Knowledge Transfer @ CERN

WIPO Conference on Innovation and Climate Change

Geneva, 12th July 2011

Giovanni Anelli

CERN was founded 1954: 12 European States

"Science for Peace"

Today: 20 Member States

~ 2300 staff
~ 930 other paid personnel
> 10500 users

Budget (2011) ~1000 MCHF

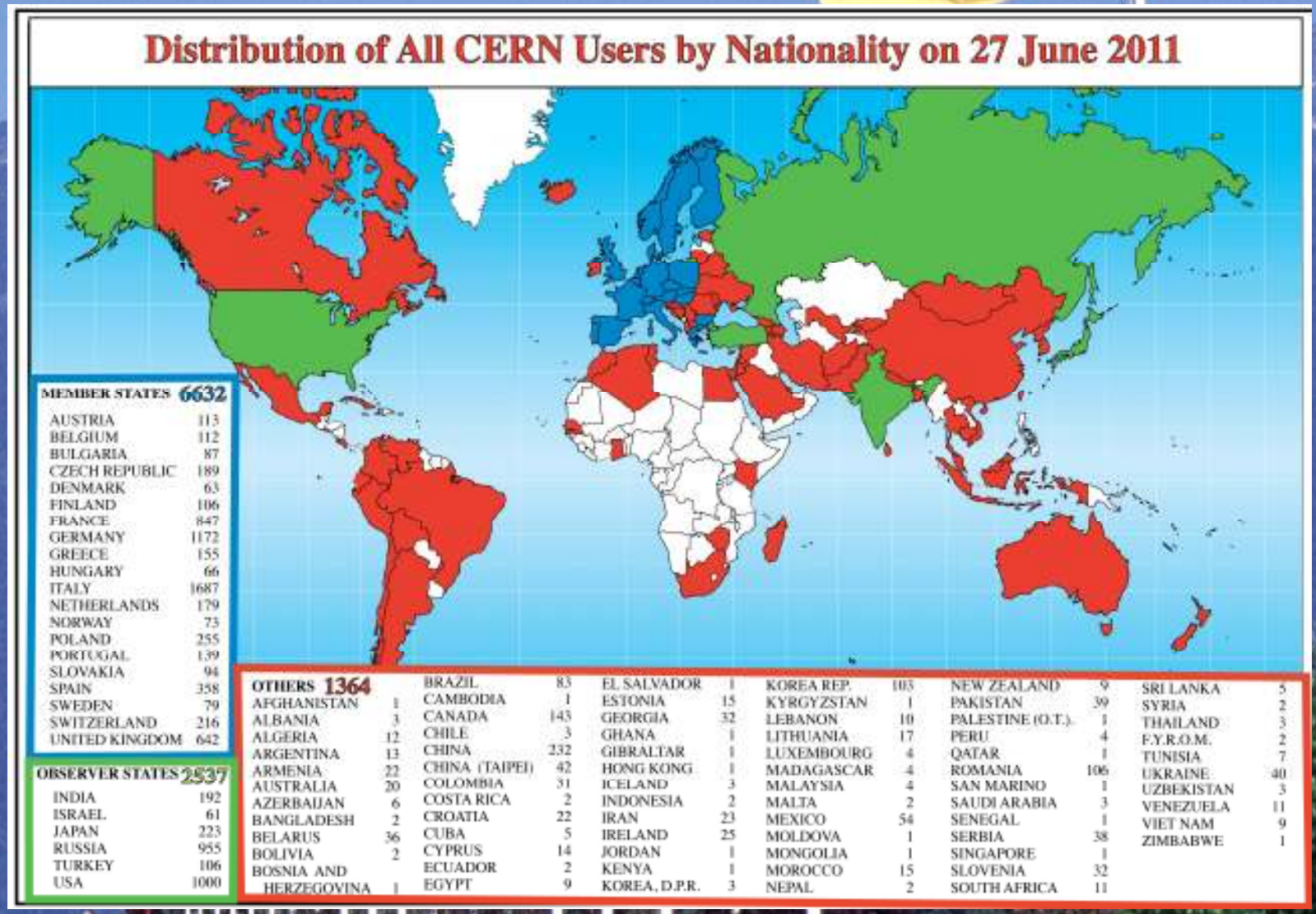
5 applicants for MS:
Cyprus, Israel, Serbia, Slovenia, Turkey
and Associate Membership discussions: Brazil, Ukraine, India, ...

20 Member States: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom

1 Candidate for Accession: Romania

8 Observers to Council: India, Israel, Japan, the Russian Federation, the United States of America, Turkey, the European Commission and UNESCO

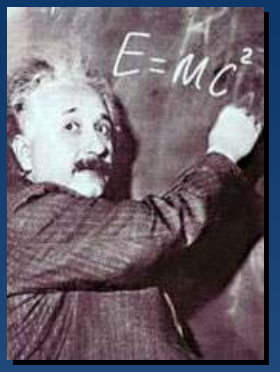
CERN worldwide collaborations



The Mission of CERN

- **Push back** the frontiers of knowledge

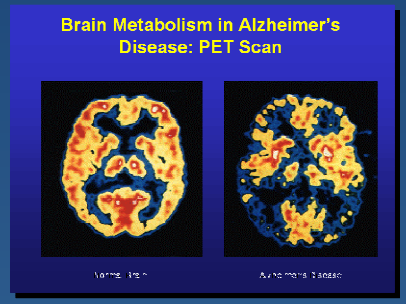
  E.g. the secrets of the Big Bang …what was the matter like within the first moments of the Universe's existence?



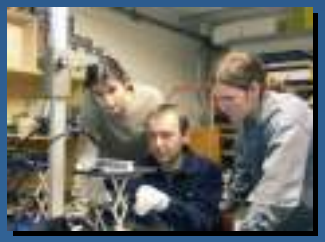
- **Develop** new technologies

  Information technology - the Web and the GRID

  Medicine - diagnosis and therapy



- **Train** scientists and engineers of tomorrow



- **Unite** people from different countries and cultures

The Knowledge Transfer group

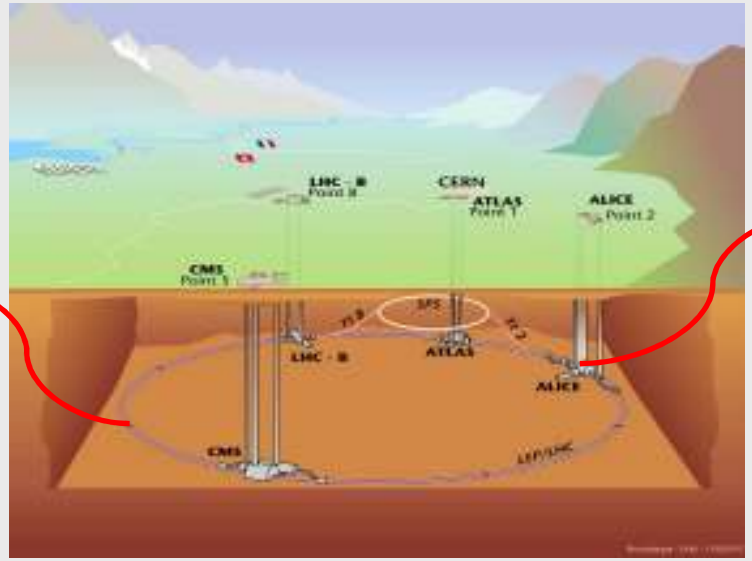
Our objective:

promote, support and maximize knowledge and technology transfer from CERN to society

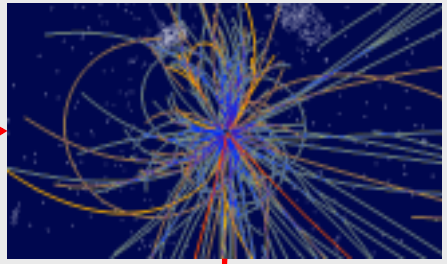
CERN Technologies

We **innovate** mainly in three areas:

Accelerating particle beams



Detecting particles

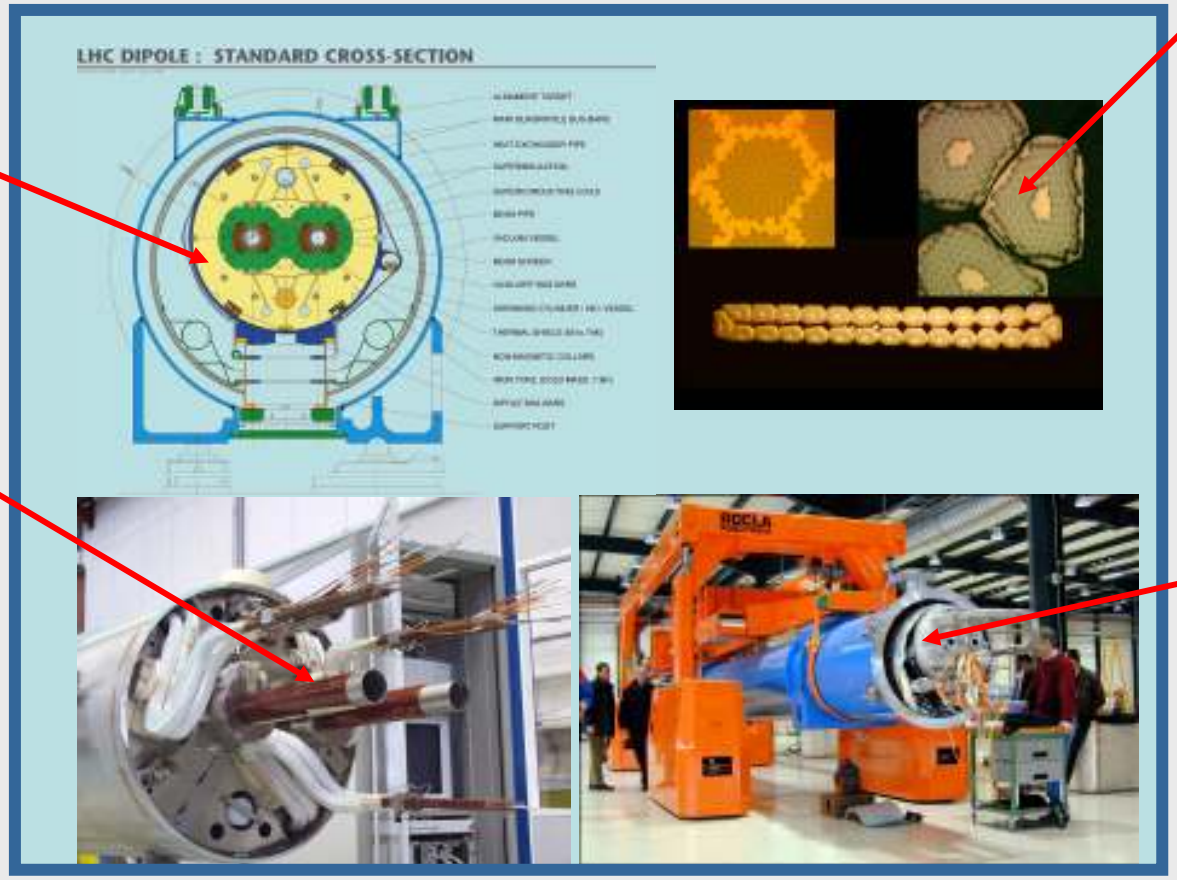


Large-scale computing (Grid)

Accelerator Technologies

Superconductivity
(12kA)

Cryogenics
(1.9 K)

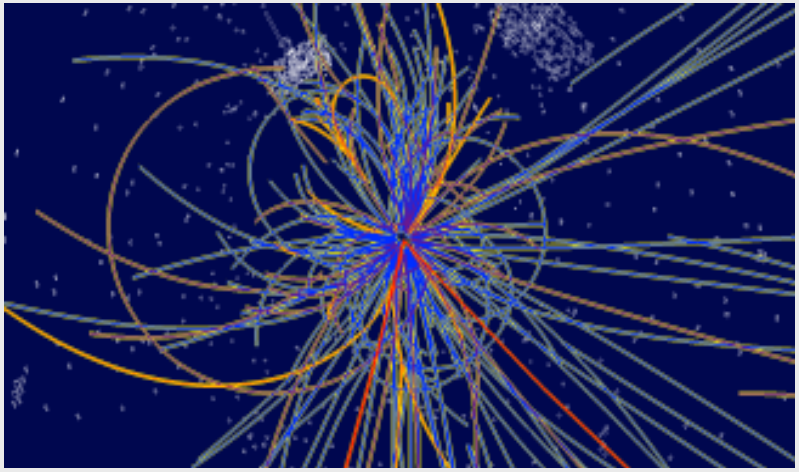


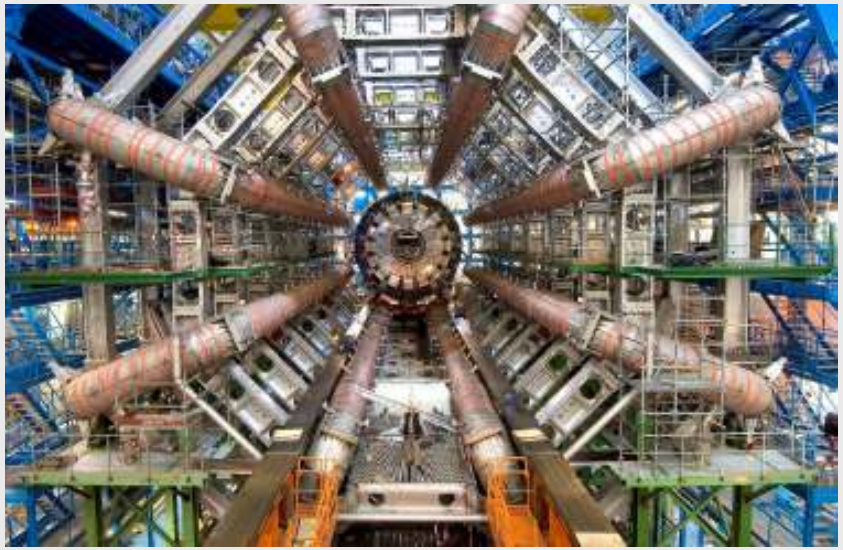
Vacuum
(10^{-13} atm)

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

After filtering, CERN detectors select ~100 interesting collisions per second.

Several MBs of data to be stored for each collision…

→ up to 15 Petabytes/year of data!

8 Megabyte (8MB)
A digital photo

1 Gigabyte (1GB)
= 1000MB
A DVD movie

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

15 Petabytes (15PB)
= 15000TB
Annual LHC data output

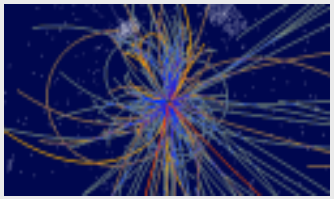
LHC Computing Grid:
Integrate over 100,000 processors from over 170 sites in 34 countries into a global computing resource.

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

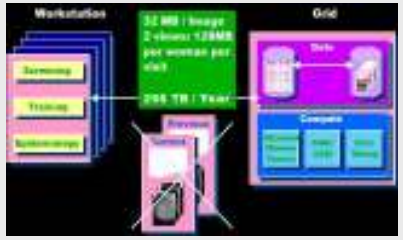
Focus on Medical Applications

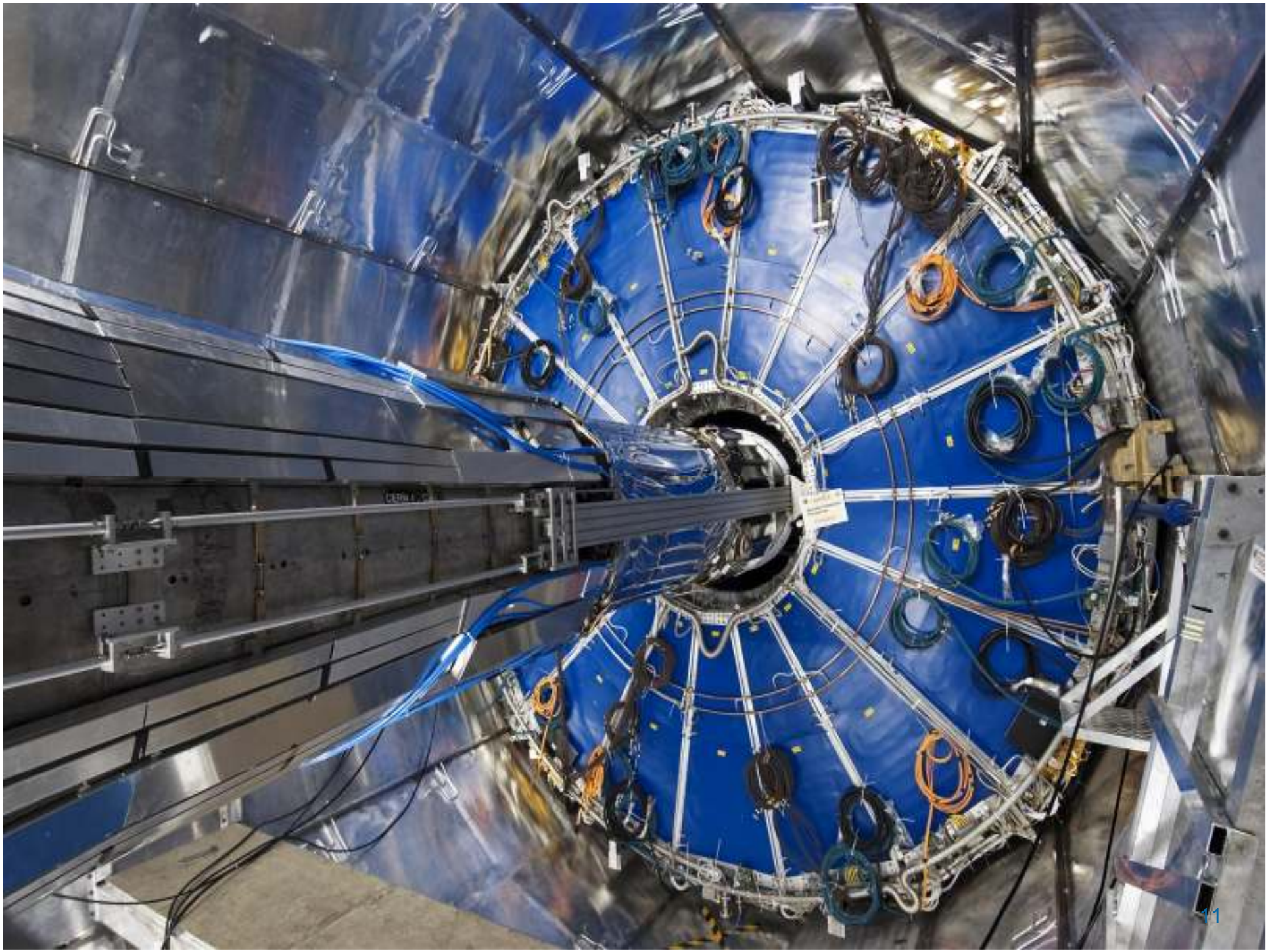
Particle beams for cancer treatment

Particle detector technologies for medical imaging



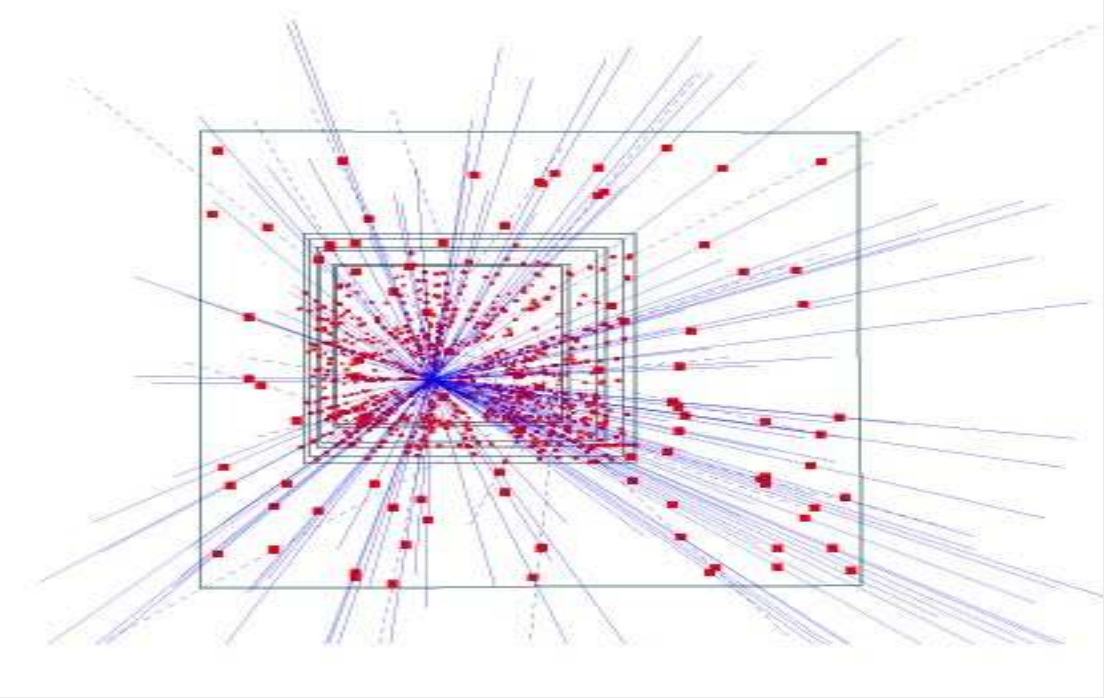
Grid computing for medical data management and analysis





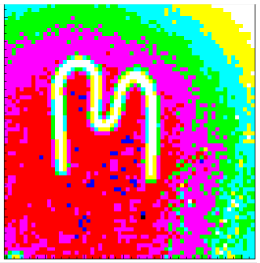
Silicon pixel detectors

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

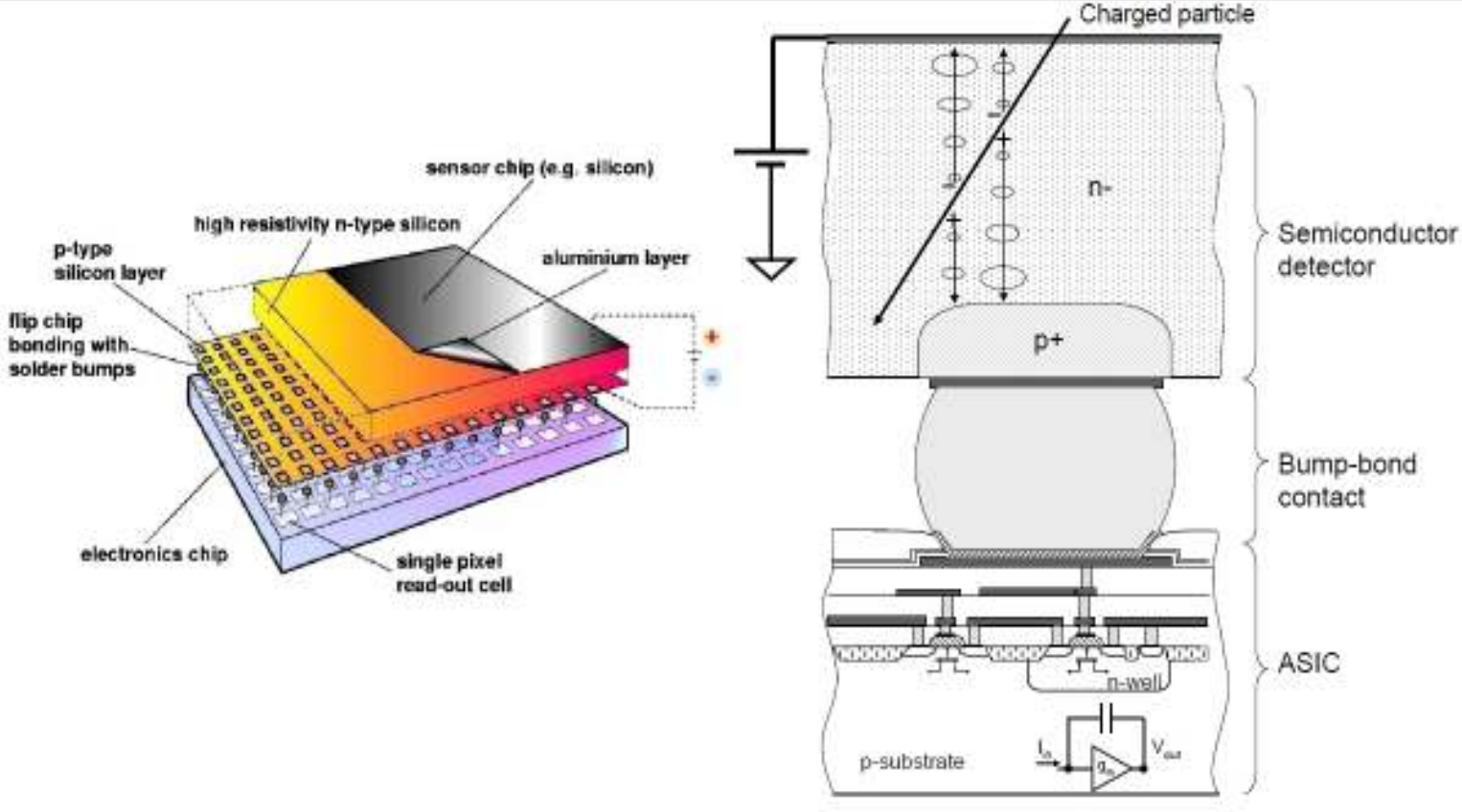


153 high energy particle tracks flying through a telescope of half a million pixels in the WA97 experiment back in 1995

Medipix



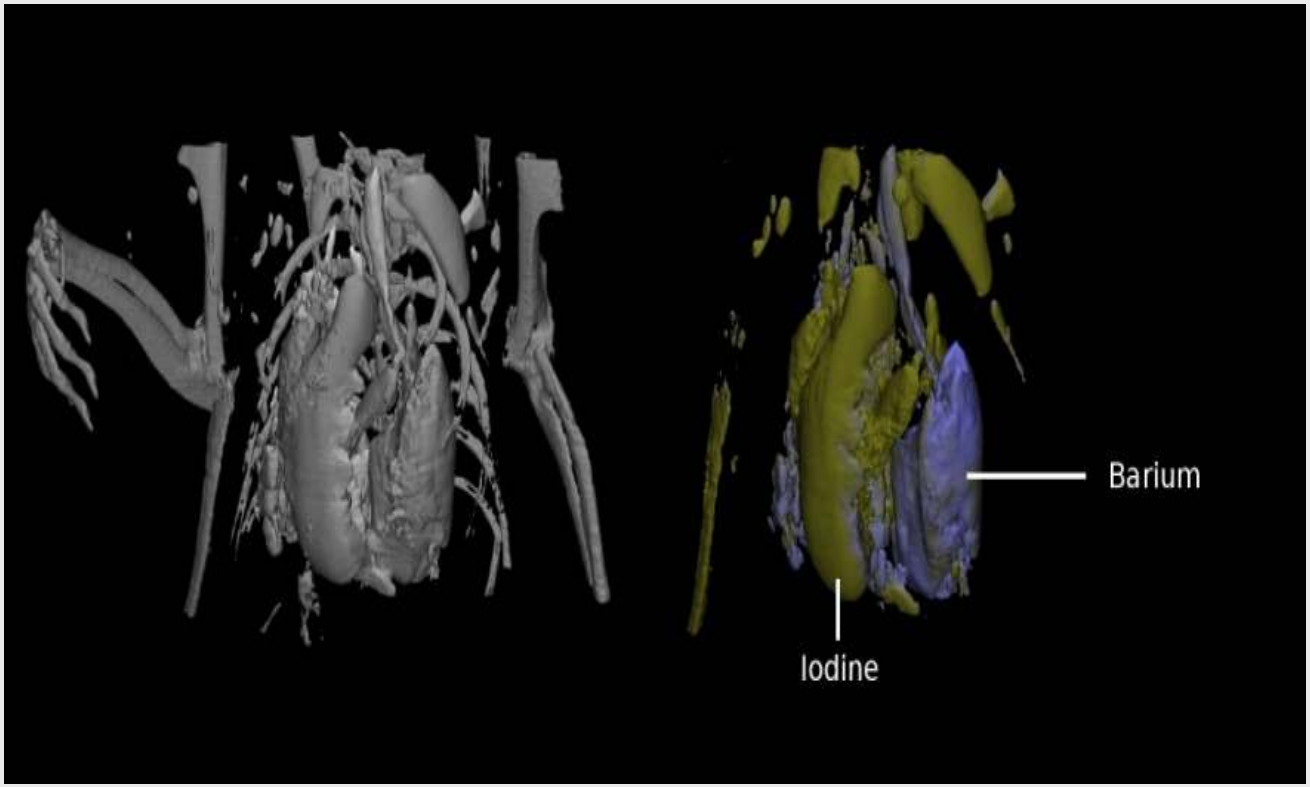
- Medipix 2 collaboration
  17 institutes and labs



Medical Imaging – Computed Tomography (CT)

- MARS project

  Colour CT X-ray scanner based on Medipix technology



(courtesy of MARS Bioimaging Ltd)

Material analysis

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

From high vacuum…

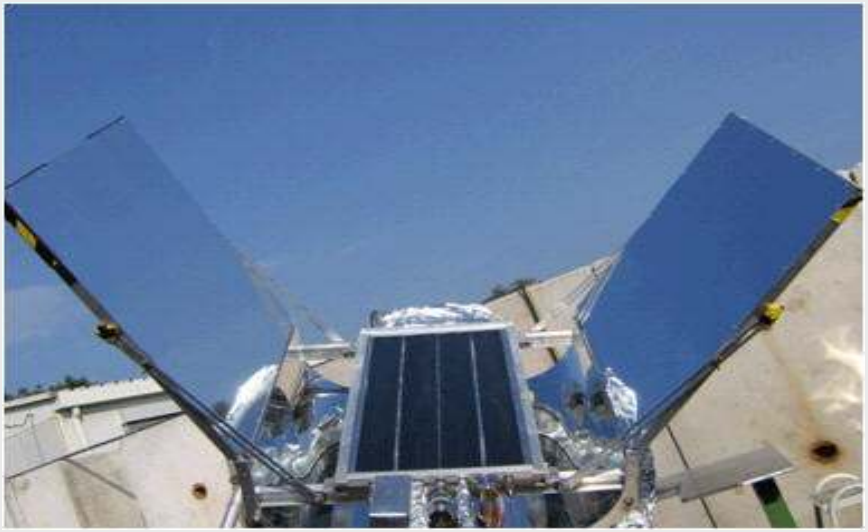
- NEG (Non-Evaporable Getter thin film coatings)

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

… to “green” 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.