QUEEN'S UNIVERSITY BELFAST

SCHOOL OF MATHEMATICS AND PHYSICS

Advancing technology to support stable ion acceleration at multi-Hz repetition rates

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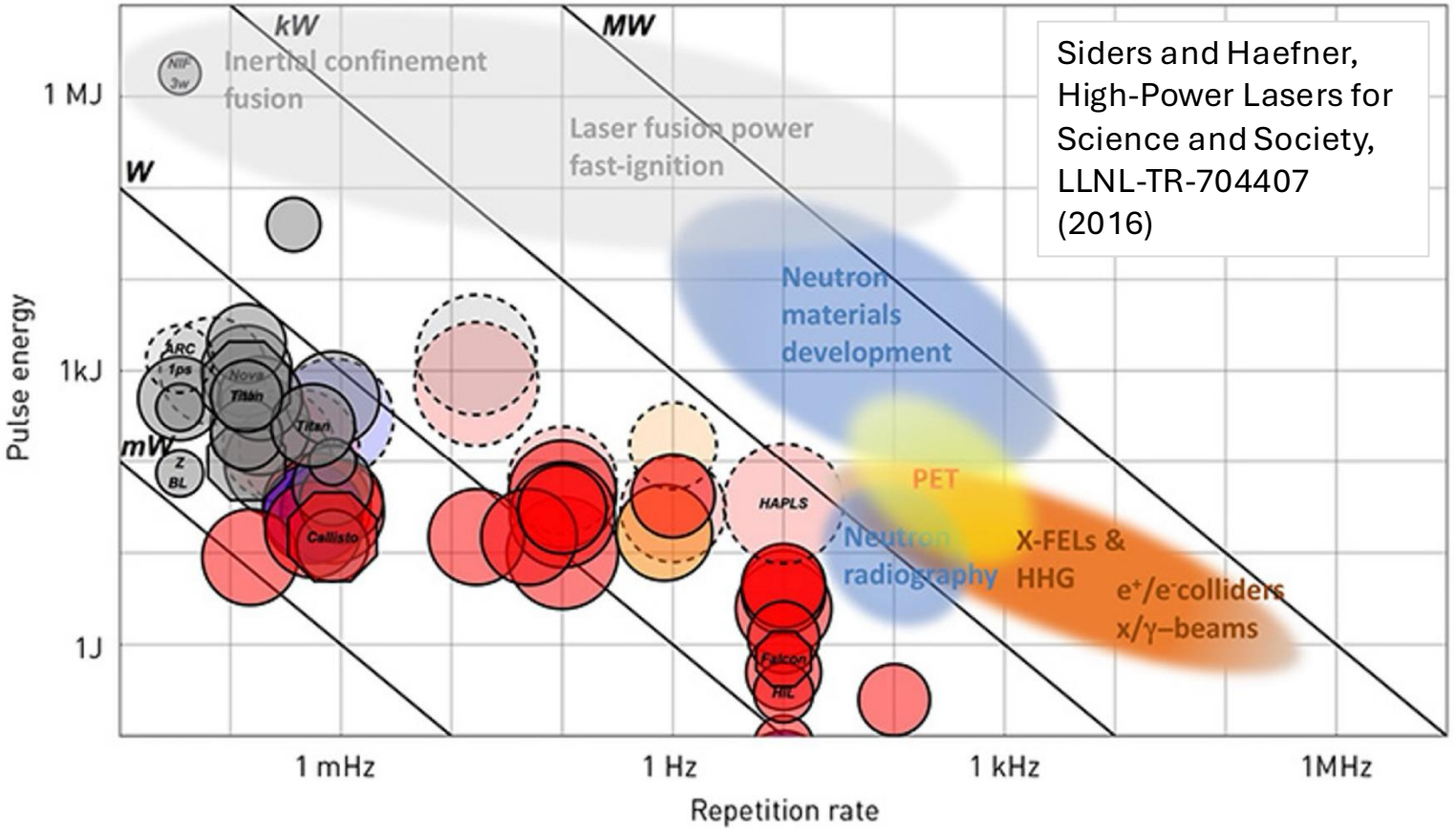
Exploitation of multi-Hz high-intensity laser facilities

- Growing number of high repetition rate, high intensity lasers available for ion acceleration.
- Multi-Hz is advantageus for scientifical study and a necessary step in exploitation of secondary sources.
- Yet, most experiments involving laser-solid interactions do not operating routinely at Hz.
- Due to technological challenges with targetry, diagnostics and control.



Siders and Haefner, High-Power Lasers for Science and Society, LLNL-TR-704407 (2016)

- Many groups are working on solutions with some duplication of effort.
- Challenging to get access time to support developments.
- Difficult to change processes/infrastructure at established facilities.

Purpose of this mini workshop

Science and Technology Facilities Council

UK is constructing a new 10 Hz high-intensity laser facility (EPAC) aimed at providing laser-driven sources for application.

Short focal length target area (EA2) is not yet finalised providing the opportunity to shape design decisions to support community needs.

Workshop seeks to gather community experience and seed collaborative development.

Extreme Photonics Application Centre (EPAC), CLF

Workshop goals:

- Review current operating procedures and development focus at international facilities.
- Discuss challenges, development avenues and collaborative opportunities.
- Output: white paper/perspective summarising current status, challenges and potential solutions.

What are the challenges impeding multi-Hz operation?

1. Refreshing targets and target alignment
    1. Tape drives, Liquid targets, variable thickness cryogenic ribbons?
    2. Automated alignment systems?

2. Debris and damage to components through prolonged operation
    1. Debris diagnostics – high frame rate cameras, witness slides

3. Online diagnostics
    1. Scintillators – decay time? Quenching? Calibration opportunities?

4. Shot-to-shot stability
    1. Key parameters impacting stability -
    2. Automated parameter stabilization – which parameters are crucial?
    3. Automated feedback?

5. Others?

Schedule for the discussion

1. ~~Introduction to workshop goals: 16:05 –16:15~~
2. Review of facilities: 16:15-16:50
   - CLF's EPAC (UK) – Chris Armstrong
   - SCAPA (UK) – Robbie Wilson
   - LBNL's BELLA iP2 (USA) – Aodhan McIlvenny
   - HDZR (Germany) – Ulrich Schramm
   - ZEUS (USA) – Veronica Contreras
3. Mixed discussion of challenges: 16:55-17:45
   1. Refreshing targets and target alignment – Robbie Wilson
   2. Debris and damage – Nick Dover
   3. Online diagnostics – Chris Armstrong
   4. Shot-to-shot stability – Aodhan McIlvenny/Jonathan Kennedy
4. Wrap-up – outlook: 17:45-18:00