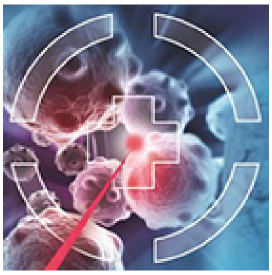

Contribution ID: **61**

Type: **not specified**

”Laser driven plasma X-ray microfocus source for phase contrast tomography

In this paper we describe the development of an stable, microfocus X-ray source driven by an ultrashort high intensity laser. This source follows a new route to high brightness and small source size somewhere in the middle of low cost microfocus X-rays and large scale synchroton facilities. We explore one application of this new type of sources with emphasis on the stability of the source at high repetition rate and the advantage over similar conventional sources.
The availability of ultrashort laser pulses with high power [1,2] has lead to the development of the Laser Driven Plasma Accelerator (LDPA) [3] where a short and ultraintense pulse can produce plasma structures which can accelerate particles to relativistic velocities.
In this paper, we report the development and application of a microfocus X-ray source for phase contrast tomography in the lambda cube regime. In this regime the laser pulse is compressed in space and time to the physical limit. This allow the use of laser with moderate energy (˜ 1 mJ) and high repetition rate (˜ KHz) to produce high intensities relevant to the physics of the LDPAs.
The X-ray source produced at the Laser Laboratory for Acceleration and Applications (L2A2) of the University of Santiago de Compostela (USC), is made by focusing a 1mJ, 35 fs, 1kHz pulses at 800 nm wavelength on metallic foils close to the diffraction limit. In this experiment, we use a microscope objective to focus the light to intensities larger than 1017 W/cm2
.
As the laser pulse destroy the target at every shot and due to the tight focusing (˜ 4 um Rayleigh length), the stable operation of the source must combine a fast refreshing of the target combined with a high precision positioning to maintain the target on focus as the intensity drops dramatically out of focus.
We first characterize the source and then optimize the stability to perform the applications. The X-ray spectra of this source are measured with a CdTe spectrometer and consist of a broad Bremsstrahlung continuum up to 150 of keV and K-alpha peaks of the target material (8.12 and 8.8 keV for Cu). Typical temperatures of the distributions are around 20 to 150 keV. The source size is measured by the knife edge technique and is 10 µm diameter.
We describe how the characteristics of this X-ray source can be used to produce high resolution images and how the online methods can be used to make phase contrast images. The stability of the source allows to do phase contrast tomography which can determine the real part of the index of refraction of materials. Finally, we compare different synchrotrons, conventional microfocus and laser driven X-rays with respect to this application to understand the opportunities of challenges of these new sources.

Author: RUIZ MÉNDEZ, CAMILO

Presenter: RUIZ MÉNDEZ, CAMILO

Session Classification: Poster Session