

# Overview of Cold Microelectronics

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## **Abstract**

It is widely recognized that advancements in radiation detectors are tightly coupled to advancements in microelectronics, and specifically in front-end application-specific integrated circuits, also known as front-end ASICs.

Detectors based on noble liquids can greatly benefit from microelectronics, especially if the ASICs are designed to operate reliably while submerged in the liquid media at cryogenic temperatures. The advantages of cold ASICs range from higher resolution due to the reduced interconnect length to the sensing electrodes, to a high degree of signal multiplexing with consequent dramatic reduction in the number of feed-through. In some cases, as for highly segmented and/or very large detectors, cold front-end ASICs have to be regarded as an enabling technology.

This presentation will cover the most relevant characteristics and challenges associated with cold ASIC design, especially when compared to those for warm operation. A critical aspect is the trade-off between the required resources and the risks associated with cold designs, and the consequent impact on both the experiment and the microelectronics programs. Examples of recent developments will be given, followed by Brookhaven's research and development plans for the upcoming years.

Duration: 20 minutes