FUTURE CIRCULAR COLLIDER

IMPACT

Flagship particle accelerators at CERN drive the development of advanced technologies in partnership with academia and industry, supporting research and innovation beyond particle physics and providing an inspiring training ground for the current and future workforce.

The Future Circular Collider is a global research infrastructure that can strengthen and expand Europe's industrial base and make a strategic contribution to capacity building.

- **Stimulate** high-tech industry via long-term procurement and co-development.
- **Upskill** tens of thousands of early-career researchers.
- **Deliver** a net societal and economic gain even under conservative assumptions.
- **Inspire** and train new generations of scientists, engineers and innovators.

CERN

An engine of knowledge and innovation

The Future Circular Collider is a driver for disruptive technologies that are relevant in many applications:

Superconductors
→ fusion reactors, medical imaging, efficient power transport

Novel materials
→ aerospace, transportation, energy systems, medical technologies

Vacuum and cryogenics
→ hydrogen production and transport, refrigeration, industrial processes

AI, electronics and digital systems
→ sustainable industrial operations, sensors, digital healthcare, quantum technologies

Radiofrequency systems and powering
→ healthcare, broadcasting, semiconductors, manufacturing

Distributed computing and big data
→ communications, large-scale data-handling, long-term data preservation

Knowledge produced by humankind's curiosity about the Universe is a public good that has the potential to transform society:

Newton's theory of gravity
→ lunar landings, satellite launches

Maxwell's unification of electricity and magnetism
→ power generation, wireless communications

Quantum mechanics
→ transistor, laser, semiconductor electronics

Einstein's theories of relativity
→ GPS navigation, energy

Dirac's unification of relativity and quantum mechanics
→ Positron Emission Tomography, Magnetic Resonance Imaging

Benefits to other fields

Particle colliders drive cross-disciplinary exchange with

Nuclear and plasma physics
Astrophysics and cosmology
Atomic and molecular physics
Medical physics
Condensed-matter physics
Electronics
AI and machine learning
Mathematics and statistics
Computer and data science
Quantum technologies

CERN's unique accelerator expertise and technology fuel gravitational-wave astronomy, fusion research, space science, and advanced X-ray facilities that enable Nobel-prize-winning research in biology and chemistry.

for the 21st century

Flagship particle colliders at CERN provide a critical mass of technology, innovation and partnership that powers **knowledge transfer** activities beyond what the market or any single nation can deliver alone:

NUCLEAR MEDICINE CERN's MEDICIS facility produces unconventional radionuclides for research in medical imaging and emerging cancer therapies.

CANCER THERAPY based on a CERN-designed accelerator, CNAO and MedAustron have treated more than 9000 patients, while CERN's CLEAR facility investigates next-generation radiotherapy with very high-energy electrons.

SPACE TECHNOLOGY CERN's CHARM facility recreates the harsh radiation conditions found in space and particle accelerators, allowing validation of electronics and full systems.

FUTURE OF FLIGHT CERN and Airbus are exploring superconducting cables for the electrical distribution systems of future hydrogen-powered aircraft.

IMAGING Medipix readout chips developed at CERN are used in medical imaging, tumour treatment, dosimetry, nuclear safety, and cultural heritage.

OPEN ACCESS CERN's Zenodo platform supports 300,000+ researchers across 7500 organisations and underpins the EU Open Research repository.

SYNCHRONISATION White Rabbit timing technology developed at CERN is used by the financial sector, telecommunications and quantum-city networks.

Impact pathways

CERN spends **600 MCHF**, around half its budget, annually with Member State suppliers.

The Large Hadron Collider mobilised over **6000 companies**.

Working with CERN enhances a supplier's reputation and knowledge, enabling high-tech firms to enter **new markets**.

> **"Through our collaboration, we were given the opportunity to acquire know-how and state-of-the-art equipment."**

> **"I like the standard of the work required for CERN and it gives us the ability to keep up our higher-end product range."**

FCC: a sustainable investment

Cost-benefit analyses show that the Future Circular Collider has a **positive net present value**, even under conservative assumptions and including wider costs beyond investment and operation.

Socio-economic impact pathways include: scientific production; training of early-stage scientists, engineers and technicians; industrial spillovers; company spinoffs; open software and hardware; cultural benefits; and environmental benefits.

Public willingness-to-pay surveys show that people perceive the Future Circular Collider as delivering **value** beyond its annual cost to CERN Member States.

Person power

Around **5500** students, technicians and early-career researchers are being trained at CERN at any given moment, most of whom move into industry, applied science and public institutions.

→ The Future Circular Collider can extend this high-value **STEM pipeline** throughout the 21st century.

The Future Circular Collider is estimated to generate 800 000 person-years of employment, or **30 000 jobs** per year, generating regional benefits on a global scale.

CERN's inspiring goals and inclusive **education and engagement** activities boost trust in science, foster critical thinking, and counter misinformation.

7 million
Followers across all CERN social media platforms

1000
High-school teachers trained at CERN per year

25 000
Participants in CERN's education workshops per year

400 000
Annual visitors from 175 countries