

Study of Hamamatsu H8500 Multi-anode Photomultiplier Tubes with a Focus on the Dynode 12 Signal

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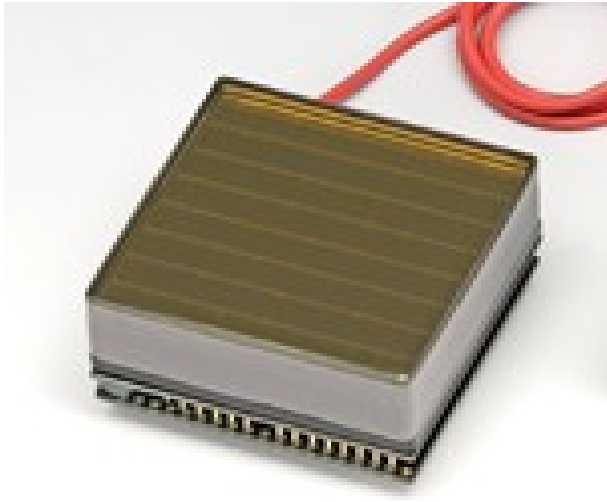
Intro

The aim of this talk is to present a study of several Hamamatsu H8500 multi-anode photomultiplier tubes with a focus on the results gained from analysis of the dynode 12 signal.

The H8500 was studied for potential use in a self triggering system involving scintillating fibres. To be used for this purpose The H8500 is required to have good position sensitivity, timing and efficiency.

These factors were studied by taking a set of 64 point scans at a range of voltages and a high resolution (1mm step) scan at 900V for each PMT.

The H8500

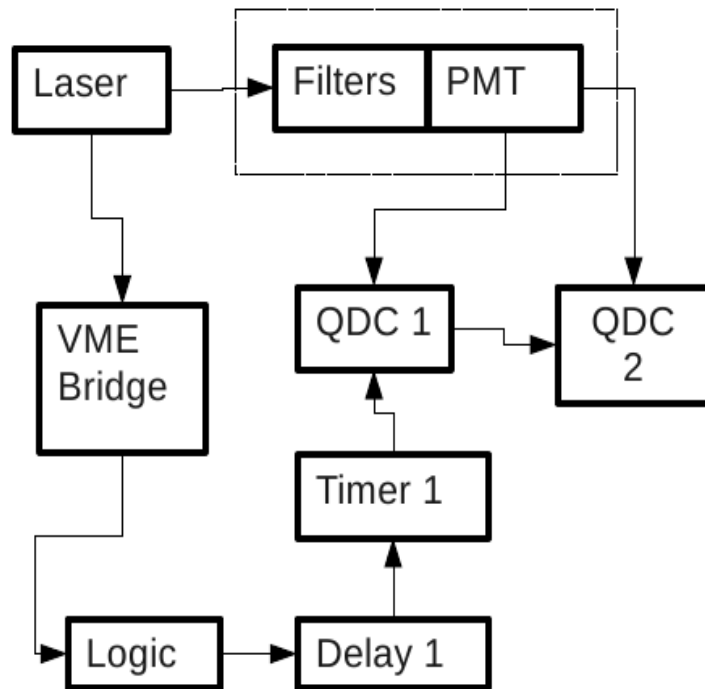


http://jp.hamamatsu.com/products/sensor-etd/pd002/pd394/H8500C/index_en.html

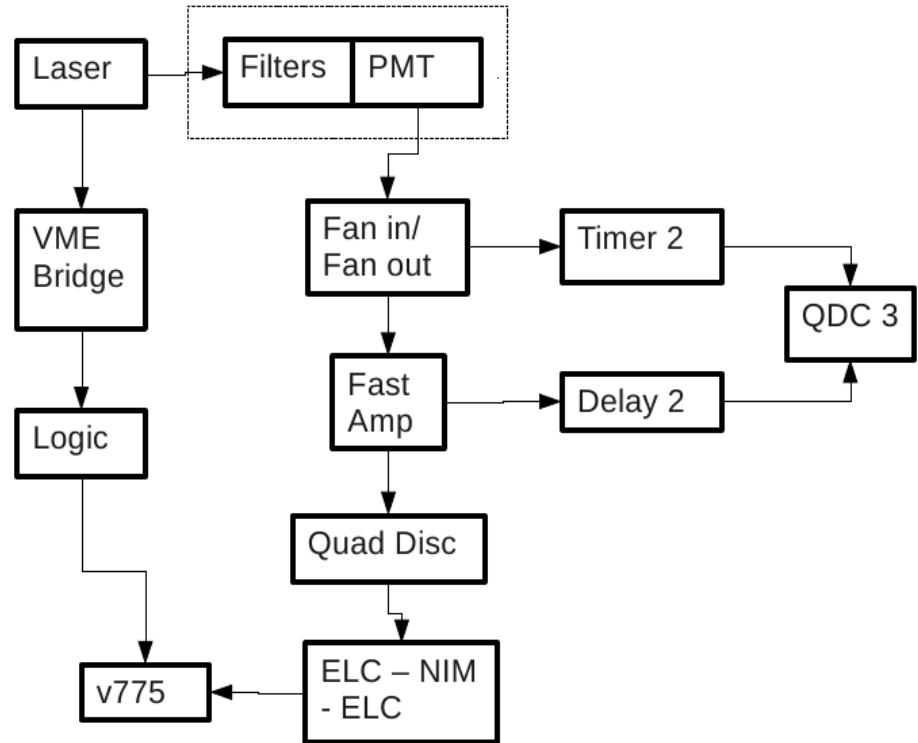
- Flat panel multi-anode photo multiplier tube.
- Max voltage is -1100V
- 8 x 8 array of pixels with each pixel having 12 dynode stages.
- It is 52 x 52mm in total size with an active area of 49 x 49mm.
- Has a bi-alkali photocathode.
- Spectral response is 300 - 650nm.
- Single channel readout.
- Dynode 12 signal which is common across the PMT.

Set up

Single channel data



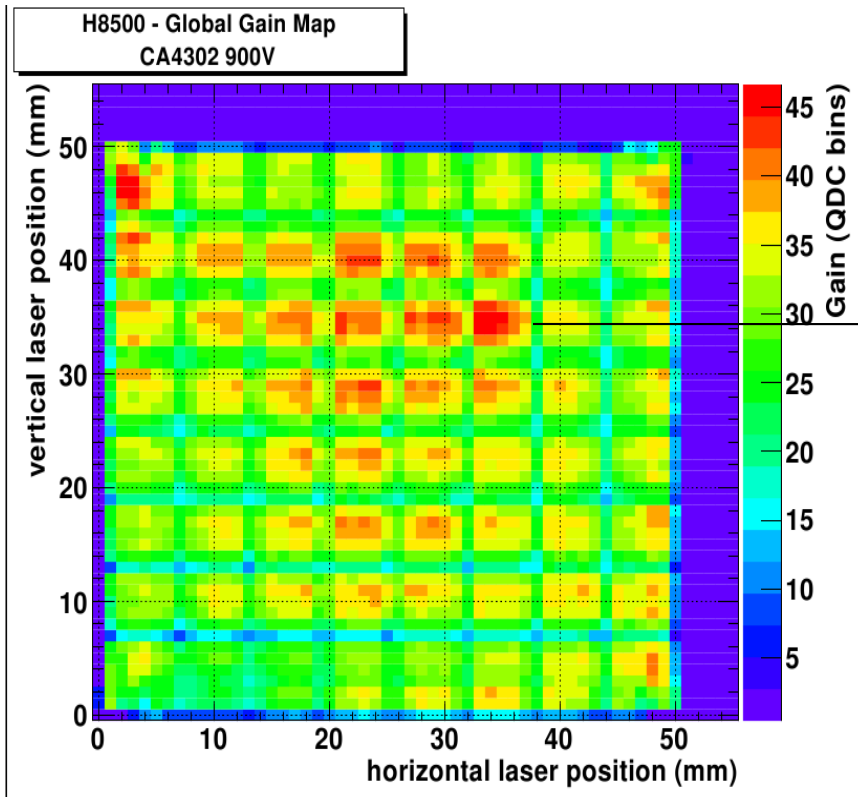
Dynode 12 data



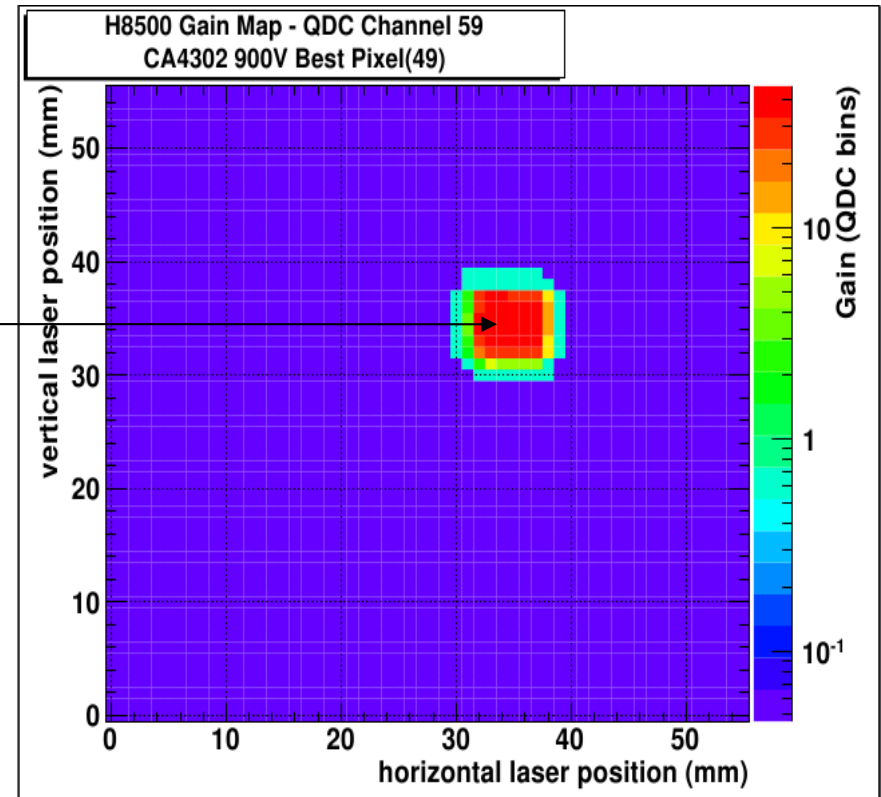
The laser was moved in both the x and y directions by a computer controlled stepper motor.

Single Channel analysis

Global gain map

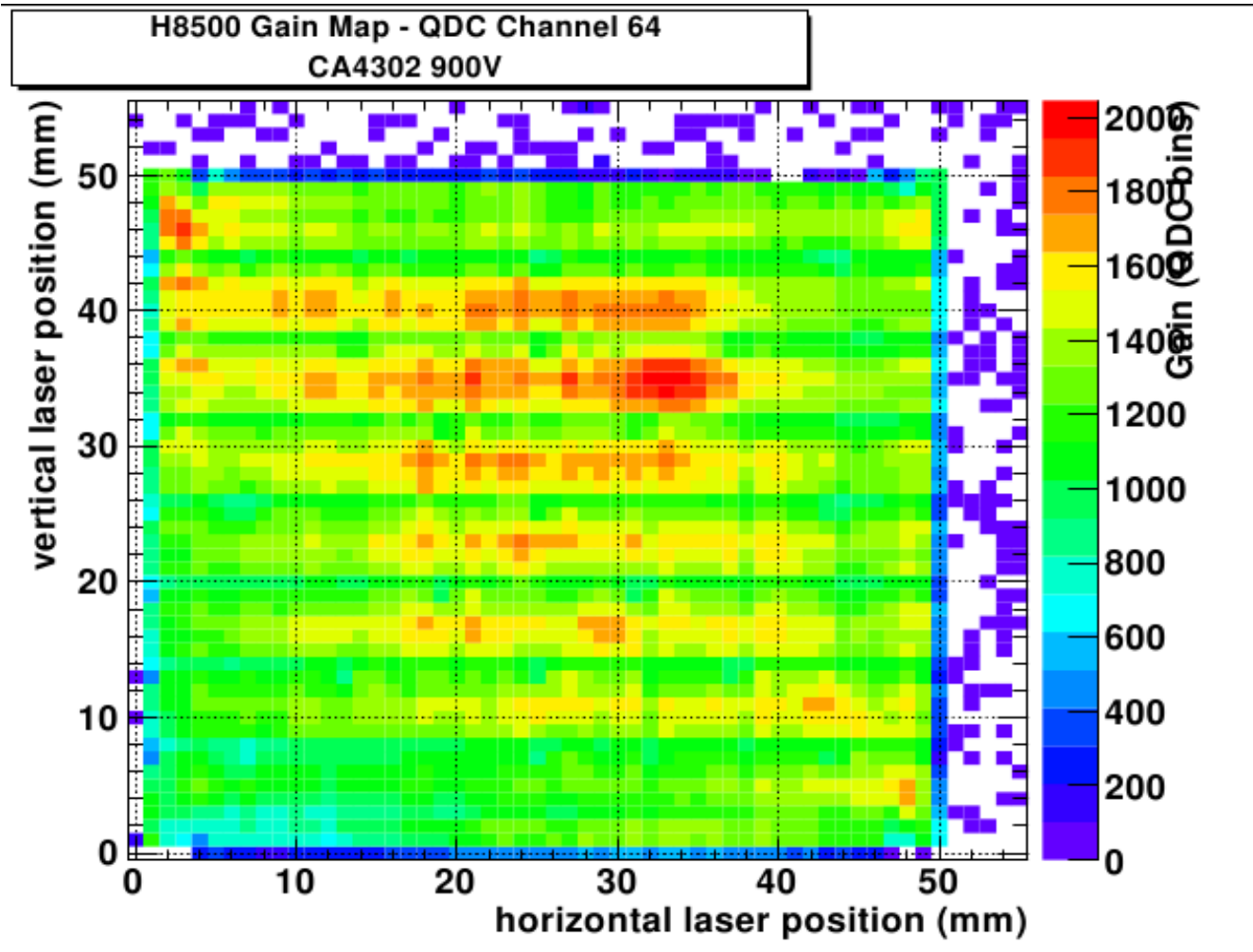


Individual channel gain map



The red area of the single channel gain map is the pixel, with the surrounding area being cross talk.

Pixel Gain V Dynode 12 Gain

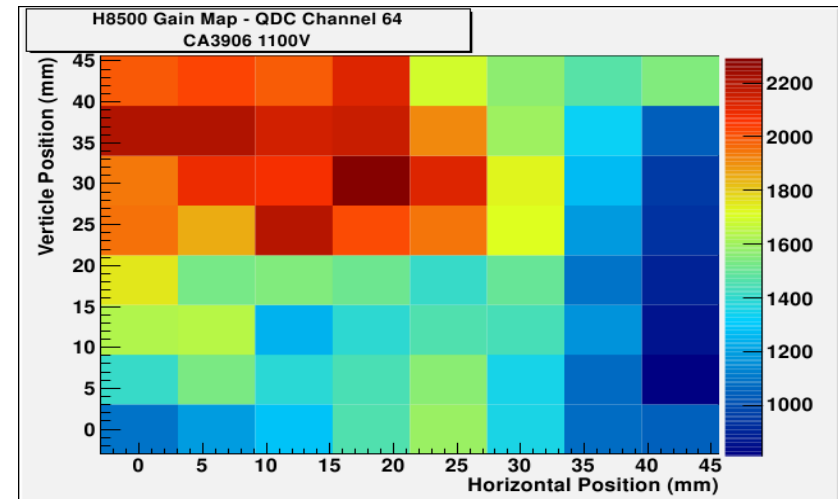
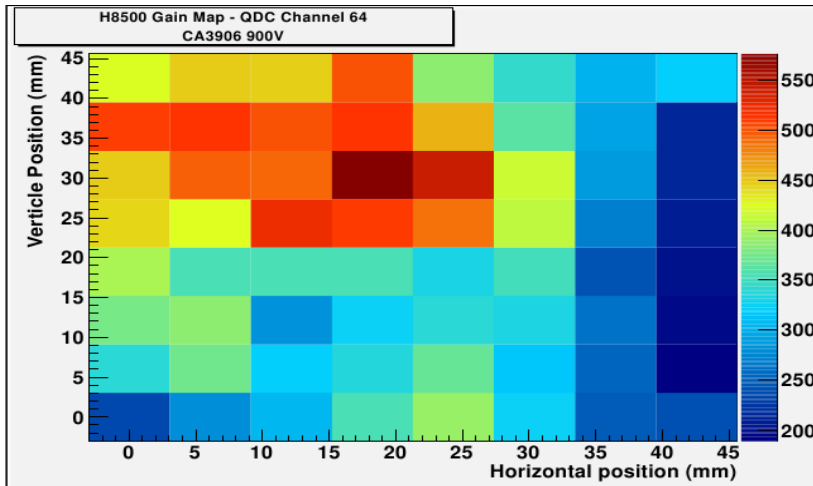
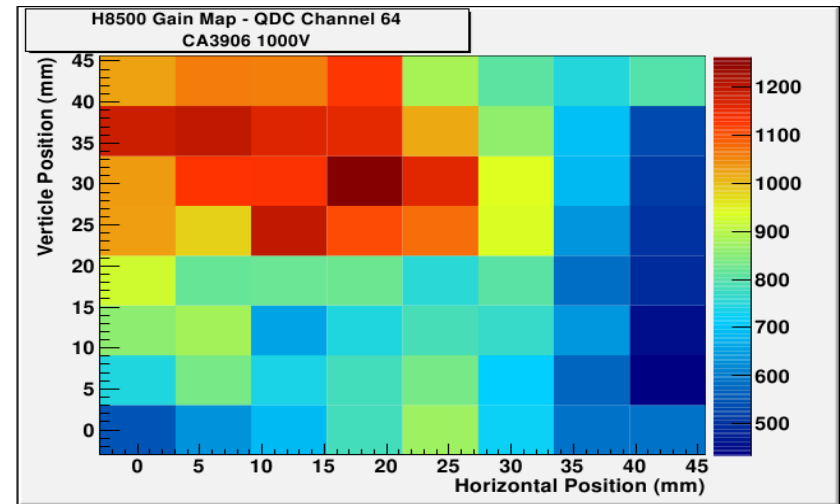
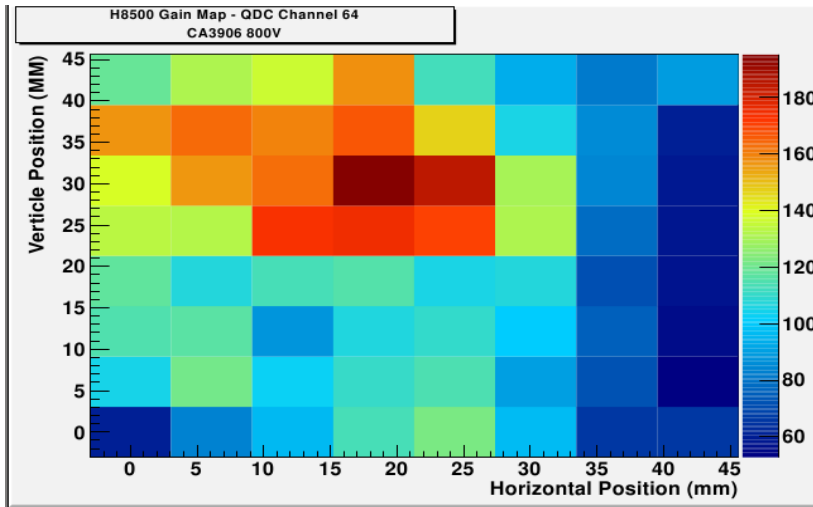


- High resolution dynode 12 map for the same H8500 tube previously show.

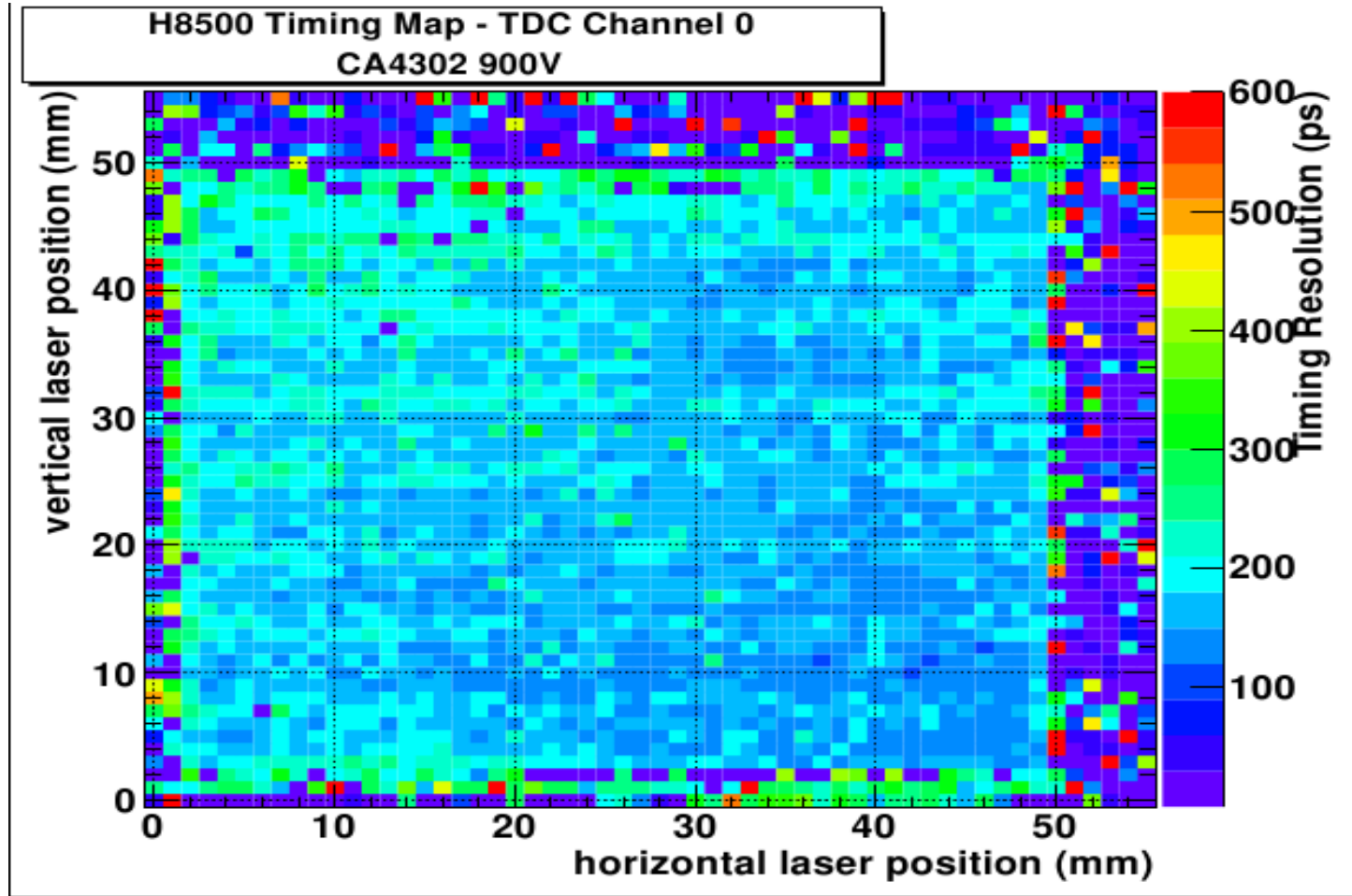
- At same voltage as global gain map previously shown.

- Can see pixel structure.

Dynode 12 response Vs High Voltage



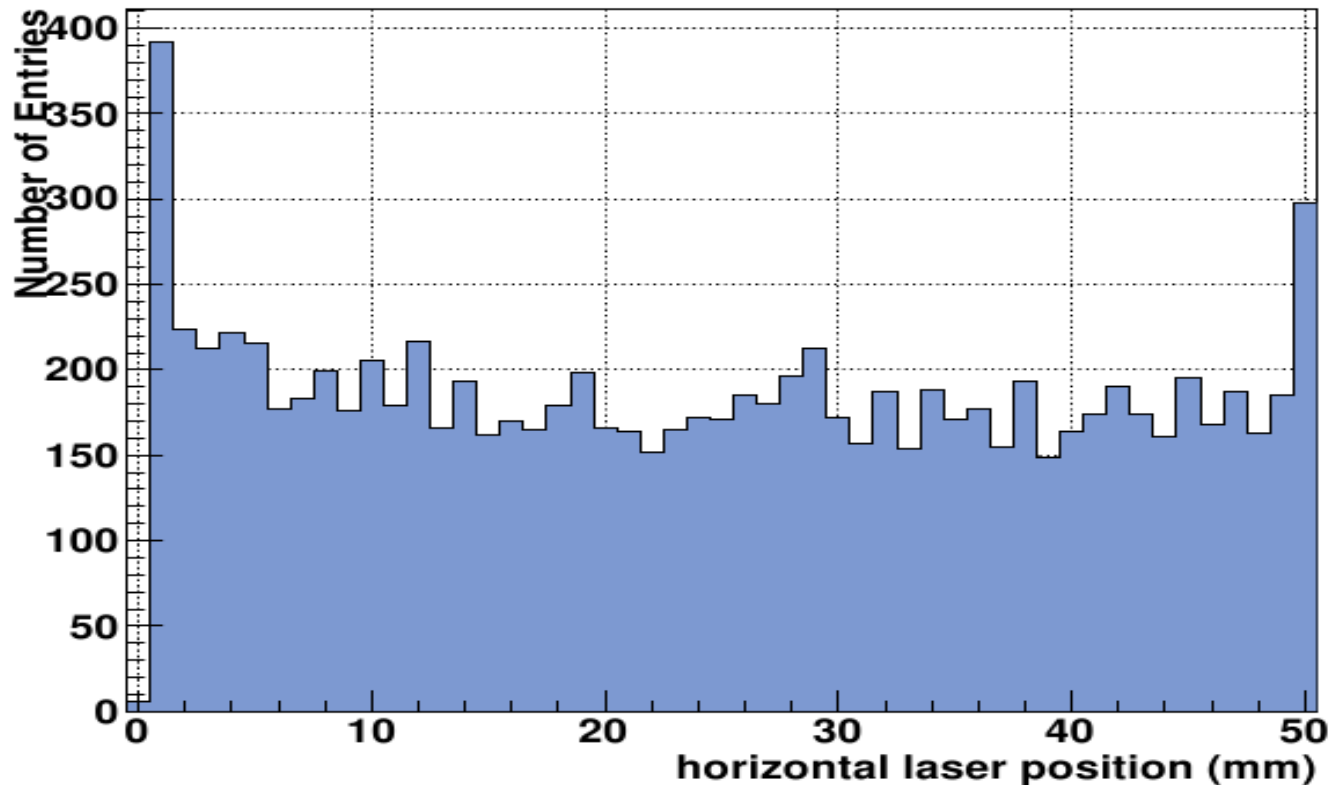
Dynode 12 Timing



Timing response quick enough for self triggering purposes

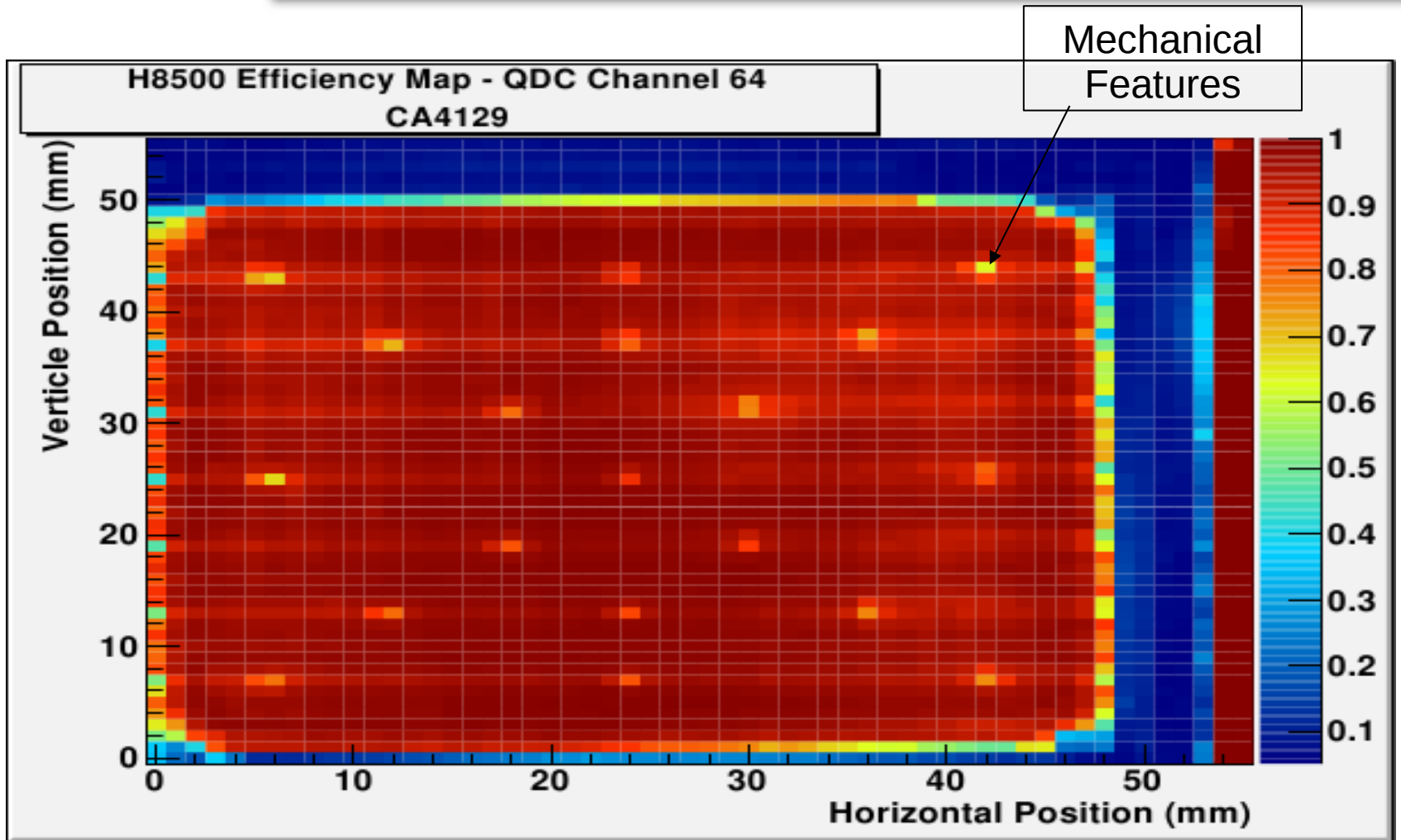
Dynode 12 Timing

ProjectionX of biny=21



Projection of previous plot demonstrating the independence of the timing with respect to position.

Dynode 12 Efficiency



Summary

So in summary:

- Have completed high resolution scans of the PMT surface.
- Can see mechanical features and pixel structure of the PMT on high resolution scans.
- Gain of the tubes increase with supply voltage.
- The dynode 12 timing response fast enough to be use for self triggering purposes.
- Timing response independent of position.
- Good efficiency as expected for light level.

Thank you for your attention. Any questions?

Example of poor H8500

Below are the results of the worst H8500 tested for comparison to the typical results previously shown.

