Laser-plasma collider for accelerating electrons and positrons

Pugacheva D V[1,2,@] **and Andreev N E**[1,2]

[1] Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg 2, Moscow 125412, Russia
[2] Moscow Institute of Physics and Technology, Institutskiy Pereulok 9, Dolgoprudny, Moscow Region 141701, Russia

[@] sedyakina.d@gmail.com

New laser-plasma methods of accelerating electrons and positrons is of great interest, since they can be used for new compact multistage accelerators up to ultrahigh energies unattainable by other methods using classical radio-frequency accelerators [1, 2]. High-quality beams of polarized electrons and positrons in the TeV energy range are required to carry out precision tests of the Standard Model [3, 4]. In this work, the developed and tested hybrid computational code [5,6], combining both PIC methods and grid methods, was adapted to simulate the acceleration process in separate stages of the laser-plasma collider of not only relativistic electrons, but also positrons. Each stage had a smooth entry and exit to ensure an adabatic change in the accelerating and focusing forces at the beginning and end of the acceleration process. The plasma profiles and channel shapes at the boundaries of the accelerating stages were studied to transport the particle beam between stages preserving its quality.

Acknowledgments: The reported study was funded by RFBR, project number 19-02-00908

[1] Assmann R W and et al 2020 *Eur. Phys. J. Spec. Top.* **229** 3675–4284
[2] Cros B 2016 *Nature* **530** 165
[3] Vieira J and et al 2011 *Phys. Rev. ST Accel. Beams* **14** 071303
[4] Schroeder C B and et al 2010 *Phys. Rev. ST Accel. Beams* **13** 101301
[5] Pugacheva D V and Andreev N E 2018 *Quantum Electron.* **48** 291
[6] Pugacheva D V and Andreev N E 2020 *Vestnik Obedinennogo Instituta Vysokih Temperatur* **5**