



### Applications:

Diagnosis of transient optical phenomena.

Gas Cherenkov Detector

### PD-PMT

The fastest “normal” photomultiplier tubes (PMTs) achieve ~100ps rise time and instrument width.

The PD-PMT uses time dilation technology coupled with a standard fast PMT components to enable the capturing of transient optical signals with a response time ~12ps (10ps is probably achievable).

The signal output can be recorded on a modestly fast (~6GHz) oscilloscope.

The record length is several ns and the repetition rate up to 100Hz. Cathode sensitivities are identical to standard PMTs and the overall gain is similar to a standard PMT.

The units can be customised at build time to accommodate changes to the record length, dilation factor and size.

### Time Dilation Technology

The application of time dilation to x-ray gated imagers is well established, see for example:

*Investigating high speed phenomena in laser plasma interactions using dilation x-ray imager*  
*Article react-text: 80 Review of Scientific Instruments 85(11)*

During a transient event photo electrons from a photocathode are accelerated down a long tube to progressively slower velocities. In this way the photo electron bunch produced by the event is spread out in space along the length of the vacuum tube, “dilated”. An axial magnetic field prevents radial movement of the electrons. At the far end of the tube the dilated bunch is detected and in the case of a PMT amplified with a Micro Channel Plate (MCP) detector and the signal from this is then recorded on a suitable oscilloscope. As the temporal information has been stretched out, the bandwidth of the oscilloscope no longer has to match that of the event but only that of the dilated event. Dilation factors of around x20 are readily achievable in a tube of about 400 mm length.

See [www.kentech.co.uk](http://www.kentech.co.uk)

### Typical Output Waveforms



This figure shows the record of the output from a 40ps laser diode pulse, with resolved structure down to ~20ps. The four blue traces are used to calibrate the time base in dilated space. They represent 100ps intervals between them although their separation is shown here at 1200ps giving a dilation factor of ~ x12.

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Specification (prototyper unit):

- Spectral sensitivity S20 typically
- Trigger 5V, 50ohms, >10ns duration
- Rise/fall ~12 ps
- Record length ~5ns
- Jitter 10ps rms typical (5V trigger, 2ns rise time)
- Maximun PRF 100Hz
- Power 100-240V AC, <70VA
- Magnet power DC ~1 amp @ 12 volts

Front panel Indicators

- Power LED
- Triggered LED
- Blanked LED
- Over temperature LED

Front panel Controls

- Gain Rotary
- Photo Cathode Bias Rotary
- Blanking Lockable toggle switch

Front panel Connections

- Trigger BNC
- Remote unblanking BNC
- Monitor SMA

Rear panel

- Output SMA
- AC power IEC with integrated rocker switch
- Power inlet for magnet 2 x 5mm sockets

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## Customerised devices

We are currently working on a cusomerised device to fit in a Gas Cherenkov Detector. In this case the tube and electronics wil not be integrated as shown here but separated by ~50 metres.

A longer tube will be used to increase the dilation and record length.

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