MEG II experiment: 
Upgraded Liquid Xe Detector with SiPM
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1. MEG II experiment

MEG II experiment will search for cLFV decay \( \mu^+ \rightarrow e^+\gamma \) with 10 times better sensitivity than MEG. Discovery of \( \mu^+ \rightarrow e^+\gamma \) will be a smoking gun signal of new physics.

2. Upgrade of LXe \( \gamma \) detector

Liquid Xe (LXe) detector was successfully operated in MEG. LXe has an advantage of high scintillation yield (~75% of NaI), high stopping power (Xe=2.8cm), good uniformity and short decay time (45 ns).

In MEG II, we replace the 2-inch PMTs at the \( \gamma \)-ray entrance surface with 12x12 mm\(^2\) MPPCs.

3. Mass test of MPPCs

- Mass test in LXe

Operation test of ~600 MPPCs was done in LXe. We confirmed that the MPPCs and their signal transmission scheme (see below) work OK in LXe. Bad connection was found for ~5% of MPPCs and signal cables. Assembly procedure and connector design were revised.

- Test of all MPPCs in room temperature

All of the MPPCs (4092 pcs + spare) were tested in room temperature before installation. I-V curve measurement was performed for all chips on all MPPCs. Some of the chips were identified as “bad” due to unexpectedly high/low current. The fraction of bad chips was only ~0.2%.

We mounted good MPPCs on the final PCBs. Waveform of all the channels was measured with LED light. There were 3 bad pins on the PCBs was found and replaced.

4. Construction of the detector

- Signal transmission scheme

MPPC signal must be transmitted through a limited space of the cryostat. High density channels with small noise and small crosstalk is realized by using co-axial like structure PCB and PCB-based feed-through.

- Cryogenics

Cryogenics system is also being upgraded to cope with increased heat from 4092 MPPCs.

Additional GM refrigerator will be placed far from cryostat to prevent from noise. Sufficient power (450W @ 160K) of new GM refrigerator is already confirmed.

5. Summary & prospect

The MEG II experiment will search for the \( \mu^+ \rightarrow e^+\gamma \) decay with unprecedented sensitivity. All of the detectors are being upgraded, aiming to start the operation in 2017. We have developed VUV-sensitive MPPCs for the upgrade of the LXe \( \gamma \) detector. All of the MPPCs are tested and already installed into the cryostat. The energy and position resolution of the detector are expected to improve from MEG by a factor of 2.

We will complete the construction work and start the commissioning in this winter.

<table>
<thead>
<tr>
<th>MEG</th>
<th>MEG II</th>
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<tbody>
<tr>
<td>Position</td>
<td>~3 mm</td>
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<tr>
<td>Energy</td>
<td>~2%</td>
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Example of charge distribution with LED light.