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Sentry: A proposed software platform for analysis of radionuclide data sets

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Advance Radioxenon Analysis Needs

- To better discriminate underground nuclear explosions from routine nuclear power and medical isotope processes the IDC and the International Noble Gas Experiment (INGE) working group have identified several advanced radioxenon data analysis needs
- For beta-gamma analysis
  - Improvements to the Stockholm equations
  - Alternative spectral fitting techniques
  - Development of standard spectra methods
  - Incorporation of silicon detectors
  - Use of preliminary files for routine automatic analysis
  - Silicon detector beta-gamma analysis
  - Memory free cells
- For HPGe
  - More robust radioxenon metastable analysis
  - Use of other spectral data to track and update efficiency, resolution, and energy
- Radioxenon data sets independent of detector type
  - Uncertainty budget determination
  - Long term tracking of critical parameters and uncertainties
  - Better use of the QA/QC data sets

Sentry: Goals

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- **Goal:** Sentry is envisioned as a radioxenon data analysis software platform that can incorporate new data analysis methods
  - Specifically, Sentry will provide radioxenon data analysis tools that
  - Incorporate the expertise developed over the past 20 years by experts: IDC, NDC, International Noble Gas Experiment (INGE), RN working group, other
  - Be flexible to future IDC and NDC needs
  - Provide a common programming platform for developers
  - Maintain a consistent data analysis experience for IDC and NDC analysts

Sentry Platform Description

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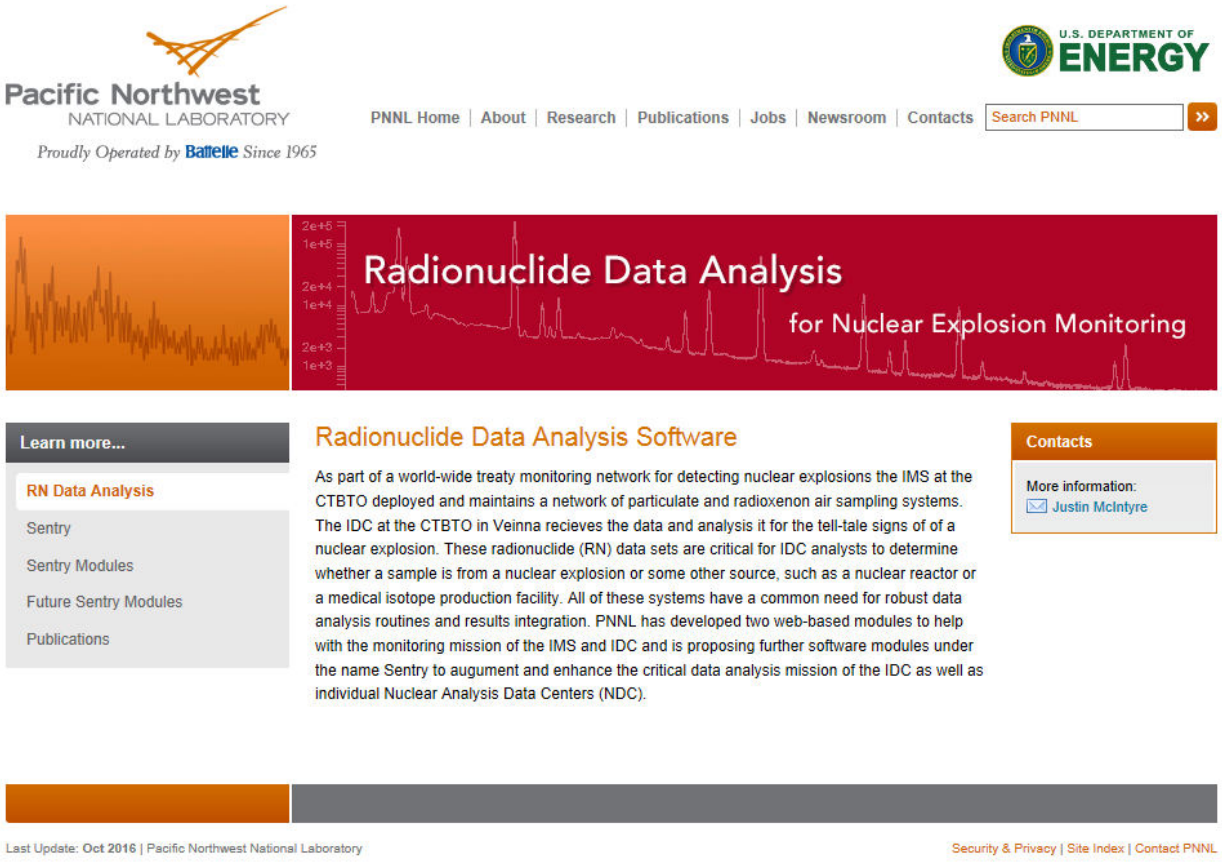
Description: The Sentry platform will:

- Utilize data analysis using a number of different computing languages and already existing analysis packages
- Provide a common software development toolset for development of new analysis modules
- Utilize the Red-Hat 6.0 operating system for compatibly with the IDC and NDC-in-a-Box
- Be a web-based software platform, which has the advantage of:
  - Being installed in one place, but used by many across a network
  - Only needing to upgrade the code on a single server
  - Data being managed by the server, users don't need database credentials
  - Taking advantage of performance optimizations of web browser, such as plotting charts and maps, etc.

Website



- Website for distribution of Sentry general purpose tools
  - http://rn-data-analysisdev.pnl.gov/

Example #1: web-based BGSim module

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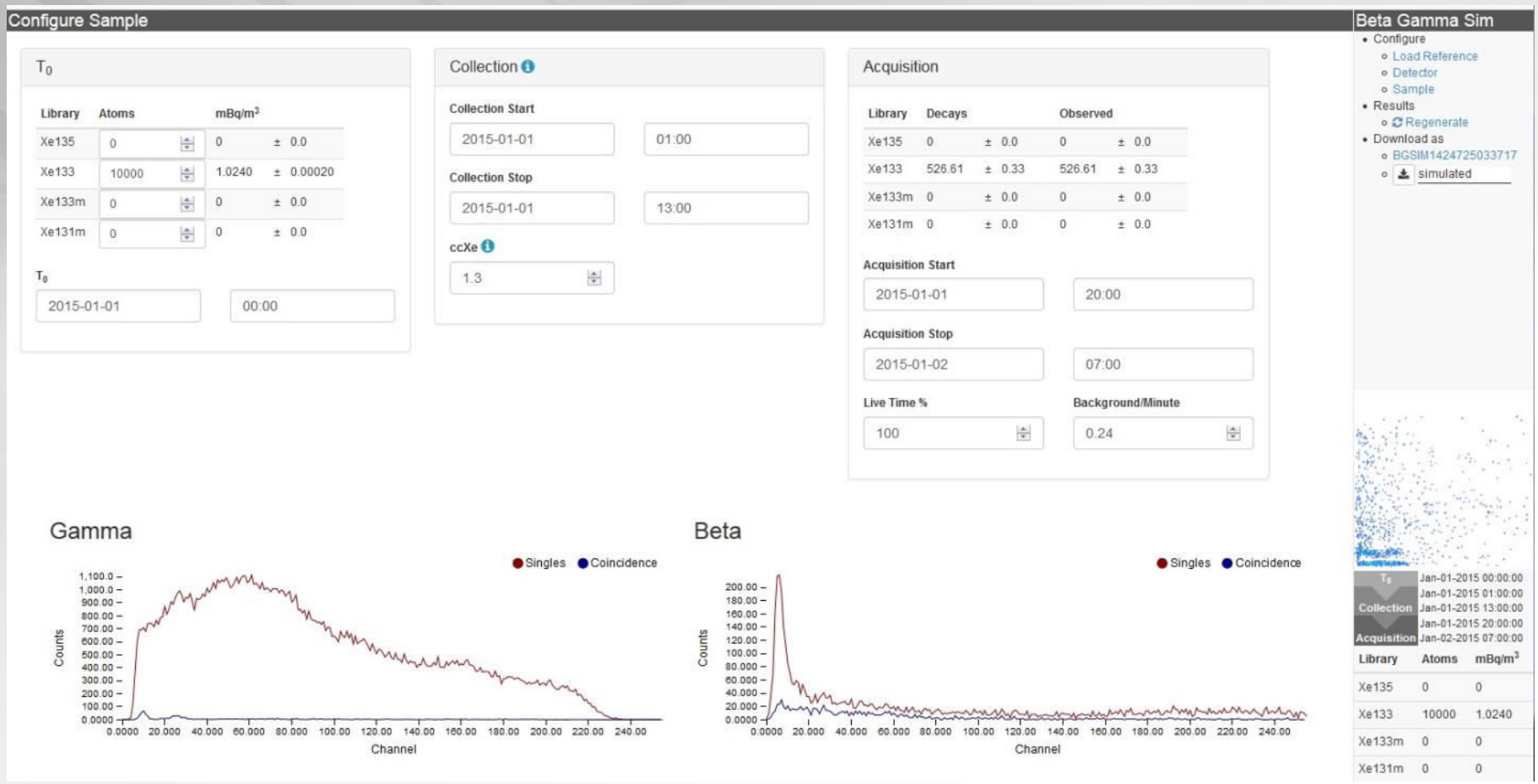

- BGSim: produce realistic beta-gamma files for testing and training purposes
  - Available on website

Example #2: web-based BGView module

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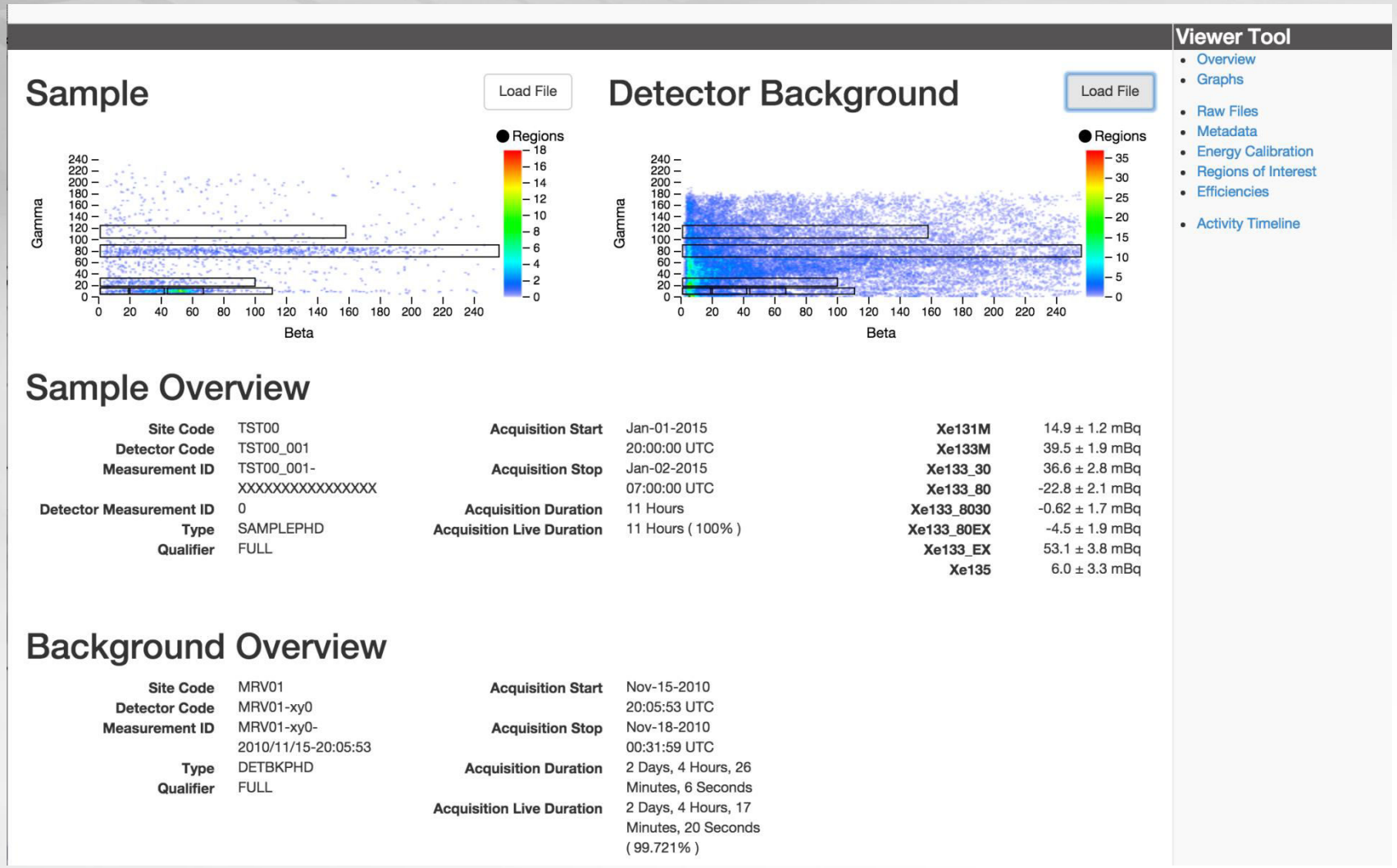

- BGView: display beta-gamma files
  - Available on website

Potential Future Modules

- State-of-health viewer recently provided to the IMS to monitor radioxenon system performance
- Advanced spectroscopy analysis of Beta-Gamma and Gamma spectroscopy
- Analysis techniques to quantify non-standard radioxenon isotopes
- Time series analysis of the preliminary data sets for better sensitivity
- Different analysis methods for new radiation detector types
- Trend analysis of existing or new state-of-health parameters or combinations of these same parameters such as:
  - Beta-Gamma, Beta and Gamma backgrounds rates
  - Ratios of isotopes measured by particulate stations
- Webgrape improvements
  - Advanced atmospheric plume model display
  - Analysis modules that include dilution and washout effects for multiple station locations

Summary

- Sentry is envisioned as a radioxenon data analysis platform that seeks to provide:
  - IDC and National Data Centers with updated radioxenon data analysis, advanced tools, and enhance the workflow of RN data analysts
  - Incorporation of best practices learned from over 20 years of IMS operations
  - Expert community-driven development and vetting of new analysis methods

- Seeking coauthors for a technical review paper to cover improvements for analysis of radioxenon datasets
  - Contact justin.mcintyre@pnnl.gov