MedVision

USER MANUAL

Virtual simulator for angiography

AngioVision Standard

Contents

Intro

Virtual simulator for angiography is a training complex consisted of hardware and software simulated controls and instruments.

Training complex is designed for studying of basics and specifics of endovascular intervention. All interventions are being performed in virtual but realistic anatomic environment, with use of real endovascular instruments imitators as well as other surgical equipment. It eliminate any risk to the health and life of the real patient unlike in many classic training programs.
Using of the simulator also helps to get acquainted with digital subtraction angiography («Roadmap» mode) and work out the various tactics of the performing angiography and angioplasty.

This user manual explains principles of working with simulator hardware and instruments operations as well as features of its educational software (performing of endovascular interventions, training courses, instruments calibrations etc.).

Please note: all endovascular instruments and medical equipment used in the simulator are only imitations of the real ones and can not be used outside simulator's environment.

1 Safety precautions

Always check condition of simulator body, connection wires and monitors brackets before work. Look for twisted wires, breaks or cracks, loose fastening of bracket etc. In case of any damage or serious defects - all work should be postponed until repair is completed.

Following things are **forbidden:**

- Exert a force upon the instrument;
- Hold instruments nearby magnetic surfaces/place instruments onto them;
- Force opening the simulator shell;
- Pierce buttons on the C-arm control panel;
- Jolting of joysticks on the C-arm;
- Jumping on the 2 key pedal;
- Turn off simulator power during exercise performing;
- Expose simulator to the high temperatures (over 30 °C) in a continuous manner;

Always retract the instruments imitators of the ports (imitator of percutaneous approach) after exercise completion.

It's also forbidden to use simulator in a rooms with high humidity conditions, there condensation may form on the electronic and mechanical components.

Vapors of acids, alkalies and other aggressive substances should not be present in the air. Air condition must meet the sanitary standards established by the GOST 7.50-2002 (RUS): maximum single amount of dust in the air space no more than - 0.5 mg/m^3, average - 0.15 mg/m^3.

Warning labels on the simulator body:

- «High voltage warning» (W08) (Figure 1.1) ;
- «Ground» (W08) (Figure 1.2)

Figure 1.1. High voltage warning

Figure 1.2. Ground

Simulator also marked with label mark, which contains information about product's name and nominal specifications (such as power consumption, frequency and voltage of the power supply).

1.1 Other dangers

Collisions with the simulator's body can lead to its falling. Do not hold or hang on the monitor bracket. If simulator fall onto you - call for

help, before trying to free yourself. After being freed make sure to visit your doctor even if there are no visible signs of injury.

Power cords, cables and wires should not be placed in the passages, it's can cause stumbling and falling as well.

Do not stumble, insert or put any of endovascula instruments imitators into the cavity of the human body or anywhere else except for imitator of percutaneous approach (port).

Note, that all endovascular instruments and medical equipment that used in the simulator - are only imitations of the real ones, and can not be used outside of simulator's environment.

2 Startup and Shutdown

2.1 Startup

Simulator must be connected to the grounded outlet (220 V, 50 Hz). Start up algorithm listed below:

- Connect simulator to the surge protector/power outlet;
- Turn on tumbler switch (0/1) on the surge protector (if used);
- Press start up button on the side panel of the simulator to turns its on;
- If needed, turn on tumbler switch (0/1) for the monitors;
- Simulator's software will start up automatically;

Simulator software will launch automatically. Otherwise you can launch the program from desktop shortcut as well.

2.2 Shutdown

Shutdown algorithm is shown below:

- Close exercise and return to the Main menu;
- Pull out imitators of endovascular instruments;
- Log in as Administrator (see «Authentication as an Administrator» section for details);

3 Angiography system

Angiography is a main medical imaging technique used to visualize the inside of the blood vessels during contrast X-ray examination which is performed via usage of the C-arm in a special operating room.

Simulator's C-arm presented as a virtual software but it's control elements such as **2 key pedal** and **control panel** are presented as a hardware.

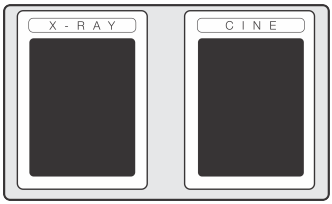

Figure 3.1. 2 key pedal

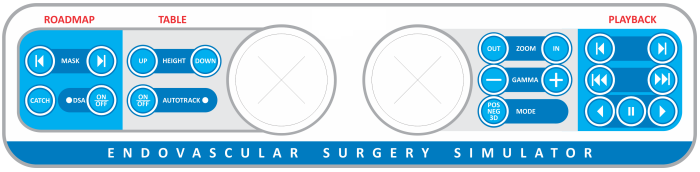

Figure 3.2. C-arm control panel (colours may vary)

3.1 Visualization system

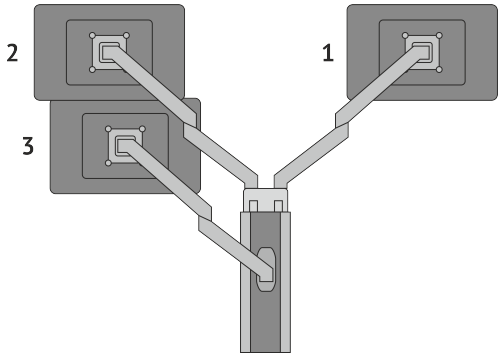

Figure 3.3. Visualization system (example)

Simulator's visualization system consist of three different monitors. Each monitor is assigned for a different task:

- **X-RAY monitor** (1) - display of X-RAY picture (see «Radiography» section for more information);
- **CINE monitor** (2) - display of recorded X-RAY sessions (see «Fluoroscopy» section for more information);
- **Touchscreen monitor** (3) - interaction with user interface. For example:
    - authentication;
    - new user registration;
    - start ups of the exercises and training courses;
    - imitators of endovascular instruments calibrations (see «Administrator» section for more information);

3.2 Fluoroscopy

Yellow key on 2-key pedal (Figure 3.1) activate fluoroscopy mode. While mode is active all performed manipulation with instruments and operating table will be displayed in real-time as an X-RAY images on the **X-RAY monitor** . Mode stay active until assigned key is pressed and hold. After release of the key image on the monitor will freeze and any changes of the instrument or table position will be displayed only after assigned key is pressed again.

Joysticks, located in the centre of the C-arm control panel, assigned as the controls of of the virtual operating table horizontal position and change of the virtual C-arm view angle and its rotation around the patient.

Vertical position of the virtual operating table can be change by pressing «up» and «down» buttons locate in the «Table» section on the C-arm control panel. This section also contain controls of «Autotrack» function (automatic change of the virtual operating table horizontal position). While **Autotrack** function if **On** changing of the virtual operating table horizontal position via joysticks will be disabled.

Figure 3.4. Lift operation table

Figure 3.5. Lower operation table

Figure 3.6. On/Off Autotrack

Figure 3.7. Zoom in the image

Figure 3.8. Zoom out the image

Figure 3.9. Positive / Negative / 3D

«Fluoro» section of the C-arm control panel allows to change the display of the X-RAY image which don't depend on the position of virtual operation table or C-arm.

Press «In» button to zoom in the image or «Out» to zoom out.

«Gamma» can increase or decrease brightness of the X-RAY image. Press «+» to increase and «-» to decrease.

«Mode» button alternately switches the display of the X-RAY image between positive, negative and 3D (special software feature may be disabled in some exercises) modes (Figure 3.12) , (Figure 3.13) .

Figure 3.10. Increase the brightness of the image

Figure 3.11. Decrease the brightness of the image

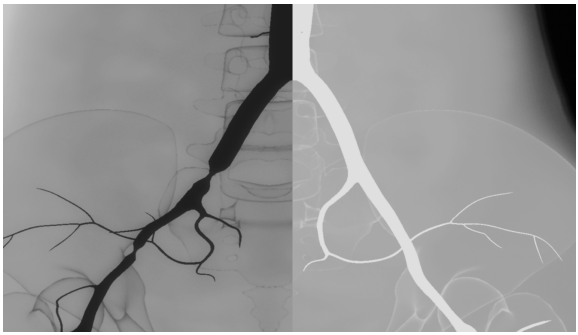

Figure 3.12. Positive/Negative X-RAY image

X-RAY image in the moment of contrast injection. On the left - positive, on the right - negative

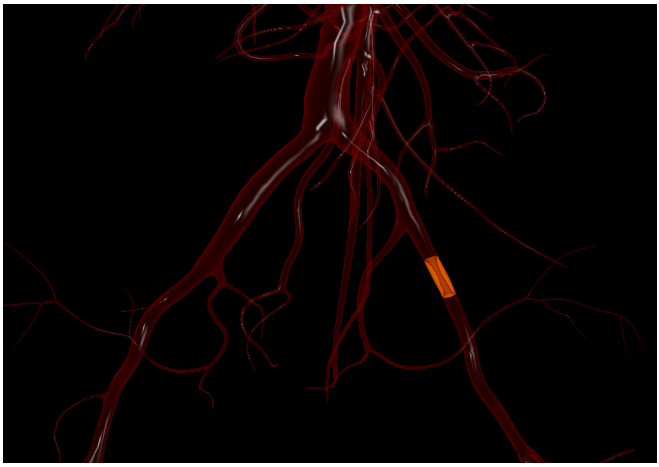

Figure 3.13. 3D Mode

3.3 Radiography

Blue key on 2-key pedal (Figure 3.1) activate radiography mode. While mode is active all performed manipulation is recorded as well as displayed in real-time on the **X-RAY monitor** . Mode stay active until assigned key is pressed and hold. After release of the key recorded session will be displayed on the **CINE monitor** . Each press of the blue button initiate recording of the new session. Number of the recorded sessions for one exercise is unlimited but only the last recorded will be displayed automatically.

To move between recorded sessions use buttons in the «Playback» section on the C-arm control panel. To switch to the next session press «next session» (Figure 3.14) , to return to the previous one press «pre-

vious session» (Figure 3.15) .

Press «move one frame forward» (Figure 3.18) or «move one frame backward» (Figure 3.17) allows to scroll a session frame by frames forward or backward, accordingly. It will also stop displaying of the session pausing it.

To resume normal playback of the recorded session press «Play forward» (Figure 3.19) or «Play backward» (Figure 3.20) . Note, that «Play backward» will results in session playing in reverse.

Figure 3.14. Next session

Figure 3.15. Previous session

Figure 3.16. Pause

Figure 3.17. Next frame

Figure 3.18. Previous frame

Figure 3.19. Play session forward

Figure 3.20. Play session backward

3.4 Roadmap

Roadmap mode assigned for use of a digital subtraction angiography.

Figure 3.21. Make a series of shots

Figure 3.22. Next shot

Figure 3.23. Previous shot

Figure 3.24. Roadmap On/Off

- During injection of contrast agent (fluoroscopic mode must be active), press «Catch» (Figure 3.21) button. It will results in the series of shots - «masks» which will later lay on of the X-RAY image.
- Press DSA «On/Off» to activate «Roadmap» mode;
- «+» and «-» buttons allow a switch between «masks».

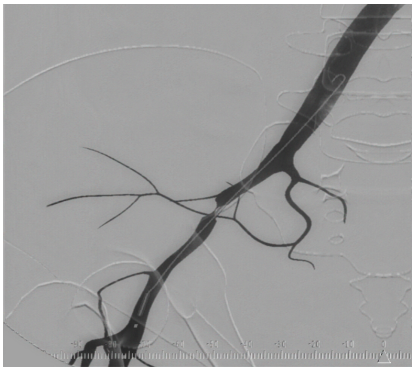

Figure 3.25. «Mask» lay on the X-RAY image

It is important to remember that any changing in the virtuals C-arm and/or operating table positions and as a result - X-ray image, will lead to shifting between «mask» and active image (Figure 3.26) .

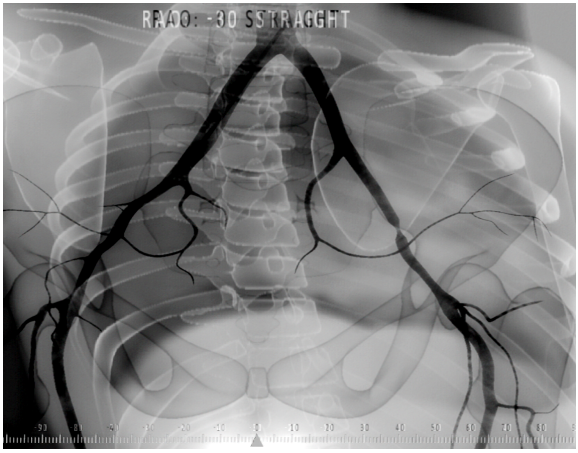

Figure 3.26. Shifting between «mask» and active X-RAY image

To deactivate Roadmap mode and press DSA «Off». Mode can be activate and deactivate as many times as needed.

4 Imitators of instruments

Simulator's standard equipment includes:

- Imitators of endovascular catheters (2 different diameters);
- Imitator of endovascular guidewire;
- Imitator of contrast agent injector;
- Imitator of indeflator;

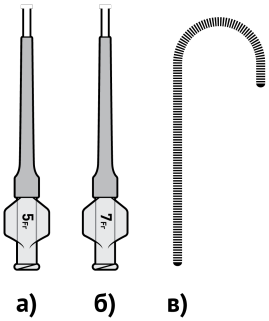

Figure 4.27. Imitators of endovascular instruments

4.1 Insertion of the instruments

Imitators of endovascular instruments (Figure 4.27) insert into the simulator via imitator of percutaneous approach point (port) during the exercises and pull out after exercise is completed. Imitators of indeflator and contrast agent injector connect to the simulator body during its montage.

Imitator of endovascular catheter with a of larger diameter is defined as the guiding catheter, while imitator with smaller diameter - as the carrier of the balloon or stent, diagnostic catheter or microcatheter, and imitator of a guidewire - as a guidwire or guidewire with EPD.

Switch between one or another types of the virtual instruments made during the exercise performance, before the assigned imitator is inserted into the imitator of percutaneous access point and determined by simulator tracking system (see «Instrument selection» sectionfor more information).

4.2 Instrument selection

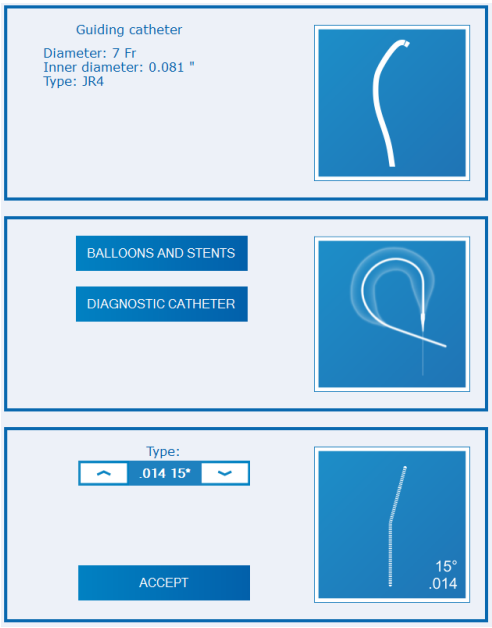

Figure 4.28. Instruments icon within the exercise

To select instrument within the exercise click on its icon in the right part of the exercise window (Figure 4.28) . This will open instrument type selection window. Second step is to determined instruments properties. First option is to determine its value by clicking on the arrows and clicking «Accept». Second option is to choose one from the pre-determine list. For some instruments, simply click on the icon with its designation.

After that selection process if complete and imitator assigned as chosen instrument can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - white icon means that instrument is identified by the tracking system.

Note: Instrument properties must be selected before its insertion into the imitator of percutaneous approach point (port) and identification by tracking system. If you need to change instrument or its properties - pull imitator of instrument out of the simulator and repeat algorithm from above.

Guiding catheter

To start work with the guiding catheter, click on its icon in the upper right side of the exercises window (Figure 4.28) . In the open menu choose diameter and shape of the curve and click on «Accept» button.

After that imitators of endovascular catheter (bigger diameter) can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

Guiding catheter moves accordingly movement performed by imitators

of endovascular catheter.

Balloon

To start work with the balloon, click on its icon in the middle right side of the exercises window (Figure 4.28) . In the open menu choose «Ballon and Stent» section, than «Ballon». After choose diameter and length and click on «Accept» button.

After that imitators of endovascular catheter (smaller diameter) can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

Inflation/deflation of the balloon regulate by imitator of indeflator. To inflate the balloon - screw the plunger of indeflator, to deflate - pull it out. Nominal and estimated burst pressure are the critical values of possible pressure for balloon. Upon exceeding of the second value - it can burst inside the blood vessel.

Balloon moves accordingly movement performed by imitators of endovascular catheter.

Self-extracting stent

To start work with the self-extracting stent, click on its icon in the middle right side of the exercises window (Figure 4.28) . In the open menu choose «Ballon and Stent» section, than «self-extracting stent». After choose diameter and length and click on «Accept» button.

After that imitators of endovascular catheter (smaller diameter) can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.
Opening of the nitinol stent regulated in the program and is similar to the first option of the selection process. Press right arrow to increase opening and lest to decrease it.

Nitinol stent moves accordingly movement performed by imitators of endovascular catheter.

Balloon-expandable stent

To start work with the balloon-expandable stent, click on its icon in the middle side of the exercises window (Figure 4.28) . In the open menu choose «Ballon and Stent» section, than «Balloon-expandable stent». After choose diameter and length and click on «Accept» button.

After that imitators of endovascular catheter (smaller diameter) can

be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

Inflation/deflation of the balloon regulate by imitator of indeflator. To inflate the balloon - screw the plunger of indeflator, to deflate - pull it out. Nominal and estimated burst pressure are the critical values of possible pressure for balloon. Upon exceeding of the second value - it can burst inside the blood vessel.

Balloon-expandable stent moves accordingly movement performed by imitators of endovascular catheter.

Diagnostic catheter

To start work with the diagnostic catheter, click on its icon in the middle right side of the exercises window (Figure 4.28) . In the open menu choose «Diagnostic catheter». After choose diameter and shape of the curve and click on «Accept» button.

After that imitators of endovascular catheter (smaller diameter) can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of

the simulator and repeat algorithm from above.

Diagnostic catheter moves accordingly movement performed by imitators of endovascular catheter.

Stent Graft

To start work with the stent graft, click on its icon in the middle right side of the exercises window (Figure 4.28) . In the open menu click on «Accept» button.

After that imitators of endovascular catheter (smaller diameter) can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

Stent Graft moves accordingly movement performed by imitators of endovascular catheter.

AAA Stent Graft

To start work with the AAA stent graft, click on its icon in the middle right side of the exercises window (Figure 4.28) . In the open menu click on «Accept» button.

After that imitators of endovascular catheter (smaller diameter) can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

AAA Stent Graft moves accordingly movement performed by imitators of endovascular catheter.

Microcatheter

To start work with the microcatheter, click on its icon in the lower right side of the exercises window (Figure 4.28) . In the open menu choose «Microcatheter». After choose shape of the curve and click on «Accept» button.

After that imitators of endovascular catheter (smaller diameter) can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

Microcatheter moves accordingly movement performed by imitators of endovascular catheter.

Super Stiff

To start work with the super stiff, click on its icon in the lower right side of the exercises window (Figure 4.28) . In the open menu choose «Super stiff» and click on «Accept» button.

After that imitators of endovascular guidewire can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

Super stiff moves accordingly movement performed by imitators of endovascular guidewire.

Guidwire

To start work with the guidewire, click on its icon in the lower right side of the exercises window (Figure 4.28) . In the open menu choose «Guidwire». After choose shape of the curve and click on «Accept» button.

After that imitators of endovascular guidewire can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator

and repeat algorithm from above.

Guidewire moves accordingly movement performed by imitators of endovascular guidewire.

Guidewire with EPD

To start work with the guidewire with EPD, click on its icon in the lower right side of the exercises window (Figure 4.28) . In the open menu choose «Guidewire with EPD». After choose shape of the curve and click on «Accept» button.

After that imitators of endovascular guidewire can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

Opening of the EPD regulated in the program. Press «Opening of the EPD» to open it and «Closing of EPD» to close.

Spiral

To start work with the spiral, click on its icon in the lower right side of the exercises window (Figure 4.28) . In the open menu choose «Spiral» and then select one of three available types. After choose diameter

and length and click on «Accept» button.

After that imitators of endovascular guidewire can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

To fill aneurysm with coil continue to insert imitator of guidewire, after microcatheter got into the aneurysm cavity. To detached coil press «Detaching» buttons after mark in spiral and microcatheter are match.

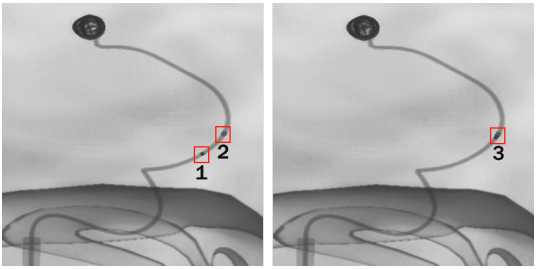

Figure 4.29. Filled aneurism. 1 - mark on spiral, 2 - mark on microcatheter 3 - matching marks, right position for detaching

Spiral moves accordingly movement performed by imitators of endovascular guidewire.

Roberts Uterine Catheter

To start work with the Roberts uterine catheter (RUC), click on its icon in the lower right side of the exercises window (Figure 4.28) . In the open menu click on «Accept» button.

After that imitators of endovascular catheter (bigger diameter) can be insert into the simulator via imitator of percutaneous approach point (port). Keep inserting until instrument icon become white - it's means that instrument is identified by the tracking system. If you need to change instrument or its properties after that - pull imitator of instrument out of the simulator and repeat algorithm from above.

RUC moves accordingly movement performed by imitators of endovascular catheter.

Imitator of contrast agent injector

Working with imitator of contrast agent injector is simple. First pull the syringe plunger to the end value of the scale of the syringe, and then push just like real syringe. Then if more contrast agent is needed repeat the algorithm.

Note: Imitator of contrast agent injector may look like a real syringe there is no need to take in any kind of liquid for insertion.

Imitator of indeflator

Imitator of indeflator regulate inflation/deflation of the balloon during the exercise. To inflate/deflate the balloon:
- Screw syringe to inflate, unscrew it to deflate;

4.3 Work with several percutaneous approach points (ports)

Percutaneous approach point (port) change

The **«percutaneous approach point (port)»** change icon allows to change endovascular instruments imitators point of introduction. In certain exercises its required to work with two or more percutaneous approach points (ports). Following percutaneous approach point (port) are available: brachial artery (1), ipsilateral renal artery (2) contralateral renal artery (3). To change percutaneous approach point (port) follow the steps below:
- Press **«percutaneous approach point (port)»** icon to open port change menu;
- Select new percutaneous approach point by pressing onto its icon;
- Icon with selected percutaneous approach point (port) will be displayed near **«injector»** icon;

Please, note: If you going to use already introduced instrument imitator for new access point, you'll need to **extract it** from the simulator, and then **insert it** again.

Figure 4.30. Direction for instrument position synchronization

After percutaneous approach points (ports) changing instrument inserted into previous port will be «frozen» (stop move) inside program and stop react to the instrument imitator manipulation. To «unfreeze» instrument in program you'll need to switch back to it's assigned port and re-insert instrument back to it's previous point. Follow the directions on screen (Figure 4.30) to synchronize both instrument positions: physical and program. As soon as instrument icon change colour from yellow to white synchronization is completed and instrument will «unfreeze».

Please, note: If you use more than one instrument (for example diagnostic catheter and guide wire) you'll need to insert and synchronize all used instruments to «unfreeze» even one instrument.

5 User account

When simulator is running, the program boots automatically and start screen (pic. 5.1) with two buttons “Select an existing user”, “Create new user” opens.

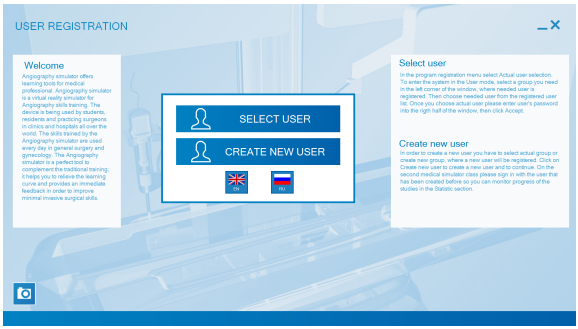

Figure 5.1. Start screen

5.1 Existing user selection

To open already existing account, press “Select an existing user” button.

Every user of the simulator is created in a definite group, pointed out by the user when registering. User name is shown only in their group. Group change is available in administrator mode.

All the existing groups are shown in the authorization window on the left. (pic. 5.2). Click the required group and choose name of the user

from the list. Enter the password and press “Accept” button.

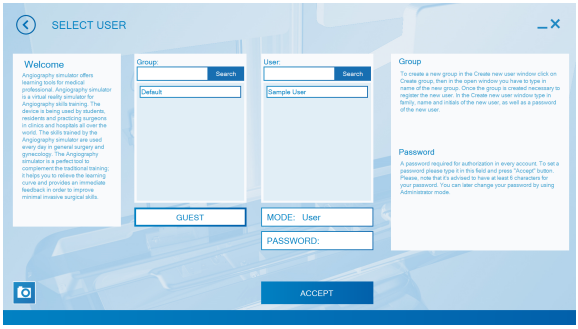

Figure 5.2. Authorization window

After user authorization the main menu opens (pic. 5.3). There are four sections: “Endosurgery”, “Training courses”, “Statistics”, “User switch”.

“Endosurgery” section comprises all exercises coming with the simulator. Exercises are divided according to the aspects, which are being chosen directly in “Endosurgery” menu. A trainee can choose the complexity level and exercise sequence on his/her own. Score given after an exercise completion is significant only for statistics (See “Exercises” section for details).

In “Training courses” section it is possible to select a course including an exercise set united in according to a certain aspects. Complexity

level, exercise sequence and minimum score required for the successful exercise completion are defined in advance (see “Training courses” section for details).

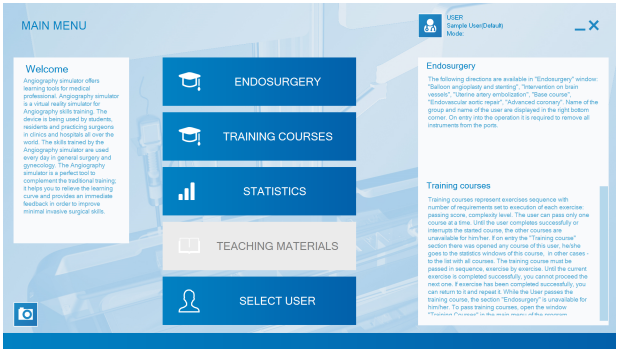

Figure 5.3. Main menu

A user can review training results of all completed exercises and courses in “Statistics” section (see “Statistics” section for details).

“User switch” section leads back to the initial user window where the current user account can be changed or new one can be created (see “User authorization” section for details).

5.2 New user registration

To create a new user select “Create new user” on the start screen (pic. 5.1). You can create a user in any exististing group or in a new one, in this case you need to create a group. (see “New group creation” section for details).

To add a new user in an existing group, select the group from the list on the left. Then enter profile name and password in Name and Password text boxes. Press “Create new user” button to finish.

5.3 New group creation

If you need to create a new group, press “Create a group” button in “Create new user” window. Enter name for the new group in the appeared window (pic. 5.5) and press “Accept” button.

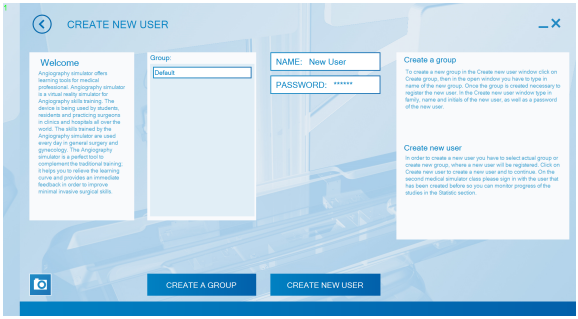

Figure 5.4. User creation form

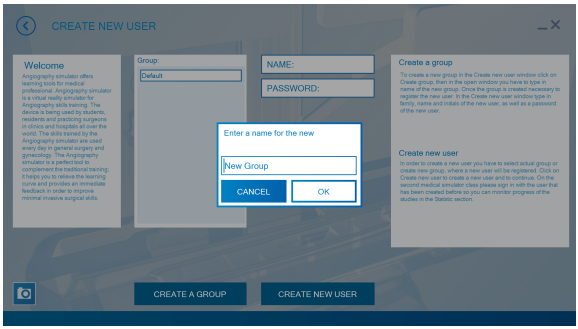

Figure 5.5. New group creation

Hereupon you can add new users to the group when registering or in the authorization window in the administrator mode (pic. 5.2) (see “Administrator mode” section for details).

6 Exercises

6.1 Endosurgery window

To open Endosurgery window (pic. 6.1) press “Endosurgery” button in the main menu.

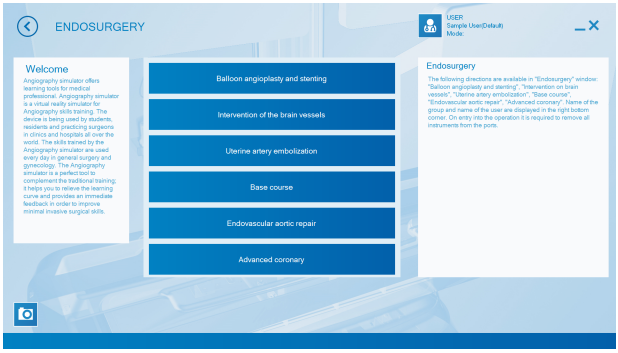

Figure 6.1. Endosurgery window

6.2 Exercise window

Position of the virtual C-arm and the table with the patient displays on the left side of the window. On the right side positioned instruments icon and «Exit» button can be found on the bottom of the right side as well.

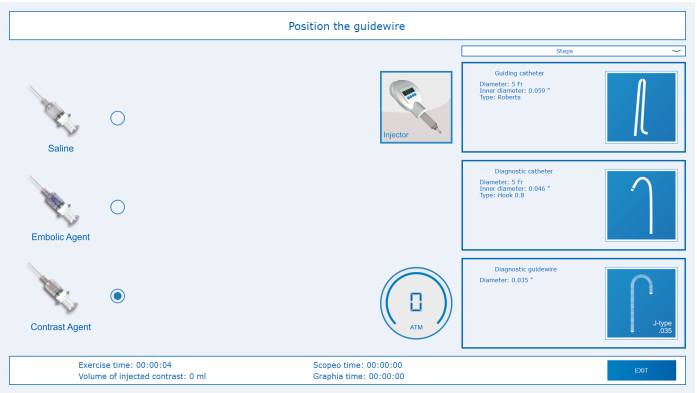

Figure 6.1. Exercise window

6.2.1 Lower panel of the exercise window

During exercises following information displays on the bottom panel of exercise window (Figure 6.1) :

- Time of operation;
- Time of scopy;
- Time of graphy;
- Volume of injected contrast agent;

- «Exit»/«Finished» button.

6.2.2 Information messages

Exercise is accompanied by three types of information messages (Figure 6.2) :
- Error messages;
- Warning messages;

Figure 6.2. Information

Error messages displays on the red field on the X-RAY monitor, warning messages displays on the yellow field n the X-RAY monitor as well.

6.2.3 Screen controls

Exercise screen also contains additional means of control - **«injector»** icon, **«percutaneous approach point (port)»** change icon and **«agent»** change icon. Please, note **percutaneous approach point (port)** change icon and **agent** change icon available only in certain exercises (such as uterine embolization and endoprosthesis of the aorta).

The **injector** allows to set the volume and rate of injection flow. This feature is useful if amount of injection, exceeds physical amount of sy-

ringe imitator. To perform injection from screen follow the steps below:
- Press **«injector»** icon to open injector menu;
- Set flow rate and injection amount using virtual keyboard in the injector menu;
- Press «**Start injection**» in the injector menu;

Please, note: To correct input numbers press **«c»** button in the injector menu;

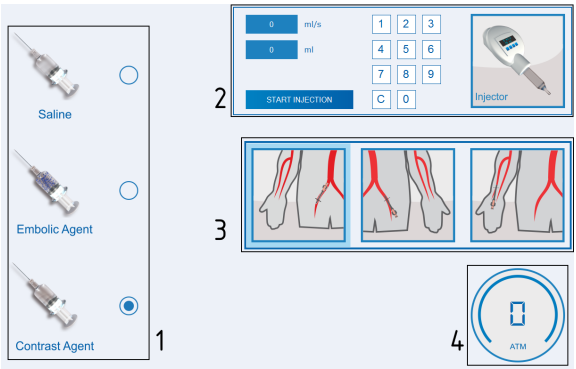

Figure 6.3. Screen controls menu. 1 - agent change, 2 - injector menu, 3 - Percutaneous approach points (ports) change, 4 - manometer

The **«agent»** change icon allows to change type of introducing agent. To change injection agent just choose one from the list.

The **«percutaneous approach point (port)»** change icon allows to change endovascular instruments imitators point of introduction. Follow-

ing percutaneous approach point (port) are available: brachial artery (1), ipsilateral renal artery (2) contralateral renal artery (3). To change percutaneous approach point (port) follow the steps below:

- Press **«percutaneous approach point (port)»** icon to open port change menu;
- Select new percutaneous approach point by pressing onto its icon;
- Icon with selected percutaneous approach point (port) will be displayed near **«injector»** icon;

6.3 Exercise completion and exit

When all the exercise stages are successfully completed, “Exercise is completed” message will appear on the screen. After that you can take out endovascular instruments imitators out of the percutaneous entry point imitator.

When all the instruments imitators are taken out of the port, “Exit” button (pic. 6.1) located in the left screen part will be highlighted with the green color. Press the button to finish the exercise and switch to statistics window (see “Statistics” section for details).

Figure 6.1. Exit button after exercise completion

Any exercise can be aborted by a user. Press “Exit” button in the left screen part (pic. 6.2). Statistics window will open afterwards.

Figure 6.2. Exercise exit button

7 Statistics

Statistics is user-personalized and is being formed after every completed exercise.

To see statistics you need to log in (See “Existing user selection” section) and select “Training statistics” in the main menu (pic. 5.3).

Information on the completed exercises (date, execution time, name and scores (0-100, wherein 100 is the best result)) will be displayed (Figure 7.1) .

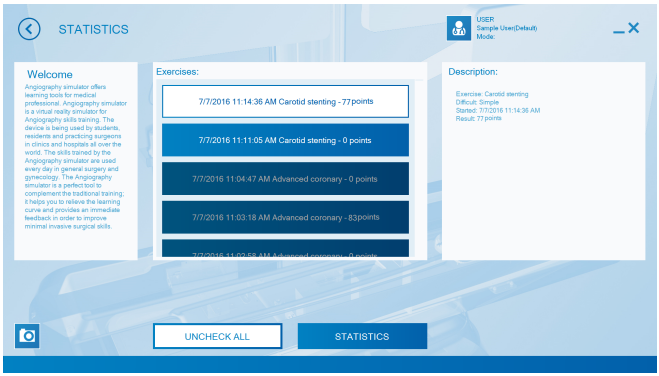

Figure 7.1. Statistics review window

To see the results of a certain exercise select it from the general list and press “Selected exercise results” button. In the appeared menu (Figure 7.2) results of the selected exercise (complexity level, execution

time, number of errors, etc.) will be displayed.

Figure 7.2. Certain exercise statistics window

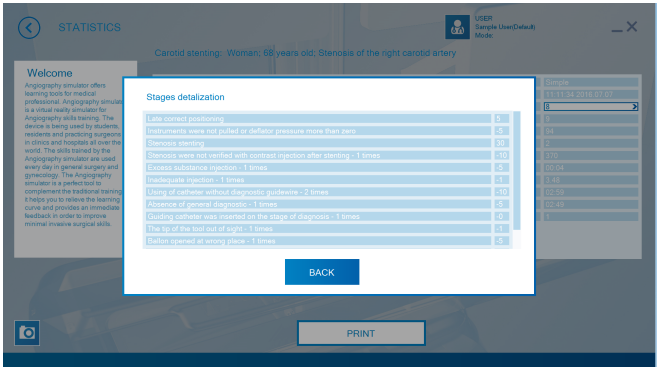

Figure 7.3. Score detailing window

Press «>» icon located in “Total score” field to open the score

detailing (Figure 7.3) . Score detailing is a detailed interpretation and explanation of the final score composed of points for the exercise in the aggregate excluding penalty points. To return to the exercise statistics window press “Back” button located in the left screen part.

Statistics window appears after exercise completion or abortion as well. It displays current exercise statistics, score detailing, return to the main menu, next exercise completion, exercise retry and results printing out functions are available. To see the details press «>» icon located in “Total score”.

8 Acknowledgement table

I have read and understood the manual:

Table 1. Acknowledgement table

Date	Name	Signature