Abstract
The MEG II experiment is designed to improve the sensitivity to the $\mu^+\rightarrow e^+\gamma$ decay by an order of magnitude, to be operational in the next years. A continuous muon beam in the world. After the conclusion in 2013 of the data taking with the first version of the detector, an upgrade (MEG-II) has been designed to improve by an order of magnitude the sensitivity, to be operational in the next years. A crucial component is the new pixelated Timing Counter (pTC) (Fig.1). It consists of 512 pixels (Fig. 2) of 3 different sizes. Each of them consists of a plastic scintillator tile and of two arrays of 6 SiPMs connected in series, attached at both sides, measuring the positron crossing time with an accuracy of 1/64 of the original (actually smaller due to losses in the fibers). The measured delays are corrected offline. For this reason, the delay versus the temperature has been measured (see Fig. 5).

Introduction
The MEG experiment, at the Paul Scherrer Institute (Switzerland), has searched for the $\mu^+\rightarrow e^+\gamma$ decay down to a Branching Ratio (BR) $5\times10^{-13}$, exploiting the most intense continuous muon beam in the world. After the conclusion in 2013 of the data taking with the first version of the detector, an upgrade (MEG-II) has been designed to improve by an order of magnitude the sensitivity, to be operational in the next years. A crucial component is the new pixelated Timing Counter (pTC) (Fig.1). It consists of 512 pixels (Fig. 2) of 3 different sizes. Each of them consists of a plastic scintillator tile and of two arrays of 6 SiPMs connected in series, attached at both sides, measuring the positron crossing time with an accuracy of ~90 ps. Combining those measurements together the positron time accuracy reaches ~30 ps.

The Calibration System of the pTC
In the pTC it is important to precisely synchronize all the counters. The counters are time-aligned by distributing synchronous light pulses to all the counters through optical fibers. To this goal, we have developed a laser calibration system shown schematically in Fig. 3. The fast light pulse is first split into two outputs: one to a photodiode to gauge the signal amplitude, the other as input to an active optical multiplexer remotely controlled with several output channels, such that the signal is output alternatively to each of them. Each output (except one used as a monitor) is then input to two cascaded stages of 1x8 optical splitters, each of which splits the input signal into eight signals of approximately equal output amplitudes. As a result, 64 channels become available in parallel with an amplitude 1/64 of the original (actually smaller due to losses in the various stages). Finally, each output signal from the last stage of the splitters is fed into a pixel through an optical fiber, fixed with a screw (see Fig. 4).

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The optical switches
An optical switch is an active device that can direct the signal injected in the input optical fiber to one of the outputs sequentially. The output channel can be selected remotely; in principle no reduction of the output is expected. An optical switch is a passive device that re-distribute the signal injected in the input fiber to all the output channels; the signal output is reduced at least by a factor of N. We used one switch with 8 outputs, followed by the cascade of two splitters 1x8, in order to get a total of 1/64 level of splitting. We investigated the performances of the switch in order to evaluate the intrinsic losses: the results are shown in Fig. 6. The 1x8 optical switch are made by Lightech. Inc. model MMC-18-A-EVEN-1-A-30CM-R-1 from Corning 50/125 μm multimode optical fiber. Each splitter is characterized in term of delay and in term of % of output power, as in Fig. 7. The measured delays are corrected offline. The Transmission is lower than 1/8=12.5% because of losses in the fibers and in the splitters but the light output is sufficient for the required precision.

Conclusion
We describe an approach to time calibration and monitoring of the pTC of the MEG II experiment based on a laser system. The sketch of the system is presented and results of the laboratory test of some subcomponents are shown to be compatible with the resolution requirements.

Design and test of the calibration system of the MEGII Pixelated Timing Counter
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Fig. 1. Timing Counter for measuring the positrons time of arrival

Fig. 2. A pixel with calibration optical fiber and the SiPM boards for different sizes.

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