

Design of imaging bolometer for 2D CT measurement of radiation in JT-60SA

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Measurement of a spatial radiation profile in fusion plasmas is important to understand power balance and radiation phenomena. Reconstruction of the radiation profile by Computed Tomography (CT) analysis from radiation integrated along diagnostic lines of sight is a preferable tool.

An InfraRed imaging Video Bolometer (IRVB) is a measurement instrument having the advantage of a large number of diagnostic channels. The large number of channels suits the CT analysis with a small number of diagnostic instruments. In this study, an IRVB is designed for the measurement of the radiation distribution using CT analysis in JT-60SA.

A typical IRVB has a pyramid-shaped Field of View (FoV) due to the pin-hole projection principle using an aperture and a metal foil screen. In this study, a new type of IRVB having two pyramidal FoVs has been introduced and designed to provide complete viewing of the entire poloidal cross section. Figure 1 shows the schematic drawing of the new type. With the designed IRVB, CT analysis can be performed in the whole poloidal cross section. The sizes of the apertures which determine the width of the sight of each IRVB channel, have also been optimized for a small reconstruction error with well-established CT solvers. Figure 2 shows a sample reconstruction using a well-established CT solver (Phillips regularization) from the given radiation profile which has strong radiation from the inner divertor region. The reconstruction shows that the reconstructed profile is similar to the source profile. The strongest radiation from the inner divertor region is also reproduced with broadening and a decrease of the peak value from 10.0 to 8.54. The quality of the reconstruction will be improved by the development of an advanced CT techniques in future research. An example of the improvement by an advanced CT technique will also be presented in this poster.

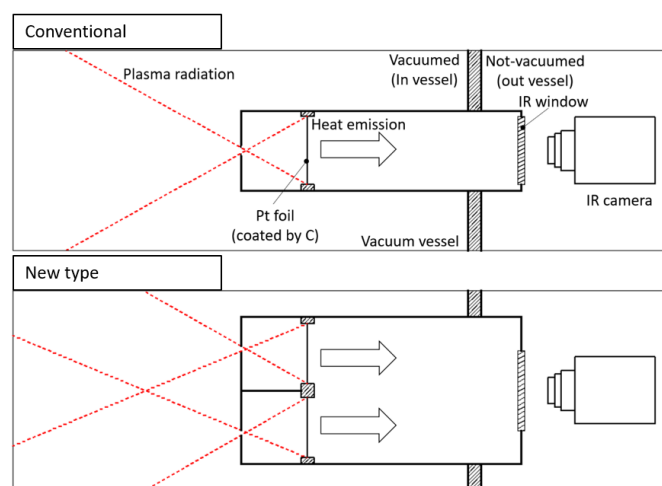


Figure 1 Schematic drawings of typical IRVB (upper) and new type of IRVB (lower).

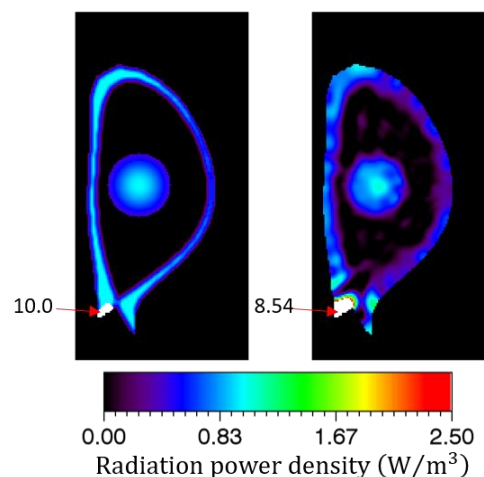


Figure 2 A given source profile (left). A reconstructed profile (right) by Phillips regularization method from the source profile.