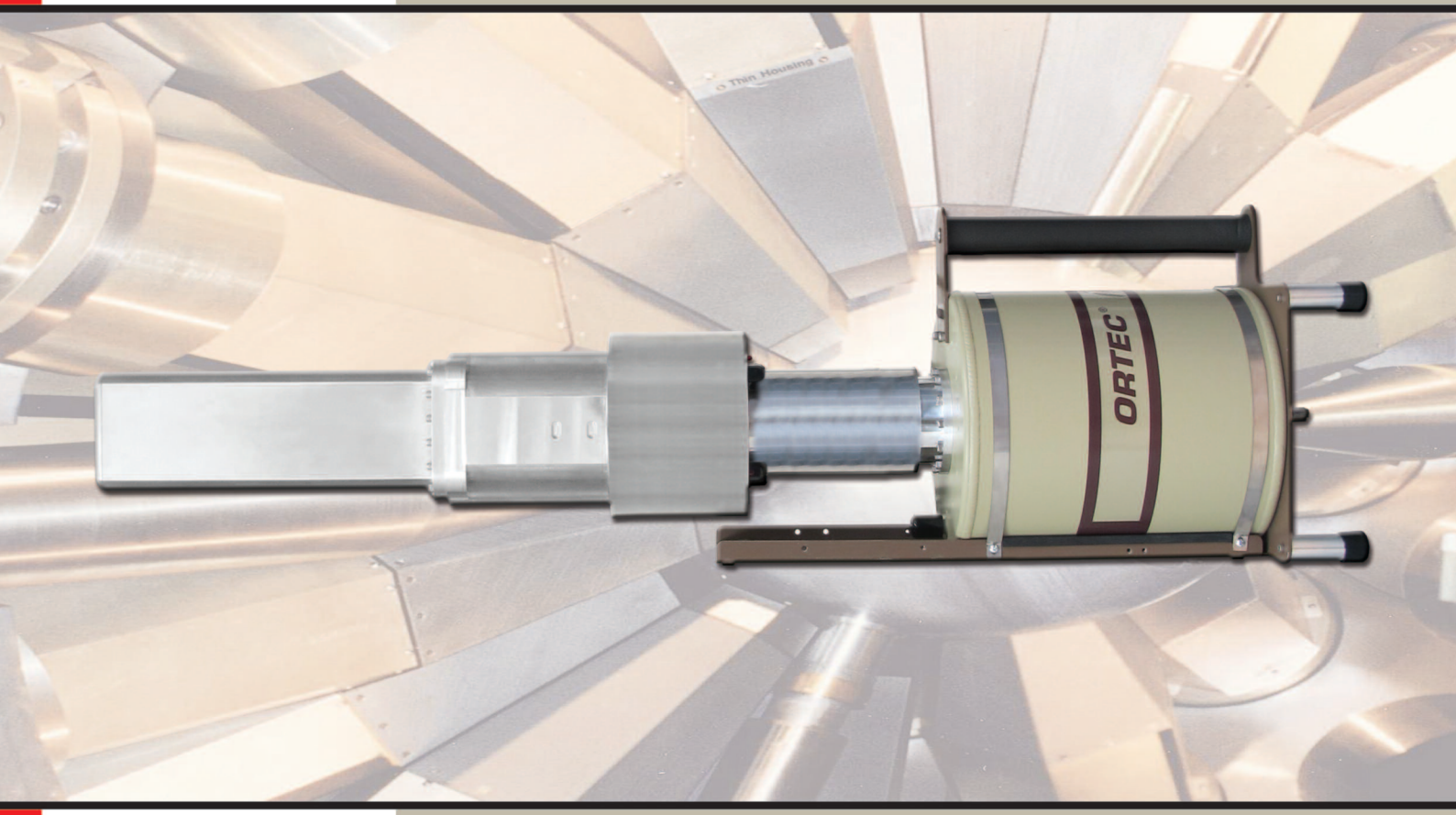
ORTEC®

AMETEK

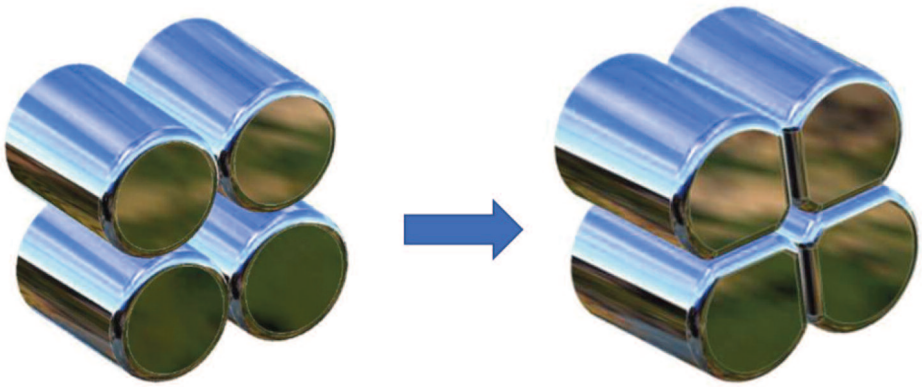
TETRAD-20



Maximum Absolute Efficiency
in a Limited Geometrical Space
for a Wide Range of Energies

TETRAD Detectors

ORTEC pioneered N-type High Purity Germanium (HPGe) detectors in the 1970s and built its first TETRAD detector consisting of four N-type HPGe detectors during the 1990s. The ORTEC TETRAD detector design delivers maximum absolute efficiency in a limited geometrical space for a wide range of energies (20 keV up to 10 MeV). Today, ORTEC maintains its leadership position in N-type detector manufacturing and is pleased to offer a standard TETRAD detector configuration for use in nuclear physics applications where efficiency and energy resolution must be provided in a limited volume.



Discrete detector elements are shaped by slicing off tangent edges to achieve closer packing and a smaller footprint.

Features	Benefits
• Thin front and side contacts (20 keV–10 MeV gamma detection) and close positioning (1.5 mm) of detector elements minimize dead space within detector endcap.	• Maximized counting efficiency in a limited geometric space — close positioning of several germanium detectors to the source. • Allows for add-back capability.
• Coaxial geometry of individual N-type crystals.	• Short shaping time performance and excellent energy resolution. • Excellent peak identification and sensitivity and high signal to background performance.
• N-type germanium material.	• Inherently resistive to neutron and proton damage. • Annealing capability to restore performance should damage occur.
• 5-liter dewar (allowing at least 12 hours operation without refilling).	• All attitude operation — allows mounting of the detector in multiple orientations.
• Robust design provides:	• Reliable performance and detector lifetime. • Vacuum integrity similar to conventional HPGe detectors. • Simplified installations.
• Four preamplifiers with independent bias control.	• Allows for optimization of each individual detector and improvement of overall system performance.

TETRAD Detectors

Each of the four HPGe detectors has a coaxial crystal geometry where two sides of the germanium crystal are at 90-degree angles and the remaining longitudinal surface spans the arc between the two sides. These four detectors are tightly packed together forming a “clover-like” shape and are mounted in a single endcap. The cryostat is cooled with liquid nitrogen from an attached 5-liter dewar providing approximately 12 hours of holding time.

The N-type germanium material used in ORTEC TETRAD detectors provides two key benefits. First, it minimizes detector resolution degradation from neutron and proton particles which are often present in nuclear experimental physics applications. Additionally, photons interacting within HPGe detectors can scatter multiple times before depositing their full energy. Depending on the energy, photons may deposit a partial amount in one detector before scattering into neighboring detector(s) where the remainder of the energy is deposited. To compensate for this scattering and provide full peak energy measurement, ORTEC N-type detectors employ a thin implanted contact on the outer surface which maximizes transmission efficiency of incident or scattered photons, even those with low energy.

Energy signals from the four detectors are collected independently. To correct for scattered gammas, an “add-back” algorithm may be used to process a summed output from the four detectors. Using the “add-back” method, the total absolute efficiency of the TETRAD detector can be much greater than simply the sum of four individual components.

Additionally, employing four smaller crystals with independent preamplifiers allows for the system to achieve much higher count rates than with a single larger detector, and with better resolution.

Typical Applications

Research Facilities/Universities

ORTEC TETRAD detectors are widely used in Nuclear Physics studies; applications that require optimal relative efficiency and energy resolution within a limited volume. As only a couple of examples, ORTEC TETRADs have been used in multi-detector arrays for:

- Beamline experiments for nuclear cross section and nuclear structure evaluations.
- Evaluation of irradiated materials for fission fragment yields (branching ratios).

Performance

Resolution and other performance specifications are provided on the following page.

Warranted specifications are offered with ORTEC analog or digital electronics.

ORTEC TETRAD detectors are robust and have a long service time. The current TETRAD design incorporates improvements in serviceability, allowing minor technical issues to be resolved on-site without returning the detector back to the factory. Additionally, individual crystals may be removed from the TETRAD detector assembly — no need to remove the entire detector assembly to service a single crystal.

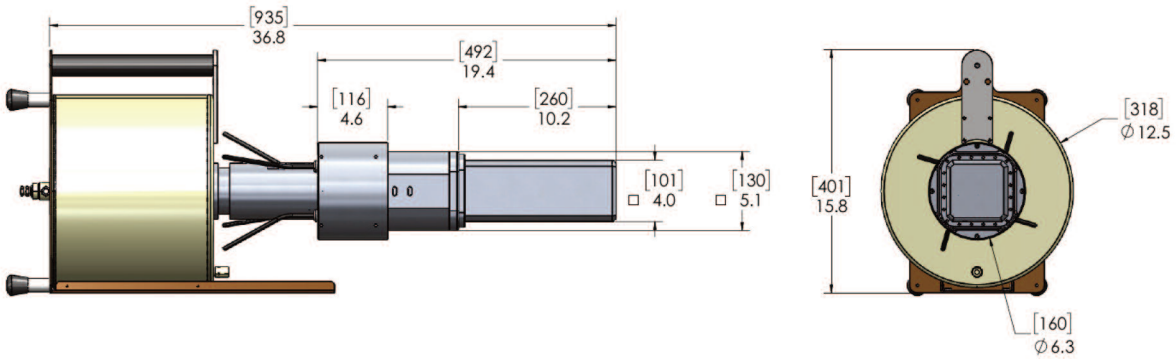
TETRAD Detectors

Specifications

TETRAD-20 Detector	Four 20% relative efficiency N-type HPGe detectors.
Efficiency	20% relative efficiency for each individual detector element.
Resolution	FWHM ≤2.25 keV @ 1.33 MeV per detector (typical performance is under 2.00 keV) FWHM ≤1.30 keV @ 122 keV per detector (typical performance is under 1.15 keV).
Energy Range	20 keV up to 10 MeV.
Peak to Compton	Approximately 43:1.
Cooler	Liquid nitrogen. Minimum capacity 5L (12-hour holding time). For other LN_2 dewar configurations and orientations, or for mechanical cooling options, consult factory.
Preamplifiers	Four individual preamps (one per detector) in approximately 140 mm remote configuration.
Detector Spacing	Approximately 1.5 mm between detector elements. Endcap to detector spacing: approximately 10 mm.
Endcap Material	Aluminum.
Warranty	1 year standard warranty. Optional extended warranty is available.

Dimensions

- Dimensions listed in mm (inches) are for reference only and subject to change.
- If dimensional constraints are critical, contact the factory.



Specifications subject to change
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