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**The Laser Path (3D ongoing) The TS light collection
(Feasibility study ongoing) THE WEST THOMSON
SCATTERING SYSTEM**

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► **To cite this version:**

G. Colledani, R. Sabot, G Lotte, A Moureau. The Laser Path (3D ongoing) The TS light collection (Feasibility study ongoing) THE WEST THOMSON SCATTERING SYSTEM. Laser aided plasma diagnostics 2019 (LAPD), Sep 2019, Whitefish, United States. hal-02520947

HAL Id: hal-02520947

<https://hal.science/hal-02520947>

Submitted on 27 Mar 2020

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Special Thanks for their valuable assistance to :

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Main characteristic of the Thomson scattering diagnostic for WEST

A **Thomson Scattering** is being designed for measuring density and temperature in the pedestal with a 3 mm radial resolution.

Constraints :

- ✦ Zone of interest : ~15 cm in the equatorial plane to cope with the various plasma equilibriums (LSN, USN, close/far X point, ...).
- ✦ Needs ~ 50 viewing lines.
- ✦ Temperature range: from 1-2 keV (pedestal top) to few 10s eV (SOL).
- ✦ Compatible with robotic arm and future core channels (phase 2).

Challenges :

- ✦ Long pulse (1000 s) measurement.
- ✦ High spatial resolution ⇨ first mirror close to the plasma.

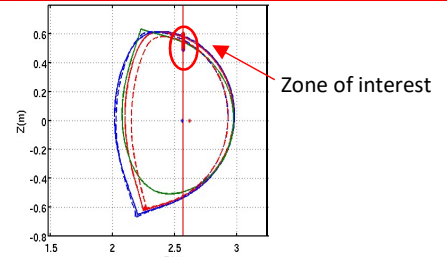


Fig. 1 : Various plasma equilibrium configurations

The Laser Path (3D ongoing)

- 3 lasers of 2J - 6nsec pulse - 30Hz each are foreseen for higher time resolution (10ms) and redundancy.
- Each laser path will be controlled with motorized mount.
- The main characteristics of the beam (power, synchronization, ...) will be analyzed in the "laser dump and control" Box.
- ~60 W beam dumps.

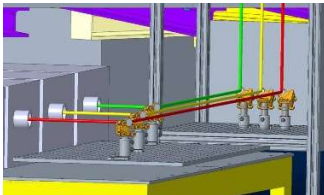


Fig. 2 : Laser beam exit

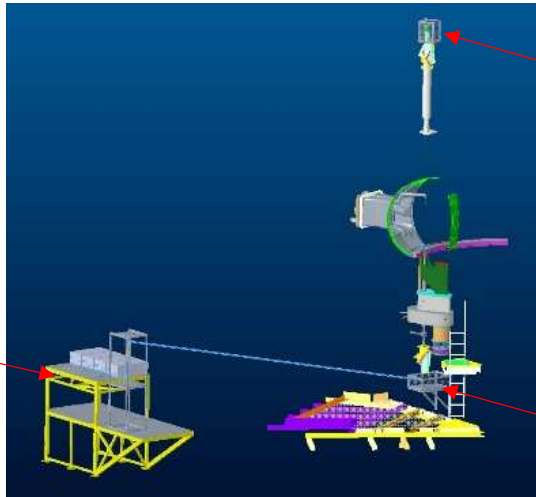


Fig. 3 : Overall view of the laser path

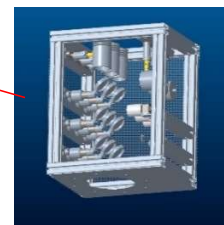


Fig. 4 : Laser dump and control box

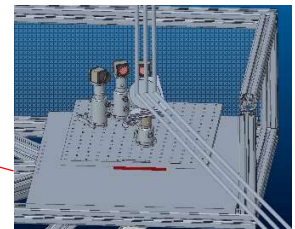


Fig. 5 : Lower path (mirror & cameras)

The TS light collection (Feasibility study ongoing)

High resolution, narrow vacuum window far from the plasma, divertor seen in the background view
✦ **first optics for the Edge Channels in the vacuum vessel**

➤ **Endoscope and optics designed for long pulses**

- ✦ The first mirror **water cooled**.
 - ✦ All in-vessel optics protected by an **water cooled thermal shield**.
 - ✦ Protection against glow discharges and boronization
 - ✦ **Water cooled viewing dump** on inner wall
- Feasibility study on going with several options being evaluated.

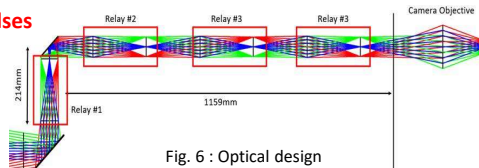


Fig. 6 : Optical design

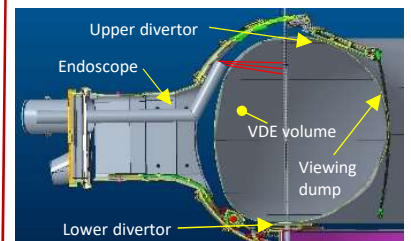


Fig. 7 : Schematic view of the endoscope

The Spectrometer and the Data Acquisition System Characteristics

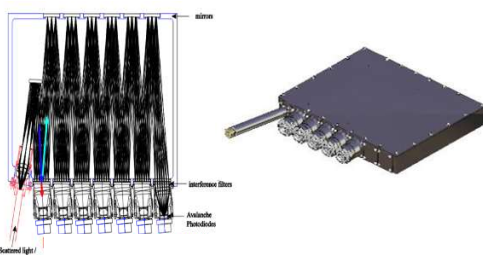


Fig. 8 : Polychromator optical Layout (Based on MAST CONCEPT)

Reference :
Scannell R., et al., Design of a new Nd:YAG Thomson scattering system for MAST, Review of Scientific Instruments 79, 10E730, 2008

- ✓ 180 to 200 data acquisition channels
- ✓ 10 to 30 ns diffused LASER light pulses
- ✓ 100 Hz LASER periodic trigger rate

Custom mezzanine board with Nectar chip to be designed

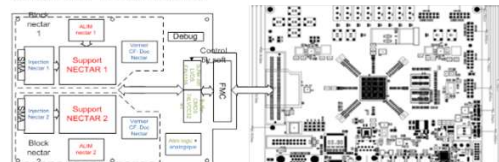


Fig. 9 : Requirements and drawing of the pre-study board

Reference :
C. L. Naumann, et al., NECTAR: New Electronics for the Cherenkov Telescope Array International Workshop on New Photon-detectors, June 13-15, 2012, LAL Orsay, France

- ✓ Data acquisition window : 1µs for each trigger
 - ✓ Sampling frequency : > 1GHz
 - ✓ Amplitude resolution : ≥ 10 bits
- Commercial FPGA development board**