SnT 2025
8 SEPTEMBER ONLINE DAY
9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

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Xenon International's Quality Control Source for Gain Performance Monitoring

M. Mayer, M. Cooper, B. Abromeit, J. Hayes, M. Panisko

Pacific Northwest National Laboratory (PNNL)

CTBTO PREPARATORY COMMISSION

INTRODUCTION AND MAIN RESULTS

PNNL has recently tested a new quality control (QC) source for the nuclear detectors in Xenon International which uses an acrylic housing for a ^{137}Cs source. The original source holder used in acceptance testing was ^{137}Cs housed in a stainless-steel pellet. The high Z of the stainless steel attenuated low energy X-rays. The new QC source allows for the lower energy (~30 keV) emissions from ^{137}Cs to be observed on the NaI detector. This work focuses on the rotated frame of reference method to monitor the beta detector gain. Over several months, targeted testing was conducted to assess metrics (count rate, dead time, resolutions) derived from the QC measurements. This works describes the testing, measurements, and algorithms used for gain and performance monitoring with a QC source.

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Introduction

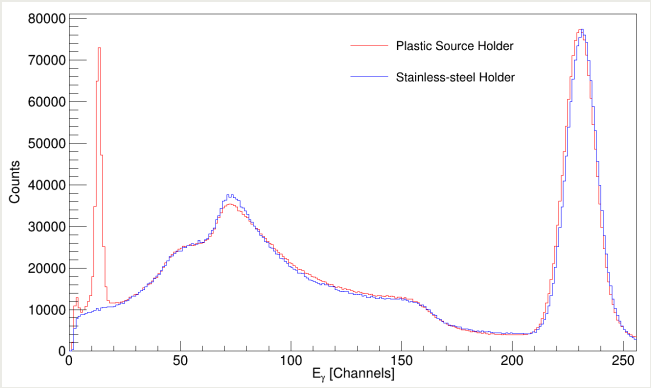
An outcome from the acceptance testing of the Xenon International system specified that the quality control measurement needed to have a peak(s) at lower energy (~30 keV) in the gamma spectrum and higher statistics during coincidence measurements. This peak was necessary to allow the software used by the International Data Center to properly analyze the data. Inclusion of this additional peak required a change in the current quality control (QC) source and the modification of the algorithm used by Xenon International.

The original QC source used by Xenon International is a stainless steel encased ^{137}Cs pellet. The stainless steel is a high-Z element which attenuates any X-rays emitted from the original QC source. The Pacific Northwest National Laboratory (PNNL) worked with the manufacturer Eckert & Ziegler on developing a suitable low Z housing (acrylic) with a similar form factor as the original QC source.

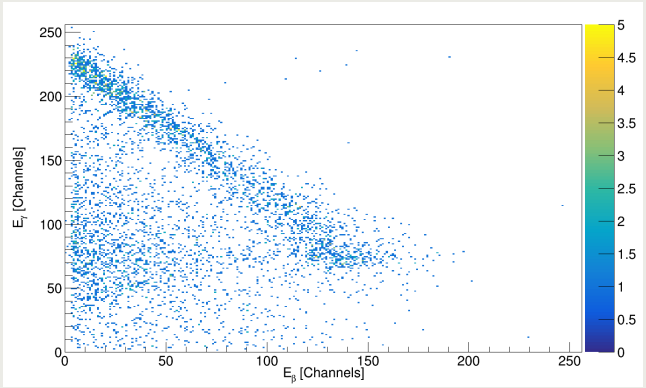
Acrylic QC source used for the testing

Setup and Spectra

- RL16 PRIME system was used for testing QC sources, employing similar detectors and shielding as Xenon International.
- New acrylic source designs were tested alongside stainless steel sources.



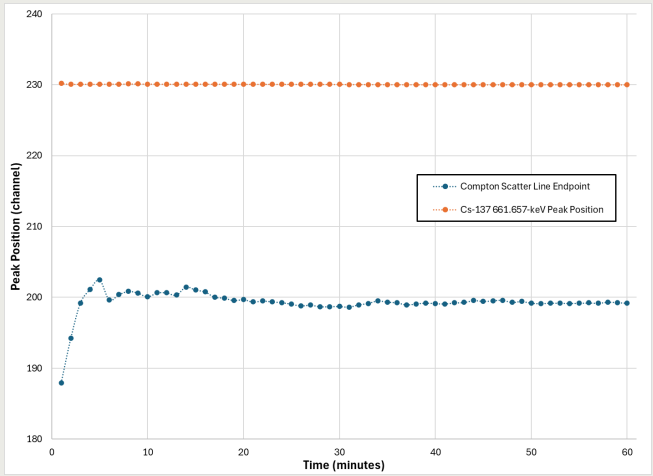
Gamma spectrum from both QC sources



Beta-gamma coincidence spectrum from plastic QC source

Performance

Functionality of autogain algorithm works as expected with acrylic QC



Conclusions

PNNL's redesigned acrylic QC source holder functions sufficiently as a replacement for the stainless steel QC source. It has delivered consistent and reliable results over several months. However, further testing is essential to assess the robustness and longevity of acrylic materials under prolonged operational conditions and varied environments.

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