ESRF – The European Synchrotron

The ESRF in a nutshell

The ESRF is a synchrotron research facility and global leader in its field. It is supported and shared by 21 countries. It circulates electrons in a 844m-circumference storage ring so that they emit beams of intense X-rays, which are used by researchers from academia and industry to study the inner structure of materials and living matter down to the atom.

Founded in 1988, the ESRF began operations in 1994 and has since exceeded all initial objectives. Today, the success of the ESRF is demonstrated by more than 4,000 users from all over the world who visit the ESRF every year to carry out experiments at the frontiers of knowledge, and through the ambitious upgrade programme which is preparing the tools necessary to meet the next 20 years of challenges in synchrotron science.

Nearly 25,000 scientific refereed articles based on work carried out at the ESRF have been published during the last 20 years, many in the world's foremost peer-reviewed journals.

ESRF – some key figures for 2013
6 GeV, 200 mA, time structured filling modes
5502 Hours of user operation
1296 Hours of machine dedicated time
98.9 % Reliability
77 906 M€ Operations budget
30 868 M€ Upgrade Programme investment
1967 Scientific Proposals received
845 Scientific Proposals accepted
~ 1800 Publications per year in peer reviewed journals

The ESRF hosts 42 specialised X-ray beamlines equipped with state-of-the-art instrumentation which are unique in their performance in Europe and worldwide.

As an internationally funded facility organised as a French non-profit company, the ESRF supports users on the basis of scientific excellence, in particular those from its partner countries, and carries out the necessary research and development work in synchrotron techniques.

After 20 years of successes, the ESRF is undergoing an innovative upgrade programme, ESRF UP, which will strengthen its global leadership in X-ray science by:

- Making the ESRF home to the world's first ultimate hard X-ray synchrotron facility,
- Providing a new suite of beamlines with routine *nano*-X-ray beams and *nano*-imaging capabilities ,
- Unlocking new research avenues in the *nano*-world,
- Generating state-of-the-art instrumentation and data taking capacities,
- Offering exciting opportunities for a new generation of synchrotron scientists.

ESRF – The European Synchrotron

The Societal Impact of the ESRF

The primary return of the ESRF to society is scientific and technological knowledge, which is shared by the whole scientific community and in particular by researchers from partner countries. All inventive research carried out at the ESRF propagates to society and impacts the scientific cultures and the economies of its member states and beyond. Moreover, industry strongly benefits from and supports fundamental research using the ESRF.

Since its creation in 1988 the ESRF has returned contracts to commerce and industry totalling more than €2bn. This feeds directly and indirectly into the economies of partner countries, for example through training and capability building in education and industry.

The ESRF impacts society at many levels:

- Taking science into new territories,
- Generating research programmes for young scientists,
- Driving innovation and creating business,
- Training highly skilled individuals for the European labour market,
- Disseminating results and achievements.

The ESRF's impact is felt in all partner countries such as helping to improve the performance of industry and making possible the discovery of new materials and products that enhance European competitiveness.

The research programmes carried out at the ESRF rely on an impressive number of young researchers, PhD students and post-doctoral fellows.

In addition to training highly skilled staff, the ESRF has a strong track record in disseminating synchrotron methods and techniques to other facilities.

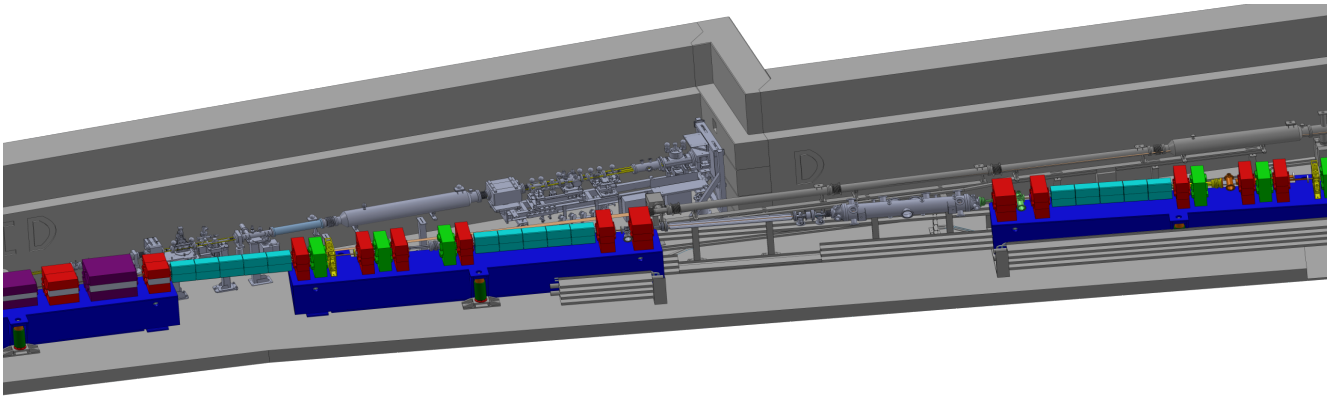
Having access to the most efficient synchrotron worldwide has become a strategic advantage for Europe.

The significance of these benefits has provided a strong support for investing into a new chapter in the ESRF's life: building an ultimate X-ray source in Europe.

ESRF – The European Synchrotron

The ESRF upgrade in short and the launching of the UP Phase II in 2015

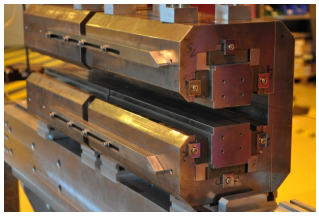
Initiated through the funding by the FP7 Capacities Programme, the ESRF Upgrade has been on the Roadmap of the European Strategy Forum on Research Infrastructures (ESFRI) since its inception. ESRF UP is a two-stage process. ESRF UP Phase I (2009-2015) is nearing completion and will provide a new generation of beamlines and experimental stations. ESRF UP Phase II (2015-2022) is about to launch.

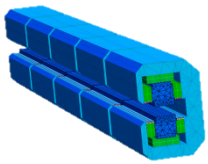


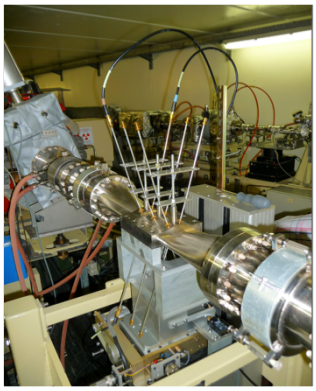
ESRF UP Phase II is centred on an enhanced X-ray source that reduces the horizontal spread or "emittance" of the ESRF's beams to unprecedented low values.

It involves:

- The construction and the commissioning of a new accelerator lattice in the storage ring,
- The construction of four state-of-the-art beamlines to exploit the brilliance and coherence of the new X-ray source,
- The development of unique instrumentation and support facilities to exploit the new X-ray source.







Permanent magnet prototypes for the new ring

Beam position monitor prototype for the new ring

Phase II of ESRF UP will:

- Make the ESRF synchrotron light source more than 30 times brighter than ever before,
- Increase the coherence of the X-ray beams to levels approaching those of lasers,
- Boost instrumentation capacities,
- Enable new technologies in magnet, radiofrequency and vacuum systems,
- Reduce the energy consumption of the storage ring by 20%,
- Optimise returns on previous investments by a 90% re-use of existing infrastructure.

Phase II will benefit from the ESRF staff expertise for a swift realisation.

Also benefitting the environment, the ESRF UP Phase II will be significantly more "green" and more energy efficient than the present storage ring, significantly reducing wall-plug power consumption.

In a nutshell, ESRF UP will open a new chapter in X-ray science by enabling spatial information in the studies of materials and living matter down to the level of a few tens of individual atoms.