

Protons and Ions for Europe



Protons and Ions for Europe

- High intensity proton and ion drivers are of utmost importance for almost every scientific discipline
 - Neutron and muon sources for material science and medicine
 - High intensity beams and colliders for fundamental physics
 - Studies of atomic nuclei and nuclear processes
- Major accelerators are moving into delivery phase
 - SPIRAL2
 - ESS
 - DONES
 - Long lead times - now need to look to future plans
- Other facilities are making important plans for next generation facilities
 - ISIS
 - CERN



Aims

- Improve performance
 - Limitation from beam intercepting devices (target, foil)
 - Limitation from collective effects
- Improve reliability
 - Loss and damage mechanisms
- Improve cost & sustainability
 - Power efficiency
 - Capital cost and new facility footprint
- Supported by latest techniques
 - Digital Twinning & Machine Learning



2026-TECH-01-01

- Aim of this topic is to deliver innovative scientific instrumentation, tools, digitalisation, methods and solutions
 - Research and development of new scientific instrumentation, tools, digitalisation, and methods for research infrastructures;
 - Technology validation and prototyping;
 - Training of RI staff
 - Potential for industrial exploitation of the solutions
- Minimise the research infrastructures' environmental footprint and increase resilience
- Should include at least three different research infrastructures as beneficiaries
- Should reach TRL3-4 by end of project (validation in lab environment)



Work Packages

- Propose 8 work packages
 - 1 Management
 - 2 Linear accelerators
 - 3 Ring accelerators
 - 4 Targets and Moderators
 - 5 Magnets
 - 6 Radiofrequency cavities
 - 7 Beam Instrumentation
 - 8 Computing, Machine Learning and Digital Twins
- Noting that sustainability is an important input that will impact every WP



WP1: Management

- Management work package will:
 - Provide overall management of the Research and Innovation Action
 - Support financial and project management
 - Ensure timely release of Deliverables and Milestones
 - Support regular meetings of the team
 - Support equality and gender dimension activities within the project
 - Ensure compliance with EU data management



WP2: Linear Accelerators

- Linear Accelerator technology improvement
 - Linac design
 - Ion source development
 - Laser stripping of H^-
 - Advanced stripping foil development
 - Loss mitigation techniques
 - Uncontrolled H^- stripping
 - Beam stability



WP3: Rings

- Ring development to deliver novel beams
 - Extreme bunch compression techniques
 - FFAs and beam stacking
 - Mid-pulse length extraction



WP4: Targets and Moderators

- Advanced target technologies to deliver the next generation sources:
 - Fluidised Tungsten target
 - Liquid metal target/dump
 - Advanced target wheels
 - Liquid metal neutron reflectors
 - Target instrumentation



WP5: Magnets

- Magnet technologies to improve sustainability, reliability and beam performance
 - Advanced kicker designs
 - High aperture permanent magnets
 - FFA magnet designs
 - Pion capture solenoid based on HTS technology



WP6: RF

- RF technology to deliver versatile and efficient performance
 - Improved MA and vacuum cavity structures
 - High efficiency klystrons and solid-state power sources
 - Breakdown and cavity degradation phenomena and mitigation



WP7: Beam Instrumentation

- Advanced instrumentation techniques
 - Non-linear BPMs for full beam reconstruction
 - Gas monitors and advanced vacuum systems
 - Novel reconstruction tools for ionisation profile monitors
 - Laser diagnostics for H⁻ sources



WP8: Computing

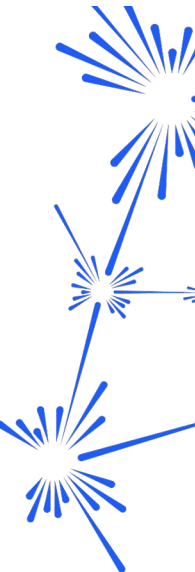
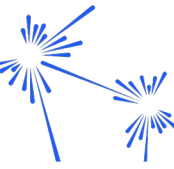
- Development of computing modelling tools important
 - Machine learning for operational reliability and optimisation
 - Development of precise software tools and models
 - Benchmarking against codes and real machines



Timeline

- **February 2025:** First draft resource requirement. Start writing words.
- **March-April 2026:** First draft proposal, distribute. Final draft resource requirement.
- **April-May 2026:** Editing
- **1st June 2026:** Submission

- Call Opens: 10th March 2026
- Submit Deadline: 16th June 2026



Next Step

- Bring working groups together for focused discussion
- Propose Tuesday 24th February and Friday 27th February:
 - See <https://indico.stfc.ac.uk/event/1848/>
- Develop material and resource requirements
- <Spreadsheet>

