## §32. Antenna System for High Power ECH in CHS

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A 400 kW gyrotron in addition to the previous 200 kW one is installed on the CHS in order to investigate the plasma confinement properties in the high electron temperature regime. This gyrotron generates Gaussian beam in contrast to the 200 kW gyrotron whose output mode is $TE_{02}$ circular waveguide mode. The launching system connected with the quasi-optical transmission line is designed with constant phase concept. In Fig. 1 are shown the 1/e waist size evolutions of the designed beam along a propagating direction. Solid line indicates that of radial direction. The waist in this direction is on the mid-plane of the CHS and is 15 mm in size. Dotted line indicates that of toroidal direction. From the requirement that the two well controlled beams must be injected from the same port of 300 mmϕ, the waist size of this direction should be optimized so that final focusing mirror width and beam width are minimized. Actually, the waist size in the toroidal direction is set 50 mm on the mid-plane. This size is selected so that the mirror size along the toroidal direction become minimum under the given distance from the mid-plane to the final mirror.

In Fig.2 is shown the drawing of the new injection antenna system for CHS, here two identical symmetric Gaussian beams from the quasi-optical transmission system are injected from the vacuum window with the axisymmetric 1/e waist size of 25 mm and waist position on the window. The vacuum windows are made of 100 mmϕ C-face cut sapphire. These beams are at first converted from axisymmetric to elliptical by the elliptic beam generating mirrors and re-shaped to the desired elliptic Gaussian beam by the final focusing mirror. These focused beam are directed to the desired direction in the poloidal plane by the plane steering mirrors. The focal position can be changed from the outer edge to the inner one of the plasma poloidal cross section without degrading the beam quality.

The results of the cold test for these two mirror sets show that both systems generate identical Gauss beams whose parameters are close to the designed one for both radial and toroidal direction.

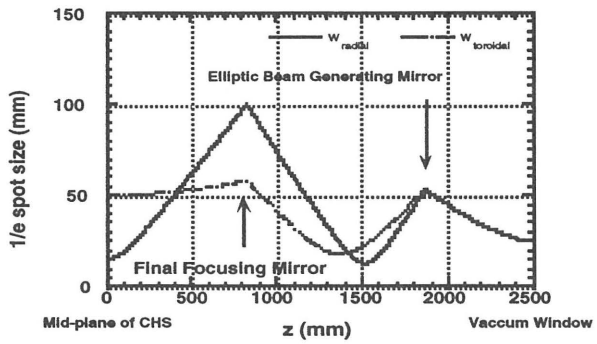


Fig.1 Designed spot size evolution along propagation in the antenna system of CHS.

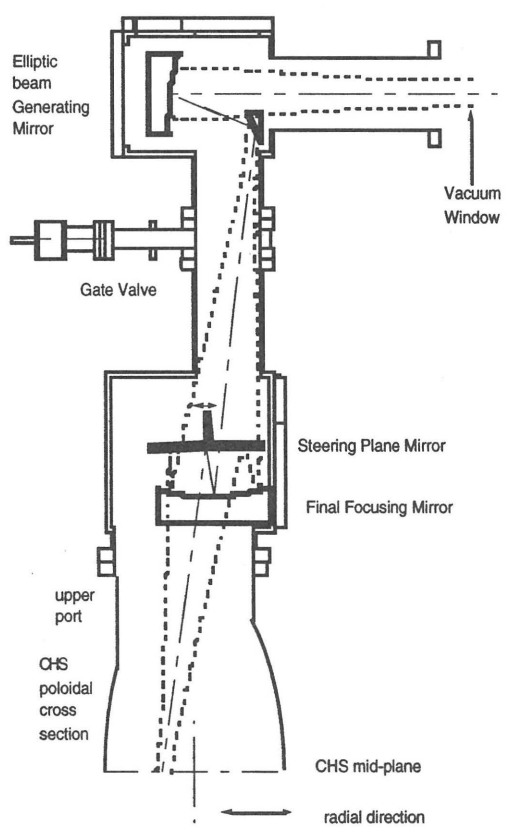


Fig.2 The side view of ECH antenna system for CHS. The spot size of the designed beams is mapped on the vertical plane and indicated by the thick dotted lines.