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event source type characterization with three-dimensional spatial analysis of radioxenon isotopic activity ratios

The three-dimensional (3D) spatial analysis of radioxenon isotopic activity ratios can be used to determine the source type of a nuclear event without any knowledge of the time of its generation. This method requires at least a triple detection from the same sample among the four CTBT-relevant radioxenon isotopes, which are ^{131}mXe , ^{133}mXe , ^{133}Xe , and ^{135}Xe . The 3D space of three different isotopic activity ratio axes can be turned around in such a way that the perspective along the axis of decay is chosen. In this projection to a 2D plane any entry changing over time by radioactive decay would remain in the same spot. The simulations and observations of different source types whether observed (data of Nevada Test Site releases, signatures from medical isotope production facilities and Fukushima accident data) or simulated (nuclear explosion scenarios, light water reactor operation cycles, neutron activation) are entered in the plot. A cluster analysis marks the areas in which measurements of these source types can be found. This can be used to characterize the potential source of any observation that has three isotopes measured above the detection limit.

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