Section 13:

PIMS International Space Station Operations

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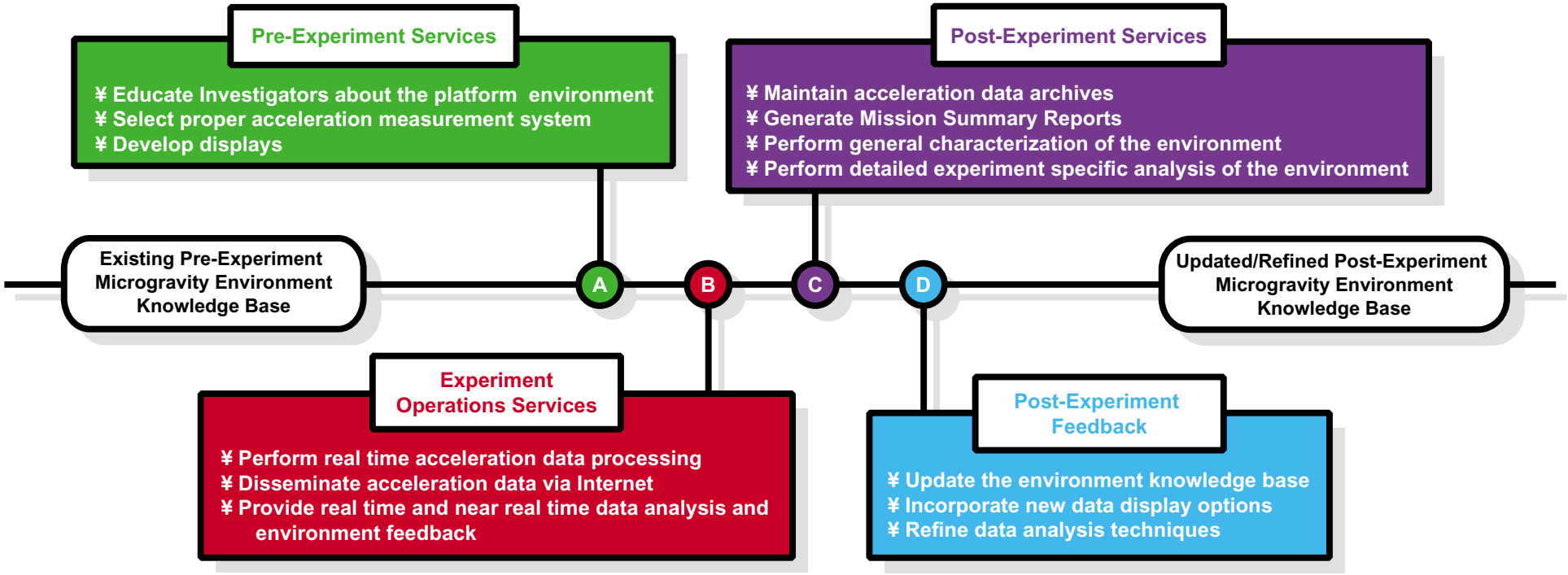
PIMS Functions During Experiment Life Cycle



Space Acceleration Measurement System-II

- **Provide distributed measurement of the vibratory and transient acceleration environment ($0.01 \leq f \leq 400$ Hz) on the ISS in support of various microgravity payloads**
- **Components**
  - **Control Unit**
    - Responsible for data and command routing
  - **Remote Triaxial Sensor (RTS) System**
    - Up to Ten RTS Electronics Enclosures (EE's)
    - Up to Two RTS Sensor Enclosures (SE's) per EE
- **Increment 2-4 configuration and operations**
  - **Three EE's and 5 SE's**
  - **Real-time data downlinked from the ISS**

Microgravity Acceleration Measurement System

- **Measure the ISS quasi-steady acceleration (f ≤ 0.01 Hz) and the ISS vibratory acceleration environment (f ≤ 100 Hz)**
- **Components**
  - **Miniature Electro-Static Accelerometer (MESA)**
    - sensor is a flight spare from the OARE program
    - measure the quasi-steady acceleration environment
    - actively downlinking acceleration data
  - **High-Resolution Accelerometer Package (HiRAP)**
    - measure the vibratory environment at the MAMS location only
    - Activated as needed via ground command to measure the vibratory environment
- **Additional features**
  - **Quasi-steady acceleration data can be mapped to various locations within the ISS using ISS body rates and body angles**
  - **Provides on orbit bias calibration capabilities**

Current Instrument Locations - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media History Print Edit

Address http://tsccrusader.grc.nasa.gov/pims/html/CURRENT_LOCATIONS.htm Go Links

PIMS INTERNATIONAL SPACE STATION

Home | PIMS Home | Acceleration Home | MSD Home

Home | Current Real-Time Plots | Current Locations | Request Data Plots | Status Data Plots | Interesting Plots | ISS Data Archives

Current Instrument Locations

NASA PAYLOAD RACK

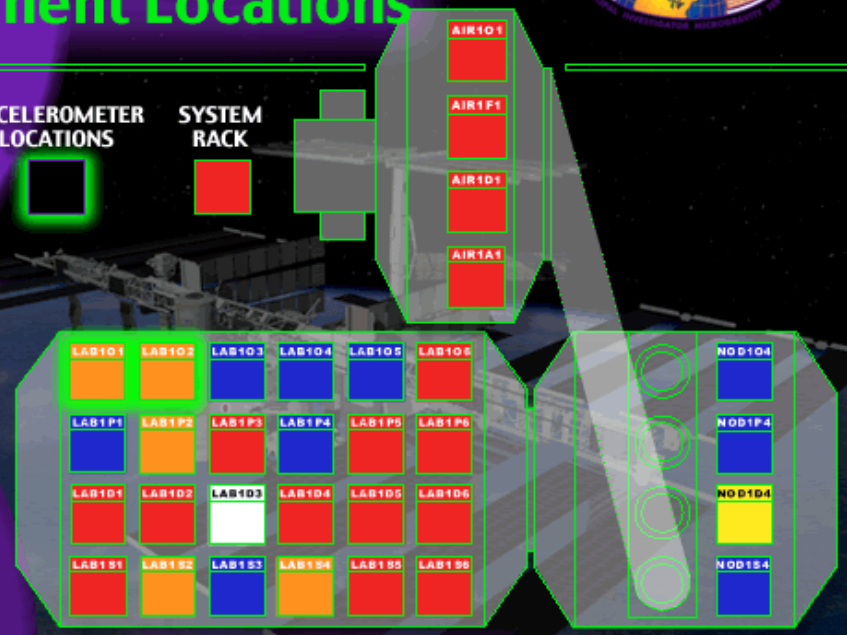
ACCELEROMETER LOCATIONS

SYSTEM RACK

INTERNATIONAL RACK

RESUPPLY STOWAGE RACK

ZERO-G STOWAGE RACK



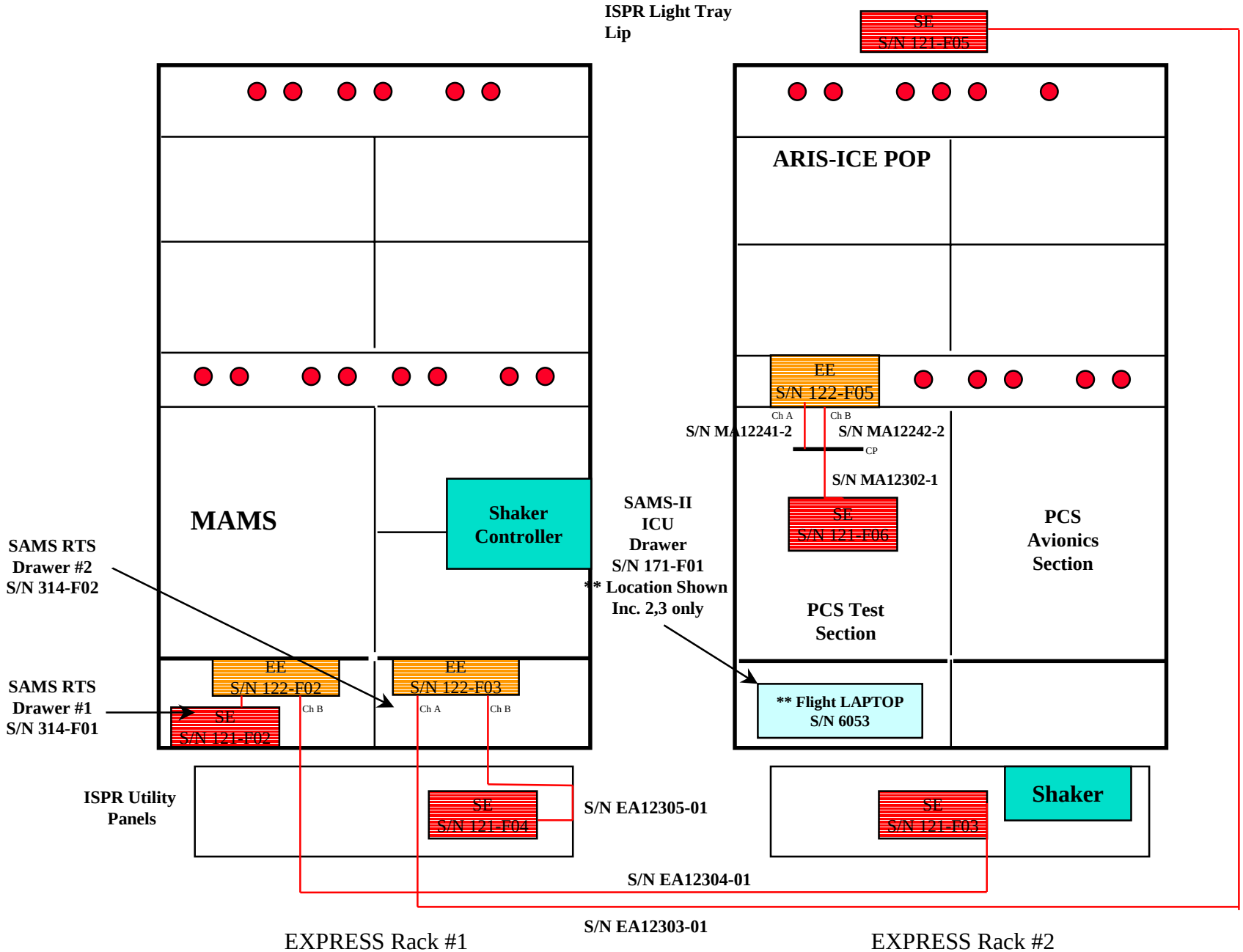
UF-1 Assembly Sequence

Status Data Plots | ISS Acceleration Archives | Current Real-Time Plots

Interesting Plots | Acceleration Homepage | Request Data Plots

3 Hierarchical Menu Trees Created

Local intranet



SAMS-II ON ORBIT SENSOR CONFIGURATION INCREMENT 2,3, and 4

PIMS Operational Philosophy

- **Operations are divided into three sections:**
  - **1) Real-time operations**
  - **2) Near real-time operations**
  - **3) Offline operations**
    - general characterization and specialized analyses
- **Acceleration measurement using SAMS-II and MAMS began with ISS Flight 6A (April 19, 2001) and is planned for the duration of ISS operations**
  - **MAMS activated May, 2001**
  - **SAMS activated June, 2001**
- **Potential for nearly continuous operations to characterize the environment**
  - **includes measurement of the environment, where possible, outside of "microgravity mode"**

Operational Philosophy

- **AOS/LOS profiles call for 30 - 60 percent AOS coverage**
  - **requires the ability to deal with AOS and LOS data streams**
  - **ISS attitude (XPOP vs. TEA greatly affects the AOS/LOS profiles**
- **Operational configuration calls for 5 SAMS-II Sensor Enclosures (SE), MAMS MESA, and MAMS HiRAP**
  - **not all sensors will be active all the time resulting in a variety of acceleration measurement profiles**
  - **MAMS HiRAP accelerometer is utilized when SAMS not available (for example, EXPRESS rack problems or power considerations)**

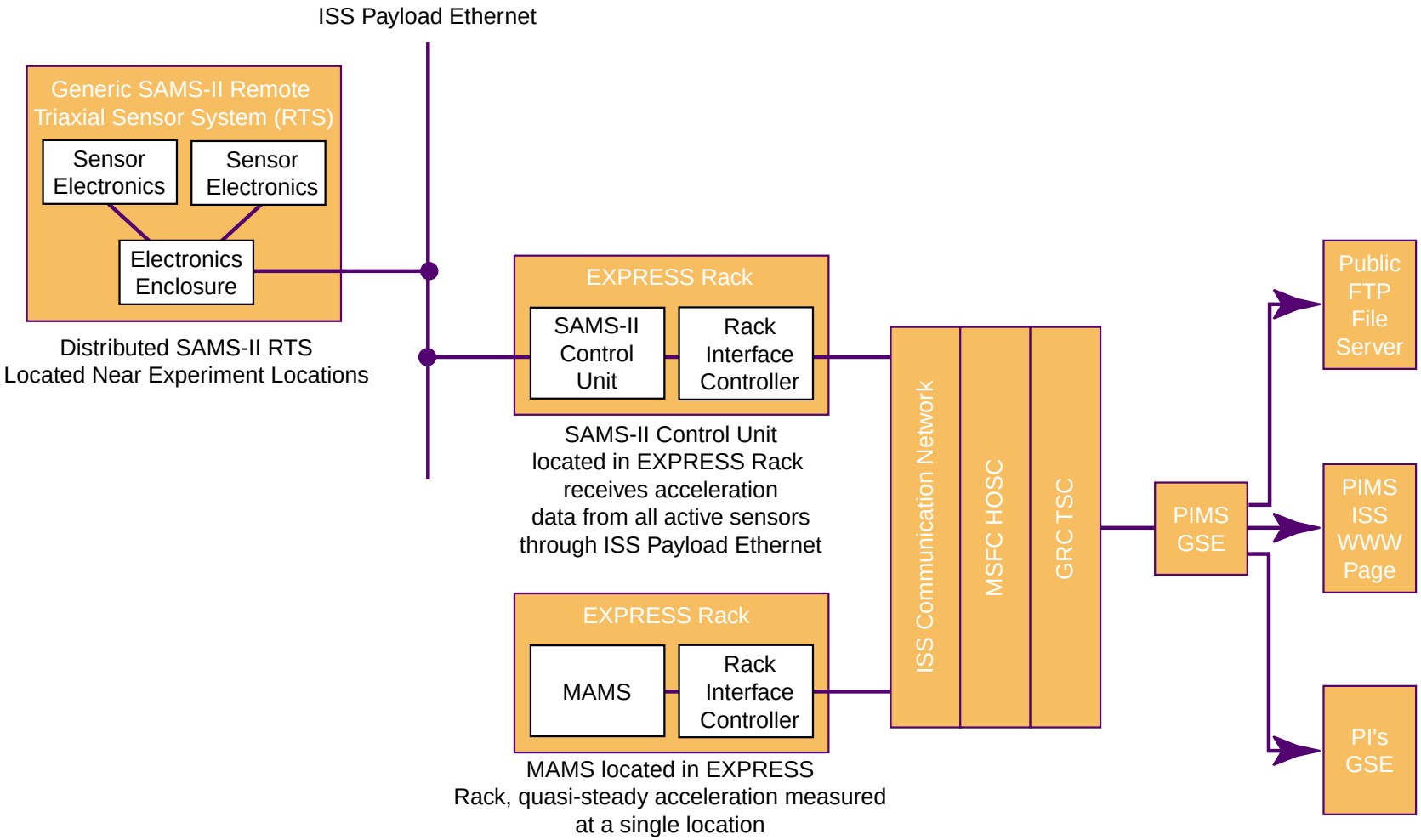
Operational Philosophy

- **PIMS has developed a core set of techniques for processing and displaying the acceleration data (see Section 6 for quasi-steady data and Section 7 for vibratory data)**
  - **Based on real-time and offline experience gained from SAMS and OARE data during Space Shuttle and Mir operations**
  - **Customized processing or displays as required by the microgravity user community**
- **Microgravity acceleration data will be available to Principal Investigators in near real time and offline through the WWW**

Real-Time Operations

- **Crux of real-time operations involves receiving, processing, and displaying microgravity acceleration data via the WWW**
- **Acceleration data displays via the WWW**
  - **PIMS displays are updated in real-time**
  - **Electronics snapshots are routed to the PIMS WWW page**
  - **Interested Principal Investigators can view the current environment by accessing the PIMS WWW page**
  - **ISS Microgravity Environment Monitoring System (MEMS) using Neural Networks (NN) will be on-line soon**
- **Example real-time plots**
  - **Figure 13-1 ADVASC Deactivation Inc2 Report Fig 9.3.6-2**
  - **Figure 13-2 De-Pressurization for ISS EVA Figure 9.2.5-1**
  - **Figure 13-3 LMS (STS-78) Nominal Microgravity Environment**

PIMS ISS Acceleration Data Flow



Near Real-Time Operations

- **Two primary functions performed**
  - **Merge AOS and LOS data streams**
  - **Generate processed (t,x,y,z) data files**
    - store the data in a standard storage format
- **Standard storage format details**
  - **SIMPLIFY ACCESS TO ACCELERATION DATA FOR PRINCIPAL INVESTIGATORS**
  - **Develop a standard file format for ISS acceleration data from any ISS acceleration measurement system and store ancillary data associated with each accelerometer**
    - Ancillary data describes the conditions and circumstances under which the acceleration data were obtained
      - current ancillary data parameters include: t-zero, sampling rate, cutoff frequency, head ID, gain, station configuration, location, orientation, coordinate system, bias coefficients, scale factor, and Data Quality Measure (DQM)
  - **PIMS-ISS-101 ISS PIMS Acceleration Data (PAD) File Description Document details the PAD storage format**

Offline Operations

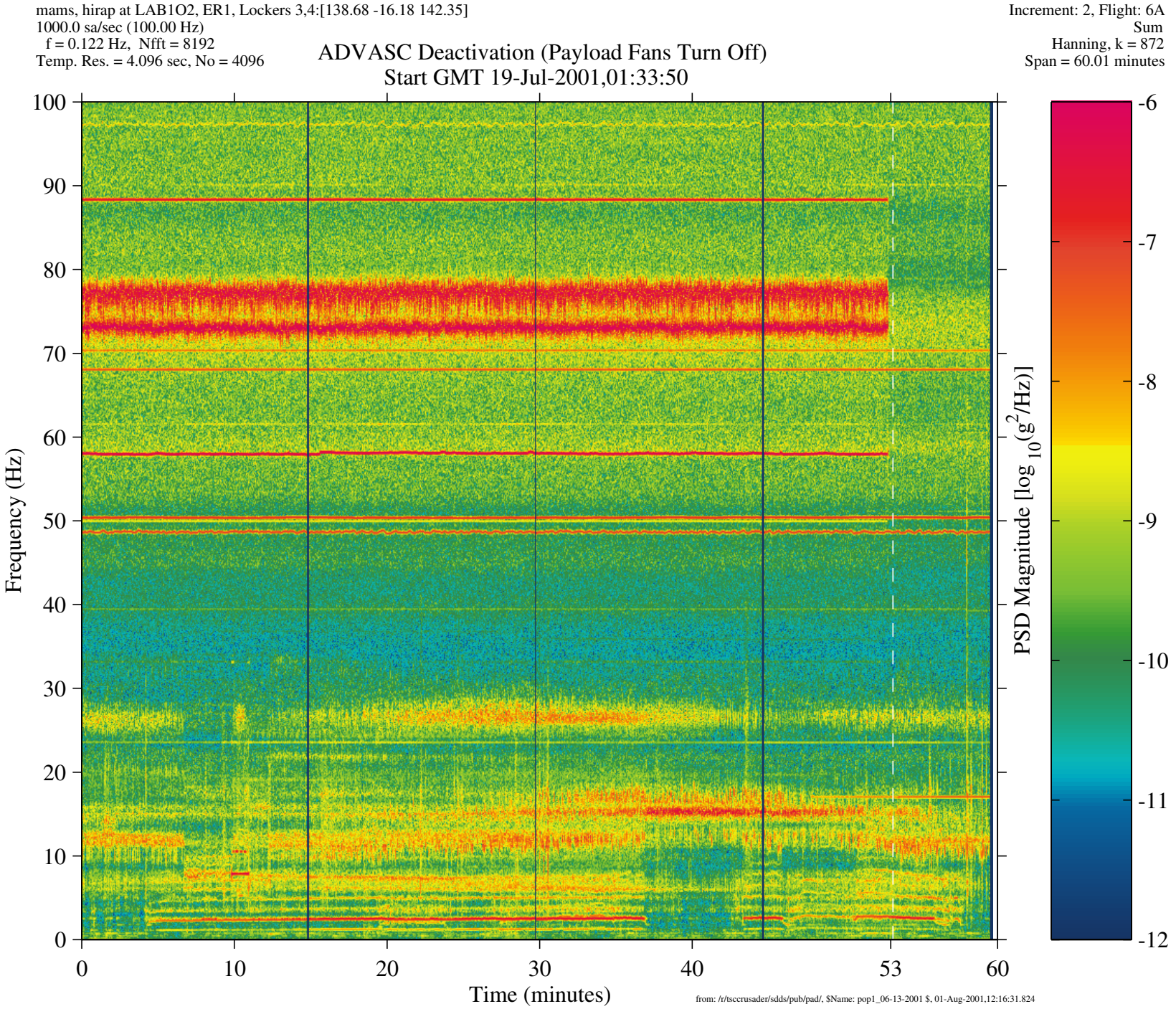
- **Primary function is to allow access to acceleration data for non-time-critical processing**
  - **In general, allows a more detailed analysis of the measured microgravity environment**
  - **Capable of processing and analyzing a long period of data**
  - **Overall access to acceleration data greatly simplified by a universal storage format**
- **PIMS WWW page offline functions**
  - **Provide the capability to request plotted data or data files through an electronic request**
  - **Provide means for access to the processed acceleration data files**
  - **Provide access to PIMS disturbance database information**

Offline Operations

- **Example Near Real-time Plots**
  - **Figure 13-4 MSL-1 (STS-94) SOFBALL Radiometry Data**
- **Example Offline Plots**
  - **Figure 13-5 LMS (STS-78) Principal Component Spectral Analysis**
  - **Figure 13-6 ISS Increment 2 Principal Component Spectral Analysis Figure 10-1**

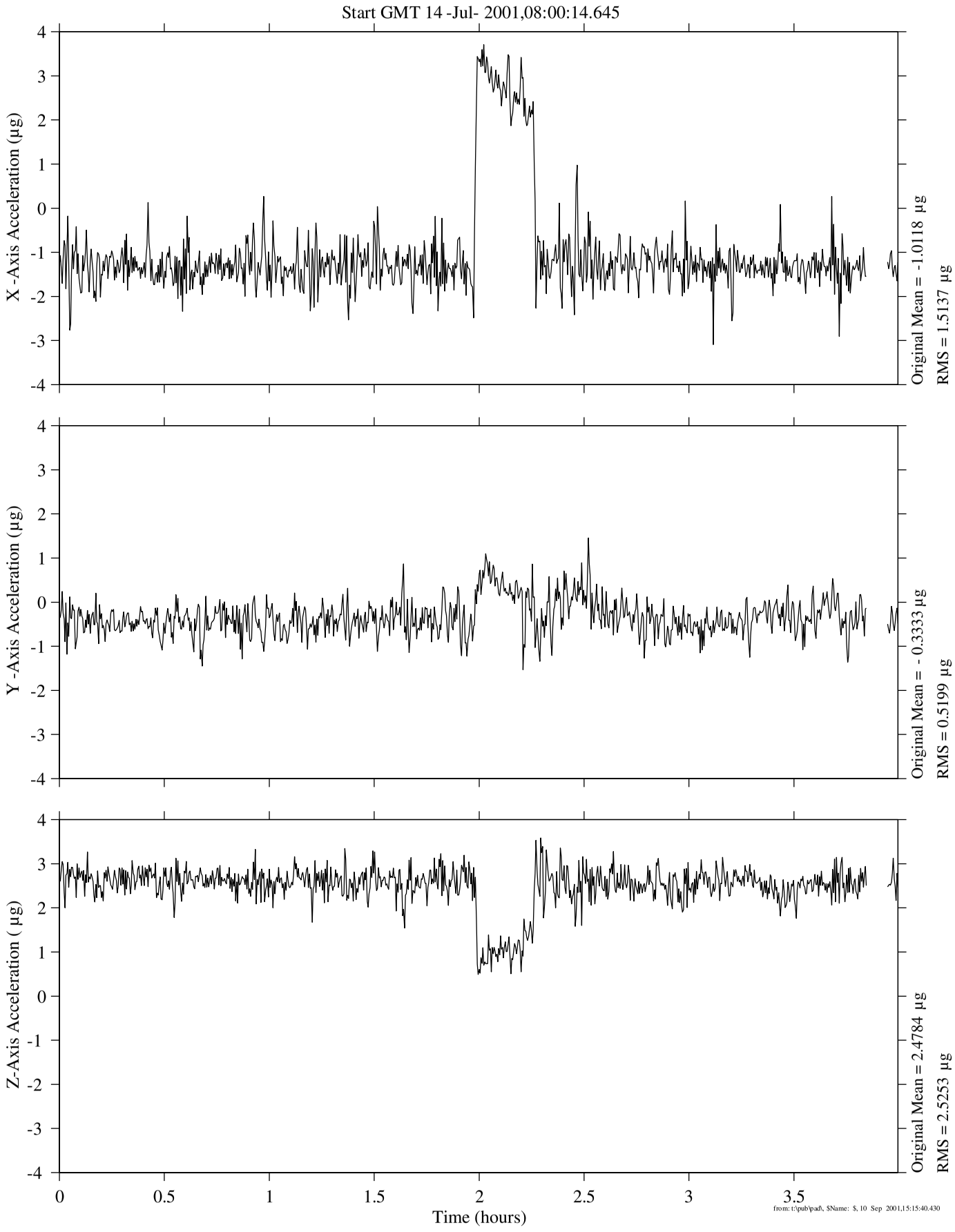
Summary

- **PIMS has been receiving, processing, and storing acceleration data for SAMS-II and MAMS data starting with flight 6A operations**
- **A universal storage format is currently employed for data storage**
  - **simplify access to acceleration data**
  - **standardize formats for data storage to maximize access to all existing acceleration data by international partners**
  - **Described in PIMS-ISS-101 document**
- **Real-time data plots of the various available accelerometers are available via the PIMS WWW page**
- **Offline access to plotted data and analysis capabilities are available through PIMS and the PIMS WWW page**
- **General and specialized characterization of the ISS microgravity environment are provided**

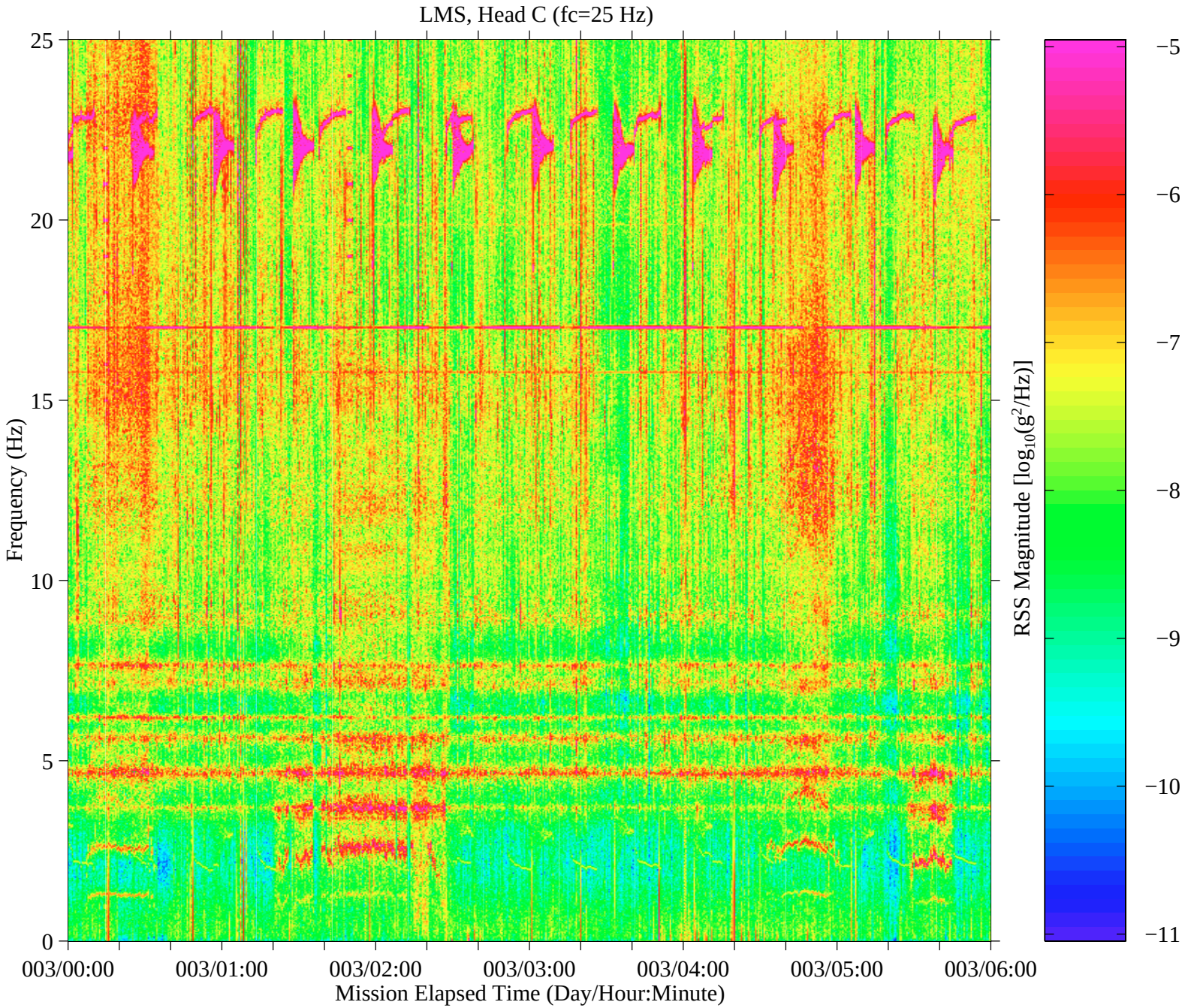


MEIT 2002 Figure 13-1: HiRAP Spectrogram of ADVASC Deactivation

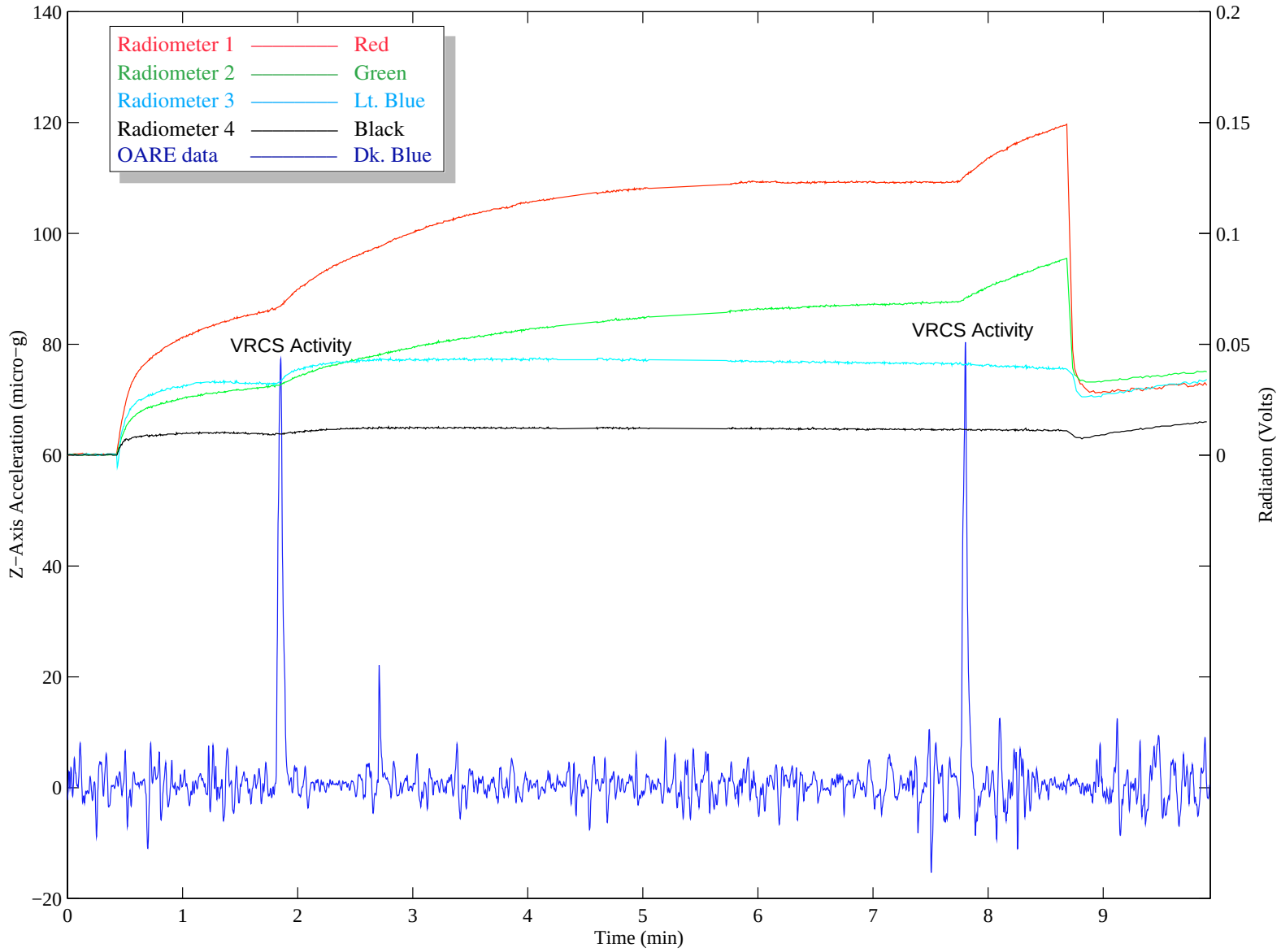
10.2 Orbiter Cabin Depressurization During STS –104



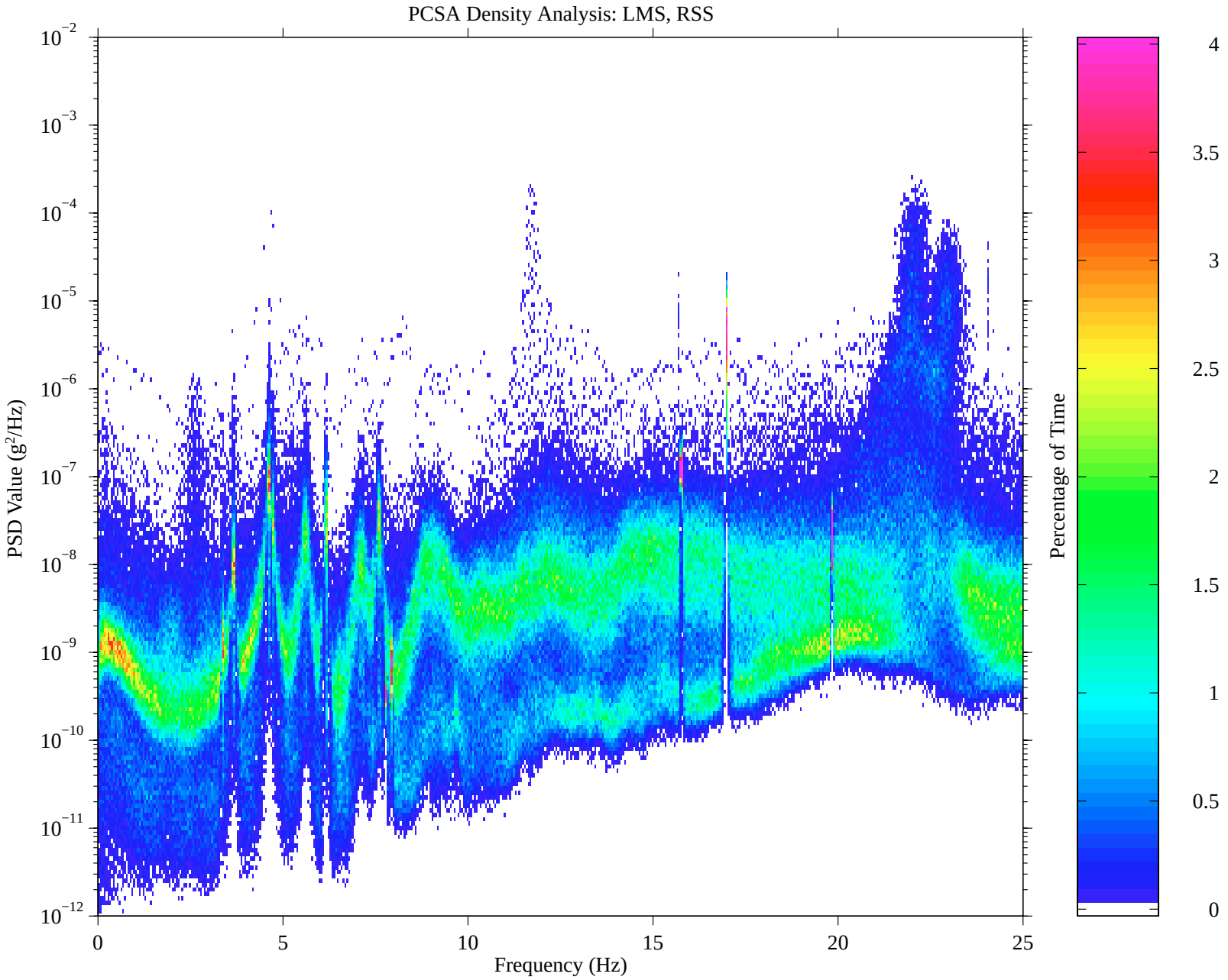
MEIT 2002 Figure 13-2: MAMS Raw OSS Data Showing Cabin De-Pressurization



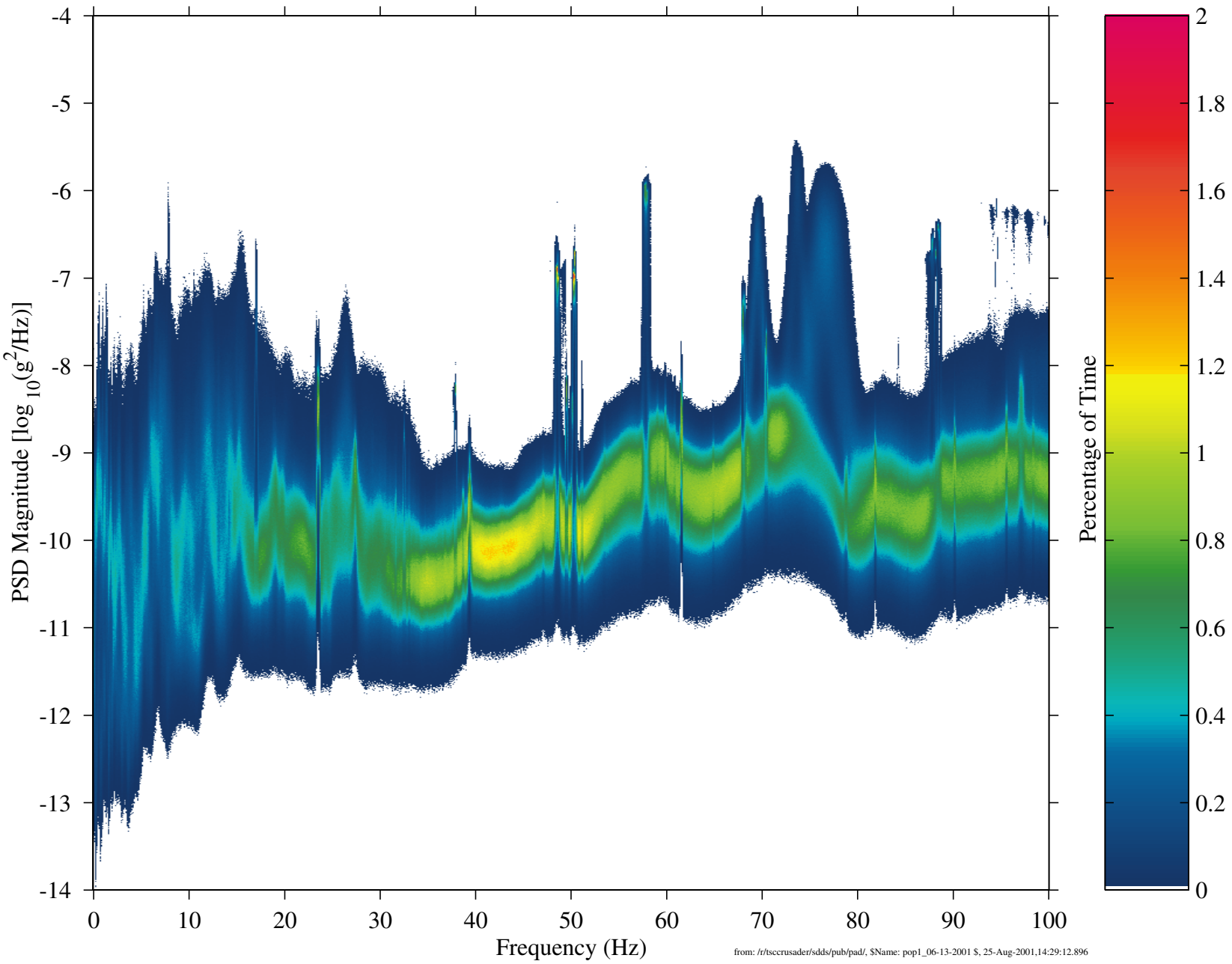
MEIT 2002 Figure 13-3: Nominal Microgravity Environment from STS-78 (LMS)



MEIT 2002 Figure 13-4: Raw OARE Data and SOFBALL Radiometry Data from STS-94 (MSL-1R)



MEIT 2002 Figure 13-5: Principal Component Spectral Analysis for the Entire STS-78 Mission (LMS)



MEIT 2002 Figure 13-6: HiRAP Principal Component Spectral Analysis Plot from Increment 2