Advanced Detectors for Science and Society

James Cocks, Chief Technology Officer

MIRION

MIRION MISSION

To harness our unrivaled knowledge of ionizing radiation for the greater good of humanity

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With safety at the core of our solutions, Mirion:

- Enables safer production of nuclear power, supporting global energy production and carbon neutrality
- Provides a safer working environment for professionals across science, industry and medicine
- Enhances safety and efficiency in cancer care, from research to production to the patient
- Helps protect our heroes on the front lines

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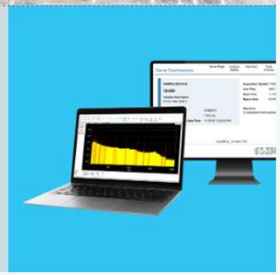
Spectroscopy & Scientific Analysis



Health Physics & Worker Safety

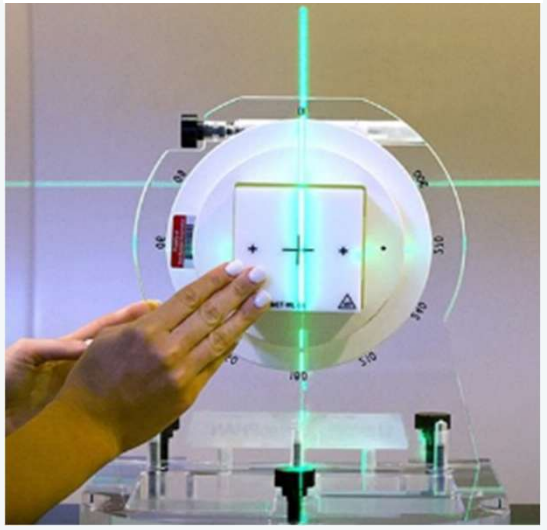
Military & Civil Defense

Reactor Instrumentation & Control

Measurement Systems & Services

Paragon Nuclear Solutions

Radiation Therapy Quality Assurance



Nuclear Medicine

ec2 Software Solutions
PART OF MIRION MEDICAL

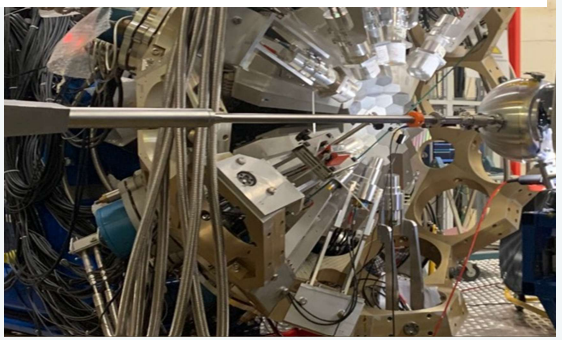
High Purity Germanium applications

Mining

Counter Test Ban Treaty Organisation

Space Missions (Psyche)

Nuclear Physics (AGATA)



Radioisotope Production

Waste Characterisation

Count Room Applications

Nuclear Fuel Applications

Environmental sustainability, nuclear safety, healthcare, clean energy & research

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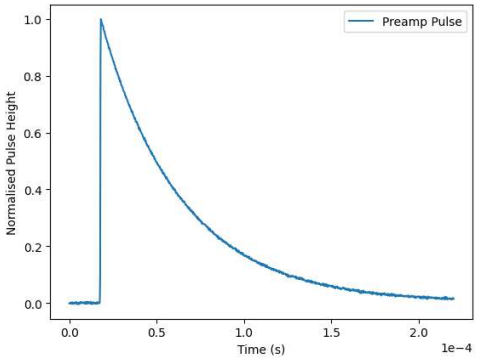
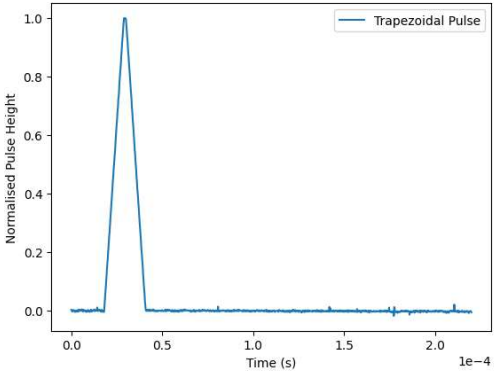
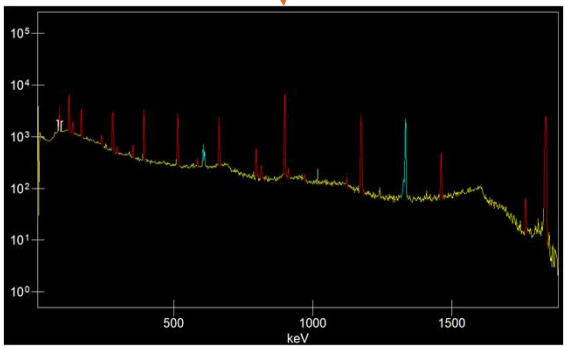
High Purity Germanium signal chain



Preamp Pulses



DSO Pulses



Spectrum

Work involving Liv.Inno PhD to use Convolutional Neural Networks for predictive maintenance and setup automation

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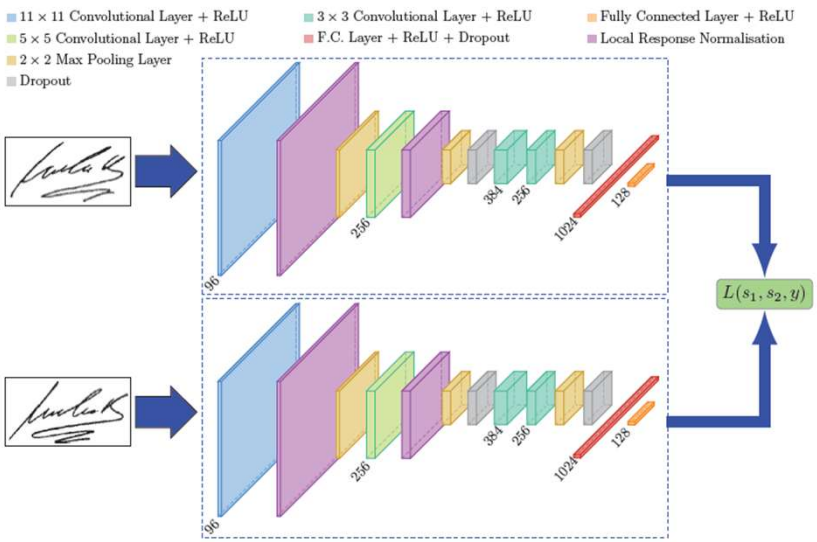
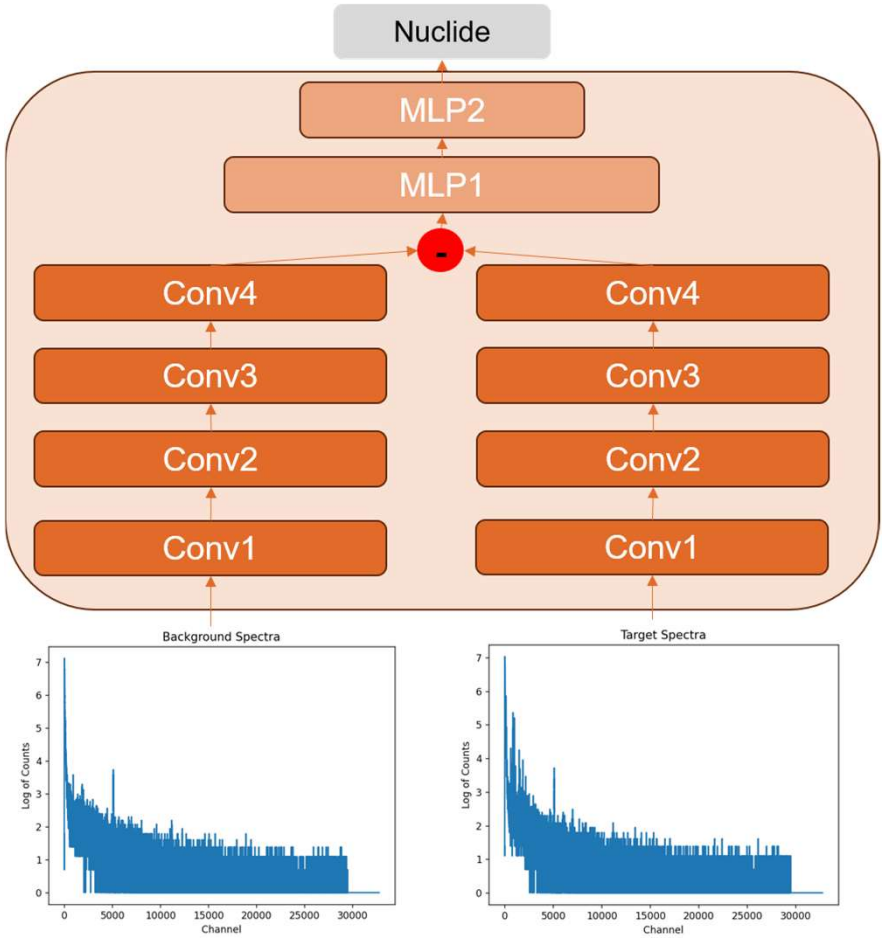
Siamese Neural Networks for Nuclide Identification





- Typically used to compare similarity of two inputs (e.g. signature recognition)
- Can be applied for identification of nuclides:
  - Sensitive measurements (low signal)
  - High, changing backgrounds
- Reduces need for expertise

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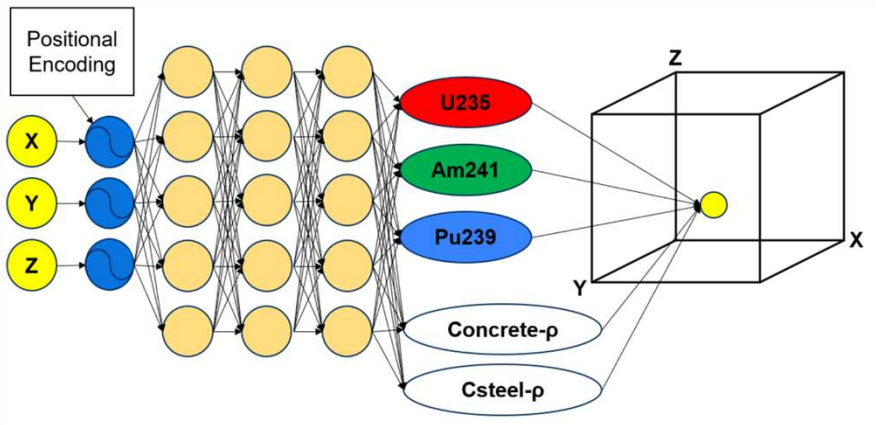
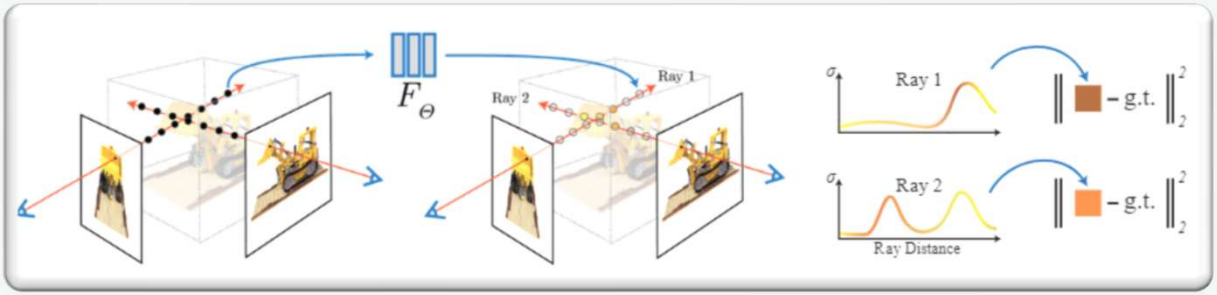
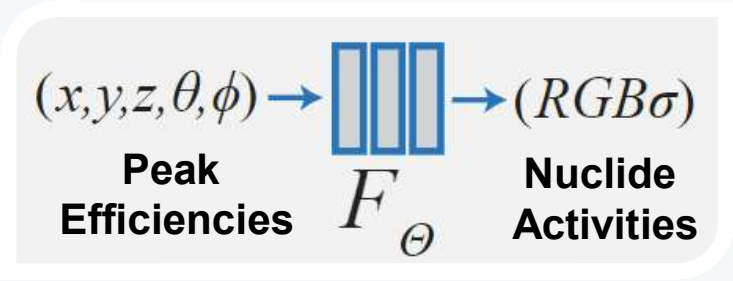
Neural Radiance Fields for Waste Characterisation



Cianci, Cameron, et al. "Using Neural Radiance Fields to Map Fissile Material in Corrugated Metal Pipes" Waste Management Symposia, 9 Mar. 2026, Pheonix, AZ.



Mildenhall, Ben, et al. "Nerf: Representing scenes as neural radiance fields for view synthesis." *Communications of the ACM* 65.1 (2021): 99-106



- Encode a 3D representation inside a neural network
- "Training" the neural network refines the 3D reconstruction

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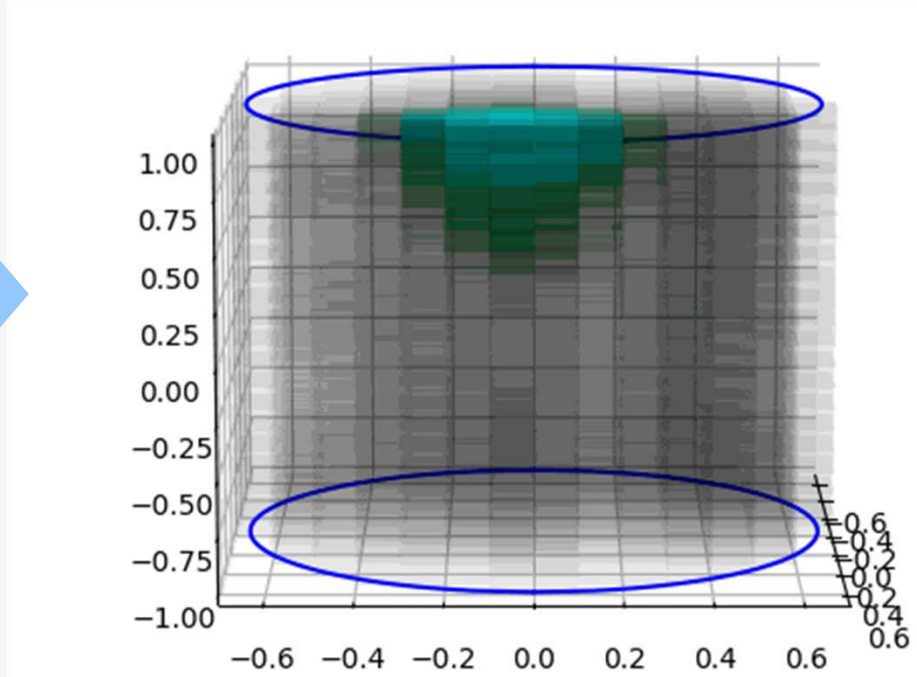
Using Gamma Ray Signals for Waste Localisation

Mildenhall, Ben, et al. "Nerf: Representing scenes as neural radiance fields for view synthesis." *Communications of the ACM* 65.1 (2021): 99-106.



Neural Radiance Fields for Drums (NERD)

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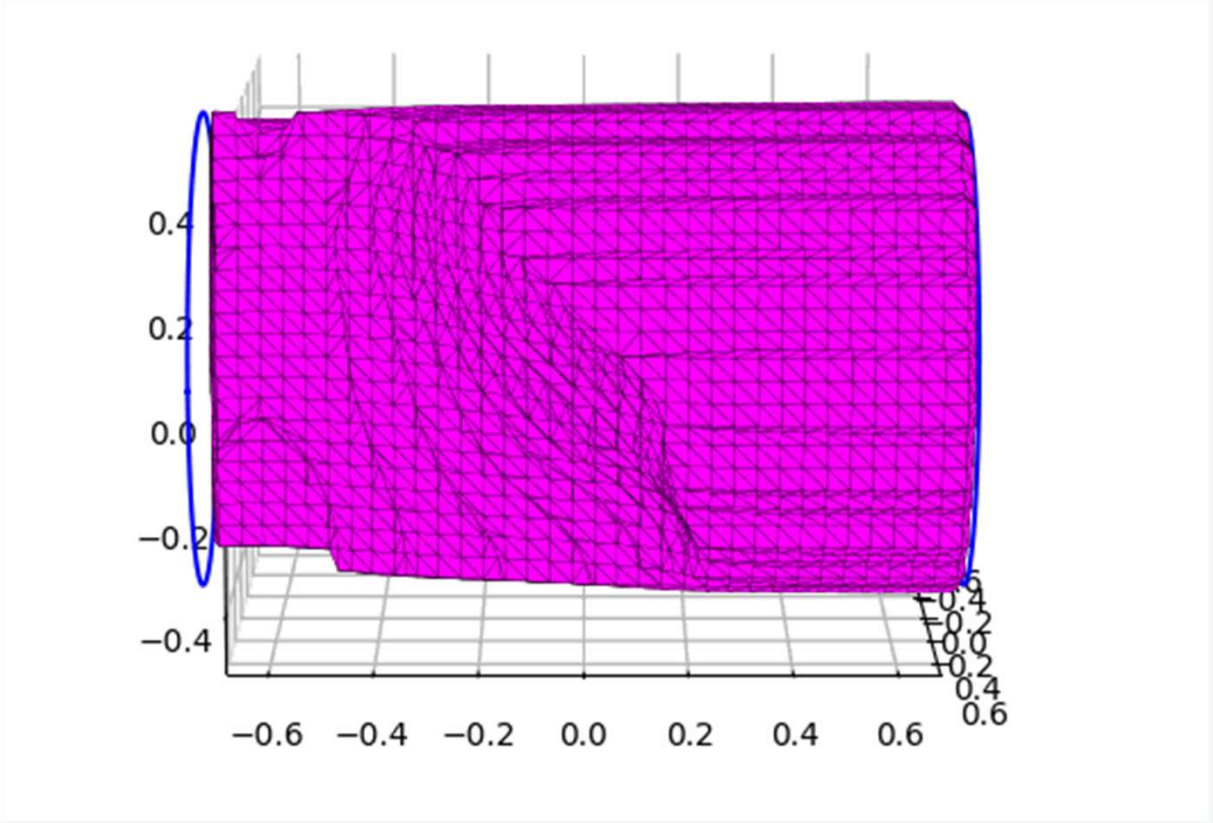
Applied to a problematic waste item

- Applied to a problematic waste item
- Result guides size-reduction to optimise transportation and storage costs
- No feasible alternative methods were available
- NERD allows analysis with limited measurements with cost and ALARP / ALARA advantages



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Summary

- High Purity Germanium Detectors enable a broad range of high-value applications
- Supporting research, clean-energy production, healthcare and nuclear safety
- Systems can be complex, requiring high levels of expertise for correct set up and operation
- Modern techniques can provide advantages in:
  - Predictive maintenance and automated set up
  - Advanced data analysis for improved sensitivity and accuracy
  - Reduction in the amount of time required to acquire data with cost & safety benefits

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