CERN Impact-Driven Innovation Approach

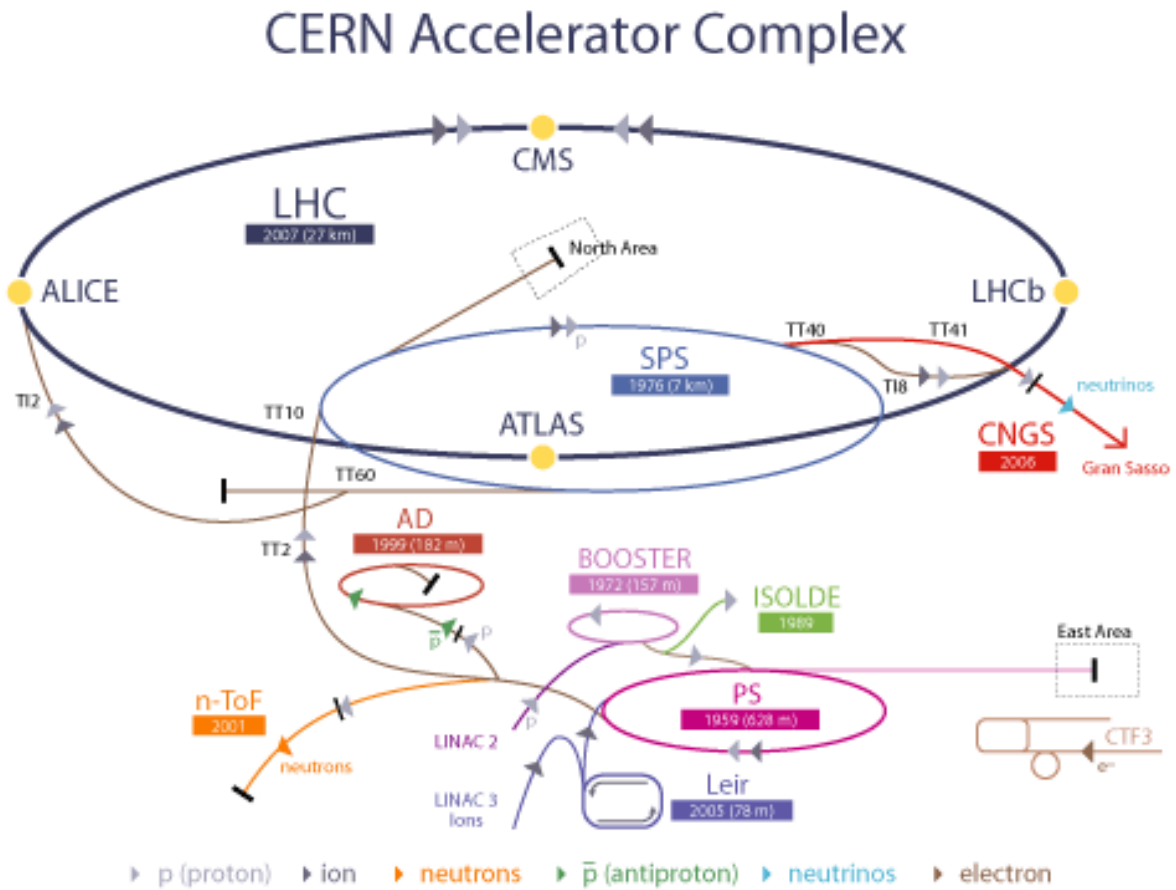
Enrico Chesta

Head of CERN Technology Transfer and
Intellectual Property Management Section

Knowledge Transfer Group, FP Department

How can CERN have an impact beyond pure fundamental physics?

Direct use of CERN beams?



Increasing particle energies:

Linac 2:
50 MeV

Proton Synchrotron Booster (PSB):
1.4 GeV

Proton Synchotron (PS):
25 GeV

Super Proton Synchotron (SPS):
450 GeV

Large Hadron Collider (LHC):
4 TeV per beam
After LS1 (2015):
7 TeV per beam
$\Rightarrow$ 14 TeV total collision energy


The Economist
In praise of charter schools
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Volkswagen overtakes the rest
A power struggle at the Vatican
When Lonesome George met Nora
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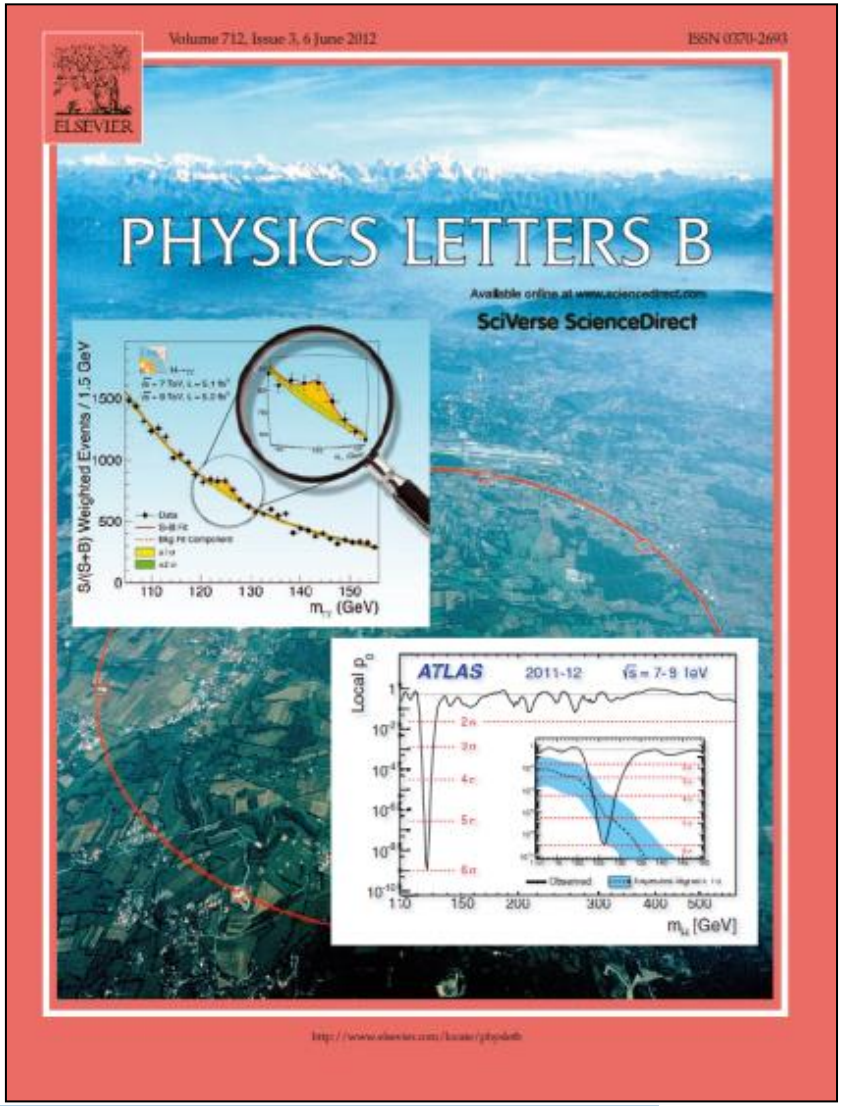
A giant leap for science
Finding the Higgs boson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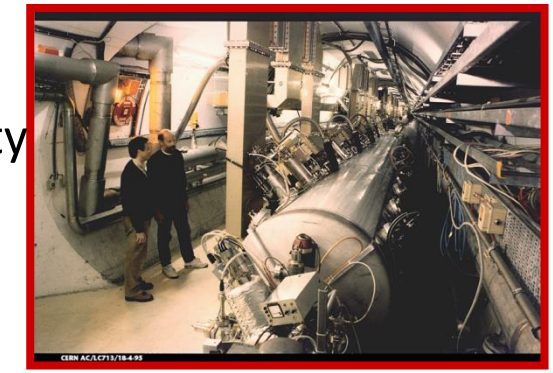
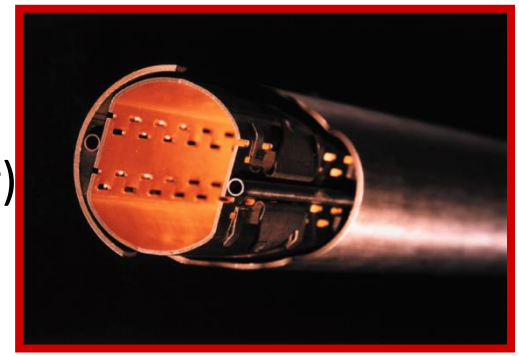
ELSEVIER
PHYSICS LETTERS B
Available online at www.sciencedirect.com
SciVerse ScienceDirect
S/(S+B) Weighted Events / 1.5 GeV
m_γγ (GeV)
ATLAS 2011-12 √s = 7-9 TeV
Local p_0
m_H [GeV]

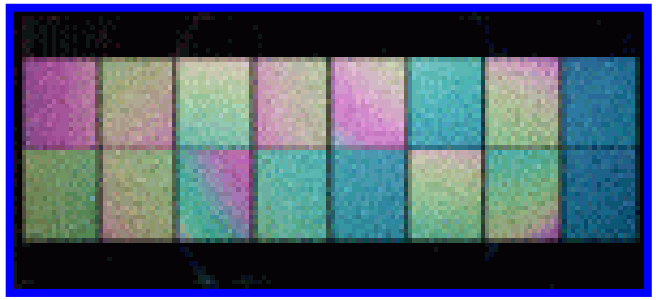
CERN Core Competences

Super-conductivity (13kA, 7MJoules)

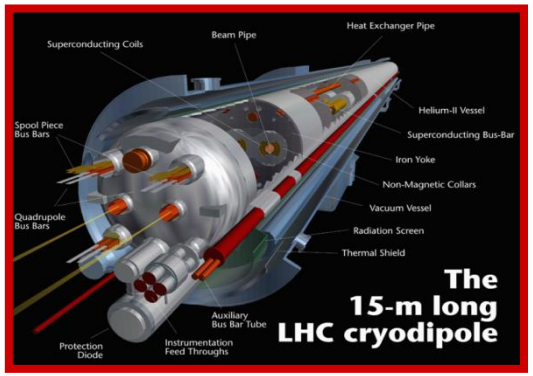


Vacuum (10^{-12} Torr)



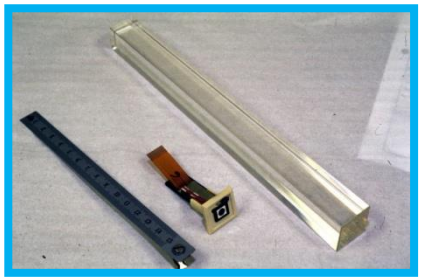


Cryogenics (1.9 K)

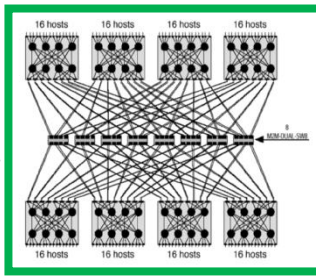


Magnets (10 T)

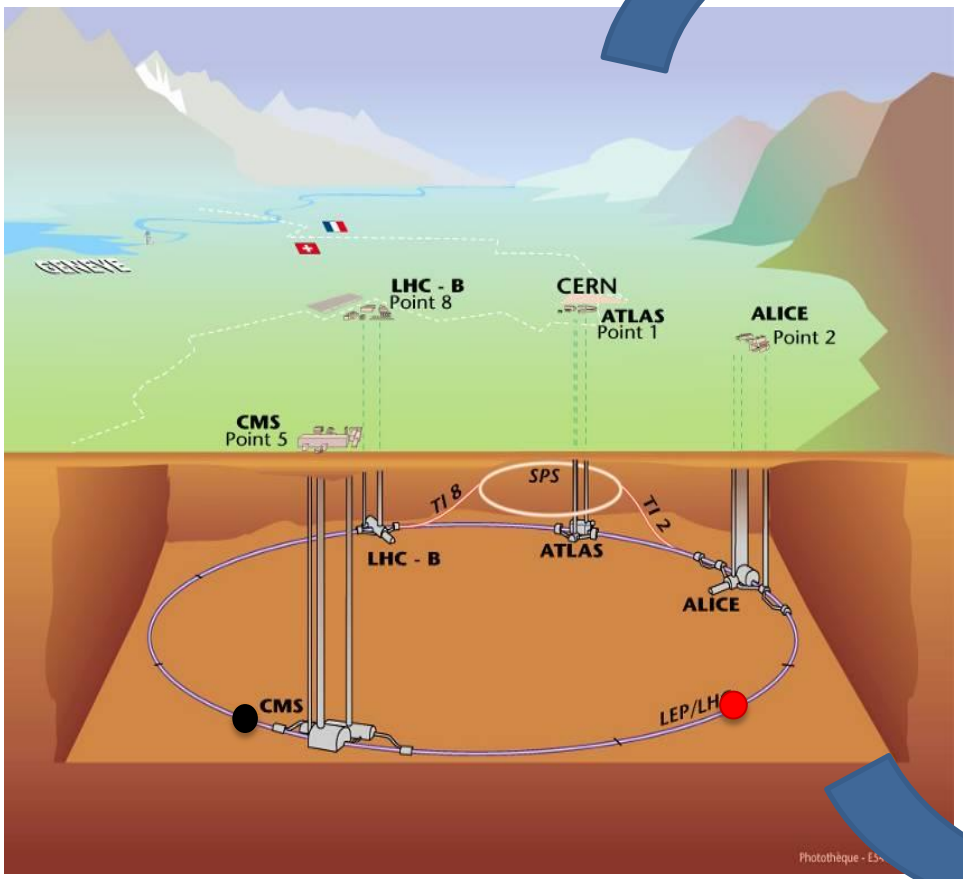
Very high performance detectors and electronics

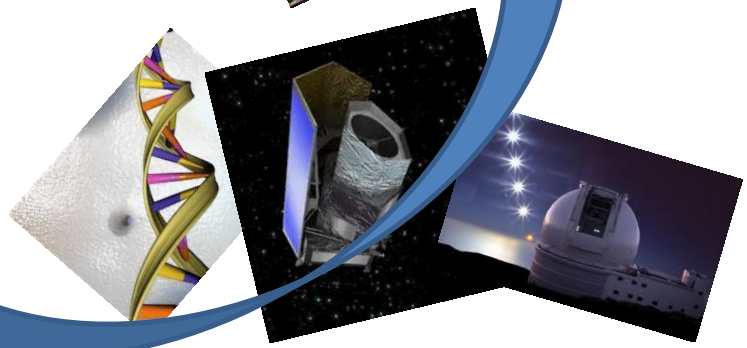


Data processing (15 PB/year)



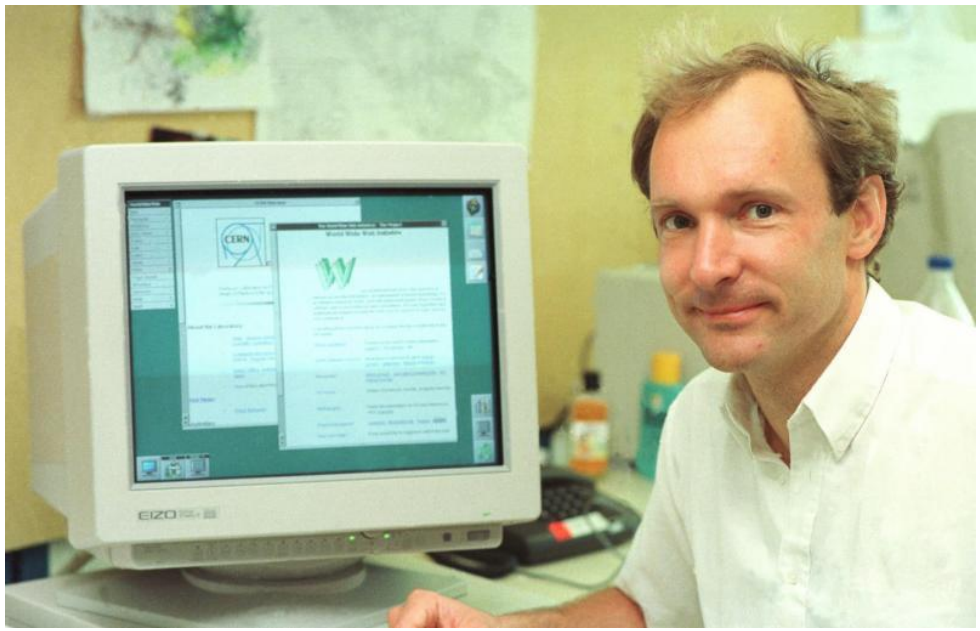
CERN TT Target

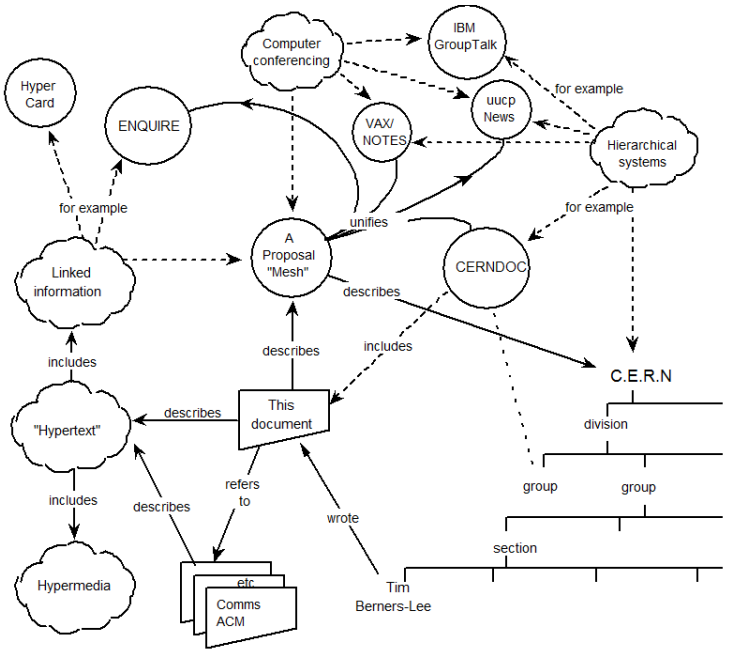




Some “high-impact” examples

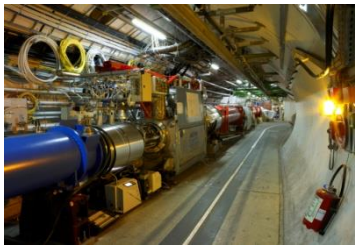
CERN: Where the World Wide Web was born

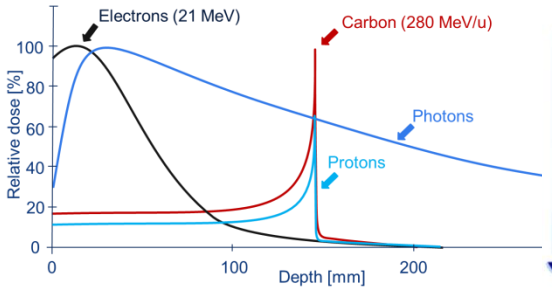


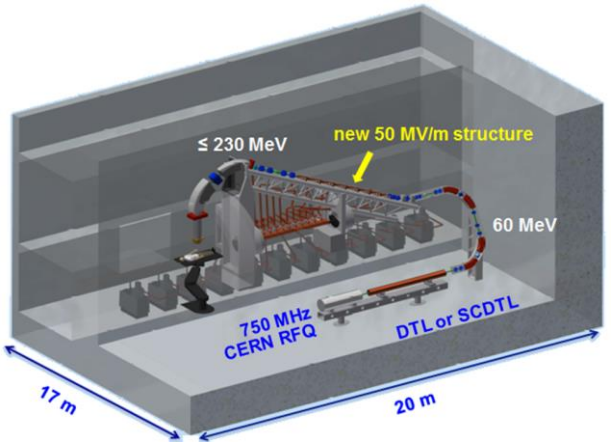


Medical Applications

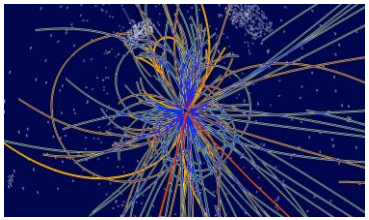
Particle accelerators for hadron therapy

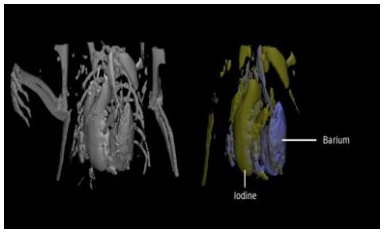


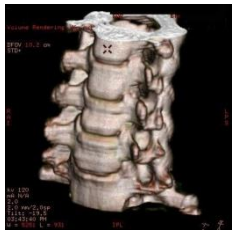


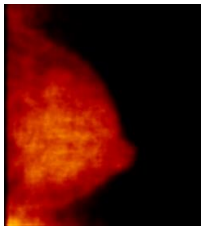


Particle detectors for medical imaging

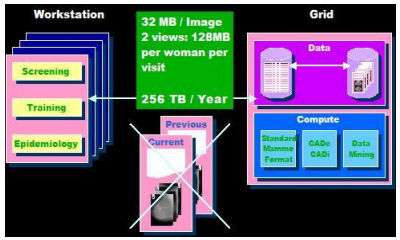






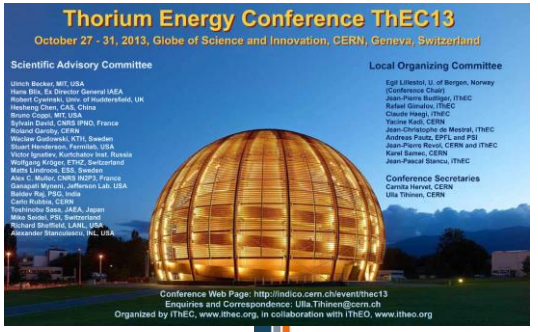


Grid computing for medical data management and analysis



Energy Applications

Thorium Accelerator Driven Systems



AkerSolutions

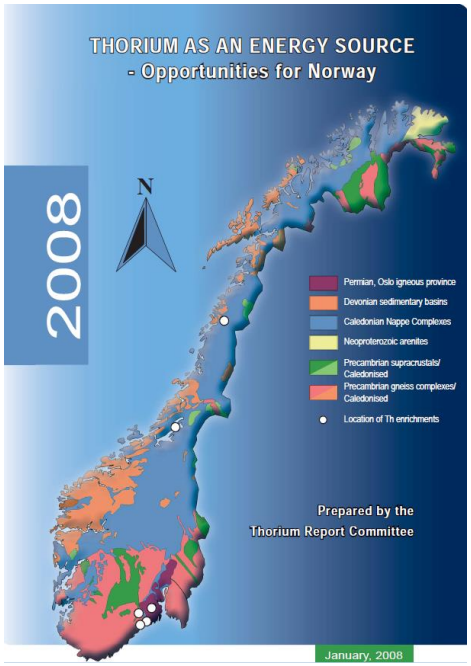
"An ADS fuelled with thorium has some clear advantages over a conventional reactor:

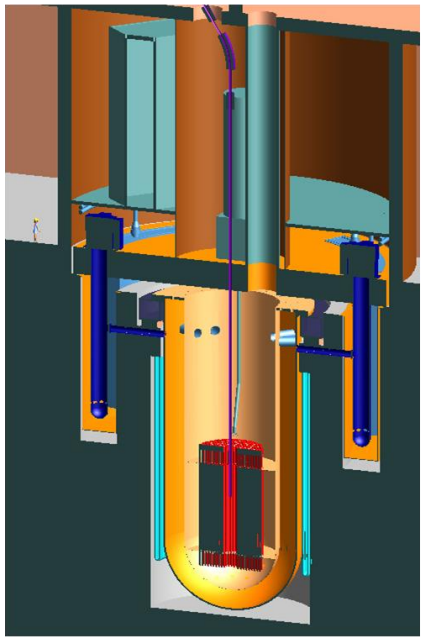
1. Much smaller production of long-lived actinides.
2. Minimal probability of a runaway reactor.
3. Efficient burning of minor actinides.
4. Low system pressure.

The most important drawbacks of the ADS are:

1. More complex than conventional reactors.
2. Less reliable power production due to accelerator downtime.
3. Large production of volatile radioactive isotopes in the spallation target.
4. The beam tube may break containment barriers.

A power producing ADS using thorium may become a reality, but it is not reasonable to expect this to happen in the next 30 years. Much research and development remains to be done, especially in the fields of accelerator technology and material properties."





A Thorium fuelled reactor for power generation

Space Applications

CERN-ESA Framework Cooperation Agreement

1. Advanced materials
- Composite materials for thermal management
- High stability silicon carbide structures
- Insulating materials radiation- predictable
- Materials for low temperature applications.

2. Surface science
- Coatings for UHV applications
- Surface treatments for e-cloud reduction
- Advanced polishing techniques for Titanium

3. High-power MW and RF systems
- Multipactoring effect reduction techniques
- Advanced simulation tools
- Development of new machining techniques

4. Rad-hard electronics
- SEU simulation, measurement, mitigation
- Generic parts: HSST, FPGA, DC/DC converters
- Standardization of qualification for radiation
- Components data base

5. Detectors
- Large-area Silicon Drift Detectors (for ALICE and LOFT)
- Medipix/Timepix chips for remote sensing and astroparticle detection

6. Radioisotopes
- Isotopes production (ISOLDE)
- Isotopes handling
- Isotopes characterization

7. Superconducting magnets
- Space Radiation Superconducting Shields
- High performance detectors
- High power electric propulsion

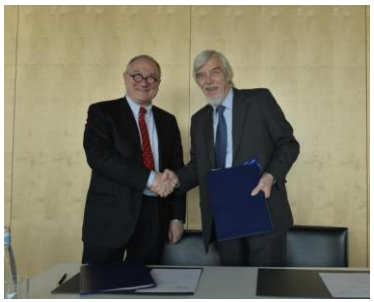
8. Micro-technologies
- Optical fibre sensors
- Micro-channel technologies for cooling and/or propulsion
- MEMS/MOEMS sensors and actuators

9. Cryogenics & Cryostat Systems
- Cryogenic fluids storage systems
- mK cooling of high precision instruments
- Cryocooling techniques for remote loads
- Software tools for advanced cryostat design engineering

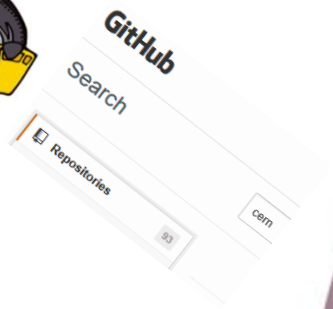
10. Monte Carlo Simulation Tools
- GEANT-4
- FLUKA

11. Data handling
- Data storage
- Cloud computing
- Automation

12. Safety
- Radiation protection tools (software and devices like portable dosimeters)
- Augmented reality and remote control robotic systems

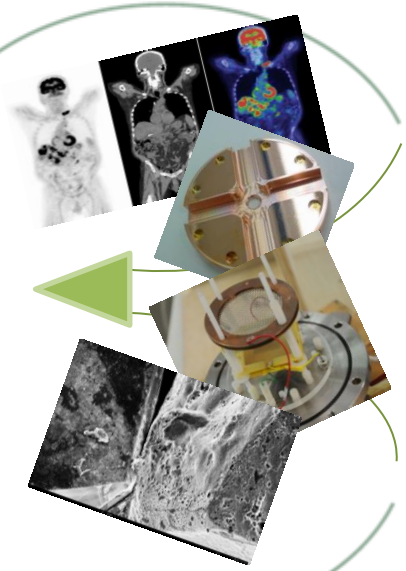


CERN TT impact-driven model



open dissemination

CERN innovation



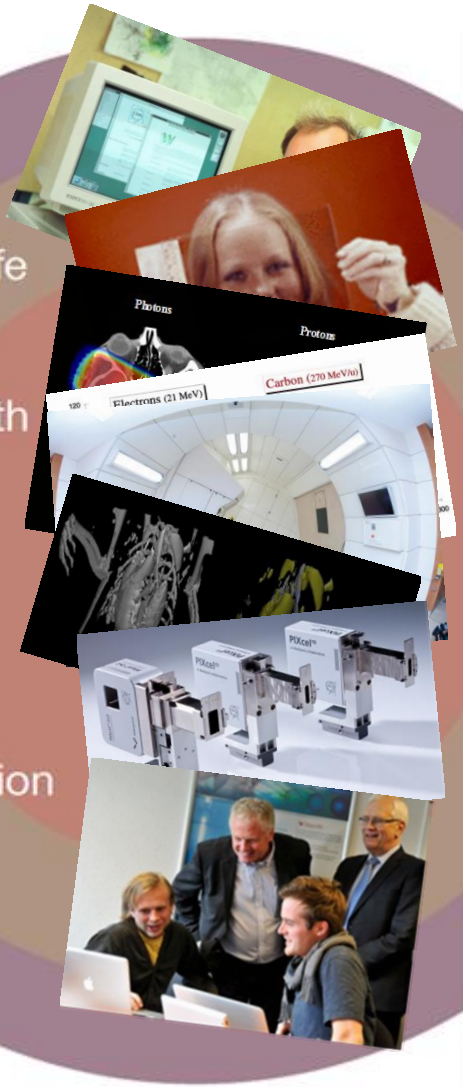
impact

quality of life

health

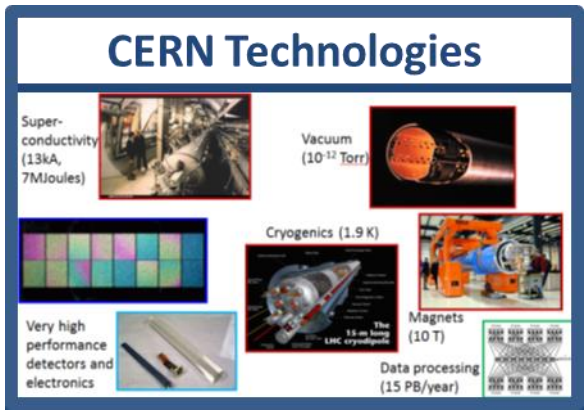
economy

education



protected dissemination

TT Partnerships



Market pull

- Contract research
- Consultancy
- Services
- R&D Collaborations
- Licensing
- Spin-outs

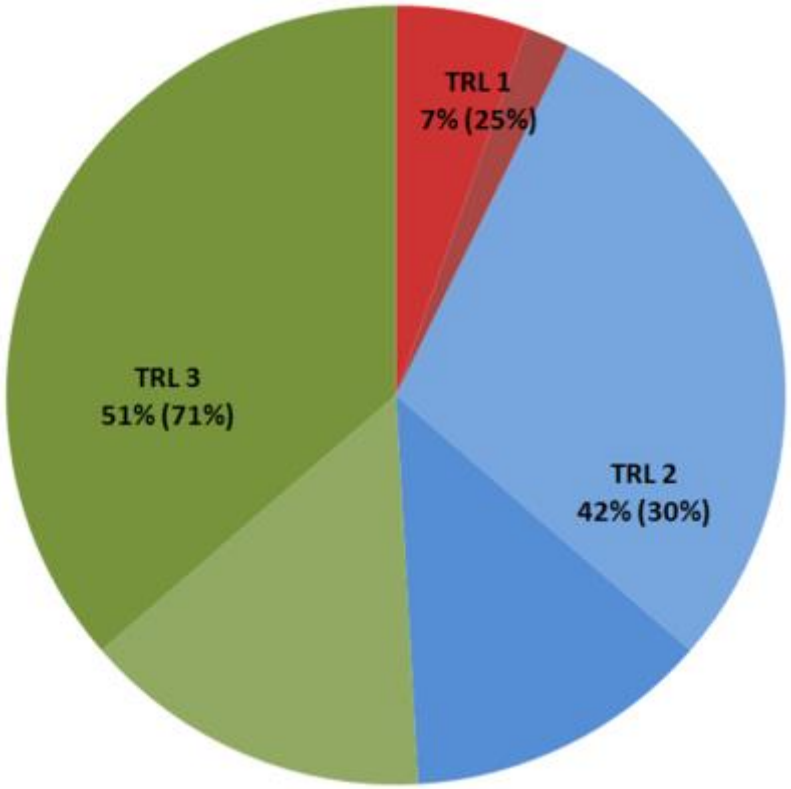
Technology push

Technology Portfolio

Some approximate numbers:

- 200 TT cases (40% open)
- 20 invention disclosures per year
- 50 patent families (50% exploited)

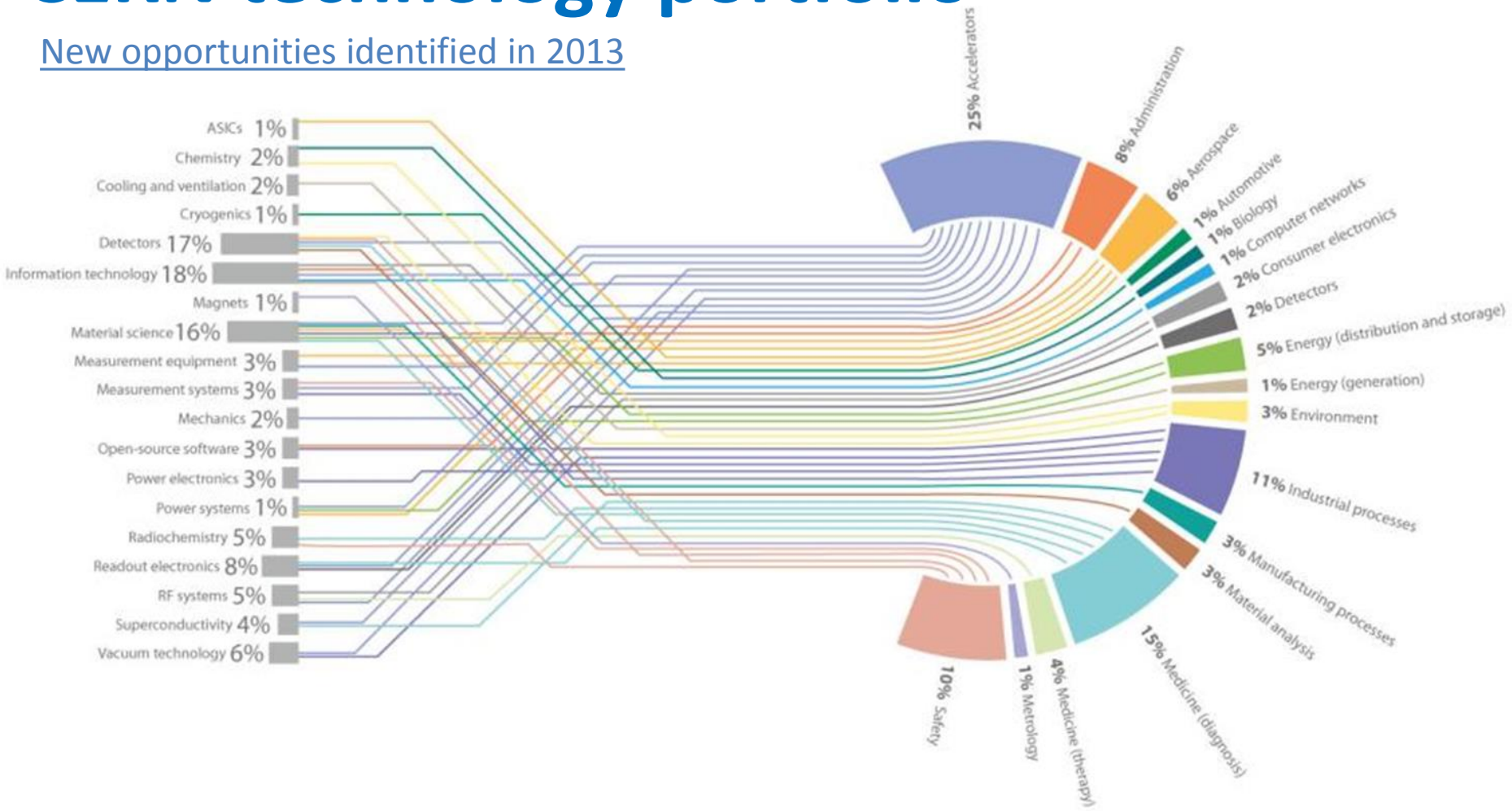
Technology Readiness Levels	Simplified Definition
1	Technology application formulated and basic concept demonstrated
2	Functional validation in laboratory environment
3	Representative prototype fully qualified (technology ready to transfer)



Technology Readiness and "Exploitation" Levels

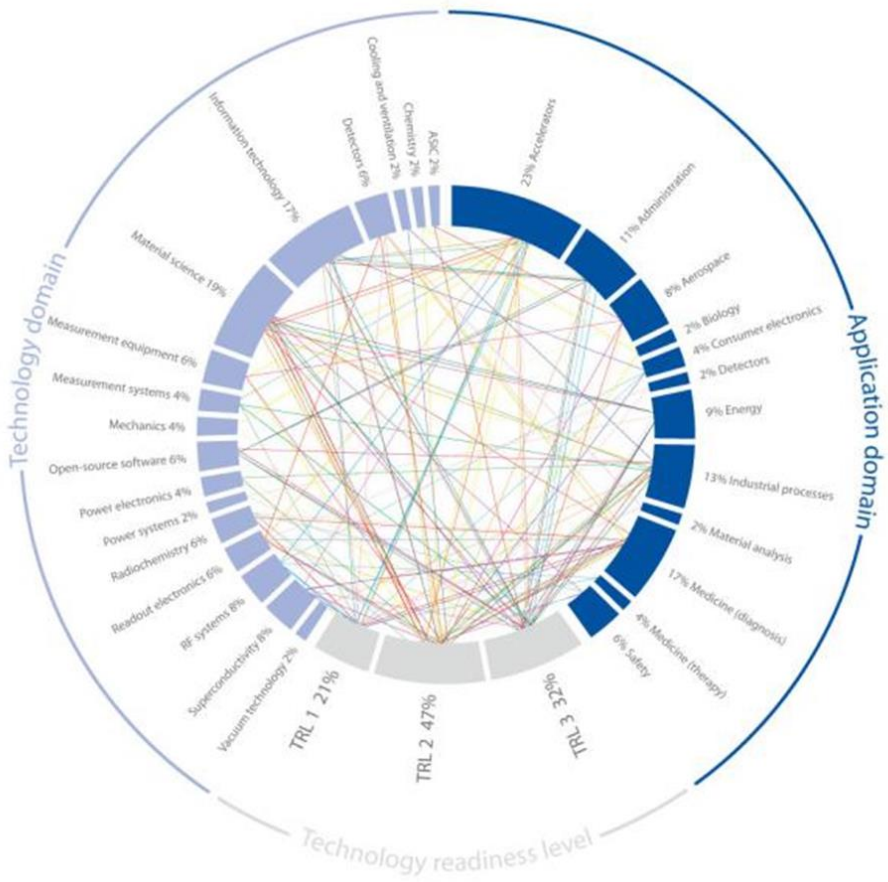
CERN technology portfolio

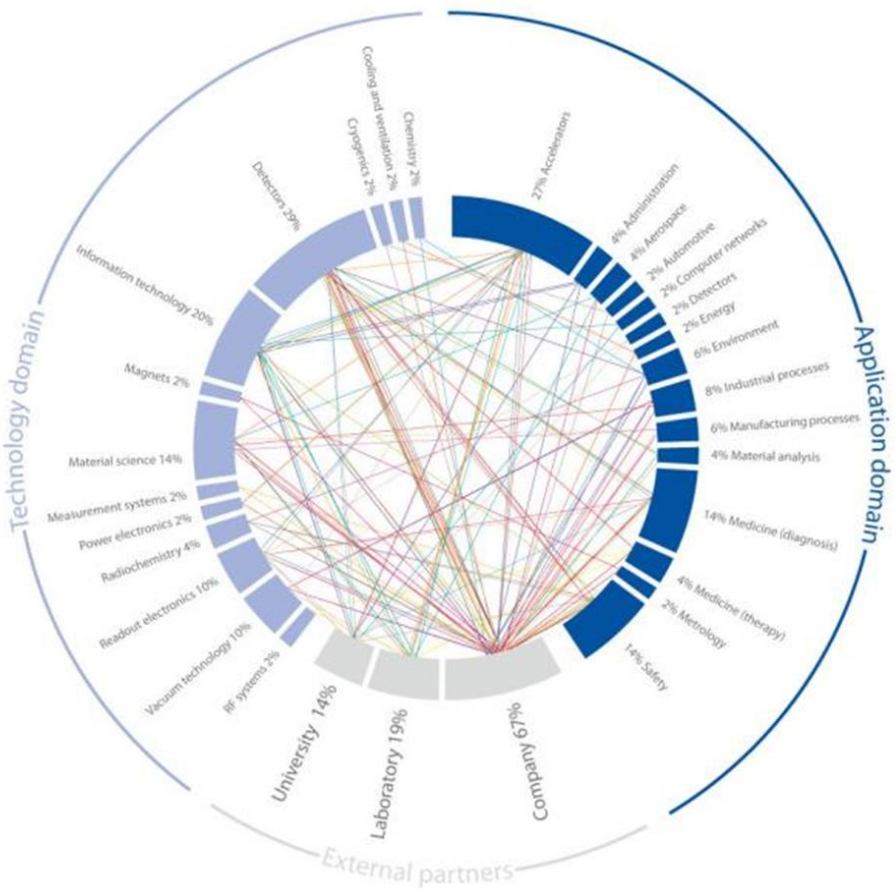
New opportunities identified in 2013



CERN technology portfolio

New opportunities 2013: Internal Technology Disclosures and External Requests of Support





CERN Business Ideas Accelerator (BIA) Concept

Network of European Universities providing technical students

Individual entrepreneurs including staff from CERN or partner organizations

BIA Admission Conditions:
-1 year max
-no revenue generation
-pre-incubation contract

CERN pre-incubator
-Part-time support from CERN inventors
-Use of Lab facilities and CERN infrastructure
-Business Creation and IP support

BIA Outcome:
-Business Plan
-Demonstrators

Projects flow

National Innovation Funds

National incubator 1 UK-STFC

National incubator 2 NL-NIKHEF

National incubator 3 N-NTNU

Investors

Spin-off companies

CERN › KNOWLEDGE TRANSFER

Knowledge Transfer

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- The KT Fund
- KT Networks
- Frequently Asked Questions

Knowledge Transfer 2013 Report

see previous reports

From Physics to Medicine | Knowledge Transfer through People | Energy Sustainability

Thank you for your attention!

Questions?

More  examples =>

Vetle's presentation