§65. Measurements of Plasma Rotation by Using Fast Charge Exchange Spectroscopy System

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Charge exchange spectroscopy (CXS) has been used to measure the profile of ion temperature and plasma rotation velocity and radial electric field. The time resolution of CXS system was improved to study the dynamic behaviors in the plasmas such as transitions from ion root to electron root and breathing phenomena in LHD. The time evolution of the radial profile of the poloidal rotation is measured for the plasma with radiation collapse to study the mechanism of radiation collapse.

Figure 1 shows the time trace of the line averaged electron density controlled by Neon gas puffing and the electron density reaches steady state phase with 1.1×10^{19} m^{-3} and 1.6×10^{19} m^{-3} after the turn off of Ne puff with the pulse width of 150 msec and 180 msec. However when the pulse width of Ne puff is 200 msec, the electron density continuously rises up even after the Ne puff is turned off and reaches up to the 2.6×10^{19} m^{-3} where the radiation collapse starts. There is a difference observed in the time evolution of radial electric field between with and without the collapse.

Figure 2 shows the time evolution of the profile of poloidal rotation velocity and the profile of the intensity of charge exchange emission of Neon (NeX). The radial electric fields during the Neon gas puff (t=0.6375s) are almost identical regardless of the radiation collapse. In the case of the plasma without radiation collapse, the radial electric field is kept to be positive and NeX intensity is also constant. This data shows that the impurity accumulation is suppressed by the positive electric field. On the other hand, the electric field goes to negative as the density increase for the plasma with radiation collapse. The NeX intensity profile shows the impurity accumulations associate with the negative electric field. The accumulation causes a drop of electron temperature and the increase of electron density. The electric field becomes more negative until the radiation collapse.

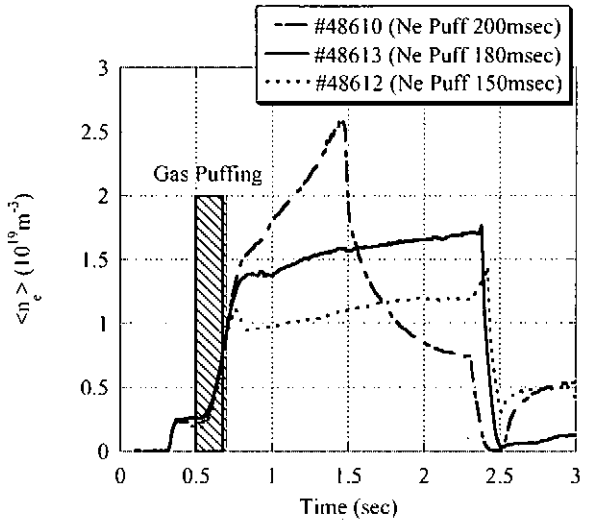

Fig.1. Time trace of the line averaged electron density measured with FIR interferometer for the plasma with the pulse width of Neon gas puff of 200 msec (broken line), 180 msec (solid line) and 150 msec (dotted line), respectively.

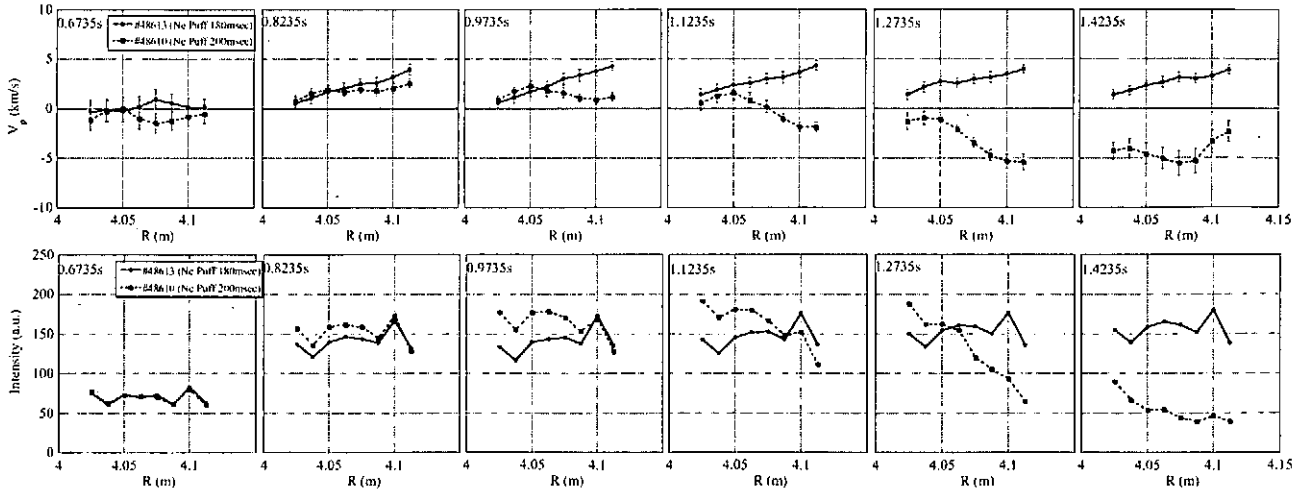

Fig.2. Time evolution of the profile of poloidal rotation (upper row) and the NeX intensity (lower row) for the plasma with (dashed line) and without (solid line) the radiation collapse.