From Design To Production:
State-of-the art web user interfaces to operate the ALICE offline-online computing system

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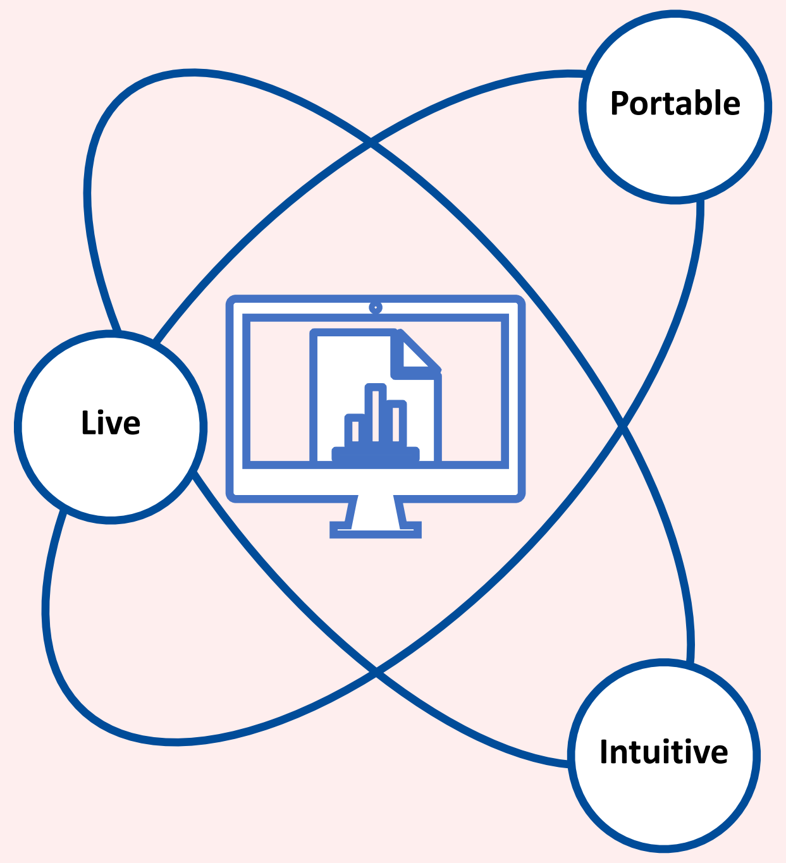
ALICE O² System and Interfaces

The ALICE Experiment at CERN's Large Hadron Collider is undertaking a major upgrade [1] during Long Shutdown 2 in 2019-2021, which includes a new Online-Offline computing system.

To ensure the efficient operation of the upgraded experiment and of its newly designed computing system [2], a new set of **reliable** and **performant** graphical interfaces is needed. These are to be used **24h/365d** in the control room by the shift crew and remotely by detector experts and on-calls.

This poster provides an overview of the newly developed web-based components focusing on their architecture and automated integration and deployment workflow used for software quality assurance.

Non-Functional Requirements



Experience from **Run 1 & 2** demonstrated that having a **common** solution for all the User Interfaces greatly optimises their development and users productivity.

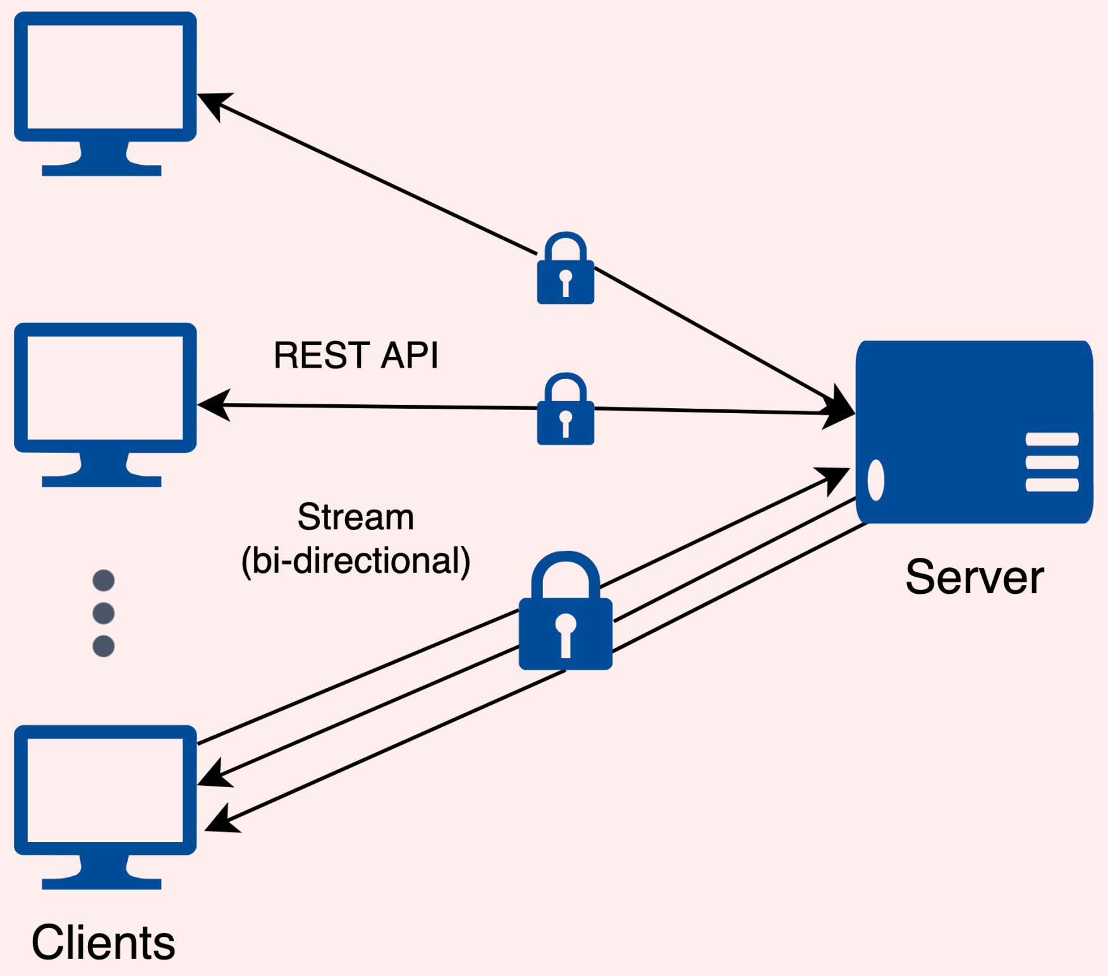
Thus we have developed Web Applications based on an in-house library, **@aliceo2/web-ui** which provides:

- Core functionalities and building blocks that can easily be plugged into other web applications.
- Common and intuitive user experience enhancing the productivity but also reducing the chance of user errors.
- Compatibility across operating systems (Mac, Linux, Windows) and devices (laptops, phones, tablets).
- Easy Integration with CERN systems.
- Real Time Data Transport.

ALICE User Interfaces

The detector environment implies **live interaction** with the system:

- We developed the tools as Single Page Applications (**SPAs**).
- We followed a Model-View-Controller (**MVC**) design.
- Front-end was developed with **Hyperscript** which via its diff algorithm will update only the affected nodes in DOM, greatly reducing the rendering times.



This allowed us to develop easy to share (via URL) tools as decentralised client applications which provide remote access without any prior installation or compilation.

Implementation of User Interfaces and CI/CD

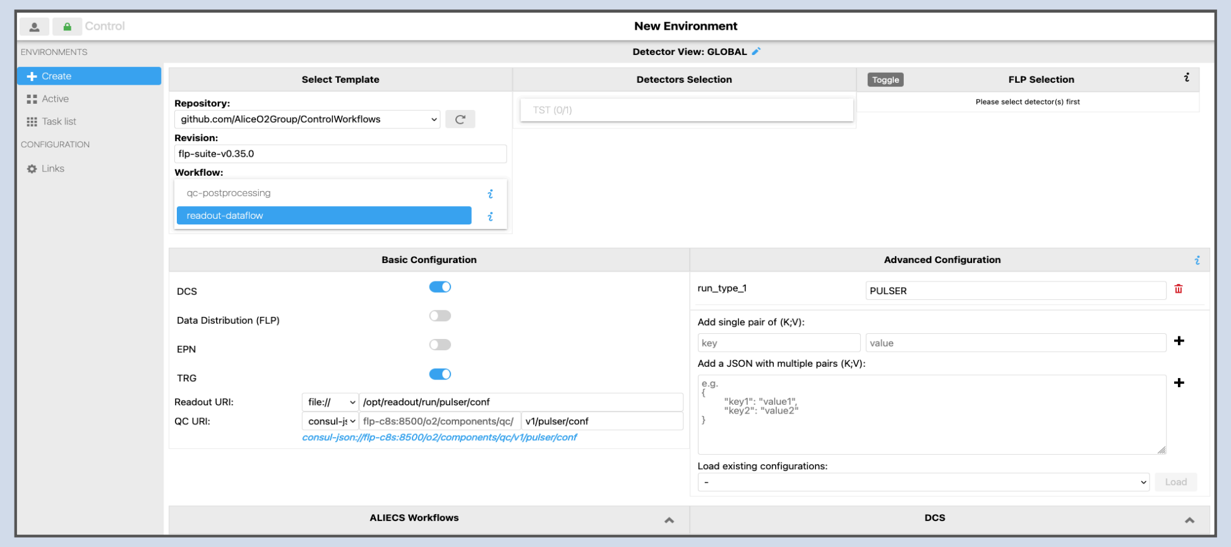
Test Driven Development (TDD)

- A wide range of **unit**, **integration** and **E2E** tests is developed based on users requirements.
- Scenarios cover cases from third party modules providing incomplete data to a successful data flow across ALICE systems.

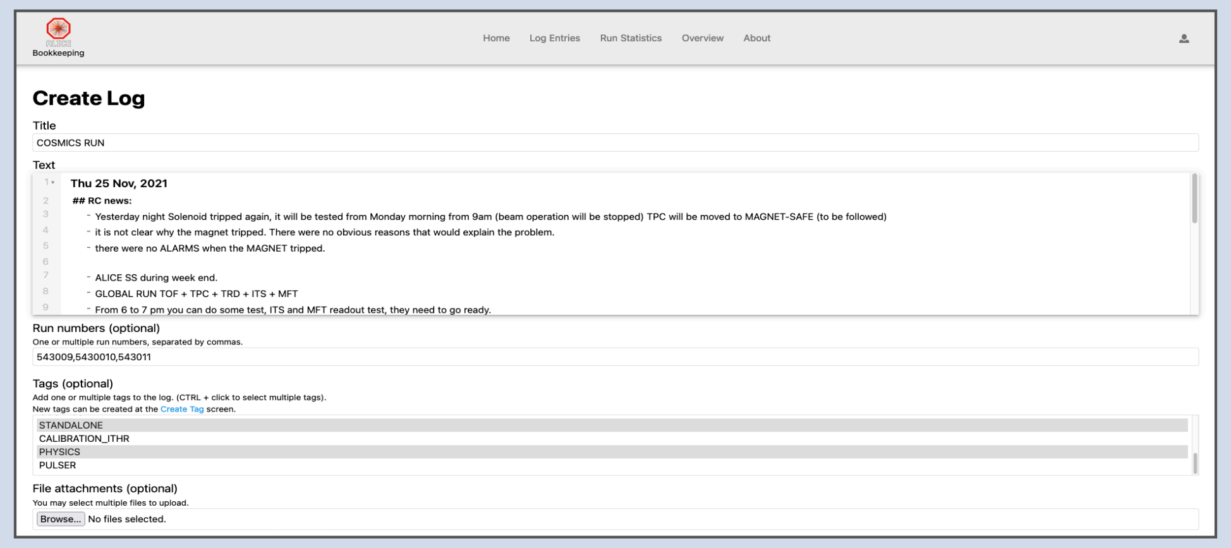
Building & Testing

Changes are validated automatically via GitHub Actions pipelines based on:

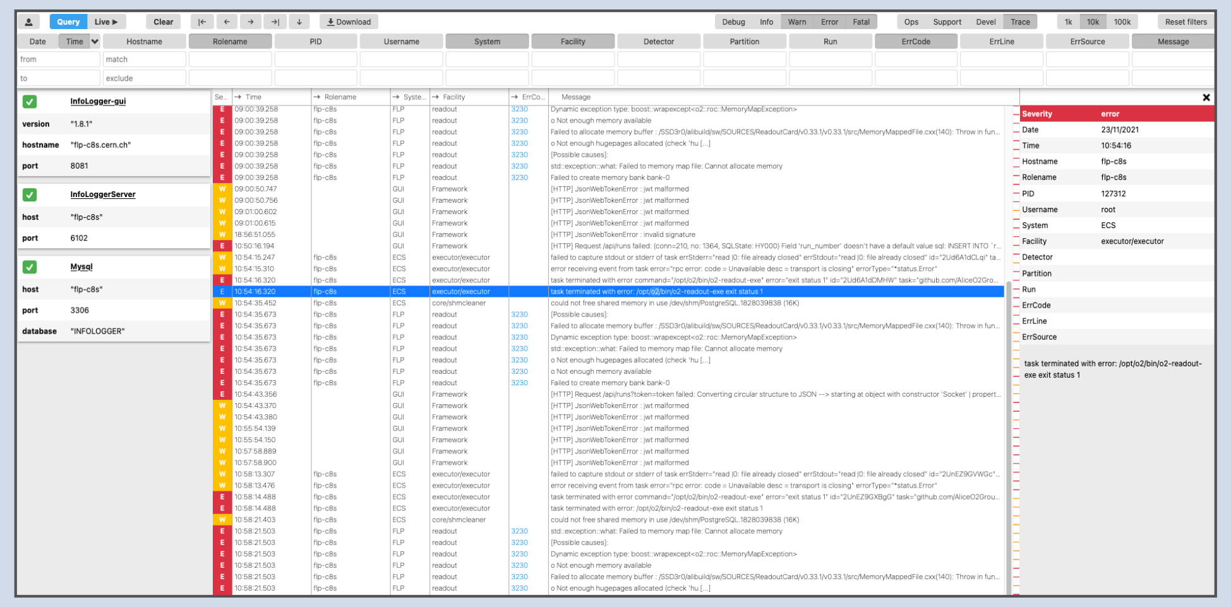
- No errors identified by the linting checks.
- A successful run of the tests with a minimum of 80% code coverage.
- Dependencies being up to date and no security issues being detected.



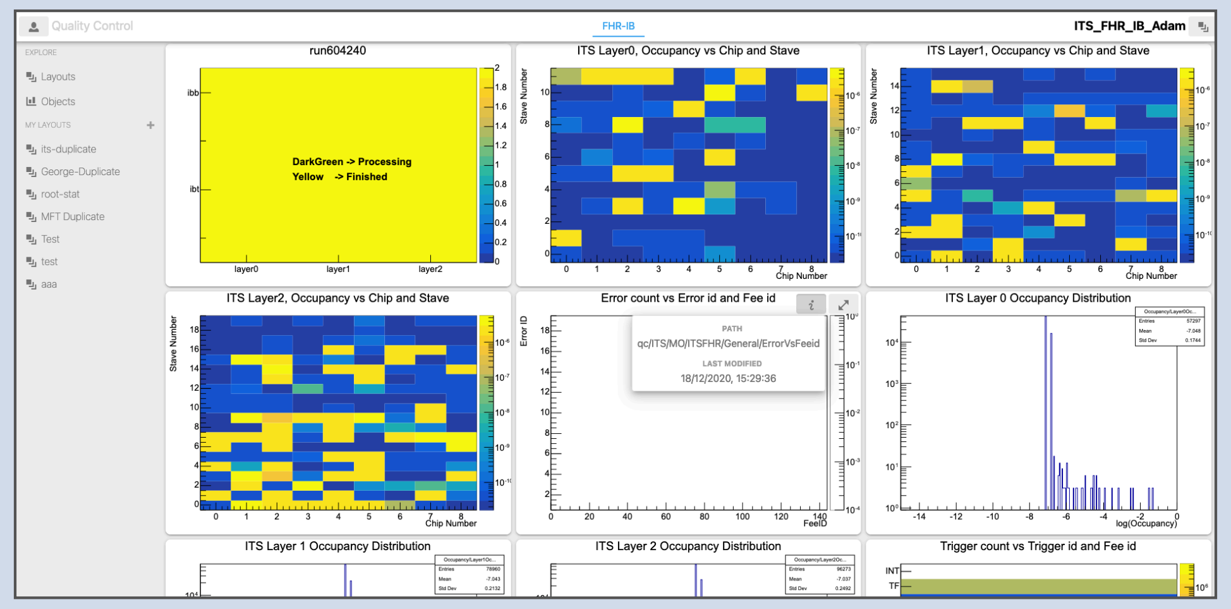
- **AliECS GUI** - Provides an intuitive way of controlling the ALICE data acquisition



- **Bookkeeping GUI** - Helps the users keep track of data taking configurations, conditions and operational interventions at the experimental area.



- **InfoLogger GUI** - Allows the users to follow live feedback from the system and investigate if necessary.



- **QualityControl GUI** - Provides an easy way for viewing ROOT objects from O² Quality Control.

Plan & Feedback Collection

- Shadowing sessions with users create new features
- Tickets are placed on a Kanban board with future versions assigned.

Packaging & Releasing

- The software is packaged in NPM modules and stored in a private registry; with easy access for future deployments or rollbacks.

Deployment

- Realistic user scenarios are validated via a GitLab pipeline, ensuring a stable and successful data flow within ALICE Systems.

Conclusion & Future Work

- Continue to follow leading industry standards and maintain best coding practices to ensure high quality code, fast releases and reduced time to resolution.
- Further develop the E2E tests for a unified workflow of actions executed in parallel which simulate the use of the platforms by multiple users.
- Functionality wise, a common live mode is envisaged. This will allow sharing notifications and updates to the clients or across platforms every-time an event is triggered.

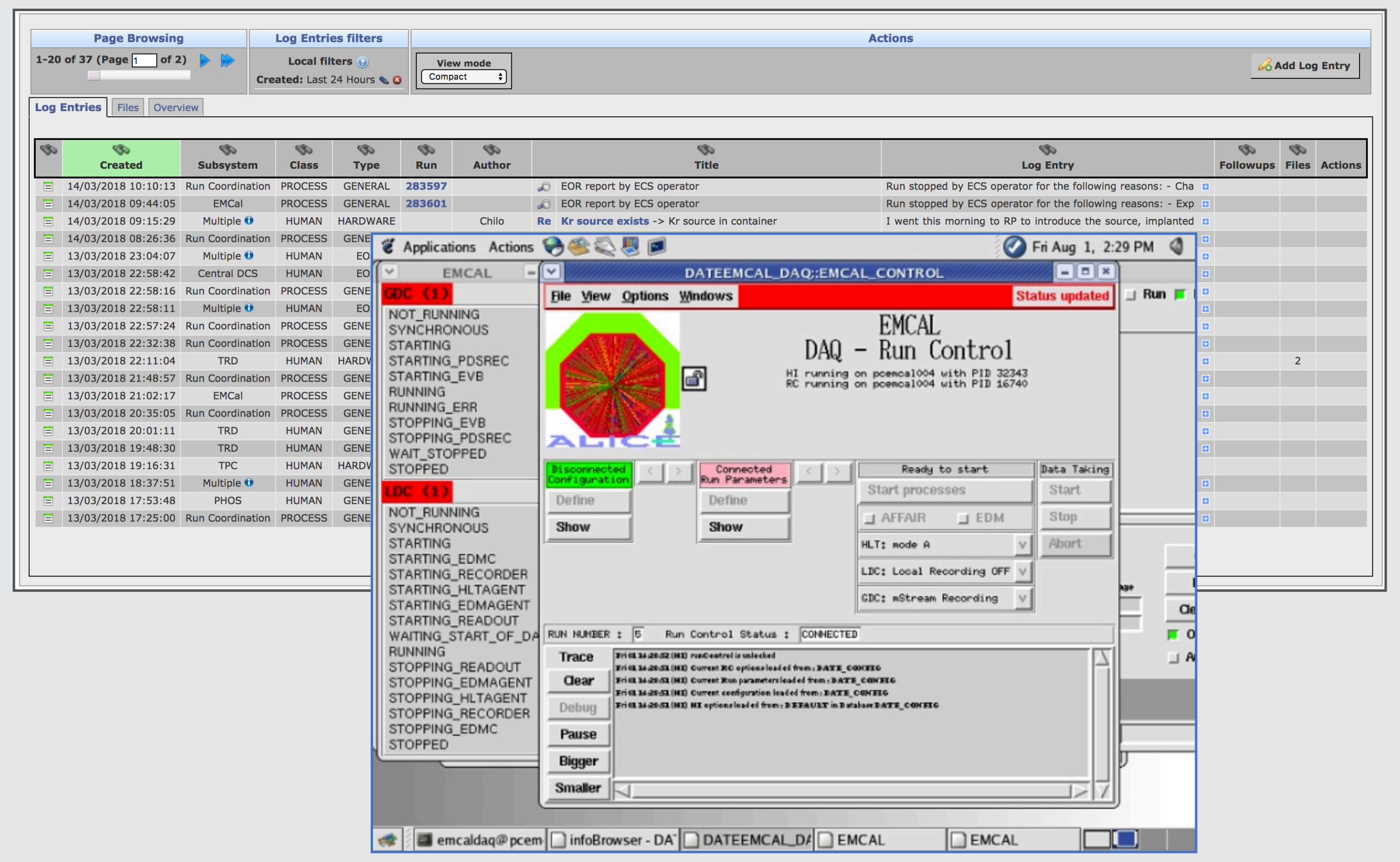


Fig.1 RUN 1 & 2 Graphical Interfaces

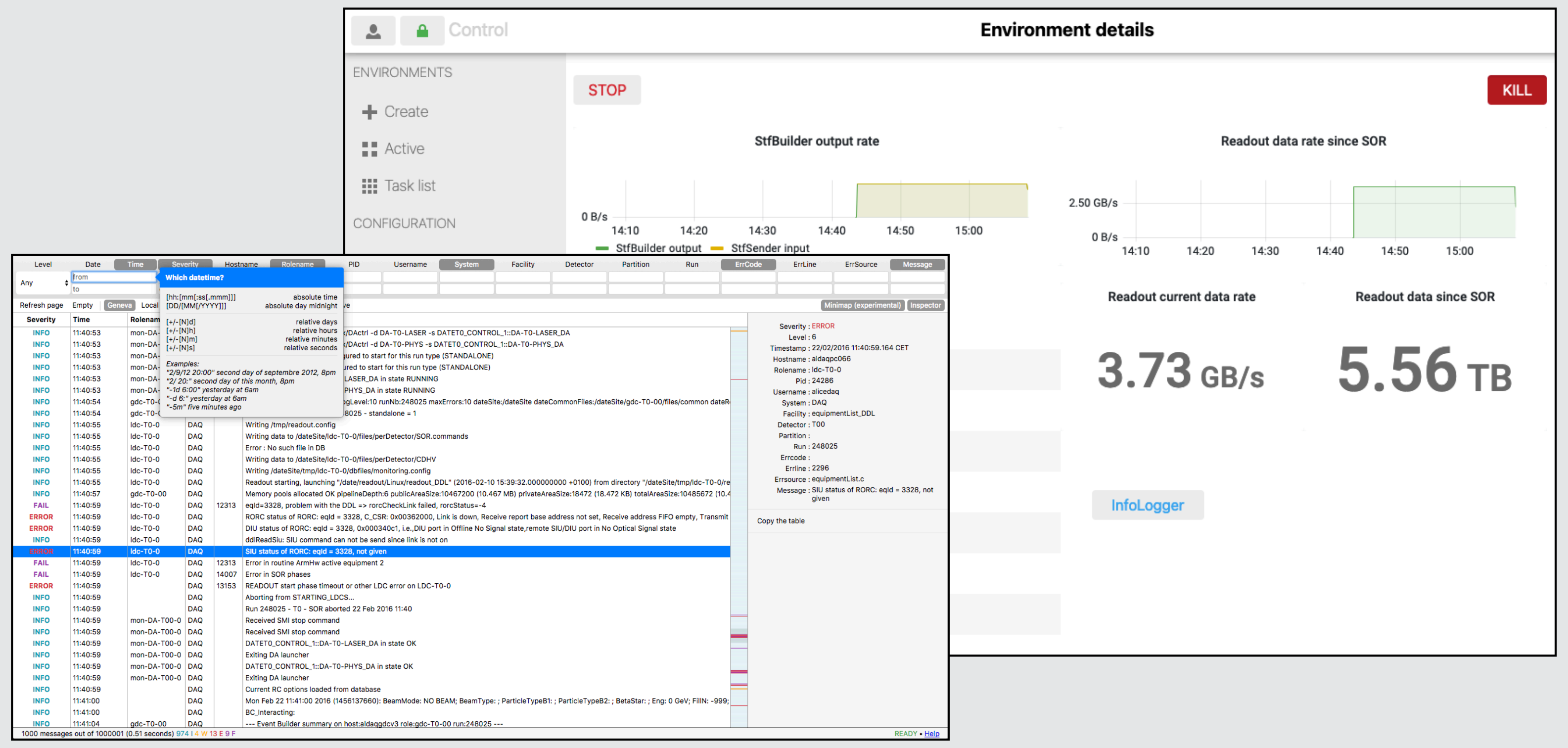


FIg. 2 RUN 3 & 4 New Web based Applications

References

[1] Buncic, P., Krzewicki, M. and Vande Vyvre, P., 2015. Technical design report for the upgrade of the online-offline computing system (No. CERN-LHCC-2015-006).

[2] Mrnjavac, T., Alexopoulos, K., Barroso, V. C., & Raduta, G. (2020). AliECS: a New Experiment Control System for the ALICE Experiment. In EPJ Web of Conferences (Vol. 245, p. 01033). EDP Sciences.