§17. Comparison of Synthetic Images from EMC3-EIRENE with Bolometric Images from an IRVB in LHD

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InfraRed imaging Video Bolometers (IRVBs) [1] can supply views of the plasma radiation which can provide insight into the impurity radiation and transport properties when compared to corresponding synthetic images generated from the IRVB's field of view geometry and the three dimensional impurity radiation predicted by an impurity transport model such as EMC3-EIRENE [2]. In experiments on the Large Helical Device (LHD) employing an m/n = 1/1 resonant magnetic perturbation (RMP), detachment is achieved at a lower density and stabilized compared to the case without the RMP [2]. Also IRVB images show a change in the location of the radiation zone with detachment that is predicted by EMC3-EIRENE [3]. The experimental bolometric images can be compared directly to synthetic images derived by integrating the three dimensional carbon radiation predicted by EMC3-EIRENE along the sightlines of the individual IRVB channels. Examples of synthetic images for an imaging bolometer that views the plasm from a top port are shown in Figures 1 (a) – (c) for varying values of cross-field carbon impurity diffusion coefficient, *D*, and sputtering coefficient, *SC*. These can be compared with each other and with the corresponding bolometric image shown in Figure 1 (d). In Figure 1 (a) the radiation is highly localized along the helical divertor x-point. In Figure 1 (b), as *D* is increased, the radiation becomes concentrated near the magnetic island x-point in closer qualitative agreement with the experimental image in Figure 1 (d). As *SC* is lowered in Figure 1 (c) the radiation pattern broadens and the levels are reduced, giving better qualitative and quantitative agreement with the experiment. However the experiment still shows a broader radiation pattern indicating that *D* needs to be increased further to give better agreement with the experimental data.

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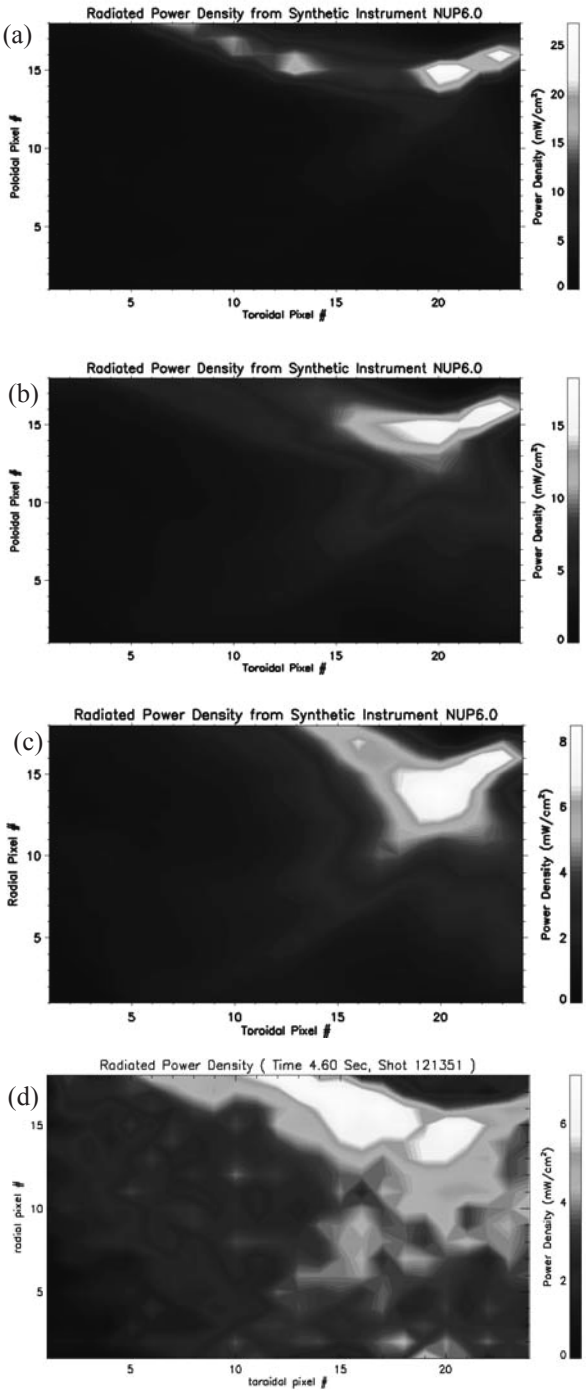

Fig. 1. Synthetic images based on EMC3-EIRENE results for an upstream density of 6 x 10^{19} / m^3 for (a) *D = 1 m^2/s, SC = 1%*, (b) *D = 2 m^2/s, SC = 1%*, (c) *D = 2 m^2/s, SC = 0.5%*. (d) Experimental bolometric image from LHD shot # 121351, *t = 4.6 s*.