§9. 4ch Pulsed Radar Reflectometer System in the 5th Cycle

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In order to measure the edge density profile and fluctuation information with high temporal and spatial resolution, we applied the microwave reflectometer on LHD. Because LHD has a complex structure of the magnetic field configuration and also has a large magnetic shear, the launched and reflected microwaves may have a complicated behavior. In order to study the effect of the strong magnetic shear on polarization of microwave, the pulsed radar reflectometer [1] is a suitable reflectometric technique. Because the pulsed radar reflectometry measures the delay time of the reflected wave, it is possible to distinguish between X-mode and O-mode polarized waves even if the mode conversion and/or the polarization rotation is occurred.

We constructed the 4ch pulsed radar reflectometer systems in the 5th cycle. The frequencies of the launched microwave pulses are 33, 39, 60, and 65GHz. The Gunn oscillator is used as a source and the PIN switch is used as a pulse modulator. The pulse width is around 2ns and the repetition rate is 200kHz. Figure 1 shows the launched pulse and reflected pulses. This figure is a screen of the digital oscilloscope. We constructed the real-time video acquisition system of the oscilloscope screen and get the information of the change of pulse amplitude and pulse shape. Each microwave pulse is propagated into the plasma and reflected at the corresponding cutoff layer. The reflected pulse is detected and then the delay time of the reflected pulse caused by the plasma is measured using a time-to-amplitude converter. Figure 2 shows the time evolution of the delay time of the reflected pulse. The reflected signal is appeared when the density grows up and the corresponding cutoff layer is appeared.

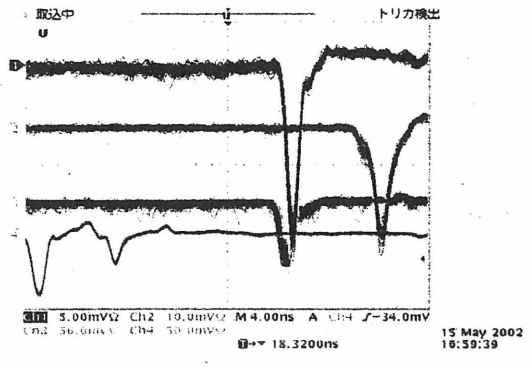

Fig. 1. The launched pulse and the reflected pulses. Reflected pulses of 39GHz(ch1), 33GHz(ch2), and 60GHz(ch3) and launched pulses of 39GHz and 33GHz(ch4) from top to bottom. This launched signal involves 2 pulses.

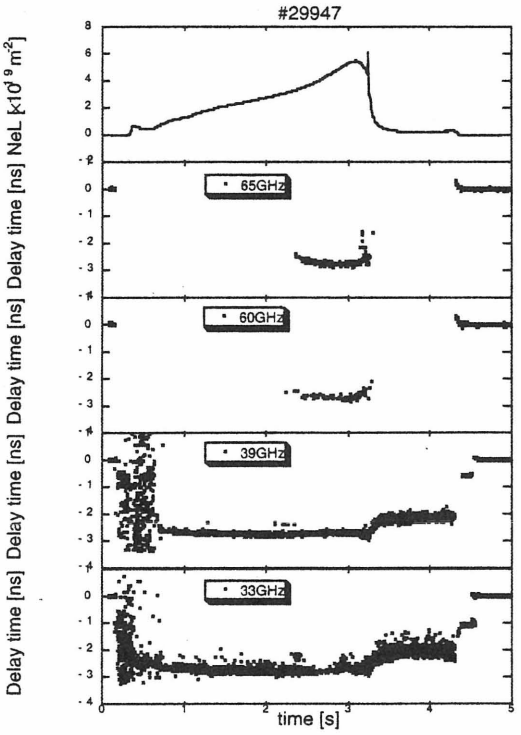

Fig. 2. The time evolution of the line integrated density measured by FIR interferometer and delay time of reflected pulses. The reflection from the opposite wall is used the standard point of the delay time. Before 0.6s ECH obstructs the reflectometer signal.

Reference

[1] T. Tokuzawa, *et al.*, Rev. Sci. Instrum. 72, 328 (2001).