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# Disruptions in ITER: Major Catastrophe or Minor Annoyance?

Disruptions are one of the most troublesome problems facing tokamaks today. In a large-scale experiment such as ITER, disruptions could cause catastrophic destruction to the vacuum vessel and plasma-facing components. There are two primary types of disruptions, Vertical Displacement Events (VDEs) and Major Disruptions (MDs) which have different effects on the tokamak and need to be addressed individually. VDEs result from a loss of vertical stability and can cause large halo currents that can flow into the first wall. MDs, conversely, are usually a result of reaching an operating or stability limit. The energy typically starts dissipating before the vertical motion begins, but MDs can still have plenty of energy to deposit on the plasma-facing components. In addition, MDs are immensely harder to detect.

Because of both the difficulty in predicting the start of a disruption, and the damaging effects one can cause, a large effort has gone into disruption prediction and mitigation. Information on disruptions from tokamaks world-wide has been collected in the International Disruption Database and this data has been used to define the expected worst-case parameters such as the shortest current quench time per area. These parameters have been used in conjunction with simulations, such as DINA, to define the expected heat load and potential melting of the Beryllium wall.

Because no machine can be built to withstand disruptions completely, mitigation methods are required. The most promising method is Massive Noble Gas Injection (MGI). Upon the detection of indicators leading to a disruption, a noble gas such as Argon is pumped into the chamber to dissipate the plasma's stored energy before it encounters any plasma-facing surfaces. These mitigation efforts have resulted in a reduction of the generated halo currents and a decrease in the heat loads on the walls. With proper prediction, the MGI could extend the life of the plasma-facing components considerably.

References:

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