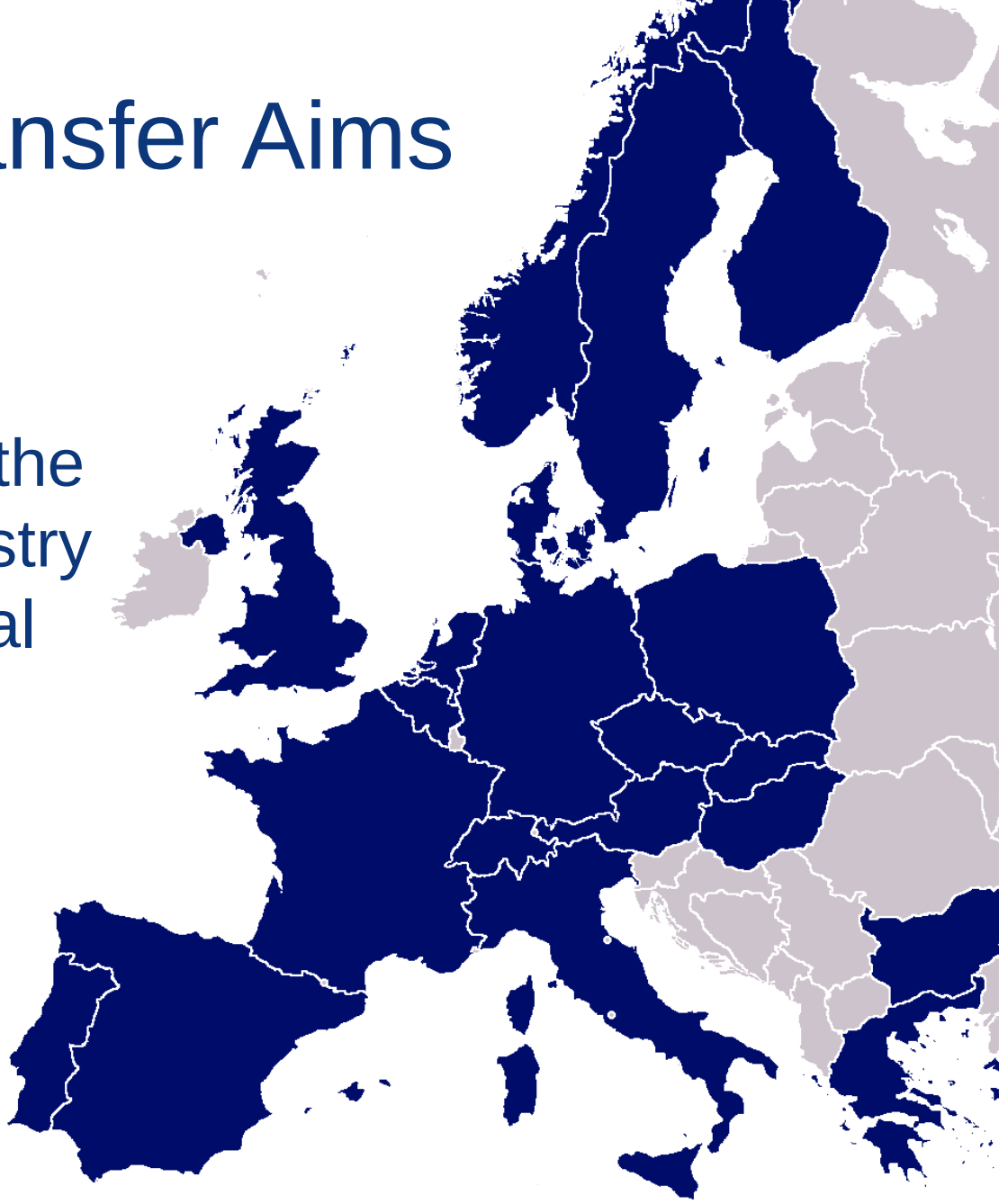
Knowledge Transfer at CERN

N.Ziogas
Knowledge Transfer Group

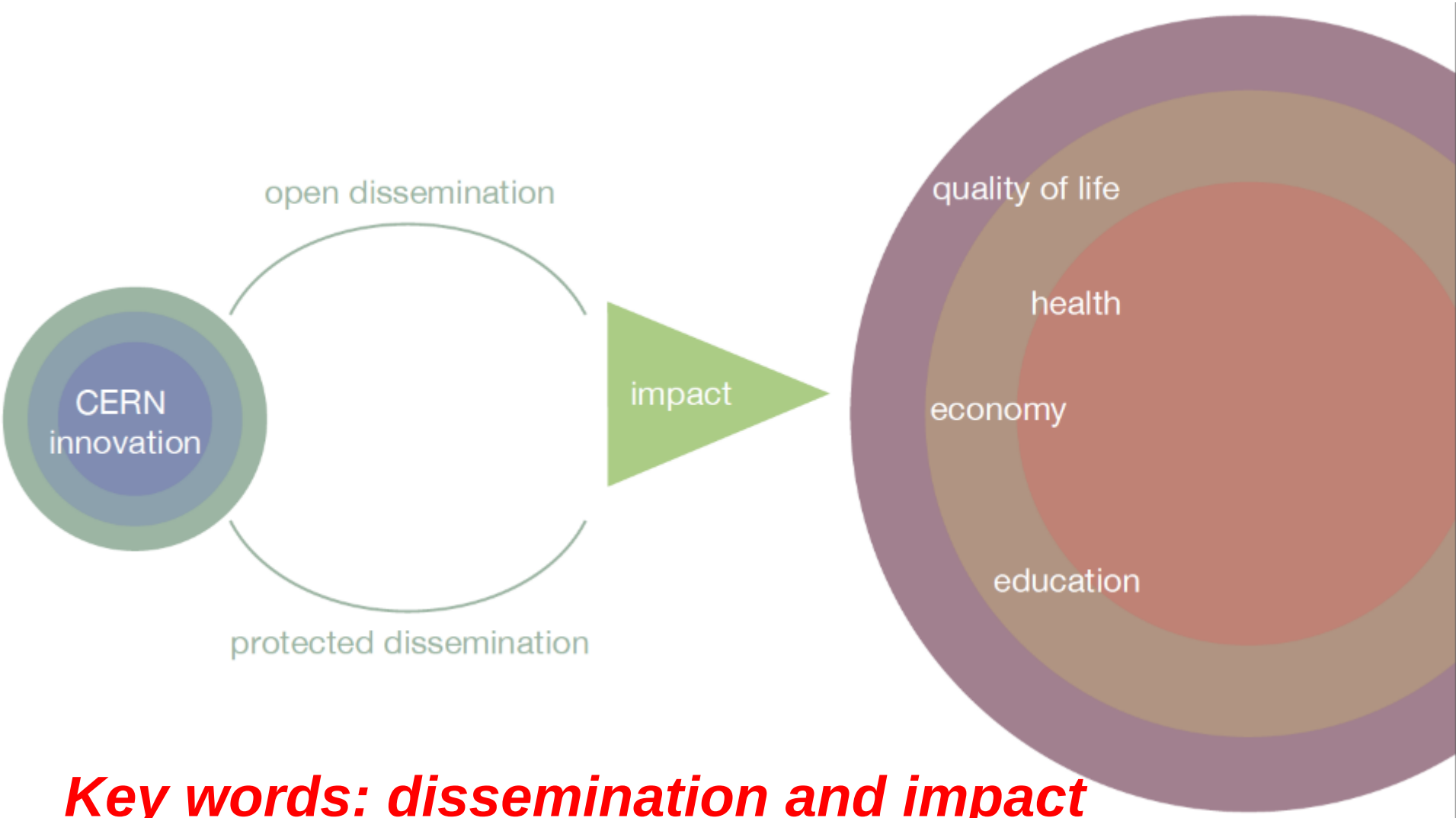
Knowledge Transfer Aims

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

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



Impact-driven Innovation Approach



Key words: dissemination and impact

The World Wide Web

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

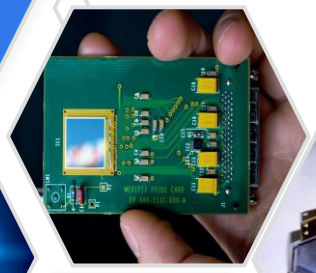
How? – The Knowledge Exchange

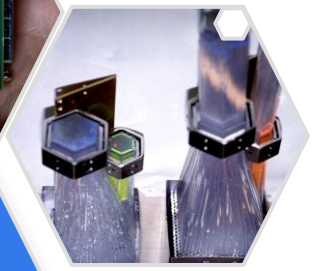
R&D Collaborations

Consortia & exploitation agreements

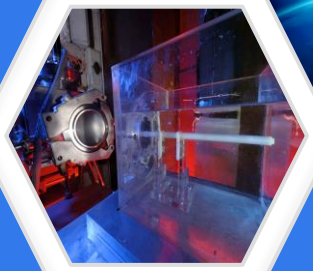
Licensing (Open, Protected)

Know-How Exchange



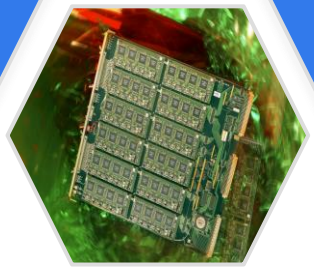


Service Agreements



Spin Out Companies and Incubators

Consultancy agreements



Procurement

Patents

Training (Research Programs, Events, Outreach)

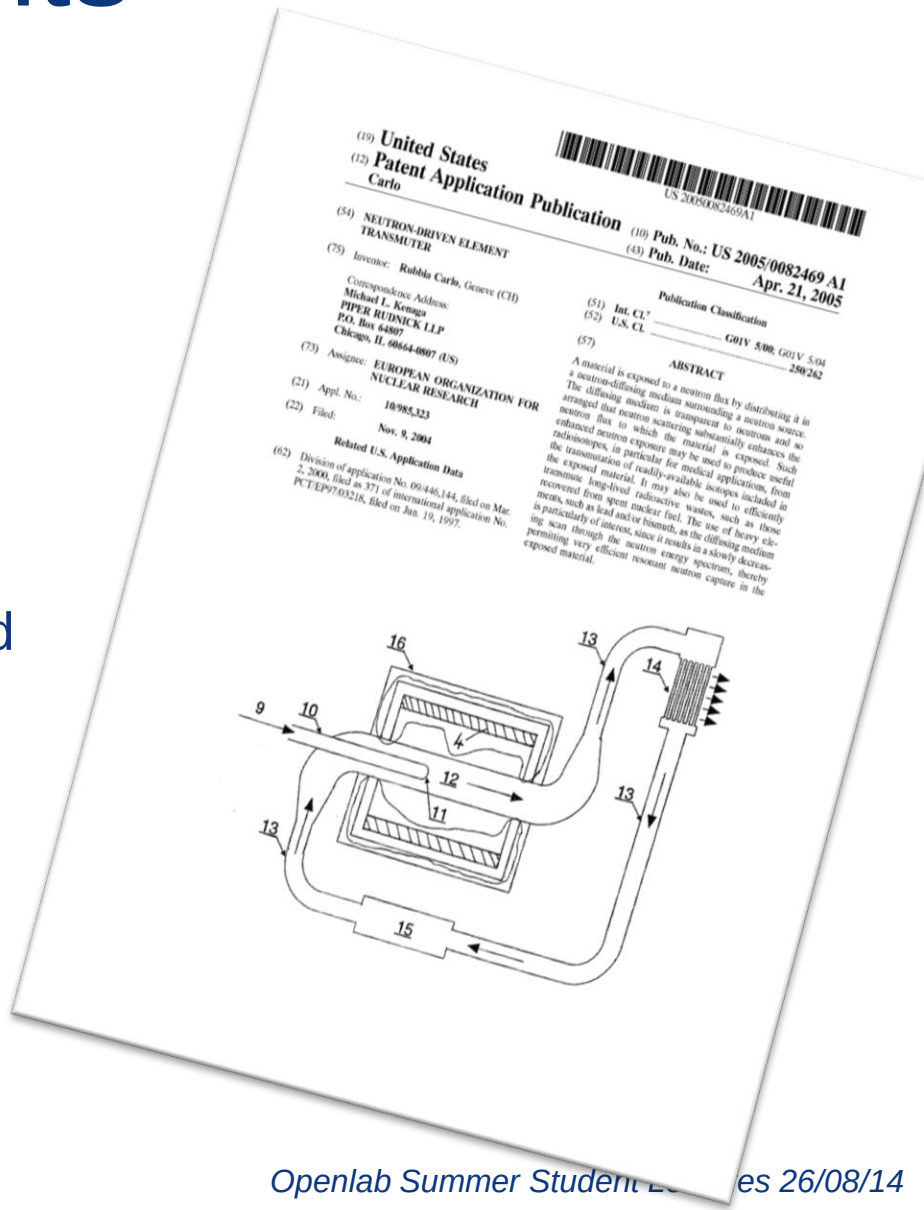
CERN and patents

Strategic motivation:

"Promote and enhance the image of the organization as a source of innovation and economic activities"

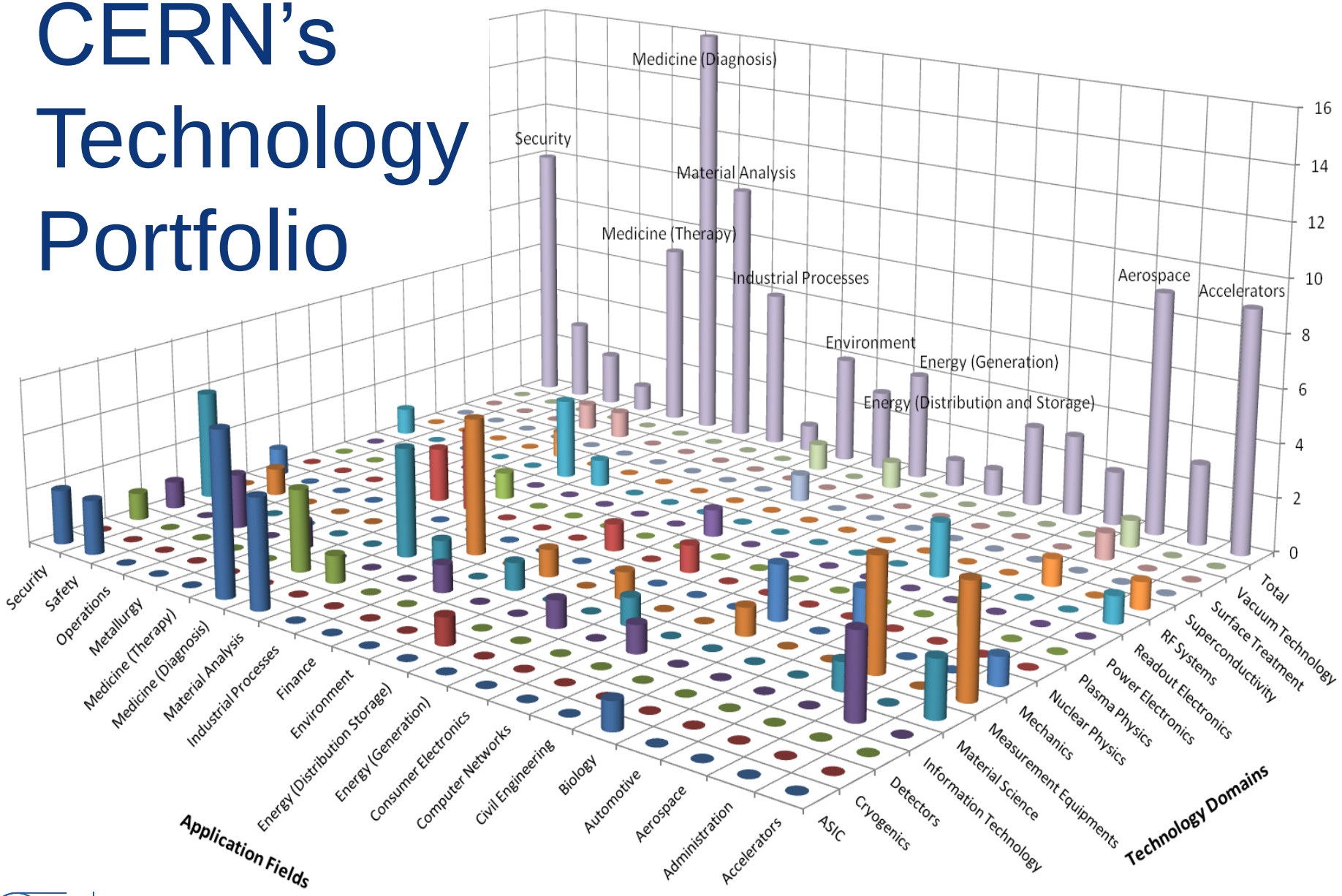
Patents are taken when it:

- Increases the probability of having the technology transferred (justify development investments from industry)
- Significantly enhances the commercial value
- Is needed to ensure CERNs recognition as inventor

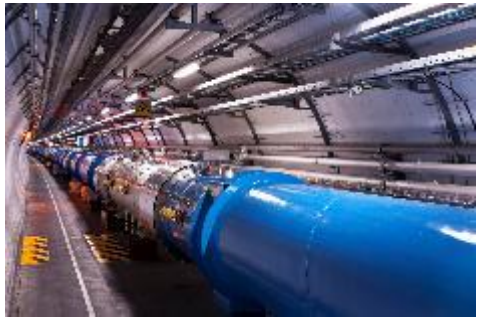


CERN's areas of excellence

CERN's Technology Portfolio

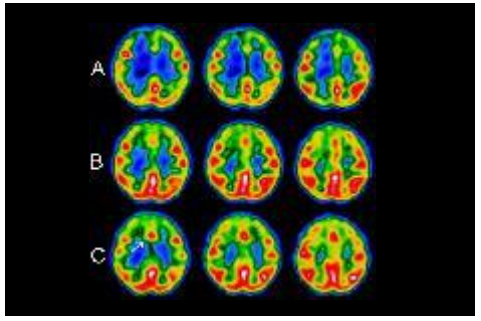


Medical application examples

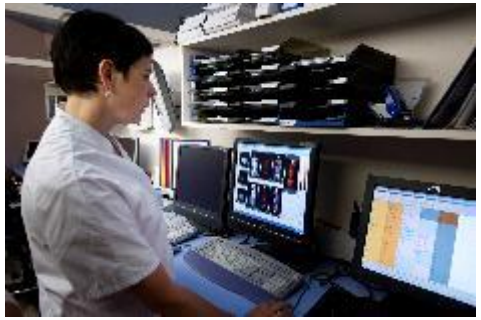


From particle accelerators to cancer therapy

From particle detectors to medical imaging

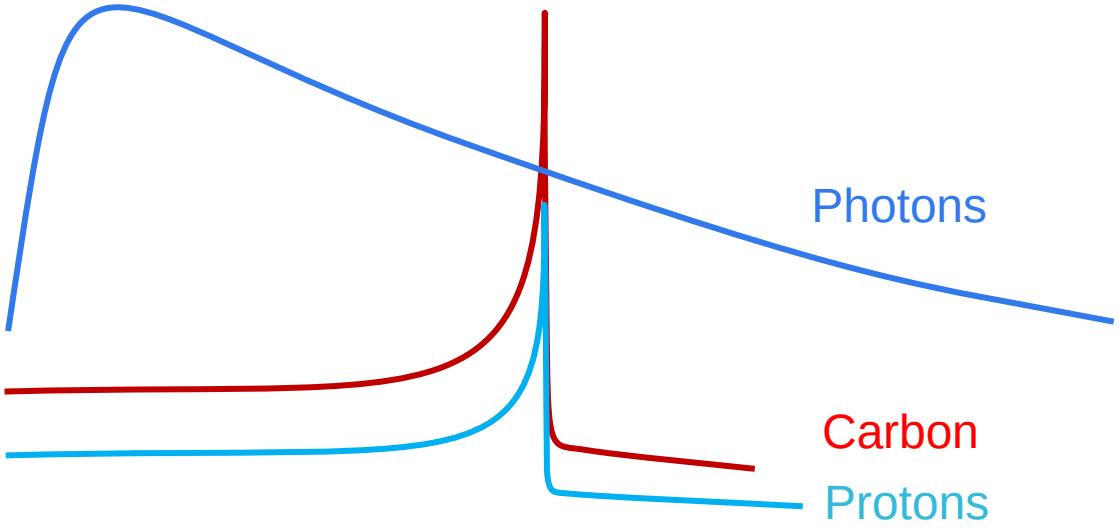


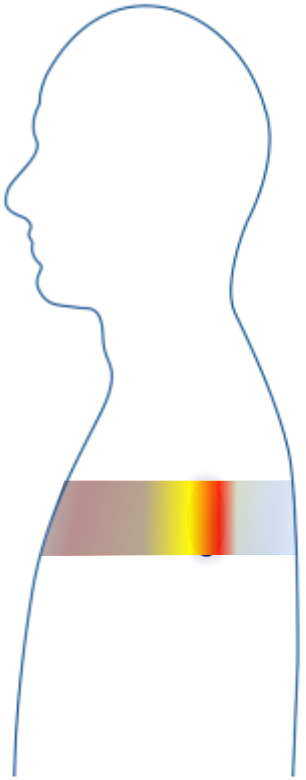
From grid computing to medical data management and analysis



Hadron Therapy

New treatment opportunities for deep-seated tumours





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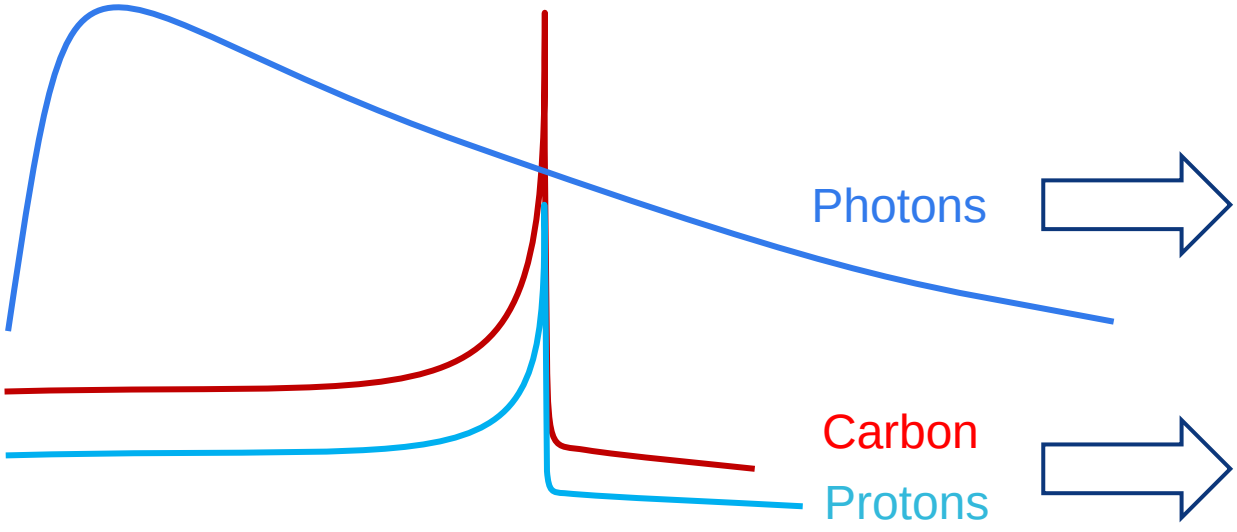
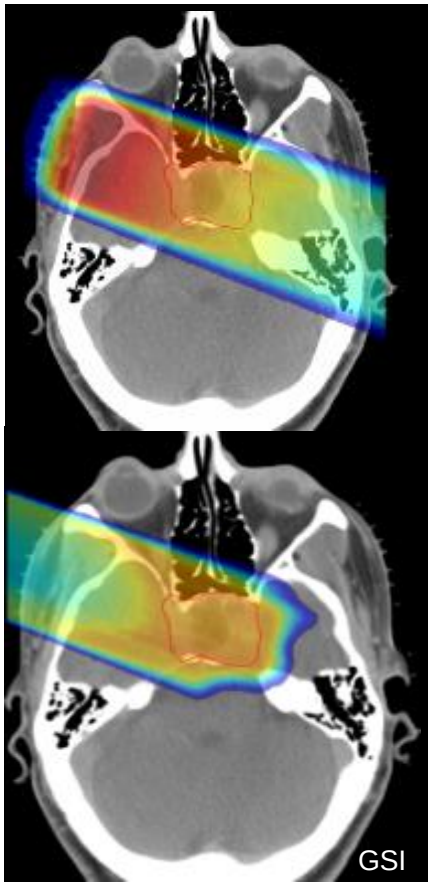
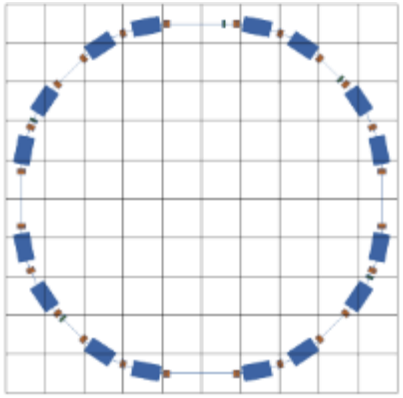




Hadron Therapy

Contributions from CERN



PIMMS Proton-Ion Medical Machine Study

Coordinated by CERN

PIMMS was then modified by the TERA foundation in Italy

CNAO in Italy and MedAustron in Austria are based on the modified PIMMS and also collaborated with CERN on the accelerator development

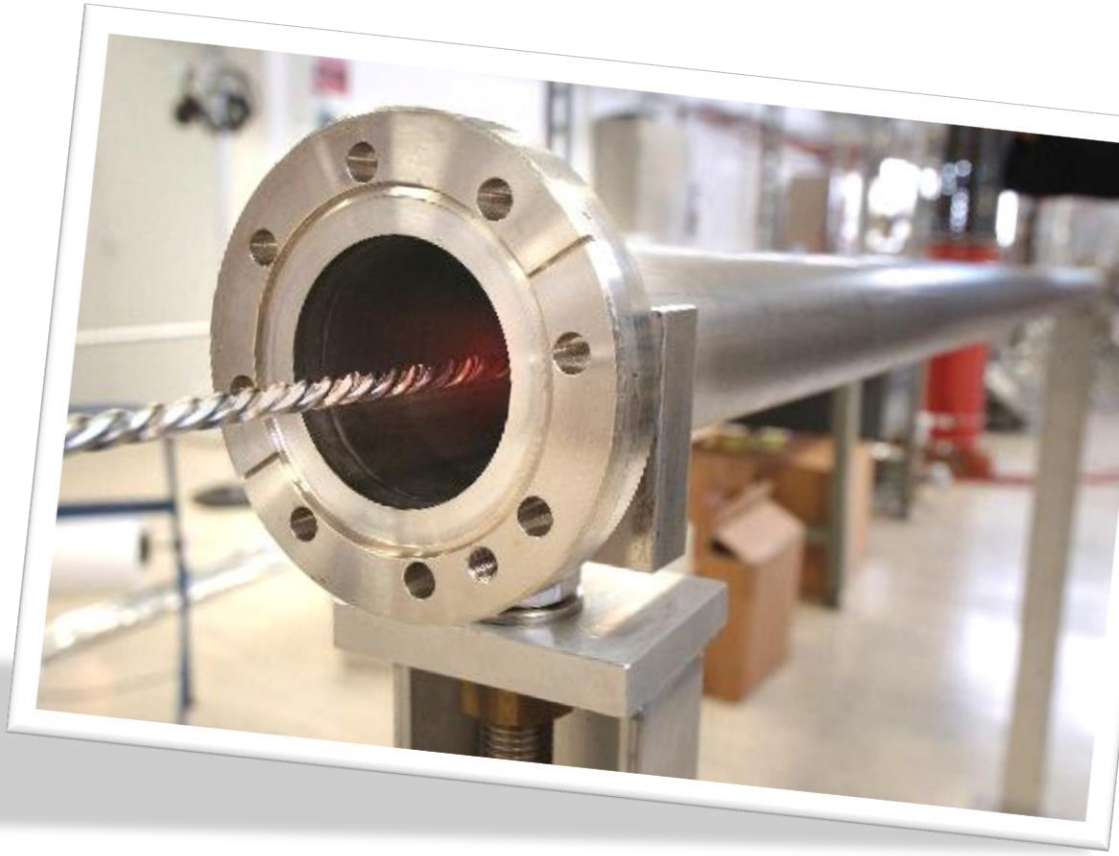
Hadron Therapy

CNAO

From high vacuum…

NEGs - Non-Evaporable Getter thin film coatings

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



… to solar energy collectors

The innovative technology within the collectors was developed at CERN and commercialized by the CERN spin-off company, SRB Energy.

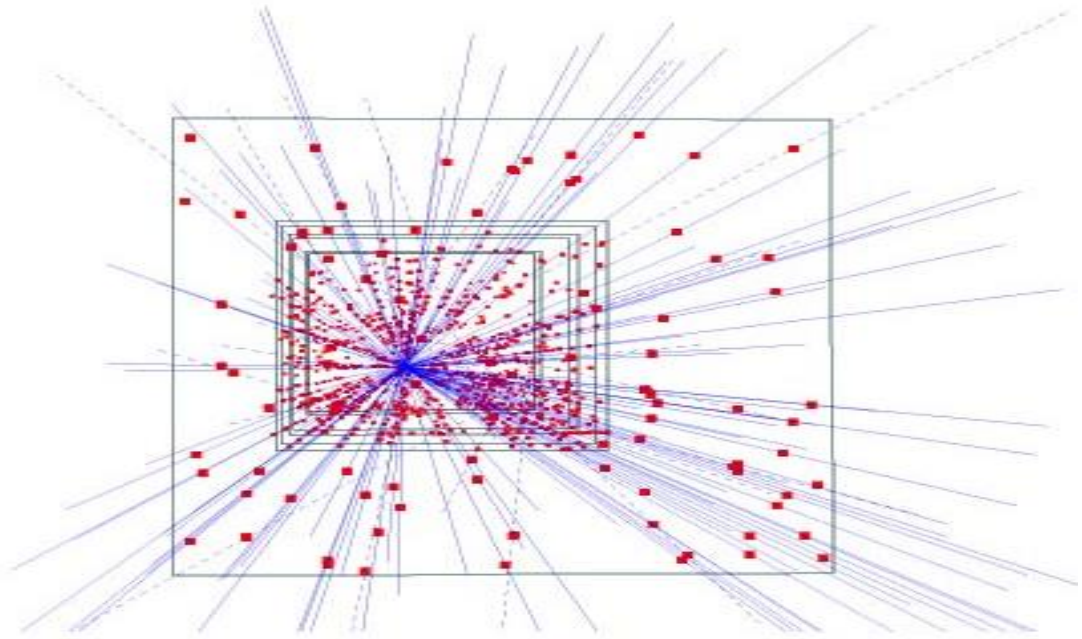
Here you can see thermal solar collector panels on the roof of Geneva airport

… to solar energy collectors

Vacuum acts as an Excellent insulator!

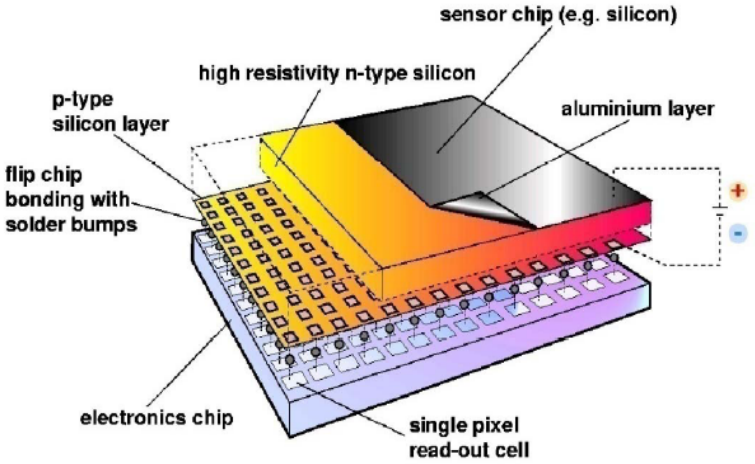
Silicon pixel detectors (SPDs)

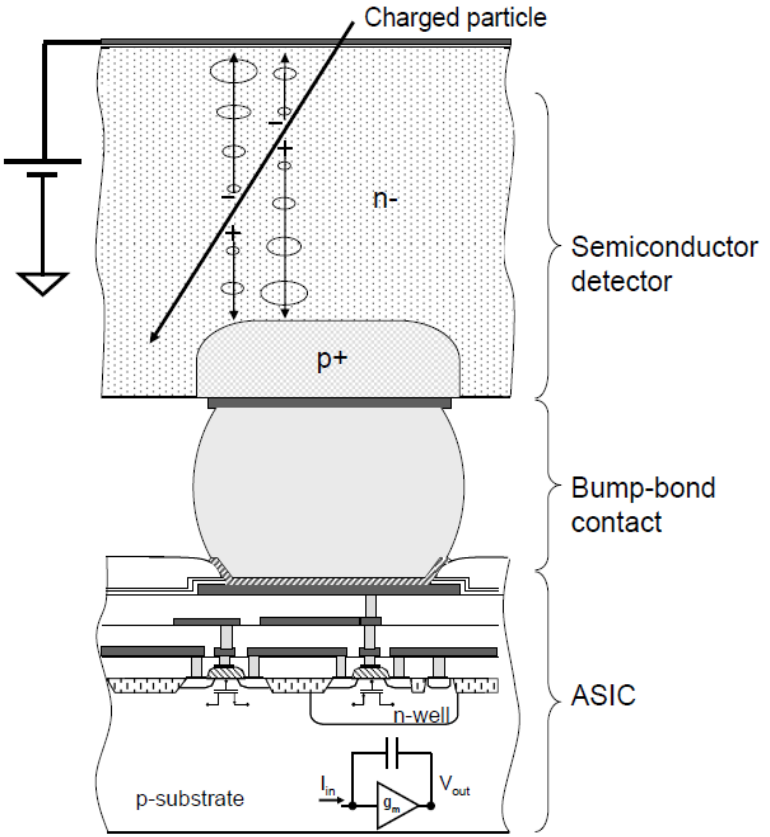
Hybrid silicon pixel detectors for tracking applications in High Energy Physics



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

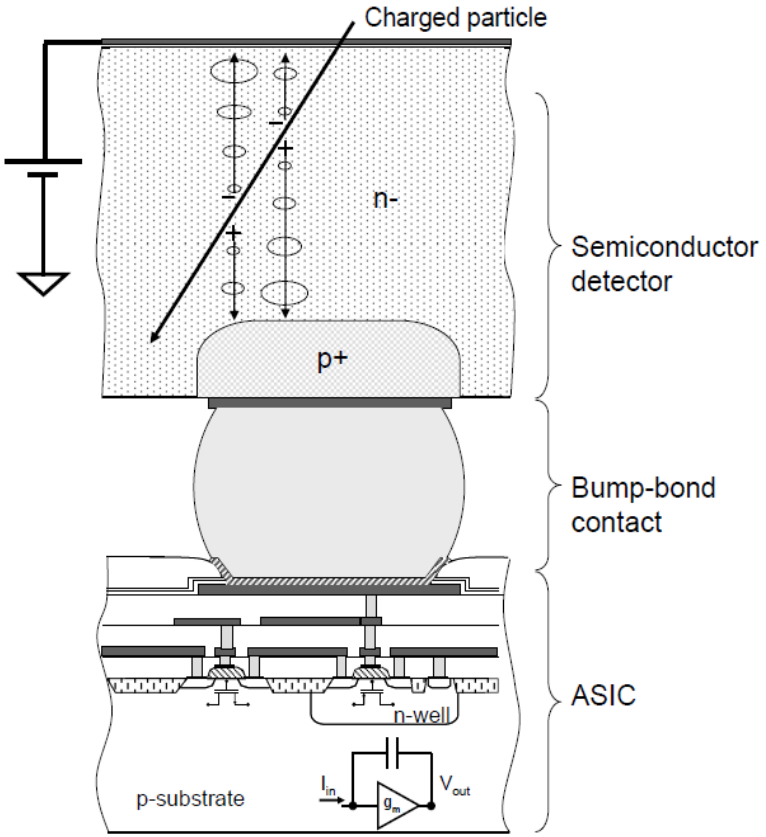
Medipix


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

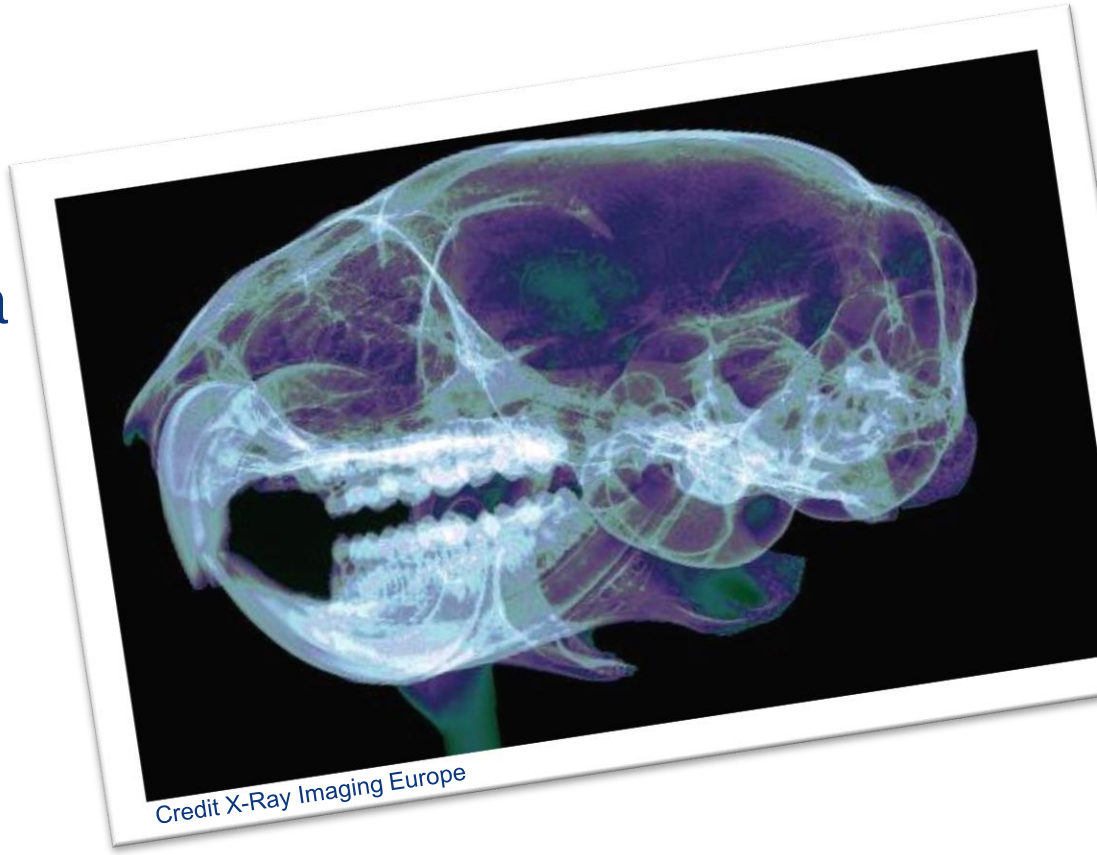
- A family of single photon counting integrated circuits used in Hybrid Silicon Pixel Detectors
- The Medipix collaborations (close to 20 institutes) contributed to the development and dissemination of the technology
- A good example of how (fundamental) science fosters innovation which can be transferred to society… and back!



Application: X-Ray

Medical and industrial X Ray imaging

Picture is from X-Ray Imaging Europe GmbH a start-up company selling Medipix2 and Timepix detectors and detector systems



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

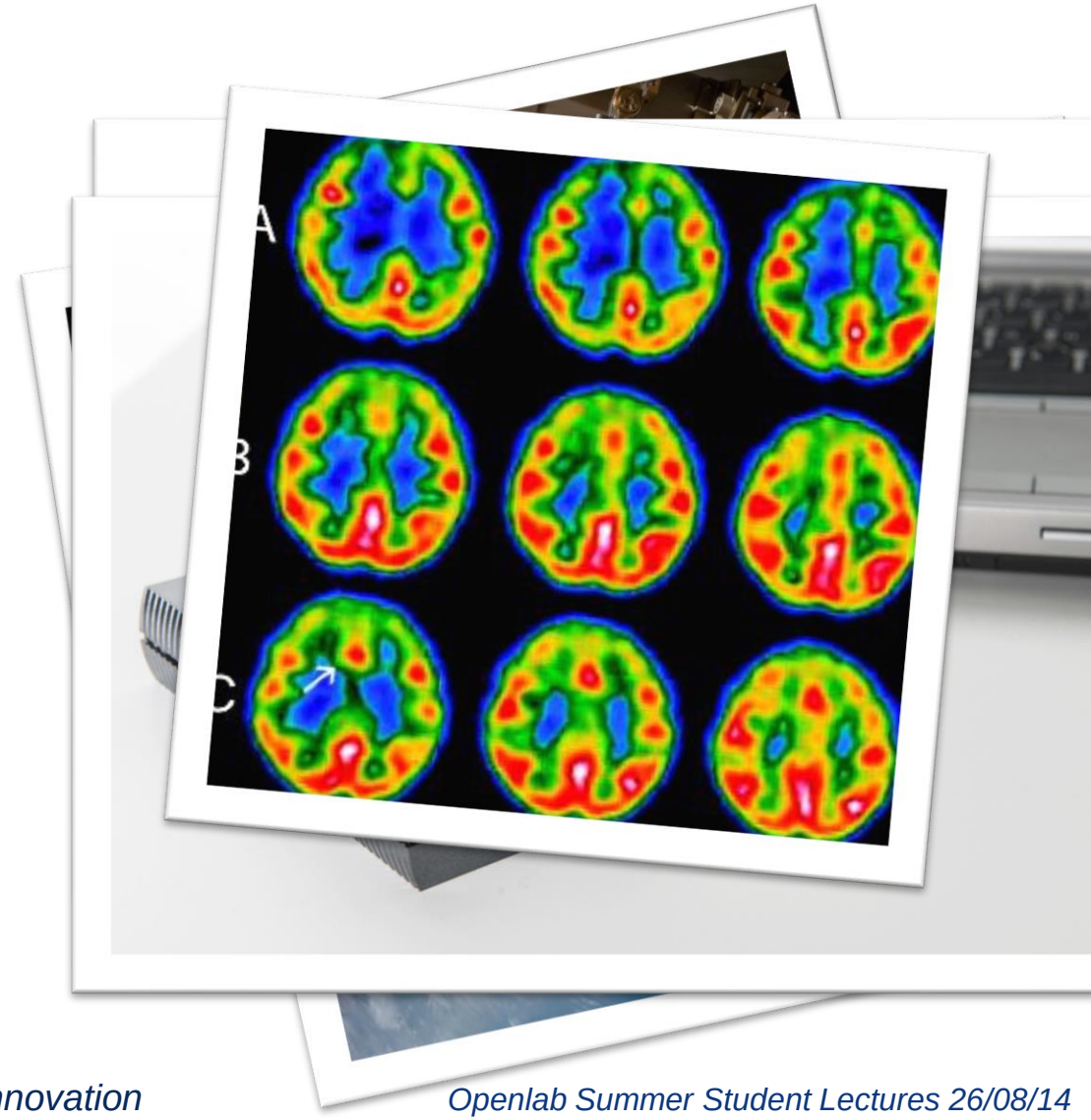
Medipix 2 technology used in an educational toolkit

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



Other ways of dissemination

The Technology Transfer process:

invention disclosure → IP protection → license to a company

- Difficult, especially for the world of particle physics.
- Collaborative R&D (with industry and other research institutes) is key for a successful transfer.

Other ways of dissemination are also very important for the Organization

CERN Open Hardware License

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

Open Source Software

Software developed at CERN is often released as open source

Some examples of the use of CERN's open source software are:

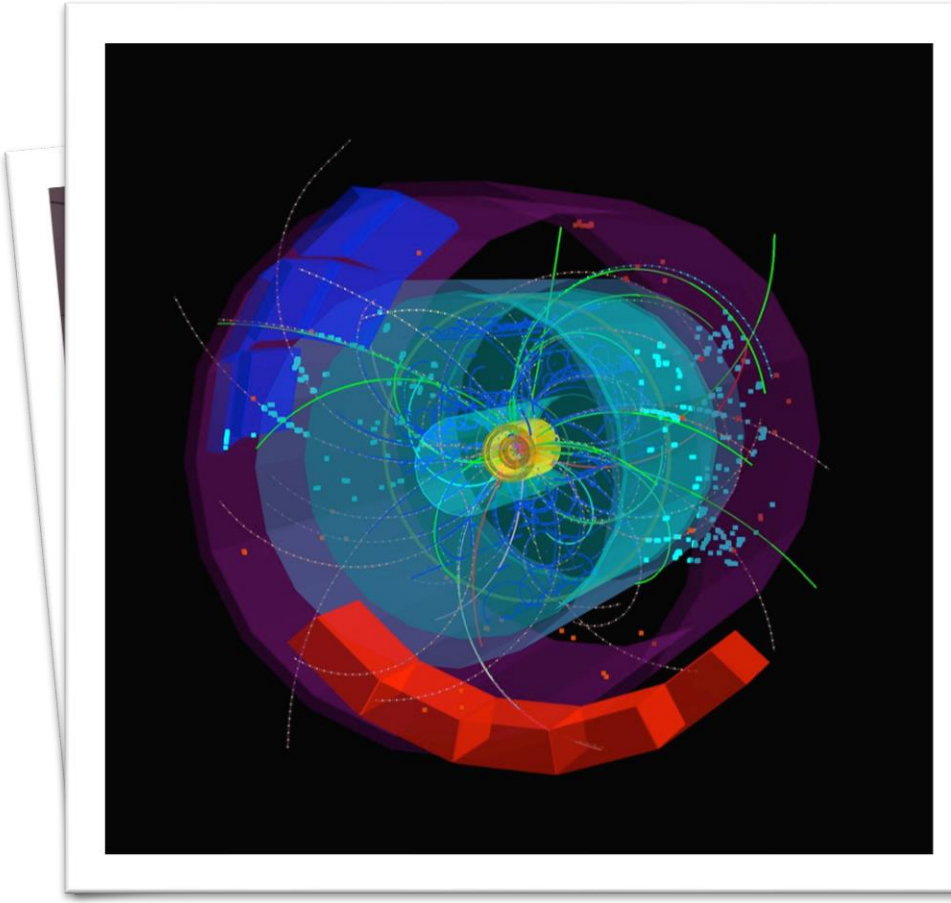
OSS example

ROOT

Powerful tool developed for handling big data in the CERN experiments

Widely adopted by the physics community and has found other applications such as:

- Finance
- Aerospace
- Telecom
- Automobile and more



OSS example

Invenio

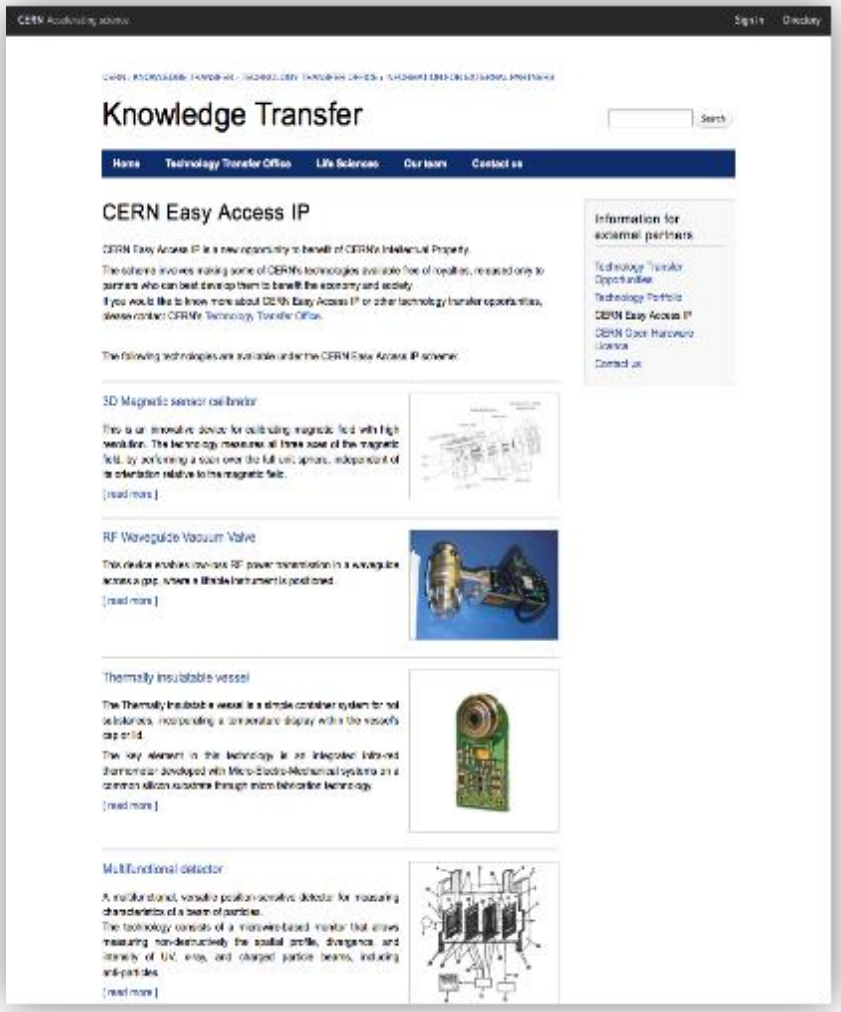
Software developed for running the digital library at CERN

Invenio is widely adopted outside CERN and a spin-off company has been created for delivering service, support and customisation

CERN Easy Access IP

Scheme pioneered by the University of Glasgow

For some of our technologies free licenses are given to companies who will demonstrate that they can turn it into a product



12 years of ENLIGHT Collaboration

CERN philosophy into health field

- Common multidisciplinary platform
- Identify challenges
- Share knowledge
- Share best practices
- Harmonise data
- Provide training, education
- Innovate to improve
- Lobbying for funding

> 150 institutes

> 400 people

> 25 countries

(with >80% of MS involved)

Coordinated by CERN

ENLIGHT platform projects

PARTNER

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

2008-2012

ULICE

- Infrastructures for hadron therapy
- 20 institutions

2009-2014

ENVISION

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

2010-2014

ENTERVISION

- Marie Curie ITN
- 12 institutions
- 16 trainees

2011-2015

PARTNER – one of the ENLIGHT platform projects:

Particle Training Network for European Radiotherapy

- 4-year Marie Curie Training project
- Research and training opportunities for 25 young biologists, engineers, physicians and physicists with aim of creating the new generation of experts

Brought together key academic institutes and research centres and IBA and Siemens

PARTNER research published in Open Access Journal of Radiation Research

Envision and Entervision

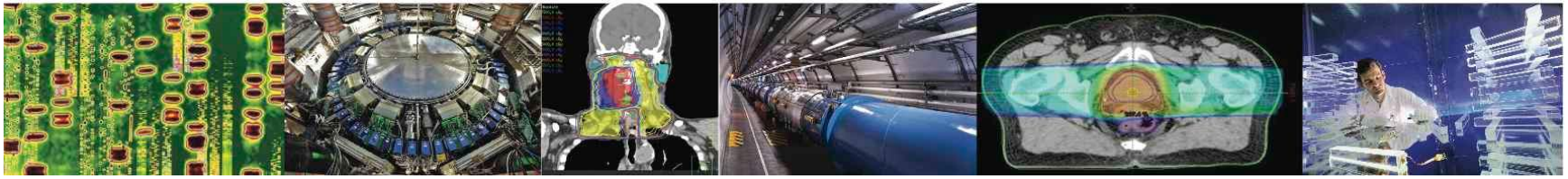
Accurate positioning is a crucial challenge for targeting moving organs during particle treatment

- R&D in real-time medical imaging for more precise and effective hadron therapy
- 2 demonstrators for real time imaging have been constructed and are being tested
- More than 40 scientific publications and 80 conference talks/posters

- Marie Curie ITN for young scientists that uses ENVISION as training platform
- 15 researchers recruited from 9 nationalities and from disciplines such as medical physics, engineering, nuclear physics, high energy physics and biological physics

ICTR-PHE 2014

Uniting physics, biology and medicine for better healthcare



February 10 – 14, 2014 (CICG, Geneva)

2 days devoted to physics, 2 days to medicine, 1 day of overlapping topics

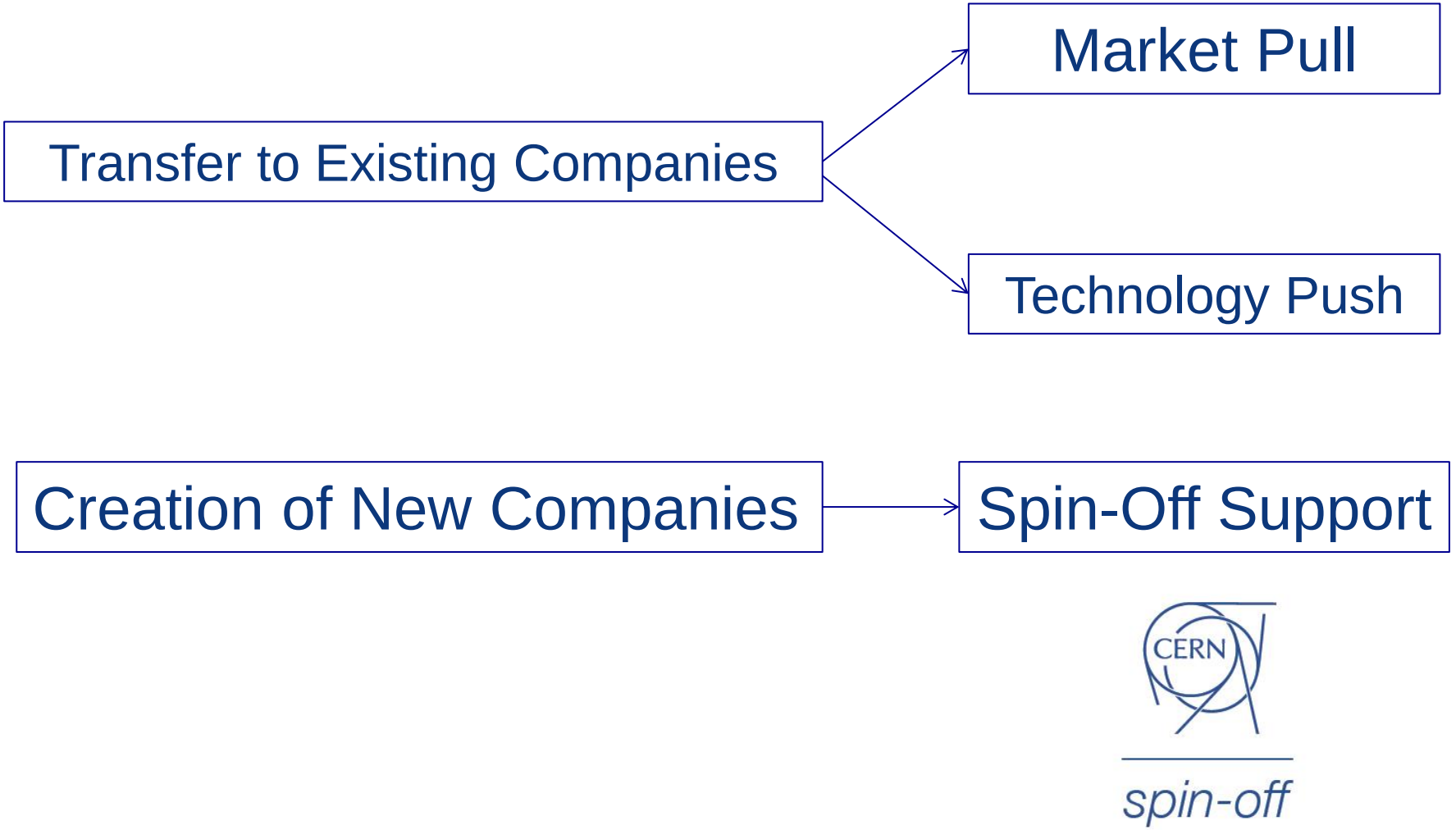
Chairs: Jacques Bernier (Genolier) and Manjit Dosanjh (CERN)

Key Subjects:

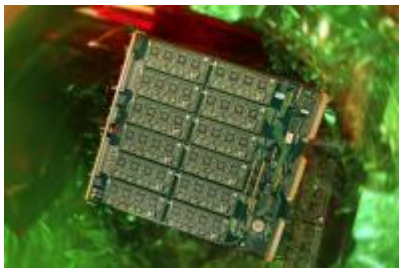
- Biology
- Pre-clinical & clinical strategies
- Nuclear medicine
- Detectors & Imaging
- New Technologies
- Radiotherapy

400 participants from 31 countries

KT implementation ways



CERN Business Ideas Accelerator



CERN
Pre-Incubator

CERN STFC
BIC

NATIONAL
BIC

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NATIONAL
BIC

Turning CERN technologies into new business opportunities

STFC

Search Go

CERN technology

STFC CERN Business Incubation Centre

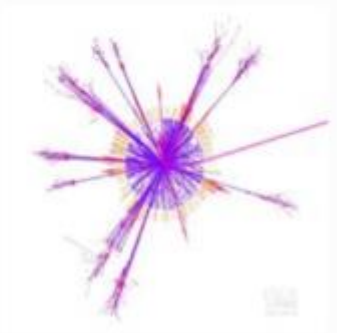
- STFC CERN BIC Home
- About us
- What we offer
- How to apply
- News and events
- Our successes
- Location
- Contact us

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**.

Knowledge Transfer through Procurement

Survey of companies involved in technology-intensive procurement contracts with CERN.

- 178 questionnaires analyzed
- 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 ontribute 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…

European Knowledge Transfer Networks

Forum for European Intergovernmental Research Organisations

EEN, Enterprise Europe Network

TTN, Technology Transfer Network

TTO Circle - European Technology Transfer Offices Circle

The European Network for LIGht ion Hadron Therapy

Conclusions

KT is integral part of CERN's mission

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

Significant contribution to innovation in medical sciences over the last 10-15 years

Impact which delivers tangible benefits to mankind

More info / Contacts

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Questions ?