The researchers (Microchannel-Plate-Based Large Area Photomultiplier Collaboration (MLAPC) in IHEP) designed a new type of MCP-PMT for JUNO (Jiangmen Underground Neutrino Observatory).

The small MCP unit instead of the large Dynode, the transmission and reflection photocathode were assembled in the same glass shell to form nearly $4\pi$ photocathode effective area to enhance the efficiency of the photoelectron detecting.

- MCP-PMT prototype technical issues mostly resolved;
- Successful 8” and 20” prototypes with normal performance;
- Three types of 8” prototypes;
- QE ~ 25%@410nm; CE ~ 60%; P/V of SPE > 2.0;
- Two types of 20” prototypes;
- QE ~ 22%@410nm; CE ~ 60%; P/V of SPE > 2.0;
- The better performance Prototype should be produced!
- QE ~ 35%@410nm; CE ~ 80%;

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The R&D of Large Area MCP-PMT in IHEP

The 8 inch Prototypes

<table>
<thead>
<tr>
<th>HV</th>
<th>Gain</th>
<th>QE@410nm</th>
<th>P/V</th>
<th>Rise Time</th>
<th>Fall Time</th>
<th>Dark rate @1E7 (0.25PE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2100V</td>
<td>~1E7</td>
<td>25%</td>
<td>-4</td>
<td>~1.3 ns</td>
<td>~3.8 ns</td>
<td>~3 kHz</td>
</tr>
</tbody>
</table>

The 20 inch Prototypes

<table>
<thead>
<tr>
<th>HV</th>
<th>Gain</th>
<th>QE@410nm</th>
<th>P/V</th>
<th>Rise Time</th>
<th>Fall Time</th>
<th>Dark rate @1E7 (0.25PE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000V</td>
<td>~1E7</td>
<td>22%</td>
<td>-3</td>
<td>~1.2 ns</td>
<td>~15 ns</td>
<td>~50 kHz</td>
</tr>
</tbody>
</table>

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