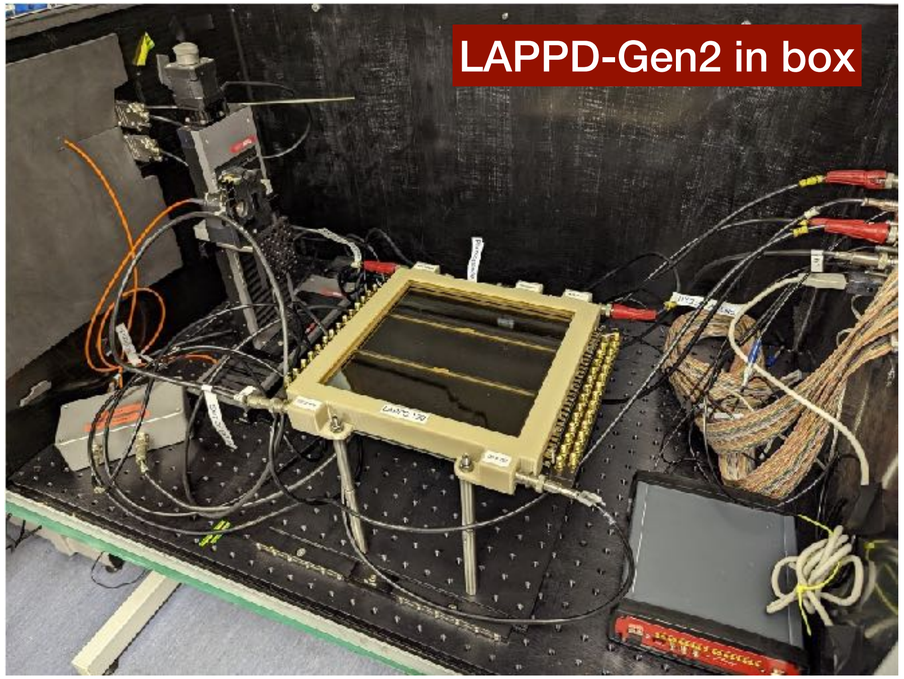
Planning Discussion

eRD110/hpDIRC MCP-PMT Activities at Glasgow

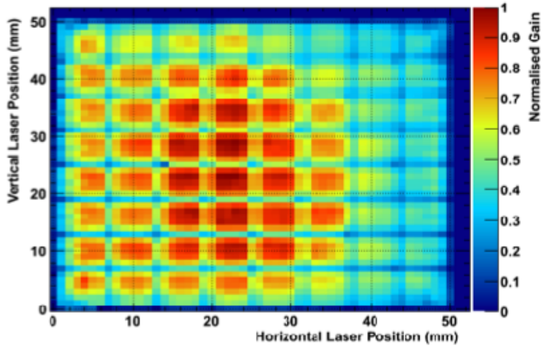
Rachel Montgomery

16/5/24 DIRC Meeting

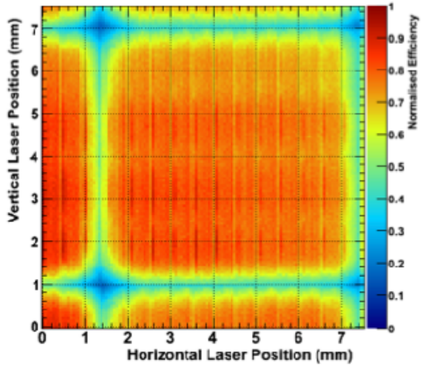
Existing Setup at UoG



64 pixels with 1mm beam



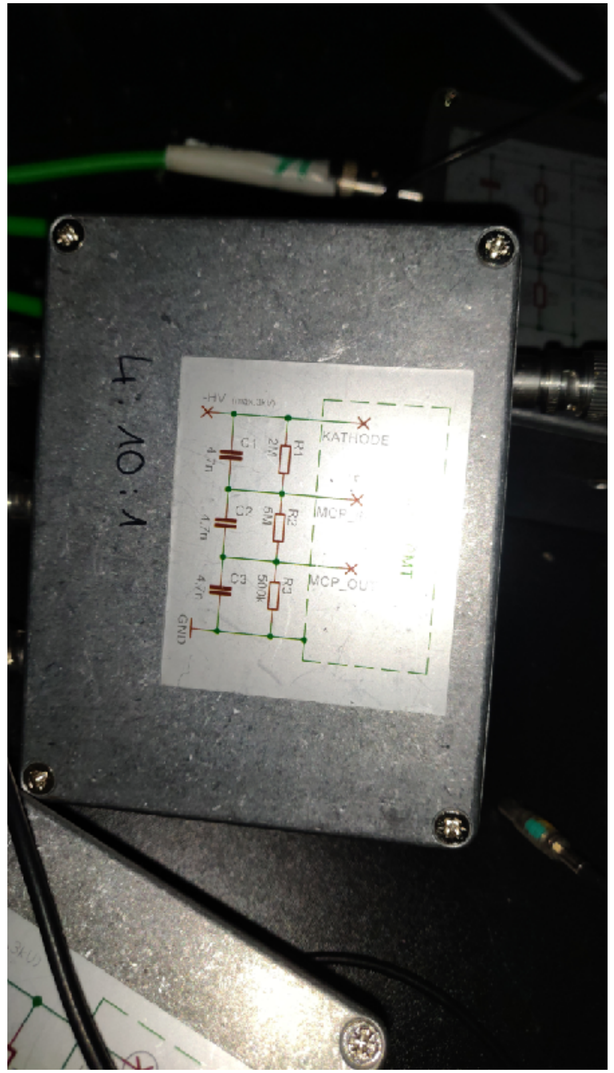
1 pixel with 0.1mm beam



Previous H8500 MAPMT scans at Glasgow

- Light tight box(es)
- PiLAS red (634.7nm) and blue (407.2nm) lasers
  - Focussed spot size 0.1mm up to ~1mm
  - Flood field available via Thorlabs square diffuser
  - CCD with no optics to image beam spot
- Thorlabs sub-mm X and Y stages
  - Manual z-stage to find focal point
- ND filters
- For reference detector: 70:30 beam splitter old photodiode with *expired* calibration, or currently using SiPM (J series 60035)
- Desktop digitisers
  - max 16 channels (CAEN DT5730B, DT5720, DT574)
- CAEN VME QDC (v792) and TDC (v1190 and v775)
- Keithley pico ammeter source meter (model 2614B)
- Potentially can borrow D2 lamp (~200-400nm) plus monochromator
  - But it is very old (no manual/specs etc) and not sure they couple together perfectly as is - may need new optical coupling (not sure how much I would trust this)

PANDA Planacon MCP-PMT as Benchmark/Reference



Now in Glasgow

Readout? Should we ask BNL to make similar style adapter cards?

HV
2, 5, 0.5mOhm for 4:10:1 HV ratio
(Improved photon timing precision compared to 1:10:1 on Photonis data sheets)
Capacitors 4.7nF

We are planning now to build the same box

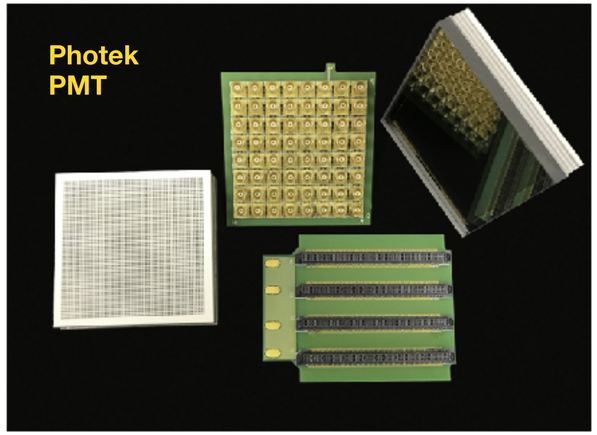
Should we expect to use this ratio for Photek? Or at least to change the ratio from what Photek recommend?

Are QA results from Erlangen available to help plan the series of measurements?

How were signals readout?

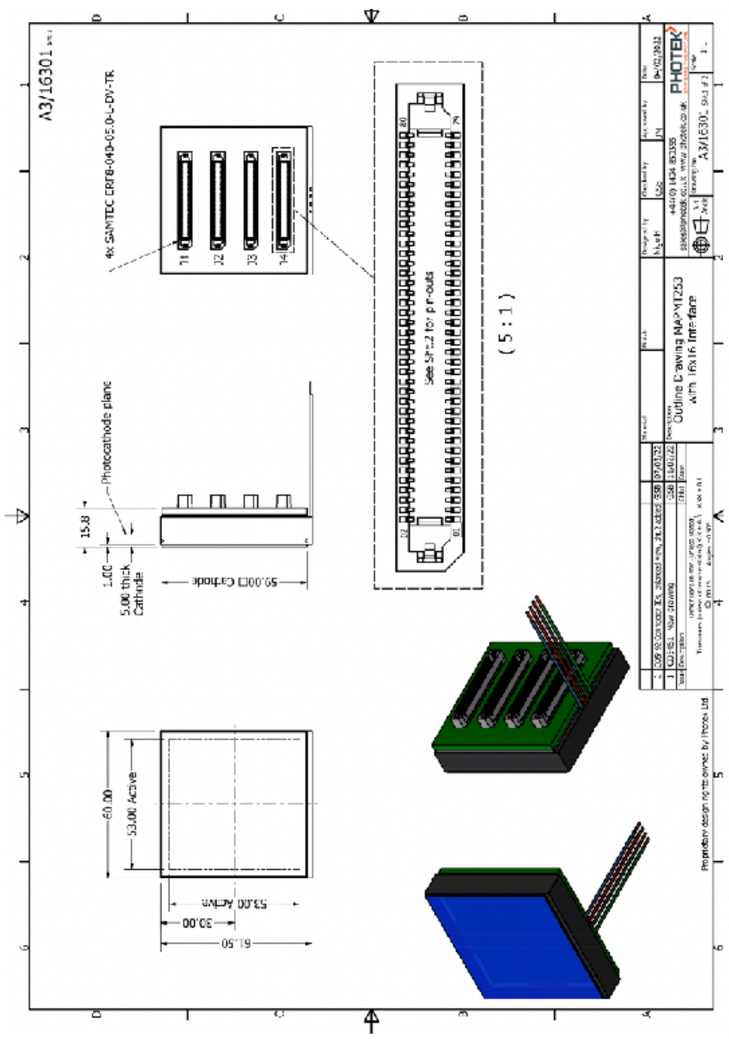
How were QE measurements done with this tube? Kiethley?

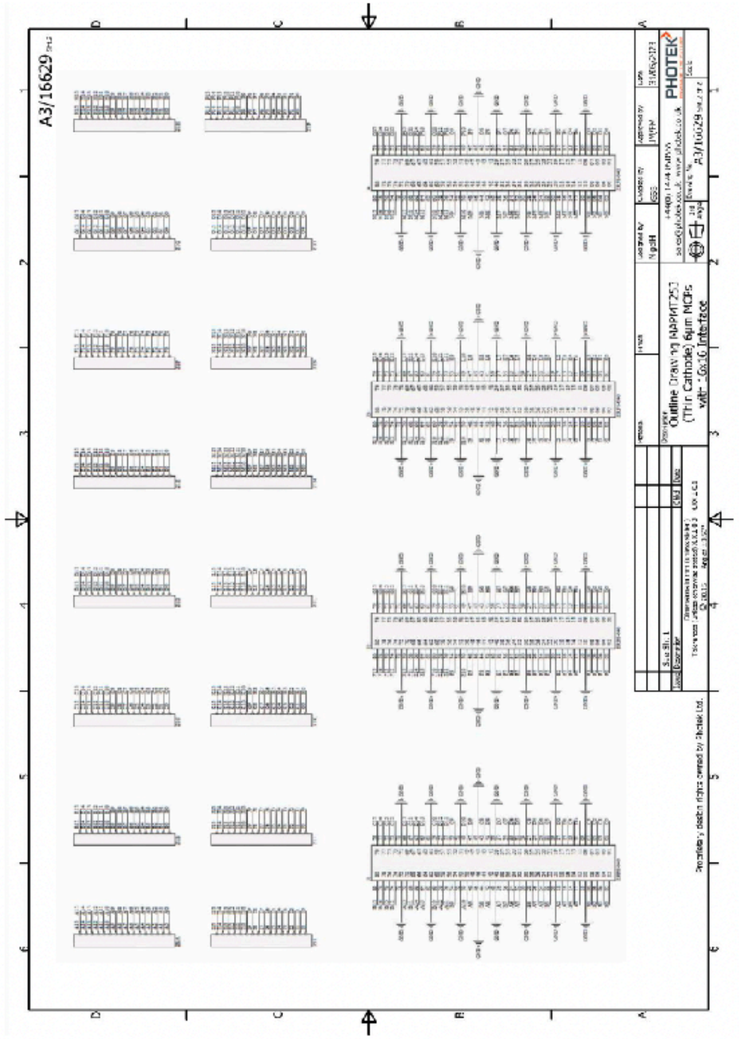
Photek MAPMT253



1 Details

Type	MAPMT253	
Input Window	Sapphire	
Active Area	53 mm x 53 mm	
Anode Layout	16 x 16 256 anodes	
Anode Pitch	3.312 mm	
Signal Connectors	4x Samtec ERF8	
Photocathode	Bi-Alkali	
MCP	2 off, 6 µm pore	
Sensitivity @ 400 nm	40 mA/W minimum 45 mA/W typical	QE 12.4% minimum QE 13.9% typical
Electron Gain	1 x 10^6	
Connections	Blue Red Black Green	Cathode MCP In MCP Out Anode
Wire Lengths	30 cm (nominal)	
Mechanical Drawing	A3/16301	



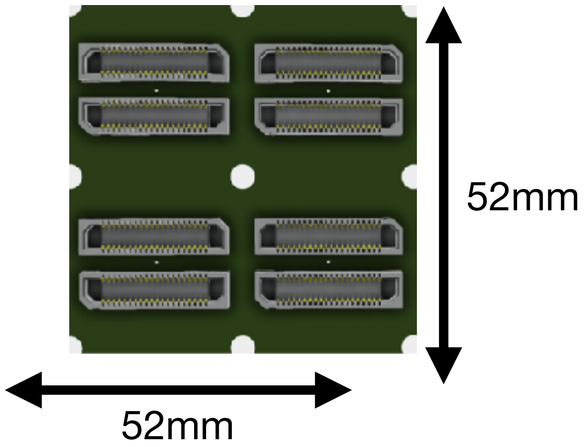


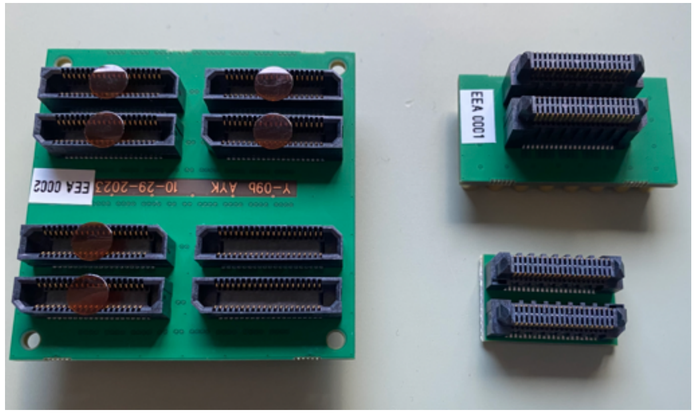
- JLab ordered this towards the end of December 2023
- Still not arrived. Last contact they advised would ship 12th April and at latest be in Glasgow end of April (which matches 16 weeks upper limit on quote)
- Had some contact today will continue to follow up

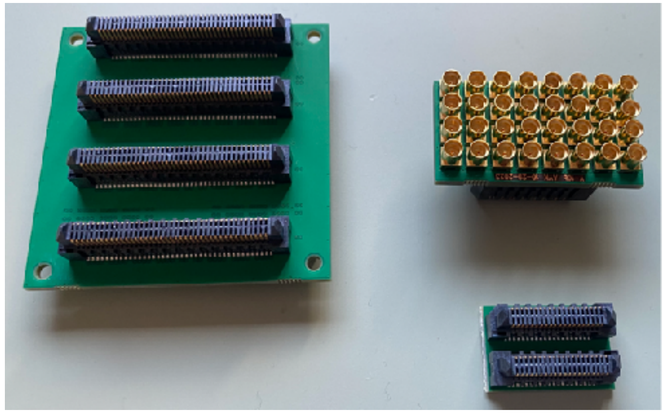
Planned Upgrades to Test Stand

- To readout 32 channels of MCP-PMTs V1742 digitiser from CAEN, and accompanying PCI purchased by USC now in Glasgow, working on integrating into setup

- Readout adapter boards designed by A. Kisselev to readout Photek MCP-PMT to V1742 now in-hand at UoG, working on manufacturing MMCX - MCX 2m cables with RG 174 co-ax







- For quantum efficiency/absolute gain measurements will need a calibrated reference detector - some funds from eRD110
- SoW Agreement between JLab/UoG still being set up by legal teams since Jan!
  - Waiting for budget in place so that pieces for upgrade of test stand can be ordered

- Plan to order
  - Calibrated photodiode for absolute gain and QE studies
  - LEDs at ~4 different wavelengths for some coarse QE scans/comparisons at different wavelengths (including UV)
  - (wavelength band probably broader than with monochromator but monochromator too expensive)
  - Fibres and LED drivers for above
  - Some upgraded optical components
  - Any suggestions for above purchases? I can get updated quotes and share the final specs before ordering

Potential Measurements

- Gain uniformity
  - Can start with relative uniformity at single photoelectron
  - With calibrated reference detector can move to absolute gain
  - (Any preferences on pixel by pixel? Finer resolution within a pixel? Flood field vs stepped?)

- QE
- Can start with red versus blue laser for relative QE differences
- With calibrated reference detector can move to absolute QE
- Perform this with Kieithley? Any advice?

- Time Resolution
  - Single photoelectron? Any multi-pe level useful?
  - Again can move to single photon with reference detector set up

- Scans of time resolution
  - Matching gain uniformity maps

- Cross-talk
  - 32-channel readout will allow crosstalk studies
  - Any suggestions?
  - Can also look at ringing on signals

Summary

- Working to set up new digitiser and readout cables
- Working to get budget set up to purchase further improvements to test stand for absolute measurements
- Can start with PANDA MCP-PMT whilst waiting on Photek MCP
- Working on HV box, should talk to BNL about readout adapter cards to match Photek readout
- Please let me know any specific set of measurements to agree on to start with
- Alexander contacted me about starting to set up shipment of HRPPD #15 to Glasgow or rather take mcp to USA
- (Have separate money available which is ear marked for a new laser for a new test stand)