

LAPPDs at Glasgow

Frank Thomson, Bjoern Seitz, Rachel Montgomery

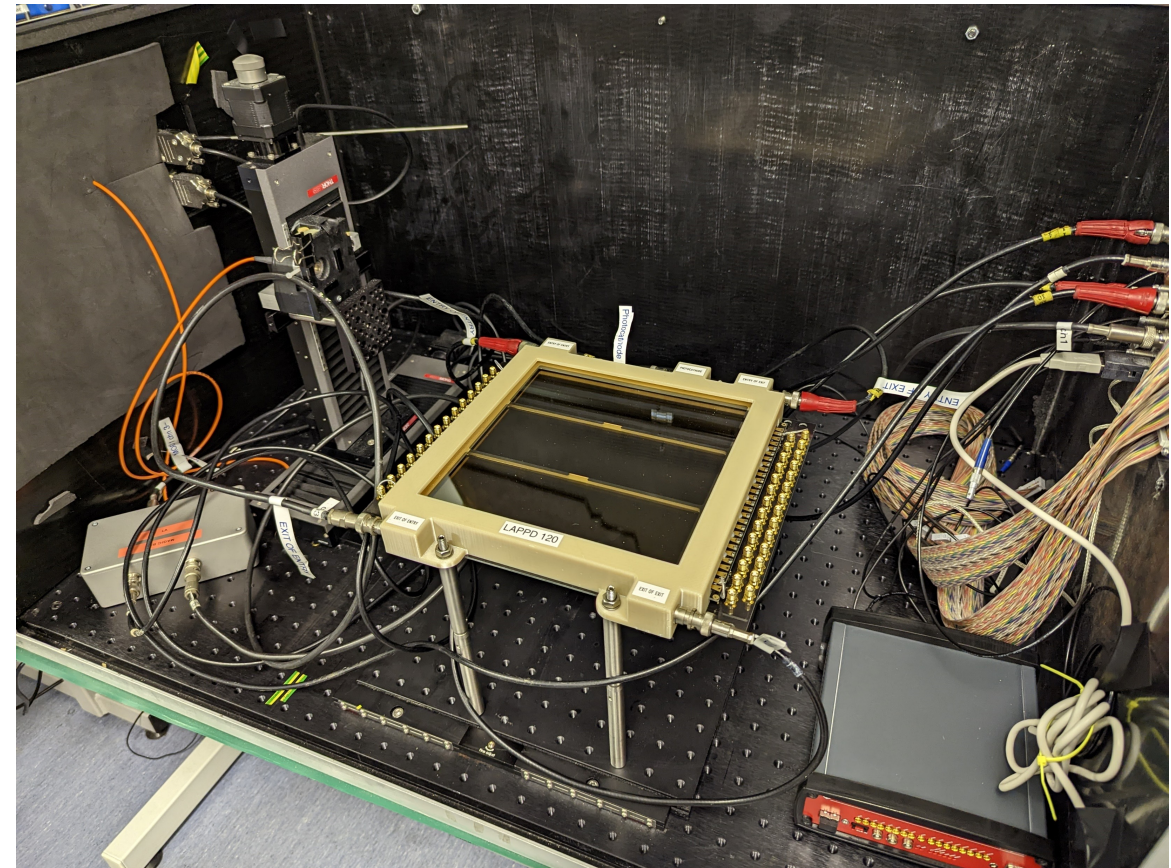
October 26th 2022



University
of Glasgow

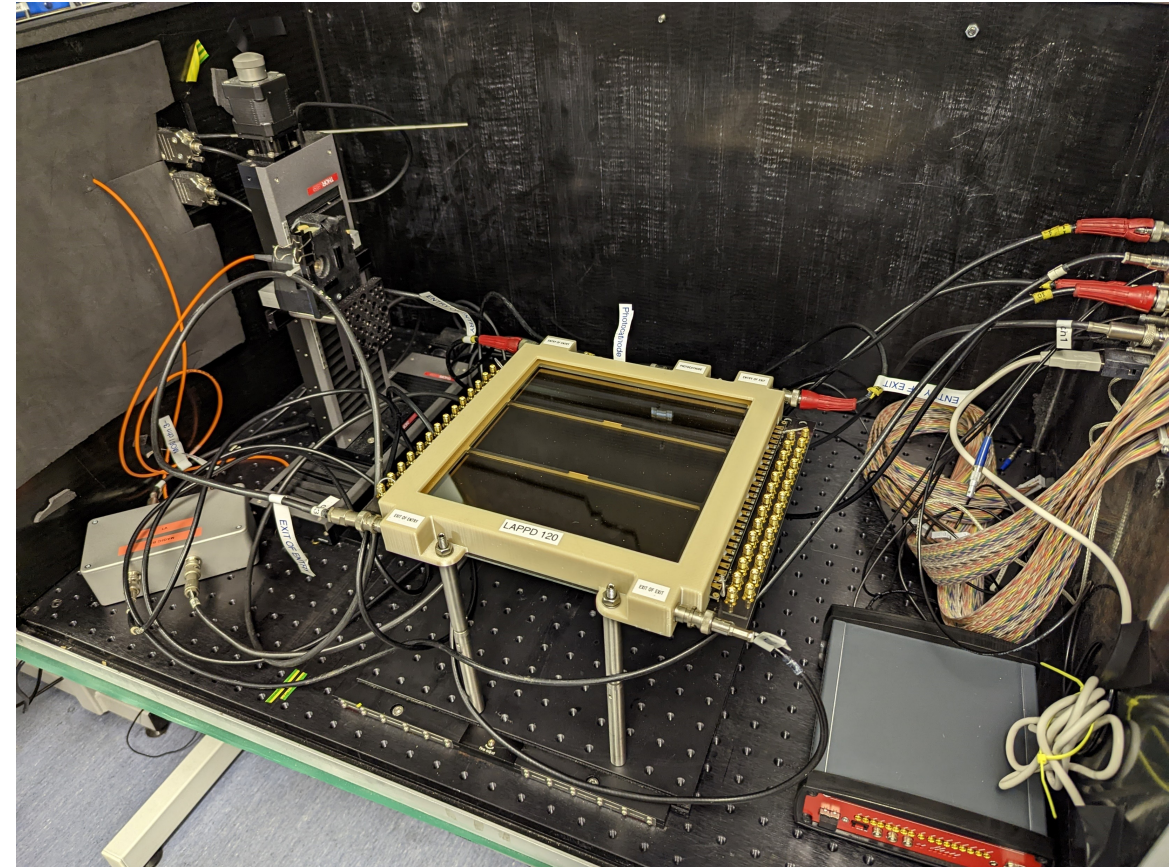
LAPPD – Current status

- LAPPD 120 is now installed in a dark box for testing
 - 20cm x 20cm from INCOM
 - Square grid arrangement of 2.5cm x 2.5cm pixels
 - Pores 20um, pitch
 - Capacitively Coupled readout (Gen II)
- “Magic Box” has been constructed as per guidance for ground referenced HV supplies (5M Ω Exit of Entry, 500k Ω Exit of Exit)



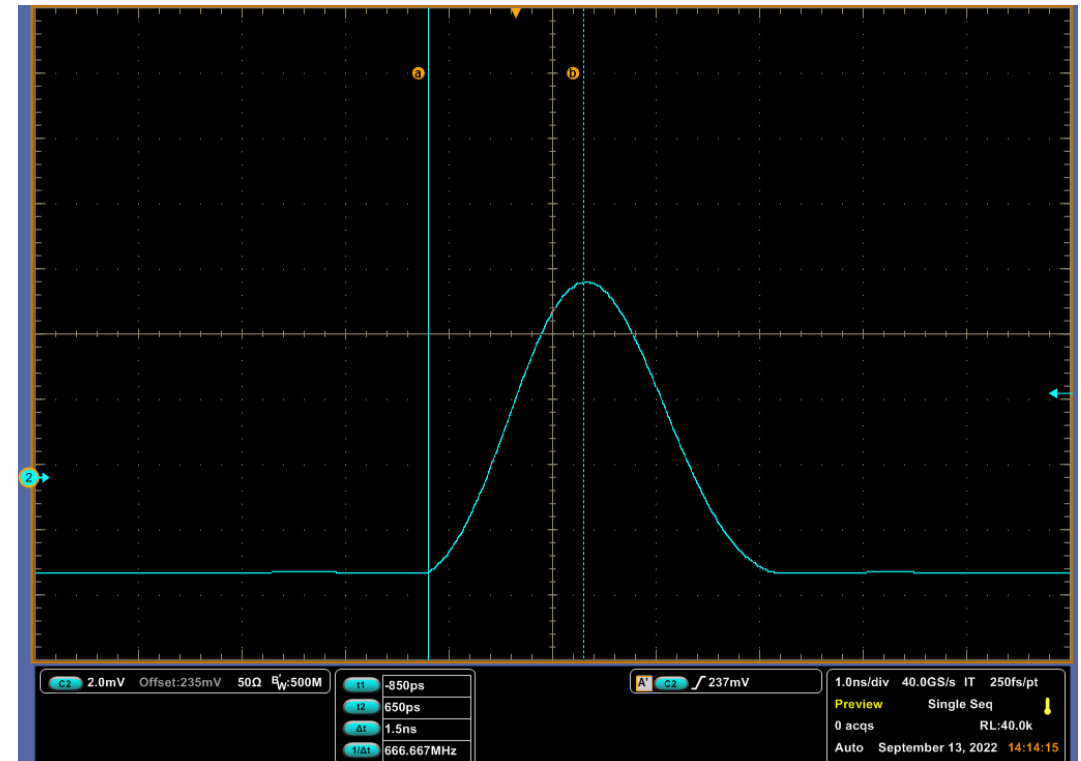
LAPPD – Current status

- LAPPD 120 has been coupled to a CAEN DT5742 to allow for 16 channels to be read out at any one time
- Initial tests was taken using a fast Tektronix oscilloscope and a CAEN DT5730B.



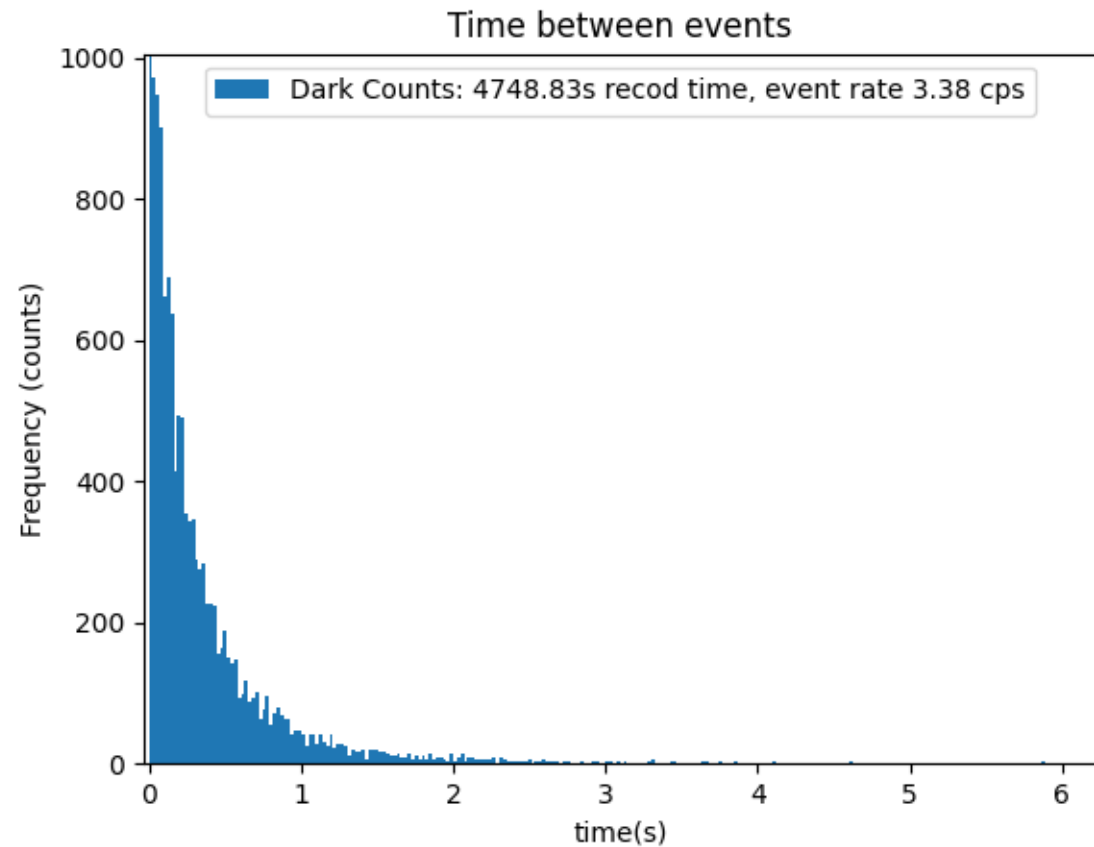
LAPPD – First measurements

- Voltages were slowly increased until dark counts observed
- Settings used for data taking were MCP = 800V
photocathode=200V
- A series of fast gaussian shaped pulses were seen
- Shown – single pe level



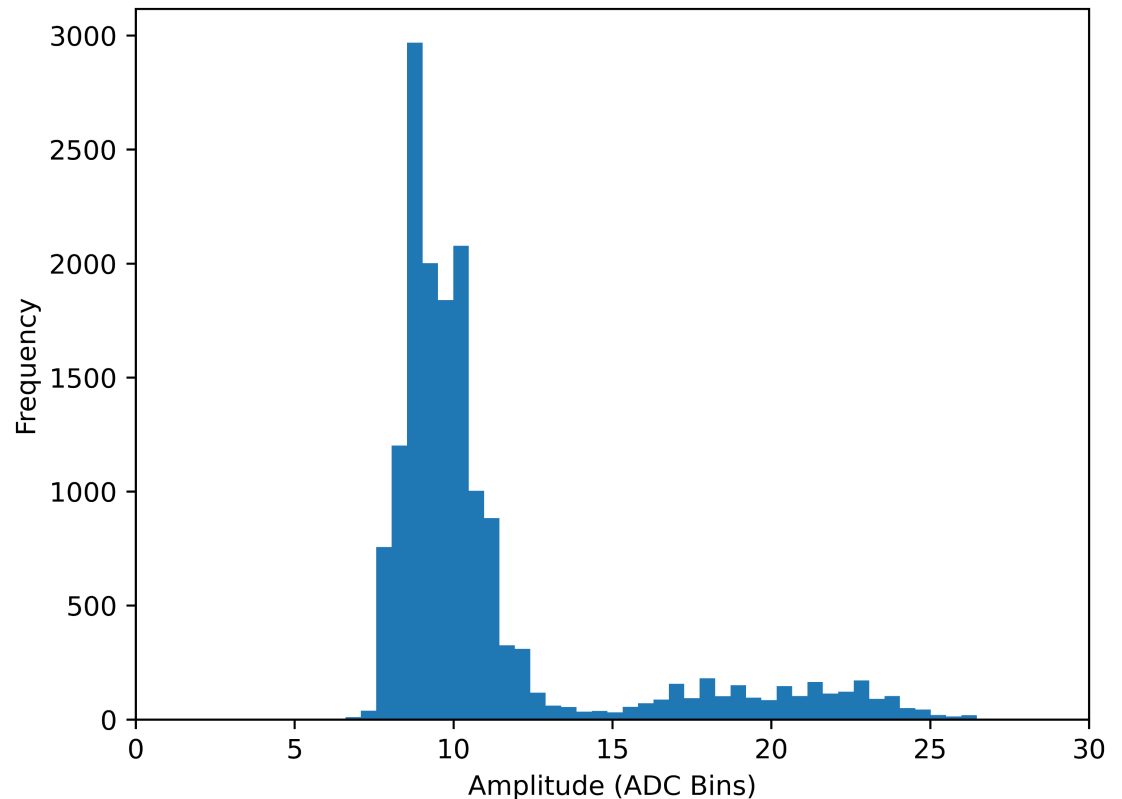
LAPPD – First measurements

- Dark count data was taken with a CAEN DT5730B for 1.5 hours
- Average count rate of 3.38 cps per channel was seen



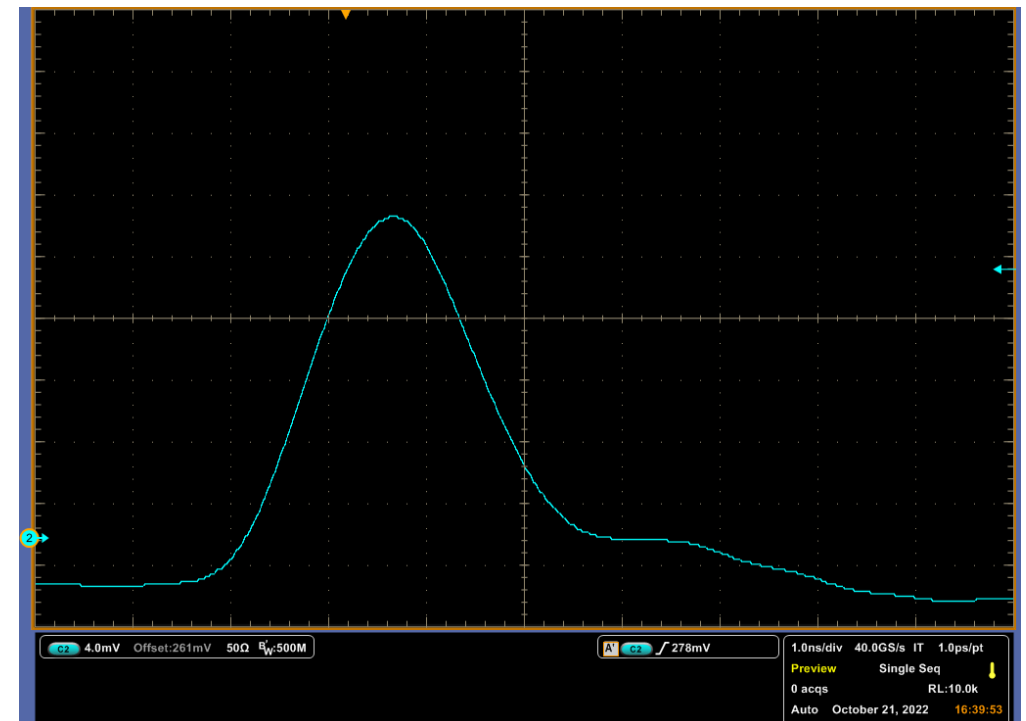
LAPPD – First measurements

- Dark count data was taken with a CAEN DT5730B for 1.5 hours
- Average count rate of 3.38 cps per channel was seen
- Dark counts can be seen above the pedestal



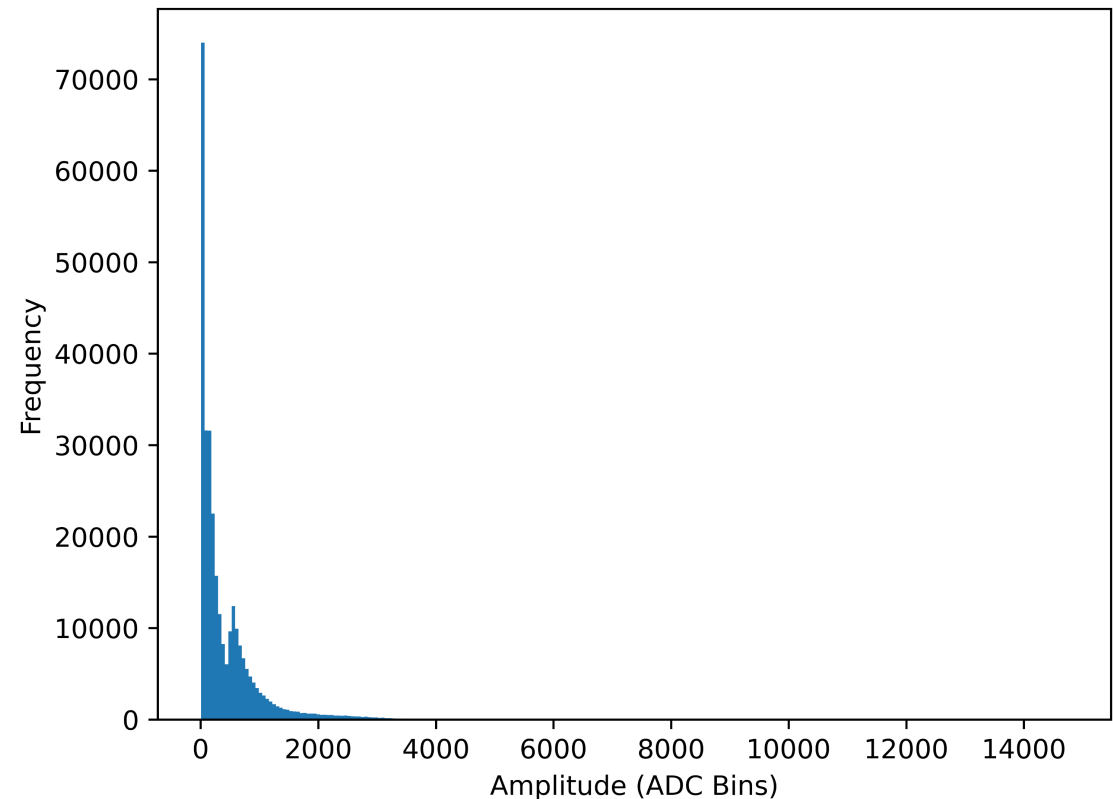
LAPPD – Cosmic Rays

- 5x5cm² tile of EJ200 placed on the central pixels of the LAPPD covering the central 4 2.5cm x 2.5 cm pixels
- This was allowed to run for around 48 hours
- 8 channels recorded around the centre of the LAPPD using DT5730B



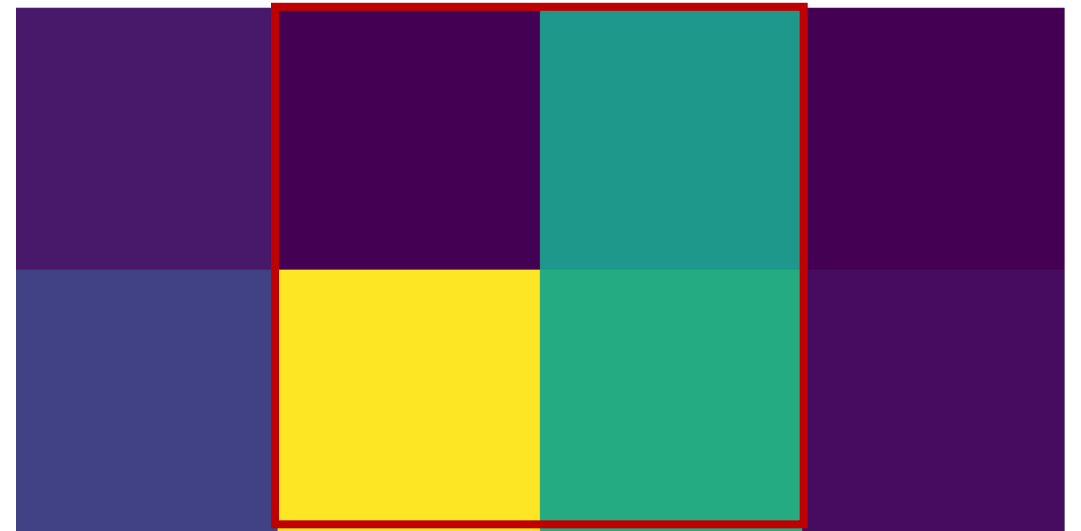
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LAPPD – Cosmic Rays

- $5 \times 5 \text{ cm}^2$ tile of EJ200 placed on the central pixels of the LAPPD covering the central 4 $2.5 \text{ cm} \times 2.5 \text{ cm}$ pixels
- This was allowed to run for around 48 hours
- 8 channels recorded around the centre of the LAPPD using DT5730B
- Right: counts above threshold, purple is zero



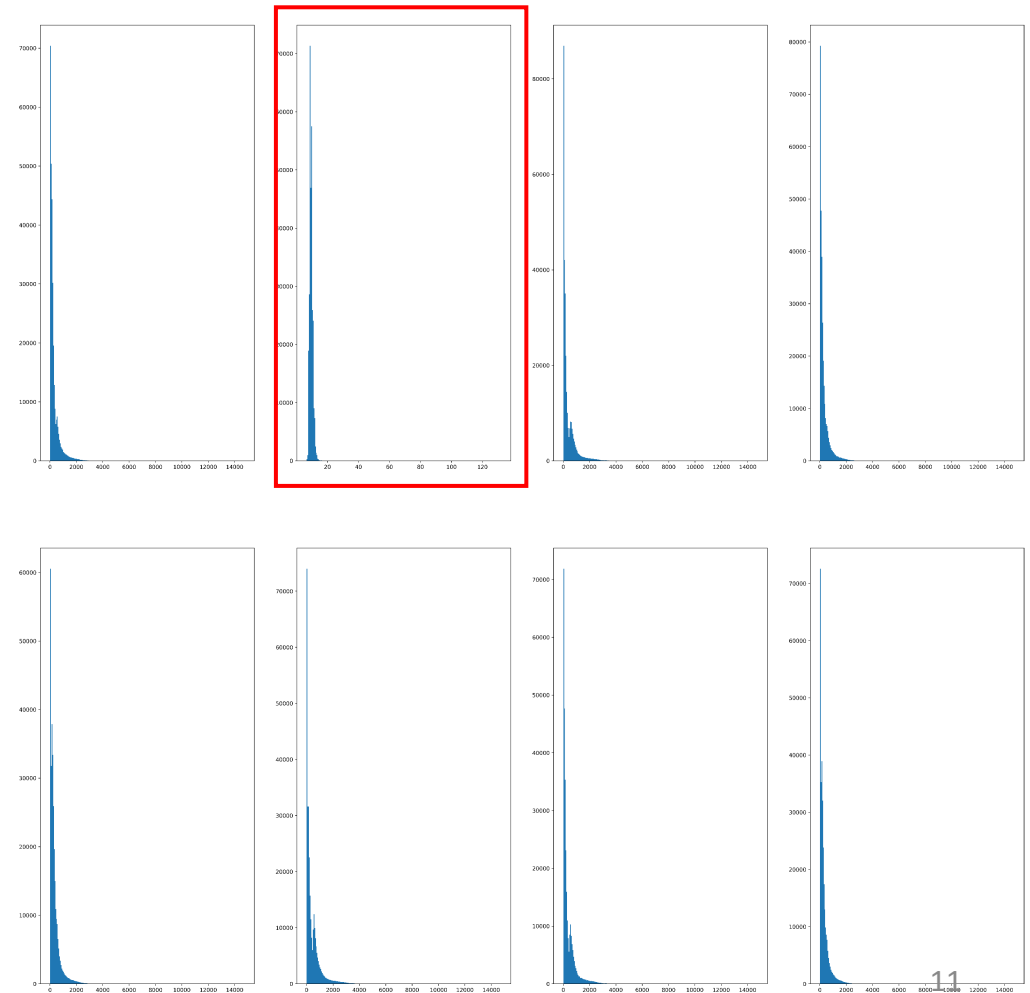
LAPPD – Cosmic Rays

- Three corners of the scintillator tile could be seen above background
- One corner, matched to pixel D4 showed no events above pedestal



LAPPD – Cosmic Rays

- Three corners of the scintillator tile could be seen above background
- One corner, matched to pixel D4 showed no events above pedestal
- This will have to be further investigated to find the cause.
- Shown – amplitude distributions



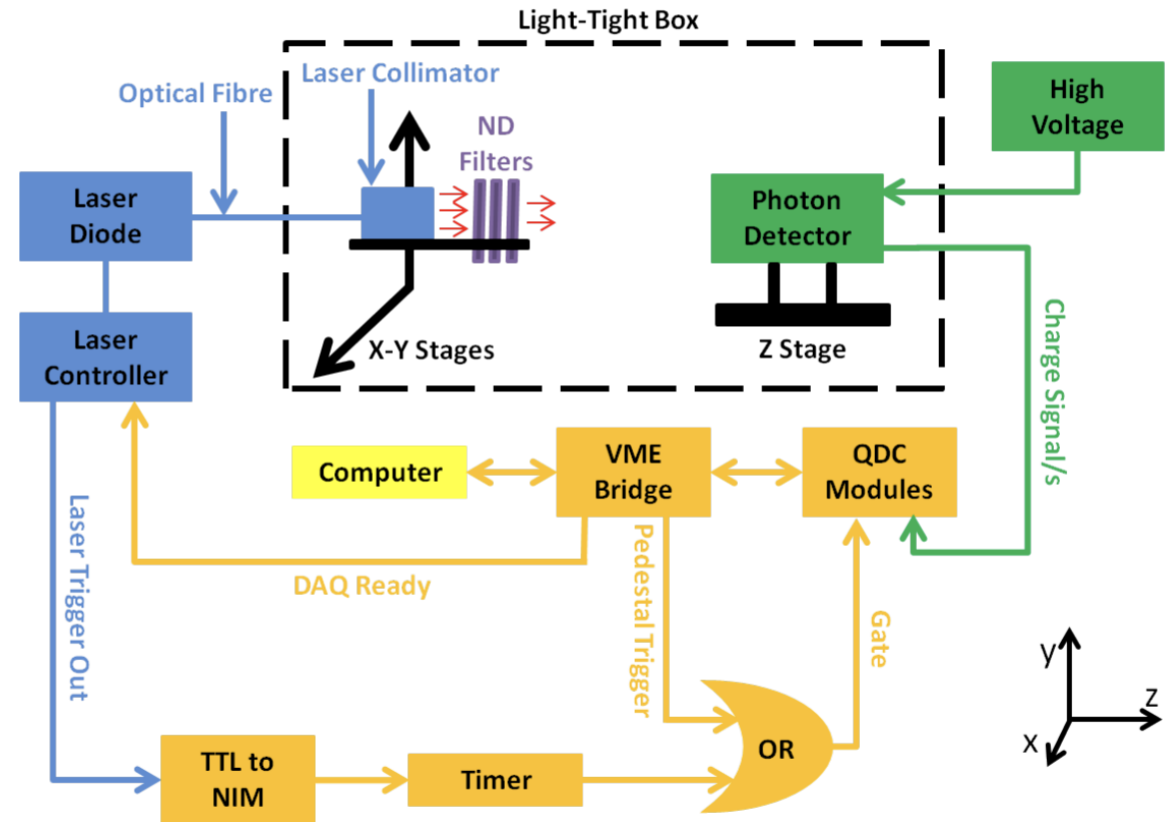
LAPPD – Measurement Plans

Current measurement plan at Glasgow includes:

- Gain Scan
- Transit time scans with reference PMT and beamsplitter
- Coarse ($O(\text{mm})$) full area laser scan with 405 nm and 635nm
- High resolution scan (sub-mm) over limited area with 405 nm and 635 nm laser
- Cherenkov and scintillation detection and separation with BGO, LYSO and LiF scintillators
 - Already demonstrated in lab with SiPM studies
- Characterisation with cosmic ray test stand

LAPPD – Laser Scanning Test Stand

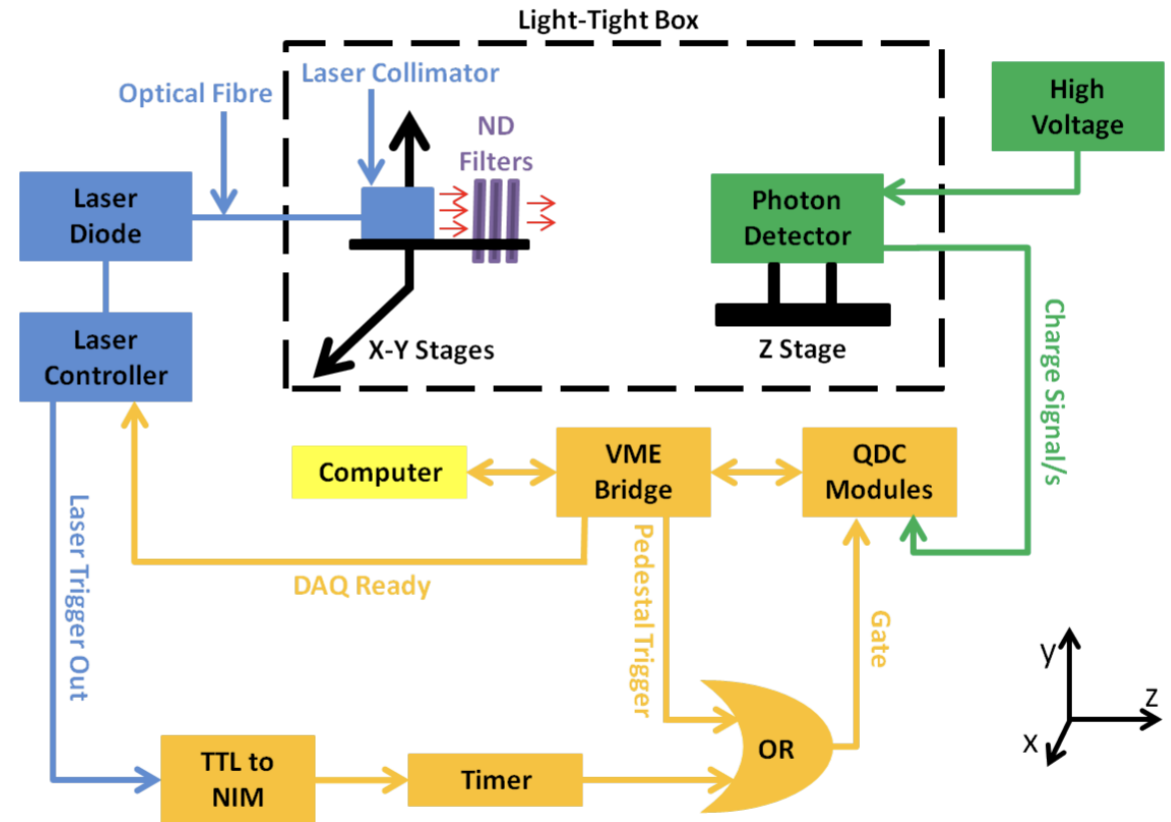
- LAPPD will be scanned with a high precision picosecond laser
- X-Y step size 0.1 μm
- Laser spot size adjustable between 0.1 and 1mm
- Laser jitter <3ps RMS
- Pulse width <60ps
- 405 nm and 635 nm lasers



VME or desktop digitiser or fast oscilloscope readout available

LAPPD – Laser Scanning Test Stand

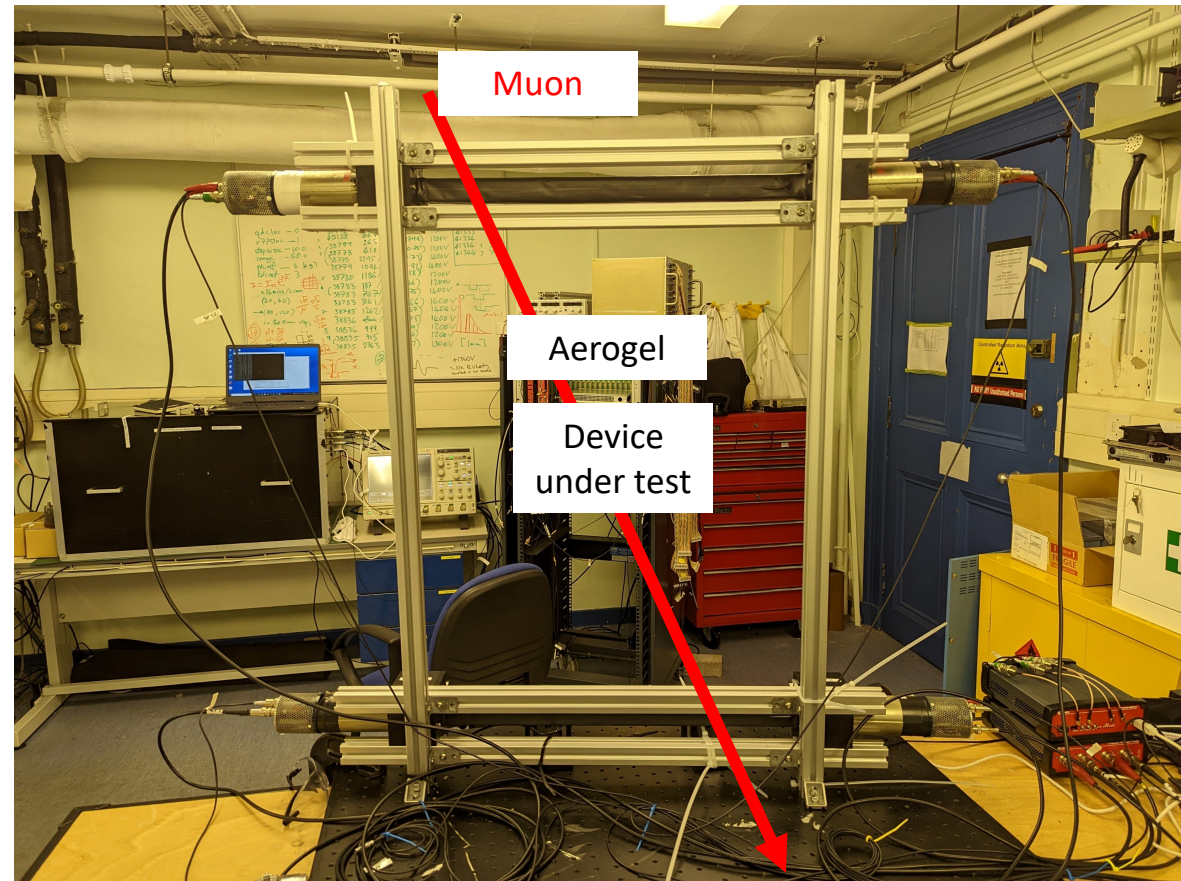
- Picosecond pulsed laser system can also be used for transit time scans
- Upgrade to system will be:
- fast photodetector used with a beam splitter to eliminate walk on the laser trigger signal



VME or desktop digitiser or fast oscilloscope readout available

LAPPD – Cosmic ray test stand

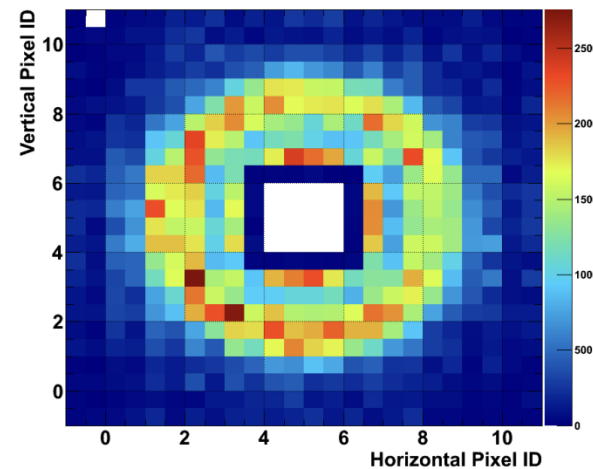
- Muon tracking setup that was previously used to test MAPMT RICH detectors reconstructed
- Allows for trigger to be generated and for the angle that the muon makes with the device under test to be calculated



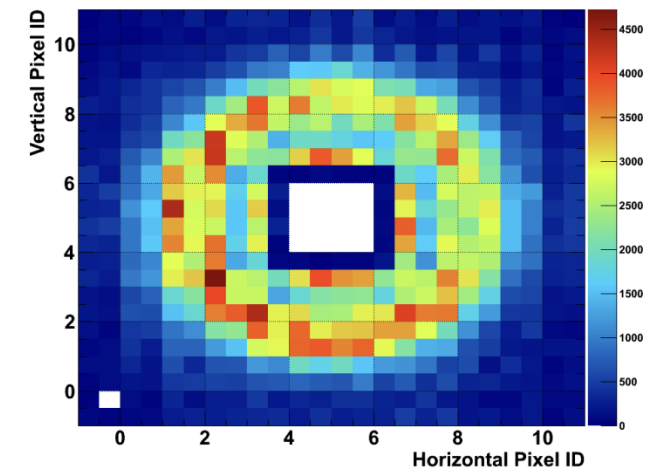
LAPPD – Cosmic ray test stand

- The LAPPD with a radiator (aerogel) would be placed between these bars
- Muons passing through would be tracked
- Previously used for MAPTs studies – right
- Can also see hit in window

H8500 plus aerogel



(a)



(b)

mRICH R&D

- eRD101 proposal - mRICH Project R&D in FY2023 (X. He, M. Contalbrigo)
 - Compact, modular RICH, fitting within EIC space requirements
 - K/pi separation 2-8GeV/c, and e/pi up to 2GeV/c
 - Aerogel plus focussing system
- Initial plans
 - testing existing LAPPD with aerogel tiles in cosmic stand
 - evaluate readout options...plans for which still under development
 - (potentially have opportunity to study picoTDC system from CAEN, planning to initially test this system with SiPMs)
 - (interested to identify potential sources of funding to apply for LAPPD to match footprint of mRICH modules)

Outlook

- 20cm x 20cm LAPPD studies on-going
- Series of tests planned using existing characterisation stands in UoG
 - Including upgrades to laser scanning system for transit time studies
- For RICH studies:
 - Next steps include testing existing LAPPD with aerogel in cosmic stand