STREAK IMAGE CAMERA "AGAT" WITH PICOSECOND TIME RESOLUTION USED FOR INVESTIGATIONS IN PLASMA PHYSICS

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Time-analizing image converters PV-001 and PV-002R, developed by the All-Union Scientific Research Institute of Optical-Physical Measurements together with the Physical Institute of the Soviet Academy of Sciences, make it possible to record the pulse signals of radiation in visible and near-infrared region as well as in soft X-ray one.

A distinguishing feature of the focusing systems of the both converters consists in the small spread of electron flight times from a photocathode to the deflection systems of an electron beam thanks to high electric field intensity at the photocathode which reaches 30 kV/cm.

The image converter PV-001 has a low resistance oxygen-silver-cesium photocathode with spectral sensitivity of 300 uA/W at the wavelength 1,06 um. An electronic shutter is arranged behind the anode in the form of two pairs of deflection plates (shutter and compensating ones), the shutter diaphragm is placed between them (the cutoff voltage of an electron beam is 400 V). Then it is followed by the wide-band deflection system for image sweep on the screen. The spatial resolution of the converter is not less than 35 mm^{-1}.

The image converter PV-002 R has a gold photocathode on a mica substrate, sensitive over the soft X-ray region. Two mutually perpendicular deflection systems, each of them is analogous to the deflection system of the image converter PV-001, are arranged behind the anode.

The calculation of the electron-optical systems of PV-001 and PV-002R is carried out with consideration for all known factors, which restrict a limiting time resolution, if the subpicosecond time resolution is ensured in the PV-001 converter and the picosecond time resolution ensured in the PV-002R converter.

The electrostatic converter PMU-I with a microchannel plate (MKP) is designed for the contact amplification of the image brightness at the output of the time-analyzing converters.

The diameters of the operating area of the photocathode and anode are equal to 40 mm, the electron-optical amplification is I, the limiting spatial resolution is 20 mm^{-1}, the conversion coefficient at the wavelength 0,45 um is not less than 10^{4} W/W.

One of the above mentioned time-analyzing converters connected with the PMU-I brightness amplifier by fiber-optical disks

may be used in a streak camera "Agat".

The image sweep at the camera output is photographed on a standard high sensitive film with the width of 35 mm by means of a contact camera attachment. The maximum dimensions of the image on the film are 10 x 40 mm at the spatial resolution up to 20 mm^{-1}. To prevent the exposure of the film by the background of the brightness amplifier, MKP is supplied by pulse voltage.

At customer's wish the camera may be also complete with a specially developed system for immediate visualization and digital processing of the recorded data.

The rest of the camera technical characteristics are given below:

- Spectral sensitivity range (A):
  with the image converter
  PV-001 3800-12000
  with the image converter
  PV-002R ..... 1 - 10
- Sweep duration, ns/cm 0,2; 0,5; 1,0;2,0;5,0 10,0;20,0; 50,0;100,0; 200,0;500,0
- Limiting time resolution, psec 1
- Self-delay of starting, nsec ..... not more, than 15
- Additional delay of starting controlled every other nanosecond ..... 0 - 110
- Power consumption of the camera 220 V, 50 Hz (VA).. 90
- Overall dimensions, mm... 920x360x250
- Mass, kg ..... not more, than 25.

The camera " Agat " has been already used when investigating different high-speed processes, such as picosecond pulse duration generation of solid-state lasers and dye-lasers, focused laser radiation interaction with different media, development of electrical breakdown in gas and dielectric creeping discharge under the action of high-voltage nanosecond pulses.

The examples of recording high-speed processes by means of the camera "Agat" are given in Fig. 1-3.

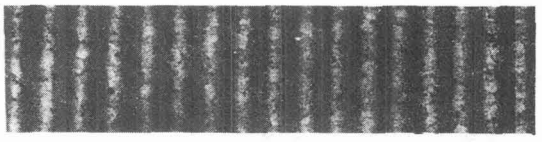

Fig. 1. Photochronogram of the internal structure of a generation spike of a Nd:glass mode-locking laser.

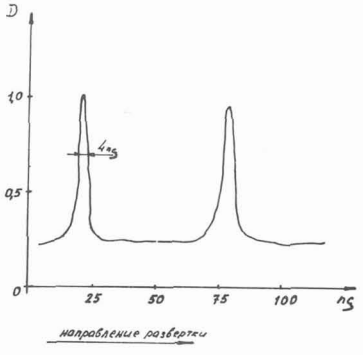

Fig. 2. Microphotogram of UV spikes of a Nd:glass laser.

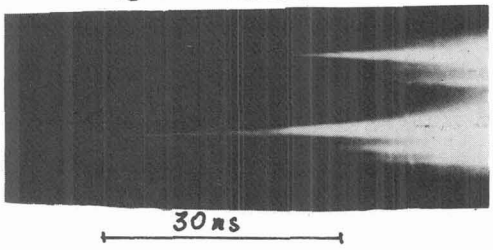

Fig. 3. Photochronographic recording of breakdown in gas between the points of the electrodes. The sweep rate is 1,3 10^8 cm/s.