FEMTOWATT NON-VACUUM TUBE DETECTOR ASSEMBLY

BACKGROUND

[0001] Photomultiplier tubes (PMTs for short), members of the class of vacuum tubes, and more specifically vacuum phototubes, are extremely sensitive detectors of light in the ultraviolet, visible, and near-infrared ranges of the electromagnetic spectrum. Unfortunately, current techniques of manufacturing PMTs is a tedious and costly process. Many manufacturers have opted to stop production of PMTs due these challenges. In addition to manufacturing issues, although highly sensitive, PMTs also saturate easily when too much light reaches it.

SUMMARY

[0002] At least some of the disadvantages associated with the prior art may be overcome by at least some embodiments of the devices and methods described herein.

[0002a] According to a first aspect of the present invention, there is provided a device comprising: a plurality of photodiodes; an analog amplification system comprising at least a high gain transimpedance amplifier (TIA) and at least a buffer on each of said photodiodes, followed by a fully differential amplifier to combine the outputs of the multiple TIAs; a digital acquisition system comprising at least one analog to digital converter (ADC), followed by a programmable processor, which is linked to a central processor as well as on board memory; and at least one shaped reflector to direct light to at least one of said photodiodes, wherein the shaped reflector comprises at least an opening that allows a sample to be lowered into position for analysis in a cavity defined at least in part by the shaped reflector.

[0002b] As disclosed, there is provided a method of optical signal detection.

[0002c] As disclosed, there is provided a device for optical signal detection.

[0003] As disclosed, a femtowatt sensitivity optical detector is provided using one or more photodiodes, intended as a replacement for the photomultiplier based photon counting unit.

[0004] In one embodiment, the system is comprised of four main components: Multiple photodiodes, which act as optical transducers by producing an electrical signal in the

WHAT IS CLAIMED IS:

1. A device comprising:

a plurality of photodiodes;

an analog amplification system comprising at least a high gain transimpedance amplifier (TIA) and at least a buffer on each of said photodiodes, followed by a fully differential amplifier to combine outputs of multiple TIAs;

a digital acquisition system comprising at least one analog-to-digital converter (ADC), followed by a programmable processor, which is linked to a central processor as well as on-board memory; and

at least one shaped reflector to direct light to at least one of said photodiodes, wherein the shaped reflector comprises at least an opening that allows for a sample to be lowered into position for analysis in a cavity defined at least in part by the shaped reflector.

2. The device of claim 1 further comprising a mechanical housing module of the analog amplification system are contained.

3. The device of claim 1 wherein the programmable processor implements the data acquisition algorithm.

4. The device of claim 1 further comprising multiple digital-to-analog converters (DACs) on the programmable processor configured to provide feedback control.

5. The device of claim 4 wherein one of said DACs is configured for offset adjustment in the differential amplifier, and one of said DACs is configured to set a reference level of the ADC.

6. The device of claim 1 wherein the shaped reflector has a semi-hemispherical shape.

7. The device of claim 4, wherein one of the DACS is configured for offset adjustment in the differential amplifier.

8. The device of claim 4, wherein one of the DACS is configured to set a reference level of the ADC.

9. The device of claim 4, wherein one of the DACS is configured for offset adjustment in the differential amplifier.

10. The device of claim 4, wherein one of the DACS is configured to set a reference level of the ADC.