

SESAME: A DREAM COMING TRUE

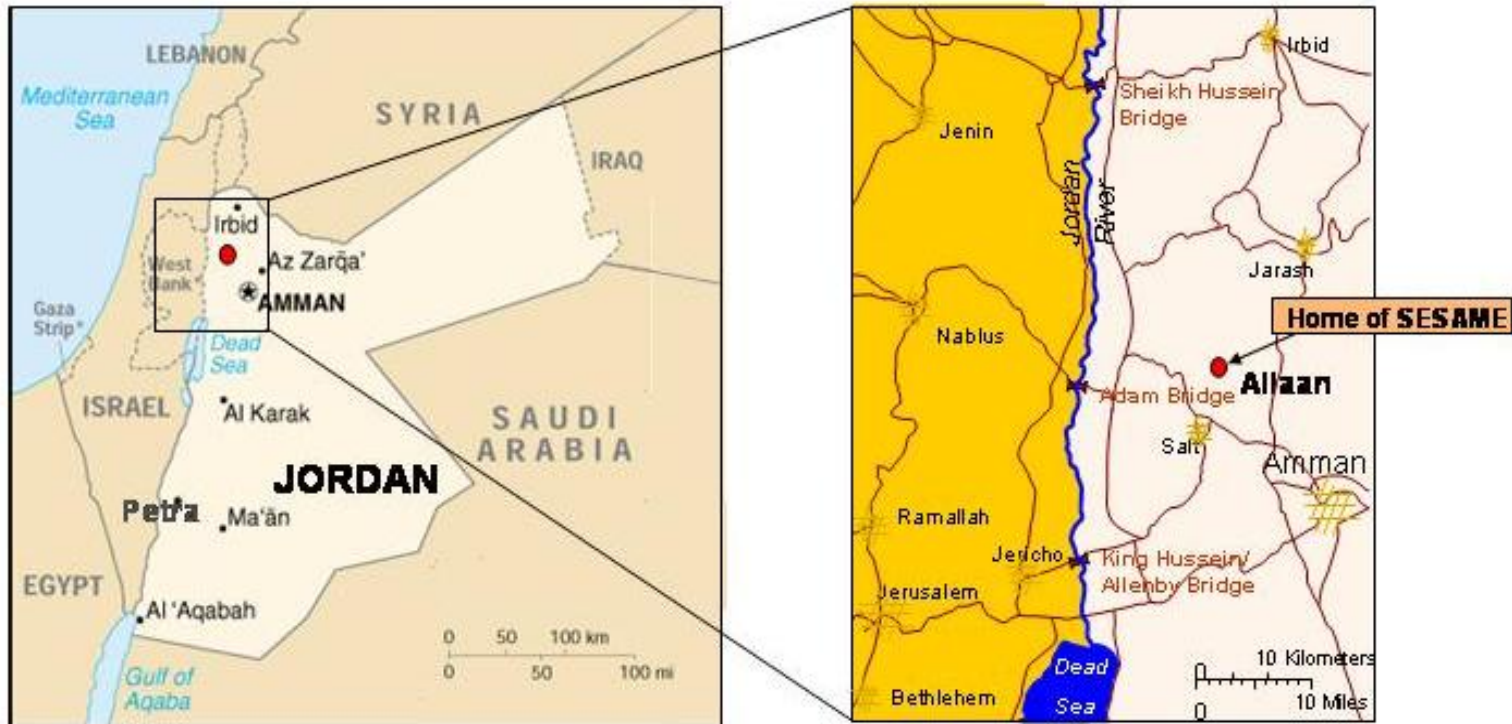
Zehra Sayers

**Sabancı University, Turkey
Chair, SESAME Scientific Advisory
Committee**

SESAME: Synchrotron Light for Experimental Science and Applications in the Middle East

A 3rd generation light source located near Amman, Jordan.

www.sesame.org.jo



There are more than 60 light sources around the world; none in the Middle East.



Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestinian Authority, Turkey.

Observers: France, Germany, Greece, Italy, Japan, Kuwait, Portugal, Russian Federation, Sweden, Switzerland, UK, USA.

Objectives:

- Foster excellence in science and technology in the Middle East.
- Reverse brain drain in the region.
- Enhance regional science and technology infrastructure.
- Contribute to improved understanding among peoples of diverse backgrounds through peaceful scientific cooperation.

- 1995:** CERN-based Middle East Scientific Cooperation (including S. Fubini and E. Rabinovici) efforts for regional cooperation.
- 1997:** Decommissioning the 0.8 GeV BESSY 1 storage ring and the injector system in Berlin.
Possibility of its offer as a gift from Germany to a Middle Eastern country. (H. Winick, SLAC, USA; G. A. Voss, DESY, Germany, S. Fubini and H. Schopper, CERN, Switzerland, E. Rabinovici, Israel). Involvement of UNESCO (F. Mayor).
- 1999:** SESAME project launched under the auspices of UNESCO.
Interim Council of SESAME. President: H. Schopper.
- 2002:** UNESCO Executive Board approval and establishment of SESAME as an independent lab under the auspices of UNESCO (2004).
Design of the 2.5 GeV upgraded SESAME ring.

A Brief History of SESAME (II)

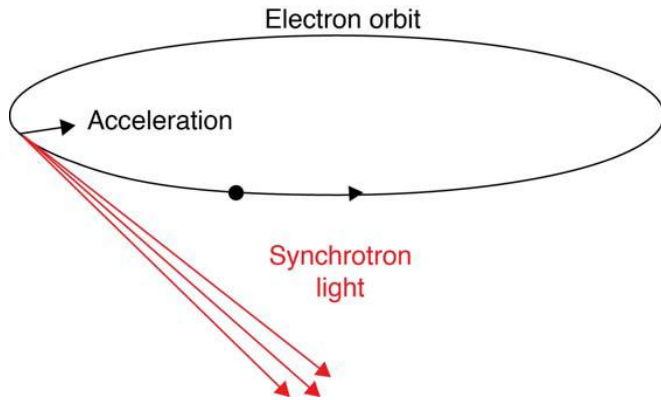


2008: Inauguration of the building.

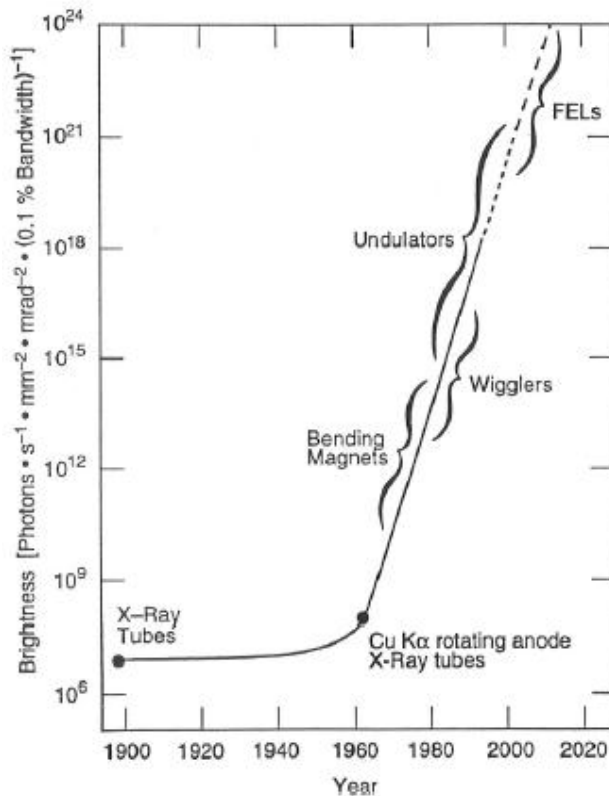
2009: Test operation of BESSY 1 microtron at 5.4 MeV.

2011: Completion of the shielding wall and operation of the microtron at~ 22 MeV.

Expected to be operational in 2015.



At relativistic velocities changes in the acceleration of electrons in a curved orbit result in emission of SR tangential to the orbit.
Wavelength range from infrared to X-rays.



3rd generation sources; Insertion devices in straight sections, wigglers and undulators, give a more intense beam.

4th generation sources; free electron lasers



X-Rays

Nobel Prizes

Chemistry

- 1936 P. Debye
- 1962 M. Perutz ve J. Kendrew
- 1976 W. Lipscombe
- 1985 H. Hauptman ve J. Karle
- 1988 J. Deisenhofer, R. Huber ve H. Michel
- 1997 P. D. Boyer ve J. E. Walker (SR)
- 2003 P. Agre ve R. Mackinnon (SR)
- 2006 R. Kornberg (SR)
- 2009 A. Yonath, T. Steitz ve V. Ramakrishnan (SR)

Medicine

- 1946 H. Müller
- 1962 F. Crick, J. Watson ve M. Wilkins
- 1979 A. Cormack ve G. Hounsfield

Physics

- 1901 W. Röntgen
- 1914 M. von Laue
- 1915 W. H. ve W. L. Bragg
- 1917 C. Barkla
- 1924 K. Siegbahm
- 1927 A. Compton
- 1981 K. Siegbahn



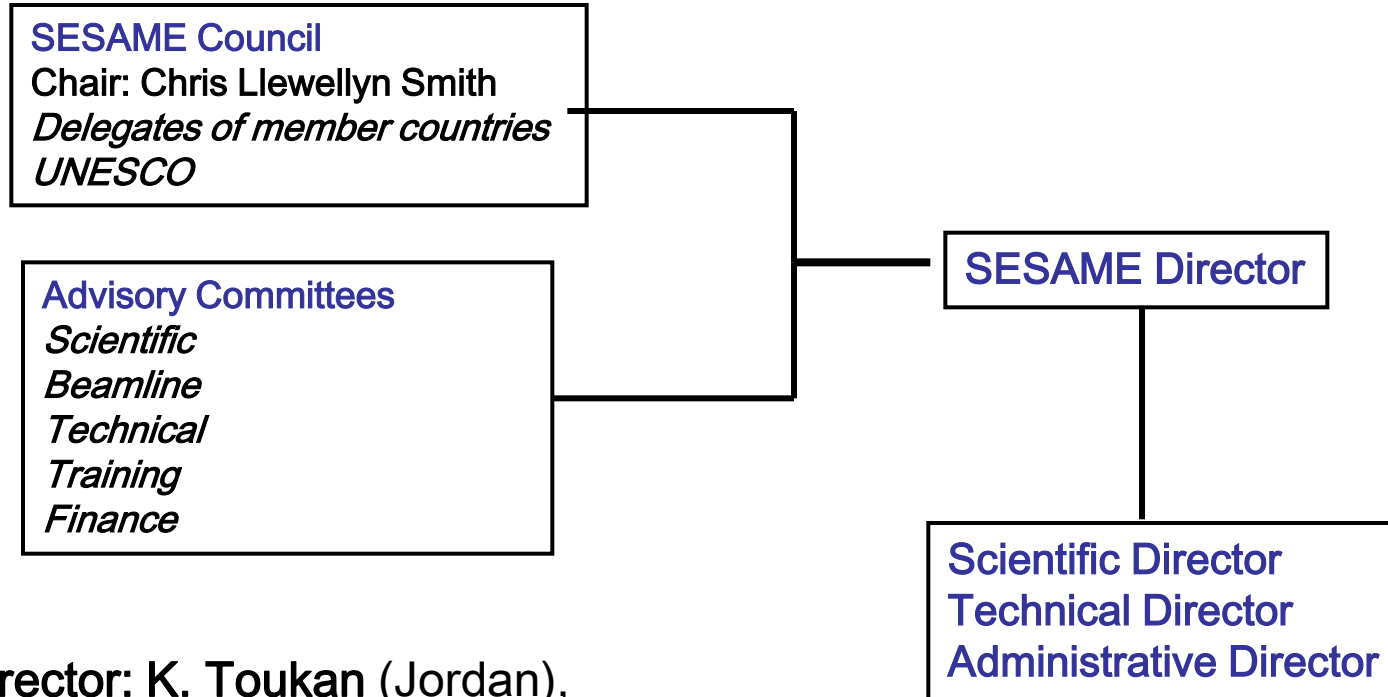
Building designed and constructed by engineers from Al Balqa' University.

Completed in 2008.

Support from His Majesty King Abdullah II.



Organizational Structure of SESAME



Director: K. Toukan (Jordan),
Scientific Director: H. Hoorani (Pakistan),
Technical Director: E. Huttel (Germany),
Administrative Director: M.Y. Khalil (Egypt)

Scientists: M. Harfouche (Algeria), I. Yousef (Jordan)

Technical Staff: T.Abu-Hanieh, A.Amro, M.Alnajdawi, M.Attal, D.Foudeh, A. Homoud, A.Hamad, A.Kaftoosian, T.Kahn, Y. Momani, F.Makahleh, S.Matalgah, M.Shehab, S.Varnasseri

Members of Scientific and Beamline Advisory Committees

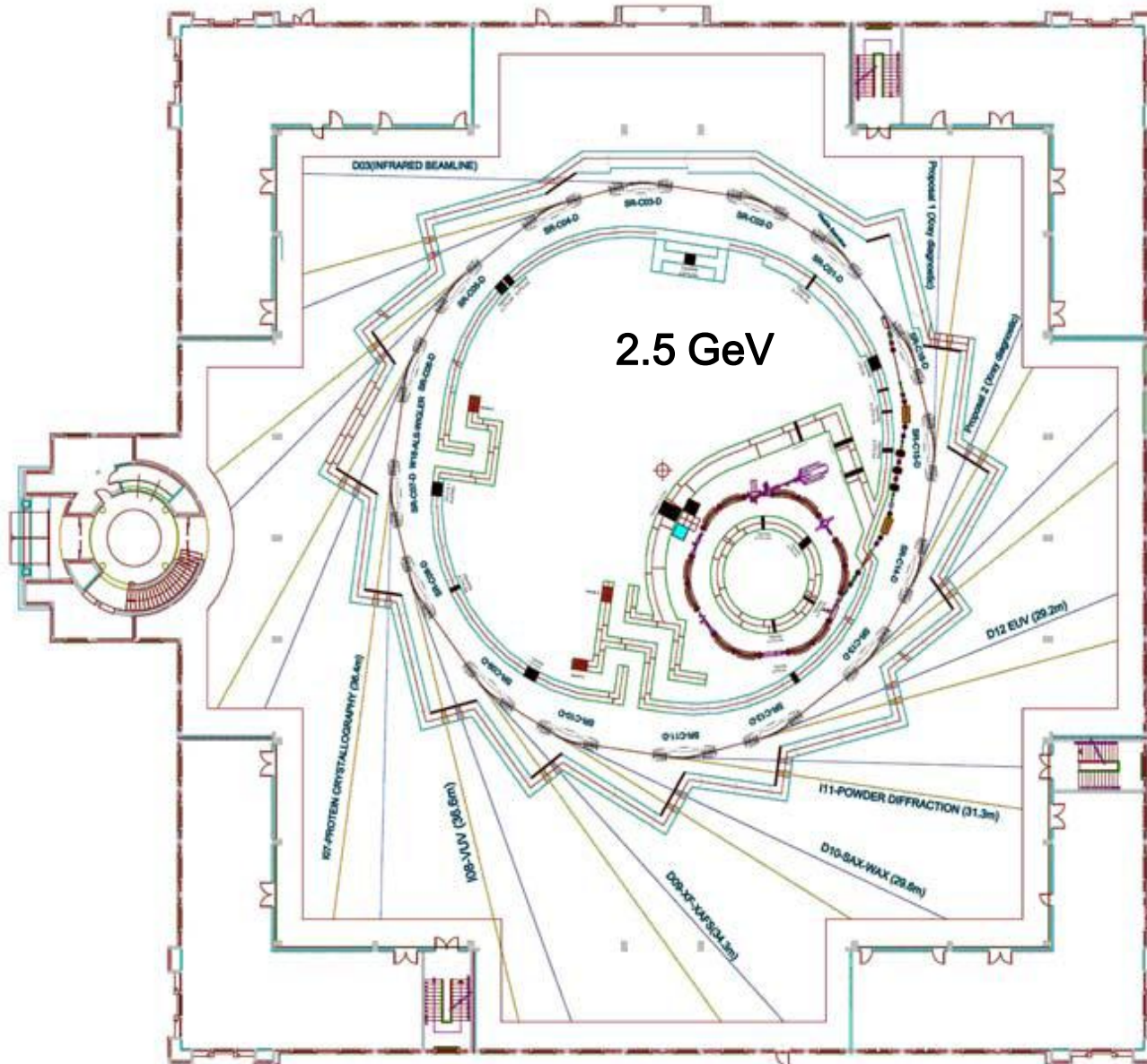
Scientific Committee

Z. Sayers (chair, Turkey), M. Al-Sherbiny (Egypt), P. Dumas (France), T. Ellis (Canada) M. Kiskinova (Italy), S. Mahmood (Jordan), i. Sagi (Israel), M. Sowwan (Palestinian Authority), M. Tabrizchi (Iran), J. F. Van der Veen (Switzerland).

Beamlines Committee

Z. Hussain (chair, Pakistan, USA), S. F. Fabregas (Spain), S. Hasnain (Pakistan, UK), M. Howell (UK, USA), E. Ozdas (Turkey), U. Raviv (Israel), S. Wakatsuki (Japan), H. Winick (USA).

Accelerators and Storage Ring



Circumference.: **133.2 m**

Emittance: **26.0 nm.rad**

Current: **400 mA**

16 St. sections.

> 25 beamlines:

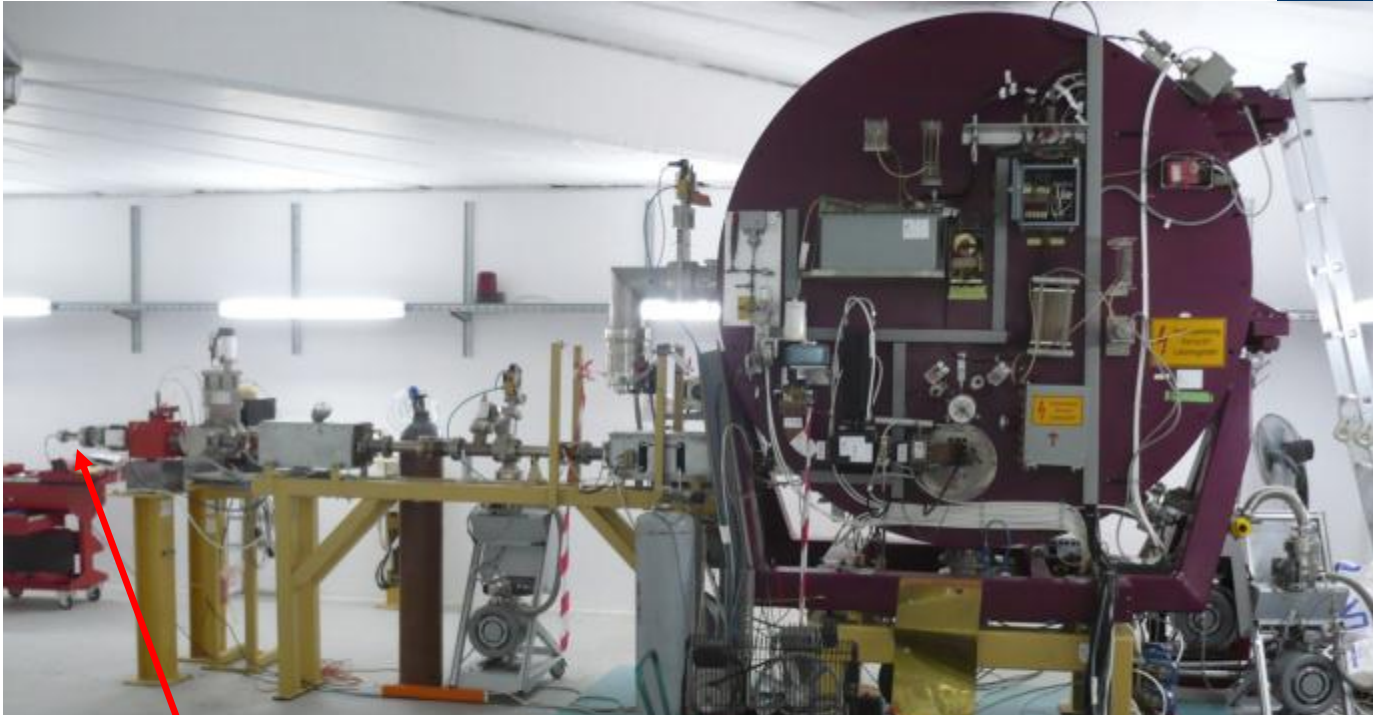
12 Insertion Devices

13 Bending Magnet

Beamlines

Length:

21 m to 36.7 m

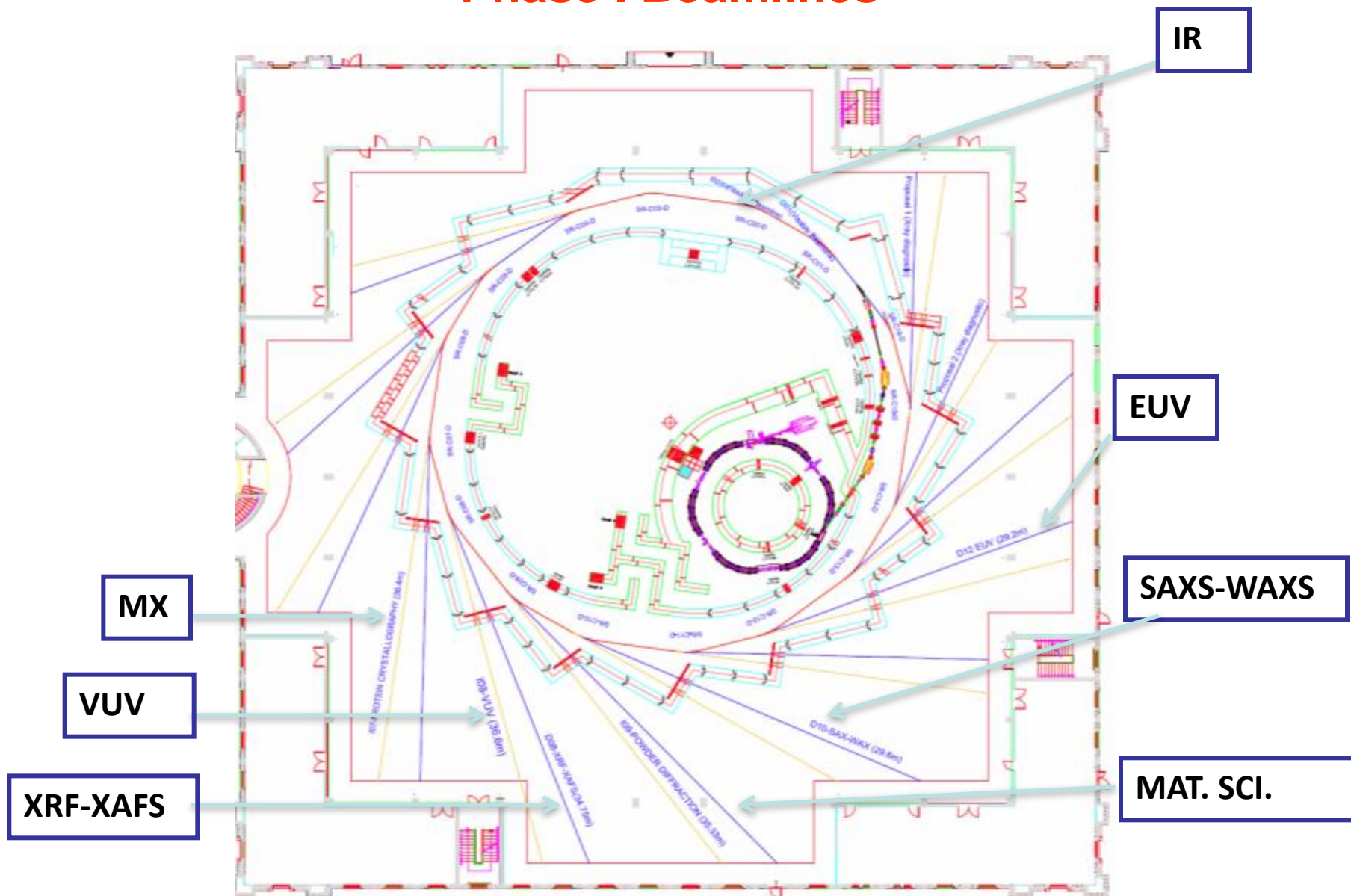


800 MeV BESSY I Booster magnets are installed on girders.
Cooling system is being installed.
New vacuum chambers have been designed and are being produced.



Booster ring is scheduled to be functional in 2013.

Phase I Beamlines



Space around the hall is allocated for preparation and technical support labs.

Phase I Beamlines*



*Decided at the 3rd SESAME Users' Meeting

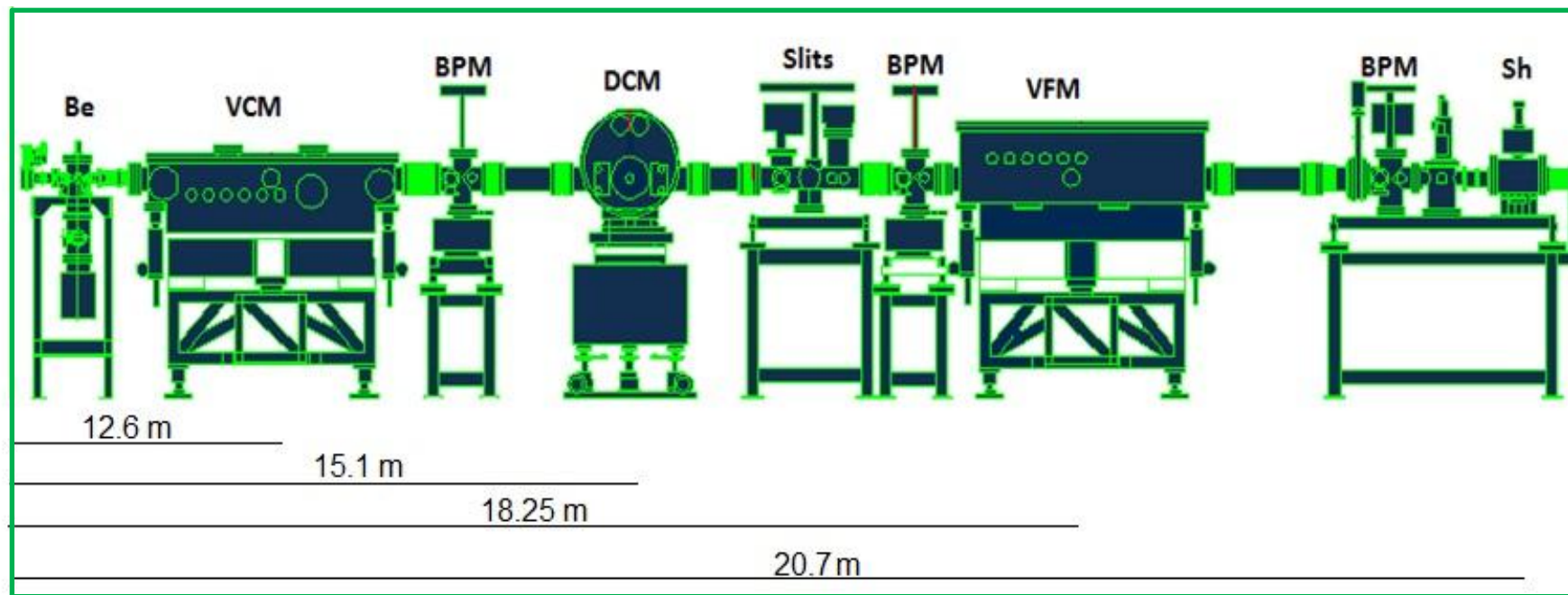
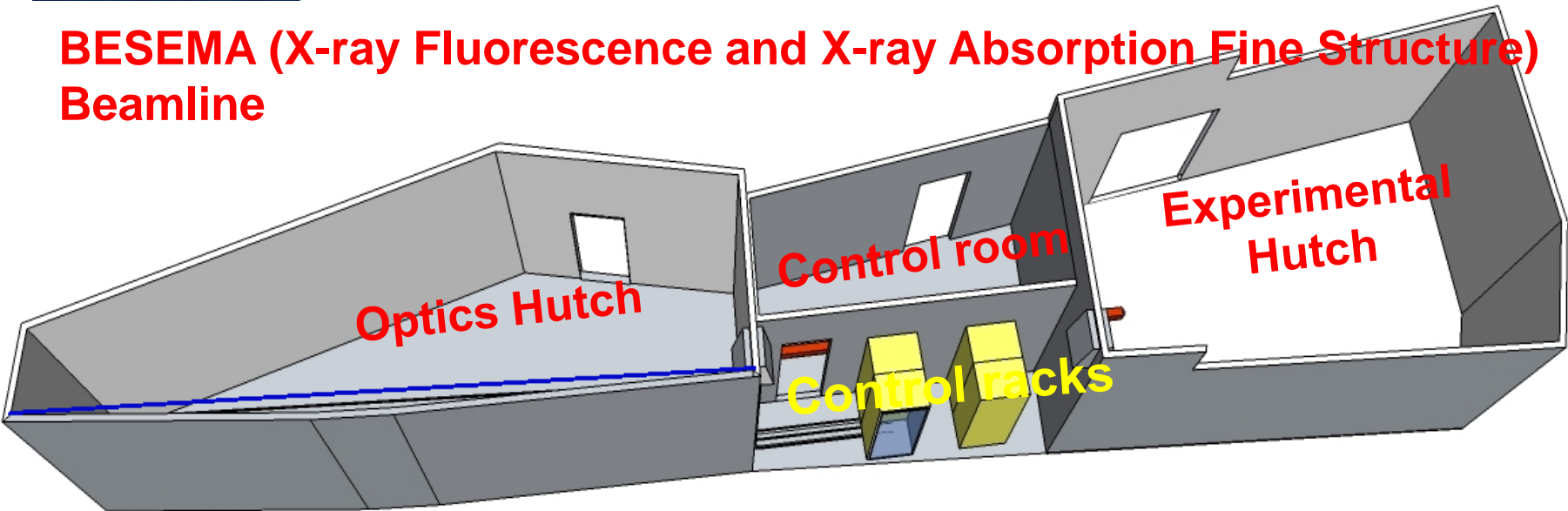
IR beamline completely new.

PD based on a wiggler and a beamline from SLS.

XAFS/XRF based on a German beamline at ESRF.

- **PX Beamline – IMCAN**
 - International **M**acromolecular **C**ryst**A**llography **N**exus
- **XRF Beamline – BASEMA**
 - **B**eamline for **A**bsorption **S**pectroscopy for **E**nvironment and **M**aterial **A**pplications
- **IR Beamline – EMIRA**
 - **E**lectro**M**agnetic **I**nfrared **R**adiation
- **PD Beamline – SUSAM**
 - **S**ESAME **U**Sers **A**pplication for **M**aterial **S**cience

BESEMA (X-ray Fluorescence and X-ray Absorption Fine Structure) Beamline



- **Structural Molecular Biology and Medical Applications**
- **Atomic and Molecular Sciences**
- **Surface and Interface Science**
- **Environmental Science**
- **Material Science**
- **Archaeological Science**

- **Medical Applications (demanded by the users community at the 3rd Users Meeting)**

SR sources are ideal for broad range of research areas and interdisciplinary science.

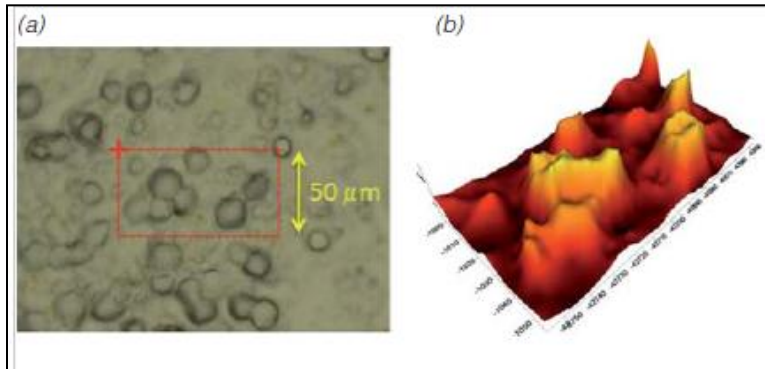
-Structural Molecular Biology (I)

Molecular structure of proteins, DNA, RNA and viruses.

Drug design.

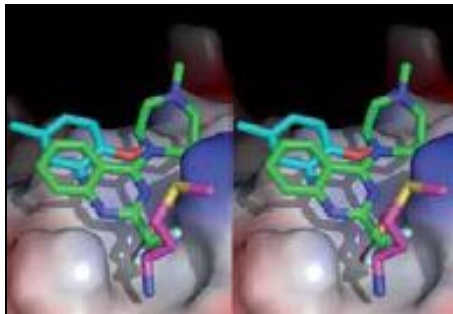
Tissue characterization.

Beamlines; MX, SAXS/WAXS, XAFS/XRF/IR.



Infrared imaging of disease conditions in liver.

(Le Naour, F. et al., Inserm U602 Villejuif and SOLEIL synchrotron, France).



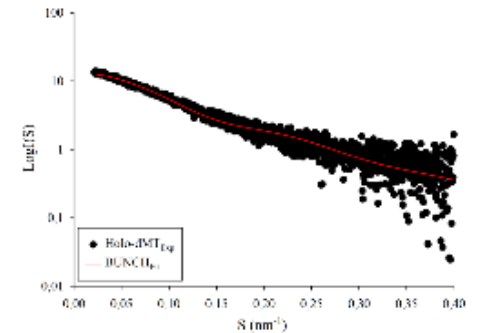
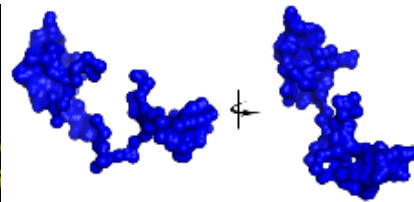
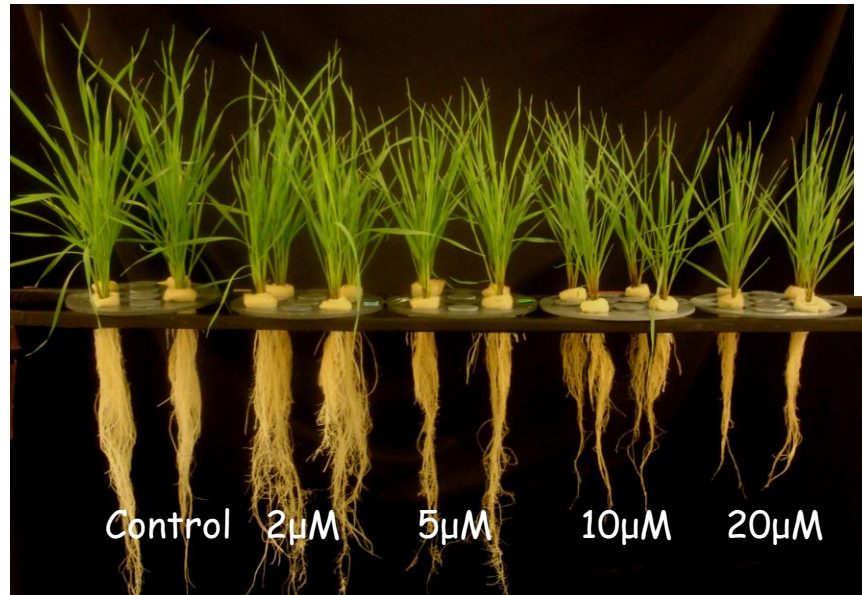
Development of drugs for motor neuron disease.

(Antonyuk, S. et al., 2010).

Investigation of molecular structures of proteins involved in metal homeostasis in wheat.



XRF analyses for enhancement of Zn content of seeds.



SAXS analysis of proteins involved in Cd tolerance.

(Aydin, M. et al., 2012).
(Bilecen et al., 2005)

Archaeology and cultural heritage;

Noninvasive investigation of material composition

Palimpsest analyses

Beamlines; PD, SAXS/WAXS, XAFS/XRF.



**Ancient pigment technology revealed
by synchrotron X-rays.**

Opaque colored glass 18th Egyptian
dynasty; new technology for obtaining
opaque glass

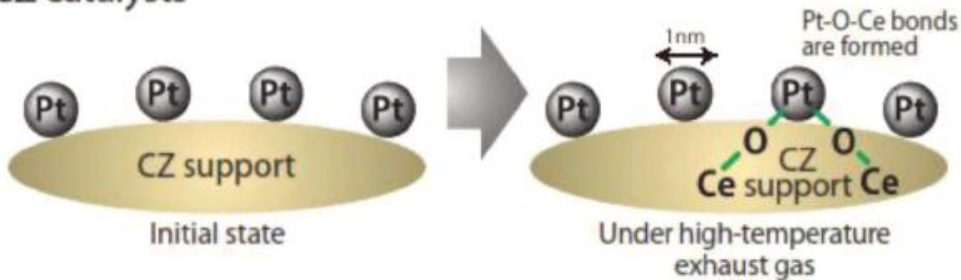
(Lahlil, S. et al., 2010)

Possible Phase II Beamlines*

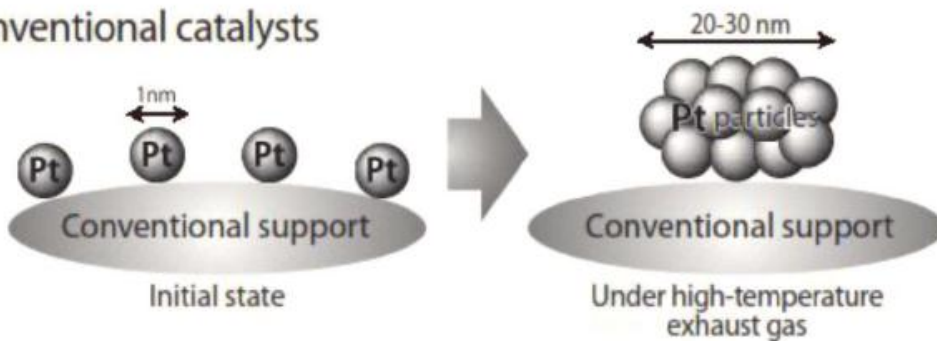
- 8) Photon in/photon out Spectroscopy; **in-situ, energy/water problem**
- 9) Nanoprobe; **Soft and/or hard x-ray Microscopy, nanoscience**
- 10) Coherent Scattering/Imaging; **biology, strongly correlated systems**
- 11) Soft x-ray Spectroscopy and Scattering; **MCD (magnetism), soft matter**
- 12) MX; **Biology (In Vacuum Undulator)**
- 13) MicroProbe/diffraction; **materials, archeology**
- 14) High Pressure; **materials**

* suggestion based on vision to meet needs of region and challenges

Pt/CZ catalysts



Conventional catalysts



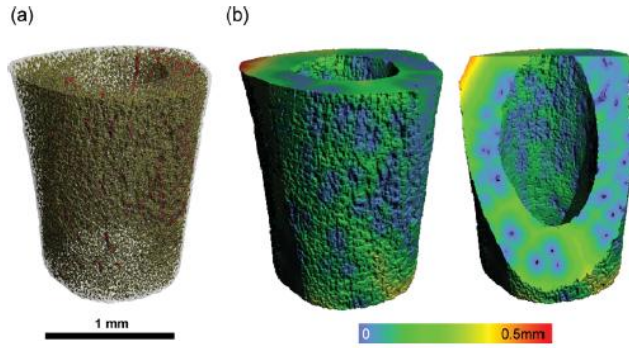
Characterization of Pt/CZ catalysts used in exhaust gas retention in cars.

CZ: ceria (CeO_2) and zirconia ZrO_2 based composite material characterization using X-ray diffraction and X-ray absorption.

(Spring8, Japan)

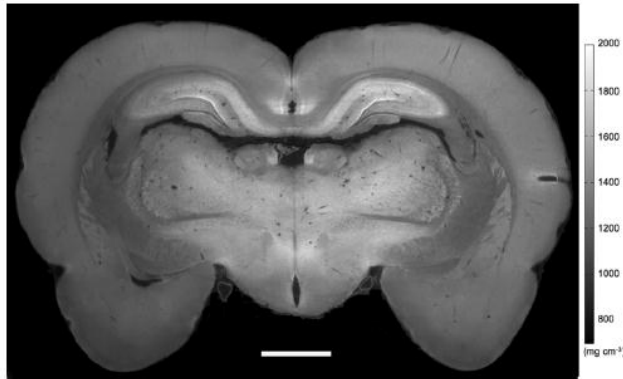
Toyota Motor Corp. & Toyota Central R &D Labs.

Medical Applications



Diffraction enhanced high resolution imaging and tomography using coherent X-rays.

(Diamond, SLS)



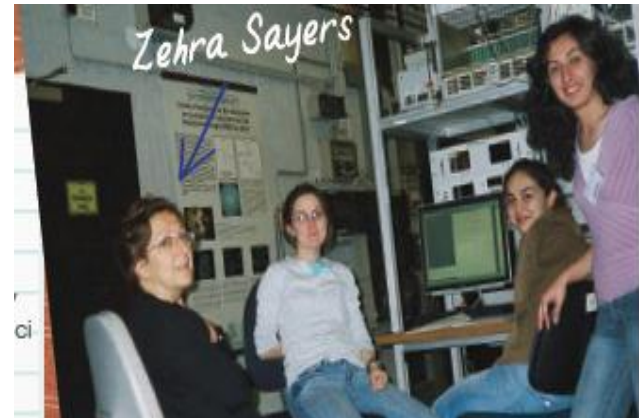
Users of SESAME



Mohammad Yous



Sumera Javeed



Zehra Sayers



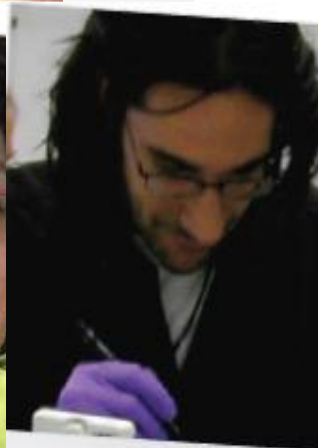
Mukhles Sowwan



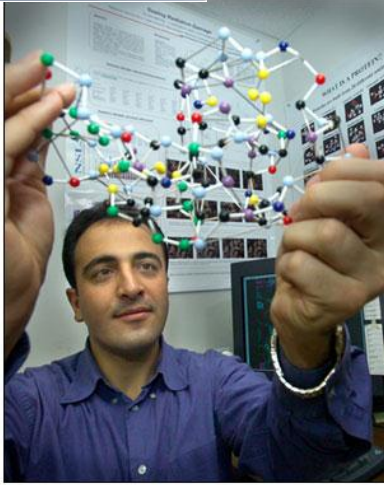
Maher Attia



Irit Sagi



Vasilis Promponas



Mehmet Aslantas holds a ball-and-stick model of the test protein he used in his research.

National Synchrotron Light Source (NSLS)

Mehmet Aslantas (Turkey) won the prestigious Margaret C. Etter Student Lecturer Award for a talk on his recent work: how to reduce the effects of radiation damage to protein crystals during synchrotron x-ray studies

Advanced Light Source Users' Meeting 2009: Haiku.

Funda Aksoy wins a prize for student poster.



NSLS: Gulgun Cakmak (Turkey) is working on the IR beamline investigating early detection of cancer cells.

Specialized Workshops

- First Workshop on Structural Molecular Biology (SMB) at SESAME, Athens, Greece, 6-7 December, 2000.
- SESAME WorkShop on Accelerator Science, Al-Balqa' Applied University, Al- Salt, Jordan, 9-19 September, 2000.
- Workshop on Materials Science, Hacettepe University, Ankara, Turkey, 21-22 September, 2000.
- Second Workshop on Structural Molecular Biology (SMB) at SESAME, University of Cyprus, Nicosia, Cyprus, 6-7 December, 2000.
- SESAME Workshop Bioinformatics and Structural Modeling, Sabanci University, Istanbul, Turkey, 3-8 September, 2001.
- SESAME Workshop on Synchrotron Applications in Macromolecular Crystallography, Cairo, Egypt 30 November-2 December, 2006.
- SESAME-JSPS Synchrotron Radiation School Antalya, Turkey. 1-5, March 2010.
- SESAME-JSPS Synchrotron Radiation School Amman, Jordan. 17-22, March 2011

SESAME Users' Meetings

- 11th SESAME Users Meeting November 7-9, 2012 Amman, Jordan.
- 10th SESAME Users Meeting November 8-12, 2011 Amman, Jordan.
- 9th SESAME Users Meeting November 12-14, 2010 Amman, Jordan.
(Together with SESAME-JSPS School)
- 8th SESAME Users Meeting November 19-21, 2009 Petra, Jordan.
(Together with SESAME-JSPS School)
- 7th SESAME Users Meeting November 17-21, 2008 Cairo, Egypt.
(Together with SESAME-JSPS School)
- 6th SESAME User Meeting November 17-19, 2007 Amman, Jordan.
- 5th SESAME User Meeting December 27-29, 2006 Alexandria, Egypt.
- 4th SESAME Users Meeting December 6-8, 2005 Amman, Jordan.
- 3rd SESAME Users Meeting October 11 - 13, 2004 Antalya, Turkey.
- 2nd SESAME Users Meeting November 29 - December 1, 2003 Esfahan, Iran.

- 1st SESAME User's Meeting October 19-28, 2002 Amman, Jordan.

About 200 scientists from the Middle East region and observer countries come together.

Users Meetings



R. Sarraf 7-12-2005

<i>Machine Technical Staff Training 2002-2003</i>			
<i>Name</i>	<i>Area</i>	<i>Country</i>	<i>Host</i>
B.Kalantari	Control System	Iranian	SLS, Switzerland
H. Hassanzadegan	Power Supply	Iranian	DESY, Germany
S. Varnasseri	Beam Diagnostics	Iranian	SRS, England
K. Tavakoli	Vacuum System	Iranian	Lure, France
H. Delsim- Hashemi	Injection	Iranian	DESY, Germany
E. Dmour	Vacuum System	Jordan	SRS, England
A. Elsis	Beam Diagnostics	Jordan	ESRF, France
M. Attal*	Beam Physics	Jordan	Lure, France
H. Tarawneh*	Magnets	Jordan	Maxlab, Sweden
A. Amro*	Vacuum system	Jordan	Elettra, Italy
A. Adwan*	Control System	Jordan	SLS, Switzerland

11 trainees
*Back at SESAME

<i>National Synchrotron Radiation Center of Taiwan</i>					
<i>2004</i>			<i>2006</i>		
Name	Area	Country	Name	Area	Country
O. Ozgen	PD	Turkey	W. A. Hatemleh	PES	Jordan
F. Elmi	PX	Iran	Y. Ozcan	SAXS	Turkey
T. Ali Khan	Instr.	Pakistan	J. Alikhajeh	PX	Iran

<i>LNLs Brazilian Light Source Laboratory</i>		
<i>2008</i>		
Name	Area	Country
J. Khoshman	XAS	Iran
H. Farrokhpour	UV-X-ray	Jordan
J.A. Suleiman	UV-X-ray	Palestinian Authority

<i>ALS, USA</i>		
<i>2008</i>		
Name	Area	Country
F. Aksoy	XAS	Turkey
s. Gul	UV-X-ray	Pakistan
<i>2004-2006</i>		
M. Farooq	UV-X-ray	Pakistan

SESAME/IAEA Fellowships

1. **2005-2006** National project on human capacity building in accelerator physics and synchrotron radiation JOR/0/007, in the context of inter-regional projects (INT/0/081).

8 X 1 month fellowships awarded to Jordanians to work in synchrotron radiation laboratories in Switzerland, France, UK and USA.

Discontinued.

2. **2007-2011** Project INT/1/055 in the context of MoU signed between IAEA and SESAME signed in December 2006.

This project provides

- 4X 6 month support for beamline users.

- 2X1 month support for machine operators.

- 1X6 month support for radiation protection training.

Within the constraints of the total budget flexibility is allowed to use the funds according to the requirements in the most efficient way.

3. **2011-:** New project is accepted.

SESAME/IAEA Fellowships			
2006-2007			
Name	Area	Country	Host
Z. El-bayyari	IR	Jordan	USA
A. Baig	PX	Pakistan	Daresbury,/UK
I. Ozen	Mat. Sci.	Turkey	Withdrawn
F. Abd-Allah	Str. Biol.	Egypt	EMBL/Germany
M. Attal	Mach.	Jordan	SOLEIL/France
A. M. Hamad	Mach.	Jordan	SOLEIL/France
A. Amro	Mach.	Jordan	Elettra/Italy
R. Sarraf	Build.	Jordan	SOLEIL/France

SESAME/IAEA Fellowships			
2007-20011			
Name	Area	Country	Host
M. Al-Hussein	Nanos tr.	Jordan	DESY/Germany
F. Afaneh	AMS	Jordan	BESSY/Germany
T. Abuelfadl	Mach.	Egypt	SLAC/United States
M. Nadeem	Mat. Sci	Pakistan	Elettra/Italy
M. Abu-Samak	Mat. Sci	Jordan	CLS/Canada
S.A. Matalgah	Mach.	Jordan	SLS/Switzerland
W. Saleh	Optics	Jordan	SRS/Great Britain
M. Gharaibeh	XAS	Jordan	SRS/Great Britain
Ö. Seckin	PD	Turkey	Elettra/Italy
A. Hamdi	Optics	Turkey	APS, USA
A.Akkaya	PD	Turkey	SLS/Switzerland

<i>2005</i>		<i>2006</i>		<i>2007</i>	
<i>Name</i>	<i>Country</i>	<i>Name</i>	<i>Country</i>	<i>Name</i>	<i>Country</i>
I. Y. Jumha	Jordan	S. Pirvadili	Turkey	R. R. Yousef	Palestine
E. Aydin	Turkey	M. El-Abeid	Jordan	F.Abd-Allah-	Egypt
M. Mostajeran	Iran	A. H. Fegghi	Iran	R. Ajaj	Syria
S. H. Shaker	Iran	P. Vahdani	Iran	A. M.Taha	Egypt
G. Kaştaş	Turkey	M. Ghorbani	Iran	Ercan Turan	Turkey
H. Ghasem	Iran	A.Mehdizahde	Iran	M. Mirzaei	Iran
Y. Jamil	Pakistan	R. Taleei	Iran	H. Azizi	Jordan
M. M. Ahadian	Iran			A.Kaftoosian	Jordan
M. Eshragi	Iran			A. El Hemiely	Egypt
				H.Golinassab	Iran
				V.Forouzesh	Iran
				L. Amin	Iran
				M. Shafaii	Iran
				S. Esmaili	Iran
				F. Ebrahimi	Iran
				R. Tarkeshian	Iran
				A. Moeeni	Iran

ANKA, Germany
Brazilian Light Source, Brazil
Elettra Sincrotrone, Italy
ESRF, France
Daresbury Laboratory, UK
DESY, Germany
LURE, France
MAX-Lab, Sweden
Swiss Light Source, Switzerland
ALBA-Cells, Spain
Diamond, UK
Taiwan Light Source, Taiwan
SOLEIL, France

UNESCO
DoE, USA
IAEA
ICTP
APS-EPS-IoP-DPG
JSPS
Portugal
Canon Foundation
Lounsbery Foundation

Continued/increased financial support

Income

EU-CERN: 5.00 M€
 Jordan: 4 x 1.25 M\$
 Turkey: 4 x 1.25 M\$
 Israel: 4 x 1.25 M\$
 Iran: 4 x 1.25 M\$?
 Pakistan: in kind contribution?
 USA?
 Norway?

Machine:	25.6 M\$
4 Beamlines upgrade:	8.7 M\$
Guesthouse+	1.3 M\$
Sum	35.6 M\$

Injector-upgrade	0.9 M€
Magnets and PS:	5.0 M€
Girder:	0.8 M€
Vacuum:	3.0 M€
RF:	3.0 M€
Diagnostics:	1.5 M€
SR-Cooling:	0.5 M€
Cabling:	0.5 M€
Commissioning:	1.5 M€
Control-System	1.1 M€
Safety P+A	0.8 M€
Front-Ends:	0.5 M€

Sum [€]	19.0 M€
Sum [\$]	23.3 M\$
10%	25.6 M\$

New members are welcome!

Political and social stability in the region!

Can science win?

Can we build lines of communication through the language of science?

CERN Model worked. Dream came true!

SESAME; Dream coming true!

THANK YOU!