# Large solid angle and high detection efficiency multi-element silicon drift detectors for synchrotron based X-ray spectroscopy

Jernej Bufon*[1,5], Matteo Altissimo[1], Giuliana Aquilanti[1], Pierluigi Bellutti[2], Giuseppe Bertuccio[3,4], Fulvio Billè[1], Roberto Borghes[1], Giacomo Borghi[2], Giuseppe Cautero[1,5], Stefano Ciano[5], Andres Cicuttin[5,6], Daniela Cirrincione[5,7], Maria Liz Crespo[5,6], Sergio Fabiani[8,9], Francesco Ficorella[2], Massimo Gandola[3,4], Alessandra Gianoncelli[1,5], Dario Giuressi[1,5], Riccardo Grisonich[1], George Kourousias[1], Kasun Sameera Mannatunga[6,10], Filippo Mele[3,4], Ralf Hendrik Menk[1,5,11], Luca Olivi[1,5], Giulio Orzan[5], Antonio Picciotto[2], Alexandre Rachevski[5], Irina Rashevskaya[12], Martina Sammartini[3,4], Stefano Schillani[1,5], Andrea Stolfa[1], Gianluigi Zampa[5], Nicola Zampa[5], Nicola Zorzi[2], and Andrea Vacchi[5,7]

[1]*Elettra - Sincrotrone Trieste S.C.p.A., Italy*

[2]*Fondazione Bruno Kessler, Italy*

[3]*Politecnico di Milano, Italy*

[4]*INFN Milano, Italy*

[5]*INFN Trieste, Italy*

[6]*ICTP, Italy*

[7]*Università di Udine, Italy*

[8]*INAF-IAPS, Italy*

[9]*INFN Roma Tor Vergata, Italy*

[10]*University of Sri Jayewardenepura, Sri Lanka*

[11]*University of Saskatchewan, Canada*

[12]*TIFPA - INFN, Italy*

**jernej.bufon@elettra.eu*

Third and fourth generation light sources have revolutionized the research in many scientific and technological disciplines. New scientific challenges impose the construction of cutting-edge performance machines and experimental stations. In this context, off-the-shelf detection systems severely constrain the achievable results. These reasons led to the birth of the ReDSoX and ReDSoX2 research projects, aiming to explore new solutions related to energy resolving imagers based on silicon drift detectors (SDD), which are among the most employed acquisition devices in X-ray fluorescence spectroscopy. The main goal of the project is to develop novel detection systems able to cover a large photoemission solid angle, being easily adaptable to the needs of different X-ray spectroscopy beamlines and ready to cope with high photon count-rates in order to exploit all the power of new light sources. Research efforts yielded two detector systems, dedicated to different experimental needs. The first system, which is composed of 32 SDD elements arranged on 4 monolithic sensors and covers a total non-collimated area of 1232 $mm^2$, is optimized for detecting low-energy photons in the 200 – 4000 eV energy range. The second detector consists of a matrix of 64 SDD elements disposed on 8 monolithic arrays covering an overall non-collimated active area of 576 $mm^2$. The latter operates in an energy range between 4 and 30 keV. Both systems are highly integrated and can either be operated as an apparent large area "single detector" or as a multi-element detector, collecting information separately from each single element in order to enable spatially and angular resolved advanced studies. The performances of the two detector systems have been studied at the TwinMic and XAFS beamlines (Elettra – Sincrotrone Trieste, Italy), respectively. Recent results obtained during these measurements will be presented and discussed.