Measurements of the natural plasma flow during the precursor of TCABR
density limit disruptions

F. Salzedas\textsuperscript{1,2}, G. Ronchi\textsuperscript{3}, J.H.F. Severo\textsuperscript{3}, R.M.O. Galvão\textsuperscript{3}, E.K. Sanada\textsuperscript{3}

\textsuperscript{1} Universidade do Porto, Faculdade de Engenharia, Porto, Portugal

\textsuperscript{2} Instituto de Plasmas e Fusão Nuclear, Instituto Superior Técnico, Universidade de Lisboa, 1049-001 Lisboa, Portugal.

\textsuperscript{3} Instituto de Física, Universidade de São Paulo, São Paulo CEP 05508-090; Brazil

Plasma flow was measured in TCABR ohmic discharges with 60 kA $\leq I_p \leq 80$ kA, $B_T = 1.06$ T, $a=0.18$ m, $R_0=0.61$ m that end with density limit disruption. Experimental values of the ion toroidal velocity, $v_{\phi i}$, and an $m=2/n=1$ magnetic island toroidal velocity, $v_{\phi 21}$, will be shown. In these pioneering experiments the natural value of $v_{\phi 21}$ was compared with the surrounding natural value of $v_{\phi i}$. It was observed that initially, while the island is small, the toroidal island velocity is more than ten times higher than the toroidal ion velocity at the island radial position, with both velocities in the same direction, the counter current direction. As the island poloidal magnetic field amplitude increased, $v_{\phi 21}$ decreases due to island-wall interaction. At the same time $v_{\phi i}$ show a small increase that becomes more pronounced as the $\hat{B}_\theta$ amplitude increases, but afterwards the ions toroidal acceleration becomes negative like the island acceleration and the ions slow down with a similar acceleration as the island’s acceleration. The disruption was observed when the island toroidal velocity was about two to three times higher than the ions toroidal velocity (see figure) and both the island and the ions have negative accelerations. The ion velocity was inferred from spectroscopy of the impurity lines of C\textsubscript{III} or C\textsubscript{IV}, while the island velocity was inferred from the cross phase of two Mirnov coils signals placed in different positions.