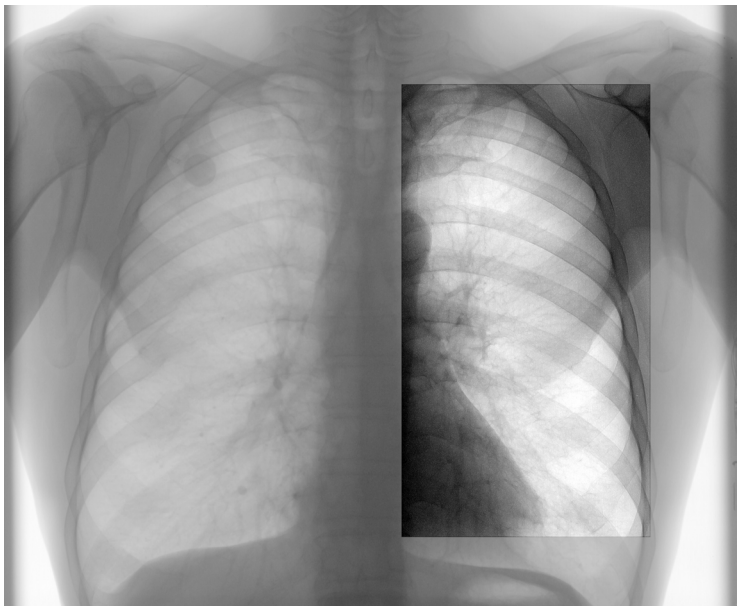
2D
Processing and Visualization of the Medical Images



Graphical Stations of 2D Processing & Visualization
- AS_GSV
- The Basic Functions & Examples of Processing

Moskow. **2003г.**

Main software features of Graphical DataBase. **AGVBase-2k02**

• *The basic functions of AVGBase-2k02 - The Graphics Database of the patients:*

1. Creation of registration records of patients in a **Graphic Database** providing search in database, by minimally significant data: *Patient ID; Patient Name; Birth Date; Sex; The notice for Study*.

2. Preview of series of shootings of the patient in **General Databank**, built on a time scale thus representing the *Graphic History of the patient*, including visualization of the significant frames.

3. Copying of the data onto the laser disk with actual recording control and subsequent data files restoration from laser disk to the **HDD Array(s)** at **General Databank**.

4. Erasing selected frames/series and patients' records from **Temporary Databank**, of those patients that are not presently actual, while preserving the scenarios created, significant frames and series of shootings in **General Databank**, if the data was not saved earlier.

5. Import of new series of shootings to **General Databank**, marked by the system of viewing and processing. Creation of the comments/annotation to patient archive.

6. Copying of the data from **General Databank** to **Temporary Databank** for interactive viewing, processing and fixing the results of patients' study.

   IMPORTANT! *The data in the General Databank is not deleted!*

7. Deleting data (series of shootings and so on) from **General Databank** is possible only when such data has been backed-up (archived) to laser disks.

   IMPORTANT! NOT RECOMMENDED!

   Optional only, to be agreed with the consumer and/or due to the minimal storage capacity!

8. System request for digitizing signal from medical TV-systems with **ADSP-50** utility from within the database application in order to create new series of shootings or single frames.

9. System request for **MedDigiView** - graphic viewing application - from within the database application for patients already selected to **Temporary Databank** with further data visualization and/or processing of a series of shootings or single frames.

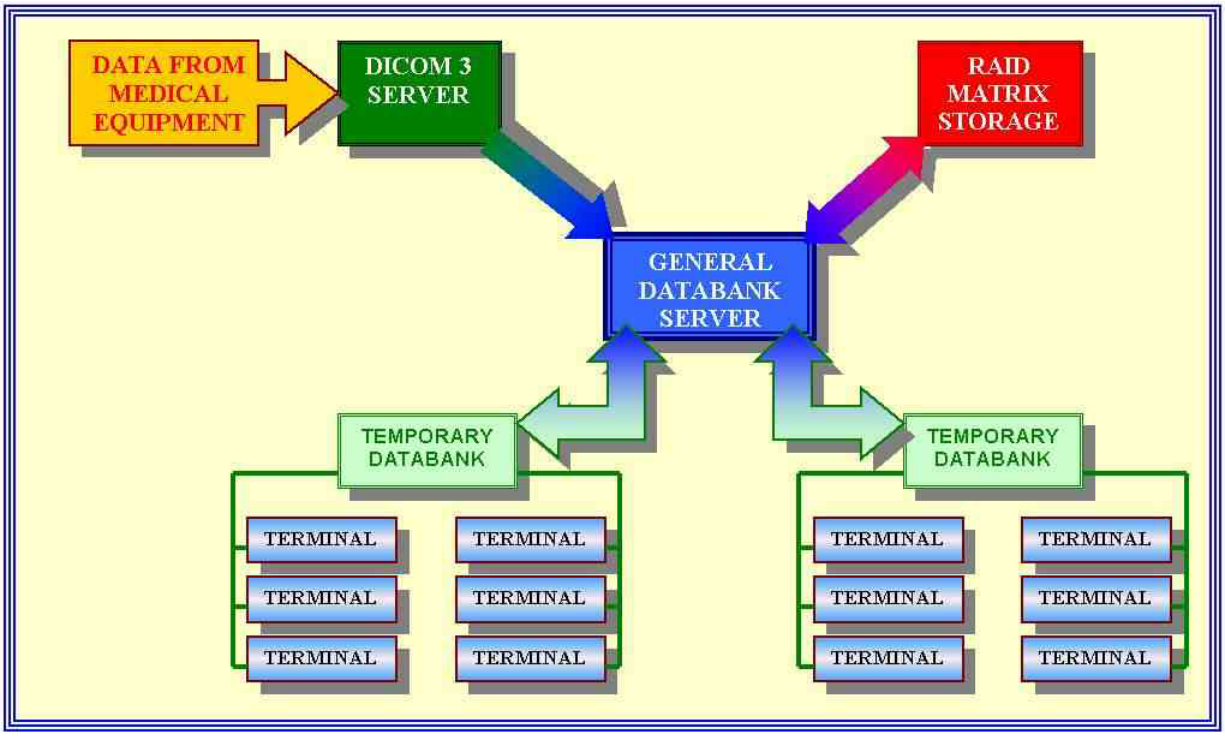
10. System request for **DICOM-Import** application to preview and import of selected series of shootings or single frames of a patient to **Graphic Database** at **General Databank**.

11. Set of options for tuning up the three systems intercommunication with the database.

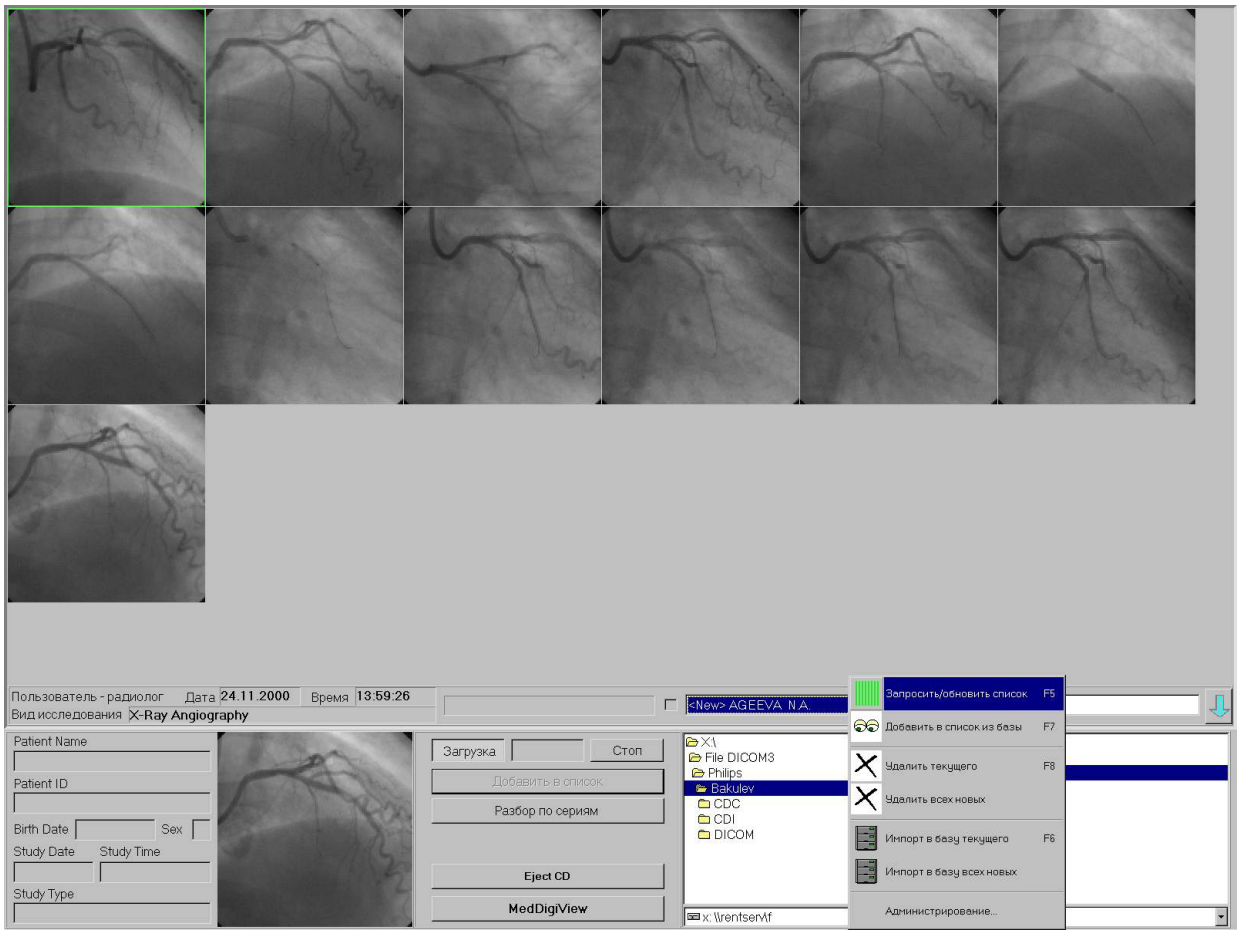
• *The basic functions of DICOM-Import application:*

- Search of **DICOM3** files on all types of storage devices at **DICOM3** server, systematizing by attributes, preview of the graphic and accompanying data.
- Automatic selection of the accompanying information (on the patient, clinic, study and series) from **DICOM3** files, as well as automatic selection of series of frames for preliminary visualization.
- Building up series from **DICOM3** files containing single frames, representing itself a sequence of one shooting.
- Retrieving from **DICOM3** files the graphic information with pixel depth up to **16** bit inclusively, irrespective of the manufacturer of the medical equipment - GE-Medical, Philips, Siemens, Acuson, HP, Trex etc., and regardless of the type of the device - CT, NMR, Angio, Roentgen, Ultrasound etc.
- Animation of selected frames, viewed with adjustable speed of frame scrolling in cine-mode.
- Import of already animated series of shooting for selected patient from **DICOM3** files to **Graphic Database** and making the accompanying description for it.

- ***DICOM3 Import description.***

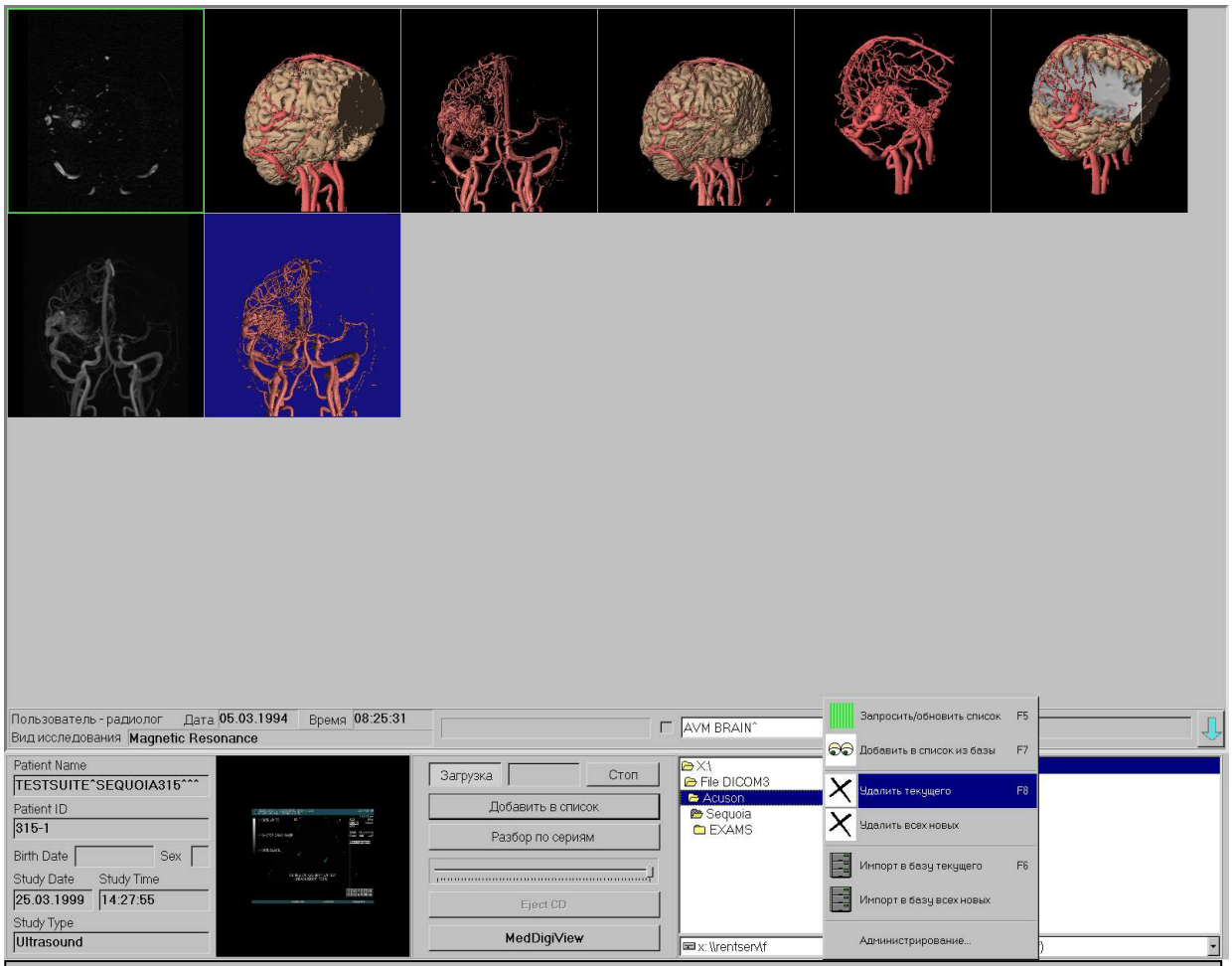


Navigator of operations DICOM files



Review of series of filmings with CD-ROM on **DICOMDIR** without call to database.

Viewing of series of filmings of the patients for review from the Graphics Database **AVGBase-2k02**.



Analysis **DICOM** of files and loading of a series for visualization in **MedDigiView**.

Real Time Stream Processing of DICOM files. **MedDigiView**.

• *The basic functions of MedDigiView - Stream Viewing and Image Processing:*

1. Selection of graphic data for any patient from **Temporary Databank** with **MedDigiView**. Selection and loading of a series of shooting for viewing. Possibility for fast switch, if necessary, to viewing data of another patient, if such data already exists in **Temporary Databank**.
2. Interactive viewing with loop, reverse and a step-by-step mode options, at a variation of scrolling speed in a cine-mode, choice of any range of frames in the series of shooting for scrolling.
3. Digital filtration allows to apply up to 3 consecutive filters in real-time mode:

   image contouring, sharpness, bas-relief etc.
4. **LUT**-manipulations with a choice of any of 6 functions - analogue of expanded brightness and contrast functions: square-law, logarithm, exponential and three trigonometry functions - (electronic level, window, nonlinear transformations, negative).
5. A post-procedure real-time subtraction by the indicated range of mask and for group of subtracted frames. All variations of cine-mode and on step-by-step scrolling are available.
6. Digital zoom, interactive viewing at chosen zoom scale. All variations of cine-mode and on step-by-step scrolling are available.
7. Selection and exclusion of insignificant frames in series of shooting, after importing raw data to a graphic database from **ADSP-50** digitizing system.
8. Converter of chosen frame to *.TIFF format for individual operations with subsequent laser printout on paper or transparency film.
9. Automatic recording of scenario for each set of manipulations when processing the series of the frames, optional subsequent saving and storage with possibility to run any existing scenarios.
10. Creation of the significant frame for fast visualization in **AGVBase-2k01** database and in **MedDigiView** viewing and processing systems.
11. Creation of comments to be added to the new series of frames received from **ADSP-50** digitizing system.

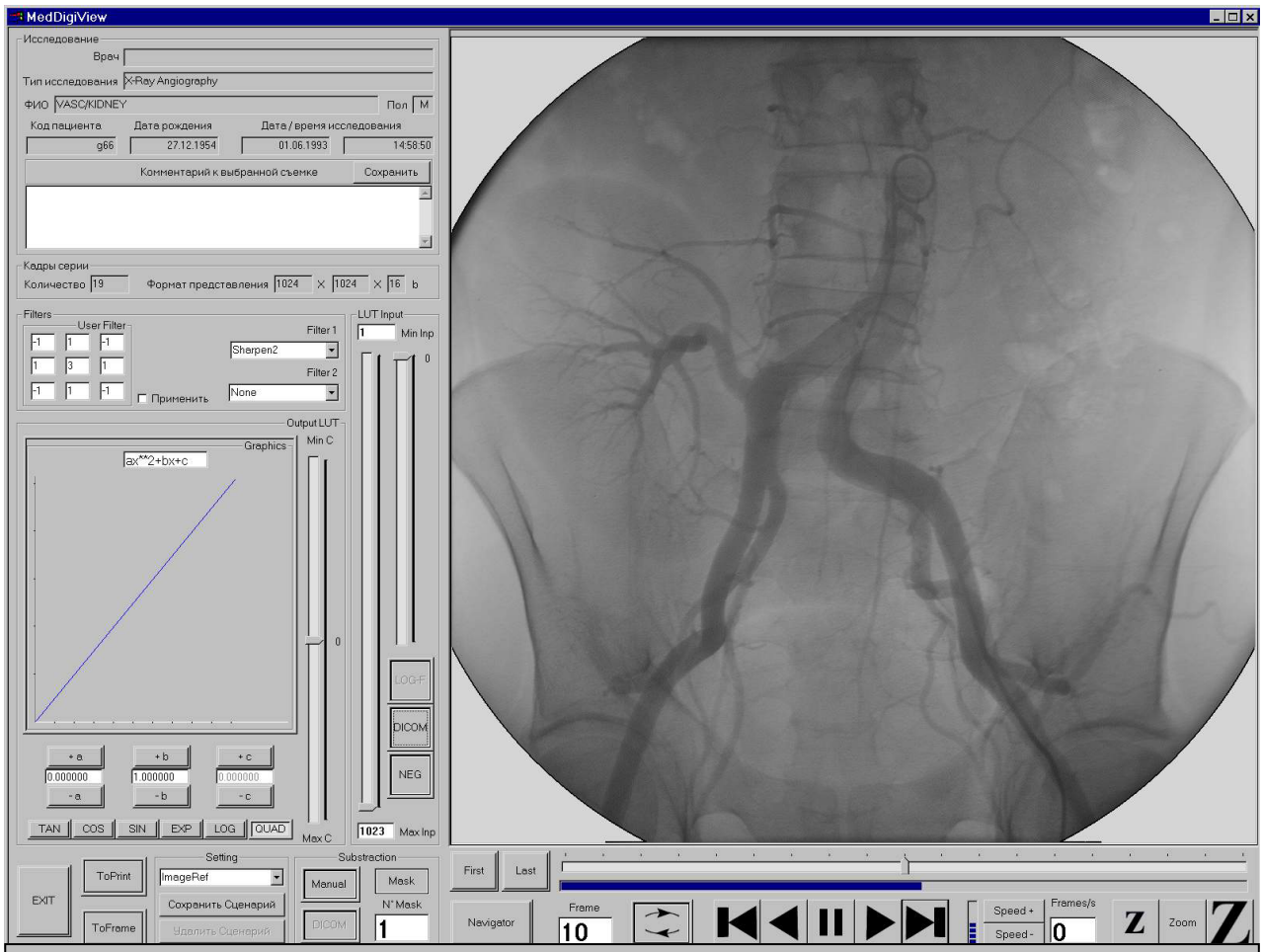
• *Program options (subject to separate agreement):*

1. Electronic shuttering of frame in series (rectangular, circular, any convex curve).
2. Electronic selection of significant area of the frame in series for further processing and visualization within the limits of significant area only (rectangular, circular, any convex curve).
3. Automatic histogram of the frame / series.
4. Frame sequences summing in real time mode.
5. Creating cyclograms with multi-mask subtraction.
6. Creating the complex scenarios of data processing for series of shootings.
7. Background laser printing.
8. The converter of graphic and add-on data of patient's shooting to **DICOM** file format.

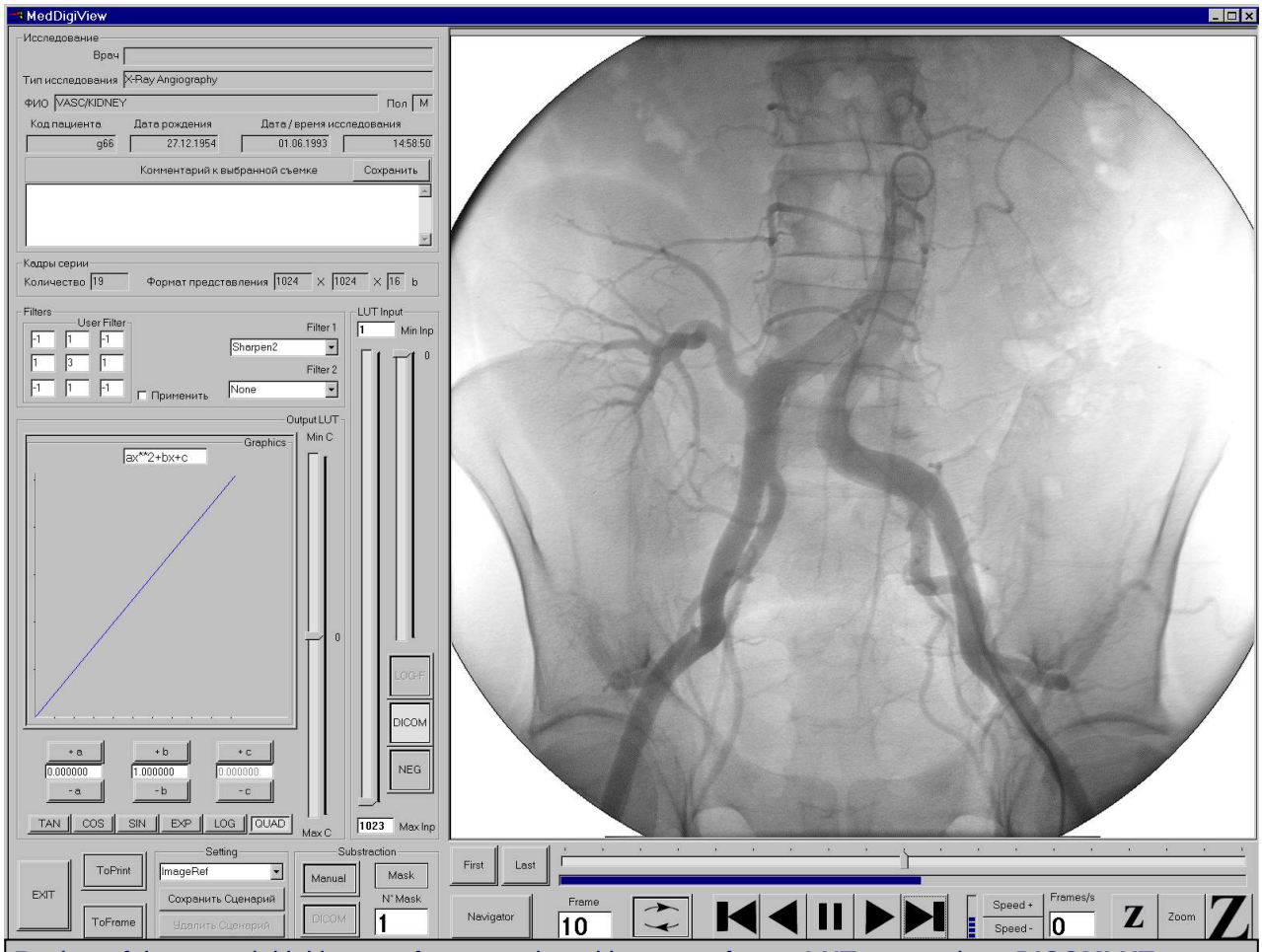
• *Example of Stream Processing and Visualization at filming an angiography.*

On screen mappings, reduced below, the processes of processing of frames, integrated in a series obtained from **DICOM** of files from the apparatus **Integris** of the corporation **Philips** (1 frame - 1 **DICOM** file) are rotined.

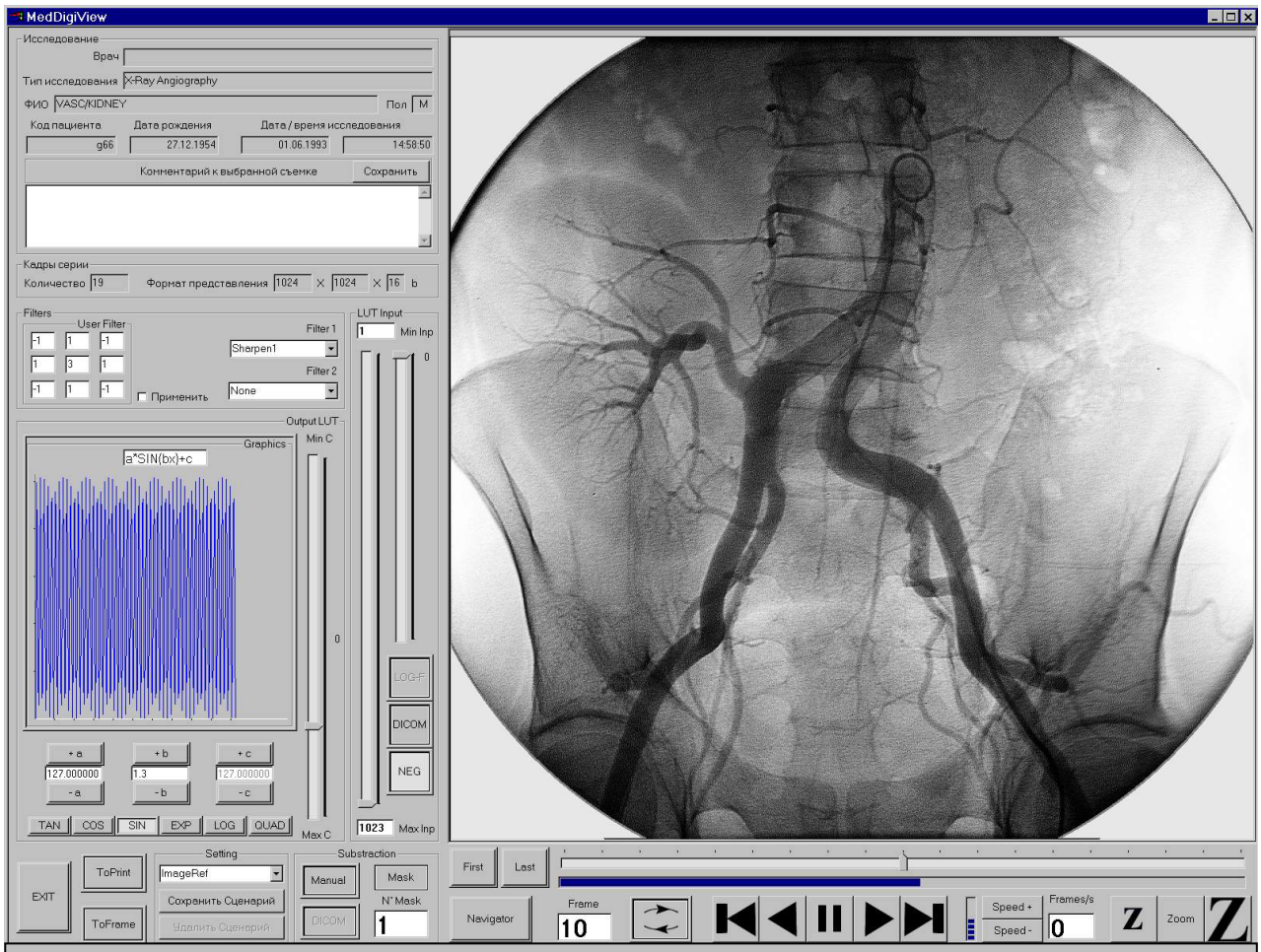
- The review of 10-th image from a series of frames by the format by 1024*1024 depth 10b (in 16b), processing is not applied - initial map obtained after digitization on the apparatus.
- Review of the same initial image of same series with usage of entry **LUT**-conversion - **DICOMLUT**.
- Review of the same image with usage of output **LUT**-conversion and filter: *Sinus* + *Negative* + *Sharpen2*.
- Obtaining of a subtraction of frames N°10 from a frame of a mask N°3.



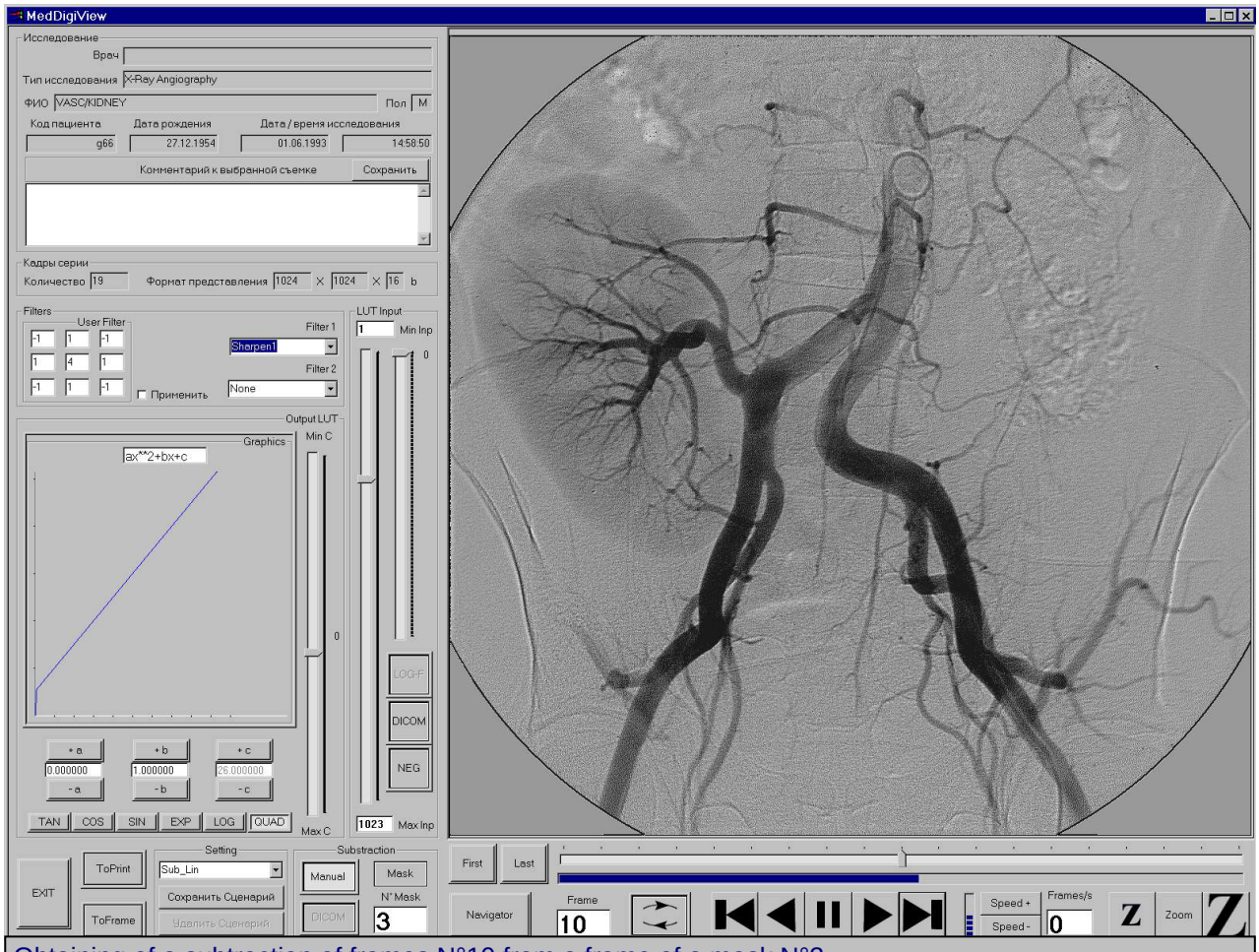
The review of 10-th image from a series of frames by the format by **1024*1024** depth **10b** (in **16b**), processing is not applied - initial map obtained after digitization on the apparatus.



Review of the same initial image of same series with usage of entry **LUT**-conversion - **DICOMLUT**.



Review of the same image with usage of output **LUT**-conversion and filter: *Sinus + Negative + Sharpen2*.



Obtaining of a subtraction of frames N°10 from a frame of a mask N°3.

Zonal Processing of DICOM files. **ZoneView**.

• *The basic functions of MedDigiView - Exclusive Zonal Processing and Visualization:*

1. Typeselection of a zone of concern - rectangular, elliptic or convex form of a zone of concern.
2. Selection of significant area - zone of concern in a frame for processing and visualization only in limits of significant area (rectangular, circle, convex curve).
3. Electron selection of significant area of a frame, holding of a spectral analysis inside a selected zone for achievement of maximum quality of visualization. An automatic histogram of datas posed inside a zone of concern. Visualization of all frame by results of a spectral analysis inside a selected zone.
4. Compilation of the composite integrated scenarios (scripts) of data processing of filming inside a zone. Choice of the scenarios - chains of series functions of processing pegged to organs-engineering; handle of parameters of functions, switching and slide-type regulators.
5. Transmission of results of visualization to the unit **RScan-1/2View** for the subsequent conversion in the format **Tiff8** and printing through the unit **SView-Print**.
6. Animation integrated in a series of frames with controlled velocity of show a film-regimen.

• *Examples of the Conveyor of Stream Zonal Processing and Visualization.*

On screen mappings, reduced below, the processes of zonal processing of frames - maximum quality visualization inside a zone are rotined.

- Image enhancement at **Zonal Processing** of a computed tomography **CT**of a mandible.
- Review of the same set of images with ***Zonal Processing***, with reference to soft tissues of the patient.
  The subtracting analysis does not give on such image of visible results.
- Review of the initial image from a series of frames by the format by **1024*1024** depth **10b** (in **16b**) from **DICOM** of the file with usage of a circle zone, with reference to soft and hard tissues of the patient.
- Review of the same set of images with ***Zonal Processing***, with reference to hard tissues of the patient.
  The subtracting analysis does not give on such image of visible results.
- The review **RGB** of the image - processing in a rectangular zone - initial image is obtained on the apparatus of scanning for of irido-diagnostics tissues of the patient.

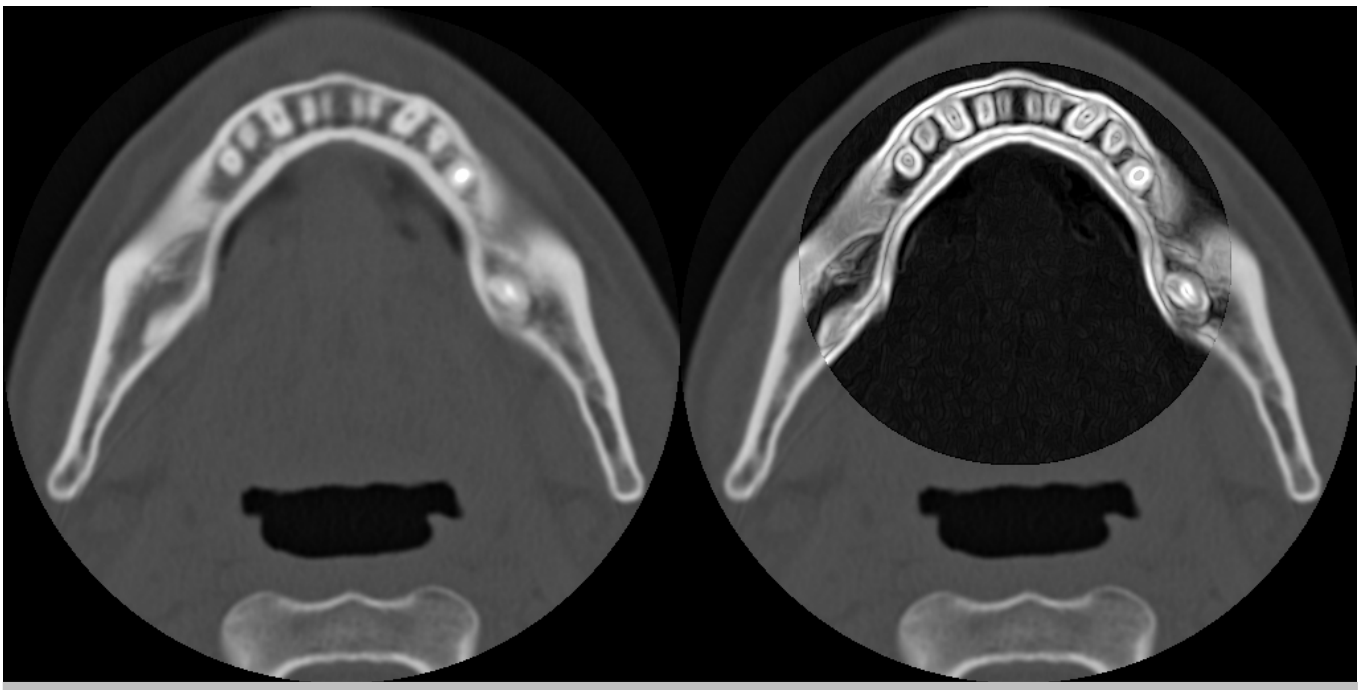
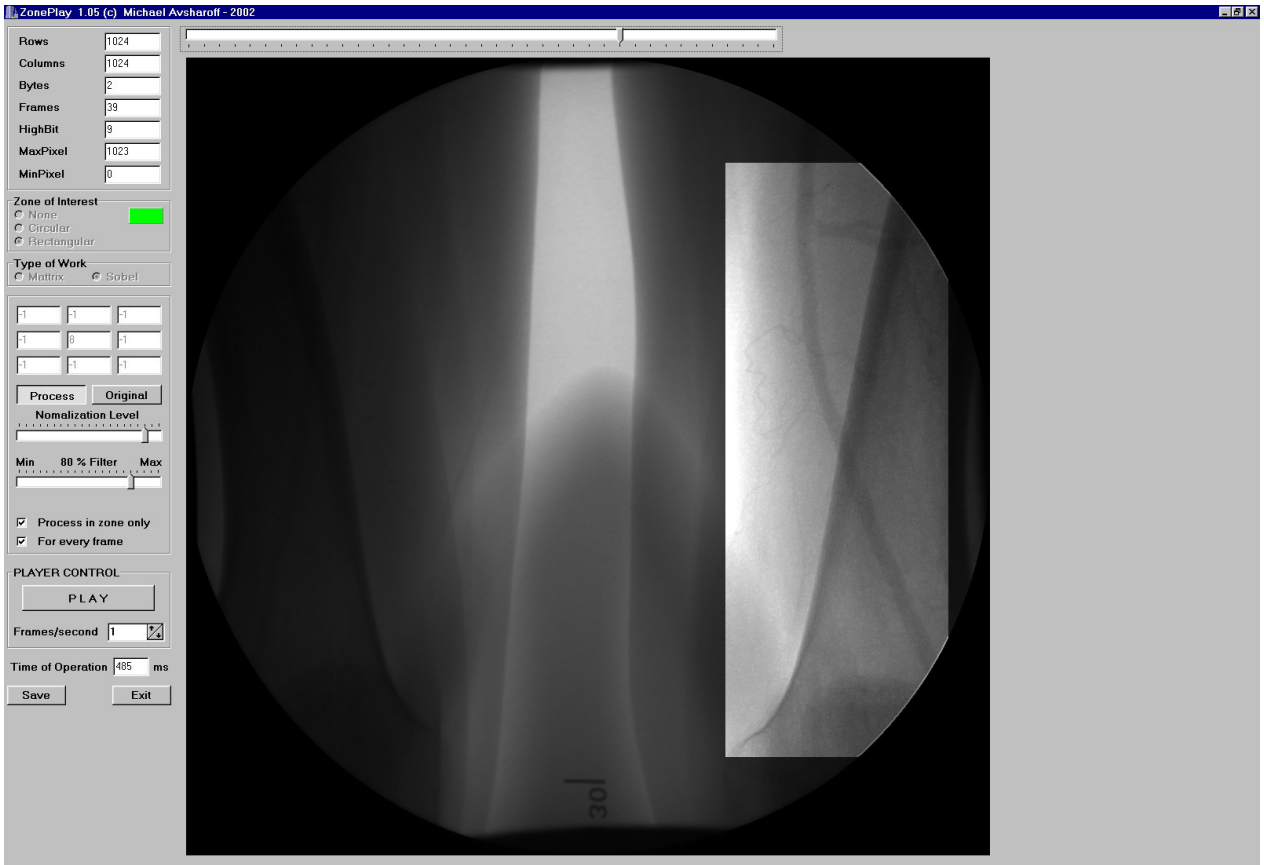
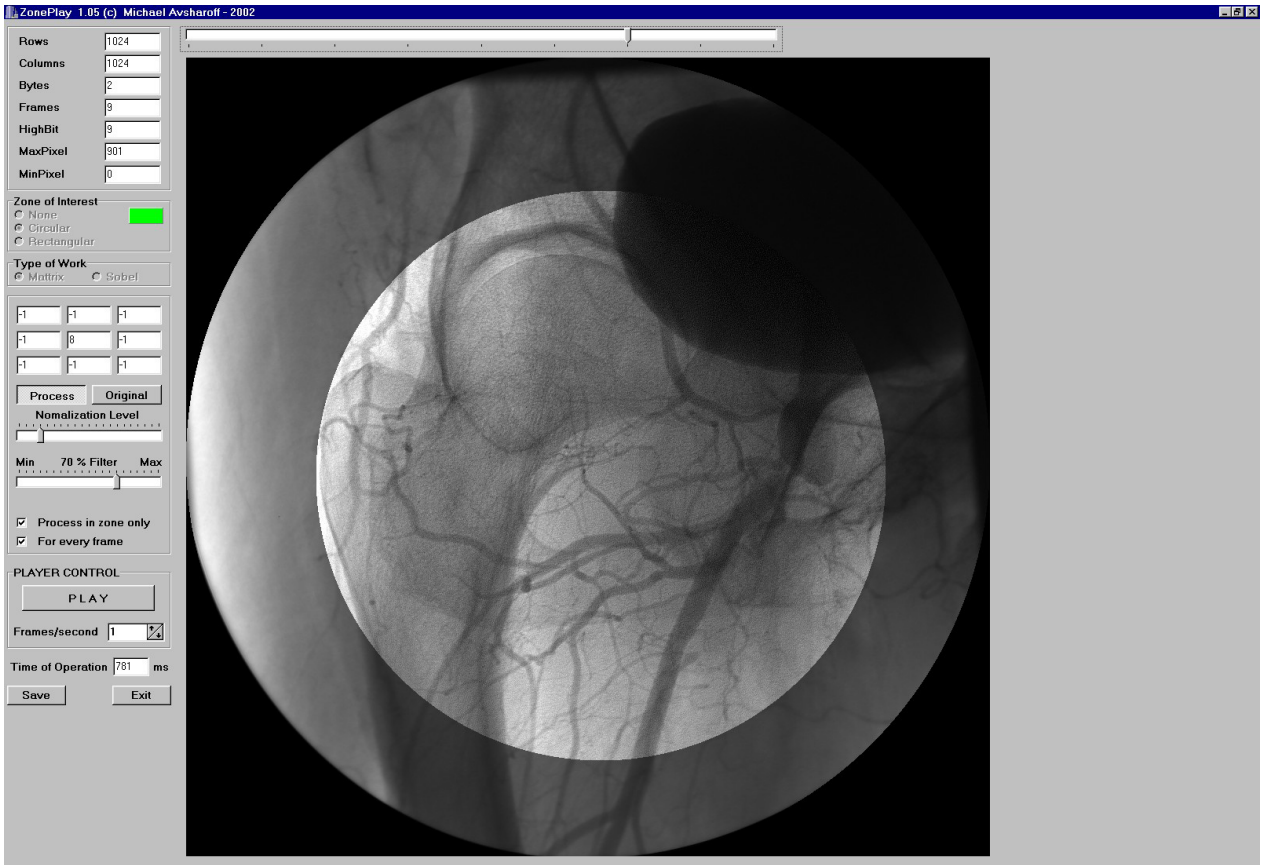


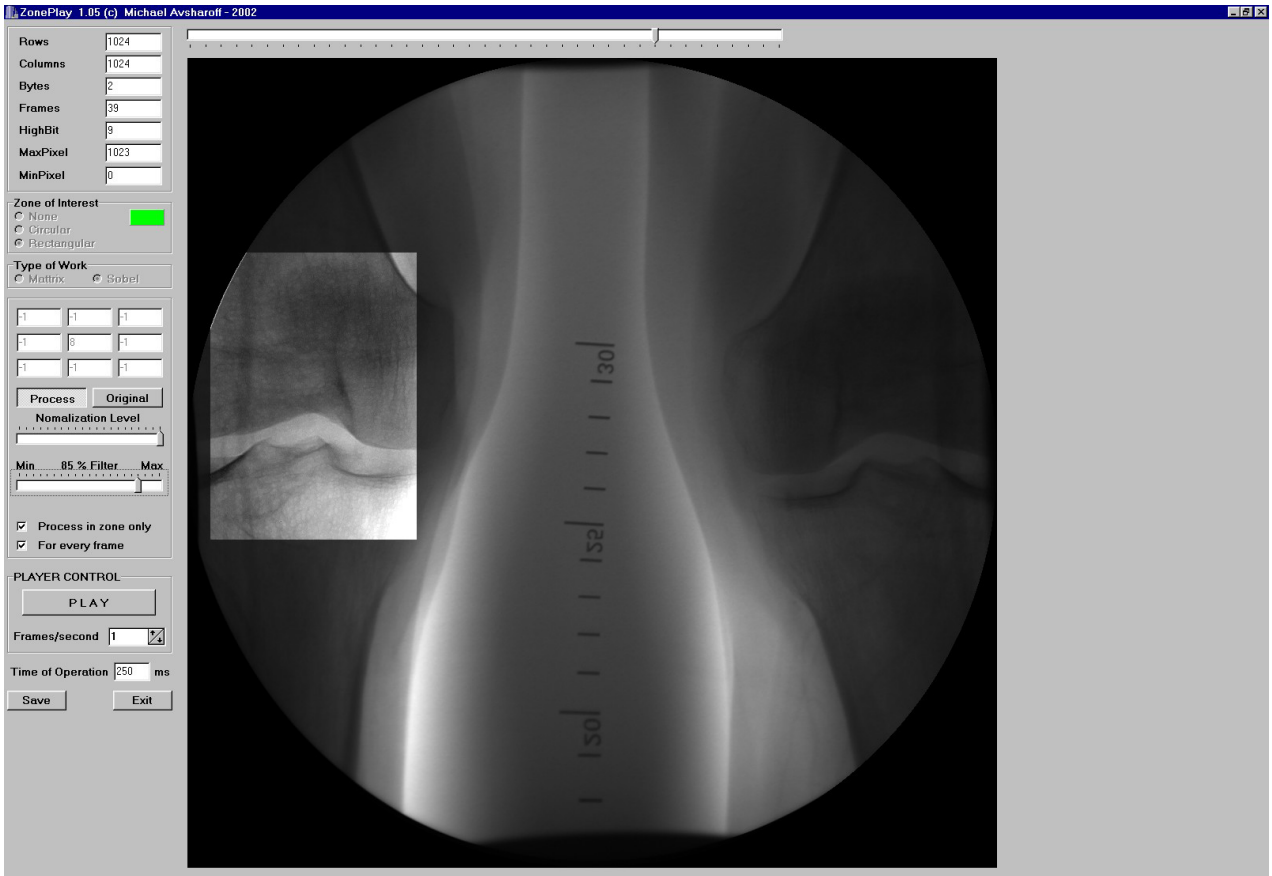
Image enhancement at ***Zonal Processing*** of a computed tomography **CT** of a mandible.



Review of the same set of images with ***Zonal Processing***, with reference to soft tissues of the patient. The subtracting analysis does not give on such image of visible results.



Review of the initial image from a series of frames by the format by **1024*1024** depth **10b** (in **16b**) from **DICOM** of the file with usage of a circle zone, with reference to soft and hard tissues of the patient.



Review of the same set of images with ***Zonal Processing***, with reference to hard tissues of the patient. The subtracting analysis does not give on such image of visible results.

The review **RGB** of the image - processing in a rectangular zone - initial image is obtained on the apparatus of scanning for of irido-diagnostics.tissues of the patient.

Preprinted Processing and Viewing for a paper print. **View-Print**.

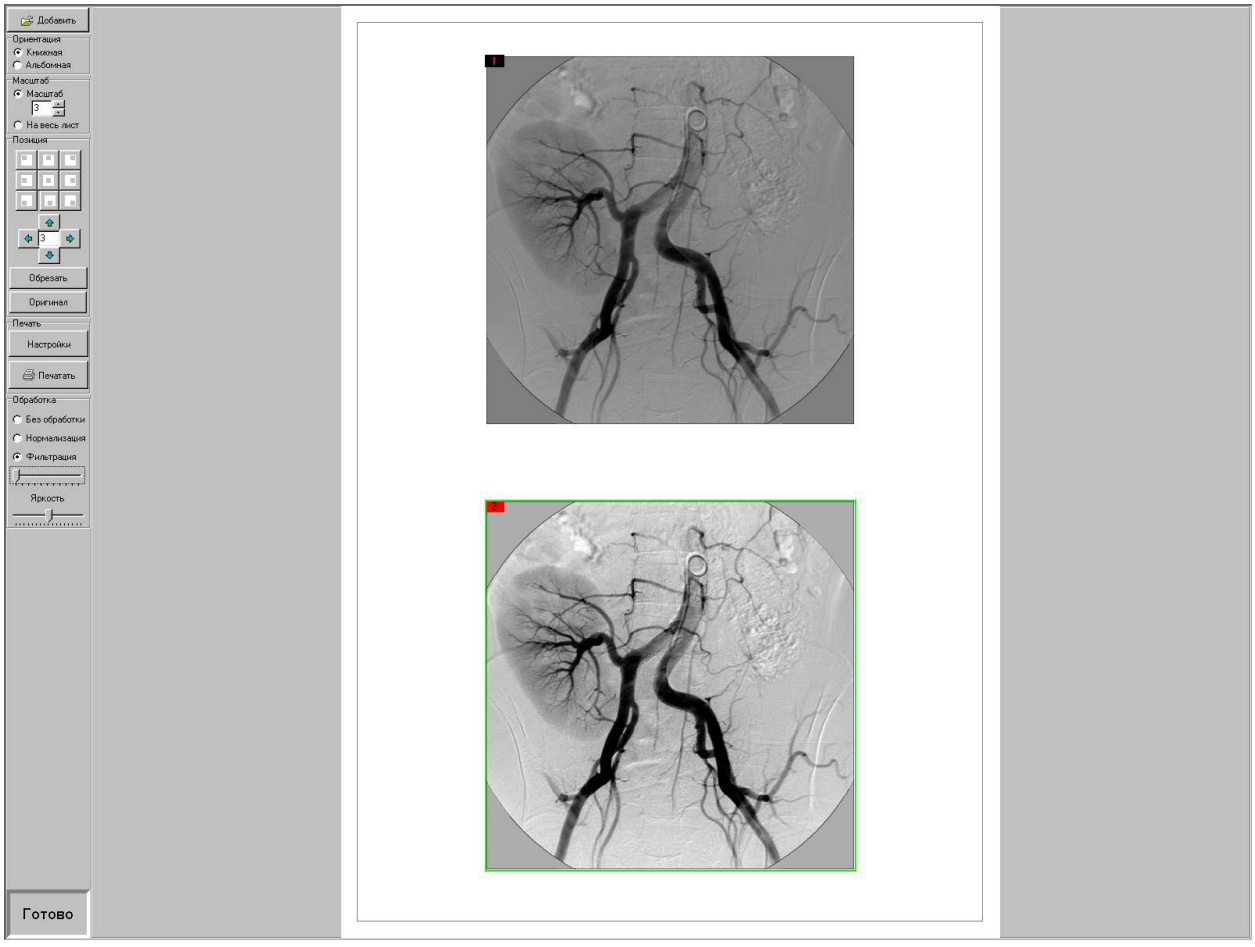
• *Visualization at Printing in the module View-Print.*

The module **ViewPrint** is intended for review and after-processing of the image going on printing to the printer.

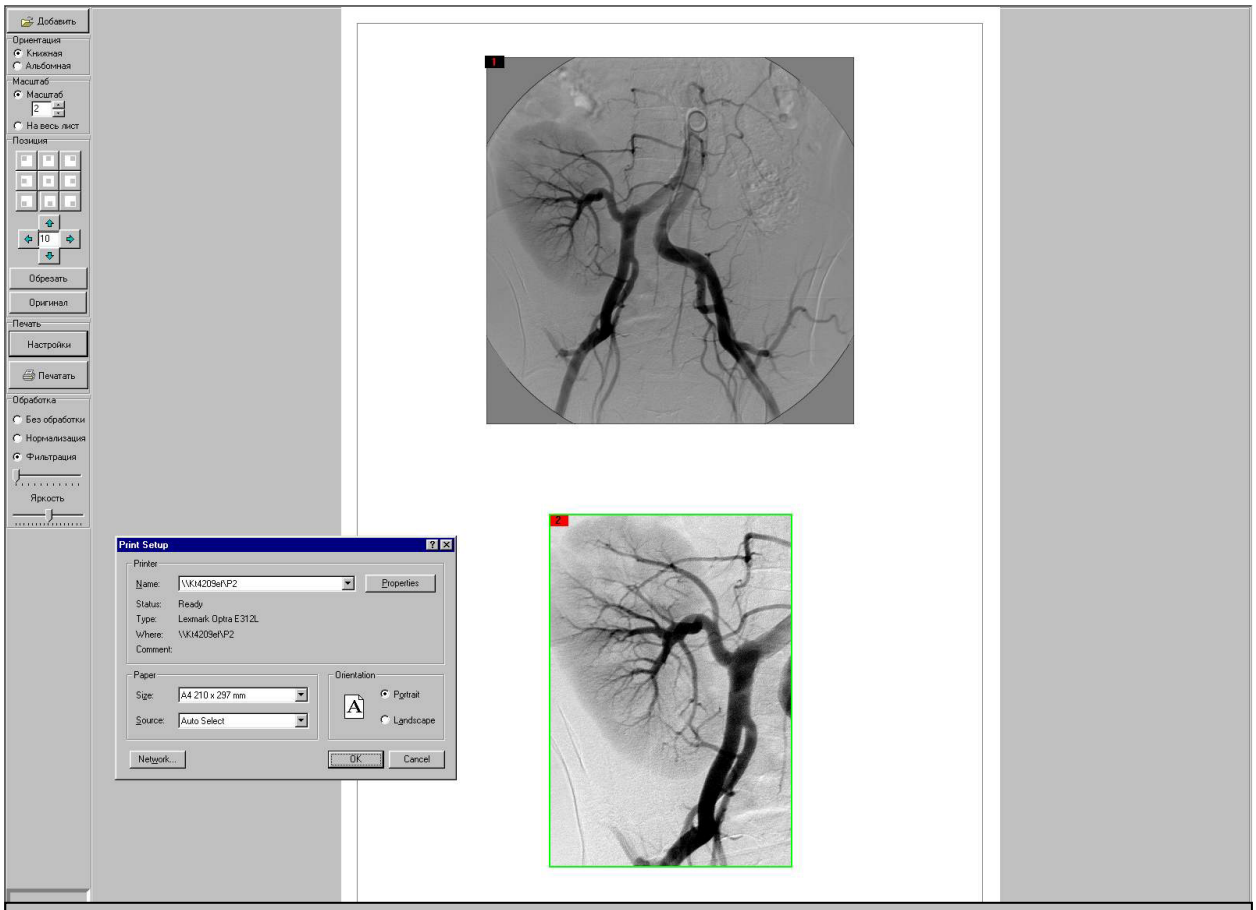
1. Free choice of the selected (processed) frames under printing produced earlier.
2. Preliminary specialized processing of the image under printing.
3. The scaling and allocation of the image on the format of a page of printing, is possible allocation from 1-st up to 16 of the images on a page the A4 size.
4. Rigid, but recognized schedule, format of documents under the printer, for printing the descriptions, conclusions, diagnoses with a set of the images obtained at stream or Zonal Processing.

• *Examples Visualization at Printing frames.*

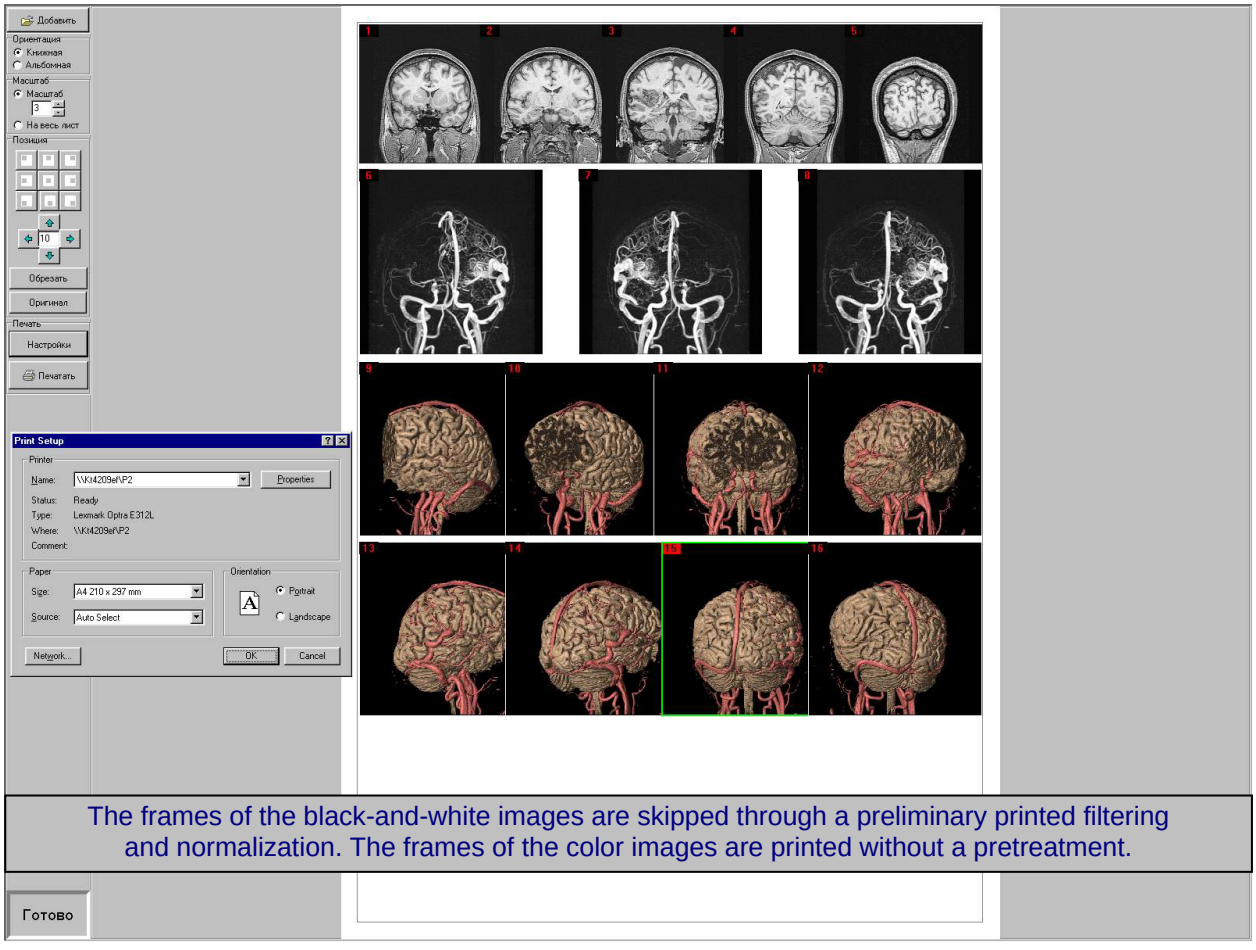
On screen mappings the processes of preparation (after-processing) and images going on printing are rotined.



Frame in top: come with stream image processing,
Frame below: the same frame, elapsed preliminary printed processing - normalization and filtering.



Multi frames printing up to 16 frames on the format A4.
Choice on frame of a Zone of Concern for the subsequent circumcision of an external part.
For each frame are installed: Zoom, position, normalization, filtering and luminance.



The frames of the black-and-white images are skipped through a preliminary printed filtering and normalization. The frames of the color images are printed without a pretreatment.