a selected panel.

Name	Plot Type	Height	Width	Xmin	Xmax	Ymin	Ymax	Additional	Parameter Arguments	Y2
Panel 1	TIME	0.4	1	0	0	-20	40	select...	Color=blue&Symbol=...	
b_mgs_mso(0)									Satellite=MGS&Clock...	
impex__LAT...									Satellite=MGS&Clock...	
Panel 2	TIME	0.4	1	0	0	-20	40	select...	Color=green&Symbol=...	
impex__LAT...									Satellite=MGS&Clock...	
b_mgs_mso(1)									Color=red&Symbol=...	
Panel 3	TIME	0.4	1	0	0	-20	40	select...	Satellite=MGS&Clock...	
b_mgs_mso(2)									Color=red&Symbol=...	
impex__LAT...									Satellite=MGS&Clock...	
Panel 4	TIME	0.4	1	0	0	0	50	select...	Color=red&Symbol=...	
impex__LAT...									Satellite=MGS&Clock...	

Configuration Section (for Panel 1):

- Time Selection: Time Table, Interval
- Time Table Name: 1 Mars_SW_Region
- Plot Title: [Empty]
- Char Size: 1.3
- Orientation: LANDSCAPE
- Description: [Empty]
- Plot File Name: [Empty]
- Line Thickness: 1
- File Format: PNG
- Points per Plot: 3000
- Request Name: MGS_simu_comp

Buttons: Plot, Get Data, Reset, Save Request, Clear.

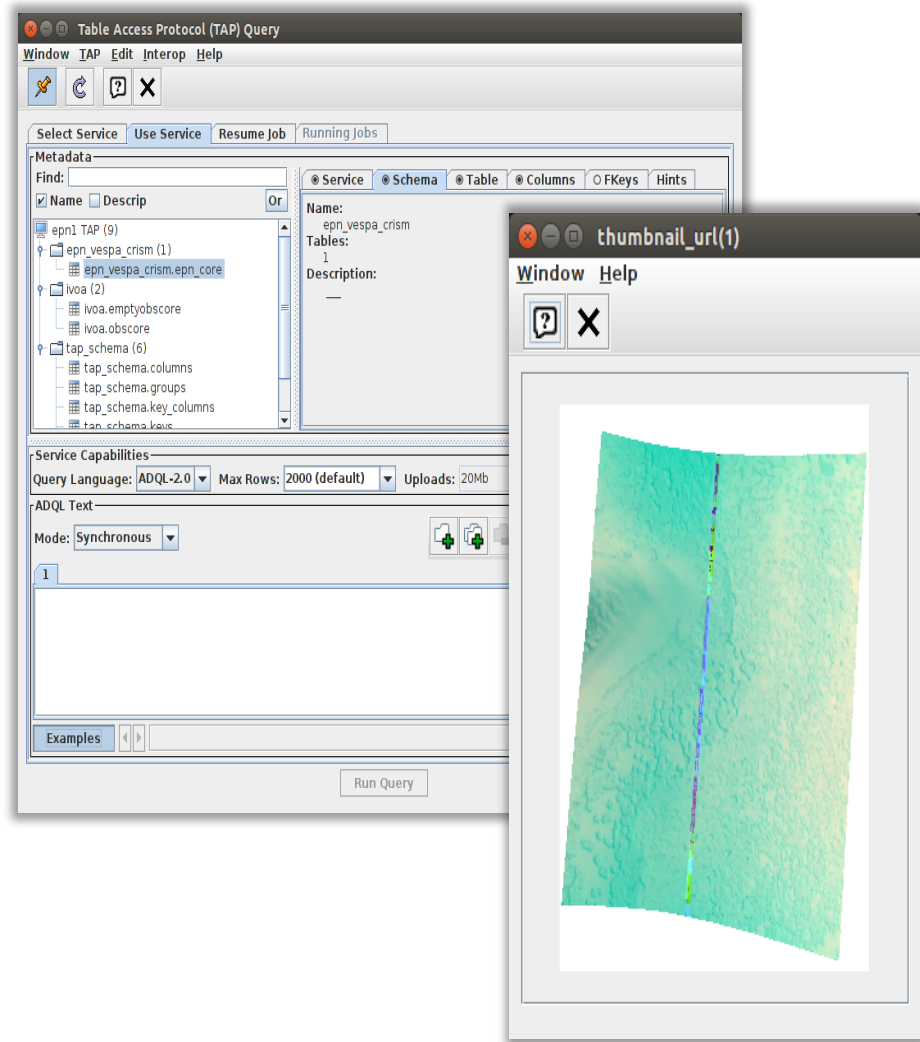


Jul 11 1998

Created by AMDA(C) V2.0 Thu Apr 17 14:47:22 2014

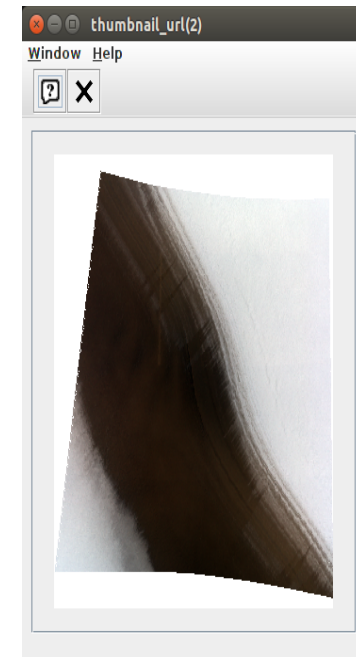
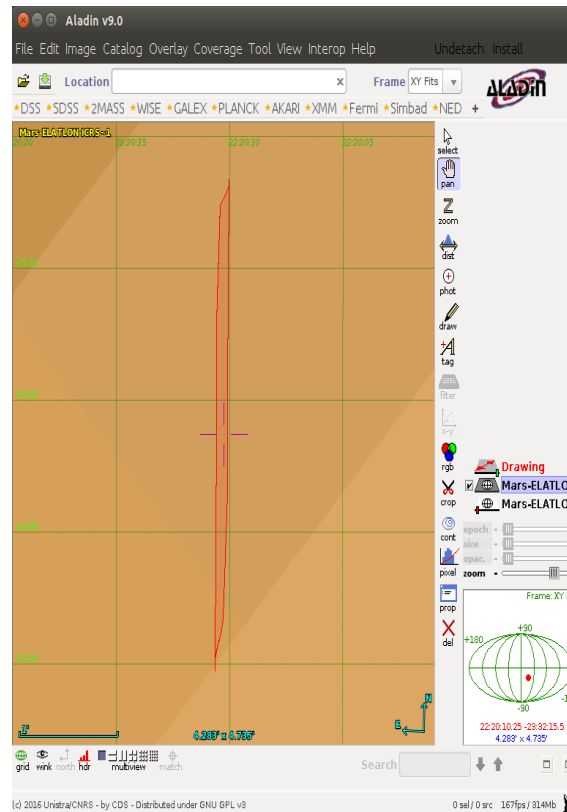
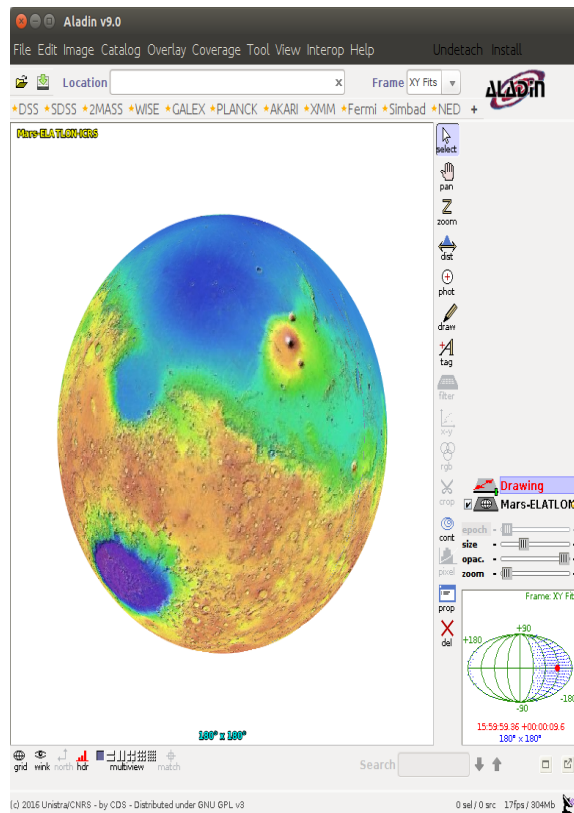
Tutorial Example 2 on MRO/CRISM data *VESPA/TOPCAT/Aladin/TapHandle/CASSIS*

- Deals with spectral cubes from MRO (Mars Reconnaissance Orbiter) / Compact Reconnaissance Imaging Spectrometer (CRISM)
<https://github.com/e pn-vespa/tutorials/blob/master/jra-t4-EPN1-CRISM/jra-t4-EPN1-CRISM-Tutorial.md>
- Data distributed by EPN-TAP service from Jacobs Uni, Bremen, with DaCHS
<http://epn1.epn-vespa.jacobs-university.de/tap>
- EPN-TAP service includes thumbnails for quick inspection



Tutorial Example 2 on MRO/CRISM data *VESPA/TOPCAT/Aladin/TapHandle/CASSIS*

Displaying CRISM footprints on Aladin



Using HiPS Mars surface from

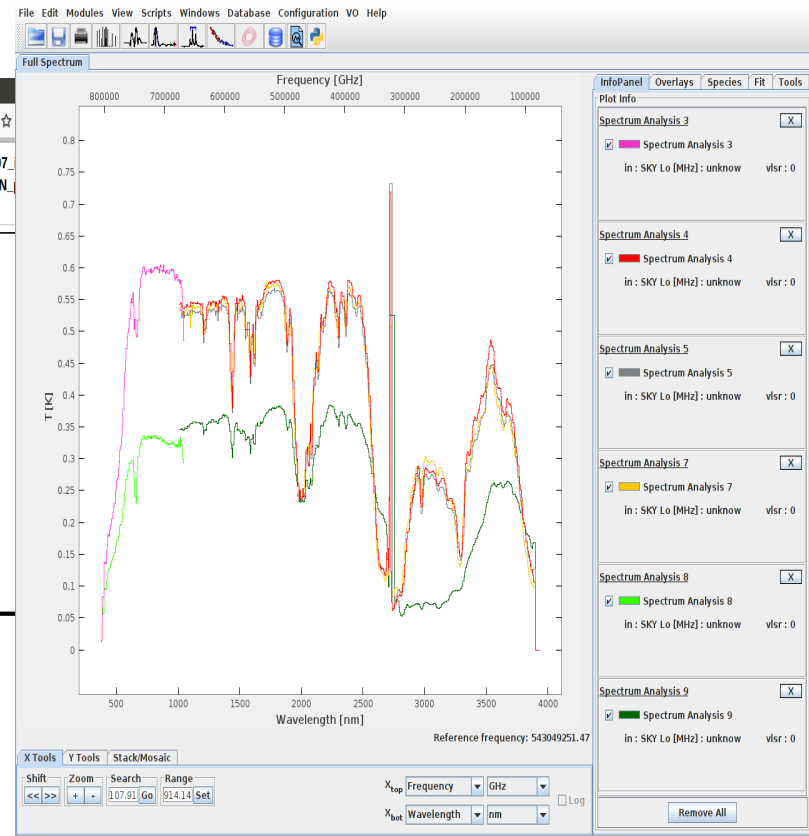
<http://epn1.epn-vespa.jacobs-university.de:8080/marsmola/Mars-ELATLON-ICRS.hpx>

Tutorial Example 2 on MRO/CRISM data VESPA/TOPCAT/Aladin/TapHandle/CASSIS

TapHandle → CASSIS using *custom cutout* service (sub-granule)
(question: datalink in the future?)

The screenshot shows the TapHandle 2.0 web interface. The main window displays a sub-granule image with a 'Spectrum preview' box overlaid on it. The preview box shows a blue spectrum plot with 'Frequency' on the x-axis. Below the image, there is a text box with instructions: 'Click on the image, spectrum for that location will appear on the box below. Copy and paste it in a text editor and save as .fus, open with CASSIS.' Below the instructions is a table of spectral data.

Frequency [GHz]	Intensity	Delta F	Delta tau		
1033.626	0.000	0.000	0.05039697	0	0
1027.168	0.000	0.000	0.101003	0	0
1020.710	0.000	0.000	0.131096	0	0
1014.252	0.000	0.000	0.181547	0	0
1007.794	0.000	0.000	0.177542	0	0
1001.336	0.000	0.000	0.175631	0	0
994.878	0.000	0.000	0.186662	0	0
988.420	0.000	0.000	0.202577	0	0
981.962	0.000	0.000	0.224896	0	0
975.504	0.000	0.000	0.221398	0	0
969.046	0.000	0.000	0.224449	0	0
962.588	0.000	0.000	0.229273	0	0
956.130	0.000	0.000	0.229748	0	0
949.672	0.000	0.000	0.237550	0	0
943.2139999999999	0.000	0.000	0.248276	0	0
936.756	0.000	0.000	0.253682	0	0
930.298	0.000	0.000	0.259003	0	0



Future plans for tutorials with Python Notebook

During a recent *VESPA/GIS* workshop, a tutorial was drafted to connect VESPA (from web portal, using SAMP) with Jupyter Notebook (using `astrophy.io.samp`), and process with GIS python modules.

Very easy to set up, work ongoing to build a tutorial.

Open a SAMP Hub

```
In [1]: from astropy.vo.samp import SAMPHubServer
hub = SAMPHubServer()
hub.start()
```

[...]

NB: GIS = Geographic Information System
(developed for earth, extended to planetary surface)

Transform *s_region* to « footprint GIS » (wkt)

```
In [12]: def getParts(sRegion):
lon=sRegion.split(' ')[2:][0::2]
lon=np.asarray([float(i) for i in lon])
if (lon.max()-lon.min()) > 180:
    lon = [[x, x-360][x>180] for x in lon]
lat=sRegion.split(' ')[2:][1::2]
parts = [[360-float(lon[i]),float(lat[i])] for i in range(len(lon))]
if not (parts[0]==parts[-1]): parts.append(parts[0])
return parts

def s_region_to_wkt(coded_s_region):
q = getParts(re.sub(r'Polygon UNKNOWNFrame ', ''))
return 'POLYGON (('+'+'.join([' '.join([str(x) for x in part]) for part in parts])+')

v_s_region_to_wkt = np.vectorize(s_region_to_wkt)
```

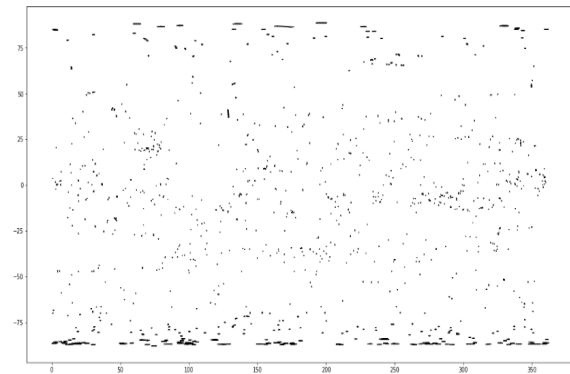
Define the crs, get the Table ad Pandas.DataFrame and define the geometry as list of `shapely.wkt.Polygon` objects.

[...]

Display the CRISM catalog with GIS plot (geopandas python module)

```
In [14]: gdf.plot(figsize=[20,10])
```

```
Out[14]: <matplotlib.axes._subplots.AxesSubplot at 0x109fc
b090>
```



Some zooming in to show the footprints.

Conclusion

Coordination with other groups within IVOA ?