CEA/CADARACHE
DIRECTION DES SCIENCES DE LA MATIÈRE (DSM)
INSTITUT DE RECHERCHE SUR LA FUSION PAR CONFINEMENT MAGNETIQUE (IRFM)
CEA/Cadarache - 13108 St Paul-lez-Durance Cedex - France

PhD PROPOSAL 2013

Supervisor :	**e-mail :**	Elise.delchambre@cea.fr
Elise Delchambre-Demoncheaux	**phone :**	+33 442 25 39 23
	secretary :	+33 442 25 65 44
Research Team : SIPP/GCECFP		

Title :
2D Tri-color Pyroreflectometer development adapted to high reflective environment.

Summary :
ITER (International Thermonuclear Experimental Reactor) is a large-scale scientific experiment that aims to demonstrate that it is possible to produce commercial energy from fusion reactions. Because of their physical and thermal properties, beryllium and tungsten have been chosen for Plasma Facing Components to cover the interior surfaces of the vacuum vessel. Such metallic environment with rather low emissivity raises the issue related to reflecting internal surfaces which can significantly disturb the machine protection system based on Infrared Thermography.
A method, able to determine simultaneously the true temperature and the emissivity, has been developed at PROMES (CNRS). The method is called Pyroreflectometry and allows to control, on line, the evolution of the emissivity and to determine the temperature of the target from 500℃ up to 3000℃. The technique has been numerica lly tested and demonstrated to be reliable when observing the hottest surface of the in-vessel components. For this purpose, the current punctual method needs to be extended to 2D techniques using near infrared cameras.

An adaptation for high reflective environment has been also explored by introducing a third wavelength. Indeed the introduction of a third unknown parameter: the surrounding temperature, Ti, allow to introduce a third equation to solve a three non-linear equations system with three unknown parameters: The true temperature, the diffusion factor (linked to the emissivity) and Ti.
The introduction of a third wavelength could allow to:

1. Asses the true temperature when $Ti > T_{TRUE}$.
2. Assess the diffusion factor η (whatever Ti) for emissivity calculation.
3. Determine the surrounding temperature Ti.

The aims of the thesis is to develop a tri-color 2D diagnostic and its numerical treatment associated (Labview) for surface temperature measurement in high reflective environment without hypothesis on emissivity.

Skills : Strong knowledge of instrumentation, electronic, optic, numerical calculation and Labview knowledge would be appreciated.