



# Accelerating Innovation

## How CERN Technology Makes its Way into Society

Han Dols, Head of Business Development & Entrepreneurship, CERN

# Oct 4, 1952: provisional CERN Council meets in Amsterdam



- Geneva was chosen as the site for the Laboratory
- Decided to build a 25-30 GeV Proton Synchrotron

# Machine Learning and Deep Learning

Industrial Controls and Automation

Data Analytics **Metrology** **High and Ultra High Vacuum Systems**

Health, Safety and Environment Management

Cryogenics

Optoelectronics and Microelectronics **High Volume Data Management & Storage**

**Superconducting Magnets**

**Particle Acceleration and Control**

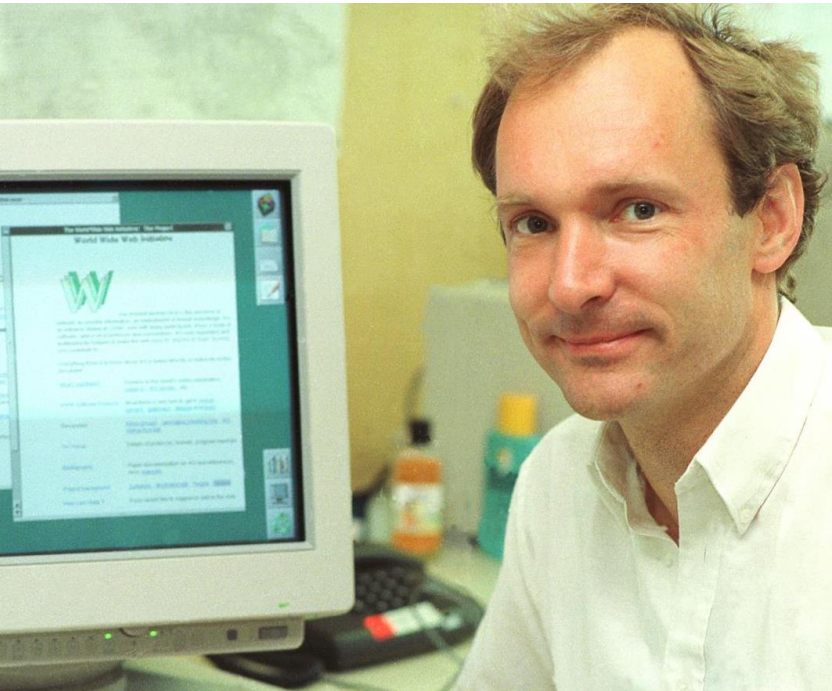
**Radiation Protection and Monitoring** Particle Tracking and Calorimetry

Robotics **Sensors** Material Science **Cooling and Ventilation**

Collaboration Tools Radio Frequency Technology

**Manufacturing and Mechanical Processes**

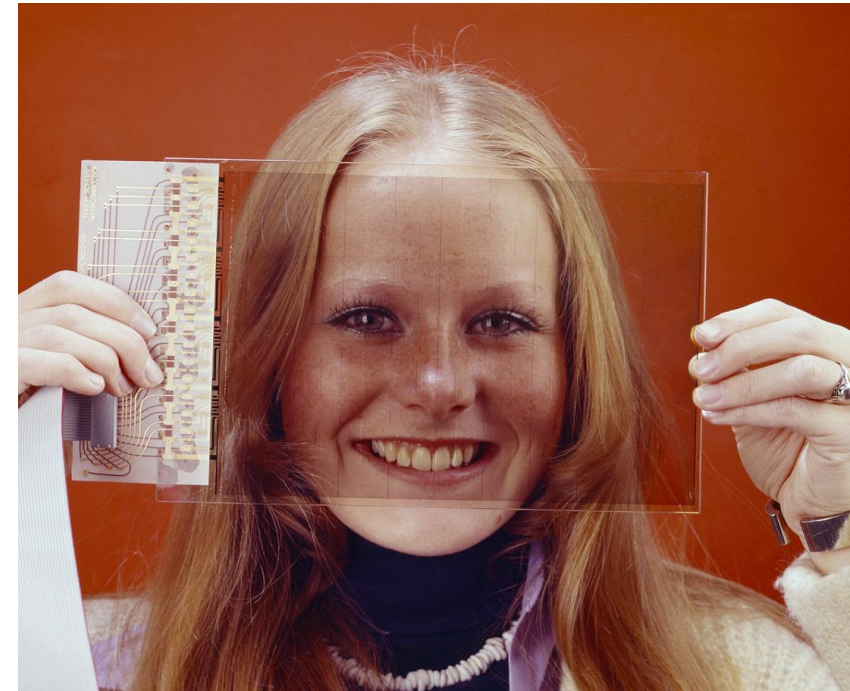
# Some historic examples



WWW



TRACKERBALL



TOUCHSCREEN

# CERN as trusted non-commercial innovation partner



HEALTHCARE

ENVIRONMENT

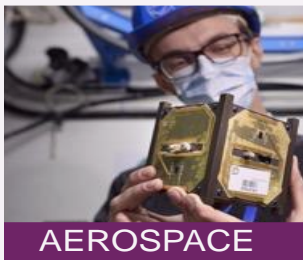
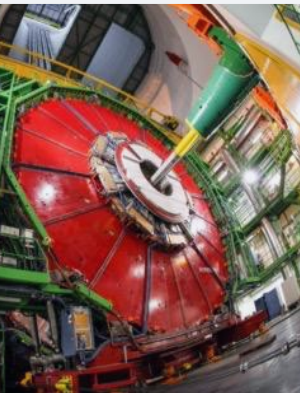
DIGITAL

AEROSPACE

QUANTUM

## Focus on industry in the CERN Member States

# Hybrid strategy: tech push & market pull



Mobilize tech experts

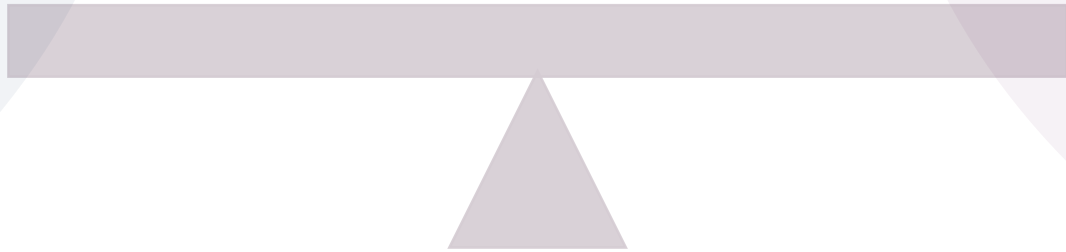
Mobilize innovation partners

Create tech and IP dossiers

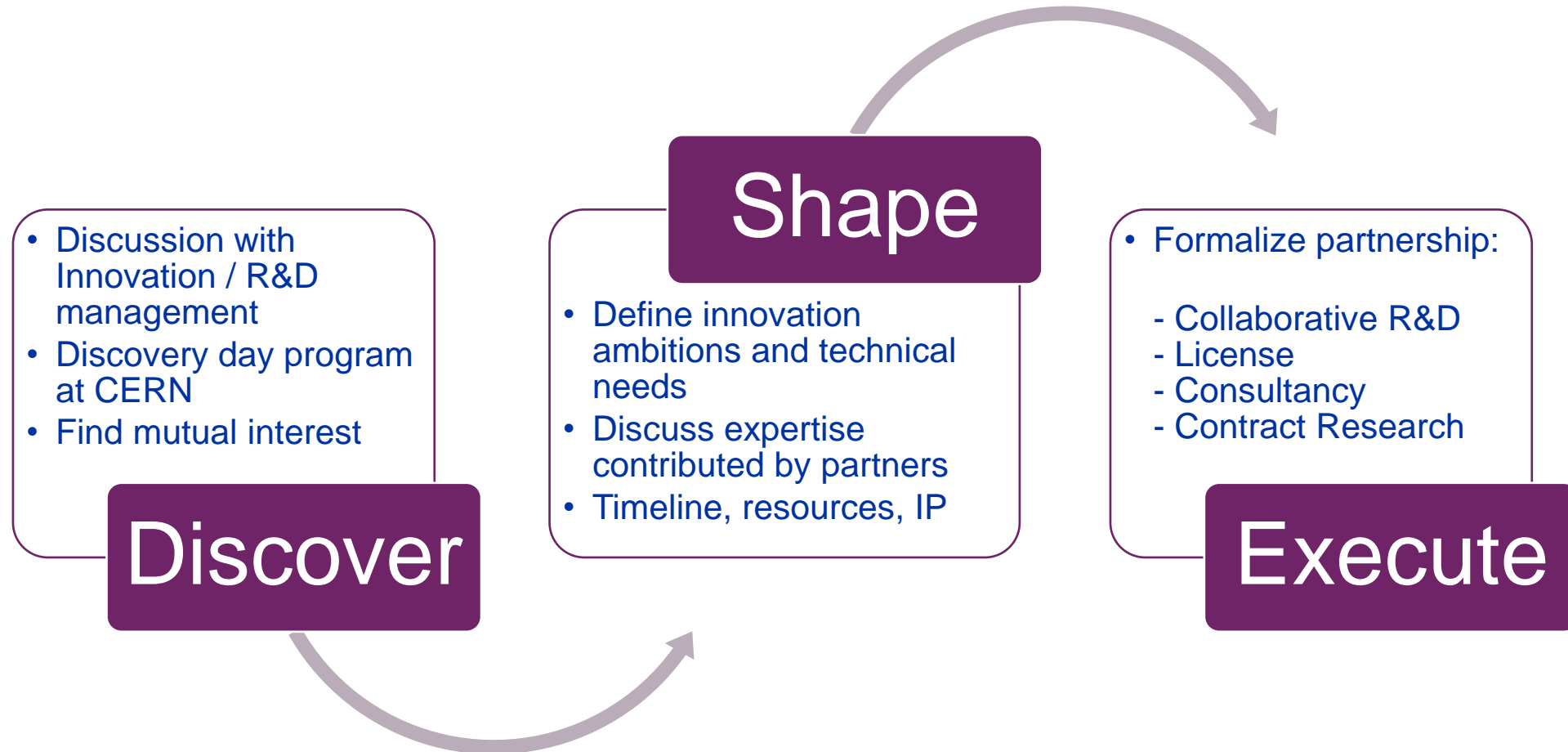
Create value propositions

Scout for technologies

Search unmet needs



# Shaping innovation partnerships





# Shaping innovation partnerships

## Licence

- Access to existing solution
- Support to implement

## Consultancy/Service

- Specific issue
- Time of experts
- Time of facilities

## Contract research

- Specific solution
- Outsource its development to CERN

## Collaborative R&D

- General issue
- Jointly find solution
- Jointly develop solution

## Open source access

- Open source software
- Open source hardware



Collaborative R&D

MedAustron and CNAO offer hadron therapy using CERN technology.

Collaborative R&D



MedAustron and CNAO offer hadron therapy using CERN technology.

Consultancy

Bundesdruckerei (Berlin) works with CERN on next generation ideas for identity management and cryptography and data handling.

## TRUSTroke EU Project

Consortium developing artificial intelligence (AI) algorithms to analyze patient data locally, and share the insights centrally (federated learning) to guarantee confidentiality.

# Almost all software at CERN is Open Source




zenodo



# And not just software...



CERN Open Hardware Licence 2.0:  
family of licences that governs the  
use, copying, modification and  
distribution of hardware designs.

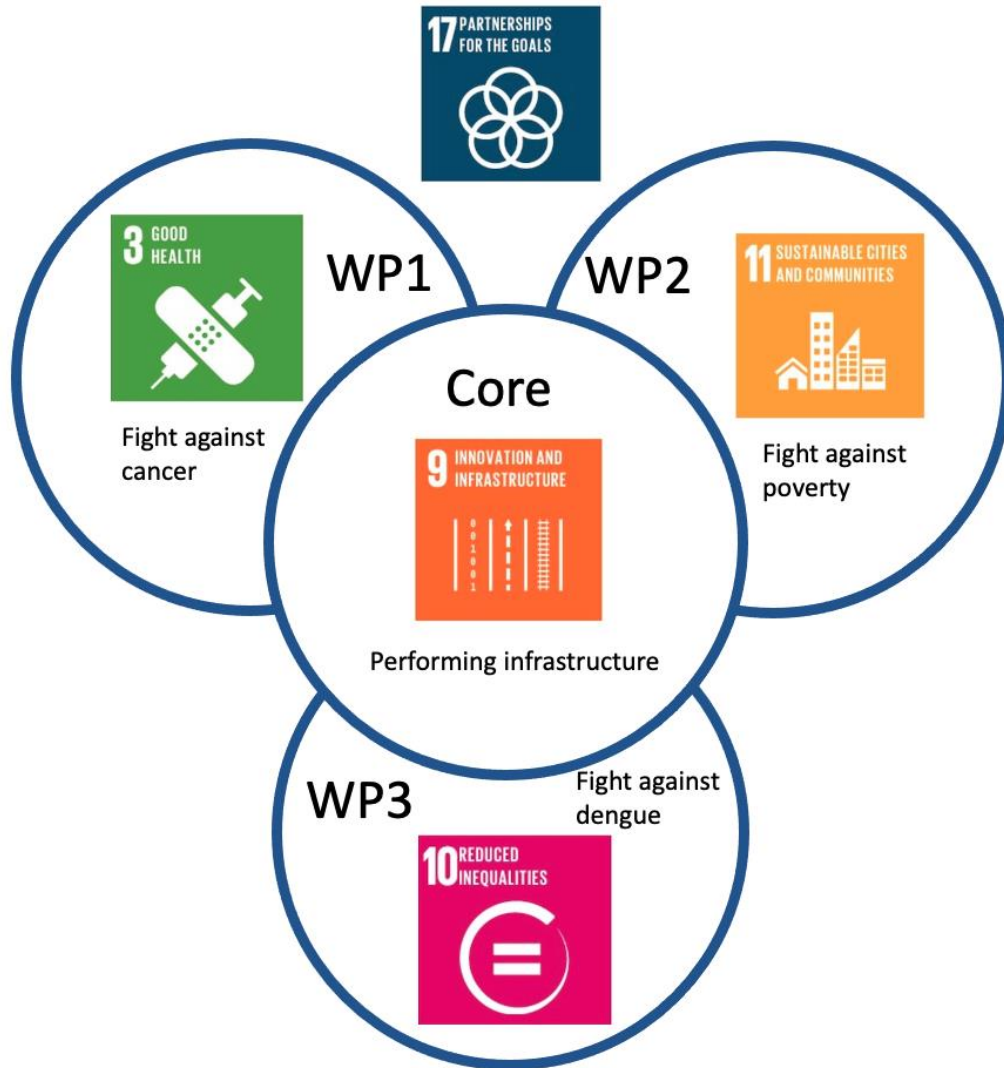
A wide-angle photograph of the Frankfurt Stock Exchange building, a grand neoclassical structure with a portico of columns and a statue on the roof. The building is bathed in sunlight, and the sky is clear blue. In the foreground, there are trees, a street lamp, and a few people walking. A semi-transparent text box is overlaid on the upper left portion of the image.

Frankfurt Stock Exchange is using CERN's White Rabbit technology to synchronize timing in their trading infrastructure to less than a nanosecond.

A dark blue rectangular box containing the text "Open Source" in white, sans-serif font.

Open Source





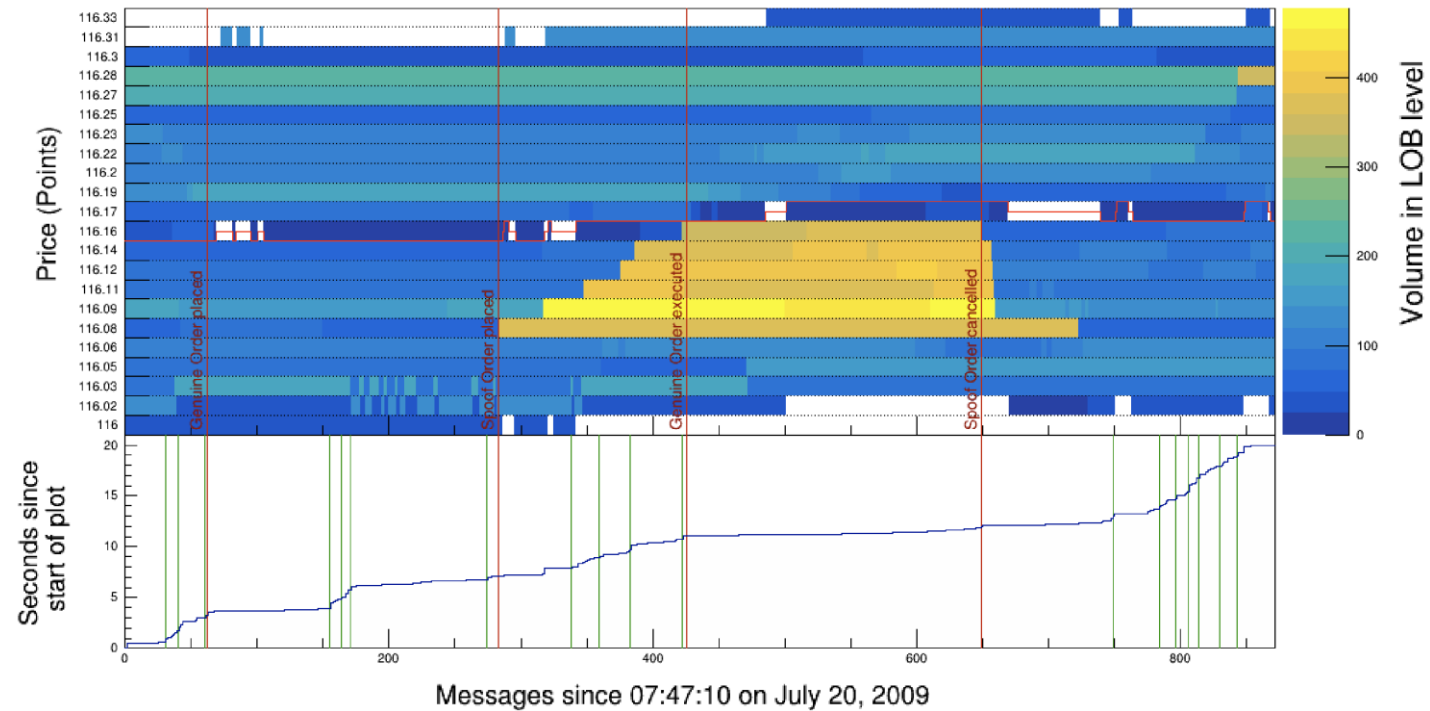
BioDynaMo: modular, high-performance, agent-based simulation platform, used to simulate cells and tissue.

# HighLo Project



U.S. Treasury Bond September 2009 contract

07:47:10 – 07:47:30 AM CT



Combatting manipulation in financial markets, using interdisciplinary new methods to detect manipulation.



## Exchanges



## Regulators



Combatting manipulation in financial markets, using interdisciplinary new methods to detect manipulation.



**CIPEA**

CERN Innovation Programme  
on Environmental Applications

## RENEWABLE AND LOW-CARBON ENERGY

Production  
Transformation  
Distribution  
Storage



## CLEAN TRANSPORTATION AND FUTURE MOBILITY

Aviation  
Shipping  
Rail  
Automotive



### CERN KNOWHOW

Superconductivity  
High Field Magnets  
High Vacuum  
Cryogenics  
Materials  
Artificial Intelligence  
Advanced Sensors  
Rad-Tol Systems  
Thermal Control  
Radioprotection  
...

## SUSTAINABILITY AND GREEN SCIENCE

Power Management  
Heat Management  
Industrial Processes



## CLIMATE CHANGE AND POLLUTION CONTROL

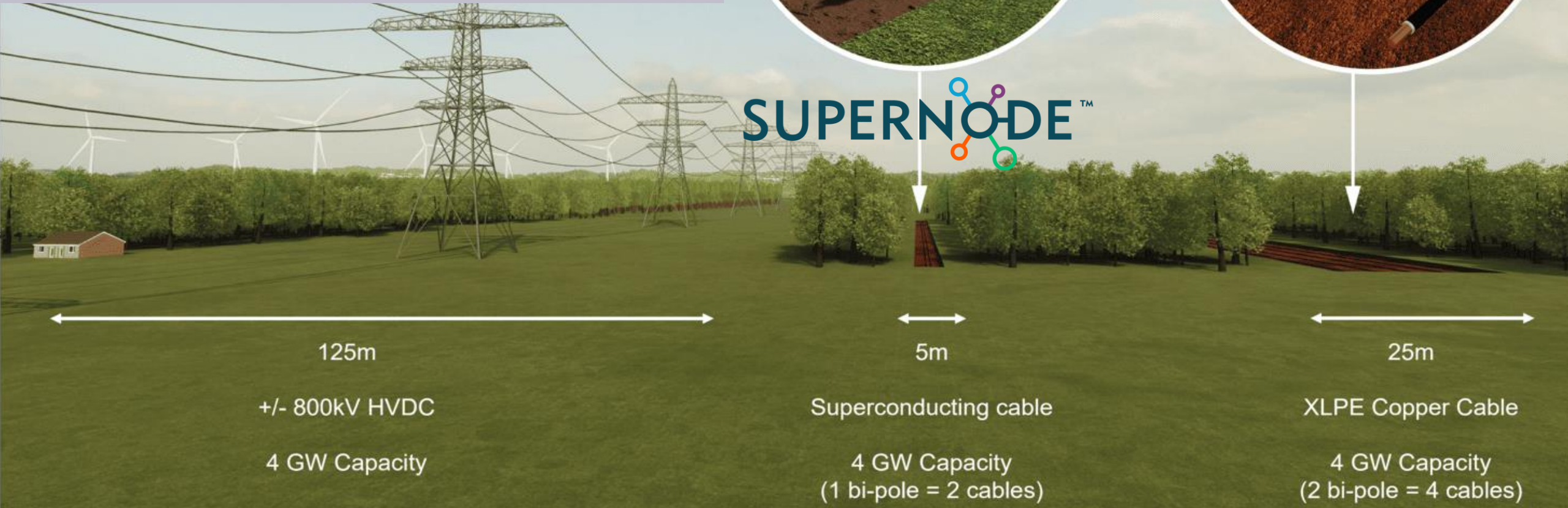
Monitoring  
Modelling  
Mitigation



# SuperNode and CERN collaborate on new solutions for renewable energy transmission



Contract research



An underwater photograph showing several pieces of white plastic litter, including bags and crumpled pieces, floating in clear blue water. Sunlight filters through the surface, creating shimmering patterns and bright spots on the plastic. The scene is set against a backdrop of deep blue water with some bubbles and light refraction.

EU Project

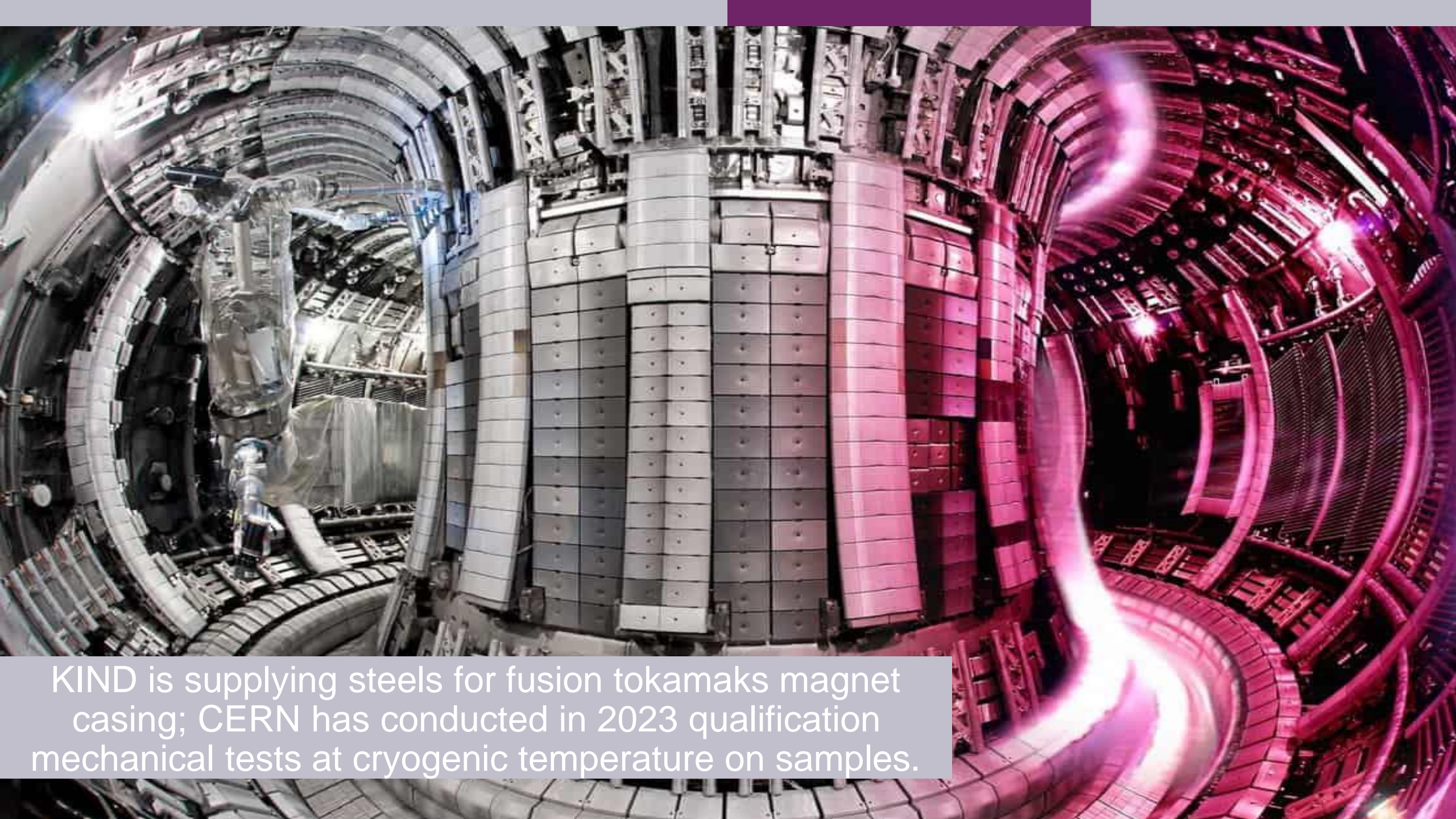
Edge SpAIce EU program: extremely efficient Deep Neural Network (DNN) deployment "at the edge", used for monitoring marine plastic litter from satellites

CERN and Airbus collaborate to assess potential of superconducting technologies for future low emission airplanes.



Collaborative R&D





KIND is supplying steels for fusion tokamaks magnet casing; CERN has conducted in 2023 qualification mechanical tests at cryogenic temperature on samples.

ZENSEACT (Volvo Cars Company) teams up with CERN on extremely fast machine learning using FPGAs.

Collaborative R&D





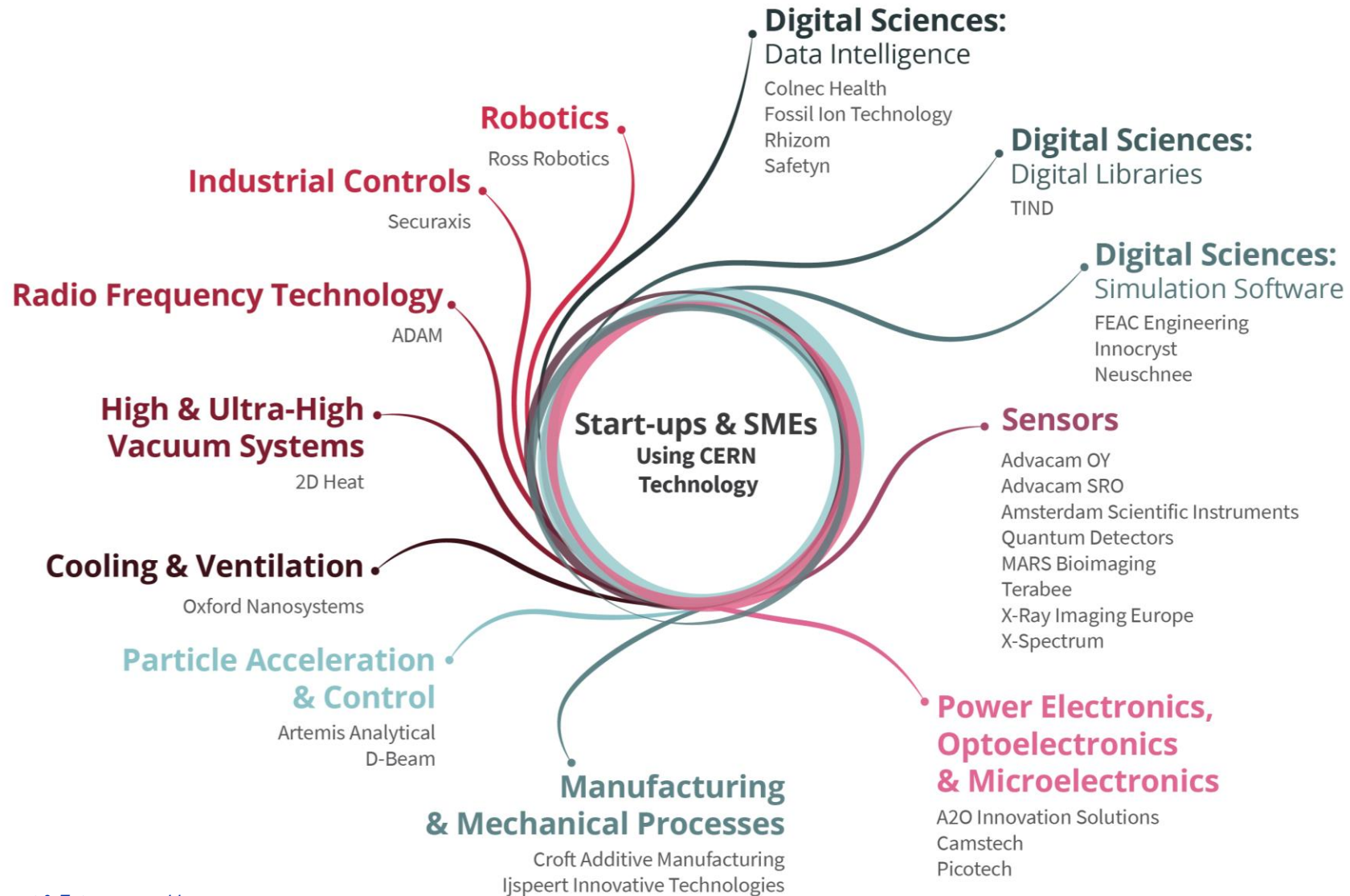
Collaborative R&D

CERN and ABB team up on reducing electricity in cooling and ventilation.



Reviewed GTT procedures for welding and material selection for LNG tankers. Provided advice on adaptation for hydrogen and tested samples at CERN.

# Startups and Spin-offs

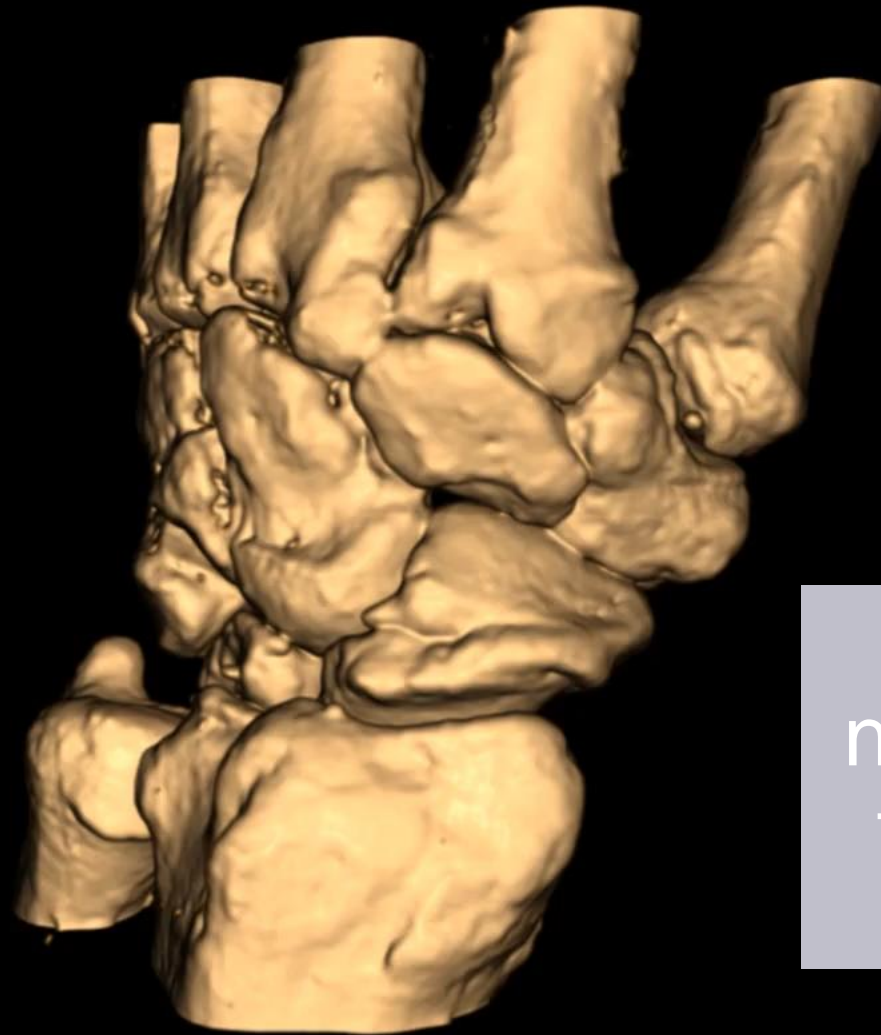


InsightART: Using CERN  
Medipix detector to analyse art.

License



License to startup



MARS Bio Imaging:  
next generation X ray  
finally in color using  
CERN chips



CERN  
Venture Connect



# Offering curated CERN technologies to deep-tech start-ups

**ACCURATE chip**  
High-Precision ASIC



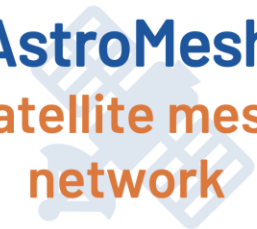
**Structured Laser Beam**  
Long-range laser



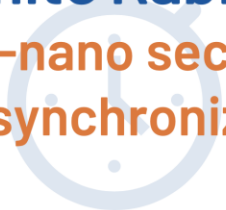
**Single Frequency Laser**  
Ultra-narrow linewidth RAMAN laser



**AstroMesh**  
Satellite mesh network



**White Rabbit**  
Sub-nano second  
Time synchronization



**RUCIO**  
Management of  
large datasets



**Ultralight Coldplate**  
cooling of heat  
dissipating elements



# CVC Partners: VCs, Incubators, Venture Builders



# Worth Remembering...

- Collaboration drives success in big science.
- Educating and nurturing talent is a key ingredient.
- Big science fuels long term innovation potential.
- Diverse (surprising!) applications with social impact.
  
- Mind the gap – in language, clockspeed and culture.

Be aware... magic may happen!

