§5. Measurement of Neutral-Beam Profile and Evaluation of NB Deposition on CHS


The evaluation of beam input power is necessary in energy confinement study of NB-sustained plasmas. The evaluation is usually done by Monte Carlo simulation code assuming a certain beam profile and port-through power. It is very difficult to confirm the validity of the calculation without the measurement of beam shine-through. Recent study at Princeton shows the importance of beam fueling profile on plasma confinement. Therefore, the beam profile measurement is necessary at the NB-counter wall to evaluate the port-through power and the beam deposition profile.

A calorie meter array for NB measurement was installed on CHS as shown in Fig. 1. Two types of calorie meter chips are used for this array. One is ordinary calorie-meter chip which consists of Off-oxygen copper cylinder and has just one temperature measurement point (Type-A). This chip only gives us the time integrated heat load onto the chip. This chip is suitable for the measurement of beam profile without target plasmas or with a steady state target plasmas. Type-A chips are usually used for constructing the database of beam port-through power under various beam operation condition. Another is a special calorie-meter chip which is designed for temporal measurement of beam heat load (Type-B). This chip is suitable for the time dependent NB shine-through measurement. The principle of the temporal measurement and the experimental verification of the method are described elsewhere.

The preliminary result of time dependent shine-through measurement is shown in Fig. 2. The lines show the result of the measurement, while the closed circles show the calculated NB shine-through evaluated by FREYA-code assuming a flat density profile. Good agreement is found between them in general. The detailed analysis must be done in evaluating the difference between them, using actual electron density profile, temperature profile and $Z_{eff}$ value.

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Fig. 1 Schematic drawing of the location of calorie meter array on CHS. The arrow express the center and the direction of injected beam by Neutral Beam Injector #1. The gray square express the calorie-meter array.

Fig. 2 Comparison of measured NB shine-through and the calculated NB shine-through evaluated by FREYA. The calculated NB shine-through are saturated around 5% after 70ms until the end of the plasma.

References
3) M. Osakabe et al, Annual Report of NIFS of this issue