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Preliminary Design of Halo Machine

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In 1996, during a disruption, 3 hundred tonnes of JET vacuum vessel moved by 7 mm sideways. In spite of significant efforts to understand the phenomena, the horizontal force on the tokamak wall during plasma disruptions still remains poorly understood. For example, the predictions for ITER vary greatly, from 2 to 60 MN, with the upper estimate exceeding the design margin of 48 MN. To resolve this uncertainty, in 2018, the ITPA community organized a dedicated joint experiment MDC25. While significant progress has been made [1 –3], it has also become apparent that for reproducible studies of the related physics a specialized linear plasma device is needed [4]. Accordingly, here we present the preliminary design of such machine. The main focus of new apparatus is the interaction between halo currents and kink modes during a plasma-wall contact. The currents in plasma facing components (PFCs) will be measured with recently developed probes [5]. The design of PFC arrangement is supported by SPICE3 modelling [6]. In many aspects Halo Machine [4] is similar to RSX from LANL [7], but it has 10 times larger magnetic field (up to 1 T) to mimic the ITER conditions [8]. Apart from disruptions, the parameters of new device are also appropriate to study magnetic reconnection [7] and stability of magneto-dynamic-plasma thrusters [9]. The synergy between these closely interconnected research topics will be exploited in the Halo Machine.

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