Humidity Study

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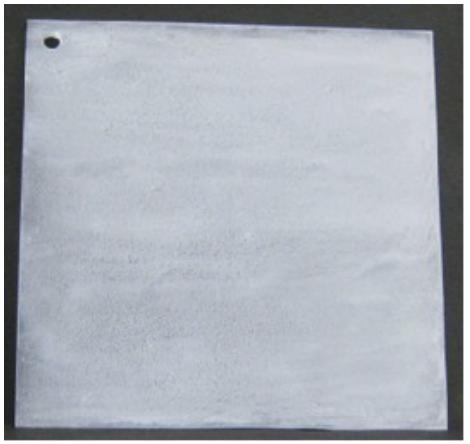
Samples

A total of 14 10 cm by 10 cm square plates were used in this study and were coated using a 50% TPB-PS coating



1. 3 plates placed in argon gas in the dark
2. 3 plates in argon gas exposed to ambient light in our lab
3. 3 plates in a sealed box in the dark with a desiccator packet and humidity monitor (average humidity was 11 % ± 2 %)
4. 3 plates exposed to the air in the (air-conditioned) laboratory in the dark
5. 2 plates exposed to the air and light in the laboratory

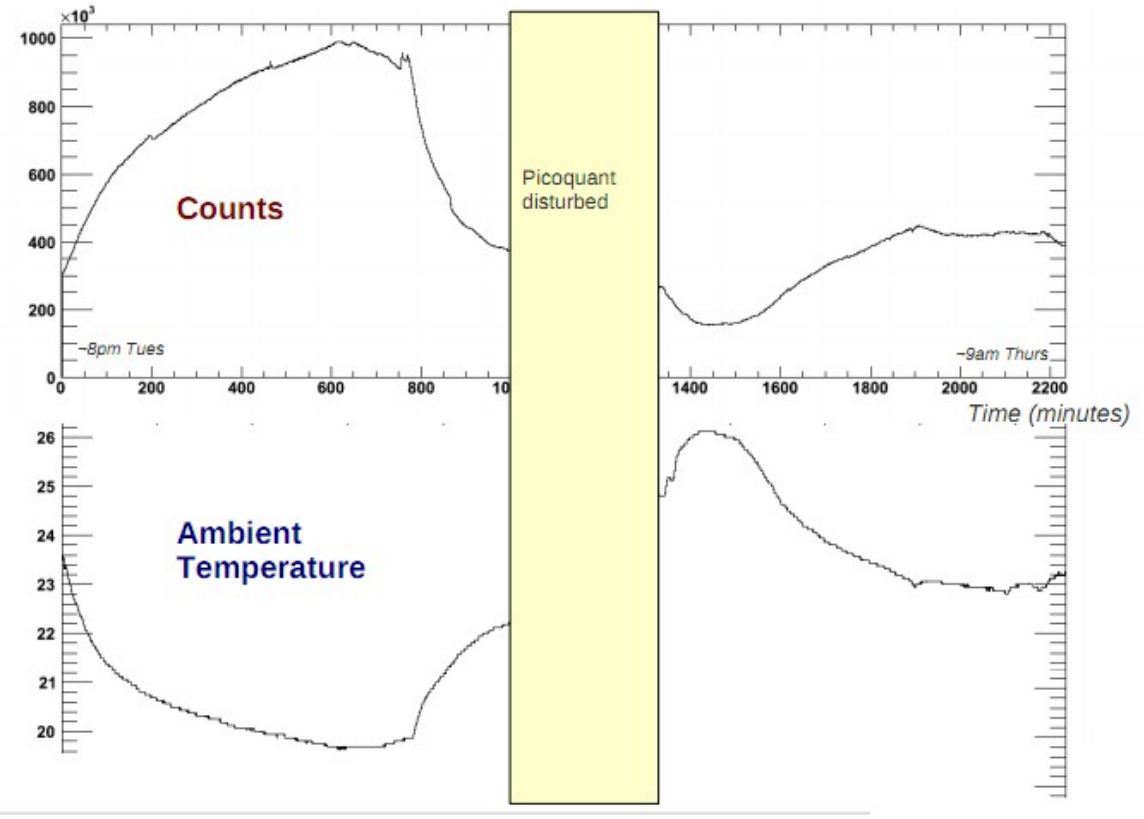
Setup

Picoquant issues

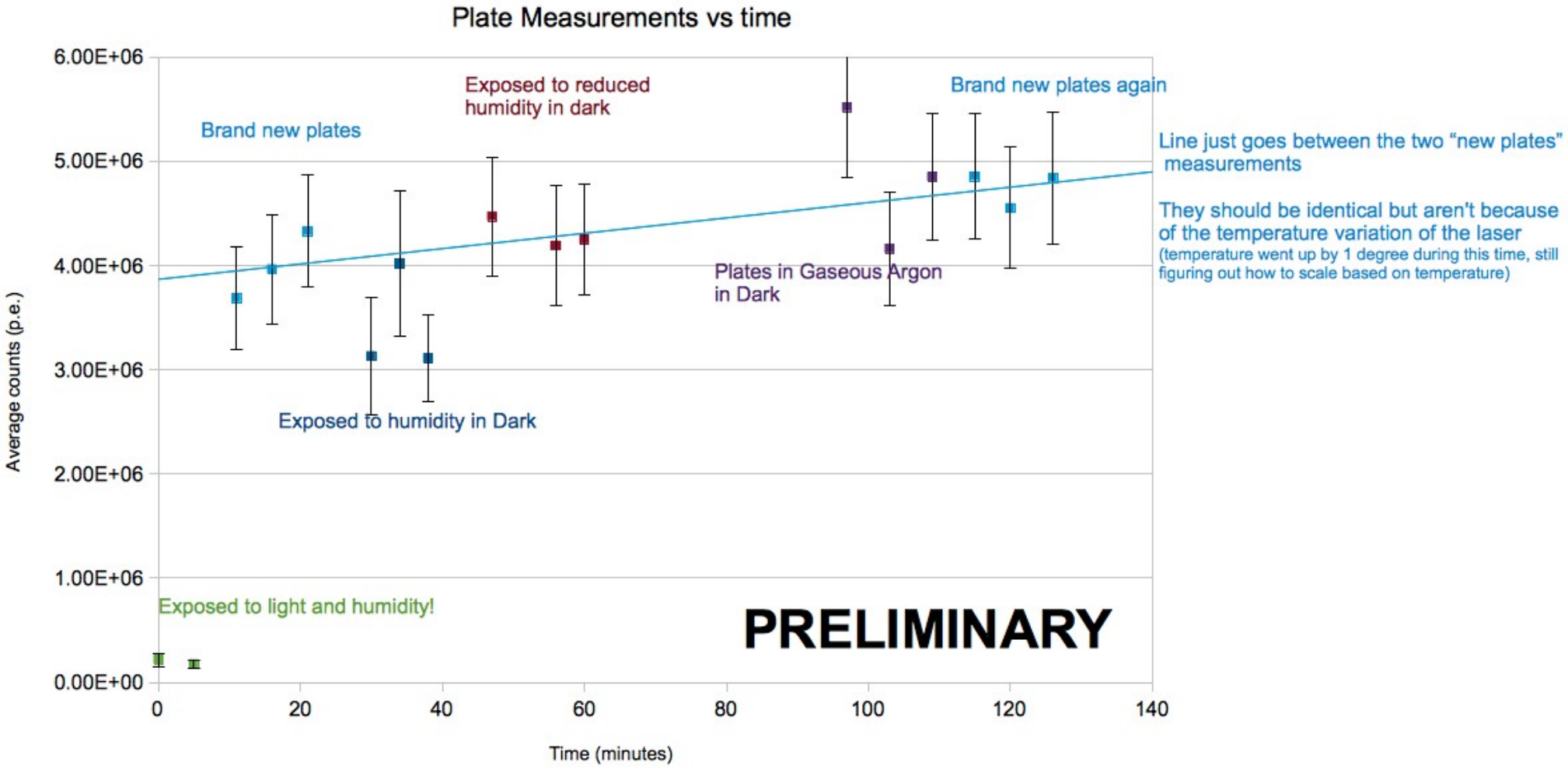
Three new plates created on the day of testing for comparison. Plates had a standard deviation of 12% between plates (about 7% for any individual plate)

The plates were measured before the study but this has not been accounted for yet.

Both the "before" and "after" measurements were done over a period of time where the temperature changed by one degree, and we have observed a temperature dependence in our picoquant light source which we have not yet corrected for

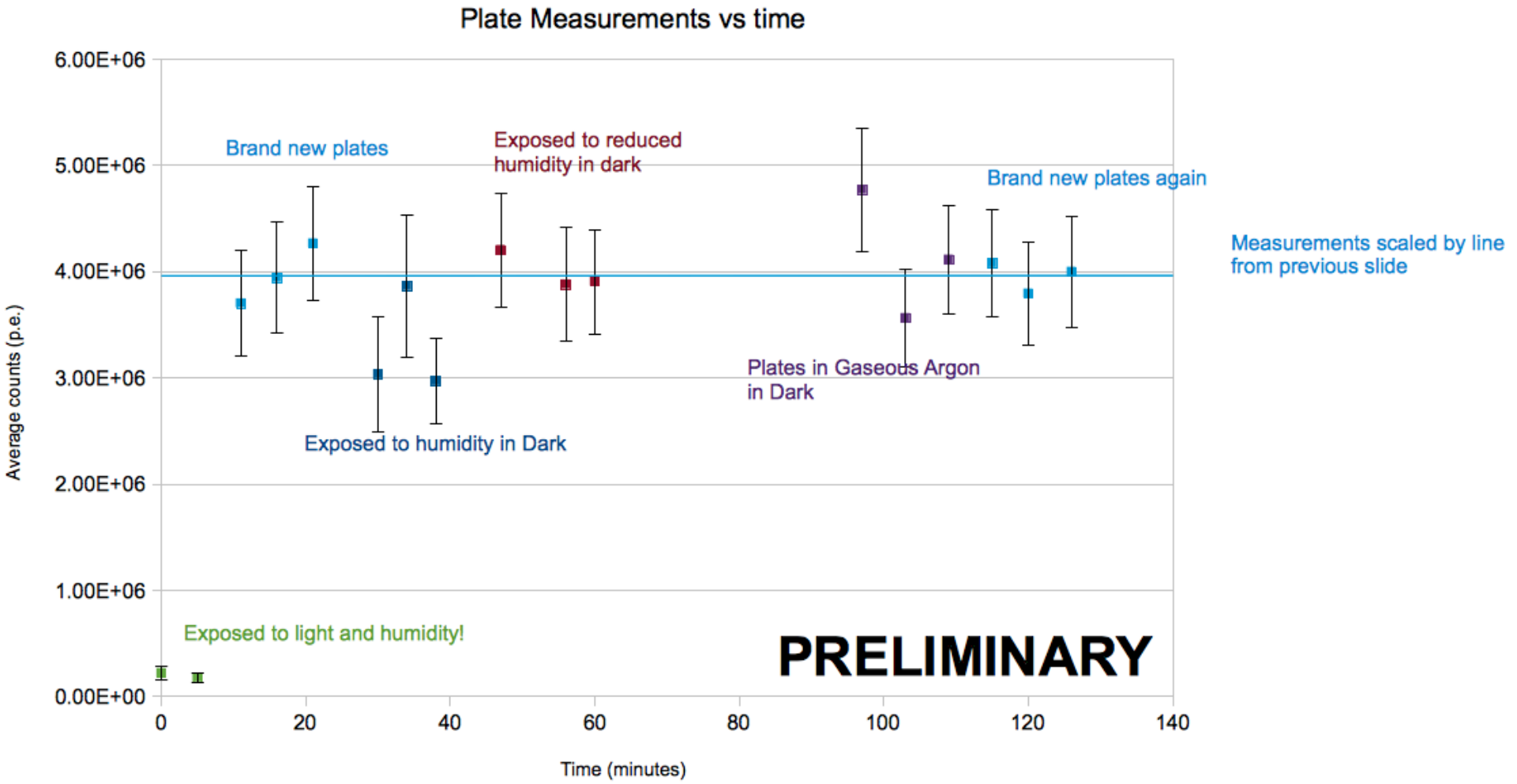


Results



Errors are the standard deviation of measurements on a particular plate added in quadrature with 12% of the light response (to represent the deviation between plates)

Results: Scaled



Conclusion

- Light is the culprit rather than humidity! TPB response goes down by over an order of magnitude with light exposure!
- Humidity seems to only have a slight effect (consistent with warp), but nothing that will hurt our triggering efficiency (we currently expect an order of magnitude more light than we need for triggering on a 5 MeV electron)
- Light should be easy to protect against: can wrap black cloth or plastic around pmts after installation and before rack portion slides in
- Haven't tried to correct for temperature yet, but this will dramatically decrease error bars on these measurements by allowing us to use “before” data

Follow up study

12 Plates:

- Repeat 3 plates exposed to light and humidity
- Repeat 3 plates exposed to dark and humidity
- Repeat 3 plates exposed to dark and less humidity (desiccator packets)
- Add in 3 plates in amber box (meant to cut out higher frequencies of light)

- We are also looking into whether a deuterium light source would vary with time