§11. Electron Beam Dump for LHD-NBI System

Oka, Y., Osakabe, M., Takeiri, Y., Tsumori, K., Kaneko, O., Kuroda, T., Asano, E., Kawamoto, T., and Akiyama, R.

The electron beam component during H- acceleration was detected in order to design the electron beam dump for LHD-NBI system[1]. The electron component accompanied together with H- ion acceleration generates needlessly high heat flux to the grids or to the vacuum vessel, and produces x-rays, etc. The primary requirement for the measurement is to know the location (profile) of heat flux and total heat load in the vacuum vessel.

Figure 1 shows a schematic drawing of the calorimeter array located downstream from the accelerator and a high current multicusp H- ion source with the grid area of 25x25 cm^2 in the test stand. Figure 2 shows three dimensional profile of the temperature rise of the array, when H- ions are accelerated with ~100 keV and ~3 A for pulse duration of 0.6 s. It can be seen that their peaks are produced at the base of the beam duct by the electrons deflected by the stray magnetic field of an external magnetic filter used in the multicusp ion source.

When only the electrons with helium plasma were extracted / accelerated, there was no such peak in the temperature rise at the center. This corresponds to the simple calculated trajectories of electrons, which impinge on the plane of the array.

It was first time found[1] during the acceleration of H- ions that the profile of the electron beam component as well as total heat load were ruled out primarily by the stripped electrons of H- ions with residual gases under the stray magnetic fields, rather than the simple trajectories of the electron. The electron beam dump for LHD-NBI is to be installed to protect the inside componenst of the beam line (i.e., bellows for adjustment of the beam orientation, etc).

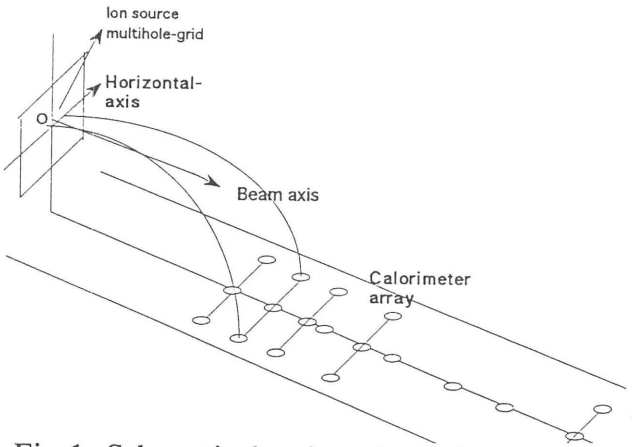

Fig.1. Schematic drawing of calorimeter array and multicusp H- ion source on the teststand.

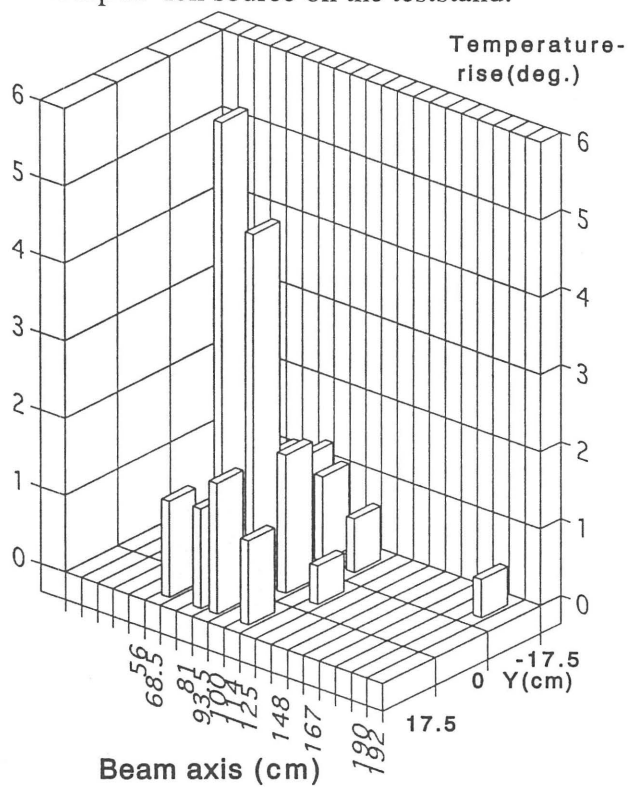

Fig.2. Measured profile of the temperature rise of the array from the electron beam component.

1) Oka, Y., in First EU-Japan Workshop on NBI at JAERI, Feb.1997.