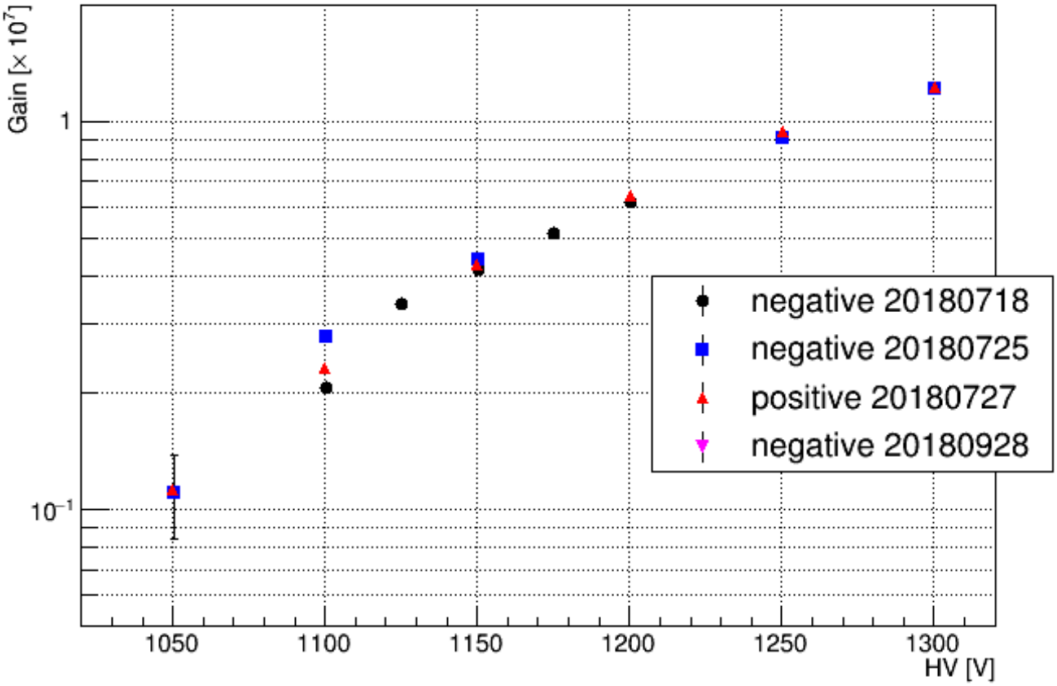
mPMT meeting summary

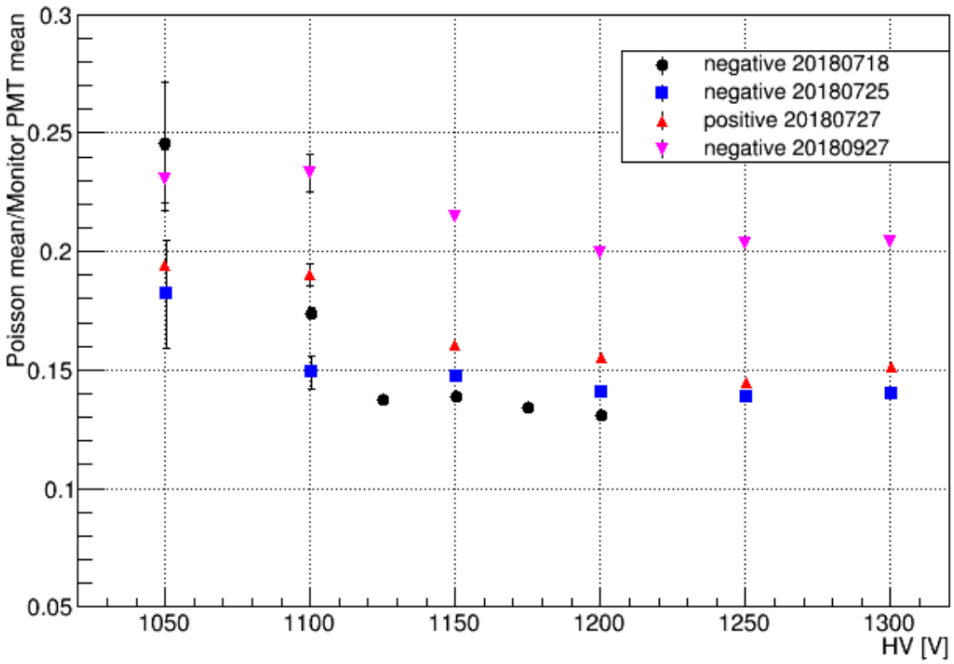
October the 19th, 2018 :

Uniform light measurement (Morikawa-san):

1. Morikawa-san made measurements of gain stability in negative and positive HV
→ Very good agreeement.



2. The 3'' PMT efficiency seems different between September and July data set. Looking more carefully, the monitor PMT response changes a lot between the 2 period. We have two hypotheses to explain this : change in monitor PMT response (degradation, temperature etc.) that is quite unlikely, and change in the fiber splitter characteristics (damaging the splitter, or not connecting it properly to monitor PMT is possible). The third hypothesis is that LED is reponsible for that.

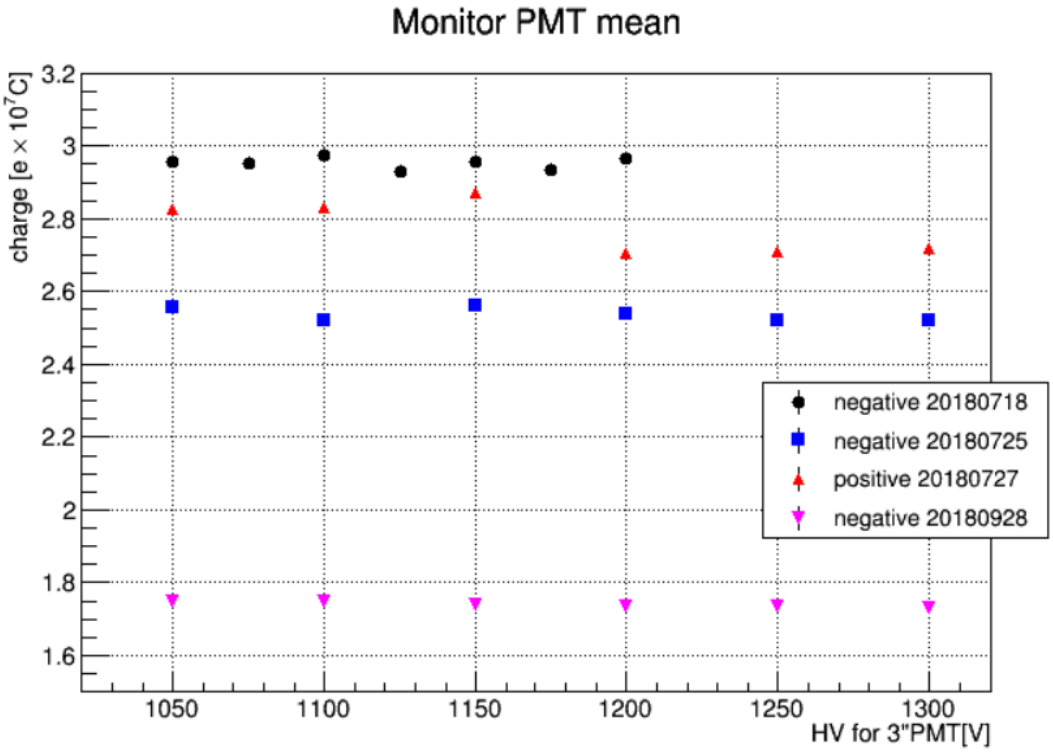


-The second hypothesis is favoured since we plugged/unplugged a lot the splitter in these periods, and also, realized that it is very fragile.

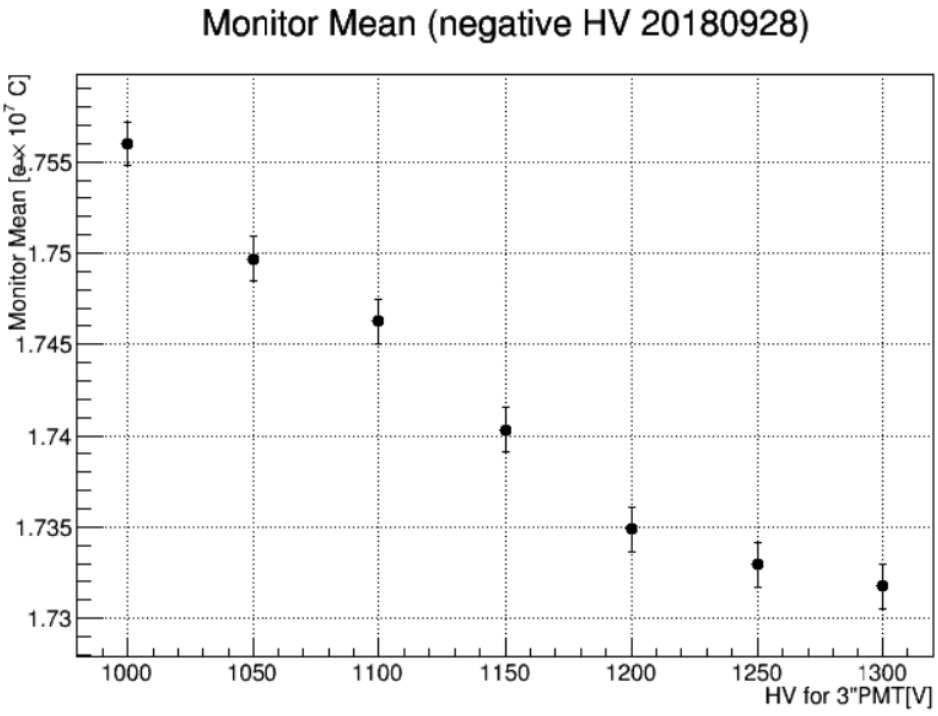
-We will test this hypothesis by taking new data with a new fiber splitter (the former one is broken) and confirm we retrieve July measurement.

-Another change between the 2 data set was the lens focusing light on 3'' PMT was changed between from a 15cm (July) to a 7.5cm (September) diameter. But this cannot explain monitor PMT intensity variation.

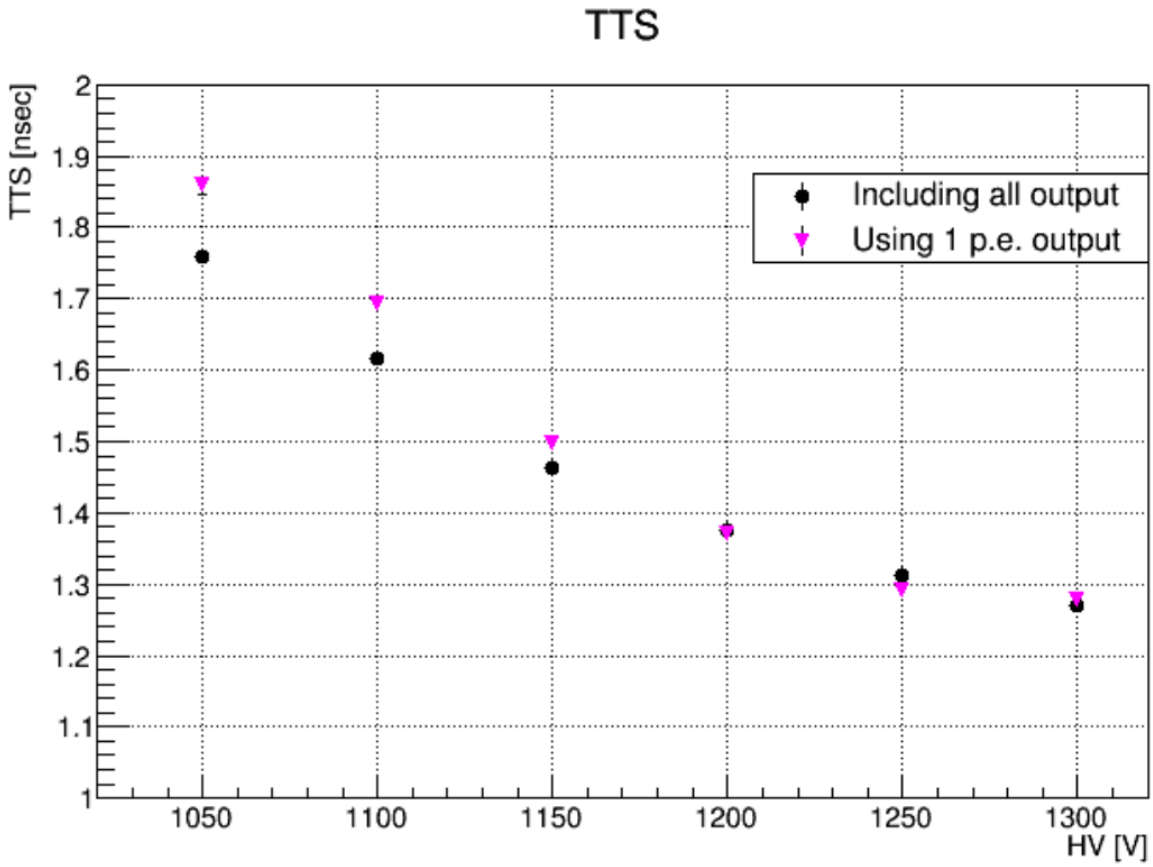
-A final change was the LED characteristics : it was moved from a 9mico-sec light window to a 50ps. However, the total light should not have changed since we increased the LED intensity in order for the 3'' PMT to receive the same amount of light than in the 9mico-sec case.



→ Here the monitor mean should not change with 3'' HV. Morikawa-san took data starting from 1300V to 1000V. This 1-2 % change seen below might be due to LED properties variations with data taking.



3. The TTS measurement shows a decreased TTS with respect to PMT HV. It was expected as the waveform 1p.e peak increase with HV. Therefore, its variation event by event is smaller, and the time-walk effect should be reduced.

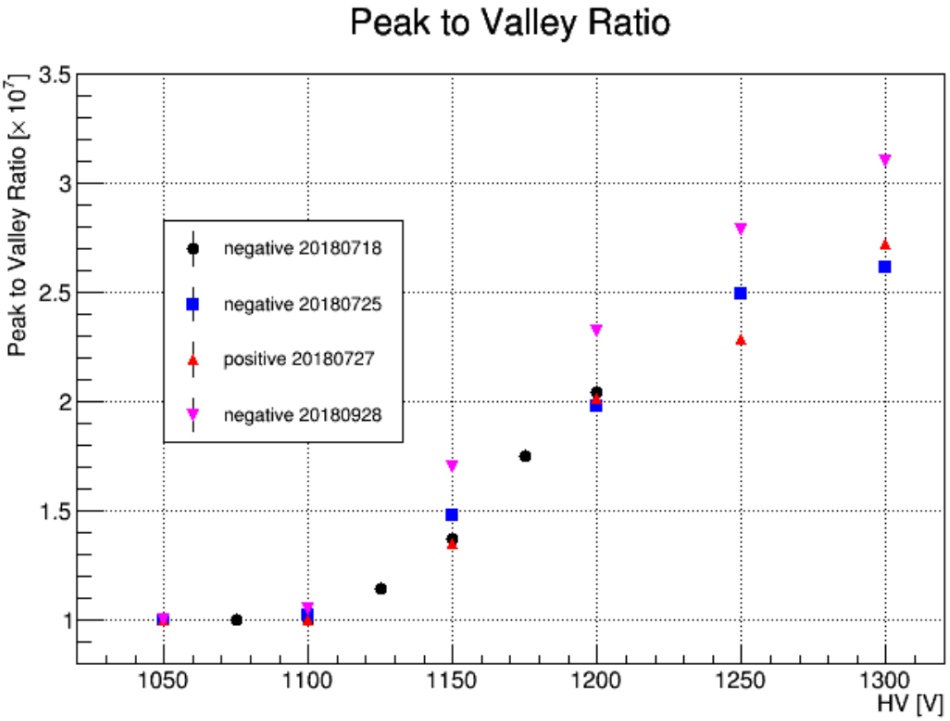


-The TTS is smaller for 1 p.e. peak than when integrating over all p.e. Two effects are expected :

a. Between different p.e., the waveform is very different and a time-walk effect is expected → It will shift the TTS distribution differently for different p.e. So when summing over the TTS from different number of p.e, it should enlarge the summed distribution.

b. At the same time, due to time-walk effect, the TTS of high p.e distribution (their width) should be smaller. So if the bias from a. is negligible compared to the decrease in width due to reduced time-walk, it should create a total reduction of the sum of gaussian.

→ Check this by measuring bias and TTS for different number of p.e (fitted gaussian center and sigma of TTS).



Finally, peak-to-valley ratio stability is remarkable, except for September data. As hypothezied earlier, it might came from the change in the LED but most likely, fiber splitter, that would affect the relative quantity of pedestal vs 1 p.e. event. Note that it should not impact the gain, which is an intrinsic property of the PMT, and this is compatible with the stability of the gain plot.

Summary of the schedule for next week :
-Investigate the September data issue with new fiber splitter → On thursday 10/25 if new fiber splitter arrived
-Determine TTS width and center as a function of the number of p.e. → On thursday 10/25 with another available LED if splitter is not there.

Motorized stage / position dependent measurement (Izumi-san):

1. Built some black light-tight walls to prevent light leaking from below the dark box.

2. Wait for :
-Black vynil to finish dark box → Arrived on Friday 10/19.
-Longer cable to connect PMT signal to the CAEN digitizer → A BNC cable extension was found in the lab.
-New fiber splitter to control/correct LED intensity variations → Not necessary for first measurements.

3. What needs to be done additionally → design the PMT holder in the mumetal so the PMT position is always the same between different measurements, after we remove and

placed again the PMT → Izumi-san proposed a new design with enlarged external diameter part to stop the holder at a given position in mumetal.

Summary of schedule for next week :
-Finish the dark box → Wednesday.
-First motorized measurement → Thursday
-If possible, print the new PMT holder to ensure the PMT position.

Reflector measurement (Adam):

1. Built some PMT holders with several reflector angle → Is height changed to keep same width of reflector ? Shall we try other geometries.

2. Cut broken part in the fiber splitter and glued it into the holder → Did not improved light collection.

3. Found a way to polish the reflector which has been scratched when bending it → Make a comparison measurement.

4. Proposed to connect the fiber splitter not directly to test bench but interface them with a connector + additional LED.

Summary of schedule for next week :
-First measurement with the reflector.
-Reproducibility of the results for same reflectors + holder types.
-Test possibly effect of polishing.
-Glue reflector on PMT holder with other angles → Needs aluminium.

B-field dependen measurement (Inomo-san):

1. Ordered a B-field probe and wait for it before starting measurements.

To-do for Benjamin:
1. Order new fiber splitter.
2. Order female → male optical connector to plug fiber splitter on other LED to avoid breaking the former in the future.
3. Order aluminium sheet → Check before with the astro group in IPMU if we can use their iron-cutting machine and what size of Aluminium fits in.