



European Strategy Forum
on Research Infrastructures

ESFRI

European Research Infrastructures
with global impact

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ESFRI Chair

In 2012 ESFRI – the European Strategy Forum for Research Infrastructures – celebrates its first ten years of successful work. This milestone gives us the opportunity to present in this brochure some of the first results of those ESFRI projects which have already reached the implementation phase.

In April 2002 the first plenary meeting of ESFRI took place with representatives from Member States and from the European Commission. The setting up of ESFRI – the idea to develop a more coordinated approach for policy making in the field of Research Infrastructures – emerged in September 2000 from the Strasbourg Conference on Research Infrastructures. Subsequently, the Competitiveness Council invited "the Commission in close collaboration with the Member States..., to explore the establishment of new arrangements to support policies related to Research Infrastructures." Following this invitation, an expert group has been set up by the Commission which recommended the creation of a European Strategy Forum on Research Infrastructures whose mandate should be

- › To support a coherent and strategy led approach to policy making on Research Infrastructures in Europe, and
- › To facilitate multilateral initiatives leading to the better use and development of Research Infrastructures.

This brochure describes a selection of those 48 ESFRI projects on the roadmap which are already in the implementation phase or should reach this phase before the end of 2012. Many of the projects have already been established as legal entities; in the coming months eight of them should achieve the status of a European Research Infrastructure Consortium (ERIC). The ESFRI projects will be located in many different regions of Europe – including the new Member States – and they cover the following scientific areas: Social Sciences and Humanities, Environmental Sciences, Energy, Biological and Medical Sciences, Material and Analytical Facilities, Physical Science and Engineering and finally e-infrastructures.

The members of the ESFRI Forum will continue to support the implementation of as many ESFRI projects as possible to support the ambitious goal to have implemented sixty percent of the Research Infrastructures on the roadmap by 2015.

It is even more important in periods of economic instability that there should be strong support for research and innovation – this is indispensable for the future of Europe. Research Infrastructures play an important role in producing the new ideas and developments which turn into innovations and, in a longer term, into jobs.

ESFRI very much appreciates the support from Ministries and Funding Agencies as well as of the European Commission towards the implementation of the projects on the ESFRI roadmap. Only with their support are success stories like those on the following pages possible. I would also like to thank the project coordinators for providing the relevant information for this brochure as proof of the excellent results they have already achieved.

This brochure presents a selection of the ESFRI projects with the goal of providing an overview of different research areas and host countries. I hope and expect that this brochure will be followed by updated versions presenting more success stories in due course.

A handwritten signature in black ink, reading "Beatrix Vierkorn-Rudolph".



The European Strategy Forum for Research Infrastructures (ESFRI) – a Strategy for Research and Innovation

The ESFRI Forum was created in April 2002 by the Member States and the European Commission to develop the scientific integration of Europe and to strengthen its international outreach. Since its foundation, ESFRI has successfully supported the development of a coherent and strategy-led approach to policy-making for Research Infrastructures in Europe. The Forum is composed by national delegates who are nominated by the Research Ministers of the Member States and Associated Countries, and one representative of the European Commission. The chair is elected from among the country representatives. An Executive Board assists the chair in his/her duties. The Forum can decide to set up temporary working groups to elaborate specific topics. The ESFRI Secretariat is provided by the European Commission.

The ESFRI Roadmap – a “Highway” to Future

The Competitiveness Council of the European Union mandated ESFRI in November 2004 to develop a strategic roadmap for Europe in the field of Research Infrastructures. The setting up of this roadmap has facilitated multilateral initiatives leading to the better use and development of Research Infrastructures, at European and at international level.

The ESFRI Roadmap identifies new pan-European Research Infrastructures or major upgrades to existing ones, meeting the needs of European research communities for the next 10 to 20 years. From more than 260 proposals, 50 projects have been identified through several review stages between 2006 and 2010. The ESFRI roadmap presents a list of 48 Research Infrastructures of different size, scope and complexity; ten of them are already in the implementation phase.

The ESFRI roadmap has stimulated national governments in most of the Member States to develop national roadmaps for Research Infrastructures. Some countries have even earmarked national budgets for Research Infrastructures to ensure participation in a common pan-European effort.

Research Infrastructures – Facilitating European and Global Outreach

Research Infrastructures are facilities, resources or services of a unique nature that have been identified by research communities to conduct top level activities in their fields. They may be single sited, distributed or virtual. Research Infrastructures often produce large amounts of data requiring data management systems to enable the dissemination of the data and the involvement of a broad scientific community. The ESFRI Research Infrastructures range from Digital Research Infrastructures for the Arts and Humanities, Social Science libraries, surveys and data banks, Biomedical and Clinical research facilities, Environmental and Biodiversity observatories, to Energy research facilities, telescopes, analytical facilities, accelerators and synchrotrons.

To tackle the “Grand Challenges” such as global warming, tightening supplies of energy, water and food, or securing quality of life for an aging population closer scientific collaboration is needed as well as the pooling of financial and human resources also on a global scale. Some of the pan-European Research Infrastructures are aiming at international partnerships just from the beginning such as Euro-ARGO, IAGOS, SKA, SHARE, EMSO, EPOS and EISCAT. To support these infrastructures, ESFRI also strengthens the cooperation with research organisations and countries outside of Europe (e.g. USA, India, Russia, Australia, Brazil, Canada and China).

ESFRI's Action Plan

ESFRI is aiming together with the European Commission to have completed or launched the construction of sixty per cent of the priority European Research Infrastructures by 2015 currently identified by ESFRI. This was committed in the “Europe 2010 Flagship Initiative – Innovation Union and Digital Agenda”. Besides this ambitious goal ESFRI will continue to develop and advocate its vision for Research Infrastructures which includes practical implementation steps like the following:

- › Developing an evaluation methodology for pan-European Research Infrastructures which could be used also for Research Infrastructures of national or regional importance
- › Strengthening cooperation between Joint Programming Initiatives and Research Infrastructures
- › Building up and strengthening cooperation with industry and other national and international organisations
- › Expanding training possibilities for young scientists and fostering mobility schemes
- › Addressing the issue of socio-economic impact of Research Infrastructures
- › Promoting regional cooperation and stimulating increased international cooperation

ESFRI Success Story

ESFRI has devoted considerable efforts to the identification of new or upgraded pan-European Research Infrastructures for the benefit of European research and innovation. This was reflected in the first European Roadmap for Research Infrastructures, published in 2006, where 35 projects were identified in all fields of science. The Roadmap was updated by ESFRI in 2008 and 2010, bringing the total number of Research Infrastructures of pan-European relevance to 48.

On the following pages ESFRI presents some of the pan-European Research Infrastructures which are on their way to implementation.



➤ Social Sciences and Humanities



The Social Sciences and Humanities contribute actively to our profound understanding of the cultural, social, political and economic life in Europe, as well as for the process of European cohesion. They facilitate the understanding between the scientific disciplines and they are more than ever needed to give societal insight in the results of different research areas. In practise these disciplines help to strengthen employment, to modernise our social welfare and education system, and to secure economic reform and social cohesion as part of the knowledge-based economy.

Public Attitudes Matter in Democratic Societies

ESS European Social Survey

PARTICIPANTS

Host Country: United Kingdom
Number of participating countries: 21

TIMELINE

Start of construction: n.a.
Start of operation: 2013

ESTIMATED COSTS

Construction: 2.3 M€
Operations: 2.3 M€/year

www.europeansocialsurvey.org

The European Social Survey finds out what people believe, want, fear and prefer



How often do people discuss politics and current affairs? What about their own political engagement? How content are they with the state of education in their country? Public attitudes like this matter in democratic societies. Policy makers as well as social scientists and society are interested in what citizens believe, want, fear and prefer. This gives a nuanced picture of Europe and its societies and thus provides an understanding of how public attitudes differ throughout Europe and how they change through the years. It is important both for informing academia and public policy debate.

However, public attitudes are difficult to measure. They are often unexpressed, and cannot be inferred from electoral choices or momentary media opinion polls. As a response to the absence of academically rigorous cross-national data about these items, social scientists designed the European Social Survey (ESS) in the late 1990s. Every two years since 2001 over 30.000 people in up to 34 European countries are interviewed with the help of a scientifically developed questionnaire. They are asked about topics like socio-political values, trust in institutions, demographic composition, financial circumstances as well as immigration and citizenship.

As a unique Research Infrastructure, ESS provides scientists as well as policy makers with these data. It coordinates the work of leading institutions in each country which are responsible for collecting the data. The data are made immediately and freely available to all via the ESS website. Thus anyone can use, report on and evaluate them. Coordinated by a team under the leadership of City University London, the ESS not only provides high quality data, it also undertakes cutting edge methodological investigations to improve its own data collection going forward and the quality of comparative quantitative measurement more generally.



The Treasure of Ageing

SHARE-ERIC Survey of Health, Ageing and Retirement in Europe

Facing the challenges of population ageing needs a profound long-term data base from across Europe

Ageing is a fascinating process. It affects all of us, both as individuals and as societies. Especially in Europe, higher life expectancy leads to population ageing – one of the megatrends of the 21st century. This is often seen as a formidable challenge for the European welfare state – to its labour markets, social security and health care systems. However, it also provides fascinating opportunities, especially to benefit from experiences and support within four generations.

To turn the challenges of population ageing in Europe into opportunities, it is crucial to understand how older peoples' living conditions depend on the interplay of health, economics, social networks and institutional conditions, which may differ from country to country and over the years.

SHARE, the Survey of Health, Ageing and Retirement in Europe, is a unique and profound Research Infrastructure that provides these data to scientists as well as policy makers since 2004. It is the first study of its kind in Europe. With the fifth wave of the survey in 2012, already more than 80,000 people aged 50 and older from 20 European countries have participated in the panel. Due to its multi-disciplinary approach it guarantees a great variety of information in a long term perspective. This includes health variables, bio-markers, psychological and economic as well as social support variables as well as methodological research. With the help of SHARE, public policy interventions can be based on sound scientific evidence.

SHARE is centrally coordinated by the Munich Center for the Economics of Aging (MEA) at the Max Planck Institute for Social Law and Social Policy. It has become a role model for several ageing surveys worldwide.

PARTICIPANTS

Host Country: The Netherlands

Coordination: Germany

Number of participating countries: 20

TIMELINE

Start of construction: 2002

Start of operation: 2004

ESTIMATED COSTS

Construction: 23 M€

Operations: 1.4 M€/year

www.share-project.org



Language Is the Key to the Understanding of Language Behaviour

CLARIN ERIC The Common Language Resources and Technology Infrastructure

PARTICIPANTS

Host Country: The Netherlands
Number of participating countries: 9

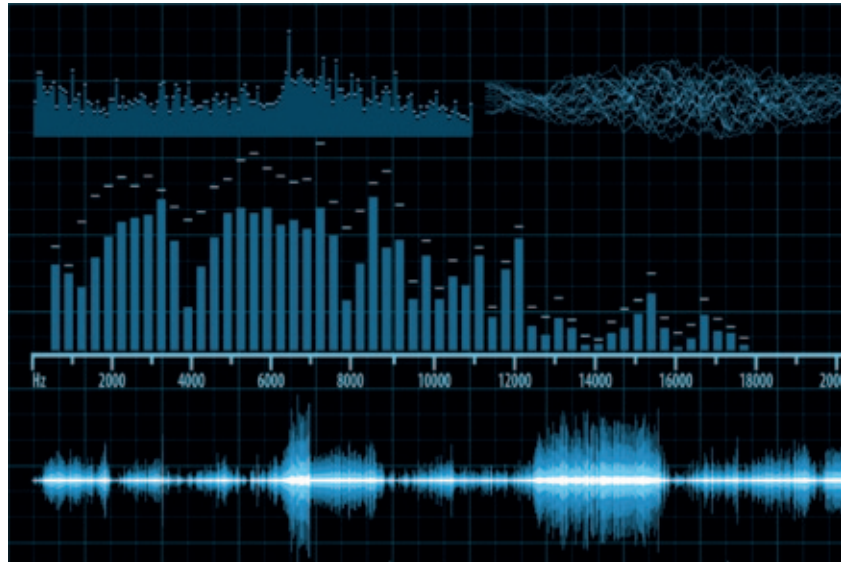
TIMELINE

Start of construction: 2012
Start of operation: 2015

ESTIMATED COSTS

Construction: 104 M€
Operations: 5 M€/year

www.clarin.eu



Virtual observatories enable better access to Europe's wide spread language data collections

Language is the carrier of cultural content and knowledge, instrument for expression, communication and entertainment, key component of our identity. It is the key to the study and understanding of human behaviour, both at the individual level and at the level of communities and societies.

CLARIN, the Common Language Resources and Technology Infrastructure, provides a virtual language observatory that enables scientists to get access to existing and emerging digital language data collections as well as to advanced tools to explore and exploit them, ready to operate on standardized data. All this will be available on the internet using a service oriented architecture based on secure grid technologies. Guidance and advice will be provided through distributed knowledge centres.

Thus, scientists as humanities scholars or linguists can easily work out tasks as 'summarize Le Monde from 11th march 2007' or 'list all uses of „enthusiasm“ in 19th century English novels written by women'. Currently data and tools for exploring tasks like this are scattered all over Europe. CLARIN will bring them together in virtual collections, directly accessible from behind the scholars' desks. Ease of access and clever tools to work faster on larger collections will have a direct impact on their productivity. Since the use of persistent identifiers allow other researchers to have access to exactly the same data collection it will improve reproducibility of results. The access to material in other countries will facilitate comparative and contrastive research across languages, countries and times, and will make it possible to address societal challenges at the European level in novel ways. For example to monitor „Social Climate Change“ under the influence of factors as migration or financial crisis, by studying human behaviour and attitudes as reflected in historical documents, and in the media, including the social media. This will also serve policy makers and journalists, and may help issuing early warnings for an emerging social tsunami.



Enabling Digital Research in the Arts and Humanities

DARIAH The Digital Research Infrastructure for the Arts and Humanities



DARIAH will create a Europe-wide e-Infrastructure for the diverse needs of arts and humanities researchers



A musicologist who analyses performances with the help of digital recordings, an archaeologist who wants to visualize buildings or cities from ancient times, a historian who extracts place names from texts to learn about their origins and changes over time – not only natural scientists or engineers rely on digital technologies, they are increasingly becoming essential tools for arts and humanities researchers. Nevertheless, an infrastructure to support this type of research does not yet exist.

With DARIAH, the Digital Research Infrastructure for the Arts and Humanities, a pan-European e-infrastructure will be developed, operated and maintained. It will support researchers in all phases of their work: in the acquisition of information needed for a research question, in the analysis of the data

gathered and in the publication of the results. To meet the particular needs of the arts and humanities researchers, the ICT-tools to be developed will be based on a deeper analysis and understanding of their special research practices and processes.

While closely cooperating with existing projects that focus on specific research communities, like CENDARI, the Collaborative European Digital Archive Infrastructure or EHRI, the European Holocaust Research Infrastructure, DARIAH aims at integrating and coordinating the different e-activities in the arts and humanities in the European countries. Thereby, it strongly relies on the participation and the input of the researchers who are encouraged to share their e-developments and e-experiences with the community via DARIAH.

DARIAH will operate through Europe wide Virtual Competency Centres (VCCs). Each VCC is coordinated by one or two leading European institutions. VCC 1 e-Infrastructure focuses on technology development, VCC 2 Research and Education Liaison provides an interface between DARIAH and the researchers, VCC 3 Scholarly Content Management will produce guidance and reference material to share data and publications with a wide audience, and VCC 4 Advocacy, Impact and Outreach aims at measuring the added value of DARIAH for the research community and seeks to build beneficial relationships with wide groups of stakeholders.

PARTICIPANTS

Host Country: France
Number of participating countries: 10

TIMELINE

Start of construction: 2013
Start of operation: 2017

ESTIMATED COSTS

Construction: 20 M€
Operations: 2.4 M€/year

www.dariah.eu





› Environmental Sciences



The Environmental Sciences or Earth system research community is dealing with one of the Grand Challenges – Climate Change. The research is focused on the knowledge needed for the promotion of sustainable management of the natural and human environment and its resources. Current emphasis lies on the prediction of climate, ecological, earth, atmosphere and ocean systems changes and on tools and technologies for monitoring, prevention and mitigation of environmental risks and pressures.



Where Do they Come from? Where Do they Go?

ICOS Integrated Carbon Observation System

Deciphering the greenhouse gas balance of Europe and adjacent regions

The current concentrations of CO₂ and CH₄ in the atmosphere are the highest in the past 2.5 million years. Compared to pre-industrial times, CO₂ levels have increased by 40%, those of CH₄ by 250%. According to the Intergovernmental Panel on Climate Change (IPCC), these effects are caused at least in part by human activities, through the burning of fossil fuels and land use changes like deforestation. These findings have a very high confidence level. And they are the driving force of current and future climate change.

A more accurate monitoring and deeper understanding of the regional budgets, of human and natural drivers, and controlling mechanisms of greenhouse gas emissions and sinks and their evolution requires high-precision, long-term observations. This will help to distinguish between short term variability and long-term trends. On a European level, the new Research Infrastructure ICOS, the Integrated Carbon Observing System, will provide these data. The concept behind ICOS is a network of about 100 stations across Europe measuring the greenhouse gas fluxes from ecosystems and their concentration in the atmosphere. Furthermore, various marine platforms for ocean observation will be integrated, with focus on the

North Atlantic Ocean sink of atmospheric CO₂. Four Thematic centers will provide coordination of measurements, data evaluation and instrument development. Combined with advanced carbon cycle models developed by researchers, ICOS will provide daily information about sources and sinks of greenhouse gases at scales down to about 10 km over European countries. It will be well integrated into other worldwide atmosphere, ocean and ecosystems observation programs.

Thus ICOS will permit to detect changes in regional greenhouse gas fluxes, early warning of negative developments and the response of natural fluxes to extreme climate events such as drought, to reduce uncertainties in Earth System models and to evaluate the success of mitigation and adaptation measures. It will provide as well useful data to help improve emission inventories, for monitoring the applications of international conventions like the Kyoto protocol and its follow-up or the European Union Emission Trading Scheme. Therefore, not only research institutions and policy makers will benefit from easy data access but also industry, especially SMEs, as well as education and Mass media.

PARTICIPANTS

Host Country: France
Number of participating countries: 15

TIMELINE

Start of construction: 2010
Start of operation: 2013

ESTIMATED COSTS

Construction: 130 M€
Operations: 36 M€/year

www.icos-infrastructure.eu



Understanding Biosphere

LIFEWATCH Science and Technology Infrastructure for Research on Biodiversity and Ecosystems

PARTICIPANTS

Host Country: Spain
Number of participating countries: 9

TIMELINE

Start of construction: 2011
Start of operation: 2011 (first release),
2016 (full operation)

ESTIMATED COSTS

Construction: 220 M€
Operations: 35.5 M€/year

www.lifewatch.eu

A Virtual Lab creates an interactive network to study the complex interaction of life on earth

The sheer variety of life on earth is impressive: There are at least 370,000 plants and more than 10,000 bird species alone of the known over 10 million of total species. They are supported by an astonishing variety of ecosystems and with an enormous genetic diversity of each species. Our knowledge of this living diversity is still poor, while our biosphere is a system under threat. Our planet, including mankind relies on healthy ecosystems: clean air and water, fertile soil, abundant food and other vital resources. The stability of these systems is changing rapidly and species are getting extinct rapidly.

A better management of our planet's biosphere is one of our greatest challenges. But meeting it requires deeper knowledge of species ranges over space and time, of how species interact on the genetic level and with one another, with their environment and with us. There are already many promising earth-watching projects underway across the globe – but that is still not enough.

LifeWatch goes beyond that. The mission of this high-end Research Infrastructure is to make research smarter, better, faster and – which is most important – more collaborative. By providing researchers with 'Virtual Labs', LifeWatch is Europe's most ambitious undertaking in e-science, a new paradigm of research. Lots of computers, software, networks will be used to interlink a wide variety of research stations, databases, monitoring equipment and scientists across Europe. On top of that network, LifeWatch installs new services and tools to help the researchers communicate, share and integrate data, analyse results, create models, test model scenarios, and manage projects.

This permits new kinds of research that were not possible before. So a marine biologist in Tallinn can easily check Baltic fisheries data in Copenhagen, continental bird migrations over Alicante, or global climate models in London for inclusion in a personalized virtual laboratory to understand processes of biodiversity change. Furthermore, LifeWatch aims at connecting the world of biosphere science to the world of policy makers, entrepreneurs, students and interested citizens – in both, Europe and the world.



Oceans under Observation

EURO-ARGO Research Infrastructure for Ocean Science and Observations

A network of a few thousand flows provides data from global oceans – now with a strong European contribution



The oceans play an important role in climate change. Rising sea levels and shrinking arctic sea ice coverage are only two of the symptoms which have further impact on its development. To understand and predict climate change, it is crucial to understand and predict changes of the oceans. Accurate models for climate and ocean prediction require long-term global data sets of the highest quality.

Since the late 1990ies more than 3,200 autonomous profiling floats have been spread out over the global oceans to measure their temperature and salinity. This international array called Argo is the first-ever global, in-situ ocean-observing network. As a complement to satellite systems, Argo provides data

directly from the sea. An Argo float descends autonomously down to 2,000 metres, drifts there for ten days and then ascends to the surface measuring temperature and salinity. At the surface, the data are transmitted in real time via satellite.

The main challenge for Argo is to maintain the array over multi-decadal time scales. Given the float life time (3 to 4 years), this requires to deploy every year about 900 floats. Argo also needs to extend towards biogeochemical measurements, observation at depths deeper than 2,000 metres and coverage of polar oceans.

The Euro-Argo Research Infrastructure is now making a sustained European contribution to this major international programme. Under the coordination of France, 12 European countries participate with their main ocean, weather and climate research centers. This will lead to an improved efficiency in all implementation aspects: operation at sea, array monitoring and evolution, technological and scientific developments, improving data access for research and operational oceanography users. A well organized European Research Infrastructure will also strengthen European excellence and expertise in ocean and climate research.

PARTICIPANTS

Host Country: France
Number of participating countries: 12

TIMELINE

Start of construction: 2007
Start of operation: 2011

ESTIMATED COSTS

Construction: 40 M€
Operations: 8 M€/year (not committed yet)

www.euro-argo.eu





➤ Biological and Medical Sciences





Health and food are two major challenges arising from the rapidly increasing population worldwide and its increase in its average age. Improving health, including the increase of effectiveness in fighting emerging epidemics, in addition to responding to the growing demand for food and for bio-resources, is a topic that requires urgent attention. Research Infrastructures in the field of life sciences will contribute to the solution of these important questions.



Systematic Fight against Diseases

BBMRI Biobanking and Biomolecular Resources

Research Infrastructure

A European biobank infrastructure is the basis of new approaches in life sciences



Biological resources, such as blood cells, tissues, DNA or other biomolecules are considered as the essential raw material for the advancement in life sciences. They are essential to find science-based responses to several of the health-related grand challenges of our time, such as sustainable health care for ageing population, widespread diseases like cancer, prevention of diseases or new pandemics.

Biobanks provide large collections of biological samples from large numbers of patients and healthy persons representing general population. They include attached data on factors like health status, nutrition, lifestyle, and environmental exposure. Thus, biobanks are a key resource in unravelling the association between genetic background, life style and environmental risk factors for various diseases and their trait components.

To improve the existing collections in various European countries, their accessibility and interoperability, the pan-European Biobanking and Biomolecular Resources Research Infrastructure (BBMRI) is implemented under the ERIC (European Research Infrastructure Consortium) legal entity. It will be organized as a distributed Research Infrastructure with operational units in most European Member States and a coordinating Central Executive Management Office in Austria. BBMRI will provide access to biological samples and related clinical data, free access to documents, standard operation procedures and best practices, and open access to published results.

To meet the goals of disease prevention and developing personalized medicine, there is a special focus on establishing a close collaboration between academic researchers and biotech as well as pharmaceutical industry. In addition, ethical and legal experts as well as patient communities are involved in the BBMRI activities to achieve standards and guidelines that properly balance individual values with health and medical interests.

PARTICIPANTS

Host Country: Austria
Number of participating countries: 16

TIMELINE

Start of construction: 2012
Start of operation: 2013

ESTIMATED COSTS

Construction: 170 M€
Operations: 3.5-5 M€/year for headquarters,
17 M€/year for resource centre

www.bbmri.eu



Bridging Basic Research and Medical Innovation

EATRIS European Advanced Translational Research Infrastructure in Medicine

PARTICIPANTS

Host Country: The Netherlands
Number of participating countries: 9

TIMELINE

Start of construction: 2011
Start of operation: 2016

ESTIMATED COSTS

Construction: 20-100 M€ per centre
Operations: 3-8 M€/year per centre

www.eatris.eu



Advancing scientific discoveries into medical applications by a European translational research consortium

Throughout Europe, there is an increasing incidence of cancer, cardiovascular and other diseases like Alzheimer due to higher life expectancy and changes in lifestyle. At the same time the cost of drug development has risen significantly, with declining innovation. Therefore, it is essential to develop new innovative, cost-effective technologies, products and treatment options for patients. In order to generate such new solutions, basic research results have to be “translated” into clinical applications. But biomedical research discoveries stay too often in labs and journals instead of resulting in groundbreaking new therapies and diagnostics.

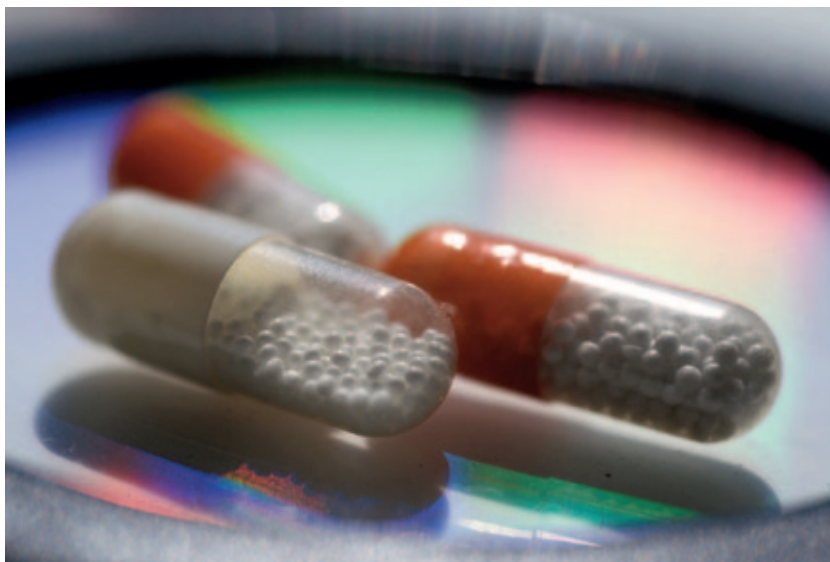
Accelerating and optimizing this translational process is the aim of EATRIS, the European Advanced Translational Research Infrastructure in Medicine. It provides a unique framework that will operate through a pan-European consortium of leading biomedical translational research centres. They cover the entire chain for diagnostic, therapeutic or preventive products up to proof-of-concept in human. Thus EATRIS will give the best brains access to state-of-the-art biomedical research facilities, biomarker facilities, and an environment for clinical trials. This will be complemented with state-of-the-art facilities and patient cohorts from hospitals to strengthen the exchange between science and patients.

Further services are offered by providing expert knowledge in fields such as regulatory issues and quality assurance. A central management promotes quality management and technology transfer and will serve as an entrance portal for users. Close interaction with industry is a crucial aspect in translational medicine. EATRIS de-risk targets for the industry as they can take already advanced product candidates. Access to EATRIS is also available to industrial partners, such as SME and even big pharma.



Connecting Clinical Research in Europe

ECRIN European Clinical Research Infrastructures Network



A new Research Infrastructure makes use of Europe's population size and medical expertise

Before patients can benefit from therapeutic innovations, lab-based developments have to undergo clinical research. This requires large populations of patients and high quality standards. To ensure the successful performance of clinical trials as well as the quality and credibility of the collected data, national networks of clinical research centres and clinical trial units have recently been created in various EU Member States. They provide infrastructures supporting patient enrolment in clinical trials, data management, quality assurance, monitoring, ethics and regulatory affairs.

To date, pan-European trials that take advantage of Europe's population size and medical expertise are hampered by the fragmentation of health and legislative systems in Europe. The mission of ECRIN, the European Clinical Research Infrastructure Network, is to bridge that fragmentation and to foster interoperability between the national infrastructures.

ECRIN currently covers 14 EU countries and is being extended to 9 new countries in Europe. After a profound analysis of the current status, ECRIN now develops strategies, instruments and services to support and coordinate high-quality, independent, and fully transparent multinational clinical research. It aims at synergizing the capacities and capabilities of national clinical research by connecting national coordinating hubs, and thus strives for European harmonisation.

ECRIN provides its services to investigators and sponsors in the preparation and in the conduct of multinational clinical studies, for any category of clinical research and in any disease area. This is particularly relevant for investigator-initiated or small and medium enterprise-sponsored clinical trials, and for clinical research on rare diseases where international cooperation is a key success factor.

PARTICIPANTS

Host Country: France
Number of participating countries: 14

TIMELINE

Start of construction: 2011
Start of operation: expected in 2012

ESTIMATED COSTS

Construction: n.a.
Operations: 3.5 M€/year

www.ecrin.org





➤ Materials and Analytical Facilities



The rate, at which new products can be developed, is closely linked to our ability to characterise materials across a range of spatial and temporal scales. Knowledge generated by Research Infrastructures in materials science – focused on analytic facilities – is essential to ensure future progress such as in the development of new materials for photovoltaic, fuel cells, or insulating materials.

Enlightening Science

European XFEL European X-Ray Free-Electron Laser Facility

PARTICIPANTS

Host Country: Germany
Number of participating countries: 12

TIMELINE

Start of construction: 2009
Start of operation: 2016

ESTIMATED COSTS

Construction: 1,100 M€ (at 2005 price level)
Operations: 77 M€/year (at 2005 price level)

www.xfel.eu



With shorter, faster and stronger X-ray pulses matter can be understood in completely new dimensions

Special tunnels are being constructed under the Hamburg area in Germany. In one of them, an accelerator 2 km in length will bring electrons to high energies. In several other tunnels branching off from the first, the particles will be sent on a slalom course, and thereby induced to emit X-ray flashes of extraordinary quality: The European X-Ray Free-Electron Laser Facility (European XFEL) will generate ultra short 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 3.4 km long facility will attract top-level scientists from all over the world. Using the short wavelength flashes, they will be able to carry out a large variety of experiments: mapping the atomic details of biomolecules and viruses, deciphering the molecular composition of cells, taking three-dimensional images of the nanoworld, filming chemical reactions, or studying processes similar to those in the interior of planets.

This unique new Research Infrastructure will provide X-rays of different properties at different beamlines, each equipped with two experiment stations. Technical, scientific, and administrative support is included. In addition to national and international public outreach measures, lots of local PR activities like public lectures, Hamburg Science Night, Girls' Day inform Hamburg citizens about the European XFEL.

The building of the accelerator structures has impact for industrial partners. It has already yielded innovations in the field of mechanical manufacturing processes, chemical engineering, metallurgy, machine construction and measuring and control technology. This high-end output is applicable in a lot of different technological branches, among others in medical technology, chemical analysis, radar and satellite technology, communications engineering, and chemical plant construction. In addition, young scientist and engineers working for European XFEL acquire highly sophisticated knowledge. While some stay, others change to industry – providing companies with specialists who received excellent training in cutting edge technology and science. Thus, not only science itself but also the provision and development of the infrastructure is to the benefit of society.



At the Heart of Life and Matter

ESRF Upgrade of the European Synchrotron Radiation Facility



As one of the most productive Research Infrastructures in the world, this synchrotron is an extraordinary tool for academic as well as industrial R&D

Proteins are the powerhouse of our bodies. They are needed for the structure, function and regulation of cells, tissues and organs. Being large molecules of up to several hundreds of thousands of atoms, revealing their 3D atomic structure gives invaluable information about body functions and diseases. Scientists use synchrotrons to delve deep into the microscopic and even atomic detail of the world around us. „Seeing“ at the atomic level is essential for fundamental and applied research, and it is a key ingredient of industrial innovation in advanced materials and new drugs.

The ESRF is the largest synchrotron facility in Europe, and with 1800 publications per year the most productive one worldwide. Operational since 1994, it is a high energy, joint facility supported and shared by 19 countries. 12,500 scientists have been using, between 2009 and 2012, one of the 29 ESRF beamlines, to which add 11 national beamlines. They investigated biological molecules, but also matter of all kind like sustainable polymers and nanostructures, archaeological treasures or innovative components for fuel cells.

Synchrotron X-rays, 10 billion times more brilliant than the Sun, are produced by electrons circulating in a gigantic doughnut-shaped accelerator, operated 24 hours a day, six days a week. The ESRF offers its users a full range of support services and world-wide collaborations.

The rapid progress of synchrotron science has allowed scientists to go towards ever complex experiments, with greater speed, higher resolution and more sophisticated sample environments. To maintain Europe's world-leading position and respond to the needs of its users, the ten-year ESRF Upgrade Programme 2009-2018 will deliver a complete renewal of this Research Infrastructure without any significant interruption of operations or reduction of capacity. New cutting-edge technology will make possible new science, which in turn will feed the innovation chain for new products meeting tomorrow's requirements: safe, sustainable, resource- and energy-efficient, and commensurate with manufacturing in Europe.

PARTICIPANTS

Host Country: France
Number of participating countries: 19

TIMELINE

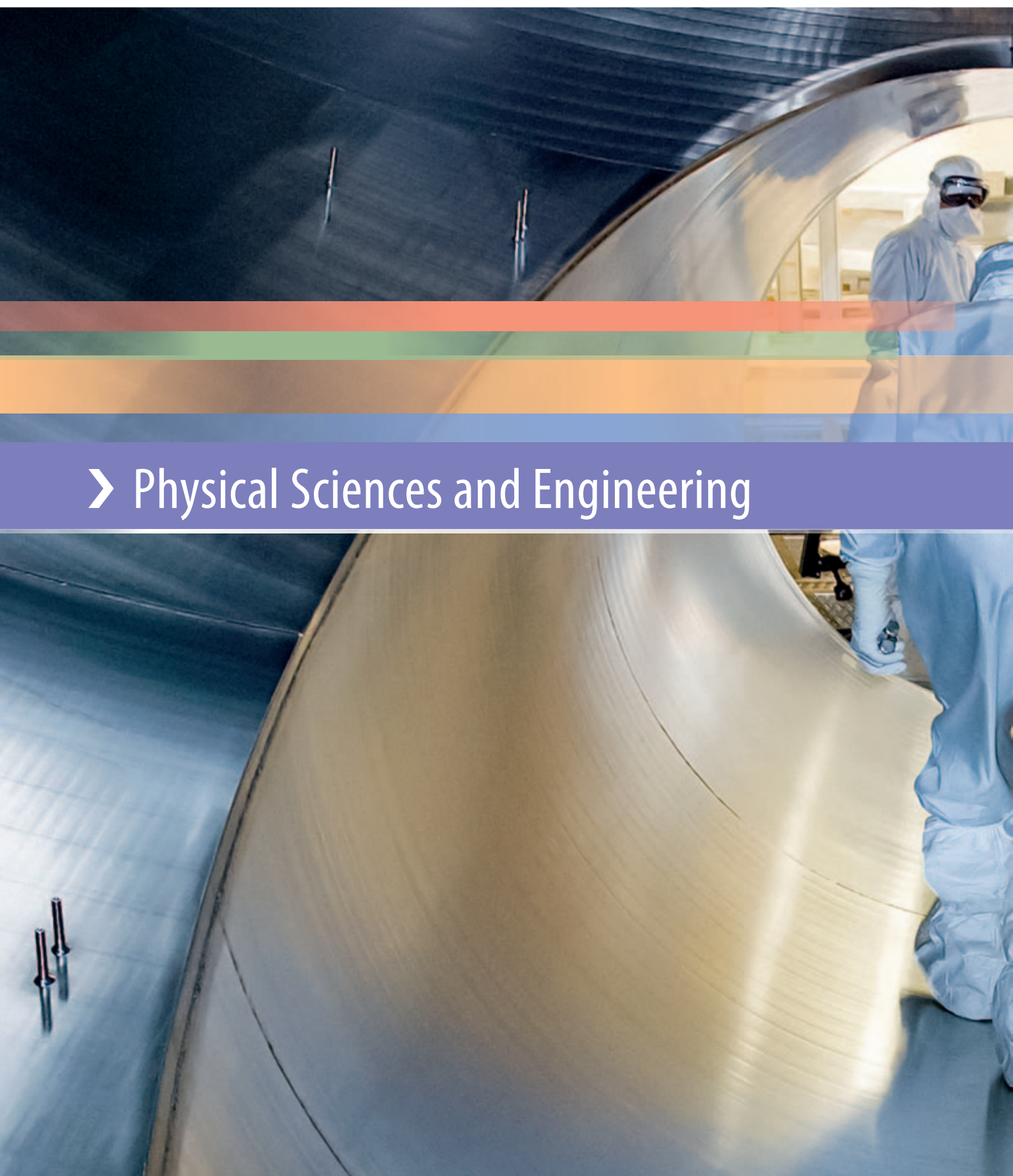
Start of construction: 2009
Start of operation: 2011-2015

ESTIMATED COSTS

Construction: 241 M€
Operations: 80 M€/year

www.esrf.fr

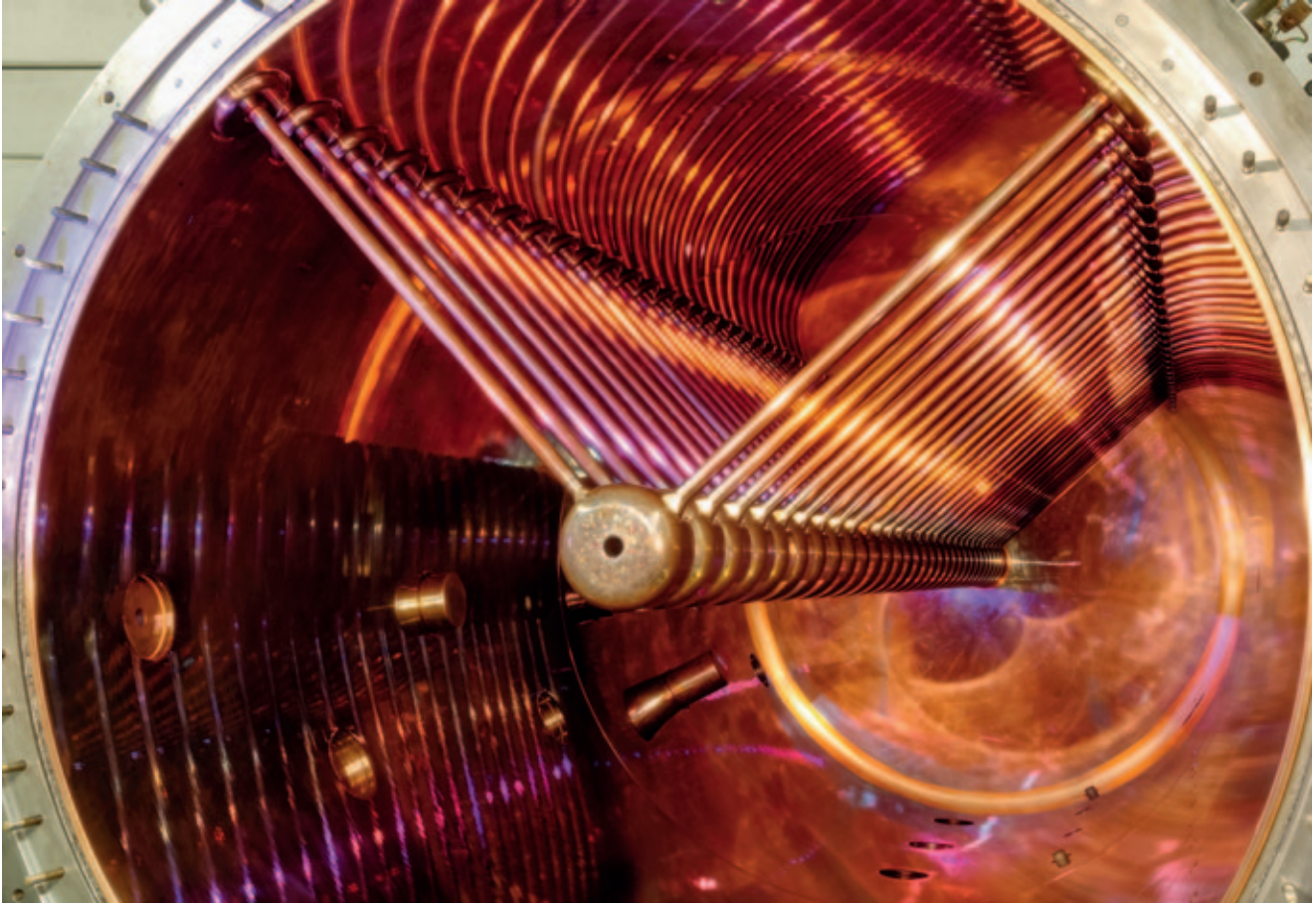




➤ Physical Sciences and Engineering



Engineering and physical sciences cover a wide range of research areas and types of Infrastructures from astronomy and astroparticle physics to particle and nuclear physics as well as nanotechnology. The presented Research Infrastructures deal with the understanding of the evolution of the early universe and with high-power lasers as a fascinating light source for future applications in research and industry.



From the Early Universe to Tumourtherapy

FAIR Facility for Antiproton and Ion Research

A new particle accelerator facility will attract researchers from all over the world

How did matter evolve in the early Universe and why does it look the way it does today? Where do the atomic elements come from? How does the strong force work, which forms the building blocks (nucleons) of atomic nuclei and binds them? In recent decades scientists have built up a deeper understanding of the subatomic constituents of matter in the Universe and the fundamental forces binding them. Nevertheless, there are still significant gaps in our knowledge on both microscopic and cosmic scale.

To answer these fascinating and crucial questions, a new large international laboratory, the Facility for Antiproton and Ion Research, FAIR, is being constructed in Darmstadt, Germany, in a joint effort of currently 10 partner countries. FAIR is a highly sophisticated compact system of particle accelerators and storage rings. It will provide with unprecedented quality high-energy and high-intensity beams of antimatter (antiprotons), and of atoms of all stable and many very short-lived, and therefore extremely rare, chemical elements. Working in international cooperation, more than 3,000 scientists

are expected to carry out experiments that will be complementary to those performed at other international high-energy facilities. Their fields of interests range from the physics of the structure of nucleons and atomic nuclei to that of the electron shell of atoms, and related applications such as plasma physics and tumour therapy with particle beams.

The design, construction and operation of this cutting-edge Research Infrastructure require innovative accelerator and sensor technology. New types of superconducting magnets are needed, and large complex detectors to trace the variety of particles generated in the experiments. New hard- and software solutions for accessing and processing the data that come in at a very high rate are necessary securing the results on large data storage devices. In collaboration with industry, this will lead to a significant transfer of technology know-how to the benefit of society.

PARTICIPANTS

Host Country: Germany

Number of participating countries: 10

TIMELINE

Start of construction: 2011

Start of operation: 2018

ESTIMATED COSTS

Construction: 1,027 M€ (price level 2005)

Operations: 118 M€/year (price level 2005)

www.fair-center.eu



Meeting Complexity with Computing Power PRACE Partnership for Advanced Computing in Europe

PARTICIPANTS

Host Country: France, Germany, Italy, Spain
Number of participating countries: 24

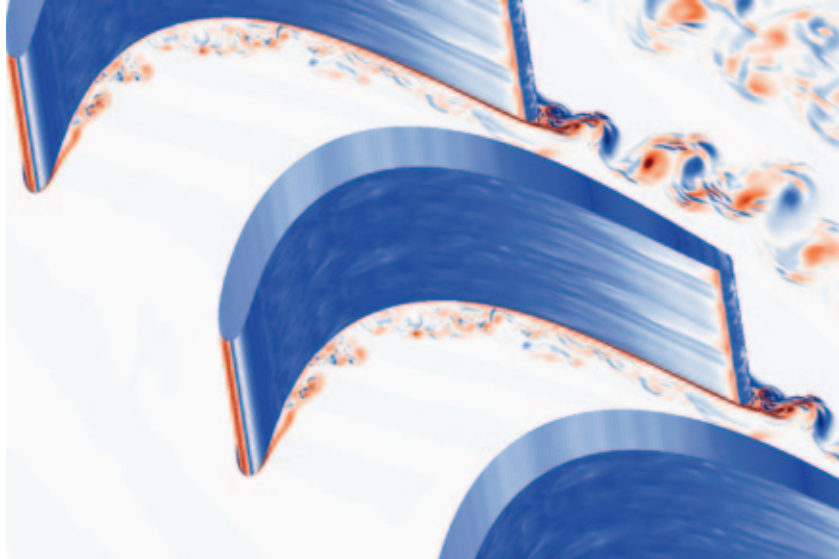
TIMELINE

Start of construction: 2008
Start of operation: 2010

ESTIMATED COSTS

Construction: 400 M€/5 years (2010-2015)
Operation: included in construction costs

www.prace-ri.eu



A pan-European supercomputing infrastructure offers faster access to more reliable scientific results

Increasingly stringent requirements for energy efficiency and noise reduction in jet engines are tightening the screw in their development and design. The Belgium research institution Cenaero is involved in different EU-projects with industrial partners to meet these goals. Thanks to PRACE Cenaero was able to predict noise, for example generated by a flow from propellers or flow instabilities in compressors and fans. Cenaero engineers rely on computer simulations. When run on medium-sized computers, a single simulation aiming to be as physically comprehensive as possible could take several months or even a year. Modern supercomputers such as those made available by PRACE offer much faster access to much more reliable calculation results.

The Partnership for Advanced Computing in Europe – PRACE – a pan-European Research Infrastructure with currently 24 member countries provides access to world-class High-Performance Computing and data management resources and services. PRACE enables large-scale scientific and engineering applications at the highest performance level. This is attractive for academia as well as for Europe's industry – to solve problems in all disciplines, like pharmacy, the optimization of solar cells or materials as well as the understanding of processes in stars.

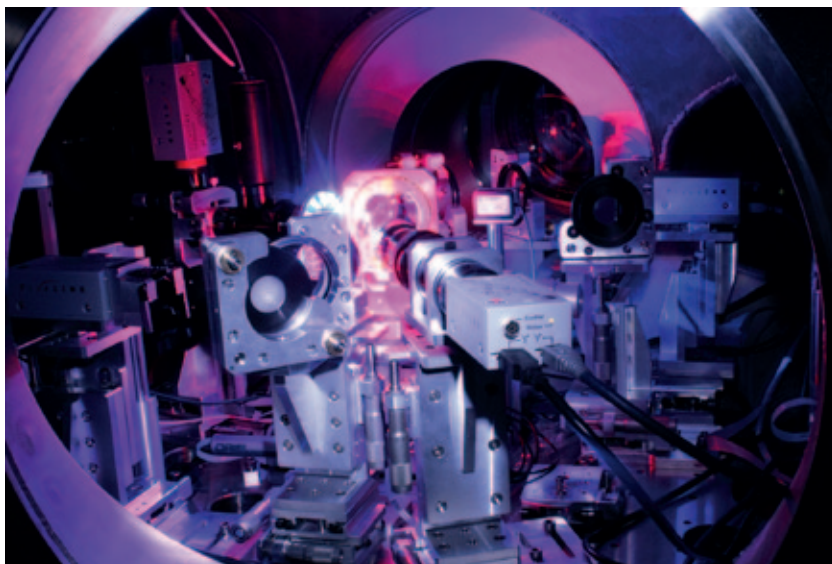
Another example for the power of PRACE is the simulation of million degrees hot plasma. This helps to understand and optimise the magnetic confinement of plasmas for example in fusion reactors that might in the future serve as a CO₂-free energy source.

Since supercomputing is a computational discipline in itself, PRACE undertakes software and hardware technology initiatives with the goal of preparing for the rapid changes in the technologies used. And it provides proper tools, education and training for the user communities to adapt to those changes.



Towards Extreme Light

ELI Extreme Light Infrastructure



Unprecedented laser power enables insights into unrevealed strata of matter from virus to quark

High-power lasers are fascinating light sources that found their place in industry as well as in scientific laboratories as an important scientific tool due to their intense and shapable light pulses. In the last decades, their intensities have increased by several orders of magnitude reaching a frontier where the laws of optics change in a fundamental way. This new generation of highly intense lasers cannot only be used as a scientific tool themselves, but they can generate particles as well as x-ray and gamma-ray beams of unprecedented quality when focused onto different targets.

To make these powerful tools available for the scientific community, the Extreme Light Infrastructure (ELI) has been founded. ELI will be the first scientific Infrastructure in the world to enable the investigation of the interaction between light and matter with the highest intensity, in the so-called ultra-relativistic range. With its ultra-intense and ultra-short pulses of light it will create new states of matter in dense plasmas or produce secondary radiation of high-energy photons or particles which, in turn, will enable higher contrast in imaging and better time resolution to understand fundamental dynamic processes in such different species as nuclei, atoms or biological cells.

ELI is the first pan-European Research Infrastructure to be fully located in new EU member states. The facility will be built on three sites: ELI Beamlines will be located in the Czech Republic. It will create a new generation of secondary sources for interdisciplinary applications in physics, medicine, biology and material sciences. ELI Attosecond is being arranged in Hungary and is to be focused on physics and applied sciences with ultrashort optical pulses of attosecond (10^{-18} s) order. ELI Nuclear Physics will be located in Romania and aims for the first time at the investigation of the interaction of laser light and extremely performing gamma beam with atomic nuclei, which opens up a new field of fundamental physics. A fourth facility, dedicated to ultra-high intensity fields, could be added later; the site is still to be chosen.

On top of fundamental research, ELI will have a considerable impact on new technical developments such as diode-pumped high-power lasers, new generation imaging techniques or small-size laser particle accelerators. It will become a driver for the socio-economic development of the hosting regions and for their integration in the European Research Area.

PARTICIPANTS

Host Country: Czech Republic, Hungary, Romania
Number of participating countries: 13

TIMELINE

Start of construction: 2011
Start of operation: 2016

ESTIMATED COSTS

Construction: 825 M€
Operation: under evaluation

www.extreme-light-infrastructure.eu



➤ Overview of the ESFRI Projects

➤ Social Sciences and Humanities

- CESSDA** Facility to provide and facilitate access of researchers to high quality data for social sciences
- CLARIN** Research Infrastructure to make language resources and technology available and useful to scholars of all disciplines
- DARIAH** Digital infrastructure to study source materials in cultural heritage institutions
- ESS** European Social Survey to monitor long term changes in social values
- SHARE** A data infrastructure for the socio-economic analysis of ongoing changes due to population ageing

➤ Environmental Sciences

- COPAL (ex EUFAR)** Long range aircraft for tropospheric research
- EISCAT_3D Upgrade** Upgrade of the EISCAT facility for ionospheric and space weather research
- EMSO** Multidisciplinary Seafloor Observatory
- EPOS** Infrastructure for the study of tectonics and Earth surface dynamics
- EURO-ARGO** Ocean observing buoy system
- IAGOS** Climate change observation from commercial aircraft
- ICOS** Integrated carbon observation system
- LIFEWATCH** Infrastructure for research on the protection, management and sustainable use of biodiversity
- SIOS** Upgrade of the Svalbard Integrated Arctic Earth Observing System

➤ Energy

- ECCSEL** European Carbon Dioxide and Storage Laboratory Infrastructure
- EU-SOLARIS** The European SOLAR Research Infrastructure for Concentrating Solar Power
- HIPER** High power long pulse laser for fast ignition fusion
- IFMIF (GLOBAL)** International Fusion Materials Irradiation Facility
- JHR** High flux reactor for fission reactors material testing
- MYRRHA** Multipurpose hYbrid Research Reactor for High-technology Applications
- Windscanner** The European Windscanner Facility

➤ Biological and Medical Sciences

- ANAE** Infrastructure for Analysis and Experimentation on Ecosystems
- BBMRI** Bio-banking and biomolecular resources Research Infrastructure
- EATRIS** European advanced translational Research Infrastructure in medicine
- ECRIN** Pan-European infrastructure for clinical trials and biotherapy
- ELIXIR** Upgrade of the European life-science infrastructure for biological information
- EMBRC** European marine biological resource centre
- Erinha** Upgrade of the High Security Laboratories for the study of level 4 pathogens
- EU-OPENSREEN** European Infrastructure of Open Screening Platforms for chemical biology
- EuroBioImaging** Research Infrastructure for imaging technologies in biological and biomedical sciences
- Infrafrontier** European infrastructure for phenotyping and archiving of model mammalian genomes
- INSTRUCT** Integrated Structural Biology Infrastructure
- ISBE** Infrastructure for Systems Biology – Europe
- MIRRI** Microbial Resource Research Infrastructure

➤ Materials and Analytical Facilities

- EMFL** European Magnetic Field Laboratory
- ESRF** Upgrade of the European Synchrotron Radiation Facility
- ESS** European Spallation Source
- EUROFEL (ex-IRUVX-FEL)** Complementary Free Electron Lasers in the Infrared to soft X-ray range
- European XFEL** Hard X-Ray Free-Electron Laser
- ILL 20/20** Upgrade of the European Neutron Spectroscopy Facility
- PRACE** Partnership for Advanced Computing in Europe

➤ Physical Sciences and Engineering

- CTA** Cherenkov Telescope Array for Gamma-ray astronomy
- E-ELT** European Extremely Large Telescope for optical astronomy
- ELI** Extreme Light Intensity short pulse laser
- FAIR** Facility for Antiproton and Ion Research
- KM3NeT** Kilometre Cube Neutrino Telescope
- SKA (GLOBAL)** Square Kilometre Array for radio-astronomy
- SPIRAL2** Facility for the production and study of rare isotope radioactive beams

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