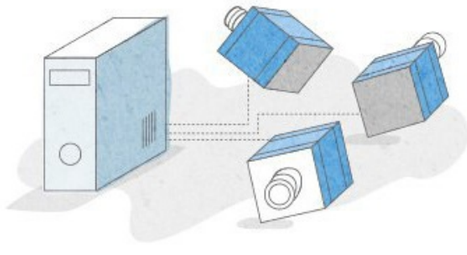
The Recorder

Data Acquisition
and
Recording Software

Operation manual

Covers software version 3.5

Multicamera.Systems



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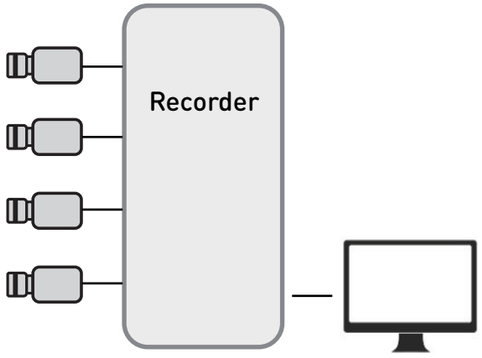
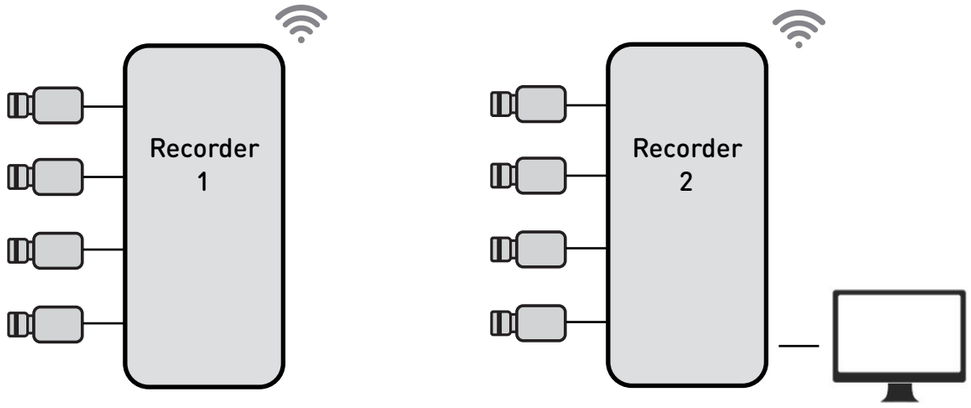
Supported configurations

The Multicamera.Systems software supports large variety of configurations enabling a user to build a system with almost any configuration. The building block of a System is the Recorder – a PC connected to single or multiple capture devices, like cameras, lidars, audio, sensors, etc. Although a PC can be used only for data acquisition and processing without the storage, we call it "Recorder" anyway. The Recording System may contain single or multiple Recorders all interconnected over the wired or wireless network and optional synchronization cables allowing whole system to run perfectly in sync.

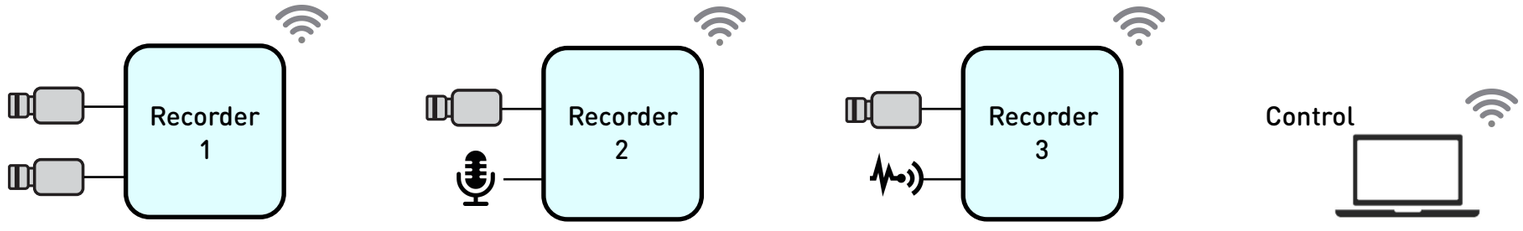
The Recording System is controlled by a user from the Recorder Control App which may be run either on the same Recorder or on a separate PC or tablet connected to the same network. Several common configuration examples are shown below.



Single Recorder System
(everything runs on a single PC)



Two Recorders System
(The Recorder Control App runs on one of the Recorders)



Multiple Recorders System
(The Recorder Control App runs on a separate laptop)

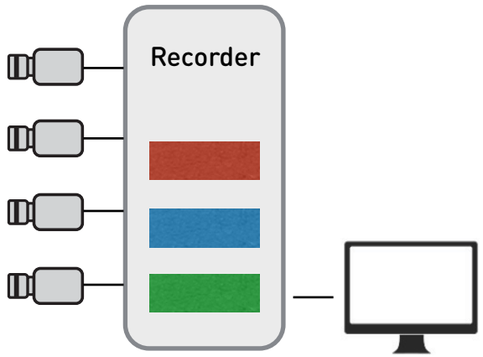
Software architecture

The cross platform (Windows and Linux) software package contains several components:

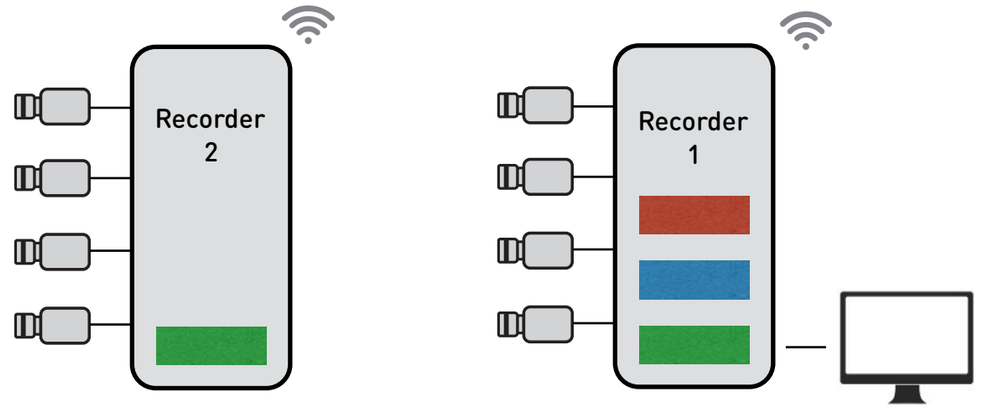
Recording Server App: unattended (no UI) application running on each (or single) Recorder in the Recording System.
It manages a capture hardware, acquisition and recording and provides access to it for playback, upload and post processing.

Recording System Manager App: unattended application running on the first (or single) Recorder in the Recording System.
It manages all Recorders and its connections to the Recorder Control App.

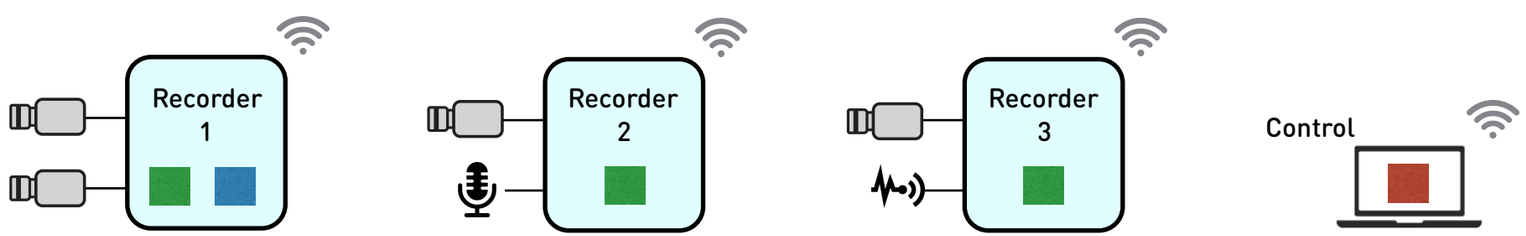
Recorder Control App: the application running either on a Recorder itself or on a separate PC.
It provides the User Interface to control the entire Recording System.



Single Recorder System



Two Recorder System



Multiple Recorders System

Installation

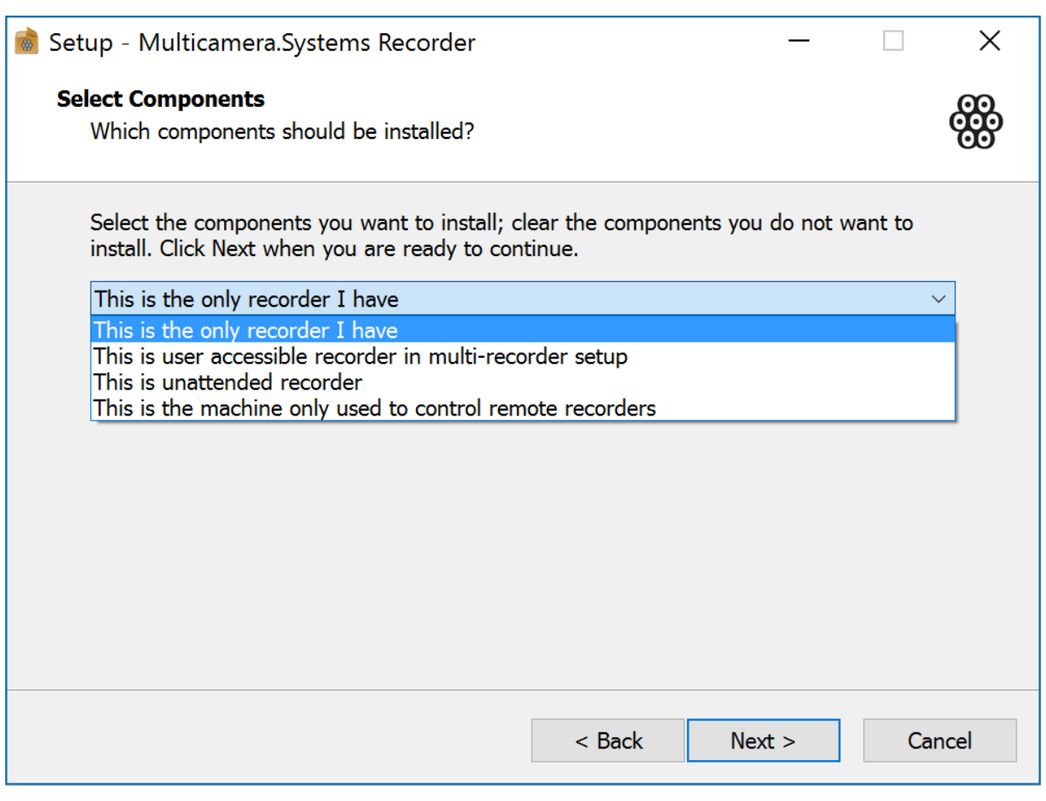
At the beginning of installation the installer offers four choices on how the software will be installed:

1. For **single machine installations** select the first option "This is the only recorder have". All components including UI will be installed. If you later add another recorder to the system or decide to control this recorder remotely from another PC there is no need to reinstall anything.

2. If you have **several machines** in your setup and the machine you are installing on is the one from which you can also **control** the whole recording system, select the second option "This is user accessible recorder in multi-recorder setup". All components including UI will be installed.

3. If you have **several machines** in your setup and the machine you are installing on is just on of recorders, select the third option "This is unattended recorder". No UI component will be installed.

4. For the machine that is used only to **control** recording system, select the fourth option "This is the machine only used to control remote recorders". Only UI component will be installed.



Recording Server App
(starts automatically on unattended recorders)
Tray icon App icon

Recording System Manager App
(starts automatically on unattended recorders)
Tray and App icon

Recorder Control App
App icon

Configuring the Software and Recording System

The configuration process is divided into two stages.

The **first** stage requires physical access to the recorder(s) and is intended to set things which rarely if ever changes:

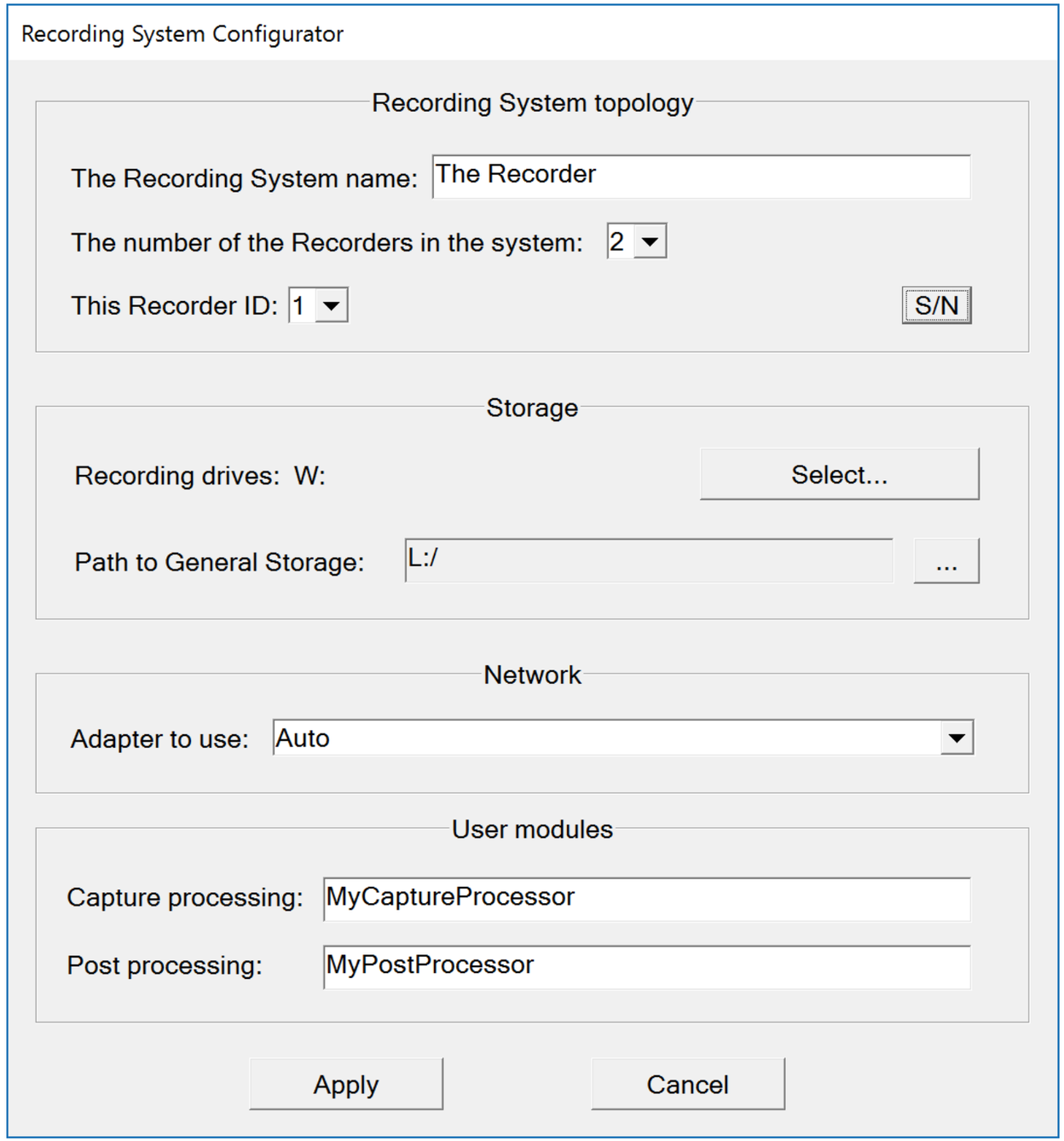
- recording system name;
- number of recorders in the system;
- each recorder ID;
- set of local drives to be used for the recording.;
- other optional setting discussed later.

Please use "RecordingSystemConfigurator" utility (shown on the right) on each recorder to set those parameters.

The **second** stage is done through the Recording Control App (thus can be done remotely) and it sets the following:

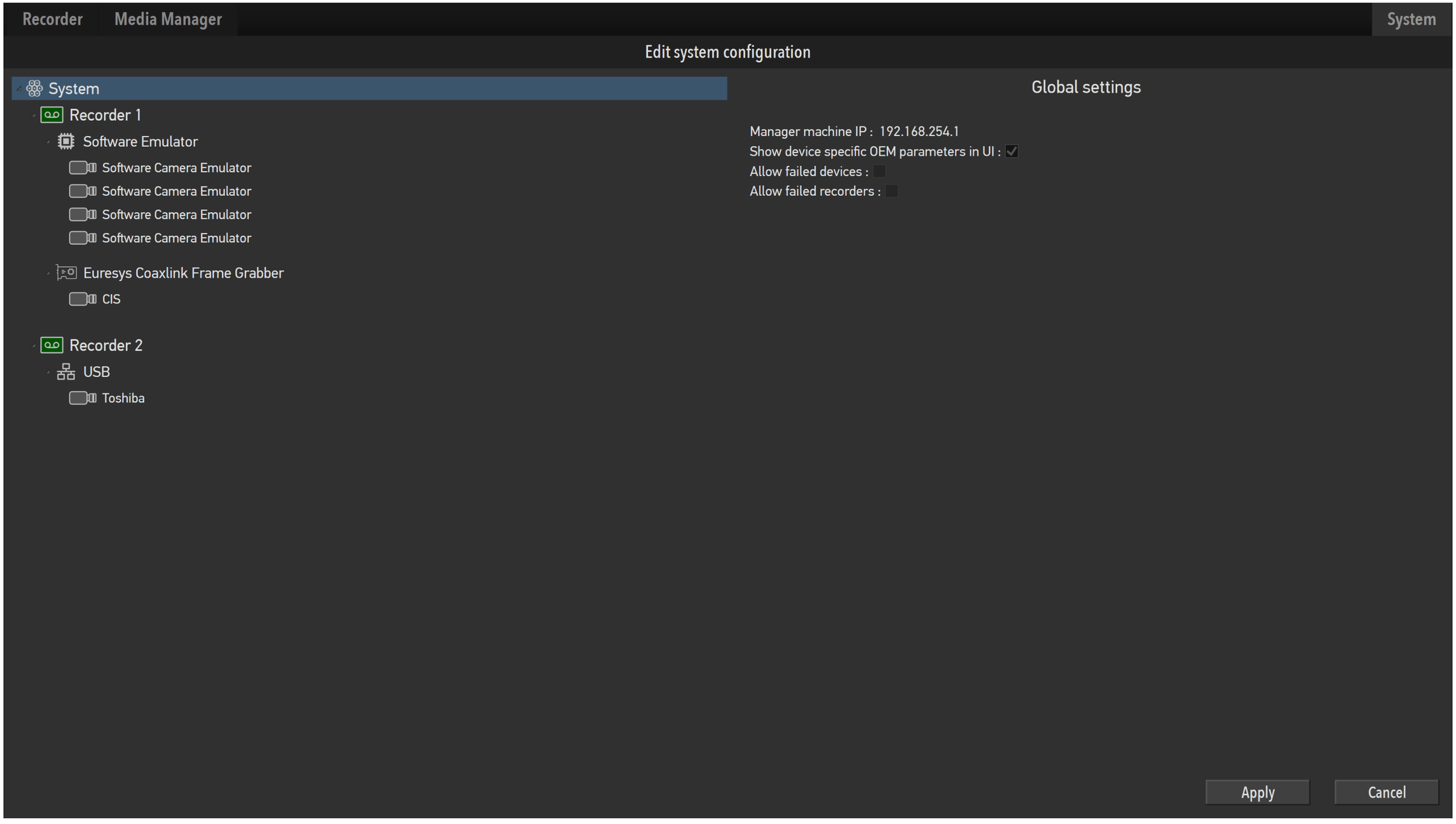
- capture hardware interface (e.g. Frame grabber, USB, Ethernet, etc) and its specific settings;
- number and type of cameras or other devices connected and its specific settings.

Please go to the **<System Tab>** and click on **<Configuration>** to bring up configuration editor in the Recording Control App. (shown on the next page)



Recording System configuration

The Configuration Editor has two panes: the left one presents a list of recorders and devices connected and the right one shows settings available for selected component.



Recording System configuration (continued)

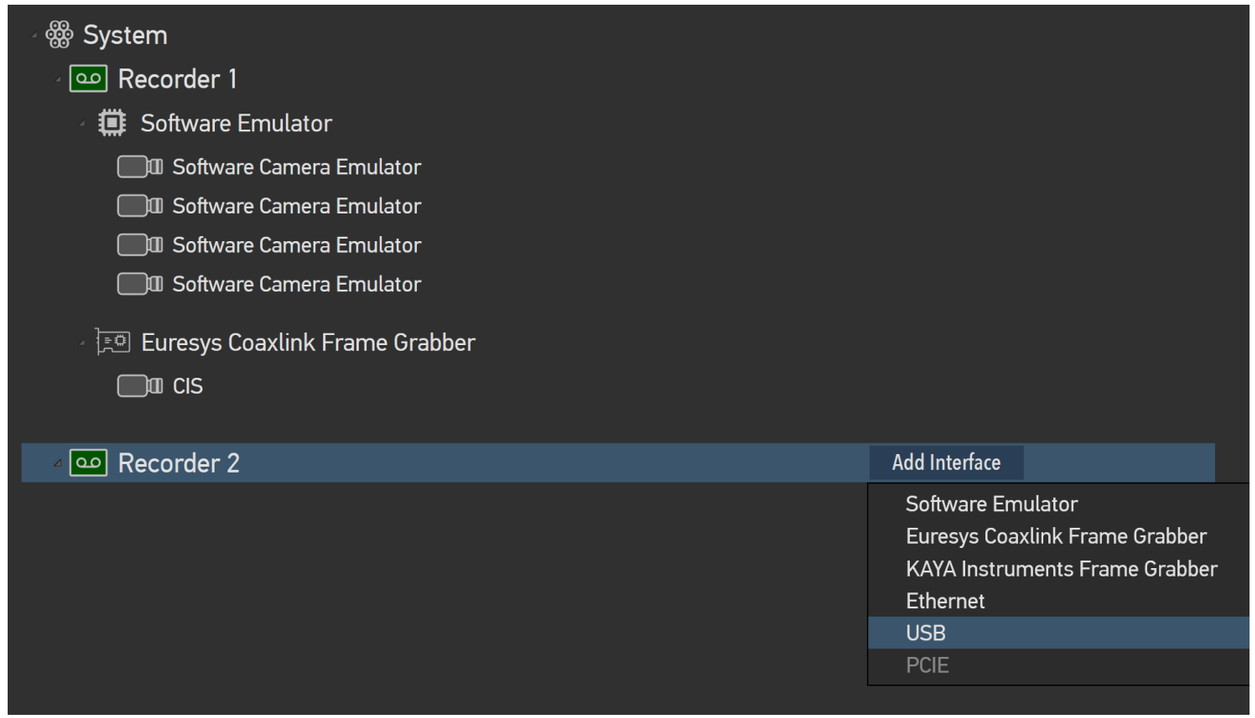
The configuration of the system is presented hierarchically starting with the list of Recorders.

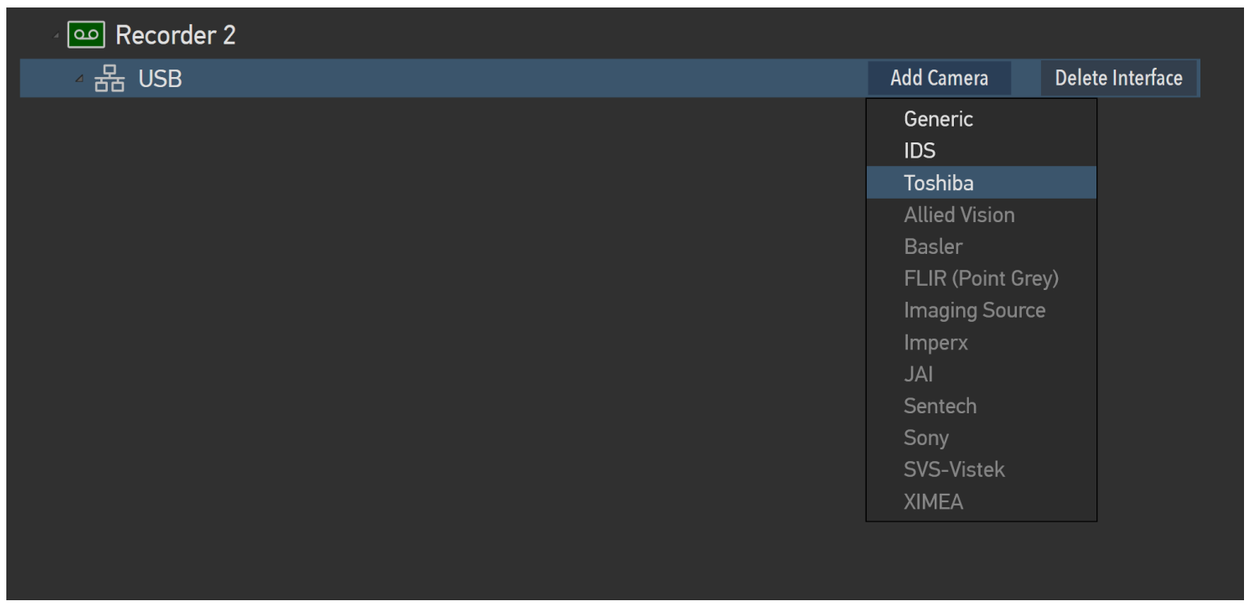
Each Recorder has one or more channels or **Interfaces** it receives capturing data from, e.g. frame grabbers, USB or Ethernet. devices (e.g. cameras) connected to it. To add a new interface select a Recorder and click **<Add Interface>**, the list of available Interfaces will be presented. Note, if you have several identical frame grabbers installed, only one interface needs to be created.

Once Interface is added you have to add camera(s) or other devices to it. To add a new device, select an Interface and click **<Add Camera>**, the list of available camera models will be shown in drop down menu. You have to add exact number of the cameras connected (even if they are of the same type).

Make sure, you install all necessary drivers and software coming with your frame grabber or camera (for USB/Ethernet).

Note for USB or Ethernet cameras: if your camera is not in the list of supported devices or you don't have access to the camera driver package or OEM software known to be problematic, you can always use "Generic" device assuming that the camera is USB-Vision / GigE-Vision compliant. The support for those devices is provided through 'eBus' driver from Pleora Technologies, please download and install it from their website.





Recording System configuration – Synchronization of cameras

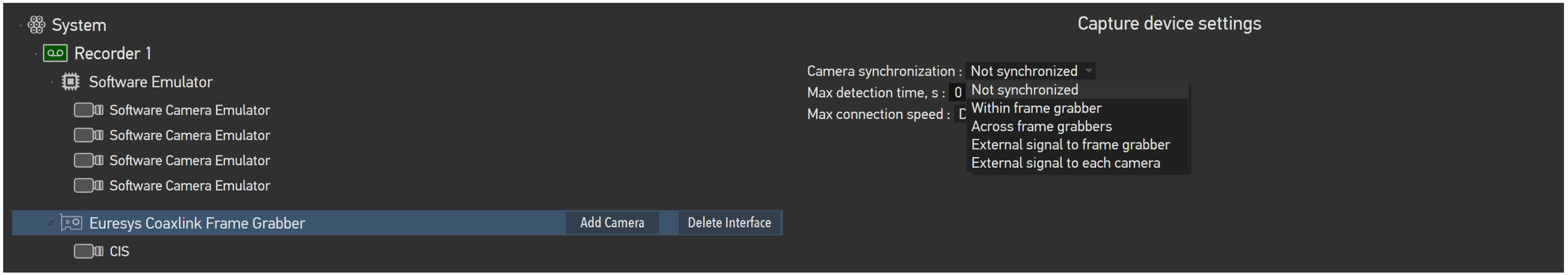
In a recording system with multiple cameras it is possible to choose how cameras are synchronized. The number of synchronization modes depend on the type of Interface used.

For USB, Ethernet and PCIE cameras there are only one synchronization method - external sync signal to cameras.

If a Frame Grabber is used then cameras can be synchronized by internal frame grabber signal. Select “Within frame grabber” synchronization option. For recorders with multiple frame grabbers or multi recorder systems you have an option to synchronize all cameras in the system be using add-on synchronization hardware from, in this case select “Across frame grabbers” synchronization option.

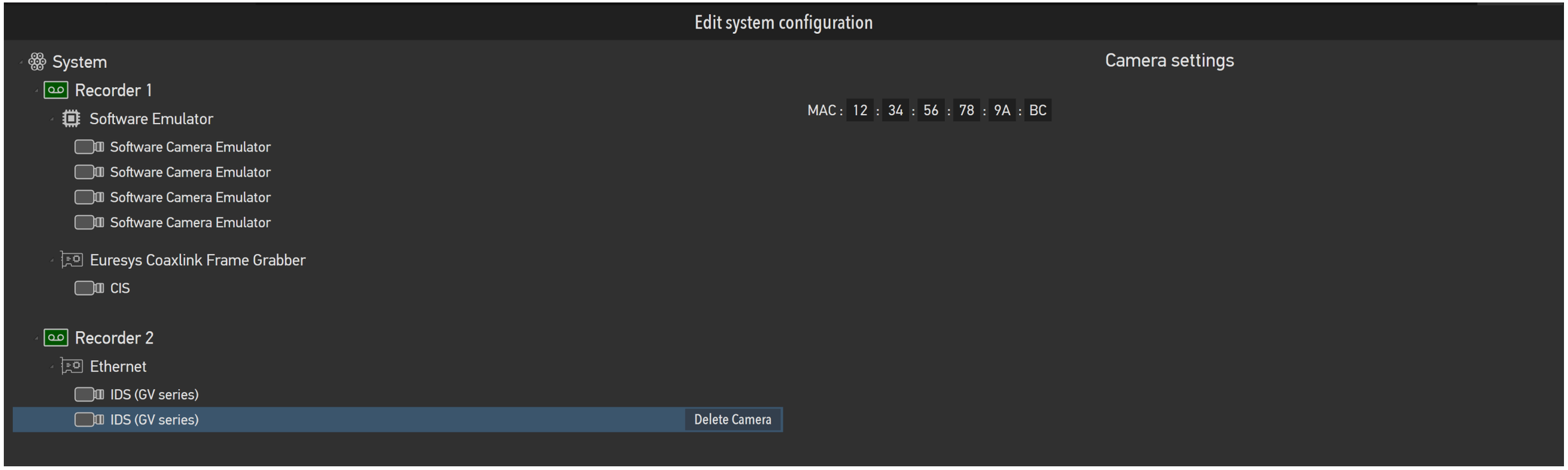
Note, that those synchronization options are not available if camera model is set to “Generic”.

In addition you can use external synchronization signal supplied to either frame grabber(s) or cameras directly – select appropriate option accordingly.



Recording System configuration – Multiple Ethernet cameras

In a recording system with multiple ethernet cameras it is often necessary (for example to balance available network bandwidth) to select which camera(s) is used with the particular recorder. The selection is done by specifying camera's MAC address in the <Camera Settings> section. Specifying all zeros will disable selection of cameras by MAC address and first enumerated camera on the network will be picked up.



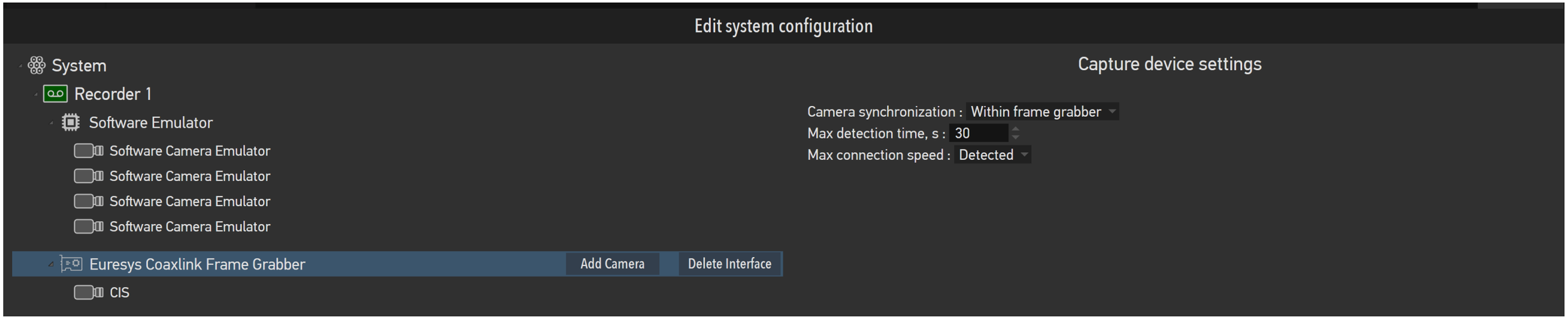
Recording System configuration – Frame grabber options and setup

Certain frame grabber models may require addition configuration steps:

“Euresys” and “SiliconSoftware” frame grabbers require that correct firmware to be uploaded according to the number of cameras connected and connection topology used. Please refer to the frame grabber manufacturer’s manual for more information.

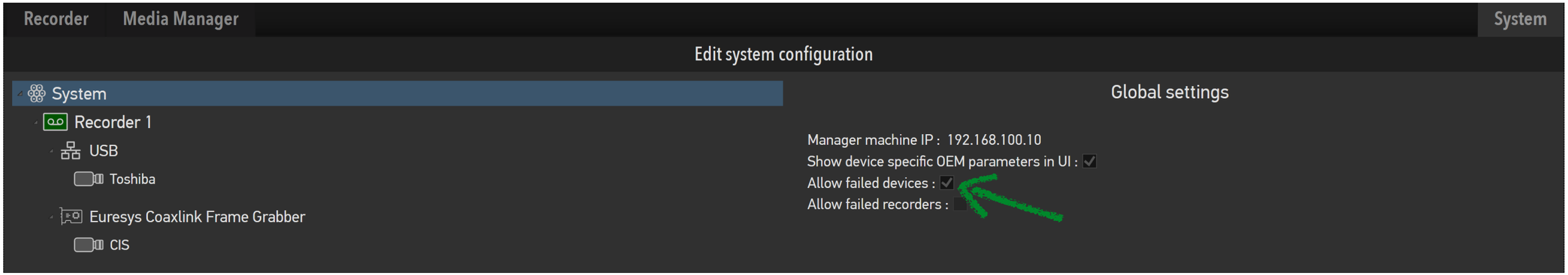
Certain cameras with long boot up time may require increasing default detection time. Set or increase “Max detection time” if the application cannot detect configured number of cameras. The default is 45 seconds.

Certain combination of frame grabber and camera may have detection or stability issues if connection speed on CXP interface is not set to a specific speed. Please adjust “Max connection speed” parameter if you observe detection problems or camera freezes.

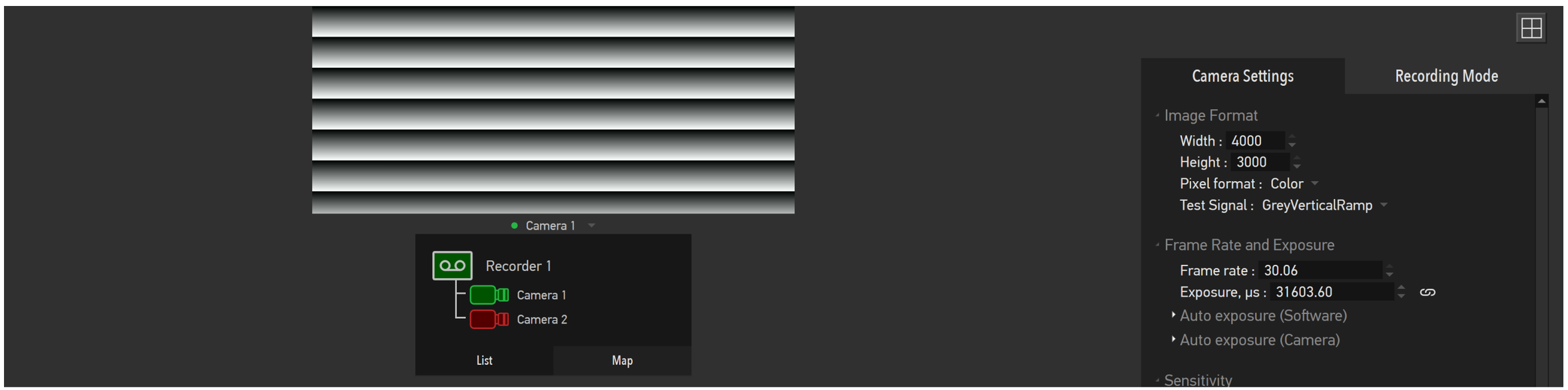


Recording System configuration – Fault tolerance options

There are two ways the system can behave in case of faulty device – ignore errors from a faulty device and continue to operate normally allowing a user to do recordings or doesn't allow to do recording unless all devices are functioning properly. This behaviors is switched on the <Global settings> pane in the configuration editor.



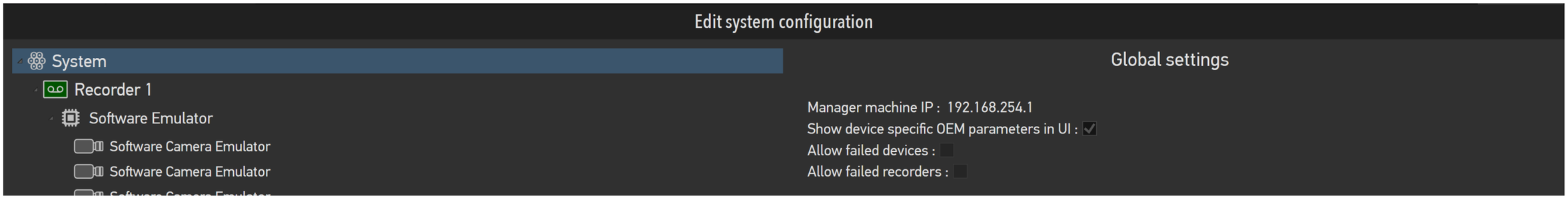
In case failed devices are allowed they will be marked in red in the device list.



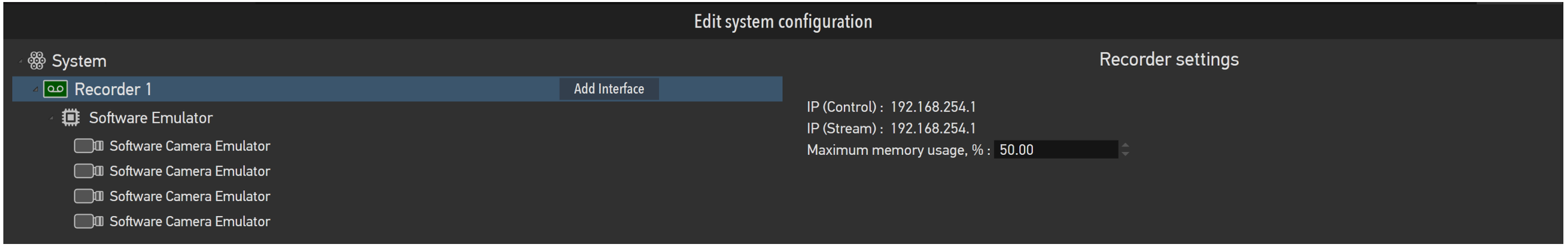
Recording System configuration – Other options

There are several system wide and recorder wide option available to a user:

- “Show device specific OEM parameters” – enables <Camera Setting> tab (described later) to show all settings provided by a device. The list of those setting depend on specific camera model and usually include a lot of diagnostic and very rare used setting, but also can contain useful ones like camera specific white balance control, flat field correction and noise and defect pixel suppression;



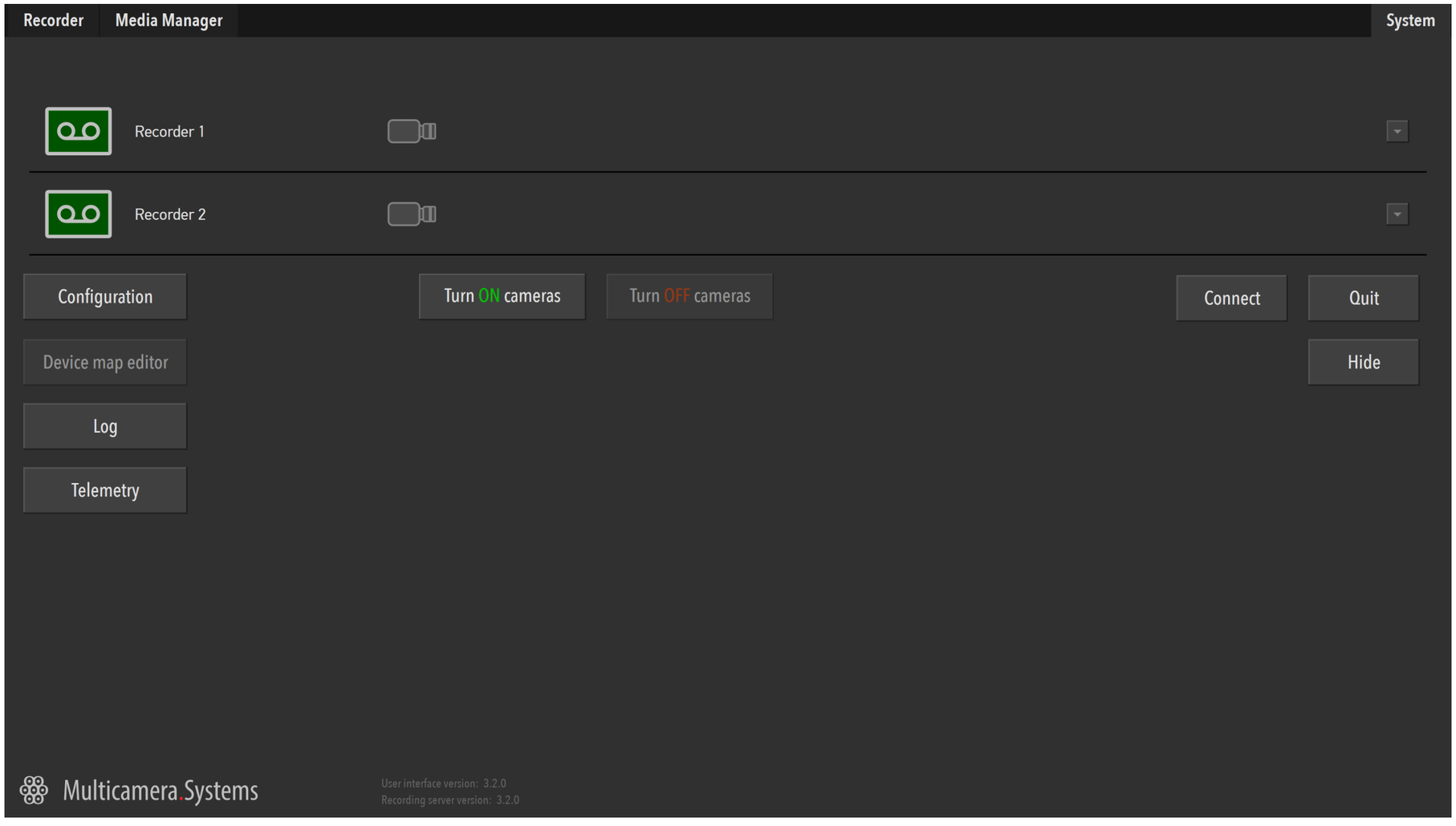
- “Maximum memory used” – sets the maximum available percentage of the system memory available to the Recording Server App. Most of the memory is used for the capture buffers. More capture buffers application has, less the possibility of dropped frames during the recording in case performance of recording media is almost the same as incoming data rate. The same applies to the processing.



Recorder list and capture device control

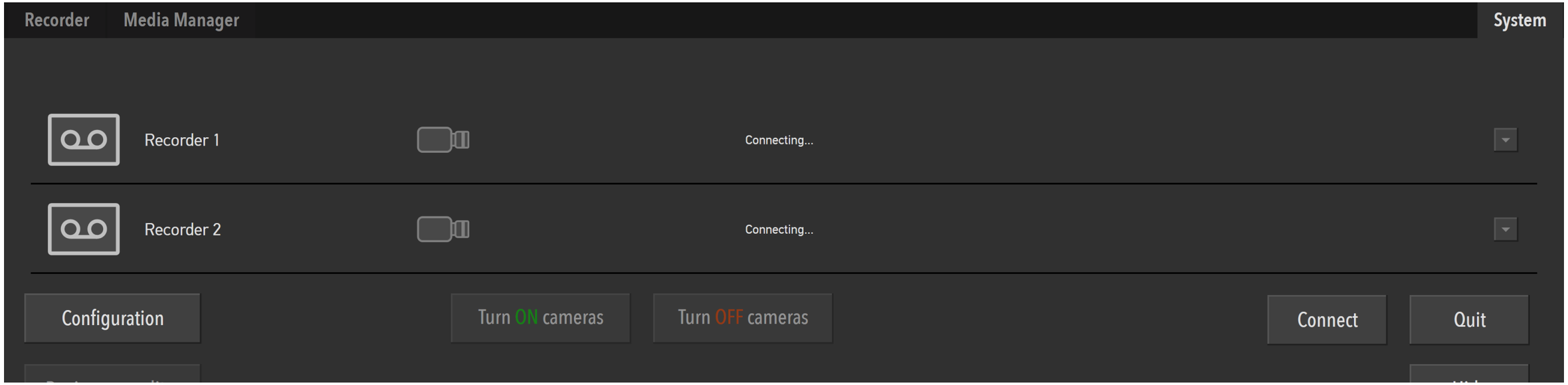
The System tab is shown when application starts and it shows all the recorders in the system, capture devices and other controls allowing a user to operate the system. Each recorder is represented by single row and shows its state, connected camera (or other capture devices) state. The color of the icons denotes **connected** / **on**, **not connected** / **off** and **error** states of the recorders and capture devices respectively.

The on-off state of the camera or other capture devices is controlled by two buttons positioned below camera icons. When system starts all devices are off and a user has to press "Turn ON cameras" button to detect and initialize cameras and/or other devices. Once detection and initialization process successfully finishes the camera icon will turns green. If for some reason devices are not detected or failed to initialize the dialog box with an error will be shown.

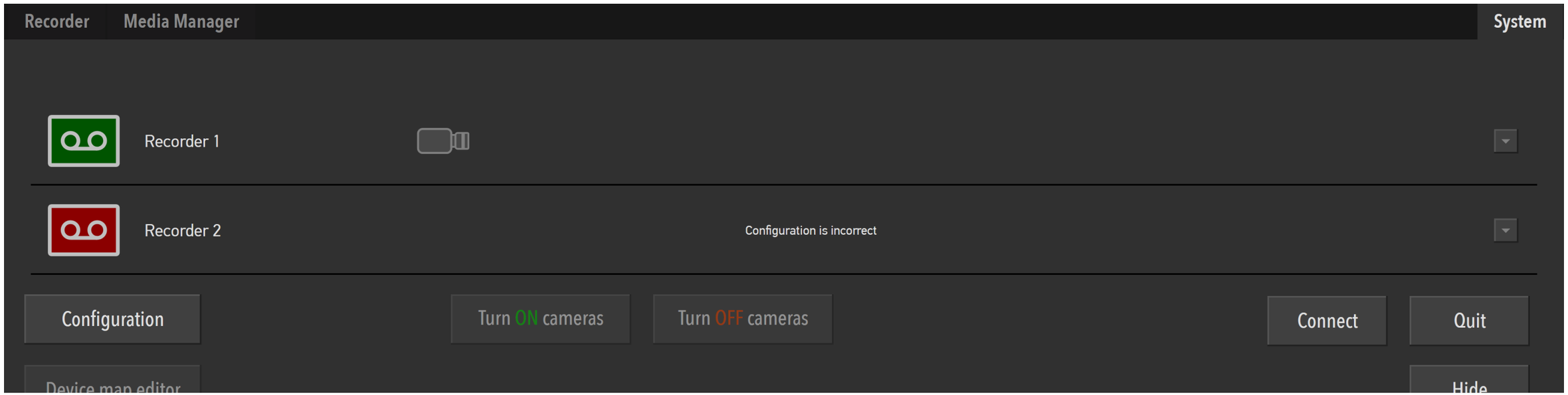


Recorder list and capture device control (continued)

The Recording Control App is not connected to any recorders.

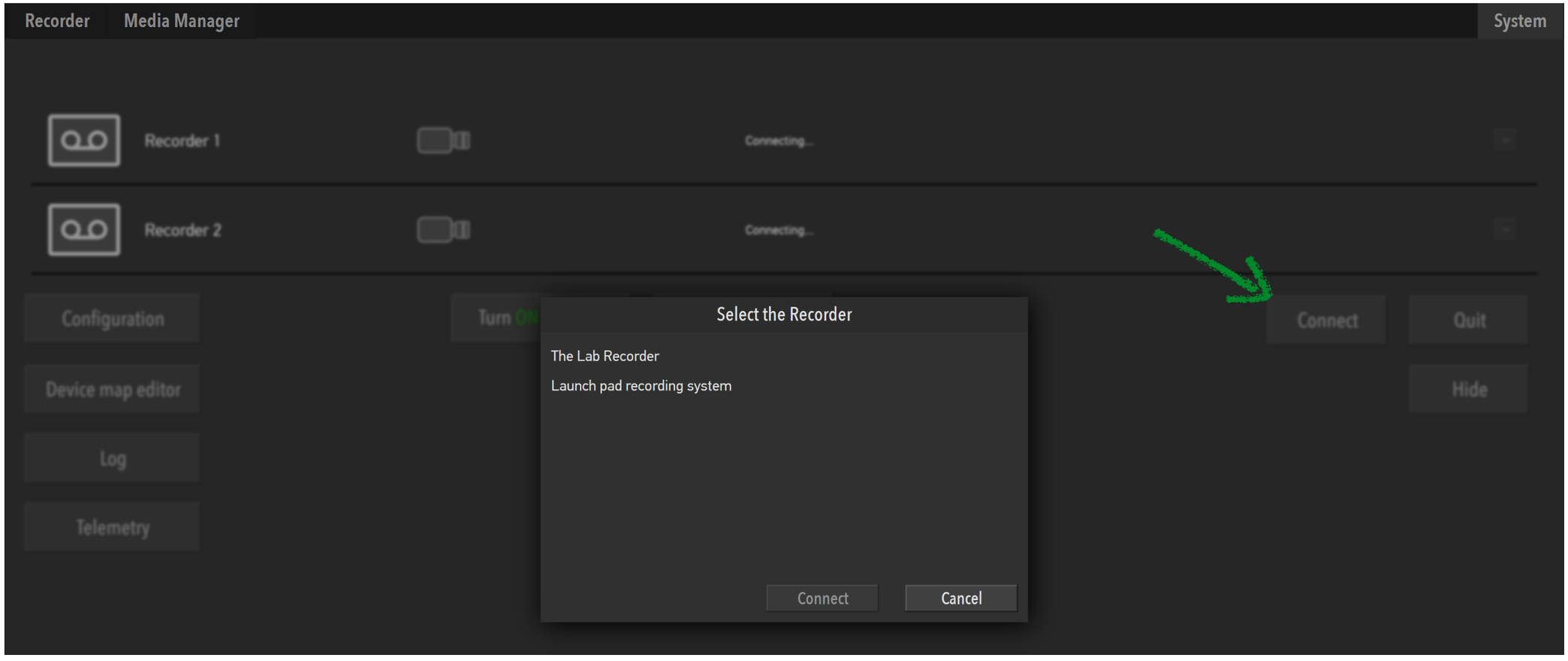


The Recorder 2 is in error state.



Connection and Exit

The Recorder Control App connects to the recorders automatically if where is only one recorder or recording system detected. If you want to connect to other recorder on your network click “Connect” button on the System tab and a list of available Recorders will be shown. Note, if selected recorder has some other user already connected to it your connection request will be denied.

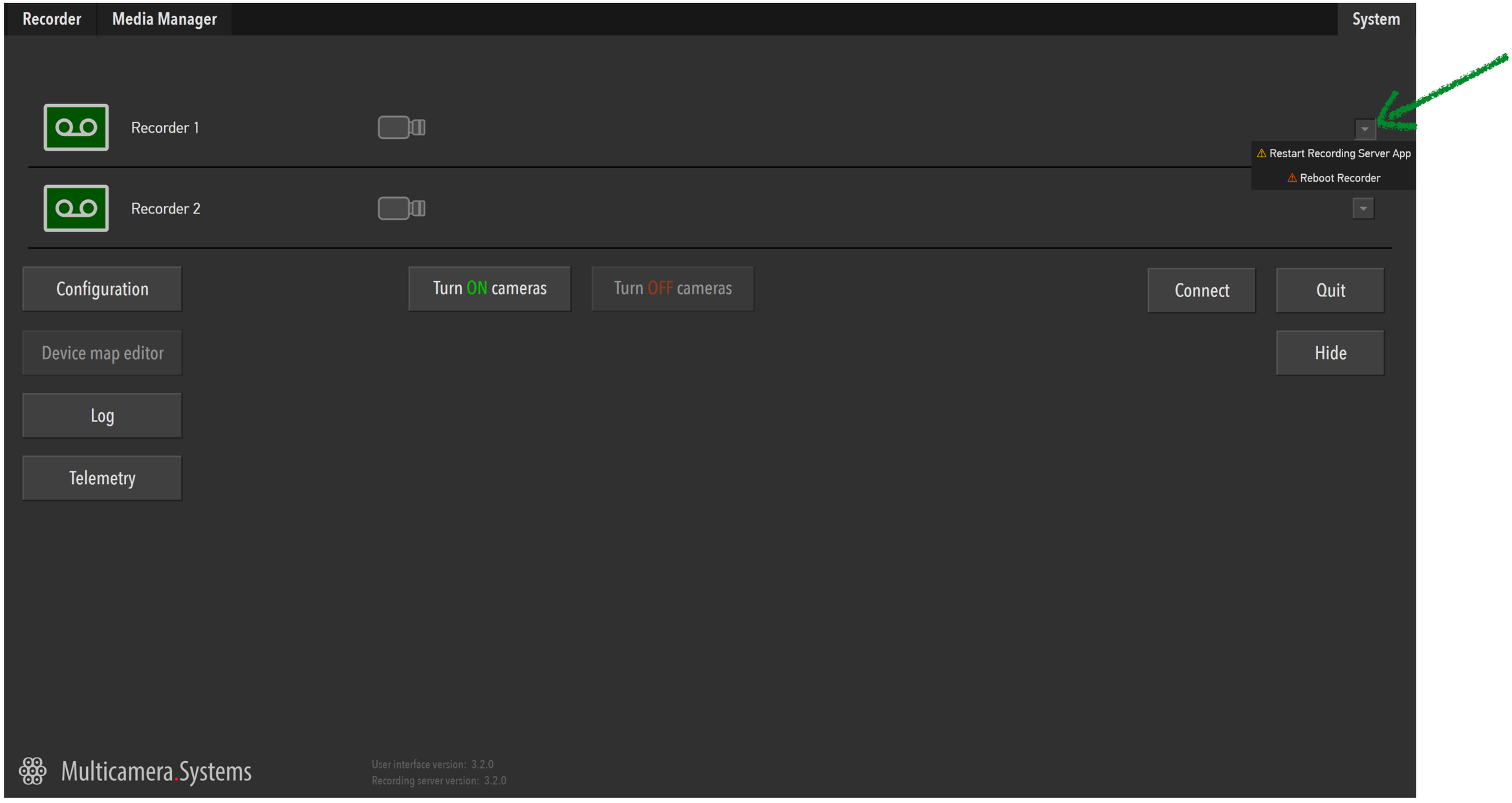


When a user quits the Recorder Control App the recorders are not affected and continue to run. In case of single system installation where all software components run on the same machine quitting the Recorder Control App also stops the Recording Server App, in other words single system installation behave as all components are just single application.

Since the Recorder Control App is full screen application there is “Hide” button available to minimize it.

Recovery control

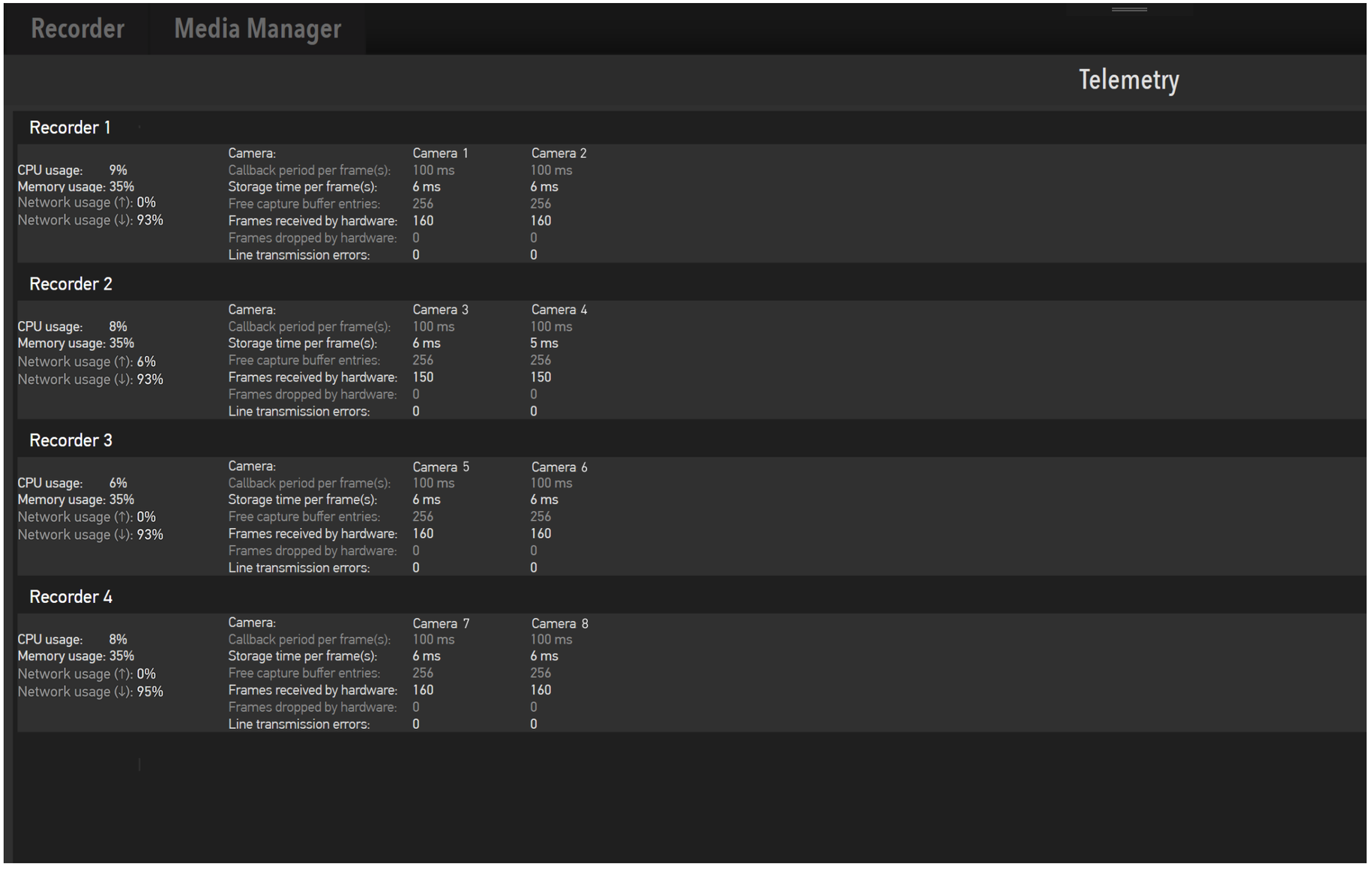
There is built-in recovery control for systems with unattended or remote recorders allowing to restart the Recording Server App or reboot a particular recorder remotely. Note, that this does require remote system to be in a reasonably alive state.



Telemetry

In addition to general status of the recorders and capture devices the software can show more detailed information helping to check that the entire recording system operates correctly on each level. The recorders are again represented by rows as on the System tab and each camera connected to a particular recorder is shown in separate column. If some of the data are our of the normal operation range it will be shown in red.

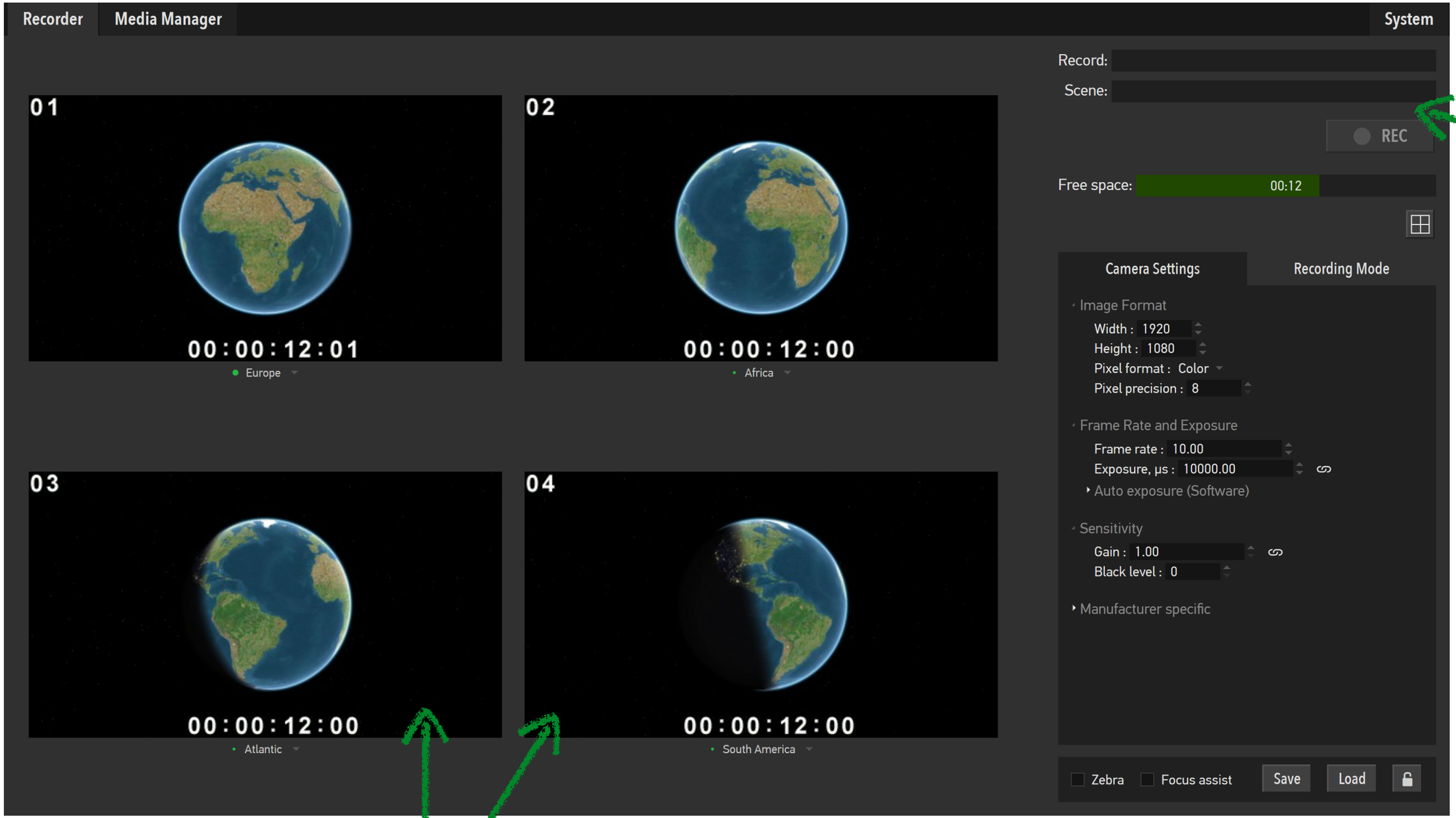
To bring up telemetry information a user has to press “Telemetry” button located on the System tab. The data is available only when capture devices are active.



Part of the System tab is shown

Recording tab

Once cameras are powered up the **<Recorder Tab>** becomes available. The tab contains preview windows showing live video streams from selected cameras, recording controls, tabs with camera settings and recording mode options.

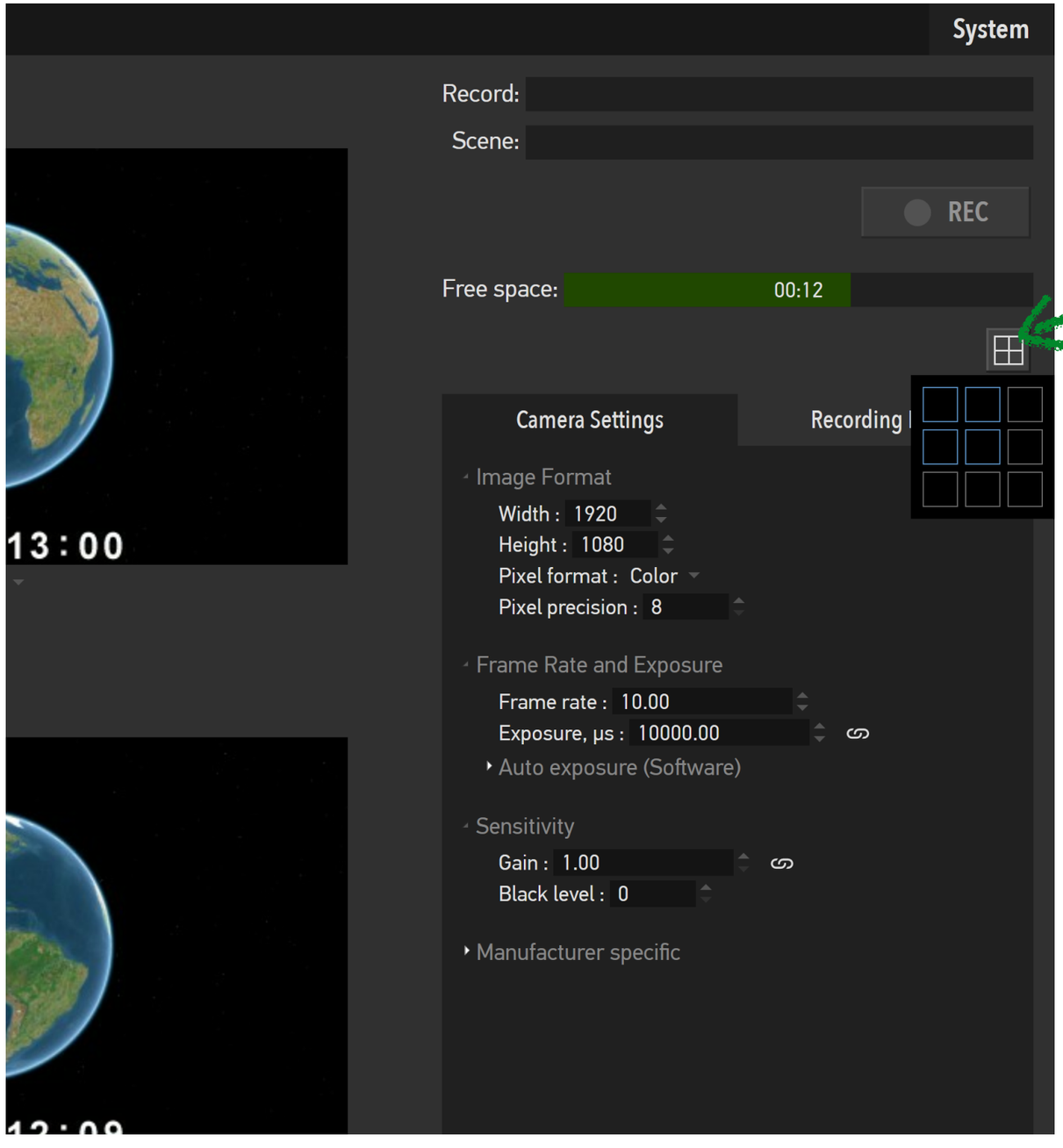


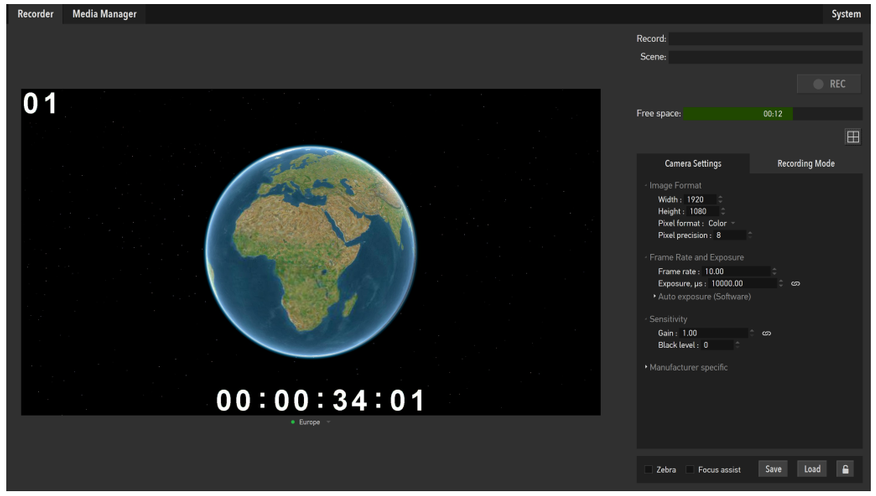
Recording controls

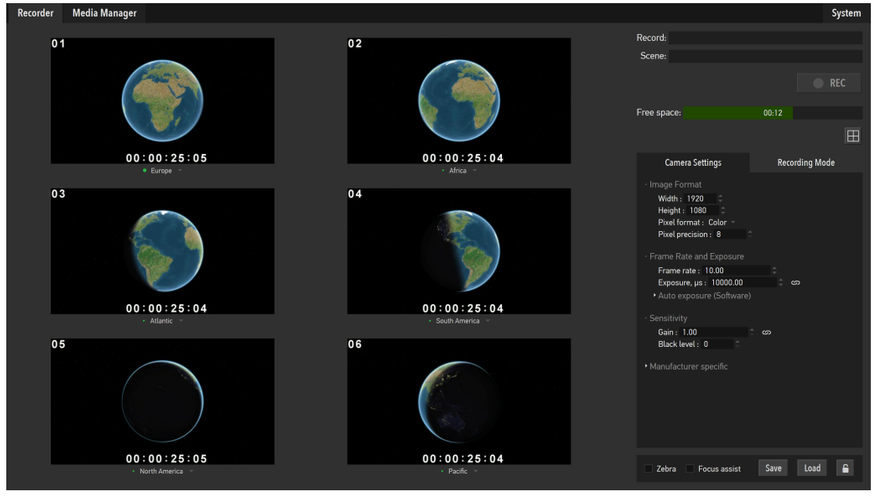
Preview windows. See next page on how to control them.

Selecting a number of live previews

A user can select the number of preview windows by clicking the button under free space indicator on the right.





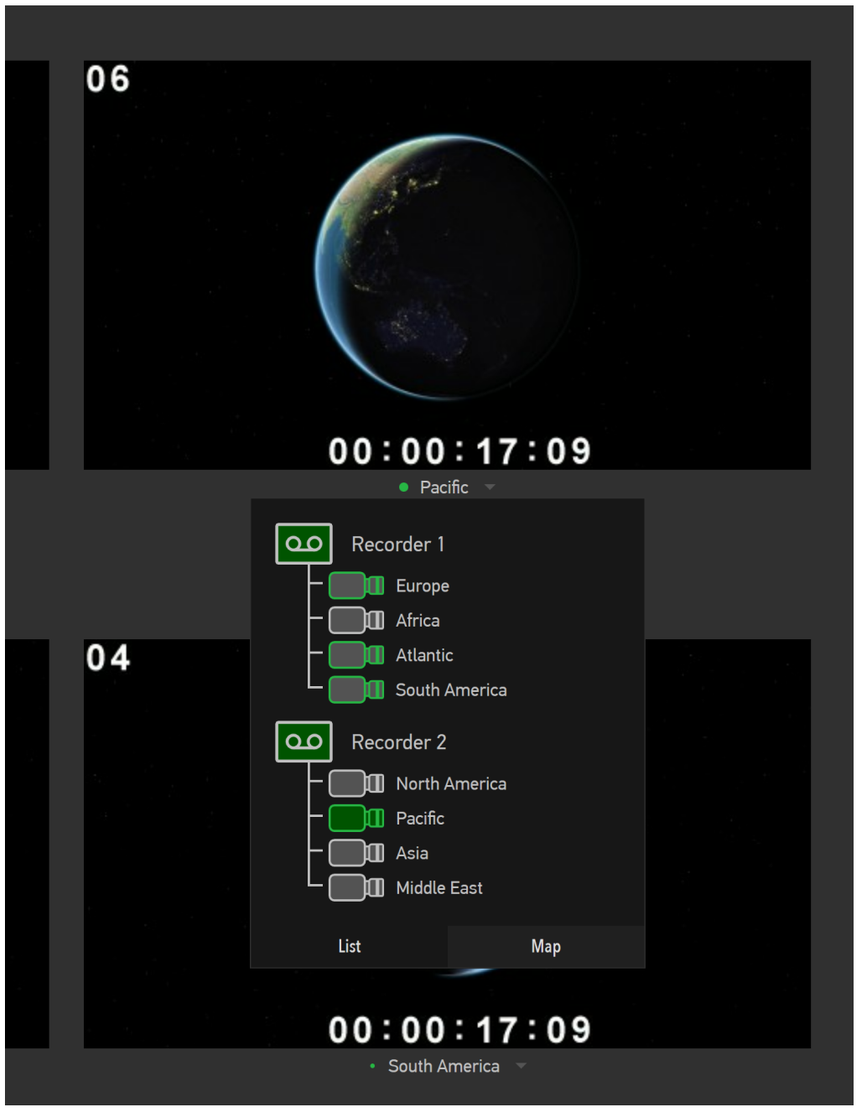


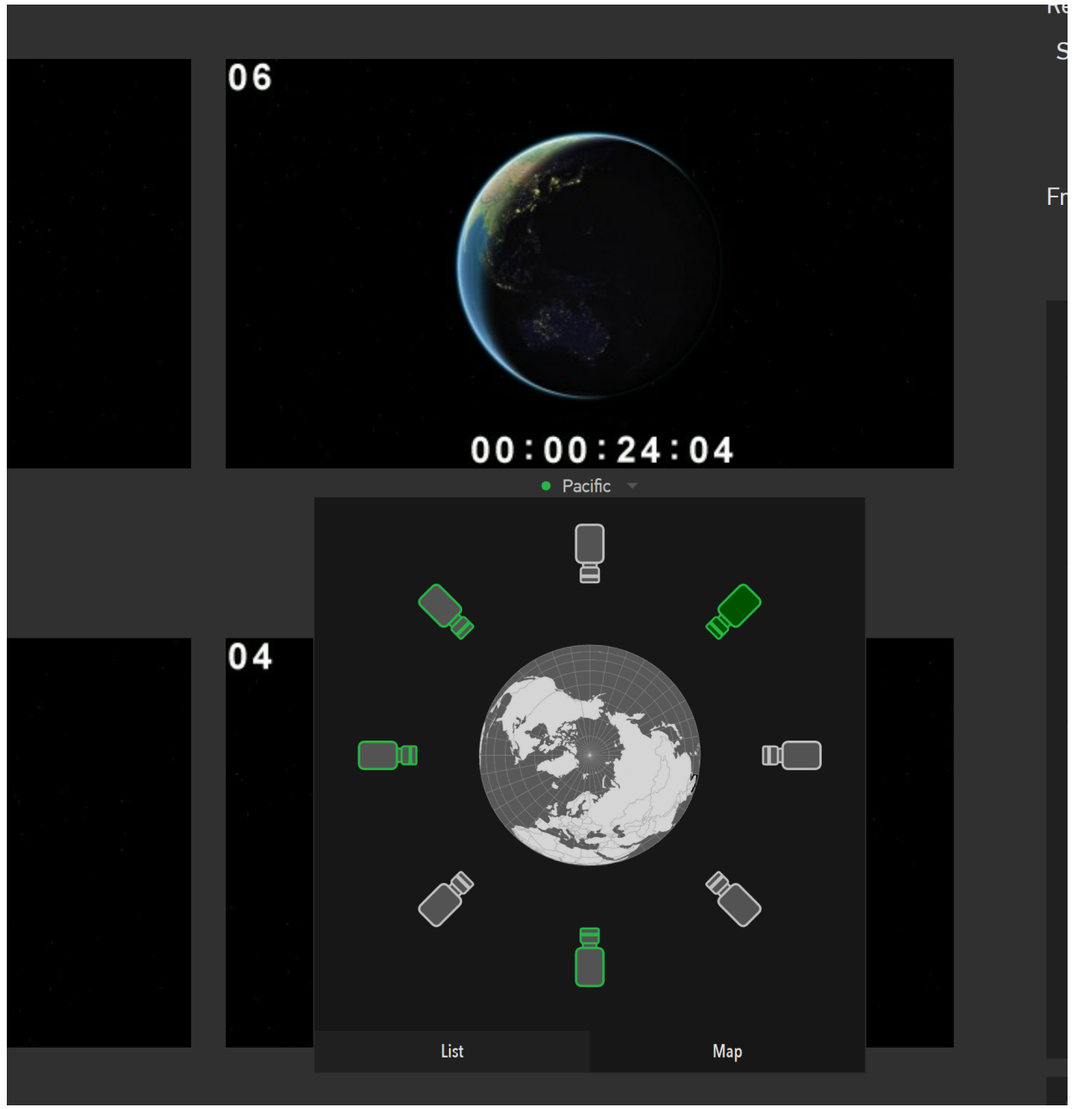
Selecting camera for live preview

To assign particular camera's live stream to a preview windows click on a camera name shown under preview window. There are two modes of the camera selection dialog: the List and the Map.

In the List mode the list of all recorders and connected cameras with its names will be shown. Already streaming cameras (to other preview windows) will be outlined in green and the camera currently assigned to selected preview window will be shown fully in green.

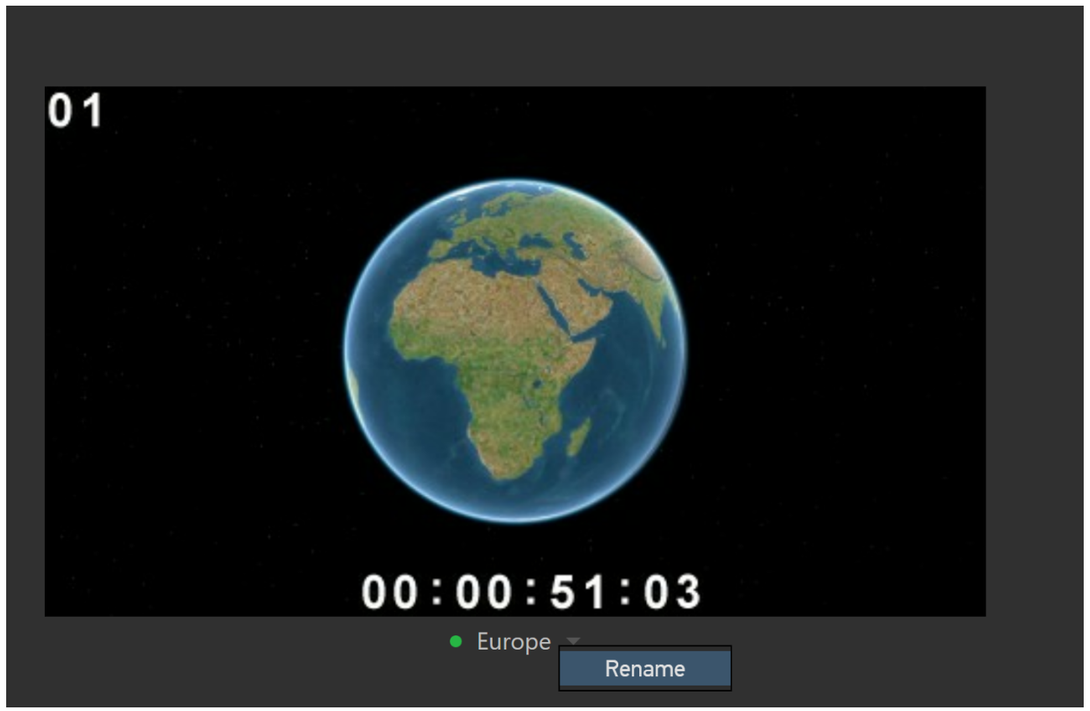
The Map mode shows the map resembling physical layout of the recording system. A user can create its own map by using build in Device Map Editor accessible from the <**System Tab**> (subject to availability in your version).





Camera names

By default all cameras are named sequentially – “Camera 1”, “Camera 2”, etc. (Expect cameras on software emulator device where names are hardcoded). A user can rename camera by right-clicking on a camera name string under preview window. The name is saved in the configuration file automatically and the software tries to match a given name to a particular physical camera regardless of the connection order in case of system configuration changes.

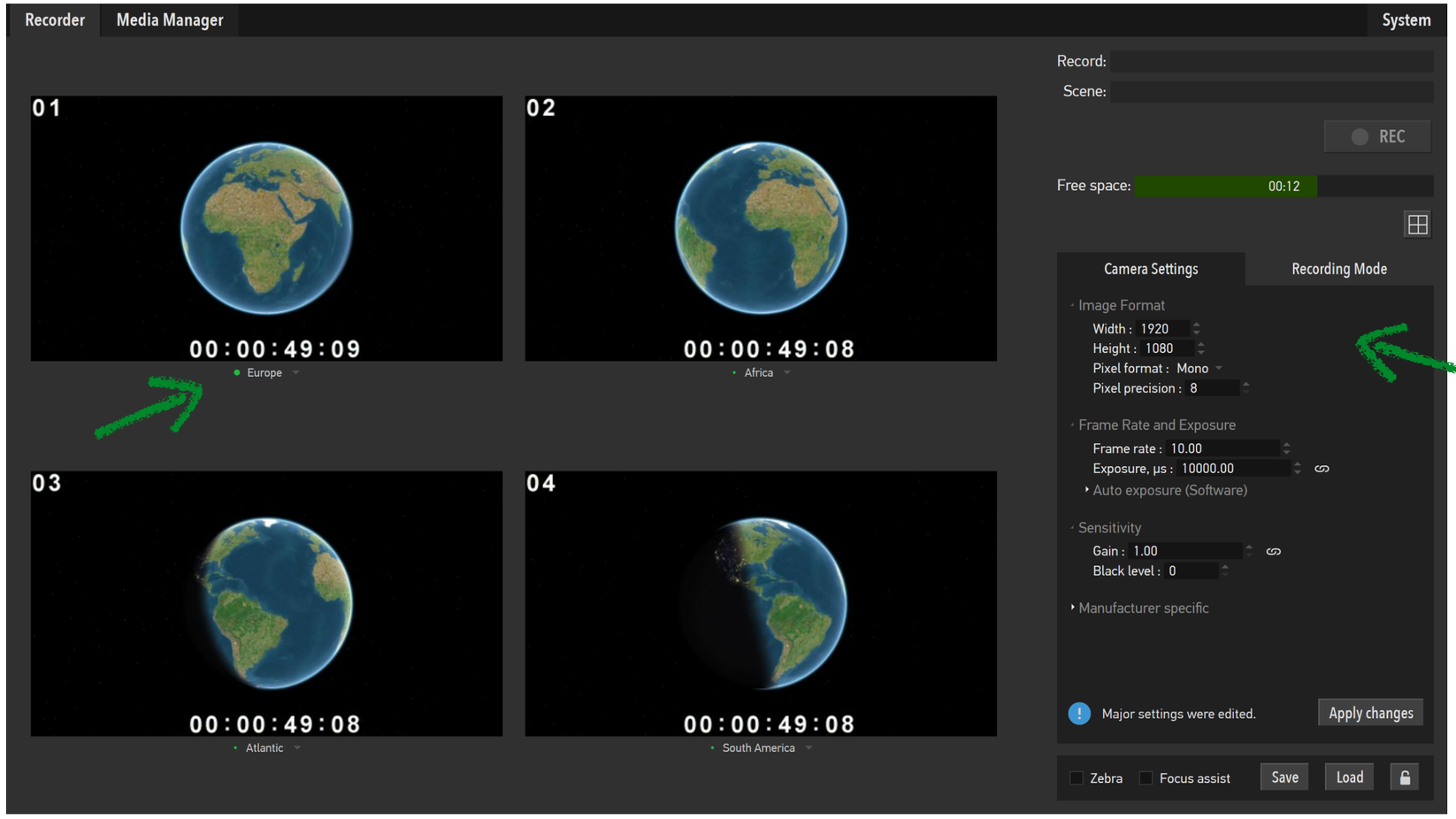


Camera settings

The camera parameters are controlled in Camera Settings tab. If you version support other types of capture devices extra tabs for those devices will be shown.

Settings are organized in groups. For camera devices there are six major groups: “Image Format“, “Frame rate and Exposure“, “Sensitivity“, “Color balance“, “Lens“ and “Manufacturer specific“.

Logically settings are divided into two categories: “soft“ settings which can be changed on the fly while camera is running and “hard“ setting which require a camera to be stopped (e.g. image format). The former are applied immediately as soon as a user changes them. The latter will not be pushed to a camera until <**Apply**> button is pressed. The bottom will be shown only if one of “hard“ settings changed. You can change several “hard“ settings before applying them.

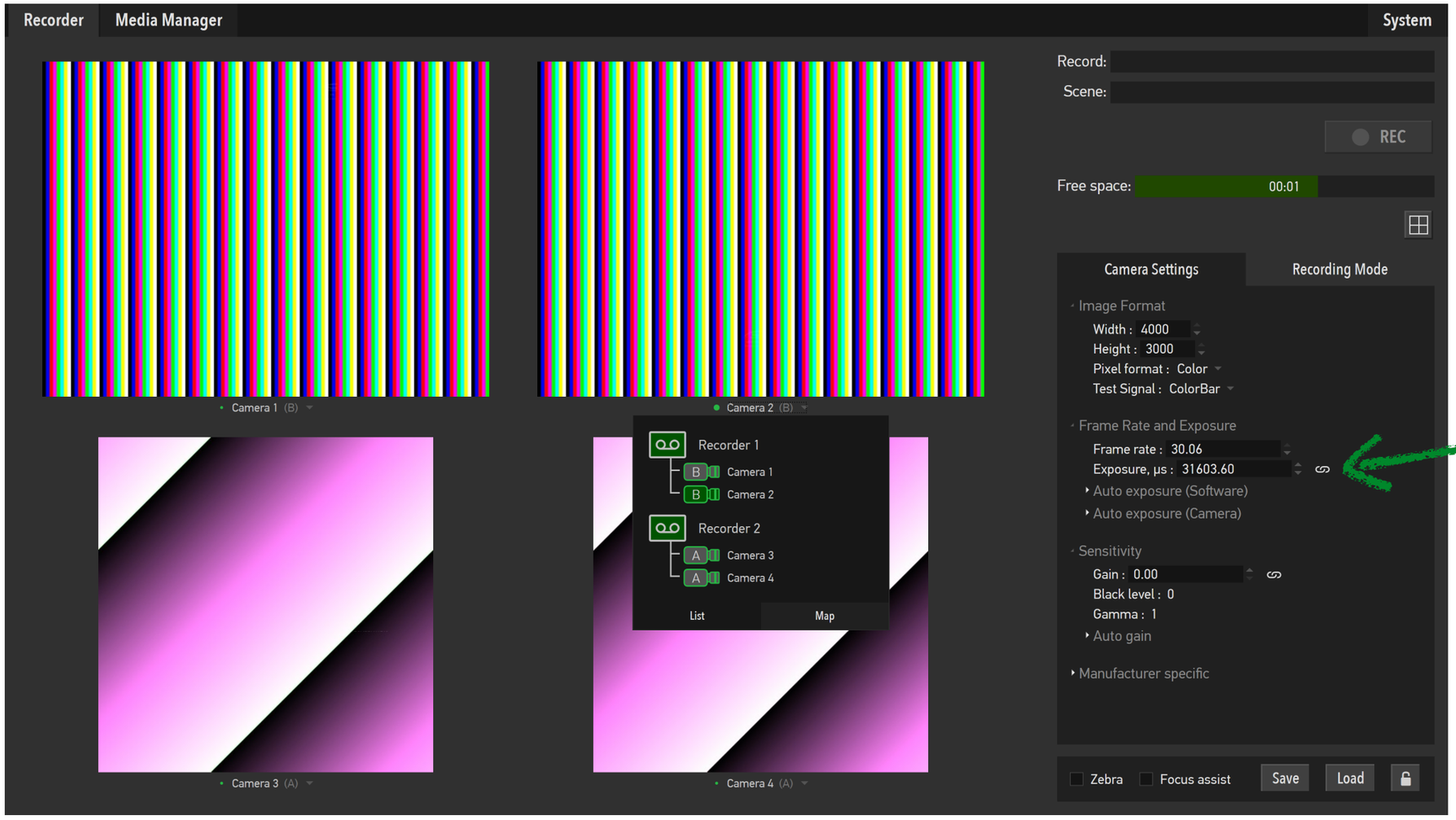


The <**Camera Setting Tab**> shows setting of the camera from selected preview window. The selected windows is marked by large green dot (left top windows on the example screenshot).

Camera settings (continued)

By default camera settings are applied synchronously to all cameras, but certain settings be controlled individually per camera (e.g., exposure or gain). To switch how changes are applied (to the selected camera only or to all cameras) use the link button next to the setting value.

If a recording system comprise cameras of different models (e.g. Color + IR) then cameras will be divided into groups according to their model. This is done because different models have different set of parameters and has to be controlled separately. Parameters are controlled per camera group. Each group is denoted by single letter: ‘A’, ‘B’, etc. The group ID will be shown by the camera name and inside the camera icon in the device list. All parameter changes will be applied only within the group. To change parameters in all cameras in the system, first select a preview window with any camera from group ‘A’, set desired parameters, them select a preview window with any camera from group ‘B’ and set its parameters.

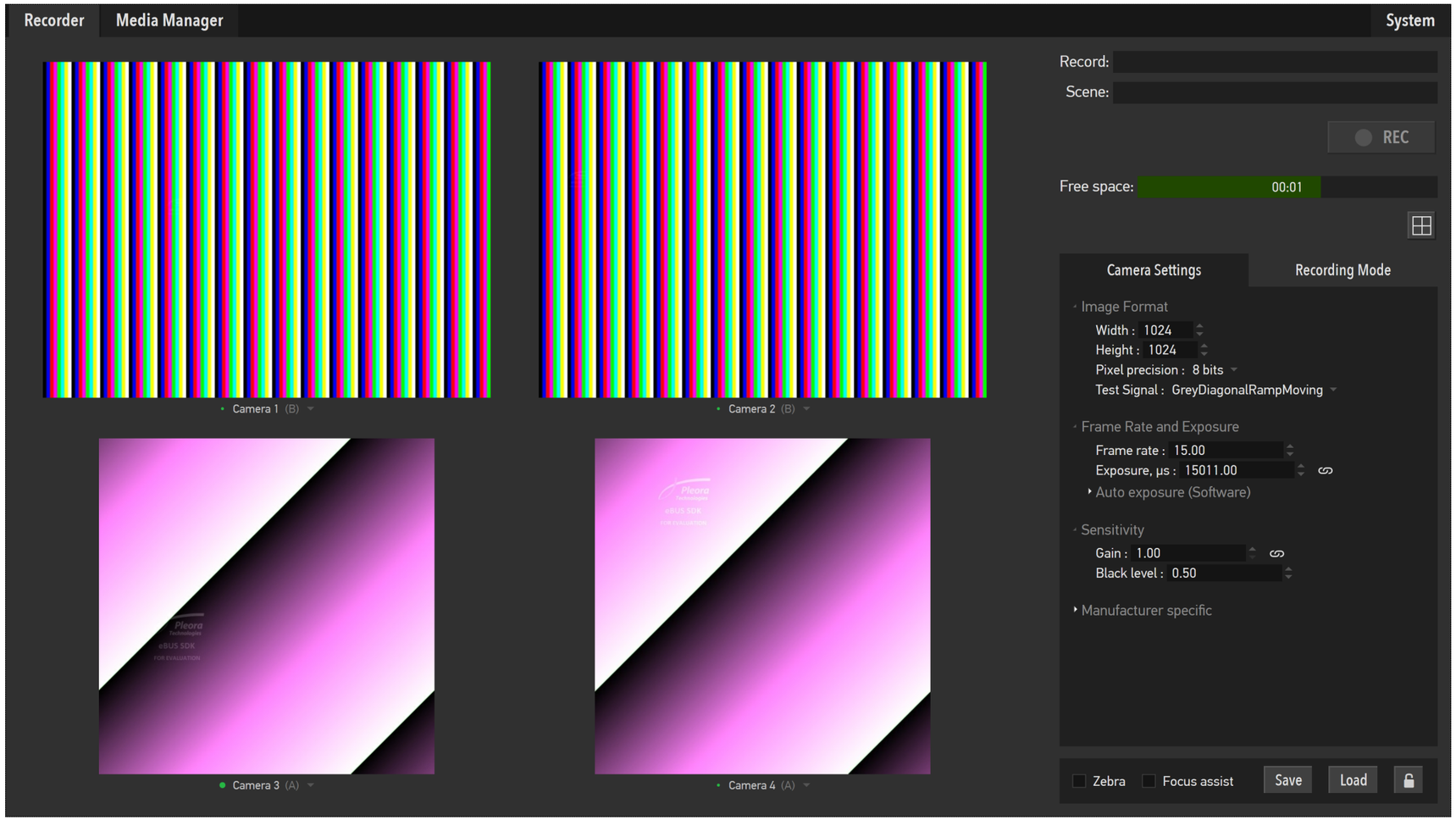


This setting can be controlled individually per camera.

Camera settings - Saving, Loading and Locking

A current set of camera settings can be saved and later reloaded. Use Save and Load buttons located at the bottom of the tab. The settings are saved for all cameras in the system.

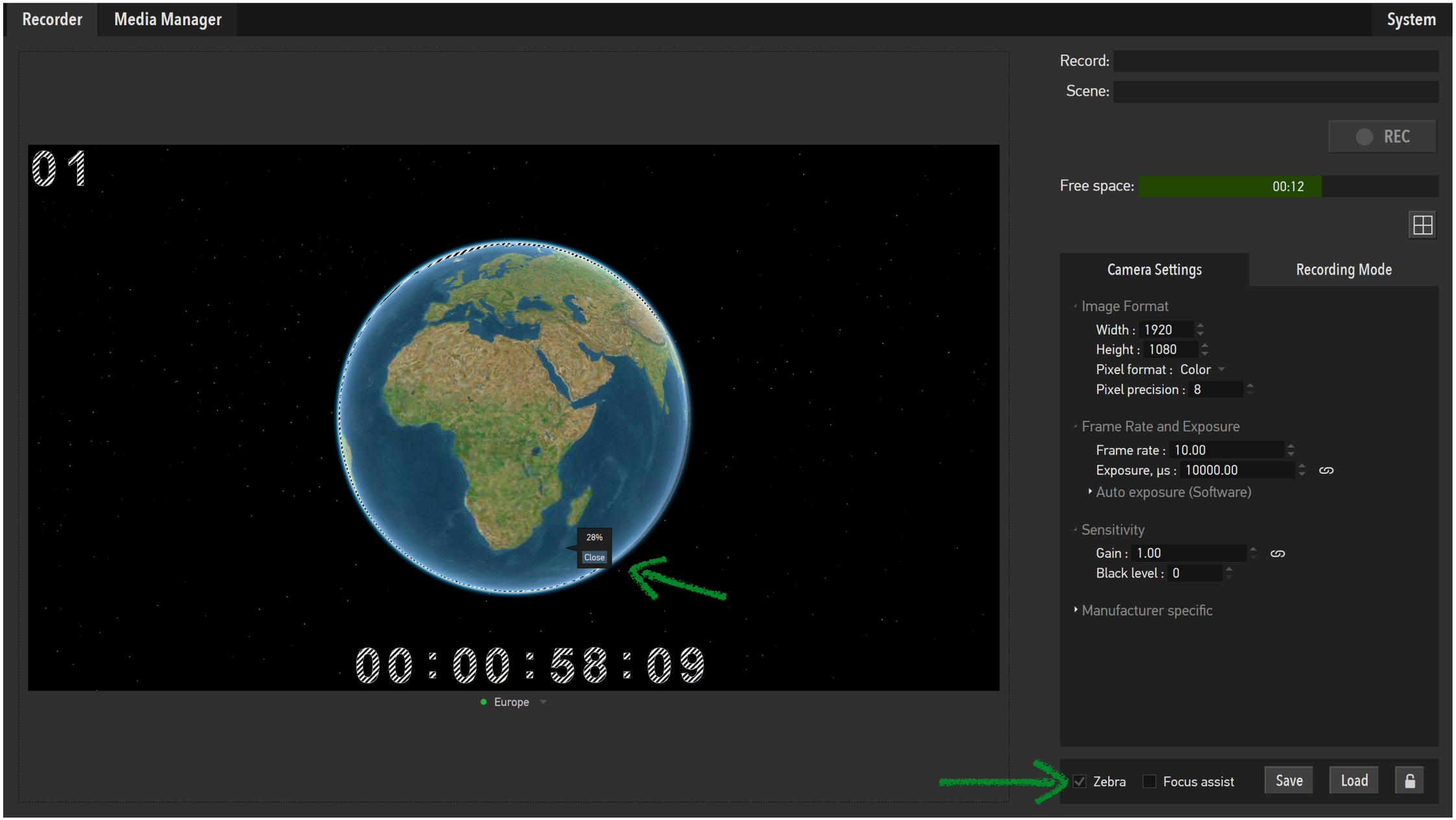
To facilitate setup engineer / operator usage scenario or to protect current settings from accidental change the software provides ability to lock cameras setting pane with a password. Use the padlock button to lock/unlock the settings.



Save, Load and Lock buttons

Image tuning

The software provides couple standard features helping to do image setup: zebra and focus peaking. Those feature can be switched at the bottom of Camera Setting tab. Use right click in a preview windows to probe image brightness at particular spot.



Recording

The recordings are organized as two-level hierarchy: Records and Scenes. Name for each one is entered in the corresponding field in the top right corner of the <**Recorder Tab**> If user doesn't update Scene name before next recording is started the software adds a number to the name and will keep increasing it automatically for each new recording.

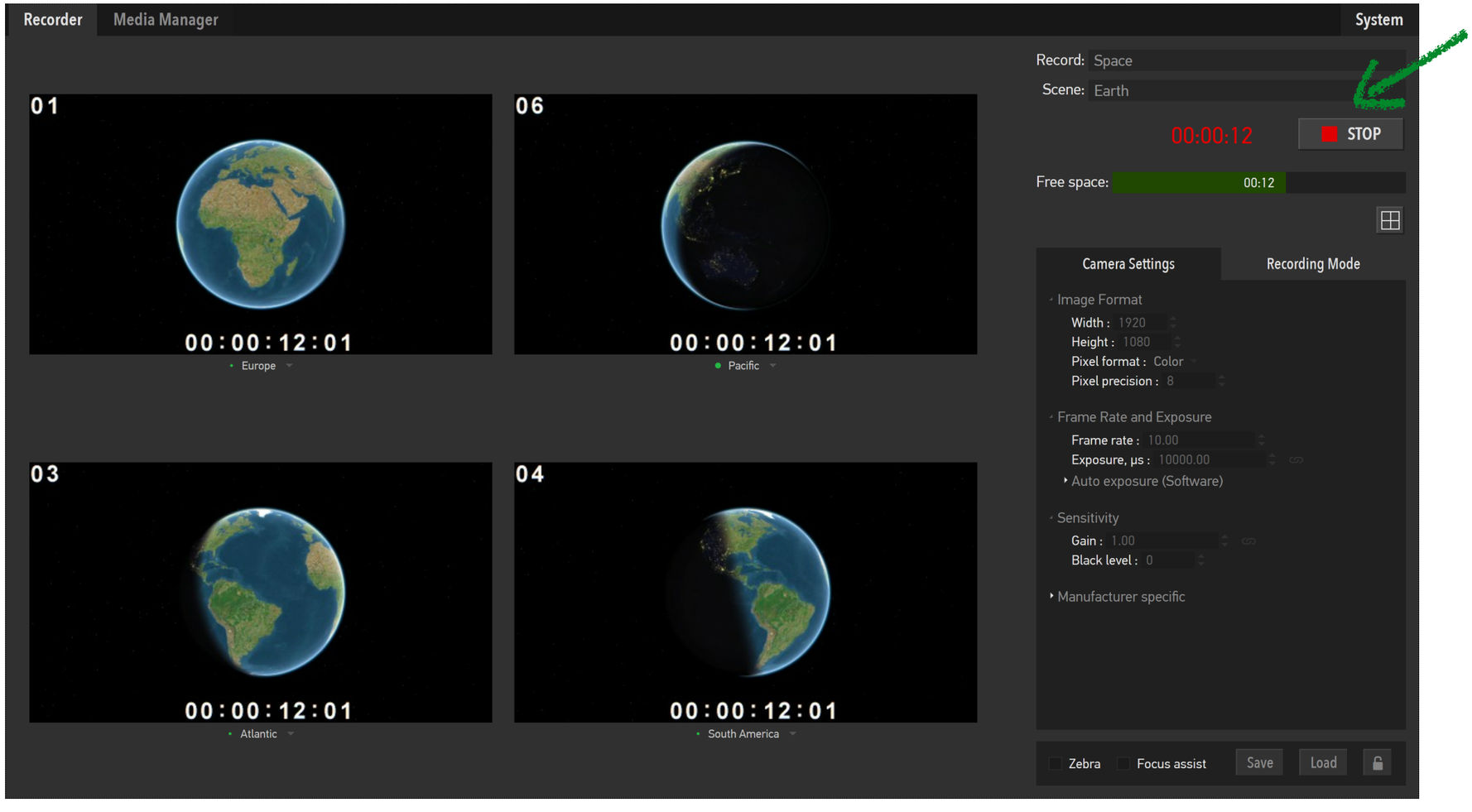
The recording is controlled just by one button which operates as "Rec" and "Stop" depending on the current system state respectively. The elapsed recorded time is shown to the left of that button. The free space bar shows remaining storage space and time. Note, that remaining time depends on the camera parameters such as resolution and frame rate and will be recalculated dynamically.

The recording will stop automatically if storage becomes full. For a setup with multiple recorders if one recorder stops for any reason the rest will keep recording until stopped by a user. This behavior allows to build setup with redundancy or capture at least some data on failed non-redundant setups.

The preview windows continue functioning as normal during the recording. Note, that the quality of the preview stream may be reduced during recording to free up more CPU cycles to avoid dropped frames. This doesn't affect recorded data.

Camera parameters are locked during the recording.

Telemetry data is available and accessible through the <System tab>.



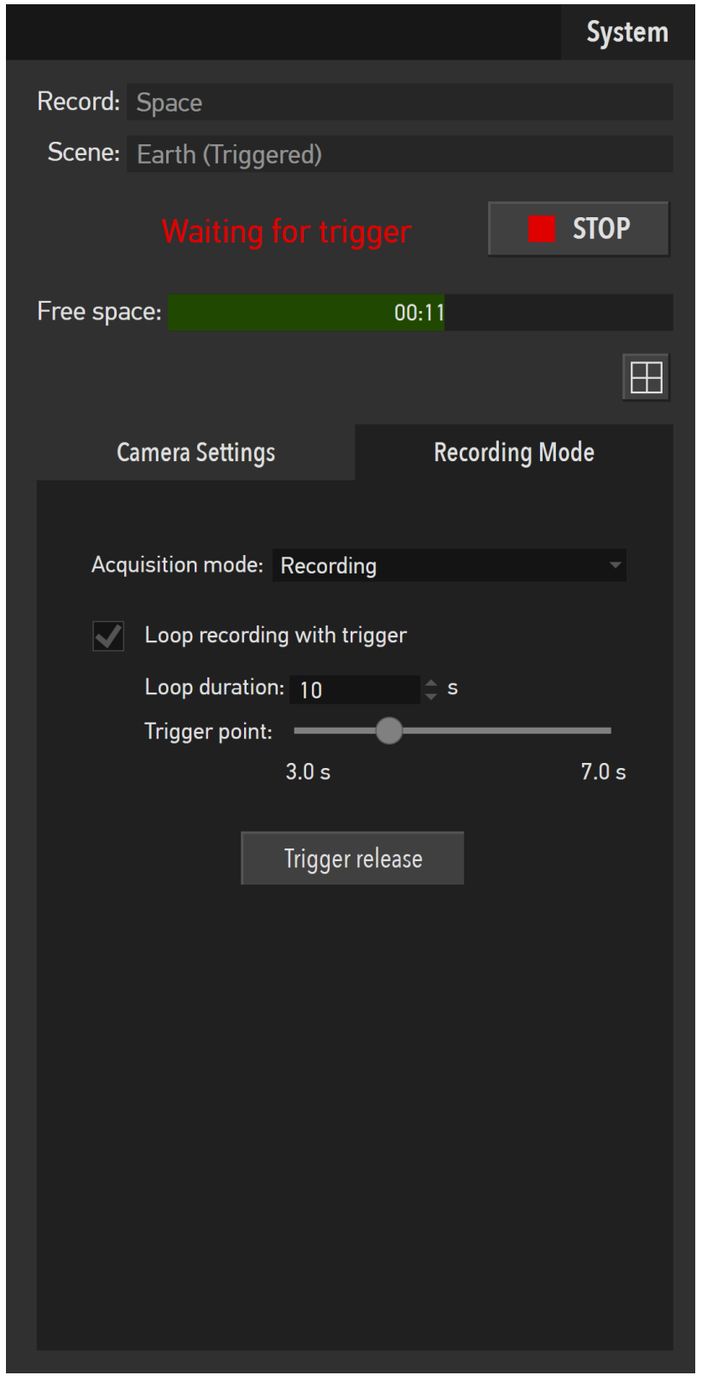
Recording - Loop mode

The loop recording is the mode when recording is done in a cyclical manner – new recorded data overwrites existing (oldest) data. The length of this loop is set by a user. There are two ways for the recording can be stopped: manually by using <Stop> button or by the trigger signal.

The trigger signal can come from different sources:

- **<Trigger release>** button;
- external signal to frame grabber GPIO;
- other hardware solution. Please contact us if you are interested in this option.

After trigger is released the recording continues to roll for preset time and then stops automatically. User can configure the total time of the recording and the split around the trigger point. For example, as shown on the picture, the total recording time will be 10 seconds and the recording will contain 3 seconds of data before the trigger was released and 7 seconds after.



Acquisition mode

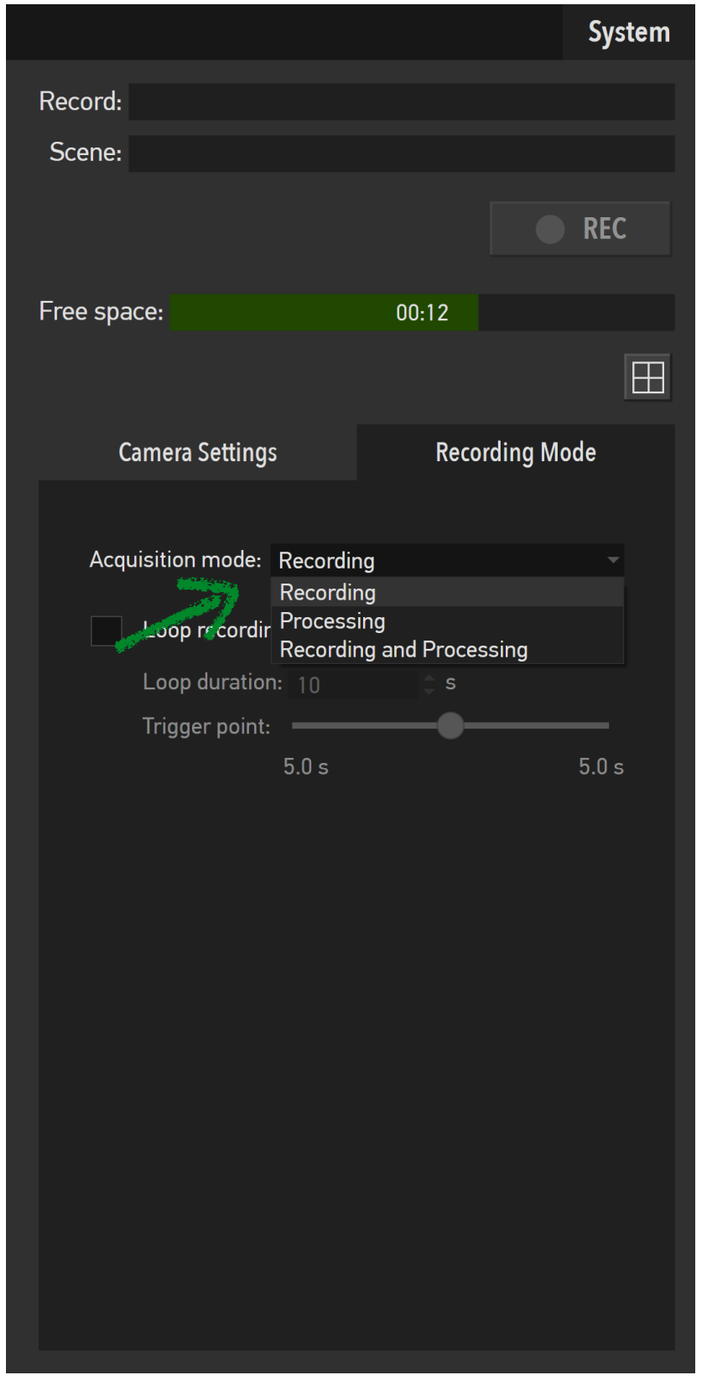
The Software allows processing of captured data in addition or instead of recording. The processing is performed by a user supplied plugin module. The name of the module is set in the "RecordingSystemConfigurator" utility.

The acquisition mode is selected on **<Recording Mode Tab>**:

- "Recording": captured data will be recorded to a recorder storage;
- "Processing": captured data will be send to a processing module and no data will be stored;
- "Recording and Processing": first data will be send to a processing module and later stored based on the return code from processing plugin.

The flow of data to a processing plugin starts when recording session is started by pressing <REC> bottom and stops when <STOP> is pressed accordingly..

Please download the user plugin SDK from our website if you desire to develop processing plugins.

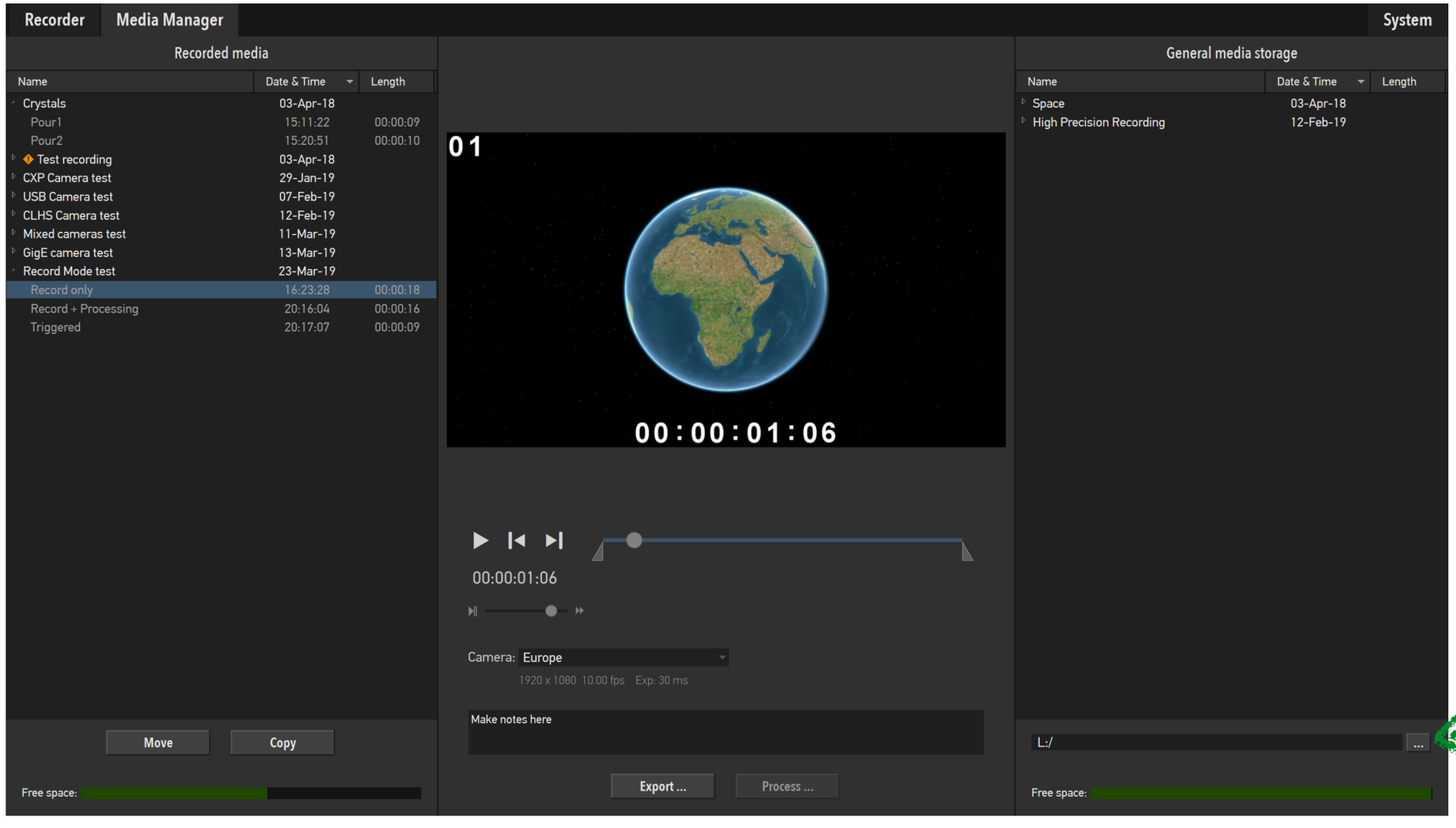


Storage organization

The system defines two types of storage: the internal fast recording storage where data from cameras and other capture devices are saved during the recording and slower general storage (internal or external) where recorded data can be uploaded after the recording session.

The <**Media Manager Tab**> provides two panes on the left and on the right showing content of each storage type.

The location of the permanent storage is configured through "RecordingSystemConfigurator" utility for each recorder in the system. The location of the general storage can be changed on the fly in the UI.



General storage selection

Note, that in multi recorder setup the general recording should be mapped to the same driver letter (windows) or mount point (linux) on all recorders in the recording system.

Also note, that the general storage is what is connected to a recorder, not to a control machine where UI is running (in case it's not the same PC).

Managing recorded data

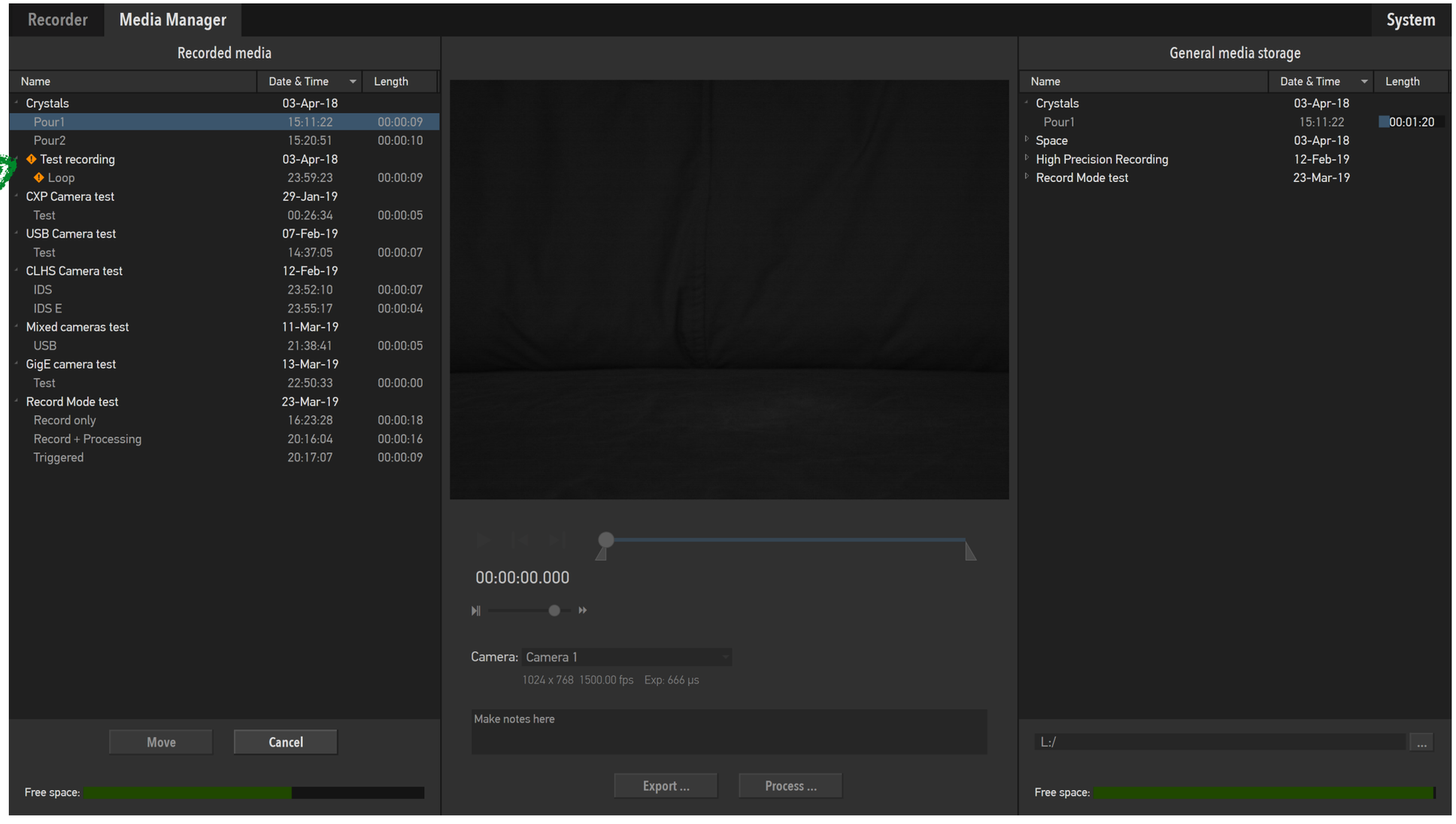
Standard file management functions are available to a user in regards to recording management: move, copy, rename and delete.

To **move** or **copy** single or multiple (using Ctrl key) scenes from the recording to the general storage use buttons below left panel. The copy progress and estimated copy time will be shown on the right panel across the scene being copied.

To **delete** a scene or entire record right-click on it to bring up <Delete> menu.

To **rename** a scene or a record use click-hold-release.

Damaged or incompletely uploaded recordings are marked with orange exclamation mark as shown on the screenshot below.

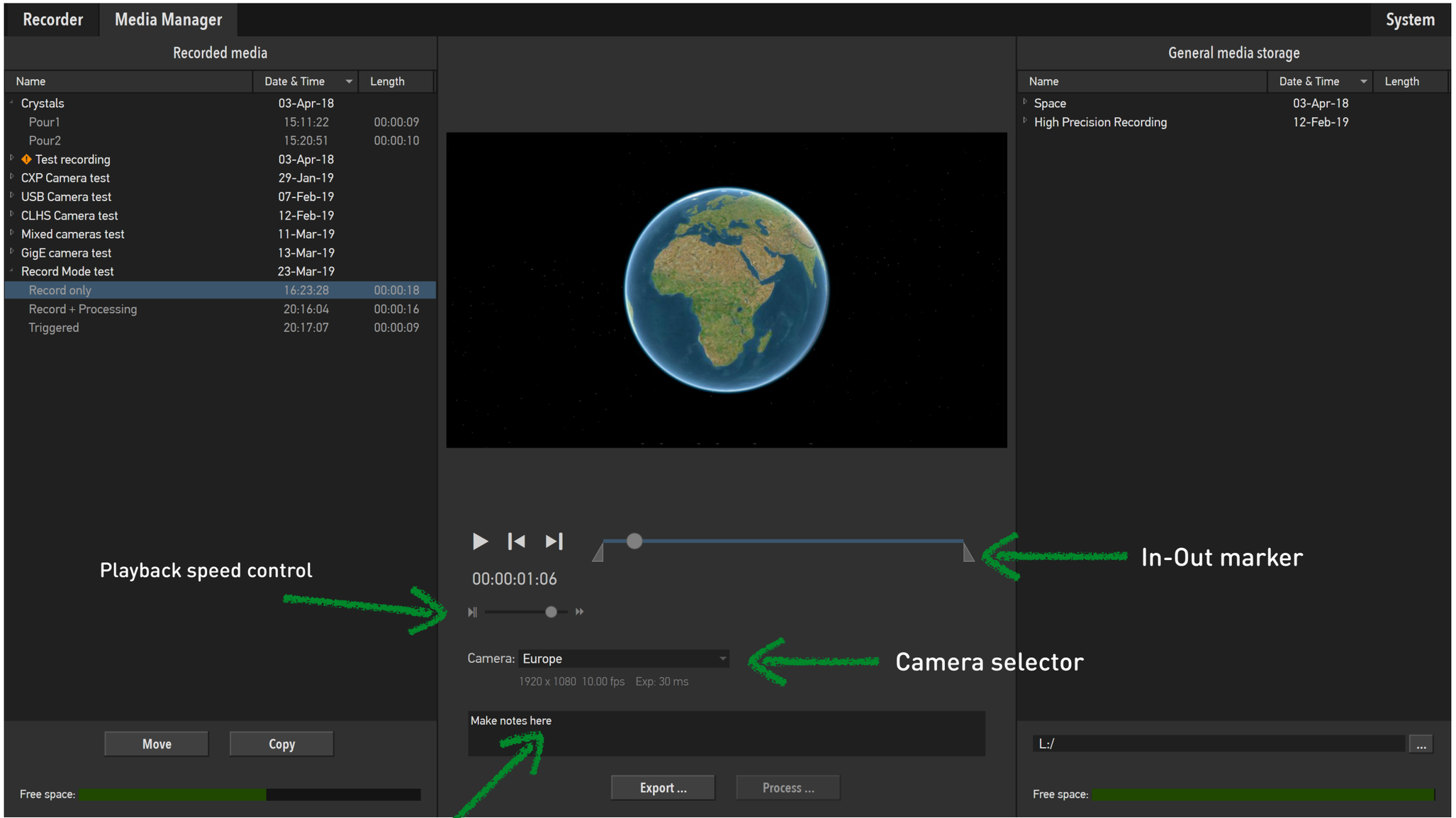


Damaged record

Move progress

Playback

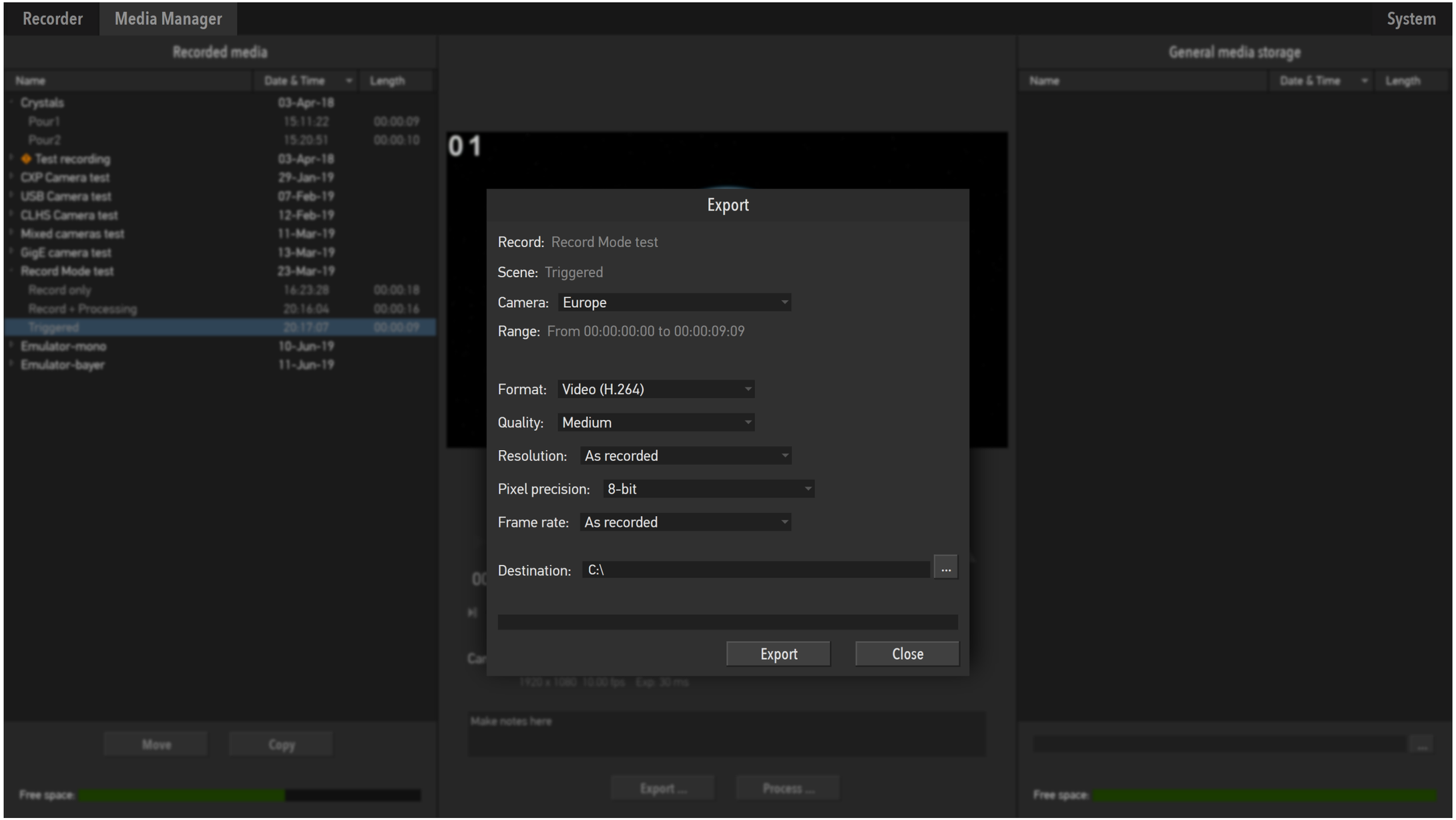
The center part of the <**Media Manager Tab**> is occupied by the player window with standard playback controls.
The playback bar has additional In and Out markers used to select part of a recording for the export.
Playback speed is adjustable by small slider located below timecode.



Export

A user can export recorded video data to commonly used video and image formats. There are handful of settings allowing a user to control various parameters of the exported media: resolution, frame rate and image quality.

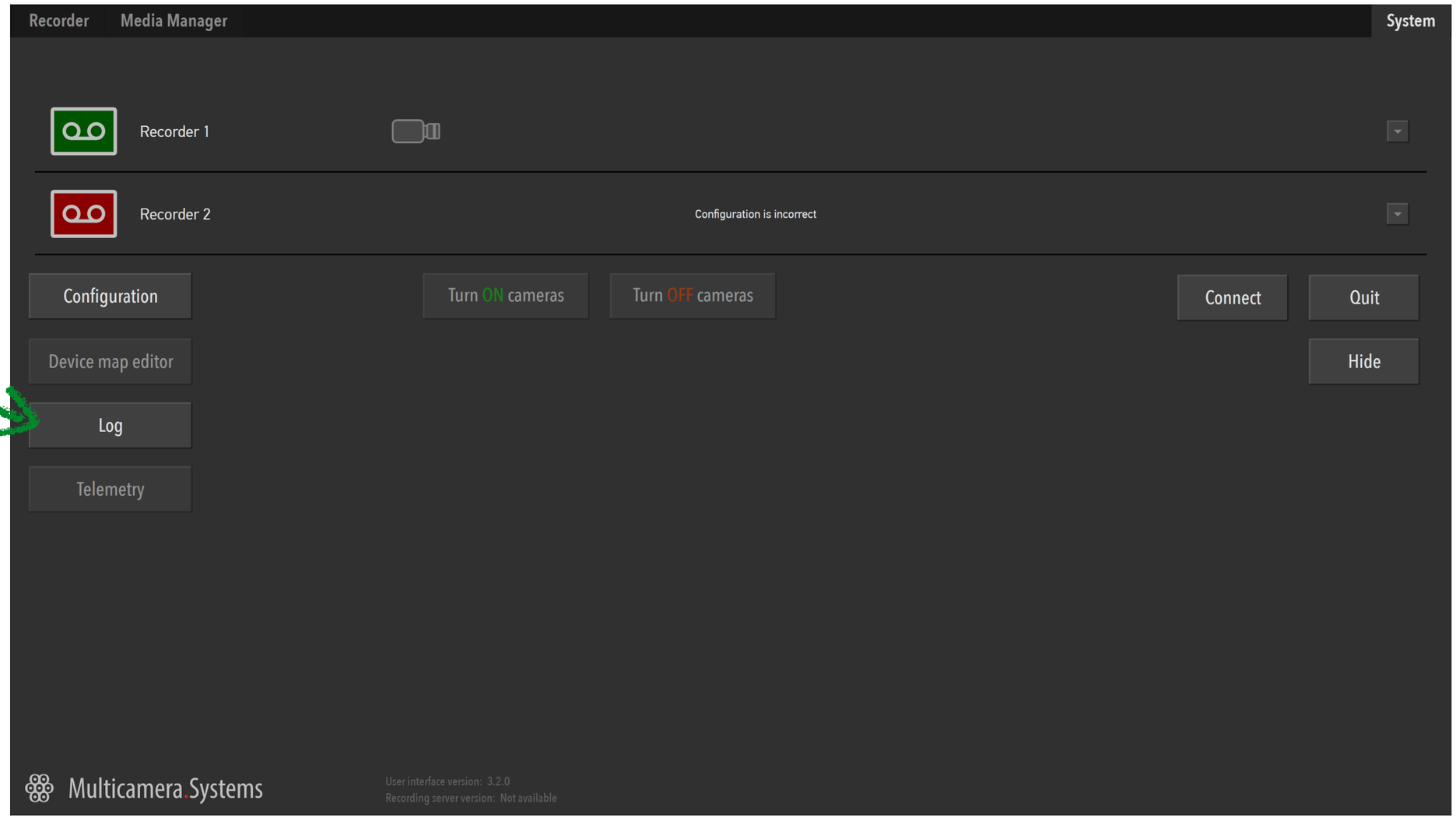
Note, that destination path is what is accessible to a recorder, not to a control machine where UI is running (in case it's not the same PC).



Troubleshooting

Here at the Multicamera.Systems we know that image and data acquisition systems depend on many complex hardware and software pieces working together seamlessly. To quickly resolve a situation when something doesn't work as expected we ask our customers to provide log files generated by our software. Please go to the System tab and press "Log" button: all necessary log files will be packaged and placed on your desktop, so you can easily forward it to our support team at support@multicamera.system.

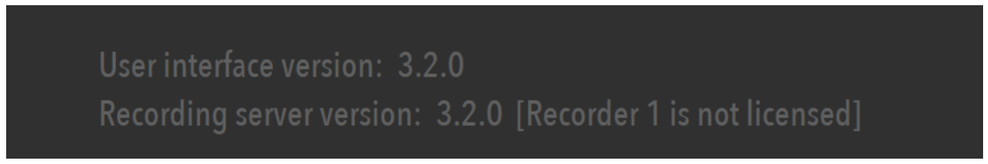
Press to collect log files

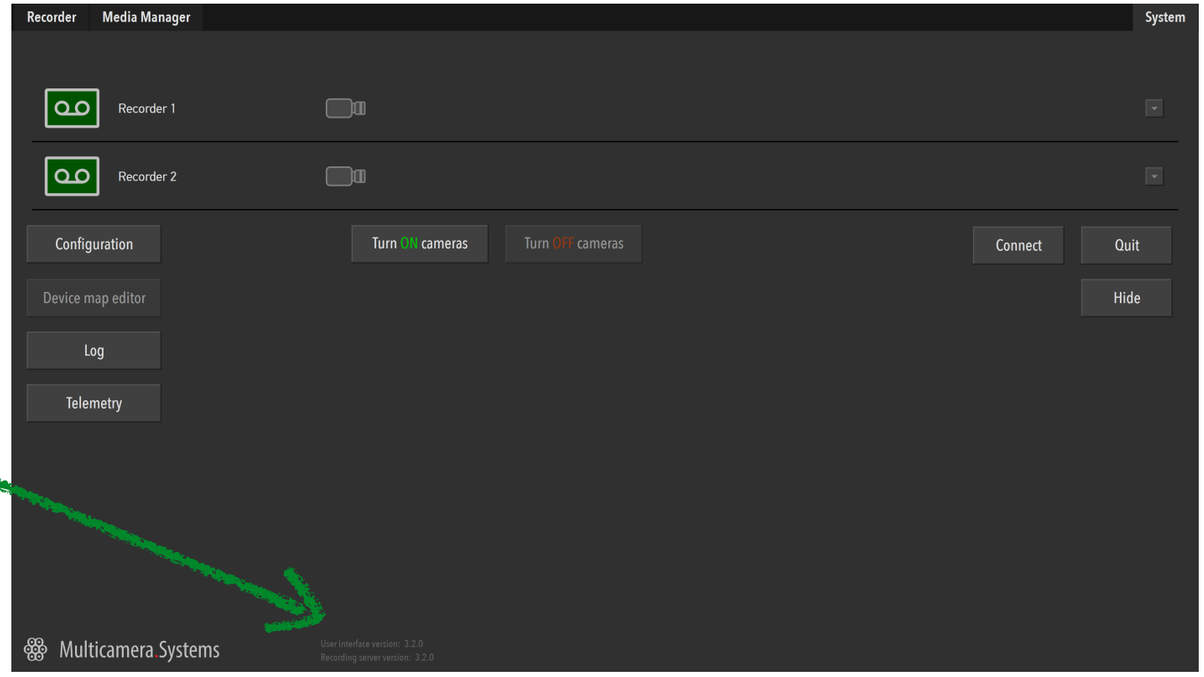


Licensing

The software requires the license file(s) to be installed to function properly. Without the license the software functions, but in limited fashion: recording will be limited to several seconds, export disabled and playback won't play beyond several seconds mark either. The license is bound to either frame grabber(s) serial number(s) and/or machine ID in case of USB/Ethernet cameras or other capture devices. The machine ID can be obtained in "RecordingSystemConfigurator" app, by pressing **<S/N>** button.

The current license status can be checked by looking at the bottom of the **<System Tab>**.



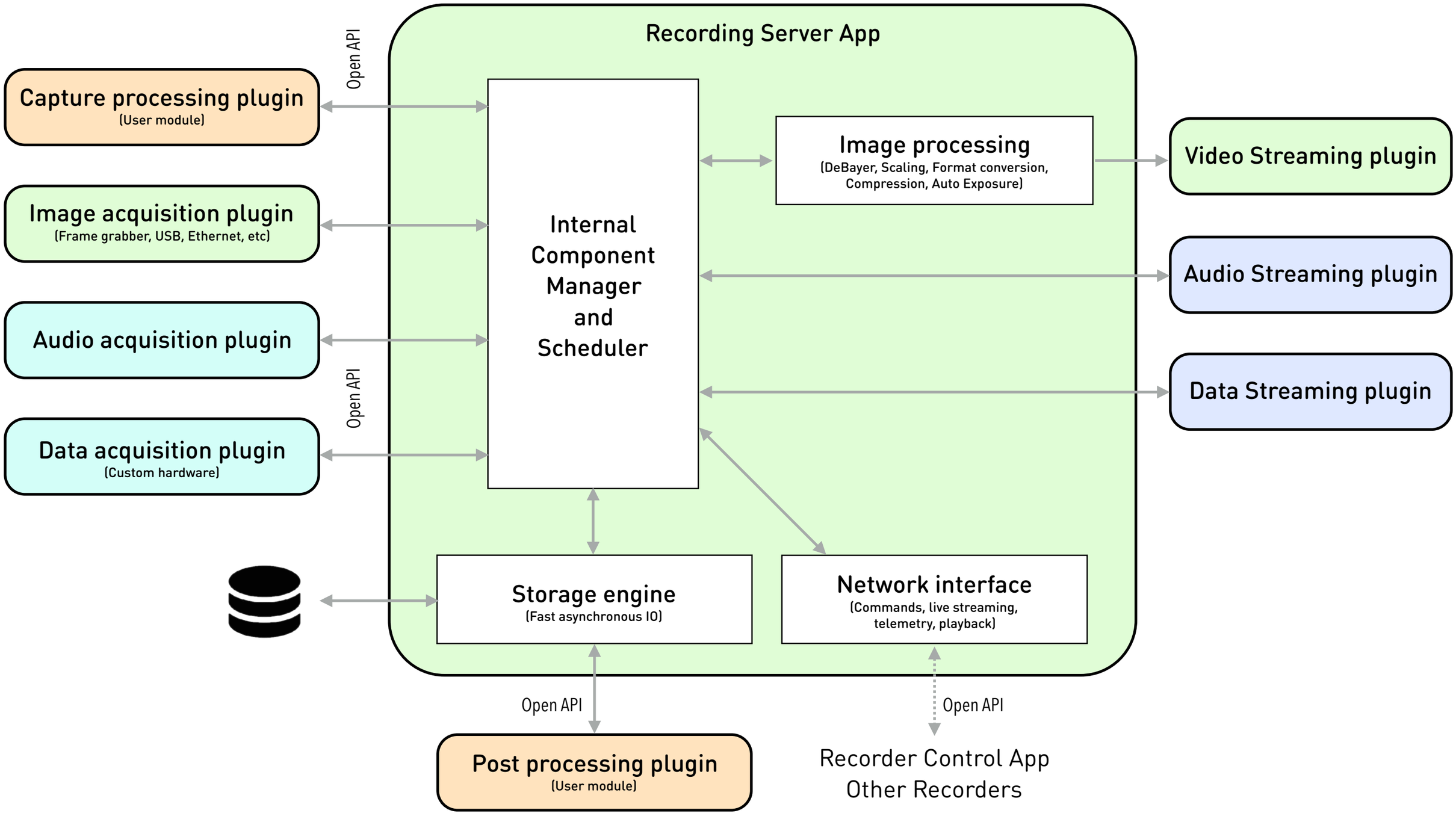


Additional support and requests

We are happy to customize our software to fit your needs, in particular we can:

- add support for your specific capture hardware, including non-camera one;
- add extra image processing of captured data with or without GPU;
- customize user interface to reflect your operating environment and use scenario;
- help to integrate user's own software for post processing of captured data;

Please contact us at info@multicamera.system to discuss possibilities.

Technical Insights

The following diagram shows general software architecture. The software is very modular and new functionality and device support can be added quickly.