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CarMa0NL modelling of halo currents on COMPASS

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During vertical displacement events (VDEs) plasma column hits the wall and scrape-off layer ("halo") currents can reach significant amplitudes [1]. Therefore, the related electromagnetic loads on plasma facing components (PFCs) should be thoroughly evaluated to guarantee their structural integrity. Modelling of halo currents for next generation tokamaks is a challenging task. For example, non-linear (3D plasma + 2D wall) MHD codes, like JOREK [2, 3], M3D [4], M3D-C1 [2, 5] and NIMROD [2, 6] are appropriate for study of the disruption physics, but might be too demanding in case one needs to analyse many scenarios and geometry configurations. Disruption-oriented (2D plasma + 3D wall) numerical tool CarMa0NL [7, 8] is more practical for design purposes, but it requires some physical insight for definition of the halo width $w_h(t)$. Such criteria is found here empirically by comparing magnetic measurements during COMPASS VDEs [3] with results of CarMa0NL modelling for a wide range of parameters.

It is shown that the halo width correlates with the value of safety factor on the last closed flux surface $q_\lambda(t)$. The best fit with experiment is obtained for $q_\lambda(t) \approx 1$, which suggests that m/n=1/1 kink instability might play a role in defining $w_h(t)$. Further, we discuss application of the findings to design of COMPASS-U tokamak [9].

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