

Improved Performance of Silicon Drift Detectors

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KETEK is the market leader for Silicon Drift Detectors and offers a large variety of sensors with collimated areas starting at 7 mm² up to 150 mm² (active area 12 to 170 mm²). All detectors are available in different configurations (FET/CUBE, Beryllium/Polymer windows) and KETEK also offers complete electronics to operate the detectors.

Silicon Drift Detectors are used in many different instruments and applications like mining or geology where harsh environments combined with high ambient temperatures of up to +50 °C can occur. These applications ask for very reliable detectors with highly efficient cooling. We will present our latest detector technology where we could improve the cooling capacity by more than 15 K in case of the VITUS H7, H20, H30 and H50 modules.

Tests were performed at ambient temperatures up to +50°C still achieving chip temperatures down to -55 °C leading to optimum detector performance. The maximum Peltier power could further be reduced by 50% compared to the current thermoelectric cooler at a given fixed temperature. Long term stability tests revealed that the vacuum integrity of the new SDD modules is given even at permanent storage temperatures of +80°C.

We will further present data for our large area VITUS H80 and H150 modules. These modules were tested at +40°C ambient. At these elevated temperatures cold side temperatures of less than -60 °C could still be achieved. This is especially important for the large areas as these modules have higher leakage currents and the performance of such detectors depends strongly on the chip operating temperature. At -60 °C the optimum performance can be achieved.

The new cooling technology is available with our vacuum encapsulated Beryllium detectors. For low energy applications detecting X-ray lines below 1 keV KETEK offers the new technology in combination with AP3.3 windows. In this case the modules cannot be vacuum encapsulated due to temperature limits of the polymer based window. KETEK developed a module with Xenon filling to minimize the heat transportation through convection. This configuration is available for the VITUS H7, H20, H30 and H50 with the cold side temperature being as low as -60 °C at +20 °C heatsink temperature.

Further qualification test results of KETEK's new Graphene windows will be presented. KETEK will offer a Beryllium replacement as well as a low energy polymer window alternative. The transmission for both types of Graphene windows is superior compared to the established Beryllium and polymer windows. Long term stability and reliability data of the new windows will be shown.

Both types of windows will allow for a vacuum encapsulation process. In combination with the new cooling technology an unprecedented spectroscopic performance can be achieved.

KETEK will also present its contribution to the next Mars rover project. For Mars 2020 KETEK works together with the Jet Propulsion Laboratory on the integration of two H50 modules into the Mars rover.