



Elegant solution:
no moderator
needed

S670e: Combined Fast and Thermal Neutron Detector

Extended energy range and robustness

The Arktis full range detector provides a unique combination of fast and thermal neutron detection, simple integration, spectral information and unbeatable robustness.

Being sensitive to both fast and thermal neutrons allows greater sensitivity and optimized performance even when shielding is present. In addition, information on the source and shielding material can be obtained. The detector delivers a standard TTL output for each detected neutron, making it easily compatible with other detection systems and suitable for drop-in replacements. It can also be used in a distinction mode, to count fast and thermal neutrons separately. The Rugged-by-Design™ family of neutron detectors uses a SiPM*-based signal readout, making it immune to shock and vibration, and scalable in length. The detectors can be custom built to user specifications.

Key features

- Sensitive to fast neutrons and thermal neutrons
- Uses natural helium (inert and abundant), not He-3
- Non-hazardous
- Rugged design, consisting only of gas, steel and solid-state circuitry
- Modular and scalable
- Not susceptible to microphonics, magnetic fields or vibration
- Gamma immunity up to at least 200 $\mu\text{Sv/hr}$ with $0.9 < \text{GARRn} < 1.1$
- TTL output
- The only plug and play combined fast neutron detector on the market
- Timing information
- Exploits low natural fast neutron background
- Up to 8 detectors controlled with one single control unit

* SiPM = Silicon Photomultiplier

**Gamma Absolute Rejection Ratio for neutrons, see R.Kouzes et al, "Neutron detection gamma ray sensitivity criteria", <http://dx.doi.org/10.1016/j.nima.2011.07.030>.

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Extended energy range and robustness

Benefits of combined fast and thermal neutron detection

Being sensitive to a large range of neutron energies provides much more information about the source and shielding. This results in higher detection probabilities and easier concepts of operations.

Fast neutron detection

Fast neutrons are detected directly without the use of a moderator. They elastically scatter off the pressurized Helium-4 (natural helium) fill gas, producing scintillation light, detected by SiPM light sensors. On-board electronics perform digital pulse shape discrimination to reject gamma induced events and provide a TTL pulse for each detected fast neutron.

Helium-4 provides a high cross section for fission neutrons. Helium-4 is an excellent scintillation medium, as it is transparent to its own light and has low electron density, which makes it insensitive to gamma radiation.

Thermal neutron detection

A ⁶Li-based coating on the inside of the tube captures thermal neutrons, emitting highly energetic charged particles in the process. The energy of the charged particles is converted into light and collected the same way as the light produced in a fast neutron interaction. Each detected neutron results in a TTL pulse.

Unbeatable robustness

Stainless steel, inert gas and military grade solid state circuitry- that's it. Unlike conventional detectors, no restricted, fragile or otherwise sensitive materials such as crystals, photomultipliers (PMTs) or anode wires sensitive to vibration and microphonics are used.

Detector setup and operation

The detector comes with a control unit which can be connected to a screen, mouse and keyboard or to LAN to remotely access and operate the detector and read out the device. The detector is powered by 12 V (no high voltage necessary). Neutron counts can be read out via TTL or flat ribbon cable. Plug-and-play handling and operation is key.



Figure 1: The detector is a plug-and-play solution with a self-contained control unit. Multiple detectors can be connected to large arrays.

Detector Specifications	S670e
Package	Detector with TTL output
Physical Specifications	915 mm total length, 600 mm sensitive length; max diameter: 70 mm; weight: 6.6 kg
Neutron Sensitivity	0.12 cps/ng ²⁵² Cf at 2 m Separate fast and thermal neutron counting in distinction mode
Gamma Rejection	Gamma rejection: 10 ⁻⁷ Gamma immunity up to at least 200 µSv/hr with 0.9 < GARRn™ < 1.1
Signal Output	Female MCX coaxial output (MCX-BNC adapters available) TTL output available. TTL level 3.3 V, rise time < 5 ns; Drive current: 24 mA Pulse width: standard 80 ns, can be programmed from 10-2560 ns Option to discriminate fast and thermal neutrons using the pulse width.
Control Cable Connection	D-SUB 15 connector cable; Connected to control unit. Up to 8 detectors can be controlled and daisy-chained with one single control unit.
Power Supply	12 V, 2.5 W per detector. No high voltage required. Detectors can be daisy-chained.
Operating Temperature	-30°C - 30°C (-22°F - 86°F); larger temperature ranges available on request.
Relative Humidity	0-100% - operable in fog.
Ingress Protection Degree	IP62. Higher IP degrees available on request.
Conformity	CE, 2014/68/EU

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