

# **DRIVING INNOVATION: SUPPORTING EUROPE'S ENTERPRISES**



Europe's Intergovernmental Research Organisations

CERN



EMBL



ESA



ESO



ESRF



EUROfusion



EuXFEL



ILL



EMBL



EUROfusion



NEUTRONS  
FOR SOCIETY

Investments in big scientific infrastructures and projects are fundamental for science and human advancement. Nevertheless, it is also important to consider the potential use in day-by-day applications of the infrastructures, technologies and know-how developed for these unique projects.

The relevance of the infrastructure, know-how and technologies for innovations in sectors such as healthcare, automotive, food, transport and other industries is promoted by dedicated teams in the EIROforum organisations. For this reason, in 2010, EIROforum members created the Innovation Management and Knowledge and Technology Transfer (IMKTT) Working Group.

The IMKTT is the EIROforum working group dedicated to the promotion of the facilities, technologies and know-how in applications other than the core scientific ones. The IMKTT goals are to identify and share best practices among the different centres and to promote together the importance of innovating with big science organizations.

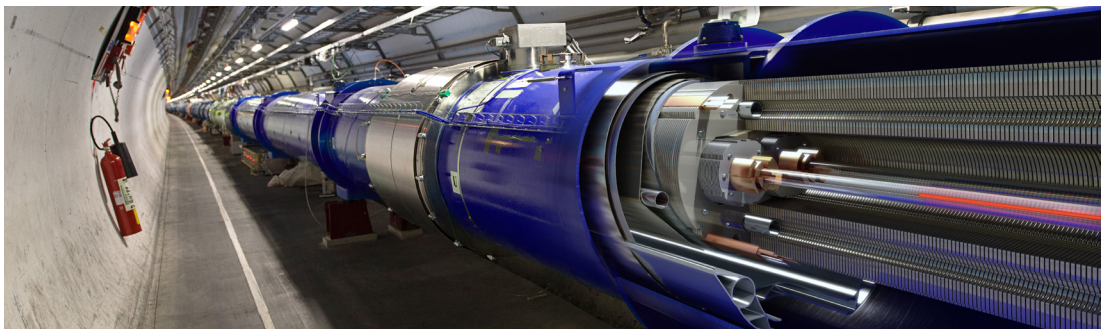
After more than eight years of collaboration the IMKTT has managed to establish a solid collaboration among the members while participating in a relevant amount of activities to promote the infrastructure and technologies of the members for the benefit of the European industry.

## CERN

## CERN

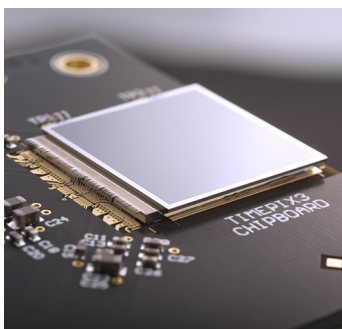
At CERN, the largest particle physics laboratory in the world, physicists and engineers use the world's largest and most complex scientific instruments to study the basic constituents of matter. CERN's expertise builds broadly on three technical fields: accelerators, detectors and computing. Behind these three pillars of technology, lie many areas of expertise: from cryogenics to ultra-high vacuums, from particle tracking and radiation monitoring to superconductivity and many more. These technologies, and the human expertise associated with them, translate into positive impact on society in many different fields. CERN's Knowledge Transfer (KT) group aims to engage with experts in science, technology and industry with the ultimate goal of accelerating innovation and maximising the global positive impact of CERN on society.

More information @ <https://kt.cern>



### Industry Support:

- **Technology Portfolio** CERN's technical expertise and most innovative technologies are available for scientific and commercial purposes. These technologies have possible applications in medtech, cultural heritage, aerospace, safety, emerging technologies and Industry 4.0.
- **Licensing, R&D collaboration, service & consultancy** CERN collaborates with companies and research institutes aiming to generate technological results with the potential for commercial exploitation. This can be achieved through working on collaborative R&D projects in CERN's areas of technical expertise or receiving professional advice from experts in these areas of technical excellence. For commercial and academic partners wishing to exploit these technologies, CERN may grant a licence.
- **Entrepreneurship support.** Fortnightly Entrepreneurship Meet-Ups (EM-Us), organised by KT's entrepreneurship team, is a forum where aspiring entrepreneurs can learn from the expertise of invited speakers. Encouraging the creation of spin-off companies the KT group also gives support to those who wish to start a company based on a CERN technology or know-how. Selected incubatees are given support in one of CERN's nine Business Incubation Centres (BICs) for CERN technologies. Chosen start-ups receive technical consultancy and services, and preferential rate licensing of CERN intellectual property.



### A Success Story

Celebrating 20 years, the Medipix technology is one of CERN's most successful knowledge transfer cases. Over the years, 4 different collaborations have triggered a significant number of commercial activities in widely differing application areas. Medical imaging, space dosimetry, education, and material analysis to name but a few. Moreover, the industrial partners and licence holders commercialising the Medipix technology range from established enterprises to start-up companies. Thus, the technology is contributing to value creation, not only in its application areas, but also through business creation.

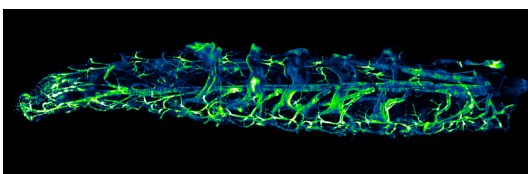
## EMBL

## THE EUROPEAN MOLECULAR BIOLOGY LABORATORY

The European Molecular Biology Laboratory (EMBL) is Europe's flagship laboratory for the life sciences – an intergovernmental organisation supported by over 25 member states. Research at EMBL is conducted by more than 80 independent groups covering the spectrum of molecular biology. EMBL operates from six sites across Europe: Barcelona, Spain; Grenoble, France; Hamburg and Heidelberg, Germany; Hinxton, UK; and Rome, Italy. EMBL was set up to promote molecular biology across Europe, and to create a centre of excellence for training Europe's leading young molecular biologists. To accomplish this, EMBL pursues five missions:

- To perform excellent fundamental research in molecular biology
- To offer vital services to scientists in the member states and the world
- To train scientists, students, and visitors at all levels
- To actively engage in technology transfer and industry relations
- To coordinate and integrate European life science research

More information @ [www.embl.org](http://www.embl.org)



### EMBLEM Technology Transfer at the EMBL

EMBL Enterprise Management Technology Transfer GmbH (EMBLEM) was founded in 1999 in Heidelberg, Germany, as wholly owned subsidiary and the exclusive technology transfer partner of the EMBL. EMBLEM is responsible for actively identifying, protecting and commercialising intellectual property and associated technologies and materials developed in the EMBL-world. Today, it manages a portfolio of more than 1000 inventions and over 450 patents, patent applications and copyrights. The technologies span the life sciences in the broadest sense and include enabling technologies, molecular tools and assays, instruments & devices as well as software applications & databases. By working closely with industrial partners in the pharmaceutical, biotech, mechanical/electrical engineering and IT fields, EMBLEM jointly develops the EMBL technologies into marketable products.

More information @ [www.embl-em.de](http://www.embl-em.de)

### A Case Study – Luxendo

Luxendo was established as an EMBL spin-off company hosted on the Heidelberg campus together with external investors in late 2015. The company is based on IP and know-how developed in more than ten years of research at the EMBL. The underlying technology, the so-called light sheet microscopy, overcomes limitations in conventional fluorescence microscopy and, for the first time, allowed imaging of living samples over longer periods of time without damaging the specimen. Only 18 months after founding Luxendo, the company was acquired by Bruker. Being part of a large corporation allows Luxendo to further develop the technology and launch new products and ultimately make the EMBL technology available to a wide scientific community.

More information @ [www.luxendo.eu](http://www.luxendo.eu)



The European Space Agency (ESA) is Europe's gateway to space. Its mission is to shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe and the world. ESA's Technology Transfer Programme Office (TTPO) focuses on encouraging space-connected entrepreneurship and innovation. Successfully it has brought space technology, application systems and expertise down to Earth and into our every-day lives. A key factor has been to develop the Technology Transfer Brokerage network and the Business Incubation Centres across Europe that make space commercially interesting to explore and accessible to businesses and entrepreneurs. Through 'ESA space solutions' it connects these initiatives to offer a complete solution for all aspects of space-related innovation, opening up a gateway to ESA and to space.

More information @ [www.spacesolutions.esa.int](http://www.spacesolutions.esa.int)

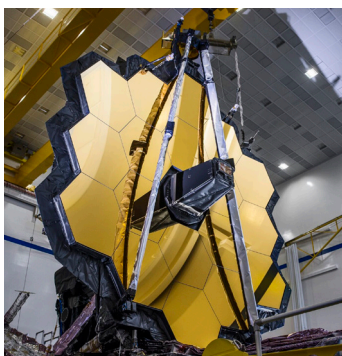


### Industry Support:

The main tools that are made available to the industry are the following:

- **ESA Business Incubation Programme.** Every year, ESA is supporting more than 200 space related start-ups. Any entrepreneur wanting to use space technology or assets can apply for a 50.000 EURO grant in any of our 20 locations in 18 Member States.
- **ESA Business Applications.** ESA Business Applications is part of ESA Space Solutions that supports the development of sustainable services utilising space assets. It provides funding opportunities and expert support to entrepreneurs.
- **ESA Technology Transfer Network.** Since 1991, ESA is supporting the Space and the non-space industry in technology transfer projects. With a network operating in several ESA Member States, ESA supported more than 380 technology transfer cases.
- **ESA Technology Transfer and Patent Office.** ESA manages and commercializes a portfolio of around 150 inventions in several technological fields. Those inventions can be non-exclusively licensed for space and non-space applications. ESA finances the de-risking of technology transfer projects with calls for Feasibility Studies, Proof of Concepts and demonstration activities.

More information contact: [business@esa.int](mailto:business@esa.int) ; [patent@esa.int](mailto:patent@esa.int)



### A Success Story

The James Webb Telescope is a joint initiative between ESA, NASA and the Canadian Space Agency, CSA, to continue exploring our universe. A team of STFC (UK) worked in the development of one of the instruments (MIRI). The same team worked with the Cardiff University's School of Optometry and Vision to develop a 'Retinal Densitometer' which measures very small changes in the reflectivity of the retina over time after exposure to light. This project has managed to early identify age-related macular degeneration (AMD), a leading cause of blindness in the developed world. In the UK, AMD accounts for 57% of all visual impairment and costs the economy between £1.2 and £3.7 billion p.a.

ESO is the foremost intergovernmental astronomy organisation in Europe and the world's most productive astronomical observatory, supported by 16 Member States. ESO's main mission is to provide state-of-the-art research facilities to astronomers to conduct front-line science. ESO also plays a leading role in promoting and organising cooperation in astronomical research. The ESO Headquarters (comprising the scientific, technical and administrative centre) are located in Garching near Munich, Germany. In Chile, ESO operates the three observing sites: La Silla, Paranal and Chajnantor, in addition to its scientific and administrative offices in Santiago.

*More information @ [www.eso.org](http://www.eso.org)*



### Working and partnering with Industry

By building and operating a suite of the world's most powerful ground-based astronomical telescopes enabling important scientific discoveries, ESO offers numerous possibilities for technology development and innovation through high technology contract opportunities for industry. The most recent opportunities are for the 39-metre Extremely Large Telescope, the ELT, which ESO is currently building, and which will become "the world's biggest eye on the sky". European industry and institutes play a vital role in the realisation of ESO projects. Without the active and enthusiastic participation of partners from all of the Member States and Chile, such projects would not be possible.

*More information*

*@ [www.eso.org/public/industry/cp.html](http://www.eso.org/public/industry/cp.html)*

### A success story - hydraulic based damping system for transporters

The Atacama Large Millimeter/submillimeter Array (ALMA), is currently the most powerful radio telescope in the world. ALMA is a partnership of Europe (ESO), North America (NSF) and East Asia (NINS), in collaboration with Chile. ALMA comprises of 66 high-precision antennas, spread over distances of up to 16km. The ability to reposition the antennas is part of what makes ALMA such a powerful telescope. For that, ALMA needed special vehicles that are capable to safely transport an 100-ton antenna in extreme conditions. The result came from the collaboration of ESO with the German company Scheuerle Fahrzeugfabrik GmbH ([www.scheuerle.com](http://www.scheuerle.com)), in the form of a special hydraulic based damping system, which fulfil the extreme requirements of very high altitude of 5000m, and rough road conditions. This development pushed the transport technology to new horizons. *See the video Gentle Giants in the Desert:*

*[www.eso.org/public/videos/esocast56a/](http://www.eso.org/public/videos/esocast56a/)*



The European Synchrotron Radiation Facility (ESRF) is the world's most intense X-ray source and a centre of excellence for fundamental and innovation-driven research in condensed and living matter science. Located in Grenoble (France), the ESRF owes its success to the international cooperation of 22 partner nations. Each year near to 9,000 scientists from around the world come to the ESRF exploiting our 40 X-ray beamlines, which operate 24 hours/day. The ESRF supports academic, applied and commercial research in exploring matter and living systems, as well as developing new state-of-the-art X-ray techniques and instrumentation.

More information @ [www.esrf.eu](http://www.esrf.eu)

### Working and partnering with Industry

Synchrotron X-rays are used as a response to industrial challenges related to the life cycle of products from raw materials to process and manufacturing, end-use, ageing and recycling. Our applications cover many economically and societally important fields including pharma and biotech (e.g. drug discovery and optimisation), chemistry and catalysis, consumer products (e.g. formulation), construction/transport engineering (e.g. wetting processes), nano-technologies (e.g. nano-electronics), energy (e.g. battery failure mechanisms) and metallurgy (e.g. stress/strain mapping).



Image: ESRF/Peter Ginter

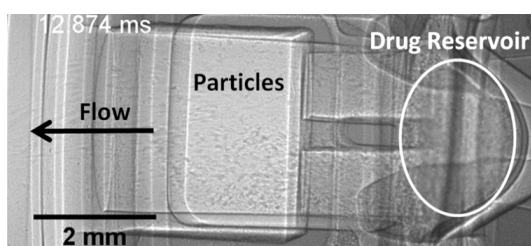
The ESRF's dedicated entry point for industry, the Business Development Office (BDO), matches industry analytical and characterisation needs with the ESRF's capabilities and skills - going far beyond conventional lab techniques. The BDO's mission extends to technology transfer, collaborations and scouting for grant opportunities. The ESRF has around 150 commercial clients and just under 40 licensed technologies.

More information @ [www.esrf.eu/Industry](http://www.esrf.eu/Industry)



### A Case Study – Prior PLM Medical

Prior PLM Medical turned to the ESRF for help in improving pressurised metered dose inhalers (PMDI), which are prescribed to treat respiratory diseases such as asthma. Inhaled medicine is used to treat these diseases due to the direct delivery and reduced side effects. However, device efficacy is often quite poor, with only 10-20% total lung deposition for most devices on the market. The dynamics of the plume up to the point at which it exits the device are thought to influence speed and aerodynamic particle size distribution when transporting the drug to the lungs, although researchers have not been able to visualise this until now. Scientists at Prior PLM Medical used X-rays at ESRF's beamline ID19 to penetrate inhaler devices and visualise internal features at a rate that conventional techniques, such as industrial CTs, cannot reach. The phase contrast X-ray imaging technique provided them with excellent contrast for the low atomic number polymer/propellant/drug materials involved.





EUROfusion (European Consortium for Development of Fusion Energy) supports and funds fusion research activities on behalf of the European Commission's Euratom programme. EUROfusion was established in 9 October 2014, involving research bodies from European Union member states, Ukraine and Switzerland with the objective to cement European collaboration on fusion research [euro-fusion.org](http://euro-fusion.org).

### **Fusion Technology Transfer Activity Project (FUTTA):**

In 2019, EUROfusion launched the Fusion Technology Transfer Activity Project (FUTTA II) with a broker network in France, Italy, Belgium, Germany, Spain and the United Kingdom. Seven brokers have been equipped with effective tools to disseminate and exploit Intellectual Property Rights from EUROfusion beneficiaries to industry [techtransfer.euro-fusion.eu](http://techtransfer.euro-fusion.eu).

Fusion research activities generate an increasing amount of fundamental technologies for the future of energy production. The societal impact of CO<sub>2</sub>-free, dense energy source for future generations is obvious. However, what is the short-term return of the investments in fusion and the benefits for the European citizens? With the help of the seven brokers under the FUTTA II activities, EUROfusion fosters fusion technology transfer by sourcing and supporting innovative projects in Europe by:

- Sourcing of fusion technologies in Europe to encourage successful transfers and know-how.
- Organization of meetings with non-fusion companies in order to collect their technology needs in accordance with their roadmap.
- Linking Technology donors and non-fusion receivers to facilitate technology transfer.
- Promotion of successful technology transfers to understand the benefits, impacts and best practices.
- An **Open Call** for demonstrators based on Fusion Technologies and with non-fusion applications (38k Euro per project, 2 projects per year).
- The perfect knowledge of all kinds of players among the ecosystem and their interactions.

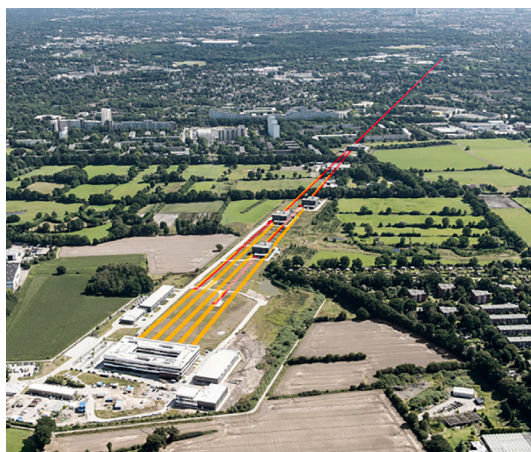


### **A Success Stories**

**Superconducting Magnets**, which are being optimized to control fusion reactions, lie at the heart of MRI devices. **Palladium alloy membranes**, originally developed for cleaning up fusion waste, effectively treat effluents from chemicals and automobile industries. **Explosive metal forming**, a technique for pressing metal sheets into desired shapes extensively used in the fusion programme has expanded its client base to include the aeronautics industry. **Remote handling techniques** that are being used in EUROfusion's JET Tokamak, are being applied to high-energy physics, space science, nuclear decommissioning, and modern surgical methods.

## EuXFEL EUROPEAN XFEL

The European XFEL is a research facility of superlatives: It generates ultrashort X-ray flashes—27 000 times per second and with a brilliance that is a billion times higher than that of the best conventional X-ray radiation sources. The world's largest X-ray free-electron laser (FEL) is opening up completely new research opportunities for scientists and industrial users. Smaller, faster, more intense: The European XFEL is making possible areas of research that were previously inaccessible. Using the X-ray flashes of the European XFEL, scientists will be able to map the atomic details of viruses, decipher the molecular composition of cells, take three-dimensional images of the nano-world, film chemical reactions, and study processes at extreme state of matter, like processes at very high temperature and pressure.



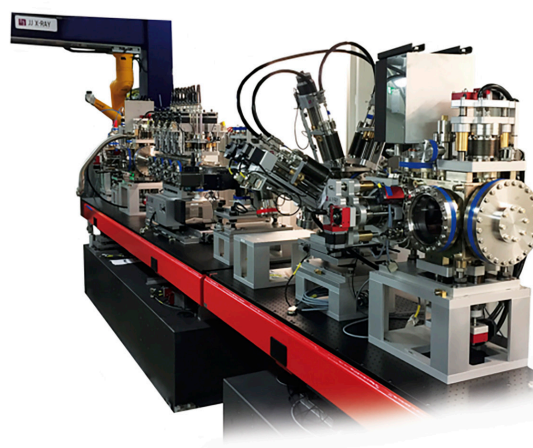
### A success story

During the construction of the European XFEL, the challenging requirements of the specification triggered collaborations with companies to develop state-of-art technology. Some of the new concepts could find alternative applications in other fields beyond FEL development and operation. One example is a high-pressure support table for all the optical components at the Femtosecond X-Ray Experiments (FXE) instrument. The component was designed and installed in the framework of the Danish in-kind contribution with the Danish Agency for Science, Technology and Innovation and the JJ X-Ray company. The optical table has a load capacity of >2600 kg and can move in vertical and horizontal directions as well as all three rotational axes. The positional accuracy is better than 1  $\mu\text{m}$  with less than 100 nm nominal resolution. The learning and experience with this optical table have led to several other projects in the big science business area. One important and major project is a sample positioning stage with very high requirements to be installed at the Chinese Neutron Spallation source in Dongguan, China. The component is also suitable for industrial applications.

### Industrial liaison

The Industrial Liaison Office serves as a bridge between the publicly funded research and development at European XFEL and private industry. In the operation phase, the Industrial Liaison Office supports the Management Board of European XFEL in the following main tasks:

- Engaging industry in using the full potential of the European XFEL, both in the experiment programme and with the ancillary laboratory systems
- Coordinating the patenting process of inventions both for licensing and for the support of new startup creation
- Attracting the engagement of industry in the big science market for the supply of cutting-edge components



## INSTITUT MAX VON LAUE PAUL LANGEVIN EUROPEAN NEUTRON SOURCE

### Institut Max von Laue – Paul Langevin (ILL), European neutron source

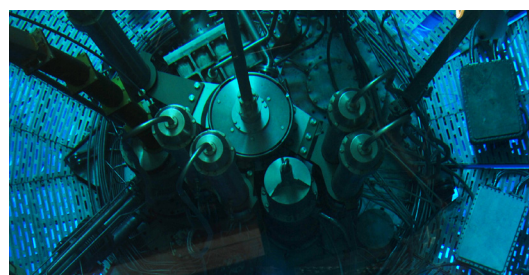
The Institut Laue-Langevin is an international research centre at the leading edge of neutron science and technology. ILL is funded and managed by France, Germany and the United Kingdom, in partnership with 10 other countries. As the world's flagship centre for neutron science, the ILL provides scientists with a very high flux of neutrons feeding some 40 state-of-the-art instruments. Every year, about 1400 researchers from over 40 countries visit the ILL. Fundamental and applied research is conducted in a variety of fields: magnetism, chemistry, biology, nuclear physics, materials & engineering science, etc.

More information @ [www.ill.eu](http://www.ill.eu)



### Working and partnering with Industry

Neutron beams provide unique, powerful and non-destructive access to the heart of materials and components, over length scales ranging from centimetres to the atom. The ILL provides industrial users with privileged access to a very broad array of highly specialised neutron instruments, supported by the expertise of experienced scientific and technical staff. An extensive range of sample environment facilities is available at the ILL, capable of accurately mimicking the operating conditions of a device or material: temperature, pressure, magnetic field, mechanical constraints, mixing devices, etc. These facilities play an essential role in the analysis of in-operando industrial processes. Additionally, the reactor produces a spectrum of neutrons of interest for the production of medical radioisotopes. Industrial researchers can access the ILL instruments via the open and peer-reviewed six-monthly calls for proposals. ILL offers consultancy and other services for proprietary research, and industrial users reap real benefits from working with ILL scientists on collaborative projects (including PhDs). Finally, the ILL can grant licences on the technologies developed with its help. *Contact: [industry@ill.eu](mailto:industry@ill.eu)*



### A success story

Whilst the ILL's nuclear reactor produces neutrons essentially for scientific studies, it is now also providing innovative radioisotopes for use in the medical sector. According to ILL scientist Ulli Köster, «the radioisotope lutetium-177 emits beta radiation with a range of just a few millimetres. This is very well suited for treating small metastases and can be considered to be today's "gold standard" in radioligand therapy.» Molecules containing lutetium-177 are now being used to treat neuroendocrine tumours and in clinical trials against metastatic prostate cancer, lymphoma, and other cancerous conditions. The ILL produces lutetium-177 by irradiating a stable precursor, ytterbium-176. The irradiated target is then transported to Bavaria in Germany, where it is separated and purified by the radiopharmaceutical company ITG Garching, before distribution to hospitals across the world. Several thousand cancer patients benefit every year from this treatment. The ILL also produces other innovative radioisotopes, such as terbium-161 and scandium-47. These are sent to scientific partners for radiochemical separation and preclinical testing.





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