

# Tuning Process of a Quasi-Optical $TE_{28,8}$ Mode Generator for Testing a Gyrotron Mode Converter System

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## Abstract

For the ECRH system of the plasma fusion experiment W7-X in Greifswald, Germany, ten 140 GHz gyrotrons each delivering 1MW continuous output power are foreseen. They are equipped with a quasi-optical mode transformer system to convert the field distribution of the resonator mode ( $TE_{28,8}$ ) to a Gaussian like output beam. An exact copy of this system consisting of an advanced launcher and three beam forming mirrors was set up for low power measurements. This system is used for cold test verification of the design calculations and studies on installing tolerances and their affect on the output beam. Design errors or mechanical errors are difficult to be corrected as soon as the system is installed in the gyrotron.

To have easy access to all of its parts, the test system has been set up outside a vacuum vessel. For measurement purposes it needs to be fed with the gyrotron's resonator mode, but at a lower power level. Building such a mode generator becomes more difficult as the order of the mode increases.

This paper shows the tuning process starting with setting up the mode generator to the current state where a nearly pure  $TE_{28,8}$  mode is generated. Problems which have occured and solved in the process will be described. Among these are machining tolerances, finding the resonant frequency, excitation of other modes, a strong influence of the inner rod and mirror alignment.