§2. Parameter Dependences of High β Plasmas

Okamura, S., Matsuoka, K., Nishimura, K., Torus Exp. Group

The progress of obtaining higher beta values was brought mainly by the effort to increase the densities. Diamagnetic average beta values are plotted as a function of the average density in Fig. 1(a). The port-through NBI power was almost constant (about 1.8 MW total) for all shots plotted in the figure. Open circles are the maximum beta values during the gas puffing and closed circles are the peak beta values in the reheat mode after turning off the gas puffing. For the data points with gas puffing (open circles), betas are almost proportional to the densities. The beta values larger than 1.7 % were obtained with the reheat mode which appeared only for higher density operations ($n_e > 5.5 \times 10^{19}$ m^{-3}).

The confinement ratio τ_E/τ_{LHD} is plotted in Fig. 1(b) as a function of the average density. The reheat mode forms different branch of data points from the normal operation data with gas puffing. It is found that the confinement improvement by the reheat mode is about 30 % for good wall conditions. Figure 1(b) does not mean that the confinement ratio is generally constant for different densities. Because these data are taken from the series of discharges when the continuous effort of wall conditioning was made, the data points for low densities correspond to the discharges with insufficient wall condition.

For high-beta experiments, we selected the optimum magnetic field strength so as to obtain a maximum beta value. Such flexibility is available because we have the ICRF target plasma production using Nagoya Type-III antenna. Figure 2 shows the dependence of the plasma average beta on the average magnetic field strength B_{av}. Beta values are plotted both for a fixed average density $n_e = 5 \times 10^{19}$ m^{-3} and for the time of peak beta in the reheat mode (closed circles). Both data show maximum beta in the range of average magnetic field strength B_{av} = 0.55 - 0.59 T.

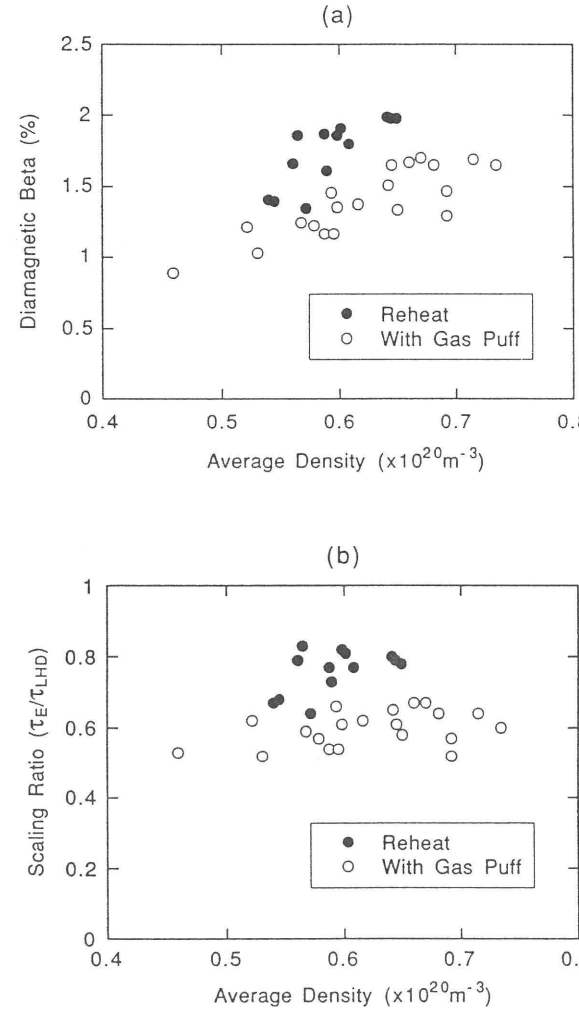

Fig. 1 (a) Diamagnetic average beta and (b) ratio of global confinement time to the LHD scaling (τ_E/τ_{LHD}) as functions of line-averaged density.

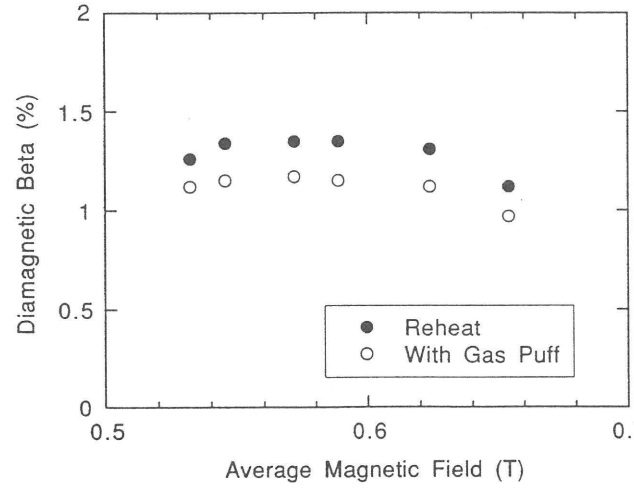

Fig. 2 Dependence of diamagnetic average beta on the average magnetic field strength.