Development of Multi-Pixel Photon Counter

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1. Multi-Pixel Photon Counter (MPPC)

100 to >1000 micro APD pixels working in Geiger mode.

Characteristics of MPPC

- Excellent photon counting capability
- Compact package, simple readout
- Operation in a magnetic field

Application to HEP experiments

Scintillator+wavelength shifting fiber

Baseline photo-detector for near detector of T2K neutrino oscillation experiment (2009-)

Linear collider calorimeters

With light guide

Aerogel radiators

2. Tested sample

<table>
<thead>
<tr>
<th>Area (mm²)</th>
<th>1.0 x 1.0</th>
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</thead>
<tbody>
<tr>
<td>Pixel size (µm)</td>
<td>100 / 50</td>
</tr>
<tr>
<td>Number of pixel</td>
<td>100 / 400</td>
</tr>
<tr>
<td>Operation voltage (V)</td>
<td>69-70</td>
</tr>
<tr>
<td>Signal width (ns, typ.)</td>
<td>40 / 10</td>
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</tbody>
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3. Basic Performance

- 400pixel (50µm pitch) sample
- Measured in temperature controlled box with 15, 20, 25 °C

Gain

Noise rate

Cross-talk rate

4. Test with spot laser system

Inject pulsed laser (859nm, 50ps) onto a 100 pixel MPPC

3.1 Position dependence of efficiency in a micro-pixel

Efficiency distribution in one micropixel

3.2 Pixel to pixel dependence of gain/efficiency

Inject light on center of each pixel

Distributions for 10x10 pixels

5. Summary and Prospects

Basic functionality confirmed
Performance satisfactory for real experiments

From initial R&D establishing functionality
to practical use and wider application

Larger area
More number of pixels
Better photon detection efficiency
Long term stability
Quality control for mass production
Optics/coupling to radiator

Promising device for future photon detection!