GRAN SASSO SCIENCE INSTITUTE
CENTER FOR ADVANCED STUDIES INFN

MANGO EL PMT Analysis

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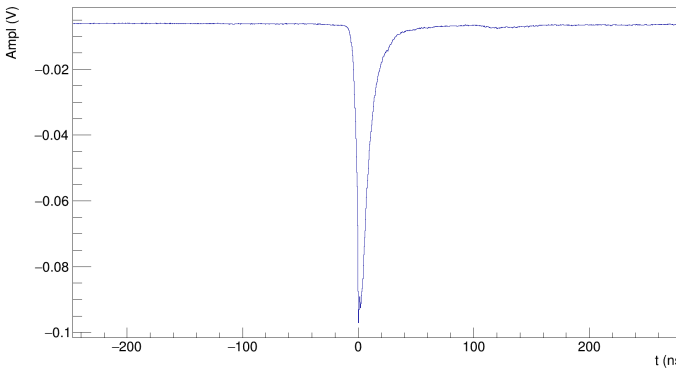
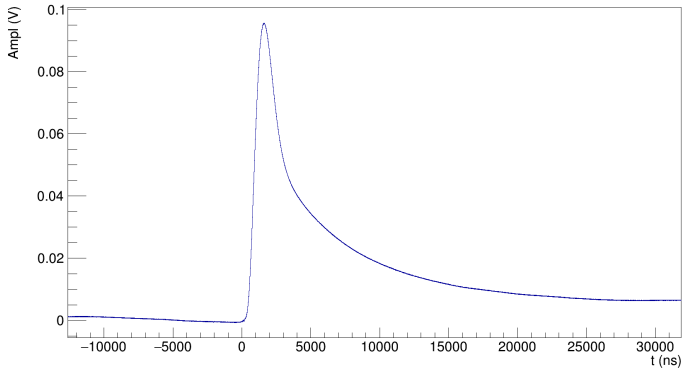
Data

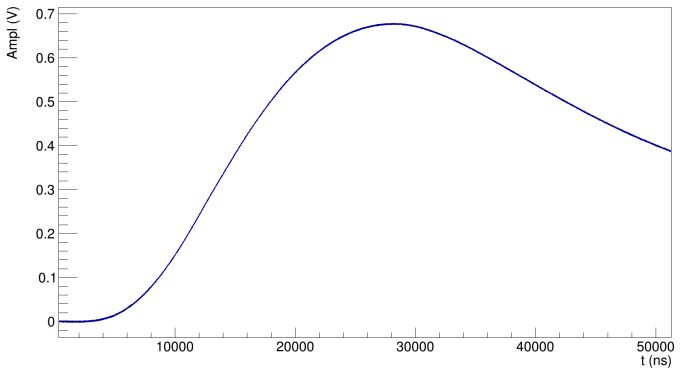
- Data available:

1. Many PMT waveforms for each kV/cm value
2. GEM waveforms obtained from shaper with shaping time 0,5 us
3. GEM waveforms obtained from shaper with shaping time 6 us

1. Avg waveforms 2. 3.







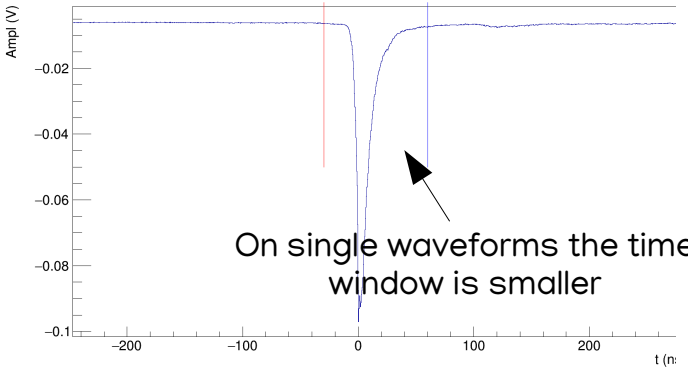
Analysis

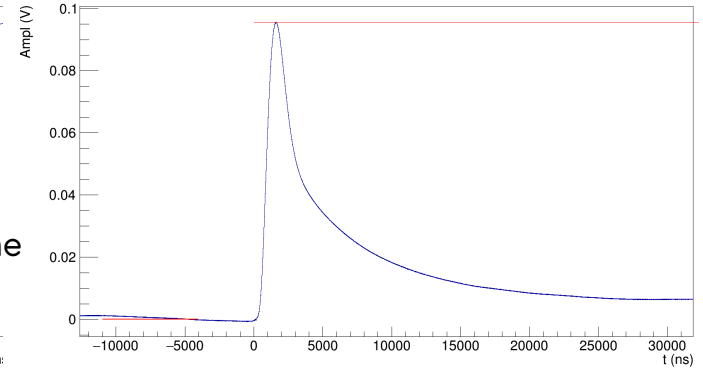
- Analysis were performed on single waveforms and average one also to reduce noise after an algorithm was reliably removing light noise and muons

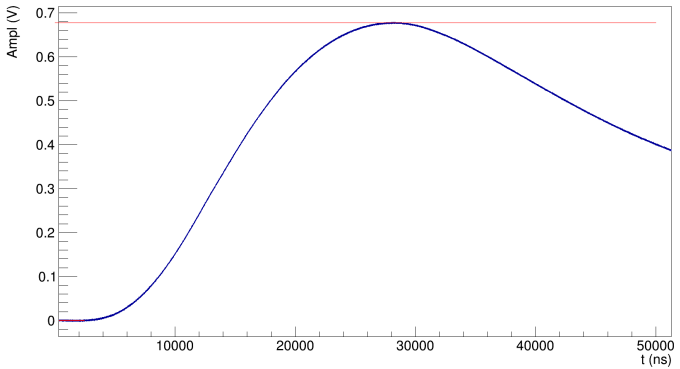
1. PMT beginning and ending of the track was found and the charge of the signal calculated

2. GEM baseline and highest peak were found to evaluate the charge

1. 2. 3.



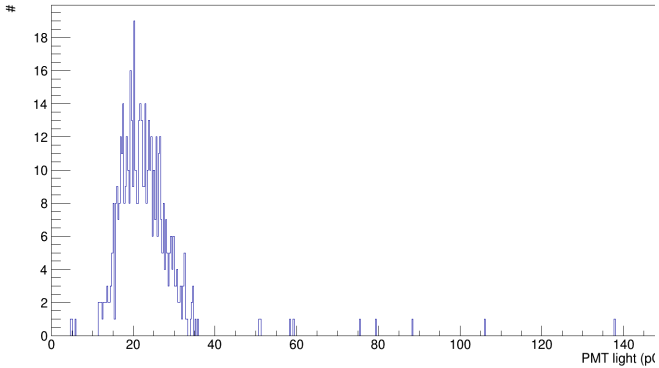




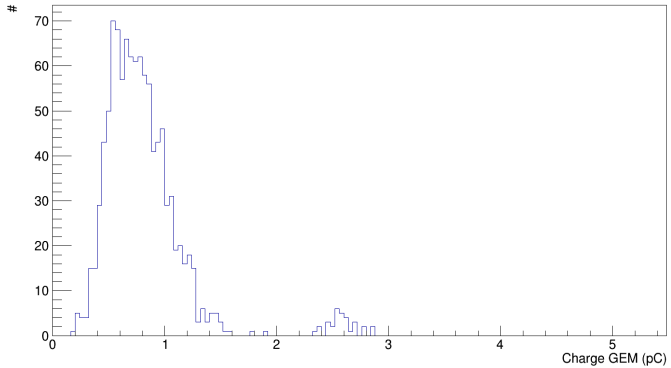
Analysis

- The same type of analysis was made on each waveform to obtain distributions of the variables and also directly on the average waveform

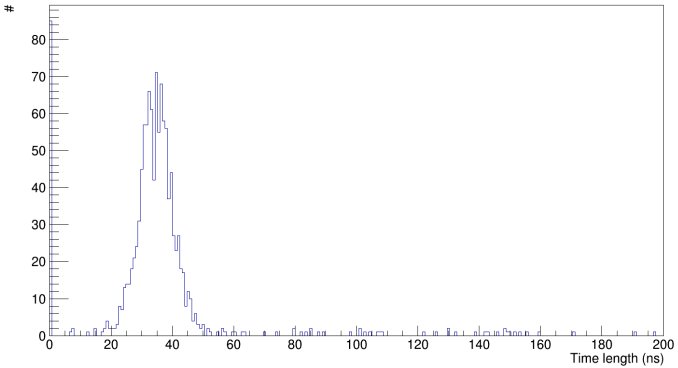
PMT light



GEM charge



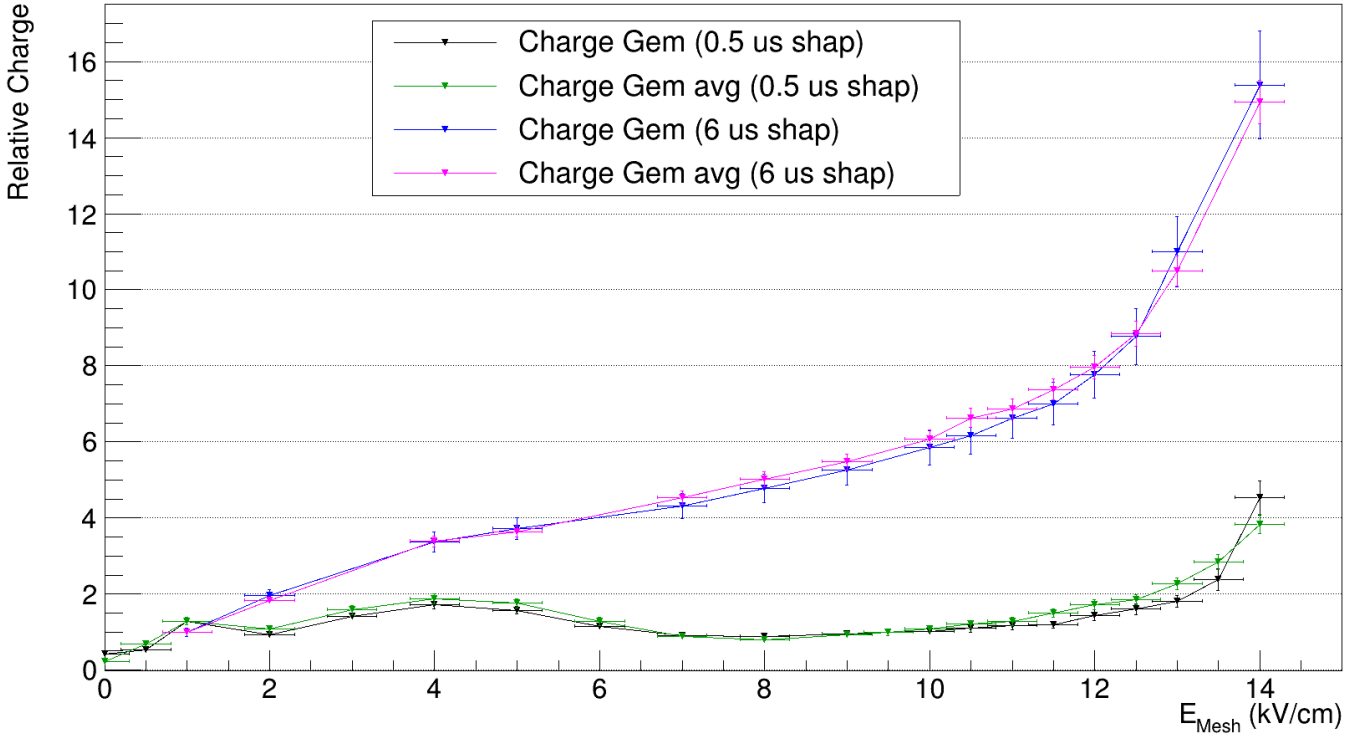
PMT time length



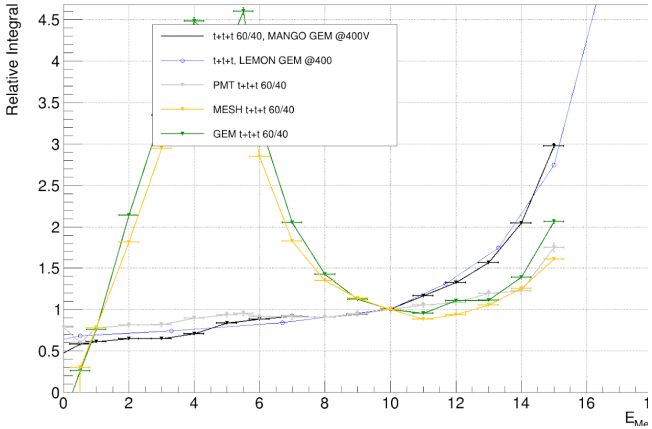
Charge Check

- The charge measured on average and obtained by the fit of the distribution is consistent

- Difference in shaping time is clearly visible:



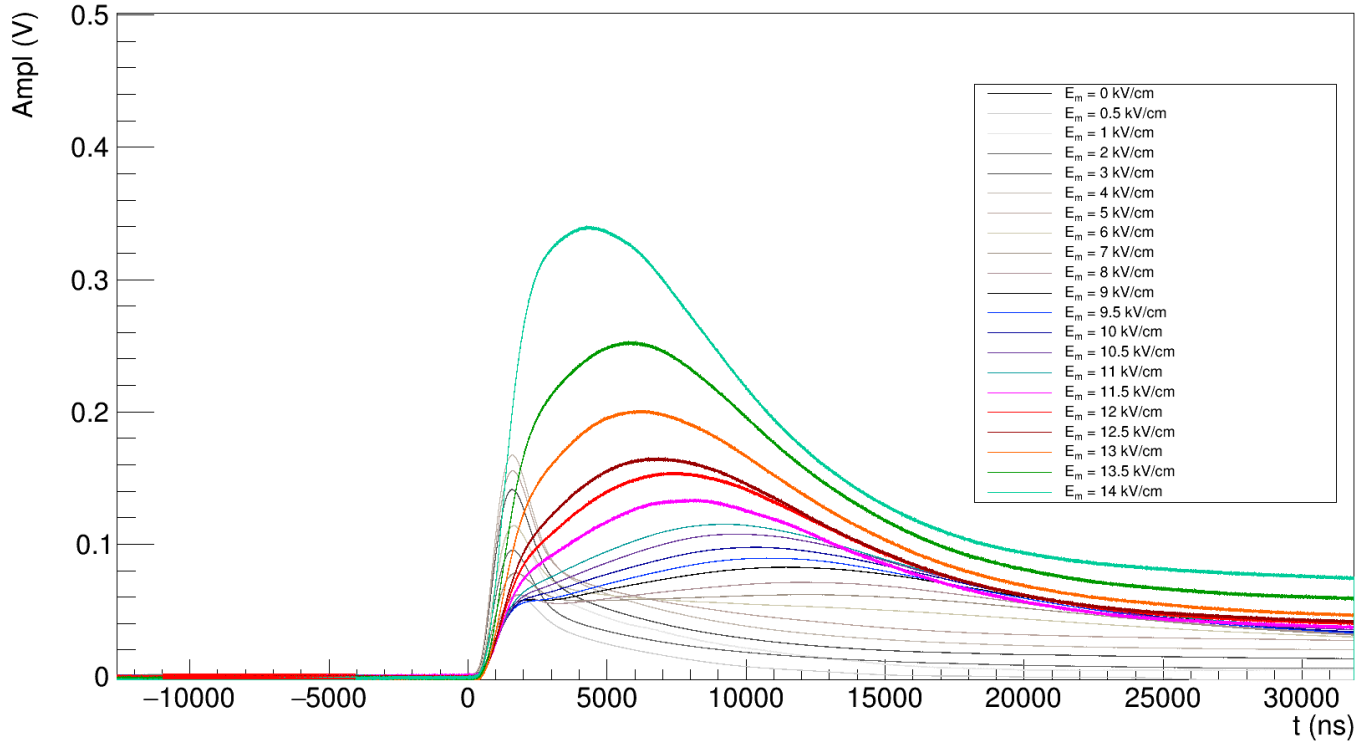
– 0,5 us keeps the fast part of the signal and suffers the same dependence on the drift velocity as the direct measurement taken in the past



– 6 us is integrating also more of the ion signal, but is it taking all or just the first portion that increases the waveform peak?

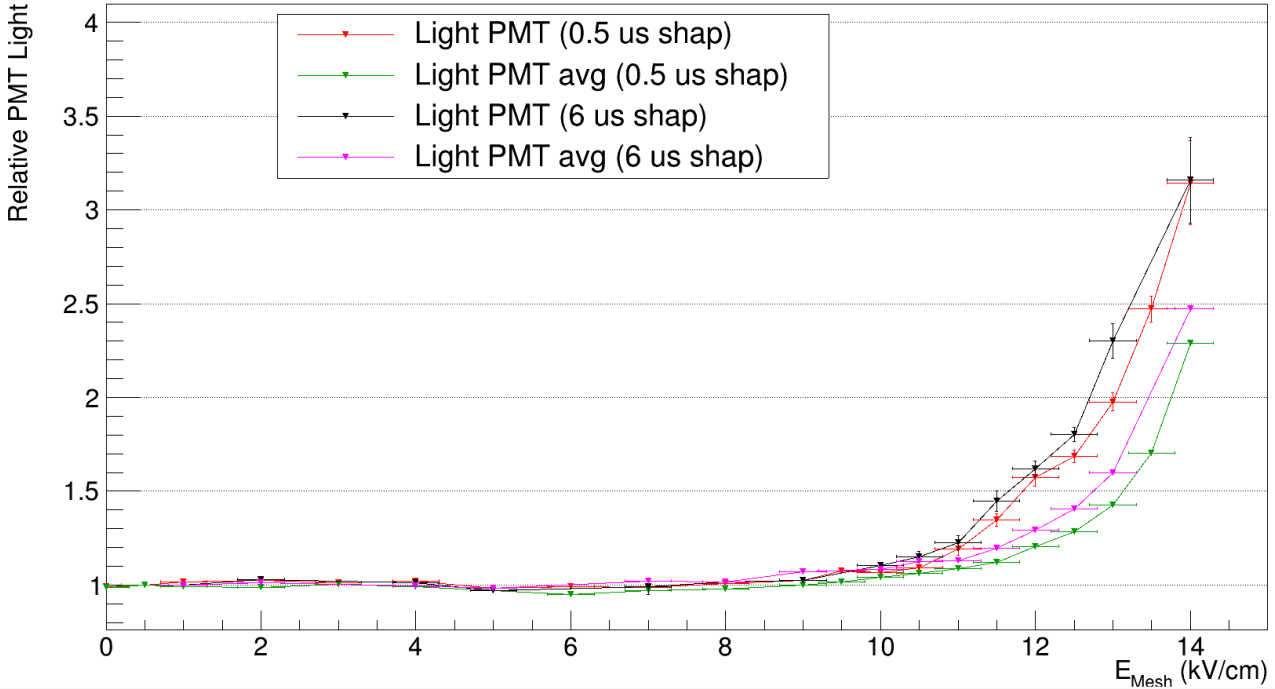
Charge Check

- Probably shorter shaping time is better
- However, the increased speed of ions at higher fields affects the signal consistently



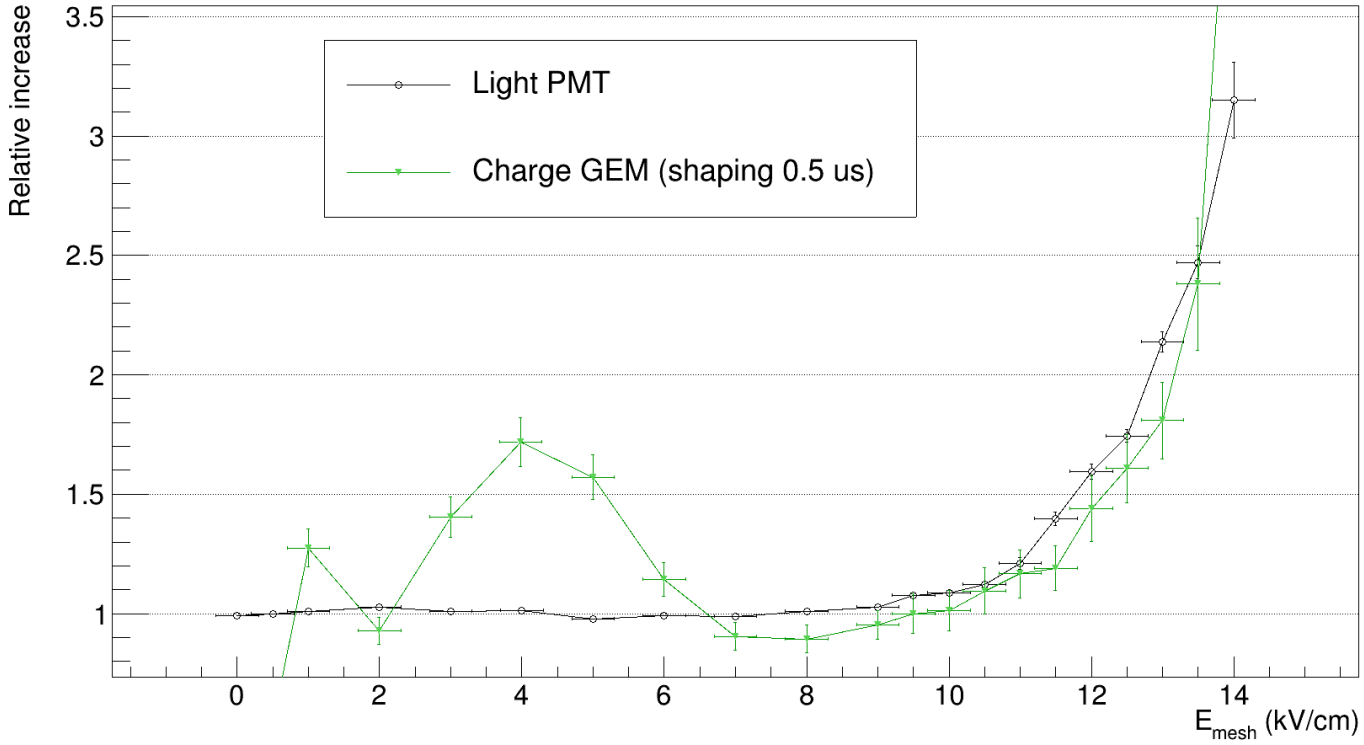
Light Check

- The light of the PMT is more affected by the averaging of the waveform
- Contours of the waveform harder to find by the algorithm used
- The values obtained by the histogram distributions are considered more reliable

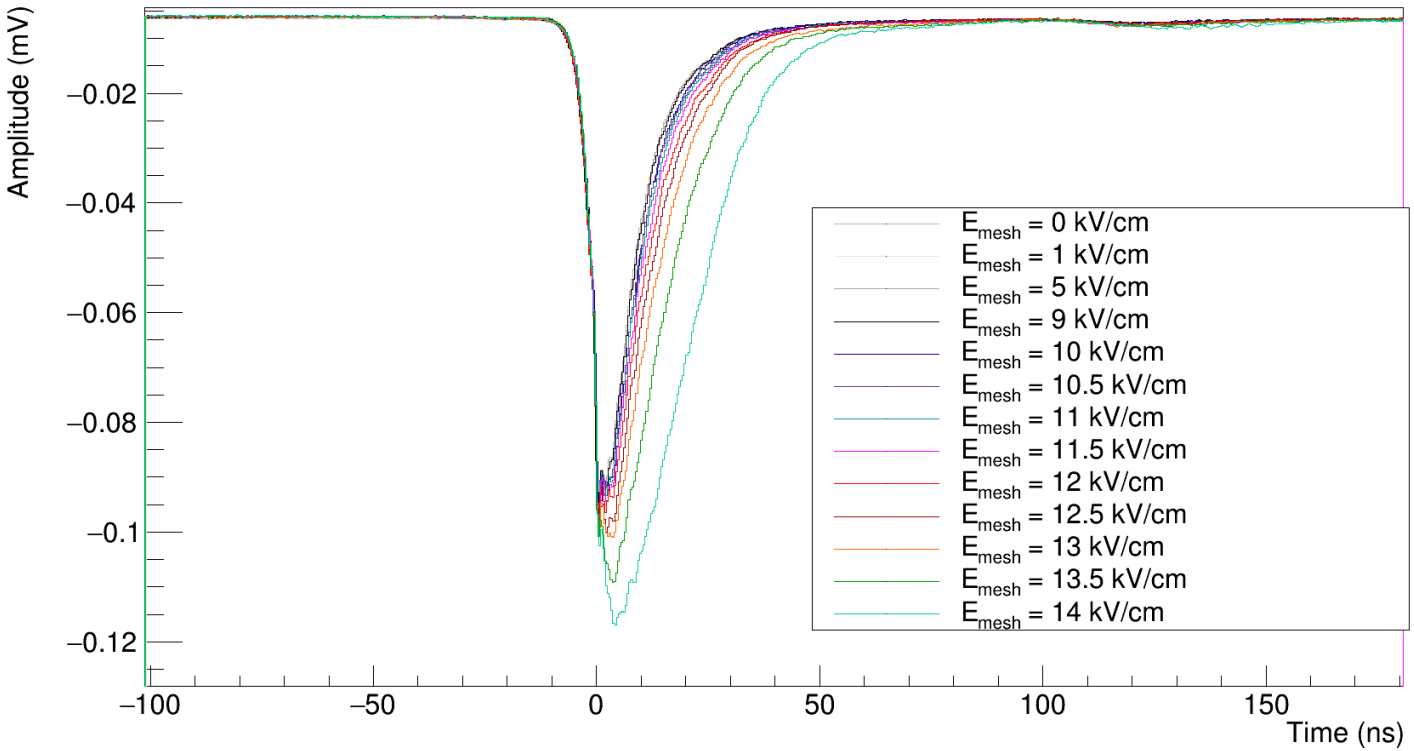


Light vs Charge

- The PMT light seems to have the typical behaviour with the charge following, even though it is very likely that the charge is overestimated from 8 kV/cm

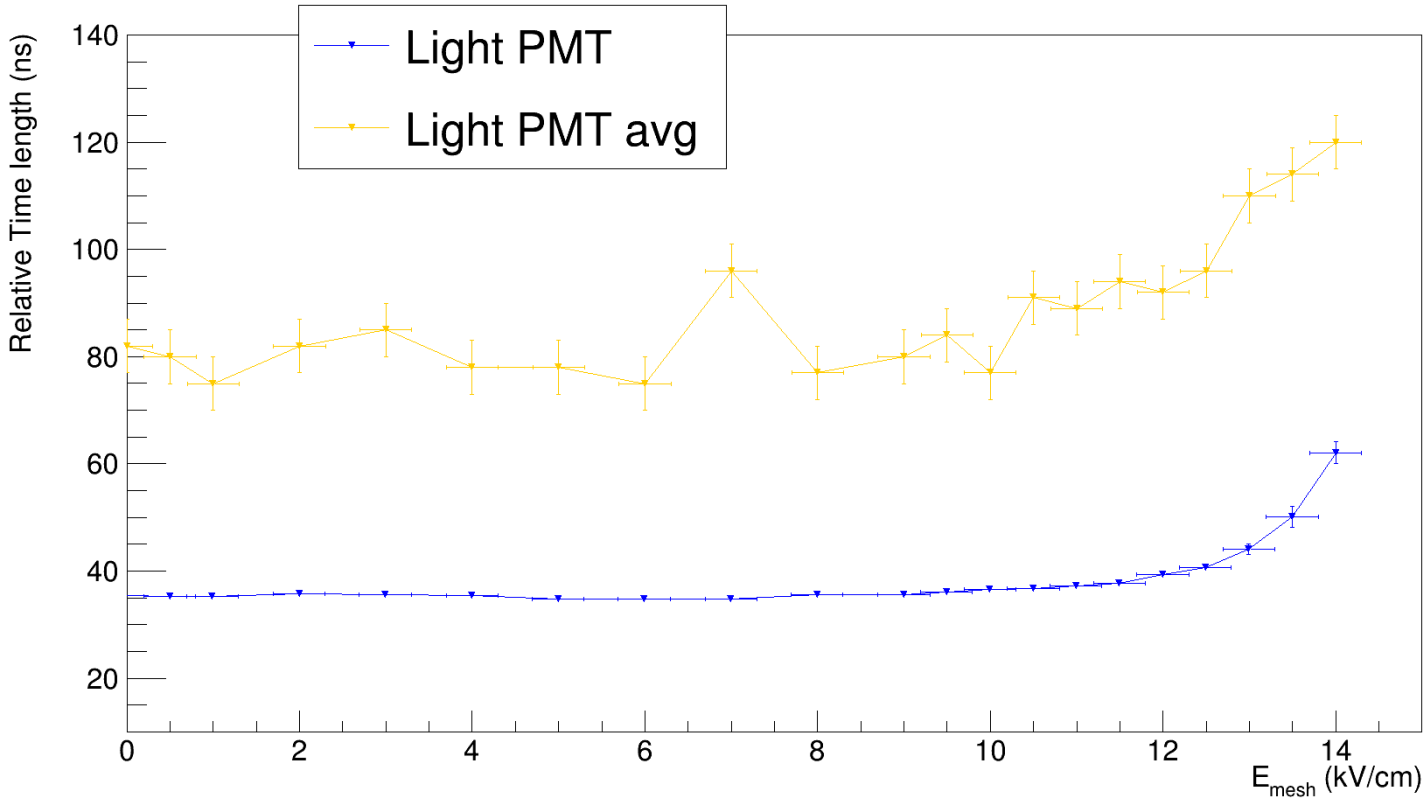


PMT Waves


Amplitude (mV)
−0.02
−0.04
−0.06
−0.08
−0.1
−0.12
−100
−50
0
50
100
150
Time (ns)
E_mesh = 0 kV/cm
E_mesh = 1 kV/cm
E_mesh = 5 kV/cm
E_mesh = 9 kV/cm
E_mesh = 10 kV/cm
E_mesh = 10.5 kV/cm
E_mesh = 11 kV/cm
E_mesh = 11.5 kV/cm
E_mesh = 12 kV/cm
E_mesh = 12.5 kV/cm
E_mesh = 13 kV/cm
E_mesh = 13.5 kV/cm
E_mesh = 14 kV/cm

PMT Time Length Distribution

- Measurement the time length of the signal



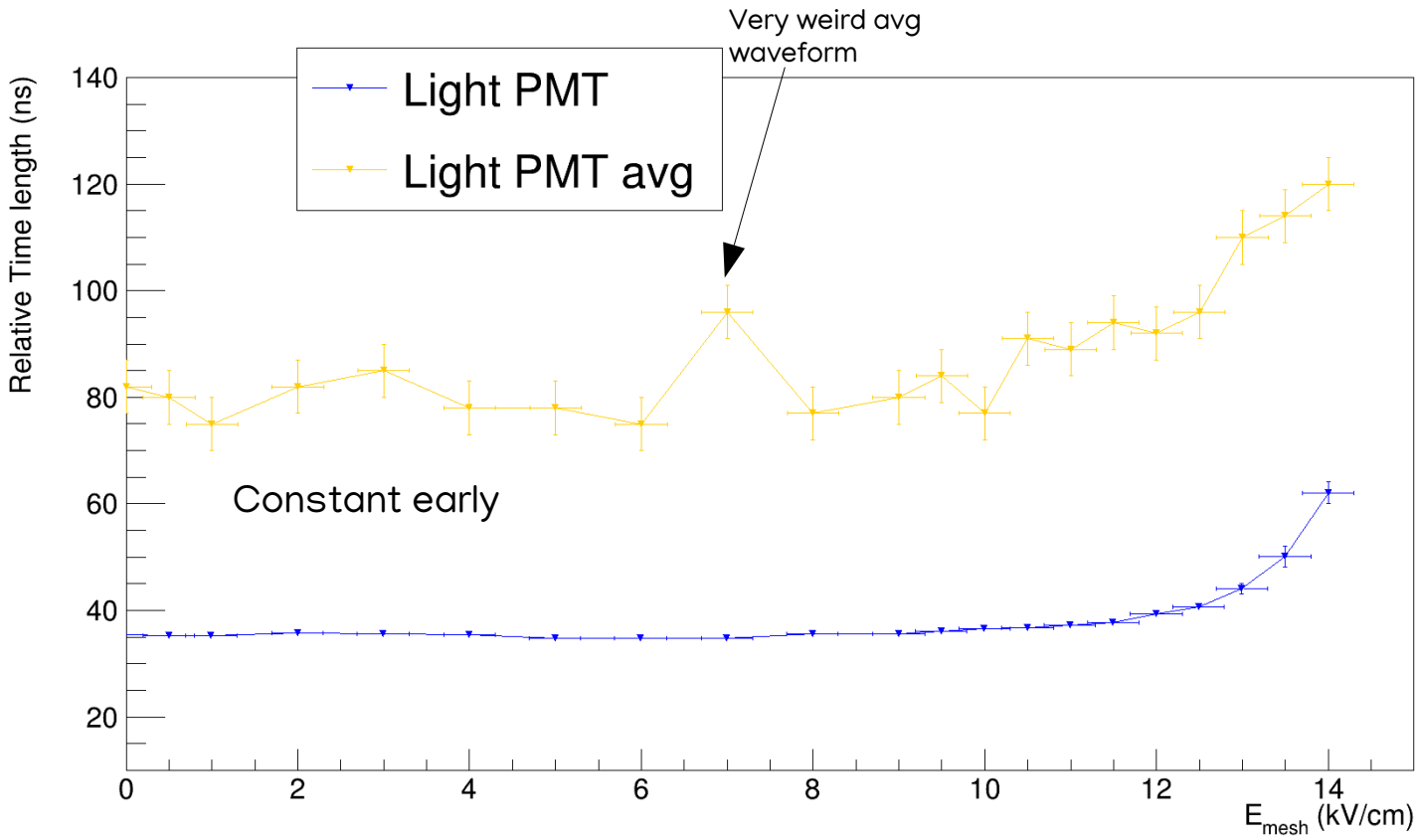
The time distributions became very wide and with no clear peak.

The simple algorithm fails in consistency with waveforms that become more jagged

Thus, it follows more the behaviour of the light

PMT Time Length Avg

- Measurement the time length of the signal



Second jump when we know charge is being generated

First jump in duration when we expect EL