MCP-PMT Discussion

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28/10/23

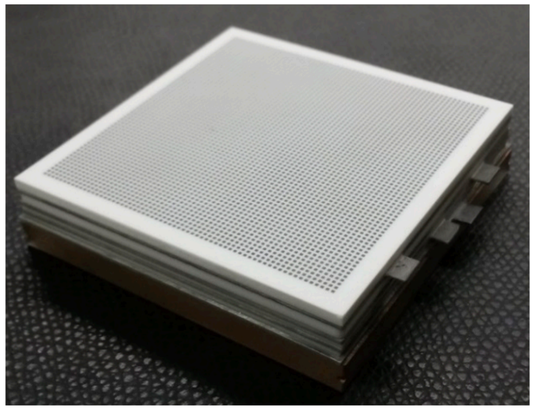
- Photek AuraTek MAPMT253
- Existing Test Stand at University of Glasgow and Future Proposed Upgrades

Photek Multi-anode MCP PMT: Auratek253

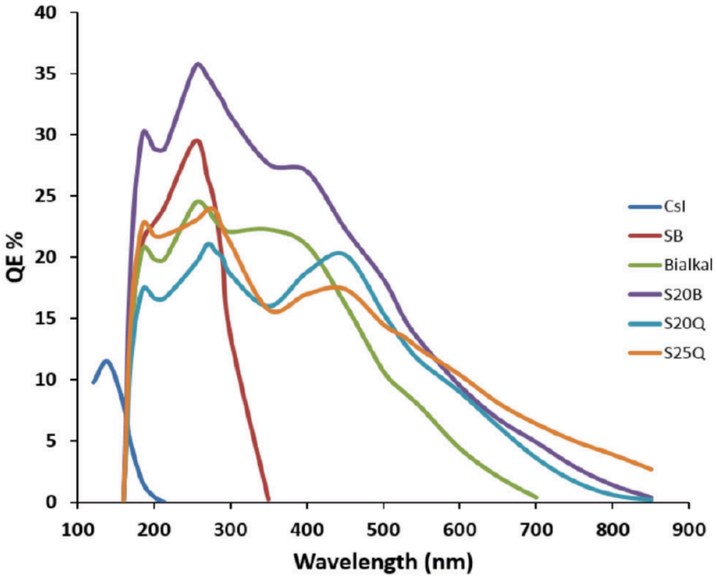
AuraTek Square: MAPMT253

Features

- A 64×64 anode square MCP-PMT
- Derived from novel PMT development with the TORCH group
- Unique build provides short front (1.5 – 2 mm) and rear (3 mm) gaps
- Results from the 15 µm pore MCP version previously published*
- This study looks at MAPMT253 with 6 µm pore MCPs



Mechanical Properties	MAPMT253
Input Window Material	Fused Silica or Sapphire
Input Window Thickness (mm)	5.0
Active area (mm)	53×53
Photocathode – MCP Gap (mm)	1.6
MCP – Anode Gap (mm)	3.0
MCP Pore Diameter (µm)	6 or 15
Bare Tube Dimensions (mm)	59×59×13
Housed Tube Dimensions (mm)	62×60×13
Native Anode Pattern	64×64
Native Anode Pitch (mm)	0.828



*See Milnes et al, JINST 15 C02036 (2020)

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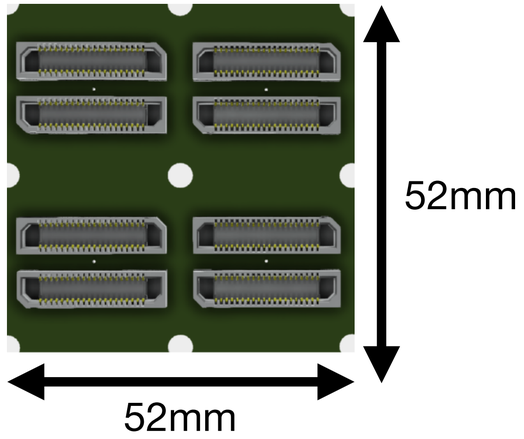
Connectors



- Standard readout config on Auratek as sold is 4x SAMTEC ERF8 connectors
- We asked Photek about additional cost to have this customised connector layout
- Additional cost would be an extra £3 100 (~$3 800)
- A. Kiselev proposed to develop in house interface board to convert from Auratek to connectors for DRS4 or HGCROC3 ASIC backplane
  - See left image (bottom) from Alexander
- Photek sent the drawings for their connectors and pins layout on the PMT

Item	Description	QTY.	Price Each (GBP)
1	**MAPMT253/M/CsI/16x16** Multi-Anode MCP-PMT Input Window: Fused Silica or Sapphire Active Area: 53 x 53 mm Electron Multiplier: Dual MCP Anode: 16 x 16 on 3.312 mm pitch Photocathode: S20 or Bi-Alkali	1	£14,610
2	**Readout electronics interface 16x16** 4x Samtec ERF8	1	£1,650
3	**Voltage divider chain box**	1	£700

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2	**Readout electronics interface 16x16** 8 x Samtec ERF8-020-05.0-L-DV-TR	1	£1,770
2a	**NRE Charge for custom connectors** One-off charge related to the design and procurement of parts for customised connectors/layout. ****Must be ordered with Item 2.***		£2,980
3	**Voltage divider chain box**	1	£700

Pore Sizes

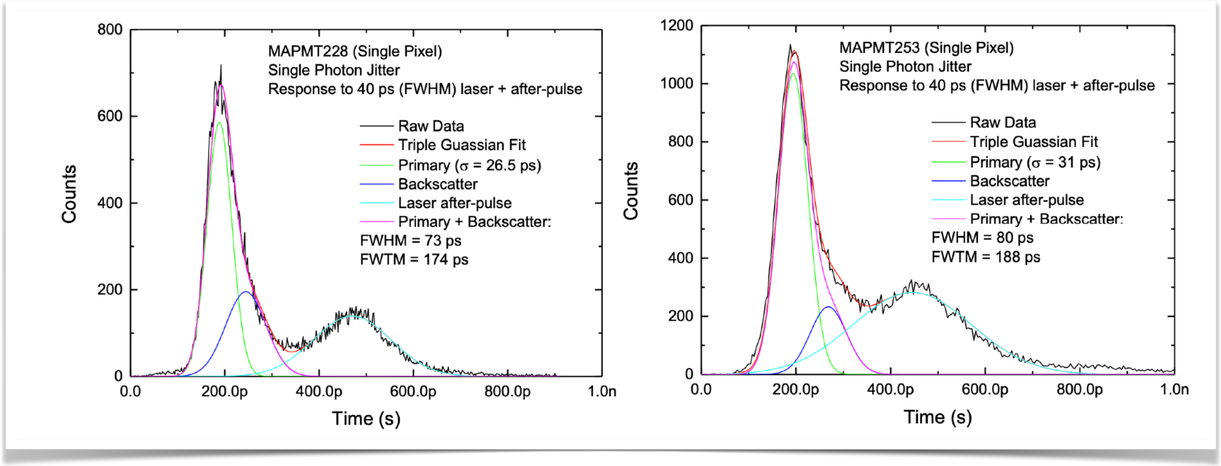
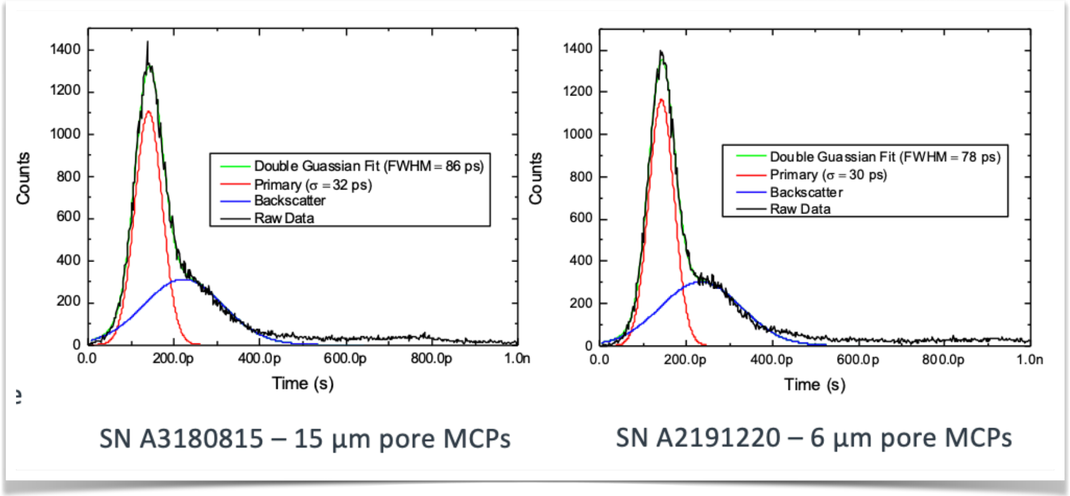


TABLE 1		
Mechanical Properties	MAPMT228	MAPMT253
Photocathode – MCP Gap (mm)	0.3	1.6
MCP – Anode Gap (mm)	2.3	3.0
MCP Pore Diameter* (µm)	10	15
Bare Tube Dimensions (mm)	62.5 (⌀) x 14.6	59 x 59 x 13

***6 µm available on request for both formats**

From Auratek technical note

https://www.photek.com/pdf/datasheets/detectors/DS042 Technical Note Auratek.pdf

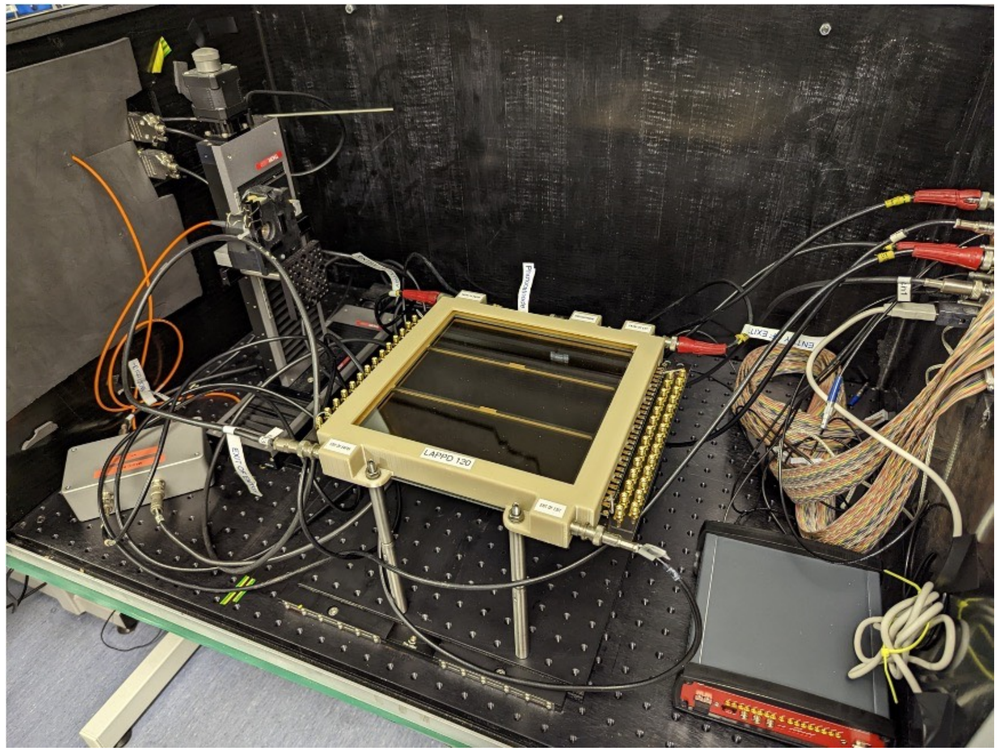


MAPMT253 results for 8 x 8 anodes, see:

https://ieeexplore.ieee.org/document/9507873

- Enquired about timing resolution with different pore sizes
- Standard pore size is 15um
- Photek can also provide 6um in MAPMT253, but not 10um yet
- 6um will cost more due to component and production costs higher
- Waiting to find out about price difference - quote should be on its way to US institution

Existing Setup UoG



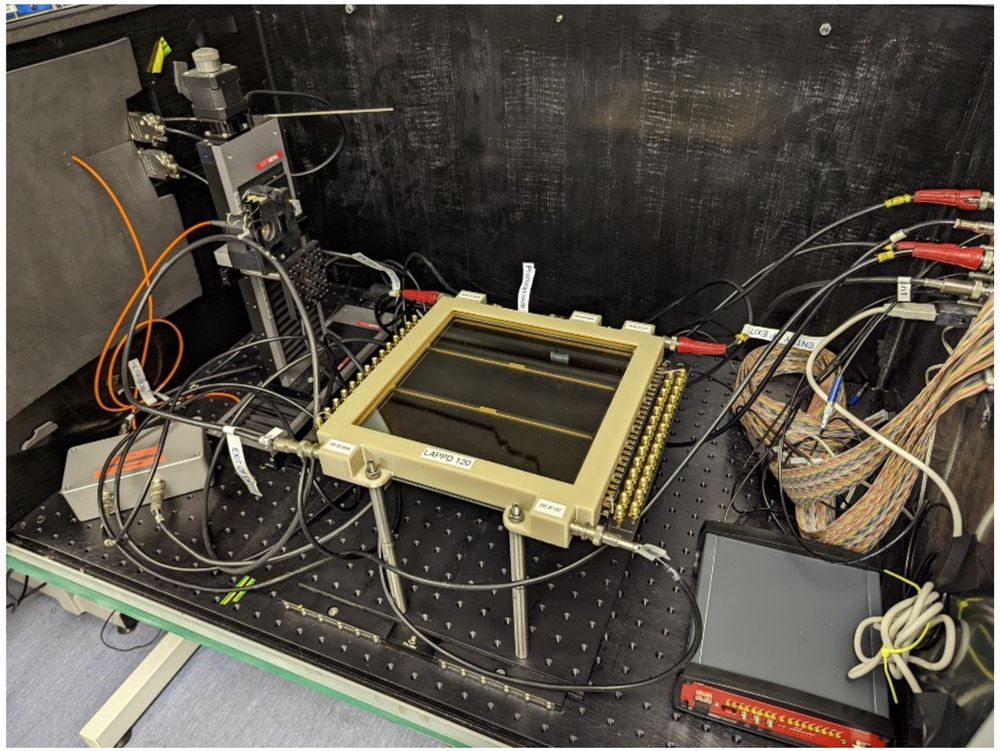
- Light tight box(es)
- PiLAS red (634.7nm) and blue (407.2nm) lasers
  - spot size 0.1mm up to anything
  - Thorlabs square diffuser
  - CCD with no optics to image beam spot
- Thorlabs sub-mm X and Y stages
- ND filters and beam splitter
- Photodiode plus readout with *expired* calibration
- Desktop digitisers
  - max 16 channels (CAEN DT5730B, DT5720, DT574)
- CAEN VME QDC (v792) and TDC (v1190 and v775)
- Keithley pico ammeter source meter (model 2614B)

- Potential to borrow D2 lamp (~200-400nm) plus monochromator
  - But it is very old (no manual/specs etc)

- Photosensors:
  - LAPPD Gen 2 plus BNL backplane
  - Standard PMTs/MAPMTs (H8500/12700)/SiPMs
  - Old Hamamatsu SL10 and planacon MCPs (with one integrated voltage divider cable so cannot access QE)

Future

Plan to upgrade stand mostly to allow for *absolute* gain measurements and increase number of channels readout



- Purchase some upgrade equipment
  - 32 channel VME-based CAEN digitiser;
  - calibrated photodiode for absolute gain measurements
  - MCX-MCX cables
  - Some LEDs at 4 different wavelengths, including UV (plus optical fibres, plus driver), to compare with laser responses for some coarse QE comparisons at different wavelengths (wavelength band probably not as good as with monochromator)
  - Some upgraded optical components

- Potential tests could be:
- HRPPD basic performance tests (gain, time resolution, scans of response)
- Test HRPPD with digitiser initially, then with ASIC readout when is available
- Perform comparison studies of MCP PMTs
  - important for DIRC and contingency planning
  - Studies will include: gain, some QE points, crosstalk/ ringing artefacts, time resolution, scans of response