Streak camera

EZstreak

EZstreak-900

Applications

- ✓ Lasers
- ✓ Ballistics
- ✓ Optical communications
- ✓ Plasma physics
- ✓ Transient optical phenomena

Features

- ✓ Compact
- ✓ Affordable
- ✓ Simple to use
- ✓ High sensitivity from UV to 1.5µm
- ✓ Temporal resolution from ps to µs

Introduction to streak cameras

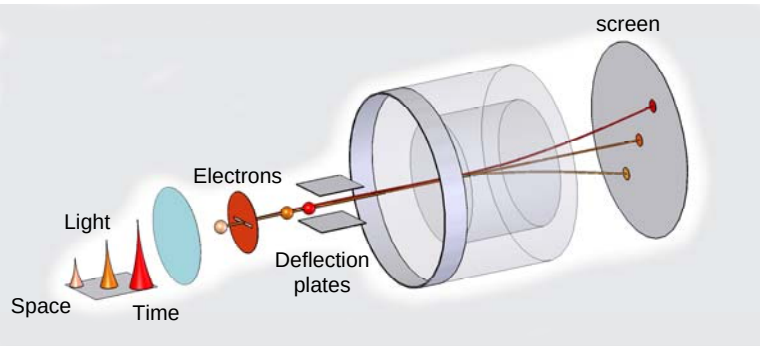
Streak cameras are used to obtain very high temporal resolution of transient photon signals. Temporal bandwidths approaching 1THz are achievable by the very rapid deflection of an image across an output image plane, usually in an electron image converter tube. Typically a one dimensional slice of the radiation source is investigated, defined by a slit at the input to the camera. An image of this slit is swept across the final image plane yielding an output image with spatial information in one dimension and time information in the other.
In an image converter streak tube, which is evacuated, a photo-cathode converts the input photon image into a photo-electron image. The electrons comprising this image are imaged onto a phosphor by an electrostatic lens but on their way pass a deflection structure which is able to deflect the electron image across a phosphor screen. The deflector is driven by a high voltage ramp signal which linearly deflects the image across the phosphor, hence mapping time onto one of the spatial dimensions in the output image. High voltage and high speed electronics generate the electrostatic focussing and deflection voltages, determining such things as the sweep speed, optical sensitivity and aperture time. The image on the phosphor is captured by a CCD camera and is recorded in a computer for analysis later.

General description of EZstreak

EZstreak is a compact and self contained streak camera requiring only a PC for control and image display/storage. It has a fibre optic input window (except UV versions) allowing for compact input optics, well suited to fibre optics as well as conventional lens imaging.
Input optics consist of a lens (CS mount with options to adapt to C or F) followed by a solenoid driven shutter and a slit. An image is formed at the plane of the slit which masks all but a thin slice of the image. This slit is in direct contact with the fibre optic input window of the streak tube and this fibre optic transports the image to the photo-cathode plane within the vacuum envelope. Photo-electrons from the cathode are imaged onto the output image plane with an electrostatic lens via a pair of deflection plates. By ramping the voltage applied to these plates linearly in time the electron image is swept across the output image plane. In order to suppress late time signal which might arrive after the time of interest a blanking signal is applied to the photo-cathode to shut-off photo-electron flow. The streak tube is internally intensified by means of a micro-channel plate which resides in front of the output phosphor screen.

Control and versions

In EZstreak all control is via an ethernet connection from a PC with image data being stored along with a complete set of acquisition settings (sweep speed, gain, date, time etc plus user annotations). The control application can allow multiple cameras to be operated from a single computer.



Streak camera working principle

EZstreak is available in various versions depending upon the spectral range of the photon signal to be investigated. Different cathode types are available to cover near infra red to UV. Note that a fibre optic input for the UV version is not available and different input optics are required.

PHOTONIS

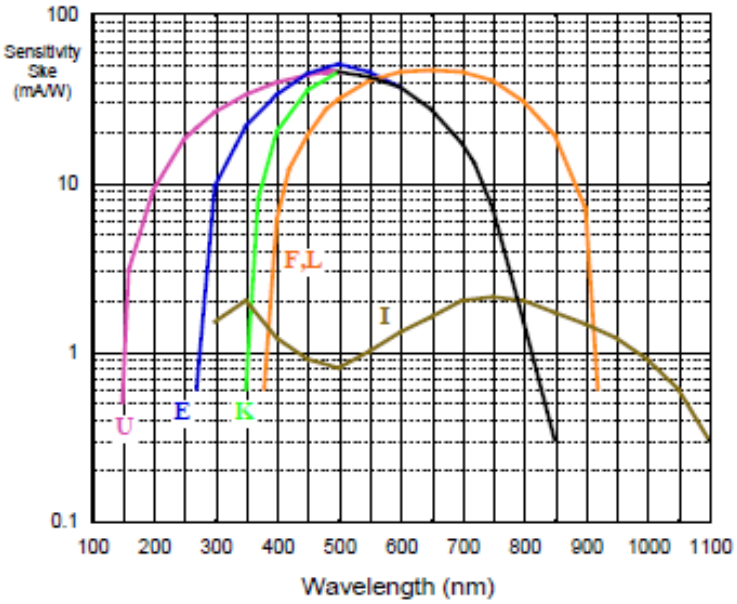
Streak camera

EZstreak

General specification

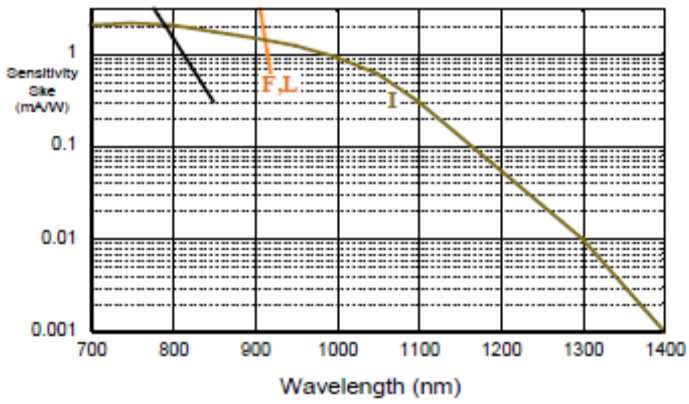
Spectrale range: S25	350nm to 850nm
S20	300nm to 800nm
S1	300nm to 1400nm, 1500nm to special order
UV	Please enquire, Pd, Au, P, etc (different input optics)
Limiting time resolution	Better than 10ps
Sweep range	2ns to 1ms full sweep
Trigger rate	Single shot to 10kHz
Input optics	Fiber optic window (except UV)
Input PC diameter	8mm
Magnification	(Enter pixels per mm of cathode)
Slit interchangeable	Contacted to FO input window in removable carrier
Mechanical shutter	Electrically operated
Lens mount	CS (easy adaption to C or F)
Intensification	Internal MCP
Readout CD camera	12 bit, 1360 x 1024
Interface	Ethernet
Control application	Included
Power supply	DC, ~50VA Universal AC PSU included
Mounting	Horizontal or vertical, sweep is in the 12cm direction.
Size	Approximately 30cm L x 12cm W x 20cm H
Weight	Approximately 6kg

Typical photocathode spectral response



PHOTOCATHODE VERSIONS		code
Standard multialkali photocathode	on sapphire window	U
	on glass window	E
	on fiber optic window	K
ERMA* photocathode	on glass window	F
	on fiber optic window	L
S1 photocathode	on glass window	I

* ERMA: Extended-red multialkali



PHOTONIS

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ADDITIONAL SPECIFICATIONS

Performance at typical operating voltages	Min	Typ	Max	Unit
Radiant power gain [1]: (with highly conductive sub layer)	200	500		-
Spatial resolution [2]: centre (DC mode)	20			lp/mm
Temporal resolution [3]	25	20	15	ps
EBI (Equivalent Background Input) [4]:				
S1 photocathode		5×10^{-7}		W/cm^2
Other photocathodes		5×10^{-9}		W/cm^2
Shutter ratio [5]		10^5		-
Magnification [6]		-2		-
Distorsion [7]	TBD			%
Image Alignment [8]	1.5			mm
Gain uniformity ratio [10]	3			-
Number of black or white spots [11]:				
Ø 0.5mm and above			0	-
Ø 0.3 to 0.5mm			1	-
Ø 0.25 to 0.5mm			3	-
Ø 0.15 to 0.25mm			15	-
Ø 0.05 to 0.15mm			30	-
Shear distortion [12]:				
Over the whole line			80	µm
Any single step			50	µm

ABSOLUTE MAXIMUM RATINGS

Temperature [13]	Min	Max	Unit
2 hr storage max.	-40	+65	°C
Long term storage	-40	+27	°C
Continuous operation	-20	+45	°C

Notes

1 PEAK RADIANT POWER GAIN: Defined as the ratio of the total output power to the incident monochromatic power on the photocathode at the wavelength of peak response. Input and output powers, expressed in watts, are measured with a standard photomultiplier. An interference filter is interposed between the source and the tube.The radiant power gain at any wavelength is proportional to the cathode radiant sensitivity.

2 SPATIAL RESOLUTION: measured on the screen in two directions (spatial and temporal axis) by focusing a pattern of white and black bars onto the photocathode
a) Centre: measurement on the centre of the screen
b) Edge: measurement on two paraxial points separated by a distance of 6 mm.

3 TEMPORAL RESOLUTION: This is the full width at half maximum (FWHM) of the pulse response to a delta intensity input function measured with an input slit limited to 100 µm width at the photocathode and well suited swiping rate..

4 EQUIVALENT BACKGROUND INPUT (E.B.I.) : value of incident radiation causing an increase in screen radiance equal to the screen background radiance, i.e. The screen radiance divided by the gain (see note 1).

5 SHUTTER RATIO: Ratio of the screen radiance when the tube is gated on to that when the tube is gated off, for the same photocathode illumination.

6 MAGNIFICATION: Two points are located on a diameter of the photocathode 2.8 mm off the tube axis. The magnification Mi is the ratio of the distance between their images on the screen to the distance of 2.8 mm on the photocathode.

7 DISTORSION: A second magnification value (see note 6) Me is obtained with a distance of 6 mm between the two points on the photocathode. The distorsion is defined by the equation : d = 100 (Me - Mi) / Mi.

8 IMAGE ALIGNMENT: The radius of the circle centered on the geometric centre of the screen and which contains the image of the geometric center of the photocathode.

9 DEFLECTION SENSITIVITY: The voltage between the two deflecting plates necessary for 1 cm image shift on the screen with all other electrodes being normally supplied.

10 GAIN UNIFORMITY: A 8 mm long and 0.1 mm large streak is projected on the photocathode at the wavelength of peak response. This streak is scaned on the whole useful screen area. The uniformity factor is the maximum to minimum brightness ratio.

11 SPOTS: The useful photocathode area is illuminated with a sufficient level to easily observe black and white spots defined as any local contrast greater than 50 %. The number and size of the spots are observed with a magnification of 10. Two spots separated by a distance of less than the maximum size of either spot are considered as one spot with a size equal to the sum of the maximum size of the two spots plus the distance between them.

12 SHEAR DISTORTION: This is the breaking of an image line on the screen produced by a defect in the screen fiber optic. The distance between the two segments of the broken line will not exceed the indicated value.

13 WARNING: This image intensifier is a very high vacuum device; any increase of temperature beyond the maximum, even for a short period, will deteriorate the vacuum and thus the life time. A special version can be delivered on request that withstand 70°C.