IA-SFS: Integrating Activity on Synchrotron and Free Electron Laser Science

Europe has taken a leadership position in the scientific and technological exploitation of the very bright light sources made possible by modern particle accelerators, with emphasis on multidisciplinary integration. Synchrotron and free electron laser (FEL) light sources are very useful tools in physics, material sciences, chemistry, biology, imaging and microfabrication, archaeology and cultural heritage. The EU-funded IA-SFS project comprises 16 laboratories from 8 different countries, of which 12 host a synchrotron source, 3 host a free electron laser and 1 is the European Molecular Biology Laboratory (EMBL).

LIGHT, BUT NOT AS WE KNOW IT

Synchrotrons are rings, measuring several hundred meters in circumference, in which high-energy electrons orbit at close to the speed of light. As they are deflected by magnetic fields, they emit radiation. This radiation can be very useful for various purposes, because it can be channelled into narrow, intense beams with precisely controlled wavelengths ranging from the far infrared to the hard X-rays. Each wavelength range allows for different microscopic techniques permitting the analysis and control of matter at nano-scale levels. For example, a common use for synchrotron radiation is in the form of X-rays which can be used to map the positions of atoms using the technique known as X-ray diffraction. Synchrotron X-rays and short-wave ultraviolet light are also used to make computer chips, while terahertz waves can be used also in medical diagnoses and security screening.

The same principle of generating radiation lies behind another type of device, the free electron laser (FEL). Starting with a linear beam of electrons accelerated to a speed close to that of light, the FEL uses a series of magnets to push the electrons into a sinusoidal path. The resulting rapid changes in direction force the electrons to emit light flashes more intense and shorter than what is obtained in synchrotrons, and whose wavelength can be easily tuned. FELs can produce waves from terahertz to hard X-rays, which are valuable in measuring microscopic dynamic properties.

Using synchrotrons and FEL light sources, scientists can explore the nature of chemical bonds in a new compound, investigate the bonding of molecules absorbed onto a solid surface, probe the arrangement of atoms in a biological macromolecule, provide three-dimensional images of tissue samples and etch nanometric patterns for a variety of industrial applications.

The IA-SFS project plans to create a "common market" of synchrotron and FEL light sources, opening up the most advanced network of facilities in the world to all qualified and approved European users.

PROMOTING ACCESS, DEVELOPING FACILITIES

IA-SFS has three basic strategic objectives. It is supporting targeted networking activities, including support for specialised workshops and dissemination activities through conferences, with the twin objectives of stimulating new ideas for transnational collaboration and preparing new generations of users. It organises joint research activities, involving different facilities in projects to develop new instrumentation and techniques, with the aim of boosting the facilities' effectiveness in serving researchers and contributing to the development of novel sources in synchrotron radiation and FELs.

Thirdly, IA-SFS is supporting "Transnational Access" which is, simply put, freeing up resources for scientists to perform experiments in top-level facilities located in other countries. European synchrotron radiation and FEL laboratories already have a good record of opening their doors to researchers from abroad, and the Transnational Access Activities of IA-SFS are building on this foundation.

Europe already has the world's most advanced network of synchrotron and FEL sources. EU funding is allowing IA-SFS to coordinate and improve access to these facilities, with consequent benefits for the European science base.

SIXTH FRAMEWORK
PROGRAMME

EUROPEAN COMMISSION

INTEGRATING ACTIVITY ON SYNCHROTRON AND FREE ELECTRON LASER SCIENCE IN SUMMARY

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Project webpage: www.elettra.eu/i3/
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