§15. LHD Plasma Emission Measurements by Means of Absolute XUV Photodiodes

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Measurements of LHD radiation profiles were made using an array of Absolute Extreme Ultra Violet photodiodes (AXUVD) [1]. AXUVD have an extended range of photon energies 20 eV – 10 keV, for which sensitivity is high and approximately constant (0.22-0.27 A/W). AXUV diodes are also fast, miniature, easy to use and relatively inexpensive.

The plasma radiation profiles were reconstructed from the chord-integrated signals using modified Abel inversion procedures. A special program providing inversion coefficients was developed and is now available for the other LHD researchers.

The AXUVD signal was compared with that obtained from usual metal foil bolometers. After simple correction, taking into account radiation spectrum of each LHD discharge, AXUVD can be used for total radiation power measurements instead of the metal foil bolometers.

Relatively small (<10%) but very stable oscillations of the AXUVD signal were detected during the whole steady state portion of the discharges which had the He puffing and the average density greater then $0.5\times10^{19}cm^{-3}$. The frequency changes smoothly during the discharge in the range of 0.5 to 2 kHz. These oscillations are possibly related to the peripheral plasma rotation and can be utilized for easy and precise poloidal velocity measurements.

With the present experimental set-up we could not resolve any neutral power flux by subtracting the AXUVD signal from the bolometer signal as it was done by Boivin [2].

References

[1] International Radiation Detectors, 2527 West 237th Street Unit C, Torrance, CA 90505-5243, www.ird-inc.com

[2] R.L.Boivin *et al.*, Rev. Sci. Instrum. 70 , 260 (1999).

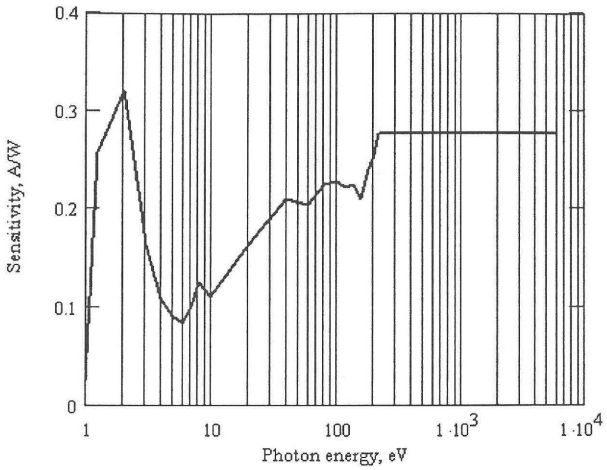

Fig. 1. AXUVD sensitivity versus photon energy. Contrary to bolometers AXUVD are not sensitive to neutrals.

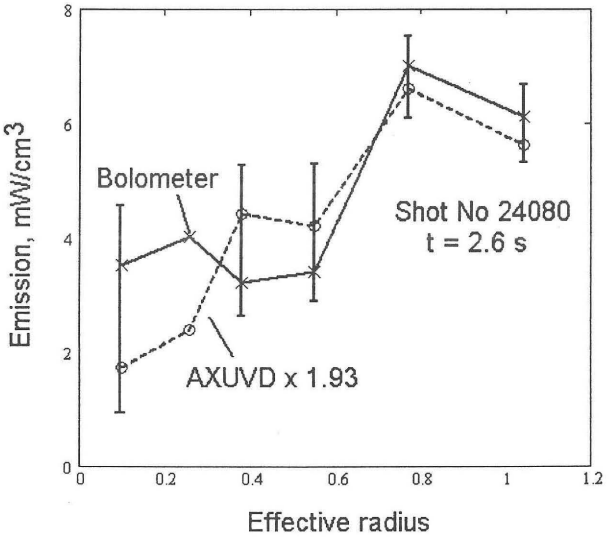

Fig. 2. Radiated power profile measured by the metal foil bolometer (solid line) and AXUVD (dashed line).
For this discharge AXUVD signal has been multiplied by K=1.93 to take into account the low AXUVD response for low energy photons. K varies from 1.2 to 2 depending on discharge parameters. Using the same K for the whole discharge and for all effective radii provides AXUVD correction with the accuracy of ± 10%.
The errors, estimated as maximal observed difference between AXUVD and bolometer, were mainly caused by the poloidal non-uniformity of the radiation power.