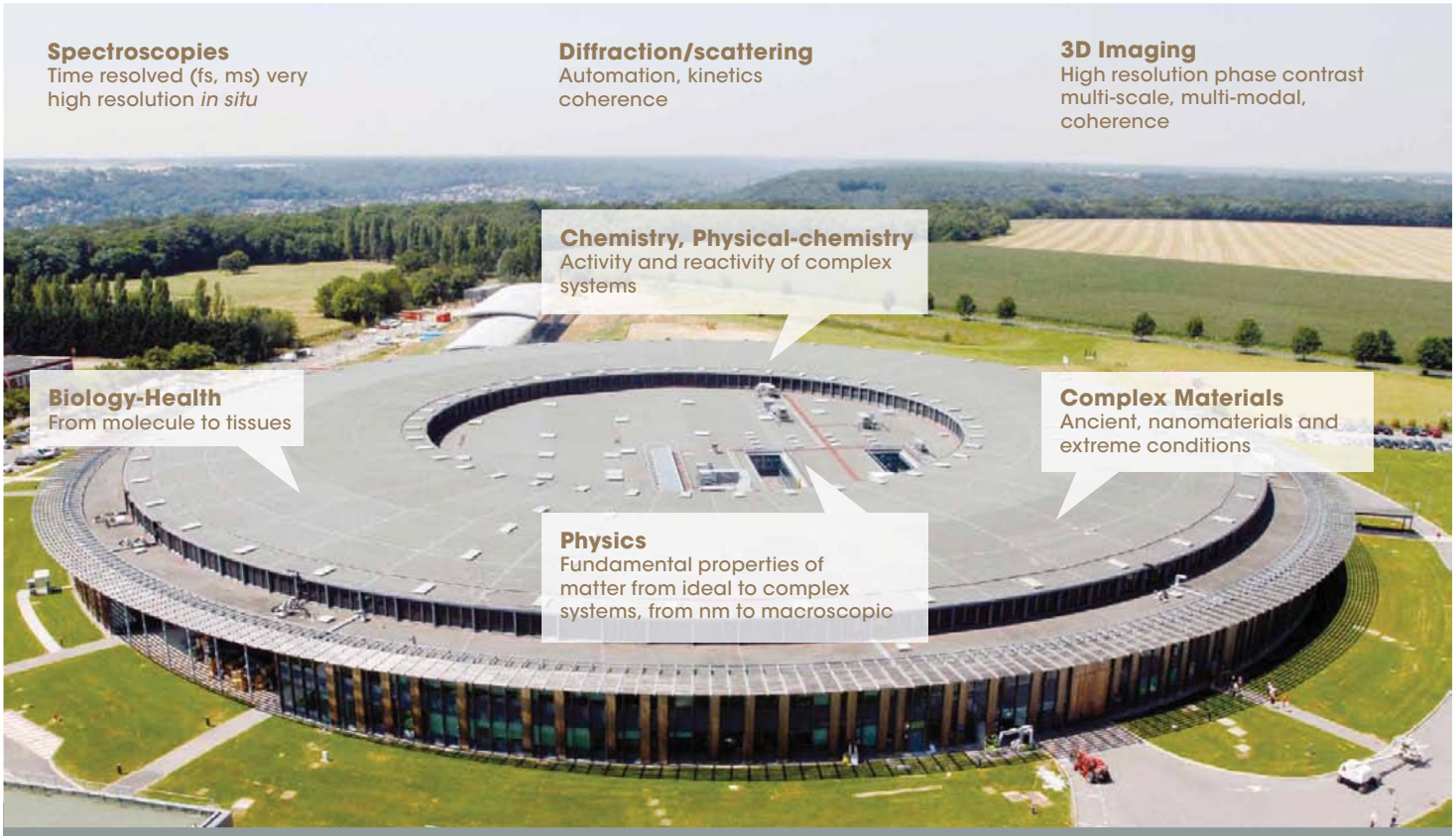
ORIENTATION

SOLEIL's strategic plans

SOLEIL is focusing its efforts and performances on four strategic areas: chemistry and physical chemistry, biology and health, complex materials and ancient materials, and finally physics.



The specificities of the 26 SOLEIL beamlines operating in 2013, with three new beamlines in the pipeline for 2015, and the expertise of the scientists who run them, reflect its strategic goals. Chemistry and physical chemistry concentrate on the study of the properties of complex model systems. Biology and health covers the study of isolated molecules right up to cells and tissues. The complex materials and ancient materials field spans the study of their structures on the nanometer scale to their properties under extreme conditions, while physics leans towards the fundamental properties of matter, aiming to make the link between isolated systems and those placed in a complex environment.

Chemistry

Regarding chemistry and physical chemistry, the specificity of synchrotron radiation is to provide a wide spectral range of X-rays perfectly adapted to the identification, quantification and speciation of the chemical elements involved, regardless of the structural and molecular organization of the sample in which they are present: liquid, gel or solid. Relying on technological developments in terms of focusing the X-ray beam, selecting its wavelength and its detection length, it is now possible to map characteristics with micrometer resolution under native conditions,

as well as time-resolved studies of structural transitions in the millisecond range. Specifically, these may concern, for example, the characterization of nucleation and growth phenomena, the study of catalysts during reactions, and studies on the organization, structure and reactivity of soft interfaces and self-assemblies.

Biology and Health

In the broad field encompassing biology and health, the whole spectrum of radiation provided by SOLEIL, from infrared to hard X-rays, is used for multi-modal and multi-scale analysis of live material. Beamlines have been designed specially to allow the study of isolated macromolecules on the atomic scale up to two- and three-dimensional quantitative imaging of cells and tissues at spatial resolutions of a few tens of nanometers. The methods available include X-ray diffraction and scattering, IR and VUV spectromicroscopy, X-ray absorption and fluorescence, and the use of coherent X-ray tomographic imaging under non-destructive and very high resolution conditions. Offering methods unique to synchrotron radiation and leading-edge instrumentation with the latest available technologies, the eight beamlines involved provide morphological and functional information resulting from an integrative approach to biology and its applications in pharmacology and biomedicine.

Physics

In fundamental physics, the emphasis is on very high spectral or angular resolution, thereby providing users with unprecedented characterization tools for both spectroscopy and diffraction based structural analysis. The spectral range available goes from the far IR (even in the THz, i.e. a few cm-1) to hard X-rays. Analyzers and spectrometers available are at the forefront of current technology with complex sample environments that make it possible to establish a continuum between a perfectly characterized isolated system and the same system placed under «real» conditions (high pressure, matrices, nanoparticles, aerosols, etc.). This also goes for studies at reduced lateral scales (using microscopes or nanobeams), which allow or will allow linking the properties of matter at the local level and the properties of samples on a macroscopic scale (so-called mesoscopic approach). A special effort has been made at SOLEIL to promote time-resolved studies by means of pump-probe experiments coupling laser and synchrotron radiation on the scale of a few ps or fs.

Paul Morin (on the left) and Jean-Pierre Samama, scientific directors of SOLEIL.

Materials

Finally, in the materials field, the aim is to characterize advanced materials to better control their functionalization or behavior in extreme situations (stress and strain, pressure, temperature, radioactivity etc.) To this end, a special effort has been made to enrich the range of observation conditions, often by combining several experimental techniques requiring the use of several beamlines for the same project. Regarding heritage material, an original approach is being developed with the construction of the IPANEMA platform next to the synchrotron to receive and optimize long-term projects.

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