The demand for electricity is constantly growing due to, among others, population growth, urbanization, industrialization of developing countries. By the end of the century, this demand will have tripled. The resources of fossil fuels, whose exploitation shaped the civilization of the 19th and 20th centuries, are limited, and their use is associated with greenhouse gas emissions and environmental pollution. The world is seeking to reduce pollution production. Currently used technologies for production and storage of energy from renewable sources such as the sun, wind or water do not ensure its stable and continuous availability. A new, practically inexhaustible, non-emitting carbon dioxide, i.e. a clean source of energy, is the fusion reaction. The reaction, that powers the sun and the stars. Fusion is a process in which light atomic nuclei combine to release energy, the huge amounts of energy. The most efficient reaction, giving the highest energy increase at the lowest temperatures, is the fusion of hydrogen isotopes: deuterium (D) and tritium (T). It is deuterium and tritium that are intended as a fuel for future fusion power plants. However, a big problem in achieving and using controlled thermonuclear fusion is neutrons derived from D-T plasma. High-energy neutrons penetrate the construction materials of the device, damaging them and being able to activate them. These problems lead to the search for an alternative fusion reaction (alternative fuel) in which neutron production does not occur.

Such possible fusion fuels are deuterium and helium-3 (^{3}He – a very rare helium isotope with only one neutron on earth) or proton (p) and boron nuclei (^{11}B). As a result of the p–^{11}B fusion reaction (usually written as ^{11}B(p,α) αα, or shortened to p–B fusion), only three alpha particles (α) are emitted. And the energy is released as kinetic energy of alpha particles rather than neutrons. The maximum active cross-section for this reaction is 1.2 barn for 600 keV, and the energy spectrum of alpha particles peaks around 4 MeV. In recent years, interest in this reaction and the possibilities of using high-energy alpha particles has increased enormously. However, for the p–^{11}B synthesis to take place, a much higher ion temperature is necessary than for D-T synthesis, practically impossible to achieve in a tokamak device. Therefore, searching for new ways of obtaining and testing p–11B reaction products is necessary.

In recent years, research is ongoing on proton-boron fusion using various systems, including high-power ultrafast laser beams. One of the types of devices where the reaction of hydrogen and boron nucleus synthesis has not yet been confirmed, and is feasible, is the Plasma-Focus system. Plasma is formed during the discharge in the gas, and by adding boron to it, we obtain a boron-hydrogen plasma, in which the synthesis reactions can take place. Boron, released from the target placed in the PF anode by the laser beam would be injected into the plasma pinch at the time of its formation. The aim of the project is to show the possibility of inducing p–^{11}B fusion in the Plasma-Focus device and to measure its products. Experiments carried out under the project will verify the theoretical model and the possibility of using Plasma-Focus for the synthesis of proton-boron. While the developed theoretical model will make it possible to determine whether it is possible to achieve partial self-sustained reactions under Plasma-Focus conditions by trapping protons and alpha particles in a strong magnetic field.