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Demonstration of aneutronic p-^{11}B reaction in a magnetic confinement device

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Aneutronic fusion using commonly available fuels such as proton (p) and boron 11 (11B) is one of the most attractive potential energy sources. The development of techniques to realize its potential is desirable for the experimental capability to produce p-11B fusion in the magnetically confined fusion device using hydrogen beam injections. We performed experiments of p-11B fusion in the magnetic confinement fusion device Large Helical Device under the collaboration between the National Institute for Fusion Science (NIFS) in Japan, and TAE Technologies in the USA [1, 2]. The experiments were conducted with the support of intense negative-ion-source-based hydrogen beams (N-NBs) [3], and an impurity powder dropper (IPD) [4] co-developed under the collaboration between NIFS and Princeton Plasma Physics Laboratory, USA. In p-11B experiments, intense N-NBs whose acceleration energy were of up to 163 keV were injected into a plasma with natural boron grain injection by the IPD. Significant quantities of signal pulses resulting from p-11B fusion-born alpha particles were measured using a custom-designed alpha particle detector based on a passivated implanted planar silicon detector. The time trend of the alpha particle counting rate obtained with the alpha particle detector was in good agreement with the global p-11B alpha emission rate calculated based on classical confinement of the energetic proton using experimentally obtained plasma parameters. We will present the detail of experimental results and comparison with the numerical calculation.

References

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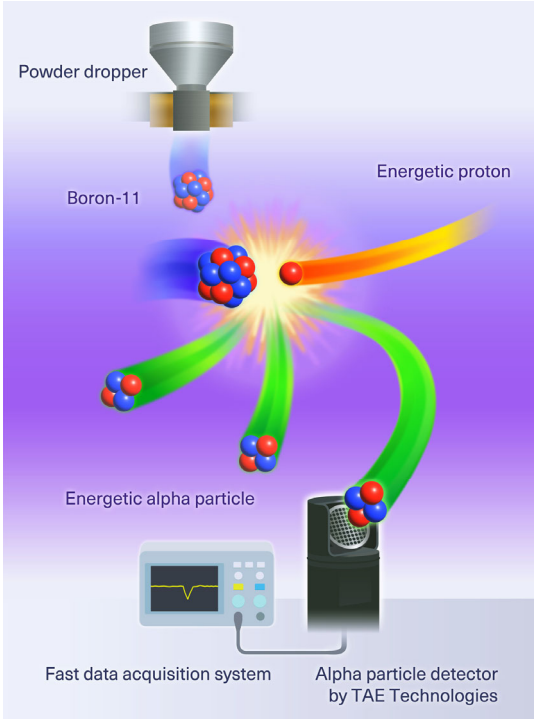

Figure Experiment for p-11B demonstration performed in Large Helical Device.