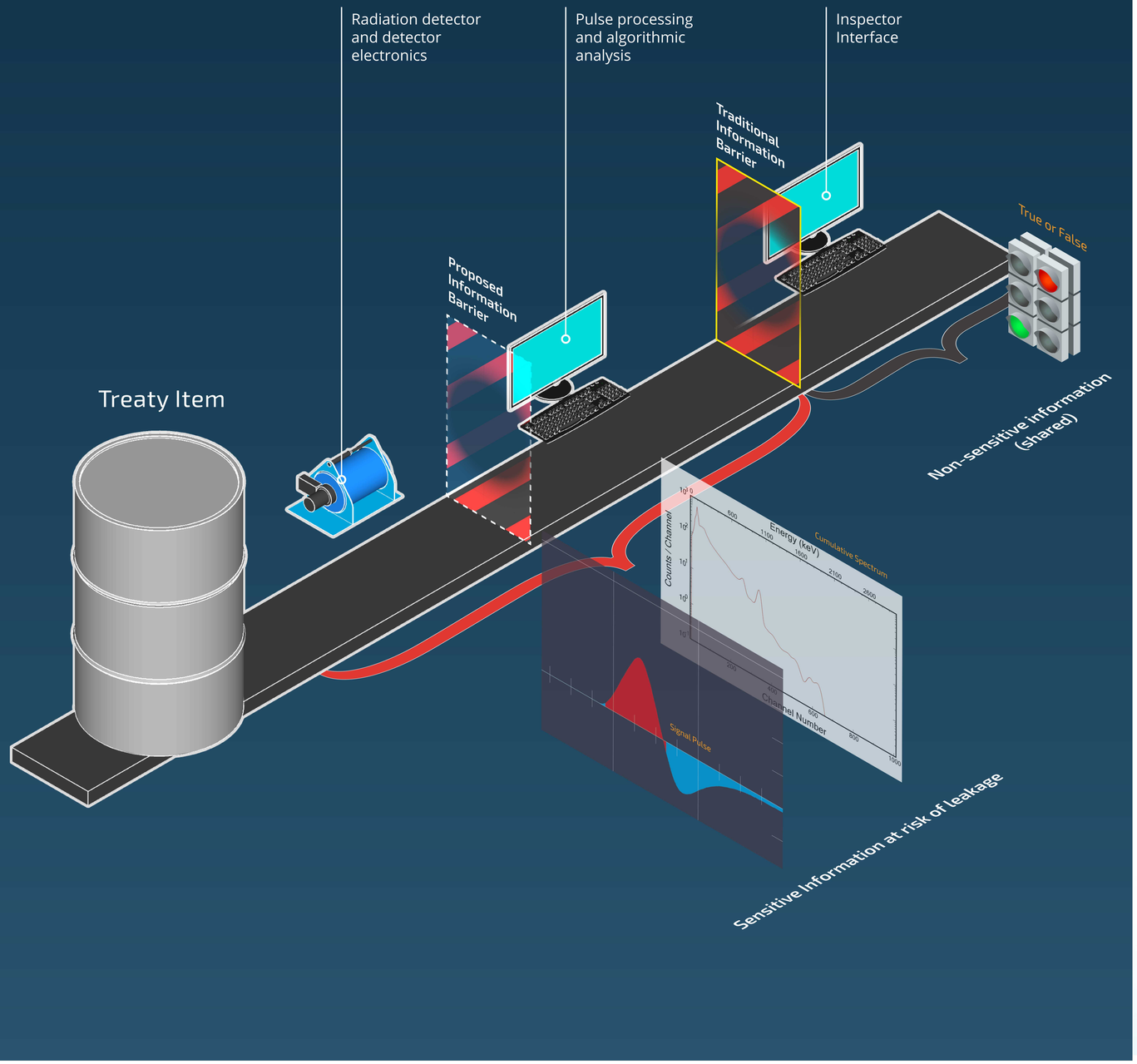
SAND2020-2826C

Demonstrating intrinsically secure warhead verification

behind a flexible information barrier



Disarmament Verification Via Intrinsically Safeguarded Information

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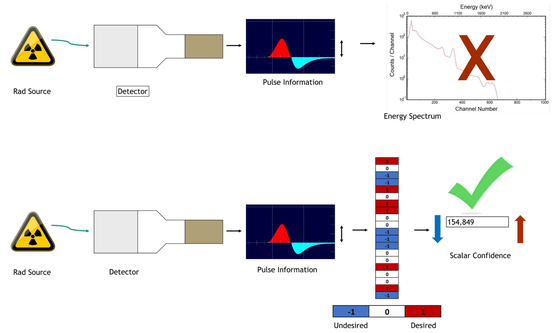
Verifying nuclear disarmament will inevitably involve performing sensitive measurements of warhead components or systems. While many technical solutions exist for measurement and analysis of gamma and neutron emission from nuclear weapon components, the crux of the issue hinges on the difficulty of developing an authenticatable electronic information barrier that prevents sensitive host country information from being inadvertently leaked to an inspecting party.

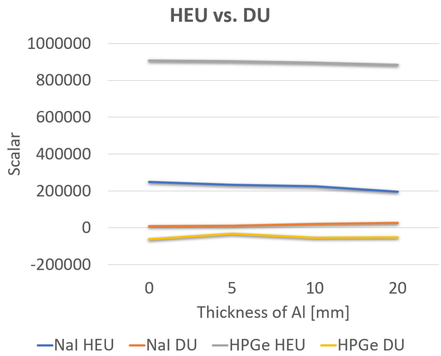


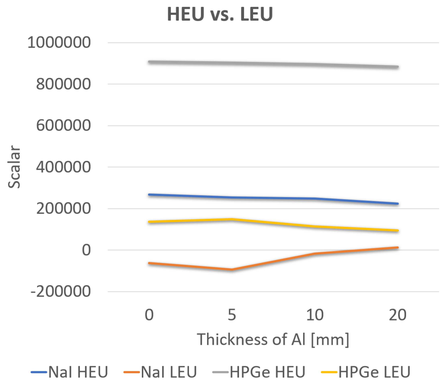
Method

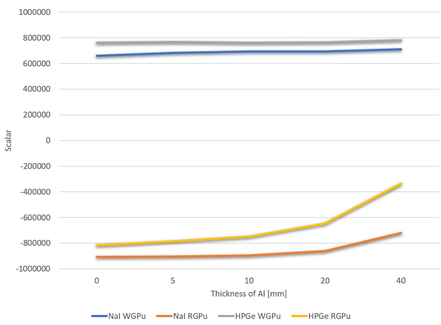
By evaluating each incoming gamma pulse according to energy level for importance to a particular set of isotopes, no spectrum needs to be collected. A weight array consists of 1s (for important energy bins), 0s (for unimportant energy bins), and -1s (for undesired energy bins). As gamma pulses arrive, each is compared against the weighting array and a scalar is built over time which indicates confidence that the object measured includes the set of isotopes defined.

Ba-133 Performance with Increasing Count Rate

	Standard	1XCR	3XCR	5XCR	20XCR	50XCR	100XCR
TP	9%	6%	8%	9%	10%	11%	14%
FP	6%	32%	33%	34%	34%	34%	31%
TN	81%	58%	54%	53%	52%	51%	51%
FN	3%	4%	5%	5%	5%	4%	4%
Accuracy	90%	64%	63%	62%	62%	62%	65%
FPR	7%	36%	38%	39%	39%	40%	38%
TR	73%	63%	64%	66%	68%	73%	80%







Results

- *Upwards of 80% accuracy with Ba-133 and Ra-226.*
- *Clear separation between weapons grade and reactor grade Pu, as well as Highly Enriched U and Depleted U.*
- *Weight array optimization research ongoing to lower false positive rates.*

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