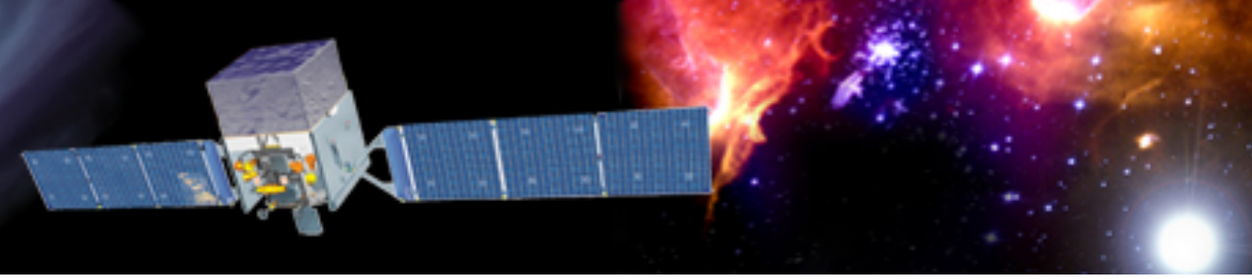
Fermi
Science Support Center



# DATA PROCESSING, DATA SERVERS & SOFTWARE DEVELOPMENT

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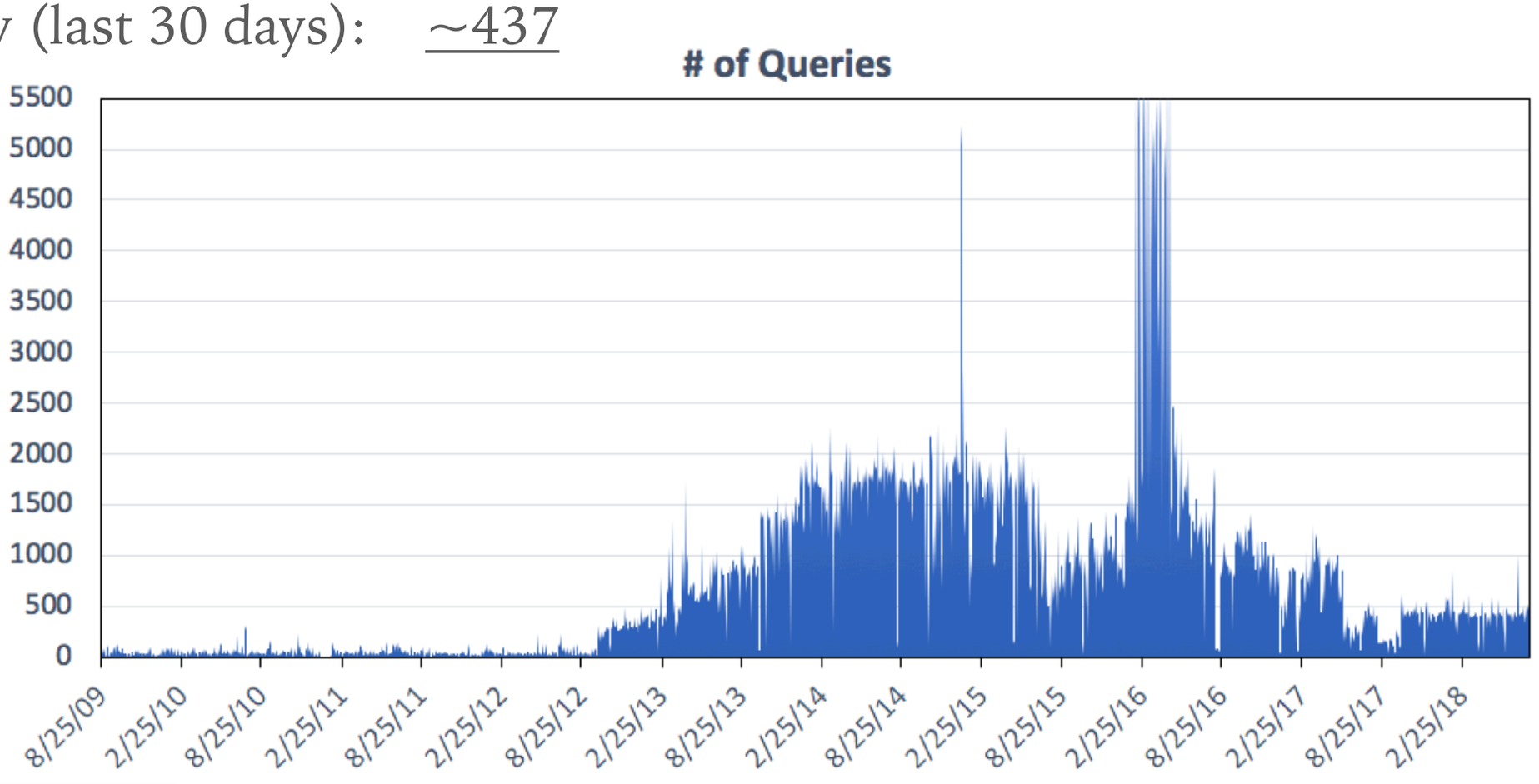
# FSSC OPERATIONS PERSONNEL

- 4 data operations & software support personnel
  - Science analysis software development & performance
  - Data server software & maintenance (GSFC)
  - LAT data pipeline & archive support (SLAC)

- 3.5 science support personnel
  - Mission operations (both S/C & LAT)
  - Documentation updates
  - Helpdesk responses

# FSSC LAT SERVER STATISTICS

- LAT Data Server
  - Currently serving: Pass 8 data (since 24 July 2015)
  - Data downloaded: 88.54 TB (as of 28 July 2018)
  - Mission average queries/day: ~721 (photon database)
  - Queries/day (last 30 days): ~437



# FSSC DATA STATUS

- Data ingest for both LAT and GBM is proceeding smoothly
  - Reprocessed Pass 8 files ingested up to March 2018 into backup data server
    - Preparing for near-term release (with updated science tools)
    - Updated spacecraft files may accompany this release

- GBM data files updated:
  - Continuous TTE files updated to use more convenient hourly format
  - “Timing glitches” prior to summer 2015 corrected back to Nov 2012

- Added “Data Gaps” page to LAT Data Server after March 2018 event
  - Summarizes all periods without LAT data lasting more than 6 hours

# NEW PAGE: LAT DATA GAPS

## LAT Data Gaps

The table below lists gaps in the LAT data than are longer than 6 hours.

| Start MET | Stop MET | Start Time | Stop Time | Duration (days) | Notes |
|---|---|---|---|---|---|
| 250687179 | 250710111 | 2008-12-11 11:19:38 | 2008-12-11 17:41:50 | 0.27 | |
| 258437343 | 258856049 | 2009-03-11 04:09:01 | 2009-03-16 00:27:27 | 4.85 | Safe Hold |
| 276023993 | 276055527 | 2009-09-30 17:19:51 | 2009-10-01 02:05:25 | 0.36 | |
| 340865214 | 340889542 | 2011-10-21 04:46:52 | 2011-10-21 11:32:20 | 0.28 | |
| 356251782 | 356274691 | 2012-04-16 06:49:40 | 2012-04-16 13:11:29 | 0.27 | |
| 377603293 | 377662072 | 2012-12-19 09:48:10 | 2012-12-20 02:07:49 | 0.68 | |
| 404112118 | 404155634 | 2013-10-22 05:21:55 | 2013-10-22 17:27:11 | 0.50 | |
| 425439971 | 425488604 | 2014-06-26 01:46:08 | 2014-06-26 15:16:41 | 0.56 | |
| 519685047 | 519739272 | 2017-06-20 20:57:22 | 2017-06-21 12:01:07 | 0.63 | |
| 542868807 | 544458120 | 2018-03-16 04:53:22 | 2018-04-03 14:21:55 | 18.39 | Safe Hold |

# NEW DATA CATALOGS

- One new LAT high-level data product
  - FL8Y source list:
    - Uses 8 years of Pass 8 data
    - Not the full catalog analysis → not recommended for scientific publications

- In work:
  - GBM Earth Occultation Catalog (249 sources)
  - Next LAT catalog in development

- Once final, catalogs are usually imported into BROWSE format (searchable)
  - FL8Y has not been made available in BROWSE

# SCIENCE TOOLS CURRENT STATUS

- Current science tools (v11r5p3) release date: 15 Feb 2018
  - Significant infrastructure changes to allow support for:
    - Scientific Linux 6, &7
    - Mac OS X 10.11 (El Capitan) & 10.12 (Sierra)
    - Ubuntu 16.04, 17.10
    - Compatible with Fedora 24, 26, & 27, & Mac OS X 10.13 (High Sierra)
  - Also supports significant improvements to fermipy functionality

- GBM analysis tools:
  - rmfit: v4.3.2 is still current
  - gtburst: updated in February ST release to v02-02-00
  - gspec: in development by GBM team
    - Not yet ready for inclusion in Fermi Science Tools release

# SCIENCE TOOLS PLATFORM USAGE

Mac OS X

| 10.11 | 10.12 |
|---|---|
| 110 | 355 |
| 3.0% | 9.8% |

Scientific Linux

| SL6 | SL7 |
|---|---|
| 129 | 212 |
| 3.8% | 5.9% |

Other Linux

| Ubuntu 16.04 | Ubuntu 17.10 |
|---|---|
| 648 | 1781 |
| 18.0% | 49.4% |

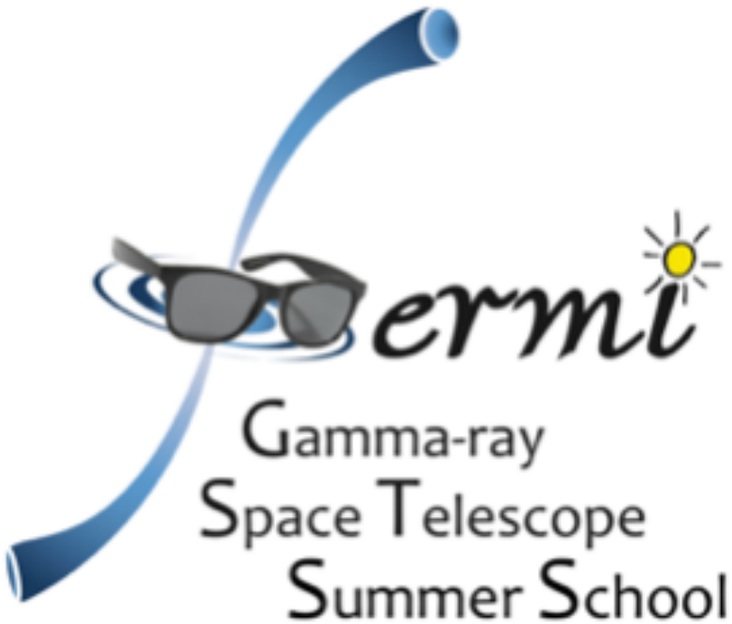
| Source |
|---|
| 372 |
| 10.3% |

*Total downloads of v11r5p3 =3607*

*(only 4 months)*

# SCIENCE TOOLS CONTAINERIZATION

- Developed annually for Fermi Summer School
- Intended for cross-platform installation (using Docker)
  - Able to be used with Windows operating system
  - Uses most recent version of Science Tools (v11r5p3)
- Available on github for general community
  - https://github.com/fermi-lat/FermiBottle




# FUTURE SCIENCE TOOLS RELEASES

- New version of tools (v11r6p3) in development
  - Moving to Conda build system (uses anaconda python)
    - 3rd party dependencies handled by Conda → smaller codebase to maintain
    - Reduces/eliminates library compatibility errors
    - Makes installation and updates much easier
    - Installation more compatible with user's environment

- Adding automated 'continuous integration' to ST development
  - Unified version (SLAC & FSSC) now being maintained in GitHub
  - Upon check-in, updated binaries are automatically built and unit tests run across multiple platforms using virtual containers
  - Should catch issues early in the development process and significantly reduce time required to resolve platform-specific errors

# MISSION OPERATIONS & USER SUPPORT

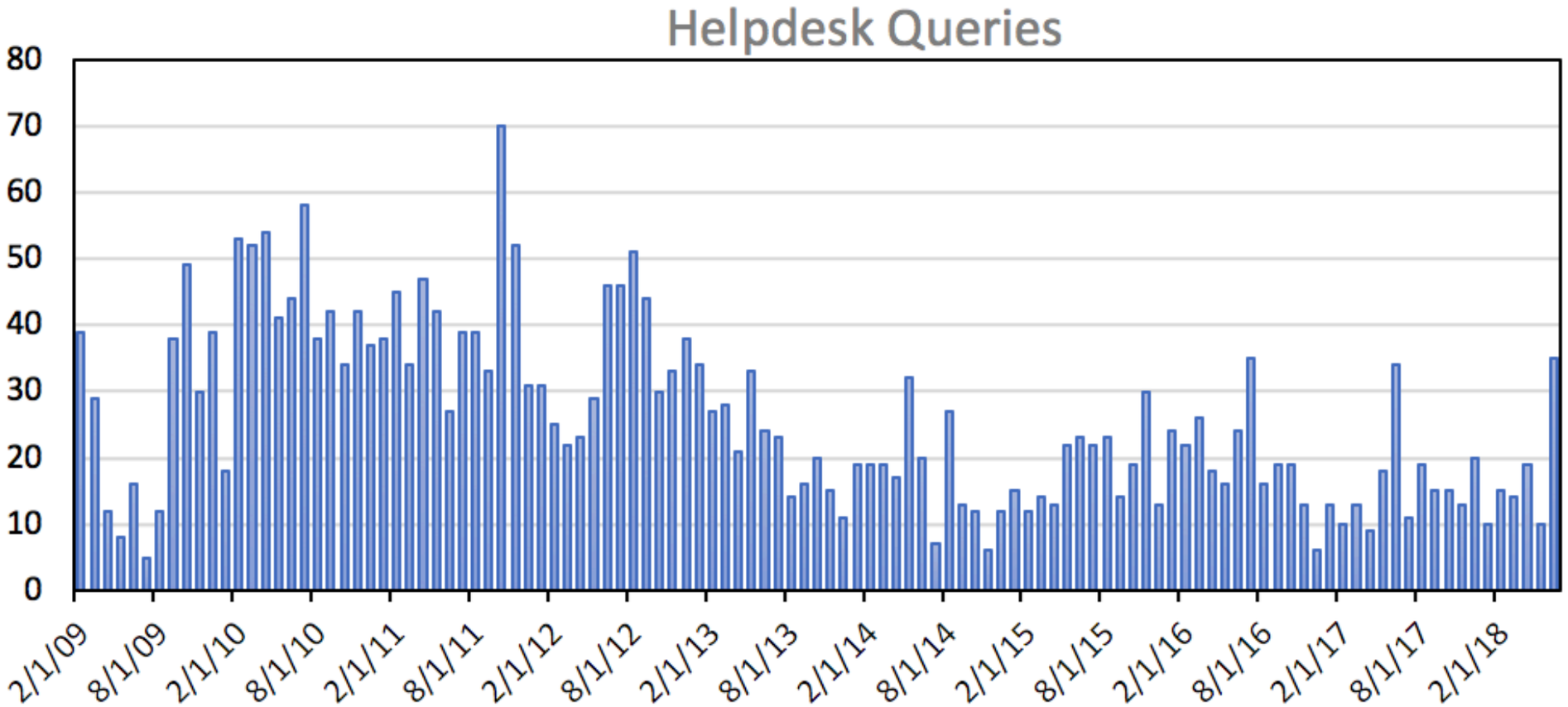
- 3 TOOs implemented since last meeting (10 months)
  - 2 for Novae
  - 1 for Crab

- Transition to AO-11 coming in mid-August 2018

- Helpdesk distributed among additional personnel
  - More diverse responders
  - Improved response time

# FERMI HELP DESK

- Help Desk
  - >3500 requests over the lifetime of the mission
  - 0.5 queries/day running average over the last year
  - ~80% asking for information, 15% reporting issues, 5% spam

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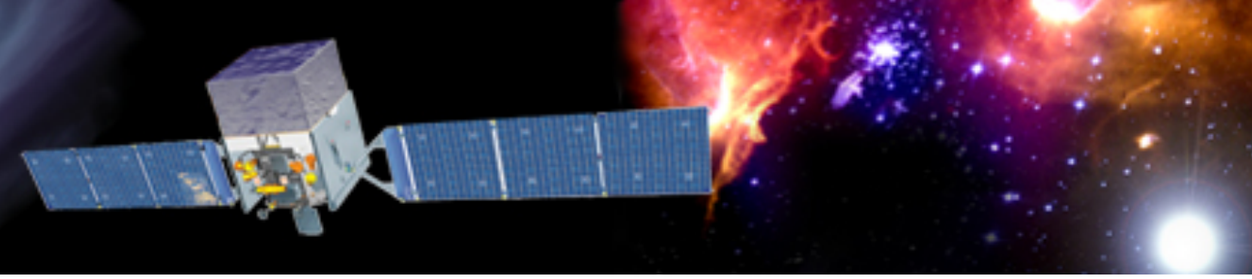


# SLAC ⇒ FSSC

# TRANSITION STATUS

# LAT OPERATIONS TRANSITION

- DOE has planned reductions / workforce transfer to new programs at Launch+10 years
  - After Oct 1, 2018, most SLAC/DOE staff available on “as-needed” basis
  - FSSC increased staff by 2 personnel to handle additional workload (reported last meeting)
- Prioritized training for tasks by mission criticality
  - Mission Operations
  - Data Processing & Archiving
  - Software development & maintenance

# TRANSITION PLAN

- Knowledge transfer ⇒ Shadow operations ⇒ Full transition
  - "Knowledge transfer" period began in Feb 2017
  - "Shadow operations" began late 2017
  - FSSC personnel now taking shifts for all standard activities

- Reminder: data pipeline & L0 archive remains at SLAC

# MISSION OPERATIONS TRANSITION

- Regular planning process now includes LAT timeline and generation of LAT weekly/quarterly reports
  - See report by Robin Corbet

# DATA PROCESSING & ARCHIVING TRANSITION

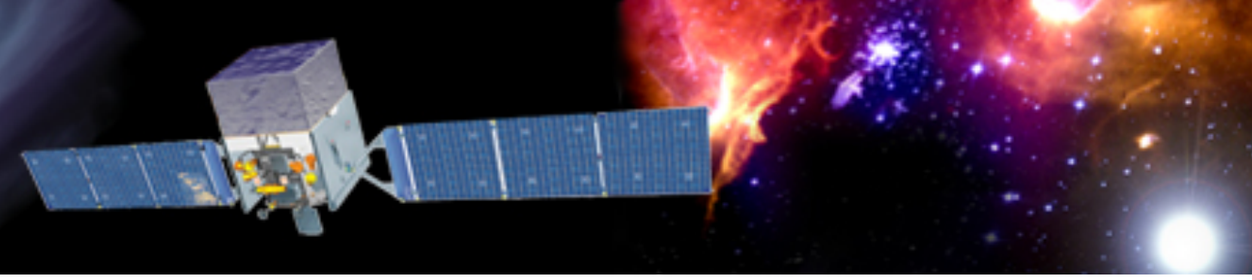
- Divide & Conquer approach
  - 2-3 FSSC members training for each task, with 1 lead
  - Refocused available skill sets & recovered legacy knowledge
  - Pulling together available documentation & expanding/revising as appropriate
- Currently in Shadow/Joint Operations
  - FSSC personnel now responding to issues as they arise, in coordination with LAT team members
  - Documentation of issues and their resolution is a high priority
- New team (LAT + FSSC) has increased # of trained personnel by a factor of 2 ⇒ Needed for mission critical task

# SOFTWARE DEVELOPMENT TRANSITION

- Transition to github nearly complete
  - Analysis tools converted
  - Still developing processes for LAT data reconstruction pipeline (uses some common code)
- Transition to Conda distribution for ST nearly complete
- Static software (pipeline) will be maintained in containers as underlying operating systems become obsolete
- Special activities (e.g. leap second implementation) will require SLAC personnel participation past the transition date
  - Time available for these activities

# TRANSITION TIMELINE

- Initiated January 2017
- Software Weeks: Face-to-face meeting of principal actors
  - February 2017 - Assign transition roles, initial training
  - September 2017 - Intensive training, documentation
  - January 2018 - Readiness for shadow operations
  - Late summer 2018 - Readiness for final transition
- Transition on track for October 1, 2018

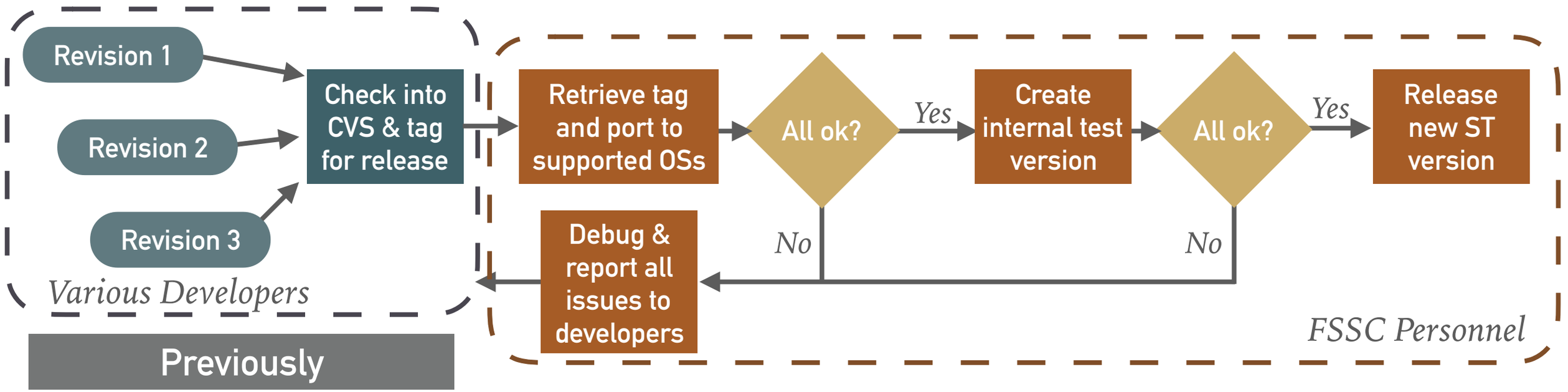


# BACKUP SLIDES

# "SOFTWARE WEEKS" FOR INTENSIVE TRAINING

- Two software weeks complete (Feb. '17, Sept. '17, Feb. '18)
  - FSSC/LAT/SLAC personnel face-to-face training
  - Focused breakout sessions ⇒ High level of knowledge transfer
- One more software week planned
  - Late Aug./Early Sept. 2018: Review results of shadow ops and complete any necessary training

# NEW SOFTWARE MANAGEMENT PARADIGM



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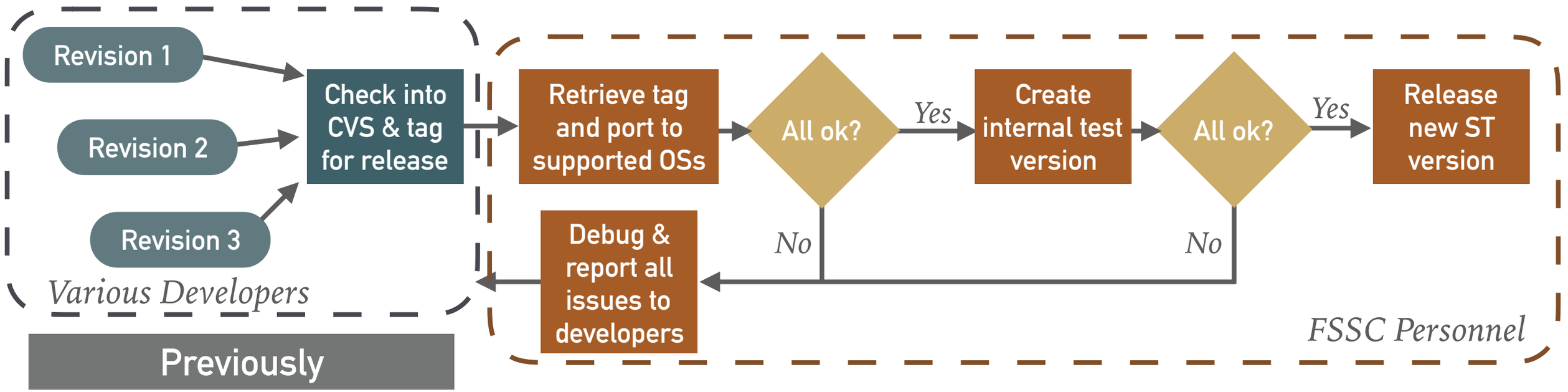


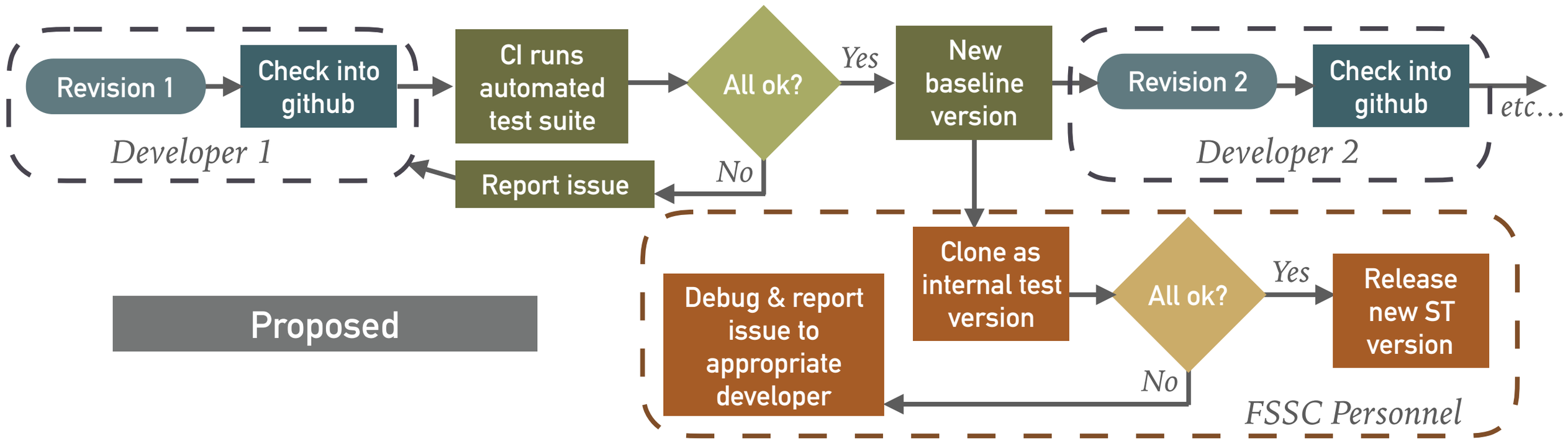

# MISSION OPERATIONS TRANSITION

- Currently performing Shadow Operations
- Training for nominal timeline planning complete
  - FSSC personnel now planning/review at 50% or greater
  - Provide regular status reporting
- Ongoing training for less-frequent nominal activities
  - LAT calibration requests, Tracker hot strip masks, etc.
  - Some issues with permissions for these
  - Not yet able to perform smoothly
- Non-nominal tasks (flight software updates, etc.) will continue to be supported by DOE personnel as needed