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LHD における赤外線イメージングボロメータ視野の最適化
Field of view optimization for IR imaging video bolometers in LHD

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An IR imaging video bolometer (IRVB) [1] is a measurement instrument for plasma radiation. The IRVB has an advantage of having a large number of channels and is useful for the measurement of both radiation intensity and spatial distribution. The advantage is necessary for three dimensional observation of plasma radiation which is planned in LHD. The IRVB is based on the same principle as a pin-hole camera. Therefore the field of view for an IRVB is defined by the relative position of the aperture and the radiation absorbing thin metal foil. Four IRVBs have been installed on LHD. Integration of the IRVB's outputs for reconstruction of the plasma radiation distribution is necessary for the observation. The reconstruction needs a geometry matrix for each IRVBs as a projection matrix to the foil from the plasma voxels which are defined in the plasma. The geometry matrix is calculated from the sight lines of each IRVB channel. The geometry matrix is also used to optimize the field of view for the IRVB. Three dimensional observation needs information from all of the plasma elements in the observation region for accuracy. Therefore it is necessary to optimize the fields of view to measure all elements by changing the aperture and the bolometer foil positions of the IRVBs.

In the present study, the LHD plasma is divided in a cylindrical geometrix into voxels which measure 5cm vertically, 5cm major radially and 1 degree toroidally as plasma element and the geometry matrices were calculated for the fields of view of the each IRVB while changing the aperture positions. An assumption of helically periodic symmetry is made by which the plasma repeats itself every 18 degree toroidally. The aperture positions which provide the best fields of view are chosen to reduce the total number of non visible voxel. Although there were 169 plasma voxels which could not be measured by any of the IRVB channels in the previous setting, this number could be decreased to 2 by this optimization. By improving the fields of view, the three dimensional plasma radiation distribution will be reconstructed with higher accuracy.

[1] B.J. Peterson, A.Yu. Kostrioukov, N. Ashikawa, M.Osakabe and S. Sudo, Rev. Sci. Instrum. **74(3)**, 2040 (2003).