

The PCU JET Plasma Vertical Stabilisation control system

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Modern tokamak machines are designed to run elongated X-point configurations; for which the plasma is always vertically unstable. To allow plasma operation beyond the vessel time, the introduction of a Vertical Stabilisation (VS) System is necessary.

Furthermore, in presence of top-bottom asymmetric passive structures, fast perturbation to the internal pressure (ELMs, H-L transition) can perturb the unstable vertical mode. This is the case for JET where H mode is restricted by the risk that an ELM could trigger a vertical displacement event (VDE) which can cause a disruption.

The PCU enhancement project was setup with the aim to effectively increase JET operating space by both improving the Vertical Stabilisation System Controller and increasing the Radial Field Amplifier power.

This talk will be focussing on the new Vertical Stabilisation Controller. It will show the hardware and software technological advancements that have been used to implement a 200 channel 20kHz control system with a ~2us jitter and a >2Gops processing capability.

The software design will be presented to show how, by using an object oriented analysis, it is possible to obtain a good compromise between real-time performances and the reliability-maintainability objectives.

The PCU project has adopted from its beginning a model-based approach to solve the plasma vertical stabilisation control problem. The method implies that, at all levels, the control system will be tested on a model of the machine before being validated on the real plant. The controller software shall therefore be tested against the plasma models before being used in the machine.

The software was designed to allow the test against the model, both by providing a multi-platform compatibility (although the code runs on RTAI, it can be run offline on Windows without changing a single line of code) and by organising a clear separation between real-time I/O, configuration and control interfaces and scientific/technical code.

The first operational experience of the system will be presented, especially focussing on the first 5 months when the system has been operating in parallel to the old VS and the controller has been progressively commissioned.

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