Quasi-Optical Launchers for Step-Tunable Gyrotrons

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A recent design study has shown that the use of step-tunable gyrotrons in ITER could greatly enhance the flexibility and, to some extent, the performance of the ITER ECRH system. A crucial component in the design of efficient CW step-tunable gyrotrons is the internal mode converter and launcher (typically referred to as the quasi-optical launcher) which converts the cavity whispering gallery mode to a Gaussian like mode. Current design techniques of QO launchers for step-tunable gyrotrons are based on an analytic theory for design of single frequency QO launchers. The resulting designs have more diffraction losses and reduced Gaussian mode content compared to single frequency designs. However, using recent numerical optimization techniques developed for single mode launchers, design of efficient multi-frequency launchers can be obtained. A QO launcher design based on the existing analytic design approach for a two frequency launcher relevant to the ASDEX upgrade had a complex Gaussian coupling factor of 0.93 and 0.73 at 105GHz (TE17,6) and 140GHz (TE22,8) respectively. Using the numerical optimization method gave a design with complex Gaussian coupling factor of 0.98 and 0.99 at 105GHz and 140GHz respectively. The optimized design also has lower launcher edge fields which are responsible for diffraction losses.

The talk will discuss the methods used to obtain a optimized two frequency design for the launcher and compare the analytic design approach with the numerical optimization method.