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Fast Ignition Realization EXperiment (FIREX) and Prospect to Inertial Fusion Energy in Japan

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Fast ignition has high potential to ignite a fusion fuel with only about one tenth of laser energy necessary for the central ignition. One of the most advanced fast ignition programs is the Fast Ignition Realization Experiment (FIREX). The goal of its first phase is to demonstrate ignition temperature of 5 keV, followed by the second phase to demonstrate ignition-and-burn. Relativistic fast electrons as the energy carrier, however, unfavorably diverge at high laser intensities necessary for significant heating. This difficulty is overcome by kilo-Tesla magnetic field collimating fast electrons towards a compressed fuel. Such super-strong field has been created with a capacitor-coil target driven by a high power laser, and subsequent collimation has also been demonstrated, suggesting that one can achieve ignition temperature at the laser energy available in FIREX. Repetitive creation of fast ignition plasmas has been demonstrated together with the technology development of high-efficient rep lasers and pellet injection, tracking, and beam steering.

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Primary author: Mr AZECHI, Hiroshi (Japan)

Co-authors: Dr IWAMOTO, Akifumi (National Institute for Fusion Science); Dr SUNAHARA, Atsushi (Institute for Laser Technology); Dr NAGATOMO, Hideo (Institute of Laser Engineering, Osaka University); Dr NISHIMURA, Hiroaki (Institute of Laser Engineering, Osaka University); Dr KAN, Hirofumi (Hamamatsu Photonics K.K.); Dr YOSHIDA, Hiroki (Gifu University); Dr SHIRAGA, Hiroyuki (Institute of Laser Engineering, Osaka University); Dr SAKAGAMI, Hitoshi (National Institute for Fusion Science); Dr KANEKO, Junichi (Graduate School of Engineering, Hokkaido University); Dr KAWANAKA, Junji (Institute of Laser Engineering, Osaka University); Dr SHIGEMORI, Keisuke (Institute of Laser Engineering, Osaka University); Dr NAGAI, Kenji (Tokyo Institute of Technology); Dr TSUBAKIMOTO, Koji (Institute of Laser Engineering, Osaka University); Dr MIMA, Kunioka (The Graduate School for the Creation of New Photonics Industries); Dr MURAKAMI, Masakatsu (Institute of Laser Engineering, Osaka University); Dr KOGA, Mayuko (Hyogo University); Dr NAKAI, Mitsuo (Institute of Laser Engineering, Osaka University); Dr SATO, Nakahiro (Hamamatsu Photonics K.K.); Dr SARUKURA, Nobuhiko (Institute of Laser Engineering, Osaka University); Dr MIYANAGA, Noriaki (Institute of Laser Engineering, Osaka University); Dr HANAYAMA, Ryohei (The Graduate School for the Creation of New Photonics Industries); Dr KODAMA, Ryosuke (Institute of Laser Engineering, Osaka University); Dr TSUJI, Ryusuke (Graduate School of Engineering, Ibaraki University); Dr FUJIJOA, Shunsuke (Institute of Laser Engineering, Osaka University); Dr NAKAYAMA, Suisei (The Graduate School for the Creation of New Photonics Industries); Dr JOHZAKI, TOMOYUKI (Graduate School of Engineering, Hiroshima University); Dr JITSUNO, Takahisa (Institute

of Laser Engineering, Osaka University); Dr SEKINE, Takashi (Hamamatsu Photonics K.K.); Dr NORIMATSU, Takayoshi (Institute of Laser Engineering, Osaka University); Dr ENDO, Takuma (Hiroshima University); Dr OZAKI, Tetsuo (National Institute for Fusion Science); Dr NAKAZATO, Tomoharu (Institute of Laser Engineering, Osaka University); Dr SHIMIZU, Toshihiko (Institute of Laser Engineering, Osaka University); Dr TAGUCHI, Toshihiro (Setsunan University); Dr KAWASHIMA, Toshiyuki (Hamamatsu Photonics K.K.); Dr NISHIMURA, Yasuhiko (The Graduate School for the Creation of New Photonics Industries); Dr FUJIMOTO, Yasushi (Institute of Laser Engineering, Osaka University); Dr KITAGAWA, Yoneyoshi (The Graduate School for the Creation of New Photonics Industries); Dr NAKATA, Yoshiki (Institute of Laser Engineering, Osaka University); Dr MORI, Yoshitaka (The Graduate School for the Creation of New Photonics Industries); Dr SAKAWA, Youichi (Institute of Laser Engineering, Osaka University); Dr ISHII, Katsuhiko (The Graduate School for the Creation of New Photonics Industries)

Presenter: Mr AZECHI, Hiroshi (Japan)

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