WEB DASHBOARDS FOR CERN RADIATION AND ENVIRONMENTAL PROTECTION MONITORING

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TUSDSC07

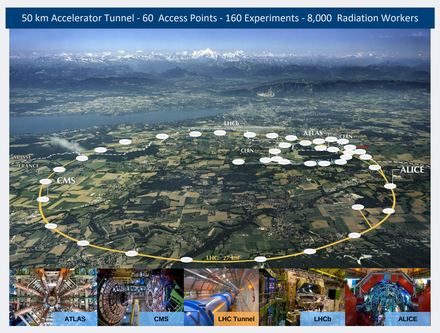
RADIATION AND ENVIRONMENTAL MONITORING AT CERN

OPERATIONAL RADIATION PROTECTION

CONTAMINATION

VENTILATION

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

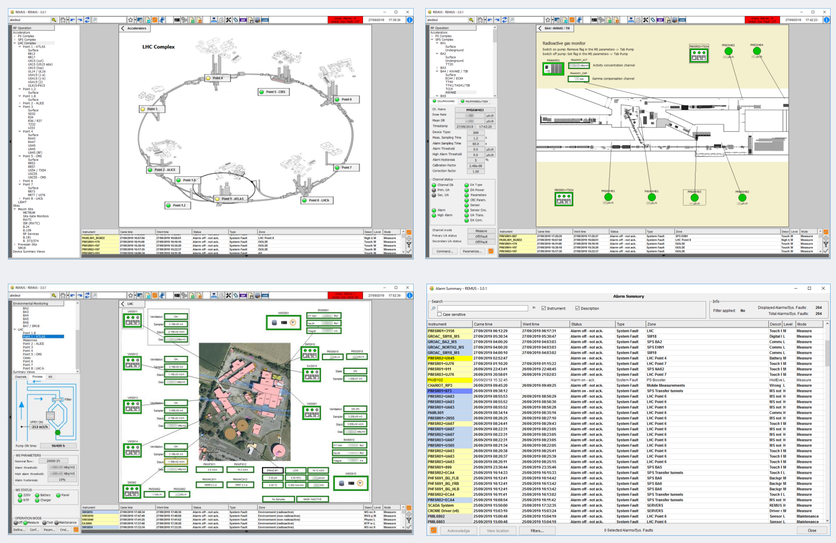
AIR

WEATHER

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



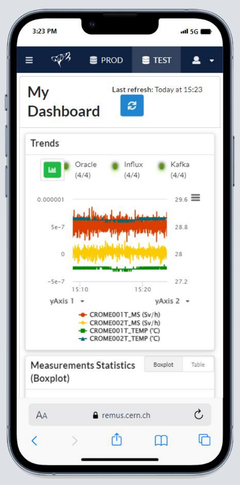
- **250+** Users
- **8** Control Rooms
- **700+** Synoptic
- **Tailorable** Layouts
- **Multiplatform**

- **900,000** Tags
- **125,000** Alarms
- **50,000** Parameters
- **7,000** Tag updates/sec

- **Continuous Operation**
- **>99.99%** Availability
- Full **Redundancy**

REMUS WEB DASHBOARDS

Progressive Web Application



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

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.

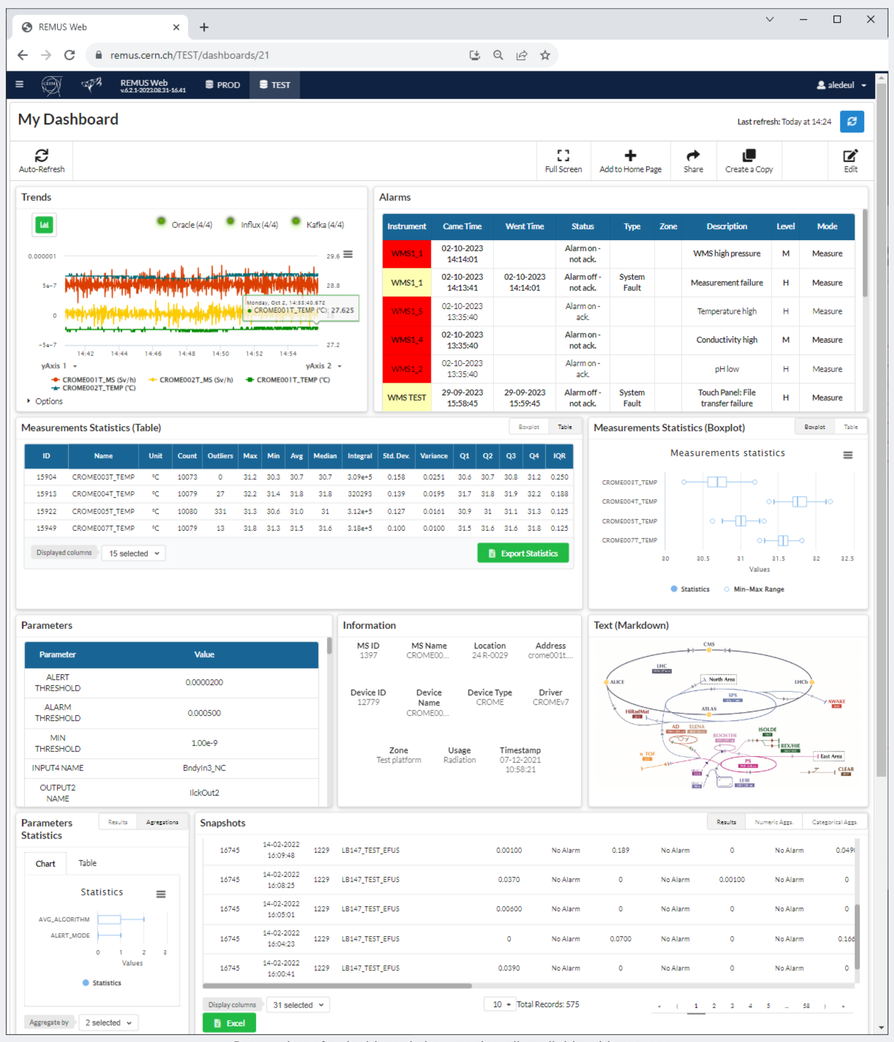
HighCharts library is used to display all the dashboards' widgets containing measurement data.
HighCharts's **Boost** module enables **GPU acceleration** using **WebGL.**

Back-end (2)

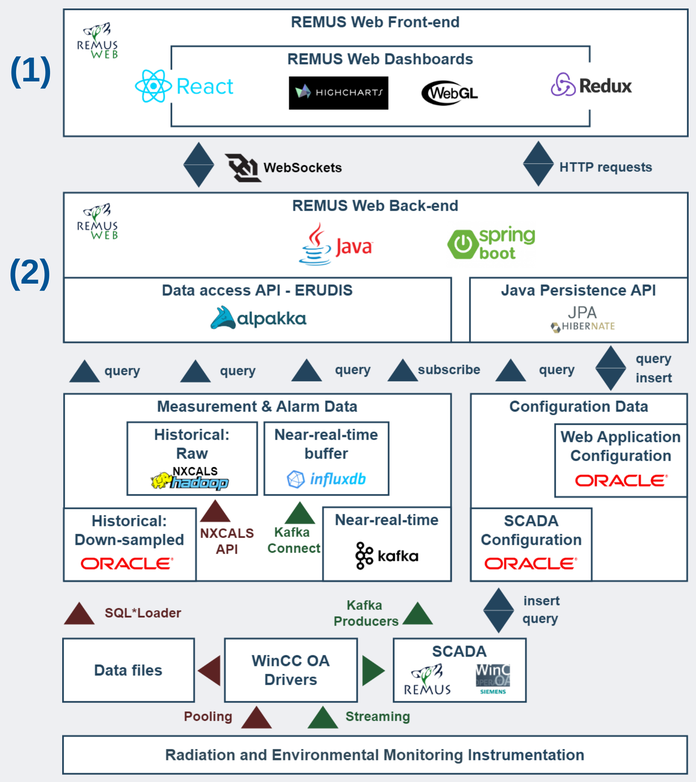
The REMUS Web back-end is built on **Java 17** and **Spring Boot**.

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



Screenshot of a dashboard show-casing all available widget types.
Data shown in this screenshot are coming from a **test** bench and are not actual operational data.



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.
- **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**.

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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