Technology Transfer at CERN and the LHC developments

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Outline

- The mission of Technology Transfer
- Two examples of TT structures:
  - Weizmann
  - GenProt
- Examples of TT @ CERN
  - patents
  - licenses
  - Grids
- How TT @ CERN operates
- Funding issues and the EC

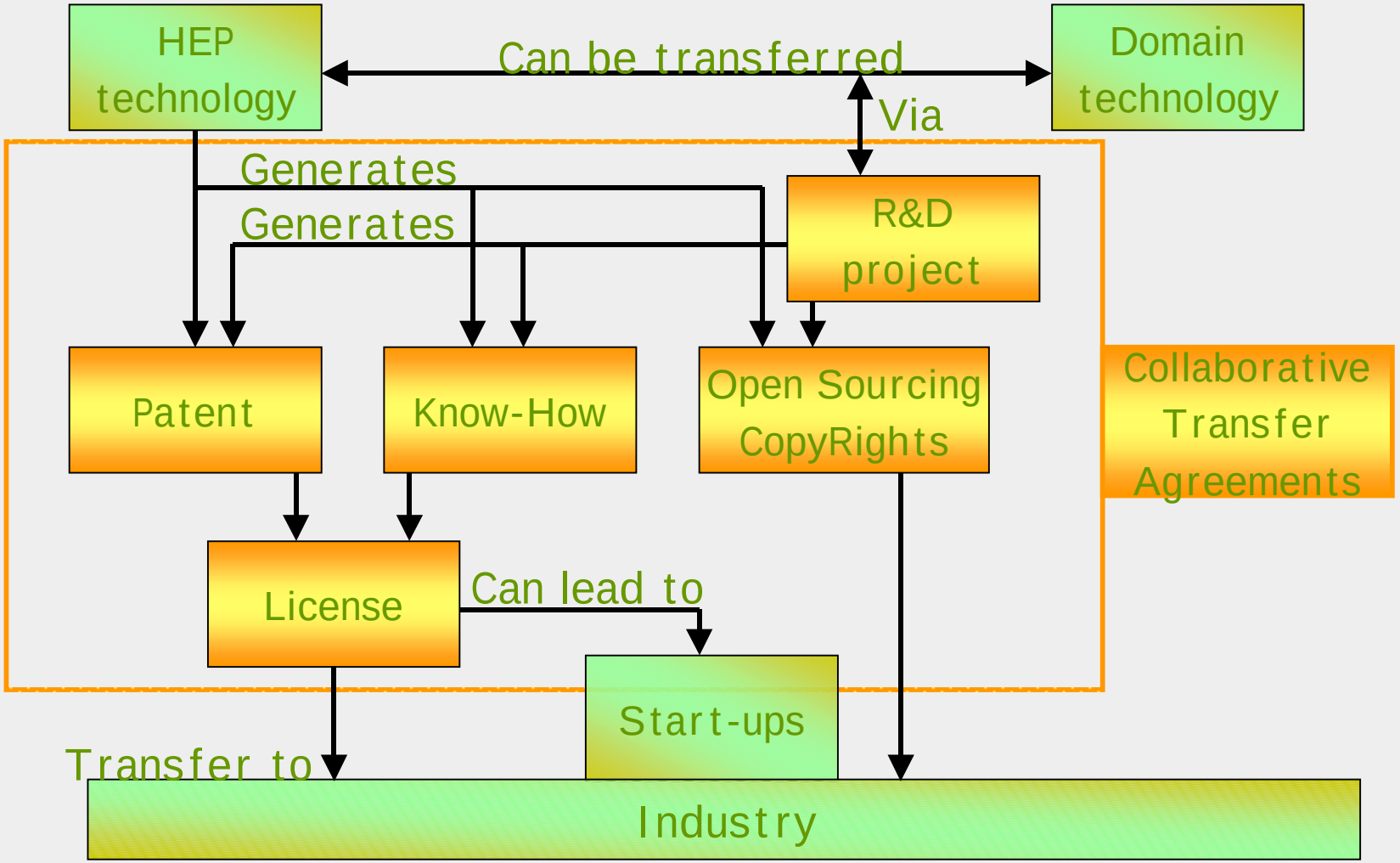
Why Technology Transfer?

- It is not ethical for scientists to keep their discoveries for themselves.
- Discoveries must be realized and the results must be disseminated to Society at large
- Technology Transfer is a potential source of revenues that can help the financing of more physics research
- Balance between fundamental Research that must be publicly funded to remain unbiased and Applied R&D that can be Society/industry driven.
- TT is a compromise that can benefit both Research and Society.

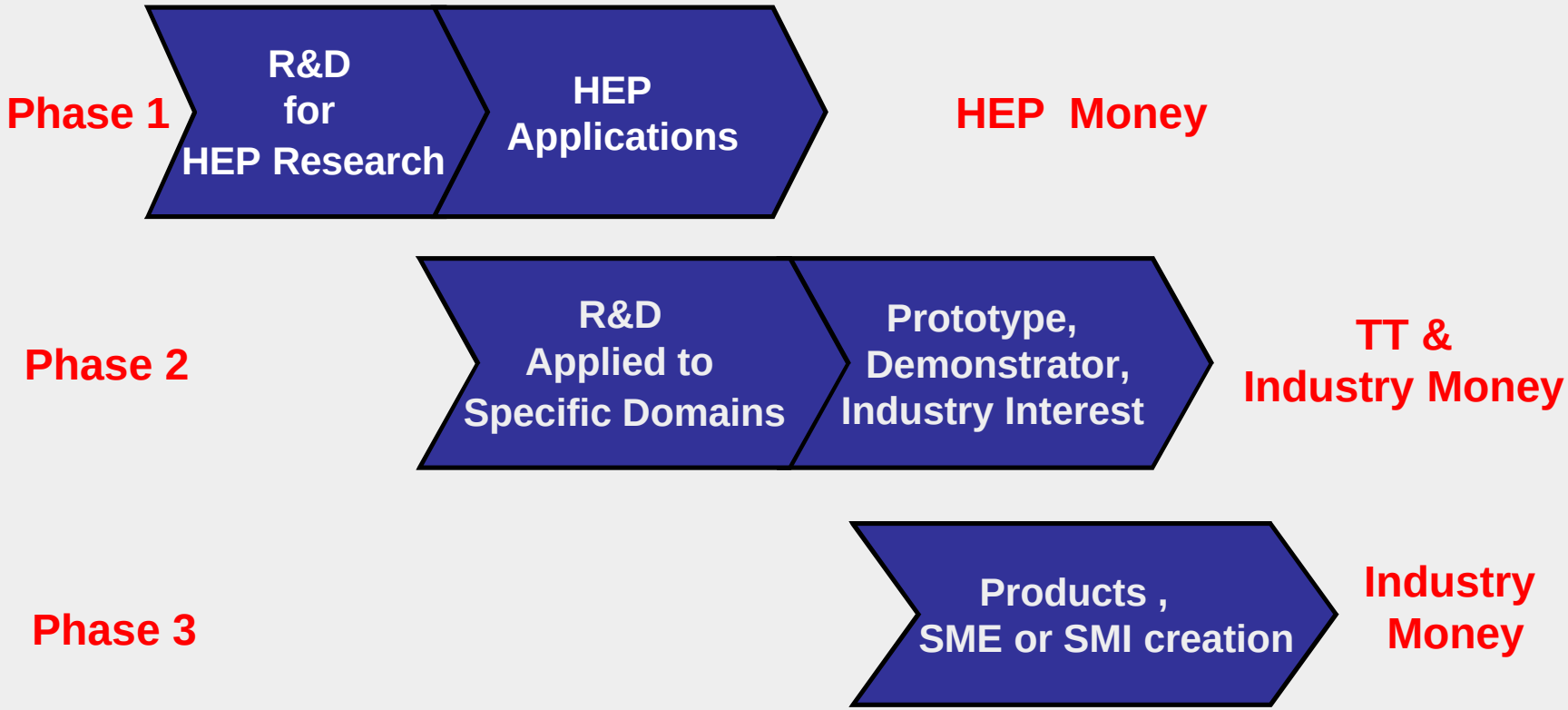
TT objectives @ CERN

- Main objectives
  - To manage, promote and license the CERN patent portfolio to industry,
  - To support TT oriented collaborations with partner laboratory and industry,
  - To maintain and update the CERN technology database,
  - To establish a TT internal and external network to identify, assess, promote and transfer CERN technologies to industry,
  - To create a TT programme based on the training of personnel at CERN and promote connection with industry,
  - To seek resources for Technology Transfer activities, in particular in the framework of the European Union programme.

TT process


HEP technology
Can be transferred
Domain technology
Via
Generates
Generates
R&D project
Patent
Know-How
Open Sourcing CopyRights
Collaborative Transfer Agreements
License
Can lead to
Start-ups
Transfer to
Industry

Stages in development of technologies and projects



Example of Weizmann

- **2,400 scientists, technicians and research students;**
- **Focused on Fundamental Research (Biology, Biochemistry, Chemistry, Physics, Mathematics and Computer Science);**
- **Main aim of TT is to separate research from commercialization;**
- **453 patents in 10 ys. 5 main products: $30M-40M in 2000;**
- **Yeda Research and Development Co. Ltd., founded in 1959, is charged with finding the right industrial partners to take Institute discoveries through the critical steps from the laboratory to the marketplace;**
- **IP is assigned to Yeda, which optimizes revenues under certain constraints (e.g. never sell a patent, only license it). After costs deduction, the remaining profit returns to the Institute;**
- **Professors are not allowed to create start-ups. But they can provide consultancy up to 1 day/week;**
- **Inventors receive 40% of royalties + 25% of equity in the case of start-ups ⇒ 10-12 scientists who have received more than $1M!**

A neighbour: GenProt

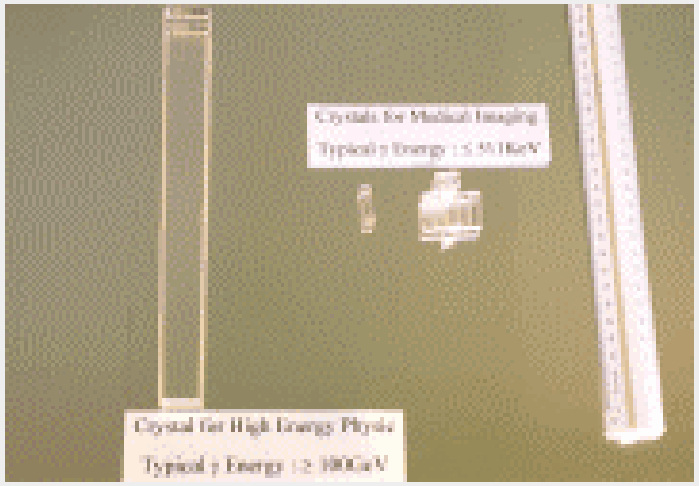
- Originated as a start-up of Geneva University
- Entirely funded by Industry for a 5-year period (pharma industries, computer manufacturers,...)
- Results offered with priority to investors
- All the results non commercially and readily exploited by investors are publicly released
- Now a 150 M$ company

CERN: two examples of patents

- A Cryogenic Optical Fibre Temperature Sensor

  (CERN & EPFL; W. Scandale, L. Thevenaz & M. Facchini) (filed in UK, May 2001)

  Standard optical fibre used to measure temperatures down to 1.4 K by mean of Brillouin scattering. Very cheap method. A single fibre can replace thousands of measuring points.



- A PET Scanner (CERN; P. Lecoq) (filed in UK and USA, June 2001)

  Use of a new high-sensitivity crystal, LuAP or LuYAP to a dual layer PET camera

  ⇒ provides greater image sharpness.

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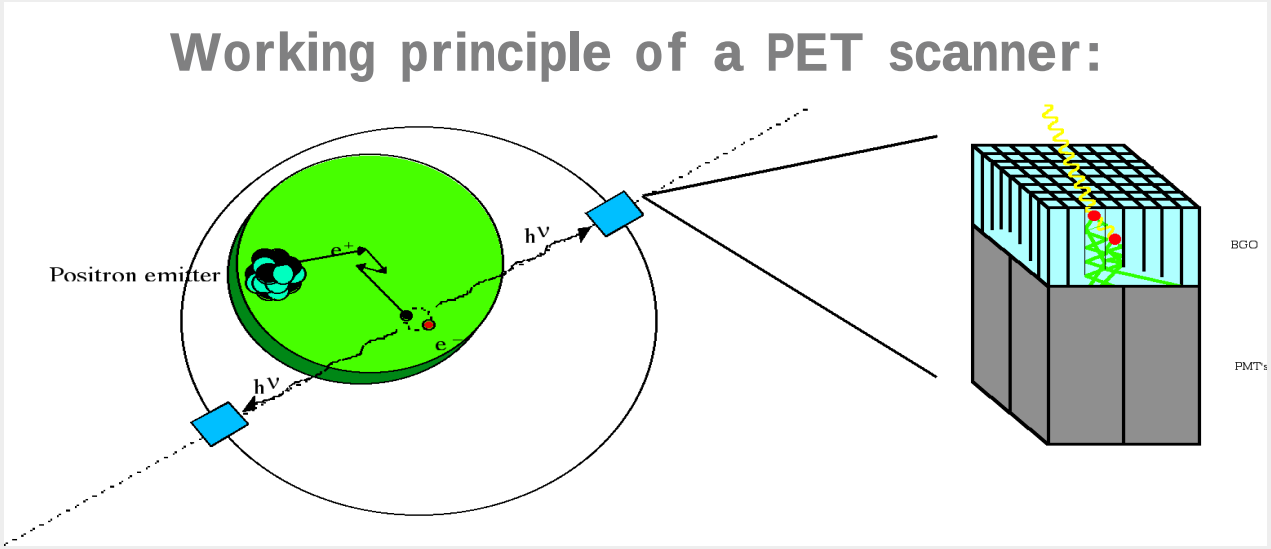
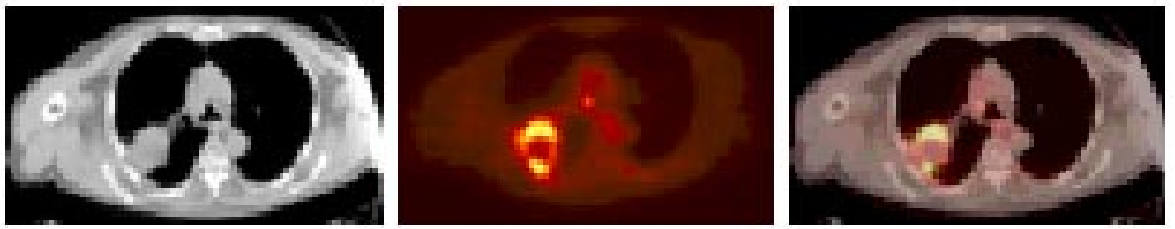
Crystal Clear collaboration

- Example of R&D agreement
- Nucleus of the collaboration started on development of crystals for calorimeters (CMS)
- Collaboration enlarged to tackle applications to Medical field (PET scanners)
- Multidisciplinary project to build a small animal PET



Some achievements by Crystal Clear

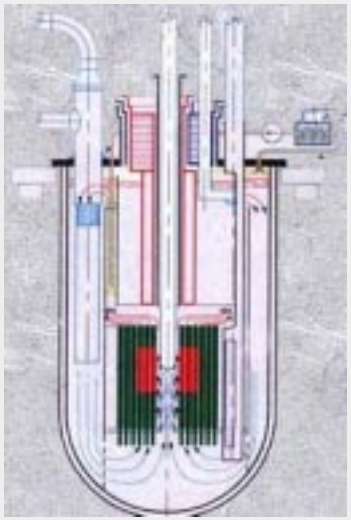
Primary lung cancer imaged with the SMART scanner. A large lung tumor, which appears on CT as a uniformly attenuating hypodense mass, has a rim of FDG activity and a necrotic center revealed by PET.



⇒Patents filed by CERN and Julich

⇒Collaboration technologies licensed to a German company

CERN: examples of licensing



- Neutron Driven Element Transmuter (C. Rubbia)

  Transfer to industry: Exclusive license to three European companies (Belgium, Italy, Spain).

- Bath Electro-polishing of Titanium and method to use it (J. Guerin)

  The invention concerns a bath composition for electro-polishing of a non-alloyed titanium metal surface

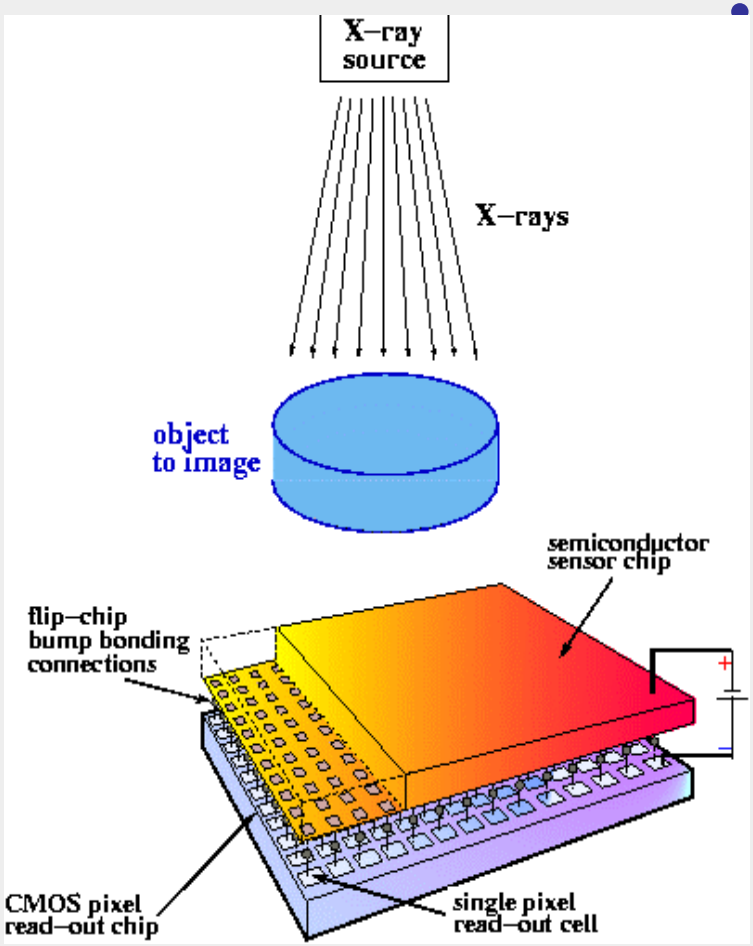
  Broker ⇒ Turbines blades & spectacle frames & orthopedic.

Pumping Device by Non Vaporizable Getter and method to use it (C. Benvenuti)

Flat screen displays, Cathode Ray Tubes, energy transportation, energy generation

Non exclusive license granted to two companies (France, Italy). Discussion in progress with two other companies

A R&D collaboration: Medipix



- Medipix1 fully working since 1997
  - 4096 170x170 µm readout cells
  - each cell 3-bit controllable threshold and 15-bit counter
  - collaboration of 5 Institutes
  - applications to Mammography (bonded to GaAs detectors) and to dental radiography ongoing
- Medipix2 under test
  - 256x256 cells, each 55x55 µm
  - double threshold, 12-bit counter, 2 input polarities allowed
  - collaboration of 15 Institutes
  - applications foreseen to bio-medical imaging, general tomography, material analysis

Medipix collaboration issues

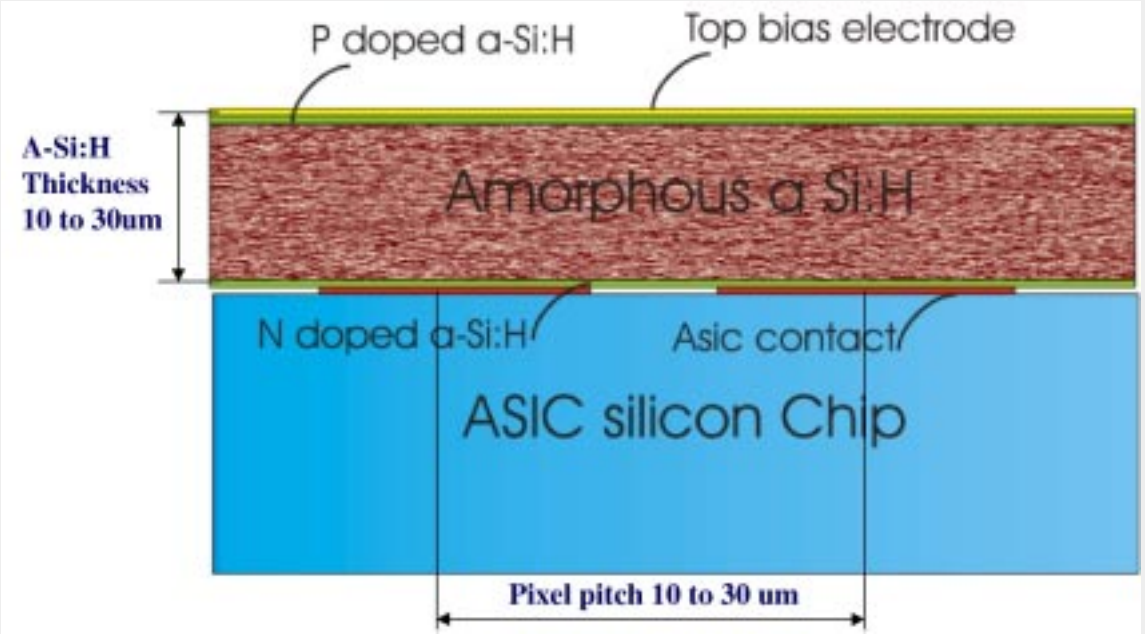
- Aim is to develop pixel detector readout chips for domains other than particle physics, in particular medical imaging.
- Project based on previous developments at CERN in the framework of R&D for the LHC detectors.
- An R&D collaboration has been set-up with external Institutes, each tackling a specific domain of application.
- IP issues covered by R&D agreement
- Transfer to a Dutch industry through one of the collaborating institutes (NIKHEF), for application in material analysis.

R&D in electronics: Monopix

Objectives:

- Achieve single particle/photon detection
  - in a monolithic IC based on commercial deep or very deep CMOS technology
- CERN applications
  - LHC-2
    - low cost high resolution 2D particle detectors
    - cost target including r/o electronics: $10/cm2
    - possibility of wafer scale integration for large area detector 14cmx14cm in 8 inches wafer
    - very rad hard
    - ultra thin detector for microvertex
  - 2D photon detector
    - multi channel solid state PMT
- Patent filed

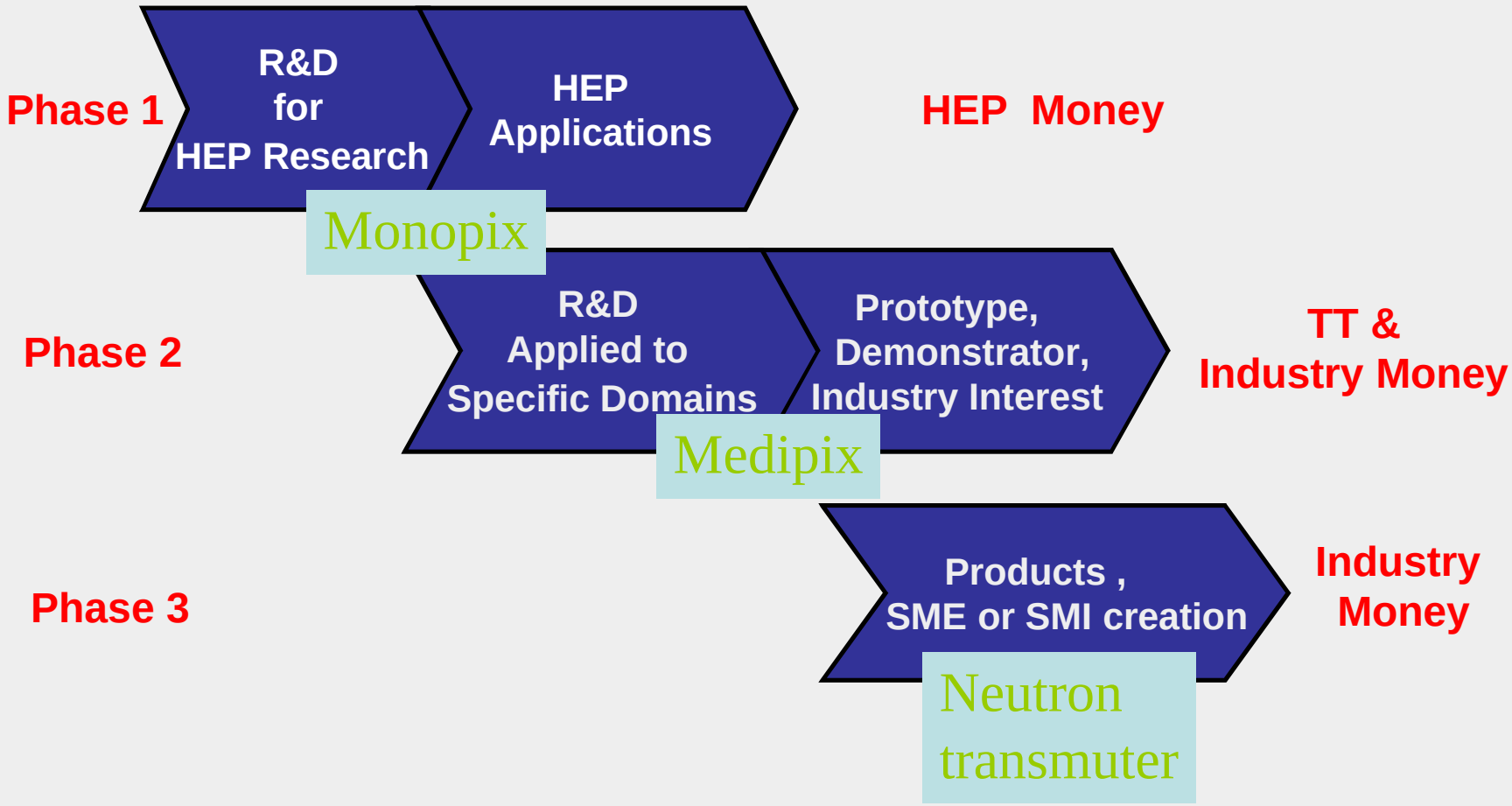
A-Si:H on ASIC pixel sensor



Spin-off of the Monopix patent

- Space applications
  - ultra sensitive 2D single photon imager
    - star tracker
    - UV detector for exp. based on atmospheric nitrogen scintillation, radiation detector
- Medical applications
  - medical imager
    - large size 2D X-ray detector based on wafer scaled integration
    - photon imagers for PET
  - biosensors
  - 2D single photon sensor for molecular biology
  - solid state 2D songle photon counting sensors
- Industrial applications
  - material research

Where are these projects?



The Grids

- CERN has a leading role in promoting and coordinating Grid projects

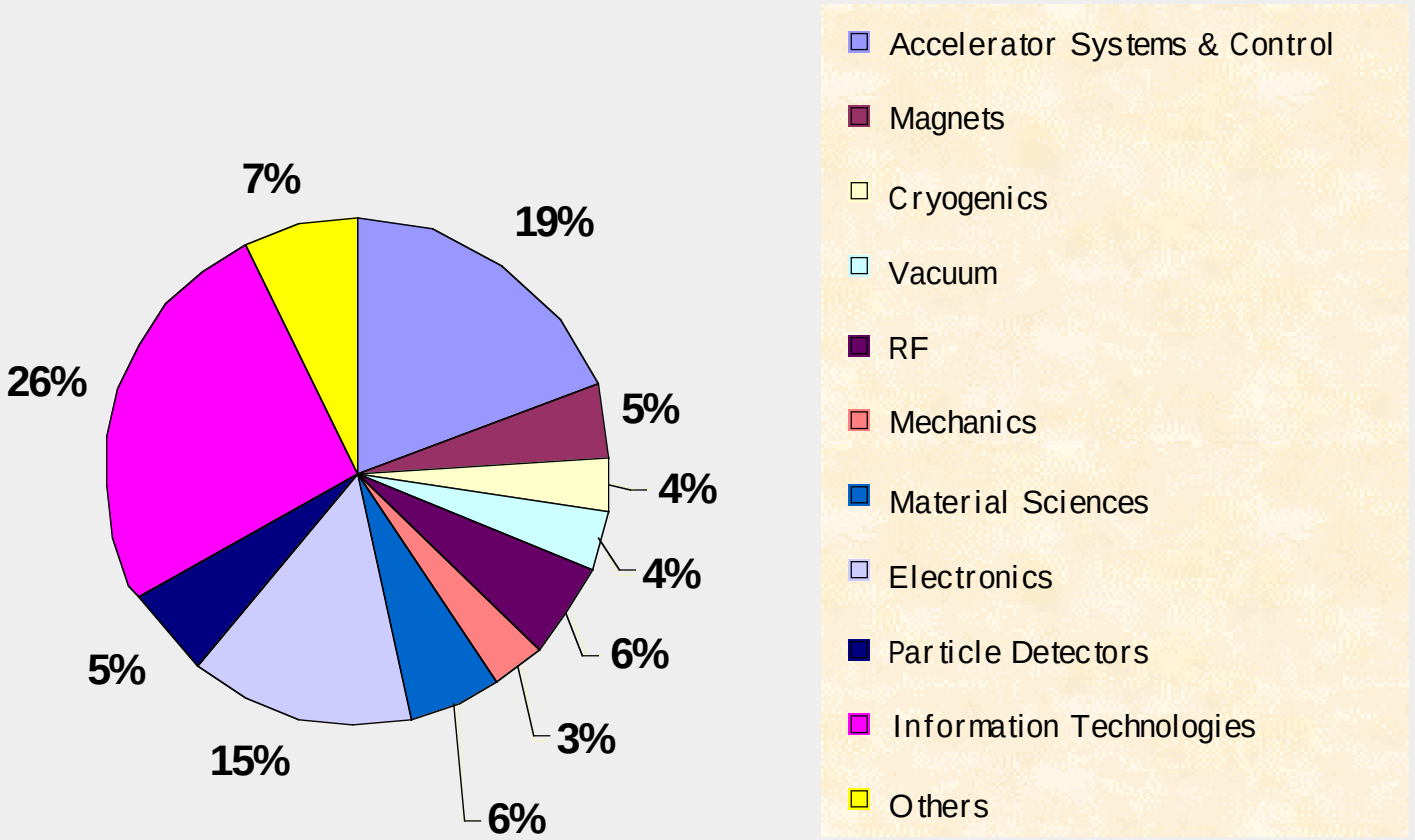
- The transfer of technology and the impact on science could be as important as the Web was
- One new EC project, MammoGrid, lead by CERN, attempts at using the Grid in a major medical application, namely constructing a pan-european database and new working tools in mammography

TT structures @ CERN

- Technology Transfer
  - To carry out all TT activities
- Technology Advisory Board (TAB)
  - To advise the DG on technology transfer matters
  - To prepare Strategy and Policy recommendations
- Internal Network
  - Divisional contact for Technology identification and promotion
- External Network
  - Prime contacts for TT promotion in Member States

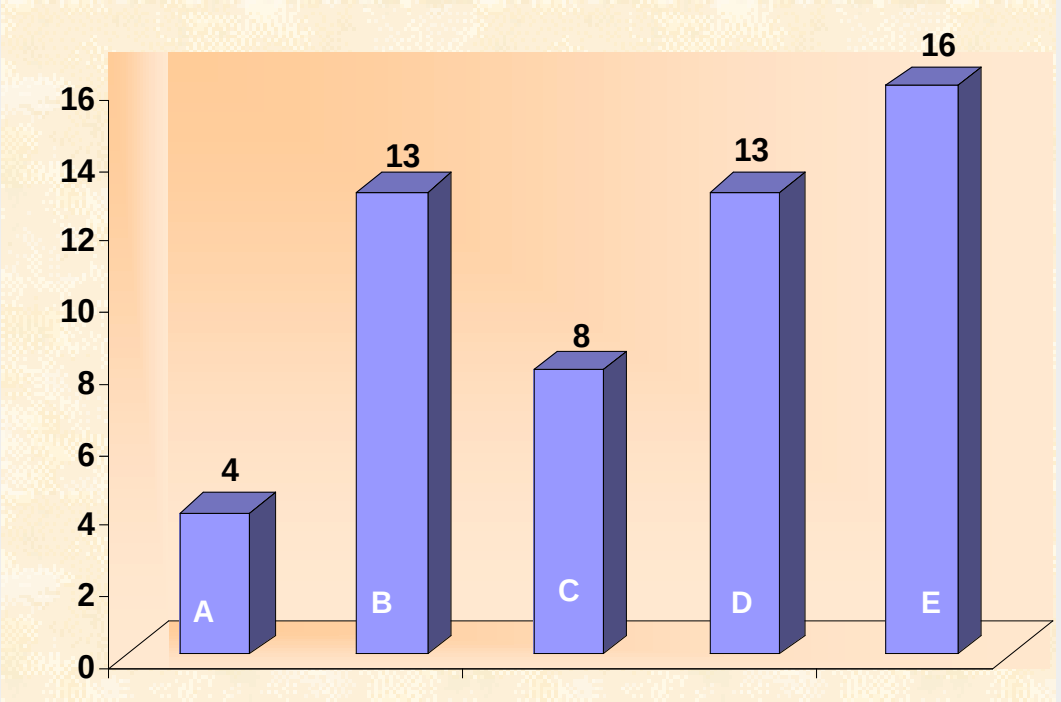
Technology Description in the TT Database

Distribution of Technologies listed in the Database



160 technologies are currently listed in the Technology Transfer Database

Present status



- A: R&D for HEP Research;
- B: HEP Applications;
- C: R&D Applied to Specific Domains;
- D: Industry Interest (Prototype, demonstrator, license);
- E: Products, SME and SMI Creation

LHC time vs. TT

- Core business of CERN is HEP
- Activities in TT can be carried on if cost free or bringing revenues
- Existing staff personnel mostly on supervision tasks, subject to Divisional approval
- Funds from external sources used for material and extra manpower
- R&D projects accepted if synergic with LHC and future accelerators' developments

Funding

- No money for HEP is used (when used, it is refunded)
- Revenues come from licensing and from collaborative R&D agreements
- EC funding crucial to future applied physics researches
- An example: Euromedim

Euromedim

- FP6 Expression of Interest for an Integrated Project to develop Medical Imaging devices
- Promoted by ETT Division, funding target ~90 M€
- 77 participants (30% industries) expressed officially their agreement
- A federated effort which joins in the same project the ongoing collaborations @ CERN
- Euromedim is a way to convey to the EC the generic technological transfer in detector, electronics and informatics in the EP Division, given the substantial overlap between HEP and Medical developments
- DG has expressed the will of CERN to host the project

Conclusions:Science and Technology

There is a deficit of people's knowledge of science

"We have arranged a global civilization in which most crucial elements profoundly depend on science and technology. We have also arranged things so that almost no one understands science and technology. This is a prescription for disaster. We might get away with it for a while, but sooner or later this combustible mixture of ignorance and power is going to blow up in our faces… "

Carl Sagan

Governments should support effective strategies for the dissemination of information on Science and Technology (Education and Communication).
Both governments and scientists should promote the application of scientific knowledge into tangible benefits for the Society (Technology Transfer).

OECD, UNESCO

I hope we conveyed the message that ETT @ CERN is trying to address these issues appropriately, and with the support of the entire HEP community