

iTHEMBA LABS:

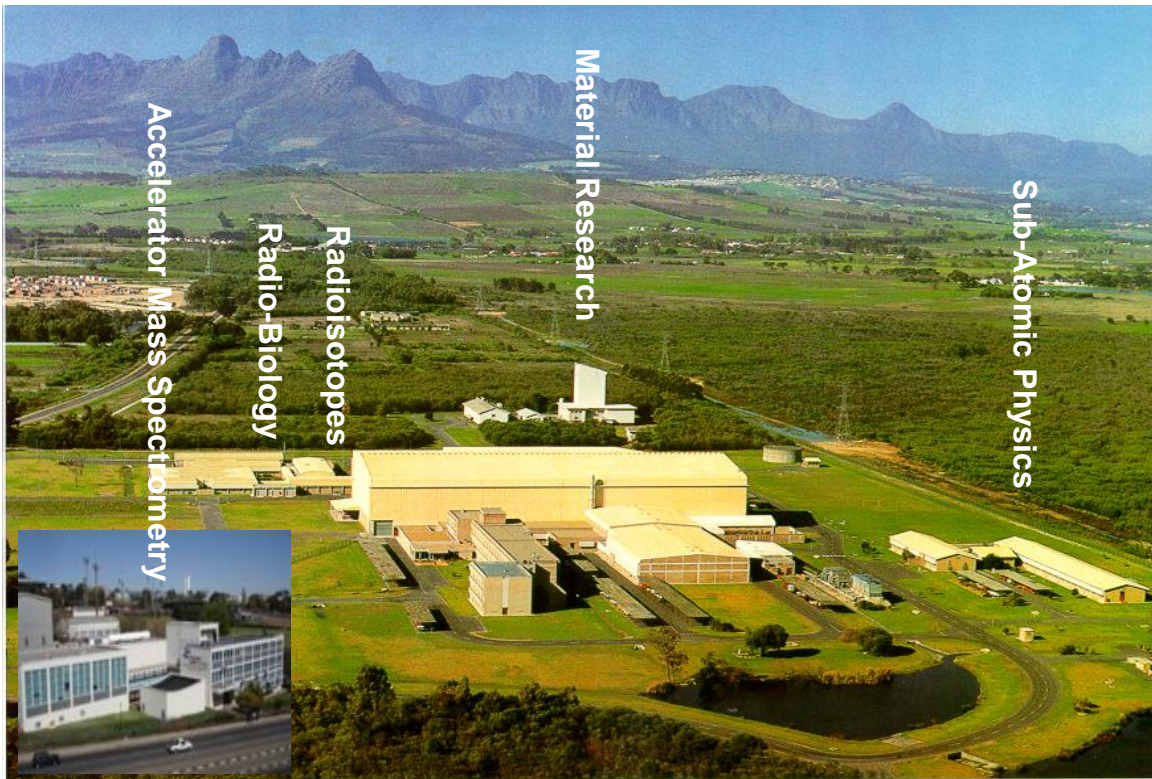
OPENING NEW FRONTIERS IN NUCLEAR SCIENCE & APPLICATIONS



iThemba LABS : National Facility for *pure and applied research, development and training in Accelerator Based Sciences*

iThemba LABS is the largest National Research Facility in SA:

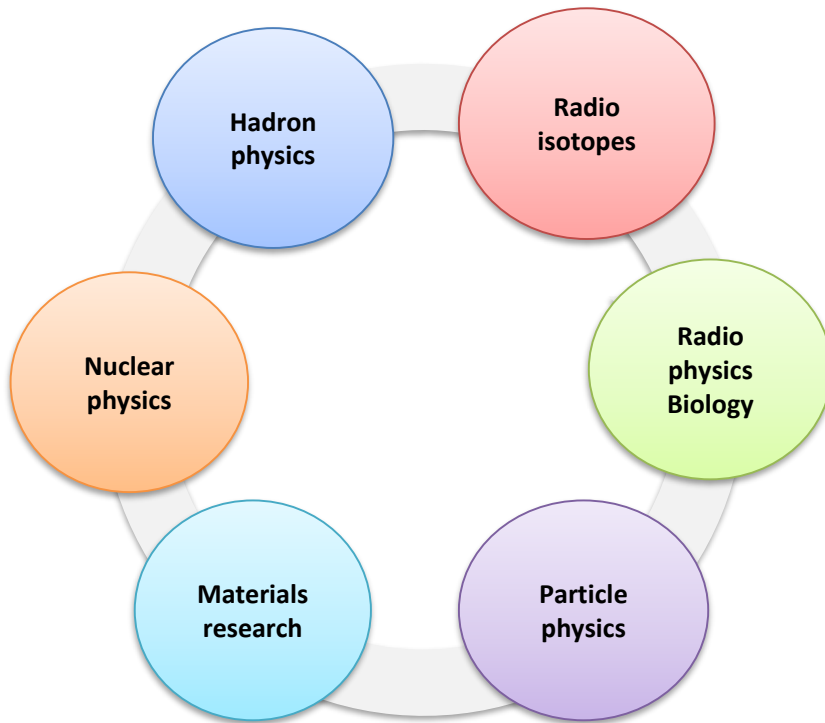
- more than 55% of the NRF budget for research facilities.
- more than 420 people (300 staff, 150 users and students...)



iThemba LABS is the largest accelerator facility in the southern hemisphere and one of the largest in the world.

Research and Collaboration: iThemba LABS

The transdisciplinary research agenda of iThemba LABS brings together scientists working in the physical, medical and biological sciences to solve real world problems while still considering the origin and evolution of the universe.



SA Collaborators and Users of the Platforms

University of the Western Cape
University of Cape Town
University of Stellenbosch
Cape Peninsula University of Science and Technology
University of the Witwatersrand
University of Pretoria
North West University
Fort Hare University
University of KwaZulu Natal
University of Zululand
North West University
Nelson Mandela Metropolitan
University of Limpopo
University of Venda
University of Johannesburg
[Europe, Asia and America](#)



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iThemba: Laboratory Accelerators Based Science

Separated sector cyclotron



K11 Cyclotron



Injector cyclotron 1



3MV Van de Graaff



6MV Tandem



Injector cyclotron 2



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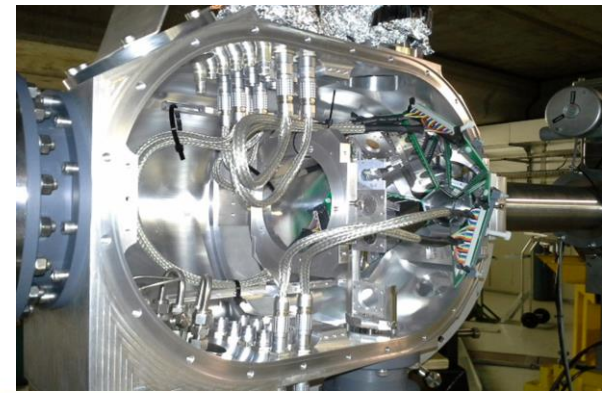
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K=600 magnetic spectrometer a high resolution spectrometer for light ions



State of the art new instruments



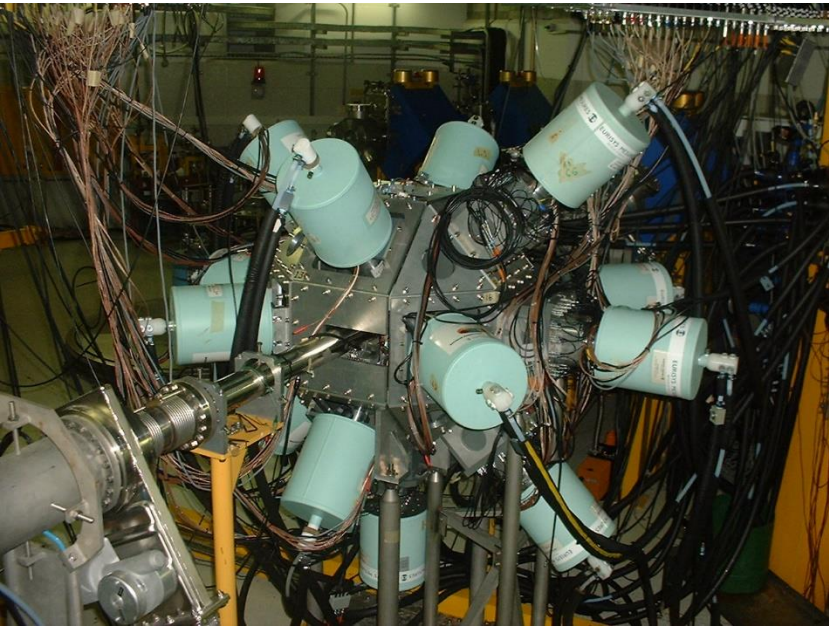
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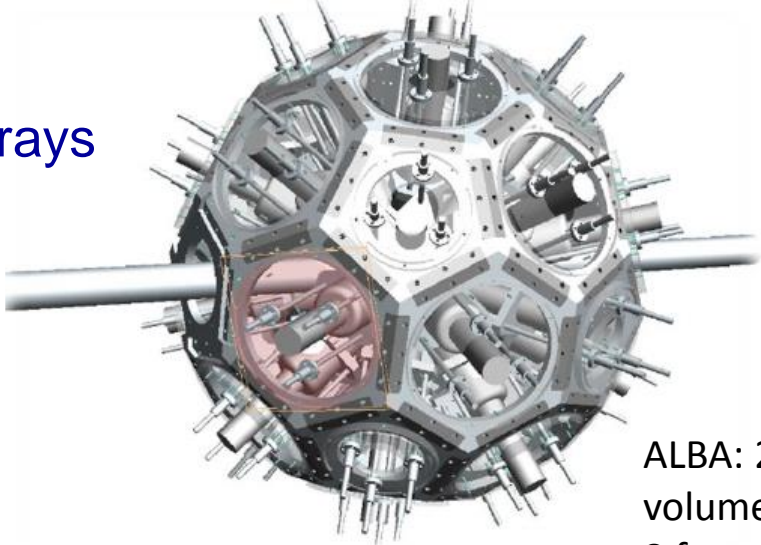


Recent developments in Gamma arrays

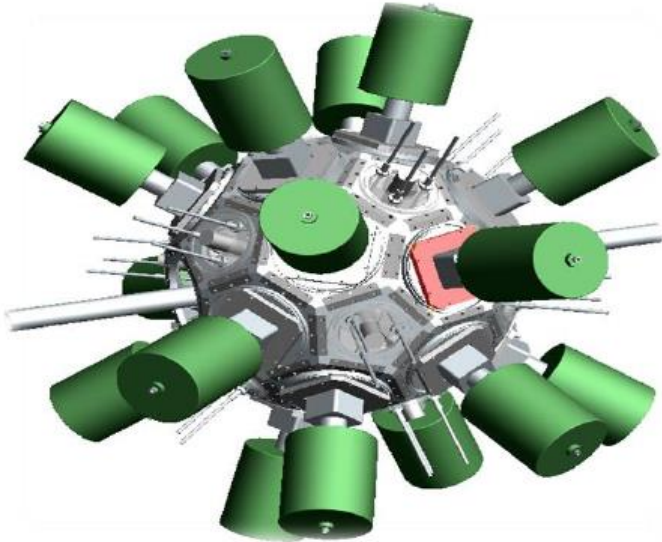
~ 3M Euros invested in 2017



AFRODITE completed to and a total of 18 Clover + 17 BGO

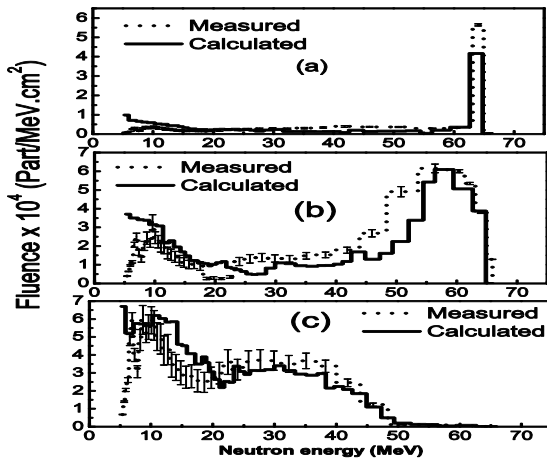
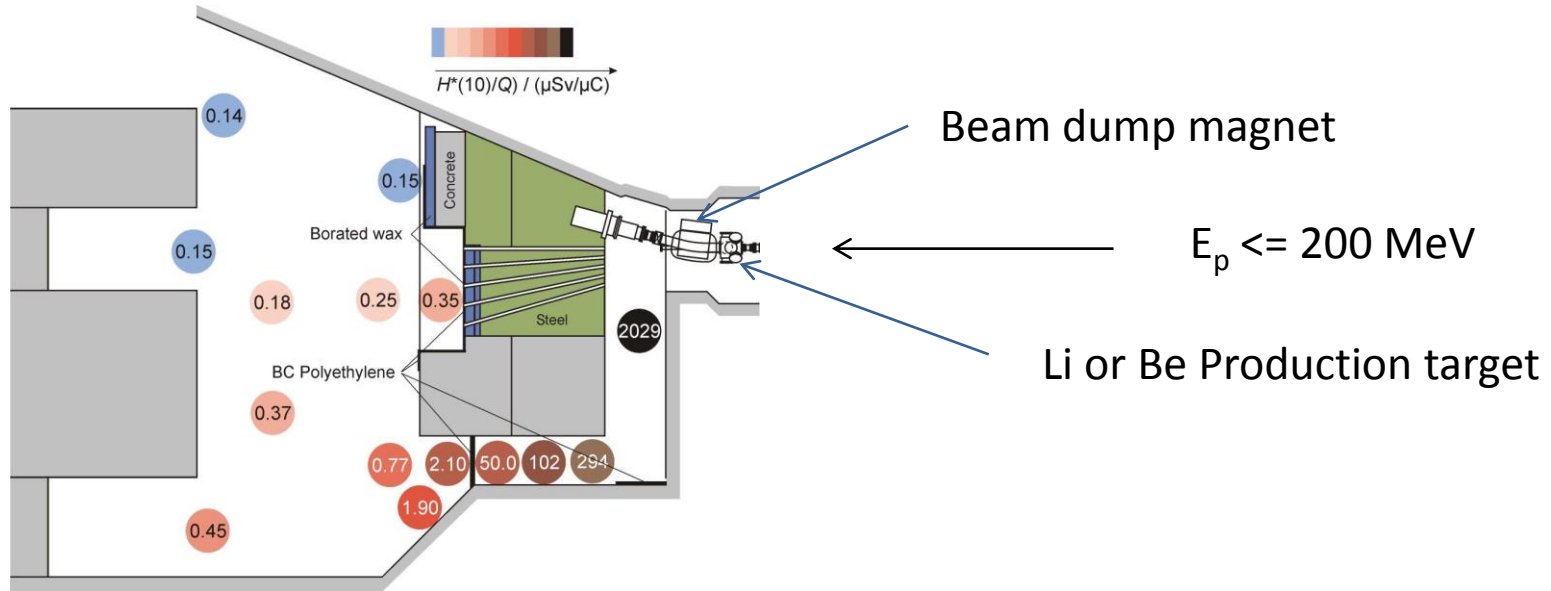


ALBA: 23 large volume LaBr3 and 8 fast timing LaBr3.



GAMKA: 13 large volume LaBr3 and 17 Clover detectors.

Fast neutron facility : 30-200 MeV



- neutron dosimetry
- radiobiological effectiveness of fast neutrons
- detector development
- Neutron induced cross sections



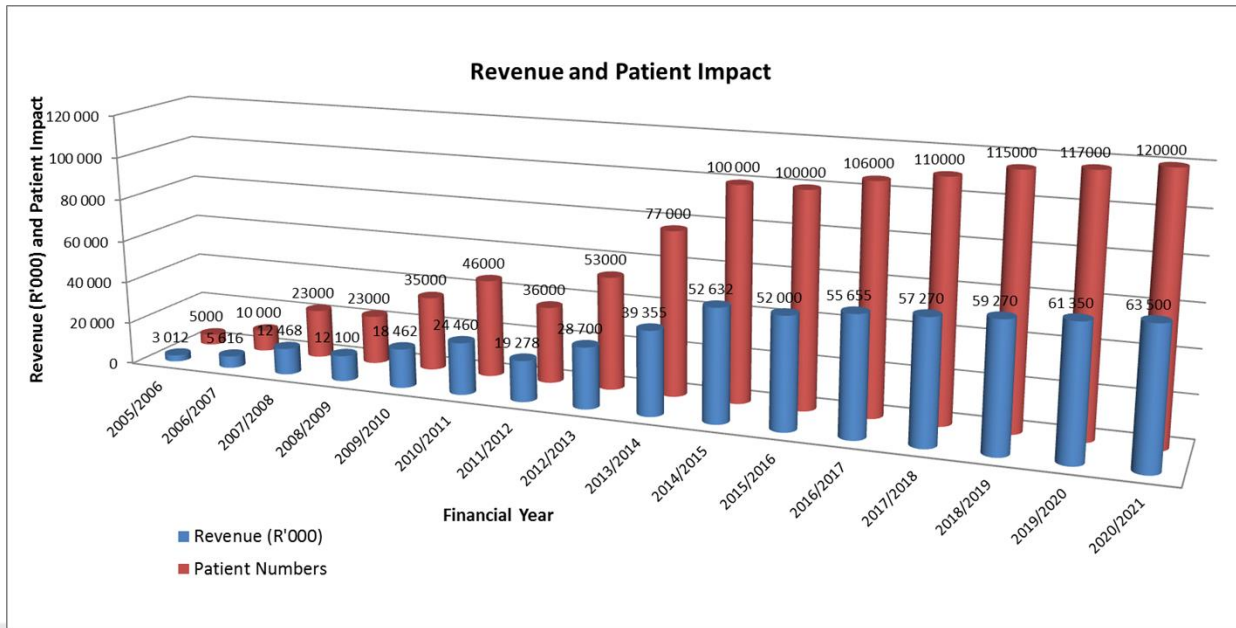
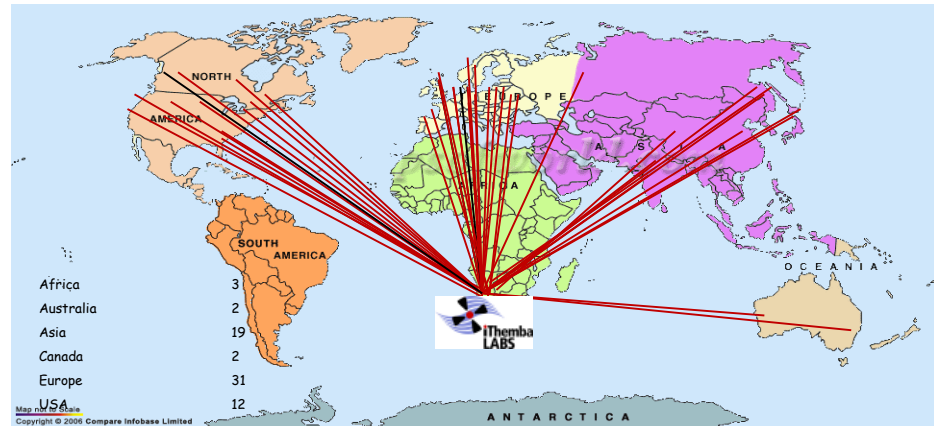
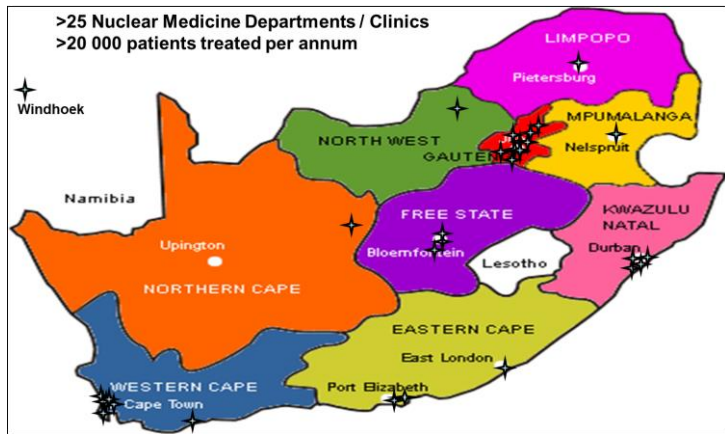
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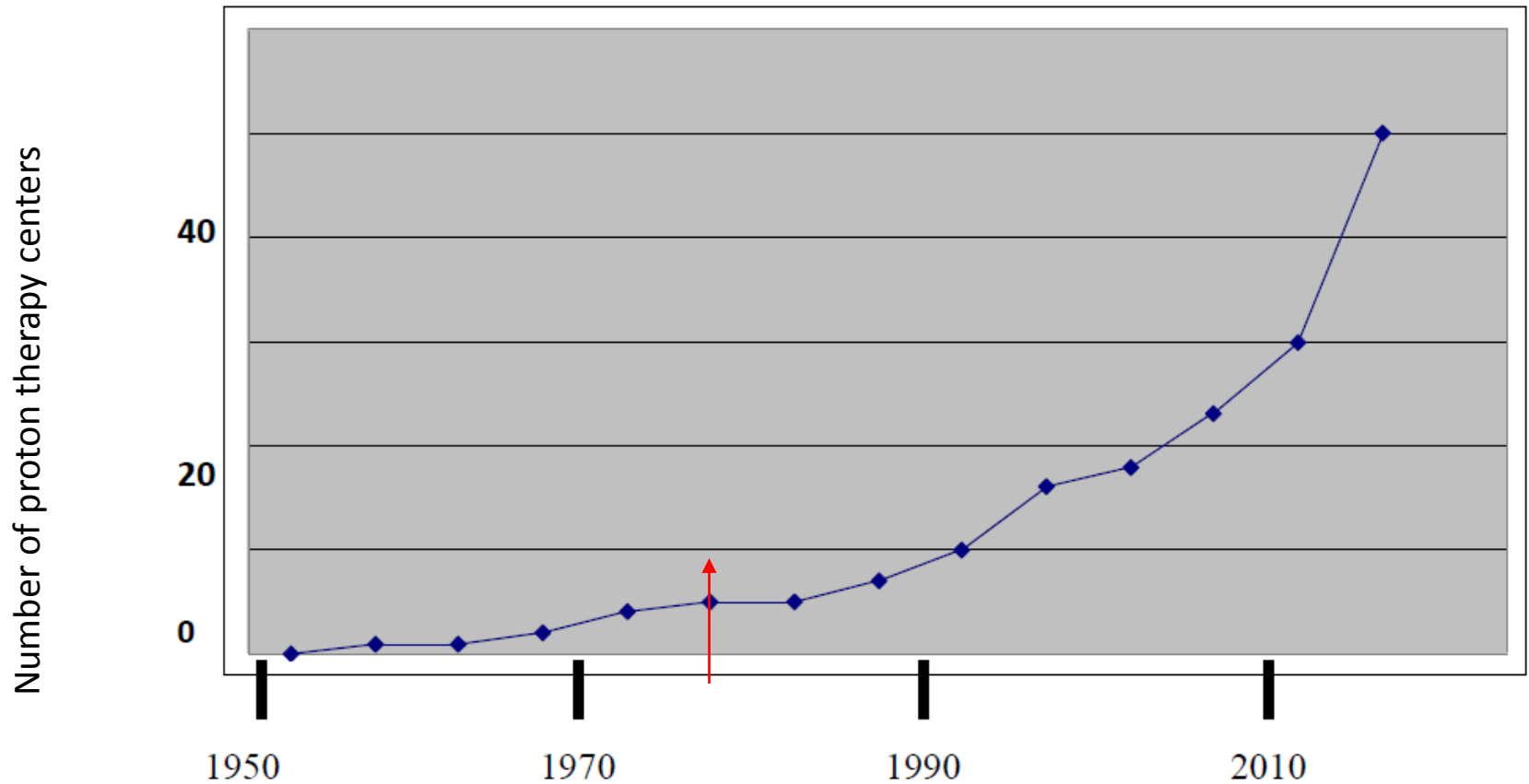


iThemba LABS:

World Leader in Accelerator Produced Radioisotopes for Medicine

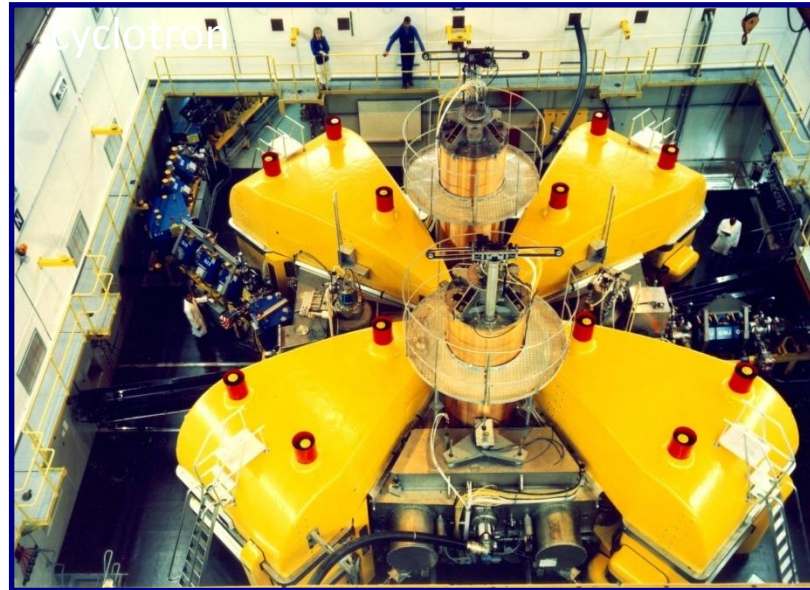


Hadrontherapy : the pionners



Evolution of the number of proton therapy centers in the world between 1950 and 2015

Separated sector cyclotron



Sub-atomic Physics / Radiation Biology and Physics/ isotope production

Research is dependent on a 30 year old accelerator:

- Operating 6000 h/year
- ~12% unscheduled shut-down
- ~70 million Rands in refurbishment
- **Strategic Risk – Ageing infrastructure**



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Future of iThemba LABS



The Facility is currently faced with two options:

1. Maintaining the *status quo*.
2. Embark on a sustainable and globally competitive NRF research facility through *research infrastructure renewal*.



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A Long Range Plan

There is a need for a strategy and a vision in planning a sustainable and vibrant future for iThemba LABS



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The South African Isotope Facility (SAIF)



iThemba LABS creating new opportunities for a shared vision
through building collaborations, and shaping the future

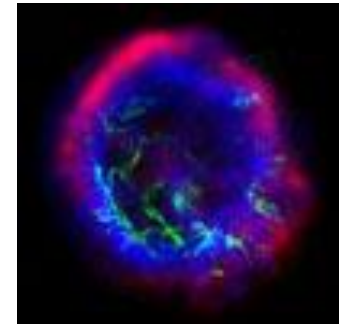
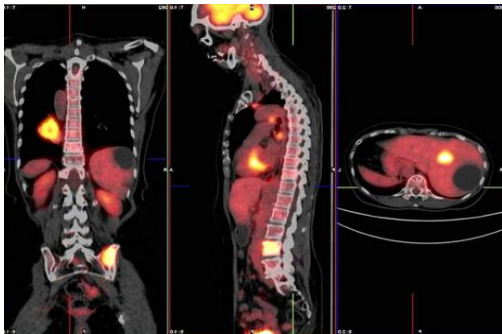
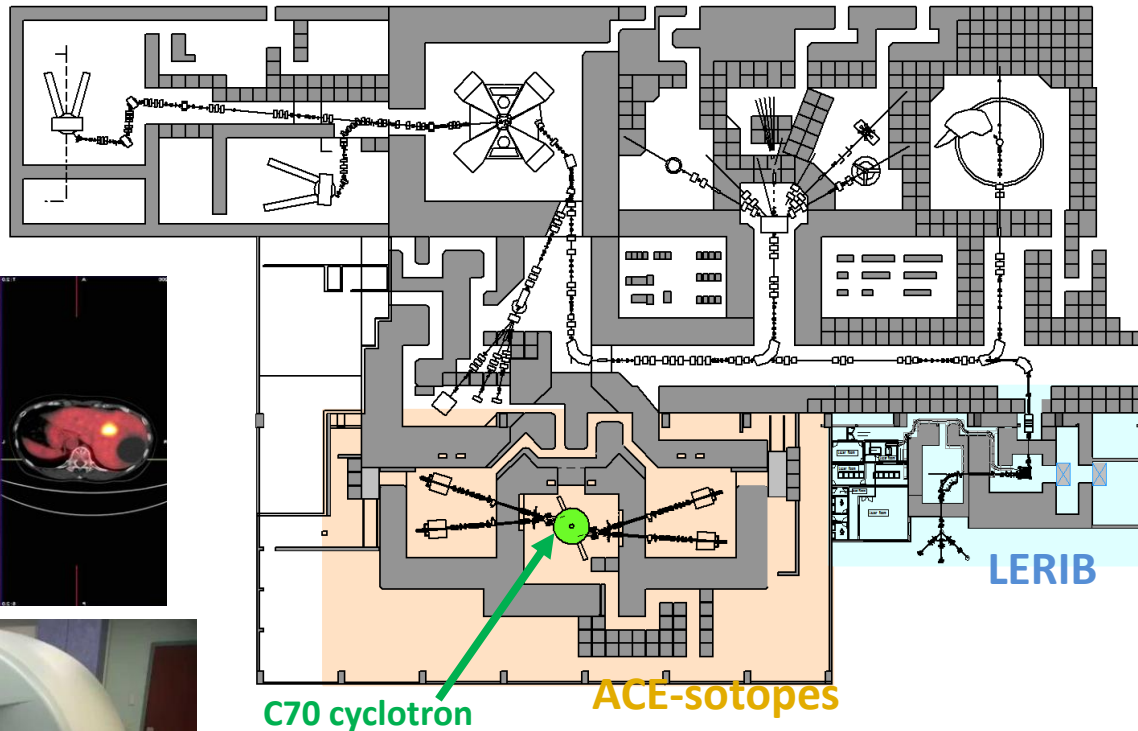


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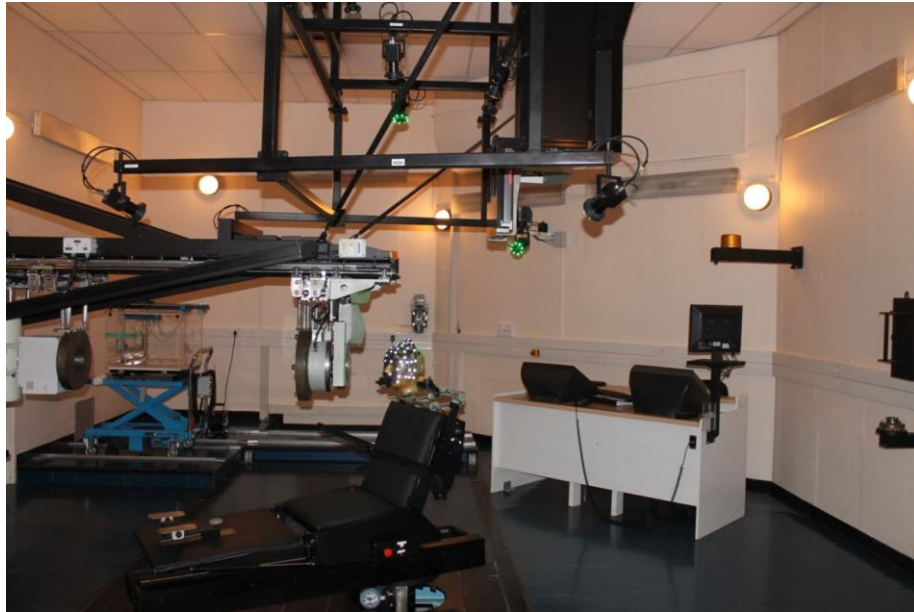


Phase 1 - ACE Isotopes

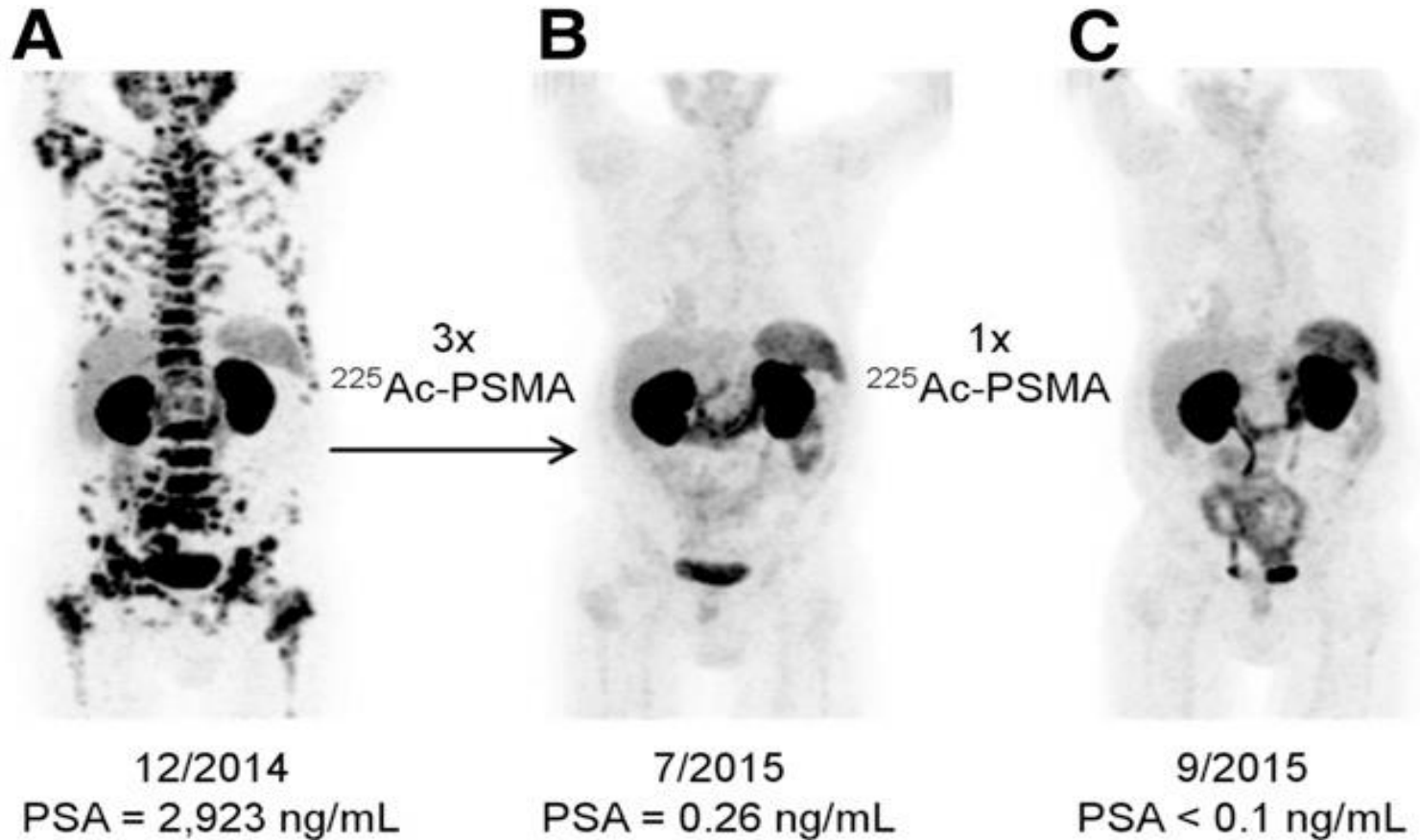


- Increased capacity for the production of Isotopes
- Timeline - 4 years to operations

From Therapy to research

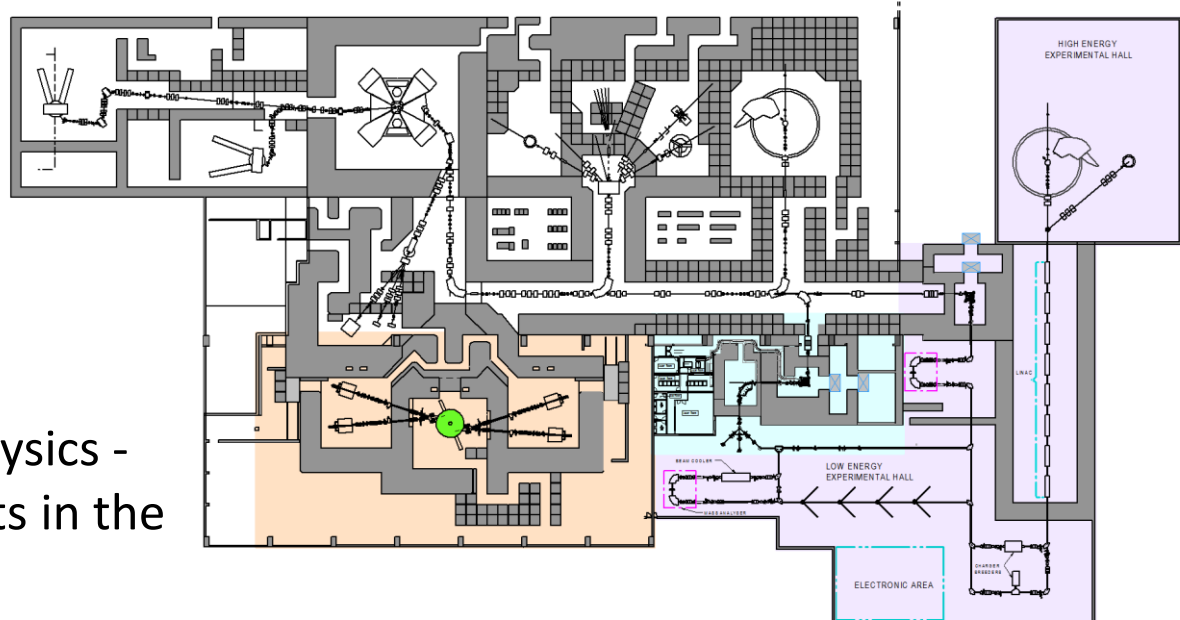
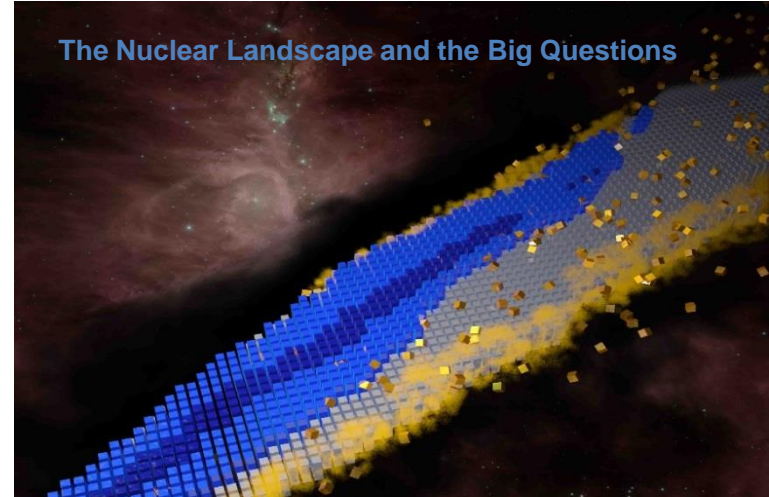
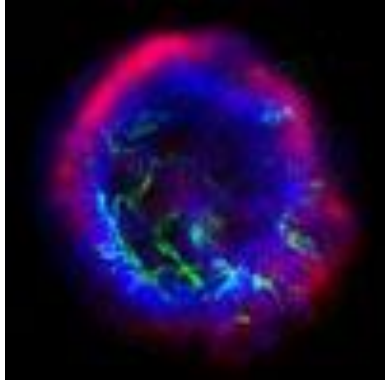


➤ Research in radiobiology and radiation physics related to hadron therapy, with a strong emphasis on radiobiological modelling for treatment planning

$^{225}\text{Ac-PSMA}/^{68}\text{Ga-PSMA}$: First-in-human; total response

Kratochwil et al., J. Nucl. Med. 57 (2016) 1941 - DKFZ, Heidelberg

PHASE 2 - ACE-Beams: The Universe in a Laboratory



- Isotopes for Astrophysics - synthesis of elements in the universe
- Timeline – 8 Years to operations

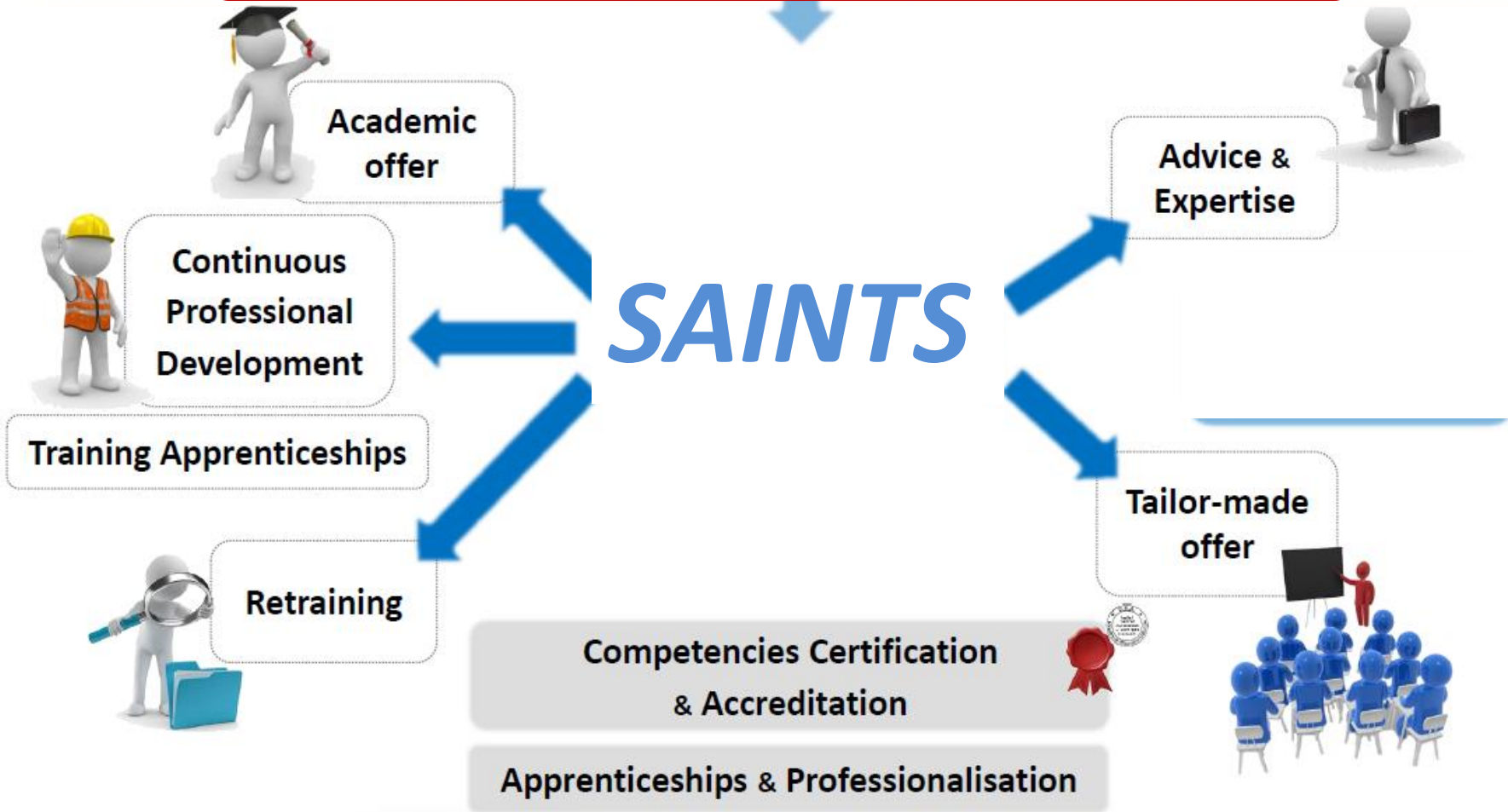
The addition of a post accelerator to LERIB - ACE Beams

SAIF in the world

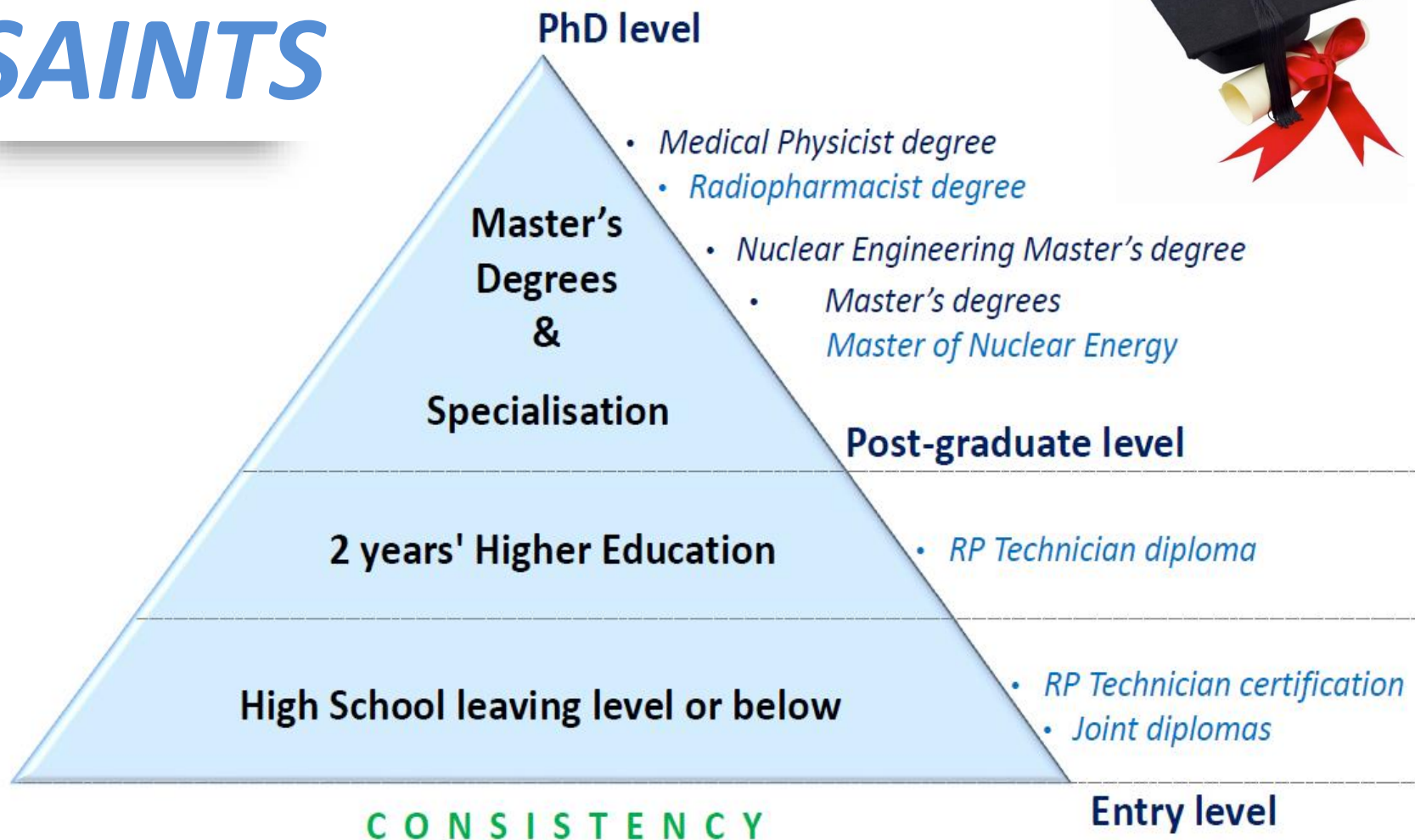
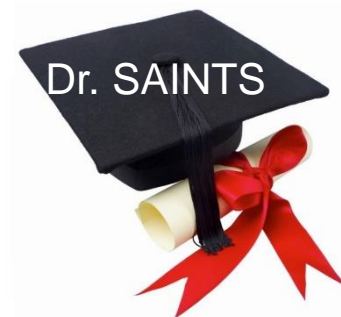


 **Future major facilities**

The South African Institute of Nuclear Technology and Science (SAINTS)



SAINTS



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Africa Agenda: iThemba LABS (SAIF + SAINTS)

Gateway to Nuclear Science and Technology for Africa

Collaborators on the African Continent

Mozambique (Eduardo Mondlane University)

Zambia (University of Zambia)

Botswana (Univ. Botswana, + BIUST)

Nigeria (University of Ile-Ife + CERD)

Sudan (Univ. Sudan Science & Tech)

Cameroon (University of Yaoande)

Ghana (University of Ghana)

Ethiopia: (University of Addis Ababa

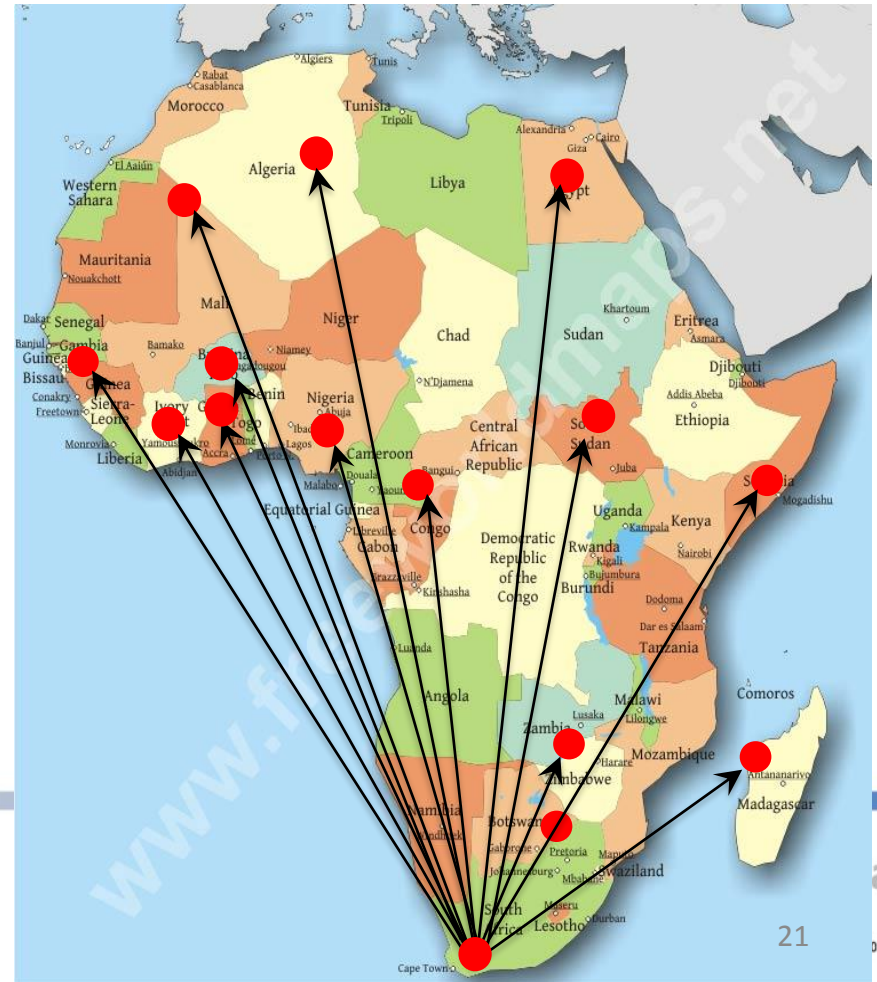
Senegal (Cheik Anta Diop University)

Algeria (COMENA)

Senegal (Cheik Anta Diop University)

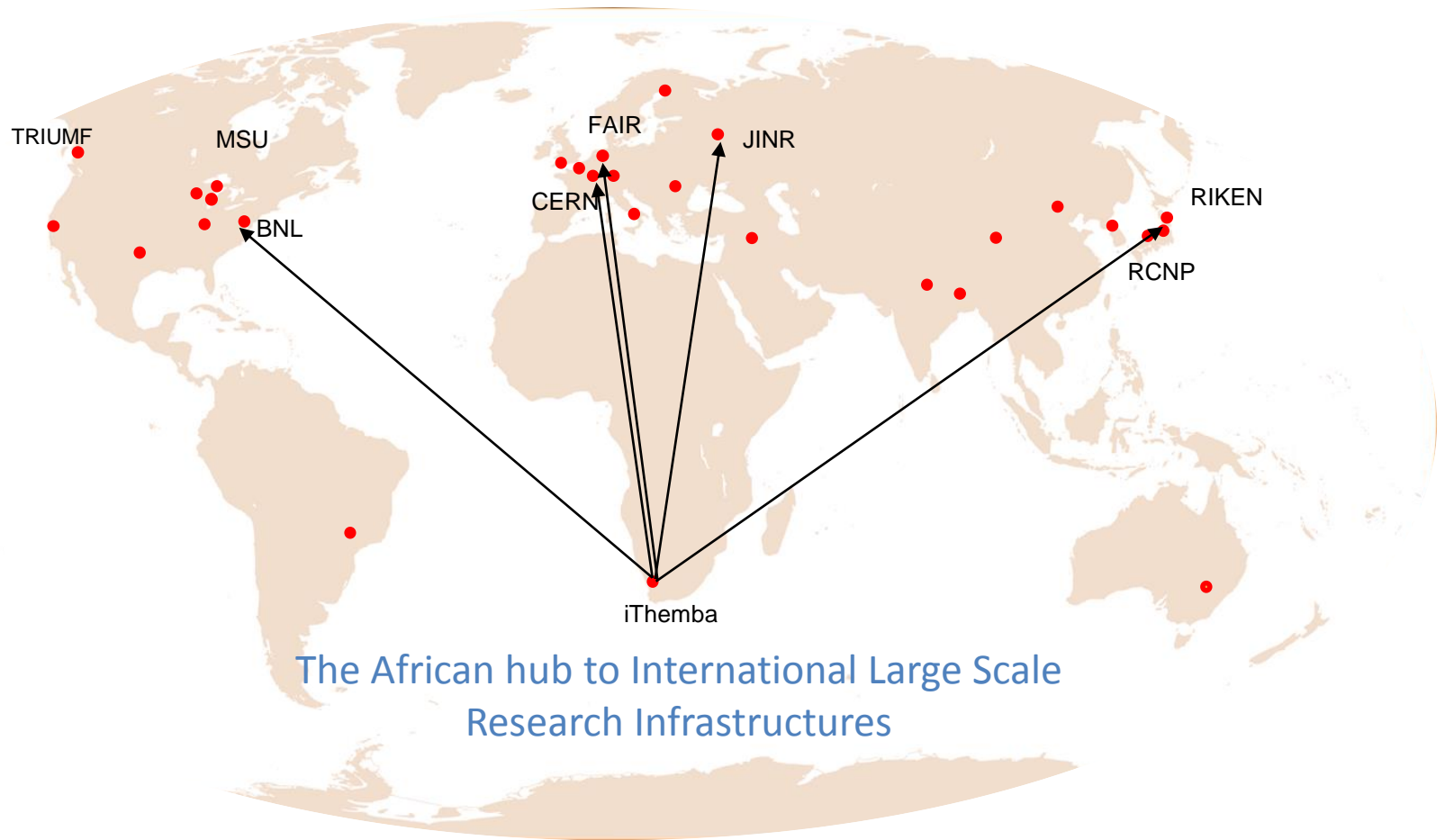
Burkina Faso

Egypt



Internationalisation: iThemba LABS

One Of Largest RI Platforms on the Continent



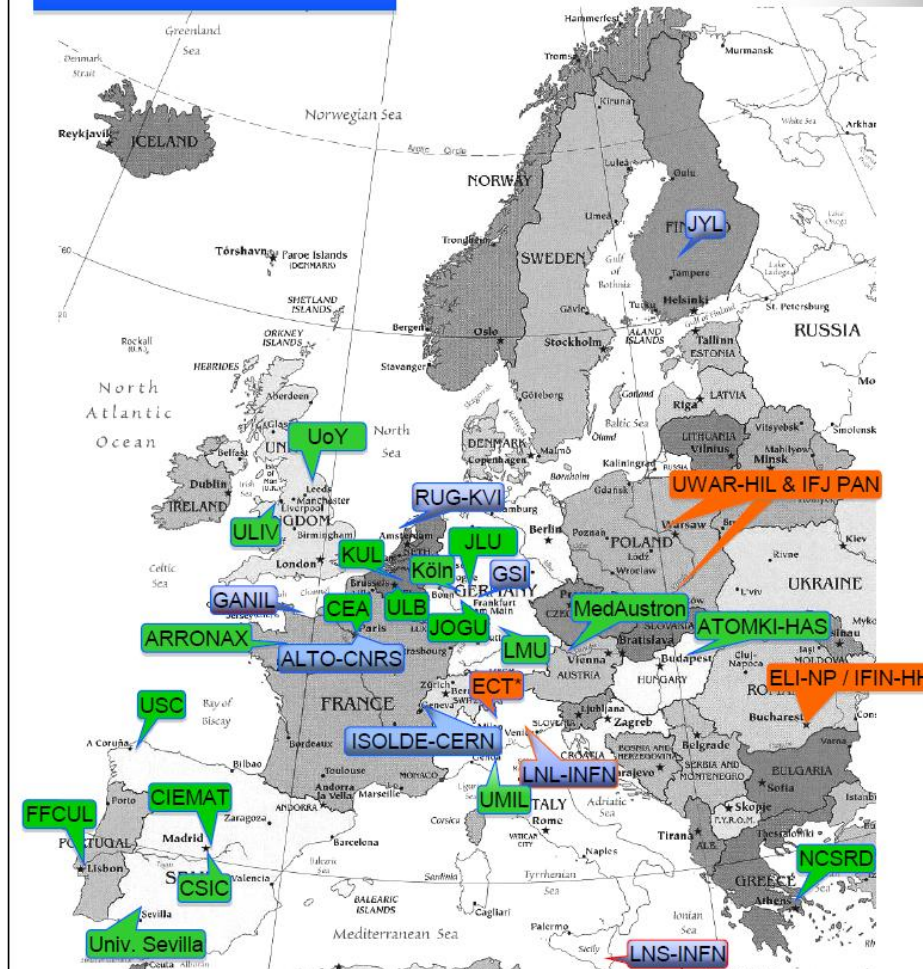
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ENSAR2

Partners of



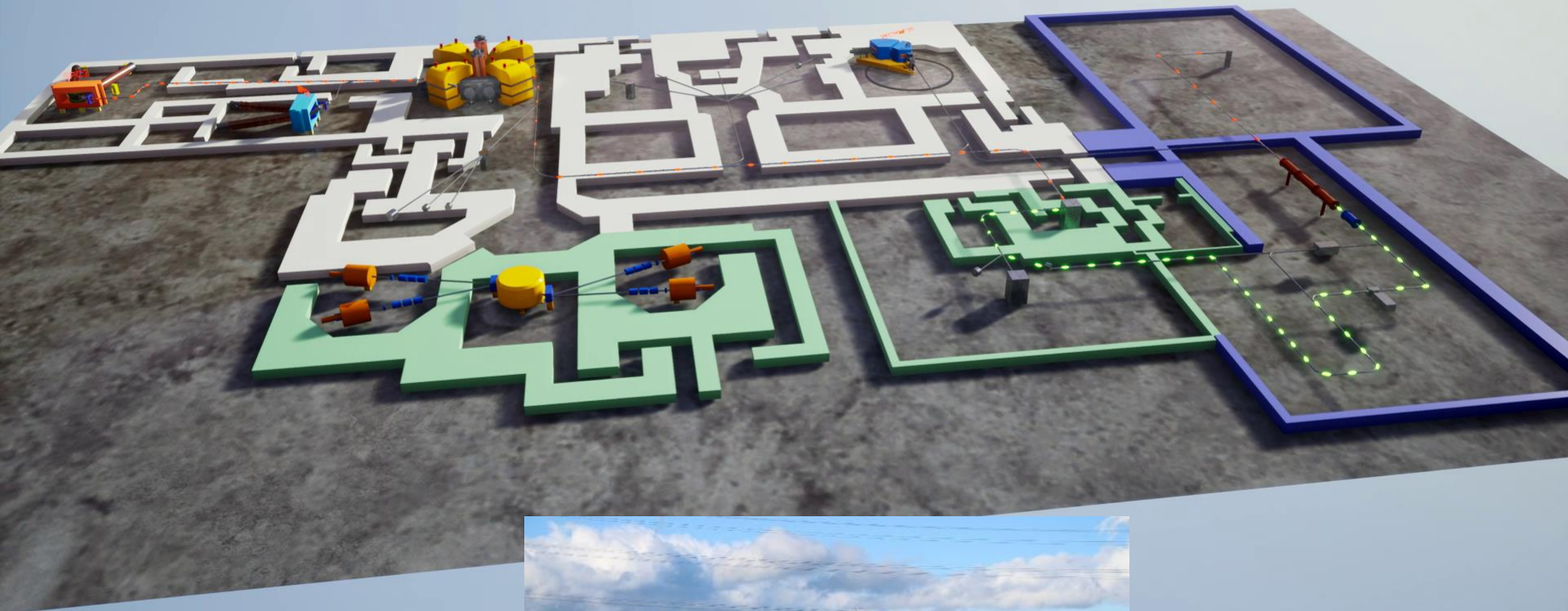
10 TNA Facilities

30 beneficiaries
15 countries

Community: 2700-3000
scientists and highly qualified
engineers

Close collaboration with infrastructures outside Europe:
Canada: TRIUMF Vancouver
China: IMP Lanzhou
India: BARC Mumbai
VECC Calcutta
Japan: RIKEN Tokyo
RCNP Osaka
Russia: JINR Dubna
South Africa: iThemba Cape Town ←
United States: NSCL East Lansing
ANL Argonne

Ultimately iThemba LABS should become CARN (the African CERN)....



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THANK YOU



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Cost to Completion - Phase 1 (including cash flow projections)

Phase 1 - Cost to Completion Budget	Year 1	Year 2	Year 3	Year 4	Total
Cyclotron	117.6	0.0	58.8	74.4	250.8
Buildings	12.0	28.4	4.9	0.0	45.3
Isotope production	4.6	37.3	74.2	13.8	129.9
Infrastructure	0.0	44.4	14.5	7.3	66.2
Beams lines, controls	8.0	15.6	16.2	0.0	39.8
Salaries	3.0	4.0	5.0	6.0	18.0
Total per annum	145.2	129.7	173.6	101.5	550.0



Projected Annual Revenue - Phase 1

Sales	Maximum Production Capacity (Ci)	Revenue (R million)					
		70MeV - Operations					
		Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Local	18.3	3.5	5.2	7.0	9.0	9.5	9.9
International	319.5	125.5	186.6	252.2	322.8	335.7	349.2
Total		129.0	191.8	259.2	331.8	345.2	359.1

Assumption:

Annual production capacity ramped-up from 35% (Y5) to 80% (Y8) on the 70-MeV cyclotron with two extraction ports available for 48 weeks of each year post commissioning