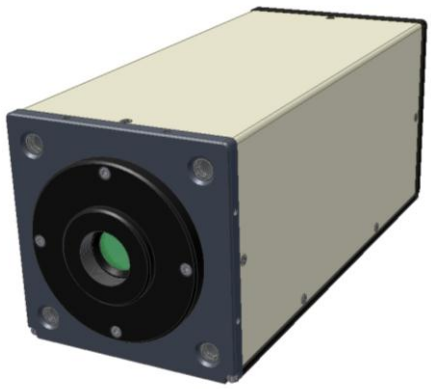
IPD3 Camera

Features

- Extreme sensitivity with single photon counting capabilities
- 18mm 25mm and 40mm intensifier options
- Variety of photocathode's
- Cooled housing option



Applications

- Bio and chemiliminescence
- Measurement of Aequorin , Luciferase & ATP
- Analysis of micro titre plates
- Multiple wavelength imaging
- Missile warning
- Astronomy
- Autoradiography

General Description

The Image Photon Detector (IPD) System , now in is 3rd generation is a true single photon counting system which offers the ability to capture and integrate an image in real time Unlike our HRPCS systems, the IPD detector is a serial device. It is capable of measuring only one event at a time and has the ability to record the arrival time of the event to nano-second accuracy.

Principle of Operation

The IPD3 camera uses Photek's Image Photon Detector (IPD) as the primary method of photon amplification in conjunction with a propriety electronic readout system.

- Incident photons pass through the input window and hit the photocathode.
- Photoelectrons are released from the photocathode and are accelerated by a potential field to the micro-channel plate.
- The photoelectron is amplified by a factor of 10^7 by the stack of MCPs. The actual gain of the detector can be adjusted by varying the voltage across the MCPs.
- The cloud of electrons emitted from the MCP is collected an anode.
- The IPD detector normally used a resistive anode which has for corners labelled A,B,C and D. Depending on the position of the event charge is proportionally split to each of the outputs (other anodes are available on request).
- Signal from the anode is then amplified by four separate charge sensitive amplifiers and a discriminator before being digitised and processed.

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Data Interfaces

The IPD camera can be connected to a PC computer via a USB-2 Interface. Data processing, image display and manipulation is provided by Photeks IFS32 software. The IPD camera is capable of operating in standalone mode where XY data is also presented as two analog voltage which can be connected directly to an X,Y oscilloscopes to provide a real time display should this be required.

Software

IPD3 systems are provided with Photek IFS32 software. This provides tools for both data acquisition and analysis.

- A live display shows integrated data in real time.
- Count rate trend graph shows how count rate changes over time
- XY time information can optionally be saved to disk and tools are provided to analyse this data.
- A sophisticated scripting language based around GTK-LUA has been incorporated allowing users to customise the data acquisition and analysis processes.

Drivers compatible with LabView 8.0 and above can also be provided

IPD System Highlights

- Because of the serial nature of the IPD detector there is no inherent frame rate limitations normally associated with CCD cameras. The IPD system is inherently noise free. The only source of noise is the dark noise from the photocathode and for applications where this is particularly important it can be controlled by cooling.
- The IPD has a very high dynamic range and is capable of detecting count rates 50,000 cps in a 1mm2 area. Special high output technology (HOT) MCPs are available to extend this further should this be necessary.
- Long Integration time with real-time image display during integration is possible. This means it is not necessary to define an integration time prior to the start of the experiment. Also, data acquisition may be stopped at any time either when enough data has been acquired or if it is clear that an experiment is not providing the expected results.

Applications

There are a number of application areas for the IPD system ranging from luminescence and fluorescence to missile detection and tracking to detection of x-rays and particles.

- The IPD is ideal for detecting ultra low level signals from engineered cells using Aequorin or Luciferase. It is not uncommon for integration to last for many hours or even days. Flash responses either from thermal or chemical stimulation can accurately be recorded. For plant scientists it is possible to watch plant growth and to monitor circadium rhythms.
- One of the main advantages of the IPD camera is its ability to timestamp every detected event. This camera is ideal for measuring ultra low level fluorescence decay in the microsecond to millisecond range and works by repeatedly cycling a stimulation/detection process and integrating data. Based on XY time information two or three dimensional representations of the experiment are possible.
- Another popular application for the IPD system is in tracking applications such missile warning systems. In this case, the detector is fabricated with a special photocathode which only responds to the UV part of the spectrum.
- The IPD detector is normally provided with a fused silica input window, however, a fibre optic input is also available and allows direct contact imaging of a sample (which significantly increases the light collection efficiency) or coupling of scintillators for applications such as such as x-ray imaging and beta autoradiograph.

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- Custom versions of IPD detector with a special anode known as the "wedge and strip" anode have been developed for NASA space projects.

IPD System / HRPCS System Feature Comparison

Feature	IPD System	HRPCS System
Single Photon Counting	✓	✓
Live Display	✓	✓
Coincident event	×	✓
Count rate trend Graph	✓	✓
High count rate point source	✓	×
Frame rate	-	100fps max
Bright Field Mode	×	✓
Time tag resolution	10ns	10ms
Real time analogue outputs	✓	×
Electronic ND Filter	×	✓
External Triggering	×	✓
Interface	USB-2	IEE1394/RS 232
Geometric Distortion	Dependant on anode	Minimal

Camera Specifications

Size	18mm, 25mm and 40mm diameter
Input windows	Fused Silica or Fibre Optic
Photocathode	Solar Blind, Bialkali, LNS20 and S20
Anode	Resistive Anode, Wedge and Strip Anode, Capacitive Coupled Anode

Performance Specifications

Spectral Response

Solar Blind	180- 300nm
Bialkali	180 - 500nm
LN S20	180 - 700nm
S20	180 - 900nm

Dark Noise

Solar Blind	<2cps/cm2
Bialkali	<10cps/cm2
LNS20	<50cps/cm2
S20	<2000cps/cm2
	<20cps/cm2 when cooled to -30C

Limiting Resolution

18mm	20 lp/mm Typical
25mm	15 lp/mm Typical
40mm	12 lp/mm Typical

Image Size

Default Size 512x512, fully scalable to 2048x2048. Window readout and image rotation also available

Count Rate

Event to event time 300ns min
Flat field count rates linear to 200,000 cps
Point source count rates (1mm^2) linear to 50,000 cps

Optional Accessories

Cooled housing and PTC6 temperature controller
DB2 Dark Box
Peltier temperature controlled stage and PTC6 temperature controller
LED Illumination

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