# High alpha particle yield in laser induced p-B fusion reaction

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Laser-induced nuclear fusion reactions are nowadays widely investigated as an alternative approach for the production of fusion energy, which could potentially have a high societal impact. In particular, the proton–boron nuclear fusion reaction leading to the production of energetic alpha particles without neutron generation can be beneficial in several application in nuclear physics, as for building "ultraclean" nuclear-fusion reactor [1], and also in Medical Physics (for cancer treatments [2, 3]). Latest results obtained using a nanosecond, low-contrast laser pulse with a relatively low intensity ($3 \times 10^{16}$ W cm$^{-2}$) and advanced boron-doped hydrogen-enriched silicon targets allowed the production of a high yield of alpha particles of around $10^9$ per steradian[4,5].

In this contribution, results from a recent experimental campaign performed at PALS laser laboratory in Prague will be presented. The main goal of the present experiment was to maximize the alpha particle yield from the proton-boron nuclear reaction ($^{11}B + p \rightarrow 3\alpha +$ 8.7 MeV) induced using thin multilayer SiHB targets thus validating and improving the surprising results achieved in our previous campaign [4,5]. Furthermore, since the complex geometry of the SiHB targets is expected to increase the efficiency of the pB nuclear reaction and produce a high brilliance alpha particle source propagating forward and backward with respect to the target normal direction, alpha particle angular distributions have been also measured for different target structures.

Thomson Parabola spectrometers, TOF-based diagnostics using diamond and silicon carbide (SiC) detector array and nuclear track detectors (CR39 type), placed at different angles, allowed to study proton acceleration and alpha-particle emission in terms of energy and flux.

Results show a strong enhancement of the alpha particle yield leading to about $10^{11}$ alpha particle/sr measured for the different target geometries.

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