



FRONTIERS IN OPTICAL COHERENT AND ULTRAFAST SCIENCE

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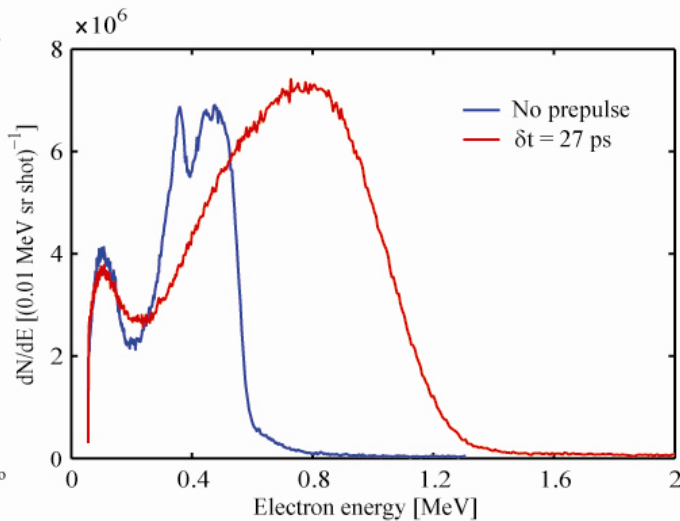
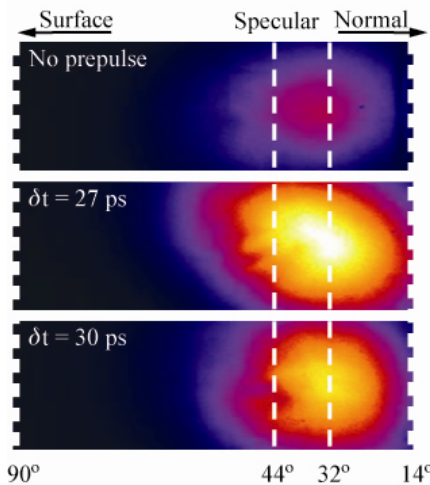
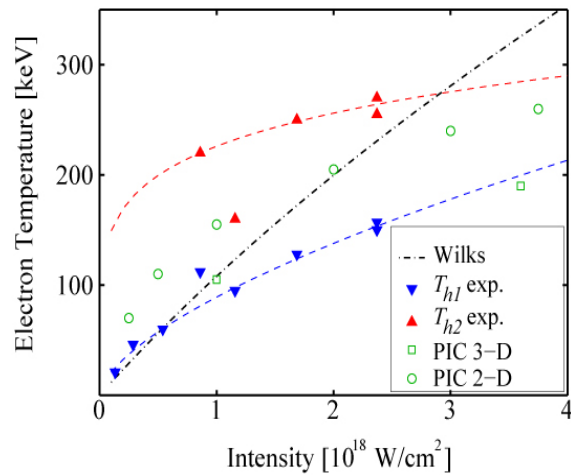
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A nugget from FOCUS:

Title: Relativistic Electrons from Laser-Solid Interactions at KiloHertz Repetition Rate

Investigators: A. Mordovanakis, J. Easter, B. Hou, G. Mourou, J. Nees,
K. Krushelnick

The characterization and control of relativistic electron beams emitted from laser-solid interactions are important in the context of laser fusion and time-resolved electron diagnostics. We study the spatial and energy distributions of these electrons in an unusual regime where millijoule pulses, available at 0.5 kHz repetition rate, are focused to relativistic intensities ($> 2 \times 10^{18} \text{ W/cm}^2$ for $\lambda = 800 \text{ nm}$). For an Al plasma, the electron temperature is found to scale like $T_{hl} [\text{keV}] \approx 120 (I\lambda^2 [10^{18} \text{ W/cm}^2 \mu\text{m}^2])^{0.6}$ in the 10^{17} - $2 \times 10^{18} \text{ W/cm}^2$ range (Fig. top right). This is in good agreement with 3-D PIC simulations and with a simple energy flux model that also describe previously obtained scalings in the strongly relativistic regime. In a separate experiment, the energy distribution from SiO_2 target is measured for different plasma scale-length. At the optimum scale-length of $\sim 0.5\lambda$, the electrons are emitted in a collimated jet with a non-Maxwellian spectrum peaking around 0.8 MeV (Fig. below). This is the first time *monoenergetic* beams of relativistic electrons are observed from solid-density interactions at kilohertz repetition rates.



(a)

(b)