

## **Real-time identification of plasma current and its position with hall sensors for long-pulse operation on QUEST**

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For long-pulse operation, the control of plasma current and its position is important to manage the heat loads, particle flux, and so on. Thus, the plasma current and its position have to be identified correctly during a long plasma discharge in real time. The plasma current and its position are usually calculated with signals of a rogowski coil sensor, magnetic flux loop sensors, and magnetic pick-up coil sensors. In order to calculate with these signals, the time-integrations of raw signals with electrical circuits or numerical calculations are required. However, these time-integrations cause drift errors which become larger according to the duration of the plasma discharge. And, this disturbs the correct identification and the control of a long-pulse plasma discharge.

We propose the use of hall sensors for the long-pulse operation. A hall sensor does not require time-integration, and does not cause the drift error. On QUEST, several hall sensors are installed on the outside of the vacuum vessel. Although the quick behavior of plasma cannot be sensed with hall sensors because of eddy current effects, this enables high-accuracy measurements with the static environment of no plasma, no RF, and no vacuum. This also enables the repair or replacement of hall sensors without a vacuum purge. The plasma current and its position are identified in real time with these hall sensor signals. The plasma position and current are calculated by the evaluation of intensity ratios and intensities itself, respectively.