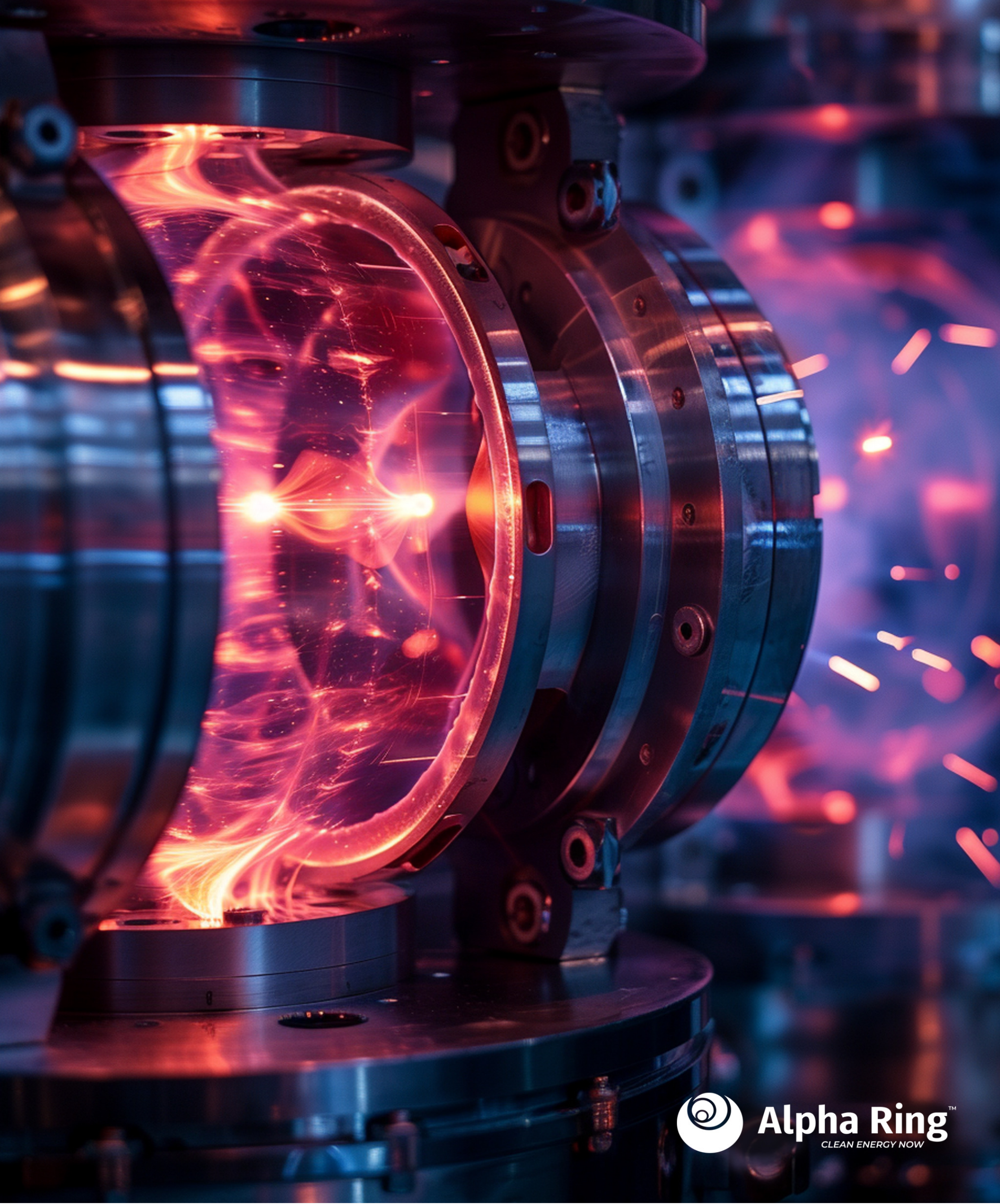
INTRODUCTION

The ION Beam International System for Nuclear Fusion in just 2 pages



Alpha Ring™
CLEAN ENERGY NOW

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Ion Beam International System for Nuclear Fusion

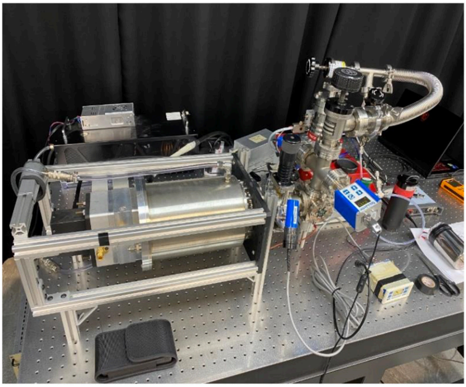
NUCLEAR FUSION

Nuclear fusion has seen incredible growth in recent years as it holds the promise to revolutionize the energy sector by providing a clean energy alternative. Consequently, new high-paying jobs are emerging with **$6 billion in private funding** and the **$50 million US DOE Milestone-Based Fusion Development Program**. At a recent hearing, U.S. Congress asked how they could ensure more young people are educated in nuclear fusion, showing their commitment to the growing field.

Alpha Ring International is uniquely positioned to supply the right equipment to students so that they can learn and advance in this growing field of vast importance.

THE PROBLEM

Universities often teach nuclear fusion only in theory because experimental setups are unavailable. As a result, **many graduates lack hands-on fusion experience**, especially at the undergraduate level.



THE SOLUTION

We have developed an **affordable, compact, and safe to use device. This can be used to study experimentally all relevant fusion reactions**, such as Deuterium-Deuterium (DD), Deuterium-Tritium (DT), and proton-Boron (pB). This amazing device will be instrumental in preparing the **next wave of scientists and engineers** to join the workforce in the growing field of nuclear fusion.

Figure 1: *Ion Beam System setup on laboratory optics table.*

WHAT CAN BE STUDIED?

1. Accelerating Deuterion Ions for Fusion:

Our Ion Beam System accelerates deuterons from a deuterium plasma to tens of keV. These highly energetic ions then bombard a thin aluminum foil target and become lodged into the metal lattice. Subsequent deuterons strike the deuterium in the target to initiate DD fusion. By changing the target to one that contains boron and starting with a hydrogen plasma, pB fusion can also be studied and the fusion product alpha particles can be observed.

2. Unveiling the Fusion Reactions:

The DD fusion reaction produces two distinct branches, each with its own unique particles and energy outputs. One branch results in the creation of Helium-3 (0.82MeV) and a neutron (2.45MeV), while the other generates a proton (3.02MeV) and a triton (1.01MeV). Students can directly measure all fusion products [Figure 2].

3. Enhanced Detection Capabilities:

Our system uses advanced detectors, including PN detectors and fast neutron scintillators, to accurately analyze fusion reactions and measure all branches of the fusion reaction. The fast neutron scintillator uses pulse shape discrimination to separate neutron signals from gamma signals [Figure 3] as well as obtain timing information.

4. Coincidence Detection:

Positioning particle detectors at opposite ends of the target chamber allows for performing coincidence detection as a more advanced measurement [Figure 4].

5. Versatility with Boron Targets:

Our Ion Beam System offers versatility by allowing the easy interchange of targets. By utilizing a target containing boron, we can observe the alpha particles generated by the p+B11 fusion reaction. This feature expands the range of fusion reactions that can be studied with our device, providing even more opportunities for hands-on exploration.

6. Efficient Ion Source:

At the heart of our system lies an ion source that utilizes microwave technology in the Electron Cyclotron Resonance (ECR) condition. This unique setup ensures efficient plasma production and high current density, enabling low accelerating potentials while maintaining a reasonable fusion reaction yield. Furthermore, our system allows controlling the plasma in various ways and thus studying the impact of different parameters on the fusion reaction.

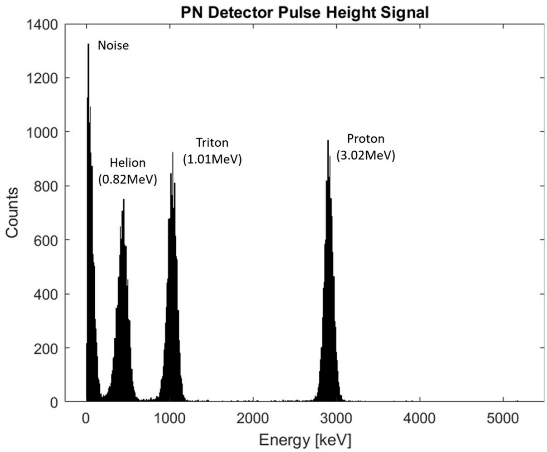


Figure 2: *Charged particle detectors showing the spectrum of DD fusion reaction.*

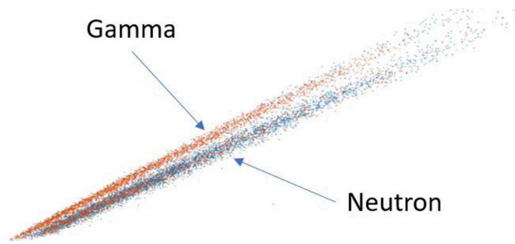


Figure 3: *Fast neutron scintillator data showing both the gamma and neutron tails after pulse shape discrimination of the signal.*

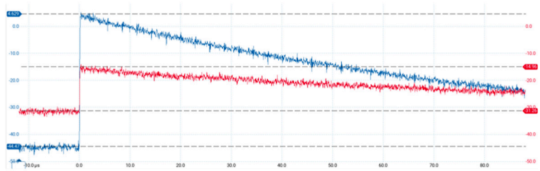


Figure 4: *Charged particle pulses on two PN-diode detectors placed at 180-degrees apart. Blue curve shows the proton signal and red curve shows the triton signal.*

7. Safety and Compact Design:

Safety and convenience are paramount considerations in our Ion Beam System. With x-ray emissions from Bremsstrahlung easily shielded at tens of keV, you can rest assured that the device is safe to use. Furthermore, the high voltage isolation is completely enclosed for safety and security. This compact toolbox-sized demonstration device is both portable and user-friendly, perfect for deployment in most university laboratories with limited available space.

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