Accelerating Innovation

From CERN Technology to Society

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CERN Knowledge Transfer
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CERN: founded in 1954: 12 European States "Science for Peace"

CERN today

| 23 Member states | 2500 Staff positions | 1600 Other personnel | 12700 Scientific users |

Annual Budget ~1100 MCHF

CERN-Accenture, June 18, 2019

Four pillars underpin CERN's mission

RESEARCH

COLLABORATION

EDUCATION & TRAINING

TECHNOLOGY & INNOVATION

The Higgs Boson completes the Standard Model,
but the Model explains only what concerns ordinary atoms i.e, ~ 5% of our Universe

Dark matter (~24%) and dark energy (~71%) make up the rest.
What are they really?

How does gravity really works?

Why there is no antimatter in nature?

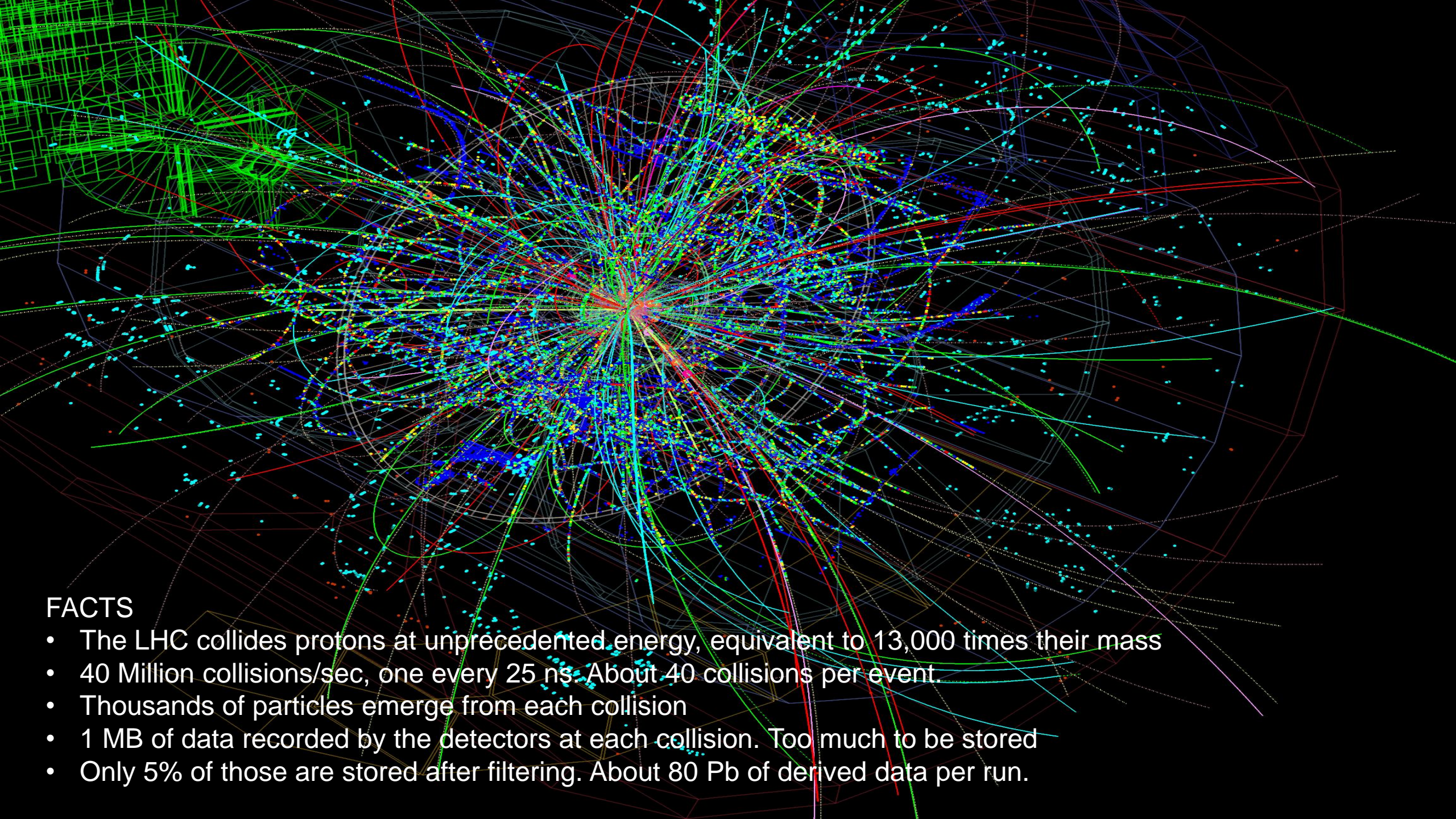*Fundamental research is our driver, what this lab is all about*

Accelerators

Detectors

Computing

FACTS
- The LHC collides protons at unprecedented energy, equivalent to 13,000 times their mass
- 40 Million collisions/sec, one every 25 ns. About 40 collisions per event.
- Thousands of particles emerge from each collision
- 1 MB of data recorded by the detectors at each collision. Too much to be stored
- Only 5% of those are stored after filtering. About 80 Pb of derived data per run.

High Luminosity LHC - 2029
- 200 collisions per event vs 40 today. Need to disentangle 200 collisions happening at once.
- Event complexity grows non linearly
- A HL-LHC run would need to store about 900 Pb of derived data. A data deluge!
- Even taking into account HW progress (storage & processing), we are off by a factor of 10, projecting to 2029

Machine Learning and Deep Learning

Industrial Controls and Automation

Metrology

High and Ultra High Vacuum Systems

Data Analytics

Health, Safety and Environment Management

Cryogenics

Optoelectronics and Microelectronics

High Volume Data Management & Storage

Superconducting Magnets

Particle Acceleration and Control

Radiation Protection and Monitoring
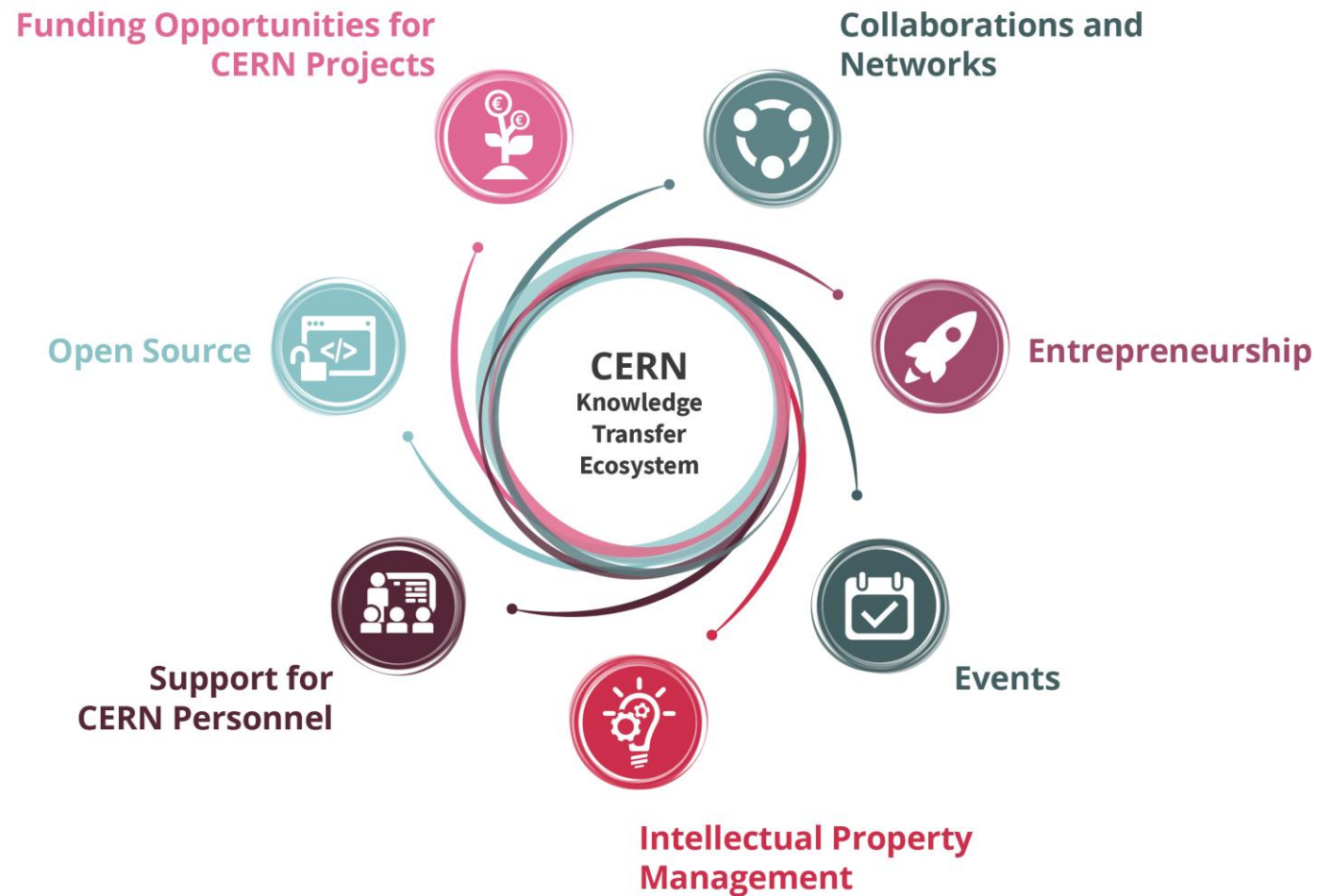
Particle Tracking and Calorimetry

Sensors

Material Science

Cooling and Ventilation

Robotics

Collaboration Tools

Radio Frequency Technology

Manufacturing and Mechanical Processes

Our toolbox to accelerate innovation

Funding Opportunities for CERN Projects

Collaborations and Networks

Open Source

Entrepreneurship

Support for CERN Personnel

CERN Knowledge Transfer Ecosystem

Events

Intellectual Property Management

CERN as trusted non-commercial innovation partner

HEALTHCARE   **ENVIRONMENT**   **DIGITAL**   **AEROSPACE**   **QUANTUM**
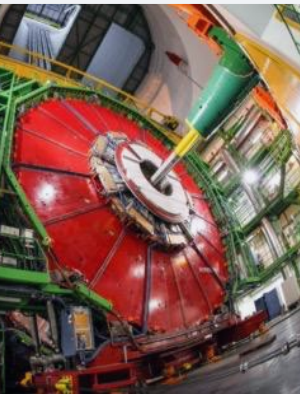
Hybrid strategy: tech push & market pull

ACCELERATORS

DETECTORS

COMPUTING

Mobilize tech experts

Create tech and IP dossiers

Scout for technologies

Mobilize innovation partners

Create value propositions

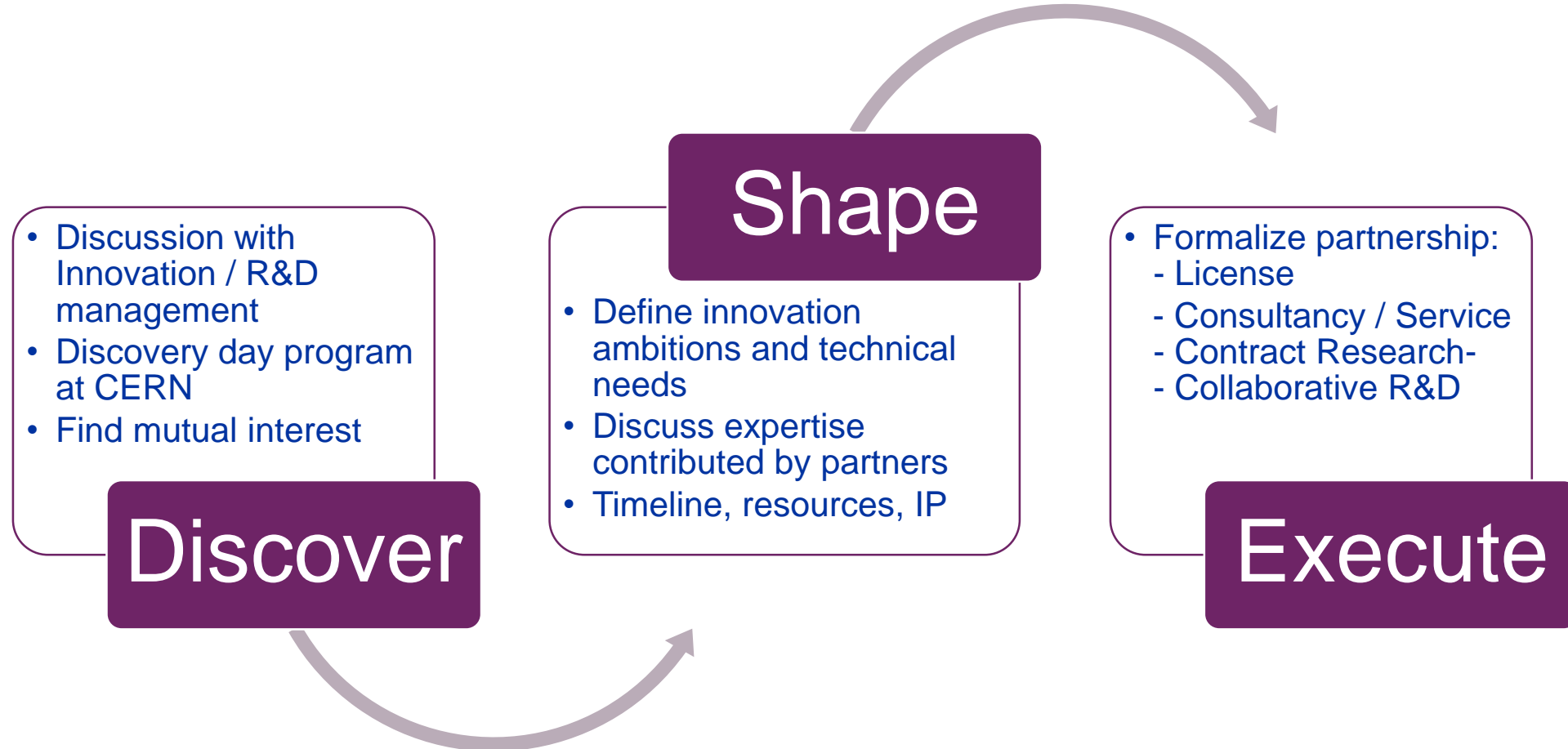Search unmet needs

HEALTHCARE

ENVIRONMENT

DIGITAL

AEROSPACE

QUANTUM

Shaping innovation partnerships

Shape

Discover

- Discussion with Innovation / R&D management
- Discovery day program at CERN
- Find mutual interest

Shape

- Define innovation ambitions and technical needs
- Discuss expertise contributed by partners
- Timeline, resources, IP

Execute

- Formalize partnership:
  - License
  - Consultancy / Service
  - Contract Research-
  - Collaborative R&D

Licence
- Access to existing solution
- Support to implement

Consultancy/Service
- Specific issue
- Time of experts
- Time of facilities

Contract research
- Specific solution
- Outsource its development to CERN

Collaborative R&D
- General issue
- Jointly find solution
- Jointly develop solution

How much time does it take to create a R&D Partnership?

What is the % of partnerships that typically make it to the execution phase?

MedAustron and CNAO offer hadron therapy using CERN technology.

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ZENSEACT (Volvo Cars Company) teams up with CERN on extremely fast machine learning using FPGAs.

Collaborative R&D

- General issue
- Jointly find solution
- Jointly develop solution

CEVA and CERN joined R&D on neural network weight and activation compression algorithms aiming make them run more efficiently. Wireless comms & computer vision applications

- Use case and requirements by the company
- Code contributed to the OS project
- Development @CERN, benefit for HEP applications

ROCHE is using CernVM-FS for application and library distribution worldwide.
Contract Research for a Company in the financial services sector. Strong interest in this tech for fast reliable worldwide file distribution.

Collaborative R&D

Collaboration with CORMEC and WUR to support national banks and regulators to detect trading anomalies in stock market.
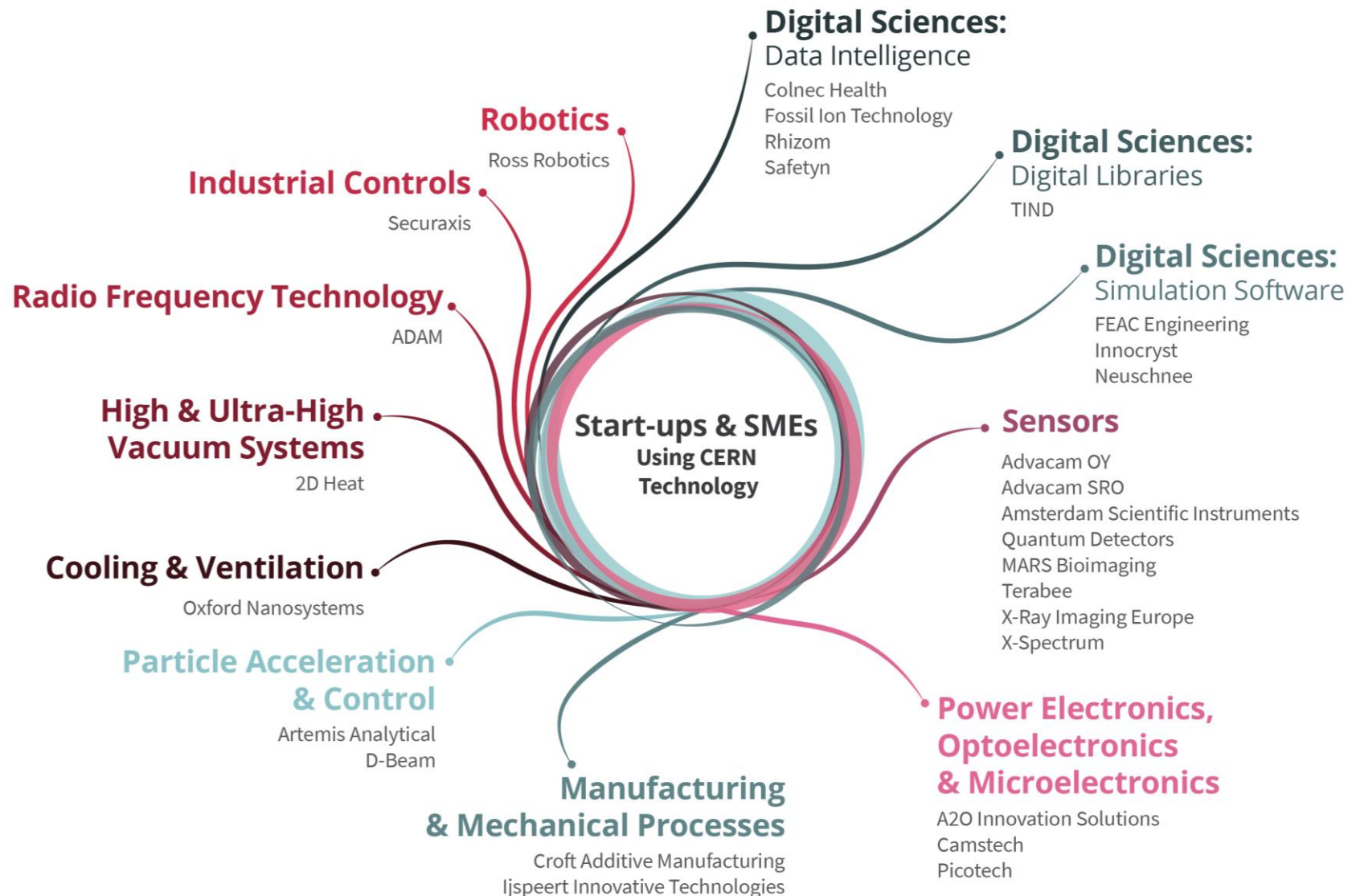
CERN and ABB team up on reducing electricity in cooling and ventilation.

Startups and Spin-offs


Start-ups & SMEs
Using CERN
Technology

Digital Sciences:
Data Intelligence

Colnec Health
Fossil Ion Technology
Rhizom
Safetyn

Digital Sciences:
Digital Libraries

TIND

Digital Sciences:
Simulation Software

FEAC Engineering
Innocryst
Neuschnee

Robotics

Ross Robotics

Industrial Controls

Securaxis

Radio Frequency Technology

ADAM

High & Ultra-High Vacuum Systems

2D Heat

Cooling & Ventilation

Oxford Nanosystems

Particle Acceleration & Control

Artemis Analytical
D-Beam

Manufacturing & Mechanical Processes

Croft Additive Manufacturing
Ijspeert Innovative Technologies

Sensors

Advacam OY
Advacam SRO
Amsterdam Scientific Instruments
Quantum Detectors
MARS Bioimaging
Terabee
X-Ray Imaging Europe
X-Spectrum

Power Electronics, Optoelectronics & Microelectronics

A2O Innovation Solutions
Camstech
Picotech

FEAC Eng: Develop advanced simulation software.
Know-how in the field of Accelerated Boundary Element Method & benchmarking
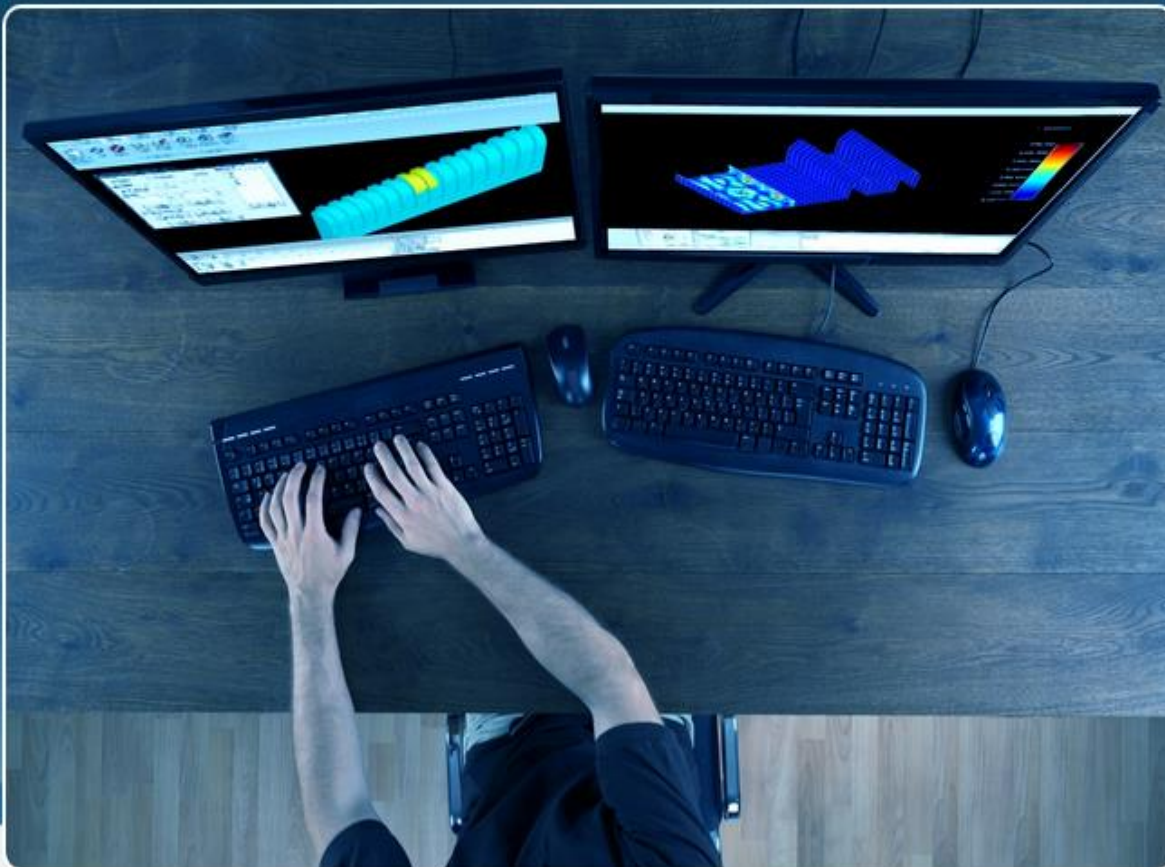
FEAC ENGINEERING | SOFTWARE PACKAGE

PITHIA – A developed BEM software package

FEAC proposes PITHIA, an in-house developed simulation software package based on accelerated Boundary Element Method (BEM). It is well known in the scientific community that BEM is ideal for providing accurate and reliable solutions to the aforementioned engineering problems. PITHIA fills the gap among existing software packages and reinforces the simulation toolbox of engineers and scientists.
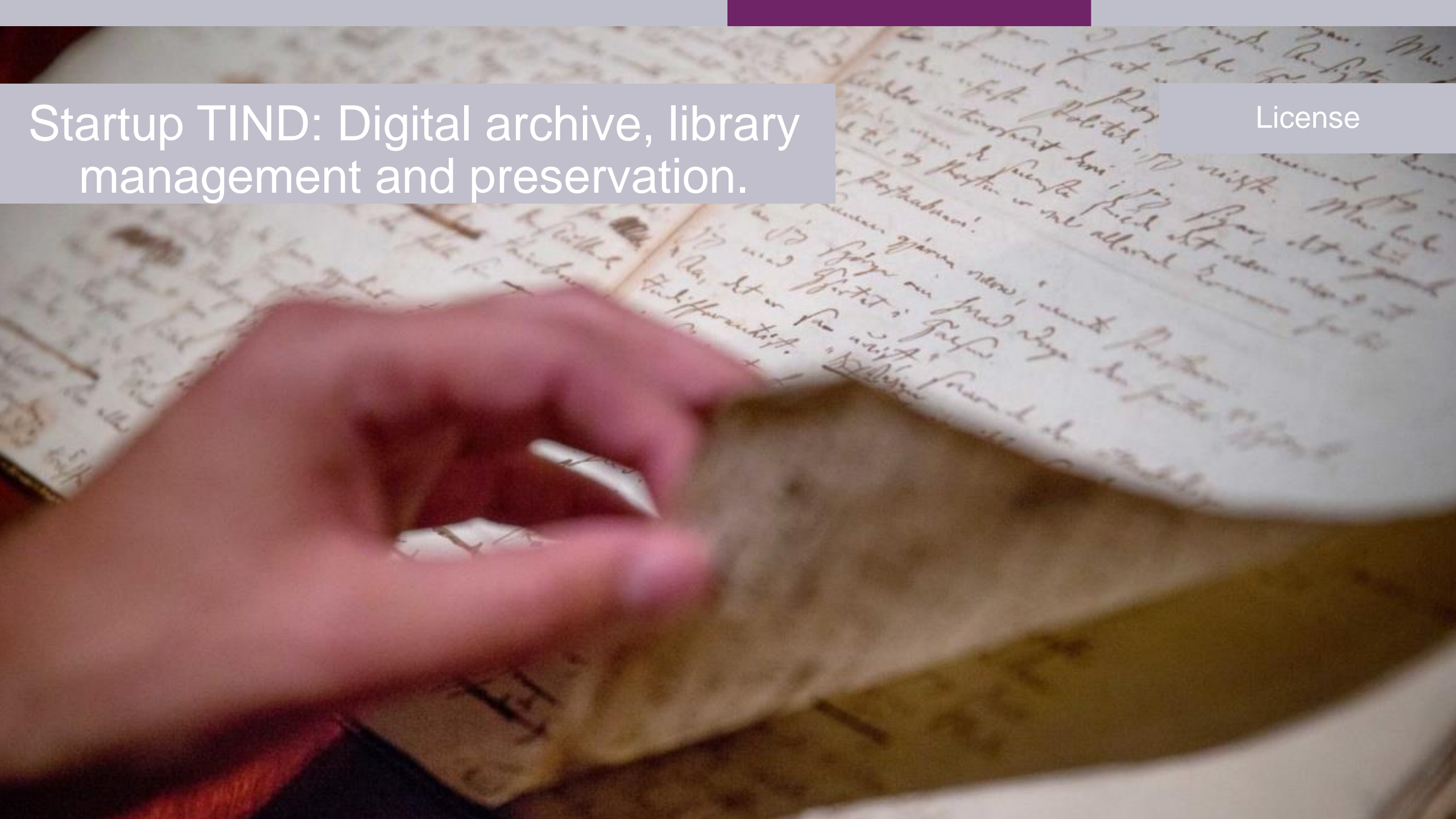
SecurAxis: Real Time Analysis, Reporting and Localization with Smart Acoustic Sensors C2MON monitoring software

Startup TIND: Digital archive, library management and preservation.

License

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
- Need to identify a concrete project & clear business case
- Keep in mind differences in culture, language, and pace
- Driving deep tech innovation requires courage, commitment & time

Be aware.. the result can be way beyond your expectations

Thank you!

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