



The Africa Light Source Foundation
Towards a Lightsource for the African Continent



AfLS7

Comments on the Geopolitical Conceptual Design Report for an African Light Source

Sekazi K. Mtingwa

Chair, Executive Committee, *LAAAMP*

Member, Executive Committee, AfLS

21 November 2024

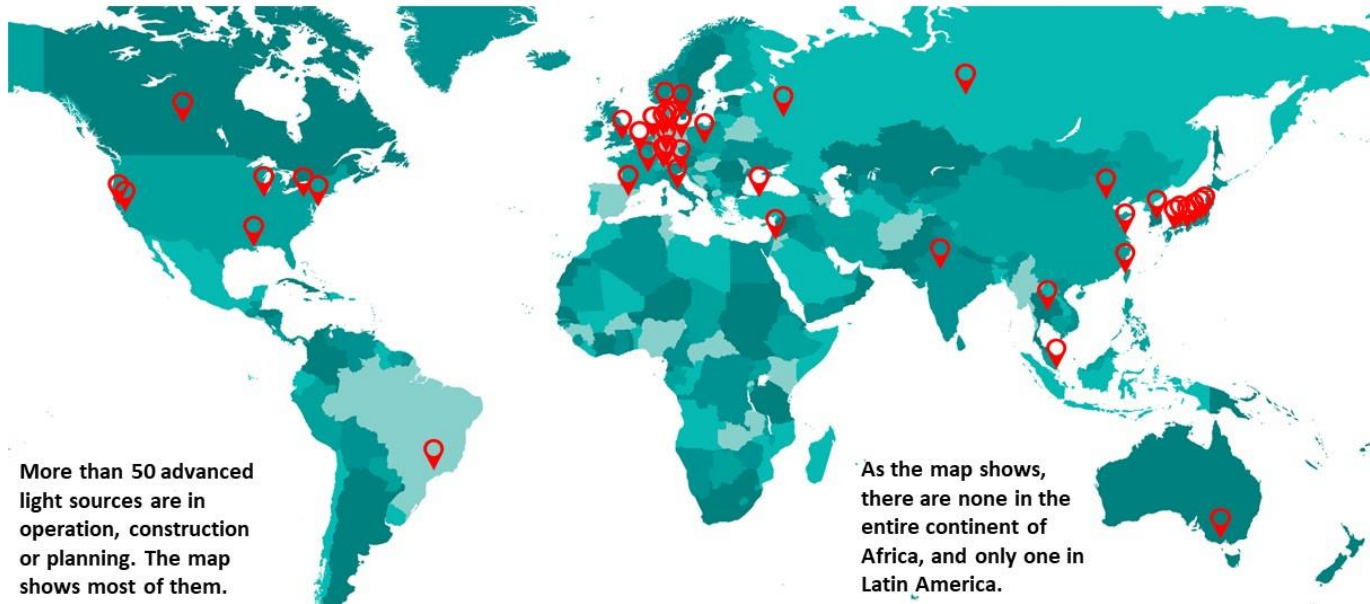


The Africa Light Source Foundation

Towards a Lightsource for the African Continent



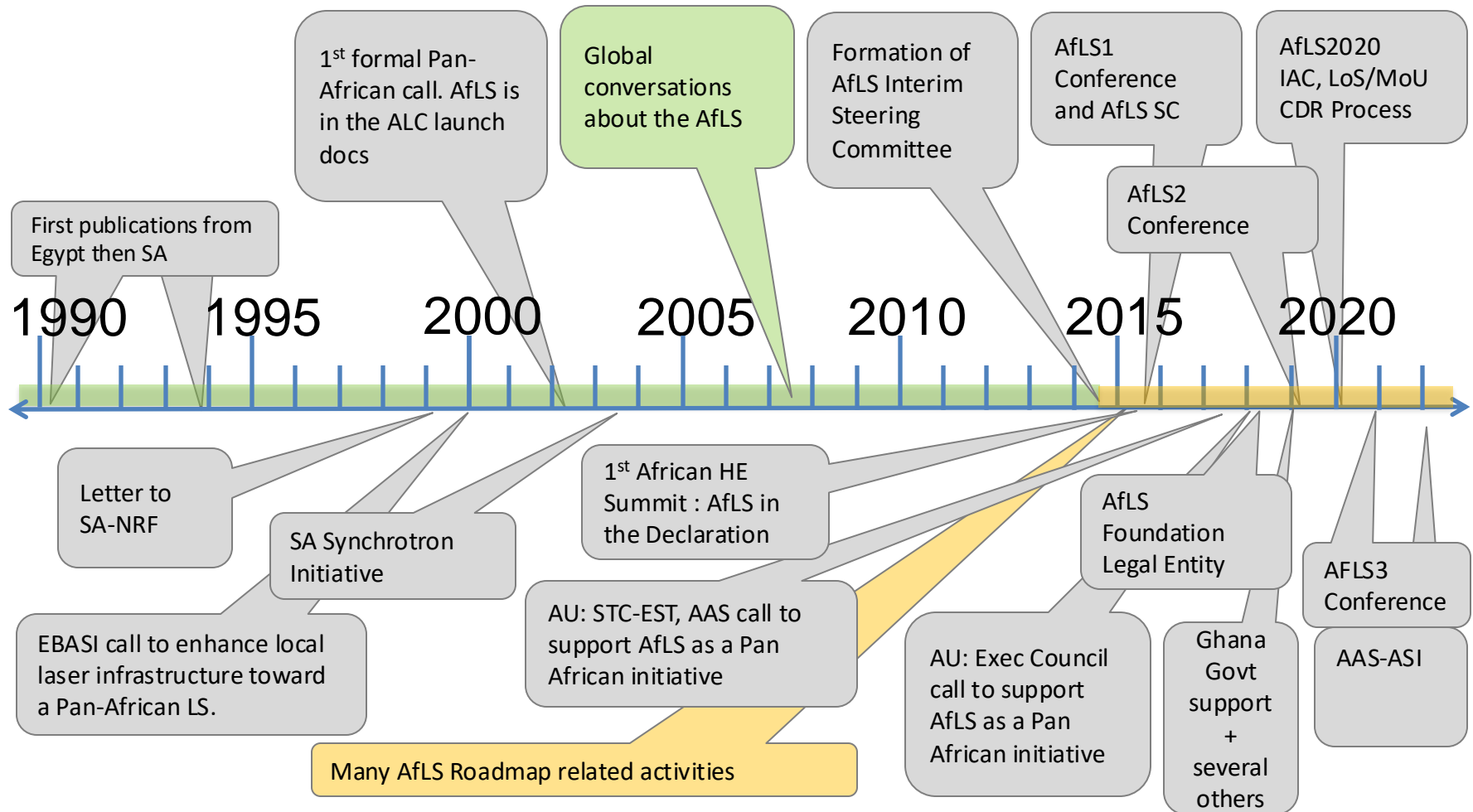
World Map of advanced Light Sources





The Africa Light Source Foundation

Towards a Lightsource for the African Continent





The Africa Light Source Foundation

Towards a Lightsource for the African Continent



1st African Light Source Conference and Workshop
15 - 20 November 2015
ESRF - Grenoble - France

Why is an AfLS essential?

Source

The Grenoble resolutions

- Advanced light sources are the most transformative scientific instruments, similar to the invention of conventional lasers and computers.
- Advanced light sources are revolutionising a myriad of fundamental and applied sciences, with an accompanying impact on sustainable industry.
- The community of researchers around the world are striving collaboratively to construct ever more intense sources of electromagnetic radiation, specifically derived from synchrotron light sources and X-ray free-electron lasers (XFELs), to address the most challenging questions in living and condensed-matter sciences.
- The African Light Source is expected to contribute significantly to the African science renaissance, the return of the African science diaspora, the enhancement of university education, the training of a new generation of young researchers, the growth of competitive African industries, and the advancement of research that addresses issues, challenges and concerns relevant to Africa.
- For African countries to take control of their destinies and become major players in the international community, it is inevitable that a light source must begin construction somewhere on the African continent in the near future, which will promote peace and collaboration among African nations and the wider global community.





The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Top-Down

Vodafone GH  

      78%  09:53

Ghana to champion African Light Source – Akufo-Addo

 2 days ago  General News  Leave a comment



Ghana will champion the African Light Source (AfLS) to make it an official project of the African Union (AU) and ECOWAS, President Nana Addo Dankwa Akufo-Addo, has said.

President Akufo-Addo made the disclosure on Tuesday, in a speech read on his behalf at the opening of





The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Bottom-Up

X-TechLab at Sèmè City, Benin



Thierry d'Almeida presenting LAAAMP and the X-TechLab project to the Cabinet of the Government of Benin.

X-TechLab is aimed at **training** Faculty and Master's and Ph.D. students from African countries every year, and at **establishing a permanent user research facility** with experienced, permanent staff to act as a hub for the region.



Bottom-Up

FAculity-**ST**udent (FAST) teams visits at Synchrotrons

Eligibility

Faculty members at universities in Africa, the Caribbean, Latin America, Central Asia, SE Asia, Middle East, and Pacific. Interested in using AdLSs to further one's research and training endeavors. Previous experience with using AdLSs is limited to a year or less. Ability to spend 2 months as a full-time visitor in residence at an AdLS that is a *LAAAMP* collaborative partner.

Student registered as full-time Ph.D. student and supervised by the Faculty member.

Categories

Continuing and **New** applications are considered.

Financial Support

LAAAMP provides **2,000 Euros per person** to cover transportation and (partially) accommodation costs. The remainder of accommodation and subsistence should be negotiated with the host AdLS and other sources of support.



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



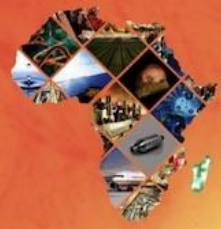
Synchrotron Science Workshop, Pretoria, 1-2 December 2011





Major Outcome Was Strategic Plan Adopted by South African Government

As recommended by Strategic Plan, on 21 May, 2013, South Africa signed a medium-term arrangement with the ESRF at a level of 0.3% and became the 20th country to join the ESRF.



Signing ceremony for South Africa joining the ESRF (2013)



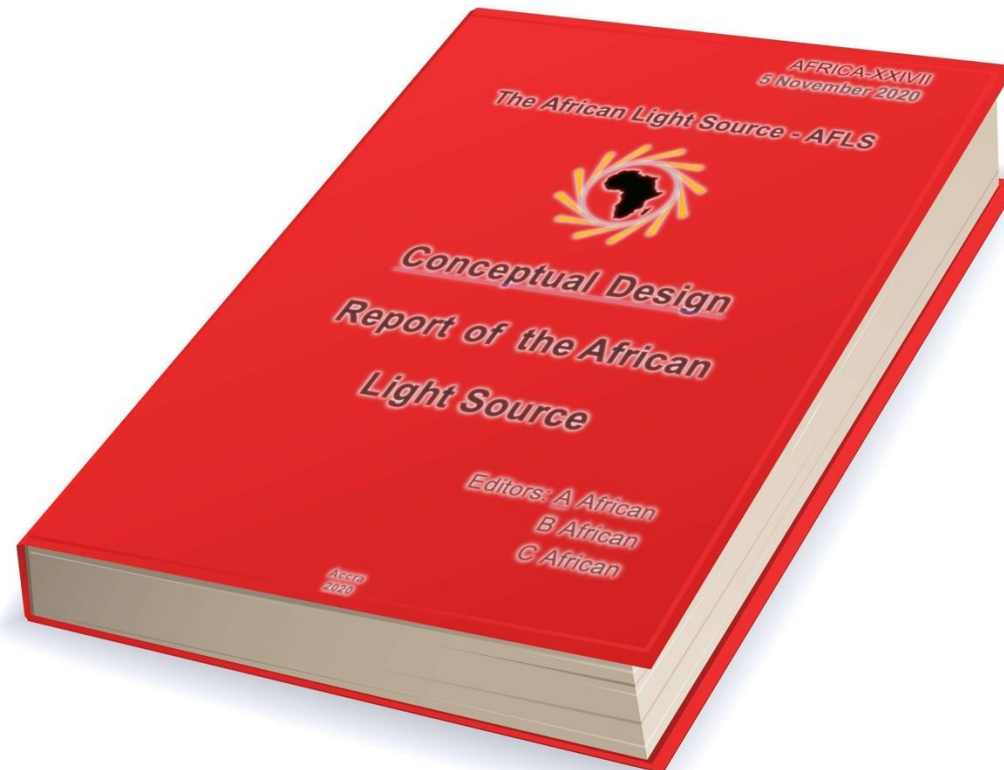


The Africa Light Source Foundation
Towards a Lightsource for the African Continent



Conceptual Design Report

Motivation for an African Light Source





The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Editorial Staff

Professor Tabbetha Dobbins
Chair, CDR Organizing Committee
Rowan University, USA

Professor Sekazi K. Mtingwa
Editor-in-Chief, Conceptual Design Report
Chair, LAAAMP Executive Committee
IUPAP C13 Commission
IUPAP Working Group 14 on Accelerator Science

Professor Connie L. McNeely
Deputy Editor, Conceptual Design Report
George Mason University, USA

Professor Michael Steinitz
Senior Editor, Conceptual Design Report
St. Francis University, Canada

Mr. Dorian Bohler
Co-Editor: *Machine Design Concepts*
SLAC National Accelerator Laboratory, USA

Professor Simon Connell
Editor: *Technical Infrastructure and Building Design*
University of Johannesburg, South Africa

Dr. Christine Darve
Co-Editor: *Machine Design Concepts*
European Spallation Source, Sweden

Dr. Ken Evans-Lutterodt
Editor: *Sci. Capabilities & Beamline Tech. Concepts*
Brookhaven National Laboratory, USA
Originally from Ghana

Professor Jean-Pierre Ezin
Editor: *Multinational Governance and Finance*
Institute of Mathematics and Physical Sciences, Benin

Professor Marcus Newton
Editor: *Scientific, Socio-Economic, Ed. & Pol. Benefits*
University of Southampton, UK



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



CDR Contributors

Hitoshi Abe (Japan), Marielle Agbahoungbata (Benin), Omololu Akin-Ojo (Rwanda, Nigeria), Thierry d'Almeida (France, Benin), El-Hachemi Amara (Algeria), Aba Andam (Ghana), Felix Emeka Anyiam (Nigeria), Riccardo Bartolini (Germany, Italy), Julien Benoit (South Africa), Asmeret Asefaw Berhe (USA, Eritrea), Muaaz Bhamjee (South Africa), Saphina Biira (Uganda), Caterina Biscari (Spain, Italy), Paul Buah-Bassuah (Ghana), Carlos Cabrera (USA, Puerto Rico), Richard Catlow (UK), Kelly Chibale (South Africa, Zambia), George Clerk (UK), Lowry Conradie (South Africa), Joseph Daafour (Ghana), Mmantsae Diale (South Africa), Rudolf Dimper (France, Germany), Tabbetha Dobbins (USA), Tchana Kamgne Duclair (Cameroon), Ahmed El-Hussein (Egypt), Ken Evans-Lutterodt (USA, Ghana), Ndèye Coumba Yandé FALL (Senegal), Vincent Fernandez (UK), Michel Fodje (Canada, Cameroon), Alfonso Franciosi (Italy), Benson Frimpong (Ghana), Gabriel Gwanmesia (USA, Cameroon), Maria Hamunyela (Namibia, South Africa), Messaoud Harfouche (Jordan, Algeria), Andrew Harrison (UK), Delia Haynes (South Africa), Kudakwashe Jakata (South Africa, Zimbabwe), W. Estella Johnson (USA), Akorede Kalejaiye (Nigeria), Gihan Kamel (Jordan, Egypt), Paul Abidemi Kappo (Nigeria, South Africa), Abebe Kebede (USA, Ethiopia), Patrice Kenfack (Cameroon), Nkem Khumbah (USA, Cameroon), Diouma Kobor (Senegal), Frank Lehner (Germany), Enzo Lombi (Australia), Kirsi Lorentz (Cyprus, Finland), Malik Maaza (South Africa, Algeria), Ernie Malamud (France, USA), Priscilla Masamba (South Africa), Brian Masara (South Africa, Zimbabwe), Genito Maure (Mozambique), Wilfred Mbacham (Cameroon), Stephen McGuire (USA), Connie L. McNeely (USA), Mongezi Mdhluli (South Africa), Gift Mehlana (Zimbabwe),

Country of origin listed second



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



CDR Contributors (cont'd)

Roland Mfondoum (Austria, Cameroon), Edward Mitchell (France, UK), Thandeka Moyo-Gwete (South Africa), Alfred Msezane (USA, South Africa), Célestin Nzanzu Mudogo (Democratic Republic of Congo), Andani Mulelu (South Africa), Kiran Mundboth (Canada, Mauritius), Amor Nadji (France), Peter Ngene (The Netherlands, Nigeria), Jean-Paul Ngome Abiaga (Jamaica, Gabon), Lawrence Norris (USA), Tshepo Ntsoane (South Africa), Abimfoluwa, Oluseyi Philip Oladijo (Botswana, Nigeria), Gideon Olaleye (Canada, Nigeria), Özgül Öztürk (Germany, Turkey), Resego Phiri (Botswana), María Josefina Robles Águila (Mexico), Alakendra N. Roychoudhury (South Africa), Ana Karen Sánchez-Hernández (Mexico), Yasien Sayed (South Africa), Sandro Scandolo (Italy), Wolf-Dieter Schubert (South Africa), Dereje Seifu (USA, Ethiopia), Bridinette Thiodjio Sendja (Cameroon), Francesco Sette (France, Italy), Trevor Sewell (South Africa), Sam Sloetjes (Sweden), Dawit Solomon (USA), Michael Steinitz (Canada, USA), Jean Susini (France), Mourad Telmini (Tunisia), Khaled Toukan (Jordan), Daouda Traore (France, UK, Mali), Bjorn von der Heyden (South Africa), Ahmadou Wagué (Senegal), Herman Winick (USA), Paul Wofo (Cameroon), Mostafa Zeidan (Egypt), Michele Zema (Italy)

List not quite complete: ~100 Contributors



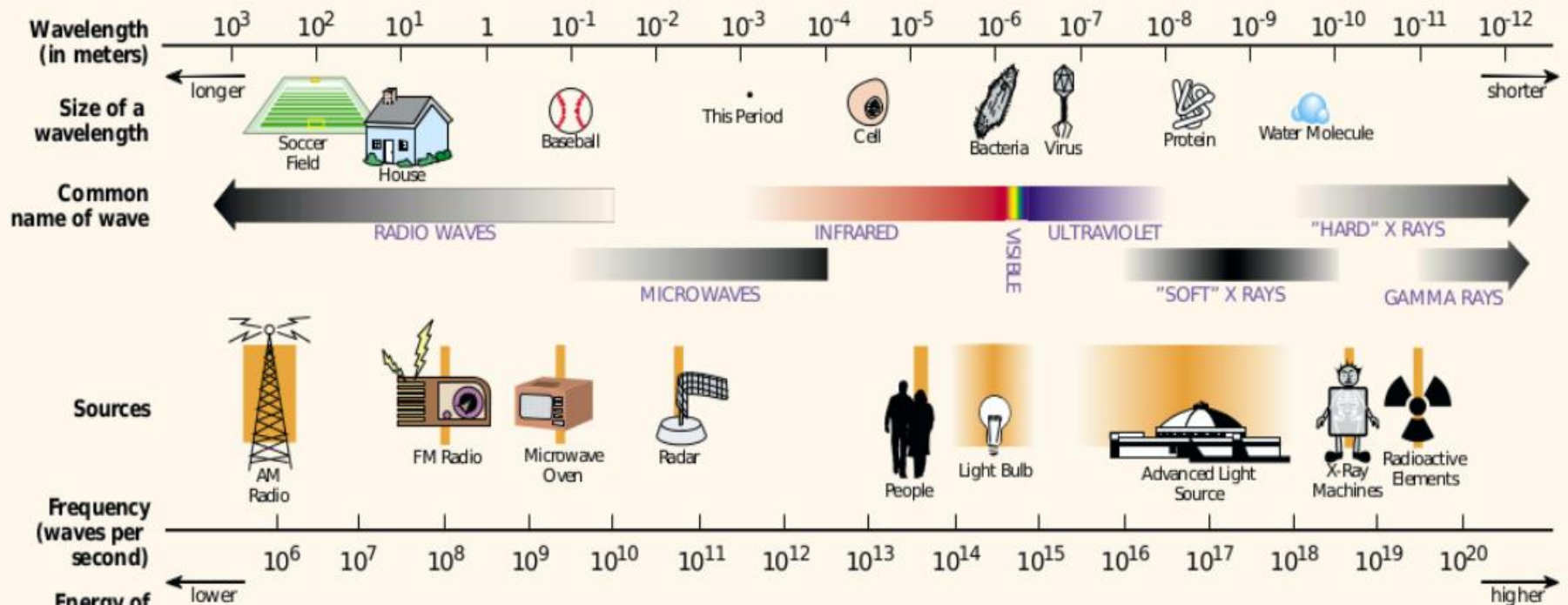
The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Chapter 1: Overview and Description of an Advanced Light Source

THE ELECTROMAGNETIC SPECTRUM



EM spectrum compared to well-known objects and sources of radiation
(Figure courtesy of Lawrence Berkeley National Laboratory, USA)



Chapter 2: Scientific Benefits

2.1 Structural Biology

*2.1.3 Role of Synchrotron Light Sources in Studying Infectious Diseases
Prevalent in Africa*

2.2 Materials for Energy Applications

2.2.2 Solar Energy

2.2.3 Rechargeable Batteries

2.3 Geoscience

2.4 Environmental Science

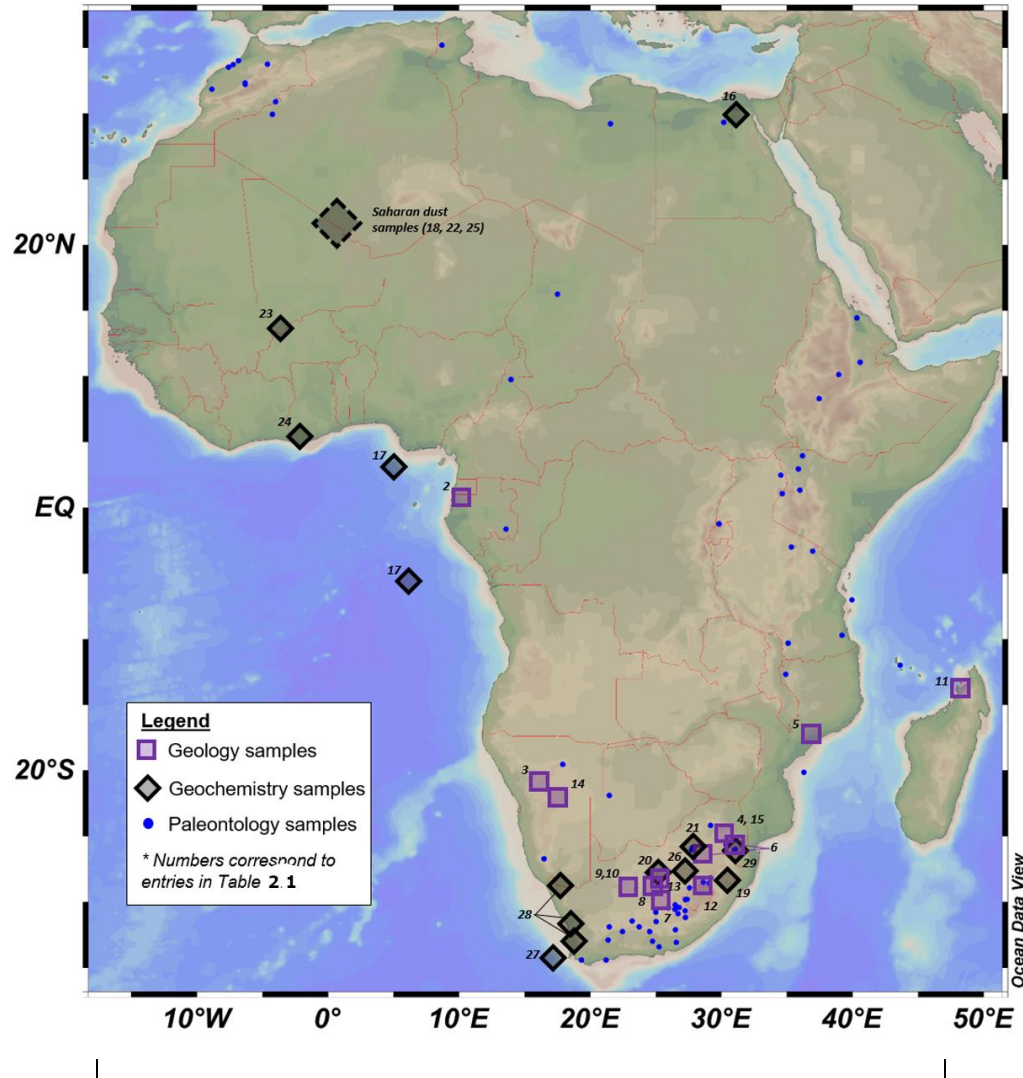
2.5 Plant and Soil Science

2.6 Palaeontology and Archaeology



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Distribution of African Earth science sample materials that have been investigated utilising synchrotrons
(Figure from Bjorn von der Heyden)



The Africa Light Source Foundation

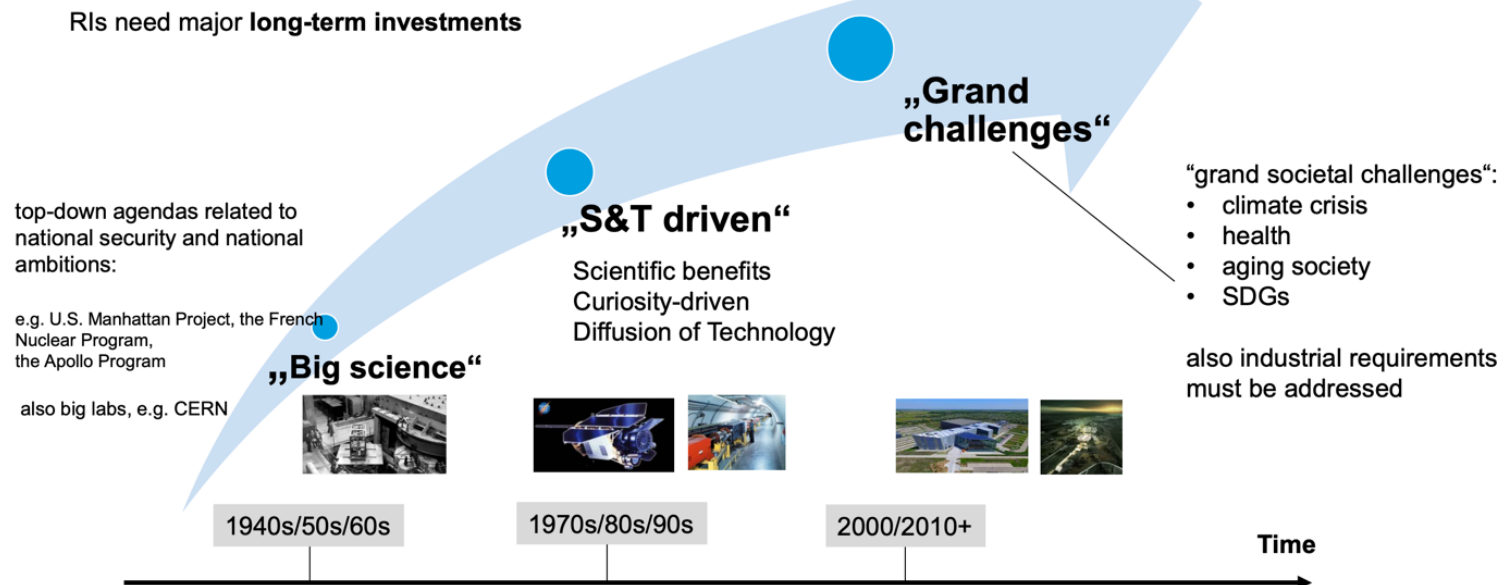
Towards a Lightsource for the African Continent



Chapter 3: Social and Economic Benefits

Justifications for large-scale Research Infrastructures RIs

Expectations & Arguments have changed over time



History of Big Science Infrastructures
(Figure Courtesy of DESY)



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Social and Economic Benefits (cont'd)

3.1.1 Disease Prevention and Cure

3.1.2 Food Security

Improvements in food and packaging characterisation; structure determination of products, including chocolate, oils and fats; and determining the oxidation states of products used for agriculture .

3.1.3 Clean Energy

AfLS would prove to be a powerful tool for developing materials and processes, including batteries, fuel cells, catalysts and catalytic processes.

AfLS would characterise sources of ecological damage, such as CO₂ and asbestos, and develop catalysts and materials to convert them to less harmful products.

3.2 Economic Benefits

According to Andrew Harrison, Former CEO, Diamond Light Source

“For every English pound put into the facility, 3.5 pounds come back into the economy.”



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Chapter 4: History of the African Light Source



Group Photo of the *1st African Light Source Conference and Workshop*
ESRF, Grenoble, France, 2015



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Chapter 5: Local Technical Infrastructures and Human Capacity Building

5.1 African Laser Centre (ALC, <https://africanlasercenter.org/>)

To Transform the Laser Community in Africa

5.2 Atomic, Molecular and Optical Sciences Network (LAM Network)

To Develop Optics and Photonics in Africa (<https://lamoptinet.org/>)

5.3 Lightsources for Africa, the Americas, Asia, Middle East and Pacific (LAAAMP, <https://laaamp.iucr.org/>)

To Enhance the Utilisation of Crystallography and Advanced Light Sources in the Developing World

5.4 X-TechLab (<https://www.xtechlab.co/>)

To Transform Crystallography Research and Training in Africa



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Local Technical Infrastructures and Human Capacity Building (cont'd)

5.6 ICTP School on Synchrotron Light Sources and their Applications

<https://indico.ictp.it/event/10057/> 23 Jan – 3 Feb 2023 (*Free Virtual School*)

5.9 African Crystallographic Association

(AfCA, <https://www.iucr.org/outreach/africa/afca/>)

To advance science on the African continent via crystallography

5.10 BioStruct-Africa (<https://www.biostructafrica.org/>)

To build capacity in the field of structural biology for Africa-based scientists.

5.11 Synchrotron Techniques for African Research and Technology

(START, <https://start-project.org/>)

Seeks to foster the development of synchrotron techniques for African research and technology, with initial emphasis on structural biology and energy materials.



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Chapter 7: Proposed Statutes of the African Light Source

ARTICLE I Purpose and Functions

ARTICLE II Membership and Participation

ARTICLE III The Council

ARTICLE IV Standing Committees

ARTICLE V Directorate

ARTICLE VI Duties of the Director-General

ARTICLE VII Legal Status

ARTICLE VIII Financial Arrangements

ARTICLE IX Contributions

ARTICLE X Other Contributions from the African Union *et al.*

ARTICLE XI Loss of Membership

ARTICLE XII Final Clauses



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Chapter 8 4th Generation Synchrotron Light Source Accelerator

Explain why 4th Generation Multi-Bend Achromat (MBA) lattices improve electron beam emittances compared to 3rd Gen.

Describe a prototype 3 GeV, ~500 meter, ~100 psec horizontal emittance storage ring.

Describe Ancillary Requirements

Offices

Food Services

Guest Housing

Water

Waste Disposal

Describe Electrical Power Plant

Comments on a nominal 10 MW Solar Power Plant à la SESAME.



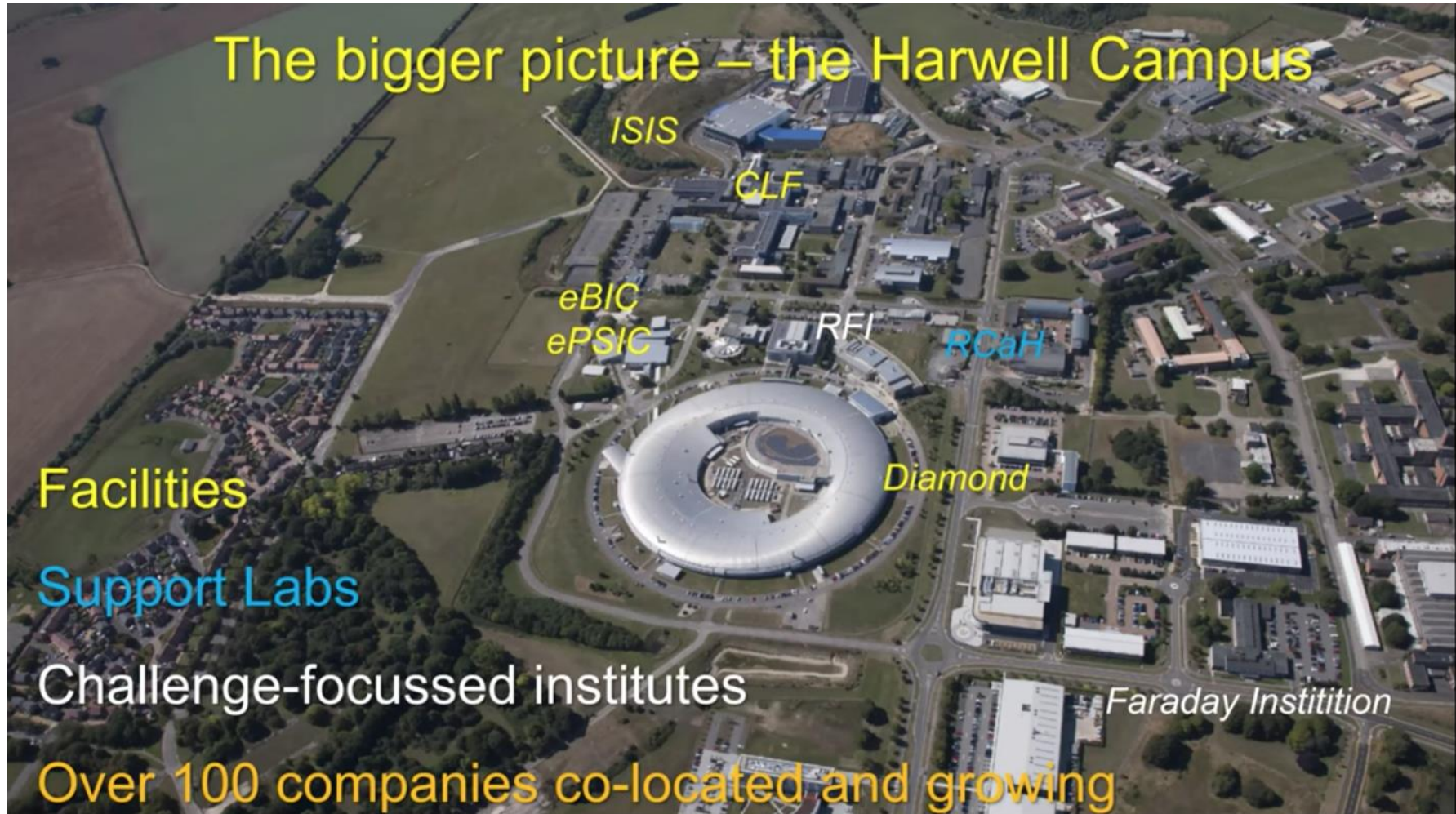
The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Chapter 9: Integrated Science and Technology Park

The bigger picture – the Harwell Campus





The Africa Light Source Foundation

Towards a Lightsource for the African Continent



Launch of the AfLS Geopolitical Conceptual Design Report

The 15th General Assembly & Scientific Conference

2024-07-01

SAVE
THE
DATE

AAS The African
Academy of Sciences

The 15th
**General Assembly &
Scientific Conference**

08 - 11 DECEMBER 2024 | ABUJA, NIGERIA

Empowering and Advancing Africa's Scientific Enterprise

Contact us for more information:
aasga2024team@aasciences.africa



The Africa Light Source Foundation

Towards a Lightsource for the African Continent



THANKS FOR YOUR KIND ATTENTION!

sekazi.mtingwa@gmail.com