

Solar Orbiter data access



GUI + Python API

Vincent Génot and the CDPP/AMDA team

Ecole des Houches / Solar Orbiter

April 2021

<http://amda.cdpp.eu/>



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

First visit, demo tour

Rules of the road

LOGIN

PASSWORD

Login / Registered Users

Register

Contact us

AMDA Info



Public Access

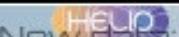
Announcements

22/02/2021

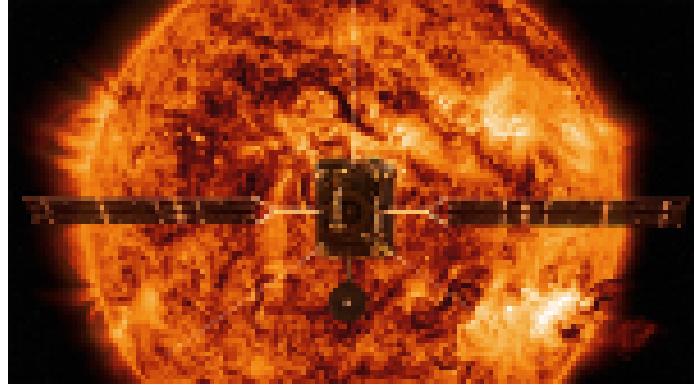
New data:
ARTEMIS, Mariner 10

25/11/2020

New data:
Solar Orbiter: EPO/EPT, EPO/SIS,
RPW density
BepiColombo: MEA



Data



- Public data from SOAR <http://soar.esac.esa.int/soar/>
- In-situ instruments: MAG, PAS, EPD, *RPW*
- Time series (scalar, vector, spectro)
- No distribution functions $f(v_x, v_y, v_z)$ → *see presentation by P. Louarn*
- AMDA can accomodate private access to data for designated groups of users (collaborations, projects, ...; see the example of Rosetta Plasma Consortium)

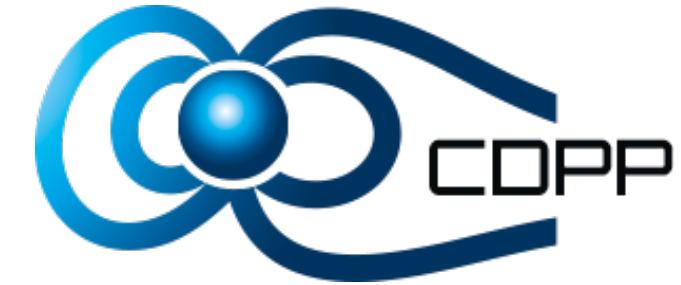


Outline

- AMDA general principles
- AMDA GUI
 - Use case #1: plotting Solar Orbiter data (MAG, PAS, derived parameters)
 - Use case #2: plotting PAS spectrograms
 - *Note: distribution functions will be shown at the end of the session by P. Louarn on CLweb*
 - Use case #3: data mining and event lists
 - *Use case #4: plotting RPW data*
 - Use case #5: downloading data
 - Use case #6: plotting EPD data (*by A. Rouillard*)
- AMDA Python interface
 - amdapy
 - Jupyter notebook



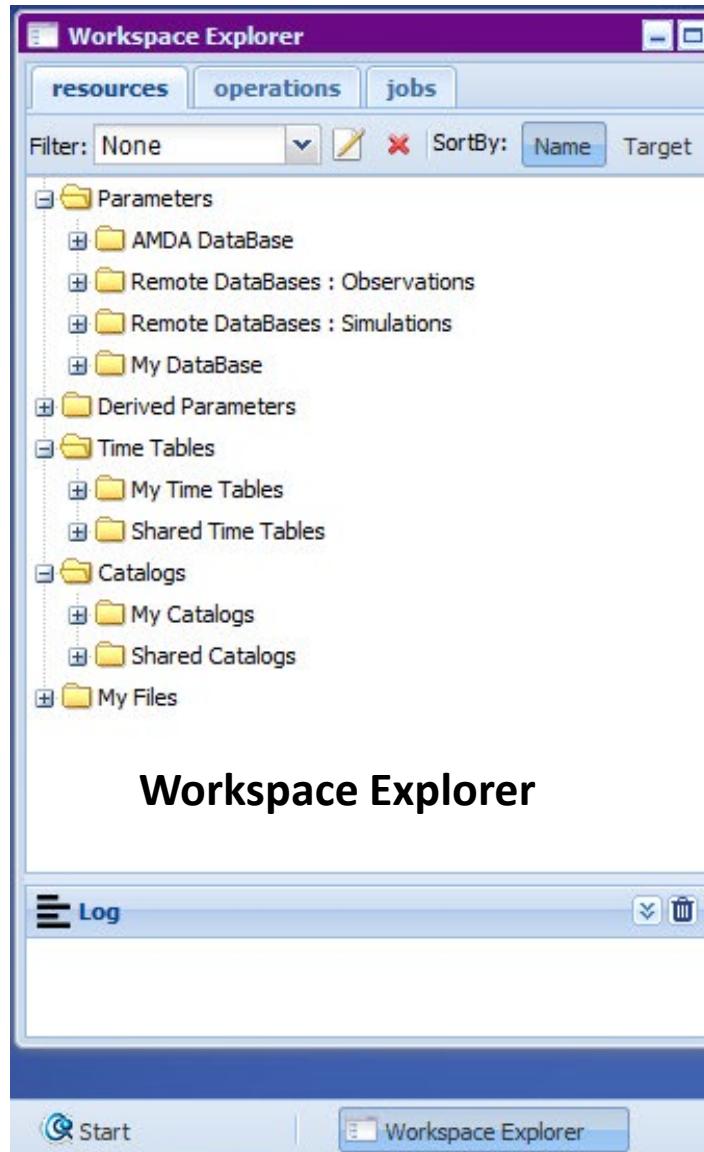
AMDA general principles



Context

- Automatic **Multi-Dataset Analysis**
- Simplifying data access to various data sources in heterogeneous formats
- A plot should only be a few clicks away
- Data mining on long time series to produce catalogues / event lists
- Developped since 2006 by the CDPP, the French Plasma Physics Data Centre <http://www.cdpp.eu/>
- Support by CNES, CNRS and various collaborative projects
- See *Génot et al., 2021* (in press in PSS) for a global overview of functionalities including access to simulations, interoperability, ...

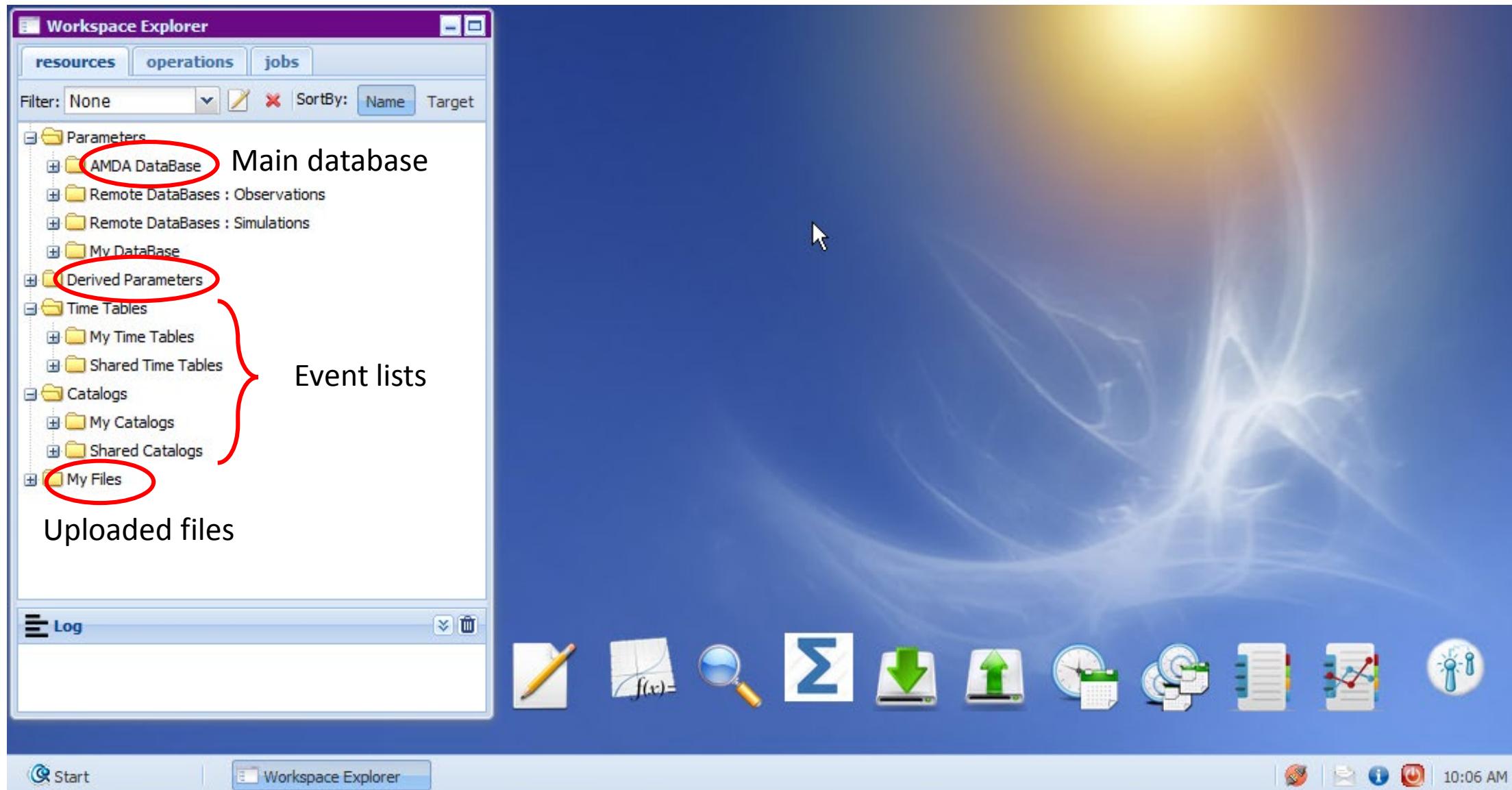
Easy access to science quantities

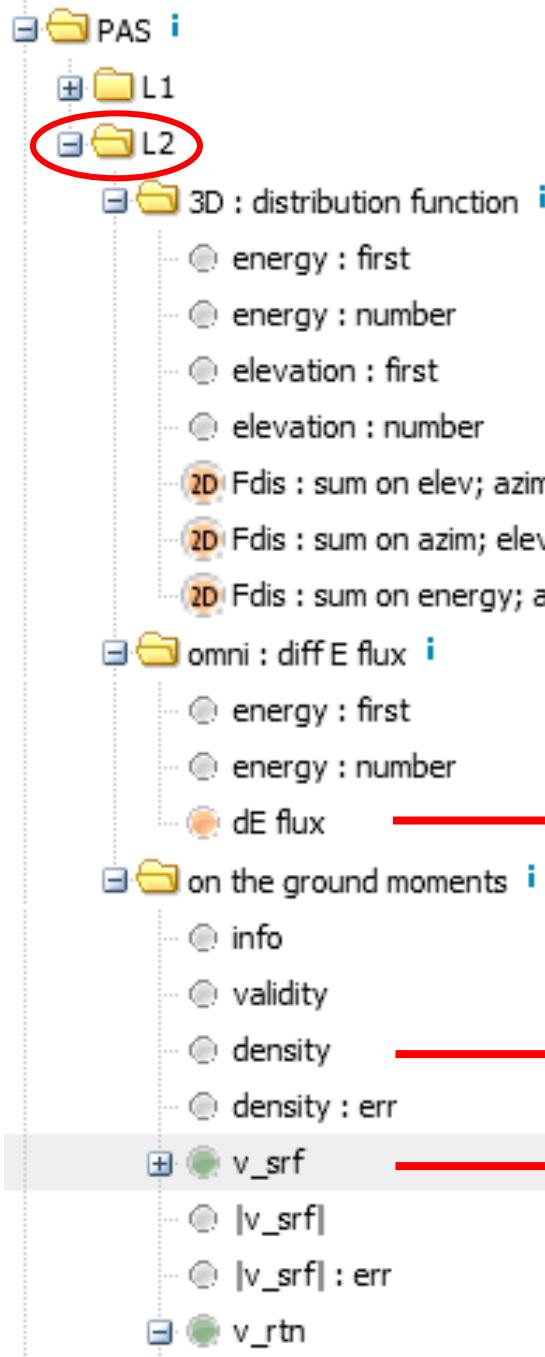


- **Via a browser / nothing to install on your machine**
- **All parameters are time series**
- **Functionalities: plot, down/up-load, combine, search, manage**



Easy access to science quantities





Parameter types

distribution function (see dedicated slides)

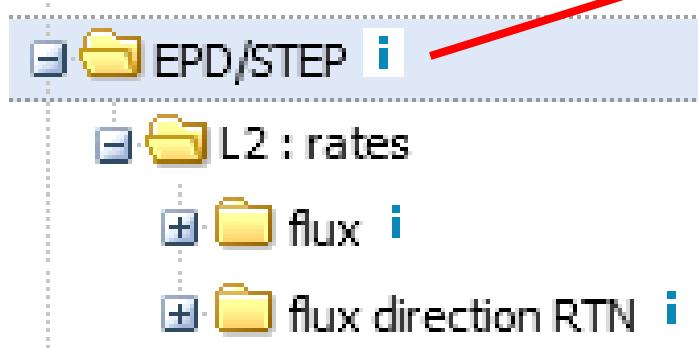
spectrogram (integrated on angleS)

scalar

vector / extend on '+' to access components

Information on instrument

- Help is provided by clicking on the blue **i**
- Information comes from the archives or laboratories which provide the data



EPD/STEP

Energetic Particle Detector / SupraThermal Electrons And Protons

Description

The Energetic Particle Detector (EPD) is an instrument suite comprising different sensors that have been designed to measure the spectra, composition, time variations, and directional distributions of energetic particles. These measurements will be performed over a partly overlapping energy range encompassing a few keV to 450 MeV/n, with sufficient time, energy, angular, and mass resolution to achieve the mission science goals. The EPD consists of the following units :

- SupraThermal Electrons and Protons (STEP).

Designed to measure protons and electrons at supra-thermal energies (between 2 and 80 keV). It employs two co-aligned sensor heads with a parallel field of view. One of the sensor heads contains a permanent magnet that deflects electrons out of the nominal field of view, this is referred to as magnet channel and measures all types of particles except electrons. The other head measures every particle in the energy range including electrons and is called integral channel. Each head contains a solid state detector divided in several pixels to achieve angular resolution. For each channel there are 15 pixels distributed in 3 rows and 5 columns, plus a separate pixel for measuring background.

Information links

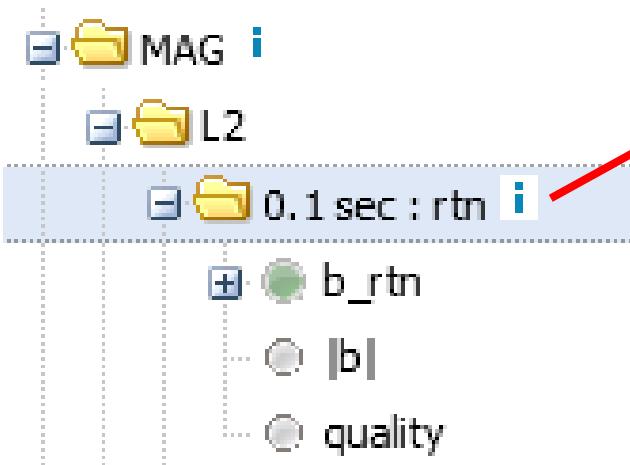
[Instrument Description](#)

Contacts

Principal Investigator: Dr. Javier Rodrigues-Pacheco
fsrodriguez@uah.es - Space Research Group, Universidad de Alcalá

Information on dataset

- Help is provided by clicking on the blue **i**
- Information comes from the archives or laboratories which provide the data



0.1 sec : rtn

Magnetic Field In RTN : 0.1 Sec

Last Updated
2021-03-02T04:21:24Z

Description
Publication quality. Take note of Quality Flag and refer to SOL-MAG-DPDD for exceptions (see SolO Archive Support Data)

Information links
[SolO home page at Imperial College](#)
[SolO Archive Support Data](#)

Caveats
Flag setting:

- 0: Bad data;
- 1: Known problems use at your own risk;
- 2: Survey data, possibly not publication quality;
- 3: Good for publication subject to PI approval;
- 4: Excellent data which has received special treatment; refer SOL-MAG-DPDD for more information on how these flags are generated."

Temporal description
Time range: 2020/04/15 00:00:00 — 2020/12/31 23:59:59
Sampling: 0.1s

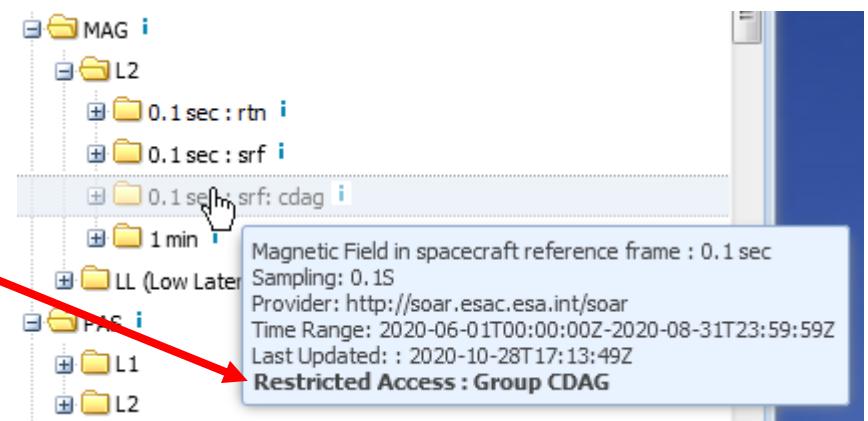
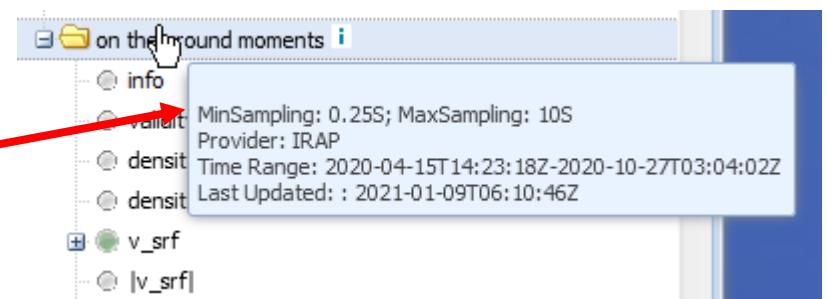
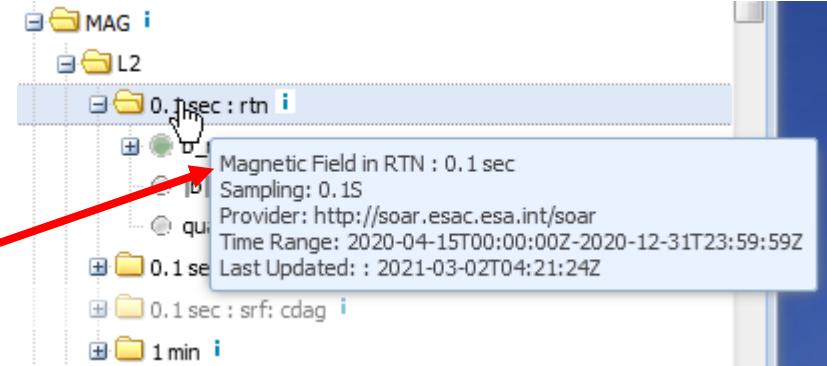
Provider
Name: <http://soar.esac.esa.int/soar>
Resource name:
MAG-RTN-NORMAL

Acknowledgement
Solar Orbiter magnetometer data was provided by Imperial College London and supported by the UK Space Agency

Contacts
Principal Investigator: Dr. Timothy S. Horbury
t.horbury@imperial.ac.uk - Imperial College, UK

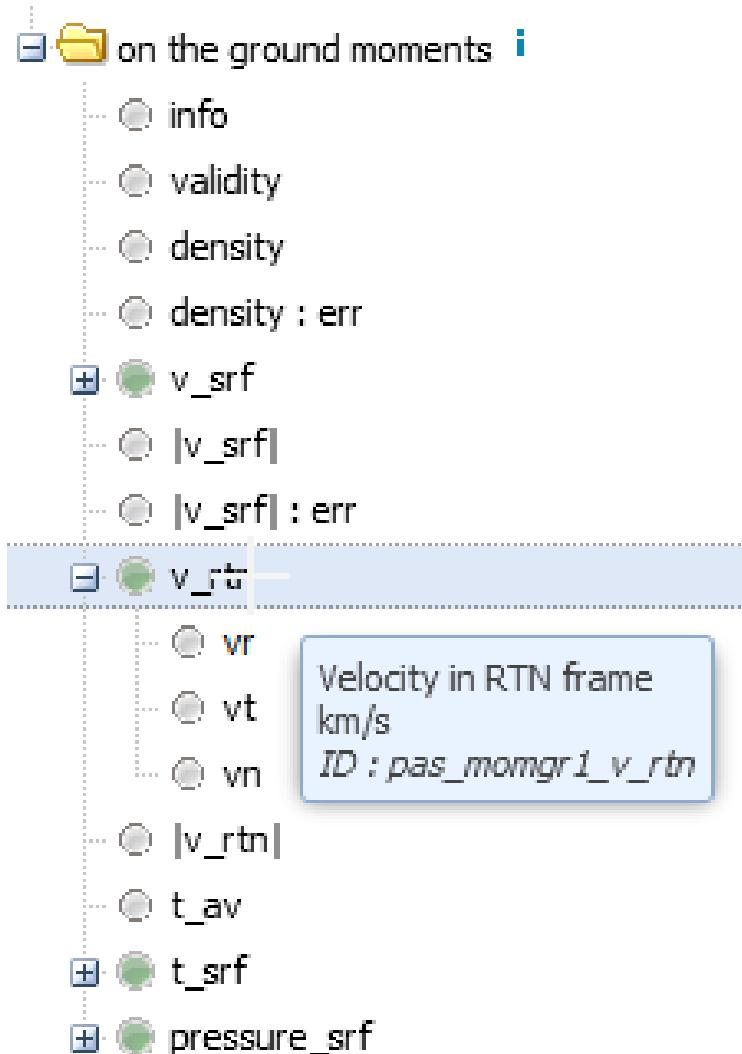
Information on datasets

- Provided in tool tips / info bubbles
- Shown « on mouse over »
- Information
 - Description
 - Sampling: single value or min/max
 - Provider: SOAR, IRAP, ...
 - Time range
 - Last update by AMDA
 - Restriction to a group of users (grayed directories)



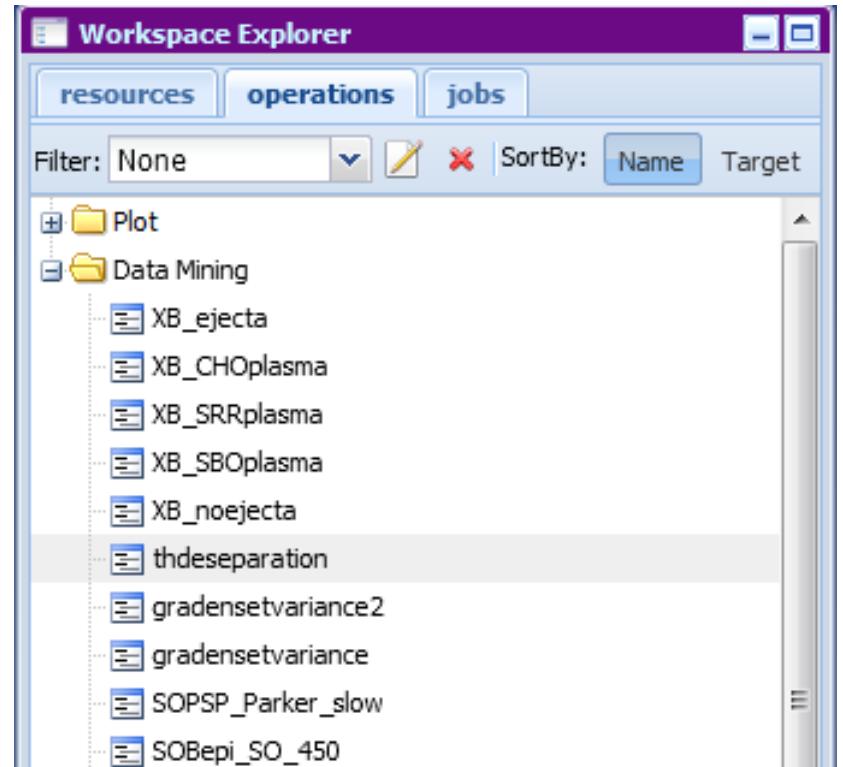
Information on parameters

- Provided in tool tips / info bubbles
- Shown « on mouse over »
- Information
 - Description
 - Unit
 - AMDA ID
 - Useful to edit derived parameters
 - Useful for the Python API



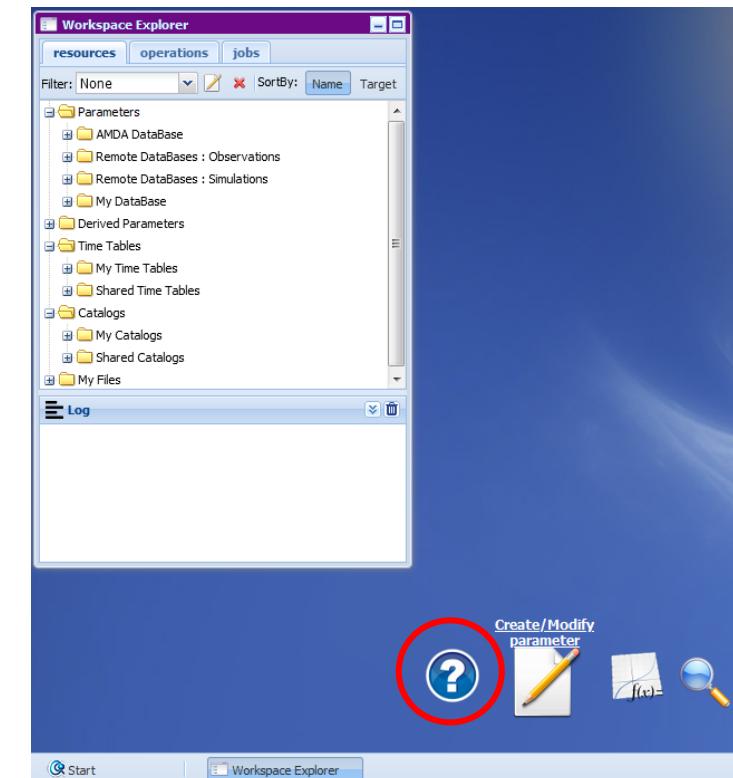
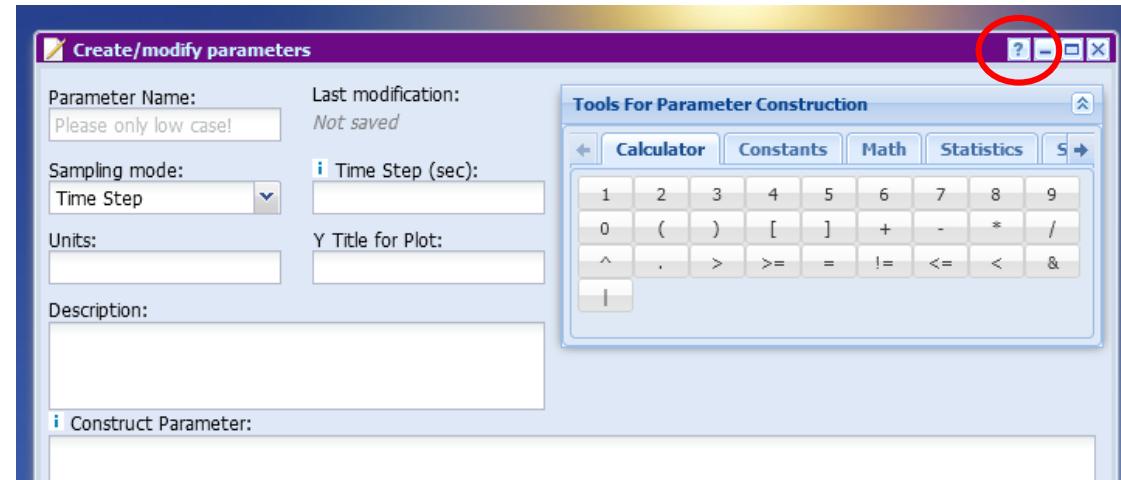
Saving requests for future use

- It is a functionality useful for registered user (for the public access the session is limited)
- ‘Plot request’ and ‘Data mining request’ can be saved on the corresponding window
- They’re all gathered in the ‘operations’ tab of the Workspace Explorer
- Double clicks on the name to retrieve the corresponding window and its settings



Getting help

- Blue **i**
- ? on all windows / upper right corner
- General help
- amda@irap.omp.eu



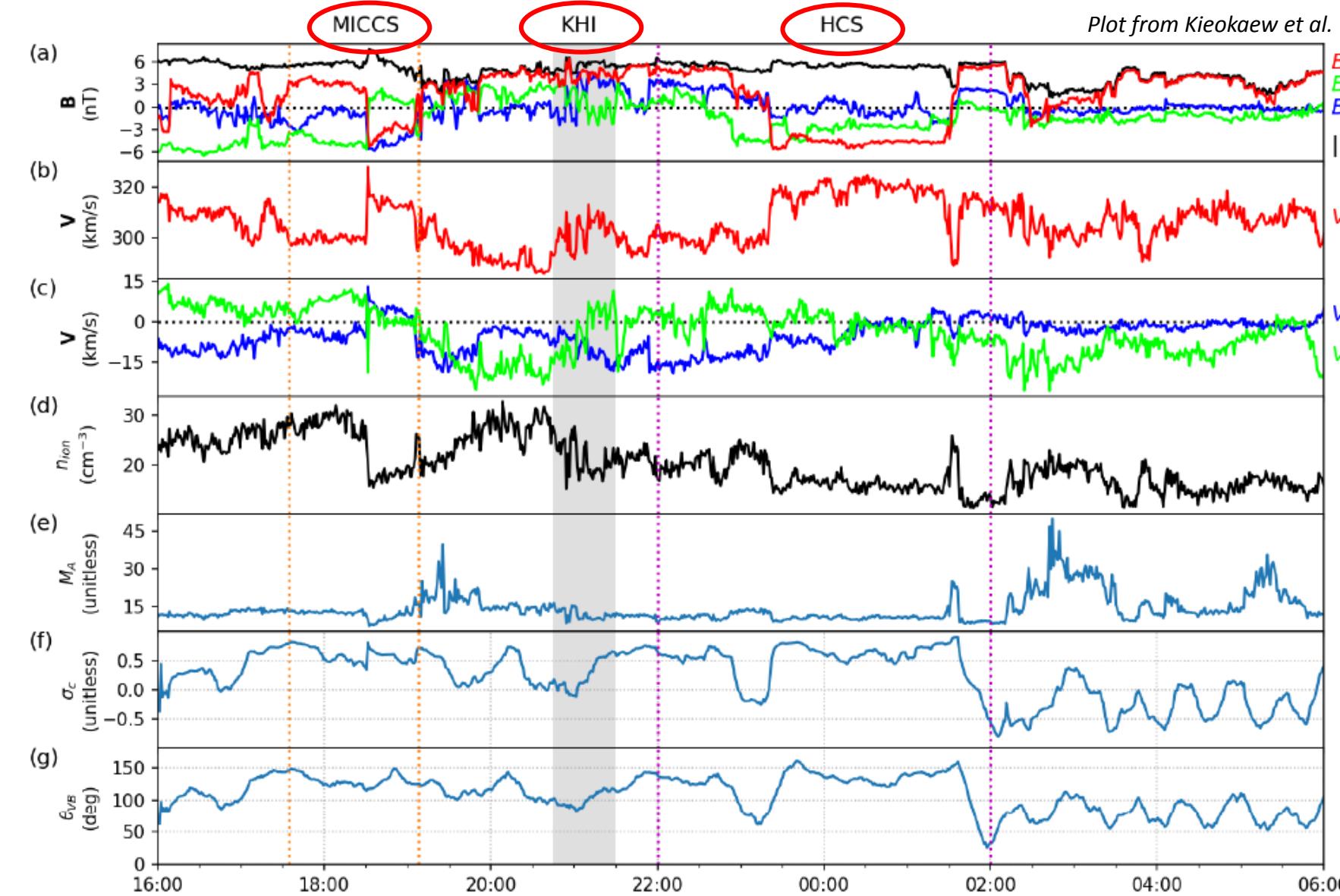
AMDA GUI

AMDA use case #1

AMDA use case #1

- Objectives:
 - Plotting Solar Orbiter data
 - Combining data
 - Downloading data
- Based on : *Kieokaew et al.*, submitted to A&A for the Solar Orbiter special issue
- Time period:
 - 23/07/2020 16:00 – 24/07/2020 06:00

3 interesting events in 14h / slide A



KHI : Kelvin Helmholtz Instability

MICCS : Magnetic Increases with Central Current Sheets

See <https://doi.org/10.1051/0004-6361/202039191>

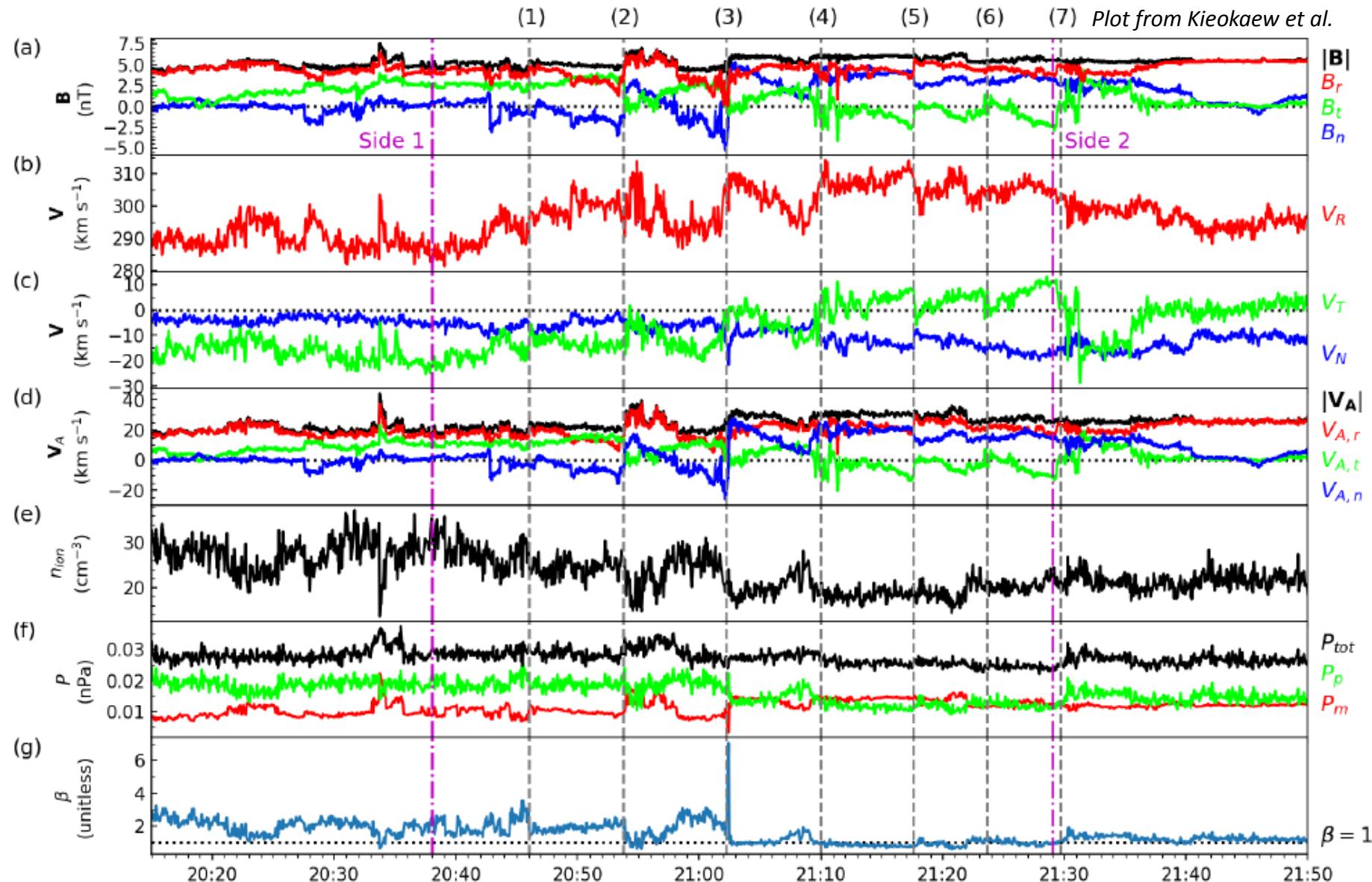
HCS : Heliospheric Current Sheet

See <https://doi.org/10.3847/2041-8213/ab8d2d>

Cross-helicity

Angle (B,V)

Focus on the KHI event / slide B

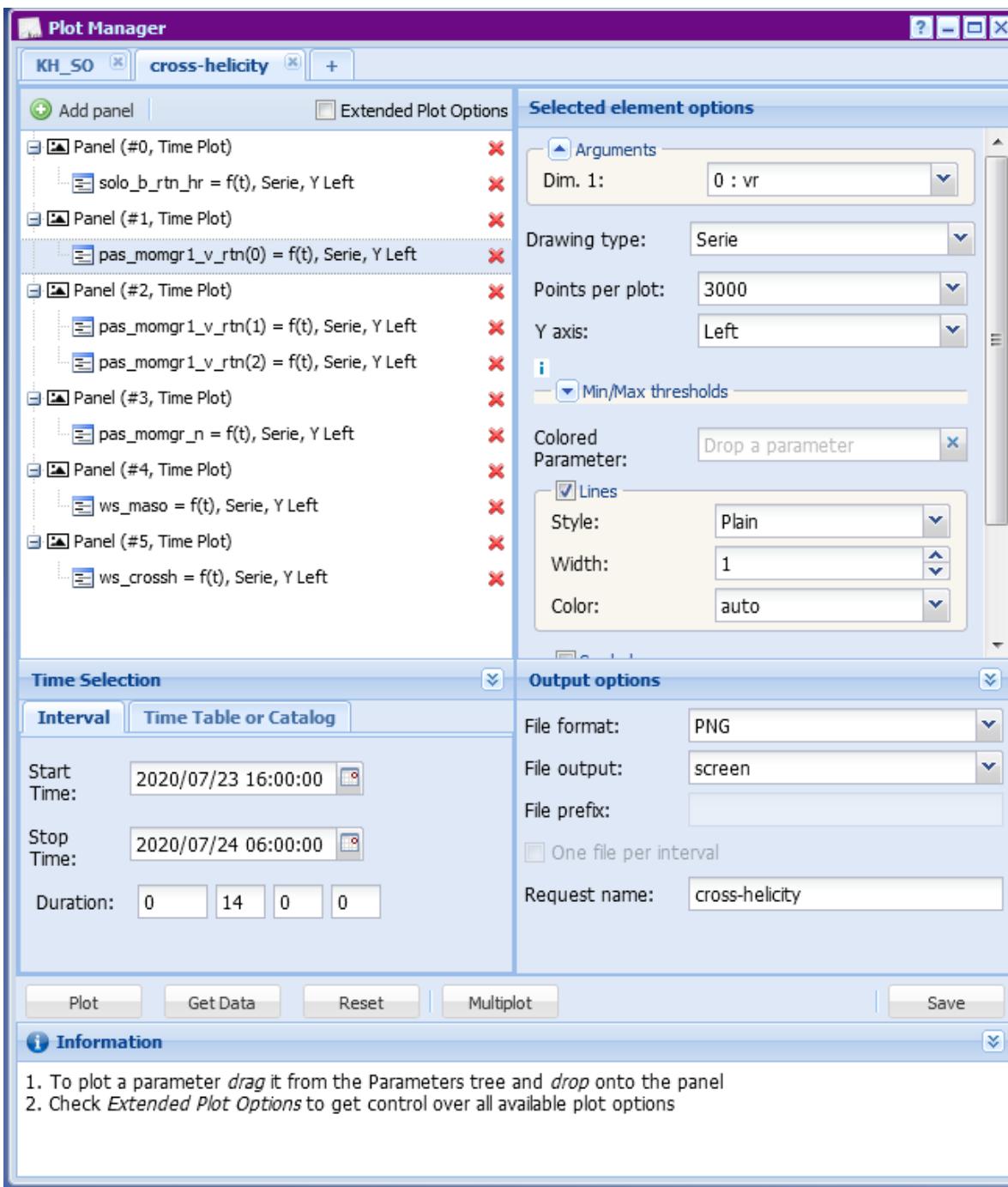


Alfvén velocity

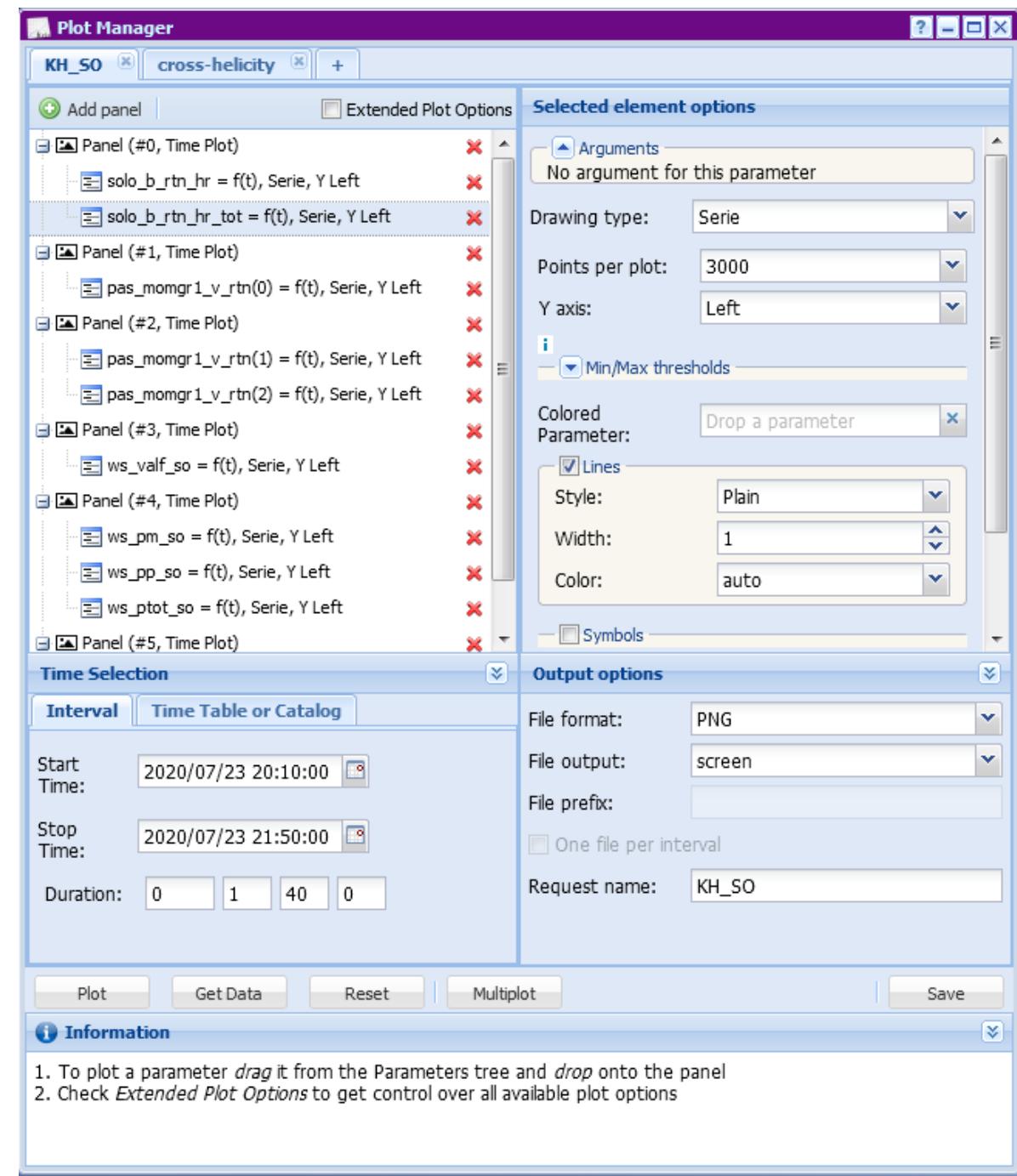
Pressure terms

Beta

Slide A



Slide B



Delta_b

Create/modify parameters

Parameter Name: `deltabso` Last modification: `2021-03-23T08:44:41`

Sampling mode: Time Step (sec): 4

Units: km/s Y Title for Plot: `deltab`

Description: `B-_20min in unit of V (dividing B by sqrt(mu_0*N))`

Tools For Parameter Construction

Calculator Constants Math Statistics S

mean_sm_() rms_sm_() min_sm_() max_sm_() var_sm_()
skew_sm_() smooth_()

Statistics Statistics/Sliding

Construct Parameter:
`(solo_b_rtn_hr/sqrt(@mu_0*pas_momgr_n*1e6*m_p)-mean_sm_(solo_b_rtn_hr
/sqrt(@mu_0*pas_momgr_n*1e6*m_p),1200))*1e-12`

Delta_v

Create/modify parameters

Parameter Name: `deltavso` Last modification: `2021-03-23T08:43:41`

Sampling mode: Time Step (sec): 4

Units: km/s Y Title for Plot: `deltav`

Description: `V-<V>_20min`

Tools For Parameter Construction

Calculator Constants Math Statistics S

mean_sm_() rms_sm_() min_sm_() max_sm_() var_sm_()
skew_sm_() smooth_()

Statistics Statistics/Sliding

Construct Parameter:
`pas_momgr1_v_rtn-mean_sm_(pas_momgr1_v_rtn,1200)`

Angle (B,V)

Create/modify parameters

Parameter Name: `thetabvso` Last modification: `2021-03-22T11:52:33`

Sampling mode: Time Step (sec): 4

Units: deg Y Title for Plot: `theta_BV`

Description: undefined

Tools For Parameter Construction

Calculator Constants Math Statistics S

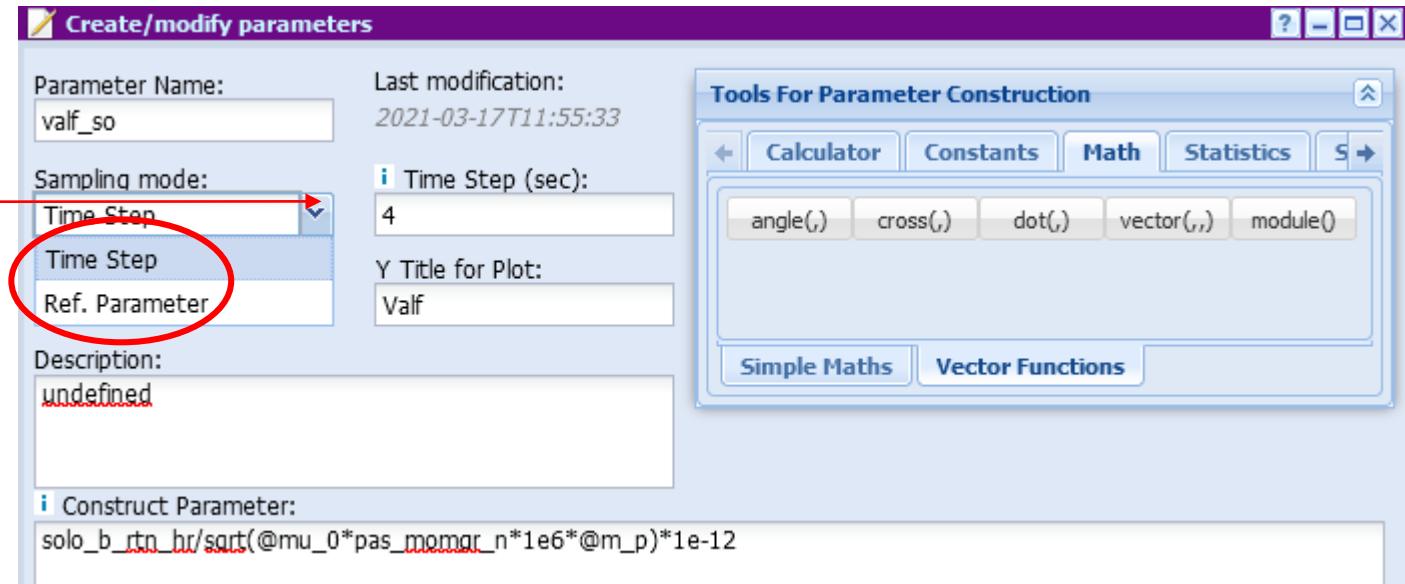
angle() cross() dot() vector(,) module()

Simple Maths Vector Functions

Construct Parameter:
`acos(dot(solo_b_rtn_hr,pas_momgr1_v_rtn)/module(solo_b_rtn_hr)/module(pas_momgr1_v_rtn))*@rad2deg`

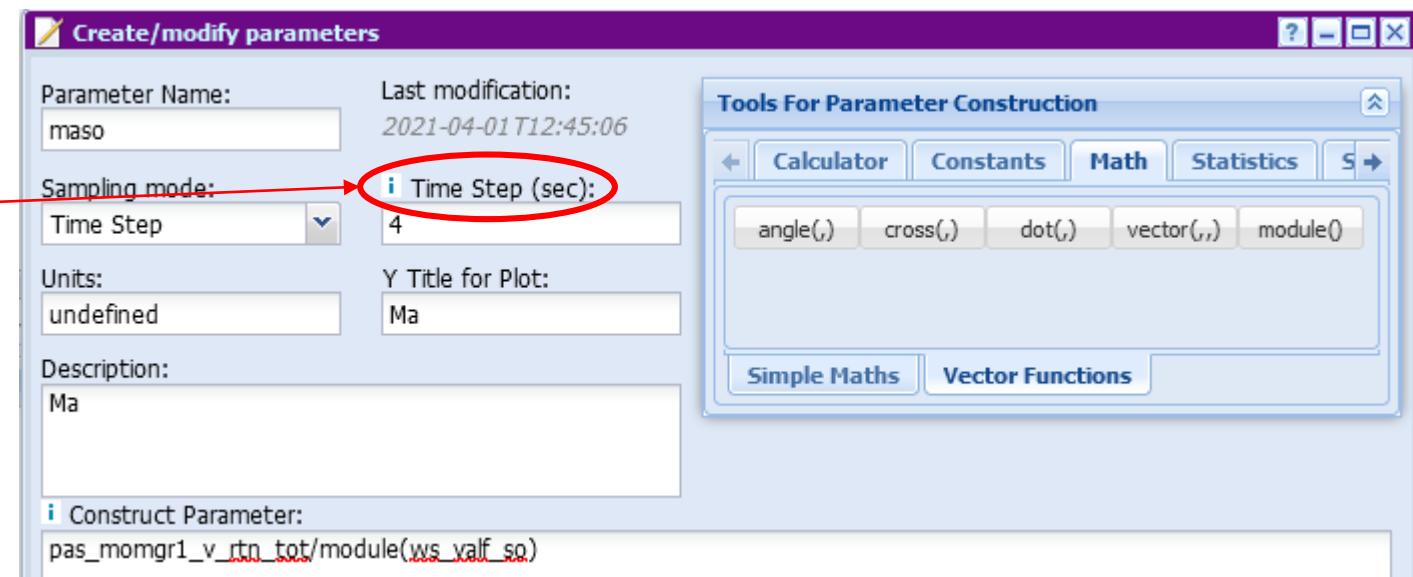
Depending on original samplings, AMDA parameters used in the expression will be averaged or interpolated to create new parameter with the requested time resolution

Time Step
or **Reference Parameter**
can be used



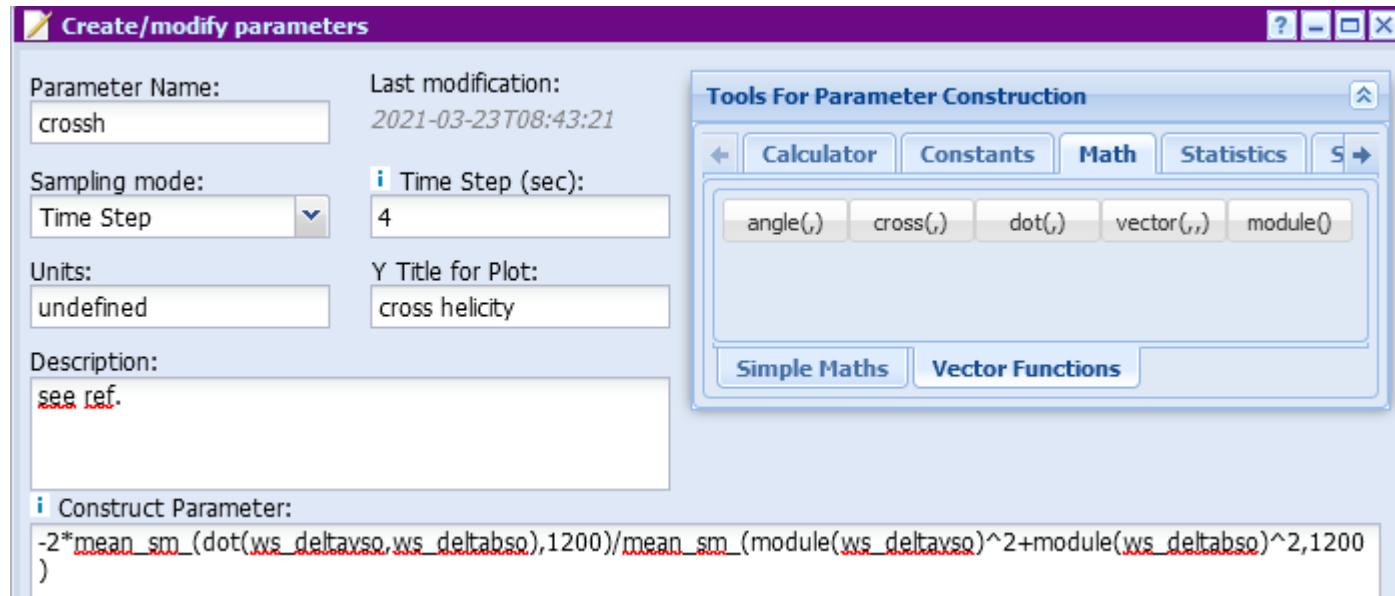
Alfvén velocity

Time Step
All AMDA parameters used in your
expression are resampled
(averaged/interpolated) with this
time step before calculations.



Ma

Cross-helicity: a proxy for the Alfvénicity



- *Matthaeus and Goldstein, 1982*
- *Roberts et al., 1992*
- *Stansby et al., 2019*

$$\sigma_c = 2 \frac{\langle \mathbf{v} \cdot \mathbf{b} \rangle}{\langle |\mathbf{v}|^2 + |\mathbf{b}|^2 \rangle}$$

$v=V-\langle V \rangle$: deltavso (km/s)

$b=B/\sqrt{\mu_0 N}-\langle B/\sqrt{\mu_0 N} \rangle$: deltabso (km/s)

$\langle \rangle$: local average over 20 min. In AMDA use the sliding / boxcar average *mean_sm_*

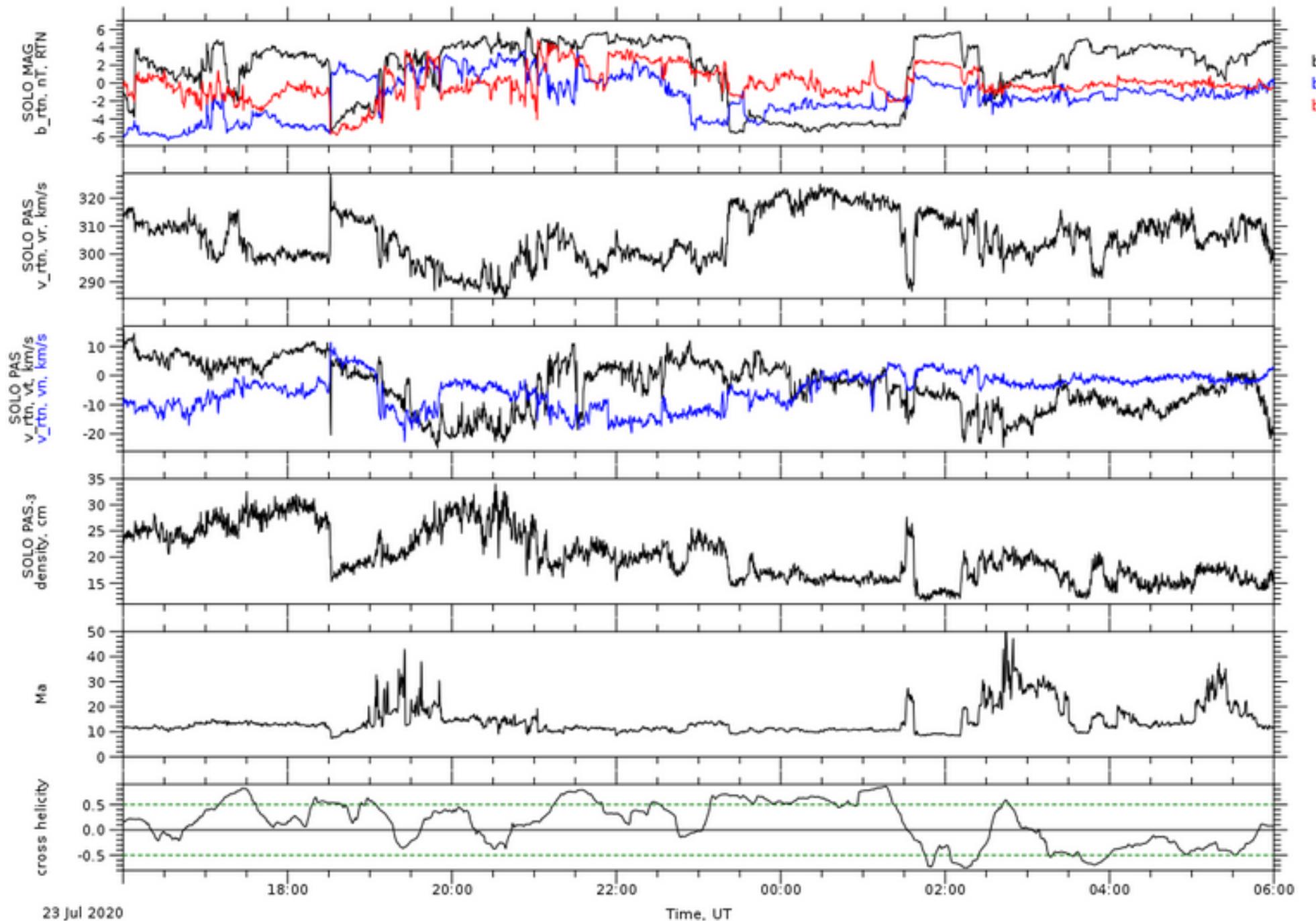
AMDA plot

14h

(same as slide A
without theta_BV)

Ma

Cross helicity



AMDA plot

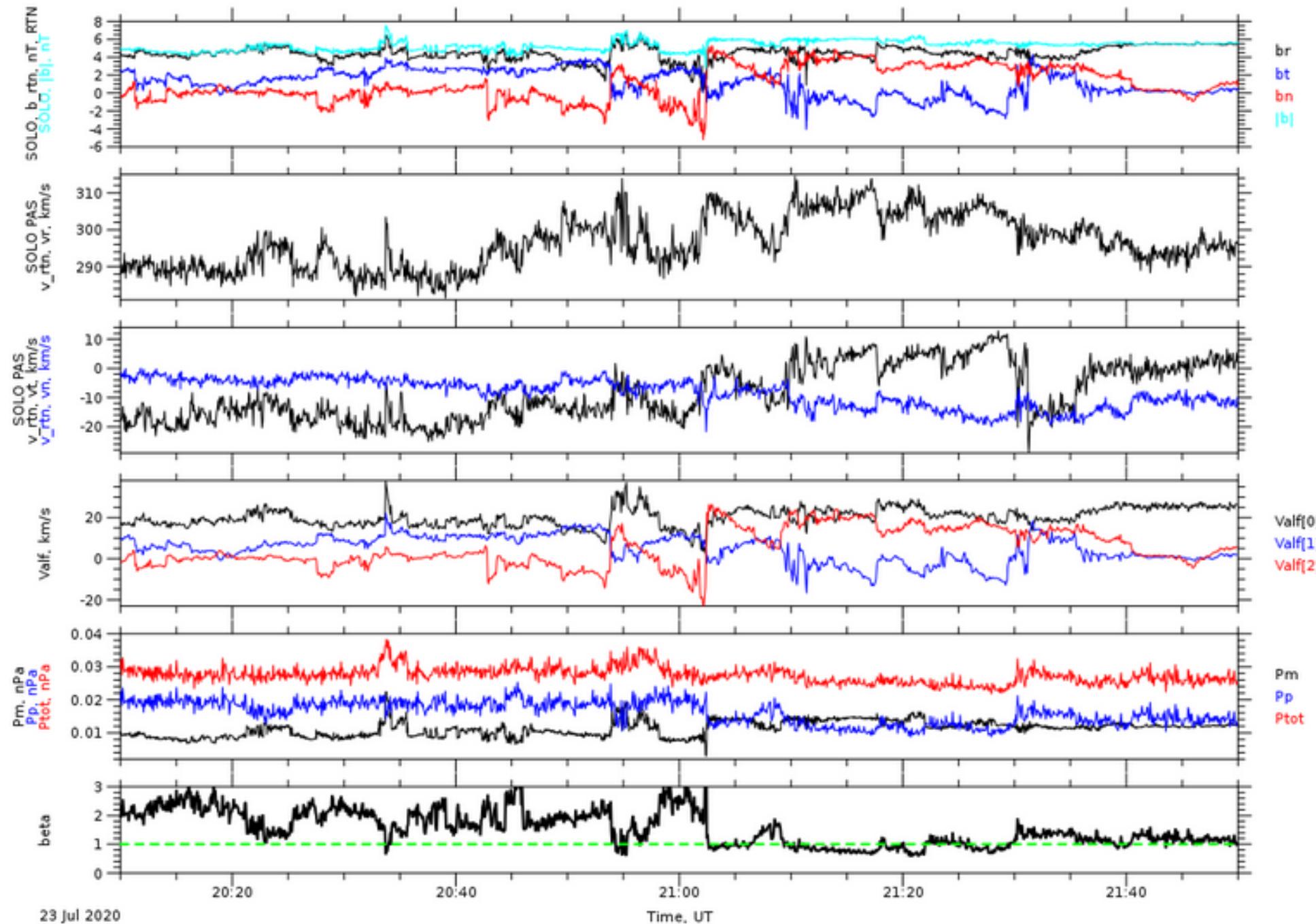
Focus on the KHI event

(same as slide B without the density)

Alfvén velocity

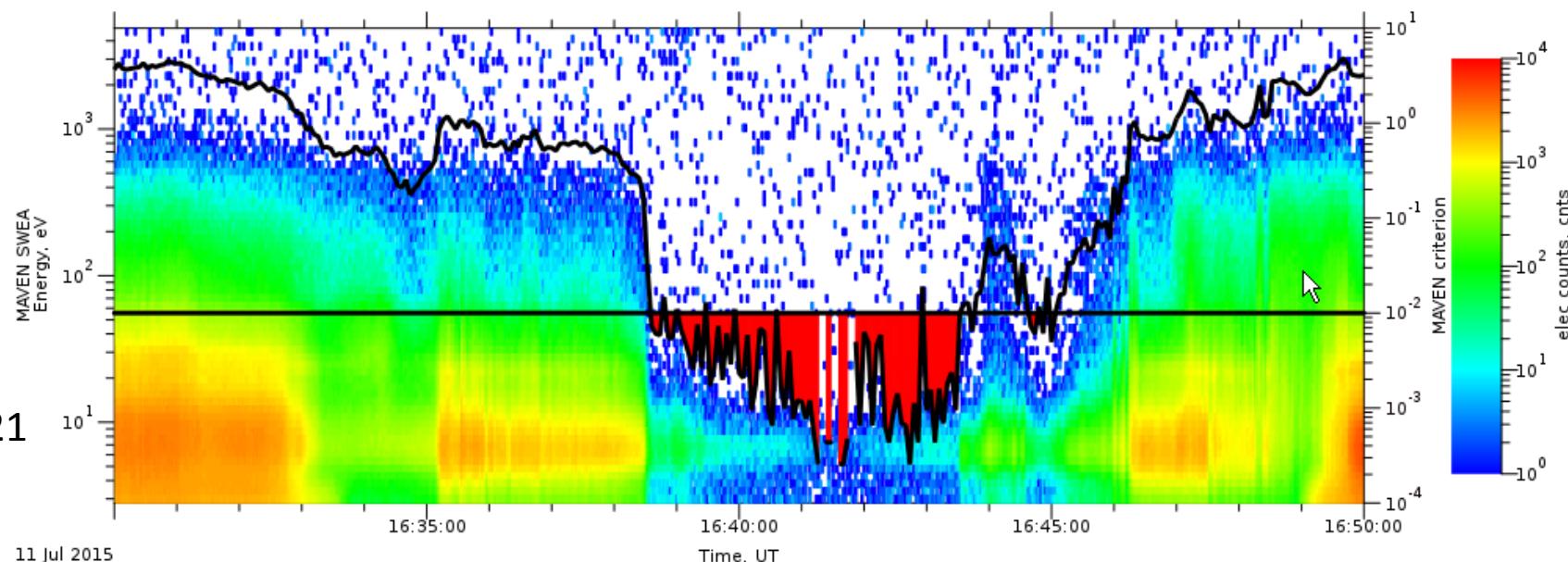
Pressure terms

Beta



Some tips

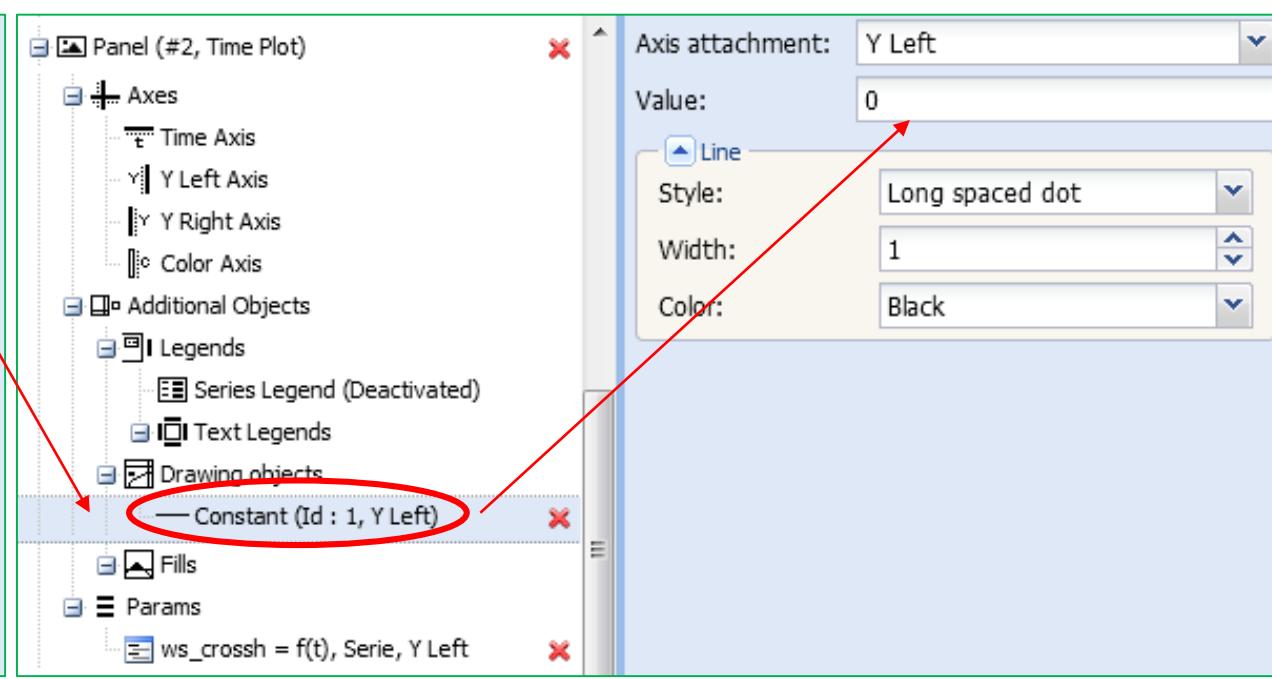
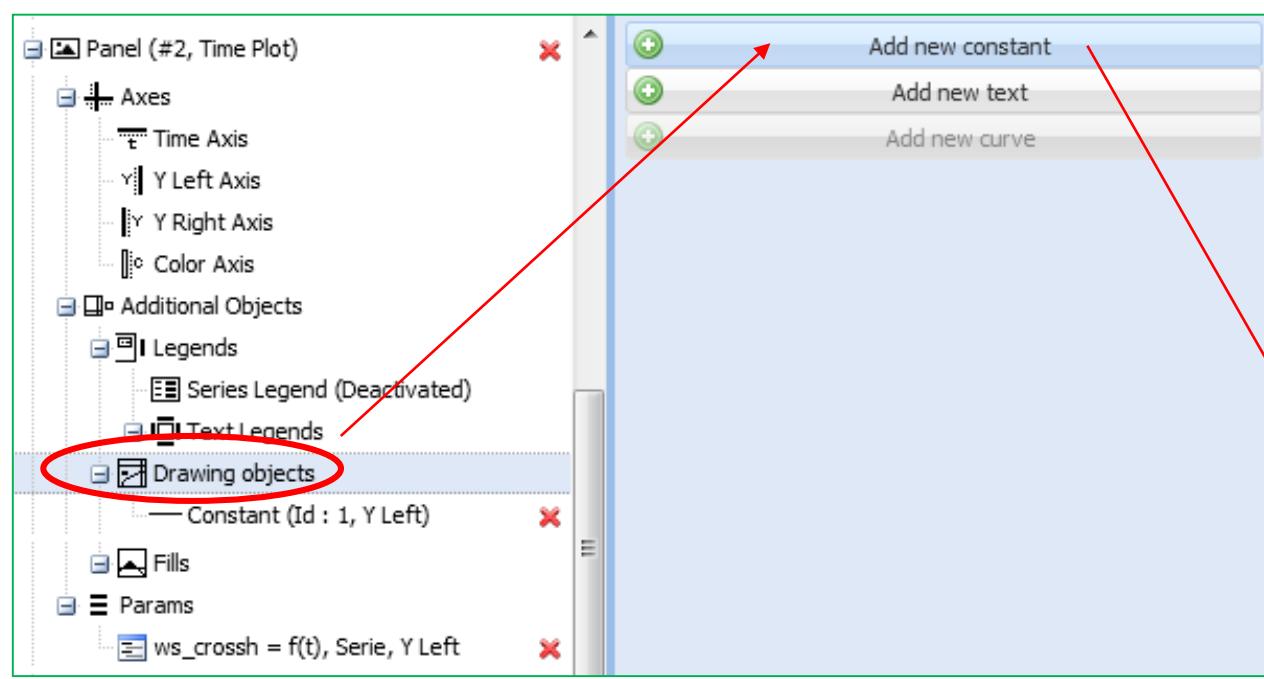
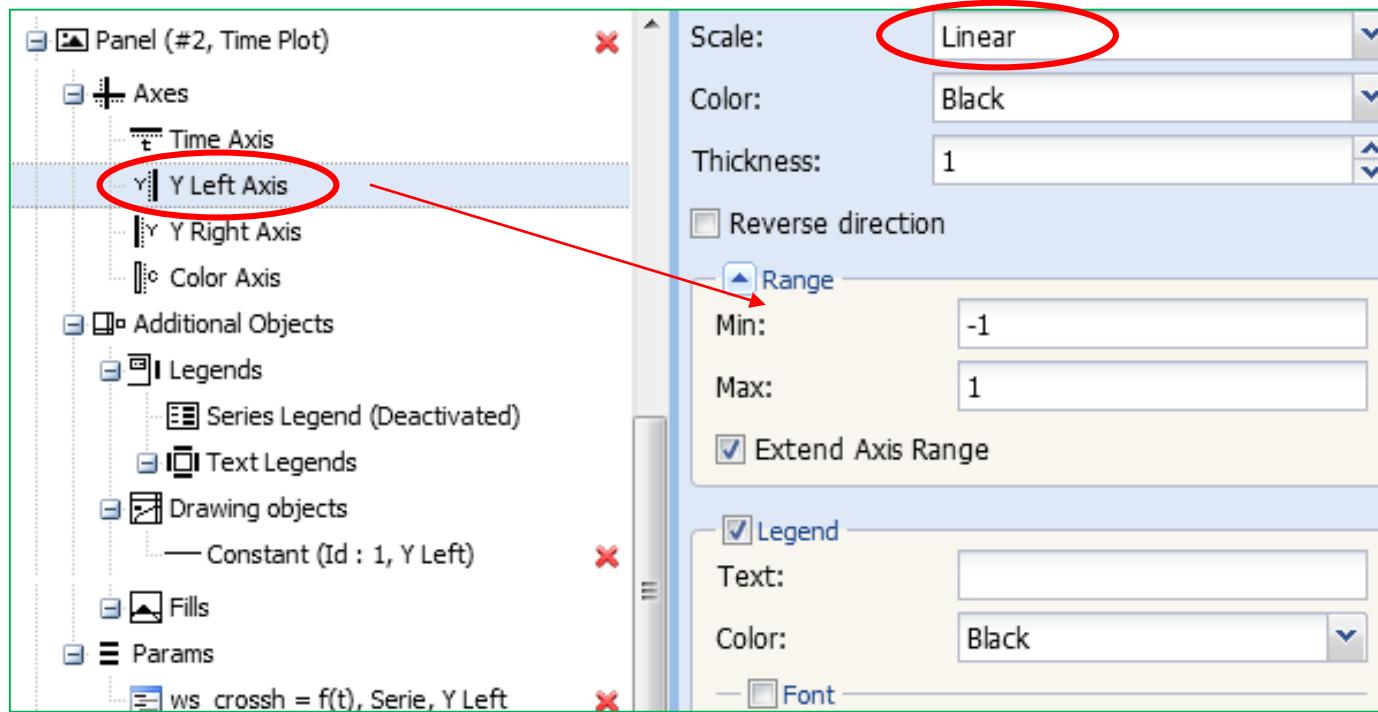
- Click on *Extended Plot Options* to access more options
 - Ranges on the axis (next slide)
 - Add a constant (next slide)
 - Color a part of the plot between 2 curves/constant (see below)



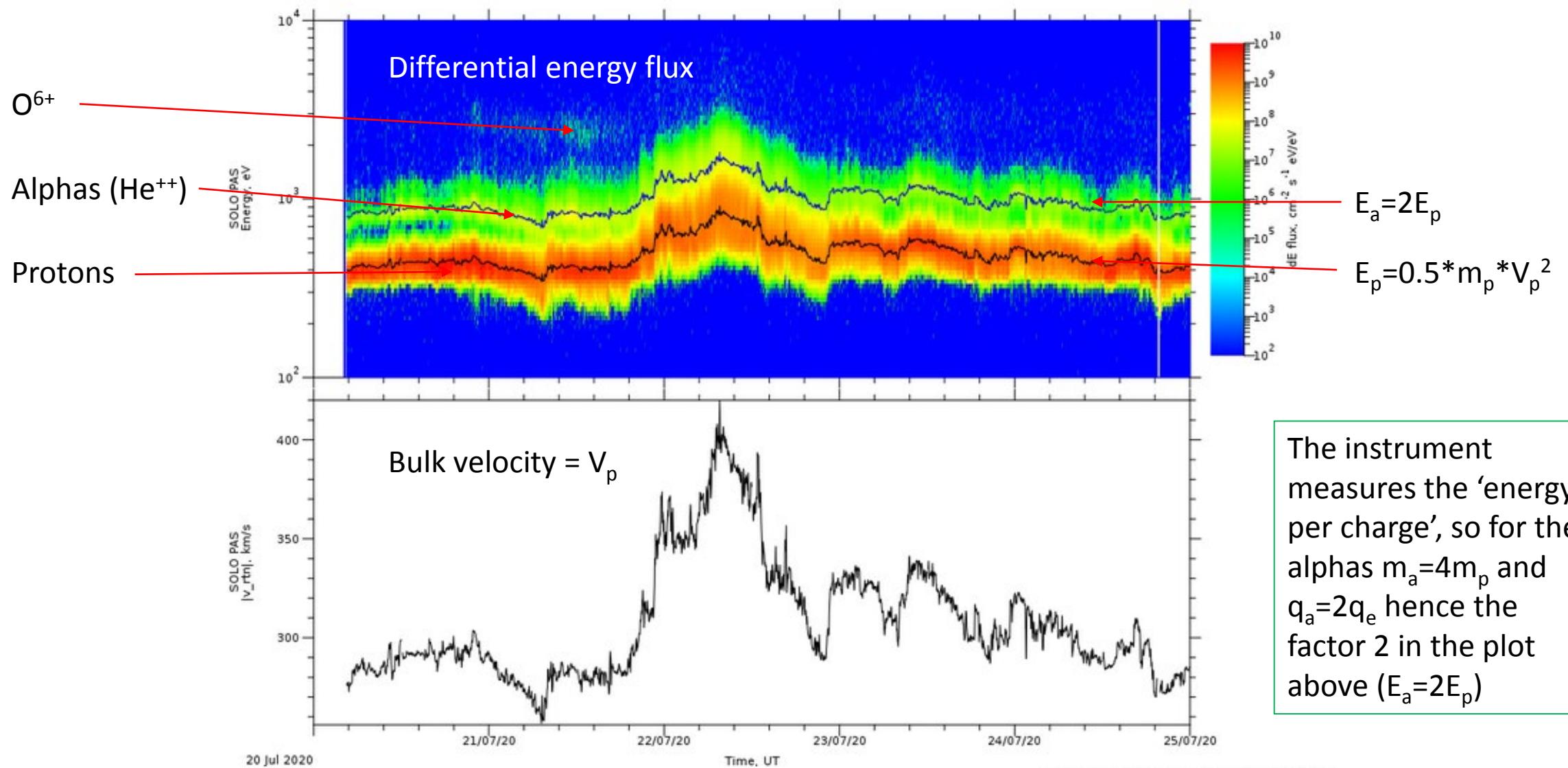
Electron depletions at Mars seen by
MAVEN (figure 10 from Génot et al., 2021
in press)

Extended Plot Options

Setting the
Y axis range



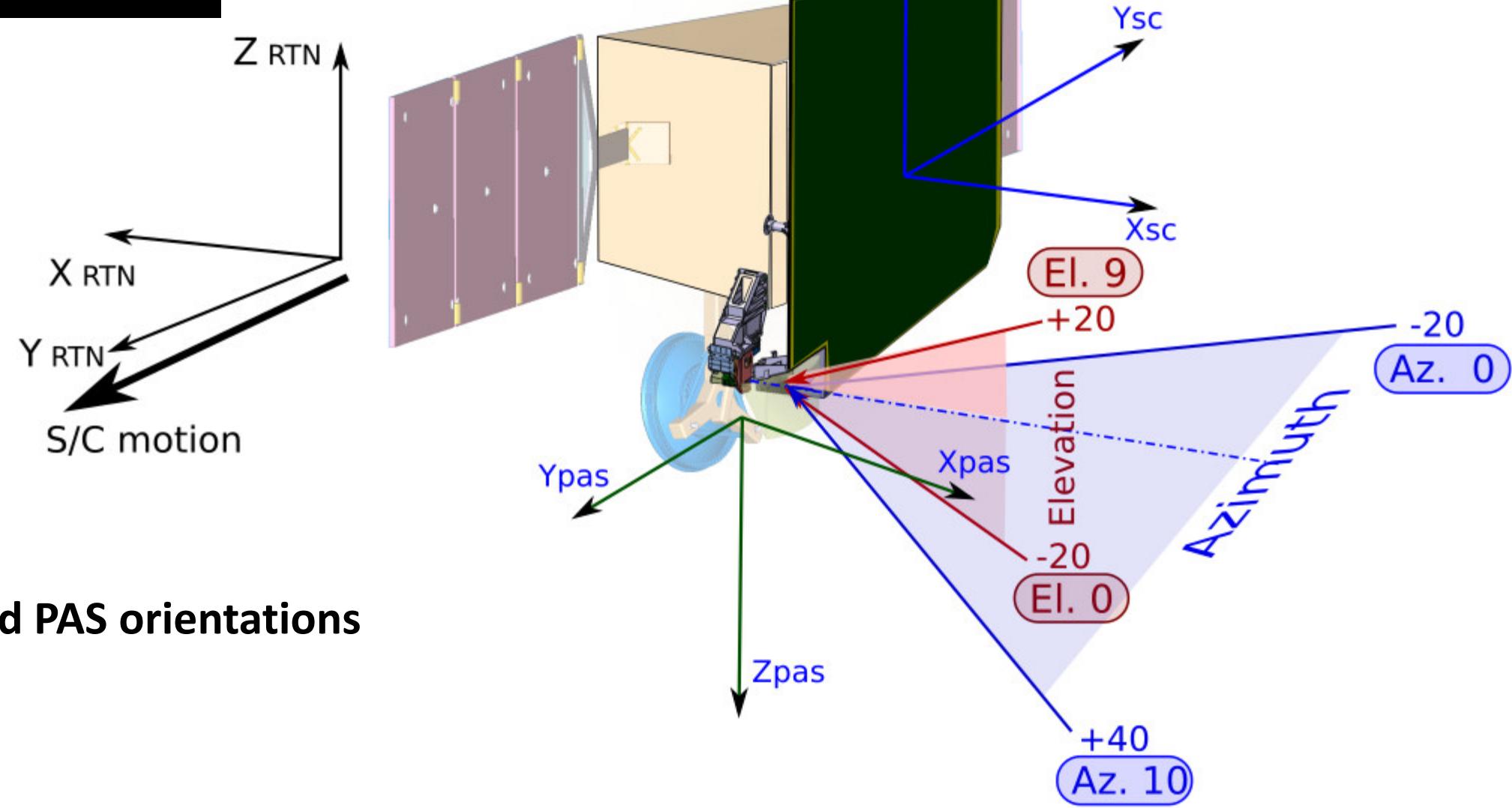
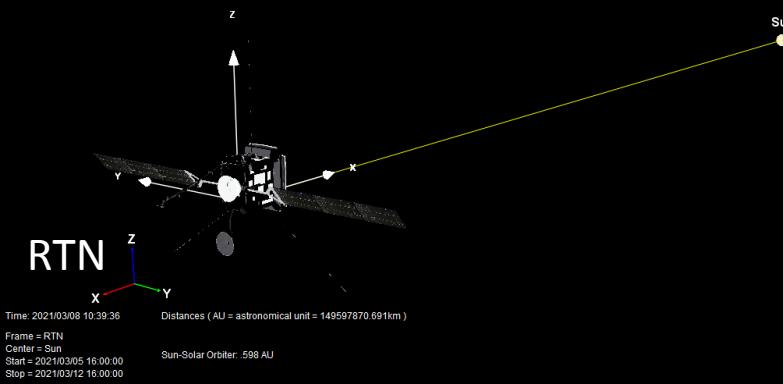
Last minute addition following P. Louarn's presentation on PAS



AMDA use case #2

AMDA use case #2

- Objectives:
 - Plotting PAS distribution functions as times series
 - Getting instant cuts
- Time period:
 - 23/07/2020 16:00 – 24/07/2020 06:00



Solar Orbiter and PAS orientations

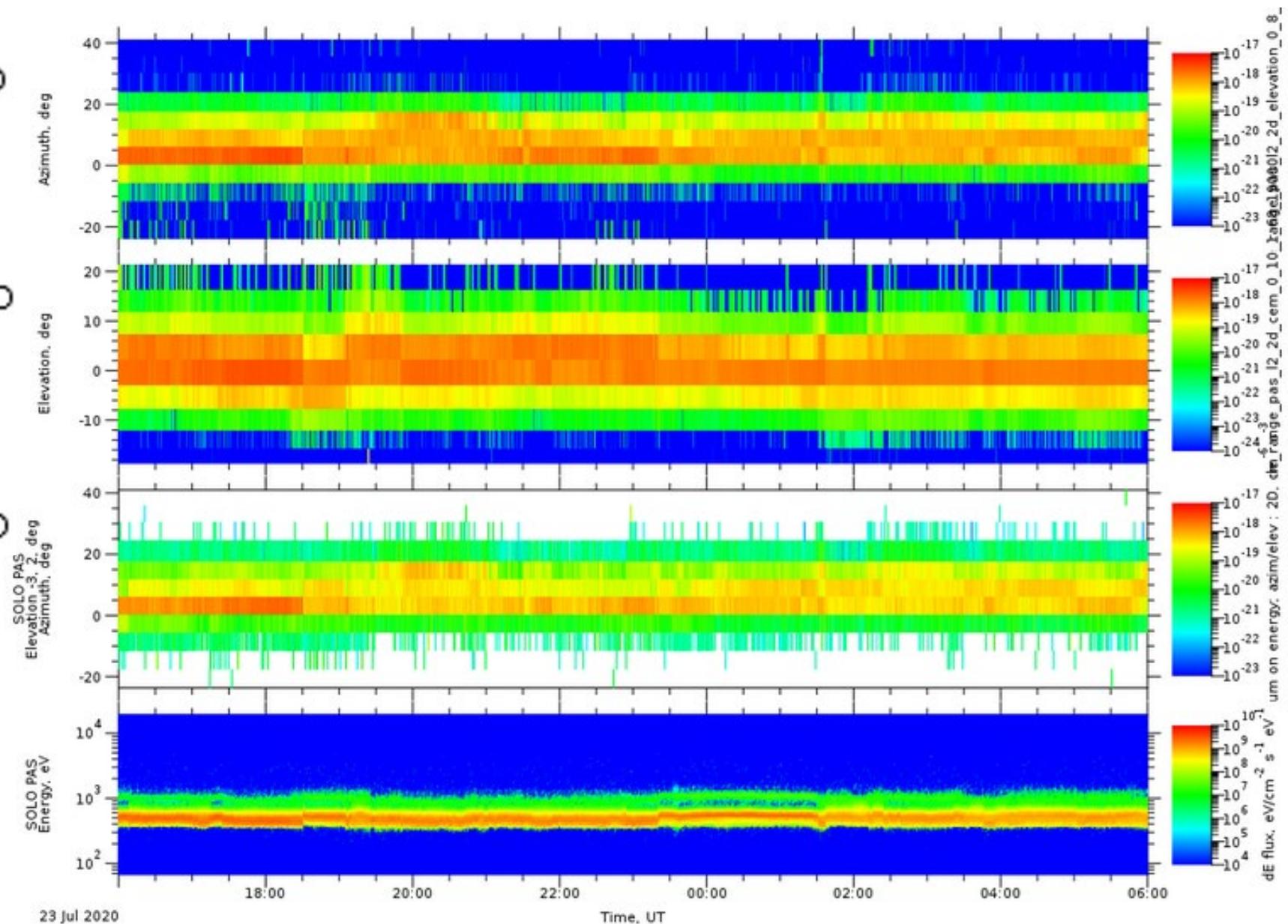
Courtesy A. Fedorov

2D Fdis : sum on elev; azim/energy : 2D

2D Fdis : sum on azim; elev/energy : 2D

2D Fdis : sum on energy; azim/elev : 2D

OMNI diff. energy flux



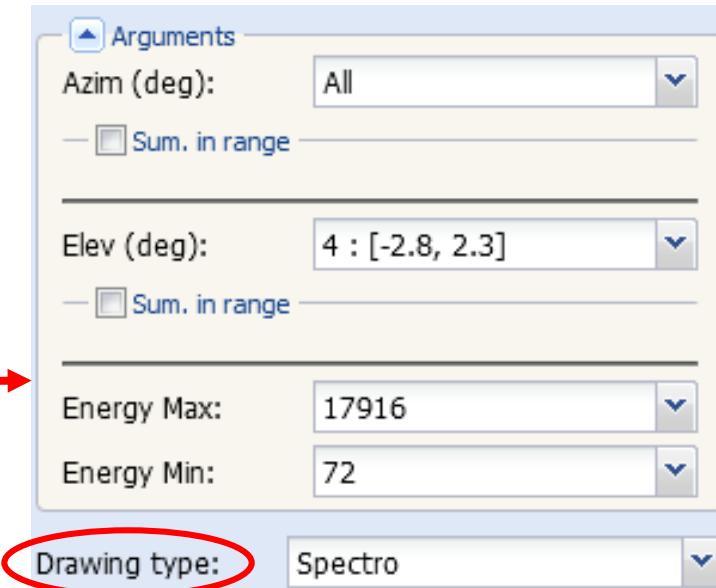
23 Jul 2020

Time, UT

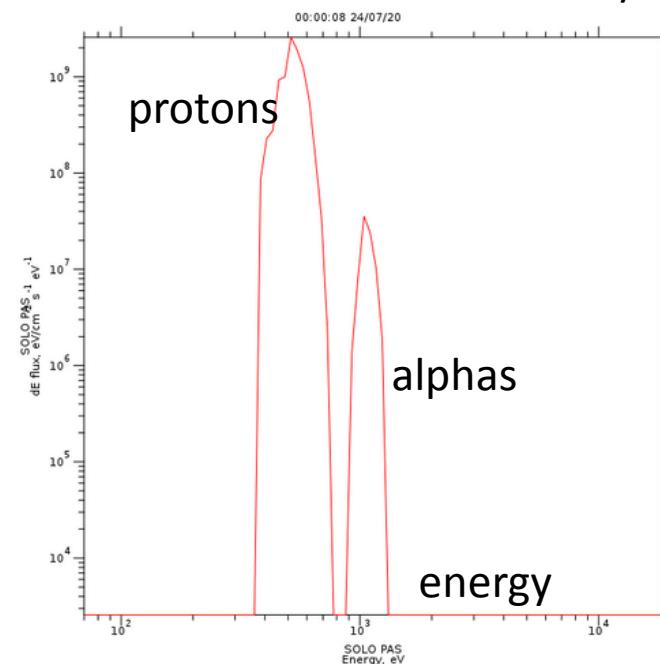
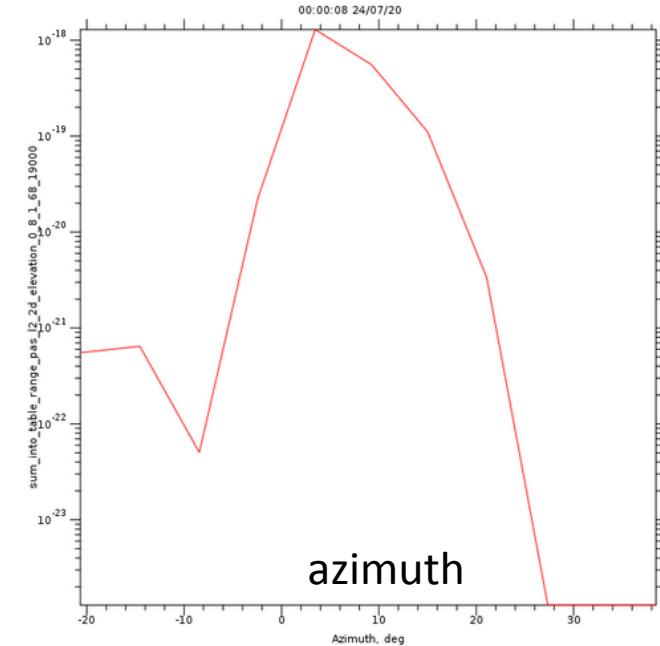
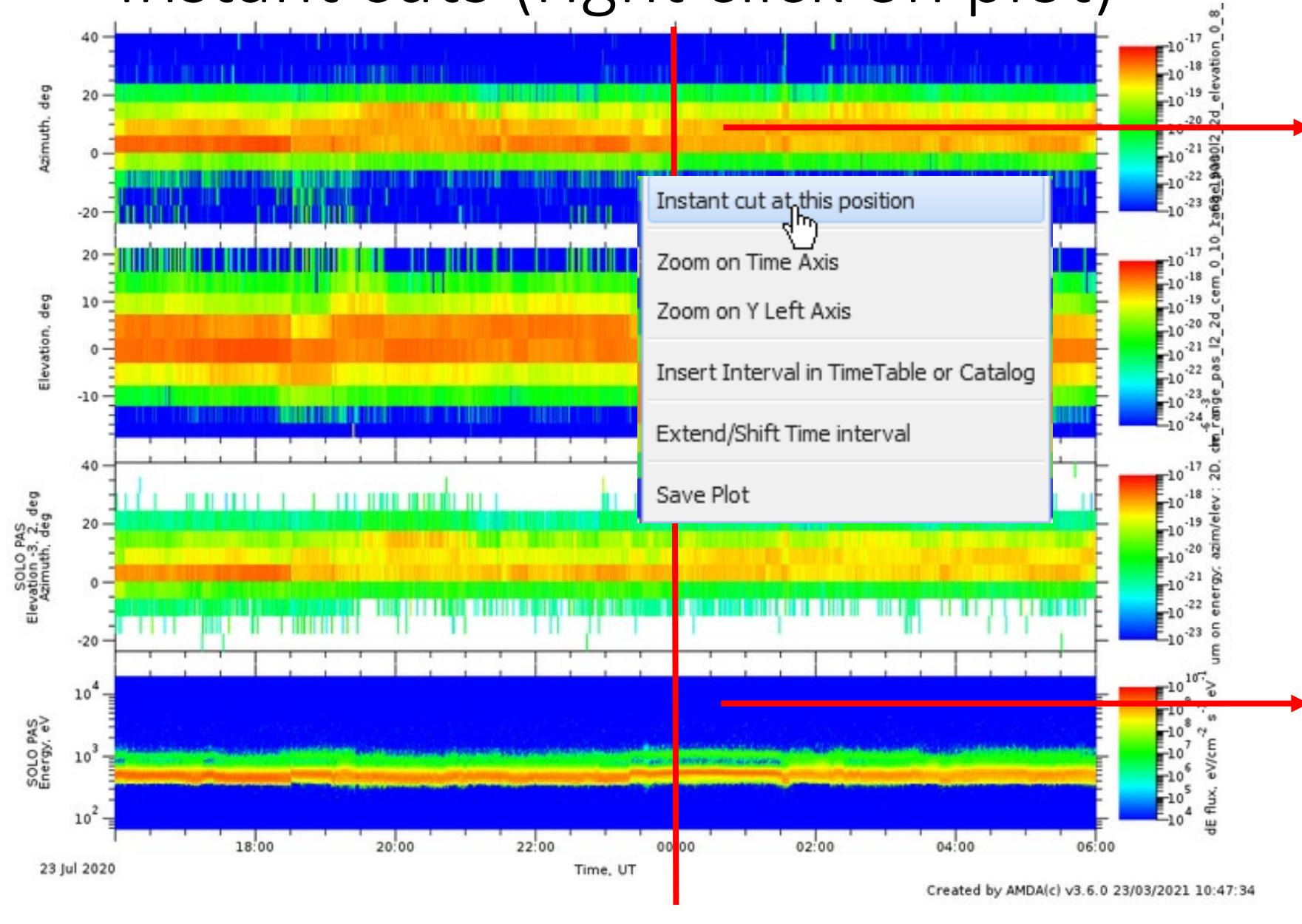
Created by AMDA(c) v3.6.0 23/03/2021 10:47:34

PAS distribution functions

- $\text{Fdis} = \text{array} [\text{elevation}, \text{azimuth}, \text{energy}]$
- AMDA shows Fdis summed on one dimension
 - $\text{Fdis} : \text{sum on elev; azim/energy : 2D}$
 - $\text{Fdis} : \text{sum on azim; elev/energy : 2D}$
 - $\text{Fdis} : \text{sum on energy; azim/elev : 2D}$
- $[\text{elevation}, \text{azimuth}, \text{energy}]$ ranges can be chosen
- For ex. the 3rd plot is obtained from this setting →
 - *Azim = all* means azimuth is the Y axis
 - *Elev = [-2.8; 2.3]* is the chosen elevation channel
 - *Energy min/max* is the range over which energy is summed
- If Fdis is summed over all dimensions change « Spectro » to « Serie »
- Change *log* to *lin* for angle on the Y axis as needed (not automatic)



Instant cuts (right click on plot)



Notes

- On the summation: it is really a ‘sum’ of f (phase space density) not a proper integration that must take into account energy bands and solid angle sectors
 - The unit therefore remains ‘ $\text{cm}^{-6} \text{ s}^3$ ’ (or ‘ $\text{s}^3 \text{ m}^{-6}$ ’)
- On OMNI differential energy flux
 - The unit is ‘ $\text{eV}/(\text{cm}^2 \text{ s eV})$ ’
 - For a typical plasma instrument this quantity is directly proportional to its count rate
- See <http://www.issibern.ch/forads/sr-007-01.pdf> for a quick recap on these different quantities
- On instant cuts: they are provided as they are; there is no option to parameterize the plots (size, color, range, ...) or download the data directly

AMDA use case #3

AMDA use case #3

- Objectives:
 - Find orbital conjunctions between Solar Orbiter, BepiColombo and PSP
 - Construct and manage a catalogue of events
- Based on the work done for the BepiCoordObs group
 - See *Hadid et al.*, in preparation for *Frontiers in Astronomy & Space Sciences*



Magnetic footprints

- “Magnetic alignments” between 2 or more bodies, i.e. when the footprints of Parker field lines passing through the bodies are in a latitude/longitude neighborhood at the source surface of the Sun
- The longitude of the footpoint Φ_s is given by

$$\phi_s = \phi(r) + \Omega(r - R_s)/u_{SW}$$

- $\phi(r)$ is the spacecraft heliocentric longitude at distance r
- $\Omega = 2\pi/25.38\text{days}$
- $R_s = 2.5 R_{\text{sun}}$
- u_{SW} is the solar wind velocity
- The latitude is equal to the one of the spacecraft as a Parker field line is inscribed on a cone of constant latitude

Parker alignments between spacecraft

- Use AMDA data mining to determine time intervals when Solar Orbiter and BepiColombo have their magnetic footprints « close enough »
 - For instance $|\Phi_{s_SO} - \Phi_{s_Bepi}| < 3^\circ$
- Time interval: Feb. 2020 - Dec. 2025
- The solar wind velocity is an unknown
 - Start with $u_{SW} = 450 \text{ km/s}$
 - See how time intervals are modified for different velocities

Data mining / conditional search

Data Mining

Request Name: (highlighted by red arrow)

Last modification: Not saved

Sampling mode: Time Step (sec): 3600

Data Gap: if no data for interval: 5

Description:

i Data Mining Condition: ws_delta_phi_so_bepi_450<3

$|\Phi_{s_SO} - \Phi_{s_Bepi}| < 3^\circ$

Tools For Condition Construction

Calculator Constants Math Statistics

Do Search Save Request Reset (highlighted by red circle)

To construct a condition for data mining drag one of the AMDA parameters from the parameter tree and drop onto the panel.

1. Use **FLOAT numbers** in math expressions
2. Enclose your expression in **brackets** - $(1./2.*imf(0)) > 0$
3. Use **&** as AND and **|** as OR and enclose every logical block in **brackets** - $(imf(0) > 0) \& (((5.*imf(1)) < -5) \& (imf(2) <$

The screenshot shows the 'Data Mining' window with various configuration fields. A red arrow points from the 'Request Name' field to the text 'Name and save the 'request' for future use'. Another red arrow points from the 'Time Selection' section to the text 'Edit the time table'. A third red arrow points from the 'Do Search' button in the bottom left to the 'Edit/Save' buttons in the 'Results' window. A fourth red arrow points from the 'Tools For Condition Construction' calculator to the same 'Edit/Save' buttons.

Name and save the 'request' for future use

Edit the time table

Results

Data Mining Results

datamining_1616584439

Time Table Edit/Save || Gaps Time Table Edit/Save || Delete Both

datamining_1616584269

Time Table Edit/Save || Gaps Time Table Edit/Save || Delete Both

The screenshot shows the 'Results' window listing two data mining requests: 'datamining_1616584439' and 'datamining_1616584269'. Each entry includes 'Time Table', 'Edit/Save', 'Gaps Time Table', 'Edit/Save', and 'Delete Both' buttons. A red arrow points from the 'Edit/Save' button for the first request to the text 'Edit the time table'.

Default name

Name*: timeTable_datamining_eea799ebfbac01bdc736365fa4!
 Creation date: 2021/03/24 12:11:08 Intervals: 9
 Description: Time Table generated by AMDA @ CDPP
 Condition: ws_delta_phi_so_bepi_450<3
 Operation log: AMDA Data Mining: Sampling: 3600s; Data Gap:
 5*3600s; Input Interval: 2020-02-01T00:00:00.000 -
 2026-01-01T00:00:00.000

Operations on Intervals

Extend [] min [] Shift [] min []
 Apply Undo
 Merge intervals Statistical info

Save Reset Generate Catalog

Information

To edit a time table **double click** one of your time tables from the Time Tables tree or use context menu (**right click** at Workspace Explorer).
Attention! Don't use spaces in the time table name.

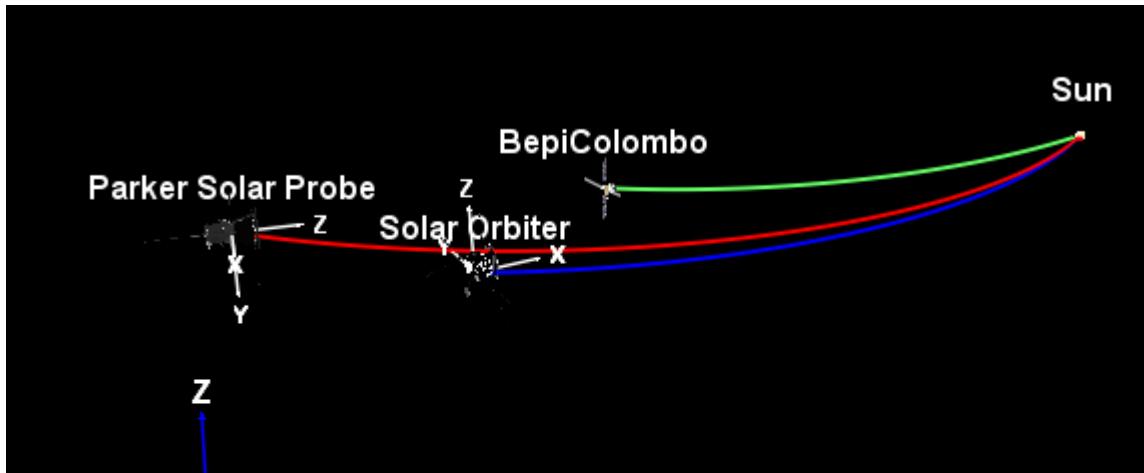
	Start Time	Stop Time	Duration (hour)
1	2020-03-03T20:30:00	2020-03-15T15:30:00	283.00
2	2020-05-16T10:30:00	2020-05-22T11:30:00	145.00
3	2021-07-19T01:30:00	2021-08-19T18:30:00	761.00
4	2021-10-08T20:30:00	2021-10-10T12:30:00	40.00
5	2023-03-17T00:30:00	2023-03-19T20:30:00	68.00
6	2023-04-01T20:30:00	2023-04-04T00:30:00	52.00
7	2024-02-15T03:30:00	2024-02-16T12:30:00	33.00
8	2024-04-05T18:30:00	2024-04-06T18:30:00	24.00
9	2024-12-10T06:30:00	2024-12-11T09:30:00	27.00

day/hour/min/sec
can be set

Time intervals of the magnetic alignments between BepiColombo and Solar Orbiter for Feb. 2020 - Dec. 2025 with $u_{SW}=450$ km/s obtained with AMDA data mining

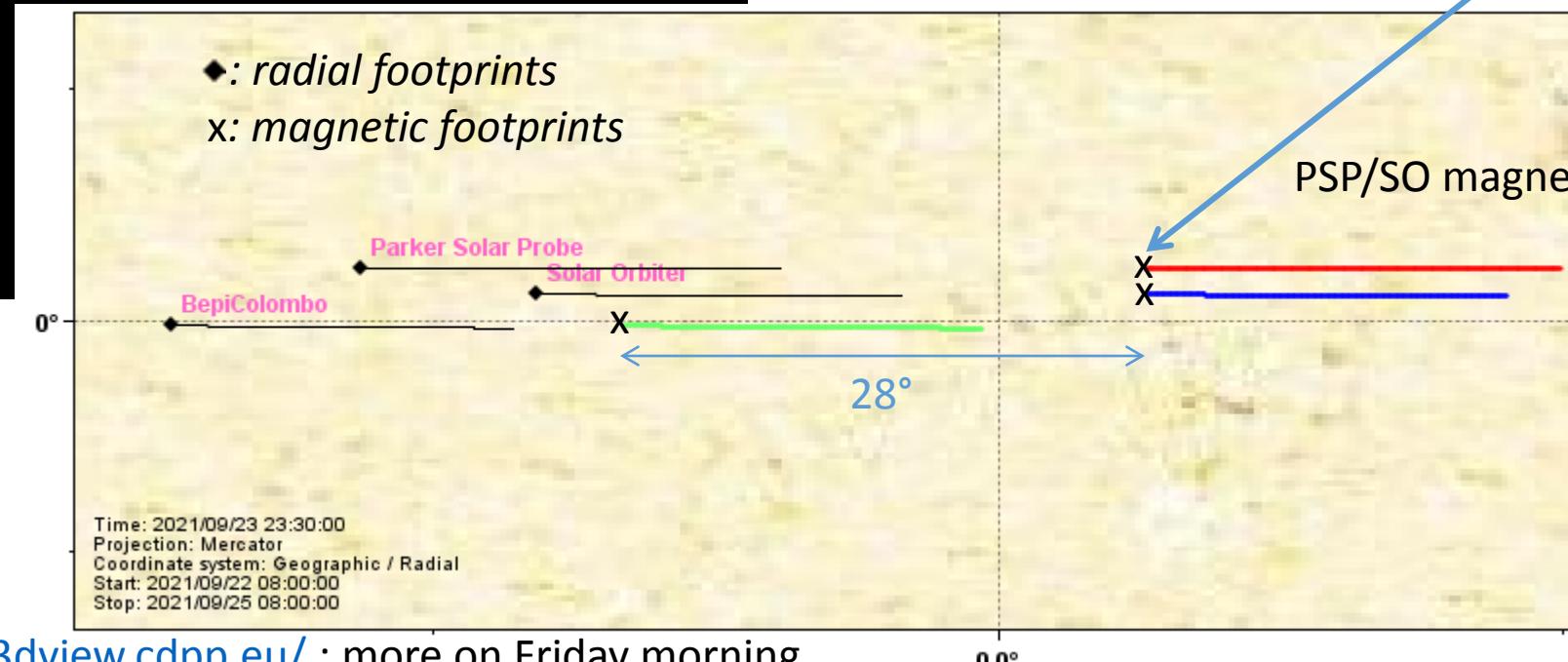
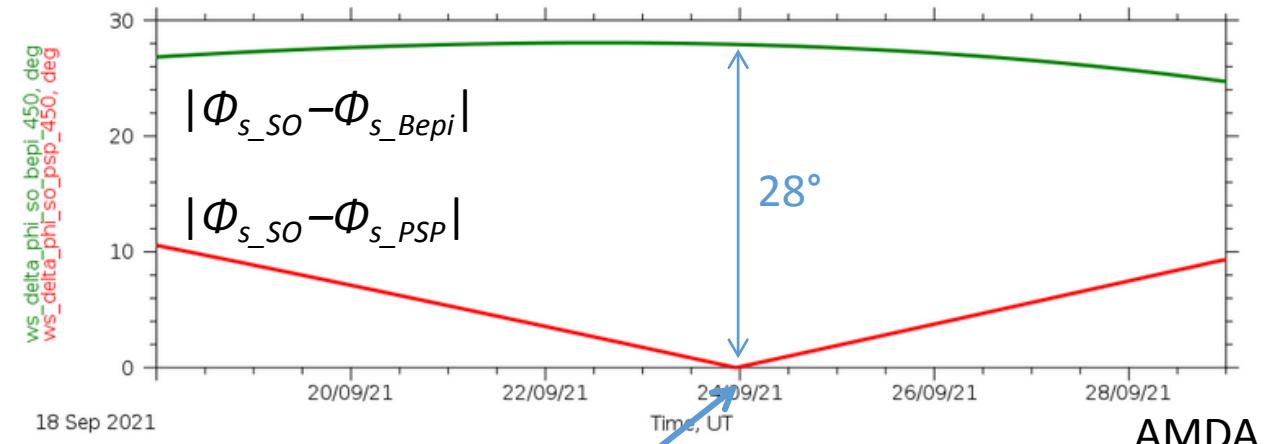
Change the default name and Save

Solar Orbiter / PSP « Parker » conjunction ($u_{SW}=450$ km/s)



Time: 2021/09/23 23:30:00
Frame = HEE
Center = Sun

Start = 2021/09/22 08:00:00
Stop = 2021/09/25 08:00:00

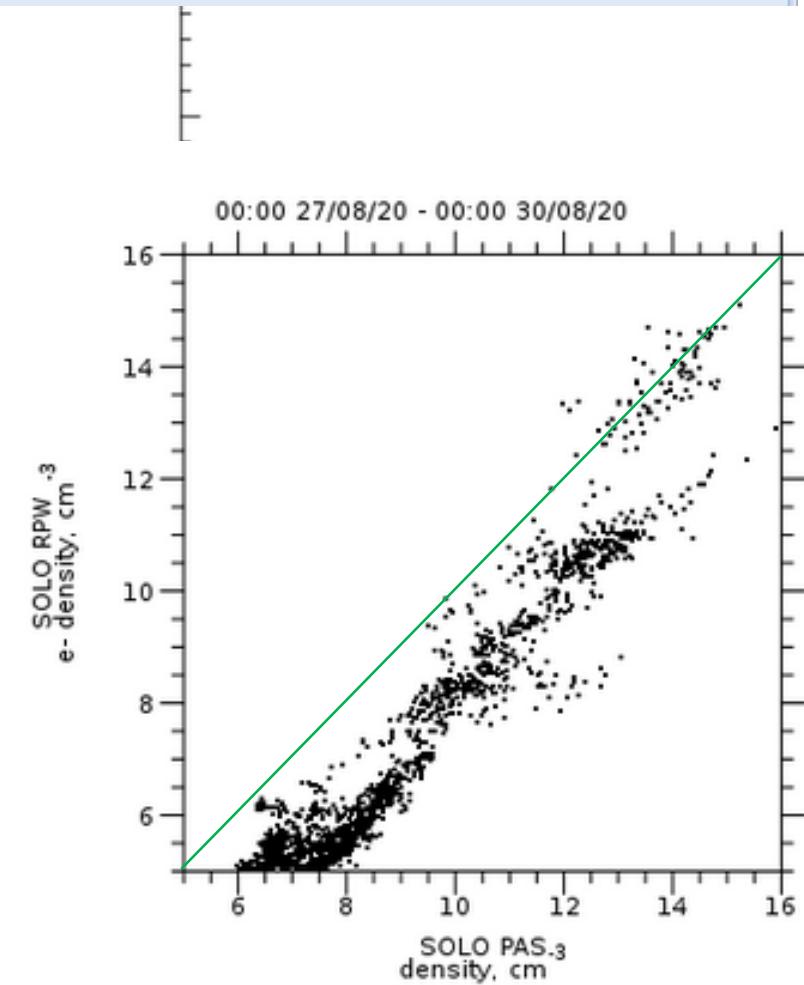
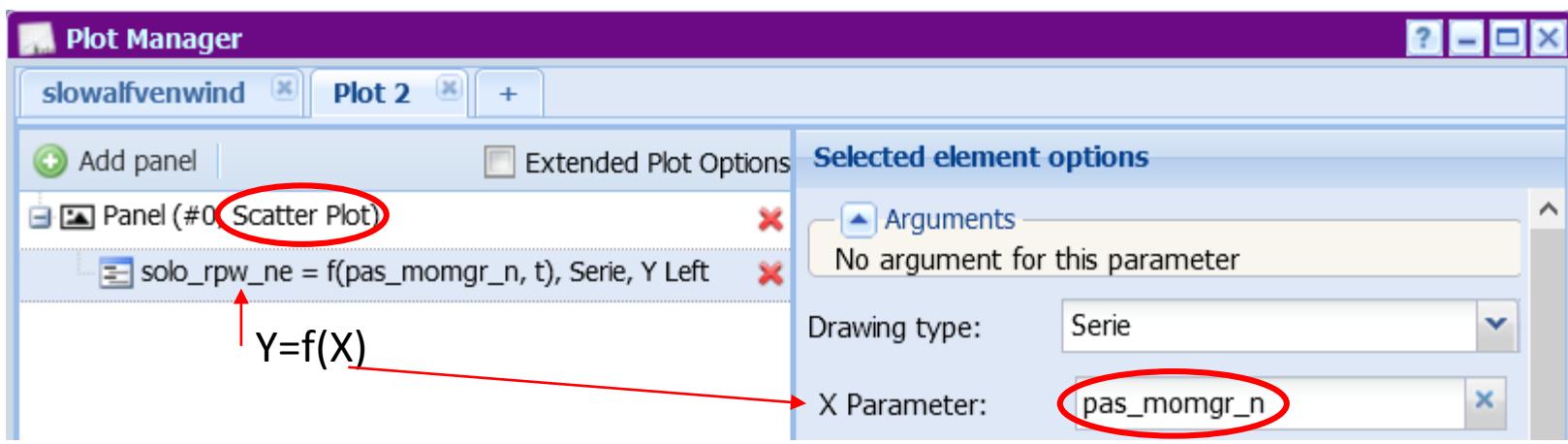
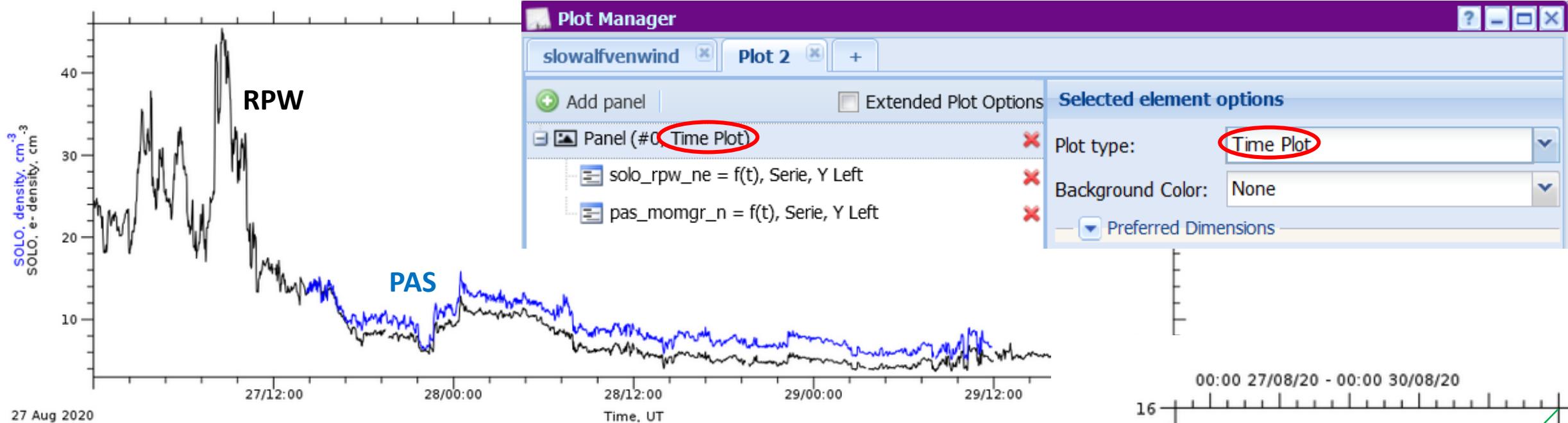


3DView

AMDA use case #4

AMDA use case #4

- Objectives:
 - Plot RPW data / only the density is available
 - Make a scatter plot
- *Data restricted only to the « PAS group » for calibration purposes*
- *More RPW public data will be integrated soon*



AMDA use case #5

AMDA use case #5

- Objectives:
 - Download data
 - 2 ways
 - From a plot: « Get data »
 - From the Download menu

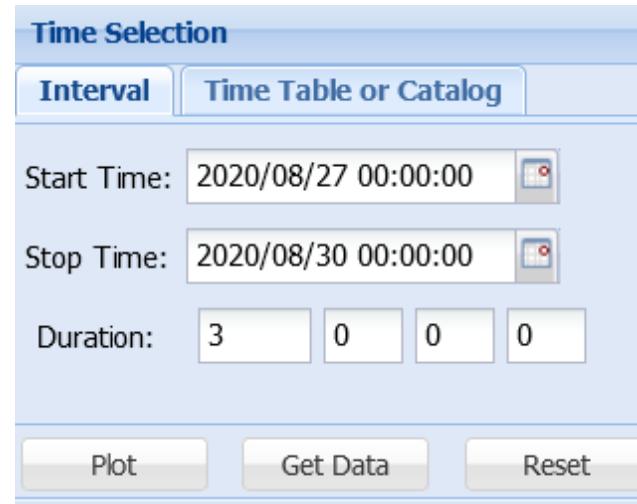
Time Selection

Interval Time Table or Catalog

Start Time: 2020/08/27 00:00:00

Stop Time: 2020/08/30 00:00:00

Duration: 3 0 0 0



Download data

Parameters **Time Tables / Catalogs**

Request Name:

Parameter Name

1	pas_momgr_n		
2	pas_momgr1_v rtn		
3	pas_l2_2d_elevation_0_8(range[-23.7,40.9],0)		

Time Format: YYYY-MM-DDThh:mm:ss.ms

File Structure: One File Per Param/Interval

Header in a separate file

All In One File

One File Per Time Interval

Use first param. as header

Sampling Time: 600

Scientific floating-point formatting

File Prefix:

File Format: ASCII

Compression: zip

Time Selection

Interval **Time Table or Catalog**

Start Time: 2020/07/23 16:30:00

Stop Time: 2020/07/24 16:30:00

Duration: 1 0 0 0

Download **Reset** **Send (via SAMP) to ...**

Information

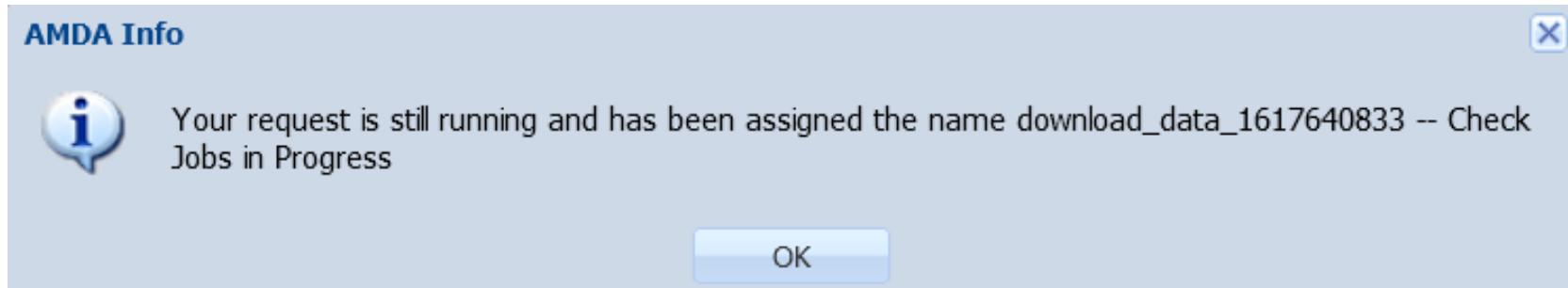
1. To download a parameter / timeTable / catalog, *drag* it from the corresponding tree and *drop* onto the corresponding panel. Timestamp of the archive file is *UTC*
2. To download data for the intervals from the TimeTable / Catalog activate the *TimeTable or Catalog mode* in the Time Selection area and *drag-and-drop* there the TimeTable / Catalog from the corresponding tree

Choose the file structure

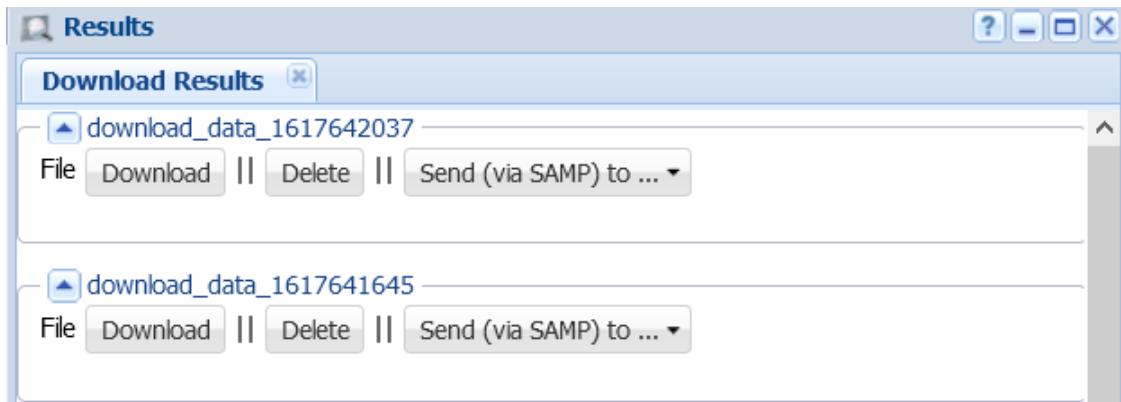
Choose time interval
or Time Table

Download process

- If the request takes too long, it goes in ‘batch mode’ and a message pops up



- A tar/zip file is created containing one or multiple files, click on download to get it



```

1 # -----
2 # AMDA_INFO :
3 #
4 # AMDA_ABOUT : Created by AMDA(c)
5 # AMDA_VERSION : 3.6.0
6 # AMDA_ACKNOWLEDGEMENT : CDPP/AMDA Team
7 #
8 #
9 # REQUEST_INFO :
10 #
11 # REQUEST_STRUCTURE : all-in-one-file-refparam
12 # REQUEST_TIME_FORMAT : ISO 8601
13 # REQUEST_OUTPUT_PARAMS : pas_momgrl_n,pas_momgrl_v_rtn,sum_into_table_range_pas_12_2d_elevation_0_8_0_-23.7_40.9
14 #
15 #
16 # DERIVED_PARAMETERS :
17 #
18 #
19 # PARAMETER_ID : sum_into_table_range_pas_12_2d_elevation_0_8_0_-23.7_40.9_17228245143598613721
20 # PARAMETER_NAME : sum_into_table_range_pas_12_2d_elevation_0_8_0_-23.7_40.9
21 # PARAMETER_SHORT_NAME : sum_into_table_range_pas_12_2d_elevation_0_8_0_-23.7_40.9
22 # PARAMETER_UNITS : unspecified
23 # PARAMETER_PROCESS_INFO : Resampling of 'sum_into_table_range_pas_12_2d_elevation_0_8_0_-23.7_40.
24 # PARAMETER_PROCESS_DESC : sum_into_table_range(pas_12_2d_elevation_0_8, 0, -23.7, 40.9)
25 # PARAMETER_LINKED_PARAMS : sum_into_table_range_5014350929172425849,sum_into_table_range_pas_12_2
26 #
27 #
28 # PARAMETER_ID : sum_into_table_range_pas_12_2d_elevation_0_8_0_-23.7_40.9
29 # PARAMETER_NAME : sum_into_table_range_pas_12_2d_elevation_0_8_0_-23.7_40.9
30 # PARAMETER_SHORT_NAME : sum_into_table_range_pas_12_2d_elevation_0_8_0_-23.7_40.9
31 # PARAMETER_UNITS : unspecified
32 # PARAMETER_PROCESS_INFO : Derived parameter from expression '#sum_into_table_range($pas_12_2d_ele
33 # PARAMETER_PROCESS_DESC : sum_into_table_range(pas_12_2d_elevation_0_8, 0, -23.7, 40.9)
34 # PARAMETER_LINKED_PARAMS : sum_into_table_range_5014350929172425849
35 #

```

```

54 # -----
55 # BASE_PARAMETERS :
56 #
57 #
58 # MISSION_ID : Solo
59 # MISSION_NAME : SolarOrbiter
60 # MISSION_DESCRIPTION : Solar Orbiter
61 # MISSION_URL : http://sci.esa.int/solar-orbiter
62 #
63 # INSTRUMENT_ID : Solo_pas
64 # INSTRUMENT_NAME : PAS
65 # INSTRUMENT_DESCRIPTION : Proton-Alpha Sensor
66 # INSTRUMENT_PI : spase://SMWG/Person/Philippe.Louarn
67 # INSTRUMENT_TYPE : ParticleDetector
68 #
69 # DATASET_ID : so-pas-momgrl
70 # DATASET_NAME : on the ground moments
71 # DATASET_SOURCE : CDPP/DDServer
72 # DATASET_GLOBAL_START : 2020-04-15T14:23:18.322
73 # DATASET_GLOBAL_STOP : 2020-10-27T03:04:02.063
74 # DATASET_MIN_SAMPLING : 0
75 # DATASET_MAX_SAMPLING : 10
76 # DATASET_CAVEATS : Info :
77 #                                     * 0: Ground
78 #                                     * 1: Normal
79 #                                     * 2: Snapshot
80 #                                     * 3: Burst
81 #                                     * 4: Engineering
82 #
83 # Validity :
84 #                                     * 1: V lt 270 km/s
85 #                                     * 2: V gt 270 km/s , V lt 380 km/s
86 #                                     * 3: V gt 380 km/s
87 #
88 # PARAMETER_ID : pas_momgrl_v_rtn
89 # PARAMETER_NAME : pas_momgrl_v_rtn
90 # PARAMETER_SHORT_NAME : v_rtn
91 # PARAMETER_COMPONENTS : vr,vt,vn
92 # PARAMETER_UNITS : km/s
93 # PARAMETER_TENSOR_ORDER : 0
94 # PARAMETER_FILL_VALUE : nan

```

The header is a bit verbose but retains all info on the production of the file (original dataset, resampling, processes, ...)

AMDA use case #6

AMDA use case #6

- Objectives:
 - Plot EPD data
- *Presentation by Alexis Rouillard*

AMDA Python API

AMDA Python API

- Objectives:
 - Get Solar Orbiter data in a Python environment
 - From Spyder or any other Python interface
 - <http://amda.irap.omp.eu/help/amdapy/>
 - From a Jupyter notebook
 - Get the file ExemplePlotAMDA.ipynb
 - <http://amda.irap.omp.eu/help/amdapy/amdapy-notebook-1.html>
- This is brand new and any feedback/bug/suggestion will be very much appreciated !

Select data products

- EUI-FSI174-IMAGE | X
- EUI-FSI304-IMAGE | X
- EUI-HRIEUV174-IMAGE | X
- EUI-HRILYA1216-IMAGE | X
- MAG-RTN-NORMAL | X
- RPW-BIA-DENSITY | X
- SWA-EAS-PAD-PSD | X
- SWA-HIS-PHA | X
- SWA-PAS-3D | X

