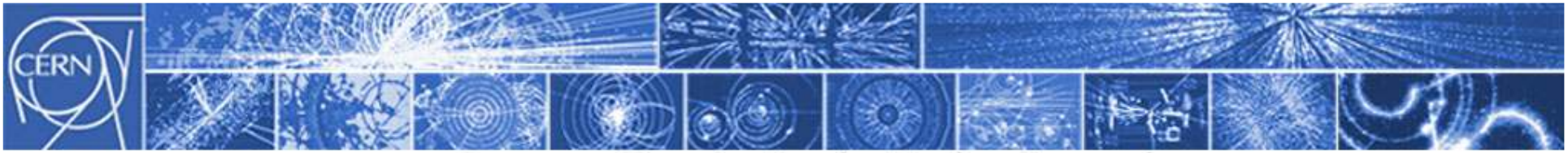

CERN
European Organization for Nuclear Research
Organisation Européenne pour la Recherche Nucléaire

Principles of technology transfer in Particle Physics

From collaborations to spin-offs

Jožef Stefan Institute – 1 and 2 October 2009

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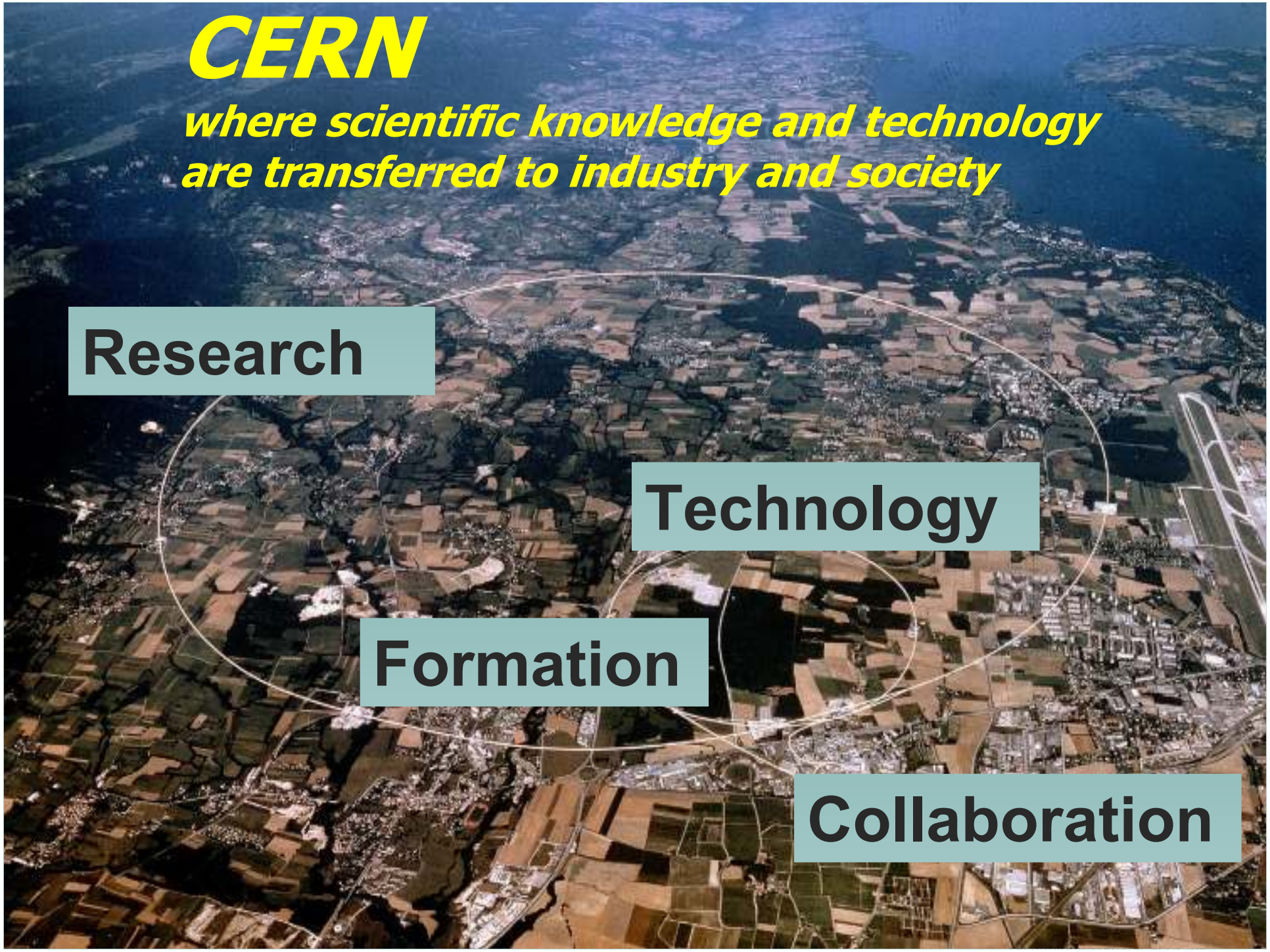

CERN
where scientific knowledge and technology
are transferred to industry and society
Research
Technology
Formation
Collaboration

CERN in Numbers

2650 staff

6500 users

500 Fellows and Associates

Budget (2008) 1100MCHF

1200 persons renewed yearly

(Tech, Doc, Post Doc, etc.)

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.

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

Fundamental Science and TT

Science leads to technology innovation.

High tech industry is the backbone of economy.

Society relies on technology.

Discoveries alone are no longer sufficient to substantiate the investment level of Member States in fundamental science*.

Particle Physics is required to demonstrate its importance to Society:

- Communication is key to reach this objective

Particle Physics is required to demonstrate its usefulness to Society:

- TT is a key mean to reach this objective.

(*) CERN Council in charge of the European Strategy for Particle Physics

Particle Physics characteristics

PP characteristics

- Research in curiosity-driven science is an important driver for technological innovation and economic success
- PP is a highly collaborative open science environment
  - requiring expertise in many technology domains
  - offering top quality education and training from apprentice to post-doctoral
- PP experiments are extremely demanding in terms of equipment design, and they generate novel technical approach which ultimately benefit society
- Technological innovations from PP benefit many research disciplines other than physics

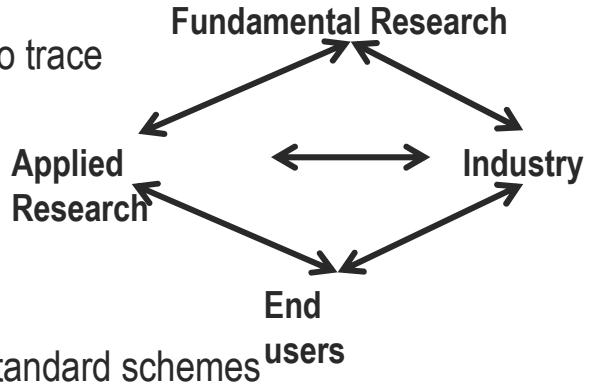
World standard institutions (centres of excellence) with high tech laboratories for:

- Accelerator elements, Vacuum technologies, magnets
- Particle detectors
- Electronics & IT
- Super-conductivity and Cryogenics
- Mechanics & surface Treatments

KTT in Particle Physics

Particle Physics uses the widely accepted schemes of licensing, collaborative and contract research to transfer innovation to industry and to other research disciplines

- Protected innovation constitutes a very small fraction of the IP generated
- New concepts, design, know-how and expertise account for the largest part
- IP originating from the research and exploited by industry is very difficult to trace
  - Patents, licences, research contracts only reflect a fraction of the transfer
- The socio-economic impacts of PP are underestimated



KTT mechanisms

- The transfer mechanisms are very complex and go significantly beyond standard schemes
- The transfer processes are therefore much more difficult to trace
- Standard indicators are not sufficient to assess the impacts of PP research on innovation
- Procurement, research contracts and licences are not sufficient to study the industrial impact
- Very limited interactions between Application users and Researchers during the conceptual phase; Privileged channels:
  - Research domains other than PP
  - Industry

R&D contexts for PP and industry, impact on TT

Research: Open science

- ***Publication of discoveries & R&D results***
  - Scientific recognition
  - Value in copyrights
- ***R&D to meet scientific programme objectives***
  - Long-term
  - Best possible solution within budgetary constrains
- ***R&D results: Technology***
  - IP rights to use internally
- ***Highly collaborative***
  - Memorandum of Understanding (MoU)
- ***Unclear IP situation***
  - Joint ownership of R&D results
  - Complex dissemination
- ***Funding***
  - Public
  - Quality of research program

Industry: In/out sourcing technology

- ***Protection of innovations & know-how***
  - Required to facilitate industrial dissemination
  - Value in IP rights (patents, etc.)
- ***R&D to increase market share***
  - Short-term
  - Best cost-effective solution
- ***R&D results: Products (prototypes)***
  - IP rights to manufacture
- ***Highly competive***
  - Licence and/or partnership agreement
- ***Clear IP situation***
  - Clear ownership of R&D results
  - Dissemination based on manufacturing
- ***Financing***
  - Private with public support (EU, National funds)
  - Product market potential

From research to industry: Challenges

Finding an IP management strategy compatible with open science

- Possible limitation of dissemination of R&D results due to unclear IP situation

Finding the right balance between openness and the commercial exploitation

- Possible negative effects of IP protection on the willingness to share research results

Identifying market for PP technologies

- Innovations in PP result from R&D programmes requiring non-commercially available products. Applications and markets identification outside PP requires dedicated efforts and understanding of potential application domains specific requirements

Funding the gap between public innovation and commercial application

- Firms are reluctant to invest in basic research; need for funds to support collaborative R&D with commercial aims and for early phases of start-ups promoting PP innovations

Collaborating with industry on basic technologies research while remaining compatible with purchasing rules

- Basic technology developed in collaboration with industry may generate IP needed for future procurement contracts. Risk of monopolistic situations incompatible with purchasing rules

From technology (PP) to product (Industry)

Difficult match between technology developments and prototypes useful for industry

- Developments for accelerators, particles detection and data processing will find applications in many domains if:
  - Match between technology offer and product needs
  - Cost effectiveness of manufacturing products with technology
  - Value of technology within product
  - Acceptable product price with added features enabled by technology

5-10 years required to develop application specific prototypes from a technology used in research

- High risks for industry due to uncertain market prospects
- Important investments from industry

Developments & know-how of fundamental research have strong impact on society

- Amazing track records of successful dissemination in:
  - Health (Particle therapy for cancer treatment, PET for treatment planning)
  - IT (World Wide Web, GRID)
  - Energy & environment (Solar collectors using accelerator vacuum technologies)
  - Industrial processes
  - Security

Applications of PP developments

Technological innovation in PP: A Study of the Cross-Discipline and societal benefits of UK research in PP; IOP, PP group

	Health	Energy/Environment/Security
Accelerators: Linacs, betatrons, hadrons beams, ions beams, multi-MW proton beams, RF/klystrons, synchrotrons, cyclotrons, electron storage, super-conducting magnets, vacuum & cryogenic systems	Radiation cancer therapy, pharmaceuticals, viral and protein imaging using synchrotrons, food and water sterilisation	Nuclear waste transmutation, accelerator-driven sub-critical reactors, conversion of waste hydrocarbons to natural gas, RF earth monitoring, radar, ion implantation in semiconductors, non-destructive testing/imaging
Radiation Detectors: Silicon microstrips, scintillation crystals/fibres, pixel detectors, gas avalanche, multi-wire proportional, CCDs, photo-multipliers, APD	Radiation dose measurements, medical imaging, food scanning, PET scanners, combined PET/MRI scanners, Small animal imaging (Drug discovery)	Detection of fissile material & non-metallic landmines, cargo scanners, whole body scanners
Microelectronics & High speed DAQ: Deep sub-micro CMOS technology	Eye implants, readout for optical tweezers experiments, medical imaging (digital autoradiography, peptide analysis)	Radiation tolerant PCBs for earth monitoring, security.
Computing and modelling: WWW, Grid computing, GEANT4, Fluka	Design of new PET scanners, new drug simulations, separation of bio-molecules	Digital reconstruction using grid of marine biological communities (global warming), radiation tolerant design for space technology, identifying new oil reserves

European Strategy for PP: Increase effectiveness

In response to the strong interest of Member States to increase effectiveness of TT, we proposed the creation of the TT Network for institutes active in particle, astro-particle and nuclear physics in order to:

Establish a genuine partnership / collaboration amongst institutes active in Particle Physics in MS

- Bridging the gap between the institutes members of the TT Network and industry
  - Be an attractive partner for industry
  - Enlarging the KT & TT Offer
  - Making the PP offer more visible
- KT & TT/IP practices and tools
  - Exchange experience and practices
  - Improve capabilities amongst TT Network members

Develop the image of the PP community as a source of knowledge that benefits society

Organisation & Composition

Organisation (during project phase):

- TT Network Board composed of one designated representative of each node to review the advancements of the programme of work and take all appropriate actions for its execution.
- Steering Committee composed of the work package conveners and the Network Coordinator to ensure the execution of the programme of work.

Institute	Member State	Category
CEA/IRFU	France	RI-HEP
CERN		RI-HEP
CHALMERS	Sweden	University
Copenhagen University	Denmark	University
CNRS/IN2P3	France	RI-HEP
DESY	Germany	RI-HEP
EPFL	Switzerland	University
GSI	Germany	RI-G
INFN	Italy	RI-HEP
JSI* Jožef Stefan Institute	Slovenia	RI-G
PSI Paul Scherrer Institute	Switzerland	RI-G
National Technical University of Athens	Greece	University
STFC*, Science & Technology Facilities Council	UK	RI-HEP
University of Sofia	Bulgaria	University

(*) members since June 09

Principles for a sensible approach for KTT and IP matters

Such a TT Network requires a common framework, endorsed by all the network members to support its operation.

Intellectual Property charter

- Set of principles aimed at helping PP institutions to adopt a sensible approach for KTT and IP matters and support the associated implementation measures while remaining compatible with open science
  - Intellectual Property policy
  - Knowledge and Technology Transfer policy
  - Collaborative and contract research policy

IP policy

General Principle

- KTT is a mission of the organisation: experimental and theoretical results shall be disseminated as widely as possible
- Full compatibility with open science

IP

- IP is an asset of the organisation. Ownership should be vested in the organisation
- The organisation is responsible for the management of IP and for the adoption of access facilitating measures

Responsibility and priority

- Same level of priority for all R&D conducted in the framework of the organisation's approved scientific programme and involving industry and/or institutions active in disciplines other than physics

Communication

- Wide dissemination of research results
- In case of IP protection associated with the results, the organisation shall keep the delays to a strict minimum

Knowledge and Technology Transfer policy

General principle

- Raise awareness of researchers and technical staff on the potential impact of their work to society
- Ensure that close links are forged between the KTT experts and the researchers.
- Staff to consider the potential socio-economic impact of their work and disclose their findings to the organisation prior to publishing

Exploitation mechanisms

- Consider all types of mechanisms and all types of partners
- Ensure fairness in all contracts, agreements and transactions
- Assessment of exclusivity with a view of maximizing dissemination and access for research
- Maximize dissemination, not revenue
- Exploitation shall entail adequate compensation (financial or otherwise)

Revenue and incentives

- Revenue is essential to covering costs, generating additional income for the organisation and providing resources for incentives
- Clear rules to ensure financial rewards for the organisation, the department or the inventor's team
- Recognition of staff contribution to be handle according the the normal merit appraisal scheme in place

Collaborative and contract research policy

General principle

- Rules governing collaborative and contract research activities to be compatible with the organisation's mission and the applicable rules and regulations of each party.
- Rules shall take into account the different funding and be in accordance with the objective of the research activities
  - Maintain an IP position that allows further academic and collaborative research and avoids impeding the dissemination of the results

IP issues

- Clarification of IP related issues at management level as early as possible (preferably before starting)
- Identification of pre-existing IP possessed by each party
- Access to the pre-existing IP and to the results for the project execution and exploitation purposes
- Share revenue from subsequent exploitation
- Join-ownership only when individual contributions cannot be dissociated

Access to results

- In collaborative research project, ownership of results to stay with generating party
- In contract research, strive to retain access to the results for further research
- In both cases, where public funding is involved, strive to retain access for non-competing areas of usage

Implementation of KTT mechanisms on the basis of these principles

These principles will lay the foundations of the TT Network's operation. Various KTT mechanisms and tools will be addressed in order to support this operation:

Technology pooling

- How to bundle technologies together?
- Elaborate concerted offers

Research contracts

- Multi-partite research contracts

Licences

- Multi-partite licence agreements with industry

Push/pull mechanisms

- Concerted offer with clear access conditions
- Access of local industry, including start-up companies to technology from foreign institute with the assistance of local laboratory

In a later stage: Spin-offs

- Bridging the gap between PP technology and saleable industrial prototype
- Support from PP including access to infrastructure, VC funding, concerted offers and fair treatment of European industry

Conclusion

Particle Physics is required to demonstrate its usefulness to Society

PP is a highly collaborative international open science environment

TT Network for PP in order to:

- Establish a genuine partnership / collaboration amongst institutes active in Particle Physics
- Develop the image of the PP community as a source of knowledge that benefits society

Principles for the adoption of a sensible approach to KTT activities are essential for enhancing effectiveness and benefits to industry and society

The IP charter must be endorsed by all the institute participating in the network

The TT Network will operate according to these principles

Color palette (nice to have when checking the projector setup)

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Standard box:
Arial Narrow,
word-wrap