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## Directional Aerial Radiation Survey Maps to enable Extrapolation and Improved Precision

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Gamma spectroscopy measurements are a key component of an on-site inspection conducted under the Comprehensive-Nuclear-Test-Ban-Treaty. Radiometric aerial survey has proven to be an efficient way to cover large areas, however the spatial distributions of features smaller than the survey altitude are smeared out and their radioactivity concentration is underestimated. Moreover, the inspected state party may declare multiple restricted access sites over which the aerial survey may not be able to fly. In previous work presented in this conference series we have shown how multi-crystal direction-capable or imaging gamma detectors can reconstruct radioactivity distributions in a restricted access site from vantage points on its perimeter. In this work, we present a new method to unfold the measurement making use of Monte Carlo generated response functions in an iterative minimization to extract the true underlying radioactivity distribution within uncertainties. By requiring the solution be consistent with the measurement from every crystal sub-detector involved in the survey simultaneously, this method greatly improves spatial precision and the distance over which extrapolation is valid. Most importantly, the method provides the significance of the observation of radioactivity in certain areas, and gives an upper limit on the amount of allowed radioactivity in other areas.

### Promotional text

A method to unfold the measurement system response from radioactivity maps made with multi-crystal spectrometers improves spatial precision, permits extrapolation, and determines the significance of the presence of radioactivity in some areas and its absence in others.

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