

Having achieved several milestones, we:

- are the only producer in South Africa of accelerator-based radionuclides, radiopharmaceuticals for nuclear medicine and mainstream radiopharmaceuticals for positron emission tomography (PET) studies,
- house the only PEPT-facility in the Southern hemisphere,
- have the world's only high-resolution magnetic spectrometer (K600) to measure proton energies in the 66 - 200 MeV range. A 0°-mode was recently added to expand capabilities,
- are the only facility to offer both protons and neutrons for particle therapy,
- are the world's only producer of current Good Manufacture Practise (cGMP) 68Ge/68Ga generators and 22Na-positron sources for annihilation studies, and
- supply 25% of the world's demand for 82Sr.

Infrastructure

iThemba LABS infrastructure is based at two sites, namely on Old Faure Road in the Western Cape and on the campus of the University of the Witwatersrand in Gauteng.

Western Cape

The Western Cape centre houses a 200-MeV Separated Sector Cyclotron (SSC), two injector cyclotrons (SPC1, SPC2) and a 6-MV Van de Graaff Accelerator. Three user groups apply the particle beams delivered by the accelerators in:

- basic and applied research,
- particle radiotherapy for the treatment of cancer and
- production of radioactive isotopes for application in nuclear medicine and research.

Gauteng

The Gauteng centre houses a 6-MV Tandem Accelerator. Particle beams delivered by the accelerator are used for low energy nuclear physics, as well as for analysis techniques linked to the nuclear microprobe.

A range of environmental samples is analysed using stable isotopes at the centre's Environmental Isotope Laboratory. The analysis capabilities are enhanced through the availability of a 370 GBq Am-Be source for neutron activation studies.

Current and future projects

iThemba Labs is committed to:

- developing a beamsplitter capable of delivering two beams of different intensities, thereby increasing the production of radionuclides,
- establishing an accelerator mass spectrometry (AMS) facility at iThemba LABS-Gauteng, the second in Africa,
- establishing a radioactive ion beam (RIB) facility to extend research capability and ensure competitive advantage.

Public INTERACTION

Our Science and Technology Awareness Programme (STAP) exposes learners, students, teachers, parents and the general public to the activities of the facility in a fun and interactive way. This includes interactive workshops, science shows, career days and guest lectures. The division also runs the 'adopt-a-school-project: changing lives, one learner at a time'.

If we cannot help students to enjoy learning their subjects, however difficult they may be, we have NOT understood anything at all about teaching.

Skills and knowledge development

iThemba LABS actively shares knowledge and provides opportunities for skills transfer through:

- involvement in three training programmes run in collaboration with South African universities,
- providing publications in peer-reviewed journals at a rate of roughly 25 publications per financial year,
- the International Computer Driving License (ICDL) course for school teachers and administrators,
- interaction with learners and teachers to promote awareness and appreciation of science through the Community and Interaction division,
- providing Nigerian scientists at the Centre for Energy Research and Development with an ion beam analysis facility for Rutherford backscattering spectroscopy (RBS), proton induced x-ray emission (PIXE) and HI-ERDA, and
- collaboration with researchers at the European Organisation for Nuclear Research's (CERNs) Large Hadron Collider (LHC) on the ALICE-project.

Career opportunities

iThemba LABS offers exciting opportunities for career growth in various positions such as office management, finance, science (physics/chemistry) and engineering. We also permit job-shadowing for learners in certain areas.

For more information

Please contact us or visit our website:

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Science FOR ALL

iThemba LABS is a multi-disciplinary facility administered by the South African National Research Foundation. Our aim is to be the leading African organisation for research, training and expertise in accelerator-based sciences and technologies.

The name iThemba LABS has been chosen for good reason: iThemba means HOPE, while LABS stands for Laboratory for Accelerator-Based Sciences.

Get A Glimpse Into Our World



Radiotherapy: THE FIGHT AGAINST CANCER

Cancer is the uncontrolled growth and spread of abnormal cells. Localised tumors can be treated by exposing the tumours to radiation.

iThemba LABS' medical radiation department has treated more than 500 cancer patients using protons and more than 1 700 patients using neutrons in a 30-bed on-site hospital at the Western Cape facility. iThemba LABS also offers treatment to patients from Germany through collaboration with Essen University. Furthermore, a number of radiopharmaceuticals are delivered for use in diagnostics at local hospitals.

Proton therapy

Due to their physical characteristics, proton beams are best for treating well-delineated tumours that are close to critical structures. The proton therapy facility uses a fixed horizontal 200 MeV proton beam.

Neutron therapy

Some tumours are referred to as radio-resistant, as conventional radiation has little or no effect on stopping their

growth. Due to their enhanced biological effect, fast neutrons are the most appropriate radiation for treating radio-resistant tumours. iThemba LABS' neutron therapy facility comprises an isocentric gantry with a moving floor. This allows for radiation from all directions.

Radioisotope PRODUCTION

How is it possible to see within the human body - to detect cancer, for instance - without requiring surgery every time? How is it possible to see what happens with an 'engine' while it is running?

The behaviour of radioisotopes in chemical and biological processes is identical to that of stable isotopes of the same element. As radioisotopes emit radiation, one can determine both the site and the rate of the biological process using sophisticated equipment such as gamma-ray cameras.

iThemba LABS produces radioisotopes for medical and industrial applications by bombarding various target nuclei with particle beams produced by a Separated Sector Cyclotron (SSC) machine.

The SSC, pictured on the right, accelerates projectiles in a circle. The circle orbit is related to the speed at which the projectile travels - the bigger the orbit, the faster it travels. The SSC can accelerate protons to an energy of 200 MeV. A proton with that energy can travel roughly four times around the earth in one second!



Research

Overseen by the Director of Research, research activities comprise experimental nuclear physics, materials research, radiation biophysics, and research and development pertaining to particle accelerators.

Experimental nuclear physics: tackling fundamental questions

Research in basic nuclear physics involves mainly experimental studies of the properties of nuclei at moderate to high excitation energy and angular momentum, as well as studies of the different mechanisms through which nuclear reactions occur.

Different experimental set-ups are used during these studies and include the K-600 magnetic spectrometer, the AFRODITE gamma-ray array and the 1.5 metre scattering chamber.

Staff are also involved in research relating to natural and anthropogenic radioactivity of the environment and its practical applications.

Materials research: pushing the frontiers of applied science

This research focuses on the modification and characterisation of materials. Research activities can be grouped into four broad themes, namely:

- nanotechnology and thin film physics,
- understanding biological systems,
- geological and environmental studies using ion beams,
- innovation in instrumentation and electronics.

Research is conducted in a cryo-preparation laboratory with specialised equipment including an X-ray diffractometer (XRD), heavy ion elastic recoil detection analysis (HI-ERDA) facility and atomic force microscope (AFM) for surface imaging and nano-lithography. Particle beams needed for materials research are provided by a 6MV Van de Graaff Accelerator.

