§36. Clearance Between Plasma and Vacuum Vessel

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The distance between plasma edge and the vacuum vessel has been investigated by using a field tracing code. At certain locations, It is fairly short and thus accurate values of the distance are needed in designing the vacuum vessel and its components. Fig.1 shows the cross sectional view of the helical coil, the vacuum vessel and the edge plasma, perpendicular to the helical coil axis. In order to find the location of the outermost edge of the plasma, we have traced the field lines from the starting points on the lines with constant ω (see Fig.1), and plot the connection length between the starting point and the divertor plate as a function of the radius of the starting point ρ. An example of such plots is shown in Fig.2 which indicates that the plasma edge is located between ρ=553.2mm and ρ=553.4mm. The shortest distance between the vacuum vessel and the plasma edge is found to be 38.4mm at toroidal angle $\phi = 36°$ and $\omega = 270°$, for the standard LHD configuration(Δ(magnetic axis)=-0.15m, β=0)

In the LHD assembly, the helical coils wind before the fabrication of the vacuum vessel. If the helical coil deformation is followed by the edge plasma deformation, then the vacuum vessel can be patched together relative to the position of helical coils. The effect of the helical coil deformation on the location of the plasma edge has also been studied. The deformation we considered is given by

$$\Delta R[m] = -0.002cos(n(\phi - \phi_0)) \qquad (1)$$

with the helical coil minor radius unchanged where n is the toroidal mode number of the deformation. In this analysis, the clearance at $\phi = 0°$ and $\omega = 270°$ were investigated with $\phi_0 = 0°$ for two toroidal modes, n=1(horizontal shift) and n=2(elliptical deformation) and are tabulated at Table I.

Fig.3 shows a relationship between the helical coil deformation Δ R and the plasma edge location ρ. It is considered that the resultant deformation of the edge plasma location is somewhat similar to that of the helical coil.

coil1	coil2	ρ(mm)	ρ-515(mm)
n=1	no deformation	551.6	36.6
n=2	no deformation	551.6	36.6
n=2	n=2	551.4	36.4

Table.I Clearance in coil deformation case

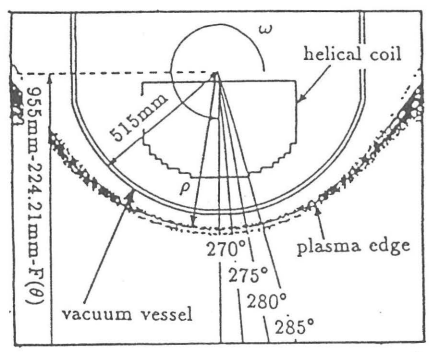

Fig.1. Cross section view of the vacuum vessel, the helical coil, and the plasma

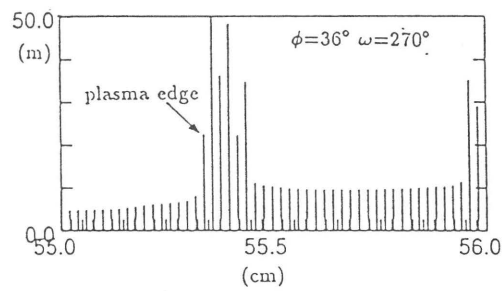

Fig.2. Connection length

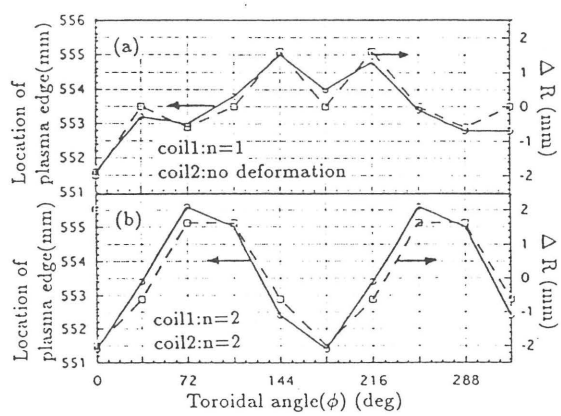

Fig.3 Location of the plasma edge and the helical coil deformation ΔR