



Science & Technology
Facilities Council

STFC Strategy and Accelerators

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Outline

- What is STFC's overall strategic direction?
- How do particle accelerators fit in to that?
- What are we doing?



The Research Councils



RESEARCH
COUNCILS UK

- Arts and Humanities Research Council
- Biotechnology and Biological Sciences Research Council
- Economic and Social Research Council
- Engineering and Physical Sciences Research Council
- Medical Research Council
- Natural Environment Research Council
- Science and Technology Facilities Council

A new vision for new times

Impact through inspiration and innovation



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A new vision for new times



“In these tough economic times for our world we look to science to provide new solutions, new technologies, new opportunities to further our common goals”

– Rt Hon Gordon Brown, Prime Minister



“At such a difficult moment, there are those who say we cannot afford to invest in science, that support for research is somehow a luxury at moments defined by necessities. I fundamentally disagree. Science is more essential for our prosperity, our security, our health, our environment and our quality of life than it has ever been before.”

– President Barack Obama



“All we need is one vision.”

– Freddie Mercury





- The Science and Technology Facilities Council makes strategic investments to support world leading science and technology for the UK. These investments include large scientific facilities used across the research base.
- **Our vision is to maximise the impact of our knowledge, skills, facilities and resources for the benefit of the United Kingdom and its people.**

Impact through inspiration and innovation.



- **Why does a world in financial crisis need particle physicists or astronomers, or big expensive science projects or facilities?**
- Weathering a global recession demands an innovative and scientifically trained workforce, and our young people must be **inspired** to become part of that workforce.
- The interlinked challenges of the 21st century – energy, global climate, health and security concerns – demand scientific and technical **innovation**. Successful innovation depends upon the highest quality **research facilities**, and new ways of bringing technology and applications together between **industry and academia**.

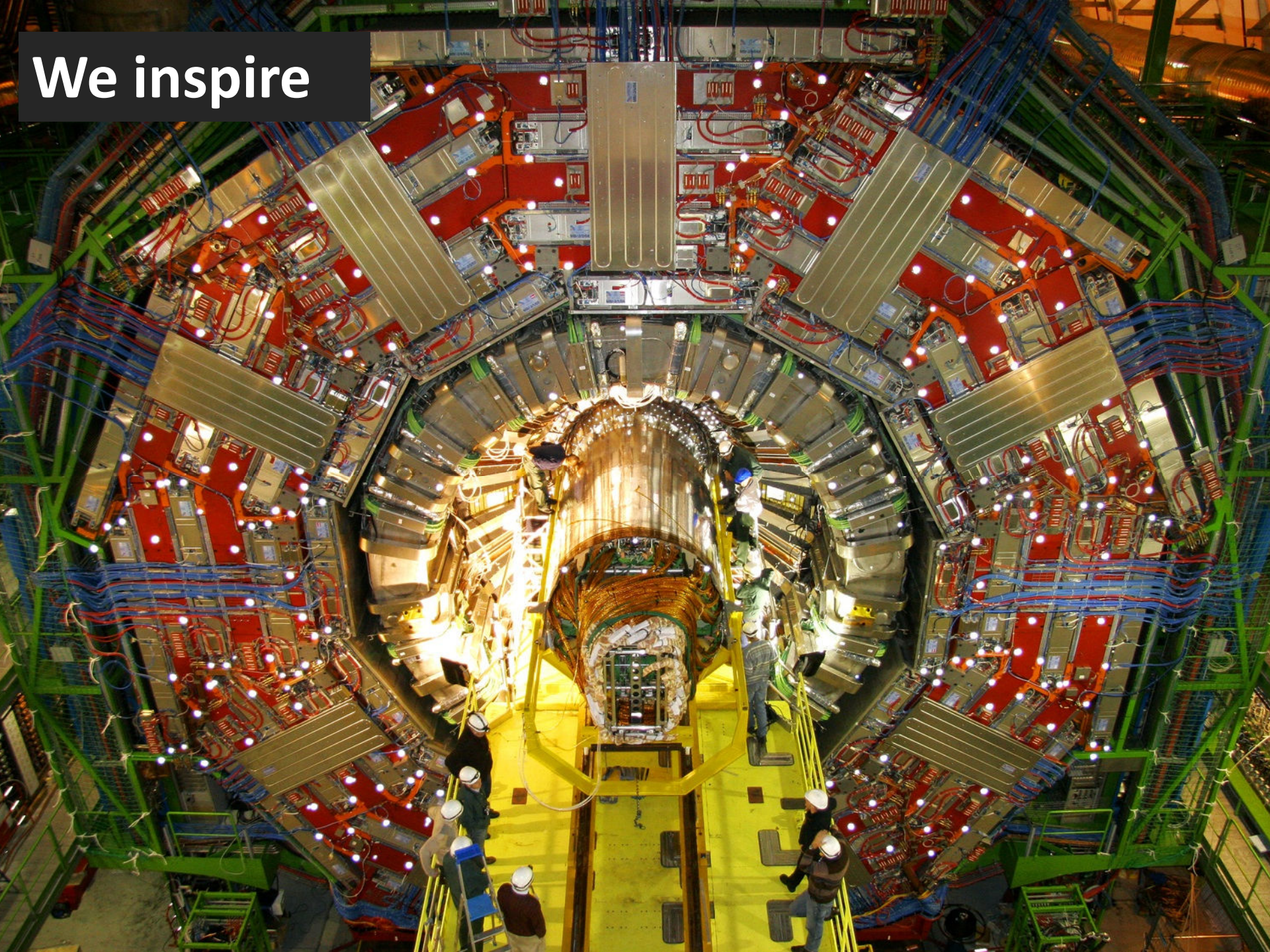
Impact through inspiration

- In some sense only 20-30% of our astronomy and particle physics programmes are about understanding the Universe – the approximate percentage of students who go on to become astronomers or particle physicists. These programmes are mainly about inspiring young people towards STEM subjects, with a huge impact on the economy and society.



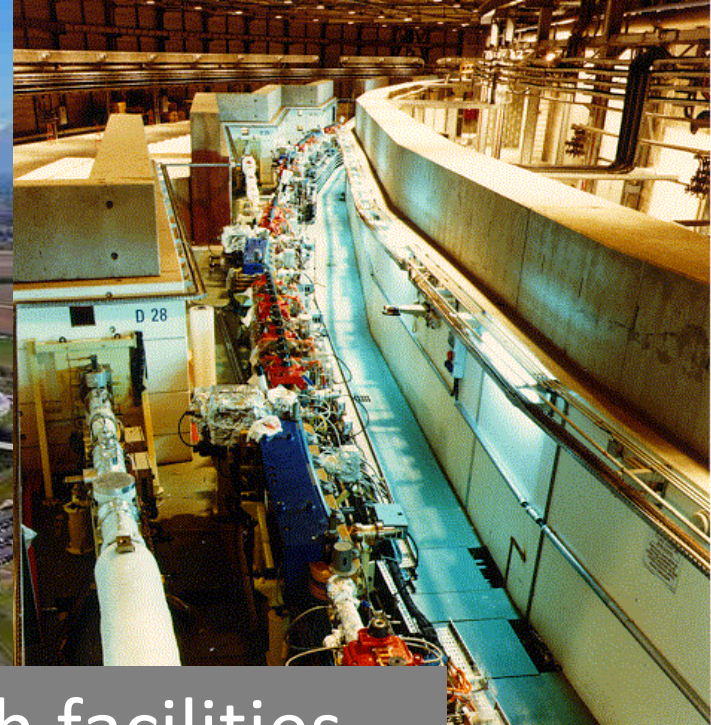
We excite

We inspire





- The US Census Bureau has estimated that each science PhD is worth an additional **\$2.2M** to the economy; we support over **250** PhD students every year.
- A survey of first year physics students in 2007 asked what subject areas had attracted them to study physics. The top three were particle and quantum physics, nuclear physics, and astrophysics; **90%** of the students expressed a significant interest in at least one of these areas.



Interdisciplinary research facilities



Infrastructures for Impact

- The breakthroughs and developments of 21st century science and technology will be dominated by our ability to manipulate and image matter at the scales from single atoms (10^{-10} m) to living cells (10^{-6} m).
- This research requires large scale infrastructures and facilities that are beyond the operation of any single university or research group, or indeed sometimes any single nation. STFC's role is to plan, develop and operate these facilities for the UK so as to have maximum impact.



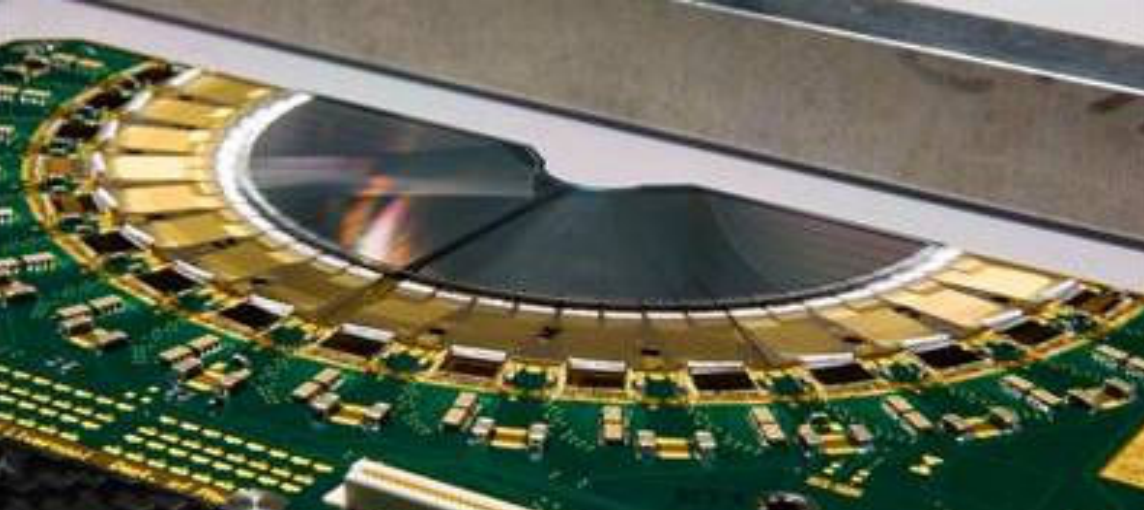
- Our facilities include intense light sources based on synchrotron storage rings and lasers, and powerful neutron sources, which can reveal the structure of artefacts, new materials or biological agents at the atomic and nuclear level.



Impact on new challenges

- We have identified four areas of particular relevance to the challenges faced by society and the economy;
 - energy
 - biomedical research
 - climate and the environment
 - security
- We will be designating director level responsibility for each of these areas.
- We will increasingly look to prioritise impact in these areas when we plan how to direct our resources, in collaboration with the other Research Councils, Government and academia.





Opening the door
to Science and
Innovation

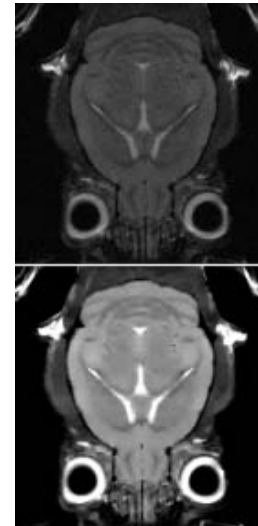
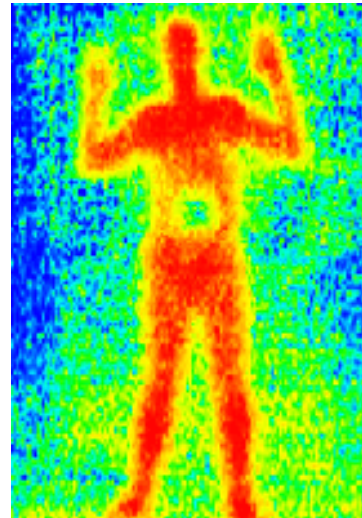
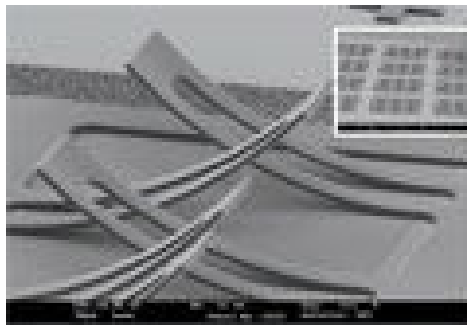


Driving innovation

The ambition of our projects attracts and inspires

– *It also drives technological innovation*

How do we make that technological innovation available to industry and society?





National Laboratories

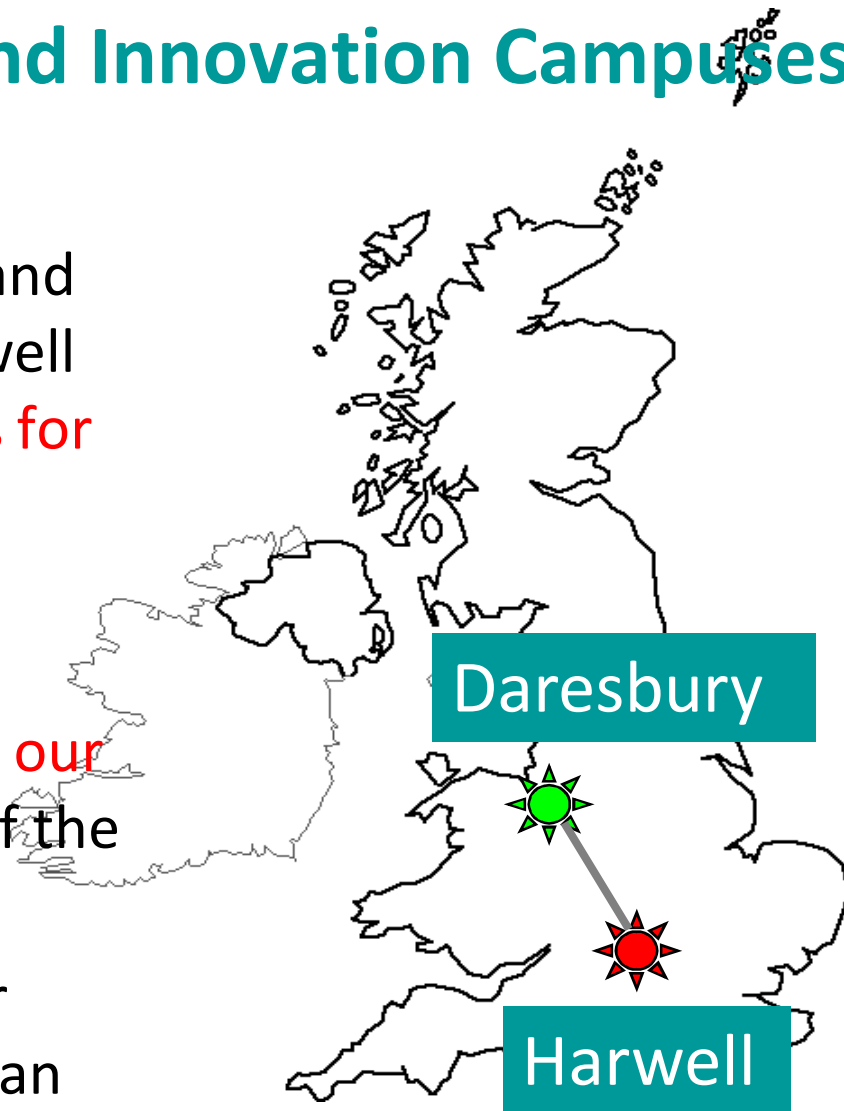
- In the 20th century, big science problems demanded the creation and application of a dedicated workforce in national facilities
 - Example: nuclear weapons and nuclear power
- In the 21st century we will find the solutions to our problems by *working with* the laboratories, and not purely by *work within* the laboratories
 - The challenges are more complex, more interdisciplinary and more inter-related

Laboratories → Science and Innovation Campuses



Science and Innovation Campuses

- We will develop the Science and Innovation Campuses at Harwell and Daresbury as **focal points for collaboration and knowledge exchange** with industry and academic researchers,
- Work to become **gateways to our in-house expertise** and that of the communities we support
- We will increasingly focus our technology competencies on an **outward facing collaborative role**



Accelerator science

- Over the past seven years, we have made a targeted and effective investment in accelerator science by setting up two UK-based accelerator science and technology centres, the John Adams Institute at Oxford/RHUL and the Cockcroft Institute located at the Daresbury Science & Innovation Campus.
- Together with UK universities and the STFC national laboratories, these institutes have revitalised the national skill base, attracted internationally recognised accelerator experts to the UK and increased the number of PhD students in this field tenfold.



Why Accelerators?

- Accelerator technology is a key enabler across a large fraction of our research
 - Particle and nuclear physics
 - Synchrotrons and free electron light sources
 - Neutron sources

Current programme

- Design studies for future science facilities
 - New Light Source project
 - Ultra short x-ray pulses for imaging dynamics
 - Future Neutron sources and Neutrino Factory
 - Ultra-high-power proton beams
- Operation of test facilities
 - ALICE and EMMA at Daresbury
 - MICE at RAL
- Work on novel techniques (FFAG...) and underlying technologies (SCRF...)
- Support of the Cockcroft and Adams Institutes, our in-house accelerator department, and university groups



- We are now exploring how we can exploit this skills base to develop transformative solutions to some of the major problems facing the nation:
 - in medicine, through the development of particle beam therapies for cancer;
 - in energy, through the development of safer nuclear reactors driven by particle beams;
 - and for the environment, by using accelerators to render nuclear waste less harmful.



Collaborations

- Working group with DIUS, MRC and EPSRC established as a point of contact for ministerial level discussions of hadron therapy in 2008
- STFC developing concepts with MRC and others for a development facility based on non-scaling FFAG proton accelerator
 - Would advance both hadron therapy and accelerator-driven reactor systems
- Organising accelerator science brainstorming workshops involving some of the key stakeholders
- Working with EPSRC and SUPA-supported researchers in novel laser driven acceleration techniques

Accelerator goals

- Our accelerator programme needs to support
 - Future particle physics accelerators
 - Future light sources and neutron sources
 - Solutions to important societal problems

A small dose of reality

- While the overall science budget has been protected, there are significant internal financial pressures on all the research councils
 - Money is tight
 - Not in a position to announce major new initiatives in the accelerator area – though we are certainly thinking how we would make the case in the next spending review (or to the next government?)
 - For now we need to work to obtain maximum leverage from existing investments and modest new initiatives

Next Steps

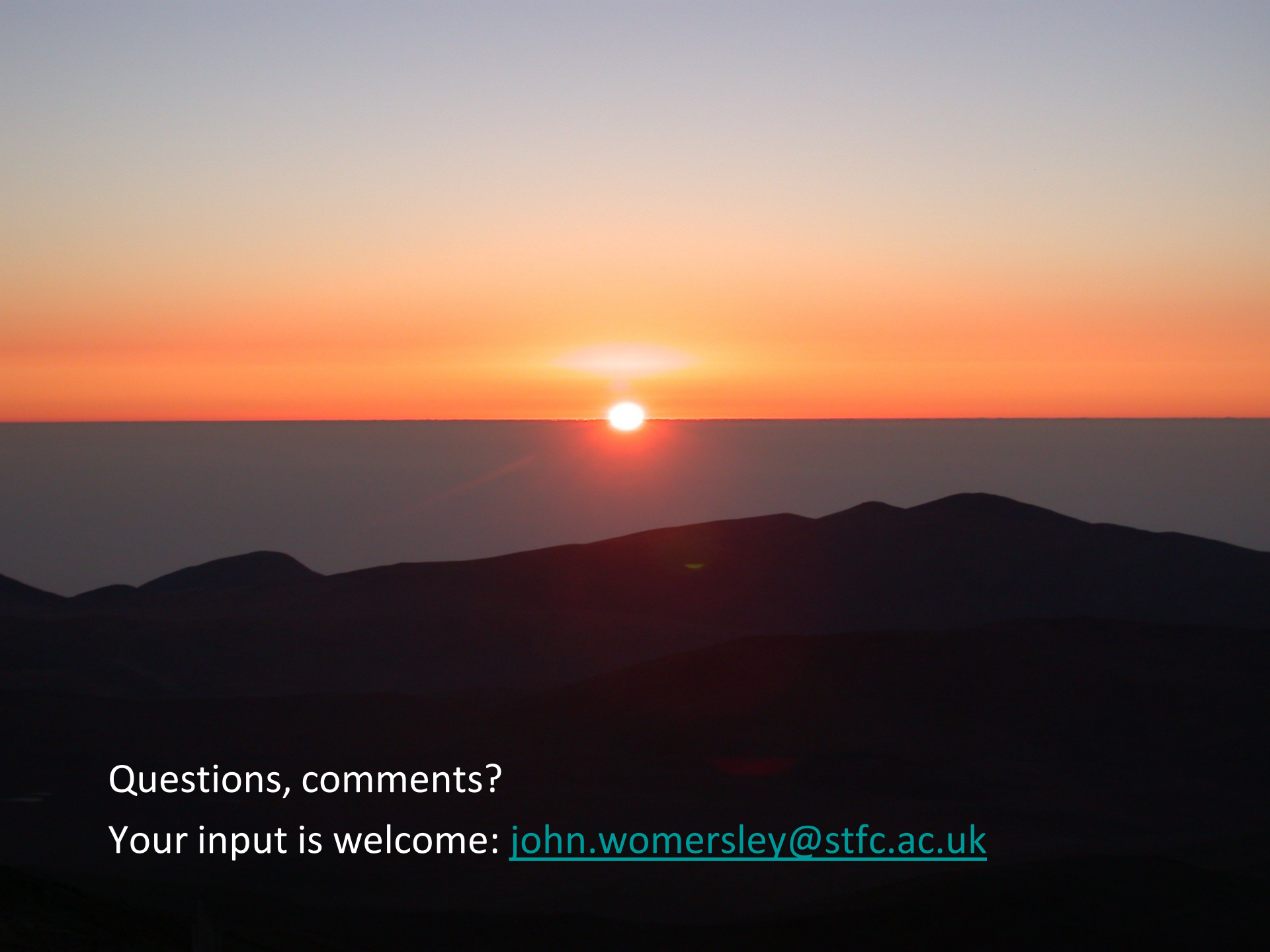
- At the Accelerator Workshop in Swindon in June it was agreed that STFC would develop a plan for how to move forward to take advantage of these new ideas
 - I am working on that
 - Also considering how accelerator science in the UK should best be organised

Your input welcome!



Conclusions

- We are in a different world from a year ago
 - STFC has developed a new vision for new times
 - Focused on impact
 - We support a substantial knowledge base in accelerator science
 - Want to work to maximise the impact of that knowledge base
- Overall financial situation is, and is likely to remain, tight



Questions, comments?

Your input is welcome: john.womersley@stfc.ac.uk