Lightweight Directional Gamma and X-Ray Detection System

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ABSTRACT

Researchers at the University of California, Davis have developed a compact system for directional detection of gamma rays and X-rays without relying on heavy mechanical collimators. The approach improves the ability to localize radiation sources while reducing size, weight, and operational complexity compared to conventional solutions. The technology supports faster, more flexible use in clinical and industrial environments where directional radiation information is valuable.

FULL DESCRIPTION

Accurate directional detection of gamma rays and X-rays is traditionally achieved using dense, rigid collimators that selectively block radiation from unwanted directions. While effective, these components add significant weight, limit portability, and reduce detection efficiency, particularly at higher radiation energies. These limitations restrict usability in settings that require handheld operation, rapid repositioning, or access to confined spaces. There is a clear need for lighter, more adaptable solutions that preserve directional selectivity. Addressing this gap can expand where and how radiation detection tools are deployed.

The disclosed system addresses these challenges by combining a compact detector arrangement with signal-based event selection to preferentially accept radiation arriving from a desired direction. Instead of reconstructing images or relying on massive shielding, the system achieves improved directional sensitivity through coordinated detector responses managed by a control unit. This design represents an advance in electronic and geometric collimation techniques while remaining simple to integrate into existing instruments. It can be incorporated into portable probes, surgical tools, or field-deployable monitoring devices. The result is improved usability, reduced weight, and enhanced performance for applications where speed, precision, and operator comfort are critical.

APPLICATIONS

- Handheld probes for intraoperative tumor localization.
- Portable nuclear medicine detection instruments.
- Radiation monitoring tools for nuclear facility maintenance.
- Field-deployable radiation survey instruments.
- Compact sensing modules for medical imaging systems.

FEATURES/BENEFITS

- Compact detector configuration — enables lightweight and portable system designs.
- Directional radiation selectivity — improves localization accuracy of radiation sources.
- Reduced reliance on heavy shielding — lowers device weight and operator fatigue.
- Fast event selection — supports real-time use in clinical and field settings.
- Compatibility with existing detection platforms — simplifies integration and adoption.

INVENTORS

- Mehadji, Brahim

OTHER INFORMATION

KEYWORDS

directional radiation sensing, electronic collimation, gamma ray detection, portable radiation detector, radiation monitoring systems, surgical imaging tools, X-ray detection, nuclear medicine instrumentation

CATEGORIZED AS

- **Environment**
  - Sensing
- **Engineering**
  - Engineering
  - Other
- **Imaging**
  - Medical
  - Other
- **Medical**
  - Devices
  - Diagnostics
  - Disease: Autoimmune and Inflammation
  - Disease: Cancer
  - Imaging
  - Research Tools
- **Security and Defense**

- Other
- Screening/Imaging
- **Sensors & Instrumentation**
  - Analytical
  - Medical
  - Other
  - Physical Measurement
- Scientific/Research

RELATED CASES

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ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

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