

DISTANT AND COMPUTER-ASSISTANT EDUCATION IN RGOTUPS

A.Demchenko, E.Silina, V.Fokin, N.Pribylov, D.Klimova, V.Nedostaev

ABSTRACT

Specifics of education in our university: most of the students are taking correspondence and moonlighting courses, a vast educational area – more than 30 towns of European Russia, - made e-learning technologies extremely important for us. For more than 10 years we are developing computer-assistant and distant education.

For students of the first 3 courses there are developed a methodology of obligatory e-learning on physics, chemistry, monitoring and ecology: electron text-books, multimedia courses, computing simulation laboratory, test and self-test systems. For the last 3 years the methodology becomes more complicated: professional training needs introduction of specialized programs, distant defending of course and diploma works, Internet and e-mail consulting, distant e-lecturing.

KEYWORDS

e-learning, correspondence and moonlighting courses, virtual learning environment, AutoCad, ArcView, ArcInfo, ArcGis, MathCad, Statgraphics, LabView

INTRODUCTION

Russian State Open Technical University of Railway Transport (formerly All-Union Correspondence Institute of Transport Engineers) was founded more than 50 years ago for teaching specialists for the railways. And the specific of our university was teaching students all around the European part of Russia even in small towns and villages. Nowadays RGOTUPS has subsidiaries in more than 30 towns of European Russia and most of our students are taking correspondence and moonlighting courses. A vast educational area (from Archangelsk to Astrakhan and from Kaliningrad to Izhevsk and Salekhard) always demanded specific forms of teaching process: years ago 10 car-laboratories of fundamental and special technical disciplines (physics, chemistry, electrical engineering and so on) were running all around the country, hundreds of teachers and lecturers spent months in business trips.

Developing of new information technologies, their introduction into the educational process, rapid rise of the computer park of the university made it possible to put forward a problem of searching of new forms of the teaching process. For more than 10 years now we are developing computer-assistant and distant education. E-learning technologies became extremely important and actually the only possible form for education in our university in the new economical conditions in Russia.

From the first moments in RGOTUPS a university entrant meets e-learning technologies: he/she has an opportunity to take 2 (of 4) entrance exams (in mathematics and physics) in the conventional written form or in the form of computer testing [1]. And from year to year the more and more entrants prefer computer testing. In the case of success and as first year students they immediately get a CD package of electron text-books in mathematics, physics, chemistry and other disciplines.

For students of the first 3 courses there is a developed methodology of obligatory e-learning on physics, chemistry, monitoring and ecology: electron text-books, multimedia courses, computing simulation

laboratory, test and self-test systems. Virtual laboratory in sophisticated parts of physics lets students to have an opportunity to become familiar with techniques and practice of Radiation Ecology, X-ray structural analyses et al.

High-grade training to the physicist in technical colleges and institutes assumes a reasonable combination of all possible forms and ways of submission of a material. Significant opportunities for creation of virtual laboratory works and demonstration appendices give the environment of graphic programming Lab VIEW [2]. Owing to simplicity of creation of the program and a rich arsenal of graphic means it is possible to receive both a material for lecture demonstrations, and the laboratory stands rather approached to their real analogues. The question on forms and ways of use of the developed programs is solved by the teacher depending on concrete conditions and technical opportunities of high schools.

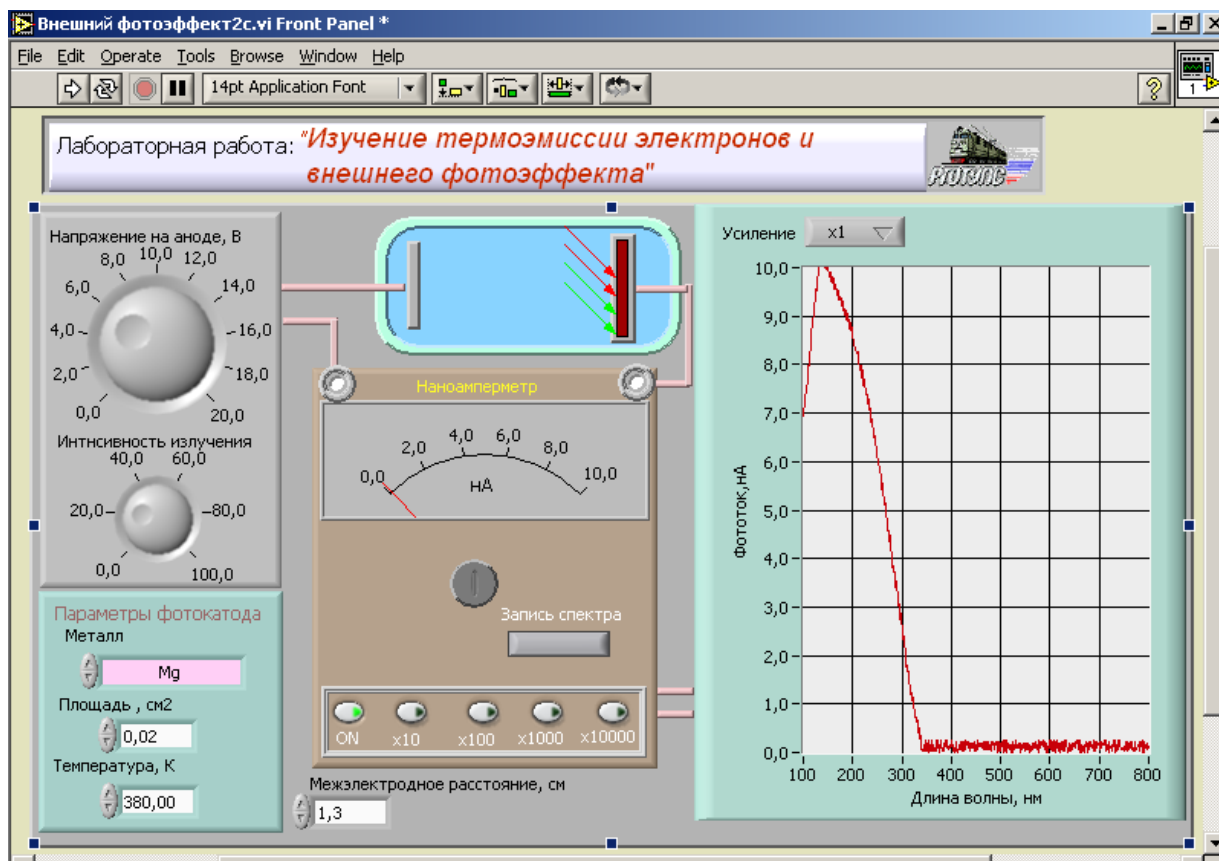
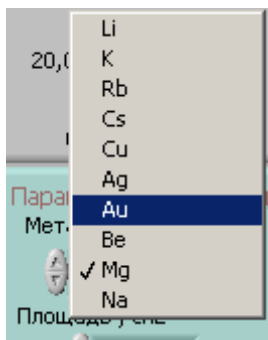


Figure 1. The working panel of the virtual device

As an example we result the working panel of the laboratory work, allowing to study the phenomenon temperature emission and an external photo effect for of some metals. The student can independently vary in all parameters of virtual experiment from a choice of a studied material from the list offered in the menu up to concrete conditions of its realization.



Presentation of performance of experiment is reached by several means. For example, at record of a spectrum of a photocurrent occurs not only the brisk blinking of arrows - beams, but also synchronized with a length of a wave change of painting of a shined part of the photocathode. The result of carrying out of experiment can not turn out (will not be displayed on a tape of a recorder) if the user has incorrectly chosen a limit of measurements of a level of a current. At rise in temperature of the cathode dark current of the diode becomes prevailing and to find out a photocurrent any more it will not be possible, as a registered signal purposely closed. Received spectra are in

dependence from appointed: the areas of the photocathode, a pressure of a feed and interelectrode distance. The area of a shined part of the cathode is supposed a constant. In mathematical model of the program effect Shotki for an effective current of saturation VAC of the vacuum diode is incorporated. Values of works of an output for ten metals, unlike real, are taken independent from temperature [3].

Problem of the student in laboratory work is reception of work of an electron output for the metal appointed to it both on red border of a photoeffect, and on temperature dependence of a current temperature emission

As an next example we shall result the laboratory work developed on the basis of program LabVIEW 7 for student of senior years of study.

DEFINITION OF PARAMETERS ONEMODE OPTICAL FIBER

Purpose of work: to study a degree of influence of design features on properties of an optical fiber; to receive representations about opportunities of deduction of fashions in step fibres; to study effects of easing of radiation in an optical fiber

The used equipment and materials: IBM a compatible personal computer with established program LabVIEW 7 Express, the program " the Fibre onemode.vi ". On the screen of a computer you will see the virtual device shown on fig.2. In an initial condition, there is an opportunity to appoint any of the parameters of a problem located on a blue floor in the left party of a picture. Set parameters are: 1. Length of a wave of the radiation, set in microns; 2. Radius of the central part of an optical fiber of step type in microns; 3. A parameter of refraction of a core of a fibre ; 4. parameter of refraction of an environment of a fibre ; 5. Factor of attenuation of radiation in a fibre; 6. Length of a studied piece of an optical fiber.

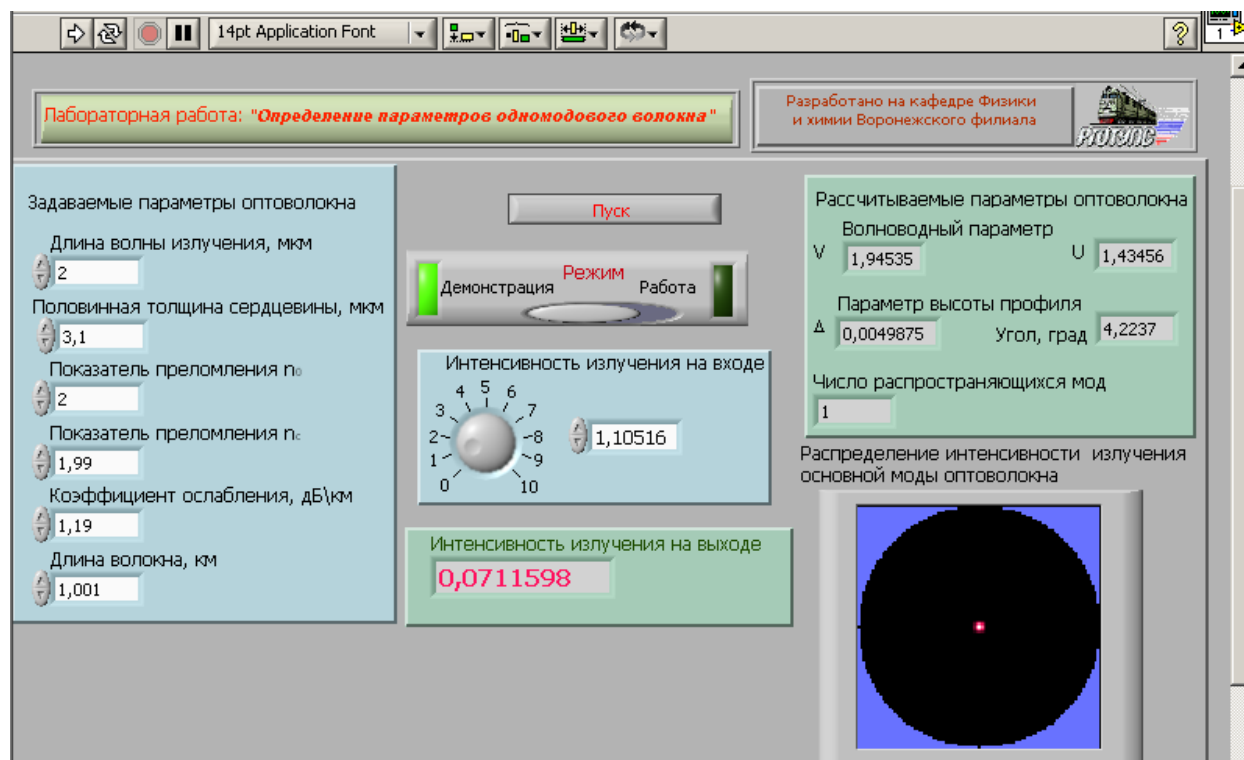


Figure 2. The working panel of the virtual device for formation of parameters one mode optical fibers and studying of laws of distribution in it of radiation in a demonstration mode.

As well as in a reality, these parameters are defined any ways to a certain extent any: the choice of length of a wave depends on type of the laser diode which is available at your order, four following parameters are defined by mark of an optical fiber and depend on quality of technology of firm of the manufacturer.

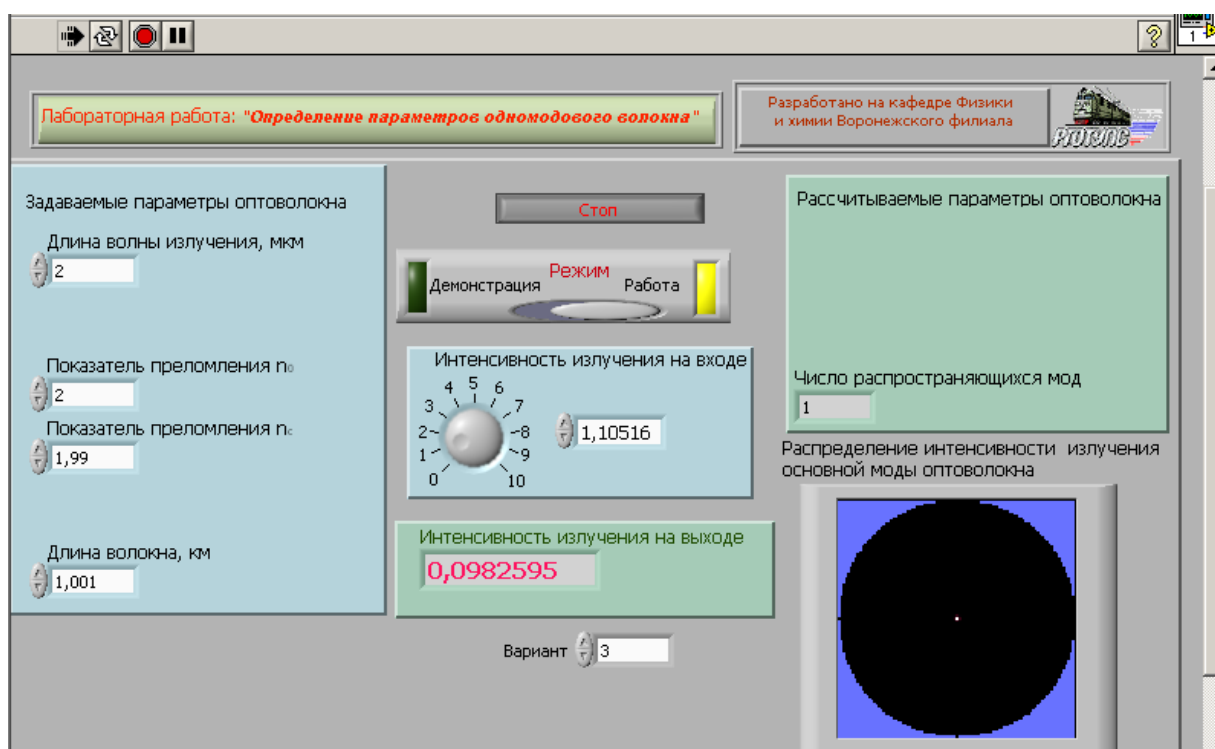


Figure 3. Working panel of the virtual device in a mode of performance of laboratory work.

One more example of performance of laboratory work at special rates 4 years of training

Purpose of work: to study a degree of influence of design features on properties of planar optical paths of various types; to receive representations about opportunities of step optical paths; to study opportunities optical paths; to investigate effects intermode dispersions in step optical paths.

The used equipment and materials: IBM a compatible personal computer with established program LabVIEW 7 Express, the program "Lab1pro.vi."

For studying laws of distribution of radiation in optical paths of different types in offered work the virtual measuring stand which working panel in a variant of a demonstration operating mode is presented on fig. 4 is used.

The working panel can be switched to a following stage of work. For рис.4 it is required to know purpose of following elements: in the top left corner there is a panel of a choice of type of an optical path - on the panel is chosen graduated optical path.. Figure explains the designations accepted in work: ρ - half of thickness of a layer with a changing parameter of refraction, n_0 - the maximal size of a parameter of refraction on an axis of a symmetric optical path, n_c - a parameter of refraction of a homogeneous thick environment. Numerical values of the listed parameters for a modeled optical path can be set by means of digital displays under a window of a choice of type of an optical path.

The program allows to trace trajectories of seven beams with the left boundary conditions appointed by you: - a directing corner of a beam extending in an optical path; - position of a beam concerning an axis of an optical path.

For reception of a qualitative picture of trajectories of beams on the screen of the graphic display it is necessary to appoint a step of distribution. Its small size will lead to long performance of a problem, greater - will give poor-quality and rather approximate results.

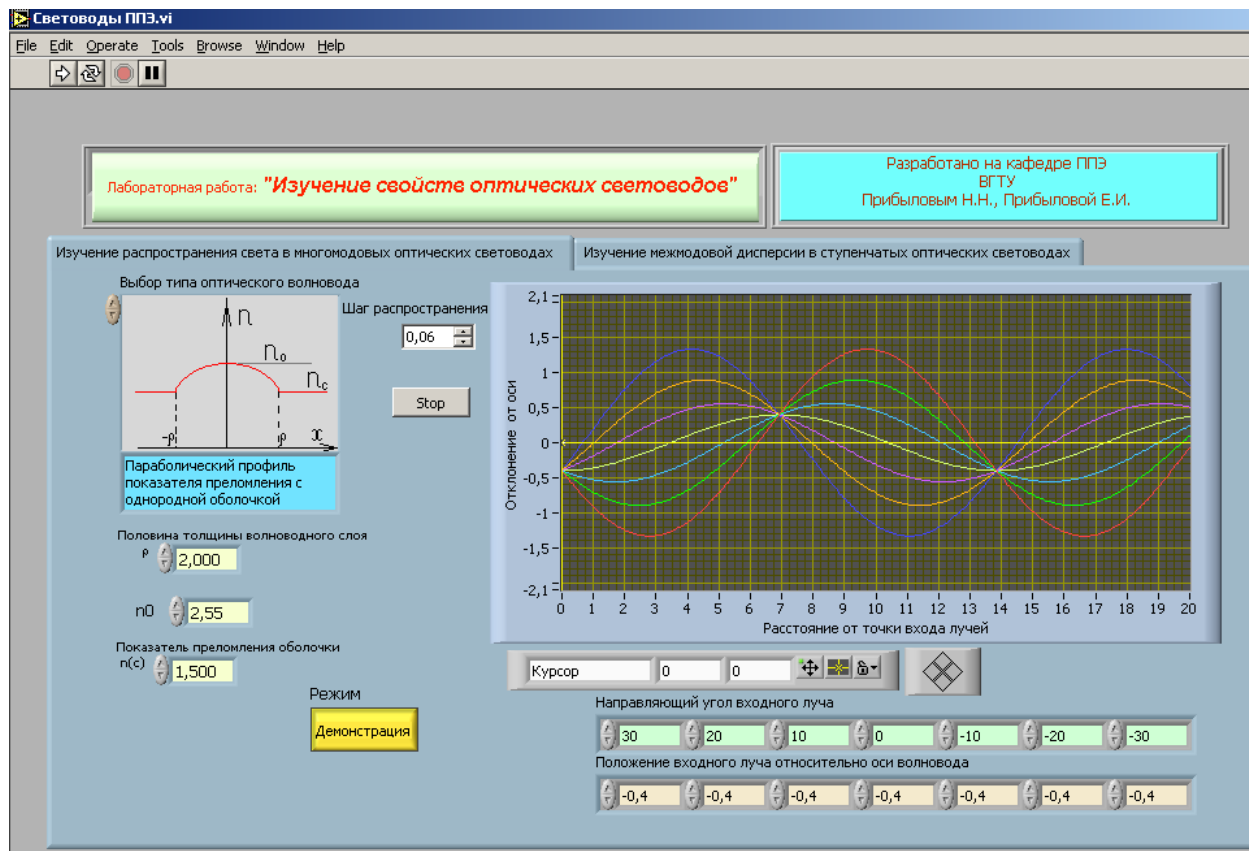
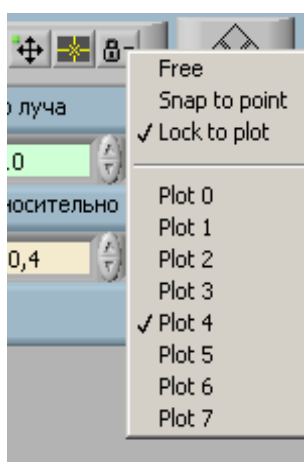


Figure 4. The panel in the demonstration mode, allowing to observe beam trajectories in a symmetric optical path, under the set boundary conditions.

If the parameters set by you will appear physically not proved, values $n_0 < n_c$ will be for example entered, there will be a corresponding text message and work of the program can be stopped.



The cursor will allow to define precisely coordinates of points of turn on schedule Fig. 4. That on one schedule the set of curves is displayed, it is required "to attach" the cursor to a trajectory interesting you. For this purpose it is required to click on a designation of the lock in the control panel the cursor that will lead to occurrence of the menu of schedules in which choose a trajectory of a beam interesting you - on an insert the fifth trajectory under the account has been chosen. It is possible to carry out switching of a binding and vertical buttons of an element of management of the cursor.

If in a mode of demonstration the step optical path the picture of beam trajectories will change also you will be chosen can analyze a picture of mirror reflections from border of section of two optical environments as it is shown on fig.5.

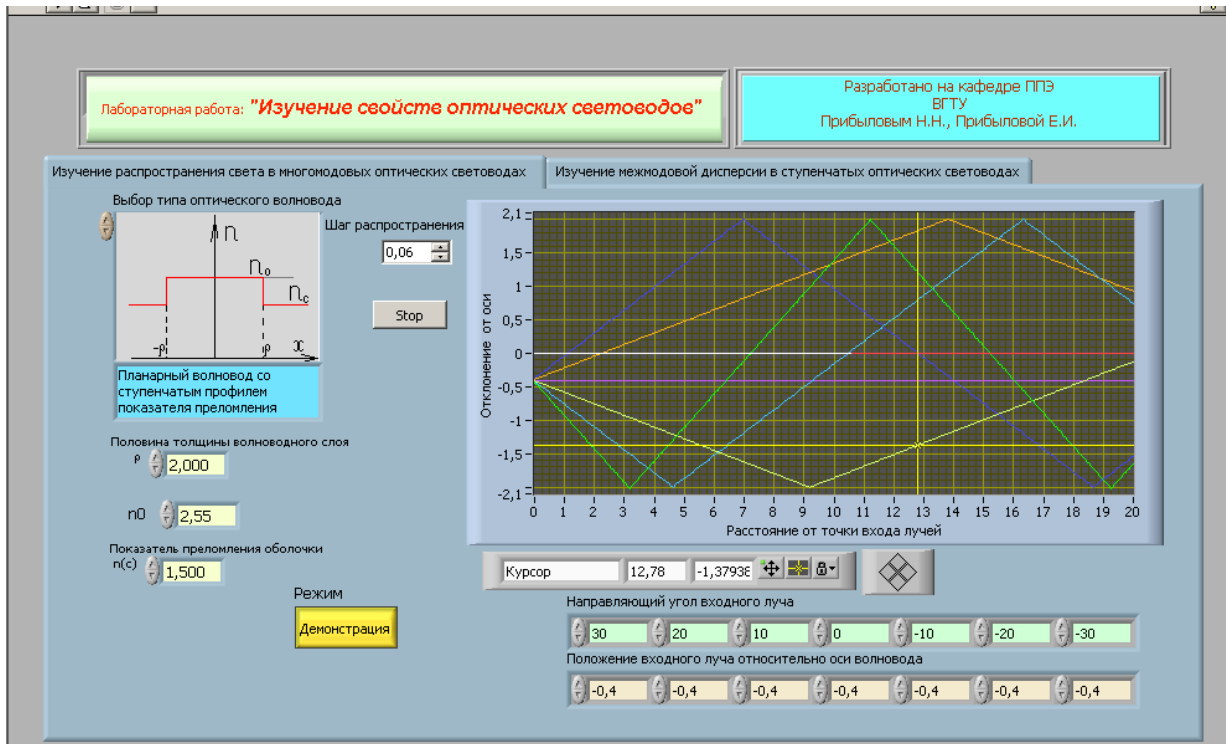


Figure 5. In a demonstration mode it is possible to appoint various trajectories of distribution of beams in a modeled optical path.

Click on an inscription in the top part of a bookmark of the catalogue will highlight the panel intended for studying of distribution of light impulses - a Fig. 6.

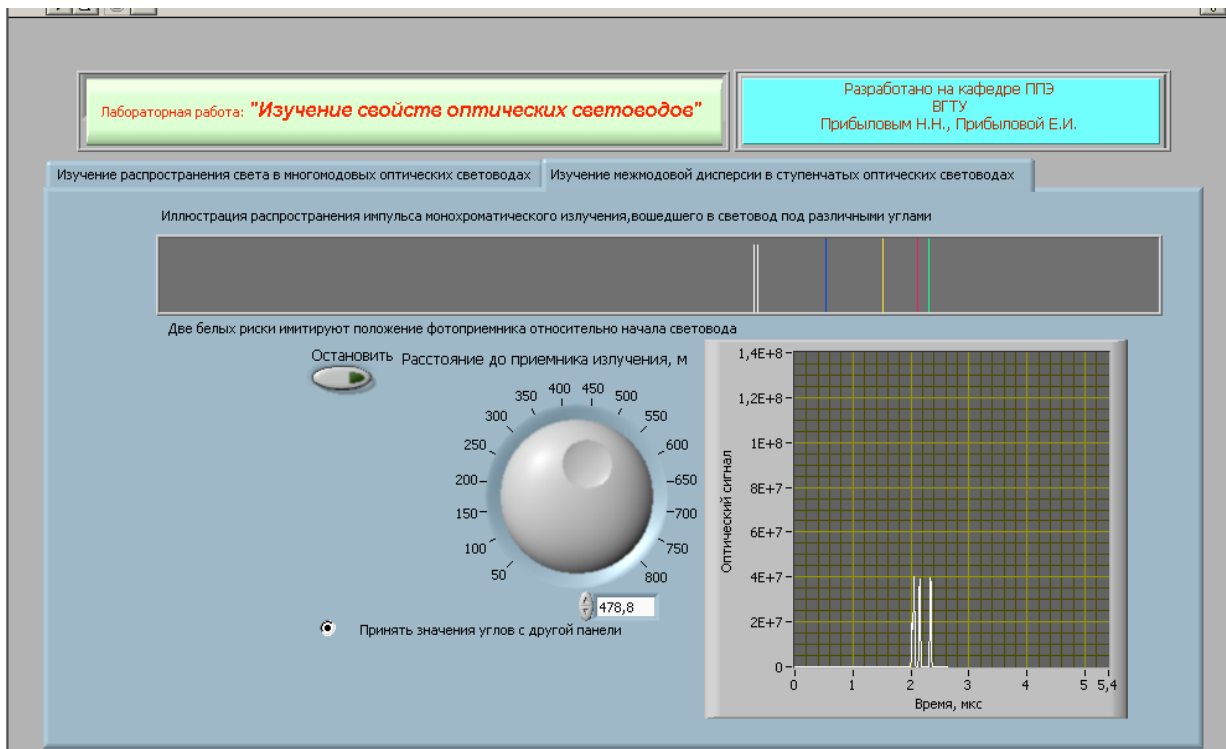


Figure 6. Registration intermode dispersions for trajectories, at entry conditions chosen on fig.5 and parameters of an optical path.

The student have an opportunity to observe distributions of a short impulse of monochromatic radiation by that set of beam trajectories which has been appointed on the previous panel. To each trajectory corresponds bunch of waves, moving with it's speed. For simplification of perception "impulses" are painted in different colors. For definition of speeds of distribution of radiation by various fashions it is offered to take advantage of a photo detector which position concerning a pulse source is set by a regulator " Distance up to a source of radiation " within the limits of 800 m and it is displayed on the display by two parallel white strokes.

Everyone bunch is reflected by occurrence of a narrow impulse. If speeds of distribution of impulses coincide, their intensity is summarized. At small distance between a source and the receiver of time division of impulses the registering device does not occur.

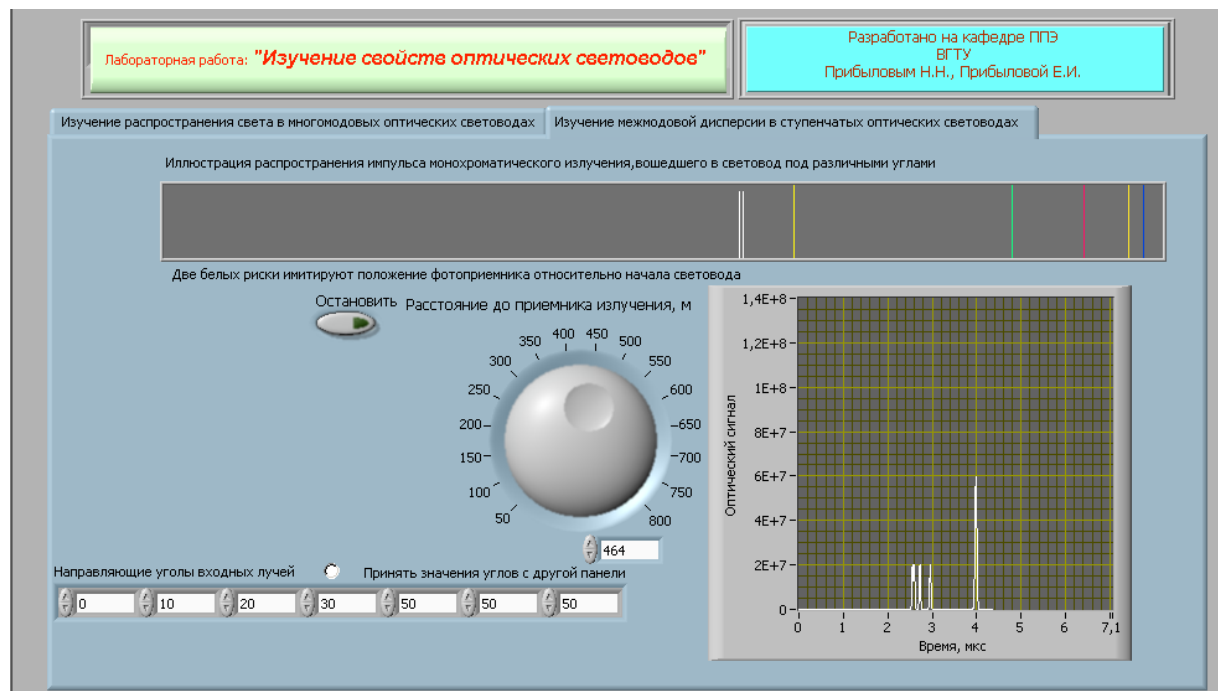


Figure. 7. Registration intermode dispersions for trajectories, at again appointed corners of distribution and before certain parameters of an optical path

After you have set all necessary parameters of a design of an optical path and have brought necessary properties of a material in windows performance of the program is carried out by pressing of the button of start. To normal work testify change of color of an arrow on the button of start-up at simultaneous coloring the button of a stop of the program in bright red color. At normal end of the program it is switched off automatically, but it is possible to take advantage of button " Stop " on the panel.

A highly qualified lecturers and specialists wrote their courses on video and/or CD so the students of RGOTUPS subsidiaries in 32 towns of Russia has an opportunity to listen and see lecture demonstrations of Moscow professors and specialists without the necessity of long and expensive trips to Moscow. And vice versa the number of lecturers' assignments is harshly reduced. Computer classes on places and computing simulation laboratory practice in main fundamental and special disciplines let an opportunity to substitute expensive car-laboratories. Regular e-mail and video-conference contacts with teachers keep students under the ruling control in the learning process. Test and self-test system does not substitute regular exams but helps teachers/students to control/appreciate their level of knowledge and learning potential.

Besides these programs, for training other software products are used also. Very convenient for the purposes of remote formation there was a program developed by teachers of our university after the

physicist, to methods of scientific monitoring of an environment. It does not demand for the realization of supernew computers and can quite work by old machines. In it besides a small lecture material is available tasks for self-checking, for delivery of offset. In the end, after performance of work, the program automatically puts down estimations on the executed work. Students very positively concern to work in such mode - it is impossible to fall down on misunderstanding the teacher of the answer; there is no subjectivity of the teacher in an estimation of the answer.

Work in such mode raises interest of the student in studying a material and very often student received an estimation "well" asks to enable to it to do all work a new, but is already closer.

For the last 3 courses the methodology becomes more complicated: professional training needs introduction of specialized programs, distant defending of course and diploma works, Internet and e-mail consulting, distant e-lecturing. In the educational process we use scientific and technical software: AutoCad, ArchiCad, ArcView, ArcInfo, ArcGis, Pspice 4, MathCad, Statgraphics, BP Win, C++Builder, Protel, Pcad, LabView and others.

Since 1998 there exists the university WEB-site www.rgotups.ru. Besides it there are sites of faculties "higher mathematics", " ", " resistance of materials " and others where materials for training the student are exposed all. For example materials of faculty " physics, chemistry and ecology " are exposed on a site www.klimova.nm.ru.

It seems important that during all years of education students could use internationally developed universal e-courses on general and special subjects available in the Internet. And the results of the exams should be accepted by different universities. Ten year practice and development of e-learning technologies in our university demonstrate their great potential and very promising future for education in the 21 century.

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Demchenko Anatoly T., Silina Elena K., Fokin Vladimir S., Pribilov Nicolai N., Klimova Diana V., Nedostaev Vladimir N.
Russian State Open Technical University of Railway Transport (RGOTUPS)
Chasovaya 22/2
125808 Moscow
Russia
E-mail: silina@rgotups.ru
ek_silina@mail.ru