

Dead-time in X-ray Photon Counting Detectors

David Laundry, *CCLRC Daresbury Laboratory, Warrington, Cheshire, WA4 4AD, UK*. E-mail: d.laundy@dl.ac.uk

With modern high flux synchrotron X-ray sources, photon counting detectors must operate at high counting rates where there can be significant non linearity in the detector response caused by the dead-time from overlap of pulses in the counting chain. We have shown that the dead-time not only affects the measured number of counts but also degrades the statistical accuracy obtained from a measurement [1], [2]. This effect can actually cause the statistical accuracy to drop if the source flux is increased beyond a certain value, even though the dead-time correction may still be relatively small.

In addition, we have derived an expression for the dead-time correction that must be used when the source of radiation is time dependent. The use of this correction for pulsed radiation from synchrotron sources operating in single bunch or gapped filling mode is demonstrated.

[1] Laundry D., Collins S. P., *J. Synchrotron Rad.*, 2003, **10**, 214. [2] Laundry D., Tang C. C., Collins S. P., *AIP Conference proceedings*, 2004, **705**, 977.

Keywords: detector properties, synchrotron x-ray instrumentation, x-ray detectors