HYDROGEN LASER STREAMER CHAMBER

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Events in a streamer chamber are registered by photographing either a luminous streamer or an optical inhomogeneity caused by gas dynamic processes in the streamer zone, which follow relaxation processes in plasma. The latter method can be regarded preferable, if the plasma luminosity is too weak to be easily detected. This is the case, for instance, when hydrogen is used as a chamber filling gas. It has also been shown that the photography of optical inhomogeneity allows the position of the streamer head to be defined with more certainty, thereby, the particle trajectory to be extracted with more accuracy [1, 2].

As shown in [3], the refractive power in the streamer zone varies slightly, $\Delta n = 10^{-3} - 10^{-4}$, so the inhomogeneity is characterized by a small-angle forward scattering. Thus, shadowgraph methods with lasers employed as light sources are useful for image recording.

We have tested the hydrogen streamer chamber with an illumination system suited to chambers of ~200 mm visible diameter. Fig. 1 shows the bright-field variant of the stereooptic system. This can be easily transformed into the dark-field variant. To do so, one should converge the light beam from point S to point S′ and here place an opaque screen.

Fig. 2 presents some pictures of electron tracks taken from the streamer chamber with a gap of 3 cm filled with pure H_2. One shoulder of the bright-field stereo-optic system was employed. Images of streamers were obtained at zero angle in respect to their directions and at a 7.5° angle, (angle parallax of the stereosystem was 15°).

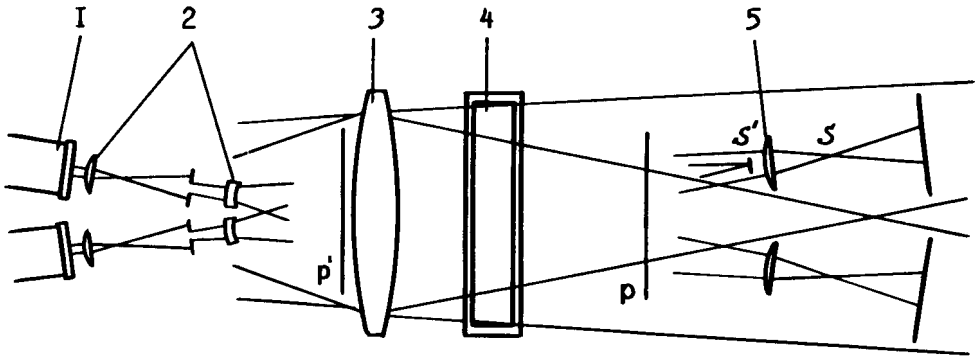

Fig. 1. Illuminating system for streamer chamber. (Schematic, not to scale): *1* — laser, *2* — beam expander, *3* — lens F = 800 mm, *4* — streamer chamber, *5* — camera lens F = 180 mm

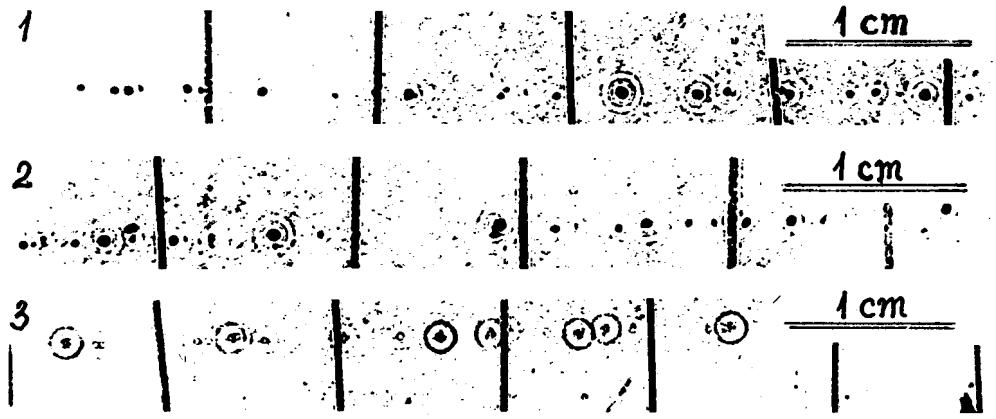

Fig. 2. Photographs of electron tracks in hydrogen streamer chamber: *1* — zero angle, object plane is P, *2* — angle 7.5°, object plane is P, *3* — zero angle, object plane is P′

Characteristics of optic system and high-voltage generator:

Light source-nitrogen laser	'ILGI-503'
Wave length	337 nm
Pulse length	10 ns
Pulse energy	$30 \cdot 10^{-6}$ J
Magnification	0.15 — 0.18
High voltage	180 kV
Pulse rise-time	4 ns
Pulse length:	
selfshunted operation	40-100 ns
pulse-forming operation	8-25 ns

The pictures show that the bright-field images of the streamers are of good contrast and resolution, no matter which of the two symmetric planes (P or P′) is taken for the object plane. Taking pictures at an angle of 7.5° has a slightly marked effect on the image quality.

The result enables us to reasonably regard the above optic system to be of use in setups with a laser streamer chamber. These can be intended either for particle-beam experiments or for laboratory-scale experiments on the study of the effect of streamer chamber conditions (sort of gas, pressure, impurities, high-voltage pulse parameters, streamer dimensions, etc) on the scattering power of the streamers. Studies of this kind are firstly associated with a streamer chamber of high resolution with supperessed electron diffusion [4, 5].

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