**Novel approach to proton-boron fusion using protons generated through laser-induced thermonuclear DD reaction**

P. Tchórz1, T. Chodukowski1, M. Rosiński1, M. Szymański1, S. Borodziuk1

*1 Institute of Plasma Physics and Laser Microfusion, Warsaw, Poland*

Majority of current research related to proton-boron approach of laser fusion employ hundreds of TW and PW-class laser systems to increase yield of alpha particles produced during reaction [1][2]. Recently, such laser systems became much more accessible, however the importance of enabling as many research groups as possible to contribute in the laser-fusion field requires seeking alternative approaches that could be implemented using moderate laser intensities. In this work we report generation of energetic ), intense and directed proton beam during Cavity Pressure Acceleration (CPA) scenario of laser-matter interaction, where foils were used inside the target cavity [3][4]. The origin of these protons is one of deuterium-deuterium fusion reaction channels, in which and are produced. The measurements of proton energy spectra carried out during this experiment served as an input for preliminary Monte Carlo simulations (FLUKA) [5]–[7] of proton beam colliding with boron targets of different thickness, which suggest potential for few-TW laser systems to generate alpha particle flux comparable to these achieved using the most powerful laser beamlines.

**References**

[1] J. Bonvalet *et al.*, “Energetic α-particle sources produced through proton-boron reactions by high-energy high-intensity laser beams,” *Phys Rev E*, vol. 103, no. 5–1, May 2021, doi: 10.1103/PHYSREVE.103.053202.

[2] D. Margarone *et al.*, “In-Target Proton-Boron Nuclear Fusion Using a PW-Class Laser,” *Applied Sciences 2022, Vol. 12, Page 1444*, vol. 12, no. 3, p. 1444, Jan. 2022, doi: 10.3390/APP12031444.

[3] T. Chodukowski *et al.*, “Neutron production in cavity pressure acceleration of plasma objects,” *AIP Adv*, vol. 10, no. 8, Aug. 2020, doi: 10.1063/5.0005977.

[4] S. Borodziuk, A. Kasperczuk, and T. Pisarczyk, “Cavity pressure acceleration: An efficient laser-based method of production of high-velocity macroparticles,” *Appl. Phys. Lett*, vol. 95, p. 231501, 2009, doi: 10.1063/1.3271693.

[5] V. Vlachoudis, “FLAIR: A POWERFUL BUT USER FRIENDLY GRAPHICAL INTERFACE FOR FLUKA,” 2009.

[6] G. Battistoni *et al.*, “Overview of the FLUKA code,” *Ann Nucl Energy*, vol. 82, pp. 10–18, Aug. 2015, doi: 10.1016/J.ANUCENE.2014.11.007.

[7] C. Ahdida *et al.*, “New Capabilities of the FLUKA Multi-Purpose Code,” *Front Phys*, vol. 9, p. 705, Jan. 2022, doi: 10.3389/FPHY.2021.788253/BIBTEX.