

Abstract

CERN's Accelerator Fault Tracking (AFT) system aims to facilitate answering questions like: *“Why are we not doing physics when we should be?”* and *“What can we do to increase machine availability?”*

People have tracked faults for many years, using numerous, diverse, distributed and un-related systems. As a result, and despite a lot of effort, it has been difficult to get a clear and consistent overview of what is going on, where the problems are, how long they last for, and what is the impact. This is particularly true for the LHC, where faults may induce long recovery times after being fixed.

The AFT project was launched in February 2014 as a collaboration between the Controls and Operations groups with stakeholders from the LHC Availability Working Group (AWG).

The AFT system has been used successfully in operation for LHC since 2015, yielding a lot of interest and generating a growing user community. In 2017 the scope has been extended to cover the entire Injector Complex.

This paper describes the AFT system and the way it is used in terms of architecture, features, user communities, workflows and added value for the organisation.

Distinct Roles & Workflows

<Accelerator Operators>

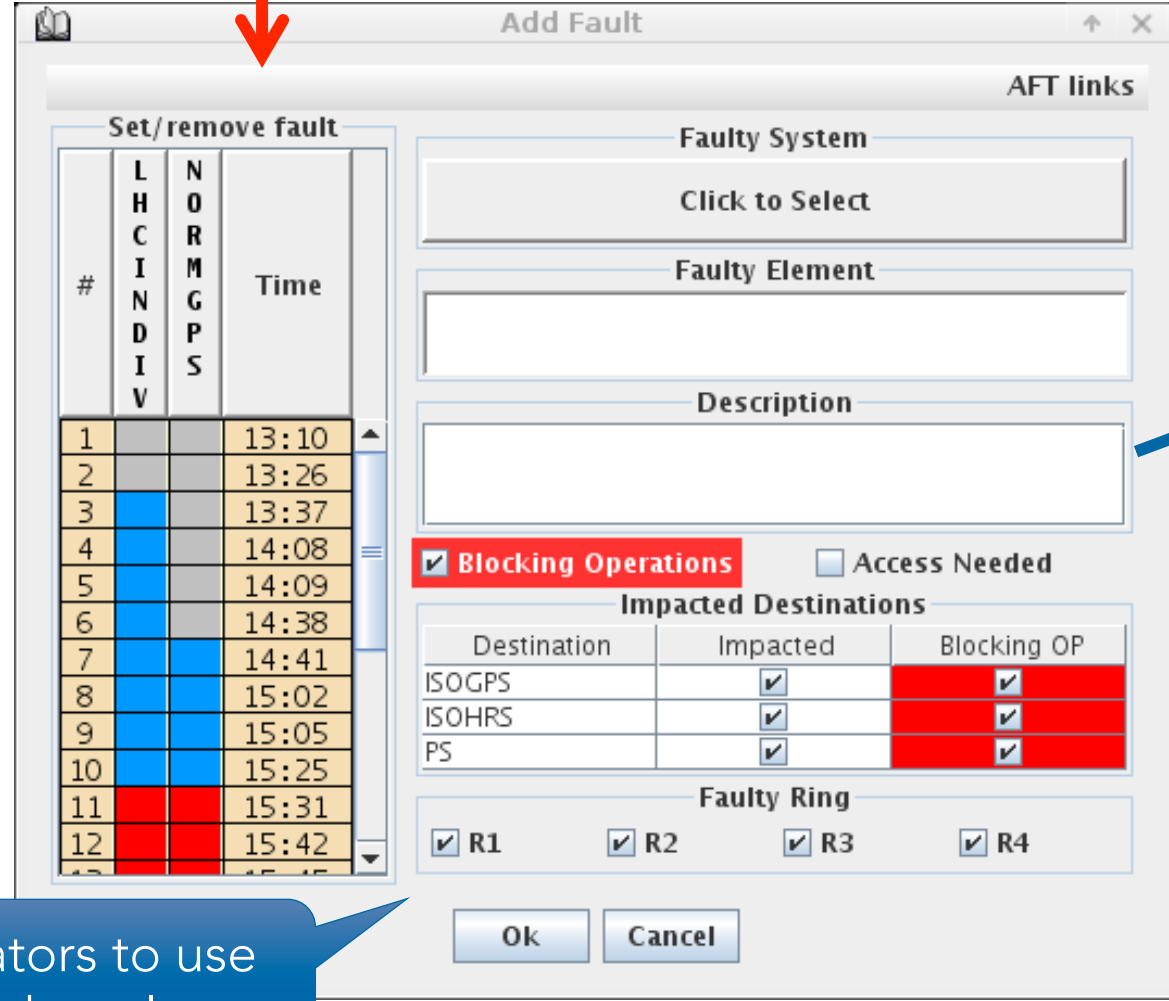
Initial Fault Registration



Electronic Logbook



Note: Important for Operators to use their existing Java Elogbook tool



AFT Elogbook Server



RMI

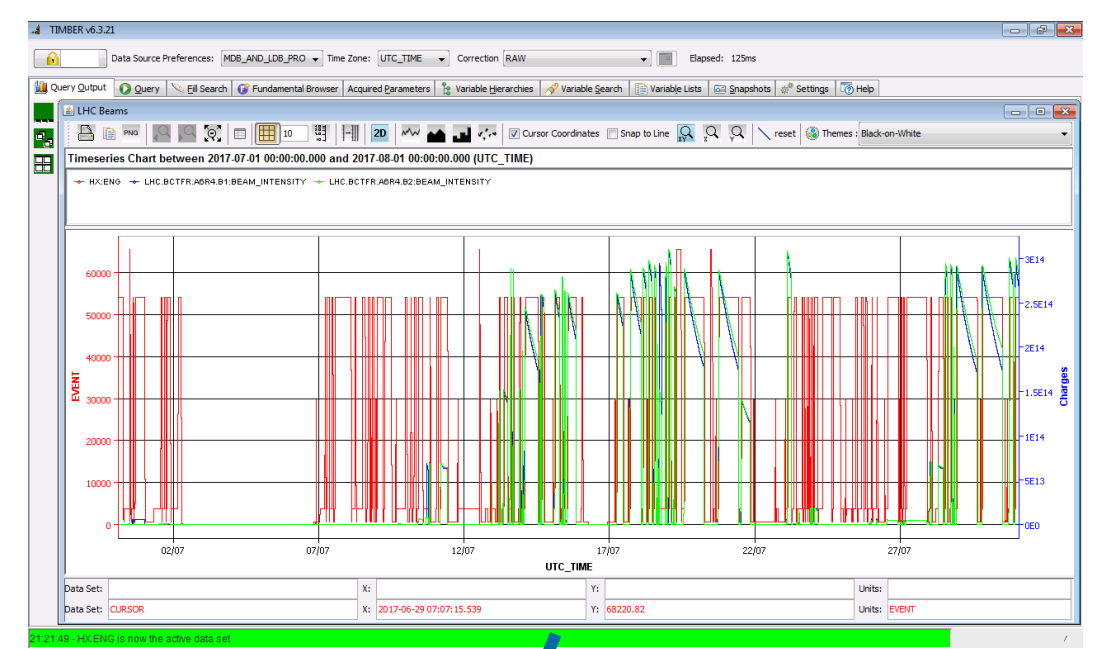
AFT Core Server



REST

External Data Integration

CERN Accelerator Logging Service (CALS)



Extendable to integrate data from other sources

AFT External Data Integrator

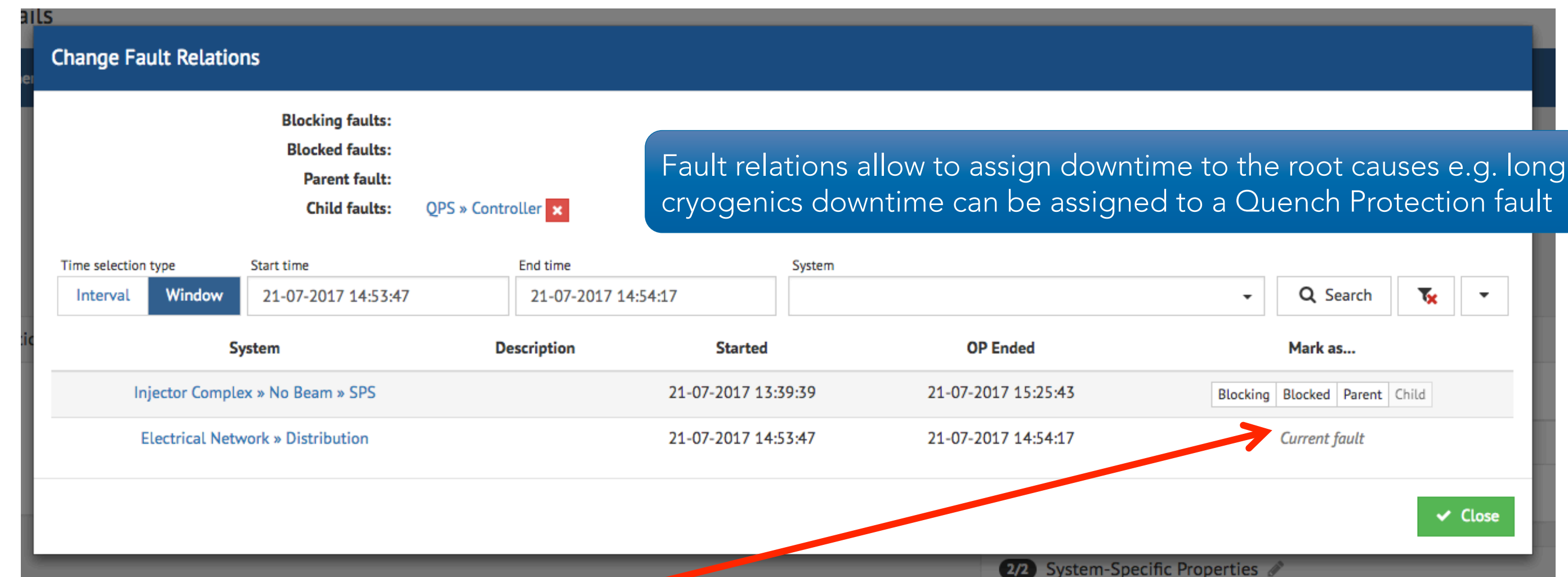
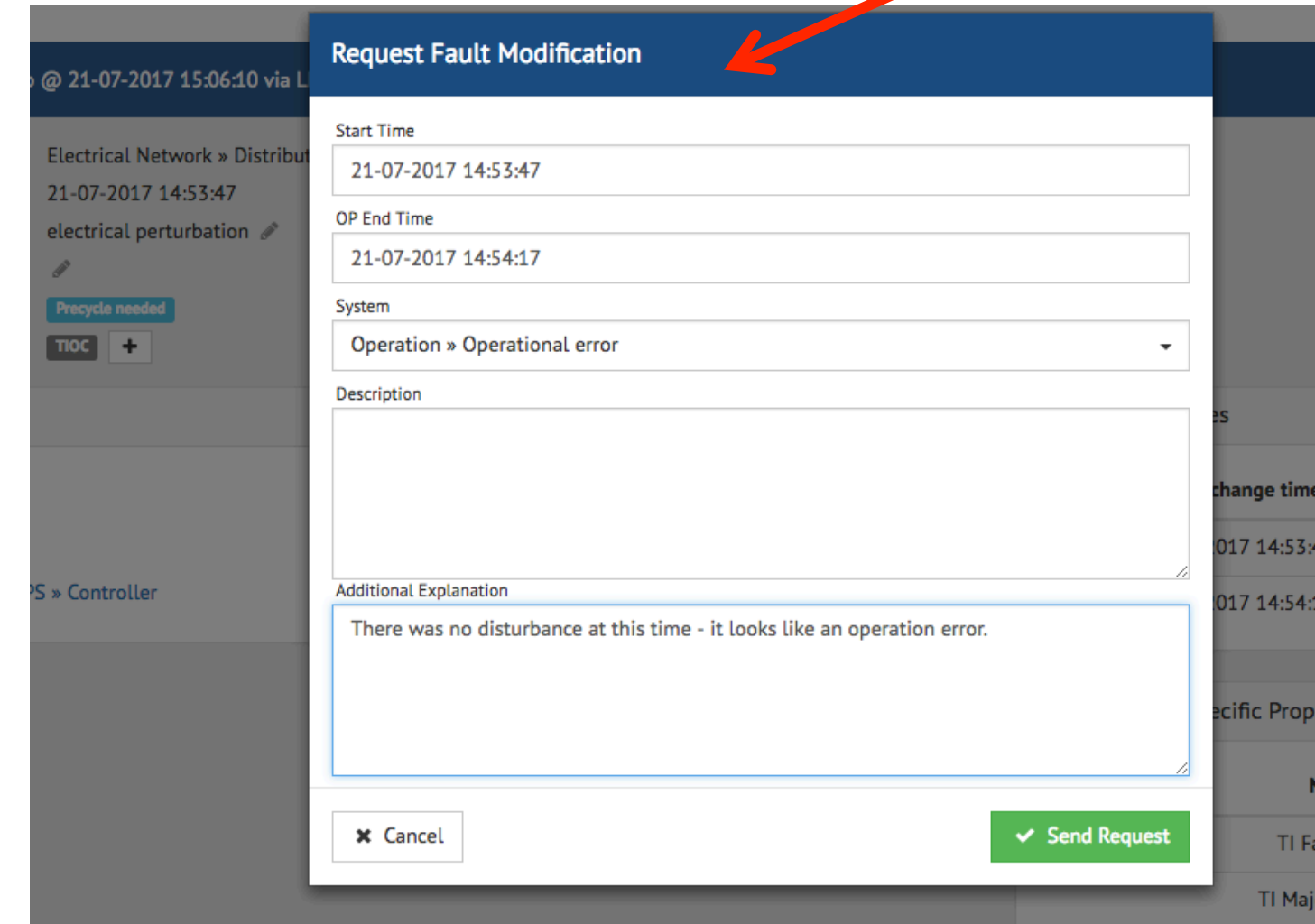
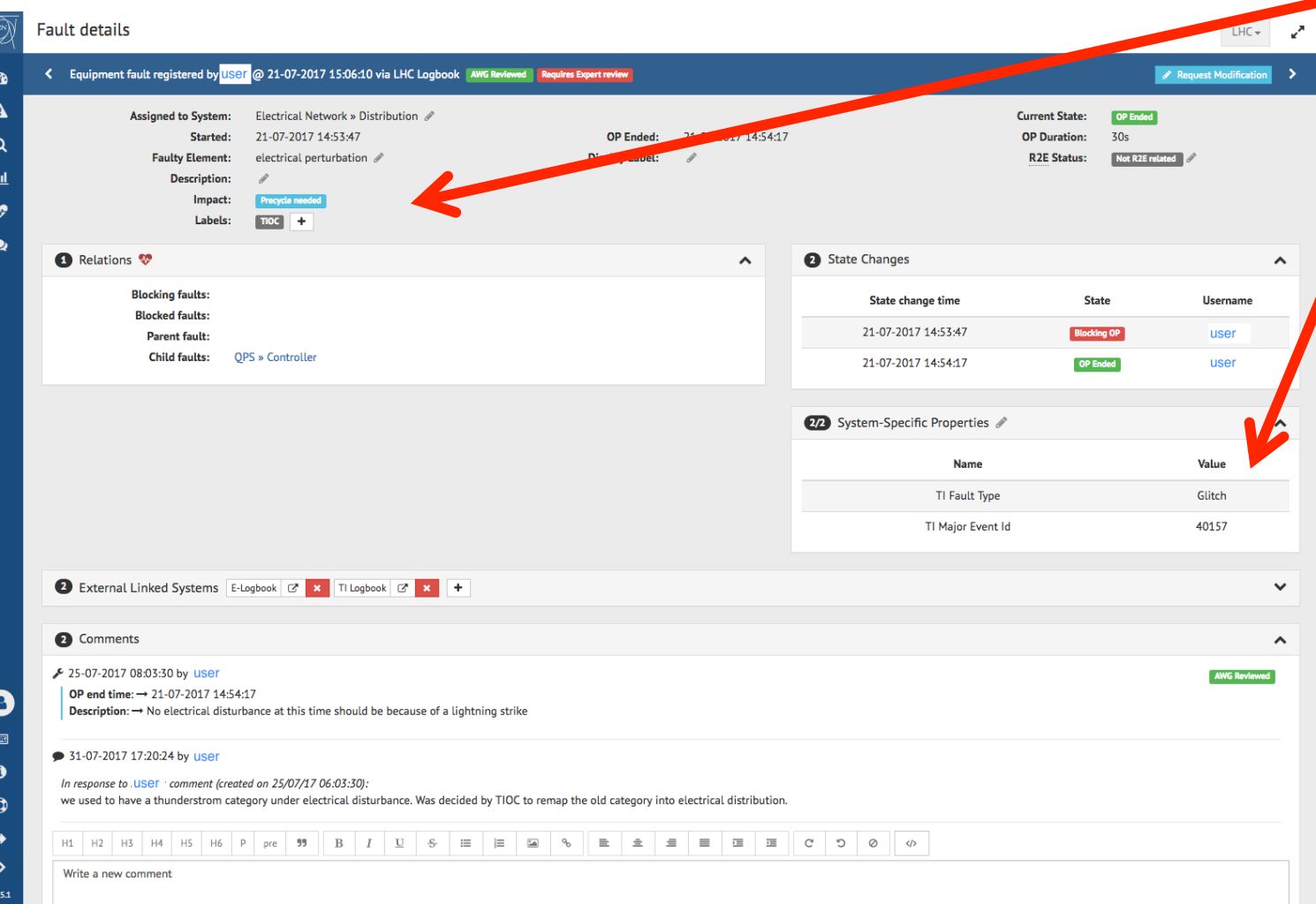


AFT Web Application (A + TypeScript)

<Equipment Experts>

Expert Review

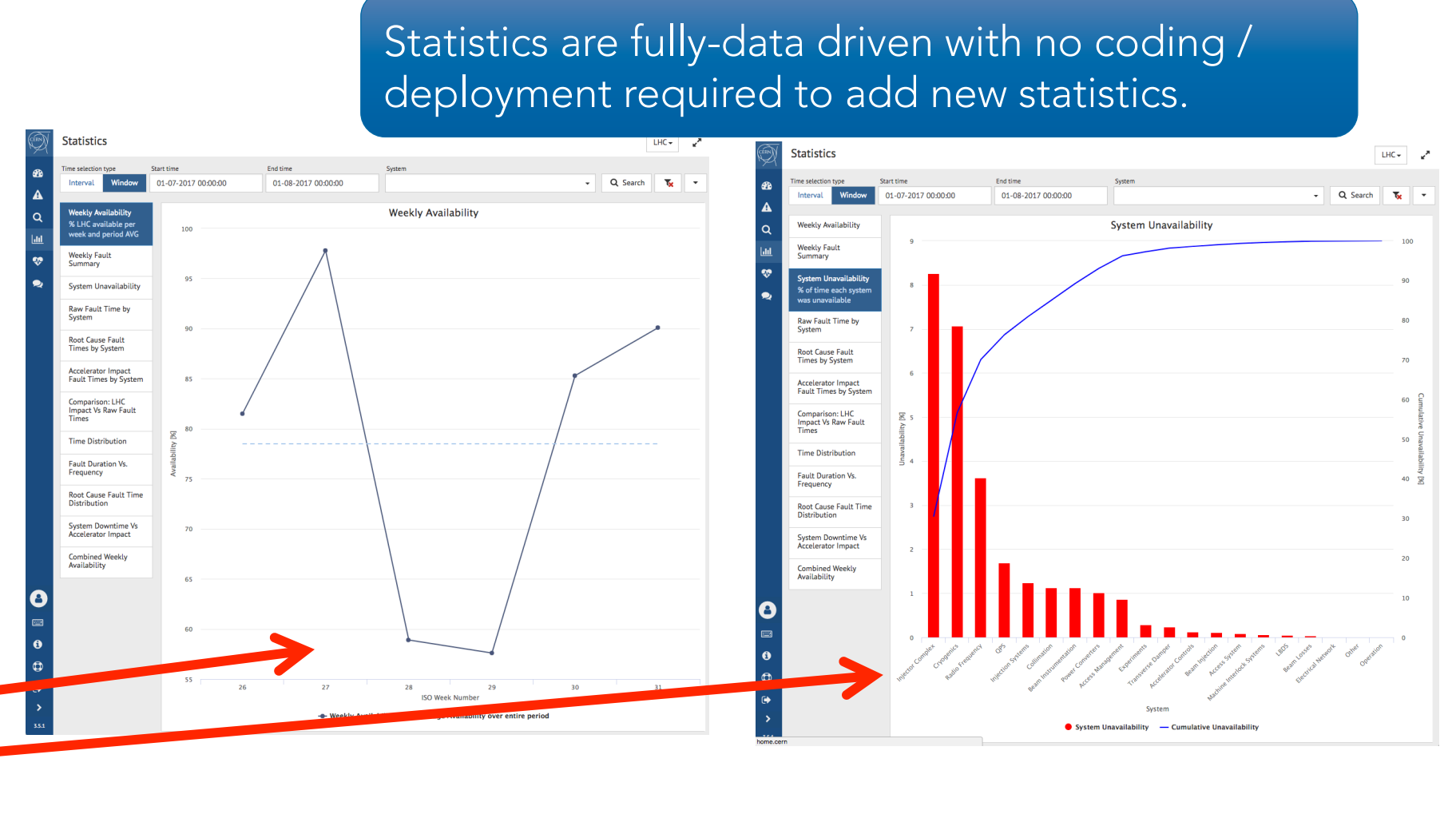
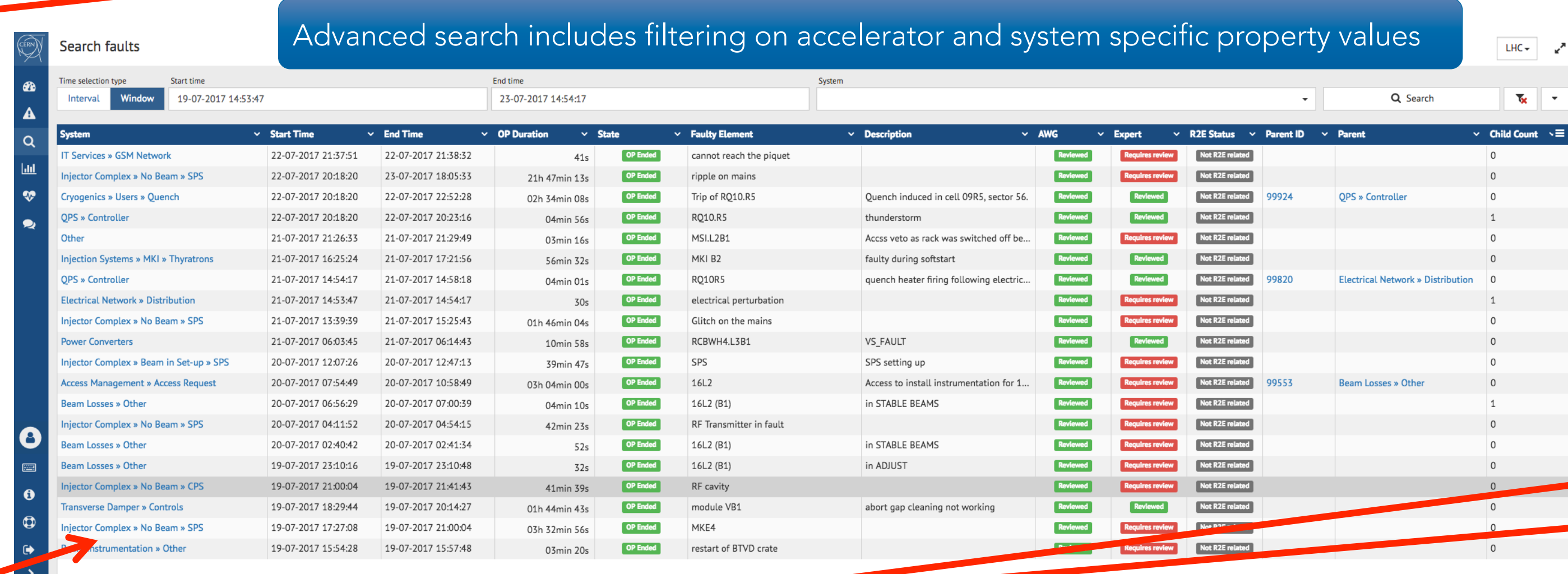
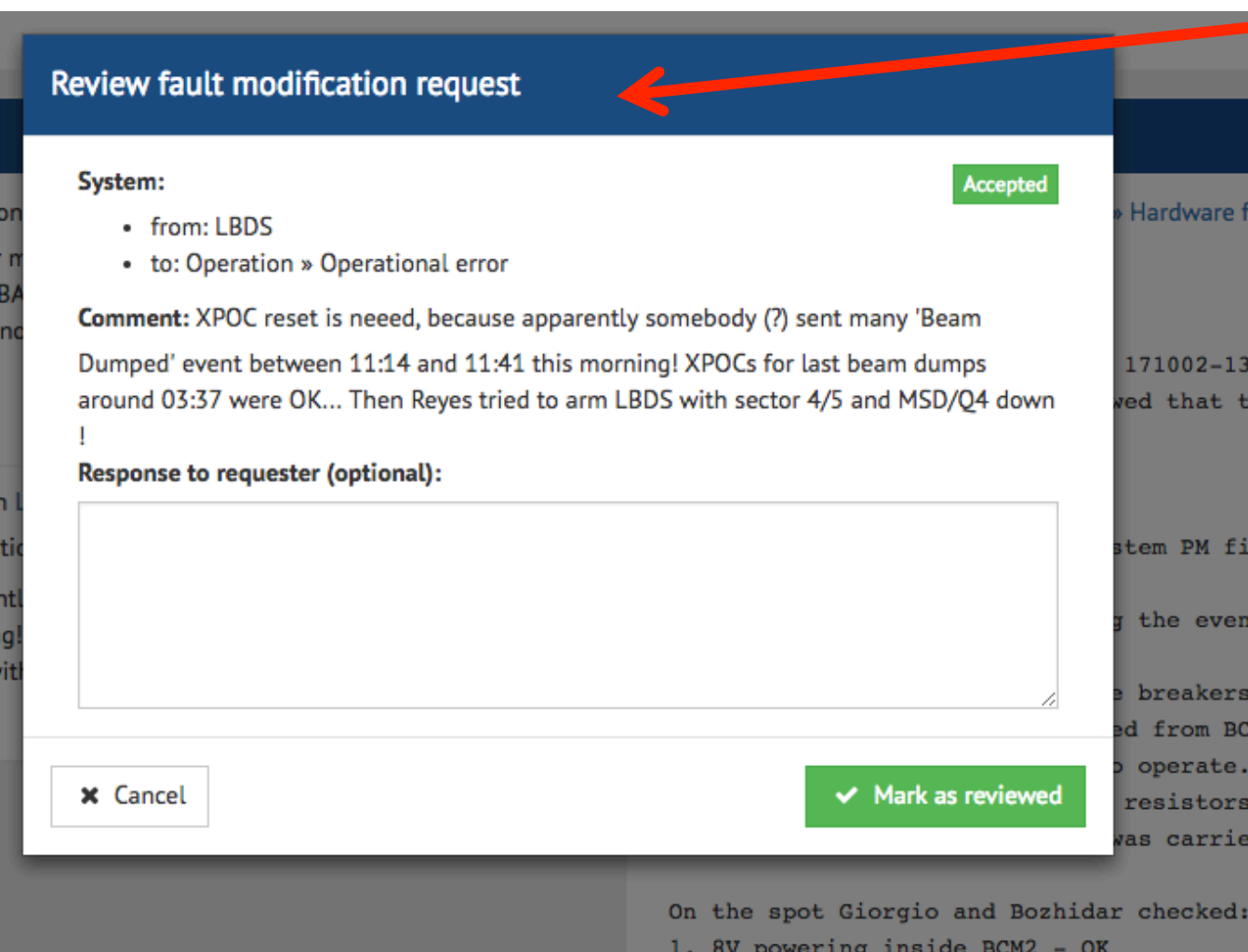
– adding more details, requesting modifications (if change of system or start or end times)



<AWG Members>

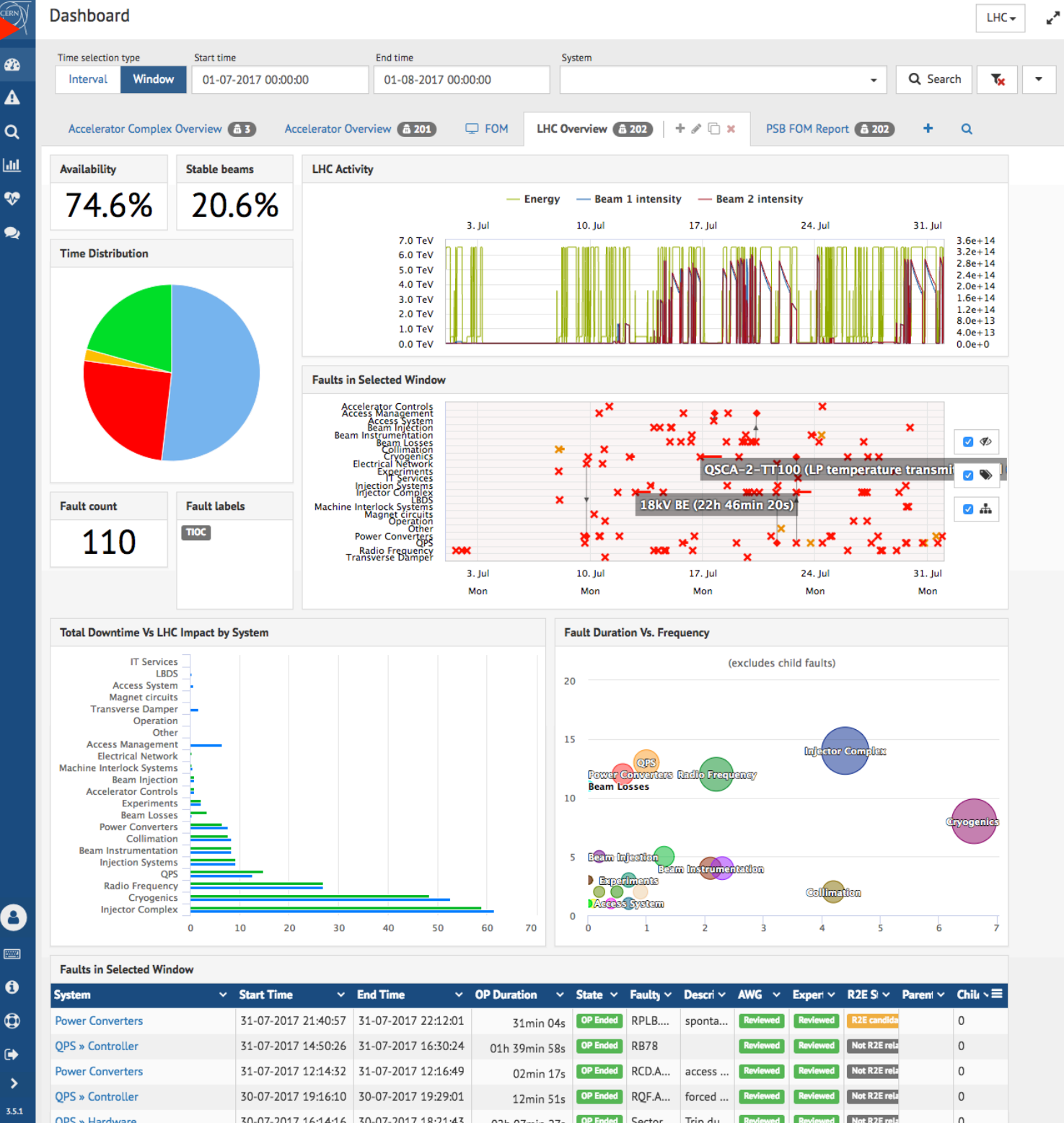
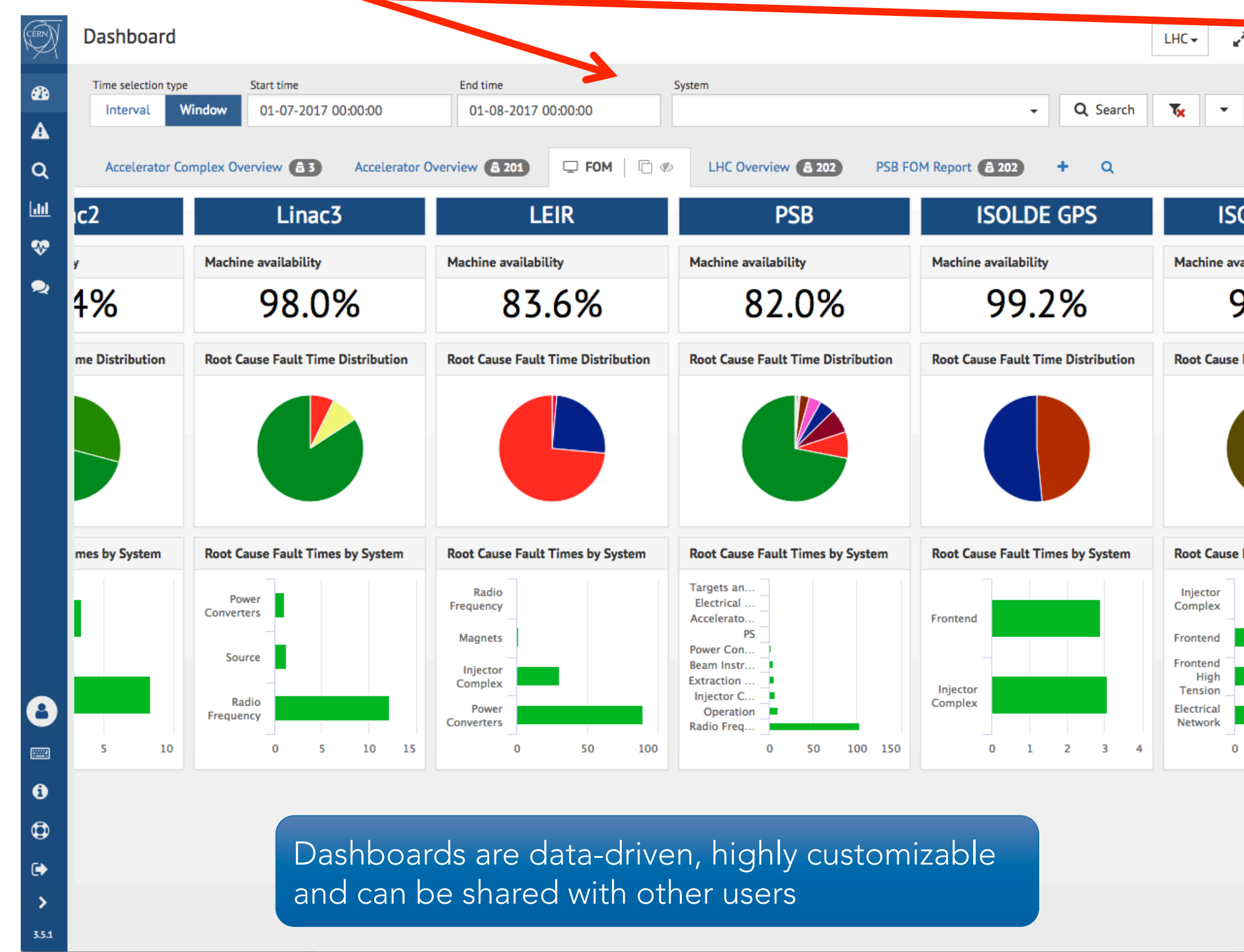
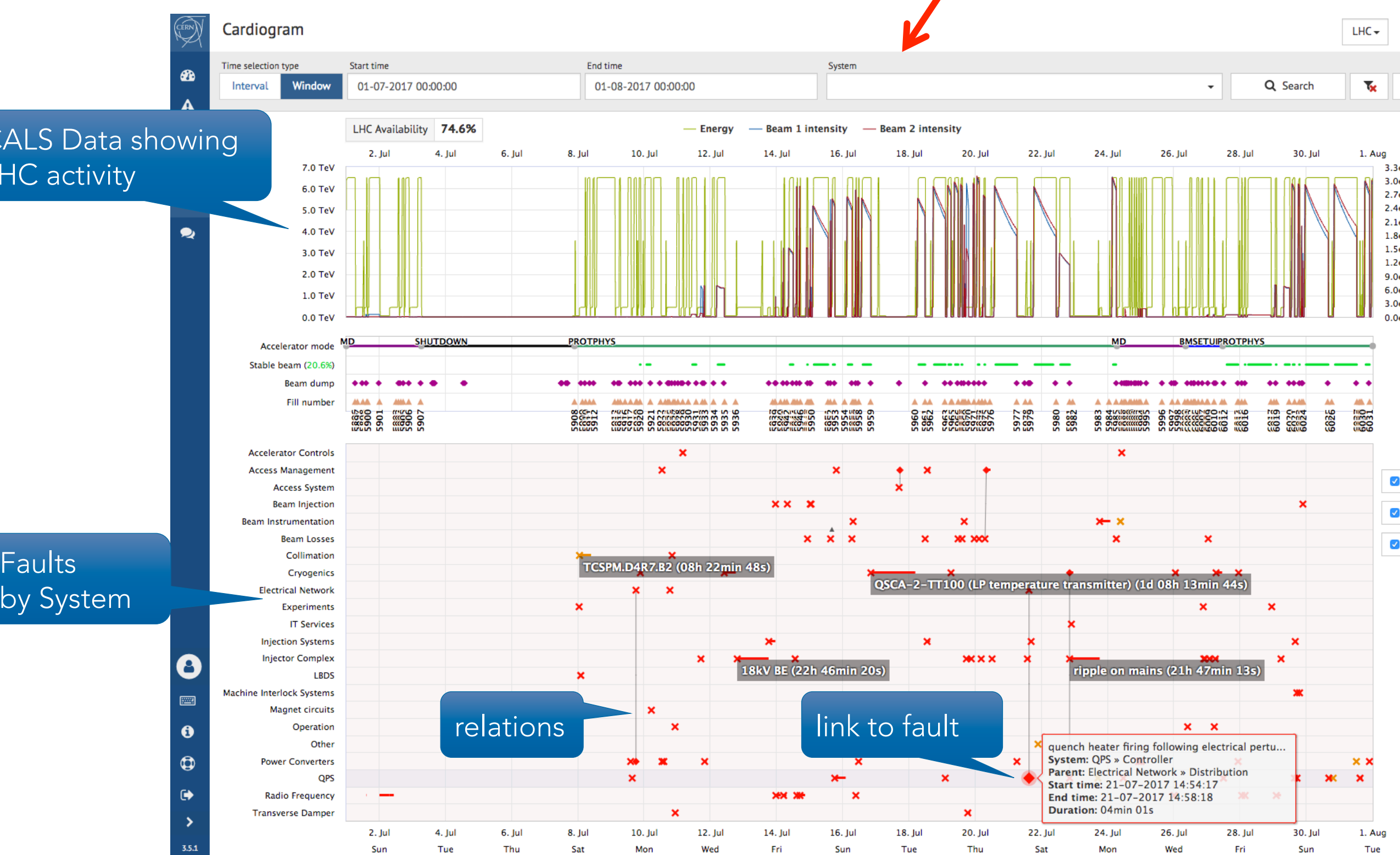
AWG Review

– validating modification requests, checking completeness and defining fault relations



<Authenticated Users>

– searching, use of “Cardiogram”, statistics & customizable dashboards for regular reports, availability studies, consolidation planning...



Conclusion

The Accelerator Fault Tracking system has been in use at CERN for the LHC since 2015. The system is extendable – as shown by the recent inclusion of CERN's Injector Complex. The AFT system has proven to be extremely useful, giving a basis for a common understanding of what problems exist and what is the corresponding impact on machine operation, performance and availability. Further work is foreseen in order to deliver additional time saving data analysis and reporting features. It is also planned to integrate with other data management systems (e.g. Layout and CMMS – asset management) in order to have a means from which to start to analyse faults and availability taking into account geographical location, manufacturing and maintenance processes. Eventually it should be possible with the appropriate features and a significant data set – to be able to start to predict failures and target repairs and consolidation work before critical faults actually occur – thus maximising machine availability for physics.

