

Integrating the MAGNEX Focal Plane Detector with the K600 Spectrometer at iThemba LABS for various nuclear structure studies.

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The endeavor to expand the research capabilities of the high-resolution K600 magnetic spectrometer at iThemba LABS has been in progress for a number of years. The primary objective is to develop a novel focal-plane detector capable of detecting light ions at energies below ~ 30 MeV/u and heavier elements like ^{12}C . Extensive efforts have been dedicated to the development of this envisioned detection system, and the initiation of the NUMEN project at iThemba LABS in 2019 facilitated the evaluation of utilizing the K600 with a low-pressure focal plane detector. The primary goal of the NUMEN project at iThemba LABS was to carry out double-charge exchange experiments with heavy ions (which are currently beyond our detection capability).

The project entails the integration of the MAGNEX FPD with the K600 spectrometer to enable studies on nuclear structure and reactions using heavy-ion beams and low-energy light-ion beams, thereby broadening research opportunities that were previously constrained by the characteristics of the K600-FPD system. The project involves initial testing of the MAGNEX FPD in an independent setup, followed by its integration with the K600 medium dispersion focal plane, leading to a phase of commissioning with low-energy beams and radioactive sources to assess particle identification, energy and angle resolution, and detection efficiency. Plans include the utilization of the African LaBr₃:Ce array (ALBA) for particle-gamma coincidence measurements. Apart from the NUMEN project, other experiments are on the horizon with the new setup, such as the investigation of the pygmy dipole response through single-neutron transfer reactions.

In this talk, an overview of the status of both projects will be given together with an example of a study that can be conducted with this state-of-the-art setup.

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