BEATS

Workpackage 1

Management of the BEATS project

Notes of the Kick-off Meeting

D 1.1

June 2019

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PROJECT DETAILS

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BEATS

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FOR MORE INFO PLEASE CONTACT: AXEL.KAPROLAT@ESRF.FR

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CONTENTS

OVERVIEW

To foster intense exchange between SESAME staff and the other BEATS beneficiaries and to establish personal contacts between the working groups expected to collaborate on the project, it was decided during an All-Parties teleconference held in January 2019 to organise the BEATS kick-off meeting in March 2019 on the SESAME site.

The meeting was organised by the BEATS Coordinator with substantial support from SESAME concerning the local activities.

It was attended by 30 people from all BEATS beneficiaries, among them 10 SESAME staff members.

The agenda was composed as follows:

- During the first (welcome) session members of the SESAME Directorate reported on the current status of SESAME with respect to i) the financial boundary conditions, ii) the accelerators and the storage ring, and iii) the general operation of SESAME and its science programme.
- This session was followed by a presentation of the principles of synchrotron radiation based tomography, currently accessible tomography beamlines, and the envisaged role of the future BEATS beamline in this context.
- The next two sessions were devoted to the status, immediate and forthcoming activities of the BEATS work packages, during the afternoon of the first day WP1 (Management), WP2 (Sustainability), and WP3 (X-ray source), during the morning of second day WP4 (BEATS beamline technical design report) and WP7 (Data Analysis and Management). Presentations on WP5 (Procurement and Construction) and WP6 (BEATS beamline assembly and commissioning) were deemed premature in view of the overall status of the project.
- The meeting ended with a keynote contribution by Prof. Khaled Toukan, Director of SESAME, and an extensive visit to the SESAME facility.

All presentations are available to the BEATS community, in electronic form, in the BEATS file repository.

THE WELCOME SESSION

The welcome session started with a presentation by **Walid Zidan, Director of Administration of SESAME.**

He drew the meeting's attention to the fact that about 40-50% of SESAME's approved Operation Budget of around $ 5.3 million were, until recently, spent on electricity. This situation was particularly problematic as with the increased use of SESAME (increasing number of beamlines and thus user operation) the aforementioned ratio was expected to get unsustainable. Fortunately, due to funding by the European Union through a renewable energy programme with the Jordanian Ministry of Energy and Mineral Resources, a photovoltaic Solar Power Plant could be installed, which will, as of 26.02.2019, allow to fully operate SESAME on solar power.

Furthermore, thanks to funding received from the Italian Ministry of Education, Universities and Research through INFN, SESAME will soon feature a Guest House with 48 guest rooms and facilities including a cafeteria, kitchenette, meeting rooms, etc.

Riccardo Bartolini, SESAME's Technical Director then took the floor to report on the SESAME accelerators, their present status, highlights from the development and operation, and the plans for the future.

R. Bartolini first reminded the audience of the overall layout of SESAME machine and beamline-wise, then presented the design and major parameters of the injector and the storage-ring as well as the existing dipole based beamlines (XAFS and IR).

Since the first users (July 2018) until March 2019 a total of 164 user shifts have been delivered with a current of around 200 mA and 2 refills per day. The average availability and the mean time between failures reached impressive values of better than 90% and 20 h, respectively. Possible room for improvement would be to operate continuously over weekends, which would necessitate increased staffing.

The plans for the coming years comprise the installation of new beamlines (Materials Science wiggler based, HESEB[1] soft X-ray, and BEATS X-ray tomography).

Giorgio Paolucci, SESAME's Science Director completed the introduction of the SESAME facility by elaborating on the status of the Science at SESAME.

He started with the presentation of the operational beamlines at SESAME:

The XAFS/XRF beamline received its first users in July 2018, the list of highlight experiments features

- the exploration of diagenetic versus biogenic uptake of metal elements in ancient Cyprus and the surrounding region (K. Lorentz et al., Cyprus),
- XAFS measurements of Cr, V, and As within various mixtures of oil shale ash solidifying additives by users from Jordan,
- probing the local and electronic structure of Cobalt Ferrite nanoparticles by Shafqat et al., Pakistan,
- and the study of the influence of Boron substitution on the electronic structure of $LiMn_{1-x}B_xO_2$ battery cathodes (Osman et al., Turkey).

In spring 2019, tThe beamline will be equipped with a new fluorescence detector. The particular importance of offering strong support and assistance to the users was emphasised.

The infrared beamline hosts users since November 2018. Among the first experiments were

- a study addressing possible treatment of Alzheimer's disease (Ahmed et al., National Research Centre, Egypt),
- as well as the FTIR Microscopy analysis on a historical parchment manuscript by Darzi et al., Isfahan University of Technology and Synchrotron SOLEIL.

The Materials Science beamline, currently delayed due to lack of funding, is expected to be completed by the end of 2019. G. Paolucci gave details on the wiggler source, its successful installation and the first successful test of the MS beamline's Pilatus detector (donated by DECTRIS), carried out at the XAFS line.

[1] Helmhotz-SESAME soft X-ray beamline

He then laid out the details of two other projects of great importance for SESAME: the EU funded initiative "openSESAME" and "HESEB", a soft X-ray beamline, funded by the Helmholtz Gemeinschaft. G. Paolucci ended with the encouraging statement: *"With good and improving accelerator performance, TWO beamline accepting users, and more beamlines to come, SESAME is no longer a promise: It is REALITY."*

X-RAY TOMOGRAPHY: BEATS IN THE INTERNATIONAL CONTEXT

Alexander Rack (ESRF, tomography Scientist ID19) gave a brief review on the principles of X-ray imaging and computed tomography (both absorption contrast and phase contrast based) and compared laboratory source computed tomography with the opportunities provided by synchrotron installations.

He then gave an overview of the major applications of synchrotron tomography and beamlines comparable to the BEATS project, which are currently operating in the international context, introducing, among others: BAMline @ BESSY, Beamline 8.3.2 @ ALS, SYRMEP @ ELETTRA, TopoTomo @ ANKA, and Tomcat @ SLS. He showed some highlight experiments for each of these beamlines.

After the presentation, a lively discussion ensued on the main characteristics of the future BEATS beamline as well as possible user communities and applications.

WORKPACKAGE STATUS SESSIONS

WP01: BEATS administration

Axel KAPROLAT (ESRF, BEATS Coordinator) first introduced the ESRF delegation to the kick-off meeting, then reminded the meeting of the general BEATS spirit aiming at not only constructing a competitive tomography beamline but also at knowledge exchange between the partners. He reported on the first accomplished activities within WP01: The Grant Agreement with the European Commission being established, the Consortium Agreement between the beneficiaries being concluded, and certain Communication activities started.

Kirstin Colvin (ESRF Directorate, Communication Group) took the floor to explain the aforementioned Communication related activities in more detail. She reported on the main aims and target groups and presented the communication tools established so far: A style chart has been created and templates for deliverables and BEATS related presentations in Word/Powerpoint format are available. Furthermore, she presented the BEATS web site (https:/beats.esrf.fr) to the meeting, the structure and content of which were approved and went public the same day. In addition to this,

a twitter account (@BEATS_eu) and a BEATS flyer were created. K.Colvin concluded her presentation by reminding everyone that good communication on the BEATS project and its progress would depend on the pro-active participation of all beneficiaries.

Finally, **Anne Talucci (ESRF Finance Service)** reminded the participants of the financial boundary conditions and procedures of the project. She summarised the approved budget, detailed the Financial and Project Reporting rules and advised the beneficiaries on the precautions to take to prepare for eventual audits by the European Commission.

WP02: Sustainability

Frank Lehner (DESY, Work Package Leader), Kirsi Lorentz (The Cyprus Institute), and **Greta Facile (SESAME)** reported on the goals of WP02 (establishment of a Science Case, staff training, a procurement strategy and the search for further funding opportunities) and gave details on the individual tasks.

Task 1 (Leader: CyI) comprises the identification of the BEATS Science Case aiming at a maximisation of the beamline's impact in the regional context and to reach out to potential users (both from academia and industry) through workshops and meetings. A first workshop to this effect will be organised end of June in Cypus.

Task 2 (Leader: ALBA) will establish the procurement strategy by establishing a Procurement Board composed of five people from the partners ALBA, DESY, PSI, ESRF, and SESAME. Furthermore, a database of suitable suppliers, preferably from the Middle East region, will be established at SESAME.

Task 3 (Leader: SESAME) concerns training of staff in all aspects related to BEATS. Building up on the successful activities of the "openSESAME" project, training activities and exchange visits will be organised.

Task 4 (Leader: DESY) will study opportunities to ensure sustainability and stewardship models to allow for long term operation of the beamline by, for instance, integrating BEATS into SESAME's suite of instrumentation, operation budget, and staffing. Furthermore, new partnerships and funding opportunities will be explored.

WP03: The X-ray source

Riccardo Bartolini (Technical Director, SESAME) and **Josep Campmany (ALBA)** presented an update on the activities of work package 3, which concentrates on the choice of the source for the BEATS beamline, its design and procurement as well as its characterisation and installation. The options for the X-ray source have been identified: i) a superbend structure, ii) a three-pole wiggler, and iii) a high field multipole wiggler. To serve a user community that is as broad as possible, one aims at a flux value of > 2 x 10^{12} ph/s/0.1bw.

Task 1 (Leader INFN) will perform the lattice studies for the different X-ray source types.

Task 2 (Leader ALBA) will perform, after the source type has been chosen, the detailed design of the source and the front end and the procurement of the elements.

Task 3 (Leader ALBA) will carry out the characterisation of the magnetic structure and the source's full installation.

Preliminary results indicate that i) the superbend is not a promising solution (modification of the vacuum system, low flux, big forces involving expensive mechanics), ii) a three pole wiggler design would be manageable and could be installed in both types of SESAME's straight sections, but suffers from possible interference with the side poles and adjacent dipoles, and iii) the high field wiggler, although delivering the highest flux, would as well need mechanics beyond budget and suffer from the photon source being non punctual and of limited angular opening.

Work is currently ongoing.

WP04: Beamline Technical Design, Instrumentation Procurement

Axel Kaprolat (Work package Leader, ESRF) presented the current status of the work package dealing with the technical design of the BEATS beamline.

Task 1 (Leader ESRF) is the establishment of the beamline's technical design report.

Task 2 (Leader ALBA) concerns the radio protection calculation and the definition of the specifications for the radioprotection hutches.

Task 3 (Leader ESRF) and Task 4 (Leader SESAME) ensure the detailed technical design of the beamline instrumentation and its procurement, respectively.

Task 5 (Leader SESAME) comprises the (off-site) assembly of the beamline instrumentation equipment.

Although both tasks 1 and 2 strongly depend on the findings of WP3 (X-ray source) and WP2 (science case) which were not yet available at the time of the meeting, first reflections on a possible design of the BEATS beamline were already carried out and presented by **Pierre van Vaerenbergh (ESRF, Mechanical Engineering Group):**

The WP04 engineers consider making use of a design similar to that of the Tomcat beamline at PSI, making use of a fixed-exit double multilayer monochromator (eventually transfocator based focusing) combined with a sample end station consisting of high precision rotation and translation stages and detectors covering a field of view from several cm down to 5 mm with corresponding spatial resolution ranging from around 10 micron down to 2 microns. The work will continue in close collaboration with WP02 and WP03.

WP05: Procurement and Construction and WP06: Beamline Assembly and Commissioning

Both WP05 and WP06 kick in only later in the project, hence no status information can reasonably be given at this stage.

WP07: Data analysis and Management

Charalambos Chrysostomou (Work package leader, CyI) explained the overall goal of this work package, which is to deal with all aspects related to data acquisition systems, 3D tomography image reconstruction, data analysis, data management, archiving and policy as well as the computing infrastructure required to keep the future tomography beamline up and running.

Task 1 (Leader SESAME) will perform the establishment and endorsement of a SESAME Data Policy.

Task 2 (Leader SESAME) will carry out the definition of hardware and software requirements.

Task 3 (Leader SESAME) will ensure the procurement of the hardware.

Task 4 (Leader ESRF) consists of delivering and commissioning a structure software library of tomography beamline data handling tools (Data acquisition system and volume reconstruction software, data archiving management system, 3D tomography data analysis)

Task 5 (Leader CyI) Data Analysis as a Service for the users of the BEATS beamline.

KEYNOTE LECTURE

The plenary meeting concluded with a well appreciated presentation by Prof. Khaled Toukan, Director of SESAME, who, complementing and building on G. Paolucci's presentation, informed the audience about the legal structure of SESAME, its history and current status. In addition, he gave interesting insight into the boundary conditions under which SEASAME is functioning.

VISIT OF THE FACILITY

Following the plenary sessions, all participants joined in an extensive visit of the SESAME premises: The accelerator installation, the operating beamlines as well as those under construction. To get

hands-on information on SESAME's procedures and technical standards as well as to visit the possible locations for the BEATS beamline was of great benefit to the participants.

GROUP PHOTO

ANNEX

Annex 01 Agenda

BEATS Kickoff meeting, 12.-13.03.2019, Amman, Jordan

Agenda

Tuesday 12. March 2019

Welcome-session

11:00 - 11:15 Introduction on SESAME financial situation (Walid Zidan)

11.15 – 11.30 Status of SESAME Machine (Riccardo Bartolini)

11:30 – 12:15 Status of and Science at SESAME (Giorgio Paolucci)

12:15 – 14:00 (Buffet) Lunch

14:00 – 14:45 X-ray tomography: BEATS in the international context (Alexander Rack)

WP-session 1

14:45 – 15:30 Administrative issues

Project coordination, WP01 (Axel Kaprolat, 15 min)

Project communication issues (Kirstin Colvin, 15 min)

Financial procedures (Anne Talucci, 15 min)

15:30 – 16:00 Coffee break

16:00 – 17:00 WP02, Sustainability (Frank Lehner et al.)

17:00 – 18:00 WP03, x-ray source (Riccardo Bartolini, Josep Campnay)

Wednesday, 13. March 2019

WP-session 2

09:00 – 11:00 WP04, 05, 06 (Giorgio Paolucci, Axel Kaprolat)

11:00 – 11:30 Coffee break

11:30 – 12:30 WP07, Data Handling and Analysis (Charalambos Chrysostomou)

12:30 – 14:00 (Buffet) Lunch

14:00 – 14:45 Keynote: Khaled Toukan

14:45– 18:00 Visit to SESAME, networking.