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Photography by:

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# EDITORIAL

## A Newsletter on biology

This Newsletter is mainly dedicated to biology, a subject which has hardly appeared in the past issues of the Newsletter. The collaboration between the ESRF and the EMBL Grenoble outstation is now arriving at full maturity and is described on page 10. Papers written by teams from ID2, ID13, BM14, ID19, ID14 and D2AM show the great variety of subjects tackled at the ESRF in the Life Science field.

## 50 years of synchrotron radiation

Information on the conference «Highlights in X-Ray Synchrotron Radiation Research» organised by the

ESRF on the occasion of the celebration of 50 years of synchrotron radiation is to be found on pages 6, 7 and 8 in the documents attached. More information will be given in the next Newsletter due out in July.

## ESRF, a gigantic microscope

Please find enclosed a poster «ESRF, a gigantic microscope», which has had a real success amongst our staff and visiting scientists (as well as their families) and that you may also enjoy.

## Cybernews

You can now find Newsletter on the ESRF Web Home Page at <http://www.esrf.fr>. You will also discover the

Annual Report 1995/1996 on the Web. It is available on-line only, since it has been decided not to print it.

Information on the conference «Highlights in X-Ray Synchrotron Radiation Research» will also be provided on the Web.





## PETER LINDLEY, NEW DIRECTOR OF RESEARCH

Peter Lindley took over the position of Director of Research on 1 April 1997, in replacement of Carl-Ivar Brändén. Before joining the ESRF, he occupied the position of Assistant Director for Diffraction and Scattering and Head of Life Sciences at Daresbury Laboratory.



Among his main responsibilities, he was in charge of the biology programme and the control of project teams in macromolecular crystallography, non-crystalline diffraction and X-ray diffraction. Furthermore, he is a member of a number of scientific societies and co-editor of several scientific journals. His research interests focus on the study of eye-lens proteins, iron and copper metabolism, iron-sulphur proteins and structural biology methods.

## APS/SPRING-8/ESRF WORKSHOP

The fourth joint APS/SPRING-8/ESRF workshop took place at the ESRF on 7 and 8 April 1997.

A series of 35 fifteen-minutes talks covered a wide spectrum of subjects of mutual interest. During three concluding parallel sessions, topics worth a closer collaboration were identified. For the accelerators these include RF couplers, transverse feedback,

RF liners, vacuum conditioning, pinhole cameras and low coupling. Under optics the following items turned out to be of common interest: high heat load material for filters, absorbers, windows; one angstrom smooth mirrors; coherence (measurement, dis-



*J.M. Filhol, ESRF Machine Director, in discussion with H. Kamitsubo, Director of Spring-8.*

turbance); diamond supply. For the field of detectors, development and data acquisition, the need of further exchange of information was expressed, in particular as to the comparison of performance and the improvement of user friendliness.

## MINISTERS AT THE ESRF

On Friday 7 February 1997, Charles Millon, President of the Regional Council (as well as French Defence Minister) was joined by François d'Aubert (French Secretary of State for Research) for a tour of the ESRF. About 80 VIPs accompanied the ministers during their visit.

The Swedish Minister of Education and Science, Carl Tham, visited the ESRF on 24 March 1997. He was shown ID11 and ID13 and also met the ESRF Swedish staff.



*C. Tham (centre) is showing a strong interest in the explanations given by C.I. Brändén (left).*



*A. Bourret explains the experiments performed at the French CRG IF beamline in front of C. Millon and the accompanying VIPs.*



## PARALLEL WORKSHOPS AT «SCIENCE AT THE ESRF»

(1996 ESRF USERS' MEETING)



*During the poster session of the workshop on «X-Rays and Magnetism».*

### WORKSHOP A: X-RAYS AND MAGNETISM

The parallel workshop on «X-Rays and Magnetism» consisted of four sessions: Magnetic X-Ray Scattering, Dichroism in Absorption, Spin Resolved Electronic Structures and Nuclear Resonance and Compton Scattering.

The «Magnetic X-Ray Scattering» session started with a talk of C. Vettier, who first introduced magnetic X-ray scattering techniques, underlining the relevant information brought by non resonant and resonant magnetic scattering; he then showed some new results obtained on different systems. Particular emphasis was given to the reduction of the Pt magnetic moment on the surface of  $\text{Co}_3\text{Pt}$ , to the unsolved problems of the energy dependence of the satellite peaks in Dy films and on the lineshape of the incommensurate phase peaks in  $\text{UPd}_2\text{Si}_2$ .

H. Zabel gave an overview of the present understanding of spin density waves in thin epitaxial Cr layers, showing that spin density waves are almost entirely longitudinal with a Q vector propagating out of plane. A thin ferromagnetic Fe cap layer causes propagation to become transverse and in plane. Sandwiching Cr(001) films between Fe(001) results (via a second reorientation) in an out-of-plane transverse spin density wave with Cr spins now lying in the plane. G. Lander showed a study on the interaction between Fe and Dy magnetic moments in  $\text{DyFe}_4\text{Al}_8$ . In this material Fe 3d

moments order at  $T = 170$  K, while Dy 4f moments order at  $T = 20$  K. By measuring the  $\sigma \rightarrow \pi$  scattering channel at the Dy L edges, it was possible to select the  $2p \rightarrow 5d$  dipole transition, thus isolating the 5d Dy magnetic moments: their temperature dependence follows the Fe one, illustrating a relevant 3d - 5d hybridisation in such compounds.

In the session on «Dichroism in Absorption», G. Sawatzky reported on spin resolved photoemission and dichroic X-ray absorption studies of high Tc superconductor antiferromagnets; C. Dalmas de Reotier on the successful determination of 5f orbital magnetic moments in  $\text{USb}_{0.5}\text{Te}_{0.5}$ ,  $\text{UFe}_2$  and  $\text{UNi}_2$  ferromagnets; C. Meneghini on the correlation between the anisotropic magnetic properties of  $\text{CoPt}_3$  thin films and the anisotropic Co-Pt local bond distribution.

In the session on «Spin Resolved Electronic Structure», C.F. Hague reported the successful observation of XMCD in fluorescence emission spectra on the Rh  $L_{\beta_{2,15}}$  in  $\text{Co}_{25}\text{Rh}_{25}$  alloys; showing the possibility to detect the spin polarisation of valence electrons with this technique; S. Eisebitt on the spin information contained in Fe  $L_3$  fluorescence spectra, which are dominated by the minority spin electrons for the presence of the Auger de-excitation which depresses the spin down channel; H.A. Durr on XMCD and resonant photoemission studies of the 3d electron localisation and exchange coupling of Mn thin films sandwiched with Fe or Ni.

In the session on «Nuclear Resonance and Compton Scattering», Y. V. Shvyd'ko presented the new Nuclear Resonant Small Angle X-ray Scattering technique showing, in the case of  $\alpha\text{-Fe}$ , how the inhomogeneous magnetisation, namely magnetic domains and walls, can be measured as well as the correlation length and the dispersion of long range spatial variation of magnetisation; R. Lubbers presented some studies of magnetic laves phases at high pressure by Nuclear Scattering; M. Cooper illustrated how Compton Magnetic Scattering determines magnetic moments showing the  $\text{UFe}_2$  case in detail, underlining the advantages that the use of ESRF high energy photons provides both in the improvement of momentum resolution and in the data interpretation, when the cross section approaches the Klein Nishima one.

**S. Mobilio**

### WORKSHOP B: CHALLENGING BIOLOGICAL STRUCTURAL STUDIES

The workshop started by giving evidence of the exciting possibilities of ID13 (the Microfocus Beamline, C. Riekel) in providing diffraction patterns from biological crystals of very small size (i.e. couple of tens of microns by dimension) or less organised biopolymers.

H. Belrhali described the experimental arrangement on ID13 set-up by a joint EMBL-ESRF team to permit data collection on protein microcrystals. A  $30 \mu\text{m}$  diameter beam was used and the images were collected on the EMBL 30 cm diameter MAR Research image plate scanner. Several experiments on different systems have been carried out and the crystallographic results presented, demonstrating clearly the feasibility of collecting high resolution crystallographic data sets from such small crystals (see the article from Belrhali *et al.* on page 15).

The different properties of starches depends on the crystalline ultra-structure, which is different according to the origin of starch (type A, cereal starch and type B, tuber starch). In the work reported by A. Buleon it was



shown that with a 2  $\mu\text{m}$  beam it is possible to map the crystallinity and the orientation within a granule of starch with 5  $\mu\text{m}$  step. By using a CCD-image intensifier system, the details of the highly ordered orientation in the structure of type B starch were described in comparison to that of type A starch.

A novel method for the crystallisation of membrane proteins was described by E.M. Landau. It was shown how well-ordered three-dimensional crystals made of membrane proteins can grow in lipidic-cubic phases. Bacteriorhodopsin crystals, not available from micellar systems, were obtained in this way and produced diffraction patterns on ID13 with a significantly higher resolution than previously obtained electron microscopy data.

On the following day, topics focused on time-resolved experiments. The structural modifications undergone by macromolecules with ns time resolution can be recorded by means of fast Laue data collection achieved at ID9 (the White Beam beamline) by using 150 ps X-ray pulses emitted by a single electron bucket from the storage ring. D. Bourgeois described a feasibility study where the structure of native cutinase (a lipolytic enzyme) was refined to 1.5  $\text{\AA}$  resolution from very fast Laue data and by using as a starting model the structure of mutant R196E. V. Srajer showed the structural changes elicited in carbonmonoxy myoglobin (MbCO) crystals by a 10 ns laser pulse. Photodissociation and rapid ( $\mu\text{s}$ ) rebinding of CO were described by processing Laue data collected from few ns to 2  $\mu\text{s}$  after the laser pulse.

F. Schotte presented his investigation on membrane protein bacteriorhodopsin (responsible for the photochemical transduction in the purple bacterium) made at ID9 with monochromatic beam and microsecond time resolution. The transient structural change induced on the protein by absorption of a photon was described with unprecedented time resolution.

Defining the structure of the nucleosome core particle (the repeating element in chromatin) is peculiar to investigate gene regulation. Data collected at ID13 and ID9 on an EMBL image-plate by T.J. Richmond made it possible to solve the crystal structure of the nucleosome at 2.8  $\text{\AA}$  resolution and thus to describe the detailed course of DNA, the structure of histone octamer and its interaction with DNA.

V. Lombardi described combined mechanical and time resolved X-ray diffraction experiments in single intact muscle cells performed at ID2 (SAXS) to investigate the structural changes in the actin-myosin cross-bridges (the molecular motor). With the highly collimated beam at ID2 and with a gas-filled detector placed at 10 m from the specimen, changes in intensity and spacing of the 14.3 nm meridional reflection, sensitive to the movement of the myosin cross-bridges, could be precisely measured with 5 ms time resolution during force development and shortening.

**V. Lombardi, G. Belrhali,  
D. Bourgeois, C. Riekel, S. Cusack**

## WORKSHOP C: SURFACES AND INTERFACES

In the «Surfaces and Interfaces» workshop, some of the most significant results obtained in this field at ESRF during the course of 1996 were reported. The title was extensively interpreted: many of the talks reported results in subjects not traditionally included under the label «surfaces and interfaces». Much emphasis was placed on those results which illustrated the new possibilities offered by the ESRF source.

The introductory invited talk was given by S. Ferrer who described recent developments in magnetic surface diffraction. In fact, on ID3, it has been possible to measure the small resonant magnetic signal at the Pt  $L_3$  edge both on the surface of  $\text{CoPt}_3$  and on the Pt(111) surface covered by a few monolayers of Co; these results extend to the case of surfaces resonant magnetic diffraction, discovered for the bulk in 1988.

Various talks reported new techniques and/or their application. A. Kazimirov described standing waves measurements on thin films of high-Tc superconductors; these measurements exploit, on the one hand, the high flux available on ID32 and, on the other, the element specificity of the technique. The high flux on the same beamline was also used by F. Boscherini to perform standing waves measurements on semiconductor superlattices; the modification of the traditional standing waves analysis in order to obtain the position of specific atoms with respect to the average superlattice planes was also described. Finally, L. Alagna reported Diffraction Anomalous Fine Structure measurements on the superstructure

reflections of ordered InGaP/GaAs(001) performed on BM 1 which yielded local structural information on Ga atoms present only in the chemically ordered phase of the InGaP overlayer.

Another group of talks dealt with dynamical processes depending on temperature or time. T. Ressler talked on chemical oscillations during oxidation of CO in the presence of Pt catalysts; measurements were performed on ID24 using time-resolved X-ray absorption spectroscopy. R. Simon reported specular reflectivity measurements performed on BM32 on Ar thin films deposited on MgO which showed pre-roughening and layer-by-layer fusion. Two talks dealt with sputtering of semiconductor surfaces, studied by surface diffraction techniques on ID3. The case of CdTe(001) was described by V. Etgens; it was possible to reveal the link between the atomic removal mechanism and temperature and also to show the presence of a strong surface anisotropy. The case of sputtering of Ge(001) was the subject of the talk by D. Smilgies who described changes in the surface dynamic scaling properties with temperature.

Finally, a number of reports tackled problems of considerable complexity with traditional techniques. L. Barbier talked on grazing incidence measurements on vicinal surfaces of a Cu-Pd alloy, describing the «truncation-rod forest» due to the miscut. The growth of Pt on Co(0001), which is highly relevant for magnetic heterostructures, was the subject of the talk by J.P. Deville. Both the talks by Barbier and by Deville were based on surface diffraction measurements performed at ID3. Investigations on the electronic structure of CeRh compounds which used the possibility offered by ID32 of performing resonant photoemission at very high energy (5.7 keV) were reported by D. Chandresis. W. J. Huisman talked on surface diffraction measurements on the rare diamond (111) surface and its interface with liquid Ga; experiments were performed on ID3 and ID10. M. Alba reported diffuse scattering measurements on amphiphilic films performed on BM32 and ID10 which allowed to measure their elastic constants. The structure of grain boundaries in  $\text{SrTi}_2\text{O}_3$  bicrystals was described by J. Zegenhagen using diffraction measurements performed on ID10 and ID11. Finally, the structure of the Pd/MgO interface was the subject of the talk by G. Renaud, using surface diffraction on ID32.

**F. Boscherini**

# HIGHLIGHTS IN X-RAY SYNCHROTRON RADIATION RESEARCH

## GENERAL INFORMATION

Fifty years after it was first observed in 1947, synchrotron radiation has become an extraordinary tool for scientific research in a wide range of areas, including "frontier science" as well as industrial research.

"Highlights in X-ray Synchrotron Radiation Research" is an international conference organised by the ESRF in recognition of the pioneering work performed by the first synchrotron radiation users and the remarkable results achieved. It will emphasise the new impetus given to this research by the third generation synchrotron radiation sources in the X-ray range, in fields such as magnetism, high pressure, structural biology, imaging, topography and soft-condensed matter.

### Scientific Programme

The scientific programme, from Monday 17 to Thursday 20 November, is made up of plenary lectures given by invited speakers on the above-mentioned topics. These lectures will be followed by poster sessions in the late afternoon. A **call for abstracts** for the poster sessions is enclosed with this Newsletter.

If you do not have it, please complete the pre-registration form below.

### Symposium in Structural Biology

The symposium in Structural Biology will take place on 19 - 20 November in the conference centre as a parallel session to the main conference. The symposium will comprise four sessions:

- «Virus structures», «DNA-replication, transcription, translation and repair», «Time-resolved crystallography» and «Membrane proteins».

### Venue

The conference and the annual Users' Meeting (see page 8) will be held at:

ATRIA  
WORLD TRADE CENTER  
EUROPOLE - GRENOBLE

### Dates to remember

- Conference date  
17-20 November
- Structural Biology Symposium  
19-20 November
- Users' Meeting  
21 November
- Abstract submission deadline  
16 June
- Early registration deadline  
15 September

We would like to encourage anyone intending to participate in the conference to return the pre-registration form at the bottom of this page in order to receive the next circular due out mid-July. This will contain registration forms for the conference and the satellite meetings as well as accommodation forms. We aim to give those submitting abstracts the date of their poster session at the same time.

### Conference Fees

	Before 15 Sept.	After 15 Sept.
Participant	1000 FF	1300 FF
Student	500 FF	800 FF
Accompanying person	500 FF	800 FF
Users' Meeting ONLY (21 Nov.)	250 FF	300 FF

The conference fee includes admission to all scientific sessions and the Users' Meeting, conference documentation and coffee breaks. There will be no published conference proceedings.

Lunch, dinner and the conference banquet are not included in the registration fee. There will be a welcome reception on Thursday 20 November before the Users' Meeting which is included in the fee.

## PRE-REGISTRATION FORM

Please return to: SR50 conference secretariat, ESRF BP 220, F-38043 Grenoble cedex, France.  
This pre-registration form is also available on the Web at <http://www.esrf.fr>

In which meetings are you interested?

- Highlights in X-ray Synchrotron Radiation Research and Users' Meeting*
- Users' Meeting only*
- Biology Symposium*

Satellite Meetings

- Magnetic Scattering*
- Topography*
- High Pressure*

Do you intend to present a poster?  Yes  No

Do you want us to send you a call for abstracts?  Yes  No

Please complete in CAPITAL LETTERS

*Mr/Mrs/Miss/Dr/Prof Name:* .....

*First Name:* .....

*Full postal address:* .....

.....

.....

*Telephone:* .....

*Fax:* .....

*E-mail:* .....

## SATELLITE MEETINGS

The satellite meetings will take place before and after the conference. To date, the following workshops have been planned:

### X-RAY SCATTERING AND MAGNETISM

(Saturday 15 and Sunday 16 Nov.)  
Organiser: C. Vettier

Present achievements and future aspirations of X-ray scattering in the physics of magnetism will be discussed during the one-and-a-half-day meeting from both the experimental and theoretical points of view. Presentations will cover such topics as magnetic surfaces, thin films and multilayers, magnetic phase transitions, L and S form factors, resonant scattering, dichroism and absorption, and inelastic scattering. Invited talks as well as poster contributions are planned.

### IMAGING AND HIGH RESOLUTION DIFFRACTION ON ID19

(Saturday 22 November  
from 9am to 3pm)  
Organiser: J. Baruchel

This workshop will focus on the results and possibilities at the long ID19 Topography beamline, mainly devoted to diffraction topography, tomography, phase contrast imaging and high resolution diffraction.

The first users arrived in June 96 and discussion of results obtained and improvements to be made comes at an intermediate date between two "X-Top" meetings. It is a natural follow-on to the imaging round table organised during the Users' Meeting on the 21 November and will consist of two talks and an extended poster session.

### CRYSTALLOGRAPHY AT HIGH PRESSURE USING SYNCHROTRON RADIATION: THE NEXT STEPS

(Saturday 22 and Sunday 23 Nov.  
with registration on Friday 21 Nov.)  
Organiser: D. Häusermann

This workshop is the first meeting organised by the newly formed High Pressure Commission of the International Union of Crystallography, and it will follow the format of the previous IUCr High Pressure Group meetings. The main subject of this workshop will be structural studies and refinement at high pressure using synchrotron radiation, which will include latest developments in high pressure devices, techniques, detectors; data collection and data analysis; and state-of-the-art in powder and single-crystal diffraction, with special emphasis on structure refinement and solution, particularly in extreme conditions of pressure and temperature.

## ESRS PRIZE

17-20 NOVEMBER 1997 • GRENOBLE (FRANCE)

*On the occasion of fifty years of synchrotron radiation, the European Synchrotron Radiation Society (ESRS) is pleased to announce a prize to be awarded for an outstanding contribution to synchrotron radiation science.*

*The prize of 1500 ecu will be presented at the International Conference on Highlights in X-Ray Synchrotron Radiation Research organised by the ESRF and co-sponsored by the ESRS in Grenoble, 17-20 November 1997.*

*It will be given to a person aged 35 years or younger (at the closing date) for work that has been undertaken in Europe after December 1994.*

*Applicants should send a summary of not more than 2000 words outlining the nature of the research, its significance and their contribution to it, together with any relevant reprints and the names of two referees, to:*

Professor C. Norris,  
Department of Physics and Astronomy  
The University of Leicester, LE1 7RH, UK  
Fax +44 (0) 116 252 2770 • e-mail ar@9le.ac.uk

Information can also be obtained from:  
<http://www.fy.chalmers.se/esrs/welcome.html>

**Closing date for submission: 1st August 1997**



Users' Organisation

## USERS' MEETING 1997

20-21 NOVEMBER • ATRIA EUROPOLE

### PROGRAMME

#### Thursday 20 November

20h00 Welcome reception

#### Friday 21 November

8h30 Coffee

9h00 Introduction

9h10 Directors Report

User Operation

10h00 «Selected User» Talk I

10h40 Coffee Break

11h00 «Selected User» Talk II

11h40 Presentation of the new

Council

11h50 Young Scientist Award

12h50 Lunch

- 14h15
- Parallel Mini-Workshops
  - X-ray Imaging using Synchrotron Radiation
  - Time-Resolved Scattering Techniques using Synchrotron Radiation
  - Industrial Applications of Synchrotron Radiation

### MINI- WORKSHOPS

#### Time-Resolved Scattering Techniques using Synchrotron Radiation

Co-ordinator: M. Wulff

21 November 1997

This workshop aims at showing new opportunities in fast diffraction and X-ray spectroscopy techniques on biological and chemical systems. The initiation of fast reactions in macromolecules will be discussed for photosensitive macro-molecules, and laser experts will speculate how ultra-fast X-ray techniques may complement the understanding of the reaction pathway of biological and chemical reactions.

#### X-ray Imaging using Synchrotron Radiation

Co-ordinator: J. Baruchel

21 - 22 November 1997

Several beamlines at the ESRF devote a substantial part of their time to X-ray imaging. Most of them will

be in operation at the end of 1997. The results already obtained and/or the new possibilities in microtomography, phase contrast imaging, topography and microscopy will be reviewed and discussed.

#### Industrial Applications of Synchrotron Radiation

Co-ordinator: J. Doucet

21 November 1997

The workshop is dedicated to the use of synchrotron radiation by industrial companies for research, development or control activities. The diversity of the types of investigations, from long-term fundamental research to urgent requests for characterisation, will be illustrated through presentations given by scientists from several European companies. There will also be open discussions concerning specific access to experimental stations, and how to increase and improve the industrial activity at the ESRF.

## YOUNG SCIENTIST AWARD

### CALL FOR NOMINATIONS

The Council of the Users' Organisation invites nominees for the 1997 Young Scientist Award. The winner will be named by the Council in October 1997 based on the recommendation of a selection committee appointed by the Users' Organisation chairperson.

**Criteria.** The award recognises outstanding work done at the ESRF by a scientist 35 years of age or younger at the time of the award.

**Nature of award.** The winner will be invited to deliver a public lecture at the 1997 ESRF Users' Meeting and will receive a cash award of 5.000 FF.

*Everybody, both scientists of the ESRF as well as external users, is encouraged to send in nominations.*

#### Young Scientist Award Nomination Form

Name of the candidate: .....

Date of birth: .....

Address: .....

.....

Name of the proposer: .....

**State precisely what you regard as the outstanding work accomplished by the nominee:** .....

.....

**What has been his/her contribution to the group effort:** .....

.....

.....

**What is the relevance of this work to science:** .....

.....

**At which beamline(s): ..... and when: .....**  
**did the nominee perform his/her experiments at ESRF.**

Please enclose a short CV and a publication list, especially related to the results to be taken into account.

*This nomination form is also available at <http://www.esrf.fr/usersorganization/callcand.htm>*

Send it to S. Pascarelli, BP 220, F-38043 Grenoble cedex. e-mail: sakura@esrf.fr  
 tel. (33) 4 76 88 24 26 • fax (33) 4 76 88 23 25



VACANCIES AT THE ESRF ON 8 APRIL 1997

	Ref	Subject
<b>SCIENTISTS</b> (5-year contracts)	2179	High energy scattering and imaging
	2169	Condensed matter theory
	2192	High pressure beamline
	2203	Troika beamline
	2201	Protein crystallography beamline
	2117	XAFS experiments in the energy dispersive mode
<b>POST-DOC</b> (2-year contracts)	PDID10A	High brilliance multipurpose undulator beamline (Troika beamline)
	PDID15B	High energy X-ray scattering group
	PDID24	XAFS experiments in the energy dispersive mode
	PDID26	X-ray fluorescence excitation spectroscopy on dilute systems
	PDID10B	Troika II beamline
	PDID2	XAFS on the high brilliance beamline
	PDID14A	Protein crystallography beamline
<b>STUDENTS</b> (2-year contract, renewable 1 year)	CFR201	Nuclear resonance
	CFR202	Application of XAS to determine short-range structural properties of liquids
	CFR206	Control of time structure with X-ray optics
<b>ENGINEER</b>	CDD/BPE	Software engineer in the experiments division (18 months contract)
<b>TECHNICIANS</b>	CDD/BPT	3 software support personnel in the experiments division (18 months contract)
	1513	Radiation protection

*If you are interested, please send us a fax (+33 (0) 4 76 88 24 60) or an e-mail (peritore@esrf.fr) with your address, and we will provide you with an application form. You can also print out an application form on the World Wide Web <http://www.esrf.fr>*