Development of arrays of Silicon Drift Detectors and readout ASICs for the SIDDHARTA experiment

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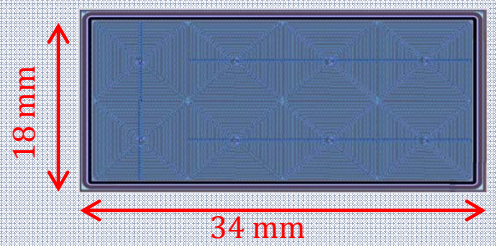
In the framework of the INFN-SIDDHARTA experiment a new SDD array has been developed. This array is characterized by eight independent elements organized in a 4 x 2 format (square SDD). Each channel is connected to a CUBE preamplifier.

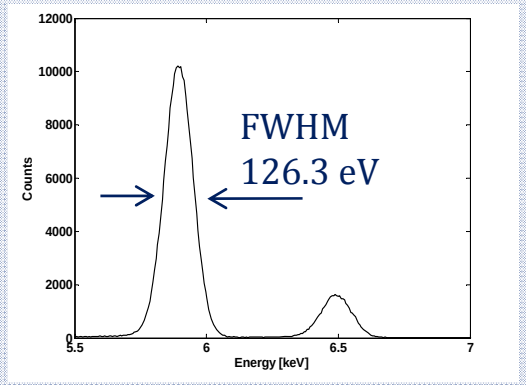
Pictures of the SDD array:



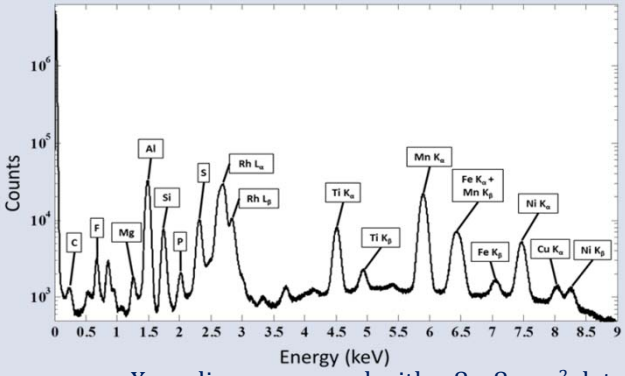
Layout of the front side

Picture of the detector mounted in a proper carrier (back side view)

Spectroscopic measurements with the single square shaped SDD (8 x 8 mm^2 active area):



^{55}Fe spectra at 150K. Shaping time 1 µs.

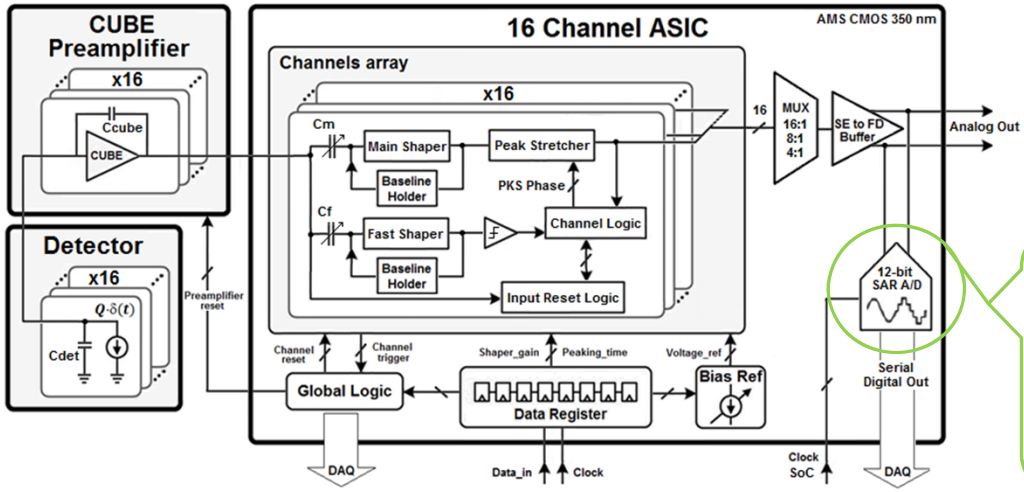


Low energy X-ray lines measured with a 8 x 8 mm^2 detector. L and K lines of various elements are indicated.

Readout ASIC – SFERA chip

The output of the CUBE preamplifiers are connected to a common ASIC called SFERA (SDDs Front-End Readout ASIC) that is a 16 channels Integrated Circuit that performs analog shaping and peak detection of the signals.

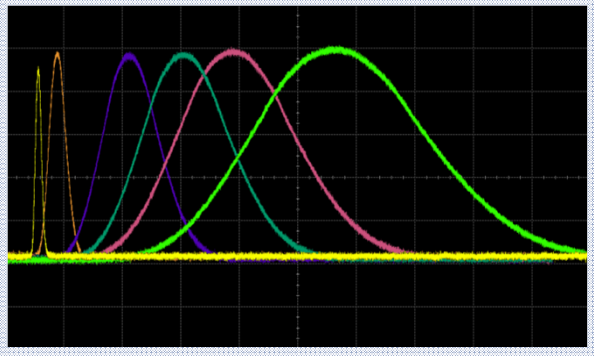
- Technology: AMS 0.35 µm;
- Area 25 mm^2;
- 16 channels;
- 9^{th} order semi-gaussian filter;
- Peaking times: 0.5, 1, 2, 3, 4, 6 µs;
- Gains: 10, 16, 36, 50 keV and 20 ke^-;
- Pile-up rejector;
- Multiplexer Output: 16:1, 8:2, 4:1;
- Polling or "sparse" multiplexer readout;
- 256-bit internal configuration register;
- 12 bit SAR ADC;



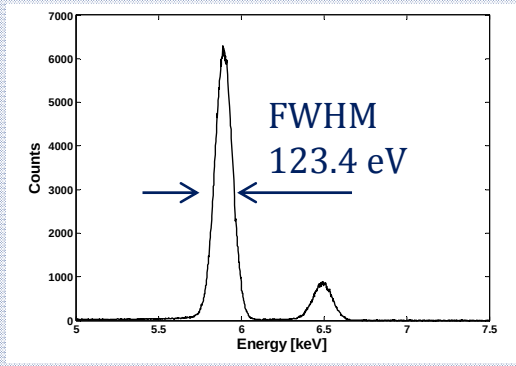
Detector readout with CUBE preamplifier and SFERA chip (shown with a blocks diagram).

Poster presentation. Session: "Front end, Trigger, DAQ and Data Management" (Thursday afternoon).
F. Schembari et al. "A 12-bit SAR ADC integrated on a multichannel Silicon Drift Detector Readout IC"

Experimental results:



Oscilloscope screenshot of the shaper (0.5, 2, 3, 4, 6 µs) and fast shaper (0,2 µs) outputs.



^{55}Fe source spectra with a small area SDD at -40 °C coupled with SFERA (4 µs shaping time).