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# Design and performance of the readout chip in the Si(Li) tracker module of the GAPS experiment

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This work reports the experimental results from the characterization of a semiconductor detector module, that is the basic unit of the tracker for the General AntiParticle Spectrometer (GAPS) balloon mission. In the austral summer of 2024, GAPS will search for an indirect signature of dark matter through the detection of low-energy (< 0.25 GeV/n) cosmic-ray antiprotons, antideuterons, and antihelium.
GAPS relies on a Time-Of-Flight system, and on a system, based on lithium-drifted silicon, Si(Li), detectors, which serves as the target and tracker for the initial cosmic-ray particle and its annihilation products. The tracker system is composed of ten layers of 6×6 modules each. The modules are arranged in lines of 6 and every line shares the same low power supply voltage. Each detector module hosts 4 Si(Li) detectors divided into 8 strips and read out by a 180 nm CMOS ASIC. The readout ASIC, named SLIDER32 (32 channels Si-Li DEtector Readout ASIC), is comprised of 32 analog readout channels, an 11-bit SAR ADC and a digital back-end section. The core of the ASIC is a low-noise analog readout channel implementing a dynamic signal compression to resolve both X-rays in the range of 20 to 100 keV and charged particles with energy deposition of up to 100 MeV. It features an energy resolution < 4 keV FWHM in the 20-100 keV range with a 40 pF detector capacitance, to distinguish X-rays from antiprotonic or antideuteronic exotic atoms. The ASIC will run at a temperature of about - 40 ℃ with a detector leakage current in the 5-10 nA range.
The ASIC has been thoroughly tested and a complete set of experimental results will be presented at the conference, including the performance of a fully assembled Si(Li) tracker module in the detection of X-rays from a $^{241}$Am source and of cosmic muons.

## Collaboration

## Role of Submitter

I am the presenter

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