Statistical properties of measured X-ray intensities affected by counting loss of detection system

Takashi Ida, Akihisa Oya, Hisashi Hibino
Nagoya Institute of Technology, Ceramics Research Laboratory, Asahigaoka 10-6-29, Tajimi, Gifu, 465-0097, Japan, E-mail: ida.takashi@nitech.ac.jp

Counting methods are widely used to measure the intensity of X-rays. Statistical errors of measured intensities are usually assumed to be equal to the square root of the observed number of counts, because independently generated signal pulses obey the Poisson distribution, where the statistical variance is exactly identical to the average number of pulses. However, the intensity measured with a realistic counting system does not strictly obey the Poisson distribution because of finite response time of the detection system. Statistical properties of two conventional theoretical models for counting loss, non-extended and extended deadtime models, examined by Monte Carlo simulations, have shown that statistical variances as well as means deviated from those predicted by the Poisson model are well approximated by simple mathematical formulae [1]. In this study, experimental evaluation of statistical variance of counted pulses based on a repeated Chipman’s method [2] has been conducted for a laboratory powder x-ray diffractometer (Rigaku RAD-2C) and a synchrotron powder diffractometer (KEK-PF BL-4B2 MDS system). The dependence of the observed average count on the expected count rate has been rather well fitted by an intermediate extended deadtime model [3] than the conventional models. It has been suggested that the statistical errors of the observed counts can also be predicted by applying the intermediate model, assuming hypothetical series of detection components with non-extended and extended deadtime characters.


Keywords: counting loss, statistical error, counting method

The XtalFinder imaging system

Erik Brostrom, Jie Nan, Xiao-Dong Su
Peking University, College of Life Sciences, College of Life Sciences R417, Peking University, Beijing, Beijing, 100 871, China, E-mail : brostromer@gmail.com

The XtalFinder is an automated imaging system for collecting crystallization results from SBS format (48-, 96-, 192-, 384-wells) microplates. The system has previously been described [1]. Our recent updates include: A mono microscope for straight viewing angle of the sample; An LED cold light source with center and radial intensity control, to improve the contrast and sample illumination for multiple sample types; A new software version with a more user-friendly graphical interface and simpler, straight forward, functions; Use of a third party software for Z-batching of multiple images (slices) of the same drop, with different focus levels, to generate one focused image per collected drop. For future developments, algorithms and software to automatically recognize crystals or potential crystalline states are underway.

References:
1. Brostromer E, Nan J, Su XD. “An automated image-collection system for crystallization experiments using SBS standard