Photosensors Studies for gamma ray detection in space application

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for the

Universities & INFN Bari Group

Feb 5-6 2015 NASA GSFC
outlook

- People @ Bari
- Heritage
- Facilities
- On-going R&Ds
The group

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Professor Phd
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Expertise

Responsibilities in Tests and Space qualification of Fermi Silicon TKR system

Recent activities on photonsensors

Very low light sensitivity for imaging cerkenkov application

SuperB with MaPMTs

CTA with SiPMs

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The facility @ Bari

We have a fully equipped lab to perform different kind of photo-sensor characterization
• Very precise beam monitor,
• test @ very low light intensity
• Performance in magnetic field
Super B - MaPMTs for PID

H8500 inner structure

Photocathode

Focusing electrode

1st Dynode

2nd Dynode

3rd Dynode

Fully characterized Hamamatsu H8500 MaMPT discovering some interesting feature about transit time and gain uniformity

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Transit time vs collected charge

Charge distribution

<table>
<thead>
<tr>
<th>( x^2 / \text{ndf} )</th>
<th>1521 / 421</th>
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<tbody>
<tr>
<td>p0</td>
<td>61.32 ± 52.4</td>
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<tr>
<td>p1</td>
<td>1.489 ± 0.035</td>
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<tr>
<td>p2</td>
<td>2.026 ± 0.025</td>
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<tr>
<td>p3</td>
<td>307.9 ± 9.1</td>
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<tr>
<td>p4</td>
<td>94.57 ± 0.70</td>
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<tr>
<td>p5</td>
<td>41.16 ± 1.13</td>
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<tr>
<td>p6</td>
<td>234.6 ± 7.3</td>
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<tr>
<td>p7</td>
<td>142.1 ± 31.2</td>
</tr>
<tr>
<td>p8</td>
<td>96.94 ± 1.01</td>
</tr>
</tbody>
</table>
Charge map

Efficiency Rate map

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The SiPM matrix

A ad8k OPA based electronics has been designed for conditioning the signals from 16 3x3 SiPMs

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Electronic optimization

Matrice Low Pass HV=28V

Matrice High Pass HV=28V

Matrice 28V High Pass

Histo

Entries 3000
Mean 26.59
RMS 12.3

Amplitude distribution

AMPLITUDE DISTRIBUTION_CH3_29V

Counts

40u
The matrix with the laser

Laser pulse

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Conclusions

- Multichannel photonsers for imaging capability
- Vacuum tube vs solid state technology
- New PMTs (new cathode & new geometry) will be tested soon
- R&D on new sensor with Italian foundry is still on-going