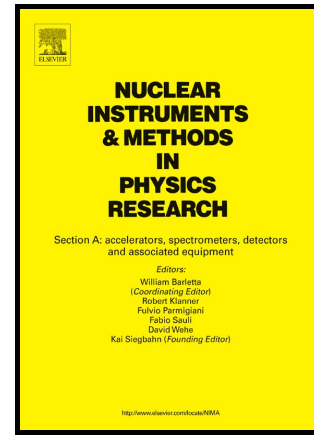


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A single-pixel X-ray imager concept and its application to secure radiographic inspections

Andrew J. Gilbert, Brian W. Miller, Sean M. Robinson,
Timothy A. White¹, William Karl Pitts, Kenneth D. Jarman, Allen Seifert
Pacific Northwest National Laboratory, Richland, WA 99354

Abstract

Imaging technology is generally considered too invasive for arms control inspections due to the concern that it cannot properly secure sensitive features of the inspected item. However, this same sensitive information, which could include direct information on the form and function of the items under inspection, could be used for robust arms control inspections. The single-pixel X-ray imager (SPXI) is introduced as a method to make such inspections, capturing the salient spatial information of an object in a secure manner while never forming an actual image. The method is built on the theory of compressive sensing and the single pixel optical camera. The performance of the system is quantified using simulated inspections of simple objects. Measures of the robustness and security of the method are introduced and used to determine how robust and secure such an inspection would be. In particular, it is found that an inspection with low noise ($<1\%$) and high undersampling ($>256\times$) exhibits high robustness and security.

Keywords: Compressive sensing, radiography, arms control

1. Introduction

Historically, high-resolution image information has not been seriously considered for arms control treaty inspections because of the potential risk of release of sensitive design information of the items being inspected [Abe (1994)]. However, as future arms control treaties put increasingly lower

¹T. A. White is currently on assignment at the International Atomic Energy Agency (IAEA), Vienna.

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