

Compact ion beam platform for on-site fusion and plasma research

The problem it solves

Access to particle accelerators for experimental work typically means scheduling time at shared institutional facilities — infrastructure that is expensive, oversubscribed, and increasingly unavailable to smaller research groups. Custom in-house builds are an alternative, but they carry significant maintenance burden, reproducibility limitations, and knowledge transfer challenges when personnel change.

Alpha-E Pro offers a third option: a commercially supported, bench-scale ion beam system dedicated to your research group's experimental programme, operated on your schedule, and integrated with your existing detection and data acquisition setup.

What it is

Alpha-E Pro is a modular, bench-scale particle accelerator producing D-D and p-B fusion reactions with a configurable multi-detector suite. The system combines a 2.45 GHz ECR microwave plasma source, high-voltage ion extraction (20–75 keV), and a target assembly with standard CF-2.75" flanges for custom detector integration.



Where Alpha-E Pro fits — and where it doesn't

Alpha-E Pro is not a high-yield industrial neutron generator. It is well-suited to applications where flux at the 10^4 – 10^5 n/s level is adequate and where experimental flexibility, on-site availability, and commercial support are the priority.

Suitable applications:

- Detector calibration and characterisation
- Low-flux activation analysis
- Plasma-facing material surface studies (5–75 keV D⁺ beam, tokamak-relevant energies)
- Radiation stress testing and early-stage detector validation
- Fusion reaction demonstration and diagnostics development
- Digital twin and neutron-transport model validation (near-monoenergetic 2.45 MeV source)

If your application requires neutron flux significantly above 10^6 n/s, Alpha-E Pro is not the right tool.

Specification Table

Ion beam energy	20–75 keV
Reactions	D-D (2.45 MeV neutrons); p-B (aneutronic alpha)
Neutron output	~10 ⁴ n/s (D-D, 30 keV)
Plasma source	2.45 GHz ECR microwave
Target assembly	CF-2.75" standard flanges; modular, configurable
Detectors	Si-PIN charged particle; fast neutron scintillator with PMT
Optional	CR-39 solid-state track detector; cloud chamber
DAQ	Web-based control dashboard; real-time streaming
Power	~100 W typical; 200 W peak
Safety	Operates below EU exempt radiation thresholds and no additional shielding required when operated at ≤30 keV.
Footprint	Bench-scale; 530 mm length; standard lab utilities

What's included

- Ion beam source, target assembly, and detector suite (configured to specification)
- Web-based DAQ and control software
- Onsite installation and operator training
- Ongoing remote technical support
- Full technical documentation and safety compliance materials

Alpha-E Pro is a configurable platform. Target assemblies, detector configurations, and beam parameters are adjusted to meet your specific experimental requirements. Contact us to discuss your application before requesting a quote.

Published results

- Chen et al. (2024) Compact Ion Beam System for Fusion Demonstration — Physics Open, vol. 21. 100234
- Wang et al. (2025) Deuterium-deuterium fusion charged particle detection using CR-39 and deep learning model — Radiation Measurements, vol. 185
- Chen et al. (2025) Performance Characteristics of the Battery-Operated Silicon PIN Diode Detector with an Integrated Preamplifier and Data Acquisition Module for Fusion Particle Detection — Journal of Nuclear Engineering, vol. 6

"A perfect fusion research tool."

Prof. Gianluca Gregori, University of Oxford

In use at:



Nuclear Engineering
Department - West Lafayette, USA



Faculty of Physics
Sofia, Bulgaria



Department of Physics
Hsinchu, Taiwan



To request a demonstration or discuss
your programme's requirements,
Contact us: alpha-e@alpharing.com