# Tutorial Example - Connection of Helio Tools, AMDA/IMPEx & 3DView/IMPEx: CME impact on Venus and Earth

This tutorial gives an example of the interconnected use of HELIO Tools, AMDA/IMPEx functionality and 3DView/IMPEx functionality. The AMDA/IMPEx-, as well as the 3DView/IMPEX-part show new features in AMDA, which were implemented within the IMPEx FP7 project, i.e. the possibility of plotting simulation runs for given spacecraft side by side with observational data.

#### 1) Searching for events in Helio $\rightarrow$ <u>http://hfe.helio-vo.eu/Helio/</u> ("Search" $\rightarrow$ "Events")

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Proposed example:

Select the Time Range:

2012-06-10T00:00:00 - 2012-06-15T00:00:00

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Afficher un menu pour « http://hfe.helio-vo.eu/Helio/# »			

Select the Event Catalogue:

Select "SOHO/LASCO CME Event List"

and add a query parameter using the gear icon and configure pa\_width >= 270

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You get only 1 CME in the list.

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Select Data successfully loaded	Step 3 Click 'Submit' to send the query to the server and retrieve the result. Depending on the query this may take a while.
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Showing 1 to 1 of 1 entries	irst Previous 1 Next Last

Note down the "pa" (Position angle) and "v\_final" (final velocity) parameter, for use in the next section.

## 2) Extraction of time range and use it as input for the Helio CME Forward PM

Select the resulting line and click on the "timer" icon sove the time of the selected event. A item should then appear in the "Data Cart" with the name typed in the "Name" field of the pop-up frame.

In Menu "Tools" select "Coronal Mass Ejection (CME) Forward PM"

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- Drag and drop extract time on grey timer (select date) Click on the "Puzzle" icon and fill the fields with the -
- -

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→ CME hits Earth, Venus, Pluto, Voyager1, New Horizons, Rosetta (see screenshot)

You can save the resulting table using the « VOT » floppy disk icon. This will create a VOTable file and download it for local use.

Note down the ETA\_min (minimum Estimated Time of Arrival) and ETA\_max (maximum Estimated Time of Arrival) for use in the next section.

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## 3) Plotting data in AMDA - Comparison of model data with in-situ data $\rightarrow$

#### http://amda.cdpp.eu/

Ask for a guest account to the organizers.

a) Verification of CME impacts on Venus and Earth:

- Open the "Plotting Data" in AMDA: Use the time range as received via HELIO and extend it properly (±6 hours), i.e. the CME impacts at Venus and Earth should be visible : Begin: 2012/06/15 15:00:00 End: 2012/06/17 05:00:00
- The following parameters may be selected (see screenshot below):
  - VEXMAG data: Remote Data (Observations)/ VexMag@Graz/ VEX/ Vex\_mag/ MAG\_VSO/ MAG\_VEX\_VSO (use drag and drop to add parameter in Plot Manager window)

• WIND-MFI data: Local Data/WIND/MFI/mfi\_high/b\_gse CLUSTER1-FGM data: Local Data/fgm\_5vps/b\_gse 0 Workspace Explorer Workspace Ex operations resources jobs resources operations jobs Filter: None 🔺 📝 💥 SortBy: Name Target Filter: None 🔺 📝 💥 SortBy: Name Target a Constant International Internations 🗄 💽 Voyager\_2 🗄 🚞 CDAWeb@NASA 🛓 殻 WIND 🛓 魺 Mapskp@irap 🛓 🧰 ephemeris 🛓 🌍 THEMIS@IRAP 🛓 🔂 MFI 🛓 🔘 VexMag@Graz 🛓 😋 mfi\_high 🛓 😑 VEX 😠 🍥 b\_gse 🛓 슬 Vex\_mag - 🕘 |b| nT 🛓 😋 MAG\_VSO 🛓 🧰 mfi\_kp 🛓 🧰 SWE 🛓 🌒 MAG\_VEX\_SC 🛓 🍥 Mag\_vex\_vso a Constant Remote DataBases : Observations 🛓 🌒 SC\_POS\_VSO 🛓 🚞 CDAWeb@NASA 🛓 🧰 CLWEB@IRAP ■ Ø MAPSKP@IRAP 🗄 🧰 Remote DataBases : Simulations 🗄 🌍 THEMIS@IRAP Log Log

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• Plot the data (see screenshot below). One can zoom into different time intervals to get a more detailed view on the data at Venus and Earth.

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b) The Venus Impact:

- Prepare another plot via the Plot Manager for the time interval of the CME impact at Venus (e.g. 2012/06/15 19:00:00 2012/06/16 13:00:00).
- Compare observational data by VEX MAG with FMI HYB simulation run data (please be aware that the FMI HYB simulation runs are by now only for quiet solar wind conditions. The runs are within a range around Venus of x=[-3,3], y=[-4,4], z=[-4,4] Venus radii). Use the following data:
  - VEXMAG data: Remote Data (Observations)/ VexMag@Graz/ VEX/ Vex\_mag/ MAG\_VSO/ MAG\_VEX\_VSO
  - Via Create/Modify parameter one can also create the absolute value of the observed magnetic field (see screenshot below)
  - Select B\_tot of one of the FMI HYB simulation runs for Venus under (Remote Data (Simulations))
  - VEXMAG ephemeris data: Remote Data (Observations)/ VexMag@Graz/ VEX/ Vex\_mag/ MAG\_VSO/ SC\_POS\_VSO
- Plot the data. One can now zoom into the region, where the FMI HYB simulation run is plotted (see screenshot below).

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	1. To plot a parameter, drag it from the Parameters tree and drop onto the panel	
	<ol> <li>to fill the lime selection, use manual entry, the calendar or simply arag a Parameter from the tree and arop it into the start or stop neid.</li> <li>XY ('Scatter') Piot/Syn takes into account only 'Symbol' and 'Color' parameter arguments</li> </ol>	
	4. If AutoScale mode is selected AMDA ignores all parameter arguments for 'AutoScaled' panels	
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4) Visualization within 3DView: IMPEx functionality within 3DView - The CME impact at Earth (Cluster1 & Geotail)



- 1. Download and open 3DView (http://3dview.cdpp.eu/)
- 2. File  $\rightarrow$  New. Open File  $\rightarrow$  Manage Scene within the new scene window and choose
  - a. Time range: Start = 2012/06/16 00:00:00 & Stop = 2012/06/17 00:00:00
  - b. Choose Cluster1 & Geotail and start scene

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- 3. Load Data : VO menu  $\rightarrow$  IMPEx
  - a. Models of magnetospheric frontiers  $\rightarrow$  Earth/MAGNETOPAUSE/Shue et al 1997, then "Add Selected data to 3Dscene"
  - b. Model data  $\rightarrow$  FMI  $\rightarrow$  Earth  $\rightarrow$  GUMICS\_Earth\_run\_000001  $\rightarrow$  3DCubes  $\rightarrow$

 $\label{eq:FieldLine} \begin{array}{l} \makebox{--} \mathsf{GSE} \rightarrow \mathsf{Magnetic} \ \mathsf{field} \ \mathsf{component} \rightarrow \mathsf{\#Field} \ \mathsf{Line} \ \mathsf{Bx}, \mathsf{By}, \mathsf{Bz}, \\ \makebox{--} \ \mathsf{select} \ \texttt{`Geotail''} \ \mathsf{in} \ \mathsf{the} \ \mathsf{spacecraft} \ \mathsf{list} \ (\mathsf{and} \ \mathsf{ckeck} \ \mathsf{corresponding} \ \mathsf{radio} \ \mathsf{button}) \\ \makebox{--} \ \mathsf{then} \ \texttt{`Add} \ \mathsf{Selected} \ \mathsf{data} \ \mathsf{to} \ \mathsf{3Dscene''} \end{array}$ 



c. Observational data  $\rightarrow$  AMDA  $\rightarrow$  Geotail  $\rightarrow$  MGF  $\rightarrow$  mgf\_preliminary  $\rightarrow$  b\_gse - and "Add selected data to 3DScene"

- d. One may additionally add Cluster1 data in the same way as described above
- 4. The different parameters can be manipulated via Scientific Control Panels (see screenshot below). One can get to the control panels via Science → Science data controls. Additionally further spacecrafts can be added via File → Manage Scene. Further data can also be added in the same way as described above.



5. Within the science control one can also add a 2DPlot by clicking on "2Dplot" on the respective Science Control Panel (see second screenshot)

