## §12. Designing and Manufacturing of High-frequency Dichroic Filter for Sensitive ECE Measurement

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ECE (Electron Cyclotron Emission) is proportional to an electron temperature, the emission location can be identified by its frequency. Therefore, ECE measurement is used to observe electron temperature profiles in magnetically confined plasma. In the case of the Large Helical Device (LHD), ECE signal is separated into two radiometer systems with different local frequency in order to cover its wide frequency. This causes a decrease in signal. Therefore, we designed an original high frequency dichroic filter for more sensitive ECE measurement.

The schematic of a perforated metal sheet filter is shown in Fig. 1. The cut-off frequency is designed to be 44 GHz.

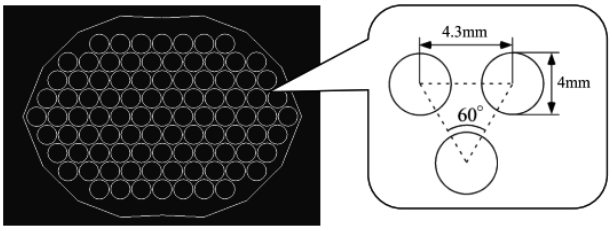


Fig. 1. Schematic of a perforated metal sheet filter with circular holes. Holes are arranged periodically.

3D-numerical analysis is performed using Efield [1]. The used 3DCAD software is CADfix [2]. The analysis model is shown in Fig. 2. The tested filter is tilted at 45-degree angle to the incident direction of electro-magnetic waves. Electromagnetic waves are emitted to the filter from a horn antenna. A horn antenna is installed to improve the directionality of electro-magnetic waves and to stabilize the propagation mode. The mesh spacing is 0.4 mm, which is less than one quarter of the wave length. The analytical algorithm is method of moment (MoM).

Figure 3 shows frequency characteristics with different filter thicnesses. It is found that thin filter shows high pass filter characteristics. These frequency characteristics are agree with measured frequency characteristics.

1) https://www.esi-group.com/
2)http://www.iti-global.com/

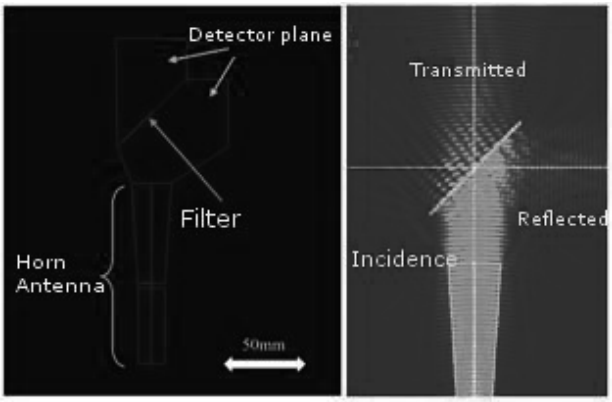


Fig. 2. Schematic of a perforated metal sheet filter with circular holes. Holes are arranged periodically.

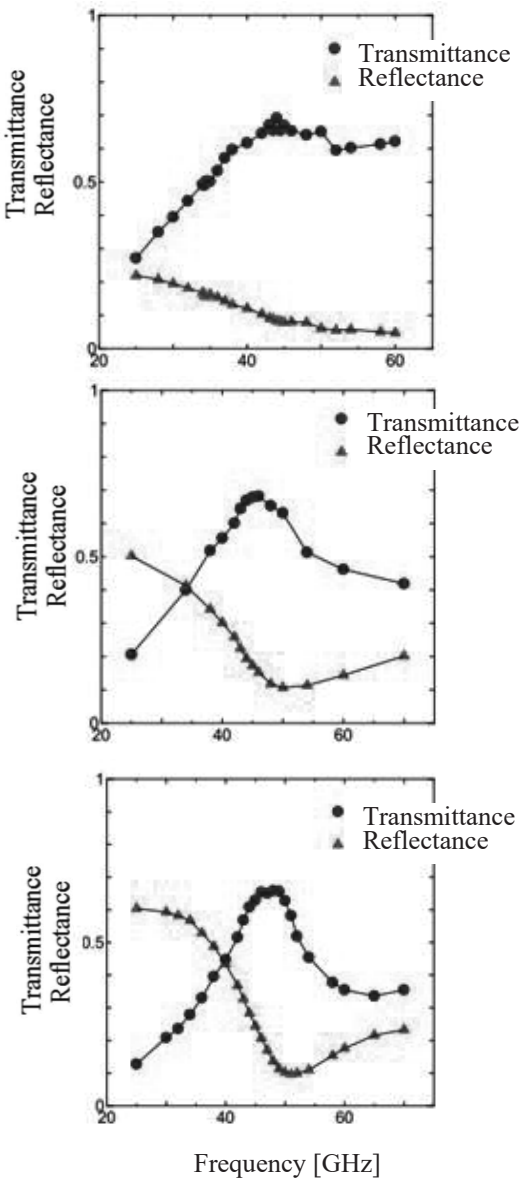


Fig. 3. Frequency characteristics.