

Priority	Goals	AlphaRing SME	Description	Challenges	KPI
Exp.1	Fusion Evidence	Chia-Yi	Use DD reaction in linear system to prove fusion.	Collecting evidence for pB fusion in a linear system is challenging.	<ol style="list-style-type: none"> 1. Neutron Detector count 4x of background 2. Publish paper
Exp.2	Digital Twin	Dr. Hsieh	Develop digital twins of AlphaRing's nuclear chambers with each twin designed for modeling and simulating relevant activities within the chamber.	<p>Due to the absence of a thorough simulation for nuclear fusion with existing parameters, experimentation becomes absolutely necessary.</p> <p>We wish to have a digital twin to simulate first and experiments are for validations.</p>	<ol style="list-style-type: none"> 1. Digital simulation of the nuclear fusion and plasma behaviors within reactor chamber for <ol style="list-style-type: none"> 1.1 Linear System 1.2 SCM System 2. Use of Plasma simulator - COMSOL 3. Generative approaches for chamber design, controls and parameters for better energy yield.
Exp.2	Chamber Sensory	Dr. Hsieh	Enhance the monitoring of chamber conditions to supply feedback to the simulations and models of the Digital Twin.	Installing sensors in linear systems proves challenging due to their size. Larger systems would benefit from the inclusion of industry-standard sensors.	<p>Measurements of:</p> <ol style="list-style-type: none"> 1. Particle densities 2. Temperature 3. Confinement time
Exp.2	Fusion Power Supply	Dr. Hsieh	Equipment designed for specific mission stages and approaches to nuclear fusion such as Linear and SCM system, aimed at optimizing energy input.	The existing power supplies are not tailored for fusion requirements. We require power supplies optimized for energy efficiency and plasma control, capable of igniting and sustaining plasma.	<p>SCM:</p> <p>Current and voltage, repetition rates, and durations 3-10 kA, 1-3 kV, 5-50 milliseconds</p>

Exp.3	Energy Extraction	Dr. Hsieh	Effectively harness and transform energy produced through nuclear fusion using techniques like Direct Energy Conversion (DEC), which directly turns electrons into electricity, and/or systems specifically engineered to efficiently extract heat, aimed at optimizing energy output.	A challenge arises as we observe high temperatures radiating from the target material. Our objectives include efficiently extracting energy and harnessing electrons to generate electricity.	1. Improved gain in the same fusion approach
Exp.4	Target Control - Geometry	Chia-Yi	Control target material geometry for better fusion-induced energy yield, while maintaining electron emission property.	The geometry of the material could impact energy yield. However, the current boron material is exceptionally hard, and we aim to manage its properties in relation to energy yield.	Capability to 1. Refine geometry of existing supply 2. New supply with flexibility geometry
Exp.4	Target Control - Cleaning	Chia-Yi	Cleaning of target material in-flight to keep it in an optimal condition.	During operation, the challenge arises from the contamination negatively impacting energy yield. Additionally, cleaning the target material in-flight within a vacuum-sealed environment poses a significant challenge.	1. Sustaining Q value in long lab run (24H+) 2. Effective cleaning of target surface
Exp.4	Chamber Material	Chia-Yi	Investigate different construction materials to enhance the conditioning of the chamber.	Over extended laboratory sessions, a challenge emerges as chamber materials may melt, necessitating construction for prolonged lab operations.	1. Sustaining Q value in long lab run (W+)
Biz. 1	Cancer Therapy	Stanley	Investigate the potential commercial applications of neutron and proton generation in the medical field.	Alpharing's core expertise lies in fundamental physics, and the gap from science to business use presents a challenge to deepen understanding in the field of neutron and proton generation for medical applications.	1. Depth in understanding of proton therapy 2. Depth in understanding of neutron therapy

Biz. 2 Fusion Education

Kai Jian

Offer educational institutions resources to instruct on nuclear fusion and its underlying physics principles.