MIRION TECHNOLOGIES

MULTI-USE HPGe SPECTROMETER

Aegis™

Portable HPGe Spectrometer

The unit is remotely controlled via a wired or wireless connection, allowing high resolution spectroscopy measurements to be made from a safe, comfortable location.

FEATURES

- Thermal-cycle free cryostat
- Laboratory-grade energy resolution
- Choice of large 40% and 50% HPGe crystals
- RDC option enabling backshielding
- Easy to deploy all-in-one design
- System control via Genie™ 2000 software
- Designed to meet IP65 ingress protection rating
- Operational in -20 °C to 50 °C (-4 °F to 122 °F) ambient temperature when cooled down

BENEFITS

- Wide energy range covering most all field situations and many lab applications
- Built-in UPS and thermal-cycle free cryostat for maximum operational time
- Compatible with the Canberra™ ISOCS™ cart
- Multi-use (lab, ISOCS cart, mobile units, field)
- Allows rapid in-field ISOCS/LabSOCS™ efficiency calculations without sources for wide range of simple and complicated geometries
- Deployable in heavy rain and dusty environments
- No risk of internal contamination

DESCRIPTION

The Aegis Portable HPGe Spectrometer is the newest transportable, battery-powered HPGe gamma spectrometer in Mirion's portfolio. Like its Falcon 5000® predecessor, it offers many state-of-the-art features, such as a thermal-cycle free cryostat, an integrated all-in-one design and laboratory-grade energy resolution. All this, however, is now also combined with larger HPGe crystals and the option to provide the portable spectrometer with a Remote Detector Chamber (RDC) cryostat (enabling detector backshielding). All these features make the Aegis spectrometer easily deployable for multiple use in the field ... and in the lab.

With the IP65 design and no cooling fans, the system can be deployed without any problem in heavy rain conditions and dusty environments without the risk of contaminating any internal parts. The exterior surface is designed such that it can be easily decontaminated and put back into service quickly. With the integration of a highly efficient cooler, the detector can remain cooled down in a wide ambient temperature range up to 50 °C (or 122 °F).

MIRION TECHNOLOGIES

MULTIPLE STANDARD CONFIGURATIONS

This is the first portable HPGe gamma spectrometer on the market where there is a choice of multiple detector and cryostat options: three different HPGe crystal types with the option to add a Remote Detector Chamber (RDC) to each one. The standard crystal offering is a large 40% coaxial crystal featuring excellent sensitivity for gamma photon energies ranging from 40 keV up to 10 MeV. If the best efficiencies are required below 100 keV (down to 15 keV), a 40% XtRa coaxial crystal is better suited. For the ultimate performance in sensitivity, the BE5030 crystal can be chosen which also offers the best possible energy resolution down to 15 keV, as well as ~45% relative efficiency at 1332 keV.

While transportable HPGe spectrometers have always been designed with the HPGe crystal integrated in the body of the device, the Aegis spectrometer is also available with an optional RDC cryostat. This feature separates the HPGe crystal from the rest of the unit enabling backshielding the crystal. As a result:

- On top of the excellent HPGe gamma-photon efficiencies and energy resolutions in all attitudes, background conditions can be easily optimized in any field application and also in lab applications;
- The Aegis spectrometer can be deployed as a Multi-Use system. Emergency responders, for example, can set up the system under a standard lab lead shield and, in case of emergency, it can be taken out for specific field applications;
- Compatible with standard ISOCS Carts as well as most laboratory HPGe Shields.

As switching between different measurement setups is quick and easy thanks to the all-in-one design, multi-use of this portable counting system indeed becomes an attractive option. Accurate on-line activity information is available by simply connecting a Genie 2000 computer to the Aegis spectrometer through Wi-Fi or a single Ethernet cable. The Wi-Fi interface simplifies the measurement of difficult-to-access, uncomfortable, and/or contaminated areas by minimizing the stay-time for the operator. Just set the system up and move to a more desirable location to initiate and analyze a count.

Four mounting holes at the bottom and six mounting holes at each side are positioned according to the VESA 100 x 100 mm^2 standard enabling easy mounting solutions for any application. With the optional AEGIS ISOXADAPT, the Aegis spectrometer can also be mounted on any new or existing Canberra ISOCS cart.

BATTERIES

The system is equipped with two rechargeable LiFePO4 batteries, which are hot swappable and provide up to 2.5 hours of operation autonomy in a cooled-down state. The batteries are designed and sized to be UN3481-certified for shipping in, or with, the equipment via air freight. The fact that the batteries are hot swappable means that the unit can be deployed in the field for continued uninterrupted operation with the use of additional charged batteries. The fully charged batteries can then replace the batteries in use one by one before they are completely depleted without interrupting the ongoing measurement. The system is provided with a total of four batteries (two internal and two spare batteries), and additional spares can be purchased.

Why LiFePO4 battery packs?

The lithium iron phosphate battery, known as LiFePO4 or LFP, is a lithium-ion battery with lithium iron phosphate as cathode material. The LiFePO4 battery pack has many advantages over standard Li-ion packs:

1. **Inherently safe:** This technology is much less likely to experience “thermal runaway” or sudden and continued overheating, possibly leading to an explosion. It is, thus, more stable and safer than Li-ion in terms of flammability and explosion risk.
2. **Longer service life:** Typically 1000-2000 charge-discharge cycles, which is more than other lithium-ion technologies. Also, LFP cells have a lower internal discharge rate and can typically support longer storage times.
3. **Environmentally friendly:** This technology does not contain any metallic chemical element or precious metals.
4. **Wide operating temperature range:** LFP cells tend to have less life cycle degradation at extreme temperature levels.

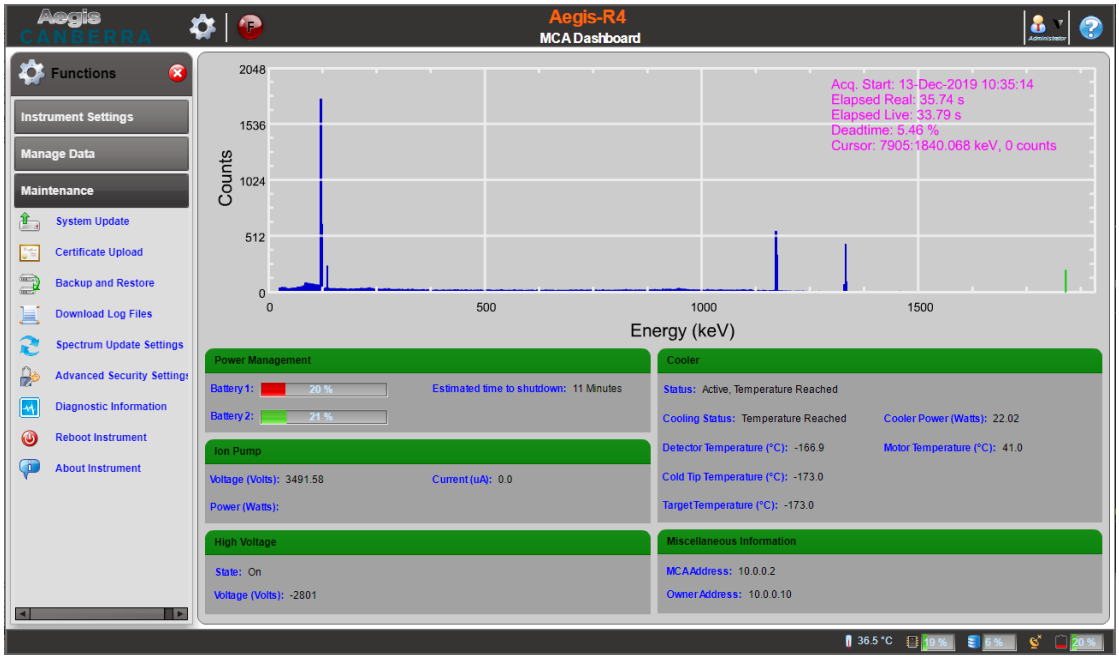
THERMAL-CYCLE FREE CRYOSTAT DESIGN

The fact that the Aegis spectrometer comes with a thermal-cycle free cryostat design guarantees minimal down time in case battery power is accidentally depleted while in a cooled-down state. While a conventional cryostat detector must be first completely warmed up to room temperature before it can be cooled back down, the Aegis cryostat incorporates improved technology not requiring such a full thermal cycle. As soon as the operator notices the power loss, he can correct the problem at his earliest convenience and immediately cool down the system again, instead of having to wait for a full thermal cycle. This means that the Aegis can be put back into service much more quickly, minutes or hours instead of days, in the event of a partial warm up. Cooling down from room temperature requires <12 hours at an ambient temperature of 25 °C.

CONTROL AND COMMUNICATIONS

Control of the system is established via Genie 2000 software with an Ethernet or Wi-Fi connection to a PC or tablet. In addition, a GPS module is integrated into the unit. The Wi-Fi and/or GPS modules can be physically removed in the factory upon request. An RJ-45 connector is provided on the back panel along with the power supply jack and six multi-purpose GPIO connectors which enable monitoring of the amplified energy signal and processing of TTL compatible signals for:

- Sample-changer control
- PHA acquisition status
- PHA external start/stop control
- Incoming count rate
- (Anti-)coincidences
- Fault status



Aegis Dashboard

While the system is controlled from Genie 2000 software, the Aegis Dashboard can be opened via a web browser providing an overview of the system operation.

It shows:

- The spectrum in the Aegis MCA memory
- General and detailed status: batteries, cooler, preamplifier, MCA, ion pump, system, GPS and network status indications and diagnostics
- Basic functions, such as:
  - Firmware Update
  - User account management
  - Network and Wi-Fi manager

Future firmware upgrade releases will be made available on the Mirion website and can be installed by using the Firmware Update functionality from the Aegis Dashboard.

The Aegis spectrometer is also provided with an integrated back lit LCD screen, LED indications and keypad control buttons on the top panel of the system. The LCD displays the State of Health (SoH) of the MCA, Cooler, Ion pump, Preamplifier and the computer unit. The four keypad control buttons are used for control of the system power, the detector bias high voltage, the cooler, and navigation through the various LCD screen pages. Two battery level indicators are provided with 25% increment indications. The screen also lists the system's IP address to simplify connection to the host Genie 2000 computer.

SPECIFICATIONS

NUCLEAR

Model Number	Typical Rel. Eff. (%)	Typical energy range (keV)	Typical Full Width Half Max (FWHM) Resolution (keV)		Endcap diameter mm (in.)
			At 122 keV energy	At 1332 keV energy	
AEGIS-GC40	40	40 – 10,000	1.4	2.1	83 (3.25)
AEGIS-GC40-RDC	40	40 – 10,000	1.4	2.1	83 (3.25)
AEGIS-GX40	40	15 – 10,000	1.4	2.1	83 (3.25)
AEGIS-GX40-RDC	40	15 – 10,000	1.4	2.1	83 (3.25)
AEGIS-BE5030	45	15 – 3,000	1.0	2.0	102 (4.0)
AEGIS-BE5030-RDC	45	15 – 3,000	1.0	2.0	102 (4.0)

Above typical specifications are in accordance with IEEE Std 325-1996, as measured at 23 °C (74 °F) ambient temperature.

Relative efficiency is a typical value, not a spec limit.

Electrical cooler

- Type: Stirling
- Time to cool: <12 hours at 25 °C (77 °F)

MCA

- 256-32768 channels, support for two memory groups of equal size
- Live Time correction
- High Voltage Inhibit: High Voltage is automatically inhibited until the detector has reached operating temperature
- Coarse Gain: x2.0 – x430.5 in 19% increments
- Fine Gain: x0.8 – x1.2 in 0.004% increments
- Gain Attenuator: ON/OFF; when ON is selected it enables a divide by four input attenuator to minimize overload due to preamp signals with large pulse amplitudes
- Three MCA General Purpose I/O (GPIO) signals

ERGONOMIC

Display

- Small-character LCD display, on top of Aegis with different pages for System-of-Health status

Handle

- Two removable handles on top of instrument

Operating controls

- Keypad:
  - Power On/Off
  - Cooler On/Off
  - HV On/Off
  - Page navigation for LCD

COMMUNICATION

Between Aegis system and PC

- Wireless: Wi-Fi 802.11b,g,n, option to physically remove in factory
- Wired: RJ-45 (Ethernet cable)

GPS

- Accuracy: <5 meters
- Option to physically remove in factory

GP I/O ports

- 6 buffered input/output MCX signal connectors, of which:
  - Three GP I/O ports are controlled by MCA enabling processing of TTL compatible signals
  - One Fault Status GPIO
  - One Monitor Out GPIO: A real-time image of the internally-shaped energy signal for use with an external oscilloscope
  - One GPIO for future use

ELECTRICAL

Instrument

- Universal AC adapter with 100–240 V, 50-60 Hz input
- STANDARD and (optional) SPARE BATTERIES: Two rechargeable LiFePO4 49.5 Wh, hot swappable, providing up to 2.5 hours operation* with two batteries. Charging time inside Aegis <2 hours. Batteries are UN3481 certified for shipping in or with equipment via air freight.
- Battery charger outside of Aegis unit: – Universal 100 – 240 Vac, 50-60 Hz input charger for one battery at a time. Charging time with external battery charger <1 hour

*Nominal value only. Actual run time depends on application specifics.

MECHANICAL

- Housing: painted magnesium, easy to decontaminate
- Aegis Unit Dimensions: 420 x 356 x 160 mm (16.5 x 14.0 x 6.3 in.) (L x H x W) with two handles, without RDC
- Aegis Unit Weight: 16.6 kg (36.5 lb) with two batteries installed and the AEGIS-BE5030-RDC configuration
- Battery Weight: 860 g (1.9 lb) per battery module
- Shipping Case Dimensions: Shipping Case Dimensions: 94 x 79 x 49 cm (37 x 31 x 19 in.) (L x H x W)
- Shipping Case Weight: 50 kg (110 lbs) (includes Aegis unit, two spare batteries, AC power supply, two external AC battery chargers, manual and spec sheet) ; 22.5 kg (49.5 lb) (empty)

ENVIRONMENTAL

- Ambient Temperature:
  - Keeping the unit cooled down: -20 °C to 50 °C (-4 °F to 122 °F)
  - Cool down from environmental temperature: -20 °C to 25 °C (-4 °F to 77 °F)
- Designed to meet IP65 ingress protection rating

STANDARDS

Supplementary Information:

- Tested by TÜV SÜD (NRTL) and includes compliance to Australia, Japan, Korea & Russia standards

EMC Standards:

- EN EN61326-1:2013

Low Voltage Safety Standards:

- CAN/CSA C22.2 No. 61010-1:2012
- CAN/CSA-C22.2 No. 61010-2-010:2019
- UL 61010-1:2012
- UL 61010-2-010:2019
- EN 61010-1:2010/A1:2019
- EN 61010-2-010:2019

following the provisions of COUNCIL DIRECTIVE(S) 2011/65/EU (RoHS), 2014/30/EU (ElectroMagnetic Compatibility), 2014/35/EU (Low Voltage (Safety). And 2006/66/EC (Battery)

AVAILABLE MODELS

- AEGIS-GC40: The Aegis HPGe spectrometer with a 40% GC crystal (and no RDC)
- AEGIS-GX40: The Aegis HPGe spectrometer with a 40% GX crystal (and no RDC)
- AEGIS-BE5030: The Aegis HPGe spectrometer with a BE5030 crystal (and no RDC)
- AEGIS-GC40-RDC: The Aegis HPGe spectrometer with a 40% GC crystal and RDC option
- AEGIS-GX40-RDC: The Aegis HPGe spectrometer with a 40% GX crystal and RDC option
- AEGIS-BE5030-RDC: The Aegis HPGe spectrometer with a BE5030 crystal and RDC option

All models include:

- A rugged shipping case
- Two internal batteries
- Two spare batteries
- AC power supply
- Two external AC battery chargers
- S504 Genie 2000 software V3.4.2
- A generic ISOCS/LabSOCS characterization
- Manual

Remarks:

- A laptop or tablet computer is not included
- The end cap diameters fit in a standard ISOXSHLD
- A specific ISOCS/LabSOCS characterization can be ordered via the standard ISOXCAL model number

Optional accessories:

- AEGIS-NGW: Physically remove the GPS and Wi-Fi from the Aegis unit
- AEGIS-NGPS: Physically remove the GPS from the Aegis unit
- AEGIS-NWIFI: Physically remove the Wi-Fi from the Aegis unit
- AEGIS AC-SUPPLY: 100-240 V ac power supply
- AEGIS DC-SUPPLY: 12 V dc vehicle adapter
- AEGIS AC-BATTCHG: 100-240 V ac external battery charger for one Aegis battery
- AEGIS BATT: Spare Aegis battery
- AEGIS ISOXADAPT: Adapter kit enabling to mount Aegis on any Canberra ISOCS cart
- 7413 Tripod

ISO 9001 SYSTEM CERTIFIED — MERIDEN CT, SMYRNA GA, OAK RIDGE TN, CONCORD ON

OPS-1795 – 04/2020

MIRION TECHNOLOGIES

www.mirion.com