

WEB DASHBOARDS FOR CERN RADIATION AND ENVIRONMENTAL PROTECTION MONITORING

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RADIATION AND ENVIRONMENTAL MONITORING AT CERN

CONTAMINATION OPERATIONAL RADIATION PROTECTION 8





GATE







820 Monitoring Stations: • **30** Station Types COTS & CERN instruments Surface and Underground Geographically Distributed 5,200 Measurement Channels: • **9,000,000** measurements archived every hour

WATER

REMUS – RADIATION AND ENVIRONMENT MONITORING UNIFIED SUPERVISION



The Occupational Health & Safety and Environmental Protection Unit at CERN provides a SCADA system for the Radiation Protection and Environment Monitoring of particle accelerators, experiments and the environment

TUSDSC07







REMUS WEB DASHBOARDS

Progressive Web Application



Dashboards are built in a **Progressive Web Application** (PWA), therefore usable from any platform using a standardcompliant browser, including desktop, tablets and mobile devices.

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Web Dashboards Features

REMUS Web dashboards provide the following widgets:

• Trends: Multiple measurement data series line charts.

• Alarms: Near-real-time and read-only replication of the SCADA alarm screen.

• Measurements Statistics: Box plots or table of metrics of the measurement data series.

• Parameters: List of current parameters of an instrument.

• Information: Meta-data of an instrument.

Front-end (1)

The REMUS Web front-end is built on top of **React**.

Dashboards pages make use of an additional library, react-grid-layout. This library enables the creation of flexible and responsive grid layouts in React applications.

REMUS Web states are managed using **Redux**. Additionally, the **react-query** library enables individual dashboard components to fetch their own data in parallel.

HighCharts library is used to display all the dashboards' widgets containing measurement data. HighCharts's **Boost** module enables **GPU acceleration** using WebGL.

Back-end (2)

The REMUS Web back-end is built on **Java 17** and **Spring** Boot.

The Environment and Radiation Unified Data Integration Service (ERUDIS) library, developed by our team, serves as an API for

Data shown in this screenshot are coming from a test bench and are not actual operational data



• Text: Markdown-enabled text area.

• Parameters Statistics: Box plots or list of current parameters of multiple instruments.

• Snapshots: List or aggregations of snapshot data (spectrum or logically-linked measurements).

Access rights can be managed per dashboard by group of users.

Dashboards can be shared by link or via **QR codes.**

In addition, there are three display modes: standard, full-screen and edition providing that the permission is granted.



Data Sources (3)

The information displayable on the dashboards are of two types: • Configuration database exploration, such as entities meta-data, and parameters applied to the different instruments over time.

Measurement and Alarm data.

data access.

The API's architecture is rooted in **Akka**, an actor concurrency model framework, and utilizes the **Alpakka** library, purpose-built for data stream handling, including features such as:

- Buffering
- Advanced error handling
- Built-in redundancy

REMUS Web dashboards leverage the WebSocket protocol, a powerful technology that enables the creation of **full-duplex**, near-real-time communication channels between clients and servers.

Measurement and Alarm data leverage four data sources: • Oracle: Stores long term, down-sampled measurement data . Ensures low latency access to data, thanks to the partitioning and down-sampling.

• NXCALS (CERN Hadoop-based solution): Stores long term, raw measurement data. Ensures high resolution access to the data.

• Apache Kafka: Provides subscribable near-real-time data coming directly from the SCADA layer.

• InfluxDB: Fed by Kafka via Kafka Connect, it provides one week buffer of the most recent data.

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