Behavior Detection System

VibraImage

Manual

Version 8.1

ELSYS Corp.

WWW.ELSYS.RU

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Saint-Petersburg

2019

Content

Introduction

Welcome to the VibraImage World! Thank you for your purchase of VibraImage system. This Manual is written to help you enjoy vibraimaging and open new features in well-known objects!

VibraImage technology measures micromovement (micro motion, vibration) of person by standard digital, web or television cameras and image processing. Human head microvibration is linked with the vestibular-emotional reflex (VER) of a person and reflects emotion status and personality traits. VibraImage system detects human emotions by the control of three dimensional (3D) head-neck movements and fluctuations, accumulated as frame difference in several video frames.

Fig.1. Amplitude vibraimage of the person

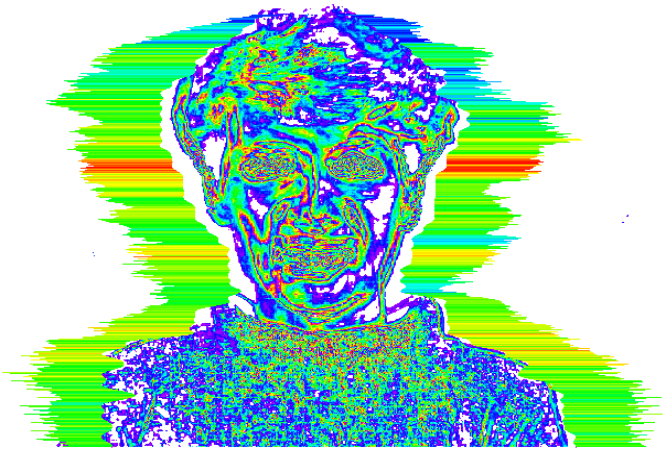

Fig.2. External vibraimage around the frequency vibraimage

VibraImage is a new image type and so primary, as original color image, thermo image or x-ray image. Each image type gives new and unique information about the object. Every pixel of vibraimage reflects vibration parameters - frequency or amplitude (fig. 1) of vibration. One frame visualization of vibration frequency and amplitude named external vibraimage and looks like aura (vibra-aura) of person (fig. 2). Typically external vibraimage colors linked with vibration frequency and external vibraimage dimension linked with vibration amplitude.

In medical imaging and biometrics, VibraImage is psychologically-based, emotion-recognition technology that measures micro vibrations as frequency and amplitude parameters. The visualization of a 3-dimensional object fluctuation, based on vibration parameters, can thus be correlated to various mental states, such as anger, anxiety, tension, aggression, etc., as well as mood, normal status, and subconscious reflections. Vibraimage can be characterized as one of primary image type like visible spectrum, infrared, x-ray, MRI or ultrasound imaging. VibraImage technology is currently being tested in the different areas such as terrorist recognition, emotional recognition, interpersonal compatibility testing, medical diagnostics etc. Live visualization of every pixels vibration became possible only in 21st century with the development of digital cameras and high power computers. Long ago, past scientists, such as Aristotle, had realized that biological

object movement parameters characterize emotions; thus vibraimage technology is a modern realization of this goal.

VibraImage system provides remote and auto monitoring of emotions levels, such as stress, aggression and tension, and detects lie in a real time mode. VibraImage also allows to measure and analyze human activity characteristics from recorded video files (AVI format) and to analyze medical, psychological and emotional human status for different applications. VibraImage parameters indicates (measures or quantitatively characterize) emotions or personality traits and psychophysiological status of a person.

The method, system and the device of said VibraImage technology are protected by the patents of Russian Federation RU 2187904 (fig.3), RU2289310 (fig. 4), RU 2510238 (fig. 5), RU 2515149 (fig. 6), Software Registration N2006614137 (fig. 7), United States Patent US 7346227 (fig. 9, 10), Korean patent KR 10-1500888 and awarded with Gold medal on the international exhibition of inventions and innovations Brussels - Eureka 2002 (fig.8).


РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2187904

Российским агентством по патентам и товарным знакам на основании Патентного закона Российской Федерации, введенного в действие 14 октября 1992 года, выдан настоящий патент на изобретение

СПОСОБ И УСТРОЙСТВО ПРЕОБРАЗОВАНИЯ ИЗОБРАЖЕНИЯ

Патентообладатель(ли):

Многопрофильное предприятие ООО "Элсис"

по заявке № 2000132334, дата поступления: 19.12.2000

Приоритет от 19.12.2000

Автор(ы) изобретения:

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Патент действует на всей территории Российской Федерации в течение 20 лет с 19 декабря 2000 г. при условии своевременной уплаты пошлины за поддержание патента в силе

Зарегистрирован в Государственном реестре изобретений Российской Федерации

г. Москва, 20 августа 2002 г.

Генеральный директор

А.Д. Корчагин

Fig.3. Patent of Russian Federation RU 2187904


РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2289310

СПОСОБ ПОЛУЧЕНИЯ ИНФОРМАЦИИ О ПСИХОФИЗИОЛОГИЧЕСКОМ СОСТОЯНИИ ЖИВОГО ОБЪЕКТА

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Приоритет изобретения 16 февраля 2004 г.

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Срок действия патента истекает 16 февраля 2024 г.

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Б.П. Симонов

Fig.4. Patent of Russian Federation RU 2289310

РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2510238

СПОСОБ ПОЛУЧЕНИЯ ИНФОРМАЦИИ О ПСИХОФИЗИОЛОГИЧЕСКОМ СОСТОЯНИИ ЖИВОГО ОБЬЕКТА

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Приоритет изобретения 26 октября 2009 г.
Зарегистрировано в Государственном реестре изобретений Российской Федерации *27 марта 2014 г.*
Срок действия патента истекает 26 октября 2029 г.

Руководитель Федеральной службы по интеллектуальной собственности
Б.П. Симонов

Fig.5. Patent of Russian Federation RU 2510238

РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2515149

СПОСОБ СКРИНИНГ-ДИАГНОСТИКИ РАКА ПРОСТАТЫ

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Заявка № 2012104786
Приоритет изобретения 06 февраля 2012 г.
Зарегистрировано в Государственном реестре изобретений Российской Федерации *12 марта 2014 г.*
Срок действия патента истекает 06 февраля 2032 г.

Руководитель Федеральной службы по интеллектуальной собственности
Б.П. Симонов

Fig.6. Patent of Russian Federation RU 2515149

РОССИЙСКАЯ ФЕДЕРАЦИЯ

СВИДЕТЕЛЬСТВО

об официальной регистрации программы для ЭВМ

№ 2006614137

«Программа дистанционного бесконтактного сканирования и идентификации психофизиологического состояния человека» («VibraImage 6.0»)

Правообладатель(ли): *Общество с ограниченной ответственностью «Многопрофильное предприятие «Элсис» (RU)*

Автор(ы): *Минкин Виктор Альбертович, Акимов Валерий Александрович (RU)*

Заявка № 2006613400
Дата поступления 3 октября 2006 г.
Зарегистрировано в Реестре программ для ЭВМ *1 декабря 2006 г.*

Руководитель Федеральной службы по интеллектуальной собственности, патентам и товарным знакам
Б.П. Симонов

Fig.7. Certificate on official registrations Software VibraImage 6.0 in Russian software database

BRUSSELS EUREKA 2002

51st WORLD EXHIBITION OF INNOVATION, RESEARCH AND NEW TECHNOLOGY
51e SALON MONDIAL DE L'INNOVATION, DE LA RECHERCHE ET DES NOUVELLES TECHNOLOGIES
51e WERELDBEURS VOOR INNOVATIE, ONDERZOEK EN NIEUWE TECHNOLOGIËEN
51e SALÓN MUNDIAL DE LA INNOVACIÓN, INVESTIGACIÓN Y NUEVAS TECNOLOGÍAS
51. WELTMESSE FÜR ERFINDUNG, FORSCHUNG UND NEUE TECHNOLOGIEN
51° SALONE MONDIALE DELL'INNOVAZIONE, DELLA RICERCA E DELLE NUOVE TECNOLOGIE

DIPLOMA

MINKIN Viktor, SHTAM Alexandre

POUR L'INVENTION
VOOR DE UITVINDING
FOR THE INVENTION
FÜR ERFINDUNG

Procédé et dispositif pour convertir une image

Médaille d'or

BRUSSELS, 17/11/2002

THE PRESIDENT OF THE INTERNATIONAL JURY

THE PRESIDENT

Fig.8. Diploma of international exhibition of inventions and innovations Brussels - Eureka 2002

The United States of America

The Director of the United States Patent and Trademark Office

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

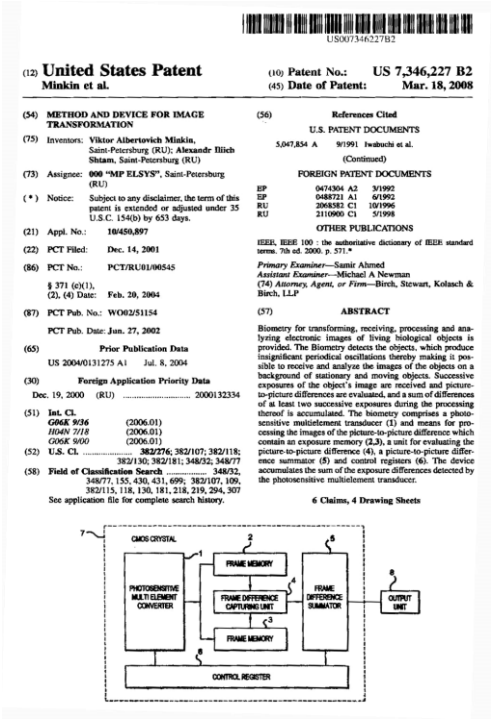
United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extensions.

Director of the United States Patent and Trademark Office



US007346227B2

(12) **United States Patent**
Minkin et al.

(10) **Patent No.: US 7,346,227 B2**
(45) **Date of Patent: Mar. 18, 2008**

(54) **METHOD AND DEVICE FOR IMAGE TRANSFORMATION**

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(73) Assignee: **000 "MP ELSYS"**, Saint-Petersburg (RU)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 653 days.

(21) Appl. No.: **10/450,897**

(22) PCT Filed: **Dec. 14, 2001**

(86) PCT No.: **PCT/RU01/00545**

§ 371 (c)(1),
(2), (4) Date: **Feb. 20, 2004**

(87) PCT Pub. No.: **WO02/51154**

PCT Pub. Date: **Jun. 27, 2002**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
G06K 9/36 (2006.01)
H04N 7/18 (2006.01)
G05K 9/00 (2006.01)

(52) **U.S. Cl.** **382/276**; 382/107; 382/118; 382/130; 382/181; 348/32; 348/77

(58) **Field of Classification Search** 348/32, 348/77, 155, 430, 431, 699; 382/107, 109, 382/115, 118, 130, 181, 218, 219, 294, 307
See application file for complete search history.

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RU 2110000 C1 5/1998

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Primary Examiner—Samir Ahmed
Assistant Examiner—Michael A Newman
(74) *Attorney, Agent, or Firm*—Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

Biometry for transforming, receiving, processing and analyzing electronic images of living biological objects is provided. The Biometry detects the objects, which produce insignificant periodical oscillations thereby making it possible to receive and analyze the images of the objects on a background of stationary and moving objects. Successive exposures of the object's image are received and picture-to-picture differences are evaluated, and a sum of differences of at least two successive exposures during the processing thereof is accumulated. The biometry comprises a photosensitive multielement transducer (1) and means for processing the images of the picture-to-picture difference which contain an exposure memory (2,3), a unit for evaluating the picture-to-picture difference (4), a picture-to-picture difference summator (5) and control registers (6). The device accumulates the sum of the exposure differences detected by the photosensitive multielement transducer.

6 Claims, 4 Drawing Sheets

Fig.9. United States Patent US 7346227

Fig.10. United States Patent US 7346227 1 p.

VibraImage goals

- Psychophysiological parameters monitoring and detection;
- Emotion recognition;
- Lie detection;
- Monitoring of person physiological parameters;
- Video surveillance in real time by vibraimage and suspicios person detection;
- Psychological testing and interview

Physiology of movements

The direct link between reflex movement and brain activity was discovered in 1863 by the famous Russian physiologist Ivan Sechenov in his publication «Reflexes of Brain». Charles Darwin in his book «The expression of the emotions in man and animals», 1872, also declared that reflex movements associated with emotions. Nobel laureate and the famous researcher of aggression Konrad Lorenz claims, that amplitude and intensity of reflex movements characterized the aggression. (On Aggression, 1966). According to the action of vestibular system functions and mechanical movement, person stands with the head in a balanced vertical position, continuously and reflexively performing three-dimension micromovements or vibrations. The dependence between head vibration parameters and emotional state characterized by the vestibular-emotional reflex (VER) or vestibular-energy reflex.

Vibraimage technology is the realization of medicine, psychology, modern computers and television sciences for human emotion recognition. Vibraimage plans to do human emotion control so precise, like physics measurements!

1. Useful information

1.1. Basic applications

Human emotions control system (further - VibraImage) intends for registration, analysis, control and research of human emotion, functional and psychophysiological states for different applications in the fields of security, biometrics, psychology, medicine, electronics and human life.

1.2. Operation conditions

The system provides serviceability in conditions of influence of external factors.
Do not store or use the system in any of the following locations:

- Humidity above 90 % at temperature above 350 °C;
- Exposed temperature below 100 °C or above 400 °C.

Note

Operating conditions of the system can be changed depending on the hardware used.

1.3. Specifications

1.3.1. VibraImage system parameters

- Resolution, TVL, not less 400
- Noise level of VibraImage, bit, less than 0,1
- Frame speed, frame/sec, not less 25
- Frequency range, Hz, more than 0,1 ÷ 10

1.3.2. Digital (web) camera requirements

- Sensor CCD or CMOS Sensor
- Resolution, pixel, not less 640 x 480
- USB compatible USB 3.0, USB 2.0, USB 1,0
- Frame speed, f/s, not less 25
- Microphone external (not built-in camera)
- Exposition control auto and manual
- Color mode color and B/W switch
- Flicker mode Flicker 50 Hz and 60 Hz

1.3.3. System requirements for local module

• Operation System	Windows 7/8/10 with DirectX 9.0 or later
• Processor	PC with Pentium Core Duo2 2400 or better
• RAM	2 GB or more
• HDD	100 GB or more free space
• DVD-ROM	DVDRW
• USB port	2 free USB ports version USB 2.0
• PCI slot	1 free slot (option)
• Video capture	WDM-compatible video device
• Audio	audio capture device (support 16 bit data and 44100Hz stream frequency)
• Network	LAN 100Mb/s or better

1.3.4. System requirements for terminal module (network monitoring)

• Operation System	Windows 7/8/10 with DirectX 9.0 or later
• Processor	PC with Pentium IV 2400MHz or better
• RAM	2 GB or better
• HDD	1 GB or more free space
• Monitor	Resolution 1024 x 768 or better. On desktop must be free area (don not cover other software windows) with size 300 x 80 point or better.
• Video capture	WDM-compatible video device
• Audio	standard audio capture device and speaker
• Network	LAN 100 Mb/s or better
• Switch Multiplexer	for connection to the terminal monitor of one of two computers: computer of the terminal or ELSYS module computer.

1.4. Package content

1.	VibraImage DVD disc with software and Guardant dongle	-	1
2.	User's Guide	-	1
3.	Passport (option)	-	1
4.	Digital USB camera (option)	-	1
5.	Microphone (option)	-	1
6.	Personal computer (option)	-	1

1.5. Structure and operation of the system

1.5.1. Software specification

VibraImage software is the part of vibraimage system and located on DVD, than installed to user's computer for electronic images processing. Image processing analyzing pixel movements, fluctuations and vibration of various frequency and the amplitude, performs by any part of object and preferably by human head.

VibraImage technology implemented in the software package VibraImage, allows to register a lie, to monitor the level of emotion (such as stress and aggression), and determine the level of potential danger of the person on whom the camera is looking.

VibraImage software solves the following tasks:

- Emotional levels recognition and detection;
- Lie detection;
- Monitoring of person physiological parameters;
- Creation and the analysis of digital videos of files in format AVI
- Surveillance in real time vibraimage
- Save the visible image in a file in format BMP;
- Measurement in real time integrated characteristics of vibraimage;
- Recording of integrated characteristics vibraimage, received for certain time, in a LOG file;
- Input and save the demographic data in a file in format TXT;
- The structured save of visible images in files in format BMP according to the entered demographic data;
- Print out the kept images and the corresponding demographic data.

1.5.2. Software structure

Video source

In directory \Soft\VideoCam utilities to test the functionality of a digital camera (provided it supplies with a complex) are located. Detailed installation instructions of drivers of a digital video camera are located on a CD disk of the camera software delivered together with the camera.

VibraImage

In directory \Soft\ VibraImage8Setup.msi the installation package of the VibraImage 8.x program is located. For start of the program it is necessary to study recommendations about the installation, specified in the section " VibraImage Program Installation" (see below).

VibraImage8 software includes 4 correlated programs - Main module (VibraImage.exe), Printing module (VIPrinter.exe), LogViewer module (LogViewer.exe) and NetMonitoring module (VINetStatus.exe).

Guardant drivers

Before starting VibraImage 8.x, you must install a device driver hardware lock (dongle). In the catalog \Soft\ Guardant2eng the installation package dongle drivers is located. To run the program should be read the recommendations for installation specified in the «Guardant dongles driver installation» (see below).

Note

To install the driver in NT/2000/XP/W7/W8/W10 administrator rights are required!

1.5.3. System components

The system consists of the following basic elements:

- TV block: TV camera or AVI-file;
- PC with operation system Windows XP or later;
- CD disk with software VibraImage 8.x and User's Guide;
- dongle Guardant II with applicable ID number.

Elements of the system are interconnected structurally and functionally to ensure maximum accuracy in registering vibrations of the object and determine the state of an object based on its vibraimage.

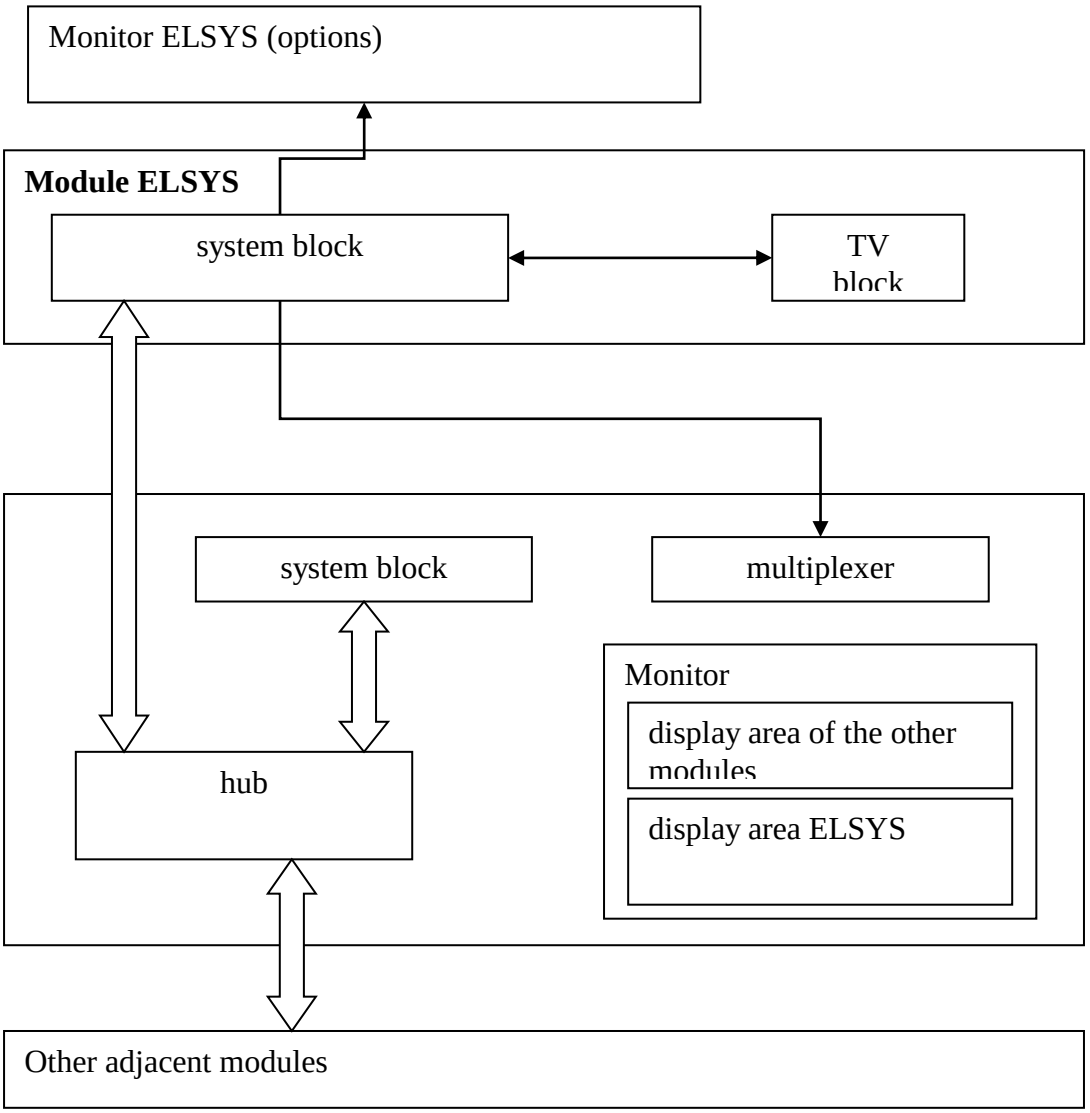


Fig. 1.1a. Example of construction VibraImage system in a network monitoring.

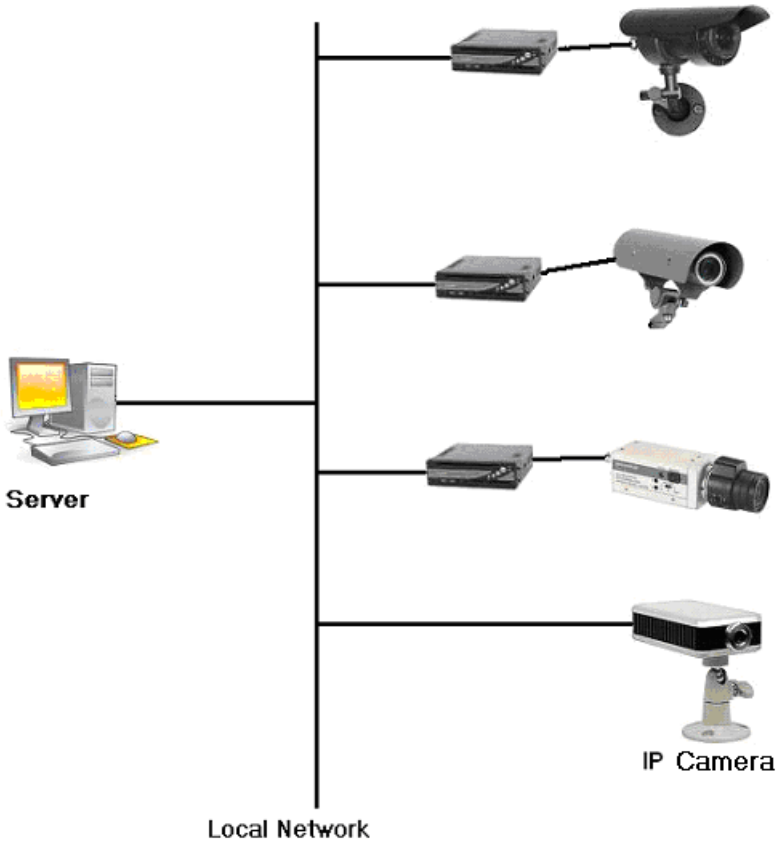


Fig. 1.1b. Example of construction VibraImage system in a network monitoring mode with various variants of used television cameras.

2. Before you begin

2.1. Information and Precautions

Notice concerning privacy

Do not use this system for purpose of person privacy irregularity. Note that simply being in possession of material that was digitally copied or reproduced by means of a scanner, digital camera or other device may be punishable by law.

Note

Disposal of this product is acceptable only in accordance with Local and National Disposal Regulations.

2.1.1. Power supplies requirements

Power supply depends on your location and power supply of your computer and camera.

For low noise and reliable system action the monitor, power units of cameras should be connected to an electric network through the special sockets having additional ground contact (the socket of a class 1).

For reliable maintenance system the equipment included in complex and the equipment, taking place in direct near should be certificated on electromagnetic compatibility according to requirements.

2.1.2. Light exposure requirements

Natural illumination of object can be used only if speed of natural light exposure changes of object does not exceed 1 Lx/s.

Illumination of object by fluorescent lamps with illumination in a range 400 - 600 Lx in a plane of object is preferable.

2.1.3. Camera vibration requirements

The television camera used for surveillance and-or object on which the camera is established, should be motionless and have no vibrations more than 1 mkm/s.

Vibraimage and processing parameters depend on camera vibrations, so unstable camera position could have influence on and gives errors in processing results.

2.1.4. Settings VibraImage recommendations

For adequate registration person vibraimage is recommended to take into account the following factors:

1. The object (person) should be well and uniformly illuminating; also preferably black-and-white image of the person should be precise and contrast.

As vibraimage depends on microvibration registration, so reflected light (optical flares, glare) and low light exposure of object can deform received result dramatically.

2. This version of the software is designed for visualization of external vibraimage (aura) only for one object in the frame, therefore the moving objects which are taking place near to the basic object of research, can essentially influence and deform aura of the basic object.

Vibraimage visualization is carried out without high dependence from quantity of objects in the frame.

3. There is a certain delay between vibraimage parameters of the person and visualization of live video on monitor. The time of this delay, basically, is defined by chosen time of frame averaging. For example, if real speed of system 5 f /s and chosen time of accumulation of 50 frame, the objective vibraimage parameters of the person can process, not earlier, than in 10 seconds after processing start.

4. The developed version of system is sensitive to the certain object macromovements (even at the switching Moving Filter), therefore for reception of objective vibraimage parameters, person must in the natural and stable state (standing or sitting).

Note

The correct analysis of person emotion levels and lie detection is possible only at detail execution of the recommendations stated in the given document, and by processing of high quality vibraimage .

2.2. Getting started

2.2.1. Hardware requirements

Vibraimage hardware requirements depend on application aims. Simple vibraimage system includes camera and computer; sure they must be software and hardware compatible. Detail hardware specification would be described in the next points of this Manual.

2.2.2. Digital camera driver installation

Note

Auto installation of system components is made according to the recommendations specified in section 2.2.5.2 of this Manual.

Install drivers for video capture device like web cam according to it manual.

Note

Restart the system after driver installation.

2.2.3. Fingerprint scanner DC21U (Option) driver installation

For Windows 7, Vista after connection of the device it is required to select manually the folder with installation of drivers, further installation will be made automatically then it will be possible to work with the device.

Note

To install the driver in NT/2000/XP/W7/W8 administrator rights are required!

Perform the following steps to install the DC21U driver for NT/2000/XP.

1. Installation of drivers and the software is necessary for making before the first connection of the device to a computer
2. From folder CD:\BioFinger\Drivers\Drv install file CyBulkSw_1008.inf For this purpose click of the right button of the mouse to cause the options menu and to choose the item «Install» (see fig. 2.1)

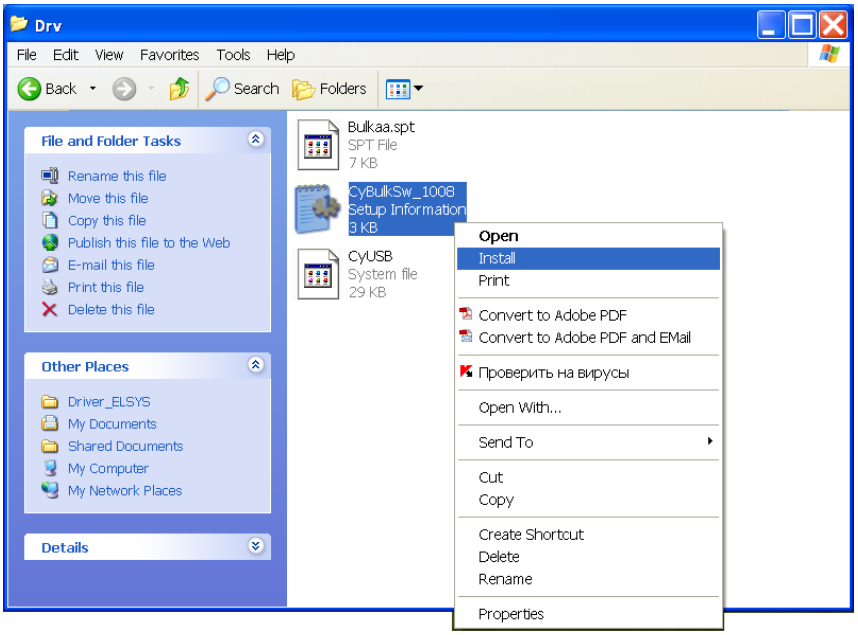


Fig. 2.1. DC21U driver installation.

3. From folder CD:\BioFinger\Drivers install updating Windows FrameWork 1.1., having started file «dotnetfx11.exe»

4. From folder CD:\ BioFinger\Drivers install drivers «DC USB CP.msi»

5. The software of ELSYS Corp. located on a CD disk, allows to work and with old versions of fingerprint scanners. If old scanners DC-21 or DC-21_Corona will be used, it is necessary to install in addition the driver for these devices

6. Connected scanner to PC. Note, scanner DC-21U work only with USB 2.0 ports.

7. To connect the scanner, when Windows will find out the new device, to specify the same driver which has been installed in item 2.

8. After Windows message, that the device is connected and ready to work, it is necessary to check up in system properties, that the scanner has been recognized as EZ_USB_Port_0547_1008 (see fig. 2.2)

9. Using «Control panel» run the program «DC USB Devices» and check serviceability of the device (see fig. 2.3, 2.4).

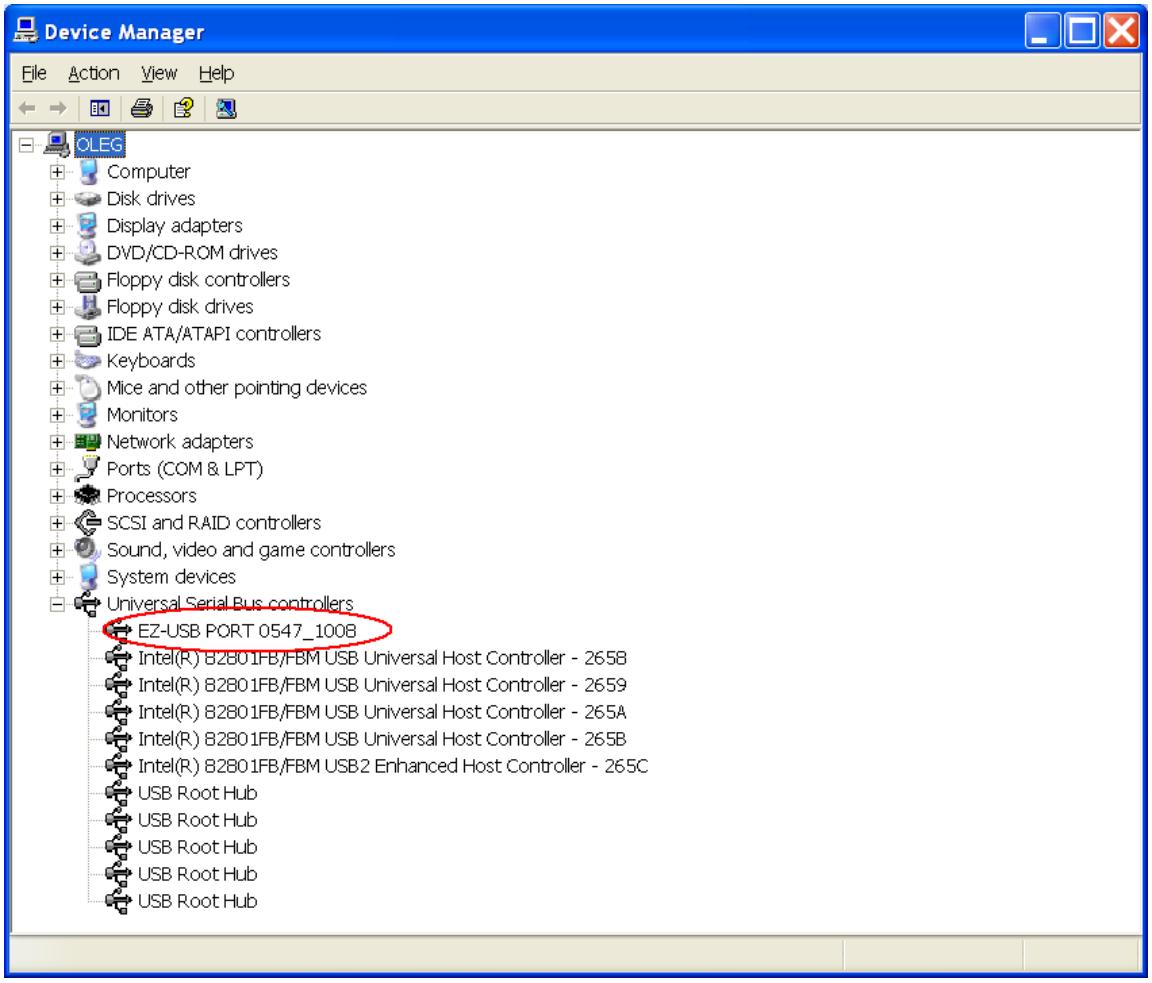


Fig. 2.2. The Windows has distinguished connected scanner DC-21U.

10. To install the driver of DC-21U device FOR ALL USB PORTS of a computer!!!! Connecting to them the scanner by turns.

11. To copy catalogues with the software (DC_Test, DCPulseUSB, FingerView and others) on a hard disk of the computer.

12. To run programs and to check up serviceability of the scanner.

Fig. 2.3. Verifying fingerprint scanner.

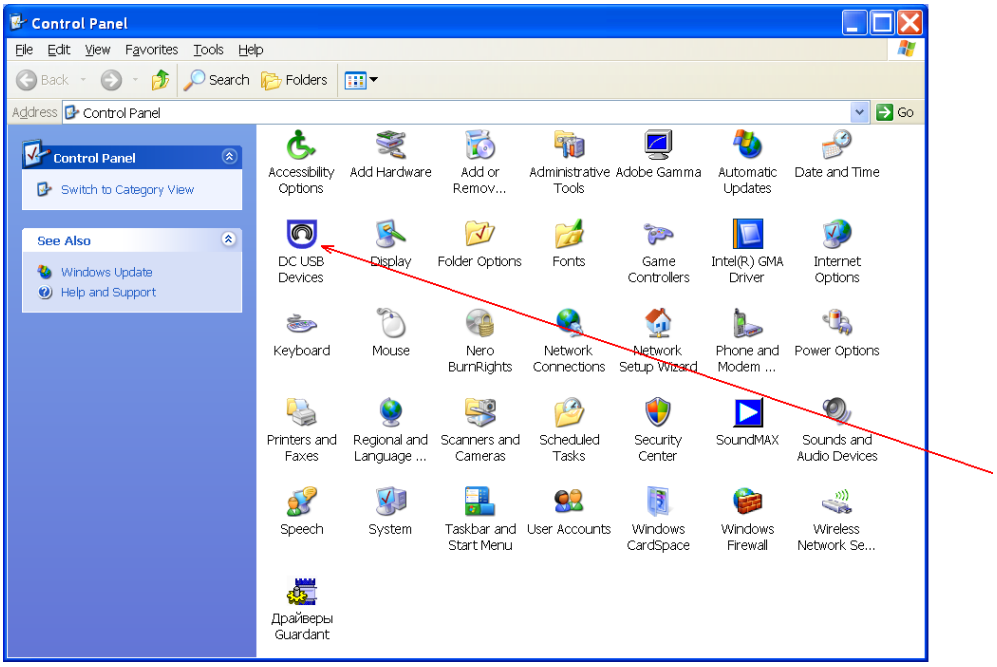


Fig. 2.4. Example of an location of DC USB Devices pictogram in the control panel.

Note

Restart the system after driver installation.

2.2.4. Guardant dongles driver installation

Note

Auto installation of system components is made according to the recommendations specified in section 2.2.5.2 of this manual.

Note

To install the driver in NT/2000/XP/W7/W8 administrator rights are required!

Perform the following steps to install the dongle Guardant driver for NT/2000/XP.

1. Close all other applications to avoid file sharing errors;
2. Run INSTDRV.EXE application from «Guardant drivers» folder «\Soft\Guardant2eng\»;
3. When the utility is started, it will check the presence of Guardant driver in the system. If the driver is not found, only [Install driver] button will be available in the main window. To install or update Guardant driver click on [Install driver] or [Reinstall driver] button. If installation is completed successfully, INSTDRV will display a corresponding message and then return to the main window.
4. If the driver installation is successful, a message box is displayed.
5. Click [OK] to continue.
6. Close INSTDRV application.;
7. Restart the system.
8. Connect video capture device and dongle to PC.
9. Run VibraImage.exe

Note

By default the system are installing the driver (2.3) for 64-bit Windows 7. If necessary, you can manually install the required driver of folders «\Soft\32\" or «\Soft\64\".

2.2.5. VibraImage installation

There are two possible types of vibraimage installation – manual and auto. User could select any type of it.

2.2.5.1. Manual installation

It is necessary to execute the following actions for installation of VibraImage program on your computer:

1. Run \Soft\ Vibraimage8Setup.msi from CD to install VibraImage 8.x application. Follow to the instructions in setup dialog. Click «Close» after installation complete.
2. Press button «Next» in the appeared window of the beginning installation;
3. Accept the license agreement and to press button «Next» in the appeared window;
4. In the appeared window specify a way to the catalogue where files of the program will be written down, then to press button «Next»;
5. Press button «Next» in the appeared window, allows installation of software files on your computer;
6. Press button «Close» at the end of installation.
7. VibraImage program pictograms appears after the end of installation in system menu and on desktop of your computer
8. To reboot a computer;
9. Install Guardant driver from DVD before start VibraImage 8.x. Connect dongle to USB port of computer and start VibraImage.exe.

2.2.5.2. Auto Installation

To begin using the VibraImage follow these steps:

1. Check «System Requirements». NOTE, check the version of DirectX software on your computer; check installed on your computer MS VS 2008 Redistributable;
2. Close other applications;
3. Insert your DVD VibraImage8.x into DVD-ROM**.** The file of installation (autorun.exe) will be automatically started. If the file has not been started - start it manually.
4. Choose language of installation in appeared window (fig. 2.5);

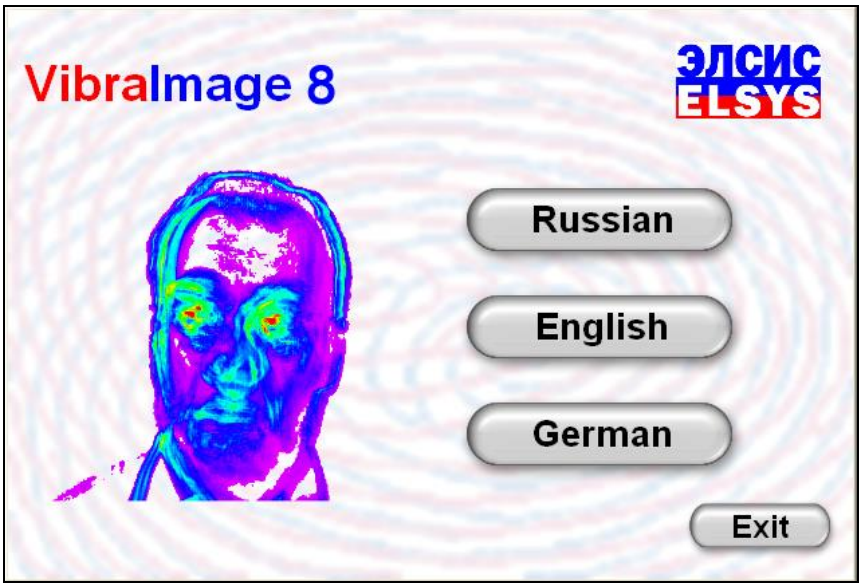


Fig. 2.5. Language selection for installation procedure.

5. Further in the appeared window will be offered to begin installation or to read the system documentation (fig.2.6).

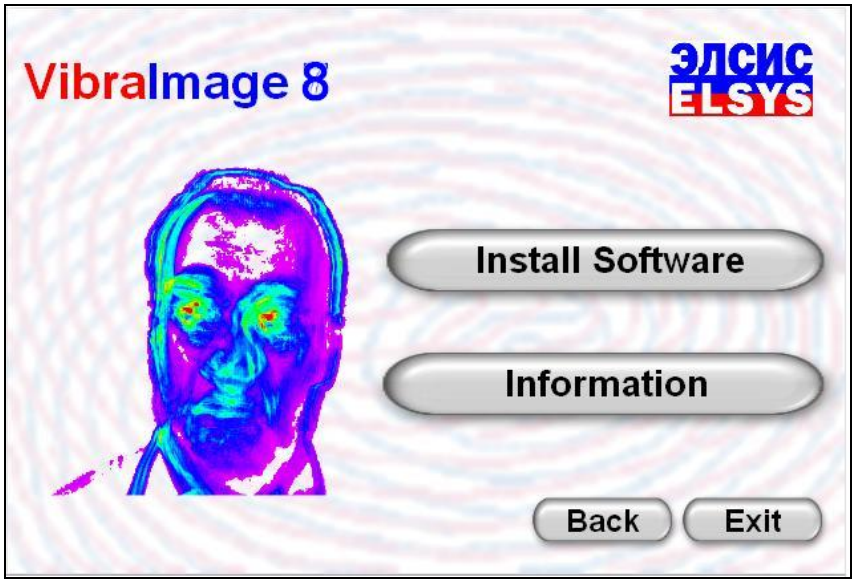


Fig. 2.6. Installation window.

6. You can read system documentations in Information window (fig.2.7).

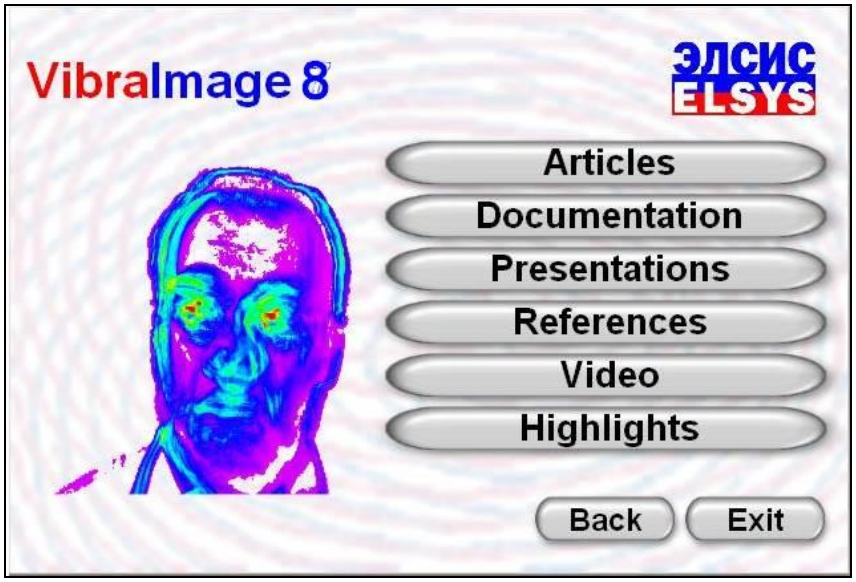


Fig. 2.7. Information about VibraImage.

7. It is necessary to execute installation of 3 components for system installation (fig. 2.8):
   - Digital camera drivers (It is not necessary if you use your own preinstalled digital camera);
   - Guardant Driver (to install this driver you need have the rights of administrator);
   - VibraImage software.

Fig. 2.8. Main Install window of VibraImage components.

In case of installation of system components it is necessary to follow attentively to recommendations and requests about settings which will be given out by system.

8. **Note**. Reboot your computer after this steps procedure.

9. On desktop you can see VibraImage software pictograms;
10. Connect USB camera to free USB port;
11. Connect Guardant dongle to the free USB port;
12. Read VibraImage manual;
13. Run VibraImage.
14. In VibraImage applications select working directory for store video capture file and protocol files. (see part 3.5 of this manual).

2.2.6. First testing of VibraImage system

It is necessary to test VibraImage system technical parameters before start human emotions control:

- Focused on test pattern (for example EIA 1956) and control resolution of used television (web) camera. Measured resolution must be more than 400 television lines (TVL) in the frame center.

- Measure the noise level of used television camera before emotions control. Noise level indicates IntegratedA parameter (§ 3.5.1), it value must be less 0,1. Approximately the image of focused test pattern must be black in VI mode, acceptable to have only several color pixels.

- Make a choice of the audio source channel and adjust its parameters according to the recommendations specified in section § 4.3.2, before lie detector mode start.

ATTENTION!

It is preferable to study vibraimage method and system principals given in patent US 7346227 before start VibraImage operation. First steps for person emotion control could be the following:

1. Place the person opposite to camera.
2. Focused camera on person face, with maximum facial size on frame.
3. Wait while person will calm down (for example, ask him to make in mind the account from 1 up to 100);
4. Measure a level of aggression.
5. Measure a level of stress.
6. Measure a level of tension.
7. Measure a level of potential danger.
8. Compare the results with norms from this document.

For network monitoring mode, please execute the next actions:

1. Connect a local network computer to the local module and terminal or server.
2. It's necessary to resolve work of VibraImage applications, if you have Firewall to protect your system.
3. Run VibraImage.exe on local module, Run VINetStatus.exe on terminal.
4. Read about Network monitoring parameters in Network Monitoring section (§ 5.1).
5. Adjust operating settings of VibraImage system and a video camera for the local module according to the recommendations specified in § 2.3.
6. Adjust the sound notification and a threshold of operation on the terminal in program VINetStatus according to the recommendations specified in section 5.1.
7. Start operation with VibraImage system in a network monitoring mode.

Note

It is recommended to system users to be trained and certification of the user on special courses and to use of VibraImage, organized at the ELSYS corp.

2.3 Camera's setting

Standing correct camera settings is very important operation for the next vibraimage processing, because mistakes in image quality have great influence to the vibraimage processing results.

2.3.1 Video camera choice

It is necessary to select in the main menu «**Settings**» => «**Video**» => «.../**name used camera**/...". In figure 2.9 the process of selecting camera «Look 1320 V2» is shown. If the camera is connected, selected and works, then on the left of the name there will be an icon « ✔ » (fig. 2.10), and the menu will be extended with the «**Video capture filter...**» and «**Video capture format...**».

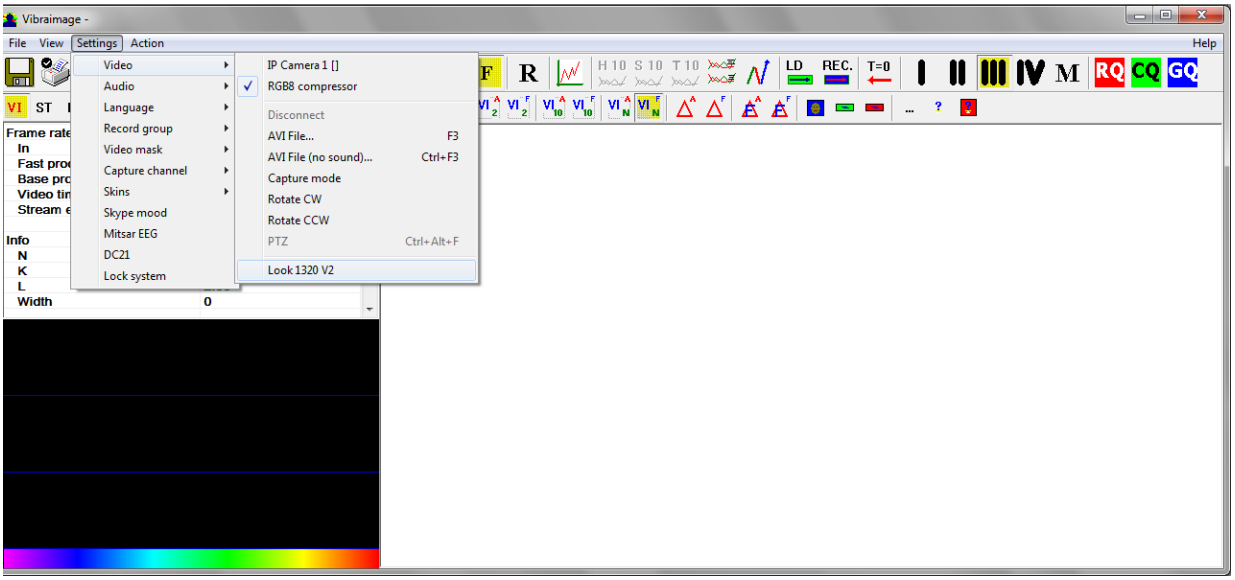


Fig. 2.9. Example of camera choice.

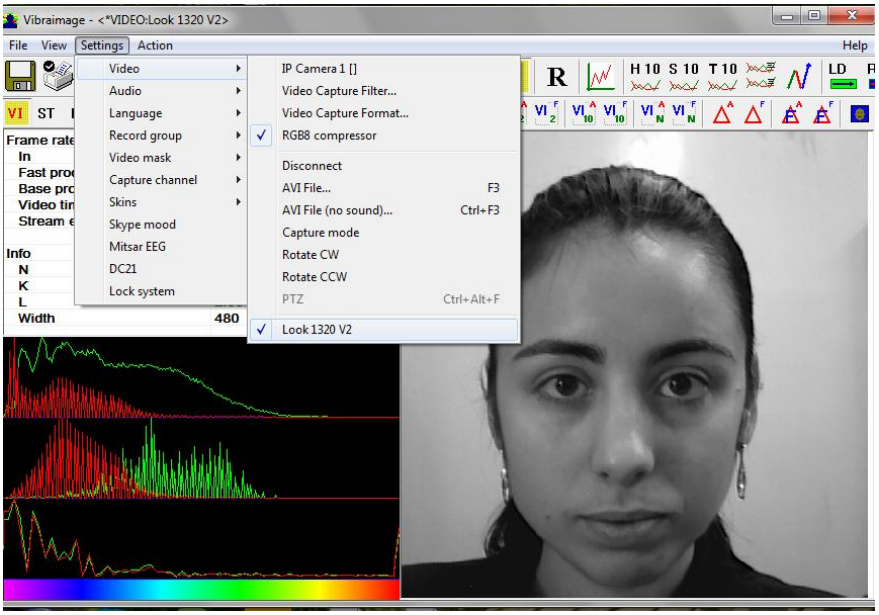


Fig. 2.10. The camera «Look 1320 V2» is selected.

2.3.2 Video capture filter

Select «**Video capture filter...**» in the submenu «**Video**» (fig. 2.11) for open menu of the camera settings. Item «**Video capture filter...**» appears in the menu only in case of the correct installation of camera drivers and correct choice of operating camera.

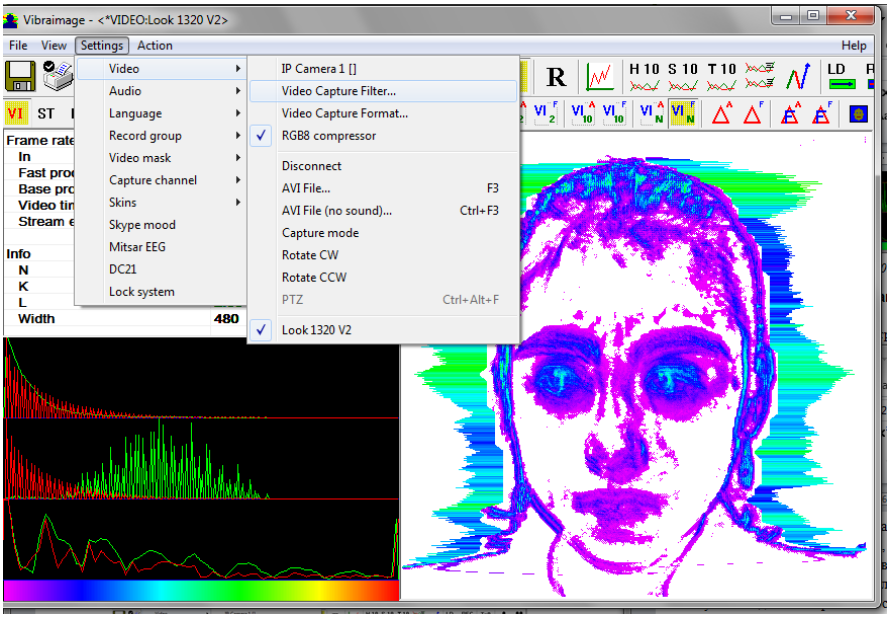


Fig. 2.11. Opening of the camera's settings menu («Video capture filter...»).

After a choice of the «**Video capture filter...**» the window «**Settings**» will open. Settings window differs depends on camera type. The first tab of this window is usually devoted to the image setup (Brightness, Contrast, etc.). In a figure 2.12 the window «**Settings**» for the camera «**Microsoft LifeCam Cinema**», and in a figure 2.12 for the camera «Look 1320 V2» is shown. Camera Microsoft LifeCam Cinema has low noise level and is preferable for vibraimage applications among webcams.

«Brightness», «Contrast» and other parameters should be set up so that image of object has more contrast. Switching on/off flicker-effect from artificial lighting could be necessary for some illumination types.

Depending on the experimental conditions and light is necessary to select auto or manual settings «**Focus**», «**Exposure**». If the illumination is constant, then it is recommended to use manual configuration, if you change (for example, the illumination of an object depends on street lighting), it is better to use automatic configuration. The «**Scale**» (Zoom) is recommended to select based on two factors. Firstly you need to have maximum image size of control object and it is preferably to stand maximum zoom level. From the other side high level of electronic zoom in some cameras could go down the frame rate and it is necessary to control this parameter and fixed frame rate more than 25 f/s. So for webcam Microsoft LifeCam Cinema the optimal meaning of zoom for personal control is 4, see Fig. 2,14. For other cameras is possible to adjust other optimal zoom settings.

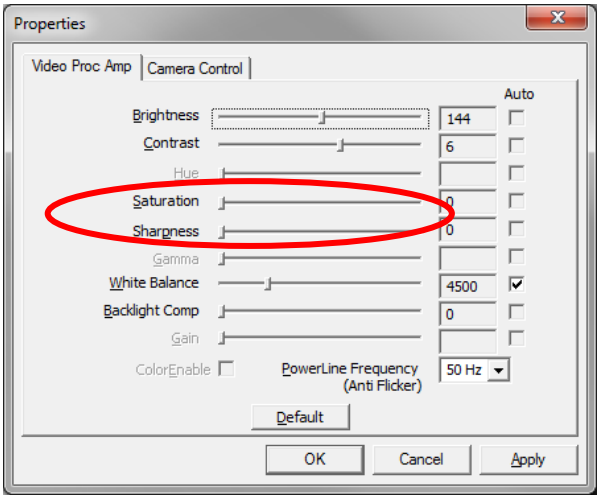


Fig. 2.12. Video setting, camera « Microsoft LifeCam Cinema»

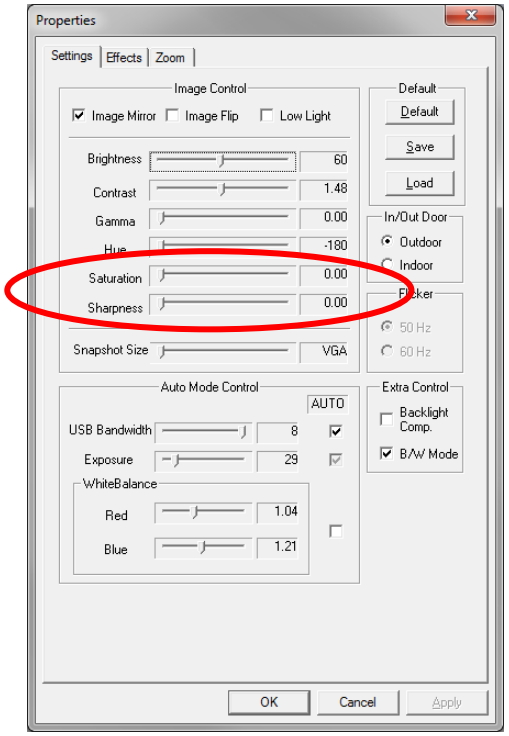


Fig. 2.13 Window «Settings», video setting, camera «Look 1320 V2»

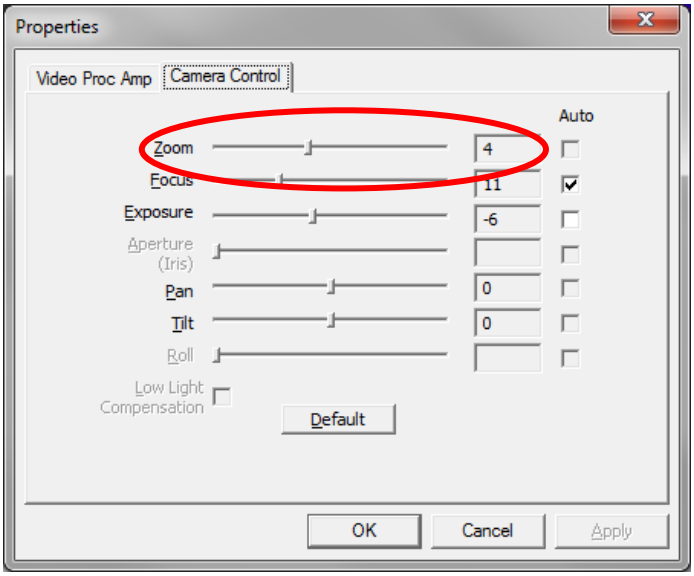


Fig. 2.14. Zoom setting, camera « Microsoft LifeCam Cinema»

2.3.3 Video capture format

Select «**Video capture filter...**» in the submenu «**Video**» (fig. 2.14) for open menu of the camera settings. Item «**Video capture format...**» appears in the menu only in case of the correct installation of drivers of the camera and a choice of the working camera. Frame rate is necessary to set 30 and the frame size to set ("Output Size") not less than 640 x 480 elements (fig. 2.15).

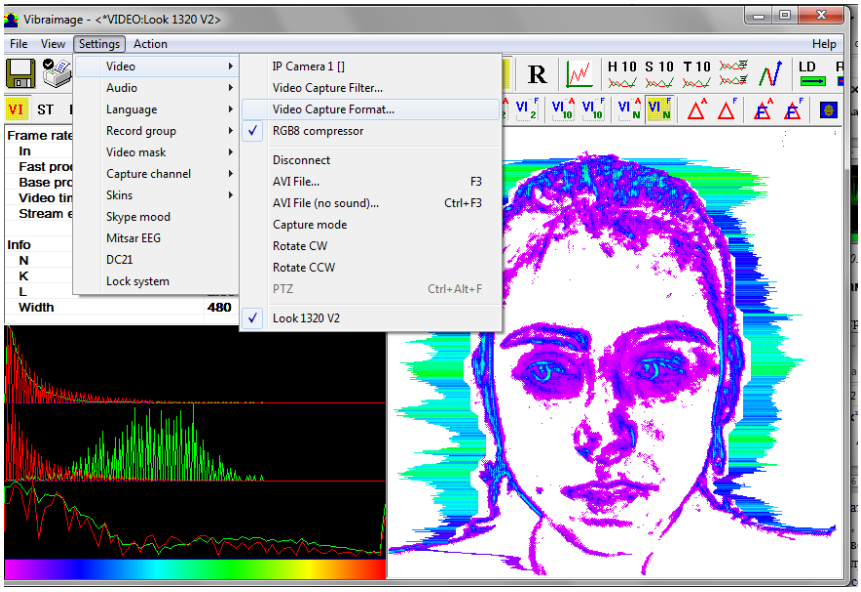


Fig. 2.14. Opening the settings window «Video capture format»

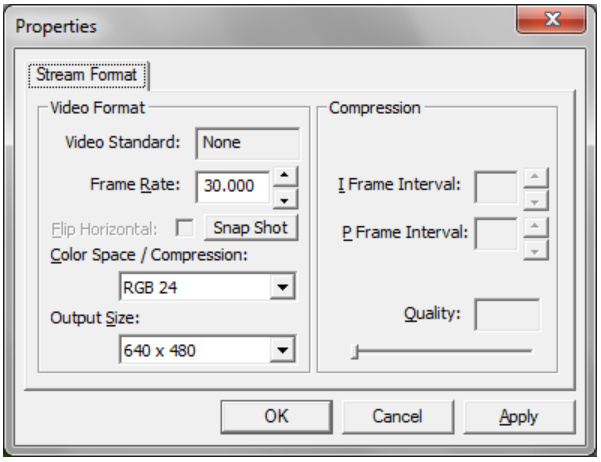


Fig. 2.15. Window «Video capture format»

Note, after changing camera settings in the program VibraImage PRO frame rate «In» must be in the range of 25 – 30 frames/s. The parameter IntegratedN (Am) indicating in main menu must be minimum and not exceeding 0.1. In other case the vibraimage processing could be wrong.

2.3.4 Checking the settings on the test table

During the first start of VibraImage system and periodically it is recommended to test image quality by the test table. It is required to place a test pattern opposite to the camera so that the image of the table occupies the entire space of the frame. To achieve the optimal contrast range of object is need to stand in camera settings auto regulation of illumination in case of unstable illumination (fig. 2.16) and manual regulation of illumination in case of a constant illumination (fig. 2.17).

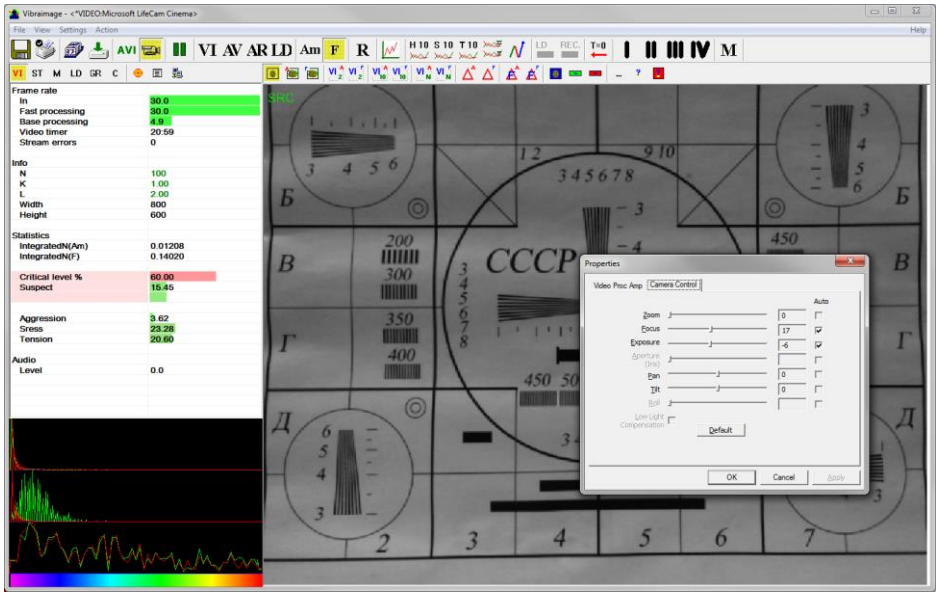


Fig. 2.16. Checking the camera settings on the test table, automatic regulation of the exposure (mode is recommended for unstable object illumination).

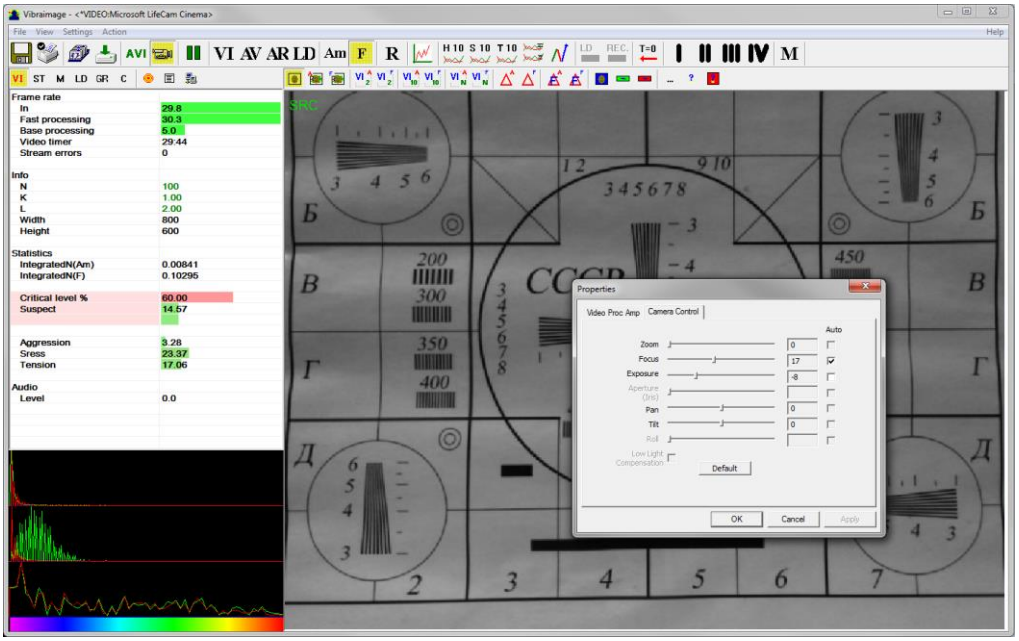


Fig. 2.17. Checking the camera settings on the test table, manual regulation of the exposure (mode is recommended for stable object illumination).

2.3.5 Video quality auto checking function

Vibraimage program has auto checking function and image quality control during the test. Auto checking function switch on in Information table  in the section «Face detection» «Quality test» Program gives error indication if the image quality is lower than standard vibraimage requests:

Error 1 – indicates when facial image is lower than necessary. For cancel this error is need to move checked person near to camera or start zoom function on camera.

Error 2 – indicates when camera noise level is higher than necessary. The reason of this error could be low illumination, incorrect camera settings or camera vibration.

Error 3 – indicates when computer input frame rate is lower than necessary. Requested norm for processed frame rate is more than 24 f/s. This errors indication was done for deleting unqualified staff influence during results control.

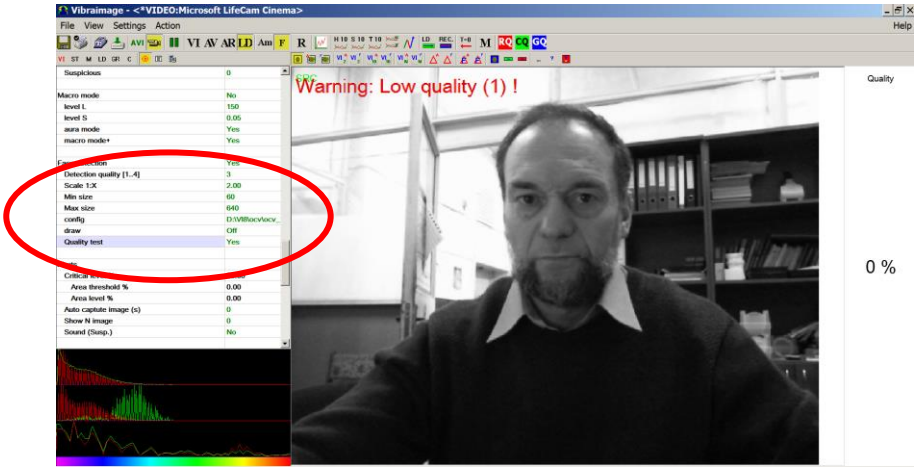


Fig. 2.18. Quality test indication stands Yes in settings and Error 1 shows in the image window. Head image size is lower than requested.

For correct operation of the quality test it is necessary to switch on «Face detection» (Face detection – Yes). If you do not want to look frame around face you should «draw» switch off, see fig. 2.18.

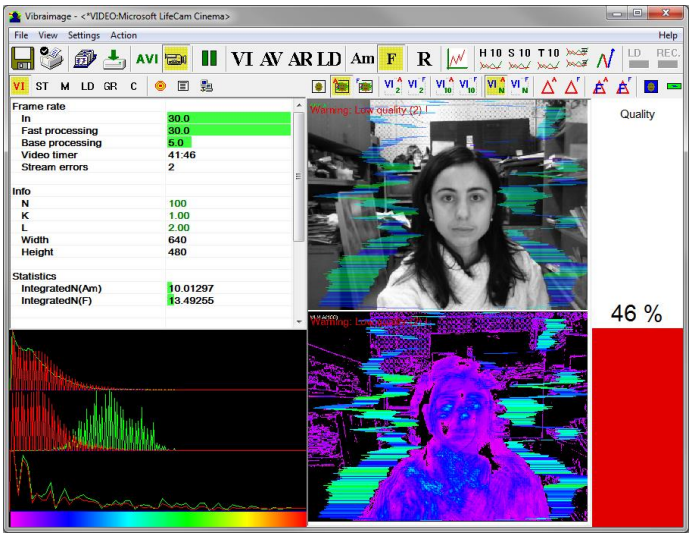


Fig. 2.19 Quality test indication stands Yes in settings and Error 2 shows in the image window. Camera vibrations is strong and on the image there is a noise.

The figure 2.19 shows an example of strong camera vibrations. For good vibraimage you should mount the camera on a fixed support so that the vibration of the support was minimal. If the camera is mounted on a table, while working with the program you should not lean on the table.

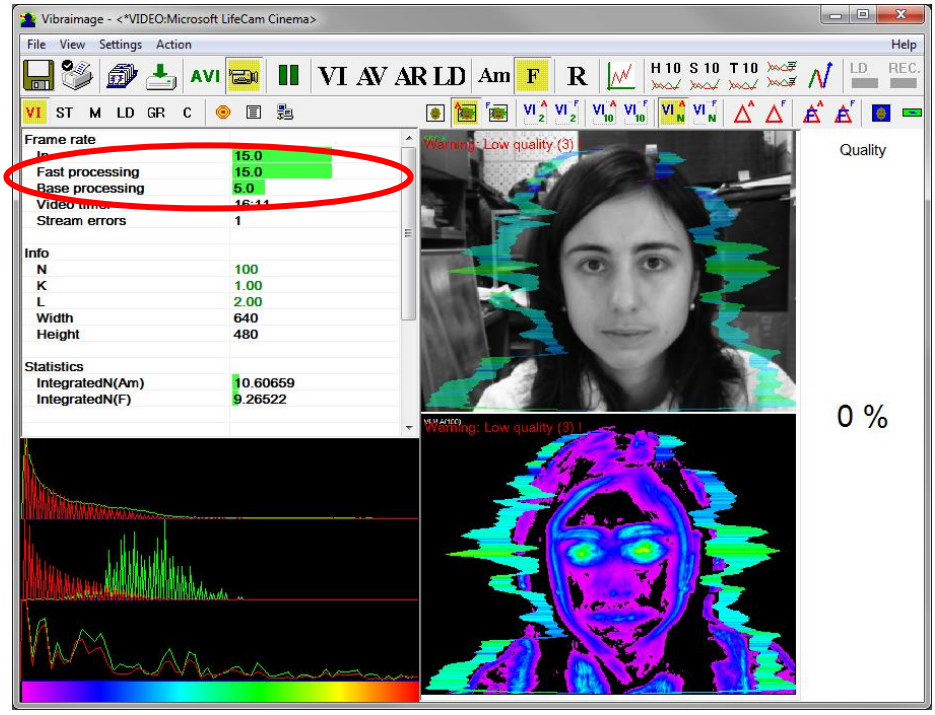


Fig. 2.20 Example of error 3. Frame rate «In» less than 24 f/s. You should set the "Brightness", "Contrast" and others in submenu "Video Capture Filter" to increase this value.

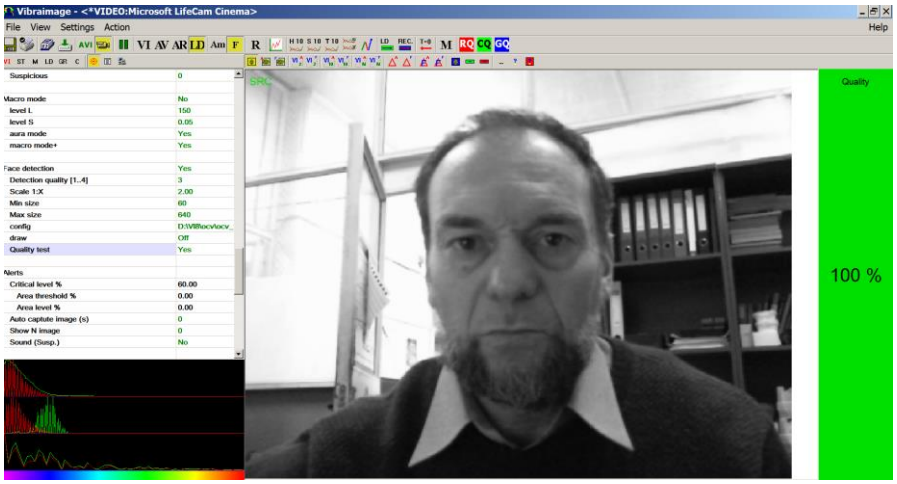


Fig. 2.21. Quality test indication stands Yes in settings and Quality 100% shows in the image window. Head image size and other parameters are correct.

Quality column shows time % during the testing when image quality is equal 100%. When we have quality indication 91 %, that means 91% of testing time image quality hasn't errors and 9% of testing time image quality includes errors with the number 1 or 2 or 3.

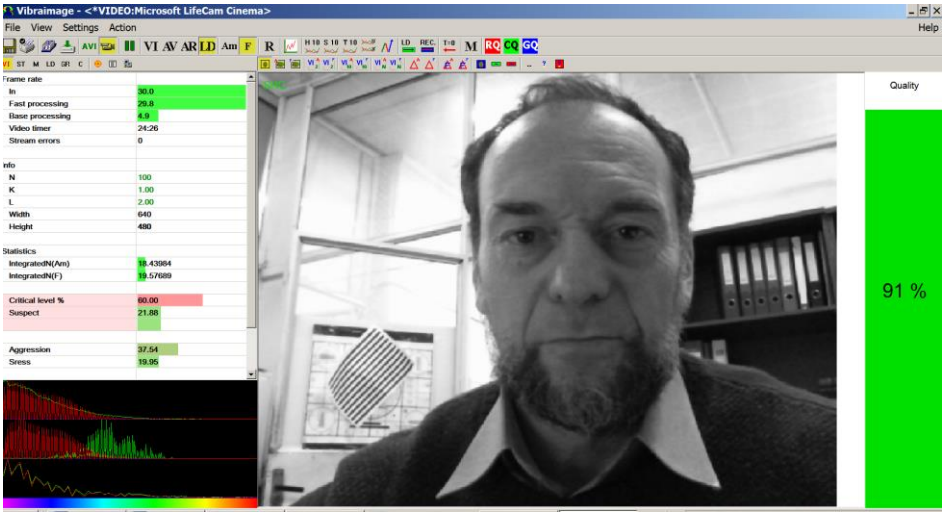


Fig. 2.22. Quality test indication 91 %

Pressing button R reset image quality to the beginning 100 %. In lie detection mode and M mode image quality is very important and testing with image quality lower 80 % could not be acceptable for processing. Advanced user can cancel Quality test in settings, see Fig 2.23.

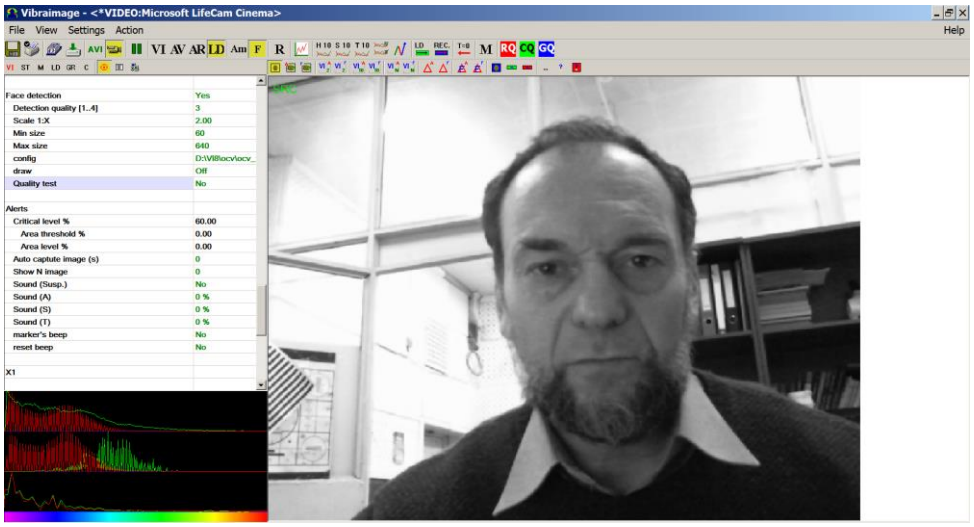


Fig. 2.23. Quality test No in settings

3. VibraImage module

VibraImage software gathers, records, processes and analyzes electronic images of biological and mechanical moving objects with various frequency and amplitude of vibration (fluctuations).

Main module (VibraImage.exe) is designed for achieving central VibraImage software goals. Printing of screens is possible from the main menu of VibraImage module on default printer. Printing of personal data and images is function of VIPrint module. For viewing the recorded LOG files use VILogViewer module. Network monitoring is function of VINetStatus module.

After software installation you will see the image on the monitor (fig. 3.1), if you connected camera to PC and adjusted it on person face.

3.1. Multifunction window

Multifunction window (fig. 3.1) consists of the following parts:

- main menu;
- image area;
- toolbar;
- information window.

In heading of the basic window the following information is deduced (fig. 3.1):

- type of video source: Video camera or AVI file;
- model of video source: Video camera model or AVI file name;
- name of running VibraImage module;
- name of the current database record to which there is an operation.

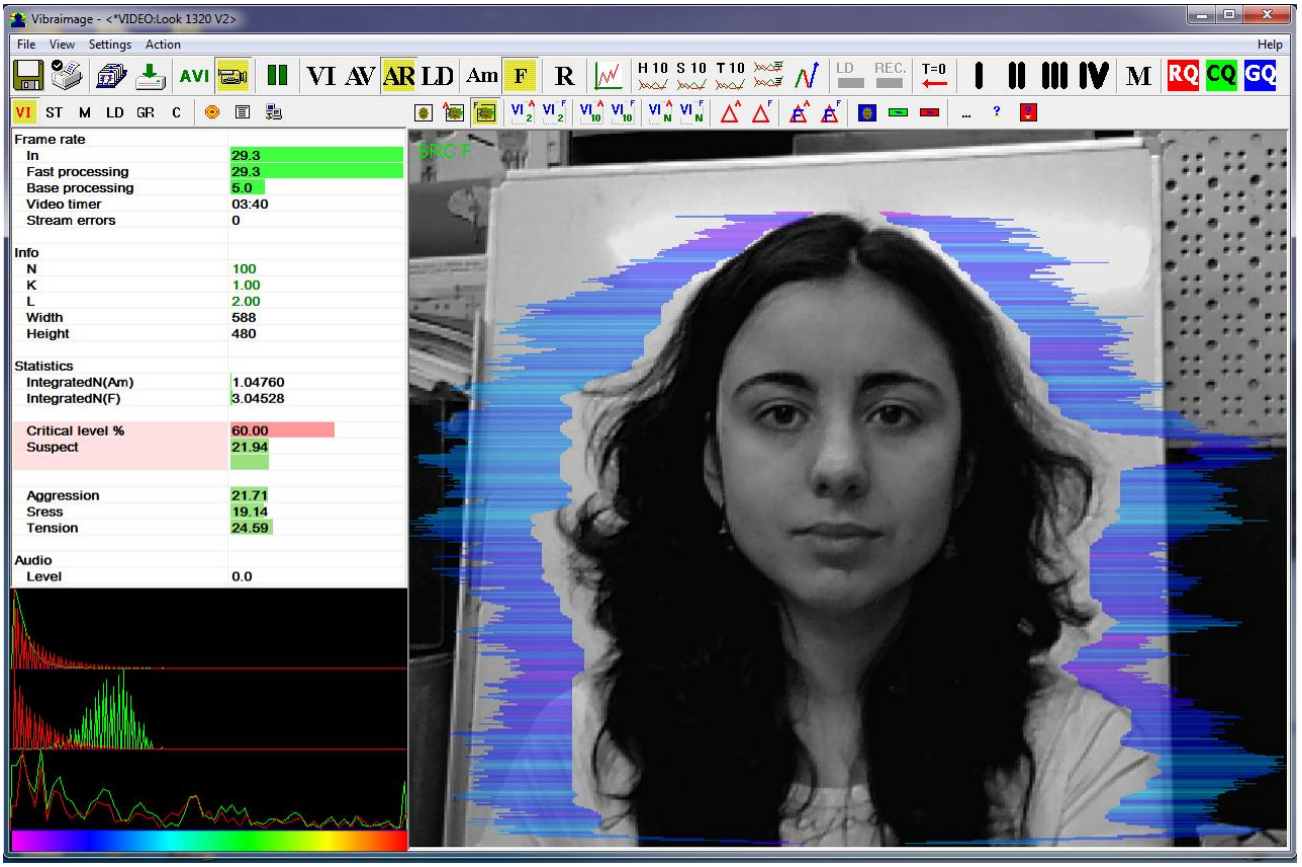


Fig. 3.1. Multifunction window of VibraImage.exe module.

3.2. Main menu

The main menu contains the following items:

- «**File**»
- «**View**»
- «**Settings**»
- «**Action**»
- «**Help**»

3.2.1. Menu «File»

Menu «**File**» (fig. 3.2) contains following items:

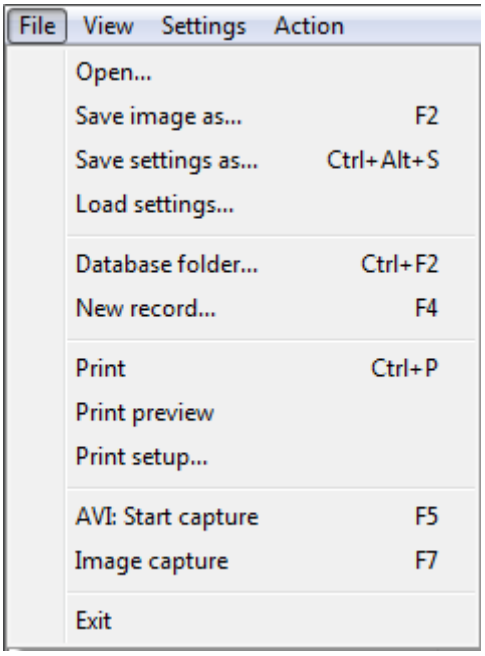


Fig. 3.2. Menu «File».

Item **«Open…»** - for viewing and printing the saved file of XML format with parameters of system for the supervision interval.

Item **«Save image as…»** - saving the current frame of a window in BMP, JPG, PNG or GIF-file.

Item **«Save settings as … »** it is intended for saving of the current system settings to the external file.

Item **«Load settings … »** it is intended for loading before saved the system settings from an external file.

Item **«Database folder…»** - changing folder where archive data is kept. If the database folder is not specified, record of AVI or BMP files is blocked.

Note

Until you specify a folder to archive record of AVI and BMP files in the archive will be blocked.

Item **«New Record... »** - Create a new record in archive folder. Further saving of AVI and BMP files in archive will be made in the folder connected to a name of entered record.

Item **«Print»** - printing the current frame from image area .

Item **«Print Preview»** - printing preview of current frame from image area.

Item **Print Setup…»** - set printing options.

Item «**AVI: Start Capture**» - start record AVI-file. If the database folder is not specified, record of AVI files is blocked.

Item «**Image capture…**» - stop record AVI-file.

Item **«Exit»** - exit from program.

3.2.2. Menu «View»»

Menu **«View»** (fig. 3.3) defines visible in the basic window information and contains the following items.

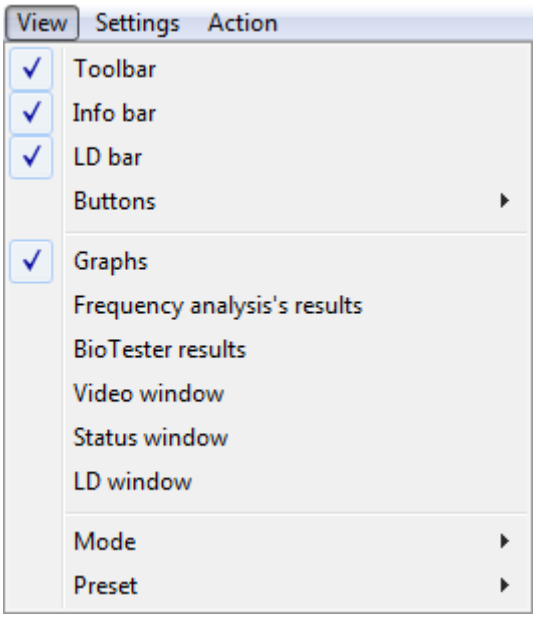


Fig. 3.3. Menu «View»».

Item **«Toolbar»** - switch on/off the toolbar.

Item **«Info bar»** - switch on/off the information panel.

Item **«LD bar»** - switch on/off the LD panel.

Item **«Buttons»** - switch on/off buttons on the toolbar (fig. 3.4).

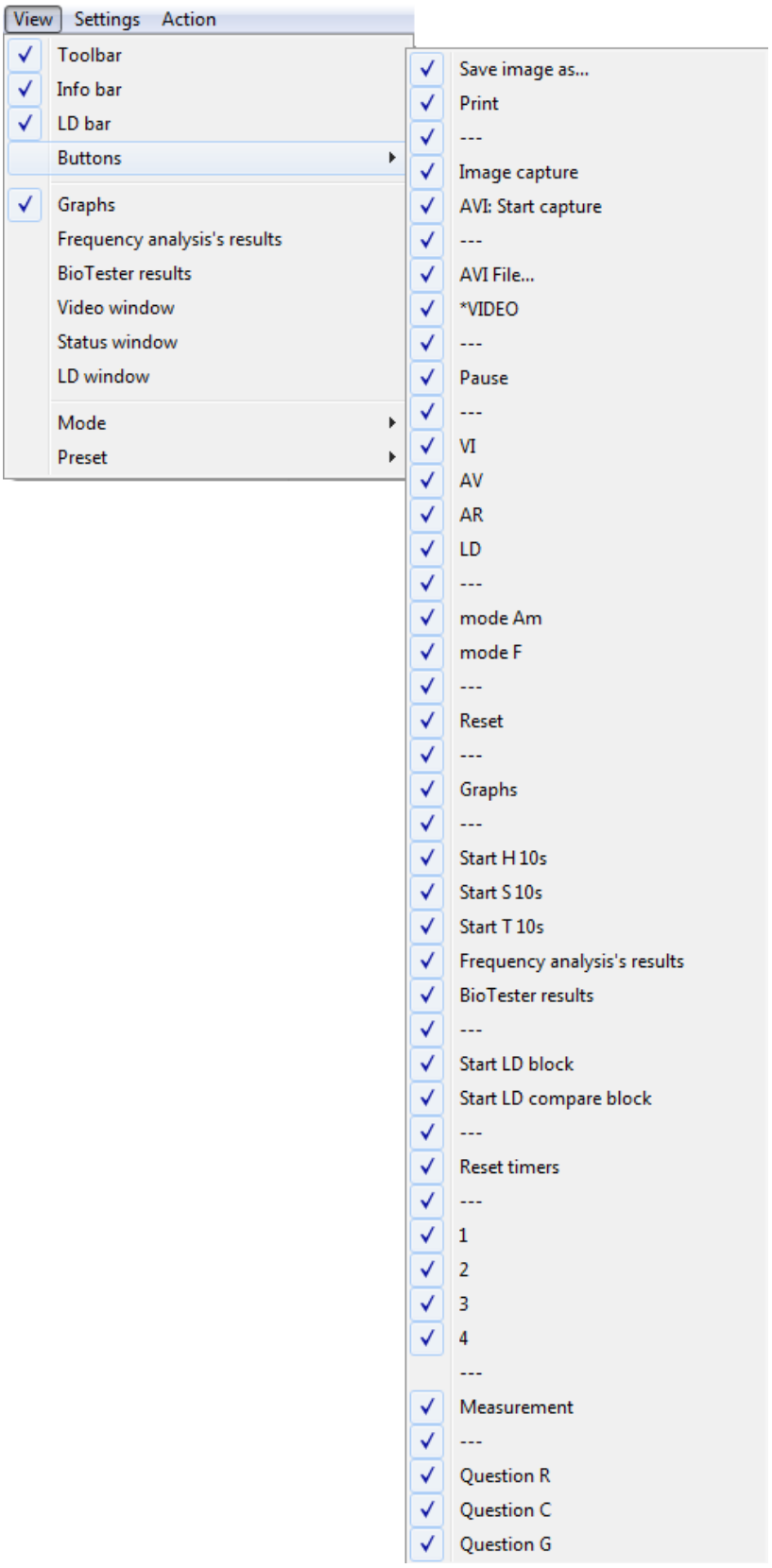


Fig. 3.4. Submenu «Buttons».

Item **«Graphs»** - show/hide graphs of the set parameters (fig. 3.28).

«Frequency analysis's results» - show/hide histogram of frequency analysis of the set values (fig. 3.20).

«BioTester results» - show/hide window with biotester analysis results (fig. 44).

«Video windows» - switch on/off the small windows with real image (fig. 3.5) (the button of the toolbar).

«Status windows» - switch on/off the windows with current suspect level (fig. 3.5) (the button of the toolbar).

«LD window» - switch on/off the windows with current lie level (fig. 3.5) (the button of the toolbar).

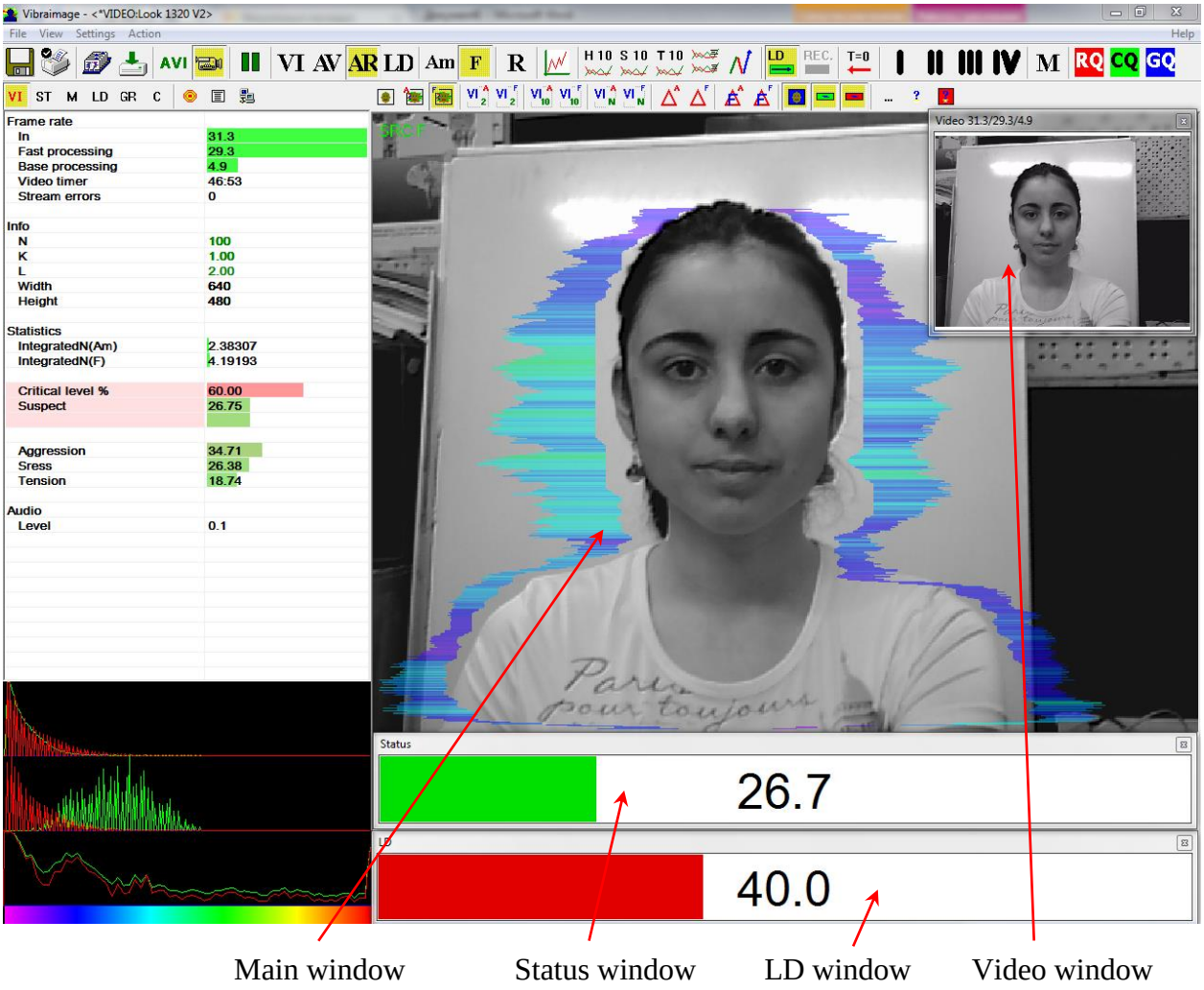


Fig. 3.5. Example of Video, Status and LD windows

Submenu «**Mode**» defines additional configuration and number of windows with an image displayed in the image area. Images also can be selected using the corresponding buttons on the toolbar (fig. 3.6).

Fig. 3.6. Windows that appear to the image area.

Submenu «**Preset**»defines the type of the display image: the real image (mode LD), vibraimage (mode VI), the aura on the real image (mode AR), the aura on vibraimage » (mode AV). Also, you can configure the corresponding buttons on the toolbar (fig. 3.7).

Fig. 3.7. Buttons defining type of displayed image.

3.2.3. Menu «Settings»

Menu «**Settings**» (fig. 3.8) contains the following items:

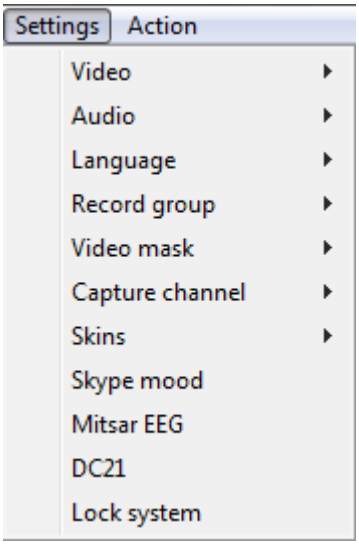


Fig. 3.8. Menu «Settings»

System VibraImage allows to process «live» video signal coming from a video camera and video data recorded before and saved as AVI-file. On default the system works with a signal from a video camera.

Submenu **«Video»** contains options of video modes. Its can differ depending on connected devices. For example this menu contains the following items (fig.3.9). You can choose as video source one from many installing in PC video-devices or load external video file.

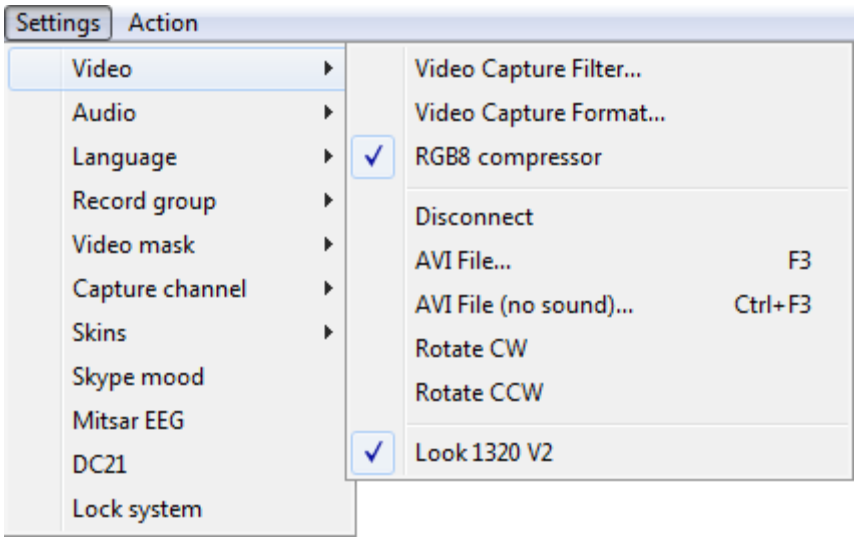


Fig. 3.9. Submenu «Video».

«Video Capture Filter…» - by pressing the window of video device setting (contrast, exposition, and brightness) opens. Each device has the especial window of settings.

Subitem **«Video Capture Format…»** - change video capture format.

The subitem **«RGB8 compressor»** is intended for management of a videofile record format. If this item is chosen, that, for economy of a space on a hard disk, the videofile saved in a black-and-white format.

The subitem **«Disconnect»** allows disconnecting all videocamera or videofile.

Subitems «**AVI File…**» and «**AVI File (no sound)…**» are intended for selecting for the analysis of an external video file. The file can be loaded with a sound and without sound. The operation mode without sound is used for VibraSound creation.

The subitem **«Capture mode»** is intended for working with cameras in which driver support separate streams of video output on the screen and write to the file. When this mode delay set the camera to record video and back is minimal.

Subitems **«Rotate CW»** and **«Rotate CCW»** allow allow making turn of an input video image on 90 and 270 degrees before its processing in the VibraImage.

Submenu **«Audio»** (fig. 3.10) allows to choose the audio source device and to adjust its parameters, which are necessary for operate in Lie Detector mode. For example: this menu contains the following items. Lower menu items allow choosing the audio device from multiple installed on this computer and configure its settings.

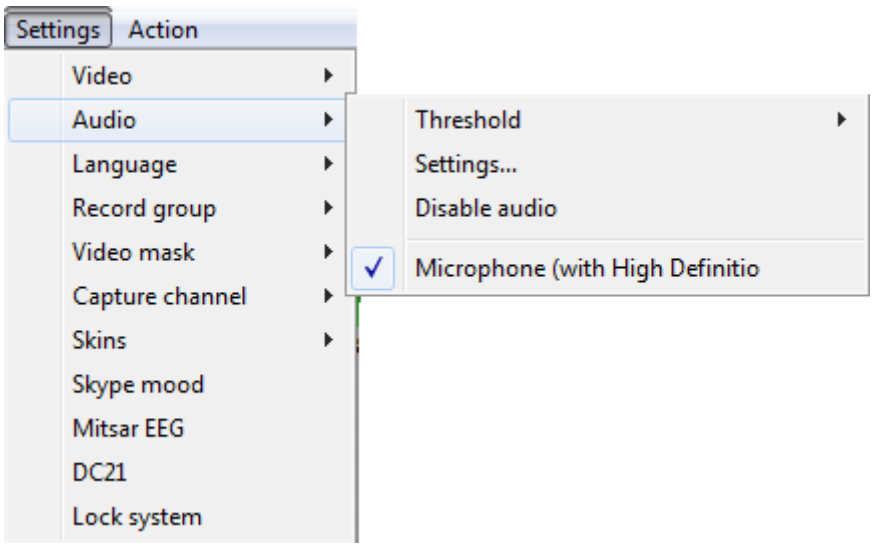


Fig. 3.10. Submenu «Audio».

Note

System VibraImage correctly works in a lie detection mode only when adjustment of input audio signal (procedure of adjustment see above) is made. The moment when the person started to speak, is used by the system for the beginning analysis of the data. Vibraimage parameters during speaking are compared to the data received earlier, for example, when the person was silent.

Before operation in lie detector mode select menu Settings/Audio Settings/Audio Devices. Before using VibraImage in this mode you may also control the level of audio signal (red strip) and change of input audio signal options in a corresponding field of information column in «ST» mode (fig. 3.59). Level of audio signal («the red strip») is necessary to stand so that it was on the average position between the minimal value of a input signal which corresponds to silence in a room (see position of «green strip» on fig. 4.47), and the maximal value which corresponds to a voice sound of a person in front of the camera (fig. 4.47). You can also to set the value of the sound threshold by clicking the sub-item "Threshold" submenu "Sound"(fig. 3.10).

The submenu **«Language»** contains the list of supported languages (fig. 3.11).

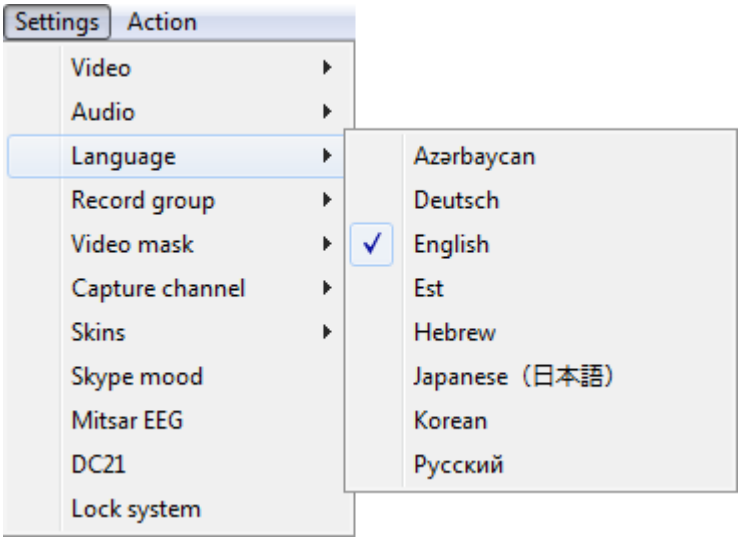


Fig. 3.11. Submenu «Language»

Submenu **«Record group»** (fig. 3.12) allows choosing the number of the catalogue where video files will saved. The direction to the catalogue should be set beforehand.

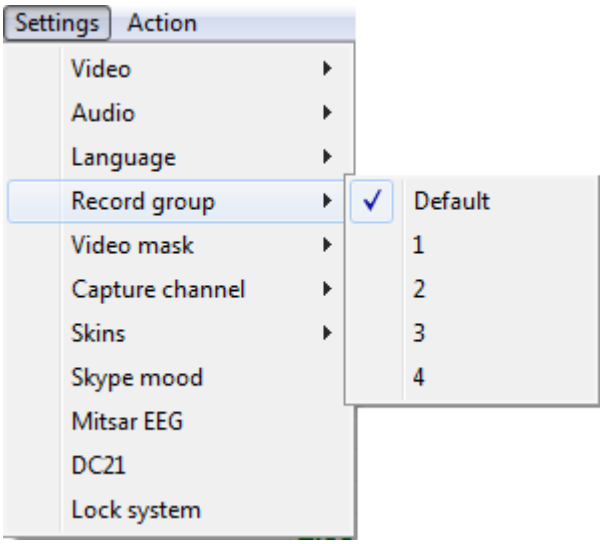


Fig. 3.12. Submenu «Record group»

Switching between different subdirectories can be performed by using a menu (fig. 3.12) or by turning on buttons «**Choice subdirectories**» on the toolbar (fig. 3.13).

Fig. 3.13. Switching between different subdirectories

Submenu **«Video mask»** (fig. 3.14) allows to edit video data. If in the field of supervision there is an additional mobile object which prevents measurements of the basic object. In **«Edit mode»**, you can cover «black» mask on addition object image. Also you can reset current mask

(**«Reset Video mask»** mode), save mask in external picture file in BMP format (**«Export Video mask»** mode) and load external mask (**«Load Video mask»** mode).

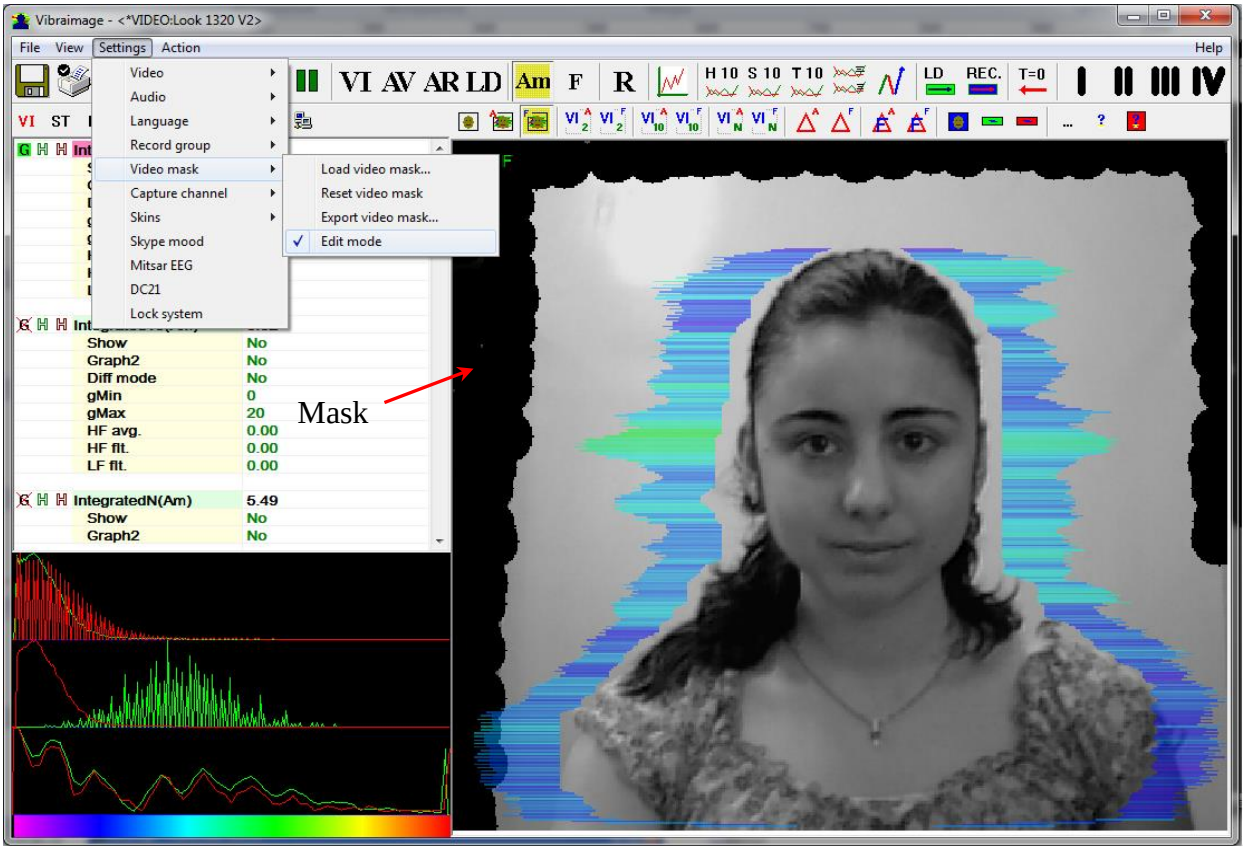


Fig. 3.14 For example, edit mask in «Video mask» mode

Note

Don't forget turn off «**Edit mode**» after masking. Otherwise, any click of the mouse in the image will continue masking!

If in the image area you have switch on some windows with video data (for example, open 13 windows, fig. 3.15), submenu **«Capture channel»** allows to choose from what window video data will be saved in video file.

Note

Data will be recorded to a file with all switching modes. If you want to record only the video image without processing, it is necessary to select the recording channel SRC (source).

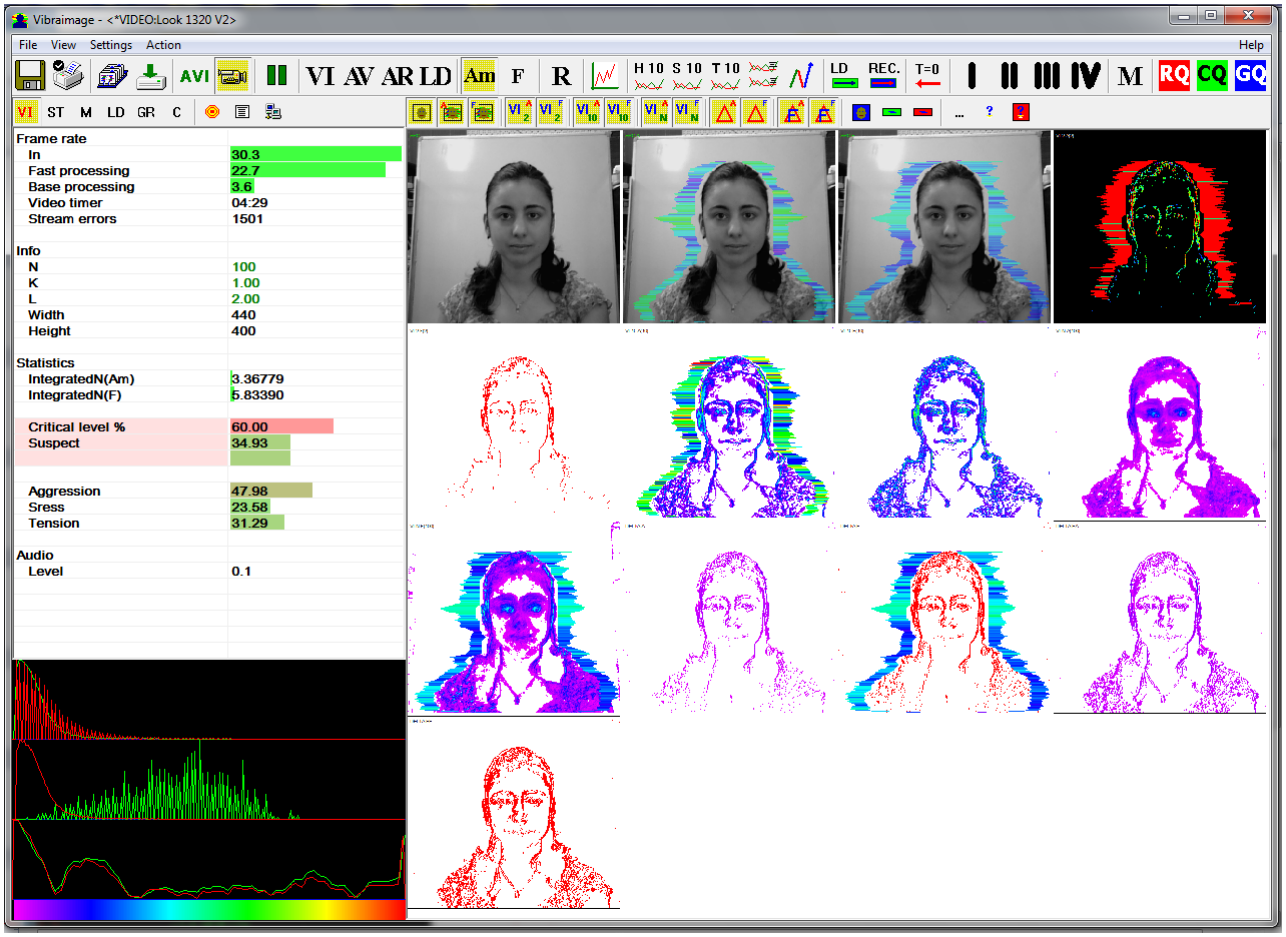


Fig. 3.15. Submenu «Capture channel»

The item **«Skins»** allows «to model» under orders of the user the interface for results display (fig. 3.16). For creation of the new interface in the catalogue where VibraImage program has been installed, subdirectory Skins is created. In it 2 files are placed: face.png - a picture of screen appearance and config.xml in which the arrangement of areas for parameters show is set.

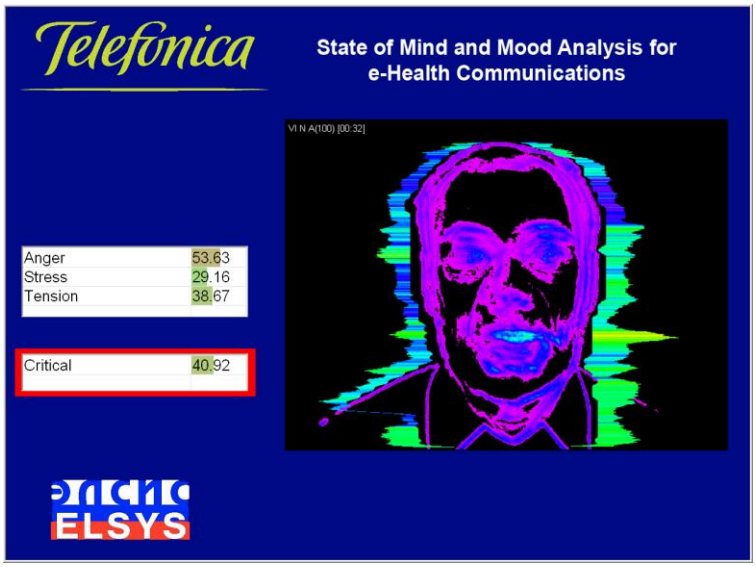


Fig. 3.16. An example of the new interface of a working window created under the order of the user.

The item **«Skype mood»** can be used, if at your computer Skype program is install. At teamwork of Skype and VibraImage programs you can observe current psycho-emotion parameters of the interlocutor (fig. 3.17).

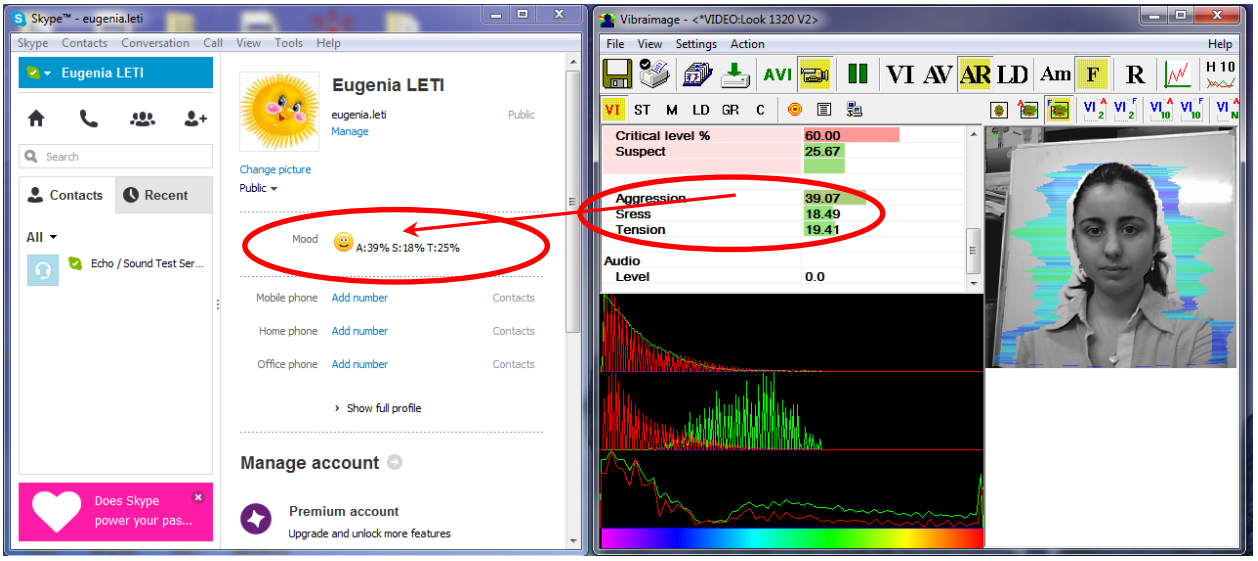


Fig. 3.17. For example, Skype and VibraImage programs teamwork.

The item **«Mitsar EEG»** can be used in case of connection of the Mitsar-EEG electroencephalograph. Then there is a possibility to display graphs of change in time of signals from electrodes (EEG-x) (details in section § 6.1).

The item **«DC21»** can be used at work with dactyloscopic scanner. Thus data from the dactyloscopic device can be reflected in diagrams (details in section § 6.2).

Item «**Lock system**» is used to lock of all toolbar buttons from stray keystroke. To unlock the system, press the icon VibraImage «» in the top left corner of the screen.

3.2.4. Menu «Action»

Menu **«Action»** (fig. 3.18) contains following items:

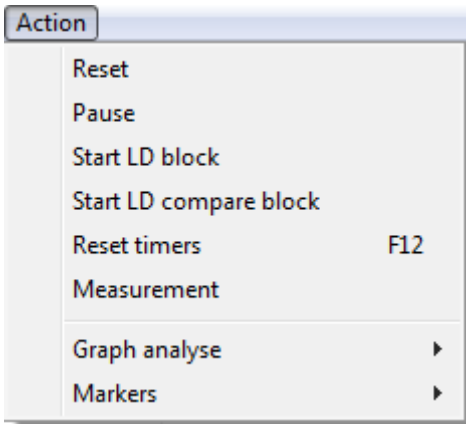


Fig. 3.18. Menu «Action»

Item **«Reset»** - reset all saved up information and statistics about frames and start new cycle collection of information.

Item **«Pause»** - stop last accepted frame of data in image area of windows.

Item **«Start LD block»** (on toolbar button 

) begin calculation of parameters of a lie level in a manual mode. It is necessary to press this button again to stop calculation in a manual mode. The moment of start calculation in a manual mode will be noted by a vertical green line, the moment of stop calculation - by red line).

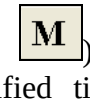
At work in a lie mode in an information table is set the Base interval during which the system collects the data on object of research that then to use these data for comparison during Stat interval. In a base mode this interval directly precedes the moment of the lie analysis beginning. But the system gives an opportunity to make gathering of the initial information on object at any time.

Item **«Start LD compare block»** (on toolbar button 

) start of the information gathering interval will be made. For end of an parameters gathering interval it is necessary to press repeatedly the same button or to choose the same menu item. Now at the lie analysis the condition of object will be compared from the information saved up beforehand.

Item **«Reset timers»** (on toolbar button 

) - reset to «0» all timers: video file timer, graph timer. The conclusion video and construction of graph begins all over again.

At a choice of item **«Measurement»** (or corresponding toolbar button 

) the system makes accumulation, averaging and a display of parameters for the specified time period.

The results display is made in the information panel in a mode «M». In the same place in seconds value of the averaging period **«Duration»** is set.

At a choice of item **«Graph analyze»** it will be open submenu gathering of the information about frequency distribution in vibraimage (fig. 3.19). Histogram of frequency distribution appears in area of images (fig. 3.20).

Items **«Start H 10s»** and **«Start H»** are intended for accumulation and viewing of the frequency information. Start of command **«Start H 10s»** gathering of information is made for 10 seconds, and the window of frequency information viewing is showed automatically after 10 seconds. After start of command **«Start H»** the time of data accumulation is defined by the user, and the window of viewing of the frequency information is showed only after a choice of item **«Stop»** (fig. 3.19).

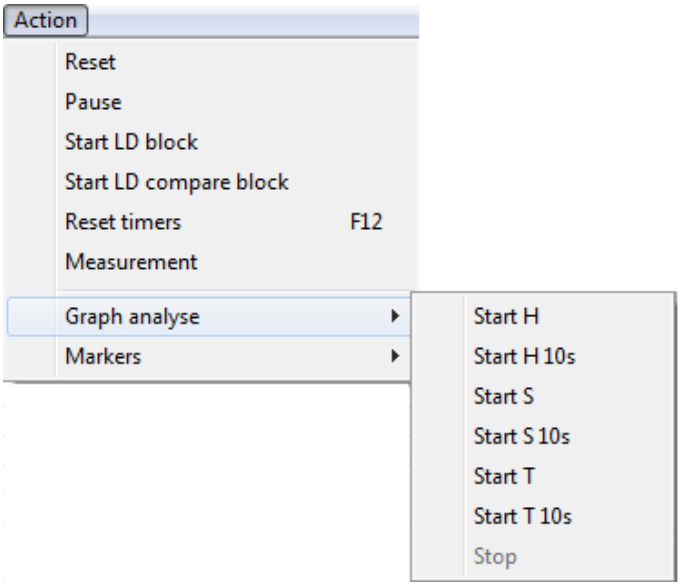


Fig. 3.19. Submenu for information accumulation about frequency distribution.

The analysis of the frequency information after its processing with the help of Fast Fourier Transform (fFT) (commands **«Start S 10s»** and **«Start S»**) shows frequency spectrum.

Items **«Start T 10s»** and **«Start T»** are intended for accumulation and viewing of the information about change in time F6 and F8 parameters. Parameters F6 and F8 define the average and current period of parameter F1fast (A1fast) change with the switch on filters (F6 HF and F6 LF). Averaging of changes of the F1fast (A1fast) signal period is made in interval F6N frames.

Note

Items **«Start H 10s», «Start T 10s»** and **«Start S 10s»** have corresponding buttons in the Toolbar.

Each time when the window with frequency histograms is caused, the system forms a text file with extension *.hist, in which for each value of parameter on line X (from 0 up to 255) enters the name corresponding values of amplitudes of graph of distribution of amplitude and frequency, and also results of mathematical processing of these data. The user has an opportunity independently to define the catalogue where these data will be stored.

In a window with the frequency histogram (fig. 3.20) switch «*N*» determines: will be the graph of amplitude histogram is showed or not (the graph is painted by red color). Switch «*N*» determines: will be the histogram of frequency is showed whether or not (the graph is painted by green color).

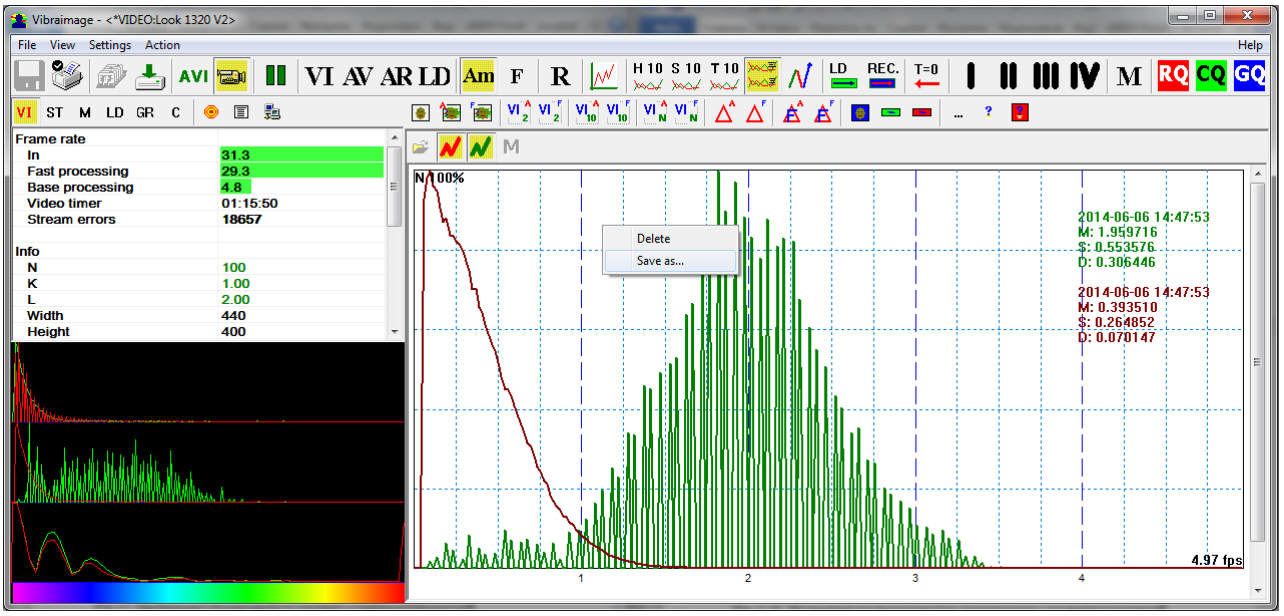


Fig. 3.20. The frequency histogram for a «normal» condition of the person

To save the resulting graphics to an external file you must click the right mouse button on the graph and select item «**Save as...**» (fig. 3.20). Pressing on button «**Load**»  the user can load earlier saved data and to compare them with just received.

For removing the received graph of the frequency analysis is necessary to bring the mouse pointer to the chosen diagram, press the right mouse button and to choose item «**Delete**» (fig. 3.20).

For printing received results choose a command «**Print**» menu «**File**».

Choice of item «**Markers**» will open submenu for input of 10 usual and 3 required at work with a lie detector markers (fig. 3.21). To enter markers it is possible also buttons «**0**» - «**9**» from the keyboard.

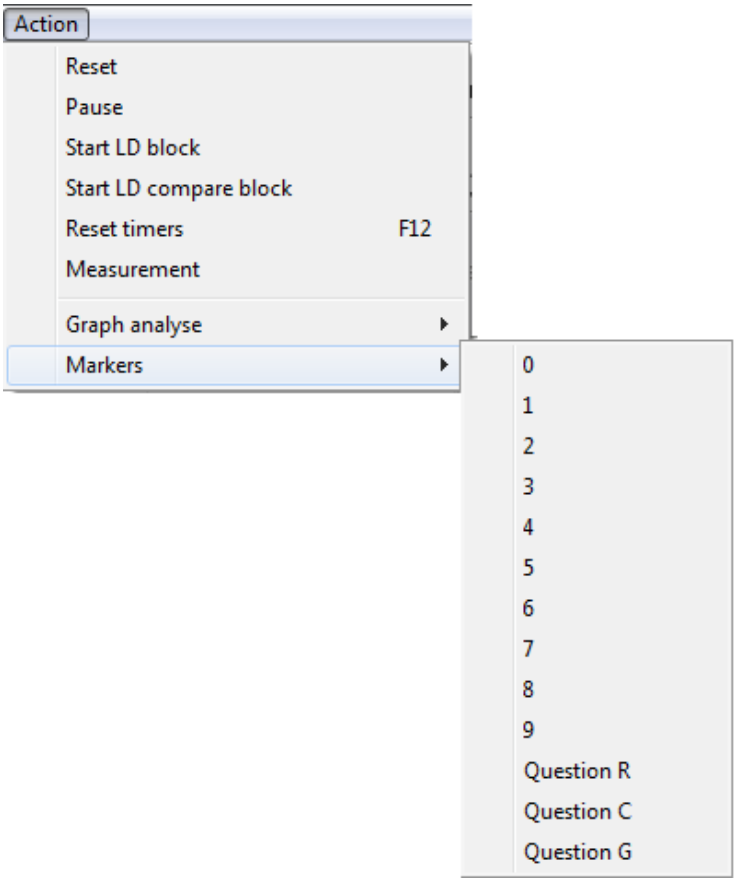


Fig. 3.21. Submenu markers set.

Each marker will be present in the field of parameters graphs by the unique color (fig. 3.22) or by the number symbol with unique color.

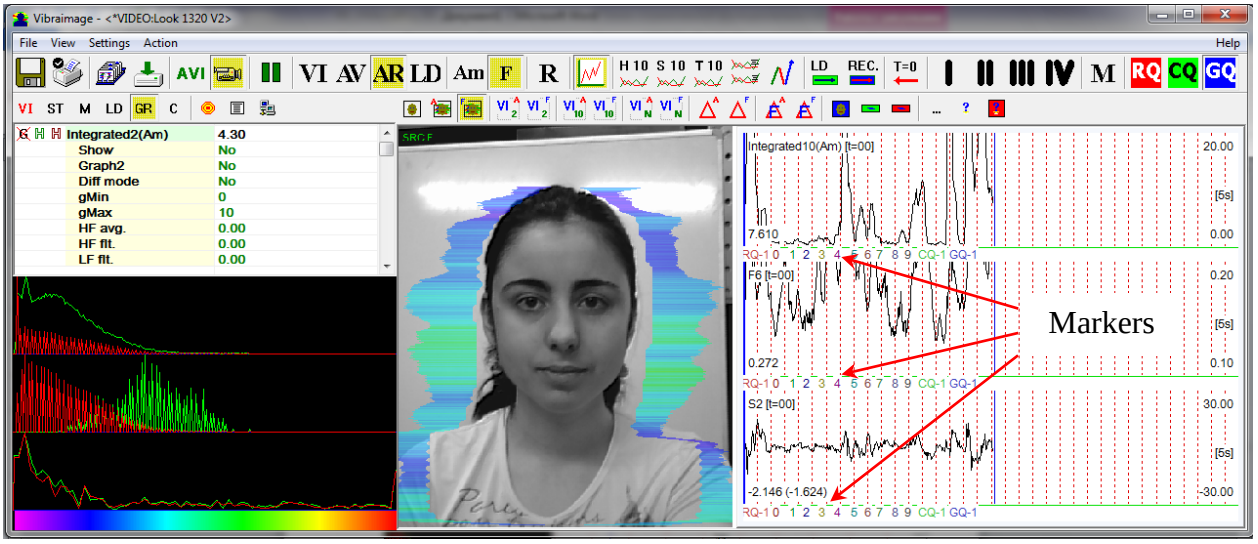


Fig. 3.23. Markers samples.

3.2.5. Menu «Help»

Menu **«Help»** (fig. 3.24) is in the main menu on the right side and contains following items:

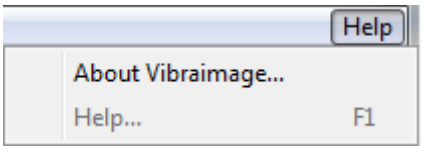


Fig. 3.24. Menu «Help».

Item **«About VibraImage…»** is intended to view the software version, the registered user name (Owner), the key number protection (Serial) and expiry date of the license (Limited) (fig. 3.25).

Use «**Help**» command to call the help system.

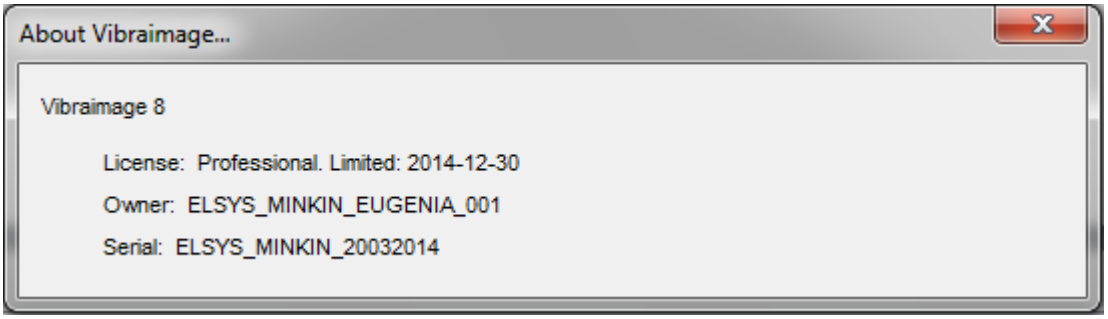


Fig. 3.25. Information about VibraImage.

3.3. Image area

Vibraimages, images and external vibraimages (auras) are displayed in the image area .

The main window of the basic VibraImage .exe module can be configured for observations in several operating modes. The choice of an operating mode is made in the item «**View**» of the main menu (fig. 3.26).

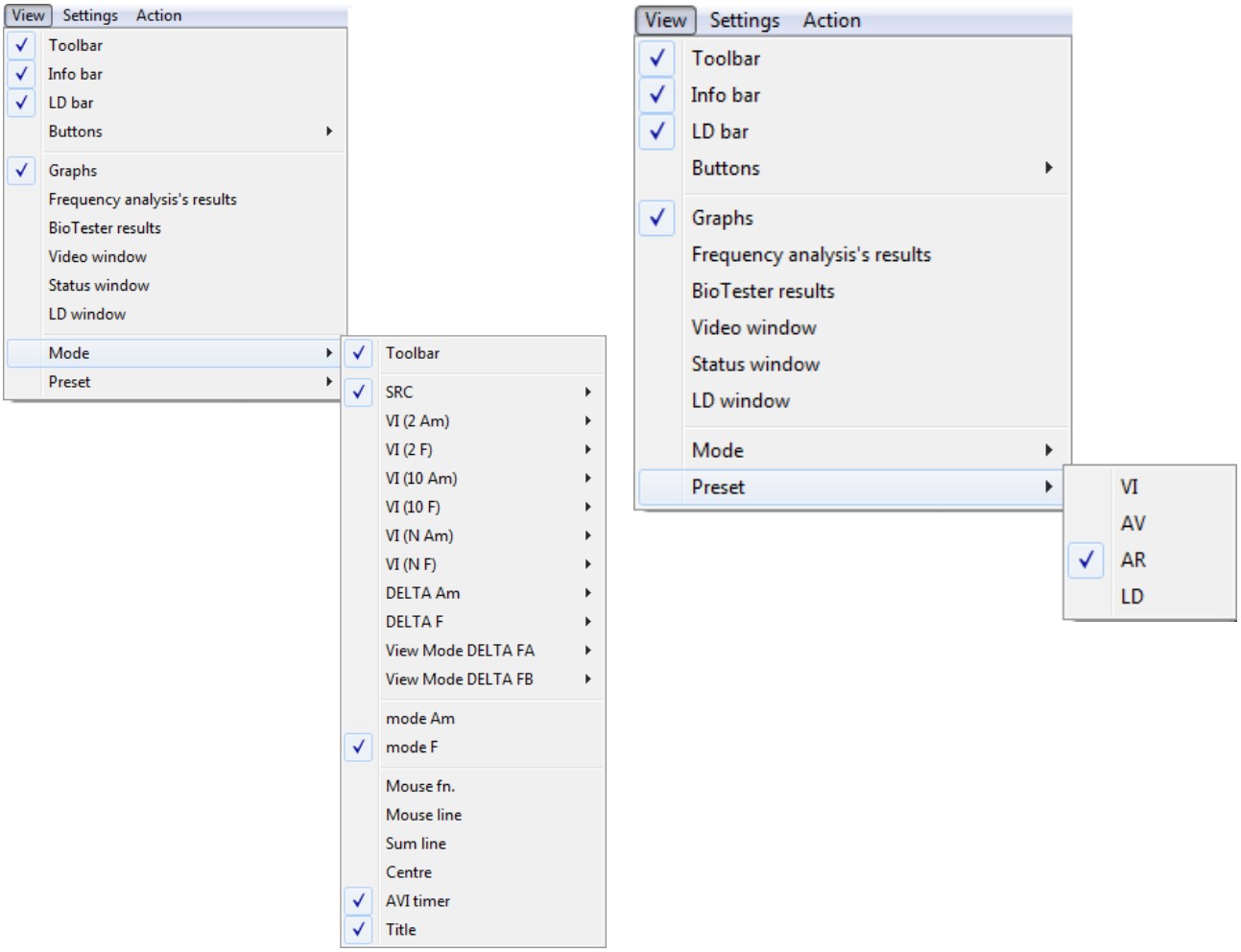


Fig. 3.26. Menu View for mode selection.

Selection of video source is used «Setting-Video...» menu (fig. 3.27).

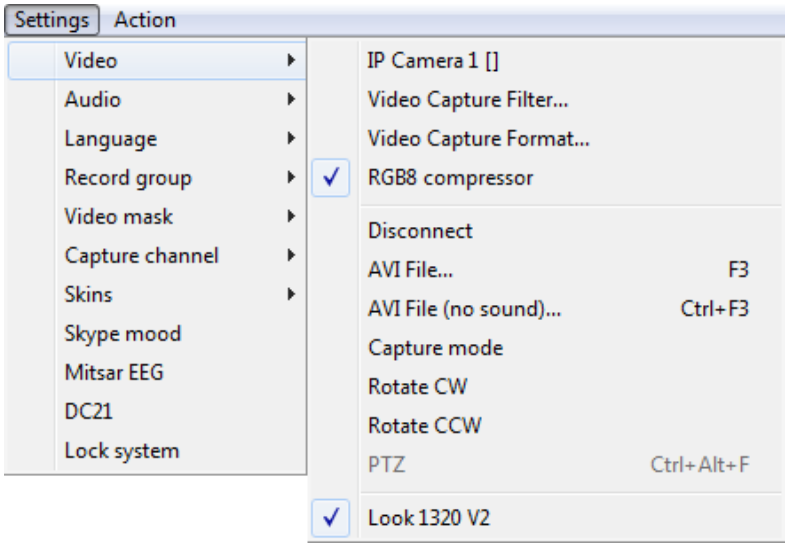


Fig. 3.27. Video source setting menu .

Video source could be standing as live video from video camera, as recorded video by the function AVI file. Recorded video file must be in “AVI” format.

3.3.1. Graphs

Choice of item **«Graphs»** the menu «**View**» makes switch on/off display in the field of image the graph of change in time of the set parameters (fig. 3.28).

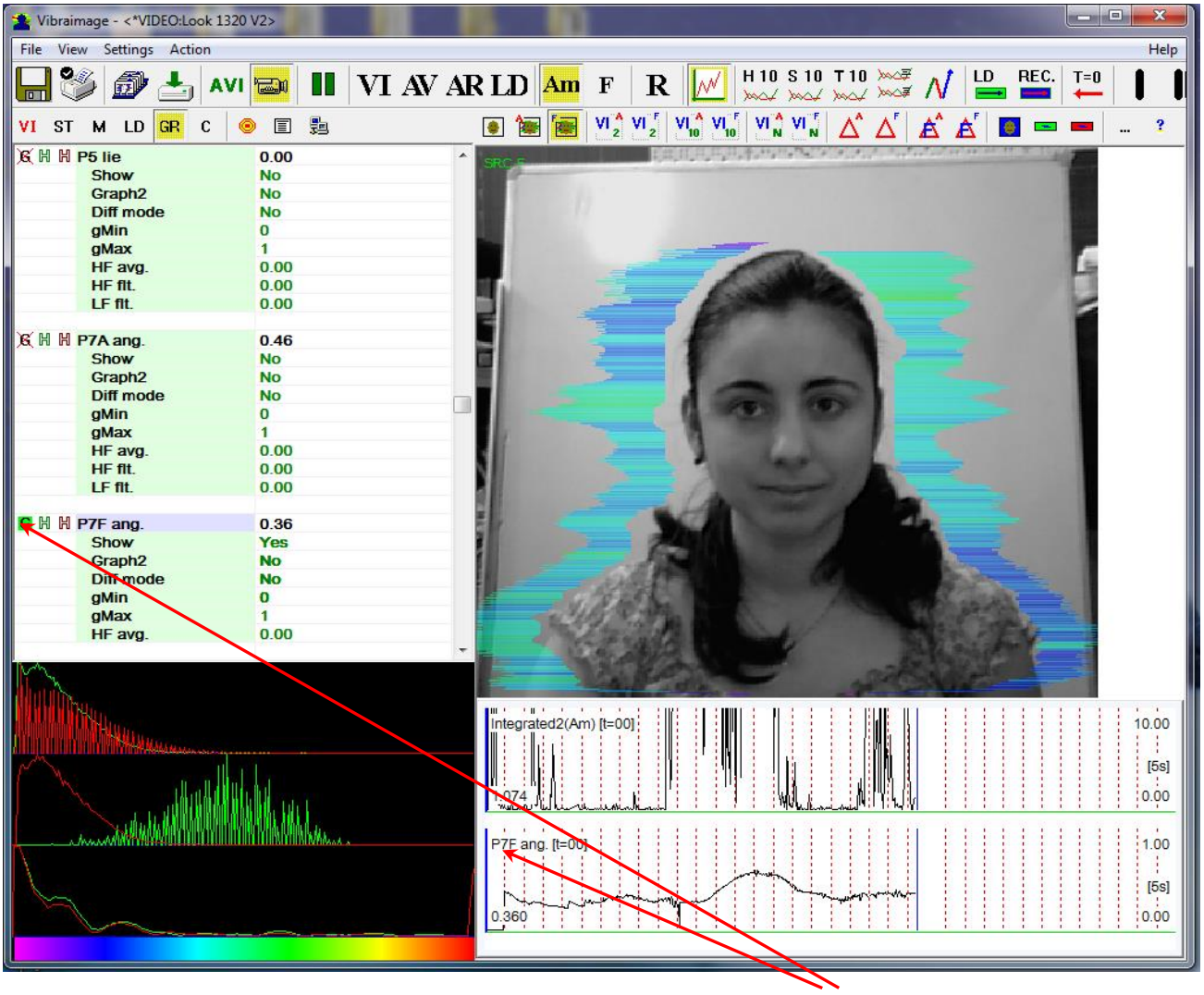


Fig. 3.28. Graph example.

The choice, what change of parameters will be displayed on graphs, is made in an information column in mode GR (fig. 3.28). Changes of the parameters marked by a G symbol are displayed on graph. To choose parameter it is necessary to click the mouse left button when the mouse pointer is above the letter **«G»** the chosen parameter. The parameters marked by G, on graph are not displayed.

The scale of each separate graph on axis Y (on a vertical) is set with parameters **gMin** and **gMax** to information panel GR.

The scale of all graphs on an axis X is (on a horizontal) set in section «Graphs» of the information panel : parameter **«Period (s)»** sets in seconds time of display of a graph part on the screen.

Note

At viewing video file double click by mouse on the button T=0 changes value «**Period**» so that on the screen the time axis corresponded to full length of video file.

If in section «**Graphs**» of the information panel to set value of **«Hist time (s)»** parameter distinct from 0 than in the graphs field additional will displayed the frequency histogram of parameter change for the specified interval (fig. 3.29). At value 0 - the histogram in graphs area is not displayed.

Note

It is possible to playback recorded information (from AVI files) with graphs on the screen in image area. For this purpose it is necessary to execute the following actions:

- Switch on **«Graphs»**;
- To bring the mouse pointer to interesting time on a time axis and twice to click the left mouse button.

Note

Graphs position on in image area adjusts according to user's needs. For this purpose it is necessary to bring the mouse pointer to the top or left border of area of graphs (fig. 3.30) and to change an arrangement of these borders.

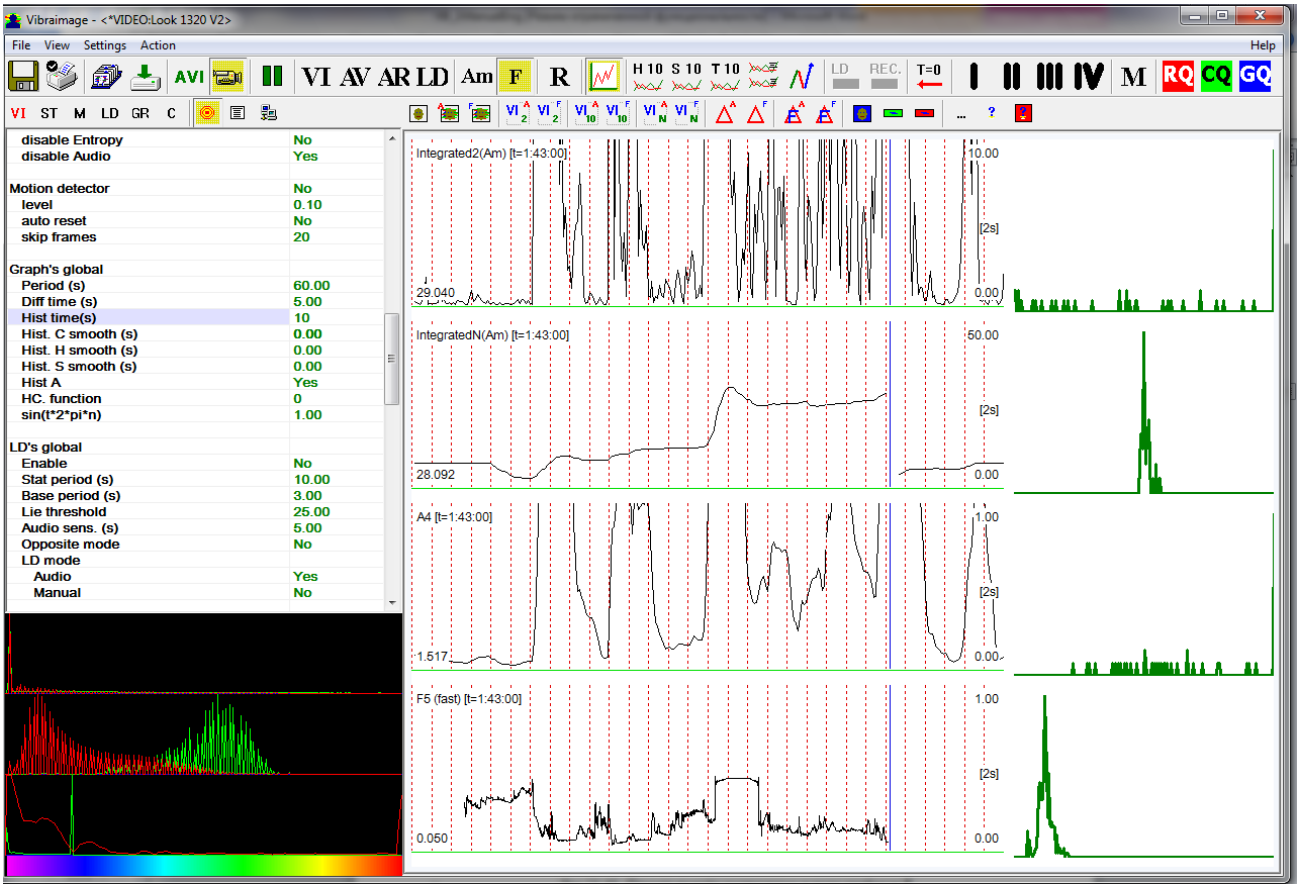


Fig. 3.29. Example, display histogram on graphs area

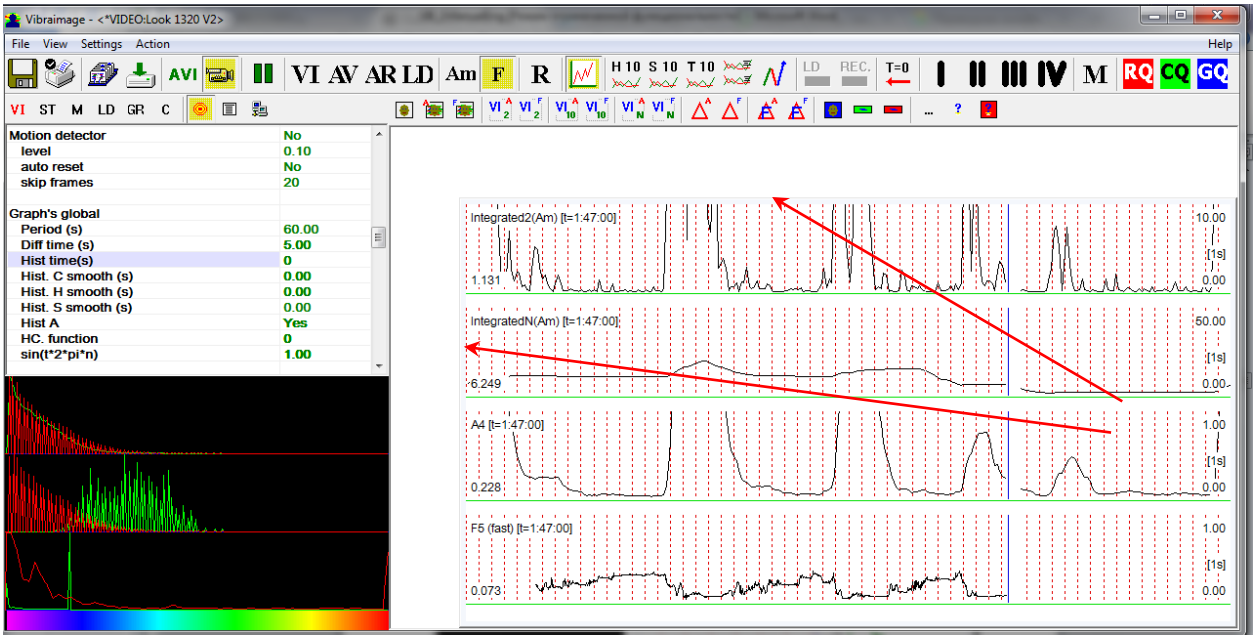


Fig. 3.30. Graphs position adjustment.

3.3.2. Graph analyze

Choice of item **«Graph analyse»** of the menu «**Action**» will open submenu gathering of frequency distribution information in vibraimage (fig. 3.19). Histogram of frequency distribution will be showed in area of images (fig. 3.20, 3.31). Frequency graph corresponds to the middle histogram window, displayed in the lower left part of the multifunction window of the VibraImage.

View mode displaying graphs of frequency analysis setpoints switched on / off button  or item «**Frequency analysis results**» selection.

The analysis of the frequency spectrum after its processing with the help of Fast Fourier Transformation (FFT) (commands **«Start S 10s»** and **«Start S»**) shows vibration spectrum.

Note

Items **«Start H 10s», «Start T 10s»** and **«Start S 10s»** have corresponding buttons in the Toolbar.

Items **«Start T 10s»** and **«Start T»** are intended for accumulation and viewing of the information about change in time F6 and F8 parameters. Parameters F6 and F8 define the average and current period of parameter F1fast (A1fast) change with the switch on filters (F6 HF and F6LF). Averaging of changes of the F1fast (A1fast) signal period is made in interval F6N frames.

Parameter F6 is parameter of person inhibition. For the concentrated person the maximum of frequency distribution of F1fast signal period changes falls at value of 0.1 seconds, for weakened - 0.2 seconds. Presence of several maxima in frequency distribution shows, that during researches the person on something distracted. Note, that changing value of F6N parameter we change a step of digitization at construction of the histogram.

The user also has an opportunity of viewing previously saved results of the frequency analysis. For this purpose it is necessary, to choose the item **«Frequency analysis's results»** menu «**View**», to pass in a mode of viewing of the frequency histogram in the area of image, and then having pressed button **«Load»**  to load earlier saved data and to compare them with just received.

In a window with the frequency histogram (fig. 3.20) switch «***N***» determines: will be the graph of amplitude histogram is showed or not (the graph is painted by red color). Switch «***N***» determines: will be the histogram of frequency is showed whether or not (the graph is painted by green color).

Each histogram is characterized by the following parameters:

- M – the center of weights of frequency distribution (average value of microvibrations frequency);
- S – root-mean-square deviation of frequency distribution;
- D – a dispersion of frequency distribution.

To print out the received results user must choose a command «**Print**» menu «**File**».

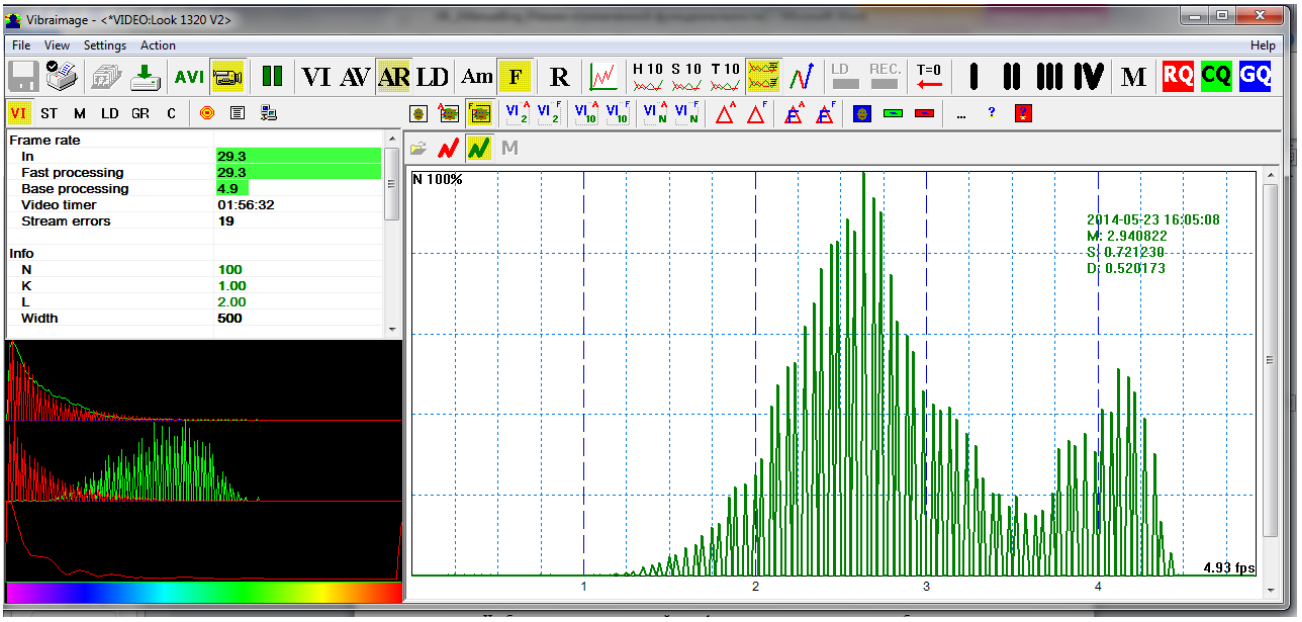


Fig. 3.31. Frequency histogram for person differs from a normal state

For removing the received graph of the frequency analysis is necessary to bring the mouse pointer to the chosen diagram, press the right mouse button and to choose item **«Delete»** (fig. 3.20).

To save the resulting graphics to an external file you must click the right mouse button on the graph and select item «**Save as...**» (fig. 3.20).

At a choice of item **«Start H 10s», «Start H»** or pressing of the button 

simultaneously with accumulation the frequency analysis information is made testing psycho-energetic conditions of the person. And a mode of viewing of testing of the person condition results (fig. 3.32) is switched on/off by the button  or a choice of menu item «**BioTester results**».

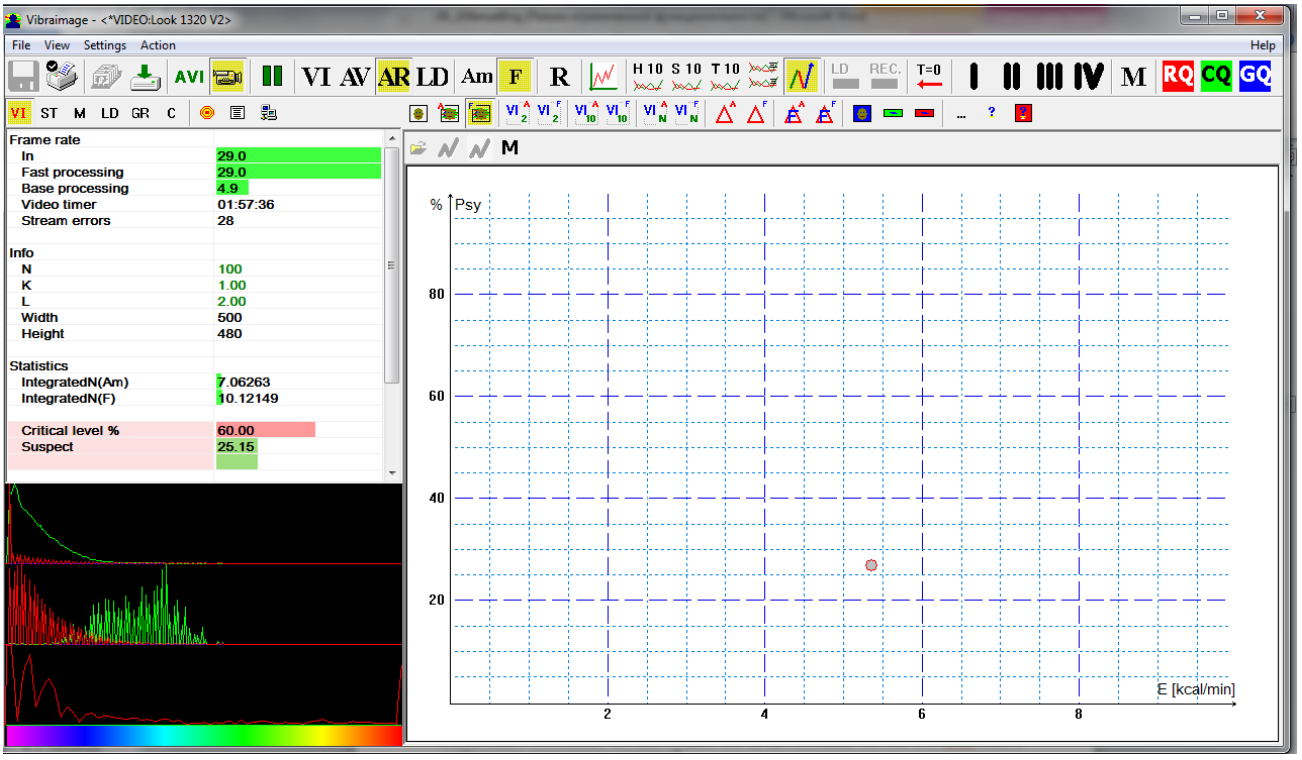


Fig. 3.32. Режим просмотра результатов анализа. Начальное состояние.

The point on the graph displays the current psycho-energy condition of the person. On axis Y the mental condition of the person is displayed in %, if it is more, than the condition is better. On axis X in a Kcal/minute energy of the person is displayed.

At repeated pressing of the  button or a choice of corresponding menu item, will be made new accumulation of the information and in graph area the following result of frequency distribution will be displayed (fig. 3.33).

To save the received graph it is necessary to bring the mouse pointer to the chosen diagram, to press the right mouse button and to choose item «**Save as…**» (fig. 3.34).

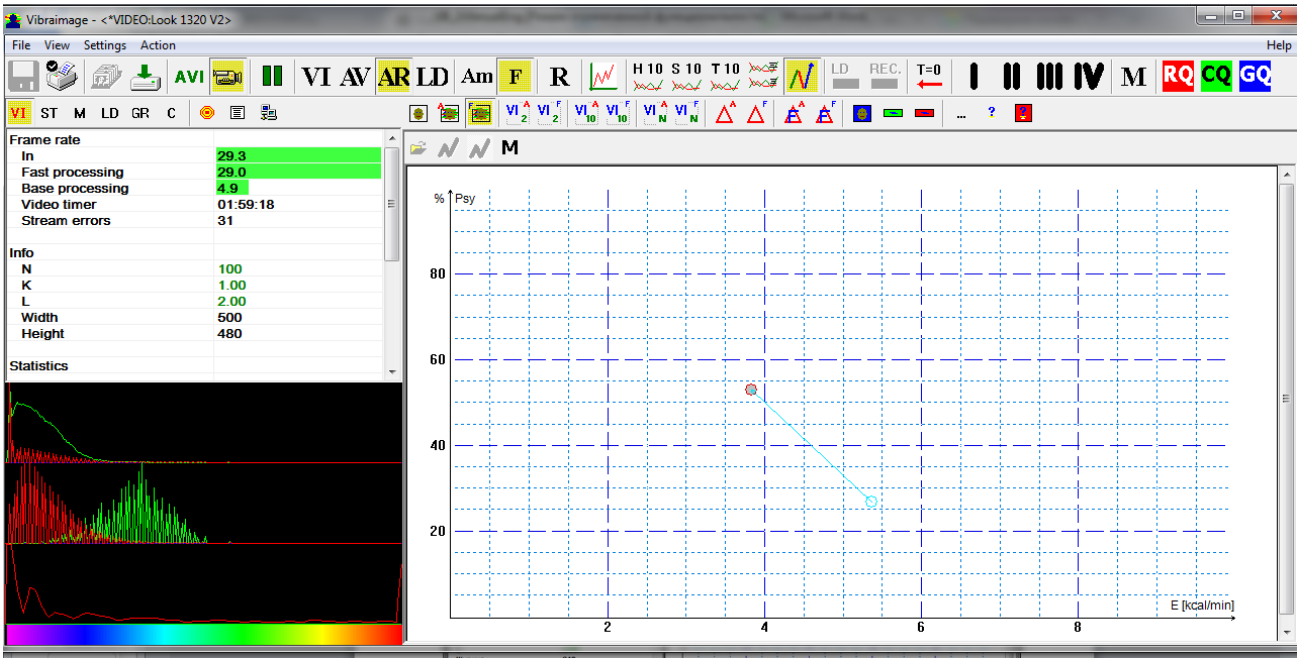


Fig. 3.33. Old and new human state.

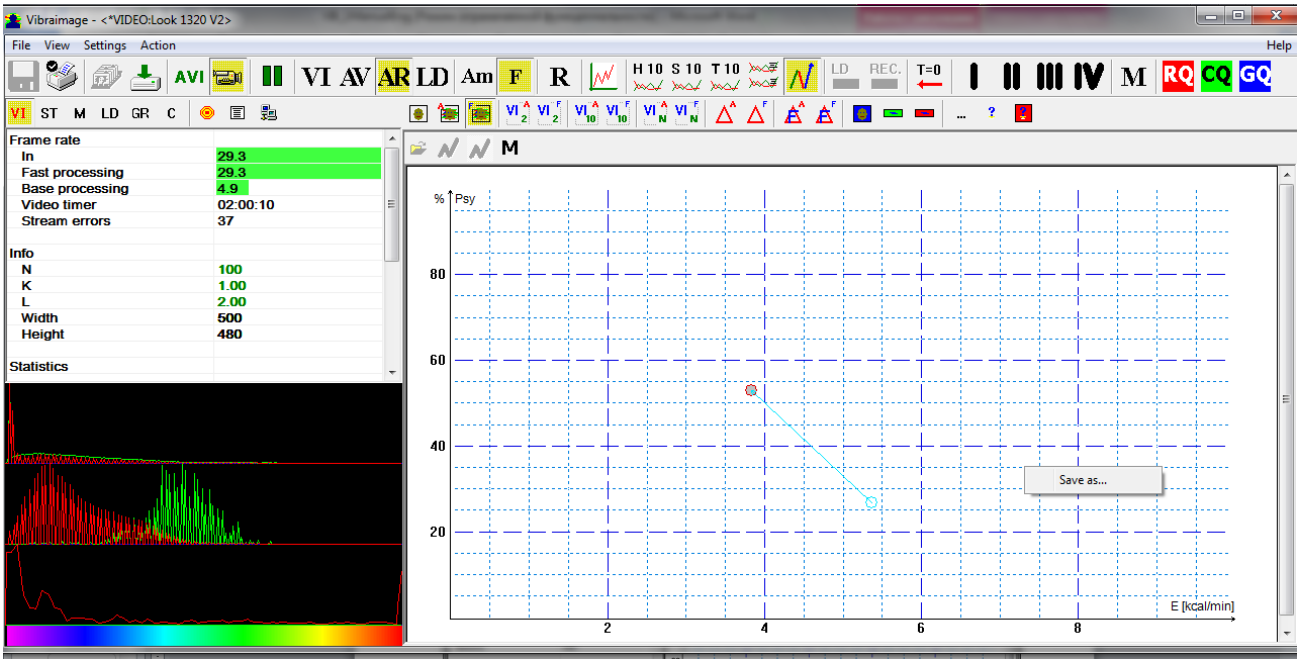


Fig. 3.34. Saving results

3.3.3. Choice of the main display mode

In the field of the image area (fig. 3.36 - 3.41), depending on the chosen mode (fig. 3.35), the user can see the «real» video image, vibraimage, external vibraimage (aura), or graphs time dependences for control in LD mode, or any other mode.

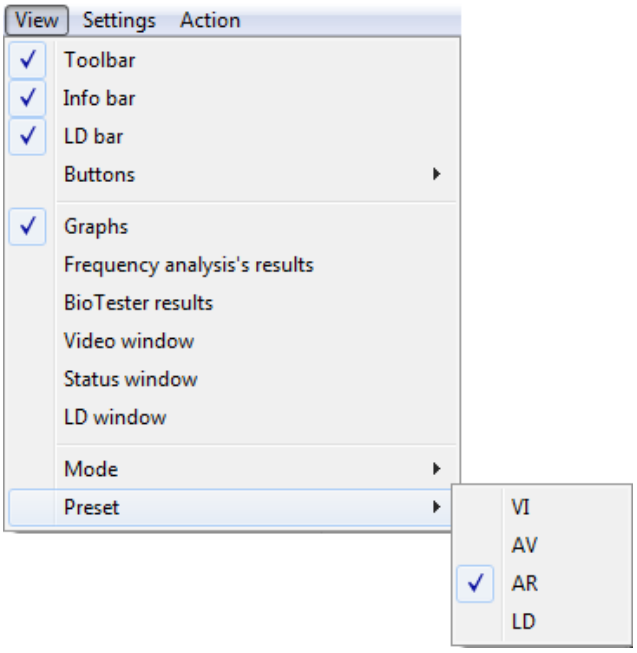


Fig. 3.35. Menu «View». Preset image area mode.

Item **«Presets»** menu «**View**» (fig. 3.35) is intended to choice one basic mode in image area.

- In **«VI»** mode [«VibraImage mode»] displays vibraimage of person. Color for every image pixel depends on its amplitude or frequency of vibrations (fig. 3.36, 3.37).
  - In **«AV»** mode [«Aura - Vibraimage mode»] the contour of the object allocated around the vibraimage. Vibra-aura line size depends on medium line vibration amplitude. Vibra-aura line color depends on maximum line vibration frequency inside vibraimage contour (fig. 3.38, 3.39).
- In **«AR»** mode [«Aura on the Real image»] the vibra-aura of the person is shown around his real image (fig. 3.40, 3.41).
- In **«LD»** mode [«Lie Detector mode»] image area shows real object image and selected graphs.

Note

Appearance of image area depends on position of the switch «Graphics»  which sets: should display graphs of changes in the time pre-selected parameters or not (fig. 3.36-3.41).

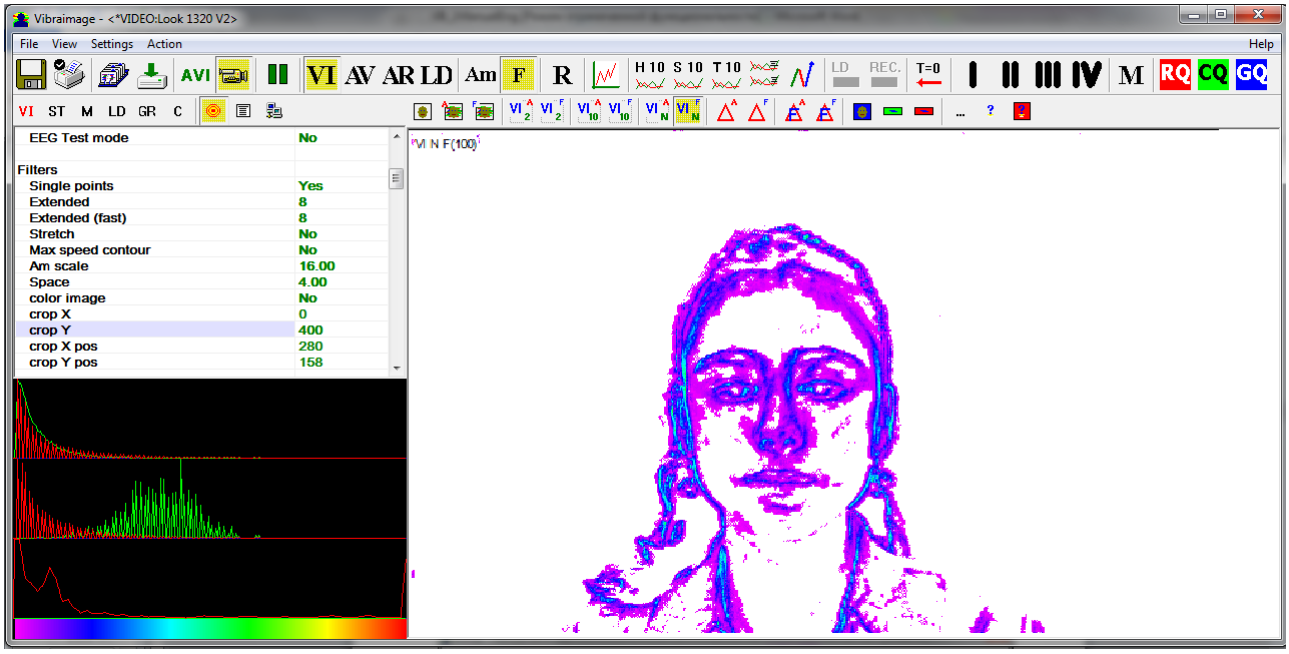


Fig. 3.36. VI mode.

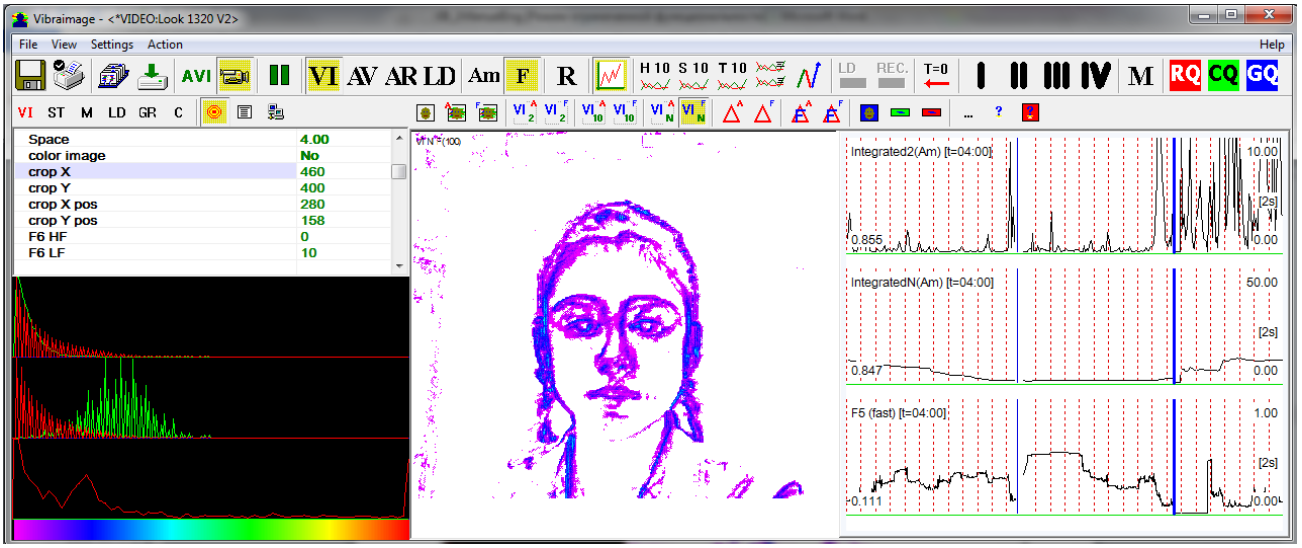


Fig. 3.37. VI mode with graphs.

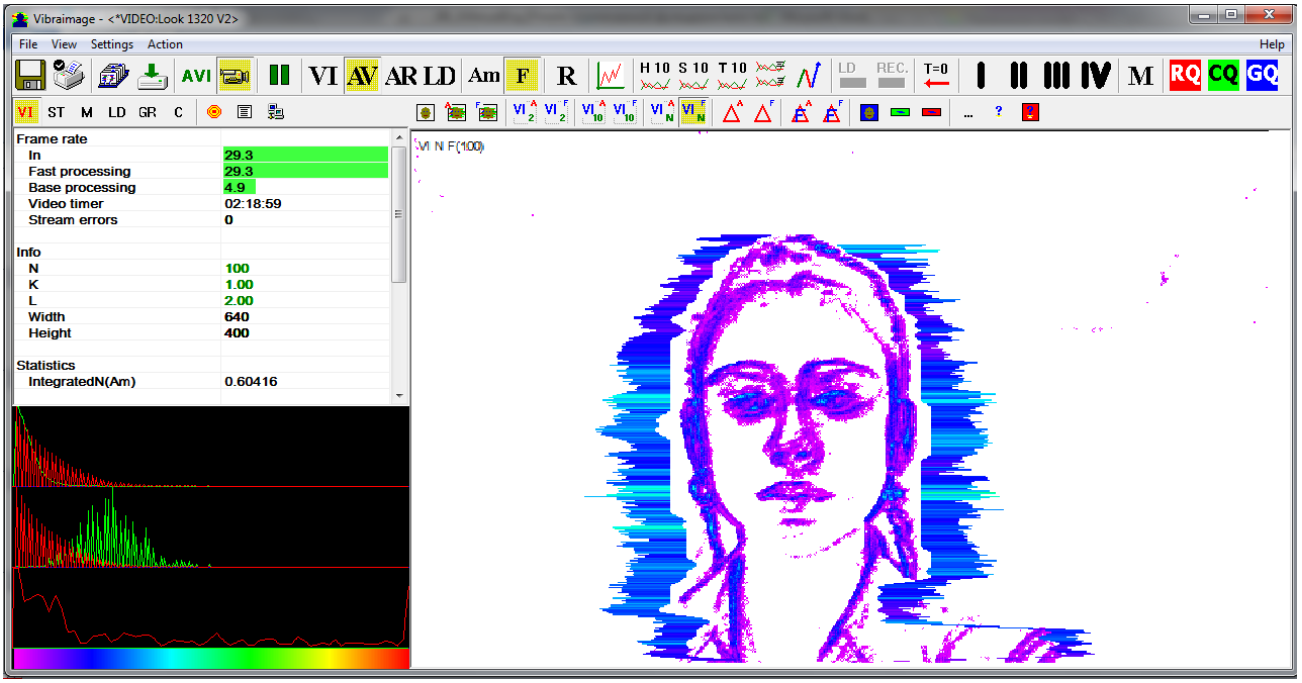


Fig. 3.38. AV mode.

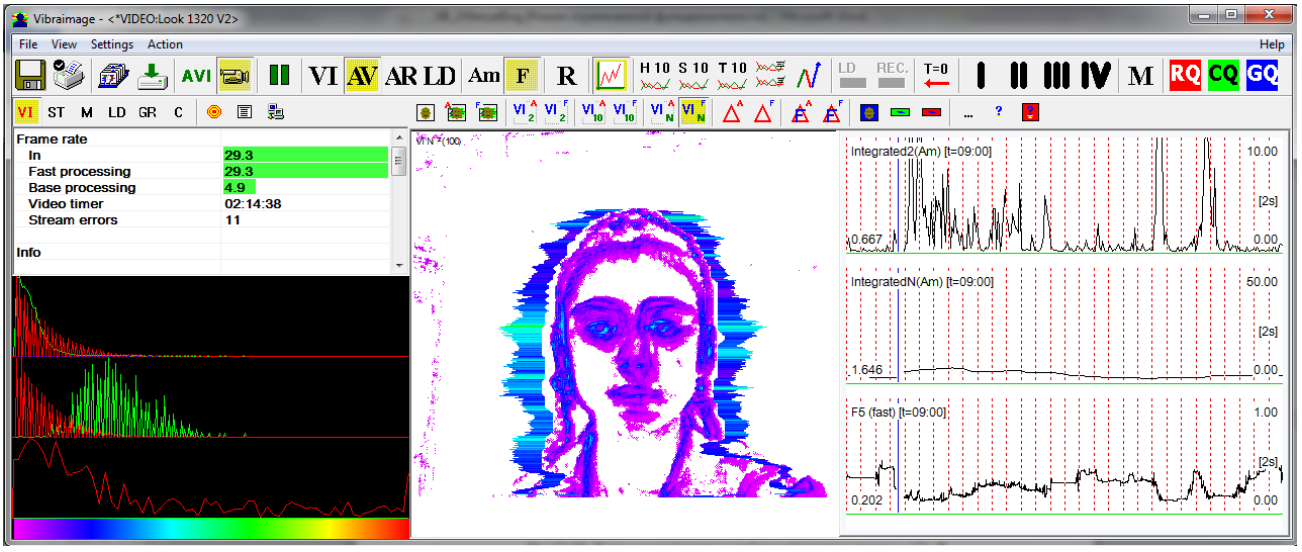


Fig. 3.39. AV mode with graphs.

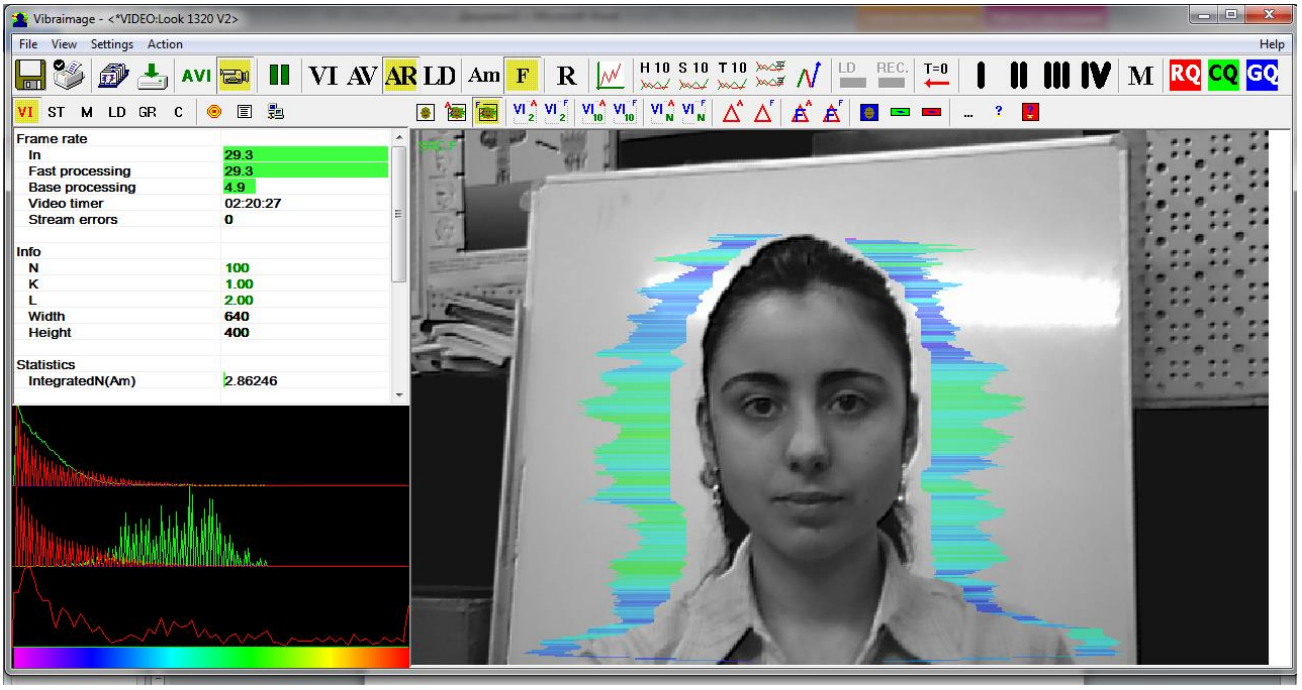


Fig. 3.40. AR mode.

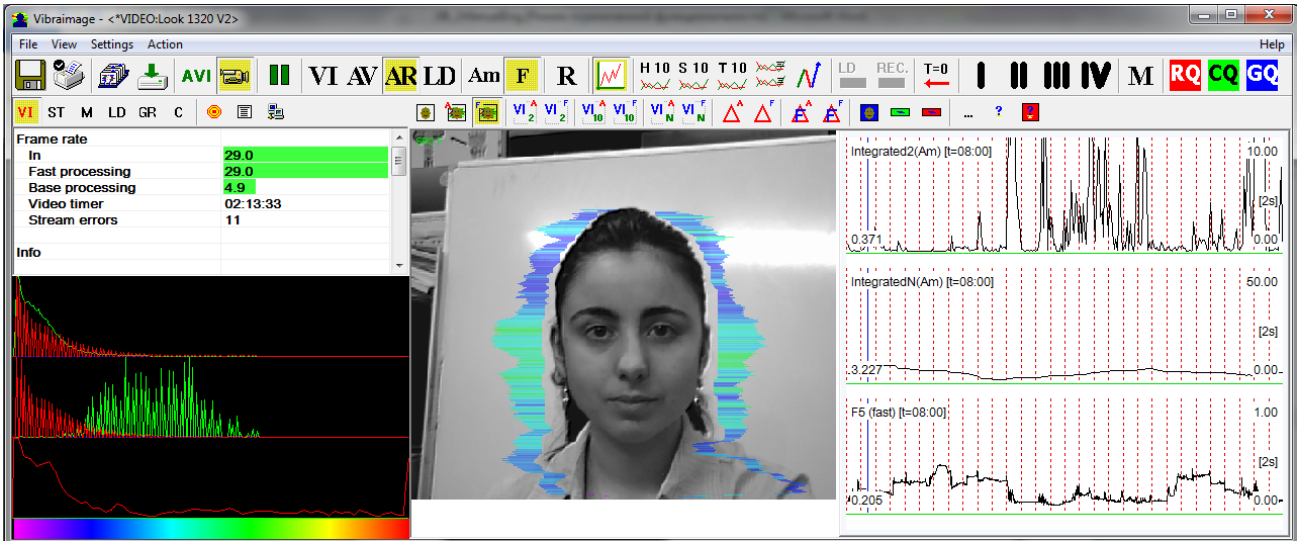


Fig. 3.41. AR mode with graphs.

3.3.4. Submenu «Mode»

Item **«Mode»** (fig. 3.42) selects additional settings of information in image area:

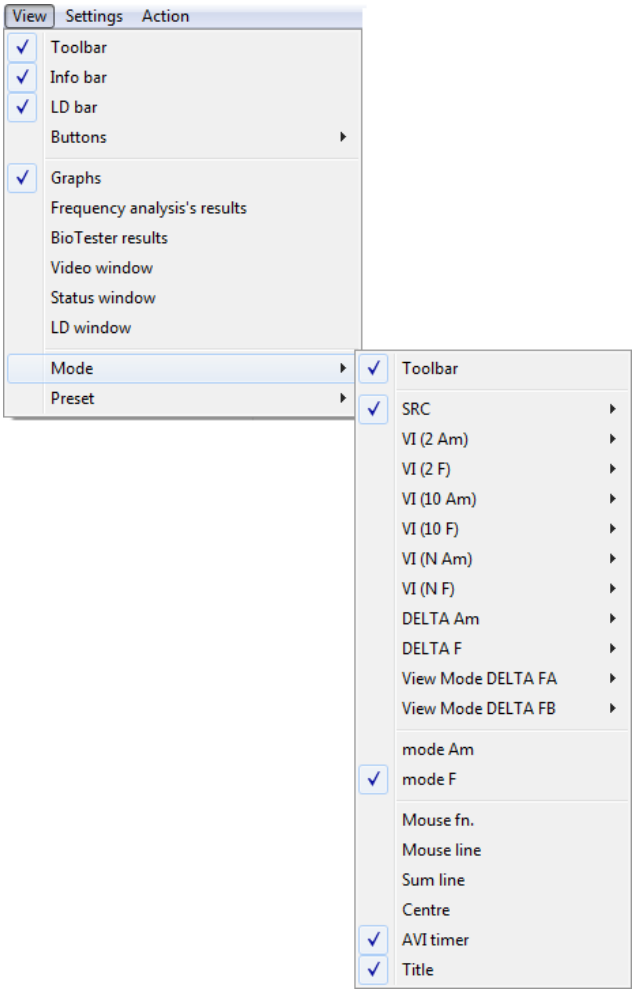


Fig. 3.42. Menu «View». Submenu «Mode»

Every item of the given menu for convenience of user is duplicated in the additional panel of toolbar (fig. 3.43). Item **«Toolbar»** switches on/off toolbar.

Fig. 3.43. Additional toolbar

Note

Pressed buttons in toolbar correlated with windows in the area of images (fig. 3.44). The maximum number of windows equal 13 (fig. 3.15). To delete a window with the set image processing it is enough to let off the corresponding button the of toolbar panel.

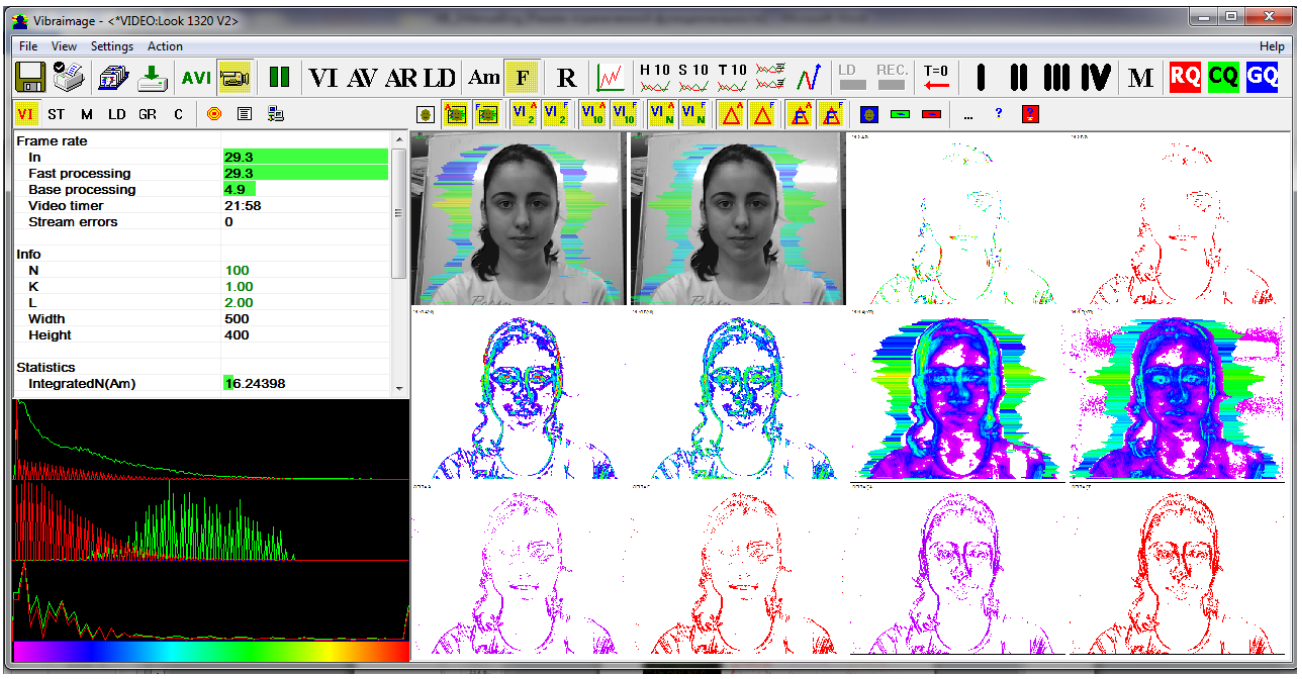


Fig. 3.44. Simultaneous output of several windows with the different image processing

Note

In the left top corner of a window could be indicated the Title of the given image processing mode (fig. 3.45).

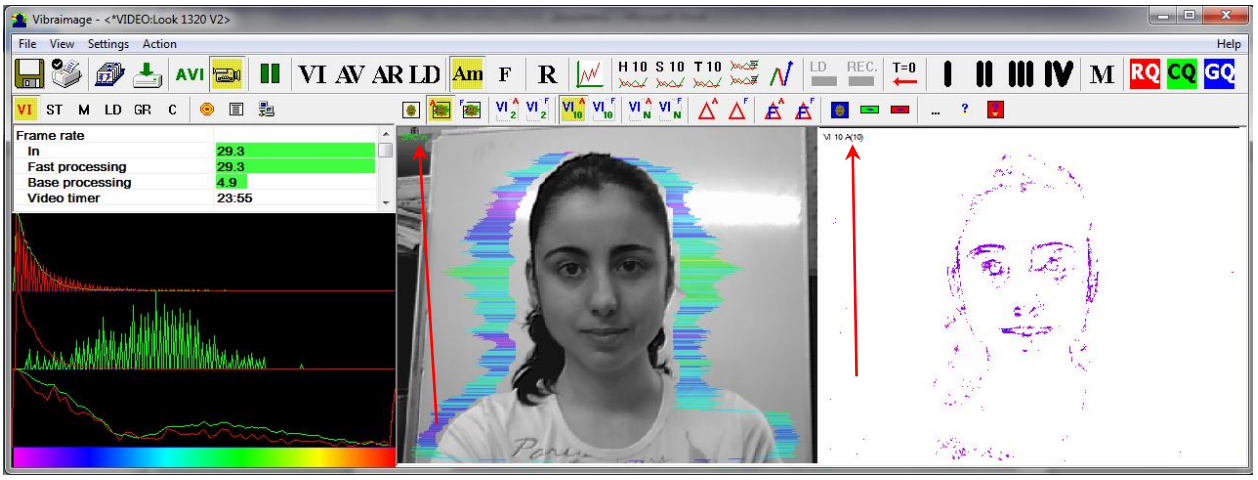


Fig. 3.45. Several images simultaneously presented in image area.
Modes of SRC+Aura u VI(10 Am).

- In «**SRC**» mode (the button) shows source video from camera without processing (fig. 3.46). It is additional possibility to display the aura on the real image of person constructed on the analysis of pixels vibration amplitude (the button) or frrequency or pixels vibration frequencies (the button). The length of the beam vibra-aura in this case will be determined by the average value of the points parameter in a row, and the color of the beam vibra-aura – by the maximum value.
- In «**VI (2 Am)**» (the button) and «**VI (2 F)**» (the button) modes display vibraimage, processed during 2 frames (fig. 3.47) and constructed on the basis of amplitude **Am** and frequency **F** analysis of vibration. It is additional possibility to change color of background image and to add vibra-aura to vibraimage (fig. 3.48).

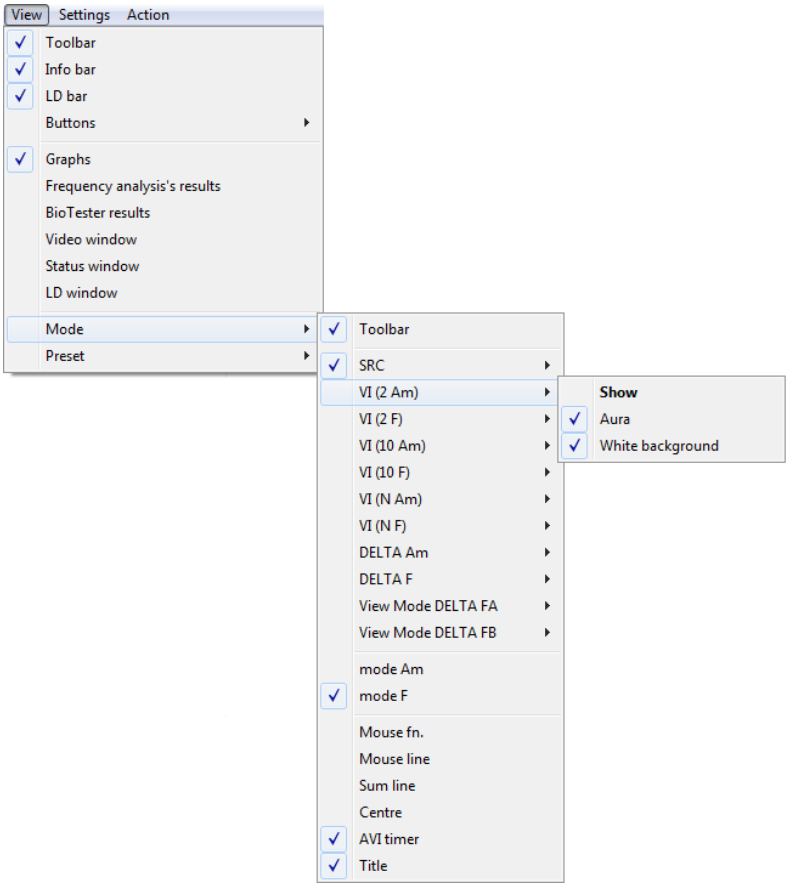


Fig. 3.47. Select mode of processing image

- In «**VI (10 Am)**» (the button of the toolbar) and «**VI (10 F)**» (the button of the toolbar) modes display vibraimage, processed during 10 frames (fig. 3.49) and constructed on the basis of amplitude **Am** and frequency **F** vibration analysis. It is the additional possibility to change color of a background image and to add aura to vibraimage. The same result is possible to receive if to bring the mouse pointer to a window of the chosen image and to press the right button of a mouse (fig. 3.49). Also in this menu there will be the «**Crop Pos**» function defining the position of the image center point (further pos.) after image cropping.

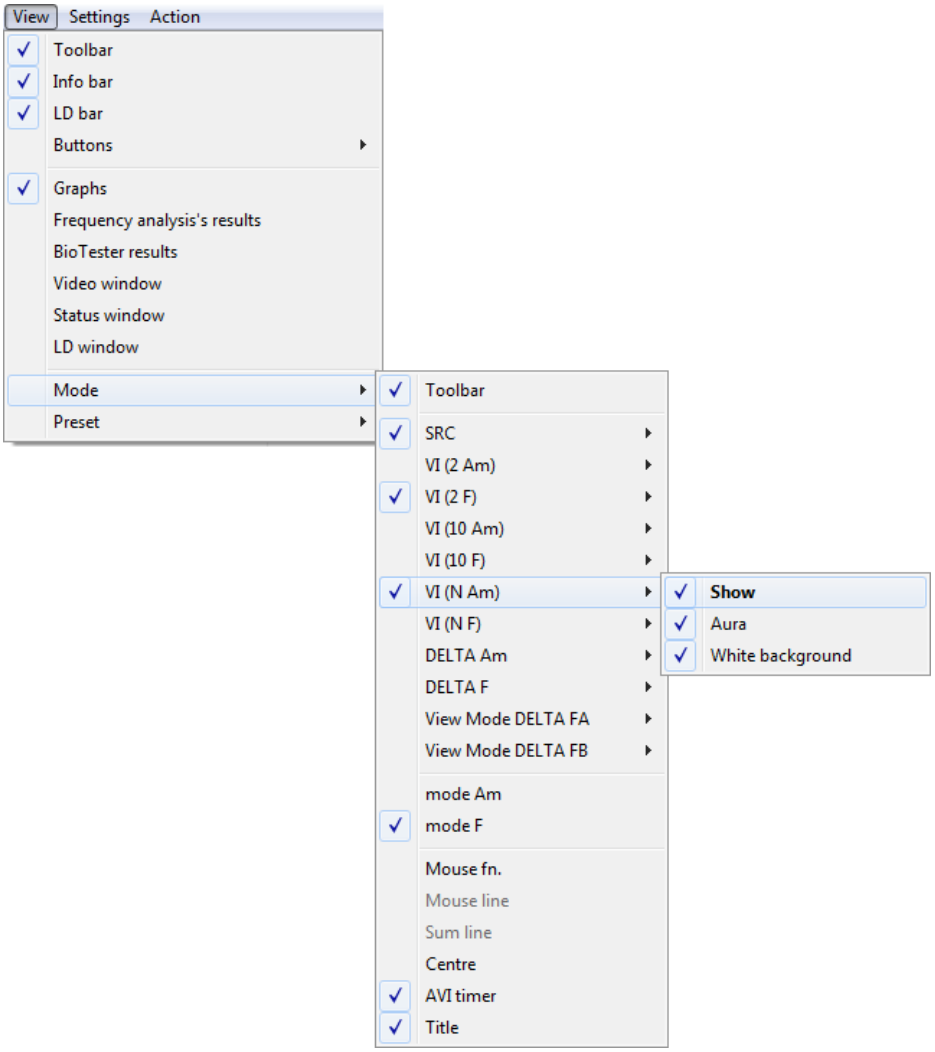


Fig. 3.48. Select mode of processing vibraimage.

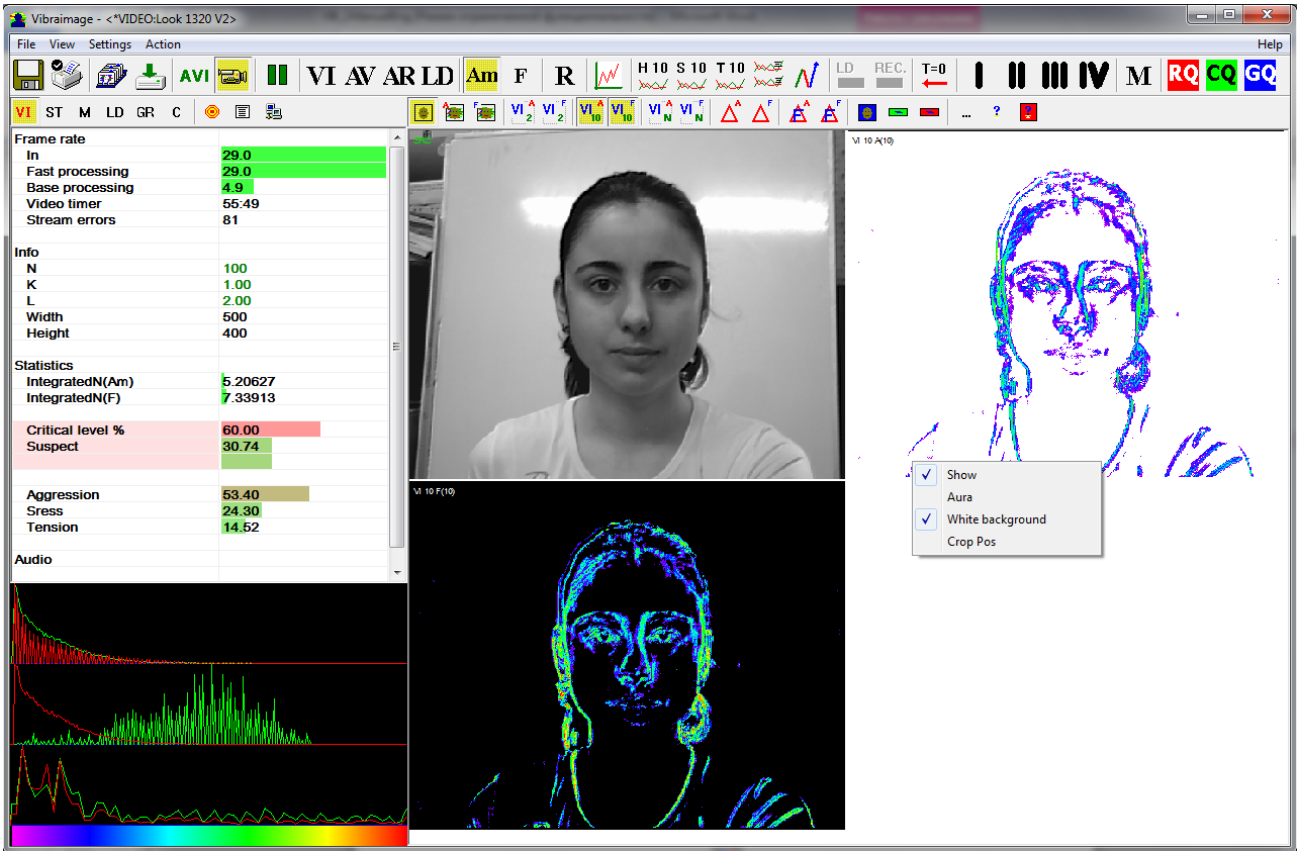


Fig. 3.48. Image area. SRC, VI(10 A) and VI(10 F) are switch on.
For image VI (10A) additional menu indication.

- In **«VI (N Am)»** (the button of the toolbar) and **«VI (N F)»** (the button of the toolbar) modes display vibraimage, processed during N frames and constructed on the basis of amplitude Am and frequency F vibration analysis. The number of frames, corresponding to parameter N, is set in information panel (fig. 3.56). It is additional possibility to change color of background image and to add aura to vibraimage (similar menu, fig. 3.48).

- In **«Delta Am»** (the button) and **«Delta F»** (the button) Am и частоты F modes display frame difference on the basis of amplitude Am and frequency F vibration analysis in base processing mode. It is additional possibility to change color of background image and to add aura to vibraimage (similar menu, fig. 3.48)

  Note.
  In this mode the vibro-aura will be based on the vibraimage which has been accumulated for N frames!

- In **«View mode Delta FA»** (the button) and **»View mode Delta FA»** (the button) modes display frame difference on the basis of amplitude Am and frequency F vibration analysis in fast processing mode. It is additional possibility to change color of background image and to add aura to vibraimage (similar menu, fig. 3.48).

- In **«mode Am»** visualization and calculation of object parameters processed by pixel vibration amplitude.
- In **«mode F»** visualization and calculation of object parameters processed by pixel vibration frequency.

- In **«Mouse line»** mode, the field of information displays vertical and horizontal brightness lines of the image for mouse position (fig. 3.49). The place of the image for which there is a cutoff, is set by the position of the pointer of the mouse pointer.
- In **«Sym line»** mode, to the field of information display are added two areas: in vertical area displays sums of frame difference lines of the visible image, in horizontal - sums of frame difference columns of the visible image. Blue dashed lines on cuts display position of the mouse pointer (fig. 3.50).

- In **«Centre»** mode, to the field of information display are added 3 vertical lines: blue line displays vibraimage center for N=2, green line displays vibraimage center for N=10, red line displays vibraimage center for N=100 (fig. 3.51).

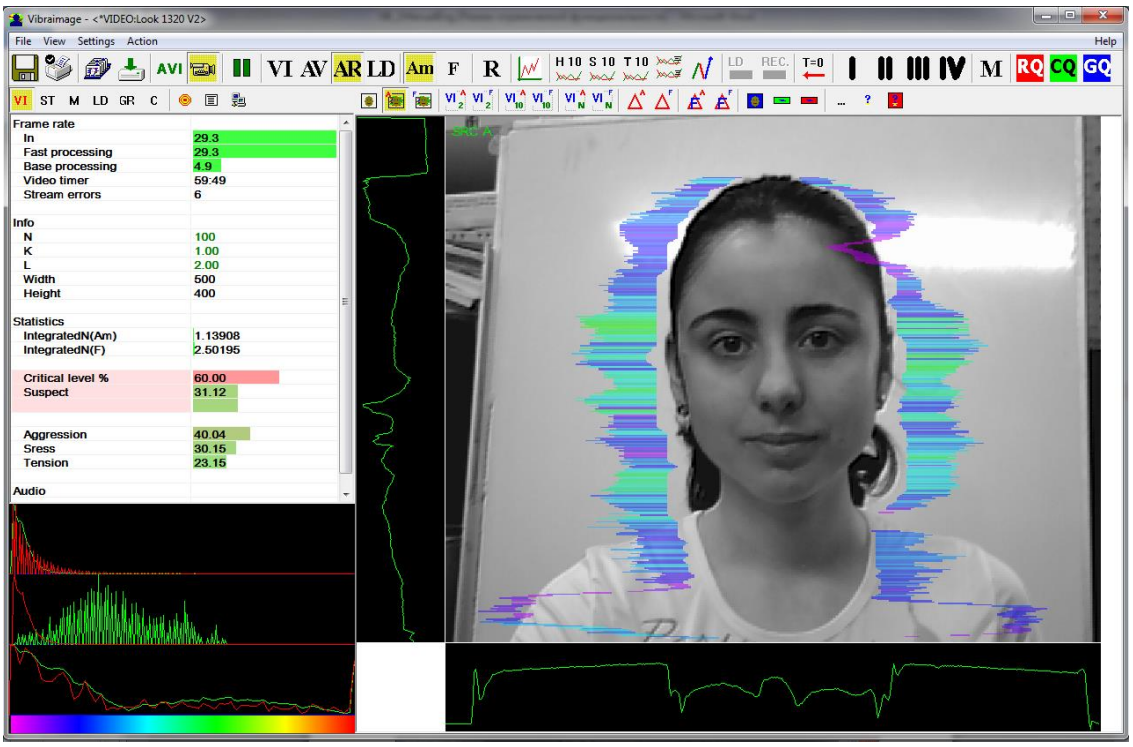


Fig. 3.49. Display mode of brightness point cuts.

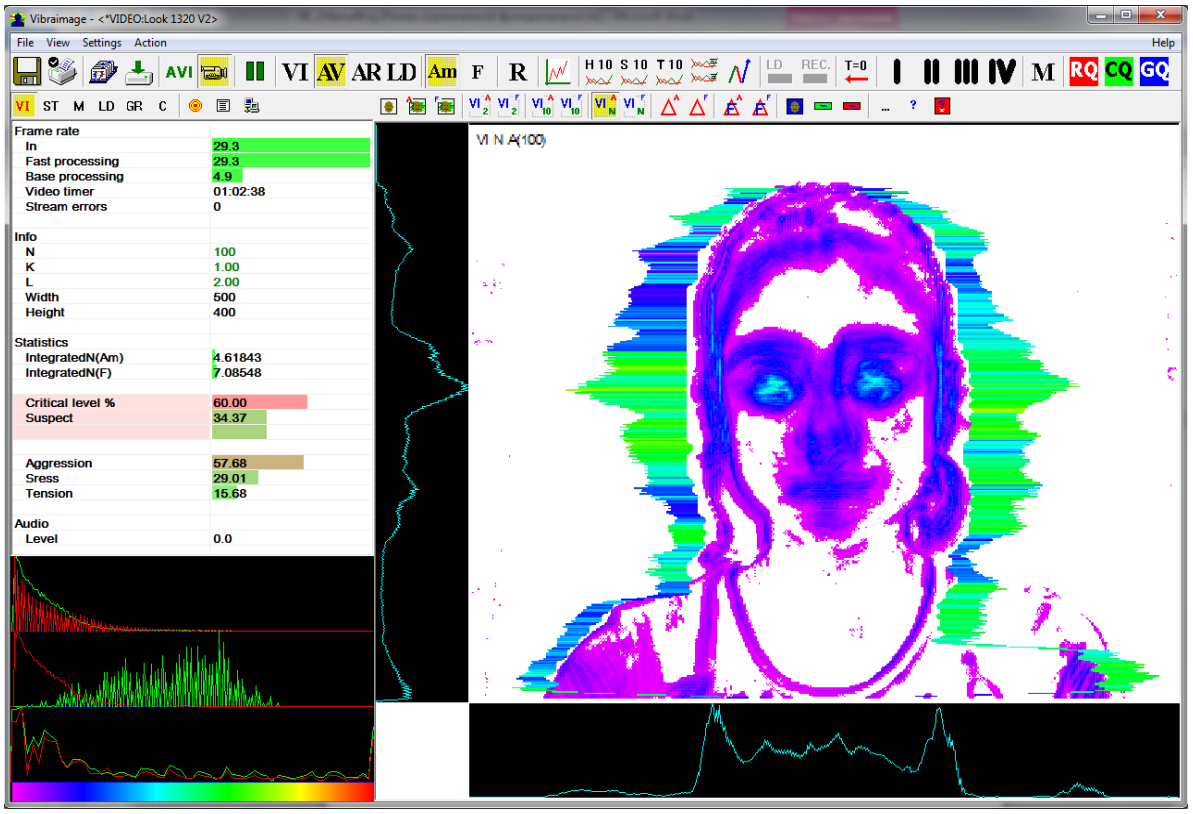


Fig. 3.50. Display mode of sum lines of the current image.

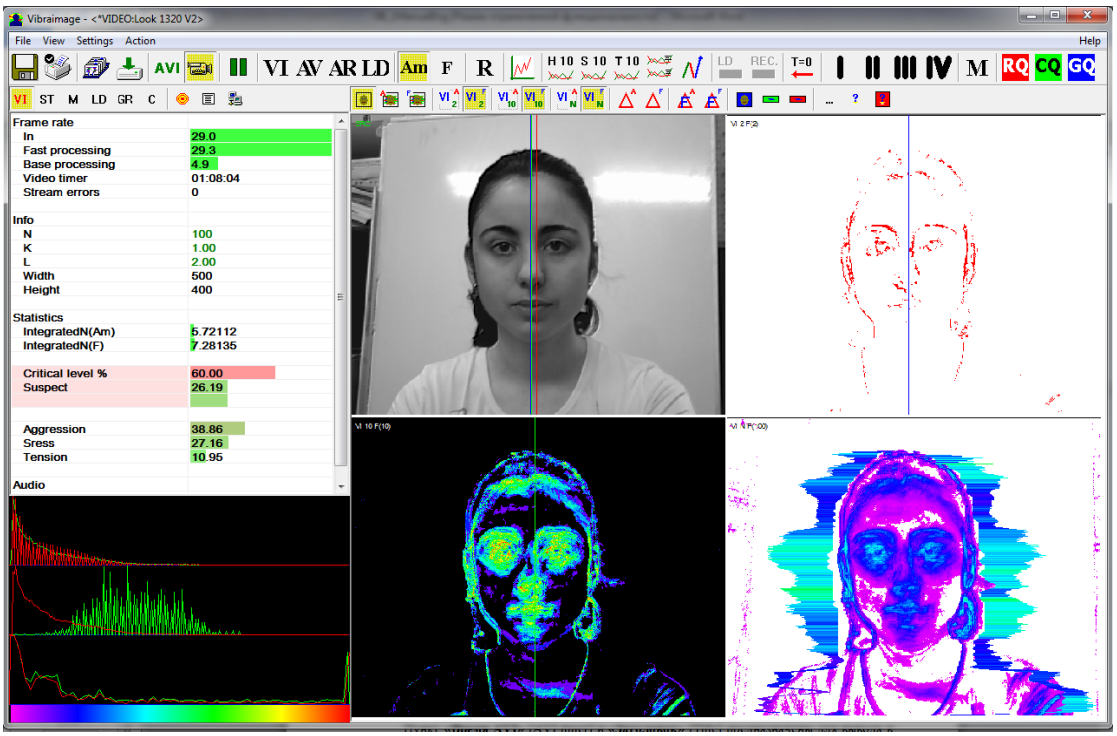


Fig. 3.51. Vertical center of vibraimage lines on image.

Item **«AVI timer»** and **«Title»** displays (in the left top corner in each of visible windows with images) the name of a processing mode which is used for the given window, and time from the beginning of viewing AVI files (fig. 3.52).

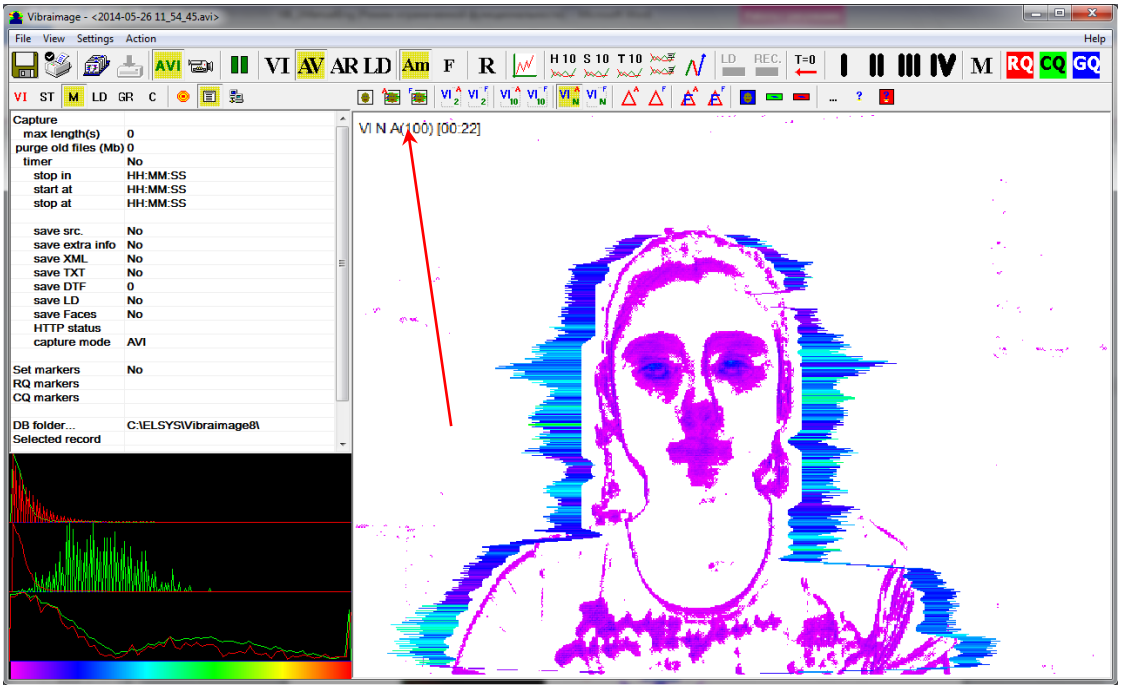


Fig. 3.52. Title of image and video time for AVI file.

3.4. Toolbar. LD bar.

Toolbar (fig. 3.54) duplicates following items:

Fig. 3.53.Toolbar.

- – «Save Image...» («File» menu);
- – «Print Image...» («File» menu)
- – «Save current image to the archive» («File» menu)
- – «AVI: start record» («File» menu). For stop AVI files recording needs push on this button again;
- AVI – Open AVI file;
- – «Camera» - image from camera;
- – «Stop/Start» («Action» menu);
- VI – VI mode («View» menu);
- AV – AV mode («View» menu);
- AR – AR mode («View» menu);
- LD – LD mode («View» menu);
- Am – Amplitude analyze («View» menu);
- F – Frequency analyze («View» menu);
- R – Reset all accumulated information about frame difference. Start accumulation again after reset. («Action» menu);
- – «Graphs» («View» menu);
- H 10 – «Frequency analysis 10s» - gathering of information for 10 seconds («Action» menu);

- S 10 – «Frequency Fourier analysis 10s» - gathering of information for 10 seconds and its processing by Fast Fourier Transformation. (Menu «Action»);
- T 10 – Gathering and averaging of the information for 10 seconds (Menu «Action»);
- «Results of the frequency analysis» - switching in a mode of frequency analysis graph display;
- – Switching in a mode of testing psycho-energy condition graph display;
- LD – to begin data processing for a «Lie detector» mode (Menu «Action»);
- REC. – Manual switch on/off of a preliminary data gathering mode for «Lie detector» (Menu «Action»);
- T=0 – reset timer of video files to «0» (Menu «Action»);
- I, II, III, IV – allow to select a folder for data saving;
- M – A mode of accumulation and averaging of parameters for the certain period;
- RQ, CQ, GQ – Are used in Lie detection mode and serve for installation markers on graphs at the time of «certain» type questions;
- ... – button in the additional toolbar (fig. 3.43), which allows to open the folder where you saved the images and data;
- ? – button appearing in the additional toolbar (fig. 3.43), if in the folder «VibraImage 8» the file «manual.rtf» is located and allowing to open it. Contents of this file depend on the user;
- ? – button appearing in the additional toolbar (fig. 3.43), if in the folder «VibraImage 8» the file «troubleshooting.rtf» is located and allowing to open it. Contents of this file depend on the user.

Note
Toolbar buttons that at the current moment switched on are highlight by yellow color.

LD panel of VibraLie program shown on fig. 3.54.

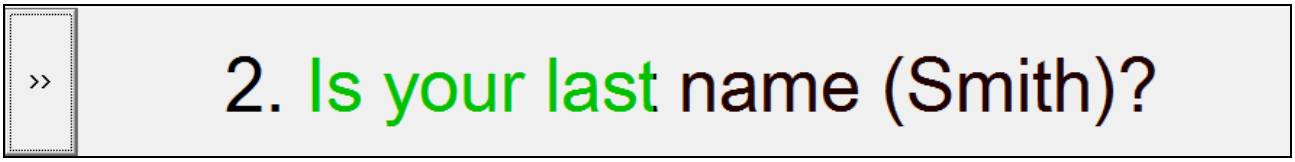


Fig. 3.54. LD bar.

One-clicking on the button » on the LD bar lets start a questionnaire at that moment. Double-clicking returns to the beginning of the questionnaire and the video file. The questionnaire can be selected by putting on the item «**LD load text…**» in the submenu «**File**».

3.5. Information panel

Indication of information column (fig. 3.55) depends on using mode:

Fig. 3.55. Information panel tables menu.

- In the mode VI information about adjustments of system and results of data vibraimage processing is displayed;
- In the mode ST statistics of LD parameters and stands audio threshold are displayed;
- In the mode M the average values of vibraimage parameters which have been calculated and are average for the certain period are displayed;
- In the mode LD settings for LD the mode parameters are displayed and stood;
- In the mode GR vibraimage parameters selected for graphs are displayed and stood;
- In the mode C the correlation parameters are configured;
- In the mode settings of basic parameters for work with VibraImage are configured;
- In the mode input and selection of the demographic information and a folder for archive storage is configured;
- In the mode adjustment of local network parameters for operation in a network monitoring mode is configured.

Note

Values of parameters in fields which are allocated by a green font, can be changed by the user (fig. 3.20, parameters N, K, L - it is possible to change in Information table). For this purpose it is necessary to bring the mouse pointer to the chosen field and twice to click the left button of a mouse.

In the bottom part of information panel displays three windows with results of the frequency analysis (fig. 3.56). In the first window the frequency analysis vibraimage on the whole frame (by red color - amplitude, green color - frequency of vibration pixels) is displayed. In the second window the frequency and amplitude histograms for external vibraimage (aura), and in the third - spectrums of the frequency analysis with application of FFT of two parameters selected in «**GR**» submenu of the information panel are displayed.

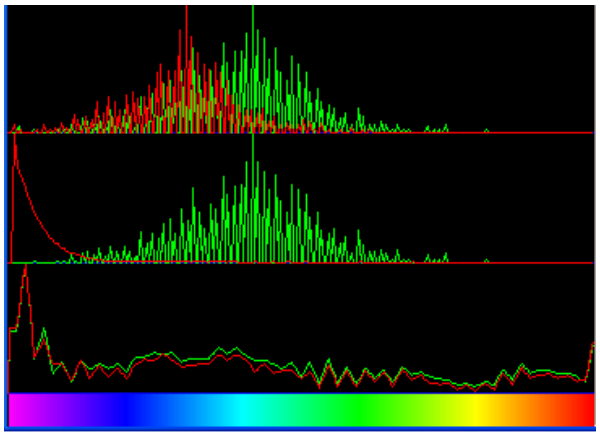


Fig. 3.56. Histograms window.

3.5.1. Information panel. VI mode.

In the mode 

information panel (fig. 3.57) displays following information:

Frame rate:

- «**In**» – Number of the frames per second, received from the video source;
- «**Fast processing**» – Maximum number of the processed frames per second used for calculation. Selected by user;
- «**Base processing**» – Number of the processed frames per second used in base algorithm. Selected by userж
- «**Video Timer**» – For camera mode- displays time of supervision. For recorded video - time of current video-file record. For viewing a video-file - time from the file beginning);

- «**Stream errors**» – The counter of mistakes which increases if time between the next accepted frame astably. This mistake can arise, if productivity of a computer suffices or poor-quality video is loaded;

Info:

- **N** - Number of the frames for accumulation. Selected by user;
- **K**. – Gain Factor. Selected by user;
- **L** – Palette Threshold. Defines a threshold in the displayed image, value of brightness less threshold is considered «black». Selected by user;

Width and **Height** – Displays the current video camera or AVI file resolution;

Statistics:

- **IntegratedN(Am)** – Average frame amplitude vibraimage intensity processed for the N frames.;
- **IntegratedN(f)** Average frame frequency vibraimage intensity processed for the N frames;

- «**Critical level %**» – threshold of a psychoemotional status of the person exposed in % in case of which exceeding on the remote terminal the warning message will be issued;
- «**Suspect**» - Calculated level of suspect for object in frame;

- **«Anger»** – Calculated level of anger for object in frame;
- **«Stress»** – Calculated level of stress for object in frame;
- **«Tension»** – Calculated level of tension for object in frame;

Audio:

- «**Level**» – current level of audio signal.

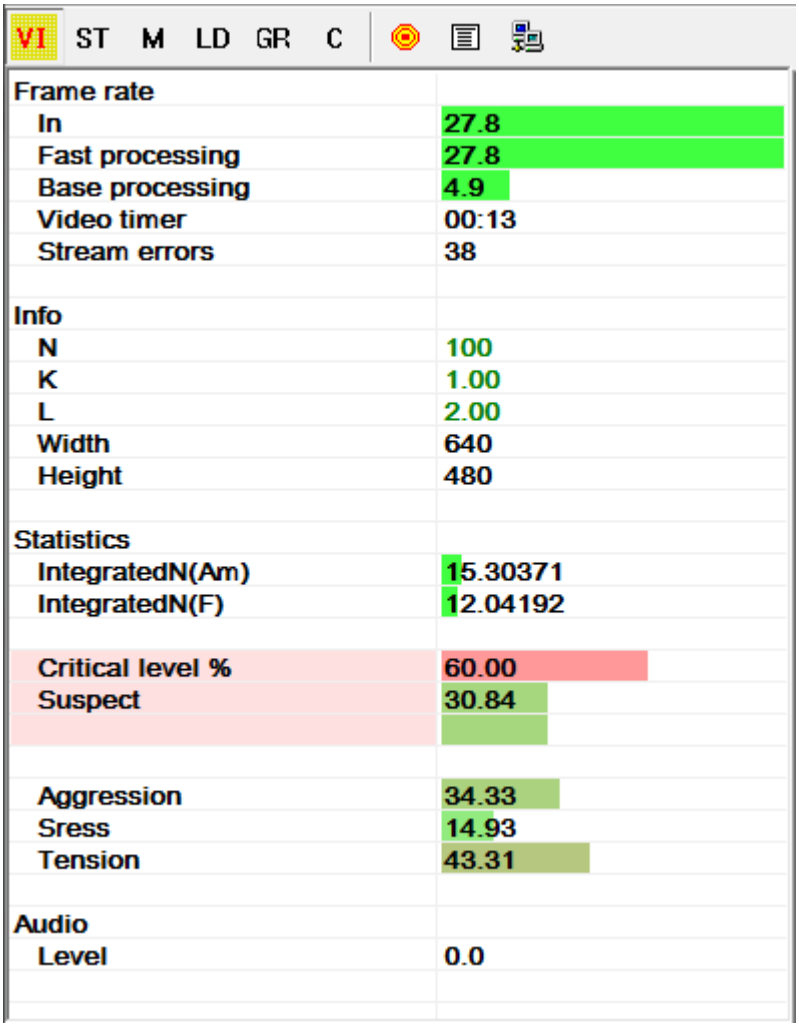


Fig. 3.57. Information panel in the VI .mode.

3.5.2. Information panel. ST mode.

In the mode ST information panel (fig. 3.58) allows controlling the statistics calculation emotional state of a person and displays following information:

- Current values of based processed VibraImage parameters A1-A4, F1-F5, S1-S7, P1-P25, Current audio level and audio threshold.
- Current values of fast processing VibraImage parameters A1 fast, A4 fast, F1 fast, F5 fast.
- For each parameter displays the following numerical values:

V – parameter current value

cMin – minimal parameter value during past stat period (only in LD-mode)

cMax – maximal parameter value during past stat period (only in LD-mode)

bMin – minimum threshold value of parameter (only in LD-mode) during past stat period

bMax – maximum threshold value of parameter (only in LD-mode) during past stat period

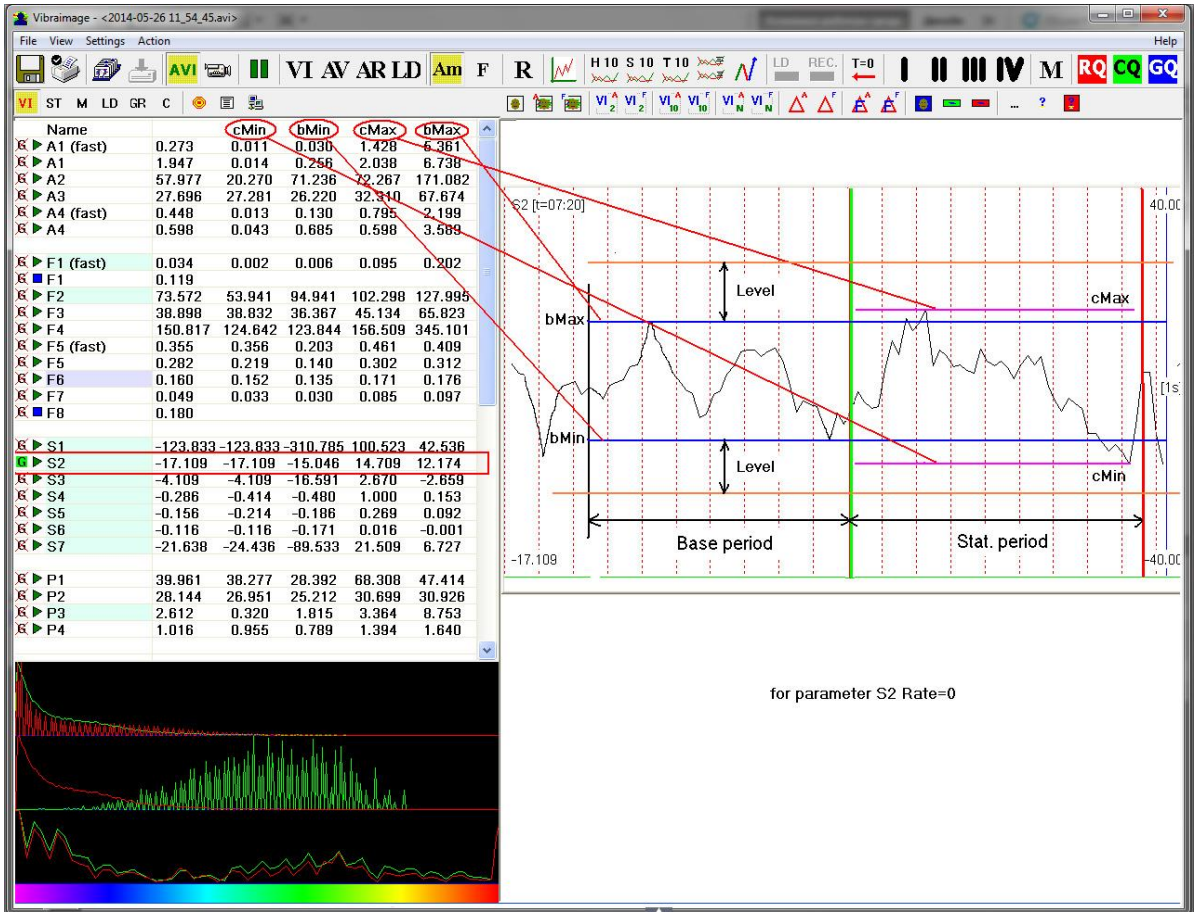


Fig. 3.58. The explanatory to parameters bMax, bmin, cMax, cMin.

Note

Values of parameter cMin, cMax, bMin and bMax displays only when the LD mode is switch on. In other modes in these fields will be show: «0» (for example, see fig. 3.58).

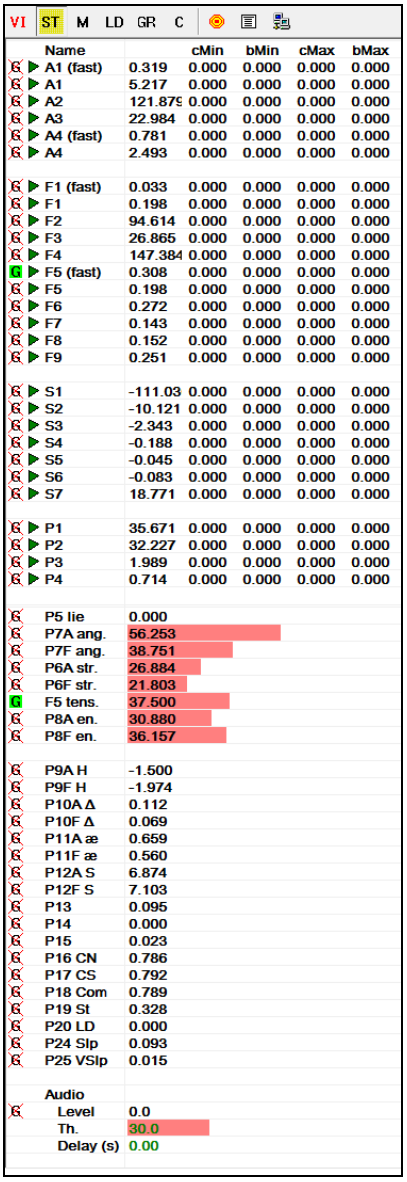
- For each parameter displays the following graphic values:

  G — Green (G) shows parameters indicated as graphs

  G — Does not show graph parameter in image area

  ▶ — Value of parameter considered for level of lie calculation

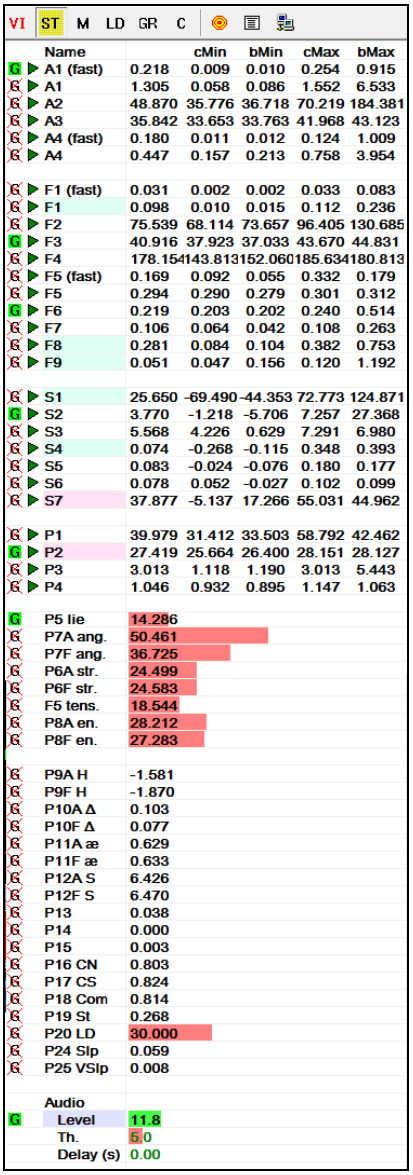
  ■ — Value of parameter doesn't considered for level of lie calculation



VI ST M LD GR C

	Name		cMin	bMin	cMax	bMax
G	A1 (fast)	0.319	0.000	0.000	0.000	0.000
G	A1	5.217	0.000	0.000	0.000	0.000
G	A2	121.879	0.000	0.000	0.000	0.000
G	A3	22.984	0.000	0.000	0.000	0.000
G	A4 (fast)	0.781	0.000	0.000	0.000	0.000
G	A4	2.493	0.000	0.000	0.000	0.000
G	F1 (fast)	0.033	0.000	0.000	0.000	0.000
G	F1	0.198	0.000	0.000	0.000	0.000
G	F2	94.614	0.000	0.000	0.000	0.000
G	F3	26.865	0.000	0.000	0.000	0.000
G	F4	147.384	0.000	0.000	0.000	0.000
G	F5 (fast)	0.308	0.000	0.000	0.000	0.000
G	F5	0.198	0.000	0.000	0.000	0.000
G	F6	0.272	0.000	0.000	0.000	0.000
G	F7	0.143	0.000	0.000	0.000	0.000
G	F8	0.152	0.000	0.000	0.000	0.000
G	F9	0.251	0.000	0.000	0.000	0.000
G	S1	-111.03	0.000	0.000	0.000	0.000
G	S2	-10.121	0.000	0.000	0.000	0.000
G	S3	-2.343	0.000	0.000	0.000	0.000
G	S4	-0.188	0.000	0.000	0.000	0.000
G	S5	-0.045	0.000	0.000	0.000	0.000
G	S6	-0.083	0.000	0.000	0.000	0.000
G	S7	18.771	0.000	0.000	0.000	0.000
G	P1	35.671	0.000	0.000	0.000	0.000
G	P2	32.227	0.000	0.000	0.000	0.000
G	P3	1.989	0.000	0.000	0.000	0.000
G	P4	0.714	0.000	0.000	0.000	0.000
G	P5 lie	0.000				
G	P7A ang.	56.253				
G	P7F ang.	38.751				
G	P6A str.	26.884				
G	P6F str.	21.803				
G	F5 tens.	37.500				
G	P8A en.	30.880				
G	P8F en.	36.157				
G	P9A H	-1.500				
G	P9F H	-1.974				
G	P10A Δ	0.112				
G	P10F Δ	0.069				
G	P11A æ	0.659				
G	P11F æ	0.560				
G	P12A S	6.874				
G	P12F S	7.103				
G	P13	0.095				
G	P14	0.000				
G	P15	0.023				
G	P16 CN	0.786				
G	P17 CS	0.792				
G	P18 Com	0.789				
G	P19 St	0.328				
G	P20 LD	0.000				
G	P24 Slp	0.093				
G	P25 VSlp	0.015				
	Audio					
G	Level	0.0				
	Th.	30.0				
	Delay (s)	0.00				

a) LD mode is off



VI ST M LD GR C

	Name		cMin	bMin	cMax	bMax
G	A1 (fast)	0.218	0.009	0.010	0.254	0.915
G	A1	1.305	0.058	0.086	1.552	6.533
G	A2	48.870	35.776	36.718	70.219	184.381
G	A3	35.842	33.653	33.763	41.968	43.123
G	A4 (fast)	0.180	0.011	0.012	0.124	1.009
G	A4	0.447	0.157	0.213	0.758	3.954
G	F1 (fast)	0.031	0.002	0.002	0.033	0.083
G	F1	0.098	0.010	0.015	0.112	0.236
G	F2	75.539	68.114	73.657	96.405	130.685
G	F3	40.916	37.923	37.033	43.670	44.831
G	F4	178.154	143.813	152.060	185.634	180.813
G	F5 (fast)	0.169	0.092	0.055	0.332	0.179
G	F5	0.294	0.290	0.279	0.301	0.312
G	F6	0.219	0.203	0.202	0.240	0.514
G	F7	0.106	0.064	0.042	0.108	0.263
G	F8	0.281	0.084	0.104	0.382	0.753
G	F9	0.051	0.047	0.156	0.120	1.192
G	S1	25.650	-69.490	-44.353	72.773	124.871
G	S2	3.770	-1.218	-5.706	7.257	27.368
G	S3	5.568	4.226	0.629	7.291	6.980
G	S4	0.074	-0.268	-0.115	0.348	0.393
G	S5	0.083	-0.024	-0.076	0.180	0.177
G	S6	0.078	0.052	-0.027	0.102	0.099
G	S7	37.877	-5.137	17.266	55.031	44.962
G	P1	39.979	31.412	33.503	58.792	42.462
G	P2	27.419	25.664	26.400	28.151	28.127
G	P3	3.013	1.118	1.190	3.013	5.443
G	P4	1.046	0.932	0.895	1.147	1.063
G	P5 lie	14.286				
G	P7A ang.	50.461				
G	P7F ang.	36.725				
G	P6A str.	24.499				
G	P6F str.	24.583				
G	F5 tens.	18.544				
G	P8A en.	28.212				
G	P8F en.	27.283				
G	P9A H	-1.581				
G	P9F H	-1.870				
G	P10A Δ	0.103				
G	P10F Δ	0.077				
G	P11A æ	0.629				
G	P11F æ	0.633				
G	P12A S	6.426				
G	P12F S	6.470				
G	P13	0.038				
G	P14	0.000				
G	P15	0.003				
G	P16 CN	0.803				
G	P17 CS	0.824				
G	P18 Com	0.814				
G	P19 St	0.268				
G	P20 LD	30.000				
G	P24 Slp	0.059				
G	P25 VSlp	0.008				
	Audio					
G	Level	11.8				
	Th.	5.0				
	Delay (s)	0.00				

b) LD mode is on

Fig. 3.59. Information panel in the ST mode.

The group of parameters **A1-A4** registers amplitude of vibrations:

A1 – Frame difference between two consecutive frames

A2 – Frame difference accumulated in 10 consecutive frames

A3 – Frame difference accumulated in N consecutive frames

A4 – Value of parameter A1 filtered on 10 frames

The group of parameters **F1-F9** registers frequency of vibrations (amount of changing points):

F1 – Calculated value of changed signal pixels amount in 2 consecutive frames

F2 – Averaged value of changed signal pixels amount in 10 consecutive frames

F3 – Average value of elements quantity which have changed for the period of N frames

F4 – Changed pixels maximum frequency during N processed frames

F5 – Ratio of «high» frequency density to «low» frequency for parameter F1. Characterized tension parameter.

F5 – current tension level (%)

F6 - Average value of the F1 parameter period (in seconds), determined during readout F6N. Value of parameter F6N is set in section [Filters] an information column in a mode  and defines quantity of the frame processed in Fast Processing mode

F6 - Inhibition parameter

F7 - Root-mean-square deviation for F6 parameter

F8 - Not average (current) value of F6 parameter (in seconds), showing the current time period of F1 parameter changing

F9 - Neuroticism parameter

The group of parameters S1-S7 registers symmetry of vibrations between left and right parts of person body:

S1 – Ratio (symmetry) of amplitude left to the right changed pixels inside the object in 2 consecutive frames

S2 – Difference between the left and right average amplitude of object vibration in 10 frames

S3 – Difference between the left and right average amplitude of object vibration in N frames

S4 – Ratio of the changed pixels quantity in the left part of object to the changed pixels in the right part in 2 consecutive frames

S5 – Ratio of the changed pixels quantity in the left object part to the changed pixels quantity in the right object part calculated in 10 frames

S6 – Ratio of the changed pixels quantity in the left object part to the changed pixels quantity in the right object part calculated in N frames

S7 – Difference between the maximal frequency of vibrations of the left and right object parts in N frames

The group of parameters **P1-P20** registers features of mathematical Processing of vibrations:

P1 – Dispersion of vibration density for frequency distribution at 10 processing frames

P2 – Dispersion of vibration density for frequency distribution at N processing frames

P3 – Center density distribution displacement of frequency at 10 processing frames

P4 – Center density distribution displacement of frequency at N processing frames

P5 – Level of lie

P6 – Level of stress. P6A – calculation of parameter is executed on vibration amplitude, P6F – on vibration frequency.

P7 – Level of anger. P7A – calculation of parameter is executed on points vibration amplitude, P7F – on points vibration frequency.

P8 – Level of energetic. P8A – calculation of parameter is executed on points vibration amplitude, P8F – on points vibration frequency.

P9 – Level of information entropy (on base of Shannon theory). P9A – calculation of parameter is executed on points vibration amplitude, P9F – on points vibration frequency.

P10 – Entropy index. P10A – calculation of parameter is executed on points vibration amplitude, P10F – on points vibration frequency.

P11 - Antikurtosis (æ). Information theory parameter characterized density distribution form.

P12 – Level of classic thermodynamics entropy (on base of Helmholtz theory). P12A – calculation of parameter is executed on points vibration amplitude, P12F – on points vibration frequency.

P13 - Characterizes shift of the histogram in the right part (high frequencies). Thus, parameters define color of active vibraimage pointer. Vibraimage pointer is active if its brightness move than «Level L» value.

P14 - Control parameter. Define relation between area of active vibraimage pointer for install threshold of active vibraimage pointer («Level S» parameters). Thus if the number of active points grows, than the parameter value increases and danger level also increases.

P15 - Control parameter. Define relation between area of active vibraimage pointer for full frame square. Vibraimage pointer is active if its brightness move than «Level L» value.

P16 - Compatibility for 2 person. Calculated on frequency histogram analysis (concurrence with normal distribution) (fig. 3.60, 3.61)

P17 - Compatibility for 2 person. Calculated on aura symmetry analysis.

P18 - Average compatibility

P19 - Suspect level

P20 - Quantity indicator of a degree of change psycho physiology parameters in view of various factors of the measured parameters importance since the part of parameters is accelerated, and others are slowed down during one reaction.

P21 - Parameter «**Health**» (Health level for general oncology);

P22 - Parameter «**Health**» (Health level for prostate oncology);

P23 - the average of the «**Health**» (Mean value of health level);

P24 - Parameter «**Sleepiness**» is normalized value of the P17 to the parameter F3;

P25 - characterizes a sleepiness state of a person on variability of parameter P17.

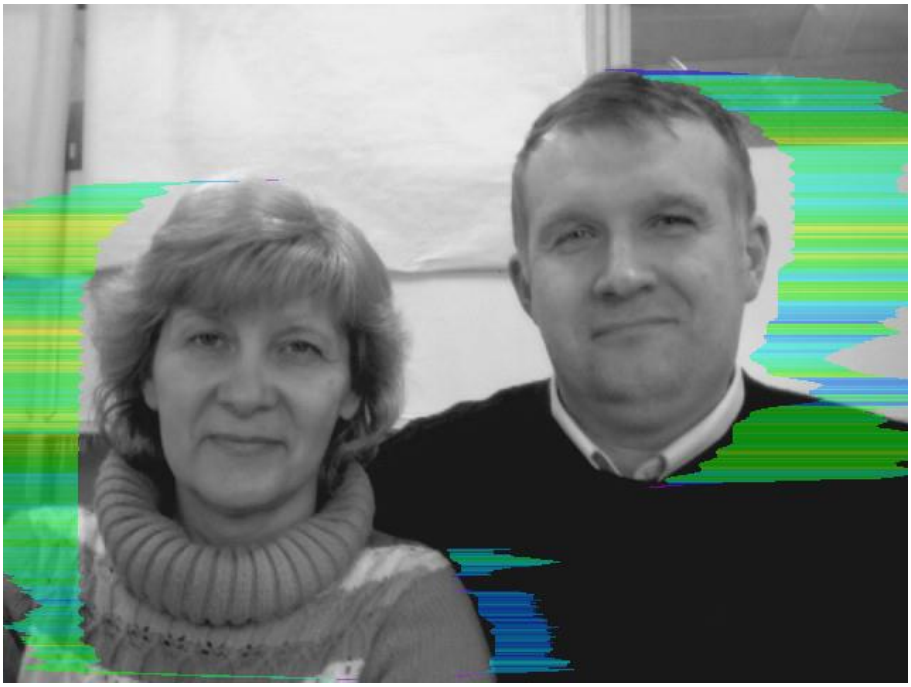


Fig. 3.60. Correct position of people at check of compatibility.

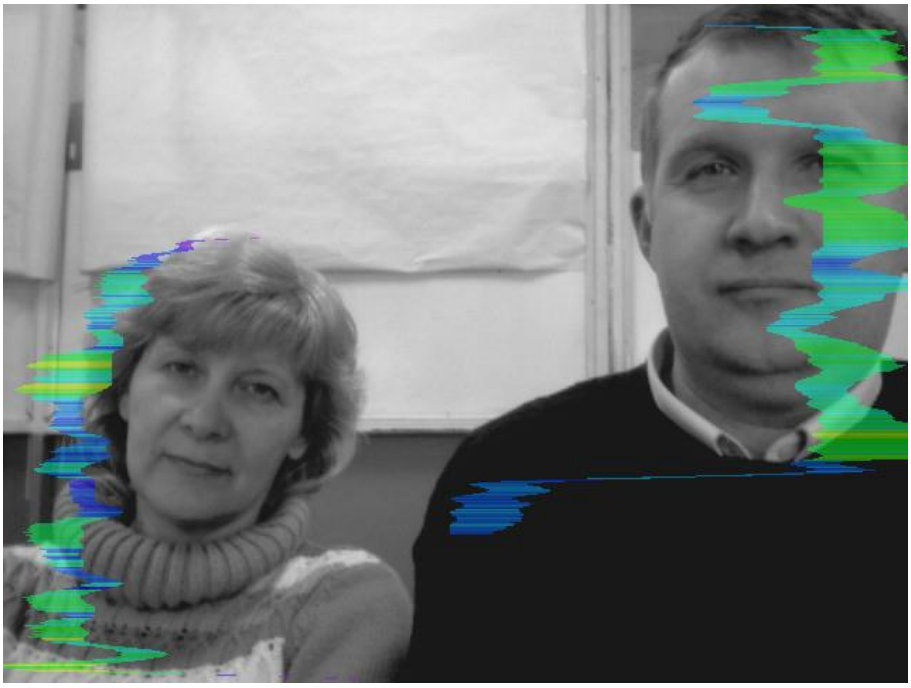


Fig. 3.61. Incorrect position of people at check of compatibility.

3.5.3. M table

In a mode  an information column (fig. 3.62) allows controlling average for the period parameter's values of psycho-emotional person conditions and their deviation from the established norm. The basic applicability of the given mode is use of vibraimage system for medical diagnostics and psychological researches.

Value of the averaging period is set in seconds in a field **«Duration»**. Start of the beginning of information accumulation is made by a choice of item «**Measurement**» the menu «**Action**» or pressing of the toolbar button  . After start of an accumulation and averaging mode in the top of information column there is a running line «**Progress**», displaying a course of data accumulation process.

M table (fig. 3.62) shows the following information:

- Current values of based processed VibraImage parameters A1-A4, F1-F8, S1-S7, P1-P19;
- Current values of fast processing VibraImage parameters A1 fast, A4 fast, F1 fast, F5 fast;
- Speed of input frame from the camera [«FPS_in»], speed of frame processing for a base processing mode [«FPS_BP»] and speed of frame processing for a fast processing mode [«FPS_FP»];
- Basic parameters describing psycho-emotional condition of the person: Aggression, Stress, Tension/Anxiety, Suspect, Balance, Charm, Energy, Self regulation, Inhibition, Neuroticism.

M table columns meaning:

V - The value of the parameter average for the set period

S - root-mean-square deviation of parameter

cMin - The minimal value of parameter for the period

cMax - The maximal value of parameter for the period

NMin - The minimal value of parameter for a normal condition of the person

NMax - The maximal value of parameter for a normal condition of the person

Note

Values of cMin, cMax parameter, are displayed only when measurement mode «**M**» has been began and the information for the specified period of time is saved up.

VI ST M LD GR C

*VIDEO:Look 1320 V2							
Duration (s)	60						
Name		S	Vi	N Min	cMin	N Max	cMax
Fps in	29.278	1.579	5.4	25.000	18.668	30.000	30.025
FPS FP	29.058	1.579	5.4	25.000	18.528	30.000	29.990
FPS BP	4.932	0.040	0.8	4.700	4.808	5.300	5.062
N	100						
Aggression (P7)	18.3	18.155	99.0	20.000	0.586	50.000	50.791
Stress (P6)	16.7	11.350	67.9	20.000	0.000	40.000	58.310
Tension/Anxiety (F5X)	43.2	11.448	26.5	15.000	8.627	40.000	54.954
Suspect (P19)	28.0	7.201	25.7	20.000	10.455	50.000	36.745
Balance (P16)	73.3	15.226	20.8	50.000	0.000	100.000	97.168
Charm (P17)	78.6	37.052	47.1	40.000	0.000	100.000	96.197
Energy (P8)	16.8	11.880	70.6	10.000	0.850	50.000	31.619
Self regulation (P18)	72.0	17.336	24.1	50.000	0.000	100.000	91.320
Inhibition (F6)	13.9	4.302	30.9	10.000	10.829	25.000	31.687
Neuroticism (F9)	43.0	10.072	23.4	10.000	0.000	50.000	45.558
Health (P21)	0.703						
Health' (P22)	1.317						
ΣVi (P23)	43.602						
Extraversion (P26)	0.920						
Stability (P27)	0.786						
A1 (fast)	0.002	5.522	319103.0	0.000	0.001	0.000	100.931
A1	0.002	15.878	908581.2	0.000	0.001	0.000	177.638
A2	8.581	183.705	2140.8	0.000	0.000	0.000	838.556
A3	15.169	40.184	264.9	0.000	0.000	0.000	102.168
A4 (fast)	0.002	4.450	289144.2	0.000	0.001	0.000	36.413
A4	0.002	11.033	728909.3	0.000	0.001	0.000	47.082
F1 (fast)	0.000	0.117	50312.0	0.000	0.000	0.000	1.000
F1	0.000	0.184	79254.9	0.000	0.000	0.000	0.989

Fig. 3.62. «M» mode of information table.

Note, after ending of the information accumulation some lines of an information column can be allocated by color:

- - parameters, which values less than the set limits are allocated.
- - parameters, which values more than the set limits are allocated.

Note, in fig. 3.62 frequency of input frame from the camera «FPS_in» less than the set limits and is allocated by color. For correct diagnostics psycho-emotion conditions of the person speed of data input from the camera should be within the limits of 25-30 frame/second.

3.5.4. LD table.

LD table LD (fig. 3.63) shows the following information:

- Current values and LD rates of based processed VibraImage parameters A1-A4, F1-F8, S1-S7, P1-P19;
- Current values and LD rates of fast processing VibraImage parameters A1 fast, A4 fast, F1 fast, F5 fast.

LD table columns meaning:

V -	Current value of parameter
«Calc»	Yes- LD detection on, No-LD detection off
R1 (Rate1)	«Weight» of parameter if its current value became more than the set base maximum bMax **OR** became less than the set base minimum bMin.
R2 (Rate2)	«Weight» of parameter if its current value became more than the set base maximum bMax **AND** became less than the set base minimum bMin.
R2V, R1V	Visualization – use in P5 parameter calculation
R2C, R1C	Calculation – use in P20 parameter calculation
Level	In % determines on how many value of parameter should exceed the set limits that the system «considered» this change.

LD parameters graphic value shows:

- Value of parameter is considered for LD detection
- Value of parameter doesn't considered for LD detection

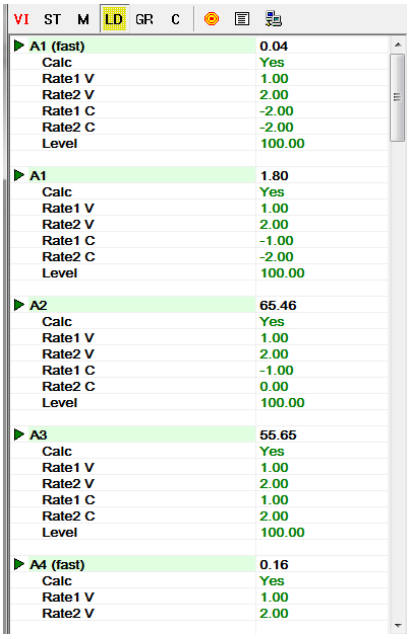


Fig. 3.63. LD mode of information panel.

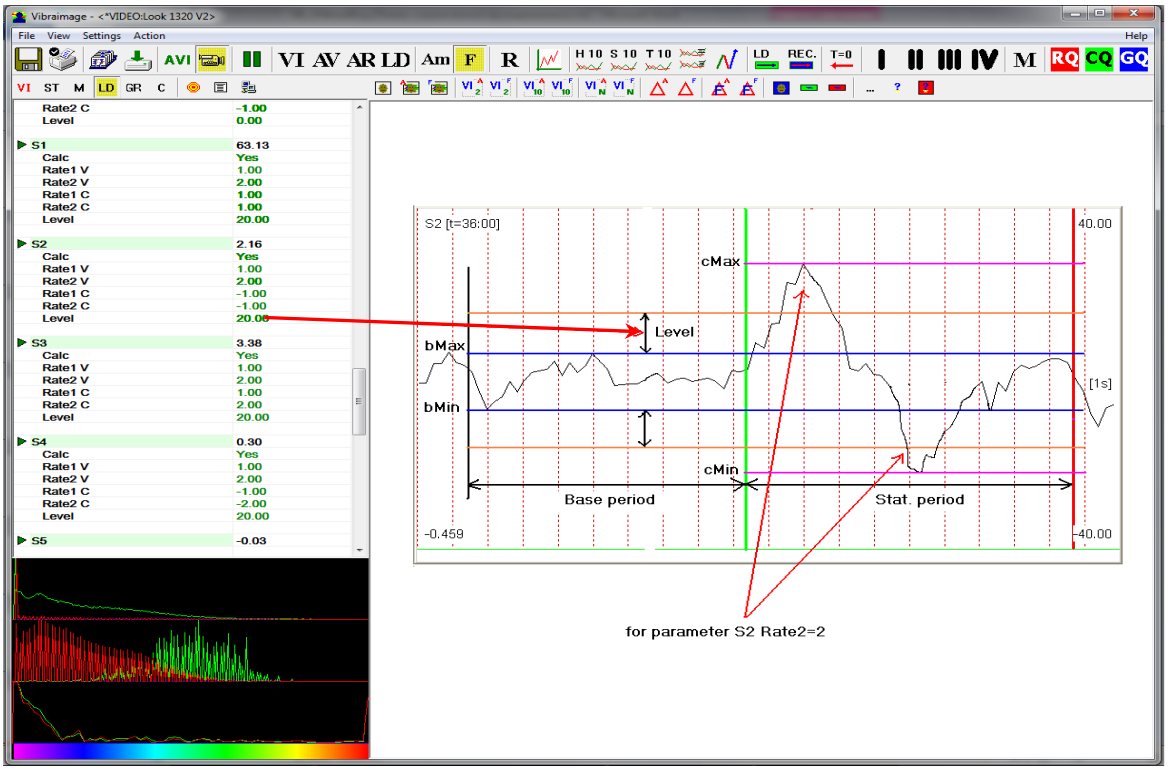


Fig. 3.64. Explanation of the parameters R1, R2.

3.5.5. GR table

GR table 

(fig. 3.65) displays the following information:

- VibraImage parameters A1-A4, F1-F8, S1-S7, P1-P19;
- Total frame difference accumulation (without filters)for 2, 10 and N the frames (Integrated Parameters);
- VibraImage parameters, with maximum frames frequencyA1 fast, A4 fast, F1 fast, F5 fast;
- Test signal: sin(2*Pi*nt);
- Audio level for last seconds and audio level (25 fps) for 1/25 seconds;
- VibraImage parameters X1-X5 which calculation is set by the user.

GR table columns meaning:

V –	Current value of parameter
Show	Show graph-Yes, delete graph- No
Diff. mode	Choice of this mode-YES, graph will show difference between current value of parameter and its average level for Diff time. Choice of this mode-NO, graph will show current value of parameter
gMin –	Defines the minimal value of parameter shown on the screen
gMax –	Defines the maximum value of parameter shown on the screen
HF.flt.%	The filter of high frequencies on Battervort. Frequency of a cut is set in % from entering graph frequency.
LF.flt.%	The filter of low frequencies on Battervort. Frequency of a cut is set in % from entering graph frequency.

- **GR table graphs color marks indication:**

G	Graph shows in image area. For convenience of observing a line of parameter will be marked by rose color (fig. 3.65)
G	Graphs doesn't show in image area

H Selected parameter displays in down spectrum histogram by green graph (fig. 3.65)

H Selected parameter displays in down spectrum histogram by red graph (fig. 3.65)

H H Parameter doesn't displayed by graphs

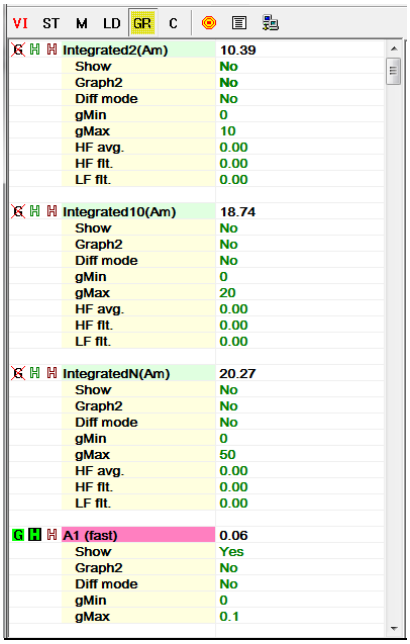


Fig. 3.65. Information panel in the mode «GR».

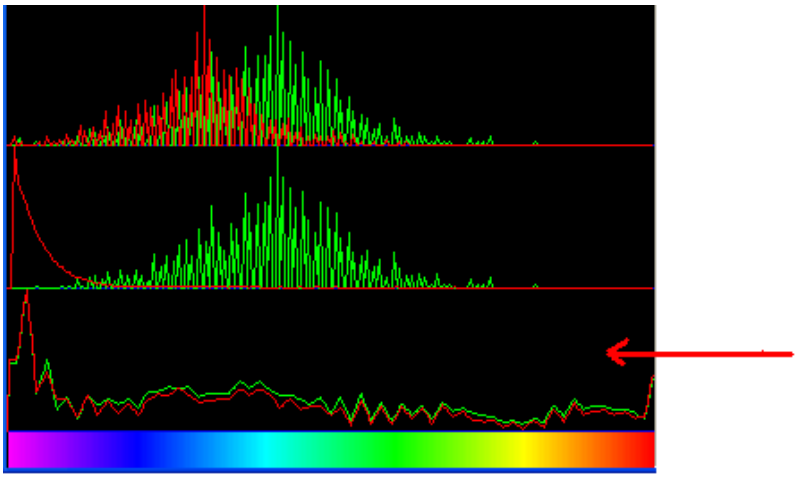


Fig. 3.66. Graph example.

3.5.6. C table.

Information table C (fig. 3.67) allows setting the mode «**Corelation**» and displays the following information:

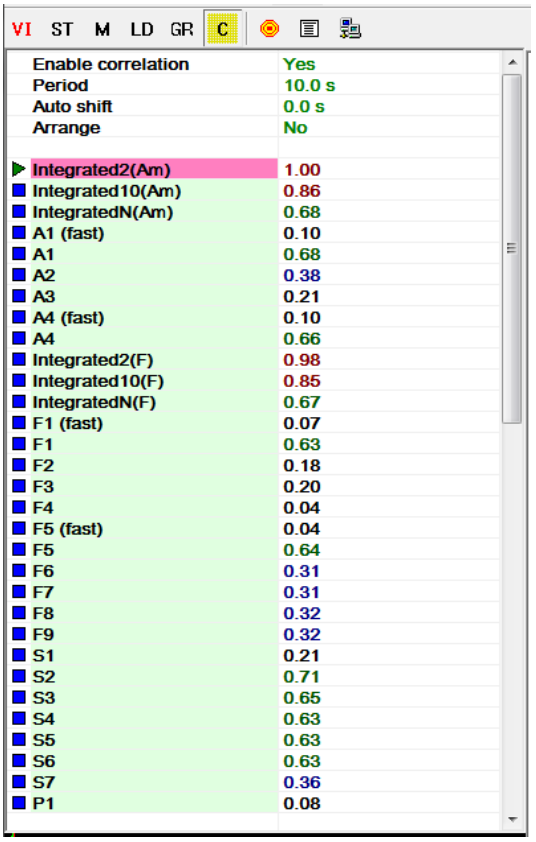


*Fig. 3.67. Information panel in the mode «**C**».*

- «Enable correlation» defines the working mode or not «C»;

- «Period» defines what period occurs correlation parameters;

- «Auto shift" determines defines the maximum shift in time not influencing correlation coefficient;

- «Sort» allows you to rank display parameters of the maximum current value of the correlation coefficient to a minimum;

- total intensity fluctuation amplitudes points across the frame accumulated over 2, 10 and N frames: Integrated2 (Am), Integrated10 (Am), IntegratedN (Am);

- parameters vibraimage A1-A4, F1-F9, S1-S7, P1-P25;

• vibraimage parameters, the calculation of which is made with higher separately specified frame rate A1 fast, A4 fast, F1 fast, F5 fast;

• total intensity of vibration frequency points across the frame accumulated over 2, 10 and N frames: Integrated2 (f), Integrated10 (f), IntegratedN (f);

• test signal sin (2π * nt);

• correlation parameters C1-C3;

• «Sound" in the last seconds and "sound level (25k / s)" for the 1/25 second;

• parameters vibraimage X1-X5, which calculation formula specified by the user;

• For each parameter value displays the following graphic:

▶ The parameter value undertakes for 1 in case of correlation, that is to it compare other parameters

■ The parameter value doesn't undertake for 1 in case of correlation, that is to it is compared with other parameters

Correlation of parameters between them is considered by the method of Pearson.

3.5.7 Information table

Information table  (fig. 3.74) allows adjusting vibraimage parameters and displays the following information:

Frame Rate Settings	
Fast processing	Frequency (fps) for processing «fast» parameters of vibraimage, noted by a word «fast»
Base processing	Frequency (fps) for processing «base» parameters of vibraimage, noted by a word «base»
FPS proc.period	Frequency of the frames (fps) during calculation period
Downrate	Reduce input frame rate. At value 3, will be processed every third frame.
	Main settings
N(2)	Minimum number of accumulated frames. By default, 2

N(10)	Average number of accumulated frames. By default, 10
N	Maximum number of accumulated frames. By default, 100
K	Gain factor.
L	Threshold of a palette. Defines a threshold of displayed image, value of less brightness considers as «black»
Parallelization	Parallel number of processing in multi core systems. Default 0- for Core 2 Duo
Filters	
Single points	Removes single points, surrounded by black
Extended	It is intended for reduction of noise of a video camera. Delete video noise in bit. By default, 8. This filter is important, when the object is motionless, and values changed because of camera noise.
Extended (fast)	Delete video noise for fast processing.
Stretch	Scale normalization filter to a range 0-255 after its «trimming» by filter **Extended**
Max speed contour	At the included mode, calculation fast parameters are made only inside of aura contour, at switched off - on the whole frame.
Am scale	Multiplication factor used for vibraimage visualization in a «amplitude» mode
Space	Reduce vibraimage on borders of motionless contrast objects. Frame difference ***D (x, y)*** is multiplied by the factor K $$K = (1\ (SV*MB)/100);$$ where SV - parameter of the filter, MB - the maximal difference between levels of brightness of a point (x, y) and the next points in the initial image **Note** Switching off filters accelerate the computer functionality. Advanced user could switch filters from default settings. **Attention**, switching-off below parameters calculation could automatically stop calculation and sets of other characteristics which used values of the switched off parameter.
Color image	No – Black and white real image in image area. Yes – color image in image area.

Crop X, Crop Y	If real image size more than 640x480 pixels, than will be use only 640x480 pixels from centre part of image.
F6 HF	Sets in % frequency of a cut for the filter of high frequencies at processing F1_fast parameter.
F6 LF	Sets in % frequency of a cut for the filter of low frequencies at processing F1_fast parameter.
F6 N	Number of averaging frame at calculation of F6 parameter
FPS filter	It is used for exact synchronization with a binding to the concrete frame at work with Avi files. Frequency of the input frame from the camera divided on set Base processing frequency and for processing will undertake each N frame.
E-Monster	Switch to the E-monster mode. The program opens the person face deformed by latent emotions though externally he can constrain these emotions. If the emotional condition of the person is like to normal, then the the program image is like to real video. Accordingly, than more emotions overflows the person, then more especially deformed his image in Monsters Detector mode (E-Monster).

Fig. 3.68. Face in E-monster mode

Auto downrate	Automatic calculation of **Downrate** parameter is made in view of frequency of the input frames, Base processing frequency and computing capacity of a computer.
Fixed contour	In this mode vibra-aura around the human contour will be built around a fixed path, and not to repeat the contours of the body.

Suspicious thresholds Ag, St, Tn	Suspicious level in the Aggression parameters (Ag), "Stress" (St), "Tension" (Tn) is set. When exceeding level of danger the system gives out a sound signal and fixes a frame. **Note:** Canceling of parameter calculation is use for increase calculation speed of other parameters.
Disable Am	Canceling of points fluctuation amplitudes calculation
Disable F	Canceling of points fluctuation frequencies calculation
Disable 2x(fast)	Canceling of 2 frames parameters fast calculation
Disable VI(10)	Canceling of 10 frames parameters calculation
Disable VI(2)	Canceling of 2 frames parameters calculation
Disable FFT	Canceling of Fast Fourier Transformation frequency processing
Disable Entropy	Canceling of Entropy processing
Disable Audio	
Motion detection	
Motion detector	**Filter of movement**. Delete emotion calculation for object with motion amount less than threshold
Level	Threshold level of Integrated10 for emotion calculation.
Auto reset	Reset emotion calculation for macro movement
Skip frames	Skip frames with the frame difference more than threshold.
Graphs global	
Periods	Graphs visualized period (in seconds) on the screen
Diff.time	Time (in seconds) for calculation of an average level parameter values
Histogram (s)	In the field of a graph the frequency histogram of parameter change will be displayed in addition (fig. 3.69). At value 0 - the histogram in graph area is not displayed
Hist. C smooth	Time (in seconds) for upper histograms accumulation (top graph on fig. 3.70)
Hist. H smooth	Time (in seconds) for middle histograms accumulation
Hist. S smooth	Time (in seconds) for down histograms (spectrums) accumulation fig. 3.70
Hist. A	Reserved for future use

HC function	Define histogram calculate mode in two top fields of a histograms window (fig. 3.70). The user can compare the frequency distribution of vibraimage to one of base distribution laws. 0 – Work mode, histogram calculate on base of real video image analysis. 1- displayed EXP law of distributions. 2- the normal law of distributions. 3 - the uniform law of distribution. 4 - single peaks. 5 - SIN signal.
Sin(t*2*pi*n)	Factor «n» defining period of Sin graph generated

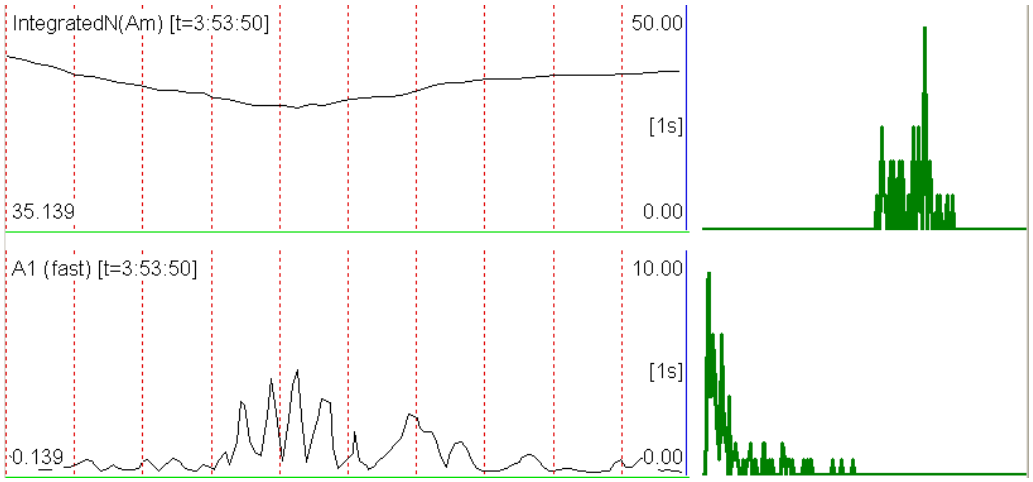


Fig. 3.69. Graph and histogram mode.

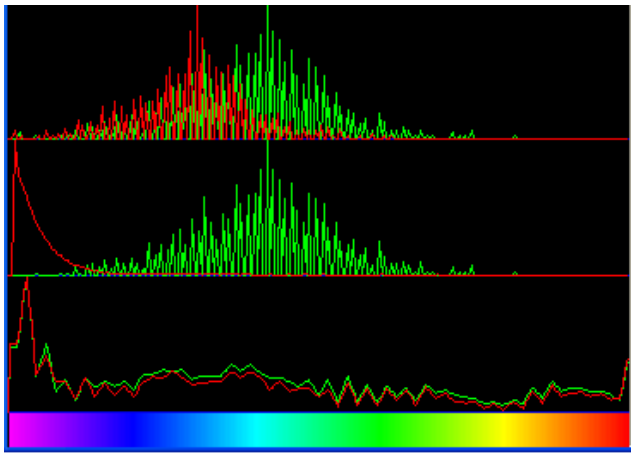


Fig. 3.70. Histogram window.

Lie detection

Enable	Enable LD mode.
Stat periods	Time period of normal person condition before LD testing
Compare periods	If the user has not executed start of «accumulation» of the information during the period of comparison, than after beginning of a lie detection mode the system as «the period of comparison» will use the information saved up for the specified number of seconds directly till of the moment of lie detection beginning.
Lie threshold	Threshold (in %) for the detection of lie level in view of every calculated parameters and their «weights»
Audio sens. (s)	After the ending of answer the system continues to expect «lie» calculation during the specified time interval.
Opposite mode	Alternative method of lie level calculation.
LD mode:	Selection of mode for lie detection
audio	Calculation of lie level starts when the level of entrance audio signal exceeds the established threshold. LD calculation stops, when the level of audio signal becomes less than the established threshold
manual	Accumulation of the information is made in time Base periods. Calculation of lie level is made only after pressing button «Start»  , end of processing - after pressing button «Reset»
auto	Calculation of a lie level works constantly, current values of parameters are compared to values processed for previous Stat period
Compare	**Off** - at the analysis of lie, as test, the interval «Stat periods» directly till the moment of started lie detection is used. **On** - at the analysis of lie, as test, the interval «Stat periods» which has been marked by the user beforehand is used. When the user includes accumulation the preliminary information, in this field value **«Capture»**

AVG filter

Anger	Number of frames for aggression level averaging
Stress	Number of frames for stress level averaging

Tension	Number of frames for tension level averaging
Suspicious	Number of frames for suspect level averaging

Macro mode

Macro mode	Define on base of which formula danger level calculated. NO – danger level calculated on base of Anger, Stress and Tension levels. YES - danger level calculated on base of P13, P14 and P15 parameters values.
Level L	Threshold of a palette for danger calculation only (not for displayed image. threshold of displayed image define parameter L). Value of less brightness considers as «black» and not used in danger calculation.
Level S	Threshold of a area (in % from full frame square). Defines area of «active brightness» pixels. If area of pixels (in %) , which brightness more than «Level L» value, less than «Level S» value, than danger parameters in Status window equal 0.
Aura mode	Reserved for future use

Face detection

Face detection	Yes- face detection mode is used. No – without face detection
Detection quality	Quality of face capture. 1 – capture one large person face in the frame (loading of the processor is minimal), 4 - search of all (even small) persons face in the frame (loading of the processor is maximal).
Min size	Sets in pixels the size of rectangle for search of persons
Max size	
Config	The program gives the user an opportunity of loading the new algorithms of person search. In the given line the path to a file of new search algorithm is displayed. In more detail procedure of loading of new algorithm is described in section 6.2 " Macro Mode»
Draw	No – not draw rectangle around face, Yes – draw rectangle around more danger single person, All – draw rectangle for all person in frame. For non-danger person rectangle draw green color, but if person suspect level more than «Critical level», than rectangle draw red color.

Quality test	Auto checking function quality of vibraimage. No – auto checking function switched off. Yes – auto checking function switched on. There is a scale of the quality of the video on the right side of the program window. Error message appear in the upper left corner of the image area.

Alerts

Critical level	Stands critical level of emotion parameters for alarm signals
Auto capture image	At excess of the set level psycho-emotion danger in the specified catalogue will automatically saved BMP files of the «dangerous» person from display screen. Record will be made 1 time for the specified quantity of seconds.
Show N image	At work in Macro mode in «Video window» will be consistently displayed N images of «dangerous» objects, for example, if for the specified interval of time has passed some «suspicious» objects.
Sound (Susp)	Defines, the sound signal will be used at work in network monitoring mode whether or not.
Sound (A), Sound (S), Sound (T)	Level for sound of a audio signal at excess of aggression, stress or suspect levels the setting limits.
Maker's beep	On/Off maker's beep in LD mode
Reset beep	On/Off reset sound beep.
X1-X5	In version VibraImage 8.0 the user can form itself formulas for calculation of new parameters of vibraimage, using any parameters on GR item. For example (fig. 3.71).

X1	(A1-A4)*P4/S5
X2	
X3	
X4	
X5	

Fig. 3.71 User's formula for parameter X1 calculation.

Vibra-sound

Disable std. sound	YES - VibraSound mode is switch on. NO - VibraSound mode is switched off, the sound acts either from a microphone or from a video file.
No sound	Off Audio modulation of vibration

CG, CR HG, HR SG, SR	If one of these items is chosen than VibraSound sound will be switch on and will be modulated by curves of signal change in one of frequency distribution windows (fig. 87). Letters C, H, S define, from what window the signal for «sound» will be used: C - the first window, H - the second, S - the third. Letters G and R – show what color of graph will define «modulation» of a sound: G-green color, R - red color.
CG	Audio modulation of vibration used green upper histogram (frequency vibraimage)
CR	Audio modulation of vibration used red upper histogram (amplitude vibraimage)
HG	Audio modulation of vibration used green middle histogram (frequency aura)
HR	Audio modulation of vibration used red middle histogram (amplitude aura)
SG	Audio modulation of vibration used green down histogram (selected signal spectrum)
SR	Audio modulation of vibration used red down histogram (selected signal spectrum)
VI device	Since VibraImage 7.2 version at installation of the software are simultaneously installed the driver of virtual videodevice «VIDeviceCapture». Use of this virtual videodevice allows to build vibraimage in any program using video signal from the camera, and to see reaction of the interlocutor, for example, at negotiations on Skype system. If to start program VibraImage, and to set in it «VI device = Yes» and to choose device VIDeviceCapture as a source of video signal in the standard program it is possible to see in a window of the standard program «real» vibraimage (fig. 81).
Indication	If in addition to set «Indication = Yes» in a window of the standard program it is possible to see the histogram of change of the basic emotional parameters of the person A - aggression, S - stress, T - tension, D - the general suspect level of emotional conditions (fig. 3.72).

Micro defaults	Switch on Micro mode. Use for single men mode.
Macro defaults	Switch on Macro mode. Use for multi men mode. Vibraimage on real image mode
LD defaults	Switch on Lie Detection mode. Use for reset users settings and load special settings for lie detection mode.

Fig. 3.72 The example, a choice of VIDeviceCapture device in program AmCap allows to see vibraimage.

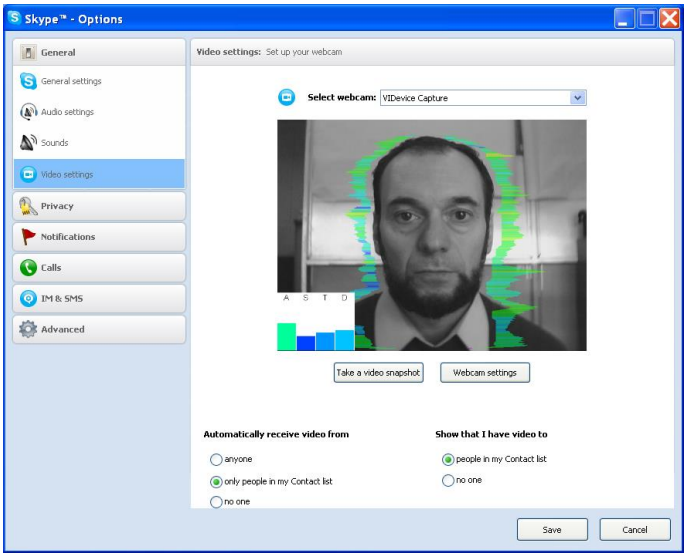


Fig. 3.73. An example, supervision of the interlocutor psycho emotional conditions through Skype program.

VI ST M LD GR C

Frame rate	
Fast processing	0.0
Base processing	5.0
FPS proc. period	2.00
Downrate	0
Main	
N(2)	2
N(10)	10
N	100
K	1.00
L	2.00
Parallelization	0
GPU processing	No
Apply global filter	No
Filters	
Single points	Yes
Extended	8
Extended (fast)	8
Stretch	No
Max speed contour	No
Am scale	16.00
Space	4.00
color image	No
crop X	0
crop Y	0
crop X pos	0
crop Y pos	0
F6 HF	0
F6 LF	10
F6 N	100
FPS filter	No
E-Monster	No
Auto downrate	No
Fixed contour	No
Stab. X	0
Stab. Y	0
State levels	
Ag	80.00
St	80.00
Tn	80.00
GV path	
disable Am	No
disable F	No
disable 2x(fast)	No
disable VI(10)	No
disable VI(2)	No
disable FFT	No
disable Entropy	No
disable Audio	Yes
Motion detector	No
level	0.10
auto reset	No
skip frames	20
Graph's global	
Period (s)	60.00
Diff time (s)	5.00
Hist time(s)	60
Hist. C smooth (s)	0.00
Hist. H smooth (s)	0.00
Hist. S smooth (s)	0.00
Hist A	Yes
HC. function	0
sin(t*2*pi*n)	1.00

Fig. 3.74 Middle part of Information table.

3.5.8. Data base (DB) table

DataBase  table (fig. 3.75) adjusts parameters of recorded video information and shows the following information:

- **DB folder** – Way to the database folder for written video files and files of statistics.
- **«Capture – max length(s)» –** Defines the maximal length (in seconds) for recorded video file. After file limit finished and closed, a new file creates.
- **«Capture – purge old files» –** Defines system action when the empty space on a hard disk will finish. «YES» – the oldest video files will be removed.
- **«Timer» -** The system can begin record at the appointed time.
- **«Save SRC» -** images of «dangerous» people will be written to separate BMP files.
- **«save face xml» -** Yes is the function of recording xml file with data about suspect face position on frame and suspect level.
- **«Save extra information», «save TXT», «save XML» -** define in what format the information on system settings and on system parameters change for the period of supervision will be saved.
- **«Save DTF»** customized information about pulse detection parameter
- **«Save LD» -** save in an external file the report of lie detector work and system settings.
- **«Save IMG+» -** save frame image plus external xml file with information about face position and suspect level
- **«Selected record» –** Data on current object of research.
- **«New record»: «Name», «Birth date», «Comments»** – The demographic information on object of research

- **«Set markers» -** it is used in a lie detection mode for set on graphs RQ and CQ markers. In fields **»RQ marker»** and **»CQ marker»** will be displayed time from the beginning of experiment (or from the beginning of a videofile) when these markers have been set.

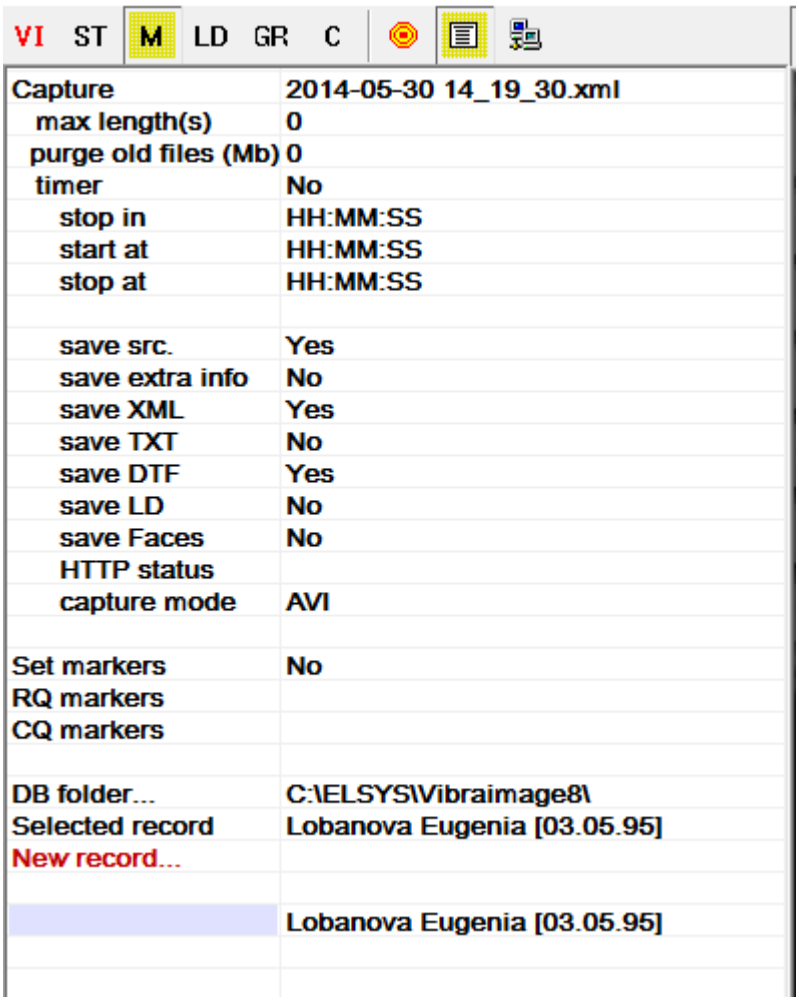


Fig. 3.75. DB table.

3.5.9. Network (NW) table.

Network (NW) table  information panel (fig. 3.76) adjusts network monitoring mode and shows the following information:

- **«Network service»** – sanction of information transfer to network between a computer on which program VibraImage.exe is started, and the terminal.
- **«Critical level» -** the Threshold psycho emotional conditions of the person at which excess on the removed terminal the warning message will be given and the picture of danger object (if parameter «Full video stream» = NO) is sent or the video information (if parameter «Full video stream» = YES) will be transferred.
- **«Local TCP port» –** VibraImage.exe program interrogates the given port for data exchange with the terminal.

- **«Remote host» –** name of the removed terminal.
- **«Enable» –** sanction of work with the terminal. When system works with several terminals possible to forbid exchange with chosen terminal.
- **«IP» –** network address of terminal computer on which program VINetStatus.exe is started.
- **TCP port [«TCP port»], UDP port [«UDP port»] –** Ports for software of terminal, through which it changed by information with the computer, on which started program VibraImage.exe. Through UDP port goes an exchange by short messages. Through TCP port goes an issue video data.

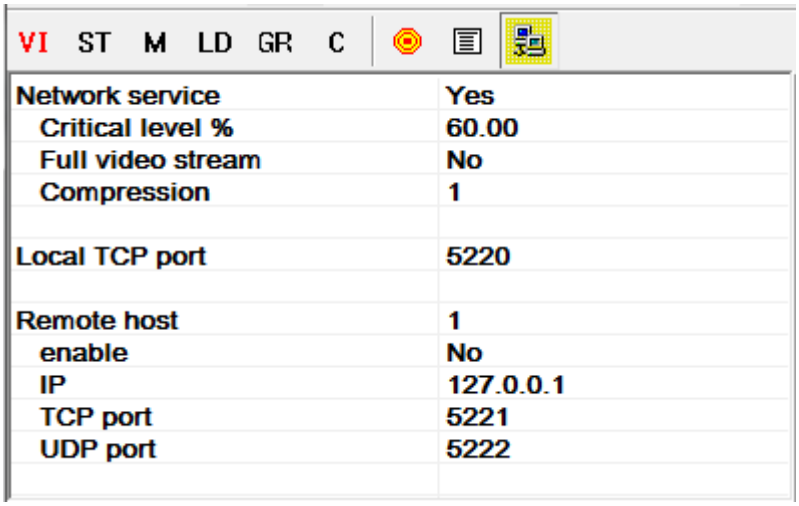


Fig. 3.76. Network table.

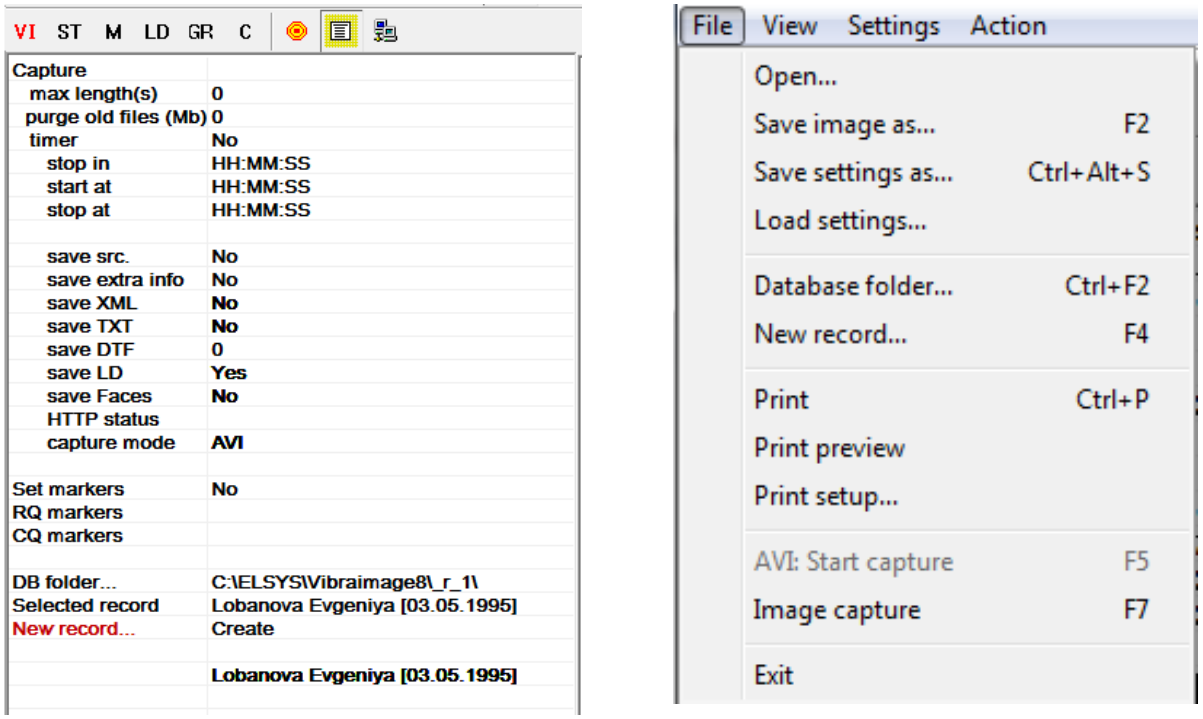
3.6. Save of measurements results

NOTE, the way to the catalogue of a archive database where video files, files of images and files of statistics will be save, is specified in a field **«DB folder»**. The list of objects, the information about which is in the specified catalogue displays as the list in the bottom of an information panel (fig. 3.77).

For choice of the catalogue where the video-file will be kept is intended a command **«Database folder...»** menu **«File»** or a line **«DB folder»** an information panel in DB table (fig. 3.77).

Input and save of the demographic data in a file db.info is carried out in information panel of DB table (fig. 3.77) at filling corresponding fields of **«New record»**: **«Name»], «Birth date»** and **«Comments».** After filling the demographic data in a field **«New record»** will appear an inscription **«Create»,** to save the data in archive, it is necessary to bring the mouse pointer and twice click the left button of a mouse.

Filling of field **«Selected record»** is made at choice of corresponding line in the list of a database.



a) *b)*

Fig. 3.77. a) Created database of persons b) menu File

3.6.1. Save of current images

Save of the current image in format BMP file is carried out with the help of a command **«Save image …»** menu **«File»** or  toolbar.

The structured store of observable images in format BMP files according to the entered demographic data is carried out with the help of a command **«Image capture …»** menu **«File»** or the corresponding button  of the toolbar. **NOTE,** in archive as separate BMP files will be written down images from all open windows in the field of supervision. For example (fig. 3.78), in the field of supervision 3 windows with processing image are open (SRC, $\mathbf{VI}_{10}^{A}$ and $\mathbf{VI}_{N}^{A}$) and in archive result 3 files of images will be kept:

- 2008-05-13 11_48_51_src_A.bmp
- 2008-05-13 11_48_51_vi1_A.bmp
- 2008-05-13 11_48_51_vin_A.bmp

NOTE

Simultaneously with the specified files of images in archive 3 more files in which settings of VibraImage system will be kept at the moment of removal images will be created:

- 2008-05-13 11_48_51_src_A.set
- 2008-05-13 11_48_51_vi1_A.set
- 2008-05-13 11_48_51_vin_A.set

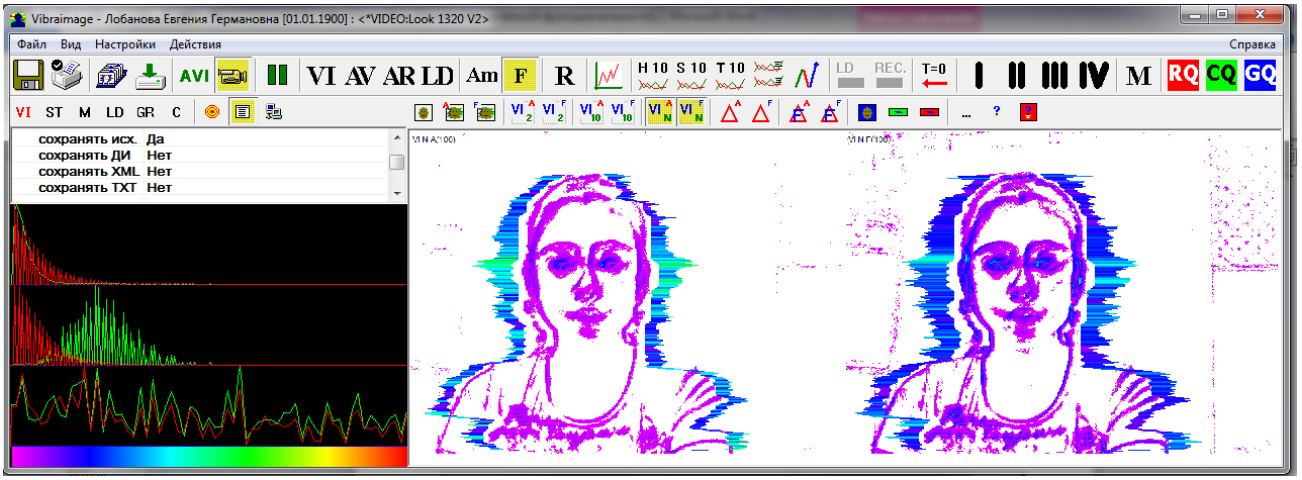


Fig. 3.78. Saving images in archive.

For viewing of saved data archive the special program the Print Module of VibraImage (VIPrinter.exe) is used.

3.6.2. Save of video file

Save of the current image which appears in the basic window, in format AVI file is carried out with the help of a command **«AVI: Start Capture»** menu **«File»**. The stop of record process of AVI-file is carried out on a command **«AVI: Stop Capture»** menu **«File»**. The same actions can be executed with the help of the corresponding button  of the toolbar (fig. 3.78).

Note, that in the specified catalogue will be written down 3 files:

- video file with expansion *.avi,
- file with the current adjustments of system with expansion *.set
- and, if it necessary, a file with the report of changes of parameters with expansion *.xml.

For increase of video files recording reliability designed the field **«Capture - max length (s)»** (records in seconds) (fig. 3.77). If record lasts over the specified interval current AVI the file will be closed and save on a disk, and record will be continued in a new file. At filling the whole disk if the switch **«Capture - purge old files»** record of new video-files will be made atop of old. The first «oldest» will leave by date of creation video-files.

The user can set time of the beginning and the ending of record (fields **«Timer»).**

If in the image area you have switch on some windows with video data (for example, open 2 window, fig. 3.78), submenu **«Settings - Capture channel»** allows to choose from what window video data will be saved in video file.

3.6.3. Save of results and settings files

VibraImage program allows saving in an external file, results of measurement and processing of integrated intensity of image pulsation for some time interval. Saving of values sequence for integrated vibraimage characteristics, received for the certain time, in a file of the report is carried out automatically at record of video file. The user can define type and a format of a file in which reports will be made (fig. 3.77):

- extension *.xml - viewing of file contents report is carried out by program Microsoft Excel;
- extension *.txt - an ordinary text file, which contains the same information, as in file XML, only in the other format of representation.

In a XML file are save changes in time of every parameter which numerical values can be observed in mode «**ST**», «**GR**» of the information panel.

Note, that save of parameters carries events character i.e. as soon as value of parameter is calculated by system, it save the name in a file, therefore, sequence of parameters records in a file is not fixed as some parameters demand more often calculation, than others.

In addition the user can save in file with extension *.set system settings at the moment of the beginning of information gathering.

In addition the user can save in an external file with extension *.xml system settings at the moment of the beginning of the information analization.

Item **«Save settings as** …**»** the menu «**File**» is intended for saving the current system settings to external XML file.

Item **«Load settings …»** is intended for loading before saving settings from external XML file.

Note, if in a DB information column (fig. 3.77) will be set item **«Save LD»** = Yes the system save in external separate TXT file with results of lie detector work. Look section «**LD mode**» in more detail.

3.7. Printing module

Printing module (VIPrinter.exe) is designed to print saved personal data and Images.

Main window of printing module (fig. 3.79) consists of the following parts:

- main menu;
- persons list;
- printing area;
- toolbar;
- status bar.

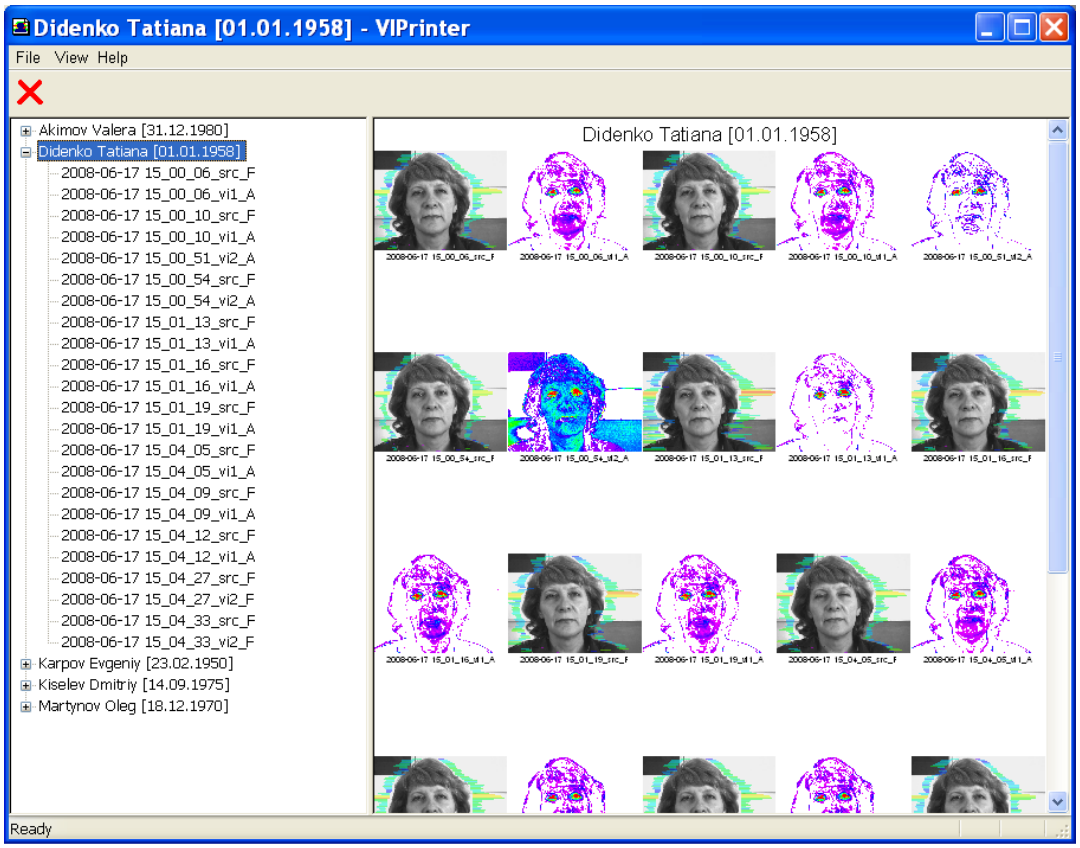


Fig. 3.79. Main window of printing module (VIPrinter.exe).

The persons list (a column at the left) displays the list of archive images records and a choice of record for viewing and print.

Current record choice is allocated with the cursor, corresponding to it vibraimages and the demographic information displayed in the printing area.

The printing area (field on the right) displays vibraimages and the demographic information, corresponding to the current record of the persons list.

3.7.1. Printing

For print out vibraimages and the demographic data the command **«Print …** Ctrl+P**»** menu «**File**» is intended. Before a call of a command «**Print …** Ctrl+P» it is necessary to choose required record in the list of persons. Thus in the field of a print the corresponding demographic data and vibraimages will be displayed.

Note

Data recording in archive, all images which at the moment of record were open in the field of images are saving. For remove files of superfluous images use «**Explorer**» Windows or the similar program.

For preliminary viewing listing (fig. 3.80) use the command **«Print Preview»** menu «**File**».

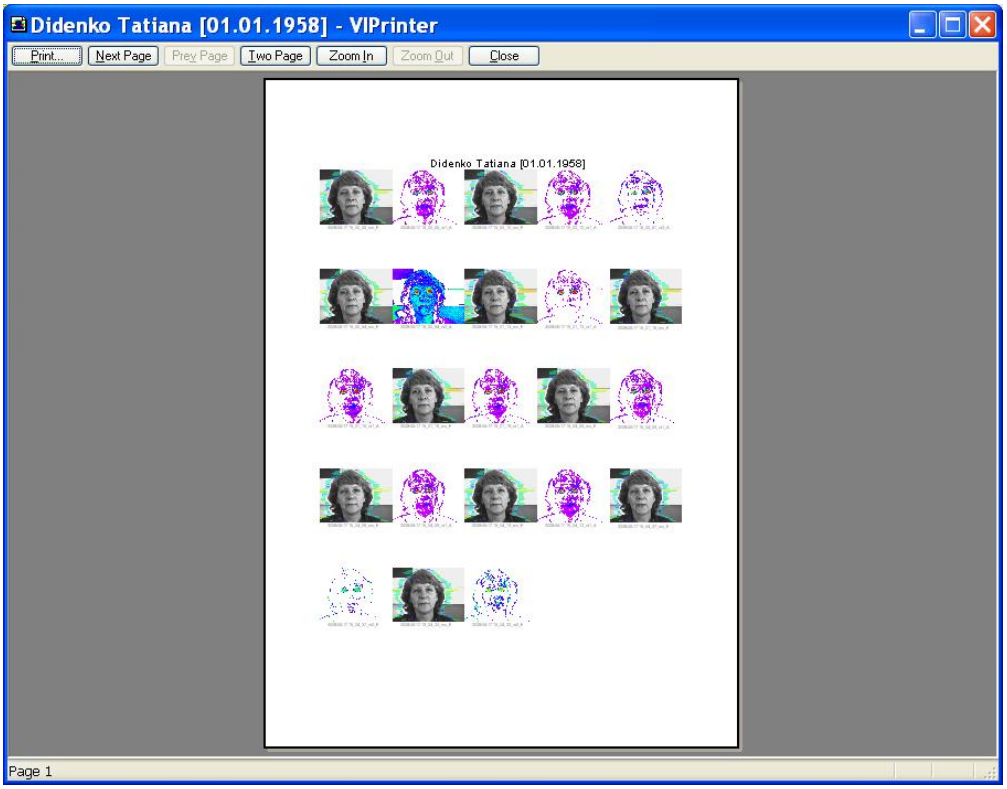


Fig. 3.80. Preview window.

For a choice of the printer and adjustment printing parameters use the command **«Print Setup…»** menu «**File**».

3.7.2. Main menu

- «**File**»
- «**View**»
- «**Help**»

Menu **«File»** (fig. 3.81) contains the following commands:

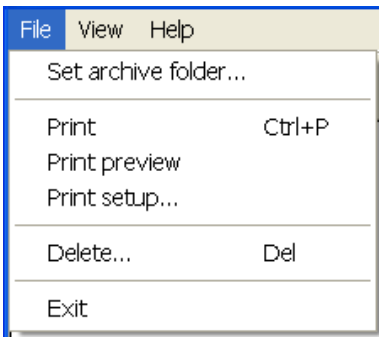


Fig. 3.81. Menu «File».

Use **«Set archive folder…»** command to change the archive folder in which the data of images archive are store. The given way can not coincide with the way established in the base module. It enables to work with different vibraimages archives.

Use **«Print…** Ctrl+P**»** command to print personal data and vibraimages. This command may be executed with [Ctrl+P] or toolbar.

Use **«Print Preview»** command to print preview.

Use **«Print setup…»** command to change the printer and printing options.

Use **«Delete»** command to remove of the chosen record from the persons list.

Use **«Exit»** command to quit the application.

Menu **«View»** (fig. 3.82) contains the following items:

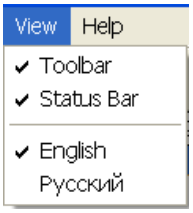


Fig. 3.82. Menu «View»

«Toolbar» - switch on/off the toolbar.

«Status Bar» - switch on/off the status bar.

«Language» - change current interface and help language.

Menu **«Help» contains the following items**:

- **«About VibraImage»** - command to view information about software version.

3.8. LogView module

LogView module VILogViewer.exe is designed for viewing and the analysis results of VibraImage program operation.

Main window of LogView module (fig. 3.83) consists of the following parts:

- main menu;
- information panel (display parameters);
- area of graph result supervision;
- toolbar.

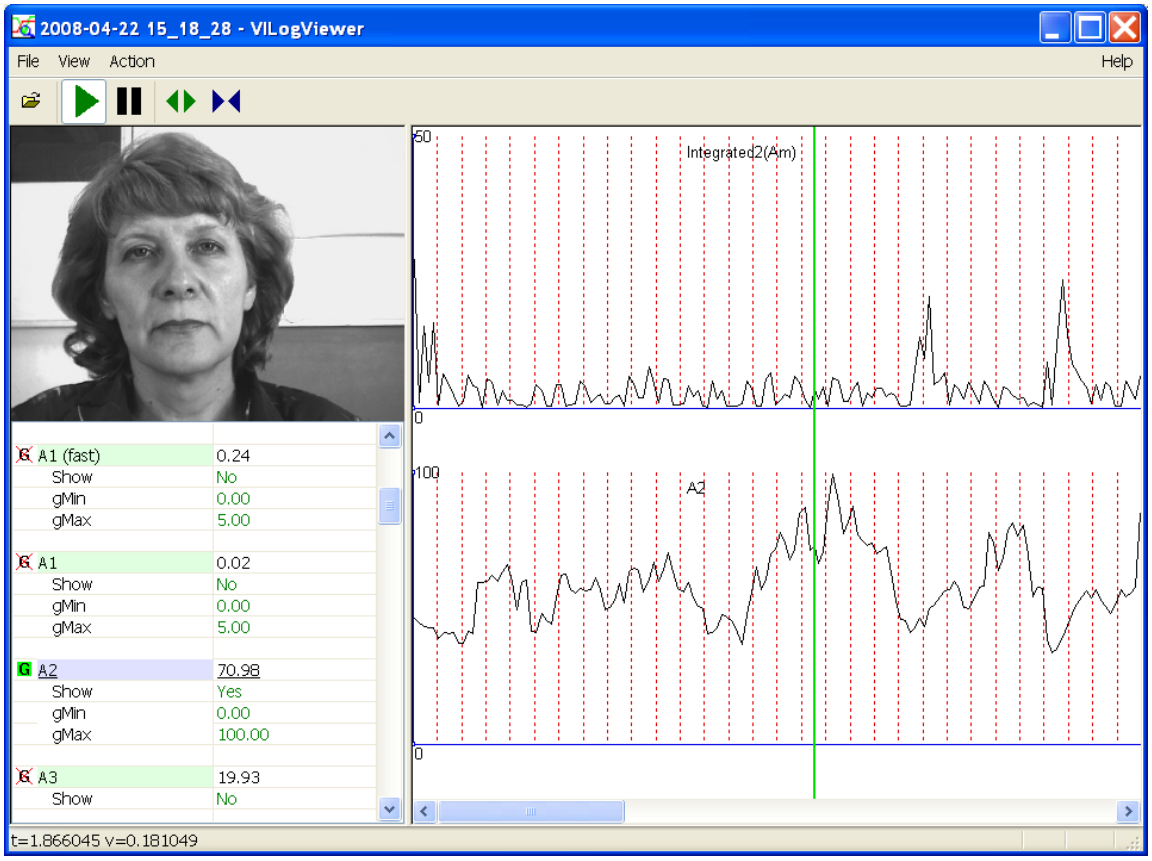


Fig. 3.83. Main window of the LogView module.

Note

Supervision of a video file can be made both from the beginning of a file, and from any chosen place. For a choice of the beginning place of viewing it is necessary double click by the mouse left button to note this place. On the chosen place the marker (a vertical line of green color, (fig. 3.84) will be established and the system will pass to a mode «**Pause**». Start of system is carried out by button «**Play**».

3.8.1. Main menu

Menu **«File»** (fig. 3.85) consists of the following items:

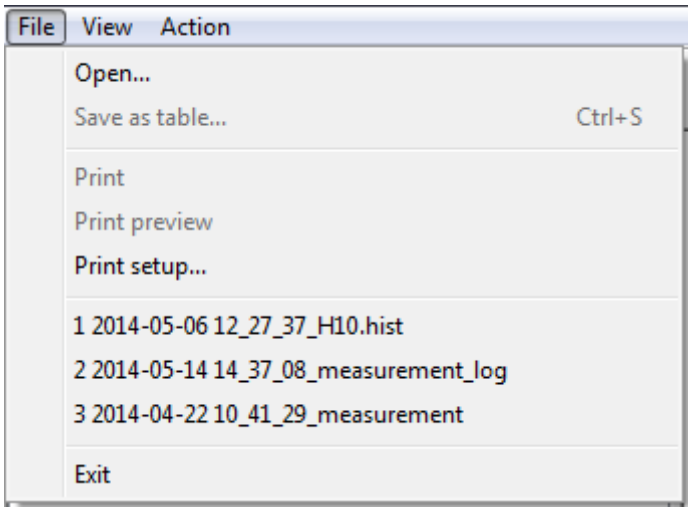


Fig. 3.85. Menu «File».

The item **«Open …»** is intended for a choice and opening of results file. It also can be replaced by the corresponding button of the toolbar.

The item **«Print…»** prints out graphs from area of supervision.

The item **«Print Preview»** used for preliminary viewing listing.

The item **«Print setup …»** used for a choice of the printer and settings printing parameters.

The item **«Exit»** used for exit from the program.

Menu **«View»** (fig. 3.86) consists of the following items:

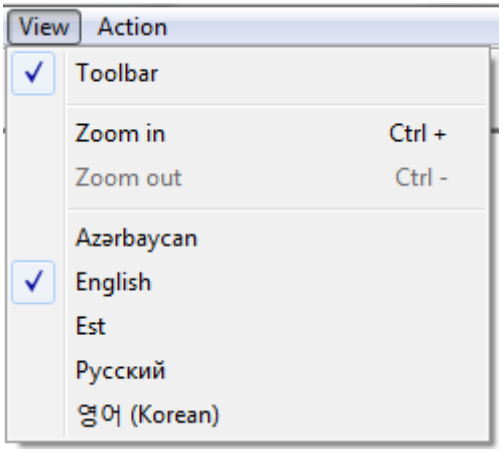


Fig. 3.86. Menu «View»

«Toolbar» - switch on/off the toolbar.

«Language» - select current interface and help language.

Use items **«Zoom In Ctrl+» or «Zoom Out Ctrl-»** to zoom in (zoom out) the image in the printing area. Items also can be replaced by the corresponding toolbar buttons.

Menu **«Action»** (fig. 3.87) consists of the following items:

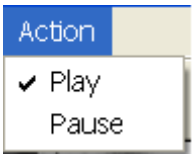


Fig. 3.87. Menu «Action».

The choice of item **«Play»** makes start of video file viewing and calculation of graph vibraimage parameters changes. It also can be replaced by the corresponding button of the toolbar.

Item **«Pause»** stops viewing a video file and calculation of graph. It also can be replaced by the corresponding button of the toolbar.

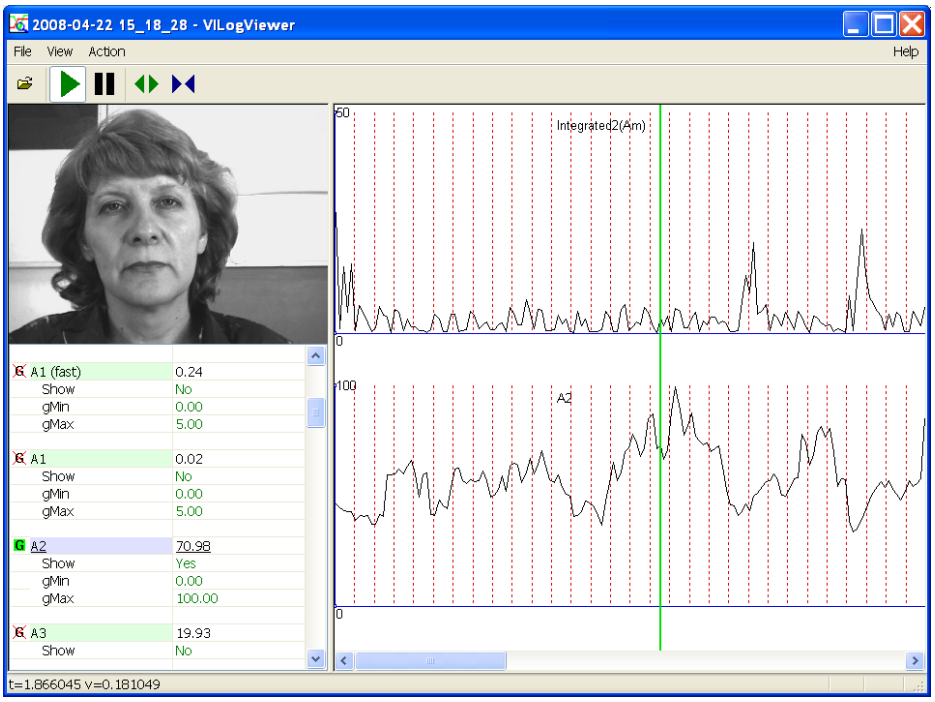


Fig. 3.88. Increased graph scale.

Menu **«Help»** consists of the following items:

- «**About VILogViewer…**» - information about program version.

3.8.2. Information panel

The information panel (fig. 3.89) displays basic parameters of the recorded results. Functional purpose of information panel is similar to purpose of information panel of the basic module VibraImage.exe in «**GR**» mode.

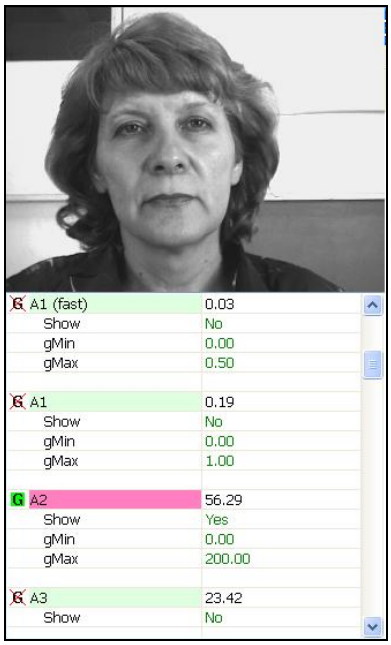


Fig.3.89. LogViewer information panel

LogViewer parameters indication:

V –	Current value of parameter
Show	Switch defines, will be show or not selected parameter in the field of images.
gMin –	Defines the minimal value of parameter shown on the screen
gMax –	Defines the maximum value of parameter shown on the screen

Parameter graphic values shows:

G Indication parameter in image area.

For convenience of observing a line of parameter will be chosen by rose color (fig. 3.89)

G Selected parameter is not shown in image area

3.8.3. Toolbar

The toolbar (fig. 3.90) duplicates, accordingly, the following items menu:

- «**Open**» (Menu «File»);
- «**Play**» (Menu «Action»);
- «**Pause**» (Menu «Action»);
- «**Zoom In Ctrl+**» (Menu «View»);
- «**Zoom Out Ctrl-**» (Menu «View»).

Fig. 3.90. Toolbar.

4. The basic modes of the VibraImage system

VibraImage system has 3 basic operation mode:

1. **Micro mode** – it is intended for supervision, research and the analysis psycho emotional conditions of the unique person in the frame.

2. **Macro mode** – it is intended for supervision, research and the analysis psycho emotional conditions of the people in crowd.

3. **«Lie detector» or LD mode** - it is intended for lie detection of the unique person in the frame center.

The user can choose a system operating mode, having set options by default, having chosen a corresponding line in the  information panel and, twice having clicked above it the mouse pointer (fig. 4.1).

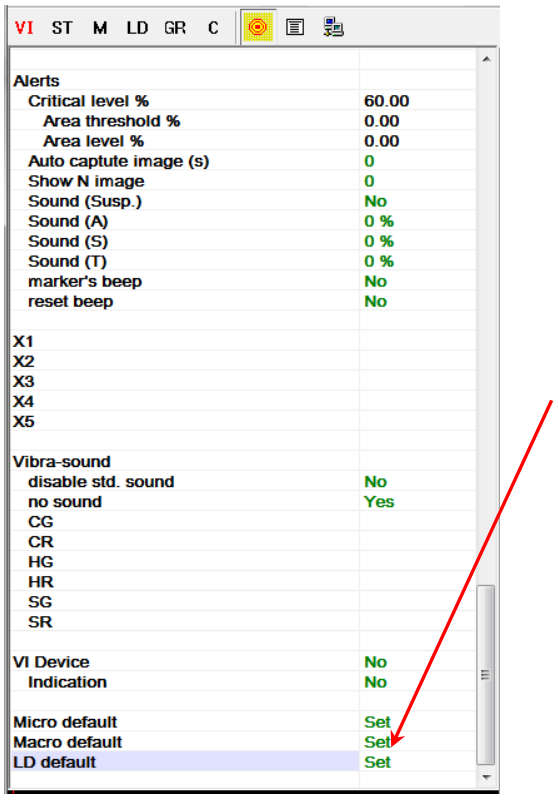


Fig. 4.1 Select mode

4.1. Micro mode. Emotions (personality traits) definition.

Micro mode measures micromovements, time and spatial fluctuations of object, by calculation of vibration parameters (frequency and amplitude) for each element (pixel) of the researched image. With the help of this method it was possible to define, that VibraImage parameters indicates (measures or quantitatively characterize) emotions or personality traits and psychophysiological status of a person.

Movements and micro fluctuations of the person head of in the 3d-space, classically determined by vestibular system and sensor physiology, are studied and discussed in comparison to display of vestibular reflexes. The person head which is taking place in balance and not making «the realized movements» can be considered as balance thermodynamic system, and the certain part of internal energy changing balance by this «closed» system, is spent for movement as mechanical fluctuations (vibration). Each emotional condition is characterized by certain power consumption, and the work which is carried out by that system, will be transformed to microvibrations if the person stands or sits without movement. Parameters of a head vibration (frequency in a range of 0,1 - 10,0 Hz and amplitude within the limits of 10-1000 microns.) for a stable emotional condition of the person are stable in time. Parameters of vibration change only after change of an emotional condition.

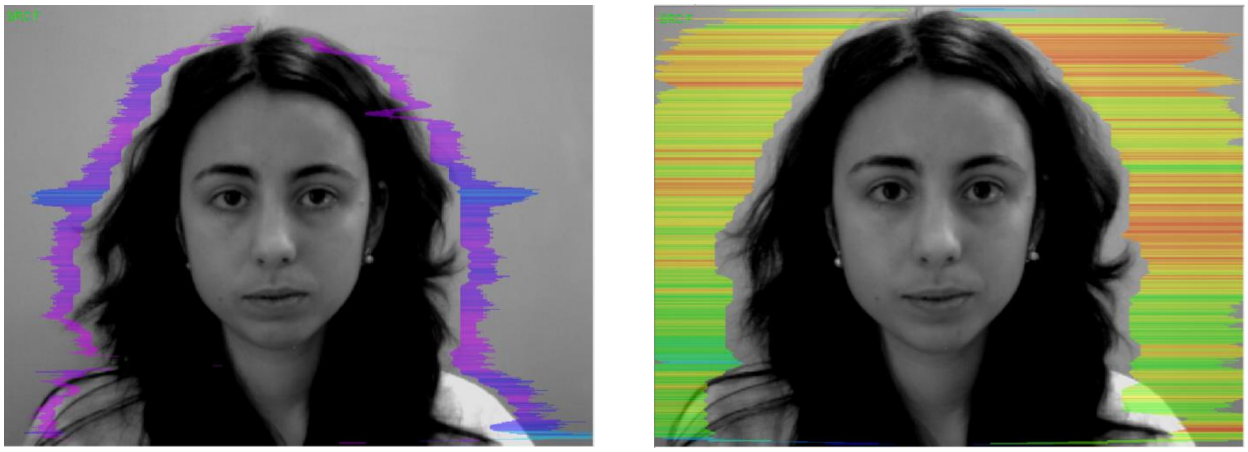
4.1.1 «M» mode

The average values of personal psychophysiological parameters, their deviation and variability are measured in the «**M**» mode. The main goals of this mode are application of vibraimage system for accuracy security checking, medical diagnostics and psychological testing and researches. M mode is based on measurement and calculation of psychophysiological parameters T1-T10 and checking its math variability during testing period. For vibraimage visual control in this chapter are given the pictures characterizing changes of said psychophysiological parameters T1-T10.

The mathematical expectation M, standard deviation (SD) S and variability V are calculating for the following human psychophysiological parameters:

T1 – Aggression (P7);

This parameter is determined by the frequency histogram and represents the maximum allocation of the frequency and SD vibration frequency of the human face. The higher value of the maximum distribution and higher SD value gives the greater value of the parameter T1.

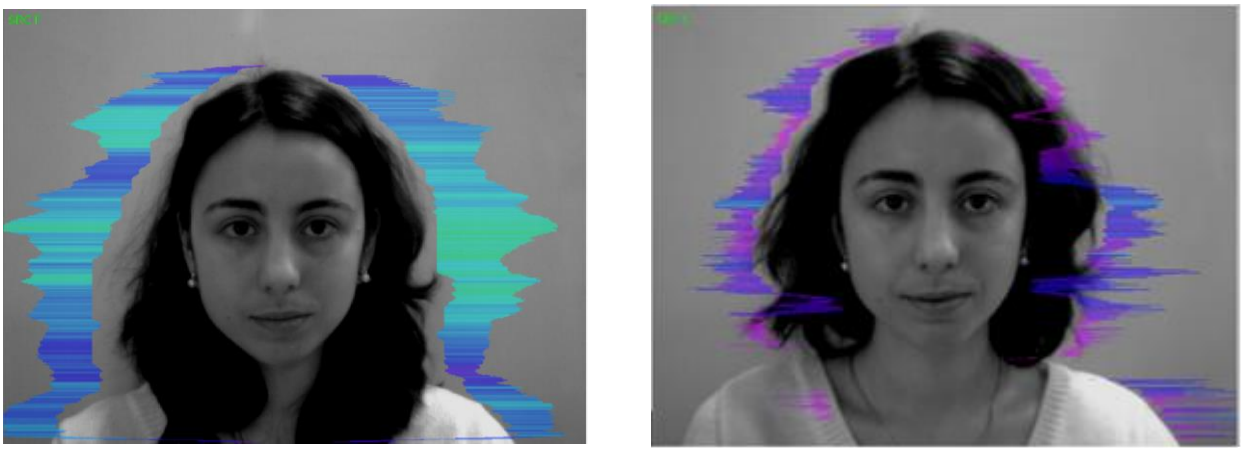


A) *B)*

Fig. 4.2 Agression A) T1 = 18 %, B) T1 = 60 %

T2 – Stress (P6);

Parameter is determined by degree of the external vibraimage (vibra-aura) asymmetry, means asymmetry of micromovements from the left and right parts of the persons head. The great difference in amplitude and frequency movements for the left and right parts of the face (head) characterizes the increased T2 parameter level.

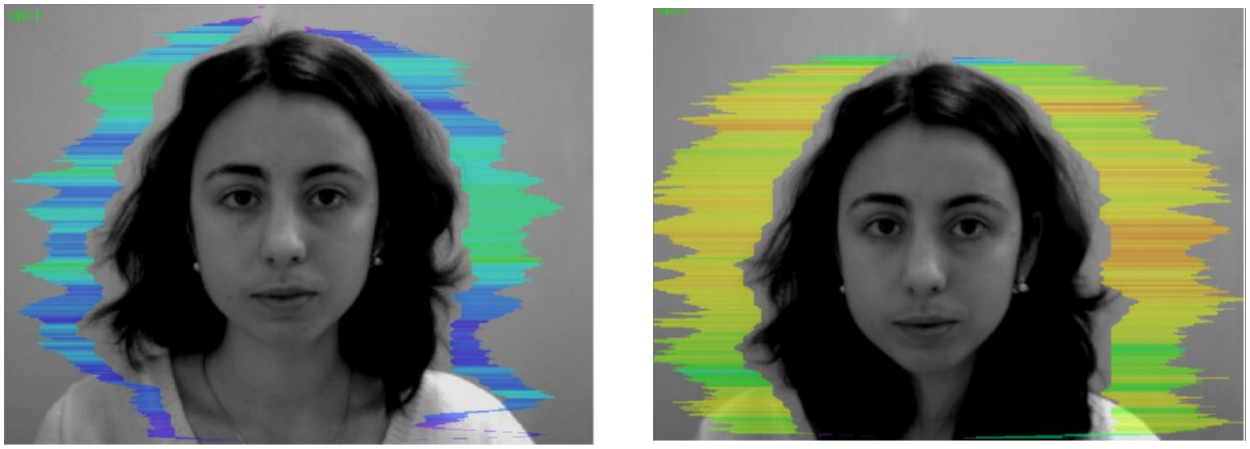


A) *B)*

Fig. 4.3 Stress A) T2 = 17 %, B) T2 = 45 %

T3 – Tension/Anxiety (F5X);

Parameter is determined by the relation of high-frequency part of a range of vibrations to the general power in a range of micromovements frequency for human head. High value of high-frequency vibrations density characterizes high value of the T3 parameter.

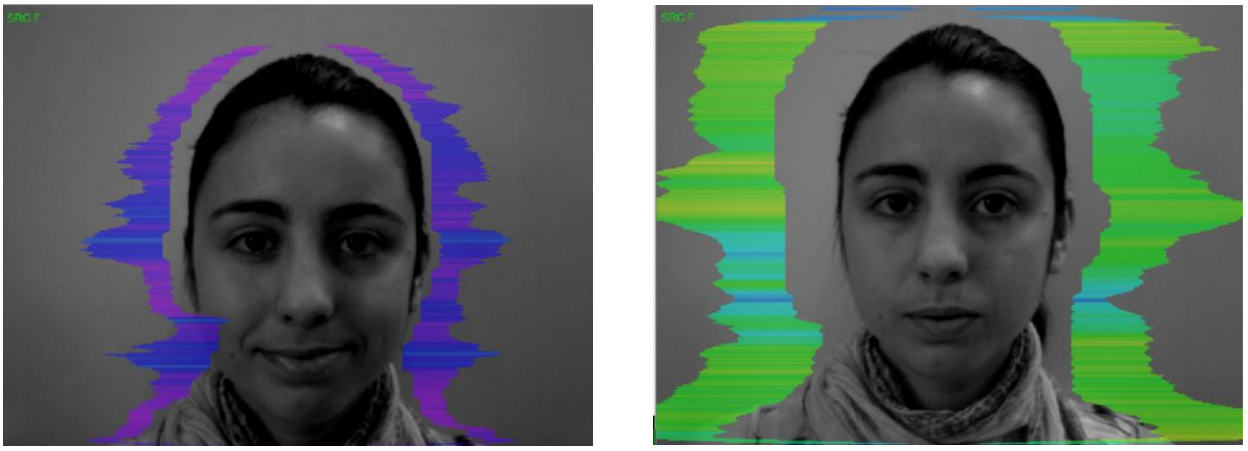


A) *B)*

Fig. 4.4 Tension A) T3 = 28 %, B) T3 = 48 %

T4 – Suspect (P19);

The parameter is determined as the sum average of the first three conditionally negative emotions (T1, T2, T3) and characterizes the general level of conditionally negative emotions in a person status.

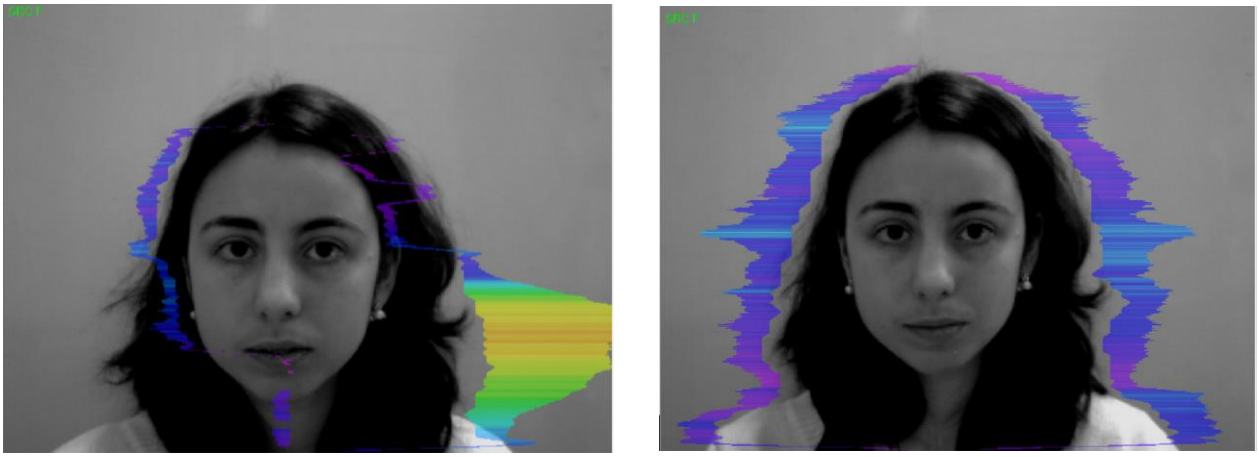


A) *B)*

Fig. 4.5 Suspect A) T4 = 20 %, B) T4 = 65 %

T5 – Balance (P16);

The parameter is determined by the frequency histogram and characterizes the level of similarity of the current frequency histogram to the Gaussian distribution law. The high level of frequency histogram similarity to the normal law is characterized by a high level of balance, and significant deviation from the Gaussian distribution is characterized by a low level of the parameter T5.

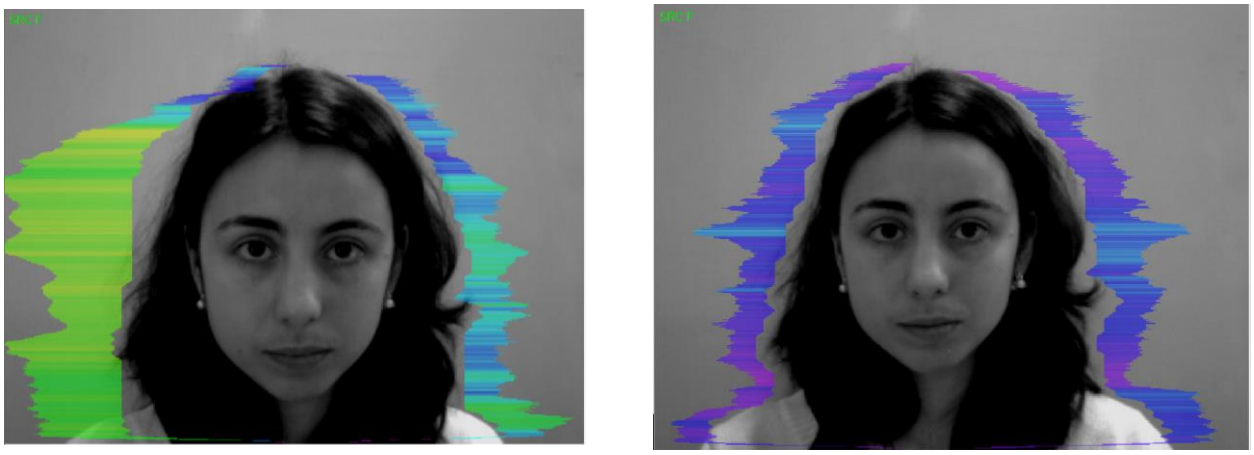


A) *B)*

Fig. 4.6 Balance A) T5 = 10 %, B) T5 = 80 %

T6 – Charm (P17);

The parameter is determined by the symmetry (left-right) of the head and face micromovements, the maximum symmetry of movements (including frequency and amplitude) represents a high level of charm T6.

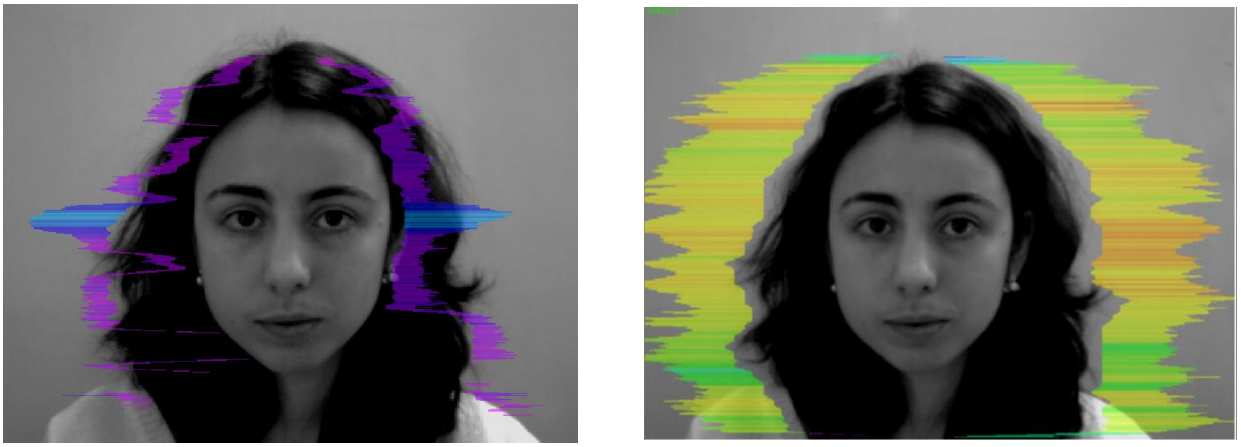


A) *B)*

Fig. 4.7 Charm A) T6 = 40 %, B) T6 = 85 %

T7 – Energy (P8);

The parameter is determined by the frequency histogram and characterizes the difference of the maximum density of the vibration frequency and vibration frequency SD for the face and human head. The higher value of the maximum density and lower SD or variation of vibration gives the higher value of energy T7.

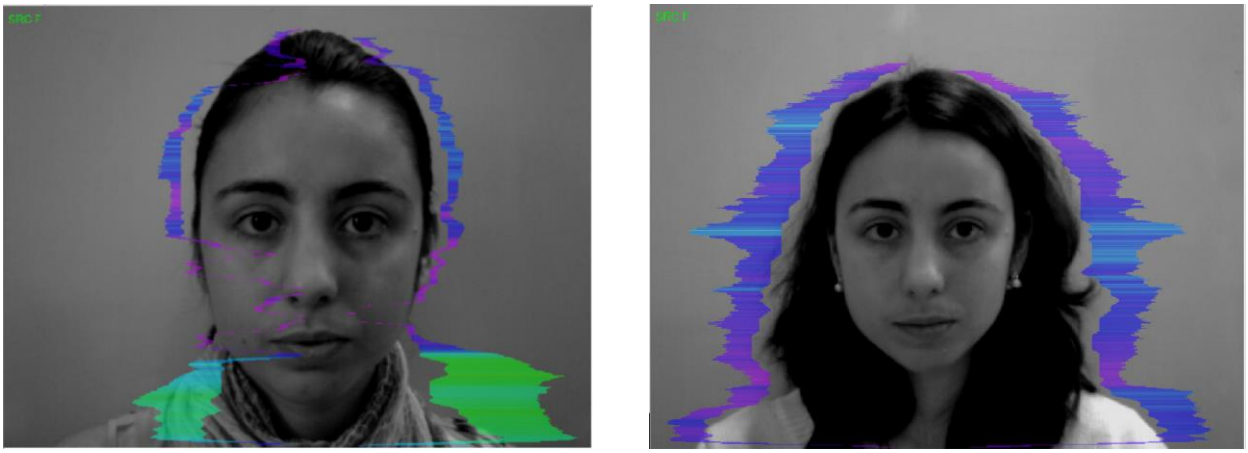


A) *B)*

Fig. 4.8 Energy A) T7 = 3 %, B) T7 = 70 %

T8 – Selfregulation (P18);

The parameter is determined as the sum average for conditionally positive emotions (T5, T6) and characterizes the general level of conditionally positive person emotions at the measurement time.

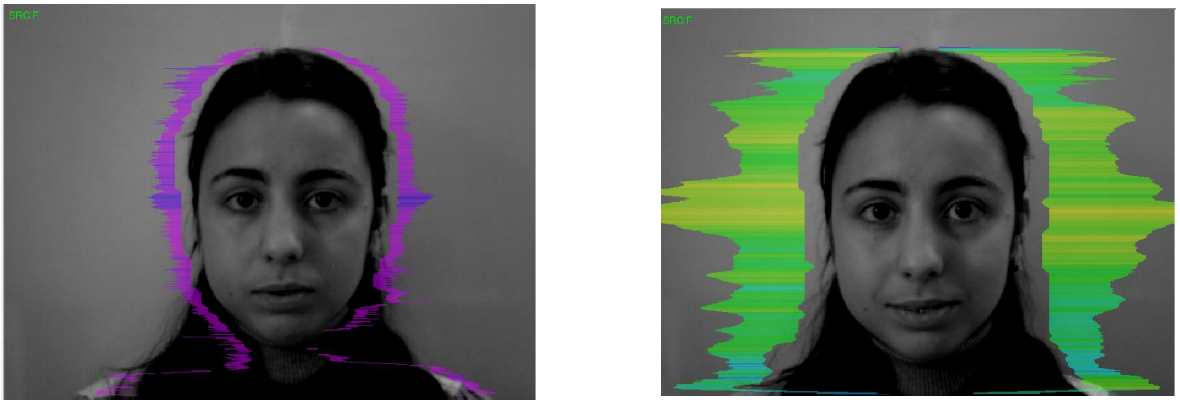


A) *B)*

Fig. 4.9 Selfregulation A) T8 = 30 %, B) T8 = 80 %

T9 – Inhibition (F6);

It has a real physical dimension (time in seconds) and characterizes the minimum time of the person reaction for the shown event (the stimulus). The value of the parameter T1 = 0.1 means that the reaction time is 0.1 s. The greater the reaction time corresponds to a higher level of inhibition.

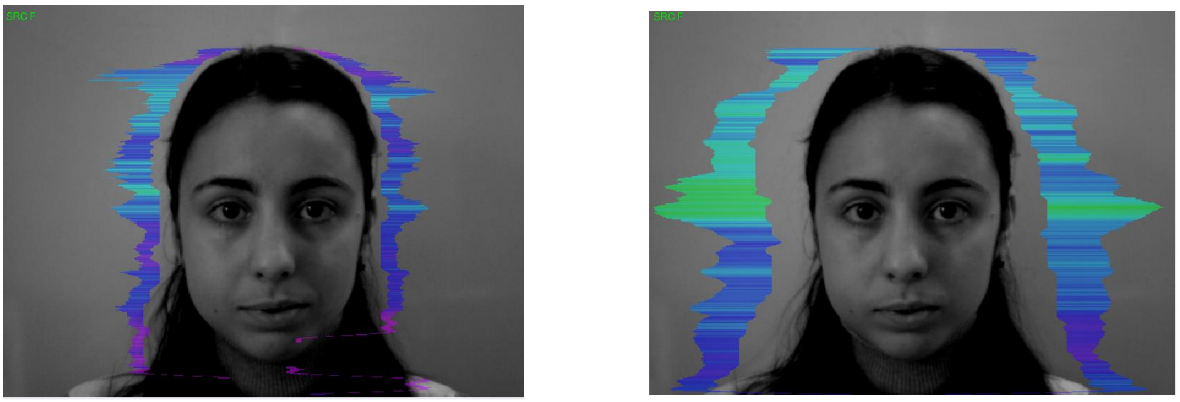


A) *B)*

Fig. 4.10 Inhibition A) T9 = 12 %, B) T9 = 25 %

T10 – Neuroticism (F9).

The parameter characterizes the SD measured value of the inhibition level (T9) at the measurement time (default 60 seconds). High level for inhibition SD of psychophysiological state characterized by instability and indicates high level of neuroticism T10.



A) *B)*

Fig. 4.11 Neuroticism A) T10 = 10 %, B) T10 = 35 %

The set of parameters T1-T10 is selected for capturing of the maximum information content for human head micromotion. At the same time the name of each Ti parameter can characterize different physiological characteristics, depending on the application of the vibraimage system. The primary characteristic for each parameter is not his name, the name can be considered secondary, but only math formula (equation) for psychophysiological parameter calculation is primary.

Integral coefficient K, characterizing the general functional state of the person based on parameters T1 - T10 is calculated using the formula:

$$K = \sum_{1}^{10} m\left(T_i - T_n\right)$$

where K - integral indicator of the general condition (IIGC); T_i - measured value of the mathematical estimation (M, S, V) of these parameters; T_n - mathematical average value of (M, S, V) i-th parameter in the sample, and m - the normalization factor.

Thus three integrated indicators K of functional states (IIGC) were defined. The first K_M is calculated based on measured values of a mathematical expectation (M) of parameters T1 – T10, the second K_S – based on the standard deviation of parameters (S), the third K_V – based on the variability of parameters (V).

Statistically defined norms (corresponding to the person normal condition) for controllable psycho emotional parameters Aggression, Stress, Tension, Suspect, Balance, Charm, Energy, Self regulation, Inhibition, Neuroticism are resulted in a fig. 4.12 in NMin and NMax columns. It is necessary to note, that each parameter has the range of normal values, and a deviation, for example, Aggressions below set level 20 % it is considered a deviation from norm. The offered approach to measurement of emotional conditions is based that each emotion has the quantitative value in any condition of the person. Even the extremely excited person has the certain Balance value, and visually absolutely quiet person, possesses the certain level of Aggression. The measured «print» of ten emotions characterizes set of psycho emotional person conditions and these set measured psycho emotional parameters allows to analyze with high accuracy any change of the person condition deviation from statistical norms. Only VibraImage system analyzes various parameters of micromovements and impellent activity of the person head, at a level of physiology connected with psycho emotional condition.

Note:

1. Every from T1-T10 psychophysiological parameters measured by vibraimage system are specified to range 0 - 1 (0 - 100) % using fixed coefficients experimentally selected.

2. Mathematical formula by which measured psychophysiological parameter is determined is primary, and a code name (for example, Agression) is secondary. Psychophysiological meaning of each parameter T1-T10 may be varied depending on the experimental conditions.

3. The set of measured parameters T1-T10 determines the total psychophysiological (psychosomatic, functional) status of a person based on the integral coefficient K.

Statistical processing of parameters measured in a mode «**M**» is carried out by the program Vibrastat.

4.1.2 Information column

In a mode M an information column (fig. 4.12) allows to control average for the period parameters value of psycho-emotional person conditions and their deviation from the established norm. The basic applicability of the given mode is use of vibraimage system for medical diagnostics and psychological researches.

Value of the averaging period is set in seconds in a field **«Duration»**. Start of the beginning of information accumulation is made by a choice of item «**Measurement**» of the menu «**Action**» or pressing of the toolbar button M. After start of a accumulation and averaging mode in the top of an information column there is a running line «**Progress**», displaying a course of data accumulation process.

M table (fig. 3.62) shows the following information:

- Current values of based processed VibraImage parameters A1-A4, F1-F8, S1-S7, P1-P19;
- Current values of fast processing VibraImage parameters A1 fast, A4 fast, F1 fast, F5 fast;
- Speed of input frame from the camera [«FPS_in»], speed of frame processing for a base processing mode [«FPS_BP»] and speed of frame processing for a fast processing mode [«FPS_FP»];
- Basic parameters describing psycho-emotional condition of the person: Aggression, Stress, Tension/Anxiety, Suspect, Balance, Charm, Energy, Self regulation, Inhibition, Neuroticism.

M table columns meaning:

V -	The value of the parameter average for the set period
S -	root-mean-square deviation of parameter
cMin -	The minimal value of parameter for the period
cMax -	The maximal value of parameter for the period
NMin -	The minimal value of parameter for a normal condition of the person
NMax -	The maximal value of parameter for a normal condition of the person

Note

Values of cMin, cMax parameter, are displayed only when measurement mode «M» has been began and the information for the specified period of time is saved up.

VI ST M LD GR C

*VIDEO:Look 1320 V2							
Duration (s)	60						
Name		S	Vi	N Min	cMin	N Max	cMax
Fps in	25.038	0.099	0.4	25.000	24.537	30.000	25.641
FPS FP	25.038	0.117	0.5	25.000	24.427	30.000	25.641
FPS BP	4.932	0.040	0.8	4.700	4.808	5.300	5.062
N	100						
Aggression (P7)	37.3	3.380	9.1	20.000	29.221	50.000	43.889
Stress (P6)	26.5	7.044	26.6	20.000	17.864	40.000	44.318
Tension/Anxiety (F5X)	22.7	9.241	40.7	15.000	6.245	40.000	49.593
Suspect (P19)	29.2	4.836	16.6	20.000	21.120	50.000	40.070
Balance (P16)	75.0	3.626	4.8	50.000	65.092	100.000	83.780
Charm (P17)	80.3	9.071	11.3	40.000	48.695	100.000	84.610
Energy (P8)	24.8	6.192	25.0	10.000	13.175	50.000	32.254
Self regulation (P18)	77.7	5.686	7.3	50.000	57.615	100.000	83.602
Inhibition (F6)	18.9	3.974	21.0	10.000	14.030	25.000	31.113
Neuroticism (F9)	39.7	6.067	15.3	10.000	0.000	50.000	39.998
Health (P21)	0.060						
Health' (P22)	0.089						
ΣVi (P23)	17.769						
Extraversion (P26)	0.592						
Stability (P27)	0.600						
A1 (fast)	0.006	0.011	189.4	0.000	0.004	0.000	0.107
A1	0.028	0.111	396.5	0.000	0.005	0.000	0.686
A2	29.078	10.157	34.9	0.000	12.601	0.000	62.671
A3	14.863	5.180	34.9	0.000	9.861	0.000	25.501
A4 (fast)	0.006	0.009	146.3	0.000	0.004	0.000	0.074
A4	0.036	0.080	225.0	0.000	0.010	0.000	0.361
F1 (fast)	0.001	0.002	167.2	0.000	0.001	0.000	0.014

Fig. 4.12. «M» mode of information table

Note

After ending of the information accumulation some lines of an information column can be allocated by color:

- – parameters, which values less than the set limits are allocated.
- – parameters, which values more than the set limits are allocated.

Note

In the fig. 3.62 frequency of input frame from the camera «FPS_in» less than the set limits and is allocated by color. For correct diagnostics psycho-emotion conditions of the person speed of data input from the camera should be within the limits of 25-30 frame/second.

4.1.3 Results of «M» mode

After the ending of information accumulating in «**M**» mode (Measurement) the user can see results of research and print them.

At a choice of item «**Print preview**» menu «**File**» in a working window of the basic program will be displayed 3 pages of results (fig 4.13-4.15). On the first page it is displayed researched vibraimage and data on it, levels of Aggression, Stress and Tension; on the second page - values of the measured parameters, and on the third - the histogram of frequency distribution and graph of change psycho-energy conditions for the specified period of researches. The results of measurements T1-T10, defined in «**M**» mode automatically processed by the program VibraStat.

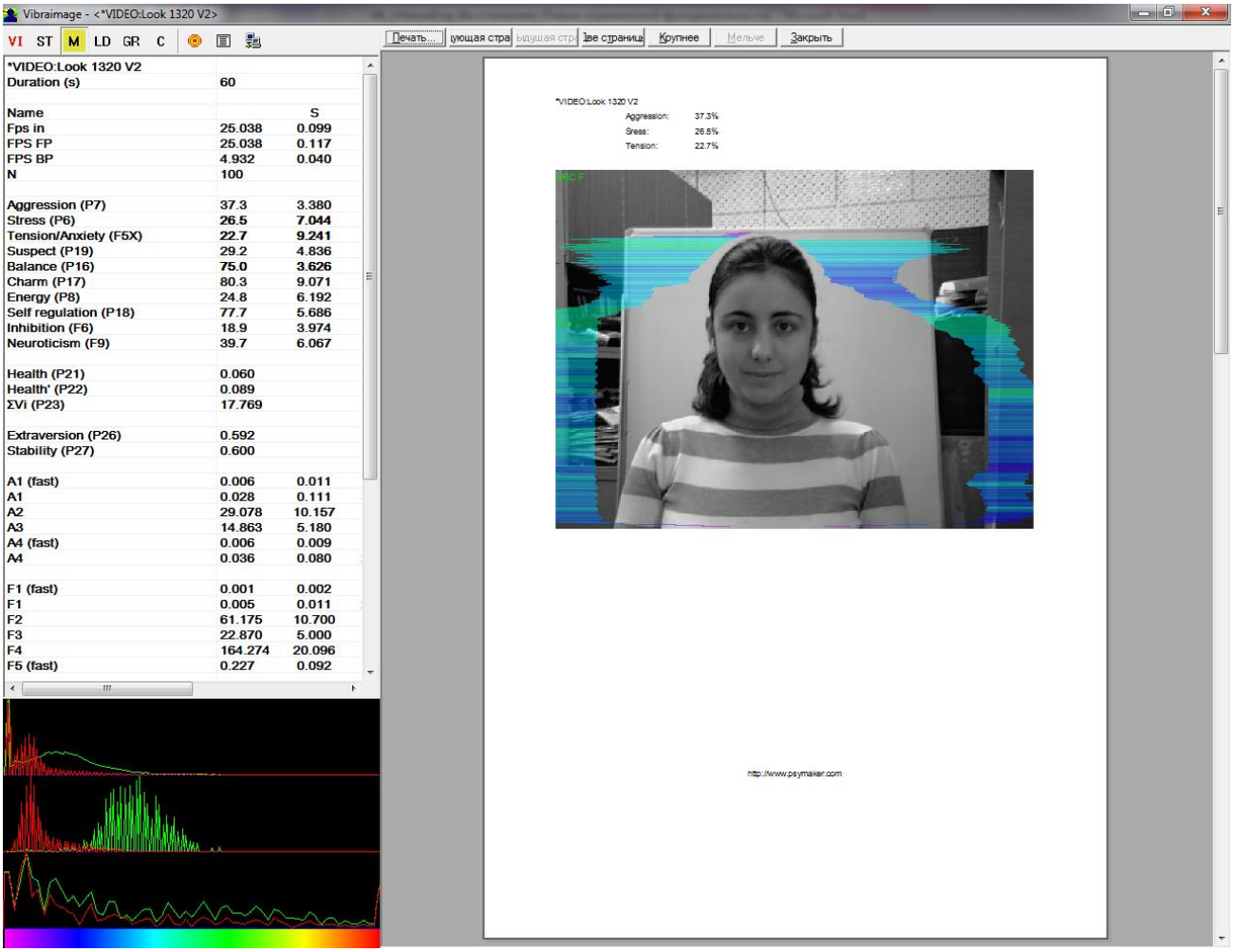


Fig. 4.13. Viewing of researches results in «M» mode. Page 1.

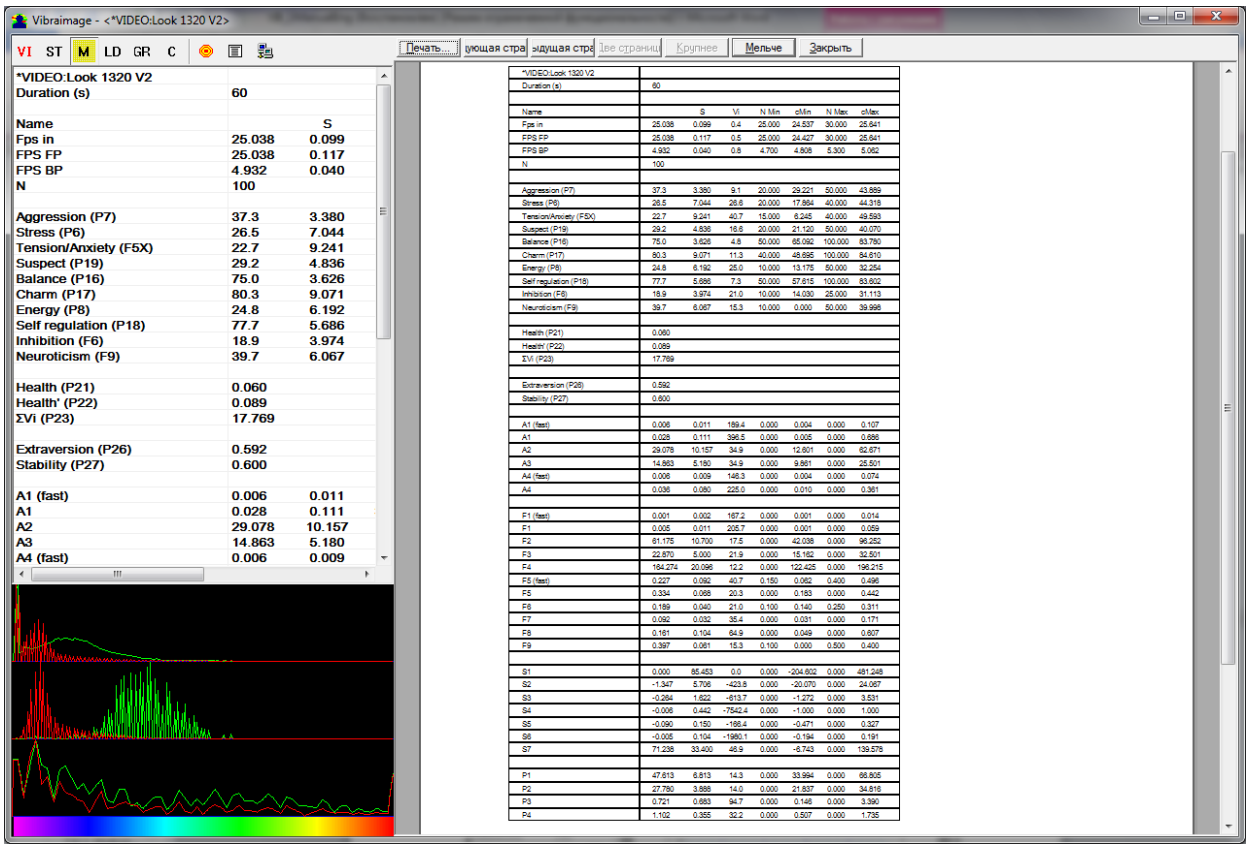


Fig. 4.14. Viewing of researches results in «M» mode. Page 2.

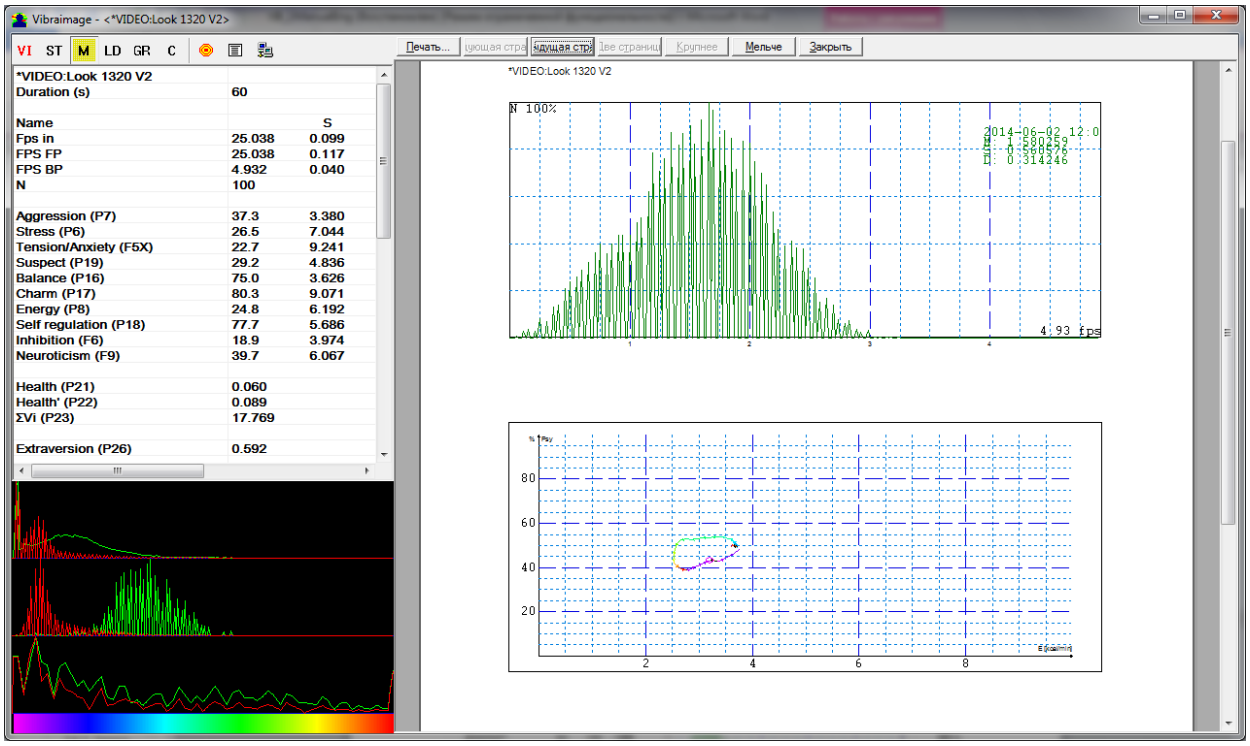


Fig. 4.15. Viewing of researches results in «M» mode. Page 3.

Simultaneously in the database catalogue, fixed for researched person, 3 files will be generated, for example:

- **YYYY-MM-DD HH_MM_SS_measurement.png** – the graphic file with vibraimage of the investigated person, allowing estimate correctness of the taken measurements from the point of view of shooting conditions;
- **YYYY-MM-DD HH_MM_SS_measurement.txt** - a text file with results of parameters measurements for the specified period;
- **YYYY-MM-DD HH_MM_SS_measurement.xls** - the document of the Microsoft Excel program displaying results of measurements of parameters and which main contents are given in figure 4.17;
- **YYYY-MM-DD HH_MM_SS_measurement.xml** and **YYYY-MM-DD HH_MM_SS_measurement_log.xml** - files with results of parameters measurements for the specified period. To open a file for viewing and printing the parameters, graph and histograms it is possible, having chosen item «**Open…**» menu «**File**».
- **YYYY-MM-DD HH_MM_SS_measurementH.png** - a graphic file with the histogram of frequency distribution (see. fig. 4.16), saved up for 10 seconds;
- **YYYY-MM-DD HH_MM_SS_measurementT.png** - a graphic file with graph of person psycho-energy conditions changes for the specified period (see. fig. 4.18). The circle on the graph shows a point of the information accumulation for calculation of the frequency distribution histogram.

In all files in names **YYYY-MM-DD** and **HH_MM_SS** date and time of measurement.

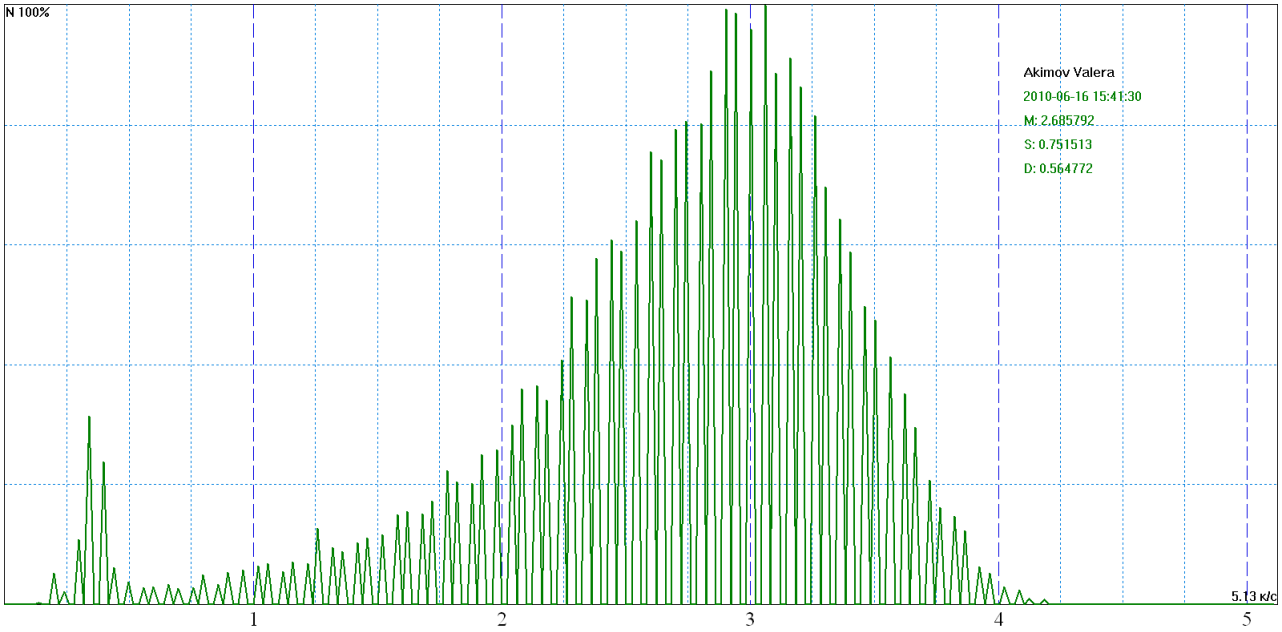


Fig. 4.16. The histogram of vibraimage frequency distribution.

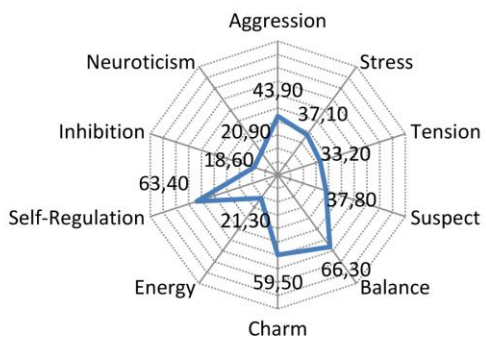
Testing Result for mental-functional state

Name	Jane	**ID**	12345
Gender	Female	**Date**	2015-05-12 11:05:39
Age	24	**Σ Vi**	9,836

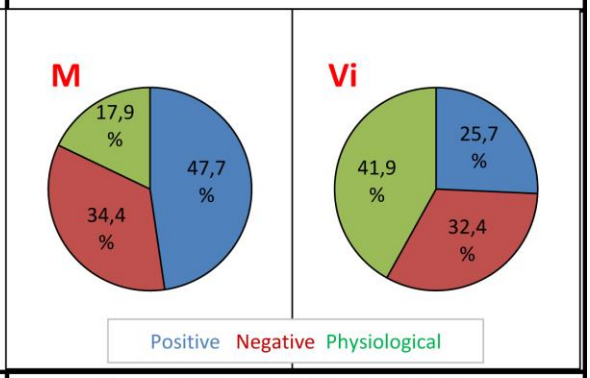
10 Parameter Results

Parameter	Min	Avg	Max	Vi	Parameter	Min	Avg	Max	Vi
Aggression (20 ~ 50)	37,9	43,9	52,1	8,2	Stress (20 ~ 40)	29,5	37,1	39,2	6,5
Tension (15 ~ 40)	11,9	33,2	50,3	18,7	Suspect (20 ~ 50)	26,6	37,8	43,4	6,9
Balance (50 ~ 100)	52,1	66,3	78,1	7,7	Charm (40 ~ 100)	52,6	59,5	67,4	6,6
Energy (10 ~ 40)	17,1	21,3	27,8	11,7	Self-Regulation (50 ~ 100)	55,9	63,4	72,1	6,0
Inhibition (10 ~ 25)	12,8	18,6	23,9	11,3	Neuroticism (10 ~ 50)	0,0	20,9	20,9	14,8

Parameter Chart

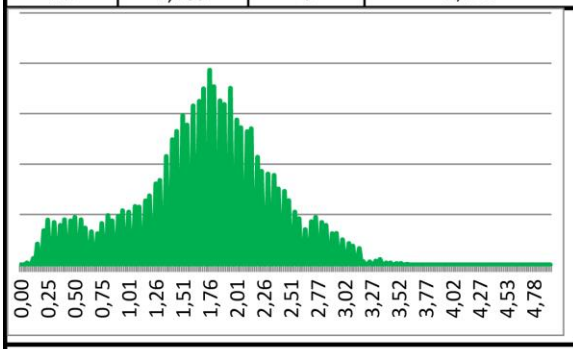


Emotion distribution Chart



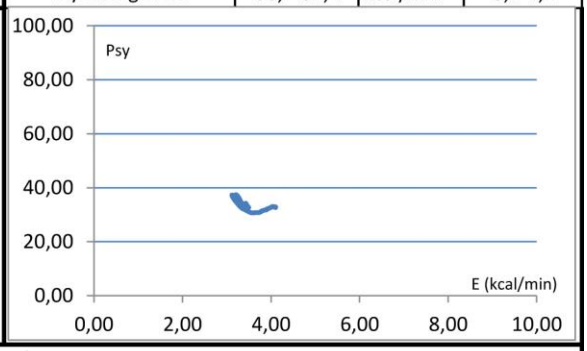
Frequency Histrogram

Mf	1,705	S	0,431



Psy variability - Mental basal metabolism

Psy change rate	30,7-37,4	Kcal/min	3,1-4,1



Result

Extraversion	**42,2**	**Stability**	55,9

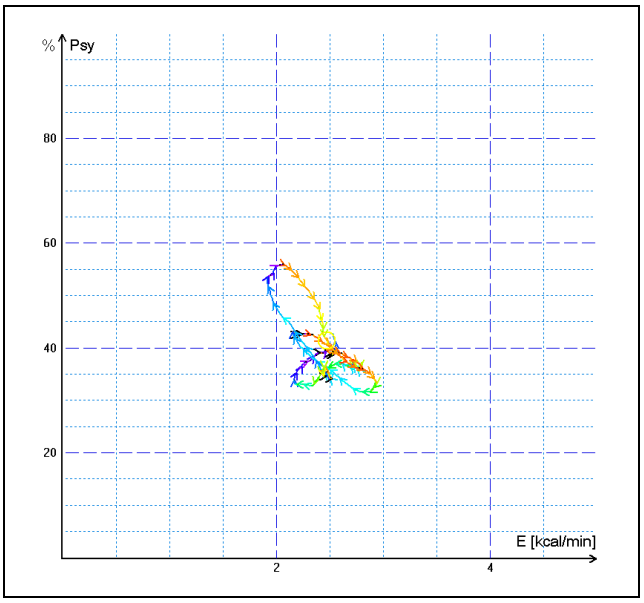
Your testing result for mental functional state is

☒ **Normal**

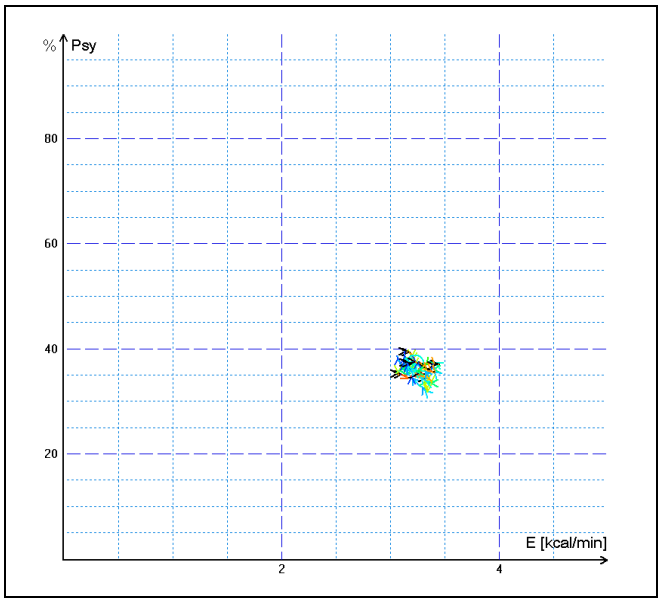
☐ **To recommend a professional consultation**

Comments	Morning

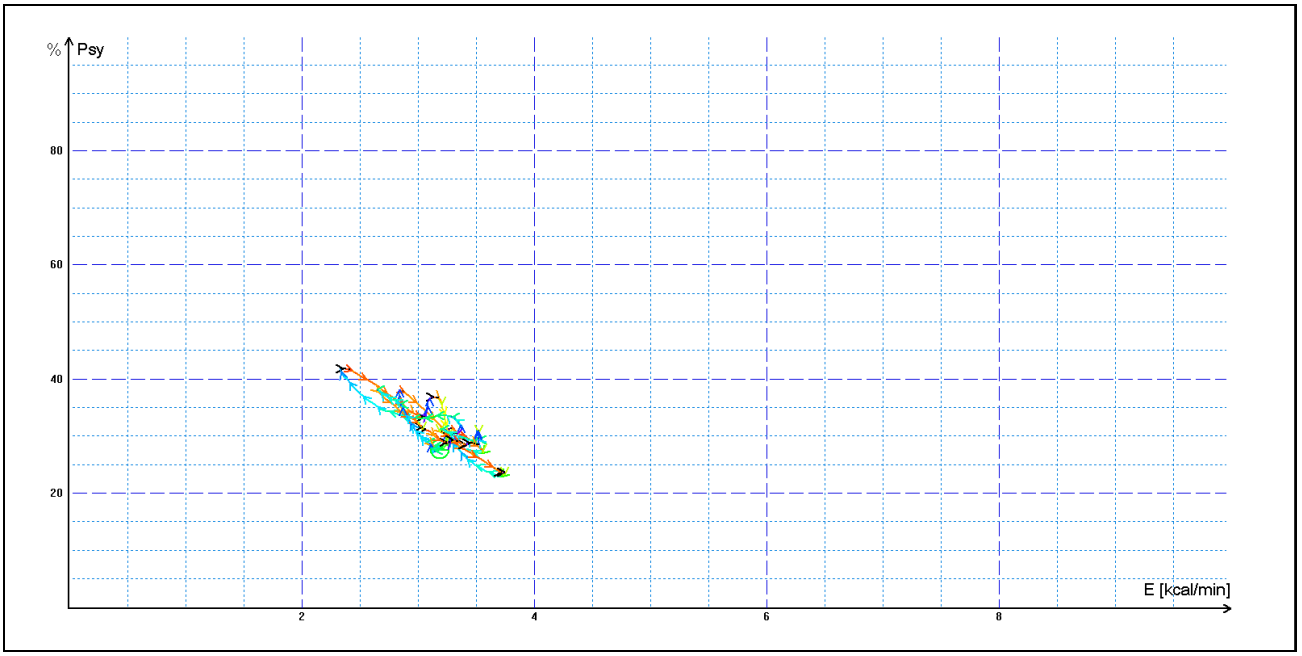
Fig.4.17. Imprint of the emotional state of a person



a) Changing around the average value



b) Stable condition, indicating a high degree of self-control person.



c) Periodic change psychoenergetic state along a certain trajectory, usually characteristic for an interview, type a question-answer

Fig. 4.18 (a, b, c). Change person psycho-energy conditions for the chosen period.

4.1.4 Vibraimage parameters

Amplitude and frequency of human head vibrations differs in every point of space and total processing of this every point meaning could present integral movement parameter of person. Some vibraimage pictures of one person reflect amplitude (fig. 4.18) and frequency (fig. 4.19) space distribution of vibrations are showed below visualized by color scale (fig. 4.20):

Fig.4.18. Amplitude vibraimage

Fig. 4.19. Frequency vibraimage

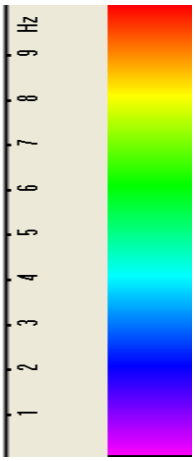


Fig. 4.20. Color scale

Each point (pixel) of the amplitude vibraimage (fig. 4.18) displays the relative movement of an element of the image which is saved up in a definite time as it is known that at insignificant movements the interpersonnel difference is proportional to the movement of object. At approximately the same location on the screen of persons, the condition of a uniform relative scale of the amplitude vibraimage is automatically satisfied. It allows comparing the received information on movement of the image for various people.

Each point of the frequency vibraimage has physical dimension of the frequency (Hz) as really displays the frequency of a signal change in each element of the image. Therefore, colors scale (fig. 4.21) is graduated in Hz, i.e. violet color on frequency vibraimage displays a range of vibrations (0-1) Hz, blue displays a range of vibration (1-4) Hz, green displays a range of vibrations (4-8) Hz, red displays a range of Vibration (8-10) Hz.

Based on these two primary images are calculated about 40 integral vibraimage parameters reflects different types of movement and vibration divided into 4 main groups:

A- amplitude parameters;

B- frequency parameters;

S- symmetry parameter;

P- space and time processing parameters.

This item gives some recommendations and samples for human emotion control realized by vibraimage system.

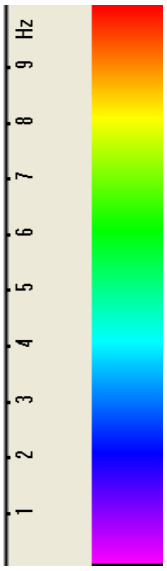
Note: Default system settings coordinate with the following human parameters for normal state.

- Level of aggression, %, no more 75
- Level of stress, %, no more 80
- Level of tension, %, no more 60
- Level of potential danger, %, no more 60
- Level of lie, %, no more 30

Recommendations for human emotion recognition are given below.

4.1.5 Vibraimage visual interpretation

VibraImage system gives different technical possibilities for emotion recognition, but typical users prefer to characterize person by external vibraimage or aura on real image. Aura based on vibraimage allows clearly and visually demonstrate emotions and physiological state of human being. Short interpretation of aura colors and forms follows below. This short information does not limited but only gives to user the main directions of person analysis. Every user after application experience could greatly diversify, extend and intensify knowledge about mental and aura of individual.



Red- activity and aggression color

Yellow – trouble and tension color

Green- normal activity and top condition color

Blue- rest and calm color

Violet- tiredness color

Fig.4.23. Brief aura color interpretation

Brief aura form analysis

- Any aura asymmetry (form, color) characterized deviation from mental or physiological norms.
- Aura colors irregularity and non-uniformity characterized unbalanced state and character of person.
- Any breaks in aura uniformity characterized deviation from mental or physiological norms.
- Ideal aura has mono color, symmetrical and uniform. Any real aura differs from ideal and the question of interpretation is to characterized real aura deviations.

Note

This brief aura interpretation correspond default vibraimage system settings and based on main rules for right vibraimage scanning:

- uniform and stable object illumination;
- high quality and low nose camera application;
- frontal plane object before camera;
- maximum facial image size on monitor;
- mechanical stabilization of camera.

Detail description of recommended vibraimage adjusting includes in previous parts of this document.

4.1.6 Frequency histogram

Frequency histogram shows head movement frequency distribution for every pixel and for accumulated time period (default time period is equal 20 seconds). Some real samples histograms coordinated with emotions and energy levels are printed in this point.

Figure 4.24 shows distribution histogram for person in normal conditions, both graphics approximately looks like normal (Gaussian) distribution. On fig. 4.25 we see un normal human states, up graphic shows person with low energy level (very tired) and down graphic shows high energy emotions (anger).

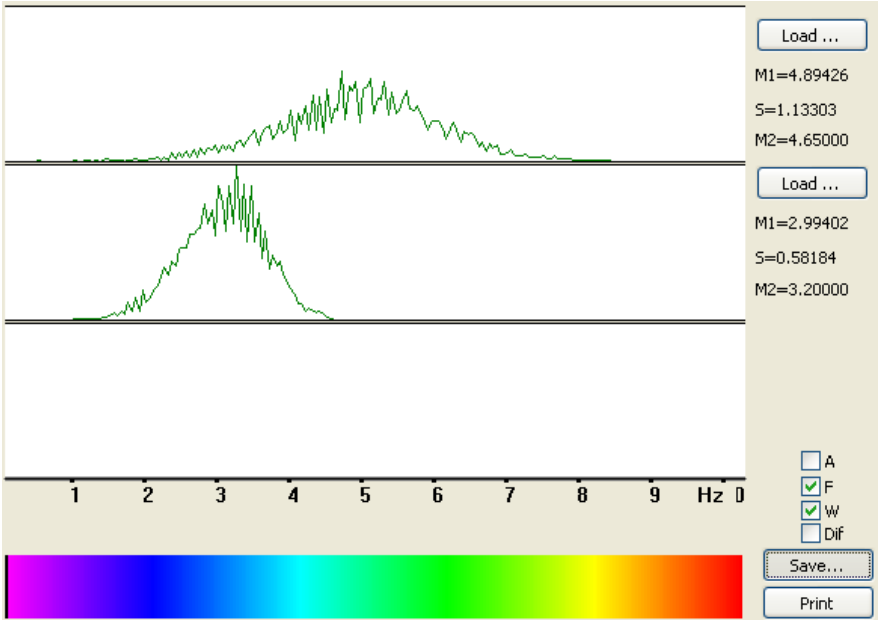


Fig. 4.24. Normal state

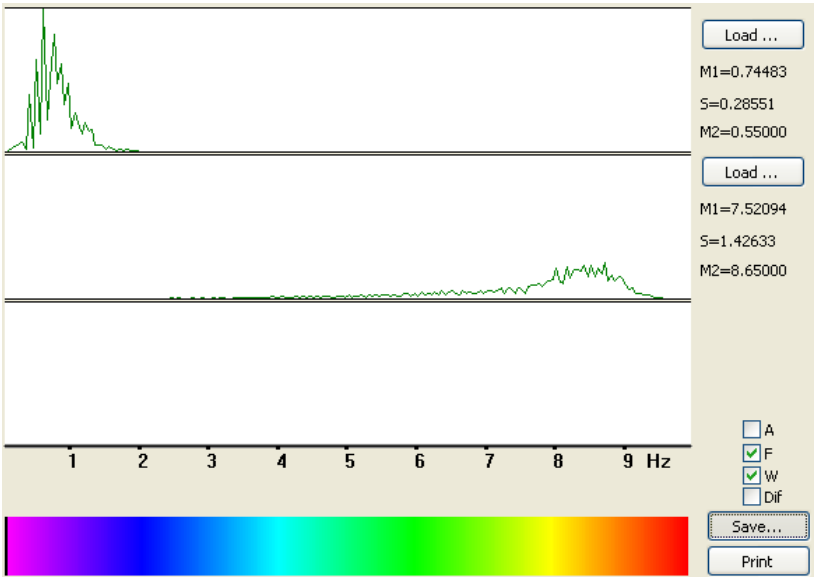


Fig. 4.25. Abnormal state

4.1.7 Spectrum analysis

Spectrum analysis of time dependence high speed vibraimage signals, also could informative reflects person emotions. Person in normal conditions has in several times more low frequency square in vibration spectrum, than person in tension or aggression. On fig. 4.26 we see the sample of normal person state on up graphic and tension frequency spectrum on the down graphic.

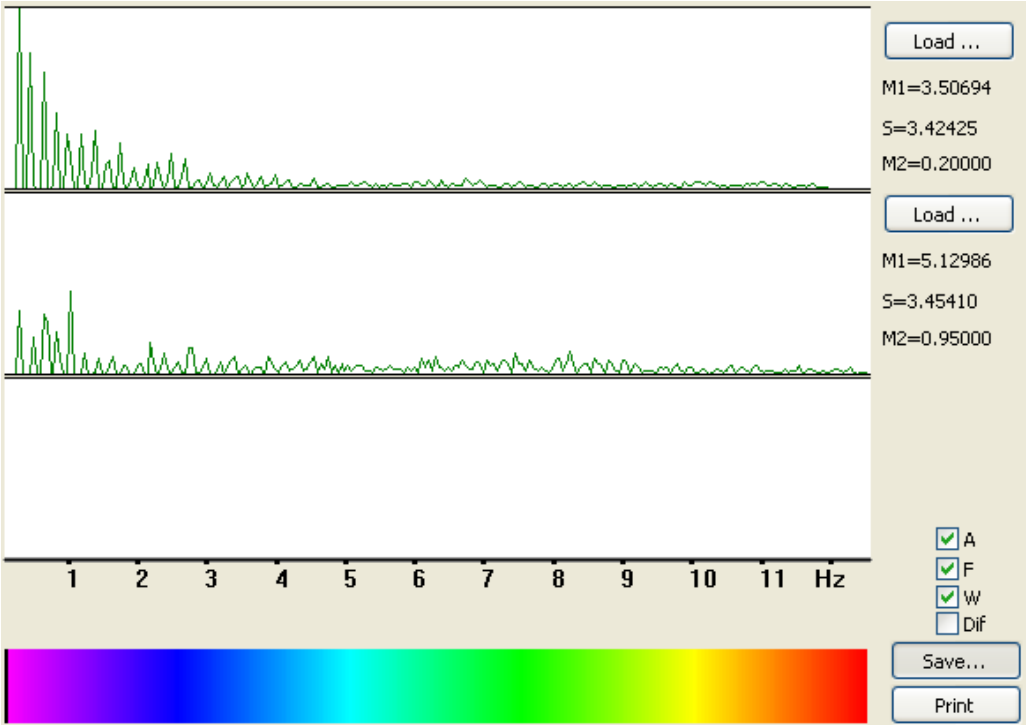


Fig. 4.26. Normal state of person shown on up graphic and tension spectrum on the down graphic

4.1.8 Examples of various states of a person

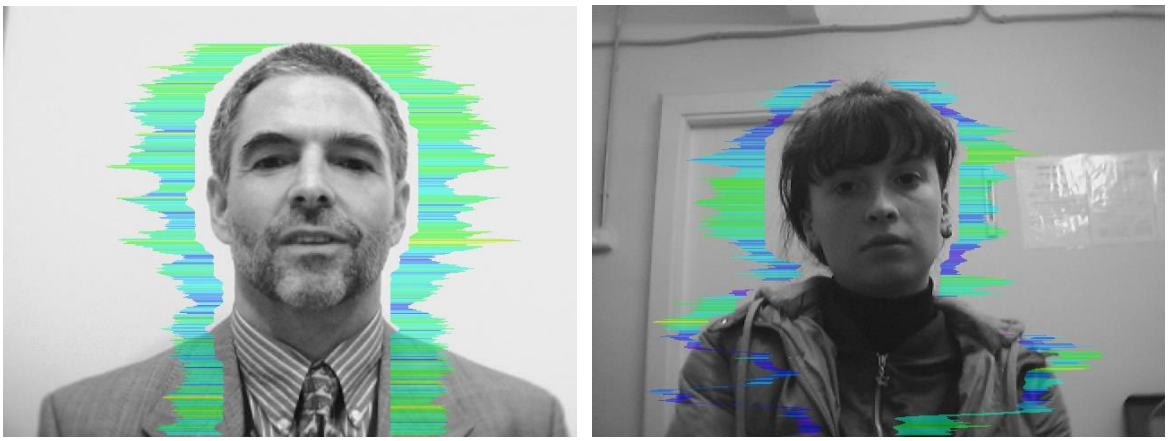
Normal and top emotional state

Normal condition characterized by aura color and form uniformity around the head, relevant monochrome color in the middle of suggested color scale. Activity level is about 0,3 – 0,6. Stress level is about 0,2 – 0,5. Tension level is not more than 0,4.

Every emotion level measured in the range from 0 till 1,0 and minimal value coordinates with minimal emotion intensity.

Frequency distribution histogram is near normal (Gauss) distribution and spectrum of high speed vibraimage signals is near exponential distribution.

Aura photos samples for normal condition of person are on fig. 4.27 below:



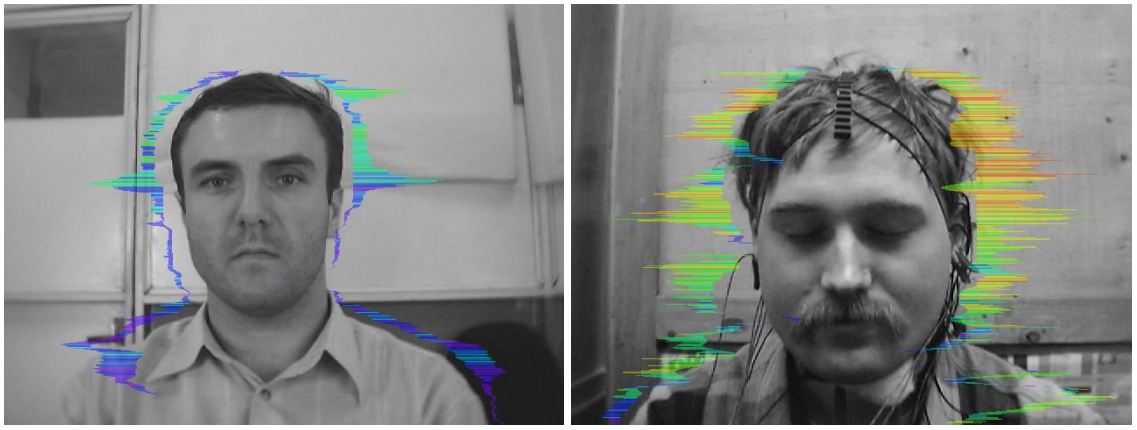
Figs. 4.27. Aura photos samples for normal condition of persons.

Stress state

Stress state characterized by amount gaps in aura form and greatly aura colors non uniformity. Aura includes every scale colors and sharp color transfer, like red color could transfer to blue (fig 4.28). Stress level more than 0,7.

Aggression or activity level is low, not more than 0,5 and tension level is high and usually more than 0,4.

Frequency distribution histogram has several modes and high speed vibraimage signals spectrum presents superposition of exponential and uniform distributions.



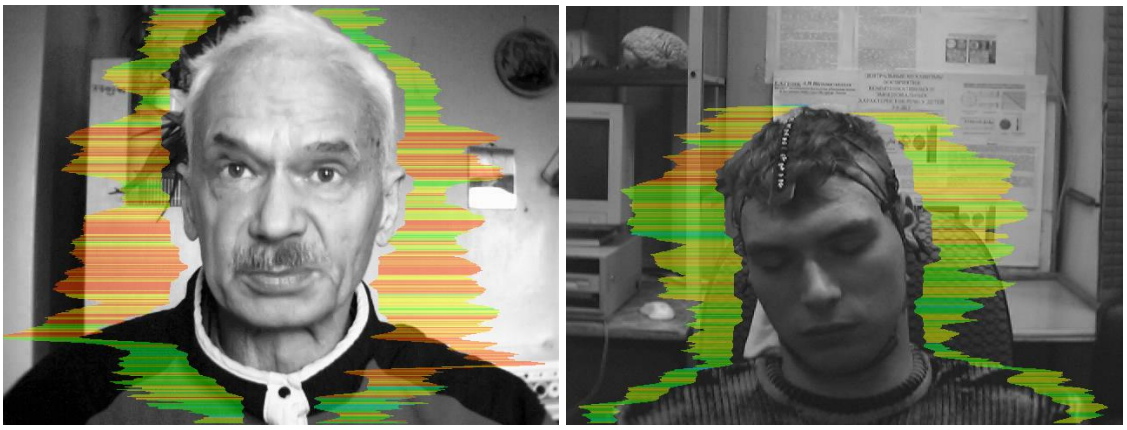
Figs. 4.28. Aura photos samples for stress condition of person

Aggressive and/or tension state

Aggressive state is not every time coordinates with tension, and tension state is not always coordinates with aggression. But often these two emotions accompany each other. Aggressive state obligatory characterized by high frequency vibrations and red colors in aura. Aura size is more than normal and gaps could absent, but color and form non uniformity must present (fig 4.29). Stress level could be low, less than 0,3.

Anger level more than 0.7 and tension level more than 0,4.

Frequency histogram distribution has maximum in right part of the range and distribution has amount dispersion. High speed signals spectrum envelope looks like uniform distribution.



Figs. 4.29. Aura photos samples for aggression condition of persons

4.2. Macro mode. The control of people condition in crowd

VibraImage system allows controlling macromovements (macrovibrations) as microvibration. Controlled vibration range depends only from the camera lens angle, camera-object distance and movement amplitude of person. Head microvibration informatively expressed reflex movements (Vestibular-Emotional Reflex) but it's well known that human body macromovements expressed behavior and emotions, too. Macromovements control has powerful advantage compared with microvibrations, it permits crowd control. Microvibration control has powerful advantage compared with macromovements, it allows auto control. Both of them are realized by Vibraimage system with different settings.

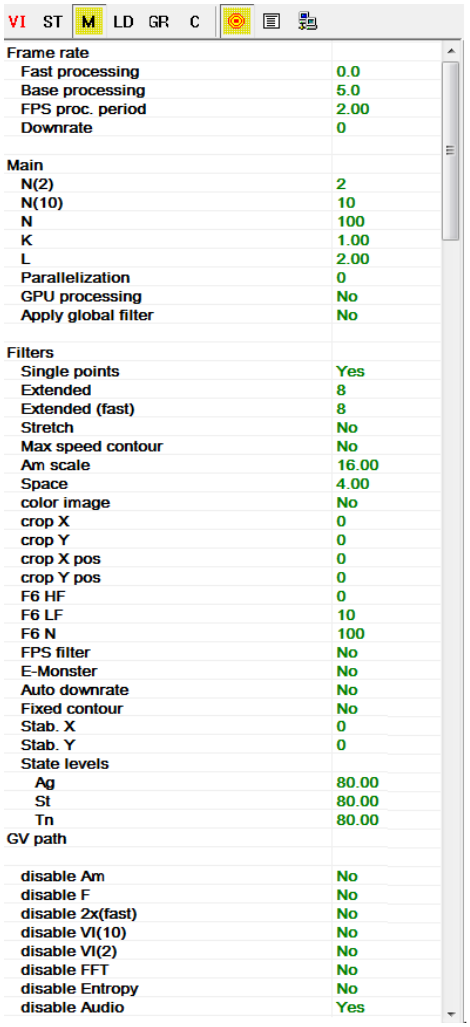
VibraImage Macro Mode control allows indicating a suspected person with the other movement value than other persons in crowd. The typical movement value for normal persons in frame shows statistics range for changes in status window for some time period.

Accumulation period for macromovements registration is smaller than for microvibration registration. It mostly determines by the speed of human body movement and do not suppose movement accumulation and movement repetition.

Typical accumulation period for macromovements covers 1 second and maximum setting N (accumulated frames) depends on camera frequency, for example for 15 f/s user stands N=15, or for 30 f/s user stands N=30.

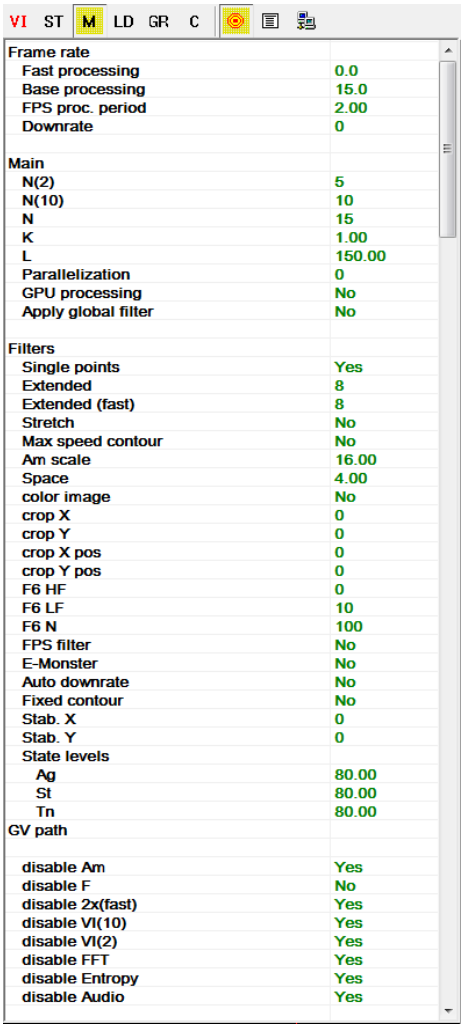
There is no sense to stand difference between base processing and fast processing frequency for macromovements registration. For micromovement analysis was recommended to stand base processing frequency lower than fast processing because head micromovement is practically invisible for time period less than 0,1 second. But for macro hand movement or body movement it is not so and when person is active or aggressive it moves very fast, so it is recommended to stand base processing frame rate between (15 - 30) f/s. Also for macromovements analysis is recommended to set frame number N(2) = 5, because standard 2 frames accumulation gives more red color for any movement (tired operators eyes) and use this window in amplitude or frequency mode. For N(10) and N(15/30) used frequency mode.

Changes in Information Table settings between default mode (microvibrations registration) and macromovements shown on figs. 4.30, 4.31.



VI ST M LD GR C	
Frame rate	
Fast processing	0.0
Base processing	5.0
FPS proc. period	2.00
Downrate	0
Main	
N(2)	2
N(10)	10
N	100
K	1.00
L	2.00
Parallelization	0
GPU processing	No
Apply global filter	No
Filters	
Single points	Yes
Extended	8
Extended (fast)	8
Stretch	No
Max speed contour	No
Am scale	16.00
Space	4.00
color image	No
crop X	0
crop Y	0
crop X pos	0
crop Y pos	0
F6 HF	0
F6 LF	10
F6 N	100
FPS filter	No
E-Monster	No
Auto downrate	No
Fixed contour	No
Stab. X	0
Stab. Y	0
State levels	
Ag	80.00
St	80.00
Tn	80.00
GV path	
disable Am	No
disable F	No
disable 2x(fast)	No
disable VI(10)	No
disable VI(2)	No
disable FFT	No
disable Entropy	No
disable Audio	Yes

Fig. 4.30. Default settings micromovements control



VI ST M LD GR C	
Frame rate	
Fast processing	0.0
Base processing	15.0
FPS proc. period	2.00
Downrate	0
Main	
N(2)	5
N(10)	10
N	15
K	1.00
L	150.00
Parallelization	0
GPU processing	No
Apply global filter	No
Filters	
Single points	Yes
Extended	8
Extended (fast)	8
Stretch	No
Max speed contour	No
Am scale	16.00
Space	4.00
color image	No
crop X	0
crop Y	0
crop X pos	0
crop Y pos	0
F6 HF	0
F6 LF	10
F6 N	100
FPS filter	No
E-Monster	No
Auto downrate	No
Fixed contour	No
Stab. X	0
Stab. Y	0
State levels	
Ag	80.00
St	80.00
Tn	80.00
GV path	
disable Am	Yes
disable F	No
disable 2x(fast)	Yes
disable VI(10)	Yes
disable VI(2)	Yes
disable FFT	Yes
disable Entropy	Yes
disable Audio	Yes

Fig. 4.31. Default settings micromovements control

After changing settings user need to control CPU usage and make sure that it is less than 100 %, preferable less than 60 %.

At the next step user need to control camera real output frequency and make sure that in VI table frame rates In, Fast Processing and Base Processing show approximately equal meanings near set Base Processing frequency (15 f/s) (fig. 4.32).

Especially for adjustment of display modes at work in Macro mode in a field of an information column  are added a number of parameters:

- **Macro mode** - If «Macro mode = Yes» than danger level calculation is made on the basis of values of parameters P13, P14, P15 (the description of parameters is see lower). In «Micro» mode danger level calculation is made on the basis of the analysis of values of aggression (P7), stress (P6) and tension parameters.
- **Level L** - sets a palette threshold at danger level calculation. Vibraimage points which brightness less than the specified threshold, are considered «black» and are not used at calculation of a danger level. The vibraimage point is considered active, if its brightness more than the set threshold «Level L». Parameter **P15** defines the relation between the area of «active» vibraimage points to the area of all frame.
- **Level S** - defining the area of «active» vibraimage points. If the area of points (in %), which value of brightness is more than value «Level L», is less than value «Level S», than danger level value displayed in status window equally 0. So, if in the frame it is not a lot of «active» points, the level of danger is not calculated. Parameter **P14** defines in % excess of the area of active vibraimage points above the set threshold of «active point» «Level S». So, if the number of «active» points grows, value of this parameter too grows also a level of danger increase.
- Parameter **P13** characterizes shift of the histogram to the right in area of high frequencies. So that parameter defines primary color of «active» points of vibraimage.

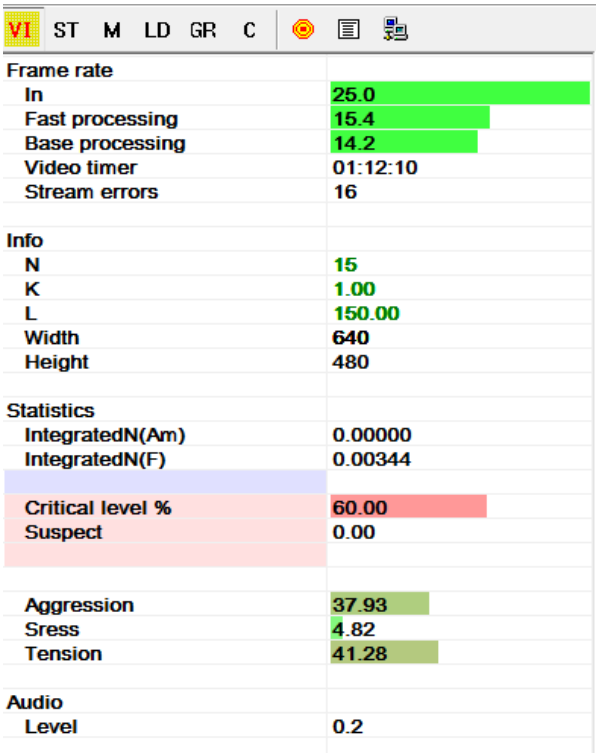


Fig. 4.32. Right VI table indication for macromovements control

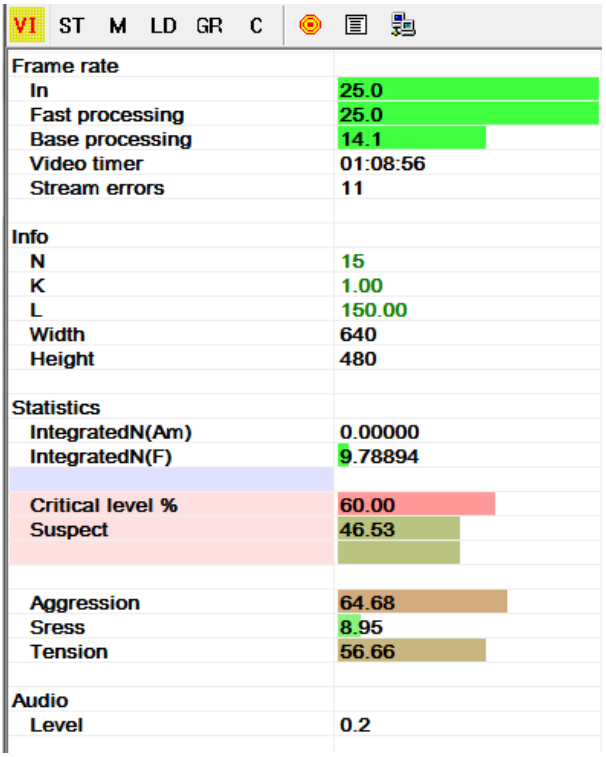


Fig. 4.33. System Setting at 100 % CPU

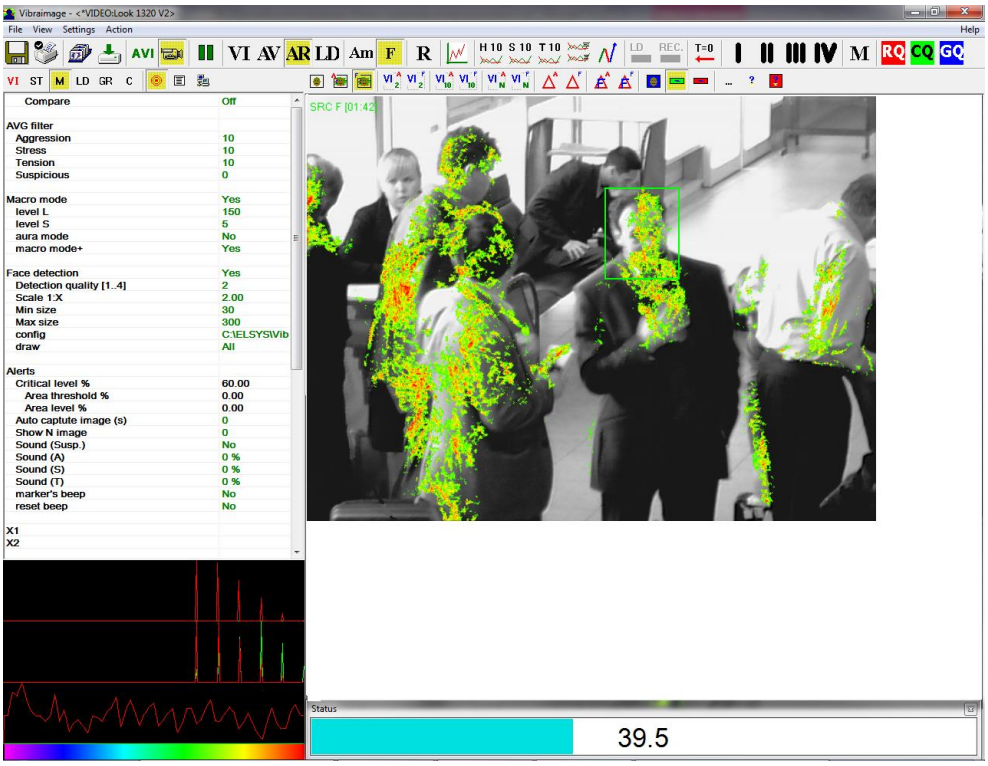


Fig. 4.34. Macro mode settings.

4.2.1. Face detection mode

Switch on **«Face detection»** mode is made in the same section of the information panel (fig. 4.35). If **«Face detection»** =Yes - face detection mode is used. No – without face detection.

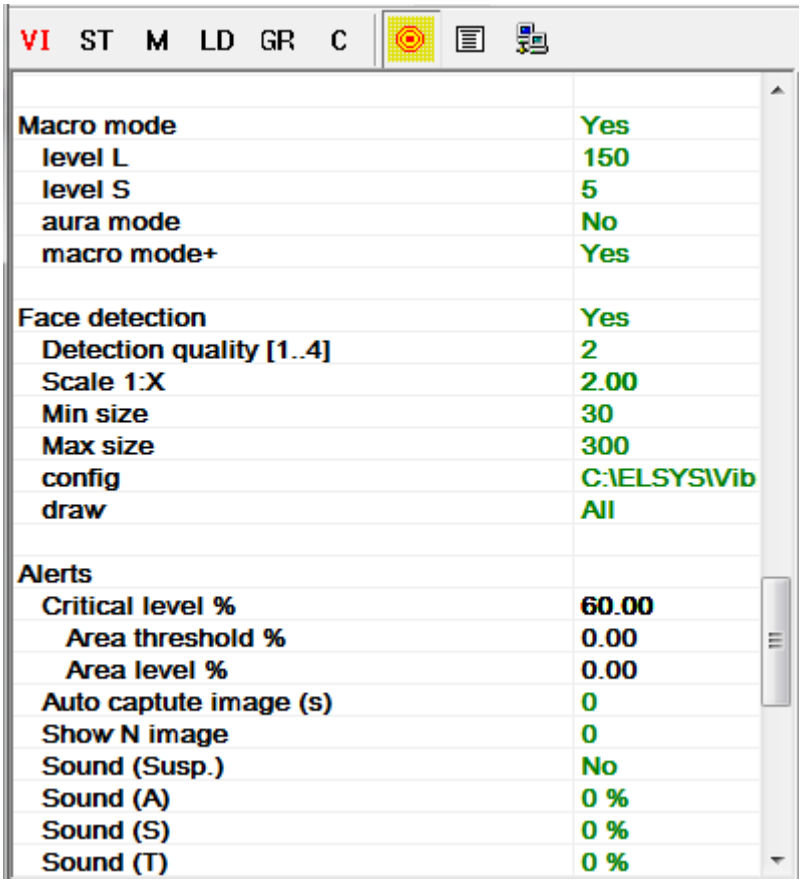


Fig. 4.35. Macro mode basic settings.

If parameter **«Draw»** = No – not draw rectangle around face. If **«Draw»** = Yes – draw rectangle around «more danger» single person, **«Draw»** = All – draw rectangle for all person in frame. For non-danger person rectangle draw green color, but if person suspect level more than **«Critical level»**, than rectangle draw red color (fig. 4.36).

The parameter **«Detection quality»** defines quality of persons face capture. 1 – capture only one large person in the frame (loading of the processor is minimal), 4 - search of all face (even small) persons in the frame (loading of the processor is maximal).

Parameters **«Mines size»** and **«Max size»** set the sizes of rectangular (in pixels) for persons face searching. The given parameter is necessary for set depending on concrete medium-sized people on the computer screen.

Parameter **«Scale 1:X»** sets picture compression ratio before process of search of persons. By default, value 2.0, i.e. video of a format 640x480 will be transformed by the program to a format 320x240. Compression of a format is necessary for reduction of loading of the central processor in case of simultaneous increase in speed of the main processing (base processing). In case of value 0 compression isn't made.

The parameter **«Config»** is intended for loading new algorithms of persons search. At installation of Vibraimage program on your computer in the catalogue \VibraImage8\ will be created the subdirectory «…\Ocv\» in which files of various algorithms of persons search settle down. For loading new algorithm it is necessary to execute the following actions:

1. To stop process of persons search: **«Face detection» =** No
2. In **«File»** menu select first item **«Open»**. Then open folder \VibraImage8\Ocv\ and choose new algorithm for calculation.
3. In line **«Config»** appear path to selected file.
4. Restart person search process: **«Face detection»** = Yes.

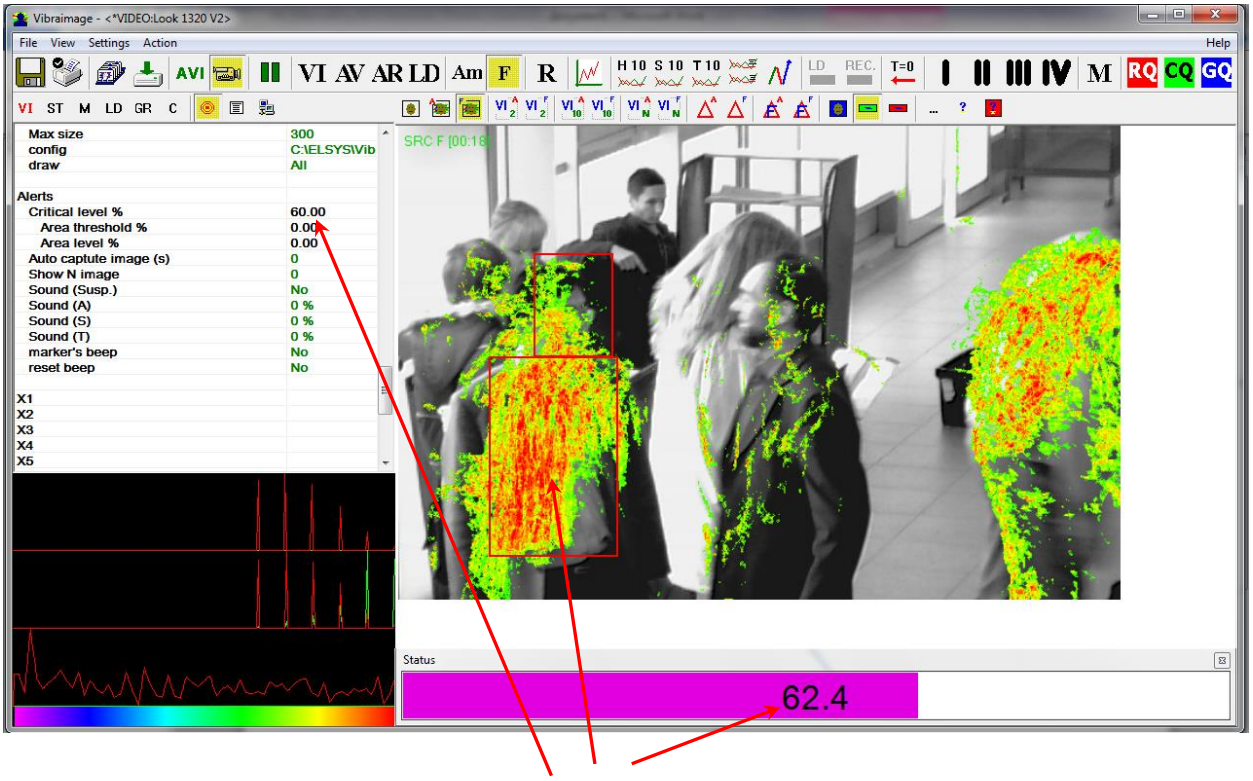
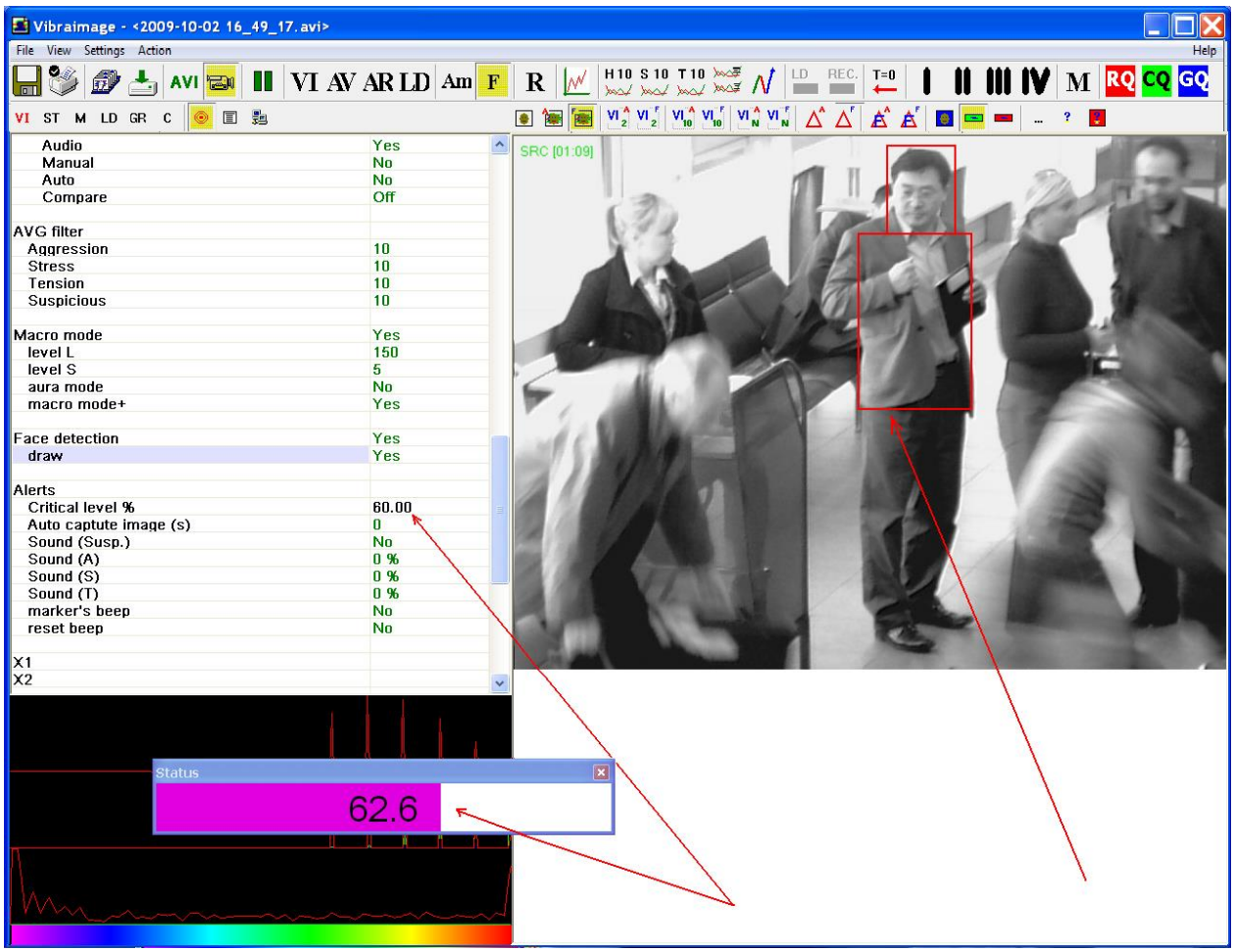


Fig. 4.36 Attention, «Critical level» is exceeded.

For convenience of the operator in section «**Alerts**» of the  information panel (fig. 4.36) the following additional parameters are entered:

1. **«Critical level» –** sets a threshold of «danger level» at which excess the person is considered «dangerous»
2. **«Auto capture image (s)»** – If set «non zero» value, than the image of «dangerous» object at his detection will be automatically save in an external file (fig. 4.36). The chosen value of the given parameter determines in seconds the period of saving the pictures in a file. Simultaneously the image «dangerous» will be displayed in **«Video windows»**.
3. **«Show N image**» - If set value N distinct from 0 in **«Video windows»** will be displayed at once N images of the «dangerous» people which have been found out for the specified interval **«Auto capture image (s)»**. If set value N = 1 - that for the specified interval in **«Video windows»** will be displayed only one image, and we can pass other «dangerous» person! **Note attention,** at work in the given mode **«Video windows»** should be preliminary open!



a) working window with «Source» video mode

b) saving information about interesting person in BMP file

Fig. 4.37. Recommendation for working mode

4.2.2. Crowd control

After software adjusting user need to select right camera and lens view for crowd control. It is recommended to place camera so that every controlled person stands approximately on one distance from camera. That means inadmissible to compare people stands on 1 m and 10 m before camera, but distance from 10 till 15 m is admissible for control.

Vibraimage shows movement amount and person with more high movement amount marks by the warm colors (based on standard vibraimage scale) from more still around. VibraImage 8.x software window allows observe persons in different mode on one display, so specialist could analyze person behavior with source image and several vibraimages that greatly rise informative of psychological analysis. Of course, staff needs to receive some experience of manual analyzing, because it is necessary to compare people performing equal movements, for example standing with standing, giving ticket with giving ticket, moving luggage with moving luggage and so on. Several pictures from tickets and luggage control shows on figs. 4.38 – 4.42.

Figs. 4.38 and 4.39 captured by the one camera on the ticket control in the same conditions and differ by several minutes. It is clear visible, that one person on fig. 4.39 differs by colors from everybody persons on figs. 4.38 and 4.39. Furthermore this person has more frequency colors in every vibraimage window, captured with different accumulation frames number N = 5, 10, 15. This three vibraimage windows give comparative information about person movement amount in different time periods as 0,3 – 0,65 – 1,0 second. Experimentally it was selected as optimal time interval for informative characterizing of human behavior through macromovements. However, sometimes specialist with own experience changed this intervals according the concrete conditions and aims. It concerns others settings, too.

Profiler or security staff view person during limited time period (about 30 s) in real ticket control, and provided testing showed that this time period is enough for conclusion. Anger, stress or nervous person has constantly higher movement activity and differs from the others passengers, practically, during whole time period. Such person could not be so calm and poor color as staff (which is practically invisible in vibraimaging) or other normal passengers.

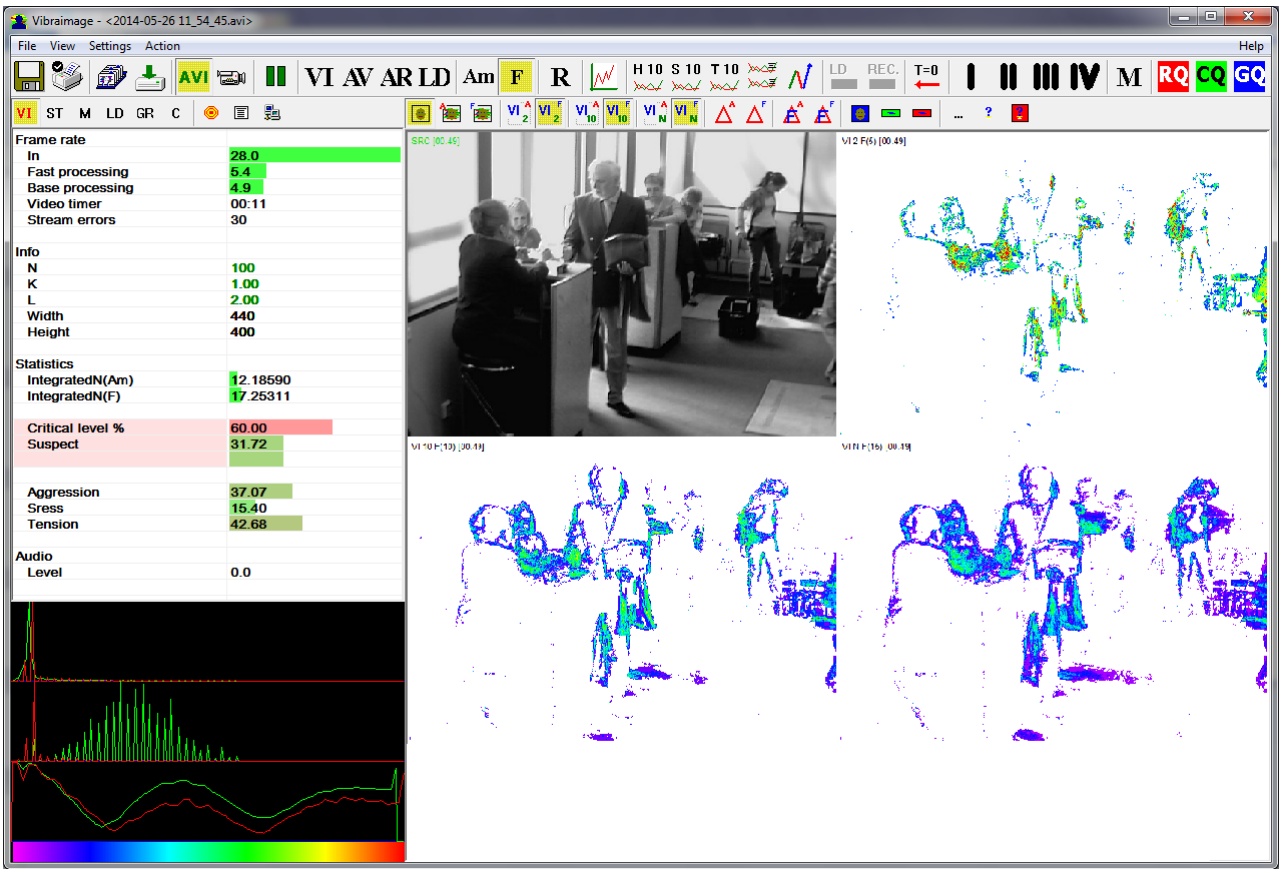


Fig. 4.38. Normal (calm) passengers on ticket control

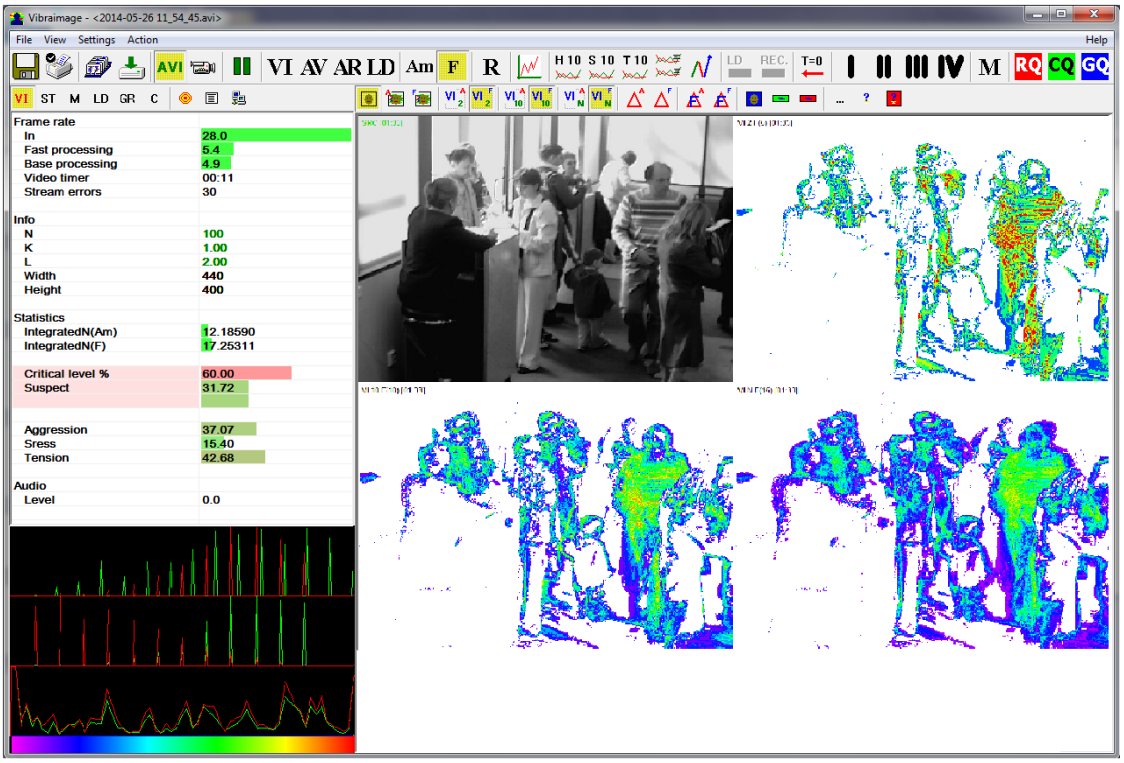


Fig. 4.39. Suspicious (aggressive) passenger on ticket control

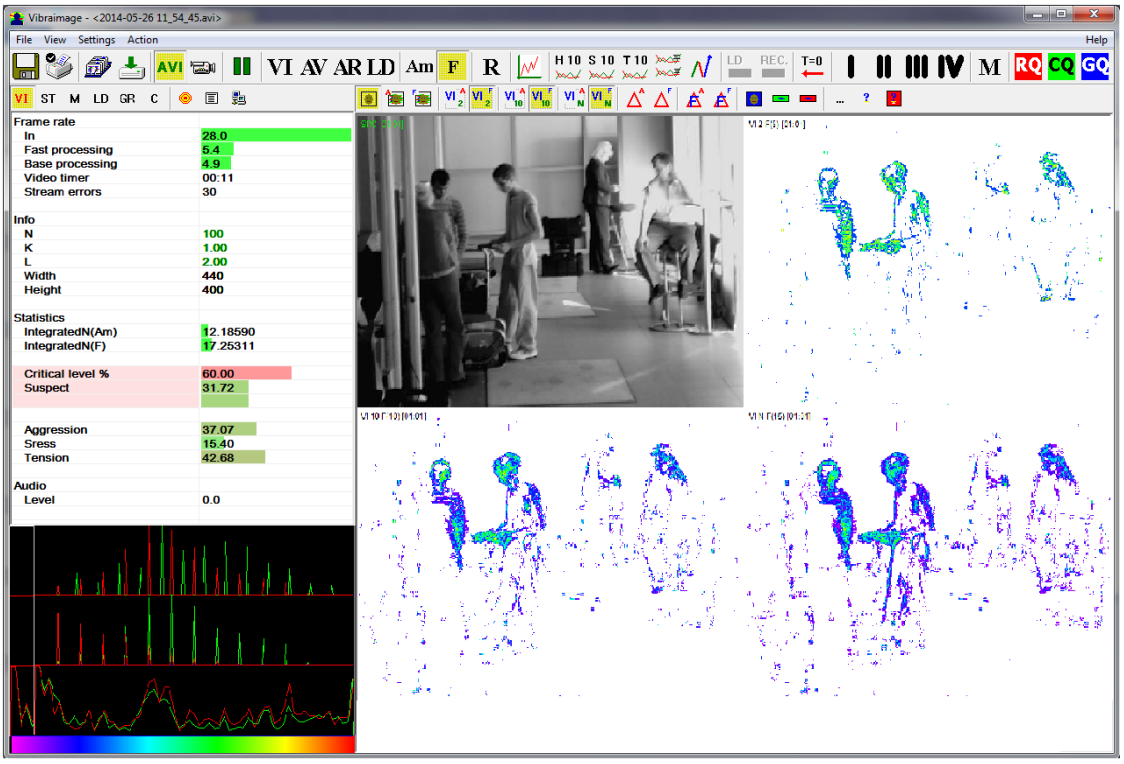


Fig. 4.40. Normal (calm) passengers on the luggage control

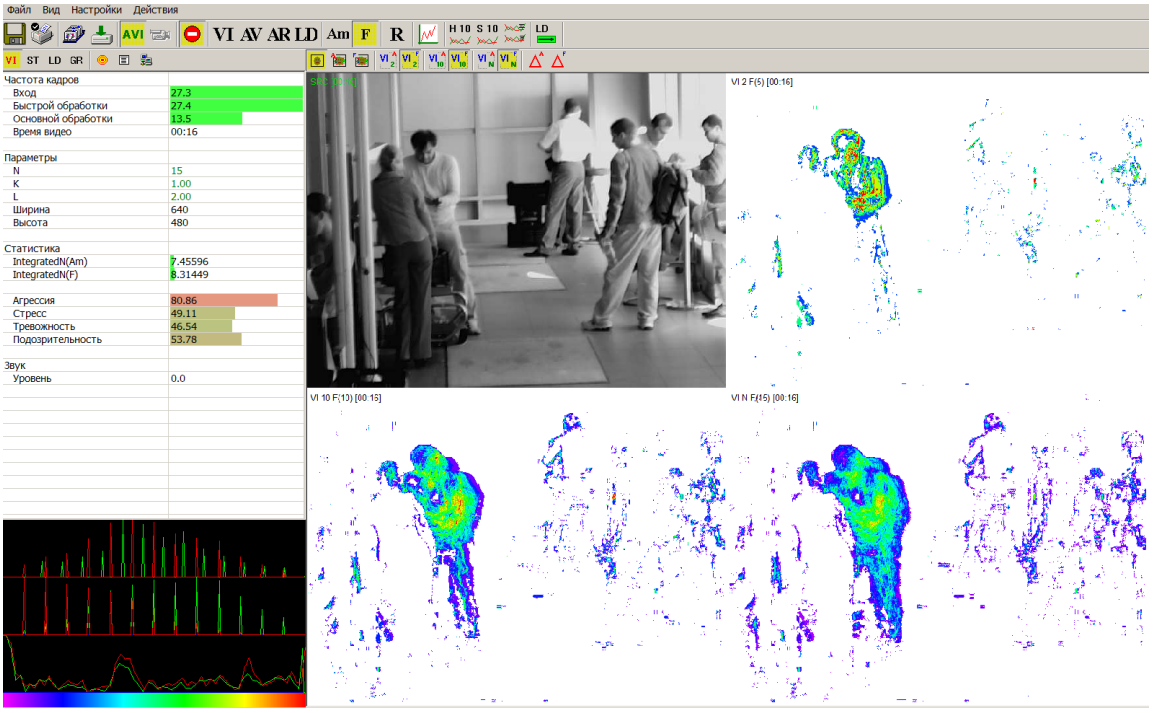


Fig. 4.41. Suspicious (aggressive) passenger on luggage control

It doesn't mean that vibraimage macromovements control is absolutely simple, and every red person in vibraimage pictures is potential danger. On the fig. 4.42 shows staff that moves fast and of course, looks red on the fast vibraimage window with accumulation frame number equal 5.

Usually it is not very hard task, don't pay attention for the fast moving personal, but sometimes fast moving people could trouble crowd control. In difficult situation it is possible to pay attention to standard parameters calculated by vibraimage system and described for microvibration analysis. Anger level calculated for fig. 4.42 shows only 55%, it is lower than in any other shown figs.

Every team of specialists in profiling or aviation security develops own instructions for operation with vibraimage system corresponding to their aims. Operation statistics of vibraimage system application in airports calculates that about 10% of passengers differ from others by macromovements analysis and could account as suspicious person. Ten times narrowing of suspicious person makes easer work of profilers because specialists are working in limited time for solution and technical prompting from vibraimage system is very important. Sure it does not mean that 10% of passengers are terrorists, but it show that this passengers have some behavior and psychology characteristics differs them from others. Some of them only have flight fear, others have prohibited goods in luggage, others are late for the flight and so on.

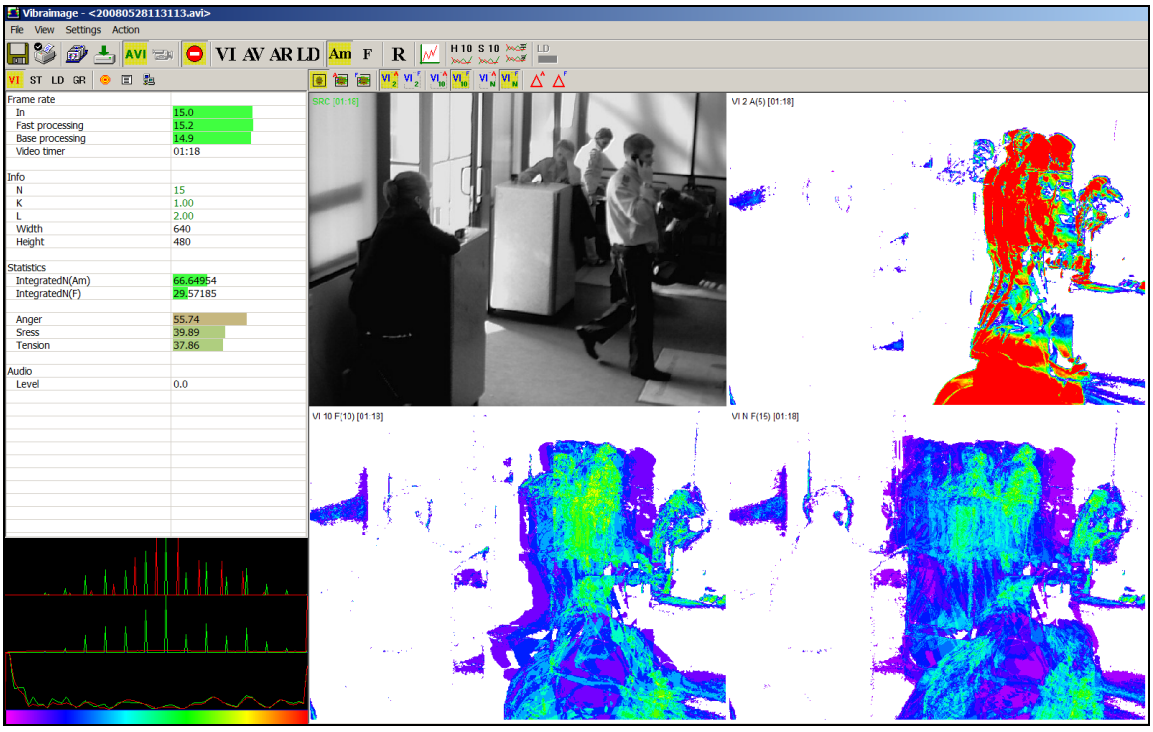


Fig. 4.42. Fast moving person looks red in the fast vibraimage window

4.2.3. First start and settings determination

1. Control status level window during the statistics period
2. Based on the aims of VibraImage Macro Mode change or leave default settings for «levels L» and «levels S» in macro mode settings.

   Standard aim of vibraimage macro mode control is to indicate situation with movement value in frame more than threshold. For example, we control entrance of 100 persons through controlled place. 50 persons has status level (during macro mode control) less than 50 %, 80 persons have status level less than 55 %, 90 person has status level less than 60 %, and only 10 persons have status level more than 60 %. That means if we want to indicate 10 % of crowd differs from middle, in this case default settings with alarm threshold 60 % are ok.

   But if we have that 100 entering persons have status level less than 30 %, that means we need to change alarm threshold, or better, levels L and S in macro mode settings from default. Standing less L and S levels we increase the sensitivity of Suspected status indication, so we could change default settings for L=1 and S=1.
3. Control status level window with changed settings during the statistic period.

   With new settings we will see the other % of Status for the same recorded or live video. Supposed that for L=1 and S=1 settings we will see that 100 persons have status level less than 55 %. That means we need to change again settings for achievement alarm threshold 60 %.
4. Based on the aims of VibraImage Macro Mode change or leave next settings for levels L and S in macro mode settings.

   So we change settings to L = 1 and S = 0.1
5. Do the same steps till status level statistics will satisfy aims of VibraImage Macro Mode.

   For this settings L=1 and S=0.1 we have 90 persons status less than 60 %, and for 10 persons more than 60 %. We could fixed this settings if we have aim to indicate 10 % of people with movement amount more than stand threshold.
6. Stand requested «non zero» level for Auto capture image (s) in Alerts settings based on Vibraimage Macro Mode aims for storage images of suspected persons on the hard disc. Stand other Alerts settings according to control aims.
7. Now control status level window on the screen. For work **it is recommended** to use a «Source video» viewing mode (fig. 4.37 a) then if suspect level of person excess «Critical level» and value of «Auto capture image» parameter not equal «0» in an external file in the specified catalogue the image will be saved (fig. 4.37 b), allowing to identify the person

   Control more colored person by the other means if status level is more than stand threshold and program gives alarm signal

4.3. LD mode. Lie detection

The program of psycho physiological lie detection allows revealing verbal and nonverbal lie in the automatic, automated and manual modes. The program allows fixing and comparing psycho physiological parameters of the person during the various moments of time at use of various modern techniques of interrogation. All means existing now lie detector register changes various psycho physiological parameters of the person, thus it is considered, and that essential change psycho physiological parameters is observed when the person worries, is excited and speaks a lie. In a still condition of person his psycho physiological parameters and emotions vary less considerably in time, hence, having compared a known still condition with the answer interesting us it is possible to define, when the person speaks the truth and when speaks lie. Basis technical lie detection is the principle of zones of comparison (entered C. Bakster); it is simple enough for understanding and allows each person to precisely enough define the truth and lie even at presence of the minimal experience in work with VibraImage system.

VibraImage system makes measurement and the analysis in time more than 40 independent parameters describing an emotional condition of the person. The standard method of definition of lie is based on an estimation of emotional reaction of the person on the «put» question.

In an operating time the operator marks on graph CQ questions (Control Question), RQ questions (Relevant Question) and GQ questions (General Question), pressing on the same buttons  ,  ,  on the toolbar at time of the given questions. After the ending of the test the operator can check results of work in a special created file.

At work in a lie detection mode in an information column is set the interval **«Base periods»** (in seconds) during which the system collects the data on object of research, accumulates the information for definition of allowable limits of current parameters values change that then at «lie detection» to define «abnormal» change of separate parameters. If value of parameter during time of **«Stat. period»** exceeds the set limits it is taken into account at lie level calculation with the certain factor (weight (Rate) the given parameter).

4.3.1. Before starting

For correct PDD (lie detection) by Vibraimage system is recommended to take into account the following factors and conditions:

1. The image of the person should be high quality, the maximal facial size preferable and face position must be in the center of the screen. For camera horizontal resolution across 640 pixels the person face should be not less than 200 pixels. Fig 4.37 shows the example of correct person position in frame is displayed.
2. The object (person) should be well and stable illuminated also (black-and-white-preferable, or color) the image of the person should be precise and contrast. As lie detection depends on detection of the microvibrations and the object micromovements fixed in reflected from object light, therefore poor light exposure

of object can increase error rates. On example of fig. 4.43, brightness of a background (1) is uniformly and contrasts to person. Brightness of person face (2) is also uniform from left to the right.

Natural illumination of object can be used if speed of natural light changes does not exceed 1 lux/sec. Illumination of object by fluorescent lamps with illumination in the range 400 - 600 Lux in object plane is preferable.

3. In a video camera options it is necessary to switch on a mode of fluorescent lamps noise suppression (flicker mode 50Hz and 60Hz).
4. In camera options it is recommended to use black-and-white image mode.
5. Presence of the other people, taking place in the frame near to the researched object, can influence and increase error rates of lie detection.

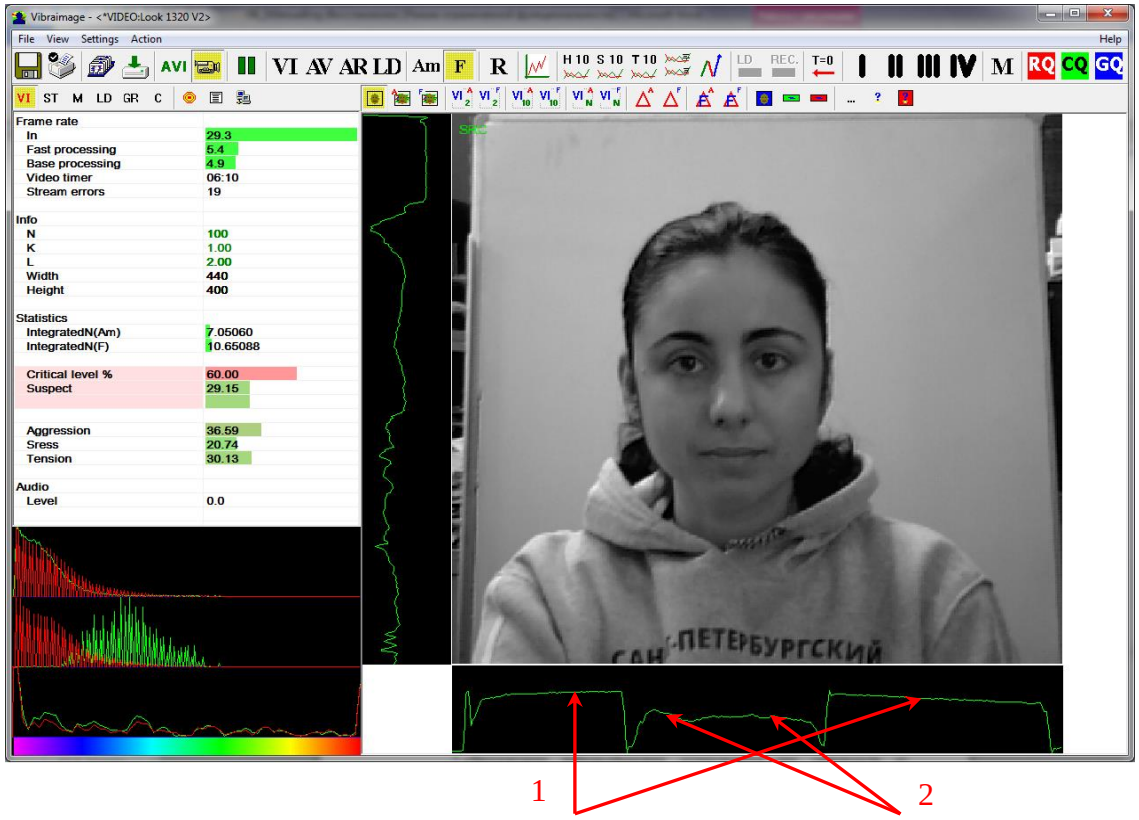


Fig. 4.43. Correct person position for lie detector mode.

6. The video camera used for surveillance, and/or object on which the camera is fixed, should be motionless and have no vibrations. The vibration or movement of camera can increase error rates of lie detection.
7. Speed of input frame from the camera should be not less than 25-30 frame per second at resolution not less 640x480 pixels.
8. After start of Vibraimage program and person vibraimage displaying on the screen loading of the computer central processor power must be less than 60 %.

9. The set of a microphone is recommended to use external, not built-in in the camera or notebook.
10. At work with videofiles it is recommended to use files in length of 5-10 minutes and for exact lie diagnostics it is recommended to analyze the same file repeatedly some times.
11. Press 

button before next lie detection of the same file. 

button works as reset and stabilized detection results. Double click on 

button fixed graphs time equal to the video file period.
12. Also in the submenu «View» there is function of switching LD bar (fig. 3.54). One-clicking on the button on the LD bar lets start a questionnaire at that moment. Double-clicking returns to the beginning of the questionnaire and the video file. The questionnaire can be selected by putting on the item «LD load text…» in the submenu «File».

Note

For stable work in a «Lie detection» mode in section «Filters» of the information panel  it is necessary to set parameter «FPS filter» =YES

Note

At repeated viewing the same videofile the deviation in repeated values the same parameters up to 5 % is acceptable because live video is the same as live object error rate less than 5% is normal. For stable work in a «Lie detector» mode is recommended use personal computer CoreDuo2 3GHz (not less than 4Gb RAM) or more powerful. At such computer speed of input frame from the camera should be equal speed of fast parameters processing FPS_in=FPS_fast> 25-30 frame/s.

13. Lie detection in a manual mode usually use, if quality of the alive or sound of video unsatisfactorily and it is impossible to separate on a level of a sound questions and answers from extraneous sounds. Calculation of a lie level in this mode is made only after a choice of item «**Start LD block**» the menu of «**Action**» (or corresponding button 

of toolbar). For end of an interval of lie calculation it is necessary to press repeatedly the same button or to choose the same item of the menu. The moment of start on the graph will be marked by a vertical green line, the ending of calculation – red.

4.3.2. Audio level settings in «ST» information panel

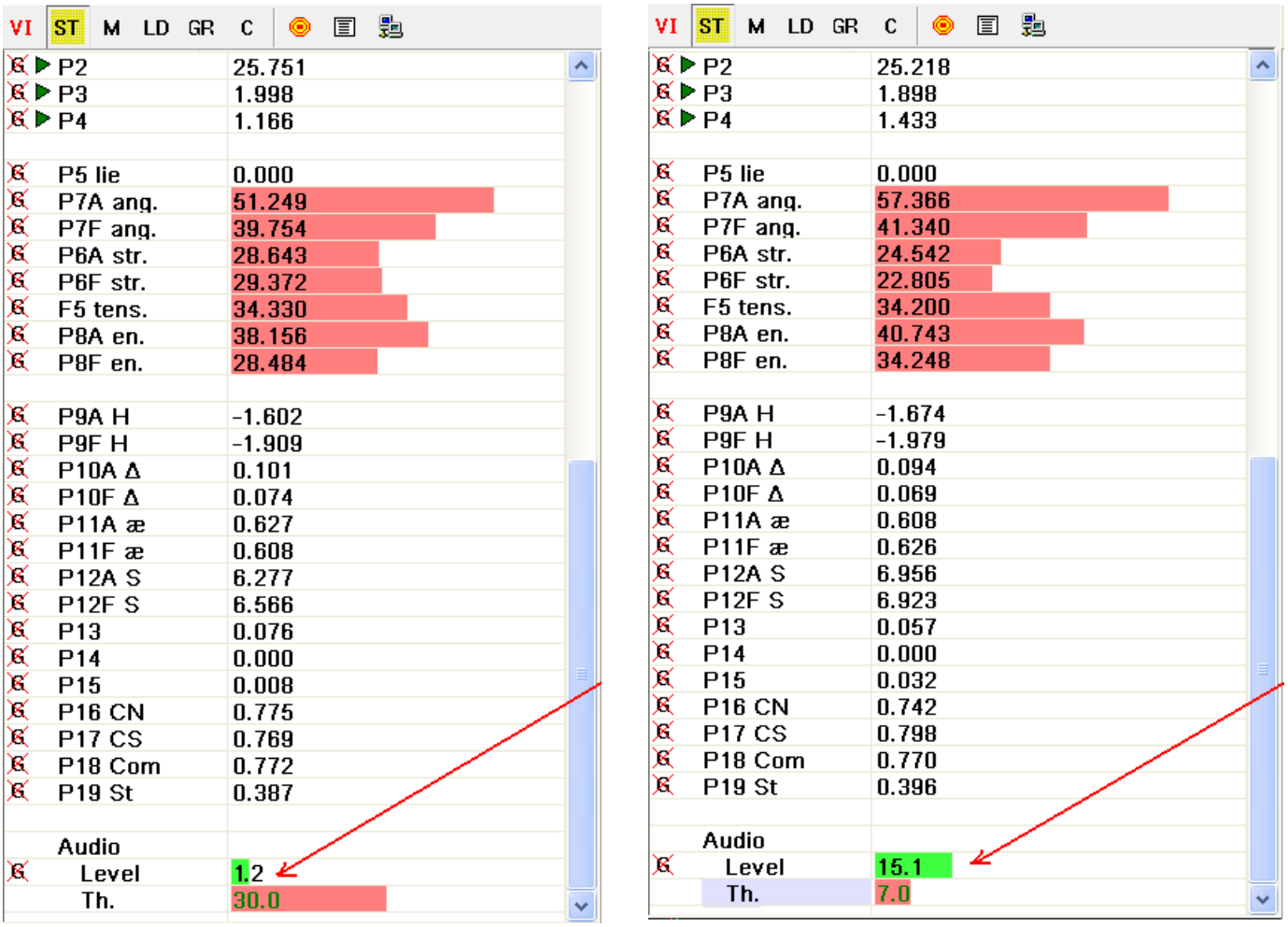
Note

VibraImage system requests correct adjustment of input audio signal (procedure of adjustment see above). The moment when the person starts to speak, is used by system for the analysis start of the data in **Audio mode**. Vibraimage parameters during speaking (Stat period) are compared to the data received earlier (Base period), for example, when the person was silent.

Therefore it is necessary to adjust preliminary an «Audio level» so that the surrounding level of a sound was below threshold, and the level of a sound at the task of a question and reception of the answer was higher threshold.

Before operating in Lie Detection mode adjust the level of audio signal. Changes of audio signal input options are made in corresponding fields of an information panel in «ST» mode (fig. 4.44). Level of audio signal (down red strip) is necessary to stand so, that it was on the average position between the minimal value of a input signal which corresponds to silence in a room (position of green strip on fig. 4.44 a), and the maximal value which corresponds to a voice sound of a person in front of the camera (fig. 4.44 b). Audio mode is preferable for lie detection in vibraimaging, if video and audio data of person were captured with high quality.

Position of a red strip stands by click of the left mouse button and input of a new value of a level.



a) *b)*

Fig. 4.44. The value of input audio signal: a) minimal (corresponding to silence); b) maximum (corresponding to voice). Threshold value setup equal 7.

Additional parameter **«Audio sens. s.»** in an information column  sets in seconds, how many seconds after the person answer finished are accepted to analyze of lie detection.

4.3.3. «Settings» information panel settings

Note

For stable work in a «Lie detection» mode in section «Filters» of the information panel  it is necessary to set parameter **«FPS filter»** = YES.

1. The parameter **«FPS filter»** provides stability of input video frame stream frequency due to resources of a computer. If the parameter **«FPS filter»** = No, than parameter **«Downrate»** in VI information panel sets factor of division of input frame frequency FPS_in for all processing mode (base and fast). If the parameter **«FPS filter»** = Yes, than parameter **«Downrate»** sets factor of division of input frame frequency only for base processing mode. If **«Downrate»** = 0, than division factor calculated by system automatically.

If input video frame stream frequency not stability, than additional parameter **«Stream errors»** in VI information panel displayed quantity of entrance frequency «failures».

2. At work in a lie detector mode in information column (fig. 4.45) the **«Base periods»** interval (in seconds) is set during which the system collects the data on object of research, accumulates the information for definition maximal and a minimum level of the current parameters values that then at «lie detection» to define «abnormal» change of values of some parameters. Then at «Lie detection» during of **«Stat periods»** the system defines «abnormal» change of values of separate parameters of object.

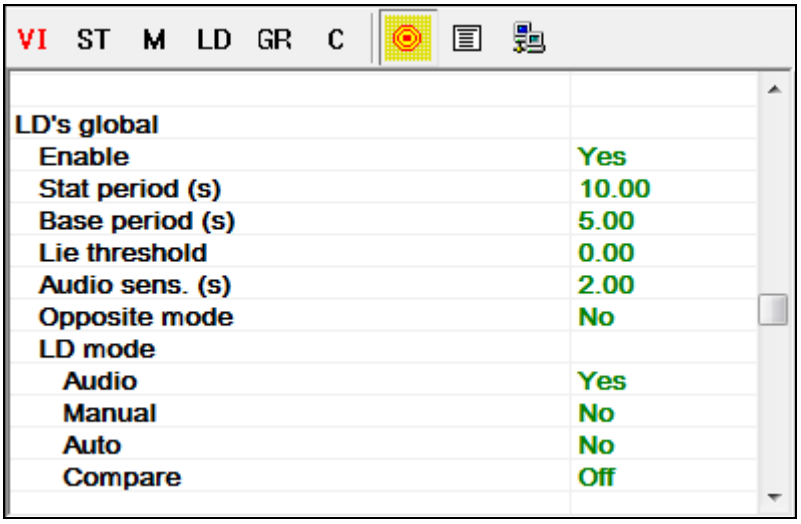


Fig. 4.45. Lie detector parameters settings.

In a base variant that **«Base periods»** interval directly precedes the moment of the beginning of the lie analysis. But the system gives an opportunity to make accumulation of the initial information about object at any time. At a choice of item «Start LD compare block» the menu of «Action» (fig. 3.18) (or corresponding toolbar item REC.) will be made start of the beginning of an accumulation interval during any time. For end of an interval it is necessary to press repeatedly the same button or to choose the same menu item. Now at the lie analysis the condition of object will be compared from the information saved up beforehand.

Parameter **«Compare»** an information column defines what way of accumulation of the «test» information is chosen. Value **«Off»** - at the analysis of lie, as test, is used an interval «Period of processing» directly till the moment started lie detection. Value **«On»** - at the analysis of lie, as

test, is used an interval «Period of processing» which has been marked by the user beforehand. When the user includes accumulation of the preliminary information, in this field - value **«Capture»**

3. Additional parameter **«Audio sens. s.»** in an information column sets in seconds, how many after the person answer ending still to continue to analyze his condition

4. The parameter **«Lie threshold»** in an information column sets in % a threshold for the indicator of a lie level in view of all designed parameters and their «weight». At excess settlement value of this threshold «a lie level» is registered and displayed

5. Each person differently reacts to lie by virtue of the psycho physiological features. The part of people when lie, «worries» also their reaction (value of parameter P5-lie) on the «important» questions (RQ questions) exceeds reaction to control questions (CQ questions), and the system registers a condition of lie (DI). For such people parameter **«Opposite mode»** = NO (it is a mode by default). And the part of people - on the contrary, internally «is clamped (strains)» and their reaction (value of parameter P5-lie) on the «important» questions (RQ questions) less reactions to control questions (CQ questions), and the system does not register a condition of lie (NDI). For such cases for increase of reliability of lie detection results the parameter **«Opposite mode»** = Yes (it is a mode is recommended for experienced users).

For the majority of cases it is recommended to use a mode **«Opposite mode»** = NO, but thus, the decision on that, lies the person whether or not, to accept on the basis of the analysis and changes of parameter P5 (lie) and change of parameter P20 (value is deduced in a LD window «the Lie indicator») and as to supervise changes other important parameters of a condition of the person during the specified time moments.

Values of system options recommended (by default) for work in a lie detection mode:

Stat period = 10 s

Base period = 5 s

Lie Threshold = 0 %

Opposite mode = No

Audio sens = 2 s

N = 100

4.3.4. «LD» information panel settings

If you have a sufficient operational experience with a lie detector, you can independently make adjustment of numerical values for parameters from A1 up to P4, having opened corresponding menu of the information panel LD (fig. 4.46).

LD table columns meaning:

V -	Current value of parameter
«Calc»	Yes- LD detection on, No-LD detection off
R1 (Rate1)	«Weight» of parameter if its current value became more than the set base maximum bMax **OR** became less than the set base minimum bMin.
R2 (Rate2)	«Weight» of parameter if its current value became more than the set base maximum bMax **AND** became less than the set base minimum bMin.
R2V, R1V	Visualization – using for calculation of P5 parameter
R2C, R1C	Calculation – using for calculation of P20 parameter
Level	In % determines on how many the parameter value should exceed the settings limits that the system «considered» this change as significant

LD parameters graphic value shows:

▶ Value of parameter is considered for LD detection

■ Value of parameter doesn't considered for LD detection

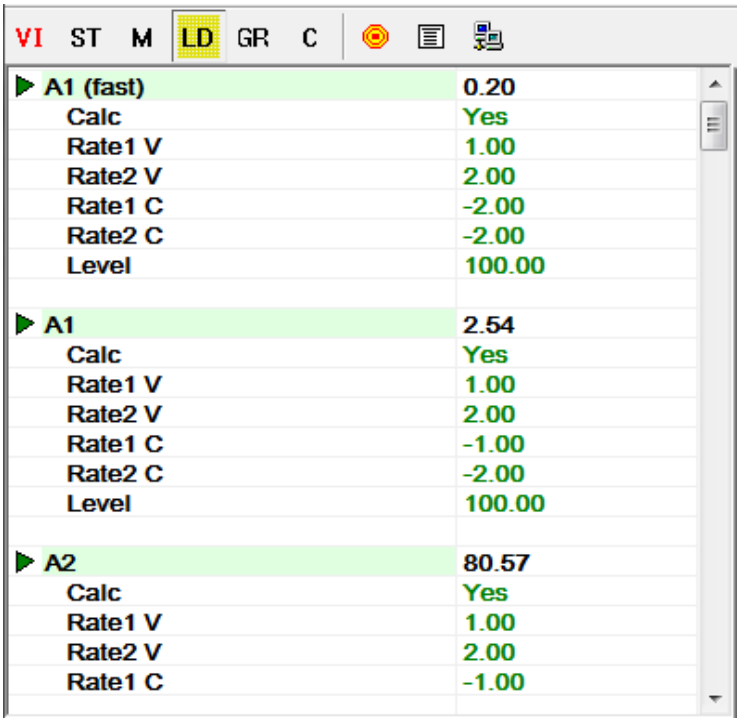


Fig. 4.46. LD mode of information panel..

Below are show 3 examples which explain a principle of information accumulation. No difference between Stat period and Base period shown on fig 4.47. Significant changes of the two levels of parameter between Stat period and Base period shown on fig 4.48.

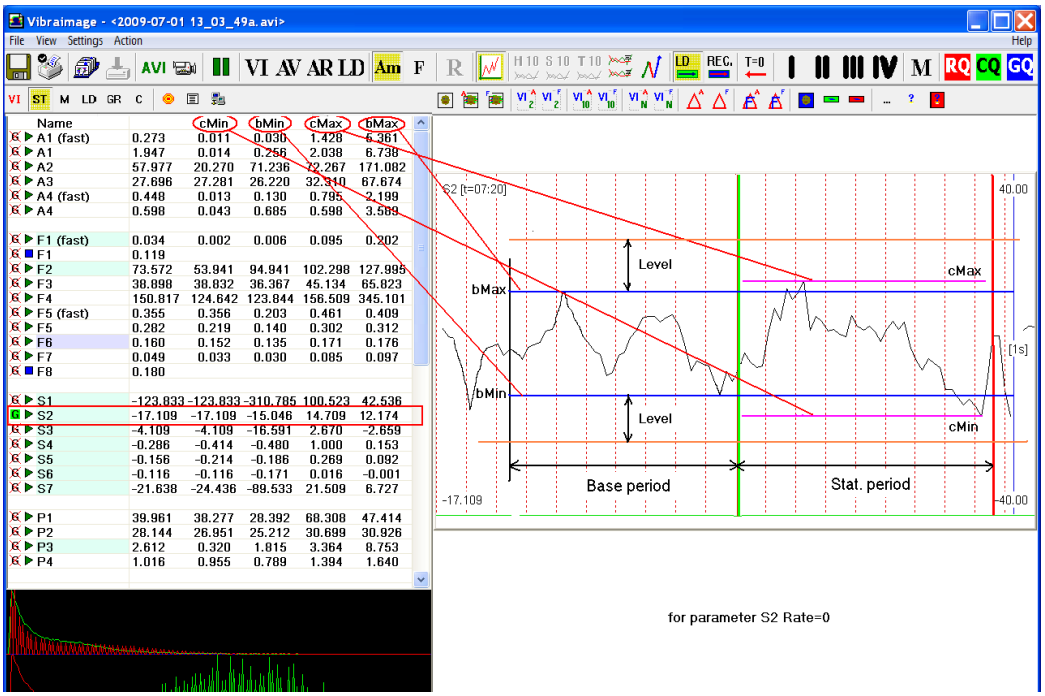


Fig. 4.47. No difference between Stat period and Base period for indicated parameter S2

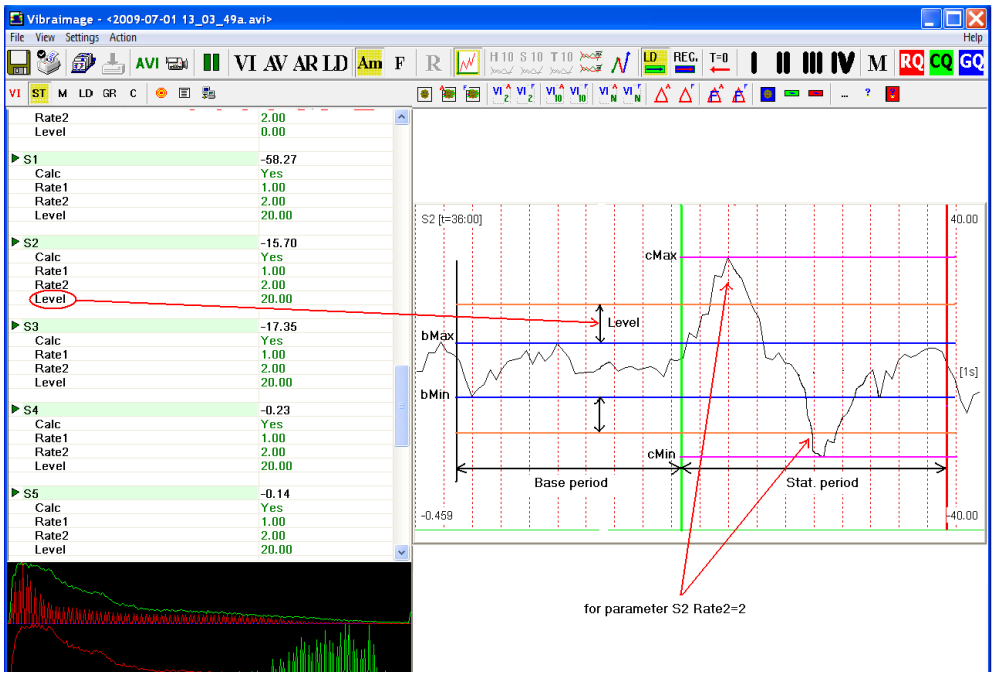


Fig. 4.48. Significant changes of the one level of parameter between Stat period and Base period for indicated parameter S2

4.3.5. Graphs settings in «GR» information panel

Choice of item **«Graphs»** the menu «View» makes switch on/off display in the field of image the graph of change in time of the set parameters (fig. 4.49).

The choice, what change of parameters will be displayed on graphs, is made in an information column in mode GR Changes of the parameters marked by a G symbol are displayed on graph. To choose parameter it is necessary to click the mouse left button when the mouse pointer is above the letter **«G»** the chosen parameter. The parameters marked by G, on graph are not displayed.

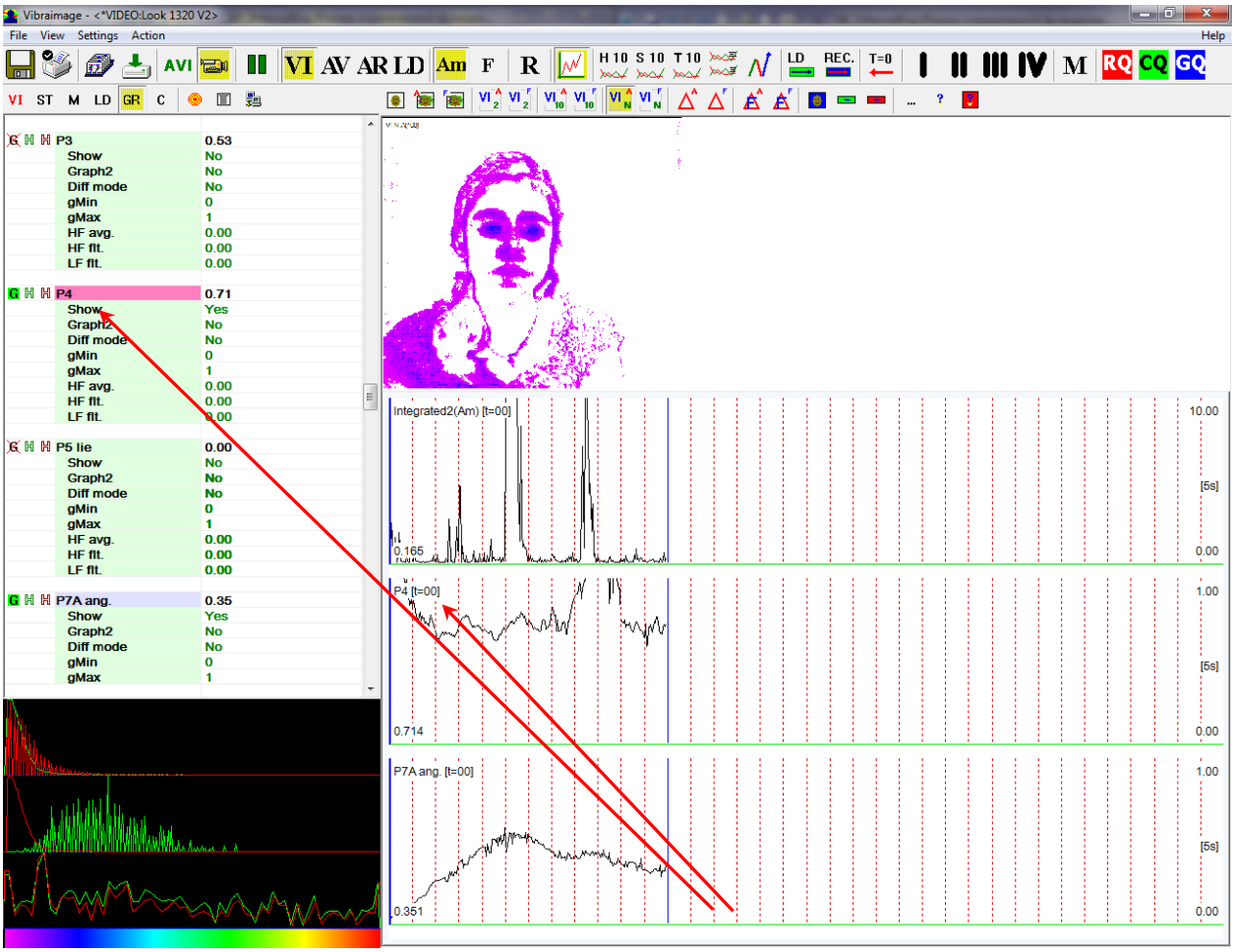


Fig. 4.49. Graph example.

Note

Operation in «lie detection» mode is recommended to indicate parameters as much as possible covering all types of general activity A1 fast, F3, S2, P2, P5-lie and F6, and also a level of a sound for the first testing.

Note

At switching of system parameters in a Lie detection mode, executed by double click by the left mouse button above line of «LD default» in the information panel, automatically in a working window of the program will be displayed all necessary graphs (fig. 4.50).

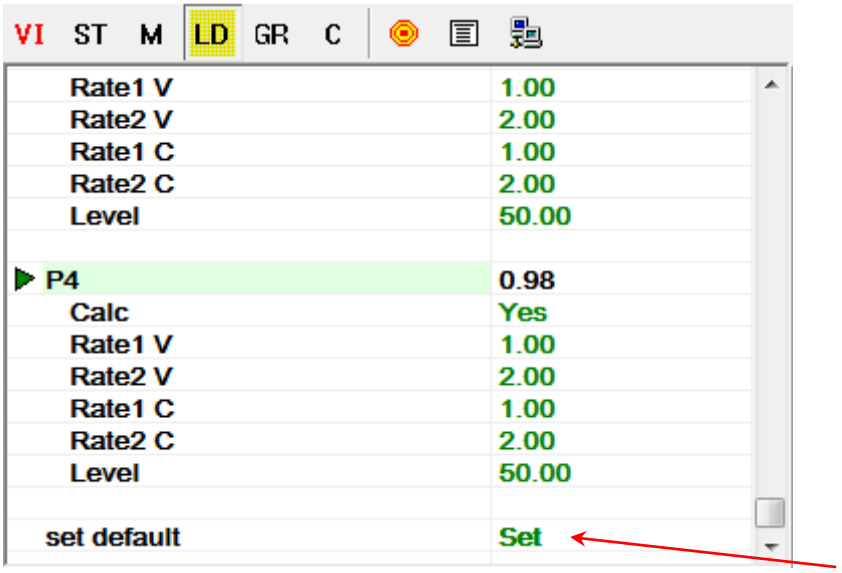


Fig. 4.50. Setting the displayed information in the mode «LD»

For visualization psycho physiological changes in the program the following parameters are used:

A1- shows maximum fast reaction of person for question or situation, so it changes before any other VI parameters, but goes down also immediately as it changed. This parameters shows macro movement and sometimes used for deleting artifacts from the lie detection process.

F3 - shows general mental energy level of examinee, in default settings this parameter calculates for time period of 20 seconds, so it is slowly changing parameter reflects psycho physiological state. High level of this parameter indicates high level of exciting, aggression or activity so it could be correlated with lie.

F6 - shows inhibition of person and also correlated with respiratory tracing or breathing activity, because it is physiology linked with inhibition process.

S2 - shows asymmetrical of movements in middle time period, so it includes left/right hemisphere activity components and it high changes usually indicates lie.

P2 - shows Mean-Square-Deviation (MSD) of frequency histogram and low meaning of this parameter usually indicates normal state, so high meaning of this parameter could be correlated with lie.

P5 – indicates Lie level auto calculated for selected parameters, in Default settings for Lie indication need to have significant changes at least in 8 vibraimage parameters, typically in Lie detection system registers significant changes in 12 or more parameters, given in Lie Report. It is impossible to register lie, only by one or two parameters changes, this is like fingerprint biometric identification, only totality of several parameters give reliable lie detection.

Audio level directly does not use in lie detection, but the selection of Audio threshold formats time level for start and finish of lie detection in Audio mode, so it is enough important for visualization and correction by expert.

P20 - Quantity indicator of a degree of change psycho physiological parameters in view of various factors of the importance of measured parameters since the part of parameters is accelerated, and others are slowed down during one reaction.

4.3.6. Lie detector begining

General switch on of a «**Lie detector**» mode is made through item «Enable» the information panel  or with the help of LD button on toolbar, or with item «**Preset**» of «**View**» menu (fig. 4.51).

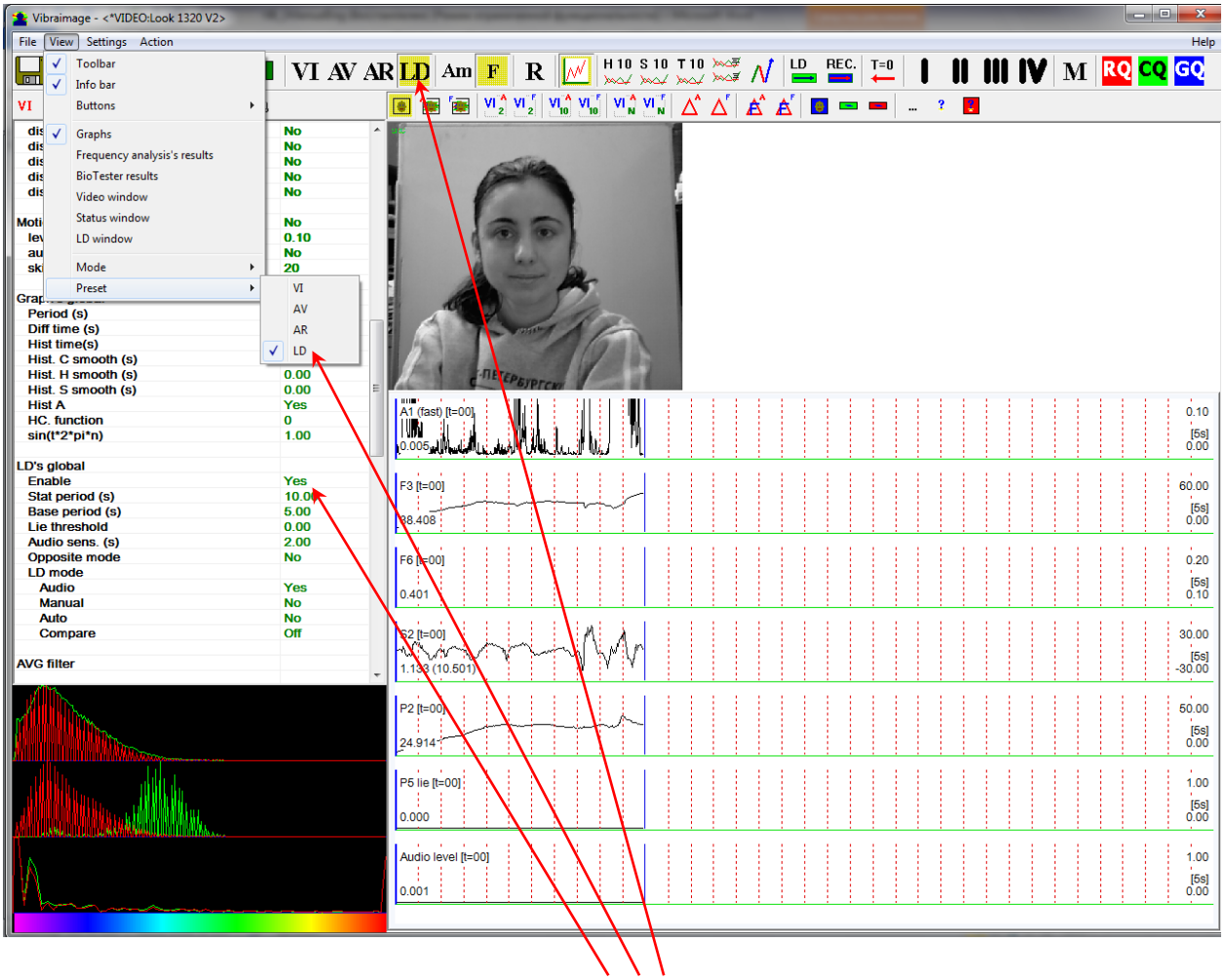


Fig. 4.51. «Lie detector» switch on and operation.

Option of operation in «lie detection» mode **«LD mode»** is made in information column in a mode (fig. 4.50). The system has the following options:

1) **Audio -** Calculation of lie level is done, when the level of audio signal exceeds the setting level, and stops, when the level of audio signal becomes less than the setting level. On graphs the moment of the beginning of data accumulation is displayed by a vertical green line, the moment of end - a vertical red line.

   That mode is the basic recommended for use at lie detection.

1) **Manual -** Accumulation of the preliminary information is done in **«Base period»** interval. Calculation of a lie level is done only after a choice of item «**Start LD block**» the «**Action**» menu (fig. 3.18) (or corresponding toolbar item LD). For end of an interval of lie parameters calculation it is necessary to press repeatedly the same button or to choose the same menu item. The moment of start on the graphs will be marked by a vertical green line, the ending of calculation – red line.

   That mode is recommended to be used, when the researched person gives long spatial answers to the put questions, for example, during interview, or with the poor sound recording where **Audio** mode is difficult to apply.

2) **Auto -** Calculation of a lie level is made constantly, the current values of parameters are compared to values saved up for the previous period «Stat periods». This mode also is used for poor audio recording, for files without audio at all and for comparative testing.

After done adjustments the VibraImage system is ready to operate and capable to detect lie in person testing which image indicates in the basic program window (fig. 4.52). The lie indicator is change of numerical values and the sizes of the histogram against a line **«P5 (lie)»** in an information column in ST mode or value which will be displayed in a window «**LD window**» (fig. 4.52). The lie indicator is change of numerical values and the sizes of the histogram against a line **«P5 (lie)»** in an information column in ST mode or value which will be displayed in a window «LD window» (fig. 4.52), in that window displayed P20 parameter value. The call of a LD window is made through item «**LD window**» the View menu or pressing of the toolbar button . Higher lie level corresponds with more long red strip and high indicated value.

For operation in «lie detection» mode with «audio starting» needs to switch the system in an «LD» operating mode by double click of the mouse left button above line **«LD default»** in the information panel (fig. 4.52).

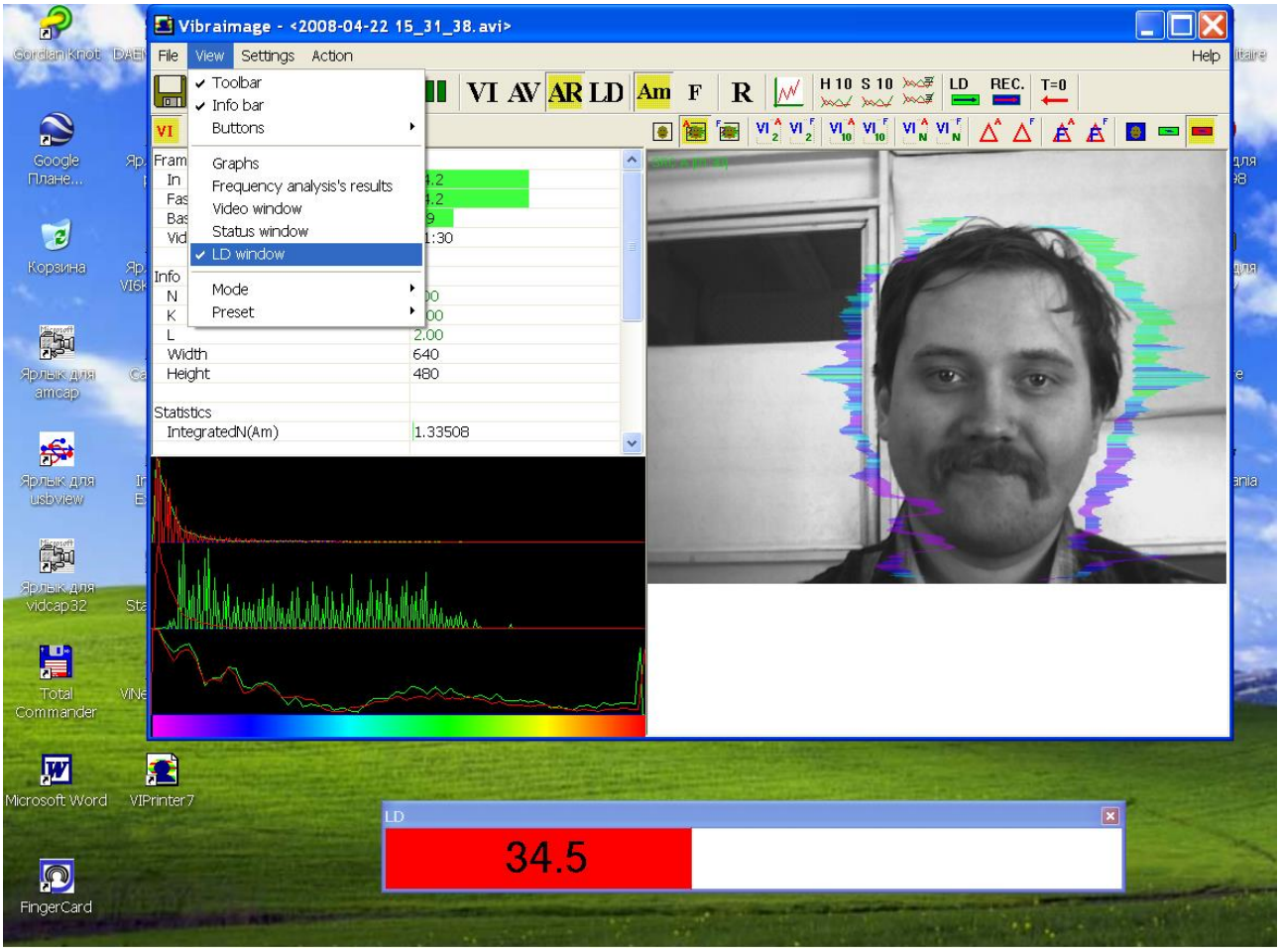


Fig. 4.52. Example of LD window

At work the special attention should be given changes of a signal on the graph of parameter P5 (lie) which define the most «suspicious» moments in reaction of the person. Each question - answer (it is desirable shared by a time interval not less than 10 seconds) is characterized by the level of change psycho physiological parameters of the interrogated person. This level is characterized by two integrated parameters - P5 (fig. 4.53) on graph and parameter P20 in a «LD window», which states the most quantitative estimation of reaction of the person on a question. The above the level of this parameter P20, the more probability of lie at the answer.

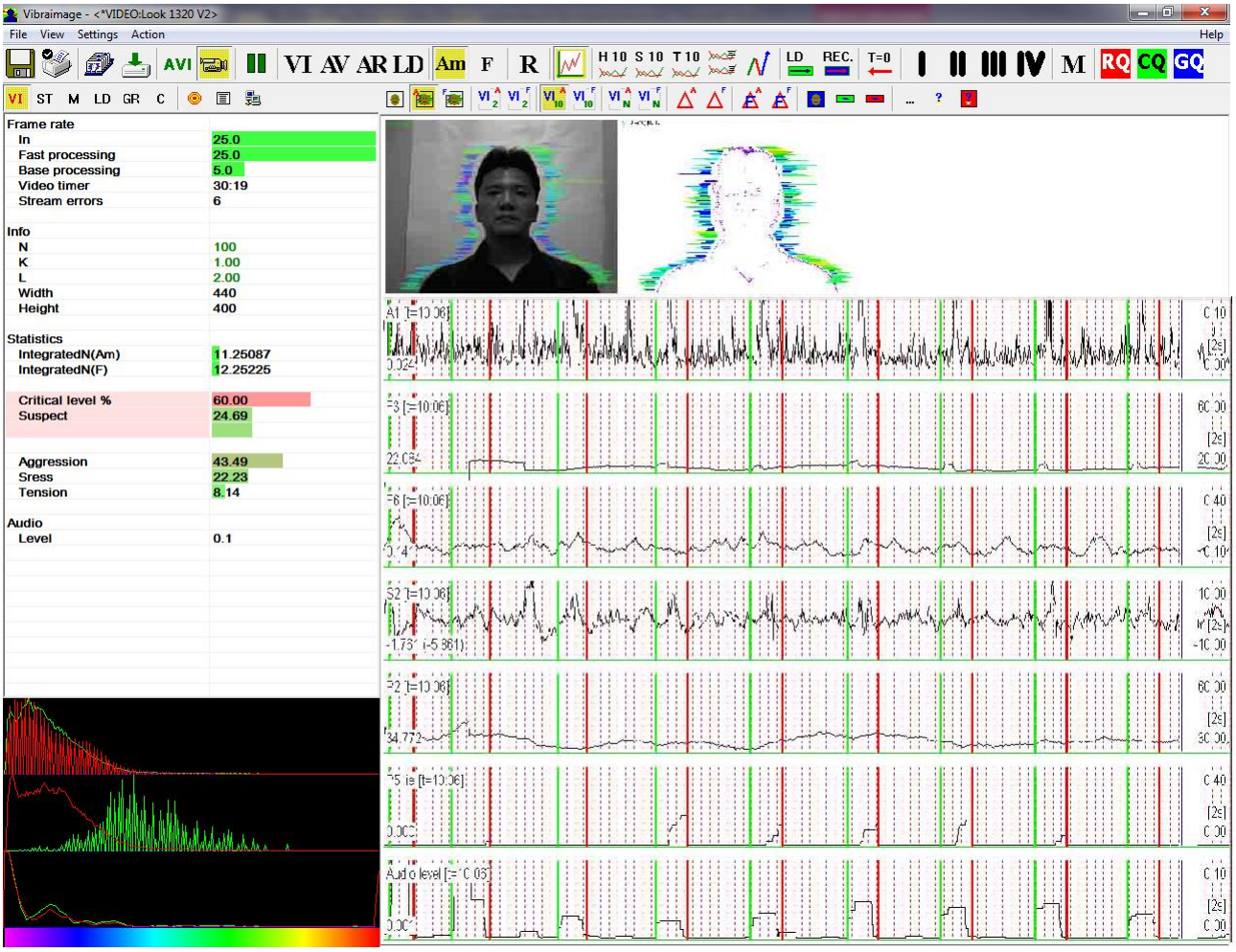


Fig. 4.53. The sample of vibraimage lie detector operation. On questions 3 - 7 system detects lie

4.3.7 Save and load VibraImage program settings for «LD» mode

Item **«Save settings as** …» menu **«File»** (fig. 3.81) is used for **s**ave of the current Vibraimage settings in external XML file.

Item **«Load settings …»** menu **«File»** is used for load saving Vibraimage settings in program.

Item **«Database folder…»** is intended for input of location archive database. To set "**The database folder...** " it is possible in the line "**DB folder**" in a data panel . The list of objects, the information about which is in the specified catalogue displays as the list in the bottom of an information panel. Filling of field **«Selected record»** is made at choice of corresponding line in the list of a database.

Item **«New records…»** it is intended for input of new record in a database. The further saving of files in archive will be made in a folder, with a name of the entered record.

4.3.8. Lie detection with fixed questionnaires

Lie detection is provided with fixed actual questionnaires like Credit, Family, Bribe, Insider etc; The selection of fixed questionnaire is provide from main menu button by pressing button «LD load text…» and looking requested file (Bribe, Insider, Credit or Family) with “ldg” extension.

The purpose of the «Credit» questionnaire is the definition of a lack of lies in the intents of the candidate for the credit obtaining and the detection of the cheating.

The purpose of the «Bribe» questionnaire is the definition the reliability of the tested person response that he (she) didn't take a bribe at the current post.

The purpose of the «Family» questionnaire is the definition of lies when the examinee response to the question, did he (she) last night at work, or different place.

The «Insider» questionnaire is intended for testing to recruit staff on the possibility of the selling of company secrets to competitors.

This mode is the default. The interviewer reads the questions that appear on the screen in karaoke mode (fig. 4.54). Respondents people, answer questions clearly, only Yes or No. The result of the survey, indicating the possibility of fraud in obtaining credit, you are immediately on the screen after the end of the test. Interviewed people answers the questions clearly, only yes or no. Result of a survey showing the possibility of cheating in the credit obtaining, is displayed directly on the screen after the test.

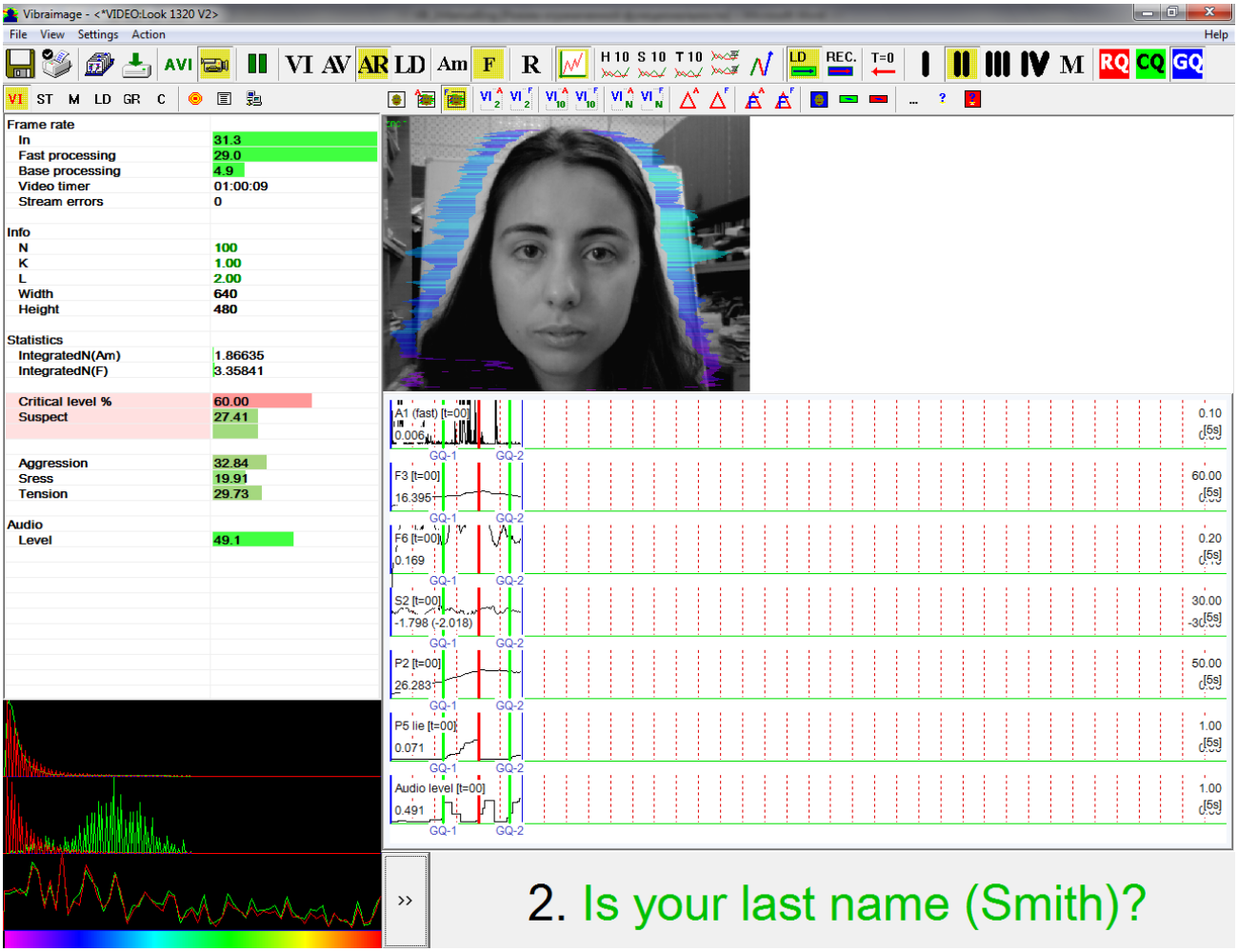


Fig. 4.54. Questions from the fixed questionnaire in the karaoke mode.

4.3.9. Saving and analyzing the lie detection results

Vibraimage system records the lie detection file with the whole information about settings and detected lie. You need to stand **«Save LD»** = Yes in DB information panel (fig. 4.55) and press Capture button on the toolbar for start file capturing and press Capture button off for the finishing file recording.

Note

Record of a videofile is necessary for carrying out even in that case when as a source of the information is external AVI a file. Simultaneously with record of a new videofile the text file with lie detection results and system settings will be generated.

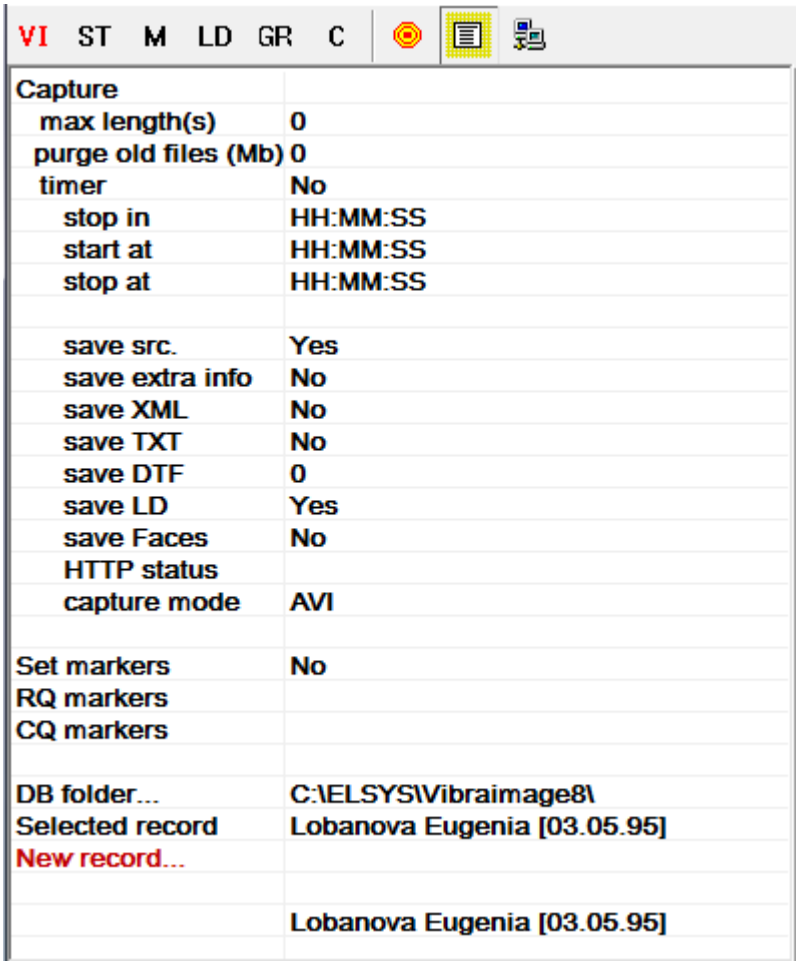


Fig. 4.55. DB information panel in the «LD»mode.

Note

The detailed analysis and technique of operation of the psychophysiological lie detector by means of VibraImage system is provided in a special application to this description (option). The special description on detection of lie is provided to the users who have passed a course on detections of lie.

Thus, when analyzing the video file it is recommended to perform the following steps:

1. Choose a directory to save the results of the study.
2. Set the options "Save XML» = Yes and "Save LD» = Yes to create output files.
3. If necessary to change lie detector settings in information panels.
4. To select a method of calculation of level of lie.
5. Switch on «LD» mode.
6. Open AVI-file for analyzing.
7. Set the parameter "Set marker" = YES for manual entry of markers (CQ, RQ, GQ).

8. Double-click the button to  the dimension axis graphs horizontally corresponded to the full length of the video file.
9. Click the button  for beginning results recording.
10. Clickthe button  to go to the beginning of the file..
11. To begin the analysis of video of the file, placing CQ, RQ, GQ markers in the right places.
12. When you reach the end of the video file, click the button 
13. Reset input parameter markers "Set marker" = NO
14. In the selected directory _LD.txt with results of detection of lie and the *.xml file with the system settings, intended for viewing in VILogViewer will be created the file *_LD.txt.

5. Network monitoring

In VibraImage system the opportunity of a network monitoring mode complex is realized. The basic program VibraImage.exe is started on the local computer (with the connected video camera). On the terminal the module VINetStatus.exe or VINetServer.exe are started, which informs the operator of the terminal about the objects controlled by local PC.

1. The VINetStatus.exe module informs the operator only if the system has fixed excess of the set threshold values of suspect dangers
2. The VINetServer.exe module gives the operator in real time mode a video information and the data on a danger level. **Note,** before start of VINetServer program it is necessary to configure system in Config.xml and Modules.xml files (the example is resulted below)

Note

Before start of VINetServer program it is necessary to configure system in Config.xml and Modules.xml files (the example is resulted below)

Note

For correct system work in network monitoring mode it is necessary to make adjustment of computers network connections, correctly having set them IP addresses.

5.1. Network monitoring mode adjustment

Before the beginning of operation in a network monitoring mode it is necessary to connect a local network computers of local module and the terminal, and also to make adjustment of network parameters.

Note

If Firewall system of protection is established on a computer it is necessary to enable of VibraImage programs complex.

Adjustment of local module network parameters is made in the program VibraImage.exe in  NW table of the information panel (fig. 3.76). It is necessary for start:

1. To enable transfer of the information on a network between a computer on which the program VibraImage.exe is started, and the removed terminal. Item **«Network service»**.
2. To set value of **«Full video stream»** parameter. If parameter **«Full video stream»** = NO, at detection of the «dangerous» person which level of danger exceeds the set **«Critical level»** limit then on a server will open «Video window» in which image «danger» person will be showed. In 30 seconds «Video window» will be automatically closed. If parameter **«Full video stream»** = Yes in «Video window» on a server video from the camera is continuously displayed.

3. To set type of video information compression by transfer on a network. If the parameter **«Compression»** is equal 1 - are transferred JPG format picture, 2 - PNG format picture
4. To enter a name of the removed terminal. Item **«Remote host»**.
5. To enable work with the chosen terminal. The item **«Enable».**
6. To establish the network address of a computer of the removed terminal on which the program VINetStatus.exe is started. Item **«IP».**
7. To specify number of port through which the application of VibraImage system started on the local module and the terminal will communicate. **«Local TCP port» -** the program VibraImage.exe will interrogate the given port for data exchange with the terminal. **«TCP port», «UDP port» -** ports for software of terminal, through which it is changed by information with the computer, on which started program VibraImage.exe. Through UDP port goes an exchange by short messages. Through TCP port goes an issue video data.
8. To establish **«Critical level» –** emotional threshold state of the person at which excess the warning message will be given out on the removed terminal and the picture of object of research is sent.

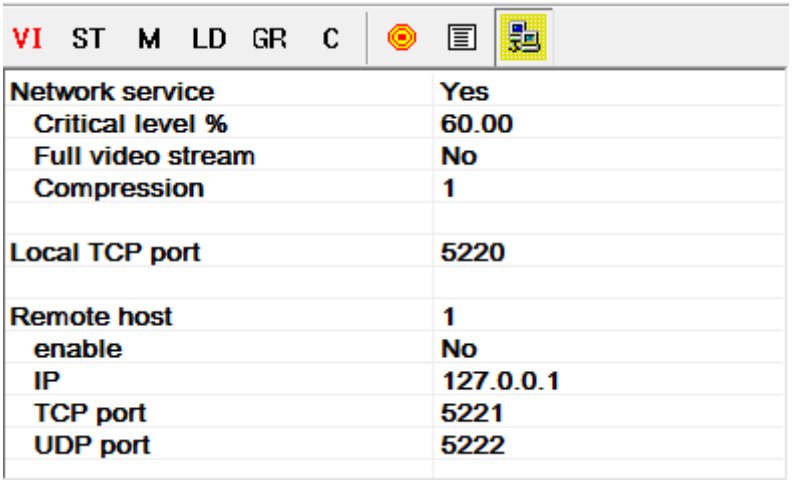


Fig. 5.1. Network monitoring mode. Information panel.

For adjustment of network parameters for the terminal it is required to start the program VINetStatus.exe. In the appeared window it is necessary to press the right button of a mouse and to choose item **«Settings …»** (fig. 5.2).

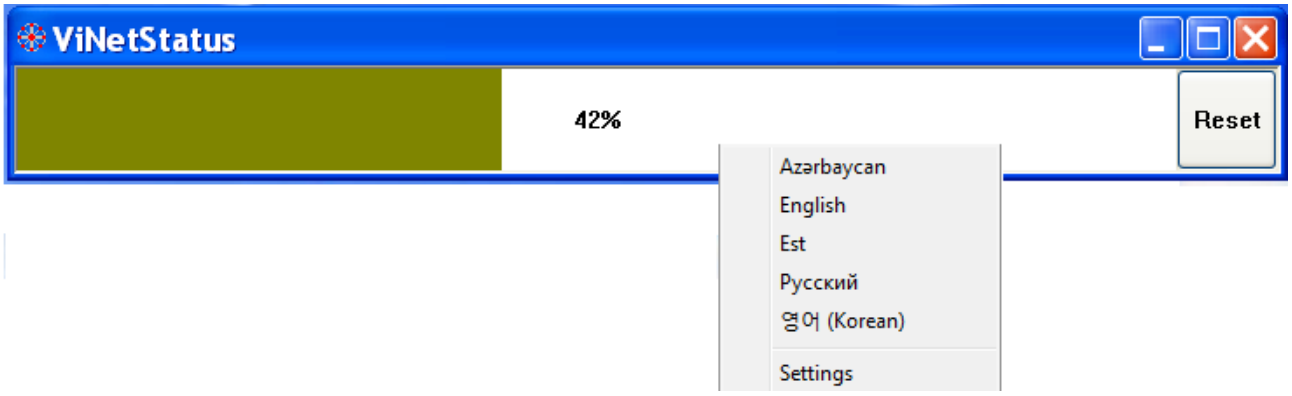
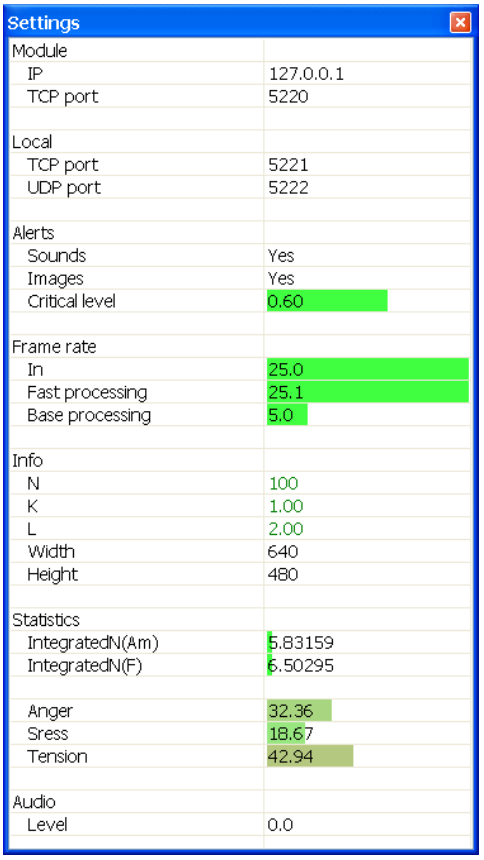


Fig. 5.2. Main window VINetStatus.exe started on terminal PC

In the opened window «**Settings** …» (fig. 5.3) it is necessary to specify same numbers of ports (UDP and TCP ports of the terminal on which program VINetStatus is started, and TCP port of the local module on which program VibraImage is started), as has been adjusted on the local module, and as the network address to set IP address of the local module.

If both programs VibraImage.exe and VINetStatus.exe are started on one computer at adjustments of a network in programs it is necessary to specify the same network address.



Settings	
Module	
IP	127.0.0.1
TCP port	5220
Local	
TCP port	5221
UDP port	5222
Alerts	
Sounds	Yes
Images	Yes
Critical level	0.60
Frame rate	
In	25.0
Fast processing	25.1
Base processing	5.0
Info	
N	100
K	1.00
L	2.00
Width	640
Height	480
Statistics	
IntegratedN(Am)	5.83159
IntegratedN(F)	6.50295
Anger	32.36
Sress	18.67
Tension	42.94
Audio	
Level	0.0

Fig. 5.3. Settings window of VINetstatus.exe started on terminal module

Note

If adjustment of a network is not made or/and on the local module the basic program VibraImage.exe is not started, than at start of program VINetStatus the window with the error message (fig. 5.4).

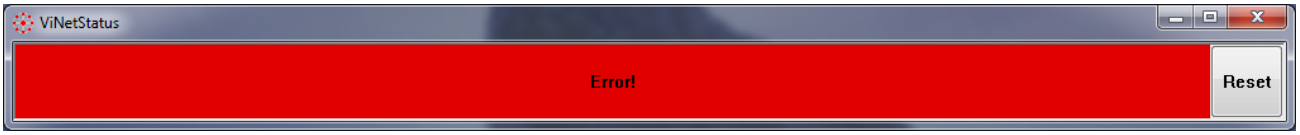


Fig. 5.4. Error message.

5.2. Operation in a network monitoring mode

For operation in a network monitoring mode it is necessary to execute the following actions:

1. To start on the local computer the program VibraImage.exe, and on the terminal - VINetStatus.exe;
2. To adjust parameters of a network;
3. To make adjustment of an operating conditions for VibraImage system and a video camera for the local module;
4. On the terminal PC in program VINetStatus to open a window of «Settings» (fig. 5.2), establish flags **«Sounds»** and **«Images»**, if you need the visual notice of the terminal operator and sound signal notice is required also. And also to stand value **«Critical Level»** at which excess to the operator warnings messages will be given out.

In a normal operating mode of system when emotion parameters of the observable person do not exceed the established threshold emotion danger, on the screen of the terminal only window VINetStatus will be display (fig. 5.5), in which the current level emotion dangers will be show.

Note

for improvement of operator visual perception the levels of scale is divided on 5 parts distinguished by color (fig. 5.2, 5.12). By pressing button «Reset», it is possible to reset the saved up values and to begin a new processing results.

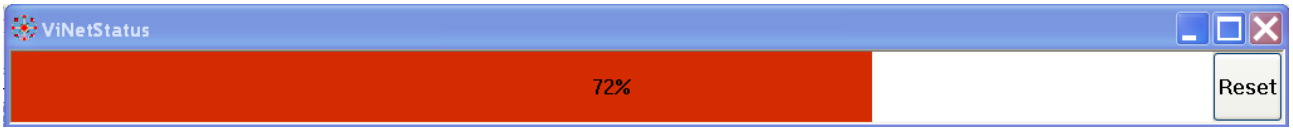


Fig. 5.5. NW window started on the terminal.

Open an additional window of «Settings» (fig. 5.3), the operator can observe, as parameters of system vary in time:

- **In** - Number of the frame in a second, received from the video device;

- **Fast processing** - Number of the processed frames in a second for calculation of «fast» parameters;
- **Base processing** - Number of the processed frames in a second;
- **N** – Current value of parameter «number of the frame for averaging»; User can change this value;
- **K**. – Current value of parameter «factor of amplification (gain)» Intensity of a point is multiplied on [K/10]. User can change this value;
- **L** – Current value of parameter «threshold of a palette». Defines a threshold in the displayed image, value of brightness less - considered «black». User can change this value;
- **Width** and **Height** – displays the current resolution of video camera;
- **IntegratedN(Am)** – Average frame amplitude vibraimage intensity processed for the N frames;
- **IntegratedN(f)** – Average frame frequency vibraimage intensity processed for the N frames;
- **Anger** – Level of anger;
- **Stress** – Level of stress;
- **Tension** – Level of tension level;
- **Level** – current level of audio signal.

Additional window with person real image appears on terminal screen if an established parameters limit is excesses (fig. 5.6). This window will be automatically closed in 5 seconds, but only if the flag **«Images»** is set up.

Note

If in a window of «**Settings**» (fig. 5.3) the flag **«Sounds»** is established, than occurrence of a window with the image will be accompanied by a sound signal.

Note

The operator working on the computer – terminal can remotely change network adjustments of the VibraImage.exe program, started on a local computer. For this purpose in a window of «Settings» (fig. 5.6) it is necessary to choose a line of parameter which numerical value is allocated by green color, and double click of a mouse to pass in editing mode of parameter value. Thus, the user can change values of parameters: number of the averaging frames N, factor of amplification K and a threshold of palette L.

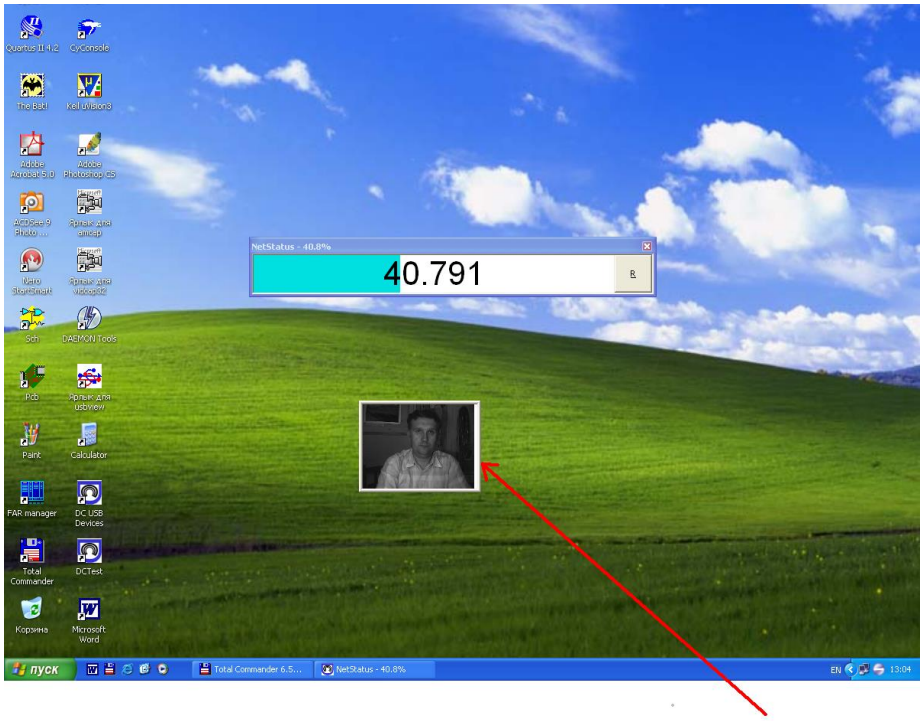


Fig. 5.6. Emotional danger level exceeded the threshold limit equal, for example, 40. The additional window displays.

5.3. IP camera support

VibraImage system allows to receive the videodata from network IP cameras. To work with the IP cameras should be used drivers of the virtual camera, for example, CamIP.

After you configure one IP camera in the CamIP, in the "Video" submenu there is an item with IP camera (fig. 5.7).

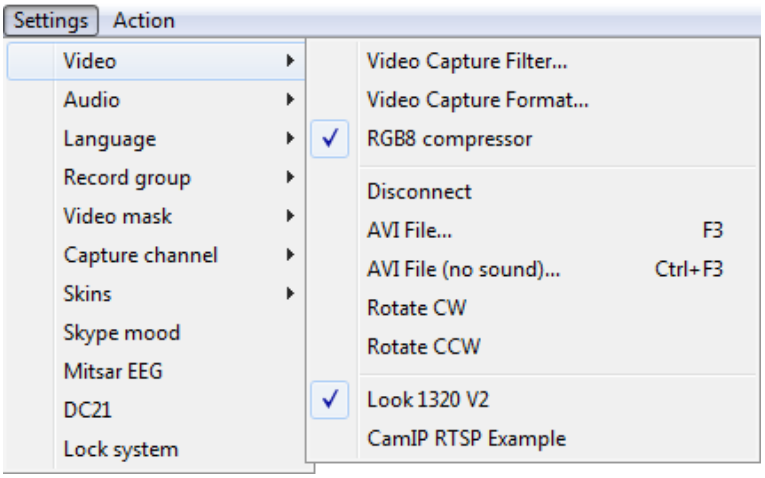


Fig. 5.7. Submenu «Video».

5.4. Multichannel behavior detection system

5.4.1. System structure

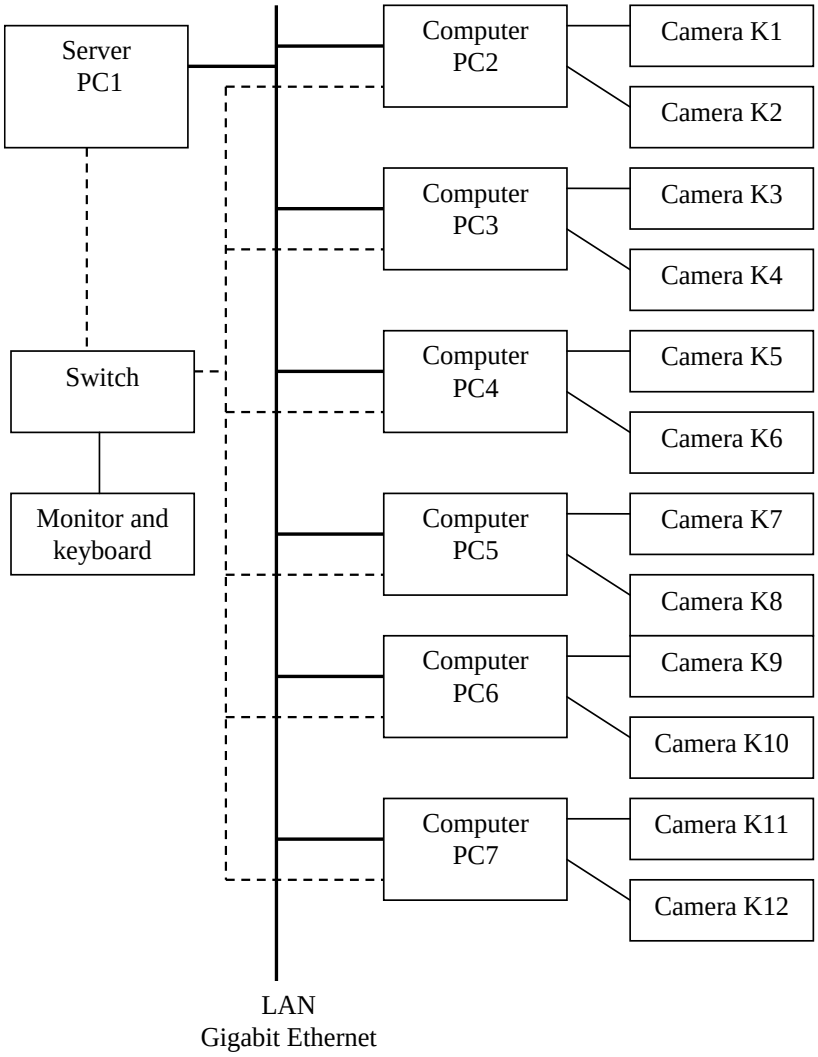


Fig. 5.8. System structure

The multichannel behavior detection system VibraImage (version Gallery) is constructed on the basis of 7 personal computers (PC1-PC7) and 12 television cameras (K1-K12). Computers configuration: processor Intel i7 e870, 2.93GHz, memory 4Gb RAM, 2 HDD disks on 500Gb, motherboard Asus P7P55LX, power source 500Wt with additional fan.

Note

Based on VibraImage 8 program user could configured any system structure, for example for 100 cameras, used the same principals described in this document.

All computers are connected to the local network Gigabit Ethernet, which constructed on basis of 8-port local network switch D-Link DGS-1008D. Each computer has own IP address.

Each computer has own IP address. Network settings of all computers make in configuration files config.xml and modules.xml, located in a folder \VibraImage8\Vins\.

For the general control from one single keyboard and for display the information to the single monitor, all computers PC1-PC7 are connected through 8-port switch D-Link DKVM-8E.

12 television cameras are connected to 6 personal computers (PC2-PC7), on 2 cameras to computer. On each of computers in an automatic mode it is started two programs VibraImage 8.1 working in «Macro» mode which carry out the basic video data processing. Record of videofiles from each camera is carried out in an automatic mode. Folders with results of work are open for access from a desktop of a server computer PC1.

Fig. 5.9. Shared network folder

Command line for start of the VibraImage .exe program on PC2-PC7:

«VibraImage.exe –copy XX –camera Y –format 352x288 –cstart 30 –noaudio»

Where *XX* - the name of a folder where the video archive from the selected camera is stored

Y - a serial number of the camera on this computer

-cstart 30 - to begin record of video through 30 seconds after loading system

Computer PC1 works as a server of system. On a server in an automatic mode two programs are started:

- VINetServer.exe - the network application of VibraImage system
- VIFaceMatcher.exe - the program for the person identification at check on a «suspected persons» database

Note

The software for work with a database is not included into the basic VibraImage installation complete set and demands installation on a computer the additional software for persons identification.

The server receives from local computers and displays for operator the following information:

- Video from the cameras
- The message on a danger threshold
- The frame with the image of the person, which danger level has exceeded the set limit.

At reception from a local computer the signal about suspected person detection, the server gives warning sound signal, will write corresponding record in the list of events and display the image of suspected person in a «Control Window».

Viewing of pictures of all people «captured» by system during work can be executed in a folder «\Logs», displayed on a server computer desktop.

Note

All «slipping mode» on computers must be switch off.

5.4.2. The order of system starting

At power on system it is required to execute the following order of actions:

1. Switch turn to power on
2. By turns to power on computers PC2-PC7
3. Power on the monitor
4. After 30 seconds to power on server computer PC1
5. From the keyboard to enter the password «00000000» for access to the switch, then press button «Enter»
6. To see on the monitor screen occurrence the images from television cameras K1-K12.

5.4.3. The order of power off

System power off is done consistently for each of computers. On the screen of the monitor it is possible to display the information from each of 7 personal computers. For switching between computers on a circle from PC1 to PC7 or on the inversion from PC7 to PC1 it is necessary to press quickly consistently the following buttons of the keyboard: [Scroll Lock] + [→ or ←]

For system power off it is required to execute the following order of actions:

1. Being switched between computers to display the monitor the information from one of 6 computers PC2-PC7.
2. On each computer 2 VibraImage.exe programs are started. In each of programs it is necessary to stop record of videofiles. For this purpose it is necessary to press the button  of the toolbar. At end of record and closing of a videofile the button will change color  .
3. Then it is necessary to close each of two programs VibraImage.exe.
4. Then to make program power off of a computer.
5. Items 1-4 repeat for each of 6 computers PC2-PC7
6. Switched to computer PC1. If PC2-PC7 have been switched off, in windows of VINetServer program there are no images from cameras.
7. Close the VINetServer.exe program
8. Close the VIFaceMatcher.exe program
9. Then to make program power off a computer PC1.
10. Switch off the monitor
11. Switch off the switch of computers management.

Note

The fast power off mode of computers PC1-PC7 is possible. Computers power off is made by unitary pressing of button «Power» on the obverse panel of computers system blocks.

5.4.4. The system operating procedure

After power on the server (computer PC1) in an automatic mode two programs are started:

- VINetServer.exe – the network application of VibraImage system
- VIFaceMatcher.exe – the program of the person identification at check on a database of suspected persons

The basic working program is the NetServer.exe (fig. 5.10). On the screen of the monitor the following information is displayed:

- From each of 12 television camera displayed video and the current «danger» level
- A window of the control
- The list of events

- Photos last 4 found out people, which danger level was exceeded with the set limit.

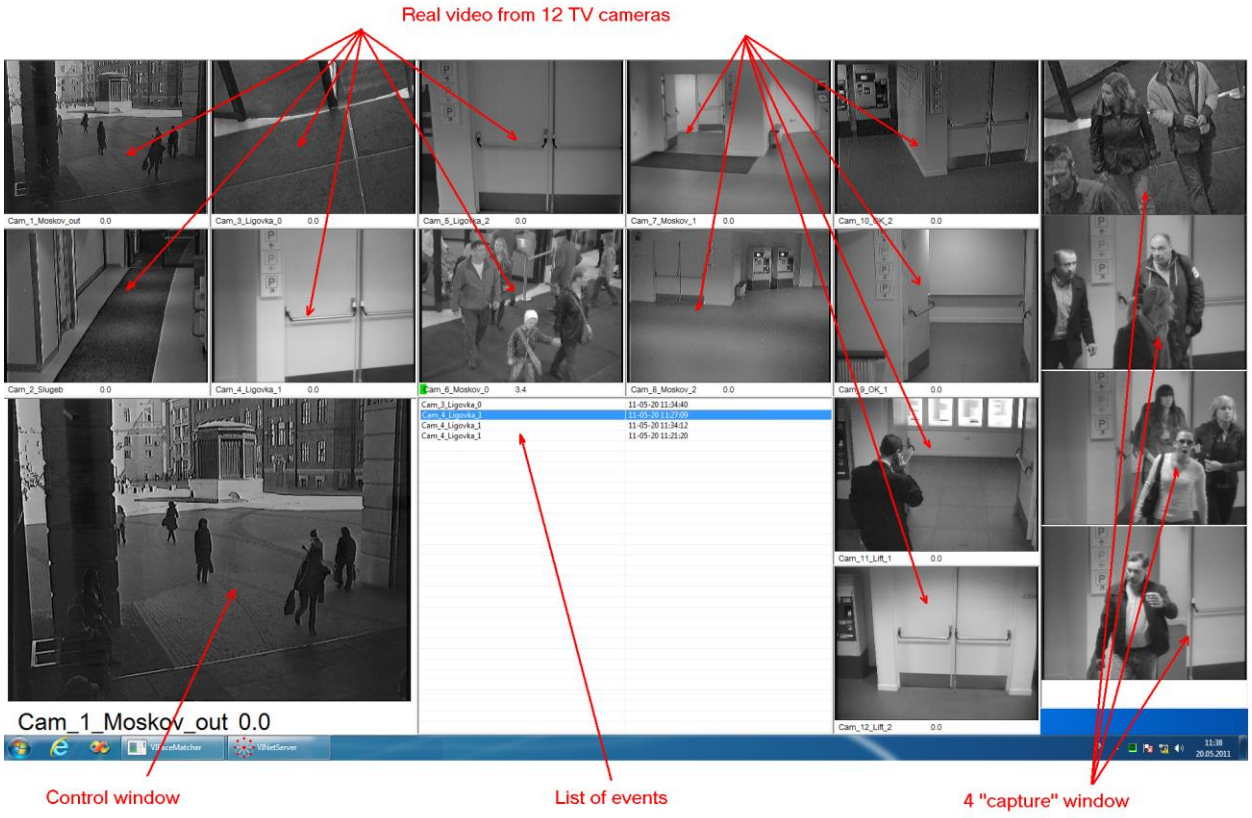


Fig. 5.10. VINetServer main window

In the **«Control Window»** the following information can be displayed:

- The video data from one of the 12 cameras. For this purpose it is necessary to bring the mouse pointer to a window of the chosen camera and to click the left mouse button.
- Detection of suspected person in a «Control Window» the picture of last «captured» person is automatically displayed.
- For monitoring procedure the operator can choose record of one of the registered events in «list of events», to click above it the left mouse button and in «Control Window» the photo of the person which danger level has exceeded a limit will be displayed.

5.4.4.1 Camera's windows

From each of 12 television cameras in a separate window the video information, the camera name (installation position) and the current value of a suspected level (fig. 5.11). Depends on suspected level value the color scale can have the different color. If the suspected level has exceeded the set limit color of a scale will be red (fig. 5.12), and the image from the camera will be captured in one of «capture» windows, and in the list of events corresponding record will be made.

Fig. 5.11. Window of camera

Fig.5.12. Capturing suspected person

For each camera the operator can change a mode of a information presentation. For this purpose it is necessary to bring the mouse pointer to the chosen window, to press the right button and to choose corresponding menu item (fig. 5.16).

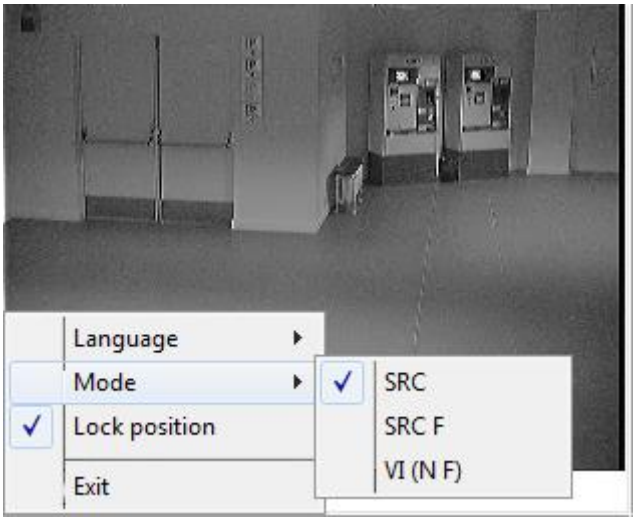


Fig. 5.13. Menu for each camera

The item **«Language»** defines a working language of system.

The item **«Mode»** defines a mode of video information presentation.

SRC - video without processing (fig. 5.13).

SRC F - video from the camera with an overlay frequency vibraimage (fig. 5.14).

VI (N F) vibraimage it is displayed on a black background.

The item **«Lock position»** fixes an arrangement of a window from the given cameras in the given place of the screen.

The item **«Save position»** save in an external file the coordinate of windows arrangement from the selected camera in the given place of the screen.

The item **«Exit»** is intended for an exit from the program.

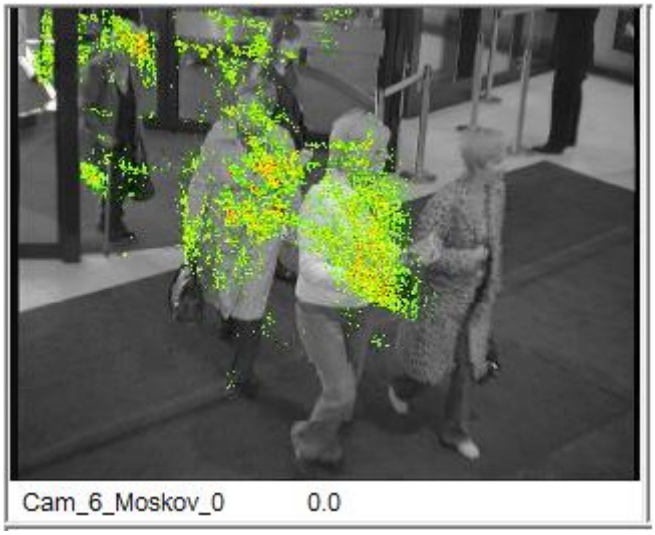


Fig. 5.14. Frequency vibraimage

5.4.4.2 The list of events and «captured» windows

If the person's suspected level, fixed by one of camera, exceeds the set limit then the following actions are automatically done:

1. The photo of the person is fixed in «Control Window». The suspected person is allocated with a red rectangular.

2. The photo of the person is added in top of four «Capture Windows»

3. In «List of events» record which contains the information is added: what camera and when the dangerous person has been found out.

4. If check of a photo of the suspected person on the Database has come to the end successfully in «List of events» the additional information about identified the person will in be displayed (fig. 5.15).

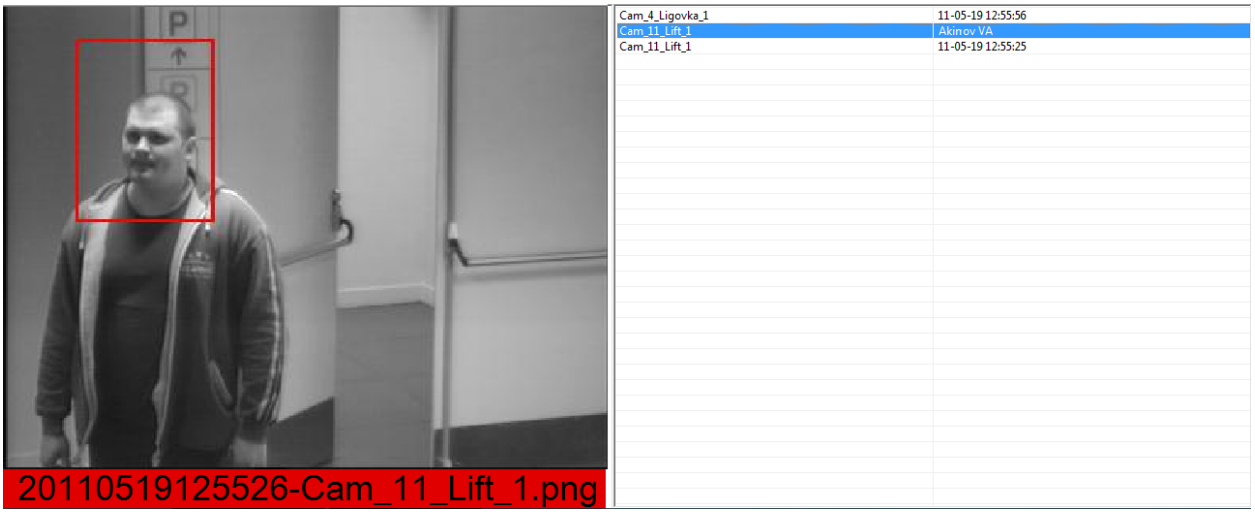


Fig. 5.15. The object is identified

5.4.5. System configuration

Note

Systems configuration is authorized only to advanced users. Casual changes in a configuration can break serviceability of system.

The configuration of system is set in config.xml and modules.xml files, taking place in catalogue VINS. All changes in files are made before start of VINetServer program.

If configuration files are not present at start program VINetServer by default displayed the single window from video from one of camera and single status line (fig. 5.16).

Fig. 5.16. Single camera window

The config.xml file sets a position of windows on the screen, the sizes of windows and other information for server operation:

Area	Purpose
Section <Face>	
bin	Path to libraries of persons recognition SDK
format	Format of a displayed the message on person identification
path	The name of the catalogue in which databases are stored and in which results of checks on bases are saved. A path by default D:\Elsys\VibraImage8\Face\. …\ Base - a database of photos …\ Face - a picture from cameras with captured «dangerous» people …\ Found - the found concurrences on a database …\ Notfound – «dangerous» persons which photos are not present in a database

Section <Frame> <FrameX_X> <FrameLog> <FrameLogImg>	 - main window - cameras windows - list of the events - «captured» window
Caption	Only for servicemen
Position	Coordinates of a window position on the monitor screen
Title	The name of the camera. It is entered only by English letters without blanks
visible	Switch on/off camera window
Status_height	Height of a strip of the level of danger indicator

The modules.xml file sets parameters for configuration of local computers:

Area	Purpose
module id=__	Sets a name of the camera which is used for identification of the camera in a local network
remIP	Network address of a camera
log_delay	Only for servicemen
log_path	Path to a folder where the videofiles from the chosen camera will be stored
log_max	The maximal number of stored records of events and the «captured» pictures
log_sound	Switch on / off the sound signal at detection of potentially dangerous person
log id=__	Name of events list
image id=__	Name of «capture» window
count	Number of the pictures simultaneously displayed in «capture» windows

5.4.6. Operation with a database

Note

The software for operation with a database is not included into the basic VibraImage installation complete set and demands installation on a computer the additional software for person's identification. Therefore before the beginning of work it is necessary for user manually to create structure of database catalogues, and also to copy in the catalogue \VibraImage 8\ additional files for person's recognition.

For updating a database of suspected persons it is necessary to execute the following steps:

1. To transform an initial file with a photo to a graphic file of JPG format
2. To rename a file, having specified in a name of a file a surname of the «dangerous» person ONLY English letters and without blanks
3. To copy a file in the catalogue \Face\Base
4. To start the program VIFaceMatcher.exe
5. At successful processing a photo file, in the specified catalogue the system automatically will add a new file with expansion TMP, and the file with expansion JPG will be automatically removed.

ATTENTION!

If the given actions will not be executed by system then the initial file with a photo is unsuitable for its add in a database and demands replacement of a photo.

All correctly processed JPG files move to subdirectory \Pass. Files which are unsuitable for recognition, move to subdirectory \Fail.

6. Operation with external devices

The main addition of the program VibraImage 8 on version 7 is the ability to synchronize other devices recording physiological parameters of the person with the system VibraImage. The synchronous registration of different physiological processes allows expanding significantly possibilities of research of psychophysiological and physiological characteristics of the person. Joint and synchronous registration with the vibraimage of a pulse wave (DC21U scanner) and an electroencephalography (Mitsar-EEG-201) allows watching visually correlation and correlation of functioning of different physiological systems of the person.

6.1. Operation with EEG

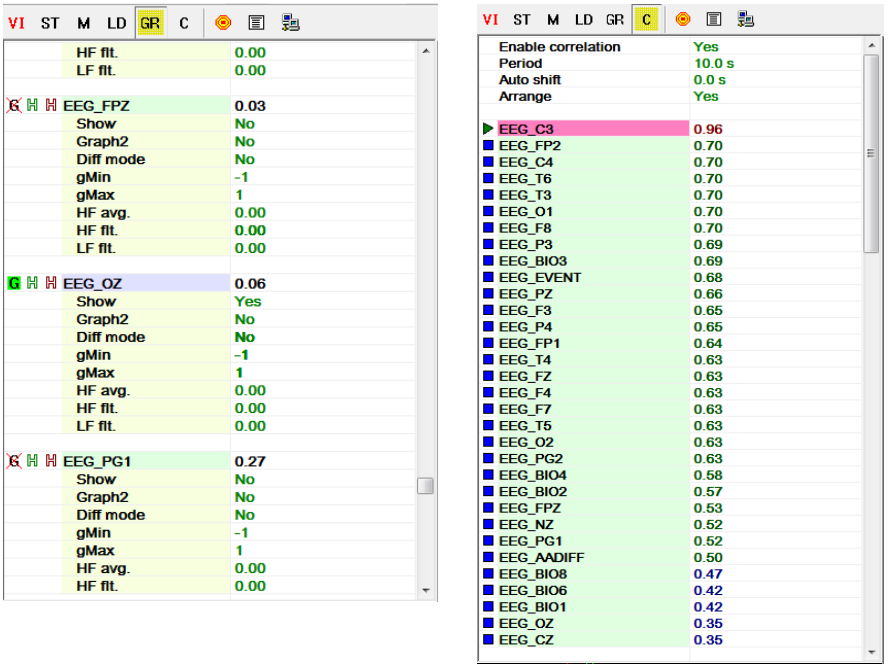
Technology electroencephalography (EEG) is the most famous and informative for psychophysiological testing. Therefore, it is EEG was chosen as the technology for comparative testing vibraimage. Software VibraImage 8 implements a joint synchronous registration and processing of the signals of electrical activity (EEG) and motor activity (vibraimage). It should be noted that the registered signals due to mechanical inertia of vibraimage are lower frequency than the EEG signals, so the correct definition of the correlation between the signals should be carried out in the frequency range up to 10 Hz.

To working EEG (for example Mitsar-EEG-10/70-201) it is not require the installation of additional software or drivers. Enough after connecting EEG to choose an item «DC21» in the submenu «Mitsar-EEG». When you connect EEG in information panels «**GR**» and «**C**» there will be additional points output of diagrams and correlation of the following parameters:

EEG_FP1, EEG_FP2, EEG_FPZ, EEG_F3, EEG_F4, EEG_F7, EEG_F8, EEG_FZ, EEG_T3, EEG_T4, EEG_T5, EEG_T6, EEG_C3, EEG_C4, EEG_CZ, EEG_P3, EEG_P4, EEG_PZ, EEG_PG1, EEG_PG2, EEG_O1, EEG_O2, EEG_OZ, EEG_NZ, EEG_BIO1-EEG_BIO8, EEG_AADIFF, EEG_EVENT.

Working with information panels described in §§. 3.5.4 and 3.5.5.

The figure 6.2 shows an example of viewing graphs of electrical impulses from the EEG in VibraImage 8.



a) *b)*

Fig. 6.1 New items when connecting EEG:
a) – in the panel «Graphics», b) – in the panel «Correlation».

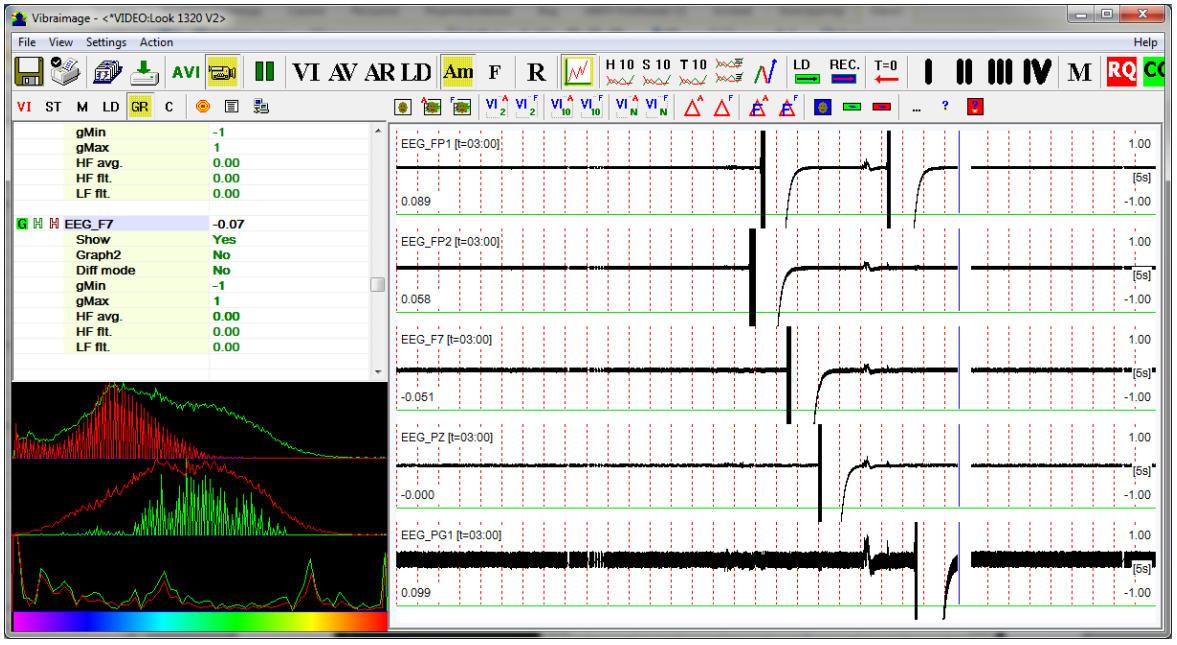


Fig. 6.2. View information from the EEG in VibraImage 8.

6.2. Operation with a fingerprint scanner and registration of the pulse wave.

For the work with a fingerprint scanner (for example DC21) it is required to set drivers in the beginning (see § 2.2.3).

You can get to work after connecting a fingerprint scanner to your PC. In the program VibraImage 8 you need choose an item «DC21» in the submenu «Settings». After that there will be a program window DCPulse (fig. 6.6). It is possible to view and process all diagrams of the program DCPulse reflecting pulse in different points of a fingerprint figure in the VibraImage 8. When you connect a fingerprint scanner in information panels «**GR**» and «**C**» there will be additional points (fig. 6.7) output of diagrams and correlation of the following parameters:

Pulse AVG_ALL, Pulse SIGMA_ALL, Pulse AVG_ZONE1, Pulse AVG_ZONE2, Pulse SIGMA_ZONE1, Pulse SIGMA_ZONE2, Pulse AVG_LINE1 - Pulse AVG_LINE3, Pulse SIGMA_LINE1 - Pulse SIGMA_LINE3, Pulse SIN, Pulse PHASE T, Pulse PHASE A, Pulse PULSE 10, Pulse AVG_X0 - Pulse AVG_X9, Pulse SIGMA_X0 - Pulse SIGMA_X9.

Working with information panels described in §§. 3.5.4 and 3.5.5.

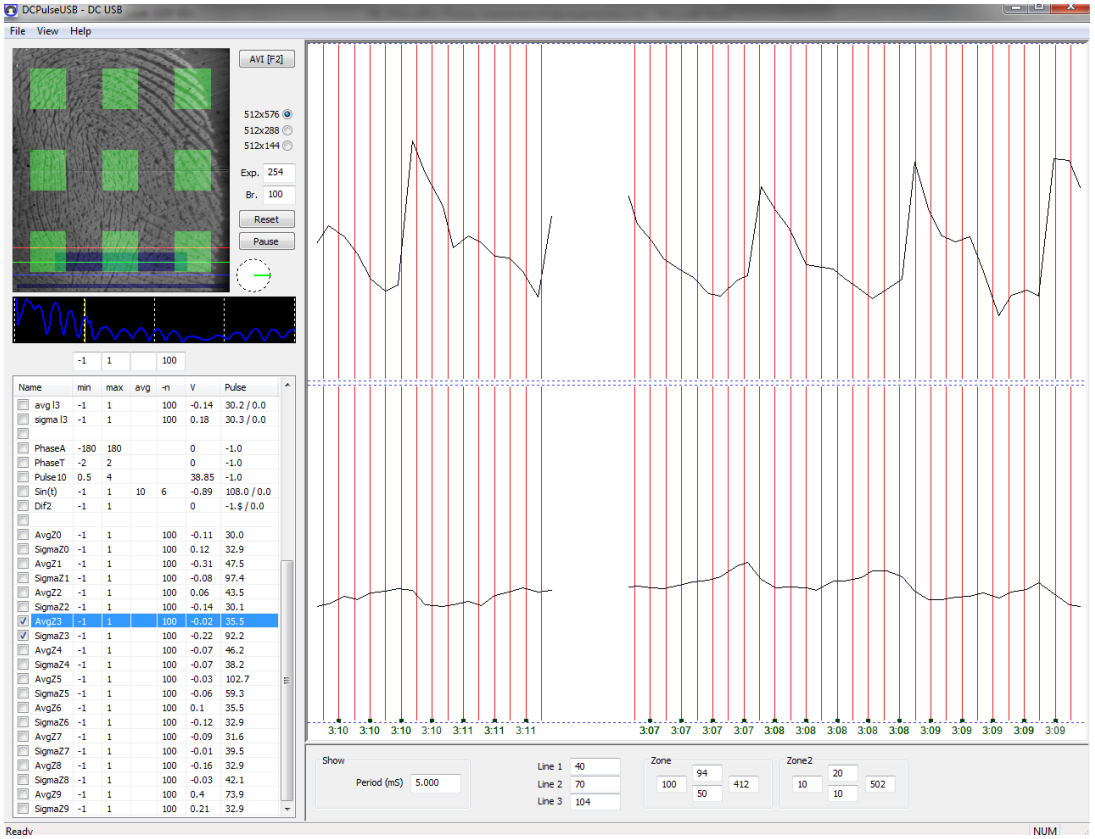
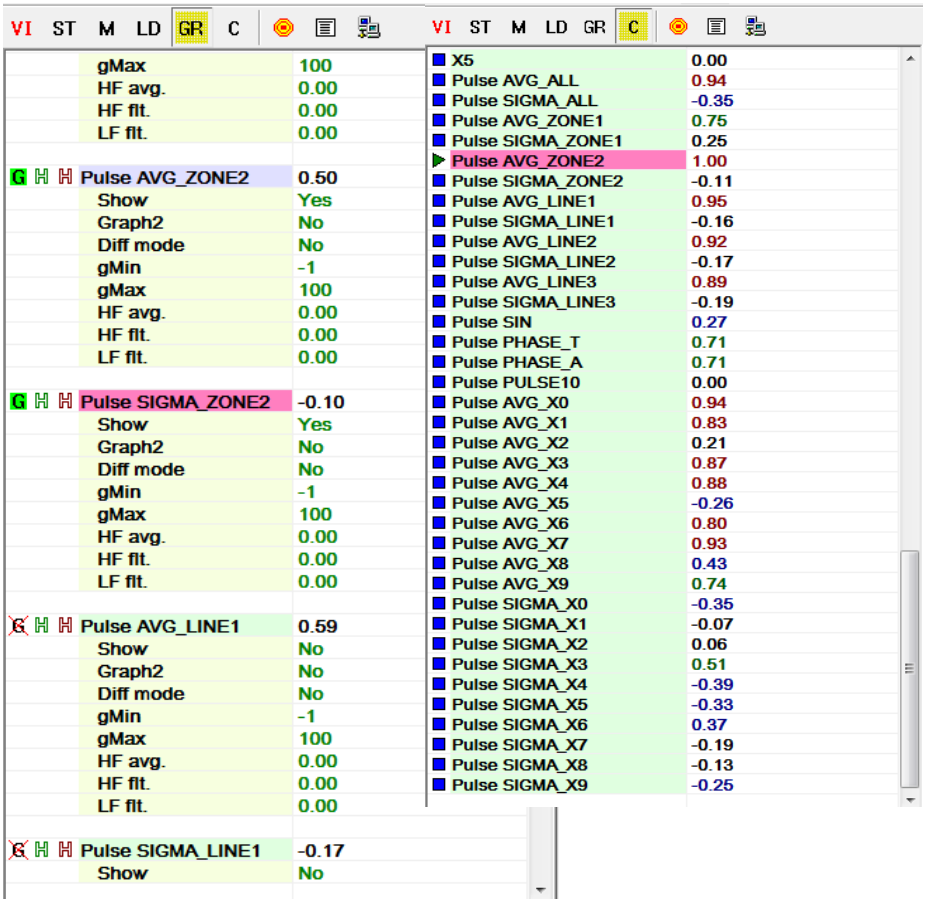


Fig. 6.5 Window DCPulse program.



a) *b)*

Fig. 6.7 New items when connecting fingerprint scanner DC_21:
a) – in the panel «Graphics», b) – in the panel «Correlation».

7. Maintenance service and service regulations

Maintenance service and service regulations of VibraImage system is carried out according to this Manual and instructions of used hardware maintenance (a computer, the camera, etc.).

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Version Vibraimage 8.1

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Licensed users could download the latest version of VibraImage software by the link http://www.elsys.ru/index_e.php

Updates and questions on www.elsys.ru

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