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Draft

ASPERA Near - earth Verification report for the period 2003 June 24 - July 13

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Planned and completed activities

Activities	Objective	Completeness
NEV-AS-001	First switch - on and initial check of the instrument health	Successfully completed
NEV-AS-002	Scanner release	Scanner was released but not operated because of lower than expected temperature
NEV-AS-003	Sensor check-up	Successfully completed
NEV-AS-004a	HV ramping	Successfully completed
NEV-AS-004b	HV ramping	Successfully completed
NEV-AS-004c	HV ramping	Successfully completed
NEV-AS-005	ASPERA calibrations against the solar wind (IMA and ELS) and optimization of the sensor operations (NPI, NPD).	10 runs successfully completed 11^{th} run interrupted due to s/c Safe mode during star calibrations (no TM is available for the time of writing)

The detailed description of the activities is given in Appendix 1.

General status of the instrument

The IMA temperatures at the beginning of NEV activities were higher (42°) than expected therefore the sensor operations were limited for a time of 2h. The reason is the late change of the type of MLI ("yellow") installed on -Z plane with respect to the one ("black") used in thermal calculations and originally planned for this surface. Since the team was informed it was discovered only during the FM delivery. The MU temperatures (DPU: -29°, scanner: -22°) were lower than expected. The reason is not unknown. However, for both units the temperatures were within operational limits. It is expected the IMA temperature to decrease and the MU temperature to increase with changing of the solar aspect angel.

All sensors and DPU perform nominally. Scanner was not operated due to low temperatures.

Instrument performance

Scanner

During the launch the scanner is locked. The locking mechanism was released on July 23. The execution of the release commands was monitored and confirmed by the observation of the expected increase in the LCL current on 200 mA for 15 sec. After the release the scanner is ready for operation. The scanner was not, however, operated because of too low temperature (-22°). While the scanner was qualified to be operational for temperatures down to -25° it was found unnecessary risky to perform initial operations at such low temperatures. The temperatures during nominal operations are expected to be above -5° that is reached by warming-up the scanner by operation the sensor assembly for the period at least 8 hours. The

scanner first operations are planned to be performed during interplanetary cruise (IC) calibrations in October.

DPU

Performed nominally. The reported anomaly (AR MEX_SC-24) - transition to the instrument safe mode after watch-dog reset - is considered to be a single event caused, probably, a single latch-up. It has not been reproduced for 21 sessions of the instrument operations (in total 27h52m).

ELS

The ASPERA-3 ELS instrument commissioning which occurred between June 23 and July 9, 2003 showed that ELS is functioning to the degree that it was tested. ELS sensor activation occurred on July 1. ELS sensor high voltage was ramped to its activation level while the deflection voltage was commanded to a non-zero value. The figure 1 below shows the green voltage ramp in the second panel and plagued by the same software problem, zero response which needed to be confirmed through the housekeeping telemetry. ELS fixed deflection voltages is confirmed by the bottom two panels. Since ELS was fully active, its operation is confirmed in the science data as single lines in all ELS sectors

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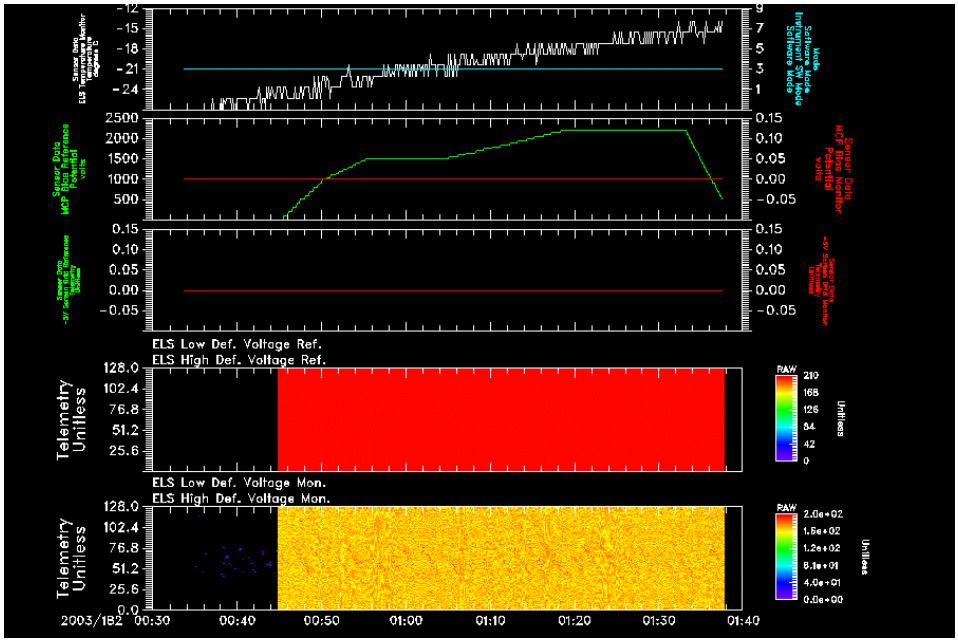

Figure 1. ELS MCP activation

ELS instrument sweeping occurred on July 8, making ELS fully operational. A sweeping ELS unit is confirmed by the figure 2, showing an operational high voltage sensor command which was confirmed by housekeeping telemetry, and the sweeping deflection commands and responses shown in the bottom two panels. The corresponding science data fully determines electron spectra as shown by Figure 3. Here, all 16 ELS sectors show measured electrons, where the solar wind can be seen in the fourth anode (fifth graph from the top on the left hand side of the page) as the upper bright red line.

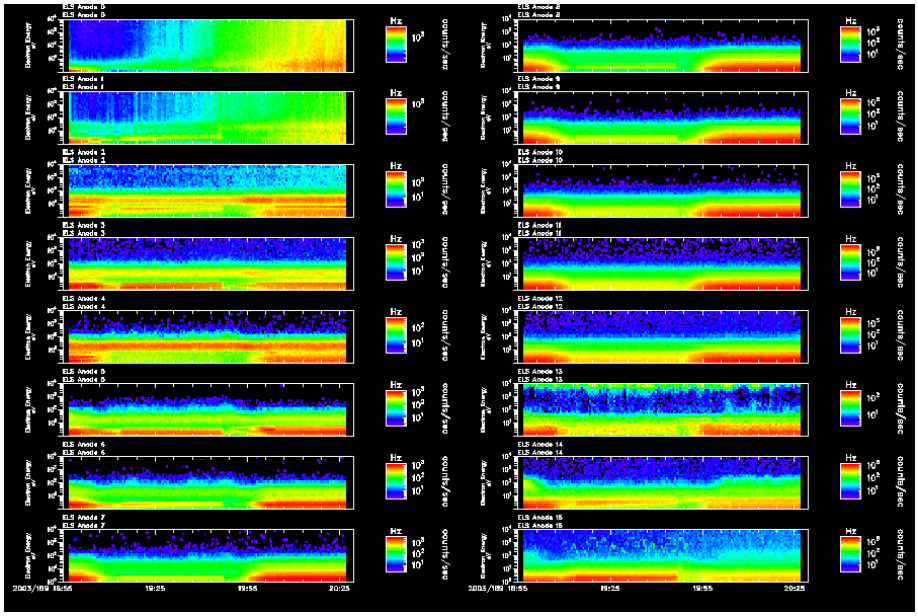

Figure 3. ELS solar wind measurements

NPI

The sensor performs nominally. During the calibration activities for certain period of time the sensor was exposed to the direct Sunlight. The measurements were not possible thought the sensor behaviors as expected.

NPD

During the sensor activation and calibration activities multiple latch-up of the NPD digital electronics interfacing the MU DPU occurred. The latch-up protection circuit is supposed to protect the NPD electronics against singe latch-up caused penetrating radiation. It is activated inside the sensor by a current measuring circuit. The multiple latch - ups were found to be a temperature effect and disappeared after sufficient worming-up of the sensor which, under the present temperature situation, is colder than expected. Analysis of the corresponding data from FM TVAC test is initiated but the anomaly is not considered critical and does effect the performance. The sensors (NPD1 and NPD2) perform normally. Analysis of the data in order to find signatures of the interstellar neutrals is on going.

IMA

The instrument activation and different mode calibration were successfully completed. The modes IMA, High, Normal were verified as well as different reduction techniques, Noise reduction level 1 =N/OFF, Shadow matrix ON/OFF. Figure 4 shows the IMA solar wind measurements together with monitor parameters Pacc voltage, electrostatic scanner monitor, analyzer voltage monitor, opto and MCP bias monitor, and the sensor unit temperature.

Figure 5 shows E – M matrix (TM units) where the solar wind protons and helium peaks separated. The matrixes shown for the noise threshold set to 0 and 1.

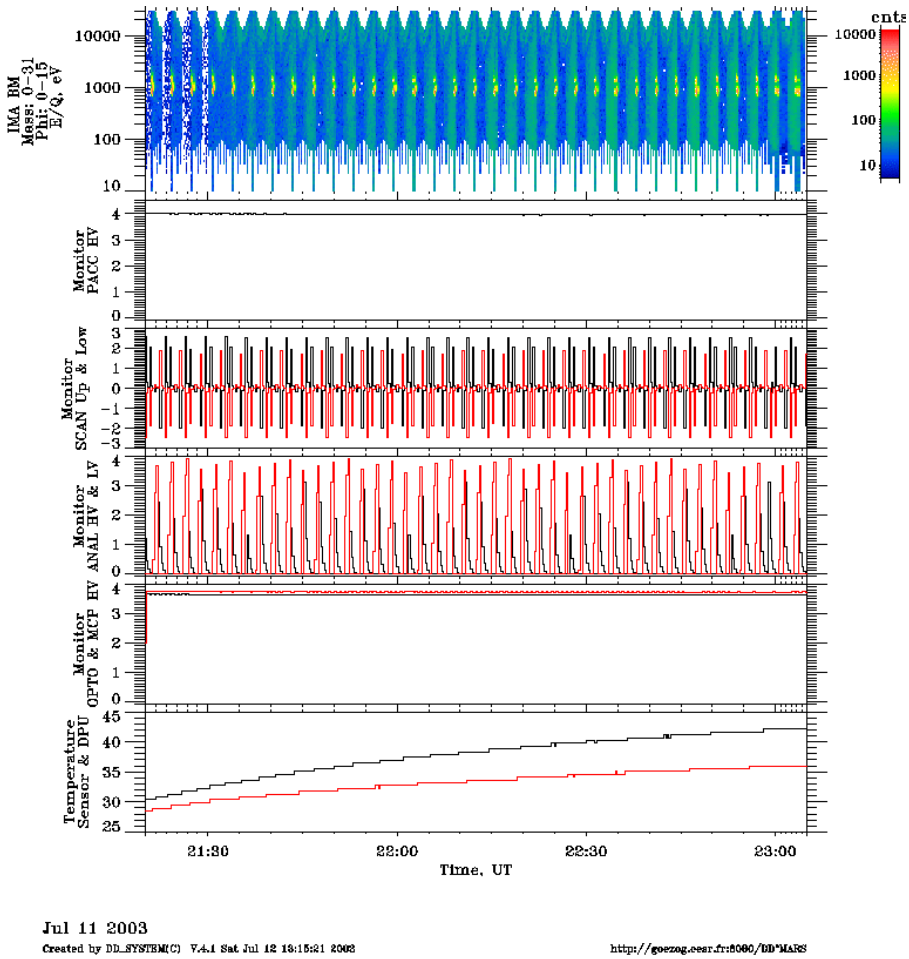

Figure 4 IMA solar wind measurements with HK parameters

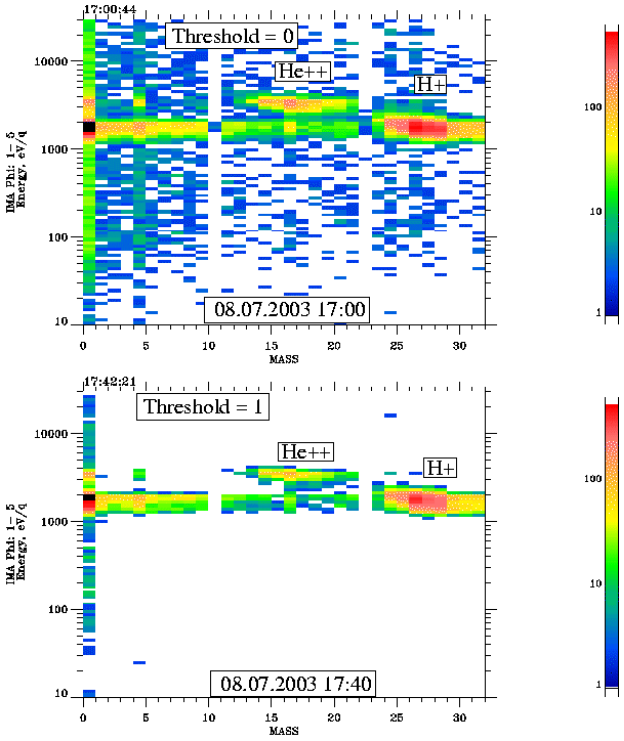

Figure 5. E – M matrix obtained in the solar wind.

Ground segment
The ground segment (DDS, operation planning, command execution, monitoring) performed satisfactory. The database needs updates of:

- Operation temperature limits
- Min / Max values on the monitor displays
- Calibration constants
- Severity checks
- Parameters displayed in ANDs

For further operation planning FOPs need updates and extensions covering certain particular commands. Some problems were encountered with receiving TM data from DDS in PISA which were attributed to a non-compatible set-up of a particular IP address in the router. The problem was fixed during the calibration activity.

Open issues and actions
Instrument
Scanner operations are to be performed. It is planned to be conducted during the IC calibrations in October. It will require long (> 8 h) worming-up. The instrument must thus be allowed to be left ON between two passes.

Adjustment of on-board macro command is required (TBC)

Testing ELS energy tables (was not planned for NEV) and –5V grid mode.

Testing of the RICE compression modes (was not planned for NEV)

Ground segment
FOPs need to be updated following the instrument performance optimization during calibrations. PI will provide inputs.

Database need minor updates. PI will provide inputs.

Acknowledgment
ASPERA would like to acknowledge excellent and dedicated work of the ESOC team during the ASPERA NEV activities. We particularly acknowledge the performance of the team during the Safe mode transition event on July 13.

Appendix 1. ASPERA Near - Earth verification. Activities log June 24 - July 14