PORTABLE TEMPERATURE-CONTROLLED CHAMBER FOR MEASUREMENTS UNDER VARIABLE AMBIENT CONDITIONS

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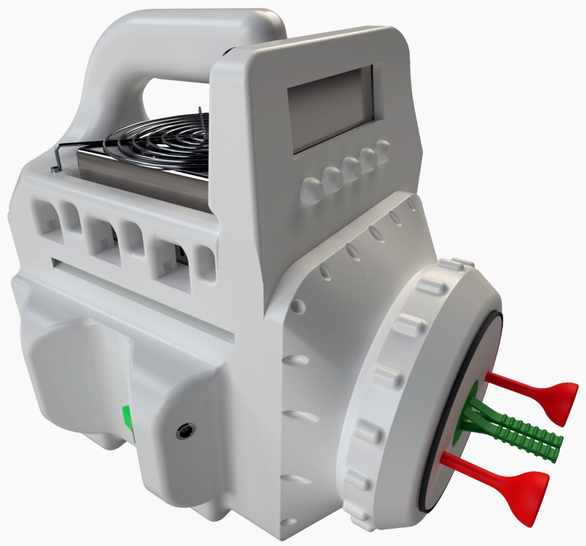
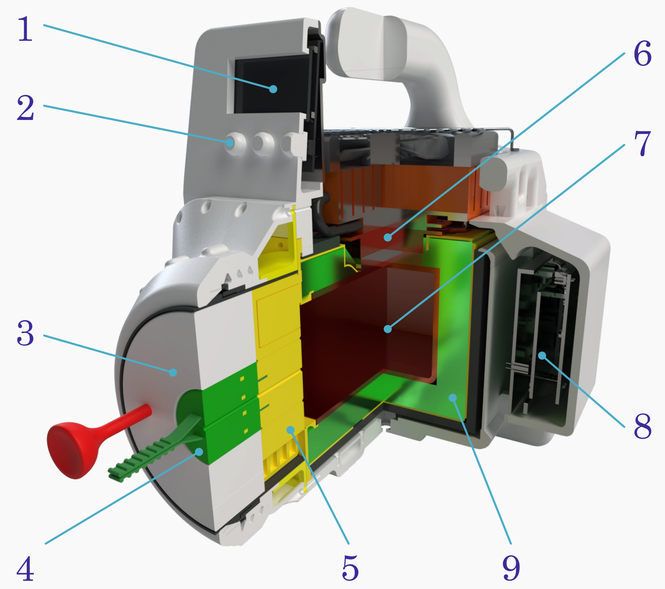
Temperature stabilization is a critical requirement for the proper operation of temperature-sensitive devices whose performance strongly depends on ambient temperature. Maintaining an optimal and stable temperature improves operational characteristics, increases efficiency, and enhances system reliability. This is particularly important for semiconductor radiation detectors such as cadmium zinc telluride (CdZnTe) detectors.

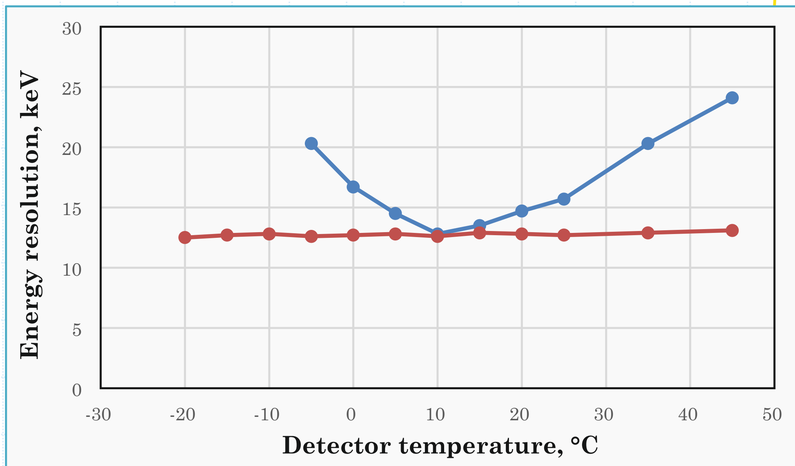
As a result, a prototype of a portable temperature-controlled chamber based on a thermoelectric (Peltier) element has been developed. The chamber is designed to stabilize the temperature of radiation detectors and other temperature-sensitive devices under variable ambient conditions. The prototype performance was tested over an ambient temperature range from −20°C to +50°C. Under these conditions, the chamber maintained a stable internal temperature of +15°C in both cooling and heating modes.



1. Display
2. Control buttons
3. Chamber access lid
4. Cable feedthrough
5. Moisture absorber (silica gel)
6. Peltier element
7. Temperature chamber with copper walls
8. Electronics PCB
9. Thermal insulation



Application Example



BLUE curve — detector energy resolution measured at different temperatures when the detector was placed inside a laboratory temperature chamber used to achieve different temperatures.
RED curve — detector energy resolution measured at different temperatures when the detector was placed inside the prototype, while the prototype itself was located inside the laboratory temperature chamber.

Table of parameters

Parameter	Value	Units	Notes
Power supply connectors	—	—	Device is powered through two USB-C PD ports
Power supply voltage	15	V	At each USB-C PD port
Power supply current	2	A	At each USB-C PD port
Power consumption	< 60	W	Total power consumption through both USB-C PD ports
Ambient temperature range	-20 to +50	°C	
Adjustable chamber temperature range	0 to +50	°C	
Achievable temperature difference in cooling mode	40	°C	Cooling from +50 °C down to +10 °C is possible
Achievable temperature difference in heating mode	70	°C	Heating from −20 °C up to +50 °C is possible
Internal temperature stability	< 0,2	°C	
Weight	3	kg	
Chamber dimensions	59x59x128	mm	
External dimensions	230x200x230	mm	Excluding lid handles

Main features

- High efficiency;
- Compact and portable design;
- Wide ambient operating temperature range;
- Real-time display of actual operating parameters;
- Wide range of achievable temperatures inside the chamber;
- Control panel with buttons for parameter adjustment and device operation;
- USB-C PD powered — the device can operate from both mains adapters and portable power banks;
- Device construction ensures minimal attenuation of low-energy gamma and X-ray radiation in applications using semiconductor radiation detectors.

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