

# Predictive Maintenance in Fusion Devices With an Application to the Ohmic Heating Circuit at JET

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Fusion power plants will need to run in a reliable way, in order to maximize the power output and avoid delays due to unscheduled maintenance or damage to components. Predictive maintenance is an approach that can contribute to this requirement by periodic or continuous monitoring of the condition of equipment. The goal is to predict when the equipment will require maintenance and, ultimately, to provide an estimate of the remaining useful lifetime of devices and components. This allows better maintenance scheduling and can help avoiding damage due to equipment failure. In this work, we introduce a number of statistical techniques that can be employed toward predictive maintenance in fusion devices. We then present an application to circuit breakers in the JET Ohmic heating circuit, powering the central solenoid. These circuit breakers are an important cause of failed pulses at JET, because they endure physical fatigue due to the large currents required for plasma formation. Using voltage and current data in the circuit, we employ on-line change point detection algorithms to determine if the circuit breakers operate in a healthy or anomalous state. In general, this approach can provide an advance warning of the deteriorating condition of subsystems and components in fusion devices, allowing maintenance as needed and prevent asset damage.

## Speaker's Affiliation

Ghent University

## Member State or IGO/NGO

Belgium

**Primary authors:** Mx CONTRIBUTORS, JET (Culham Science Centre); CAPUTO, Leonardo (Ghent University)

**Co-authors:** Mr VERDOOLAEGE, Geert (Ghent University); Mr STEPHENS, Jake (Culham Science Centre)

**Presenter:** CAPUTO, Leonardo (Ghent University)

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