Contribution ID: **24** Type: **not specified**

Silicon Drift Detectors and low-noise readout ASICs for X-ray Spectroscopy

This work reports about the development of Silicon Drift Detector (SDDs) arrays and readout electronics for the upgrade of the INFN- SIDDHARTA experiment. The SIDDHARTA experiment uses high resolution X-ray spectroscopy of kaonic atoms to determine the transition yields and the strong interaction induced shift and width of the lowest experimentally accessible level. A new detection system based on 200cm2 SDDs will be installed within 2018 to run kaonic-deuterium measurements in 2019.

The detector is a Silicon Drift Detector (SDDs) array composed by 8 independent elements, square shaped with 64 mm2 (8×8) area each. The detector is organized in a 4×2 format for a total area of 34×18 mm2. The upgrade of the SIDDHARTA experiment requires 48 detector arrays that are designed and manufactured by the Fondazione Bruno Kessler (FBK). The readout electronics is composed by CUBE (a low-noise CMOS preamplifier), individually connected to each SDD, and by SFERA (SDDs Front-End Readout ASIC), a 16 channels ASIC that perform analog shaping of the signals.

SFERA is designed in a 0.35 μm technology and the main elements of the single channel are a high order shaping amplifier (9th order Semi-Gaussian complex poles), a fast shaper amplifier, a peak detector, a baseline holder and a high efficiency pile-up rejection logic. The shaping amplifier is characterized by selectable gain and peaking times that can be selected with different configurations of an internal 256-bit register. The available gain settings are (corresponding energy of the shaper full scale): 10 keV, 16 keV, 36 keV, 50 keV and 20000 e-. This last setting is useful when SFERA chip is used to read an SDD array coupled to a scintillator crystal in gamma-ray applications. The main shaper has peaking times of 500 ns, 1 μs, 2 μs, 3 μs, 4 μs and 6 μs (selectable) while the fast shaper has a fixed one of 200 ns.

The outputs of the channels are connected to an analog multiplexer that can be connected to an external ADC card or to a 12-bit SAR on-chip ADC.

Measurements of the detectors arrays will be reported (coupled to the SFERA chip) in this work. Moreover, a study the effect of charge sharing on SDD channels upon absorption of X-rays and background particles on SDD is discussed. This study aims at investigating the performances of such devices when expected to be irradiated with X-rays signals and with a large background due to MIPs of the accelerator.

Primary author: AMIRKHANI, Aidin (MI)

Presenter: AMIRKHANI, Aidin (MI)