

Master Internship

SYNTHETIC DIAGNOSTIC FOR PASSIVE EMISSION IN LAB PLASMAS

Laboratoire de Mécanique, Modélisation et Procédés Propres M2P2

Location: M2P2 Laboratory, Marseille, France

Collaborations: ENS Lyon, PIIM (Marseille), LAPLACE (Toulouse)

Duration: 5 months — February/Mars 2026 to June/July 2026

Level: Master 2 (Physics, Plasma Physics, or Computational Science)

Context: Optical diagnostics enable non-intrusive observation of plasmas through the detection of light they emit. By recording spectra, images, or tomographic reconstructions, one can infer temperature, density, and dynamics of the plasma. These techniques are essential in devices where physical probes cannot be inserted without perturbing the plasma. A synthetic optical diagnostic reproduces the emission and collection of light within a simulated plasma, including all the relevant optical geometries and detector responses. This internship builds upon the CHERAB open-source library, originally developed for tokamaks, and aims to adapt it to linear plasma devices such as MISTRAL and Von Karman Plasma (VKP). The goal is to simulate camera and spectrometer measurements under realistic conditions and to interpret experimental data with the help of synthetic reconstructions.

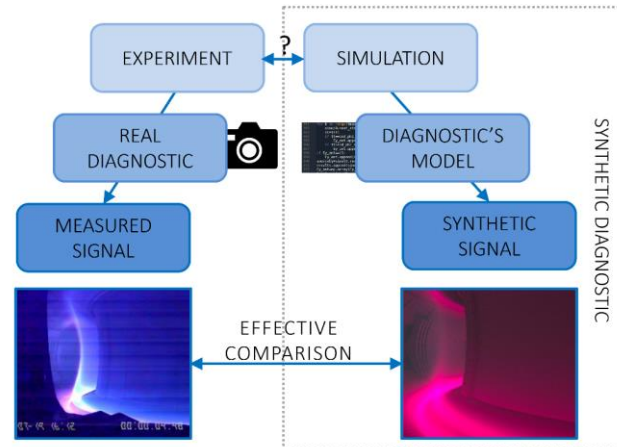


Figure 1 Example of a synthetic diagnostic principle for the fast visible camera on WEST tokamak allowing to compare directly the experimental video (to the left) with the synthetic camera signal (to the right).

Internship Objective: To develop and apply a synthetic passive emission diagnostic for visible and near-infrared cameras operating on MISTRAL and VKP. The student will model plasma emission using CHERAB, simulate optical detection, and analyze synthetic spectra and images to compare them with experimental measurements.

Main Tasks:

- Adapt CHERAB's emission and geometry models to MISTRAL and VKP configurations.
- Simulate synthetic camera and spectrometer signals.
- Compare synthetic and experimental data across selected wavelengths.
- Contribute to tomographic reconstruction and image analysis routines.

Required Skills:

- Background in plasma physics, optics, or spectroscopy.
- Experience with Python (data analysis, visualization).
- Interest in imaging diagnostics and plasma modeling.

Supervision:

The internship will be hosted at M2P2 (Aix-Marseille University), in collaboration with ENS Lyon, PIIM, and LAPLACE laboratories.

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