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The strike-point wetted area is quite important for determination of the heat flux flowing into the divertor plate. In an axisymmetric device such as a tokamak type, the wetted area can be simply calculated from a product of a width and a total length of the strike point along the torus. In a helical system, due to the difference of the rotation transform around divertor plates, the length of the strike point is usually longer than that of a comparable-size divertor tokamak. However, the width of the strike point is not uniform at different toroidal angles in helical devices; the divertor flux is located on particularly narrow areas.

![Diagram](image1.png)

Fig. 1. (a) $L_c$ distribution around the divertor plate for $R_{ax} = 3.675$ m, (b) width of the $L_c > 20$ m area, and (c) Poincaré plot of magnetic field lines on the horizontal-elongated cross-section for $R_{ax} = 3.675$ m.

In the Large Helical Device (LHD), the divertor flux concentrates on the inboard-side divertor region in an inward shifted configuration of the magnetic axis position, $R_{ax} \sim 3.6$ m\(^1\). On the other hand, the deposition pattern moves to the upper and lower sides at $R_{ax} \sim 3.75$ m. The past study\(^2\) indicated that there is a sudden change of the strike-point pattern at $R_{ax} \sim 3.66$–3.67 m. In this study, we have investigated the detailed relationship between the $R_{ax}$ and the strike-point pattern from the magnetic field tracing; then, we confirmed the calculation result with the Steady-State Operation (SSO) experiments.

Firstly, we have calculated magnetic-field connection length ($L_c$) around the toroidally and poloidally rotating divertor plates at the minor radius of ~1.52 m for several $R_{ax}$ cases. Figure 1 (a) shows a $L_c$ distribution with two strike points at $R_{ax} = 3.675$ m as functions of the toroidal and the poloidal angles, $\phi$ and $\theta$, respectively. From such figure, we estimated the width of long $L_c$ area ($L_c > 20$ m) as a function of $\phi$ for $R_{ax} = [3.6$ m, $3.75$ m], as shown in Fig. 1(b). It can be found that there are two typical patterns having curves elongated from the inward and outward shifted $R_{ax}$ positions. These patterns are strongly related to the X-point positions that release the divertor flux. At $R_{ax} \sim 3.675$–3.68 m, there is no thick strike point ($>\sim 10$ mm), but both the two patterns merge; length of the effective strike point along the torus becomes relatively long.

In the aim of decreasing a maximum temperature of divertor plates during a SSO discharge, broadening of the divertor flux in the poloidal direction is one of the valid procedures. To confirm the broadening effect, we measured temperatures inside the poloidally-distant divertor plates by thermocouples for $R_{ax} = 3.65$ and 3.675 m, as shown in Fig. 2. By comparing these two cases, we concluded that there was a certain effect (~10%) to reduce the maximum temperature.

![Diagram](image2.png)

Fig. 2. (a) Divertor plates with a thermocouple. Time series of the divertor-plate temperatures during the same heating power shots for (b) $R_{ax} = 3.65$ m and (c) 3.675 m.