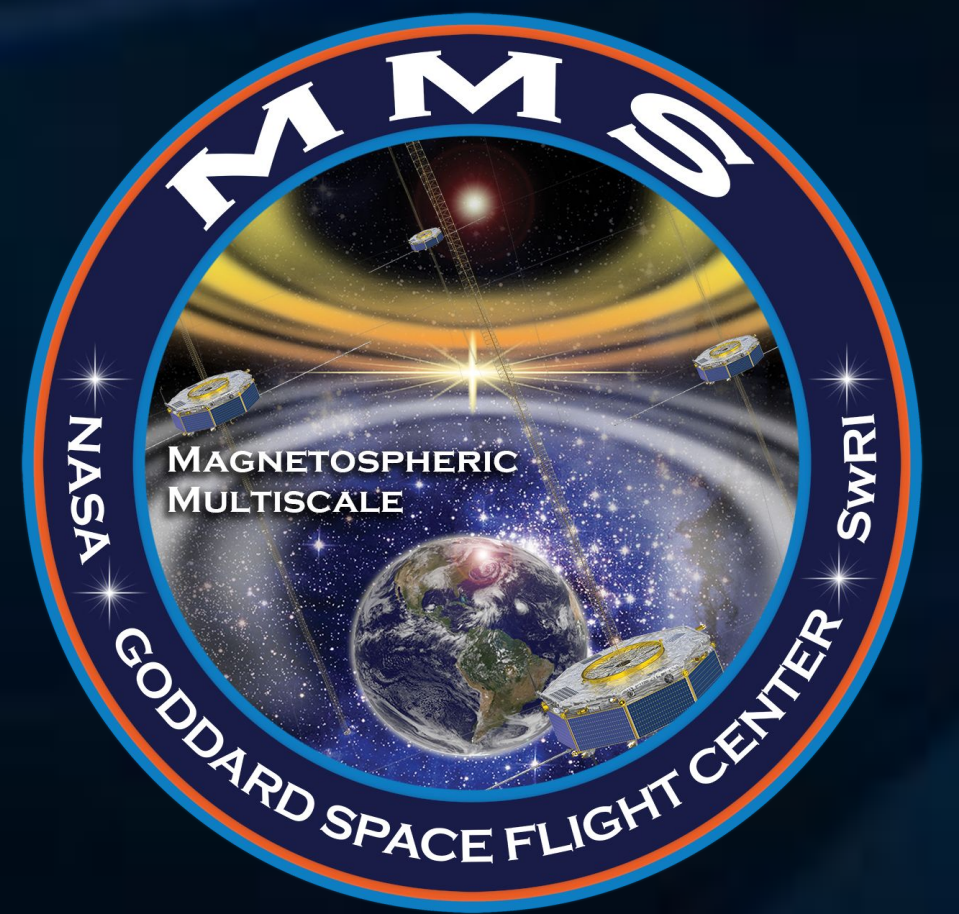




# FPI Dashboard: An Inside Look into Operational Ion/Electron Spectrometers



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**Abstract** Built to support the FPI operations team at GSFC, the dashboard is a visual software system running on a four monitor display at the FPI operations center in Building 21. It displays recent plots of housekeeping telemetry as well as derived variables related to hardware health and status. When in demonstration mode, the view alternates between sets of plots every 20 seconds. A secondary interface exists for desktop browsers, allowing remote access.

The **bus current tab (right)** displays currents and voltages on the bus between the central instrument data processing unit and the individual spectrometers.

Detailed, up-to-date logs of individual spectrometry activity is vital to build confidence in measurements and avoiding concern that hardware is reporting irregularly or in patterns against expectations.

Across the MMS mission, a **color convention exists for each spacecraft**, reflect here in the color of the top banner on each monitor.

The **Micro-Channel Plate (MCP) Tab to the right** displays voltages and currents powering the MCP receivers attached to each spectrometer head.

All generated plots are **archived** and can be revisited for later analysis.

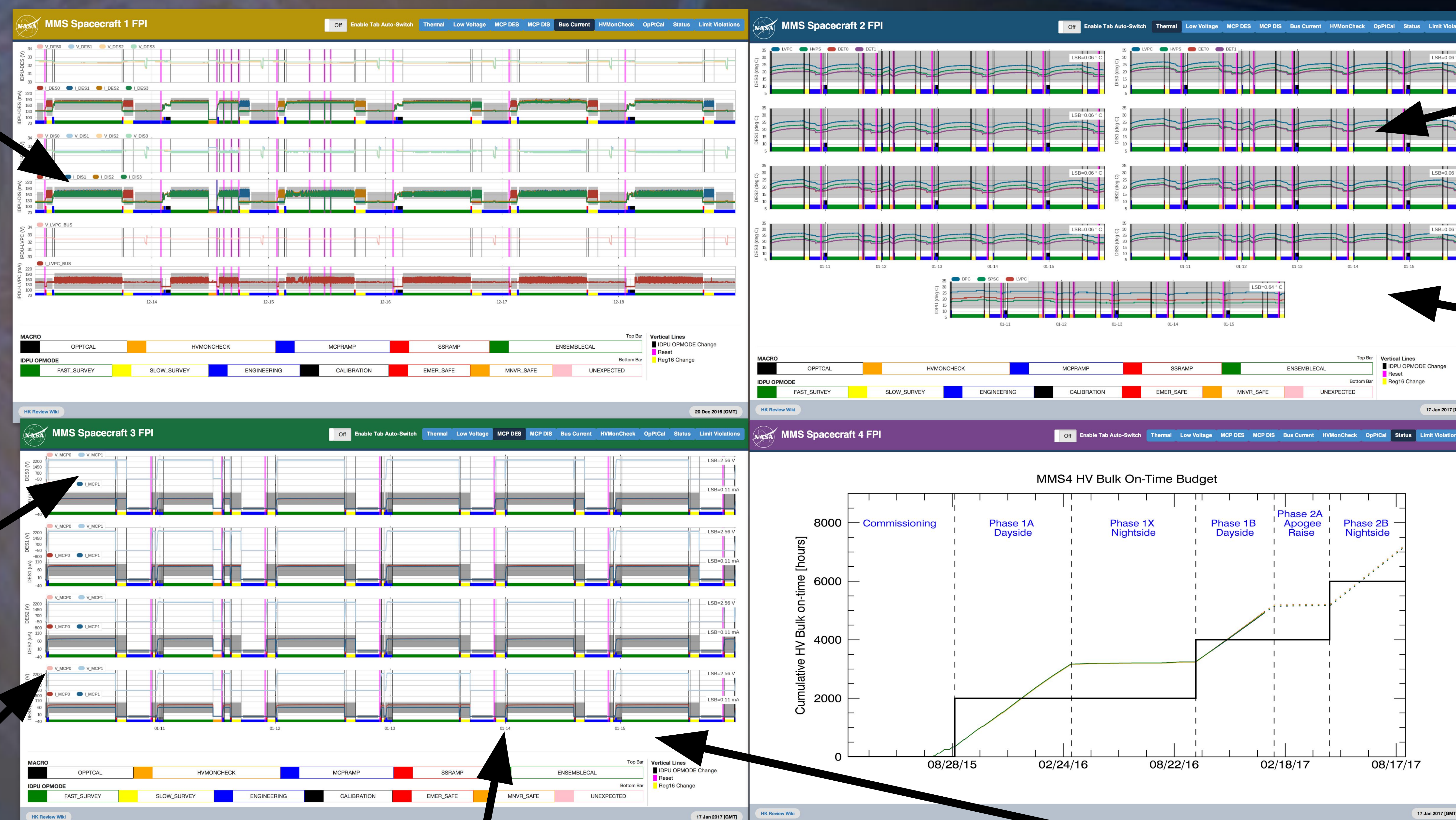
In each plot, **vertical lines are drawn to at instrument resets and changes of operating mode**. This allows us to quickly dismiss suspect features around these actions as permissible when an understanding of the scenario justifies it as so.

Plots are **annotated with the current instrument mode and on-board executing procedure**. This is done in the form of bars colored across time at the bottom of each plot, present in every plot.

A detailed **thermal report (left)** is included, allowing us to detect long-term drifts in temperature due to failure of solar protection, or disruptions to internal thermal control systems.

Plots can be **zoomed to three levels**: 7-day, 1-day, and 1-hour.

**Low Voltage Line Monitors** are also included in their own tab (not shown here).



## Level-1 Telemetry Database

The backend for the dashboard is designed around an automatically fully qualified database system, housing level 1 CCSDS housekeeping telemetry. The database automatically synchronizes with the larger FPI ground system to ingest new data as it arrives at GSFC. In addition, it integrates with ITOS to convert ADC values to engineering units. The database is managed by MySQL with an abstraction layer allowing MySQL to be easily replaced by another database system. The database is replicated on a RAID disk.

## Open-Source Components

The dashboard is built using 100% open source technologies with no dependency on COTS software or languages requiring licensing fees. The overall framework is managed by Django, while the plotting and binary decoding are handled by Python. An in-memory cache is hosted by Redis. There has been discussion with the SpacePy developers around open sourcing the vectorized decoding algorithm for CCSDS packets and including it in the SpacePy library.