

Rapid Prototyping of the Central Safety System for Nuclear Risk in ITER

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In the current ITER Baseline design, the Central Safety System for Nuclear Risk (CSS-N) is the safety control system in charge to assure nuclear safety for the plant, personnel and environment. In particular it is envisaged that the CSS shall interface to the plant safety systems for nuclear risk and shall coordinate the individual protection provided by the intervention of these systems by the activation, where required, of additional protections.

The design of such a system, together with its implementation, strongly depends on the requirements, particularly in terms reliability. The CSS-N is a safety critical system, thus its validation and commissioning play a very important role, since the required level of reliability must be demonstrated.

In such a scenario, where a new and non-conventional system has to be deployed, it is strongly recommended to use modeling and simulation tools since the early design phase. Indeed, the modeling tools will help in the definition of the system requirements, and they will be used to test and validate the control logic. Furthermore these tools can be used to rapid prototype the safety system and to carry out hardware-in-the-loop (HIL) simulations, which permit to assess the performance of the control hardware against a plant simulator.

Both a control system prototype and a safety system oriented plant simulator have been developed to assess first the requirements and then the performance of the CSS-N. In particular the presented SW/HW framework permits to design and verify the CSS protection logics and to test and validate these logics by means of HIL simulations.

This work introduces both the prototype and plant simulator architectures, together with the methodology adopted to design and implement these validation tools.

IAEA-TM2009/83

Number of words in abstract: 278

Keywords: CODAC - Safety - Control

Technical area: ITER

Special session: Not specified

Presentation: Poster presentation preferred