IL NUOVO CIMENTO Vol. 30 C, N. 1 Gennaio-Febbraio 2007
DOI 10.1393/ncc/i2006-10034-x

Dedicated liaison office for cultural heritage at the SOLEIL synchrotron(*)

L. Bertrand(1)(**) and J. Doucet(2)

(1) *Archaeology and heritage liaison office, Synchrotron SOLEIL - Saint-Aubin, BP48 F-91192 Gif-sur-Yvette cedex, France*

(2) *Laboratoire de physique des solides, UMR 8502, Université Paris-Sud - Bât. 510 F-91405 Orsay cedex, France*

(ricevuto il 31 Ottobre 2006; pubblicato online il 22 Febbraio 2007)

Summary. — Starting January 2004, the SOLEIL synchrotron has set up a dedicated interface for cultural heritage (art and technology history, archaeology, conservation and restoration). The present contribution aims at summarising the activities of the interface for the period 2004-06. A first step consisted in a detailed survey of the current context of synchrotron usage for cultural heritage through strong interactions with actors of the field, an extensive review of the existing publications and the co-organisation of specific workshops and round tables. From this preliminary survey, the interest of a dedicated project involving European research infrastructures is clearly emphasised. Such a project should focus on solving the major issues and limitations encountered by the heritage community in its use of advanced characterisations techniques.

PACS 07.85.Qe – Synchrotron radiation instrumentation.
PACS 87.59.-e – X-ray imaging.

1. – Introduction

In January 2004, the SOLEIL synchrotron announced its aim to develop actively an interface on heritage research. Simultaneously, the French National Research Center (CNRS) launched a 4-year national concerted action (*"groupement de recherche"*, or GdR) named *Matériaux du Patrimoine et synchrotron SOLEIL* (Heritage materials and SOLEIL synchrotron).

(*) Paper presented at the Workshop "RICH—Research Infrastructures for Cultural Heritage", Trieste, December 12-13, 2005.

(**) E-mail: loic.bertrand@synchrotron-soleil.fr

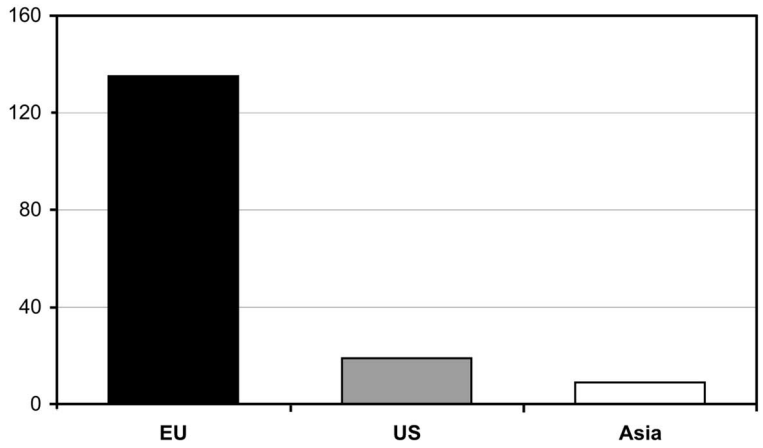

Fig. 1. – The European synchrotrons play a major role in heritage research, as shown from the number of heritage publications signalling the use of the corresponding facilities (time span 1986-Nov. 2005).

Before the start of operations of the facility, the target of the liaison office has been to clarify the needs of the cultural heritage community for synchrotron spectroscopy, diffraction and imaging techniques and to identify the major gaps in the current situation.

2. – Analysis of the needs expressed by the heritage community

Figures on the use and needs for synchrotron from the heritage community can be extracted from a variety of sources, primarily a review of the existing synchrotron/heritage publications (time span: 1986-Nov. 2005; number: 170) made publicly available and regularly updated [1] and reports from the *LabsTech* network activities [2]. Direct interaction with a number of groups at an international level helped us to identify the major gaps to solve in a near future.

2˙1. *Research areas*. – The review of existing publications clearly shows that a variety of prominent heritage fields can benefit from synchrotron techniques: history of art and technologies, alteration and corrosion, studies in conservation and restoration, provenancing and attribution of works and objects. The variety of the fields under the general term "cultural heritage" should not be under-estimated and the focus of synchrotrons on a restricted set of topics is by no means satisfactory to the heritage users community.

2˙2. *Synchrotron usage*. – Publications show that European synchrotron sources have strongly contributed to this field compared to Americas and Asia. Facilities from three countries have played a prominent role from 1986 to 2005: France (LURE/SOLEIL and the multinational facility ESRF), the UK (SRS) and Germany (HASYLAB and BESSY primarily) (see figs. 1 and 2).

The current work done at synchrotron facilities on heritage is mainly carried out by a fraction of expert users. These users usually belong to regular laboratories in direct contact with museum conservators, curators or archaeologists. They constitute what could be called *interface* groups or laboratories.

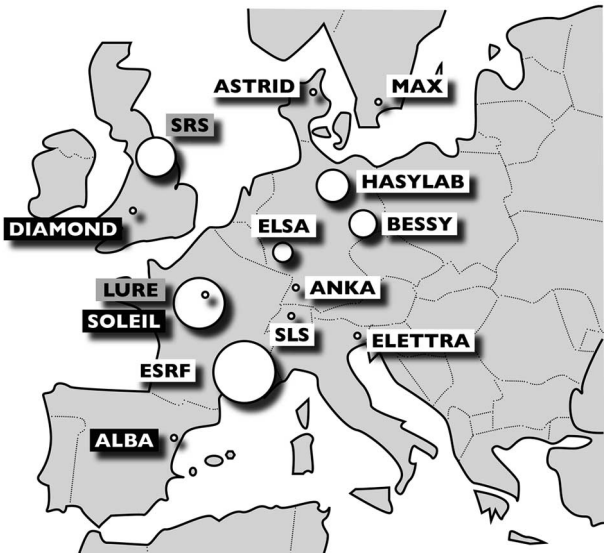

Fig. 2. – Schematic map of Europe showing the number of publications reporting the use of synchrotron techniques on heritage materials. *The dot* (◯) *area is proportional to the number of heritage publications for each facility.*

2˙3. *Techniques.* – As clearly shown by the data gathered by the *LabsTech* network, European "cultural heritage" research institutions are heavy users of laboratory methods such as infrared microscopy, X-ray diffraction, X-ray fluorescence and radiography, all among the top ten methods used to study ancient materials [3]. These methods find direct counterparts at synchrotrons with μm-scale imaging capabilities, extremely short acquisition times and a strongly increased analytical sensitivity. The use of the imaging mode is particularly high for this community (fig. 3).

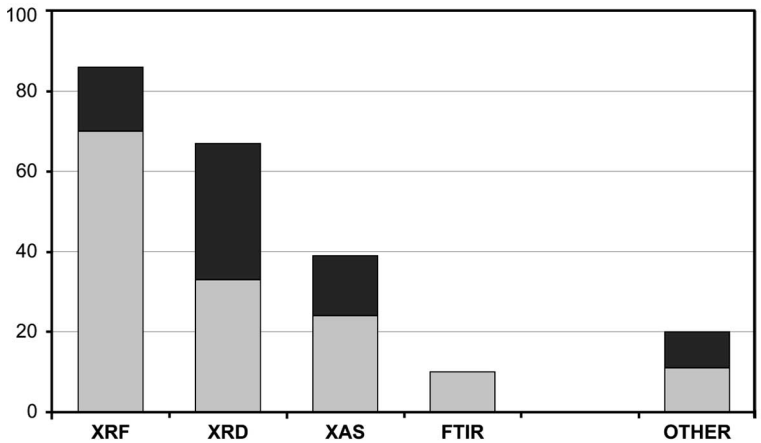

Fig. 3. – The synchrotron methods most widely used for heritage research are XRF *(X-Ray fluorescence)*, XRD *(X-Ray diffraction)*, XAS *(X-ray absorption)* and FTIR *(Fourier-transform infrared microscopy)*. Publications using micro-imaging mode are represented in *light grey.*

2˙4. *Difficulties in the access to synchrotron techniques pointed out by the heritage community.* – Although one can notice a very steep increase in the number of these works in the recent years [3], heritage experts tend to remain sceptical as they regard many of these studies as pure feasibility works *(case studies)*, hardly usable for in-depth heritage research purposes.

Major limitations that have been pointed out to us by the community are:

– the *insufficient support* from synchrotron facilities;

– the *lack of statistics*, as analysing heritage materials, most often hand made from heterogeneous natural materials sometimes heavily altered by long-term ageing, requires a statistical approach most often not available at synchrotron facilities;

– the *inappropriate peer-review process* at synchrotrons that does not take into account heritage specificity in the evaluation of experimental proposal and are confusing for heritage actors.

Both expert and non-expert users could be helped in their access to synchrotrons. On the one hand, the whole process that researchers have to follow to access these facilities is a major difficulty for non-experts. These users should be backed appropriately: information on analytical capabilities, proposal preparation, sample preparation and data processing. On the other hand, expert users should be given the opportunity to develop new methodologies to study heritage artefacts. When applicable, standardised protocols could be developed to address the most common characterisation needs ("service" activities).

3. – The SOLEIL heritage liaison office

The initiative at SOLEIL [4] is focused on the major issues mentioned and seeks to address them on a pragmatic basis. Five actions are currently being carried out in parallel: (1) the building of a technical platform, (2) facilitating the access, (3) information and training activities, (4) valorisation and (5) participation to networking activities. Access to all beamlines of SOLEIL will be provided, among which 6 to 8 are particularly expected to contribute to heritage research with an expected uppermost involvement of imaging beamlines (infrared, medium and hard X-rays).

For the period 2004-05, the key actions of the SOLEIL liaison office were:

1. the hiring of a *dedicated officer* on a permanent basis fully devoted to the setting-up of these activities;

2. the organisation of the first ever *international training school* on the synchrotron analysis of museum objects, *New lights on ancient materials 2004*, co-organised by SOLEIL and *COST action G8*, at the synchrotron (Dec. 2004) [5] and the scheduling of its follow-up in 2007 on "Ageing, conservation and restoration";

3. the on-going setting-up of a *dedicated peer-review committee* to take into account the specific evaluation criteria of the discipline and to give a stronger control to heritage professionals;

4. the co-organisation of workshops and dedicated sessions at congresses (SR2A, Archéométrie 2005, etc.) and the launching of a dedicated web portal [6].

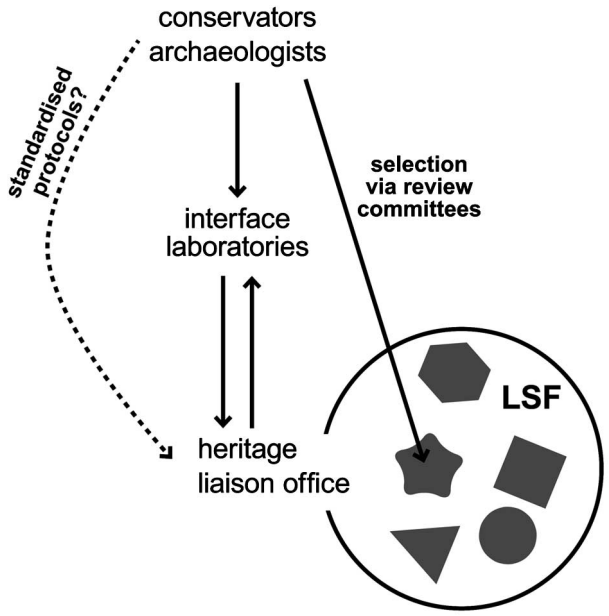

Fig. 4. – Schematic drawing illustrating the possible ways of interaction between heritage institutions (museums, archaeology departments...), *interface* laboratories and a large-scale facility (LSF).

4. – Conclusions and governance suggestions

The present survey shows that the moderate size of the community and the adequacy between a variety of needs and the offer provided by advanced synchrotron sources seems ideal for the development of joint activities in the years to come at a European level. The building of such a network should strongly benefit from scaling effects at a synchrotron (training, design of experimental set-ups, etc.),

More specifically, the SOLEIL team makes the following governance suggestions regarding the development of such a supra-national project, with a contribution from synchrotron sources and more generally from *large-scale facilities* (LSF).

1. Such an initiative should ideally contribute to provide *access, support, training, dissemination and networking*. Its setting-up should benefit from the best achievements of former or on-going actions such as *EU-Artech* [7] and *COST action G8* [8]. The European institutions funding such a project should ensure it is really based on a truly multinational representation at a European level, as is currently the case for *COST action G8*.

2. Such a project should be driven *jointly* by the heritage community, the regular *interface* laboratories and the LSFs. The stronger visibility of LSFs at a European level should not distort this mandatory equilibrium. In any case, the evaluation of the efficiency of such a European project should be carried out primarily by direct heritage actors (restorers, conservators, curators, archaeologists).

3. Prior to asking additional support from the EU, each LSF should start by *adapting its own organisation*. In particular, participating LSFs should appoint a dedicated liaison officer working full time for heritage activities, as answering the true pragmatic issues is a necessary pre-requisite. Such contact persons are expected to be highly solicited by the heritage community and should be able to reorient "lost" non-expert users towards other facilities.

4. A very efficient network of *interface laboratories* is in the best position to codevelop this research area (see fig. 4). Except for specific standardised activities, heritage actors are expected to contact LSFs through interface laboratories and via the facility liaison office for heritage.

5. For LSFs, a key step lies in the *peer-review process* that selects the proposals. The European institutions should make sure that the evaluation is carried out by experts in museum and archaeology departments, and not only interface laboratory scientists.

* * *

LB acknowledges the support of the Région Île-de-France and wish to thank all colleagues from visited laboratories and from SOLEIL met in the context of the presented survey.

REFERENCES

[1] http://www.synchrotron-soleil.fr/heritage/references-en.htm.
[2] http://www.chm.unipg.it/chimgen/LabS-TECH.htm.
[3] Bertrand L., Vantelon D. and Pantos E., *Appl. Phys. A*, **83** (2006) 225.
[4] Bertrand L. and Quinkal I., *Culture et recherche (French Ministry of Culture and Communication)*, **104** (2005) 14.
[5] Bertrand L., *Soc. Archaeol. Sci. Bull.*, **27** (2004) 8.
[6] http://www.synchrotron-soleil.fr/heritage.
[7] http://www.eu-artech.org/.
[8] http://www.srs.dl.ac.uk/arch/cost-g8/.