Numerical simulation of EM loads acting on the plasma facing units of ITER divertor cassettte [[1]](#footnote-1)\*)

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Some aspects of electromagnetic (EM) simulation for the central divertor cassettes (CDC) in the ITER machine are described. CDCs are located in front of the lower ports of the tokamak vacuum vessel. The study was focused on EM loads anticipated on the plasma facing units (PFU) of CDC. The simulations were carried out in the course of activities requested by the International Organization ITER (IO ITER). Ten EM events have been simulated [1] for 3 categories of plasma disruption independently and in combination with the fast discharge of the toroidal field coils. The paper is devoted to the EM simulations of the most crucial scenarios associated with high mechanical stresses: fast downward vertical displacement events of Categories II and III with 36 ms linear current quench (FD VDE‑II and FD VDE‑III with 36 ms LCQ). The input data for the simulations have been provided by IO ITER.

The selected events have been analyzed with the use of the original code TORNADO [2] developed at Efremov Institute for simulation of EM transients in 3D solids using the finite element representation.

Results of computations include evolutions of EM loads on PFUs in the form of integral EM forces and moments, their peak values, and relevant time points. The highest EM loads are expected to take place on the extreme PFUs of the vertical targets and the dome collectors and are associated with interaction between the total poloidal current and the toroidal field.

The symmetrical component of eddy current produces near equal integral EM loads on CDC PFUs. The peak EM loads occur in the middle of the plasma current disruption when the halo current through CDC is maximal.

The integral EM loads associated with anti-symmetrical current component have opposite directions at the extreme PFUs and tend to fall to zero when approaching the symmetry planes of the vertical targets and the dome. The peak loads occur at the end of the plasma current disruption and are much higher than peak loads from the symmetrical current component.

References

1. [D.Arslanova, A.Belov, E.Gapionok, M.Kaparkova, N.Krylova, V.Kukhtin, E.Lamzin, N.Maksimenkova, S.Sytchevsky, “Design Supporting Analysis of the Full-W Divertor”, Part 2 “Electromagnetic Analysis” of Final Report to Phase 1 “3D Global Electromagnetics, Thermal and Stress analysis of the Divertor”, IDM UID HDVF5E v.1.4, date 16/05/2014](https://user.iter.org/?uid=HDVF5E)
2. V. Amoskov, D. Arslanova, A. Belov, V. Belyakov, T. Belyakova, E. Gapionok, N. Krylova, V. Kukhtin, E. Lamzin, N. Maximenkova, I. Mazul, S. Sytchevsky “Global computational models for analysis of electromagnetic transients to support ITER tokamak design and optimization”, Fusion Engineering and Design, 87, Issue 9, Sept. 2012, pp. 1519-1532
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/E/ru/IV-Arslanova.docx) [↑](#footnote-ref-1)