

# Readout Electronics for high-count-rate high-resolution X-ray spectroscopy

Luca Bombelli, Roberto Alberti, Tommaso Frizzi

XGLab s.r.l., Via Francesco D'Ovidio 3, I-20131 Milano, Italy (email: [info@xglab.it](mailto:info@xglab.it)).

## ABSTRACT

New synchrotron facilities are able to deliver higher and higher photon flux while most of the experiments performed with synchrotron radiation require spectroscopy-grade detectors and electronics to measure single X-ray fluorescence lines. As a consequence, detector-system requirements are always moving towards extended energy-range, higher count-rate and better spectroscopy capability. XGLab is always working with similar targets in order to provide single and multi-channel readout solutions.

XGLab develops CMOS preamplifiers (the CUBE family) for different radiation detectors. The coupling of CUBE with the traditional SDD (Silicon Drift Detectors) enables to get superior energy resolution at short shaping time. As an example, energy resolution FWHM of 148 eV at 6keV with ultra-short peaking time of 100 ns is now possible as well as operation above 1 Mcps per channel.

XGLab will also present complete acquisition systems. One multichannel DAQ is based on a custom-designed CMOS ASIC (named VERDI). The use of custom developed ASIC (application specific integrated circuit) became the preferred solution for the readout of hundreds of parallel channels. VERDI implements 8 complete readout channels, each one is composed by the hybrid charge preamplifier, analog shaping amplifier, baseline holder, peak-stretcher and output buffer. The compact 8-channel VERDI module is 6 x 10 cm in size, requires less than 2 W of power, and it is controlled via single USB2 for configuration and data-taking. Each module is equivalent to an 8-channel adjustable shaper and 8-channel multi-channel analyser. The design foresees the possibility to daisy chain several modules in order to further increase the number of channels. We will show the possibility to achieve the best noise and count rate trade-off with pixelated Si(Li) (Silicon-Lithium) and HPGe (High Purity Germanium) detectors.

Finally, XGLab will present a new single channel DPP (digital pulse processor) tailored on CUBE characteristics (like noise, gain, dynamic range, etcetera). Such DPP has been designed to operate together with CUBE-equipped detector and to take advantage of the superior CUBE performances. The peculiarities of the DPP are its compactness, low-power consumption, good noise-level and operation up to 1.5Mcps. The DPP has been designed in a single board with power consumption below 5W with the purpose to make the implementation of multichannel DAQ with relatively small equipment possible.