Gas puff injection is an ordinary fueling tool; in addition, it is also used to achieve large radiation loss in the edge region. In the future reactor, huge power flows into the SOL and divertor regions from the core. Therefore, not only fueling gas (D₂) puffing but also higher Z impurity (N₂, Ne, Ar, Xe, and Kr) seeding is expected as an effectual solution. To reduce peak heat flux effectively, understanding of impurity behavior is quite important.

From 16 cycle experiment in the LHD, we had installed Langmuir probe arrays on inboard divertor tiles at #2, 4, 6, 8, 10 toroidal sections. In each section, two tiles with probes were set at left and right hand sides, viewed from each O-port.

Figure 1 shows time series of ion saturation current ($I_{\text{sat}}$) at the left and right tiles. During a discharge (#114809), high flow rate H₂ gas puff was done from $t = 3.3$ s; then, the flow rate was decreased at $t = 3.7$s. In addition, supersonic gas puffing (SSGP) of N₂ was carried out at $t = [4, 4.2]$ s. In Fig. 1(a), $I_{\text{sat}}$ at #2 section shows a unique time series among the left tiles. It rapidly increases after high flow rate H₂ gas puffing; then, it decreases and again decreases after the SSGP of N₂. On the other hand, among the right tiles in Fig. 1(b), all $I_{\text{sat}}$ show similar change during the H₂ gas puffing. After that, only $I_{\text{sat}}$ at #6 decreases at the N₂ injection period. Amplitude of $I_{\text{sat}}$ is proportional to electron density ($n_e$) and square root of electron temperature ($T_e$). Therefore, observed increase and decrease of $I_{\text{sat}}$ would dominantly reflect increase of $n_e$ and decrease of $T_e$, respectively. In comparison between Figs. 1(a) and (b), $I_{\text{sat}}$ at right tiles are basically larger than those at left tiles. This magnitude relationship depends on the toroidal magnetic field direction; thus, it would be caused by the ExB flow in the edge region. These results imply that divertor flux is asymmetrically affected in toroidal direction according to the gas puffing. Moreover, it is found that the asymmetrical effect depends on the injection position, flow rate, gas species, and so on.

To clarify the positional relationship between the gas deposit location and the divertor probes, magnetic geometry was analyzed with KMAG code. Figure 2 shows magnetic field lines connecting to the left tile at #2 and right tile at #6, which had high sensitivity against the N₂ gas puffing. Divertor channels connecting to the two tiles are lying side-by-side between #2 and #6 sections. The SSGP was approximately intermediately positioned (3.5L) in toroidal direction. Because $I_{\text{sat}}$ at #4 was not influenced from the N₂ seeding (see Fig. 1), N₂ deposition was localized in narrow area in toroidal and poloidal directions.