

AMS and other accelerator-based sciences in the golden heart and heady wine-lands of the RSA

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The Republic of South Africa (RSA) was reborn in 1994 under possibly the most enlightened constitution of any country and a redrawn provincial structure. One of these provinces is Gauteng, which means place of gold of in Sesotho, while another is the Western Cape, where the vineyards instigated by Dutch and French Huguenot settlers thrive to this day. Though these two provinces reside in the same country, they are worlds apart, but share a common linkage through the two sites of the iThemba Laboratory(ies) for Accelerator-Based Sciences (LABS).

At the Cape site, there are four accelerators, namely the venerable Van de Graaff of the Materials Research Department and four cyclotrons, two of which are solid-pole designs which act as injectors to the man K = 200 Separated-Sector Cyclotron (SSC), while the most recent addition is an 11 MeV machine for the production of ¹⁸FDG. From Monday to Friday, the SSC delivers beams of protons at 200 MeV for cancer treatment and at 66 MeV for the production of Radio-Nuclides as well the generation of secondary neutron beams for the treatment of large external cancer tumors. The weekends are used by nuclear physicists for research and training with a variety of beams produced from the former HMI ECRIS4 and GTS (Grenoble Test Source) ion sources. Measurements focused primarily on nuclear structure are carried out with AFRODITE gamma-ray spectrometer, both in stand-alone mode and coupled with auxiliary detectors such as the Recoil Detector (to suppress the background from fission) and DIAMANT (to detect light-charged particles). Measurements on reaction mechanisms and giant resonances are carried out with the K600 magnetic spectrometer with zero-degree and faint-beam capabilities. There is also a general-purpose scattering chamber which has been used to study the barrier distribution for the Super-Heavy-Element-relevant ⁸⁶Kr + ²⁰⁸Pb reaction.

At the Gauteng site, there is the fully-refurbished EN Tandem Accelerator which was inherited from the facility in its previous incarnation, namely the Schonland Research Centre of the University of the Witwatersrand in downtown Johannesburg. Ion-beam analytical techniques such as Particle-Induced X-ray Emission (PIXE), Rutherford-Back-Scattering (RBS) and Heavy-Ion Elastic Recoil Detection (HI-ERDA) are carried out, but the flagship project is the Accelerator-Mass Spectrometry (AMS) facility that is nearing completion. At the time-of-writing, the Low-Energy-Injection-System (LEIS) is undergoing commissioning and the High-Energy-Analysis-System (HEAS) is under construction by the National Electrostatics Corporation (NEC) with delivery expected later in 2013. Progress on the commissioning and the plans for the research programme to be carried out with the AMS facility will be presented.

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