

# X-ray streak camera

for sub-picosecond time-resolved measurement

## C4575-03

Enables ultrafast measurements of X-rays in the range of 10 eV - 10 keV with 0.5 ps or less temporal resolution and high spatial resolution



The C4575-03 X-ray streak camera employs a X-ray streak tube which is capable of achieving extremely high temporal resolution and high spatial resolution. The camera can detect X-rays from 10 eV to 10 keV with 0.5 ps temporal resolution. It utilizes an image intensifier to achieve high gain (sensitivity) along with high spatial resolution. A high-performance, 1-megapixel cooled CCD camera is included to preserve the streak image in digital format.

#### Features

- Temporal resolution: 0.5 ps or less FWHM (Calculated)
- Large photocathode: 8.6 mm
- Simultaneous measurements of time, position and light intensity

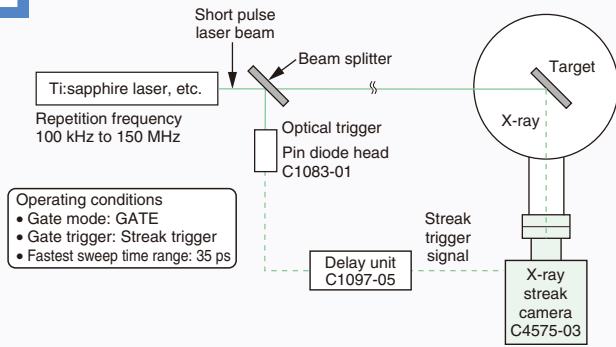
#### Applications

- XFEL
- X-ray laser
- X-ray plasma light emission

# Setup examples

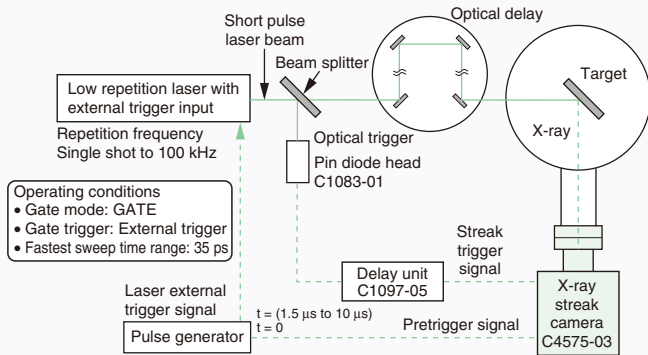
## Setup with high repetition laser (100 kHz to 150 MHz)

The figure at the right shows an example setup with a high repetition frequency (100 kHz to 150 MHz) laser. The incident light is split by a beam splitter. One beam is used to trigger the streak camera by means of the photodiode and delay circuit, while the other beam is directed to the sample target and streak camera. Since the max streak sweep repetition is 100 Hz, the streak camera circuit will adjust accordingly, including an internal gate control to suppress extraneous light between sweeps.



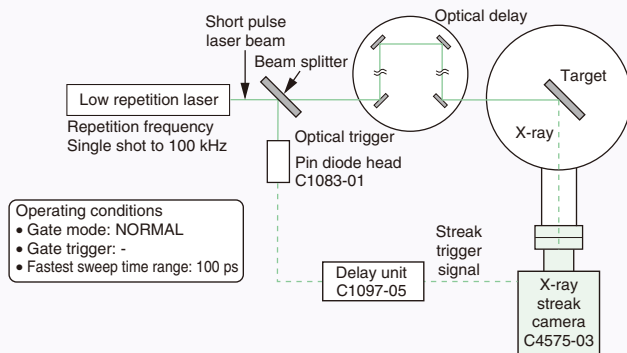
## Setup with low repetition laser (single shot to 100 kHz) for highest time resolution

The figure at the right shows an example setup using a laser with single pulse up to 100 kHz repetition rate. In order to minimize shot-to-shot timing jitter, it is necessary to create a streak trigger signal from the same laser pulse incident on the sample target. For this reason, an optical delay line is introduced. An additional pretrigger pulse generator is also required to achieve the highest temporal resolution.



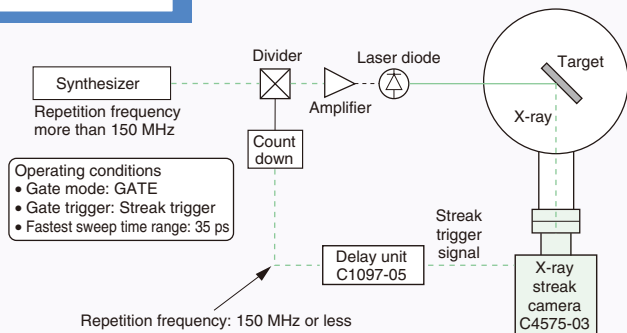
## Setup with low repetition laser (single shot to 100 kHz) for 100 ps and slower sweep times

The figure at the right shows an example setup using a laser with single pulse up to 100 kHz repetition rate. In this case, although the maximum speed range is 100 ps, the pretrigger signal is not necessary. Also in this case, an optical delay line is used in order to minimize shot-to-shot timing jitter.



## Setup with very high repetition laser beam (exceeding 150 MHz)

The figure at the right shows an example setup when the laser and streak trigger repetition frequency exceeds 150 MHz. In this case a trigger countdown circuit is required to reduce the trigger frequency to below 150 MHz.



# Advanced femtosecond X-ray streak tube with a large photocathode

## X-ray streak tube

Window material	Parylene film (Approx. 100 nm thickness)
Photocathode	Au (Approx. 30 nm thickness)
Replacement of photocathode	Yes (Demountable)
Phosphor screen	P-43
Spectral response	10 eV to 10 keV (Except for parylene absorption band 20 nm to 100 nm)
Effective photocathode size	20 $\mu\text{m}$ $\times$ 8.6 mm
Phosphor screen size	$\phi$ 25 mm
Image magnification	Approx. 1:2
Focus	Magnetic focus
Output material	Fiber plate
Vacuum	$1.3 \times 10^{-3}$ Pa or less

## Main unit of X-ray streak camera

Temporal resolution	0.5 ps or less (at the fastest range, calculated)
Sweep time/Full screen	35 ps, 100 ps, 200 ps, 500 ps, 1 ns, 2 ns
Trigger jitter	$\pm 20$ ps or less
Trigger delay	30 ns or less (at the fastest range)
Maximum sweep repetition frequency	100 Hz
Operation mode	FOCUS/OPERATE
Trigger signal input	$\pm 5$ V p-p (50 $\Omega$ )
Trigger mode	Cont. / Single
Monitor out	Approx. 3 V p-p (50 $\Omega$ )

## IMAGE INTENSIFIER TUBE

An IMAGE INTENSIFIER TUBE is included to increase system gain and detection sensitivity.

Photocathode	GaAsP
Window	FOP
Phosphor screen	P-43
Photocathode size	17.3 mm $\times$ 13.2 mm
Phosphor screen size	17.3 mm $\times$ 13.2 mm
Luminous gain	10 000 or more

## RELAY LENS: A2098

A lens for coupling the readout camera

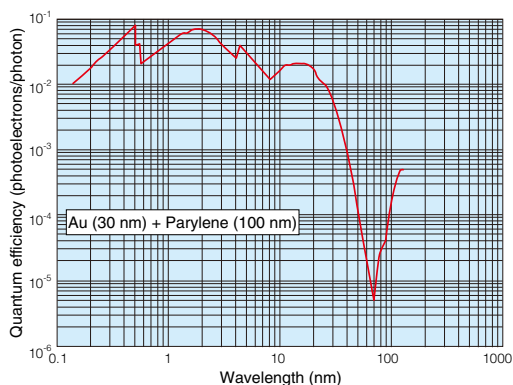
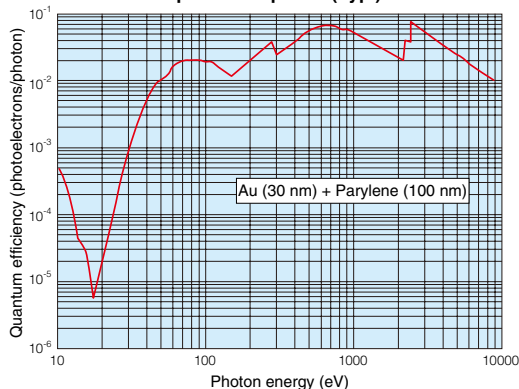
Image magnification	2:1
Effective F value	F=2.5

## ORCA<sup>®</sup>-R2 Digital CCD camera C10600-10B (Option)

Recommended readout camera

Effective number of pixels	1344 (H) $\times$ 1024 (V)
Cell size	6.45 $\mu\text{m}$ (H) $\times$ 6.45 $\mu\text{m}$ (V)
Effective area	8.67 mm (H) $\times$ 6.60 mm (V)
Effective field of view on phosphor screen	12.39 mm (H) $\times$ 9.43 mm (V)
Effective photocathode size	Approx. 4.42 mm (H)
Exposure time	10 $\mu\text{s}$ to 4200 s
Readout speed	28.4 frame/s (2 $\times$ 2 binning)
A/D converter	12 bit/16 bit

Spectral response (Typ.)



## Gate valve (Option)

Vacuum gate valve	10840-XE01-AFG2 (VAT Ltd.)
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## Pin diode head: C1083-01 (Option)

Used to generate a trigger signal for the streak camera.

Spectral response	400 nm to 1100 nm	
Rise time	0.8 ns	
Dimensions/Weight	Head	(W) 100 mm $\times$ (H) 160 mm to 235 mm $\times$ (D) 50 mm/400 g
	Power supply unit	(W) 100 mm $\times$ (H) 83 mm $\times$ (D) 100 mm/400 g
Power supply	+18 V (Battery)	

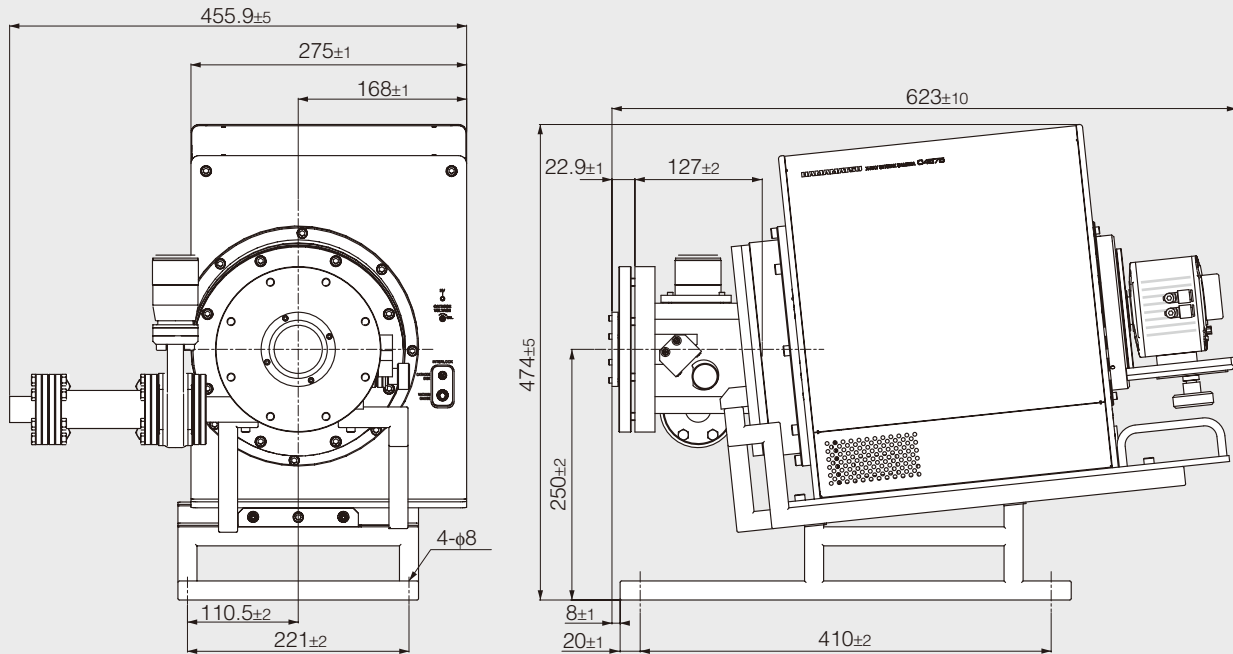
## Delay unit: C1097-05 (Option)

A jitter-free delay unit that can be used for single-sweep as well as high repetition rate setups.

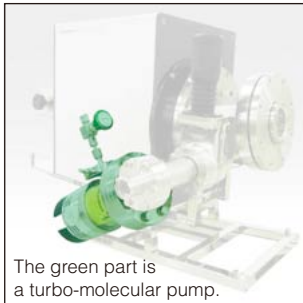
Variable delay range	0 ns to 31.96 ns
Delay setting range	30 ps, 60 ps, 120 ps, 250 ps, 500 ps, 1 ns, 2 ns, 4 ns, 8 ns, 16 ns
Minimum delay time	Approx. 12 ns
Maximum input voltage	30 V
Interface	USB 2.0
Power supply	AC 85 V to AC 250 V
Power consumption	Approx. 30 VA
Dimensions/Weight	(W) 215 mm $\times$ (H) 102 mm $\times$ (D) 350 mm/3.4 kg

## Dimensional outlines (Unit: mm)

### ● X-ray streak camera C4575-03 main unit (Approx. 43 kg: Except the turbo pump)

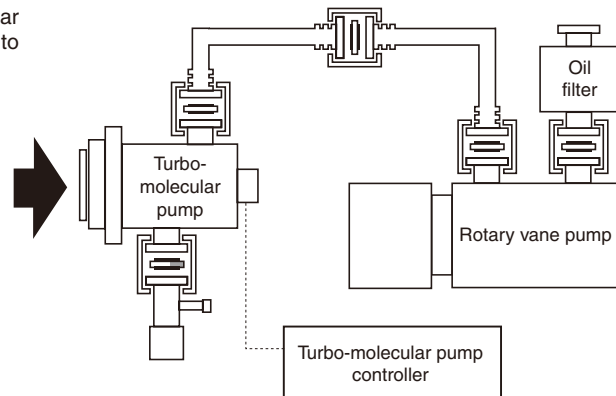


## Vacuum system (Option)



A vacuum system such as a turbo-molecular pump and a rotary vane pump are required to operate the C4575-03. Please contact us for more information.

Connect to X-ray streak camera



Turbo-molecular pump	TURBOVAC 50 (63CF) (Oerlikon Leybold Vacuum GmbH)
Rotary vane pump	TRIVAC-B D4B (11304) (Oerlikon Leybold Vacuum GmbH)
Oil filter	AF4-8 (Oerlikon Leybold Vacuum GmbH)

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