

# Knowledge Transfer @CERN

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Knowledge Transfer Group Leader  
CERN



# KT: one of CERN's missions

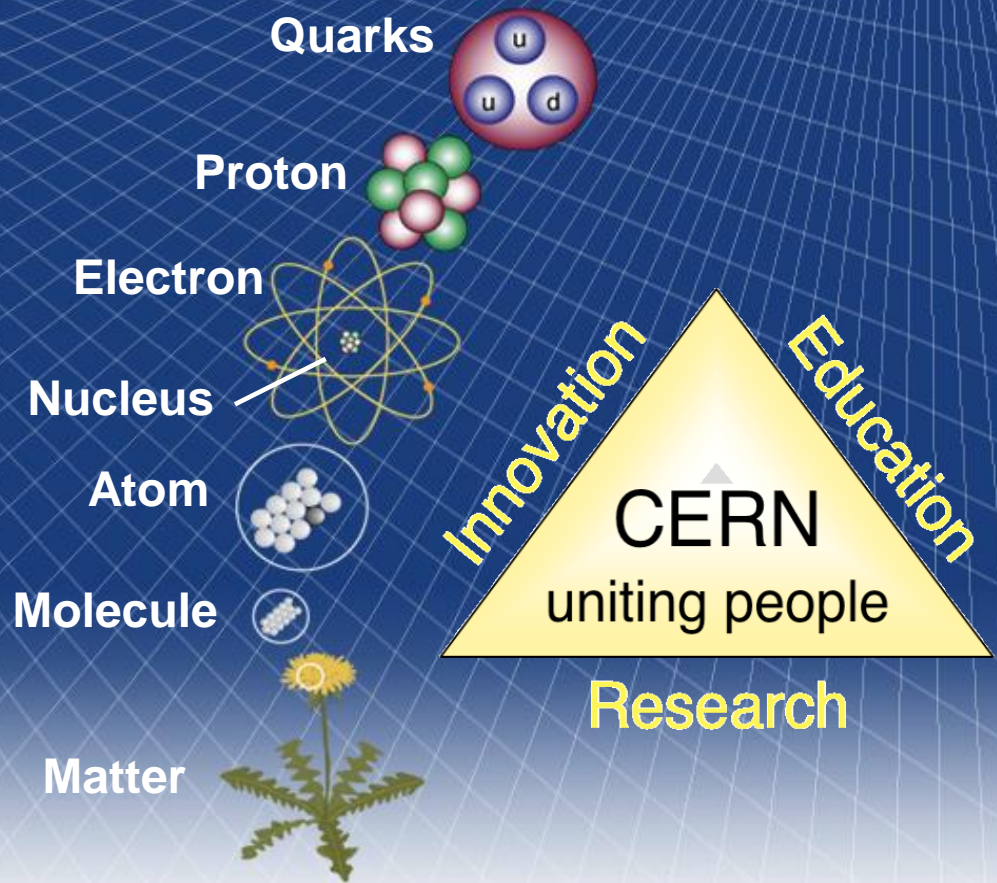
Push back the frontiers of knowledge in nuclear research

Develop new technologies for accelerators and detectors

Train scientists and engineers of tomorrow

Unite people from different countries and cultures

Knowledge Transfer

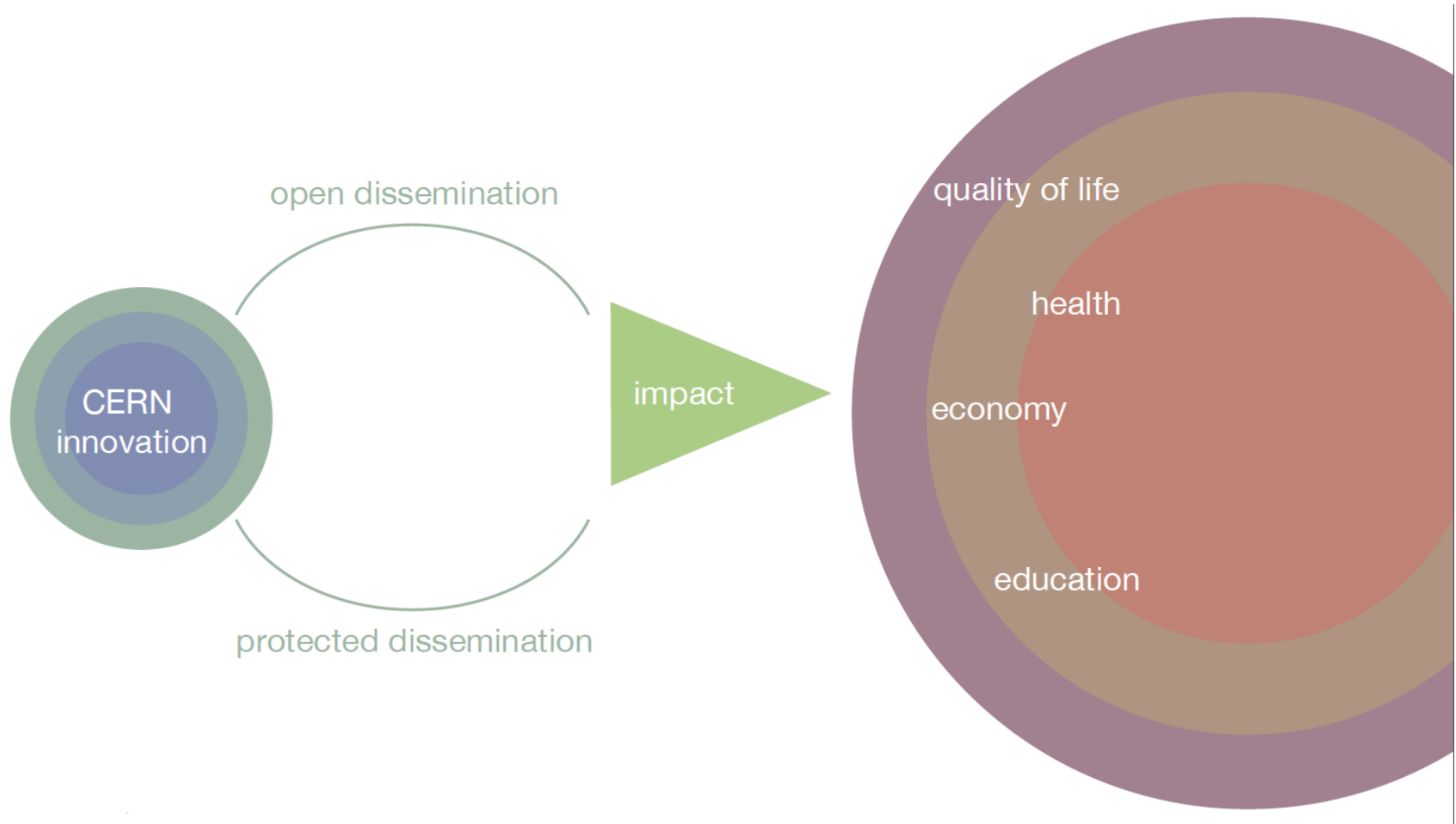


# The KT Group Mandate

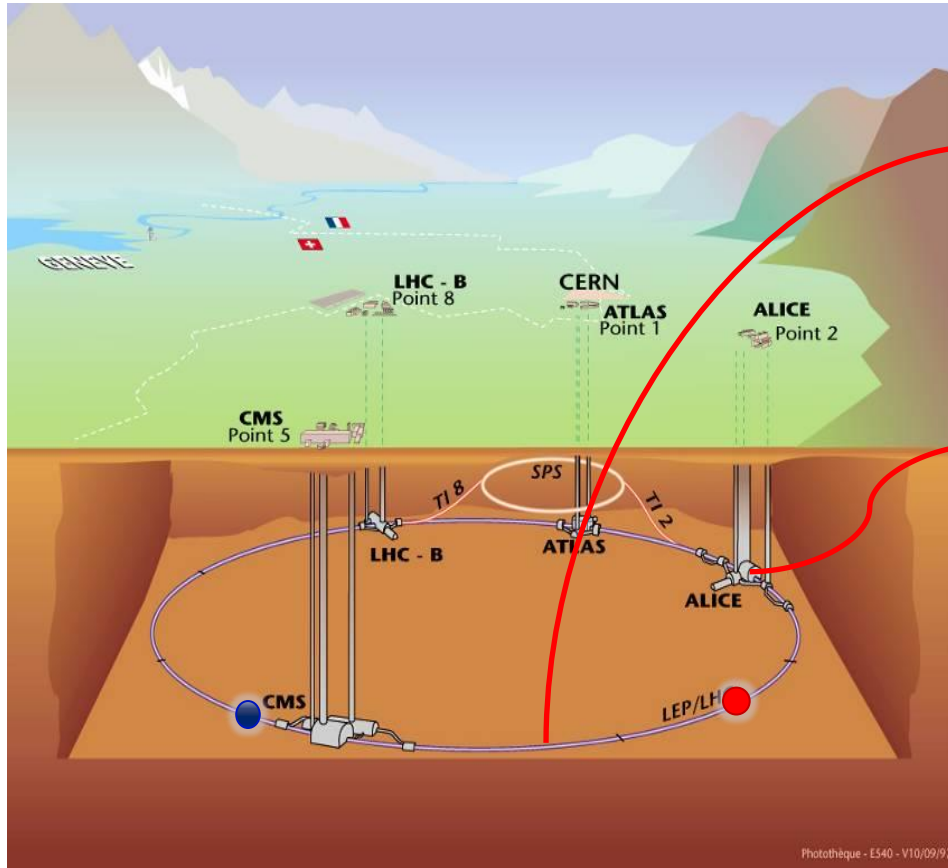
- Optimize the impact of CERN's science, technology and know-how on society and promote knowledge exchange with CERN's stakeholders.
- Function as a catalyst to foster KT transfer between the different stakeholders. Promote and sustain a culture of inventiveness and of knowledge and technology transfer.
- Promote, raise awareness and participate in multidisciplinary activities, in particular those relevant to life sciences application.

***Key words: dissemination and impact!***

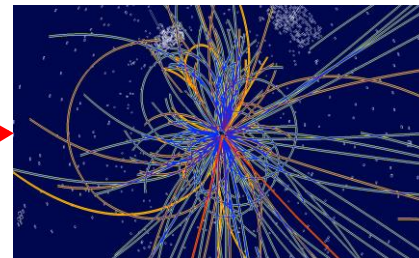
# Why KT?



# CERN's areas of excellence



Accelerating  
particle beams



Detecting  
particles



IT  
technologies

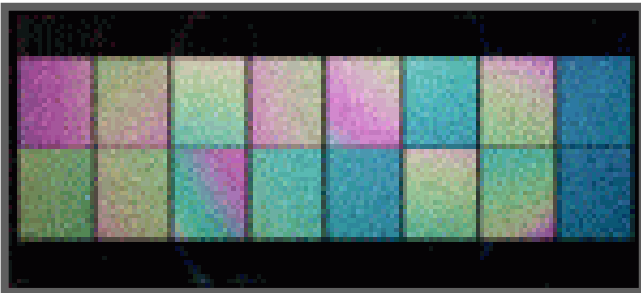
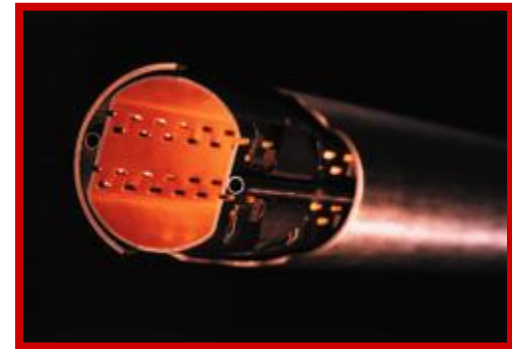


# CERN Core Competences

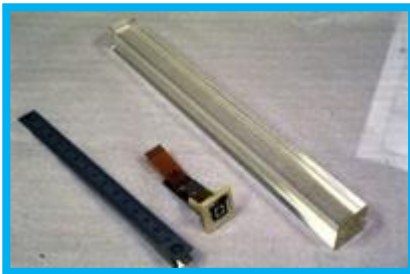
Super-  
conductivity  
(13kA,  
7MJoules)



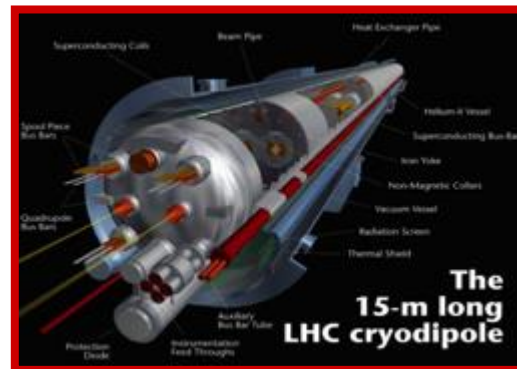
Vacuum  
( $10^{-12}$   
Torr)



Very high  
performance  
detectors and  
electronics

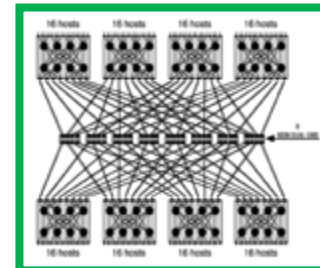


Cryogenics (1.9 K)



Magnets  
(10 T)

Data  
processing



# KT happens in many ways

**Licensing**

**CERN Open  
Hardware License**

**Service and  
consultancy**

**CERN Easy Access IP**

**R&D Collaborations**

**A network of Business  
Incubator Centers in  
the Member States**

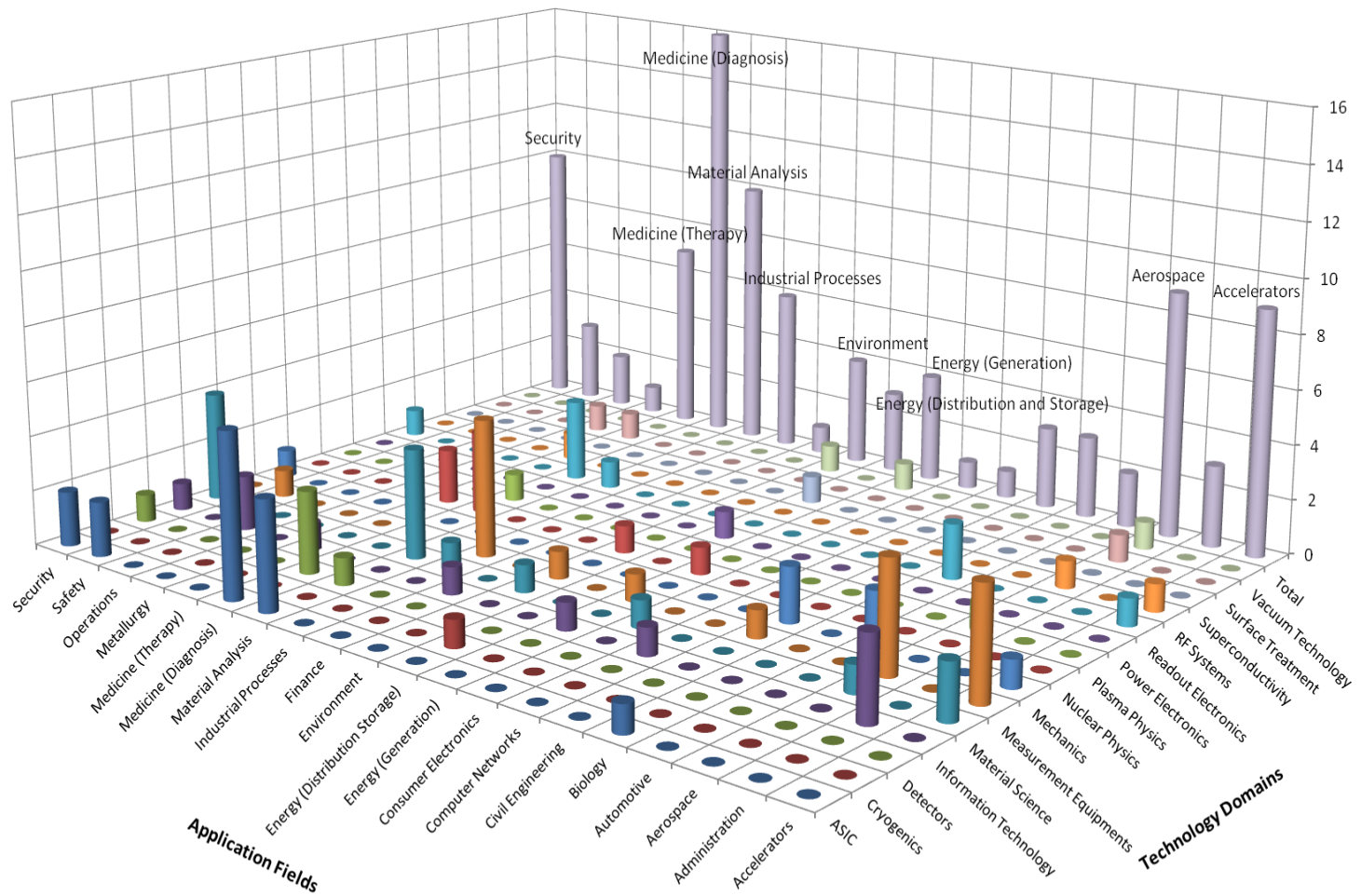
**KT through  
procurement**

**EU Projects**

**KT through People**

The KT group helps making KT happen, and choosing the best dissemination channel

# CERN's Technology Portfolio





Visit our website  
to have a look at  
our technology  
portfolio in detail

[www.cern.ch/  
knowledgetransfer](http://www.cern.ch/knowledgetransfer)

## Knowledge Transfer

 Search

[Home](#) [Technology Transfer Office](#) [Life sciences](#) [Our team](#) [Contact us](#)

### Technology portfolio

All CERN technologies listed below are available for licensing and/or research collaborations with industry or institutes.

- 3D Magnetic sensor calibrator
- Compact cryogenic cooling pump
- CRISTAL
- Cryogenic optical fiber temperature sensor
- Cryogenic Saving Unit
- Diaphragm System
- Evacuable Flat Panel Solar Collector
- Fast front-end readout electronics for photon and electron counting applications
- Gas electron multiplier
- High performance time to digital converter
- High power high frequency loads for energy recovery
- Hood clamshell tool
- Indico
- Integrated CO<sub>2</sub> cooling system
- Invenio
- MammoGrid
- Medipix2
- Method for the production of carrier-free radioisotopes
- Micro Chemical Vias
- Micro-scintillation particle detector for hadrontherapy
- Mounting mechanism for cantilever with high precision positioning
- Multifunctional detector
- Neutron-driven element transmuter
- NiceAdmin
- NINQ
- Non-evaporable getter (NEG) thin film coatings
- OnnoPi: Data compression
- Palladium thin-film coatings
- PHOSWICH
- Power converter with integrated energy storage
- Pulse tube refrigerator/cryo-cooler
- Quantum cosmometry
- Reduction of SEY by magnetic roughness
- Resistive MicroMegs
- RF Waveguide Vacuum Valve
- ROOT
- Single layer 3D tracking semiconductor detector
- Thermally insulatable vessel
- Titanium polishing

[View technologies by domain »](#)



# From high vacuum...

- **NEG** (Non-Evaporable Getter thin film coatings)

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



# ... to solar energy!

- License and partnership with a start-up company

Development of a commercial product able to use diffused or indirect light and reach very high temperatures of up to 300 degrees  
Development of a prototype production chain



# Vacuum is an excellent insulator!



# Solar panels plant

- Civil-engineering company opened a new solar power plant

Environmentally friendly "solar field" heats close to 80,000 cubic metres of bitumen to 180 degrees.





# Installation at GVA airport



# NEG

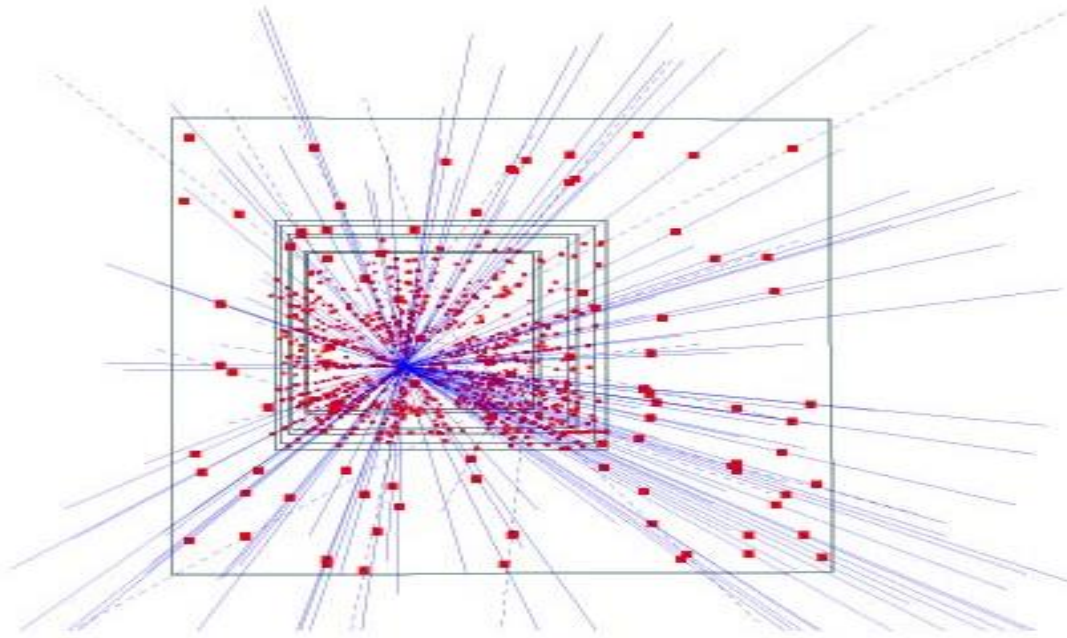
## Licenses to:

- SAES, which has developed the product IntegraTorr based on the NEG technology
- Italian company



# Silicon pixel detectors (SPDs)

- Hybrid silicon pixel detectors for tracking applications in High Energy Physics

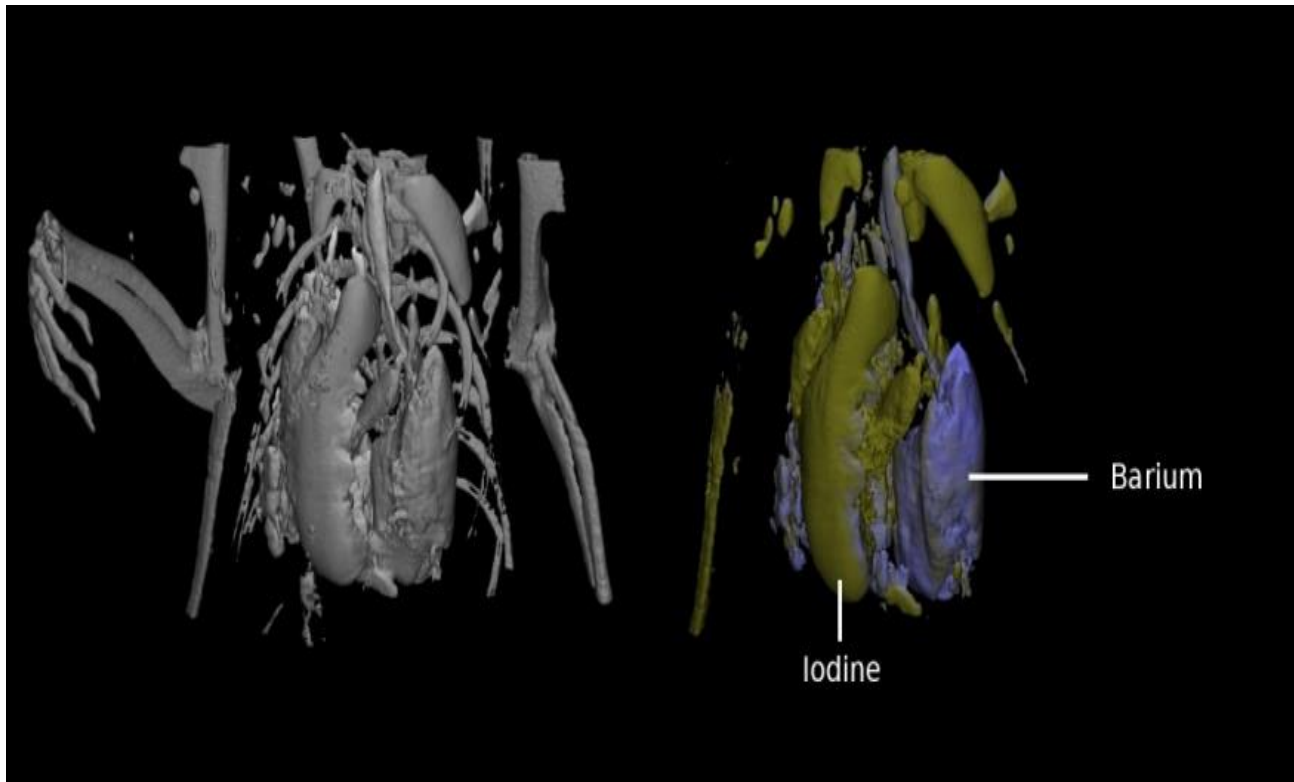


153 high energy particle tracks flying through a telescope of half a million pixels in the WA97 experiment back in 1995

# Application: Medical imaging

- **MARS project**

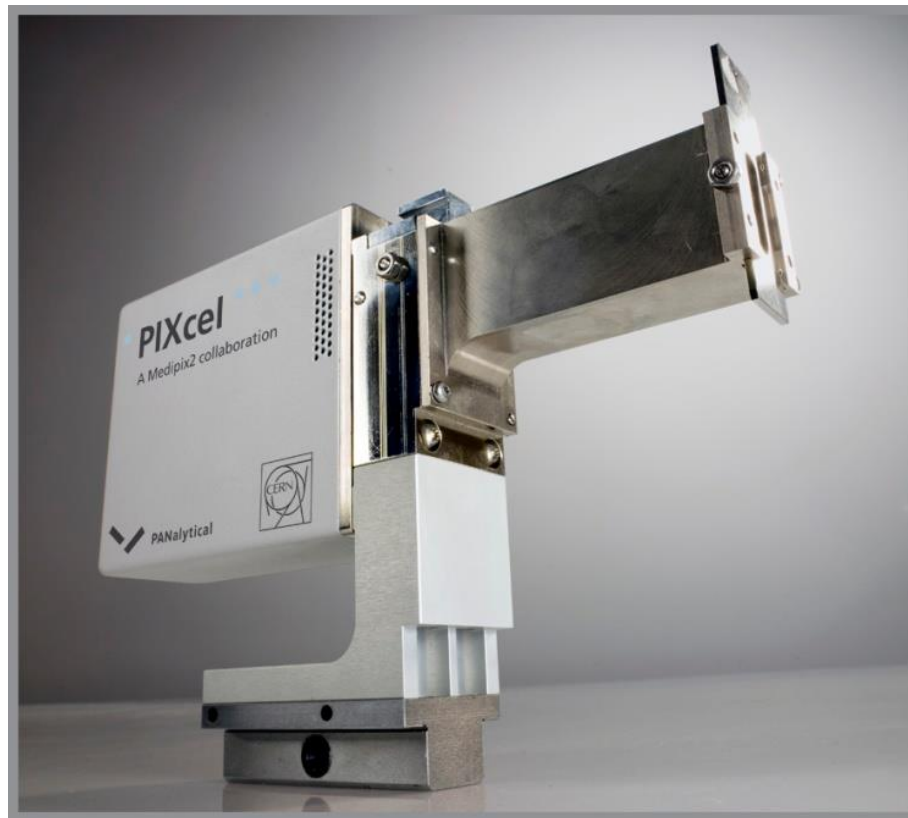
Colour CT X-ray scanner based on the Medipix technology



(courtesy of MARS Bioimaging Ltd)

# Application: Material analysis

- Partnership and license agreements with a company to build a X-ray diffractometer





# HPTDC

## HPTDC

- **H**igh **P**erformance **T**ime to **D**igital **C**onverter
- Precise time-tagging of electronic signals

CAEN - Costruzioni Apparecchiature  
Elettroniche Nucleari S.p.A

- Holds a licence to and has developed 3 different Time to Digital converters based on the HPTDC

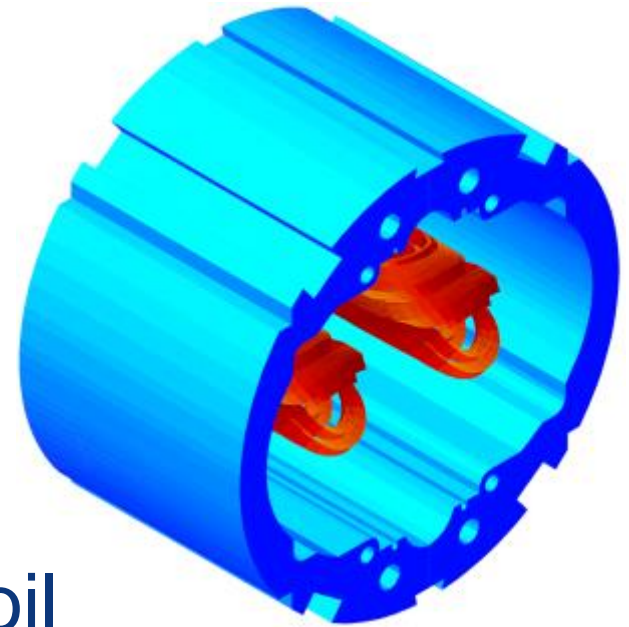


# Roxie

Routine for the  
Optimization of magnet  
X-sections,  
Inverse field calculation and coil  
End design

License to:

- INFN - Laboratori Nazionali di Frascati



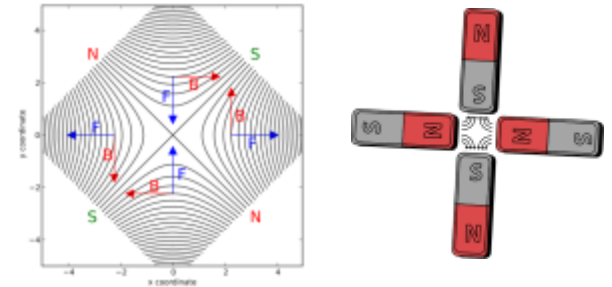
ROXIE model of the  
LHC main dipole  
extremities

# Magnetic Measurement

Technology for measurement of quadrupole magnets with the rotating coil principle

Ansaldo Superconduttori SpA holds a license to the technology

Ansaldo developed and supplied magnets to among other CERN and CNAO



Measurement of quadrupole magnet

# Recent cases

## Collimator Material Collaboration

- Collaboration with company
- R&D on the processing, manufacturing, characterization and testing of advanced thermal management materials with high structural and thermal properties

## Linac4 Drift Tubes

- License to LNL-INFN for the linac4 drift tube linac design and related patent
- Purpose of the agreement is for LNL-INFN to be able to manufacture drift tube linac for the European Spallation Source ESS

## Large monolithic SiPMs with excellent timing

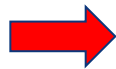
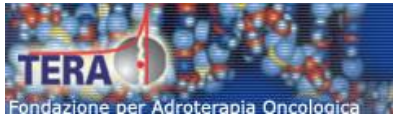
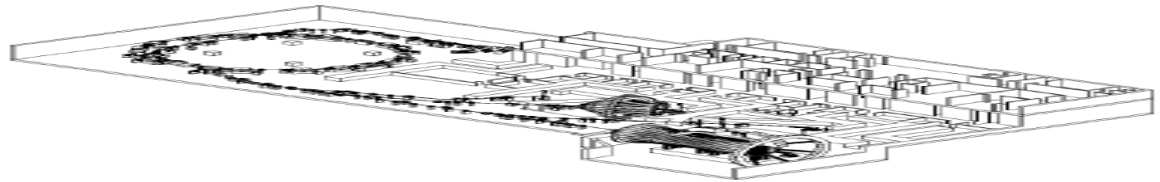
- Shared patent between CERN and INFN

## Portable Radiation Survey Meter

- Joint ownership agreement between CERN and Politecnico di Milano

# CERN's PIMMS Study

PIMMS 2000  
(coordinated by  
CERN) has led to:



fondazione CNAO

Treatment centre in Pavia, Italy.

**First patient treated with Carbon ions in November 2012!**



Treatment centre in Wiener Neustadt, Austria,  
foundation stone 16 March 2011, will be ready in 2015



# CNAO



# ENLIGHT



CERN physics into health field

- Common mu
- Identify chall
- Share know
- Share best
- Harmonise
- Provide tr
- Innovate
- Lobbying

Coordinate



> 150 institutes

> 400 people

> 25 countries

(with >80% of MS involved)



2008-2012

- Marie Curie Initial Training Network
- 12 institutions
- 29 trainees



2009-2014

- Infrastructures for hadron therapy
- 20 institutions



2010-2014

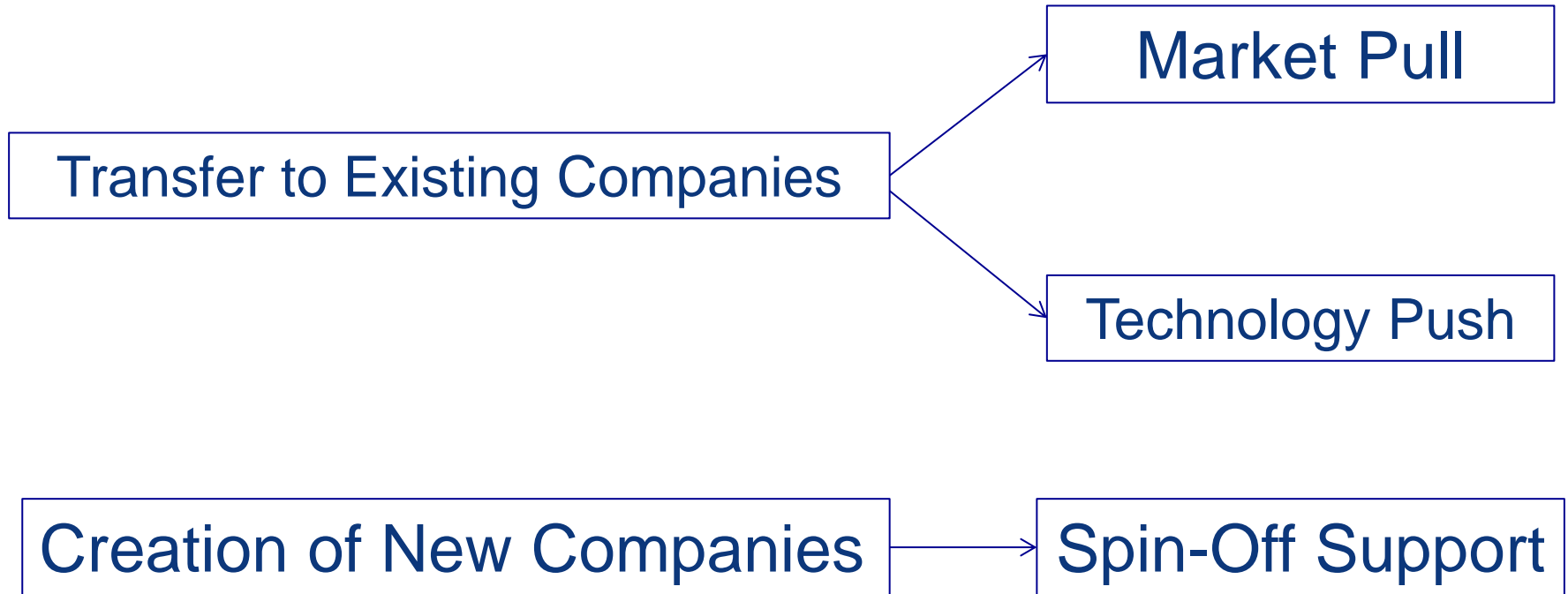
- R&D on medical imaging for hadron therapy
- 16 institutions



2011-2015

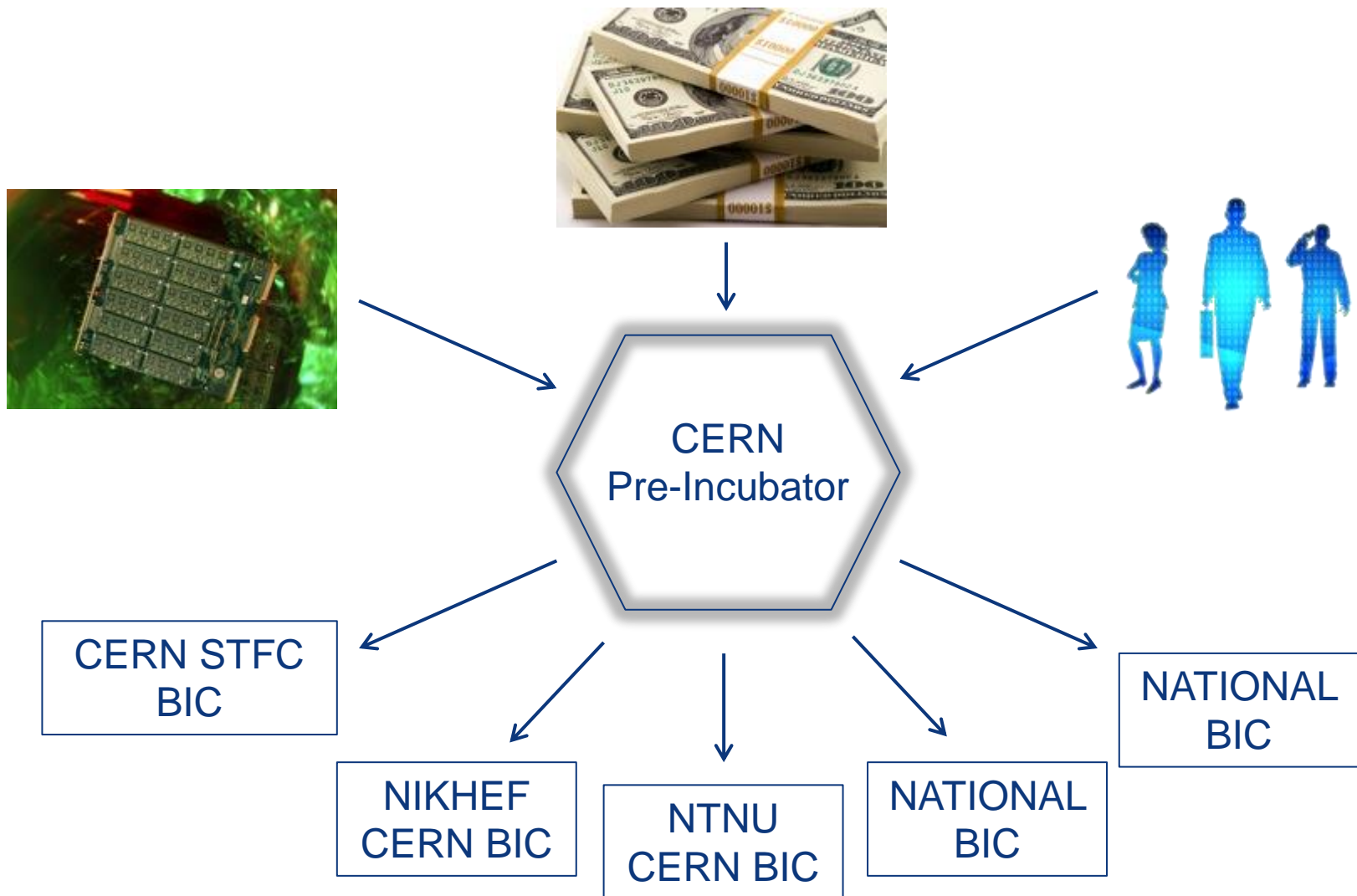
- Marie Curie ITN
- 12 institutions
- 16 trainees

# KT implementation ways





# CERN Business Ideas Accelerator



# Turning CERN technologies into new business opportunities

 **STFC**

  
*technology*

## STFC CERN Business Incubation Centre

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### Welcome to the STFC CERN BIC

#### High energy physics accelerating business

**Creating innovative new products, services and business opportunities from high energy physics technologies**

The STFC CERN Business Incubation Centre (BIC) offers funding, business support and technical assistance to entrepreneurs and small high-tech companies seeking to accelerate their innovative business concepts.

Focused on developing new products and services using technologies originally developed for use in high energy physics research, this pilot scheme draws on the world-leading capabilities of the Science and Technology Facilities Council (STFC) and the European Organization for Nuclear Research (CERN), home of the Large Hadron Collider.

The BIC combines the incubation experience of STFC with the unique opportunity to access STFC and CERN intellectual property (IP), technologies and expertise. It will help businesses to grow from technical concept to market reality, from small start-ups into thriving high-tech companies.

There is an open call for applicants to join the scheme and the deadline for applications is **June 2013**.

For all the latest news, information and opportunities at the STFC CERN BIC, follow us on twitter [@STFC\\_B2B](#).





Medical scanners



Cern has been at the forefront of the technology behind PET and MRI medical imaging machines since building prototype scanners with Geneva's hospital in the 1970s. Electronics developed for Cern's atom-smashing Large Hadron Collider are offering fresh promise of combined PET/MRI scanners that would provide more detailed images of the human body.

Touch screens



More than three decades before the technology became ubiquitous, the first touch screen control pad was developed at Cern in the 1970s by Bent Stumpe, a Danish engineer. He had been asked to come up with a system to replace the thousands of buttons, knobs and switches needed to operate Cern's Super Proton Synchrotron particle accelerator.

World wide web



Tim Berners-Lee developed the world wide web in 1989 as part of a Cern project to improve information sharing between its network of 8,000 scientists working in universities and institutes around the world. The achievement was celebrated in Mr Berners-Lee's appearance in the opening ceremony of the London Olympics.

# Greater commercial returns sought from Cern

By Andrew Bounds, North of England Correspondent

Britain is spearheading an effort to extract bigger commercial returns from the \$8bn invested by the world's governments in Cern, the European physics research laboratory.

Cern is best known as home to the Large Hadron Collider, the most powerful atom smasher, where scientists in July discovered the Higgs boson "God particle", which explains matter.

Its research also helped create the world wide web and MRI scanning since its inception in 1954.

Yet, the UK believes more can be done to harness commercial value.

"We want to get technology from inside the ivory tower into the economy,"

says John Womersley, chief executive of the Science and Technology Facilities Council, the UK research body. "Cern understands this is something it needs to get better at."

Cern and the STFC are opening a competition this week for five companies to receive funding and technical help from scientists at the laboratory near Geneva.

Prof Womersley said the collaboration would help develop findings from Cern's atom-smasher in a way that "can impact on people's lives".

He said small companies were often best at exploiting new technology, noting how touch screens were first used at Cern but not commercialised by it.

Winning companies will receive £40,000 funding, up

to 40 hours technical support from Cern and 40 hours form the STFC, access to intellectual property at preferential rates and cheap incubator space at Sci-Tech Daresbury, the council's innovation campus near Warrington.

Paul Vernon, head of campus development at STFC, said possible spin-

offs could include airport security scanners - as Cern has developed technology to detect radiation - or treatments for conditions such as osteoporosis. But he added: "It is as likely to be something we didn't expect. That is why we are opening it up to these innovative companies."

Winning companies will

also be able to collaborate with universities from Liverpool and Manchester as well as the 100 or so other businesses on the Daresbury site, which include IBM and Dell.

The STFC contributes £100m a year to Cern, a sixth of the council's budget. UK companies receive about £15m annually in contracts in return.

Steve Myers, Cern's director of accelerators and technology, said: "Cern is committed to maximising the benefit to society of Cern technology through the development and exploitation of innovative ideas."

The STFC's Rainbow venture capital fund could also become involved.

STFC Innovations, the commercialisation company, has created more

than 16 spinouts worth £50m.

The STFC is collaborating with the European Space Agency on a similar model. There are some 15 businesses at its Harwell campus near Oxford, including Radius Health, which is working on a portable X-ray machine that could be used by paramedics at accident scenes. Another company is working on a drone that can map the condition of crops and then network with a tractor's GPS system to ensure the right amount of fertiliser is spread in the right place.

The space agency has seven technology transfer centres across Europe and Cern hopes to follow suit. The competition is open to companies from the 20 countries that pay for Cern.

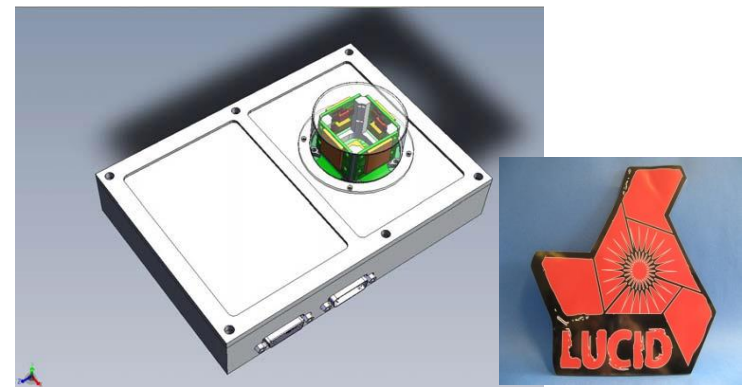
## Technology and trophies

£40,000	£100m
Funding winning companies will receive	Sum the STFC contributes to Cern each year
40hrs	£15m
Technical support from Cern winners will receive	Value of Cern contracts UK companies receive annually

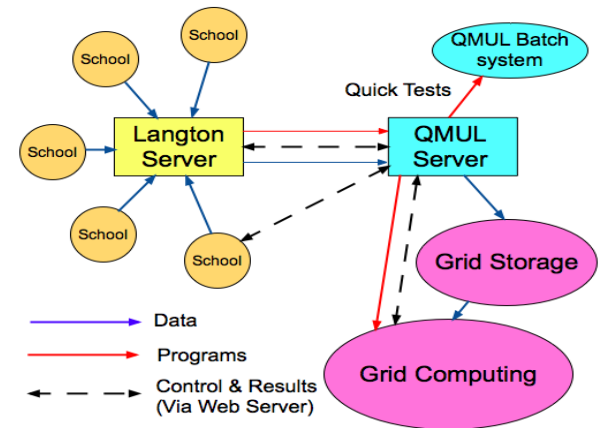
Financial Times, 19.10.2012



CERN@school allows students to use a Timepix chip in the lab to visualise radiation



Langton Ultimate Cosmic ray Intensity Detector uses 5 Timepix chips to monitor the radiation environment in Space



Data from LUCID and CERN@school detectors will be uploaded to the Grid and made available for students to analyse

# CERN Open Hardware Licence

A legal framework to facilitate knowledge exchange across the electronic design community.

In the spirit of knowledge and technology dissemination, the CERN OHL was created to govern the use, copying, modification and distribution of hardware design documentation, and the manufacture and distribution of products.



# CERN OHL: it is making an impact!

- CERN OHL v1.1 Launched in 2011, great interest from the worldwide community
- More than 50 hardware designs licensed under CERN OHL
- More than 20 companies are using it
- The license is being used by people outside our community as well (and for any kind of hardware)
- Thanks to the interactions with the community, we improved the license and prepared v1.2





# CERN Easy Access IP

CERN Easy Access IP is a new opportunity to benefit of CERN's Intellectual Property.

The scheme involves making some of CERN's technologies available free of royalties, released only to partners who can best develop them to benefit the economy and society.

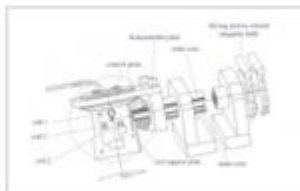
If you would like to know more about CERN Easy Access IP or other technology transfer opportunities, please contact CERN's [Technology Transfer Office](#).

The following technologies are available under the CERN Easy Access IP scheme:

## 3D Magnetic sensor calibrator

This is an innovative device for calibrating magnetic field with high resolution. The technology measures all three axes of the magnetic field, by performing a scan over the full unit sphere, independent of its orientation relative to the magnetic field.

[\[ read more \]](#)



## RF Waveguide Vacuum Valve

This device enables low-loss RF power transmission in a waveguide across a gap, where a liftable instrument is positioned.

[\[ read more \]](#)



## Thermally insulatable vessel

The Thermally insulatable vessel is a simple container system for hot substances, incorporating a temperature display within the vessel's cap or lid.

The key element in this technology is an integrated infra-red thermometer developed with Micro-Electro-Mechanical systems on a common silicon substrate through micro fabrication technology.

[\[ read more \]](#)

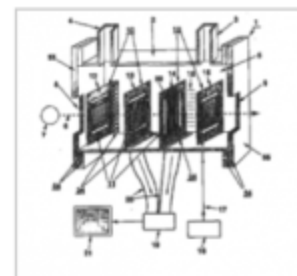


## Multifunctional detector

A multifunctional, versatile position-sensitive detector for measuring characteristics of a beam of particles.

The technology consists of a microwire-based monitor that allows measuring non-destructively the spatial profile, divergence, and intensity of UV, x-ray, and charged particle beams, including anti-particles.

[\[ read more \]](#)



## Cryogenic optical fiber temperature sensor

The technology consists in a simple and relatively cheap cryogenic temperature sensor, composed of an optical fiber and a Brillouin spectral analyzer for measuring one or more temperature dependent Brillouin scattering parameters.

[\[ read more \]](#)



Easy Access IP was first trialled by [Easy Access Initiative](#), a collaborative project between the University of Glasgow, King's College London and the University of Bristol.

[CERN Easy Access IP Exclusive Licence agreement](#)

[CERN Easy Access IP Non-Exclusive Licence agreement](#)



# Knowledge Transfer through Procurement

Results from a survey of companies involved in technology-intensive procurement contracts with CERN.

178 questionnaires analyzed, related to 503 MCHF procurement budget.

## Results:

- 44% indicated technological learning
- 42% increased their international exposure
- 38% developed new products
- 36% indicated market learning
- 13% started new R&D teams
- 52% would have had poorer sales performance without CERN
- 41% would have had poorer technological performance

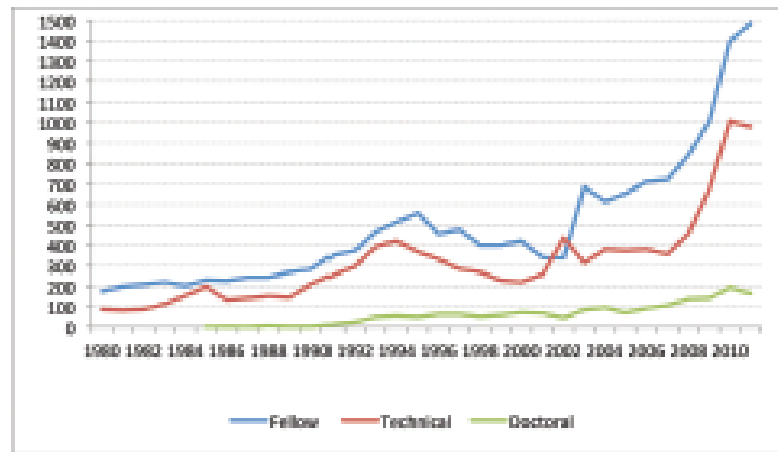


# Knowledge Transfer through People

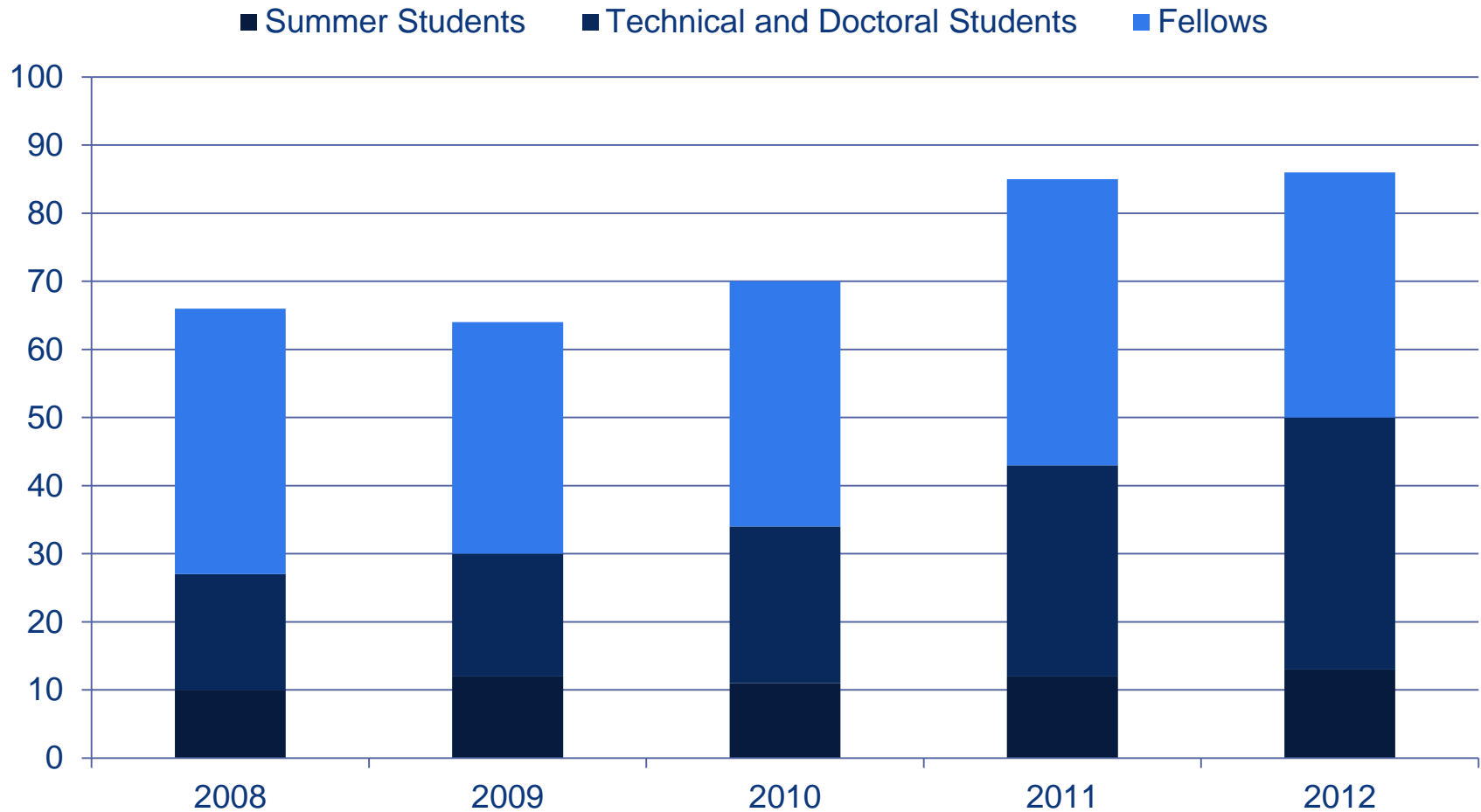
Every year, hundreds of students come to CERN to contribute to our research programs

An opportunity for young people to learn in a multicultural environment

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



# Students and fellows selected from Italy



# More info / Contacts

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