

Advanced Pixel-Cell Detector



Daniel M. Kopp

Advanced Pixel-Cell Detector

- ORDELA has been developing and manufacturing a line of position-sensitive proportional counter systems for the detection neutrons, charged particles and other scientific and environmental radiation monitoring system for over 25 years.
- One-Dimensional Neutron Counter
- Two-Dimensional Neutron Counter
- Low-Background, Windowless Large-Area Proportional Counter

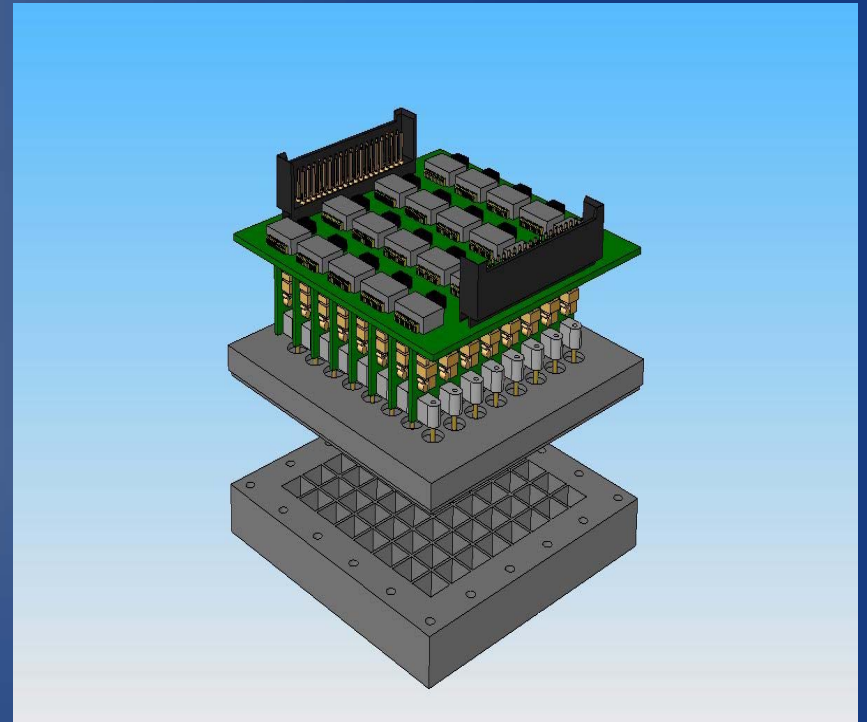


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- A new technology has been developed that uses a modular approach to fabricate detector systems composed of small 1cm x 1cm or less, gas counter pixel cells.
- The readout features one amplifier per pixel
- Sets of pixel-cell detectors and their electronics are grouped into detector modules
- These modules can be arranged into detector systems of versatile, large-area arrays

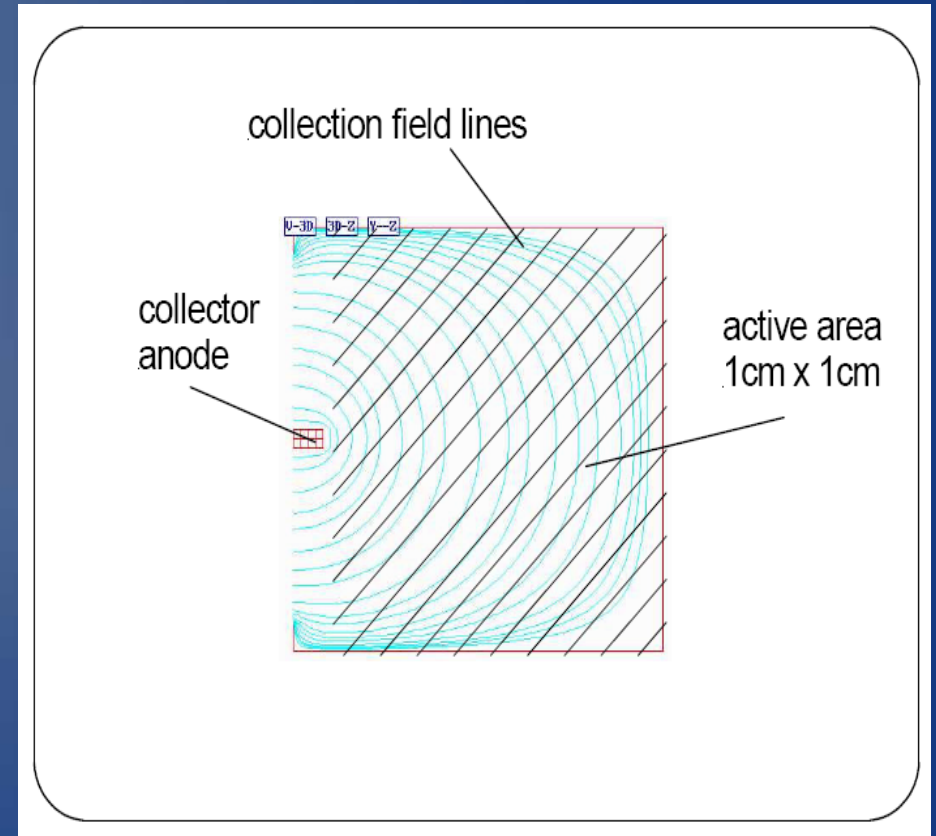
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- By providing discrete, independent pixel-cell detectors for each resolution element, count rates of 10x5 nps per pixel (independent of adjacent pixels) are feasible regardless of detector size.
- multiple counting of single events are intrinsically avoided because the tracks of charged particles resulting from any neutron interaction are confined to a single pixel cell.



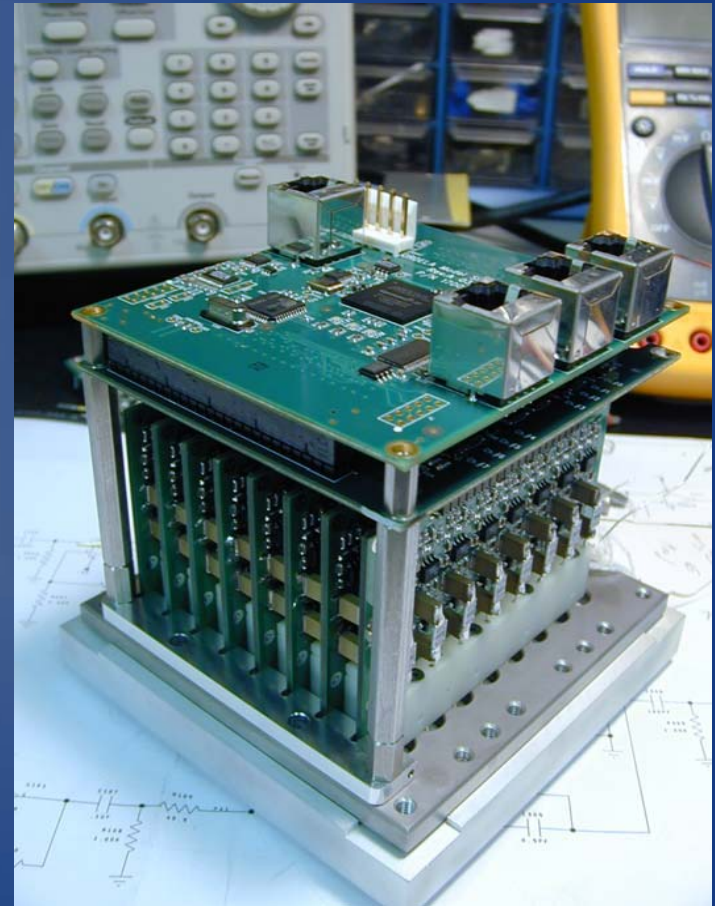
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- Neutron Converter is helium-3 or boron-10, or a combination of both
- The dark current and gamma-background sensitivity are intrinsically low because the probability of background radiation losing sufficient energy in any pixel cell to exceed the discriminator threshold is small



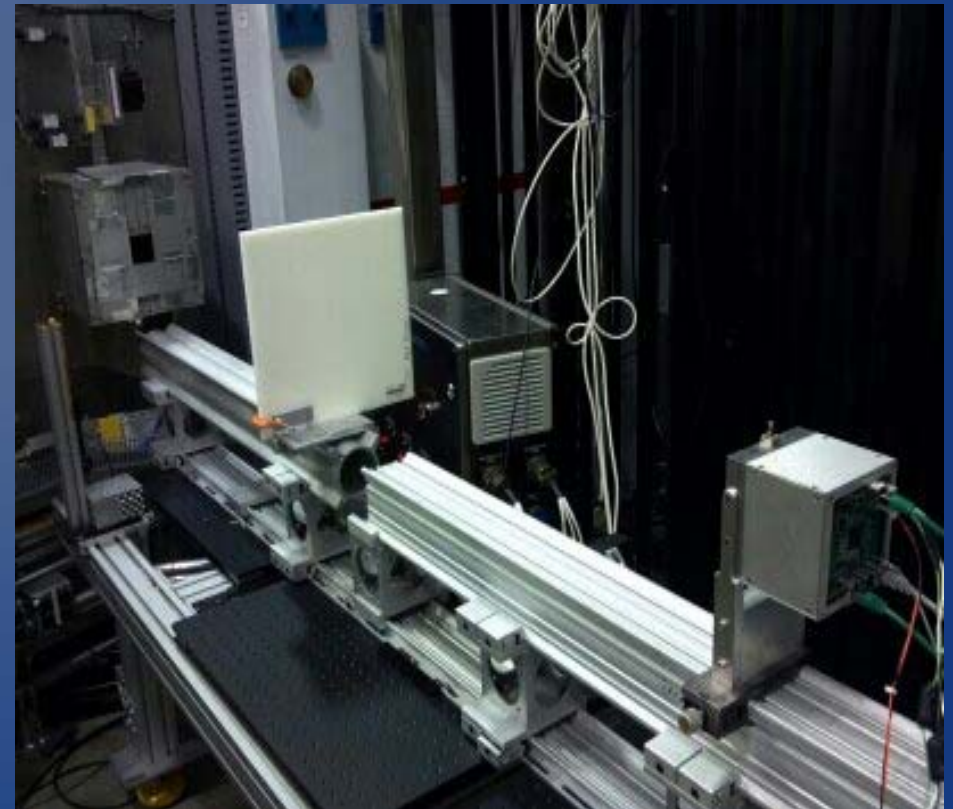
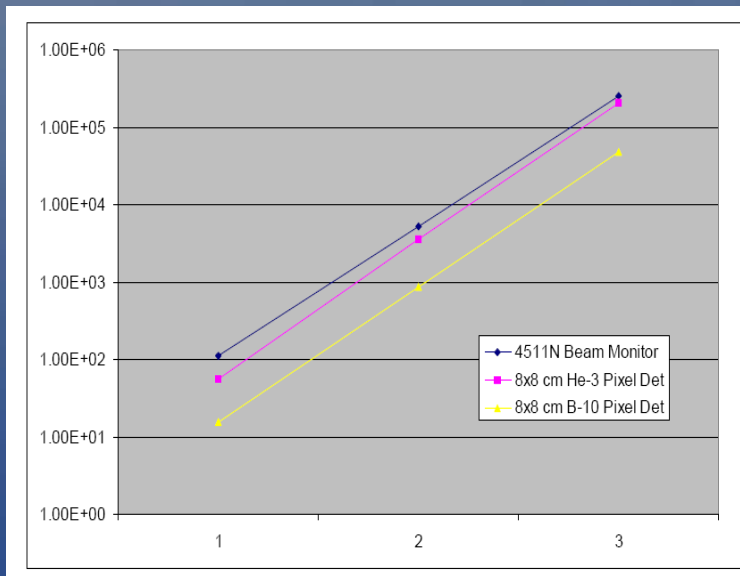
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- A prototype 8 x 8 pixel-cell detector module, containing 64 independent cells of 1.0 cm x 1.0 cm x 1.0 cm deep was fabricated and tested at HFIR CG1-A .



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- Tests showed that count rates of $>2 \times 10^5$ nps per pixel were achievable without saturation of the anode or the amplifier and detector electronics



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- Data taken at CG1A shows that the count rate of the boron-10 detector is comparable and follows the helium-3 filled detectors very closely.
- Boron-10 detectors with efficiency of up to 22% for 1 cm deep volume.
- Efficiency may be increased with additional depth or the addition of helium-3
- The count rate linearity is excellent

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- The development and test results have provided the required data to initiate the fabrication and commercialization of this next generation of neutron-detector systems.
- Detector configurations of 32 x 32 pixels of 1cm² area seem to be an optimized modular configuration for production and fabrication of large area detectors.

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- Our research effort was aimed at developing detector designs suitable for low-cost mass fabrication featuring good spatial and timing resolution, high count-rate capability, gamma-background, and enhanced durability.
- Results of this work enables ORDELA to commercially offer modular pixel-cell neutron detectors aimed for application at next generation of pulsed spallation neutron scattering facilities