ID contributo: **41** Tipo: **non specificato**

Hybrid detectors for soft X-ray photon science using iLGAD sensors

mercoledì 21 febbraio 2024 12:35 (20 minuti)

Single photon counting and charge integrating hybrid pixel detectors are an established standard for photon science applications at hard X-ray energies between ~ 2 keV and 20 keV. Their capabilities for high frame rates and dynamic range, large area coverage, high signal-to-noise ratio and spatial resolution also make them attractive for applications at soft X-ray energies (< 2keV). However, using hybrid detectors for soft X-ray detection has been difficult so far. This is mainly due to the low quantum efficiency of standard silicon sensors at soft X-ray energies and the noise of the readout electronics.

At PSI, we have been developing inverse Low Gain Avalanche Diode (iLGAD) sensors for soft X-ray detection in collaboration with FBK. These sensors feature an optimized thin entrance window, enabling a quantum efficiency at soft X-ray energies comparable to standard CCD and CMOS image sensors (i.e., 62% at 250 eV). The internal signal amplification in the iLGAD sensor improves the signal-to-noise ratio at low photon energies and enables single photon resolution down to ~ 200 eV

We present the development of iLGAD-based hybrid detectors for soft X-ray photon science at PSI and illustrate the capabilities and current limitations of the technology. We discuss in depth characterization results of a prototype consisting of an iLGAD sensor bump bonded to the charge integrating 75 µm pixel JUNGFRAU chip. Cooled to -22℃, this system achieves an effective equivalent noise charge of ≤ 5.5 electrons r.m.s. at a 5 µs integration time. Single photon resolution at 200 eV with a signal-to-noise ratio better than 5 becomes feasible by cooling further to -50℃. Based on these results, we give an outlook on future improvements and show a first look on applications of iLGAD hybrid detectors for soft X-ray experiments.

Autore principale: HINGER, Viktoria (Paul Scherrer Institute)

Coautore: MOZZANICA, Aldo (Paul Scherrer Institut); BERGAMASCHI, Anna (Paul Scherrer Institut); SCHMITT, Bernd (Paul Scherrer Institut); MEZZA, Davide (Paul Scherrer Institute); GREIFFENBERG, Dominic (Paul Scherrer Institut); FRÖJDH, Erik (Paul Scherrer Institut); BARUFFALDI, Filippo (Paul Scherrer Institut); FICORELLA, Francesco (Fondazione Bruno Kessler); BORGHI, Giacomo (Istituto Nazionale di Fisica Nucleare); PATERNOSTER, Giovanni (Fondazione Bruno Kessler); ZHANG, Jiaguo (Paul Scherrer Institut); HEYMES, Julian (Paul Scherrer Institut); PATON, Kirsty (Paul Scherrer Institut); CARULLA ARESTE, Maria del mar (Paul Scherrer Institut); CENTIS VIGNALI, Matteo (Fondazione Bruno Kessler); BOSCARDIN, Maurizio (Istituto Nazionale di Fisica Nucleare); HAMMAD ALI, Omar (Fondazione Bruno Kessler); SIEBERER, Patrick (Paul Scherrer Institut); DINAPOLI, Roberto (Paul Scherrer Institut); RONCHIN, Sabina; XIE, Xiangyu (Paul Scherrer Institut)

Relatore: HINGER, Viktoria (Paul Scherrer Institute)

Classifica Sessioni: LGAD 2