

## Wide-field single-molecule fluorescence detection by hybrid photo-detectors (HPDs)

Atsuhito Fukasawa<sup>1</sup>, Gaku Nakano<sup>1</sup>,  
Takayasu Nagasawa<sup>1</sup>, Minako Hirano<sup>2</sup>, Toru  
ide<sup>3</sup>, Hiroaki Yokota<sup>2</sup>

1. Hamamatsu Photonics K.K.
2. Grad. Sch. Creation Photon Indust.
3. Grad. Sch. Nat. Sci. Technol.,  
Okayama Univ.

314-5 Sihimokanzo, Iwata, Shizuoka, Japan

E-mail : [fukasawa@etd.hpk.co.jp](mailto:fukasawa@etd.hpk.co.jp)

**KEY WORDS: HPD, SINGLE MOLECULE FLUORESCENCE**

### 1. WIDE-FIELD SINGLE-MOLECULE FLUORESCENCE DETECTION BY HPDs

In recent years, high-speed single photon counting has become an important technique to observe fast phenomenon in various fields such as biology, physics and chemistry. Hybrid Photo-Detector (HPD) [1] is a superior candidate for high-speed single photon counting. The HPD consists of a photocathode, an avalanche diode (AD) attached on a ceramic carrier with output pins, and a cylindrical ceramic sidewall. A schematic diagram and an external view photograph of HPD are shown in Figs. 1 and 2, respectively.

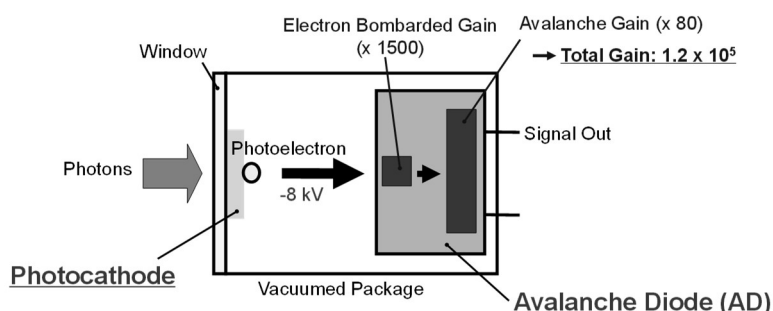


Figure 1: Schematic diagram of HPD



Figure 2: External view of HPD

We will report our latest development progress various HPDs such as a multi-channel HPD [2]. In addition, we will present some applications of the HPDs to biological single molecule fluorescence microscopy: wide-field sub-millisecond single-molecule fluorescence intensity detection and wide-field single-molecule fluorescence lifetime measurement with nanosecond temporal resolution. Trajectories of the target mobile single fluorophores attached to biomolecules were simultaneously monitored by an Electron Multiplying Charge-Coupled Device (EMCCD). These HPD based time-resolved single-molecule fluorescence detection provides us with a new approach to dynamics of mobile single biomolecules.

[1] A. Fukasawa et al., "High Speed HPD for Photon Counting," IEEE Trans. Nucl. Sci., vol. 55, No.2, April 2008 pp.758-762

[2] A. Fukasawa et al., Multichannel HPD for high-speed single photon counting, Nucl. Instrum. Methods Phys. Res. A 812, 184 (2016).