Biology, chemistry, and surfaces: three support laboratories at SOLEIL

After a beamline commissioning[1] period and tests by the SOLEIL teams, followed by the arrival of expert team members, the teams of the nine beamlines operating so far at SOLEIL welcomed the first external users. To complement the beamlines, three laboratories are also available to users.

The Biology, Chemistry and Surface laboratories at SOLEIL are brand new and in working order, even though the Surface laboratory is still waiting for the last few instruments. The teams in charge of these laboratories, each consisting of a research scientist and an engineering assistant, also welcomed their first external users in January. Their work in collaboration with the managers of the SOLEIL beamlines, however, had already begun several months ago. Like the beamlines, the laboratories have a dual function: to be open to users as well as to SOLEIL scientists for their own research.

Two chemistry laboratories

For chemistry, this dual function is reflected in the facilities, since two laboratories have been set up on the site: the first is for external users, and the second is for internal scientific projects. To set up these laboratories, Stéphanie Blanchandin considered the requirements of beamline managers and their future beamline users, particularly as revealed at the first SOLEIL Users' Meeting held in January 2006, a few months after her arrival at SOLEIL.

"Given the number of disciplines in chemistry, it was impossible to provide very specific equipment for each one: organic chemistry, inorganic chemistry, electrochemistry, etc.," she explained. "The lab therefore has a more generalised function, and contains all the basic equipment for characterising samples or preparing them before putting them in the beamlines. The glove box, for example, lets you work in a chosen controlled environment, required for certain sensitive materials. A lyophilize device was purchased at the request of several beamline scientists. Those are just a few examples." (See Table 1).

Figure 1: Stéphanie Blanchandin busy with the glove box, in the Chemistry Laboratory.

There is strong interaction with SAMBA (x-ray absorption spectroscopy), which was the first operational 'chemistry-oriented' beamline at SOLEIL. Ph.D. students and postdocs have already come to work at the Laboratory on topics concerning the mechanisms of titanium oxide nanoparticle formation by soft chemistry and the controlled release of drugs inserted in hybrid (organic-inorganic) matrices. Whilst awaiting the requirements of the other beamlines and their users.

Scheduled for 2008, the creation of a storage facility for chemical and biological products, intended to store new products and waste. This facility, with a surface area of approximately 100 m^2, will be located outside the synchrotron building, and should be operational in 2008.

A "P2" Biology laboratory

Since coming to SOLEIL at the end of 2006, Paloma Fernández-Varela has gone from

	Biology laboratory	Chemistry laboratory	Surface laboratory
Team in charge	**Paloma Fernández-Varela (head)** **Blandine Pineau (assistant engineer)**	**Stéphanie Blanchandin (head)** **Karine Chaouchi (assistant engineer)**	**Stefan Kubsky (head)** **François Nicolas (assistant engineer)**
Equipment available	**Scientific instruments** PCR, electrophoresis and blotting systems, protein liquid chromatography system (FPLC), UV/visible spectrophotometer, imager (fluorescence, chemoluminescence). **Experimental devices and equipment** Cold room, fumehood, safety cabinet, laboratory benches, sinks, autoclave, -20°C and -80°C freezers, vacuum pump, ultra pure water, pH meter, magnetic agitators, cryothermostat, vortex, concentrator, bacteriological oven, centrifuge, microcentrifuge, sonicator, incubator.	**Scientific instruments** Raman spectrometer*, Raman microscope, UV/visible spectrometer*, optical microscope, differential scanning calorimeter* (DSC). **Experimental devices and equipment** Fumehoods, sinks, laboratory benches, 220°C oven, fume cupboards for solvent storage, vortex, balances (to 0.1 mg), ultrasonic cleaner, freezer, sieve, mortars, press/pellet equipment, vacuum filtration, ultrapure water, pH meter, glove box, dessicators, lyophilize device, centrifuge, vacuum tube furnace / inert atmosphere (max t°: 1100°C), muffle furnace.	**Scientific instruments** Variable temperature scanning tunneling microscope, UHV metals evaporator, Auger spectrometer, Argon gun, low energy electron diffraction spectrometer (LEED), spin coater, optical microscope with CCD camera. **Experimental devices and equipment** Mobile UHV chamber, fumehood, laboratory bench, sink, laminar flow hood, point soldering tool, ultrasonic bath.

Table 1. Description of the three support laboratories: personnel, equipment, and scientific facilities available.
*** Instrument shared with the SAMBA beamline.**

being a "user" to the status of "head of the Biology Laboratory". She knows synchrotrons well, having used them since the time when she was working on her molecular biology and biochemistry thesis, specialising in the crystallography of proteins. Her specialist knowledge in this area helps in her interactions with the scientists of the biocrystallography beamlines, PROXIMA 1 and 2, but also with the beamlines: SWING (small angle scattering), SMIS (IR microscopy and spectroscopy) and DISCO (dichroism, imaging, mass spectrometry) also work or will work with the Biology Laboratory.

"The laboratory has a P2[2] rating," explains Paloma, because we will be handling *E. coli* bacteria, the host most often used in the cloning of recombinant proteins. The idea is to produce proteins of interest (bacterial or otherwise) via *E. coli* after inserting the coding gene for each protein of interest into the genetic material of *E. coli*.

To comply with the new standard that came into force last summer, we have installed a "Laminar Flow Cabinet". We also have the classic molecular biology and biochemistry equipment: PCR, electrophoresis, chromatography, etc. Everything used to clone, produce by bacterial culture, purify, and store recombinant proteins. On the other hand, we do not have cellular biology equipment. That will be on the DISCO beamline." (See Table 1)

Paloma has also taken on an additional job: checking that all "biology" projects proposed and accepted by the Programme Committees comply with SOLEIL safety standards. For other scientific topics, this role is fulfilled by the Safety Group.

UHV[3] Surfaces and Technology

Stefan Kubsky, head of the Surface Laboratory (LaSu), is also familiar with the "world of synchrotrons". He was an occasional user, but also has a commercial connection: he worked for a manufacturer of scientific instruments for several years. During that time, he even negotiated with SOLEIL about the aquirement of a supraconducting undulator!

"Being in charge of the technology watch on synchrotrons, I knew what type of machine SOLEIL would be. The characteristics and qualities of this machine would determine the science that would be done on it. I wanted to contribute to its creation."

Like his Biology and Chemistry colleagues, Stefan designed the LaSu "from the ground up", by adapting a basic document, the "Technical Specifications of Requirements", to the expectations of researchers, both outside and at SOLEIL.

"The Laboratory provides added value above and beyond the beamlines. It can be used for complementary tests on the samples, most notably using the scanning tunneling microscope, as well as other standard devices such as an optical microscope.

The LaSu can also be used to prepare samples for testing on the beamlines and to transfer them to the beamlines using a mobile UHV chamber, due in the spring. We offer scientific and technical support in the field of UHV.

Not all of the equipment planned is available at this stage," says Stefan, "but we have started to welcome SOLEIL users and researchers internally." (See table)

Multi-project collaborations have already started, involving the DIFFABS (diffraction, absorption, x-ray fluorescence) and TEMPO (soft x-ray time-resolved spectroscopy) beamlines, and concerning the properties of intelligent diamonds and the functionalisation of the surfaces of semi-conductors. The SIXS beamline (x-ray scattering) is also already a user of LaSu in the context of a Ph.D. project, and CASSIOPEE (soft x-ray photoelectron spectroscopy), DEIMOS (x-ray magnetic circular dichroism), and ANTARES (angle-resolved photoemission spectroscopy, photoelectron diffraction) also belong to the "network".

The three laboratories are open around the clock to users who stated in their project proposal that they wished for that type of access. And so, equipment, advice and expertise are all available to users...

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Figure 3: Stefan Kubsky (on the left) and François Nicolas in the Surface Laboratory

Figure 2: the team in charge of the Biology Laboratory, Paloma Fernández-Varela (on the left) and Blandine Pinon.

1 Commissioning: life-sized test phase, which continues until the expected performance characteristics are achieved.

2 Risk group P2: presence of a biological agent which is potentially pathogenic to humans, but whose propagation is unlikely, and for which effective prophylactic measures or treatments exist.

3 UHV: ultra-high vacuum