Spain@CERN

Knowledge Transfer at CERN

Vetle Nilsen
Knowledge Transfer Officer

KT: one of CERN's missions

Push back the frontiers of knowledge in nuclear research

Develop new technologies for accelerators and detectors

Train scientists and engineers of tomorrow

Unite people from different countries and cultures

KT Mission

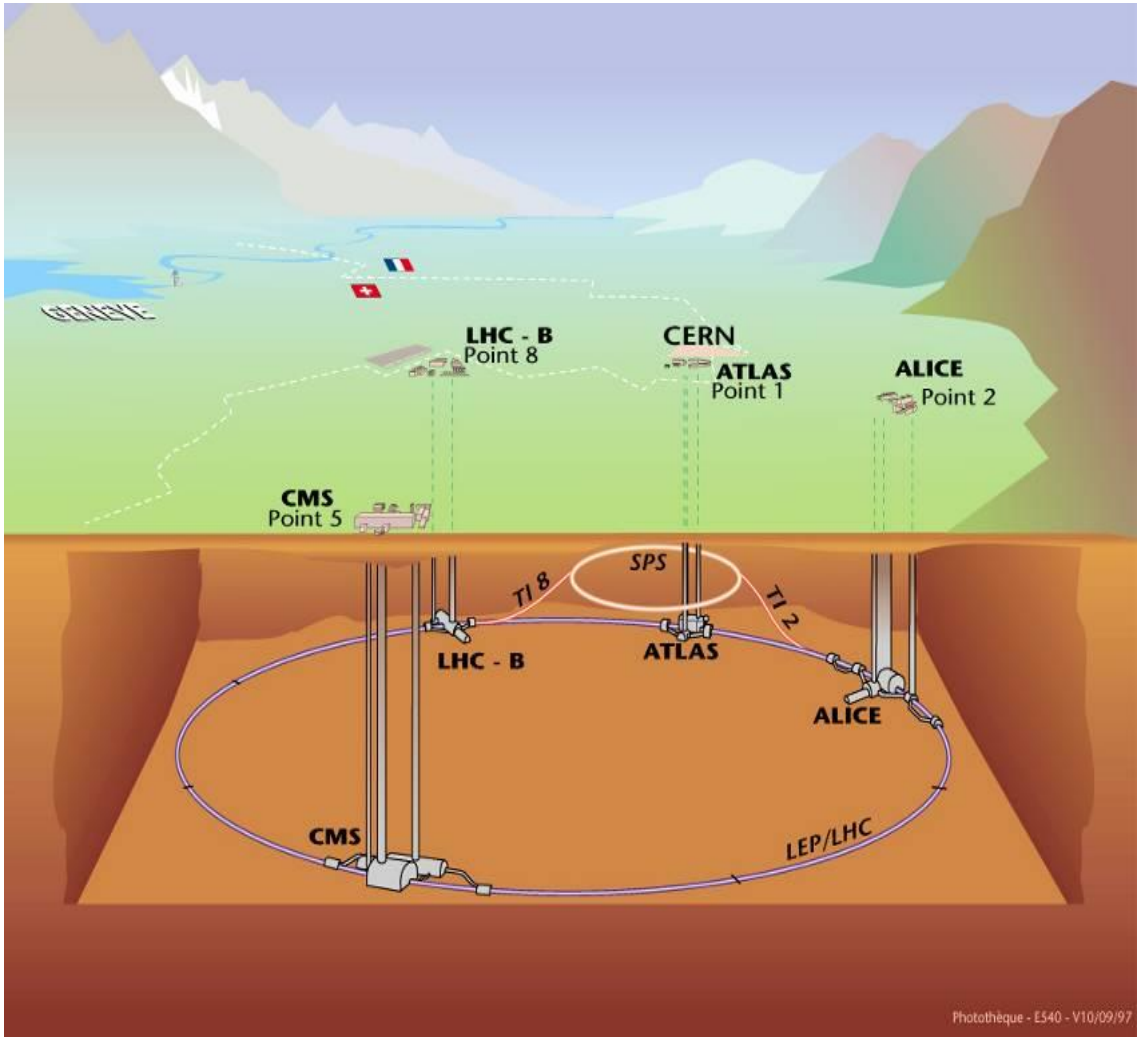
Maximizing the technological and knowledge return to the Member States industry and society

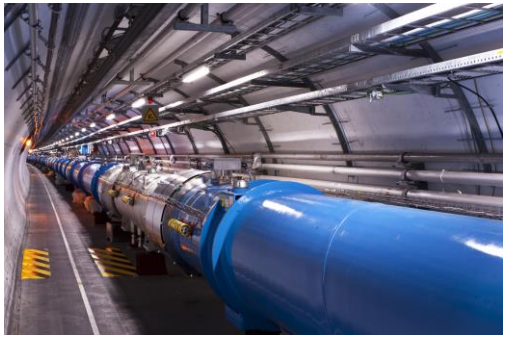
Promoting CERN's image as a center of excellence for technology

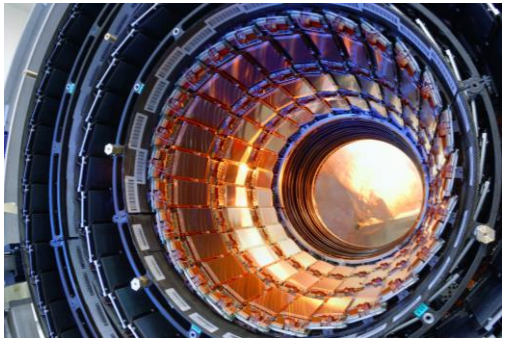
The World Wide Web

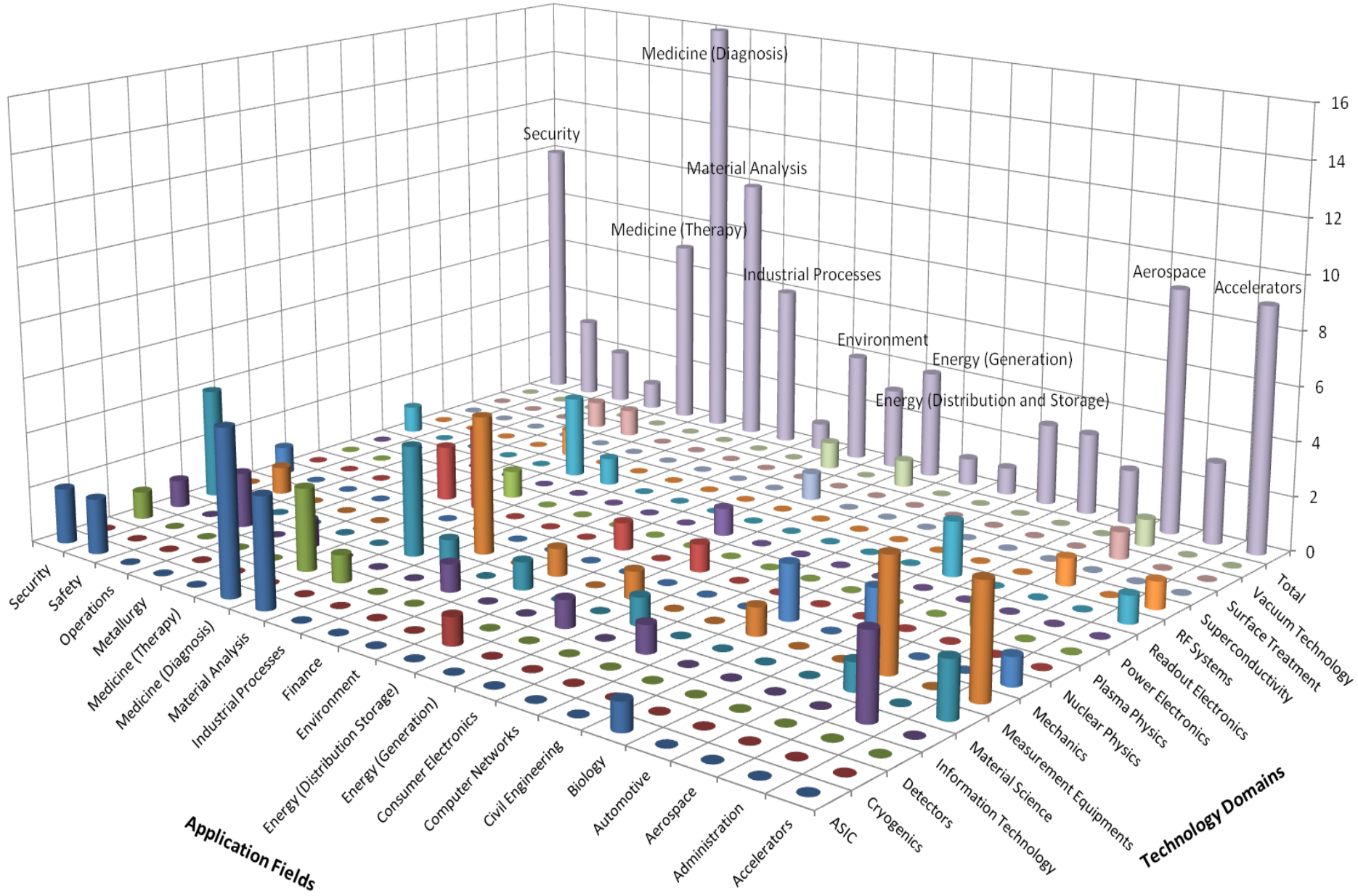
Invented at CERN in 1989 by British scientist Tim Berners-Lee and has grown to revolutionize communication worldwide

CERN's areas of excellence

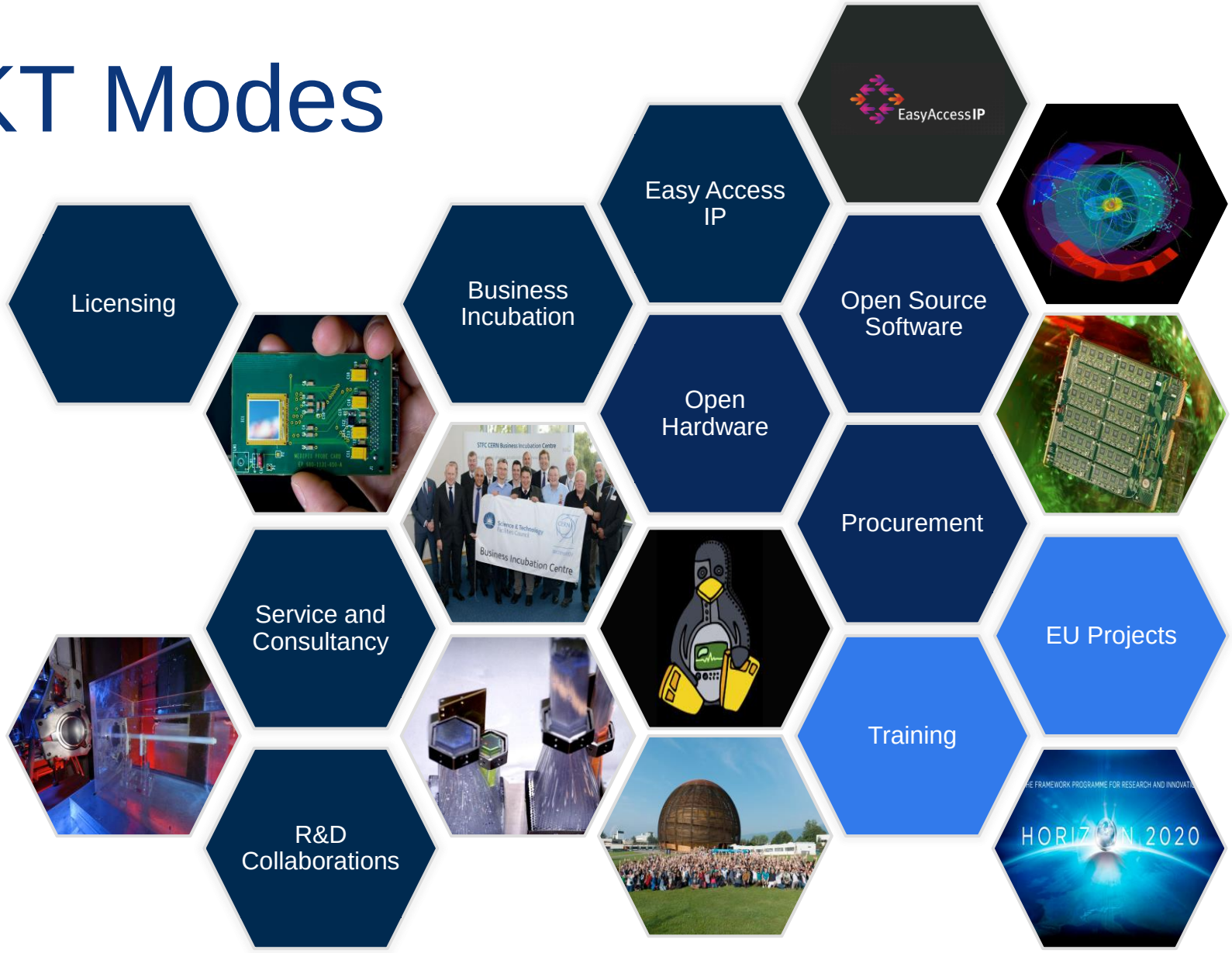




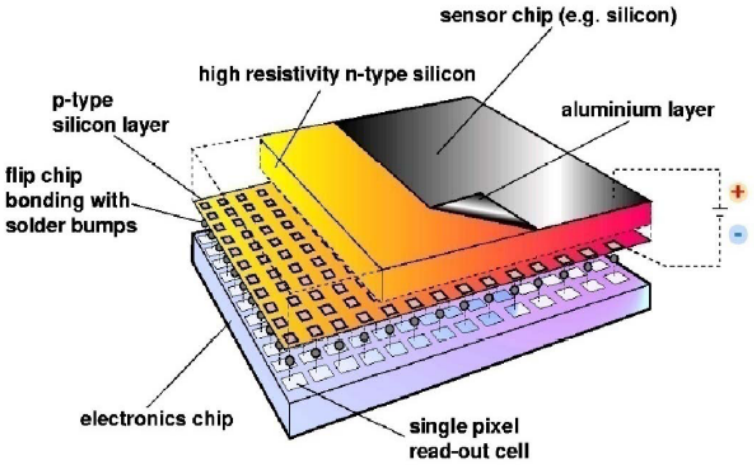


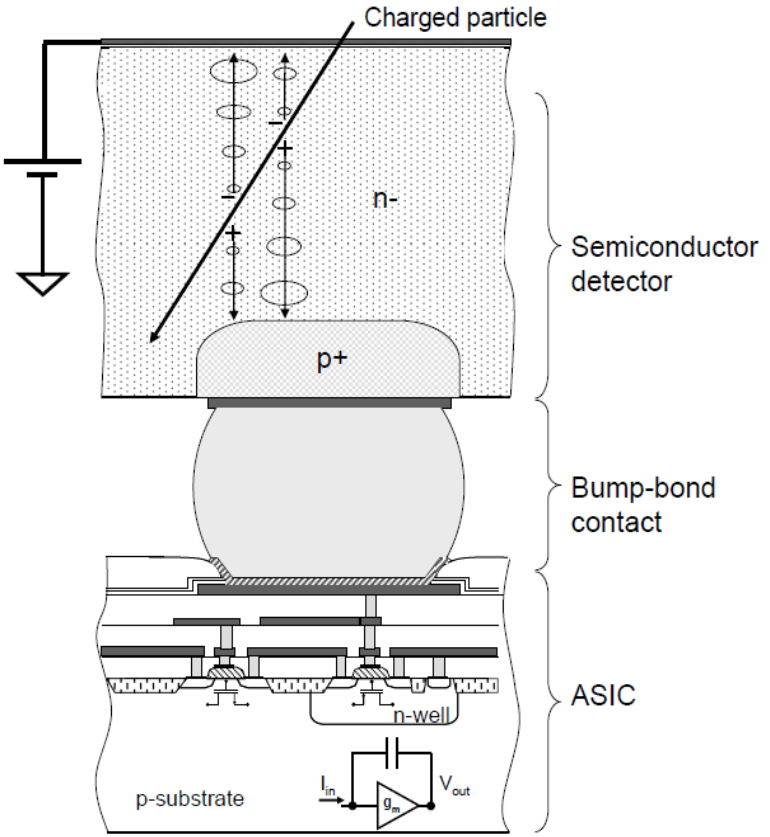

Medicine (Diagnosis)
Security
Material Analysis
Medicine (Therapy)
Industrial Processes
Aerospace
Accelerators
Environment
Energy (Generation)
Energy (Distribution and Storage)
16
14
12
10
8
6
4
2
0
Security
Safety
Operations
Metallurgy
Medicine (Therapy)
Medicine (Diagnosis)
Material Analysis
Industrial Processes
Finance
Environment
Energy (Distribution Storage)
Energy (Generation)
Consumer Electronics
Computer Networks
Civil Engineering
Biology
Automotive
Aerospace
Administration
Accelerators
ASIC
Cryogenics
Detectors
Information Technology
Material Science
Measurement Equipments
Mechanics
Nuclear Physics
Plasma Physics
Power Electronics
Readout Electronics
RF Systems
Superconductivity
Surface Treatment
Vacuum Technology
Total
Application Fields
Technology Domains

KT Modes


Licensing
Business Incubation
Easy Access IP
EasyAccessIP
Open Source Software
Open Hardware
Procurement
EU Projects
Training
Service and Consultancy
R&D Collaborations
Business Incubation Centre
HORIZON 2020

Medipix


sensor chip (e.g. silicon)
high resistivity n-type silicon
p-type
silicon layer
aluminium layer
flip chip
bonding with
solder bumps
electronics chip
single pixel
read-out cell

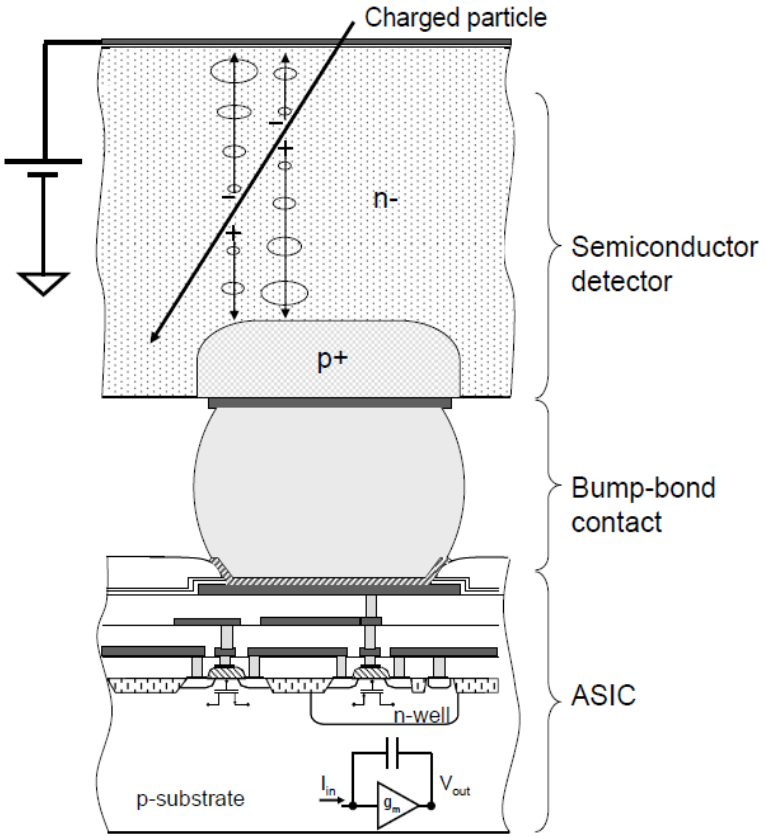

Charged particle
n-
p+
Semiconductor
detector
Bump-bond
contact
ASIC
n-well
p-substrate
I_{in}
V_{out}
g_m

Medipix

The Medipix collaborations (close to 20 institutes) contributed to the development and dissemination of the technology

The x-ray group at Institut de Física d'Altes Energies (IFAE) Barcelona is part of the Medipix 2 collaboration

A good example of how (fundamental) science fosters innovation which can be transferred to society… and back!



Application: X-Ray

Medical and industrial X Ray imaging

XRAY IMATEK, a spin-off company from IFAE, is selling products and services around the Medipix2 and the Timepix chips

Application: Material analysis

PANalytical is a Dutch company that develops and produces scientific instruments

Medipix is used in their range of for x-ray diffractometers

Application: Radiation monitoring

Medipix is used for radiation monitoring in space and other types background radiation monitoring and dosimetry

Application: Research

Research applications:

- Synchrotron radiation
- Electron microscopy
- Detection of low energy particles
- Adaptive optics
- Neutron imaging
- and more

Application: Education

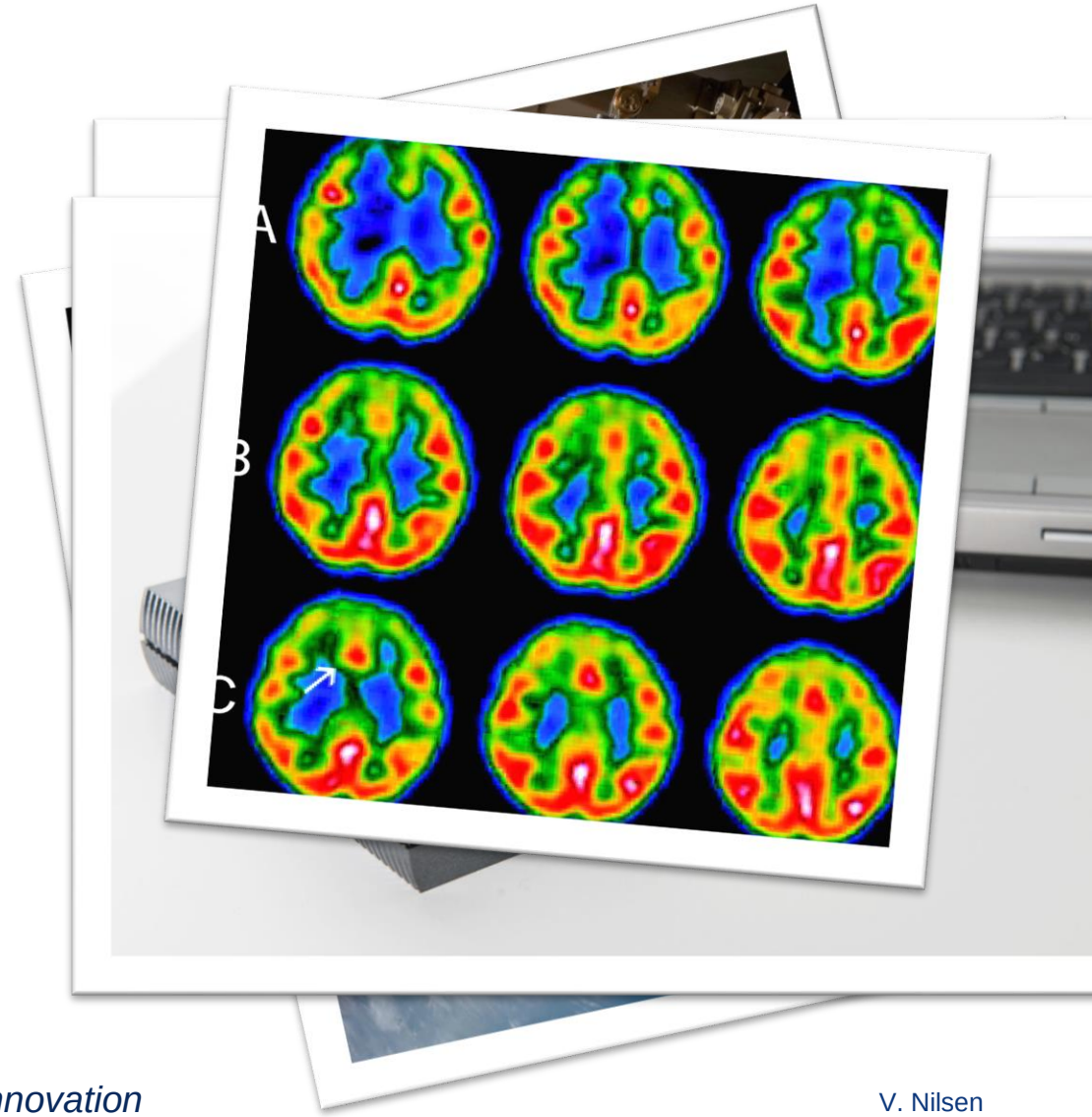
Medipix 2 technology used in an educational toolkit

Allows students to use a Timepix chip in the lab to visualise radiation

CERN has recently adopted this toolkit as part of its new SchoolLab

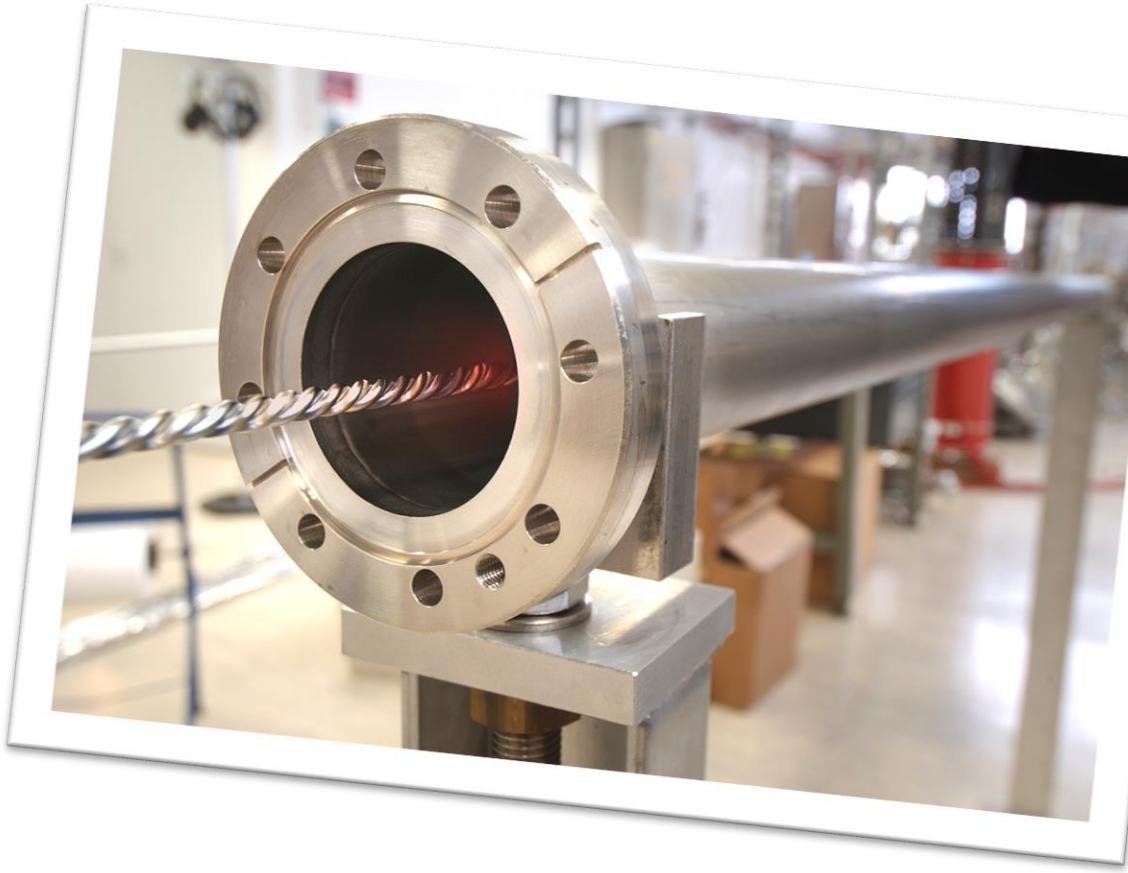
Application: Medical Imaging

- Computed Tomography (CT)
- Radiography,
- Mammography,
- SPECT,
- Dental radiography,
- Angiography,
- PET
- and more



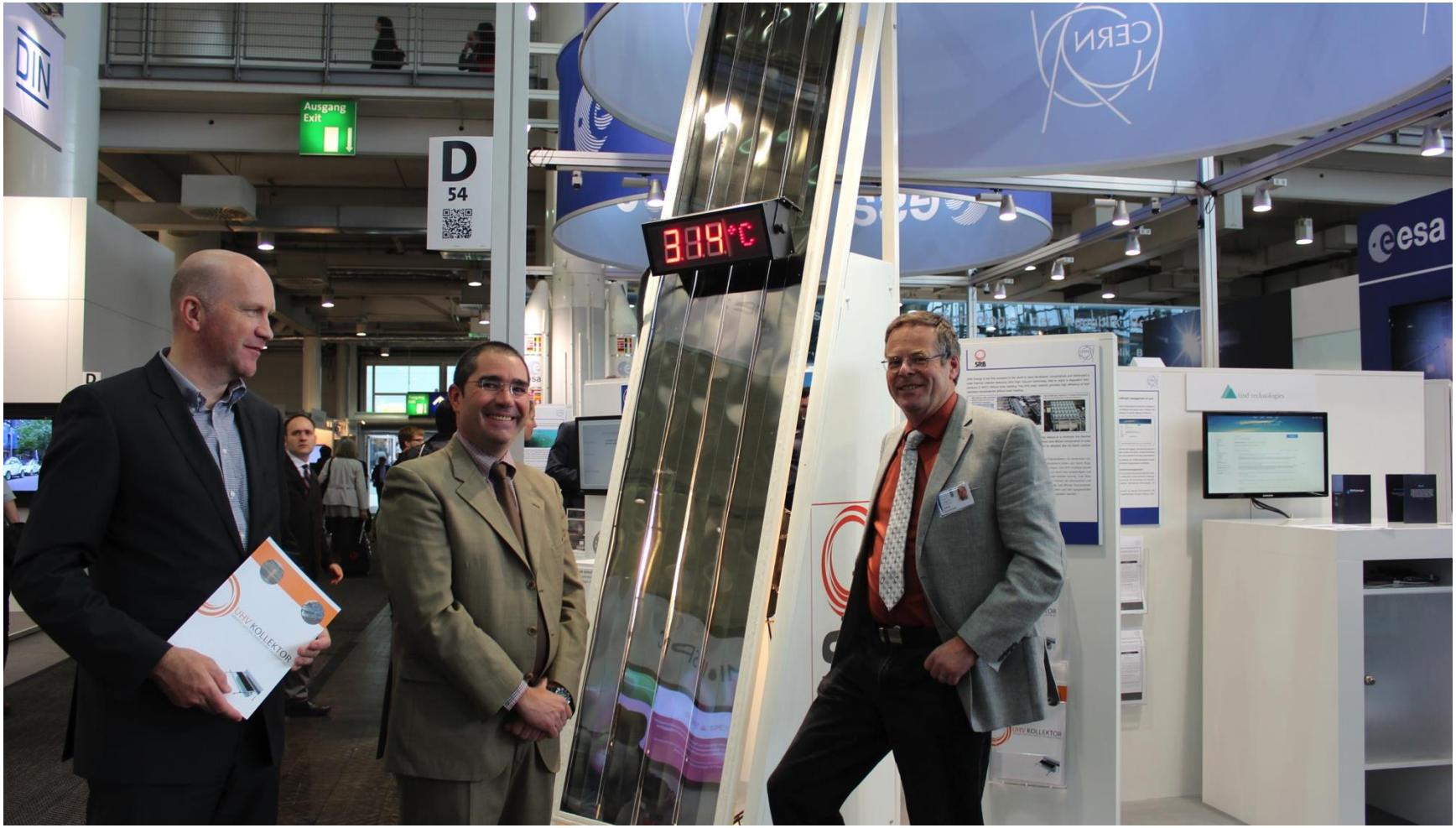
NEGs - Non-Evaporable Getter thin film coatings

Technology used to create and maintain ultra-high vacuum in the accelerator vacuum chambers



SRB Energy

SRB Energy



Large accelerator facilities

Kryolize® Software

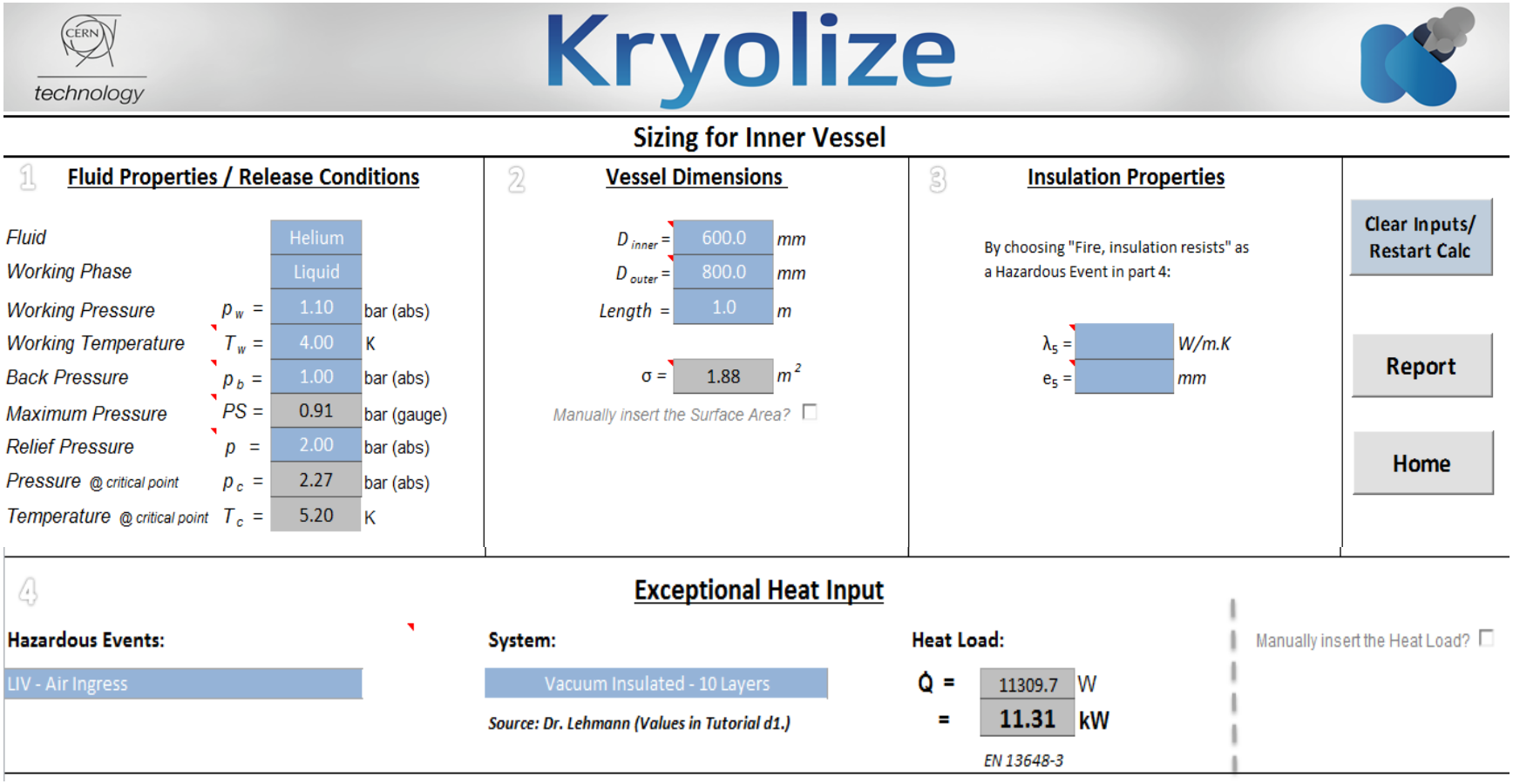
Pioneer software, used for sizing the **minimum discharge area** of a pressure relief Safety device, to protect **cryogenic equipment** from an accidental overpressure scenario

Includes the necessary calculation steps, used at CERN, to ensure that the pressure of a cryogenic vessel will not exceed the stress limits imposed by its design.

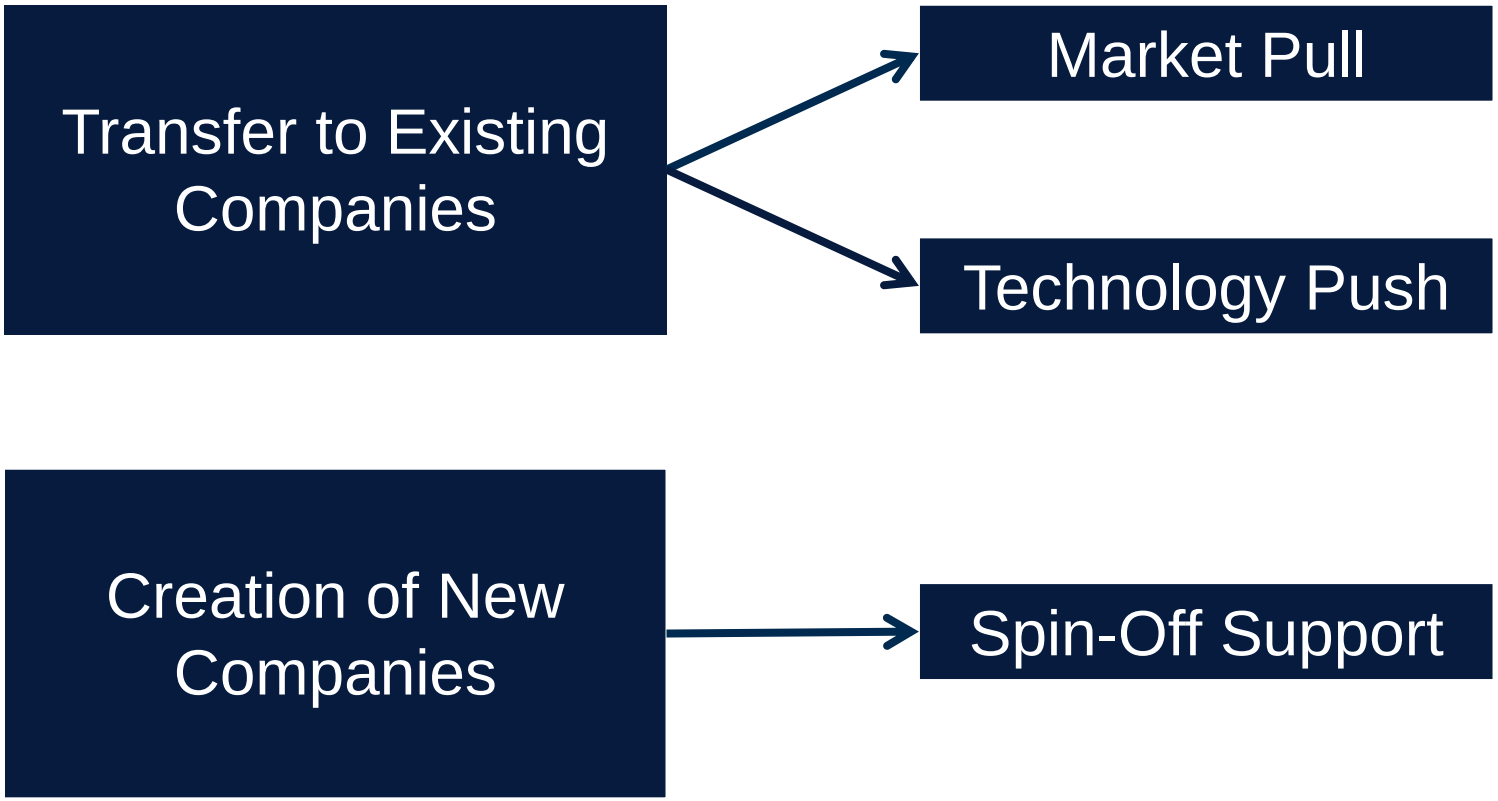
Based on International (ISO), European (EN) and American (API) standards and adapted from models, made at CERN, tailored to cryogenic fluids

Software developed by the HSE Unit. Technical contact: André Henriques (DGS-SEE-XP)

Software Interface



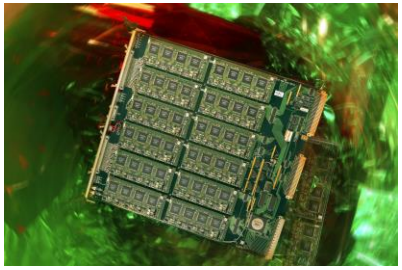
KT implementation ways



The KT Fund:

Bridging the « valley of death »

CERN Business Ideas Accelerator



CERN
Pre-Incubator

- STFC CERN BIC
- NIKHEF CERN BIC
- NTNU CERN BIC
- National BIC
- National BIC

KT through People

Every year, hundreds of students come to CERN to contribute to our research programs

An opportunity for young people to learn in a multicultural environment

Not only for physicists! Also engineers, computer scientists, administrative students…

National Teacher Programmes

One week on high-energy physics and applications for high school teachers at CERN

Provided in language of the participants

Bringing particle physics and modern research closer to schools

9 sessions of the Spanish teacher programme have been arranged training a total of 356 teachers from Spain

Participants in the CERN teacher programme observe particle trajectories in a cloud chamber they have built

Conclusions

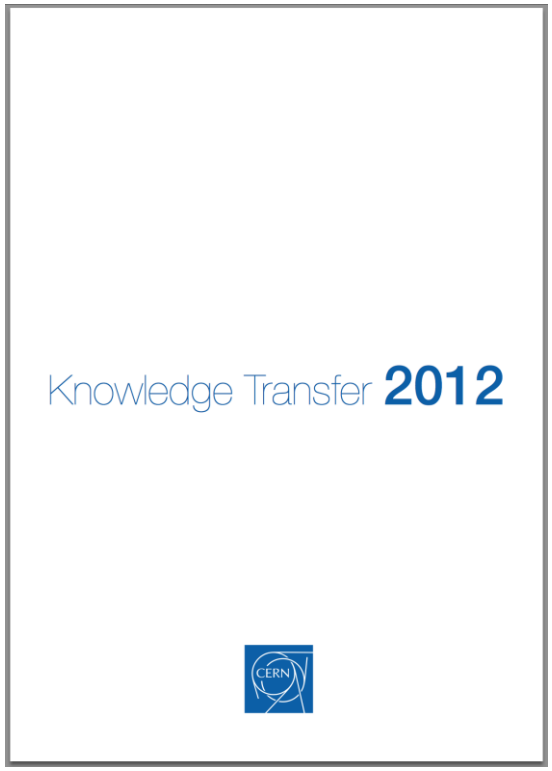
Integral part of CERN's mission

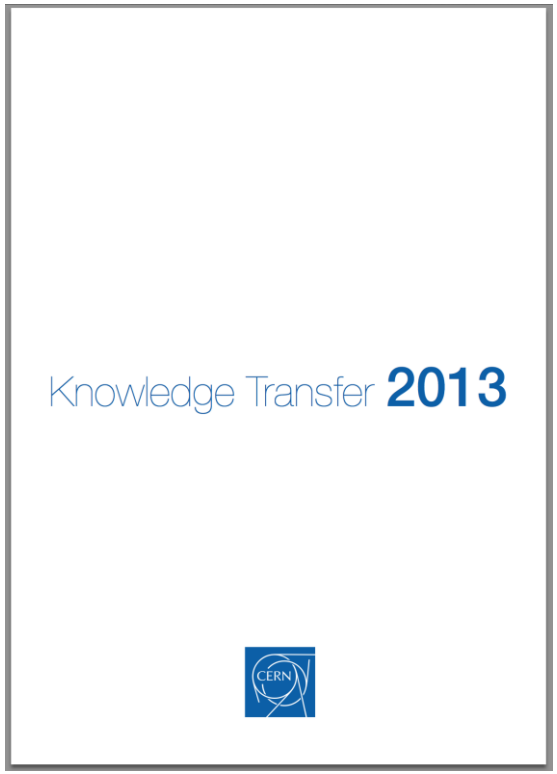
CERN technologies have applications in several domains with high relevance to society.

Impact which delivers tangible benefits to mankind

Questions

KT Annual Report





More information

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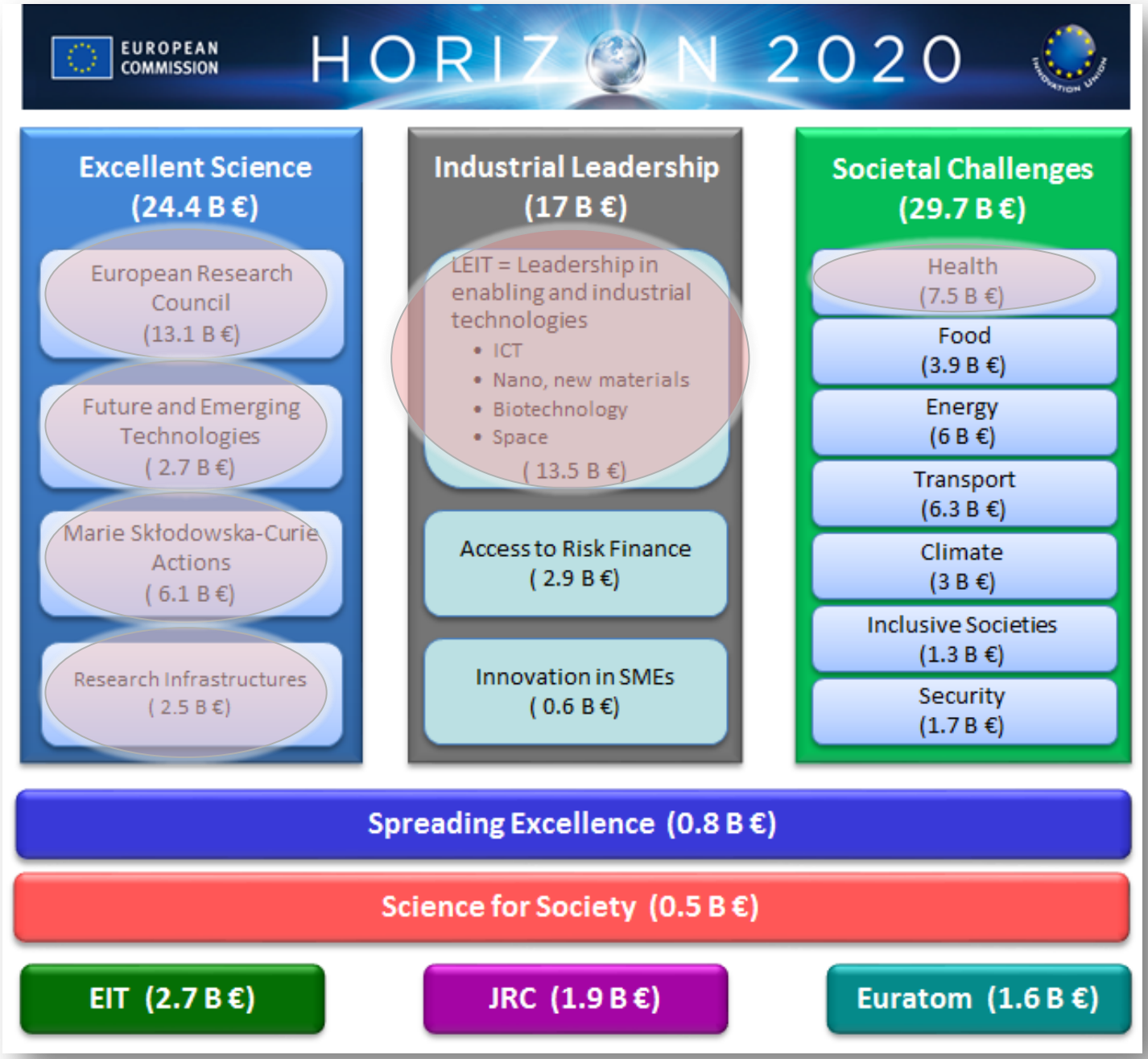
Areas of potential interest for CERN in Horizon 2020

Pablo Garcia Tello, CERN, Knowledge Transfer Group

Spain at CERN, 28-29 October 2014


EUROPEAN COMMISSION
HORIZON 2020
Excellent Science
(24.4 B €)
European Research Council
(13.1 B €)
Future and Emerging Technologies
(2.7 B €)
Marie Skłodowska-Curie Actions
(6.1 B €)
Research Infrastructures
(2.5 B €)
Industrial Leadership
(17 B €)
LEIT = Leadership in enabling and industrial technologies
• ICT
• Nano, new materials
• Biotechnology
• Space
(13.5 B €)
Access to Risk Finance
(2.9 B €)
Innovation in SMEs
(0.6 B €)
Societal Challenges
(29.7 B €)
Health
(7.5 B €)
Food
(3.9 B €)
Energy
(6 B €)
Transport
(6.3 B €)
Climate
(3 B €)
Inclusive Societies
(1.3 B €)
Security
(1.7 B €)
Spreading Excellence (0.8 B €)
Science for Society (0.5 B €)
EIT (2.7 B €)
JRC (1.9 B €)
Euratom (1.6 B €)

European Research Council (ERC)

The European Research Council supports frontier research, cross disciplinary proposals and pioneering ideas in new and emerging fields which introduce unconventional and innovative approaches.

Individual grants:

- 1 researcher;
- 1 host institution;
- 1 project;
- 1 selection criterion: scientific excellence

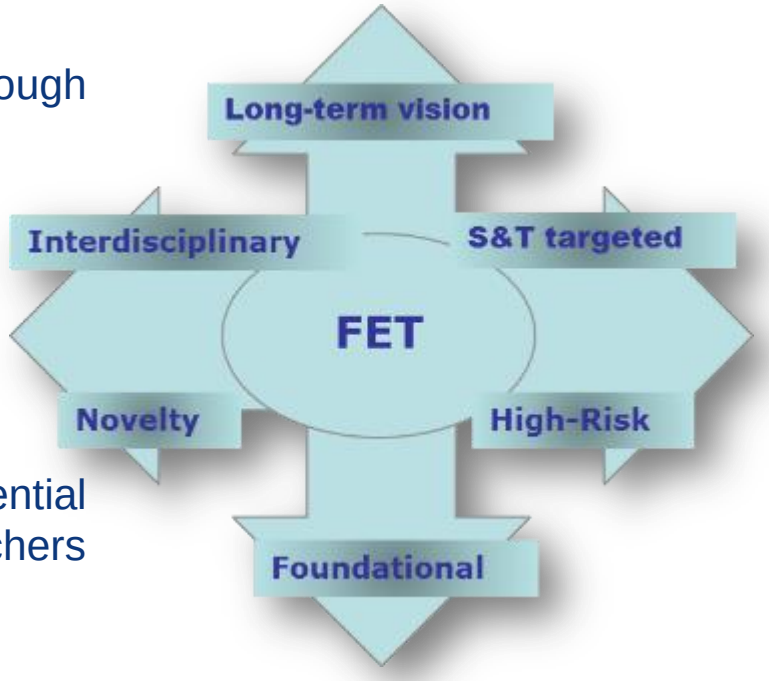
Industrial participation is very low but awarded researchers may use industrial contacts to develop technology if the project so requires.

Future and Emerging Technologies (FET) Open

- New programme for CERN.

- FET Open main characteristics:

  - ambitious scientific and technological breakthrough goal,
  - foundational character,
  - high degree of novelty,
  - high-risk,
  - long-term vision,
  - deep synergistic interdisciplinary approach.



FET Open encourages also proposals from new high-potential actors in research and innovation (such as young researchers and high-tech SMEs).

- Potential areas of interest (examples):

  - ICT (i.e. detection & imaging technologies, augmented reality, photonics/microelectronics)
  - New materials (i.e. superconducting magnets)
  - Medical Physics (i.e. particle therapy)

Marie Curie Actions (Initial Training Networks (ITNs)

- Wide Experience at CERN.
- The objective of the MSCA is to support the career development and training of researchers – with a focus on innovation skills – in all scientific disciplines through worldwide and cross-sector mobility.
- ITNs support competitively selected joint research training and/or doctoral programmes, implemented by European partnerships of universities, research institutions, and non-academic organisations. The research training programmes provide experience outside academia, hence developing innovation and employability skills.
- Potential areas of interest (examples):
  - ICT (i.e. detection & imaging technologies, augmented reality, photonics/microelectronics)
  - New materials (i.e. superconducting magnets)
  - Medical Physics (i.e. particle therapy, dosimetry, imaging for ion therapy)
  - Theoretical Physics (i.e. interdisciplinary teams on different disciplines).

Industrial participation specially of SMEs is high.

Research Infrastructures (1)

- Wide Experience at CERN.

- Scope of the projects according to funding thematic
  - Developing the European infrastructures for 2020 and beyond;
  - Fostering the innovation potential of the infrastructures and their human resources
  - Reinforcing European policy and international cooperation

- Potential areas of interest (examples):

  - Accelerators and Detectors Instrumentation aligned with foreseen technology upgrading programmes:

    - Solid state radiation hard components, devices;
    - Cryogenic detectors;
    - Data Acquisition Systems;

Typically academic consortia with industrial participation through subcontracting etc.

Research Infrastructures (e-Infrastructures) (2)

- Wide Experience at CERN.

- Scope of the projects according to funding thematic
  - Developing the European infrastructures for 2020 and beyond;
  - Fostering the innovation potential of the infrastructures and their human resources
  - Reinforcing European policy and international cooperation

- Potential areas of interest (examples):

  - High Performance Computing
  - Big Data transmission, storage, processing;
  - Grid Computing

Industrial participation is high mainly through established partnerships, etc.

Leadership in Enabling and Industrial Technologies (LEIT)

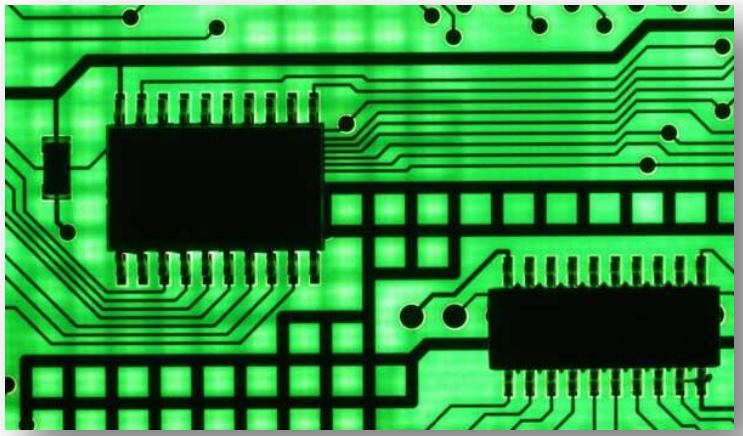
- Limited experience but increasing interest at CERN.

- LEIT ICT (examples of areas)

  - Photonics (i.e. fibre optics, photonics integrated circuits, photomultipliers, etc)
  - Solid state radiation hard detectors
  - Augmented/enhanced reality
  - Cyber-physical systems

- LEIT NMP (nanotechnologies) (examples of areas)

  - 3D printing
  - High performance materials (i.e. cryogenics, superconductors, etc)



- Space (examples of areas)

  - Radiation hard instrumentation components

Industrial participation foreseen high through partnering in project consortia.

Societal Challenges: Health

- Limited experience but increasing interest at CERN.
- Area of Medical Physics (examples):
  - Particle therapy
  - Imaging Systems for Ion therapy
  - Enhanced real-time imaging for radiotherapy
  - Radiation Dosimetry

Industrial participation foreseen high through partnering in project consortia specially with SMEs.

Final Considerations

- CERN expects most of its H2020 participation to be under the Excellence Science pillar.
- For ERC, there is no industrial participation needed or foreseen but a pool of contacts is always interesting in case that researchers need it.
- For Marie-Curie actions, the industrial participation is a must, and SMEs are particularly welcome.
- For FET Open, the presence of industrial partners is welcome as well although CERN experience is building up.
- For Research Infrastructures, industrial participation is rare.
- For e-infrastructures, industrial participation may be useful e.g. for cloud computing and other service provisions.
- For the projects under the Industrial Leadership and Societal Challenges pillars the industrial participation is crucial but as the experience of CERN is building up it is not expected that CERN will coordinate a significant number of projects for the moment.

Thank you for your invitation
Questions?