THE UNIVERSITY of EDINBURGH

Photon Detectors for LHCb RICH

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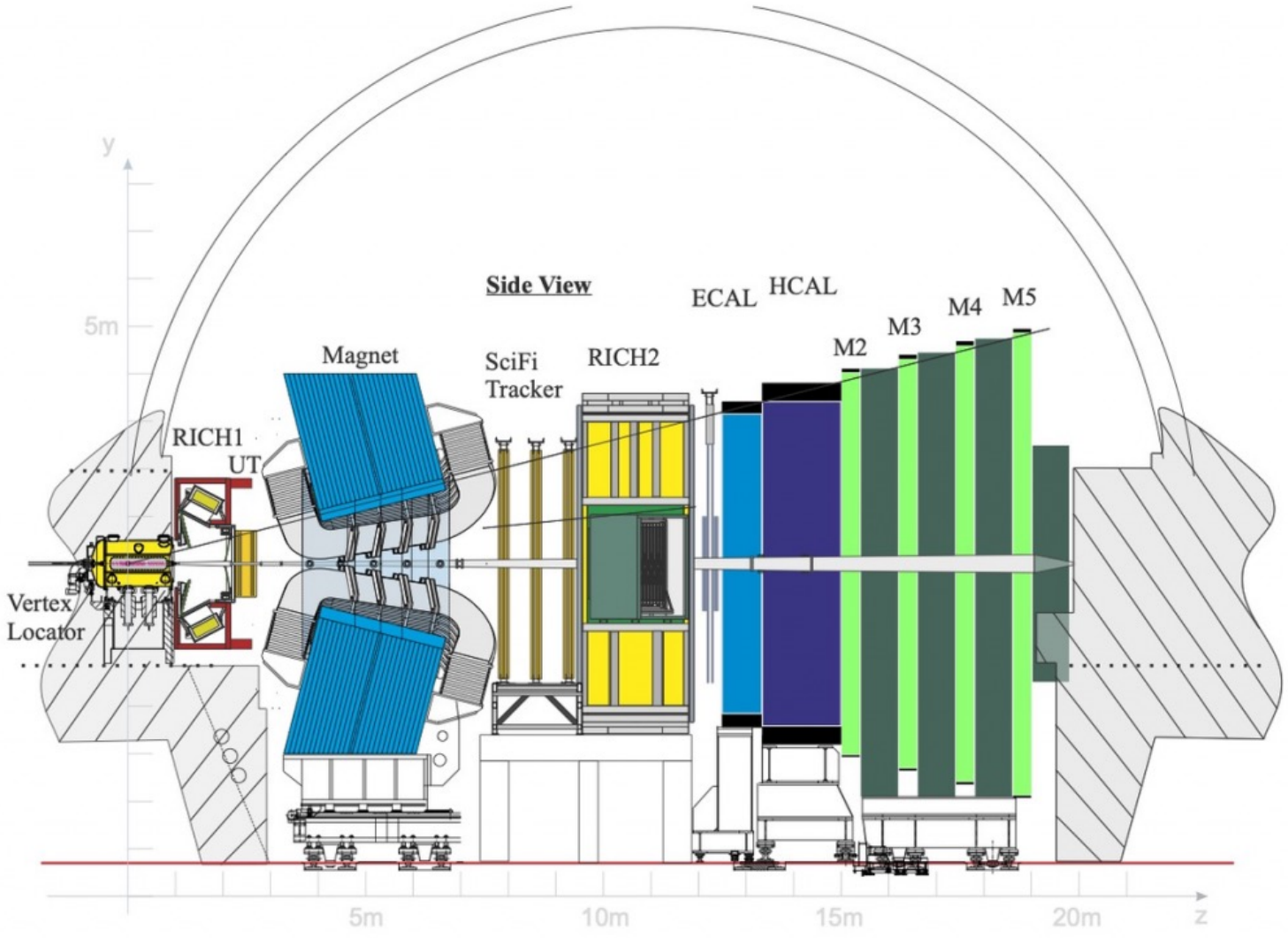
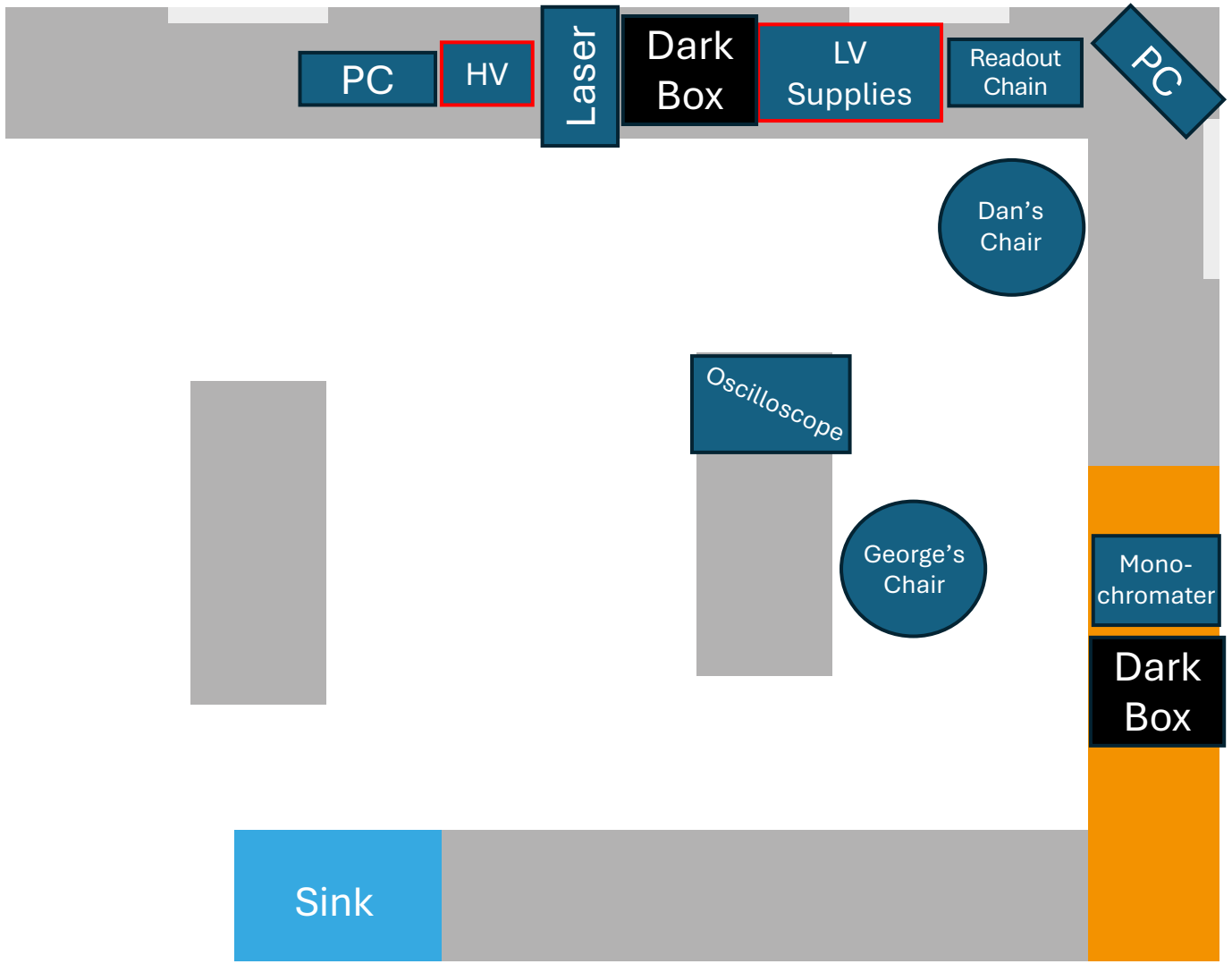
LHCb RICH



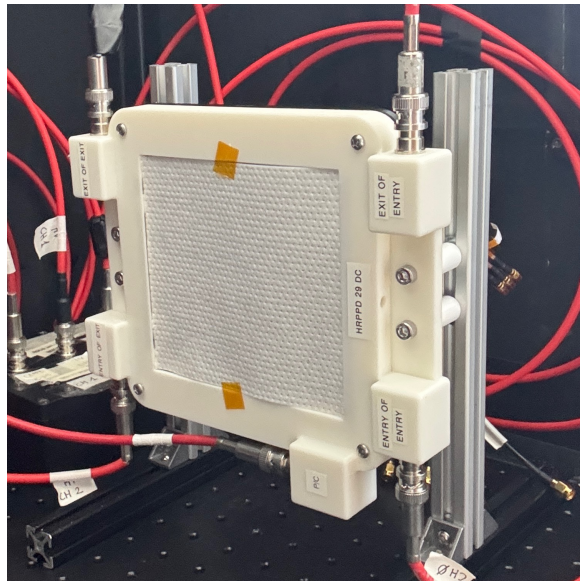
- Ring Imaging Cherenkov Subdetectors at LHCb: PID
- LS3 Enhancements; FastRICH, fast timing ~100ps
- Upgrade II – Photon Detector Testing and Selection; TDR

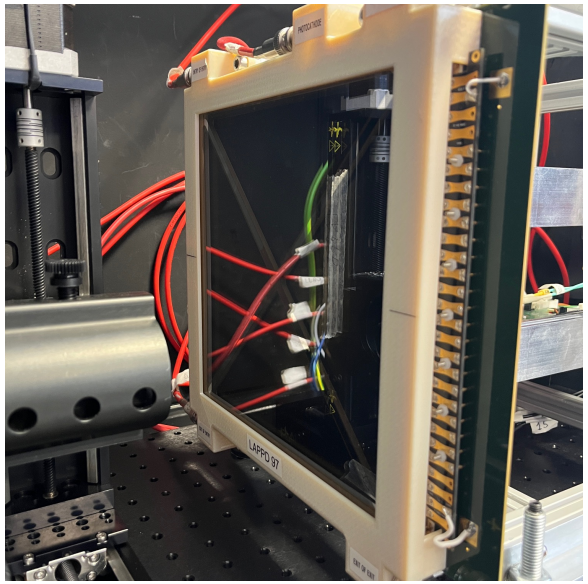
Edinburgh Photon Lab

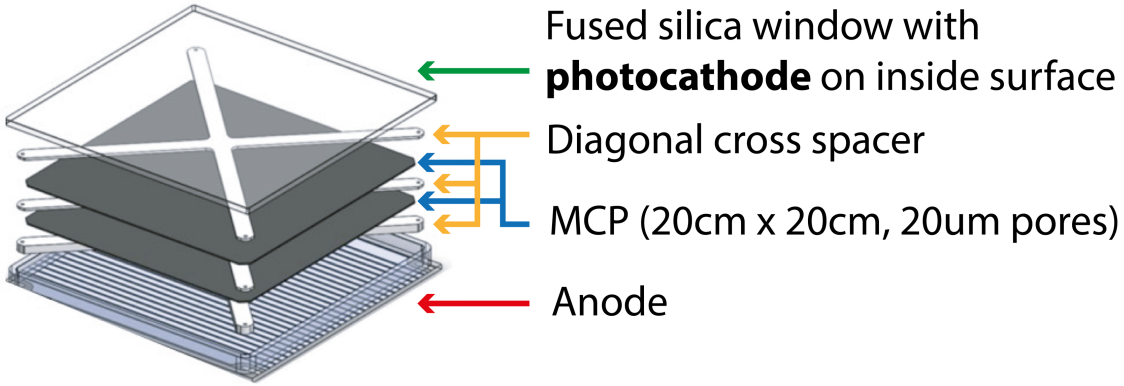


- Monochrometer for QE: CS260B-1-MC-D from Newport
- Newport Monochromator Illuminator
- Custom picosecond 405 nm Pilas laser. 25 ps pulse width, timing jitter < 2ps micro focussing
- CCD: AmScope 4K HDMI 2160P, HD408N-EUL
- 2 HV, 4 LV supplies
- muDAQ, picoTDC, picoammeter readout
- Keysight UXR0204A, 4 Channels, 10 bit, 20GHz, 128 GSa/s oscilloscope
- 4 Thorlabs translation stages (+2 other)
- 1 1/2 PCs
- HRPPD & LAPPD
- Various Git repositories: LAPPD Testbeam Analysis, LAPPD Sim, SiPM Toy, FastRICH Testbeam

Detectors

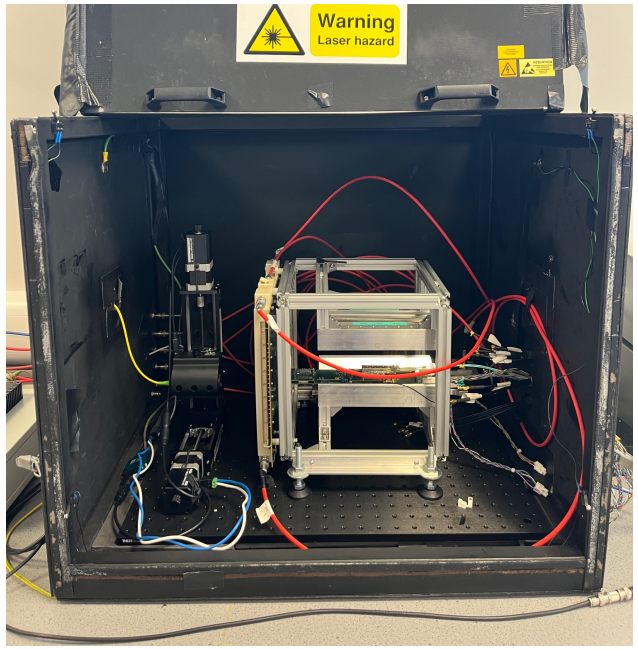


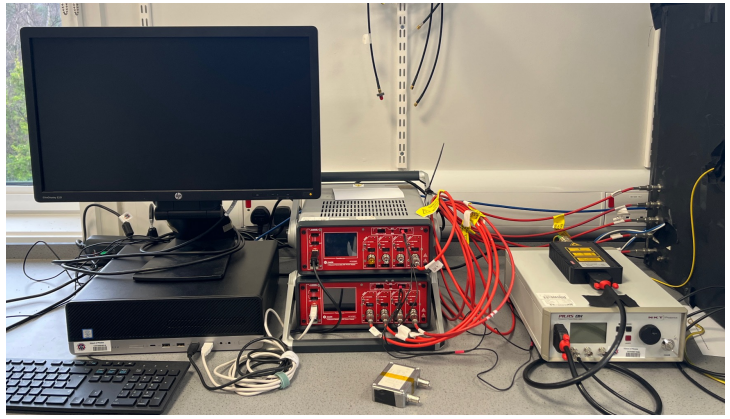


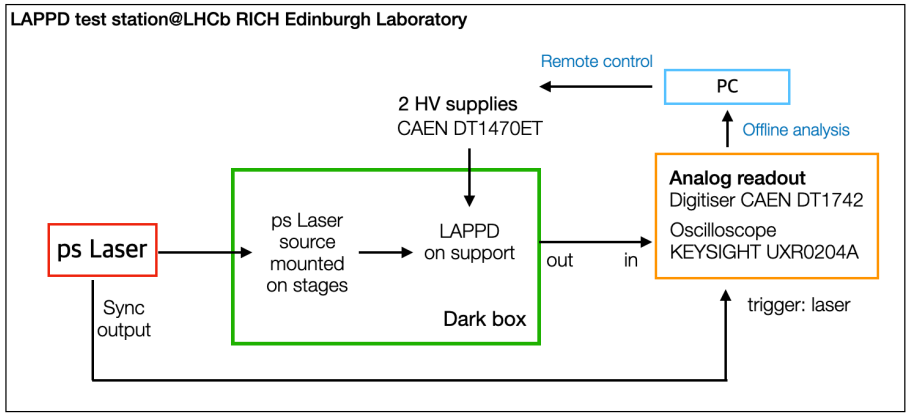


- LAPPD (Large Area Picosecond Photodetector) and HRPPD (High Rate Picosecond Photodetector) – both are microchannel plate technologies (MCP)
- Fast timing ~100ps, high yield
- Also have SiPMs and MaPMTs

Pulsed Laser Setup

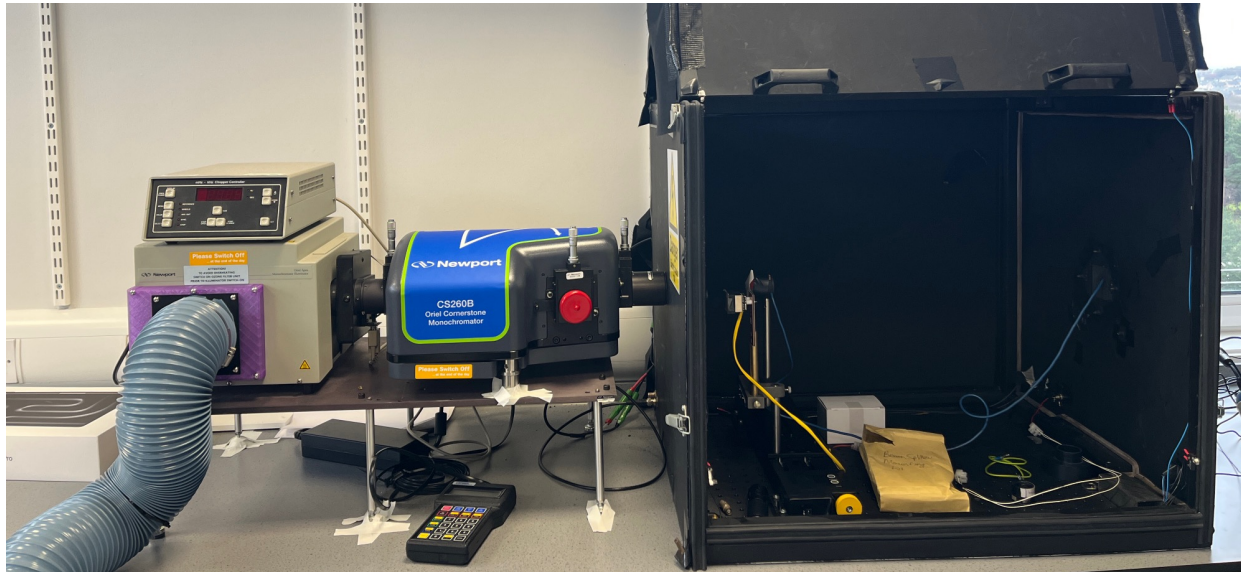


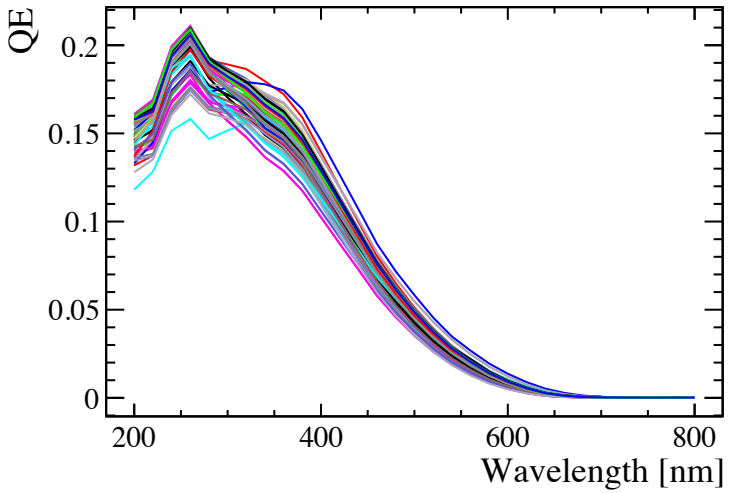


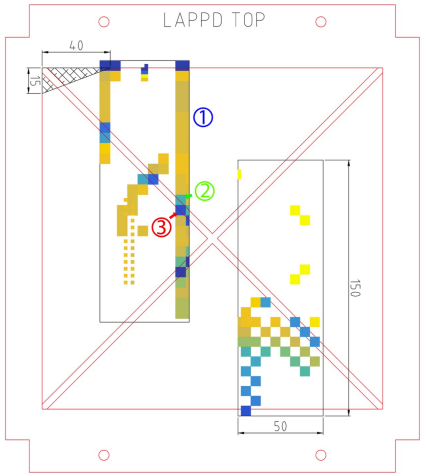


- Translation Stages + Microfocusing
- muDAQ and picoTDC readout
- LV supplies for readout and translation stages
- HV supplies for Pulsed Laser
- Rate Measurements

QE Setup

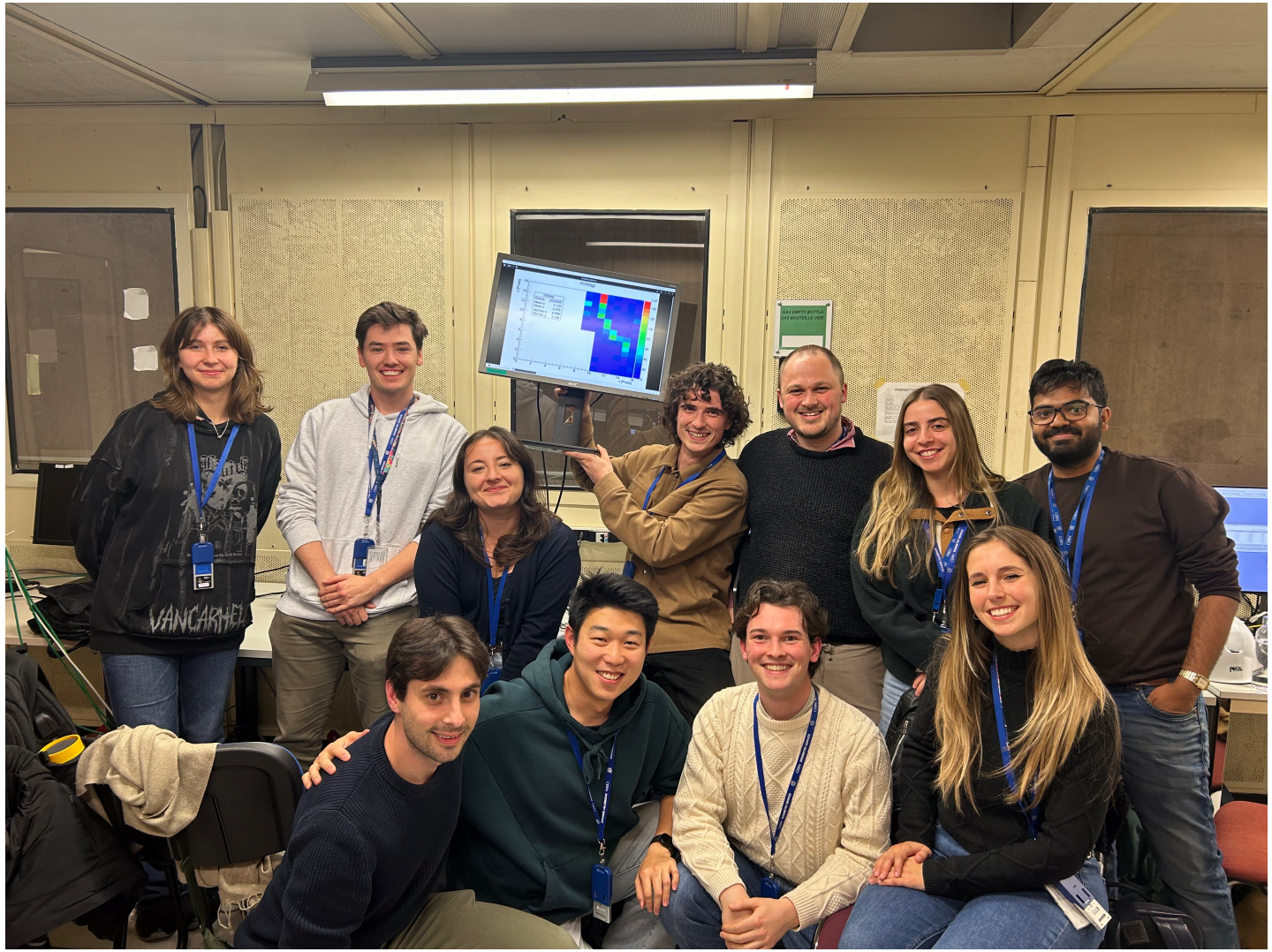




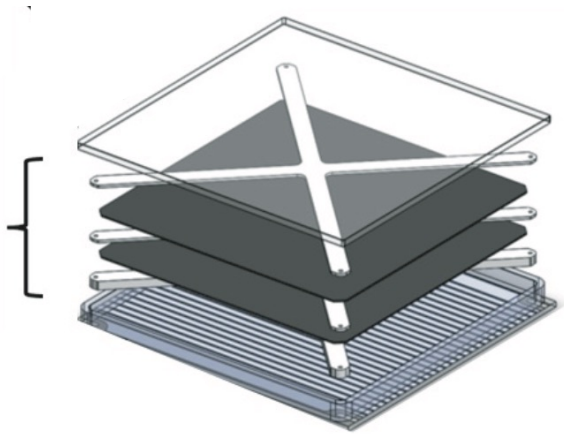


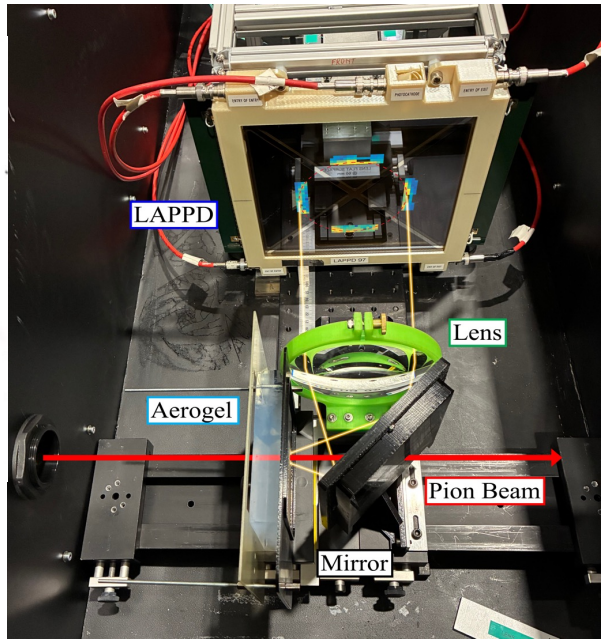
- Translation Stages for position scan
- Reference Photodiode for QE calibration
- Monochromator and Monochromator Illuminator
- Picoammeter readout
- QE Measurements

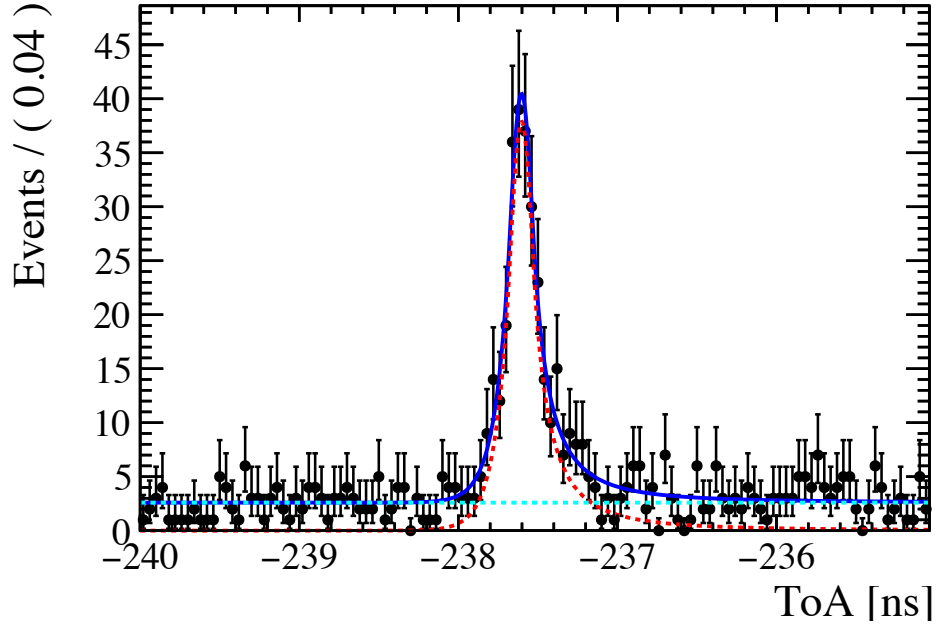
Upcoming Papers/Projects

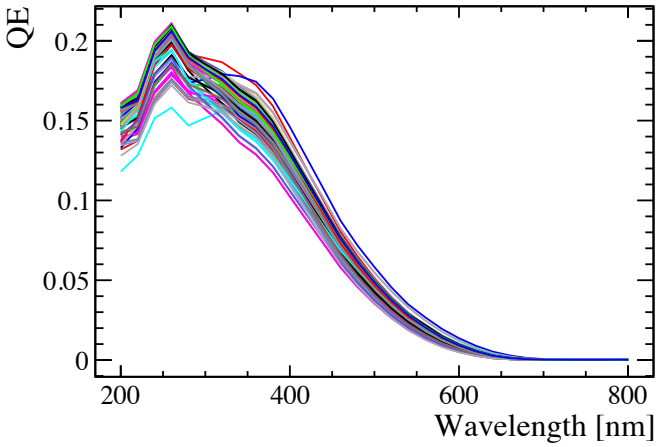


LAPPD Paper



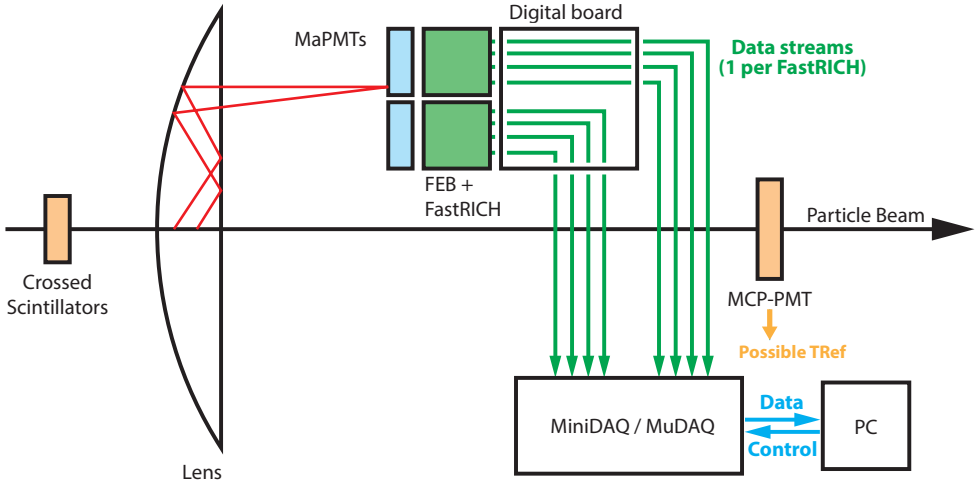


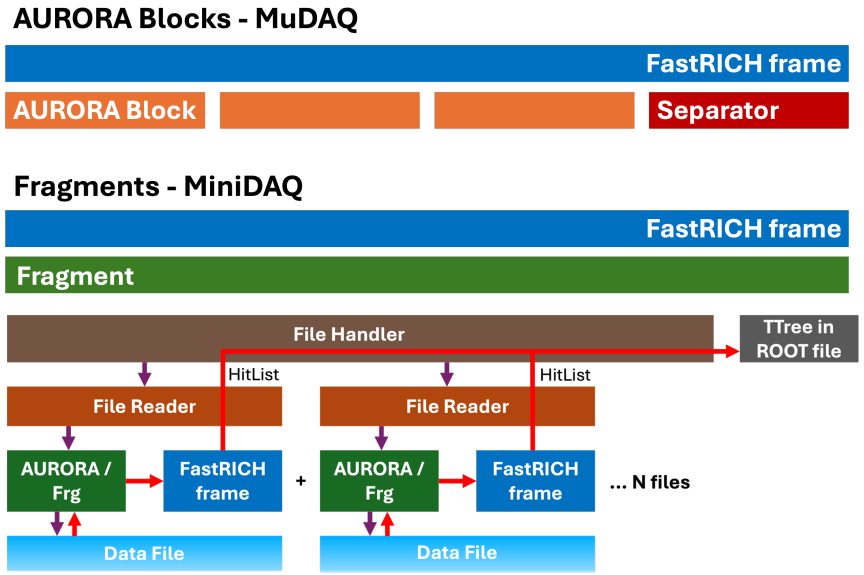


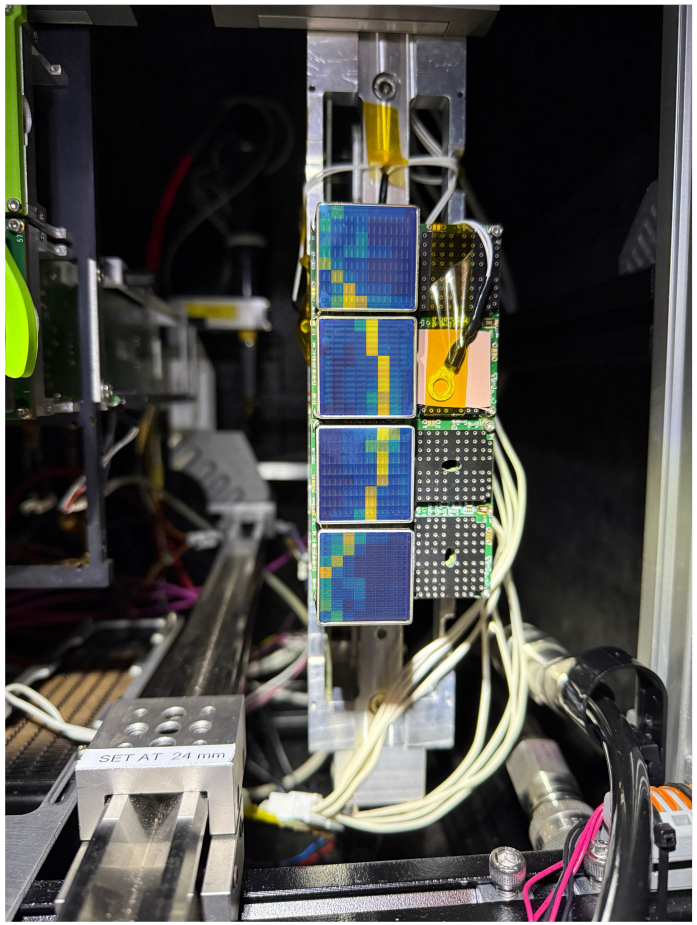


- LAPPD Lab and Testbeam Results
- Federica, Lais, Michael Deb, Pratik and Dan attended May Testbeam
- First time LAPPD in beam at SPS (CERN North Area)
- CERN Lab QE Measurement
- Edinburgh QE Dark Box Measurment
- Timing analysis ongoing for imminent paper

LS3 Enhancements: FastRICH testbeams

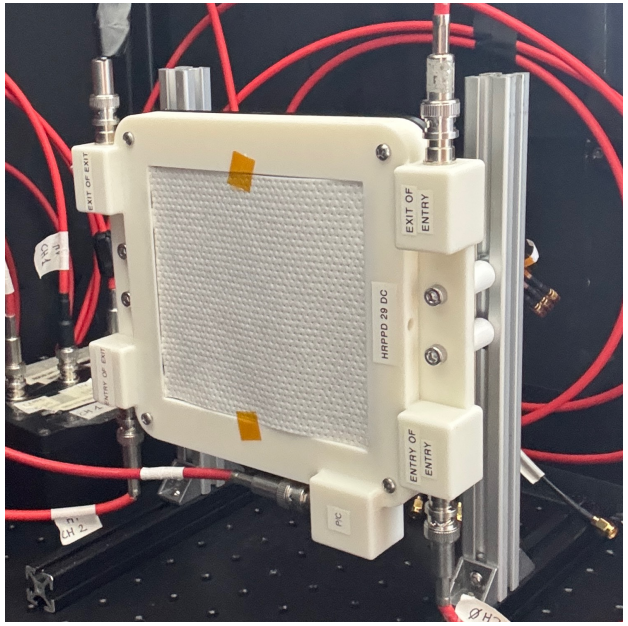


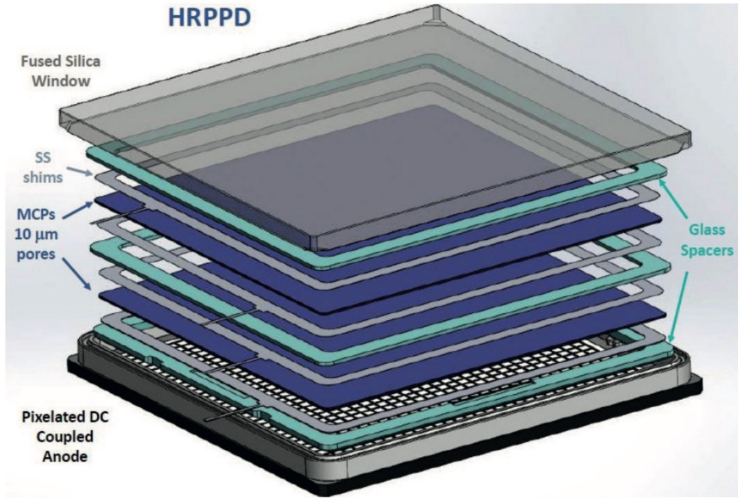


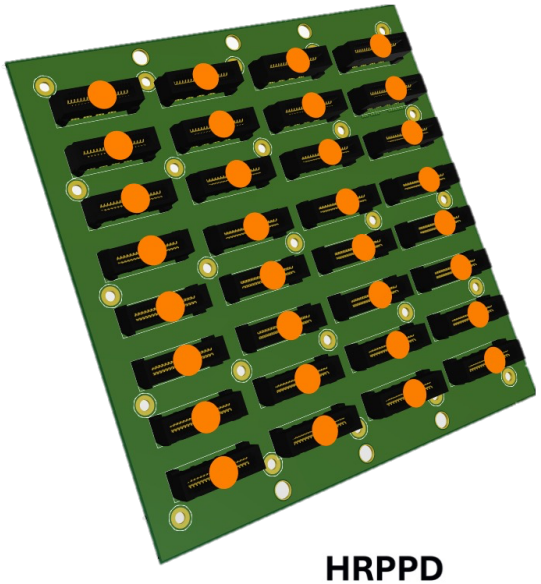


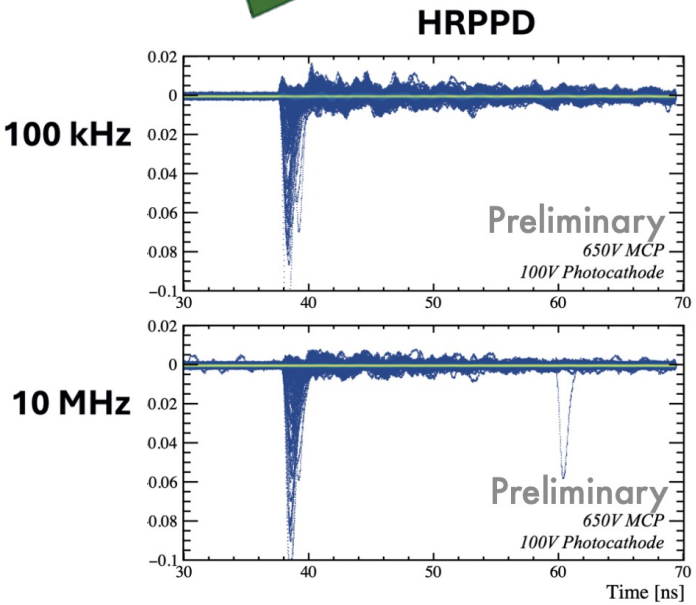
- Federica, Alex, Dan and George attended October (SPS) and November (PS) Testbeams
- Large Edinburgh effort towards intricate software development: See oct-25-decoding
- First readout ring with FastRICH
- Two readout chains with muDAQ and miniDAQ

HRPPD Studies



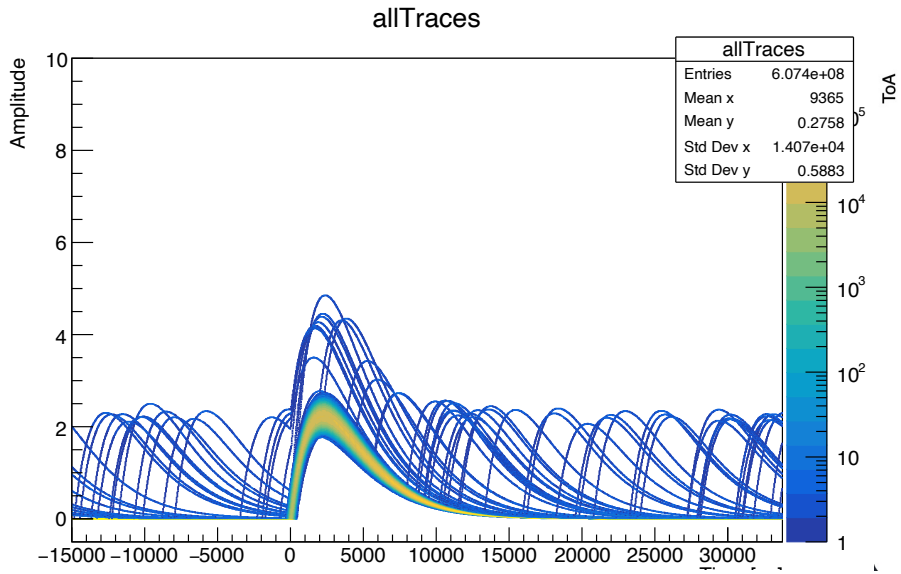


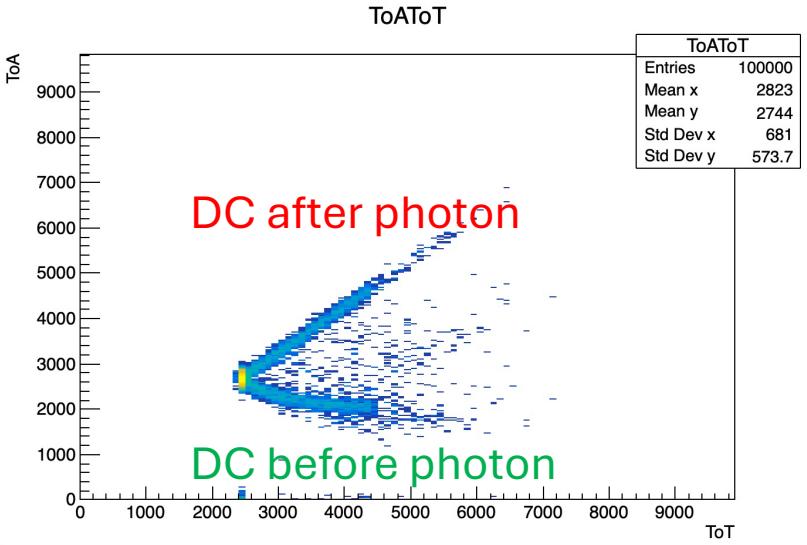


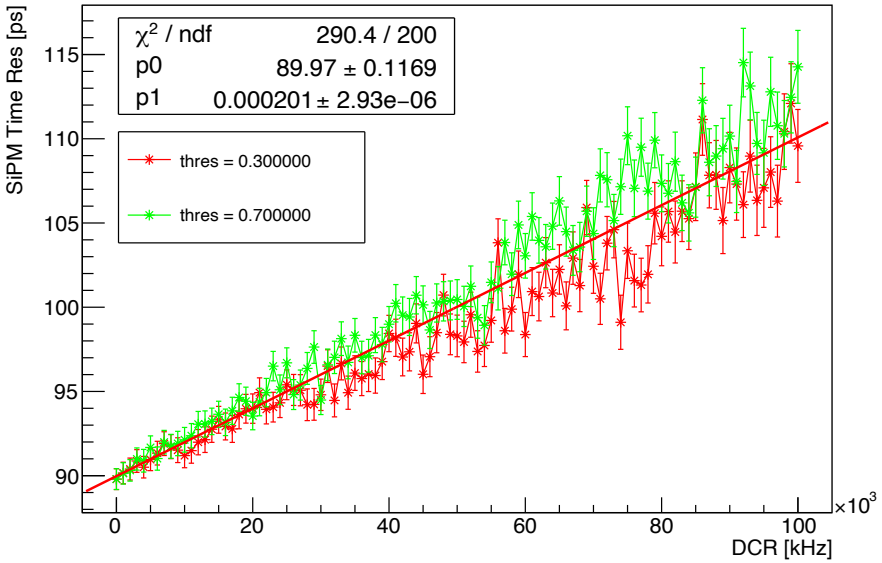


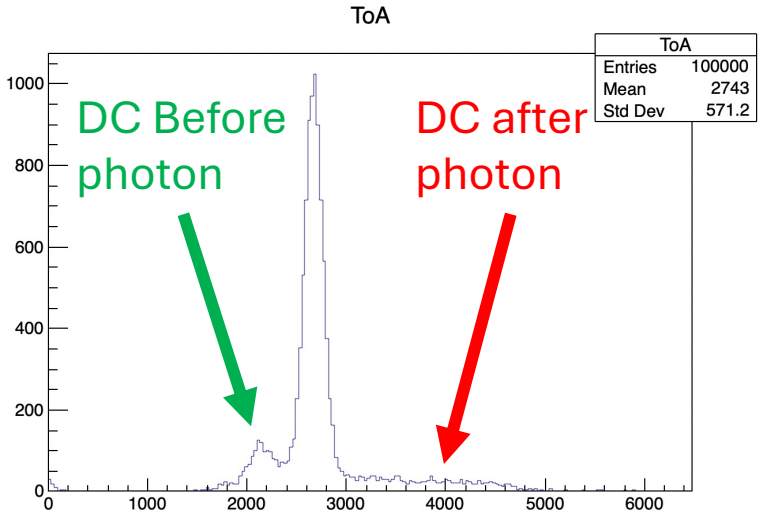
- Currently instrumenting 3 channels (possibly up to 16)
- Backplane in development to readout all channels
- Upcoming Lab Rate Measurements
- Upcoming April and July (SPS) Testbeams

SiPM Toy Simulation



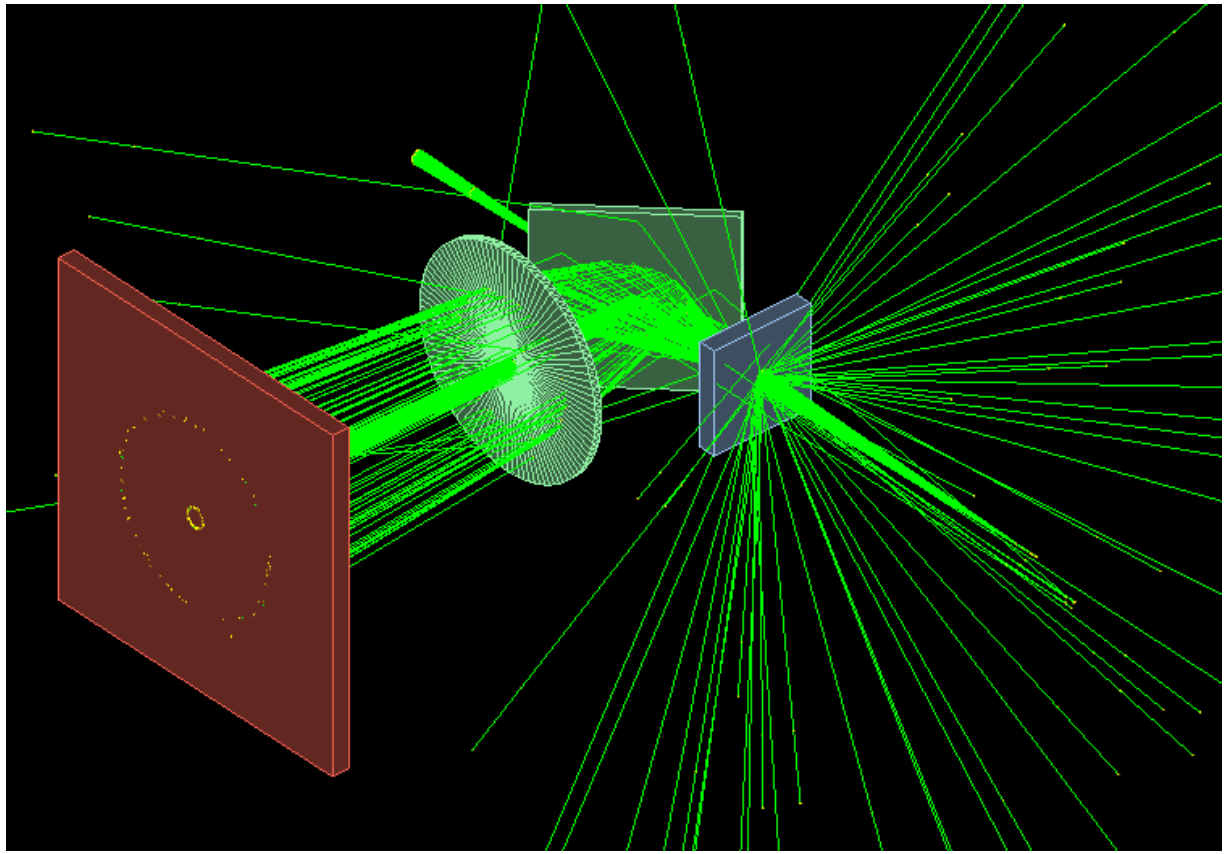






- Silicon Photomultipliers (SiPMs) are the leading technology for RICH Upgrade II
- Open question about Dark Count Rate (DCR) effecting Time Res
- Ensures Edinburgh involvement in all possible upgrade technologies
- Based on GosSiP framework
- Highly TDR relevent!

Geant4 LAPPD/HRPPD Simulation



- Initial work complete: currently working on segmenting the detector
- Should be ready in time for HRPPD paper

Current Bottlenecks

- Slow control computer for pulsed laser
- Storage on disk for large amounts of Testbeam data
- No network connection on main PC for sharing results/data
- Difficult design/fabrication parameters for HRPPD backplane
- Time!