LABORATOIRE INTERACTIONS, DYNAMIQUE ET LASERS

LIDyL- LFP URA 2453

SEMINAIRE LIDyL-LFP

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Attention Jour inhabituel

Le lundi 9 Novembre 2015 à 10h30

Bâtiment 522 - Salle 138

«X-Ray radiation and Particle Yield increase in ultra high-contrast and high-intensity laser pulse interaction with metallic nanowires»

The interaction of nano and micro structured targets with high-power lasers is being under intense investigation [1, 2]. Thus, it has been shown that high energy densities can be reached with moderate laser intensities when irradiating nanostructured samples compared with flat foils [3].
We present the results of an experimental campaign performed in 2015 at the PHELIX laser facility located at the GSI Helmholtz Center for Heavy Ion Research in Darmstadt, Germany.
The targets consisted of arrays of free standing wires (107 cm-2) with a diameter of about 1.5 µm randomly distributed on a flat metal substrate. The microtowers with various lengths in the order of a few tens of microns, were fabricated by electrodeposition in etched ion track membranes. Using different electrolytes, arrays of copper, silver and gold microtowers were produced and investigated.
Microtowers were irradiated with 0.5 ps-long 100 J-laser pulses at 1ω (1053 nm) focused in order to achieve various intensities on target from 1016 to 1020 W.cm-2. The temporal contrast, a key factor for nano and micro structure laser experiments, was better than 110 dB thanks to the latest uOPA technology developments at PHELIX and the use of plasma mirrors.
Broad-band K and L shell spectroscopy was performed and high spectral resolution of Cu-K_α and Cu-He_α lines was achieved. Several hard X-ray detectors measured the flux of photons with energies above 100 keV. Particle acceleration was also in our sights: we realized beam expansion dosimetry together with energy and charge dispersion measurements.
We measured an enhancement of the X-ray yield in addition to higher charge state line emission, a larger flux of TNSA protons and heavier particle acceleration.

[1] Jiang, Sheng, et al. "Enhancing Bremsstrahlung production from ultraintense laser-solid interactions with front surface structures." The European Physical Journal D 68.10 (2014): 1-8.
[2] Schwoerer, H., et al. "Laser-plasma acceleration of quasi-monoenergetic protons from microstructured targets." Nature 439.7075 (2006): 445-448.
[3] Purvis, M. A., Shlyaptsev, V. N., Hollinger, R., Bargsten, C., Pukhov, A., Prieto, A., ... & Rocca, J. J. (2013). Relativistic plasma nanophotonics for ultrahigh energy density physics. Nature Photonics, 7(10), 796-800.

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