Knowledge Transfer @CERN

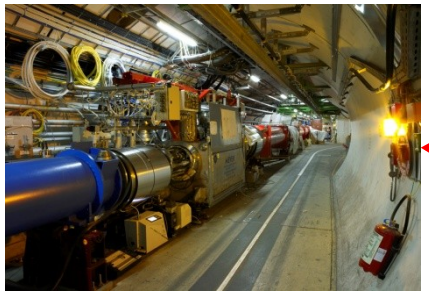
A. Unnervik
Head of Procurement and Industrial Services

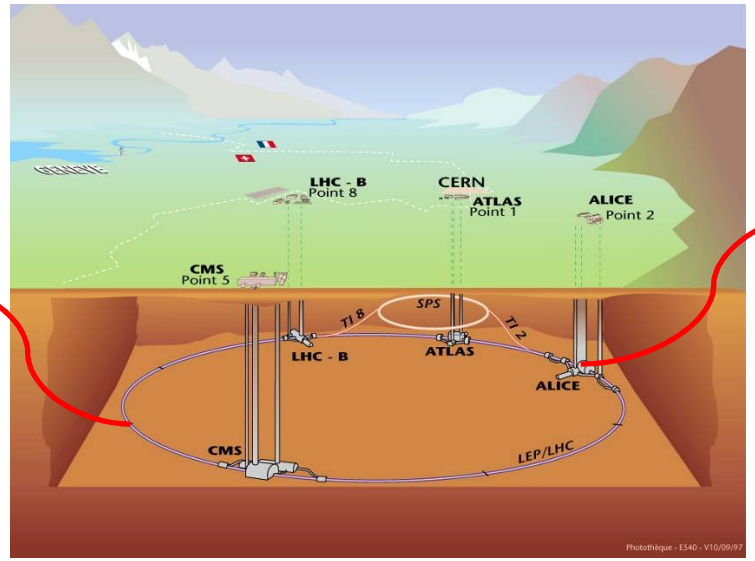
Seminar on possibilities of cooperation between Czech companies and CERN
23 October 2012

CERN Technologies

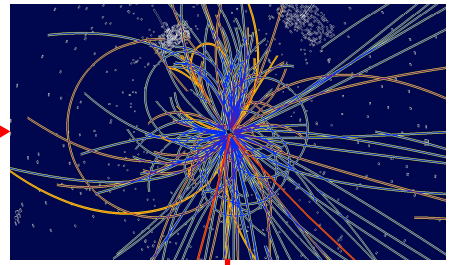
CERN innovates in three areas

Accelerating particle beams





Detecting particles



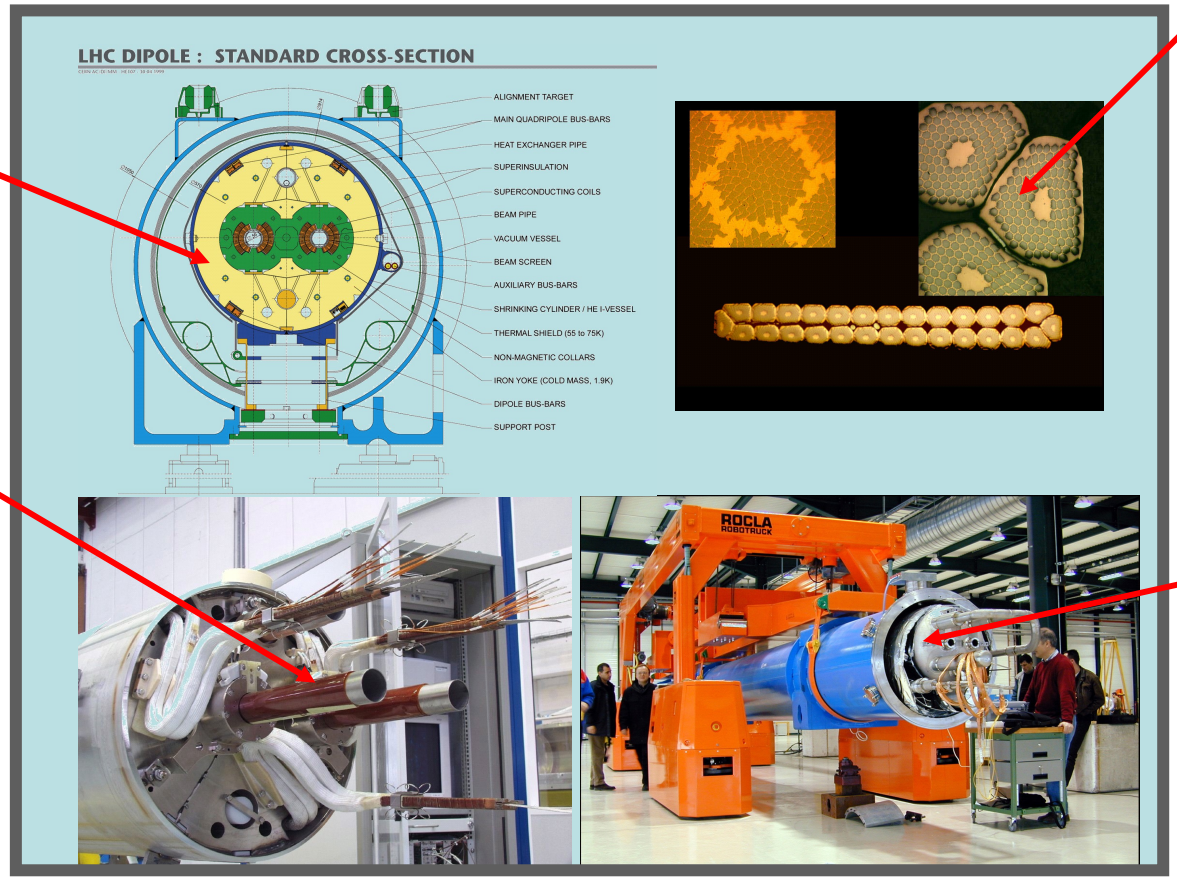
Large-scale computing (Grid)



Accelerator Technologies

Superconductivity
(12kA)

Cryogenics
(1.9 K)

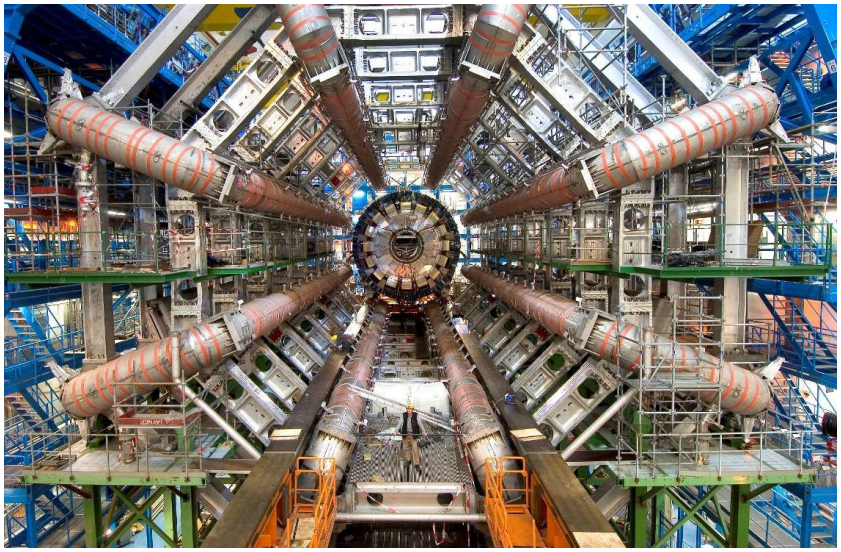


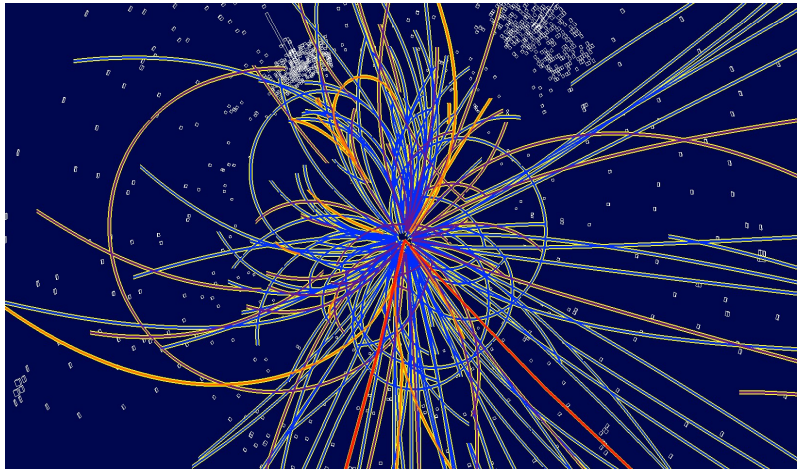
Vacuum
(10^{-13} atm)

Magnets
(8 T)

Detector Technologies

Challenge: sample the results of up to 600 million proton-proton collisions per second!





LHC detectors have sophisticated electronic trigger systems that precisely measure the passage time of a particle to accuracies in the region of a few billionths of a second. The trigger system also registers the location of the particles to millionths of a metre. This is essential for ensuring that the particle recorded in successive layers of a detector is one and the same.

Computing Technologies: the Grid

After filtering, CERN detectors select ~100 interesting collisions per second.
Several MBs of data to be stored for each collision...

→ up to 25 Petabytes/year of data!

LHC Computing Grid:
Integrate over 100,000 processors from over 170 sites in 34 countries into a global computing resource.



8 Megabyte (8MB)
A digital photo

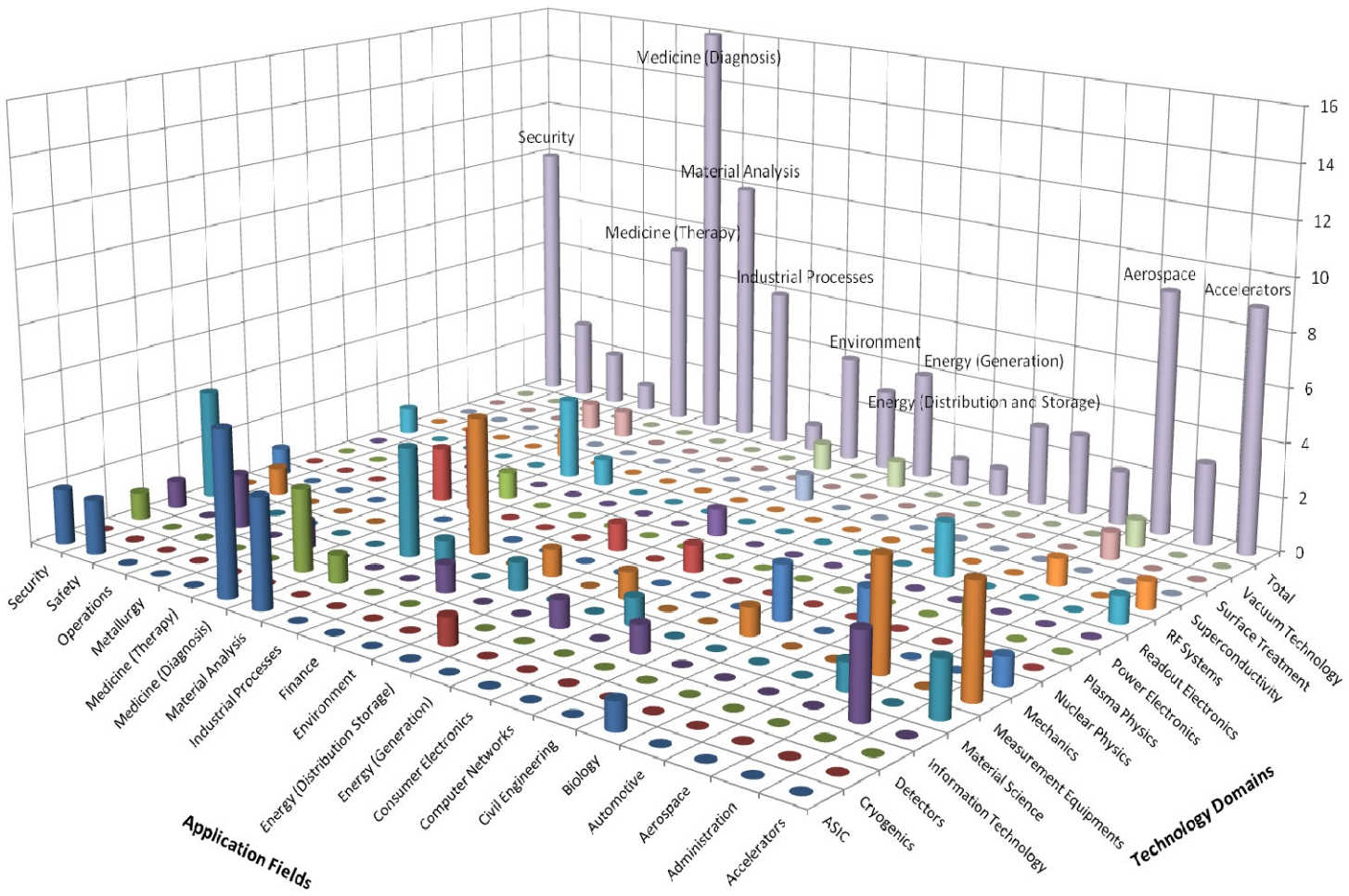
4 Gigabyte (4GB)
= 4000MB
A DVD movie

1 Terabyte (1TB)
= 1000GB
World annual book production

25 Petabytes (25PB)
= 25'000TB
Annual LHC data output

CERN, home of the World Wide Web, is a driving force in Grid Computing

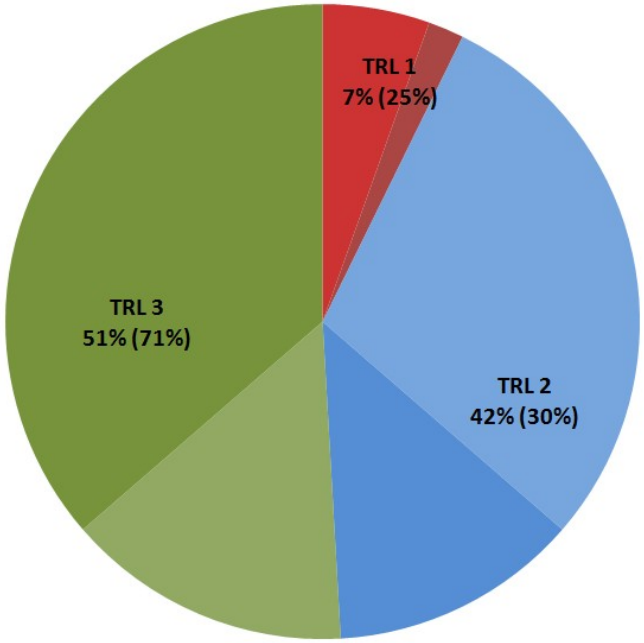
CERN's Technology Portfolio



Technology Portfolio - statistics

Technology Portfolio - General Statistics

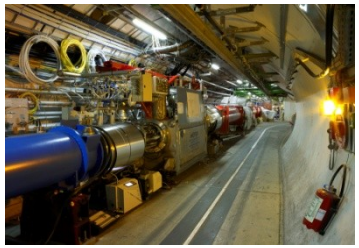
- ~200 TT cases (30% open, 20% protected by patent)
- ~10 new disclosures per year
- Exploitation level: ~50%

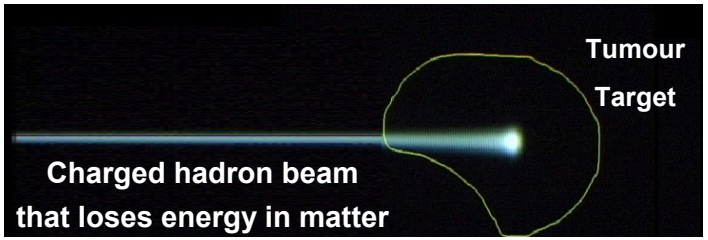


TRL	Simplified Definition
1	Technology application formulated and basic concept demonstrated
2	Functional validation in laboratory environment
3	Representative prototype fully qualified (technology ready to transfer)

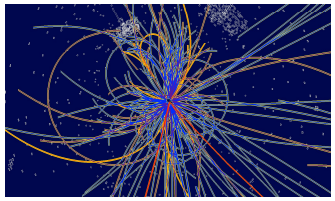
Medical applications

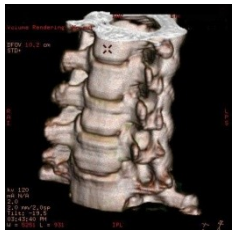
Particle accelerators for hadron therapy





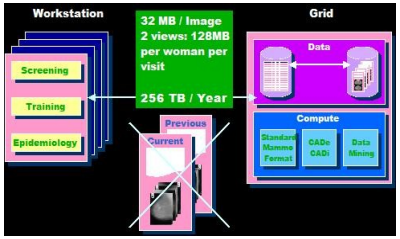
Particle detector for medical imaging



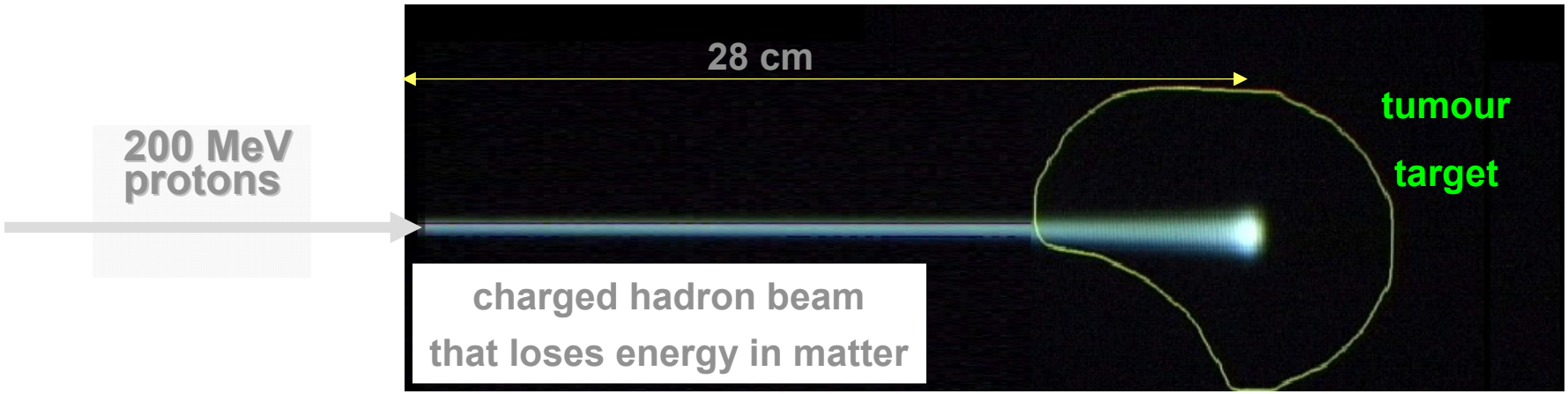


Grid computing for medical data management and analysis



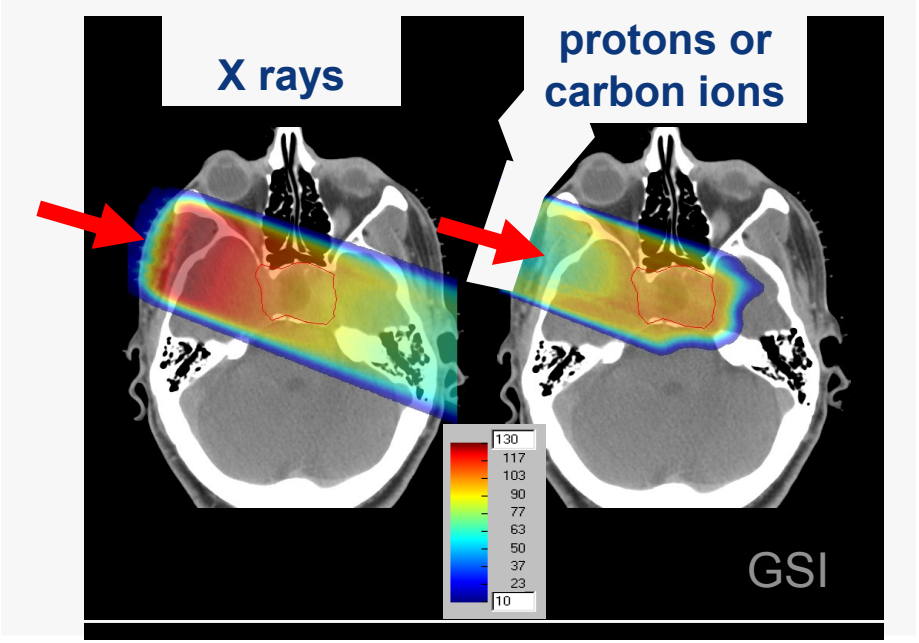


Hadron Therapy



Hadron beams provide new treatment opportunities for deep-seated tumours.

Hadron beams are more effective than X-rays in destroying tumours while sparing healthy tissues nearby.



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



Solar panels plant

- Civil-engineering company opened a new solar power plant

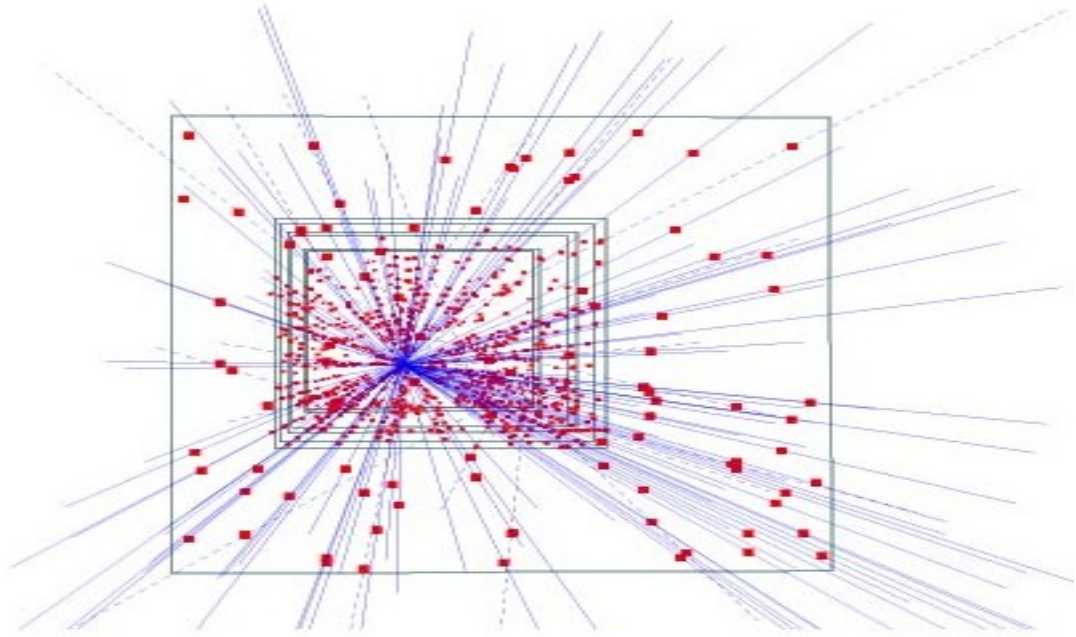
  Environmentally friendly "solar field" heats close to 80,000 cubic metres of bitumen to 180 degrees.





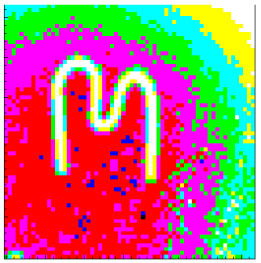
Silicon pixel detectors (SPDs)

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



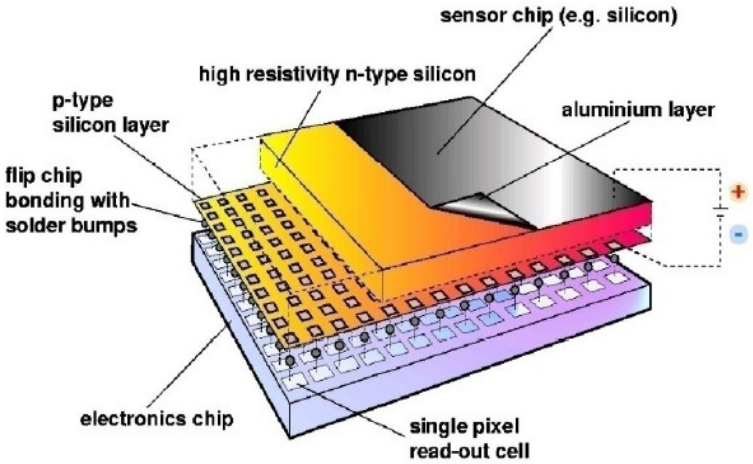
153 high energy particle tracks flying through a telescope of half a million pixels in the WA97 experiment back in 1995

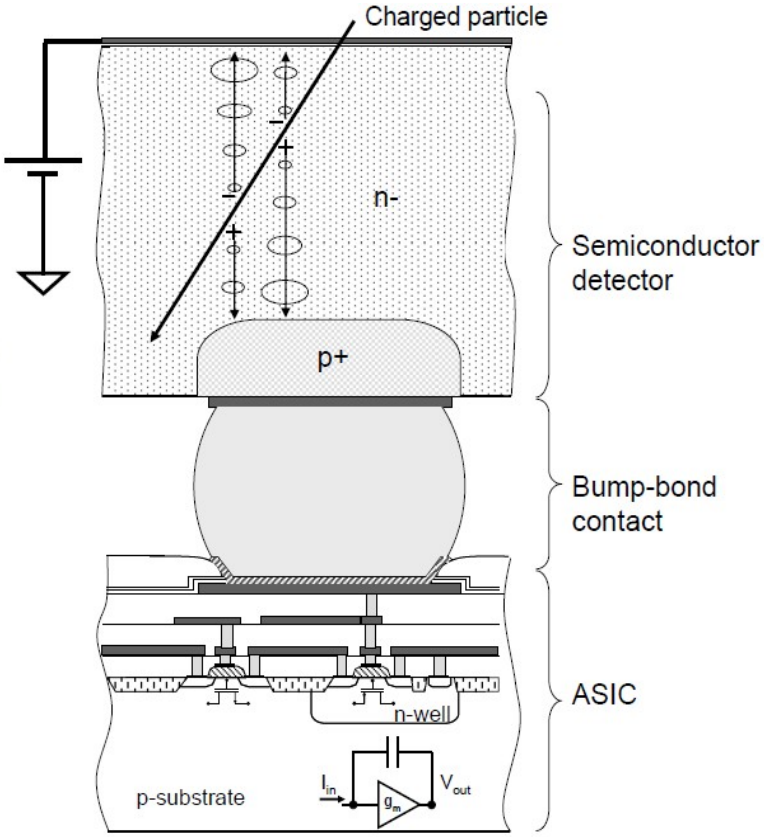
Medipix



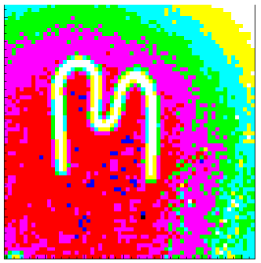
- Medipix 2 collaboration

  17 institutes and labs





Medipix

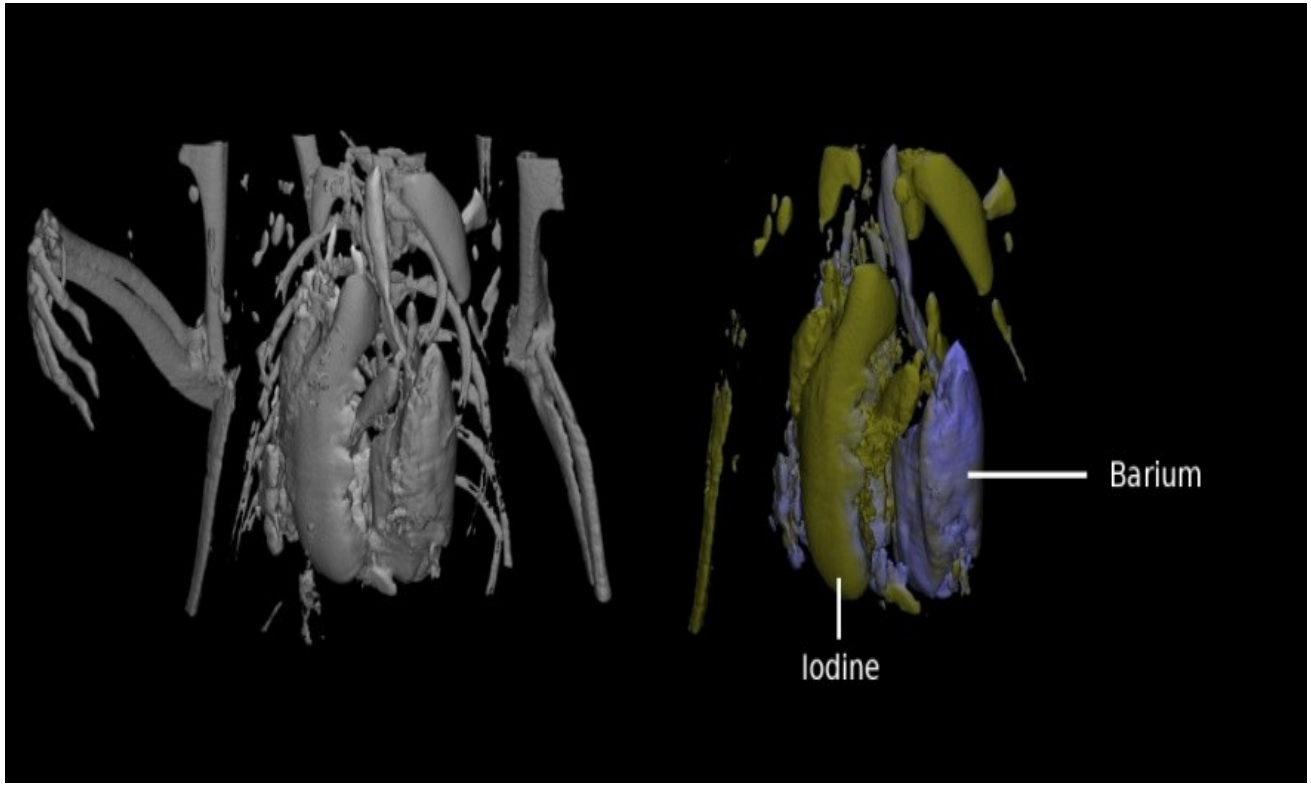


- A family of single photon counting integrated circuits used in Hybrid Silicon Pixel Detectors
- The Medipix collaborations (close to 20 institutes) contributed to the development and dissemination of the technology
- A good example of how (fundamental) science fosters innovation which can be transferred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

Application: Medical imaging

- MARS project

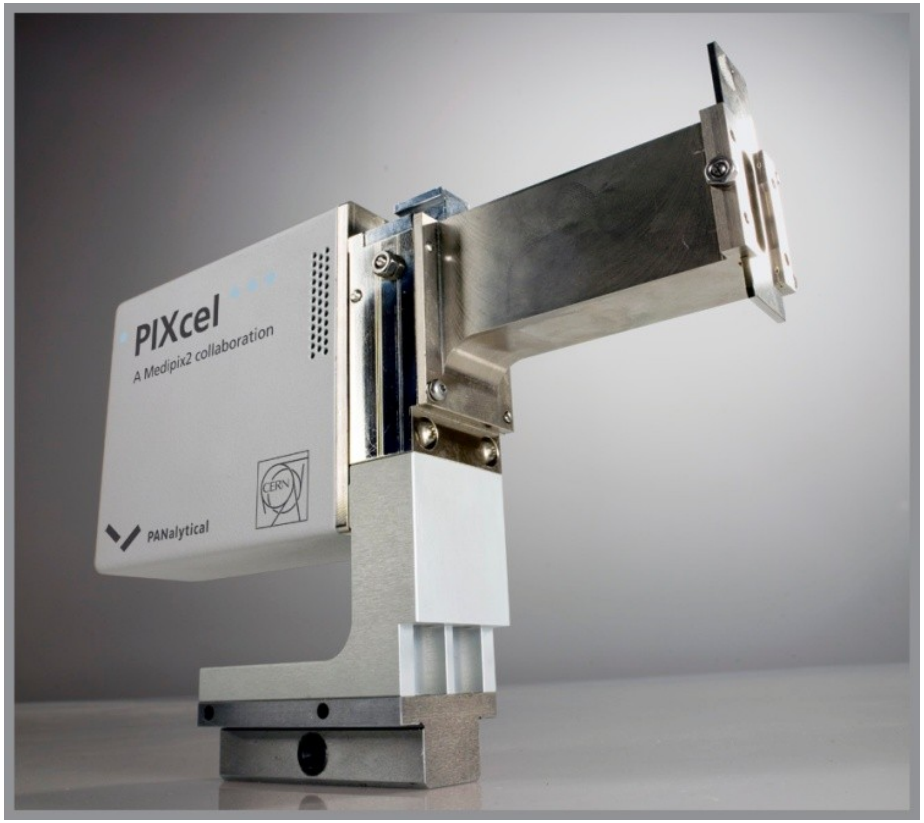
  Colour CT X-ray scanner based on the Medipix technology



(courtesy of MARS Bioimaging Ltd)

Application: Material analysis

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



Other ways of dissemination

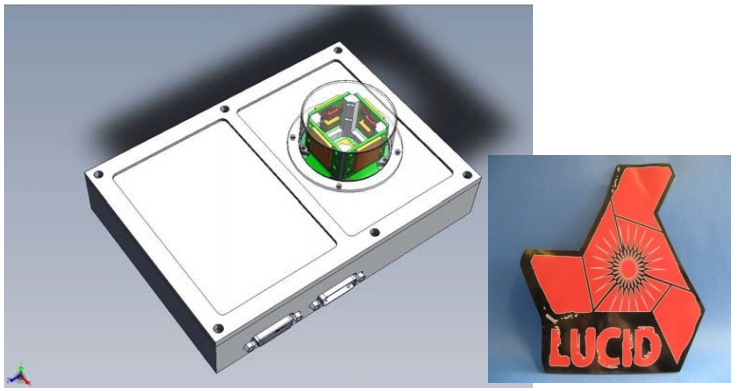
- The Technology Transfer process:

  invention disclosure → IP protection → license to a company

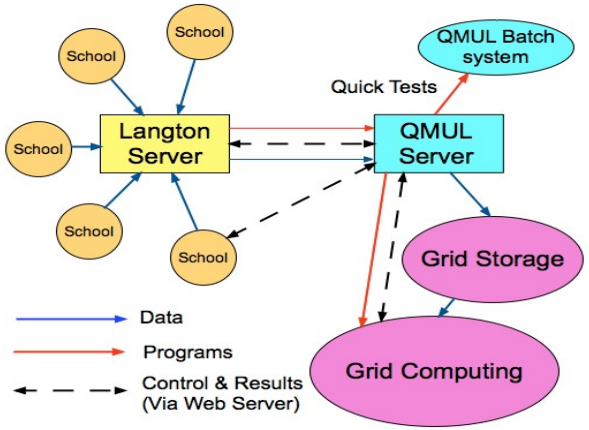
  is difficult, especially for the world of particle physics. Collaborative R&D (with industry and other research institutes) is key for a successful transfer.
- Other ways of dissemination are also very important for the Organization



CERN@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.



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

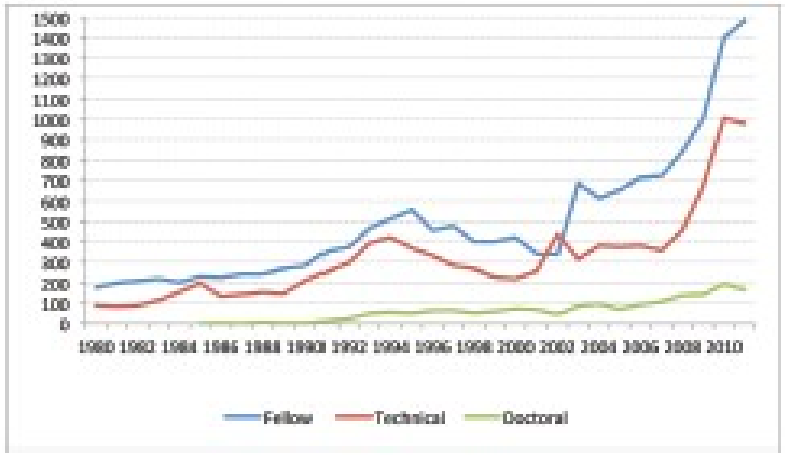
Knowledge Transfer through People

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…







Physics for Health in Europe

First workshop on physics for health applications @ CERN

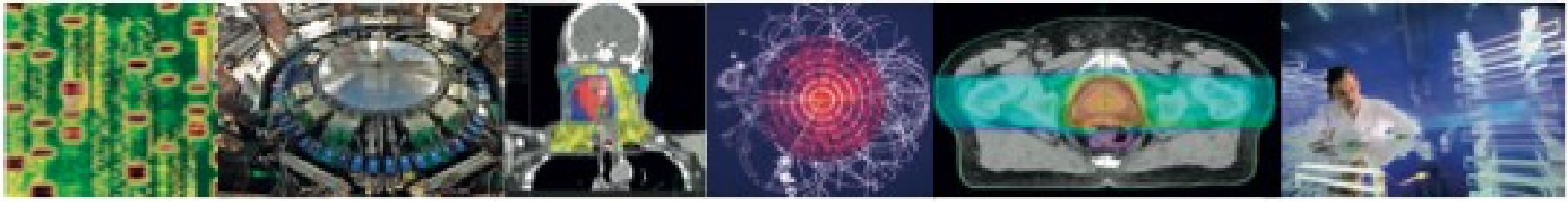
- review the progress in the domain of physics applications for health
- identify the most promising areas for further developments
- explore synergies between physics and physics spin-offs
- catalyse dialogue between doctors, physicists, medical physicists……

3 CERN Initiatives arising from PHE2010

- Biomedical Facility
  - creation of a facility at CERN that provides particle beams of different types and energies to external users interested in radiobiology and detector development
- Medical Accelerator Design
  - coordinate an international collaboration to design a new low-cost accelerator facility, which would use the most advanced technologies
- Radio Isotopes
  - Set up a European user facility to supply innovative radioisotopes (produced at ISOLDE-CERN, ILL, PSI, Arronax,...) for R&D in life sciences (preclinical and clinical studies)

ICTR-PHE 2012

Uniting physics, biology and medicine for better healthcare



International Conference on Translational Research in Radio-Oncology

&

Physics for Health in Europe

- February 27 – March 2, 2012 at CICG, Geneva
  2 days devoted to physics, 2 days to medicine, 1 day of overlapping topics
- Over 500 people registered, nearly 400 Abstract
- http://cern.ch/ICTR-PHE12

Summary of Knowledge Transfer Modes

- Licensing of intellectual property and consulting
- Joint R&D with external partners (Industry !)
- Start-up companies creation
- Open Hardware License and similar initiatives
- CERN training programs and personnel mobility
- Procurement activities
- Networking and catalyzing knowledge exchange (multidisciplinary events)

Conclusions

- CERN regards knowledge and technology transfer as an integral part of its mission.
- CERN technologies have applications in several domains with high relevance to society. In particular, CERN has been providing a significant contribution to innovation in medical sciences over the last 10-15 years.
- By making an impact on key application domains we aim to illustrate the role of fundamental research as a driver of innovation which delivers tangible benefits to mankind.
- CERN's technical departments have unique knowledge and skills. We are keen to collaborating with industry and to investigate how our know-how can be used to satisfy industry needs.

We have a lot to offer to industry – please get in touch!

More info / Contacts

www.cern.ch/knowledgetransfer

giovanni.anelli@cern.ch

mail-KT@cern.ch