WP 7
Parallel Session Summary
KTT and Industrial Liaison

Rob van der Meer - Nikhef

ET-PP is a project supported by the European Commission Framework Programme Horizon Europe Coordination and Support action under grant agreement 101079696

Collaborations with Industry and Tech Transfer:

LIGO Laboratory's Experience

David Shoemaker
LIGO Laboratory

Case Study: Advanced LIGO Core Optics Coatings

- **Test masses coated by Laboratoire des Matériaux Avancés, Lyon, France**
- CNRS/INFN support, but also a commercial undertaking; LIGO awards competitive bids to LMA for optical dielectric coatings
- Unique capability at LMA to coat optics for GW detectors
- However: coatings initially did not meet requirements
- Over a 20-year period, significant interaction with LIGO with transfer of intellectual insights from LIGO to LMA to aid in their industrial processes

Coating challenges mitigated:

- Spirograph figure error
- Anti-Reflection coating performance
- Excess absorption
- Large radius figure error
- Transmission at secondary wavelength (532 nm)
- Point defects

LIGO Innovations

There was no grand plan, no orchestrated endeavor, still some nice innovative results:

- Long term development with LMA
- QA/QC is a major risk factor
- Several patents
- LIGO is a laboratory (factory/company), not a collaboration, so students are well trained in the company environment → major TT
- Start pathfinder projects to find capable companies with low risk.

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Lessons from LIGO in industrial collaborations and tech transfer

- LIGO's needs are very unique and challenging → defining and specifying requirements is very important
  - The challenge often motivates companies to want to work with LIGO
- 'Throw over the fence' doesn't work → it's critically important, as much as possible, to work in a partnership with industry
  - Careful management of intellectual property and proprietary processes is important
  - High bandwidth communications between LIGO cognizant scientists/engineers and companies
- Contamination control and quality assurance/quality control comes into almost every aspect of the LIGO detector
  - Initial LIGO had detector QA/QC, but needed much better QA/QC
- Money matters → developing state-of-the-art technology is risky and therefore expensive.
  - Value engineering is critical to maintain budgets

And…Tech Transfer: Workforce

- Many students and postdocs in the LIGO environment
  - » Some stay in the field
  - » Some go to academic positions
- Many go to industry
  - » High-tech training and the work culture in the Lab is excellent preparation
- Broad range of skills and destinations – Interferometry, mechanical engineering, programming; SpaceX, ASML, NASA, Google, etc.
- **This is perhaps the most important and enduring technology transfer value from LIGO to industry**

We are looking forward to Tech Transfer with Cosmic Explorer, the US next-generation GW Observatory

Four pillars underpin CERN's mission

RESEARCH

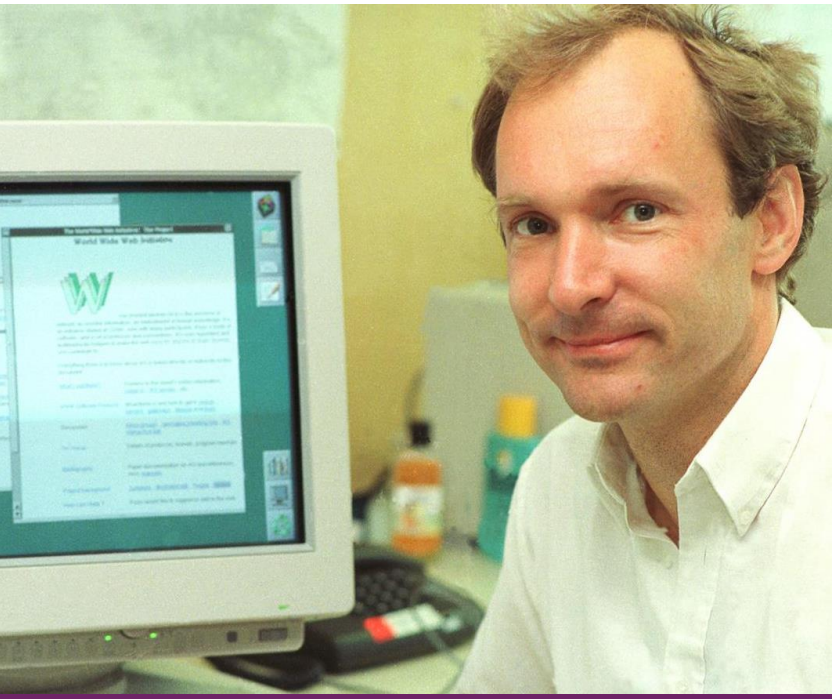
COLLABORATION

EDUCATION
& TRAINING

TECHNOLOGY
& INNOVATION

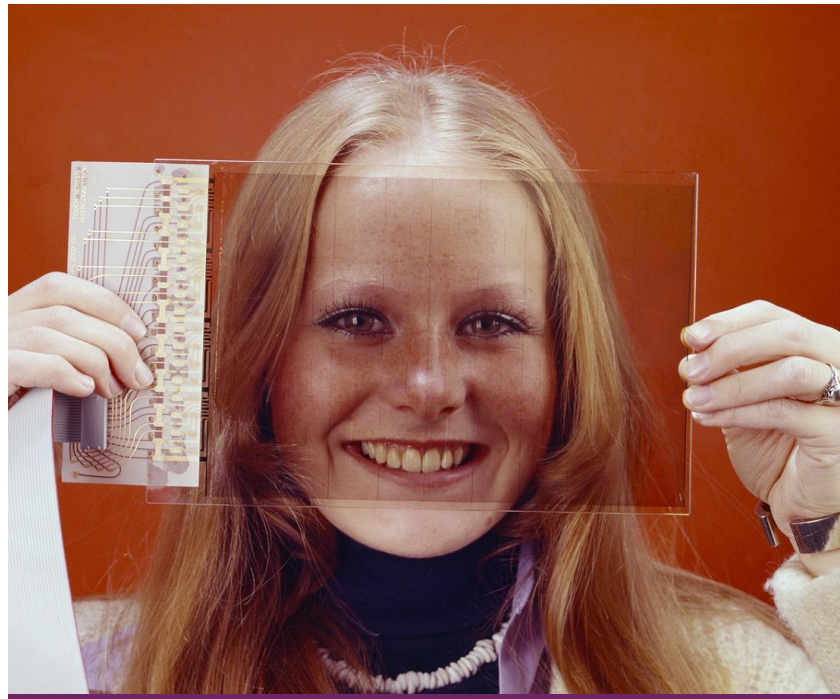
By Giovanni Anelli

Some historic examples



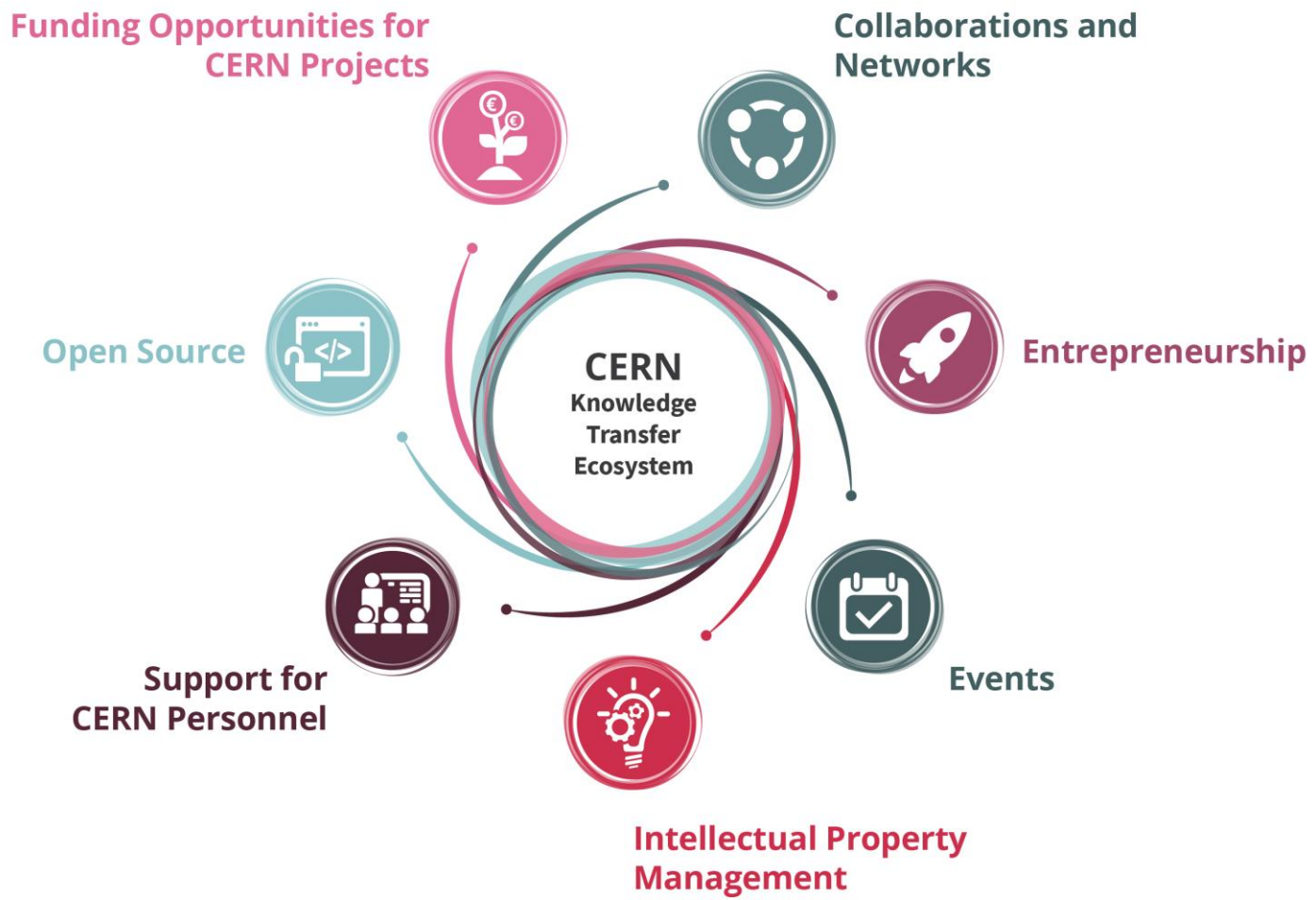
WWW

TRACKERBALL



TOUCHSCREEN

Our toolbox to accelerate innovation



Key lessons learned when innovating together

- CERN is strong in the ‘extremes’ of the technology scale
- You need passionate experts on both sides to succeed
- Start with a concrete project and clear business need
- Mind the gap – in language, ‘clockspeed’ and culture
- Driving deep tech innovation requires courage

Key challenges

- CERN experts are busy
- Our technologies have low TRL
- What is our Unique Value Proposition?

CERN: How to get information out of the groups?

- Ask department leaders for antennas for interesting developments
- Regular meetings with group leaders
- Distribute money for interesting ideas
- Innovation days

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CONCLUSIONS FROM THE IFAE's EXPERIENCE IN THE MEDIPIX COLLABORATION LED BY CERN

The development of pixel sensors technology at CERN (LHC), conducted to the creation of the Medipix Collaboration, aimed at developing tech applications beyond science (e.g. medical imaging, materials characterization, radiation dosimetry, etc.)

IFAE joined Medipix 2 collaboration (and MediPix 4 later) and this opened a great opportunity for the IFAE team to delve into the technology of pixel sensors.

Innovation outputs derived from the IFAE's membership in the Medipix Collaboration:

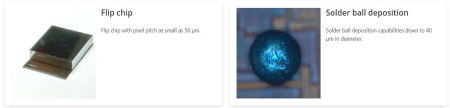
-Creation of a **valuable own portfolio of know-how and IPR** in pixel sensors development and packaging (40% portfolio licensed). Most of IFAE pixel sensor inventions were **successfully protected by patent** in key industrial regions, mainly the EU, the US, and China (85% patents filed are granted).

-IFAE **valorised the know-how** by coordinating an **FP5 project** based on Medipix2 chip and an **ERC advanced Grant** to develop a PoC PET scanner based on pixel CdTe.

-IFAE constructed one of the most advanced pixel sensor packaging facilities in Spain and was acknowledged as "**Top 10 Microelectronics Solutions Provider in Europe 2022**" by *Semiconductor Review Europe* magazine.

-The deep-tech activities in pixel sensor has lead to the **creation of 3 start-up companies**: X-Ray Imatek (CERN's and IFAE's know-how licenses), Deep Detection (IFAE's patent and know-how license) and Baretek (IFAE's patent and know-how license).

2006-2016



2019-

2020-

R1
i2

Institut de Física d'Altes Energies

CONCLUSIONS FROM THE IFAE's EXPERIENCE IN THE MEDIPIX COLLABORATION LED BY CERN

-A CERN's **collaborative research programme** (ATTRACT initiative) for RIs and Industry cooperation (100K€ / project) served to achieve big experiment scientific goals & market needs, as well as to **validate the technical feasibility** of 2 IFAE technologies protected by **patent** and to **increase TRL** (PoC level), attracting the interest of 2 **potential licensee companies**.

-An **Innovation Training Network** H2020 project led by CERN in collaboration with Vienna University of Economics & Business, provided **business models** for several experiment R&D results, facilitating development, protection and exploitation strategies for one IFAE technology, **valorized** later with private funds.

-An **innovation public procurement** project managed by CERN facilitated PIC data center (IFAE/CIEMAT) **acquiring innovative and tailor made solutions from providers** for archiving and preservation of scientific petabyte range data (Archiver project).

CERN Council in charge of the European Strategy for Particle Physics statement:

"Discoveries alone are no longer sufficient ***to substantiate the investment level of Member States*** *in fundamental Science…****Tech Transfer is a key mean to demonstrate the usefulness*** *of particle physics to society"*

Innovation in a regional context:
the Euregio Meuse-Rhine (EMR) experience

Rob van der Meer - Nikhef

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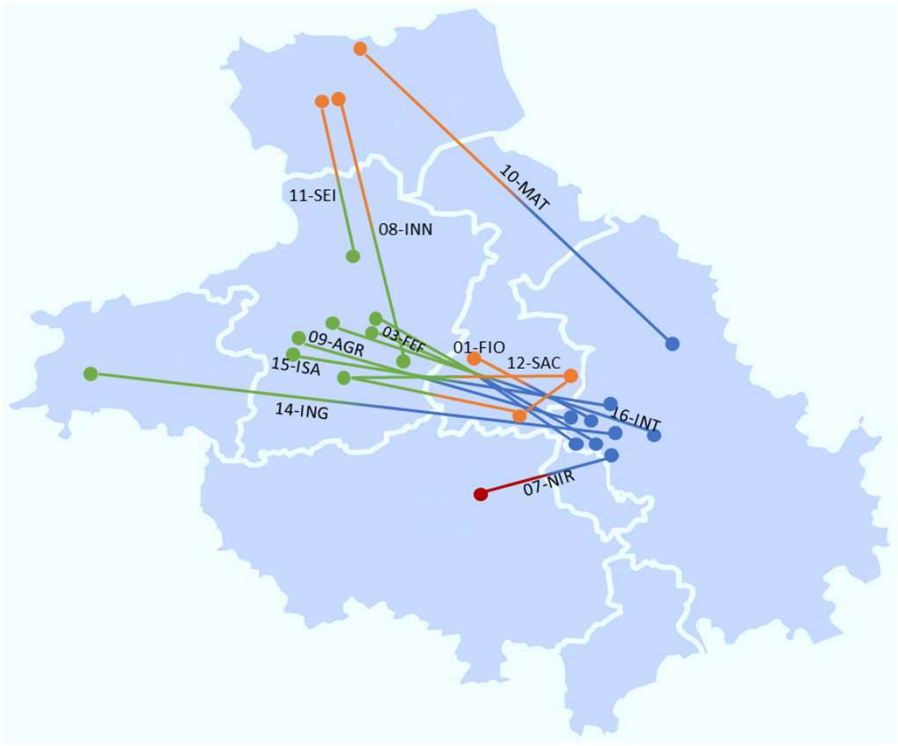
ET2SMEs cross border voucher scheme – new partnerships



Source: AGIT, April 2023.

11 New cross-border partnerships via ET2SMEs

Interreg project

Would this work for ET across EU as well?

Maybe with Horizon-Europe programme.

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Valorisation Einstein Telescope

NGF ET Project

- Goal: show (economic) value
- Funding: National Growth Fund
- Timeline: October 2022 – October 2026
- Geography: Nationwide - NL
- Partners:

Regionale Ontwikkelings Maatschappijen

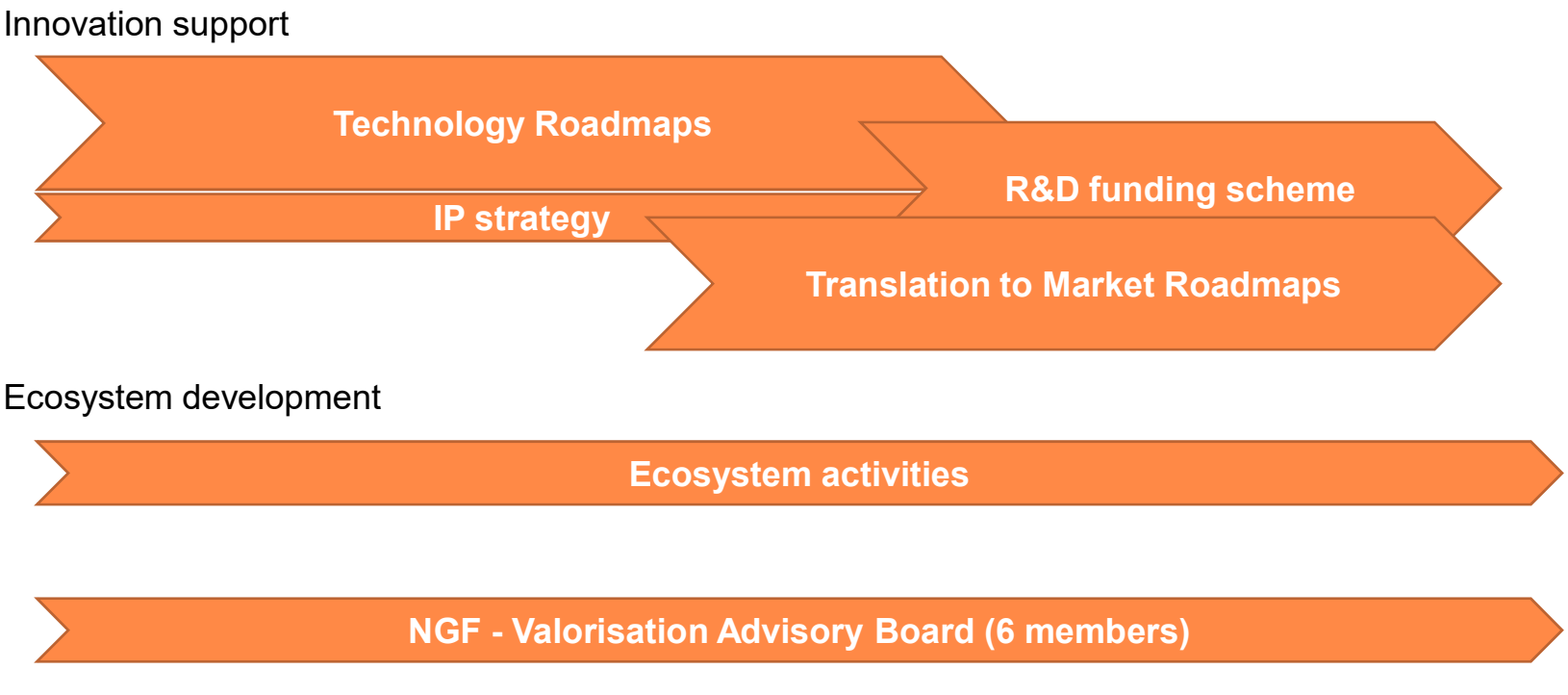
Nikhef

Ministerie van Economische Zaken en Klimaat

Ministerie van Onderwijs, Cultuur en Wetenschap

provincie limburg

Action plan


Innovation support
Technology Roadmaps
R&D funding scheme
IP strategy
Translation to Market Roadmaps
Ecosystem development
Ecosystem activities
NGF - Valorisation Advisory Board (6 members)

Technology domains

Technology domain	Development
Vibration-free cooling	development of vibration-free cooling of mirrors to 10-20 K
Vacuum technology	cost savings of the vacuum system and production facility design and installation scenario
Vibration damping	development of optimal combination of passive and active vibration damping
Optics	development of large Si mirrors and coating for application at 10-20 K
Thermal deformations	development of technology to monitor and compensate thermally induced deformations