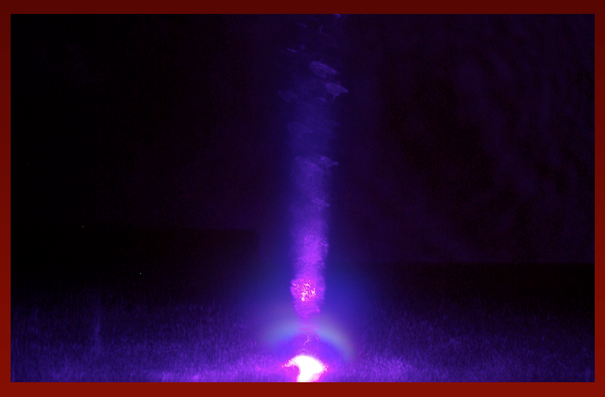
Single-shot, energy encoded X-ray imaging of laser-plasmas

T. Levato[1*], L.Labate[2+], N.C.Pathak[2+], C.A.Cecchetti[2+], P.Koester[2], N. Booth[3], H. Chen[4], R.G. Evans[5], G. Gregori[6], B. Li[5], M. Makita[7], J. Mithen[5], Ch. Murphy[5], M. Notley[8], R. Pattathil[8], D. Riley[7], N. Woolsey[3], L.A.Gizzi[2+]

tadzio.levato@lnf.infn.it

1- National Laboratory of Frascati (LNF), INFN, Frascati (Rome), Italy
2 - Intense Laser Irradiation Laboratory (ILIL) at INO, CNR, Pisa, Italy and INFN-Pisa, Italy
3 - Physics Department, University of York, UK
4 - Lawrence Livermore National Laboratory, Livermore, USA
5 - Imperial College London, UK
6 - Physics Department, University of Oxford, UK
7 - Physics Department, Queen's University Belfast, UK
8 - Rutherford Appleton Laboratory, STFC, Didcot, UK
** also at ILIL*
+ also at LNF



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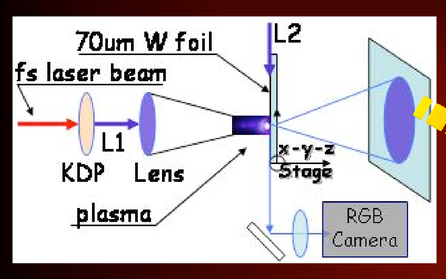
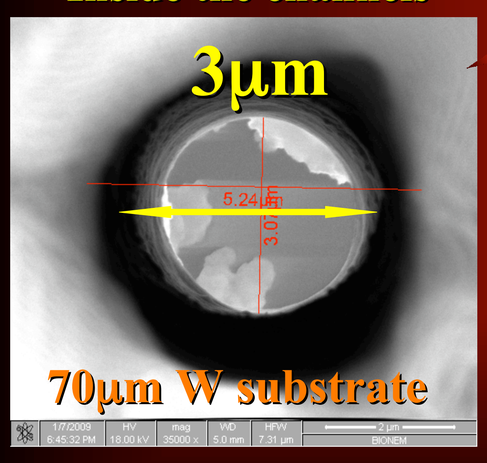
In view of Laser Fusion oriented experiments in Large Scale Facilities (es. RAL, PALS) a new technique was proposed: the Energy Encoded Pin Hole Camera (Labate RSI 2007, Gizzi PPCF 2007). The heart of the single-hit version of this diagnostic is a pin-hole array (PHA) of unique specifications which was fabricated using a custom developed process (Levato NIMA 2010, Levato AIP Proc. 2010). This device makes it possible to acquire, in a single-hit, many hundreds image of a laser produced plasma at low photon flux. After a reconstruction process it is possible to achieve micrometer resolution, 0.1 keV energetic resolution. It can be extended to high X-ray energy (Levato NIMA 2008). The entire diagnostic was shown to be effective in different laser-plasma interaction regimes: 70 micron W thick substrate with 3 micron aperture for 10^{16} W/cm^2 experiments at P.A.L.S. (Labate LPB 2009, *Ciricosta this conf.)* and 200 micron Pt with 2 micron aperture for a new double beam 10^{19} W/cm^2 experiments at R.A.L. related to the European HiPER project (here some new results). In this poster we show the working principle and the key specifications necessary to make the EEPHC working in the high-energy, high intensity experiments.

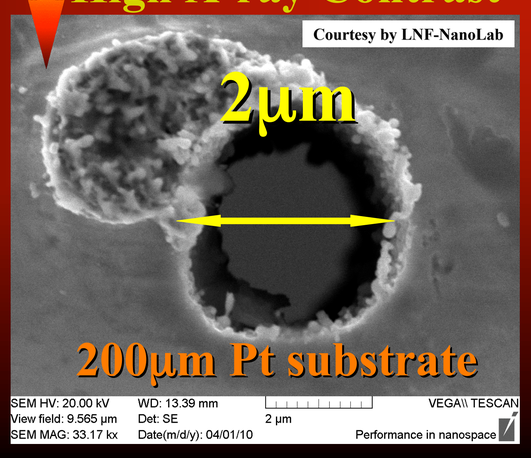
Pin Hole Array (PHA) Fabrication



Inside the channels

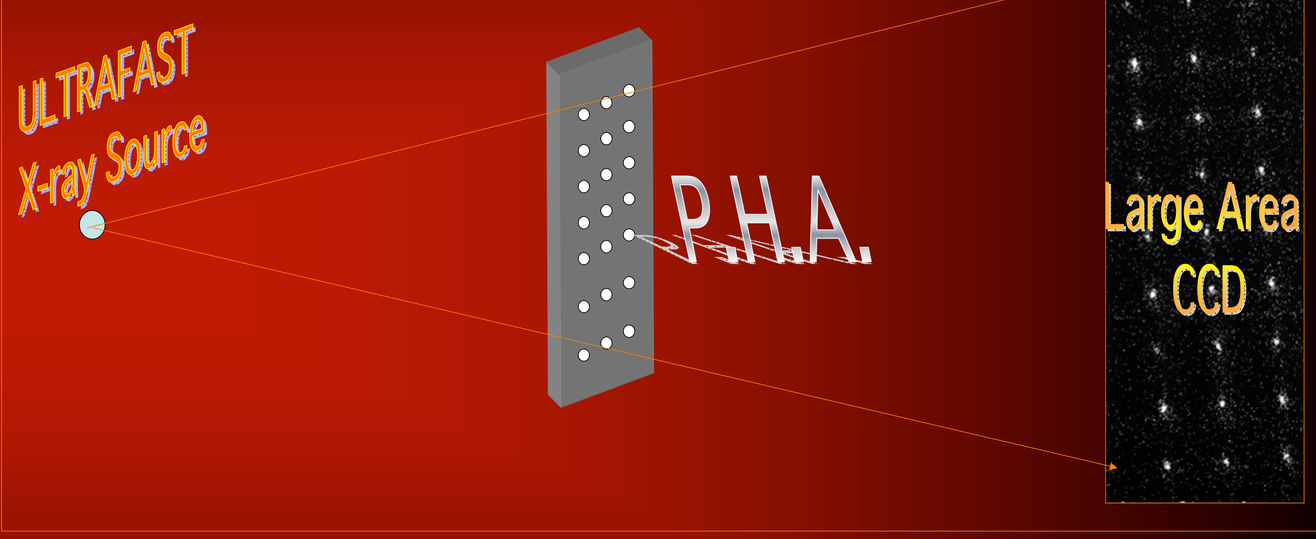


High X-ray Contrast



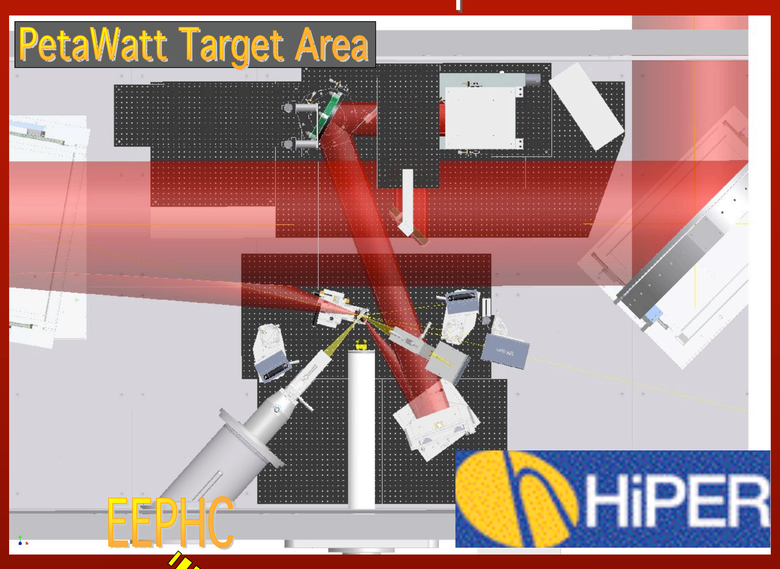
Energy Encoded Pin Hole Camera (EEPHC)

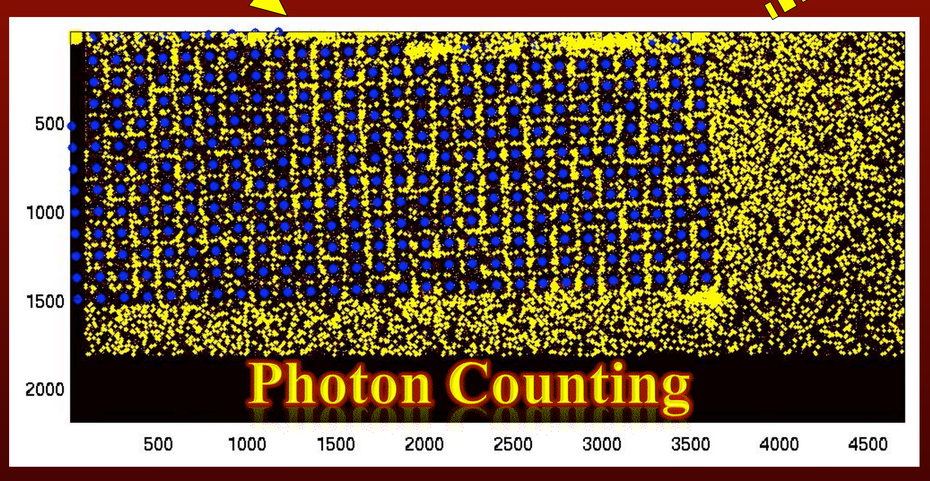
The EEPHC diagnostic technique



EEPHC gives in a single-shot some microns spatial resolution and 150 eV energetic resolution

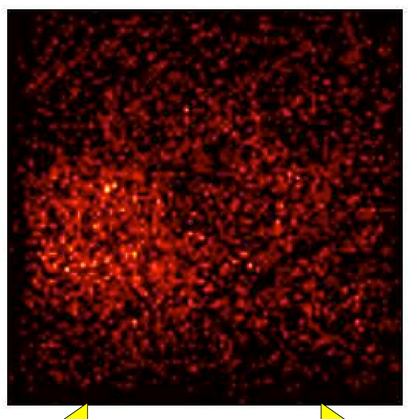
Double-Beams experiment at RAL





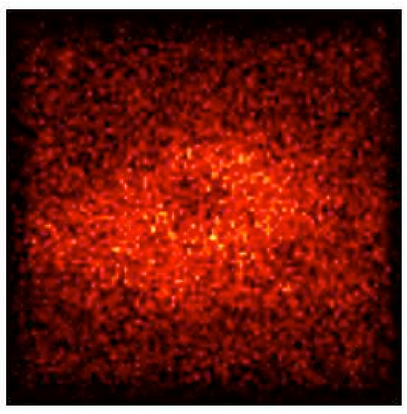
Energy resolved X-ray source reconstruction

E < 4 keV

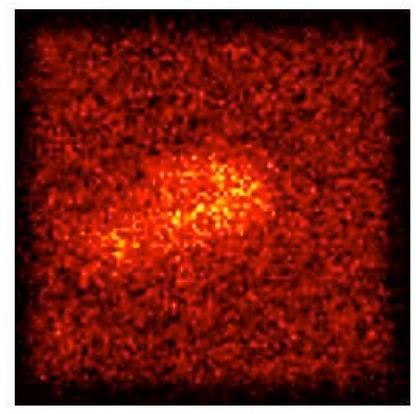


150 µm

E > 4 keV & < 9.6 keV

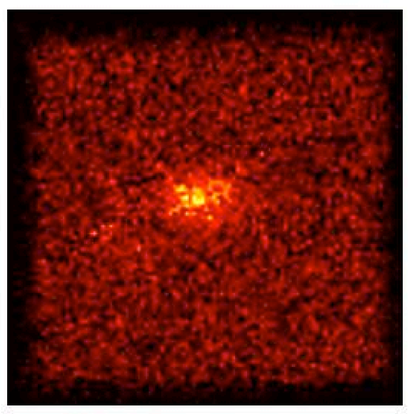


E > 9.6 keV & < 24 keV

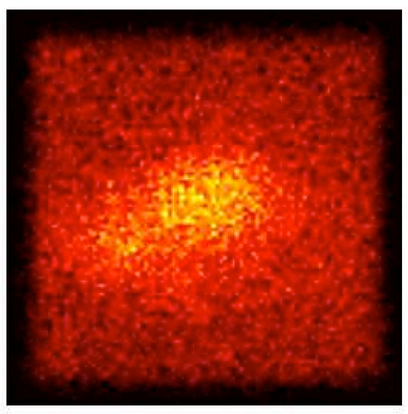


Beam Spot 1
Beam Spot 2

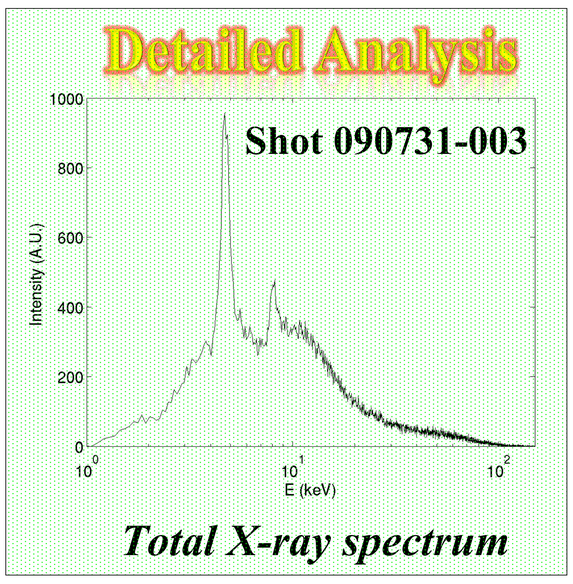
E > 24 keV



Total



Detailed Analysis



Total X-ray spectrum

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L. Labate. et al., *Experimental investigation of fast electron transport in solid density matter: recent results from a new technique of X-ray energy-encoded 2D imaging.* **Laser Particle Beams,27(4), 643-649 (2009).**
T. Levato et al., ***Detailed analysis*** *of events from high-energy X-ray photons impinging on a two-phase front-illuminated CCD.* **Nucl. Instrum. Meth. Phys. Res. A 592, 346-353 (2008)**