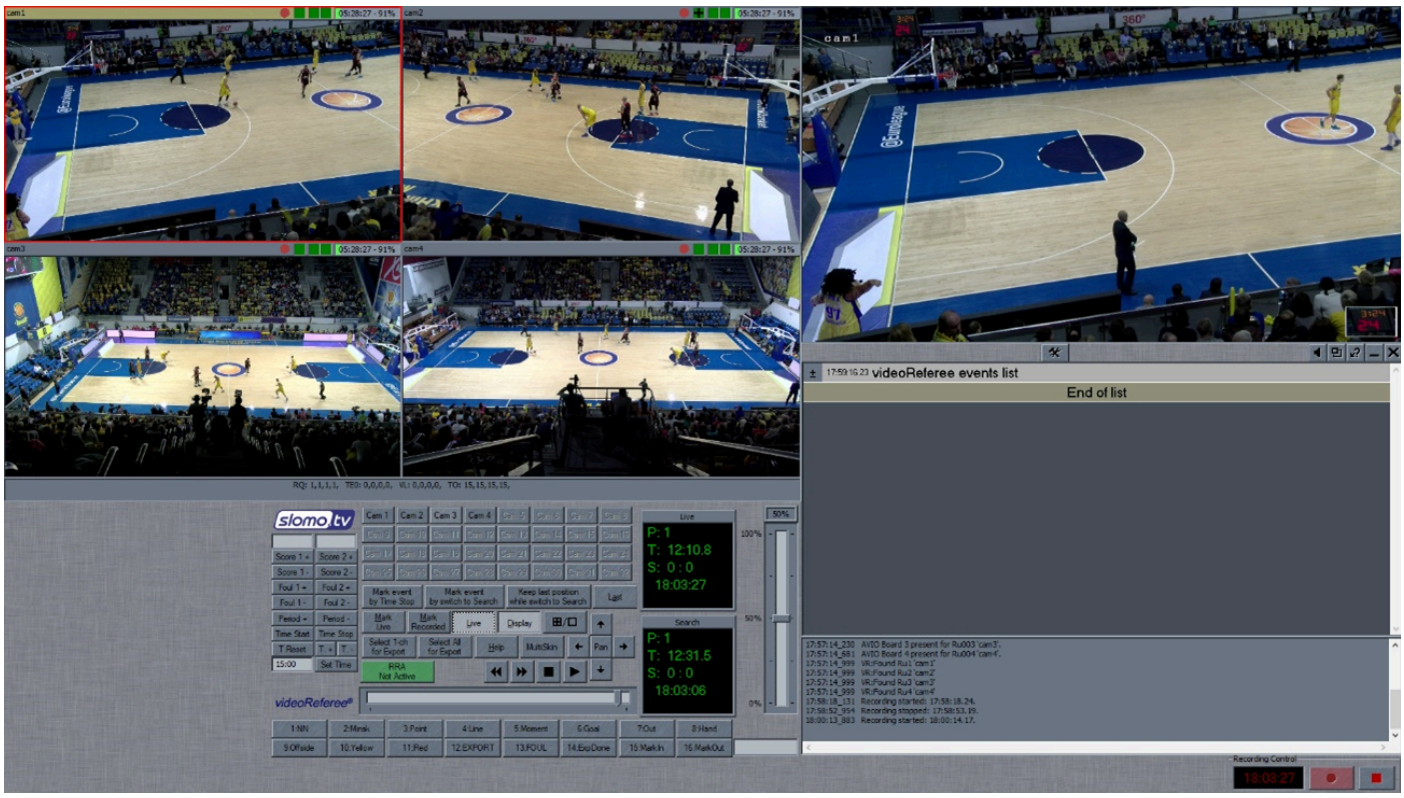
videoReferee®

Manual for video engineers

Important information 4
videoReferee® application overview 6
videoReferee® components 6
videoReferee® description 7
Starting the software 8
Select Project 12
Create New Project 13
Program interface 14
Recording indication bar 17
Window with operating mode information and messages about special situations (counters monitor) 21
Video output monitoring window 22
Slomo.tv logo 23
Control panel in the interface 23
Working with videoReferee® 58
Pre-match setup and checkup 59
Preparation and inspection of the videoReferee® video engineer's workplace 59
Setting up and inspection of the video referee's workplace 61
Working with the program 61
Start video recording 61
Scoreboard recording 62
Work with events 65
Presets 73
Search through the recorded video 74
Stop the recording 74
Multiviewer 75
Export of events (creation of a video report) 78
Selection of events for export 79
Duration of exported moments 80
Export of selected events 81
Export of selected channels 85
Preview of exported video files 90
Program settings – Tools menu 90
Project archiving 90

Video delay 95
Selection of Multiviewer layout 96
Display of project information on the Multiviewer screen 98
Configuration of audio channels for export 99
Setting the display of fields in Live 99
Icons in the event list 100
Operating, transportation and storage conditions 101
Normal operating conditions 101
Normal transportation and storage conditions 102
Appendix B. Assignment of buttons in the program interface, keyboard shortcuts, remote control buttons 103



Important information

Users should be familiar with safe operation of computers and know the basics of Microsoft Windows.

The *videoReferee®* system is a software and hardware complex of high complexity. During its development, all hardware and software components were carefully tested and selected for long-term operation and usage. Therefore, any attempts to modify the system independently, including installation of any additional software, drivers or OS updates, change of network or disk configuration settings, installation of viral or anti-virus software will most likely lead to unstable operation or system failure.

These cases are not covered by the warranty!

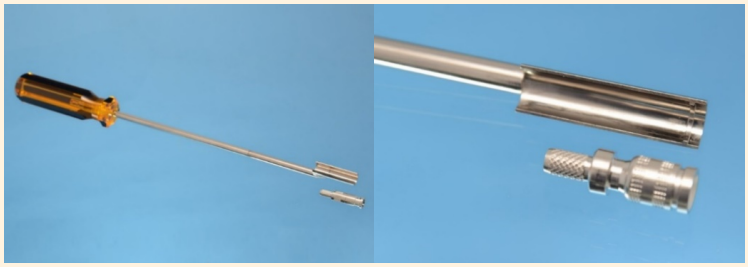
It is strictly not recommended to connect the *videoReferee®* system to the Internet or to a local network that is not protected by a Firewall.

Note: due to the peculiarity of Direct X in Windows 10, it is strongly recommended not to use the **Ctrl + Alt + Delete** shortcut during operation. After pressing this key combination, there may be no video in the video windows of the program for 2 minutes.
All consequences of using the specified key combination while the program is running are at your own risk.

All slomo.tv systems come with a USB Recovery Stick for quick system recovery.
The USB Recovery Stick contains an image of your system. This image is unique and is created specifically for your server, installed server components
and pre-installed software.
The data on the USB Recovery Stick should be carefully stored, not deleted and, if possible, backed up to an additional external storage media!
With the included USB Recovery Stick you can restore your original software configuration independently and have a fully functioning system within minutes.

Insert the connectors gently into the ports. Do not use force.
When connecting, make sure that:
– no other objects are obstructing the connection to the port;
– the connection is made to the corresponding port;
– the connector is correctly positioned relative to the port.

Use the special tool to disconnect the Din 1.0/2.3 connectors when removing the SDI cables. Non-compliance will invalidate your right to have the connectors repaired under warranty in case they are damaged.
The image below shows the tool and where to apply it to the connector (the picture is for reference only).



Tool for disconnecting Din 1.0/2.3 connectors

videoReferee® application overview

The *videoReferee®* system is used to record the entire competition as well as to review controversial moments. At any time, the referee can search through the recorded video to review a controversial moment and make the correct decision. This greatly simplifies the referee's work and allows him/her not to be distracted from key moments of the match.
The system allows exporting marked events in ***.mpeg** to an HDD, available in the system, as well as exporting the entire match (from all cameras or selected only) in ***.mpeg2** or ***.mpeg4**.
The video record of marked events contains the entire chronology of events that happened during the competition and official game information: time, period, score, fouls[1].
The *videoReferee®* system allows you to create event marks both while watching the game live and while watching and reviewing the controversial moments.
The system has an engineering and referee interfaces. The engineering interface is designed to control the recording and to monitor the performance of the system. The referee interface is designed for reviewing game moments and searching through video. The referee interface can display one or four video channels simultaneously. Additional monitors can be connected to display the Multiviewer or to duplicate the referee interface.

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videoReferee® components

The *videoReferee®* is a system unit in a 19" case to which 1920 x 1080 LCD monitors (engineering and referee), keyboard, optical mouse and referee control panel are connected. Depending on the configuration, an additional duplicating referee monitor or additional referee workplaces (up to 3) can be installed, as well as additional monitor for displaying the Multiviewer.
All connections are made with cables to the connectors located on the rear panel of the *videoReferee®*.
Power supply – a single-phase 110/220 V 60/50 Hz electrical network with grounding. Power consumption does not exceed 350 W.



A mandatory requirement to ensure the safety and performance of the system is the availability of a ground connection common with the equipment to be connected. For important installations, the use of an uninterruptible power supply (UPS) is mandatory.

The connection procedure and components of the *videoReferee®* server are described in detail in a separate manual – “*videoReferee®* Installation Guide”.

1. The data set depends on the sport which the system is used for.

videoReferee® description

The *videoReferee®* system is available in various configurations and can have from 4 to 32 SDI video inputs for recording video.
DIN 1.0/2.3 or BNC (75 Ohm) connectors are used to connect the input video signals.
All connectors for video signals are located on the rear panel of the system.

videoReferee® has three operation modes:

- Live – live video;
- Recorded – search through the recorded video;
- Play – video playback.

The *videoReferee®* system comes with a specialized referee control panel, which makes the referee's work more comfortable. From the control panel it is possible to:

- switch between the cameras displayed on the monitor;
- select the display mode for the referee monitor – 1, 2, 3 or 4 cameras simultaneously;
- view a zoomed-in image of the selected channel;
- mark events;
- follow the match in real time or search through the recorded material;
- mark events to be exported;
- playback from a selected moment;
- loop playback;
- create Presets / Preset chains;
- assign keys (tags) to events / search by keys (tags).

Almost all functions of the system can be accessed using computer keyboard (using "hotkeys") and mouse, but the control console significantly increases productivity and convenience. You can choose what suits you best.

The visual interface of the *videoReferee®* is a 1920x1080 monitor. One monitor displays an engineering interface and the second one – a referee interface.

The engineering interface contains virtual video windows of all incoming video channels, a program control interface, event lists, and indicators. Engineering Interface:

- provides real-time video signals from the cameras;
- duplicates the image displayed on the referee monitor in the control window;
- provides a color indication of the processes running in the system and the output of service messages;
- displays lists of marked moments;

- displays the real-time information received from the scoreboard controller and its recorded values for the selected game moment;
- displays real-time audio channel status information;
- allows setting the match time, score, period (if necessary and agreed with the referee);
- allows setting of recording parameters;
- allows recording video footage to external media;
- allows exporting video footage to external media or via Ethernet;
- provides controls for all system operations.

The referee interface is designed for viewing and searching through the recorded video and displays one selected channel or split-screen with 1, 2, 3 or 4 selected video channels simultaneously (**Quad** mode). From the referee interface you can:

- switch between operation modes – the live camera signal to the recorded video;
- select cameras;
- select display mode for the referee monitor – 1, 2, 3 or 4 cameras;
- view a zoomed-in image of the selected channel;
- mark events;
- mark events to be exported / included in the video report;
- search through marked moments and play back video clips, control playback;
- create/delete/select camera presets;
- assign keys (tags) to the events;
- quick key search.

Starting the software

To launch the software, find the *videoReferee®* shortcut 

on your desktop figure 1 and double-click it with the left mouse button.

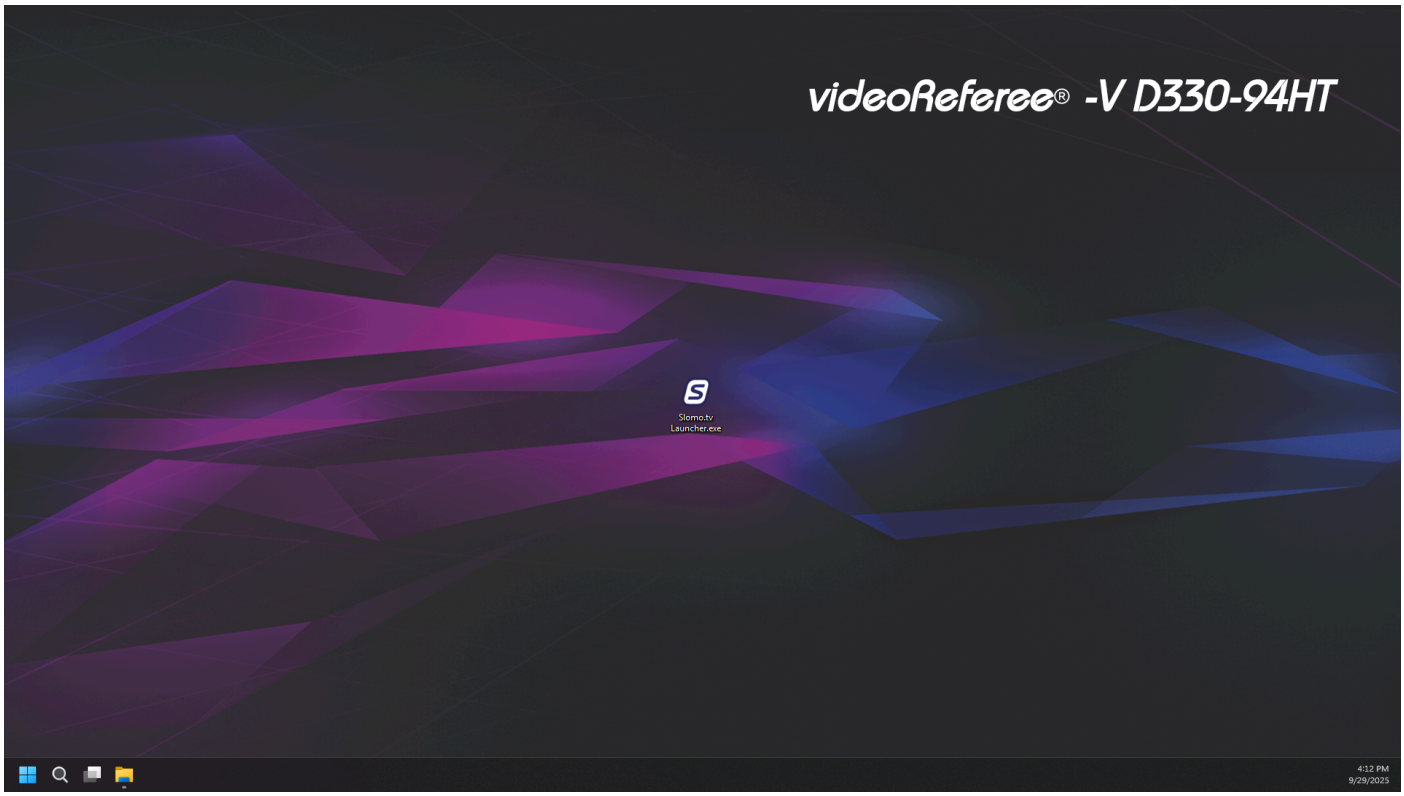
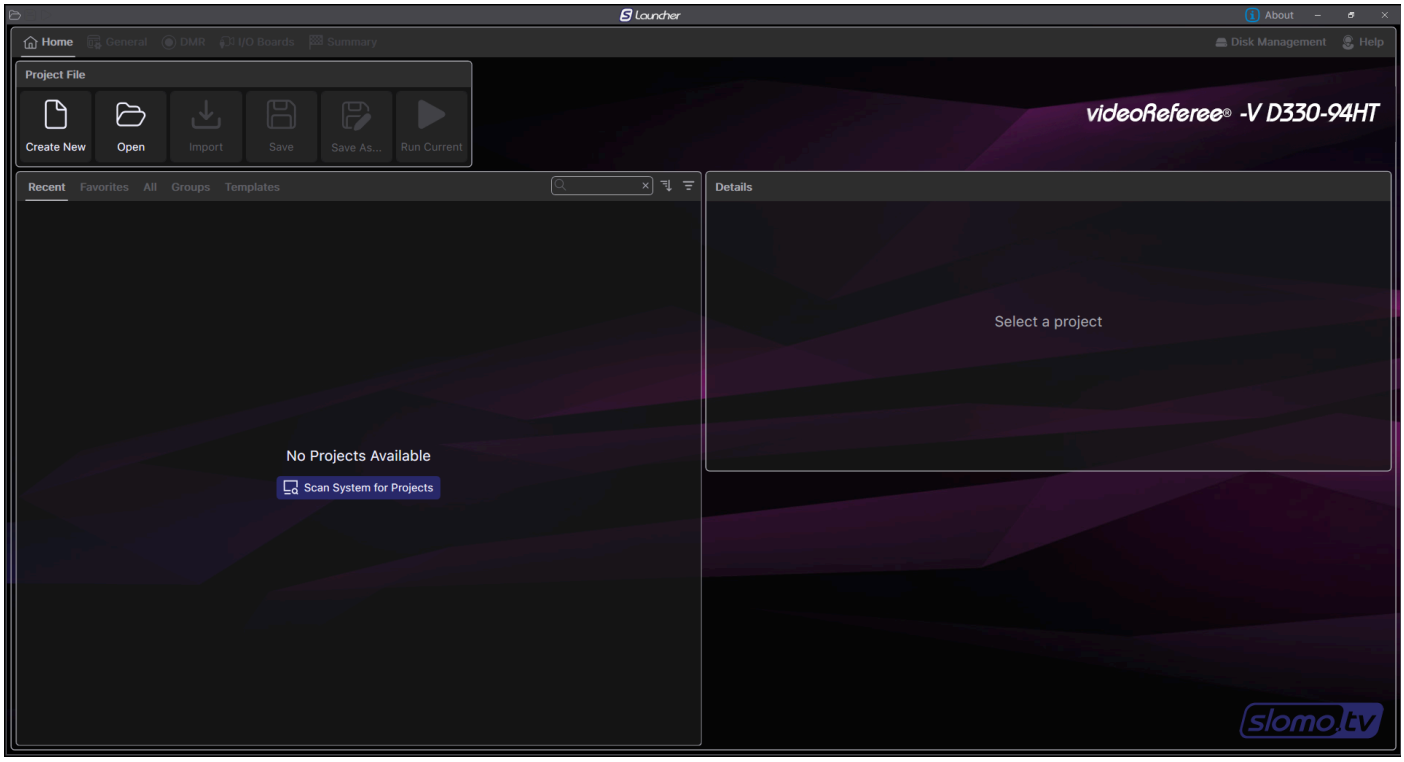


Figure 1 – *videoReferee®* Desktop

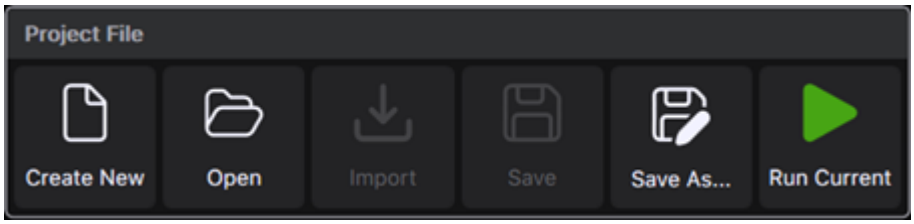
The program window will open – figure 2.
The main Slomo.tv Launcher page is the **Start** tab (figure 2). The server name and serial number[1] are displayed in the top right corner.
When you first launch the **Start** tab, only the following controls are displayed:



1. The data set depends on the sport which the system is used for.

Figure 2 – Program window

The following controls are available in the **Project File** area:



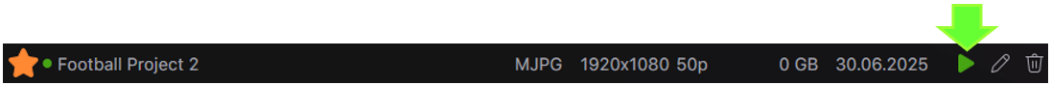
– **Create New** – create a new project;
– **Open** – load an existing project from an INI file. After clicking, the Explorer window will open to select the INI file;
– **Import** – import an existing project taken from another server using settings specific for your machine;

– **Save** – save the currently open project to an INI file without changing the name;
– **Save as...** – save the open project to an INI file with a specified name;
– **Run Current** – starts server for the currently open project

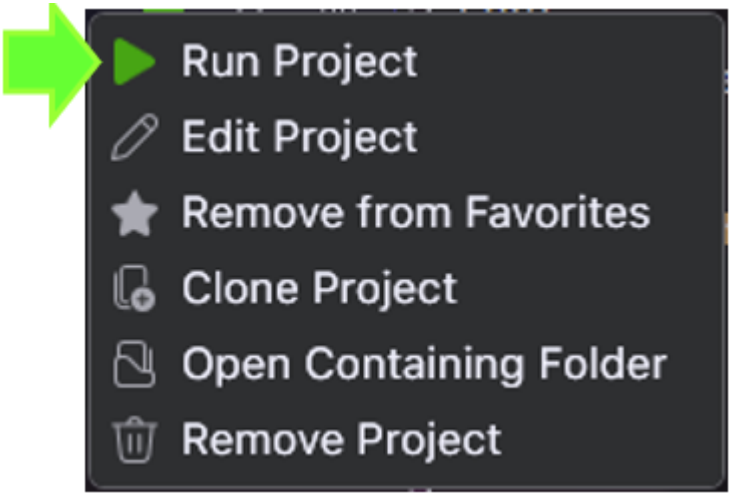
To continue working, you need to select an existing project or create a new one.

Run an open project.
A project can be launched from the **Start** and **Summary** tabs.
Launching from **Start** can be done in four ways:

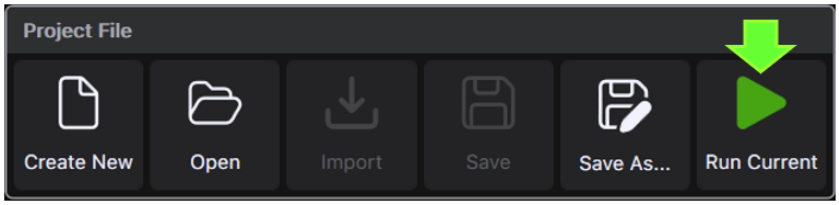
1. Double-clicking the project;
2. Clicking the **Run** button ( ) on the right side of the project line:



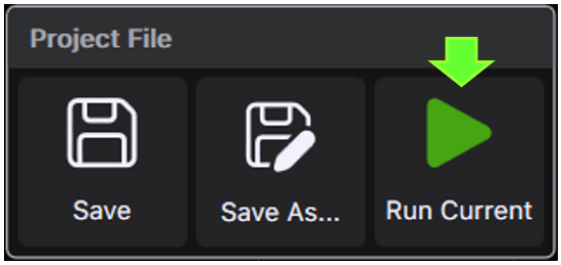
3. Launch from the context menu: right-click the project and select **Run Project**.



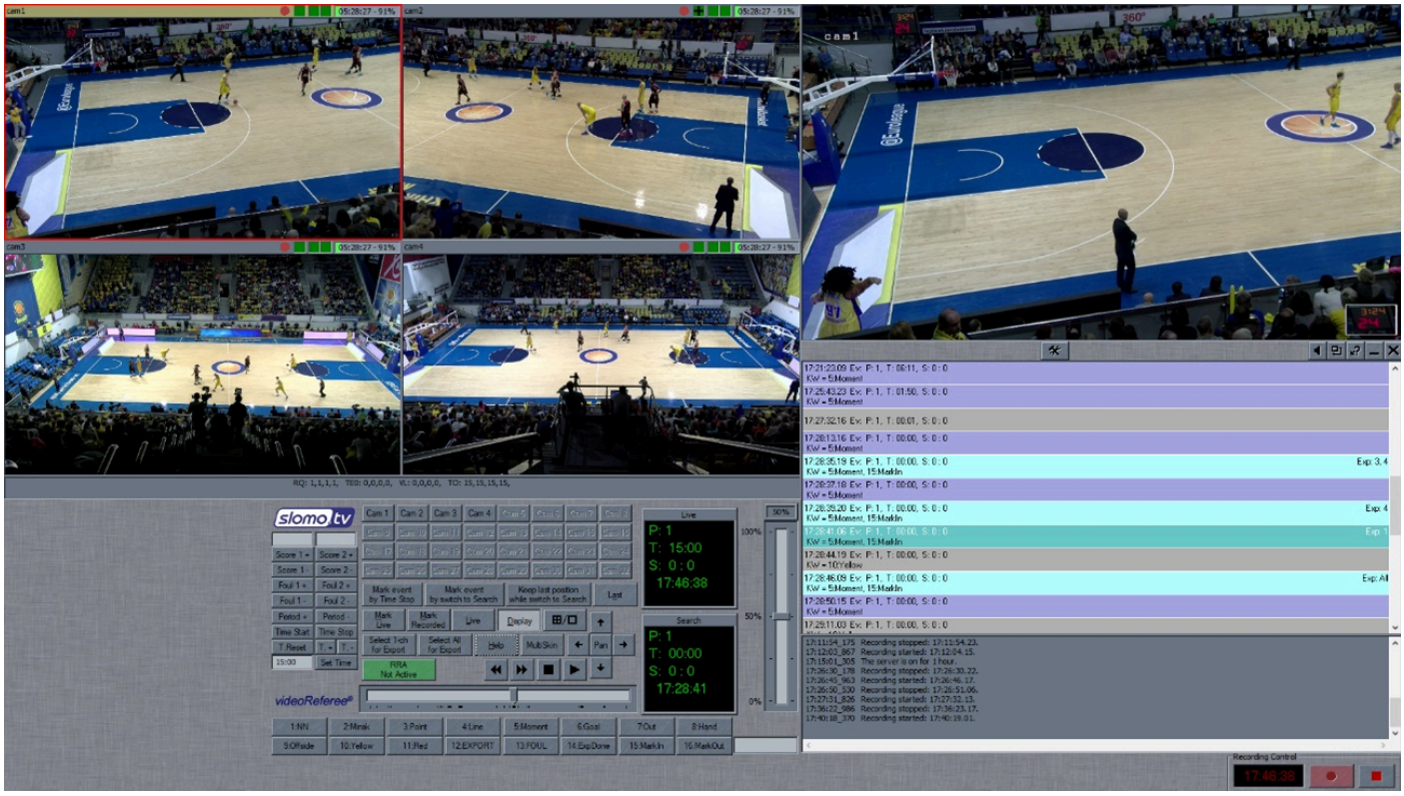
4. Clicking the **Run Current** button in the **Project File** section if the project is in editing mode (the project is marked with a  indicator in the "Home" tab);



Launching from **Summary** is possible when you are in project editing mode.
To start a project, click the **Run Current** button in the **Project File** section.



After launching the project, the Slomo.tv Launcher window will close and the *CESM.exe* application with the created project configuration will open.



Depending on the hardware configuration you have purchased, the program window may differ from the one shown in terms of the number of displayed video windows.

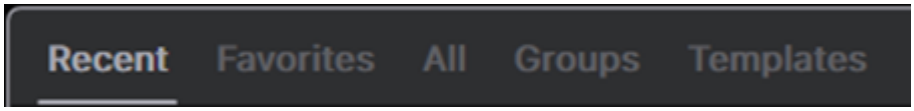
As performance and reliability are important in video recording, the *videoReferee®* has some special operating features that differ from regular Windows applications.

The *videoReferee®* desktop interface does not respond to standard Windows hotkeys, which allow you to scale the program window and close it. This is to avoid accidental closing the *videoReferee®* application (for example, holding down "**Alt + F4**" for too long when trying to exit a third-party program, which is arranged in front of the *videoReferee®* window), which would lead to an unintentional interruption of the match recording and, as a consequence, the partial loss of the match footage.

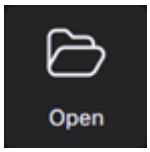
Another difference between *videoReferee®* and standard Windows applications is the highlighting of the program window when the focus is lost. It is known that a window which has lost focus, for example, due to a pop-up of the same or other program, stops responding to keyboard input, including hotkeys. Given how important it is for the video recording server to provide real-time and instantaneous response to the actions of the operator, we added color indication that the *videoReferee®* window may not be in focus – the window background changes from grey to pink.

Select Project

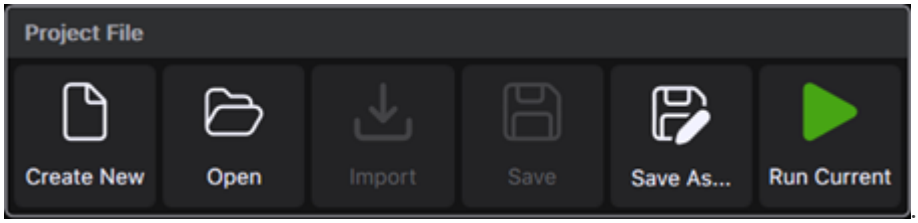
After launching Slomo.tv Launcher, you need to decide which project to record to. You can select a project from the list or create a new one. When selecting an existing project, keep in mind that the project's storage size is static and will not grow as needed. Therefore, choosing an existing project is only recommended in special cases and only if the project's video is guaranteed not to be needed or if there is sufficient remaining space for recording.
As stated, recording will be done simultaneously to the project file and to the internal storage. Video recorded to the internal storage can be exported partially or in full, from a single channel or from all channels.
Project selection is made in the **Lists** area:



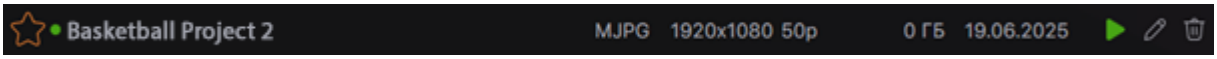
- The **Recent** list displays the most recent (up to 15) open projects,
- The **Favorites** list displays projects marked with  , as favorites,
- The **All** list displays all the projects ever opened with Slomo.tv Launcher,
- The **Groups** list displays all created groups,
- The **Templates** list displays preconfigured project templates.

You can also select a project by clicking the 

button in the **Project File** area



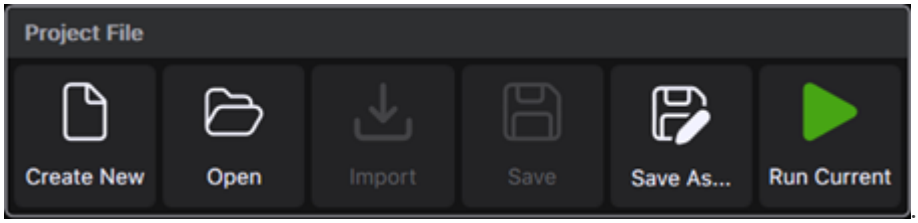
The current (selected) project will be marked with an indicator  to the left of the project name.



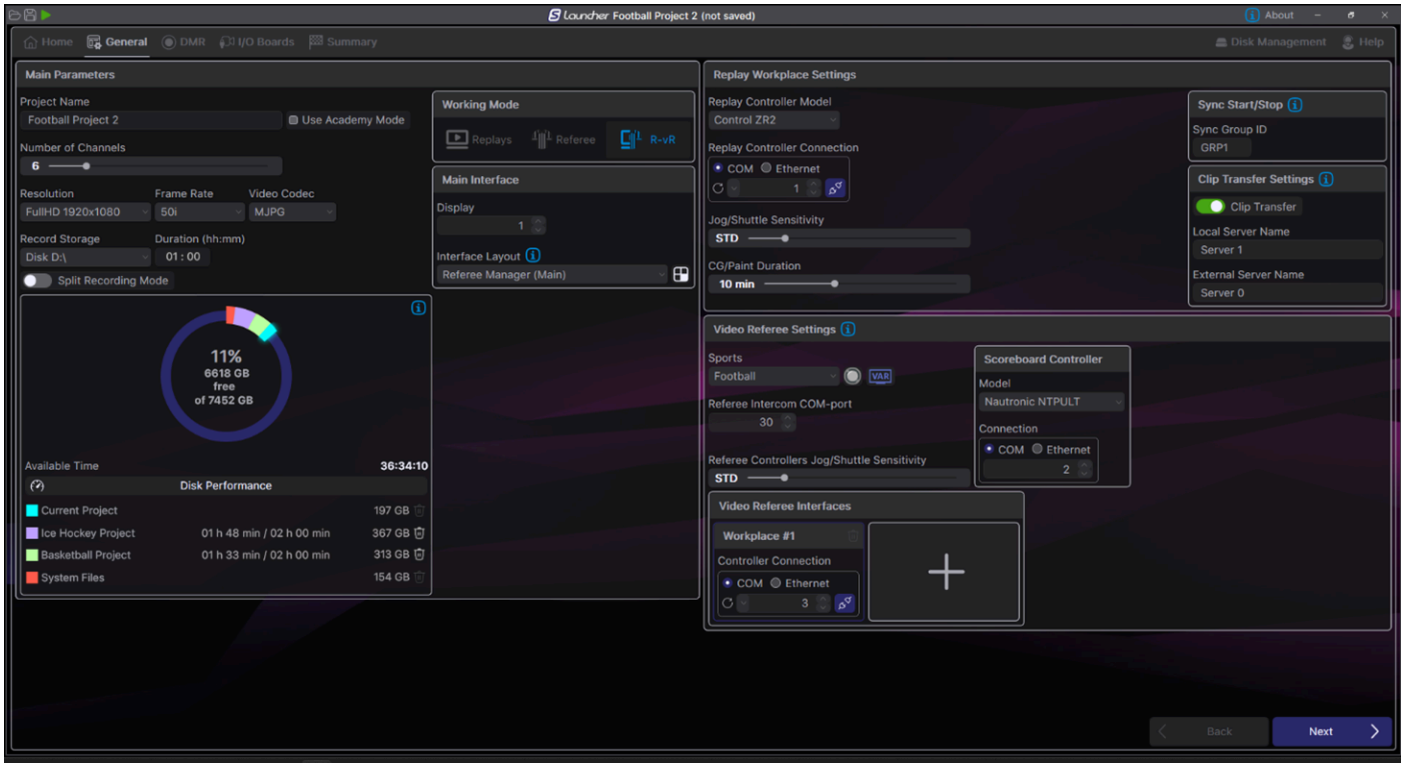
Create New Project

To create a new project, click the 

button in the **Project File** area



After clicking, you will be redirected to the **General** tab:



To configure a project, you'll need to specify its parameters. These parameters are specified in different tabs.

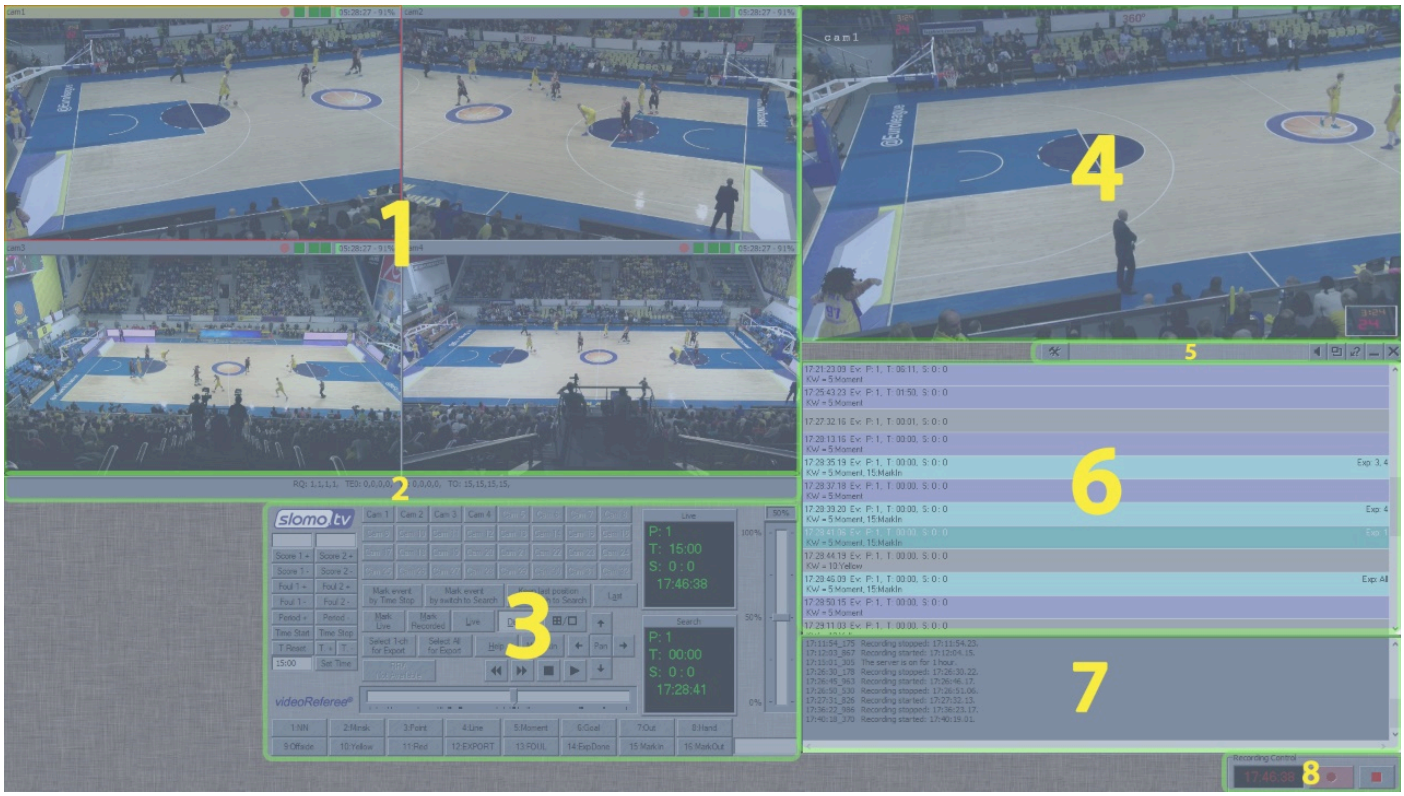
For more information on configuring a project, see the Slomo.tv Launcher User Guide in the sections "Main Parameters", "Settings for Video Refereeing Systems", "DMR™ Tab", "I/O Boards Tab" and "Summary Tab".



If your system runs on hard drives (HDD), it is recommended to use project archiving – for more details, see Archiving projects for systems with HDD drives.

Program interface

This section describes the features available in the *videoReferee®* engineering interface and the information displayed on the engineering monitor. In addition to the engineering monitor, a referee monitor is connected to the *videoReferee®* server. The information displayed there is exactly the same as in the video output monitoring window (see below) in the engineering interface, only the scale is different.
Figure 3 shows the engineering interface of the program and the purpose of each interface element.



1 – monitoring windows; 2 – window with operating mode information and messages about special situations; 3 – control panel; 4 – video output monitoring window;	5 – toolbar; 6 – list of created events; 7 – notification area; 8 – recording control panel;

Figure 3 – Program interface

The main program window contains the monitoring windows, the list of created events, the control panel, the toolbar and the notification area.

The **Monitoring windows** (1) display the incoming live video from the cameras. The general layout of the monitoring windows area depends on the number of cameras connected to the system. Each of the monitoring windows provides real-time video from the camera or OB Van. If there is no incoming video signal from the camera, the "Video Lost" caption appears on a grey background in the corresponding window.

The **Window with operating mode information and messages about special situations** (2) displays error messages, reports dropped frames, connected/disconnected timecode.

The **Control panel** (3) is designed to work with the video: recording control, event creation during recording, playback, operation mode selection, etc. The work with the control panel is given in each section of this manual, in relation to the specific task to be performed.

The **Video output monitoring window** (4) fully duplicates the referee interface and allows you to view either a single selected (active) channel in Live/Search/Play mode, or view several channels in the Quad mode.

The **Toolbar** (5) provides access to additional program features controls, such as:

- the *Tools* menu (). This menu is opened by clicking on  or by pressing the key combination **Ctrl + Shift + T**. The *Tools* menu provides project management (opening and creation), settings of the program interface and video, export management;
- audio control panel (). The audio panel window allows you to monitor the audio feed. This panel is opened by clicking on  or by pressing the key combination **Ctrl + Shift + A**;
- enable/disable hints (). When hints are enabled, hovering your mouse over a particular control or screen area brings up a text window describing the purpose and function of that element and (for controls, if set by default) the hotkey combination;
- program window control ():
  - minimize[1] (). Clicking the  button minimizes the main program window, without exiting the program. Quick access to the function from the keyboard – keyboard shortcut **Ctrl + Shift + N**;
  - size (). Being a real-time system, *videoReferee®* does not automatically resize the screen and rearrange visual elements and controls to save performance resources. This happens only on direct command from the operator – by pressing  button. Quick access to the function from the keyboard – keyboard shortcut **Ctrl + Shift + L**;
  - close (). Clicking the  button closes the main program window and exits the *videoReferee®* application. Quick access to the function from the keyboard – keyboard shortcut **Ctrl + Shift + X**.

All events created during operator's or referee's work will appear in the **list of created events** (6). For more information about the list of created events, see the "Work with events" section of this manual.

The **Notification area** (7)[2] is used to display information about the program's operation: the general progress of the program and hardware failures in the system. Figure 4 shows an example of the contents of the notification area immediately after loading the system. During operation, messages about the operation of the program and devices will be displayed here.

The **Recording control panel** (8) is used to start/stop video recording.

1. By default, this feature is disabled. To enable it, contact slomo.tv technical support.
2. Depending on the program settings, it may be absent.

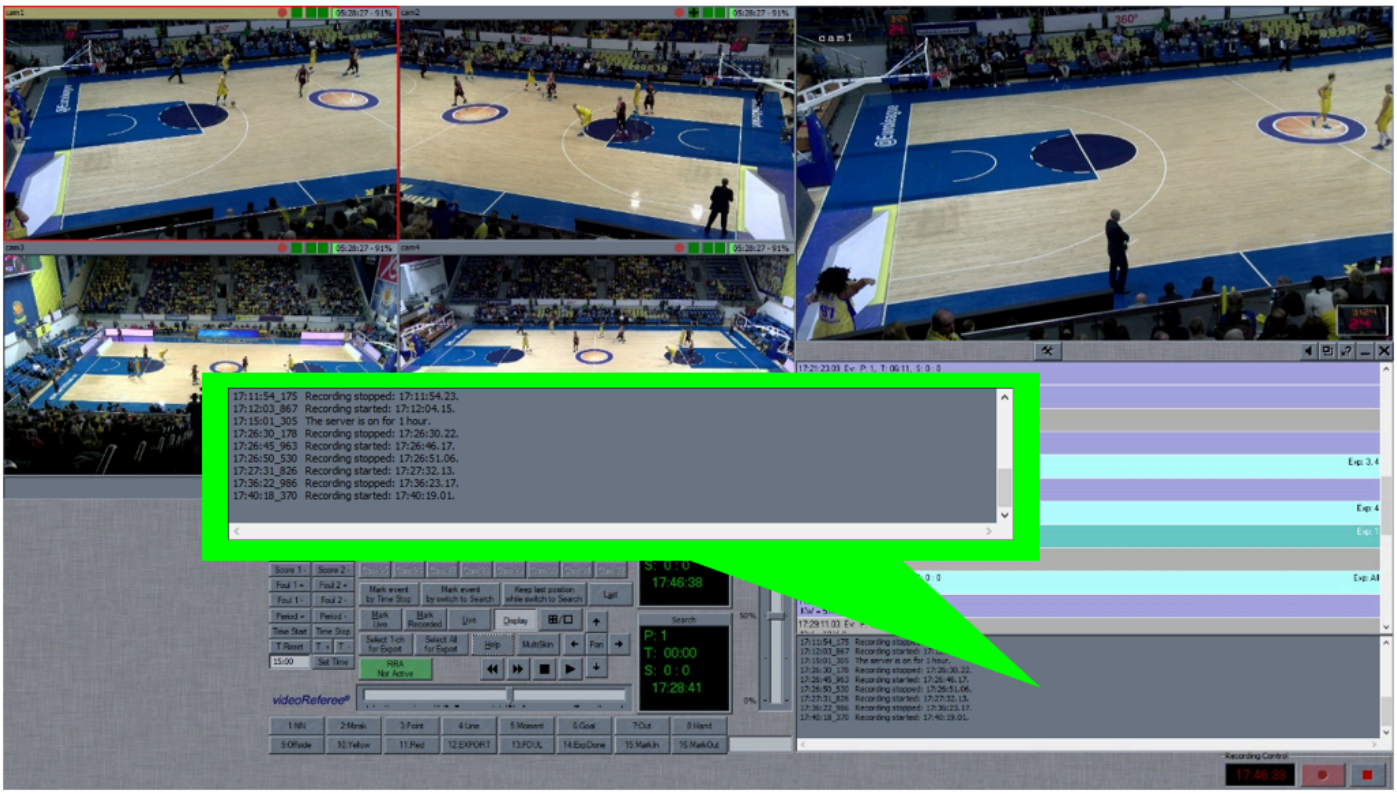


Figure 4 – Notification area

Recording indication bar

Each of the video windows of the recording channels has a camera name and an indication bar with recording process indicators:

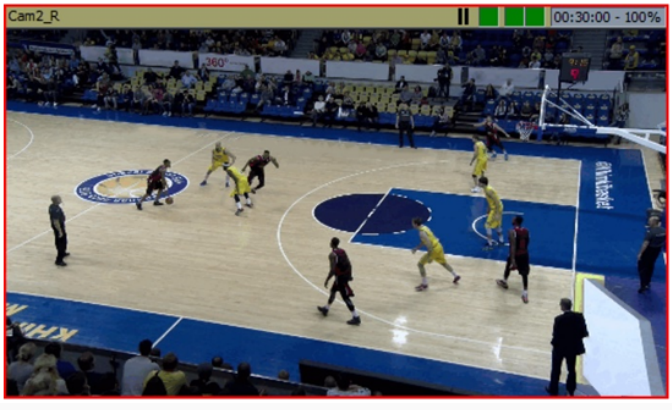
	
The window is inactive – there is no red frame around the window and the indication bar is grey.	The window is active – there is a red frame around the window and the indication bar is sand-colored

Figure 5 – Recording channel window

The indication bar is designed for visual control of the recording process.

When working with events, the concept of an active channel is important. The active channel is the selected channel, i.e., the channel you are currently working with. The active channel can be selected:

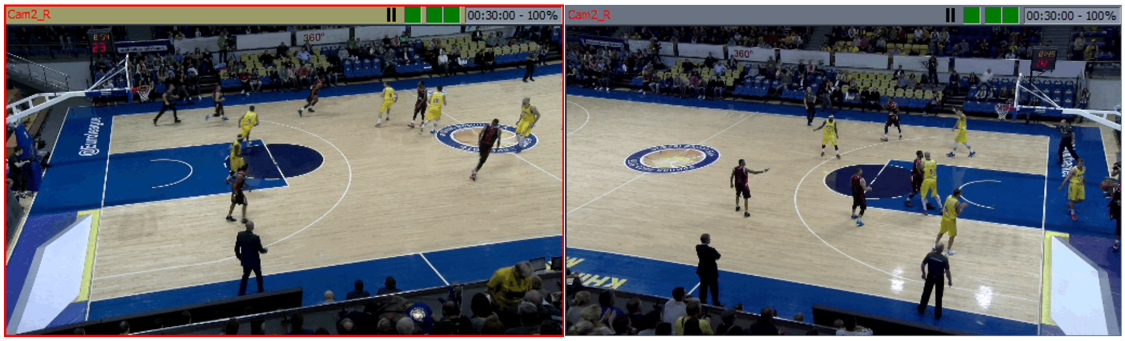
- using the mouse pointer in the engineering interface;
- by pressing **F1...F12** (Up to 12 channels) keys on the keyboard ( );
- with the **Ch1...Ch16** buttons on the control panel ( ).

The selected (active) channel is marked with a red frame around it and the color of the indication bar changes from grey to sandy – Figure 5.
The indication bar is located above each recording channel and contains the channel name (1), the indicators of the recording channel state – Record Unit (2...5), and the time available for the recording to the built-in disk array (6):



Below is a more detailed description of each indicator and its possible states:

1. **Channel name**. This parameter can be changed by double clicking the left mouse button on the channel name and by entering the desired name from the keyboard. Confirm the entered name by pressing **Enter** or by selecting another channel. To cancel the editing, press **Esc**. If you enter the same channel name in several windows, the entered name will be highlighted in red:



For easier identification of the recorded video, we recommend setting a unique name for each channel.

2. **Record Unit – Recording process indicator**:

- black “Pause” symbol ( ) – the recording is stopped;
- red circle ( ) – the recording in progress;
- black crossed-out circle ( ) – the recording of this channel is disabled in the settings (“*Disable record*” is activated in the menu:
  Tools → Hardware setup → Channel setup (Ch... tab) → Disable record:).

3. **Record Unit – Audio state indicator**. Shows the presence/absence of problems with audio. The indicator may look as follows:
   • green square ( ) – normal operation, no audio problems detected;
   • cross on a flashing red ( ) / yellow ( ) background – there may be an audio defect;
   • cross on a green background ( ) – there may have been audio defects earlier;
   • plus on a flashing red ( ) / yellow ( ) background – audio frame length errors;
   • plus on a green background ( ) – there may have been audio frame length errors earlier.

When an audio error indication appears, it is recommended that you listen to the audio to confirm that there is a systematic error and not an accidental interference. Should a systematic error be confirmed, first try to fix the error by configuring external audio sources, and only after unsuccessful attempts to configure external sources, activate the built-in audio error fixing function:
Tools → Settings → Recover Embedded Audio Errors (Recover Embedded Audio Errors [Off]).
Reset the Record Unit audio indicator by double-clicking with the mouse on the indicator.

4. **Record Unit – Record state indicator**. Shows the status of the channel recording to the built-in disk array. The indicator may look as follows:

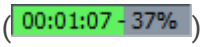
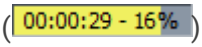
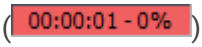
- green ( ) – the built-in disk array is working properly;
- cross on a green background ( ) problems with the built-in disk array have occurred earlier, some data has been lost;
- yellow ( ) – there is a problem with the built-in disk array, the array does not manage to record data in time – the performance of the array has dropped. If the indicator is yellow, the information is not lost, it is buffered and will be recorded later. If the indication has changed from yellow ( ) to green ( ), the disk array performance is restored, but the operator should pay attention to the functioning of the array and check its performance with third-party programs;
- cross on a red background ( ) – there is a problem with the built-in disk array, the array does not manage to record and buffer data in time – the data is lost. If the indication has changed from red ( ) to green ( ), the disk array performance is restored, but the operator should pay attention to the functioning of the array and check its performance with third-party programs;
- indicators 4 and 5 blink red ( ) and grey ( ) alternately:
  

This shows that the video signal is missing on this input. In this case the last received frame is displayed in the video window.

5. **Record Unit – DMR™ recording status indicator**. Shows the channel recording status on the DMR™ disks installed in the system. Depending on the system configuration, this indicator may not be displayed. The indicator may look as follows:

- green ( ) – the DMR™ disk is working properly;
- cross on a green background ( ) – problems with the DMR™ disk have occurred earlier, some data has been lost;
- yellow ( ) – there is a problem with the DMR™ disk, the disk does not manage to record data in time – the performance of the disk has dropped. If the indicator is yellow, the information is not lost, it is buffered and will be recorded later. If the indication has changed from yellow ( ) to green ( ), the DMR™ disk performance is restored, but the operator should pay attention to the functioning of the disk and check its performance with third-party programs.
- cross on a red background ( ) – there is a problem with the DMR™ disk performance, the disk does not manage to record and buffer data in time – the data is lost. If the indication has changed from red ( ) to green ( ), the disk performance is restored, but the operator should pay attention to the functioning of the DMR™ disk and check its performance with third-party programs.
- indicators 4 and 5 blink red ( ) and grey ( ) alternately:
  

This shows that the video signal is missing on this input. In this case the last received frame is displayed in the video window.

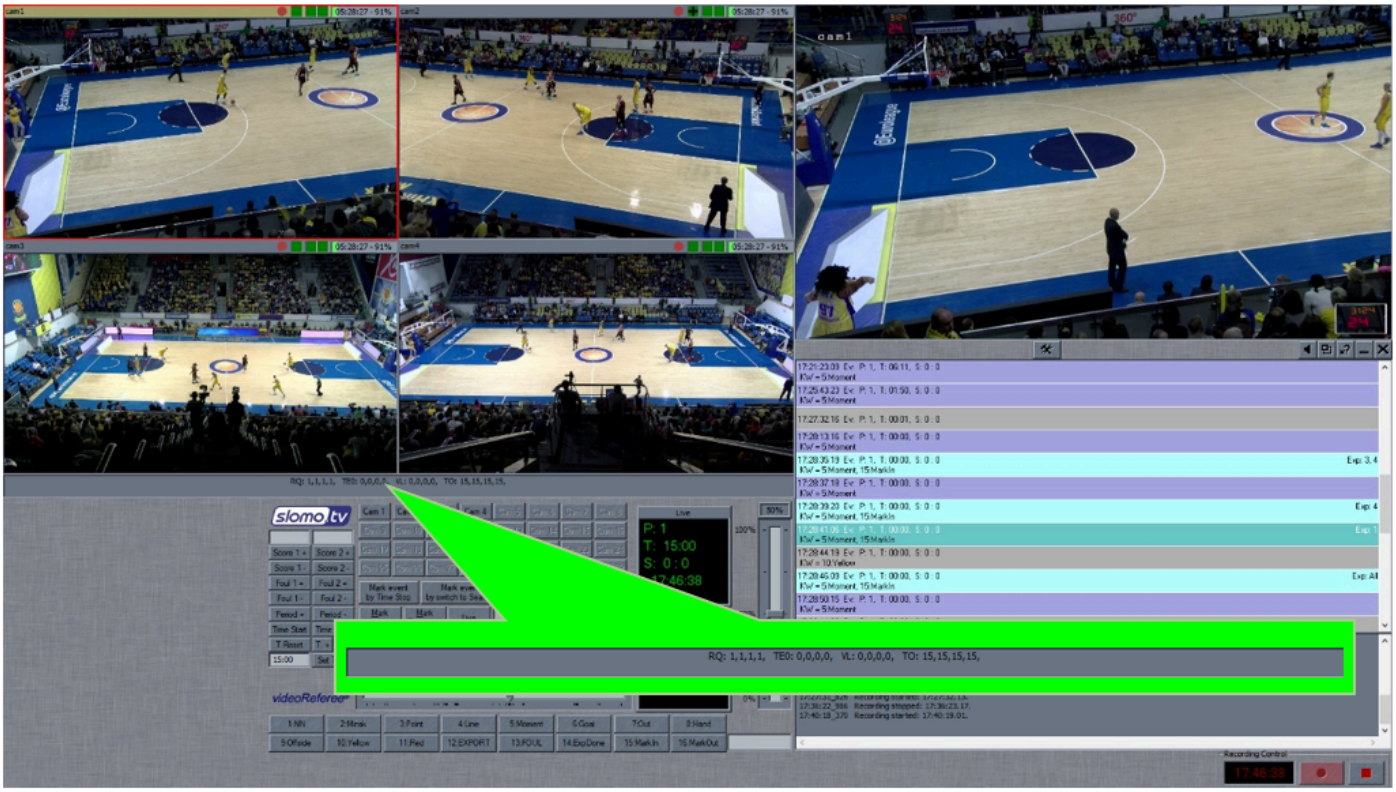
6. **Free space indicator in the project** – shows the remaining free time for recording (HH:MM:SS) and the percentage of free space left from the reserved storage space. If there is enough disk space for recording in the project, the time will be distributed proportionally on all channels. If there is not enough disk space to record a project, the time will be subtracted from the last channel. If there is even more shortage, the time will be subtracted also from the second-to-last channel, and so on. Thus, the shortage of reserved space can show itself long before it is fully used up - by losing video material in the last, second-to-last and subsequent channels.
   The color indication[1] looks as follows:
   - green () – 0 to 68% of the reserved memory is used;
   - yellow () – 69% to 84% of the reserved memory is used;
   - red () – 85% to 100% of the reserved memory is used.

---

1. The color indication changes consistently and smoothly – from green to yellow and from yellow to red.

Window with operating mode information and messages about special situations (counters monitor)

The window with operating mode information and messages about special situations is located directly below the input monitoring windows:



The window displays information about the video and possible errors related to the video parameters.
The data for each of the input video channels is displayed, with the values by channel separated by commas within the same counter.
The counter values are reset by double-clicking in the counters monitor area. It must be remembered that all values are reported since the last reset and not necessarily since the start of the system software.

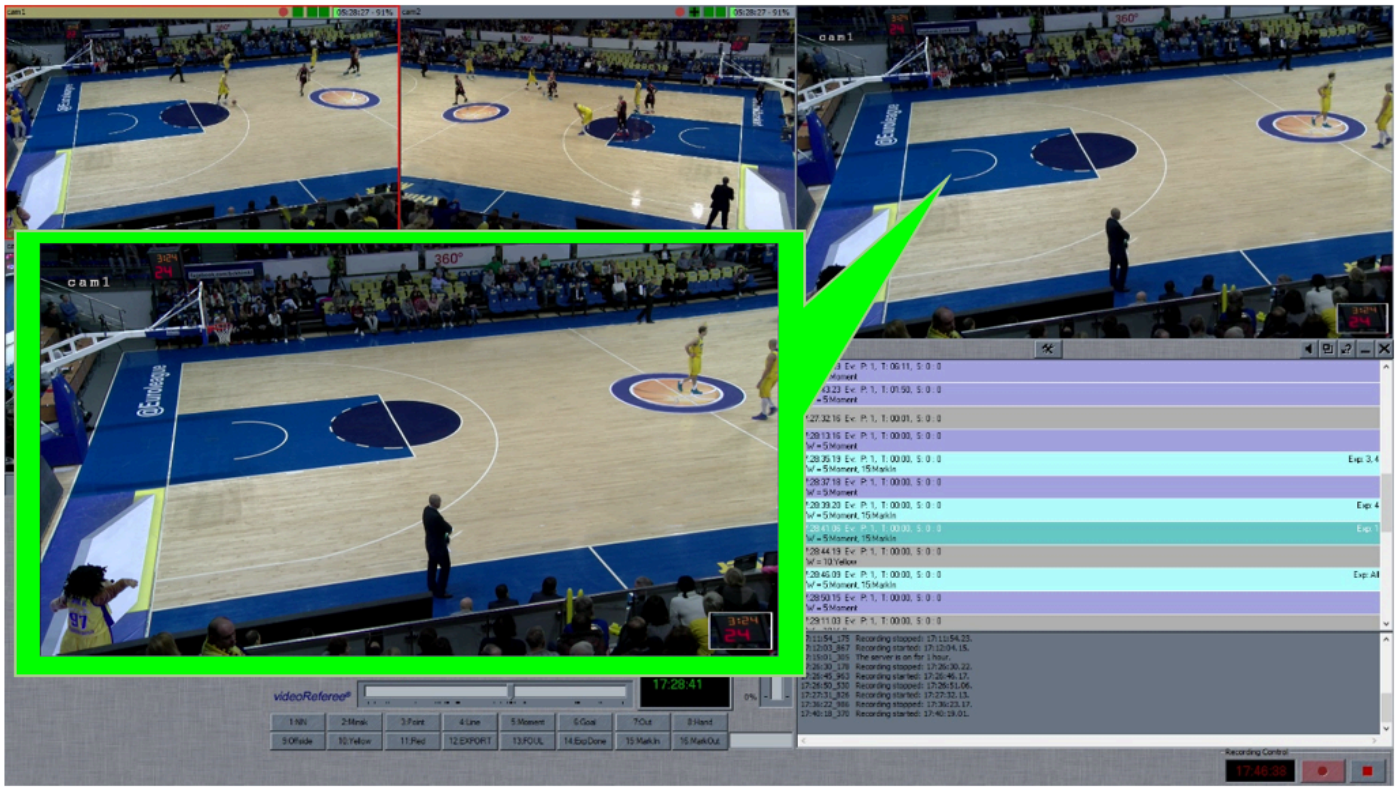
RQ – if the value of this parameter increases, it means that the processor is at the limit of its video processing performance load, i.e., it works without pauses. If this value increases continuously, the operator should use the resources of the system with caution and not waste resources on processing additional secondary tasks without an urgent need.

TE0 – a counter of lost frames in each channel. It may be negative when the channel is not synchronized, or when there are problems with timing in the system and two frames have the same timecode.
Due to the difference in camera speeds, the counter value for an individual camera may accumulate 1-2 frames per hour. If the accumulation rate is higher, it may indicate a malfunction, including processor overload, problems with recording to disk, or cable issues.

VL – the number of inserted VideoLost frames.

T0 – the offset of the timecode and the video signals of all channels relative to the first channel (value in ms). The value is displayed as an *offset + 15 ms*. The number of values corresponds to the number of video channels in the system. If the value of the first parameter is 0, it indicates that there is no time code signal.

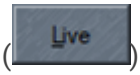
Video output monitoring window



Video output monitoring window fully duplicates the referee interface.
The video in this window can be displayed in three modes:

- live video from an active camera (Live);
- recorded video from an active camera in search mode (Recorded);
- playback of recorded video from an active camera (Play).

You can switch between Live and Recorded/Play modes by one of the following options:

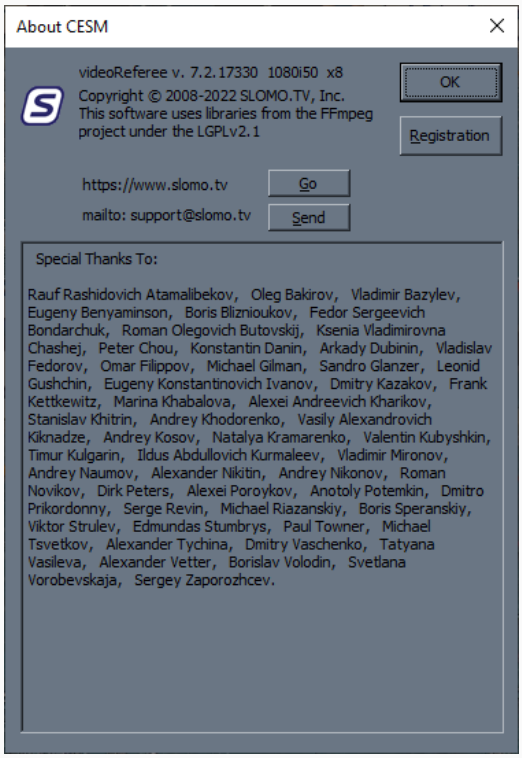
- by pressing the **Live** button (

) on the remote-control panel;
-  : **Ctrl + L**;
-  : **Rec | Live**.

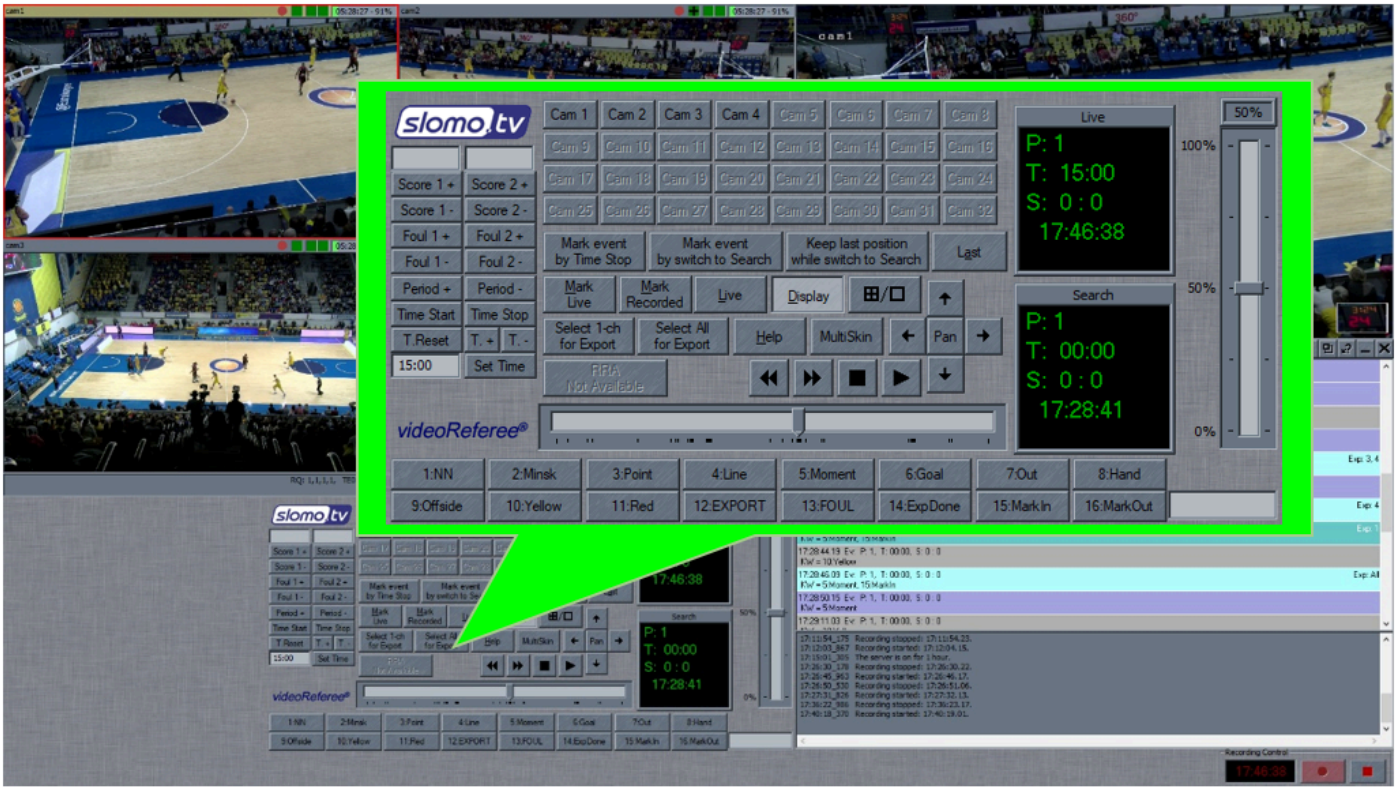
Slomo.tv logo

When you double-click on the slomo.tv logo (slomo.tv), a window with information about the *videoReferee®* application appears:
– software version,
– technical support contacts,
– copyrights, etc.

When contacting technical support, you may need information about the software version.
If you click the **Registration** (Registration) button, you can see the serial number (S/N) of your server. The server serial number can also be found on the desktop or in the *Tools* (🛠) using **Ctrl + Shift + T**.



Control panel in the interface



The control panel contains all the active interface elements that are used to perform all the operations.
The control panel includes the buttons for:

- switching the display modes on the referee monitor,
- active channel selection,
- searching through the video,
- creating events and assigning tags to them,
- zooming in/out,
- controlling the playback of recorded video,
- management of game data (time, period, score, violations).

On the control panel, there are also game information indicators for live and recorded video (time, period, score), a search/playback timeline, and a playback speed control.

The Appendix B briefly describes the functions of the control panel buttons, keyboard shortcuts and referee control console buttons for quick access to the functions.
A detailed description of the functions of the control panel buttons is provided below.

Help

The **Help** is used to show information about the purpose and functions of the referee control console buttons. The video output monitoring window in the engineering interface displays (Figure 6) displays a brief hint on the use of the control console – an image of the control console with text explanations of the functions of the buttons. The same information is displayed on the referee's monitor as well.

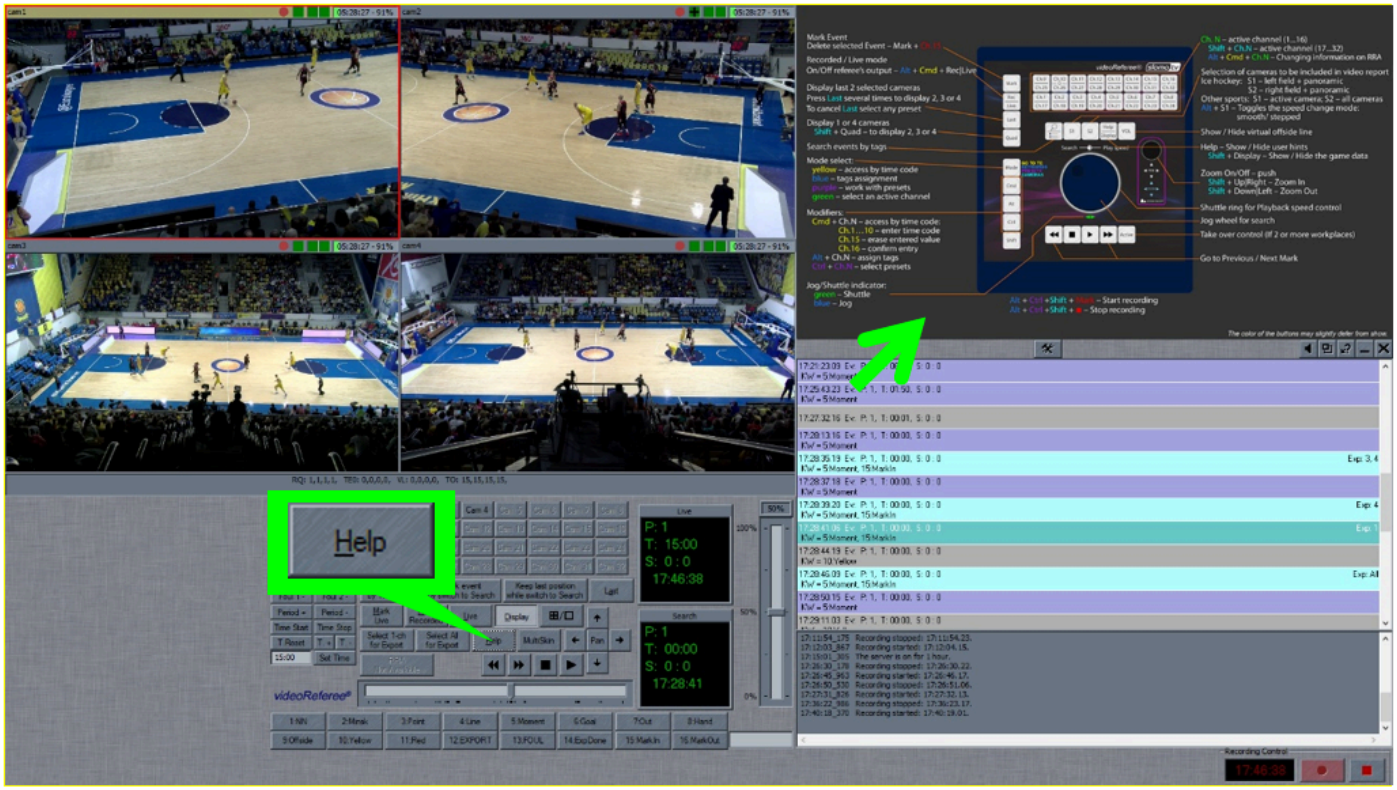
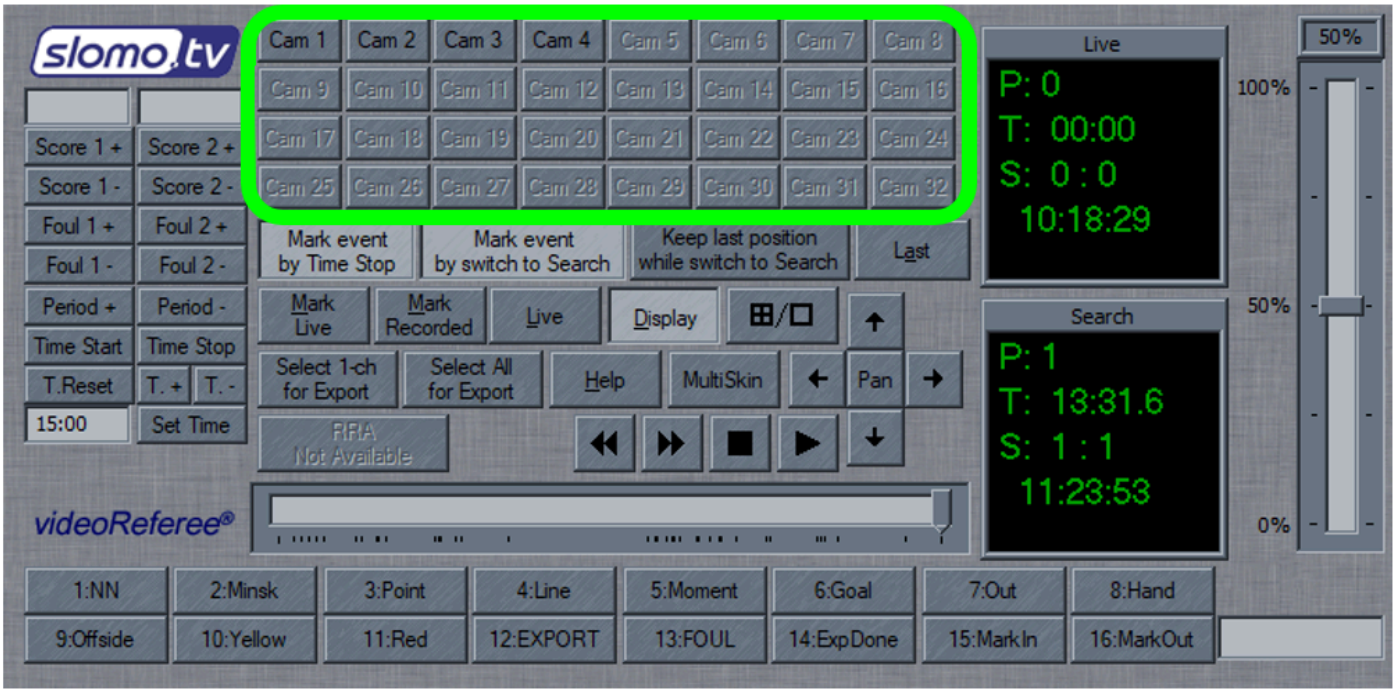


Figure 6 – Help button

Pressing the **Help** button again changes the Help screens / returns you to the live broadcast or to the recorded video of the match.
An alternative to the **Help** button in the interface is:

-  : **Ctrl + H**;
-  : **Help | Display**.

Cam1 – Cam32



Use the **Cam1 – Cam32**[1] buttons to select the active camera (channel) to be displayed in the referee interface and in the video output monitoring window.

You can select the active camera (channel) using:

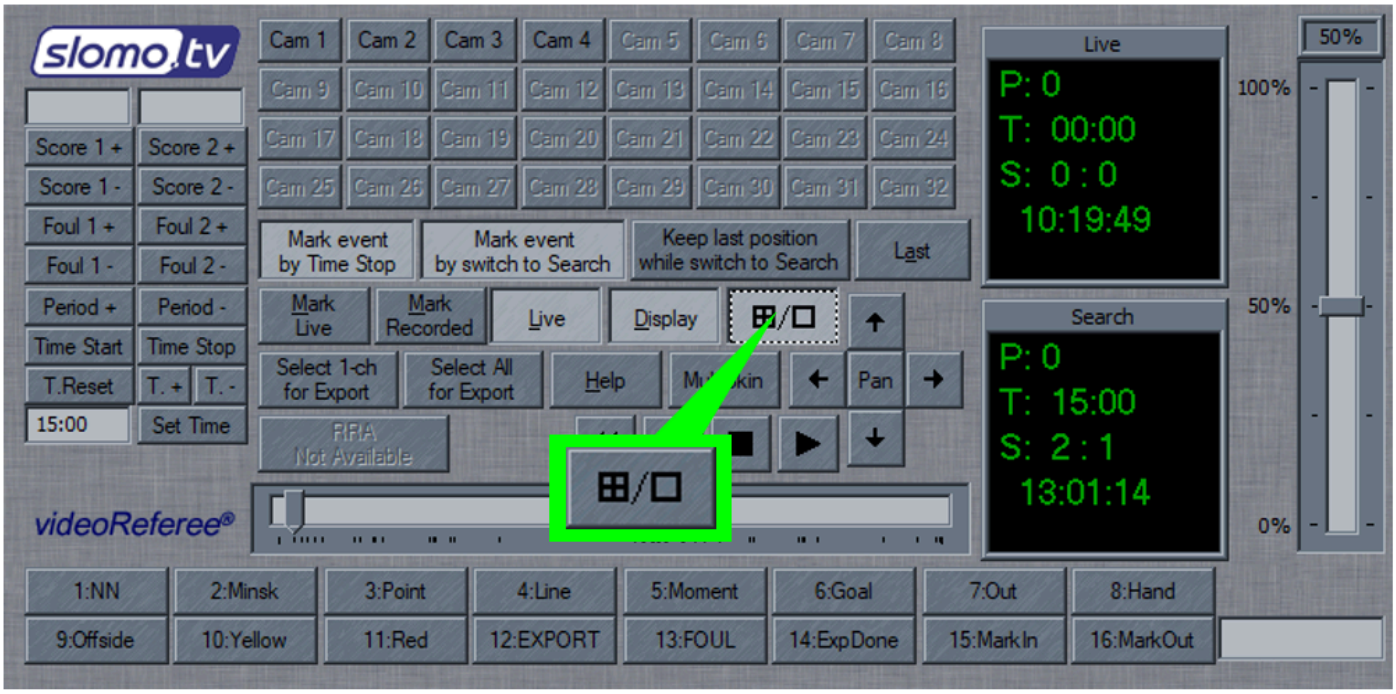
- with the mouse – left-click on the channel button in the program's engineering interface;
-  : **F1...F12** (Up to 12 channels only);
-  :

Ch. N	Channels 1 to 16 (buttons are green).
Shift + Ch.N	Channels 17 to 32 (buttons are blue).
Ctrl + Ch.N	Quick access to cameras from working with presets mode. 

In the referee interface, the active camera is indicated by a yellow frame.

1. The number of available channel buttons depends on the purchased and used configuration of the equipment.

Quad mode



The ⊞/□ button controls the display mode on the referee monitor and in the video output monitoring window: single camera / four cameras simultaneously.

Works both when viewing live broadcasts and recorded video. In **Quad** mode, the referee screen is split into four equal windows, each of which displays video from one of the four cameras.
The following display options are available:

- single channel – **Quad** mode is inactive – ⊞/□ button is not pressed;
- four channels – **Quad** mode is active – ⊞/□ button is pressed.

To switch between display modes, you can use:

- : **Ctrl + Q**,
- : **Quad**.

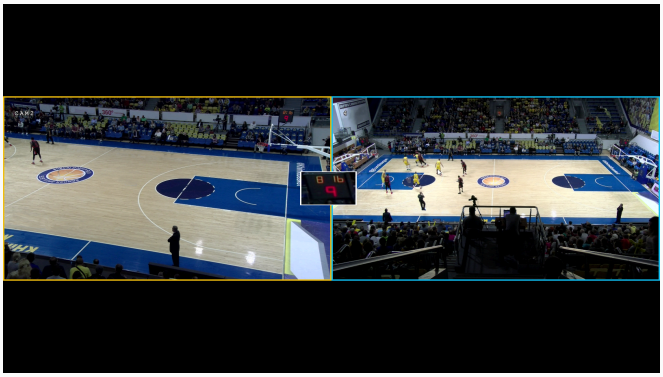
The **Shift** + **Quad** button combination on the control console toggles the number of displayed channels on the referee monitor – 2, 3 or 4 (Figure 7).

A 2-channel system in **Quad** mode displays two Live channels in the upper row, and the same two channels in Search mode in the bottom row.
A 4-channel system in **Quad** mode displays all four channels in Live or Search modes.

If the system has more than 4 recording channels, the **Quad** mode displays cameras preset for the sport for which the system is used[1].



1 camera



2 cameras



3 cameras

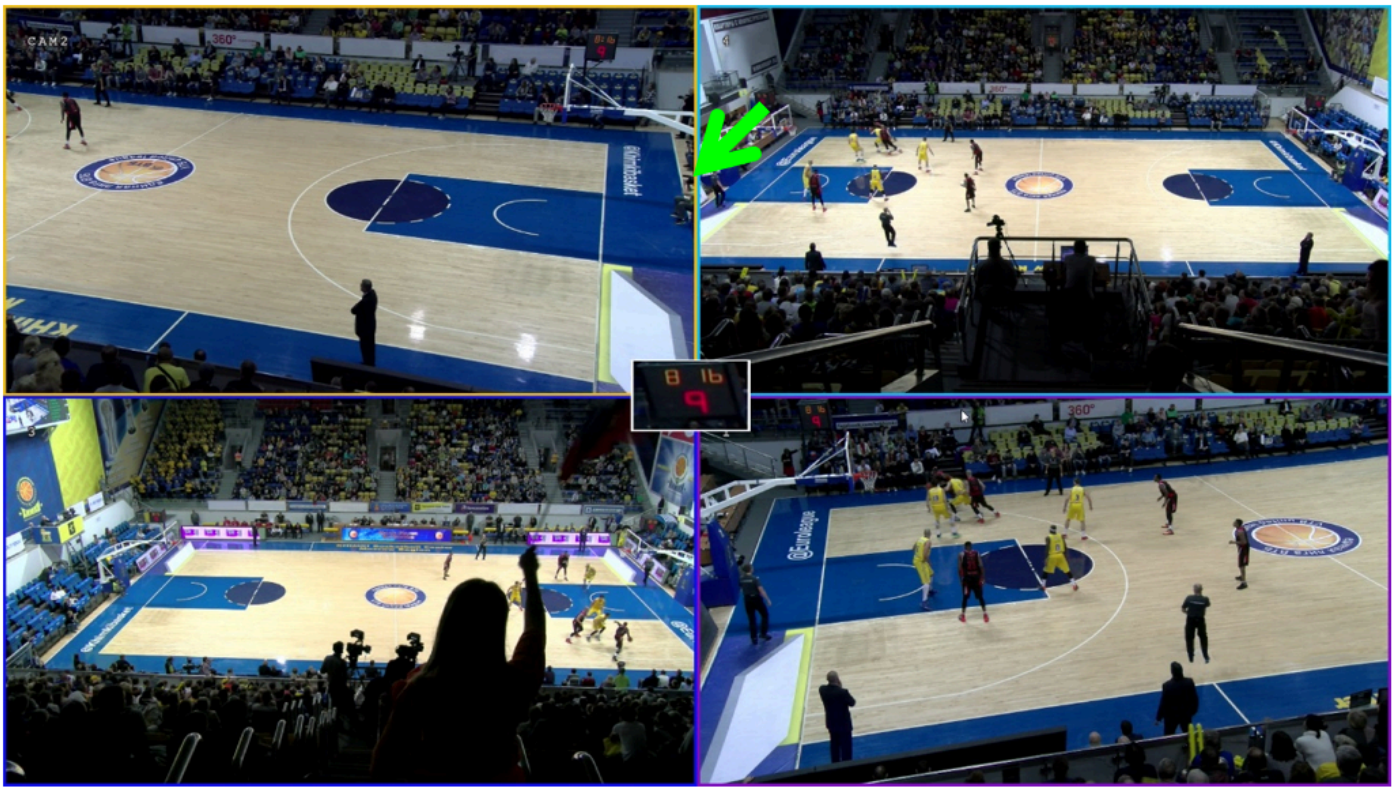


4 cameras

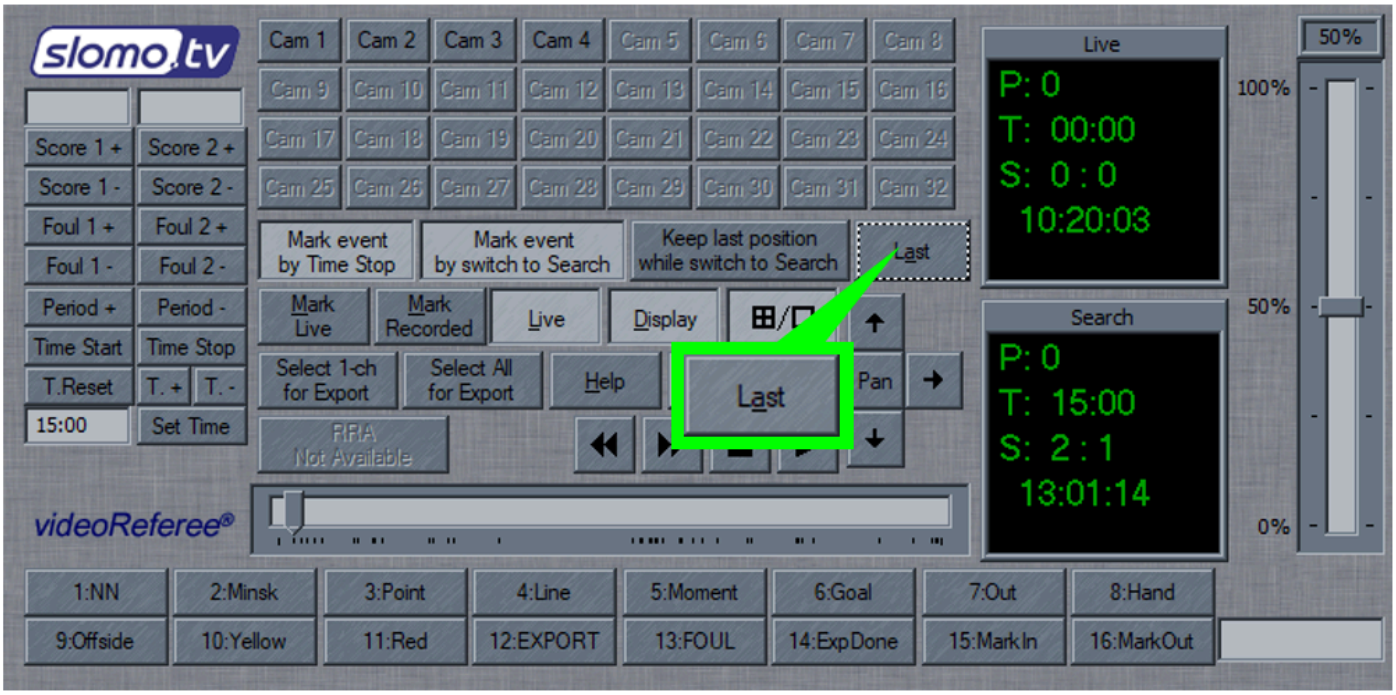
Figure 7 – Quad mode layouts

The active channel in the **Quad** has a yellow frame:

1. These settings can be changed by contacting technical support.



Last


slomo.tv
Cam 1
Cam 2
Cam 3
Cam 4
Cam 5
Cam 6
Cam 7
Cam 8
Cam 9
Cam 10
Cam 11
Cam 12
Cam 13
Cam 14
Cam 15
Cam 16
Cam 17
Cam 18
Cam 19
Cam 20
Cam 21
Cam 22
Cam 23
Cam 24
Cam 25
Cam 26
Cam 27
Cam 28
Cam 29
Cam 30
Cam 31
Cam 32
Score 1 +
Score 2 +
Score 1 -
Score 2 -
Foul 1 +
Foul 2 +
Foul 1 -
Foul 2 -
Period +
Period -
Time Start
Time Stop
T.Reset
T. +
T. -
15:00
Set Time
Mark event by Time Stop
Mark event by switch to Search
Keep last position while switch to Search
Last
Mark Live
Mark Recorded
Live
Display
Select 1-ch for Export
Select All for Export
Help
Last
Pan
RRIA Not Available
videoReferee®
Live
P: 0
T: 00:00
S: 0 : 0
10:20:03
Search
P: 0
T: 15:00
S: 2 : 1
13:01:14
50%
100%
50%
0%
1:NN
2:Minsk
3:Point
4:Line
5:Moment
6:Goal
7:Out
8:Hand
9:Offside
10:Yellow
11:Red
12:EXPORT
13:FOUL
14:ExpDone
15:MarkIn
16:MarkOut

The **Last** button displays the last four cameras used in the video output monitoring window and on the referee's monitor.

: **Alt + A**.

To change the displayed cameras, press the direct camera access buttons (the **Quad** is filled in from the bottom right corner).
Also, to visualize the order in which the cameras are selected, they have different-colored frame on the referee's monitor:

- yellow – last selected – active camera;
- blue – the third camera selected;
- dark blue – the second camera selected;
- purple – the first camera selected.

The function of the **Last** button on the control console is slightly different from the function of this button in the program interface. When you press the **Last** button on the control console, the last two cameras used are displayed in the video output monitoring window and on the referee's monitor. Subsequent clicks on the button change the number of channels displayed on the screen – 2, 3 or 4 (similar to the **Shift** **+ Quad** combination on the control console).

When you press **Last** on the control console, the **Quad** button automatically lights up blue, because **Last** activates the **Quad** display mode.

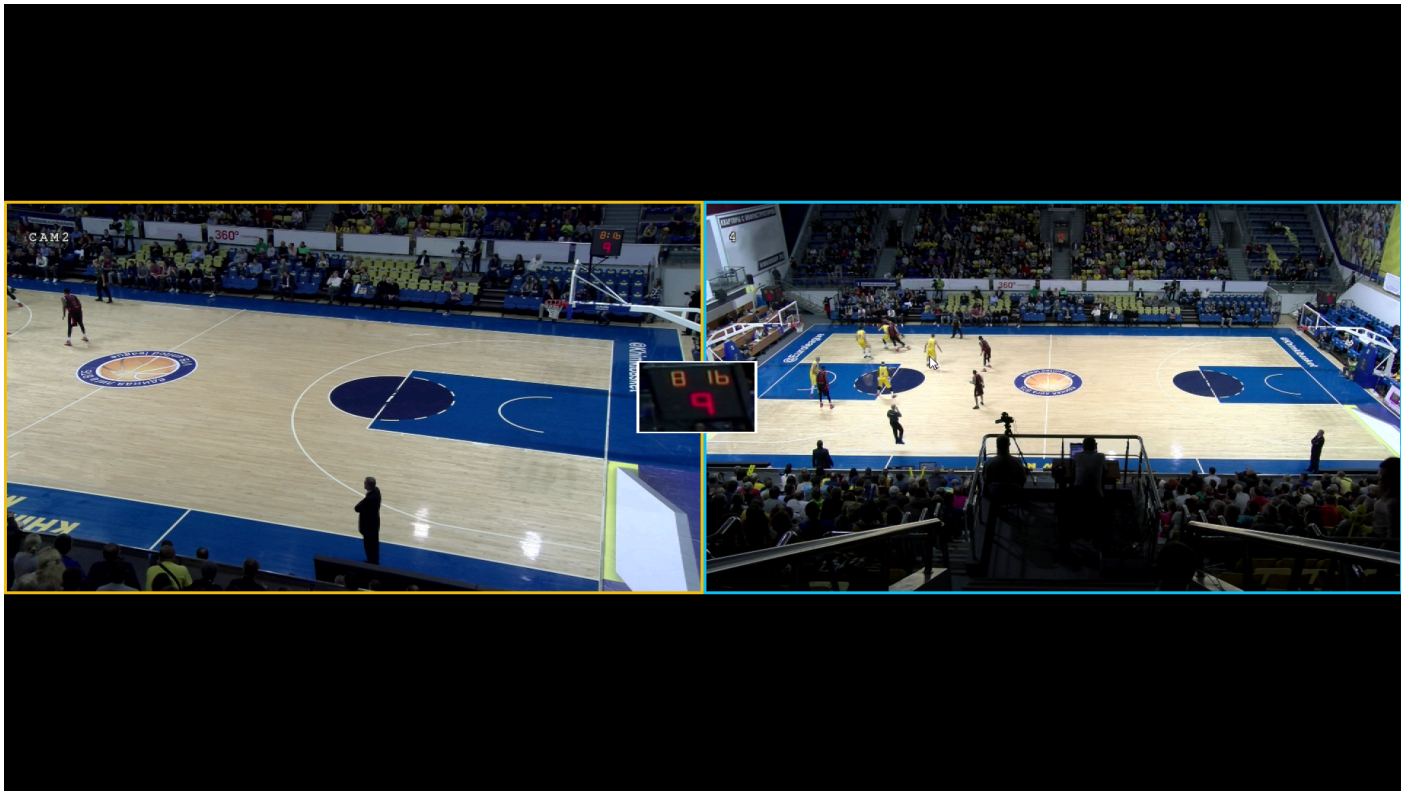
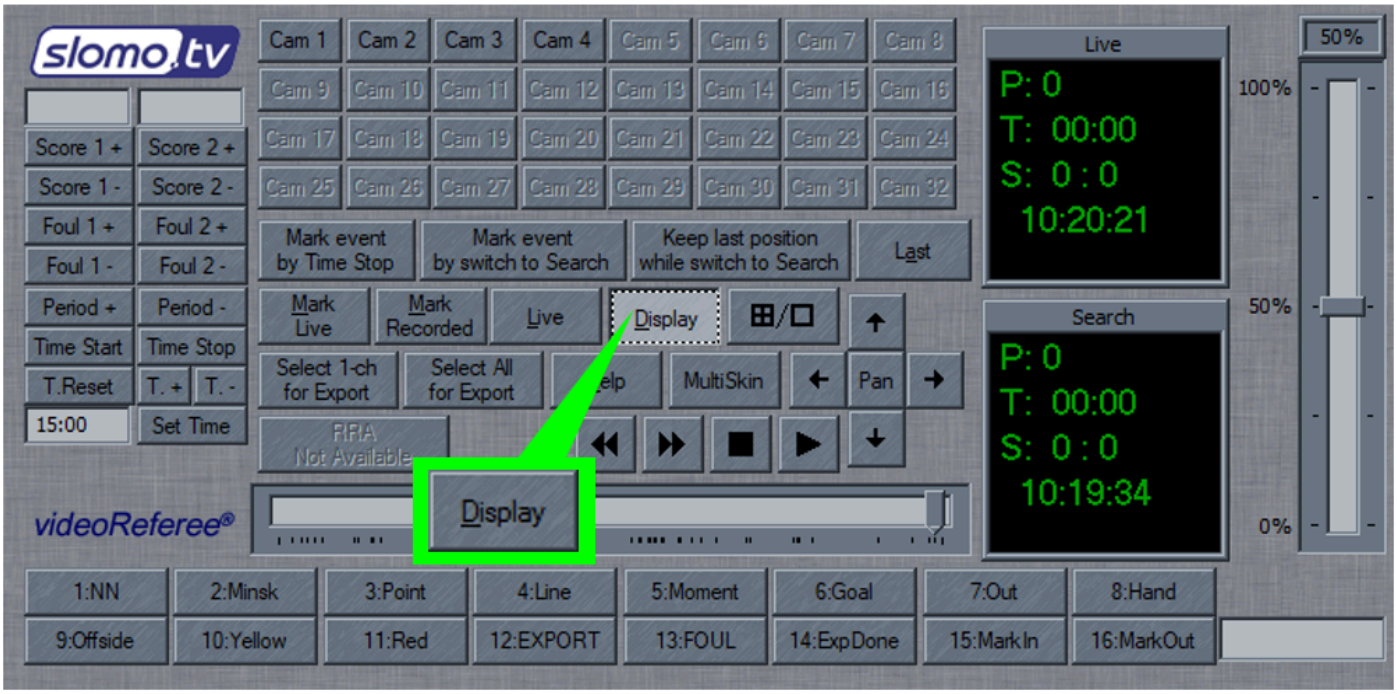


Figure 8 – Quad formed from Last cameras

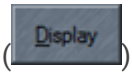
From the cameras in **Last**, you can create Presets for quick access to camera layouts from the control console. For more information, see the "Presets" section of this manual.

You can turn off **Last** by selecting a preset.

Display



The **Display** button enables or disables the display of information on the video output monitoring window. The displayed information is recorded in the video report as a subtitle track.
You can turn on/off the information display using:

- the **Display** button (

) in the engineering interface;
-  : **Ctrl + D**;
-  : Shift **+ Help | Display**.

For each channel, the camera name is displayed in the referee's interface – in the upper left corner:



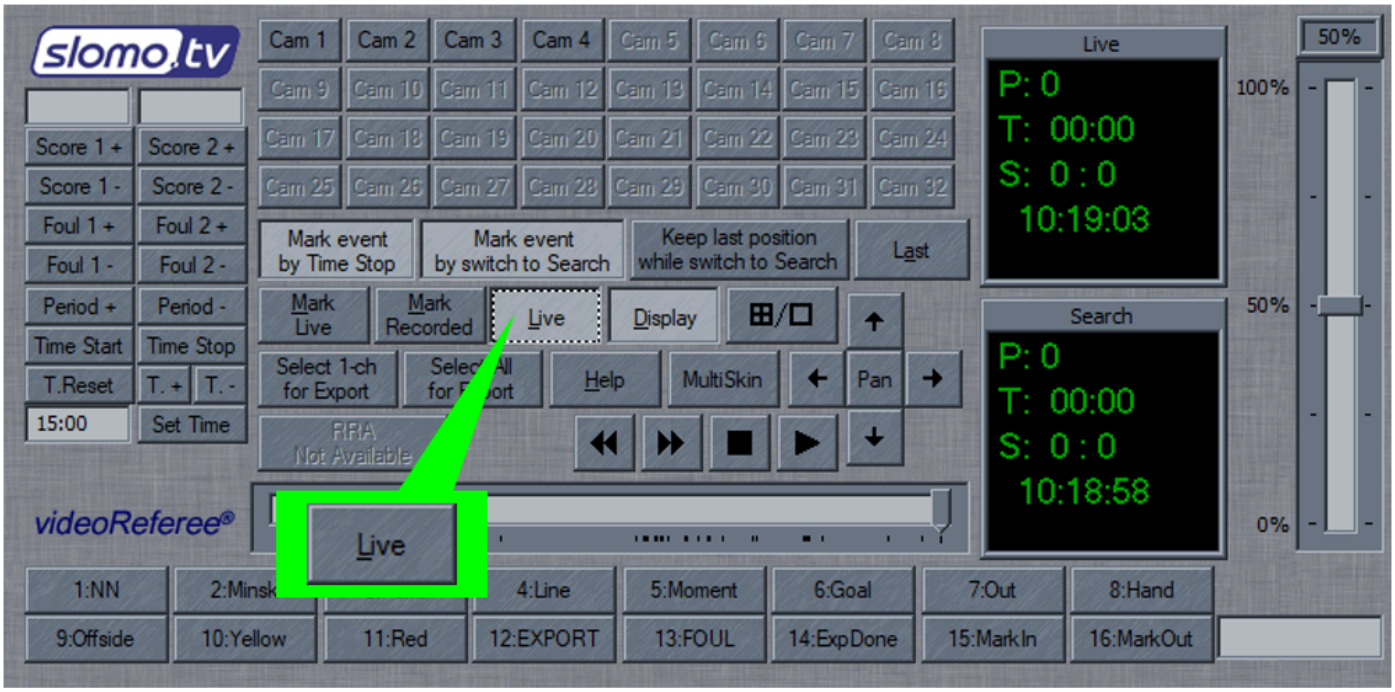
Figure 9 – Display Info

During playback, the playback speed (percentage) is displayed in front of the camera name and a scoreboard is displayed in the lower right corner:



Note that in **Search** mode the ***recorded*** parameters are displayed, i.e., their values at the moment of recording.

Live



The **Live** button toggles between Live and Recorded video modes.
In Recorded video mode, you manipulate the recorded video – Search/Playback – search for the desired moment, analyze individual frames, manually rewind forward/backward, play the recorded video at normal or in slow motion.
If the **Jog** wheel on the referee's control console has been activated, the system automatically enters the search mode and creates a mark (only if the **Mark event by switch to Search** button is pressed).
You can switch between Live and Recorded modes using:

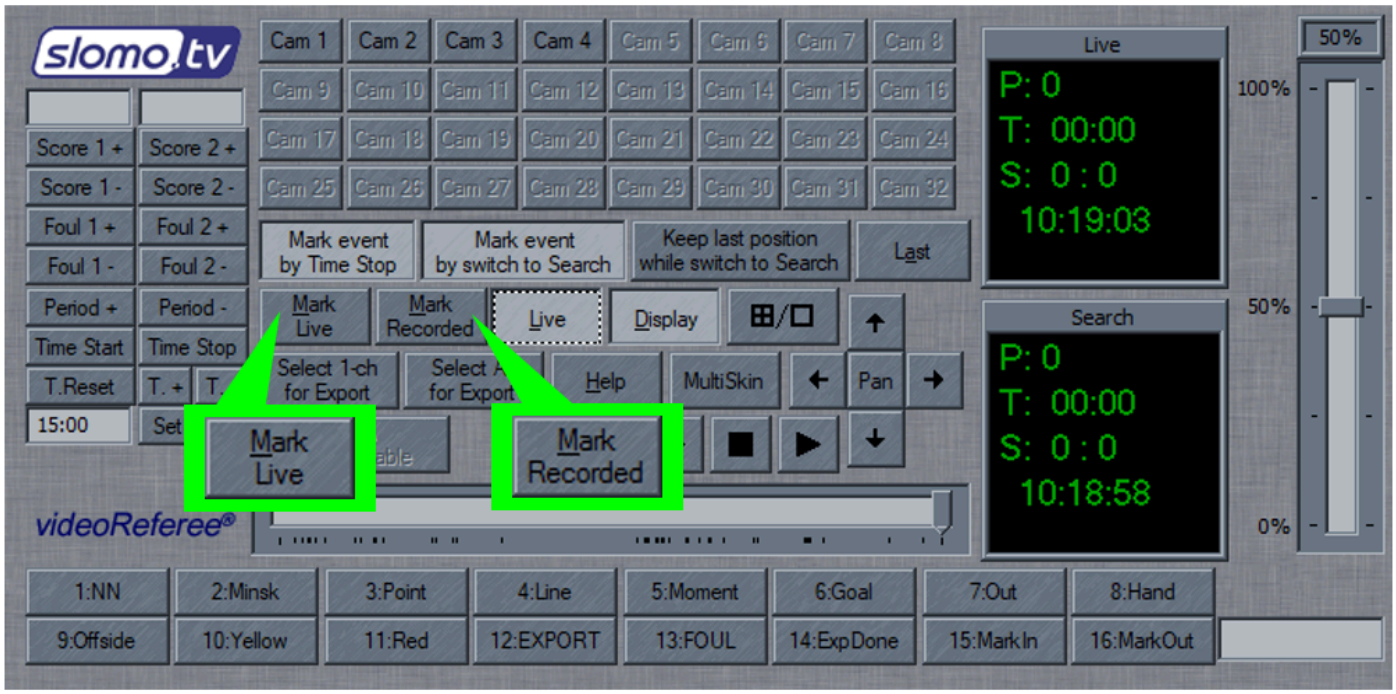
- Live button. When the **Live** button is pressed, the video output monitoring window displays the video currently being recorded. When the **Live** button is not pressed, the Search mode is active;
- : **Ctrl + L**;
- : **Rec | Live**.

The playback of the recorded video starts with the **Play** ( ), button and stops with the **Stop** ( ) button.
When you switch from Live to Recorded mode, the video on the referee monitor and in the video output monitoring window stops. You can navigate through the recording in one of the following ways:

- discretely, through the marks you have placed before (using the **Forward** ( ) and **Backward** ( ) buttons);
- smoothly, by sliding the pointer on the Search/Playback timeline or by rotating the **Jog / Shuttle** wheel on the control console.

In the Search mode, the desired moment of the video recording can be played on the referee monitor (see « Play and Stop buttons»).
The camera selection buttons (**Cam1 – Cam32**) and Quad button work identically in both modes, the only difference is whether we see the match in real time or the recording.
The pointer on the Search / Play timeline and the **Forward / Backward** buttons do function only in Recorded mode.
Furthermore, trying to use any of the above-mentioned controls in Live mode will cause the system to enter the Search (Recorded) mode, and the **Live** button will automatically become unpressed.

Mark Live & Mark Recorded



The **Mark Live** and **Mark Recorded** are used for manual event marking.

- **Mark Live** – marks event on live video.
- **Mark Recorded** – marks event on recorded video.

Marks can be placed both in the Live and in the Recorded modes. In the first case, the real-time moment will be marked, and when working with a recorded video, the moment corresponding to the one being played back will be marked.

Marks have several functions. Firstly, marks are used to register and record necessary moments of the game. When the video report is generated and recorded to the hard drive, only the marked moments of the match are included into it.
In video report, the standard recording of each marked moment is preceded by a 1 second pause, during which the first frame of the recorded video is displayed on the screen, followed by the 15 second recording of the moment itself: 10 seconds before the mark and 5 seconds after it. A one second pause, during which the last frame of the moment is displayed, ends the recording of the marked moment[1].
Secondly, marks allow you to navigate through the recorded video, "jumping" from one mark to another, and to quickly position to the desired previously marked moment – see "Forward, Backward".

The attributes of the mark are the moment in time when the mark was created and the name of the mark. Created marks cannot be repositioned. On the basis of the previously created mark, you can create a new one, i.e., go to the mark, rewind to the desired moment and create a new mark.
The created events (marks) are displayed in the right part of the program window as a list, sorted by creation time.
The events can be created both in Live or Recorded modes.

In Live mode (when watching the live video) an event can be created in one of the following ways:

- by pressing the 

(**Mark Live**) button in the engineering interface,
-  : **Ctrl + M** or **[~]**.

In Recorded mode (when working with the recorded video) an event can be created in one of the following ways:

- by pressing the 

(**Mark Recorded**) button in the engineering interface,
-  : **Ctrl + Shift + M** or **Shift + [~]**.

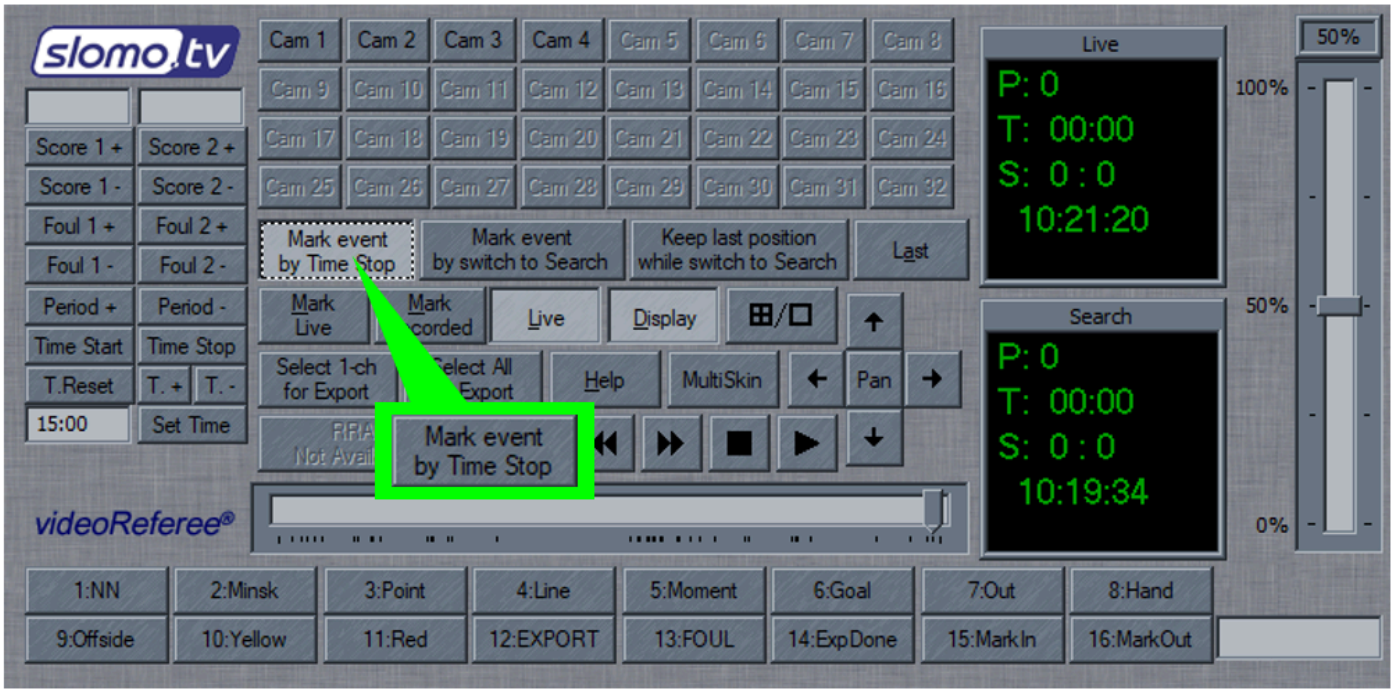
 : **Mark** (in both modes).

Regardless of how the event was created, it will be saved and placed in the list of created events.
When you create an event using the **Mark Live** button, the newly created event will be placed at the end of the event list.
When you create an event with the **Mark Recorded** button, the newly created event will be placed in the list between existing events according to its position on the recording.
For easy navigation through the recorded footage, the system has the ability to automatically create events every 10 minutes during an hour. This feature is active by default and can be useful if no event marks have been created during the game and automatic event creation by time stop (**Mark event by time stop**) has been disabled [2].

---

1. These settings can be changed, if you contact our technical support.
2. Used in ice hockey.

Mark event by time stop



Mark event by Time Stop – an event is created when the match time is stopped. At each stop of the game time, an event will be created that corresponds to the stop time and the current game parameters (period, score, time, fouls).

If the **Mark event by Time Stop** is enabled, a mark will be automatically created and added to the event list upon receiving a signal from the scoreboard controller[1] that the game time has been stopped or when the **Time stop** (Time Stop) button in the program's interface is clicked.

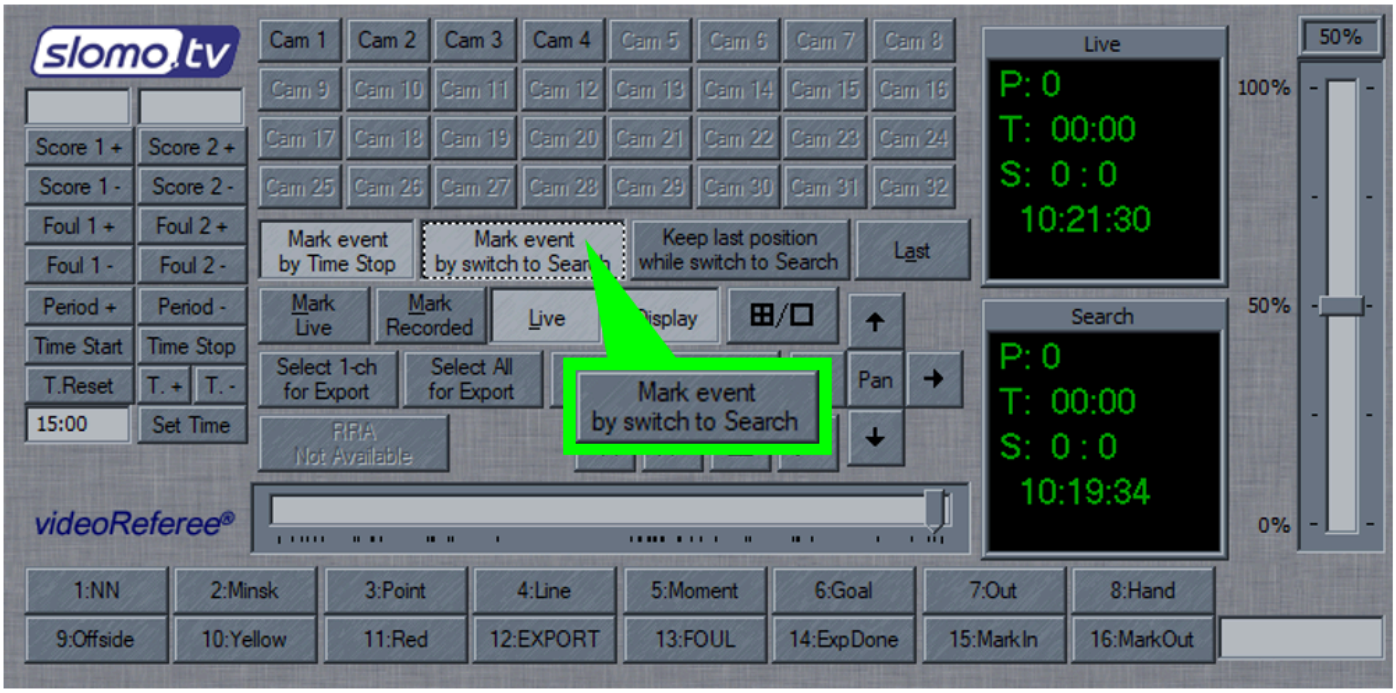
Note that the mark is placed only when the state of the timer changes. Thus, the **Time Stop** button generates a mark only if the timer was started before you pressed it. Pressing the button repeatedly without starting the timer will not generate new events.

If the **Mark event by Time Stop** is disabled, the automatic marking is performed only upon the change of the score while the time is stopped.

---

1. If present.

Mark event by switch to Search



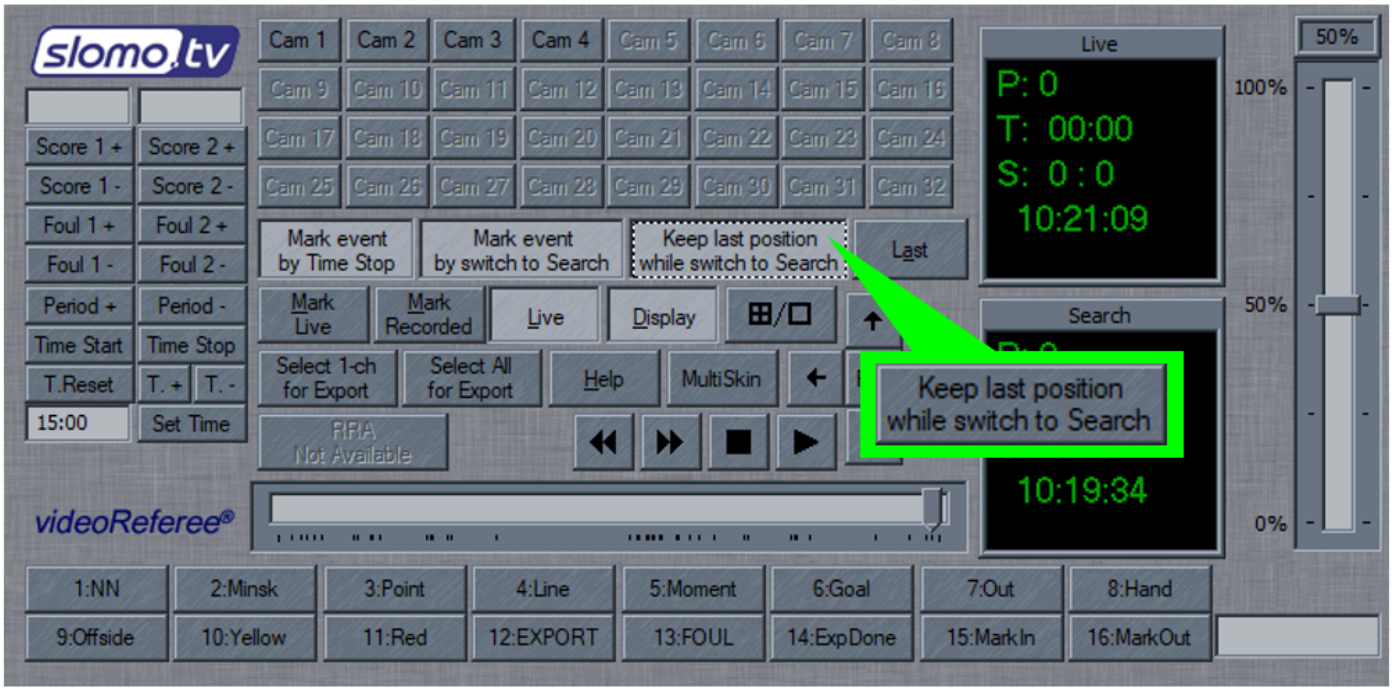
Mark event by switch to Search – automatic event creation when you switch from Live to Recorded mode.

When the **Mark event by switch to Search** is enabled, switching to Search mode by pressing the **Live** button in the program interface or **Rec | Live** button on the control console will automatically create an event and the pointer on the Search/Playback timeline will position itself on the newly created event. This allows fast playback of the moment.

When the **Mark event by switch to Search** is disabled, switching to Search mode by pressing the **Live** button in the program interface or the **Rec | Live** button on the control console will not create an event and the pointer position on the search/playback timeline will not change.

If the Search mode is triggered by turning the **Jog / Shuttle** wheel on the control console (not by the **Rec | Live** button), the event will be created and the pointer on the Search/Play timeline will be positioned at that event.

Keep last position while switch to Search



If **Keep last position while switch to Search** is enabled, the position of the pointer on the Search/Playback timeline is remembered and it does not re-position to the last mark when switching to Search mode.

If the button is not pressed, each time you create an event (the **Mark Live** button in the program interface or the **Mark** button on the control console) or switch from Live to Search (rotating the **Jog**), the last event you created will be jumped to.

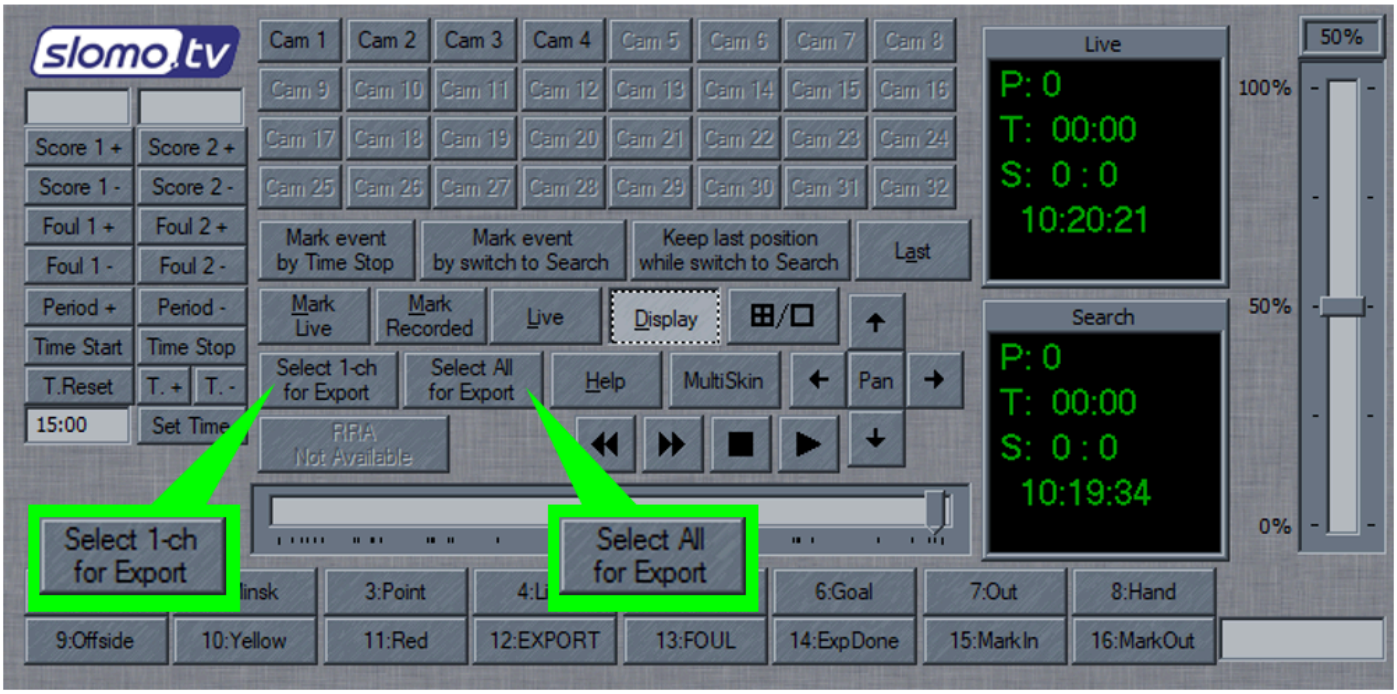
If the button is pressed, then no matter how many times the **Mark Live** button is pressed, or how many times you go from Live to Search and back, the pointer on the search/playback timeline will still be at the position that was found earlier.

When you enter the search mode the transition will be to the last created mark, if both the **Keep last position while switch to Search** and **Mark event by switch to Search** are not pressed.

This can be used when it is frequently needed to play back the last created mark. For example, an important moment occurred or you found such an event on the recording and pressed **Mark**. You have created a mark, and now you can quickly go to this mark by pressing **Rec | Live**. The pointer on the Search/Playback timeline will be positioned on the last mark created, regardless of whether it is the last one in the list of events or not.

The necessity of using this button is determined by the operator and the sport for which the system is used.

Select 1-ch for Export & Select All for Export



The **Select 1-ch for Export** and **Select All for Export** buttons allow you to set marks indicating that this moment should be included in the video report and video from which cameras should be used[1]:

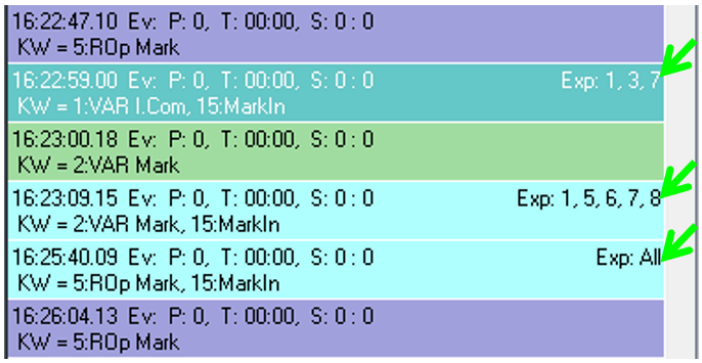
- **Select 1-ch for Export** – select one active camera for inclusion in the report. Switching the active camera of the moment and pressing the button again allows to select several cameras of the event for export;
- **Select All for Export** – select all cameras of the event for inclusion in the report.

Pressing the button again removes the corresponding mark.

The presence of such marks indicate to the *videoReferee®* system that video of the marked moment from the group(s) of cameras specified for that moment should be included in the video report.
If there is no mark, the moment will not be included in the video report.
A special mark in the list of events indicates that the mark has been placed (Figure 10):

- `Exp: All` – the **Select All for Export** mark was set for the event;
- `Exp: 1` – the **Select 1-ch for Export** mark was set for the event (active camera – 1);
- `Exp: 1, 5, 6, 7, 8` – the event is marked **Select 1-ch for Export** for several channels (recordings from the selected cameras will be included in the report for the selected moment). If the event is marked **Select All for Export** and **Select 1-ch for Export** at the same time, then the report will include recordings from all cameras except the active one.

1. The camera groups may vary depending on the configuration.



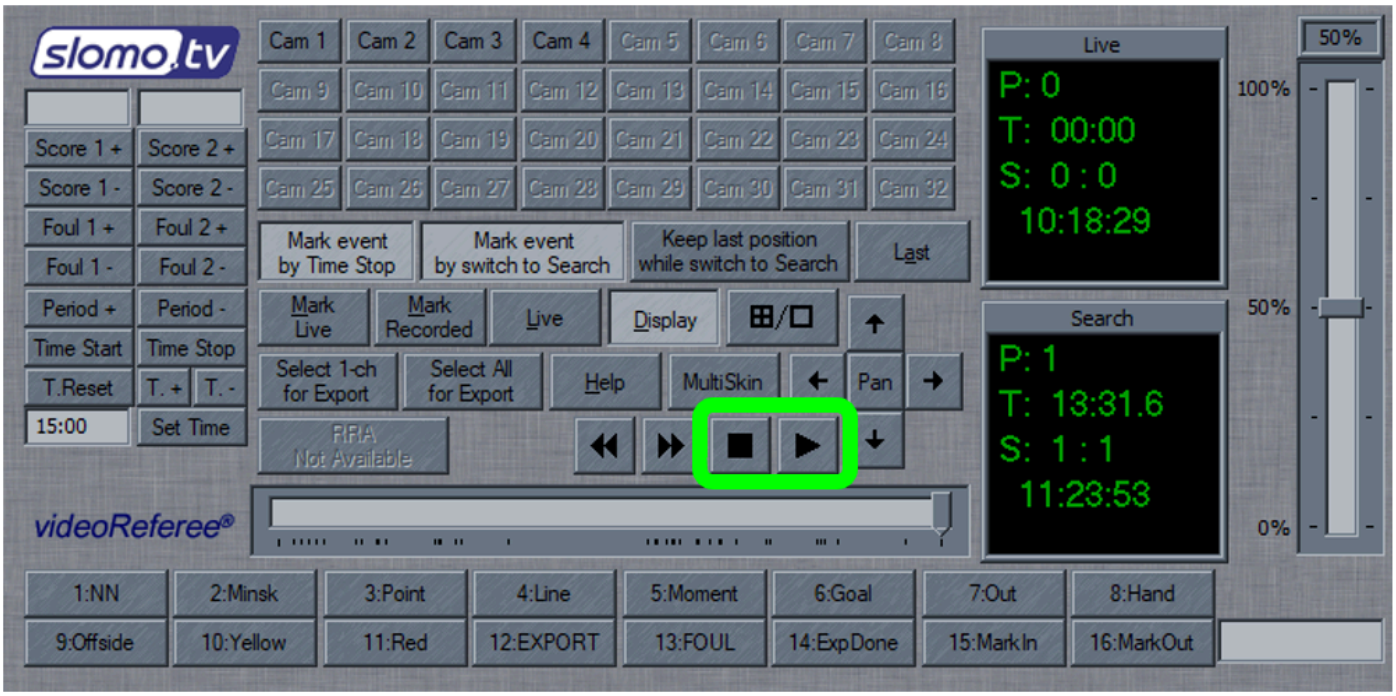
An alternative to the Select 1-ch for Export button on the control panel is the **S1** button on the referee control console.

An alternative to the Select All for Export button on the control panel is the **S2** button on the referee control console.

Figure 10 – Export Marks

The selection of events for export is described in the "Selection of events for export" section of this manual.

Play and Stop buttons



Use the **Play** (▶) and **Stop** (■) buttons to start and stop the video playback, respectively. The playback can also be started with:

- ⌨: **Ctrl + P** or **Ctrl + Spacebar**,

-  :  (**Play**) button.

Playback can be stopped:

-  : **Ctrl + S**,
-  :  (**Stop**) button.

Loop playback

If necessary, you can play the desired moment in a loop:

- Rewind to the beginning of the moment,
- Start playing it by pressing the **Play** (),
- Watch the moment up to the point where you want to end and press the **Play** () again[1]. This will trigger a looped playback of the moment with a duration equal to the time between presses of the **Play** button.

This video clip will play in a loop on the referee's monitor and in the video output monitoring window.

Press **Stop** twice to stop loop playback.

Loop playback with a set duration

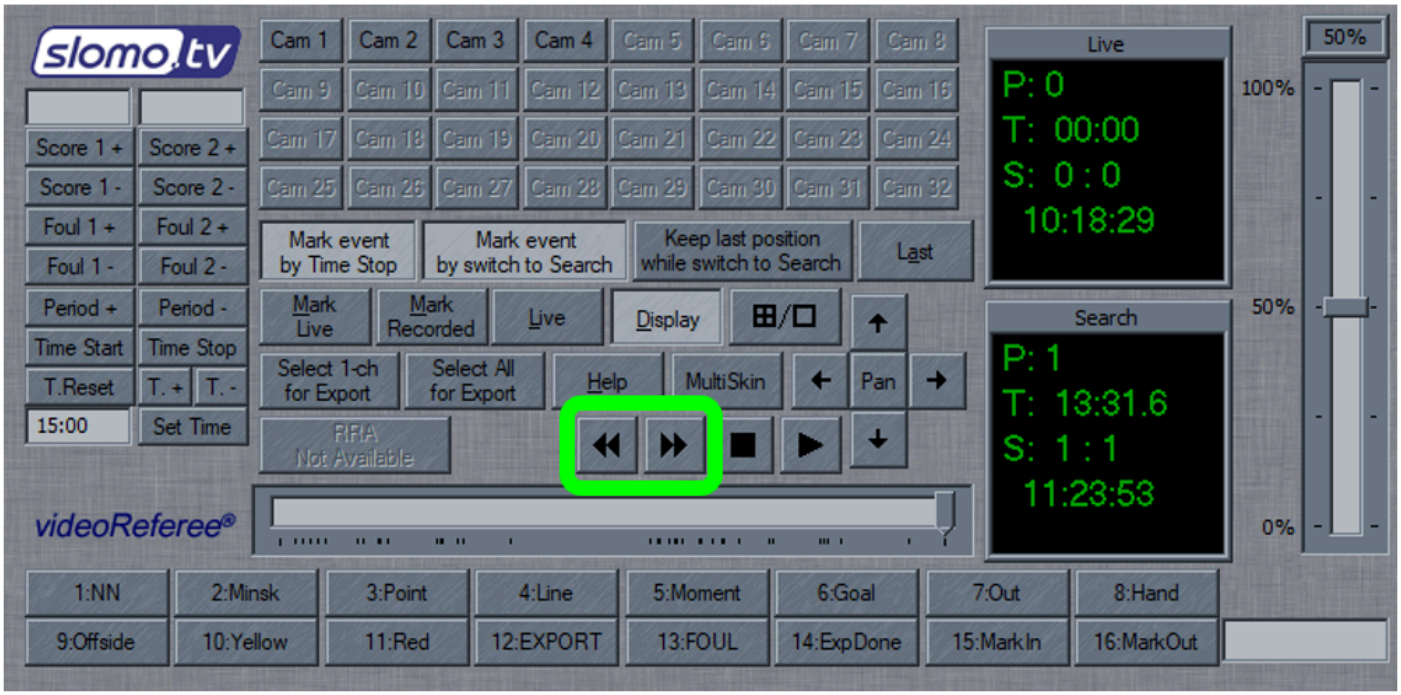
Playback with a set duration is available for a quick review of the moment in the loop mode. Press the **Shift** + **Play** button combination on the control console and the moment will be played with the duration set in the program settings – 1 second[2] – half the time before the moment and half after the moment you started the loop playback.

Press **Stop** twice to stop loop playback.

---

1. There is a software limitation on creating a loop of a very short duration. If you try to create such a loop, it will automatically be increased by the program to the minimum possible.
2. The duration of the loop can be changed by contacting slomo.tv technical support.

Forward, Backward



The **Forward** () button positions you to the next mark on the recording timeline. If there is no such mark, the positioning is made to the end of the recording.
Trying to use the **Forward** button in Live mode causes the system to enter the Search mode, and the **Live** button automatically becomes unpressed.

To go to the next mark, you can also use the  button on the control console.

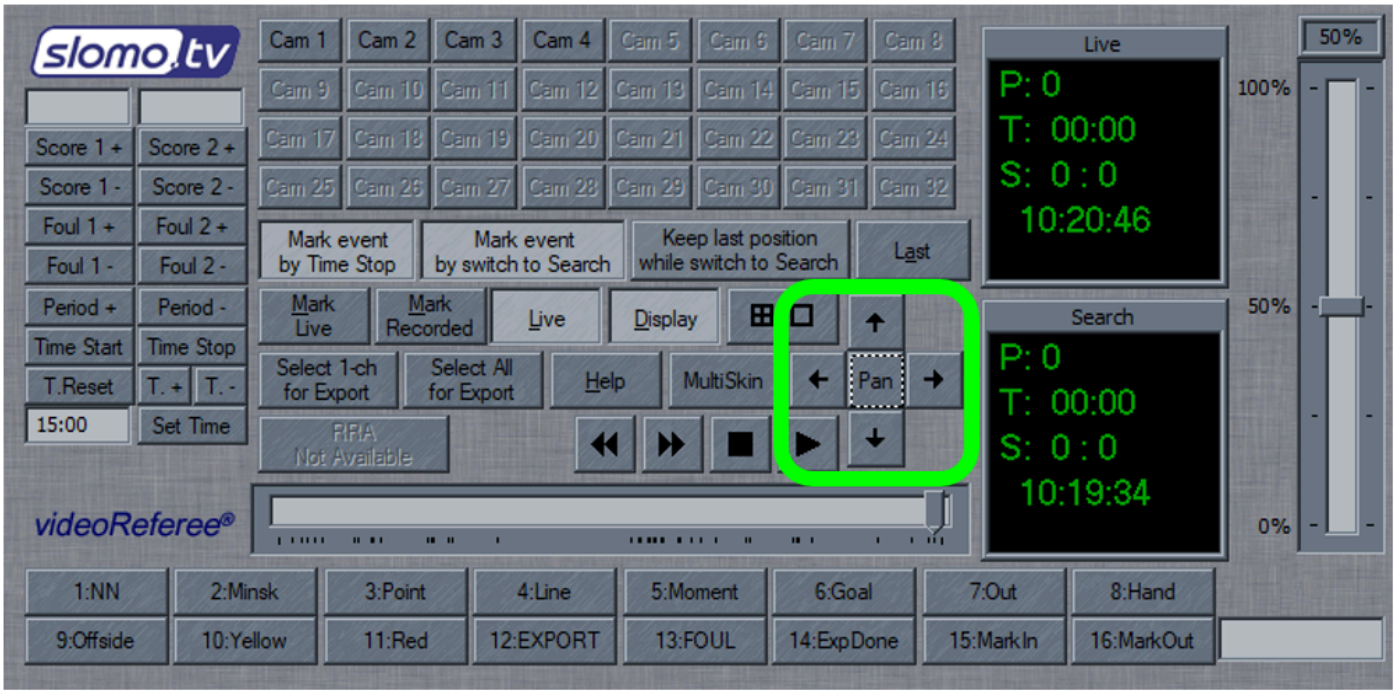
The **Backward** () button positions you to the previous, earlier mark on the recording timeline. If there is no such mark, the positioning is made to the beginning of the recording.
Trying to use the **Backward** button in Live mode causes the system to enter the Search mode, and the **Live** button automatically becomes unpressed.

To go to the previous mark, you can also use the  button on the control console.

From the keyboard, these actions are performed using keyboard shortcuts:

- **Shift +** → – go to the next mark;
- **Shift +** ← – go to the previous mark.

Pan



The analog of the zoom control joystick on the referee console (**PAN | ZOOM**). Allows you to zoom in and navigate around the image on the monitor.
Available in the Recorded mode.

Press the **Pan** (

) button to double the scale of the current frame. You can navigate in the frame with  ,  ,  ,  .

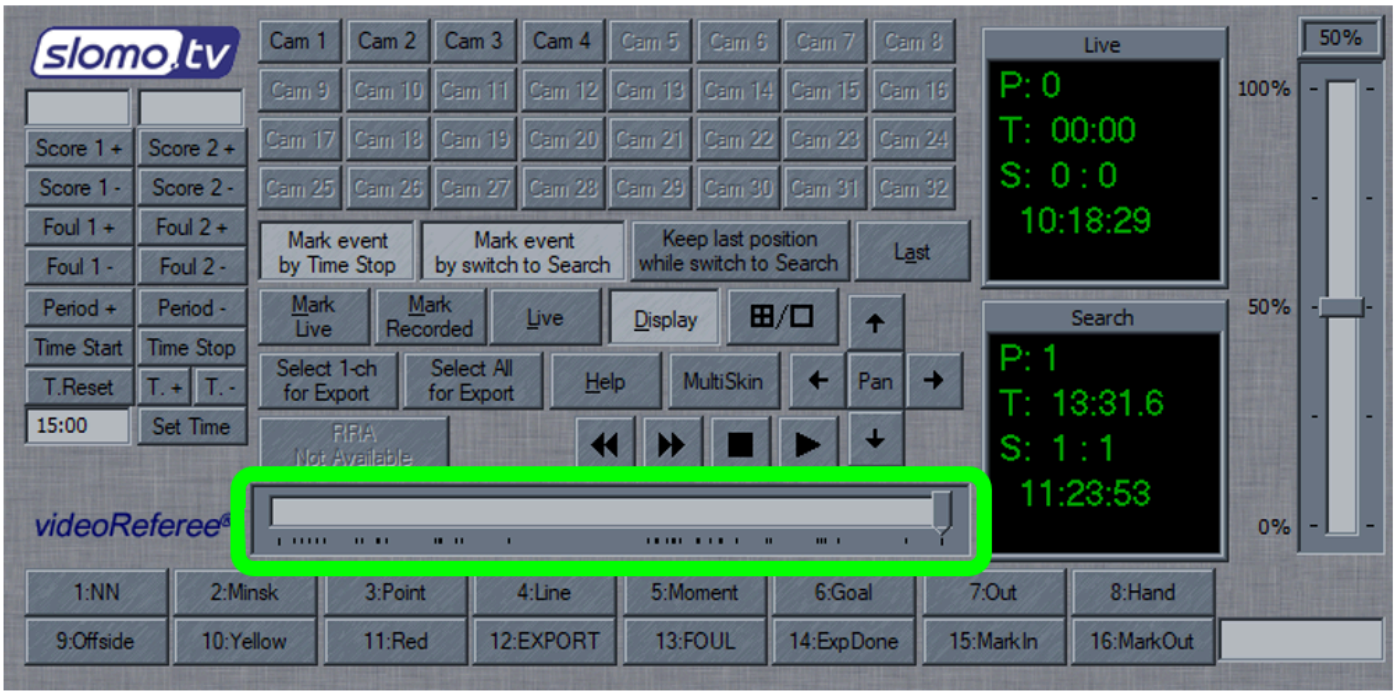
An alternative to pressing the **Pan** button in the engineering interface is the keyboard shortcut **Ctrl + Enter** (starting from 2x zoom). When the image is magnified, an alternative to pressing the arrow buttons in the engineering interface are the keyboard shortcuts **Ctrl+**↑, **Ctrl+**↓, **Ctrl+**←, **Ctrl+**→ for the corresponding movements.

These manipulations will be visible only in the video output monitoring window in the engineering interface.

Change scale in the channel window

In the engineering windows you can also change the scale and navigate through the frame with the mouse. To change the scale, press the right button and, without releasing it, rotate the mouse wheel to select the desired scale. Smooth movement through the frame is performed by moving the mouse while the right button is pressed.

Search/Playback timeline



Move the pointer to position yourself on the desired frame of the video recording. There is an analogy between this slider and the **Jog** wheel on the referee control console.
When you use the **Forward** and **Backward** buttons, you navigate through the marks. Each press of the button positions the pointer on the timeline to the next mark in the corresponding direction. If you use the list of marked events to navigate through the marks, the pointer on the timeline will also be positioned to the selected mark.

You can also right-click once with the mouse on the timeline to the left or to the right of the pointer. You will jump one second forward (if the cursor is to the right of the pointer) or backward (if the cursor is to the left of the pointer) on the recorded video. If the playback was in progress before you clicked it, it will stop.

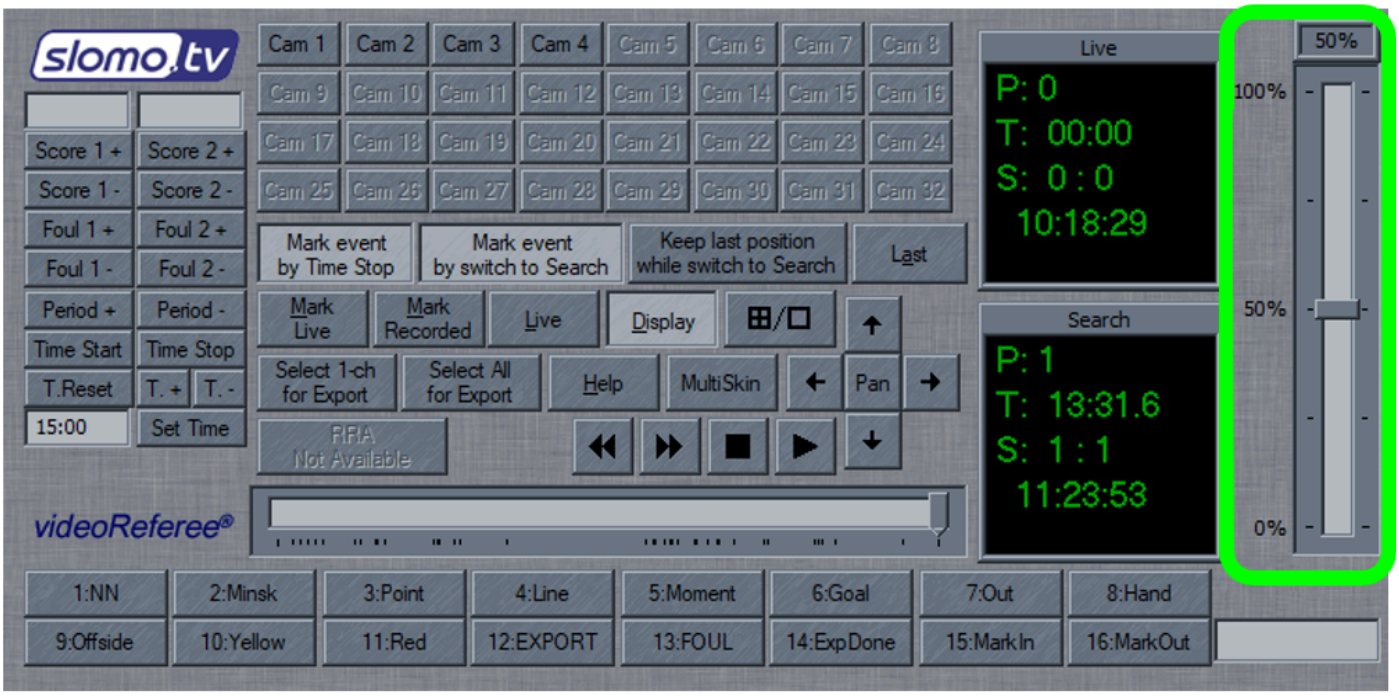
If you click the mouse button on the timeline and do not release it, you will start moving forward or backward through the video, depending on the position of the cursor relative to the pointer, one second per step.

If the slider is in focus, pressing the **[←]** and **[→]** button moves one frame backward or forward, respectively. If the button is pressed and held down, the system starts going frame-by-frame. This can be useful for determining if the ball has crossed the goal line.

If you use the **PageDown** and **PageUp** keys instead of **[←]** and **[→]**, you will move second-by-second instead of frame-by-frame backward and forward, respectively. This way you can position to a moment less precisely, but quicker.

The Search/Playback slider is active only when working with the recorded video. Moreover, trying to use the slider in Live mode will cause the system to enter the Recorded mode, and the **Live** button automatically becomes unpressed.

Playback speed controller



Adjusts the playback speed by moving the slider. Set the speed to 0 to stop the playback.
This is the direct analog of the **Shuttle** on the referee control console.

Available in Playback mode only.

When you start the program, the slider is set to 50% of normal playback speed. When you move the slider up and down, the playback speed increases or decreases, respectively. The possible range is from 0 (stop) to 1 (normal playback speed).

During playback, the playback speed (in percent) is displayed in front of the camera name on the referee's monitor.

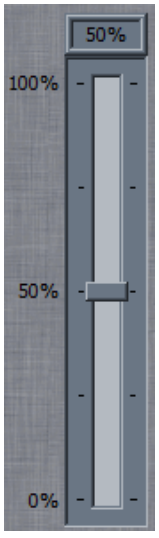


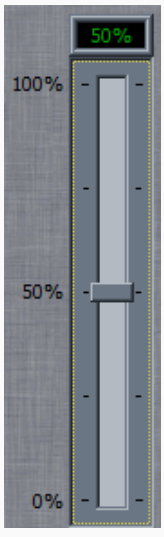
Changing the speed control mode

You can change the playback speed control mode for your convenience. Two options are possible: smooth (percent by percent) and stepped (25%, 50%, 75%, 100%).

To change the speed control mode:

- double-click on the speed value window above the slider in the program interface:

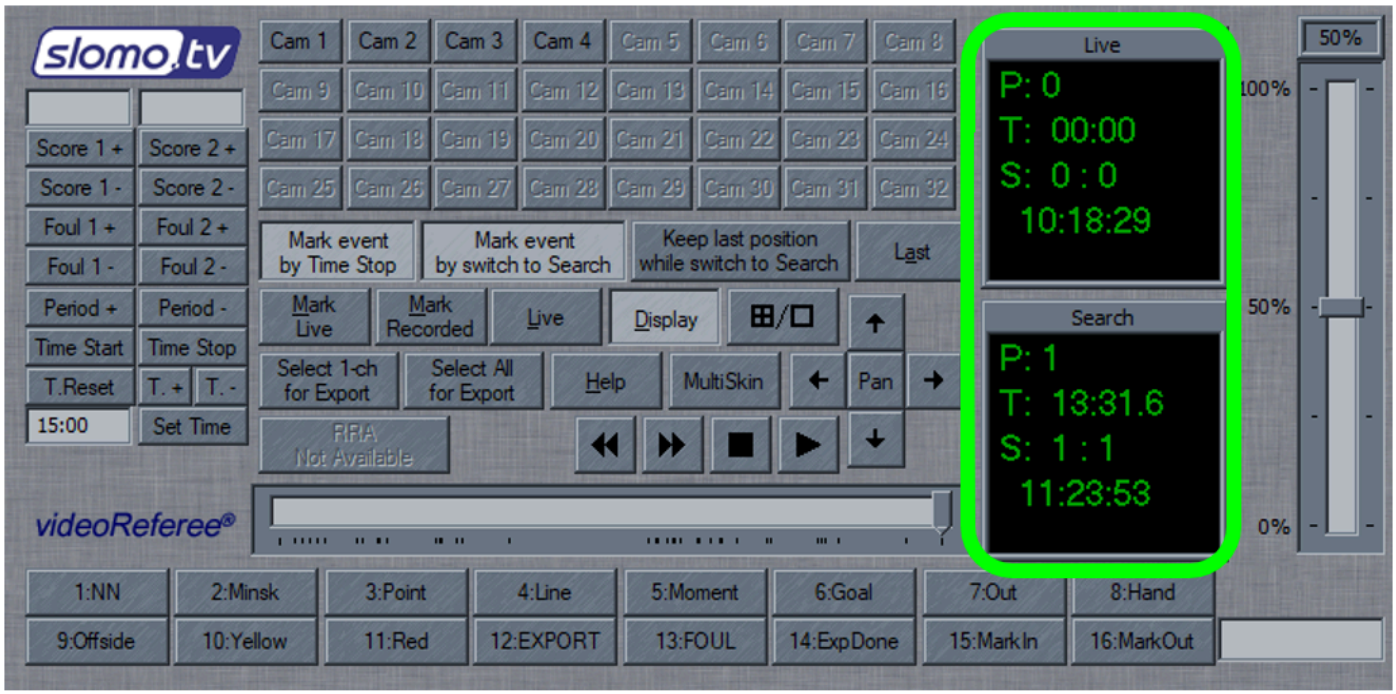




The window will change color to black: the stepped playback speed control is enabled.

- or press **Alt + S1** on the control console. The **S1** button will change the backlight to blue – the stepped playback speed control mode is enabled.

Match-controller data window



The *Live* window displays the current data from the scoreboard controller[1].
The *Search* window displays the data at the time corresponding to the moment being viewed.
The set of data in both windows is the same[2]:

- P – period,
- T – time to the end of the current period,
- S – score,
- the astronomic time.

For basketball, team fouls and the side of ball possession can be displayed.
The period number, the time to the end of the current period, the time to the start of the match/next period and the score are from the scoreboard controller[3]. When the timer is running, the time will be decreasing.
The *videoReferee®* software sets the astronomical time according to the system time. The astronomical time cannot be set manually and does not depend on the scoreboard controller.

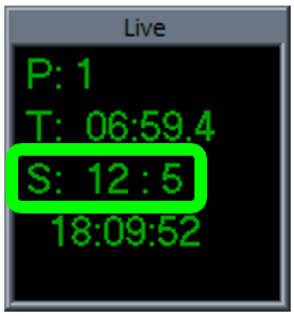
1. If available and in use.
2. The set of data depends on the sport for which the system is used.
3. If available and in use.

Score1+, Score1-, Score2+, Score2-

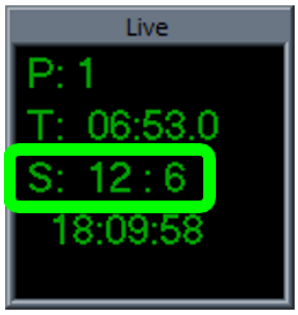


If the connection to the scoreboard controller is lost, these buttons allow you to set the score.

- **Score1+** and **Score2+** increase the score parameter of the first and second team, respectively, by one each time the button is pressed.
- **Score1-** and **Score2-** reduce the score parameter of the first and second team, respectively, by one each time the button is pressed.



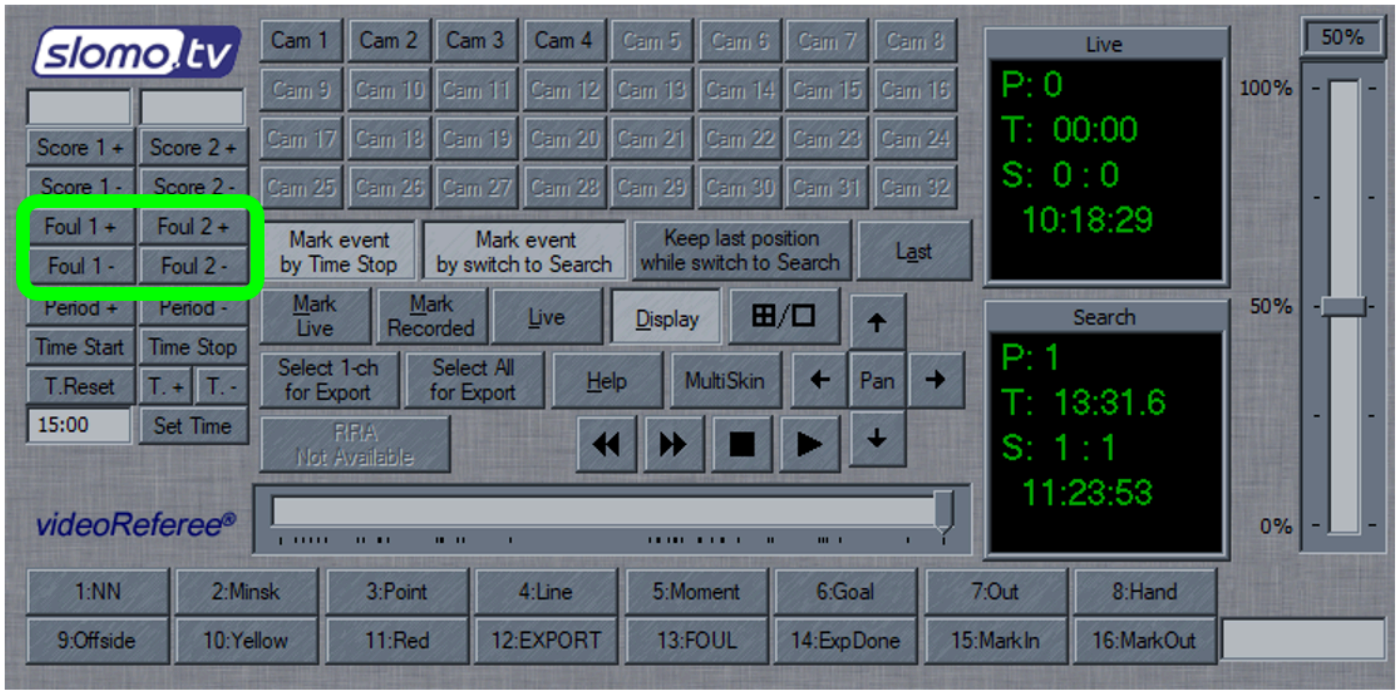
→



Pressing the **Score2+** button increases the score value (Live window, parameter "S").

⚠ Do not use these buttons when the data from the scoreboard controller are being received normally, without any problems.

Foul1+, Foul 1-, Foul2+, Foul 2-

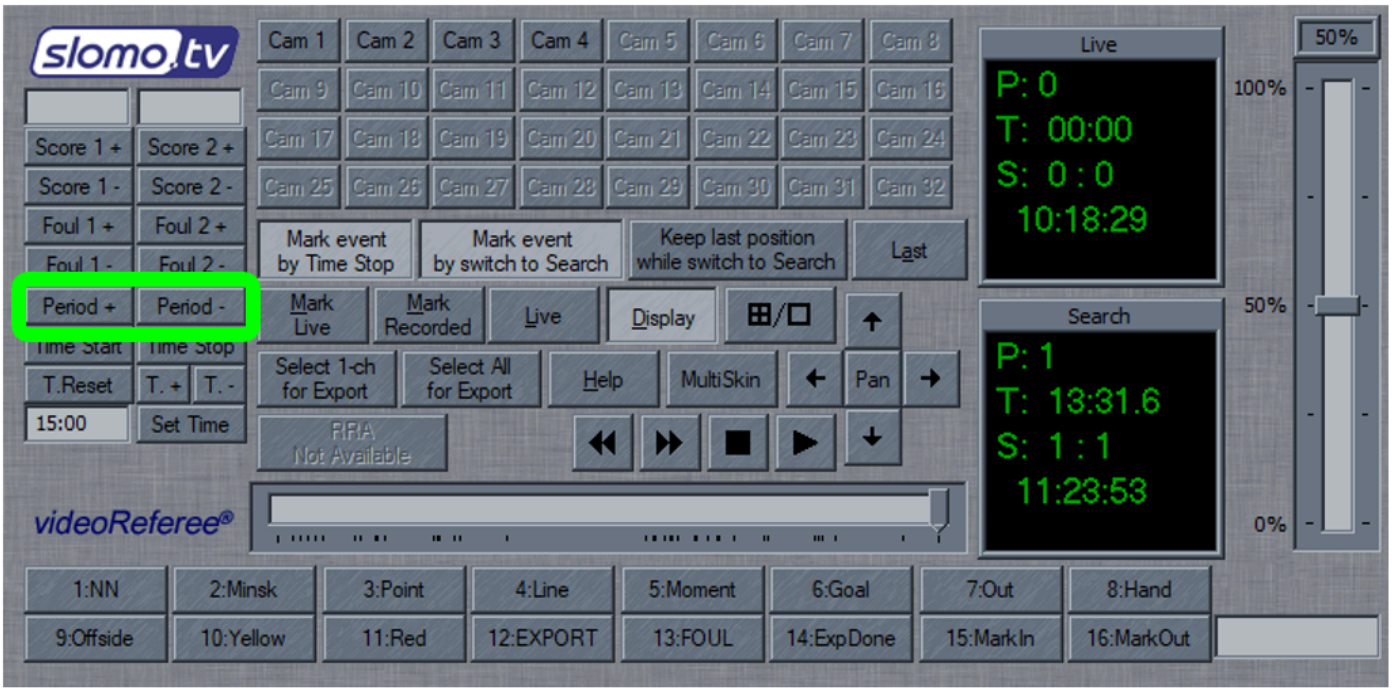


If the connection to the scoreboard controller is lost, these buttons allow you to set the foul count value.

- **Foul1+** and **Fou2+** – increase the foul count value by one with each press for the first and second teams, respectively.
- **Fou1-** and **Fou2-** – decrease the foul count value by one with each press for the first and second teams, respectively.

> ⚠ Do not use these buttons when the data from the scoreboard controller are being received normally, without any problems.

Period+, Period-



If the connection to the scoreboard controller is lost, these buttons allow you to set the period number.

- **Period+** – increases the value by one each time you press it;
- **Period-** – decreases the value by one each time you press it.



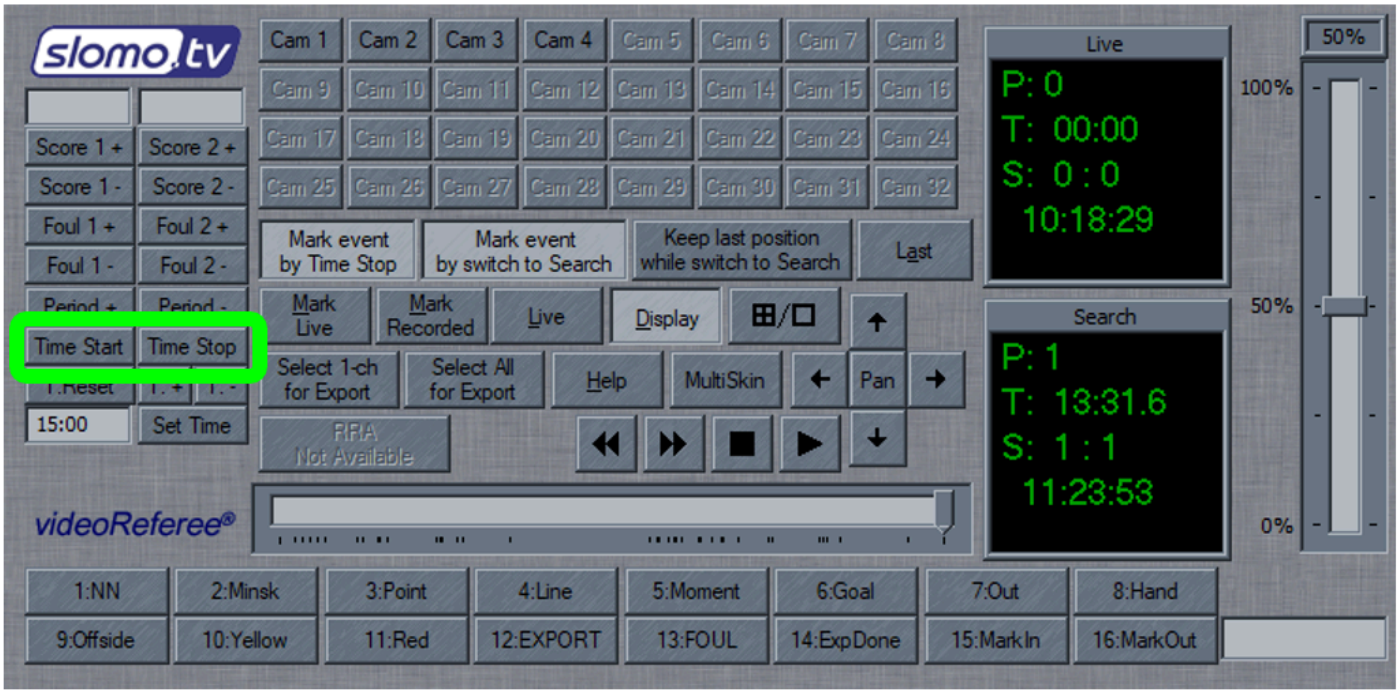
→



Pressing the **Period+** button increases the value (Live window, parameter "P").

Do not use these buttons when the data from the scoreboard controller are being received normally, without any problems.

Time Start, Time Stop



If the connection to the scoreboard controller is lost, **Time Start** and **Time Stop** buttons allow you to start and stop the game time (to set the time, use the **T.+**, **T.-**, **Set Time**, **T.Reset** buttons).

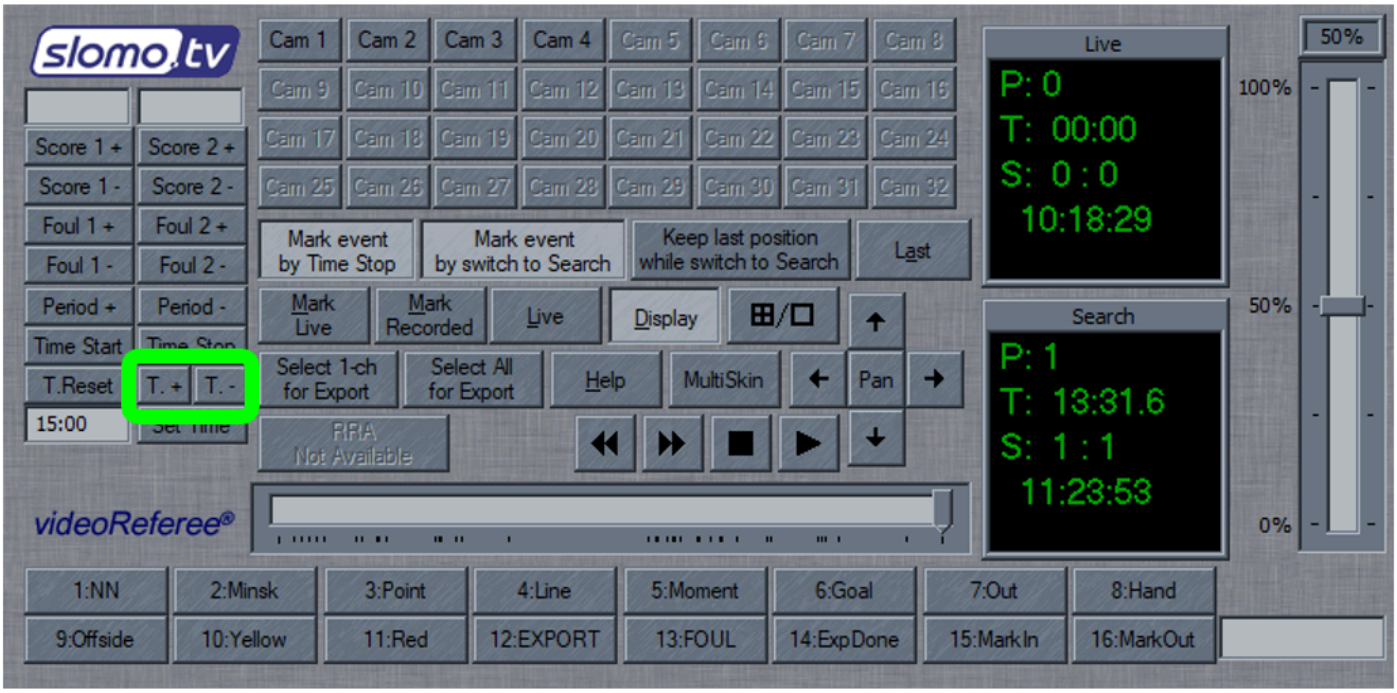
- **Time Start** – starts the game time,
- **Time Stop** – stops the game time.

When the timer is stopped, the match time remains unchanged, the system timer does not stop.



Do not use these buttons when the data from the scoreboard controller are being received normally, without any problems.

T.+, T.-



If the connection to the scoreboard controller is lost, **T.+**, **T.-** buttons allow you to make small adjustments to the game time parameter.



Before pressing **T.-**

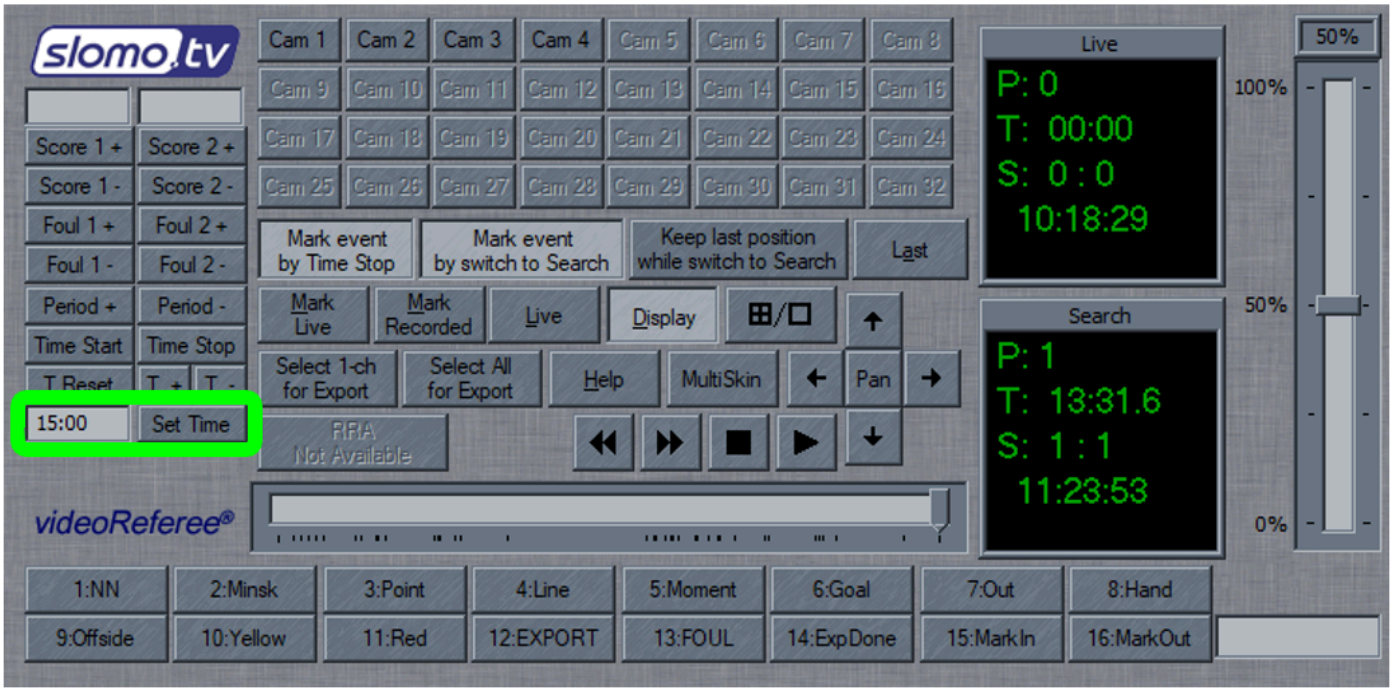


After pressing the **T.-**

T.+ – increases the game time parameter by one second each time you press it,
T.- – reduces the game time parameter by one second each time you press it.

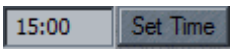
Do not use these buttons when the data from the scoreboard controller are being received normally, without any problems.

Set Time

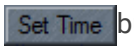


If the connection to the scoreboard controller is lost, the **Set Time** allows you to set the game time. Enter the desired value in the input field to the left of the **Set Time** button and press the button.

The game time is entered either in seconds 

and the program then recalculates it into minutes, or in minutes 

using the ":" divider. The game time parameter cannot exceed the 59:59 min. Note that into this field you enter the time of a period, not of the entire game.

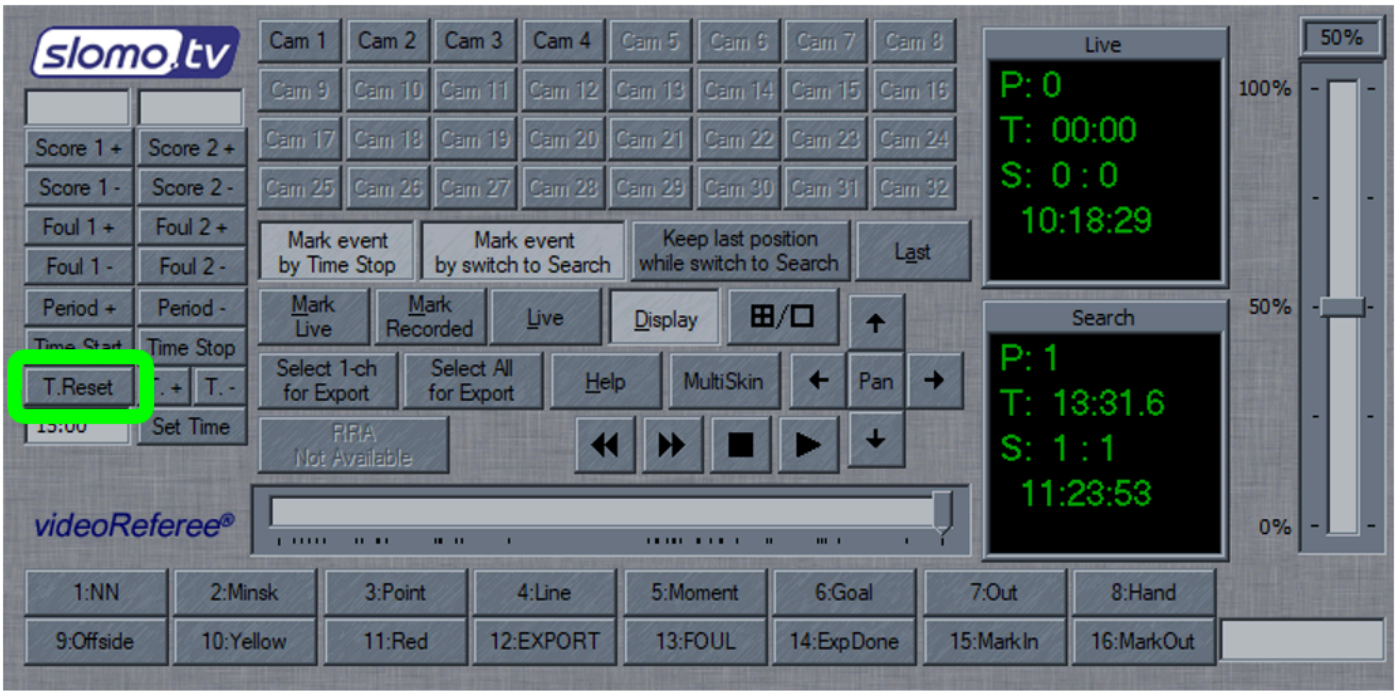
Press the 

button to confirm the time entered.
Regardless of how you enter the time, it will be recalculated and displayed in minutes, with the ":" divider.
The time entered will be displayed in the Live window at the top right of the control panel:

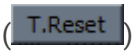


Do not use these buttons when the data from the scoreboard controller are being received normally, without any problems.

T. Reset



If the connection to the scoreboard controller is lost, the **T.Reset** clears the game time value.

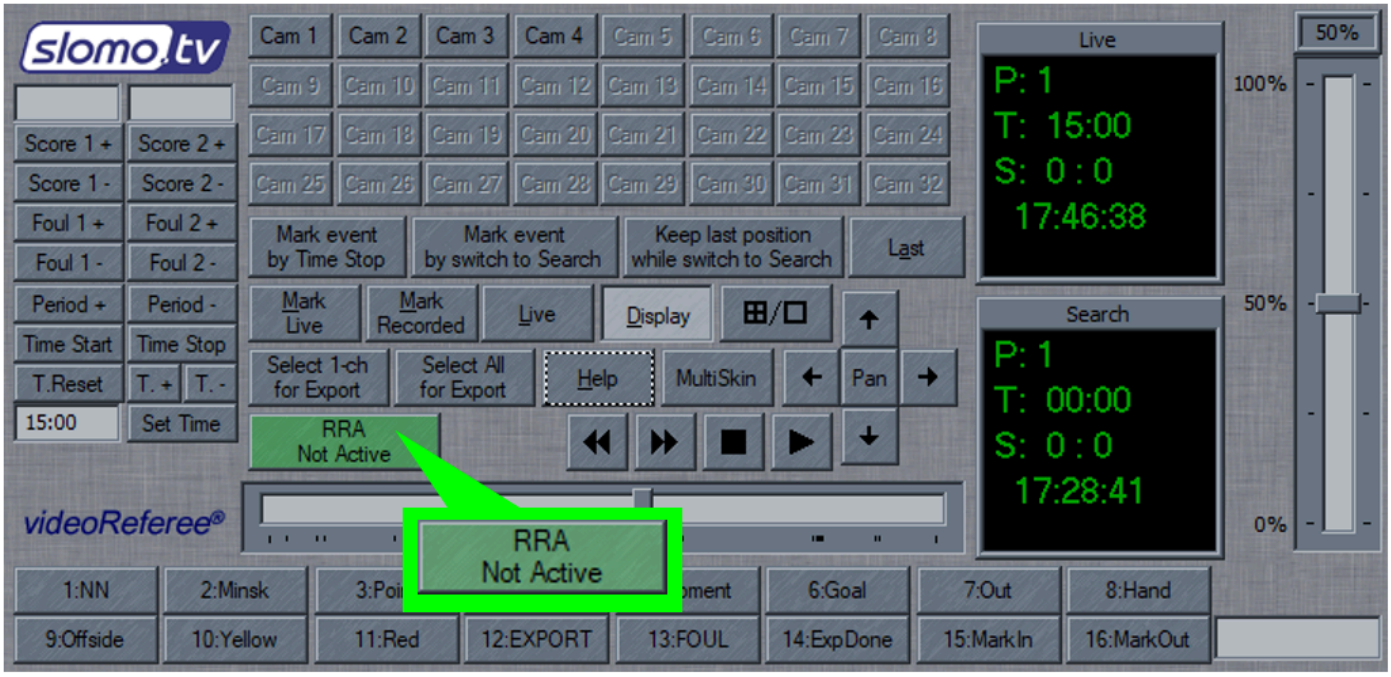
Pressing the **T.Reset** (

) button resets the game time counter to zero. This button can be used to delete the current time value and then enter a new one.



Do not use these buttons when the data from the scoreboard controller are being received normally, without any problems.

Referee Review Area – RRA Option



The RRA option[1] – displays the synchronous referee output or preset graphic files on a separate video output. When RRA is activated, the referee output or, if available, the preset graphic information will be duplicated on a separate video output.

To duplicate the referee interface to the RRA output use:

- from the engineering interface – by pressing the button RRA Not Active;
- : **Alt + R**;
- : **Cmd + Alt + Rec|Live**.

To select and output the preset graphic files on the RRA output use:

- : **Ctrl + Alt + F...** (F1...F12) – up to 12 images;
- : **Cmd + Alt + Ch.N** (Ch.1...Ch.16) – up to 16 images.

When an RRA output is inactive, the button in the program interface looks like RRA Not Active and a preset background screen saver is displayed.

When an RRA output is active, the button in the program interface looks like RRA Active and the RRA screen duplicates the referee monitor or displays a preset graphic file.
Graphical images are preloaded in the following folder on the server[2]: *C:\RRA_Picture*.

1. Purchased separately.
2. The location of the files can be changed by contacting slomo.tv technical support.

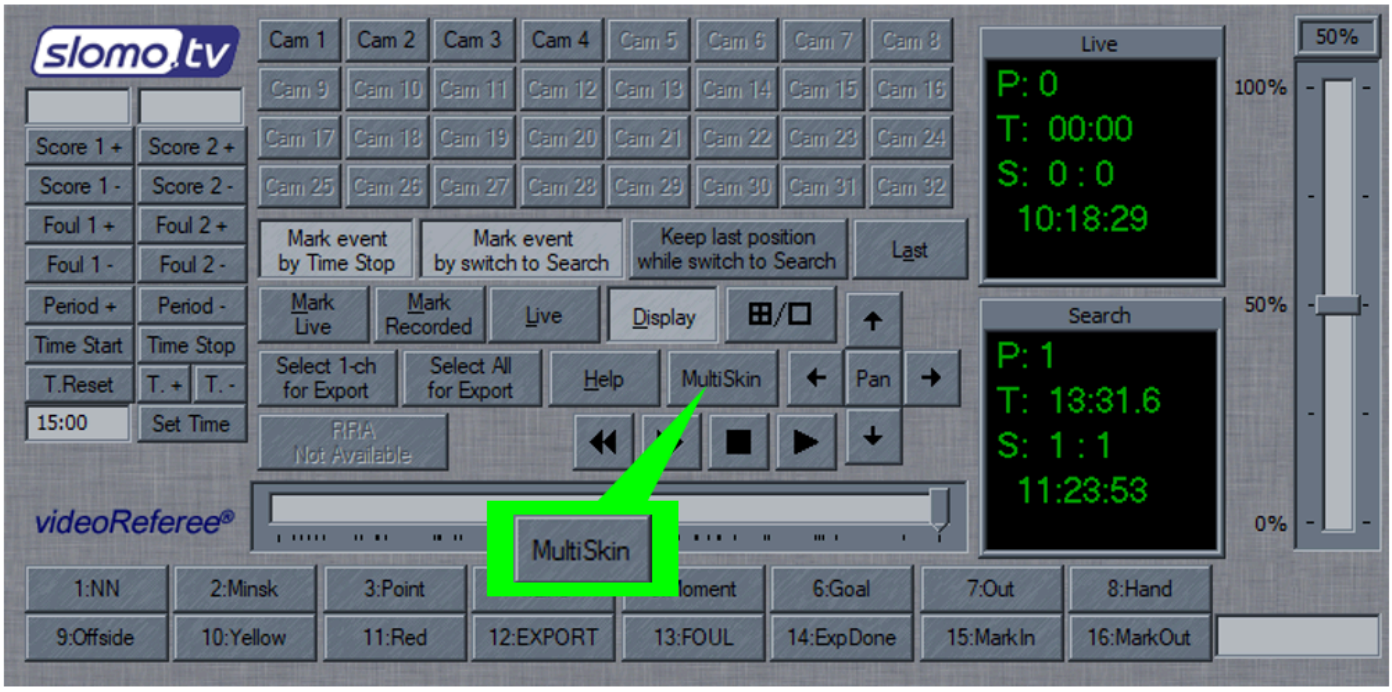
Image format – ***.png**.
Image name format – RRA_XX.png, where XX – sequential number 00, 01, 02, etc. The maximum number (XX) corresponds to 16 or to the number of available channels in the system, if less than 16.

The image named RRA_00.png is displayed as a screensaver when the RRA output is inactive.

The selected image will disappear automatically after 30 seconds if no next image has been selected, and the background screen saver will be displayed instead.

If the selected image is not found in the folder, the background screen saver will be displayed instead.

MultiSkin



MultiSkin function is used to display additional interfaces on the engineering monitor with the ability to switch between them. The Multiviewer and Game Analyzer can act as additional interfaces.
Multiviewer (MV) is an interface that simultaneously displays video from all cameras connected to the system, as well as the referee output[1]. This allows you to comfortably follow the game and, if necessary, position on controversial moments.
Game Analyzer (GA) is designed to apply graphical elements and markup to live or recorded video. The markup can be in the form of focusing on an object, showing the trajectory of movement, borders, etc. This option allows you to analyze the moments that have occurred.

To switch from the main interface to the additional interfaces, use one of the options:

1. May not be displayed, depends on the selected layout.

-  : **Scroll Lock**;
-  : **Active**.

When using several additional interfaces for different functions, such as MV and Game Analyzer, press the Scroll Lock key repeatedly until the desired interface appears on the monitor.

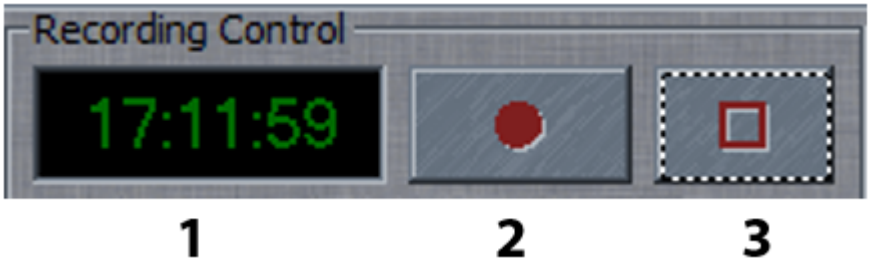
When using MultiSkin, exiting the MV on the touchscreen monitor is done by double-tapping on the window with the logo or Info (if available, in the bottom right corner) or by pressing the **Esc** key on the keyboard.

To return to the main interface, use one of the following options:

-  : **Esc** or **Scroll Lock**;
-  : **Active**.

Recording Control panel

The Recording Control panel has three functional elements:



1 – Time – the current time of the system clock;

2 – **Record** () button – start video recording;

3 – **Stop** () button – stop video recording.

Start the video recording in one of the following ways:

- press the **Record** button  in the Recording Control area of the program interface;
-  : **Ctrl + Shift + R**;
-  : **Alt + Ctrl + Shift + Mark**.

The video recording can be stopped in one of the following ways:

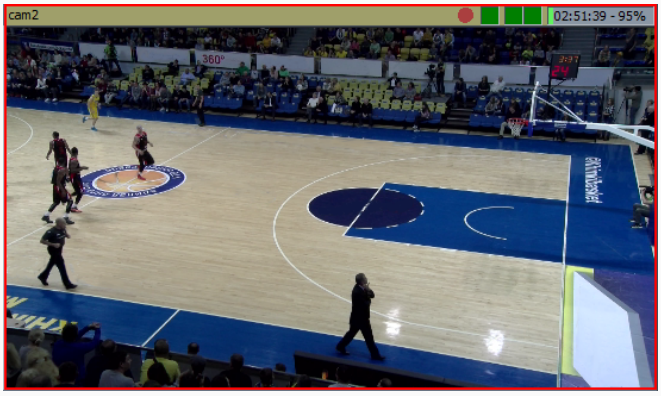
- click the **Stop** button  in the Recording Control area in the program interface;
-  : **Ctrl + Shift + S**;
-  : **Alt + Ctrl + Shift + ■**.

After you start the video recording, the recording control panel will look as:



The time indicator will be red while the recording is in progress.

When you start the recording, the recording indicator of each channel (unless the recording of the channel is prohibited in the settings) changes from a pause sign (⏸) to a recording sign (●):

	
The video is not recorded	The recording is in progress

Working with *videoReferee®*

The *videoReferee®* system functions available to the video engineer can be divided into two groups. The first group includes technical functions, namely:

- pre-match performance check of the *videoReferee®* server from the engineering interface;
- pre-match performance check of the referee's workplace;
- during the match – system monitoring, including the presence of signals on inputs and outputs, as well as monitoring of the recording to the built-in disk process;

- after the match – creation of a video report and export of other video materials, recording of the required video materials to a file media and handing it over to the referee team, organizer's representative or other authorized persons.

The second group of functions can be characterized as backup of referee and scoreboard controller functions. The video engineer needs to perform these actions only during the pre-match preparation while checking system performance and the connection to the scoreboard controller. Under normal conditions, these functions would conflict with the actions of the referees and/or distort the information from the match controller.
However, in case of a lost connection between the *videoReferee®* system and the scoreboard controller, the video engineer at the express direction of the main referee or the video assistant referee may perform the following actions:

- stop and start the match time counting by the referee's whistle, change the score, change the period number, as well as mark the goal scoring moments using the tools in the engineering interface;
- search and playback the desired game moment, place more accurate marks, include/exclude the marked game moments in the video report.

Please read the "videoReferee® – Manual for Video Referees" for a detailed description of the functions of the video referees.

Pre-match setup and checkup

During the pre-match preparation and testing of the *videoReferee®* system, two main aspects are checked:

- performance of the entire system in general;
- functionality of the referee's workplace with the use of the control console.

Preparation and inspection of the *videoReferee®* video engineer's workplace

- Ensure that the system date and time settings on the *videoReferee®* server are correct. Adjust these values if necessary. The *videoReferee®* software checks the system time only at startup, so you should make adjustments before starting the software.
- Check that the *videoReferee®* server receives signals from all video cameras connected to it. In the monitoring windows you should see live video from the cameras.
- Check the signal from the scoreboard controller[1]. It is recommended to check only when a video signal is available. Pay attention to the time remaining before the match starts parameter in the Live window, which shows the current values received from the scoreboard controller.
- Create a new project to record the match. It is recommended to name the project either with the abbreviated name of the teams (with a hyphen), or, if this name proves to be uninformative, to use the date of the match. In those rare cases when none of the recommended names is sufficiently informative, you can name the

1. If available and in use.

project at your discretion. However, there are two things to keep in mind. Firstly, the name assigned to the project will be displayed in the video report. Therefore, it should be informative and official. Secondly, it should not be too long, so as not to overload the video output on the engineering and referee monitors. Since the project is an object of the NTFS file system, you cannot use letters and symbols not recommended or prohibited for NTFS file names, and also take into account the limits on the maximum length of a file name.

- Make sure that the disk space for the project is reserved and sufficient. If there is not enough free disk space, the system will display a warning message, but for various reasons (such as holding down the Enter key for too long) it may be missed. Therefore, a good practice is to check the indication bars of all monitoring windows and to check the recording time remaining to the end of the project. The values should be the same in all monitoring windows. If not, find the *V:* drive of the *videoReferee®* server in Windows Explorer, delete one or more old projects or previously exported videos that have not been deleted, and recreate the project.
- After successfully creating a project, it is recommended to make sure you have 10-15% free space on the *V:* drive. This is not a mandatory requirement, but it is highly recommended that you free up the disk space in order to fulfill it, if possible. Remember that every time you free up disk space, you need to recreate your project, because otherwise the freed space will not be used, since the storage space for a project is reserved statically.
- Make sure that recording is enabled (not prohibited) for all cameras. To do this, check all indication bars of the monitoring windows and make sure that the "Record Unit Indicator" (the leftmost square in the general row of indicators) is not crossed out. The video engineers usually prohibit the recording due to camera malfunctions or connection problems, and this configuration may have been inherited from a previous match. If this is the case, you need to find out if the problems have been resolved and if so, you need to reconfigure the *videoReferee®* system and allow recording for those cameras.
- Start the recording.
- Open the Task Manager and make sure that the CPU load does not exceed 90% when the recorded material is played back, and 80-85% when it is not. If the load is higher – find out the reason and fix the problem. The two main potential reasons for processor overload are running processes that are unnecessary for the *videoReferee®* software and problems with disks. Problems with disks can cause extra processes to run, taking up additional processing resources and exacerbating problems that occur when recording to the disk. For example, PIO (Programmed Input/Output) mode, to which the operating system can switch the disk in case of failure; the input/output operations are provided by the CPU. If the CPU load is high, unnecessary processes must be terminated and problems with disk storage must be resolved. The absence of CPU load is also an indication of malfunctions, such as video data from cameras is not being encoded.
- Check the change of the time remaining for the recording in the indication bar of all monitoring windows. The values must change synchronously. Otherwise, there are problems with recording to the disks.
- Make sure that the *TE0* counter values in the message window is within the normal range. Due to the difference in operation speed of the cameras, the counter value for an individual camera can accumulate 1 or 2 frames per hour. If the accumulation rate is higher, it may indicate a malfunction, including processor overload, problems with recording to disk or with cables.
- Check the Record Unit and DMR™ status indicators (the fourth and fifth from the left, respectively) in the indication bar of each of the monitoring windows. They should not indicate any frame loss or recording to disk problems.

Should any disk problem[1] be detected during the pre-match checkup, the video engineer has the option to rebuild the RAID array by excluding the failed disk from the array. The *videoReferee®* system's performance is sufficient for a match without one disk. To identify the failed disk, you need to find the corresponding fault message in the Windows Event Viewer.

Setting up and inspection of the video referee's workplace

To check the performance of the referee's workplace (workplaces, if more than one is deployed), it is necessary to:

- make sure there is proper connection between the *videoReferee®* server and each of the referee workplaces, i.e., check that all video signals are displayed on the monitor and that the server responds to the commands from the referee control console;
- together with the video referee, carry out all the checks described in the "videoReferee® – Manual for Video Referees", section "*videoReferee®* operation check".

Working with the program

Start video recording

You can start the recording of the video with:

- click the  (**Record**) button in the Recording Control area of the program interface;
-  : **Ctrl + Shift + R**;
-  : **Alt + Ctrl + Shift + Mark**.

After you start the recording, the Recording Control area will look as shown below:



The time indicator will be red while the recording is in progress.

1. Our experience shows that a serious disk subsystem failure is never sudden, but is preceded by a period of time during which read and write performance deteriorates gradually rather than catastrophically. Checking your videoReferee® system regularly and replacing drives in time will ensure that problems are detected early and fixed proactively.

Scoreboard recording

When holding various competitions that require the use of a video refereeing system, the system is connected to a match controller installed in the arena so that the system can receive match data (time, period, score, etc.). Quite often, there is a situation when a match controller is installed in the arena, from which for some reason it is impossible to receive data using a direct connection. However, for a large number of game sports, synchronous recording of the video from cameras and match controller information is required. This is necessary in order to obtain a time reference of the video from the cameras to the game time when analyzing a controversial moment. To work in such situations, a special function has been developed. This function selects the game scoreboard from the video coming from any of the cameras, records it with a synchronous video channel and displays the recorded scoreboard with the PIP effect during search and playback.

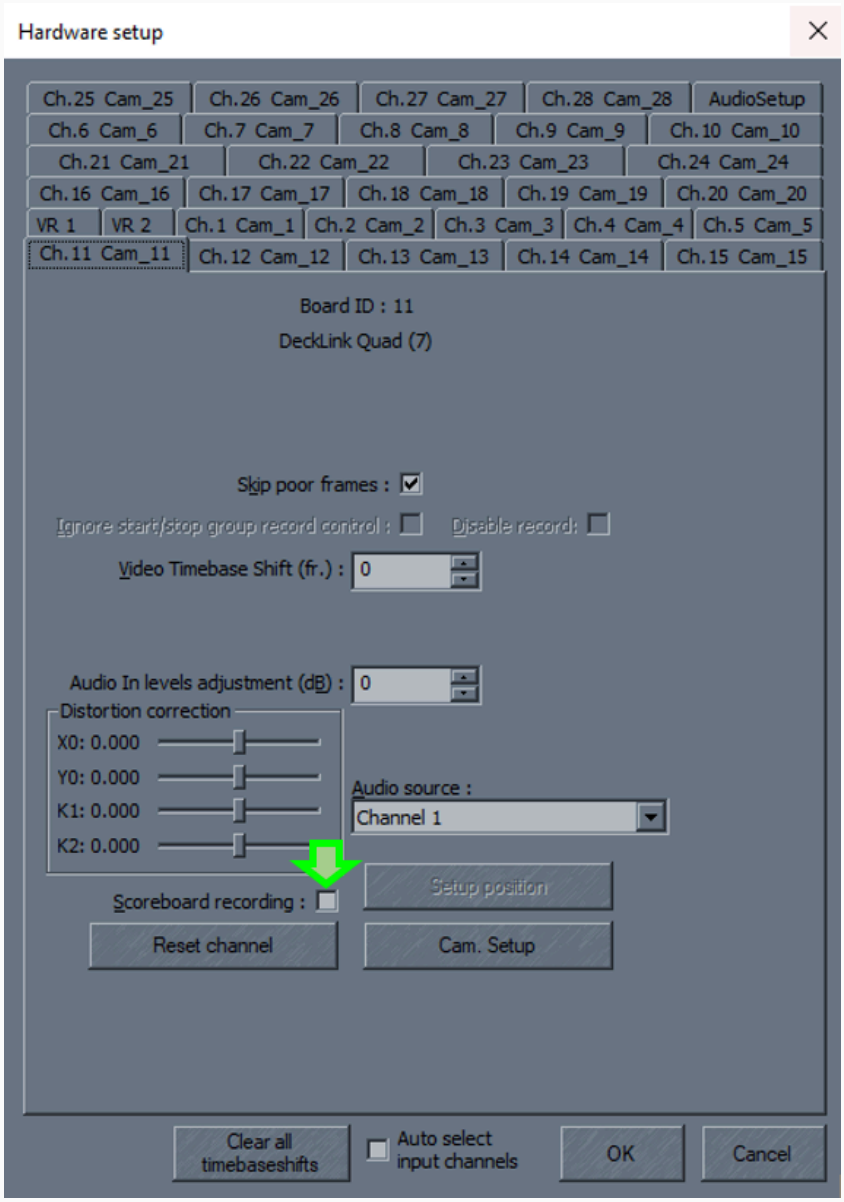
Any video channel with a clear image of the game scoreboard can be used to obtain the image. This can be a separate dedicated video channel[1] or any of the channels recording the game.

---

1. For video referee systems with a limited number of channels (videoReferee®-B, Jr. or videoReferee®-SR) there is a special option for connecting an additional video channel via the USB interface. With this option, any camera with an SDI or HDMI™ output can be used, including a consumer camcorder.

Enabling scoreboard recording

To enable scoreboard recording:
1) select a channel where the scoreboard is clearly visible and where the angle will not change throughout the match, remember the number of this channel;
2) open the menu: **Tools (**  **)** → **Hardware setup** → **Channel tab (Ch...)** with the number selected in the first step;
3) activate the "*Scoreboard recording*" parameter →



When the "*Scoreboard recording*" option is activated on another channel, it is automatically deactivated on the previous one.

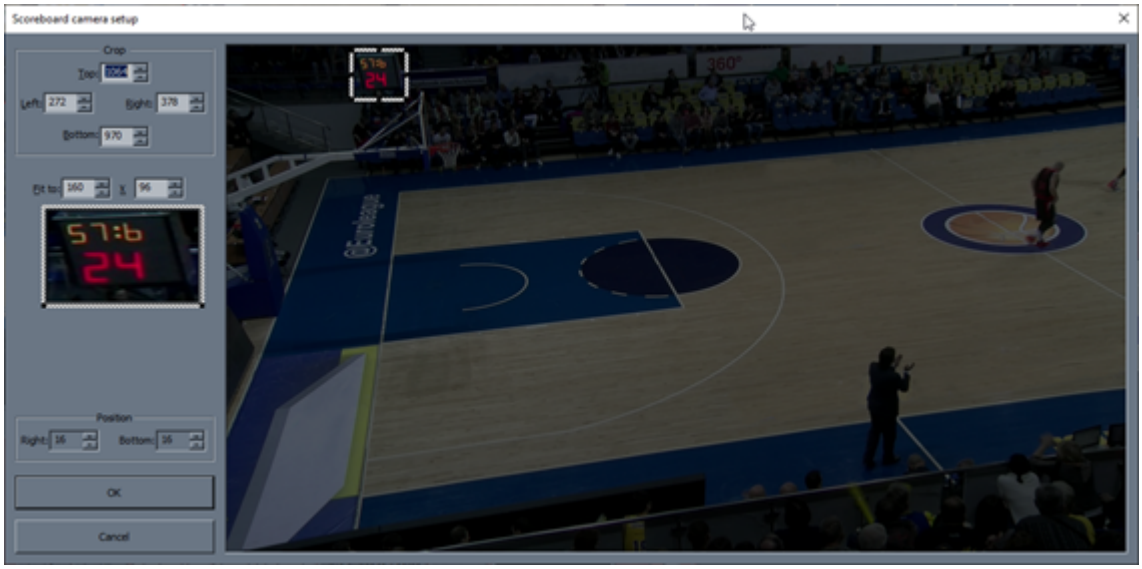
Setting up the display of the scoreboard

To set up the size of the scoreboard capture area click the **Setup position** button () in the *Hardware setup* window. In the *Scoreboard camera setup* window that opens, set up:

- the location and size of the capture frame – Crop.

- the size of the displayed area – Fit to.

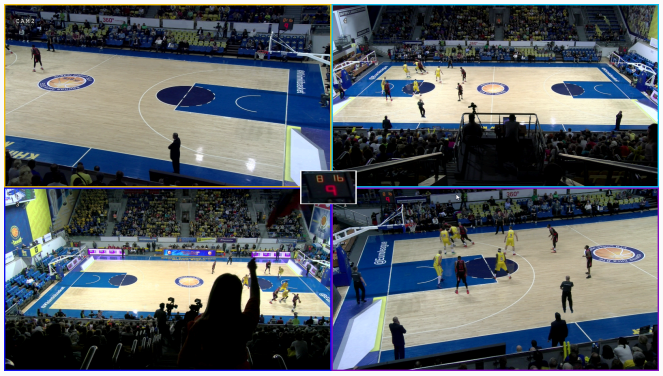
The mouse can be used for rough adjustment, and the buttons on the left side of the *Scoreboard camera setup* window – for more precise positioning.



The image in the *Scoreboard camera setup* window corresponds to the image in the channel at the moment the Setup position button was pressed in the *Hardware setup* window.
To save the settings, press the **OK** button.

> ⚠ The settings will not be saved without pressing the **OK** button!

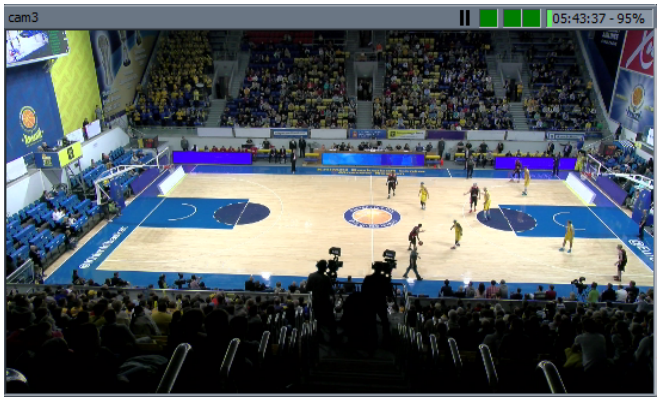
After closing the *Scoreboard camera setup* window, press the **OK** button in the *Hardware setup window*.
If the settings are correct, the scoreboard image should appear on the recorded video:

	
for one channel	for the quad

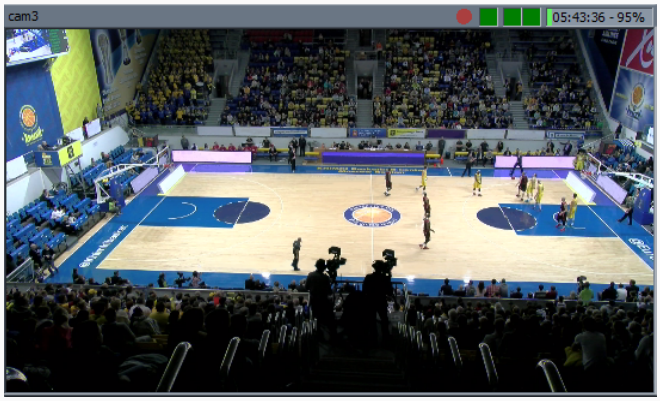
If the scoreboard is not displayed, the display of information about the game and operating mode may be disabled – the **Display** button in the control panel.

Recording indication

When you start the recording, the recording indicator of each channel[1] changes from a pause sign (⏸) to a recording sign (●):



The video is not recorded



The recording is in progress

Work with events

Create event

During the match, you can and need to create events.
An event is a time mark on the video which corresponds to the moment in time when it was placed. An event has no start or end point. The attributes of such mark are the moment in time when it was placed and the name of the mark. The created marks cannot be repositioned. You can create a new mark on the basis of the previously placed one:

1. go to the mark,
2. rewind to the required moment,
3. create a new mark.

The created event marks are displayed in the right part of the program window as a list, sorted by the time the event was created.
An event can be created both in Live mode (when watching the live video) or in Recorded mode (when working with the recorded video).
In Live mode an event can be created in one of the following ways:

- by pressing the 

(**Mark Live**) button in the engineering interface,

1. Unless its recording is prohibited in the channel settings.

-  : **Ctrl + M** or **[~]**.

In Recorded mode an event can be created in one of the following ways:

- by pressing the 

(**Mark Recorded**) button in the engineering interface,
-  : **Ctrl + Shift + M** or **Shift + [~]**.

 : **Mark** (in both modes).

Regardless of the method used, the event will be created and placed in the list of created events.
The referee monitors the video in all channels, and if he spots an interesting moment, he can press the **Mark** button immediately, or select the best camera angle, rewind the video to the desired moment (in the engineering or referee interface) and press **Mark** to create an event. When the referee starts searching through the video, the system will automatically switch from Live to Recorded mode.

In the Recorded mode, the **Rec | Live** button on the referee control panel will be backlit in yellow, and in the engineering interface the **Live** button will become unpressed.

When you create an event using the **Mark Live** button (in Live mode), the newly created event will be placed at the end of the event list.
When you create an event using the **Mark Recorded** button (in Recorded mode), the newly created event will be placed in the list between the existing events according to the time, when it was recorded.

Pressing the **Mark** button will create an event (Figure 11). Each created event is assigned a name, located in the status bar. The event mark contains the following information:

- time-code in the HH:MM:SS.NN format, where:
  - HH is the hour,
  - MM is the minute,
  - SS is the second,
  - NN is the frame number.
- event name (by default, *Ev:*);
- period number (P: 00);
- game time (T: 00:00);
- score (S: 0:0);
- fouls (F:0:0)[1];
- key (tag)[2] – additional mark; may include a description of the event (goal, offside, etc.) or the origin of the event (created by operator, referee, assistant referee, etc.).

1. Availability depends on system settings and sport type.
2. Depending on the system settings and the type of sport, it may be absent when creating events, but can be added manually for created events. Adding is possible from the program interface or from the remote control panel.

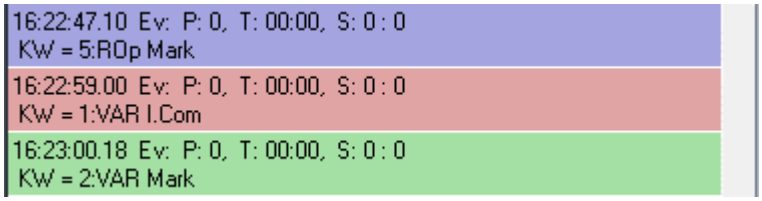


Figure 11 – Created events

In the event list, events can be displayed as text information about the event or include icons (frame of the moment). To customize the display, see the "Icons in the Event List" section of this manual.

Automatic event creation

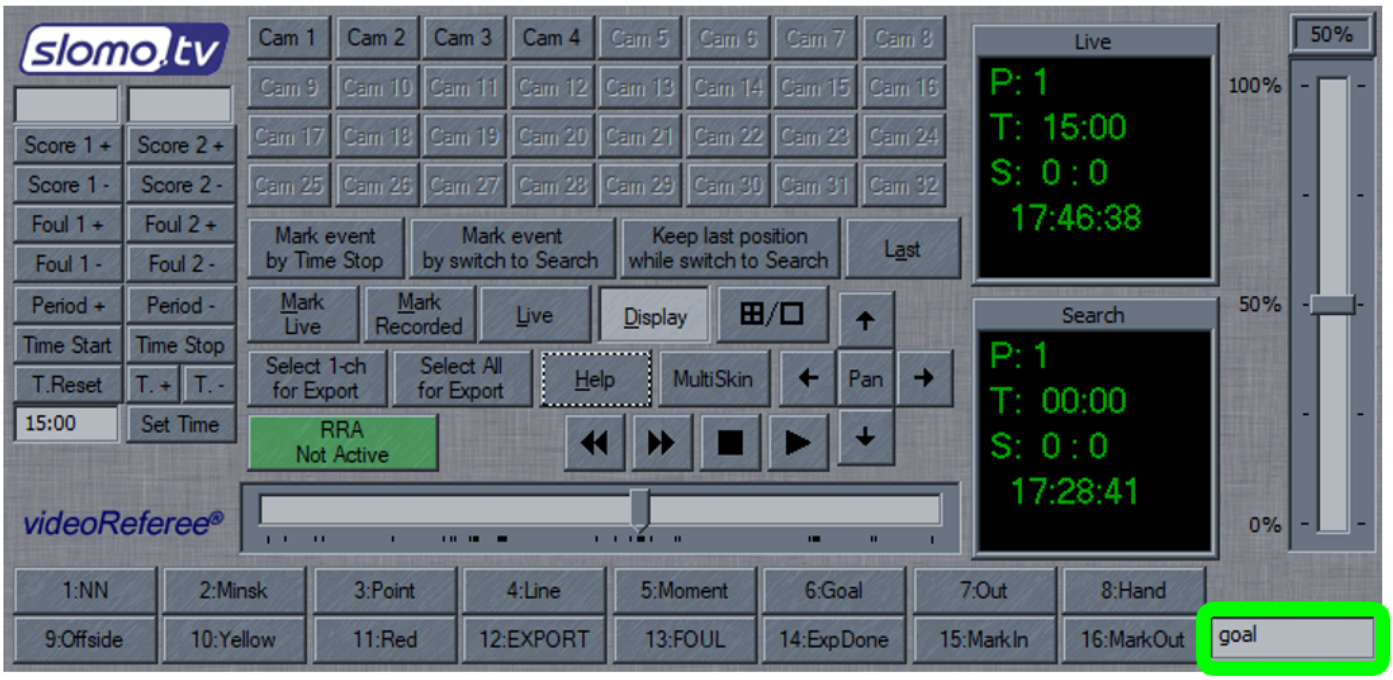
In addition to manual creation, events can be created automatically:

- when switching from Live to Search – see section Mark event by switch to Search;
- on stoppage time – see section Mark event by time stop;
- when some of the presets are selected. By default selecting a preset (**Ctrl + Ch.N**) on one of the first four channels (**Ch.1...Ch.4**) an event will automatically be generated and added to the event list[1]. The channel button may not have any presets assigned, but if the key combination for selecting a preset was pressed, an event will be created automatically.
- every 10 minutes within an hour – for convenient navigation through the recorded video material. This function is enabled by default and may become convenient in case when no event marks were created during the game in any other way, and the **Mark event by Time Stop** function was disabled.

Rename event

The created events have the default name *Ev:*. For further manipulation with the events and for quick identification of the event, this name can be easily changed to another one, suitable for the moment. To rename an event use the event name input field:

1. You can disable this feature or change the number of preset buttons that generate events. Please contact technical support to make these changes.



To rename an event:

- enter a desired event name in the name input field;
- select an event to be renamed in the list of events;
- right-click twice on the event status bar.

A new name will be assigned to the event.
If you use the same event name several times in a row, starting from the second use, a counter will be automatically added to the event name – Figure 12.
If you do not want to add a counter to an event, you must enter the event name before each renaming of the event and double right-click on the desired again.



Figure 12 – Event renaming

Event tags

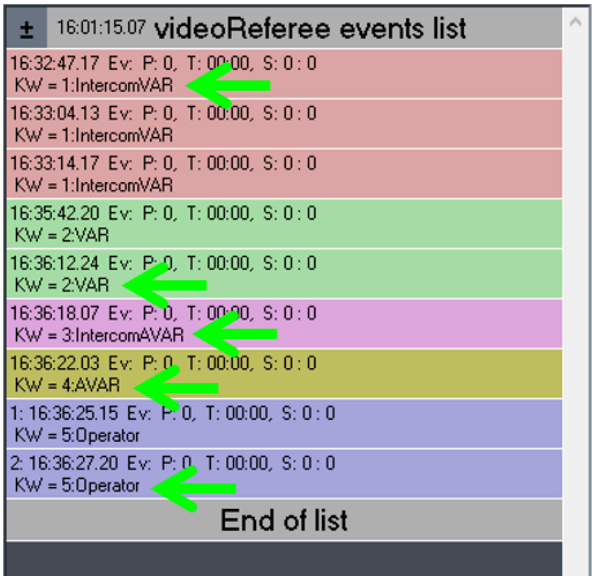
You can assign tags to the event in addition to the name. This can be done either from the program interface or from the control panel. Tags can be set both manually and automatically.

The tags can be used to describe an event (goal, offside, etc.) or to indicate the origin of the event (referee, assistant referee, operator, etc.).

Indication of event's origin

The tags indicating the origin of the event are created automatically and are color-coded[1] in the event list depending on the source[2]:

- the green referee button was pressed;
- the red referee button was pressed;
- the green AVAR's button was pressed;
- the red AVAR's button was pressed;
- actions from the control panel.



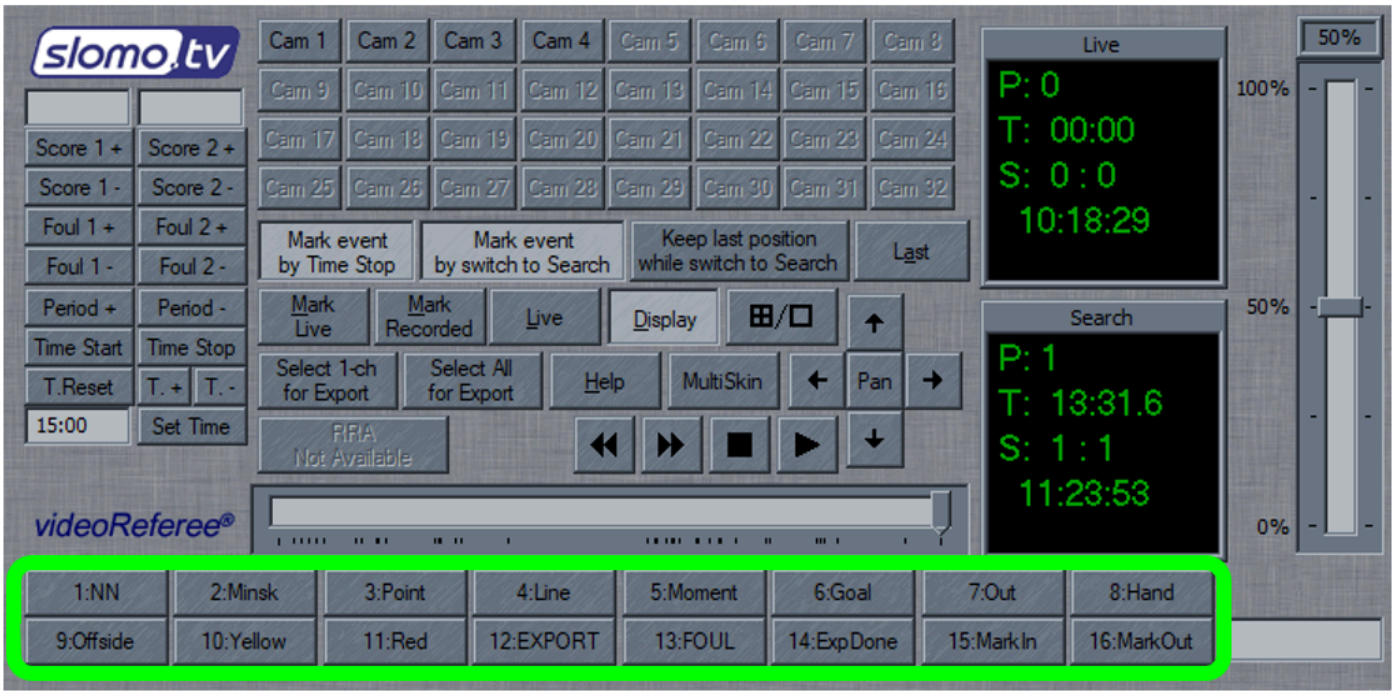
For example, keys can have the following color marking:
VAR – green – the event was created by pressing the green button of the referee;
IntercomVAR – red – the event was created by pressing the red button of the referee;
AVAR – yellow – the event was created by pressing the green button on the AVAR workplace;
IntercomAVAR – purple – the event was created by pressing the red button on the AVAR workplace;
Operator – dark blue – the event was created from the remote control panel.

Figure 13 – Color coding of events depending on source

Event description

To assign a tag to an event from the program interface, use the following buttons:

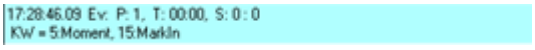
1. The colors can be changed by contacting slomo.tv technical support.
2. Can be changed by contacting slomo.tv technical support.



To assign a tag to an event:

- select an event in the event list;
- left-click on the button corresponding to the tag you want to assign.

The selected tag will be assigned to the event. Several different tags can be assigned to one event.



The tag buttons from 1 to 13 are used for marking game moments.
The tag buttons from 14 to 16 are used for marking events when compiling the video report:

In the program interface	On the control console	Meaning
14:ExpDone	**Alt + Ch.14**	The event has been exported. It is set automatically for previously exported events. If you try exporting events with this mark again, they will not be exported. Can be set / deleted. Has a light green highlight in the list of events.

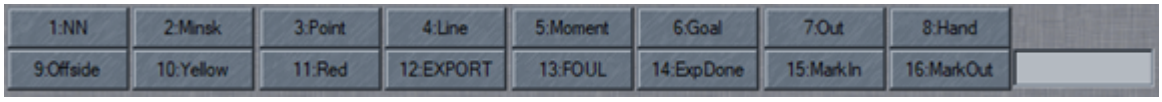
15:MarkIn	**Alt + Ch.15**[1]	Marks the starting point of the moment to be exported. Set automatically when selecting an event for export using the **Select 1-ch for Export** (S1) and **Select All for Export** (S2) buttons. Cannot be set/removed manually. Have light blue color in the list of events. Marks the entry point for the moment to be exported. It is set automatically when the event is selected for export with the **Select 1-ch for Export** (S1) and **Select All for Export** (S2) buttons. It cannot be set / deleted by the user. Has a light blue highlight in the list of events.
16:MarkOut	**Alt + Ch.16**	Marks the end point of the moment to be exported. Can be set / deleted. Has a light-yellow highlight in the list of events.

To assign tags with the control console, the **Alt + Ch.N** combination is used, or simply **Ch.N** if the tags assignment mode is enabled – the **Mode** button is blue.

The events with specific tag(s) can be further selected from the entire event list using the control panel. Use the [◄ ◄] and [► ►] buttons on the control panel to navigate through the events with selected tags.

Rename tag buttons

The tag buttons (from 1 to 13) can be renamed for your convenience. The length of the text displayed on the button is limited by the size of the button itself.
To rename a button, enter a new button name[2] in the name input field and right-click twice on the button you want to rename.



The new button name will be saved by the system, and the next time the system is started, the buttons will have the last used names.

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1. The remote key combination is used only for searching by this key.
2. The characters entered as the button name must be ASCII encoded. The non-ASCII characters may not be displayed correctly.

Search by tags

The search by tags is available from the control console – button  . After pressing the button, the search mode will be activated – the buttons will glow orange.
Light orange backlighting of channel button(s) indicates that tag(s) with this number have been assigned. When you press it, the button turns bright orange, indicating that the search by that tag has been activated.
Using the [◄◄] and [►►] buttons on the control panel or in the program interface, you can navigate through events with the selected tag only. Also, the search/playback timeline will display time marks only for events with the selected tag(s).
To exit the search by tags mode press **Mode**.

Delete event

To delete an event from the event list:

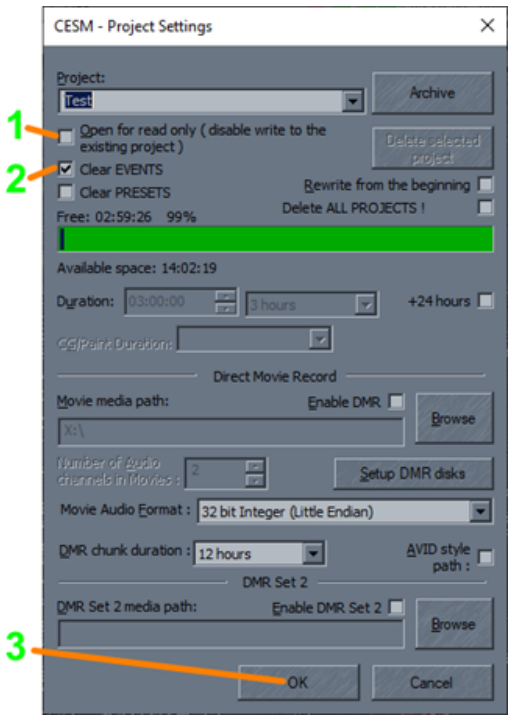
1. select the event you want to delete;
2. press the **Ctrl + Del** shortcut on the keyboard or **Mark + Ch.15** on the control panel.

> The event is deleted immediately after the key combination is pressed. This action cannot be canceled; the event cannot be restored after deletion.

You can delete an event from the control console only in the Recorded video mode. This function is not available in Live mode.

Deleting all events in the project

To delete all created events in the project, go to  **(Tools)** → **Change Project** and, in the window that opens:



1) uncheck **Open for read only**,
2) check **Clear EVENTS**,
3) press **OK**.

All the events in the project will be deleted (the recorded video will not be deleted).

Presets

The *videoReferee®* systems allow creating presets – configurable and saved camera sets (layouts) of 2, 3 or 4 cameras, which can be quickly accessed later by button combinations on the control panel.
Presets are assigned to the channel buttons **Ch.1...Ch.14**. A sequence of up to 16 presets can be assigned to each button.
Presets can only be created from the control panel.



The presets are saved by the program and are transferred from project to project.

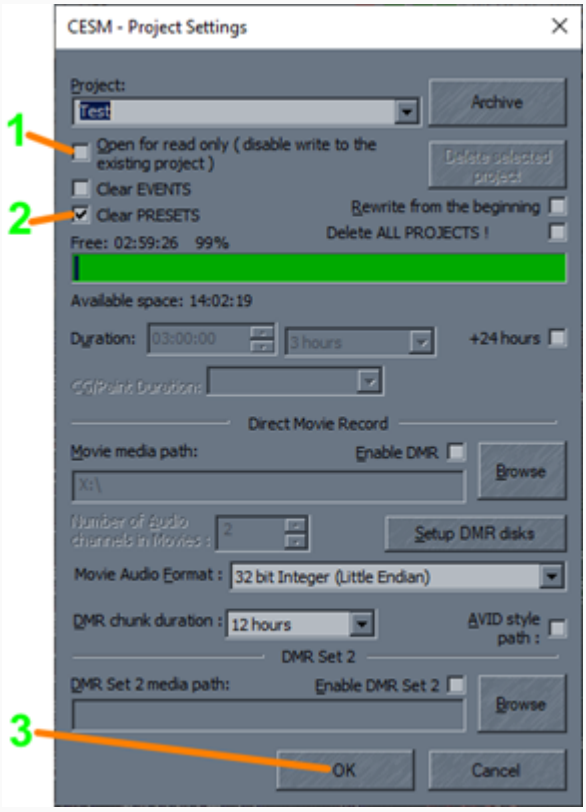
The mode of work with presets is activated by the **Mode** button – the button is backlit in purple.
Use **Ctrl + Ch.N** to quickly access the cameras from the preset mode.
For more details on working with presets (creating, selecting and deleting), see the "videoReferee® – Manual for Video Referees".

Deleting all presets in a project

To delete all presets in a project, go to  **(Tools)** → **Change Project** and, in the window that opens:

1) uncheck **Open for read only**,
2) check **Clear PRESETS**,
3) press **OK**.

All the presets in the project will be deleted.



Search through the recorded video

You can search through the recorded video in several ways:

- with the mouse using the search/playback timeline in the program interface;
- with the **Jog** wheel on the referee control console.

When using any of these options, the system will enter the Search mode, which will be indicated by the Recorded caption in the video output monitoring window and the referee monitor.
The search is performed on all channels simultaneously and the recorded video is displayed in the channel windows during the search.
If a separate monitor is used to display the Multiviewer, it will also display the search on all channels[1].

Stop the recording

You can stop the recording of the video with:

- the **Stop** button () located in the Recording Control area of the engineering interface;

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1. Available not for all configurations.

-  : **Ctrl + Shift + S**;
-  : **Alt + Ctrl + Shift + ■**.

Multiviewer

Selecting an active channel

The active channel is selected by single-clicking the left mouse button in the corresponding channel window.
If a touchscreen is used to display the Multiviewer, the active channel is selected by single-tapping (pressing) on the screen in the channel window.
Selecting an active channel on the Multiviewer is equivalent to selecting a channel in the main interface.

Displaying a channel in full screen

Double-clicking the left mouse button on the channel window causes the selected channel to expand to full screen. Double-clicking the mouse button again switches back to the Multiviewer (MV) mode.
Selecting a channel from the keyboard or on the remote control changes the selected full-screen channel.
If a touchscreen is used to display the Multiviewer, the channel is expanded to full screen by double-tapping on the channel window[1]. To return to viewing all channels, double-tap the screen again.
When a channel is expanded to full screen, the operating mode (live/recorded) on it does not change.

Changing Live / Recorded mode

There is no indication on the Multiviewer when switching from Live to recorded video mode.
When the channel is expanded to full screen, the operating mode on this channel does not change – Live is always on.

Video search

To search recorded video, in the referee's output window press the left mouse button and, without releasing it, move the pointer left or right depending on the search direction: backward or forward, respectively. The mouse cursor will look like this:  .
To speed up or slow down the search, the keyboard keys can be used additionally:

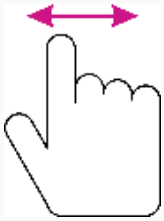
- pressing **Shift** slows down the search by 10 times;
- pressing **Ctrl** speeds up the search by 10 times.

The channel name is displayed during the search in the referee's output window on the Multiviewer.

1. Disabled feature. To disable, please contact technical support.

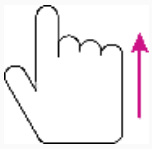
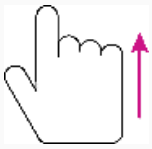
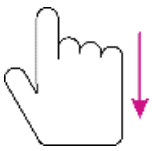
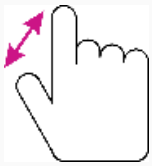
Gesture control on Multiviewer

If a touch screen monitor is used to display MV, then gesture control can be used:

Gesture	Description	Function
	Single tap with one finger on the channel	Select active camera
	Double tap with one finger on the channel	Expand channel to full screen
	Single finger left / right horizontally in the referee's exit window	Search video back / forward
	Double tap with one finger on the window with the logo or Info	Exit MV (when using one monitor)
Alt + 	Hold down the **Alt** key on the keyboard and single tap in the window of the channel for which the label is set	Create tag

Gesture control on the referee's monitor

If the referee output is displayed on a touch screen monitor, it can be controlled using simple gestures:

Gesture	Description	Function
	Single tap with one finger	Select active camera
	Single tap with two fingers	Expand the channel to full screen / minimize the channel During playback – Stop.
	Quick upward swipe with one finger	Change camera while one channel is displayed in the full-screen mode
	Slide with one finger left / right horizontally	Search backward/forward through recorded video
	Gentle upward swipe with one finger	Starts playback at a certain speed Increases the playback speed
	Downward swipe with one finger	Stops playback Slows down the playback speed
	Spread / bring together two fingers	Zoom in/out the video in the channel
	Double tap with one finger	Go back to Live

Export of events (creation of a video report)

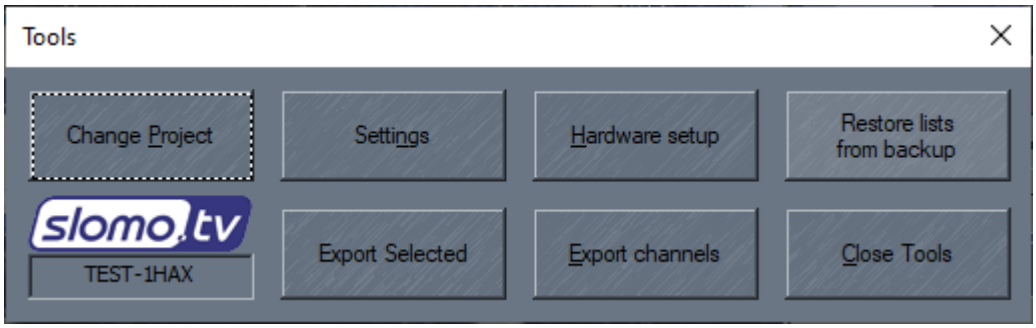
A video report must be generated at the end of the match; it is formed from the marked game moments. This does not mean that the video report automatically includes data from all cameras for each marked moment. If an event has been marked automatically, but it does not contain any key information, there is no point in including it in the video report. The video report will be too large, unnecessary information will complicate further work.

Therefore, for each marked game moment, you should specify whether it should be included in the report, and the information from which camera should be included. In most cases, the video referee will indicate the need to include a game moment in the video report immediately as it occurs or while reviewing it. However, if necessary, the referee may review all marked moments with the video engineer and ask to include or exclude them from the report.

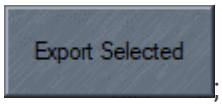
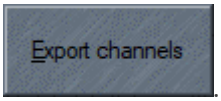
Remember that 10 seconds preceding the mark and 5 seconds after the mark are saved in the report. The mark should be set so that the 15-second video is evidentiary. If it is not, it is worth placing a new, more accurate mark.

The *videoReferee®* provides several options for exporting created events and recorded video footage. All export options are available in the *Tools* menu.

To access the *Tools* menu, press the  (**Tools**) button on the toolbar or the keyboard shortcut **Ctrl + Shift + T**.



The following export options will be available in the open *Tools* window:

1. export of selected events –  ;
2. export of channels –  .

The detailed description of each export option is provided further in the Manual. Before you start exporting, you should select events and cameras, from which each event will be exported. This requirement does not apply to exporting of a selected channel (Export channel). If you need to export selected channel(-s), refer to the "Export of selected channels" section of this Manual.

> The export can be performed only after the video recording is stopped (see section "Stop video recording").

If the video is recorded in interlaced format (1080i, 720i, etc.), deinterlacing is automatically performed when exporting[1].

Selection of events for export

Use **Select 1-ch for Export** and **Select All for Export** buttons in the interface or **S1** and **S2** button on the control console respectively to indicate to the system that the moment should be included in the video report.
For basketball[2], the buttons are configured as follows:

- **Select 1-ch for Export (S1)** – the active camera of the selected moment is included in the report;
- **Select All for Export (S2)** – all cameras are included in the video report.

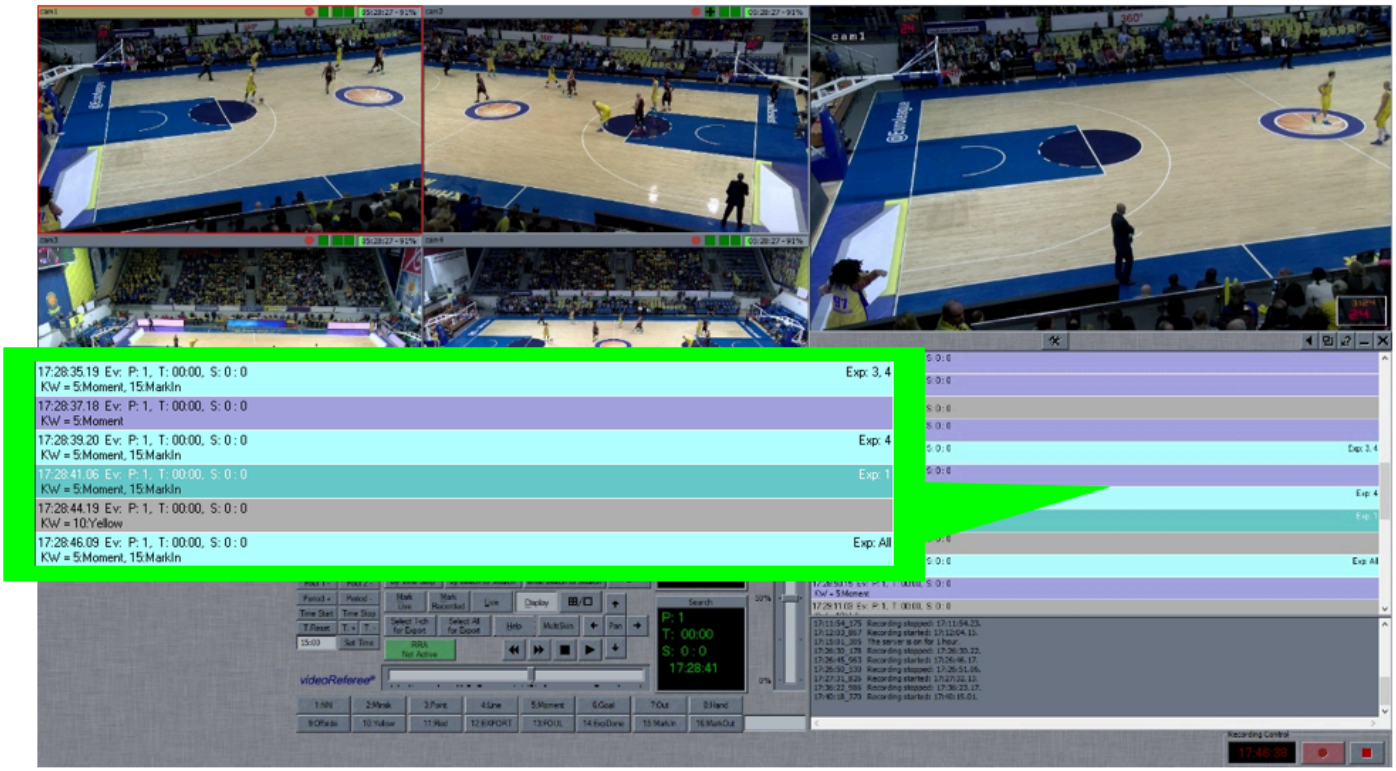
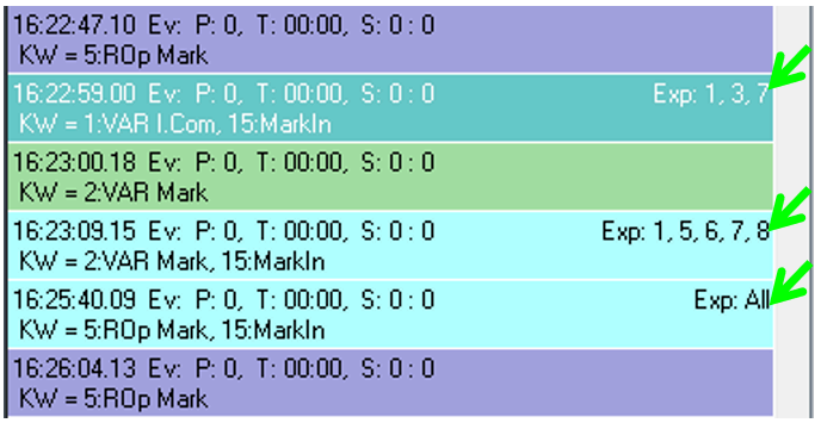


Figure 14 – Selecting cameras for export

Should it be needed to include all cameras except for the active one, place two marks – **S1**, **S2** (Figure 15).
If there is no longer a need to record an episode or a group of cameras (for example, **S1** or **S2** were pressed accidentally), then pressing the button again removes the corresponding mark. To exclude a specific camera, select an event and make the camera active, for which the mark is removed. Then press the **Select 1-ch for Export (S1)** button again.

1. To disable this operation, contact technical support.
2. The combination of selectable cameras can be changed by contacting technical support.



One active camera will be exported for the event – *Exp.1*
Several cameras will be exported for the event – *Exp. 1, 5, 6, 7, 8*
All cameras will be exported for the event – *Exp. All*

Figure 15 – Export marks



When you place an export mark for an event, a **Mark In** tag is automatically assigned to the event. The event changes its color in the list to light blue indicating that the Mark In tag has been set.

Duration of exported moments

When generating a video report based on export marks, there are two options to specify the duration of the moments to be exported:

1. *Standard* – by marking the events with **Select 1-ch for Export (S1)** and **Select All for Export (S2)** export marks – 10s before the event mark and 5s after it[1] are recorded in the report. The event mark should be set

1. This setting can be changed by contacting technical support.

so that the video that fits into the 15-second is evidential. If it does not, you should place a new, more accurate mark.

2. *Custom* – the duration of exported moments is affected by the **Mark Out** tag. If the **Mark Out** tag is placed close[1] to an event with **Mark In** tag, a video segment with the duration from **Mark In** to **Mark Out** will be exported. If the **Mark Out** tag is set too far, it will have no effect on the duration and the events will be exported with the default duration of 15 seconds.

The **Mark Out** tag can be placed:

- from the control console using the **Alt + Ch.16** or just **Ch.16**, if the tag assignment mode is enabled – the **Mode** button is blue;
- with the 

button in the program interface.

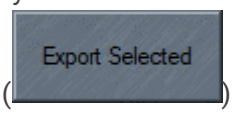
If a **Mark Out** tag is placed but there is no **Mark In** tag, it does not affect anything.

> Marking nuances:
> If multiple moments are marked for export, for example, if two or three moments are marked in a row and then there is a **Mark Out** tag a little later, then each of those marked moments will have that **Mark Out** as its endpoint. They will have different beginnings, but the endings will be the same. Therefore, it makes no sense to set several marks for export within one **Mark Out**.

After marking up events for export, you can perform the export operation.

Export of selected events

The Export Selected function in the *Tools* menu allows you to export the marked events in HD quality to a ***.mp4** or ***.m2ts**. The created file contains a 3-second intro, which displays the event info, has no subtitles; match information is "burned" directly into the video.

Clicking the **Export Selected** (

) button in the *Tools* opens the Export Selected window shown in the Figure 16.

1. For HD video, no further than approximately 6 minutes. This setting can be changed by contacting technical support, but may not exceed 15 minutes.

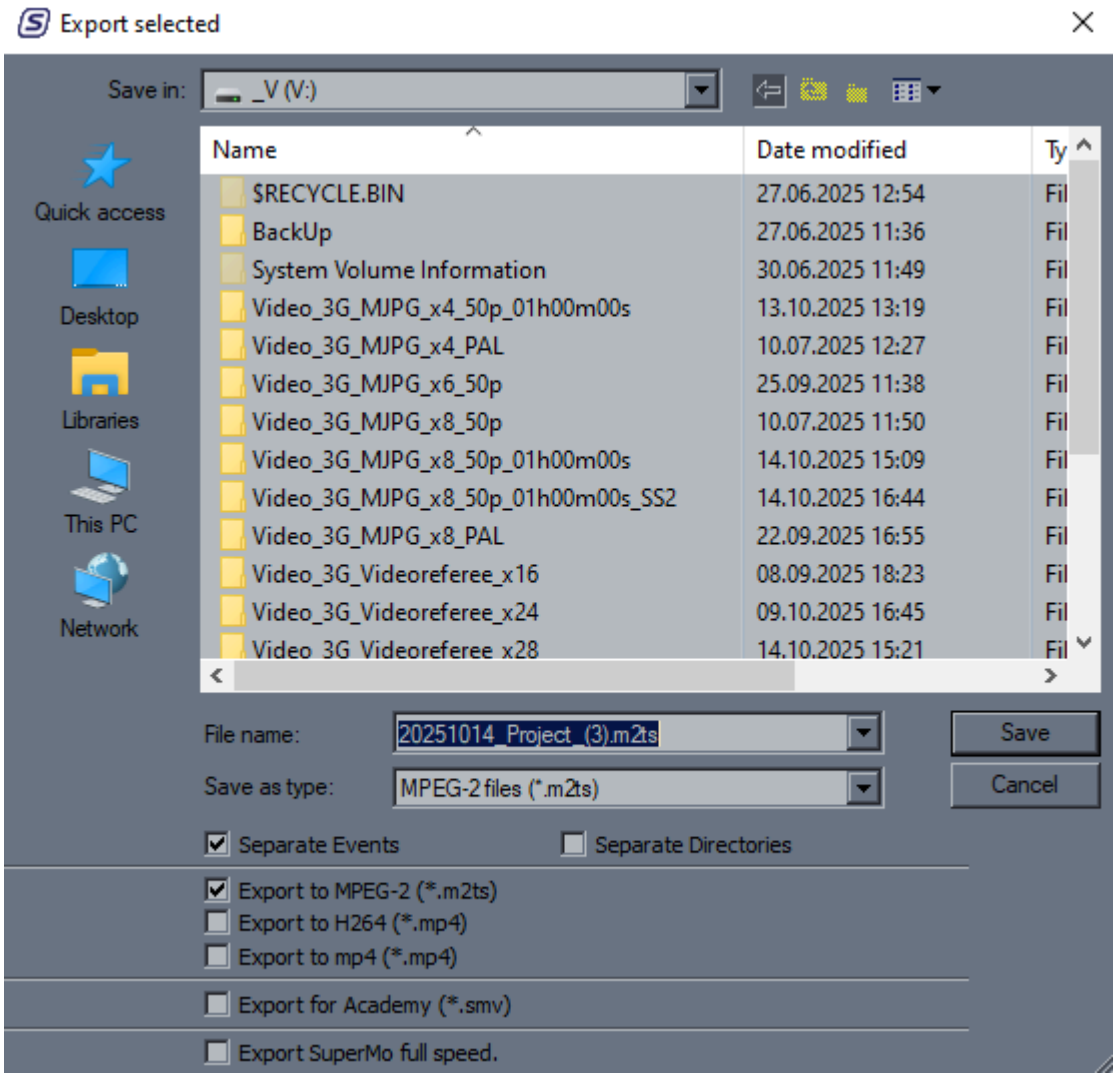
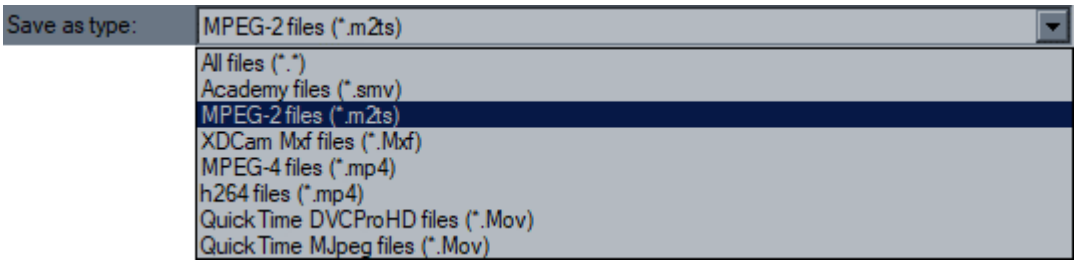


Figure 16 – Export Selected window

In this window, you can set the parameters for export, specify where to save the file and the name of the file. When exporting, the following parameters of the file to be created can be specified:

- file location – where the file is to be stored (disk and folder);
- file name. The default name is the name of the current project;
- file type – Save as type:



- Separate Events – select if you want to create separate video files for each marked moment. If there are multiple cameras selected for one event, the video from them will be combined into one file;

- Separate Directories – if enabled, files in different formats are organized into subdirectories. By default, the directories are named m2ts, h264, mp4, mxf, smv, and the recording date is added to these names.
- Codec:

Export to MPEG-2 (***.m2ts**)	good quality video files, small size (but larger than H264), fastest export process
Export to H264 (***.mp4**)	high quality video files, small size, slowest export process
Export to mp4 (***.mp4**)	video files with the worst image quality, smallest size possible

To select several codecs at the same time, use the **Ctrl** key + codec. However, if "Separate Directories" is not selected, only one of the following two codecs will be selected:
– Export to H264 (***.mp4**);
– Export to mp4 (***.mp4**).

- Export for Academy – export video in a specialized format for further use in Academy training servers.
- Export SuperMo full Speed – set if you want to export video from high-speed (SSM) cameras at normal speed – without the slow-motion effect. In this case excess frames from SSM cameras will be discarded. If this option is not selected, video from SSM cameras will be exported at a slowed down speed proportional to the camera shooting speed used.

After entering the parameters, click the **Save** button.

During the export, the progress window will open (Figure 17). If necessary, you can abort the operation by pressing the **Stop** button (Figure 18a). When the export is complete, the progress window will close automatically and a message will be displayed indicating that the export operation is complete (Figure 18b).

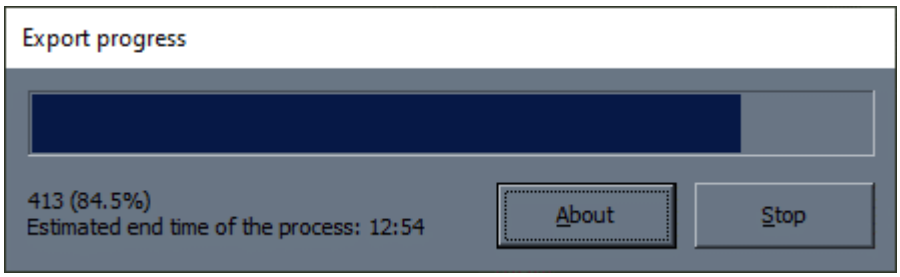
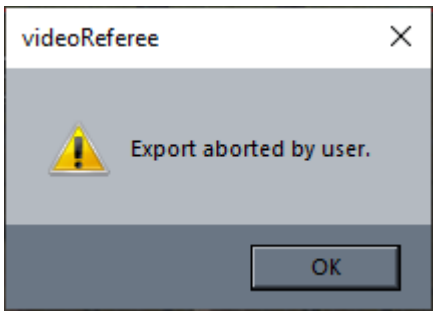
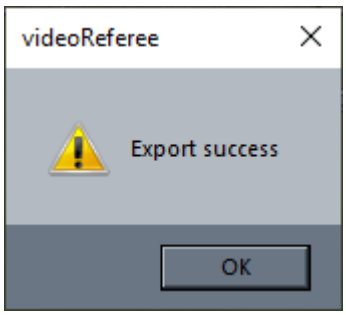


Figure 17 – Export Selected progress window

If you abort the export process, the already created file will not be deleted automatically. If you do not need it, you should delete it manually.



a) The export was aborted by the user



b) The export is completed successfully

Figure 18 – Export completion

Press **OK**.

All exported events are placed in a folder with a name composed of the selected codec and the current date. For example, *m2ts_2023_02_07*.

The name of the created file will consist of:

- project name;
- period number;
- game time;
- event creation time.

Example: *Test_P1_T29_54__D17_48_13.m2ts*.

For each event, the created video file is preceded by a 3-second intro that displays technical information:

– server name and serial number;
– export date;
– record date;
– project mane;
– start time of recording.



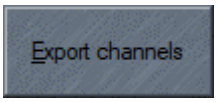
Export of selected channels

The Export channel function on the *Tools* menu allows you to export video from one, several or all channels.

> The export can be performed only after the video recording is stopped (see section “Stop video recording”).

Export of selected channel

Select the channel (make it active) from which you want to export the video.

Then open the export window:  **(Tools)** →  **(Export channels).**
The export window shown in the Figure 19 will open.

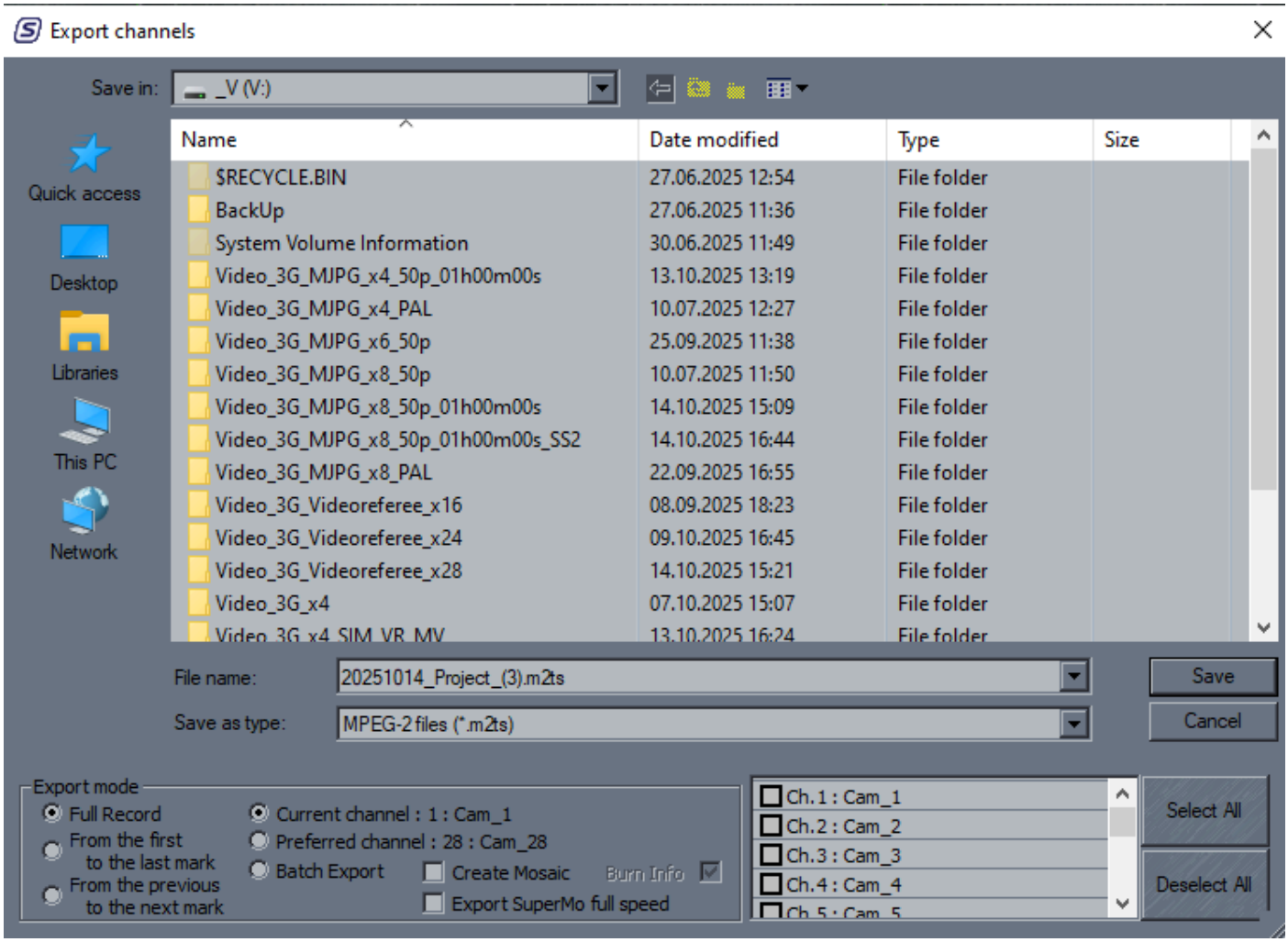


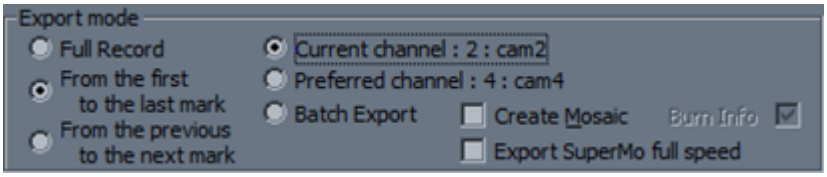
Figure 19 – Export channels window

The following parameters of the file to be created should be specified:

- location to save the file (disk and folder) – Save In;
- name of the file to be saved (File name). The default name is the name of the current project;
- file type (***.mp4**, ***.m2ts**, ***.Mxf**) – Save as type:



- in the Export mode section, select the length of the video to be exported:
  - Full Record;
  - From the first to the last mark;
  - From the previous to the next mark.
- in the Export mode section select Current channel:



- Export SuperMo full Speed – set if you want to export video from high-speed (SSM) cameras at normal speed – without the slow-motion effect. In this case excess frames from SSM cameras will be discarded. If this option is not selected, video from SSM cameras will be exported at a slowed down speed proportional to the camera shooting speed used.

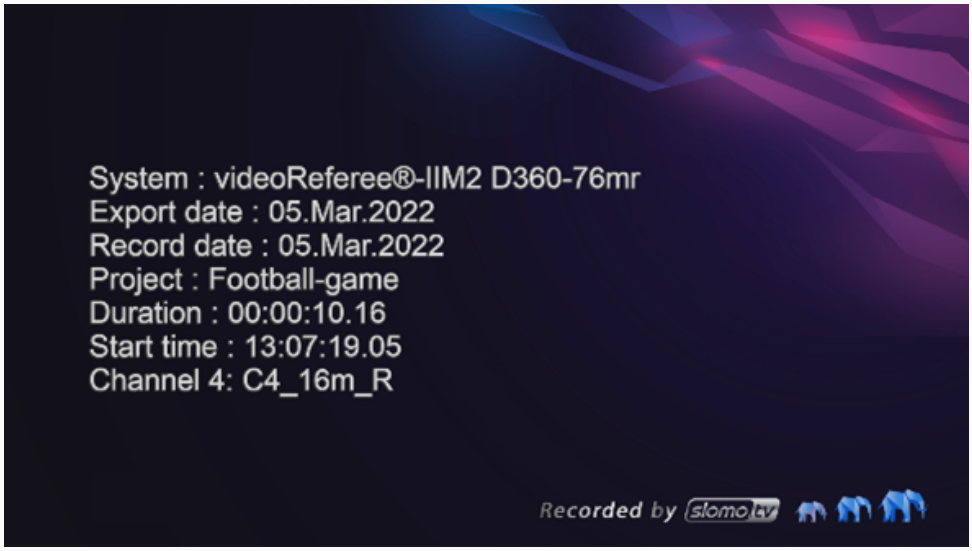
When all the settings are made, click **Save**.

During the export, the progress window will open (Figure 17), When the export is complete, the progress window will close automatically and a message will be displayed indicating that the export operation is complete (Figure 18b).
The name of the created file will consist of:

- project name;
- channel number;
- channel name;
- start time of recording;
- export date.

Example: *Test_1_L_Top_17_28_12_04__07.Feb.2023.m2ts*.
The created video file is preceded by a 3-second intro that displays technical information:

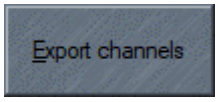
– server name and serial number;
– export date;
– record date;
– project mane;
– recording duration;
– start time of recording;
– channel number.



The channel name is displayed in the video.

Batch export

To export several channels or all channels at once, the program has a batch export option.

To perform a batch export, open the menu:  **(Tools)** →  **(Export channels)**.

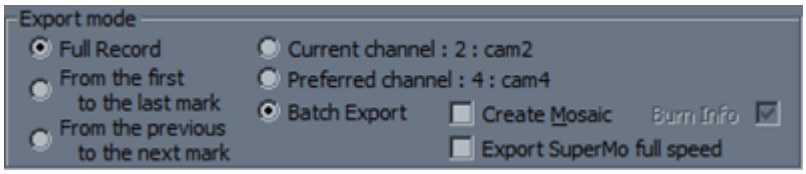
The export window shown in the Figure 19 will open.

The following parameters of the file to be created should be specified:

- location to save the file (disk and folder) – Save In;
- name of the file to be saved (File name). The default name is the name of the current project;
- file type (***.mp4**, ***.m2ts**, ***.Mxf**) – Save as type:



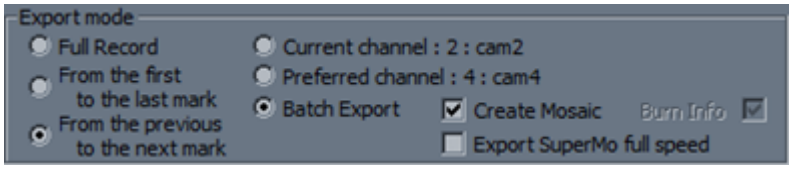
- in the Export mode section, select the length of the video to be exported:
  - Full Record;
  - From the first to the last mark;
  - From the previous to the next mark.
- in the Export mode section select Batch Export:



- Select the channels for export by checking/unchecking the boxes – all channels (Select All) or only the necessary channels:



- To create a separate video file containing all channels/selected channels simultaneously displayed on one screen (Figure 20), check the Create Mosaic checkbox:



A video created using *Create Mosaic* allows you to play all exported channels simultaneously on one screen. The name of the created video file will consist of:

- project name;
- word "mosaic";
- start time of recording;
- export date.

Example: *Test_Mosaic_18_11_36_01__07.Feb.2023.m2ts*.

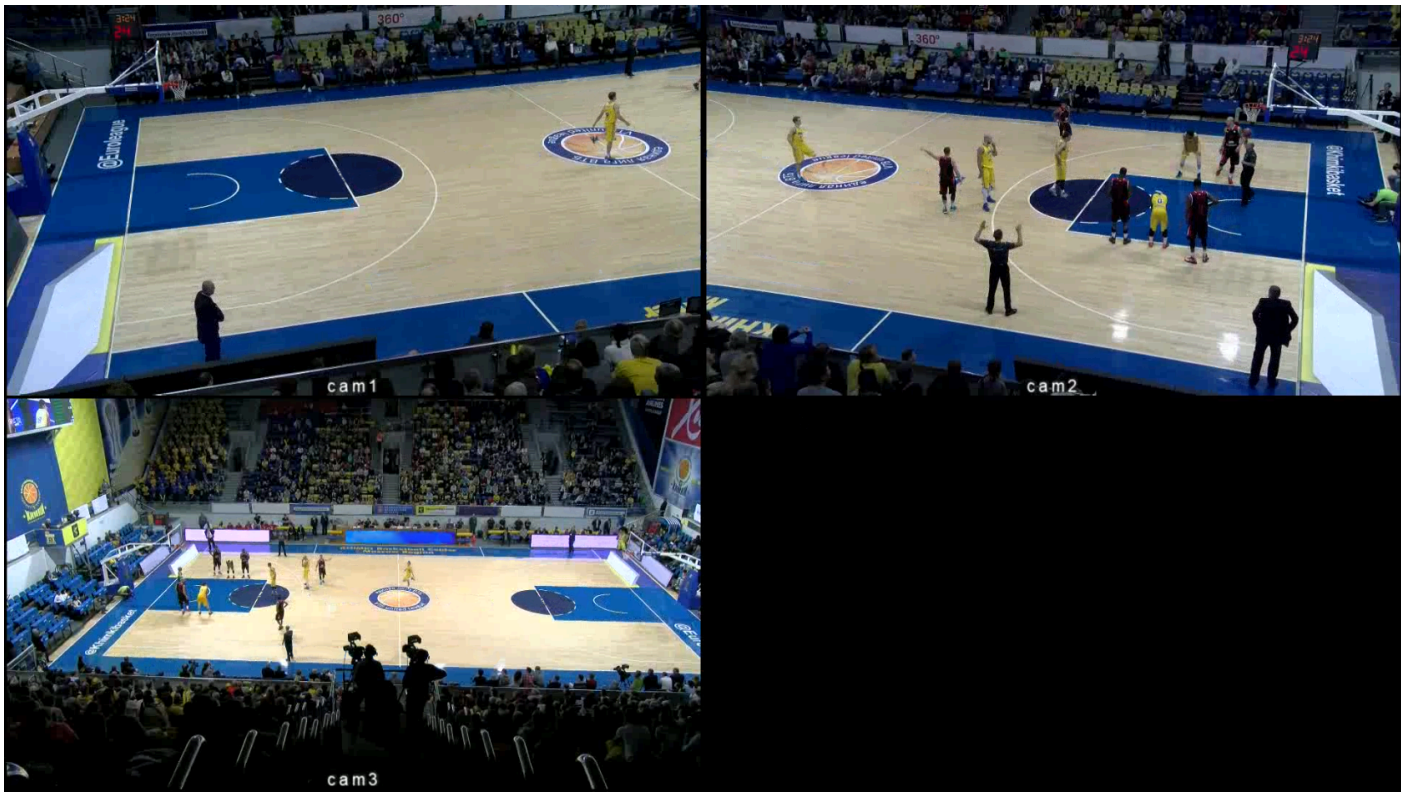
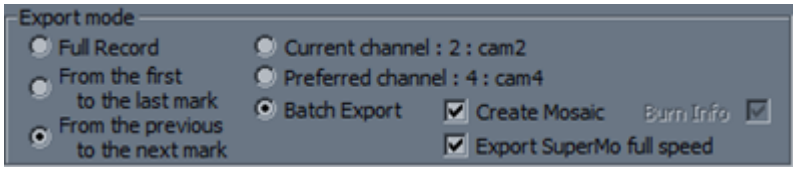


Figure 20 – Example of Mosaic Export

- Export SuperMo full Speed – set if you want to export video from high-speed (SSM) cameras at normal speed – without the slow-motion effect. In this case excess frames from SSM cameras will be discarded. If this option is not selected, video from SSM cameras will be exported at a slowed down speed proportional to the camera shooting speed used.



When all the settings are made, click **Save**.
During the export, the progress window will open (Figure 17), When the export is complete, the progress window will close automatically and a message will be displayed indicating that the export operation is complete (Figure 18b).

The name of the created file will consist of:

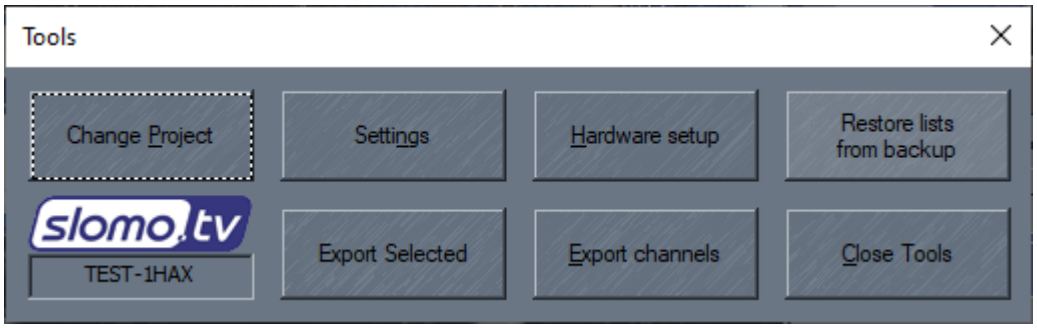
- project name;
- channel numbers;
- camera names.

Preview of exported video files

The *videoReferee®* server has preinstalled **VLC** video player to preview the videos you have exported. The video files can be viewed in a variety of video formats.

Program settings – *Tools* menu

The program tools are located in the *Tools* menu. To access them in the toolbar, press the  (**Tools**) button. After pressing it, the window will be opened:



The *Tools* window also displays the serial number (S/N) of your server (in the lower left corner).

Project archiving

When you switch to working with 3G-SDI signals (1920x1080 50p), the data stream recorded to the hard disk doubles. As the result, the HDD-based system is operating at the limit of its performance. There are several ways out of this situation.
The first way is to reduce the operation speed. In fact, it makes the system less interactive. For example, four channels will be searched at 1 frame per second.
The second option is to replace HDDs with high-performance SSDs. The use of SSDs has many advantages, such as faster search through the recorded material. However, the price of this solution is quite high.
The third way is based on the fact that HDDs have maximum performance at their physical beginning. Based on this knowledge, this part of the hard drive can be allocated as a "fast" video array, where there is no slowdown or degradation of the recording/searching process. However, the size of such an array is small and allows you to record only one or two games, depending on the duration. The second part of the disk array may be used to store recordings of matches which should be saved for further analysis or for submission to the Federation on request. Thus, the main work is performed on the array created from the high-speed part of the hard disks, and the rest of the disk space is used for archiving.
A hybrid disk subsystem is also possible, in which the small (i.e.,"fast") part is made on the basis of high-performance SSDs, and the hard drives create an archive subsystem to which the data is archived.
This third option is implemented in slomo.tv HDD-based *videoReferee®* systems with support for 3G-SDI signals. The **Archive** button allows you to transfer the projects recorded on the "fast" part of the array to

the "slow" part. In this case, it is possible to work with the recorded material in the same way as with the projects in the "fast" part.
Since during the "offline" work with the recorded material (review, analysis of moments, training, etc.) the recording to disks is not performed, the work with the "archive" array is as quick as the work with the "fast" one.



We recommend archiving all finished projects.

To access the project settings, click the  button in the toolbar or press the keyboard shortcut **Ctrl + Shift + T**. The *Tools* window will open:

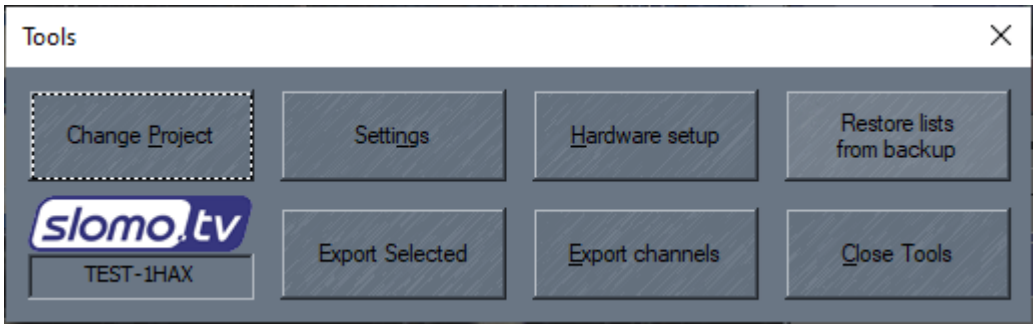
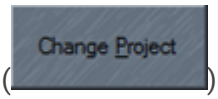
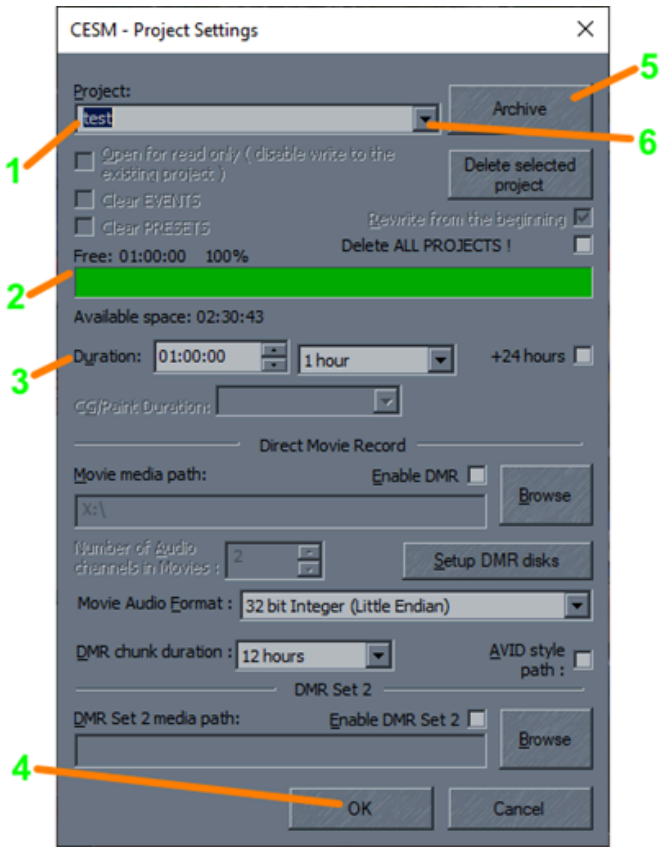


Figure 21 – Tools window

To access the *Change Project* menu in the *Tools* window, click the **Change Project** button (

). After clicking, the *Project Settings* window will open – figure 22:



1 – entering the name of the new project
2 – digital and graphic display of free space on disks
3 – indicating the duration of the project (in one of two fields)
4 – confirming the entered settings
5 – archiving previous projects
6 – selecting and opening a previously created project

Figure 22 – Окно CESM – Project Settings

To archive a project (Figure 23):

1. select the project you want to archive in the "*Project*" field,
2. click the **Archive** button,
3. in the confirmation window (Figure 24), click **Yes** to continue, or **No** to cancel.

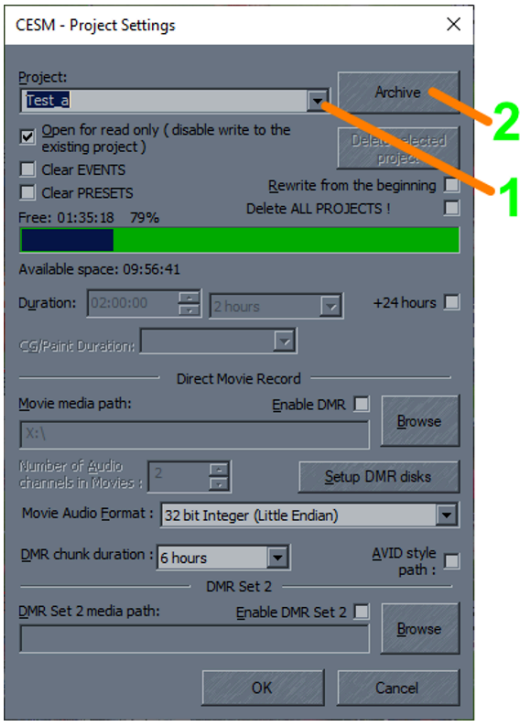


Figure 23 – Project Settings – Archive project

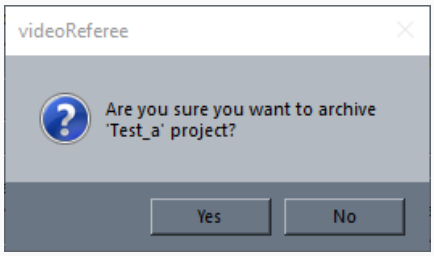
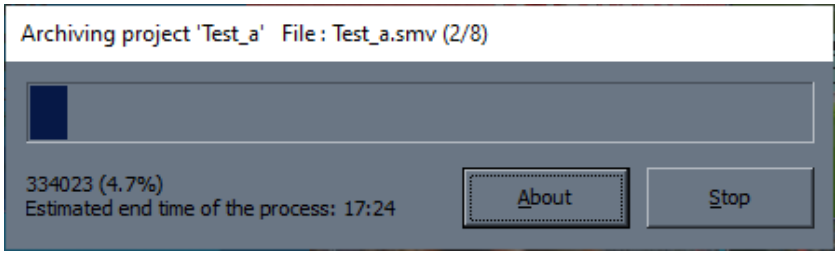


Figure 24 – Confirmation of project archiving

During the archiving process, the progress window will be shown (Figure 25). It will be closed automatically, when the archiving is done.



To abort the archiving, press **Stop** button.

Figure 25 – Archiving progress window

After pressing the **Stop** button, the window to confirm the abortion of the archiving process will open (Figure 26). Press **Yes** to continue, or **No** to cancel. If the **Yes** button was pressed and the archiving was aborted, the confirmation message will appear – Figure 27.

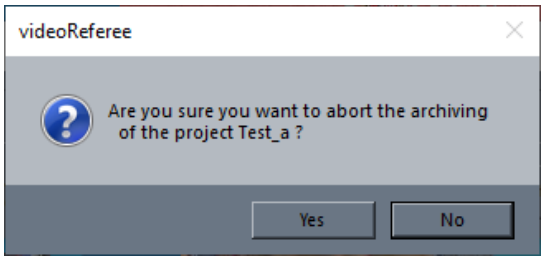


Figure 26 – Confirmation window - Abort archiving

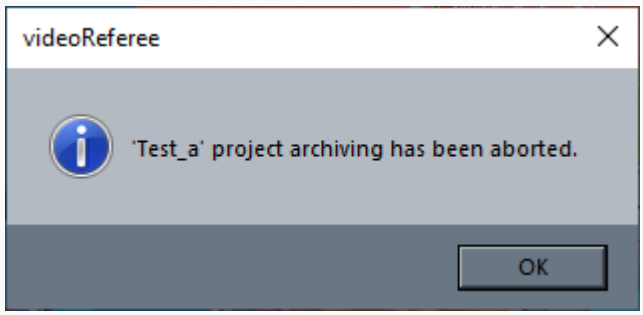


Figure 27 – Information window – Successful abortion of archiving process

If the project has been archived successfully, the "*A:*" prefix will be shown in front of the project name in the *Project Settings* window. Also, a message stating that the project has been archived will be displayed above the project name – "*The project has been archived*" – Figure 28.

If the project archiving has been aborted, this project has a "*P:*" prefix before the its name, and a message "*The project archiving has been paused*" is displayed above the project name – Figure 29. To finish an interrupted archiving, simply click the **Archive** button for such a project again and wait for the archiving process to finish.

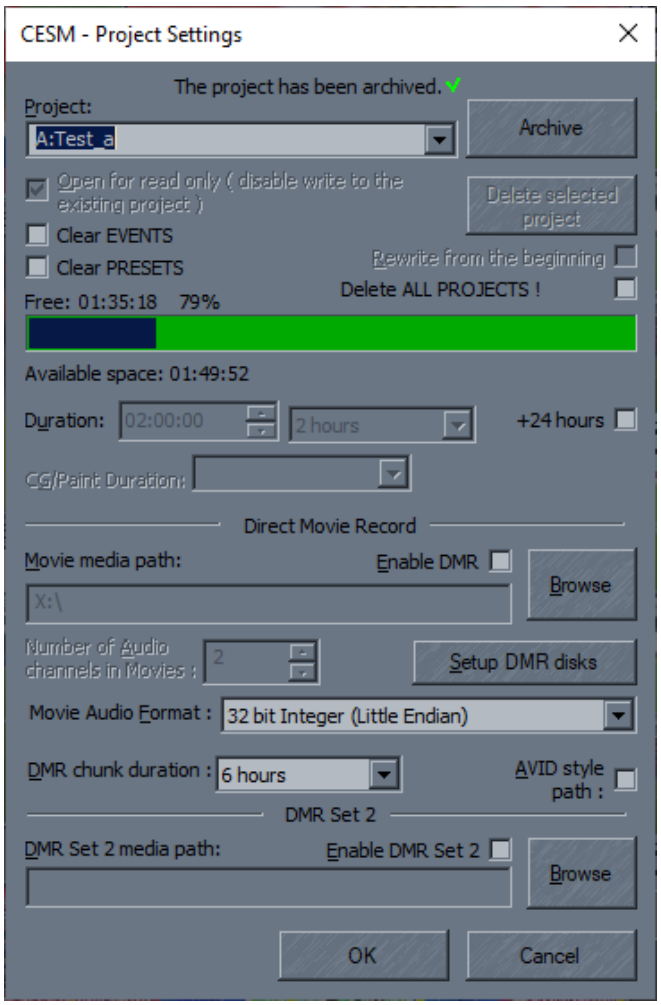


Figure 28 – Archived project

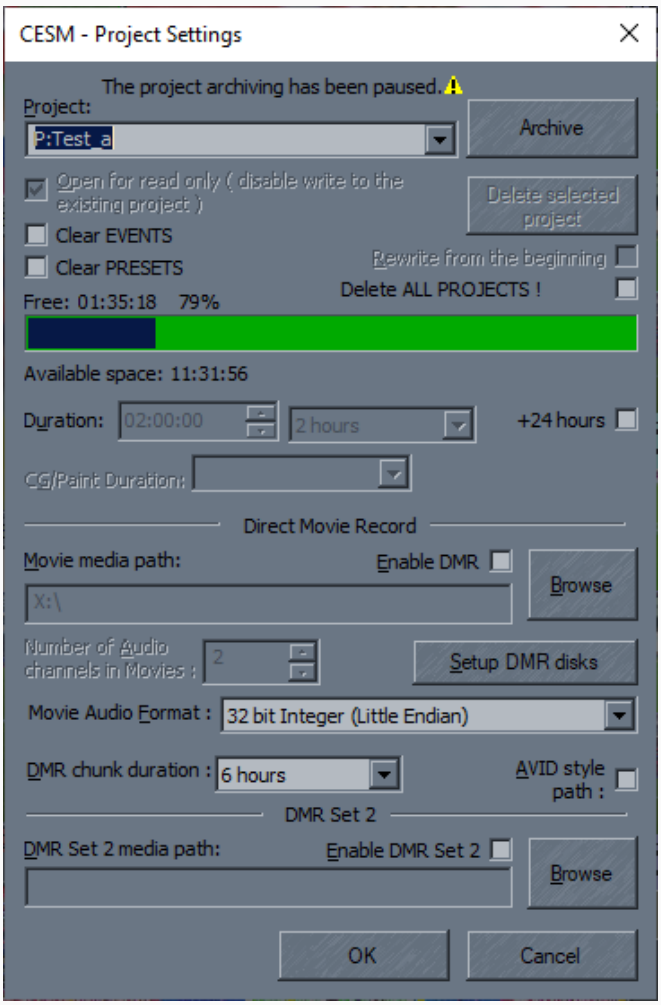


Figure 29 – Project archiving was interrupted

Video delay

The video-refereeing system supports operation with video delayed by several seconds. This means, that the live windows do not display live video, but the video with the set delay. In this case, the event is marked relative to the time of the event, which is currently displayed on the referee's monitor. If the event is delayed, the mark will also be delayed.

The delay function is very memory-sensitive and requires a lot of system resources, so you cannot set the maximum value at once. If you use a large number of channels, you may run out of memory. The operator can change the delay value from 0 to the maximum value. The maximum value limit cannot be changed by the operator - it is set in the configuration by the manufacturer[1].

Note that when you create an event by pressing the **Mark** button on the control console, it is created without taking into account the delay on the live video.
But when the **Jog** wheel is rotated, the event is created considering the delay.

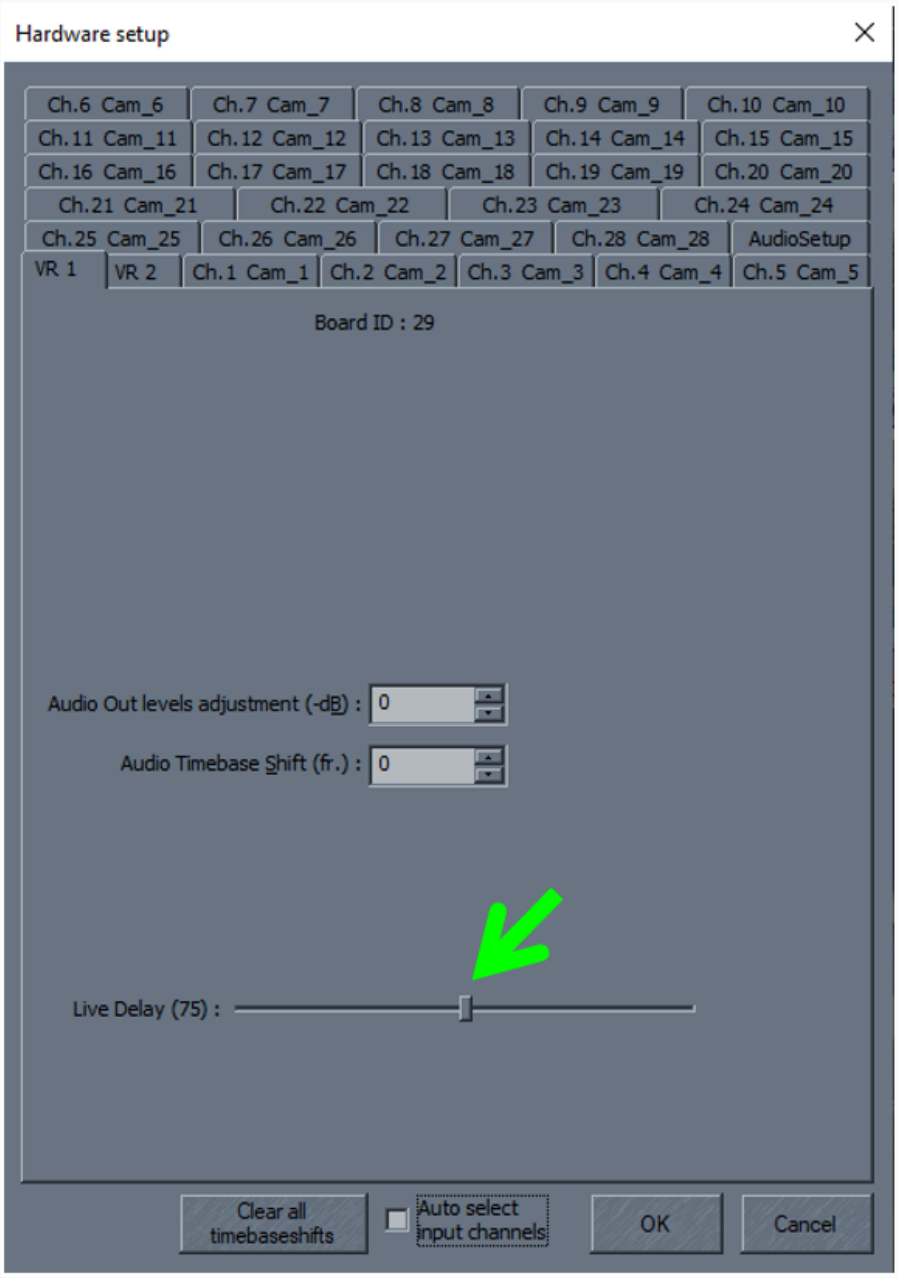
1. To change the maximum delay value to another one, you need to contact technical support.

To change the delay, open the program settings panel:  **(Tools) → Hardware setup → VR tab → Live Delay** slider (the value is set in the number of frames).

This setting is applied immediately, i.e., when you move the slider, you immediately see the delay in the live windows, which allows you to set a comfortable value for your work.

When Live Delay is configured, the video on the Multiviewer is shown without delay (Live), but it is delayed (Live Delay) in the referee's and operator's interfaces.

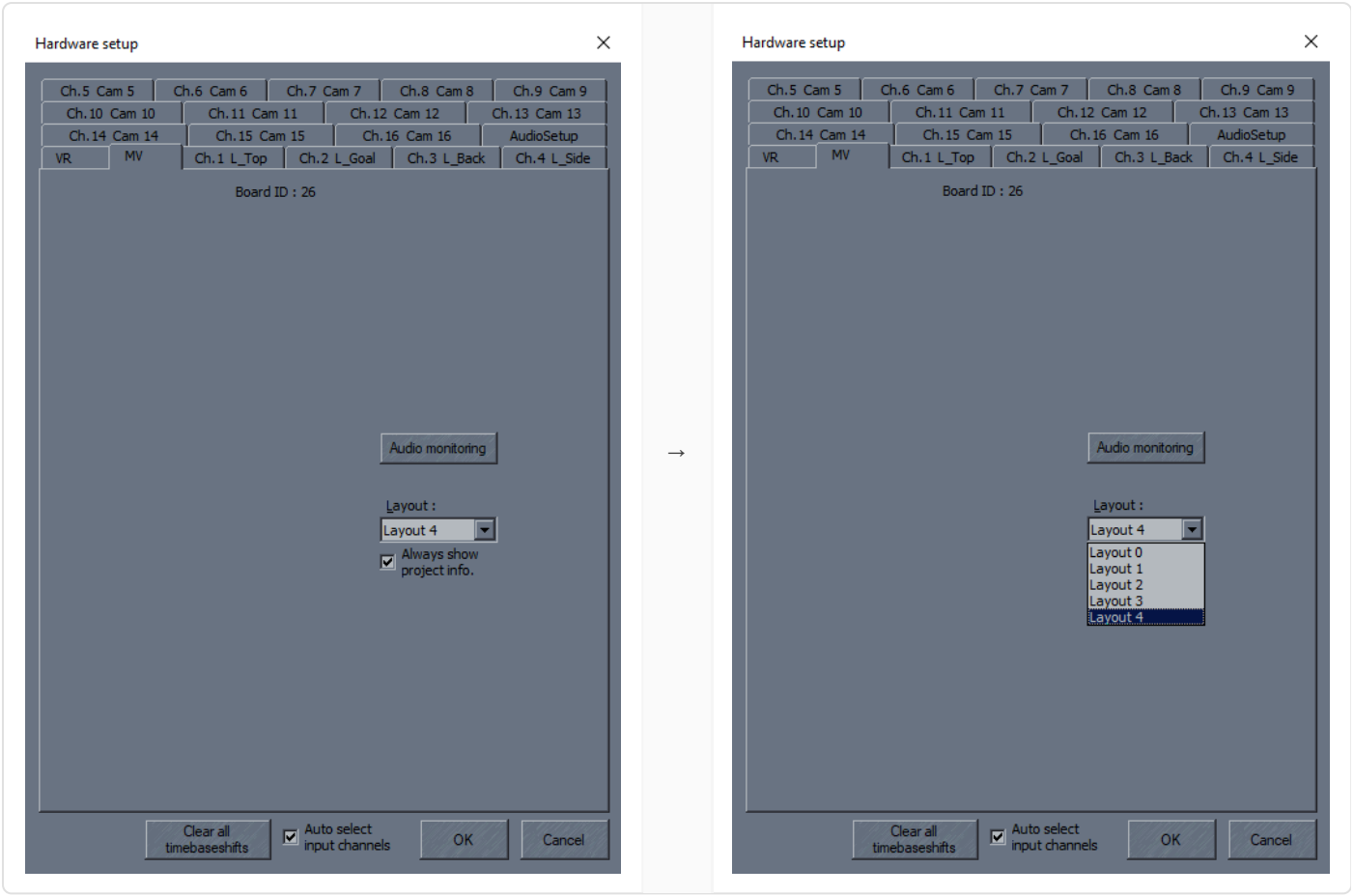
From the control console, the Shift **+ Rec | Live** button combination can be used to enable/disable video delay in the engineering and referee interfaces[1].



Selection of Multiviewer layout

Six display layouts are available for the Multiviewer. To select a Multiviewer layout:  **(Tools) → Hardware setup → MV tab → Layout**:

1. The events will be created with this delay taken into account.



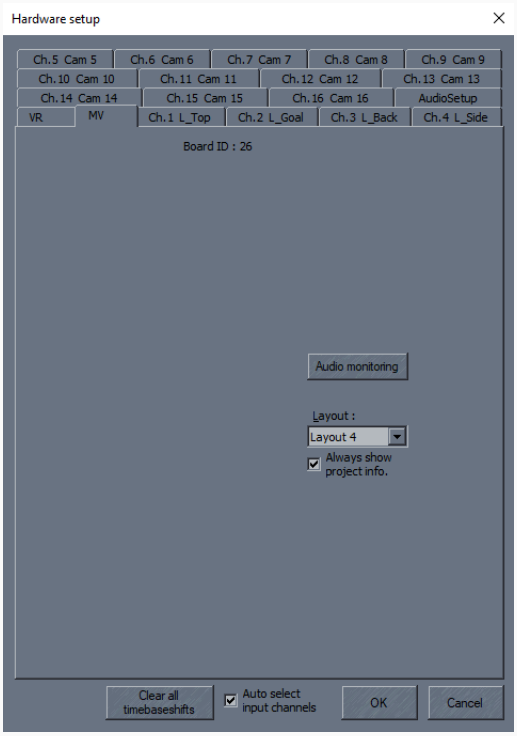
If you use a separate monitor for the Multiviewer, after selecting a layout in the list, you can immediately see it on the screen.
Select the preferred option and press the **OK** button to confirm your selection.

Display of project information on the Multiviewer screen

Project information can be hidden when the Multiviewer is displayed. To set up hiding/display of the information, go to:  **(Tools) → Hardware setup → MV tab → check *Always show project info***.

Always show project info – on – information in the Multiviewer interface is displayed.

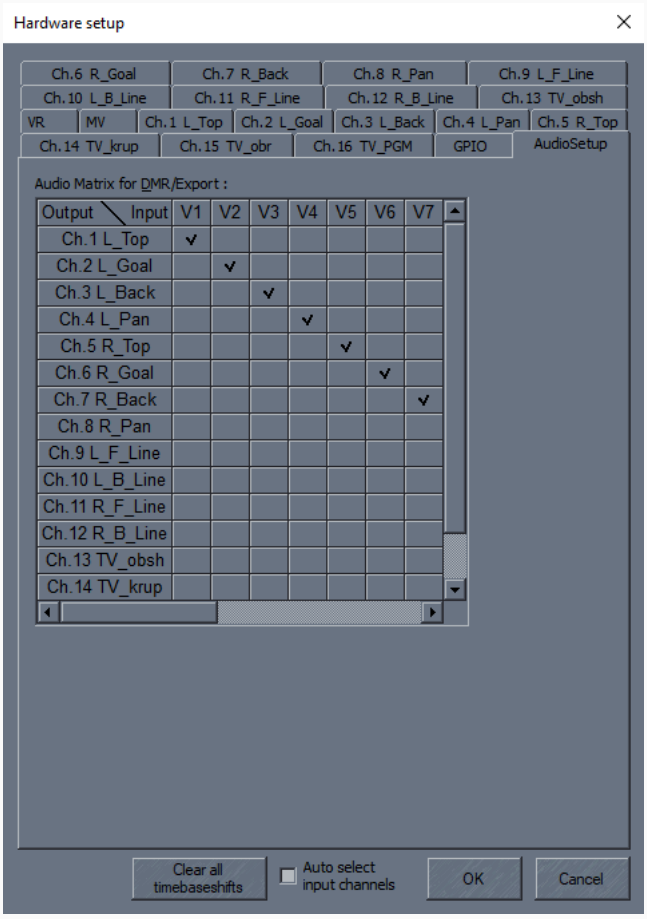
Always show project info – off – information in the Multiviewer interface is not displayed.



Configuration of audio channels for export

To specify the audio source for the exported video, use the audio matrix.
Open:
 **(Tools) → Hardware setup → AudioSetup tab**.

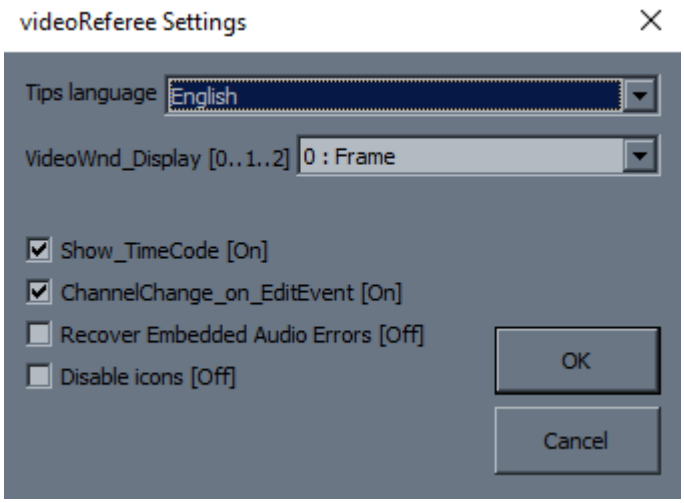
Using the mouse, select the audio source for each channel by ticking the boxes.



Setting the display of fields in Live

For the live video, you can set the displayed frame field – top or bottom field.

Open:  **(Tools) → Settings → VideoWnd_Display parameter**:



The parameter has the following options:

- Frame – equivalent to the Field 1 option;
- Field 1 – display the top field only;
- Field 2 – display the bottom field only.

Toggling this parameter may be necessary to diagnose problems occurring in only one of the frame fields.

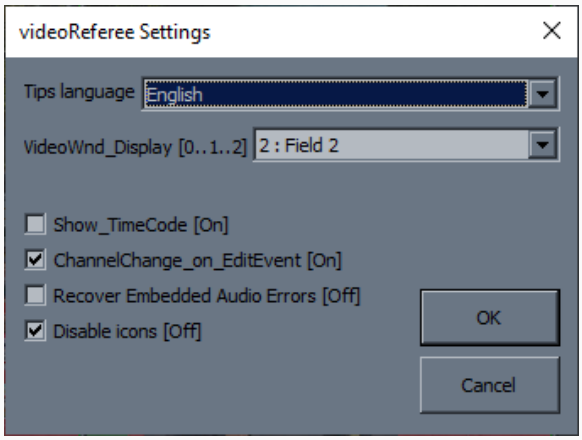
Icons in the event list

In the event list, marks can be displayed with icons (a freeze frame of the moment) or without them (only text information about the event).

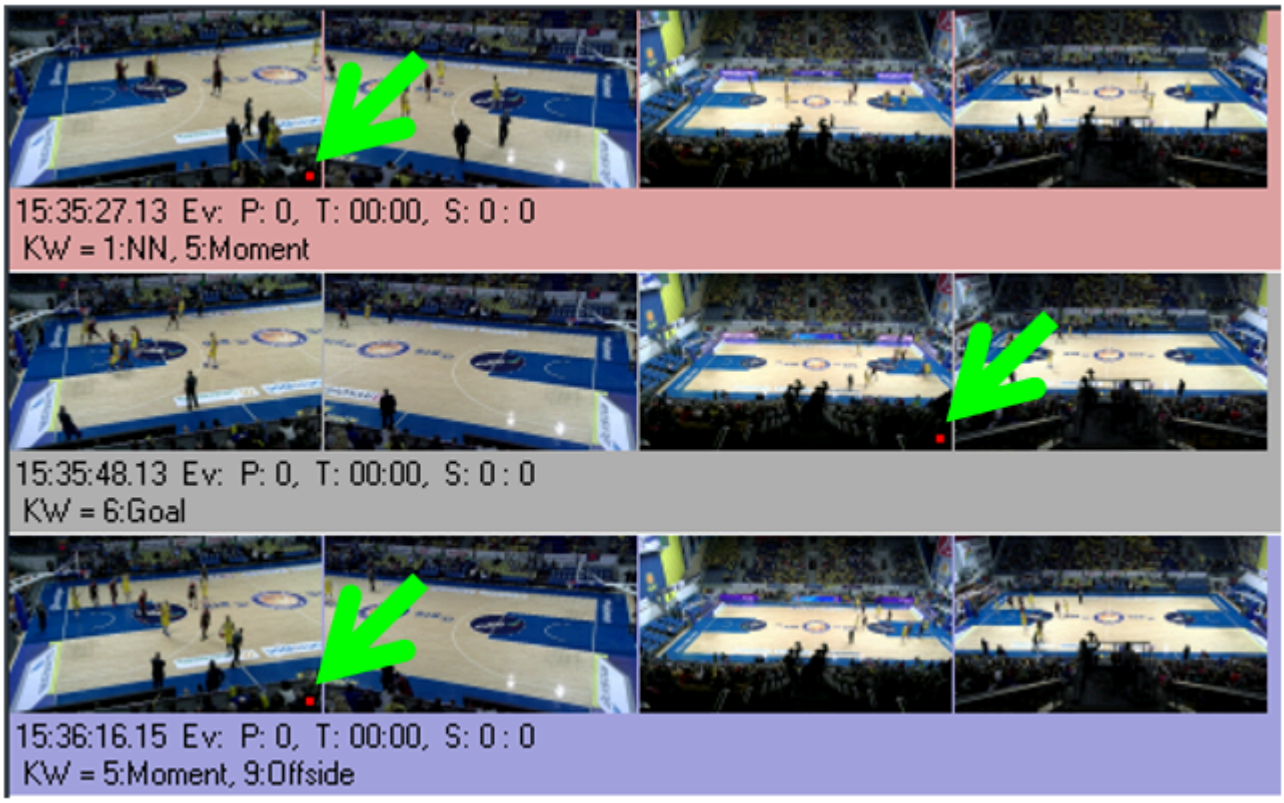
To enable the display of icons in the event list, go to the menu:  **(Tools) → Settings → check *Disable icons***.

To display icons, uncheck **Disable icons** and click **OK**.

To display events without icons, check the **Disable icons** and click **OK**.



When icons display is enabled, the active camera is marked as follows:



To display events without icons, check the **Disable icons** box and click **OK**.

Operating, transportation and storage conditions

Normal operating conditions

- The system can be installed and normally operated in rooms with heating, ventilation and air exchange that meet sanitary standards.
  An air conditioning system is recommended.
- Room temperature for normal operation: 16 to 24 °C.
- Temperature limits: 12 to 29 °C.

⚠ Room temperatures below 12 °C require mandatory "warm up" of the disks!

- Relative humidity: 20 to 65 %.
- Room dustiness: not more than 0.70 mg/m^2.
- No chemically active vapors (alkalis, acids, organic solvents, mercury, halides) or gases that corrode metal or plastics. Do not use the system in the presence of microfine smoke.

- No strong magnetic or electric fields, no electromagnetic radiation or radiation background exceeding safety standards.
- Avoid direct sunlight on the monitor.
- Provide distance of at least 1.5 meters to the climate control devices.
- The operating position of the system is on a flat horizontal surface.

Installing the system lower than 60 cm from the floor is strictly prohibited!

The distance between the rear panel of the server and the nearest vertical surface should be at least 20 cm.

- To connect the power supply network (single-phase 110/220 V), use sockets with grounding.
- Power quality must be in accordance with IEC 61000-2-2/EN 61000-2-2 / EN 50160/ IEC 61000-3-2 /EN 61000-3-2 or a similar standard of another country.
- It is recommended to connect through an uninterruptible power supply (providing consumption of 1000 VA), working by on-line technology. Time of switching the UPS to backup is not more than 2 ms.

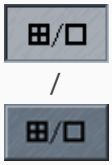
Normal transportation and storage conditions

- All system components and parts should be stored in the original factory package or in the transportation case supplied by the manufacturer.
- It is necessary to ensure that the components are securely positioned in the package so that they do not move freely.
- Do not use the factory packaging to transport additional equipment together with the system.
- The system in its original factory packaging can be transported by any means of transport over any distance.
- During transportation, the system must be protected from strong shocks, vibrations and all kinds of atmospheric precipitation that may reach the packaging.

The system has a built-in mechanism for recording limit shock accelerations. Should they be detected, the system warranty will be voided.

- After transportation in winter or at temperatures below 5 ºC, leave the video server in its package at a room temperature of 15 to 25 ºC for at least 8 hours before turning it on.

Appendix B. Assignment of buttons in the program interface, keyboard shortcuts, remote control buttons

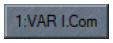
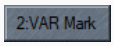
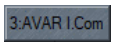
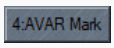
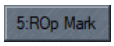
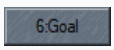
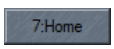
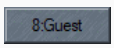
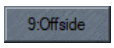
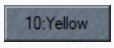
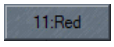
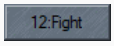
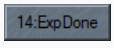
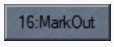
Buttons in the interface			Function
	F1 ... F12	Ch. N	Active channel selection – Console – from 1 to 16 – Keyboard – from 1 to 12
	–	Shift + Ch.N	Active channel selection – from 17 to 32
	Ctrl + M or [~]	Mark	Create an event on live video
	Ctrl + Shift + M or Shift + [~]		Create an event on recorded video
–	Ctrl + Delete	Mark + Ch.15	Delete an event
	Ctrl + L	Rec | Live	Switch between Live and Search modes
–	–	Shift + Rec | Live	Enable/disable video delay in the engineering and referee interfaces[1]
	Ctrl + D	Shift + Help | Display	Enable/disable display of information on the video
	Ctrl + Q	Quad	Enable/disable Quad display mode
	–	Shift + Quad	Toggle the number of displayed channels – 2, 3 or 4

1. The events will be created with this delay taken into account.

Last	Alt + A	–	Displaying the last four cameras used
–	–	Last	Display the last two cameras used. Subsequent presses – change the number of displayed cameras – 2, 3 or 4.
Select 1-ch for Export	–	S1	Select 1 channel for export
50%	–	Alt + S1	Switch the speed change mode – smooth / stepped. In stepped mode, the button on the control console is blue.
Select All for Export	–	S2	Select all channels for export
Help	Ctrl + H	Help | Display	Display the hint on the functions of the control console's buttons
MultiSkin	Scroll Lock	Active	Activate the Multiskin mode. The engineering monitor will display the Multiviewer or Game Alalyzer interface. Press the **Esc** key on the keyboard to exit the Multiskin
Mark event by Time Stop	–	–	Create an event when the game time is stopped
Mark event by switch to Search	–	–	Create an event when switching to search mode
Keep last position while switch to Search	–	–	Keep the last position when switching to search mode
RRA Not Active / RRA Active	Alt + R	Alt + Cmd + Rec | Live	RRA option – display the referee output synchronized with the main one or preloaded graphic information on a separate video output

–	Ctrl + Alt + F ...	Alt + Cmd + Ch.N	Select a preset graphics to be displayed on the RRA output (up to 16 images)
Period + / Period -	–	–	Increase/reduce period number
Score 1 + / Score 1 -	–	–	Increase / reduce the score of the first (left) team
Score 2 + / Score 2 -	–	–	Increase / reduce the score of the second (right) team
Foul 1 + / Foul 1 -	–	–	Increase / reduce the number of fouls for the first (left) team
Foul 2 + / Foul 2 -	–	–	Increase / reduce the number of fouls for the second (right) team
Time Start	–	–	Start the game timer
Time Stop	–	–	Stop the game timer
T.Reset	–	–	Reset the game timer
T. + / T. -	–	–	Add / shorten the game time
Set Time	–	–	Set the game time
◀◀	Shift + Left (←)	◀◀	Go to the previous event
▶▶	Shift + Right (→)	▶▶	Go to the next event
■	Ctrl + S	■	Stop the playback

	Ctrl + P Ctrl + Spacebar		Start the playback
	Ctrl + Enter	Pan / Zoom joystick	Exit Quad mode and zoom in a selected channel
	Ctrl + Up (↑)	Pan / Zoom joystick	Navigate through the video in the zoom-in mode
	Ctrl + Left (←)		
	Ctrl + Right (→)		
	Ctrl + Down (↓)		

               	–	–	Event tags that can be assigned to the created events during a match. These preset names can be changed to any other values required for a particular sport.
Recording control			
 / 	Ctrl + Shift + R	Alt + Ctrl + Shift + Mark	Start the recording
 / 	Ctrl + Shift + S	Alt + Ctrl + Shift + ■	Stop the recording
Program menu			

	Ctrl + Shift + T	–	Open «Tools» menu
	Ctrl + Shift + A	–	Open audio panel
	Ctrl + Shift + N	–	Minimize program window
	Ctrl + Shift + L	–	Resize the window
	Ctrl + Shift + X	–	Close the main window and exit the program

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The slomo.tv software products are constantly developing. Therefore, there may be discrepancies between the documentation and the implemented functionalities.
Please report any inconsistencies, incompleteness, etc. in this Manual to slomo.tv technical support by email at support@slomo.tv so that we can send you an updated Documentation.