



#### **RADIATION ID INSTRUMENT (RIID) OPERATION AND FIELD DATA REACHBACK TU-N2**



CAL CUPA 2025 Anaheim, CA







#### RADIATION ID INSTRUMENT (RIID) OPERATION AND FIELD DATA REACHBACK

#### • Presenters

- Ron Zeszut- ORTEC Detective-X High resolution nuclide identifier
- Dave Martinez- ORTEC Radeaglet-R- Medium resolution nuclide identifier

#### • Topics

- Detecting Alpha, Beta, Gamma, and Neutron ionizing radiation
- Practical and technical differences of medium resolution (Radeaglet-R) and high resolution (Detective-X) RIIDs
- Field use of RIIDs- Information that RIIDs provide a user.
  - Personal safety information, dose rate, alarms, etc.
  - Search, detect, and ID process
- Why collecting spectral data for 5 minutes for submission to radiological reachback is important.
  - Background
  - Known
  - Unknown
- Hands on with Detective-X and Radeaglet-R- Getting results; reviewing and downloading data for reachback.

**Refresher**- Ionizing Radiation

- Radiation is statistical (random) in nature and emitted when an unstable nucleus spontaneously decays into another. There are four types of (ionizing) radiation:
  - Alpha particles: positively charged heavy particles made up of two protons and two neutrons from an atom's nucleus;
  - Beta particles: negatively charged, small, fast particles similar to electrons but originating from an atom's nucleus;
  - **Gamma-rays**: high-energy waves, similar to visible light, emitted from an atom's nucleus;
  - Neutrons: chargeless particles emitted from an atom's nucleus.





#### ORTEC<sup>®</sup> AMETEK<sup>®</sup> Refresher-Radiation Intensity-The Inverse Square Law 1 square = How far away can a RIID detect the area radiation? covered by Inverse Square Law- Detected intensity decreases with the square of the detector the distance from a gamma source. Factors that impact nuclide detection and ID • Intensity Time on target $\gamma$ -ray Distance distance = rdistance = 2r Shielding field area = A Gamma-ray energies area = 4Ae.g. 4 mR/hr e.g. 1 mR/hr, or ¼ the rate

ORTEC<sup>®</sup>/ AMETEK<sup>®</sup>

### What is a Radiation ID Device (RIID)?

The RIID is radiation detection instrument that identifies radionuclides by measuring the unique **gamma** energies that radionuclides emit. A graph of these unique energies depicts a spectrum.

- RIIDs may also detect/ count neutrons, but neutrons alone cannot identify specific radionuclides.
- Neutron detection and gamma spectra are used together to assess the presence of *Special Nuclear Materials*; these spontaneously emit neutron and gamma energies.







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Main Technical Differences Between Medium and High Resolution RIIDs

	High Resolution	Medium Resolution
Detector Types	Gamma- HPGe- Cryogenic Temp Neutron-Li-6F Instrument Weight: 15 pounds	Gamma-Nal or LaBr- Room Temp Neutron- He-3 Instrument Weight: 5 pounds
Gamma Resolution	Cs-137 @ 662keV approximately 1.5 keV	Cs-137 @ 662keV approximately 60 keV
Applications	Nuclear search, HAZMAT, health physics, and radiological adjudication	Nuclear search, HAZMAT, and health physics
Time to detect most nuclides	2-15 seconds; lowest false ID rate of all RIID types	30 seconds to 2 minutes
Size of nuclide library and notices	186 distinct results which include: nuclides, neutron counts, suspect gamma rays, neutron interactions on materials and shielded and unshielded nuclides. Classifications: SNM, NORM, Medical, Industrial, Other	61 distinct results which includes nuclides and neutrons. Classifications: SNM, NORM, Medical, Industrial, Other









Collecting data for Reachback

- Typical reachback data requested from RIIDs are a 5-minute-long spectrum each of local background, a known source, and the unknown source also called the Item of Primary Concern (IPC).
  - **Background** Allows the reachback scientist to strip background from the known and unknown spectral data, giving improved signal to noise for nuclide ID. Also used to validate instrument energy calibration.
  - **Known-** Allows the scientist to perform an energy recalibration if the reachback spectrum has suffered a peak shift for any reason. Improves nuclide ID.
  - Unknown/ IPC- Especially for low intensity or shielded sources, or sources that emit low energy gamma rays, gives better signal to noise. Improves nuclide ID

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Important information to know about data collected for Reachback

2025-03-17T14-23-51 1 unknown.n42 3/17/2025 3:03 PM 9 KB N42 Data N42 Spectral Data Spectral file format- Readable by a text editor; standard, defined, and independent of RIID manufacturer <?xml version="1.0" ?> <RadInstrumentData n42DocDateTime="2025-03-17T21:23:51Z" n42DocUUID="1f7a1770-0376-11f0-8717-38d26939df75" xmlns="http://physics.nist.gov/N42/2011/N42" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance</pre> xsi:schemalocation="http://physics.nist.gov/N42/2011/N42 http://physics.nist.gov/N42/2011/n42.xsd"> <RadInstrumentDataCreatorName>RADEAGLET</RadInstrumentDataCreatorName> <RadInstrumentInformation id="device"> <RadInstrumentManufacturerName>innoRIID GmbH</RadInstrumentManufacturerName> <RadInstrumentIdentifier>18310</RadInstrumentIdentifier> <RadInstrumentModelName>RADEAGLET</RadInstrumentModelName> <RadMeasurement id="Measurement-1"> <MeasurementClassCode>Foreground</MeasurementClassCode> <StartDateTime>2025-03-17T14:23:09-07:00</StartDateTime> «RealTimeDuration>PT40.05</RealTimeDuration> <Spectrum energyCalibrationReference="ENCAL" id="Spectrum-1" radDetectorInformationReference="primary"> <LiveTimeDuration>PT39.05</LiveTimeDuration> <channelData compressionCode="None">0 1 1 3 4 1 2 2 3 4 1 10 15 18 34 47 53 96 122 165 179 228 204 246 213 180 173 159 152 115 108 87 92 66 65 55 28 75 478 59 73 61 66 85 68 94 71 67 98 91 99 9 71 91 71 83 86 80 84 67 67 95 100 94 87 89 92 93 86 89 85 91 81 94 94 92 93 86 92 108 104 87 79 99 74 97 92 85 89 75 82 96 98 71 80 87 90 77 85 90 102 85 102 109 89 74 102 94 83 99 104 103 106 137 115 113 102 108 107 112 96 108 95 91 90 85 70 81 82 85 91 74 87 83 74 70 62 101 79 70 80 73 76 85 66 67 61 61 63 60 71 76 77 62 80 66 69 62 66 43 60 70 46 61 50 56 52 46 66 56 50 57 55 52 53 51 52 48 47 46 55 63 48 41 45 48 57 60 48 43 51 53 41 46 49 40 41 35 48 49 40 51 43 56 53 43 52 47 41 44 40 33 55 40 43 40 47 54 34 48 40 34 37 49 32 52 45 44 49 33 51 53 45 43 60 31 44 42 35 39 36 58 53 42 48 38 47 51 46 64 43 51 39 42 40 44 31 49 32 40 44 45 45 32 31 30 36 24 31 26 21 29 22 34 25 30 32 21 27 30 17 20 20 24 21 20 18 21 15 14 14 20 12 16 10 13 12 14 25 10 16 14 7 13 12 9 17 13 7 13 12 11 16 10 4 12 8 10 16 11 11 2 11 7 8 9 5 7 10 2 9 10 5 13 14 4 3 7 7 6 7 8 10 7 13 10 11 11 12 20 16 16 21 24 16 30 24 32 32 32 41 42 51 61 59 69 82 75 78 93 99 100 104 123 142 115 139 135 143 184 162 143 142 138 167 173 180 170 \*\*\*\*\*\* \*\*\*\*\*\* </Spectrum> <DoseRate id="min" radDetectorInformationReference="primary": <DoseRateValue>0.02</DoseRateValue> </DoseRate> <DoseRate id="max" radDetectorInformationReference="primary"> <DoseRateValue>1.06072</DoseRateValue>





The new, <u>CBRNResponder</u> <u>Mobile Application</u> uploads data in real-time, saves data locally when no data connection is detected











Live Demo of Doserate, Background, ID, Report, and data to be sent to Reachback.

- RADEAGLET-R LIVE DEMO using Remote Screen
- Extracting data from the Radeaglet-R and visualization using Spectrum Browser and reporting
- Sending spectral data to Reachback and importing spectrum into Peak Easy







Live Demo of Detect Mode, Identify, ID, Spectrum, and data to be sent to Reachback.

- Apps...Detective-X, Sleuth, RAPID
- Detective-X LIVE DEMO using WiseMo Remote Screen
- Extracting data from the Detective-X and visualization
- Sending spectral data to Reachback and importing spectrum into Peak Easy

# MAIN PURPOSE OF THE INSTRUMENT



- Assist HAZMAT Specialists, law enforcement, first responders, and Military, intelligence organizations to locate and accurately identify Gamma Emitting radioactive sources
- Warn the user in high dose environments
- Detects neutrons (optional)
- Simple and easy data transfer to Reachback including all spectra associated with the measurement



# HANDS ON USE OF RIID

- Search, identify nuclides
- Review spectrum
- Extract data