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New research opportunities with the K600 magnetic spectrometer

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Abstract content
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Recent modifications to the scattering chamber and focal plane detectors of the K600 magnetic spectrometer at iThemba LABS allows for exciting new research opportunities.

Measurements at extreme forward angles, including zero degrees, became feasible circa 2009. However, the different beam-stop configurations did not allow for measurements between 2 and 5 degrees. Information about the angular distribution in this small angular range is quite important to positively identify different spin-parities. A new small-angle mode was designed and successfully tested in March 2014. This will allow one to distinguish between M1 and E1 states in inelastic proton scattering. Also, at these angles one can study the poorly known spin-dipole mode. Knowledge of the spin-dipole response in selected nuclei is crucial for description of the dynamics prior to core collapse in massive stars.

It is well known that the addition of coincident particle and gamma detection to the K600 zero degree capability enhances the selectivity of such a facility. For this purpose funding from the NRF was secured to allow for the establishment of a coincident segmented ancillary detector system for the K600. A number of Double Sided Silicon Strip Detectors (DSSSD's) as well as NIM and VME electronics were acquired as part of this project. Furthermore a new scattering chamber, optimized for coincident particle and gamma detection, was recently manufactured. The first experiment to make use of the new hardware is scheduled for June 2014.

The lower detection limit for charged particles in the K600 depends critically on the trigger scintillators in the focal plane. Presently low energy charged particles in transfer reactions studies at 0 degrees are stopped inside the first scintillator, which necessitates the creation of a trigger with only one scintillator. This results in a unusually high trigger rate due to the high rate of low energy charged particles and photons originating from the internal beam-stop. The use of two thin scintillators should however enable coincidence triggering. The expected reduction in signal-to-noise ratio will allow for experiments to be performed more efficiently at higher beam-currents. This is crucial in the study of weakly populated states.

Preliminary data to illustrate the new capabilities will be presented.

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