Cluster based Analysis for Multi-Speckle XPCS Experiments

Michael Sprung[1], A. Sandy[1], S. Narayanan[1] and B. Tieman[2]

[1]X-Ray Science Division, Argonne National Laboratory, Argonne, IL 60439 USA
[2]APS Engineering Support Division, Argonne National Laboratory, Argonne, IL 60439 USA

Using fast and efficient area detectors has extended the range of accessible timescales in multi-speckle X-ray Photon Correlation Spectroscopy (XPCS) experiments to the millisecond regime [1,2] and with the plans to build even brighter x-ray sources it seems feasible to investigate dynamics of microsecond timescales with multi-speckle XPCS in the near future. However, data rates are approaching GB/s levels and the ratio of data collection time to data reduction time has become very unfavorable, e.g. a standard data set of 1000 frames might be collected in ~10s or less and its analysis would take ~1000s or more.

The data reduction time increases linearly with the number of pixels involved. This suggests that the multi-tau algorithm to calculate the intensity-intensity auto-correlation function g2 is highly parallelizable. We have implemented a set of C^{++} routines to perform the multi-speckle XPCS analysis on a computer cluster. In a first step, we interfaced the cluster based g2 calculation with the existing Matlab based code to analyze XPCS data in a post data collection mode. First tests show strongly improved data analyzing times. In addition, we will present a roadmap towards (near) 'real time' multi-speckle g2 calculations.

References:

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