In the future fusion reactor, it is desired to keep the maintenance ports as large as possible for easy access to the devices inside the vacuum vessel. This is possible by reducing the poloidal coils. In Fig. 1, compared are the possible port sizes in the cases with or without a pair of poloidal coils called “IS coils” in LHD. In a normal condition in LHD experiment, the toroidally averaged plasma cross section is kept circular by cancelling the quadrupole components of the magnetic field for 100 %, which is called the “circular” configuration ($B_Q = 100 \%$).

The toroidally averaged plasma cross section becomes vertically elongated when the IS coils are not used, which is called the “vertically elongated configuration” ($B_Q = 53 \%$, at $R_{ax} = 3.75 \text{ m}$).

On the other hand, the direct profile extrapolation (DPE) method has been developed to predict the radial profiles in fusion reactors from the profile data obtained in the experiment.\(^1\)\(^2\) To apply this DPE method, experiments has been carried out in the vertically elongated configuration. Although no clear difference between the circular and the vertically elongated configurations are recognized in the relation between the central density, $n_{e0}$, and the central plasma beta, $\beta_0$ (Fig. 2), a factor $C_{\text{exp}}$ used in the DPE method, which is proportional to the reactor size,\(^1\)\(^2\) has been shown to be smaller in the vertically elongated configurations, as shown in the right in Fig. 3.

2) J. Miyazawa, et al., in this issue.

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\[ \beta_0 \propto n_{e0}^{0.6} B_0^{-1.2}. \]