

Upgrade of Imaging Bolometers on LHD

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Infrared Imaging Video Bolometers (IRVB) provide an image of the plasma radiation consisting of hundreds of channels [1] which can be used to diagnose complex three dimensional radiative structures in helical experiments such as the Large Helical Device (LHD) [2]. The IRVB uses a thin metal foil to absorb the radiation collimated by a pinhole and then measures the foil temperature with an IR camera. Therefore, the lack of wired vacuum feedthroughs and the neutron and gamma resistance of the component materials indicates that the IRVB is well suited for application to a future fusion reactor. In LHD IRVBs at Ports 6-T and 1-O have been upgraded to improve sensitivity and extend the measurement to higher energy photons that are expected from higher temperature plasmas. Both of the ~1 micron x 70 mm x 90 mm gold foils have been replaced with ~2.5 micron Pt foils of the same area for greater sensitivity (Pt vs Au) and absorption of higher energy photons (material and thickness). The corresponding upper range of the absorbed photons will increase from 5.5 to 8.2 keV. Also the IR cameras have been replaced an FLIR/SC500 (100 mC, 60 fps, 320 x 240 pixels) IR camera with a FLIR/Phoenix (11 mC, 345 fps, 320 x 256 pixels) IR camera at Port 1-O and a AGEMA/THV 900 LW (190 mC, 15 fps, 136 x 272 pixels) [3] with a FLIR SC-4000 (11 mC, 345 fps, 320 x 256 pixels) IR camera at port 6-T for improved sensitivity and time resolution. In the current campaign these IRVBs will use 8 mm x 8 mm apertures resulting in 8 x 10 channels on the foil. The noise equivalent power density for these two new IRVBs is estimated to be $10 \mu\text{W}/\text{cm}^2$ for 60 fps operation, which is better than an order of magnitude improvement over the previous versions [3].

[1] B. J. Peterson, Rev. Sci. Instrum. **71** (2000) 3696.

[2] B. J. Peterson et al., Plasma Phys Cont. Fusion **45** (2003) 1167.

[3] B. J. Peterson, Rev. Sci. Instrum. **72** (2001) 923.