Development and realization of Supermirrors for 5-20 keV for high resolution X-ray Imaging plasma diagnostic

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ABSTRACT

With regards of the experiments at "Ligne d'Intégration Laser" (LIL) and "Laser Mégajoule" (LMJ) at CESTA near Bordeaux, France, our laboratory is developing advanced High Resolution X-ray Imaging (HRXI) microscopes**.** These microscopes are dedicated to diagnose laser produced plasma used for Inertial Confinement Fusion (ICF) research.

I present in particular a type of Wolter microscope. It is a section of Wolter composed of three off-axis revolution concave toroïdal mirrors working at grazing incidence. This microscope, the so-called Plasma Imageur X pour les Expériences Laser Megajoules (PIXEL) can be used either for 2D imaging studies using X-ray films, or for 1D time resolved images associated with a streak camera. We have achieved a spatial resolution of 5 μm in a field of 500 μm. This device has two advantages compared to a classic Wolter microscope : 1) a high object depth focus (a few millimeters) and 2) the possibility to work in a large magnification range without loss of spatial resolution.

Non-periodic W/Si multilayer mirrors ("Supermirrors") are used to reflect high-energy photons. These multilayer mirrors were developed at the Commissariat à L'Energie Atomique (CEA-DIF) in collaboration with the Laboratoire des Matériaux et de Microélectronique de Provence (L2MP). Super mirrors are designed to work at 0, 6° grazing incidence with a reflectivity above 40 % in almost the entire energy range 5-10 keV. We have also studied other systems of super mirrors in this range. The experimental results show good agreement with theoretical computations from the XR-vision code.

We will present the imaging studies performed with PIXEL and with two kinds of X-ray Sources : an x-ray generator and a picosecond laser interaction in the EQUINOX facility.