§56. Edge Plasma Behavior and Neutral Particle Transport Analysis in Non-Axisymmetric Plasmas

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Behavior of neutral particles plays an important role in recycling phenomena and is an essential subject to understand the characteristics on particle confinement of the plasmas. In the GAMMA 10 tandem mirror [1], neutral hydrogen density in the central-cell has been estimated by measuring spatial-profiles of Hα line-emission together with neutral transport simula-tion [2,3]. The DEGAS code [4] has been applied to investigate the neutral particle transport in the GAMMA 10 plasma [2].

Two minimum-B anchor cells are mounted at both ends of the GAMMA 10 central-cell. In the anchor-cell, there exist transition regions where the shape of the magnetic flux tube becomes flat and the cross section of plasma is elongated elliptically in order to smoothly connect the lines of magnetic force between the anchor-cell and the neighboring cells.

In standard hot-ion-mode plasmas of GAMMA 10, Hα line-emission from the central-cell midplane to the outer transition region of the anchor-cell was measured by using absolutely calibrated Hα detector systems [5]. In order to evaluate the neutral density profile in non-axisymmetric region such as anchor-cell, a 3-dimensional neutral transport simulation by using the DEGAS ver.63 code has been utilized and the behavior of neutrals in the anchor-cell was investigated precisely. In this simulation research, detailed mesh structure composing the inner-wall surface and non-axisymmetric plasma are designed as shown in Fig.1.

Figure 2 shows the comparison between the simula-tion results and measured one. Calculated results of Hα intensity obtained with two typical density models are normalized so as to fit to the measured results at each

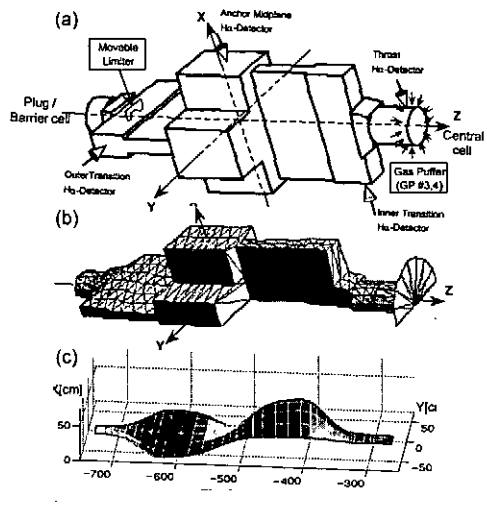

Fig.1 Mesh model of the anchor minimum-B region used for DEGAS ver.63. (a) schematic view of the vacuum vessel, (b) surface structure of the vessel wall, (c) cross

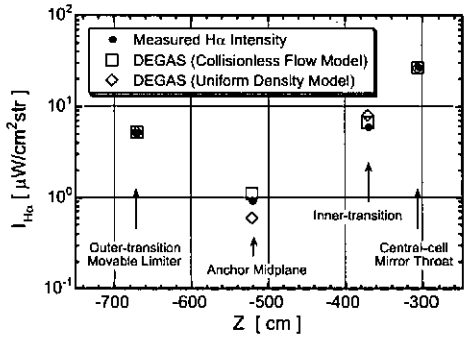

Fig.2 Axial intensity profile of Hα line-emission.

source location. The simulation assuming both particle sources from the gas puffer and from the movable limiter successfully reproduces the axial profile of measured Hα intensity. The hydrogen recycling near the movable limiter plays an important roll on the behavior of neutral particles in the non-axisymmetric anchor region.

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