§2. Development of Thomson Scattering Detector System for Measurement of the Temporal Evolution of Multiple Signals and Real-Time Processing

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Two types of new ADC were installed in the LHD Thomson scattering measurement system [1] . One is a charge-integration type AD convertor (CAEN V792) and the other is a fast digitizer (CAEN V1742), which is a switched-capacitor-type digitizer with 32+2 channels and with the sampling frequency of $1 \sim 5$ GS/s.

Figure 1 shows the data acquisition process of V792. The stored data are transferred into a computer by a LabVIEW program with the block-transfer (BLT) method, in which all stored data are transferred by one command. The data are saved as computer files with the time interval of a few tens of milliseconds. An example of electron temperature in a long pulse plasma is shown in Fig. 2, where white data are the results by the existing charge-integration type detector (FAST-BUS) and the grey data in $10 \sim 30$ sec. are T_e by V792. The duration of this plasma was 41 minutes. The data of FAST-BUS can be read only after the plasma discharge, while the data of V792 can be monitored during the plasma discharge.

Observation of the temporal development of the Thomson scattered light is useful to improve the quality of the T_e and n_e measurement since it is possible to reduce noise component by processing the signals. The CAEN V1742 modules are installed for such purpose, however, they have not used during the plasma experiment yet. In this report, the signals which were acquired by some osciloscopes are shown. Figure 3 shows an example of the Thomson scattered light signal and a fitting by the Rayleigh signal shape, which were obtained by averaging 500 signals of Rayleigh scattering. This fitting process is more effective when the magnitude of the signal is small. In Figure 4 (a) and (b), the results of T_e which are derived from these time developing data are shown as closed circles at $R = 3.74$ m. They are compared with the T_e profile by FAST-BUS. No significant difference is found between them.

The data acquisition by V1742 is already tested in the gas-calibration experiment. It is planned to acquire the multi-channel Thomson scattering signals by V1742 and the signal processing method which is described here will be applied.

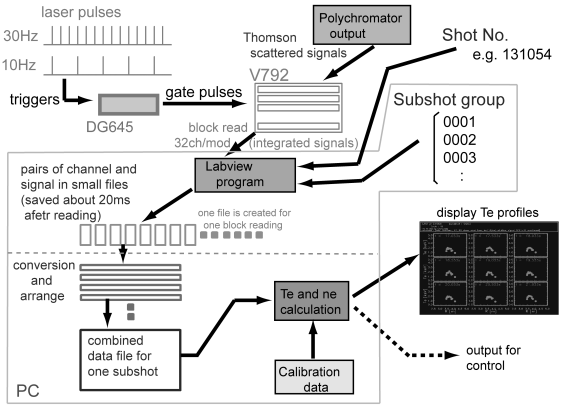

Fig. 1: Data flow in real-time signal processing by CAEN V792 for long pulse discharges.

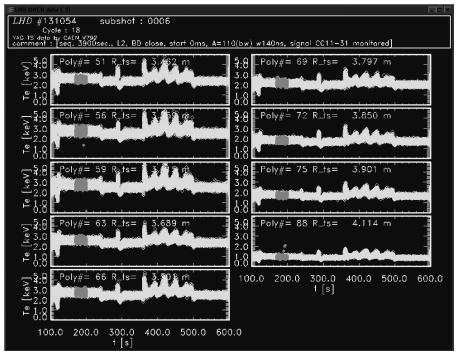

Fig. 2: Time evolution of T_e in a long time discharge. white : FAST-BUS data, grey : CAEN V792 data

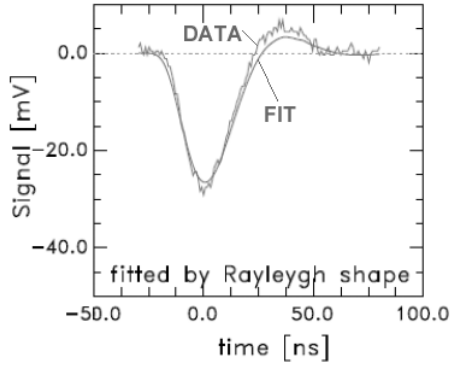

Fig. 3: Temporal development of the Thomson scattered signal and a fitting by the Rayleigh signal shape.

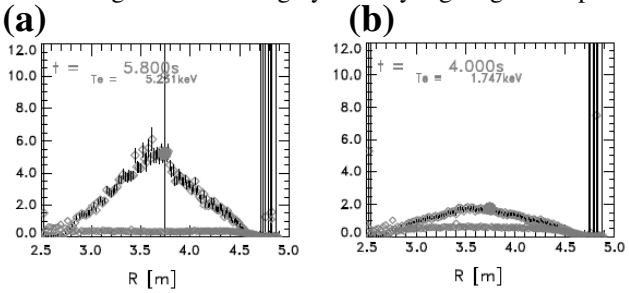

Fig. 4: Comparison between T_e by FAST-BUS data and time-developing data. (a) High T_e (b) Low T_e

1) K. Narihara, *et al.*, Rev. Sci. Instrum., Vol. 72, 1122, (2001).