§1. Four Infrared Imaging Video Bolometer Systems in LHD

Mukai, K., Peterson, B.J.,
Pandya, S.N., Sano, R. (Grad. Univ. Advanced Studies)

Radiation profile measurement is a key issue to investigate plasma detachment and radiation collapse phenomena. It is known that the radiation from the ergodic region plays an important role in the phenomena.[1, 2] Then, three-dimensional measurement of radiation profile is required to study them in more detail since the radiation from the ergodic region has a three-dimensional structure. The InfraRed imaging Video Bolometer (IRVB) is a useful diagnostic to investigate the plasma radiation profile. It has a large number of channels and this characteristic is an advantage for a tomography technique to reconstruct the three-dimensional radiation profile.

In the 16th cycle, four IRVB systems were operated in LHD. The Field of Views (FoVs) and the specifications of the four IRVB systems are shown in Figure 1 and Table 1, respectively. Here, NETD means noise equivalent temperature difference. There are three improvements in this cycle. First, a new IRVB system was added at 6.5-L port with a poloidal view. It has 20x28 bolometer channels and will make a large contribution towards the three-dimensional tomography. As the results of this installation, the total number of bolometer channels is increased to 2528. Second, the IR camera at 6.5-U port is replaced from a SC500 to a SC655. The number of IR camera pixels is quadrupled and the performance of the NETD is improved by this replacement. Finally, the FoV at the 10-O port was rotated to focus on the helical divertor X-point as shown in Figure 2. The current FoV can observe only the helical divertor X-point region tangentially and the signal intensity from the helical divertor X-point region can be increased with this tangential view. The radiation around that region can be investigated in more detail by the modification of the FoV.

In the 17th cycle, the FoV at 6.5-U port will be improved for the three-dimensional tomography[3] and new IR cameras will be installed at 6.5-L and 10-O ports to improve the number of pixels and NETDs. In the near future, these IRVB systems will be operated automatically and a new IRVB system will be installed at 8-O port to focus on the closed divertor measurement.

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2) Peterson, B. J. et al.: J. Nucl. Mater. **415** (2011) S1147.
3) Sano, R. et al.: 22nd International Toki Conf. (2012) P1-39.

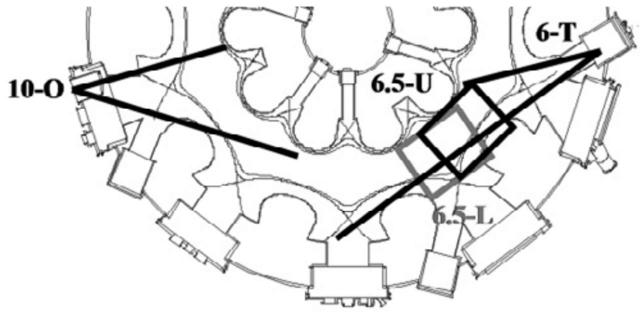
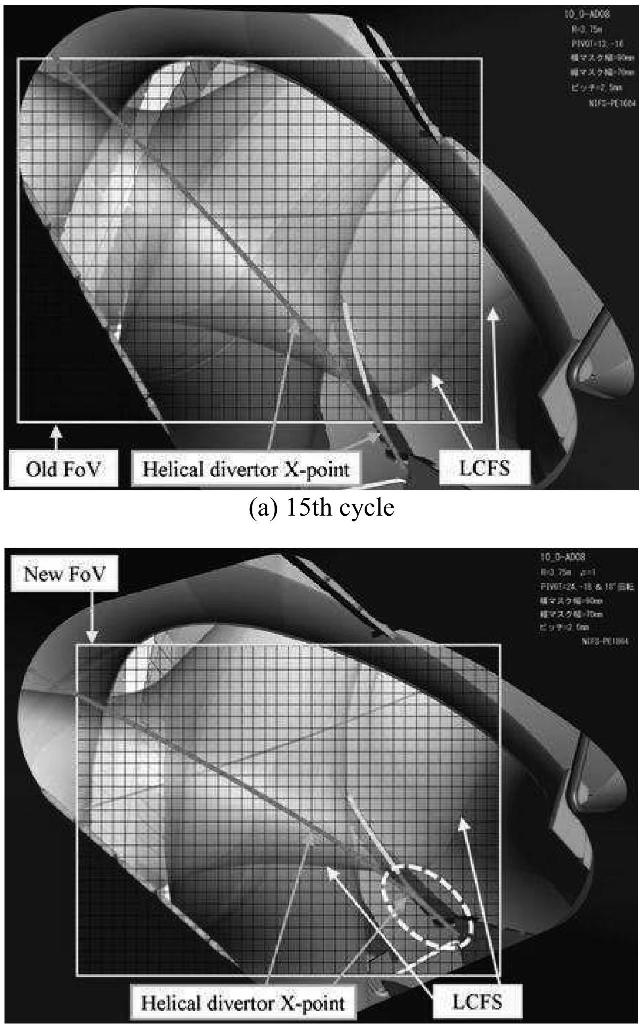


Fig. 1. FoVs of four IRVB systems in LHD

Table 1. Specification of IR cameras

Port	Camera	Pixels	Full frame rate	NETD
6-T	FLIR/ SC4000	320x256	420 Hz	<25 mK
6.5-U	FLIR/ SC655	640x480	50 Hz	<50 mK
6.5-L	FLIR/ Omega	160x120	30 Hz	<85 mK
10-O	FLIR/ SC500	320x240	60 Hz	<70 mK



(a) 15th cycle

(b) 16th cycle

Fig. 2. FoVs of IRVB at 10-O port