Warm Dense matter studies using a wire target geometry
S.A. Pikuz\textsuperscript{1,2}, P. Neumayer\textsuperscript{3}, O. Rosmej\textsuperscript{3}, L. Antonelli\textsuperscript{4,5}, V. Bagneux\textsuperscript{4}, G. Boutoux\textsuperscript{4}, A. Debayle\textsuperscript{6}, A. Franz\textsuperscript{7}, A.Ya. Faenov\textsuperscript{1,8}, L. Giuffrida\textsuperscript{4,9}, S.B. Hansen\textsuperscript{10}, J.J. Honrubia\textsuperscript{11}, J. Jacoby\textsuperscript{7}, D. Khaghani\textsuperscript{3}, T. Sakaki\textsuperscript{4}, J.J. Santos\textsuperscript{4}, A. Sauterey\textsuperscript{4}, A. Schoenlein\textsuperscript{7}, I.Yu. Skobelev\textsuperscript{1,2}, D. Batani\textsuperscript{4}.

\textsuperscript{1} Joint Institute for High Temperatures RAS, Moscow 125412, Russia
\textsuperscript{2} National Research Nuclear University MEPhI, Moscow 115409, Russia
\textsuperscript{3} GSI - Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany
\textsuperscript{4} University of Bordeaux, CNRS, CEA, CELIA, F-33405 Talence, France
\textsuperscript{5} Dipartimento SBAI, Università degli studi di Roma “La Sapienza”, Rome, Italy
\textsuperscript{6} CEA DAM DIF, F-91297 Arpajon, France
\textsuperscript{7} Goethe-Universität Frankfurt, D-60438 Frankfurt-am-Main, Germany
\textsuperscript{8} Institute for Academic Initiatives, Osaka University, Suita, Osaka 565-0871, Japan
\textsuperscript{9} Institute of Physics ASCR, v.v.i (FZU), ELI-Beamlines project, Prague, Czech Republic
\textsuperscript{10} Sandia National Laboratories, Albuquerque, New Mexico 87123, USA
\textsuperscript{11} ETSI Aeronauticos, Universidad Politecnica de Madrid, Madrid, Spain

Warm dense matter generated due to the interaction of high contrast sub-PW laser pulses with solid matter is investigated experimentally. The proposition of thin metal wires to be used as a target allows to trace the isochoric heating of a matter deep into the target. Additionally, for such targets with reduced cross dimensions, a strong electrostatic sheath fields confine the electrons to the target which efficiently and homogeneously heat it to high energy densities. The experiment was set up at PHELIX facility providing ultra-high-contrast 0.5 -1 ps laser pulses of $\sim$ 200 J energies focused to a 4 $\mu$m spot (5e20 W/cm$^2$ laser intensity) at the tip of 50 $\mu$m Ti wire targets. The temperature of the matter was measured by means of K-shell X-ray spectroscopy data obtained with spatial resolution along the wire axis and compared with the spectra simulation by collisional-radiative SCRAM code. For the first time, it becomes possible to distinguish surface target regions heated by the laser and mixed plasma mechanisms from those heated only by the hot electrons that generate warm dense matter with temperatures up to 50 eV, 800 $\mu$m deep into the matter. Detailed simulations were performed to reproduce the hot-electron source and heating inside the target. They unravel an efficient confinement of the electron current, causing a substantial increase of energy deposition both from resistive and from collisional effects, when compared with the common foil-target geometry.