LCLS Machine Protection System High Level Interface Improvements*

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Abstract

The Linac Coherent Light Source (LCLS) is a free electron laser (FEL) facility operating at the SLAC National Accelerator Laboratory (SLAC). The LCLS Machine Protection System (MPS) contains thousands of inputs and hundreds of protection interlocks. Control room operators use a high-level Graphical User Interface (MPSGUI) to view and manage faults.

MPSGUI contains a wealth of useful information, from hardware input details to high-level logic flow, but in its first version it was difficult for accelerator operators to take full advantage of this. A recent project has greatly improved the workflow and usability of MPSGUI. This poster describes the enhancements that were made.

Introduction

The purpose of the MPS is to prevent damage to beamline components due to beam. The MPS monitors the states of devices throughout the accelerator. If it detects a condition that may lead to damage, it turns off the beam.

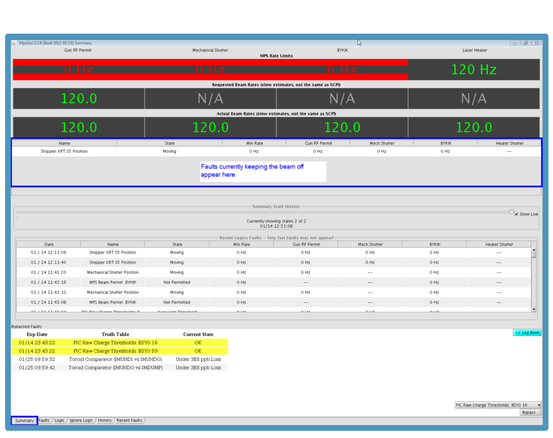
MPSGUI, a Java application, is the primary operator interface to the MPS. Operators use it to identify, diagnose, and manage faults. The MPS defines its static input and logic configuration in SQLite database files. Real-time state information is hosted by EPICS signals. MPSGUI uses this combination of static and dynamic data to provide detailed fault and diagnostic information to operators.

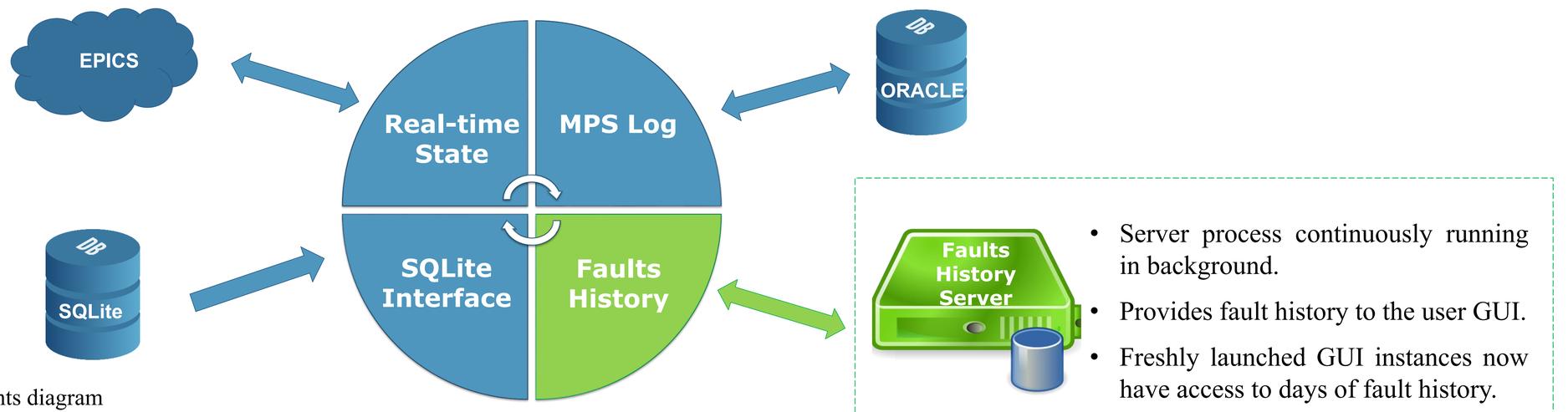
Project Motivation

- Hard to find inputs associated with a given piece of logic.
- Missing information in displays.
- Challenging to identify faults that clear quickly.
- Difficult to associate a fault to the related logic details.
- Resolve issues that were discouraging operators from using the GUI.

The complete requirements list was defined during a series of meetings with control room operators.
A task list was made based on MPSGUI's maintenance tickets, user feedback and feasibility balanced with the limited resources of time and budget.

MPSGUI



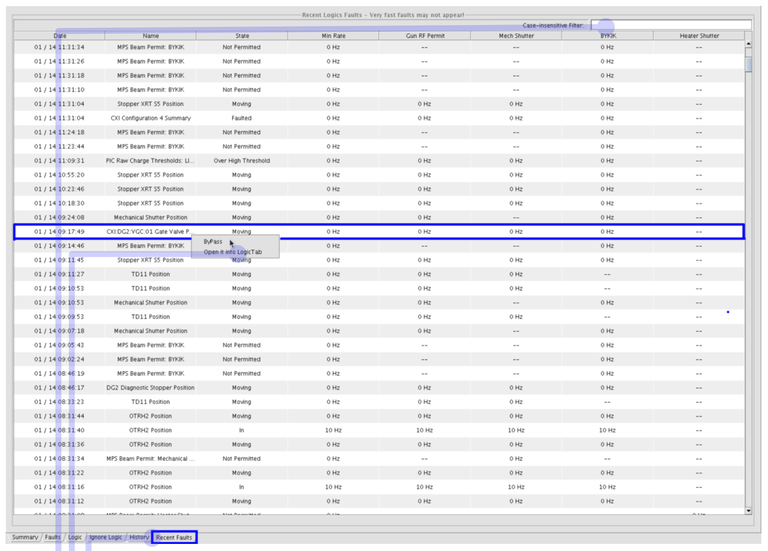


- Server process continuously running in background.
- Provides fault history to the user GUI.
- Freshly launched GUI instances now have access to days of fault history.

Figure 1: MPS GUI summary tab and components diagram

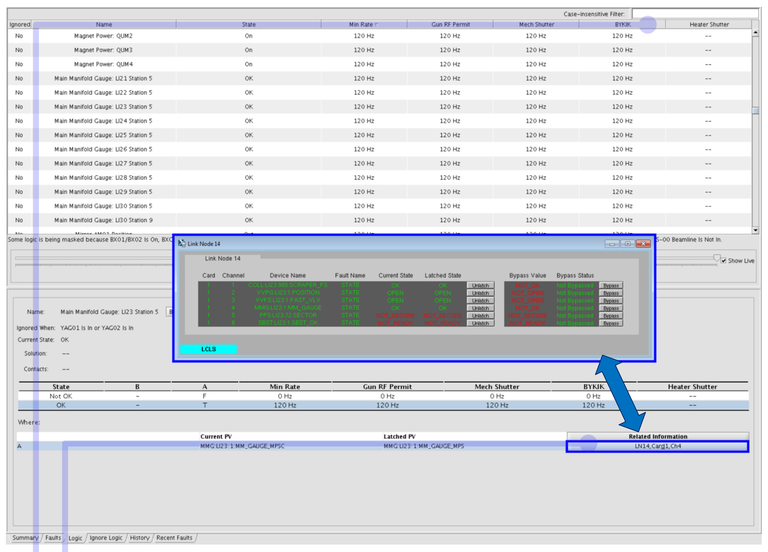
User Interface Improvements

Figure 2: MPS GUI "Faults History" tab.



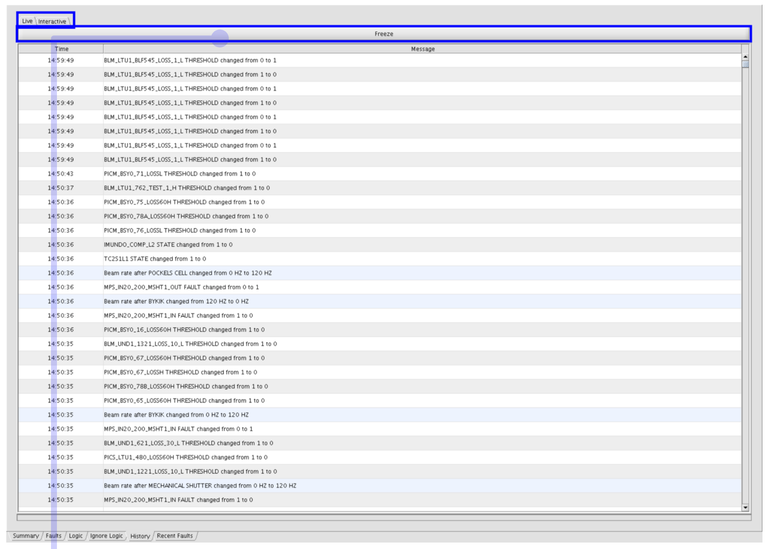
- Addition of a new tab displaying MPS Logic Faults History. This tab allows users to view recent faults when launching the GUI by reading the information from the Faults History server.
- Map hardware inputs to high level logic, using right click.
- Search for faults.

Figure 3: MPS GUI "Logic" tab.



- Map hardware inputs to high level logic.
- Ability to bypass with a right click while selecting a row.
- Hardware inputs display.
- Search for faults.

Figure 4: MPS GUI "Input History" tab.



- Added a "freeze" button which allows users to control the GUI and stop receiving updates to the list of input state changes.
- In the past, the list updated at a very fast rate, discouraging the operators from using it.

Summary

The new features now allow operators to quickly identify MPS faults and diagnose problems. The troubleshooting time has been reduced, increasing the uptime for FEL delivery to user experiments. The MPS Logic Faults History server, in particular, has had a strong positive impact, allowing users to access days of recent fault history with freshly launched GUI instances.

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