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Managing control HMI with artificial intelligence

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► **To cite this version:**

Julian Colnel, Hervé Calamy, Yassir Moudden. Managing control HMI with artificial intelligence. SOFT 2022 - 32nd Symposium on Fusion Technology, Sep 2022, Dubrovnik, Croatia. . cea-03862819

HAL Id: cea-03862819

<https://cea.hal.science/cea-03862819>

Submitted on 21 Nov 2022

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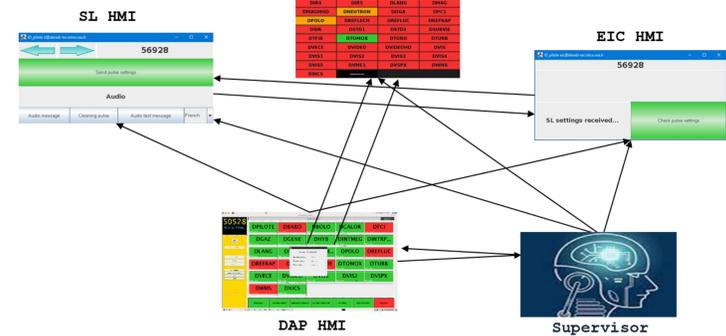
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Introduction

Over the years, the operational teams in charge of WEST operation have separately updated their respective software tools and user interfaces (HMI) in the control room to display always more information as required by their respective control room responsibilities. It appeared recently that the information displayed on the various HMIs could be inconsistent which could affect machine availability and safety. To alleviate such risks, a decision was made to redesign the whole operation toolset.

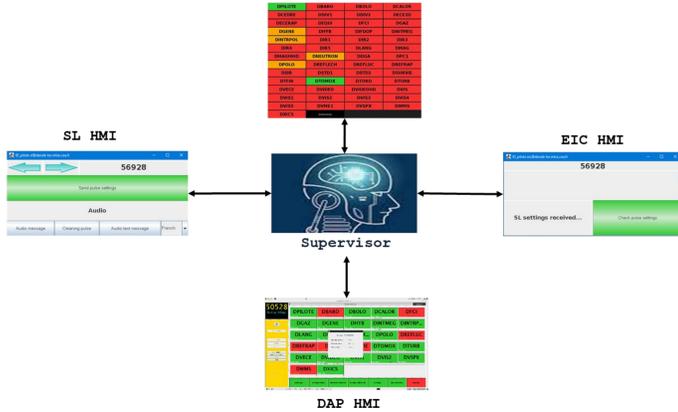
Allow the Supervisor to become the main actor

Acquisition Unit Status



After several years of development, the old way of exchanging information between processes has become widely unmaintainable. The new solution builds on a unique centralized source of tokamak information and its status, and passive HMIs which are mediators between the centralized description and the users. To achieve this centralization, we took advantage of the existing expert system (called WEST Supervisor) in charge of managing the sequential steps of plasma experiments since the beginning of WEST.

Acquisition Unit Status



Taking advantage of Artificial Intelligence

Thanks to the centralized data exchange, the WEST Supervisor knows everything about every process involved in the pulse. New rules have been developed in the expert system to continuously check what action is allowed/possible or not. In case of trouble, the WEST Supervisor immediately disables actions that could have undesired effects. This is a new **preventive detection** that has already save a lot of machine operation time.

DPILOTE is green, Pulse can go on, « Authorize » button is enabled ✓

DPILOTE is red, Pulse cannot go on, « Authorize » button is disabled ⚠

Same interfaces opened twice, commands are given only once (left). Next users are only allowed to see information (right).

Improved user experience

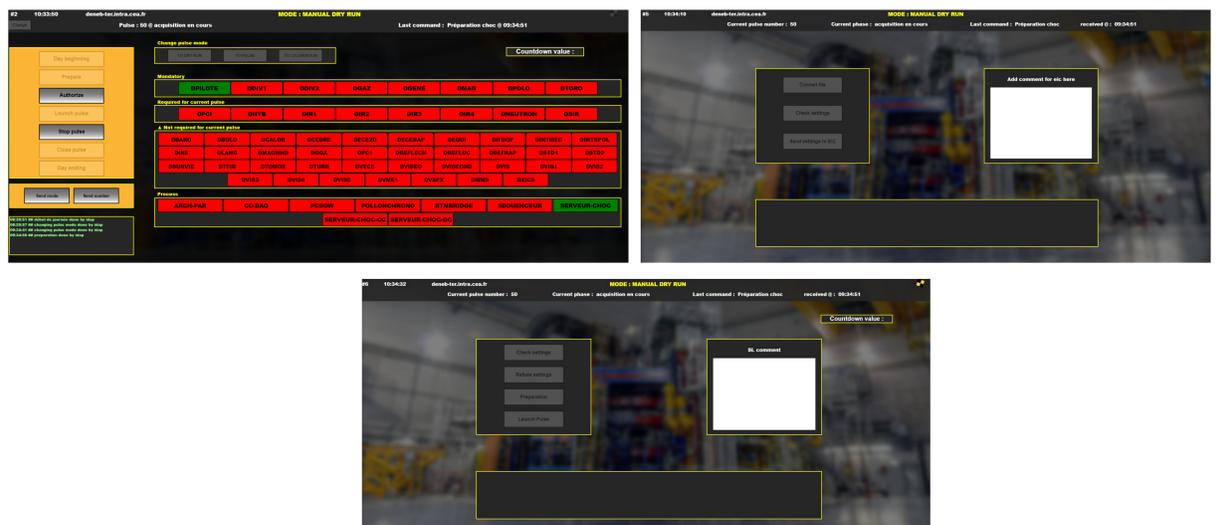


Fig : view of the operational team HMIs in dry run mode (yellow)

All user interfaces have been rebuild using the language (HTML/Javascript) and the same graphical charter as well. The main data that is shared is the operation status : either test pulse, calibration, or pulse mode. Each mode is associated with a color that is used in every HMI.

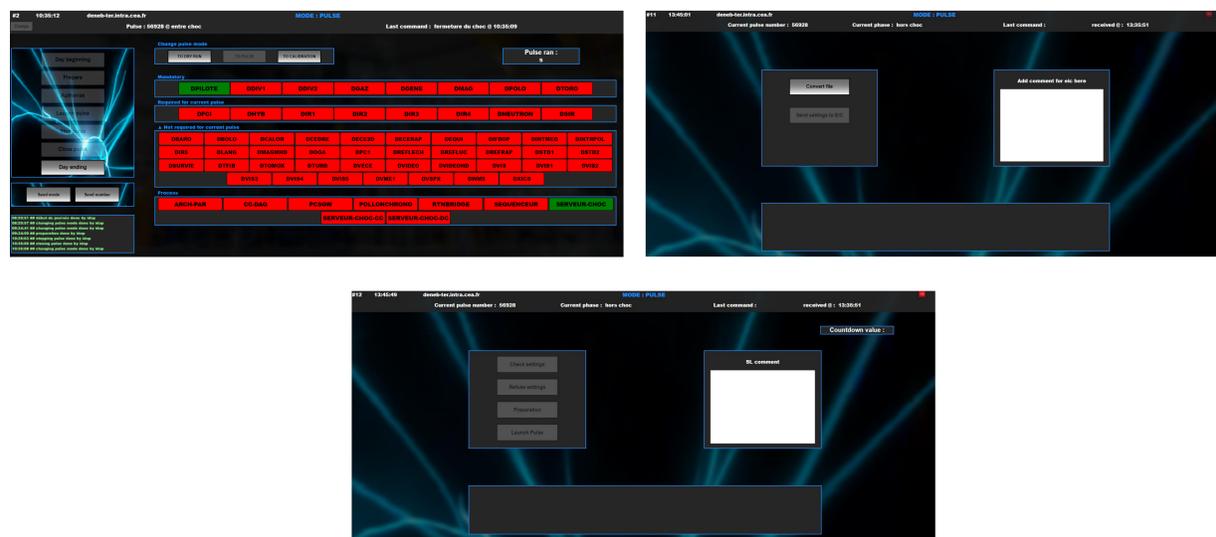
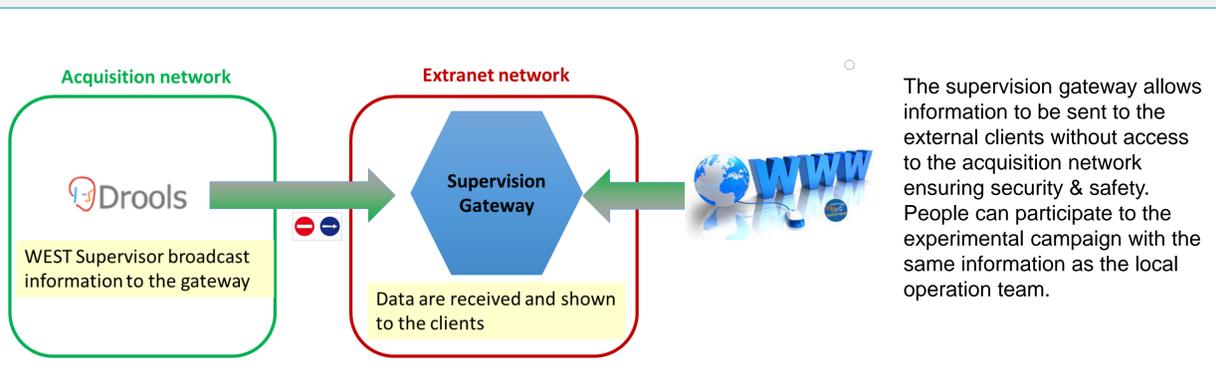


Fig : view of the operational team HMIs in plasma mode (blue)

Remote participation



Conclusion

The new WEST Supervisor has been successfully integrated into the WEST control infrastructure and has been used on real plasma experiments during the C6 Campaign in July 2022. All HMIs have been easily adopted by the different operation teams. In the future, the new infrastructure has been design to offer a lot a new capabilities for remote participation. Some of which are still under development: accessing data and status of acquisition unit, operate the West tokamak and conduct plasma experiments remotely.