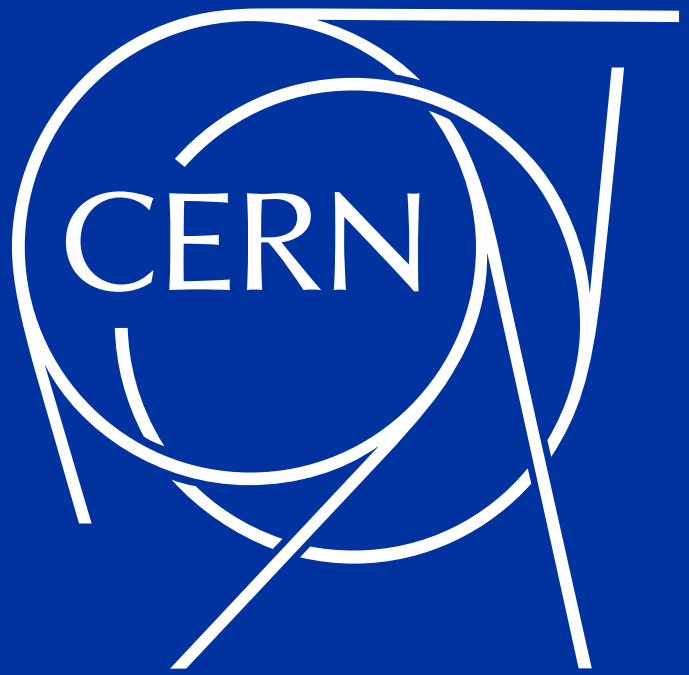
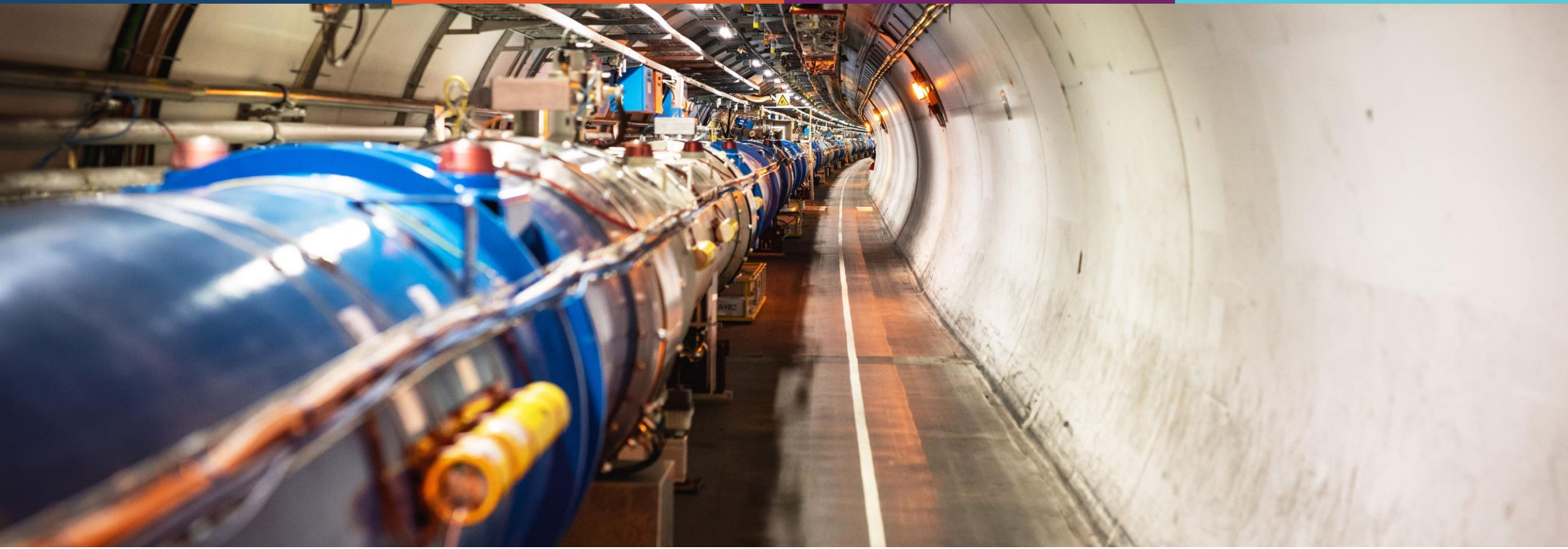
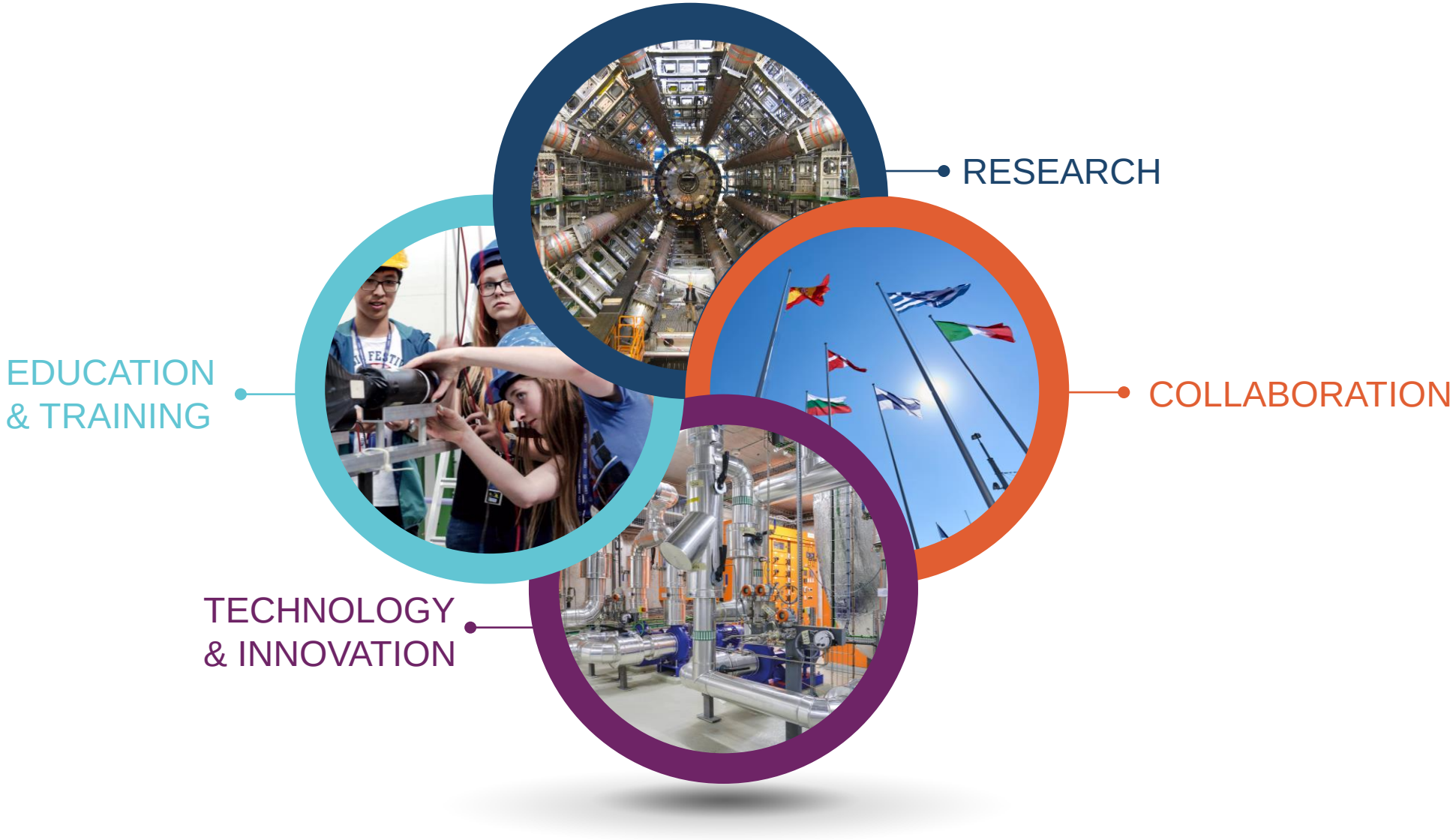

CERN



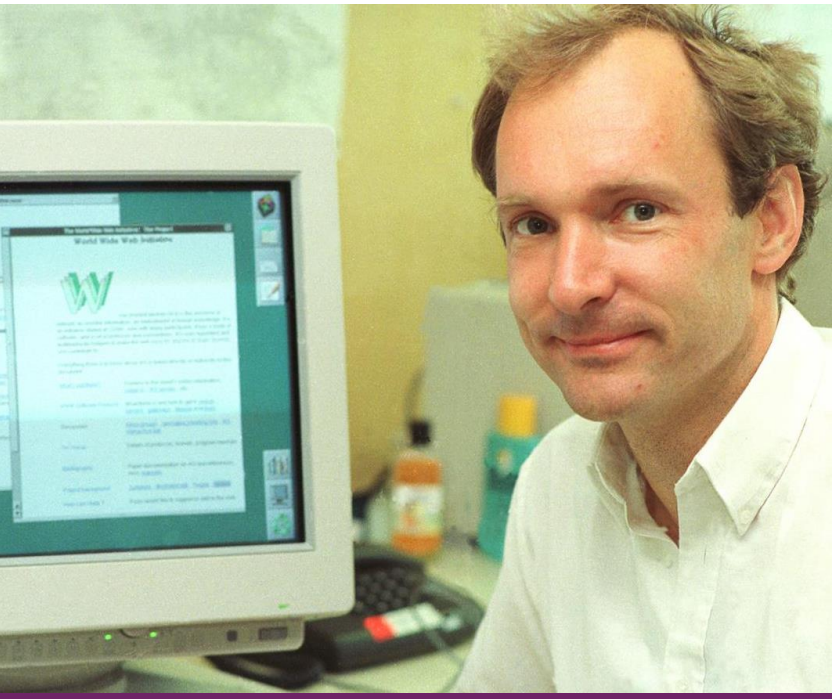
# The programme of KT for society and environment

Giovanni Anelli, Head of Knowledge Transfer Group, CERN

# Four pillars underpin CERN's mission

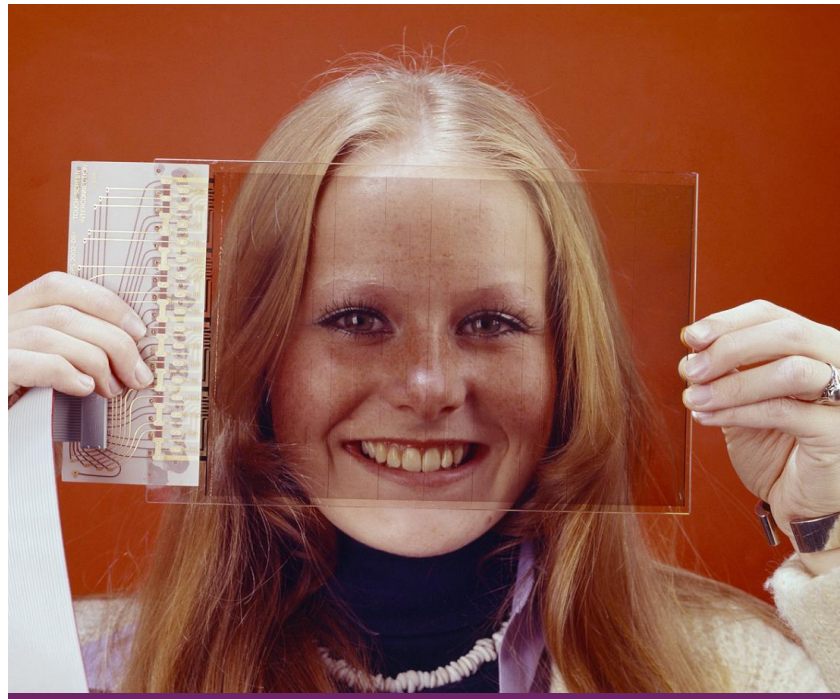


# Some historic examples



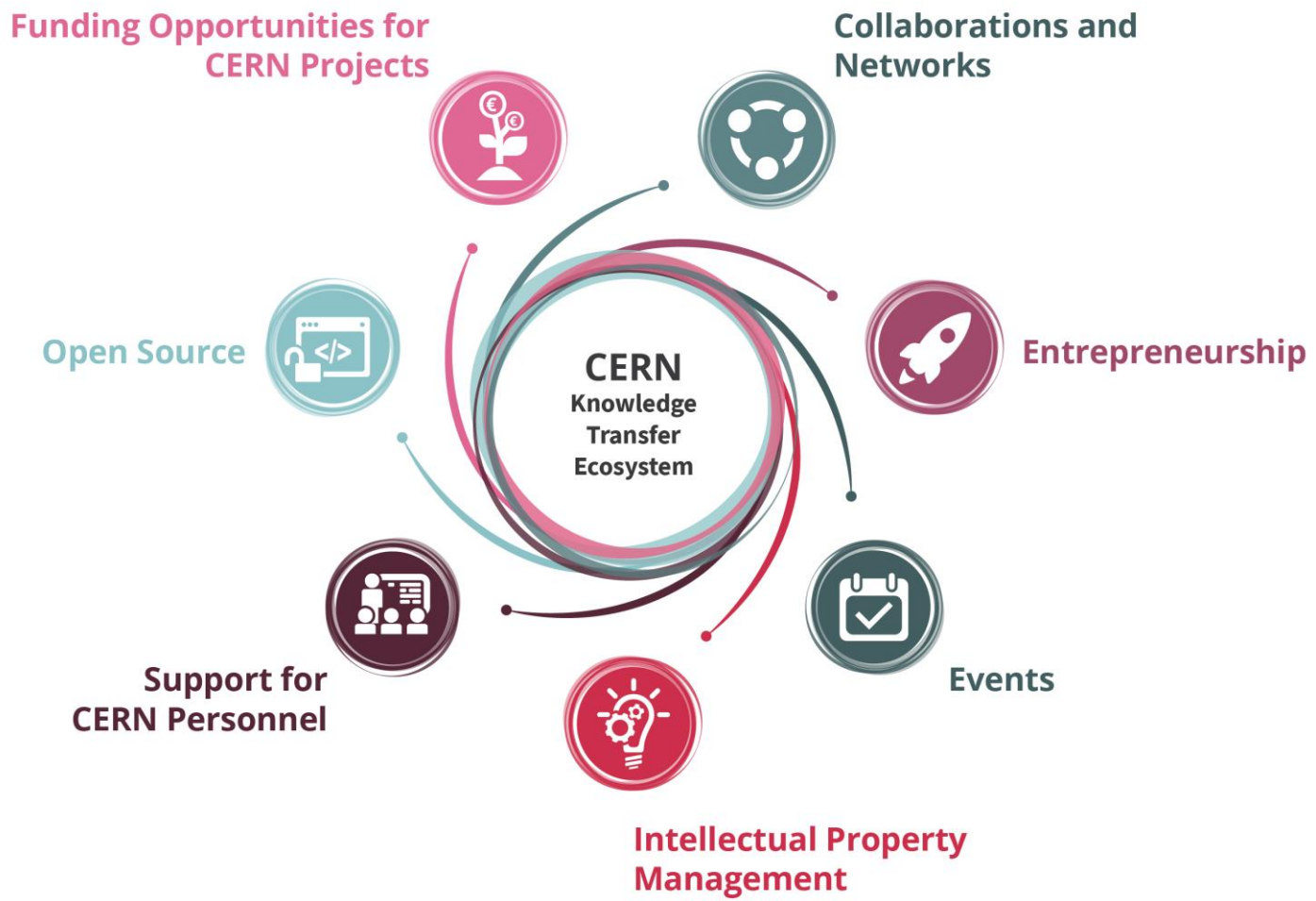
WWW

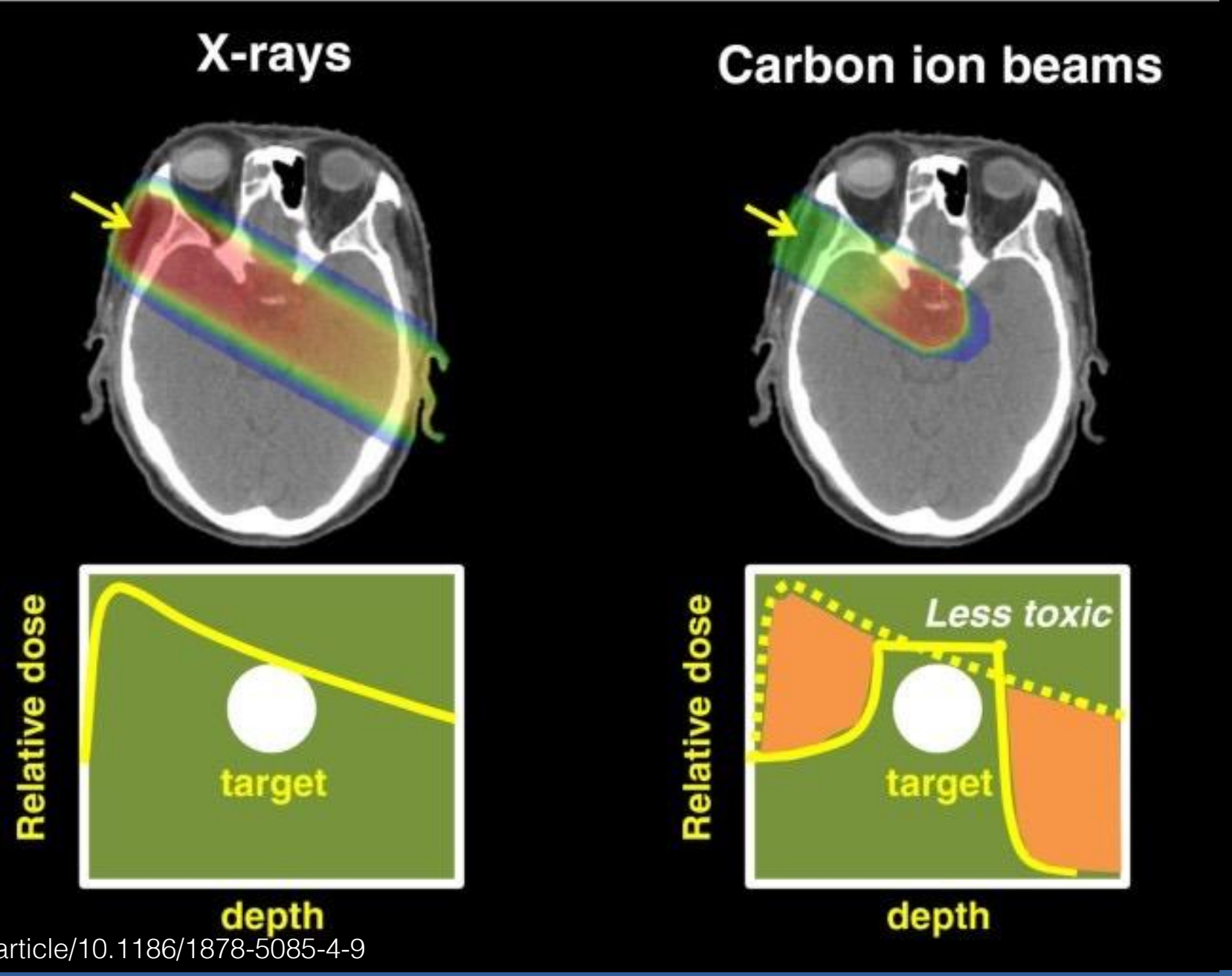
TRACKERBALL



TOUCHSCREEN

# Our toolbox to accelerate innovation






https://link.springer.com/article/10.1186/1878-5085-4-9

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
CERN - PS DIVISION

CERN/PS 2000-007 (DR)

# PROTON-ION MEDICAL MACHINE STUDY (PIMMS) PART II

Accelerator Complex Study Group*
supported by the Med-AUSTRON, Onkologie-2000 and the TERA Foundation
and hosted by CERN

***ABSTRACT***

The Proton-Ion Medical Machine Study (PIMMS) group was formed following an agreement between the Med-AUSTRON (Austria) and the TERA Foundation (Italy) to combine their efforts in the design of a cancer therapy synchrotron capable of accelerating either light ions or protons. CERN agreed to support and host this study in its PS Division. A close collaboration was also set up with GSI (Germany). The study group was later joined by Onkologie-2000 (Czech Republic). Effort was first focused on the theoretical understanding of slow extraction and the techniques required to produce a smooth beam spill for the conformal treatment of complex-shaped tumours with a sub-millimetre accuracy by active scanning with proton and carbon ion beams. Considerations for passive beam spreading were also included for protons. The study has been written in two parts. The more general and theoretical aspects are recorded in Part I and the specific technical design considerations are presented in the present volume, Part II. An accompanying CD-ROM contains supporting publications made by the team and data files for calculations. The PIMMS team started its work in January 1996 in the PS Division and continued for a period of four years.

*Full-time members: L. Badano[1], M. Benedikt[2], P.J. Bryant[2] (Study Leader), M. Crescenti[1], P. Holy[3], A. Maier[2+4], M. Pullia[1], S. Reimoser[2+4], S. Rossi[1],
Part-time members: G. Borri[1], P. Knaus[1+2]
Contributors: F. Gramatica[1], M. Pavlovic[4], L. Weisser[5]
1) TERA Foundation, via Puccini. 11, I-28100 Novara.
2) CERN, CH 1211 Geneva-23.
3) Oncology-2000 Foundation, Na Morani 4, CZ-12808 Prague 2.
4) Med-AUSTRON, c/o RIZ, Prof. Dr. Stephan Korenstr.10, A-2700 Wr. Neustadt.
5) Sommer & Partner Architects Berlin (SPB), Hardenbergplatz 2, D-10623 Berlin.

Geneva, Switzerland
May 2000



From the PIMMS Study @ CERN → TERA

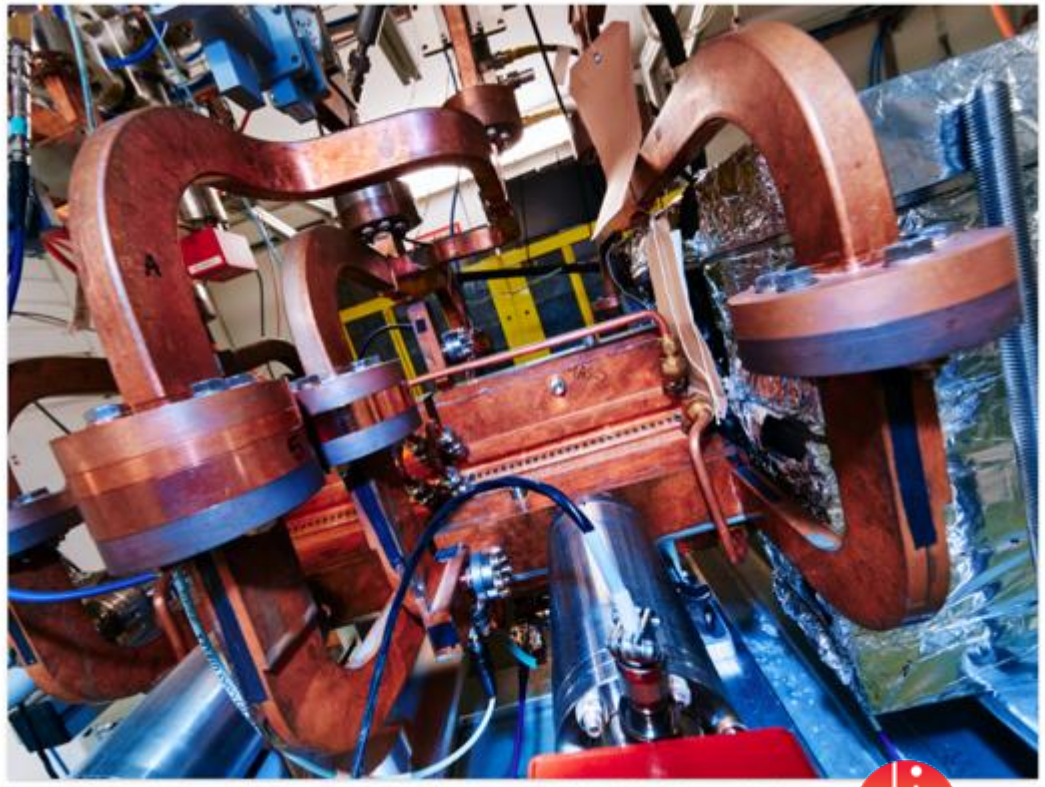
INFN

fondazione CNAO

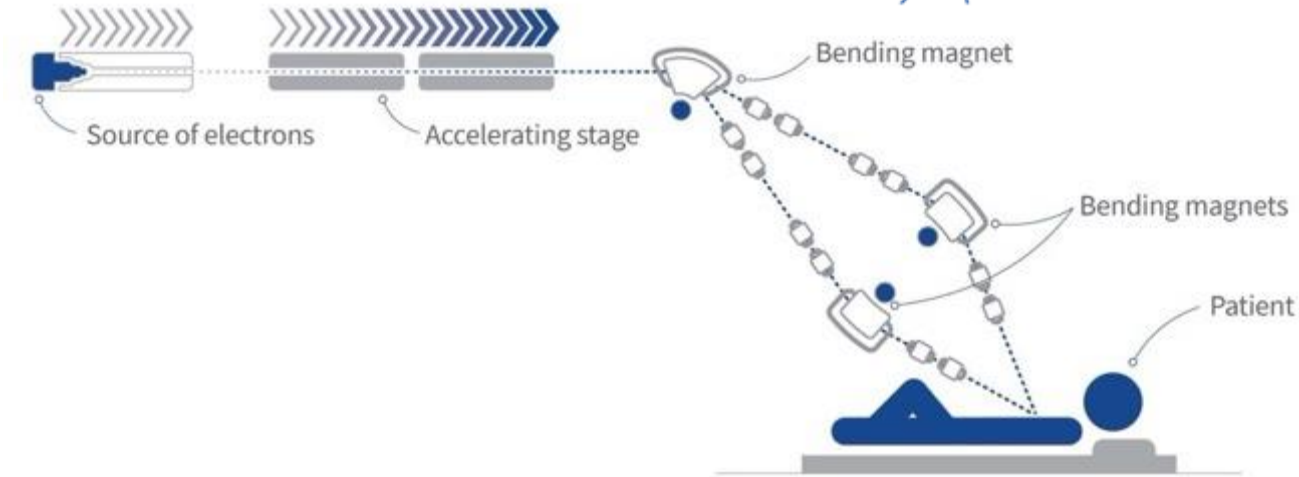
MedAustron

# FLASH VHEE therapy

CLIC technology for a FLASH VHEE facility being developed in collaboration with CHUV (Lausanne University Hospital) and THERYQ (ALCEN Group)



Close-up of the Compact Linear Collider prototype, on which the electron FLASH design is based (Image: CERN)




An intense beam of electrons is produced in a photoinjector, accelerated to around 100 MeV and then is expanded, shaped and guided to the patient.

The design of this facility is the result of an intense dialogue between groups at CHUV and CERN.

Jean Bourhis from CHUV:
"The clinical need that we have really converges with the technological answer that CERN has."

# Environmental Applications: Key Areas for CERN

**RENEWABLE AND LOW-CARBON ENERGY**

Production
Transformation
Distribution
Storage

**CLEAN TRANSPORTATION AND FUTURE MOBILITY**

Aviation
Shipping
Rail
Automotive


CIPEA CERN Innovation Programme on Environmental Applications

CIPEA CERN Innovation Programme on Environmental Applications

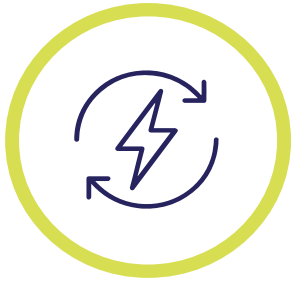
**SUSTAINABILITY AND GREEN SCIENCE**

Power Management
Heat Management
Industrial Processes

**CLIMATE CHANGE AND POLLUTION CONTROL**

Monitoring
Modelling
Mitigation

# High Priority CIPEA Poles of Competence in Environmental Applications

| | | | |
|---|---|---|---|
|  | **Compact Magnetic Confinement Fusion Energy Systems** | **SC Links for On-board, Data Centers and Grid Power Distribution** |  |
| | Accelerator Driven and Advanced Nuclear Reactors | Liquid Hydrogen Storage and Handling Systems | |
|  | **Engineering Systems and Tools for Low Emissions and Energy Efficiency** | **Technologies and Facilities for Remote and In-situ Environmental Monitoring** |  |
| | Fast, Low-power Computing Techniques based on AI | AI Platforms for Global Phenomena Modelling and Climate Simulations | |

**We are actively exploring these areas in order to define and build up high profile projects together with partners in the MS: please get in touch if you have ideas!**

# SCALE: Demonstration of superconducting power distribution systems for future LH2 electric aircraft

**Feasibility assessment of SC transmission lines in the powertrain of future electric planes**

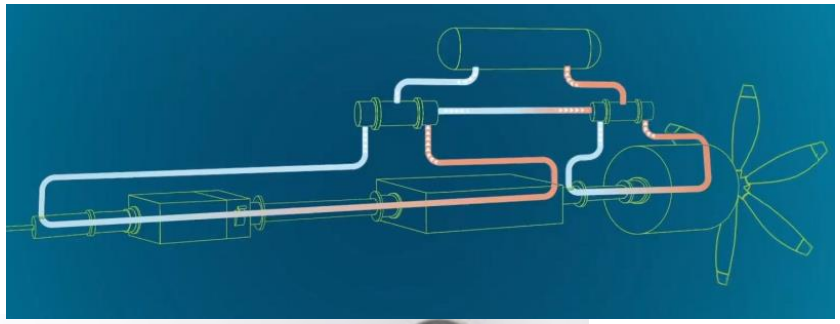
- SCALE demonstrator consists of a DC link (cable and cryostat) with two current leads
- Cooling system based on gaseous Helium

**Impact:** Support critical decisions on advanced technologies for clean aviation with the ambition to:

- Halve weight and volume of components
- Reduce voltage to below 500V
- Increase system efficiency (+5-10%)

**Project kick-off: Sept 2022**

| |
|---|
| **SCALE demonstrator designed – dec 2022** |
| **SCALE demonstrator assembled – sep 2023** |
| **SCALE demonstrator tested – dec 2023** |
| **Integration with Airbus ASCEND developments - ongoing** |



Airbus and CERN SC powertrain demonstrators: ASCEND layout and SCALE mock-up

**TE-MSC**

A. Ballarino

AIRBUS

Airbus UpNext

https://kt.cern/news/press-release/knowledge-sharing/cern-and-airbus-partnership-future-clean-aviation

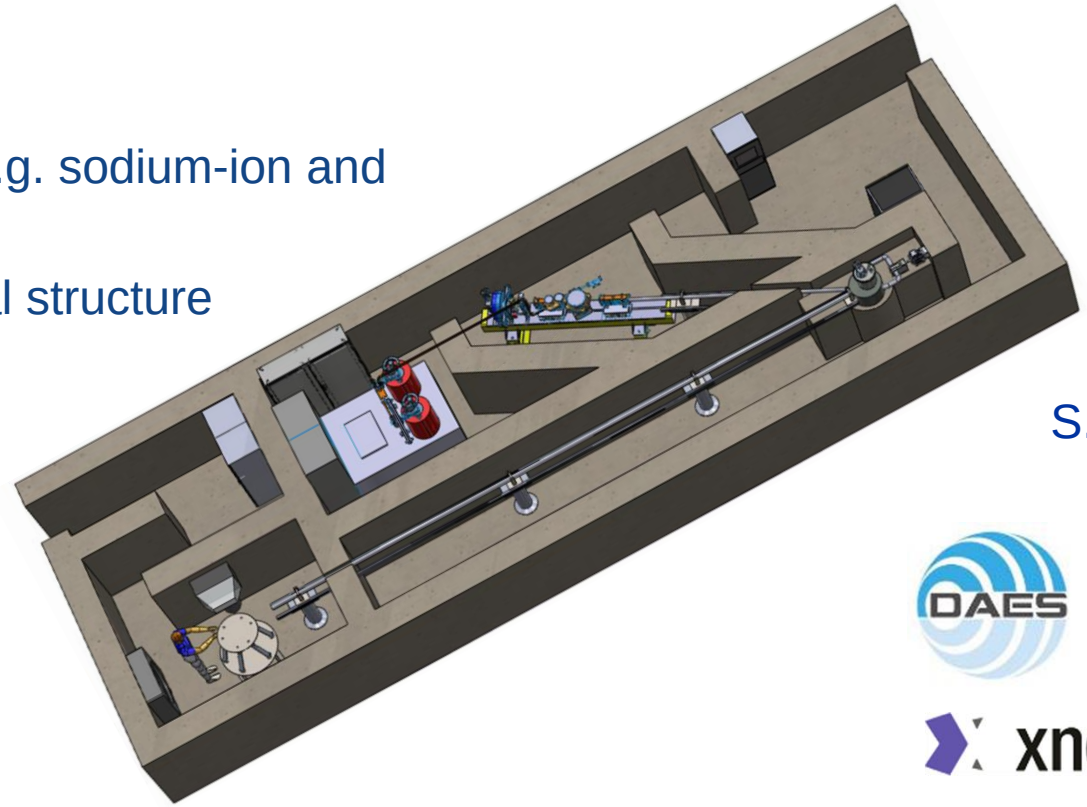
# VULCAN - Versatile Ultra Compact Accelerator (electron)-driven Neutron source for material analysis green technologies R&D

**Development of a compact source for neutron scattering applications like non-destructive measurement of internal stresses and dendritic growth in metallic and ceramic structures**

- Characterise the Target-Moderator-Reflector system for generating neutrons in CERN's CLEAR beamline
- Develop conceptual design for compact and affordable electron linac optimized for VULCAN requirements

**Impact:**

- Explore alternatives to lithium-ion batteries (e.g. sodium-ion and magnesium-ion)
- Improve solid oxide fuel cells by studying local structure and oxygen electrocatalysis



**Project kick-off: October 2023**

| |
|---|
| **TMR assembly test in CLEAR** |
| **Electron linac conceptual design** |
| **Refinement of TMR design and additional tests in CLEAR** |

**ATS-DO**

S. Stapnes

L. Wroe

DAES

xnovotech

CERN

CIPEA CERN Innovation Programme on Environmental Applications

Thank you for
the attention