

CERN technologies in daily life

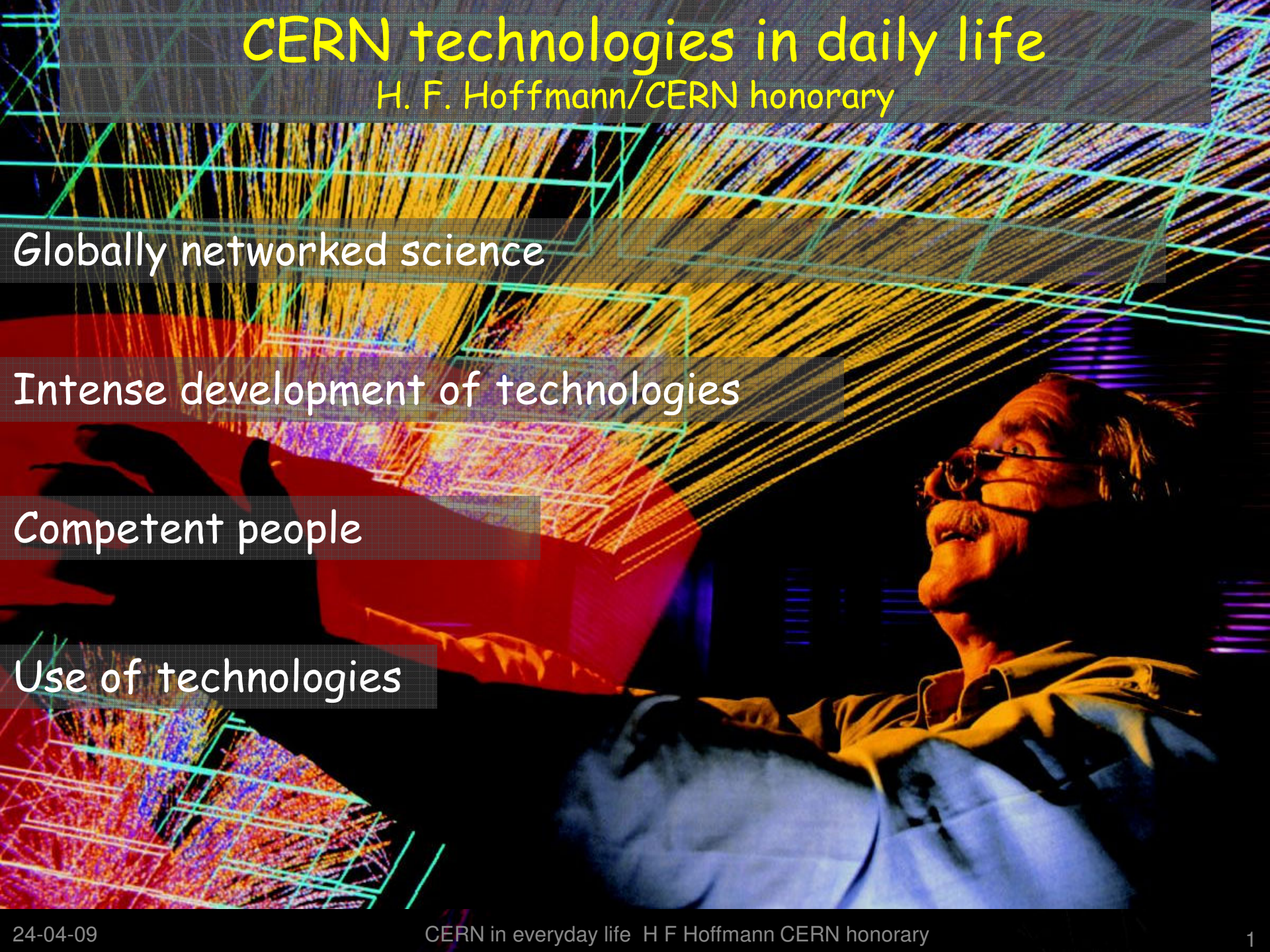
H. F. Hoffmann/CERN honorary

Globally networked science

Intense development of technologies

Competent people

Use of technologies



The High Energy Physics, HEP, mechanism



8-2005
8724A1

Science - Technology - Innovation

December 17, 1903



Grow
applicability



Grow
reliability

Optimize
components

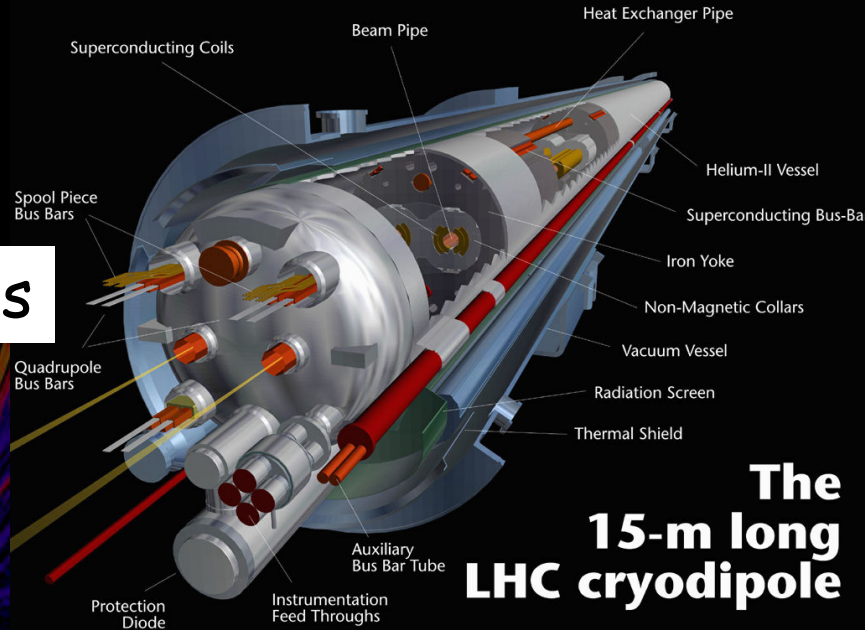
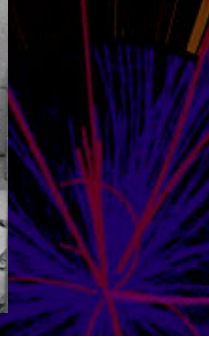


Fly in 2005?

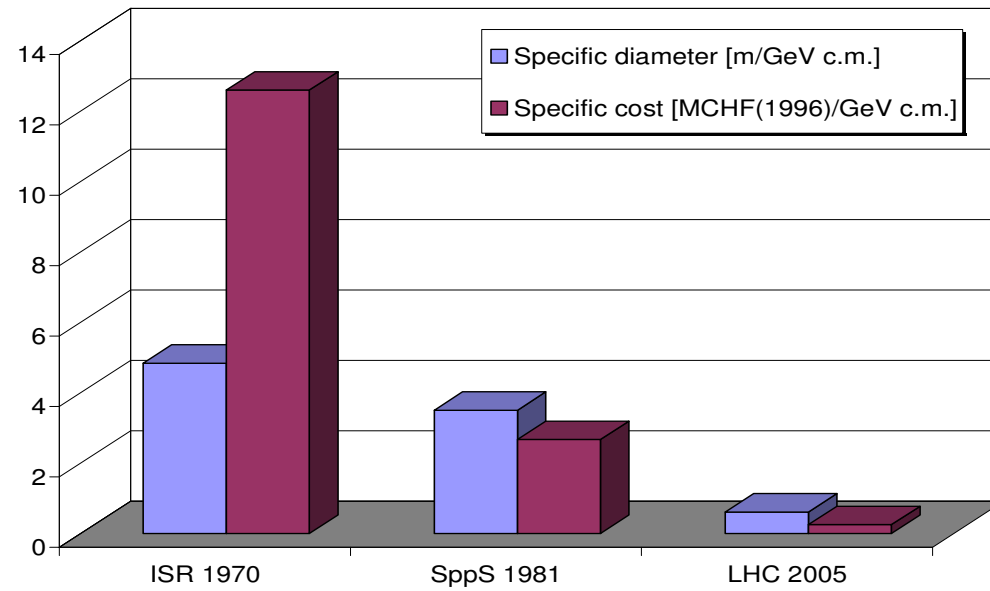




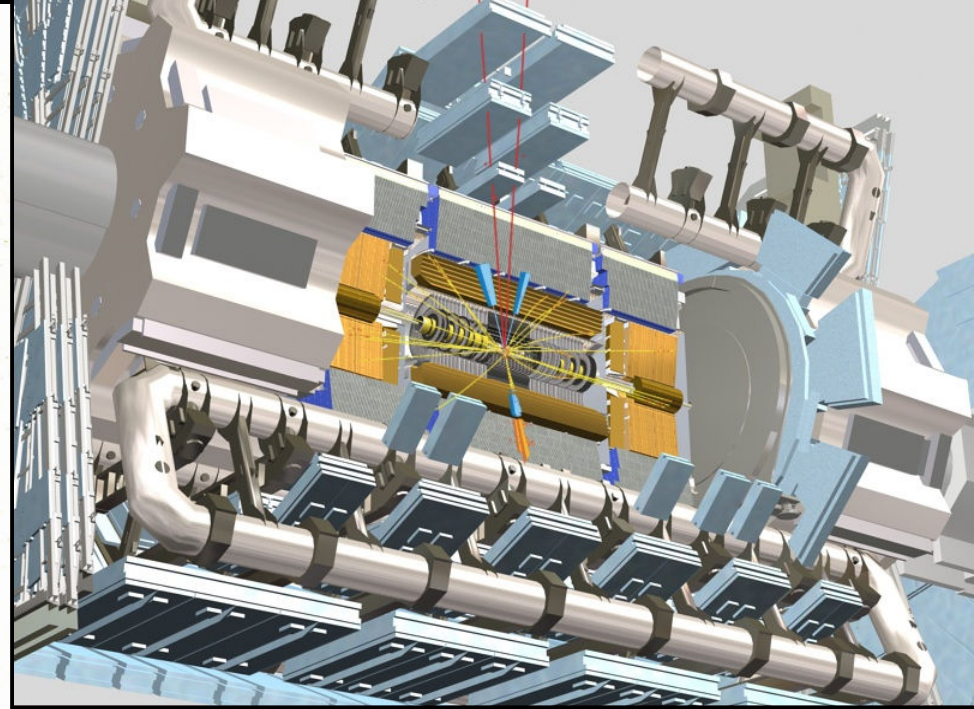
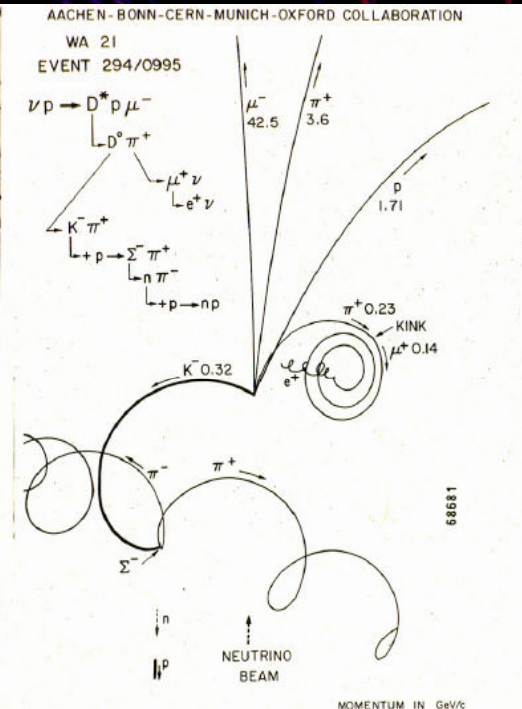
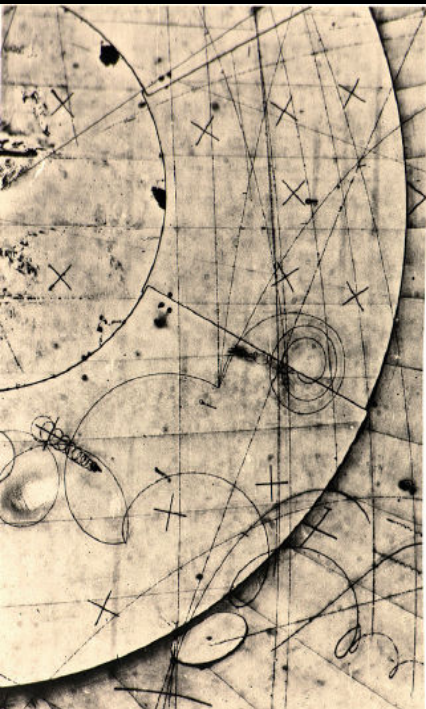
50 years



The
15-m long
LHC cryodipole



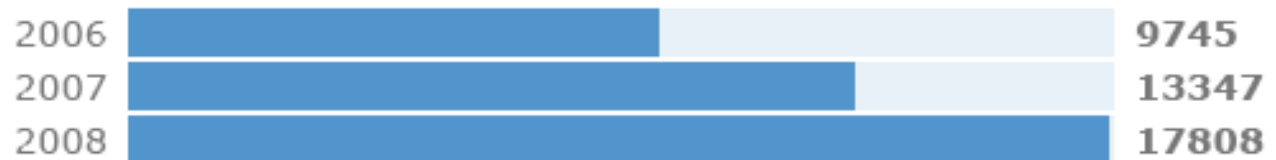
30 years,
Recording: factor 10^9



Fundamental science: quantum jumps in technologies!!!

Last years' ATLAS meetings

Scheduled meetings



Recorded contributions to those meeting



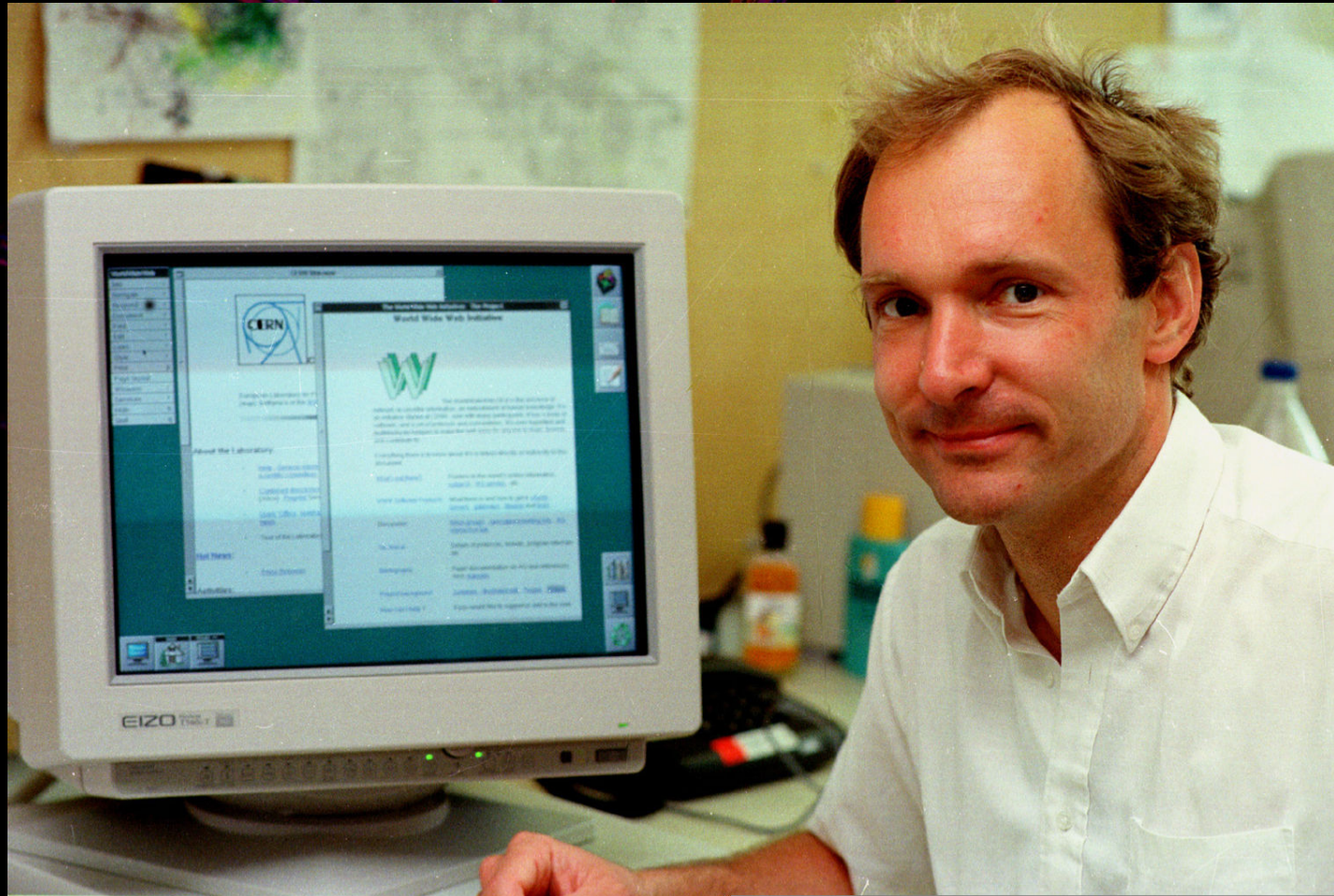


Competent People

Learning by doing

the details of a "state of the art"- Science in an international, competitive environment

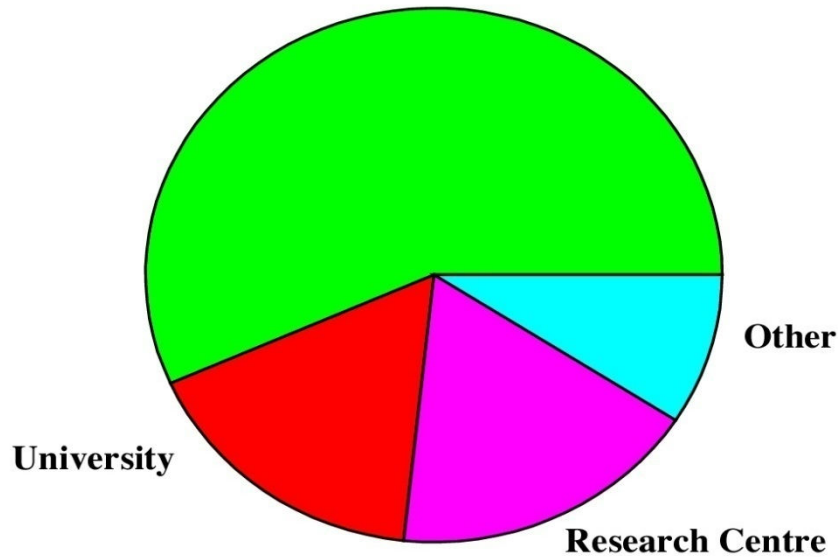
And have you heard of the... **Web?**



Competent People HEP's best Spin off?



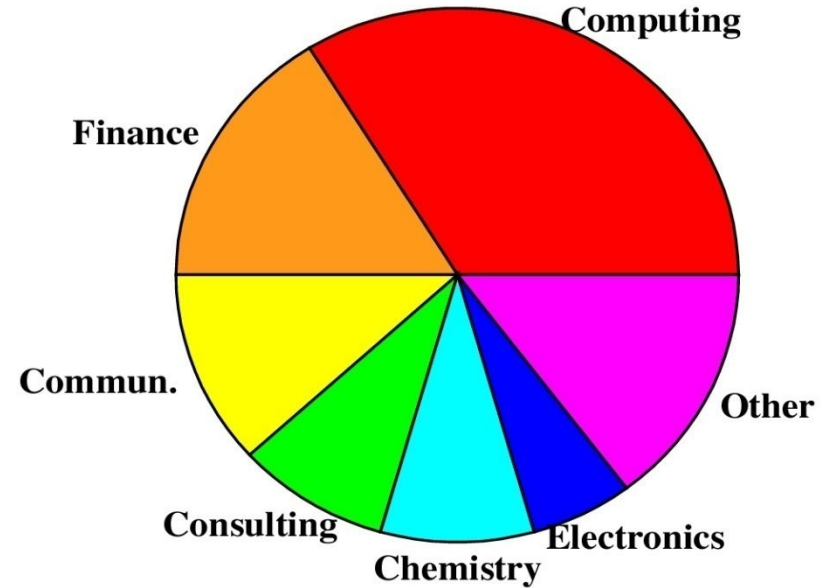
Industry



Whereabouts of PhD's



Computing



Whereabouts of PhD's in Industry





Use of technologies

Technologies derived from accelerators

Superconductivity

Cryogenics, super-fluid He- cooling

Particle sources

UHV-vacuum, measuring techniques

Surface, material sciences

RF, microwave engineering

Mechanical engineering

Electrical engineering and power electronics

Controls

Instrumentation

Survey

Accelerator technologies, beam dynamics, beam cooling,
FEL, computer codes to design accelerators, **systems** ...

Technologies derived from HEP experiments

Detectors for ionising particles,

Electronics

Data acquisition systems,
Computer controls, calibration of complex apparatus,

On-line pattern recognition and data selection, simulation of the behaviour of ionising particles in matter also in complex apparatus or environment: Geant4, Fluka, ..

Analysis software

Complex systems management

Computing, networking, e- (cyber)-science infrastructure

Today's library of Alexandria



Open Access:

Access to the results of academic research through internet and the WWW

"Goal"

Make available a comprehensive source of human knowledge and cultural heritage, approved by the academic community

"e-libraries' school" at KIST / Rwanda

Collect all scientific outputs of research institutes and universities in Rwanda and make them available on the internet in Rwanda and globally

Common prototype now constructed at KIST 4

"Science teachers" best practices & content???



e-science and development

Abdus Salam, Pakistan:

"in the final analysis, creation, mastery and utilization of modern science and technology is basically what distinguishes the South from the North. On science and technology depend the standards of living of a nation"

Calestous Juma, Millennium project Task Force on Science & Technology
"It is inconceivable that the eight Millennium Development Goals can be achieved by 2015 without a focused science, technology and innovation policy"

Goal: Participation to the (e-) sciences of the world for all

The Club of Rome



The emergence of a networked knowledge society in the next twenty to thirty years is a major paradigm shift from the industrial model of the 19th and 20th century.

This transition is of crucial importance in opening up new opportunities for education, social inclusion, and more efficient use of resources.

Information and communication technologies are the effective tools of this transition. © 8/2003 The Club of Rome

Accelerators: developed in physics labs are used in hospitals



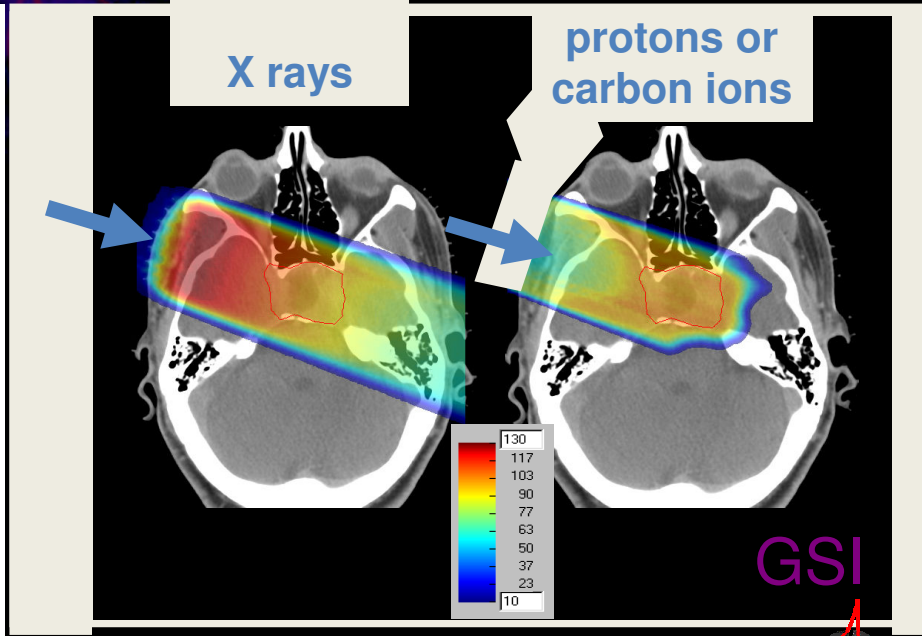
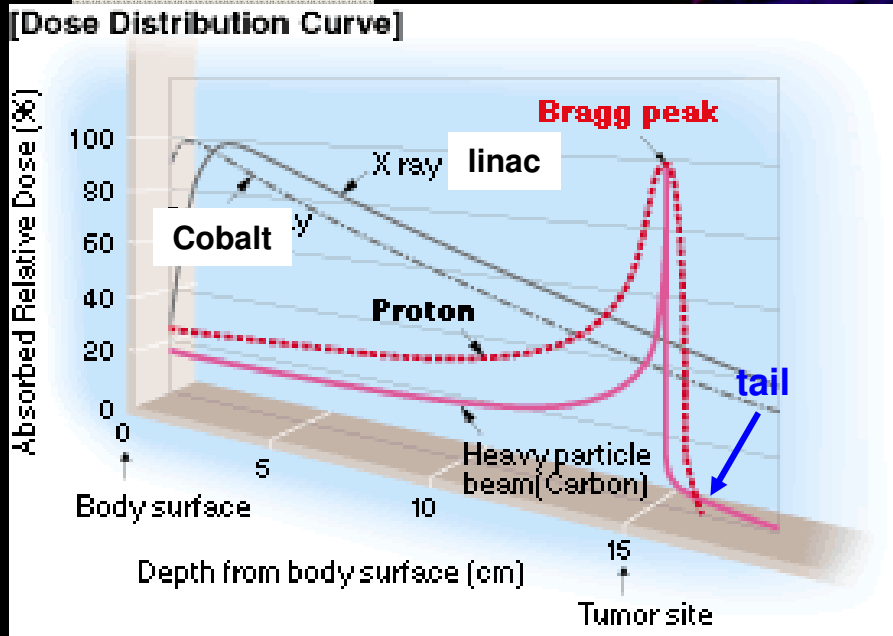
Hadron Therapy

Courtesy of IBA

Around 9000 of the 17000 accelerators operating in the world today are used for medicine

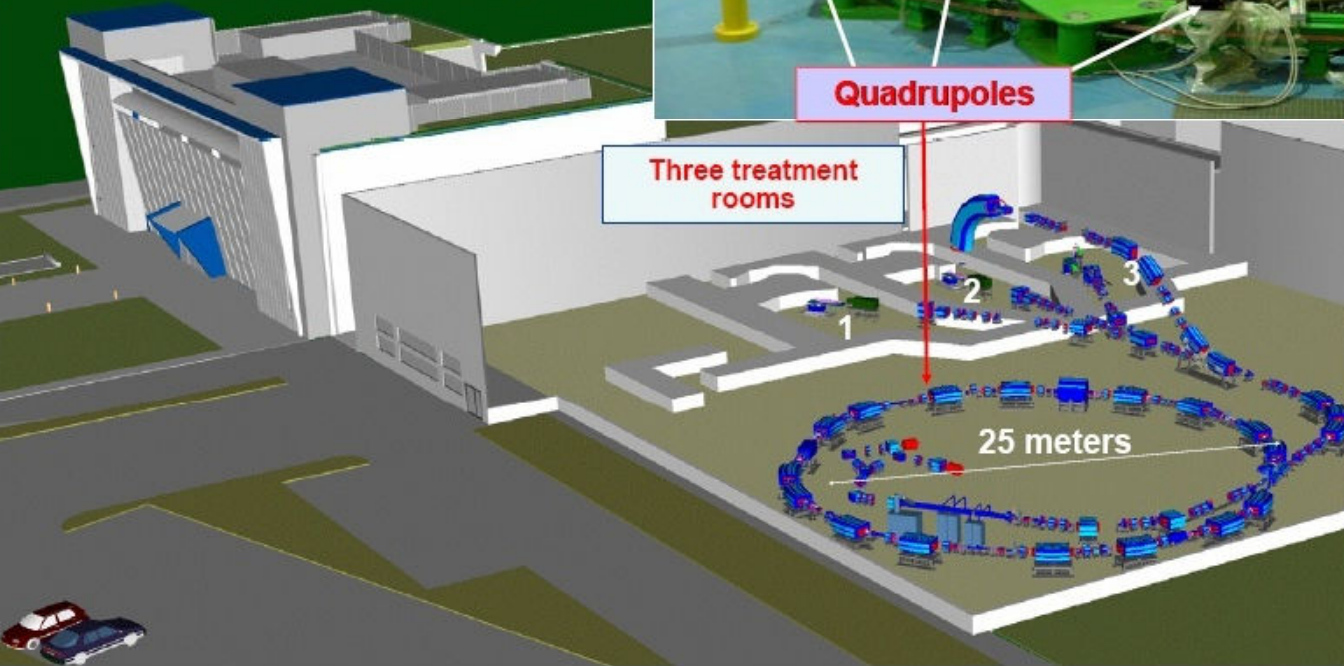
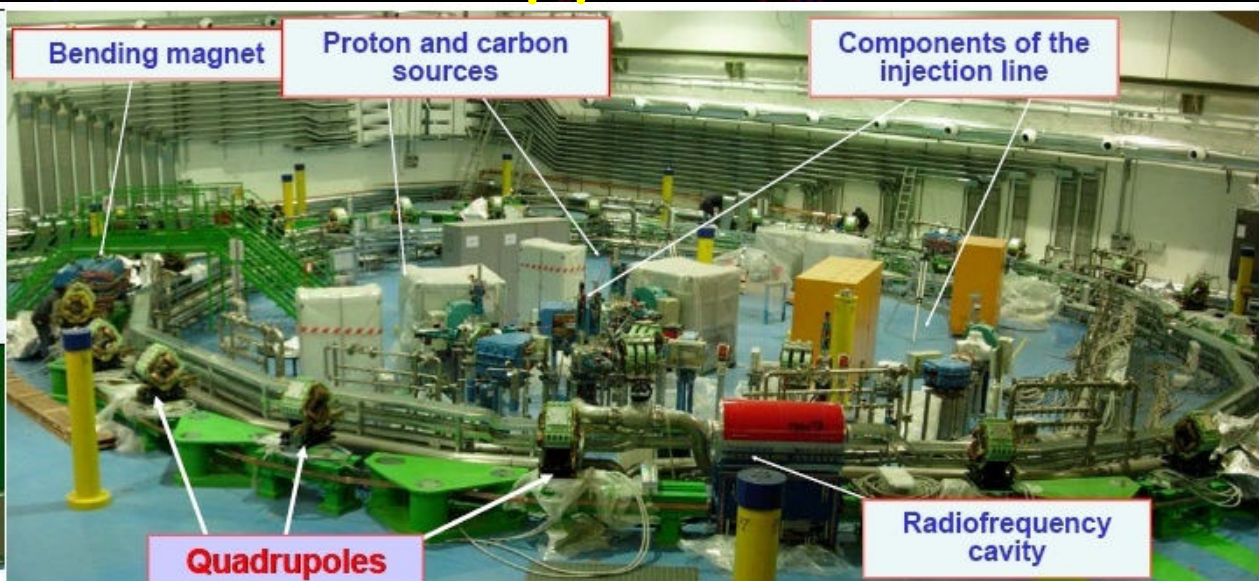
Hadrontherapy

HEP-TT opportunity in accelerators, imaging, HEP-ICT(e-health)



Loma Linda(p), US; Chiba, Jp; PIMMS/CERN; GSI, De; PSI, CH (p), ...

Hadrontherapy



CNAO
Centro Nazionale di
Adroterapia Oncologica
Pavia

PIMMS - TERA - Enlight - Partner - ULICE - Envison

Detectors: developed in physics labs are used for medical imagery



PET (Positron Emission Tomography) is a very important technique for localising and studying certain types of cancer using the Fluor-18 isotope produced by particle accelerators. PET uses antimatter (positrons)

e-medicine: MammoGRID and e-Diamond

To manage health care information for screening

To assist health operators in their work environment and exchange data and practices

To integrate last technical developments in clinical practice

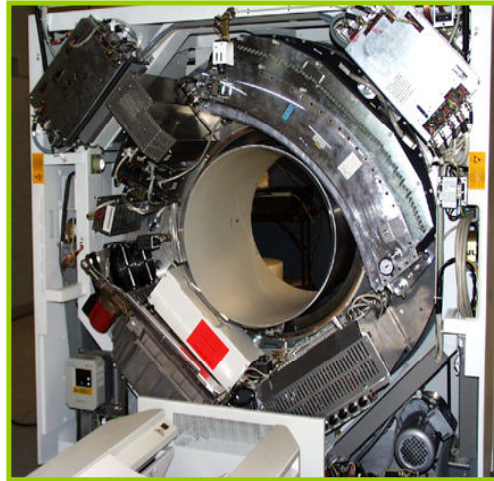


At work at Cambridge, UK Hospital

Example of today's morpho+functional imaging



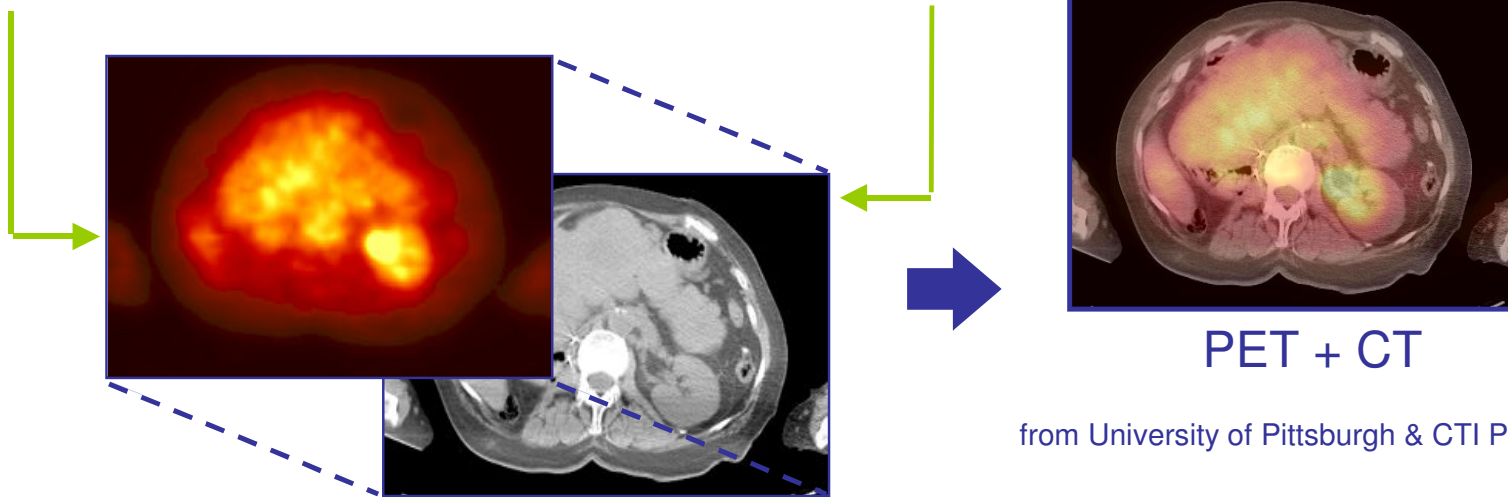
ECAT ART



Somatom AR.SP



SMART scanner



PET + CT

from University of Pittsburgh & CTI PET Systems

Bio-medical applications of HEP technologies

Properties of HEP apparatus

Objectives: Particle Physicist

Highest possible performance

Lab environment/physicist operated

Possible complex maintenance

Possible complex operation

Single unit production

Non commercial

Industry as a manufacturer only

Networked devices, specialist online

Properties of biomedical apparatus

Objectives: Medical Doctor

Robustness

Non-specialist operated

Minimal maintenance

Simple to operate

Small series production

Commercial distribution

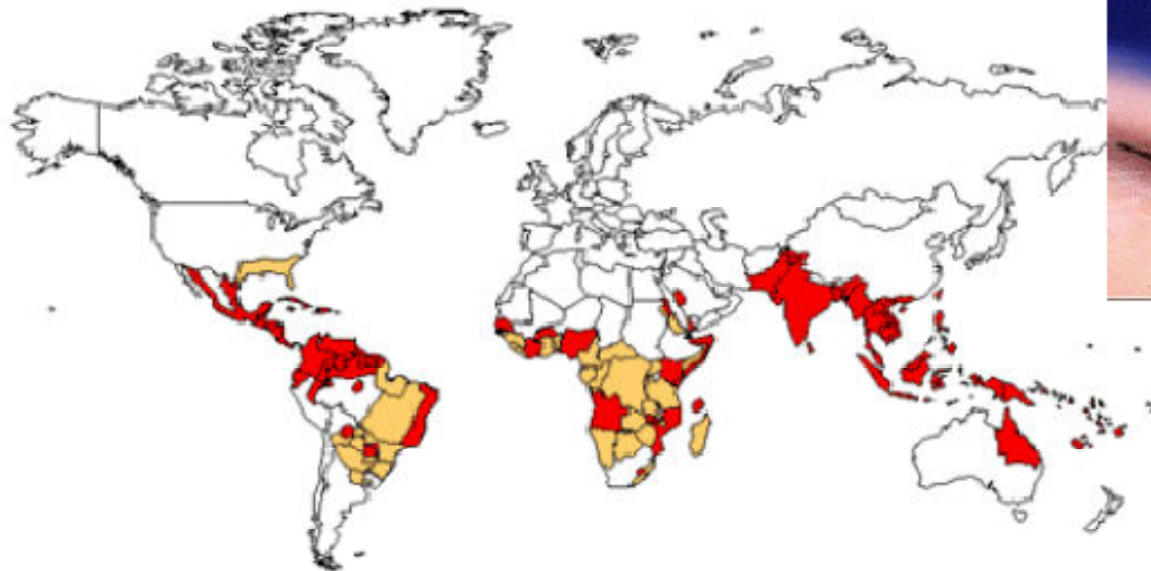
Industry as a partner

Aim: Higher sensitivity, better resolution, lower dose, systems (PET+CT, MRI +PET,)

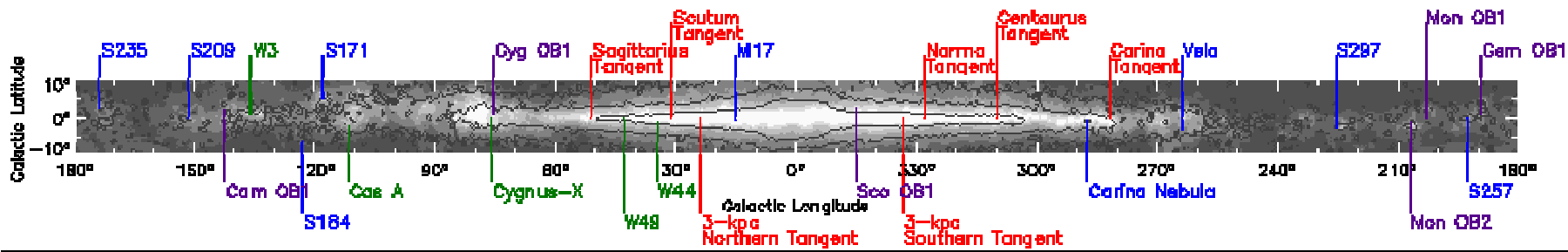
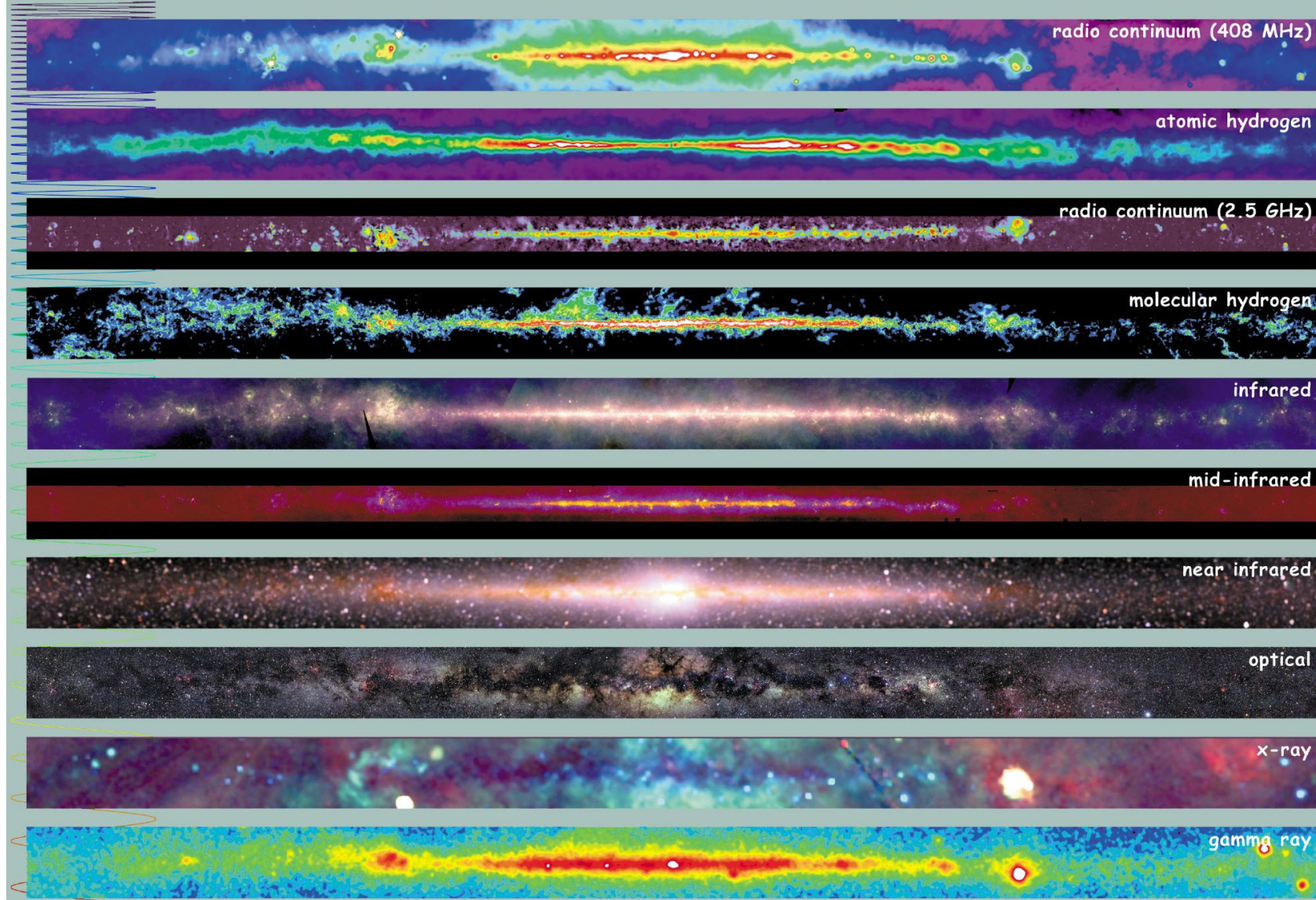
Comprehensive, networked solutions - integrated technologies , collaborative treatment

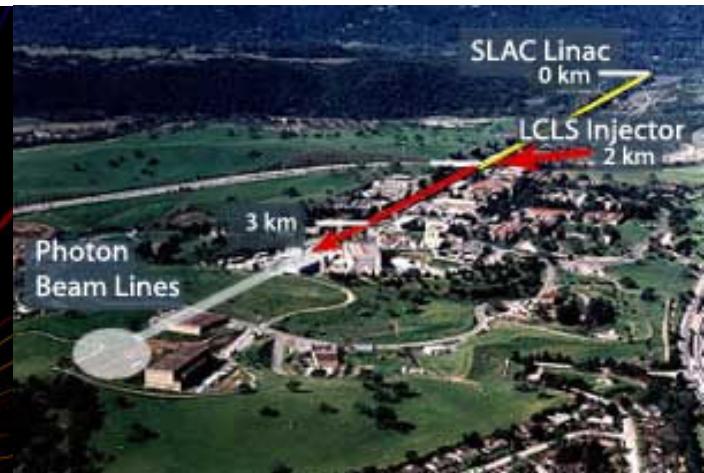
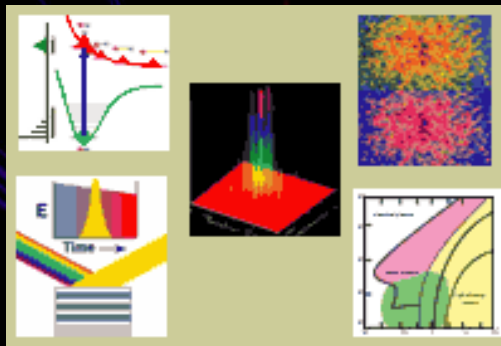
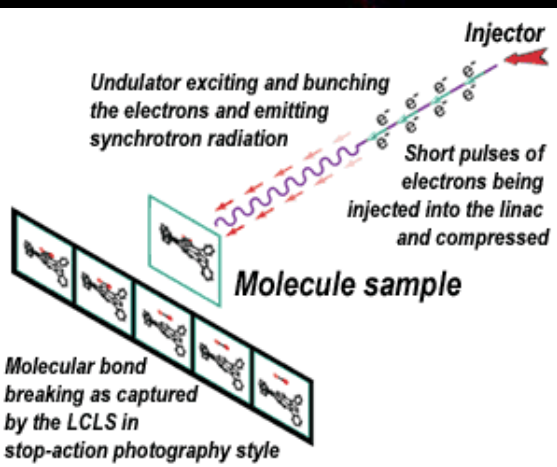
GRID-based Virtual Screening on Dengue Virus Target Proteins

- 50 to 100 million cases of dengue fever (DF) and several hundred thousand cases of dengue hemorrhagic fever (DHF) per year
- Widely neglected by Pharma Industry as well as academic funding agencies



■ Areas infested with *Aedes aegypti*
■ Areas with *Aedes aegypti* and dengue epidemic activity



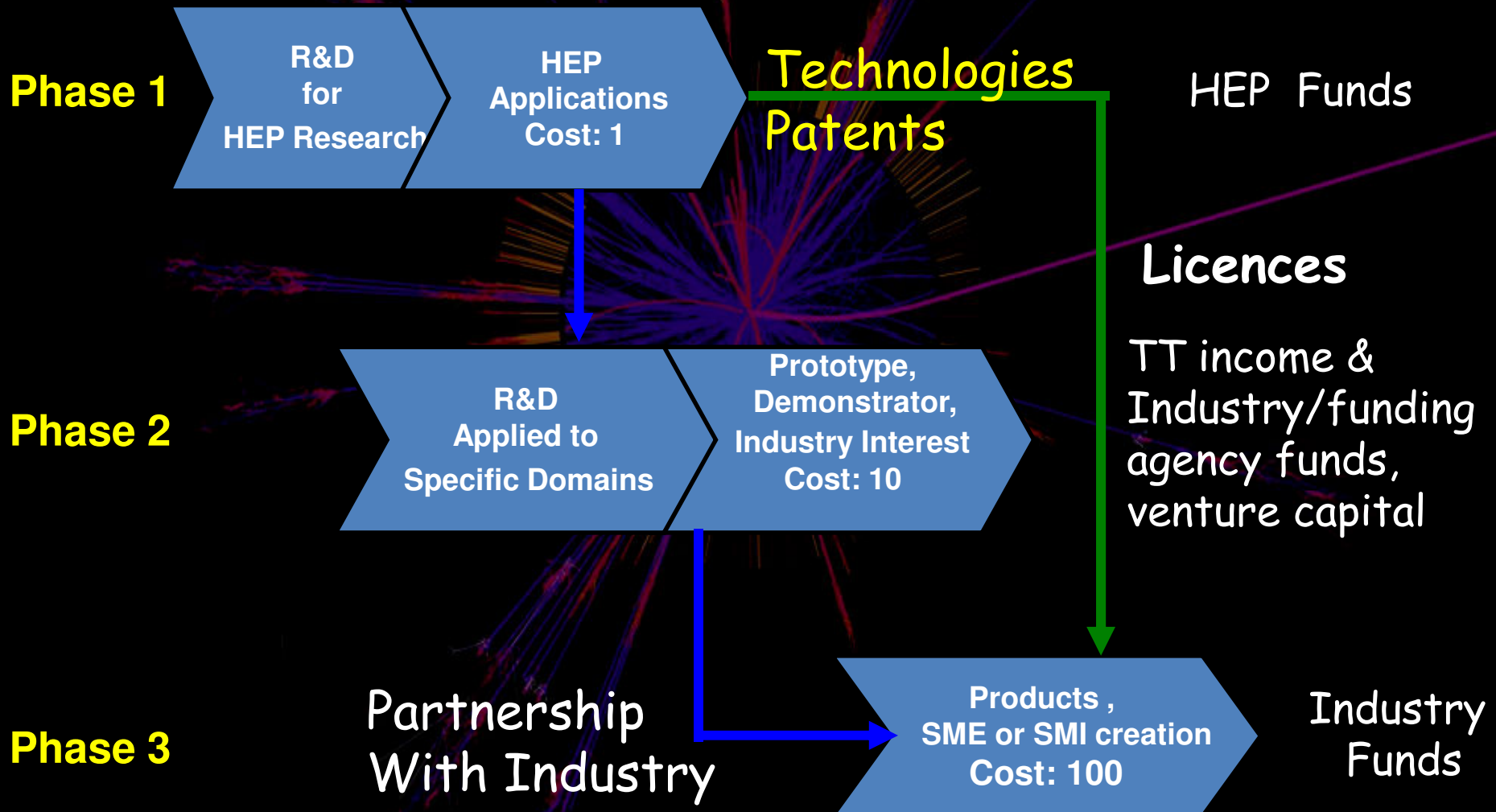


SCSS X-FEL Conceptual Design Report May 2005

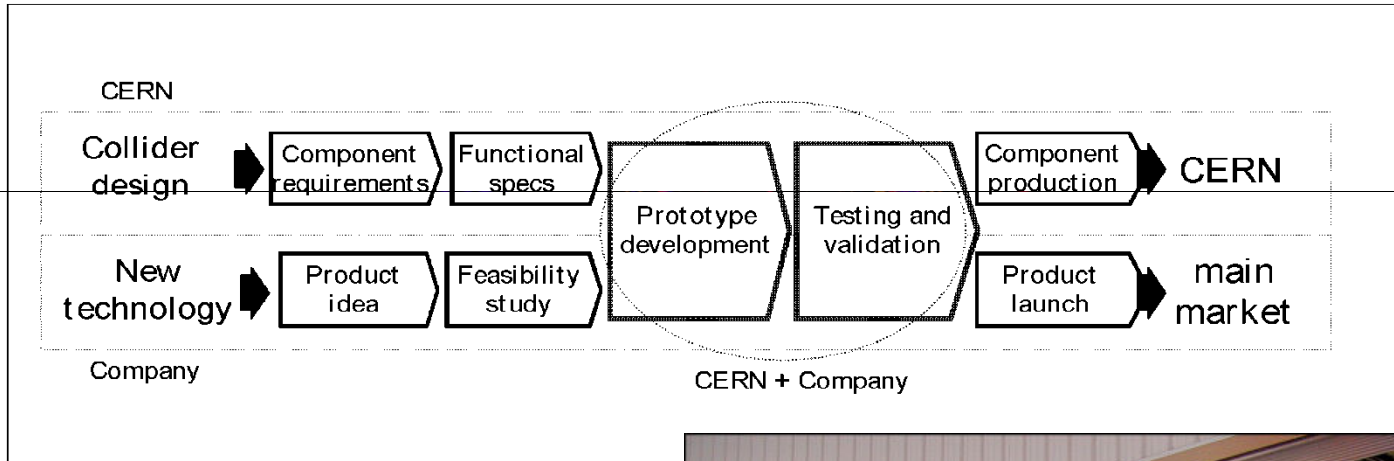
RIKEN Harima Institute
Coherent X-Ray Optics Laboratory
Coherent Synchrotron Light Source Physics Laboratory
Advanced Electron Beam Physics Laboratory



Fundamental research & TT



"Win-win" with industry



Standard Spin Offs and their evaluation

Patents and copyrights

Economical utility to industry of high tech contracts placed by HEP institutes

(Technology transfer and technological learning through CERN's procurement activity; [CERN-2003-005](#), [CERN yellow report](#))

Collaborative projects with other sciences or industries

Exchange of personnel (rare), consultancy (often informal)
"win-win" developments of products

Start-up companies based on technology from HEP

Development and science

December 17, 1903



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applicability

Optimize
components

Grow
reliability

Fly in 2005?

