simulation of capillary discharge with various cross-section channels

Bagdasarov G.A., Sasorov P.V., Olkhovskaya O.G., Gasilov V.A., and 1Bulanov S.V.

Keldysh Institute of Applied Mathematics, Russian Academy of Sciences, Moscow, Russia,  
 [gennadiy3.14@gmail.com](mailto:gennadiy3.14@gmail.com)  
1National Institutes for Quantum and Radiological Science and Technology,  
 Kansai Photon Science Institute, Kyoto, Japan

For several decades the capillary discharges have been under intensive investigations due to various promising applications, e.g. for the laser electron accelerators as well as for the X-ray lasers [1, 2]. A majority of the experiments use the circular cross-section capillaries, which reduce the dimensionality of the problem under the consideration, greatly simplifying the theoretical and computer simulation studies, and allowing to use 1D MHD computer codes. On the other hand, the square cross-section capillaries, which have been attracting substantially less attention, have several advantages for the plasma diagnostics and for their fabrication.

The aim of our work is to compare the plasma density and temperature distribution formed at the quasistationary stage of the discharge inside the hydrogen-filled capillaries with circular and square cross-sections under almost the same conditions characterizing the initial configurations and the external electric circuit. The simulation parameters are choosen to correspond to the capilllary discharge based waveguide for the laser wake-field accelerator (e.g., see [3]).

References

1. Leemans W P et al 2014 Phys. Rev. Lett. 113 245002
2. Benware B R et al 1998 Phys. Rev. Lett. 81 5804
3. Esarey E et al 2009 Rev. Mod. Phys. 81 1229