

# Improving the limits of detection of low background alpha emission measurements

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## Content

Alpha particle emission – even at extremely low levels – is a significant issue in the search for rare events (e.g., double beta decay, dark matter detection). Traditional measurement techniques require long counting times to measure low sample rates in the presence of much larger instrumental backgrounds. To address this, a commercially available instrument developed by XIA uses pulse shape analysis to discriminate alpha emissions produced by the sample from those produced by other surfaces of the instrument itself. Experience with this system has uncovered two residual sources of background: cosmogenics and radon emanation from internal components. An R&D program is underway to enhance the system and extend the pulse shape analysis technique further, so that these residual sources can be identified and rejected as well.

In this paper, we review the theory of operation and pulse shape analysis techniques used in XIA's alpha counter, and briefly explore data suggesting the origin of the residual background terms. We will then present our approach to enhance the systems ability to identify and reject these terms. Finally, we will describe a prototype system that incorporates our concepts and demonstrates their feasibility.

## Summary

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