

72nd meeting of the ESRF Scientific Advisory Committee

Item 07

Review of the Conceptional Design Reports submitted by the Collaborative Research Groups

Material: CRG Beamline Responsibles

WHY A CDR CAMPAIGN FOR THE CRGS?

ESRF – EBS offers new opportunities

ESRF – EBS changes the current situation with respect to:

- source type
- source geometry
- no more 2-branch beamlines

ESRF – EBS heavy strain on all ESRF resources

- need to integrate / schedule in advance infrastructure activities of both ESRF and CRG beamlines

All CRG operation contracts to be renewed by 2020

Carry out a review of the CRG intentions

THE CDR TEMPLATE

The scientific case for the beamline after ESRF-EBS

Brief project history

The science case

For double-branch beamlines: which branch moves?

Choice of the new source

Measures needed to adapt the beamline to the new source

Modifications of beamline's optics and experimental equipment

Modification of the beamline's general infrastructure

Support requested from ESRF services

Timeline, list of milestones

11 CRG branches replied this round, 3 to come in Fall: BM02, BM16, BM32

STRUCTURE OF THE PRESENTATION

1. Overview of the participating CRG beamlines
2. The science cases
3. The source types chosen
4. List of infrastructure projects
5. List of major upgrades of beamline optics / experimental equipment

1. CRG CDR REVIEW, OVERVIEW

Beamlines staying on their current port

BM01	SNBL-I	Swiss-Norwegian	SCD
BM08	LISA	Italian	XAS
BM20	ROBL	German	XAS
BM25B	SpLine	Spanish	XRD, PES
BM26B	DUBBLE	Dutch-Belgian	SAXS/WAXS
BM28	XMaS	British	XAS, XRD, XRR
BM31	SNBL-II	Swiss-Norwegian	XAS, HRPD

Beamline branches to apply for a new port

BM25A	SpLine	Spanish	XAS, HRPD
BM26A	DUBBLE	Dutch-Belgian	XAS

Particular cases:

BM30A	FIP	French	MX
BM30B	FAME	French	XAS, IXS
(BM26A/B)			

2. SCIENCE & ACTIVITIES: BM01, SNBL-I

1994: Origin: The SNBL facility, 2 branches:
BM01A (Single crystal diffraction)
BM01B (powder diffraction, EXAFS)

2014: Move BM01B to BM31

New BM01A currently: 50% **sc**, 50% **PD**

Evolution with ESRF – EBS:

target total scattering (TDS, Bragg & diffuse) for detailed structure analysis of complex materials
preserve reputation in multi-technique experiments
introduce application of electric fields
more “exotic” diffraction experiments (mapping reciprocal space)
software issues (data handling, data analysis)

Performance (BM01A and BM01B): 100 – 120 publications/year

2. SCIENCE & ACTIVITIES: BM31, SNBL-II

1994: Origin: The SNBL facility, 2 branches:
BM01A (Single crystal diffraction)
BM01B (powder diffraction, EXAFS)

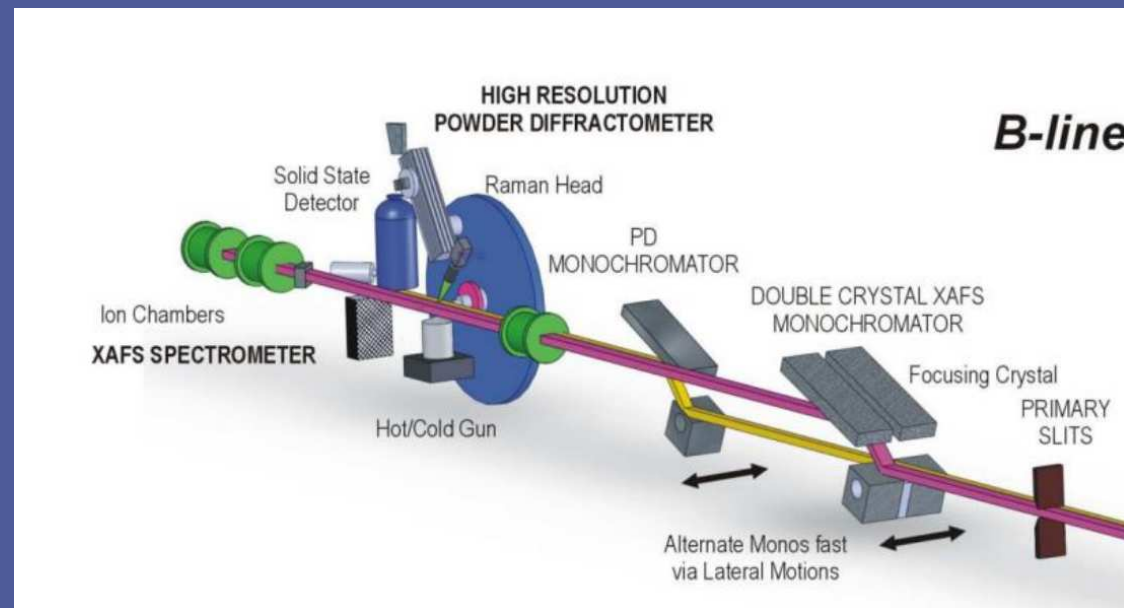
2014: Move BM01B to BM31

New BM31 (from Fall 2016 onwards):

HRPD / EXAFS merged into one setup

Quasi-simultaneous *in situ* experiments (swap w/in a few seconds)

2D detector: PDF on disordered samples **w/in** a few minutes



2. SCIENCE & ACTIVITIES: BM08, LISA

1994: Origin: The **GILDA** beamline, structural studies by EXAFS / XRD

2014: upgrade of the project: **LISA**
dedicated to **XAS using a small-sized and intense beam**.
New optics based on toroidal mirrors , cryo-cooled MC,
focus 100 μm x 150 μm (h x v)

Bouquet of experimental techniques:

XAS on diluted samples

High quality XAS in transmission mode

XAS in total reflection (incl. linear dichroism)

Differential XAS for experiments with excited samples (static or pump-probe)

Scientific fields:

Microelectronics

Fundamental physics

Electro- and Photochemistry

Life sciences

Surface analysis

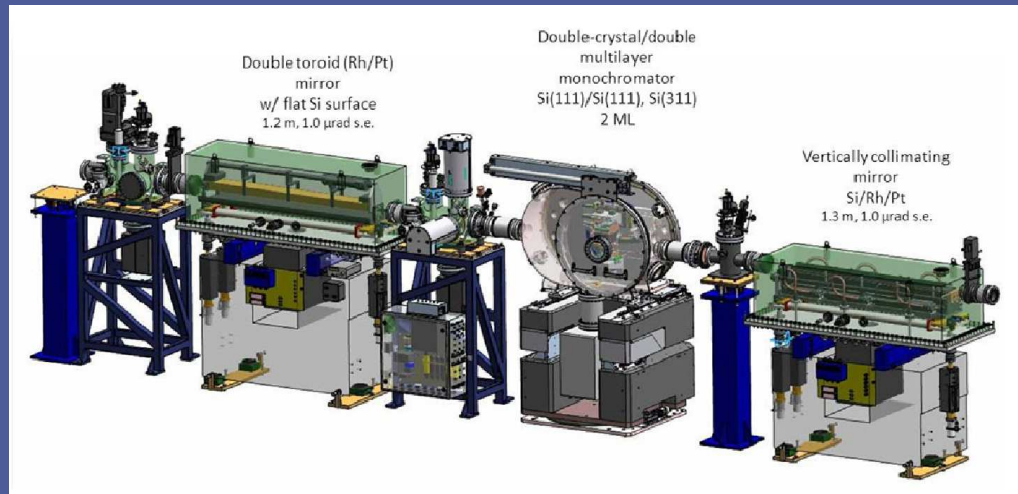
Environmental science

Cultural heritage

2. SCIENCE & ACTIVITIES: BM20, ROBL

1997: Origin: The **ROBL** beamline: RCH (EXAFS on actinides) nuclear waste
MRH (XRD, XRR, GIXS) Mat. Sciences

2010: **complete upgrade** of the beamline optics



2015: MRH ceases to exist, whole beamline dedicated to RCH

2016: 4 Mio. EUR investment (until 2019)

- New radiochemical alpha-lab
- Single crystal diffraction in RCH-2 (detector, diffractometer)
- High-res XANES and XES (Johann-type spectrometer incl. detector)

Performance: 30 publications / year; 450 until today

2. SCIENCE & ACTIVITIES: BM25A, SPLINE

2005: **Origin: SpLine** Multipurpose and interdisciplinary beamline
BM25A (XAS, HRPD) structural and electronic properties
BM25B (XRD, (HXPES) Mat. Sciences

ESRF – EBS: BM25A will request to be moved to a new port

Scope:

Maintain the multipurpose and multidisciplinary capabilities to serve different research areas: Physics, chemistry, Mat. Sciences, biology, environmental,...

In particular: Understanding the kinetics of heterogeneous reactions, including morphological changes and the subsequent tailored design of reaction processes.

BM25A will provide time-resolved XAS and HRPD and the necessary sample environment for *in situ* studies.

2. SCIENCE & ACTIVITIES: BM25B, SPLINE

2005: **Origin: SpLine** Multipurpose and interdisciplinary beamline
BM25A (XAS, HRPD) structural and electronic properties
BM25B (XRD, (HX)PES) Mat. Sciences

Scope:

Maintain current activities: Materials Science with XRD and PES

Multi-purpose X-ray diffraction station

adaptability and flexibility of the sample environment offered
high throughput of users
XRR, SXRD, SCD, RSM, GI-XRD, GI-HRPD
large free space for user setups

Station for simultaneous XRD and Hard/Soft X-ray photoelectron spectrosc.

correlate atomic structure with compositional, chemical, electronic
properties
applications: strongly correlated electron systems

2. SCIENCE & ACTIVITIES: BM26AB, DUBBLE

Operational since 11 (BM26A) and 15 (BM26B) years serving the Dutch-Flemish and international communities

BM26A: (time resolved) EXAFS

Users interest: Catalysis, environmental studies, supramolecular chemistry

BM26B: (time resolved) SAXS/WAXS

Users interest: Nanotechnology, self assembly

BM26 gathered over the years complicated sample environments and auxiliary non X-ray based techniques (30 T magnetic field, gas mixing system, polymer spinning, film blowing)

BM26A would move, operation of one branch alone is not reasonable

Performance: 40 publ./year (A), 60 publ. / year (B)

2. SCIENCE & ACTIVITIES: BM28, XMAS

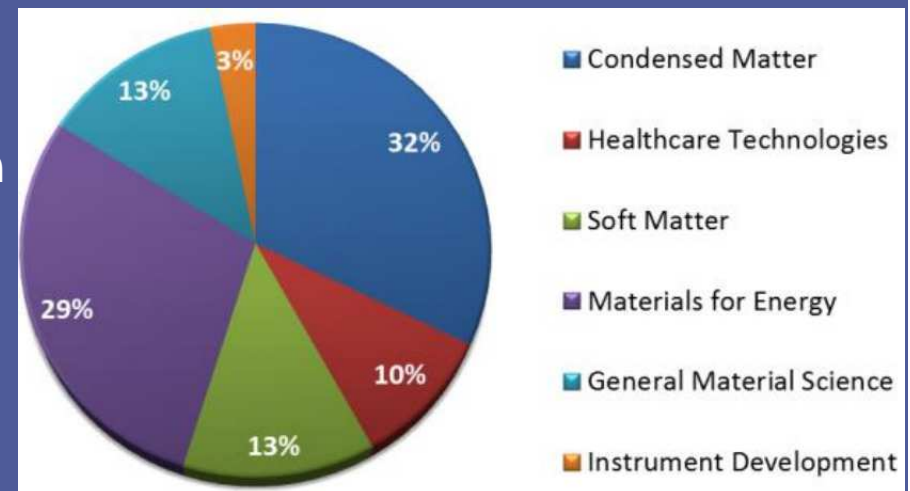
1997: XMaS operational, investigation of magnetic materials, since then:
Evolution towards a considerably broadened remit.

Extension to energies **down to 2.2 keV**: spectroscopy and scattering at S, Cl, P edges, resonant XRD at Ru and Pd L edge, Ir M edge.

Extension of sample environments and metrology techniques: *in situ*, *in operando* experiments under electrical and magnetic field

Variety of techniques: XRD, XMCD, WAXS, GI-SAXS/XRR + instrumentation

- **The energy problem**
- **Magnetic materials**
- **New functional materials**



ESRF – EBS: 1 order of magn. flux, smaller spot size
Extension of the Experimental Hutch

2. SCIENCE & ACTIVITIES: BM30A, FIP

BM30A (FIP, French beamline for Investigation of Proteins)

Dedicated to the crystallography of biological macromolecules with **emphasis on anomalous diffraction (SAD / MAD)**, highly automated.

Science case, current activities:

- Anomalous diffraction with larger beam (and larger crystals up to 100 μ m), less radiation decay
- G-rob based routine macromolecular diffraction experiments at room temperature
- Homogeneous exposure of larger samples to induce specific changes, online absorption measurements

ESRF – EBS:

SAD/MAD faster, better S/N, ligand screening, redo exp. w/ frozen samples,
Ligand screening

DECISION ON MOVING / STAYING IS PENDING

Performance: 25 publ./year

2. SCIENCE & ACTIVITIES: BM30B, FAME

BM30B (FAME, French beamline for Absorption Spectroscopy beamline for Material and Environmental Sciences)

Dedicated to XAS on in-situ and in-operando studies of diluted systems

Science case, current activities: Bio-environmental Earth science
hydrothermal fluids, minerals and soils, biological systems, catalysis,
electrochemistry, materials science

ESRF – EBS:

- Study highly diluted real (non-model) samples
- Smaller spot size (30µm x 30µm) with full flux
- Contribute at an increased performance level to ICEINT and equipex PLANEX

DECISION ON MOVING / STAYING IS PENDING

Performance: 22 publ./year

3. CHOICE OF SOURCE

BM01	2PW	total flux
BM02		to be decided in Fall 2016
BM08	1PW	clean beam, source size, beam quality
BM16		to be decided in Fall 2016
BM20	2PW	total flux
BM25A	2PW	total flux
BM25B	2PW	total flux
BM26A	2PW	
BM26B	0.86 T BM	
BM28	0.86 T BM	clean beam
BM30A	2PW	total flux
BM30B	1PW	clean beam
BM31	2PW	total flux
BM32		to be decided in Fall 2016

4. INFRASTRUCTURE PROJECTS

General: All beamlines will need support for re-aligning and radiation protection (except BM31)

Confirmed requests:

- BM08:** combine EH2 / EH3, modify beampipe
- BM20:** creation of a new radiochemical alpha lab
- BM28:** increase lead thickness in OH
extension of EH by 4 m
construction of additional control area

To be confirmed / clarified:

- BM25A:** construction of a new beam line
- BM26A:** construction of a new beam line
- BM30A:** shielding, transfer to another port
- BM30B:** no, unless moved to another port

5. BEAMLINER PROJECTS WITH ESRF INVOLVED

Beamline upgrade projects:

BM08: optics refurbishment, cryo-cooled MC

BM20: new diffractometer/spectrometer, cryo-cooled MC

BM25B: windowless beam line, cryo-cooled MC

BM28: new mirrors, upgrade of motor axes (ICEPAP)

BM30A: tbd

Included in the overall project “construction of a new beam line”:

BM25A:

BM26A: