




The African Light Source Foundation

Towards a Lightsource for the African Continent



AfLS Website <https://www.africanlightsource.org>

Institute of Physics  Institute of Physics

Debating the Societal Impact of Big Science in the 21st Century

Recent Progress Towards an African Light Source


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To appear soon

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<https://www.worldscientific.com/doi/abs/10.1142/S0217732318300033>

Synchrotron light sources in developing countries

Sekazi K. Mtingwa Herman Winick*



SCIENCE AND PUBLIC POLICY

2023-06-14 Science and Public Policy 00 (2023) 1-12 "Science diplomacy from the Global South: the case of intergovernmental science organizations"

* Research Professional News

African Light Source aims for science with ubuntu

By Katharina Cramer et al Share    




<https://www.researchprofessionalnews.com/rr-news-europe-views-of-europe-2022-5-african-light-source-aims-for-science-with-ubuntu/>

<http://lamp.ictp.it/index.php/aphysrev/article/view/1610/586>

The African Review of Physics (2018) **13**: 0019

Proceedings of the first African Conference on Fundamental Physics and Applications 2018, Namibia.
Guest Editors: K. A. Assamagan, M. Backes, D. Charlton, S. Muanza, D. Sahu, and D. Singh

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nature reviews physics

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<https://i0.wp.com/www.africanlightsource.org/wp-content/uploads/2022/12/Nature-Review-Physics.png?ssl=1>

Comment | Published: 19 October 2022

Building a brighter future for Africa with the African Light Source

BIOPHYSICAL REVIEWS

Biophysical Reviews
pp 1-9 | [Cite as](#)

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<https://link.springer.com/article/10.1007/s12551-019-00578-3>

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Modern Physics Letters A | Vol. 33, No. 09, 1830003 (2018)
| Brief Review  No Access

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Overview of AfLS Context

Challenges → Science → Infrastructure

>50 AdLS, none in Africa

Proposed Large Scale Infrastructure – Pan African: AfLS

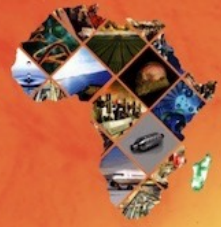
Proposed small associated Infrastructures – Regional: Lab sources, CLS

Milestone on AfLS Roadmap → Destination is AfLS !



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Roadmap : AfLS Conference 2015

<http://events.saip.org.za/conferenceDisplay.py/getPic?picId=66&confId=61>

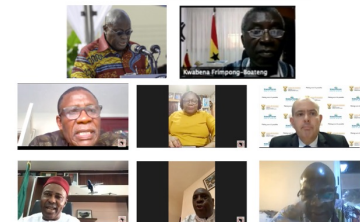
Bottom Up

1. Human Capacity: scientists, engineers, technicians
2. African scientists access existing LSs
3. African relationships with existing LSs.
4. Involvement of industry
5. Community for the African light source Users
6. Conferences, Workshops, Outreach, Media



Top Down

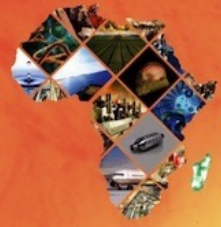
1. Strategic approach to African Governments and (Pan) African orgs.
2. Conceptual Design Report (CDR)  ← Ready soon !!!!
3. Inter-African co-operation on Regional feeder infrastructure
4. African multinational beamlines at existing LSs
5. Regional / Pan African membership of existing LSs
6. Technical Design Report (TDR)





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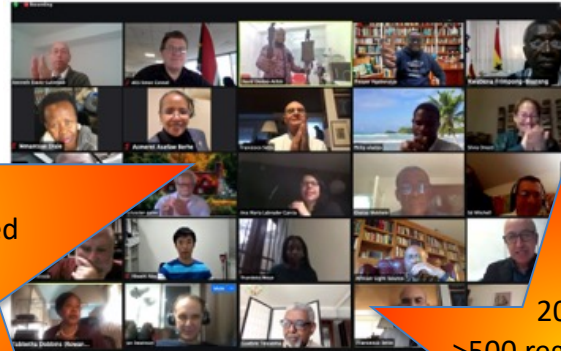
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Conferences

2015, 2019, 2020,
2021, 2022,
2023

2021
Now 5 African
Governments involved
Many co-conveners
Prof bodies
Academies

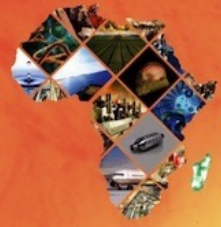


2021
>500 registrations

2022
~1000 registrations



- AFLS1 2015
<https://events.saip.org.za/event/61/>
- AFLS2 2019
<https://events.saip.org.za/event/145/>
- AFLS3 2020
<https://events.saip.org.za/event/211/>
- AFLS4 2021
<https://events.saip.org.za/e/AFLS3>
- AFLS5 2022
<https://events.saip.org.za/e/AfLS2022>
- AFLS6 2023
<https://events.saip.org.za/event/243/>



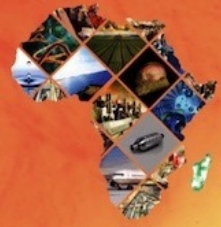
Example motivation based on Bio Science

- **Structural information helps to elucidate function**, the mechanisms of enzymes → inspires the design of new drugs.
- Africa should lead research of this nature → cures for diseases of particular relevance to Africa
- Synchrotrons are extremely important facilities for the imaging of bio-molecules.
- Development of 210 new drugs that depended on protein structural information [[Westbrook et al. 2019](#)].
- Development of drugs for treating HIV-AIDS, [[Wlodawer et al. 1998](#)].
- Listing of about drugs, their targets “*Practical Fragments*” Website [[Prac. Frag 2018](#)].
- Development of new treatments for tuberculosis [[Blundell 2017a](#)].
- Interplay between academia and industry [[Blundell 2017b](#)].
- **See Light Sources for vaccine development for the previous Pandemic** [[AflS web page](#)]



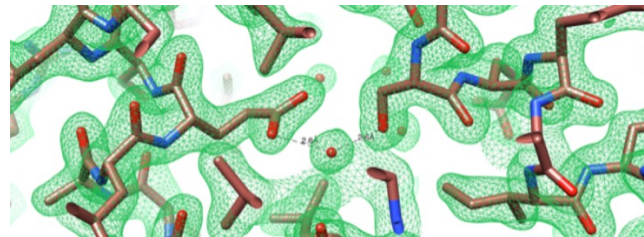
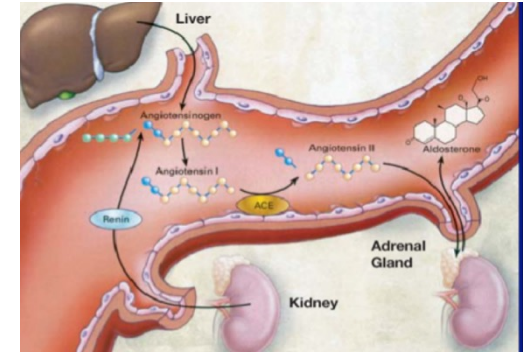
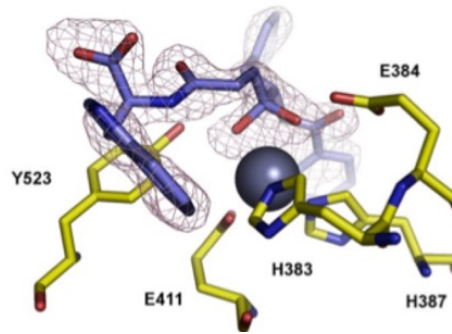
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Bio-Science

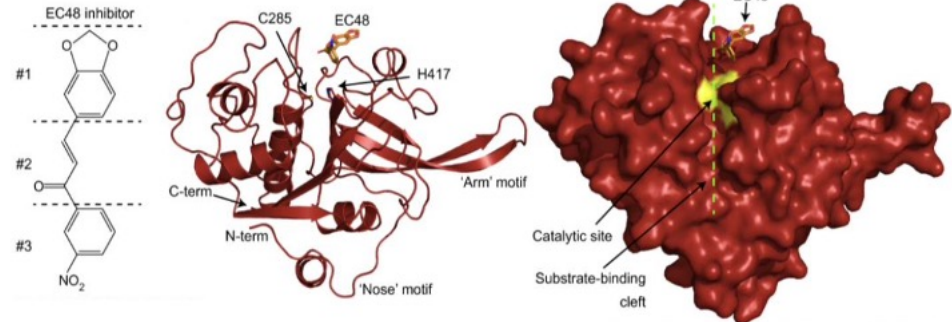
- SARS-CoV-2,
- snakebite envenomation,
- HIV, tuberculosis,
- malaria,
- bilharzia,
- human papilloma virus,
- cardiovascular disease,
- human metabolic disorders,
- African Horse Sickness virus,
- Industrial enzymes



HIV and its interaction with CD4

Fig. 1: A model representation of the structural organization of the HIV-1 virion and its associated proteins [2].

Fig. 2: Conformational changes in the gp120 trimeric complex induced by CD4 binding and the associated consequences for viral attachment to the target cell [3].



Broomistega : Temnospondyl amphibian, aquatic predator, the best skeleton ever discovered



Thrinaxodon : Mammalian reptile, close to the origin of mammals

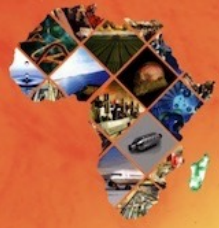
350 mm

Paul Tafforeaux



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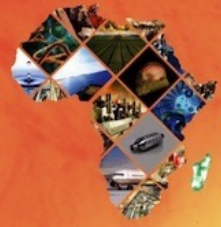


Berger shows fossils to South African President Jacob Zuma



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Feeder Facilities

1. South Africa

- Aaron Klug Centre, UCT, [link](#),
U Witwatersrand, U Free State,
U Stellenbosch, iThemba

2. Benin, X-TechLab, Benin, [link](#)

3. Ghana, U Ghana, [link](#)

4. Côte d'Ivoire, LaCPM, Université Felix Houphouët Boigny, **Abidjan**, [link](#)

5. Senegal, Ziguinchor, [link](#)

6. Cameroon, Dschang, [link](#)

7. Kenya, Kenyatta University, [link](#)

8. Tunisia

- Monastir, [link](#), Nabuel, Tunisia, [link](#)

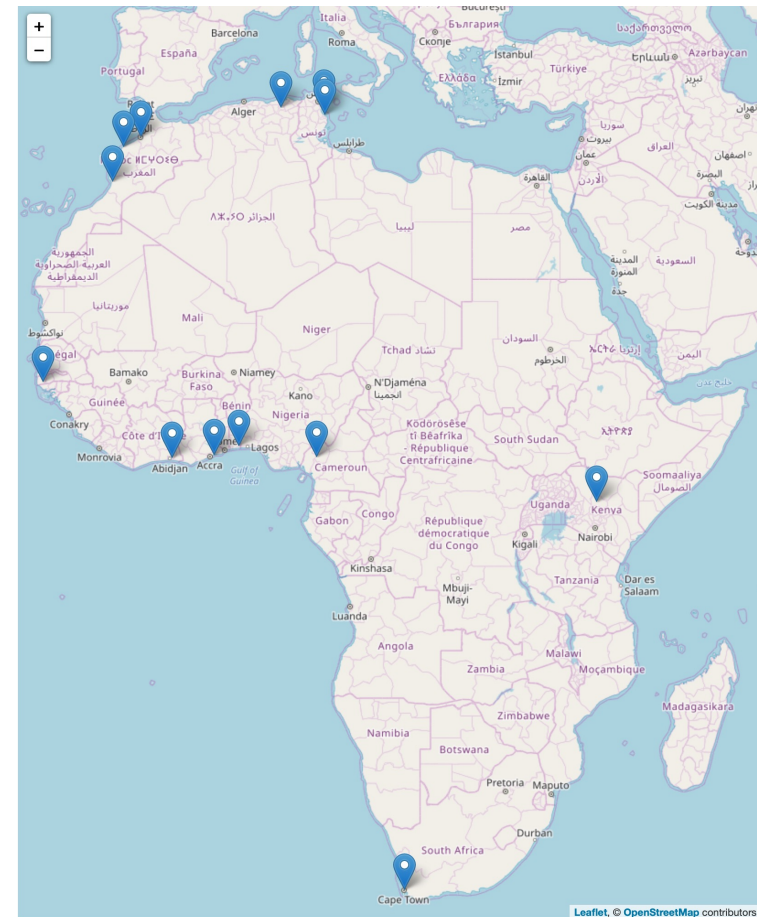
9. Algeria, Constantine 1, [link](#)

10. Morocco

- U Rabat,, [link](#), El Jadida, Morocco, [link](#),
Agidir, Morocco, [link](#)

Significant
facilities

IUCr
OpenLab
venues
with
facilities

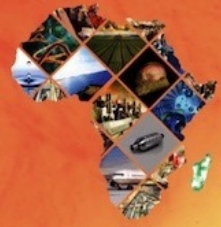


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Bottom Up

Bio-Science Capacity in Africa

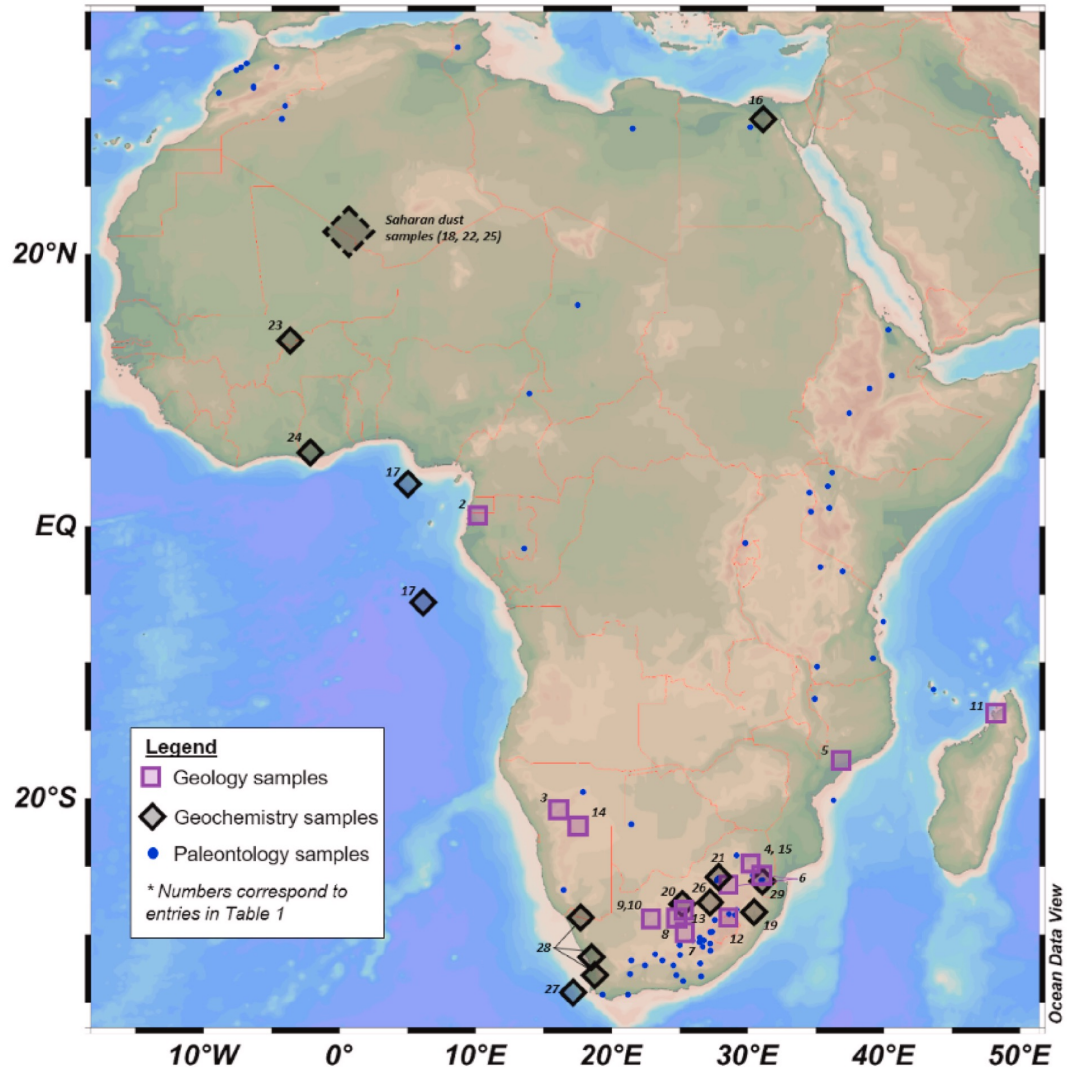
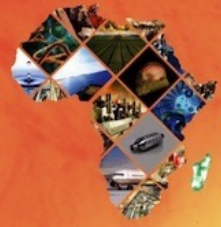
- Ghana**
University of Ghana
- Zambia**
The University of Zambia
- Algeria**
Ecole Nationale Polytechnique de Constantine
- Nigeria**
Federal University of Technology, Akure
University Ile-Ife
- Burkina Faso**
Institute of Research in Health Sciences, Burkina Faso
- Morocco**
University Sidi Mohamed Ben Abdellah
- Ivory Coast**
Universite Felix Houphouet Boigny
- Egypt**
Helwan University, Ain Shams University
- Lesotho**
National University of Lesotho
- Ethiopia**
Addis Ababa University





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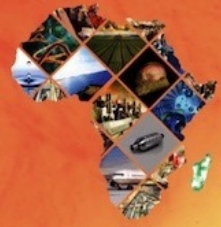
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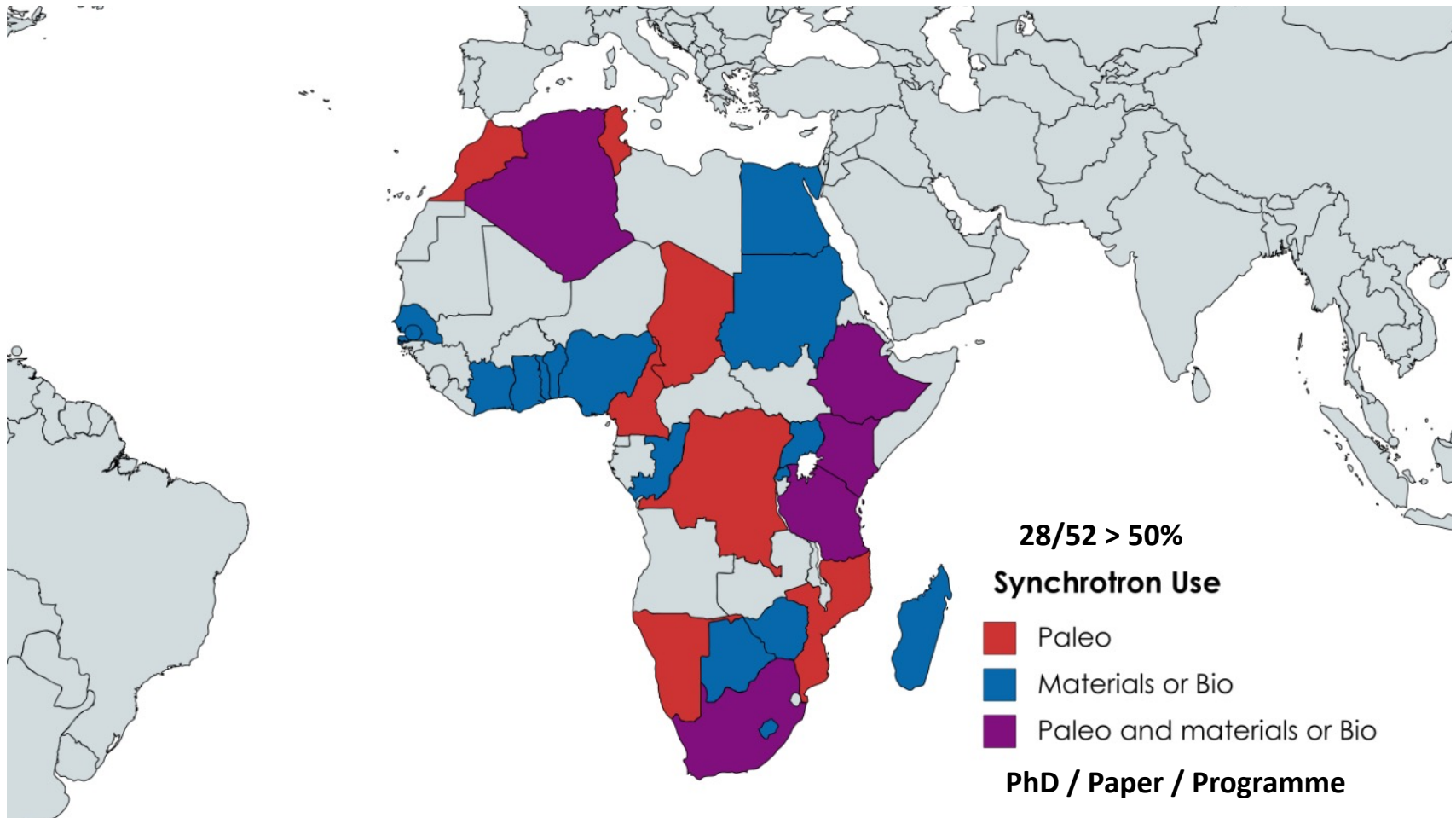


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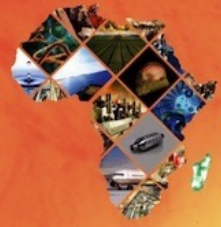
Bottom Up





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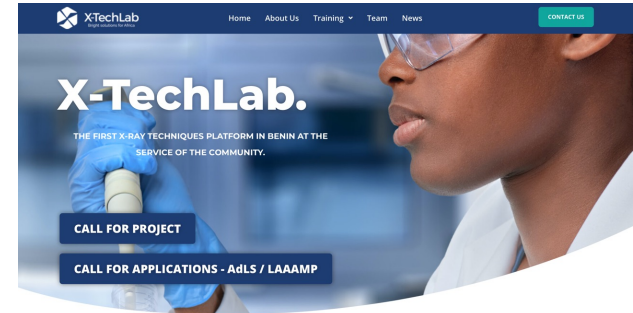
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Some Existing Regional Facilities

X-TechLab - Benin

Materials analysis, spectroscopy for many disciplines.
Energy, health, environment, agriculture, materials



Microscopy Centre – UCT in SA

Structural biology resource widely used in SADEC region

African Laser Centre

Pan-African NEPAD flagship initiative

ICTP-EAIFR - Rwanda

Condensed matter, Geology, Particle Physics,
Cosmology, Astroparticle physics



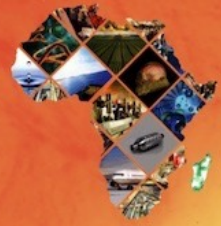
Partner with LAAAMP, IUCr – OpenLABS, START, Others





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3 Strategic Task Forces to report by Dec 2023

The African Beamline at an international AdLS

This is an African designed and operated beamline at an International AdLS that can address selected African Research Imperatives. It leads additionally to the training of engineers and technologists and will result in Technology Transfer.

The Collective African membership of an international AdLS

Here several African countries jointly acquire formal membership of an international AdLS. They leverage a threshold of participation that allows African Government involvement in the Council of the Facility, so that there is increased African Access of Researchers, technologists, Industries and also Governments.

African Regional Infrastructure

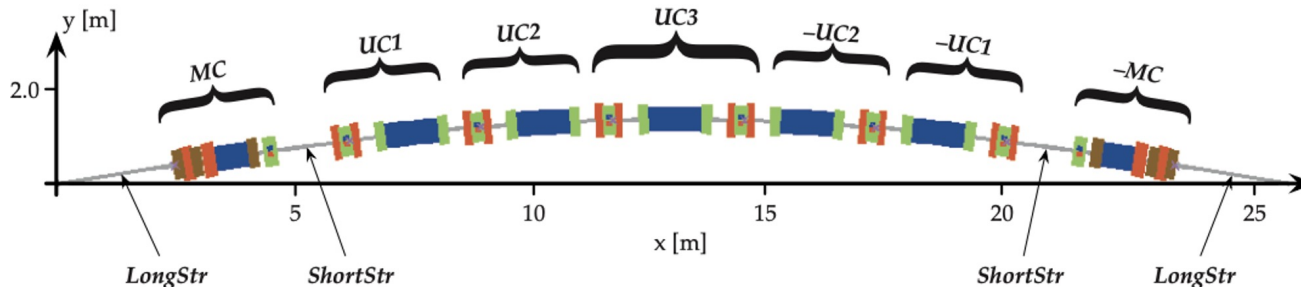
This is research infrastructure that is both highly competitive in its own right but which is also seen as important training and feeder infrastructure to an AdLS.

“Leave no country behind.”



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$$\varepsilon = C \frac{E^2}{N_d^3}$$

• 4th Generation - MBA Upgrades

• 10⁴ x better :

- x100 – emittance,
- x100 - detectors

- ESRF upgrade → EBS
- Sirius in Campinas, Brazil
- MAX IV in Lund, Sweden

• 3 GeV, MBA, 20 Beamlines

- Imaging
- Diffraction
- Spectroscopy

• 5th Generation ?





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Compact Light Source : Inverse Compton Scattering : STAR in Calabria

Logarithmic performance : lab source - CLS - synchrotron



Istituto Nazionale di Fisica Nucleare

African Regional
Infrastructure

Workshop

Milestone on AfLS Roadmap → Destination is AfLS !

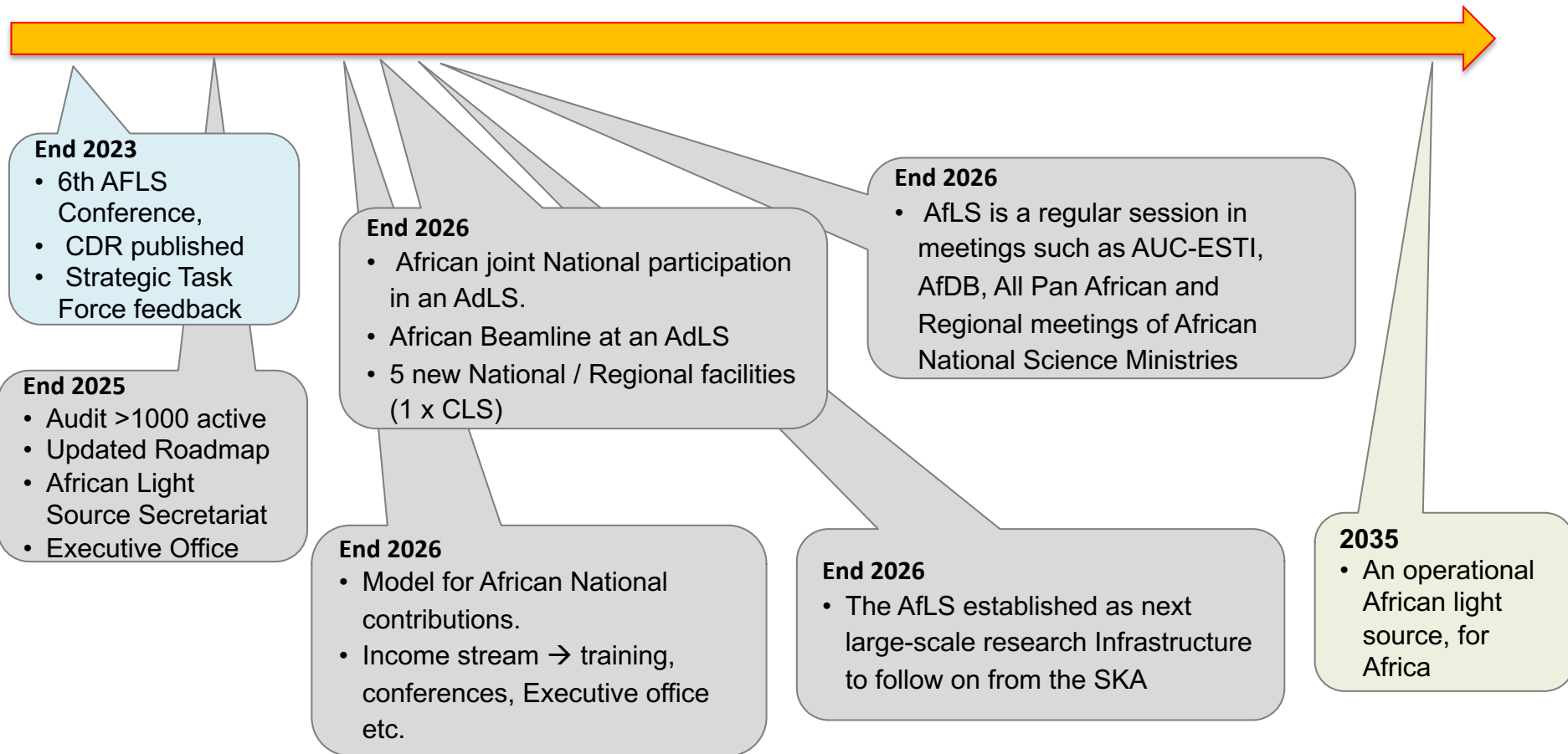


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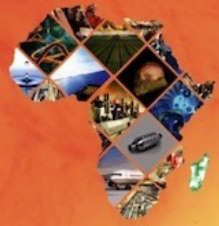
Milestones on the Timeline of the Roadmap





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Many thanks
AfLS-STF-ARI