

ARDESIA: 4-Channels Fast SDD X-ray Spectrometer for Synchrotron Applications

G.Bellotti^{1,2}, F.Lussignoli^{1,2}, A.D.Butt^{1,2}, M.Carminati^{1,2}, C.Fiorini^{1,2},
A.Balerna³, V.Tullio³, G.Borghi⁴, C.Piemonte⁴, N.Zorzi⁴, A.Capsoni², S.Coelli²,
L.Bombelli⁵

(1) Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria, Milan, Italy

(2) INFN, Sezione di Milano, Milan, Italy

(3) INFN, Laboratori Nazionali di Frascati, Frascati, Italy

(4) Fondazione Bruno Kessler - FBK, Trento, Italy

(5) XGLAB srl, Milano, Italy

email address of presenting author (giovanni.bellotti@polimi.it)

This work reports the development of the ARDESIA spectrometer, supported by INFN. ARDESIA is a SDD-based, multichannel X-ray spectrometer, optimized for synchrotron applications that require a high-rate (Mcps), high-resolution (below 150 eV FWHM at shaping time faster than 200 ns) soft X-ray detection. The main applications for which ARDESIA is designed are X-ray fluorescence (XRF) and X-ray absorption fine structure (XAFS) techniques. In this work the first prototype of ARDESIA 4-channels complete instrument is presented. After optimization and characterization of the 4-channel detection module [1], the mechanical cooling structure of the instrument has been realized so that it can properly fit inside a synchrotron scattering chamber with a finger-like structure. The mechanical structure grants cooling, with a double Peltier TEC strategy, vacuum, insulation from the harsh surrounding environment and potential for placing side-by-side several spectrometers. The detector signals are amplified by a monolithic four-channel CUBE preamplifiers chip [2] and processed by a digital pulse processor (e.g. XGLab-DANTE) to achieve short pulse processing times, to show the good performances of the module at high count rates (about 1 Mcps per channel, see Fig1). Experimental results, taken also at the LNF DAΦNE-Light DXR1 soft X-ray beamline, will be here reported. At the DXRI beamline XRF tests on low atomic number elements will be performed measuring also their near absorption edge XANES spectra.

[1] G. Bellotti, A.D. Butt, M. Carminati, C. Fiorini, A. Balerna, C. Piemonte, N. Zorzi, L. Bombelli, The Detection Module of ARDESIA: a New, Versatile Array of SDDs for X-Ray Spectroscopy Synchrotron Applications, 2016 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC).

[2] L. Bombelli, C. Fiorini, T. Frizzi, R. Alberti, R. Quaglia, High rate X-ray spectroscopy with “CUBE” preamplifier coupled with silicon drift detector, IEEE 2012 NSS/MIC Conference Record.

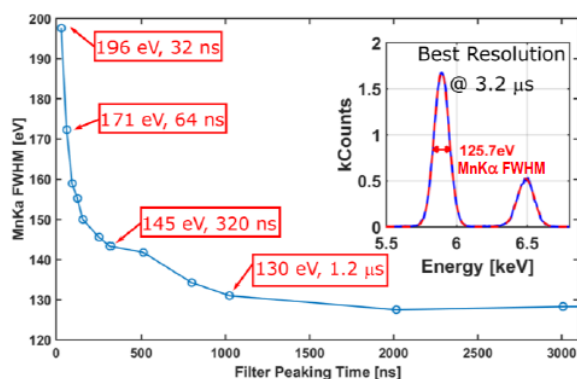


Fig.1a ARDESIA resolution: ⁵⁵Fe Mn-Kα FWHM vs. peaking time.

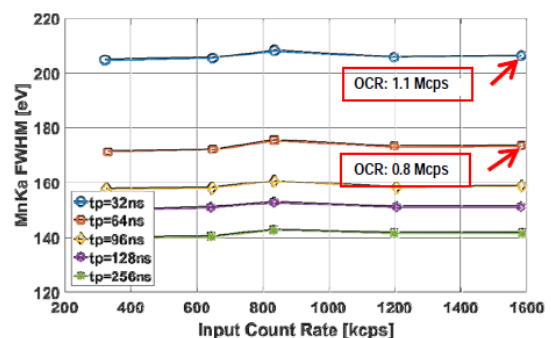


Fig.1b ARDESIA throughput: ⁵⁵Fe Mn-Kα FWHM vs. input count rate for different pulse processing times.