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A Pixelated Positron Timing Counter with Fast Plastic Scintillator Readout by SiPMs for the MEG-II Experiment

The MEG experiment searches for the charged lepton flavor violation, $\mu \to e\gamma$ decay, with an unprecedented sensitivity which is expected to occur in the context of the new physics beyond standard models.
The upgrade of the experiment (MEG-II) is planned to improve the sensitivity by another order of magnitude with a higher beam intensity and improved detector performance.

The pixelated timing counter to precisely measure the positron time consists of several hundreds of small counters, each of which is a plastic scintillator plate readout by several SiPMs at both ends. The SiPMs at each end are connected in series to reduce the sensor capacitance and thus to make the waveform sharper for a better time resolution.

In the pixelated timing counter, the signal positron will pass through several counters.
A proper averaging of the measured positron times over the several hit counters will give an overall time resolution much better than the single counter resolution.
The overall time resolution is expected to be 30-35ps, which is almost twice better than that of the present timing counter.
The pixelated configuration will also help to suppress the pileup under the high rate environment in MEG-II.

The status and prospects of the R&D studies on this new timing counter are presented.
We optimized the configuration of the single counter and obtained a resolution of 50-70ps (RMS) for the single counter.
The beam test result with several counters will be also discussed. We obtained the expected good resolution with 8 counters.

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