

FSD High Level Apps

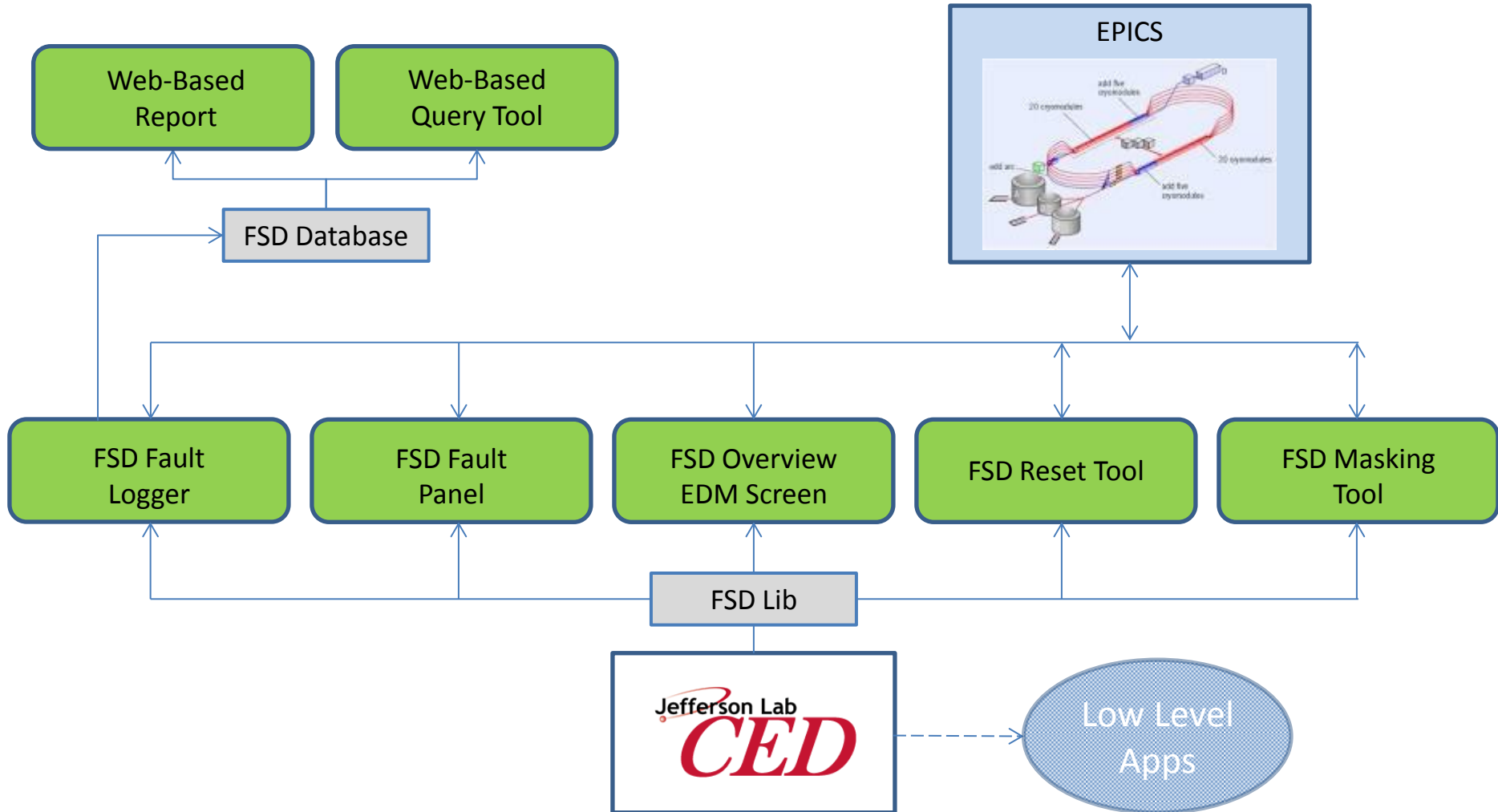
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Outline

- Overview and Problem Statement
- Catching and Recording
- Alerting, Resetting, and Masking
- Reporting and Analyzing
- Known Issues
- Conclusion

Overview



What problems are we solving?

- Maintainable, consistent, correct: CED / OTF
- Transparent, accountable: web-accessible archived data
- Easy to use: mask by destination for example
- Improve machine performance: understand / minimize trips

FSD High Level Apps

CATCHING AND RECORDING

FSD Lib

- Common library of FSD functions
- Used by all HLA FSD applications
- Monitors FSD System status
- CED driven
- Logic to interrogate devices



Who Faulted?

FSD Database

- Stores Trips
- Each Trip is due to a fault in the master node and zero or more child node faults
- Each faulted Node has zero or more faulted channels (zero = Phantom)
- Each faulted channel references either a child node or one or more devices
 - Referenced entity may not be faulted (Phantom)

FSD Fault Logger

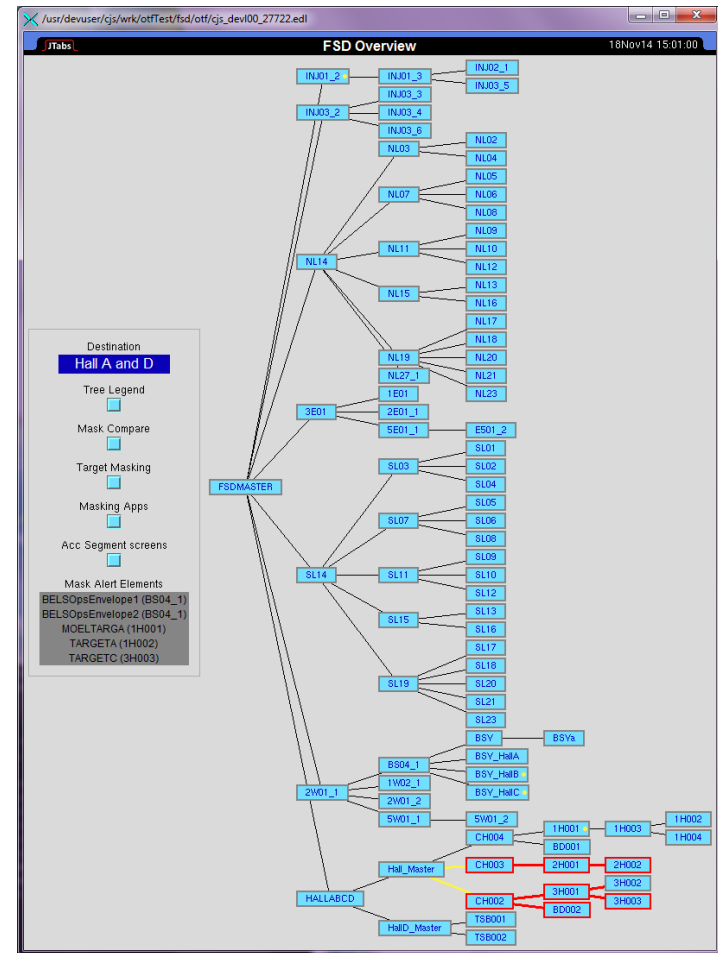
- Continuously running daemon process
- Logs information into the FSD Database

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ALERTING, RESETTING, MASKING

FSD Overview Screen

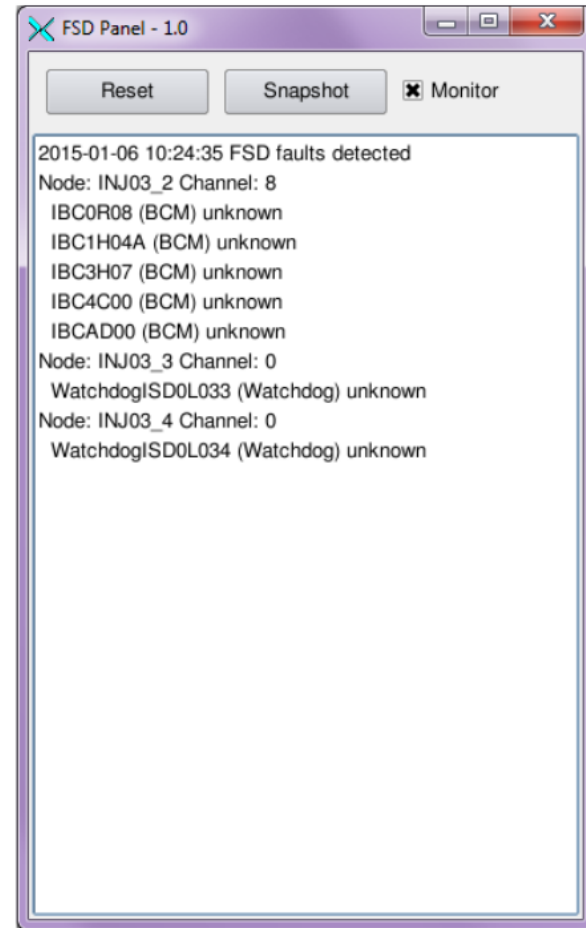
- Graphical view of FSD Tree and its current masking and fault state
- On-the-fly (OTF)



JTabs > Operations > FSD > Overview

FSD Fault Panel

- Displays textual description of faulted devices
- Reset option
- Current snapshot on-demand
- Continuously monitor root node state changes (faulted/reset) and display tree snapshot

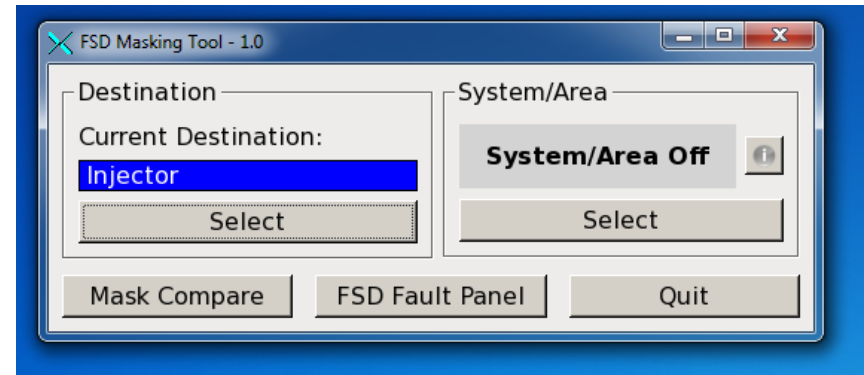


FSD Reset Tool

- Command line application
- Used to reset the FSD Tree
- Can be invoked from Overview, Panel, or Masking GUIs via button

FSD Masking Tool

- New (reworked); still in acceptance testing
- Use to setup destination and system based masking of devices that should not propagate faults



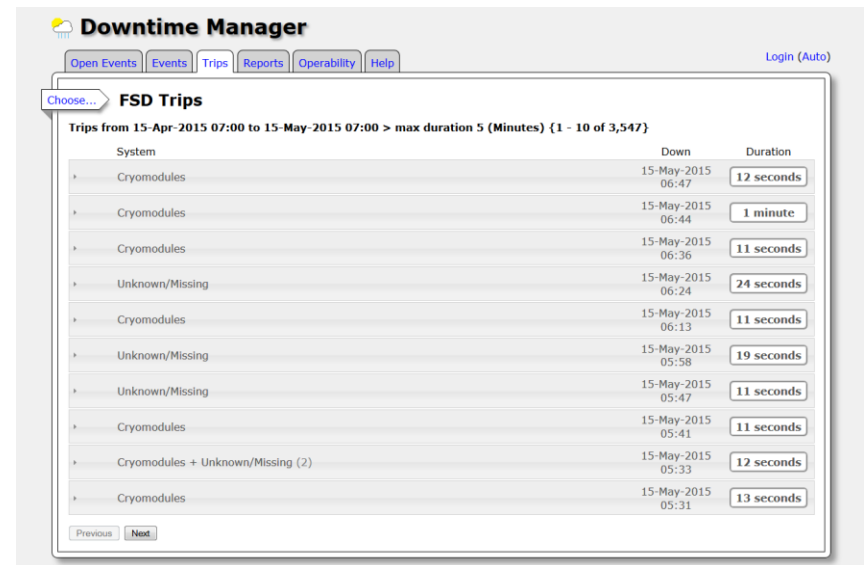
JTabs > Operations > FSD > Masking

FSD High Level Apps

REPORTING AND ANALYSIS

Trip Database Query Tool

- Query Trip History
- Filter results
 - Machine beam state
 - Trip duration
 - Date range
 - CED Type
 - CED Component
 - HCO System
 - And more...



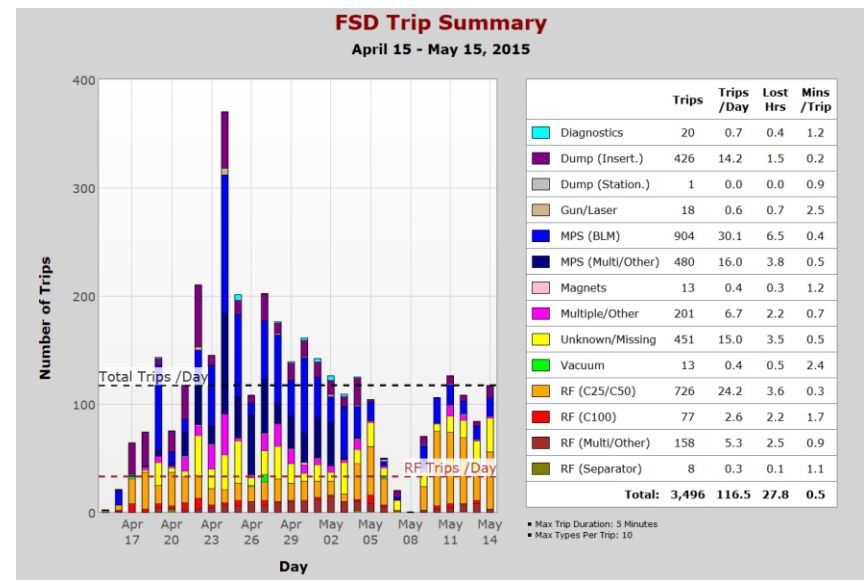
The screenshot shows the 'Downtime Manager' web interface. The main heading is 'FSD Trips' with a sub-header 'Trips from 15-Apr-2015 07:00 to 15-May-2015 07:00 > max duration 5 (Minutes) {1 - 10 of 3,547}'. The table below lists individual trips with columns for System, Down, and Duration.

System	Down	Duration
Cryomodules	15-May-2015 06:47	12 seconds
Cryomodules	15-May-2015 06:44	1 minute
Cryomodules	15-May-2015 06:36	11 seconds
Unknown/Missing	15-May-2015 06:24	24 seconds
Cryomodules	15-May-2015 06:13	11 seconds
Unknown/Missing	15-May-2015 05:58	19 seconds
Unknown/Missing	15-May-2015 05:47	11 seconds
Cryomodules	15-May-2015 05:41	11 seconds
Cryomodules + Unknown/Missing (2)	15-May-2015 05:33	12 seconds
Cryomodules	15-May-2015 05:31	13 seconds

<https://accweb.acc.jlab.org/dtm/trips>

Trip Summary Report

- MCC 8:00 AM Summary
- Configurable Histogram
 - Date range + bin size
 - Legend Data
 - And More...



<https://accweb.acc.jlab.org/dtm/reports/fsd-summary>

FSD High Level Apps

KNOWN ISSUES

Device Interrogation

- We don't always know how to query various devices on a faulted channel to find culprit(s)
 - We must record all devices on channel as faulted
 - If only one device on channel then no issue

First Fault Tracing

- Faults cascade; but difficult to know which came first; some may truly be concurrent
- FSD Lib just reports all faulted nodes
 - Web Histogram indicates “Multiple/Other” when more than one of differing types
- Scan rate and clock skew = race condition
 - root node may indicate fault before leaf node that generated it does! (shown in archiver)

Phantom Faults

- Master node signaled, but either:
 - No leaf node admits fault
 - A leaf node admits fault, but no channel/device does
- Costs downtime / confusion
 - 685 Phantoms in Spring
- Many possible causes
 - Hardware / IOC software sync
 - Incomplete / Incorrect device interrogation rules ([dtm1442](#))
 - Scan-rate timing issues
 - And more...



Conclusion

- CED and FSD Lib ensure all apps have consistent view
- Trip reporting available on web
- To Improve FSD Apps & Operator experience we need to:
 - Minimize Phantom Faults
 - Explain device interrogation details
 - ~~Synchronize FSD System?~~

Bonus: What is wrong here?

The screenshot displays the FSD Overview software interface, which includes a hierarchical tree of nodes, a control panel, and three comparison windows.

FSD Overview: A hierarchical tree structure starting with **FSDMASTER** at the root. The tree branches into several main categories: **INJ** (Injection), **SL** (Solenoids), **2V** (2-Volt), **SW** (Switches), **CH** (Chokes), **Hall** (Hall Effect Sensors), and **TS** (Target Stations). Each node is represented by a blue box with a red arrow pointing to its children.

Control Panel: Located on the left side, it includes a **Destination** dropdown menu set to **Injector**, a **Reset FSD** button, and checkboxes for **Mask Compare Screen**, **Target Masking Screens**, **Masking Tool**, and **Tree Legend**. Below these are **Mask Alert Elements** listed as: BELSOpsEnvelope1 (BS04_1), BELSOpsEnvelope2 (BS04_1), MOELTARGA (1H001), TAROETA (1H002), and TARGETC (3H003).

FSD Mask Compare: A window showing a grid of checkboxes for various nodes. The nodes are arranged in columns: INJ, NL, SE, SL, SW, CH, Hall, and TS. Each node has a green checkmark in the first column and a blue checkmark in the second column.

FSD Node 3H003: A window showing a detailed view of the **FSD_24VOLT / HALLC** node. It features a grid of checkboxes for various components, including Watchdog, HallCTungstenPlug Waterflow, TARGETC Exit Window Waterflow, TARGETC Movement, 2 devices Differential Pressure, HallCctor (Hall), HallCComptonDetector Motion, and 2 devices Hall C Fast Raster Beam Current. The grid shows a mix of green and blue checkmarks.

Interesting Read

- J. Perry and E. Woodworth. The CEBAF Fast Shutdown System. CEBAF PR-90-15. September 1990
 - In 1990 we needed 24 μs to shutdown, and at that time burn through was in 30 μs .
 - We improved FSD speed for 12GeV, right?