

Thomson Scattering Diagnostic System

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1. Objective

Electron temperature (T_e) and density (n_e) profile measurement

2. Apparatus

2.1. LHD Thomson scattering system

- measures electron temperature (T_e) and density (n_e) profiles of LHD plasmas along the LHD major radius at a horizontally elongated section (LHD 4O port – 4I port) in 144 spatial points.
- consists of four YAG lasers, light collection optics, 144 optical fibers, 144 polychromators, and data acquisition system.
- has a backscattering configuration, in which the typical scattering angle is 167 degree. (see Fig. 1)

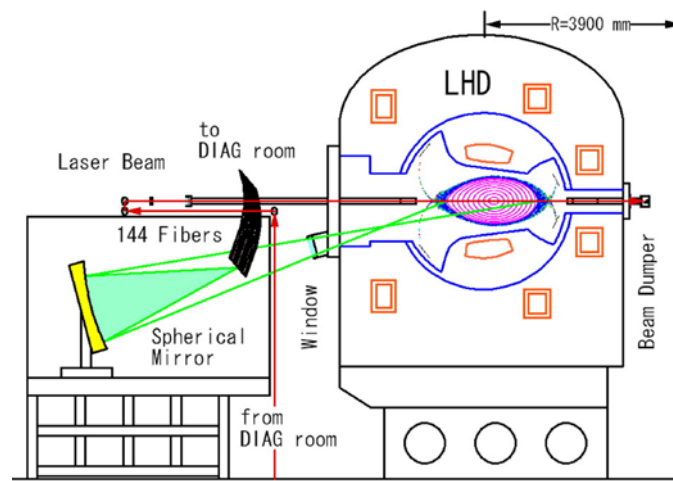


Fig. 1. Schematic diagram of the LHD Thomson scattering system.

2.2. YAG lasers

- One 1.6 J-30 Hz YAG laser (Continuum DLS 9030), two 2 J-10 Hz YAG lasers (Thales SAGA 230-10), and one 0.55 J-50 Hz YAG laser (Continuum NY-8050).

2.3. Light collection optics

- collects Thomson scattered light with a large (1.8 m in height and 1.5 m in width) gold coated spherical mirror onto 144 optical fibers whose core diameter is 2 mm.

2.3. Polychromators

- have five wavelength channels for the Thomson scattering measurements.
- have also a Rayleigh scattering wavelength channel for absolute density calibration.

2.4. Data acquisition system

- consists charge-integrating analog-to-digital converters, data storage PC, and data analysis PC.

3. Operation

3.1. Typical specification

	Outside - Inside	Units
Scattering angle	161 - 171	[degree]
Solid angle	39.0 - 9.4	[msr]
Spatial resolution	11.6 - 25.4	[mm]
Number of spatial points	144	-
Sampling frequency	10 - 100	[Hz]
Measurable T_e Range	5 - 20000	[eV]
Measurable n_e Range	$\geq 10^{18}$	[m ⁻³]

Tab. 1. Typical specification of the LHD Thomson scattering system.

- The LHD Thomson scattering system works routinely. No special requirements.

- Special operation modes are acceptable. For example, quasi-simultaneous laser firing, short interval laser firing, and forward scattering measurements (the scattering angle ~13 degree)...

4. Data availability

- T_e and n_e data obtained by the LHD Thomson scattering system are stored in the LHD data server, and can be seen anytime.

5. Remarks

Detailed operational manual should be submitted at least three days before the experiment.

Discussion with operator is strongly recommended for special operation modes.

References

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