videoReferee®

Manual for video engineers

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Important information

The *videoReferee®* users must be familiar with Windows OS-based computers, know the rules of safe usage of a computer, and the basics of Windows OS.

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.

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).

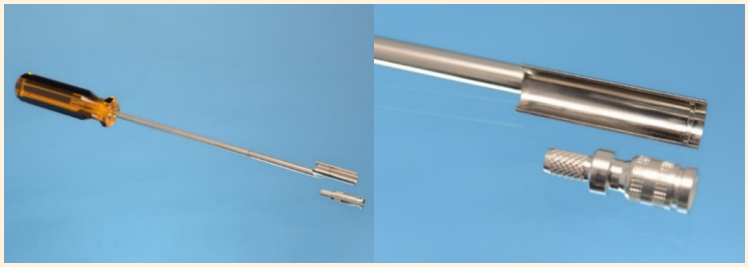


Figure 1 – Tool for disconnecting Din 1.0/2.3 connectors

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 .
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.

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”.

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.
The *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 2 and double-click it with the left mouse button.

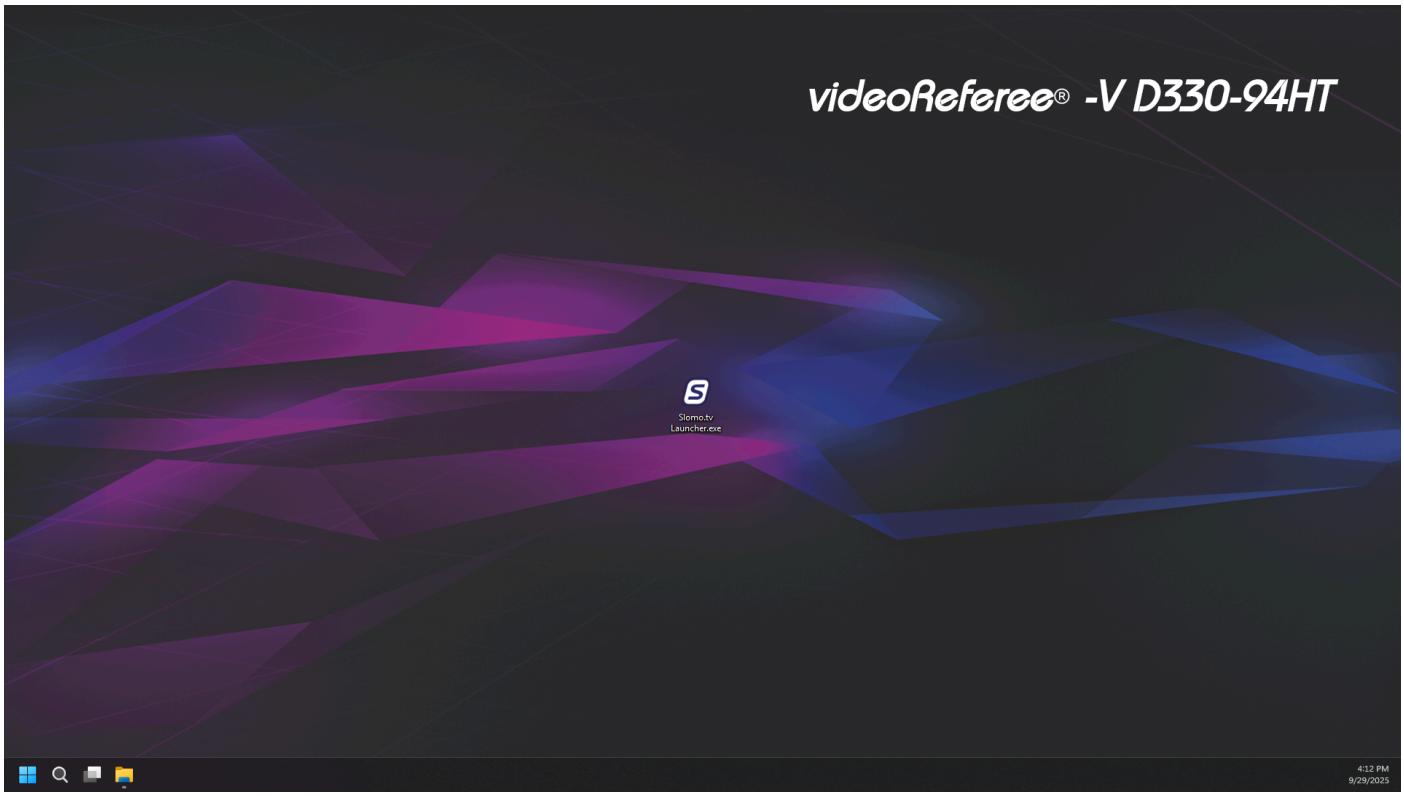


Figure 2 – *videoReferee®* Desktop

The program window will open – figure 3.
The main Slomo.tv Launcher page is the **Start** tab (figure 3). 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:

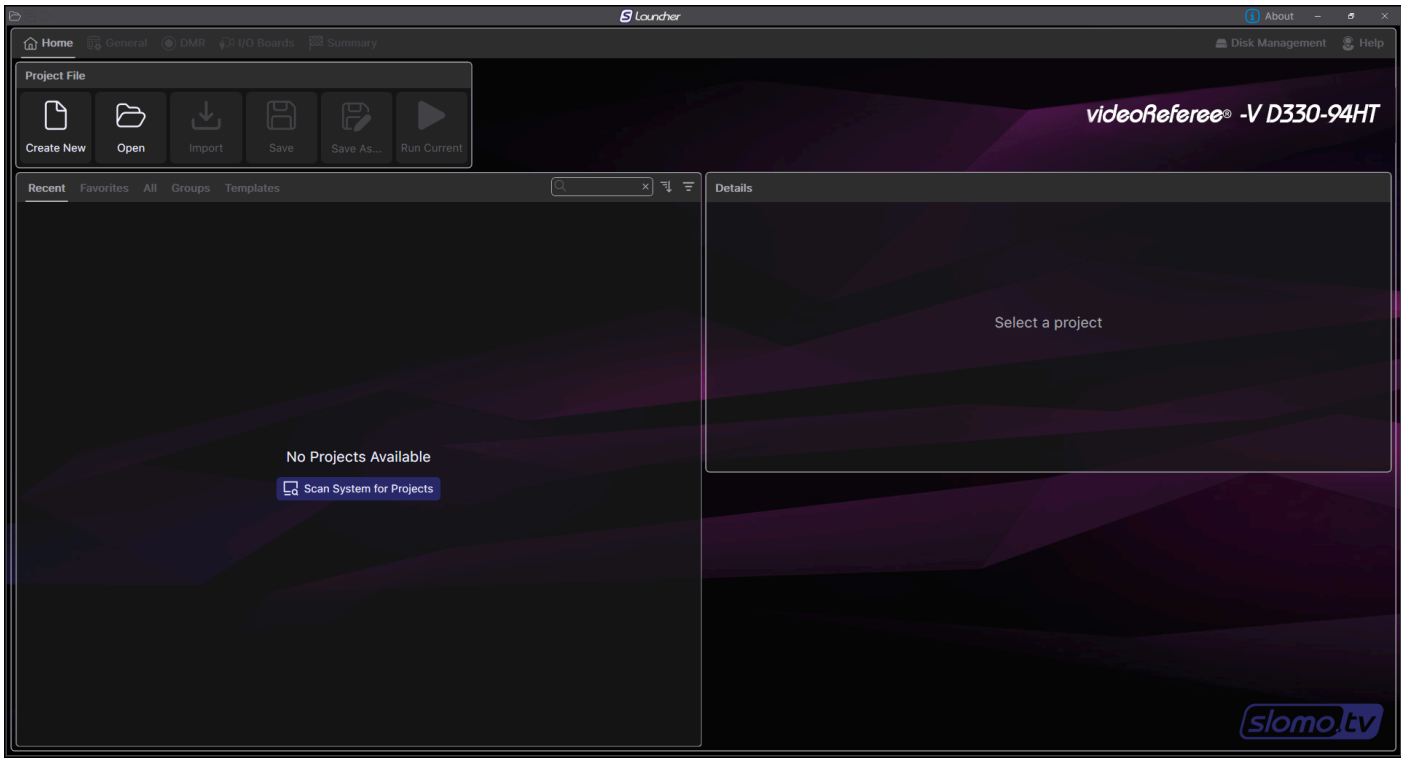
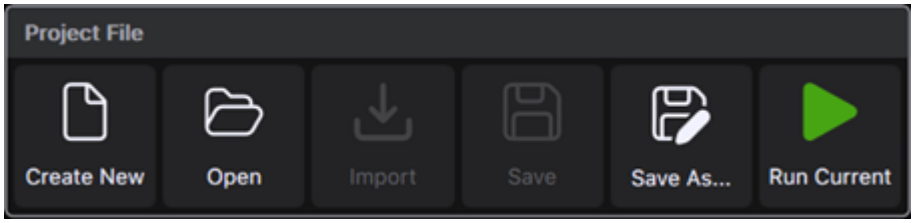


Figure 3 – Program window

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;

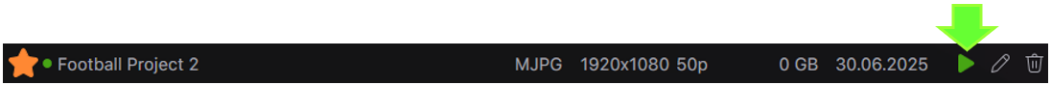
– **Save** – save the currently open project to an INI file without changing the name;
– **Save as...** – save the open project to an INI file with a specified name;
– **Run Current** – starts server for the currently open project

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

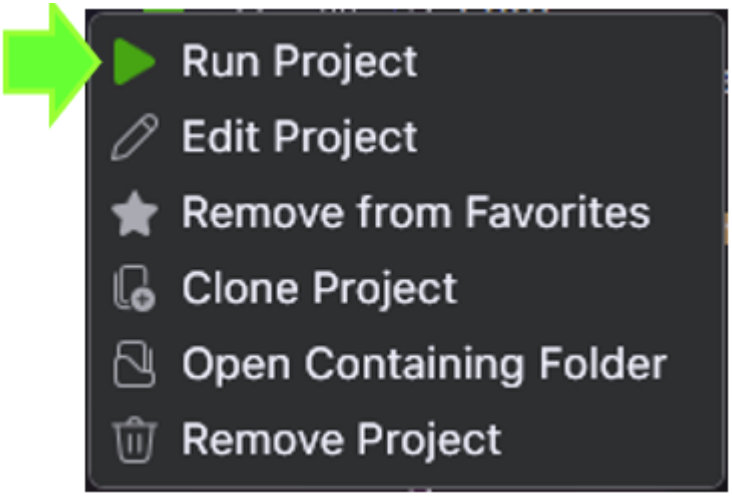
1. The server name and serial number, indicated in the upper right corner of the desktop, depend on the purchased equipment and may differ from those indicated.

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

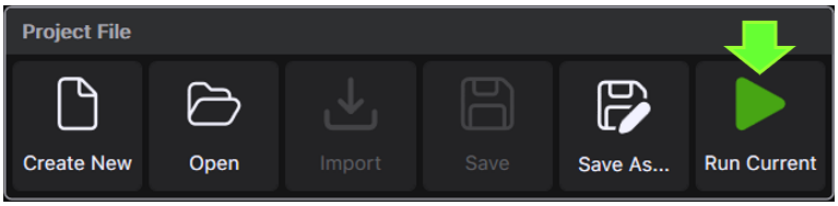
1. Double-clicking the project;
2. Clicking the **Run** button ( ) on the right side of the project line:



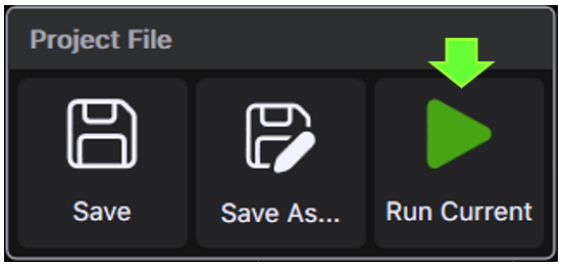
3. Launch from the context menu: right-click the project and select **Run Project**.



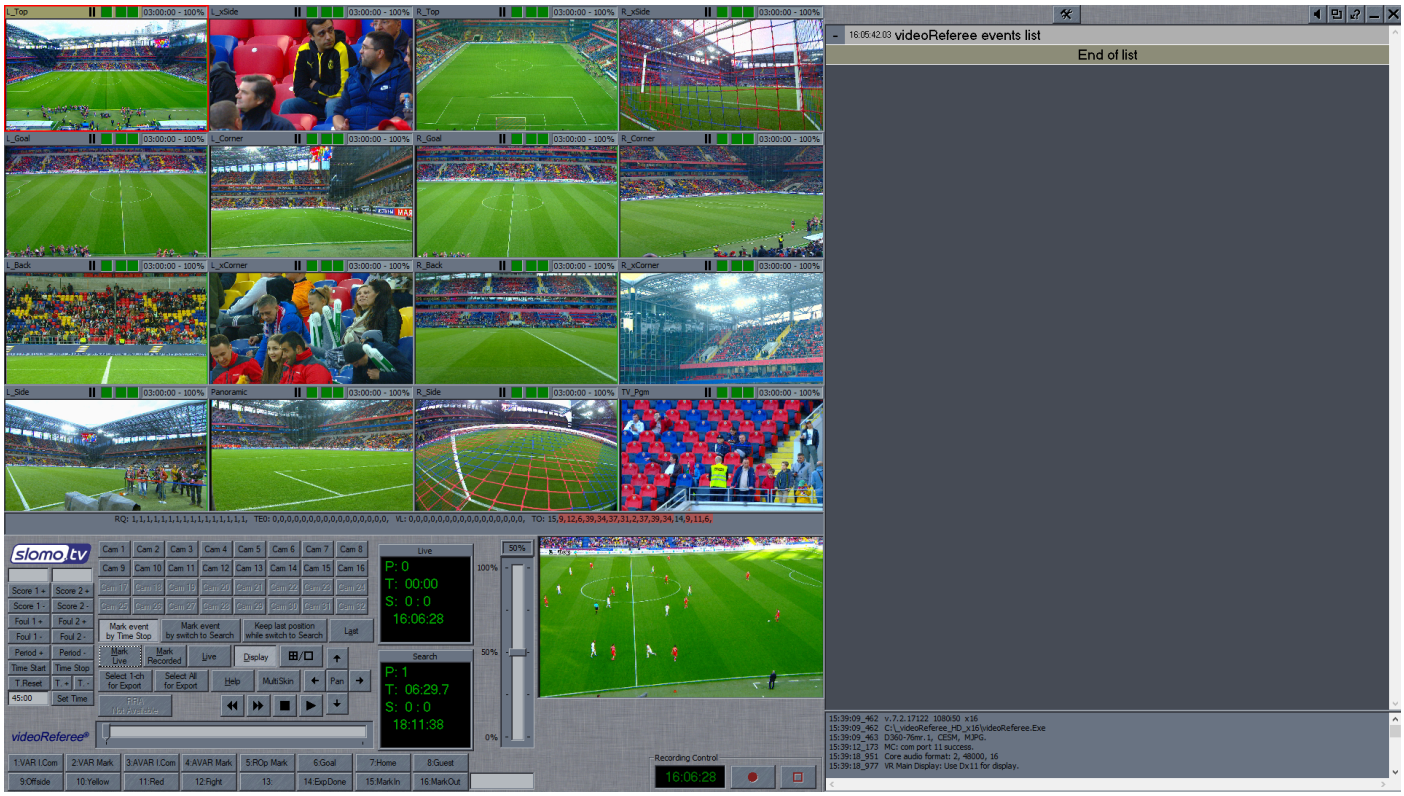
4. Clicking the **Run Current** button in the **Project File** section if the project is in editing mode (the project is marked with a indicator in the "Home" tab);



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.

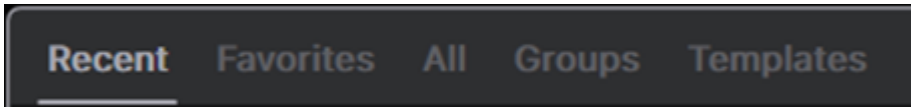


After launching the project, the Slomo.tv Launcher window will close and the *CESM.exe* application with the created project configuration will open.



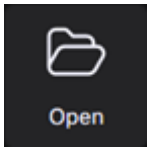
Select Project

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:

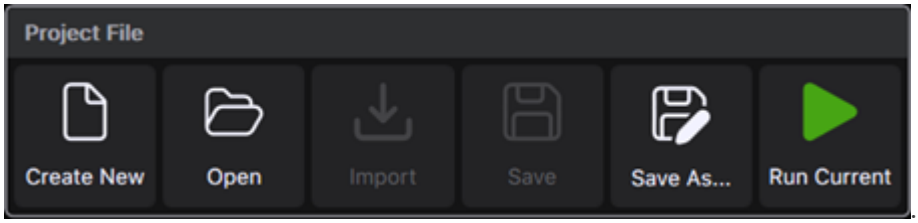


- The **Recent** list displays the most recent (up to 15) open projects,
- The **Favorites** list displays projects marked with , as favorites,

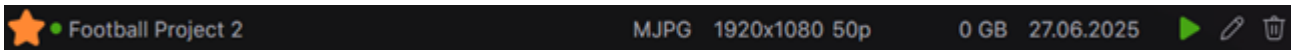
- The **All** list displays all the projects ever opened with Slomo.tv Launcher,
- The **Groups** list displays all created groups,
- The **Templates** list displays preconfigured project templates.

You can also select a project by clicking the 

button in the **Project File** area



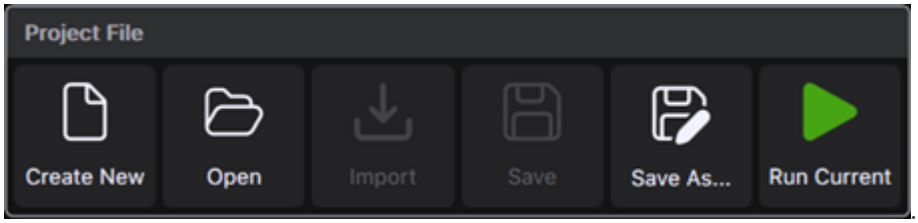
The current (selected) project will be marked with an indicator to the left of the project name.



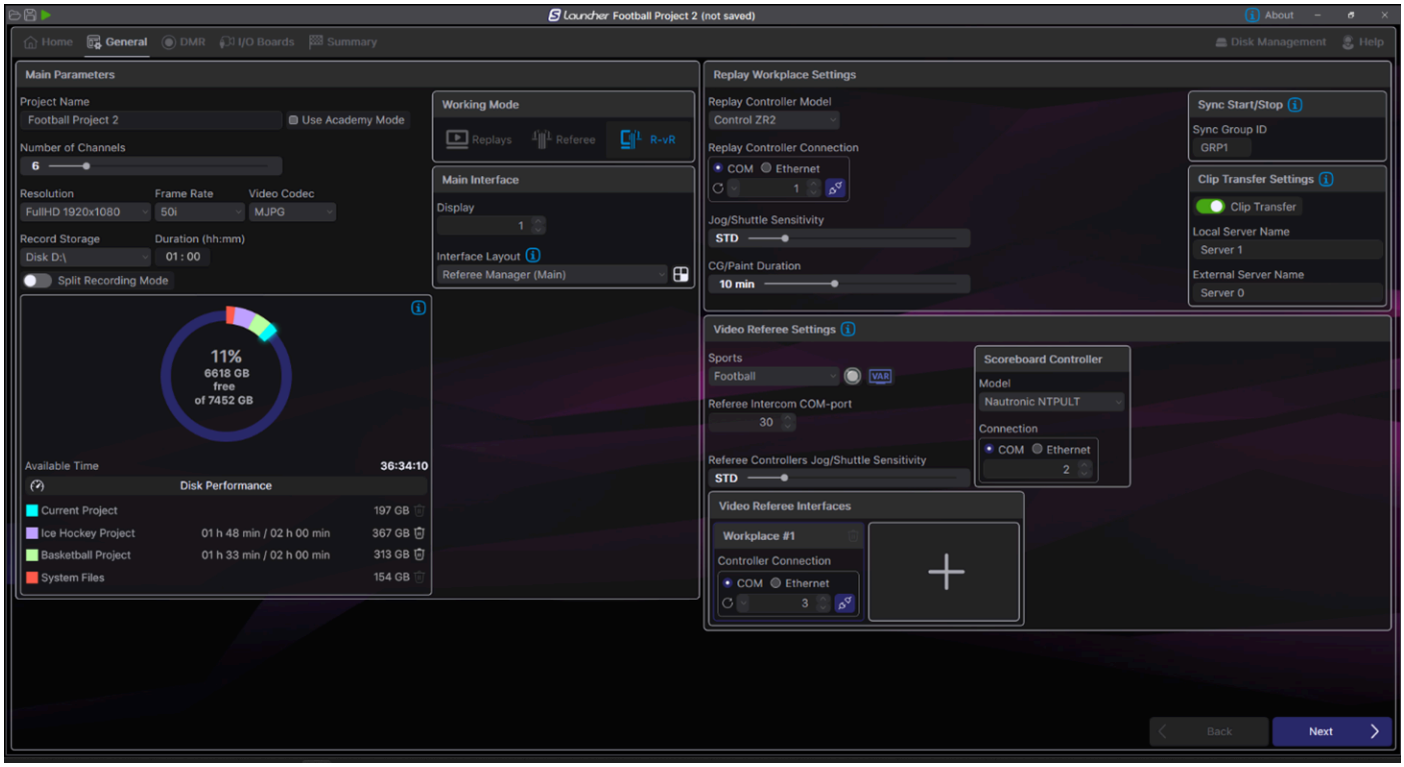
Create New Project

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 4 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 – recording control panel;
6 – toolbar;
7 – list of created events;
8 – notification area.

Figure 4 – 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 **Recording control panel** (5) is used to start/stop video recording.

The **Toolbar** (6) 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** (7). For more information about the list of created events, see the "Work with events" section of this manual.
The **Notification area** (8)[2] displays information about the program performance: general state of the program and notifications about hardware failures. Figure 5 shows an example of the notification area immediately after the system has started. During the program operation, messages about the program and devices performance will be displayed here.

1. By default, this feature is disabled. To enable it, contact slomo.tv technical support.
2. Depending on the program settings may not be displayed.

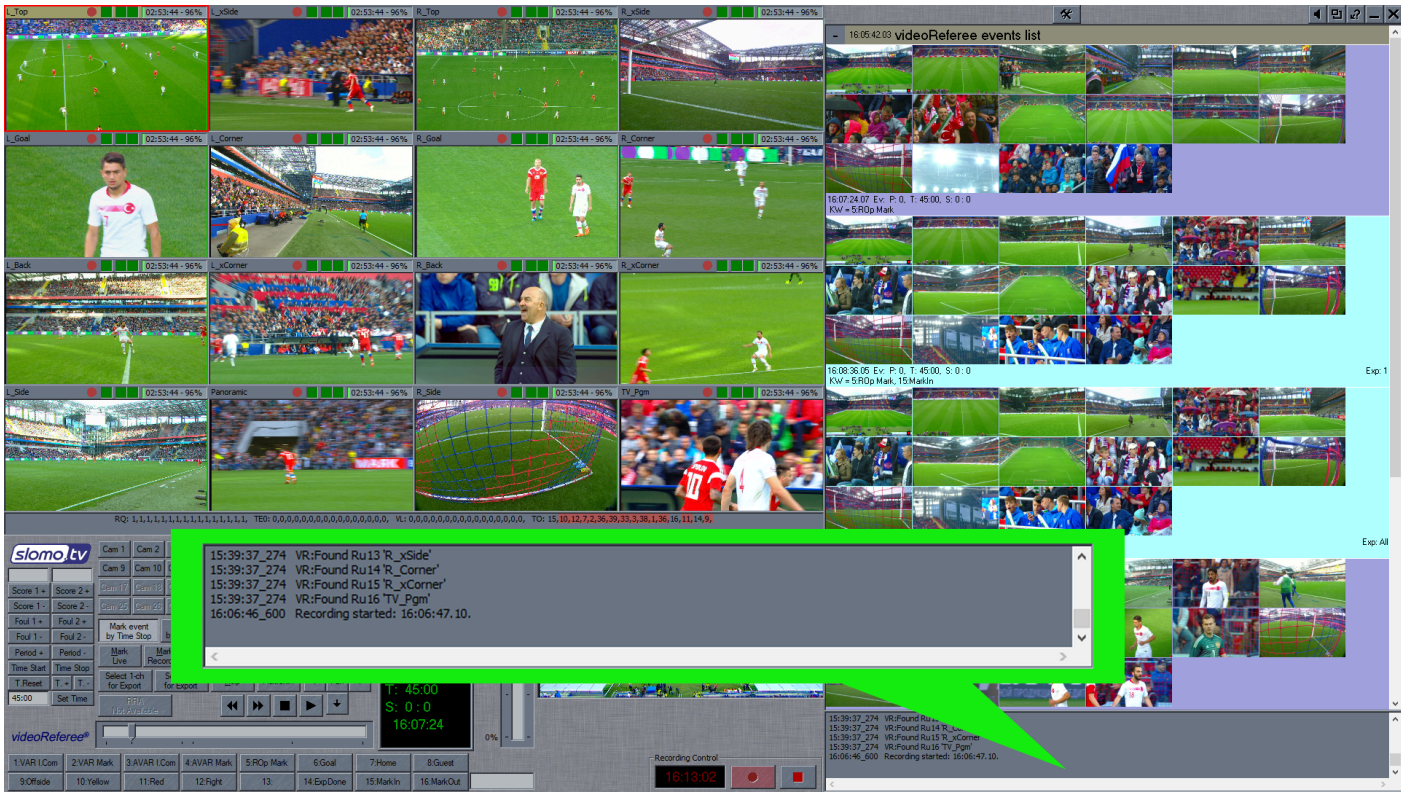
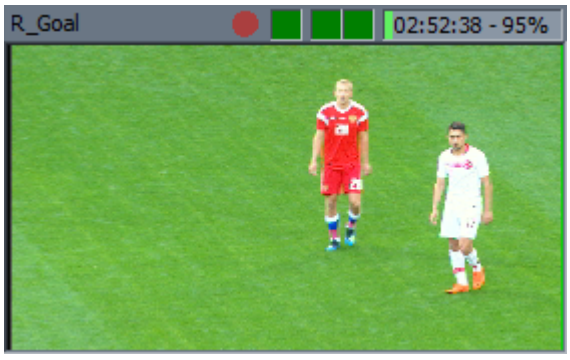


Figure 5 – Notification area

Recording indication bar

Each of the video windows of the recording channels has a camera name and an indication bar with recording process indicators (figure 6):



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 6 – 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 in the engineering interface;
- – by pressing **F1...F12** (up to 12 channels) keys;
- – with the **Cam1...Cam16** buttons.

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 6).

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:

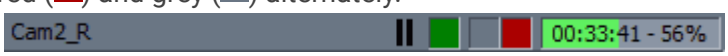
- green square ( ) – normal operation, no audio problems detected;
- cross on a flashing red ( ) / yellow ( ) background – there may be an audio defect;
- cross on a green background ( ) – there may have been audio defects earlier;
- plus on a flashing red ( ) / yellow ( ) background – audio frame length 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 (00:01:07 - 37%) – 0 to 68% of the reserved memory is used;
   - yellow (00:00:29 - 16%) – 69% to 84% of the reserved memory is used;
   - red (00:00:01 - 0%) – 85% to 100% of the reserved memory is used.

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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.

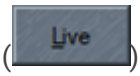
T0 – the offset of the timecode and the video signals of all channels relative to the first channel (value in ms). The value is displayed as an *offset + 15 ms*. The number of values corresponds to the number of video channels in the system. If the value of the first parameter is 0, it indicates that 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:

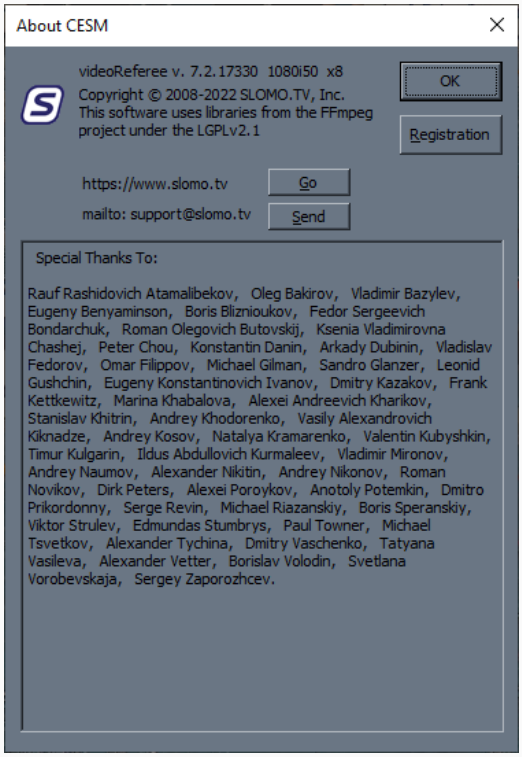
- by pressing the **Live** button () in the control panel of the interface;
- – by pressing the **Ctrl + L** key combination;
- – by pressing the **Rec | Live** button.

Slomo.tv logo

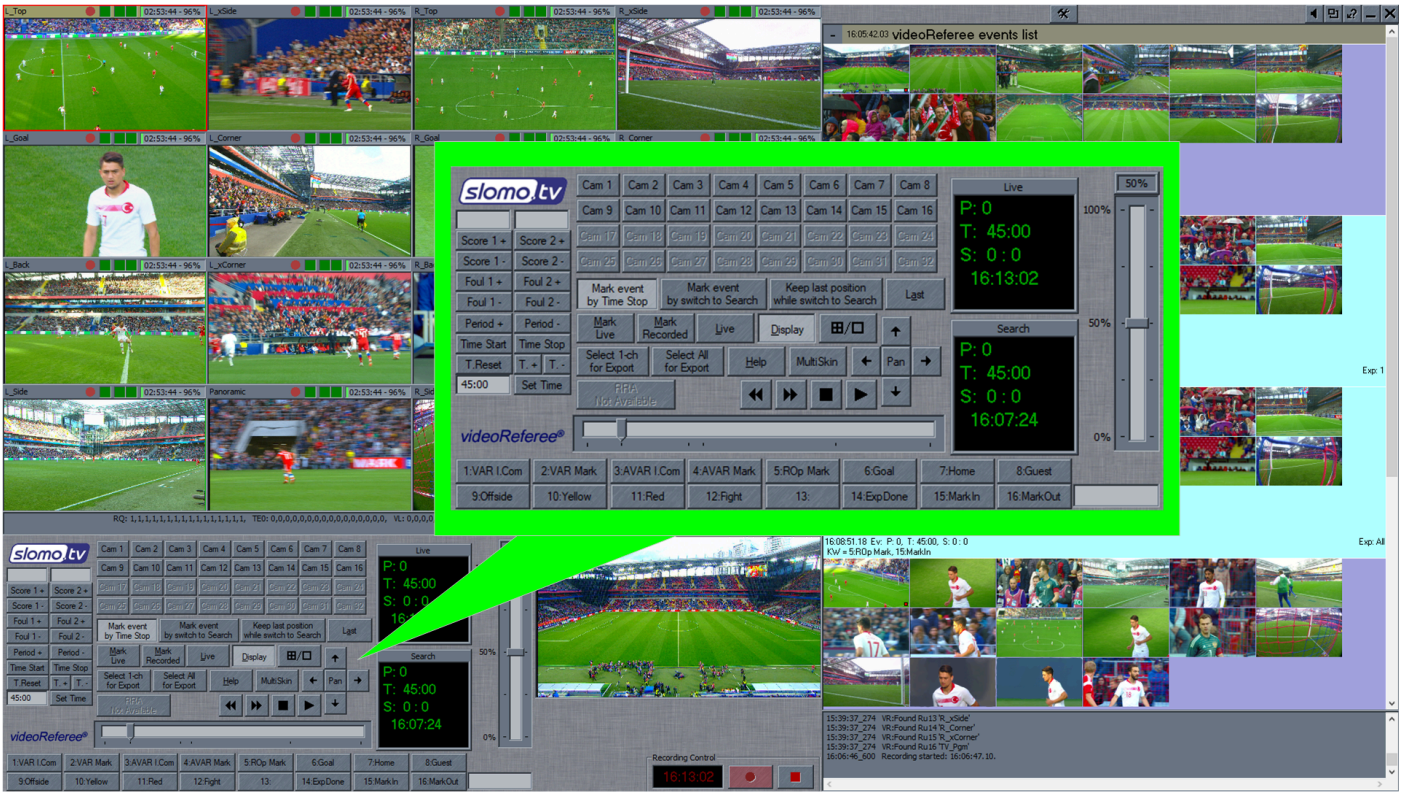
When you double-click on the slomo.tv logo ( ) a window with information about the *videoReferee®* application appears:
– software version,
– technical support contacts,
– copyrights, etc.

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 7) 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

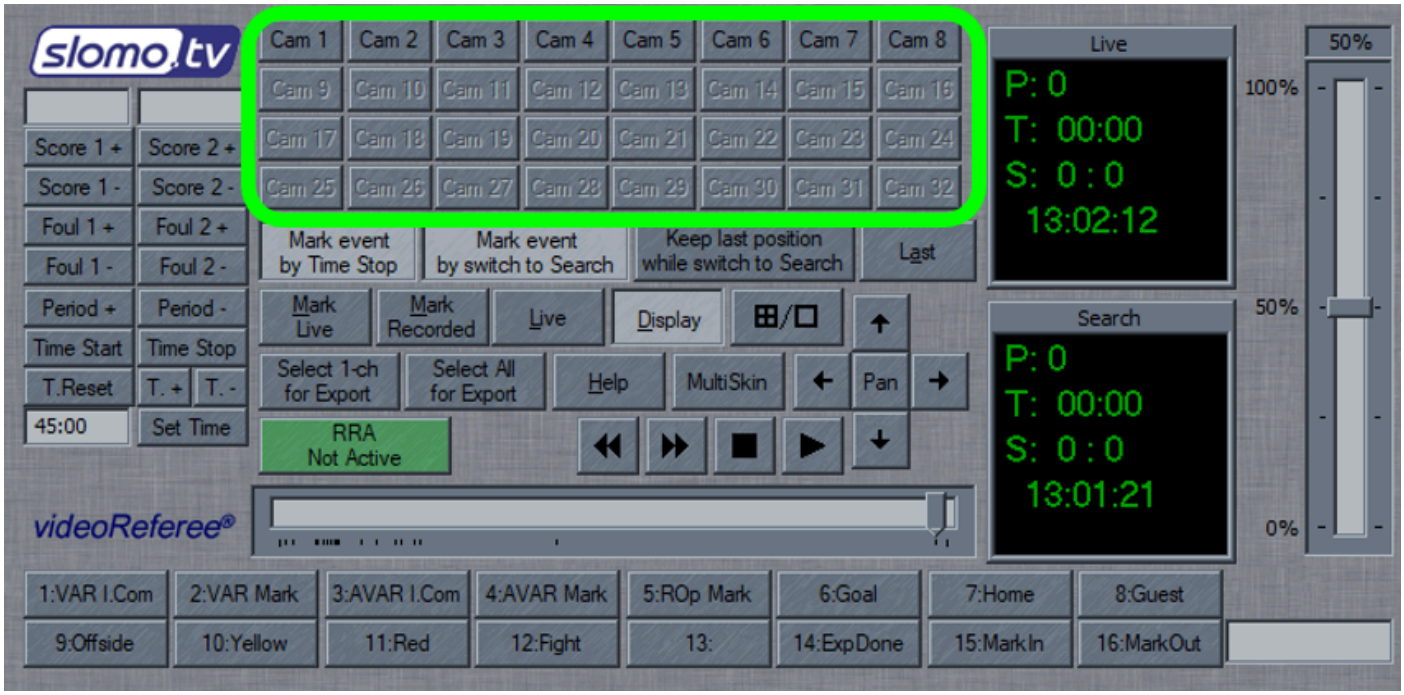
Figure 7 – Help button

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:

- the **Ctrl + H** key combination on the keyboard;
- the **Help | Display** button on the referee control console.

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:

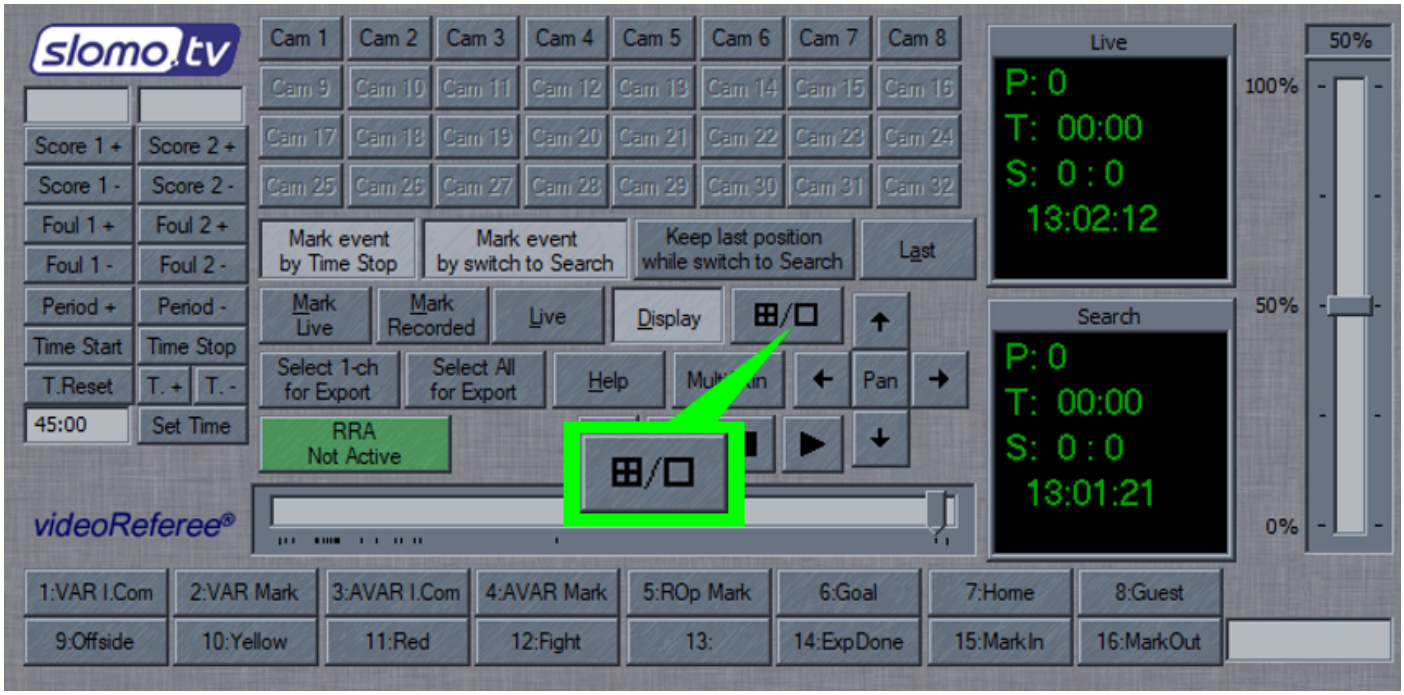
- computer mouse – click on the channel button in the engineering interface of the program;
- – keys **F1 ... F12** (up to 12 channels only);
- :

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 the **Ctrl + Q** key combination on the keyboard or the **Quad** button on the control console.

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

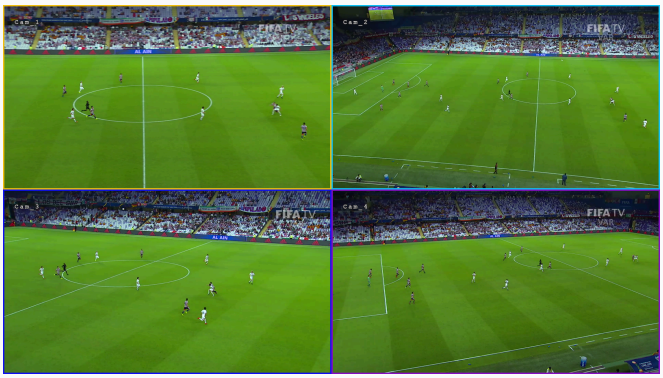
A 2-channel system in Quad mode displays two Live channels in the upper row, and the same two channels in Search mode in the bottom row.
A 4-channel system in Quad mode displays all four channels in Live or Search modes.
If the system has more than 4 recording channels, the Quad mode displays cameras preset for the sport for which the system is used[1].

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

1 camera

2 cameras

3 cameras



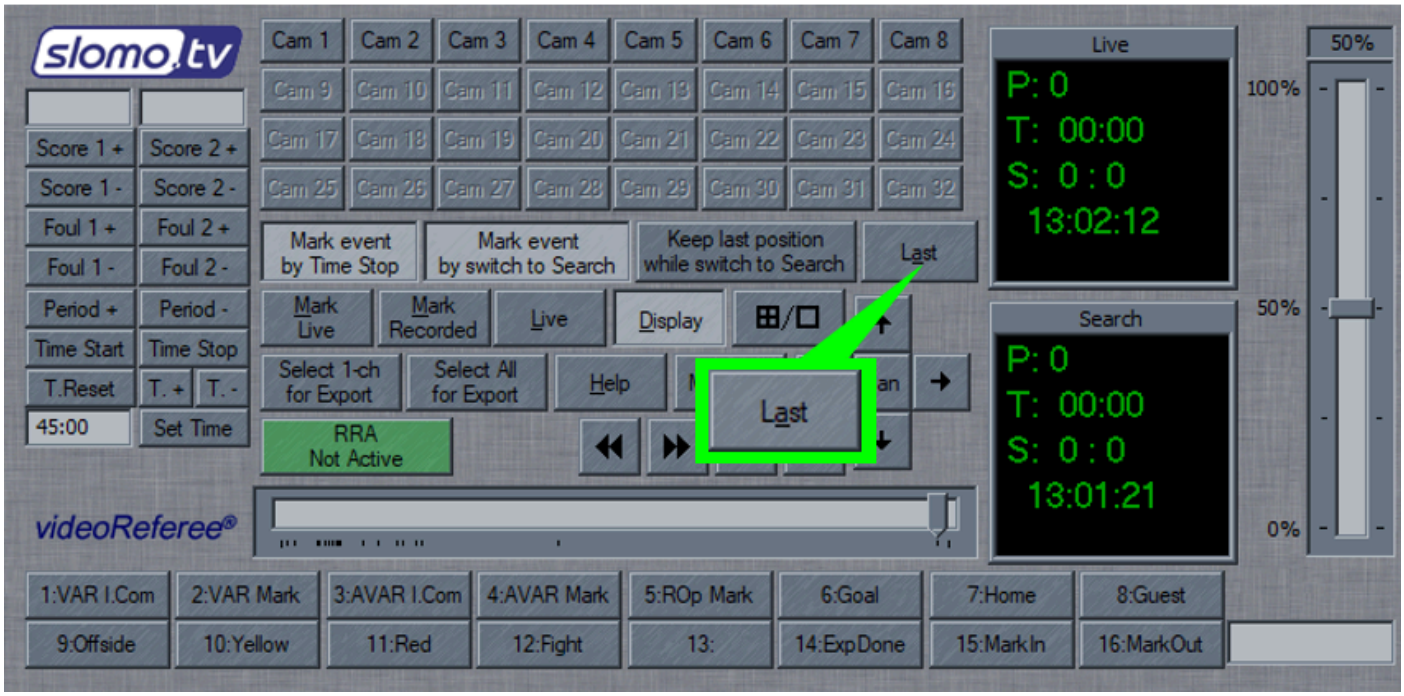
4 cameras

Figure 8 – Quad mode layouts

The active channel in the Quad has a yellow frame:

Cam_5
Cam_6
Cam_7
Cam_8

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. -
45:00
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
RRA Not Active
Live
P: 0
T: 00:00
S: 0 : 0
13:02:12
Search
P: 0
T: 00:00
S: 0 : 0
13:01:21
50%
100%
50%
0%
videoReferee®
1:VAR I.Com
2:VAR Mark
3:AVAR I.Com
4:AVAR Mark
5:ROp Mark
6:Goal
7:Home
8:Guest
9:Offside
10:Yellow
11:Red
12:Fight
13:
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.

: the shortcut **Alt + A** activates **Last**.

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).

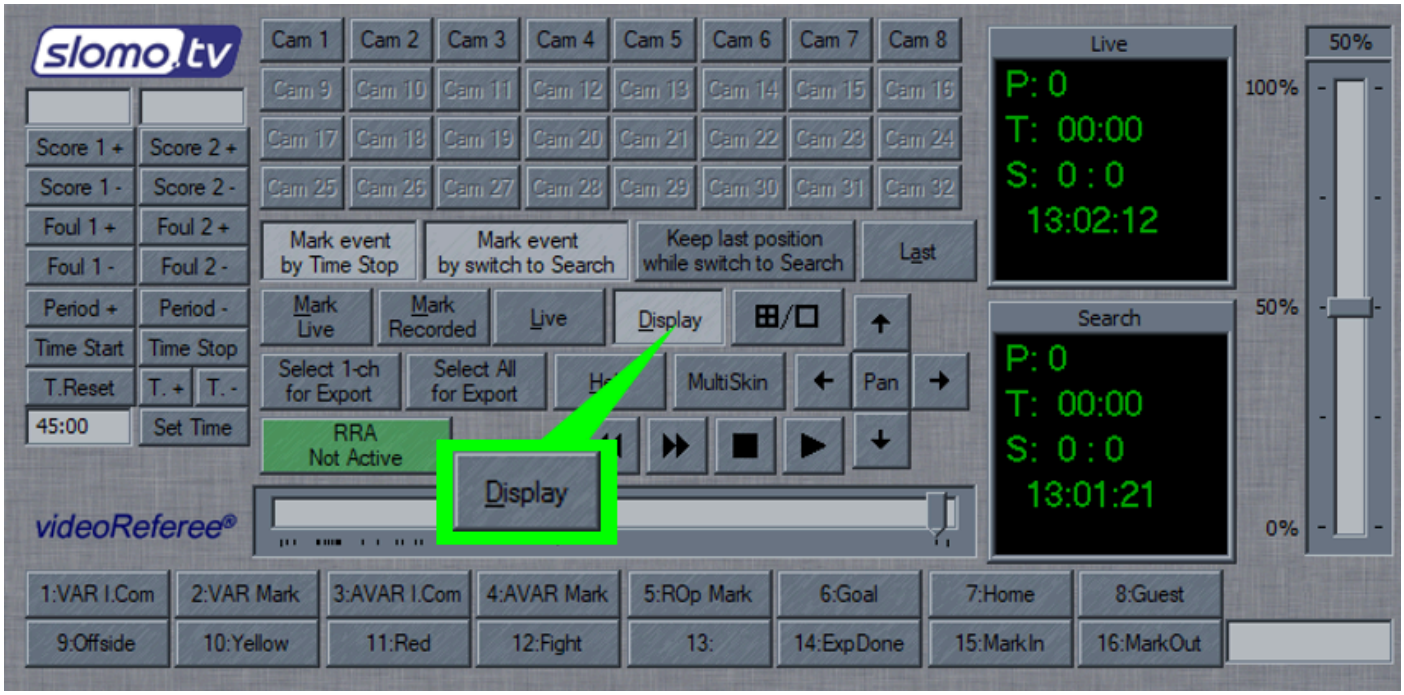
When you press **Last** on the control console, the **Quad** button automatically lights up blue, because **Last** activates the **Quad** display mode.

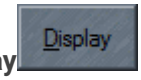
Figure 9 – Quad formed from Last cameras

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.

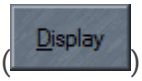
You can turn off **Last** by selecting a preset.

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:

- **Display** (

) button in the engineering interface;
- – **Ctrl + D** key combination;
- – Shift **+ Help** | **Display** button combination.

In football, the camera name is displayed for each channel[1] (figure 10):

1. To change the set of displayed data, contact slomo.tv technical support.

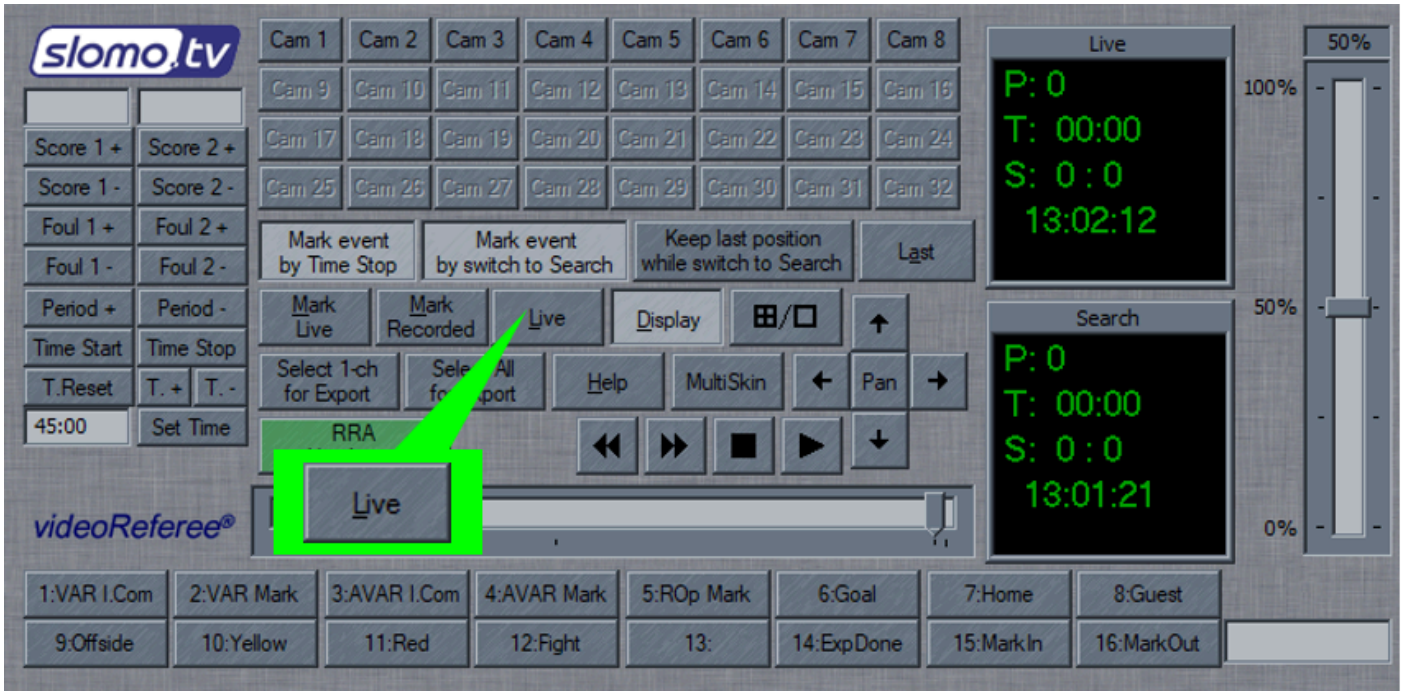
The display of information is disabled

The display of information is enabled
Info: 1 – camera name

Figure 10 – Display Info

During the playback, the playback speed (in percent) is displayed before the camera name.

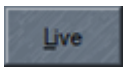
Live



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.
You can switch between Live and Recorded modes using:

- 

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** key combination;
- – **Rec** | **Live** button.

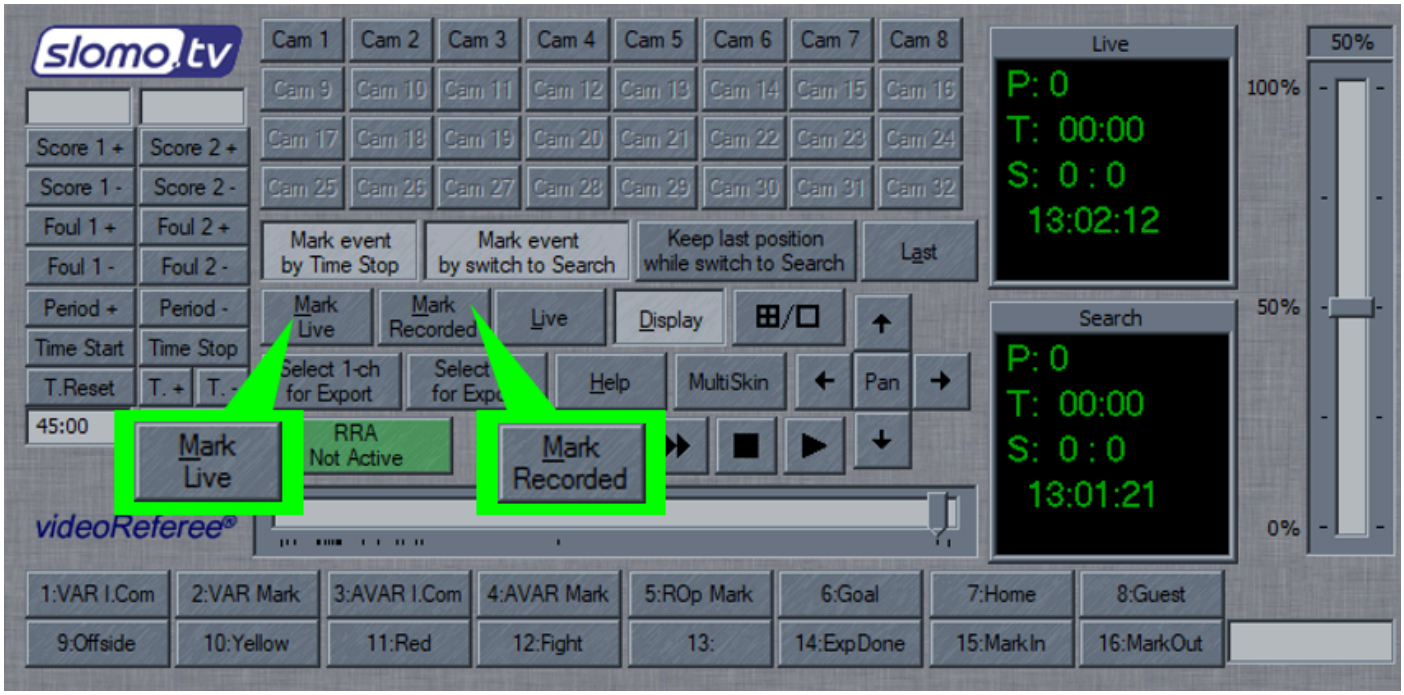
The playback of the recorded video starts with the **Play** ( ) button and stops with the **Stop** ( ) button.

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 / Playback 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.

An event can be created in one of the following ways:

1. These settings can be changed, if you contact our technical support.

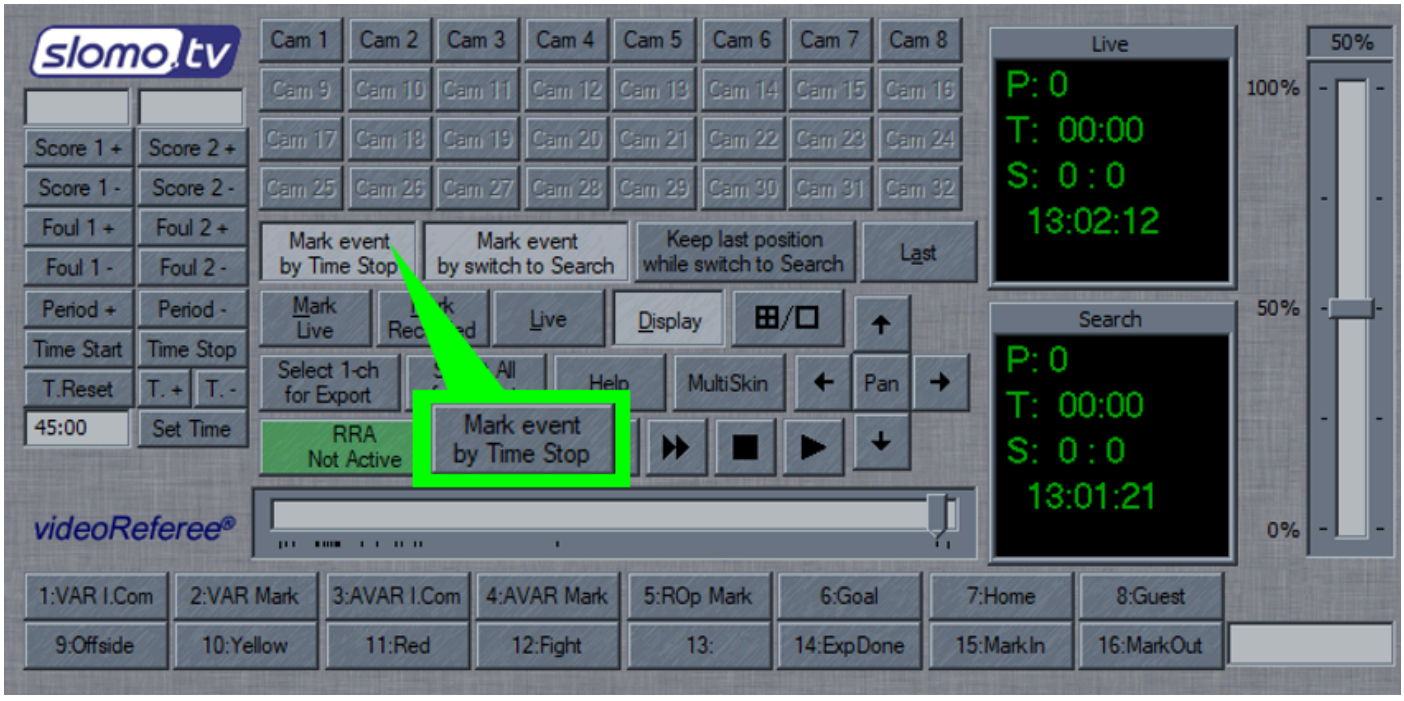
- by pressing the

(**Mark Live**) button in the engineering interface.
- by pressing the

(**Mark Recorded**) button in the engineering interface.
- – by pressing **Ctrl + M** or **~**;
- – by pressing the **Mark** button.

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 [1].

Mark event by time stop



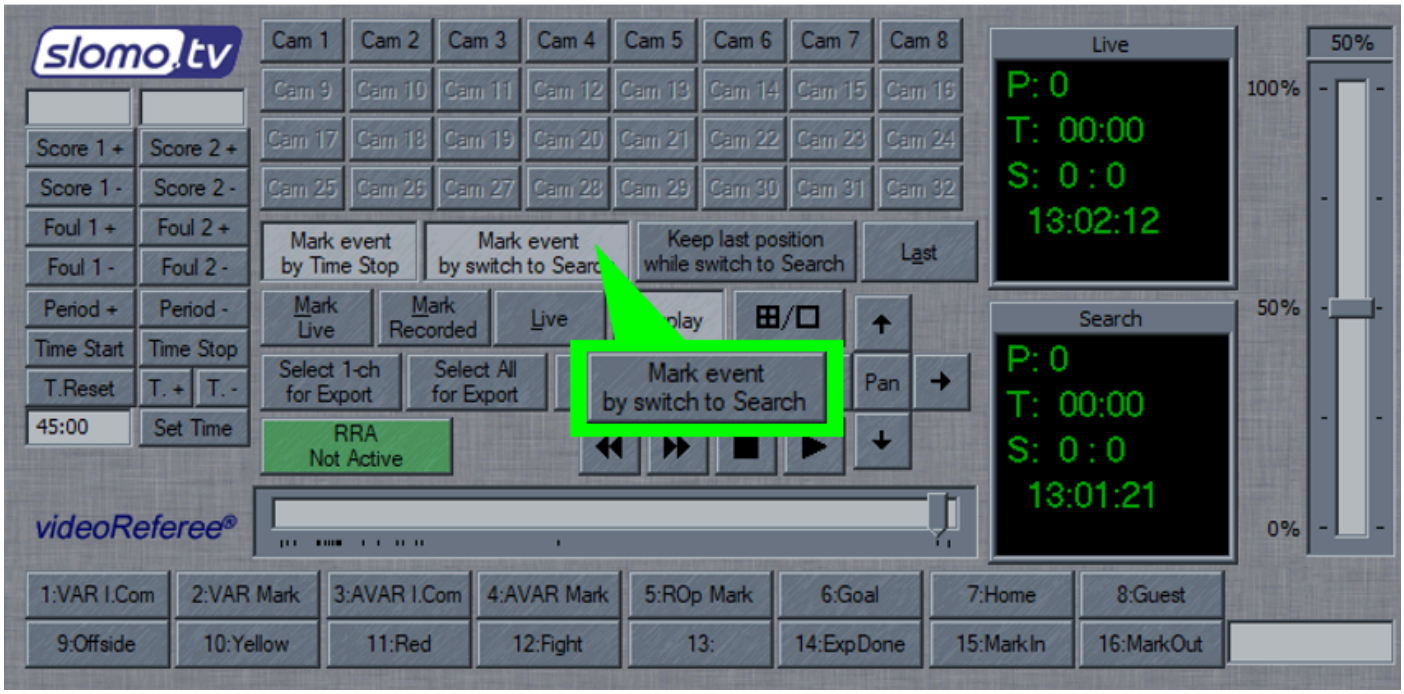
Mark event by time stop[2] – an event is created when the match time is stopped. At each stop of the game time, an event will be created that corresponds to the stop time and the current game parameters (period, score, time,

1. Used in ice hockey.
2. Used in ice hockey only.

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.

Mark event by switch to Search



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

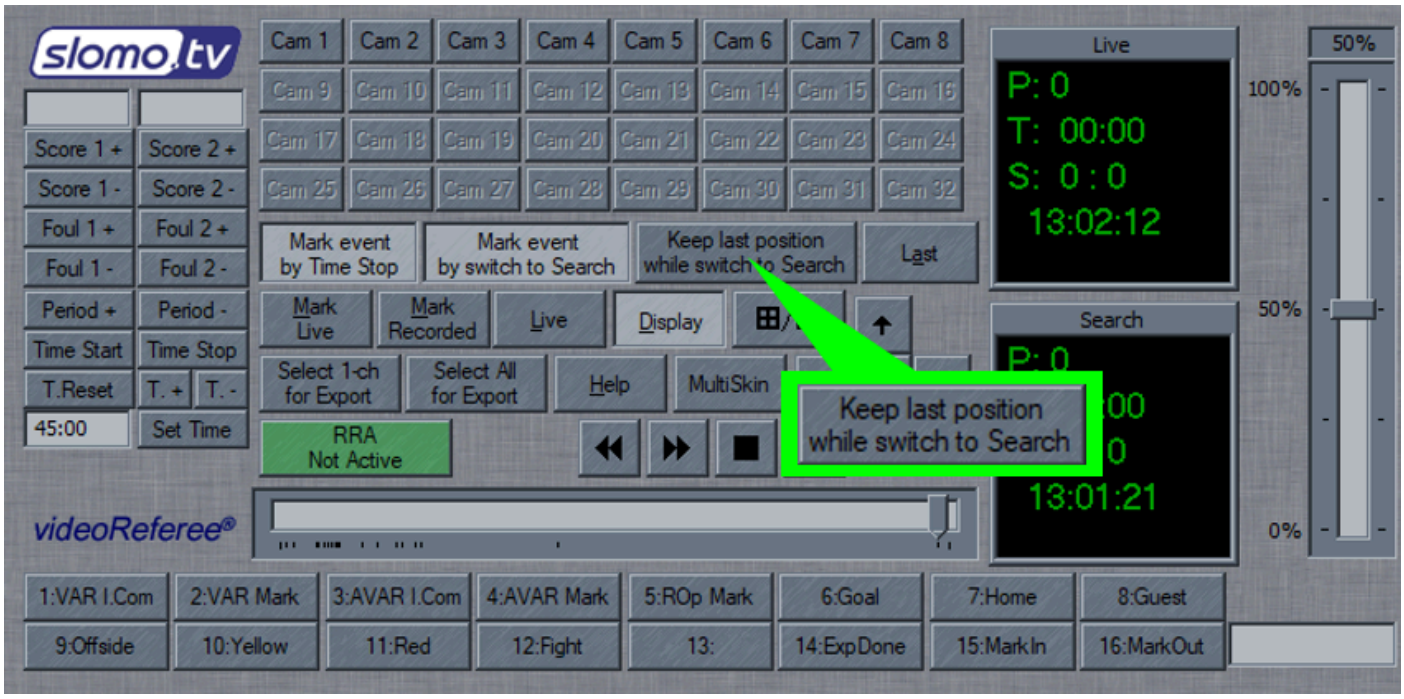
When the **Mark event by switch to Search** is enabled, switching to Search mode by pressing the **Live** button in the program interface or **Rec | Live** button on the control console will automatically create an event and the pointer on the Search/Playback timeline will position itself on the newly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

1. If present.

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/Playback 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.

In the figure 11, the **Keep last position while switch to Search** button is pressed – when you switch to Search mode, the pointer on the timeline remains at the same position as it was before.

Figure 11 – Keep last position while switch to Search is enabled

In figure 12, the button is not pressed – when you switch to search mode, the pointer on the timeline positions to the last mark.

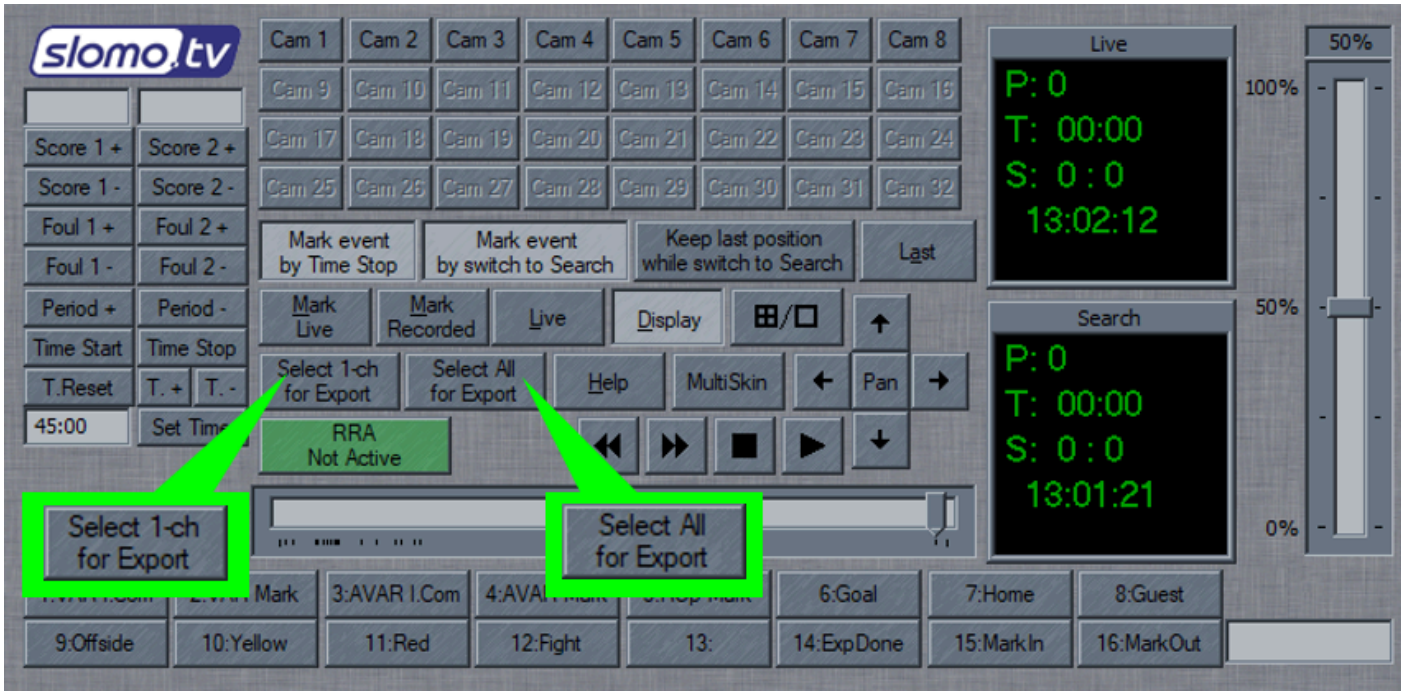
Figure 12 – Keep last position while switch to Search is disabled

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 put marks on events, indicating to the system the need to include data from cameras in the video report[1]:

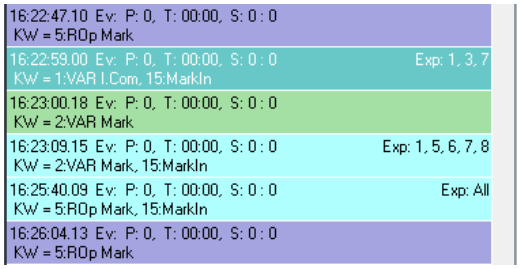
- **Select 1-ch for Export** – video from one active camera will be included in the report. Changing the active camera for the moment and pressing the button again allows you to select multiple cameras related to the same event for export;
- **Select All for Export** – video from all cameras related to the event will be included in the report.

Pressing the button again removes the corresponding mark.
These marks indicate to the *videoReferee®* system that video recording of the marked moment from the group(s) of cameras specified for that moment should be included in the video report.
If there are no marks, the moment will not be included in the video report.
A special note in the list of events indicates that the mark has been placed (figure 13):

- `Exp: All` – **Select All for Export** is marked for the event;
- `Exp: 1` – **Select 1-ch for Export** is marked for the event (active camera – 1);
- `Exp: 1, 5, 6, 7, 8` – **Select 1-ch for Export** is marked for several cameras related to this event (the recordings from the selected cameras will be included in the report for the selected moment).

If both **Select All for Export** and **Select 1-ch for Export** marks were set for an event, the report will include recordings from all cameras except the active one.

1. The set of cameras may vary depending on the configuration and sport.

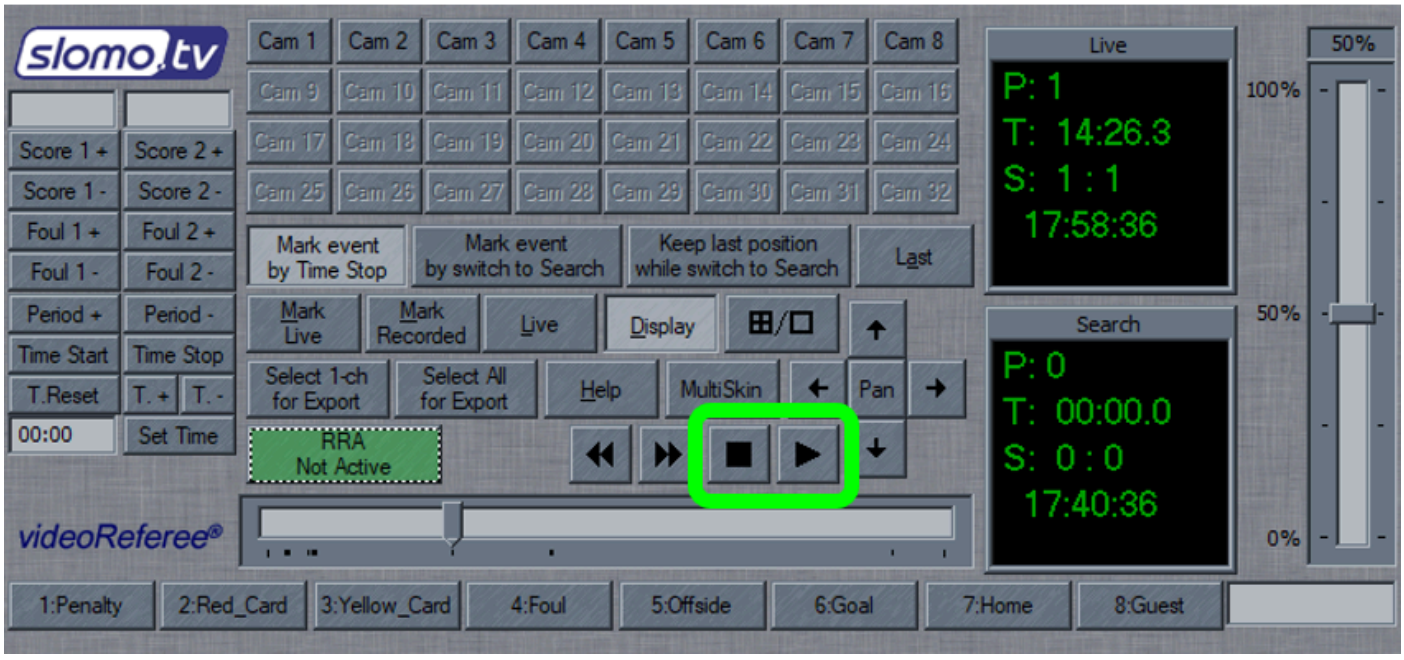


The analogue of Select 1-ch for Export button on the control panel in the interface is the **S1** button on the referee's control console.
The analogue of Select All for Export button on the control panel in the interface is the **S2** button on the referee's control console.

Figure 13 – Export marks

How to select 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**;
- – the (**Play**) button.

To stop the playback, you can also use:

- – **Ctrl + S**;
- – the (**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.

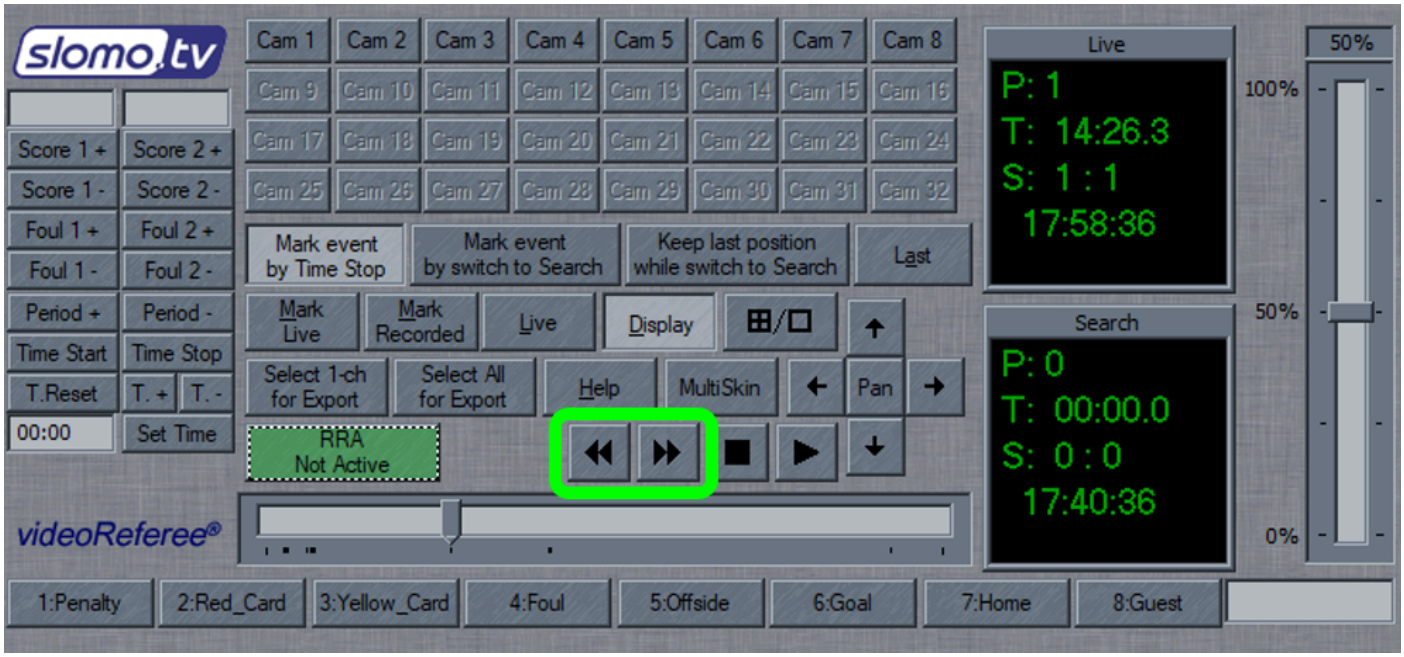
Press **Stop** twice to stop loop playback.

---

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

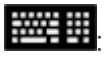


The **Forward** ( ) button positions you to the next mark on the recording timeline. If there is no such mark, the positioning is made to the end of the recording.
Trying to use the **Forward** button in Live mode causes the system to enter the Search mode, and the **Live** button automatically becomes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

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

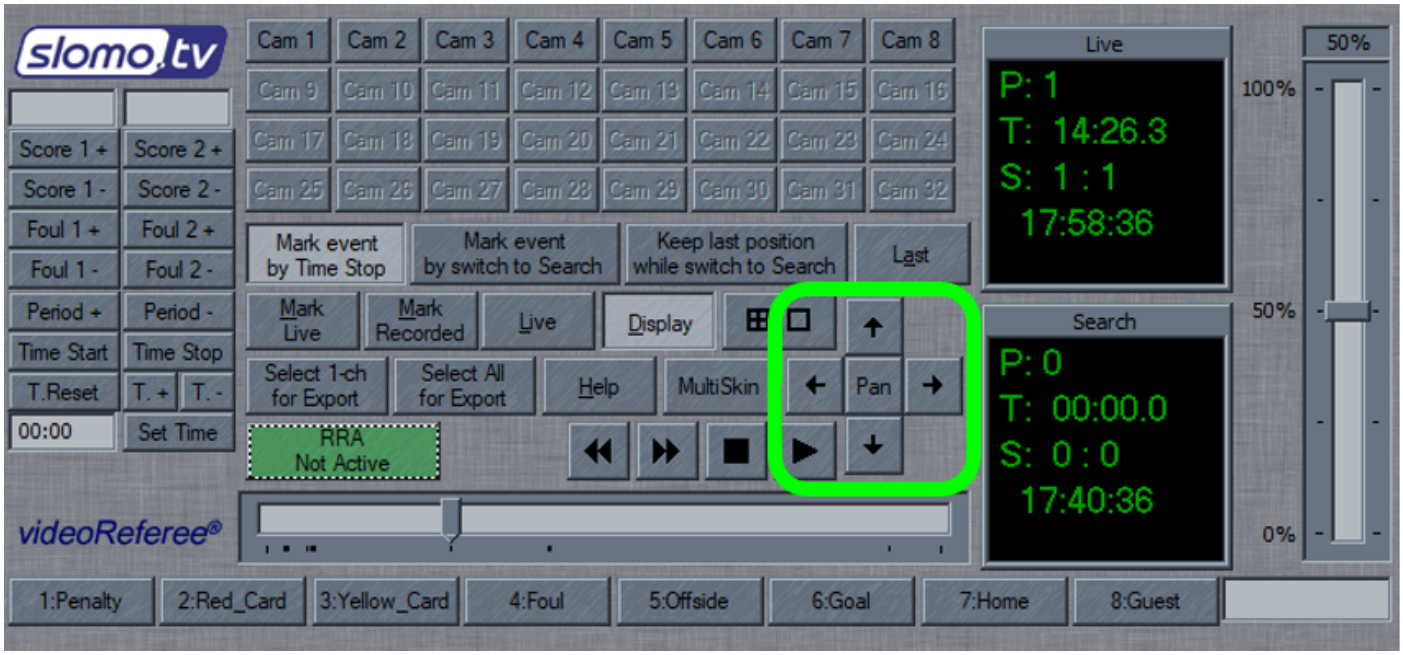
The **Backward** ( ) button positions you to the previous, earlier mark on the recording timeline. If there is no such mark, the positioning is made to the beginning of the recording.
Trying to use the **Backward** button in Live mode causes the system to enter the Search mode, and the **Live** button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

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

 : these actions are performed using 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** (

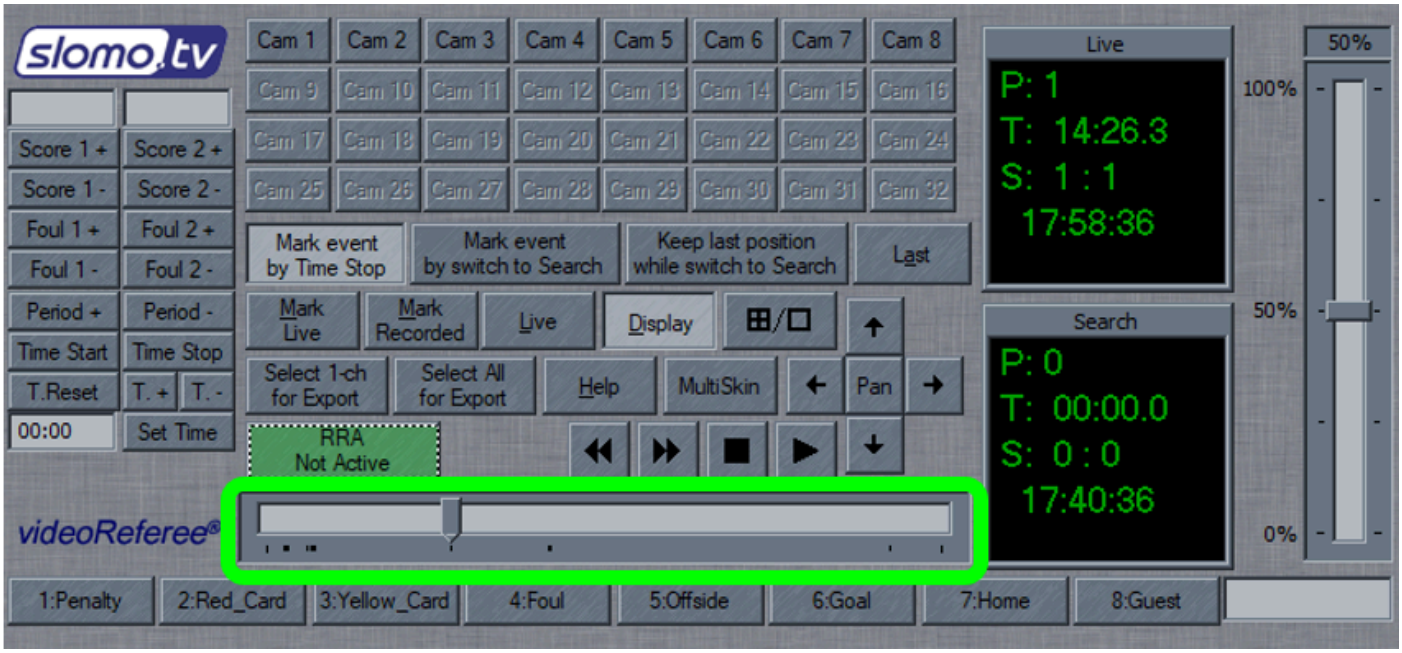
) button to double the scale of the current frame. You can navigate in the frame with , , , .

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.

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).

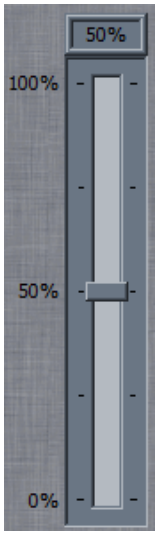
During playback, the playback speed (in percent) is displayed in front of the camera name on the referee's monitor.

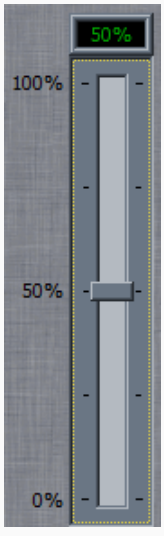
Changing the speed control mode

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:

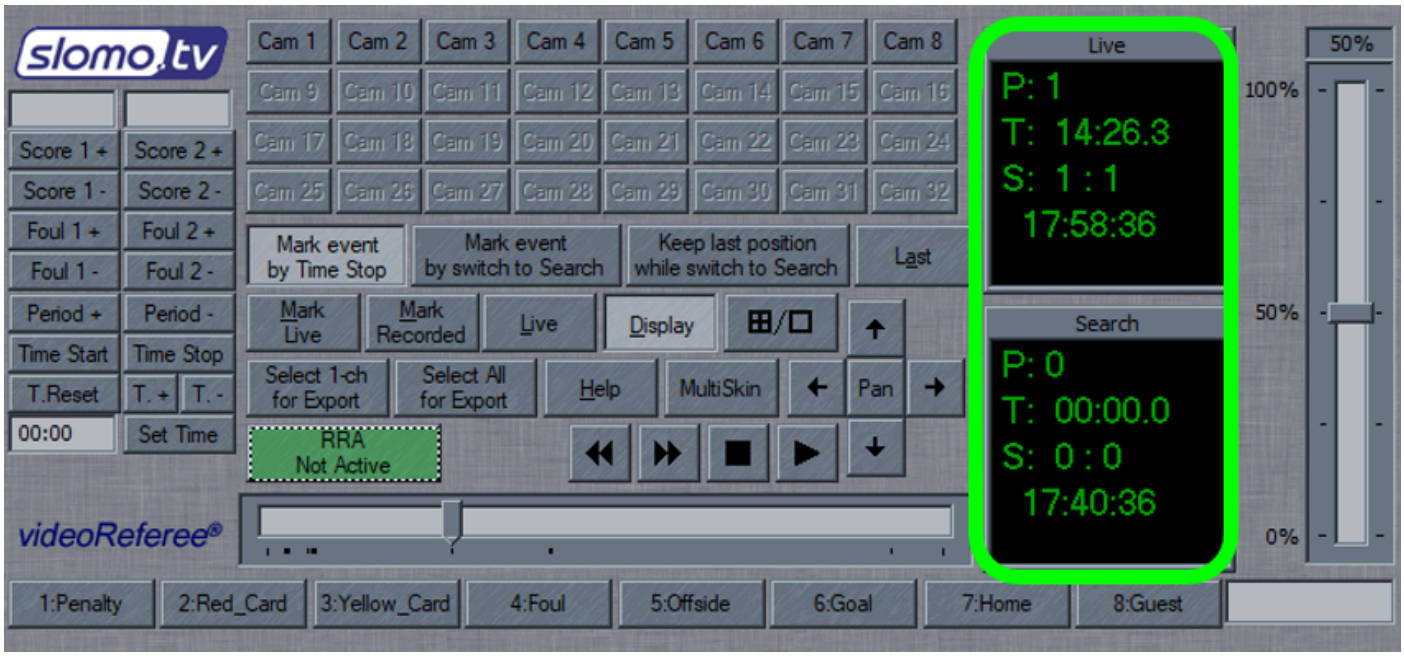




The window will change color to black: the stepped playback speed control is enabled.

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

Game data window



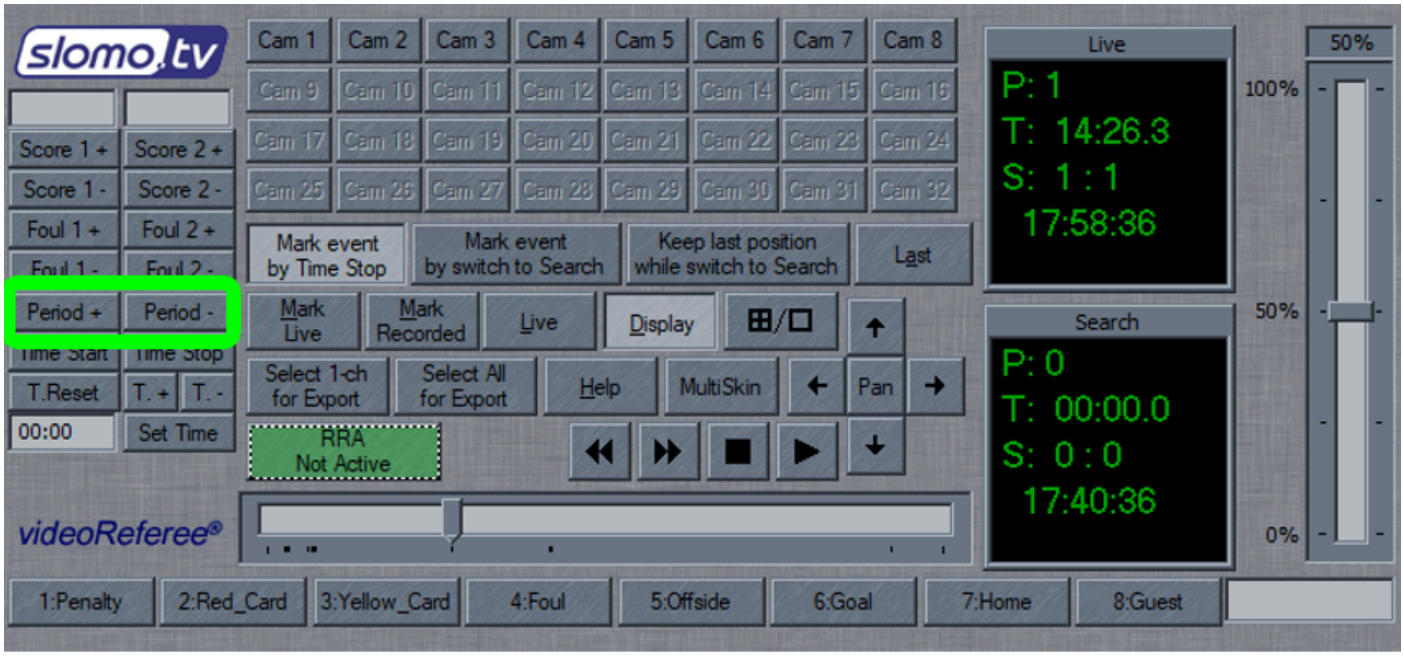
The Live window displays the current match data.
The Search window displays the data recorded at the time corresponding to the moment being viewed.
The set of data in both windows is the same[1]:

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

When the timer is running, the time will be decreasing.
The *videoReferee®* software takes the system time and sets the astronomical time accordingly. The astronomical time cannot be set manually.

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

Period+, Period-



These buttons allow you to set the period number.

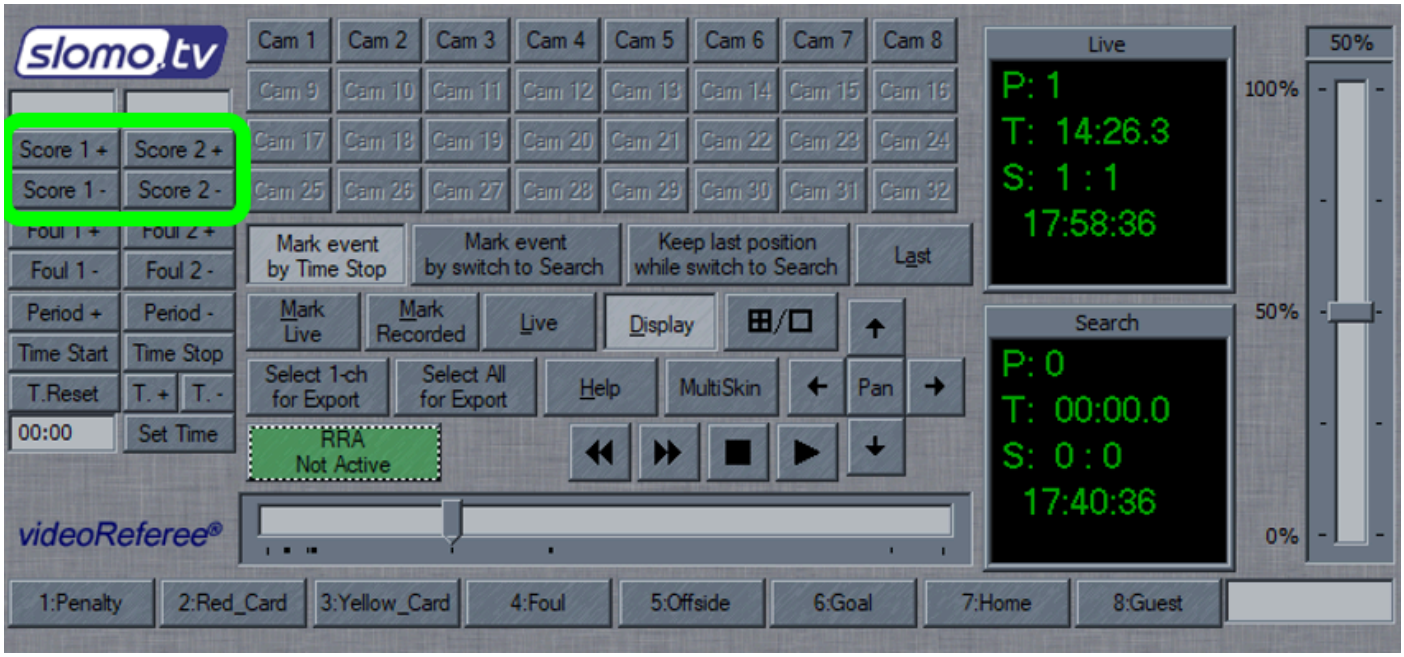
- **Period+** – increases the value by one each time you press it;
- **Period-** – decreases the value by one each time you press it.

→

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

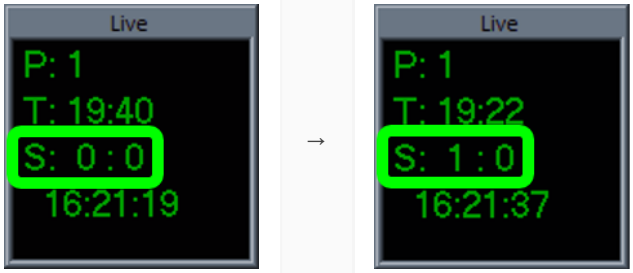
It is strictly forbidden to use the buttons unless absolutely necessary, as data entered from the engineering station will distort the data received from the match controller, and at the same time, it cannot be considered official.

Score1+, Score1-, Score2+, Score2-



These buttons allow you to set the score.

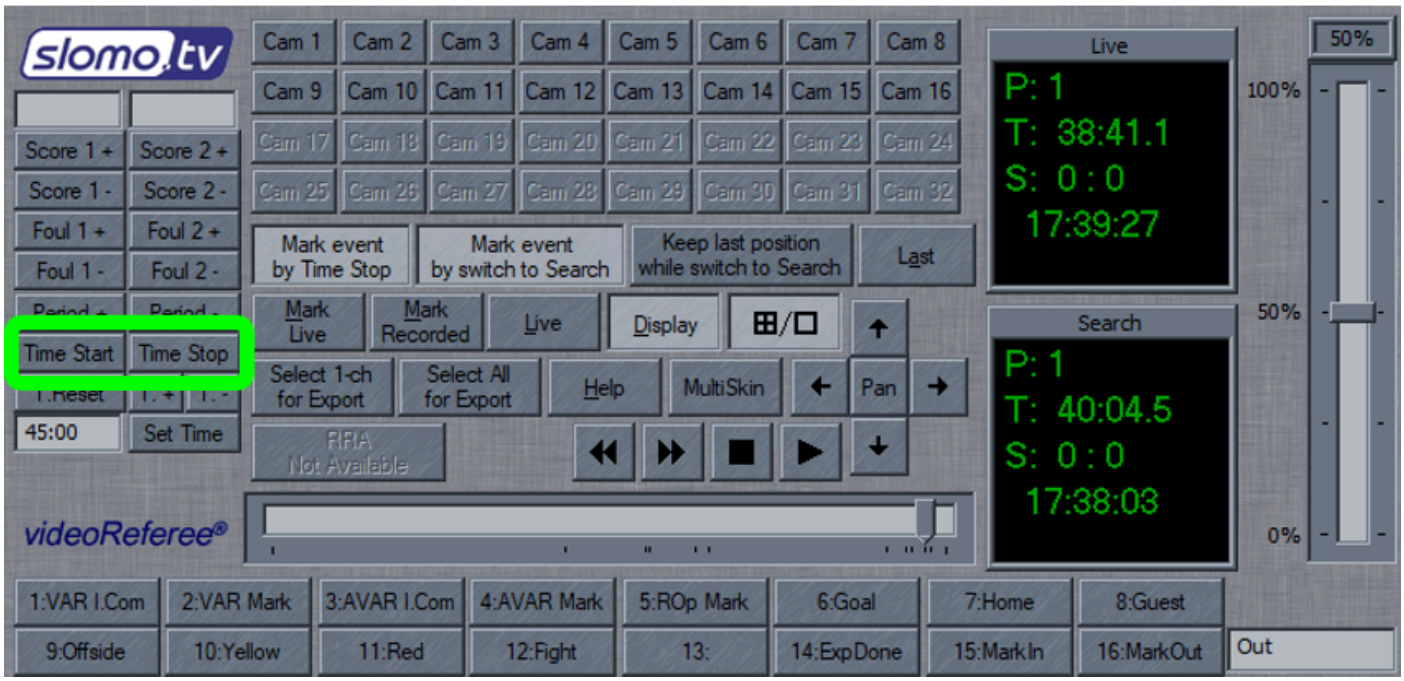
- **Score1+** and **Score2+** – increase the score of the first and second teams, respectively, by one each time the button is pressed.
- **Score1-** and **Score2-** – reduce the score parameter of the first and second teams, respectively, by one each time the button is pressed.



Pressing the **Score1+** button increases the score value (Live window, parameter "S").

⚠ It is strictly forbidden to use the buttons unless absolutely necessary, as data entered from the engineering station will distort the data received from the match controller, and at the same time, it cannot be considered official.

Time Start, Time Stop



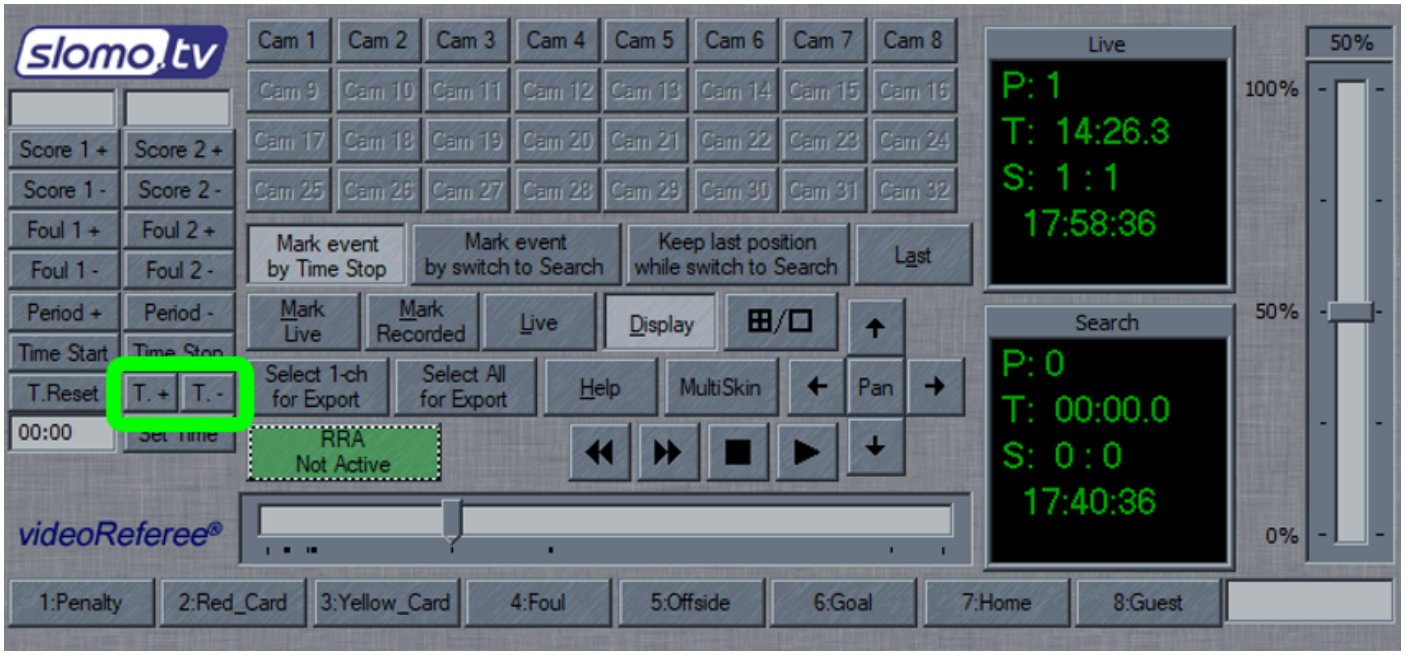
The **Time Start** and **Time Stop** buttons allow you to start and stop the game time (to set the time, use the **T.+**, **T.-**, **Set Time**, **T.Reset** buttons).

- **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.

> ⚠ It is strictly forbidden to use the buttons unless absolutely necessary, as data entered from the engineering station will distort the data received from the match controller, and at the same time, it cannot be considered official.

T.+, T.-



The **T.+**, **T.-** buttons allow you to make small adjustments to the match time parameter.

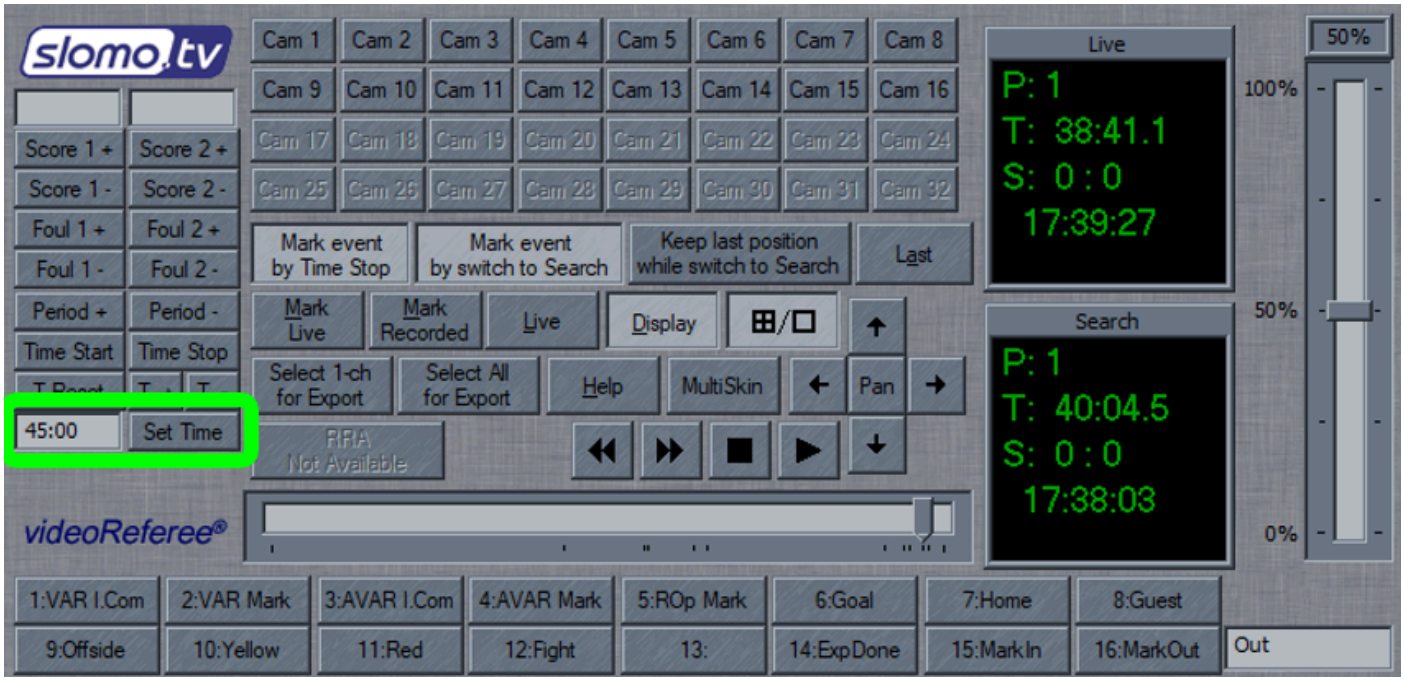
Before pressing the **T.-** button

After pressing the **T.-** button

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.

It is strictly forbidden to use the buttons unless absolutely necessary, as data entered from the engineering station will distort the data received from the match controller, and at the same time, it cannot be considered official.

Set Time

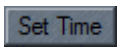


The **Set Time** allows you to set the game time. Enter the desired value in the input field to the left of the **Set Time** button and press the button.

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 entered time.
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:

It is strictly forbidden to use the button unless absolutely necessary, as data entered from the engineering station will distort the data received from the match controller, and at the same time, it cannot be considered official.

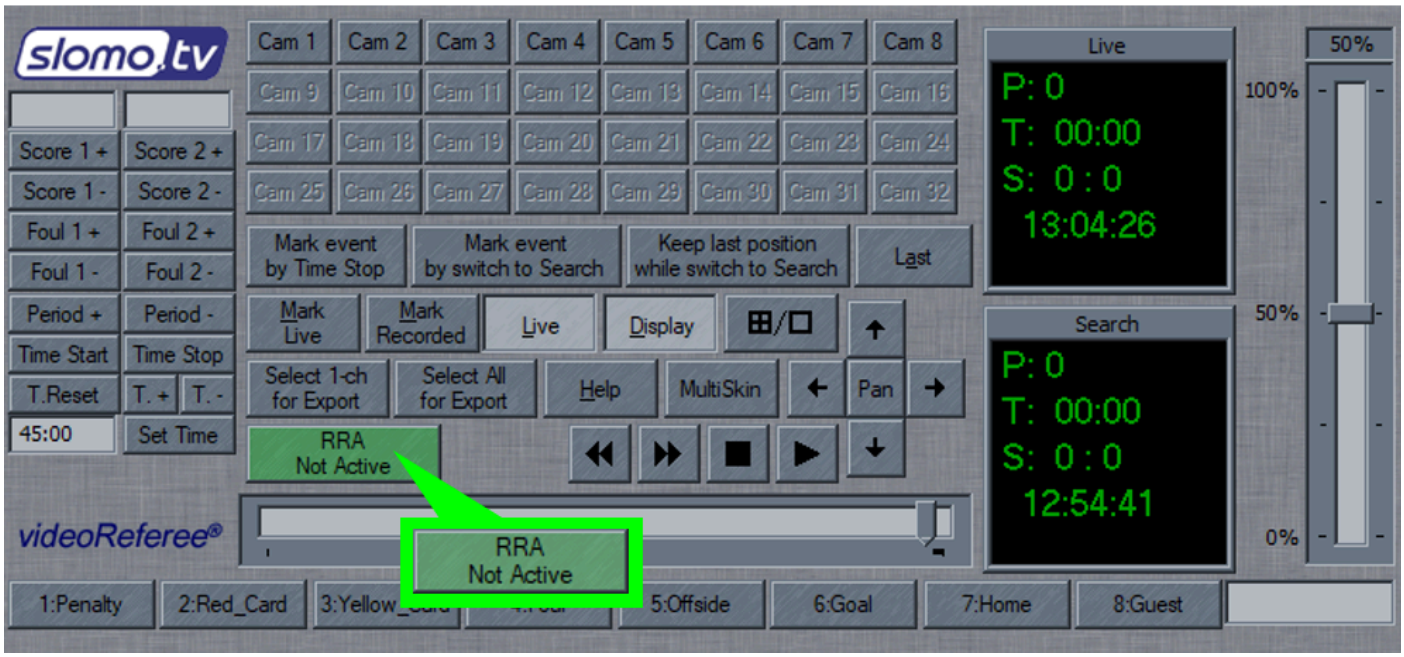
T. Reset

The **T.Reset** clears the game time value.

Pressing the **T.Reset** (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.

> ⚠ It is strictly forbidden to use the button unless absolutely necessary, as data entered from the engineering station will distort the data received from the match controller, and at the same time, it cannot be considered official.

Referee Review Area – RRA option



The RRA[1] option 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:

- RRA Not Active button in the engineering interface;
- – **Alt + R** key combination;
- – **Cmd + Alt + Rec** | **Live** combination.

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

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

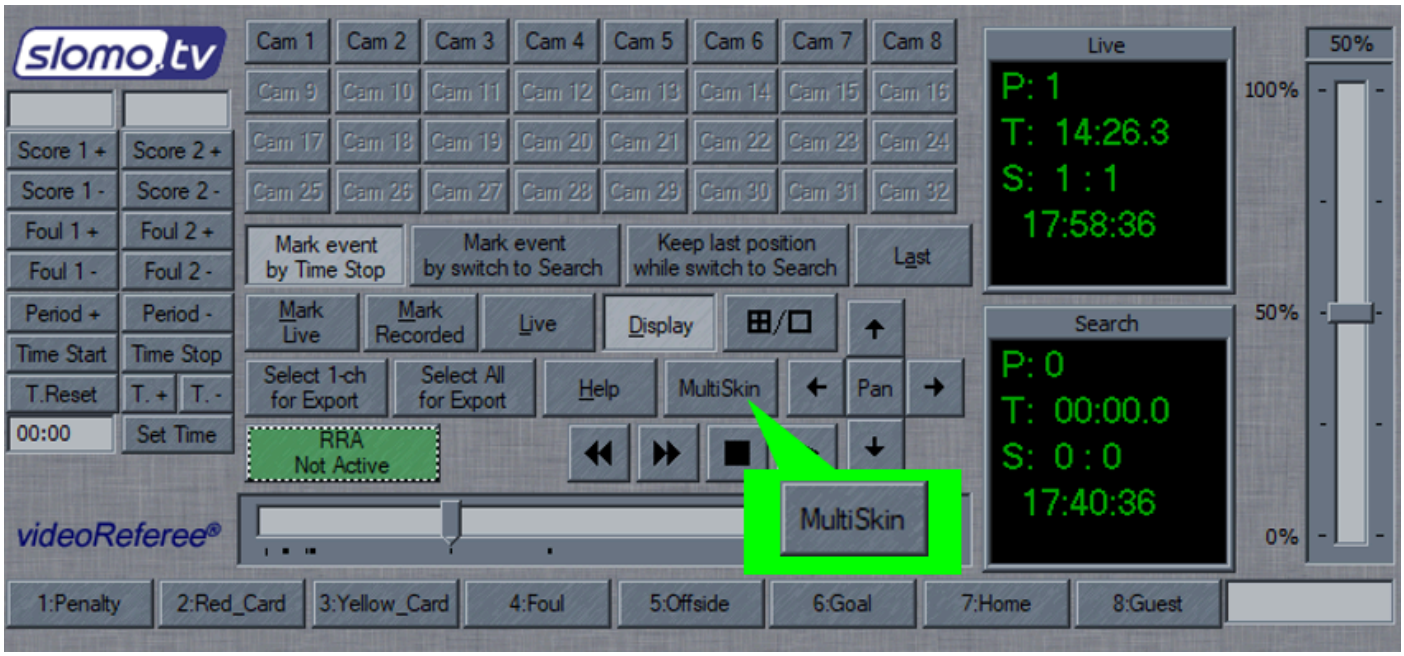
Image name format – *RRA_XX.png*, where *XX* – sequential number 00, 01, 02, etc. The maximum number (XX) corresponds to 16 or to the number of available channels in the system, if less than 16.

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:

- press the **Scroll Lock** key on the keyboard:
- press the **Active** button on the control console.

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

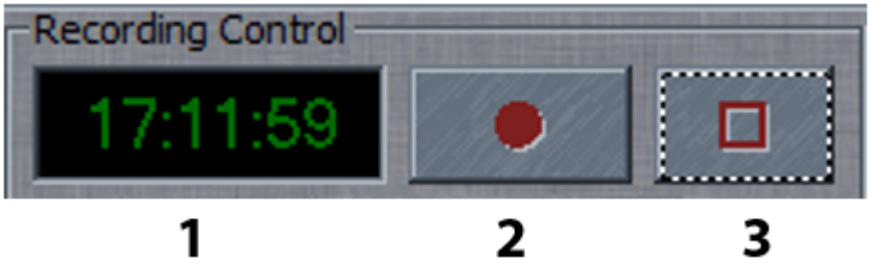
When using several additional interfaces for different functions, such as MV and Game Analyzer, press the **Scroll Lock** key repeatedly until the desired interface appears on the monitor.

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:

- – press **Esc** or **Scroll Lock** again;
- – press **Active** button.

Recording Control panel

The Recording Control panel has three functional elements:



1. Time – the current time of the system clock;
2. **Record** ( ) button – starts video recording;
3. **Stop** ( ) button – stops video recording.

Start the video recording in one of the following ways:

- press the **Record** button (2) on the recording control panel of the program;
- – press **Ctrl + Shift + R** combination;
- – press **Alt + Ctrl + Shift + Mark** combination.

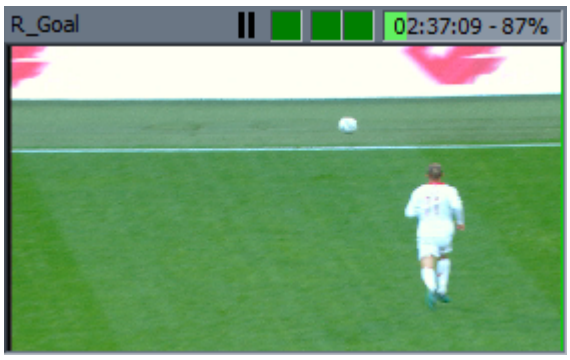
Stop the video recording in one of the following ways:

- press the **Stop** button (3) on the recording control panel of the program;
- – press **Ctrl + Shift + S** combination;
- – press **Alt + Ctrl + Shift + ■** combination.

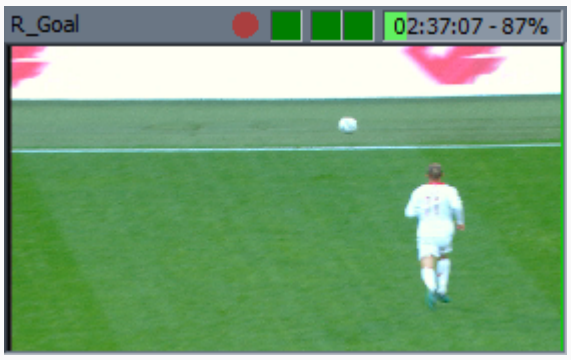
After you start the video recording, the recording control panel will look as:

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

Video engineer's work with the *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 to check the performance of the functions available to the video-refereeing team.
The video engineer may perform the following actions at the direct instruction of the main referee or of the video assistant referee:

- stop and start the match time by the referee's whistle, change the score, change the period, 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 and exclude the marked game moments from the video report.

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.
- 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 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.

Working with the program

Start video recording

You can start the recording of the video with:

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. Regular checks of videoReferee® system and disk replacement on time will ensure early detection of problems and proactive troubleshooting.

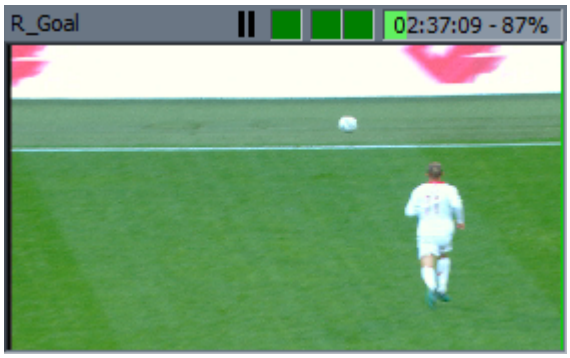
- the **Record** button ( ) located in the Recording Control area of the engineering interface;
- – the **Ctrl + Shift + R** key combination;
- – the **Alt + Ctrl + Shift + Mark** combination.

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.

Recording indication

When you turn on video recording, the recording indicator of each channel[1] changes its indication from a pause sign (⏸) to the 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, i.e., go to the mark, rewind to the required moment and 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

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

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).

An event can be created in one of the following ways:

- by pressing the

(**Mark Live**) button in the engineering interface when viewing live video;
- by pressing the

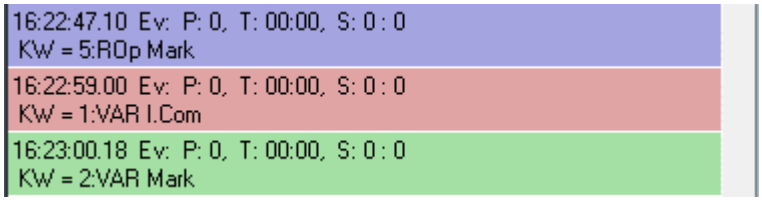
(**Mark Recorded**) button in the engineering interface when viewing recorded video;
- – by pressing **Ctrl + M** or **~**;
- – by pressing the **Mark** button.

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.

After you press the **Mark** button, an event will be created (figure 14). A name is assigned to each created event. The event mark contains the following information:

- time-code in the HH:MM:SS.NN format, where NN stands for frame number;
- event name (by default, *Ev:*);
- period number (P: 0);
- game time (T: 00:00);
- score (S: 0:0);
- key (tag)[1] – 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. Depending on the system settings and the sport, it may not be available when creating events, but can be added manually for the existing events. You can add it from the program interface or using the control panel.

Figure 14 – List of 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.

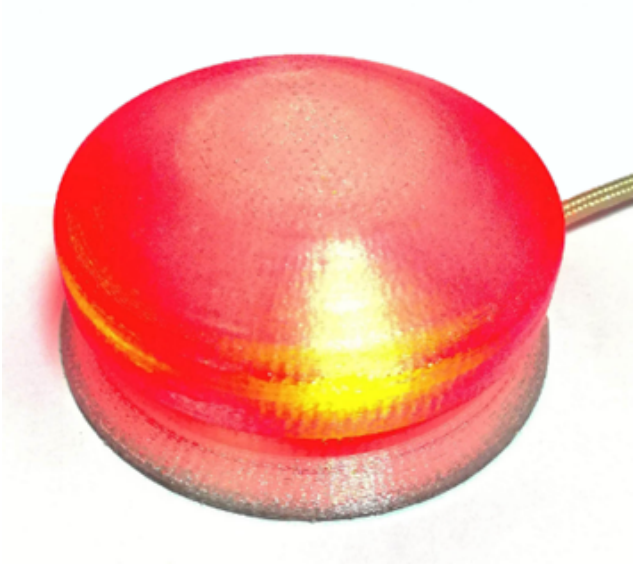
Create events with Referee Buttons

The referee's workplace can be equipped with Referee Buttons[1] for convenient and fast operation.
Up to six buttons can be connected to the system – three red and three green.
Each button is connected via USB. The cable length of each button is 3 m. For ease of use, there is a magnet at the base of the button.
The button is white before it is connected to the system. Before the software is loaded, the button is glowing with different colors.
The function of the button is determined by the configuration of the system. After the software is loaded, the button will take on the color corresponding to its setting and function.
When a button is pressed, an indication is displayed on the referee monitor screen: horizontal lines at the top and bottom of the screen matching the color of the pressed button. If 2 or 3 buttons with different functions were pressed simultaneously, the lines will also have several colors corresponding to the pressed buttons.

On the RRA monitor, the horizontal lines at the top and bottom of the screen indicating that a button has been pressed are only displayed if the playback is in progress.
The referee buttons can be used to create events.
The green referee button is used to mark event (equivalent to the Mark button on the control panel).
The red referee button is used to activate the referee intercom; an event is automatically created when doing so. The radio channel between the VAR and the referee on the field is active as long as the button is pressed.

1. If included in the delivery set for the selected equipment configuration.

Green referee button



Red referee button

The VAR workplace is equipped with two buttons, one red and one green, and the same set of buttons is available at the AVAR workplace.
Events created by pressing the buttons have a color difference in the list of events, as well as a text marking indicating by whom it was created (see “Event tags”).

Pressing the referee buttons is accompanied by a color indication on the referee monitor and in the video output monitoring window – the lines of the corresponding color at the top and bottom of the screen:

Green referee button is pressed	Red referee button is pressed

Both red and green referee button are pressed

Figure 15 – Color indication when the referee button is pressed

---

Automatic event creation

In addition to manual creation of event, 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].
- 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 16.
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 16 – Event renaming

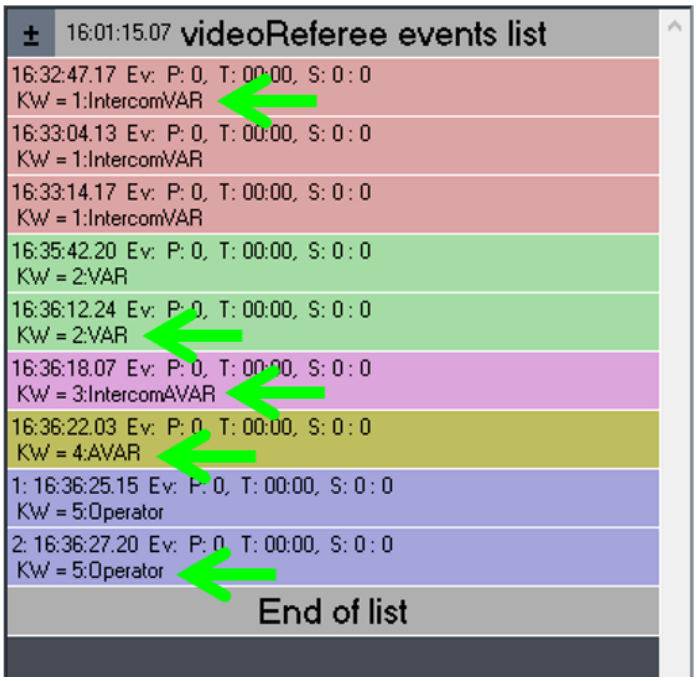
Event tags

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.



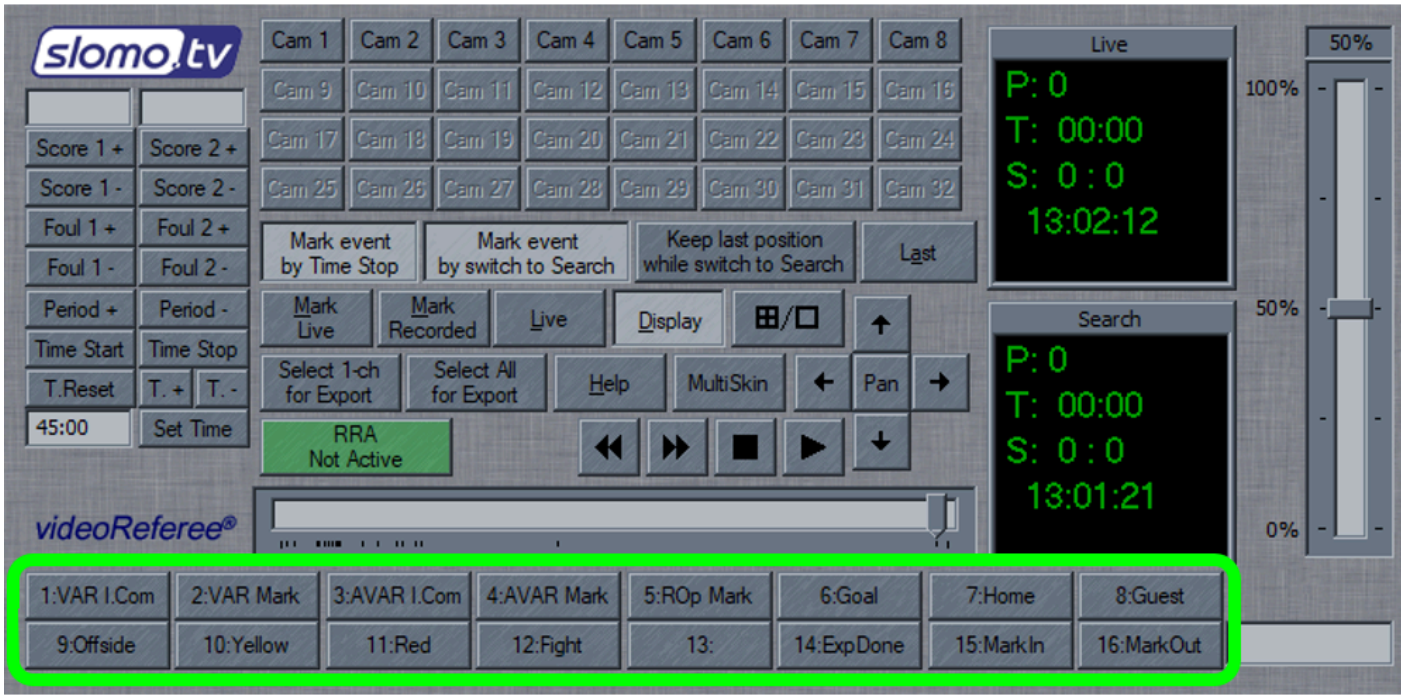
Example of color coding depending on the tag:
VAR - green color - event created with green referee button;
IntercomVAR – red color - event created with red referee button;
AVAR – yellow color – event created with green AVAR's button;
IntercomAVAR – purple color – event created with the red AVAR's button;
Operator – event created from the control console.

Figure 17 – Color coding of events depending on the 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.

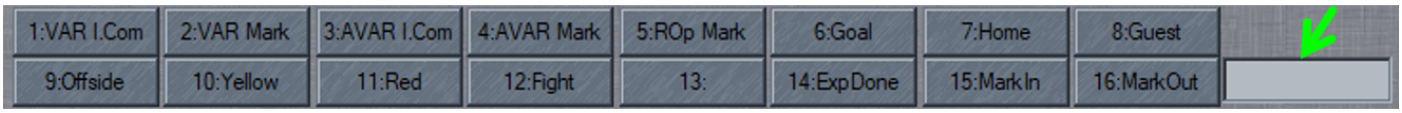
15:MarkIn	**Alt + Ch.15**[1]	Marks the entry point for the moment to be exported. It is set automatically when the event is selected for export with the **Select 1-ch for Export (S1)** and **Select All for Export (S2)** buttons. It cannot be set / deleted by the user. Has a light blue highlight in the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

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).

1. Used for search by this tag only.
2. The characters entered as the button name must be ASCII encoded. The non-ASCII characters may not be displayed correctly.

To exit the search by tags mode press **Mode**.

Delete event

To delete an event from the event list:

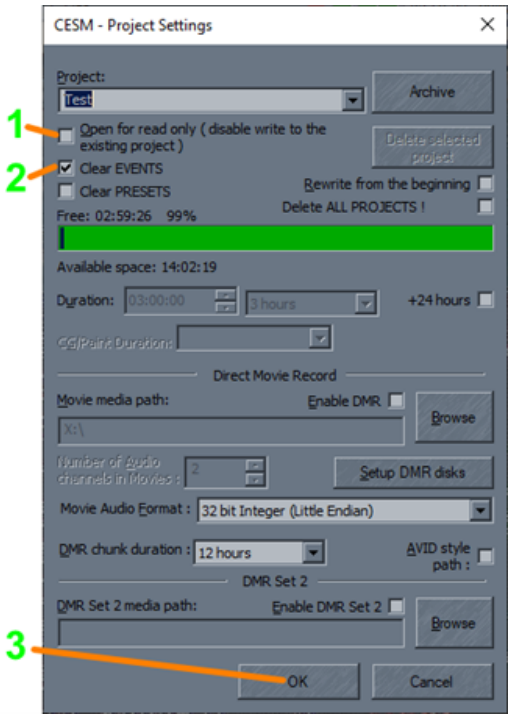
1. select the event you want to delete;
2. – press the **Ctrl + Del** shortcut;
3. – press **Mark + Ch.15**.

> 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.

Delete 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.

Create preset

To create a Preset, perform the following steps sequentially from the control panel:

1. use the Last button to select the required number of channels to be displayed on the referee's monitor – 2, 3, or 4;
2. select the channels to be included in the preset using the channel buttons – **Ch.1...Ch.16** (with Shift if there are more than 16 channels);
3. go to preset assignment mode – the **Mode** button is purple;
4. select the channel button to which you want to assign the new preset – **Ch.1...Ch.14**, press it and hold it down until the button starts blinking (~ 2-3 seconds)[1];
5. confirm the selection with **Ch.16** (**Enter**) – the button of the selected channel will stop blinking and the preset will be saved to the selected channel. To interrupt preset saving, press any functional button (not the channel button).

If any preset has been previously assigned to the selected button, the new preset will be added after the current (last used) preset. If you want to create a preset not after but before the current preset, press Shift **+ Ch.16** (**Enter**) when confirming (step 5).

Select preset

Preset selection is available from the mode of work with cameras – the **Mode** button is green. Use **Ctrl** **+ Ch.N** (Ch.1...Ch.14) to quickly select a preset.
From the preset mode – the **Mode** button is purple – selection is made directly with the **Ch.N** channel buttons.
If several presets are recorded on one button, press the button / button combination several times until the desired preset is selected.

1. If no preset(s) have been assigned to the button before, it flashes white-pink. If the button already has a preset(s), it flashes yellow-pink.

If more than two presets are saved on the same channel button, you can move backwards through the presets with the Shift button while you are in preset mode – the **Mode** button is purple.
When you select a preset, as many channels as have been saved for that preset will be displayed on the monitor.

Also, selecting some presets automatically creates events. By default, it is configured that when a preset assigned to one of the first 4 channel buttons (**Ch.1...Ch.4**) is selected (**Ctrl + Ch.N**), an event is automatically created and added to the event list[1]. There may be no preset assigned to a channel button, but regardless of that if a preset selection shortcut is pressed, an event will be automatically created.

Delete preset

To delete a preset, enter the Preset mode (the **Mode** button in purple):

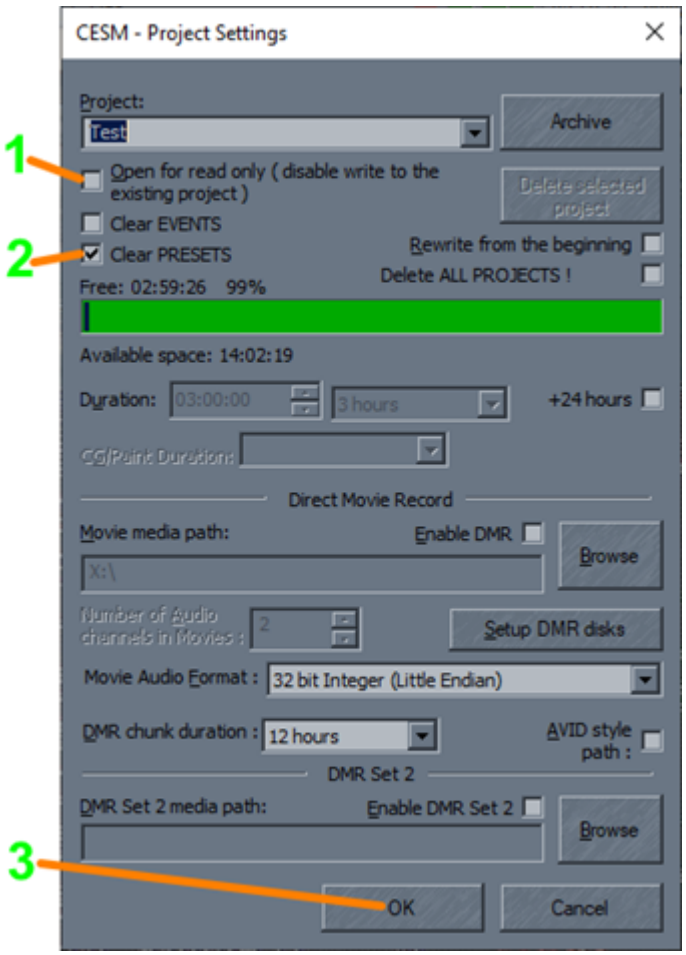
- select a preset you want to delete – make it active at the moment – with the channel buttons **Ch.1...Ch.14**;
- press and hold down this preset button until it starts blinking (~ 2-3 seconds);
- press **Ch.15** (**Backspace**). Press any other button to abort the deletion of a preset.

If multiple presets are saved on the same channel button, you must repeat the deletion steps as many times as the number of presets you want to delete.

Delete all presets in a project

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

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



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].

1. Available not for all configurations.

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;
- – the **Ctrl + Shift + S** key combination;
- – the **Alt + Ctrl + Shift + ■** combination.

Multiviewer

Active channel selection

The active channel is selected by a single left mouse click in the window of the corresponding channel.
If a touch screen monitor is used to display the Multiviewer, the active channel is selected with a single finger tap on the channel window.
Selecting the active channel in the Multiviewer is equivalent to selecting a channel in the main interface.

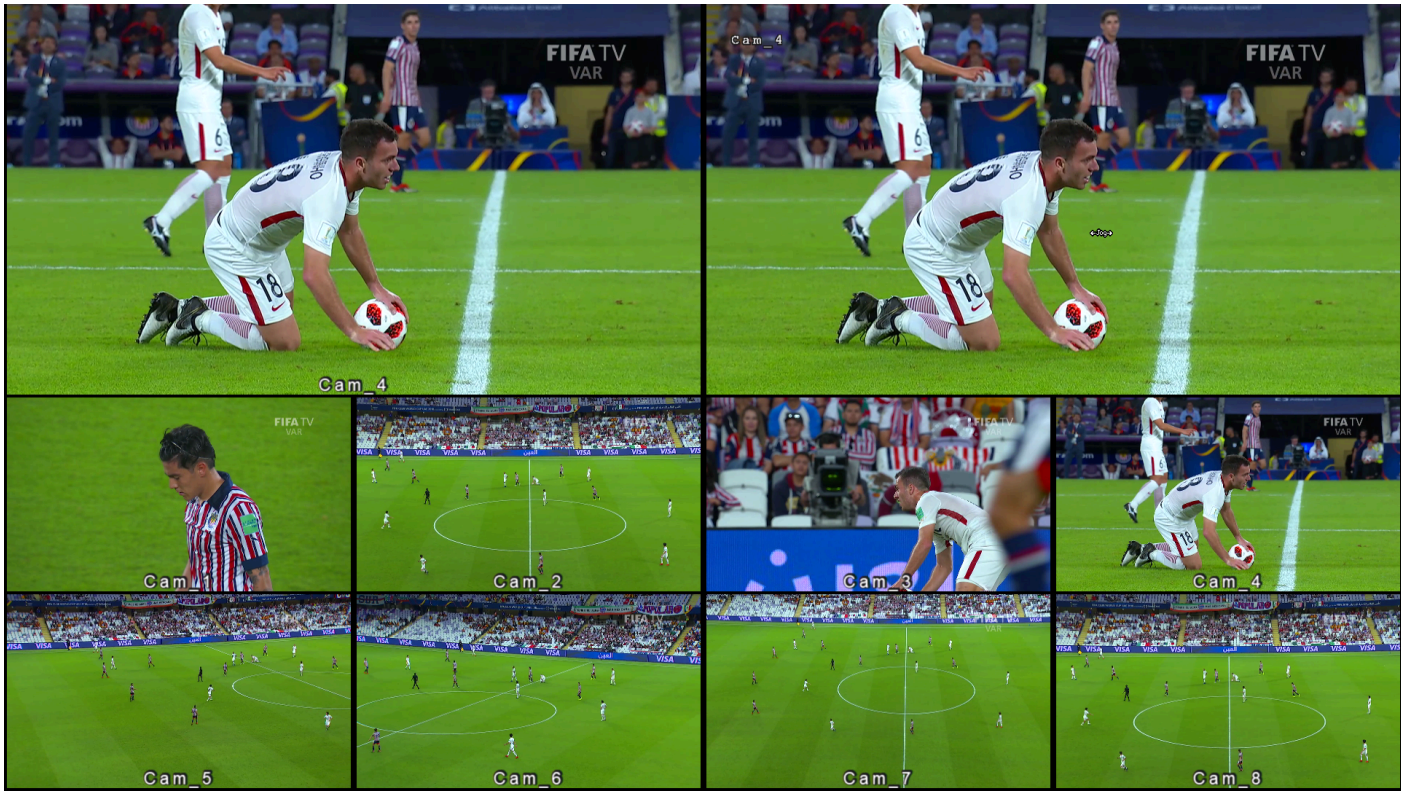


Figure 18 – Cam_4 channel is active

Display the channel in full screen

Double-click the left mouse button on the channel window to expand the selected channel to the full screen (figure 19). Double-clicking the left mouse button again to return to MV mode.
Selecting a channel from the keyboard or from the referee control console changes the selected full-screen channel.

Figure 19 – Full screen mode

If the Multiviewer is displayed on a touch screen monitor, double tap with your finger on the channel window to expand the channel to the full screen[1]. To return to all channels (Multiviewer), double tap on the screen.
When a channel is expanded to the full screen, the operating mode (live/recorded) on the channel does not change.

Switch between Live / Search modes

There is no indication on Multiviewer when switching from Live to Recorded video mode.
When you expand the channel to the full screen, the operating mode on this channel does not change – it is always Live[2].

Search through recorded video

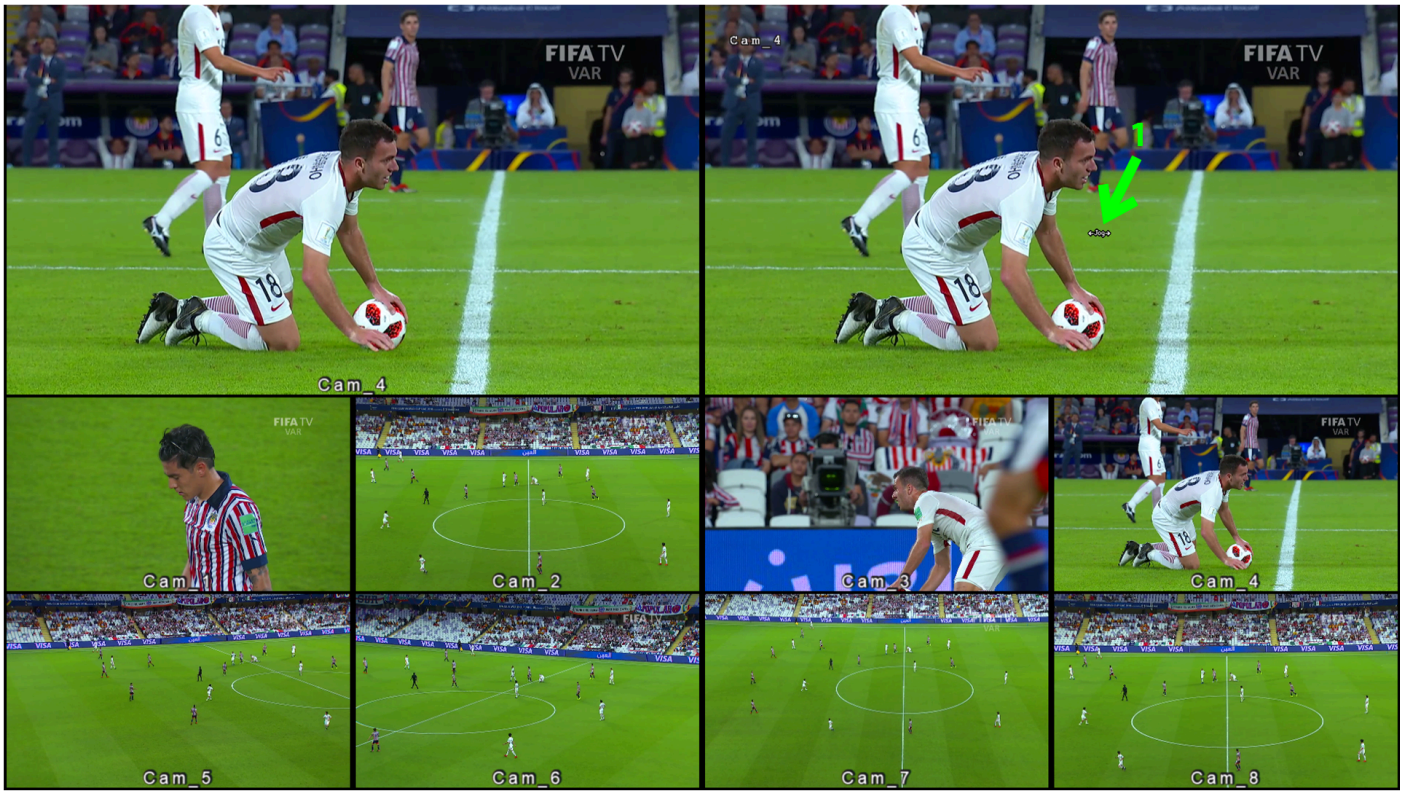
To search through the recorded video in the referee output window, press the left mouse button and without releasing it move the cursor to the left or to the right: rewind backward or forward, respectively. The mouse cursor will look like this: (figure 20).

1. This function can be disabled. To deactivate it, contact technical support.
2. This behavior can be changed by contacting technical support.

You can speed up or slow down the search by using the following buttons:

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

The referee output window in Multiviewer displays the channel name during the search.



1 – Search through the video – ⇦Jog⇨

Figure 20 – Search through recorded video

Gesture control on the Multiviewer

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

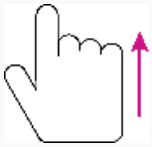
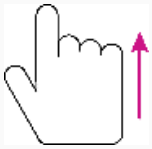
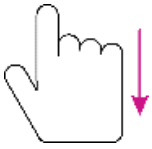
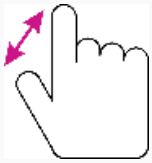
Gesture	Description	Function
	Single tap with one finger on the channel window	Select active camera

	Double tap with one finger on the channel window	Expand the channel to full screen
	Slide with one finger left / right horizontally in the referee output window	Search backward/forward through recorded video
	Double tap with one finger on the logo or info window	Exit MV (when one monitor is used)
Alt +	Press the **Alt** key on the keyboard and single tap on the channel window for which you want to create a mark	Create mark

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

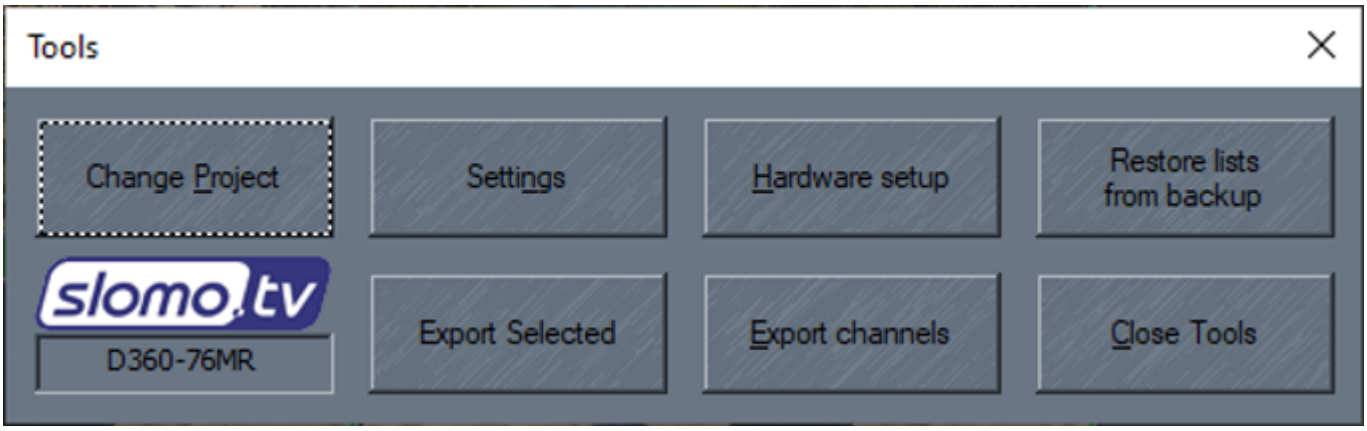
Export of events (creation of a video report)

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.

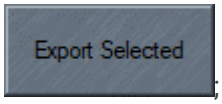
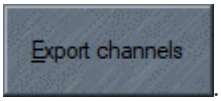
Therefore, for each marked game moment, you should specify whether it should be included in the report, and the information from which camera should be included. In most cases, the video referee will indicate the need to include a game moment in the video report immediately as it occurs or while reviewing 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.
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 button on the toolbar
or the keyboard shortcut **Ctrl + Shift + T**.



The following export options are available in the opened *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 the recording").

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

---

1. To disable this operation, contact technical support.

Selection of events for export

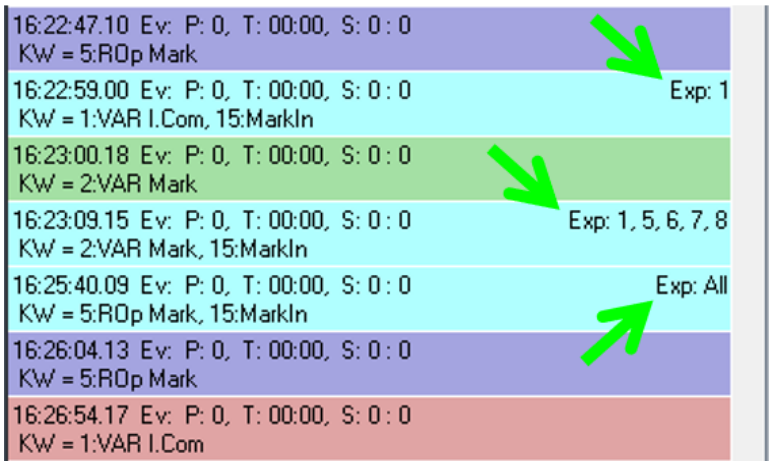
Use **Select 1-ch for Export** and **Select All for Export** buttons in the interface or **S1** and **S2** button on the control console respectively to indicate to the system that the moment should be included in the video report.
For football, the buttons are configured as follows[1]:

- **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 21– Selecting cameras for export

Should it be needed to include all cameras except for the active one, place two marks – **S1**, **S2** (figure 22).
If it is no longer needed to include a moment or a group of cameras (for example, **S1** or **S2** was pressed accidentally), press this/these button(s) again and the mark(s) will be removed.

1. The set of cameras to be included 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 22 – 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 - 10 s before the event mark and 5 s 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:

- with the

button in the program interface;
- – **Alt + Ch.16** or just **Ch.16**, if the tag assignment mode is enabled – the **Mode** button is blue.

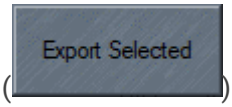
If a **Mark Out** tag is placed but there is no **Mark In** tag, it does not affect anything.

> 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 23.

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.

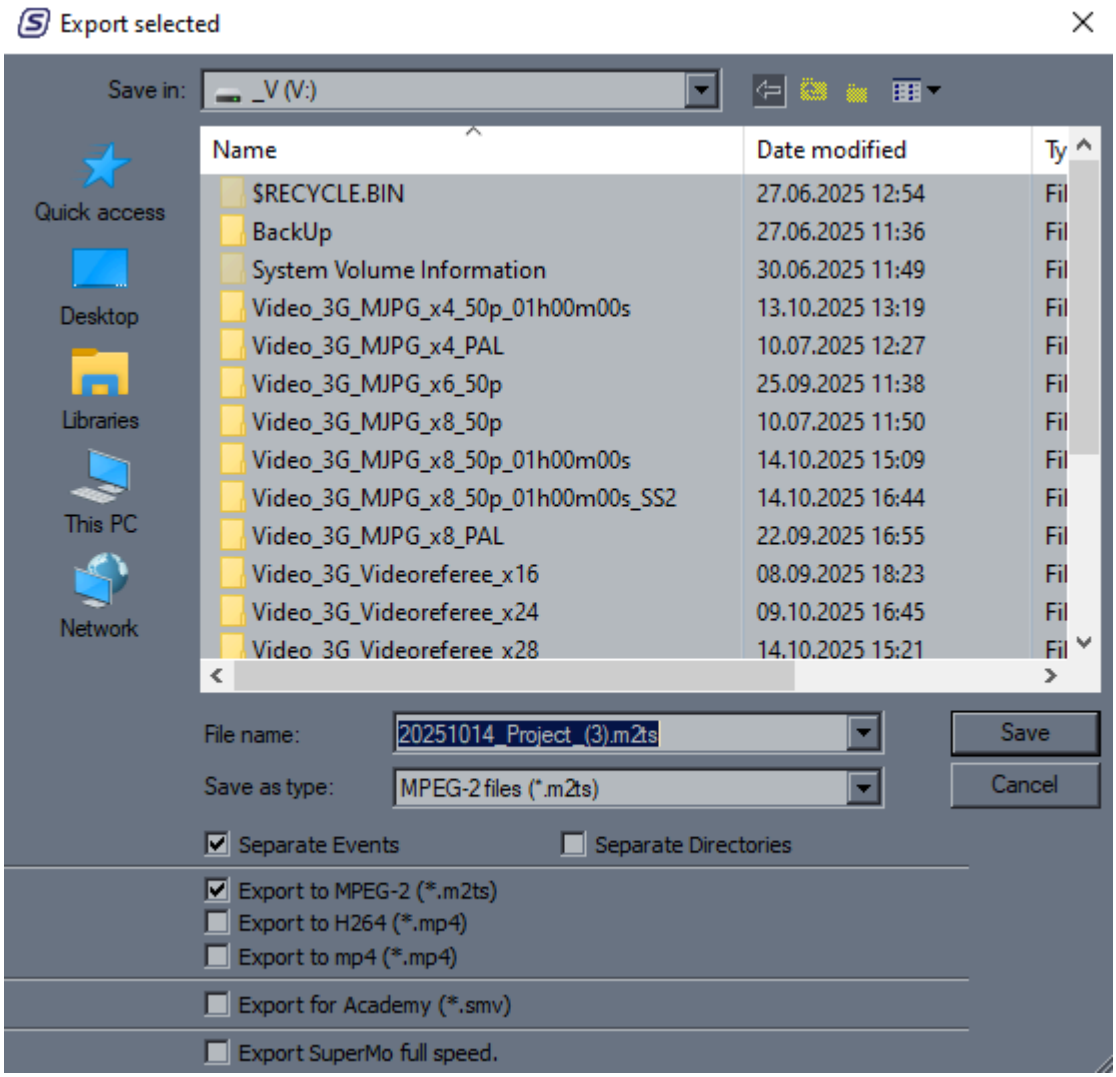
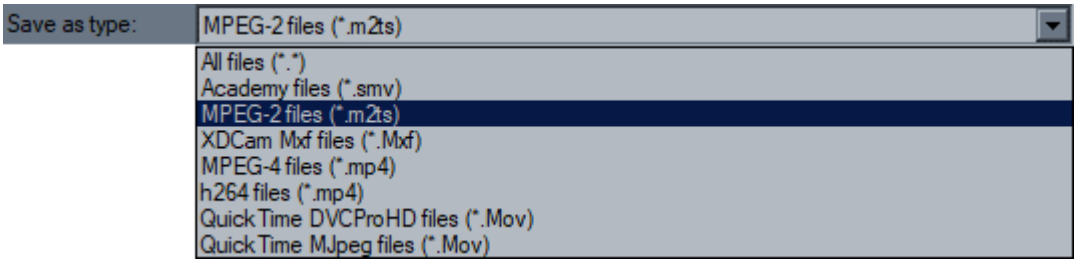


Figure 23 – Export Selected window

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.

When all the parameters of the video file to be created have been set, click **Save**.

During the export, the progress window will open (figure 24). If necessary, you can abort the operation by pressing the **Stop** button (figure 25a). 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 25b).

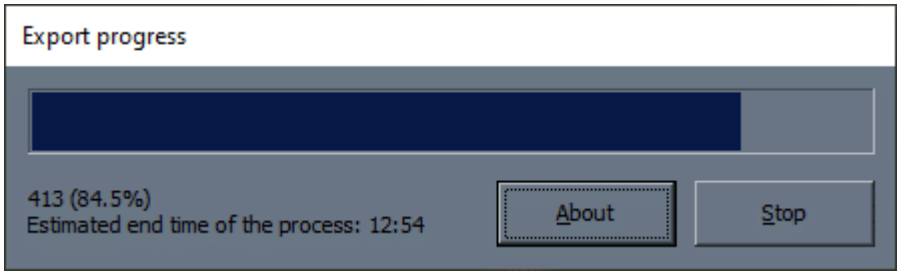
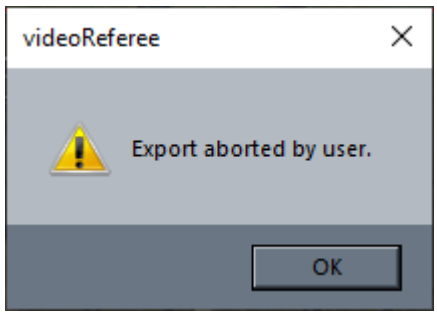
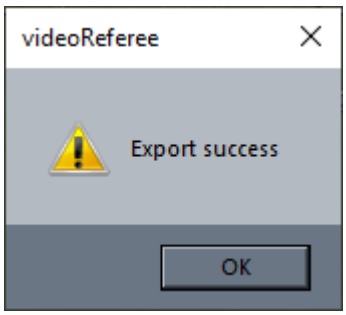


Figure 24 – Export Selected progress window

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 25 – Export completion

Press **OK**.

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

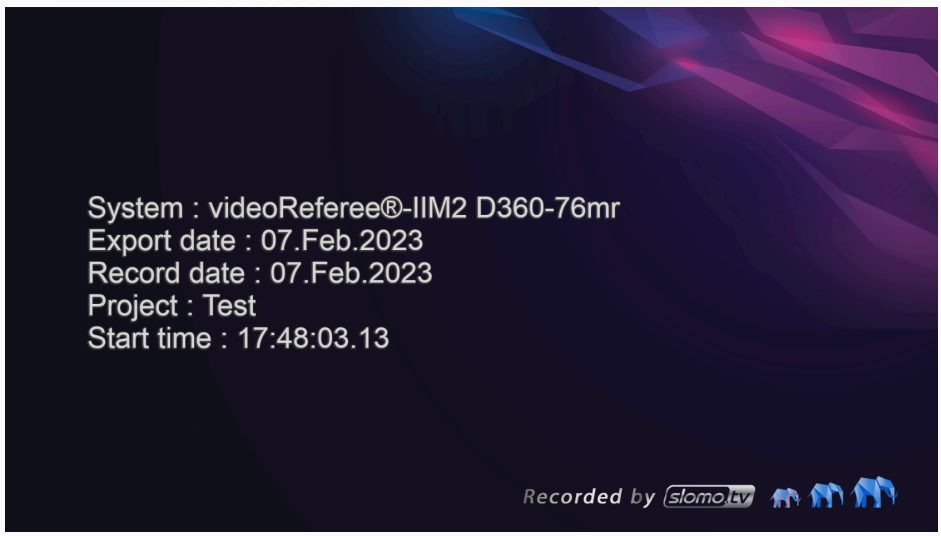
The name of the created file will consist of:

- 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.



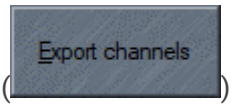
Export of selected channels

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 the recording").

Export of selected channel

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

- open *Tools* menu by pressing ;
- press **Export channels** () in the *Tool* menu. The export window shown in the figure 26 will open.

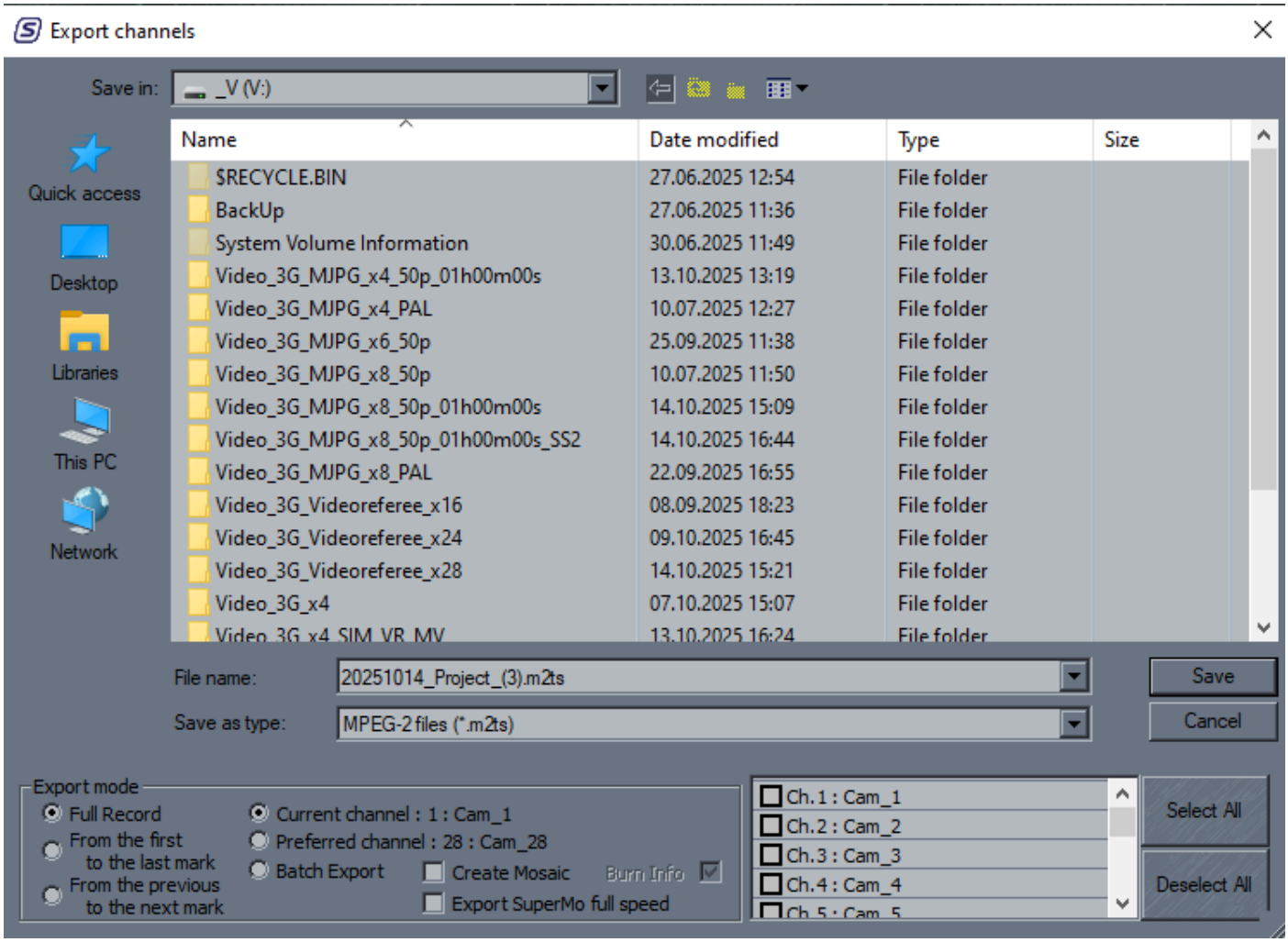
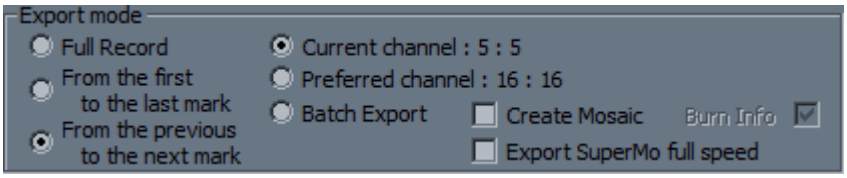


Figure 26 – Export channels window

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 24). 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 25b).

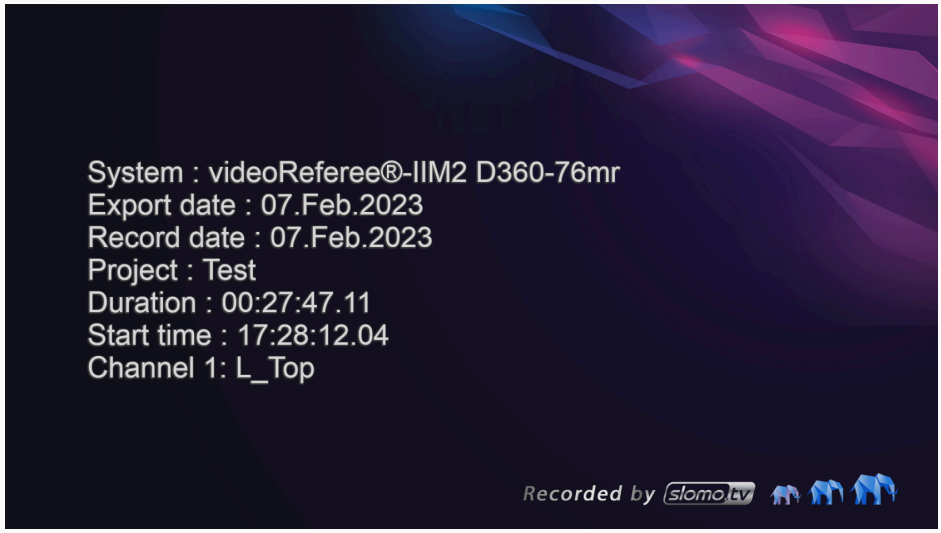
The name of the created file will consist of:

- 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.

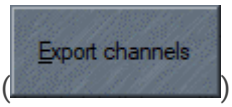


The channel name is displayed in the video:

Figure 27 – Example of Export channel

Batch export

To export several channels or all channels at once, the program has a batch export option.
Follow these steps to perform the batch export:

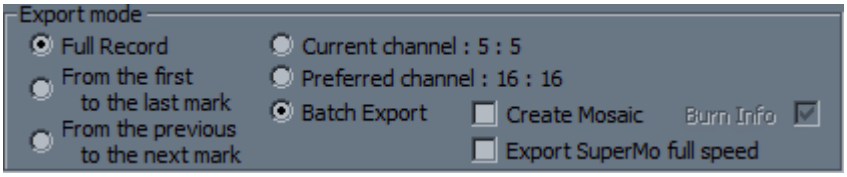
- open the *Tools* menu by pressing ;
- press **Export channels** (

) in the *Tool* menu. The export window shown in the figure 26 will open.

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

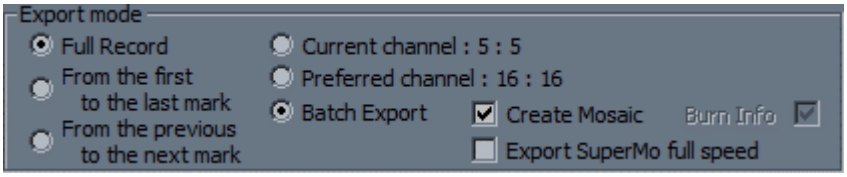
- location to save the file (disk and folder) – Save In;
- name of the file to be saved (File name). The default name is the name of the current project;
- file type (***.mp4**, ***.m2ts**, ***.Mxf**) – Save as type:

- 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 28), check the *Create Mosaic* checkbox:



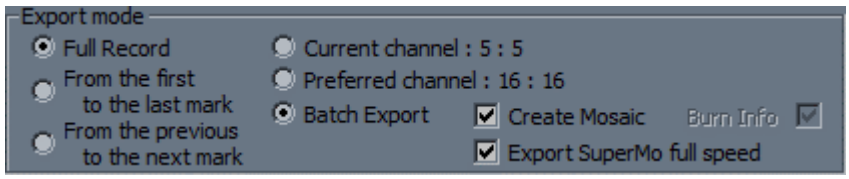
A video created using *Create Mosaic* allows you to play all exported channels simultaneously on one screen. The name of the created video file will consist of:

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

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

Figure 28 – 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 24). 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 25b).

The name of the created file will consist of:

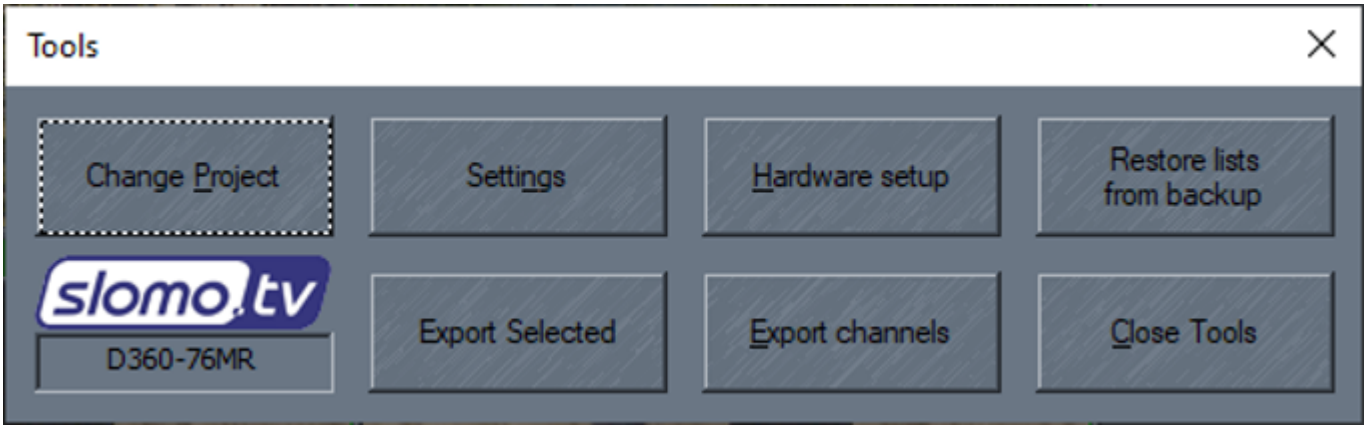
- project name;
- channel numbers;
- camera names.

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:

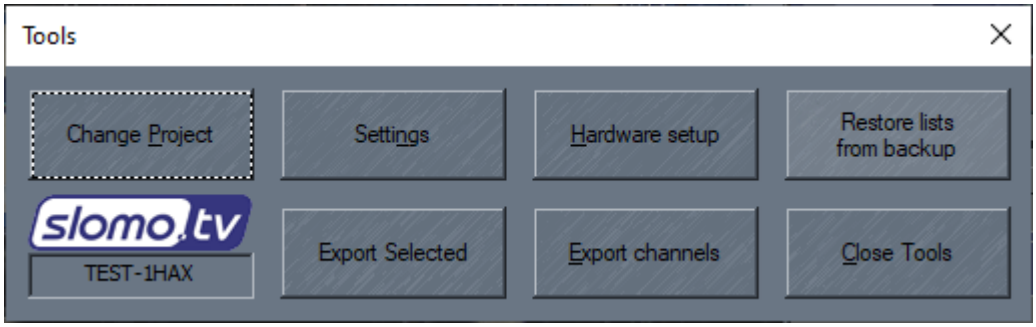
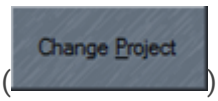
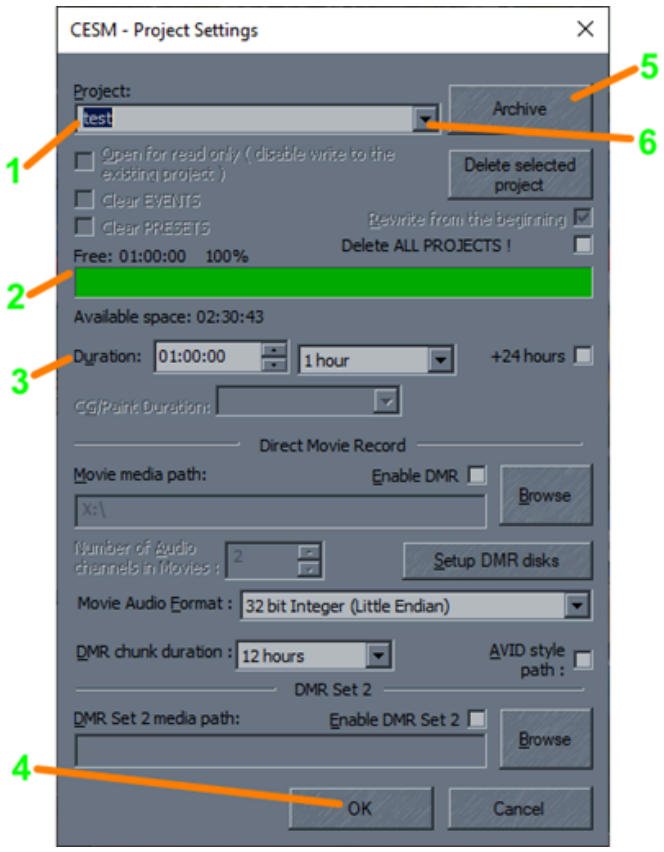


Figure 29 – Tools window

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

). After clicking, the *Project Settings* window will open – figure 30:



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 30 – Окно CESM – Project Settings

To archive a project (figure 31):

1. select the project you want to archive in the "Project" field,
2. click the **Archive** button,
3. in the confirmation window (figure 32), click **Yes** to continue, or **No** to cancel.

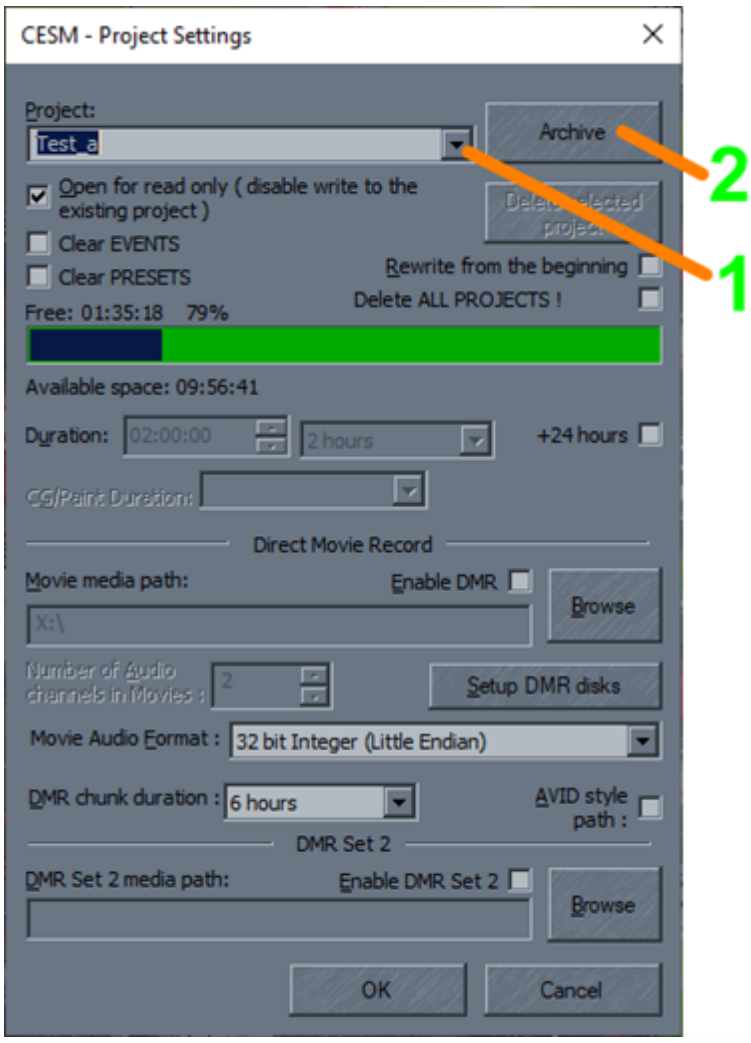


Figure 31 – CESM - Project Settings – Archive project

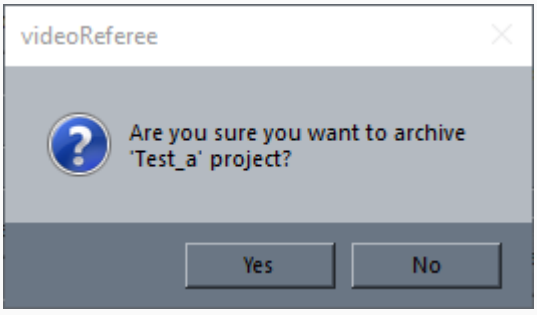
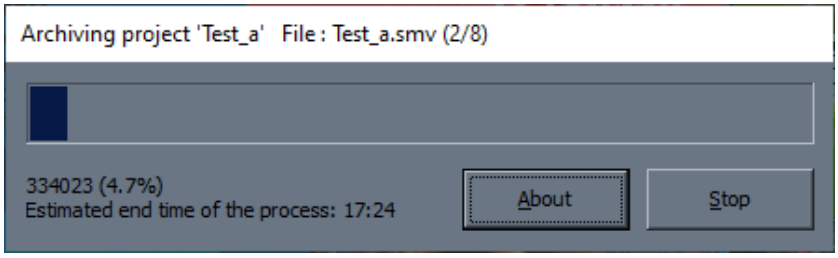


Figure 32 – Confirmation of project archiving

During the archiving process, the progress window will be shown (figure 33). It will be closed automatically, when the archiving is done.



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

Figure 33 – Archiving progress window

After pressing the **Stop** button, the window to confirm the abortion of the archiving process will open (figure 34). 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 35.

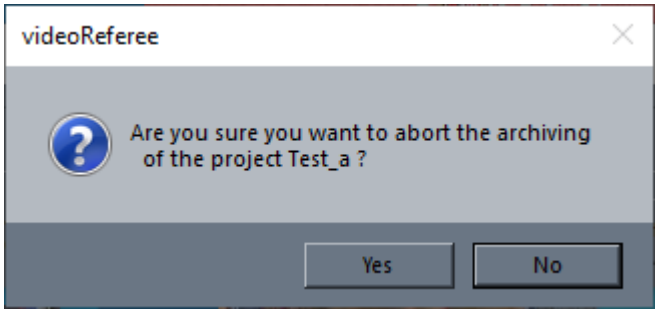


Figure 34 – Confirmation window - Abort archiving

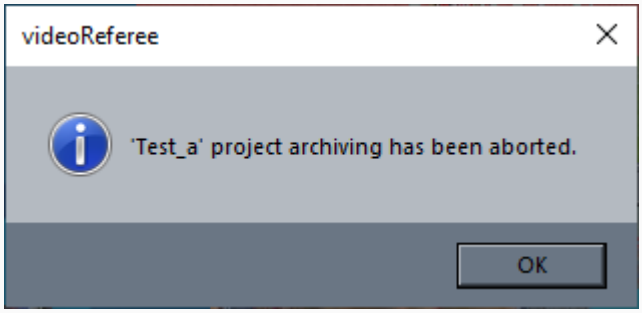


Figure 35 – Information window – Successful abortion of archiving process

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 36.

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 37. To finish an interrupted archiving, simply click the **Archive** button for such a project again and wait for the archiving process to finish.

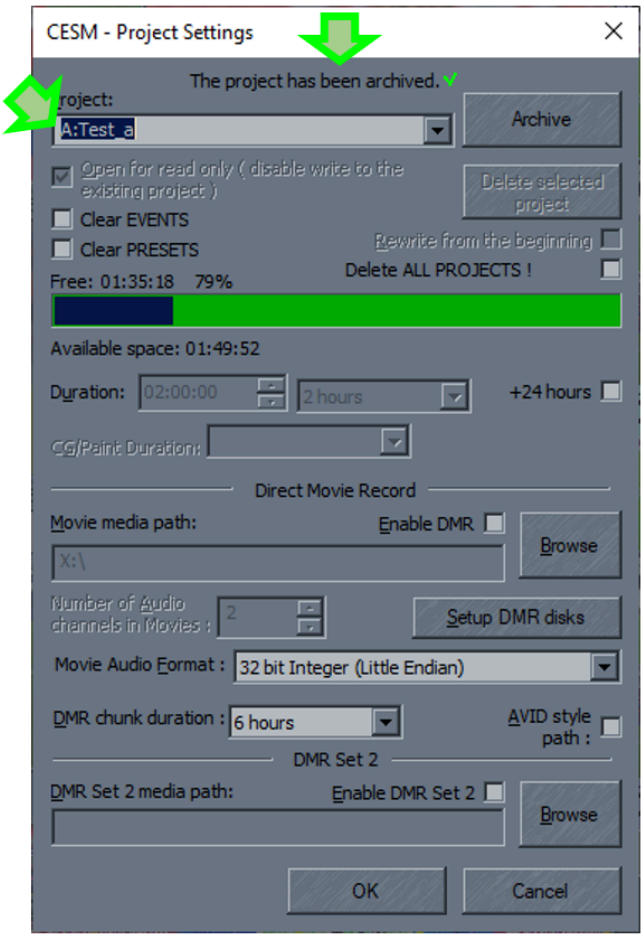


Figure 36 – Archived project

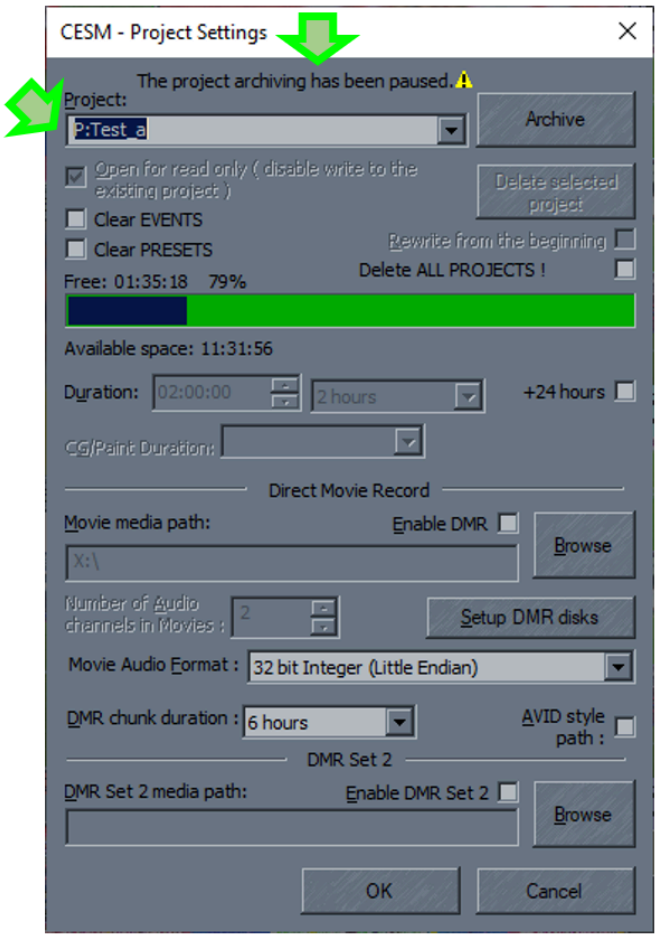


Figure 37 – The project archiving was paused

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.

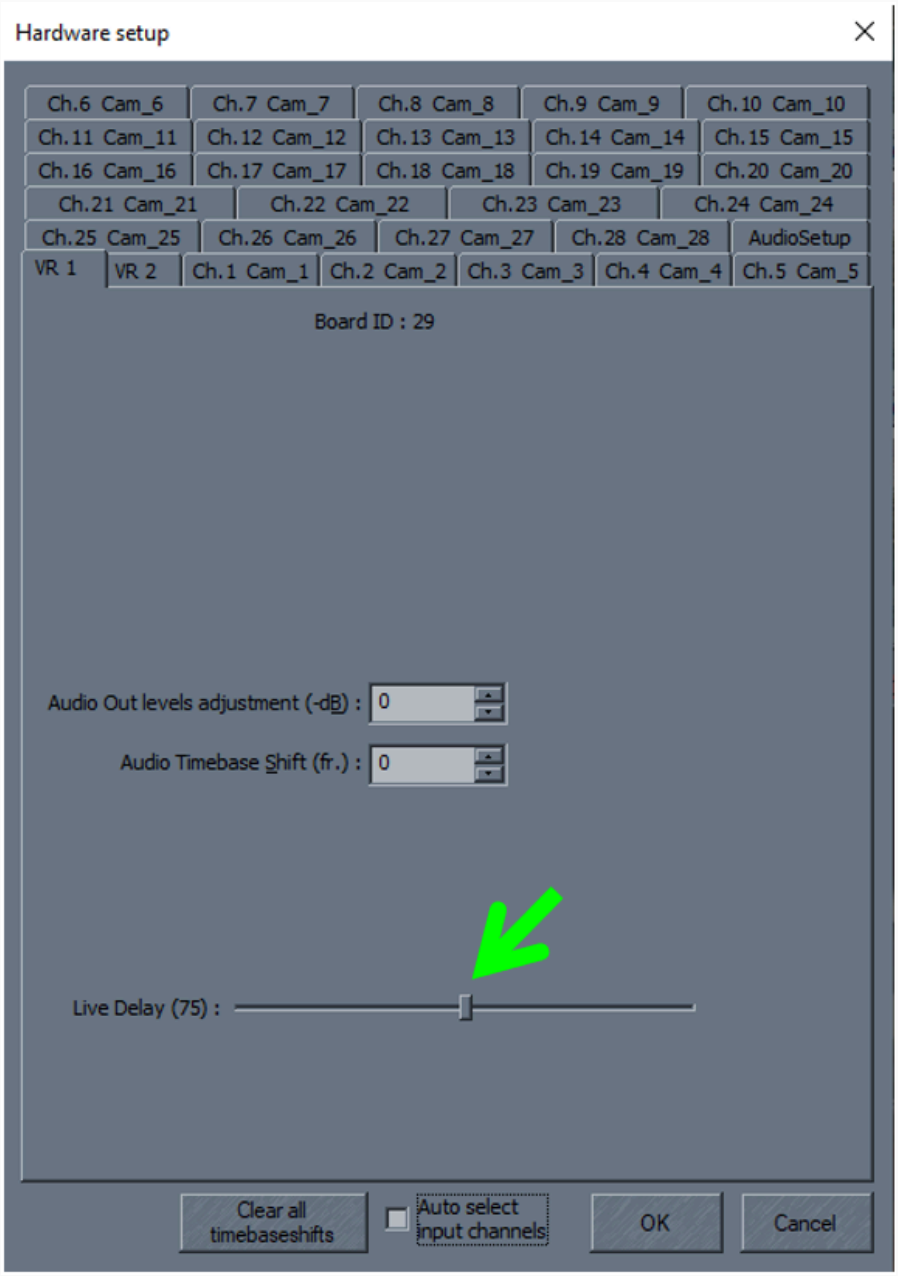
1. For HD video, no further than approximately 6 minutes. This setting can be changed by contacting technical support, but may not exceed 15 minutes.

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.

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



[1] If you need to change the maximum delay value, please contact slomo.tv technical support.

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.

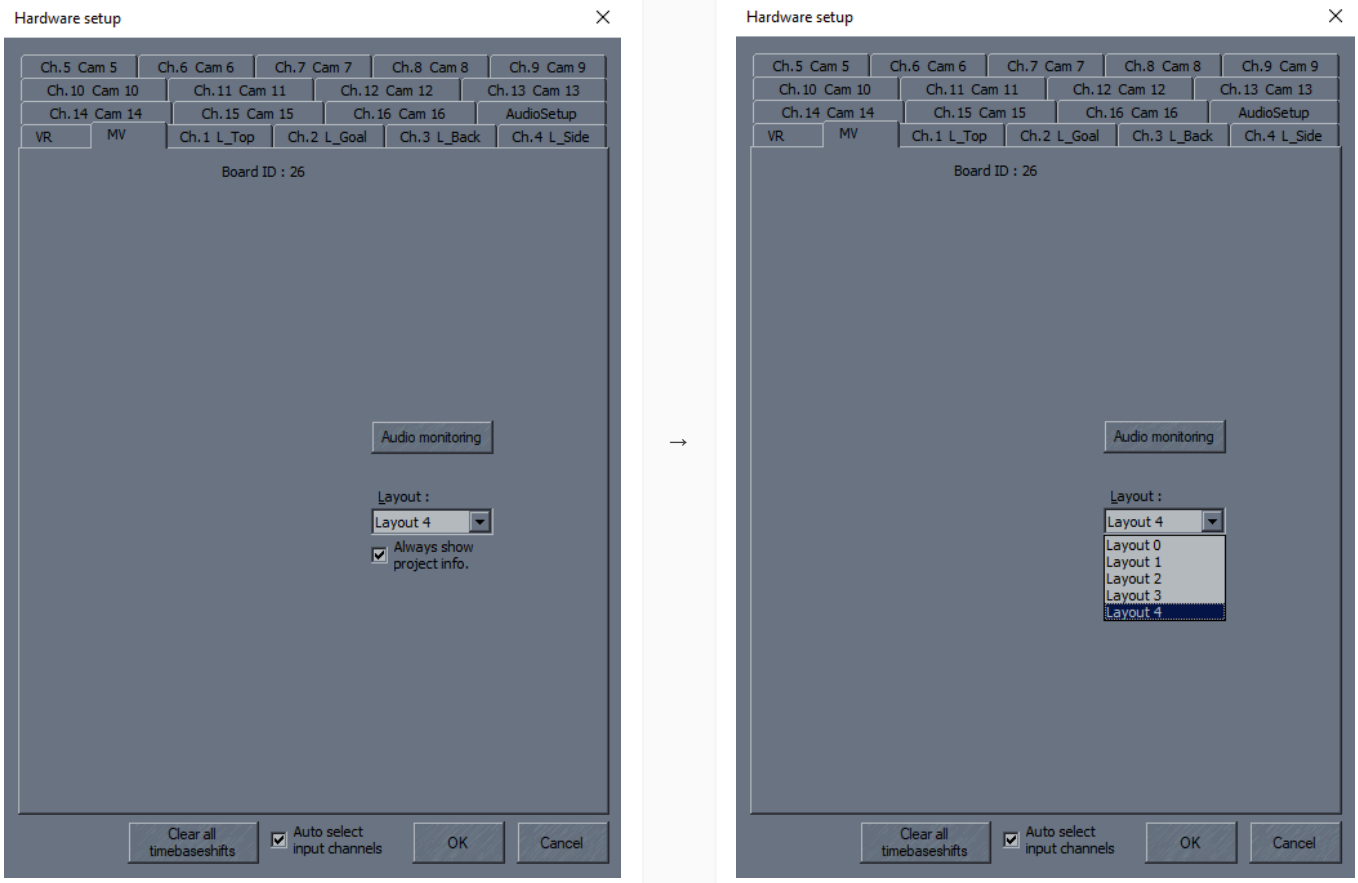


Figure 38 – Hardware setup – MV tab

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.

Layout 0

Layout 1

Layout 2

Layout 3

Layout 4

The display depends on the created setup[1]

Custom

Figure 39 – Multiviewer layouts[2]

1. Contact technical support team to create a custom layout.
2. The exact arrangement and the number of video windows depend on the number of channels available in the system and may differ from that shown in the image.

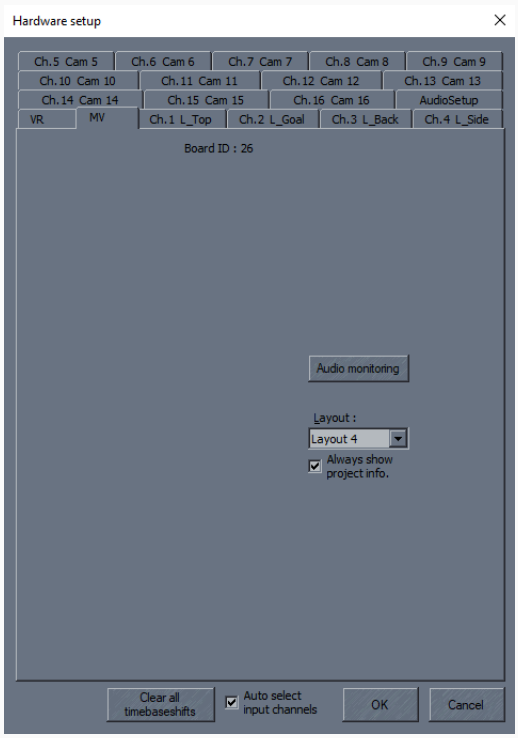
Display of project information on the Multiviewer screen

Project information can be hidden when the Multiviewer is displayed. To set up hiding/display of the information, go to:

Tools → Hardware setup → вкладка MV → чекбокс 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.



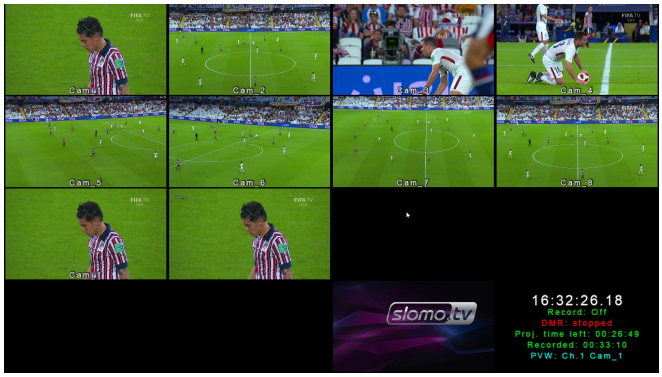
The following are options for displaying project information depending on the selected Multiviewer layout:

Multiviewer Layout 1 – Project info off

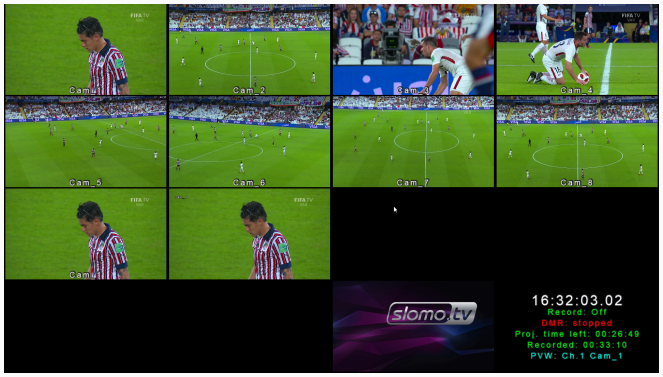
Multiviewer Layout 1 – Project info on

Multiviewer Layout 2 – Project info off

Multiviewer Layout 2 – Project info on



Multiviewer Layout 0 – Project info off



Multiviewer Layout 0 – Project info on

Figure 40 – Display of project info on the Multiviewer[1]

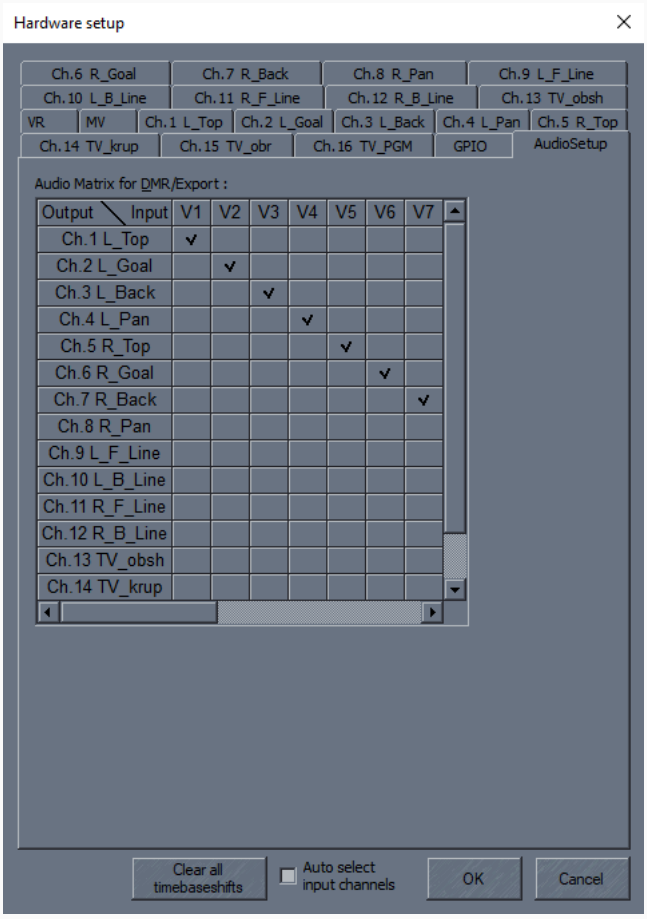
1. For certain Multiviewer layouts, project information is always displayed as long as there is enough space on the screen (e.g., Layout 0).

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.

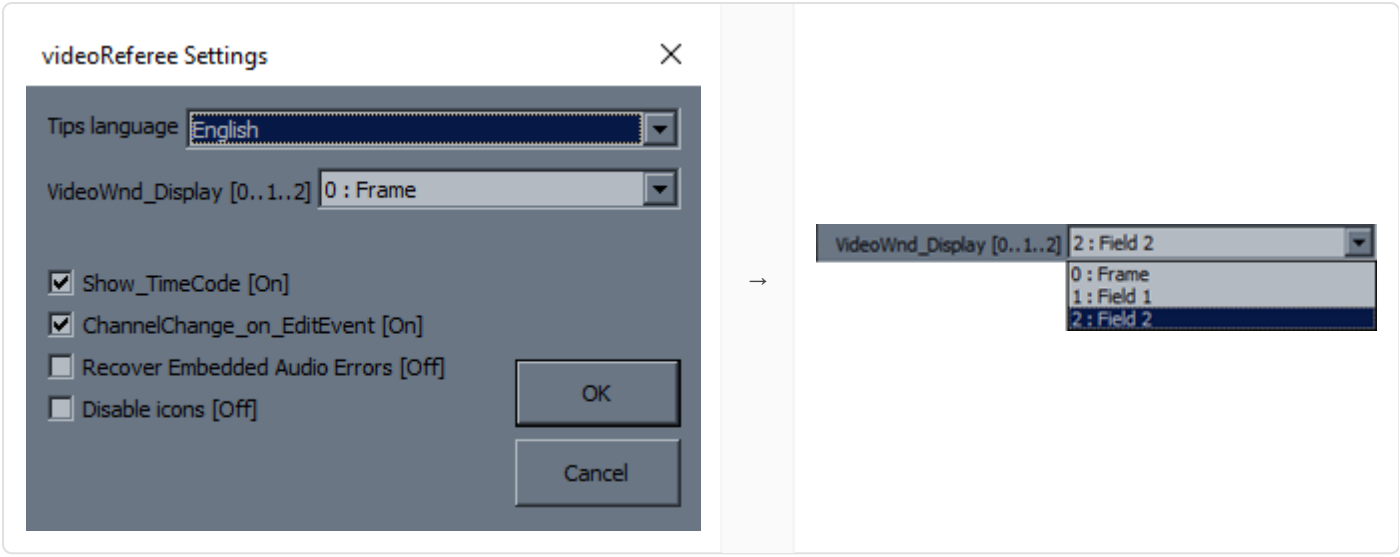
Using the mouse, select the audio source for each channel by ticking the boxes.



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**.



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.

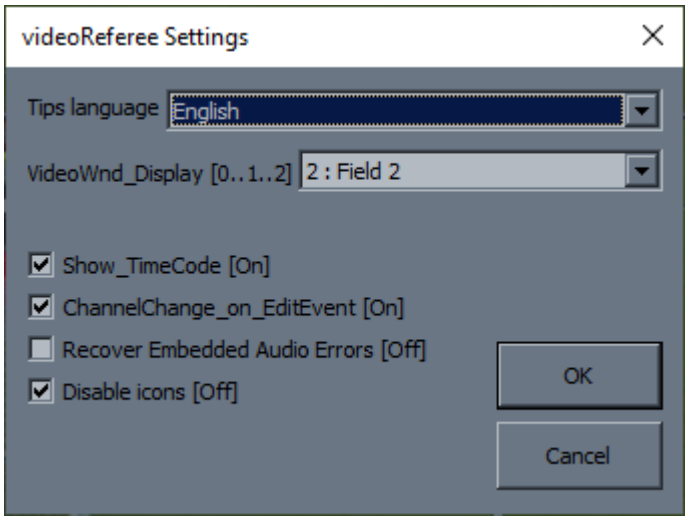
Icons in the event list

In the event list, event marks can be displayed with or without icons: a snapshot of the moment or text information only.

To enable the display of icons in the event list, go to: **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:

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.

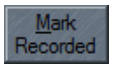
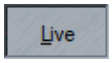
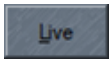
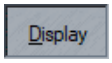
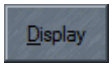
Normal transportation and storage conditions

- 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. Function of buttons in the program interface and on the referee control console, keyboard shortcuts

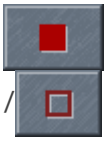
Buttons in the interface			Function
...	F1 ... F12	Ch. N	Active channel selection: — Console – from 1 to 16 — Keyboard – from 1 to 12
	—	Shift + Ch.N	Active channel selection – from 17 to 32
	Ctrl + M or [~]	Mark	Create an event on live video
			Create an event on recorded video
—	Ctrl + Delete	Mark + Ch.15	Delete an event
 / 	Ctrl + L	Rec | Live	Switch between Live and Search modesy
—	—	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

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

⊞/□ / ⊞/□	Ctrl + Q	Quad	Enable/disable Quad display mode
	–	Shift + Quad	Toggle the number of displayed channels – 2, 3 or 4
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		Pan / Zoom joystick
	Ctrl + Enter	Pan/Zoom	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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