# Improvement of electron temperature and density evaluation in the 20 kHz Thomson scattering diagnostics on LHD

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Operation with a high-repetition-rate Nd:YAG laser started in the recent diagnostics of Thomson scattering system on the Large Helical Device (LHD) [1] in order to study fast changes of electron temperature, $T_e$, and electron density, $n_e$, profiles. This laser works in the "pulse-burst" [2] operation and in two modes of the repetition rate, one of which is 1 kHz with 30 pulses and the other is 20 kHz with 100 pulses. The scattered signals are acquired by new multi-channel fast digitizers of the switched-capacitor type, which can acquire the data with the time interval of 50 $\mu$s. Figure 1 shows an example of the data of Thomson scattering (green) which is acquired by the new digitizer. When the time-integration for evaluating of the intensity is made simply by summation, it is made between the two vertical dotted lines in Fig. 1. The background noises which are caused by the fluctuation of the light from the plasma or the reflection from the wall are observed. Moreover, a spike which is generated by the digitizer is found in the region of the time-integration. Although some large spikes can be removed by a calibration, it is difficult to remove such small spikes which appear near the signals. Therefore, as one of approximation methods, the "model fitting" method [3] is applied in order for evaluating the signal intensity. In this method, an ideal signal shape is derived by averaging of many signals from the same laser and in the same channel assuming that the signal shape doesn't depend on the intensity. In Fig. 1, the signal is well fitted with this method as shown by the red curve. In this study, improvement of the error and the scattering of the data in $T_e$ and $n_e$ profiles using this method is evaluated.

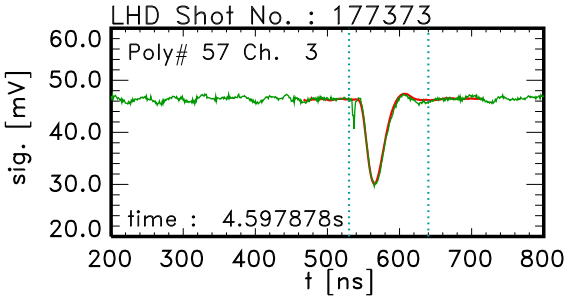


Figure 1: *An example of Thomson scattered signals (green) on LHD and approximation by the "model fitting" method (red).*

## References

[1] I. Yamada, *et al.*, Fusion Sci. Tech. **58**, 345 (2010)

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[3] H. Funaba, *et al.*, (submitted to Plasma Fusion Res.)