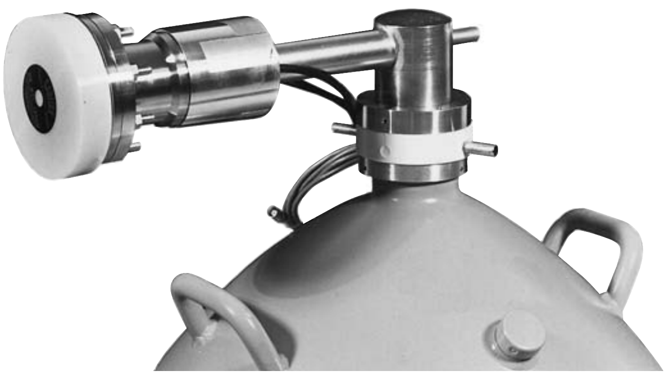
ORTEC®

BETA-X

Cooled Spectrometer

- **Excellent spectroscopy for up to 2-MeV electrons and 20-keV x rays**
- **4-1/2-in. ConFlat® flange permits insertion of a source or connection to a beam tube**
- **Contains reliable 10-mm diameter, 5-mm thick Si(Li) device**
- **Room temperature storage**
- **High-voltage shutoff protection**



When conversion electron spectroscopy or determination of a beta decay end point is the objective, room temperature silicon detectors are often unsatisfactory because of their relatively high noise level (an 80-mm^2 detector has about 7 keV FWHM noise). To minimize the noise, both the detector and the first stage of the preamplifier must be cooled. Considerable expertise is required to deal with the subtle technologies involved.

The problems are solved with ORTEC's cooled BETA-X Spectrometer. It contains a 10-mm diameter, 5-mm deep Si(Li) detector coupled to a noise-optimized cryogenic electronic front end. An easy-to-operate valve gives access to the cryostat vacuum. The front flange can be opened for connection to an experiment chamber or a beam tube. A beryllium window in the front flange makes the BETA-X Spectrometer a useful tool for x-ray spectroscopy (Fig. 1) and permits measuring noise and x-ray resolution without opening the front flange.

Using the BETA-X Spectrometer requires familiarity with vacuum equipment. The vacuum system must be absolutely oil free (via a well trapped diffusion pump or a cryogenic pump) and should provide a vacuum of 10^{-5} torr or better. Because the detector responds to light of any frequency, there must be no light leaks.

The electron energy resolution is limited, at low energies, by the thickness of the entrance contact on the Si(Li) detector (equivalent to approximately 2000 Å of silicon) and, at high energies, by the thickness and density of the material supporting the source and any source window thickness.

Beta and electron spectroscopy is feasible from 20 keV to 3 MeV.

The BETA-X is equipped with a pulsed optical feedback (POF) cryogenic streamline preamplifier and high-voltage filter combination optimized for the specific application. This includes high-voltage shutoff to protect the detector from FET failures.

Specifications

PREAMPLIFIER PERFORMANCE

TEST INPUT One 18-in. RG174 coaxial cable with female BNC connector.

HIGH-VOLTAGE BIAS INPUT One 18-in. RG59 coaxial cable with female SHV connector.

OUTPUTS Two 18-in. RG174 coaxial cables with female BNC connectors.

CABLE DRIVE CAPABILITY AND TERMINATION Test Input terminated in 93 Ω; outputs are series terminated in 93 Ω and may drive terminated and unterminated 93 Ω coaxial cables (RG62 recommended). Termination recommended for cable lengths greater than 50 ft.

RISE TIME Pulse rise time typically 25 ns; actual rise time to nuclear event depends on detector characteristics.

MAXIMUM OUTPUT Maximum pulse output to a single event is –10 V.

MAXIMUM ENERGY RATE 4000 MeV/s.

NONLINEARITIES Integral and differential, <±0.05% over 90% of the dynamic range of the preamplifier.

BIAS VOLTAGE High-voltage filter capable of supplying needs of detector up to 5000 V bias.

TEMPERATURE INSTABILITY
≤±50 ppm/°C over 0°C to +50°C recommended operating temperature range.

POWER REQUIREMENTS Typically +24 V, 50 mA; –24 V, 25 mA.

MECHANICAL

VALVE OUTPUT CONNECTION 1/2-in. OD tube.

GASKETS Provided for connection to user's system.

*The POF does not "lock up" or saturate at high count rates, unlike resistor-feedback designs. At ultra-high count rates with the POF, throughput is limited by reset pulse rates. 4000 MeV/s is an estimate of maximum "useable" energy rate.

®Trademarked by Varian.

BETA-X

Cooled Spectrometer

ELECTRICAL

CABLE PACK BETA-X is provided with a standard cable pack containing: signal cable and test pulse cable (both RG62A/U, 93 Ω BNC), high-voltage cable (RG59A/U, 75 Ω SHV female), and a preamplifier power cable (9-pin D connector, male). Supplemental or extra cable and connector options are available on request.

AUTOMATIC, HIGH-VOLTAGE SHUTOFF The cryostat contains a temperature sensing element attached to the cooling path. The sensing element connects to a hybrid monitoring circuit, which is incorporated into the preamplifier electronics. An output cable from the preamplifier is connected to the remote shutdown input on the rear panel of the ORTEC Model 659 Detector Bias Supply. This supply is designed to reduce the detector bias voltage to zero if the remote shutdown input's center contact is provided with a low-impedance (<30 Ω) path to ground. The monitoring circuit in the preamplifier provides this condition if the detector temperature becomes too high. Although no alarm is provided, the bias supply meter will indicate zero voltage, and system noise will greatly increase after shutoff occurs. For the unit to be operational, preamplifier power must be provided through the power cable.

The automatic shutoff should be placed in operation before attempting to apply bias to the detector. Thus the circuit will also prevent the accidental application of bias to a detector which has not yet reached operating temperature.

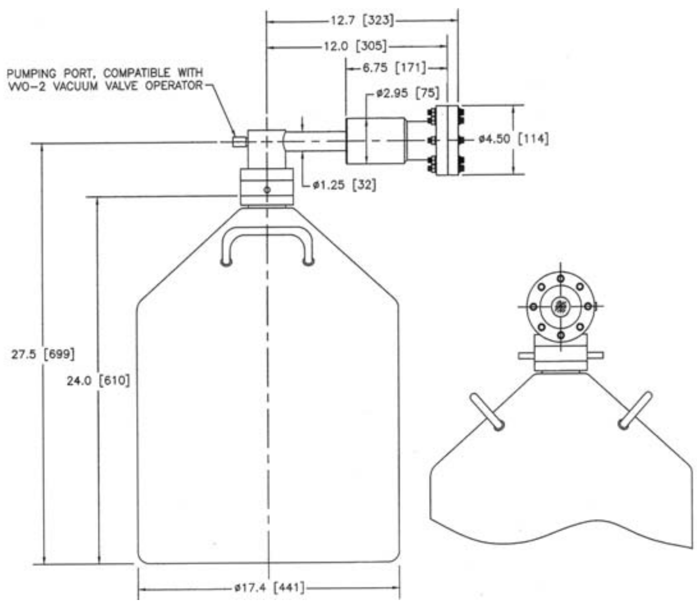


Fig. 1. Si(Li) Electron and X-Ray Spectrometer.

References

1. C.T. Prevo and J.L. Cate, "A Practical Solid State Beta Spectrometer," *Nucl. Instrum. Methods* **55**, 173–176 (1967).

2. R.E. Wood, P. Venugapala Rao, O.H. Puckett, and J.M. Palms, "Si(Li) Spectrometers for Electrons and Low Energy Photons," *Nucl. Instrum. Methods* **94**, 245–252 (1971).

3. I. Amad and F. Wagner, "A Simple Cooled Si(Li) Electron Spectrometer," *Nucl. Instrum. Methods* **116**, 465–469 (1974).

Ordering Information

To order, specify:

Model	**Description**
SLB-10490	BETA-X Spectrometer. Includes CFG-B-SH Pumpable SH Cryostat and DWR-B-30 30-Liter Dewar

Radiation Type	Energy (keV)	Warranted Energy Resolution (eV) FWHM	Max. Energy Rate (meV/s)	Max. Single Pulse Energy (MeV)
^{55}Fe X-Ray	5.9	490	130,000	10
^{57}Co Conversion Electrons	115	1000	130,000	10
^{207}Bi Conversion Electrons	976	3500*	130,000	10

*This figure was obtained with a source deposited on aluminum, causing peak broadening due to backscattering. It is expected that with an accelerator beam or with conversion electrons from a thin source, the energy resolution will be ~2 keV FWHM at 1 MeV.

Specifications subject to change
122607

ORTEC®

www.ortec-online.com
Tel. (865) 482-4411 • Fax (865) 483-0396 • ortec.info@ametek.com
801 South Illinois Ave., Oak Ridge, TN 37831-0895 U.S.A.
For International Office Locations, Visit Our Website

AMETEK®
ADVANCED MEASUREMENT TECHNOLOGY