§2. Parameter Dependence of the Core Density Collapse Phenomena

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Core density collapse (CDC) is a relaxation events observed in the IDB/SDC plasmas. The IDB/SDC plasma is realized by the core localized refueling by sequentially injected ice–pellets. While the electron density rapidly decreases after the pellets, the core electron temperature recovers faster than the decrease of the density. Therefore, the electron pressure becomes peaked (IDB/SDC formation). However, the peaking is often terminated by a CDC event, where the core electron density is lost within several hundreds of micro seconds. In order to avoid the CDC and to achieve higher central beta plasmas, understanding of the CDC phenomena is thus required. However, CDC is quite different from other relaxation events and is hard to be understood. Here, the parameter dependence of the CDC phenomena is studied in order to unveil this newly found phenomenon.

In Figure 1, the magnetic axis position, estimated by the electron pressure profile, when the CDC events happen is shown. The threshold value is about 4.1m and 4.0m at the horizontally and vertically elongated section, respectively. They slightly decrease with the increase in the peaking factor of the pressure. The threshold value is fairly fixed against the change in the magnetic field and the vacuum magnetic axis position. The threshold can be seen neither in the core electron density/temperature nor in the core electron pressure/the pressure gradient.

From the time evolution of the soft X-ray (SX) radiation intensity, the time scale of the events is studied. Two stages are identified in the events. The pre-cursor phase (t1) and the rapid drop phase (t2) (see small figure in Fig. 2(B)). The time scales become shorter when the core electron temperature increases (Fig. 2). It is noted that in the IDB/SDC phase, the electron temperature profile is fairly flat; this dependence does not necessarily mean the phenomena is originated from the core of the plasma.

From the SX radiation profile, rapid movement towards outboard side just before the events is often observed. Magnetic reconnection from the movement is one possible scenario to explain this rapid loss. If the heat flux is mainly transferred by the parallel plasma transport, the electron temperature dependence can be understood ($\tau \propto 1/v_{e//}$). However, the mechanism of the rapid movement at a certain magnetic axis position is still an open question to be answered.

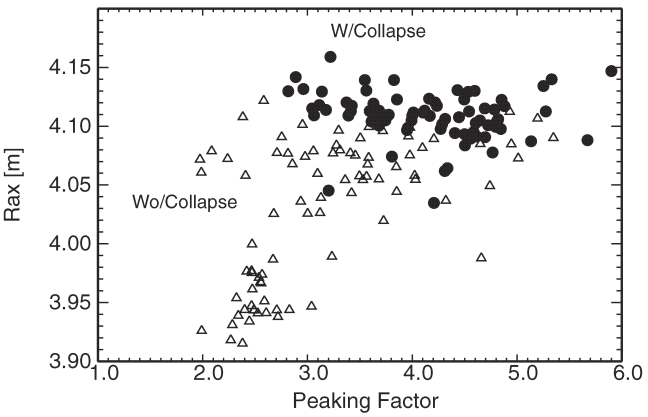

Fig.1: Magnetic axis position when CDC occurs as a function of peaking factor ($\beta_0/ < \beta >$) is shown.

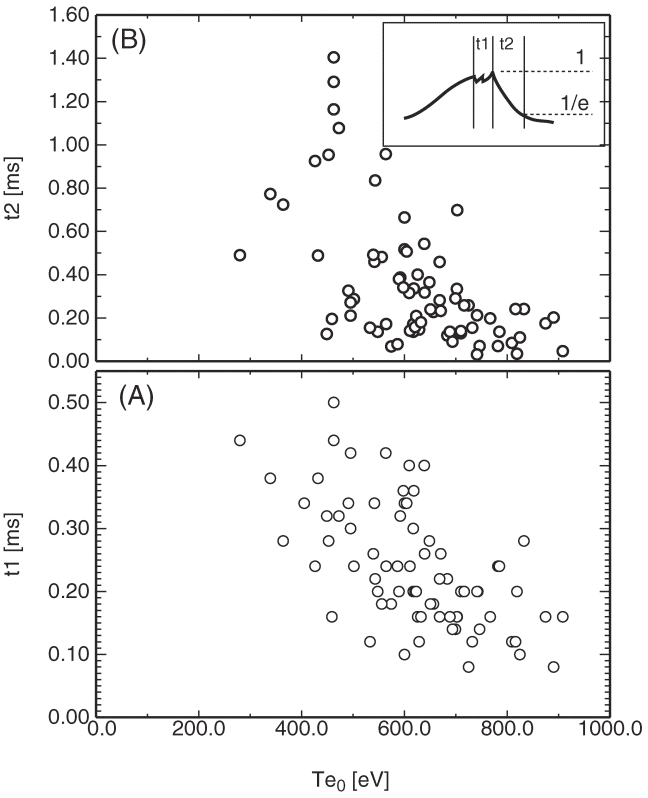

Fig.2: Time scale of the collapse as a function of the central electron temperature.