HELIOS®

LED Processing Platform

User Guide

HELIOS v.22.11
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Legal

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Warranty Information

Megapixel VR warrants the HELIOS® LED Processing Platform, hardware products, against defects in materials and workmanship under normal use for a period of one (1) year from the date of retail purchase by the original end-user purchaser.

Megapixel VR does not warrant that the operation of the product will be uninterrupted or error free. Megapixel VR is not responsible for damage arising from failure to follow product or installation instructions.

Safety Information

The symbols below are used throughout this manual to identify important safety information. Heed all warnings and safety information.

Symbol	Meaning
	Warning, Danger, or Caution Risk of injury to yourself or the product.
	Risk of Electrical Shock Risk of severe electrical shock.

This device contains Electrostatic Sensitive Devices. Wear anti-electrostatic gloves or bracelet when handling the device.

This device passed test under the condition of being used with professional devices only. It may cause frequency interference when used in a domestic environment.

Signal may become disconnected when electrostatic is induced externally.

Installation Environment

The HELIOS Processor is designed to be rack mounted in a central control room for fixed installations or flight cased for rental / temporary applications.

The unit has been qualified to operate in a dry environment within a temperature range of 10°C to 40°C (50°F to 104°F).

NOTE: Never obstruct the airflow to the side ventilation slots. The front filters need to be regularly checked and cleaned.

WARNING: Below is a set of environmental conditions that must be met prior to installing Megapixel VR products. The installation and/or use of products in these environments not meeting these conditions may void all warranties.

- Installation locations must be free of moisture.
- Installation locations must be dust free.
- All heavy and dirty site work must be complete. This includes re-working or modifications to walls, ceiling and floor.
- All construction materials and debris must be removed, area swept, vacuum cleaned, and the floor wet-mopped.
- Building structure, roof, and walls are sealed and weather proofed. Roof successfully tested for leaks.
- Outside drainage system and floor drains checked and tested to protect the equipment from flooding.
- Floors sealed and cleaned.
- All doors and windows installed and operational with weather seals.
- All final wall preparation complete including all taping, joint compound and fire sealant. Walls to be primed and finish painted.
- Overhead fire sprinkler or suppression system installed and pressure tested.
- HVAC ducts blown free of debris. HVAC shall be operational/balanced and running 72 hours prior to equipment installation.

EMI Statement

FCC

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy. If the equipment is not installed and used as directed in the instruction manual, it may cause harmful interference to radio communications. It is the responsibility of the user to correct any interference.

CCC

Warning: This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

警 告: 此为A级产品。在生活环境中，该产品可能会造成无线电干扰。在这种情况下，可能需要用户对干扰采取切实可行的措施。

Carrying and Handling the Equipment

Before you handle the HELIOS LED Processing Platform equipment, disconnect all cables and cords. Do not operate the HELIOS LED Processing Platform equipment in areas with significant amounts of airborne dust or smoke, or near a humidifier. Tiny airborne particles can damage the equipment.

Power

Unplug the power cord (by pulling the connector, not the cord) and disconnect all other cables if any of the following conditions exist:

- The power cord or plug becomes frayed or otherwise damaged.
- Liquid has spilled onto the equipment.
- The equipment is exposed to rain or excess moisture or humidity.
- The equipment has been dropped, and has been damaged.
- You suspect that the equipment needs service or repair.
- You want to clean the case (use only the recommended procedure, described later in this document).

IMPORTANT: The only way to completely turn off power is to unplug the power cord.

WARNING: The AC cord has a three-wire grounding connector. This connector fits only a grounded AC outlet. If you are unable to insert the connector into an outlet because the outlet isn't grounded, contact a licensed electrician to replace the outlet with a properly grounded one. Do not defeat the purpose of the grounding pin.

Liquid Exposure

Keep the HELIOS LED Processing Platform equipment away from all sources of liquid. Protect equipment from dampness, humidity, or wet weather, such as rain, snow, and fog.

Repairing

The HELIOS LED Processing Platform equipment does not have any user-serviceable parts. Do not attempt to replace or repair any components inside the equipment. If the equipment needs service, contact the company that provided or installed the equipment. If you open the equipment or install items, you risk damaging the equipment. Such damage isn't covered by the limited warranty on the equipment.

Medical Device Interference

HELIOS LED Processing Platform equipment contains components that emit electromagnetic fields, which may interfere with pacemakers, defibrillators, or other medical devices. Maintain a safe distance of separation between your medical device and equipment. Consult your physician and medical device manufacturer for information specific to your medical device. If you suspect equipment is interfering with your pacemaker or any other medical device, stop using the equipment.

Medical Conditions

If you have a medical condition that could be affected by using HELIOS Processing equipment (e.g., seizures, blackouts), consult with your physician prior to using HELIOS LED Processing Platform equipment.

High-Consequence Activities

HELIOS LED Processing Platform equipment is not intended to be used where failure could lead to death, injury, or severe environmental damage.

Explosive Atmospheres

Using HELIOS LED Processing Platform equipment in any area with a potentially explosive atmosphere (e.g. where the air contains high levels of flammable chemicals, vapors, or particles (such as grain, dust, or metal powders), may be hazardous. Obey all signs and instructions.

Using Connectors and Ports

Never force a connector into a port. When connecting a device, make sure the port is free of debris, that the connector matches the port, and that you have oriented the connector correctly in relation to the port.

Storing the Equipment

If you are going to store the HELIOS LED Processing Platform equipment for an extended period of time, keep it in a cool and dry location (ideally, 71° F or 22° C).

Cleaning the Equipment

When cleaning the outside of the HELIOS LED Processing Platform equipment and its components, first shut down the equipment, then unplug all cords and cables. Use canned air such as 'Turbo Blast' by ACL Staticide Inc. or a clean, soft, lint-free cloth to wipe the equipment exterior. Avoid getting moisture in any openings. Do not spray liquid on the equipment. Do not use sprays, solvents, abrasives, or cleaners.

Changes

Megapixel VR provides this manual 'as is' without warranty of any kind, either expressed or implied, including but not limited to the implied warranties or merchantability and fitness for a particular purpose. Megapixel VR may make improvements and/or changes to the product(s) and/or the program(s) described in this publication at any time without notice.

This publication could contain technical inaccuracies or typographical errors. Changes are periodically made to the information in this publication; these changes are incorporated in new editions of this publication.

Certifications

Megapixel VR

C ETL LISTED US

Intertek

5015417

I.T.E.

1

System Components

The HELIOS LED Processing Platform was designed to support high density display products for use in pro A/V, broadcast, and production applications. The HELIOS Processor is compatible with video sources that have up to 8K resolution (i.e media servers, production network switchers, and broadcast cameras). The HELIOS system will automatically integrate system components as they are connected or replaced.

The HELIOS system consists of a Processor unit and one or more network switches. The HELIOS Processor is designed to be located near the video source. The HELIOS Processor ingests the source video and converts it into a fiber signal. The HELIOS Processor is also responsible for serving the web based user interface (web UI) that is the user interface of the system. The network switches carry both the video signal and the communication signals to and from from panels. As such, there is information passing in both directions on the HELIOS fiber links that can be up to 10km in length.

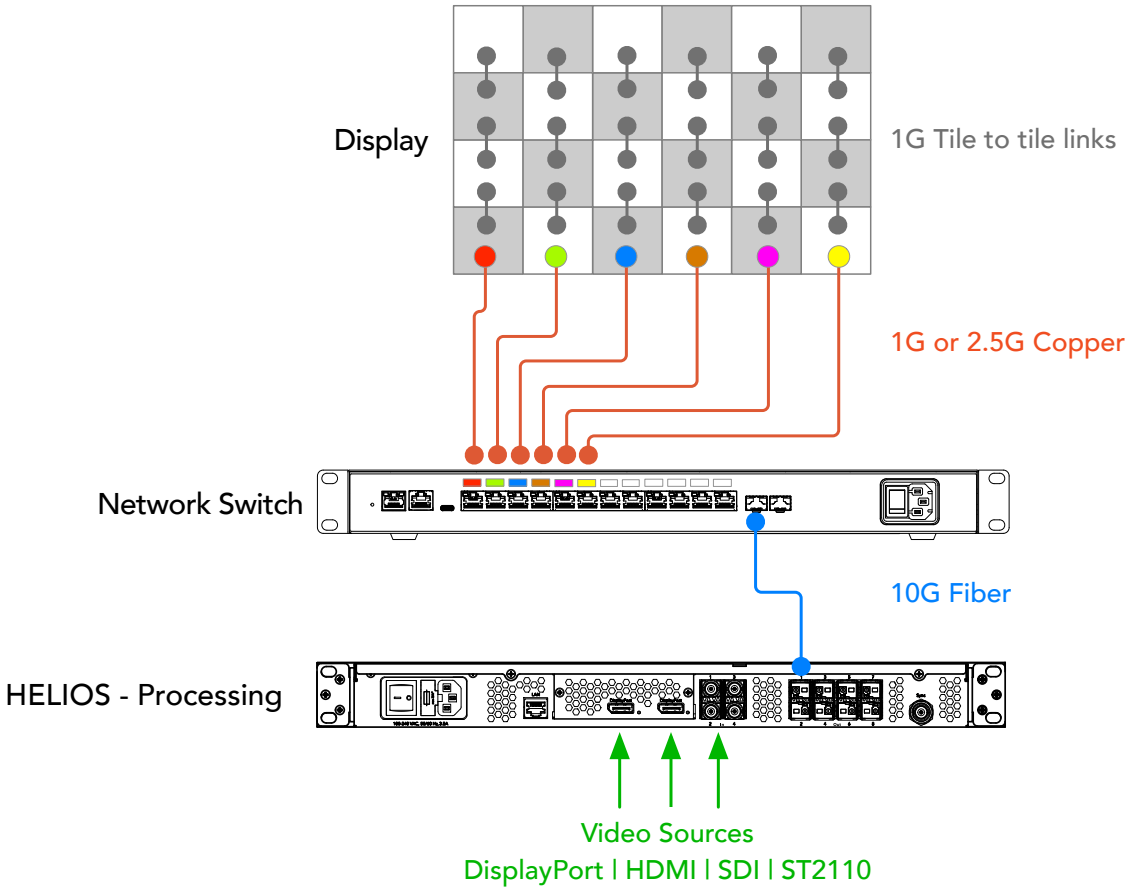


Figure 1: HELIOS system diagram.

Processor Overview

The HELIOS Processor is a one RU (1.75") tall rack mount unit that can receive video in resolutions up to 8K and outputs that video as a proprietary stream to compatible video panels (Figure 2).

The HELIOS Processor is capable of receiving HDMI, DisplayPort, SDI and ST2110 signals. The HDMI and DisplayPort inputs are designed to be modular. Alternate combinations of DisplayPort and HDMI inputs are supported (e.g. two DisplayPort, or two HDMI). Contact your Megapixel VR representative for more details. SDI inputs are provided by four Megapixel VR SFP+ units which can receive quad 12G SDI. In order to receive ST2110, the SDI SFPs are replaced with ones that support the ST2110 protocol. The default 8K processor configuration consists of (1) x HDMI, (1) x DisplayPort and (4) x SDI.

The system is configured remotely via a web UI running Chrome or Safari browsers. The input image can be scaled up or down to suit LED panel configurations and also has all the common controls for brightness, gamma, color temperature, etc.

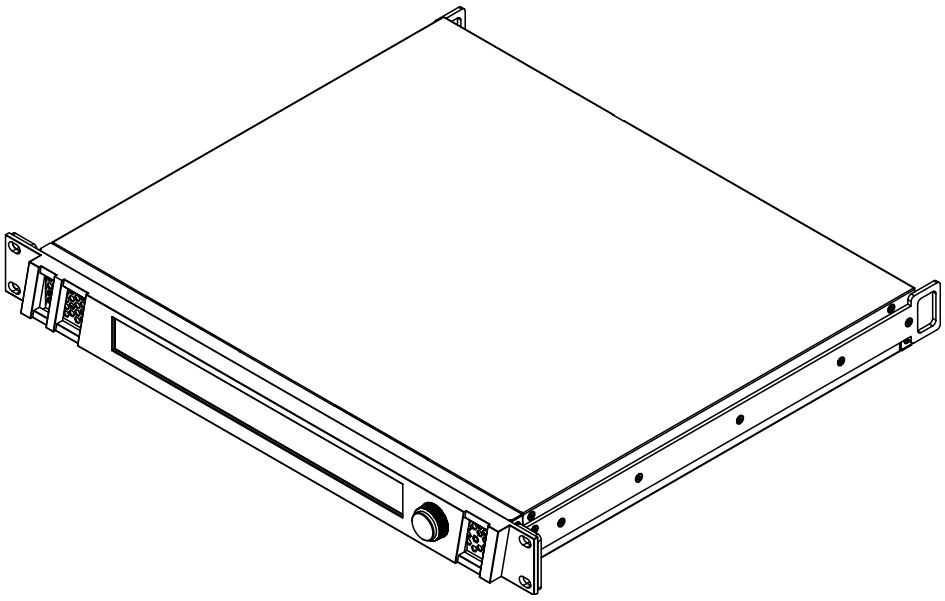


Figure 2: HELIOS Processor.

Processor Front Panel

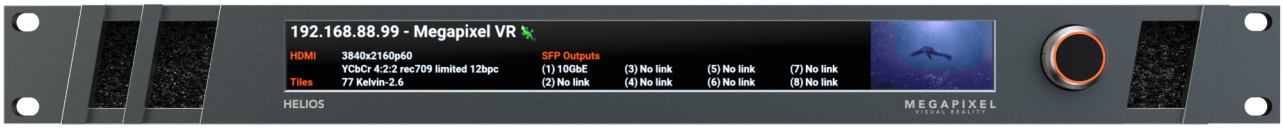


Figure 3: HELIOS Processor front.

Configuration Interface - on the front of the HELIOS Processor is an LCD display and a turn/push knob interface.

Air Inlets - slots to the left and right of the LCD display are filtered vents for chassis airflow.

Processor Rear Panel

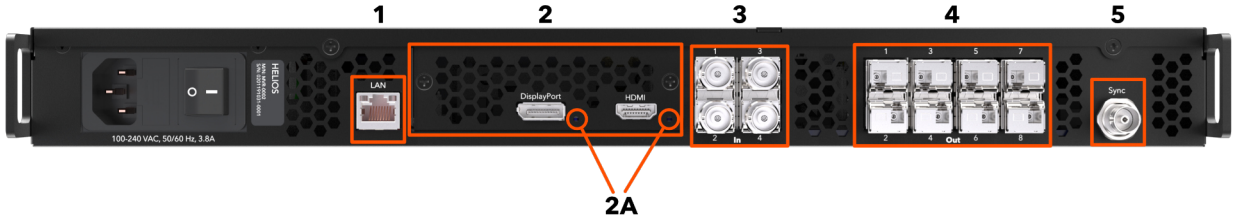


Figure 4: HELIOS Processor rear.

1 - Control Port - On the left side is an Ethernet port. This port should be used to place the processor on the system control LAN. A laptop may directly connect, or in larger systems a wireless router connects here.

2 - VFMC Video Inputs - The video inputs are modular. At the center of the unit is a removable plate that houses removable VFMC input boards. The HELIOS system supports HDMI and DisplayPort cards in these slots. HELIOS units can be configured with dual HDMI or dual DisplayPort cards.

2A - VFMC Video Input Indicators - Next to each video input connector is a small LED that indicates the status of each VFMC input link.

Indicator Color	Meaning
White	System boot
Black	No link (no cable)
Yellow	Valid link, no video
Blue	Valid link, valid video
Red	Error detected in the last 1.25 sec
Green / Cyan / Magenta	Training cycle

3 - SFP+ Inputs - Four (4) SFP+ slots provide copper SDI inputs. Each input requires a ***Megapixel 12G SFP+*** and supports formats up to 12G SDI. See the **Input Capability Matrix** in Appendix G for details. Indicators on each SFP+ slot show link status.

Indicator Color	Meaning
Green	Receiving a carrier signal
Blue	Valid frame detected

4 - SFP+ Outputs - HELIOS Standard units support up to eight ***Megapixel 10G fiber SFP+*** outputs for data transmission to the display. Likewise, HELIOS Junior units support up to eight ***Megapixel 1G copper SFP*** outputs. Indicators on each SFP+ slot show link status.

Indicator Color	Meaning
Green	Link to switch
Blue	Connected to tiles

5 - External Sync - The BNC connector to the right of the fiber outputs allows the HELIOS Processor to receive genlock timing signals. An external sync is required when using multiple processors for data redundancy.

Network Switch Overview

The HELIOS system leverages network switches for data distribution to the tiles. The network switch connects to the HELIOS processor via 10Gb fiber SFP+ uplink and has twelve 1 / 2.5Gb copper Ethernet ports that serve as outputs to the display. Systems may have up to eight switches per HELIOS and are typically co-located with the display. All user controllable functions of the network switch are accessed via the HELIOS web UI.

MSM4214X Network Switch

OOB and Console ports - These ports are never connected in a HELIOS system.

Display Outputs - 1Gb/2.5Gb copper Ethernet ports, transmit video and control data to and from connected panels.

Input from HELIOS - 10Gb fiber SFP+ input, receives display data from HELIOS processor.

Port 14 - Unlike the legacy switch (GSM4210P) the MSM4214X switch does not support copper SFPs. This port is not intended for use.

Power Inlet - IEC C14 A/C power connector. The network switch will boot as soon as power is supplied.

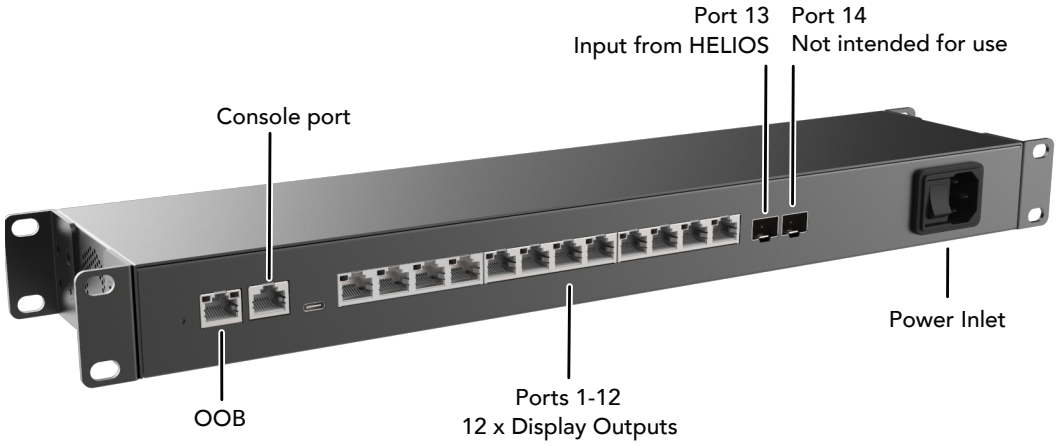


Figure 5: Network switch MSM4214X.

NOTE: Do not factory reset switches. A factory reset switch requires an RMA to Megapixel in order to restore to functionality.

Network Switch Overview (continued)

GSM4210P Network Switch

OOB and Console ports - These ports are never connected in a HELIOS system.

Display Outputs - 1Gb/2.5Gb copper Ethernet ports, transmit video and control data to and from connected panels.

Input from HELIOS - 10Gb fiber SFP+ input, receives display data from HELIOS processor.

Power Inlet - IEC C14 A/C power connector. The network switch will boot as soon as power is supplied.

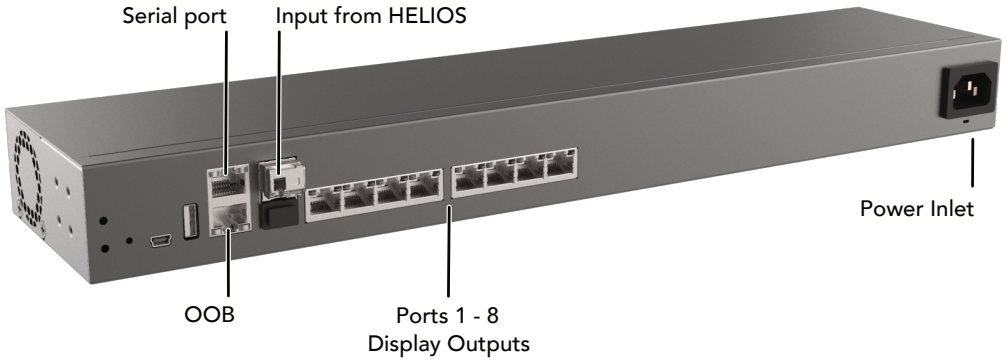


Figure 8: Legacy switch GSM4210P.

NOTE: Do not factory reset switches. A factory reset switch requires an RMA to Megapixel in order to restore to functionality.

Display Tiles

Display Tiles are light emissive video panels containing receiver cards. They operate at the end of the video signal chain. Display tiles come in many shapes and sizes from a variety of vendors. Below are some common characteristics.

Input - Copper Ethernet input receives display data from a network switch or from another tile ahead of it in the chain.

Output - Copper Ethernet outputs send video and control data to the tiles downstream.

Power - Power must be supplied to each tile. Power connectors differ for each tile type.

Status Indicators - On the rear of each display tile is a multi color indicator button, the exact location varies by tile type. The table below details the buttons functions and the meaning of each indicator color.

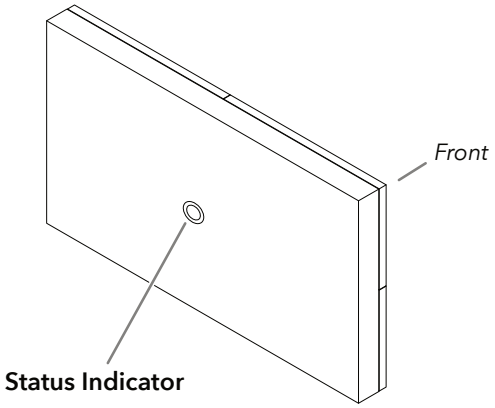


Figure 7: Status Indicator

Indicator Color	Meaning
White	Booting
Cyan	Booted into safe mode
Green	Ready (No network connection)
Blue Single Flash	No HELIOS connection (1 tile link active)
Blue Double Flash	No HELIOS connection (2 tile links active)
Blue Solid	Connected to HELIOS (Normal operation)
Yellow	Internal Pattern (press and hold center button 4 seconds to enter and leave this mode). Press and release to advance to the next pattern.
Red	Flash once every 10 sec to indicate a system error.

2

System Planning

Overview

This chapter covers the activities and considerations that need to be made prior to ordering equipment. If assistance is needed with any of the items below, Megapixel VR is available to assist. Please contact a sales associate.

Ensure compatibility of the display product being considered with the HELIOS system. The HELIOS system can be used with a continuously expanding list of products. Please see the HELIOS software release notes available on the Megapixel VR website for current product compatibility **https://megapixelvr.com/support/helios**.

Video Input

Pixel dimensions - The number of pixels in the final display is a major factor in selecting a video input type. If at all possible it is best to first settle on a quantity of pixels that need to be driven before selecting an input format.

Input formats - Select an input format that can support the required pixels. HELIOS accepts four (4) input formats:

- HDMI
- DisplayPort
- SDI
- ST2110

A detailed **Input Capability Matrix** can be found in Appendix G.

Custom Input Bandwidth Calculations

HDMI, DisplayPort and ST2110 can support custom input resolutions and frame rates, it is important to confirm that the intended resolution/frame rate fits within the bandwidth limits. The bandwidth formula below should be used as a ballpark calculation. It does not include the full-size pixel width/height with blanking for DisplayPort and HDMI. ST2110 does not need additional blanking, but it does need an additional five (5) percent bandwidth to account for protocol overhead.

Input	Bandwidth
HDMI	14.4G
DisplayPort	22.6G
ST2110	10G

Bandwidth = Total Width × Total Height × Frame Rate × Bits/Color × Pixel Format

For the **Pixel Format value use **2** for 4:2:2 and **3** for RGB or 4:4:4.*

As an example, the largest standard aspect ratio DisplayPort signal HELIOS supports is 5K (***5120***×***2880***) @***60*** Hz ***8***bit. This example signal is an RGB signal, multiply by ***3*** for the pixel format value.

(5120 × 2880) × 60 × 8 × 3 = 21,233,664,000 (21.2G)

NOTE: Extreme cases of very tall and narrow displays may not work due to overhead timing constraints of blanking time.

Creating a Raster Map

It is a good idea to create a raster map drawing to document which region of the video signal serves each display tile. The example below contains two separate displays (blue tiles). In this case, the pixel dimensions of both displays will fit on a 6K raster. The larger 8K and DCI 8K rasters are shown for reference.

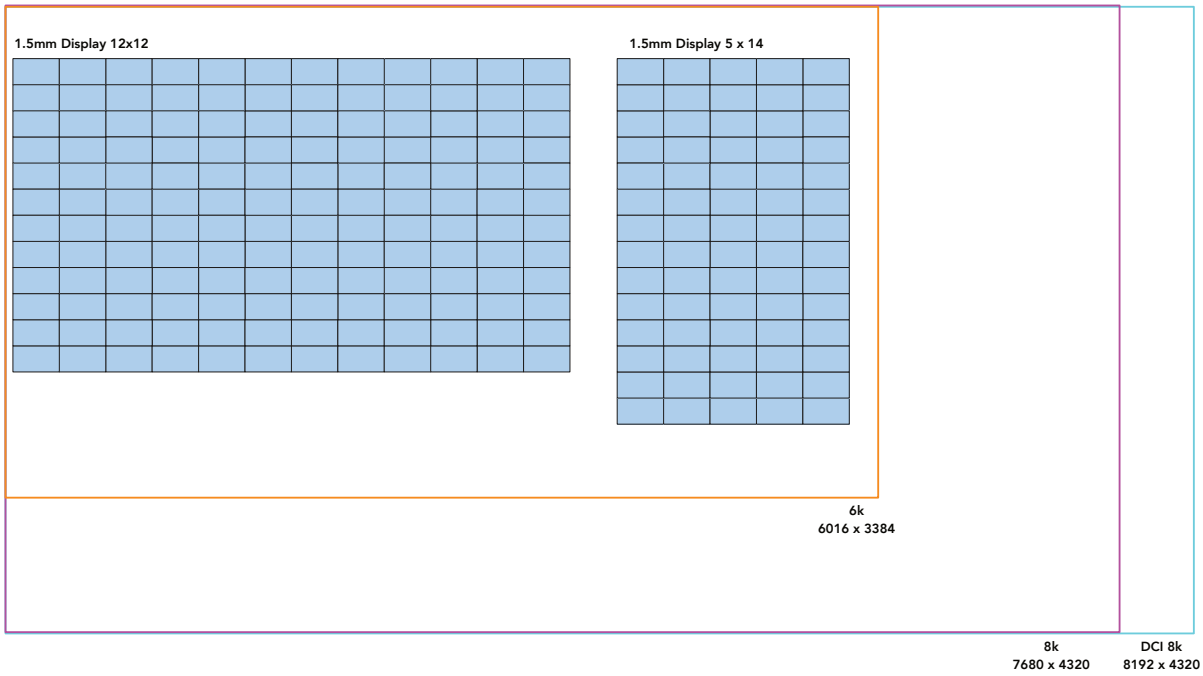


Figure 10: Example raster map

Sometimes, the 'as built' shape of the system does not fit any horizontal or vertical rasters, but the total number of pixels can. This is the case with a long ribbon display. Rasters can be rearranged, (within certain limitations) on the front end if necessary. In the end, the picture to be transmitted to a display needs to fit inside of the pixel dimensions of one of the three supported input signals (HDMI, DisplayPort, or SDI). For long strip style displays this means that the incoming picture needs to be divided into segments, these are labeled with capital letters in the example below (A, B, C, etc.). Content can be created in segments or the segmentation can be accomplished with media processing equipment prior to the HELIOS Processor. The example below shows a dual HDMI input configuration (see the following section on dual input cards).

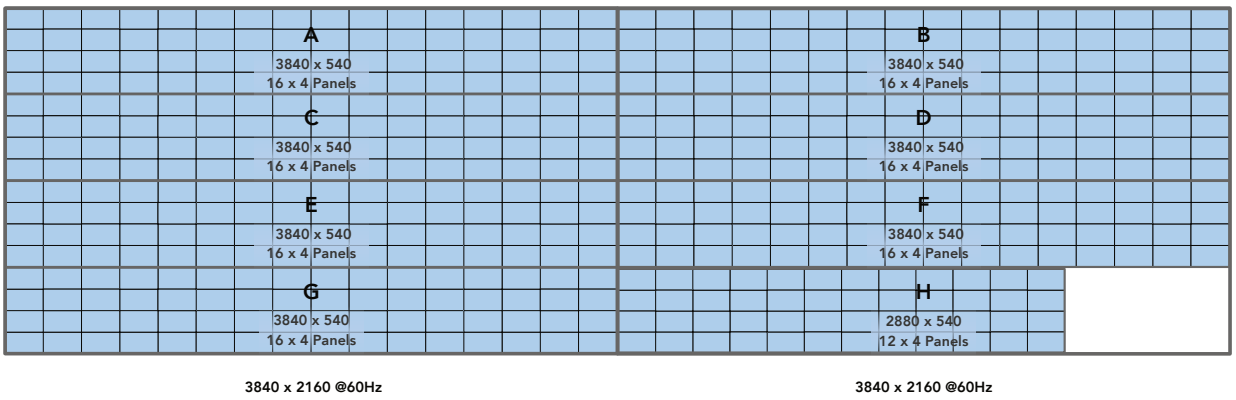


Figure 11: Long ribbon display map example

Dual Input Cards

If the total number of pixels will not fit any single input raster, the system can be fed video from multiple input cards. A HELIOS Processor with the necessary hardware (dual DisplayPort or dual HDMI cards) can receive dual video signals of the same type of signal. When HELIOS is outfitted with two of the same card type (DisplayPort or HDMI) it will stitch the two rasters together into one continuous output to tiles. Please see the **Input** section in Chapter 5 for more information on configuring this mode.

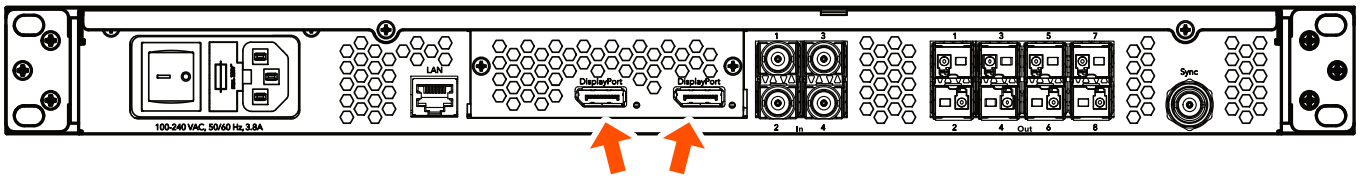


Figure 12: Dual DisplayPort Input Card Configuration

Data Distribution

At this point it can be helpful to draw out the data topology (figure 10). Decide if the display will be cabled vertically or horizontally. Calculate the number of network switches it will take to distribute data to the display. In the system example below we use a tile with the pixel dimensions 480 x 270 (tiles are 129,600 pixels). From the **Output Port Capacity** table in Appendix G we see that a 1Gbps switch port running a color bit depth of 12 at 30Hz can support up to 850,000 pixels (850,000 / 129,600 = 6.5). If bit depth and frequency requirements change, the system bandwidth must be recalculated. This tells us we can safely put 6 of these tiles on a 1Gb link.

HELIOS Processor - Output Port Capacity (Pixels)

Bit Depth	10	10	10	12	12	12
Device	Switch Port	Switch Port	HELIOS Fiber	Switch Port	Switch Port	HELIOS Fiber
Ethernet Speed (Gbps)	1	2.5	10	1	2.5	10
Video FPS						
24	1,275,000	3,187,500	12,750,000	1,062,500	2,656,250	10,625,000
25	1,225,000	3,062,500	12,250,000	1,020,000	2,550,000	10,200,000
30	1,020,000	2,550,000	10,200,000	850,000	2,125,000	8,500,000
48	635,000	1,587,500	6,350,000	531,000	1,328,125	5,312,500
50	610,000	1,525,000	6,100,000	510,000	1,275,000	5,100,000
60	510,000	1,275,000	5,100,000	425,000	1,062,000	4,250,000
120	240,000	600,000	2,400,000	200,000	500,000	2,000,000
144	195,000	487,500	1,950,000	160,000	400,000	1,600,000
240	100,000	250,000	1,000,000	90,000	225,000	900,000

Figure 13: Output capacity table

Check to make sure the entire data load on each network switch is within the limits of 10Gb fiber. In this case, we are using a color bit depth of 12 at 30Hz. So, the 10Gb link can support 8,500,000 pixels / 129,000 = 65.58 tiles per 10Gb link. With only 24 tiles in the example system we know we are well within the limits. Always aim to distribute data evenly, spread the load across switches and switch ports as evenly as possible.

Cable infrastructure - Check that the types of cables chosen are appropriate for the display type and for the location. This is the point at which site specific considerations need to be made.

Important items to check:

- Where will the video source device reside?
- Is the HELIOS Processor close enough to the video source device to be within the specification of the video protocol being used. Confirm the distances needed with the protocol ***and*** cable type. Even if a protocol supports long distances cable quality plays a major factor in the signal quality.
- Is there power for the HELIOS Processor at the location?
- Has power for the network switches been allotted?
- What is the distance from the HELIOS Processor to the network switches at the display? Is this under the 10km specification of the single-mode fiber?
- What is the distance from the network switch to the first panel in the display that each drives? Is this under the 100 meter limit of the copper Ethernet signal?

3

Connections

Overview

The HELIOS system consists of the HELIOS Processor, the network switches, and the fiber link between them. The HELIOS Processor is designed to be the receiver unit that the primary video signal connects to. We recommend installing the HELIOS Processor near source equipment. The network switches are intended to be placed next to the LED display panels. The system is always aware of the components that are connected to it and where the components are connected.

System Latency

The task of receiving a video signal, processing it for tiles and sending it through the network to the tiles takes the HELIOS system one (1) frame. Tile latency will vary between tile types. However, tiles typically need one (1) frame to read the HELIOS data and another one (1) frame to send the data to LED driver chips. The complete HELIOS system, from HELIOS input to eyeball typically requires three (3) frames regardless of the input frame rate. When comparing the latency of one system vs another, it is important to note the contributions each component makes to the overall system latency. Often, manufacturers only state the latency contribution of their processor and/or receiver card, but do not account for the contribution of all components in the signal chain. HELIOS Ultra Low Latency (ULL) allows for as low as one (1) frame of delay through the entire system chain. (See the **Latency (advanced)** section for more information.)

The total delay time from input to eyeball can be reduced even further by running the system at high frame rate. At 60Hz, 3 frames = 50 milliseconds, at 120Hz, 3 frames = 25 milliseconds. However, using a 120Hz input source will cut the maximum quantity of pixels in half (e.g., 4,250,000 pixels per 10Gb HELIOS port to 2,125,000 pixels).

Constructing high frame rate systems can be a challenge. When planning such a system, consider that the entire image pipeline from media server to aligned camera shutters must be in sync.

Processor Connections

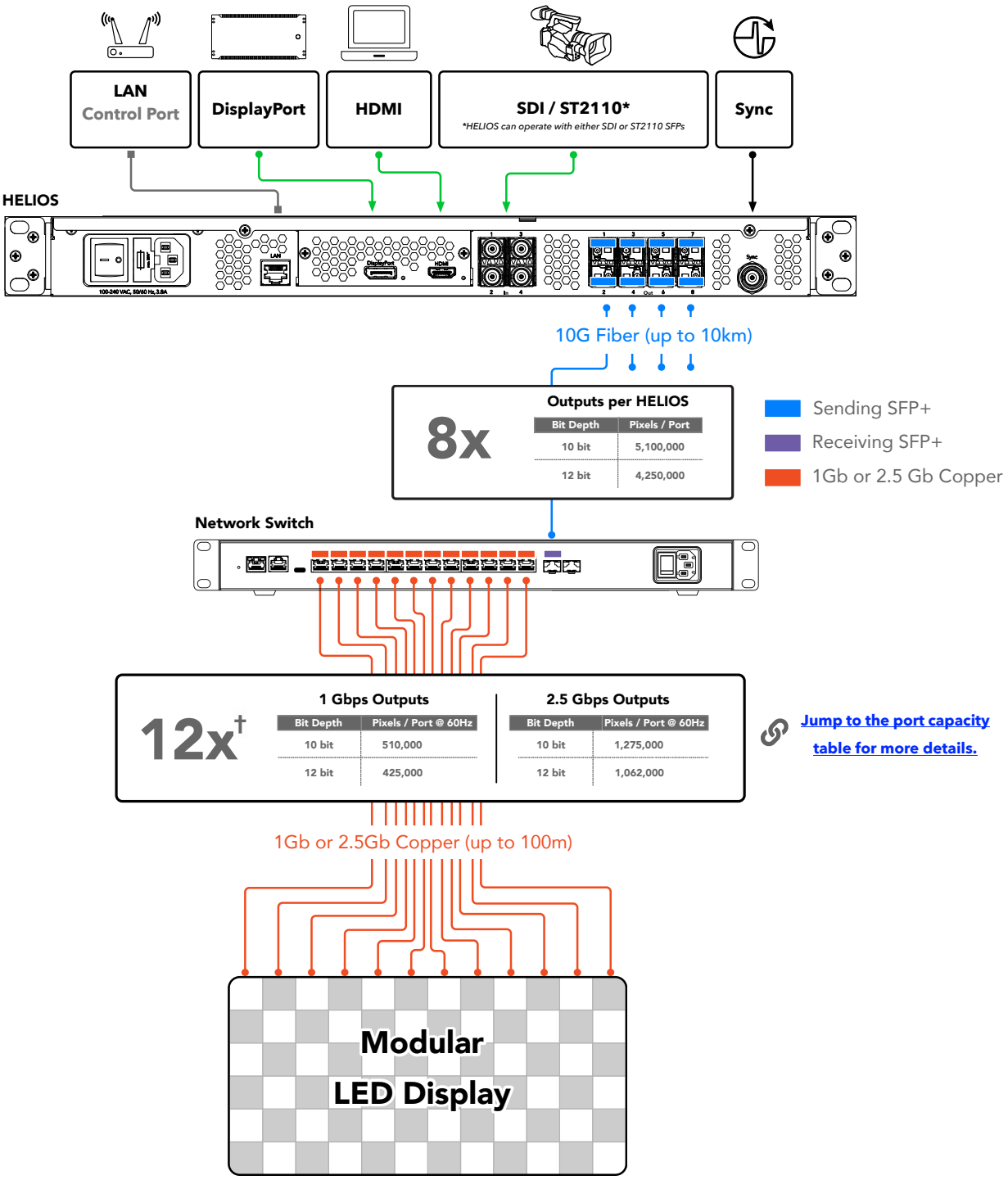
Power - A/C power is supplied to HELIOS Processor's built-in redundant power supplies on a C14 style IEC connector. Next to the power input connector is a rocker switch. When power is turned ON, the system will begin to boot. After about 15 seconds the front LCD display will be lit. When the boot logo disappears, the HELIOS Processor is ready for use. The HELIOS Processor should be powered OFF via the rocker switch on the rear of the unit.

User Interface - The HELIOS system can be used with a wide variety of LED display products. It is necessary to configure the system to the products in use. The mapping of the HELIOS system is accomplished with a web user interface. The web UI runs on any remote host capable of running a modern web browser such as Chrome or Safari. In order to communicate with the HELIOS system, the web UI host must be configured to be on the same LAN as the HELIOS Processor (see Chapter 4, Networking).

Input Signals - The HELIOS Processor accepts HDMI, DisplayPort, SDI, and ST2110 signals for input. See the **Technical Specifications** in Appendix G for the full list of all the compatible formats and resolutions. Interlaced signals are not supported. When synchronization is needed such as with redundant systems, the HELIOS Processor is provided with a genlock signal.

Output Signal to Displays - The output ports of the HELIOS Processor broadcast HELIOS video and control data over LC-LC, 9/125 Single mode (SMF) OS1 (<=1000m) or OS2 fiber to network switches, which in turn send the data on to the display devices via copper cables.

Processor Connections (continued)



† The maximum number of possible outputs is limited by the 10Gb maximum throughput per switch.

Figure 14: System diagram.

NOTE: For convenience or compatibility with wireless-only devices such as tablets, a wireless router can be attached to the HELIOS LAN control port.

4

Networking

Overview

In order to provide access to control the HELIOS system, a LAN port is provided on the rear of the unit. This port provides access to the web UI. Once the client device (tech laptop) is on the same network as the HELIOS, open a web browser and enter the IP address displayed on the front LCD of the HELIOS Processor. In large systems, it is good practice to confirm that the device name at the top of the page matches the intended HELIOS unit.

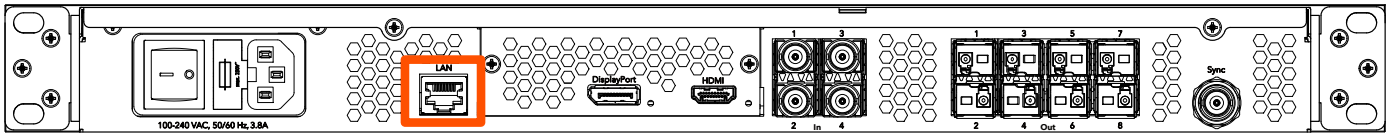


Figure 15: LAN Port.

IP Addressing

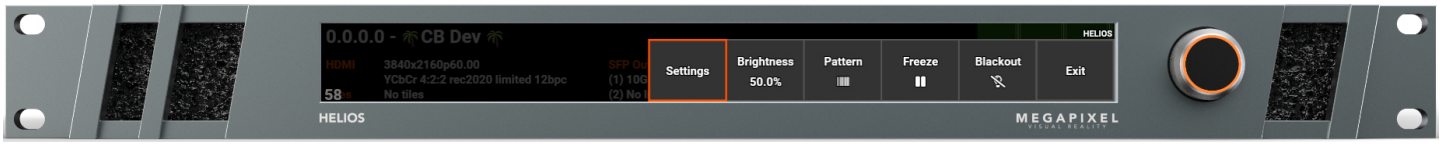
The IP address of the HELIOS Processor is reported on the front screen of the HELIOS Processor. Regardless of what the final network settings for the HELIOS system will be, the web UI client must initially be configured to the network that the HELIOS Processor is on so that the web UI is accessible. Each device and operating system has slightly different ways to make these settings, please refer to the instructions of the particular device being used.

A HELIOS Processor that has been factory reset will be set to DHCP/Auto IP by default. This is the mode that should be used when operating the HELIOS Processor with a wireless router attached to the control port. If the HELIOS Processor has discovered a DHCP server, the HELIOS Processor will likely have a 192.168.XX.YY address. If it has not been served an IP address by DHCP, the HELIOS Processor will default to an automatic private address (169.254.XX.YY). If DHCP/Auto IP is the chosen mode, the web UI host device must also be set to DHCP in order to join the same network.

The HELIOS Processor can be configured to a fixed IP as well. If this is the desired mode, ensure both the IP and the subnet mask for the web UI host have been set to the correct range.

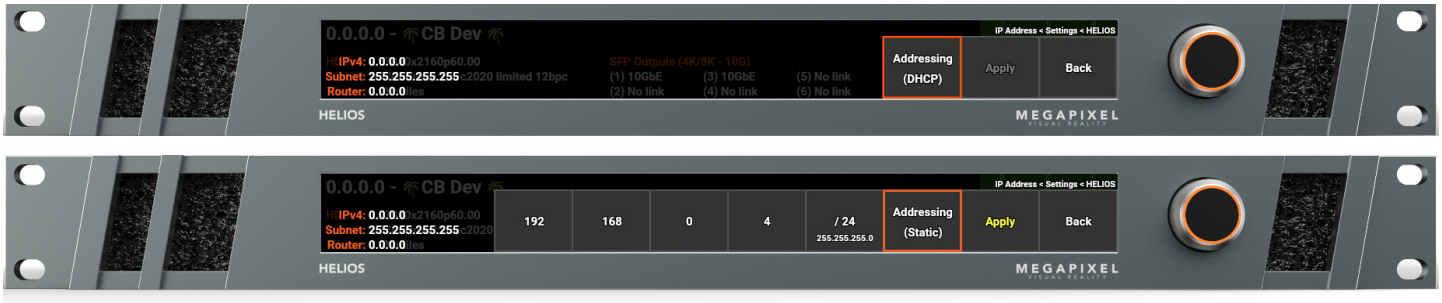
The IP address of the HELIOS can be set using the front panel interface.

1. Press the encoder on the front of the HELIOS unit, then turn the encoder to select ***Settings.***



2. Select IP Address.

3. Choose between DHCP or Static IP, depending on the network that the HELIOS needs to join.



4. Once the settings have been made press ***Apply.***

The IP address of the HELIOS can also be set using the web UI interface under ***Settings > Processors Settings > Networking***.

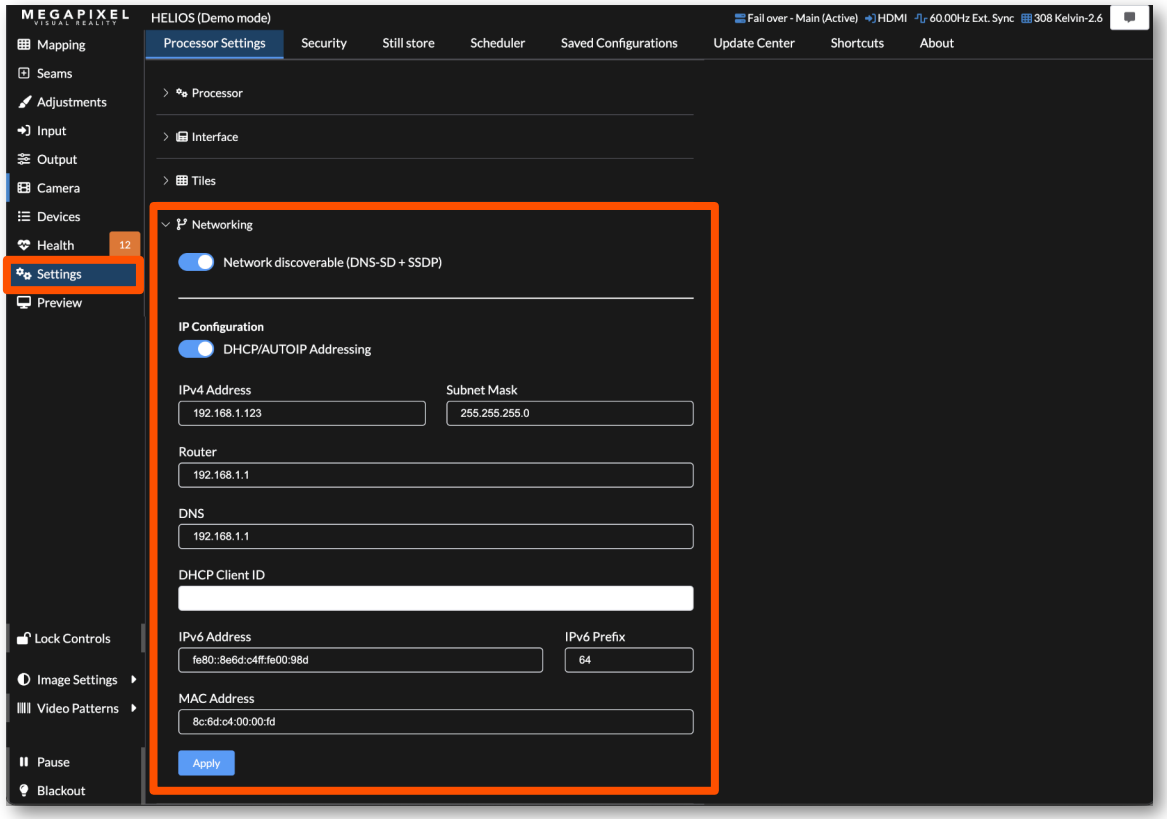


Figure 17: Web UI network settings.

NOTE: With DHCP enabled, it is possible to set the ***DHCP Client ID.*** If a MAC address is used, ensure that it is formatted with colons. Otherwise HELIOS will not advertise it as a MAC address.

5

Configuration

Overview

Prior to beginning to configure the system, a majority of the components of the system should be physically connected. The HELIOS Processor should be connected to at least one network switch and the switch should have panels connected.

The HELIOS Processor has two user interfaces; a front panel rotary encoder / push button interface with LCD display, and a web UI.

Front Panel UI

The front panel interface is targeted towards getting remote web UI access to HELIOS. When the encoder is rotated (not pressed) the HELIOS will cycle through four (4) data display pages. The fourth page (shown below) will display a QR code for the IP address of the unit. The front menu also has a few other basic controls for settings and operation of the display. To configure the IP address settings, press the encoder, highlight the ***Settings*** menu option, and press the encoder to select.

Figure 16: Front panel UI.

Web UI

The web UI contains all of the other controls that are needed for setting up a display system. The web UI configures the HELIOS Processor for the various supported video panels and provides controls to the input and output signal parameters such as selection of source, position and color.

In the previous chapter on Networking this guide discusses the necessary settings to both the HELIOS Processor and the device that is to be used as the web UI host. Having configured these settings correctly is a prerequisite. The web UI will not be accessible if this has not been done. The HELIOS web UI runs remotely on any device capable of supporting Chrome or Safari web browsers. Shown below is the mapping pane of the HELIOS web UI.

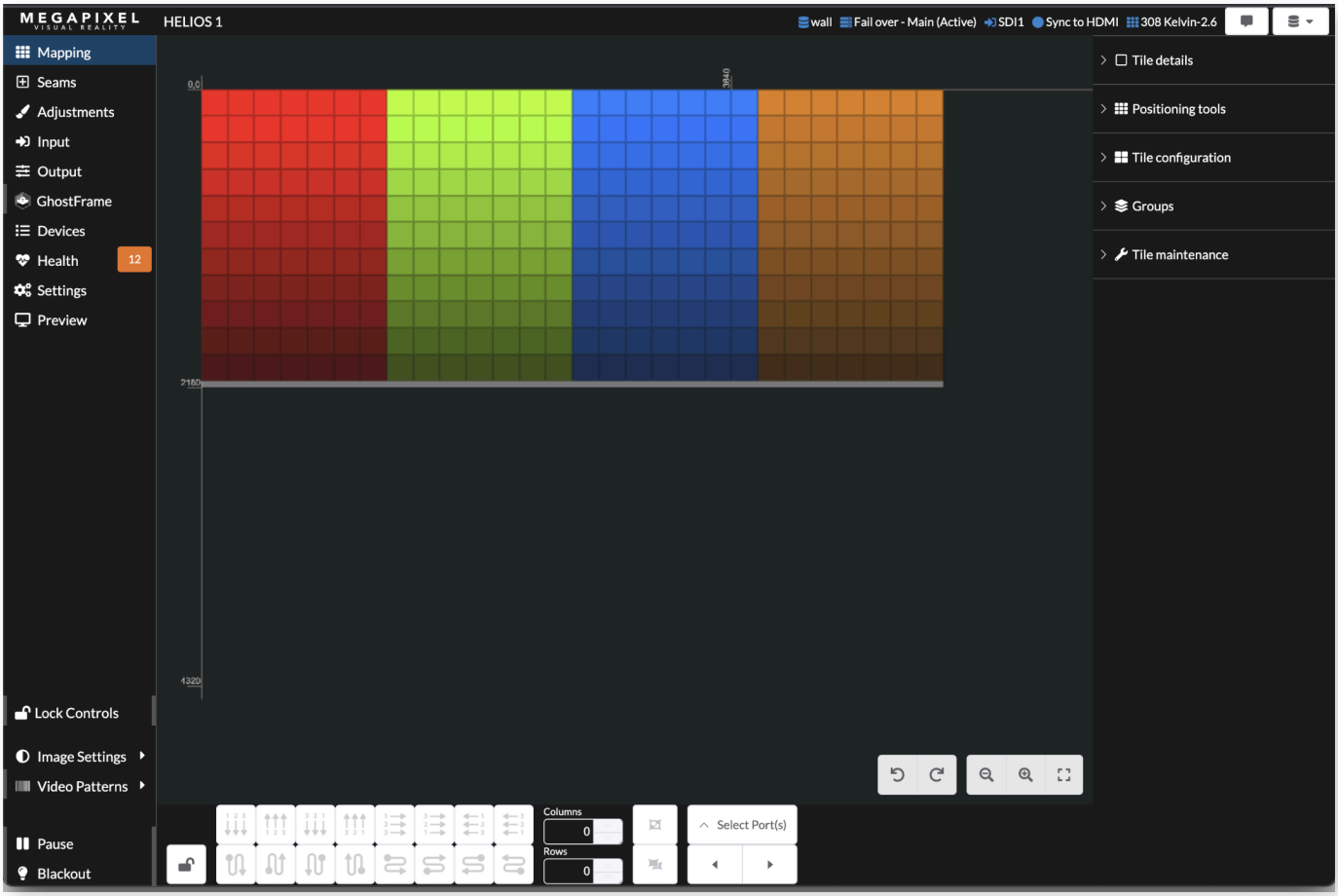


Figure 18: HELIOS web UI.

Processor Name

At the top left is the name of the processor. This can be changed in the **Processor Settings** pane.

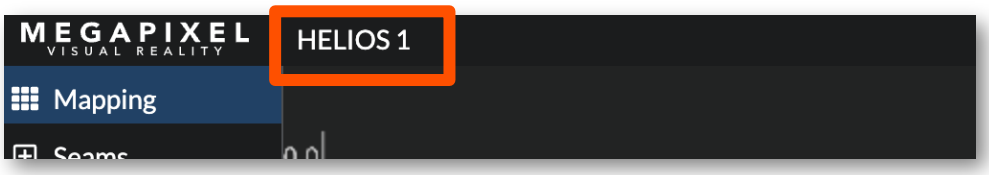


Figure 19: Processor name and Navigation bar.

System Status Indicators

At the top right are the essential system status indicators for important system states such as redundancy, input signal, sync signal, and connected panels. Blue indicates good system health. Yellow is an alert, and red is a warning of a critical error. Look to ***Devices*** → ***Display Devices*** tab to discover more details about connected devices.

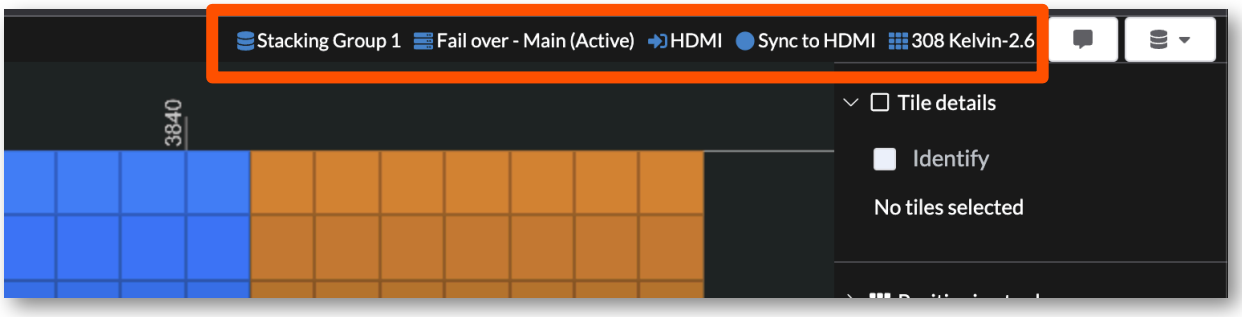


Figure 20: System status indicators.

Feedback

At the top right of the interface is a button to provide us with feedback. 

Use the ***Send(remote)*** to submit the form. An active internet connection is required for the client device that is accessing the HELIOS interface (the laptop or tablet the user is on). If no internet connection is available use the ***Save(local)*** option to store the feedback on the tech laptop.

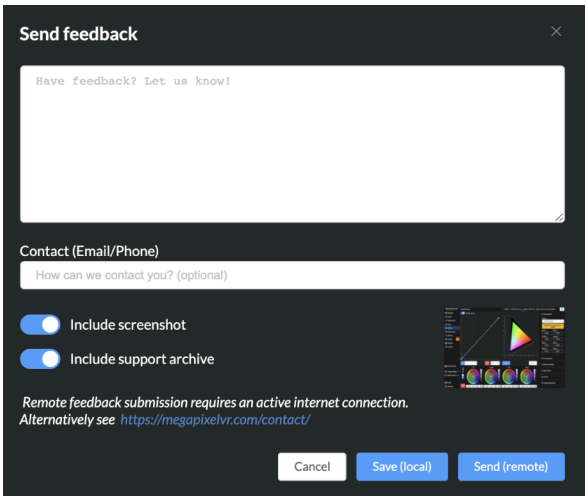


Figure 21: Feedback form.

Processor Stacks

When ***Stacking*** is enabled in ***Settings*** → ***Processor Settings*** → ***Stacking***, a ***Stacks*** button [ ] appears next to the ***Feedback*** button at the top right of the UI. The ***Stacks*** button opens a window that displays all available processors and the stack each belongs to. This feature helps identify the system status of processor stacks and gives confidence that backup units are available. Select the IP address to the right of the processor name to open the web UI page of a processor. Visit the section on **Stacking** settings and **Appendix F** on Redundancy to read more about how this feature is used.

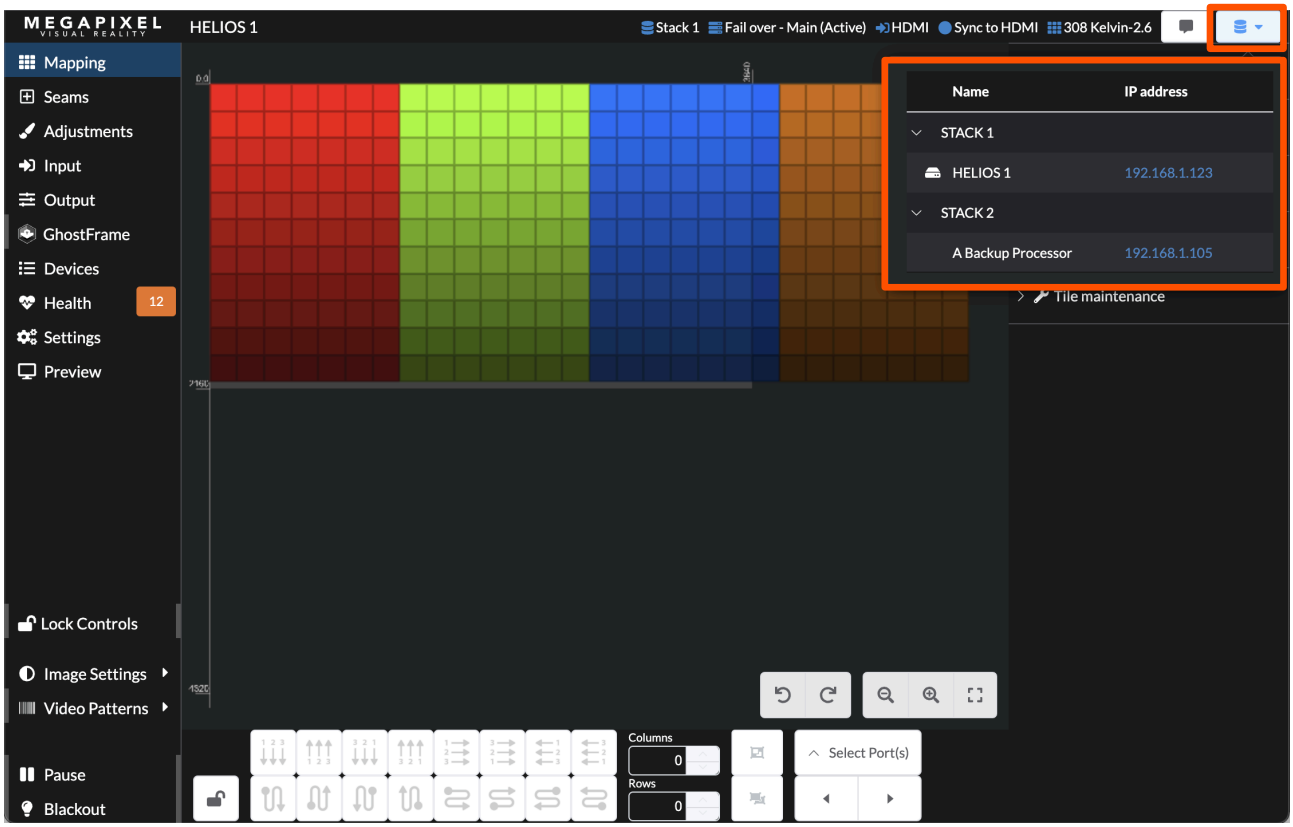


Figure 22: Processor Stacks.

Global Controls

1. ***Lock Controls*** - Enable this to prevent accidentally triggering any of the controls below it.

2. ***Image settings*** - contains the ***Brightness, Gamma,*** and ***Color temperature*** controls (pictured above). These types of sliders can be found throughout the web UI. Once they have been selected with a mouse click, sliders such as these can be controlled with a mouse wheel .

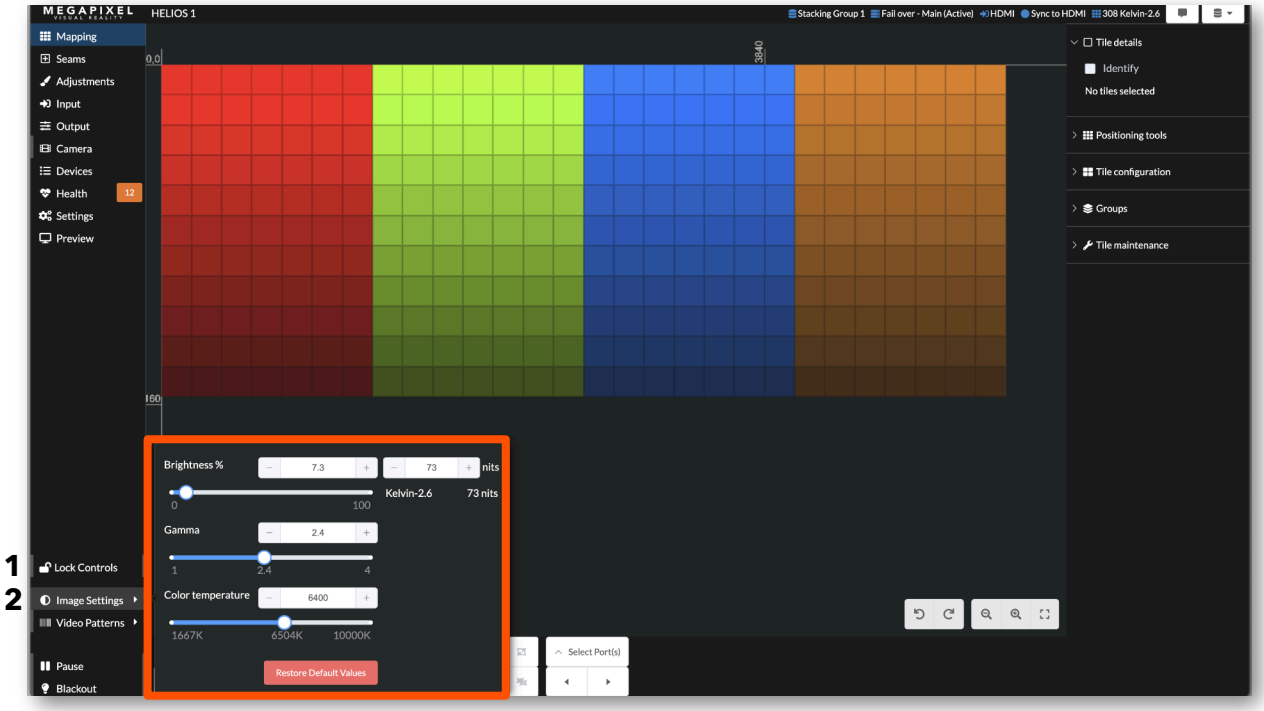


Figure 23: Global controls.

NOTE: By default, systems with multiple display device types limit the maximum luminance. This behavior can be overridden, see the **Limit to lowest tile max** section for more details.

Global Controls (continued)

3. ***Video Pattern Selection*** - Video patterns over-ride video inputs. A drop down menu provides a selection of HELIOS generated patterns.

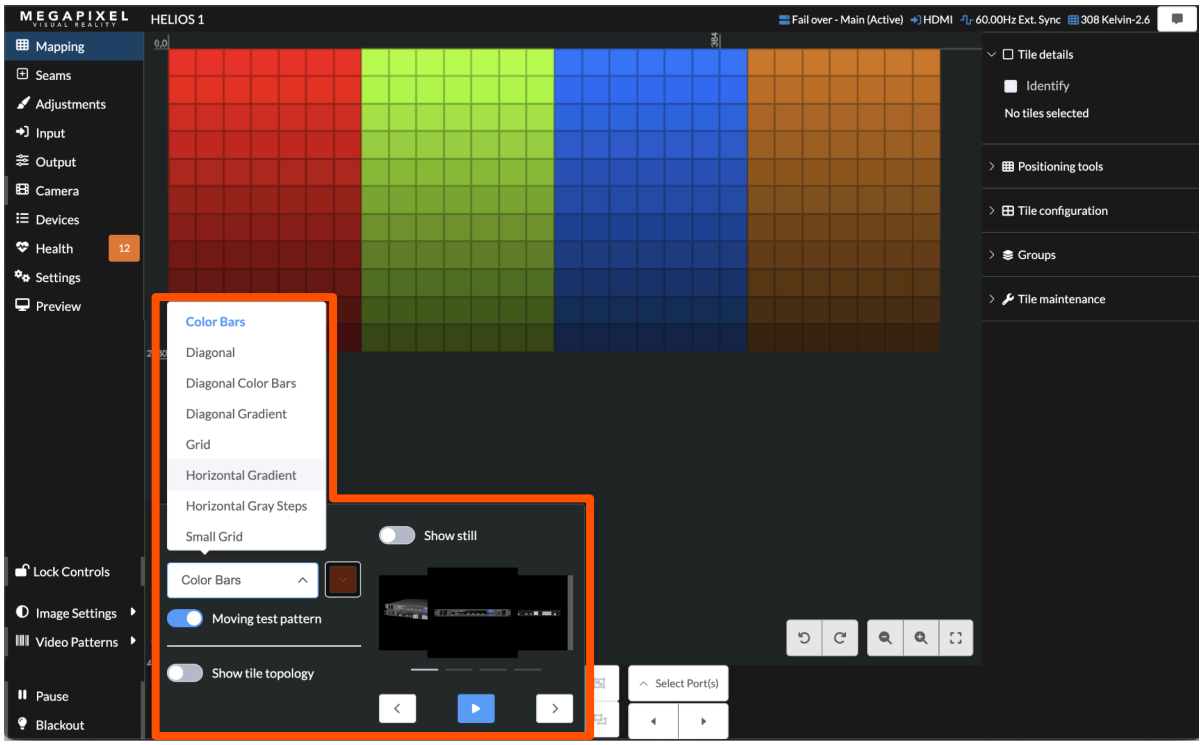


Figure 24: Video pattern selection.

Custom color patterns - Some patterns can be custom colored. When custom color is available for the selected pattern, select the color box to the right of the pattern selection drop down menu to open up a color picker.

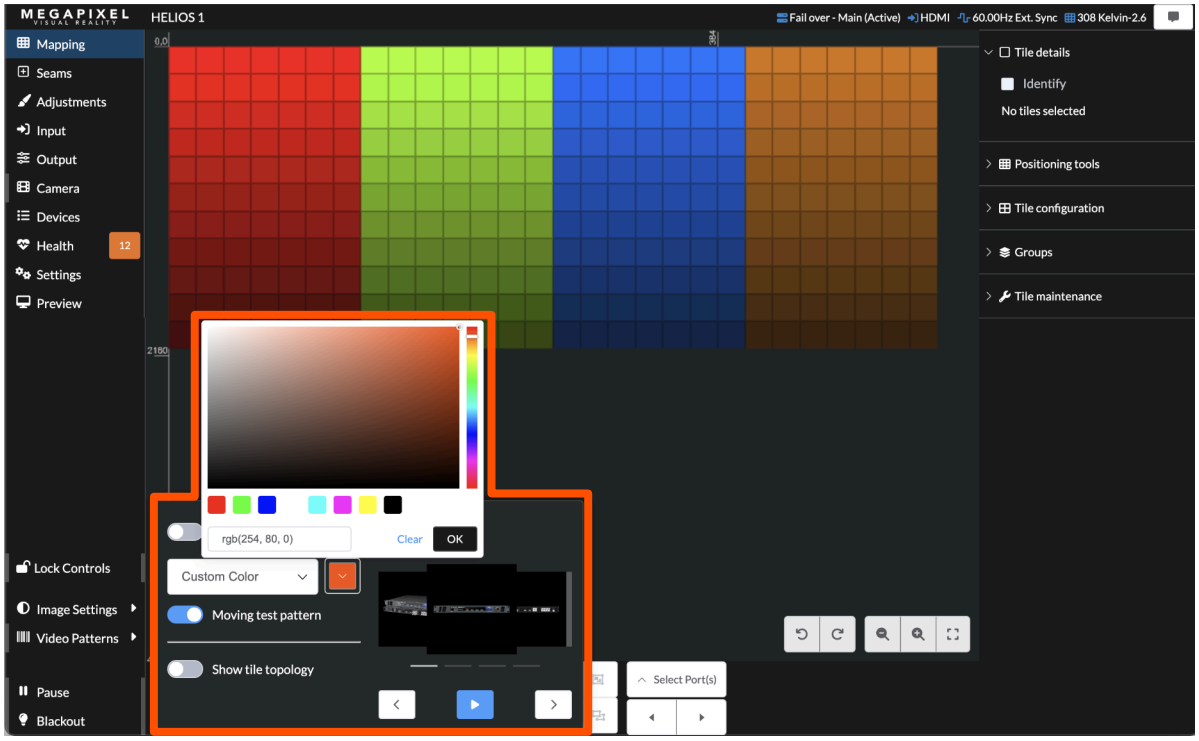


Figure 25: Video pattern color picker.

Global Controls (continued)

Still images - Show stills that have been stored on the HELIOS. Select an image from the carousel and press the playback triangle to display the selected image. See the ***Processor Settings > Still store*** pane to store and manage images.

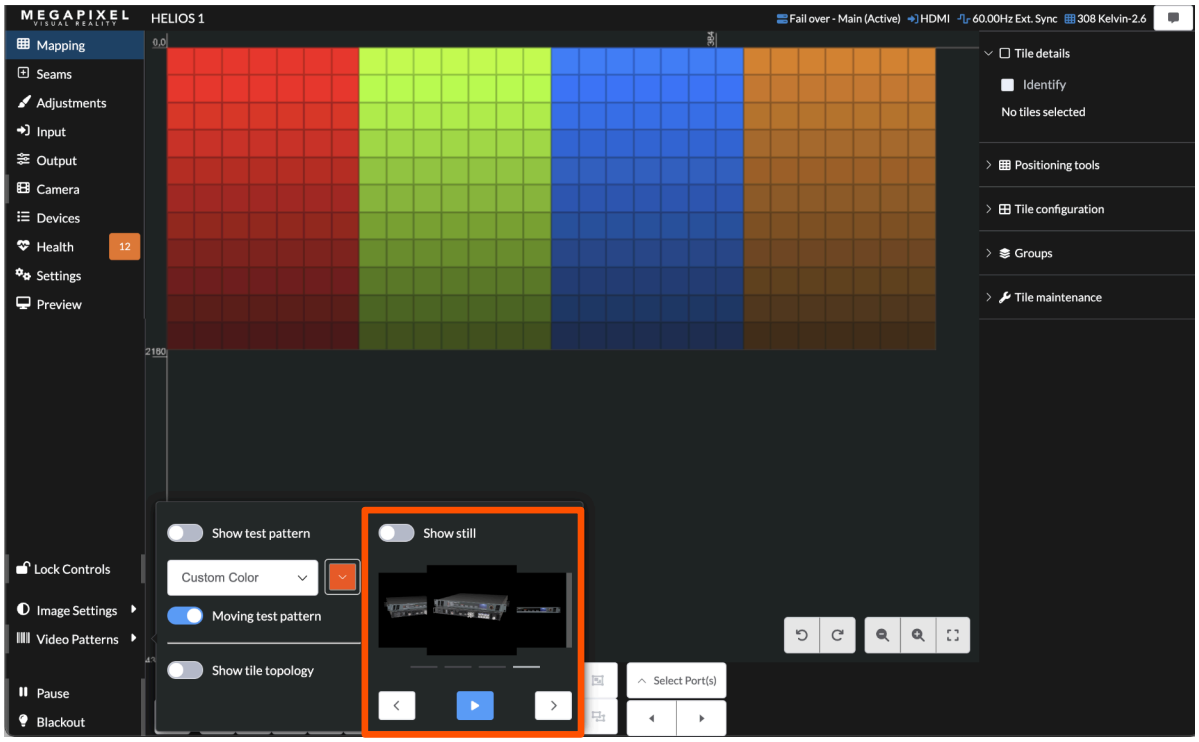


Figure 26: Show stills.

Global Controls (continued)

The bottom two options are controls for pausing or blacking out the output.

Pause - will continuously display a still image of the last input frame at the time pause was pressed. This feature is convenient to use when the input signal must be interrupted, and the live display can show a still image such as a logo. To use this feature, display the desired image and press the pause button. The input signal can now be interrupted and the HELIOS Processor will continue to display the still frame grab. When it comes time to resume, display the same image again with the connected playback device and toggle pause off to resume live playback.

Blackout - is a black generator that ensures all LEDs are completely off. This feature is ideal to use for situations when panels need to be placed on stand-by with power use at a minimum. HELIOS compatible tiles all have a low power mode that enables after five (5) minutes of blackout. When low power mode is enabled a green leaf shows up next to ***Blackout***.

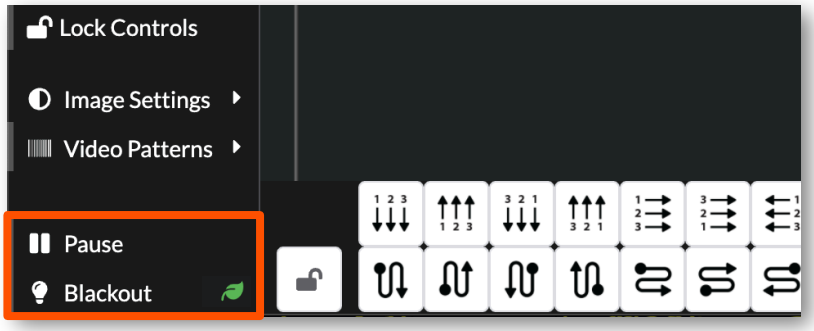


Figure 27: Pause and Blackout.

Canvas Lock

When changes on the mapping pane and the and inputs pane are complete it is good practice to lock the panes to prevent any unintentional changes. The lock mechanism locks and unlocks the canvas functionality simultaneously on both the mapping pane and the inputs pane.

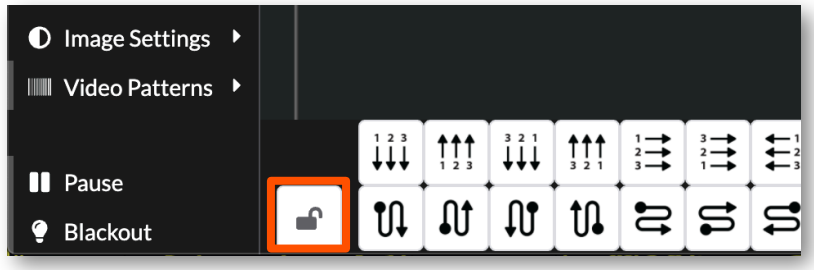


Figure 28: Canvas Lock.

Keyboard Shortcuts Menu

Always available with the press of '?' on the keyboard, the shortcuts menu provides a list of functions that have been assigned to key combinations. This pane is also available on the ***Settings*** pane → ***Shortcuts*** tab.

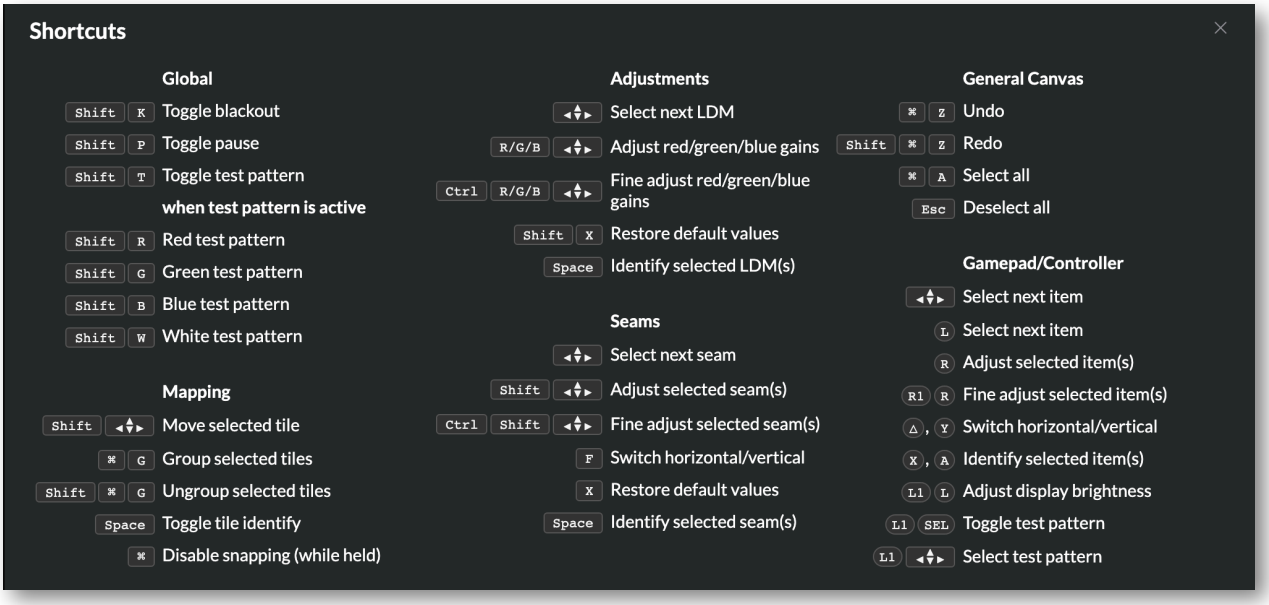


Figure 29: Keyboard Shortcuts

Advanced Mode

Throughout this user guide several features are marked as ***Advanced***. This means that the feature is hidden by default and can be accessed by enabling ***Advanced Mode***. When ***Advanced Mode*** is enabled, HELIOS reveals numerous hidden features that have not been selected for general release. The Advanced Mode toggle can be found under ***Settings*** → ***Processor Settings*** → ***Advanced***.

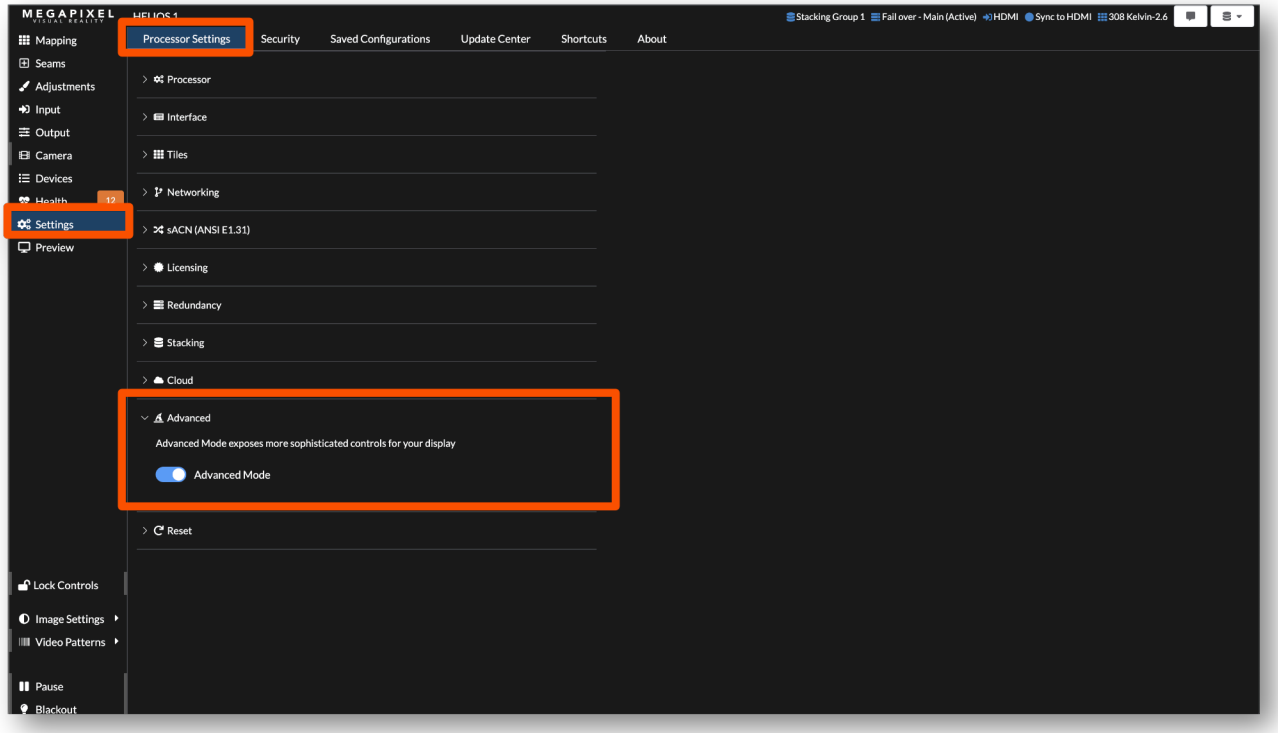


Figure 30: Advanced Mode toggle

Creating Maps

The HELIOS Processor uses a map to determine which segments of the incoming raster to consider as an 'active pixel region'. Areas of the incoming raster that are not associated with display fixtures, are never transmitted to the system. If only two fixtures are mapped, only two fixtures worth of panel data is transmitted.

If tiles have been discovered they will be placed on the map. By default, when panels are discovered, they are all collected in the top left (0,0) position. HELIOS does not support offline mapping. Only automatically discovered tiles can be mapped.

The thin light gray line on the outside of the tile region marks the boundaries of an 8192 x 4320 pixel space. It can be used as a guideline for placement, but maps do not need to be constrained to it. On a layer below the colored panel icons is a preview of the selected input (or a grey rectangle if the input is unavailable) that represents the incoming signal's raster area. It will only be visible if the input signal raster is set larger (using the ***Input*** pane) than the space occupied by the tiles. In the example below it is slightly oversized to the panels.

The mapping tools at the bottom of the page are used to move the panels into the positions that they occupy in the physical system. Select a group of panels, define the columns and rows that they should be arranged in, then select the cable order. When the cable order icon button is pressed, the selected panels will be re-ordered. HELIOS can undo and redo maps incase something did not turn out as desired. Panel locations can also be adjusted manually by drag and drop or by typing the desired X and Y coordinates.

Display panels are tinted according to the network switch that the panels are connected to (Red = 1, Green =2, Blue = 3 etc.). In the example below the system has been cabled in columns with seven columns per port. There are four network switches in the system example below.

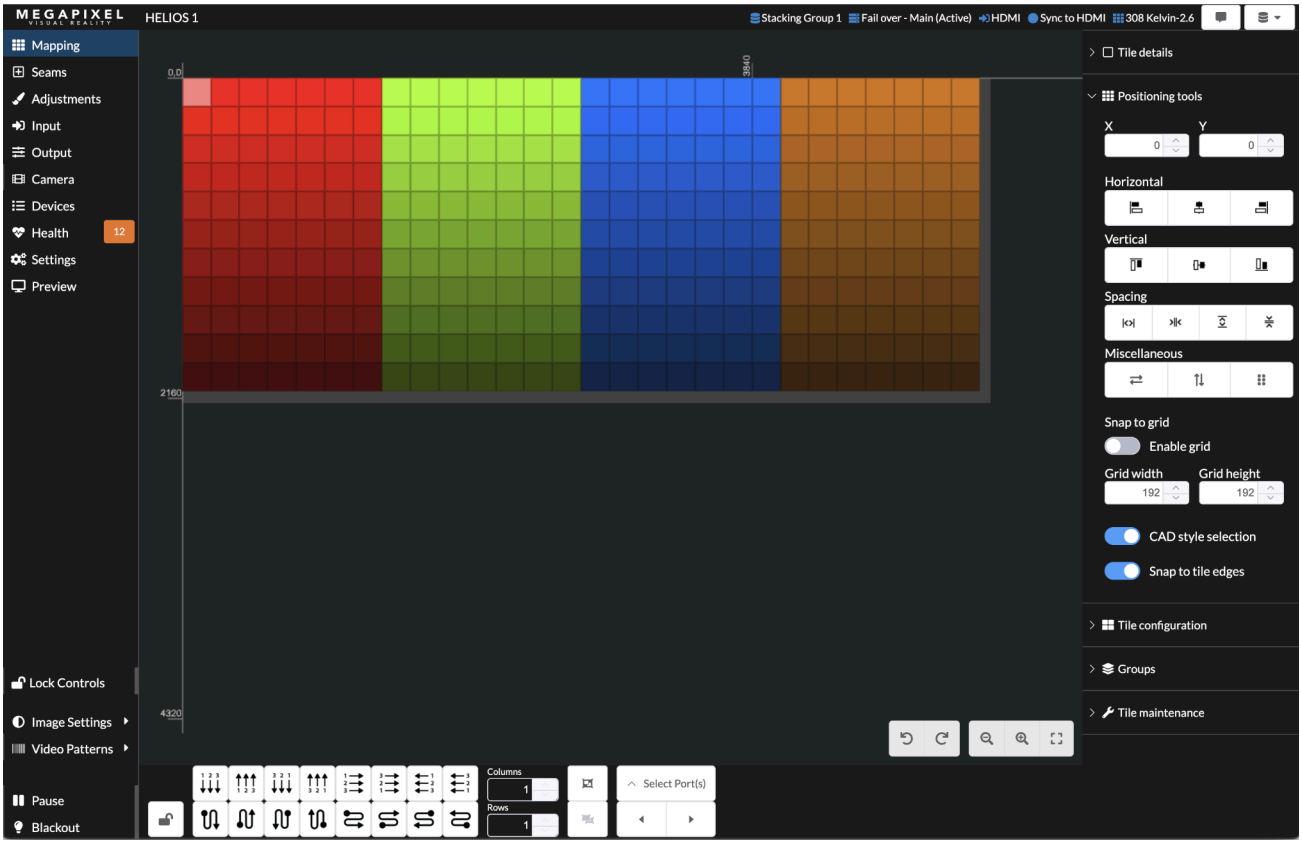


Figure 31: Mapping pane.

Mapping Pane

The right side of the mapping pane has accordion menus with tools to manage tiles. Select at least one tile to see information about it.

Tile details

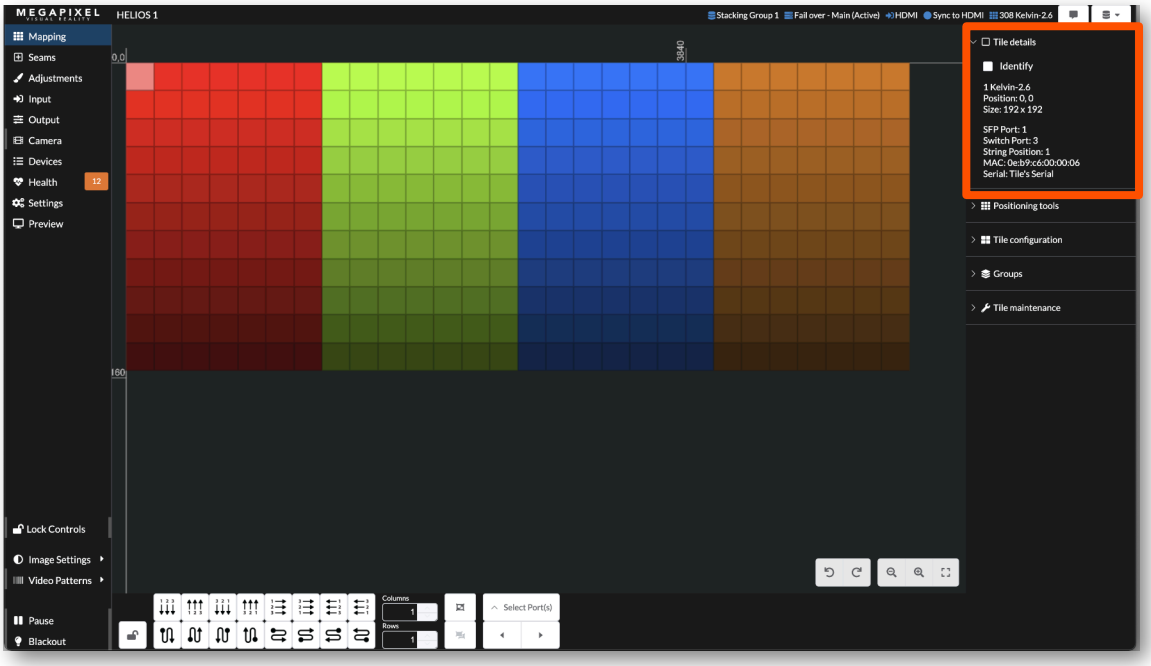


Figure 32: Tile details

Directly below, is an ***Identify*** checkbox. When this is checked ON, selected tiles will be highlighted in the system (blue dot on tile in the user interface). The Identify behavior has two modes (1) ***Rear indicators only*** or (2) ***Front identify & Rear indicator***. On the ***Processor Settings*** tab in the ***Tiles*** accordion, a drop down menu offers these two choices.

The ***Show Indicators*** toggle on the ***Settings → Processor Settings*** pane, enables/disables the rear tile run time indicators (i.e solid blue, red, etc.). The ***Identify*** function operates independently, it will be available even when this setting is disabled.

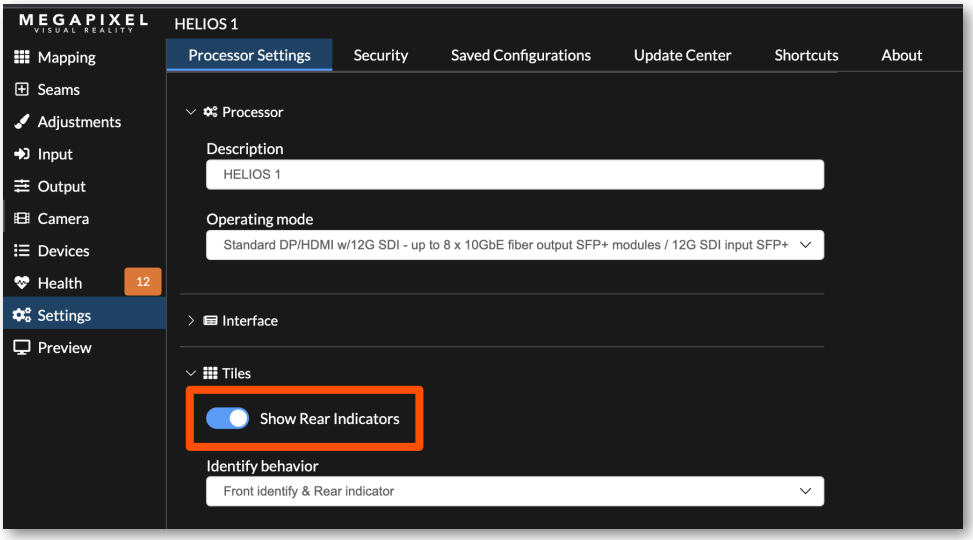


Figure 33: Tile Identify behavior

Positioning Tools

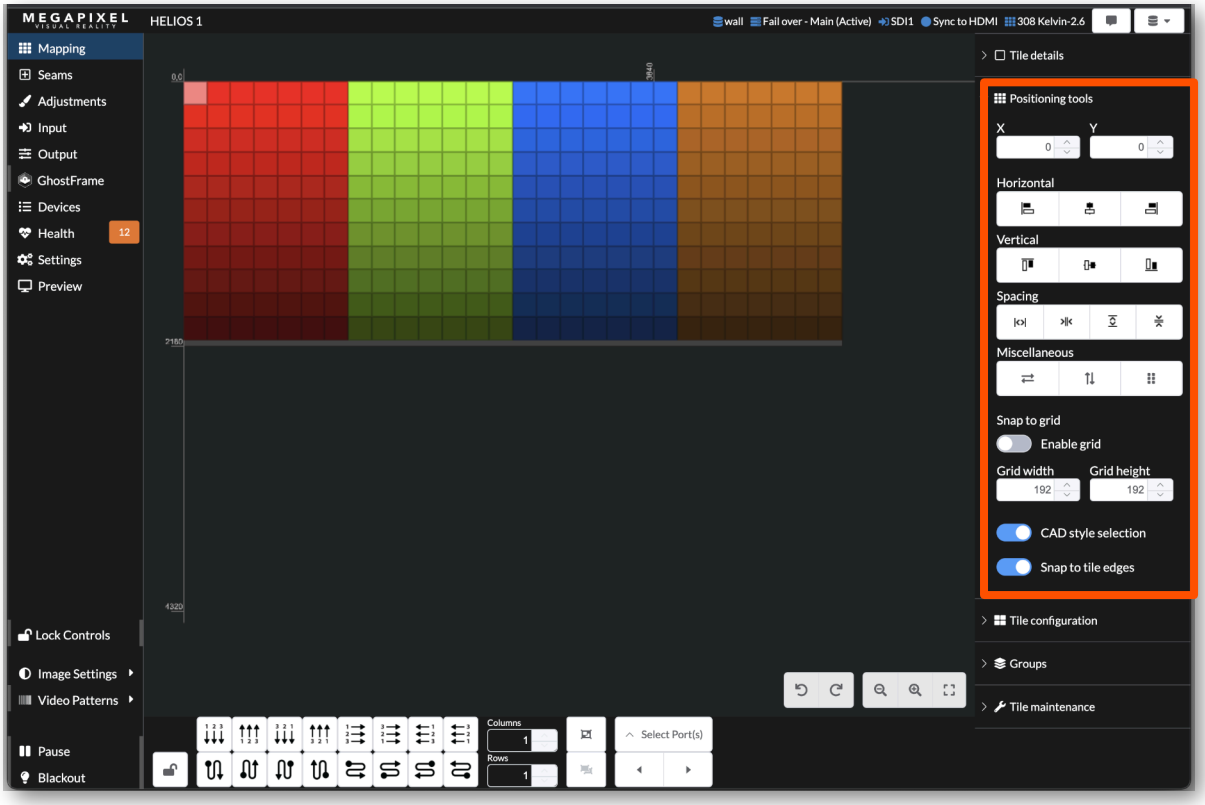


Figure 34: Positioning tools

The mapping tools section contains alignment and spacing tools to aid in manual positioning tiles on the map. A grid with a ***Snap to grid*** function is available. Set the grid to the pixel size of the tiles being mapped to ensure accurate positioning of all tiles.

The ***CAD style selection*** toggle can help make the selection style behave in a more familiar way. When this mode is ON dragging from right to left (⬅) only selects the tiles inside the drag boundary zone. When this mode is OFF the drag right to left (⬅) action selects all tiles that the drag boundary touches. Regardless of how CAD style selection is set, dragging from left to right always (➡) selects everything that is touched by the selection box.

Tile Configuration

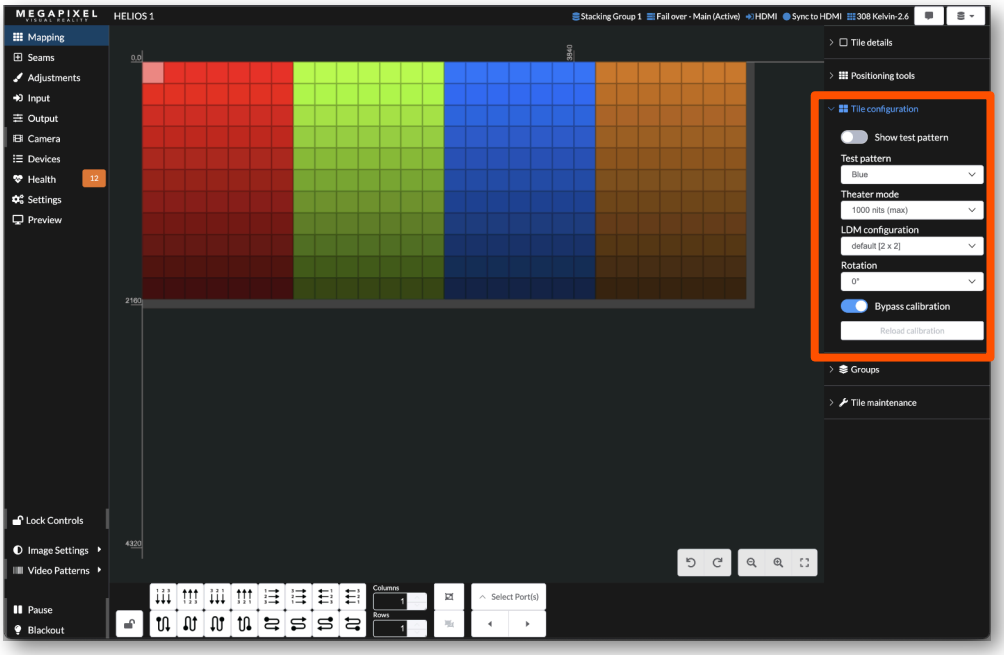


Figure 35: Tile configuration.

Test pattern toggle - Select the tile test pattern desired and then choose to enable it with the toggle. These patterns are tile patterns that each individual tile calls up from on board memory. As such, the list of available patterns can vary based on the tile(s) selected. Tile test patterns are different from the ***Video Patterns*** located above Pause and Blackout that send a video signal from the HELIOS to the entire array of tiles.

Test Patterns:

Pattern Name	Function
Black / Red / Green / Blue / White	Solid color test patterns.
Counters	Total run time along with various diagnostic counters to help with troubleshooting.
Diagonal Lines (moving)	A pattern of moving white lines.
Gradient (moving)	A moving grey gradient.
Grid	A cross hatch of white lines on a black background.
LDM Details	Batch and serial number information for all the LDMs in each tile.
LDMs	ID numbers on each LDM with boundaries of each LDM marked with a cross at each corner.
LED Batch info.	Manufacturing information for the LEDs.
Tile Details	Detailed information for each tile (tile type, firmware version, serial number, PXR number, MAC address, thermal info and fan info. where applicable)
Topology	Connection information regarding each tile. At the top of the test pattern is a numerical code that corresponds to how the tile is connected to the system (HELIOS Port / Switch Port / String position). A blue arrow indicates the direction of the data flow to the next tile.

Tile Configuration (continued)

Theater mode **-** A special low light level calibration configuration. If a tile has been calibrated for special low light situations, the tile will utilize full bit-depth at the selected lower luminance. If a tile does not have this additional calibration file, it will not support theater mode and will default to showing maximum luminance.

LDM arrangement - A single tile type can sometimes have multiple LDM configurations. If the tile type being used supports this, the drop down menu will list them here.

Rotation **-** Rotate the video being displayed on a tile so that the tile can be physically installed at a rotated angle but still display right side up video. Keep in mind that rotated tiles may not look the same as other non rotated tiles. LED panels with vertically stacked diode SMDs are especially affected by rotation changes to their viewing angle.

GhostFrame ***Opt Out*** **-** GhostFrame can be turned on/off on a per panel basis. The drop down menu to the right of the toggle assigns a video stream for the tile to display instead of GhostFrame. This feature is used to isolate GhostFrame to on camera tiles. A wall in front of the camera can be displaying GhostFrame with tiles to the side opted out to showing only the human visible stream.

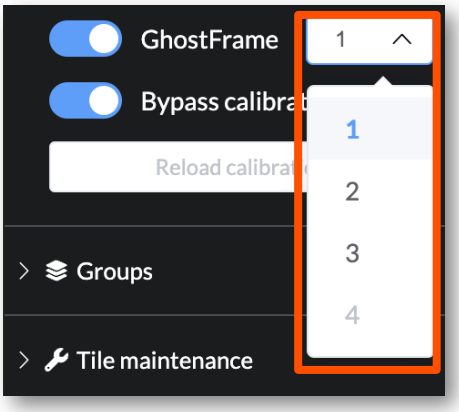


Figure 36: GhostFrame Opt Out

Reload calibration **-** Reload calibration is useful if an LDM has been replaced and calibration data needs to be reloaded.

Bypass calibration (Advanced) **-** This toggle is available as an advanced function for rare cases where tile calibration data is suspect. Turn the toggle on to disable tile's uniformity correction and color space retargeting.

Tile Groups

Tile groups enable the adjustment of sections of tiles separately from others. This type of configuration is common for systems that contain multiple independent displays. Select tiles in the map and (command+G) to create the group, (SHIFT + command + G) to ungroup. Additionally, the center bottom of the ***Mapping*** pane has ***Add to Group*** and ***Remove from group*** icon buttons. When tiles are grouped, the boundary of the tiles will be outlined in white and the name of the group will appear transposed on top of the group. HELIOS lists groups as they are created under the ***Groups*** accordion on the right side of the ***Mapping*** pane, the ***Seams*** pane, and the ***Adjustments*** pane. Double click on a group to edit the position of tiles within the group.

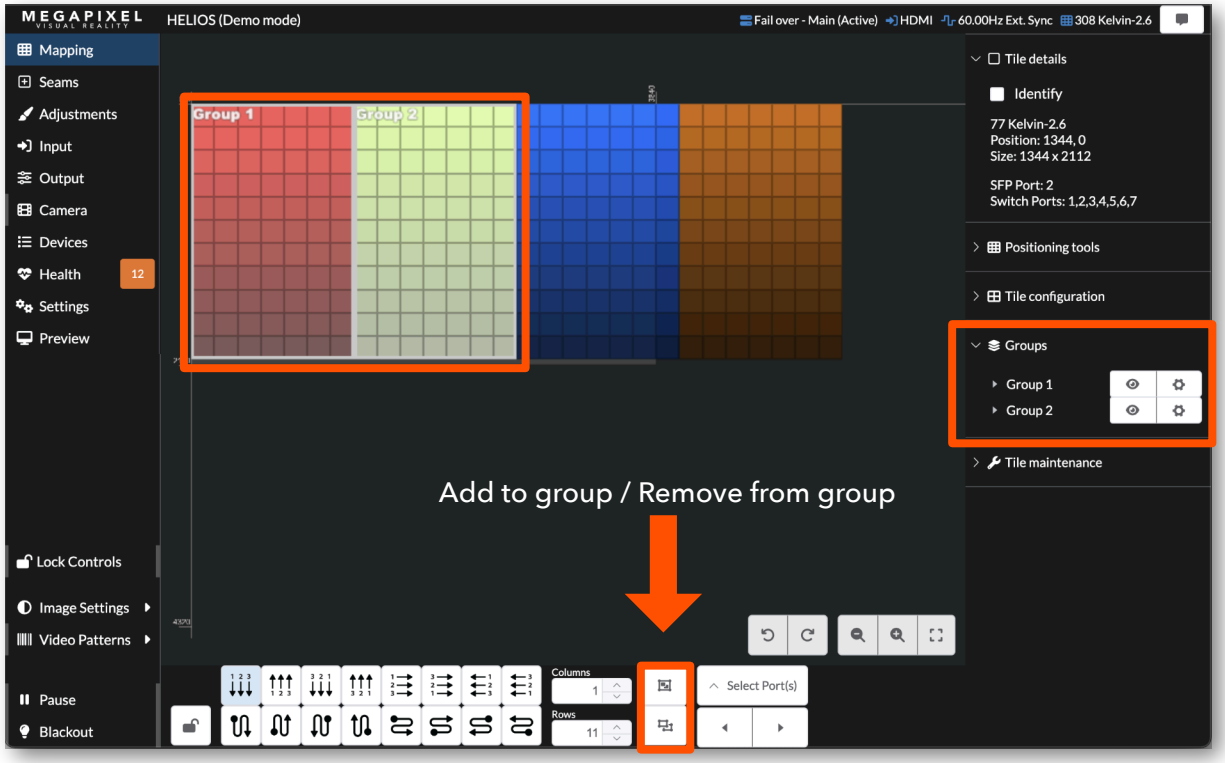


Figure 37: Tile groups.

Tile Group Accordion

The ***Tile Group Accordion*** lists each group and details about the tiles in the group under a disclosure triangle. Groups can be re-ordered by dragging the group name to the desired position within the accordion. Next to the group name is a group ***Visible on canvas*** button and a ***Group settings*** icon button. ***Group settings*** are also available by right clicking on a group on the ***Mapping*** pane.

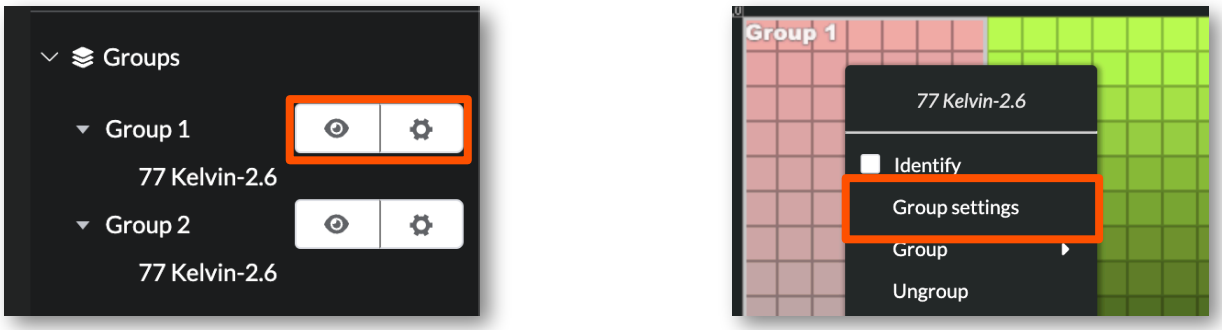


Figure 38: Tile group accordion.

Tile Group Controls

The tile group control window contains the settings for each group. Click on the group settings button (shown on the previous page) to open the tile group control window. Group adjustments on tiles require tile firmware to be updated to version 22.04 or higher. The firmware update enables tiles to respond to the gains controls.

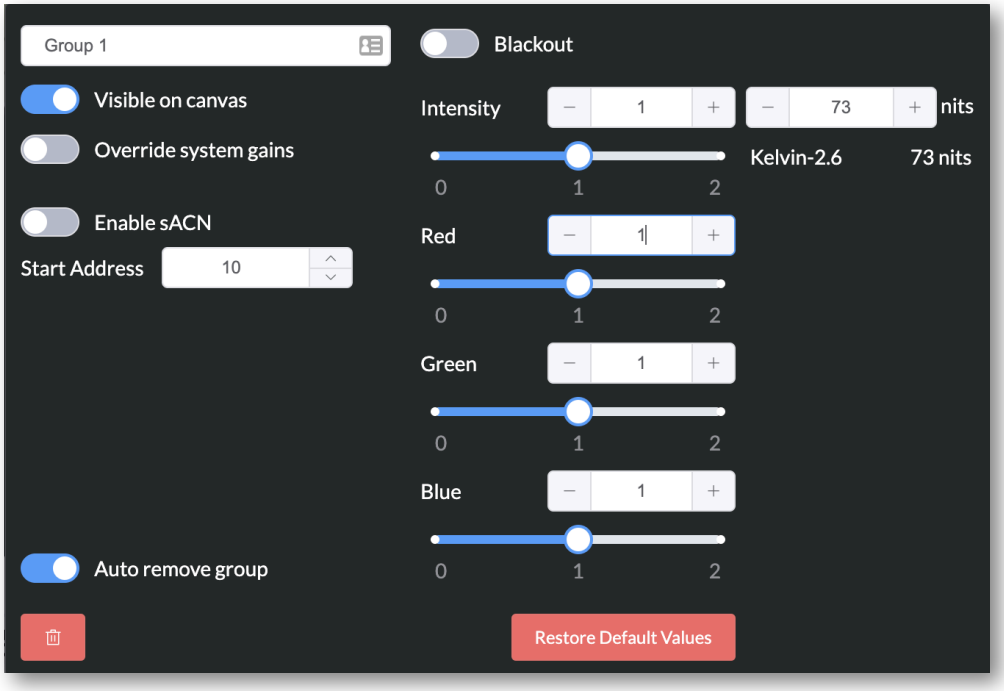


Figure 39: Tile group controls.

Group name - By default, HELIOS names groups with the word 'Group' + 'a number'. The name can be changed here.

Visible on canvas - A toggle to show/hide the tile group on the system canvas. This is the same as using the visibility button, .

Override system gains - A toggle that gives priority to tile group gains (***Intensity***, ***Red***, ***Green***, and ***Blue***). With this toggle enabled, the tile group gain settings are absolute and the group of tiles operates independently to the rest of the system. Global intensity and blackout still override these group gains.

Enable sACN - A toggle to enable remote control of a group via the sACN protocol. sACN functionality must also be enabled in the ***Settings*** > ***Processor settings***. With sACN enabled, channel assignment values appear in brackets in front of the name of each control. In the following example, [10] Intensity [10] is the sACN channel for ***Intensity*** control of the group. This channel assignment is defined by the ***Start Address***.

Auto remove group - By default, when all of the tiles in a group have been ungrouped (removed) the group will also be removed. For cases where it is important to retain a group configuration, turn off the ***Auto remove group*** to have HELIOS keep empty groups and the relevant settings. This way, tiles can be added and removed from groups without fear of losing the group settings.

Gains - ***Intensity***, ***Red***, ***Green*** and ***Blue*** are gains controls for the group. The brightness (nits) is proportional to the overall system brightness (system brightness * intensity * RGB). Use the ***Override system gains*** toggle to have tiles operate independently.

Tile Maintenance

This accordion contains commands that HELIOS can send to tiles; ***Reboot Tile(s), Eject, and Download tile support logs.***

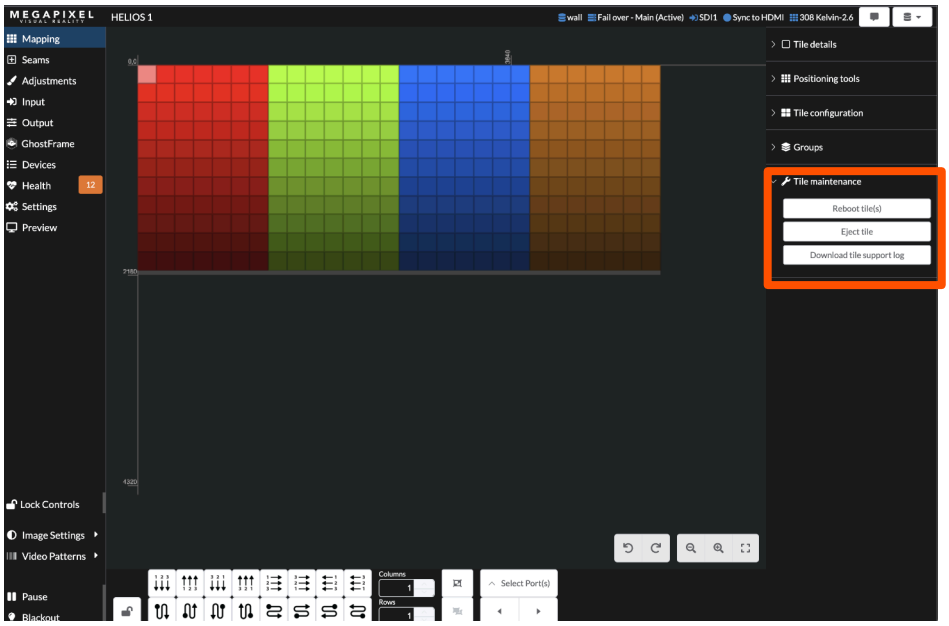


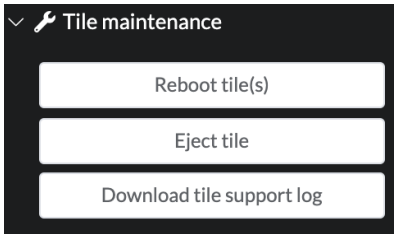
Figure 40: Tile maintenance.

Reboot tile(s) - HELIOS can send soft reboot commands to selected tiles. Select tiles to reboot and press the ***Reboot Tiles(s)*** button. Caution using this feature in a show environment! The tile(s) will go black as they reboot.

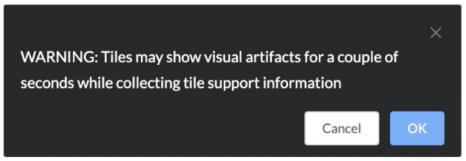
Eject tile - Some tiles have an ejection mechanism this button can be used to trigger it. Once ejected a tile will lose communication with HELIOS. For safety reasons only one tile at a time can be ejected.

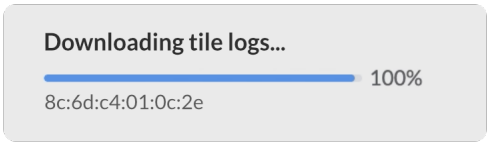
Download tile support log - Requests technical support logs from selected tile(s). These logs contain current state and some activity logs since boot that are used by MVR technicians and developers for troubleshooting. When tiles report information in this manner they may show visual artifacts for a few seconds as the tile is processing and sending the log.

1. Press the ***Download tile support log*** button.

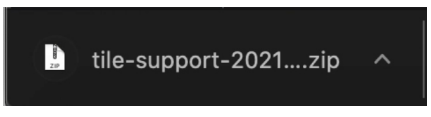


2. A warning will appear. Press ***OK*** to continue with the download.





3. After pressing ***OK*** a zip'ed log file is downloaded to the download location set in the browser.



Input Pane

The HELIOS Processor supports four different types of input formats (HDMI, DisplayPort, SDI, and ST2110). After a factory defaults restore, HELIOS will automatically select the first valid input that it receives. As an example, if the first valid input HELIOS receives is SDI, HELIOS will remain selected on SDI even if the signal is no longer present. If SDI is unplugged and DisplayPort plugged in, the HELIOS needs the user to select the DisplayPort source manually. Changes are sent live to the entire system immediately.

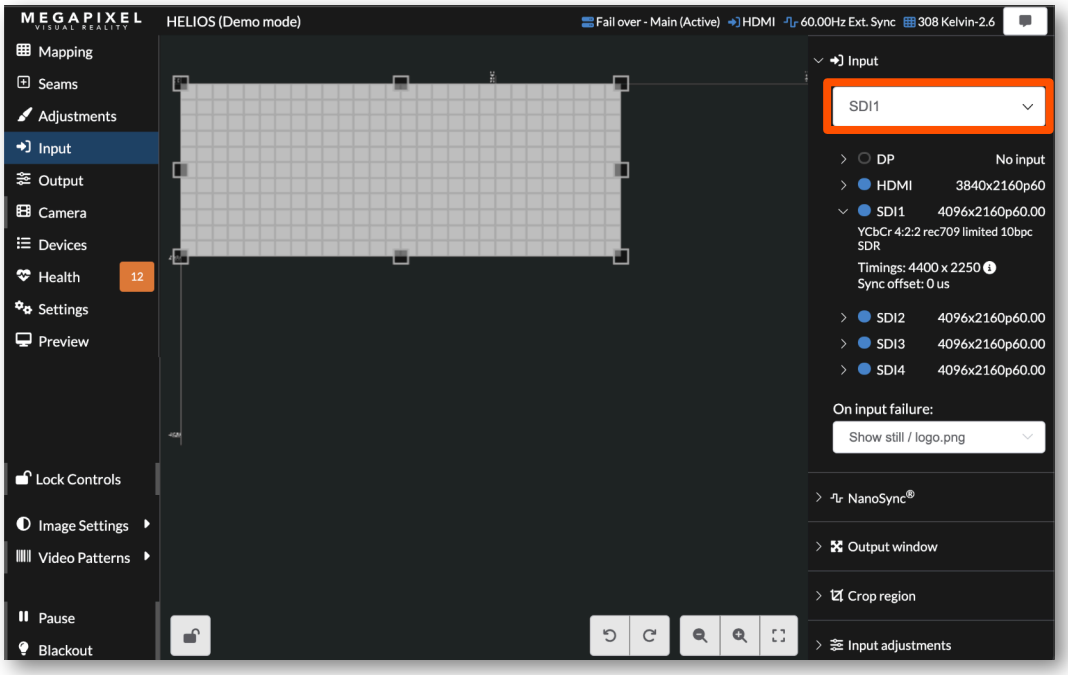
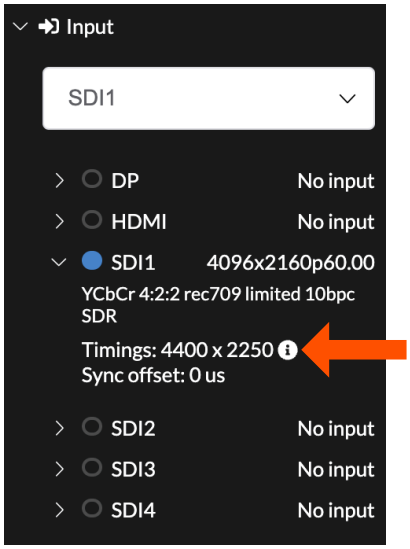


Figure 41: Input select.

Inputs select drop down - The HELIOS interface for selecting inputs is a drop down menu on the ***Inputs*** pane (highlighted by the orange rectangle in the example above).

Input Details - Below the input select dropdown is the input details region. Each possible HELIOS input has a line with a disclosure triangle to view signal details. HELIOS displays details for color timing, and sync. With advanced mode enabled in the HELIOS settings, an information icon (arrow below) serves as a button to display advanced timing information.



	Front Porch	Sync	Back Porch
Horizontal	0	88	296
Vertical	8	10	72

Figure 42: Input details

Input Pane (continued)

Sync - When an external sync (genlock) is not present, HELIOS will lock to the frequency of the input signal. If using an external sync we strongly discourage using a different frequency than the selected input signal. Mismatched frequencies can cause stuttering and vertical tearing between displays, along with other undesirable artifacts.

Sync offset shows how far away that input's sync is from the system's sync. If HELIOS is locked to input it should be close to zero. For external genlock it should be a fixed value (non-changing). The key thing to look for is a stable value. If sync offset is incrementing or decrementing, the source is shifting relative to the sync. A shifting sync offset is a reliable indication that the source is not locked. If the sync offset frequency is shifting more than half of a frame time, something is adding a large delay to the signal.

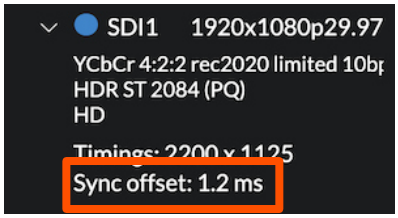


Figure 43: Sync offset

In the case of multiple inputs, the joined inputs will show the sync offset for the primary input. Expand the other inputs to check that they also have similar sync offsets to the primary. If the inputs are not in sync, a warning will appear and the stitching option will turn orange to warn about the sync issue.

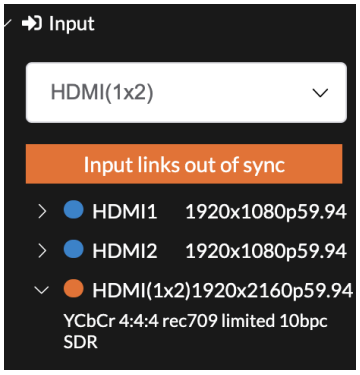


Figure 44: Sync warning

Ideally the ***Sync offset*** between inputs is close to zero. If they are not, or if the sync offset values are not stable, those signals are not using the same clock.

Input Pane (continued)

EDID (Advanced) -HELIOS makes use of the EDID (Extended Display Identification Data) protocol to communicate the capabilities of the HELIOS DisplayPort and HDMI cards to media playback devices. DisplayPort and HDMI input cards each have a unique default EDID configuration that has been preconfigured to work with most common resolutions and frequencies. However, there are situations when a custom EDID file is needed. This can be the case when a media player needs to confirm with HELIOS that it supports a non standard resolution or alternate frame rate. Typically, an EDID file has multiple allowable resolutions and frame rates to ensure universal compatibility. By custom making a limited EDID with only a single resolution and frequency, issues after reboot or disconnect where the system comes back in a different state can be eliminated.

The DisplayPorts and HDMI ports on a HELIOS support loading custom binary EDID files. With **Advanced** mode enabled, HELIOS reports the name of the current EDID file in use, and has two icon buttons; ***Upload EDID*** and ***Reset to default***.

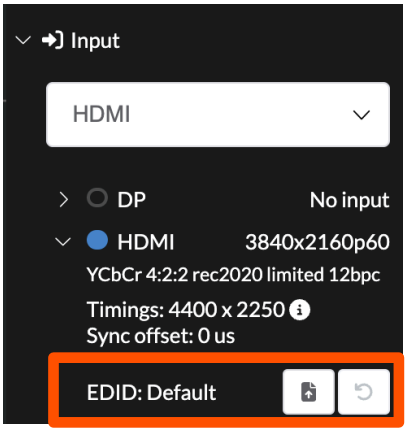


Figure 45: EDID tools

Input Pane (continued)

HDCP - HELIOS supports only HDCP 2.2 signals. HELIOS requires a separate HDCP license in order to receive an HDCP signal. Please contact your MVR sales representative for this license. Once licensed, HELIOS will automatically negotiate an HDCP 2.2 connection when possible. On a successful handshake the input details will report ***HDCP 2.2*** (example below).

Prerequisites:

- HELIOS v22.04.0 software
- HDMI 2.0 (rev 2) VFMC card. (MVR part number: PCB-0215)
- HELIOS HDCP license

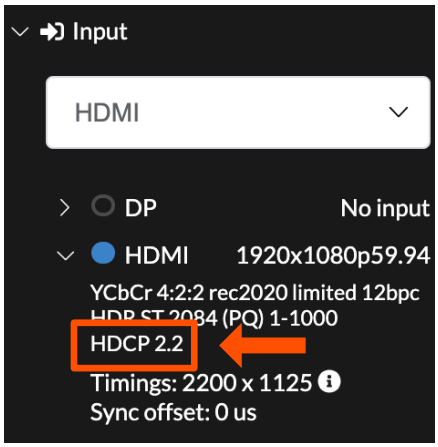


Figure 46: HDCP details on the HDMI input

NOTE: When troubleshooting HDCP protected input signals, ensure the upstream device generating the signal is set to negotiate HDCP 2.2. HDCP 1.4 protected signals can appear to be valid on the input details report, but display as black, blue or other aberrant color.

120HZ - HELIOS supports 120Hz input signals (see the **Input Capability Matrix** in Appendix G). 120Hz operation can decrease system latency by half (compared to a 60Hz setup) and improve the on camera appearance of some displays. Using a 120Hz input source will reduce the maximum quantity of pixels by half (e.g. 4,250,000 pixels per 10Gb HELIOS port to 2,125,000 pixels). 720P and 1080P are the best suited input resolutions for 120Hz operation.

Input Pane (continued)

Stitched SDI - HELIOS supports input stitching. This feature will join from two (2) to four (4) rasters depending on the option selected. The inputs with a formula in the line (e.g. ***SDI (1x2) 4096x4320p60***) are stitched inputs. ***(1x2)*** indicates one (1) raster wide and two (2) rasters tall. In this case, HELIOS is stitching two vertical (top to bottom) rasters. If selected on an input with a ***(2x1)*** designator, the picture is made up of two side by side rasters. The position of the SDI rasters matches the physical port layout on the HELIOS unit viewed from the rear; the top left input (input #1) is the top left quadrant, the bottom right input (input #4) is the bottom right quadrant.

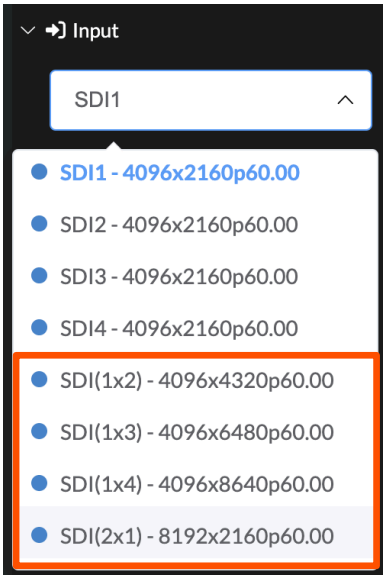


Figure 47: Stitched SDI

Stitched Dual HDMI / Dual DisplayPort - When HELIOS has dual HDMI or dual DisplayPort cards installed, the two rasters are stitched together automatically. The input drop down menu will show the stitched rasters as two options (1x2) one wide by two tall or (2x1) two wide by one tall.

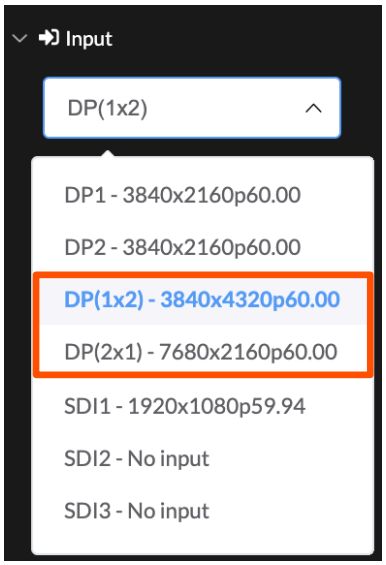


Figure 48: Dual DisplayPort options

Input Pane (continued)

ST2110 - HELIOS supports ST2110 digital media over IP. In order to use an ST2110 signal with HELIOS an ST2110 compatible SFP must replace the usual SDI SFPs. When HELIOS is switched into ST2110 operating mode (***Processor Settings > Operating mode*** SDI is disabled and the input will show the available ST2110 inputs.

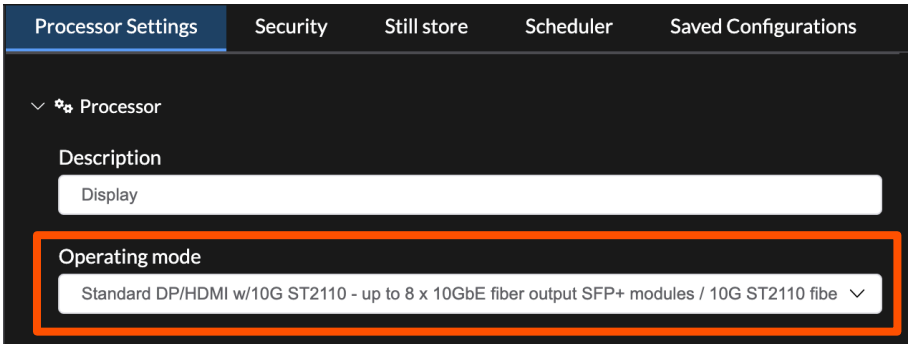


Figure 49: ST2110 Operating mode

ST2110 inputs are stitching capable. Select a single input to connect only one, select a stitched input to show more than one input at the same time. In the example below ***ST2110(2x2)*** indicates that all four ST2110 inputs are being stitched.

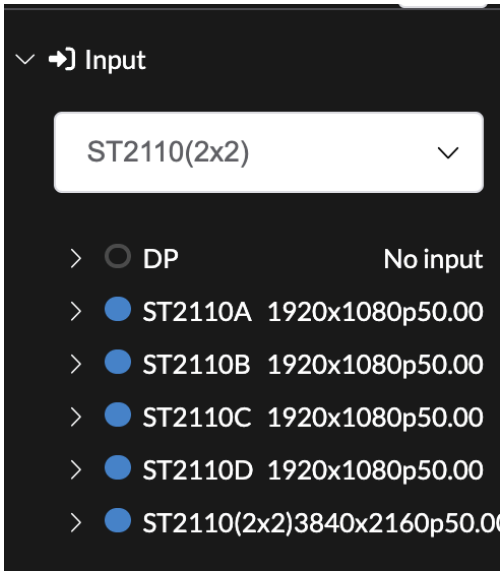


Figure 50: ST2110 inputs stitching

Input Pane (continued)

On input failure **-** Select how the HELIOS should behave if the selected input no longer has a valid signal.

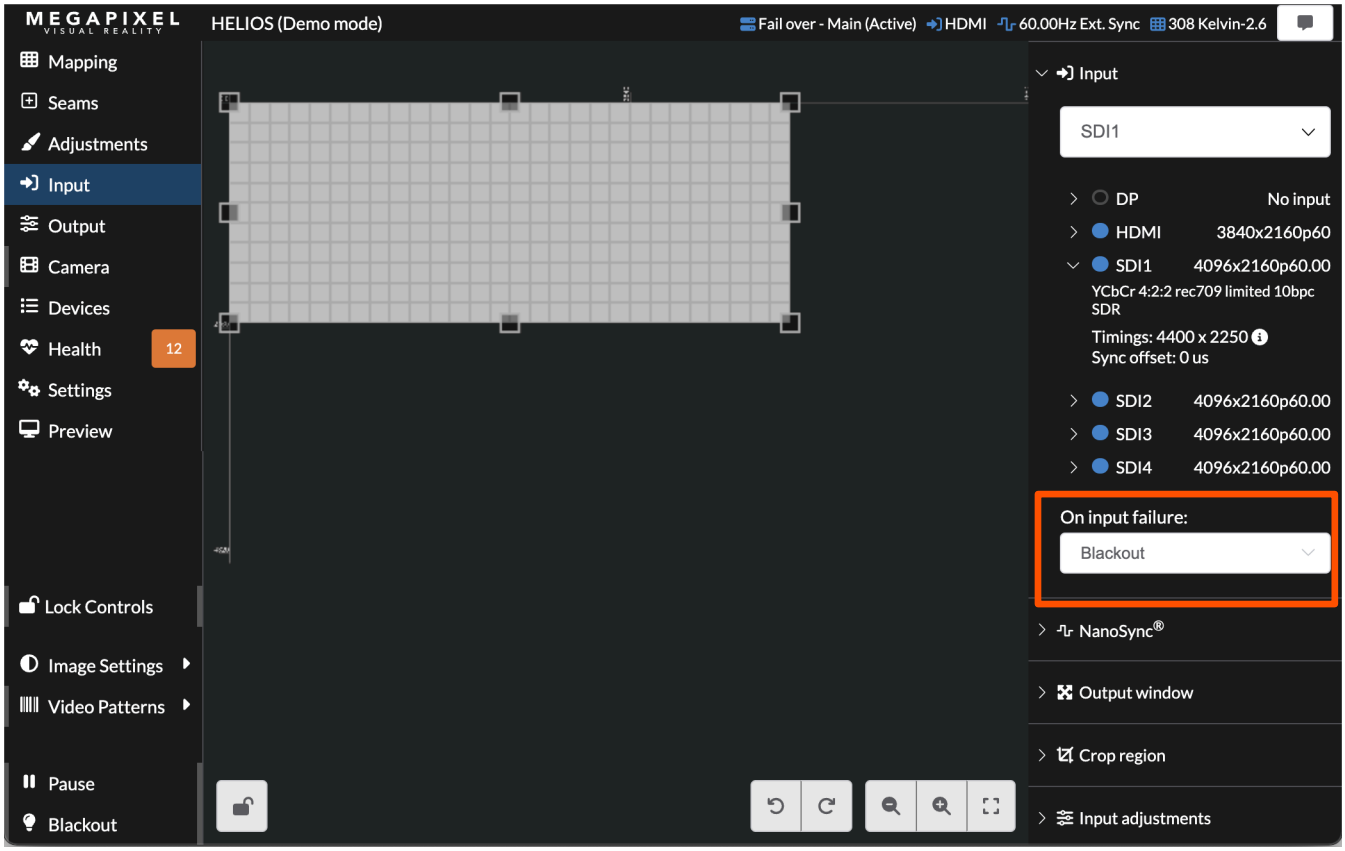


Figure 51: On input failure location

• ***Blackout*** **-** the HELIOS will display black.

• ***Show still*** **-** the HELIOS will display a preselected still image. See the ***Processor Settings > Still Store*** section for loading images.

• ***Show input*** **-** the HELIOS will show the selected input. When the selected input recovers, HELIOS will revert to it. As an example, ***SDI1*** is the selected on the Input pane. The ***On input failure > Show input*** is set to ***HDMI.*** If ***SDI1*** fails, HELIOS will display ***HDMI***. When ***SDI1*** recovers, HELIOS automatically switches back to ***SDI1***.

• ***Switch to input*** **-** the HELIOS will switch to the selected input. As an example, ***SDI1*** is the selected on the Input pane. The ***On input failure > Switch to input*** is set to ***HDMI.*** If ***SDI1*** fails, HELIOS will switch the input to ***HDMI***. When ***SDI1*** recovers, HELIOS does nothing. The input remains selected on ***HDMI***.

NanoSync®

HELIOS can sync frames to either the frame rate of the inbound signal or to an external genlock. When an external genlock signal is required (as is the case with redundant systems), use the ***Allow external sync*** toggle to enable it.

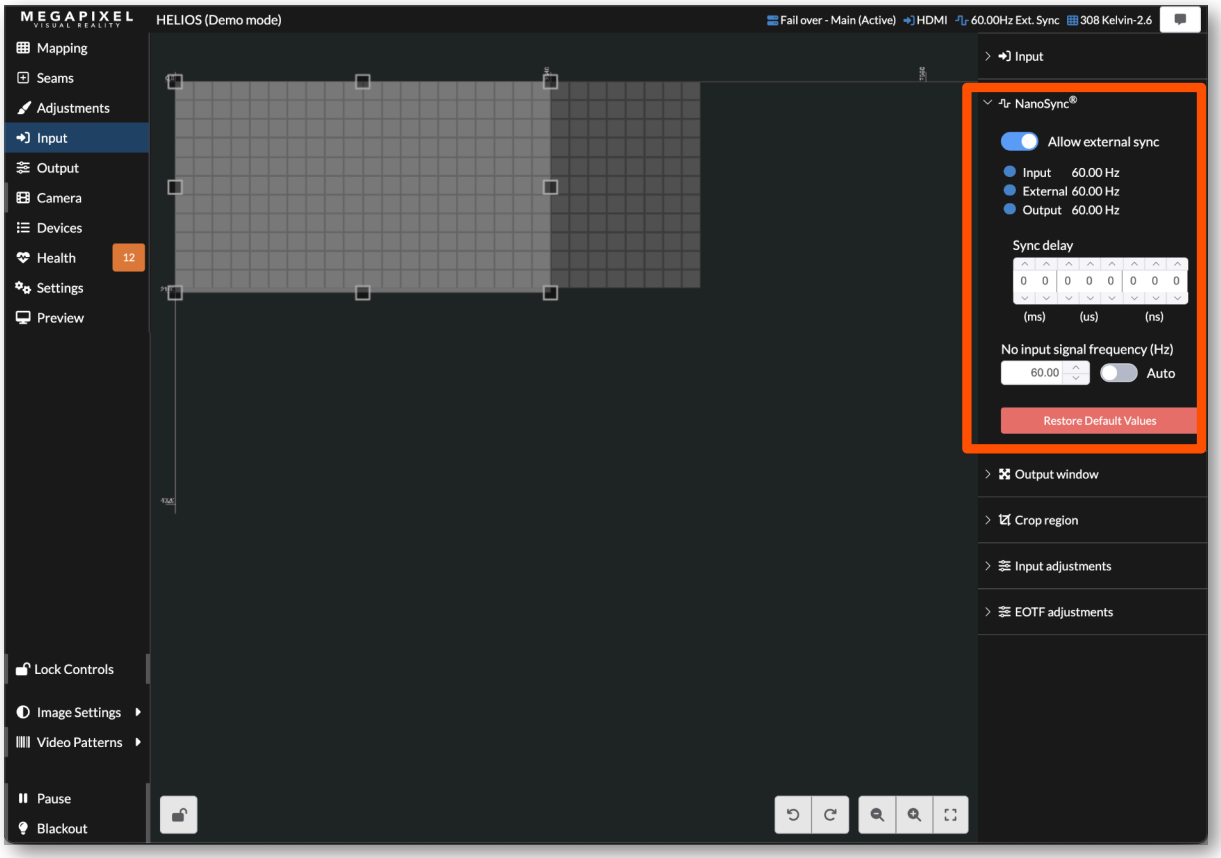


Figure 52: Sync settings

When the ***Allow external sync*** toggle is enabled, the front display of the HELIOS will report the frame rate it is receiving. If the HELIOS does not recognize an external sync signal it will report ***No Sync***.

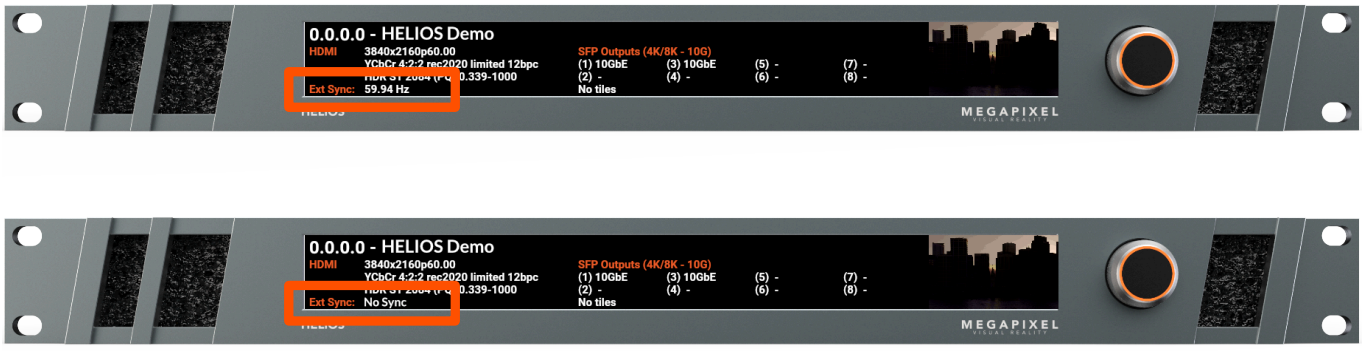


Figure 53: Front panel sync report

NanoSync® (Advanced)

HELIOS has hidden NanoSync controls under the ***Advanced Mode*** toggle. Enable ***Advanced Mode*** under ***Settings → Processor settings → Advanced***, to reveal the hidden controls, then return to the ***NanoSync*** panel to use them. HELIOS NanoSync gives users the most accurate sync control of any LED system. HELIOS synchronizes the actual light output of the LED tile to the source within 1/4 microsecond (250 nanoseconds). Often HELIOS delivers frames much faster than other equipment such as projectors. Cameras can also require precise alignment to match with the shutter exposure.

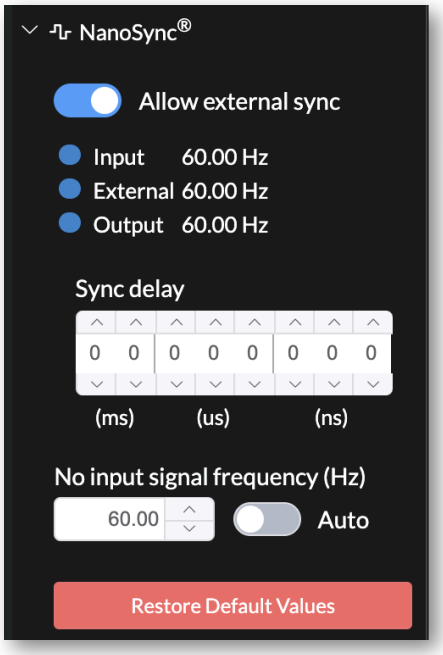


Figure 54: Advanced Sync settings

No Input signal frequency (Hz) - (Advanced)

If the inbound signal is ever lost, HELIOS will continue to output test patterns at the frame rate of the last valid input. There are some cases where it is useful to toggle ***Auto*** off in order to set the output frequency manually so that test patterns are generated at the frequency of a future valid signal before it arrives.

Output Window

The input signal is contained within the output window (light grey region with small square handles). The output window allows for sizing and positioning of the inbound video signal using the output window controls. Drag any of the handles (circled below) on the edges of the window to manually resize or use the numerical fields to enter precise values. Generally, the output window size should be set to the aspect ratio of the input signal to avoid distorting the picture.

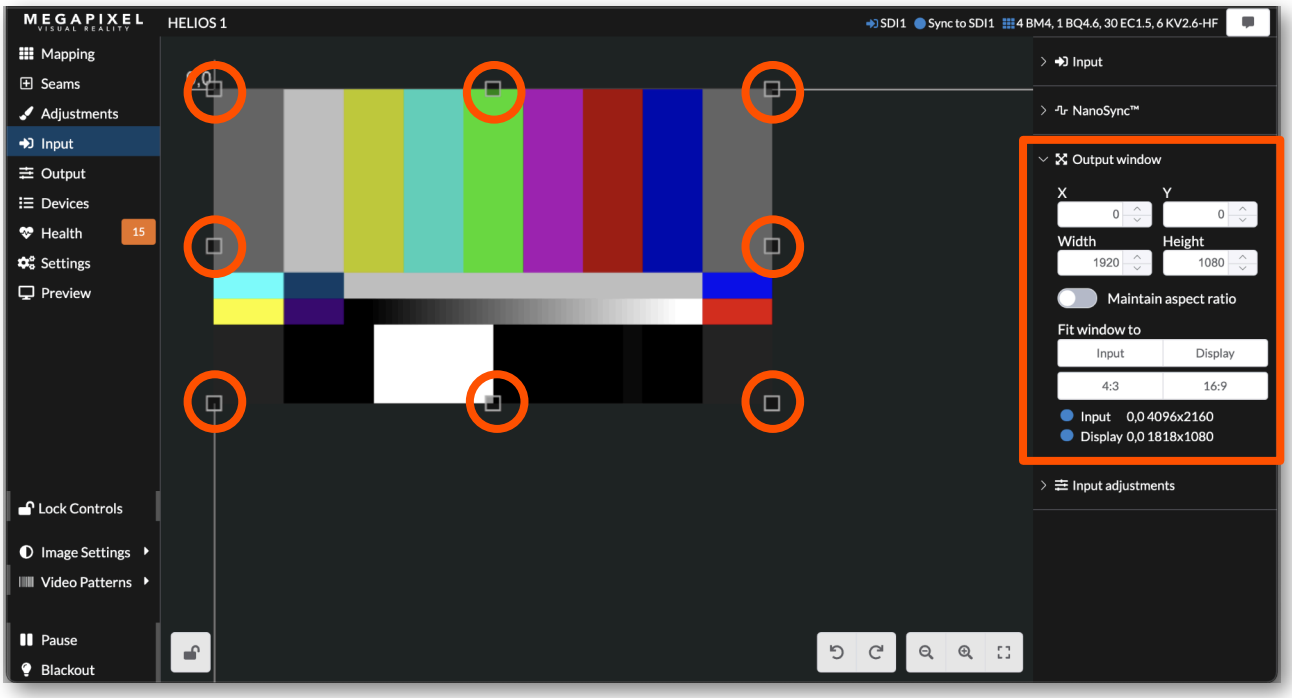


Figure 55: Output window

Canvas Repeat - Output Window (Advanced)

Canvas repeat is useful in cases where multiple screens are driven from one processor ***and*** display the same content. Previously, the solution was to layer the mapping (one screen on top of the other). The canvas repeat feature duplicates the content across the canvas so that each screen can be mapped in different regions of the canvas. The advantage is that this separates out the displays in space making it easier to interact with the map for the various displays. In the example below, ***Canvas repeat*** has been enabled and numerous copies of the content are visible.

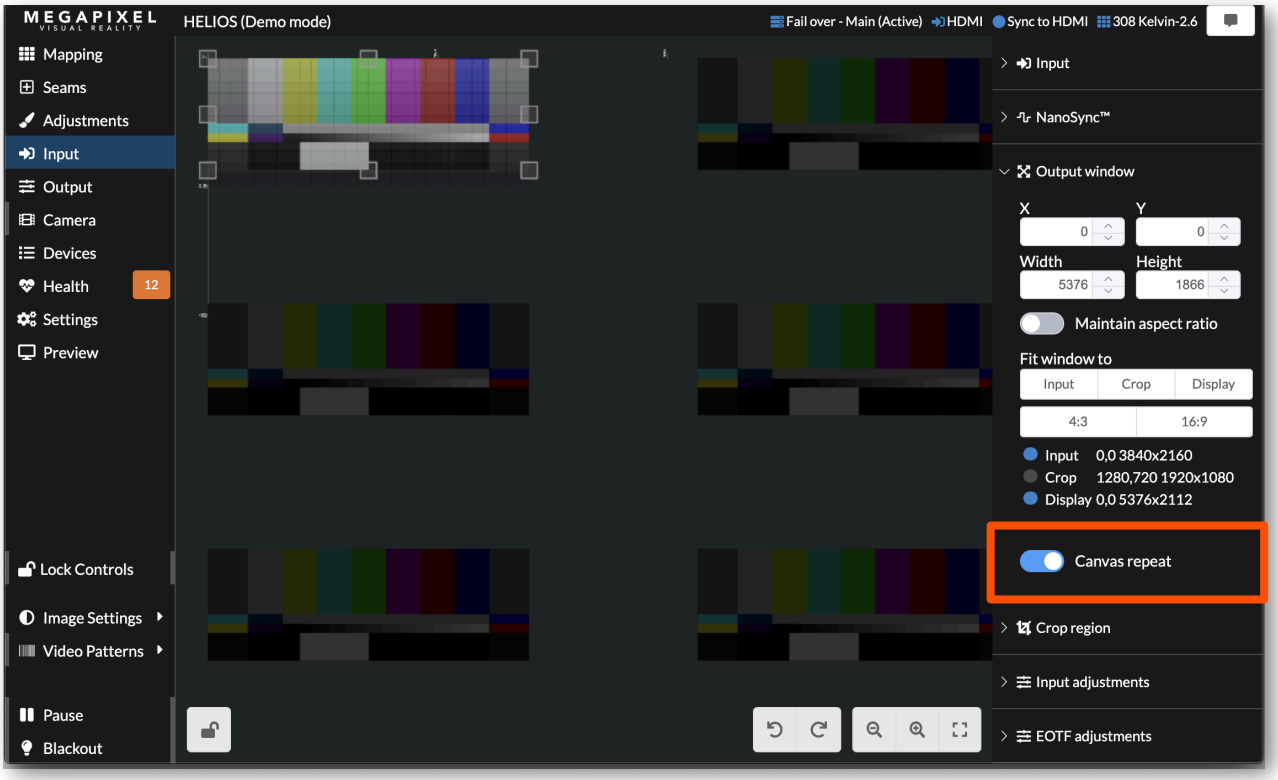


Figure 56: Output window

When ***Canvas repeat*** is enabled, the ***Mapping*** pane's tile positioning tools display ***X (Local)*** and ***(Y Local)*** controls above the regular ***X*** and ***Y*** position fields. Use local positioning to move tiles relative to the copy of the canvas that they are currently using. This tool aims to simplify the positioning of tiles. Each repeated canvas will start at local 0,0. The regular ***X*** and ***Y*** position fields can also achieve the same result, but these relate to the entire canvas so there is more math involved with discovering the desired canvas position.

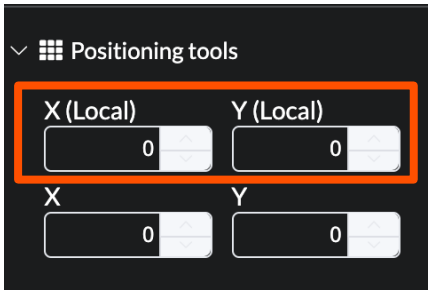


Figure 57: Output window

Crop region (Advanced)

Use the crop function to display only a portion of an input signal. Toggle the ***Enable Cropping*** function ***ON,*** then enter the size and position coordinates for the crop box.

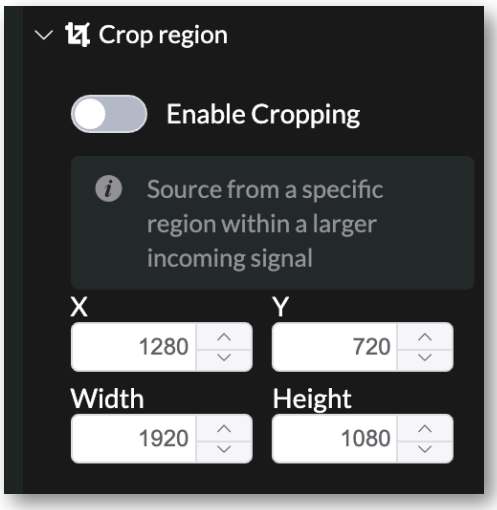


Figure 58: Crop region controls

Input Adjustments

The input adjustments section allows the user to make visual changes (brightness, contrast, saturation) to each of the incoming signals independently. Input adjustment settings are saved separately for each input.

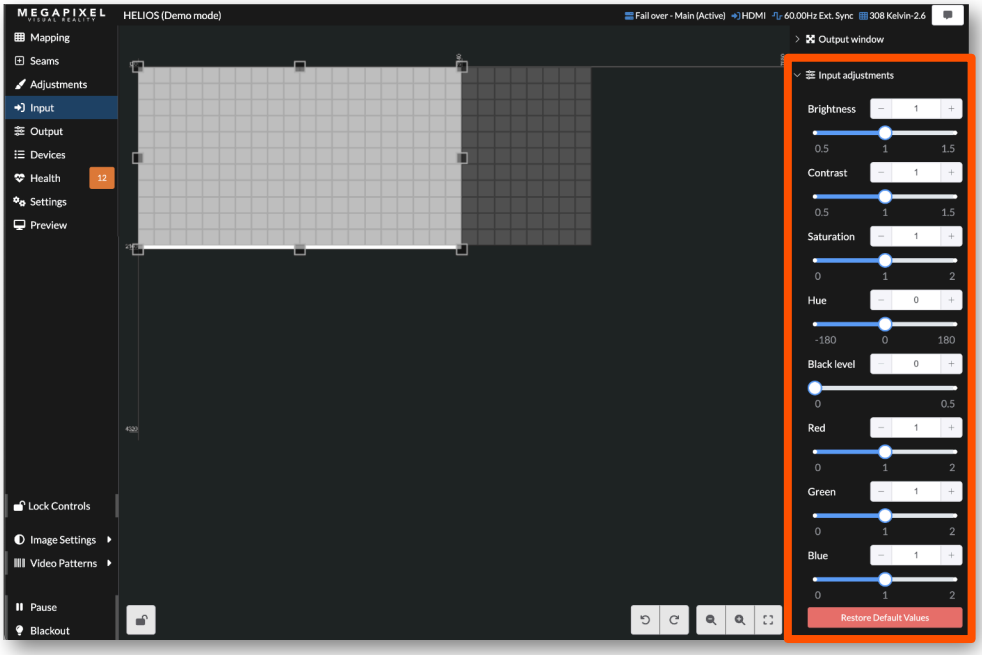


Figure 59: Input adjustments

Brightness - adjusts the incoming image to be lighter or darker. First, adjust the brightness to reproduce black correctly then, contrast.

NOTE: This brightness control adjusts the incoming video brightness and should not be used for adjusting the luminance of the display.

Contrast - increases or decreases the differences in brightness across the image.

Saturation - increases or decreases purity of colors. Full desaturation turns colors grey.

Hue - changes the color of the video, re-mapping it around the color wheel.

Black level - a combined brightness + contrast control. See **Low Level Noise Reduction** in Appendix D for how this control is used to eliminate low level noise in an image.

RGB gains - boost or reduce the amount of Red, Green or Blue in the image. Note that these controls are intended for content correction/tweaking. To adjust the RGB levels of the display it is recommended to instead use the ***Output → RGB Gains***.

Input Adjustments (Advanced)

With Advanced mode enabled the Color range override controls will appear as well as the EOTF adjustments accordion

Color range override - defines how to interpret the levels of values in the video signal. The range of values used to interpret the video is defined by two quantization ranges, ***Limited*** and ***Full***. ***Limited*** video content is contained within 16 - 235 standard for video. In the limited range, 16 and below is treated as pure black and 235 - 255 is treated as pure white. ***Full*** range video content uses the full 0-255 range (pure black is 0 and pure white is 255). The way that HELIOS interprets the video must match how it was encoded. If this isn't set correctly there can be a complete loss of shadow detail or conversely, washed out highlights. If ***Auto*** does not identify the encoding correctly this toggle is the location to make a manual selection.

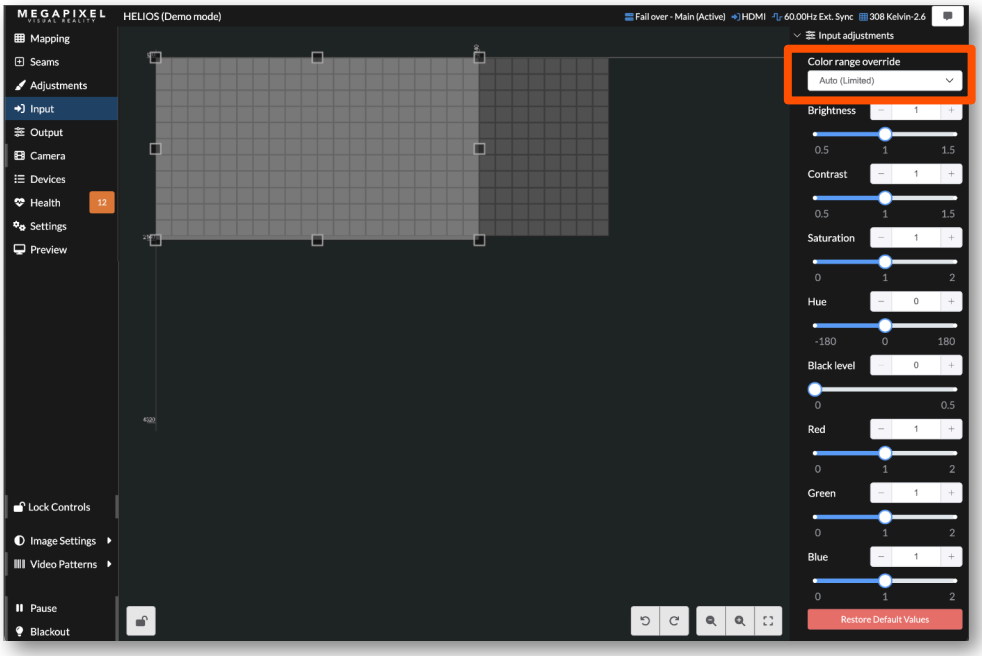


Figure 60: Color range override

NOTE: Video routing equipment can change the color range metadata on an input signal. It is good practice to manually set HELIOS onto the correct setting.

EOTF Adjustments (Advanced) - Continued

The HELIOS EOTF (Electro Optical Transfer Function) adjustments are used to inspect and manually override EOTF settings encoded in the source signal's metadata. If content has a standard dynamic range, it should be interpreted with the SDR setting. Content encoded with a high dynamic range should be set to the EOTF with which it was mastered. Most HDR content will have a metadata label indicating which transfer function was used. HELIOS with default settings, should automatically recognize and select the correct EOTF for the content.

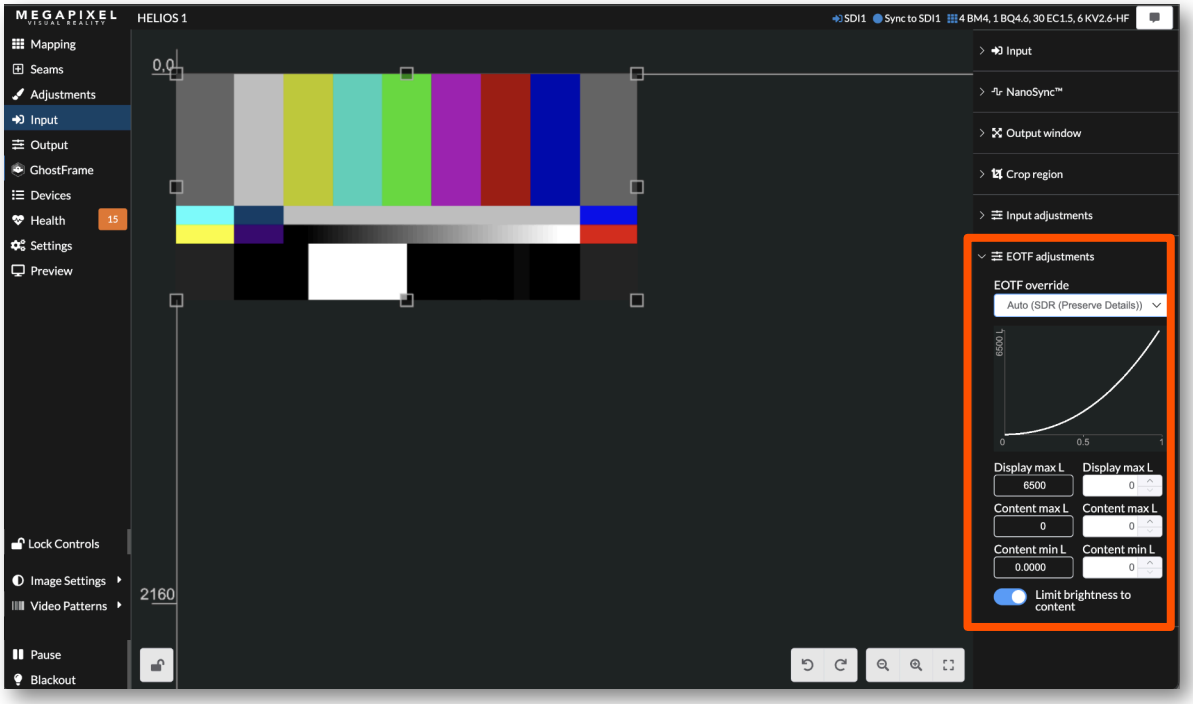


Figure 61: EOTF adjustments

EOTF override - If HELIOS reports that a PQ signal is SDR when set to ***Auto (SDR)*** it is possible upstream equipment has stripped the PQ metadata. Use the ***EOTF override*** setting to manually set HELIOS correctly.

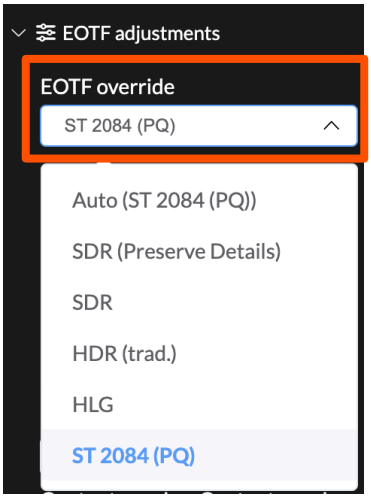
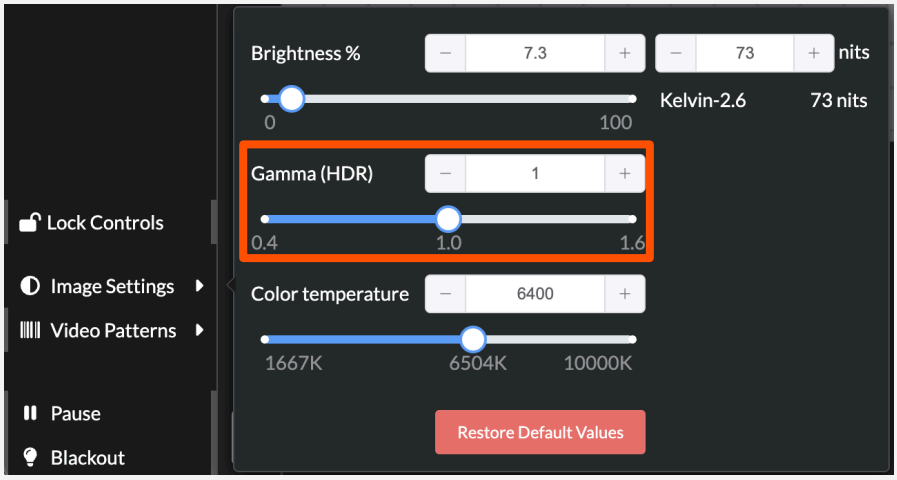


Figure 62: EOTF override

NOTE: The visible slider range for global Gamma is re-mapped when HELIOS is operating in HDR so that a nominal PQ gamma is reported as ***1.0***. In SDR mode, the nominal value for ***Gamma*** is ***2.4***



Display max L, Content max L, and Content min L are read only values on the left side with manual override fields to the right. Advanced users may enter specific numbers here. If the correct values are not known, keep the field values at zero. The system is in automatic mode when these values are at zero. If non-zero values are entered, keep ***Advanced*** mode ***ON*** so that the values affecting the system are visible.

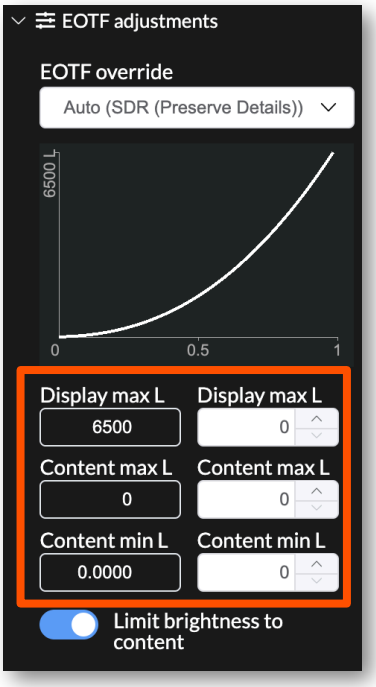


Figure 63: Advanced mode adjustments

EOTF Adjustments (Advanced) - Continued

The PQ curve is defined in nits. As such, PQ content reports a ***max L*** (luminance) to HELIOS. In other words, PQ content needs to be displayed at the brightness level at which it is mastered. The graph below the drop down is provided to help explain the relationship between the ***Content max L*** and ***Display max L***. If there is a max L mismatch between the content and the display, the graph shows how the mismatch is being handled.

Example (A) - ***Display max L*** and ***Content max L*** are both 10,000 nits.

Example (B) - ***Display max L*** is 10,000 nits, ***Content max L*** is 1,000 nits. HELIOS can show all the content directly 1:1.

Example (C) - ***Display max L*** is 1,000 nits, ***Content max L*** is 10,000 nits. HELIOS introduces rolloff to preserve highlights.

Example (D) - HELIOS will also show the curves of SDR and other supported transfer functions.

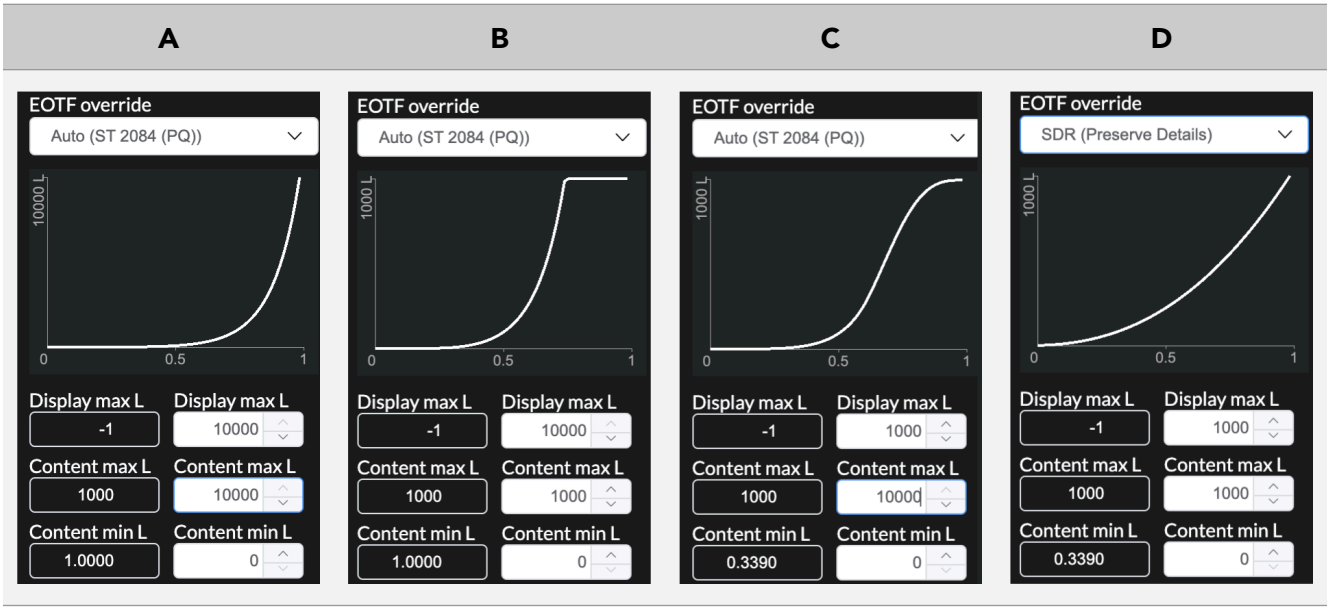


Figure 64: EOTF max L graph examples

EOTF Adjustments (Advanced) - Continued

If PQ encoded content calls for a level that exceeds the capabilities of the tiles, the limit will be the tile's maximum brightness. The ***Limit brightness to content*** toggle is available for cases where the content's brightness information is not desired. If tiles are being limited by PQ encoded content and a brighter display is needed, turn OFF the toggle. The HELIOS will ignore the content brightness and allow the tiles to reach their max brightness.

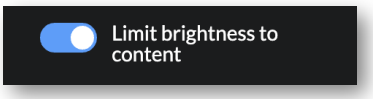


Figure 65: Limit brightness toggle

PQ is currently the only signal which advertises and uses content light levels. HLG uses display max L but ignores content levels. The numerical fields are not used for SDR + traditional HDR signals. Display max L is always determined by the connected tiles. Tiles will still respect the ***Output adjustmen***t → ***Limit to lowest tile max*** setting. If it is not set, then tiles should all be at the same brightness regardless of the EOTF. An image settings popup will notify when the ***Limit brightness to content*** or the ***Limit to lowest tile max*** is being applied. In a scenario where HELIOS is receiving a PQ signal, with content max L set to 100 nits, and the tile max L is 500 nits, the ***Image Settings*** adds the words ***(Limited by content)*** below the nits value report. If the EOTF is switched to where content max L is no longer used, the input settings message also goes away.

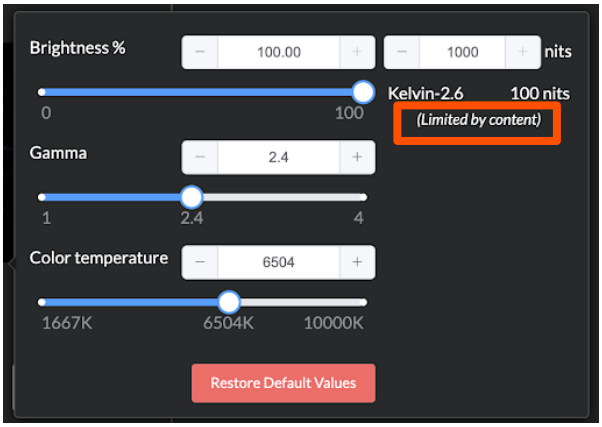


Figure 66: Limit message

NOTE:

• When the content level is unknown or not advertised, content max L is assumed to be the same as display max L. In other words, content is assumed to have been mastered for the display.

• In the case of mixed tile types, brightness is restricted to the tile type with the lowest peak brightness. Mixed tile type systems are not recommended.

Please see the section in **Appendix E** for more information on ***Content to Panel Luminance Curves***.

High Dynamic Range

HDR on HELIOS is comprised of several features all working together: bit depth, gamut, and decoding with an HDR transfer function. Standard definition content uses the the typical SDR gamma curve. HDR uses an entirely different function to map a higher range of brightness onto a display. HDR is more than just brightness, it also includes a wider range of colors. As such, the system must use, at minimum, 10 bit color. HELIOS should ideally be set to 12 bits if possible. Check that the bandwidth is sufficient under the ***Outputs*** pane ***Display bit depth*** accordion.

A true HDR end result requires that the entire pipeline, from content to wall, is aligned and capable of supporting HDR.

HDR Checklist:

1. The tiles must be capable of a wide gamut.
2. Output gamut needs to be set to ***Automatic*** (see the ***Output*** pane ***Display gamut*** accordion).
3. Content must be encoded in HDR.
4. The playback device must support HDR.
5. HELIOS must receive the signal and recognize it as HDR. Check under the disclosure triangle to see the details of the input signal. In the example below, HELIOS is receiving a PQ signal. If for some reason an HDR input signal is not recognized as HDR, use the manual override discussed on the next page.

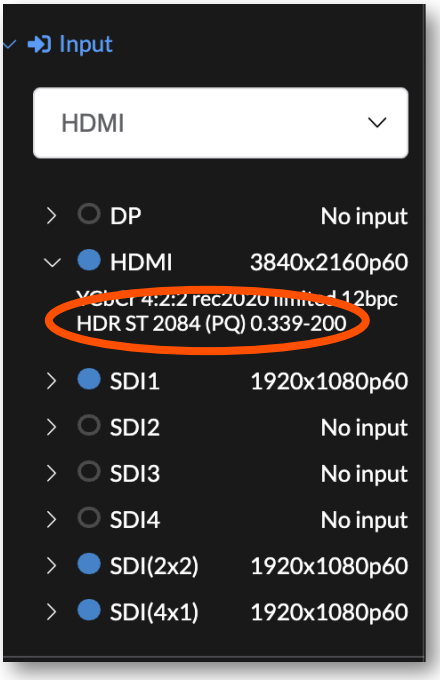


Figure 67: Input signal info

NOTE: When connecting consumer playback equipment such as an Apple TV or an Xbox to be an input source it is important to be mindful that these units default to a 4:2:0 color scheme. HELIOS does not fully support 4:2:0. When HELIOS receives a 4:2:0 color signal, it will send a black and white image to the tiles. Set the input source to 4:2:2 in order to regain full color operation.

Unreal Engine

Metadata may indicate an SDR signal when Unreal Engine is transmitting PQ content. Unreal Engine takes over the the configuration of the outbound video because Unreal Engine prefers to be in control of the encoding entirely in-engine. The Windows video output needs to remain set to SDR. This will cause the HELIOS processor to think that the signal is SDR. If Windows HDR mode is set, it applies an additional encoding to the signal, which is like double-LUTing.

HELIOS Settings

- Set the ***EOTF override*** to ***PQ***.
- Set the ***Color range override*** to ***Full***.

Unreal Engine Windows Output Settings

NVIDIA Control Panel > Output resolution settings

- The radio button for ***Use Nvidia Settings*** is selected.
- Desktop color depth = ***30 bit color***
- Output color bit depth = ***10 bps***
- Color output format = ***RGB***
- Output dynamic range= ***full***

Output Pane

Display Gamut

The display gamut tool sets the range of each color for the system using CIE1931 chromaticity (x & y) coordinates. Common preset gamuts are available from a drop down menu. HELIOS is set to ***Auto (rec. 2020)*** in the example below. Just because a system has been set to certain color targets does not mean tiles are performing at those values. The ***Target*** tab shows the values the system is set to. The ***Actual*** tab shows tile performance. This data is also represented visually on the dynamic CIE chart.

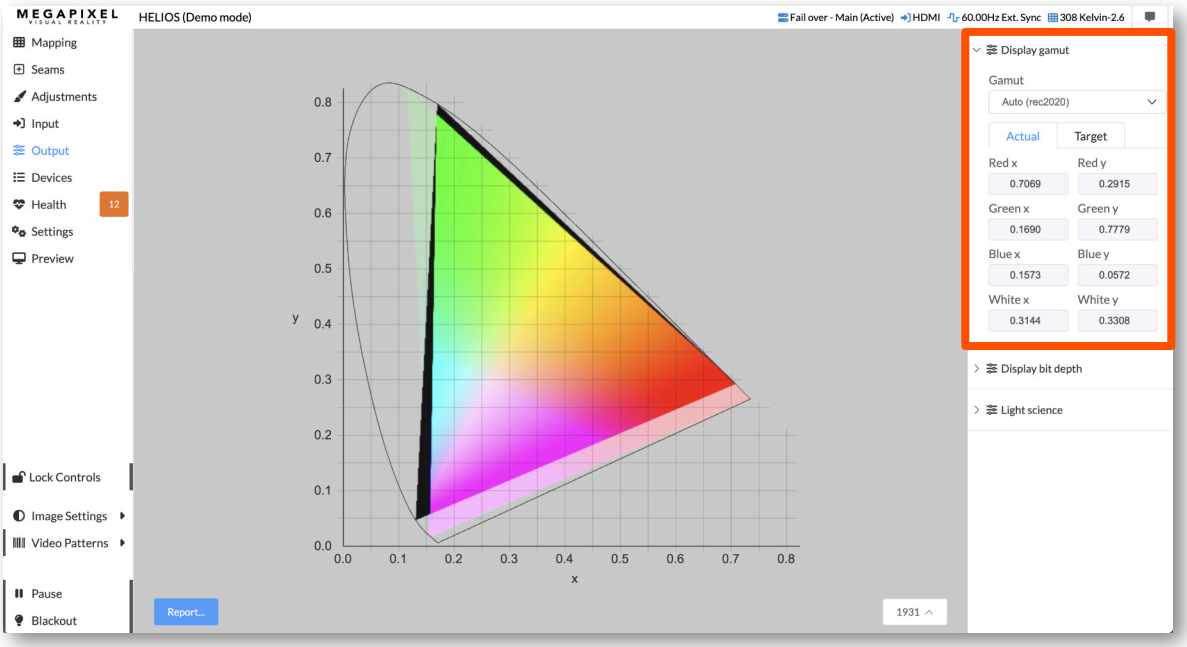
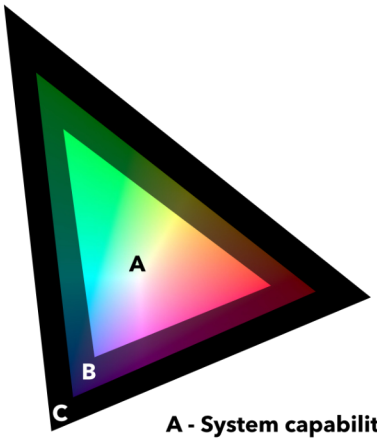


Figure 68: Display gamut

On the CIE chart, tile capabilities are indicated by the entire rainbow region, ***A*** + ***B*** (both transparent and opaque regions). The achievable colors for a system are indicated by the ***A*** center opaque rainbow region. Lastly, a black region ***C*** indicates colors targeted by the settings that are beyond the capability of the display. If the color targets are set within the display capabilities, this black region will not appear.



A - System capability (tile and system settings)

B - Tile capability

C - Out of range (tile and system settings)

Figure 69: Display gamut chart key

NOTE: When a system made up of more than one tile type, wide gamut tiles can be color restricted by narrow gamut tiles. When a system is made up of mixed tile types, HELIOS is automatically set to ***Widest gamut***. HELIOS will determine the widest possible gamut from all connected tiles. This can result in a lowest common denominator color target selection; tiles with wider gamut capabilities will be restricted to the more narrow gamut setting to match all tile capabilities.

Report

HELIOS can generate a ***Tile Calibration Report*** for a system. Press the blue ***Report…*** button to open the report in a new tab.

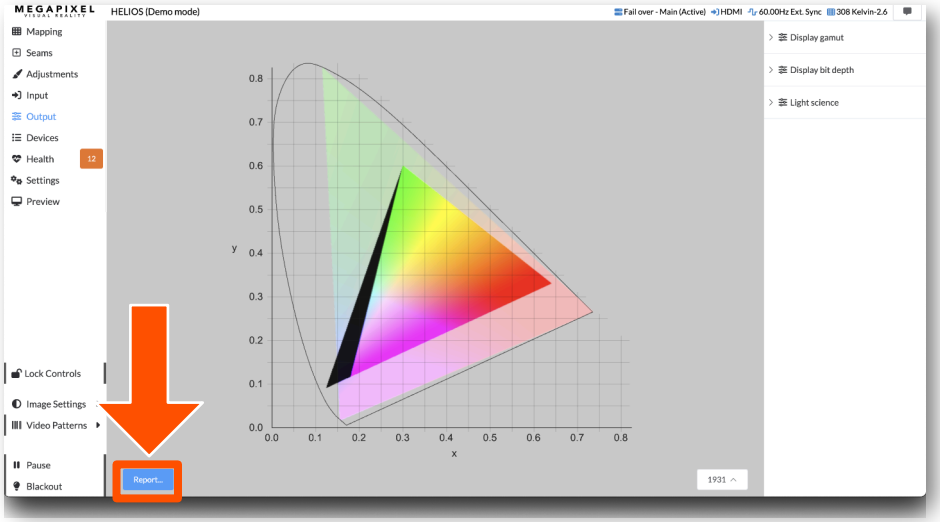


Figure 70: Calibration report button

The Tile Calibration Report (shown below) is useful for content creators and colorists who need to know the color capabilities of the system.

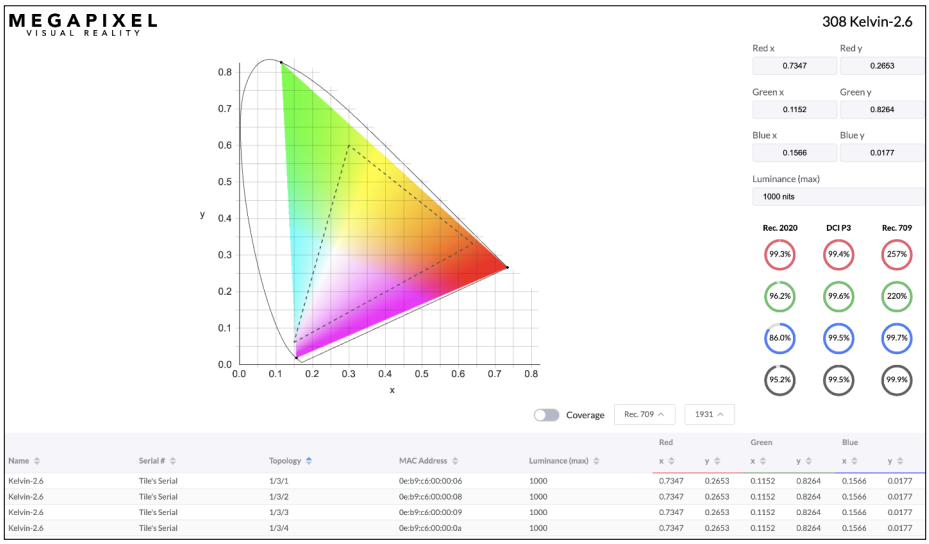


Figure 71: Tile Calibration Report

Custom Gamut (Advanced)

HELIOS supports custom gamut settings. Enable ***Advanced Mode*** under ***Settings → Processor settings → Advanced*** to reveal the ***Custom gamut*** accordion.

1. Set the chromaticity coordinates in the ***Custom gamut*** accordion.

2. Press ***Apply custom gamut***.

3. Selected ***Custom gamut*** from the ***Gamut*** drop down. The chromaticity coordinates under the ***Target*** tab should match the custom gamut values.

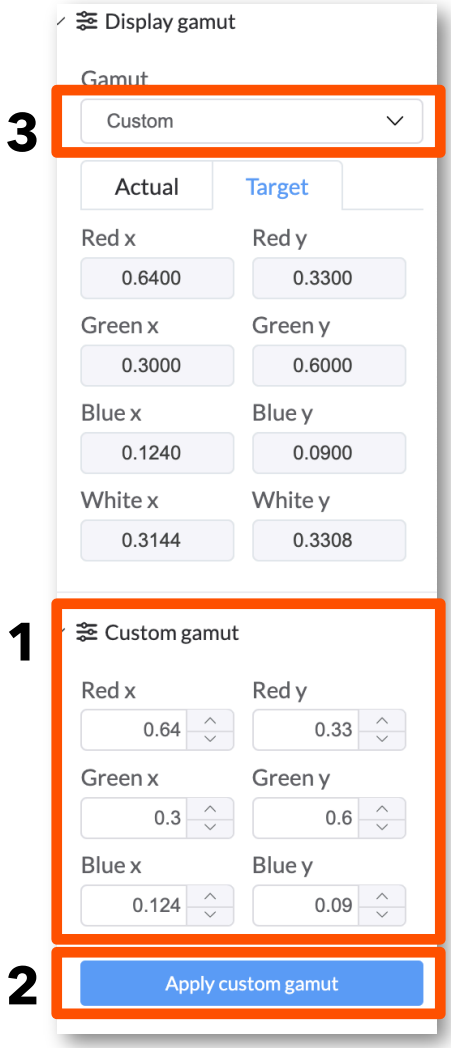


Figure 72: Custom gamut settings

Display bit depth

The system can operate at 10 bit or 12 bit. This menu controls the current setting and shows per-port bandwidth percent utilization. 12 bit operation is recommended. Selecting 10 bit operation will reduce bandwidth utilization.

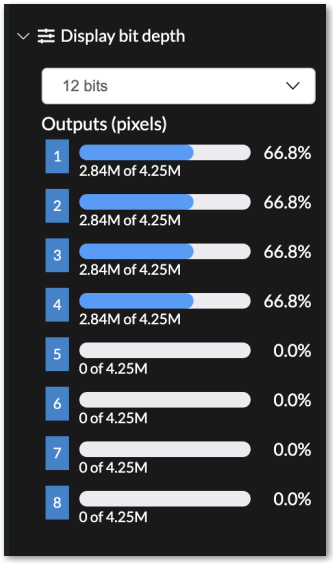


Figure 73: Display bit depth

Light science

Low light levels and shadow detail can be challenging for LED displays to reproduce. HELIOS can drastically improve the visual appearance of these near-black video regions by expanding the bit depth of each tile. With ***Light Science*** enabled, the proprietary algorithm will increase bits per color to 21 or as high as 32 bits per color.

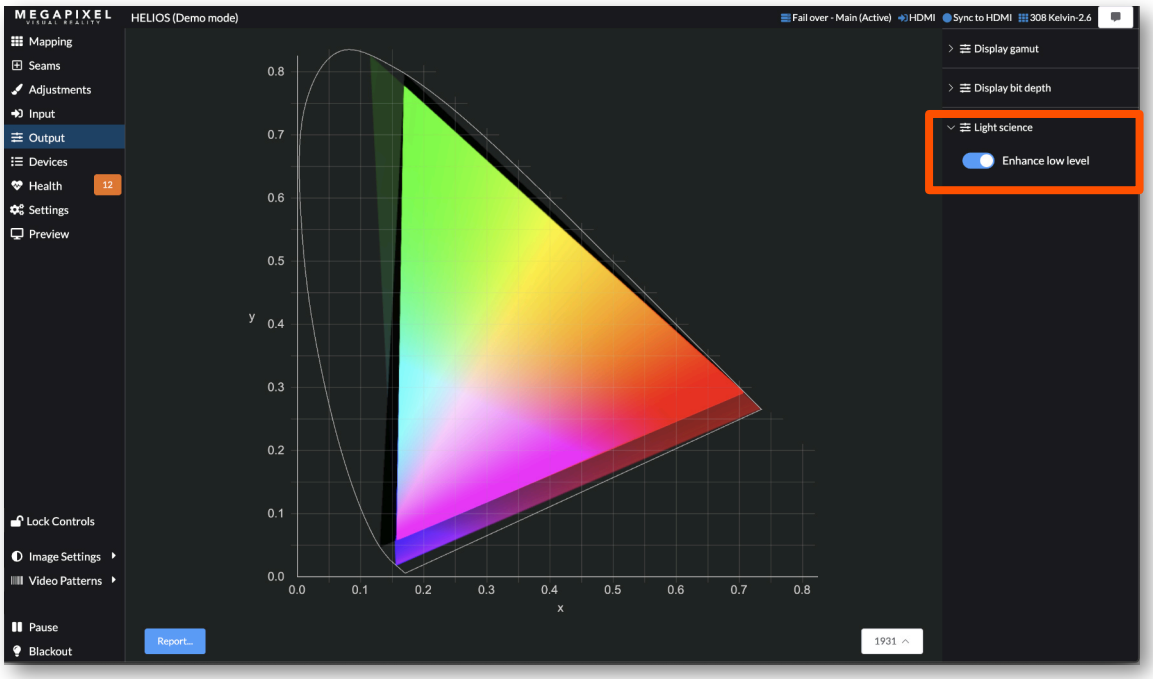


Figure 74: Light Science

Output Pane (Advanced)

With ***Advanced*** mode enabled, HELIOS displays two separate interfaces for color grading, a curves graph and a set of color wheels. In the HELIOS processing pipeline, these two tools are applied sequentially. Any adjustment made by the color wheels will come first, followed by the curves. Below is a simplified color processing pipeline diagram for the entire HELIOS system.

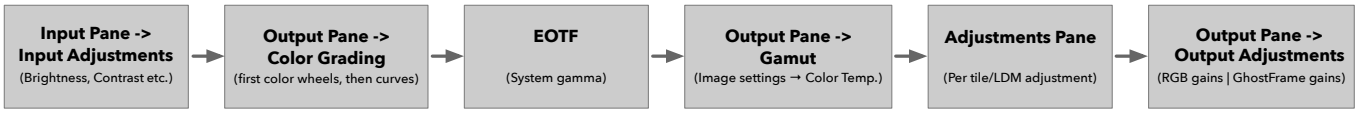


Figure 75: HELIOS color processing pipeline

Color grading tools - Curves

HELIOS offers curve control for luminance (Y) and the primary colors (***R***ed, ***G***reen, and ***B***lue). Select which curve to control from the ***YRGB*** radio buttons at the bottom of the curve graph.

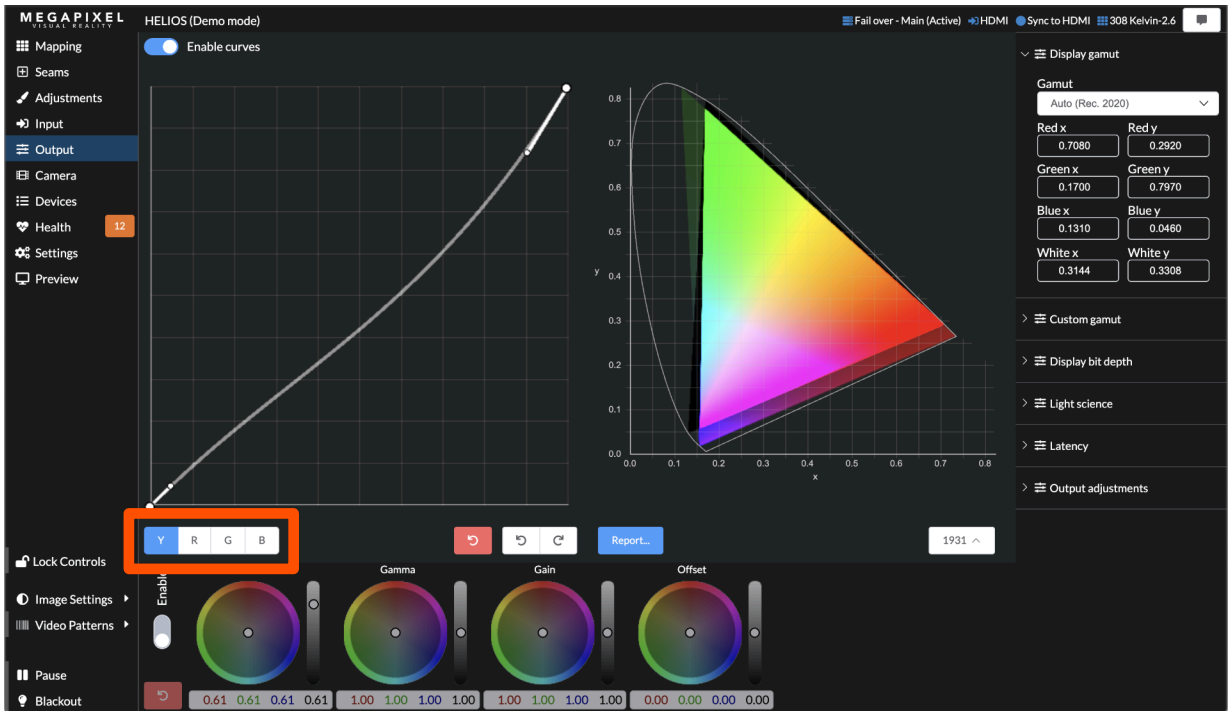


Figure 76: Color grading curves

Color grading tools - Curves (continued)

The curve controls provide adjustment of the image based on tonality regions. The bottom of the graph represents the shadows, the middle are the mid-tones, and the top the highlights. Highlight and shadow points exist by default. Click on the graph to create additional region control points. Place region control points at the boundaries of regions to isolate tonalities. Move the region control point up/down to adjust the region lighter/darker.

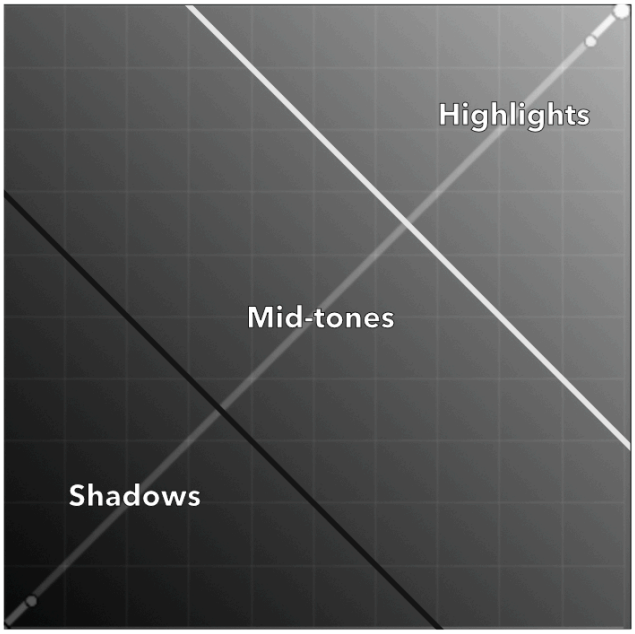


Figure 77: Control regions

Region control points have a transition control handle. In the example image below, the red arrow is pointing at the region control point. The green arrow at the transition control. The slope of the transition control sets the steepness/smoothness of the transition into and out of a tonal region.

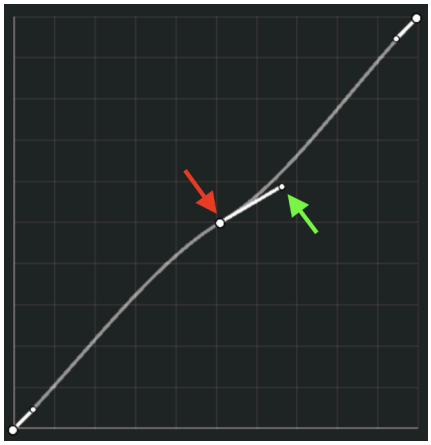


Figure 78: Control point slope

Color grading tools - Color wheels

In addition to curve controls HELIOS has four color wheels for adjusting Lift, Gamma, Gain, and Offset. Each color wheel controls a particular range of tones (shadows, mid-tones, and highlights). When the position of the point on the color wheel is adjusted, HELIOS shifts the hue of the tones towards the selected color. Use the grey slider next to the color wheel to adjust the color brightness.

Lift - Dark tones and shadows

Gamma - Mid-tones

Gain - Highlights

Offset - Overall image control

Saturation - Increases or decreases overall purity of colors. Full desaturation turns colors grey.

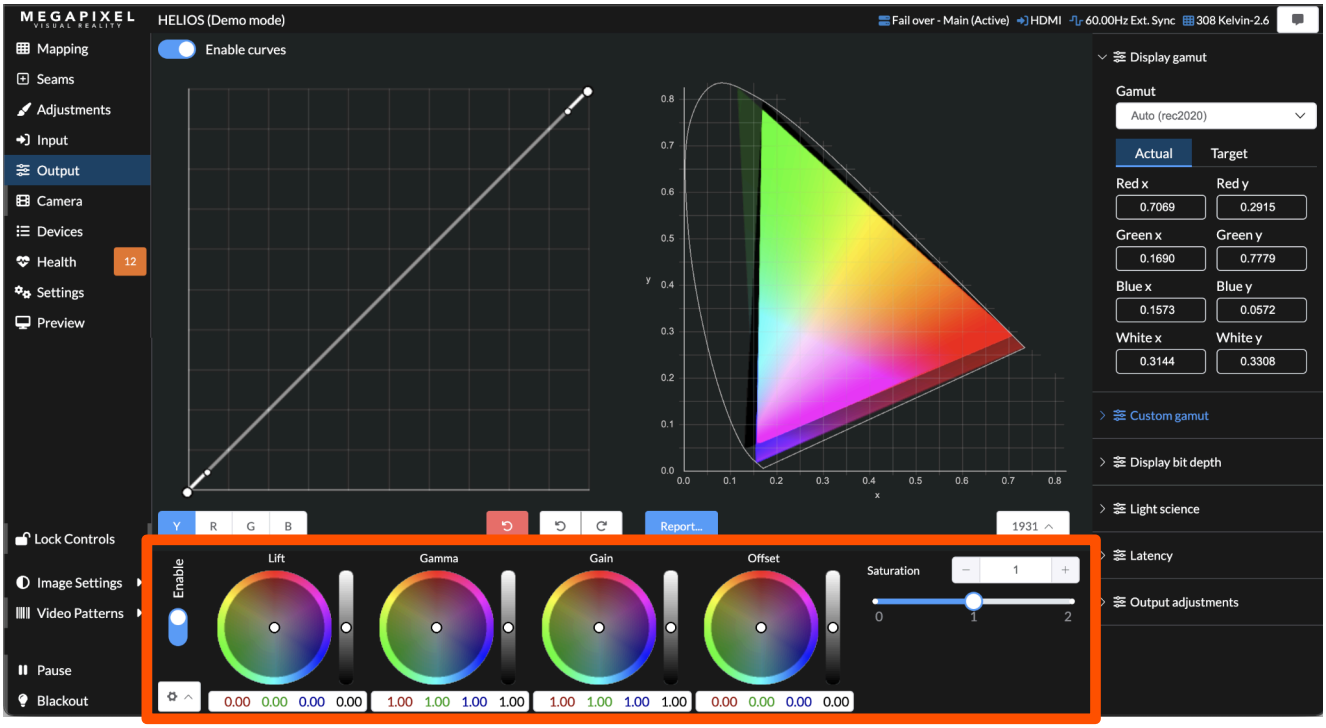


Figure 79: Color grading color wheels

Ultra Low Latency (Advanced)

HELIOS Ultra Low Latency (ULL) allows for as low as one (1) frame of delay through the entire system chain without the need for custom EDIDs or high frame rates from the source. HELIOS is operating in ULL mode when both ***Tile Low Latency*** and ***Processor Low Latency*** are toggled on.

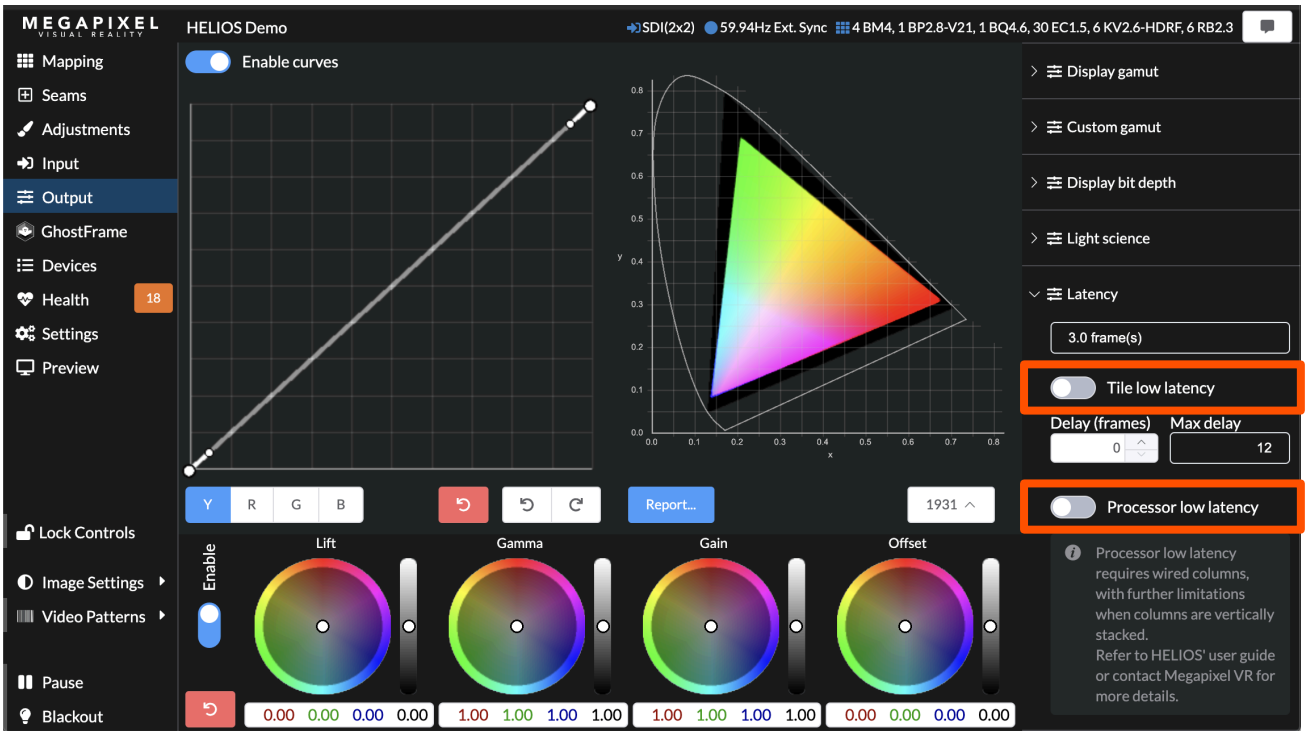


Figure 80: Latency settings

Ultra Low Latency (Advanced) - (continued)

Key rules:

- ***Processor Low Latency*** is compatible with ***GhostFrame***. When using multiple inputs with ***GhostFrame Multi-Source***, the inputs must be horizontally stitched. As an example, configure SDI as a (2x1) rather than a (1x2). See the **Input stitching** section for more information.
- Vertical stitching of inputs and Square Division are not supported.
- Tile cabling and mapping must be in columns (top to bottom and bottom to top are both ok).
- There are no capacity limitations or reductions when tiles are cabled as a single column high. Therefore, tile quantity per daisy chain is no different than normal (see the HELIOS Output Port Capacity section in **Appendix G**) for data daisy chain limits). In the example below, the tile type has a maximum daisy chain of six (6) tiles. Although some tile types can achieve larger daisy chains, this example is limited to six (6) for simplicity.
- Stacked columns (e.g. a wall that is taller than the maximum tile chain length) will have capacity reductions. The rule of thumb is that when columns are stacked, the maximum string length is halved from that of normal operation. The example tile type at normal operation has a maximum daisy chain of six (6). In a stacked configuration, the system requires chains of three (3). Additionally, only the top ½ of the input may be used. For more specific design guidelines contact MVR for assistance.

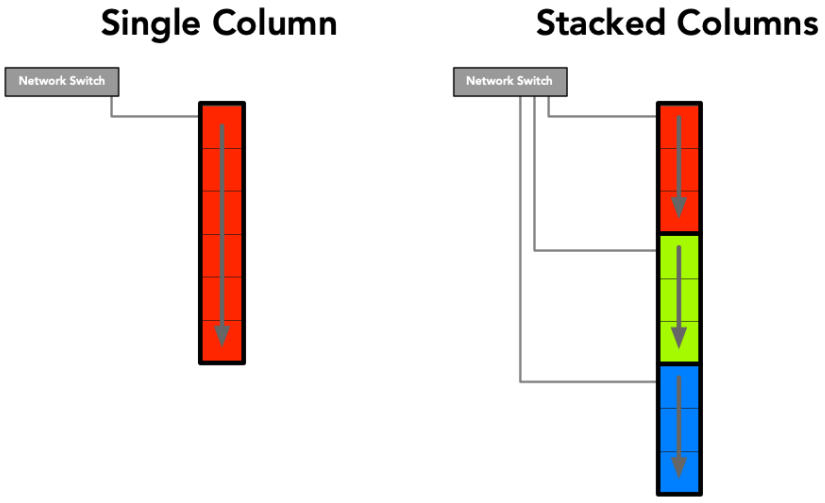


Figure 81: Single Column vs Stacked Columns

Ultra Low Latency (Advanced) - (continued)

In order to access ***Ultra Low Latency*** mode, enable ***Advanced Mode***. A hidden accordion menu will appear on the ***Output*** pane. Enable ULL mode with two toggles; ***Tile low latency*** and ***Processor Low latency***. ***Tile low latency*** reduces latency by one (1) frame. ***Processor low latency*** independently reduces latency by one (1) frame. Enabling both reduces latency in the system by two (2) frames. The example interface shown below reports ***3.0 frame(s)*** of latency in the system. With both latency modes toggled on, latency should report ***1.0 frame*** of delay.

1. Toggle ***Tile low latency*** on. The only restriction here is the tile firmware must support ULL.

2. Toggle ***Processor low latency*** on. Stacked column restrictions apply.

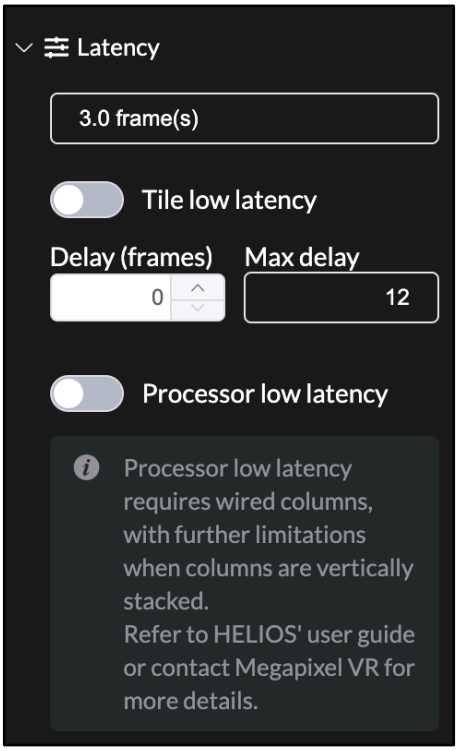


Figure 82: Ultra Low Latency

Ultra Low Latency (Advanced) - (continued)

Below are four test results with ***Low Latency*** off and on. Using the SDI output of an ImagePro-II* connected to the HELIOS system, the yellow line measures a phototransistor reading the tile's light output. The green line measures, the HD-15 (VGA) output of the same ImagePro connected directly to the scope.

Yellow - ImagePRO-II 720p50 -SDI → HELIOS → Tile → Scope (photo transistor)

Green - ImagePRO-II -HD15→ Scope

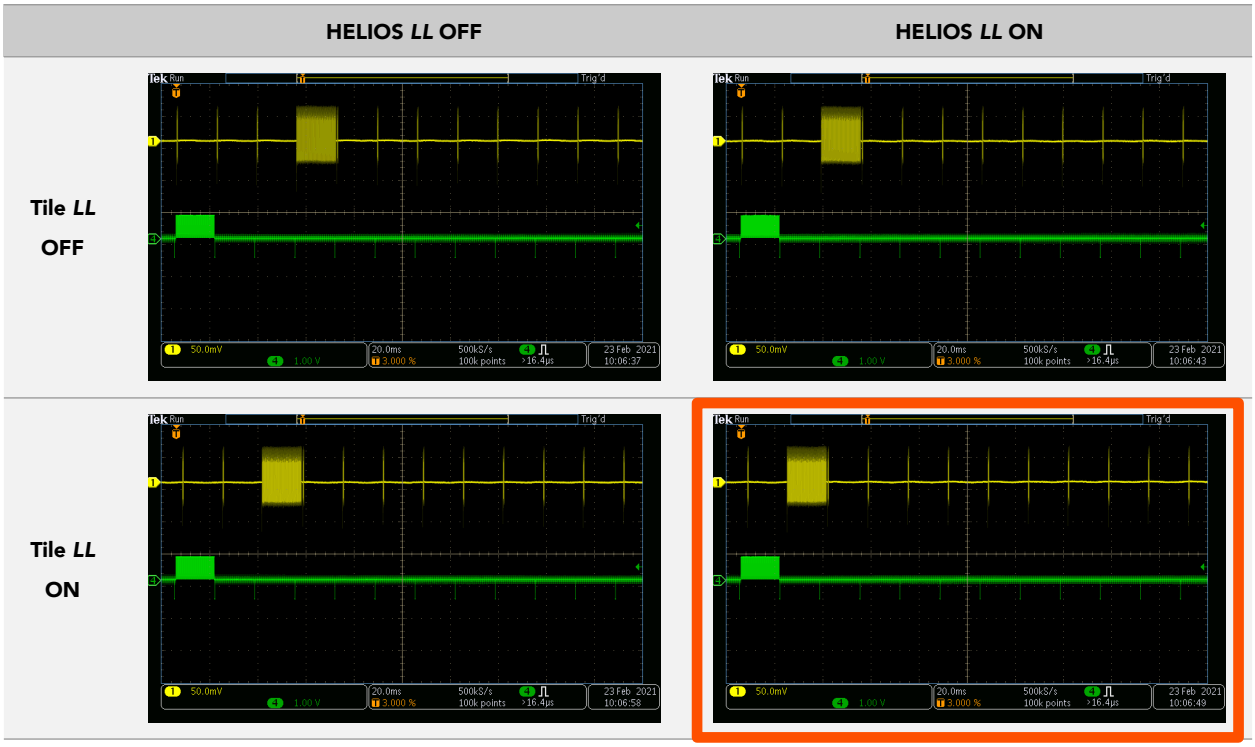


Figure 83: Ultra Low Latency oscilloscope readings

Top left image - Both (HELIOS and tiles) LL toggled **OFF.** Three (3) frames delay.

Top right image - Only the HELIOS LL function **ON.** Two (2) frames of delay.

Bottom left image - HELIOS LL **OFF** and tile LL **ON.** Two (2) frames of delay.

Bottom right image (Orange) - *Both* (HELIOS and tiles) LL toggled **ON.** One (1) frame of delay. This is Ultra Low Latency.

* The ImagePro-II is a registered trademark of Barco.

Output adjustments (Advanced)

RGB gains - Controls overall tile color gain. This is the final color adjustment point in the HELIOS color processing pipeline.

Black clipping - sets the black threshold. At zero the content will be displayed as it is encoded. Increasing the black clipping value will increase the portion of the content that is pure black. See the **Low Level Noice Reduction** section in Appendix D for a discussion on how to use this control.

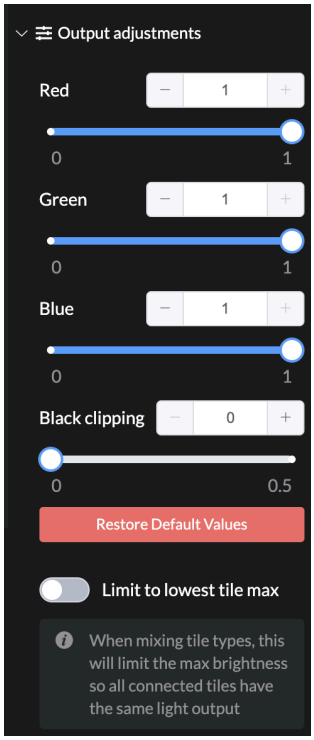


Figure 84: Output Adjustments (Advanced)

Limit to lowest tile max - helps in situations where mixed tile types form a contiguous display. HELIOS can restrict the brightness of all tile types to the limit of the tile with lowest max brightness. HELIOS calculates this in two stages. First stage sets the tile target L to the lowest tile when the ***Limit to lowest tile max*** is set. Then, the second stage will further reduce the brightness based on the PQ content max if the ***Input*** pane → ***EOTF adjustments*** → ***Limit brightness to content*** is set. The ***Image Settings*** menu will add the message ***(Limited by lowest tile max)*** below the nits report when this function is active.

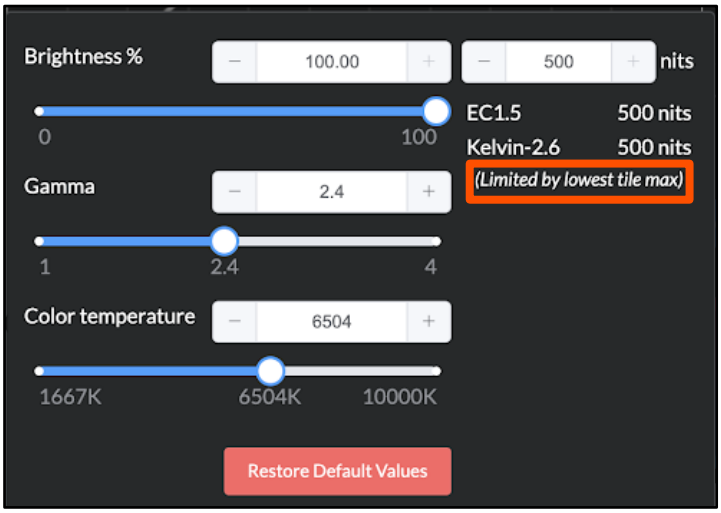


Figure 85: Image Settings message

GhostFrame (Advanced)

GhostFrame is a tool for the motion picture and virtual production industries that takes advantage of the high refresh rates of LED displays to interleave content for cameras with content meant for human vision. LED display panel refresh rates are usually many times higher than the video input frequency. With content usually delivered at 60Hz there is plenty of time for HELIOS to add several sub-frames (up to the tile limit) to the primary video signal. These sub-frames can be solid colors, still images and even secondary video feeds to support digital production tools like chroma key or motion tracking. GhostFrame gives the user control of where in time each sub frame is placed, and the luminosity of the frames. GhostFrame's patented process is able to make the; secondary video feeds, chromakey and tracking markers all invisible to the human eye, free of any flickering or strobing. Multiple cameras can capture independent images simultaneously as camera shutters are put in phase with different frames.

System bandwidth is unaffected by the use of still images, chroma key frames, and inverse images. These are all handled on the tile's processor. It is the video streams which are bandwidth costly. If a GhostFrame configuration makes use of two video streams, the overall system bandwidth is halved.

GhostFrame features require a separate license to activate (more information about licenses can be found in the Settings Pane **Licensing** section) please see **http://ghostframe.com** for additional details.

GhostFrame requires compatible LED tiles. Currently, GhostFrame is available on ROE Visual and Megapixel VR display products.

NOTE: Tile test patterns disable GhostFrame. Tile test patterns and tile ***Identify*** are mutually exclusive to GhostFrame.

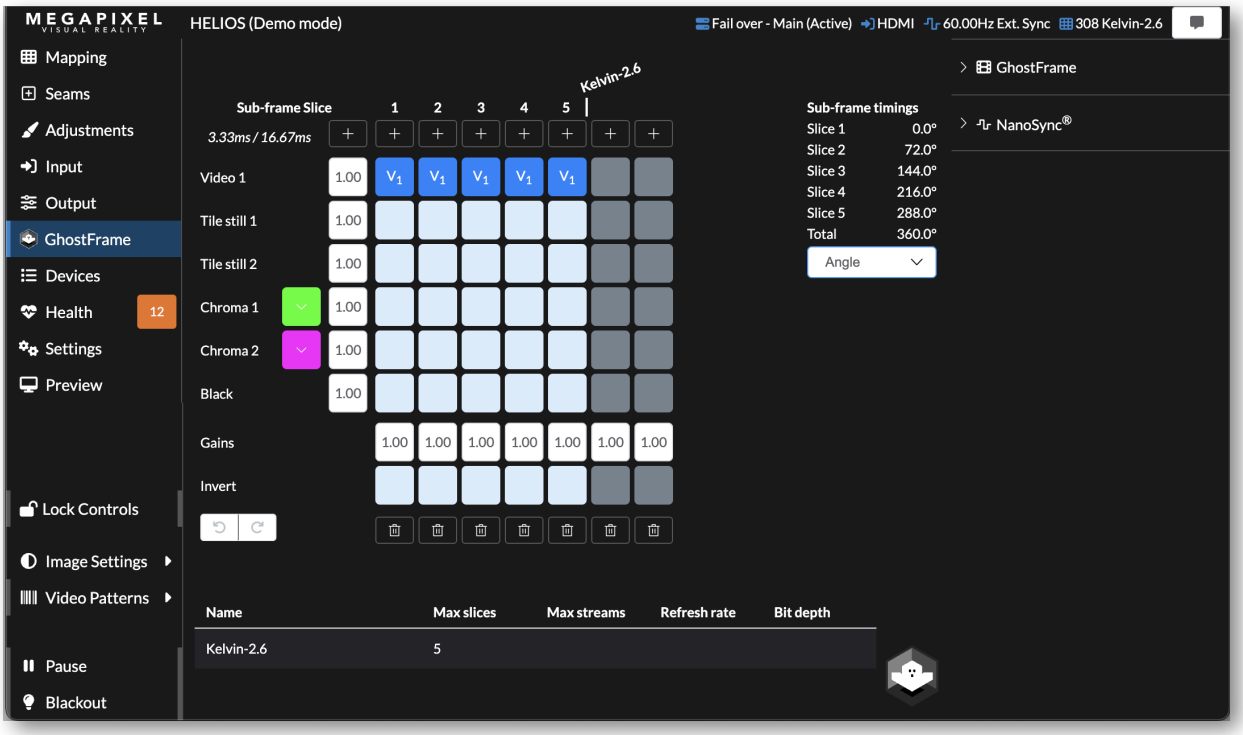


Figure 86: GhostFrame interface

GhostFrame Configuration

The GhostFrame menu is hidden by default, enable ***Advanced Mode***. ***GhostFrame*** will now appear in the navigation bar on the left. Select the GhostFrame pane to reveal the controls. The accordion on the right side of the page contains the main settings for GhostFrame. The ***Enable GhostFrame*** toggle enables/disables GhostFrame system wide. Once GhostFrame has been enabled system wide, use the GhostFrame toggle on the ***Mapping*** pane to enable/disable individual tiles or groups of tiles.

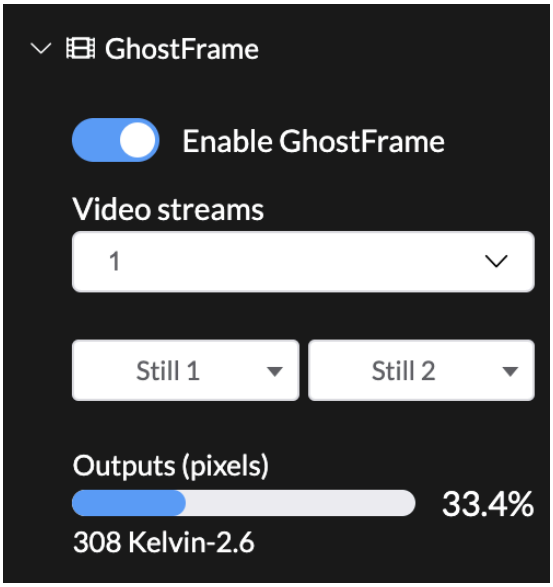


Figure 87: GhostFrame controls

The ***Video streams*** selection box is used to select the number of streams to use (remember multiple streams use more bandwidth!). ***Still 1*** and ***Still 2*** allow the user to capture a single frame of the live input to be used as a video slice. Captured frames are stored in a tile's volatile memory. If tiles are rebooted, any stored stills will be lost. Similarly, each tile will only store its portion of the video frame. If the tile(s) are re-mapped, the still frame needs to be re-stored. The ***Sync*** section allows the user to enable or disable external sync, add a delay to the sync, and set the internal refresh rate if there are no active inputs.

The ***Outputs (pixels)*** reports the current total pixel load as a percent of capacity.

NOTE: When using multiple input sources with ***GhostFrame Multi-Source*** in combination with ***Processor Low Latency*** the input sources must be stitched horizontally. As an example, configure SDI as a (2x1) rather than a (1x2). See the **Input stitching** section for more information.

The canvas section of the GhostFrame controls (center of the web UI) has a grid of square buttons that are used to activate and assign content to slices. The rows are the various slice type options while the columns represent each individual slice as they occur in time from left to right. Higher input frame rates mean fewer available sub-frame slices. Slices should be chosen based on desired features and camera frame alignment requirements. In some cases it may be better to choose less slices. Having less slices is better in cases where it aligns the number of slices with a multiple of the camera exposure time (consider 2/3 vs 3/4). Interleaving the various image options allow the user to hide slices in the video from the human vision that are at exact timings for camera shutters. While all of this is happening behind the scenes, the performer will see a normal video output on the LED wall.

To be optimal for human vision, GhostFrame relies on symmetrical timing. If the slices are not temporally balanced, the audience will see an unpleasant pulsing. To illustrate this, let's pretend like we have 12 slices available. If the slices are configured as in example 1 below to have a Chroma key and inverted Chroma key, the unbalanced frame can give the audience an unpleasant strobing effect. This is due to 10x 'Video 1' slices in a row then 1 Chroma + 1 Chroma Inverted. To correct this, work towards evenly spacing the Chroma keys across the frame (example 2 below). This eliminates the unpleasant pulsing by giving the human vision even intervals to blend the Chroma frames. Consult your GhostFrame integration partner for configuring and aligning camera capture for use with appropriate GhostFrame sub-frame slices.

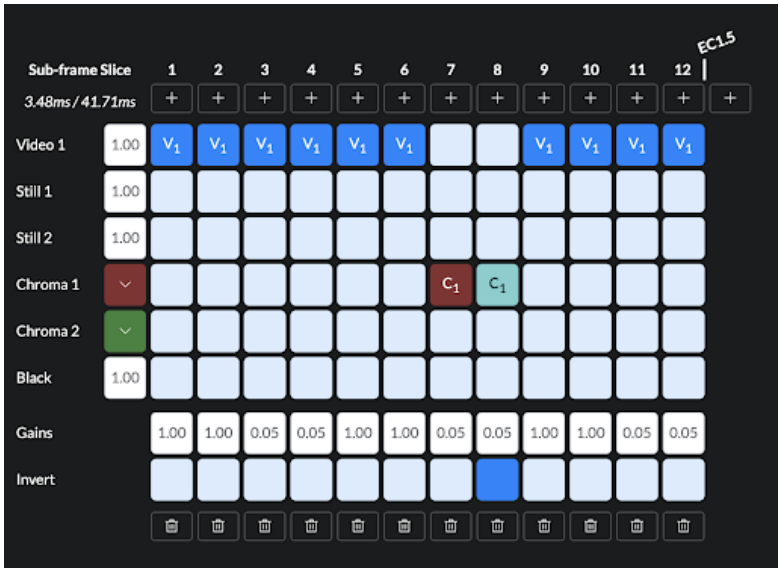


Figure 88: GhostFrame configuration (example 1)

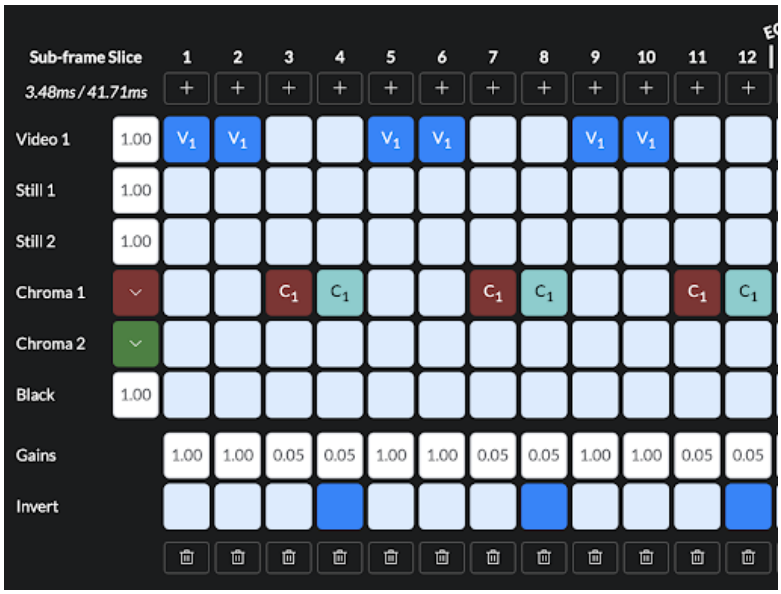


Figure 89: GhostFrame configuration (example 2)

Sub-frame Slice Gains

Click on the gains button (red rectangle below) to open the Sub-frame gains control window. By default, the gains button reads ***1.00***. The gains value is intended to help the user to quickly gauge the net effect the gains settings. The value represents the cumulative effect that all the controls are having on the Sub-frame slice. If the controls are increasing the gains, the value will be greater than ***1.00.*** If the controls for the group are decreasing the tile gains, the value will be less than ***1.00***.

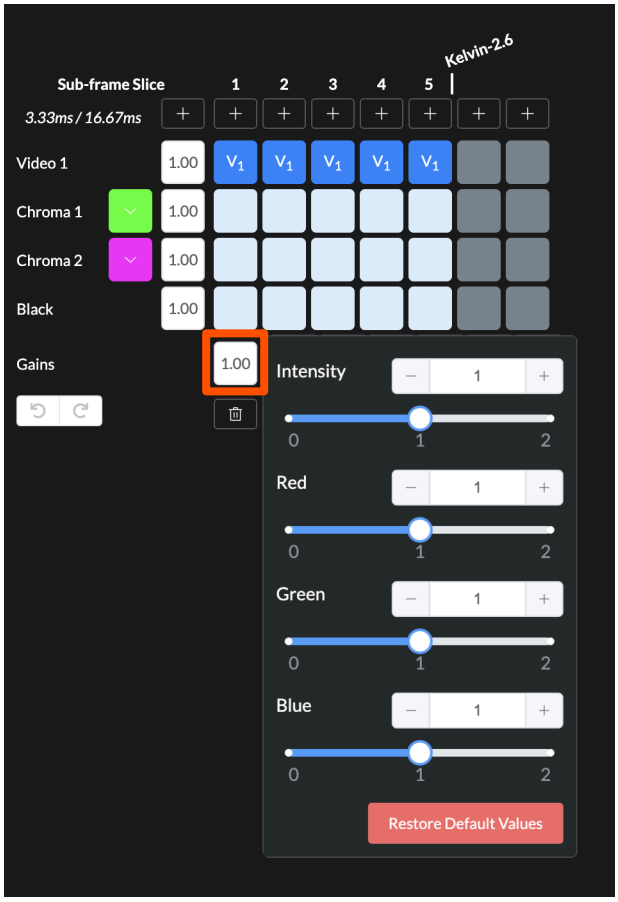


Figure 90: Sub-frame Slice Gains

Video Streams

Below are examples of a 4k canvas (grey area below). The small orange rectangle represents a mapped tile. Inputs are mapped to this canvas.

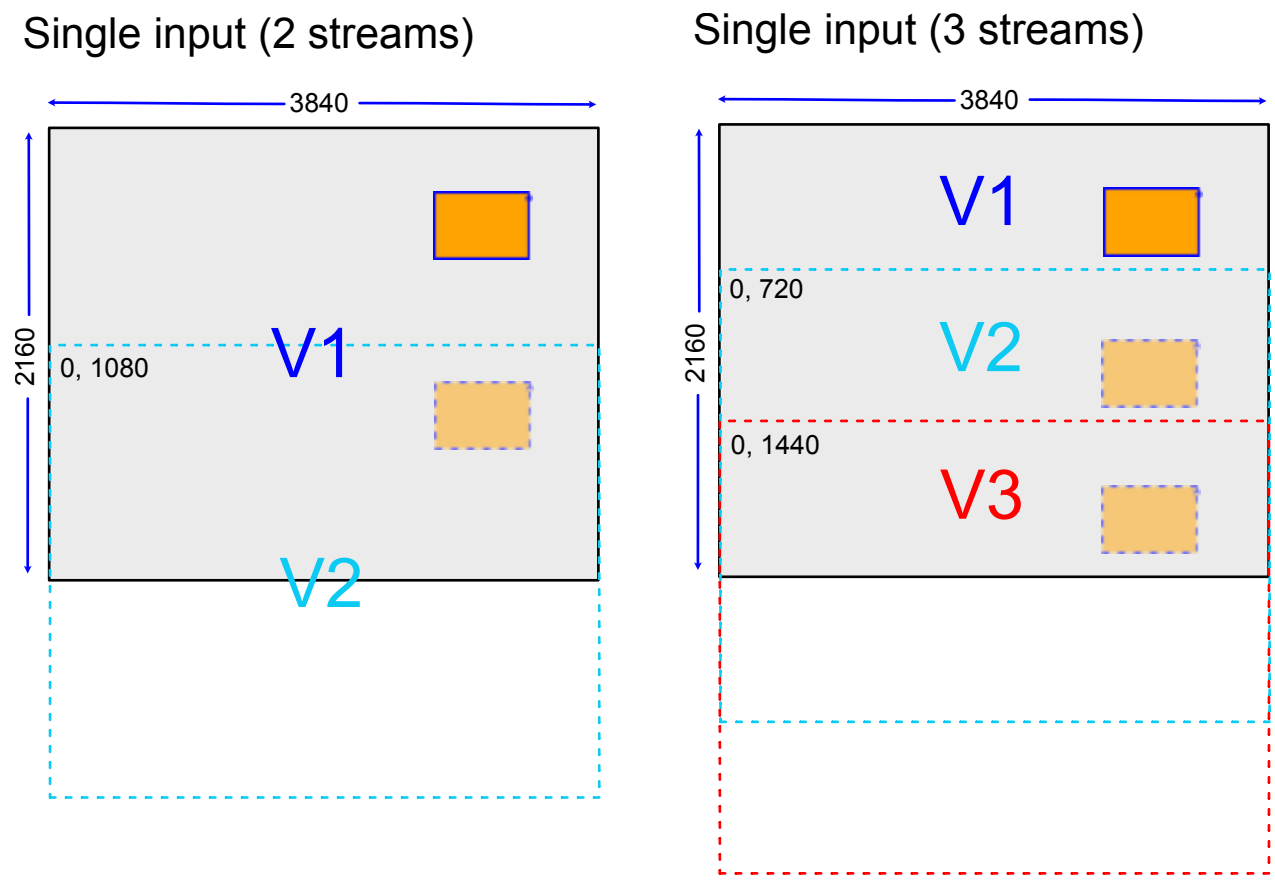


Figure 91: GhostFrame video streams

When two streams are selected, HELIOS offsets the second stream vertically by half of the canvas height. This way, the first stream contains the full canvas (as before), and now HELIOS has a second stream containing the bottom half of the canvas. The mapped tile will show content from the top orange section for the GhostFrame V1 slices and the bottom dashed orange section for the V2 slices. Think of the tile as being mapped within each of the dashed sections (V1/V2) ,but then showing its data from the underlying canvas (grey background).

When the number of video streams is set to 3. HELIOS offsets the V2 stream by a third of the canvas size, and the V3 stream by two thirds of the canvas size. So, V1 will show the top section, V2 will show the middle section, and V3 the bottom section.

Notice that this has nothing to do with the input. It's all relative to the canvas.

The point of this is that it allows a user to show different feeds on the panels at different points in time. With this system, the user can send multiple feeds into HELIOS. HELIOS will then combine these feeds into the same canvas. GhostFrame is used to split the feeds back out again temporally. The end result is a direct mapping from input to offset video stream output.

Below is shown what happens when HELIOS is given two inputs and GhostFrame is set to two (2) streams. The second stream is offset half way down the canvas, and the second input is also placed in the second half of the canvas. This results in V1 showing content from the first input and V2 showing content from the second. All of this happens in the background and allows the HELIOS to use one canvas to interleave multiple video streams.

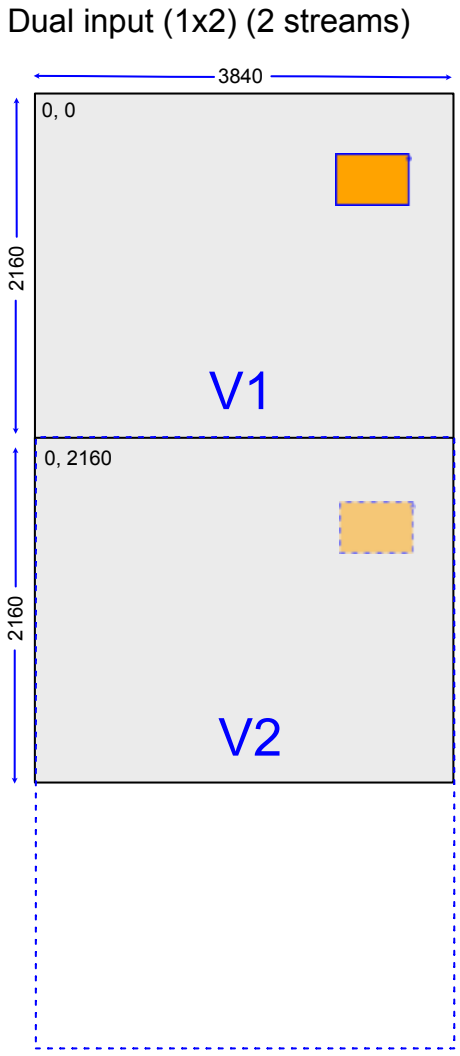


Figure 92: Dual input stream position

NOTE: Tiles can opt out of GhostFrame and be set to display any of the video streams. See the **Mapping> Tile configuration** section for more information.

Camera (Advanced)

Without a GhostFrame license, HELIOS will display the Camera pane. The Camera pane is a limited subset of the full GhostFrame tools. As such, all of the rules and methodology discussed in the previous section of GhostFrame apply to Camera. The Camera pane is used for aligning camera shutters to colored slices. One video slice and colored slices are possible, but stills and additional video slices require a GhostFrame license.

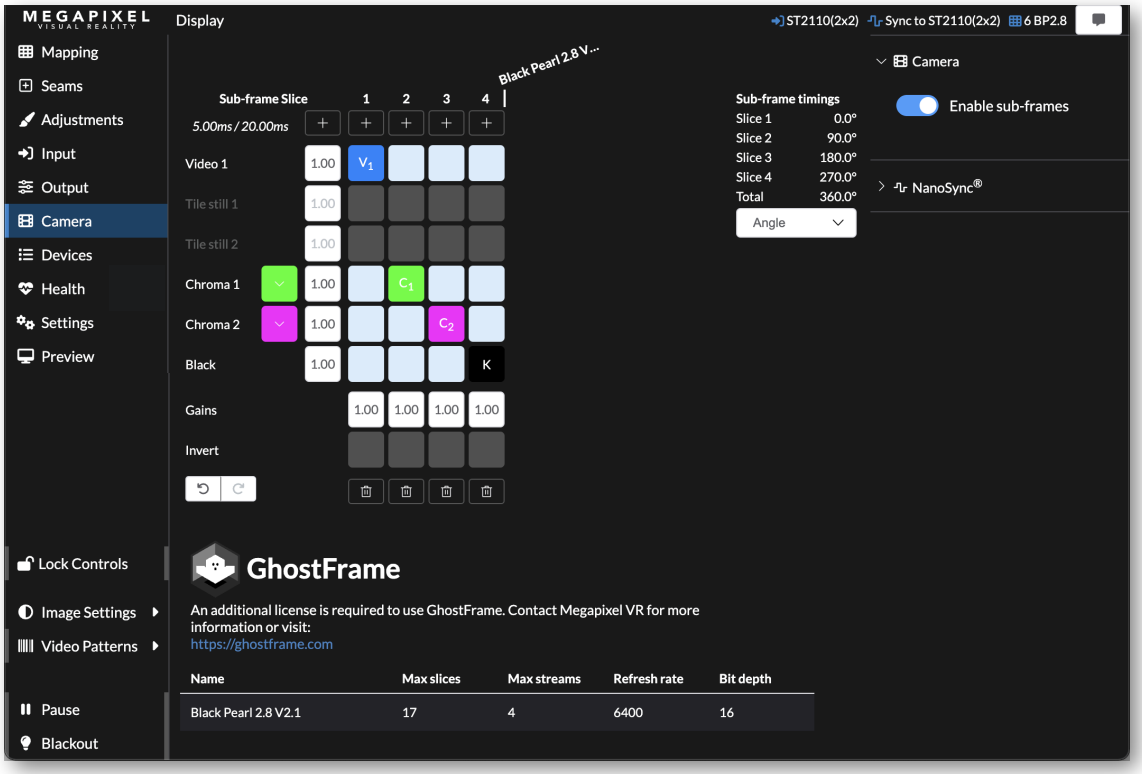


Figure 93: Camera interface

NOTE: Tile test patterns disable Camera. Tile test patterns and tile ***Identify*** are mutually exclusive to Camera.

Devices Pane

The Devices pane is a dynamic list of all connected system devices. The information is split into two tabs, a ***Processing*** tab and a ***Display Devices*** tab. This pane is usually the first place a system technician will check to discover the status of a system.

Processing Tab

Divided starting at the top with information for the HELIOS ***Processor***(s) followed by ***Network Switches***.

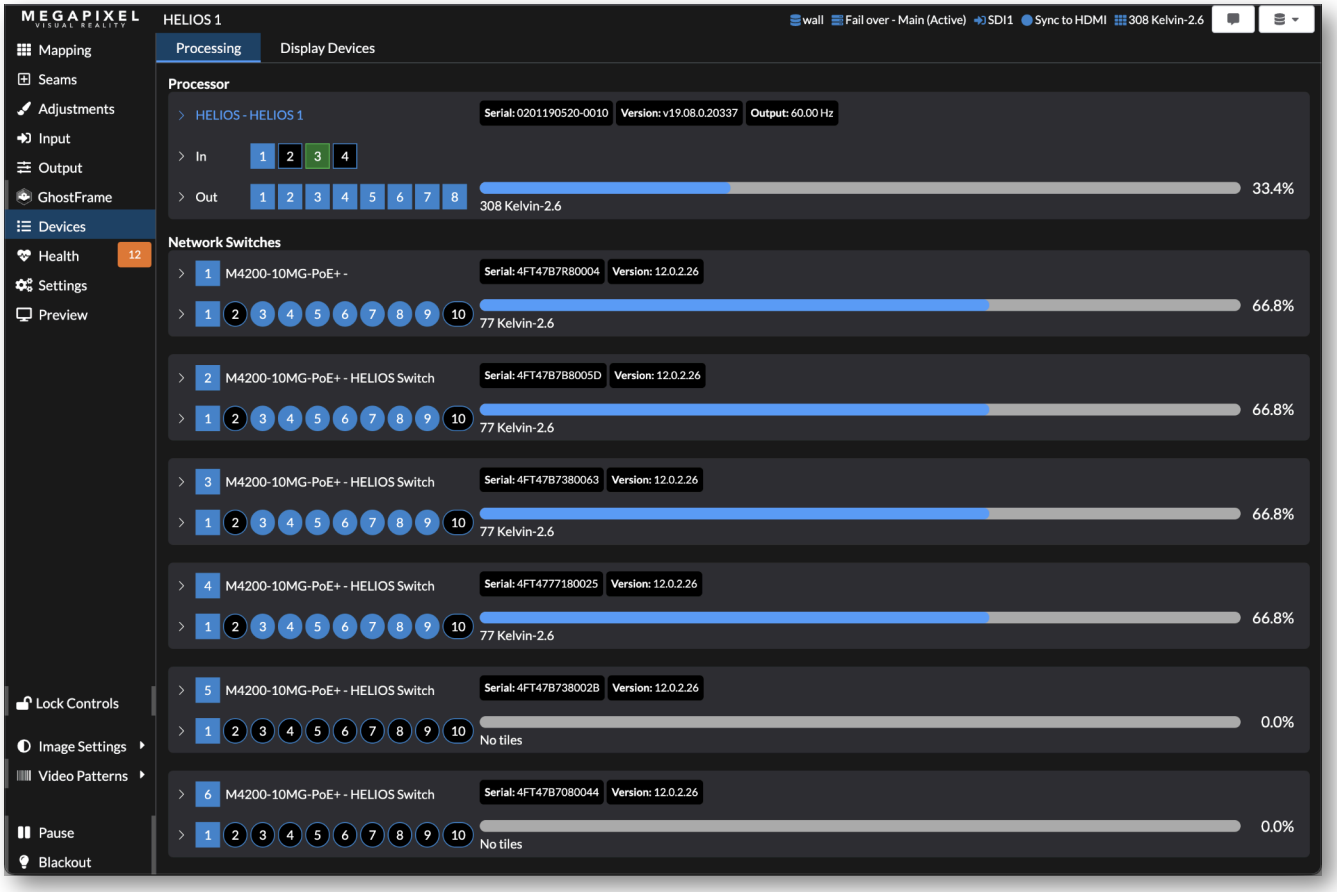


Figure 94: Devices pane

Processor

The main device section of the HELIOS Processor displays the full list of tracked parameters. Use the description field to name the processor as desired. This is the same as changing the name in ***Settings > Description***.

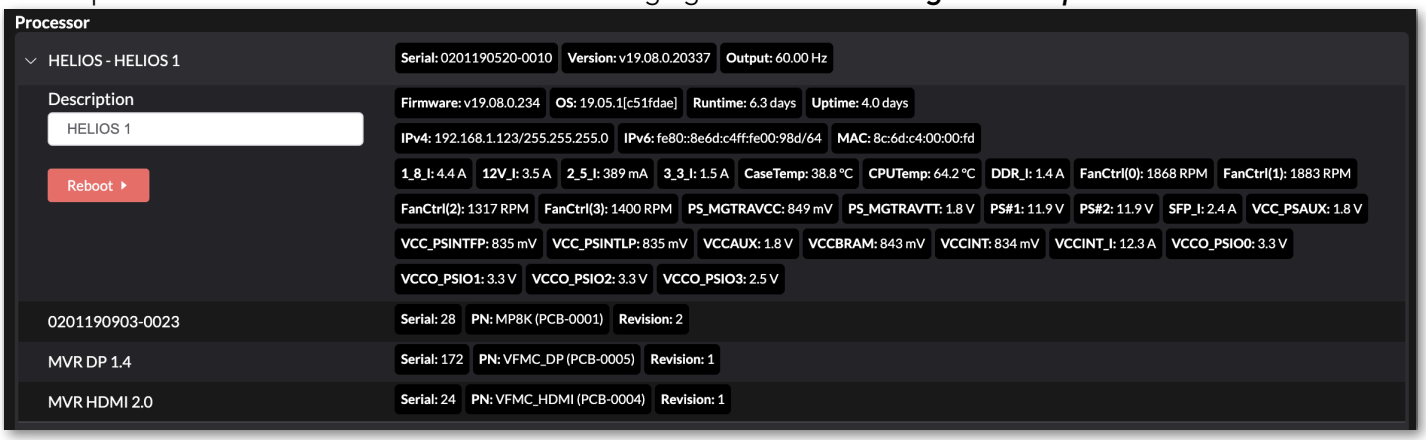


Figure 95: Devices Pane - HELIOS Parameters.

The ***In*** section of the HELIOS Processor displays details about the input SFP+ units. The square icon with the number on it is the input icon. When this icon is a blue square with white text (input 1 in the example below) the unit is receiving video through the SFP+. When the HELIOS recognizes the SFP+ but there is no video, the icon will be a dark green (input 3 in the example below). In both blue and dark green modes the there will be parameters displayed and a label regarding the type of SFP+ that is in the slot. A black with light blue outline icon (ports 2 and 4 in the example below) indicates that the HELIOS unit does not recognize any SFP+ in the slot.

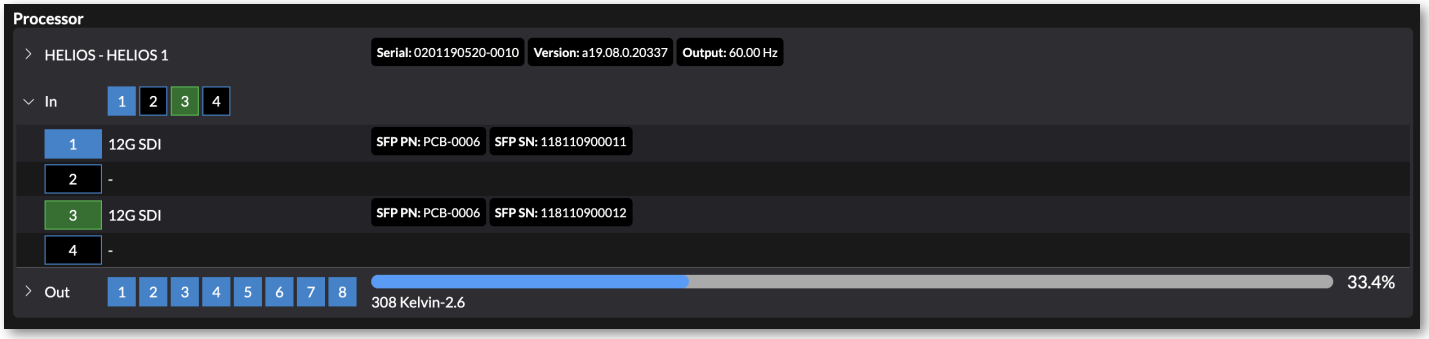


Figure 96: Devices Pane - HELIOS Inputs

The ***Out*** section shows the status of the outputs and a percentage of utilization of the entire HELIOS Processor. Expand the output section of the HELIOS Processor to see details about the outputs.

The shape and the color of the port indicators relate to the port connection. Links connecting to a processor are square. So all the processor ports are square. The port on the switch connecting to HELIOS will be square (as it's connected to a processor). Similarly the upstream port on the first tile in a chain is also square (as it links back to a processor). Standard HELIOS outputs will always be square since all Standard HELIOS output SFP+ units are 10Gb.

Each port shows a progress style bar showing the port's percent utilization. Underneath the bar is the quantity and type of tiles connected.

Indicator Color	Meaning
Orange	Unsupported SFP
Red	< 1GbE link speed
Blue	1 GbE - 2.5 GbE
Dark Blue	10 GbE
Dark Green	SFP with no link
Inverted Blue	SFP with link

Figure 97: Devices pane - HELIOS Outputs

Network Switches

This section displays details for the network switches. Enter a description for the switch if this is helpful for managing the system. This assigned description is persisted within the switch. A remote reboot switch button can also be found here.

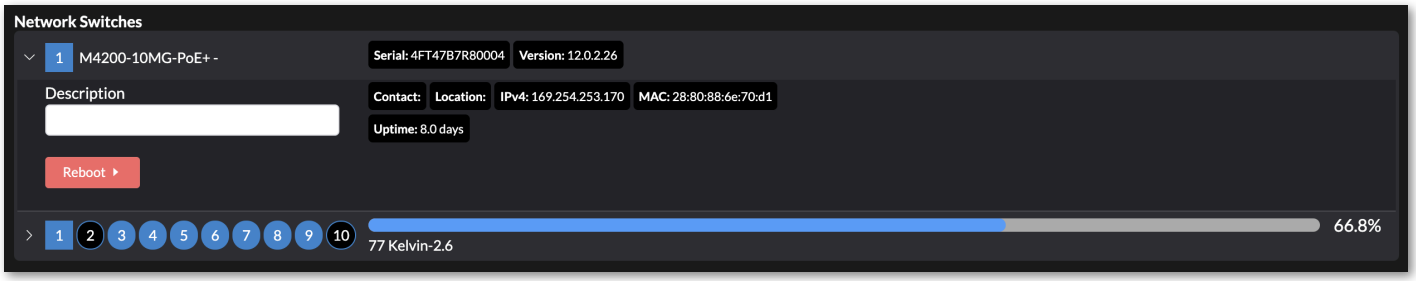


Figure 98: Devices pane - Network Switch Parameters

The ports section displays details about the ports. Here again, the square shape icon indicates that 0/1 is connected to a processor. Switch port IDs use slot/port nomenclature. On standard size switches, all ports are considered slot 0; port IDs are numbered 0/1 - 0/9 as shown in the example below. HELIOS also works with larger switches with up to 96 ports. These switches are divided into 12 slots of 8 ports each. Numbering follows the same schema starting with slot 0.

To the right of each port ID is a percent utilization bar with connected tile quantity and type below.

Figure 99: Devices pane - Network Switches

Display Devices Tab

The Display Devices section contains a list of connected tiles with detailed parameters and status for each. The list can be sorted by any of the column headers. The ***Alerts*** column (orange rectangle below) can be especially useful to identify all devices with active alerts.

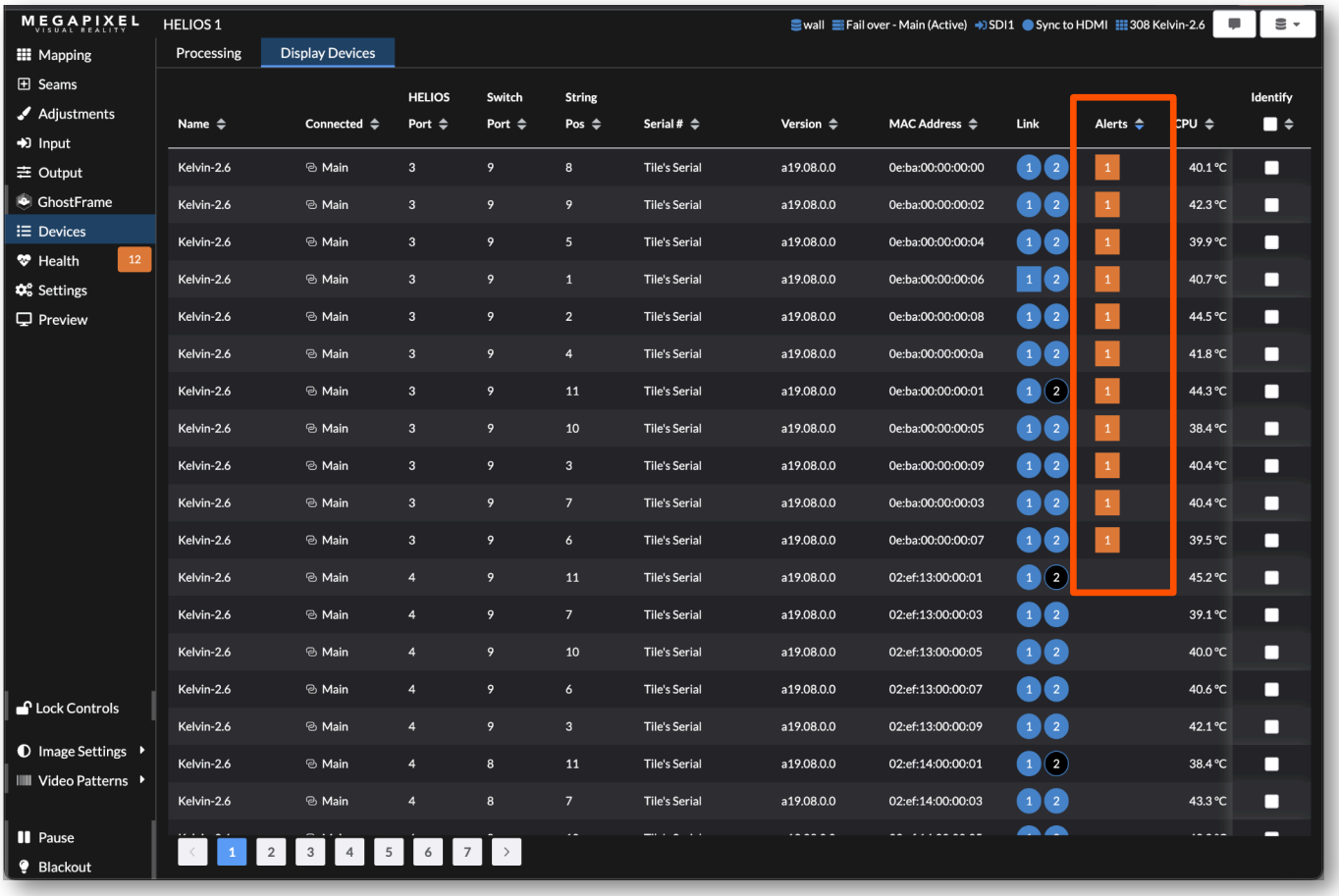


Figure 100: Devices pane - Display Devices

Health Pane

The health pane contains comprehensive network status information about all parts of a connected HELIOS system. This pane contains three tabs; ***Alerts***, ***Heat map*** and ***Reports***.

Alerts

To help prioritize alerts, the HELIOS color codes alert badges based on the severity of the condition.

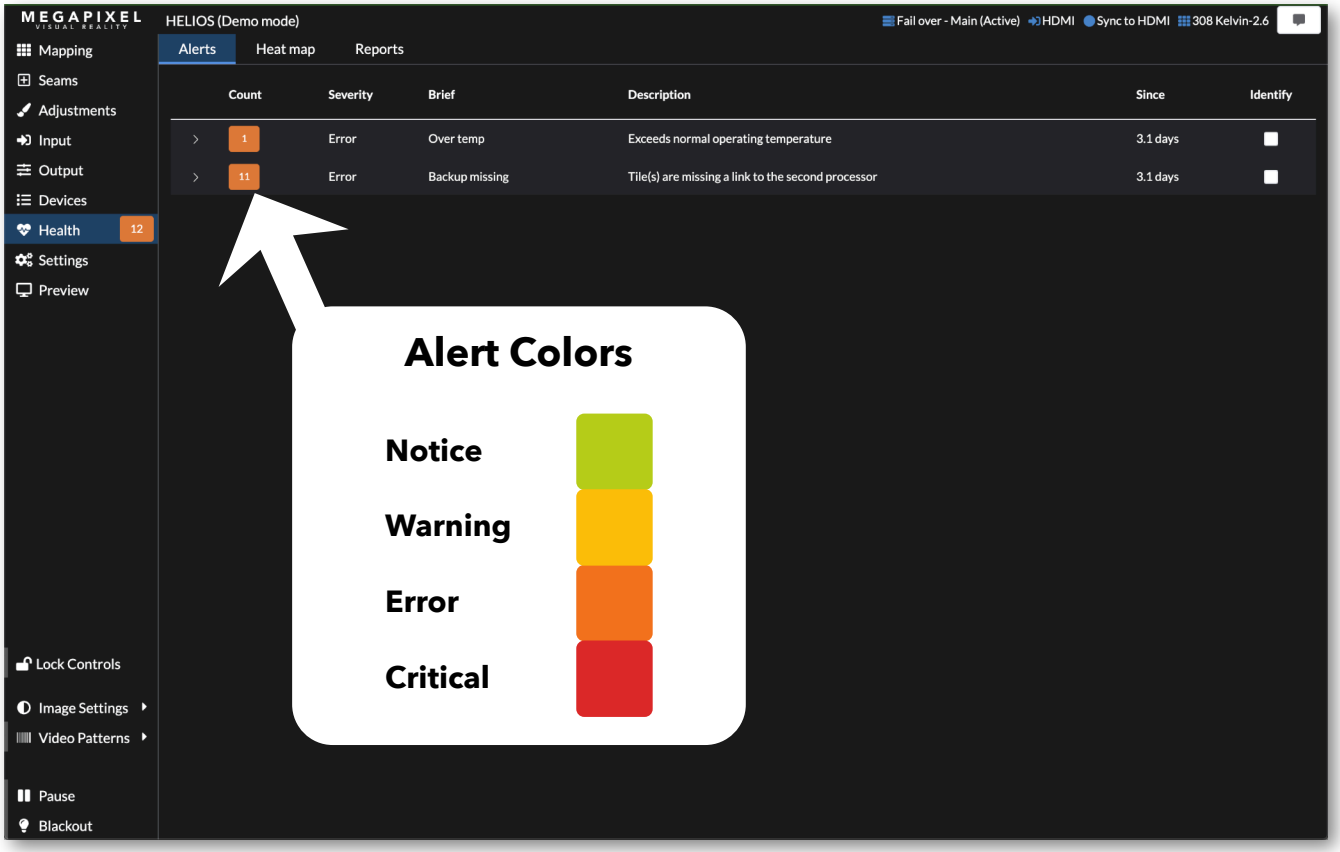


Figure 101: Alert Color Codes

The alerts tab provides a list of devices that need attention. Use the disclosure triangle to reveal details about the location of each alert within the system.

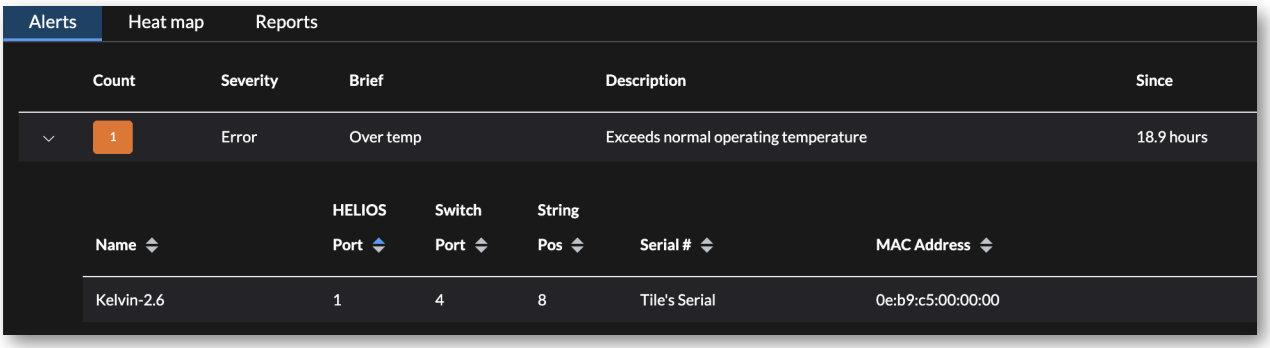


Figure 102: Alerts tab

Heat map

The heat map tab displays thermal information for tiles in the system. Temperatures are indicated in a rainbow palette that shows thermal differences in 5° degree increments.

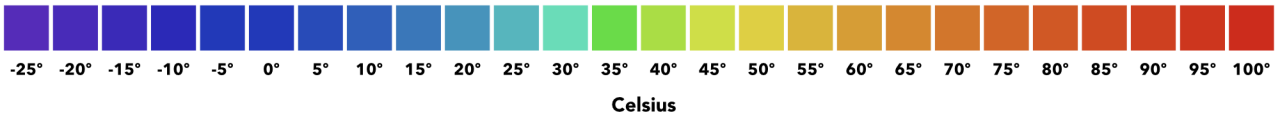


Figure 103: Color to temperature

In the example below, one tile has raised an alert with a CPU at 89.5°C. Use this view to quickly identify any temperature anomalies in the system. The heat map is not just useful for recognizing panels that are excessively hot. It is good practice to warm LED panels up prior to being used at full brightness. Use the heat map to monitor progress and to confirm when panels are ready for use.

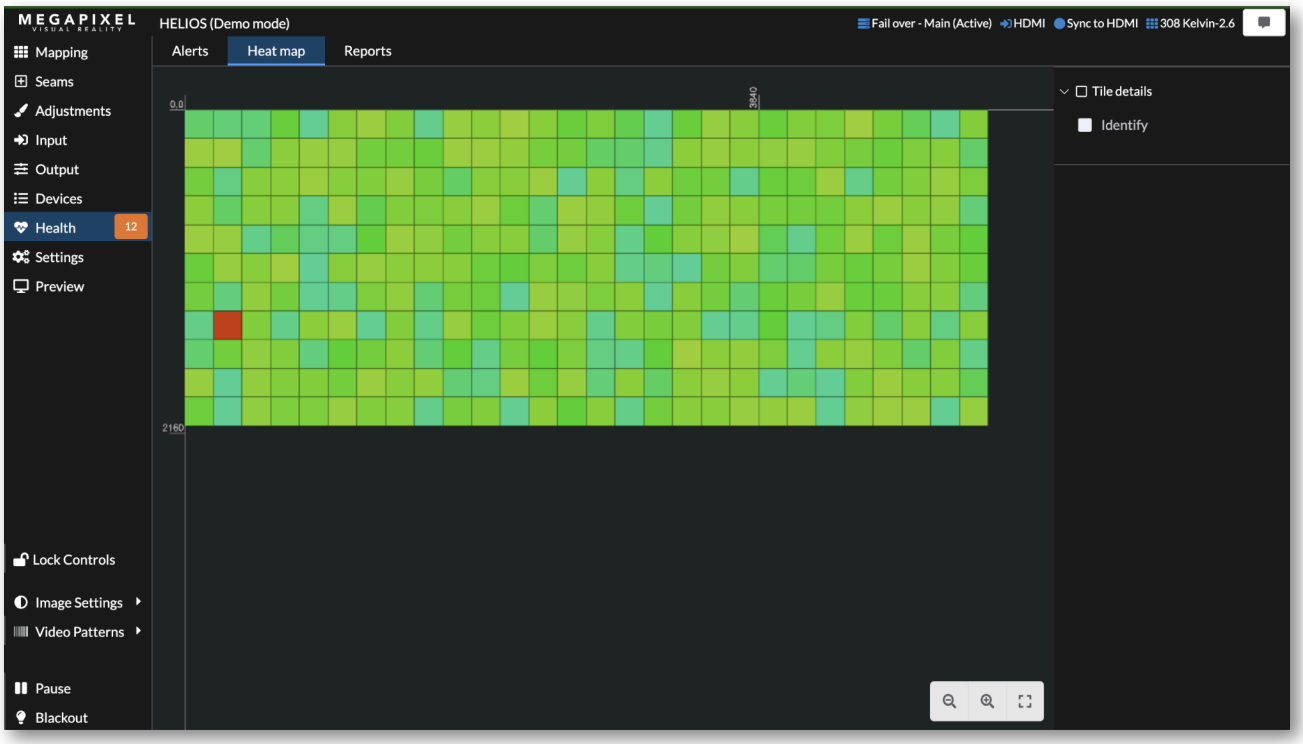


Figure 104: Heat map

Reports

The reports tab can fetch data from tiles and provide a downloadable (csv file format) report for several data points in the system. This function queries tiles for the information when a selection is made with the drop down menu. The page will be blank until a report type has been selected. In the example below, ***Alerts*** was selected.

Alerts - A view of devices that need attention.

Device uptime/runtime - A view of all devices and how long they have been operational. Useful for finding units that reboot more often than others.

Device Serial Numbers - A view of all SNs, useful for inventory tracking.

Device Versions - A view of active device software and firmware versions.

Fiber sensors - A view of the fiber hardware's health.

Tile counters - A view of tile connectivity health. These various diagnostic counters can help with troubleshooting tile health and cable issues.

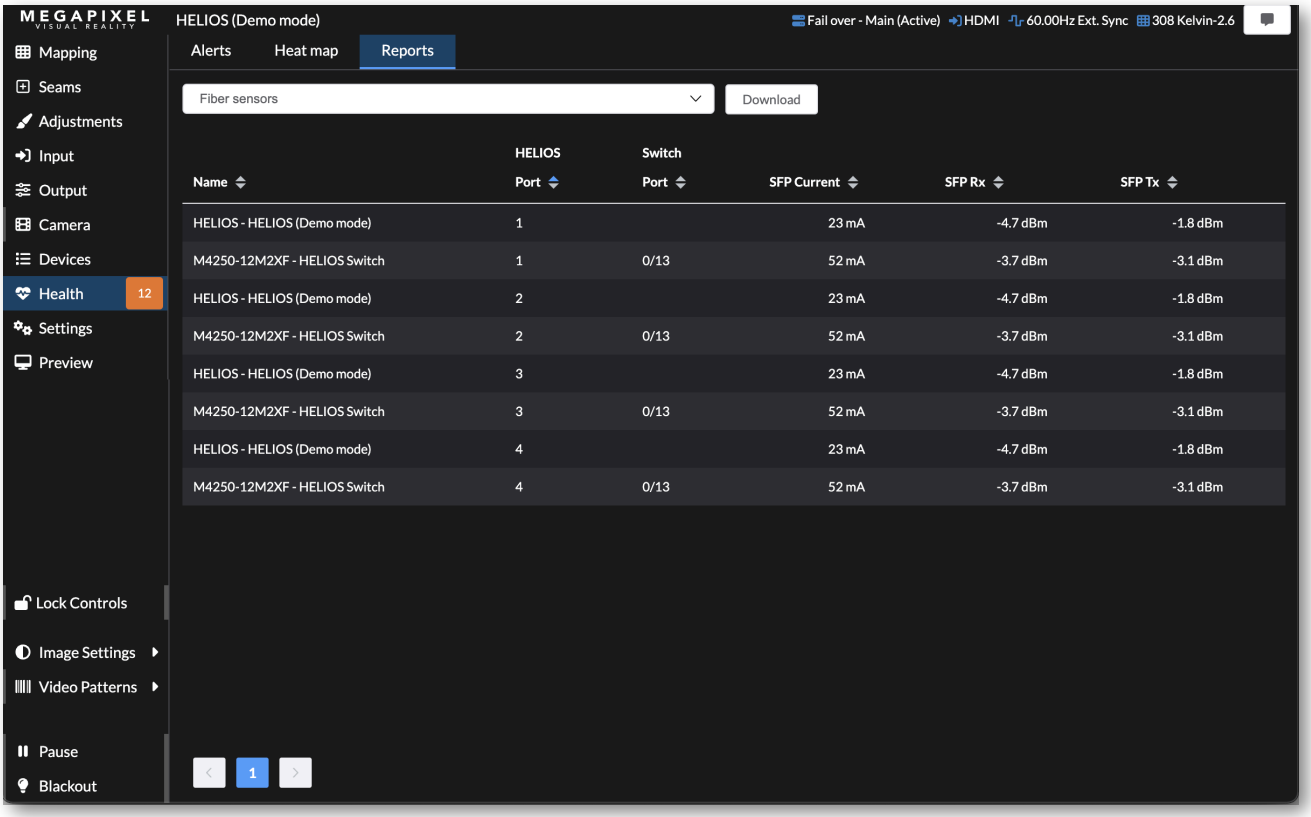


Figure 105: Reports tab

Settings Pane

With **Advanced mode** enabled the ***Settings Pane*** contains eight (8) tabs; ***Processor Settings***, ***Security, Still Store, Scheduler, Saved Configurations***, ***Update Center***, ***Shortcuts*** and ***About***. The following pages describe the functionality found on these tabs.

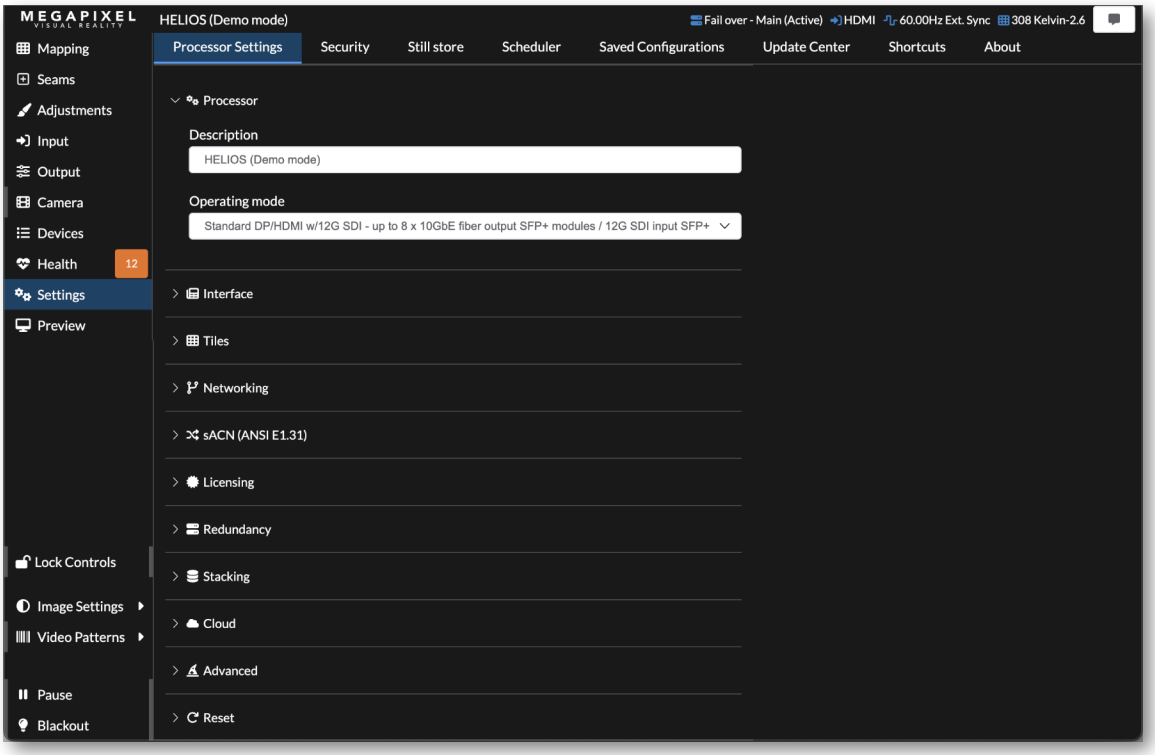


Figure 106: Processor settings.

Processor Settings

- ***Processor***

  Description - Enter the name of the processor, changes are updated live.

  Operating Mode -

  - ***Standard license*** - HELIOS can use both 10GbE fiber SFP+ modules or 1GbE copper SFP modules.
  - ***Junior license*** - HELIOS can only use 1GbE copper SFP modules.

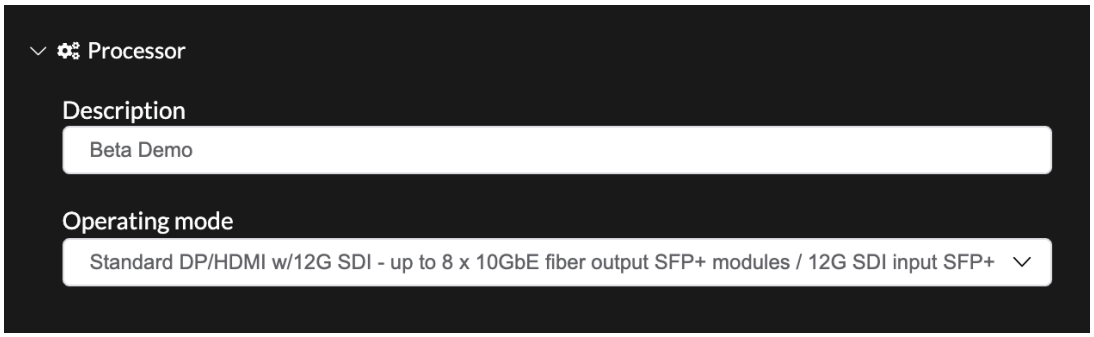


Figure 107: Description and Operating mode selection

Operating Mode (continued) - Changing the operating mode will trigger a pop-up warning asking for confirmation. Select ***Switch Mode*** to change and reconfigure the system for the new module type.

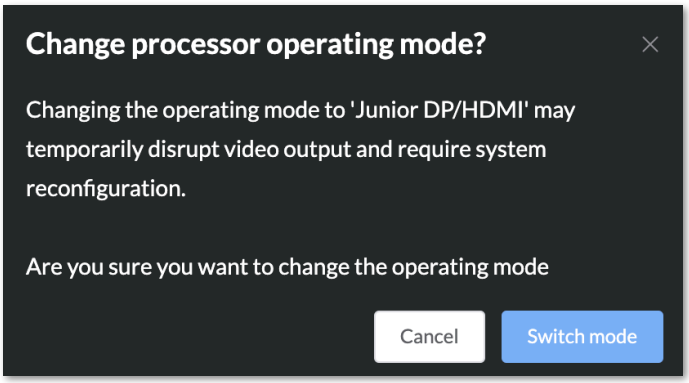


Figure 108: Switch mode confirmation

- **Interface -** Select between a ***Dark*** or a ***Light*** colored theme.

Figure 109: Theme selection

- **Tiles -**
  - ***Show Rear Indicators*** toggle - see ***Tile details*** for more information).
  - ***Identify behavior -*** select how tiles should behave when the tile Identify feature is enabled. Techs usually set this to ***Rear indicator only*** once a system is show ready.
  - ***Fan control -*** when supported by tile firmware, select from available tile fan modes.
  - ***Low power mode -*** when supported by tile firmware, set how tiles behave when **global blackout** is enabled.

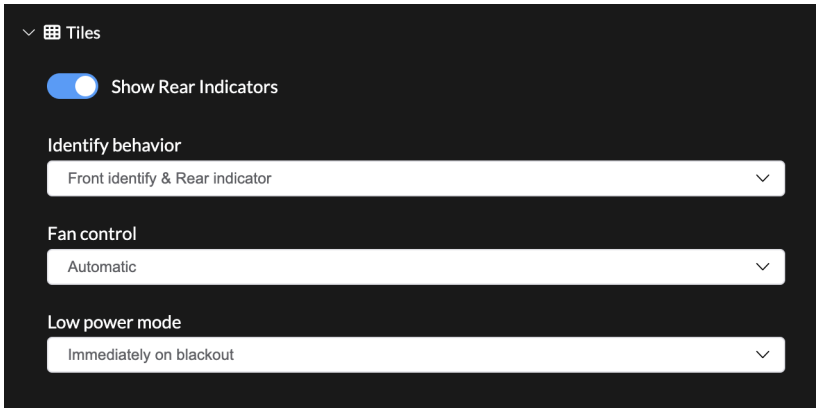


Figure 110: Tile setting

• **Networking** - Toggle on/off network discovery protocols (DNS-SD + SSDP) and configure the IP settings of the HELIOS Processor (see **IP Addressing**) for more details on how these controls are used.

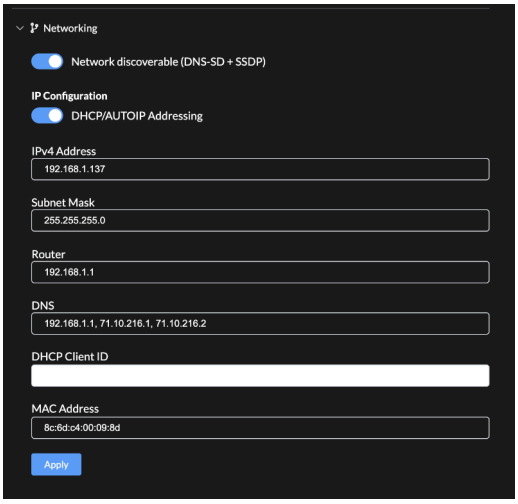


Figure 111: Networking

• **Networking (Advanced) -** With ***Advanced mode*** enabled, the ***Networking*** accordion will display a ***Redirect to HTTPS*** toggle. Toggle on to redirect all browser ***http://*** requests to ***https://***.

HELIOS supports customer provided HTTPS certificates. This feature allows users in high security conscious applications to be able to load their own signed HTTPS certificates. HELIOS by default uses a self-signed certificate. Users can upload their own certificate using the ***Upload cert + key*** button (arrow below). This will show a dialog where a user can upload a ***cert + private key*** in ***pem*** format. Once applied, all future https sessions will be secured with that certificate. The advantage of loading your own certificate is that it can be properly signed. Once signed, the connection can actually be secure and properly validated. Adding a signed certificate will also remove the certificate warning HELIOS gets when using self-signed certificates. See the **Seams pane** section for more information about this error.

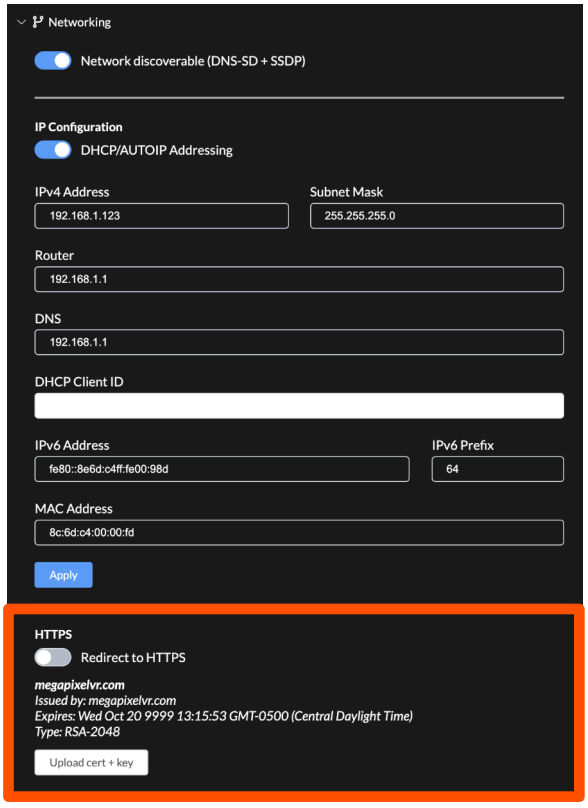


Figure 112: Networking Advanced

• **sACN (ANSI E1.31)** - Use the sACN or E1.31 protocols to control the HELIOS Processor. When sACN is valid and active, a green bar with the name of the sACN will be shown above the channels. The GUI controls are locked out for sACN controlled functions and function names will be highlighted in 'bright turquoise' throughout the interface.

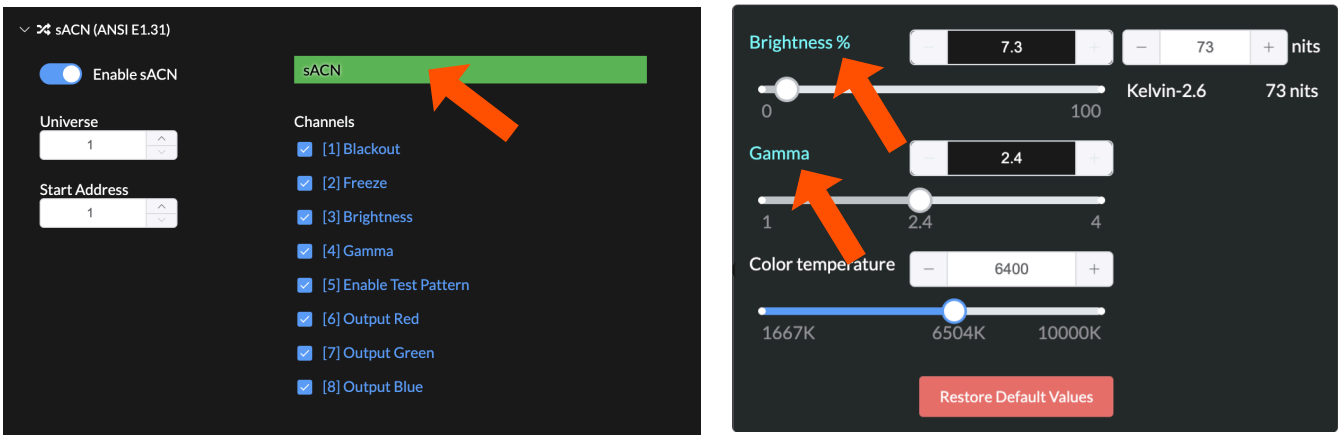


Figure 113: sACN enabled

The table below describes how HELIOS will behave when it receives the listed sACN values.

Channel	Function	Value
1	Blackout	0 = Normal operation | 1 - 255 = Blackout
2	Freeze	0 = Normal operation | 1 - 255 = Freeze
3	Brightness	Slider position % mapped to sACN
4	Gamma	Slider position % mapped to sACN
5	Test Pattern	0 = Normal operation | 1 - 255 = Show test pattern
6	Output Red	Slider position % mapped to sACN
7	Output Green	Slider position % mapped to sACN
8	Output Blue	Slider position % mapped to sACN

• **Licensing -** HELIOS units require a license to operate. There are two main types of licenses, HELIOS Standard and HELIOS Junior, other specialized licenses such as the GhostFrame license are also available. Shown below is a HELIOS Standard license. To enter a license use the ***Activate license*** button. This button allows license activation via an activation key. The web UI will then communicate with the MVR licensing server to generate a license for the system. Alternately, to obtain a license the system ID and serial number will need to be sent to a MVR representative. The **About** tab (shown later in this section) has a ***Download Support Archive*** button. Contact your Megapixel VR representative with this archive to obtain new or upgrade existing licenses. Once the new license file has been obtained, select the ***Upload license*** button, then navigate to the license file on the local host machine to load a license into the HELIOS.

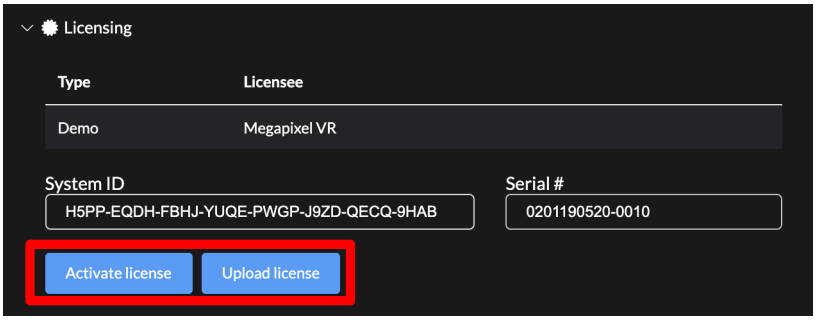


Figure 114: Licensing

• **Redundancy (Advanced) -** Please see the **Data Redundancy** section in Appendix F for details.

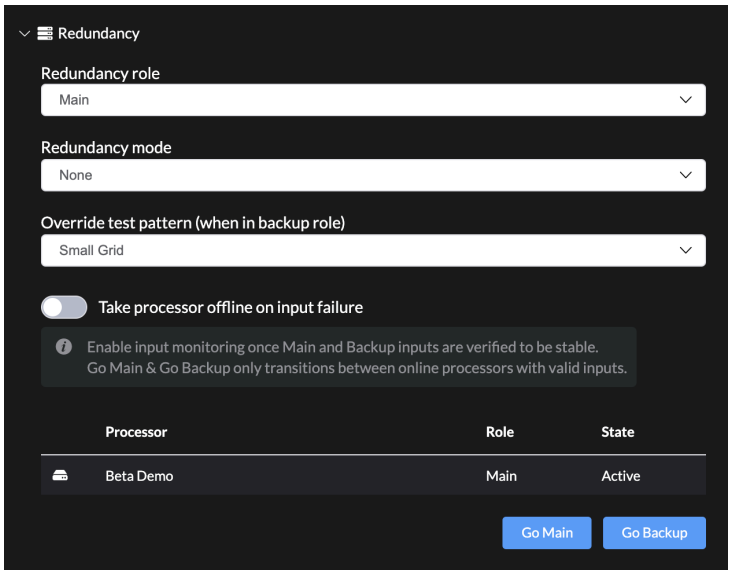


Figure 115: Redundancy settings

- **Stacking (Advanced)** - Stacking allows individual processors that operate sections of a large screen to synchronize functions such as blackout, pause, and color adjustments. In most cases, stacking should be used with redundancy in the HELIOS system. Enter a ***Stack*** name to have the processor join a stack. In the example below, the current HELIOS processor has been assigned to ***Stack 1.*** Below the ***Processor stack*** name field, a table shows that HELIOS is aware of another processor in the system named ***A Backup Processor***, assigned to ***Stack 2***.

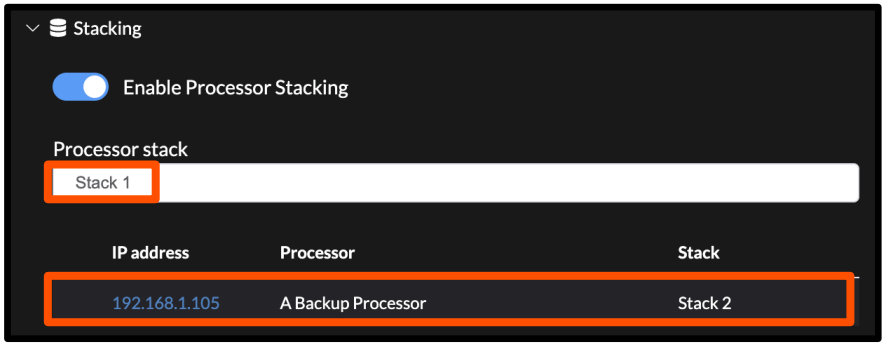


Figure 116: Stacking settings

- **Cloud -** Enable analytics to be sent to the development team.

- **Advanced** - When advanced features are enabled, several features that have not been selected for general release will show up throughout the user interface.

- **Reset -** Returns a unit to factory defaults. It removes all mapping, saved configurations, and saved software/firmware. Creating a saved configuration prior to resetting is recommended.

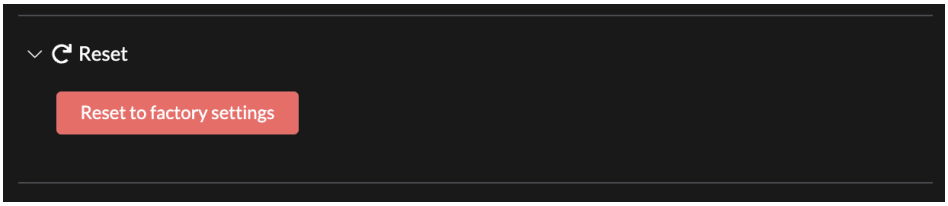


Figure 117: Reset to factory defaults

Security (Advanced)

In the ***Security*** tab, HELIOS can be configured to require a user and password for access. Press the ***Create User*** button to open a form window for the user info. It is good practice to create an Admin account first. Once security is enabled, standard users will only see a list of logged in users.

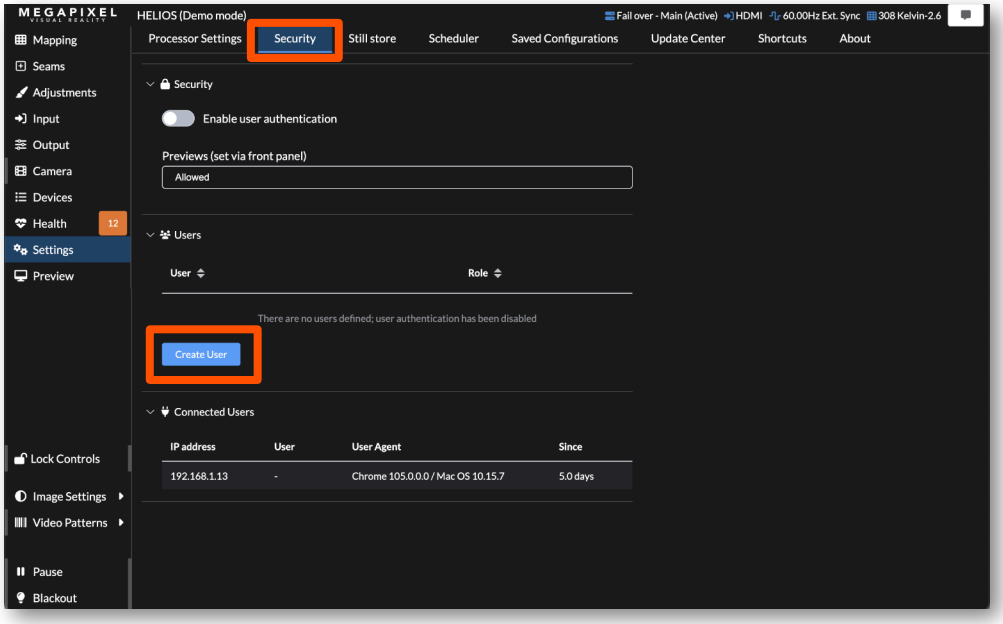


Figure 118: Security pane

Complete the fields, then press ***Add User*** to create the account.

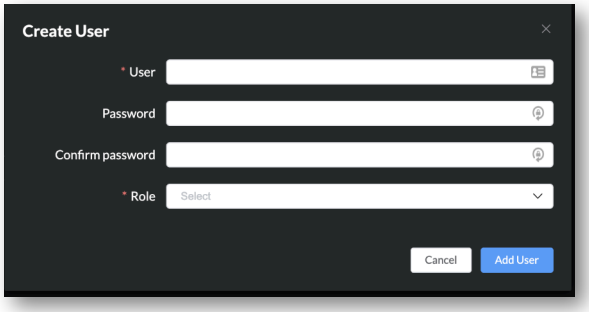


Figure 119: Create user

Google maintains a list of compromised passwords. If a user is created with a simple password such as 'test' or 'password' expect a Chrome warning.

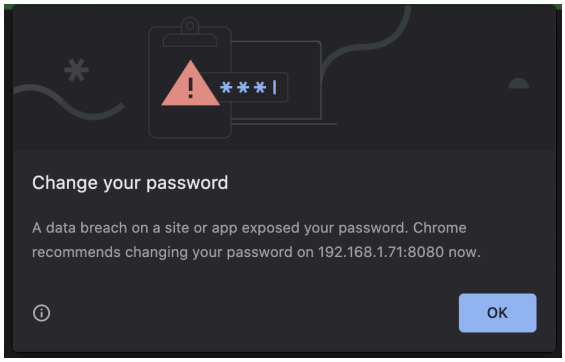


Figure 120: Password warning

Security (Advanced) - (continued)

Use the ***Enable user authentication*** toggle to turn on security. Be certain of the user and password prior to enabling security! If credentials are lost, only a factory default reset will unlock the HELIOS. (See the **Unknown User / Password** section in Appendix B)

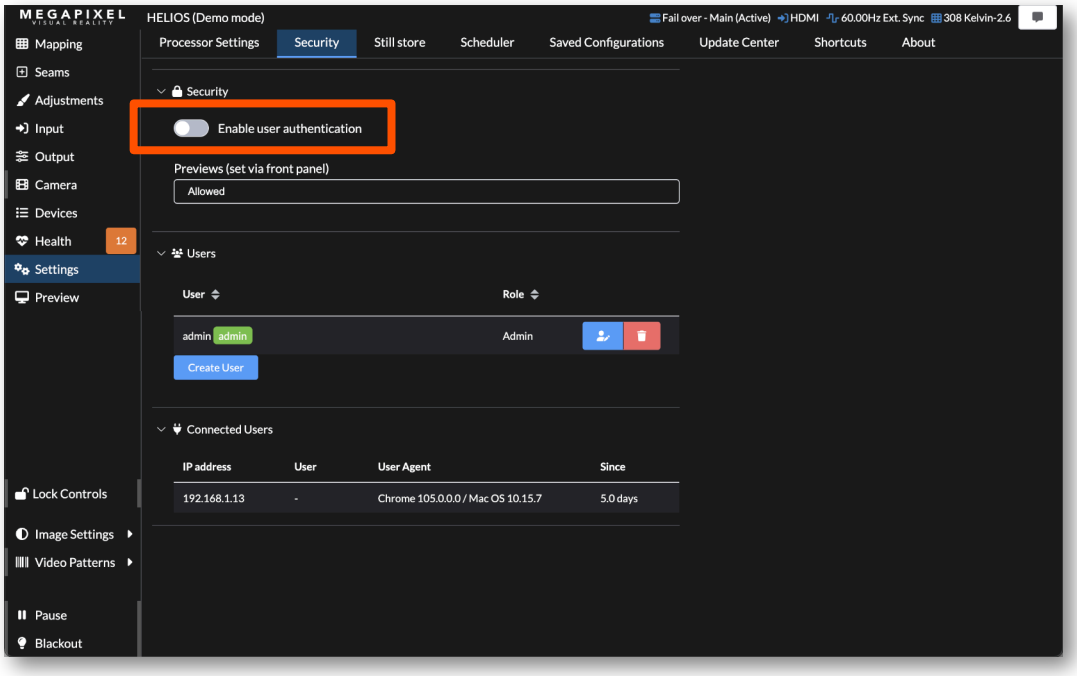


Figure 121: Enable User Authentication

Authentication is required immediately after enabling.

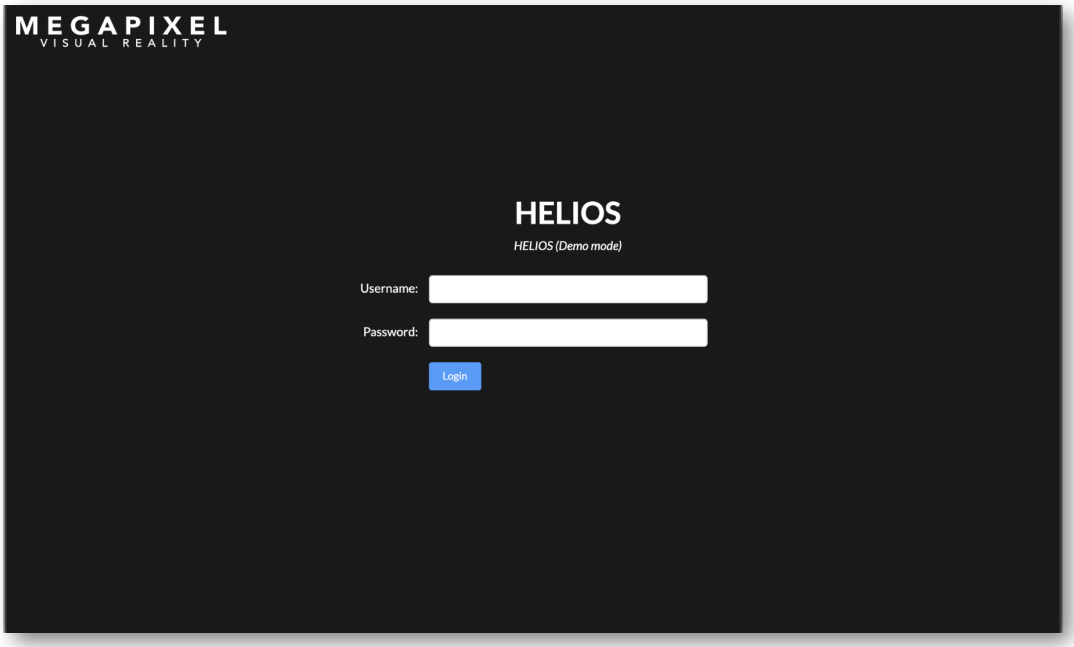


Figure 122: Authentication required

Security (Advanced) - (continued)

When logged on, the user name will appear on the top right.

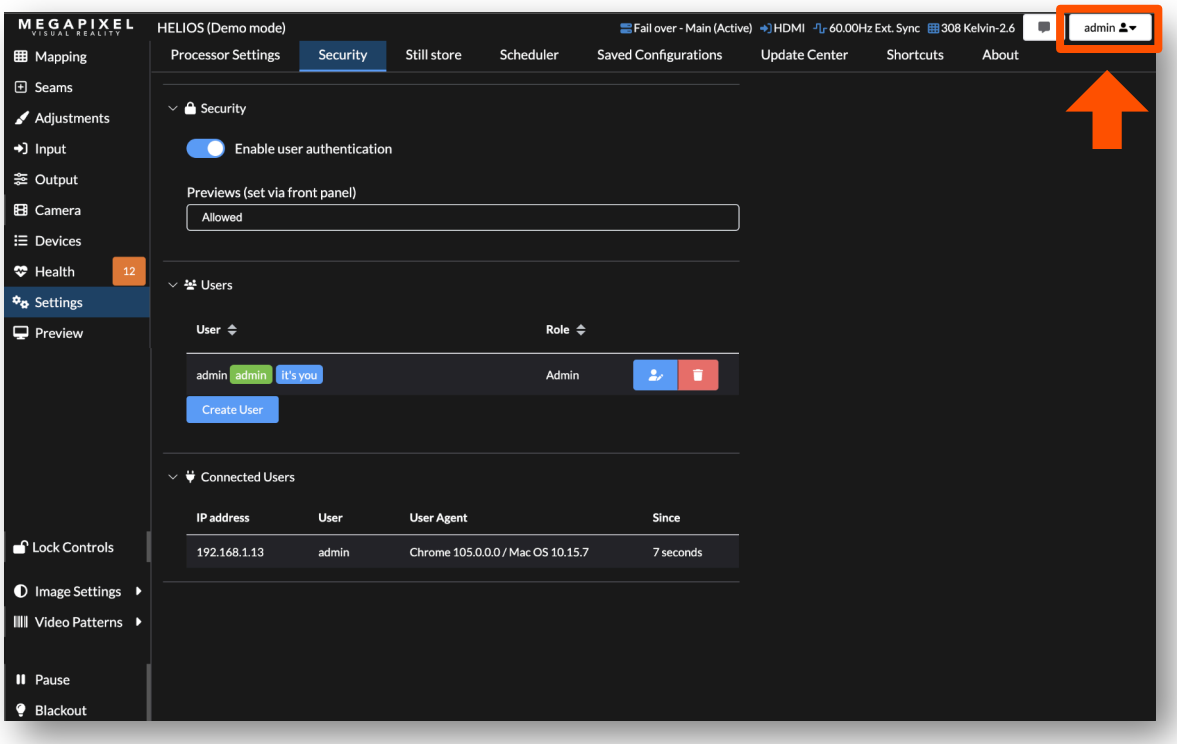


Figure 123: User list

Select the user name button to ***Sign out*** or change the password.

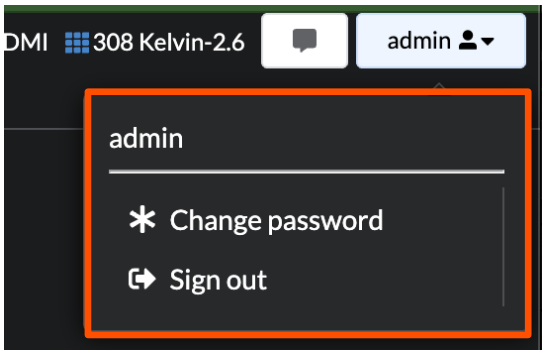


Figure 124: Sign out button

Security (Advanced) - (continued)

Manage users with the edit and delete buttons. Use the edit icon button to change the password for a user or to block a user. If a name change is required, it must be created as a new user.

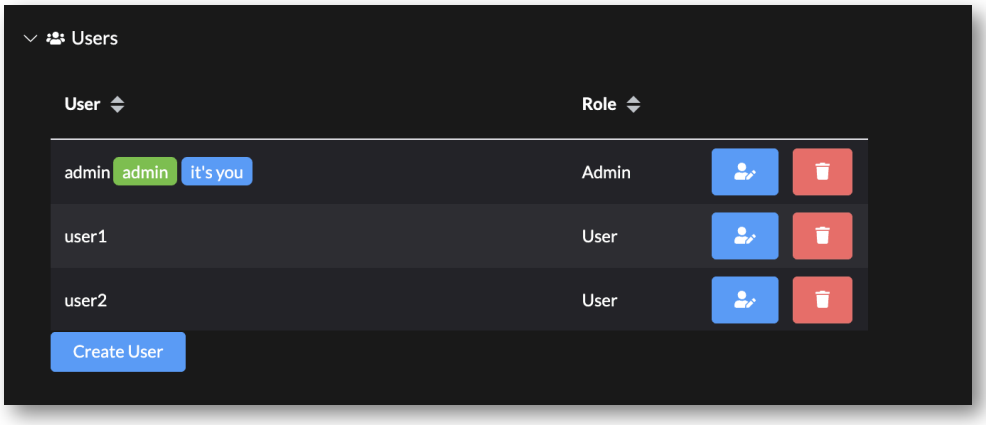


Figure 125: User list

If a user has been blocked, an amber notification will appear next to the user name in the user list. Blocked users are not allowed to login.

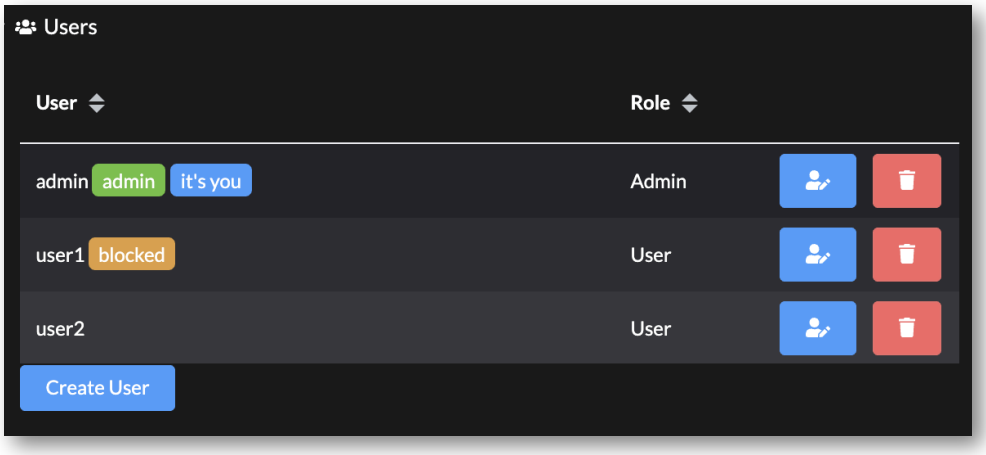


Figure 126: Blocked user

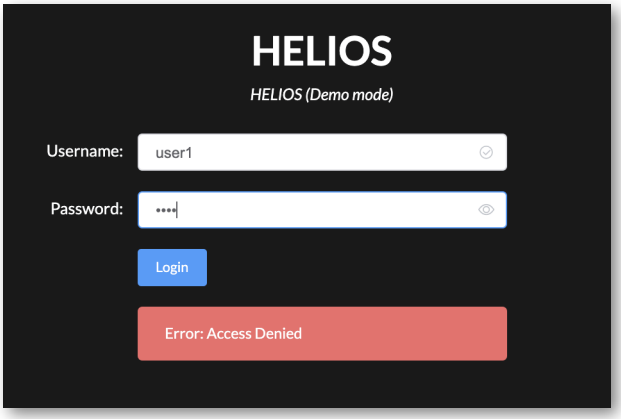


Figure 127: Access denied

Still Store

Use ***Still store*** to add still images (jpeg and png) to HELIOS and to display them. The maximum image resolution is 4096 x 2176. This feature works with the ***Input*** > ***On input failure*** feature and the ***Global Video Pattern Selection***. By default HELIOS will show all the loaded images in the carousel. Select favorites to show only favorites in the carousel.

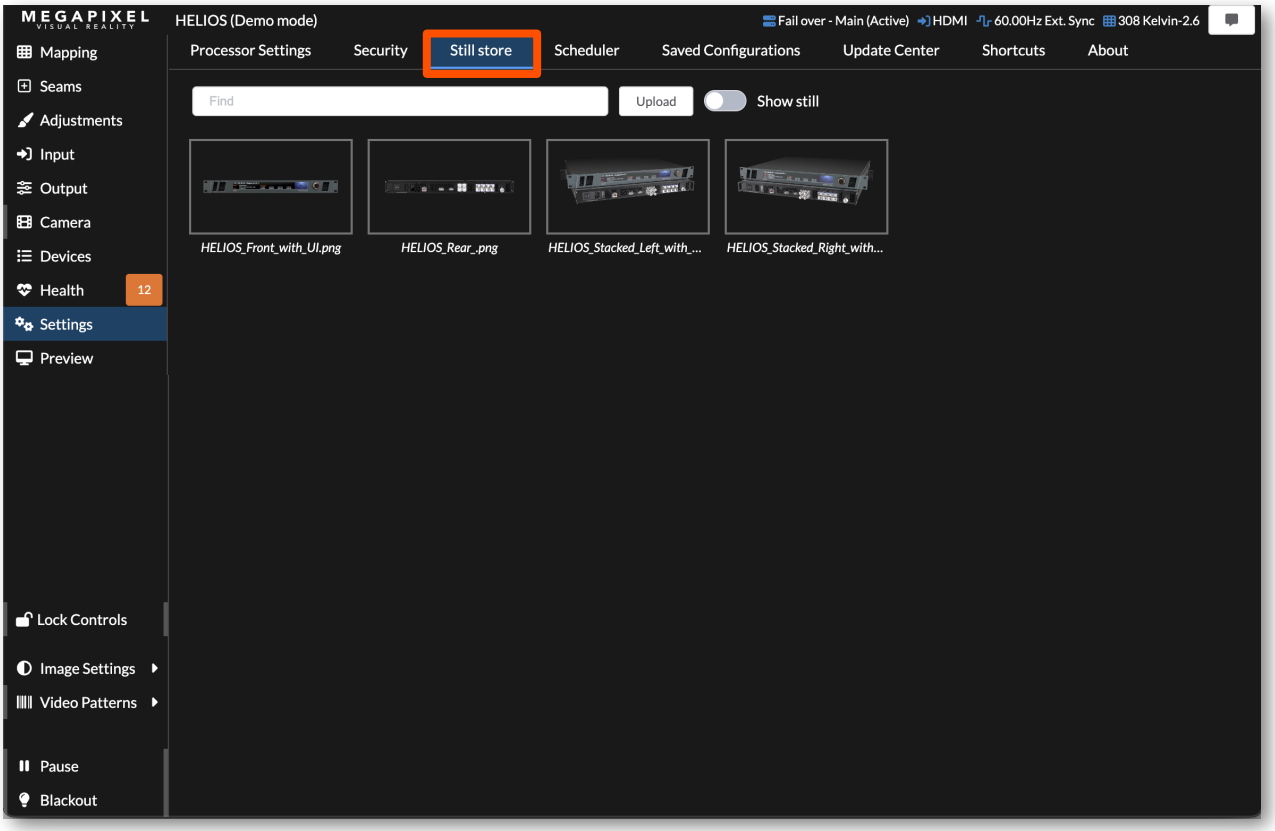


Figure 128: Still store

Scheduler (Advanced)

Use the ***Scheduler*** to have HELIOS to make system changes at a predetermined date and time. Press the ***Add entry*** button to add an event.

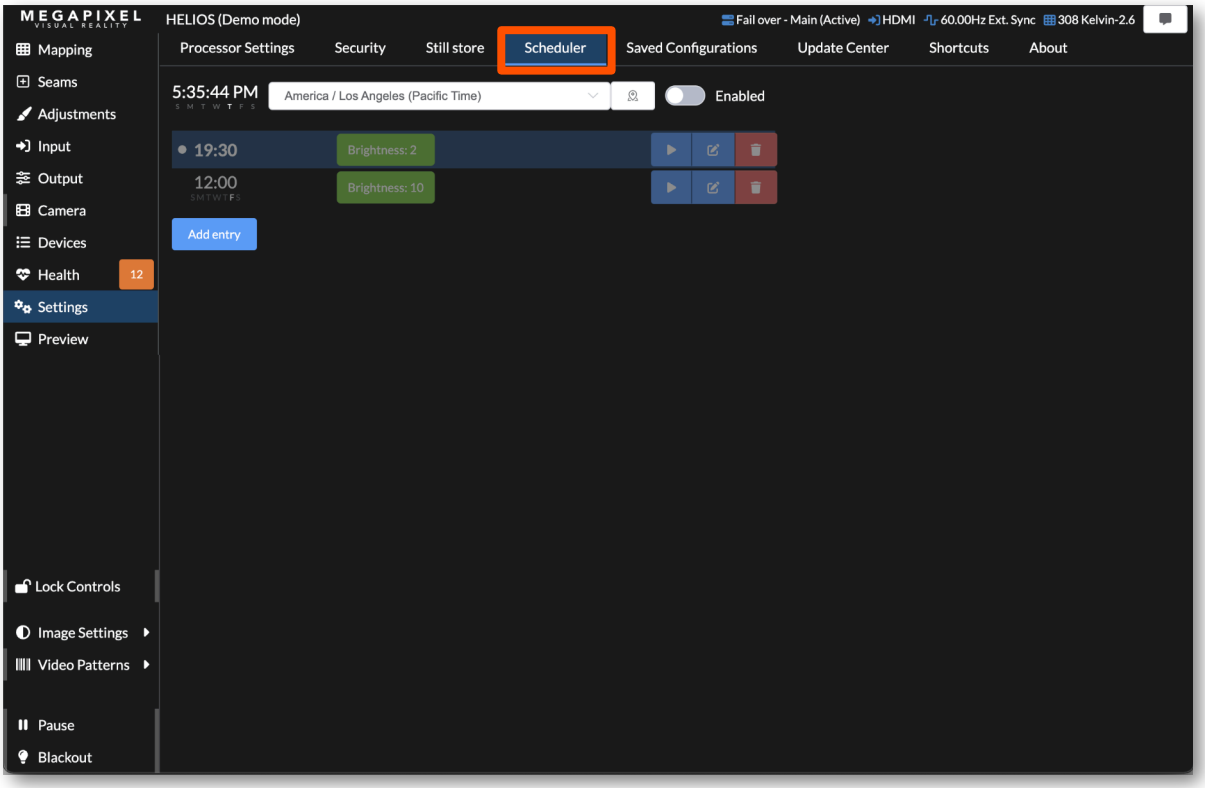


Figure 129: Scheduler

In the scheduler's form window set the time and date of the event. Then, select a value for one of the common functions (***Brightness***, ***Blackout***, ***Input*** selection). For more complex configuration changes create a custom configuration first. Then, set it to be applied here.

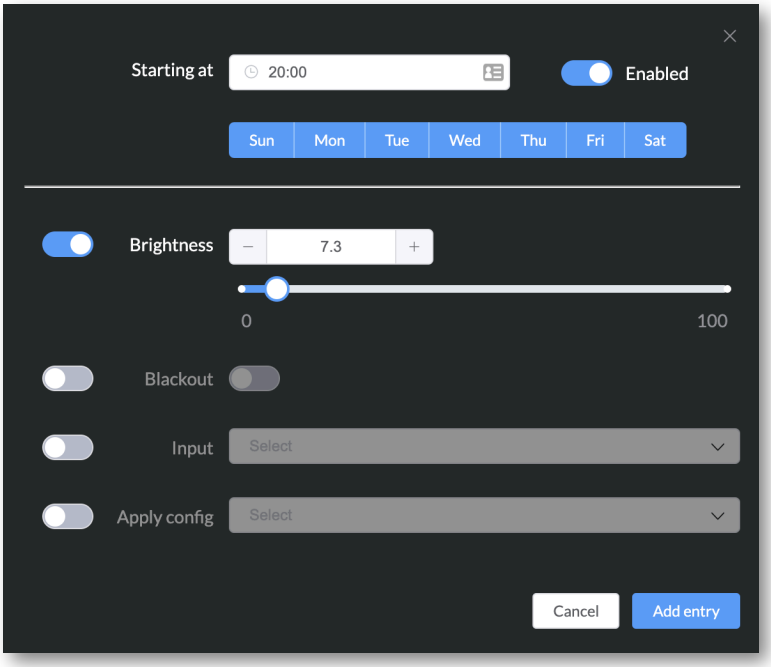


Figure 130: Scheduler form

Saved Configurations

Saved Configurations are used to export a collection of settings. This is useful for configuring a spare unit or to save a progress state while building a new system. It is also the recommended method for documenting and storing full configurations.

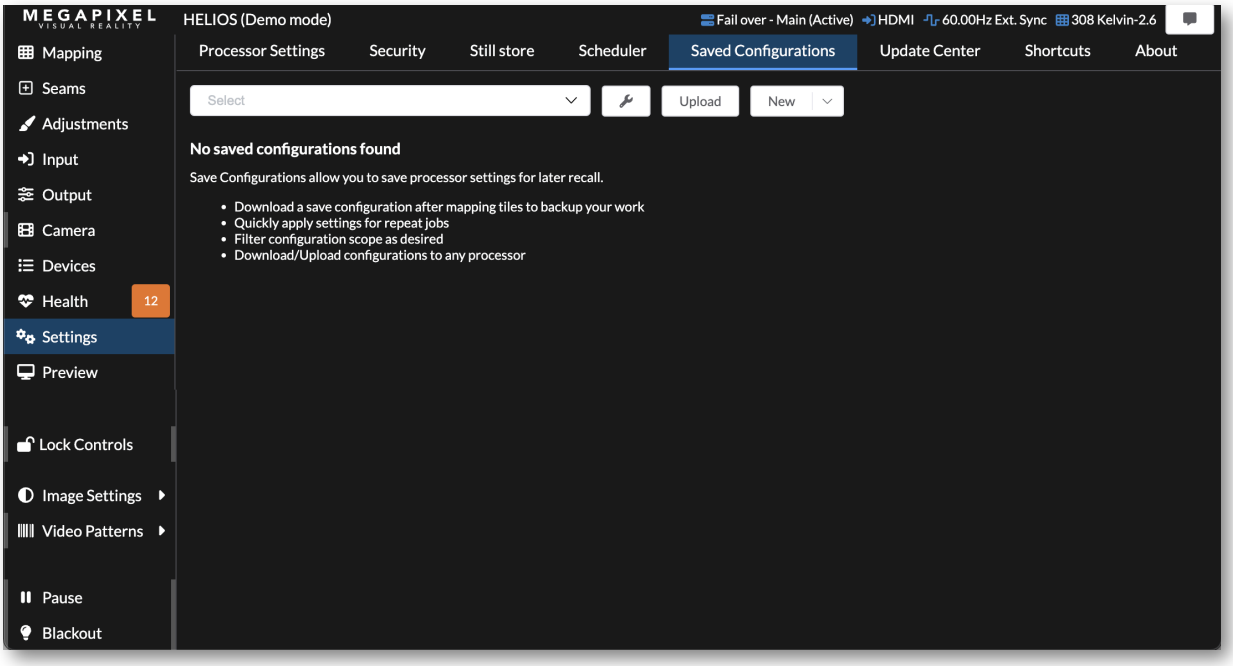


Figure 131: Saved configurations

HELIOS has a factory default configuration. Select the ***Factory Default*** configuration from the dropdown menu to load the file. With this file loaded, and the ***Only show changes*** toggle switched on, HELIOS displays all the settings that deviate from the factory defaults. In this example, the only change is the creation of one (1) ***Mapping Group***. Press the ***Apply Configuration*** button to return the HELIOS to factory default settings. In the case of the example below, one ***Mapping Group*** will be deleted.

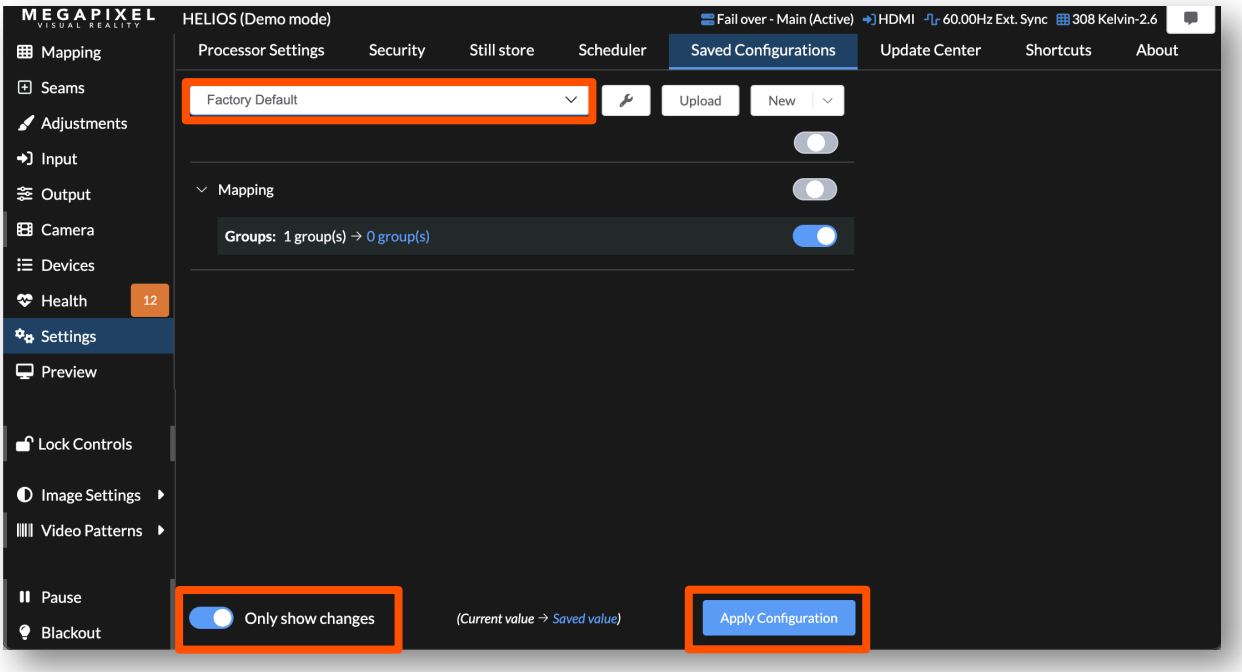


Figure 132: Factory Default

Saved Configurations (continued)

In order to create a new configuration press the ***New button***.

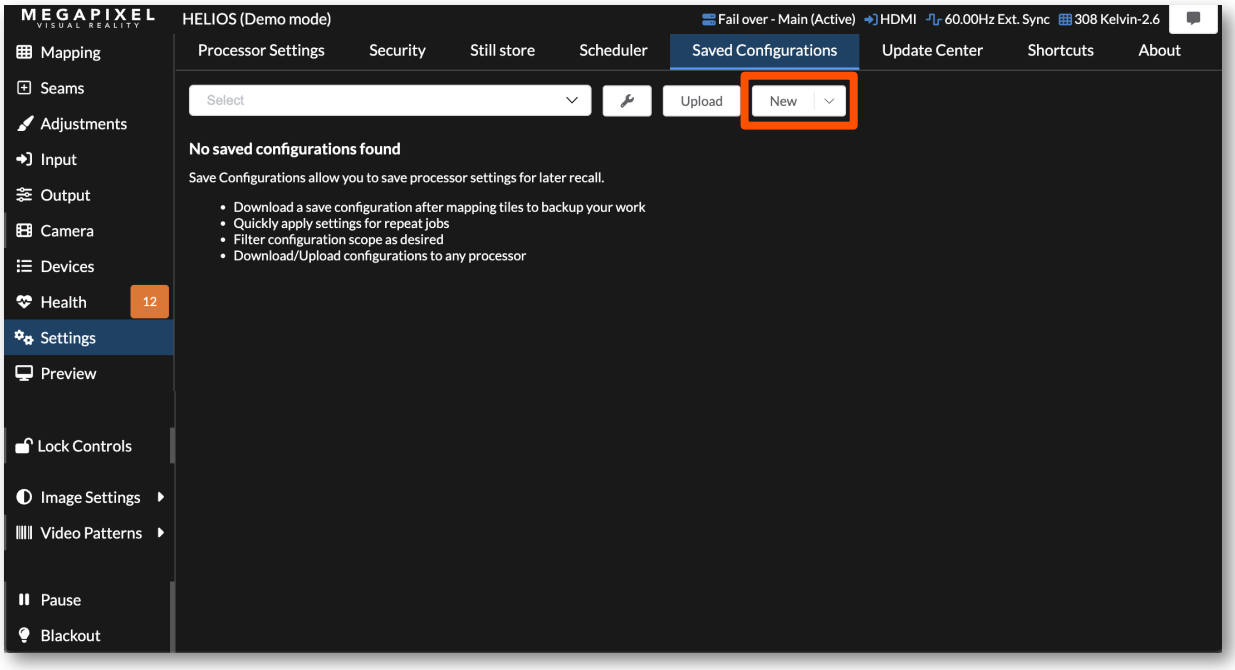


Figure 133: New configuration

The system automatically assigns a title based on system time and date, which can be customized by editing the name field. Below the name of the configuration is a list of system parameter filters. If certain parameters are not desired, use the toggle to remove that particular parameter. For example, inputs often have similar color settings across processors in a multi processor system. Rather than manually entering the same input color adjustments to all processors, create a ***New Saved Configuration*** with input settings enabled and upload to each processor.

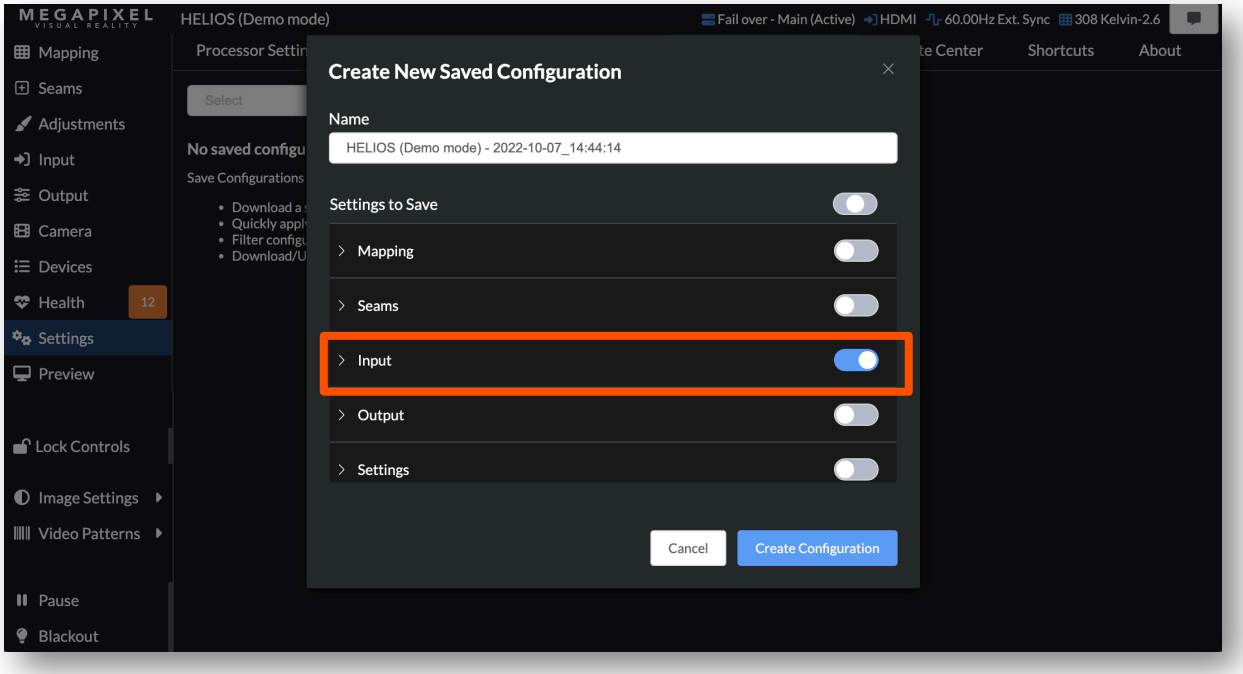


Figure 134: Settings filters

Saved Configurations (continued)

The ***New*** button has 'quick access' file management functions under the drop down on the right of the button.

Download - retrieve the configuration as a file

Update - overwrite the existing configuration with recent changes

Rename - change the name of the file

Clone - duplicate the file

Delete - remove the file

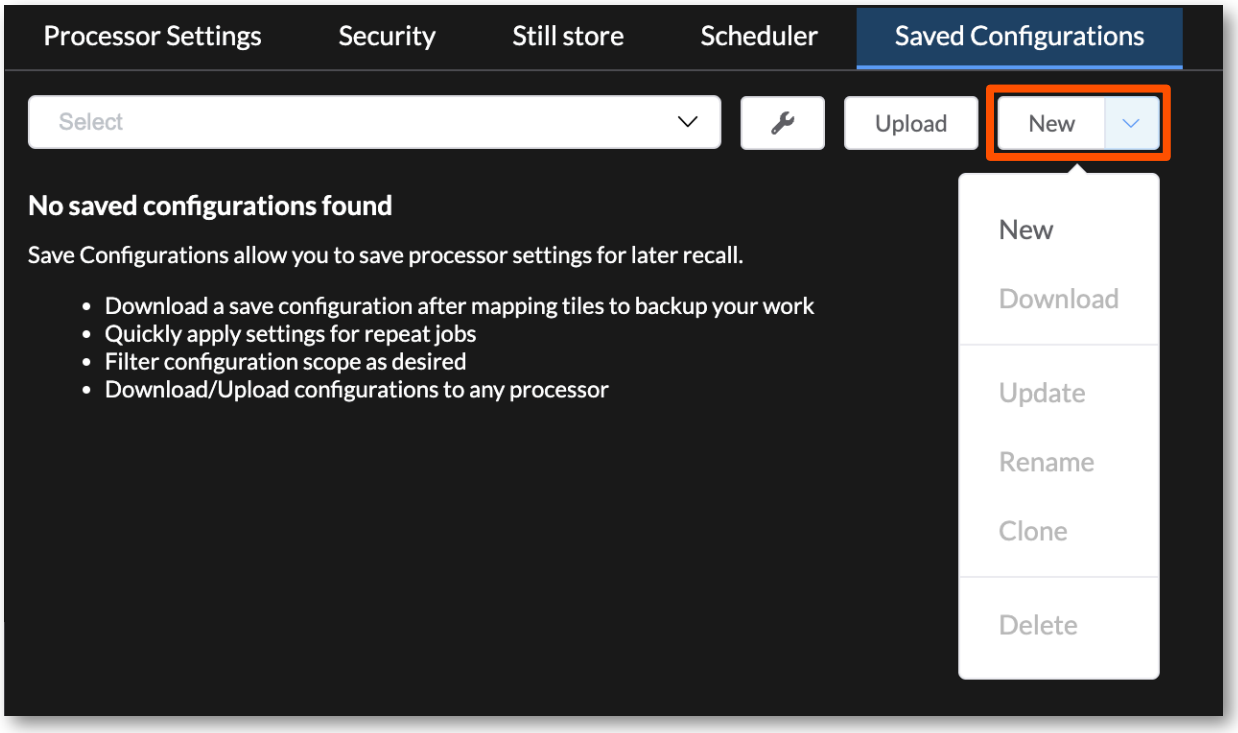
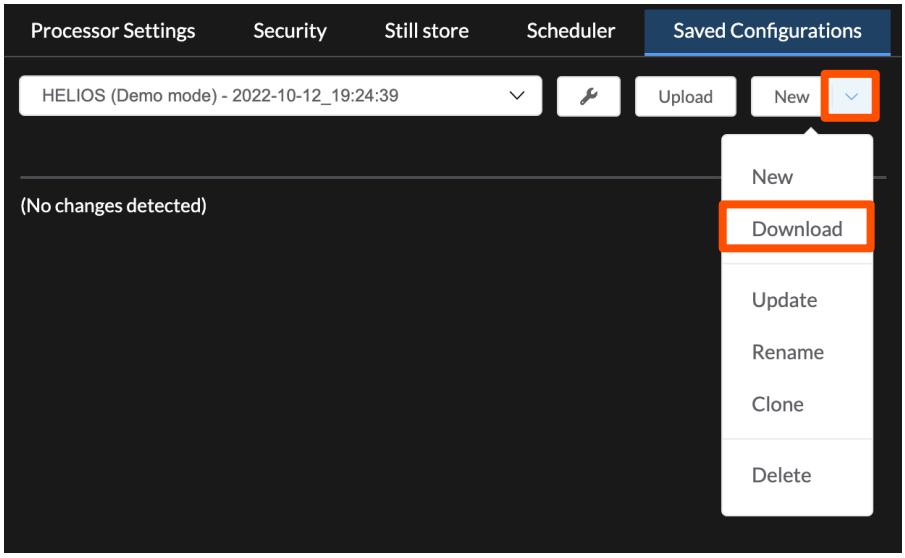


Figure 135: Blank 'Saved Configurations' pane

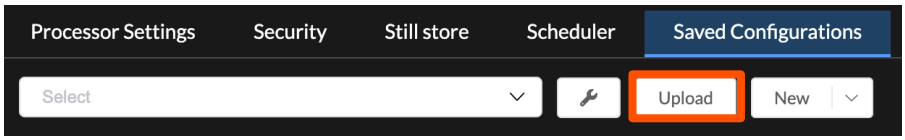
Saved Configurations (continued)

The following steps detail how to move a configuration file from one processor to another.

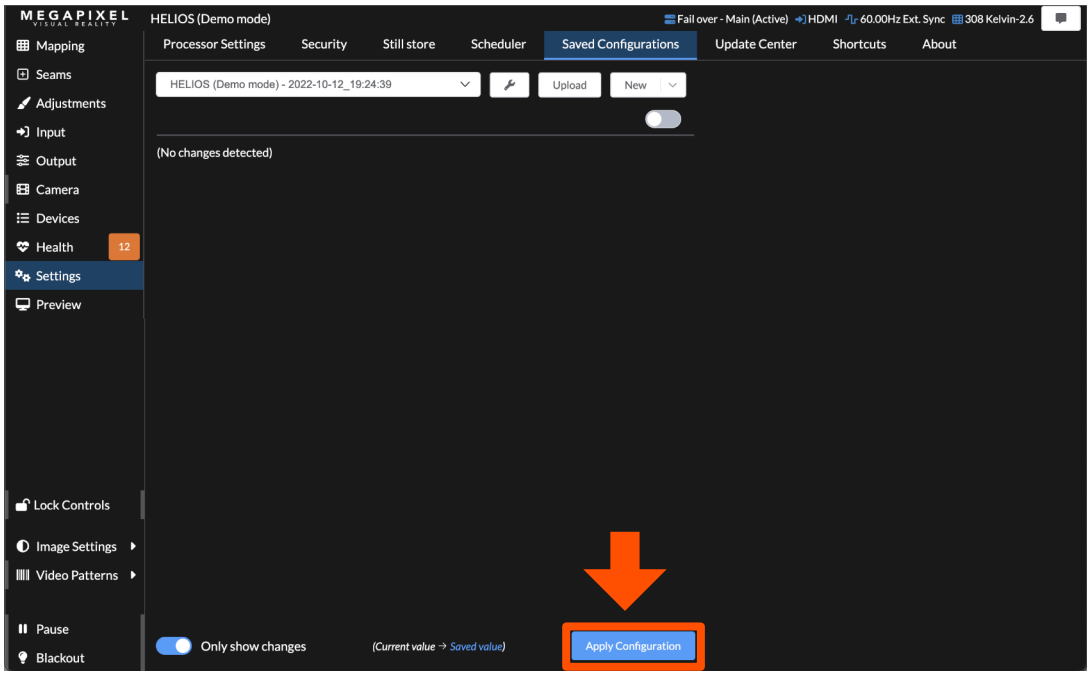
1. After the configuration file has been created, select the file with the drop down menu. Then use the disclosure triangle on right side of the ***New*** button to select Download from the options.



2. Connect to the target processor, navigate back to the ***Saved Configurations*** tab and ***Upload*** the configuration file.



3. ***Apply Configuration*** to activate the file.



Update Center

The ***Update Center*** is used to send Firmware and Software updates to the HELIOS system components. All software or firmware packages must be uploaded to the HELIOS Processor in order for the system to be able to make use of them. Select either an existing package or add a new one, with the ***Upload*** button. All of the Megapixel VR packages will end with the ***.mvrp*** extension. The HELIOS packages will be labeled with ***'helios'*** at the beginning of the file name. Tile packages begin with ***'px1'*** (the name of the receiver card). Switch packages will begin with '***helios-switches***'. Detailed upgrade steps on the next two pages.

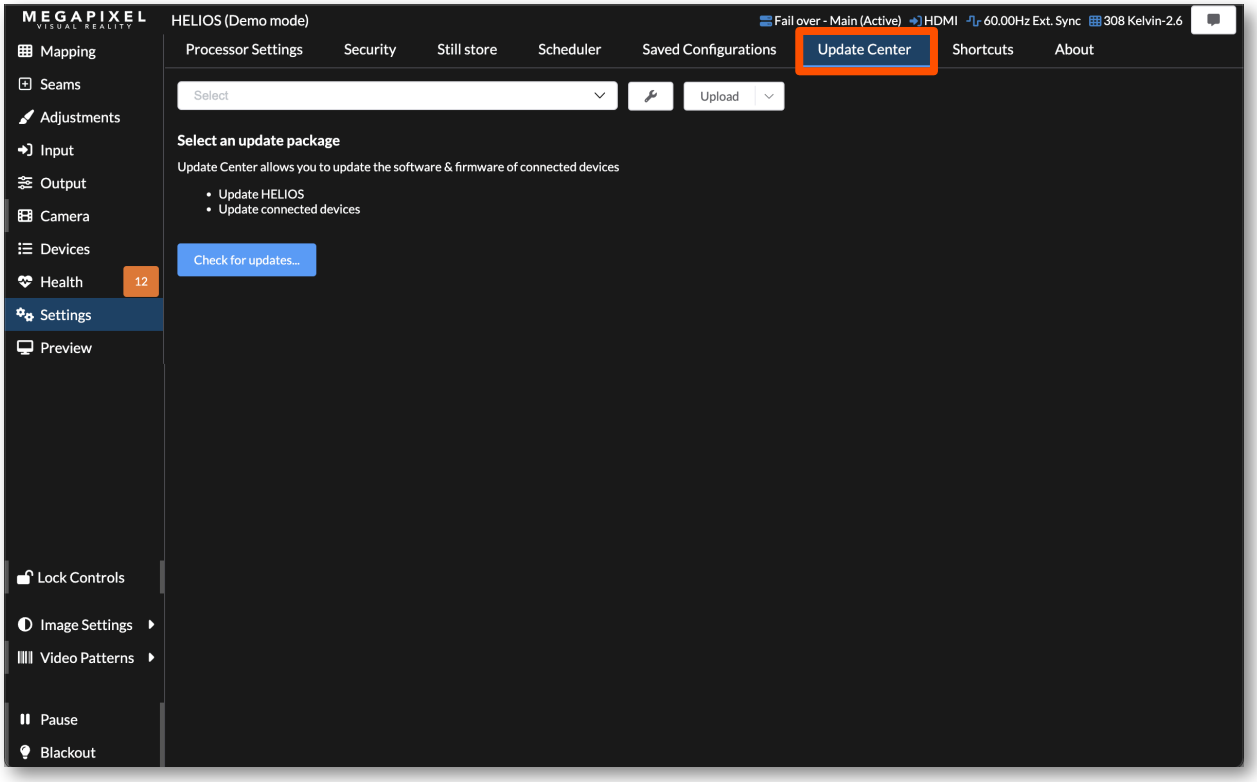
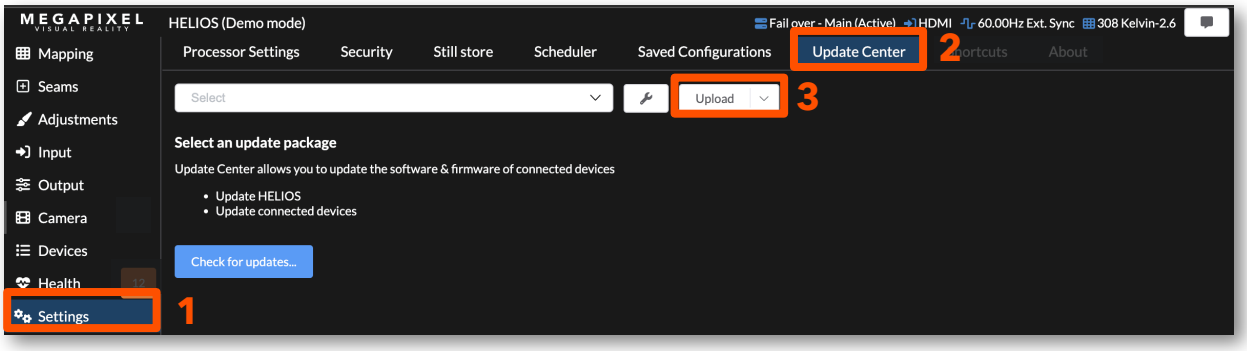


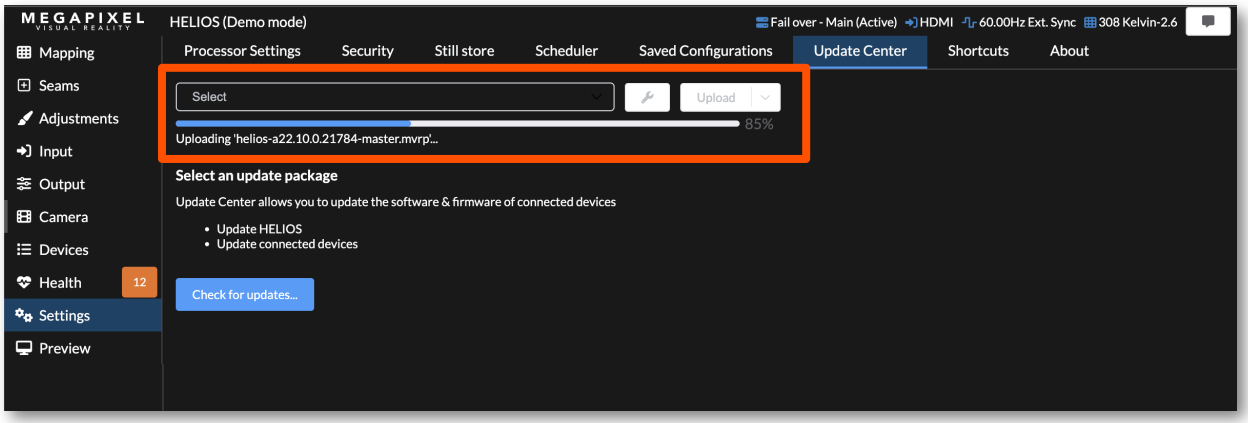
Figure 136: Update Center

Software upgrade steps

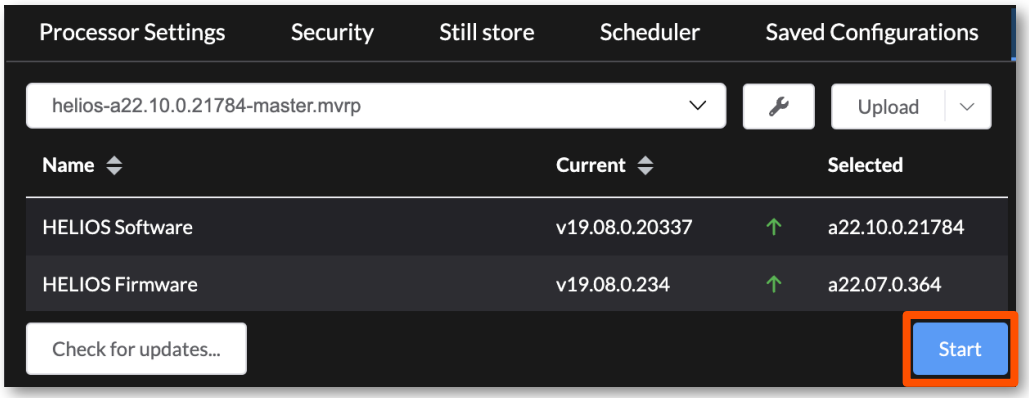
1. Navigate to: ***Settings → Update Center*** and select the ***Upload*** button.



2. Browse to the current software ***.mvrp*** file on your computer and upload it. A progress bar will appear during the upload.

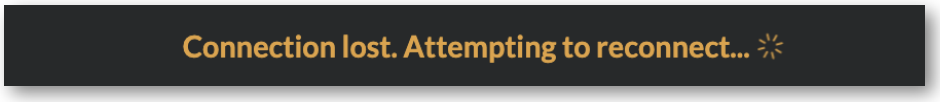


3. After the package has uploaded, select the new .mvrp package from the drop down list, then click ***Start***. The upgrade process will show a progress bar.

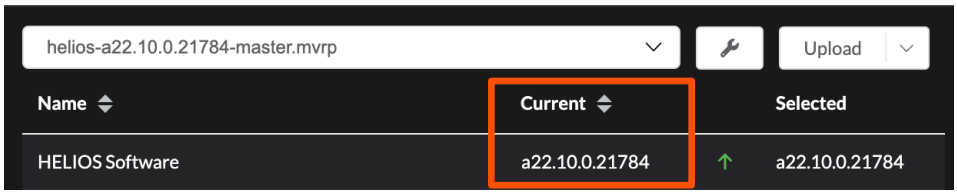


Software upgrade steps (continued)

4. During the upgrade, a ***Connection lost.*** message is shown as HELIOS extracts and installs the package.



5. Once the upgrade is complete, the current software version can be confirmed in the table below.



Shortcuts

The shortcuts menu provides a list of functions that have been assigned keyboard shortcuts. The information here is also available with the press of ***SHIFT*** + ***?***.

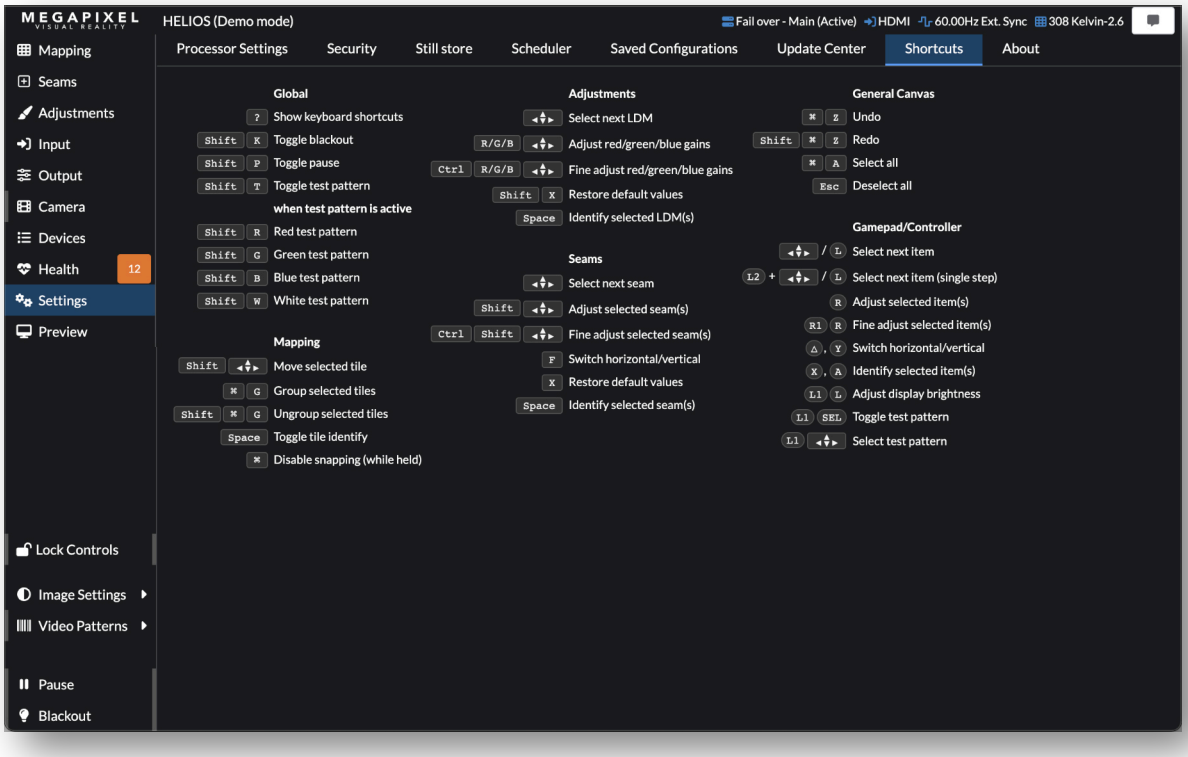


Figure 137: Shortcuts tab

About

The ***About*** tab displays the current HELIOS version number along with important links for contacting support. Press the ***Download support archive*** button to save a zip file containing HELIOS system information files that are essential to obtaining new system licenses and are helpful for troubleshooting.

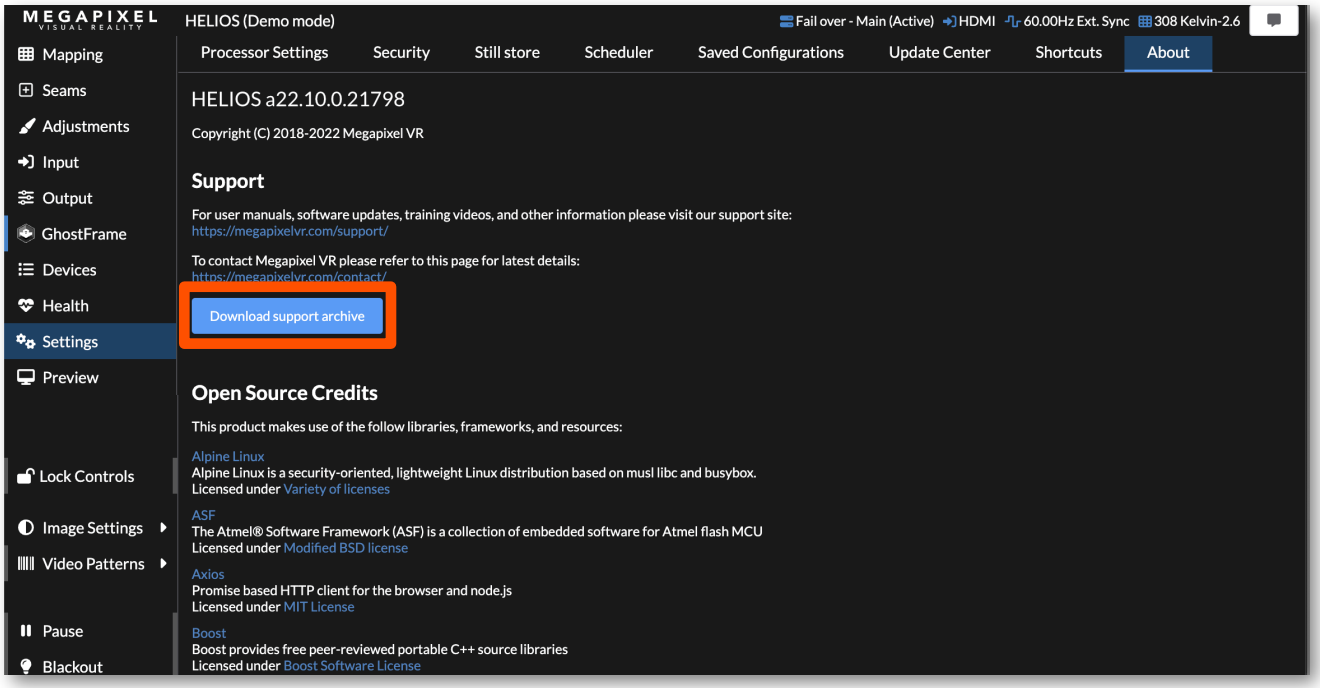
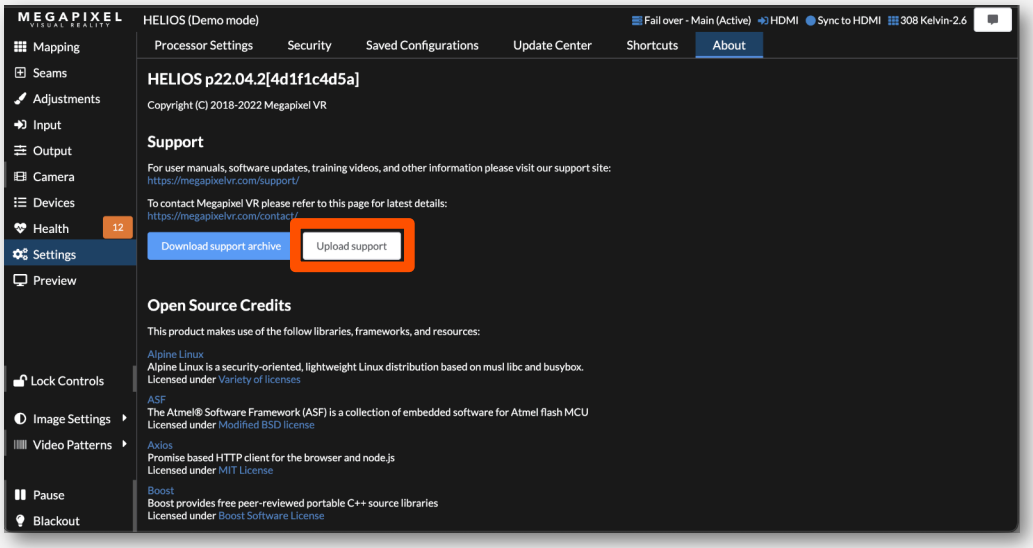


Figure 138: About tab

NOTE: Support archives can be uploaded and inspected at the HELIOS demo website ***About*** page. Visit **https://demo.megapixelvr.com** and create a login if you don't have one. Once on the ***About*** page, press the ***Upload support*** button. Navigate to a support archive saved from a real HELIOS and upload it to the demo site. The demo site will switch from using the the demo backend to the ***Support archive*** data. Reload the website to return it to using the usual demo backend.



Preview Pane

The Preview pane displays a low resolution, low frame rate version of actively connected inputs. The layout of the preview window layout will reconfigure based on which inputs are active and which input is selected. In the example below the HELIOS unit is receiving a quad SDI signal, but the unit has HDMI selected as the current input. Four active SDI feeds are visible below a black HDMI preview.

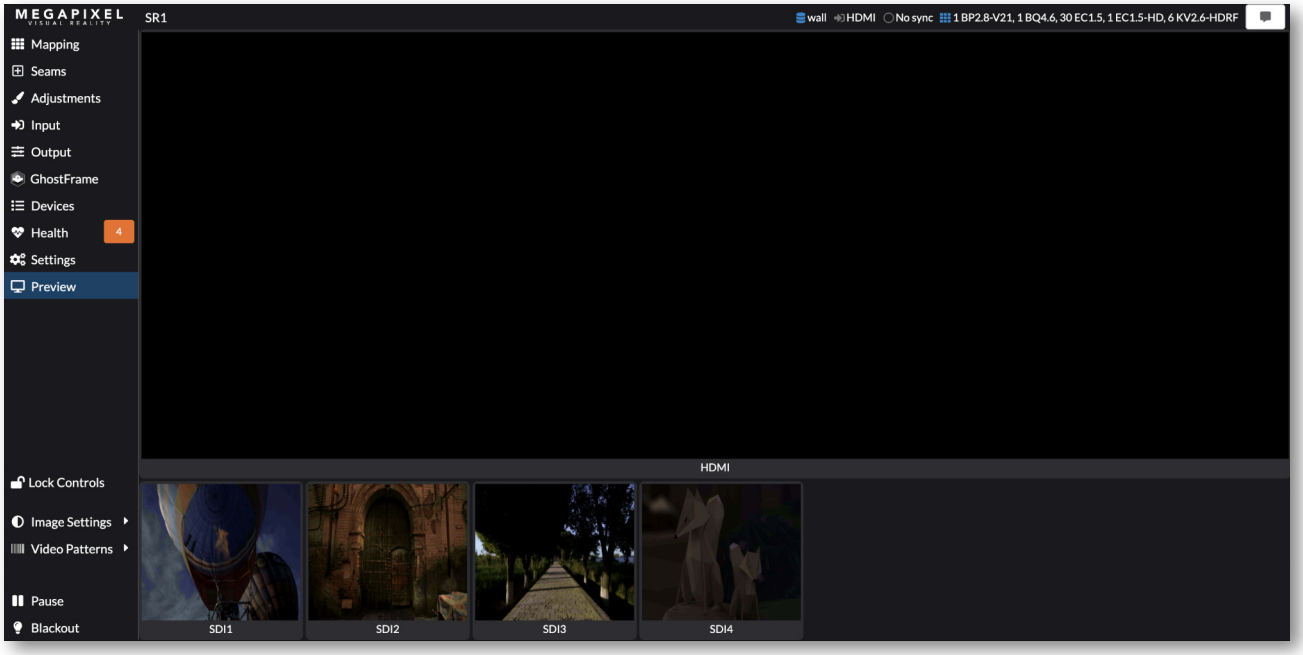


Figure 139: Preview pane - No HDMI input

In the example below SDI 1 has been selected as the input. The preview pane shows SDI 1 maximized at the top. Other active, but not selected inputs are shown as thumbnails at the bottom of the pane.

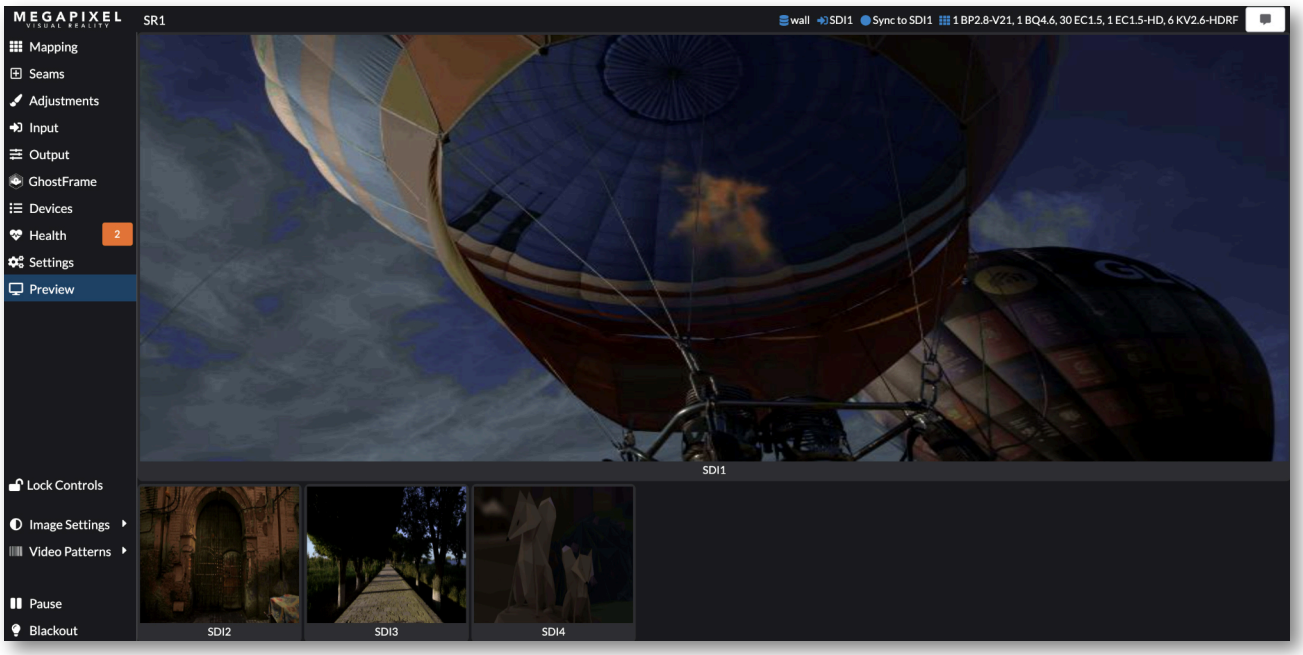
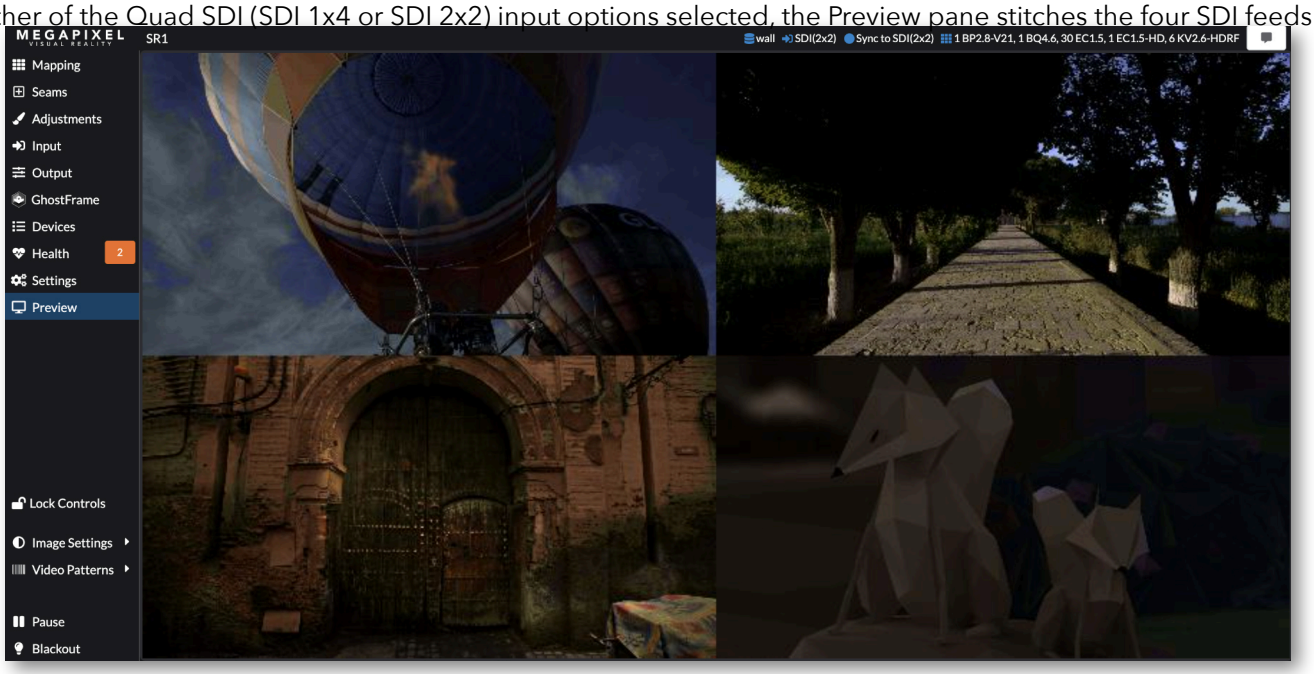


Figure 140: Preview pane - SDI 1 selected

Preview Pane (continued)

With either of the Quad SDI (SDI 1x4 or SDI 2x2) input options selected, the Preview pane stitches the four SDI feeds



together.

Figure 141: Preview pane - Quad SDI

Seams Pane

Displays occasionally have minor intensity variations at physical tile seams. This is usually caused by inconsistent physical gaps between tiles. Prior to adjusting seams electronically, the installation should be checked for hardware inconsistencies (e.g. latches not engaged, tiles and LDMs not seated properly). The HELIOS Processor provides seam correction by specifically adjusting the intensity of the edge LEDs. Shown below is a selection of horizontal seams highlighted in light blue. When using the ***Tile Seams*** tab, each selectable region in the user interface is the edge of a tile. When using the ***LDM Seams*** tab each selectable regions is an LDM (LED module) boundary.

We have found that video game controllers are well suited for the seam correction workflow. The HELIOS UI supports Xbox and Playstation* controllers. The game controller connects via USB or Bluetooth to the laptop or mobile device that is running the HELIOS web UI. Multiple users are supported as each browser connection can have a game controller connected.

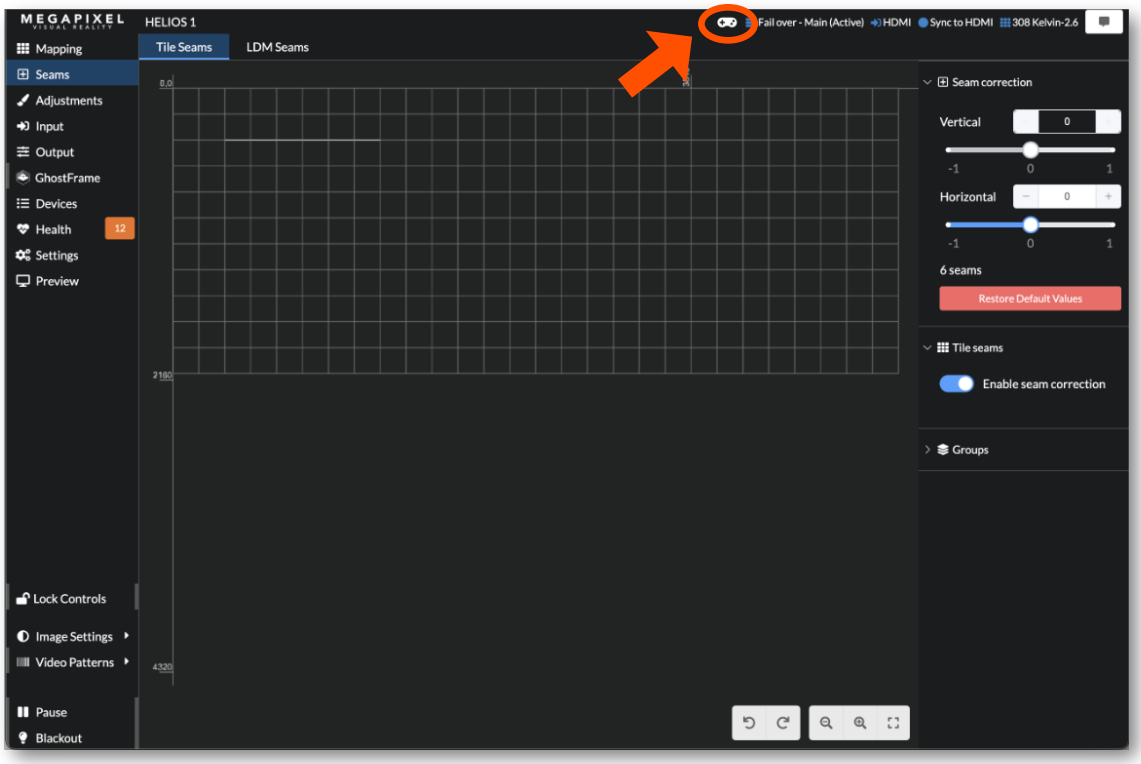


Figure 142: Seams pane.

Steps to setup a Bluetooth controller with a mobile host:

1. Begin with the controller turned off. Then, put the controller in pairing mode:
    - Xbox - press the Xbox button to turn on the controller. Then, press and hold the Connect button for a few seconds.
    - PlayStation - press and hold the PS and Share buttons at the same time until the light bar begins to flash.
2. Navigate to the Settings and ensure Bluetooth is turned on.
    - Find the name of the controller under Other Devices. Tap the name to connect.
3. With the web browser in focus and connected to HELIOS press the X button on the controller.
4. A game pad icon should appear on the HELIOS UI confirming the link with the game controller.

* Xbox is a trademark of Microsoft® Corporation. PlayStation is a trademark of Sony Interactive Entertainment Inc.

Seams Pane (continued)

The warning below is shown when a user connects to HELIOS using the ***https://*** protocol because each HELIOS includes its own self-signed certificate. HELIOS supports loading custom signed HTTPS certificates. See the **Networking (Advanced)** section for more information on loading custom HTTPS certificates.

As browsers move to requiring a secure context for gamepad support, users will need to use an ***https://*** connection to enjoy gamepad powered seam correction. Existing ***http://*** (no 's') connection will soon no-longer register that a game controller is even connected.

This change was defined by the W3C who are concerned with protecting the privacy & security of users on the internet. We are actively exploring options, but for now a user has to connect to HELIOS using the ***https://*** protocol to be able to use gamepads on Firefox, and soon the other major browsers

If a warning such as the one below appears when connecting to HELIOS via ***https://***, press the ***Advanced…*** button on the warning page and ***Accept the Risk and Continue*** in order to bypass the warning.

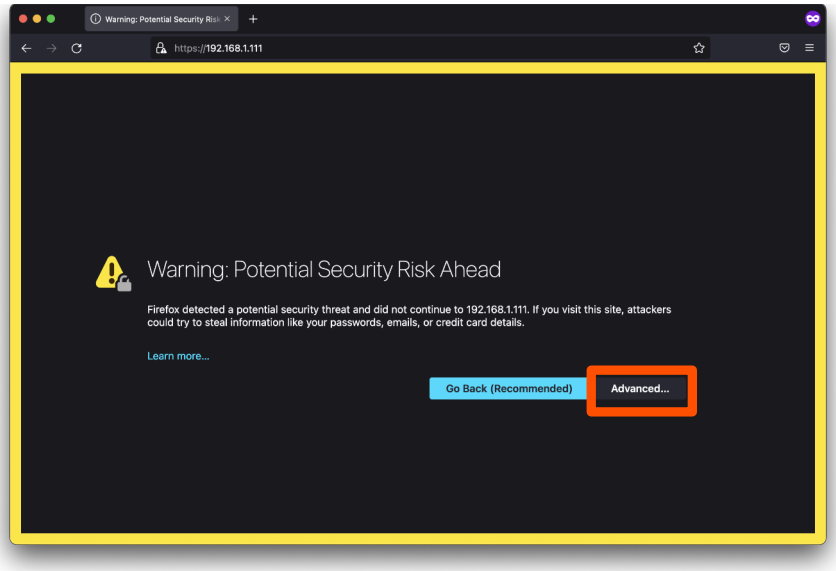


Figure 143: https:// warning 'Advanced'

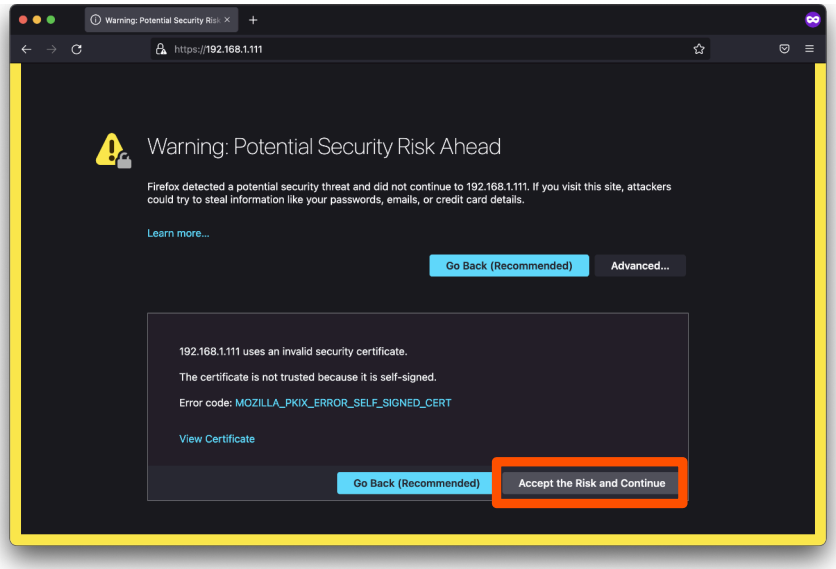


Figure 144: Game pad warning 'Accept the Risk and Continue'

Seam selection - Both the D-pad and the left stick control seam selection. However, there is a key difference between the two. The D-pad moves the selection one seam per click, whereas the left stick is an analog control. The further the stick is pushed, the faster the selector moves across seams.

Adjust seam - analog control of brightness for the selected seam.

Toggle H/V adjust - Toggles between Horizontal or Vertical seams.

X button - Flashes the selected seam. Since the seam will not remain highlighted while adjusting, it is easy to lose track of which seam is currently selected. This function helps identify the currently selected seam.

R1 - For fine control, press and hold the R1 button while using the analog stick.

Figure 145: Control assignment

Tips:

- Start on one side and work across the screen systematically.
- If multiple users are working, assign regions to each user.
- Check the screen from several view points and distances.

Adjustments Pane

The HELIOS Processor can adjust the RGB gains on individual LED modules (there is no full tile option). Gain adjustments at the LDM level are available if supported by the tile manufacturer and firmware. Select tiles and use the sliders to make the adjustments. The user interface will tint the tile region to show the color bias assigned to the tile. ***Shit+click*** selects multiple tiles. ***Alt+click*** selects individual LDMs (if individual LDM adjustment is supported).

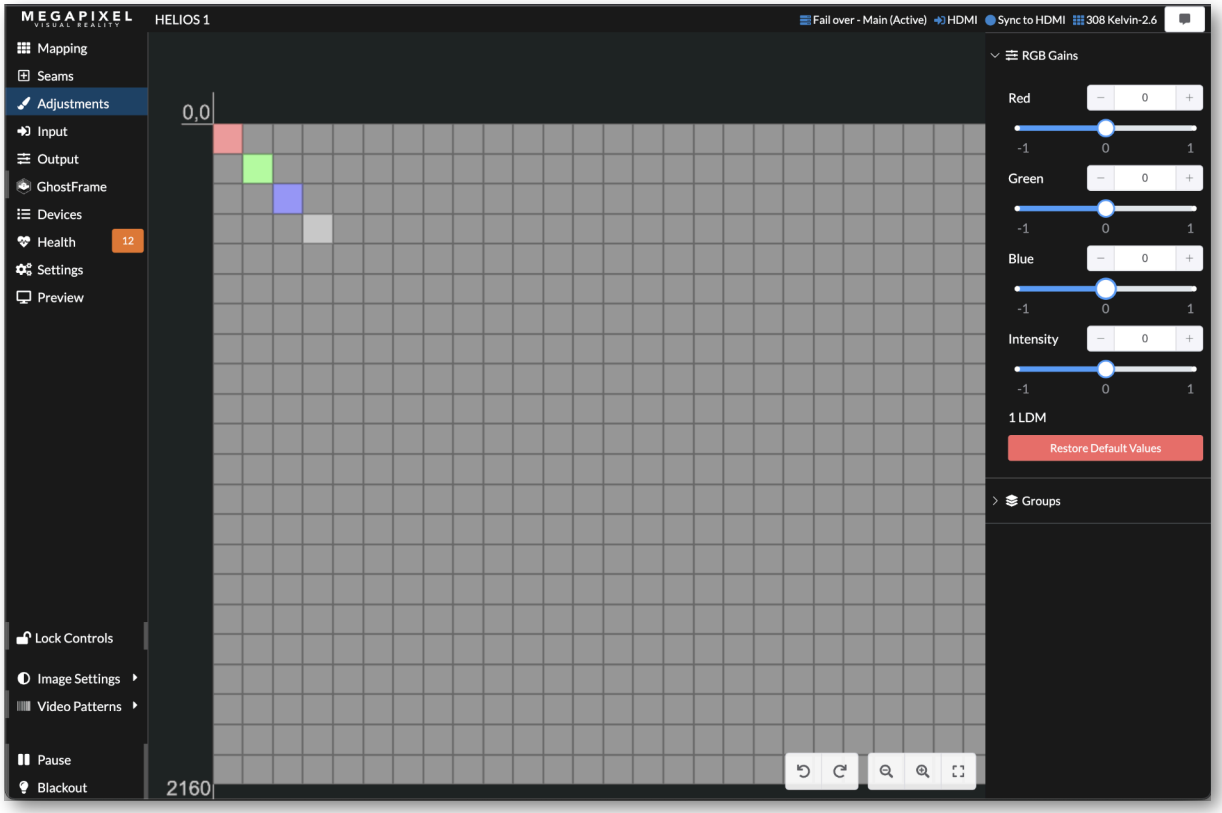


Figure 146: RGB gains Adjustments pane

Maintenance & Accessories

General Maintenance

Proper maintenance of the HELIOS Processor involves periodically checking the hardware for any parts that are loose or become damaged. Connectors should be checked and the unit replaced if housings are damaged or pins are bent or deformed.

Processor Filter Maintenance

The front filter on the air intake ducts of the HELIOS Processor should be periodically cleaned. Gently pry the foam filter out and clean or replace the filters.

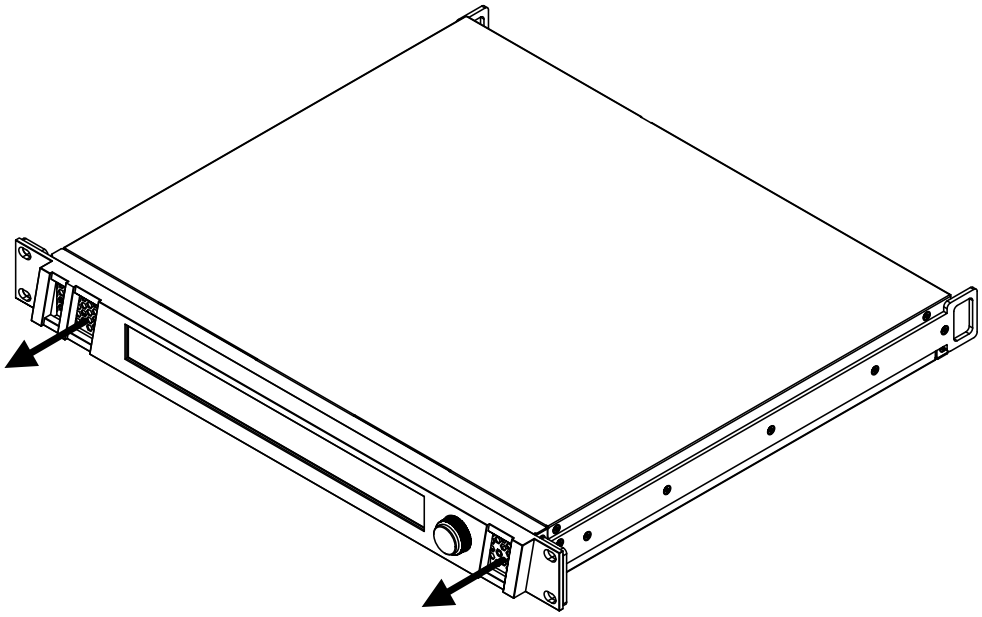


Figure 147: Remove air intake fan filters for service.

Processor Fuse Replacement

The HELIOS Processor has two 6.3A fuses at the power inlet. To replace these, use a small flat head screwdriver to gently pry loose the fuse tray. Slide the tray out to the limit. Examine and replace fuses as necessary. If blown fuses are a persistent issue, return the unit to Megapixel VR for repair.

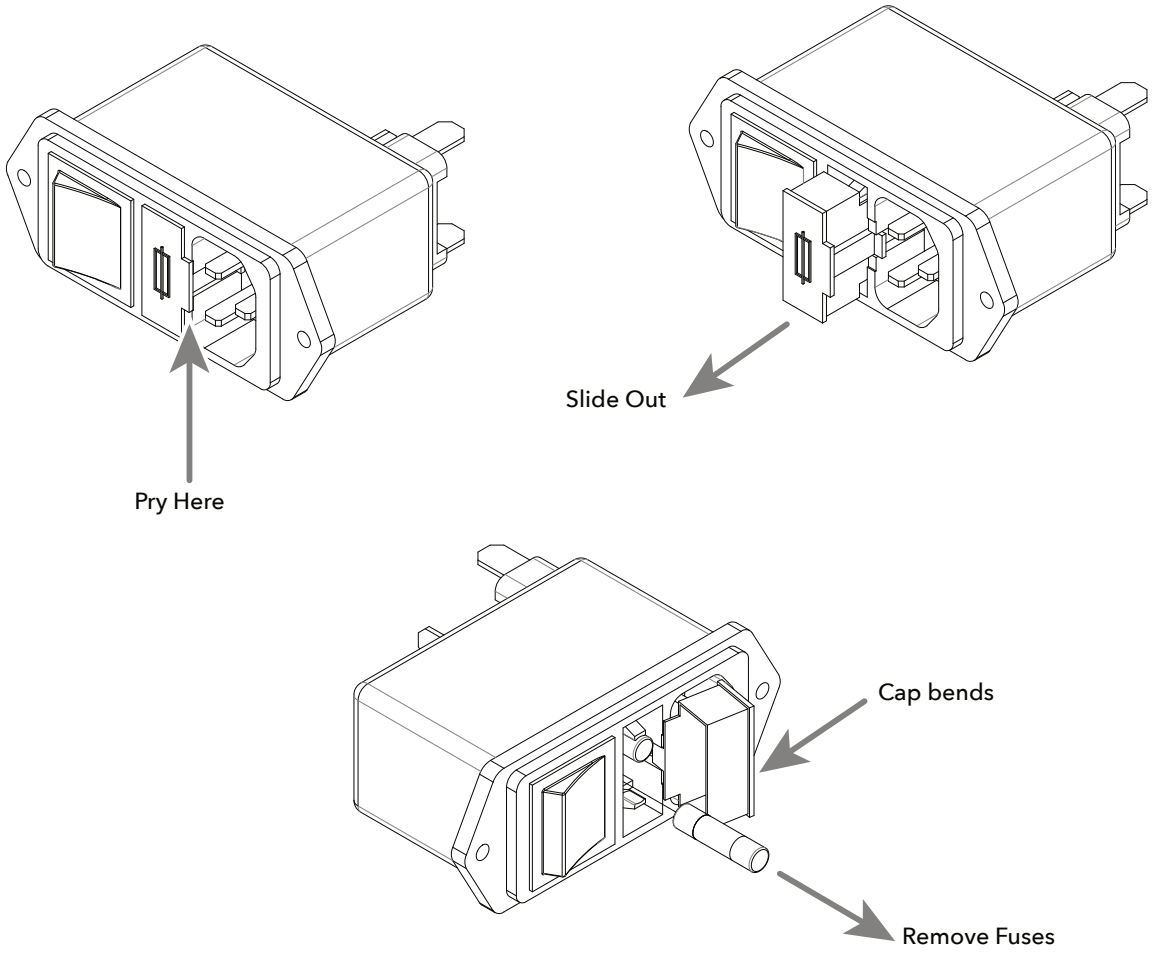


Figure 148: Processor fuse replacement.

B

Unknown User / Password

Overview

When user authentication is enabled, the web UI requires a user name and password for access. If the user name and password are lost, the only way to regain access is to restore the HELIOS to factory defaults.

All current show information will be deleted!

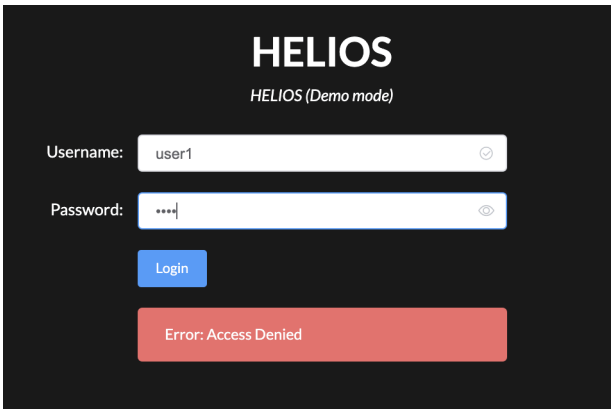
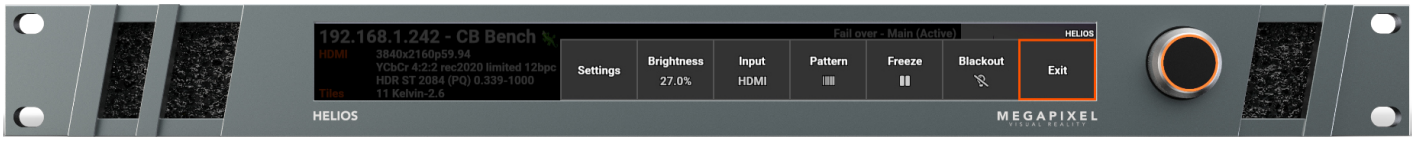


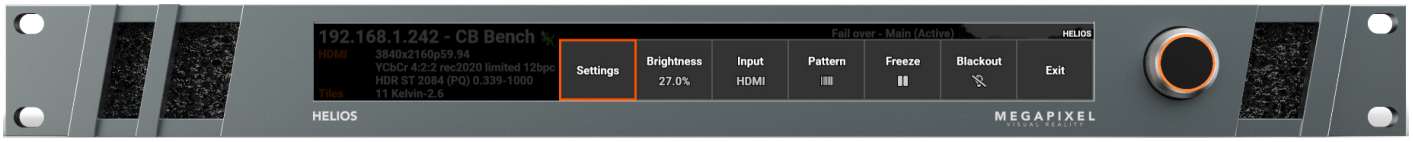
Figure 149: HELIOS 'Access Denied'.

Restoring to Factory Default

1. Press the encoder on the front of the HELIOS unit to access the HELIOS menu.



2. Turn the encoder to select ***Settings***.



3. Select ***Factory Default***.

4. Confirm the selection reset to factory defaults. The HELIOS will reboot.

All current show information will be deleted!

Troubleshooting Fiber

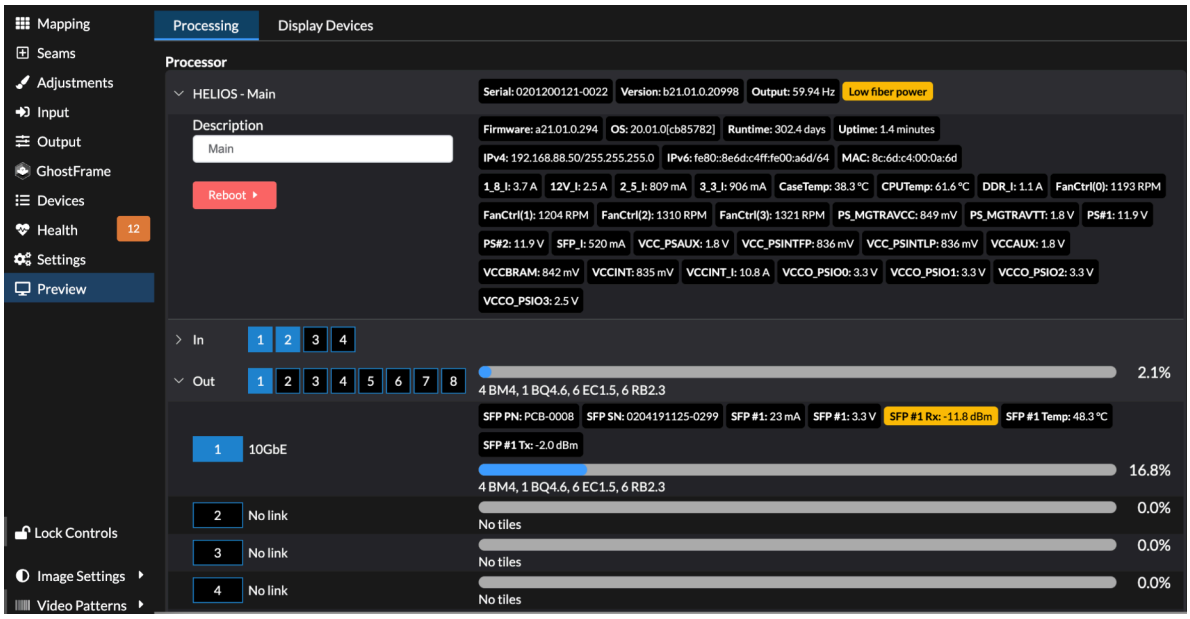
Overview

The root causes of fiber connectivity issues are typically related to the fiber cable or the SFP+ units (sending or receiving).

Troubleshooting checklist:

1. Check for fiber link activity lights. HELIOS units have a row of fiber connectivity indicators across the middle of the sending SFP+ group. If there is activity on these indicators, the fiber is connected.

2. Check the HELIOS UI for reported signal loss. The SFP *TX* value must be greater than -9 dbm. The example below shows a -11.8 dBm transmit signal. This is below the minimum -9 dbm required. Also check for any network related error messages on the ***Health pane***.



3. Swap the connection for a different fiber strand or cable.

4. Verify fiber type is correct. It should be single mode fiber, 'OS1' or 'OS2'.

5. Confirm correct SFP+ units are being used on each end. Fiber connectivity between the HELIOS and the network switches require unique MVR branded SFP+ units. HELIOS units have sending SFP+ units, network switches have receiving SFP+ units.

SFP+ Types

Sending SFP+ - **Blue** bale clasp, labeled with arrows pointed away from the HELIOS (top example).

Receiving SFP+ - ***Purple*** bale clasp, labeled with arrows pointed towards the network switch (bottom example).

Figure 150: Send and receive SFP+ units.

Testing SFP+ units

These three strategies below can help diagnose a cable or SFP+ issue.

1. Setup the network switch near HELIOS, and connect a known good, short fiber cable, and test the link

2. Remove the purple SFP+ from a network switch and move it to an available HELIOS SFP+ output slot. Use a known good, short fiber cable to link the purple SFP+ with the blue SFP+. If the SFP+ units link successfully, they are good*. The issue is likely related to the fiber cable itself.

3. Remove a blue SFP+ from a HELIOS output slot and move it to an available SFP slot on a network switch. Connect a known good, short fiber cable between the two SFP+ units and check for link. If the SFP+ units link successfully, the issue is likely related to the fiber cable itself.

4. If an SFP+ fails this test, it will need to be returned for replacement. Please contact your MVR representative for further instructions.

NOTE: The above can only be done using different models of SFP+ (purple and blue). Fiber systems cannot link two sending units or two receiving units.

Incompatible SFP Alert

HELIOS units must be properly licensed for the SFP modules in use. The standard license allows 1G copper if set to junior operating mode OR 10G fiber if set to standard operating mode. Whereas the junior license only allows 1G copper, and will have standard mode grayed out in the selection drop down. Mismatched licenses and SFP modules will generate system alerts.

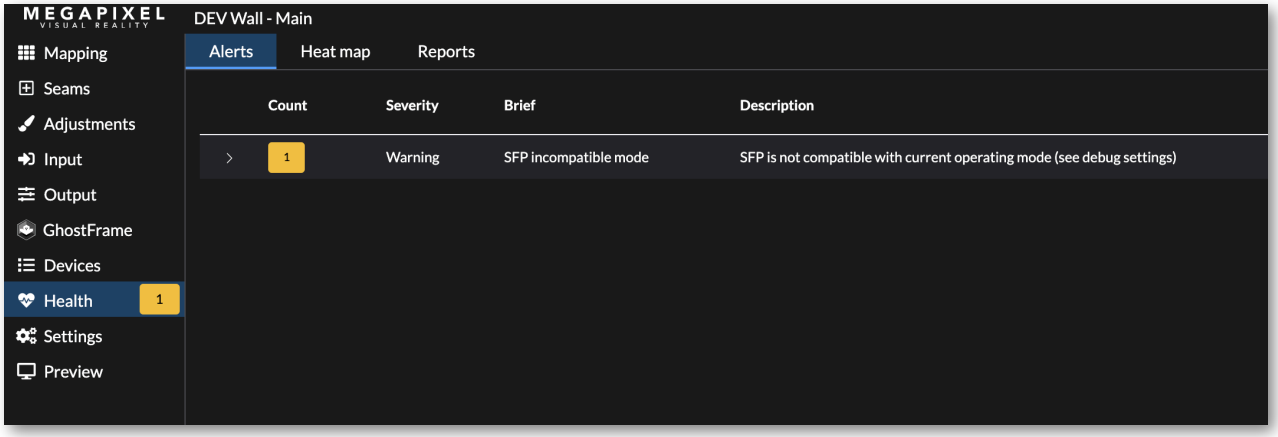


Figure 151: Incompatible SFP.

Checklist:

1. Check the system settings for the license type. A HELIOS Standard license enables both copper and fiber SFP+ modules, whereas a HELIOS Junior license only enables copper SFP modules.

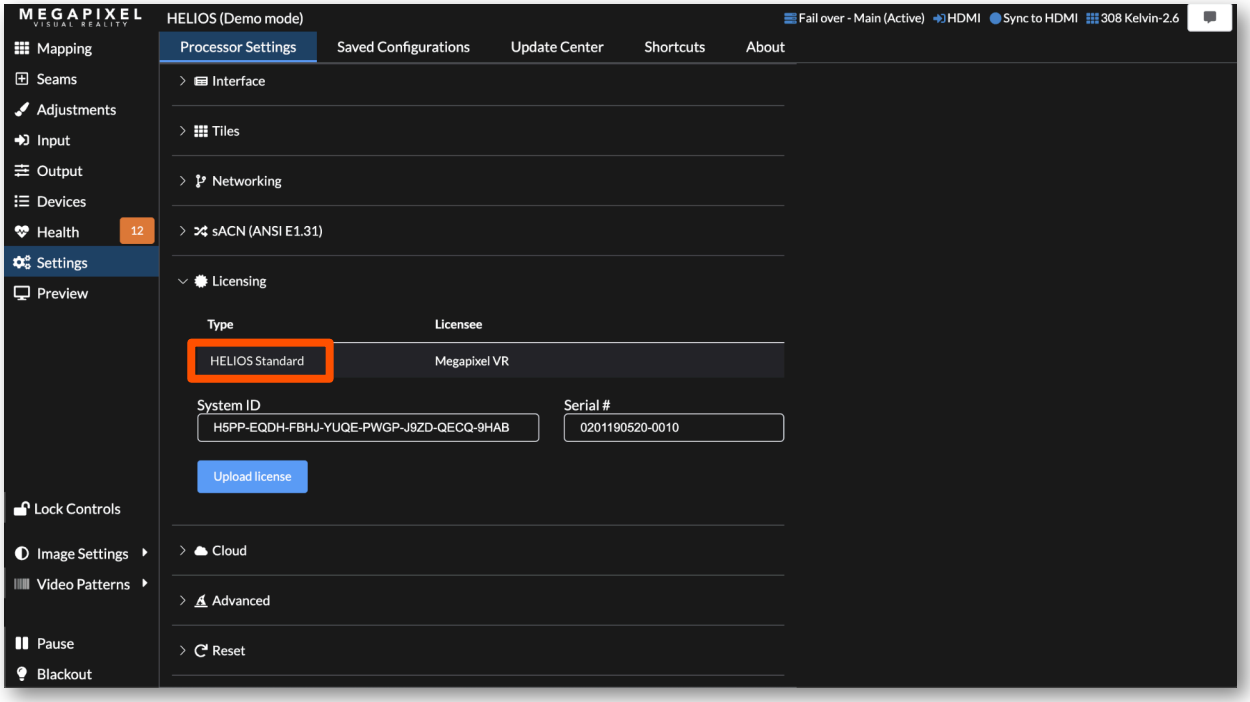


Figure 152: HELIOS Standard license.

2. Check the operating mode in system settings. A HELIOS Junior license will only operate Junior mode.

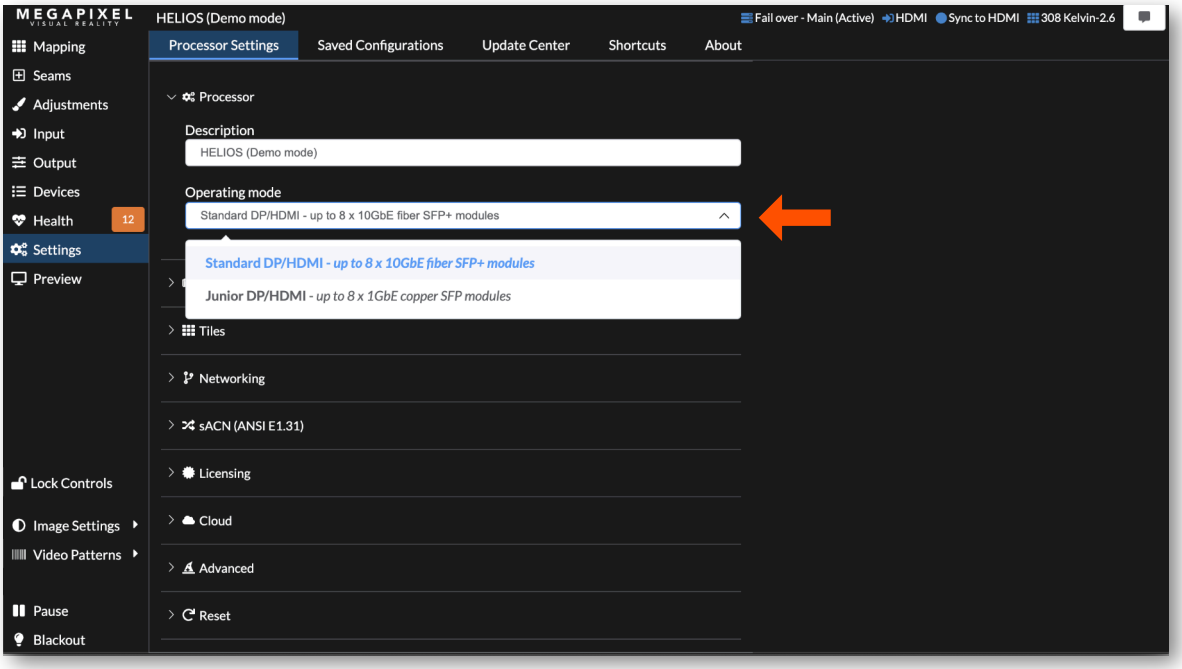


Figure 153: Operating mode

3. Check the type of SFP modules and in which ports they are installed in the Devices pane. The image below shows the error a HELIOS Standard system will generate in Standard mode with a copper SFP installed in port 7. Copper SFP modules are only compatible with a HELIOS in Junior mode. If copper SFP module(s) are needed, the user should switch the HELIOS to Junior mode (in Processor Settings). A HELIOS Standard can operate in both Junior and Standard modes.

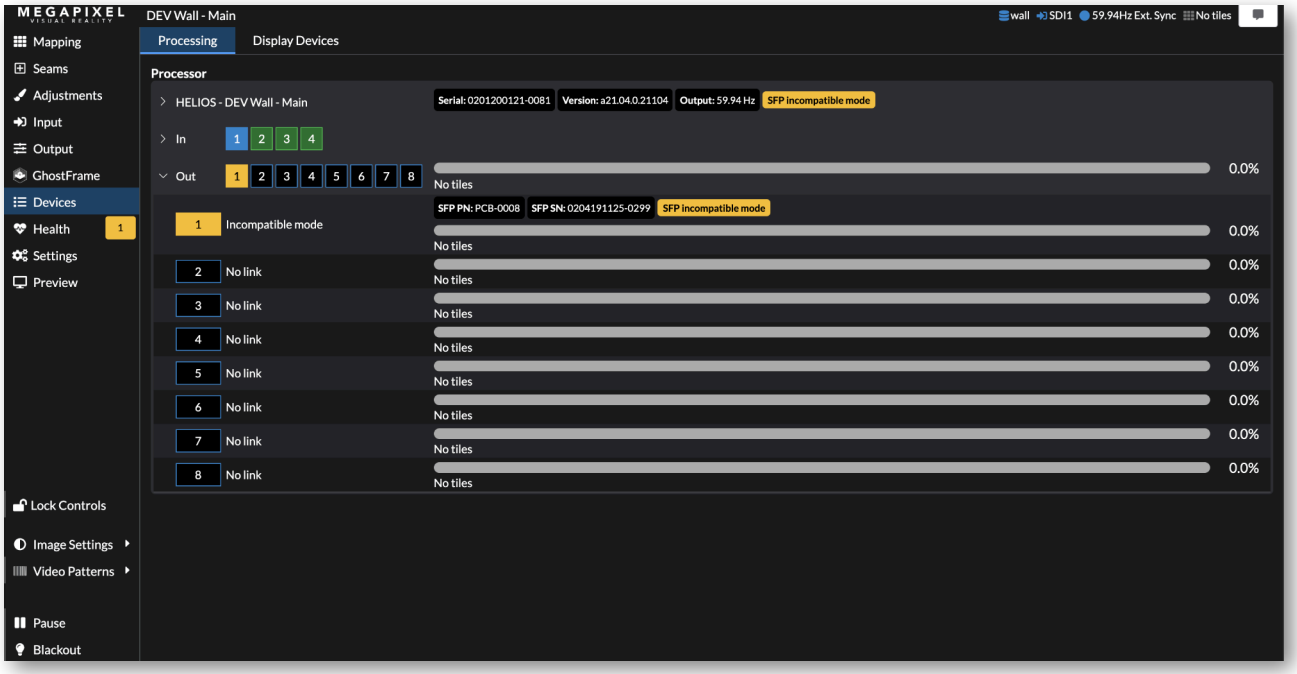


Figure 154: Devices Pane Incompatible Copper SFP+ modules

D

Low Level Noise Reduction

Overview

This section describes what MVR has found to be the most effective method for reducing low level video noise on LED displays.

Below are two images of an LED display with a dark field next to a person. The image on the left is an example of low level noise that needs to be removed (the errors in black have been exaggerated for illustrative purposes). The black region to the left of the person shows several blocks of different degrees of black. After the adjustments in HELIOS, the image on the right shows fewer irregularities in the black region next to the person.

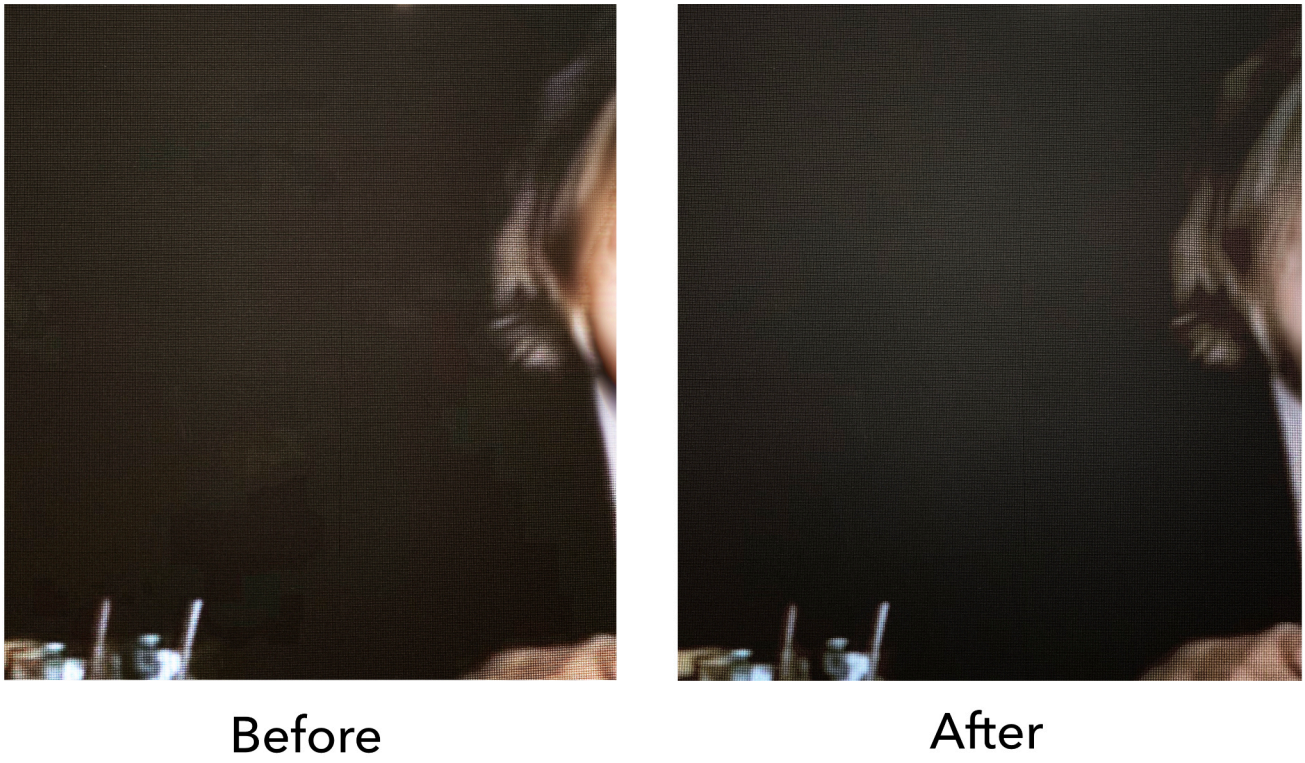


Figure 155: Before and After Correction

Low Level Noise Reduction Steps

1. Ensure that the content is as noise free as possible before it is sent to HELIOS.

2. Enable Advanced Mode in ***Settings → Processor Settings.***

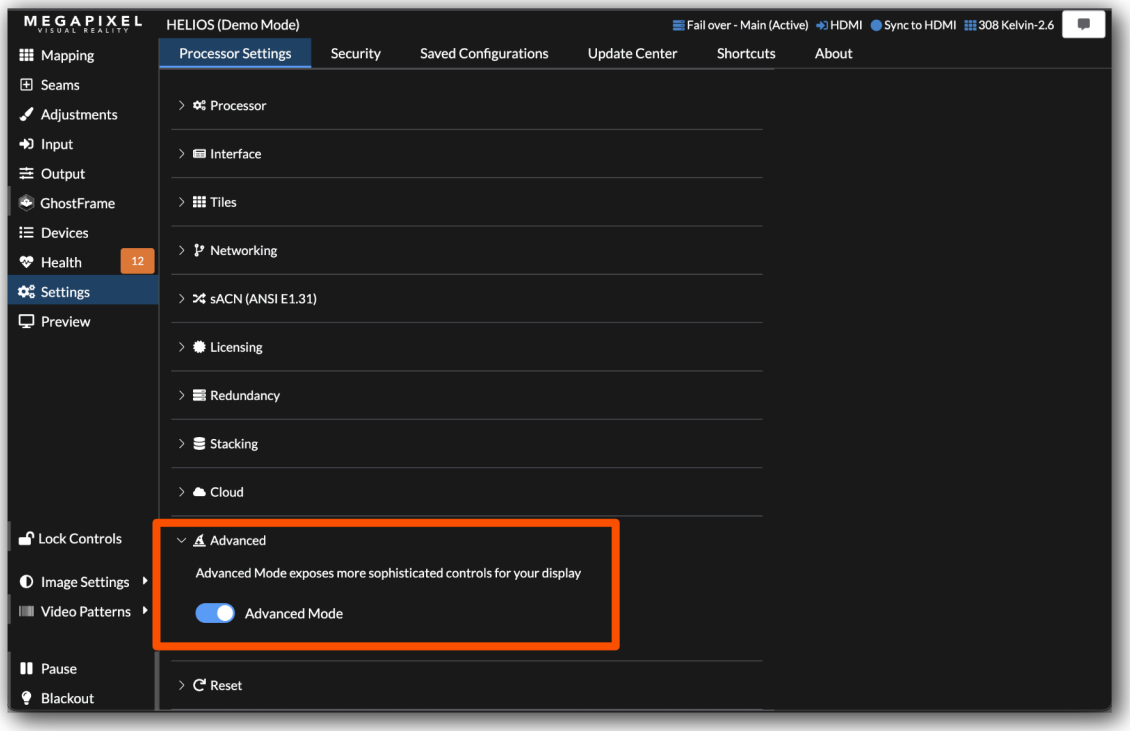


Figure 156: Advanced Mode

3. Navigate to the Output pane, Output adjustments accordion and increase the Black clipping value.

Black clipping - raises the floor for the value to be considered black. This causes a loss of detail in shadows and other dark content regions as values below the threshold are not displayed.

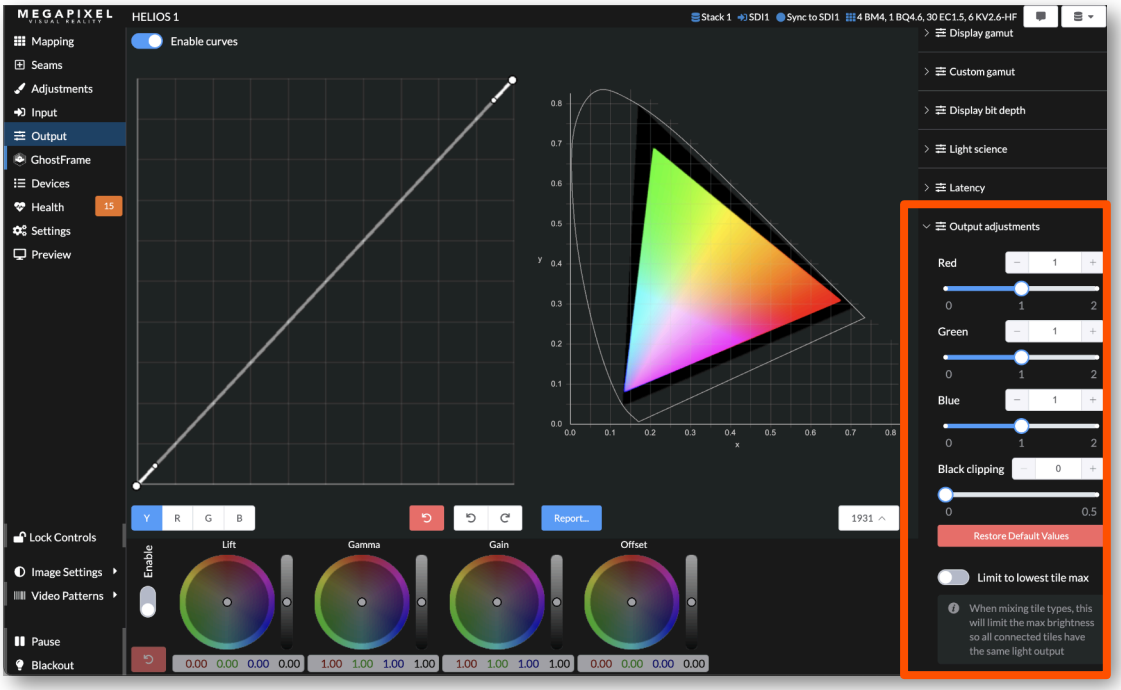


Figure 157: Output adjustments

Low Level Noise Reduction Steps (continued)

4. Navigate to the ***Input*** adjustments pane, ***Black Level*** control to reduce the noise coming in by raising the black level.

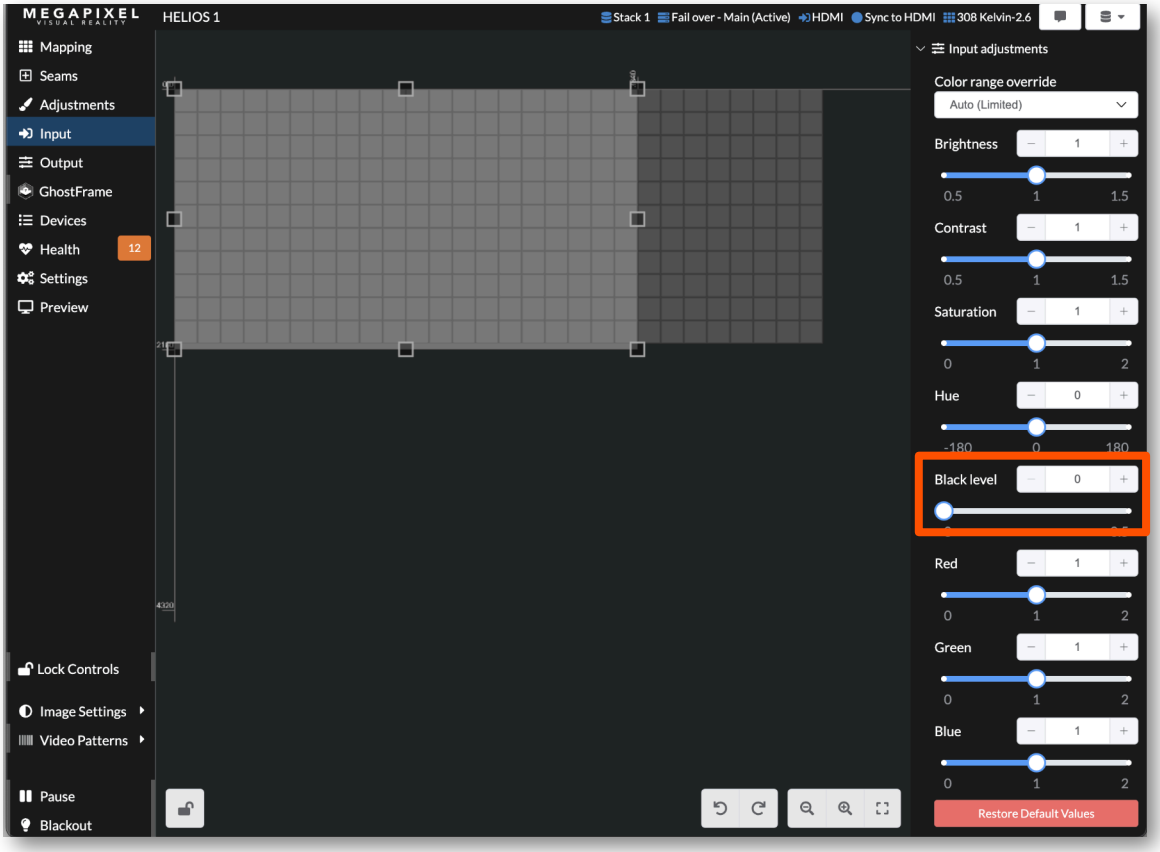


Figure 158: Input Black Level

E

Content to Panel Luminance Curves

PQ encoded HDR content reports a luminance range for the content in the metadata of the HDMI or SDI signal. This section covers how HELIOS handles this luminance data to maximize the capabilities of panels.

The various colored dots on the chart below represent scenarios where panels of different luminance capabilities are matched with content mastered to narrow, medium, and wide range luminance. The far right side cyan dots represent the luminance curve supplied by the PQ content. Each of the 'tile to content' scenarios is mapped against this 0 - 10,000L range.

The blue dot scenario in the graph below shows a panel with a maxL of 100 receiving content mastered with a maxL of 100. The max content level is 100, and the panel is 100. The panel is capable of showing the full range of content (0-100). An image being reproduced in this manner displays the image as artistically intended.

The red dot scenario shows the same 100 maxL panel receiving content mastered to a wider range of 1,000L. The graph shows a more rounded curve as the image loses some of the high level details and the panel is unable to reach the intended brightness levels. The same holds true with the yellow dot scenario, in which a low luminance panel (100L) is given a very wide luminance range. In this case, the slope is even more pronounced as the panel limitations don't allow for the accurate reproduction of the content.

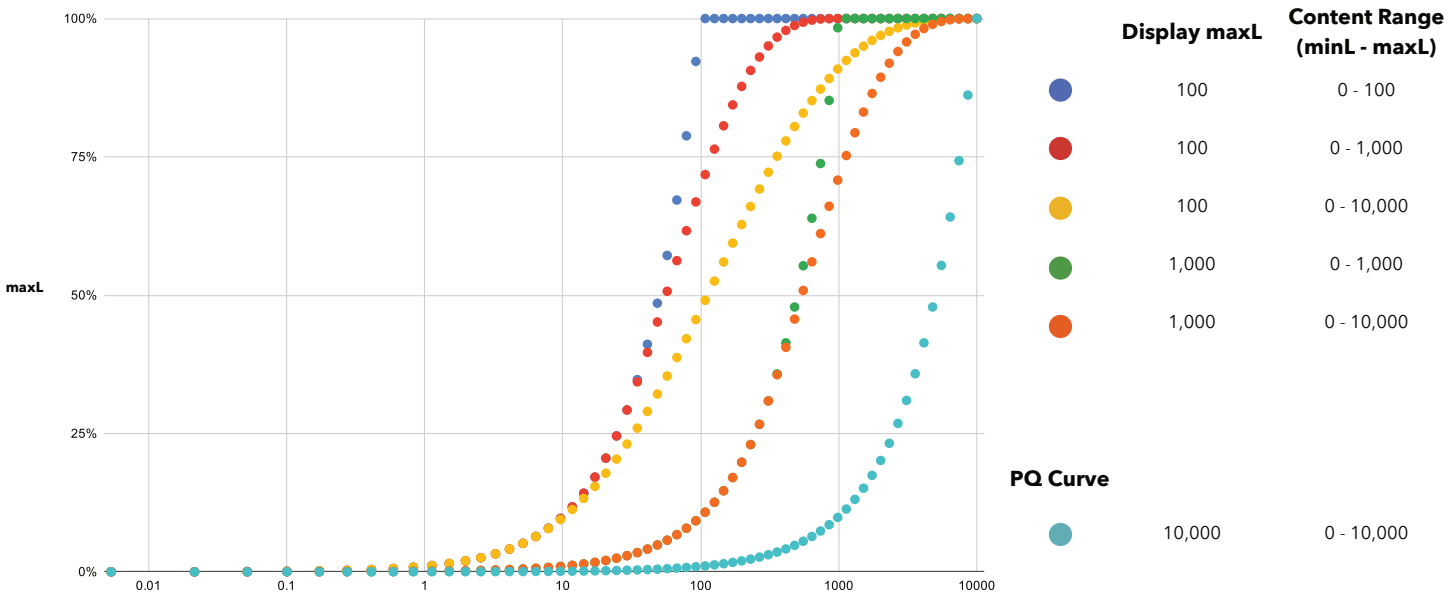


Figure 159: HELIOS EOTF Luminance Curves

The image below is a graph of a scenario where 500 nit content is not being displayed correctly on a 100 nit display. As HELIOS has been configured to expect content mastered at 100 nits, while the incoming signal actually has a max content level of 500 nits. Red dots are the content, blue is what actually happens on the display. All of the information above 100% is being clipped by the display.

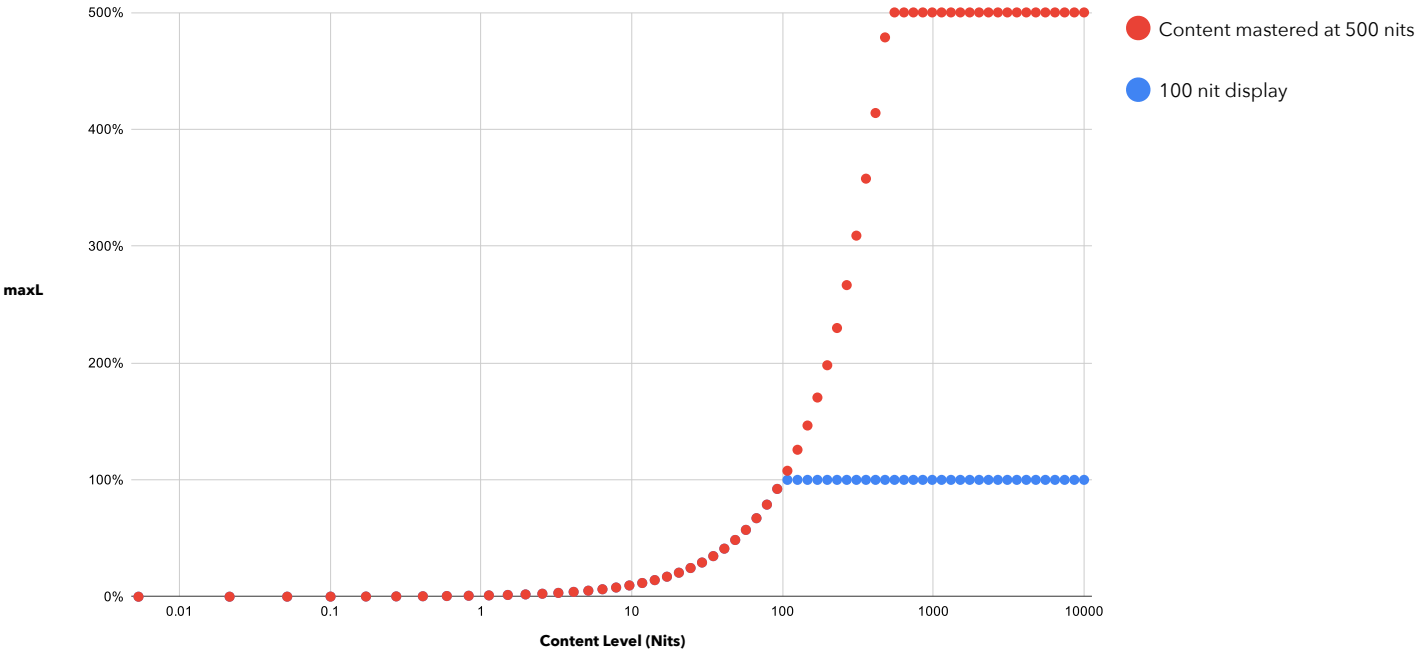


Figure 160: Incorrectly configured content

It is best practice to align the luminance range of the content to that of the panels. As a workaround for when the content is not mastered for the display, the HELIOS EOTF overrides can be used to "boost" the display's brightness, but will have the side effect of lowering the overall output brightness. An alternative is to adjust the content levels, but that risks clipping content highlights.

NOTE: In cases where the content doesn't advertise a content *MaxL*, HELIOS uses the *MaxL* of the display.

Content should always be intentionally mastered at a MaxL matching the final display's nit level. In the real world, however, it is quite common for content to be delivered at a default of 1000L. Below are a series of images showing how correct vs incorrect metadata can greatly increase or decrease detail and fidelity. Note the detail of the buildings outside the window are lost. This is due to a Display MaxL of 100 with Content MaxL defaulting to 100L due to a lack of metadata in the video signal. The actual content was mastered for 1000L, so all levels above 100L will lose detail.

Figure 161: Detail lost

In the second image, the Content MaxL has been overridden to 1000 nits to match how the actual content file was mastered. Notice the significant increase in detail in the buildings outside the window.

Figure 162: Detail retained

F

Data Redundancy

Overview

The HELIOS system supports multiple high availability redundancy modes. This is accomplished by sending video data from two HELIOS Processors to the same string of tiles at once using bidirectional data flow from each end of the tile string simultaneously. Illustrated below, are two HELIOS processors and associated switches sending data into strings of tiles from two directions (top down and bottom up). HELIOS Junior units can also be used to create redundant systems. In the case of HELIOS Junior, the processors send data directly to tiles without the use of network switches. Since there is duplicate data on the network, tiles need to know which processor to listen to. This is done by a system of priority. The processor with the role ***Main*** has the highest priority. All of the processors must be connected to an external genlock sync.

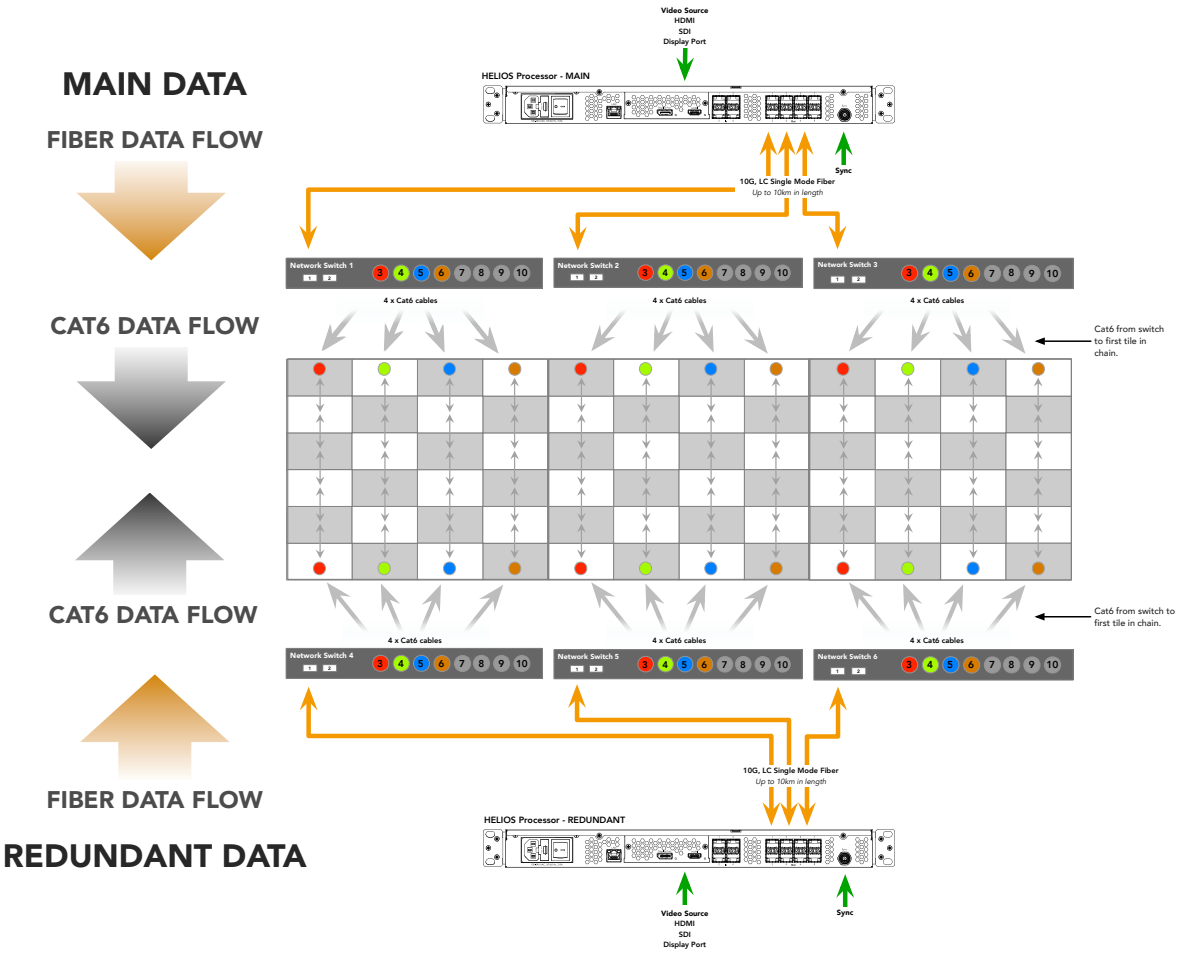


Figure 163: Redundant system topology

NOTE: Tiles must have software version 20.03.0.256 or later to support the HELIOS redundancy features. See the end of this section for upgrade steps.

Redundancy Settings

Redundancy is enabled by physically configuring the system as illustrated by the previous figure. In the user interface, ensure the ***Advanced*** mode is ***ON (Settings → Processor Settings → Advanced)***. The redundancy controls are located under ***Settings → Processor Settings*** just under the ***Licensing*** section.

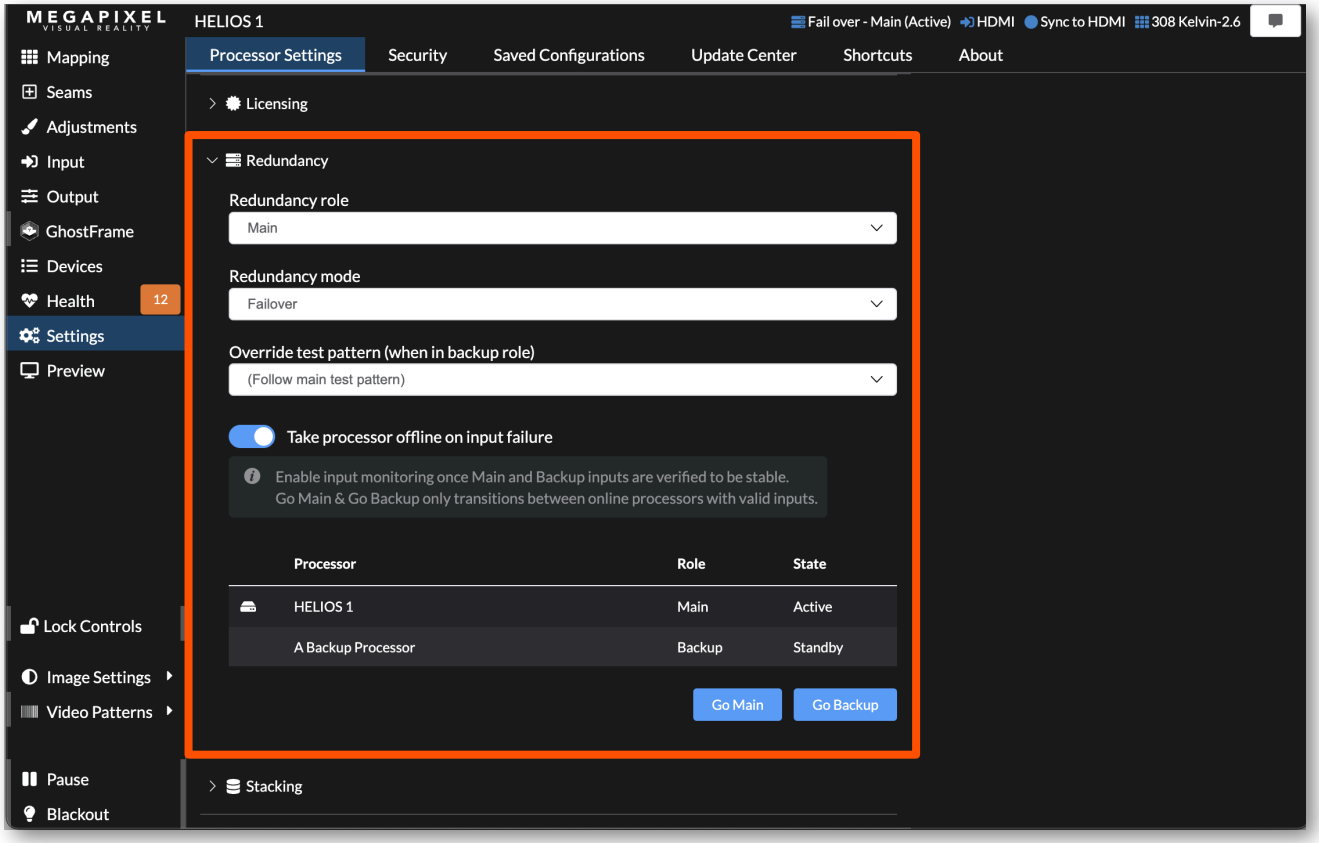


Figure 164: Redundancy settings

Processor Role

The role selection lets the system know how the particular processor should be prioritized in the system. HELIOS has three options for role:

Main (default) **-** Selecting this role identifies the processor as the primary processor in the system.

Backup **-** Identifies the processor as the redundant unit to be used in case of an issue with the Main processor.

Offline **-** Identifies the processor as not available to the system. This is the role to use when a known issue has occurred with a processor. The HELIOS system will ignore a processor in this role.

Figure 165: Role options

Redundancy Modes

One of the three operating modes must also be selected; ***None, Failover or Seamless***.

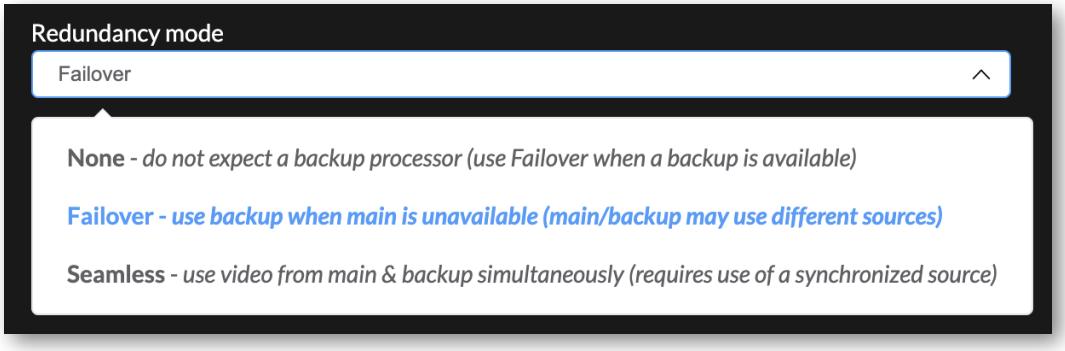


Figure 166: Mode selection

None - HELIOS will not be expecting a backup processor. If the backup processor goes away HELIOS will not throw any errors. If HELIOS detects a backup processor on the network it will still be able to make use of it.

Failover - Tiles are set to receive video from one processor only, the main processor. This provides tiles with a predictable signal path. Tiles will re-associate to the backup processor if the main processor stops sending video or the input fails. Since tiles only accept videos from one processor, a failure event will have a slight perceptible disruption in the content as the affected tiles associate with the backup processor.

Seamless - Tiles are automatically associated with the highest priority processor available to them during startup. In this mode, the tiles in the display are allowed to receive video simultaneously from both processors. The image that a tile displays can be made up of data from both the main and backup processor. When using the ***Seamless*** mode, the input video to each of these HELIOS Processors must be identical and frame synced. This is so that there will be no perceptible difference in the image, as tiles use data from both processors. Since the system is using both processors simultaneously, failures have a near imperceptible impact. However, ***Seamless*** mode does not do well in situations where a complicated upstream video pipeline can make it difficult to detect input failures.

Override test pattern (when in backup role)

An alternate processor test pattern can be assigned to backup processors. This feature is primarily designed to help technicians during setup see clearly which processor a tile is currently connected to. The default mode is to follow the main test pattern (the first option in the list).

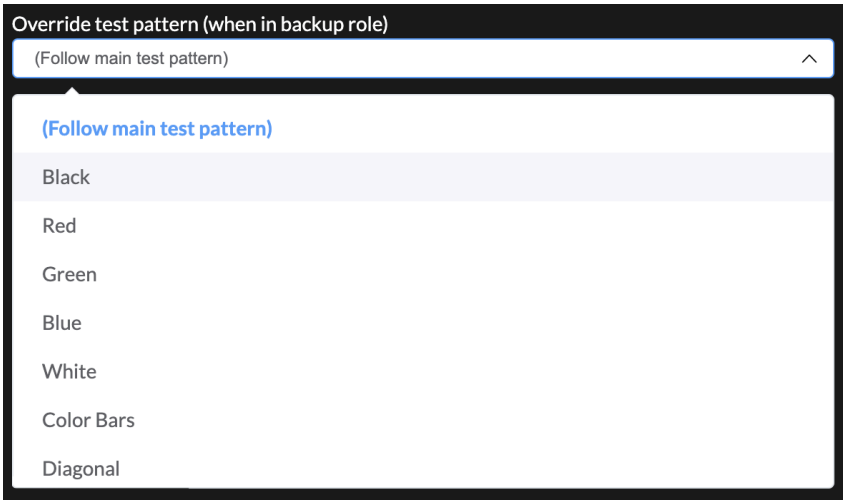


Figure 167: Test pattern override

Take processor offline on input failure

Should the input on the main processor fail to receive frames, the system will switch to a processor with a functional input. In the case of stitched inputs (dual DP/HDMI and quad SDI) losing one of the input links will make that entire input be considered invalid and will trigger a switch. If this toggle is left off, input failure is not used as a criteria to switch processors. Displays will show black until incoming frames are restored to the processor.

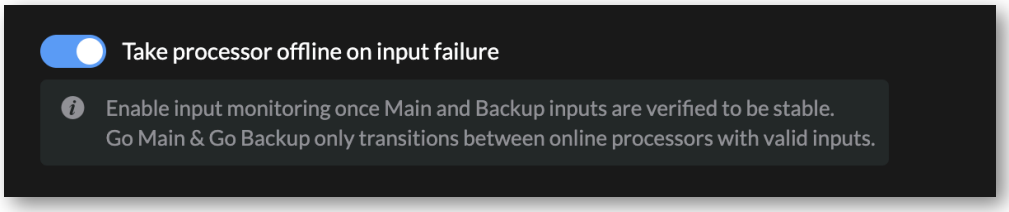


Figure 168: 'Take processor offline…' toggle

NOTE: When ***Take processor offline on input failure*** is toggled **ON** HELIOS will not allow the user to ***Go Main*** a processor with no input.

Redundancy States

Active **-** Processors are ***Active*** when panels are connected to only that processor.

Mixed **-** Processors are ***Mixed*** when panels are connected to both the main + backup processors.

Standby - Processors are ***Standby*** when no panels are connected.

Offline - A Processor is considered ***Offline***, either via explicit role selection or through input failure

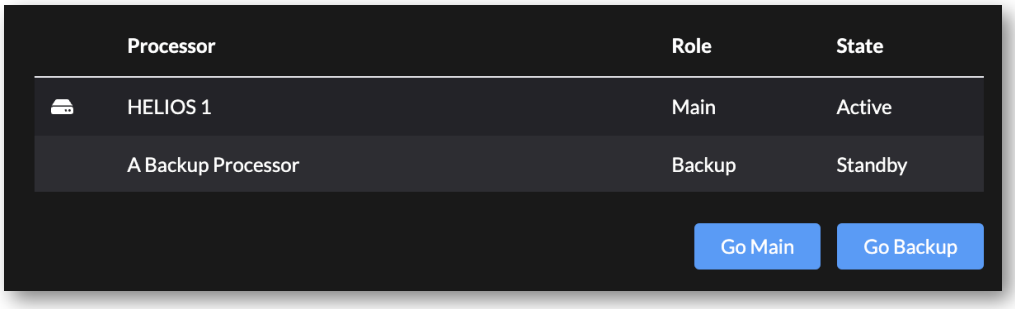


Figure 169: Processor Roles and States

Manual Overrides

If both processors have equal priority on startup, tiles will associate with the first processor they see. If the results of the automatic tile to processor association are not what the display operator needs, a manual ***Go Main*** or ***Go Backup*** command can be sent to re-associate the tiles to the desired processor.

Go Main **-** A manual override command to tiles. When this command is issued, tiles will associate to the main processor.

Go Backup **-** A manual override command to tiles. When this command is issued, tiles associate to the backup processor.

Processor Stacking

Stacking should be used when configuring a redundant system. When enabled, processors share states such as global brightness, tile positions, and redundancy settings. After enabling stacking, enter a stack name to join. If another processor is found with the same stack name, a blue dot icon shows up in the list next to the IP address indicating that the processor has joined the stack.

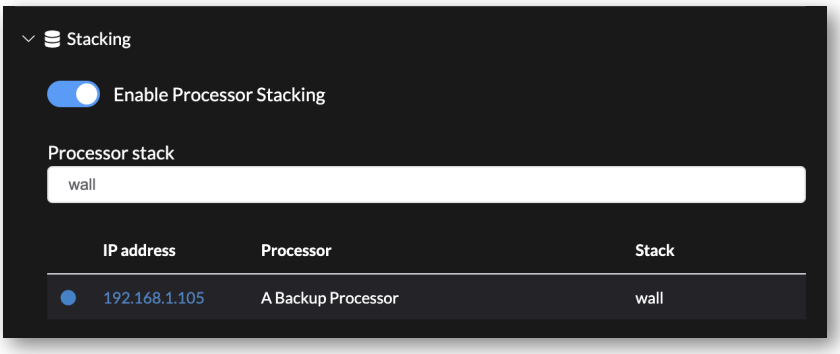


Figure 170: Stacking settings

NOTE: Let stacking take care of sharing data from one processor to another. Do not manually transfer saved configurations from one stacked processor to another. Stack processors before mapping tiles. Alternatively, create the stack with the primary processor first. The order in which processors join a stack matters! Settings are propagated based on how long processors have been part of the stack. Newly added processors will copy the settings from the existing. If stacking is done in the wrong order, without a saved configuration, settings will be lost.

Front Panel Redundancy Info

When redundancy is enabled, the top right of the HELIOS front panel display reports the redundancy ***Mode***, ***Role***, ***State*** and ***Stack*** name. The example below, is set to ***Fail over*** mode. Possible modes are ***Fail over*** and ***Seamless***. The example below, is set to the ***Main*** role and ***(Active)*** state. Possible states are ***Active***, ***Standby*** and ***Mixed*** (cases where tiles are split between the main and backup processors). Below the ***Mode***, ***Role***, and ***State*** info the HELIOS reports the ***Stack*** it has joined (as set by the ***Stacking*** settings). In the example below, the ***Stack*** that the HELIOS 1 has joined is called ***Stack Name Here***. When redundancy is not enabled, only the ***Stack*** name will be displayed.

Figure 171: Front UI Redundancy Info

Devices Pane Link Icon

The devices pane shows a **link** icon next to items connected to the same system as the current webUI. In other words, if the operator is currently controlling the ***Main*** system while browsing the ***Display Devices*** tab, all of the tiles connected to the **Main** processor show **link** icons as in the example below.

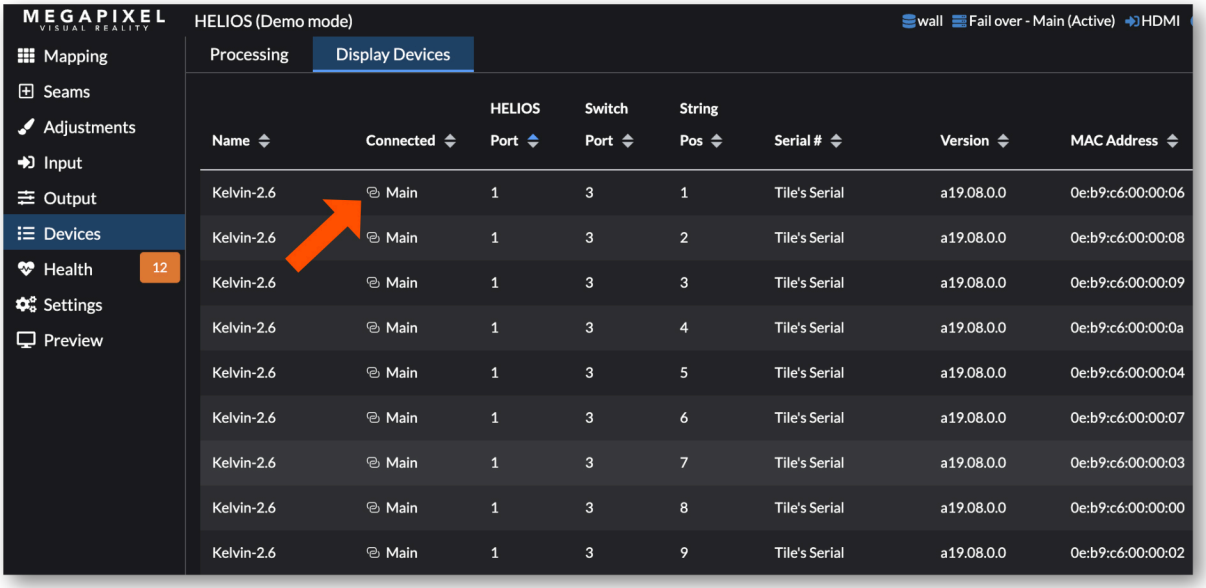


Figure 172: Devices Pane link icon

Upgrade Process

Upgrade tiles to version 20.03.0.256 or greater using only a single HELIOS processor. Please see the **Update Center** section in Chapter 5 for more details. Tiles need to reply to processors after finishing an upgrade. Having two processors in the system during an upgrade can cause issues with these replies from tiles with earlier firmware versions.

When upgrading a redundant system to a version of HELIOS and tile firmware that supports redundancy it is important to follow a specific sequence:

1. Connect HELIOS MAIN, network switches MAIN, and tiles as normal. Confirm mapping/video as expected.
2. Upgrade the HELIOS MAIN.
3. Upgrade tiles.
4. Boot up HELIOS BACKUP and network switches BACKUP (do not connect tiles yet).
5. Upgrade HELIOS BACKUP.
6. Wait for the network switches BACKUP to appear in devices page.
7. Connect tiles to the network switches BACKUP.
8. Activate stacking and configure redundancy options.

Technical Specifications

Network Switch - Specifications Table

Dimensions (W x H x D)	440mm (17.32”) x 43.21mm (1.70”) x 100mm (3.93”)
Power Requirements	100 - 240V AC, 50Hz/60Hz, 1A (IEC C14 Connector)
Weight	2.1 kg (4.62 lb) shipping dimensions and weights below
IP Rating	Indoor only
Ambient Operating Temperature	10° to 40°C (50° to 104°F)
Certifications	UL, FCC (Class A), CE, WEEE, C-TPAT
Fiber Optic Input from HELIOS Processor	1 x 10Gb SFP+ Single Mode Fiber Input (LC)
Copper Output Ports	8 x 1Gb / 2.5Gb Ethernet (Video Output ports) 1 x 1Gb Ethernet (OOB management port)
Maximum pixels per port	425,000 pixels (12-bit, 60Hz) = 918Mb/s per port
Maximum pixels per 10 port network switch	4,250,000 pixels (12-bit) = 9.18Gb/s per network switch

Network Switch - Shipping Info.

Shipping box dimensions (W x H x D)	533mm (21”) x 279mm (11”) x 305mm (12”)
4K Kit - 3 switches	1 full box
8K Kit - 8 switches	3 boxes (2 full + 1 partial)
Full box (3 switches)	12.2 kg | 27 lb
Partial box (2 switches)	8.5 kg | 19 lb

HELIOS Processor - Specifications Table

Dimensions (W x H x D)	481.5mm (19.0") x 44.2mm (1.7") x 414.5mm (16.3")	
Power Requirements	100 - 240V AC, 50Hz/60Hz, 3A (IEC C14 Connector)	
Fuses	2 x 6.3A 250V Glass Tube Slow Blow, Ø 5 x 20mm	
Weight	~3.9 kg (8.6 lb) shipping dimensions and weights next page	
IP Rating	Indoor	
Ambient Operating Temperature	10° to 40°C (50° to 104°F)	
Certifications	ETL, FCC (Class A), CE, RoHS	
Maximum pixels per Processor	35M pixels	
Heat Load	256 BTU/hr thermal dissipation	
HELIOS web UI	1 x Gb Ethernet	
System Latency *	3 frames (@ 60Hz = 50ms | @ 120Hz = 25 ms)	
Inputs		
HDMI	1 x Input - HDMI 2.0b	
DisplayPort	1 x Input - DP 1.4 HBR3	
SDI	4 x Inputs:	SD and HD-SDI (Progressive only)
		3G and 6G SDI (level A and B)
		2SI on12G-SDI **
ST2110	4 x Inputs up to 4k @50Hz	
Sync	1 x - Black burst and Tri-level ***	
Outputs to Display Devices		
HELIOS Standard	8 x 10Gb SFP+ Outputs:	9/125 Single mode (SMF) OS1 (<=1000m) or OS2 LC-LC terminated UPC Polish Riser / plenum rated Maximum / port: 4,250,000 pixels (12-bit, 60Hz) = 9.18Gb per output
HELIOS Junior	8 x 1Gb SFP Outputs:	RJ-45 Cat 6/Cat 6a Maximum / port: 425,000 pixels (12-bit, 60Hz) = 918Mb per output SFP

* Input to eyeball including network switches.

** Square Division is supported, but it can not be scaled.

*** Tested to work with: Evertz MSC5601, AJA GEN-10, BlackMagic Design CONVMSYNC

HELIOS Processor - Shipping Info.

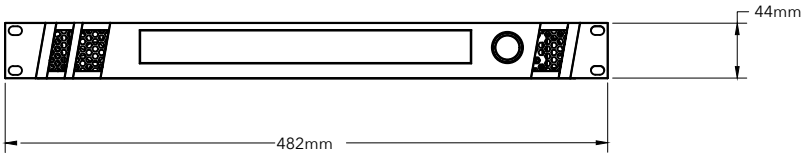
Shipping box dimensions (W x H x D)	533mm (21″) x 597mm (23.5″) x 184mm (7.25″)
HELIOS - JR	8.2 kg | 18.1 lb
HELIOS Standard - 4K	8.2 kg | 18.1 lb
HELIOS Standard - 8K	8.7 kg | 19.1 lb

Each HELIOS box contains:

- HELIOS Processor
- Power cord
- Ethernet cable (5ft)
- Rack mount screws
- Quick start guide

HELIOS Processor Dimensions

Front View



Top View

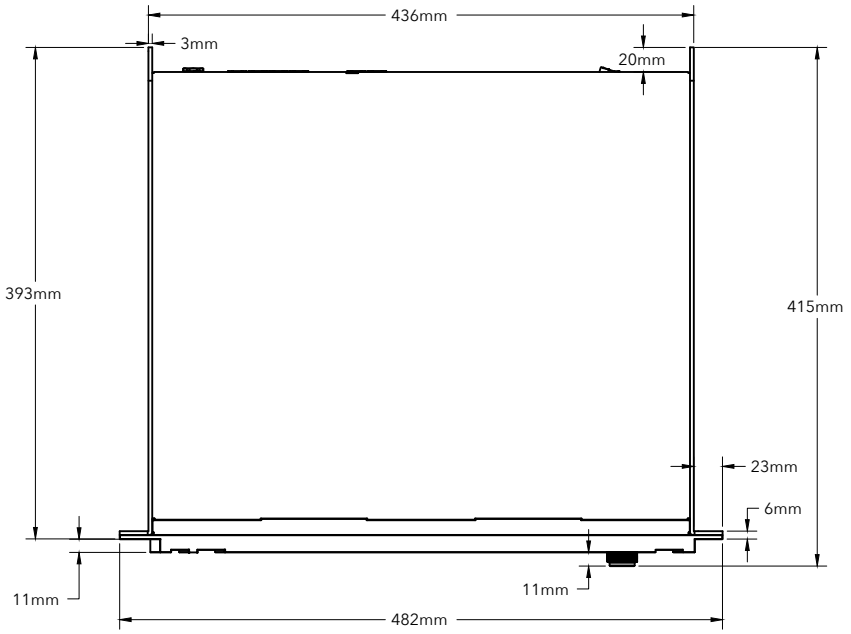


Figure 173: HELIOS dimensions

HELIOS Processor - Input Capability Matrix

The charts below show three common refresh rates. HELIOS supports any frequency between 15Hz and 120Hz. When capacity planning, use the rate in the table that is closest to the actual frequency that will be used. See the **System Planning** section for the bandwidth calculation formula that can be used for HDMI, DisplayPort and ST2110.

NOTES:

- **HDMI signals cannot exceed 4K, regardless of bandwidth.**
- **HDR (High Dynamic Range) using both PQ and HLG is supported on all interfaces.**

	720p (1280 x 720)	1080p (1920 x 1080)	UHD (3840 x 2160)	DCI 4K (4096 x 2160)	5K (5120 x 2880)	6K (6016 x 3384)	8K (7680 x 4320)	DCI 8K (8192 x 4320)
120 Hz								
RGB 12-bit	DP/HDMI/ST2110	DP/HDMI/ST2110	No	No	No	No	No	No
RGB 10-bit	DP/HDMI/ST2110	DP/HDMI/ST2110	No	No	No	No	No	No
RGB 8-bit	DP/HDMI/ST2110	DP/HDMI/ST2110	DP Only	No	No	No	No	No
YCbCr 12-bit 4:4:4	DP/HDMI/ST2110	DP/HDMI/ST2110	No	No	No	No	No	No
YCbCr 12-bit 4:2:2	DP/HDMI/ST2110	DP/HDMI/ST2110	No	No	No	No	No	No
YCbCr 10-bit 4:4:4	DP/HDMI/ST2110	DP/HDMI/ST2110	No	No	No	No	No	No
YCbCr 10-bit 4:2:2	DP/HDMI/ST2110	DP/HDMI/ST2110	DP Only	DP Only	No	No	No	No
60 Hz								
RGB 12-bit	DP/HDMI/ST2110	DP/HDMI/ST2110	DP Only	DP Only	No	No	No	No
RGB 10-bit	DP/HDMI/ST2110	DP/HDMI/ST2110	DP Only	DP Only	No	No	No	No
RGB 8-bit	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI	DP/HDMI	DP Only	No	No	No
YCbCr 12-bit 4:4:4	DP/HDMI/ST2110	DP/HDMI/ST2110	DP Only	DP Only	No	No	No	No
YCbCr 12-bit 4:2:2	DP/HDMI/ST2110	DP/HDMI/ST2110	DP Only	DP Only	DP Only	No	No	No
YCbCr 10-bit 4:4:4	DP/HDMI/ST2110	DP/HDMI/ST2110	DP Only	DP Only	No	No	No	No
YCbCr 10-bit 4:2:2	DP/HDMI/ST2110/SDI	DP/HDMI/ST2110/SDI	DP/HDMI/SDI	DP/HDMI/SDI	DP Only	DP Only	4 x SDI Only	4 x SDI Only
30 Hz								
RGB 12-bit	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI	DP Only	DP Only	No	No
RGB 10-bit	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI	DP Only	DP Only	No	No
RGB 8-bit	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI	DP Only	DP Only	DP Only	No
YCbCr 12-bit 4:4:4	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI	DP Only	DP Only	No	No
YCbCr 12-bit 4:2:2	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI	DP Only	DP Only	DP Only	No
YCbCr 10-bit 4:4:4	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI/ST2110	DP/HDMI	DP Only	DP Only	No	No
YCbCr 10-bit 4:2:2	DP/HDMI/ST2110/SDI	DP/HDMI/ST2110/SDI	DP/HDMI/ST2110/SDI	DP/HDMI/SDI	DP Only	DP Only	DP / 4 x SDI	DP / 4 x SDI

HELIOS Processor - Supported SDI Input Formats

Supported Resolutions for each SDI Input
1280 x 720
1920 x 1080
2048 x 1080
3840 x 2160
4096 x 2160

Supported Frame Rates
23.98 / 24
24.97 / 25
29.97 / 30
49.95 / 50
59.94 / 60

NOTES:

- The pixel format must be YCbCr 4:2:2
- All video signals must be Level A with the exception of 1080p 50/60 Hz can be Level B.
- Inputs can be combined using 2SI or square division. Square division is only supported across separate physical inputs (not within a single 12G link).
- HELIOS does not support interlaced or progressive segmented frame (PsF) signals.

HELIOS Processor - Output Port Capacity (Pixels)

Bit Depth	10	10	10	12	12	12
Connection	Switch to Tiles	Switch to Tiles	HELIOS to Switch	Switch to Tiles	Switch to Tiles	HELIOS to Switch
Ethernet Speed (Gbps)	1	2.5	10	1	2.5	10
Video FPS						
24	1,275,000	3,187,500	8,500,000	1,062,500	2,656,250	8,500,000
25	1,225,000	3,062,500	8,500,000	1,020,000	2,550,000	8,500,000
30	1,020,000	2,550,000	8,500,000	850,000	2,125,000	8,500,000
48	635,000	1,587,500	6,350,000	531,000	1,328,125	5,312,500
50	610,000	1,525,000	6,100,000	510,000	1,275,000	5,100,000
60	510,000	1,275,000	5,100,000	425,000	1,062,000	4,250,000
120	240,000	600,000	2,400,000	200,000	500,000	2,000,000
144	195,000	487,500	1,950,000	160,000	400,000	1,600,000
240	100,000	250,000	1,000,000	90,000	225,000	900,000

Fiber Out / Data to Tiles

	720p (1280 x 720)	1080p (1920 x 1080)	UHD (3840 x 2160)	DCI 4K (4096 x 2160)	5K (5120 x 2880)	6K (6016 x 3384)	8K (7680 x 4320)	DCI 8K (8192 x 4320)
120 Hz								
444 12-bit	1 x 10Gb	2 x 10Gb	5 x 10Gb	6 x 10Gb	8 x 10Gb	No	No	No
444 10-Bit	1 x 10Gb	2 x 10Gb	4 x 10Gb	5 x 10Gb	8 x 10Gb	8 x 10Gb	No	No
60 Hz								
444 12-bit	1 x 10Gb	1 x 10Gb	3 x 10Gb	3 x 10Gb	5 x 10Gb	5 x 10Gb	No	No
444 10-bit	1 x 10Gb	1 x 10Gb	3 x 10Gb	3 x 10Gb	4 x 10Gb	5 x 10Gb	8 x 10Gb	8 x 10Gb
30 Hz								
444 12-bit	1 x 10Gb	1 x 10Gb	2 x 10Gb	2 x 10Gb	3 x 10Gb	3 x 10Gb	5 x 10Gb	6 x 10Gb
444 10-bit	1 x 10Gb	1 x 10Gb	2 x 10Gb	2 x 10Gb	2 x 10Gb	3 x 10Gb	5 x 10Gb	5 x 10Gb

Network Ports

The HELIOS Processor is running a Linux build based on Alpine Linux. The following network ports and services are used by the system:

Network Ports	Notes
80 (TCP)	Main Web UI and Public API (HTTP)
443 (TCP)	Main Web UI, Public API (HTTPS)
443 (TCP Outbound)	General MVR Cloud connections
1900 (TCP+UDP)	Service Discovery (SSDP)
2222 (TCP Outbound)	MVR Cloud back-channeled remote connections
5353 (UDP)	Service Discovery (mDNS)
5568 (UDP)	Public API / Control (sACN)
56004 (TCP+UDP)	HELIOS stacking
ICMP	Network ping, etc.

API

HELIOS has a REST-like API. The API documentation is available on request. Please get in touch via our **website contact form**.

Thermal Sensor Alert Levels

The table below provides the operating ranges for several internal sensors. This is not related to ambient temperatures of the HELIOS environment. It is important to note the even Critical alerts will not shut down a HELIOS processor.

Sensor	Value	Alert Severity
CPU Temp.	>=80°C	Error (Yellow)
CPU Temp.	>=100°C	Critical (Red)
Case Temp.	>60°C	Critical (Red)
SFP Temp.	>70°C error	Error (Yellow)

Normal Voltage Ranges

Sensor	Value
SFP Voltage	3.2 - 3.4 V
SFP Current	1 - 45 mA
SFP Tx Power	-7.0 - 1.0 dBm
SFP Rx Power	-8.0 - 1.0 dBm

The above sensor readings can be found on the ***Devices*** pane (example below).

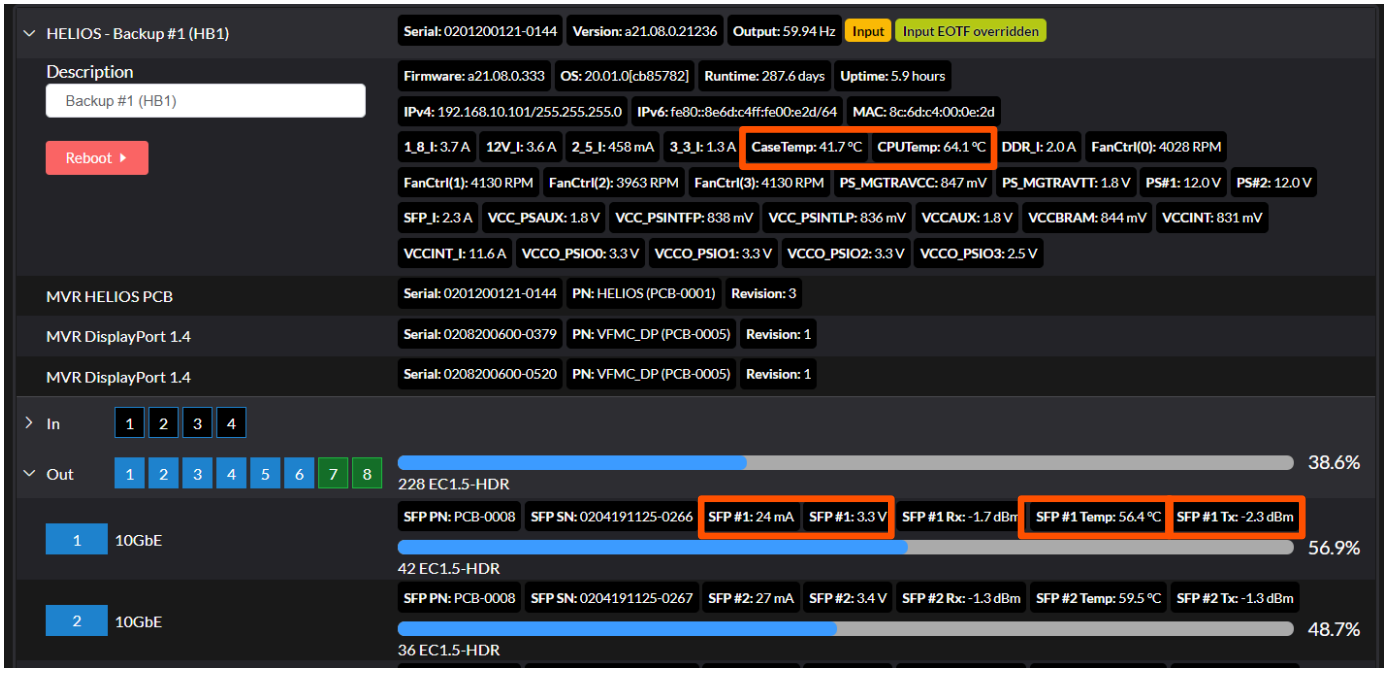


Figure 174: Devices Pane Sensor data