

# **GLAST Large Area Telescope**

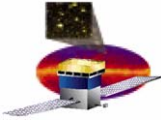
## **Monthly Mission Review**

### **LAT DAQ and Flight Software Status**

**September 28, 2006**

**Jana Thayer**

**Stanford Linear Accelerator Center**



## B0-6-12 status

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- **Incorporates all changes in FSW since May 18, 2005 (B0-6-9)**
  - **100 JIRAs resolved, addressing bug fixes and defects**
  - **Several changes to the C&T database necessitated LICOS release**
- **B0-6-12**
  - **Built on 9-15-06**
  - **Full FSW FQT regression test run 9-15-06 to 9-19-06**
  - **I&T regression testing 9-19-06 to 9-24-06**
  - **Installed on LAT 9-25-06**
- **Installation**
  - **Burned 9.5/10 banks without problems**
  - **Disk full error from /ee1**
  - **TRC LATC\_verify error came back**

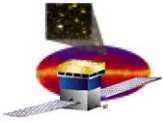


## B0-6-12 installation: disk full error

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- During upload of B0-6-12 to redundant SIU(siu0) /ee1, encountered a disk full error
  - Each bank is 3 MB = 1 MB (boot partition) + 2 MB (TFFS)
  - Files get uploaded to the file system (TFFS) = 2 MB
    - Used (bytes) includes B0-6-12
    - SIU1 (primary SIU) is shown for comparison

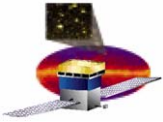
SIU/bank	Used (bytes)
Siu0/ee0	1720523
Siu0/ee1	1842360
Siu1/ee0	1527173
Siu1/ee1	1581504



## B0-6-12 installation: disk full error (cont)

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- History of file management on flight crates
  - Crate production happened over several months
  - SIU0 was the first crate to go through ELX testing
    - ELX test code in ee1 (predates FSW builds, FMX, LICOS)
    - ee0 was reserved for I&T
    - EEPROMs *did not get formatted* before hand-off to I&T
    - Contains all builds from B0-6-6 to B0-6-12
  - Crates handed off to I&T with the “latest” build
  - Once format command was available, re-formatted EEPROMs and loaded latest build before handoff to I&T
- SIU0, being the first crate, has more files on it than the other crates
- Builds are always loaded into both ee0 and ee1
  - I&T (LICOS) predominantly boots from ee1

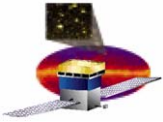


## B0-6-12 installation: disk full error (cont)

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- Enter FMX and LICOS
  - FMX is the database that tracks files uploaded to the LAT
  - When FMX was first introduced long after crate production and the first FSW builds were complete, it was *not* integrated with LICOS and did not have any knowledge of the history of each of these crates.
    - An effort was made to populate FMX with the builds that were uploaded to the LAT by I&T
      - This “history” was put into FMX by hand
    - ELX uploads were not always included
      - Consequently, more files exist on the LAT than exist in database

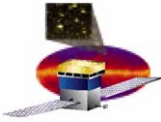
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## B0-6-12 installation: disk full error (cont)

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- **FMX and LICOS today**
  - From now on the tool that uploads or deletes files on the EEPROMS is inextricably linked to FMX
    - File uploads are an automated process, and any file that gets put on the LAT must go through FMX
    - FMX and LAT upload operations happen synchronously
    - All present and future uploads will be tracked by FMX
- **As of several weeks ago, a feature was put into fmx to determine how much space is taken up on the EEPROM**
  - This feature has not migrated to LICOS yet
  - Ideally, the script doing the uploading would query fmx to determine whether there is enough space on the EEPROMs to put the build on before uploading:
    - Existing files + new build  $\leq$  2MB?
  - This tool will exist when we launch
    - Integrate with ITOS, FMX, activities database, MOOT/MOOD
- **Onboard FSW tools also available to check TFFS**



## B0-6-12/13: TRC LATC\_verify error

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- TRC LATC\_verify error root cause (known issue from TKR subsystem):
  - The tracker readout controller (TRC) chip has a flaw in that it does not have a clean power up state. Occasionally upon power up, the chip cannot accept commands. The only way to reset the chip is to pull on TRC reset line.
  - Issue a commanded reset to the tracker cable controller (TCC) in the TEM (one layer up) immediately after power up
  - This feature was being worked around using LATTE since 1st tower
- History of fix:
  - Originally fixed by issuing reset in LICOS during power up script
  - Once LATC was installed on LAT --
    - LATC configured TCC, TRC, and TFE to known, non-zero values
    - LICOS subsequently issued TCC reset and cleared everything
      - This had the effect of clearing the timeout register on the TCC after it had already been set by the FSW. Not good.
  - Moved the reset into the FSW (FSW-559)
  - Later, in response to a separate LATC\_verify error, a reset to the CAL readout controller was added to the FSW
  - At this time, code was restructured and the desired TCC\_reset turned into a TRC\_reset (not a HW reset, so it doesn't work)
- Known bug, known fix. Recognized almost immediately. Will be fixed in B0-6-13, installed Thursday PM.



## Tested: ability to roll back to B0-6-9

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- LAT can be booted into either B0-6-9 or B0-6-12
  - B0-6-9 and B0-6-12 files are present in the file system of both banks of all processors
- To switch between builds, upload a new secondary boot script to each processor
  - Started in B0-6-12
  - Switched to B0-6-9
    - Uploaded B0-6-9 secondary boot script
    - Secondary booted using the B0-6-9 boot script
    - Message log indicated that B0-6-9 was running
  - Switched back to B0-6-12
    - Uploaded to B0-6-12 secondary boot script
    - Secondary booted using the B0-6-12 script
    - Message log indicated that B0-6-12 was running
- Currently, all secondary boot scripts are B0-6-12





## B0-7-0 status

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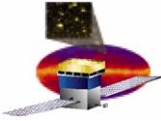
- **Difference between B0-6-13 and B0-7-0 is compression**
- **Compression encode/decode of normal (zero-suppressed, single-range readout) complete and tested**
  - **Compression factor is slightly >3 on Gamma sample**
  - **Smaller events compress by a factor of 4-5**
- **Remaining work**
  - **Verify that “checker” is working correctly, ~2 days**
  - **Pedestal type events, ~1 day**
  - **4-range, zero-suppressed events (ACD and CAL), ~3 days**
    - **Encoding side is written**
    - **Decoding side (on the ground) is not**
  - **Run on testbed to check for errors and performance measurement, 5 days**
    - **Budget for encoding an event is 2 ms**
    - **Can be performed in parallel by developer not on critical path**
- **Success-oriented schedule (assumes that testing turns up nothing)**
  - **If no other bugs turn up, could be ready by 10-4-06**
  - **Upload to LAT 10-6-06**



## B0-7-0 status

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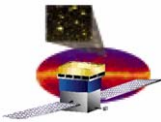
- Difference between B0-6-13 and B0-7-0 is compression
- Compression encode/decode of normal (zero-suppressed, single-range readout) complete and tested
  - Compression factor is slightly  $>3$  on Gamma sample
  - Smaller events compress by a factor of 4-5
- Remaining work
  - Verify that “checker” is working correctly, ~2 days
  - Pedestal type events, ~1 day
  - 4-range, zero-suppressed events (ACD and CAL), ~3 days
    - Encoding side is written
    - Decoding side (on the ground) is not
  - Run on testbed to check for errors and performance measurement, 5 days
    - Budget for encoding an event is 2 ms
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- Success-oriented schedule (assumes that testing turns up nothing)
  - If no other bugs turn up, could be ready by 10-4-06
  - Upload to LAT 10-6-06



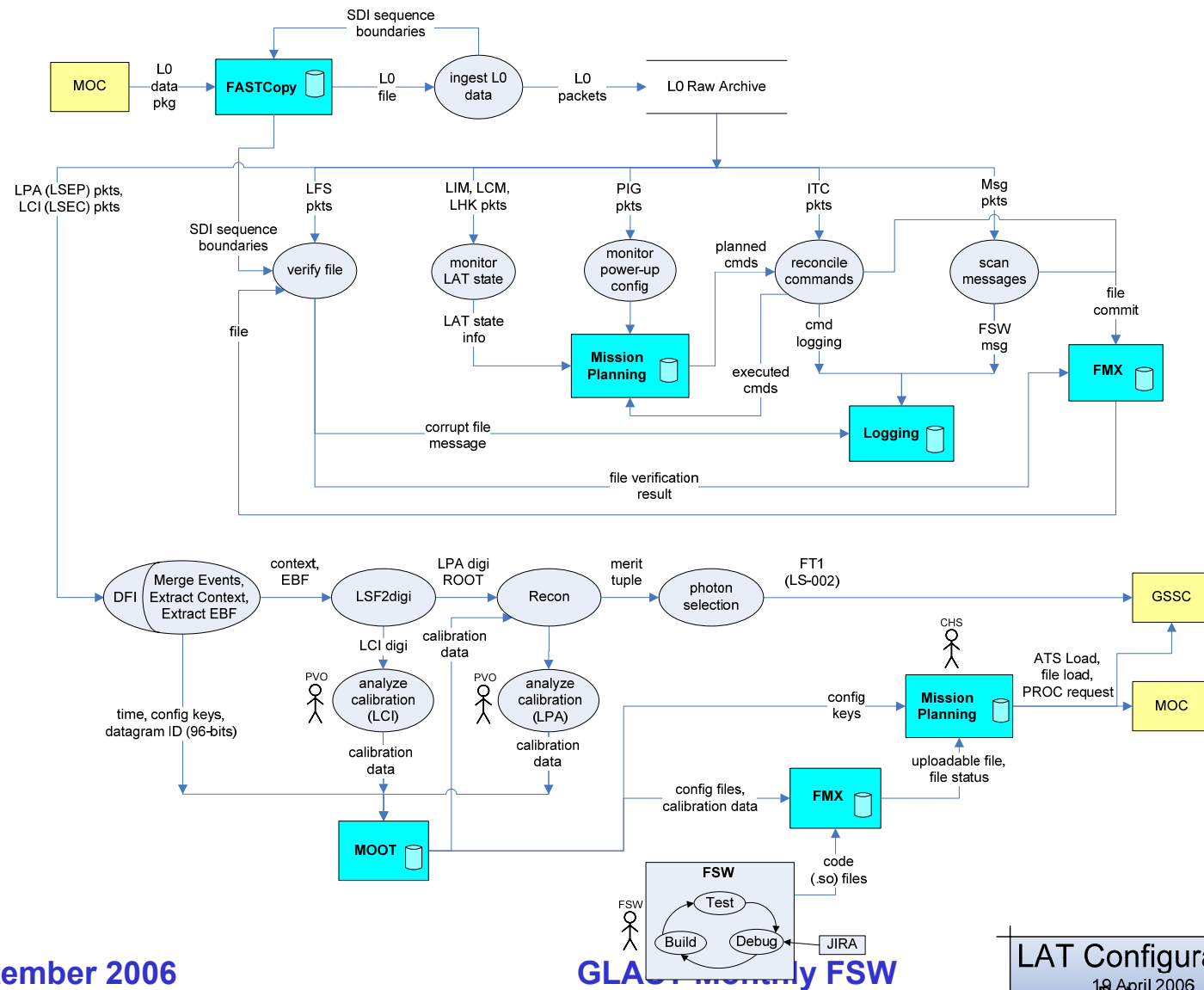
# Moving from I&T to ISOC

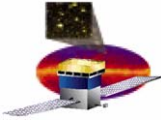
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- **Now (I&T operating the instrument)**
  - Use LICOS to command the instrument and display telemetry
  - Command and command verification done internally by LICOS
  - FSW code modules tracked using integrated LICOS/FMX
  - NOTE: New configurations are often generated by I&T or other subsystem (not necessarily FSW). These configurations are not tracked by MOOT/MOOD yet nor by FMX. Consequently they are uploaded only when they are needed to RAM not TFFS
- **ISOC**
  - Use ITOS to command the instrument
  - Use LICOS to display telemetry
  - Track commands issued/verified in activities database
  - Track all files and all configurations using FMX and MOOT/MOOD
  - Develop tools to integrate all of these elements
- **FSW provided software and databases already exist**
  - On-board FSW
  - FMX
- **There are significant interactions among the LAT Configuration, Mission Planning, and L0 Processing components within the ISOC**



# LAT Configuration Interactions

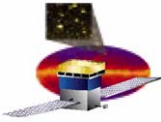




# Summary

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- **B0-6-12 is on the LAT**
  - Regression testing is continuing
  - One bug found that necessitates new build, B0-6-13
- **B0-6-13 is built**
  - FSW regression testing in progress
  - Installation planned for 9-28-06 PM
- **B0-7-0 includes compression**
  - All encoding (compression) is done
  - Decompression is about 90% done
  - Rigorous testing of compression/decompression required prior to release of build



# GLAST Large Area Telescope

## Monthly Mission Review

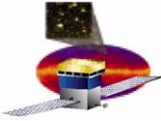
# Backup

Stanford Linear Accelerator Center

28 September 2006

GLAST Monthly FSW

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# FSW B1.0.0

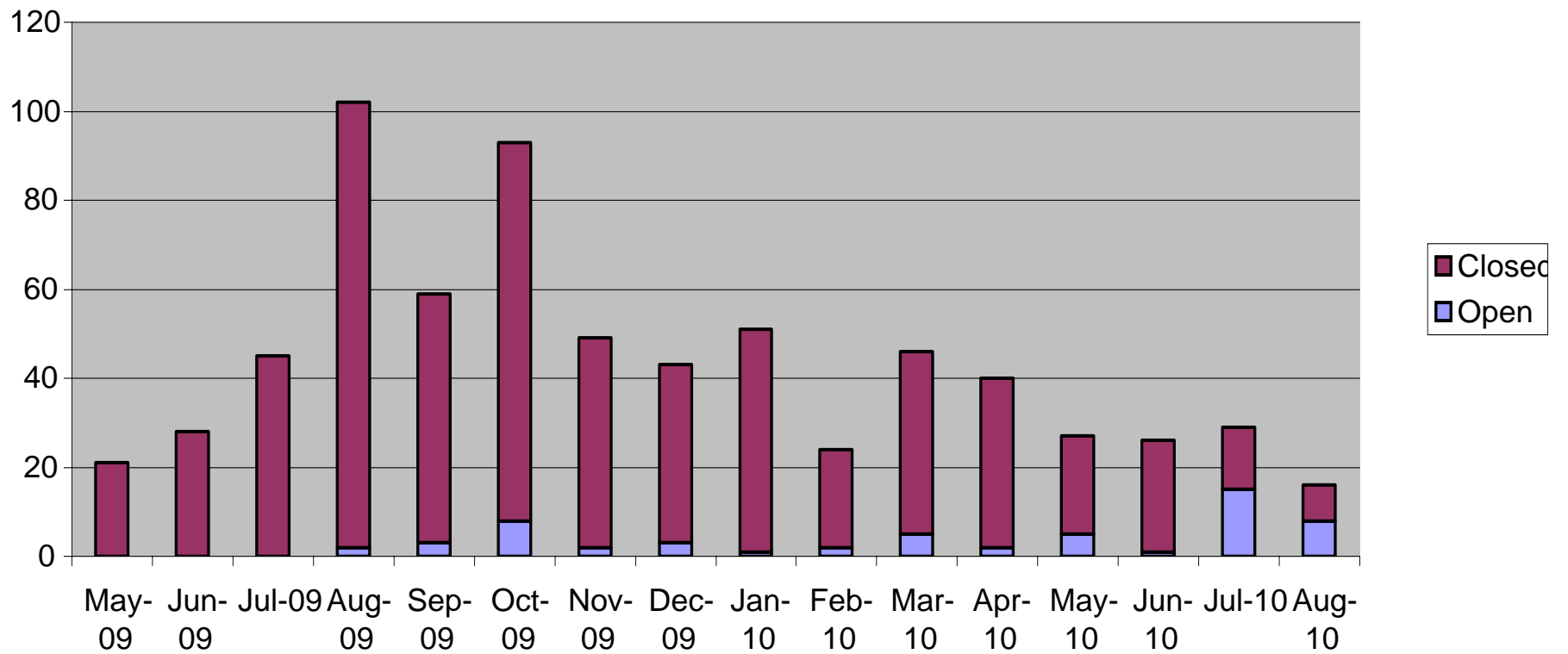
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- **Build 1.0.0**
  - **Includes GRB algorithm**
    - 5.3.10.2.1 GRB Location Accuracy
    - 5.3.10.2.2 Modification of GRB criteria
    - 5.3.11.3.3 Process Attitude Data
    - 5.3.11.6 GRB Alert Message Latency
    - 5.3.11.7 LAT GRB Repoint Request Message to SC
  - **Includes FSW Standards**
    - 5.4.1 System of Units (metric system)
    - 5.4.2.x Coordinate Systems (3 requirements)
    - 5.4.3 Resource Margin
- **Available around 11/6/06**
- **Delta-FQT-B (11/28/06)**
  - **Complete 183 of 183 requirements**
- **Install on LAT prior to Observatory Environmental Test**



# JIRA Metrics

## JIRA Metrics as of 22 August 2006







## Top FSW JIRAs (Critical or Major Severity)

Priority	Key	Summary	Issue Type
Critical	<a href="#">FSW-716</a>	Implement science data compression	Improvement
Critical	<a href="#">FSW-292</a>	Implement GRB detection algorithm	New Feature
Major	<a href="#">FSW-684</a>	There need to be general no-op commands for each task.	New Feature
Major	<a href="#">FSW-680</a>	Swap LHKPnxHP3DSIT and LHKPnxHP5DSIT to address miswiring of thermal sensor	Bug
Major	<a href="#">FSW-718</a>	Expose LookAtMe in telecommands	Improvement
Major	<a href="#">FSW-717</a>	Expose LAT reset command to Telecommand	Improvement
Major	<a href="#">FSW-456</a>	EMP and LCM do zlib compress with malloc/free, should use MBA_alloc/free	Improvement
Major	<a href="#">FSW-305</a>	Summary/statistics telemetry stream needs to be created for on-board event processors	Improvement
Major	<a href="#">FSW-369</a>	MSG needs to disable reports from within the MSG task	Bug
Major	<a href="#">FSW-576</a>	Bug in CAL data compression algorithm	Bug
Major	<a href="#">FSW-623</a>	CLONE -Documentation for several apids needs to be added to standard webpage	Improvement



## Top FSW JIRAs (Critical or Major Severity)

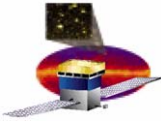
Priority	Key	Summary	Issue Type
Major	<a href="#">FSW-703</a>	Ensure all registers are set	Improvement
Major	<a href="#">FSW-704</a>	Read, report and clear flag registers	Improvement
Major	<a href="#">FSW-701</a>	Add flexibility to MSG level output based on destination	Improvement
Major	<a href="#">FSW-699</a>	Create report to identify configuration files in use	Improvement
Major	<a href="#">FSW-698</a>	Separate LTC master config files into fof, data	Improvement
Major	<a href="#">FSW-270</a>	mnemonics in telemetry packet 720/0x2D0 do not begin with ?L?	Improvement
Major	<a href="#">FSW-562</a>	Make sure that PIG's power sequence is still correct	Improvement



## B0.6.12 JIRAs

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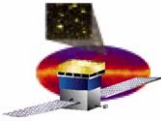
- Existing JIRA items address requirements, bug fixes, and open NCRs:
  - FSW-164, 167, 270, 419, 526, 538, 562, 636, 690-2, 695-7, 703-4, 716-8
  - Example: Data compression, LAT reset
- Correct deficiencies in current functionality
  - FSW - 287, 369, 582, 682, 698-9, 707
  - Example: Anti-flooding for MSG, LTC Configuration files traceable with FMX, MOOT/MOOD
- Needed for operations visibility
  - FSW-684, 693
  - Example: No-op commands, command confirmation and task messaging configuration report



# FSW role in LAT Configuration

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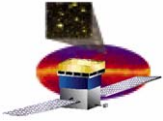
- **Mission Planning requires:**
  - **Knowing current LAT configuration**
  - **Knowing the proposed LAT configurations**
  - **Understanding the effect of recent commanding activities on LAT configuration**
- **LAT flight software must be able to:**
  - **Configure the instrument and alter its data-taking configuration in different observation modes**
- **LAT Operations Plan links mission planning to LAT on-board operations**
- **Creating a new configuration:**
  - **FSW provides the mechanism for creating binaries**
  - **PVO/SAS/LAT collaboration provide the inputs (the data)**
- **Tools on the ground track history of LAT configuration**



# FMX

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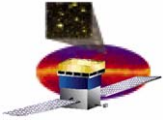
- **File Management eXtra (FMX) database tracks every file uploaded to LAT (and any teststand in ISOC dataflow lab)**
- **FMX relates an uploadable binary file to a unique file identifier**
  - **Tracks FSW code modules and configuration files on LAT**
  - **Integrates with higher-level configuration management tools (MOOT/MOOD)**
  - **Tracks onboard file system history for life of mission**
- **FMX understands the same file operations that the onboard FSW understands:**
  - **FILE upload**
  - **FILE commit**
  - **FILE delete**
  - **EEPROM format**



# MOOT/MOOD

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- **MOOD (Mode of Operations Database)** is the repository for LAT configuration parameters. It —
  - Tracks LAT configuration parameters using descriptive terms: thresholds, channel masks, delays...
  - Can reconstruct any uploaded configuration, present or historical
  - Can avoid creating and uploading redundant information
  - Interfaces with FMX to log the binary representation of these configurations
  - Interfaces to SAS tools for data analysis
- **MOOT (Modes of Operation Tracker)**
  - populates MOOD
  - drives the infrastructure of FSW utilities used to build binary files



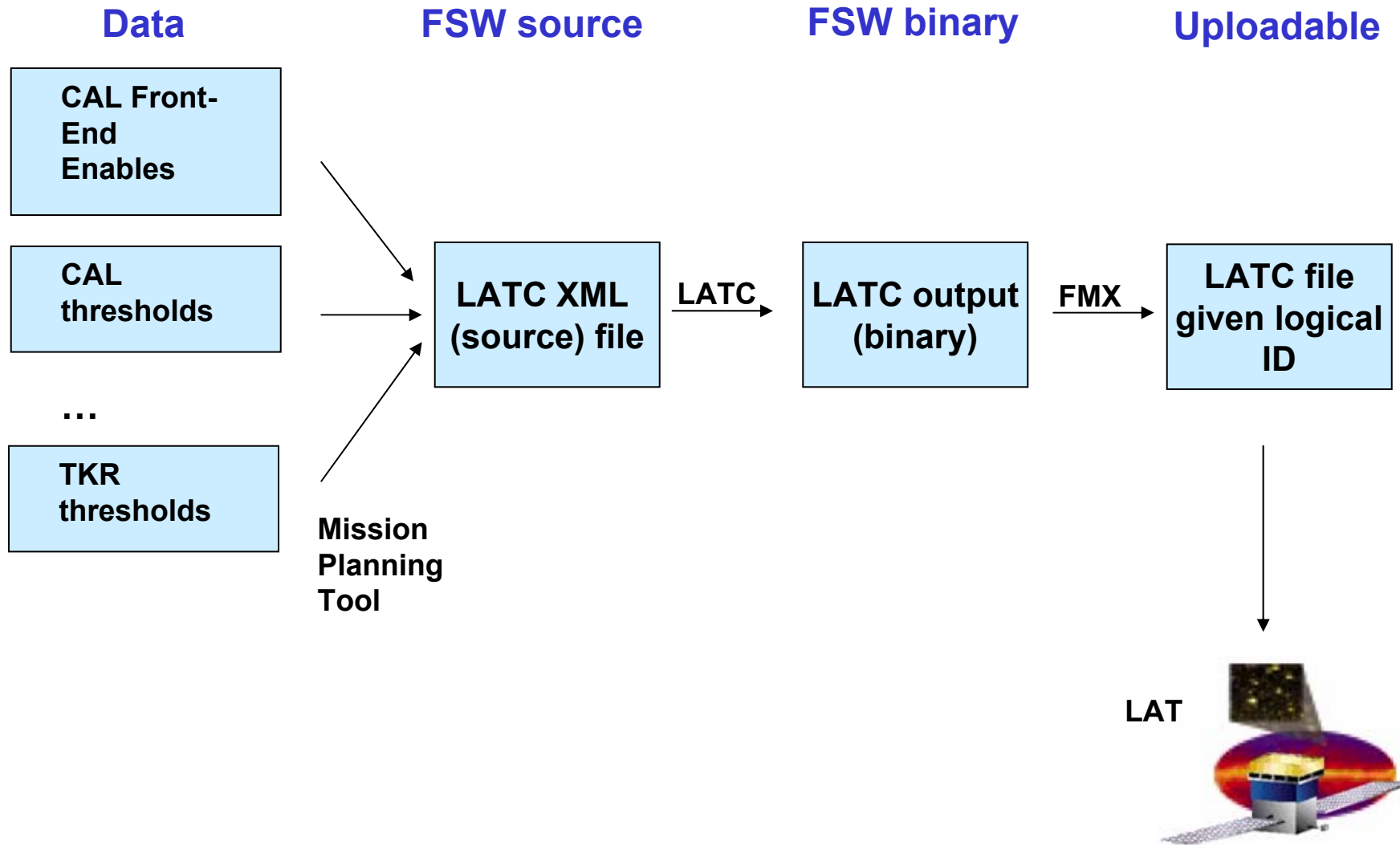
## MOOT/MOOD (cont'd)

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- **MOOT/MOOD defines and creates configuration files for:**
  - **LAT register settings (LATC)**
  - **Definition and execution of calibration runs (LCI)**
  - **Thermal Control**
  - **pedestals and gains, parameters for each detector component**
    - **Returns these values to SAS during reconstruction**
    - **Transmits values in a specified format to FSW**
- **MOOT does not deal with FSW code modules**



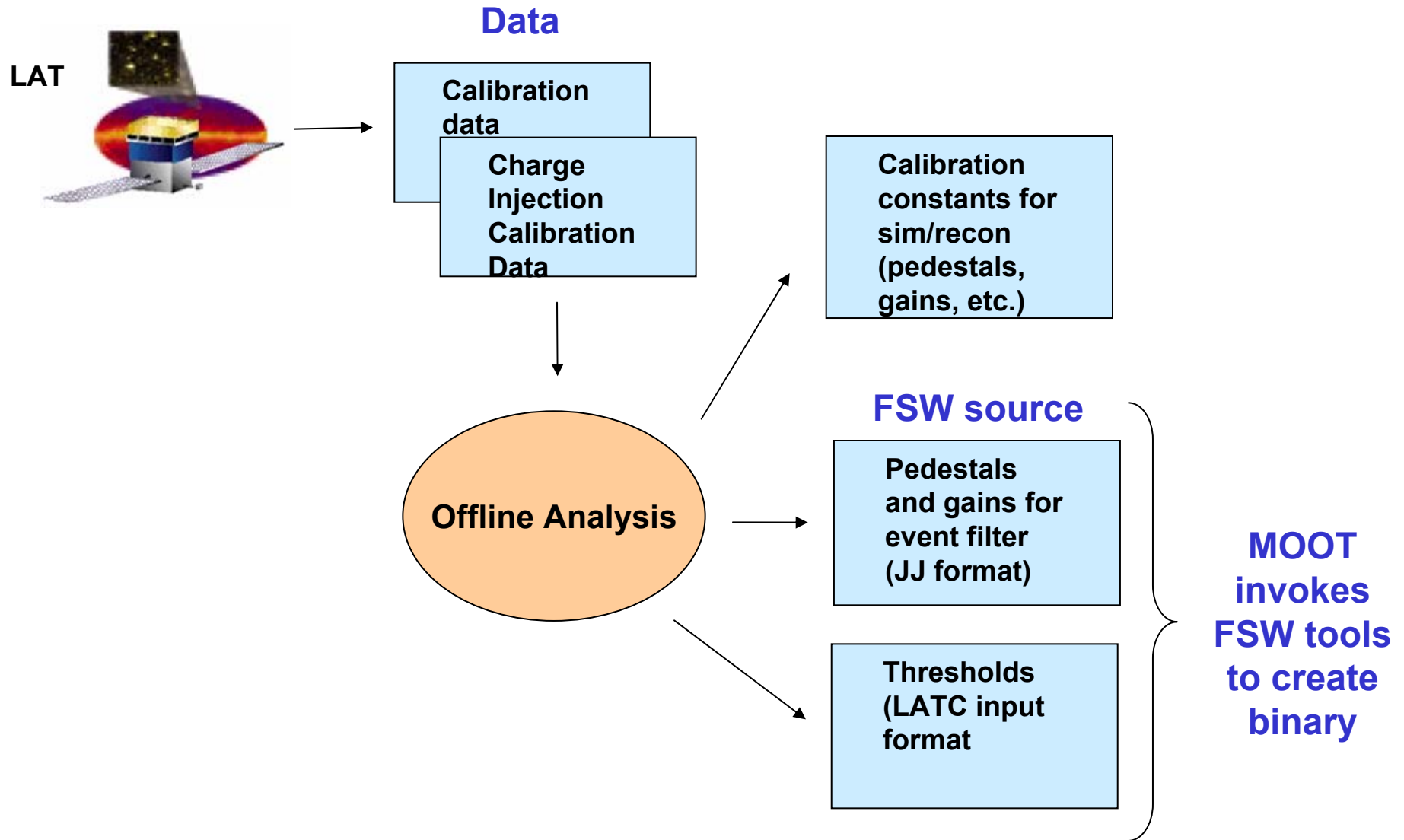
# MOOT creates a new file







# MOOT: Calibration to configuration





# How a file becomes a LAT Configuration

