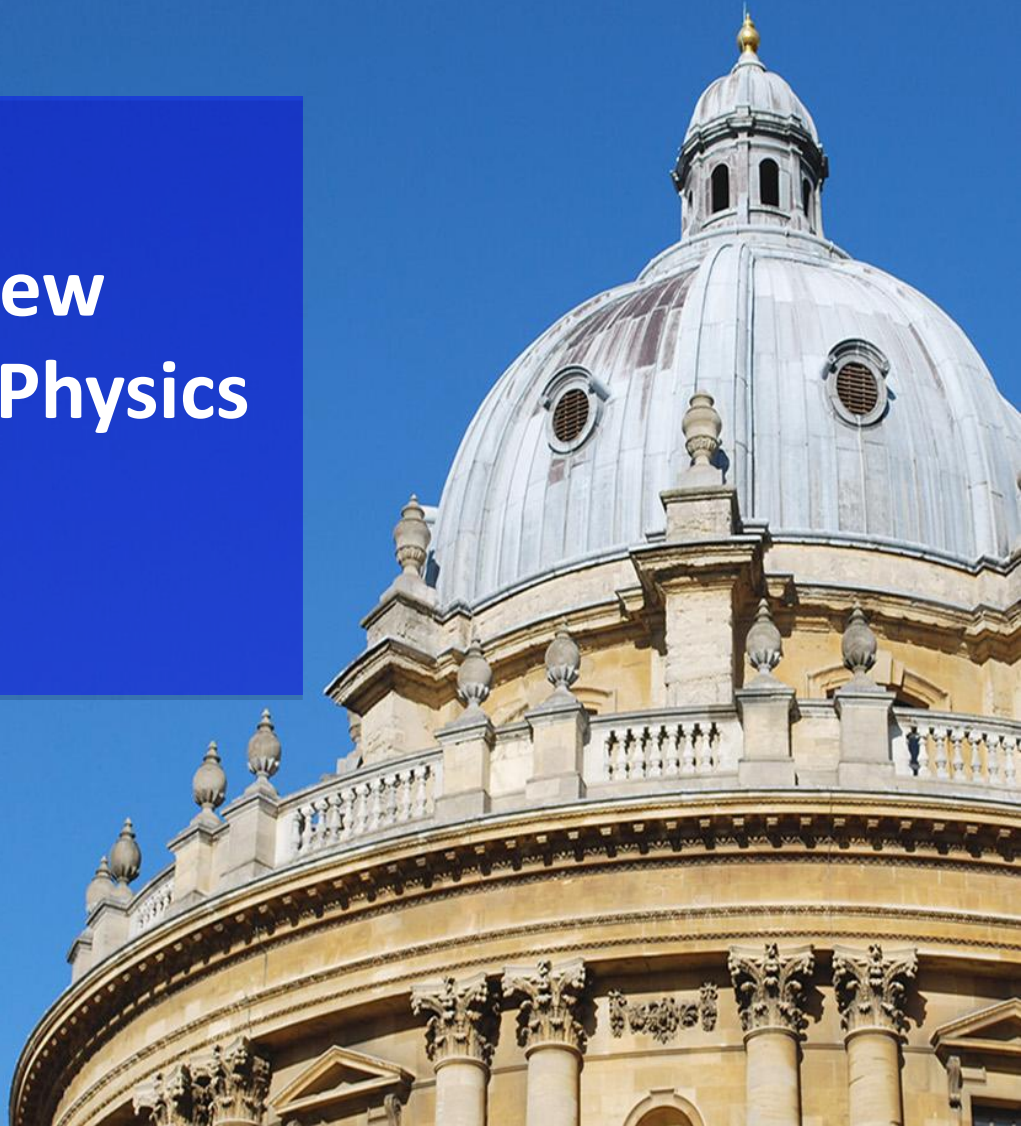


# The UK- Japan collaboration for New Frontier in Plasma Physics

Dean of Degrees, University College

4<sup>th</sup> September 2024





# Peter Norreys

Professor of Inertial Fusion Science  
University of Oxford

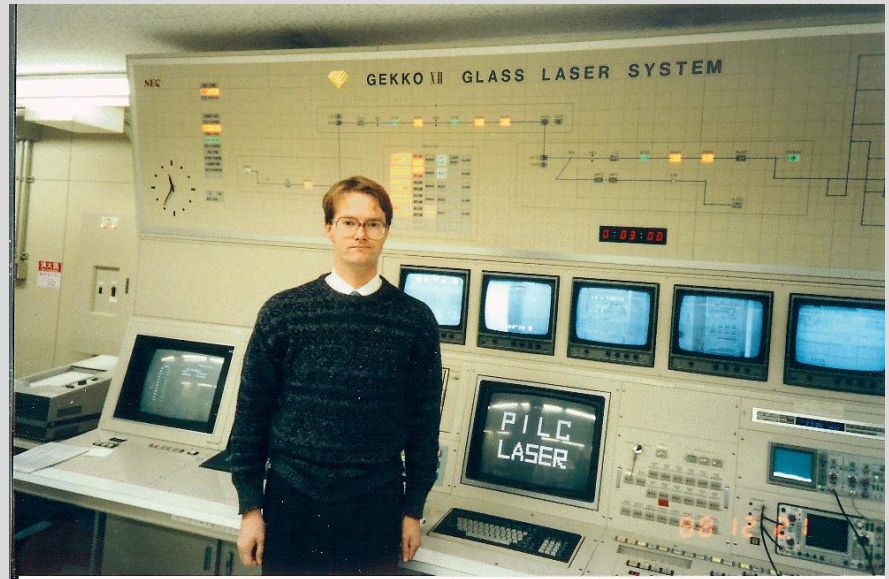
William Penney Fellow,  
Atomic Weapons Establishment

## United Kingdom



Ryosuke Kodama  
Post-Doctoral Fellow  
Oxford University 1990

## Japan

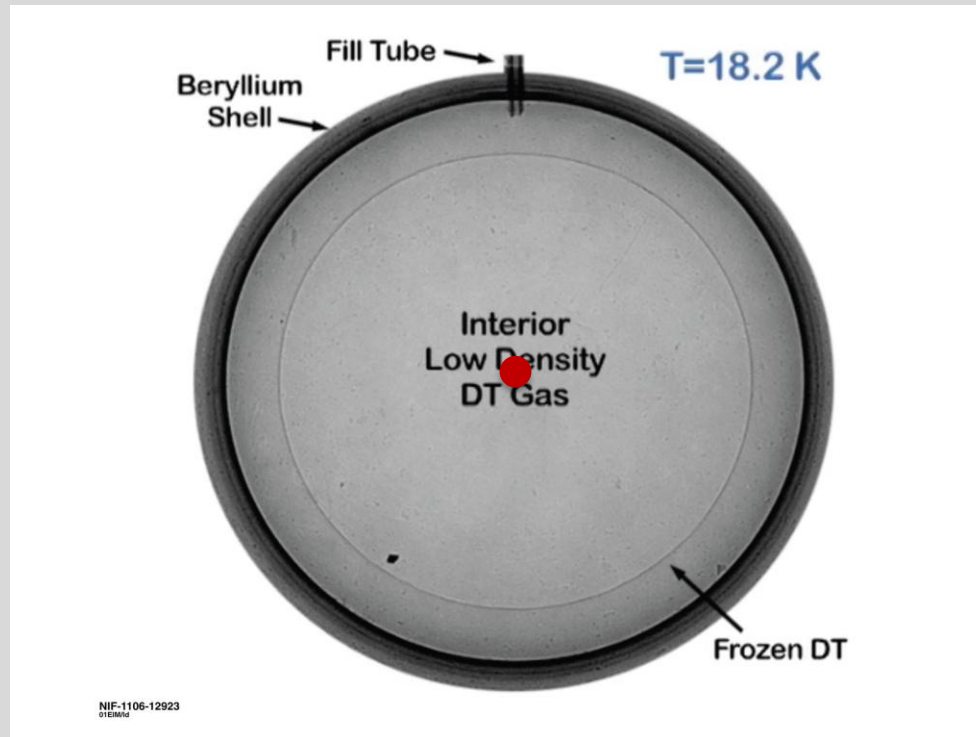


Peter Norreys  
JSPS Post Doctoral Fellow  
ILE Osaka University 1988

# International Recognition of Japan-UK Collaboration

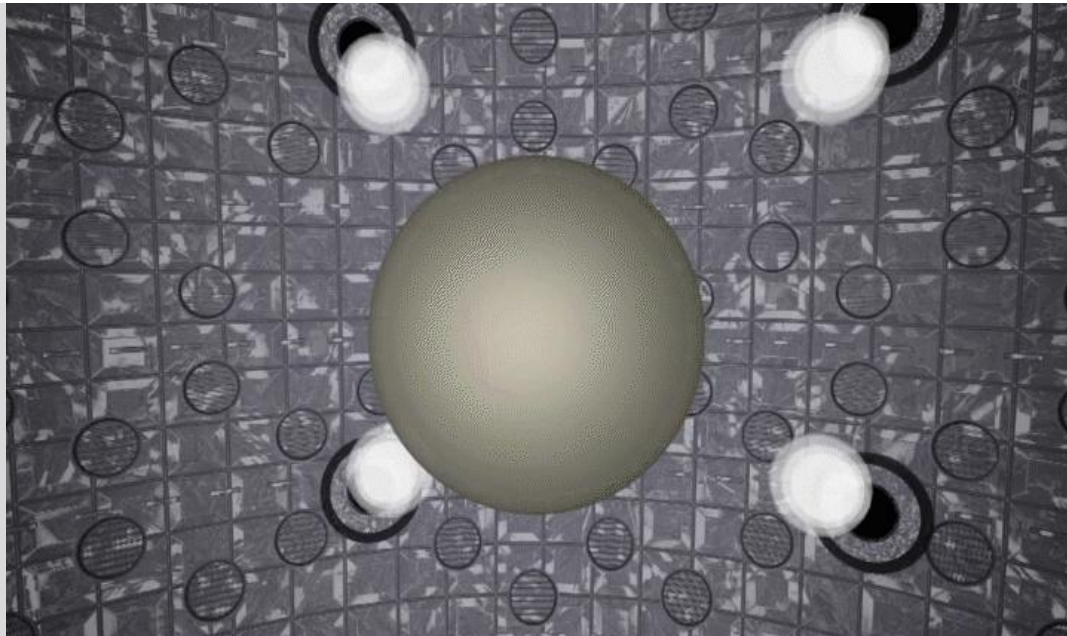
- 1994** Anglo-Japanese Daiwa Foundation's Daiwa-Adrian Prize for X-ray Laser Research
- 2006** American Physical Society's "Award for Excellence in Plasma Physics Research"
- 2007** Anglo-Japanese Daiwa Foundation's Daiwa-Adrian Prize for HED Physics Research
- 2021** American Nuclear Society's "Edward Teller Medal Award" (Ryosuke Kodama)
- 2023** American Nuclear Society's "Edward Teller Medal Award" (Peter Norreys)

Pressure × Volume = constant × Temperature





# Compression of Fusion Fuel



**Fusion Energy:**

70g water  
(carbon free)

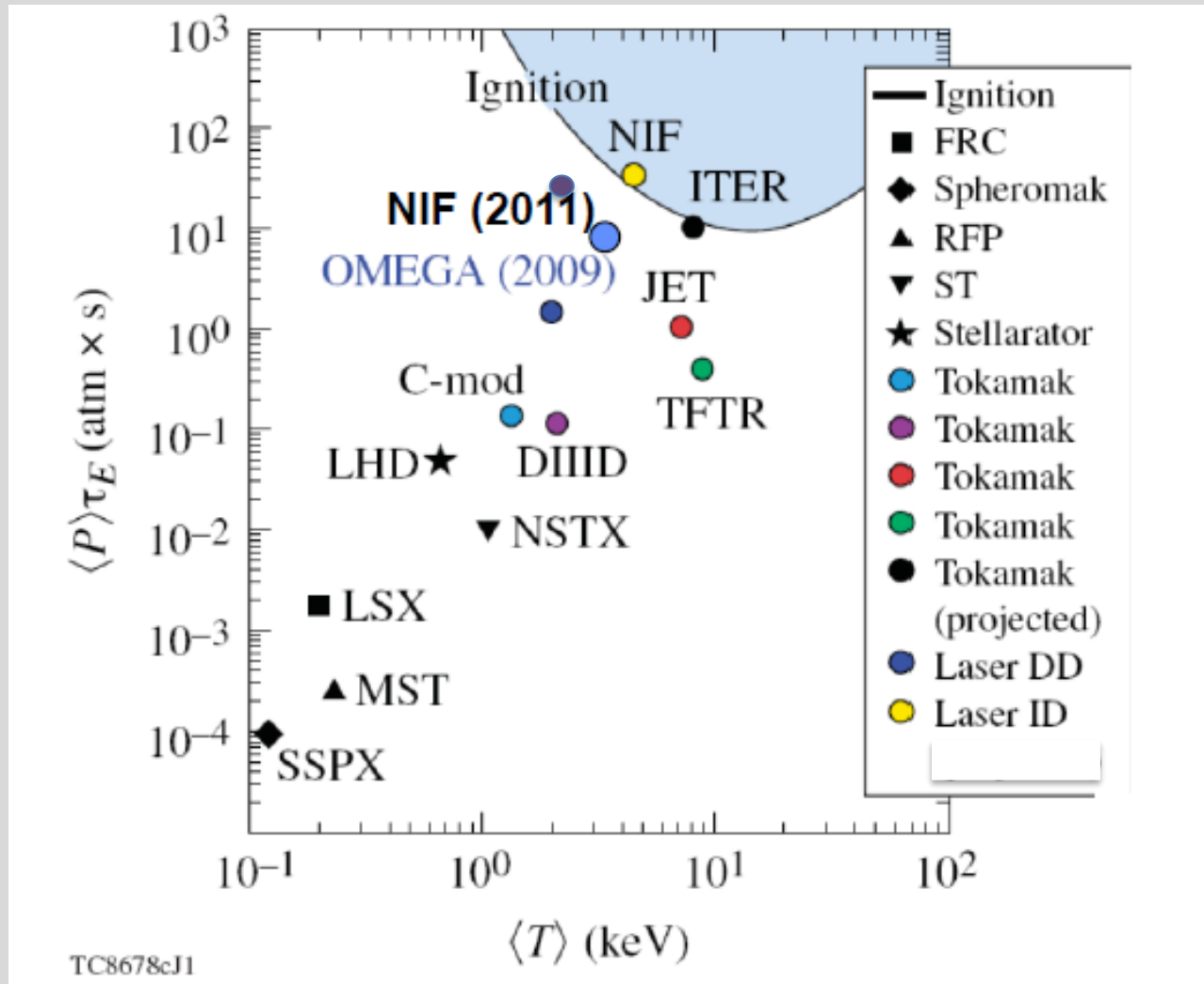
**=**

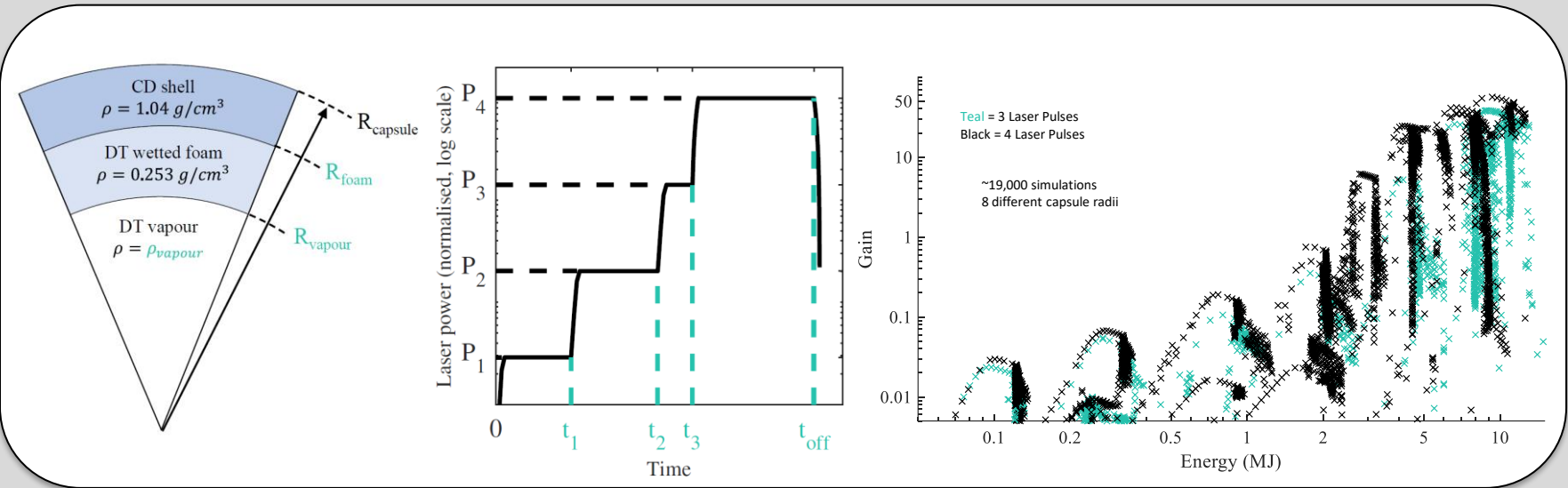
**Chemical Energy:**

Super-tanker full  
of oil

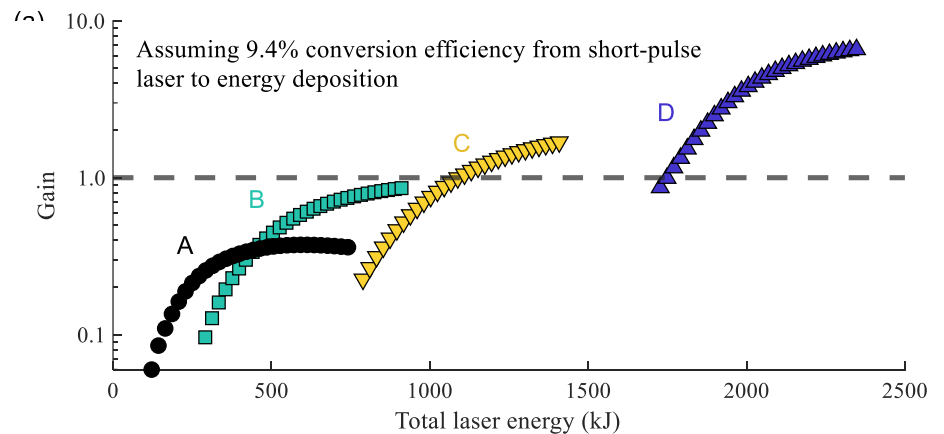
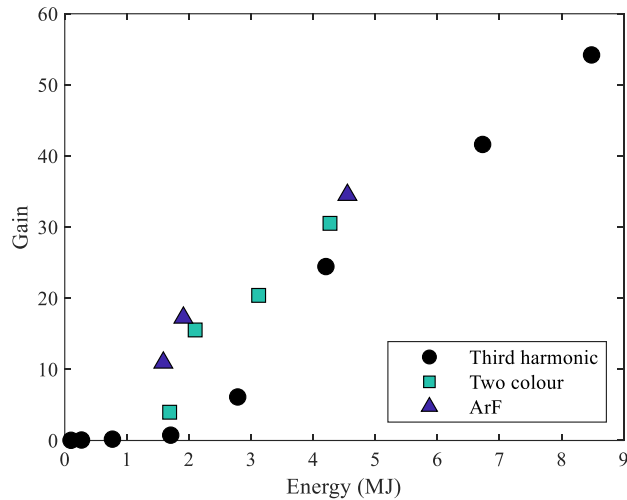


allows comparison of different fusion devices

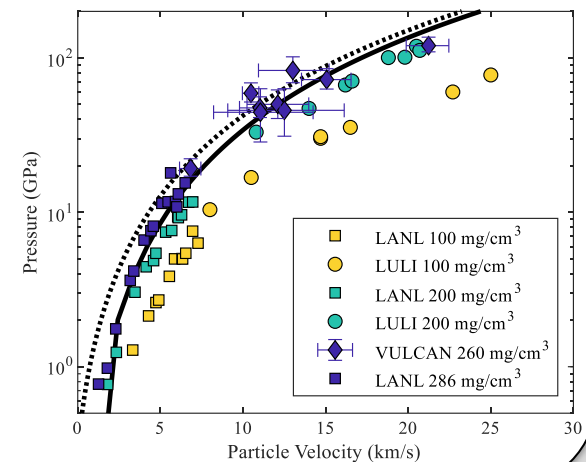
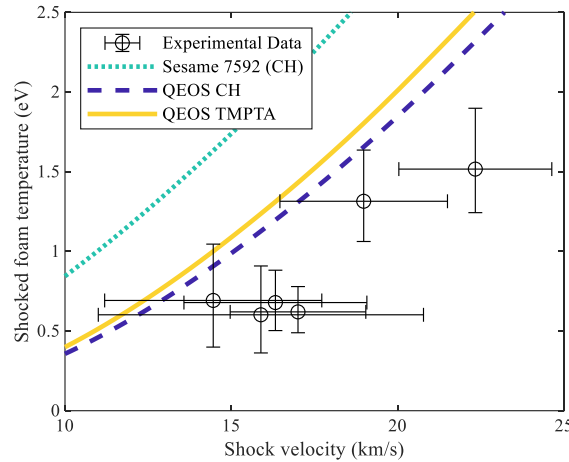
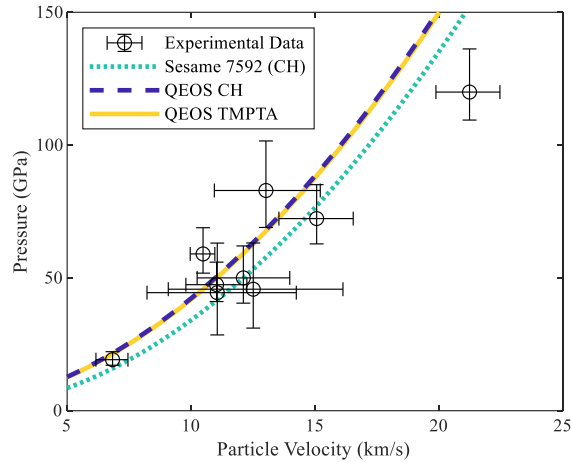




- An optimisation campaign used 1D simulations to explore the possible direct-drive performance of wetted-foam capsules in an expected 'low-instability' regime - achieved by restricting key variables (Convergence Ratio, In-Flight Aspect Ratio, Implosion Velocity, and  $I \cdot \lambda^2$ ).
- Results included gains of  $\sim 0.2$  for 800 kJ,  $\sim 0.8$  for 1.7 MJ, and  $\sim 50$  for 8.4 MJ.

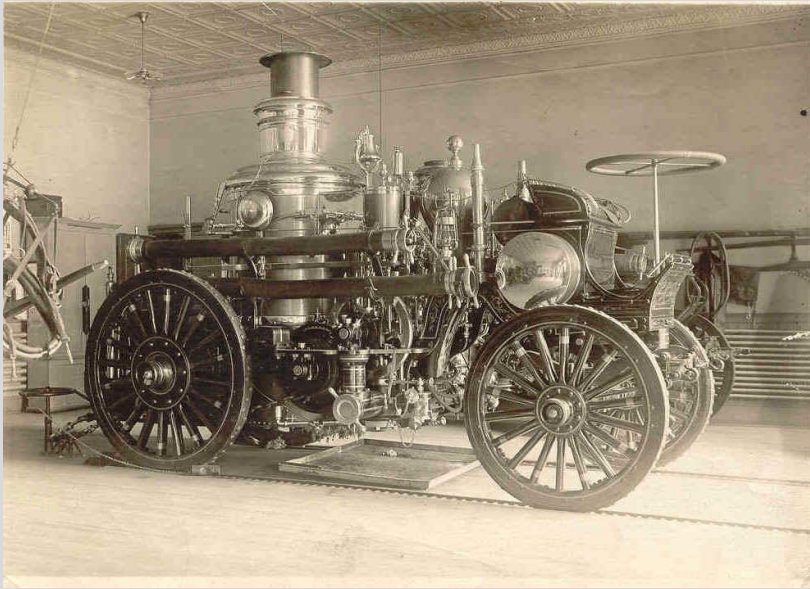


- **Further simulations showed that performance could be significantly improved using higher frequency lasers, or a novel ‘two-colour’ laser scheme.**
- **Auxiliary heating of third harmonic implosions was investigated using relativistic electron beams, and also demonstrated significant improvements to fusion performance.**



- A VULCAN experiment was performed in Jan/Feb 2022, using interferometry and streaked optical pyrometry to measure principal Hugoniot data for ICF-relevant plastic foams at 260 mg/cm<sup>3</sup>.
- Results showed agreement with previous experiments, and suggested that this foam can be well approximated using the EOS for homogenous plastic at low density

UK-Japan experiments planned for the GEKKO XII facility Dec 2024



## Jet Engine



PublicDomains.net

## Internal Combustion Engine



Ferrari



# Company overview

**Founded in 2022, US company**

## US and Japan sites

- Headquarters: Palo Alto, CA (Silicon Valley)
- CA Office & Lab: Goleta, CA (Santa Barbara)
- Japan entity: Tokyo office, Osaka lab

## World renown team of innovation experts

- Target modelling and fabrication
- Laser beam combination & optical enhancement cavity
- Target injection & reactor design

## Experienced growth stage commercialization team

- Gov program & commercial business development
- Site planning for power plant design & construction
- IP, legal, regulatory & export compliance



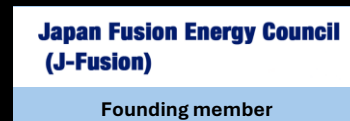
Shuji Nakamura, Ph.D.  
CEO, Co-Founder  
Board Member



Hiroaki Ohta, Ph.D.  
CTO, Co-Founder  
Board Member



Richard Ogawa, Esq.  
General Counsel, Co-Founder  
Board Member



**“COMMERCIALIZING LASER FUSION TO SAVE OUR PLANET”**

- High energy density plasma science is increasing in importance for industry and society
- The UK and Japan should consider joint training of next generation scientists
- A 20 MJ laser facility will address many issues in fundamental physics





We are working together to develop a new carbon-free source of electricity for humankind's future.

Fusion energy is difficult and is a multi-generational endeavour.

Deep and long-lasting international cooperation will accelerate progress.