

Development of ECE in Japan-Korea “KSTAR” Collaboration

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The electron cyclotron emission (ECE) is one of the key issue in the Japan-Korea “KSTAR” collaboration. KSTAR is a superconducting tokamak with $R_{ax}=1.8$ m, $a=0.5$ m, $\kappa=2$, $\delta=0.8$, $B_t=3.5$ T in National Fusion Research Center (NFRC), Daejeon, Korea. In this collaboration, NIFS is to provide radiometers for the frequency between 110 and 196 GHz. In the first stage of KSTAR experiment, the toroidal field is 1.5 T and the low frequency ECE radiometer, which is made in Korea, is to be installed. In the diagnostics collaboration meeting on June 15, 2007 at NFRC, we decided the installation schedule of the ECE diagnostics as follows:

- (1) 70 – 84 GHz, before 1st plasma (June 2008)
- (2) 86 – 110 GHz, October 2008
- (3) 110 – 162 GHz, October 2008
- (4) 164 – 196 GHz, June 2009

The ECE collection optics was installed to the KSTAR vacuum vessel in 2007 as shown in Fig. 1. From the vacuum vessel to the diagnostics room, ECE is transferred by the circular waveguide with smooth inner wall. The ECE becomes 1/10 due to the waveguide loss.

Schematics diagram of high frequency ECE radiometer system is shown in Fig. 2. The front end of the radiometer, which converts the high frequency to the intermediate frequency using local oscillators and mixers, is developed at NIFS. The frequency dividing network with the filter bank and detectors is developed at Kyushu University. In Fig.2, the filter bank for 110 – 119 GHz is shown as an example. The frequency dividing network system has the second local oscillator, which is a 17 GHz oscillator for 19 – 26.5 GHz. By using this technique, the filter bank of 2 – 9 GHz can be commonly used in different frequencies.

The frequency dividing network system has been installed at the LHD ECE radiometer as a test. This system

has shown very good performance. This new technology will be useful in the next generation ECE diagnostics.

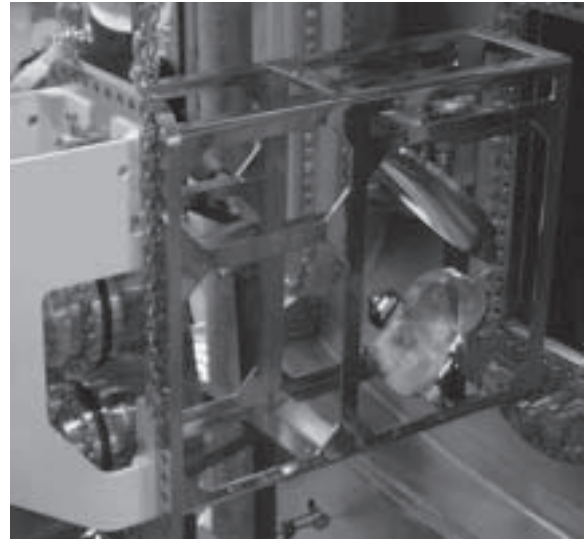


Fig. 1 ECE collection optics in KSTAR

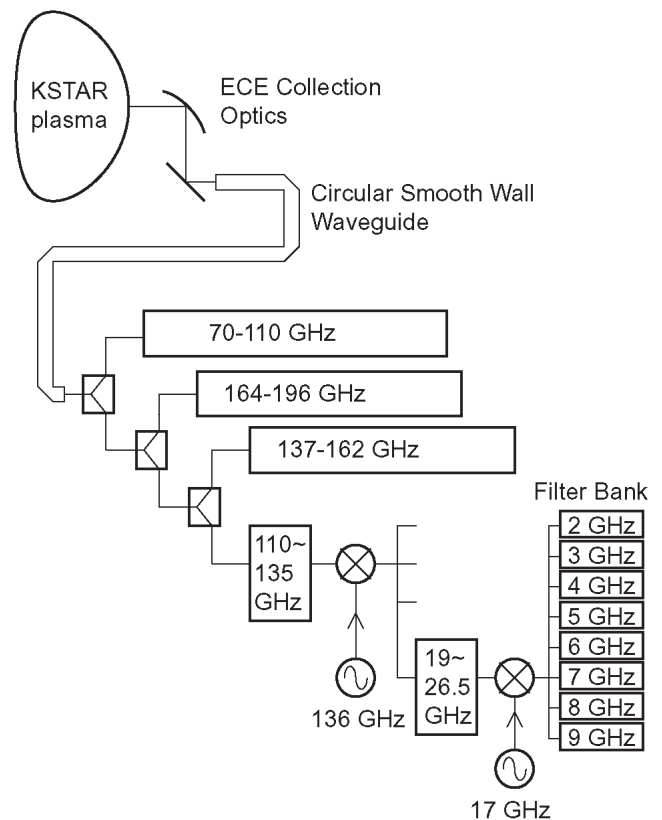


Fig.2 Schematics diagram of KSTAR ECE radiometer system. Filter bank for 110 – 119 GHz is shown here.