



Recent Results and Future Prospects with Skipper CCDs in the CONNIE Experiment

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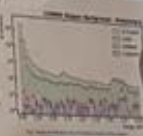
Introduction
CONNIE (Current Neutron-Neutron Interaction Experiment) aims to measure the neutron-neutron scattering cross-section of nuclear spin-polarized and other nuclei in CCDs (Charge-Coupled Devices). This scattering phenomenon involves the interaction of low-energy neutrons with a nucleus, which is mediated by a neutron. The detector requires a high-resolution detector and a high rate of data acquisition.




Skipper-CCDs
These devices consist of an array of read-out electronics (operating at a rate of 100 MHz) that allows for the detection of single electrons. The read-out electronics are arranged in a grid, and the charges are collected, converted to a digital signal, and read out.




Event Selection
A timing module was developed to identify and select events. It is based on the 100 MHz read-out electronics and is capable of identifying events with a timing resolution of 10 ns.




Results
The Skipper-CCD is a highly sensitive detector for low-energy neutrons. It has a timing resolution of 10 ns and a read-out rate of 100 MHz. The detector is currently being used to measure the neutron-neutron scattering cross-section.



Reactor Location
Located 30 meters from the 3-MW research reactor at Instituto de Física de UFRJ, the Skipper-CCD is shielded by a lead and concrete structure to protect the detector from the reactor's neutron flux.



Detector Setup
The Skipper-CCD is mounted on a custom-built detector assembly. It is shielded by a lead and concrete structure to protect the detector from the reactor's neutron flux. The detector is connected to a read-out electronics module and a timing module.



Future Perspectives
• Improving the read-out electronics to increase the read-out rate to 1 GHz.
• Developing a new timing module to improve the timing resolution.
• Using a larger detector array to increase the detection area.
• Improving the shielding to reduce the background rate.
• Developing a new data acquisition system to handle the high data rate.

References
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