

Accepted Manuscript

A fitting model of the pixel response to monochromatic X-rays in photon counting detectors

P. Zambon, V. Radicci, M. Rissi, C. Broennimann



PII: S0168-9002(18)30905-7
DOI: <https://doi.org/10.1016/j.nima.2018.07.069>
Reference: NIMA 61015

To appear in: *Nuclear Inst. and Methods in Physics Research, A*

Received date: 30 April 2018
Revised date: 19 July 2018
Accepted date: 22 July 2018

Please cite this article as: P. Zambon, V. Radicci, M. Rissi, C. Broennimann, A fitting model of the pixel response to monochromatic X-rays in photon counting detectors, *Nuclear Inst. and Methods in Physics Research, A* (2018), <https://doi.org/10.1016/j.nima.2018.07.069>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

1 A Fitting Model of the Pixel Response to
2 Monochromatic X-Rays in Photon Counting Detectors

3 P. Zambon, V. Radicci, M. Rissi and C. Broennimann

4 DECTRIS Ltd., Taefernweg 1, 5405 Baden-Daettwil, Switzerland (e-mail:
5 pietro.zambon@dectris.com)

6 **Abstract**

7 We present a simple fitting model for the pixel response to monochromatic
8 X-rays in single photon counting pixelated detectors that takes into account
9 the 2D effects of the charge sharing and of the electronic noise on the photon
10 counting process. It is based only on geometrical and physical parameters such
11 as the pixel size, the charge cloud size at the pixel depth and the total electronic
12 noise of the front-end circuitry. The equations describing the pixel point spread
13 function and the integral pulse height spectrum are derived preserving the gen-
14 uine 2D nature of the charge collection process. The fitting performances of the
15 model has been assessed on a set of experimental integral pulse height spectra
16 measured with an IBEX photon counting ASIC bonded to a 450 μm thick Silicon
17 sensor with $75 \mu\text{m} \times 75 \mu\text{m}$ pixel size, irradiated with monochromatic X-rays in
18 the energy range 6-12.4 keV, with excellent agreement between model and mea-
19 surement. The actual contributions of the charge sharing and of the electronic
20 noise are identified and estimated. As a possible consequence, the model can be
21 used to predict precisely the behavior of photon counting detection systems as
22 a function of the design parameters.

23 *Keywords:* X-ray detectors, photon counting, pixel response model, spectrum
24 fitting.

Download English Version:

<https://daneshyari.com/en/article/9953883>

Download Persian Version:

<https://daneshyari.com/article/9953883>

[Daneshyari.com](https://daneshyari.com)