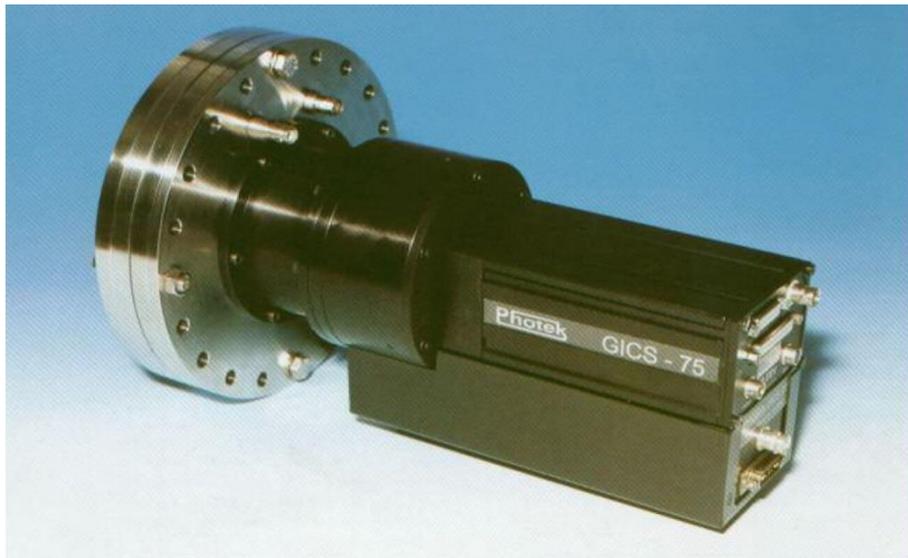


VACUUM COMPATIBLE DETECTORS



FEATURES

- Custom CAD Designed
- Ultra High Resolution
- Optional MCP Gating to 8 ns
- 18, 25, 40, 75 and 150 mm active diameter
- Choice of Flange Size
- Phosphor Screen or Electrical Output
- Optional TOF Module with Phosphor Screen
- Resistive Sea Anode Options
- Manufactured in Europe
- Integrated Detector Systems
- High Calibrate Design Team
- Ultra High Speed
- Detection of Molecules, fragments, ions, antimatter, neutrons, leptons, hadrons photons etc.

APPLICATIONS INCLUDE

- Mass Spectroscopy
- Electron Microscopy
- VUV Imaging
- Space Telescopes
- Fusion Research
- Nuclear Physics
- Field Ion Microscopy
- Measurement of Chemical Bond Strength
- Low Temperature Physics
- Synchrotron Radiation
- Photon Ionisation
- Molecular Disassociation

INTRODUCTION

Photek is a small company of dedicated scientists and engineers engaged in designing, manufacturing and selling detectors to meet specific customer requirements. We have designed and build custom detectors for many of the major laboratories in Europe and overseas.

Photek detectors are used to measure picosecond, nano-degrees Kelvin, anti-proton fluxes, molecular spin etc: the diversity is quite extraordinary. The following photographs and text gives some indication of the capabilities of Photek to design and manufacture custom detectors for vacuum environment.

The Photek Vacuum Imaging Detector (VID) is an open face detector without a photocathode. It is designed to be mounted into or onto a vacuum chamber. The VID is designed to detect charged particles, UV photons and neutrons. It is available with either a phosphor screen, solid anode or resistive sea which provides re-configurable anode options. The phosphor screen can also include a time of flight module which provides timing response to 5 ns. Typical applications include electron microscopy, nuclear physics research and VUV imaging.

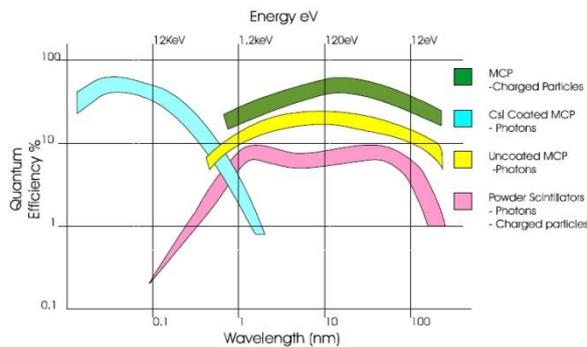
Photek Limited

26 Castleham Road, St Leonards on Sea,
East Sussex, TN38 9NS, United Kingdom.
T: +44 (0)1424 850555 F: +44 (0)1424 850051
E: sales@photek.co.uk W: www.photek.com

Exclusive sales Agent

GIDS-GmbH
Julius-Hatry-Str. 1
D-68163 Mannheim
T: +49 (0)621-820394-34 F: +49 (0)621-820394-33
E: info@gids-gmbh.com W: www.gids-gmbh.com

RESPONSIVITY OF VACUUM COMPATIBLE DETECTORS



The basic detector element is a microchannel plate (MCP). This is fabricated from a microtubular matrix of secondary electron emissive glass, and responds well to electrons and other charged particles. The approximate responsivity, collated from various published sources, is shown in Figure 1.

Figure 1- Responsivity of MCP (Multichannel Plates) for Photons and Charged Particles

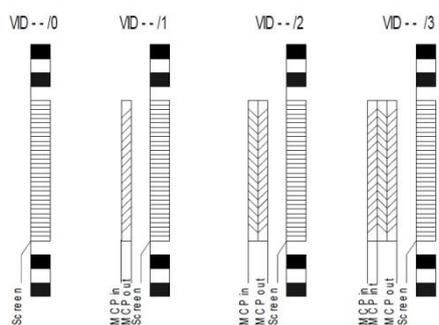
The exact response depends upon many parameters including the angle of incidence of the charged particles and the history of the MCP. MCP vacuum baking sometimes reduce the responsivity but also reduce the noise generated by these detectors.

CsI coating will enhance the responsivity of an MCP, but as this is chemically reactive to moisture, it may be unsuitable for application where the detector has to be repeatedly exposed to air.

Powder scintillators are normally used to convert the electron output of microchannel plates to an optical output in Vacuum Imaging Detectors. Table 1 shows the time response and optical output of common powder scintillators.

Type	Colour	Peak Emission	Decay Time to 10% Brightness	Efficiency (Lumens per Watt)
P11	Blue	446	50 μ s	10
P20	Yellow/Green	540	50 μ s - 10 ms	30
P31	Green	550	40 μ s	25
P43	Green	548	1.2 ms	50
P45	Red Enhanced White	-	1.4 ms	20
P46	Yellow/Green	530	160 ns	7
P47	Green	410	80 ns	2.3

Table 1- Phosphor Characteristics



VACUUM IMAGE DETECTORS

Photek holds stocks of 12, 18, 25, 40 and 75 mm active diameter MCPs and fiber optic screen assemblies. The general schematic is shown in Figure 2. In double MCP or triple MCP setups the assembly is possible with middle electrode between the MCPs. This allows the individual High Voltage supply of each MCP.

Figure 2 – Vacuum Image Detector Schematic



A Typical assembly, VID240 is shown in Figure 3. This particular device is designed for UV spectroscopy, and uses a 40/25 fiber taper outside the vacuum for connection to a linear diode array.

Figure 3 – Vacuum Image Detector 340 (Radial Connectors)



Photek manufactures a wide range of image intensifiers, and the metal-ceramic bodies of these devices are often used as the basic for the Photek range of Vacuum Compatible Detectors. Figure 4 shows a bare image intensifier adapted to be mounted on a vacuum manipulator M3 screw connector with flying leads and operated as a beam finder.

Figure 4 – Bare Image Intensifier (VID125 & Flying Leads)



Image Intensifier bodies can also be mounted directly onto a vacuum flange as shown in Figure 5. The device illustrated is part of an ultrahigh resolution photon counting UV imager with resolution of 40 lp/mm.

Figure 5 – High Resolution UV Imager VID325 (Connected to CF flange assembly for transport)

The inherent resolution of a scintillator screen on its own is typically 75 lp/mm. With one MCP this is reduced to 30-40 lp/mm, but a gain of approximately 10^4 is achieved; with 2 MCPs, resolution is in the range of 20-30 lp/mm but the gain in the range of 10^5 to 10^7 is possible.

The gain and temporal response of the detector depends on the phosphor screen selected of which characteristics are shown in Table 1.

Readout Systems

Vacuum Image Detectors convert particles and high energy photons into visible images. This in turn can be converted into quantitative data by utilizing a solid state detector such as a diode array or CCD camera. As Photek does not manufacture these items, we are pleased to sell our detectors on their own, or coupled to a readout system selected by the customer, with or without a frame grabber and image processing software.

Considerable experience of integrating cameras by EG&G, EEV, CIDTEC, Philips and SONY, has been gained. These devices mostly give an analogue TV signal and Photek can also provide A-D conversion electronics with or without photon/particle event software, and appropriate centroiding. Centroiding option allows this resolution of Vacuum Image Detectors to be enhanced to 3080 x 2304 pixels in the photon counting mode.

Our GM-MCP and GM-MAG gate modules enable our Vacuum Image Detectors to provide time resolved images with frame exposure time down to about 8 nanoseconds.

RESISTIVE ANODE

This is the ideal readout for very low count rates, on systems requiring an X-Y address as well as event timing information. A two dimensional resistive sheet encoder, specially terminated at the edges to reduce distortion, enables accurate charge cloud centroiding to be carried out by taking the ratio of the output signals from the four corners. Essentially this is a Ultra High Vacuum (UHV) version of the Image Photon Detector IPD), and is sensitive to charged particles and UV photons. It can, therefore, be used for field ion microscopy and mass spectroscopy where time of flight gives information on mass and molecular spin.



The Photek IPD processing electronics and image processing system are compatible with this detector. The support electronics encodes positions to a 512 x 512 of elements and operates at count rates up to 10^5 counts/second. As events positions are calculated in real time excellent spatial and temporal resolution can be attained. Figure 6 shows a 40 mm resistive anode detector with ancillary head electronics build for high resolution VUV spectroscopy.

Figure 6 - 40 mm Resistive Anode Detector Assembly with Preamplicifiers

VACUUM PHOTOMULTIPLIERS

These devices often described as Time of Flight (ToF) Detectors gives better temporal resolution than dynode electron multipliers or channel electron multipliers. The anode is designed with a matched con structure to give sub-nanosecond pulses from single photons or particles into a 50 Ohm cable.

Our pre-amplifier PA 200-10 and discriminator electronics enable these devices to be connected to sampling scopes, or to provide event counting at rates up to 400 MHz. Smaller devices are faster because the electrical signal has a shorter distance to travel, they have a lower capacitance (and thus shorter CR time constant). Typical performance parameters are shown in table 2.

	10 mm Diameter	13 mm Diameter	25 mm Diameter	40 mm Diameter
Rise Time	70 ps	100 ps	250 ps	500 ps
FWHM	150 ps	250 ps	500 ps	1000 ps
3DB Frequency Response	1600 MHz	750 MHz	500 MHz	250 MHz
Transit Time Jitter	~ 15 ps	~ 15 ps	~ 50 ps	~ 100 ps

Table 2 – Typical Performance Parameters for VPMT

MULTIPIXEL PARALLEL READOUTS

Multi-anode devices are sometimes required for high speed parallel channel detection. These are often designed to customer specific requirements; equal area concentric rings for Fabry-Perot interferometry are an example. Photek has designs that are in regular production, and are shown in Figure 7.

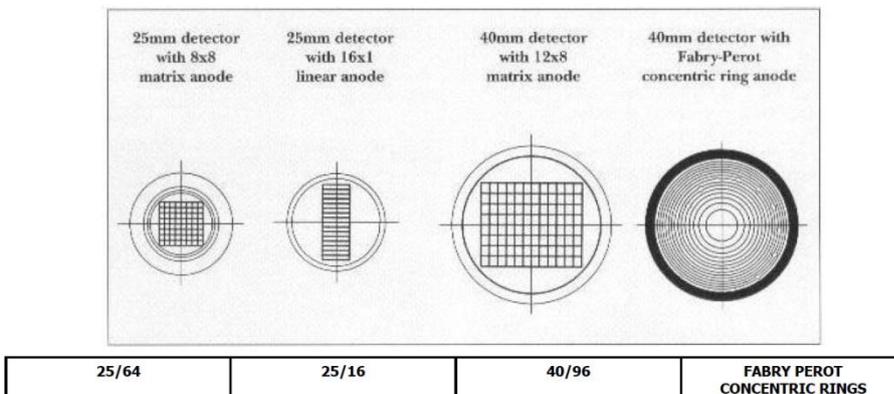


Figure 7 Multi-Anode Design

POWER SUPPLIES

Photek can supply a range of high voltage power units and systems compatible with its range of vacuum compatible imaging detectors. Photek Bench Power Supplies are offered with 1, 2 or 3 high voltage modules. Automatic "Ramp-Up", Interlock function to inhibit high voltage outputs and remote control via RS-232 interface is possible. The units may be used in conjunction with MCP gating modules for time slicing of electrons or ions.

MCP Gating Modules

For UHV detectors our GM-MCP and our GM-MAG gate module enables direct gating of the MCP to 8 ns. This is particularly useful when time slicing of electrons and ions is required. The gating modules work

SYSTEM INTEGRATION

Photek has all the capabilities for customizing and integrating them with cameras and other electronics to provide complete systems. Imaging Software IMAGE32 can also be supplied.

AVAILABILITY OF FLANGES AND DETECTORS

CF flanges are based on the established conflate design in which a precision OFHC copper gasket is captured between two knife edges sealing surfaces. The vacuum interface devices are also available mounted on ISO and other "O" ring sealed flanges with an equivalent tabulation to the CF mounted detectors.

FLANGE SIZES	DETECTORS								
	KEY: ●	AVAILABLE ON REQUEST			⊙	STANDARD	X	NOT AVAILABLE	
	VID 12	VID 18	VID 25	VID 40	VID 75	VPM 8	VPM 12	VPM 25	VPM 40
COPPER SEALED									
CF38 (70 MM OD)	⊙	⊙	X	X	X	⊙	X	X	X
CF64 113.5 MM OD	●	⊙	⊙	X	X	●	⊙	X	X
CF100 151.6 MM OD	●	●	●	⊙	X	●	●	⊙	X
CF150 202.4 MM OD	●	●	●	●	⊙	●	●	●	⊙
CF200 202.4 MM OD	●	●	●	●	●	●	●	●	●
CF250 305 MM OD	●	●	●	●	●	●	●	●	●

Photek Limited
 26 Castleham Road, St Leonards on Sea,
 East Sussex, TN38 9NS, United Kingdom.
 T: +44 (0)1424 850555 F: +44 (0)1424 850051
 E: sales@photek.co.uk W: www.photek.com

Exclusive sales Agent **GIDS-GmbH**
 Julius-Hatry-Str. 1
 D-68163 Mannheim
 T: +49 (0)621-820394-34 F: +49 (0)621-820394-33
 E: info@gids-gmbh.com W: www.gids-gmbh.com