



Update from AWE

UK IFE Meeting
26-27th March 2024

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AWE has a longstanding interest in ICF

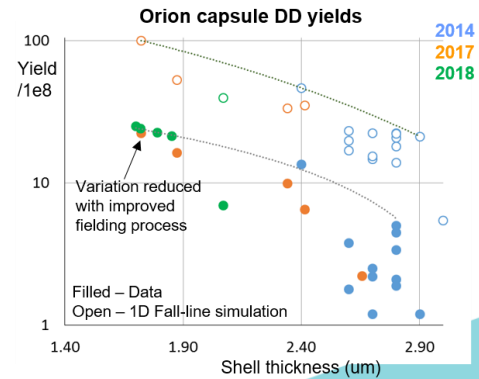
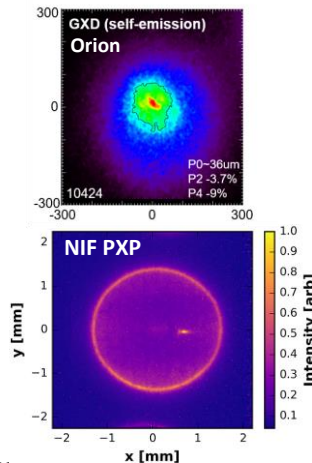
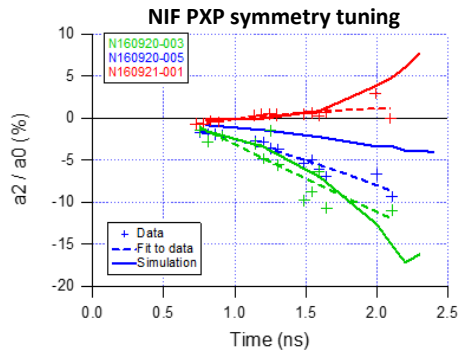
- Historically: successful demonstration by UK during 1980s¹
- More recently, through involvement in NIF HED and ICF programs (and elsewhere)
- Although AWE (currently) has no IFE remit, it can carry out research in ICF
 - Access to exciting new regimes²
 - Understanding fundamental physics of HED
 - Cutting edge field drives improvements in diagnostic & code capabilities and often highlights new physics
 - Development of high gain and/or robust physics platforms
- The achievement of ignition on NIF has further stimulated interest

1. Evans R. 2010 *Phys. World* **23**, 23. (doi:10.1088/2058-7058/23/03/34)

2. Randewich et al 2020 *Phil. Trans. R. Soc. A* 378: 20200012

Our interest is not restricted to conventional indirect drive ignition

- AWE has strong capability in indirect drive, with proven hohlraum physics capability, and experience of delivering campaigns at NIF
- We also have experience of fielding direct drive implosions at Orion, Omega and NIF
- Orion's combination of LP and SP for advanced schemes
- Reinvigoration of MHD capability



1. Ellison et al, 2018 PoP 25 072710
2. Gatu-Johnson et al 2018 PoP 25 056303
3. Garbett et al 2019, IFSA

AWE is strongly supportive of UK effort in ICF/IFE

- Recognise need for healthy, vibrant UK HED community, with strong knowledge base and world leading expertise
- Involvement includes
 - OxCHEDS centre and studentships on HED physics
 - Imperial Post doc and studentships
 - Warwick studentships, with emphasis on ODIN development
 - Participation in Fusion Energy CDT with York
 - Interest in participating in UPLiFT (tbc)

AWE's HED program has an increased emphasis on capability

- Presents increased opportunity for collaboration
- Have agreed more frequent academic access on Orion during Vulcan shutdown
- Further opportunity for collaborative experiments as appropriate
- LLNL experiments related to Fast Ignition are also scheduled for Orion later this year

AWE's future HED facility strategy is currently being developed

- Continued engagement with NIF, including continued funding of a joint diagnostic development program¹
- Mid-life refurbishment of Orion, with capability uplift (details tbc)
 - Improved SP capability (1kJ, 3PW)
 - Increased LP energy
 - Ultra SP capability, for drive and diagnosis
- Investment in national capabilities (e.g. EPAC LP beam - tbc) to enhance scientific opportunities
- Enhanced collaborations in Target Fab and diagnostic development

1. Randewich et al 2020 Phil. Trans. R. Soc. A 378: 20200012

Beyond Orion/Vulcan 2020, a larger scale laser would need to be built as a national facility

- Facility to meet needs of both HED and ICF
- >200kJ direct drive implosion capability for ICF research
 - This scale of facility would occupy a niche as an R&D facility
 - Ignition or sub-ignition scale?
 - With favourable physics ~200kJ could be ignition scale for direct drive SI, but this would be marginal
 - Assume multi-MJ facility is prohibitively expensive
- Additional synergies if co-located with other facilities
- A classified capability would be necessary for AWE

A large-scale UK facility raises a number of questions

- Appropriate scale and purpose of facility (given likely timescales and progress of field)
- Rep-rate technology?
- Could the UK community support/operate a facility of this scale?
- When/where will direct drive ignition be demonstrated?
- Relationship with international projects (e.g. HiPER+)
 - Is UK likely to build large dedicated facility if collaborating in HiPER+?
- Target Fabrication needs – UK capsule capability?
 - Capsule capability as a broader issue regardless of facility

Summary

- AWE has an interest in the study and advancement of ICF, both direct and indirect drive, and other approaches.
- AWE supports the need for a strong UK HED community and is investing significantly in external partnerships
- HED program has increased emphasis on capability – broader opportunity for collaboration in support of basic physics, capability development, diagnostics, etc
- Orion is available through academic access and collaborative work
- Proposed HED facility strategy includes Orion refurb/uplift and investment / enhanced collaboration
- Beyond the lifetime of Orion, facility strategy proposes a UK national facility for HED and ICF research