

Letters of Interest Submission



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Unique Research Facilities at the SSC Laboratory in South Africa

The intention of this letter is to engage with the organizers of the African Strategy for Fundamental and Applied Physics (ASFAP) and create awareness of the research facilities at the Separated Sector Cyclotron (SSC) Laboratory as well as its training and research mandates. These are elaborated on in the recently developed Long Range Plan which plays a prominent role in the future strategy of accelerator-based research and training on the African continent. We believe, that this Letter of Intent and associated research activities fits into the ASFAP Physics Groups such as Nuclear Physics, Medical Physics, Instrumentation and Detectors, Applied Physics, as well as Accelerators.

Research and training on nuclear reactions, structure, astrophysics, applications as well as radiation biophysics take place primarily at the SSC Laboratory of iThemba LABS. iThemba LABS is the largest multi-disciplinary accelerator facility in the southern hemisphere and competitive with other similar-sized facilities worldwide. The research infrastructure has been significantly to enable the SSC Laboratory to deliver on its research and training/education mandates in close collaboration with universities. Over the last five years, the SSC Laboratory has had well over 500 users and collaborators and is the academic home of 15 post-docs as well as 100 MSc and PhD students annually. The South African Isotope Facility (SAIF) is a major infrastructure investment and phase 1 is nearing completion with a new 70 MeV cyclotron which will become operational in 2022 allowing for the radiopharmaceutical production to be entirely shifted to the 70 MeV cyclotron. This will double the available SSC beam time for research and will ultimately lead to an increase in the number of users as well as student projects. Phase 1 of SAIF also includes the implementation of a low-energy radioactive ion beam facility. The second phase of SAIF will start in 2023 and will include a major photo-fission facility for the production of rare isotopes for science and medical applications. The SSC Laboratory has developed a sustainable and result driven strategy as part of iThemba LABS Long Range Plan which has already had a major impact on education and research and will continue to do so over the next decade. As the premier accelerator facility the research facilities and strategies are ideally suited to be included in the ASFAP strategic direction.

SSC Laboratory

The vision is to maintain and expand the role of accelerator-based research being a center of expertise and innovation in the field and by improving the public perception of the value of basic and applied research with accelerators. The mission is to perform and facilitate world-class research through in-house and collaborative projects and to fully exploit all training opportunities that arise from these research efforts.

The latest facility developments, together with the existing infrastructure lay the foundation for research during the next decades. Research is the cornerstone of economic development and for the establishment of innovation driven industries. The attractiveness to foreign investments lies in the availability of a technologically knowledgeable workforce of a location and these are increasingly dependent on research which generates innovative thinkers. International competitiveness is one of the primary drivers of progress in research. South Africa is a developing country that has recognized that international excellence in research lays the foundation for technological leadership which is built on cutting-edge knowledge. The promotion of internationally competitive scientific research is an invaluable part of establishing a knowledge-based economy and the SSC Laboratory together with its stakeholders at universities play a major role in achieving this goal. In the spirit of internationalism, the SSC Laboratory facilitates access of university-based researchers to world-class research infrastructures such as CERN, GSI-FAIR and JINR in addition to many other collaborating institutions across the world.

Education and training

The SSC Laboratory, in collaboration with universities, addresses training needs by providing training opportunities to university students. These are:

- a) Specialized and topical lectures relevant to the research programs of the students are organized by the Southern African Institute for Nuclear Science and Technology (SAINTS);
- b) Supervision of research projects for Honours, M.Sc., and Ph.D. students;

- c) Internships, in-service and short-term training (workshops, schools, vacation programs).
- d) Mentorship of postdoctoral fellows and junior researchers.

SSC Laboratory research facilities

The available research facilities include an electron spectrometer, tape station, silicon detector arrays, and environmental radiation laboratories. The main research facilities are briefly summarized as follows:

Fast neutrons

One of the main niche facilities is the availability of quasi-monoenergetic neutrons with energies up to 200 MeV. Even at high currents and 200 MeV, excellent beam quality can be achieved and nanosecond-pulsed beam can be delivered with a background free interval between pulses possible.

K600

The K=600 magnetic spectrometer is a high-resolution kinematically corrected magnetic spectrometer for light ions. It has the capability to measure inelastically scattered particles and reactions at extreme forward angles that includes zero degrees, making it one of only two facilities worldwide where high-energy resolution is combined with zero-degree measurements. Coincident particle and gamma detection capabilities were also added to the K=600 repertoire.

Gamma-ray detection

A wide range of gamma-ray detectors is available. These include background-shielded single-crystal high-purity germanium (HPGe) detectors, a segmented Clover detector, eight low-energy photon detectors, eight fast-timing LaBr₃:Ce detectors, the AFRODITE-PLUS and ALBA arrays. AFRODITE-PLUS consists of 17 Compton suppressed Clover HPGe detectors. ALBA consists of 21 large-volume LaBr₃:Ce detectors. In coincidence with the K600 these allow for experimental configurations which are among the most advanced in the world.

Biophysics

A new proton beam line is available for world-class research leading to a better understanding of biological effects on normal and cancerous cells. This provides insight into how to improve cancer treatment, by increasing efficacy, reducing side effects and finding new ways to overcome radiation resistance of specific tumours. Support is extended to the broader community by offering bio-dosimetric follow-ups to radiation incidents nationally and internationally.

The above is the proposal for a unique African facility for the strategic future of radiation biology and nuclear physics on the continent. The Long-Range Plan and list of collaborating institutions are available upon request.

Primary Category

Nuclear Physics

Secondary Category

Medical Physics

Subgroup categories

NONE

Did you / will you submit this LOI to another category?

NO

Additional Information

Instrumentation and Detectors, applied physics, accelerators

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