

EUROPEAN  
PLASMA RESEARCH  
ACCELERATOR WITH  
EXCELLENCE IN  
APPLICATIONS



# View from EPAC

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EAAC, September 2023

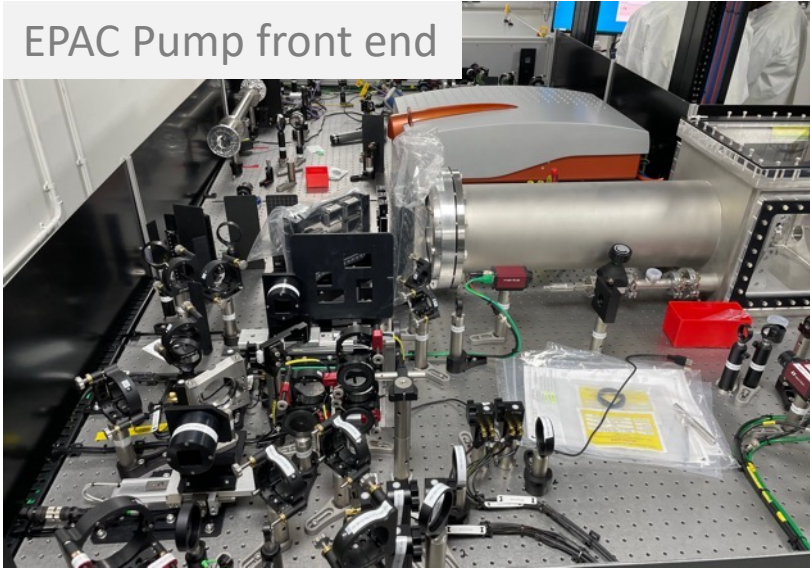


- EPAC will host a 1PW laser at 10Hz driving plasma accelerators
- Designed for 10GeV electron beams and energetic protons, ions and secondary radiations
- £100M investment from the UK government in plasma accelerators
- Ideally placed to start with **10Hz** (20Hz), laser-driven plasma accelerator arm of EuPRAXIA
- Significant internal expertise on all aspects of laser-plasma accelerator technology – both within STFC and via PWASC
- 100Hz laser-driver and plasma-based FEL development in progress



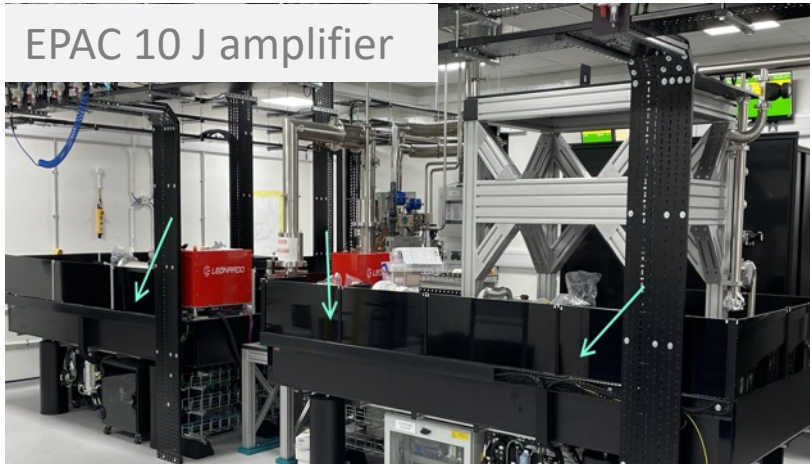
**Building completed; installations ongoing;  
commissioning in 2025, operations in 2026**

EPAC Pump front end

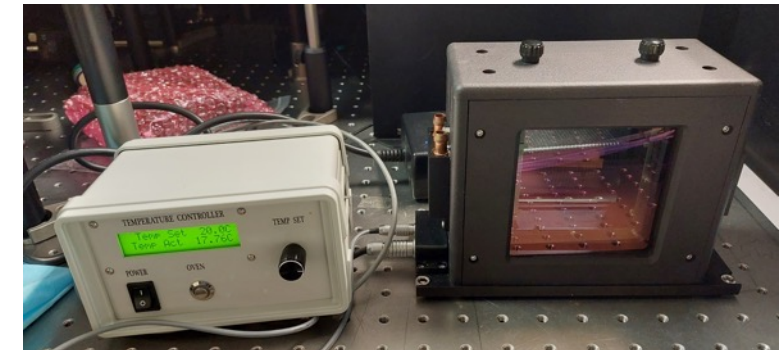


EPAC 100 J amplifier

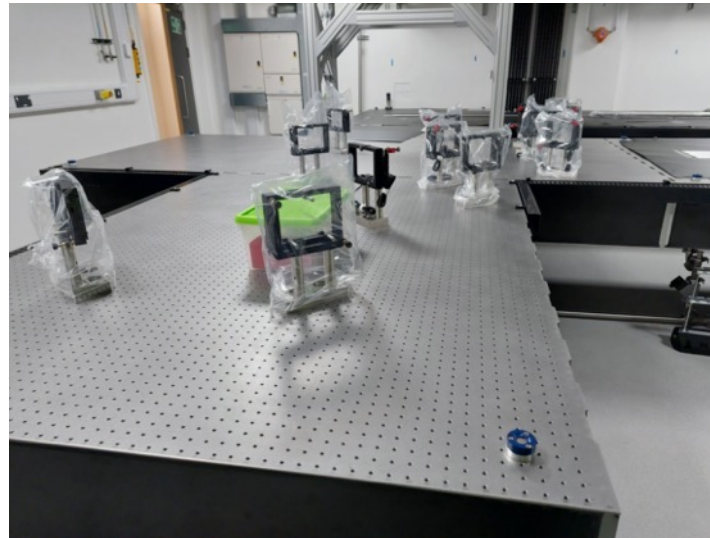
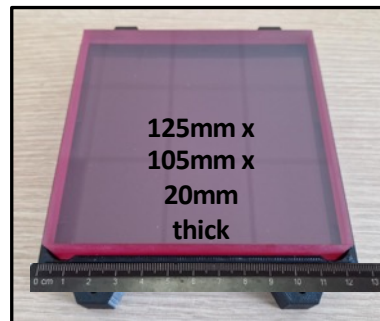
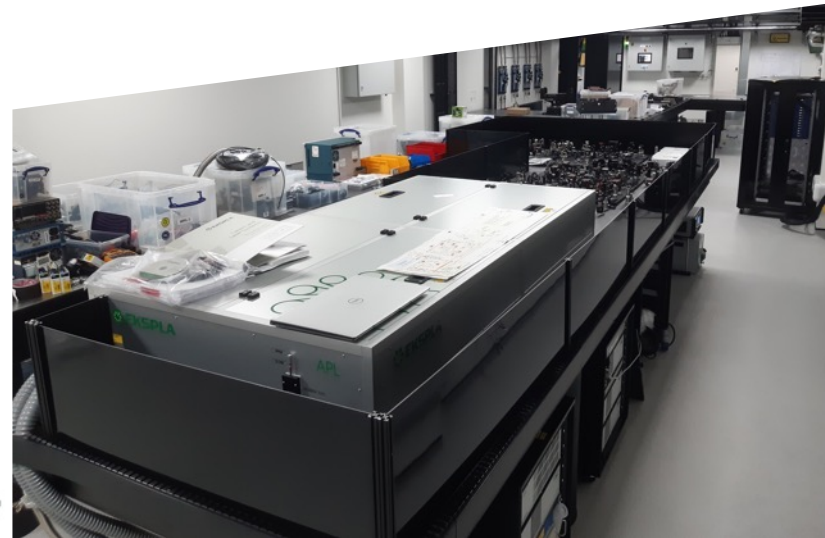
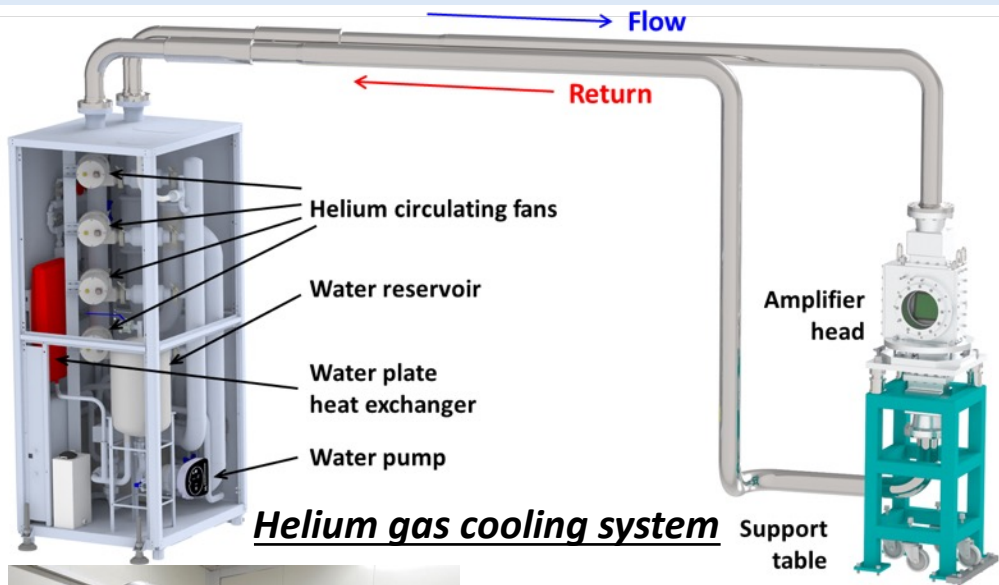
EPAC 10 J amplifier



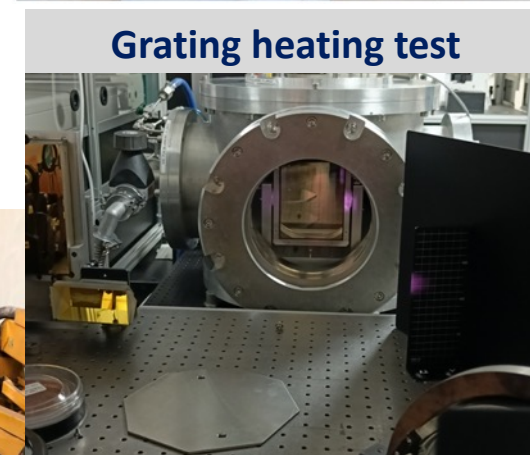
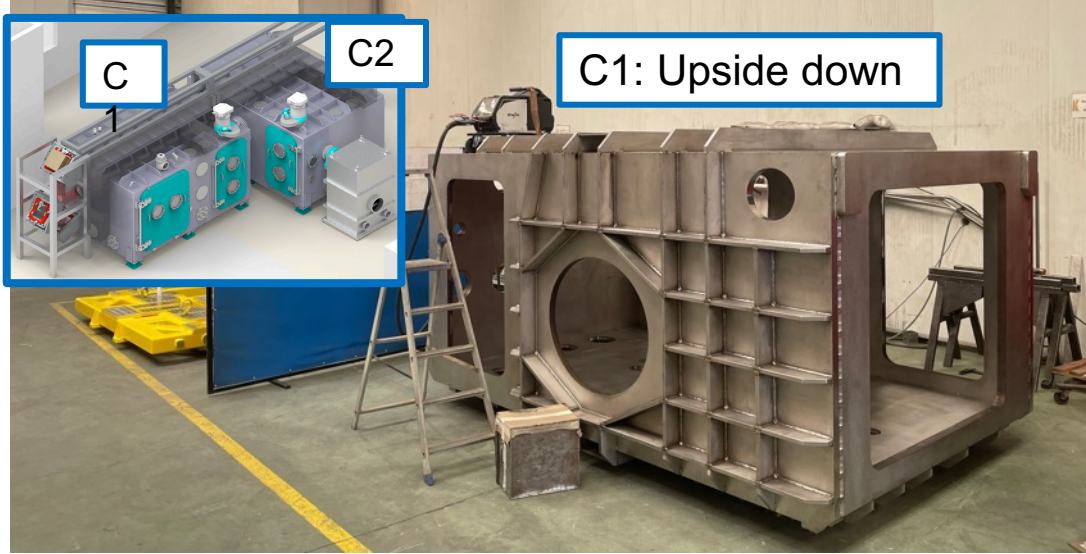
- Most components are installed and tested
- Only a few remain to be installed (100J FAT, blast shields etc.)
- SHG – components in place – working on converting square beam to circular
- Finishing installation in October and starting commissioning in November



# EuPRAXIA Ti:Sapph amplifier is getting ready for installation



- 4 crystals available
- Cooling system and amplifier head will arrive in October
- Front-end being installed



- Compressor chambers being manufactured in Spain
- Delivery of chambers and breadboards expected in the New Year
- Floor being prepared to grout them onto the floor
- **Standard gold gratings**
  - Have substrates – need polishing – contract to be placed for gold gratings
- **MLD gratings**
  - Have a prototype - LiDT and diffraction test are good. Conducting longevity test



- **Cooled gold gratings**
  - Initial work confirmed that water cooling grating is feasible option to meet the flatness requirement. Testing impact of mounting
  - Currently testing a prototype; initial results show good cooling



### Preparation of area

- Granite support for focusing chamber in place
- Beamline 1 floor hole pattern drilled

### Vacuum chambers

- Focusing chamber and Target chamber manufacture started – expected delivery for both Dec 2023 / Jan 2024





Space for a second beamline  
The building can be extended beyond the existing footprint

## Option 1 – Extending EA1

- EA1 is 40m long – but only ~ 20 m after the plasma source
- Enough length to get gain for 1GeV beam but not saturation
- Need extension for 5GeV cases as well as user area
- Some setup can be done in parallel with operations but will have disruptions and require shut-down to fully implement. **Not ideal solution**

## Coherent Radiation Sources using Plasma accelerators



CRISP



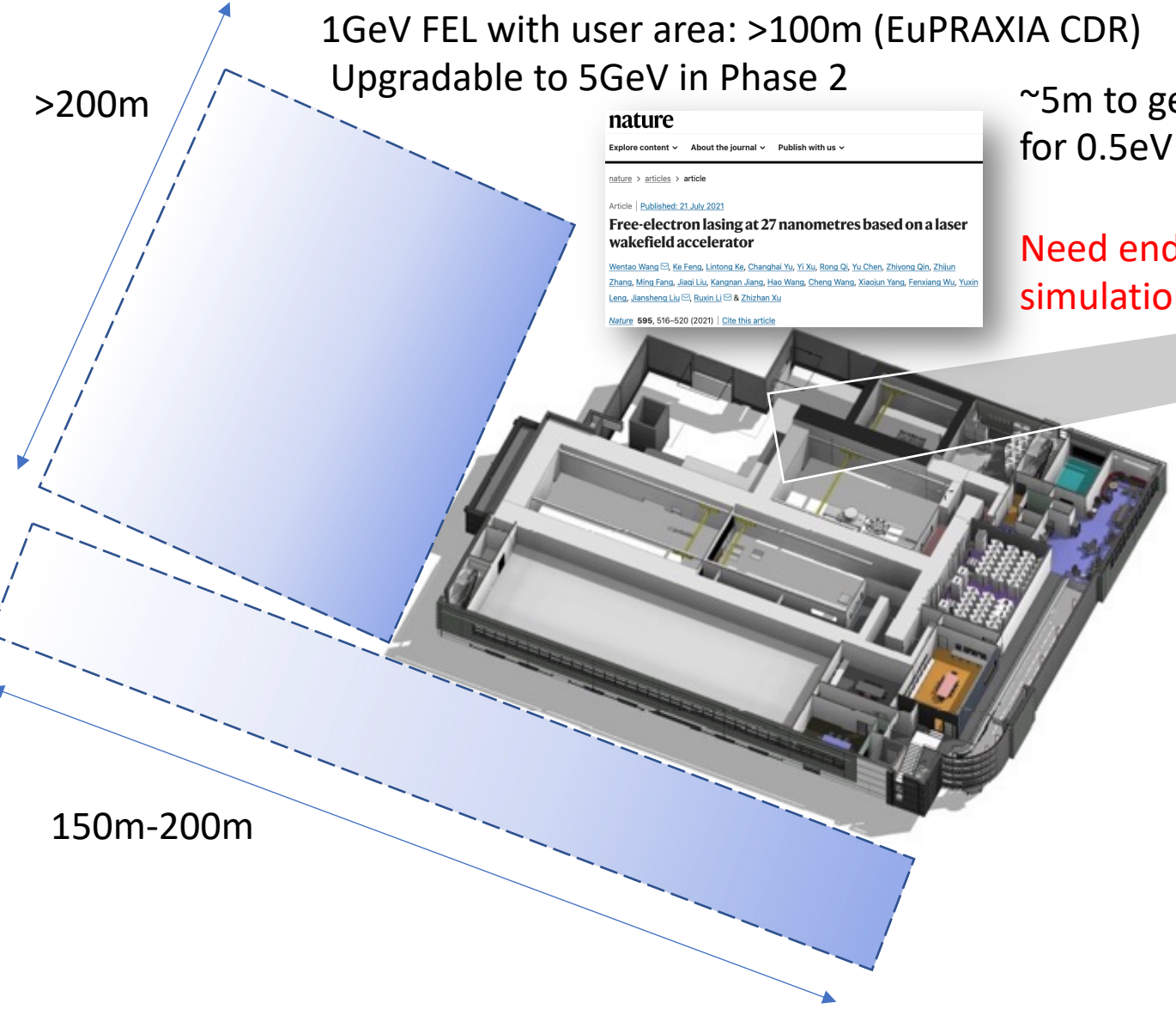


1GeV FEL with user area: >100m (EuPRAXIA CDR)  
Upgradable to 5GeV in Phase 2

~5m to get saturation for 0.5eV beams?



**Need end-to-end simulations**



**Option 2 – Building an Annex**

- Surrounding areas are green/brown fields
- Earmarked for “large science” – so extendable
- More expensive but more ideal in the end
- Can divert 10Hz PW beam to start with
- Easy to transport the 100Hz, ~100TW beam
- **Building works and beamline construction can go in parallel with operation of EPAC**

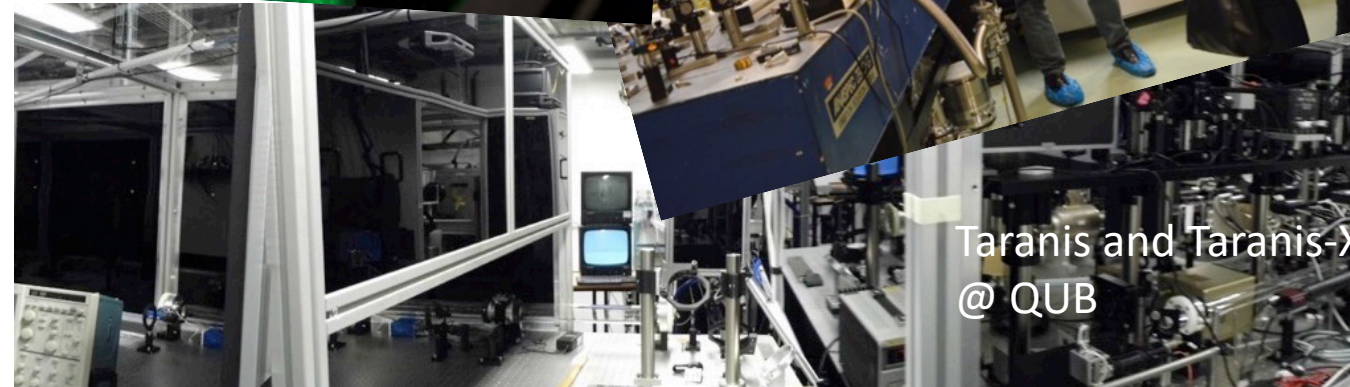
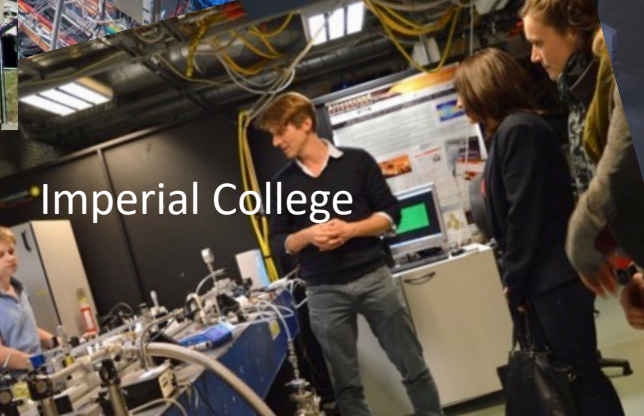
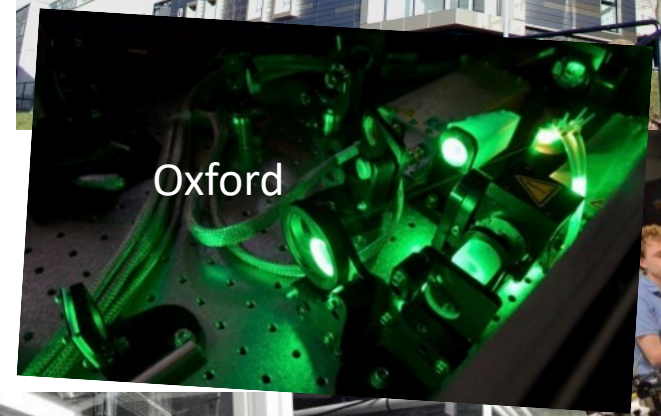
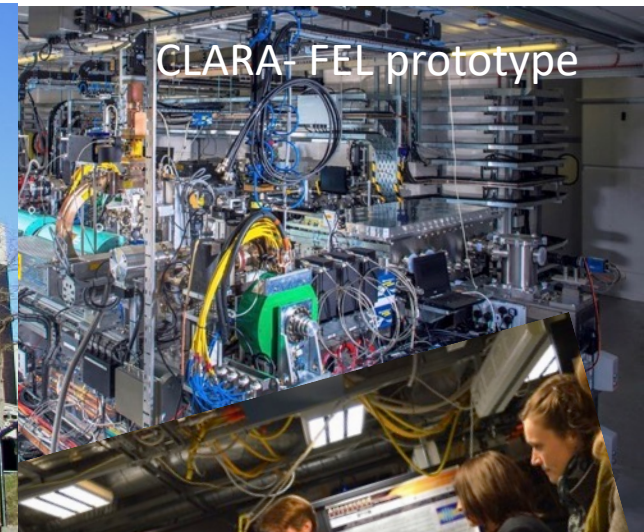


UK CoE will focus of the design and delivery of Applications Beamlines in Sites 1 & 2

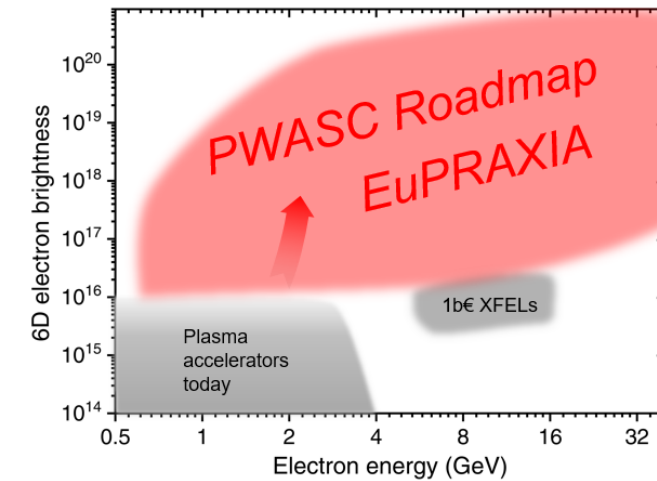
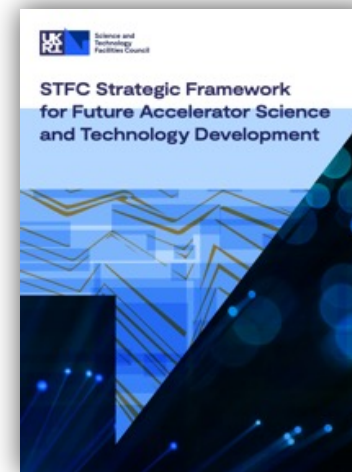
The UK University Centers, Accelerator Institutes and the CLF are leaders in the underpinning science and technology

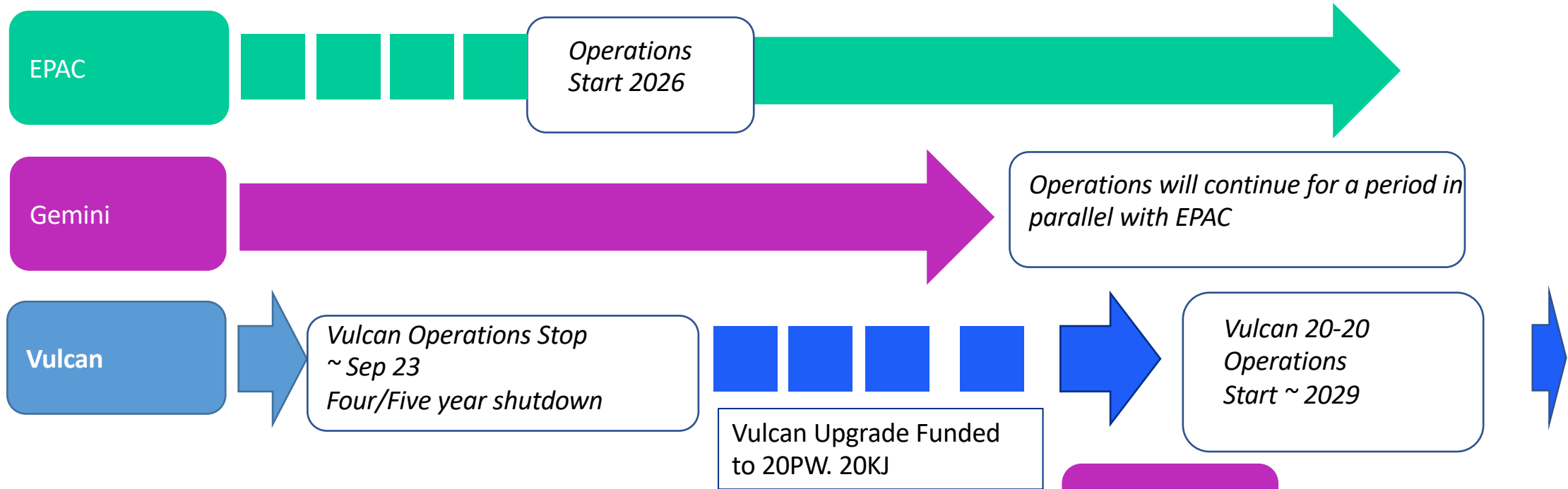
The UK PWASC coordinates activities in this area in the UK

PWASC discussed and agreed for **STFC-ASTeC** to be the **nodal point of UK Centre of Excellence**



- EPAC's operations to start in 2026 – EuPRAXIA can be built on this – EPAC will be a **plasma accelerator facility** (not just a laser facility)
- **Propose to start with 10Hz PW beam with 100Hz upgrade option (under development)**
- Has the capacity to expand the EPAC building to house the additional beamlines – EuPRAXIA @ EPAC
- Strong **expertise** within **STFC** (lasers and accelerators) and the **academic community** (plasma accelerators)
- EPAC's applications-oriented program and industry links would help EuPRAXIA
- STFC has **long history** and **all the infrastructures** required to run a successful user programme
- STFC's Accelerator Strategy now includes development of plasma accelerators
- **Need to explore viable funding options with EuPRAXIA management**
- **UK has re-joined Horizon EU – Removes a potential roadblock to EuPRAXIA@EPAC**





**Recruiting Senior Laser Scientists/Plasma accelerator physicists/control/data specialists**

For the people who **Want to** be part of incredible projects