THE POSSIBILITIES OF USING A HARDWARE AND SOFTWARE COMPLEX "NANOGATE-22/HSC" IN PHYSICAL EXPERIMENTS

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Abstract: The technical characteristics and capabilities of the NANOGATE-22/PAC hardware and software complex developed at NPP NANOSCAN LLC are presented. The complex is compared with foreign analogues. The basis of the complex is an 8-channel 16-frame electron-optical camera designed for high-speed recording of optical images of fast processes in nano- and microsecond time ranges. Examples of using the complex for diagnostics of high-speed pulse experiments with processing of the obtained results are given. Prospects for increasing the spatial and temporal resolution of the complex are shown.

Keywords: multiframe high-speed recording; hardware-software complex; high-speed explosive process; metrologic image processing

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Figure Captions

Figure 1 The NANOGATE-22/16 camera (*a*) and its optical scheme (*b*)

Figure 2 NANOGATE-22/HSC: a window for preparing the received images for subsequent metrological processing

Figure 3 NANOGATE-22/HSC: the result of the tracer's work on the extremum of the image function

Figure 4 Dynamics of detonation transition through the channel bend of 60° (*a*), 90° (*b*), and 120° (*c*)

Figure 5 A photograph of the experimental device before the experiment

Figure 6 The first frames of eight channels for recording the process of detonation propagation in bulk explosives, the frame of the seventh channel is the result of strobing six frames (*a*); and the second frames of eight channels for recording the process of detonation propagation in bulk explosives (*b*)

Figure 7 The routes of the detonation wave that took place in experiment No. 1, grey color corresponds with the routes obtained through the gated channel

Figure 8 Dynamics of detonation waves for detonation cords No. 5 (*1*, $y = 5.666013x - 1,797010$, $R^2 = 0.999895$), No. 6 (*2*, $y = 5,584961x - -1.281966$, $R^2 = 0.999927$), and No. 7 (*3*, $y = 5.556537x - 1.260894$, $R^2 = 0.999792$); empty signs correspond with the gated channel

Figure 9 Photograph of the experimental device before conducting experiment No. 2

Figure 10 Images obtained during experiment No. 2 on the formation of a cylindrical detonation wave

Figure 11 The results of tracing (*a*) and the dynamics of equivalent radii S (*b*): *1* — detonation wave in the detonation cord; *2* — passage in the initiation node; *3* — excitation of detonation wave in the sample; *4* — detonation wave in the sample; and *5* — cumulative jet in the air

Figure 12 Photographs of detonation at time $\tau = 47$ (*a*) and 49 μs (*b*)

Figure 13 Experimental assembly with 48 initiation points

Figure 14 The first frames of eight channels for recording the process of transition of a cylindrical detonation wave to a shock wave in argon (*a*); and the second frames of eight channels for recording the outcome of the shock wave into the cuvette and the dynamics of axisymmetric compression of argon (*b*)

Figure 15 The results of tracing the detonation and shock waves (*a*) and the dynamics of equivalent radii S (*b*): *1* — detonation wave; *2* — detonation wave to shock wave transition; and *3* — shock wave in argon

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