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# Analysis of ion temperature profile in high intensity gas puffing experiments of Heliotron J

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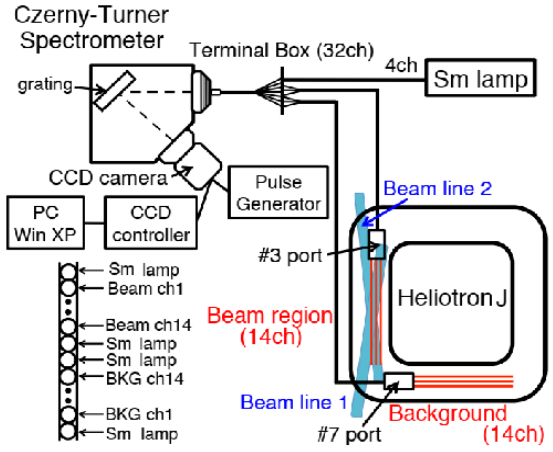
A parallel/toroidal CXRS system is used to measure the ion temperature and the parallel/toroidal flow velocity of the high temperature plasma in Heliotron J [1,2]. The diagnostic system consists of 32 channels of optical fibers, 14 at the NBI side for CXR emission's measurement, 14 at the background side for removing the 'cold component' of CXR emission, and 2 channels connected to a Sm line on both sides to define the wavelength of the CXR emission line, as shown in figure 1.

In this study, the ion temperature profiles obtained from the CXRS system under high intensity gas puffing (HIGP) and conventional gas puffing (GP) was compared. The typical time evolution of basic plasma parameters is shown in figure 2. The maximum value of line-averaged density and the stored energy are similar. In both cases, the plasma was initiated by ECH from 172ms to 202ms. The NBI beam was injected from 204ms to 272ms, with the power $P_{NBI}$~0.2MW. In HIGP shots, the gas puffing was intensified from 220 ms and lasted for 10ms while in GP shots the gas puffing was continuously injected until 260ms.




**Figures 1.** Scheme of the parallel CXRS on Heliotron J[1].

The radial ion temperature profile $T_i$ is shown in figure 3. When the line-averaged density and stored energy in the HIGP case reached the maximum value at $t$=241ms, the $T_i$ profile of HIGP case surpassed the $T_i$ profile in the GP case. At $t$=261ms, when the line-averaged density and stored energy in the GP case reached the maximum value, the $T_i$ profile HIGP case is still higher. For further study, we are now analyzing the heat transport based on power absorption calculation.

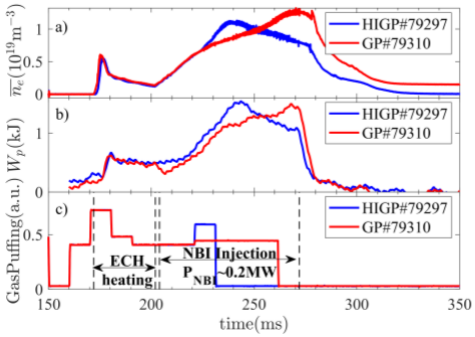



**Figure 2.** The time evolution of (a)line-averaged density (b)stored energy (c)Gas puffing signal for HIGP (blue) discharging and GP (red) discharging. $P_{NB}$I~0.2MW.

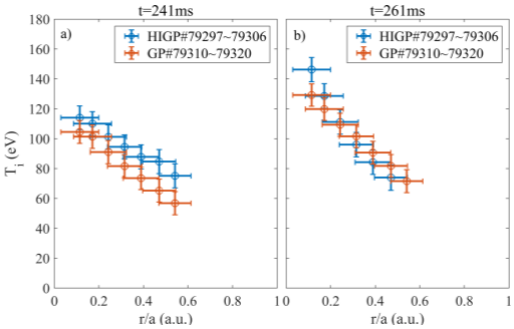



**Figure 3.** $T_i$ profile of HIGP (blue) case and GP case(red), at t=241ms and t=261ms.

**Reference**

[1]. HY. Lee, et al., *Plasma Phys. and Controlled Fusion* **55** 035012(2013).
[2]. XX. Lu, et al., *Plasma and Fusion Research* **13** 1202077(2018)