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Information Barrier Technique for Nuclear Material Characterisation

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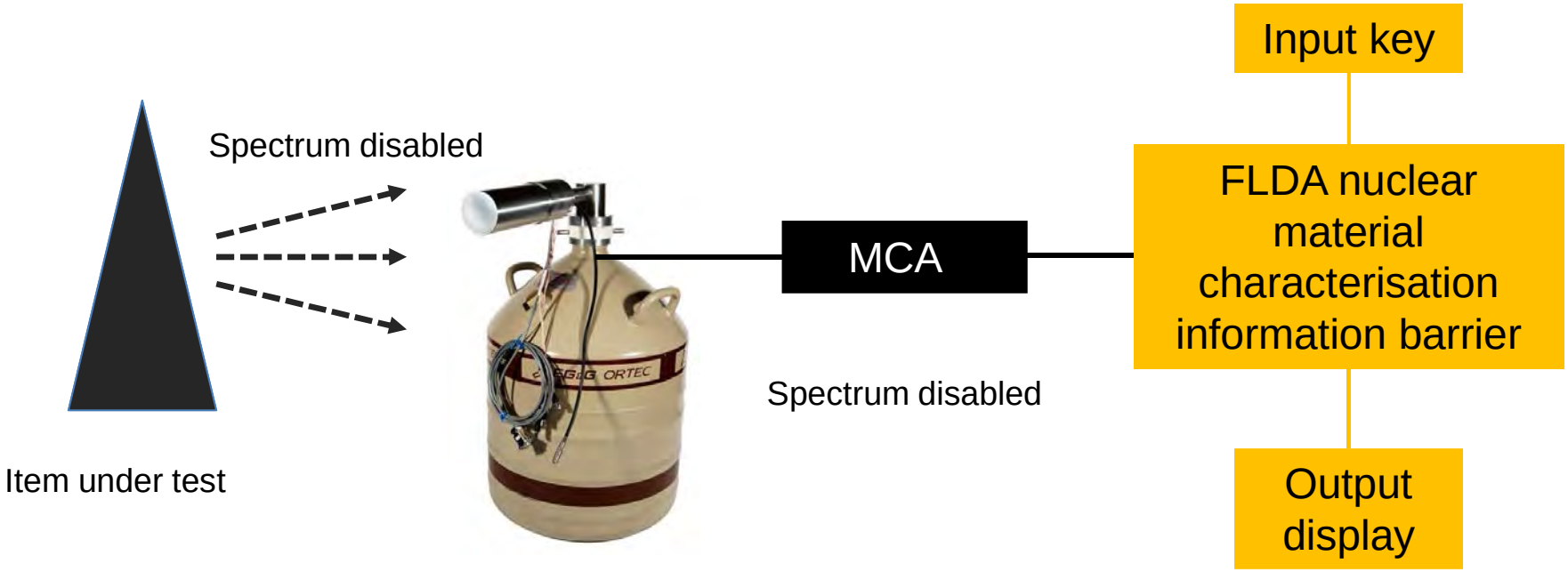
WG3 - International Partnership for Nuclear Disarmament Verification, 18-19 February 2016

Overview

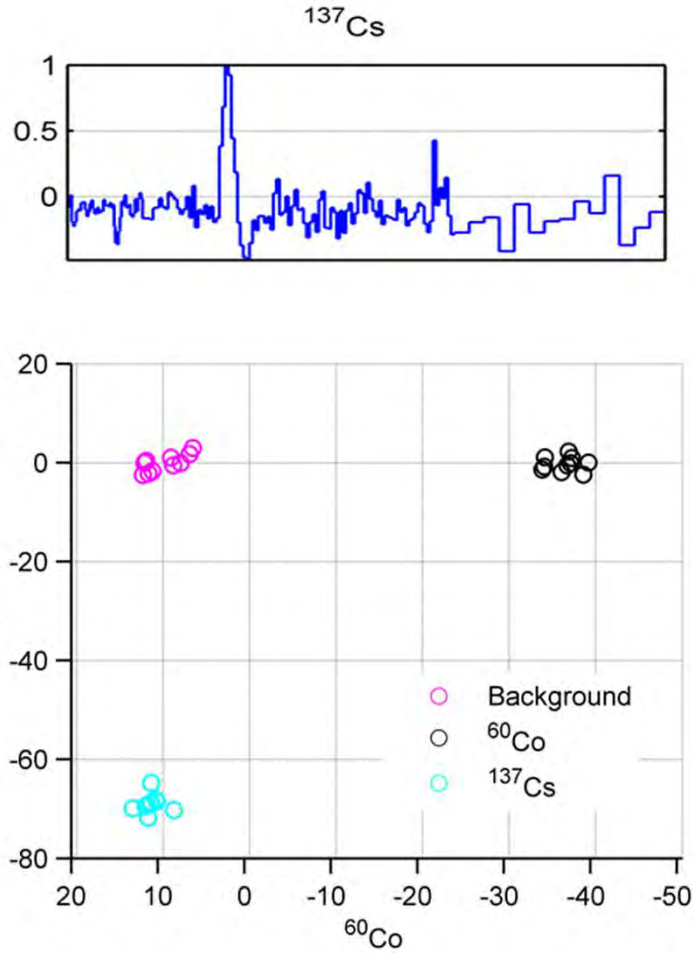
- Name of technology: FLDA nuclear material characterisation Information Barrier
- Potential Monitoring use: Characterisation of fissile material
- Physical Description: Small box (CPU, dedicated algorithms, operator display)
- Time: Typical Radiation Detection Equipment acquisition time
- Complexity: Standard RDE hardware (HPGe); simple interface
- Infrastructure: Power and requirements for HPGe
- Physical Principle: Fisher Linear Discriminant Analysis (FLDA) algorithm
- Limits: Limited only by selected RDE
- Commercial availability: No; prototype status (TLR6)
- Other applications: Border security screening
- Estimated cost: ~$45k per unit (excluding costs of RDE)

FLDA nuclear material characterisation Information Barrier



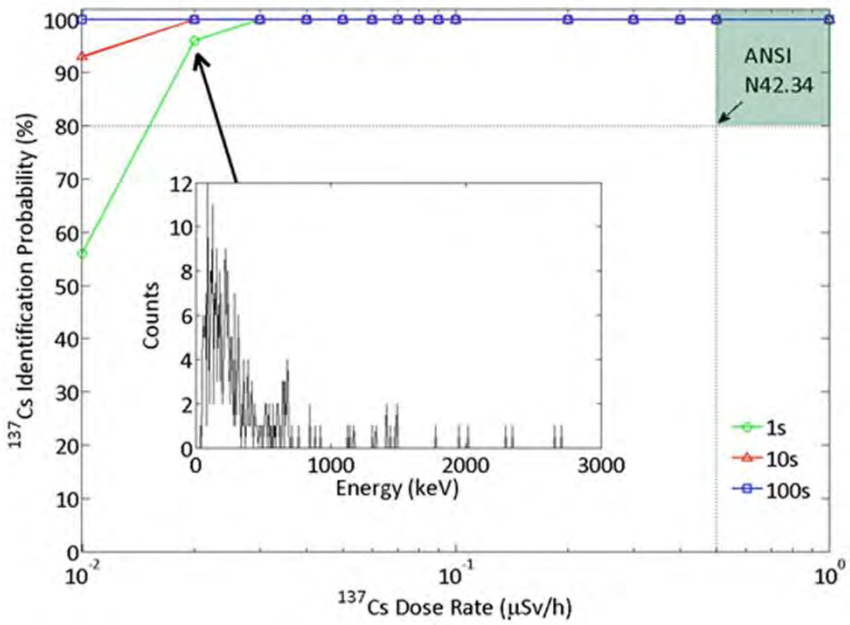
Fisher Linear Discriminant Analysis Algorithm

- FLDA is a multiple two class multivariate classification technique
- The algorithm creates loading coefficients which project data away from all other sources
- Projected data is compared to a standard background sample using the Mahalanobis distance
- Implemented in any spectroscopic gamma detector
- Calculation of loading coefficients requires a library of gamma spectra (input key)



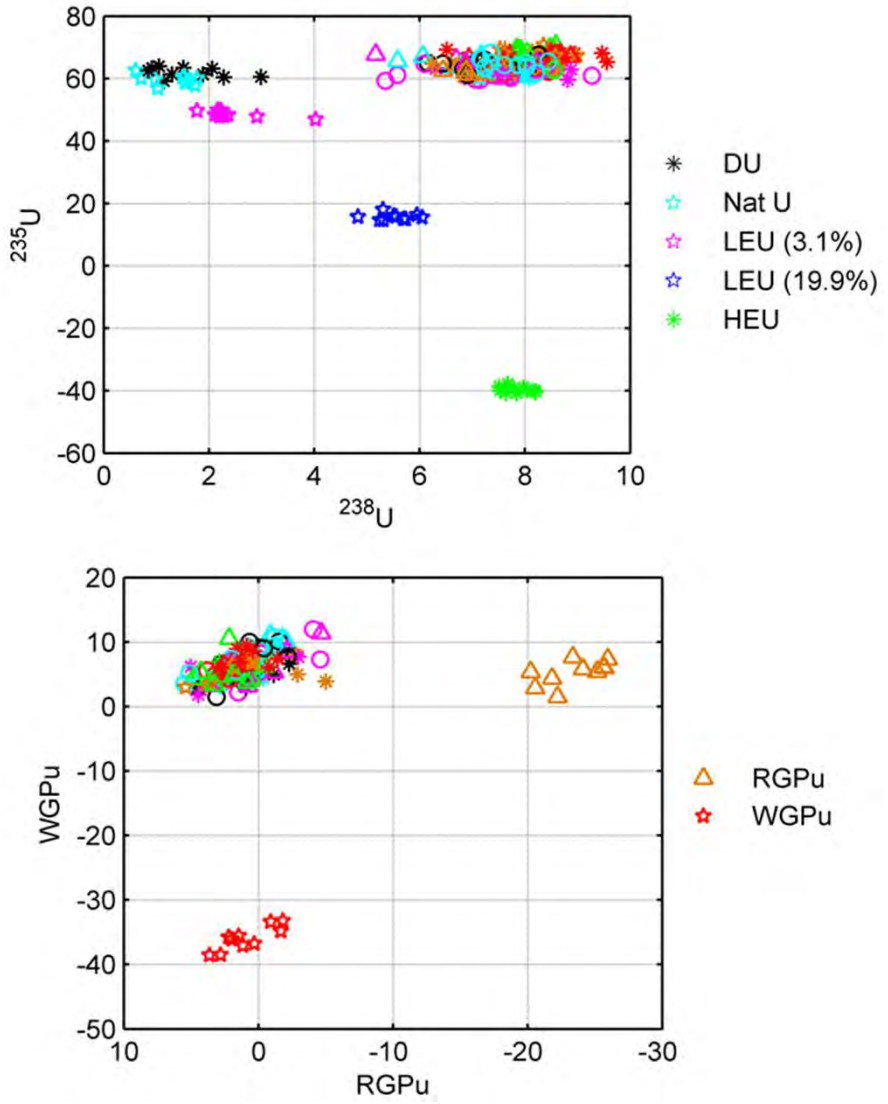
Detection limits

- FLDA has been developed to identify radionuclides in count starved gamma spectra
- Results can be obtained in a little as 1 s although reliable results are obtained in as little as 100 s
- The algorithm has shown to maintain identification performance with the presence of shielding and in masking scenarios

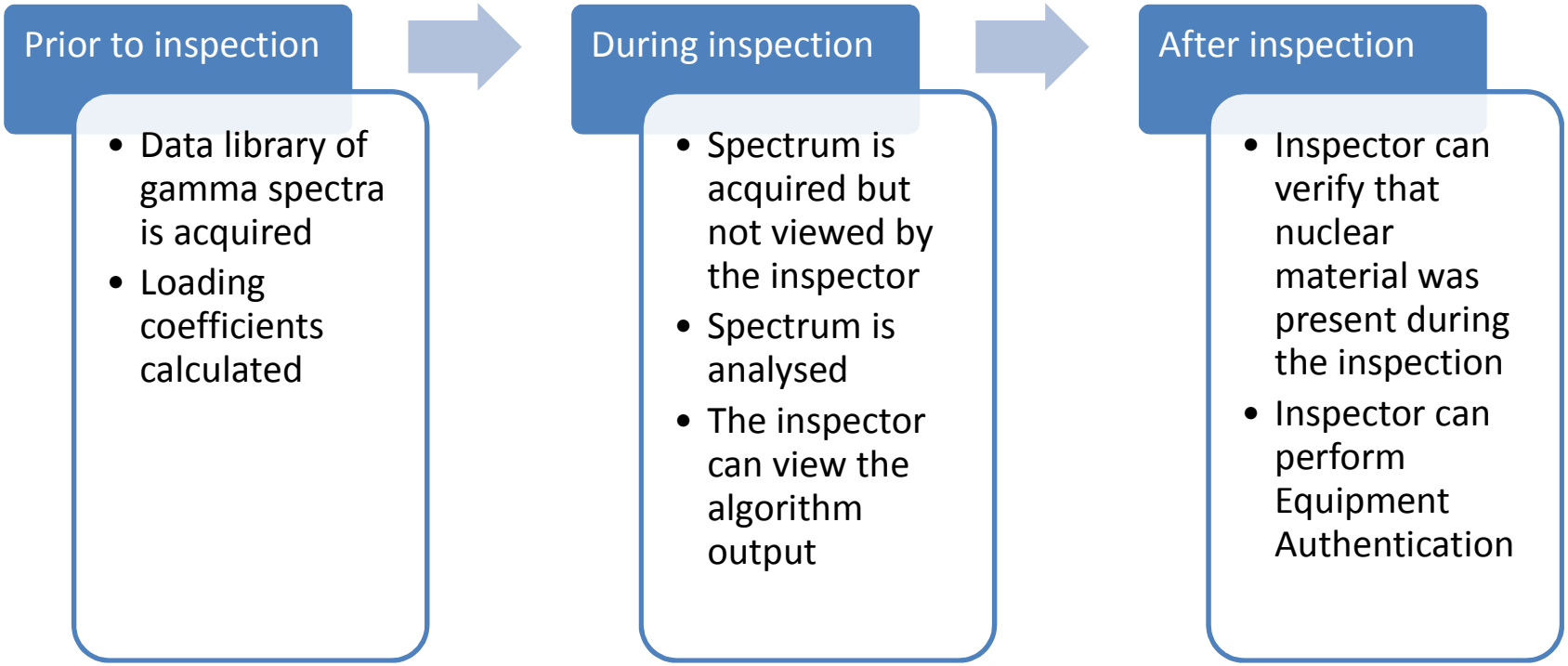


Nuclear material identification

- The algorithm can provide information on the grade of nuclear material
- The specificity of the grade of nuclear material can be agreed up front (i.e. use IAEA definitions)
- The inspector can be confident in the algorithm output without seeing the original gamma-ray spectrum



Implementation as an information barrier



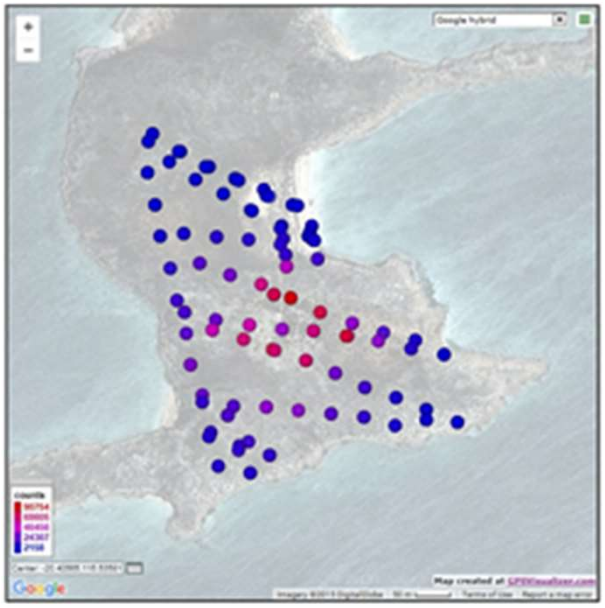
Development status

- The algorithm has currently been demonstrated with HPGe, NaI(Tl) and LaBr detectors
- Two patents have been filed on May 2011 and January 2013
- Three peer reviewed journal papers have been published on this technique
- Technology is currently at TRL6 for nuclear material characterisation

Current implementation

- The algorithm has been implemented in a potable system

- Has been tested at the Montebello islands to map distributions of radionuclides



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