

§33. Transmission Line of High Power Gyrotron System in CHS

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The quasi-optical transmission system from the source to the Gauss beam antenna system described in the previous section is designed by the same quasi-optical concept. The major differences are in the large waist size for the long distance between mirrors and in the adoption of the axisymmetric Gaussian beam. In order to get a good coupling between output beam from the gyrotrons and the transmission mirror array, matching mirrors are set to convert the Gaussian beam from elliptical to circular. The schematic diagram of the transmission system is shown in Fig.1. Total distances from two gyrotrons to the antenna system are 15 and 20 meters. Quasi-optical transmission mirrors are placed by every 5 meters. This means the optimum waist size, with which the spot size at mirrors is minimized, is in the range of 70 mm. The mirror boxes are basically made of 3 mm thick aluminum plate. These boxes are used also as beam duct for shielding the radiation and for preventing the dust from coming into the transmission system. These mirror boxes are connected with flexible aluminum circular duct.

Total power transmission efficiency is estimated from the power measured by calorimetric loads. The output power from the gyrotron is measured with the water load for TE_{02} mode. The power transmitted is measured with the water load for Gaussian beam placed at the inlet of the antenna system. The ratio of the measured power at the gyrotron and the window is 70%. Taking into account the fact that the total conversion efficiency of the combination of Vlasov coupler and modified reflector from TE_{02} mode to the Gaussian beam is about 80%, transmission efficiency for the pure Gaussian beam mode is roughly estimated to be about 90%. Theoretical loss estimation is not done for the actual system. The number of mirrors in between the two measured points is

eight. This indicates that the loss rate by one mirror was about 1% in average. This loss rate is not so far from that of the normal aluminum mirror.

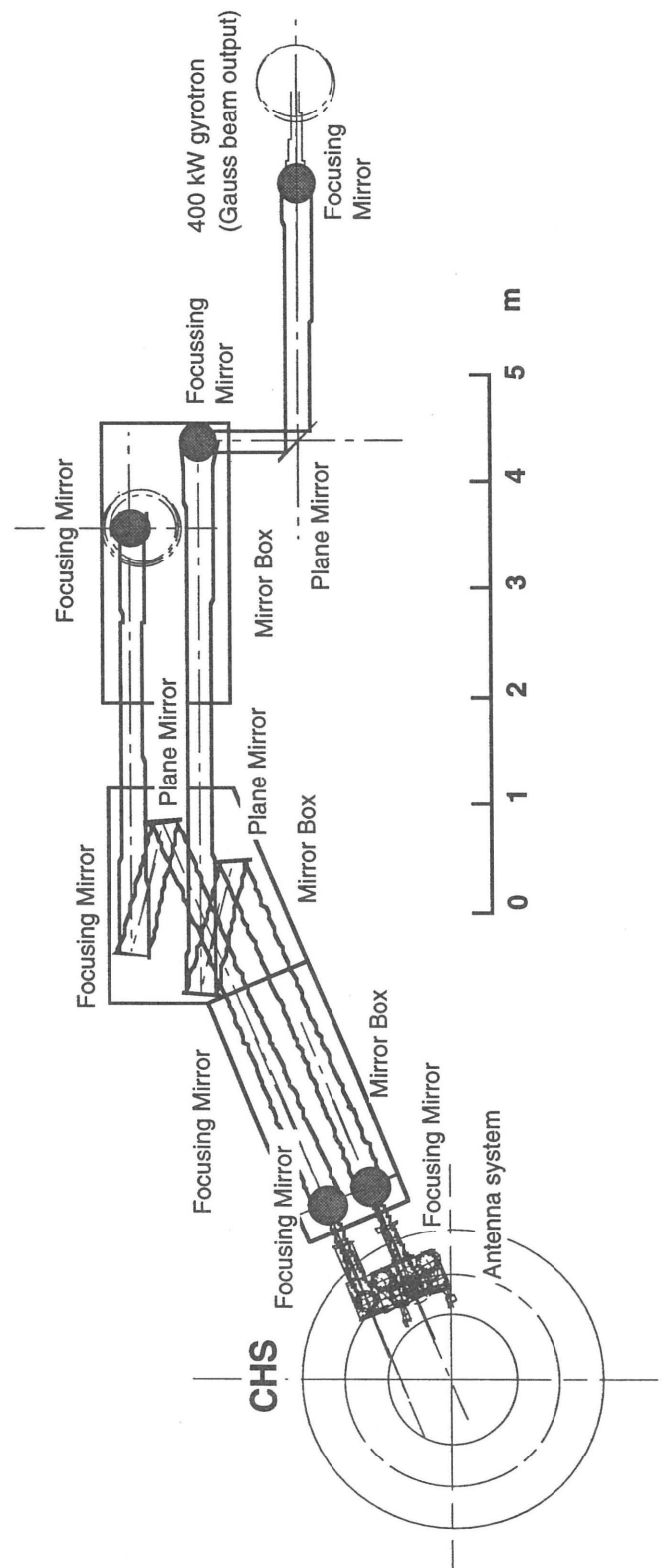


Fig.1 The schematic diagram of the quasi-optical transmission system for the ECH in CHS.