Scintillation detectors can be used in a variety of experiments including diffraction and reflectometry. With over 250 Oxford Danfysik systems installed world wide they are the detector of choice in many of the world's synchrotron beamlines.

A complete system consists of a detector head (that contains the scintillator crystal, photomultiplier tube, and preamplifier) and pulse processing unit; both of which are available from Oxford Danfysik in various varieties to match your specific experiment.

The scintillation crystal inside the detector absorbs X-rays and produces visible photons. This crystal is optically coupled to a photomultiplier tube, which converts the light into an electronic signal; the amplitude of which is dependent on the incident X-ray intensity. The signal is then pre-amplified before being transferred to the processing unit.

Cyberstar Scintillation range of detector heads

Oxford Danfysik provides a full range of scintillation detector heads with various dimensions, crystal types, and thicknesses; allowing you to match a product to your efficiency, resolution, speed, and integration requirements.

Specifications

Part number	CBY48NA01B	CBY48NA02B	CBY48NA05B	CBY12NA02B	CBY48YA11P	CBY12YA12P	CBY17LA05B	CBY48LA05B
Body length	138mm	138mm	138mm	144mm	138mm	144mm	164.5mm	138mm
Body diameter	48mm	48mm	48mm	12.5mm	48mm	12.5mm	17mm	48mm
Detector aperture	30mm	30mm	30mm	6mm	30mm	6mm	10mm	30mm
Scintillator	NaI(Tl)	NaI(Tl)	NaI(Tl)	NaI(Tl)	YAP	YAP	$LaCl_3$	$LaCl_3$
Crystal thickness	1mm	2mm	5mm	2mm	1mm	2mm	5mm	5mm
Photomultiplier Ø	38mm	38mm	38mm	10mm	38mm	10mm	13mm	38mm
Photomultiplier gain	10^6	10^6	10^6	10^6	10^6	10^6	1.4x 10^6	1.4x 10^6
Window	0.2mm Beryllium	0.2mm Beryllium	0.2mm Beryllium	0.2mm Beryllium	70µm Conducting Polymer	70µm Conducting Polymer	0.2mm Beryllium	0.2mm Beryllium
Background noise	<0.2cps @ 5keV	<0.2cps @ 5keV	<0.2cps @ 5keV	<0.2cps @ 5keV	<0.2cps @ 5keV	<0.2cps @ 5keV	<0.2cps @ 5keV	<0.2cps @ 5keV
Minimum energy	1.5keV	1.5keV	1.5keV	1.5keV	5-6keV	5-6keV	1.5keV	1.5keV
Advantages[1]	Best efficiency and good energy resolution				Fastest count rate upto 3.5Mcps		A good compromise between speed and energy resolution	

Preamplifier

	The preamplifier is internal on 48mm diameter heads, and external on a short flying lead for smaller diameter heads							
Output impedance	50Ω	50Ω	50Ω	50Ω	50Ω	50Ω	50Ω	50Ω
Bandwidth gain	180Mhz	180MHz	180MHz	180MHz	500MHz	500MHz	500MHz	500MHz
Slew rate	2000 V/µs	2000 V/µs	2000 V/µs	2000 V/µs	2000 V/µs	2000 V/µs	2000 V/µs	2000 V/µs

[1] *Please refer to page 12 for the scintillation detector frequently asked questions, which provides further details to aid the selection process.*

Ordering information

Detector head, 48mm body, 30mm aperture, 1mm NaI(Tl) scintillator, Be window	CBY48NA01B
Detector head, 48mm body, 30mm aperture, 2mm NaI(Tl) scintillator, Be window	CBY48NA02B
Detector head, 48mm body, 30mm aperture, 5mm NaI(Tl) scintillator, Be window	CBY48NA05B
Detector head, 12.5mm body, 6mm aperture, 2mm NaI(Tl) scintillator, Be window	CBY12NA02B
Detector head, 48mm body, 30mm aperture, 1mm YAP scintillator, Polymer window, fast preamp	CBY48YA11P
Detector head, 12.5mm body, 6mm aperture, 2mm YAP scintillator, Polymer window, fast preamp	CBY12YA12P
Detector head, 17mm body, 10mm aperture, 5mm $LaCL_3$ scintillator, Be window, fast preamp	CBY17LA05B
Detector head, 48mm body, 30mm aperture, 5mm $LaCl_3$ scintillator, Be window	CBY48LA05B
Detector head, vacuum compatible	CBY48VNA01B

The Oxford Danfysik processing modules are designed to obtain maximum performance from the entire scintillation detection range. Please see the specifications below for both the single and five channel option performances.

Cyberstar Scintillation Counter processing modules

Three processing modules are available; a single channel module, a five channel module, and a linear rate meter.

Specifications

CBY-2202 NIM Electronics module (single channel)

Shaping amplifier

Gain	Adjustment by front panel scroll keys
Shaping constants	40, 100, 300, and 1000ns adjustable by front panel scroll keys
Baseline shift	Negligible
Pulse output	0-4V (BNC - 50Ω)

Single channel analyser

Controls	
lower level	Front panel mounted scroll keys
upper level	Front panel mounted scroll keys
Outputs	BNC, Positive TTL, 0.8-2V into a 50Ω load (short circuit protected) Jumper selection for lower level, upper level, or window output

High voltage power supply

Output range	0-1250V adjustable by front panel scroll key
Output connector	SHV high voltage socket on rear panel

Display

2 LCDs each having 2 lines of 8 characters with backlight. Displays gain, shaping constant, lower level, upper level, and high voltage

Miscellaneous

Power req.	+24V, 120mA; 12V, 200mA; -12V, 20mA; +6V, 250mA; -6V, 150mA
Phototube preamp power	NIM standard, 9pin sub-D, female connector on rear panel
Head cable length	5m, 10m, 15m, and 20m

Computer control

The RS232 communications port can be used to independently control phototube high voltage, preamplifier gain, single channel analyser lower and upper levels, and shaping constant. The standard cable lengths are 5m, 10m, 15m, and 20m.

CBY-2206 NIM Electronics module (5 channel version)

The specifications are identical to the CBY-2202, except that the module does not contain the high voltage supply. We recommend a dedicated HV PSU. The current consumption on the 6V rails is higher as follows: +6V, 1250mA; -6V, 750mA.

CBY-1300 NIM linear rate meter

General

Linearity	Better than 0.1% of full scale
Stability	0.01% of full scale per °C
Count rate	Six position front panel switch giving count rate selection between 10 and 10^6cps full scale reading
Time constant	Four position front panel switch selecting 0.1, 0.3, 1, and 3µs
Pulse input	Front panel BNC, TTL standard, 50ns minimum duration
Indicator	Large 70mm x 23.5mm edge reading galvanometer
Output	Front panel BNC, recorder output, 0-1V, short circuit protected
Speaker	4 BNC, positive TTL, 0.8-2V into a 50 load (short circuit protected) for upper level, lower level, signal, and window
Power req.	+24V, 50mA; -24V, 20mA
Dimensions	Single NIM format, 34.3mm x 221.3mm. 3U 19" rack mounting version available.

Pulse processing modules;
Single channel module (CBY-2202) on the left,
Five channel module (CBY-2206) on the right.

Ordering information

Fast scintillation counter PPU NIM 1 channel + RS232	CBY-2202
Fast scintillation counter PPU NIM 5 channel + RS232	CBY-2206
Linear rate meter NIM module	CBY-1300
Pulse processing cable 5m, 10m, 15m, and 20m long	CBY-1401,2,3,7
RS232 cable 5m, 10m, 15m, and 20m long	CBY-1404,5,6,8

Cyberstar Scintillation Counter - Frequently Asked Questions

Can I connect multiple detectors together?

The RS232 protocol used permits a system to be installed as part of network of up to 16 detectors (including other scintillation counters or our IC Plus Ion Chambers) through just one serial port on a host computer. Each unit is assigned a unique address for communications. This is particularly common for powder diffraction experiments where large numbers of heads may be used simultaneously.

- Custom cables to "daisy-chain" multiple electronics modules are also available to order.
- Custom built arrays of heads in a single housing can be constructed to order.

Which scintillator material should I use?

Oxford Danfysik offers three types of scintillation crystal: NaI(Tl), YAP and $LaCl_3$. Which one you decide to use is a compromise between count rate and energy resolution.

Light pulses from YAP decay very quickly compared to NaI(Tl), so it offers faster count rates. However when it comes to stringent energy resolution requirements, NaI would be the scintillator of choice.

So for energy resolution NaI has the advantage whilst for higher count rates YAP is desirable; $LaCl_3$ offers a compromise of the two parameters.

Note: YAP low energy performance is impaired due to the lower efficiency of conversion; typically 5keV should be considered a minimum workable energy for this material.

	Count rate	Energy resolution		Energy Range
		5keV	22keV	
NaI(Tl)	1Mcps	65%	30%	5-100keV
$LaCl_3$	2.5Mcps	70%	25%	5-100keV
YAP	3.5Mcps	100%	45%	10-100keV

How fast will the detectors count?

Count rates will be affected by the experimental conditions and synchrotron bunch structure, however in theory the following maximum count rates can be expected:

NaI(Tl): 1Mcps
$LaCl_3$: 2.5Mcps
YAP: 3.5Mcps

How can I use the scintillation counter?

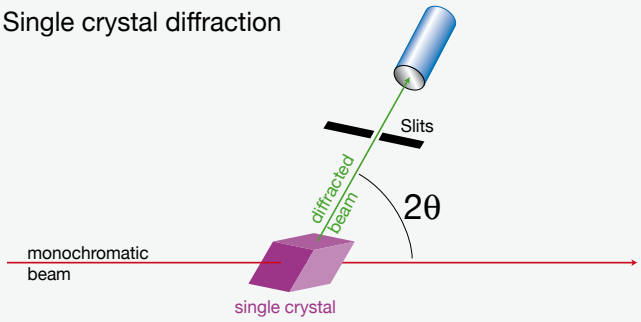
A range of typical experiments is shown below. If there is a need to cover a larger solid angle then multiple detectors can be used. The narrow (CBY12) detector head may be useful in crowded experimental areas or can be used in multiples where the larger aperture (CBY48) head would perhaps limit positional information. Vacuum adaptors are also available.

What thickness of scintillation crystal should I choose?

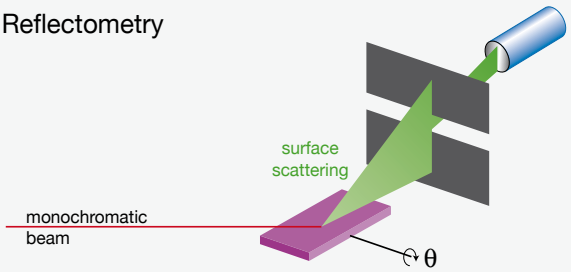
In practice the thickness has little effect, and the heads can be used over a wide range of energies; please see our table of absorption versus energy for various crystal thicknesses. If the crystal is thinner than ideal for a particular energy then some X-rays will penetrate the crystal and not be converted into visible light (so there is an apparent counting loss,) if the crystal is too thick then the light produced has to go through a greater thickness of crystal before entering the PMT.

	Thickness (mm)		
	1	2	5
99% absorption	20keV	30keV	90keV
90% absorption	30keV	80keV	120keV
80% absorption	70keV	95keV	150keV

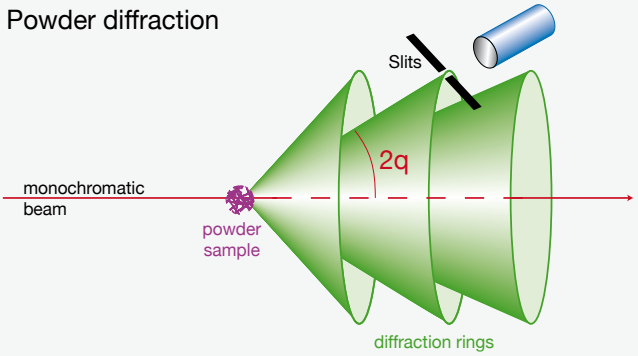
Single crystal diffraction



Reflectometry



Powder diffraction



Intensity or polarisation monitor