

**multiCAM**  
systems

**BACKDROP Solution**

[www.multicam-systems.com](http://www.multicam-systems.com)

# multiCAM BACKDROP Context

**multiCAM BACKDROP** is an immersive solution for virtual productions. This solution is developed around Unreal Engine and delivered with a choice of free and customizable environments. With Backdrop, you can have multiple virtual sets, or you can integrate your own using the Unreal Engine and Backdrop plugin.

**BACKDROP** uses tracking data (Free-D) to know the position and angle of view of cameras. By using video mapping, the virtual set is projected on **LED walls** according to the camera position. As long as the camera moves in space, the depth can go beyond the screen. This will allow the immersive environment to react in real time with the camera position and adapt the angle of view.

BACKDROP is one of the first virtual production solutions that **supports multicamera workflow**.

**BACKDROP** is fully automated and lets you control the scene, change the set and make widgets appear, offering your viewers an unprecedented immersive experience. BACKDROP can be remotely controlled via any device talking OSC (StreamDeck), or any computer or mobile device through HTML.

Regarding the LED Virtual Studio project, our multiCAM Systems solution **BACKDROP** answers all the key requirements.

## Requirements

Technical components are necessary for a xR workflow with multicamera setup.

- **Cameras:**  
All cameras need to deliver pictures of the real world with the same latency. Different camera models mean different latency. If the setup includes different camera models a delay needs to be added in the workflow, in order to delay and to synchronize all cameras to the slowest. All cameras have to be genlocked.
- **LED controller:**  
This device ingests the video signal to display on LED Walls. It has to be 4K compliant, using HDMI or DisplayPort connection. It has to be genlocked.
- **LED Panels:**  
xR requires very specific characteristics that are related to the refresh rate. Usually, at 50Hz, the LED display rate will be 2400Hz or 4800Hz. It is related to scan drive mode. It needs to be 1/16 or 1/32.

- **BACKDROP server:**  
Backdrop software runs on a dedicated server. The specifications are detailed in this document. It has to be genlocked.
- **Video switcher:**  
The video switcher for this project is a Kahuna 9600. It has to be genlocked.
- **Genlock:**  
It synchronizes Frames between cameras, Backdrop server, video switcher and LED controller.
- **Commands:**  
Backdrop system integrates an OSC server. All interactions can be controlled externally using this real-time protocol. GPIO can also be used but requires an additional device.
- **Tracking:**  
Backdrop need to receive a Free-D signal for each camera. An additional software, multiCAM TRACKER, is delivered to combine individual tracking data from robotic systems (rail system, remote head, ...) into one virtual camera signal.

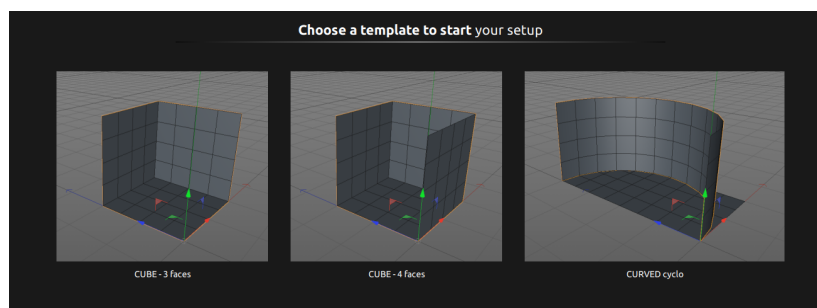
## Easy setup with Backdrop Launcher

The «**BACKDROP Launcher**» is an application to configure your Backdrop setup. You will be able to configure your LED wall, cameras, connect your switcher and load your virtual sets.

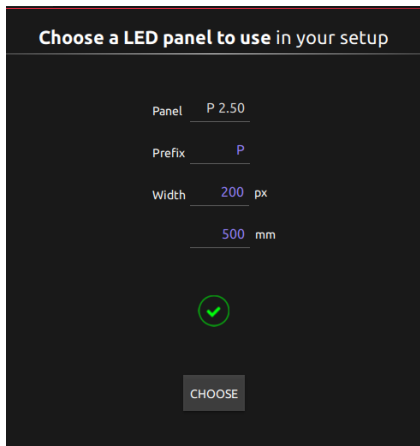
### LED Screens

BACKDROP offers templates to allow you to quickly and easily create your LED volume configuration.

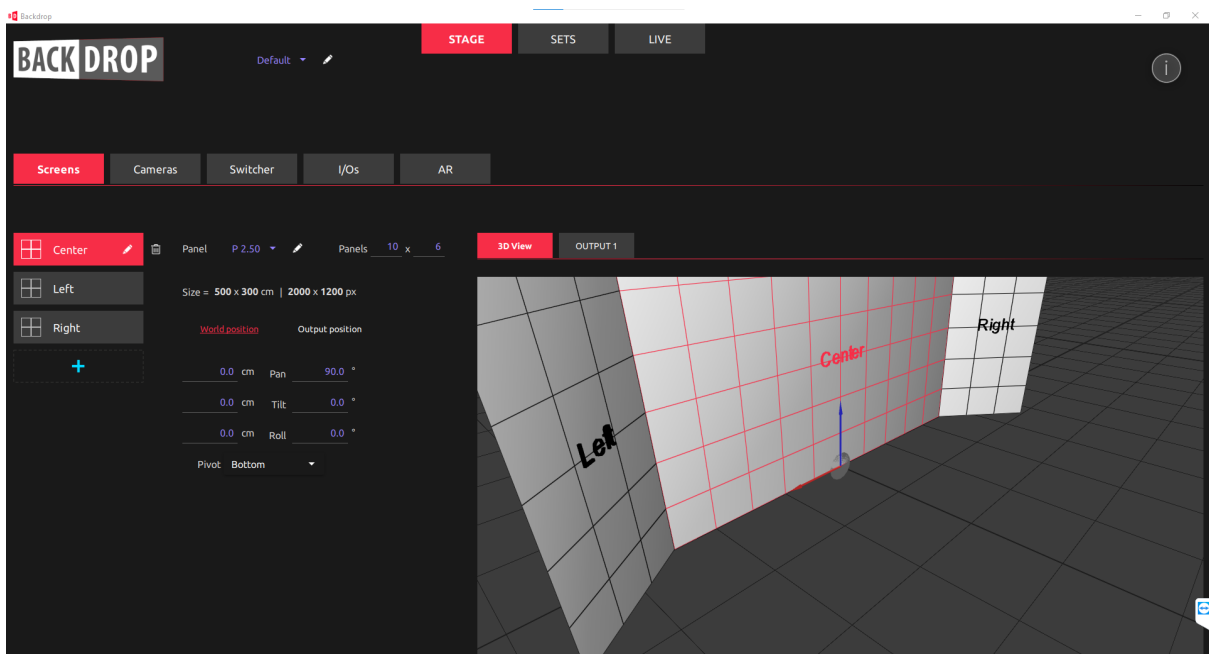
All you have to do is choose the type of installation (Cube, Cyclorama, etc.), the type of panels and the size of it.



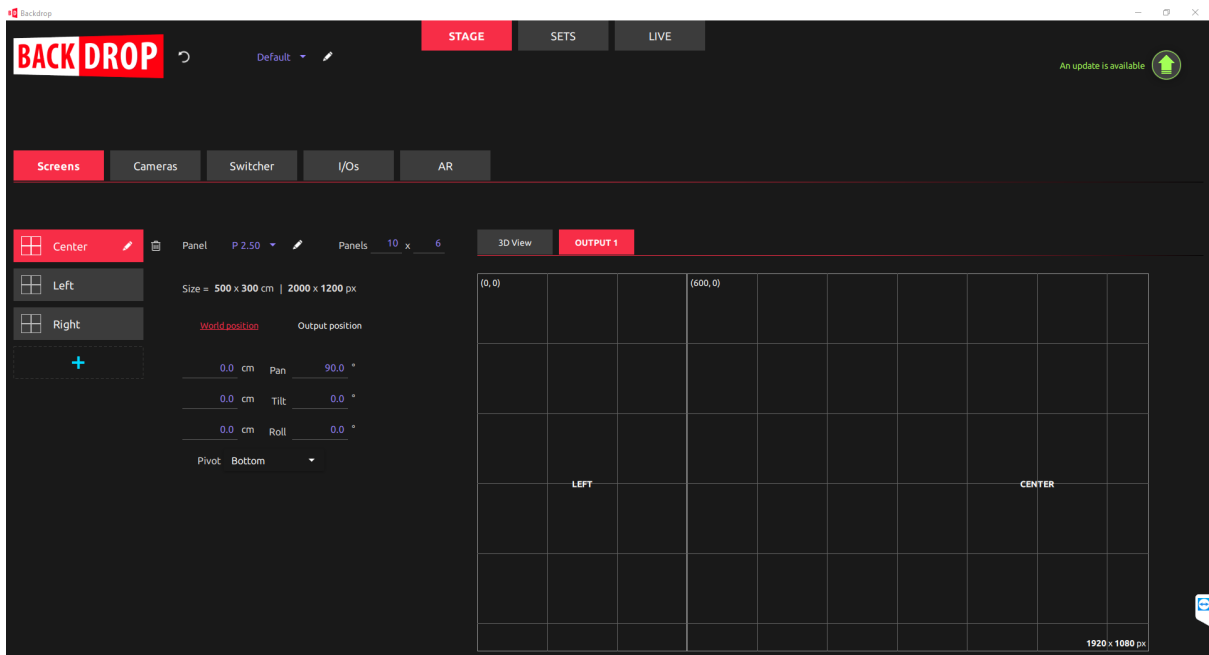
You can specify the characteristics of LED Panels (resolution and size) and Backdrop calculates the pixel pitch automatically.



Then you give the number of panels that compose your walls and global size and resolution are calculated for you.

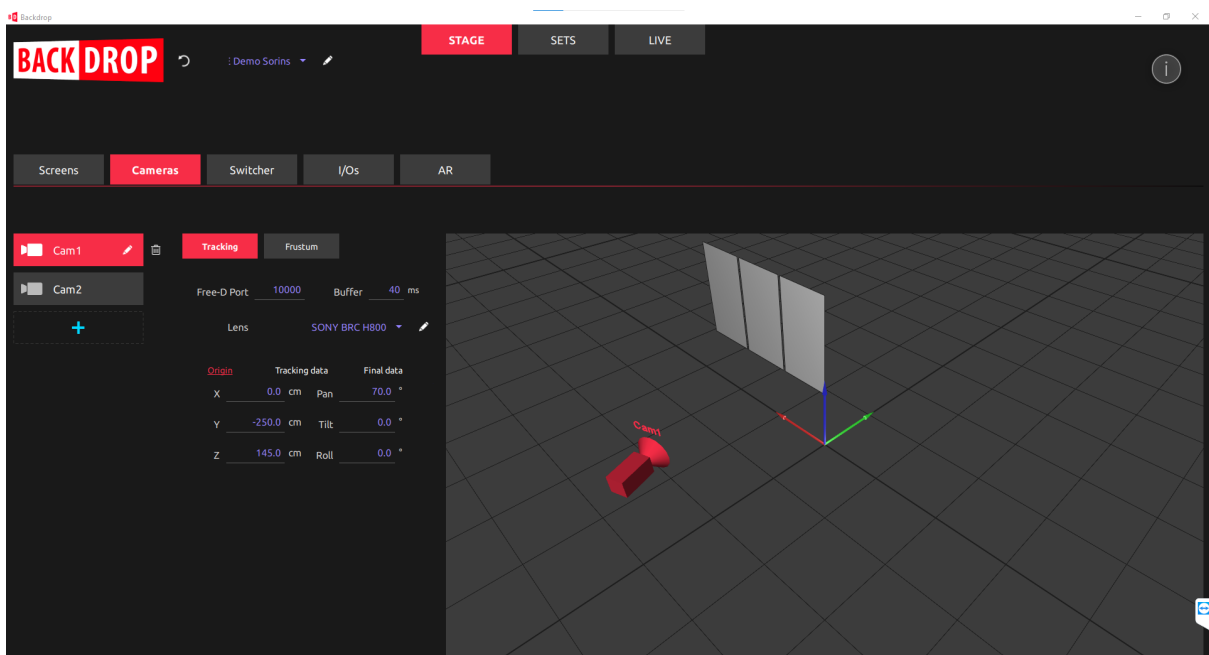


You access to graphic card video outputs and map your screens in it:

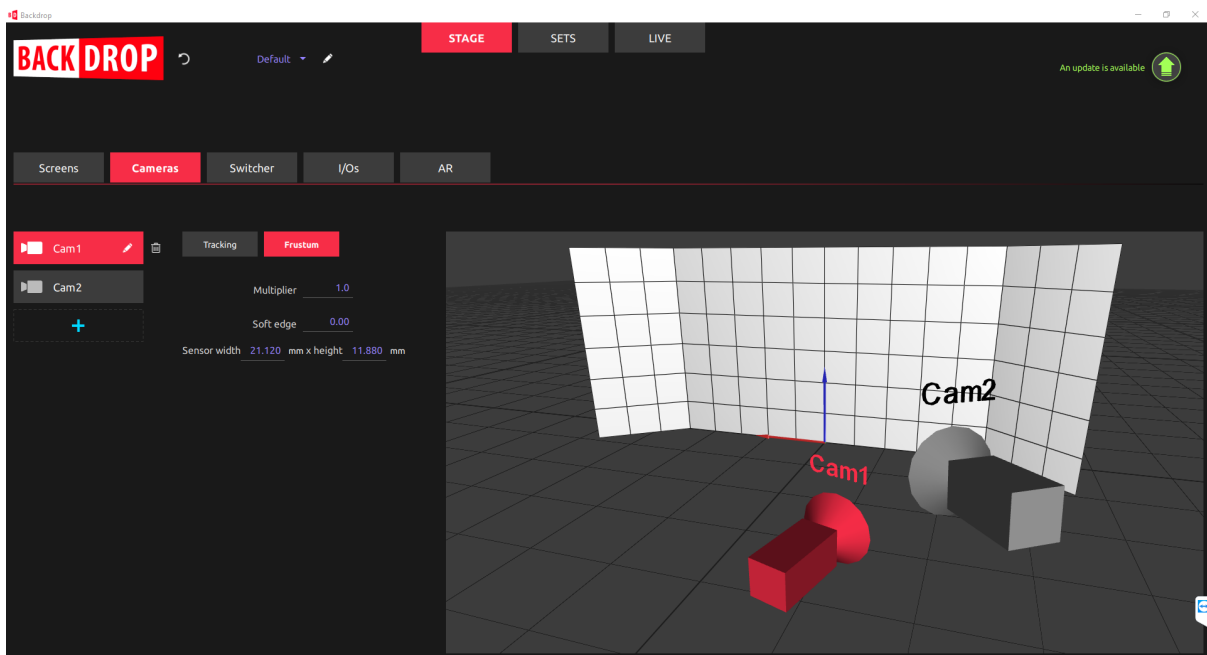


## Cameras and tracking

The application allows you to easily add your cameras with FreeD protocol. You will have to indicate the data receiving port, the lens calibration file and an initial position if necessary.



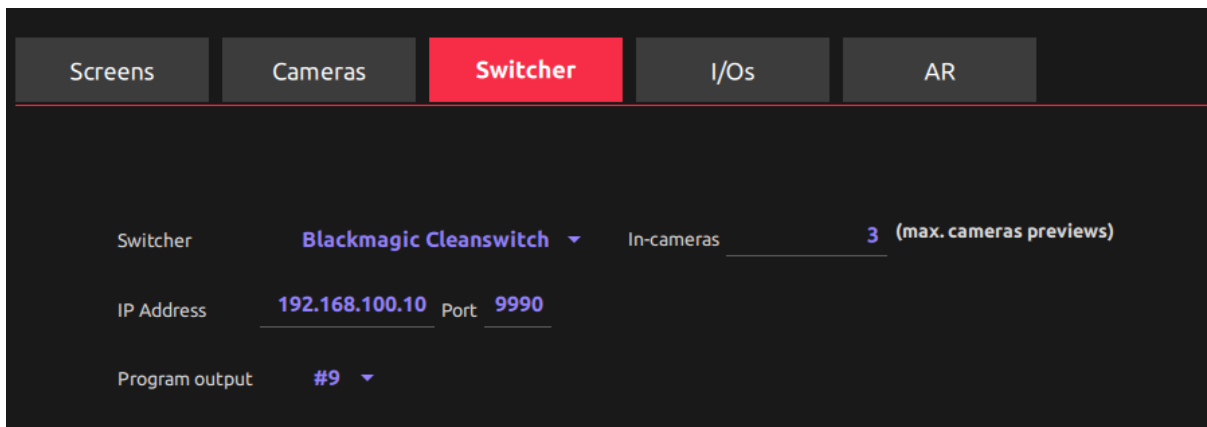
Then you will see your camera appearing on the 3D real-time visualizer.



## Video Switcher

You will be able to connect your video switcher by selecting the switcher and entering the IP Address and Port number.

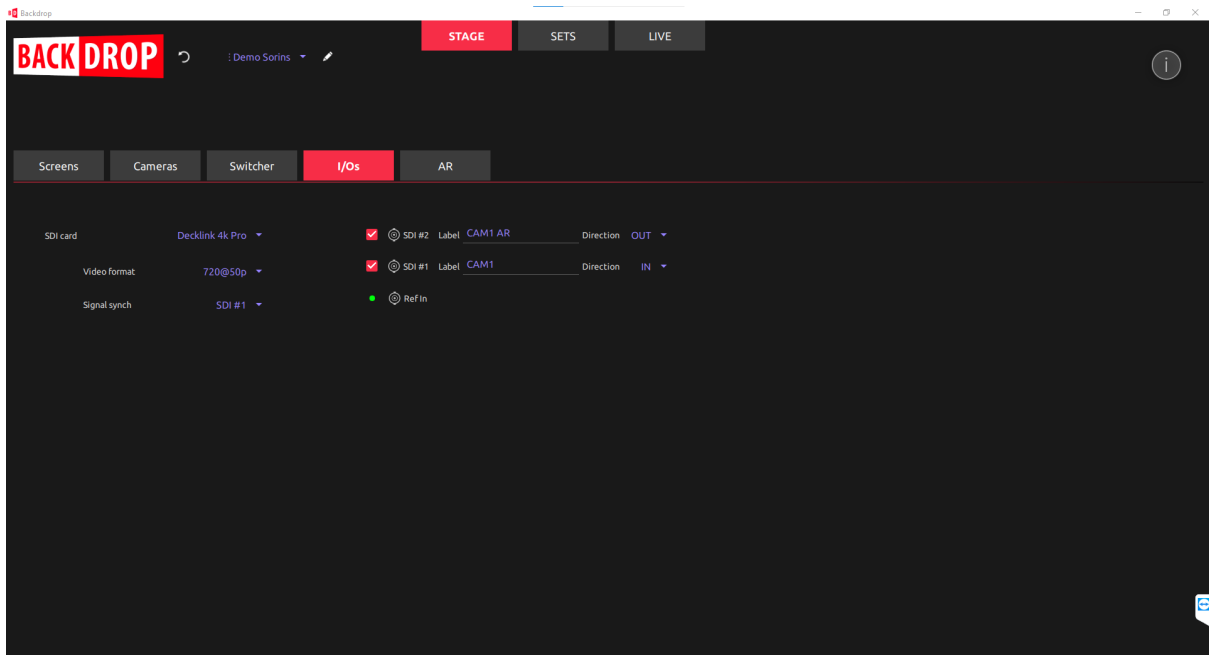
In-camera is the maximum number of cameras to render simultaneously (preview mode).



For a standard installation, a list of supported switcher models is available.

## Video Inputs/Outputs

This part will allow you to configure the SDI connections, specially for setting up Genlock, video rendering format and if necessary the inputs and outputs used for Augmented Reality.

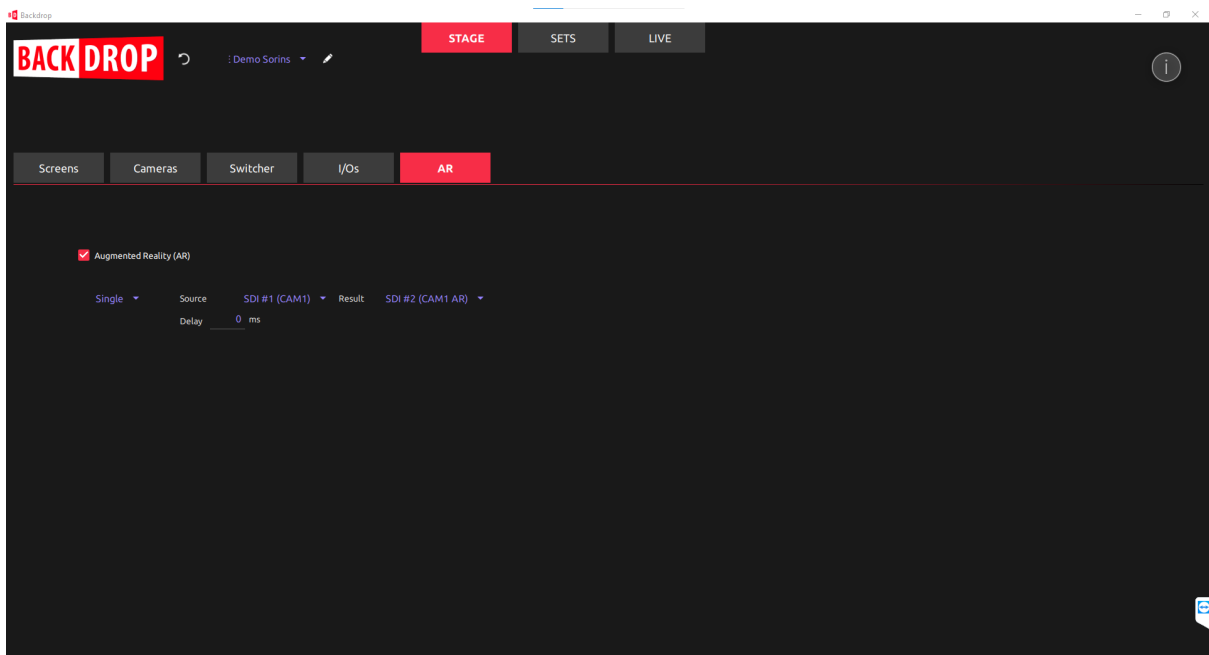


## Augmented Reality

This part allows you to activate the AR overlay.

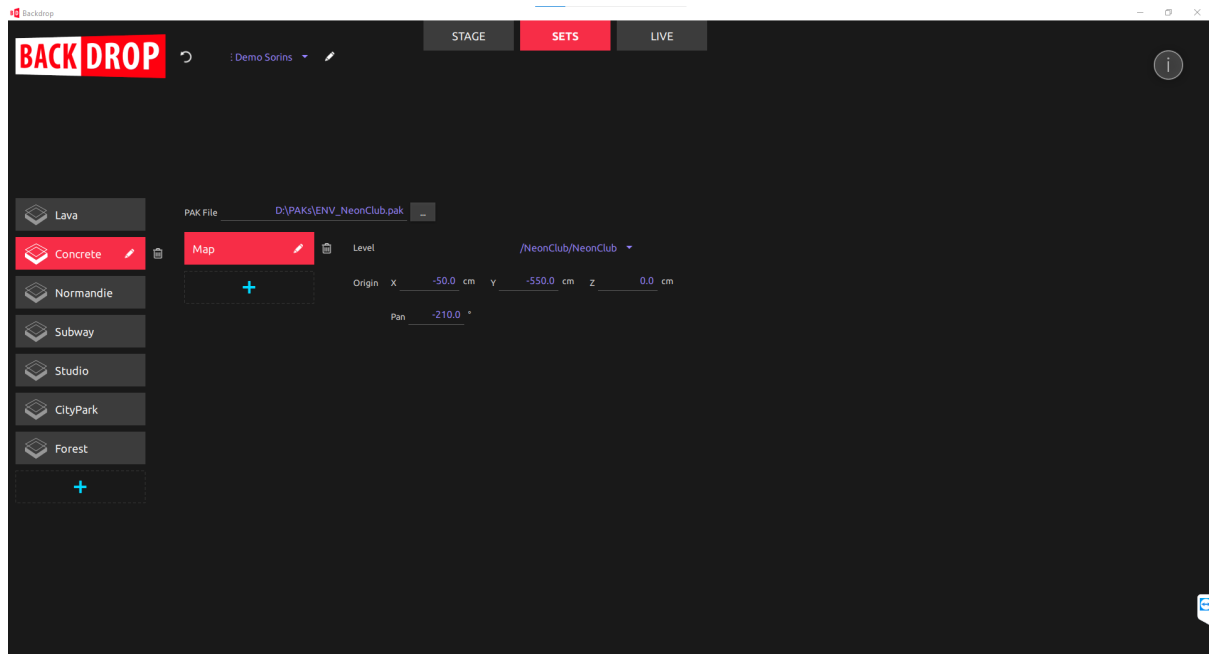
Backdrop supports AR and the main server can output the background projected but also receives the program and composites with a synchronized AR overlay (multi mode).

You can also choose to deliver only AR for a specific list of cameras (single mode).



## Virtual Sets

Virtual Sets are packaged in a single file. With BACKDROP UI, you just have to add a new «Set» and import the PAK file. You can optionally specify an origin that is not the standard “zero reference” of the scene.



## Live section

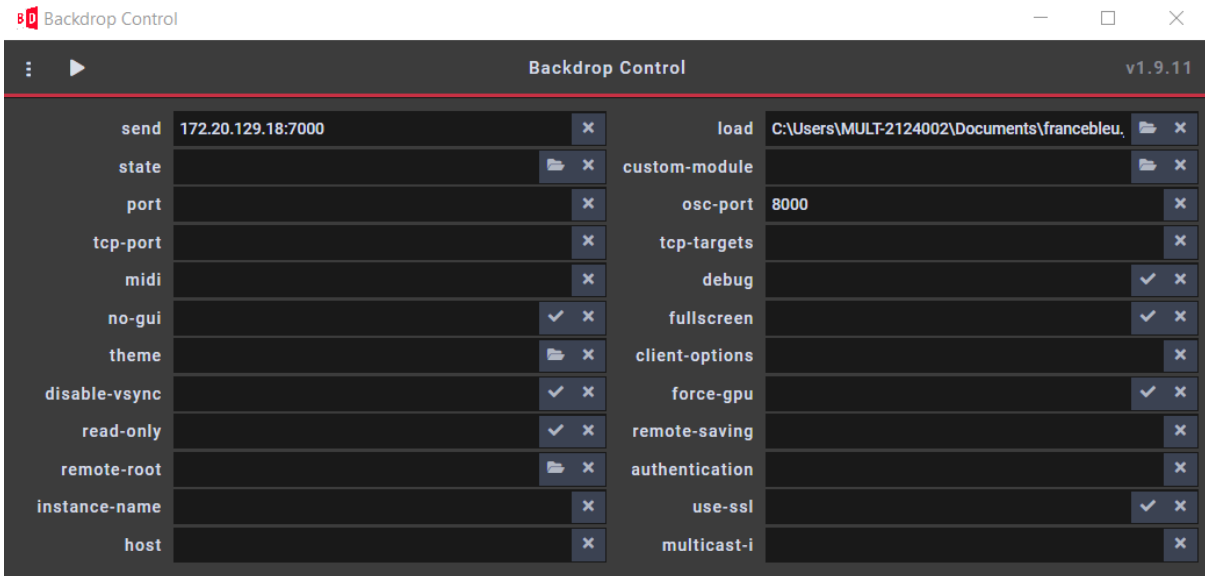
The live section offers some insights about performances like the number of frames per second calculated and it displays logs for support.

Some basic controls are available like switching or set loading. For more advanced controls, it is recommended to use Backdrop control and the remote.

## Easy control with Backdrop Control

Backdrop Control is an application that needs to run for enabling OSC commands.





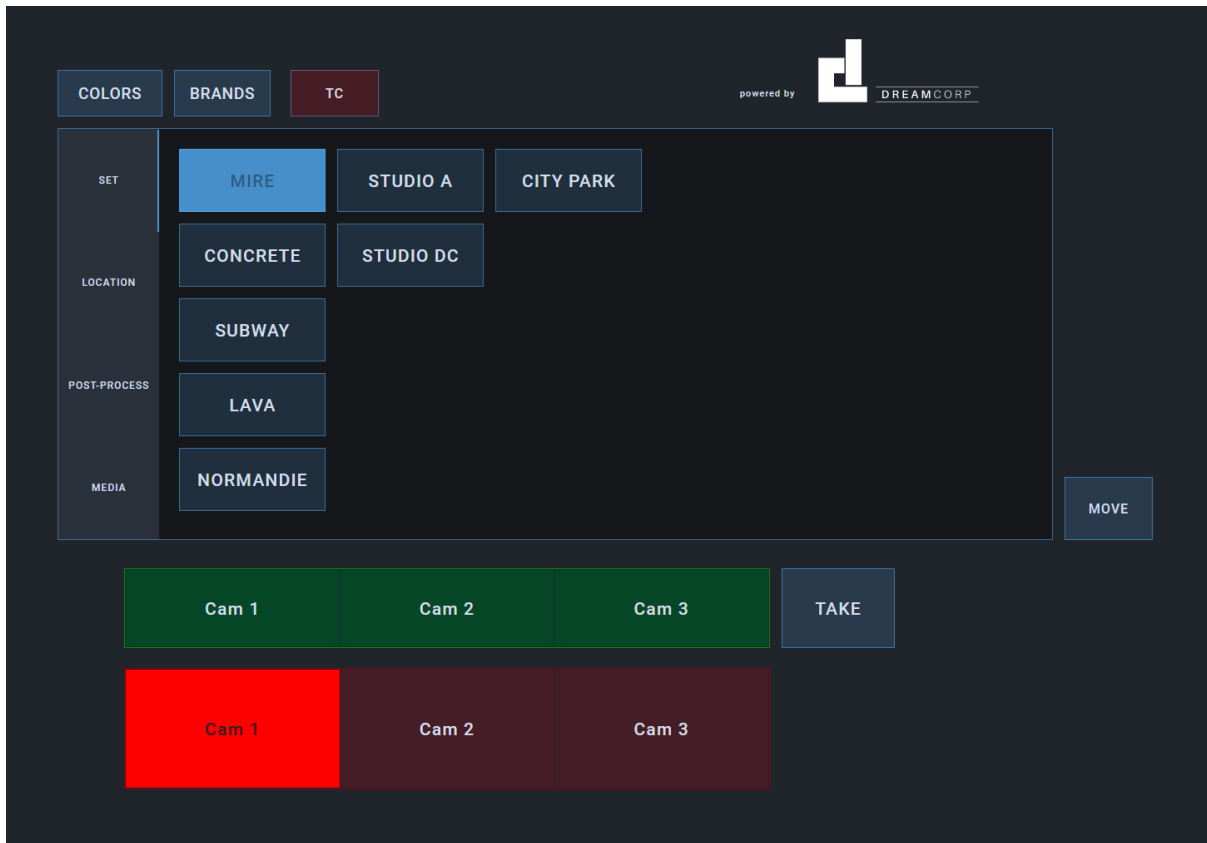
We specify the server IP address, the OSC ports for incoming and outgoing data.

A json file will be loaded and it contains the remote UI configuration.

## Custom Web remote interface

In order to simplify operation and interactions with the virtual sets, a custom remote can be designed. It allows the operator to orchestrate the virtual set. It is available on any device connected to the local network. In our case, we can open it by typing in the browser address: "172.20.129.18:7000"

Here is an example:

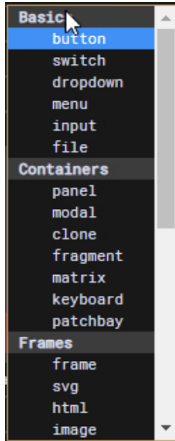


Four tabs are presented:

- **Set:**  
We add a button to load/unload virtual environments.
- **Location:**  
We can change the position of the stage in the virtual world. The user can create presets in order to move the stage in a particular position. That way it is fast and easy to switch between locations. It takes less than 2 seconds to go from one place to another. By default, the transition is animated. With the “Move” component, you can move inside the virtual set to find a suitable location. Then you just have to report the XYZ and Pan values to create a new position preset.
- **Post-Process:**  
Post-process are parameters to adjust the picture rendering: Exposure, White-Balance, Gamma, etc...  
This is interesting so that the virtual scene matches with the real stage lighting and camera settings.
- **Media:**  
Depending on the virtual set, some texture can be dynamically changed. For example, virtual screen content. Then, in the Media tab, you can specify a list of media (pictures, video files) and choose a video source (NDI or SDI) to assign to a screen.

## Camera switching:

In case you want to use the remote to do switching, buttons are available: in red for take and in green for previews. “Take” button will select a camera that is in preview for online.



These are just examples of controls for a standard remote. But you can organize it as you wish, thanks to a modular system that helps to build specific remotes.

Javascript is available to achieve complex commands. For example, you can define variables in a list and map a UI dropdown menu to this list.

Backdrop remote offers a large choice of UI components: button, switch (multiple buttons in one), dropdown menu, file input, ...

## OSC commands

Backdrop offers a complete set of commands you can use with [OSC protocol](#). Here are some examples:

Function	Command	Arguments
Switching a camera	/Switcher/Commut	camera id (0 for camera #1, 1 for camera #2, etc...)
Previewing a camera	/Switcher/Preview	idem
Loading/unloading a virtual set	/Set_Level/MustLoad (Set name and Level name has to match with names specified in Backdrop Launcher)	true/false
Changing a virtual screen texture to a NDI source	/ScreenName/Texture	/Media/NDI/NDISource (NDISource is the name of NDI Source to be used)

## GPIO



GPIO is an option and needs an external device. We recommend the ETH-GPI Link from Skaarhoj manufacturer.

We can assign a GPI command for switching a camera. ID #0 is used for camera 1, ID #1 for camera 2, etc...

GPIOs are far limited compared to OSC protocol. It is why we strongly recommend OSC. Anyway, GPIO allows us to integrate with old technology.

## Multicamera workflow

BACKDROP supports natively multicamera workflow. You can define the number of camera previews to render simultaneously.

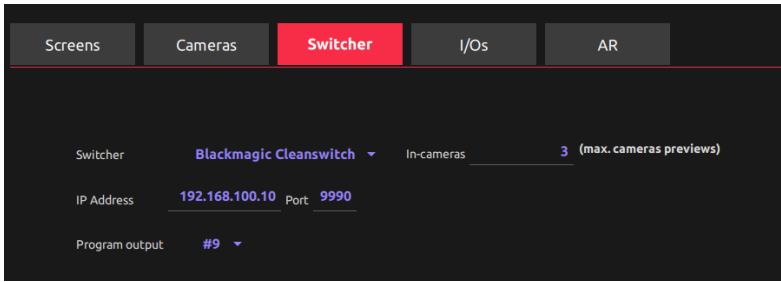
### Camera previews

The “frustum” is the projection of the camera view angle. Whatever the shape of the LED and where the camera is, the projection stays “flat” from the point of view of the camera. This is similar to projection mapping technique.



Because we are using a physical surface of projection (LED Wall), we cannot display two frustums of two cameras looking in the same direction. One must be prioritized. The online camera is always on top of preview cameras.

The number of cameras for the preview is defined in Backdrop Launcher interface, section “Switcher”:

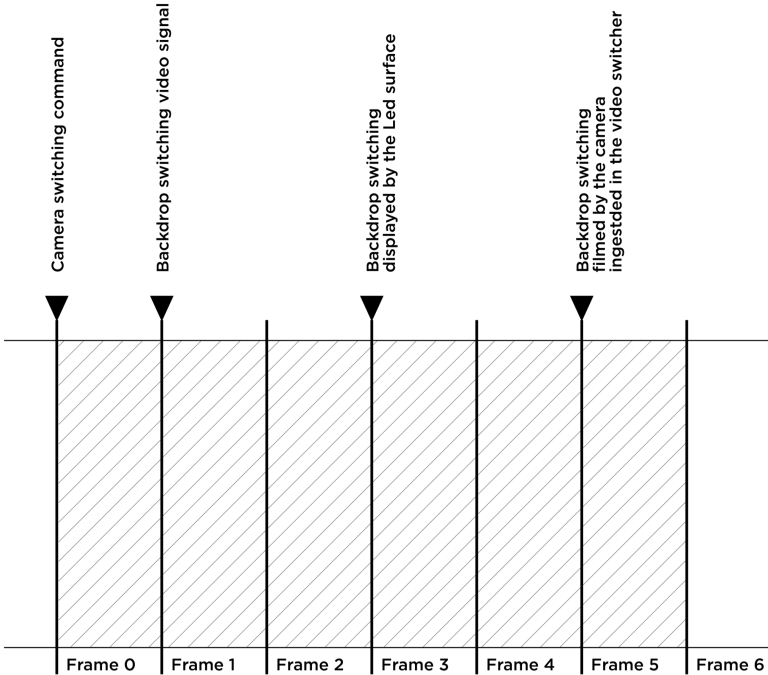


In the screenshot, three camera frustums can be displayed. Please notice each one involves a 3D rendering and performance resources will be allowed accordingly.

## Background switching

The LED display introduces some latency in the workflow. Depending on the LED technology and video frame rate, it can take up to 7 frames to display the picture that is sent out of the 3D server. This delay is reduced by the camera latency. So if the camera delay is 2 frames, that means when a switching command is sent to the 3D engine, it will be seen 5 frames later. So that means, if we need to switch between 2 cameras, switching can be delayed 5 frames.

Here is a schematic that explains the workflow and delays:



In this example, the Led surface has 2 frames of delay, camera has 2 frames of latency and video switcher has one frame to ingest the camera signal. That means, the video switching has to be delayed by 5 frames.

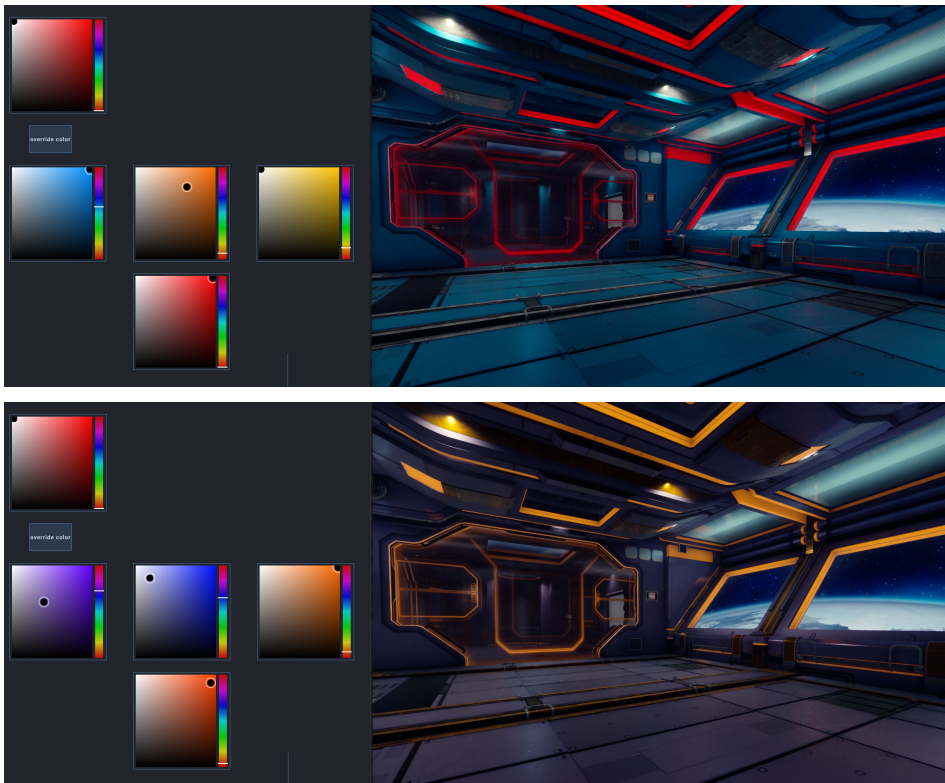


Here are some examples of interactive components:

- **BP\_ControlledLevelSequence:**  
This allows you to play an animation created in the LevelSequencer. Simply name your LevelSequencer using a "ConfigName" label so that control can be activated using the remote command: /ConfigName/Play
- **BP\_ControlledTextRender:**  
This allows you to change the text content using a command like: /TextName/Text where TextName is the ConfigName for the text and string argument will be the value for this text field.
- **BP\_ControlledStaticMesh:**  
This allows you to change materials properties like a Media texture or base color.

The interactions plugin offers a large choice of interactivity with no skills in programming needed.

Here are two examples of a scene where textures color is exposed and controlled with the color component in the remote:



## Environments packing

Backdrop offers a unique way to distribute your environments. It uses the PAK building.

PAK is a kind of export of the project into one unique file. It gives a lot of benefits:

- **Protect design:**  
Some original designs are like a piece of Art. Artists want to protect their work and property. This is the guarantee it will not be copied partially. During live sessions, operators don't take risks in manipulating an Unreal project. Indeed, no Unreal skills are required. Only designers need to know about Unreal.
- **Easy distribution:**  
This is not a folder with dependencies, this is one unique file. Then it is easy to exchange and to import into Backdrop Launcher.
- **Performances saver:**  
At last but not least, this is a huge amount of performance that users save. Other virtual production systems are using an In-Editor run of the project and this considerably decreases the performances. With PAK loading, **Backdrop is 140% more performant than competitive systems.**
- **Modular sets:**  
Backdrop can load multiple PAKs at the same time. Imagine you have a hologram area in the 3D design and you want to populate later with 3D objects? Just build the hologram zone and add later PAKs for the 3D Object that you would like to make appearing in. This is also extremely useful for Augmented Reality Widgets. One PAK for the background, one for the AR content.

AR content can be composed within the same server and using a dedicated virtual set or the same as the background. Using our Unreal plugin, it is easy to select if an object has to be displayed in foreground or background. Lights of the scenes are shared for a perfect mixing of foreground and background.

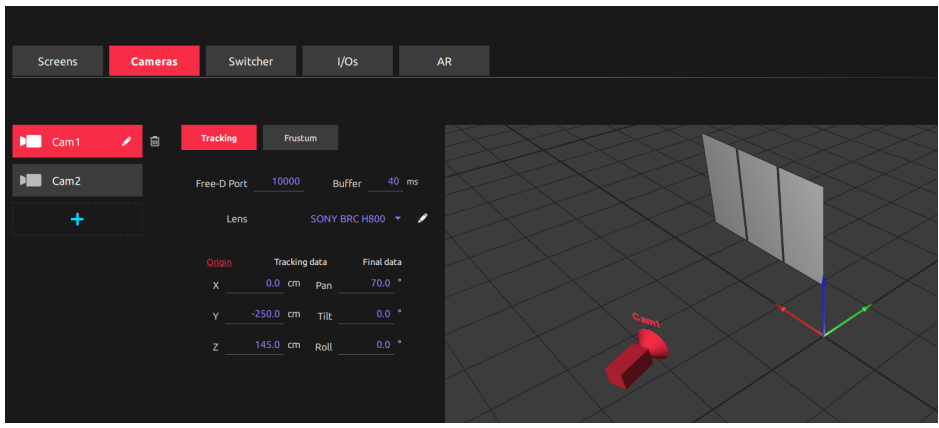
Backdrop doesn't support "Set Extension" (recreating the virtual picture outside the LED Wall) yet.

## Calibration / Tracking

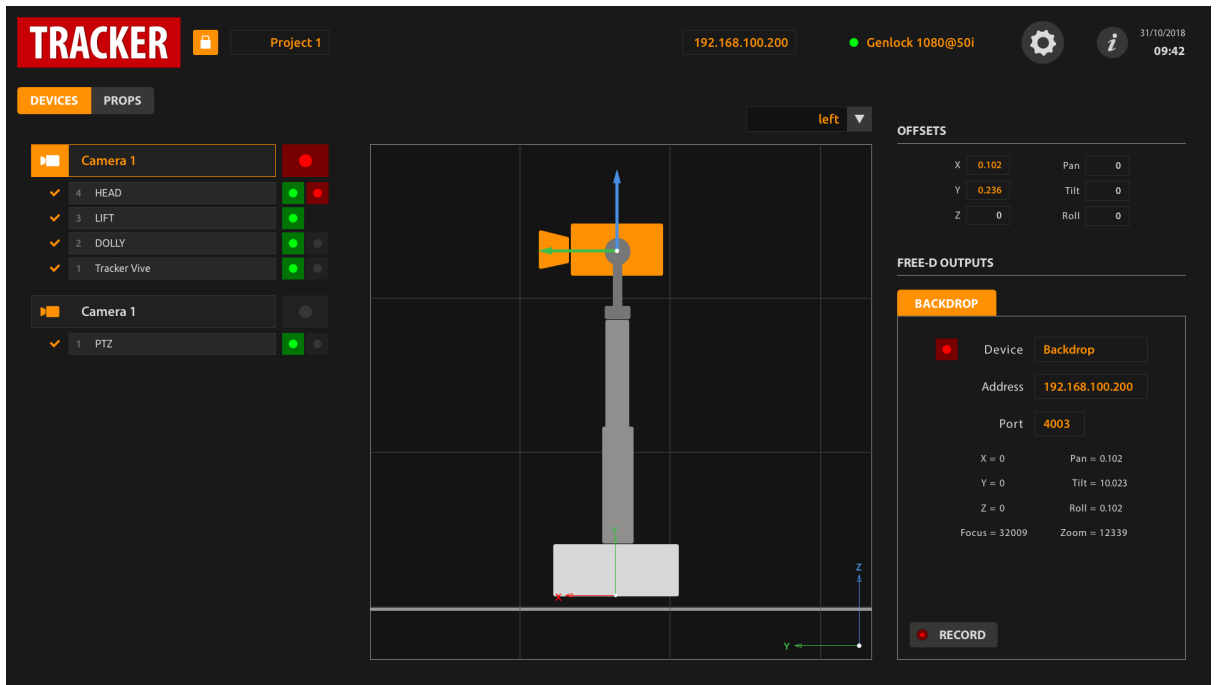
### Positional tracking

The Backdrop virtual cameras take a Free-D signal for receiving tracking data. You just have to specify the Port number used. An offset can be added, and Backdrop will add these values to the data received.





If multiple data needs to be combined, for example when using a robotic system assembled with separate devices sending individual data, you need to use our complimentary software: multiCAM TRACKER.



TRACKER is an easy-to-use solution to combine several tracking data (Free-D) into one virtual camera signal. Let's say you have a camera composed of a Dolly, a Lift and a Head. The dolly sends data for the X axis. The lift along the Z axis. The Head sends Pan and Tilt values. We set up offsets for each device so that we can manage the optical center for the camera for instance.

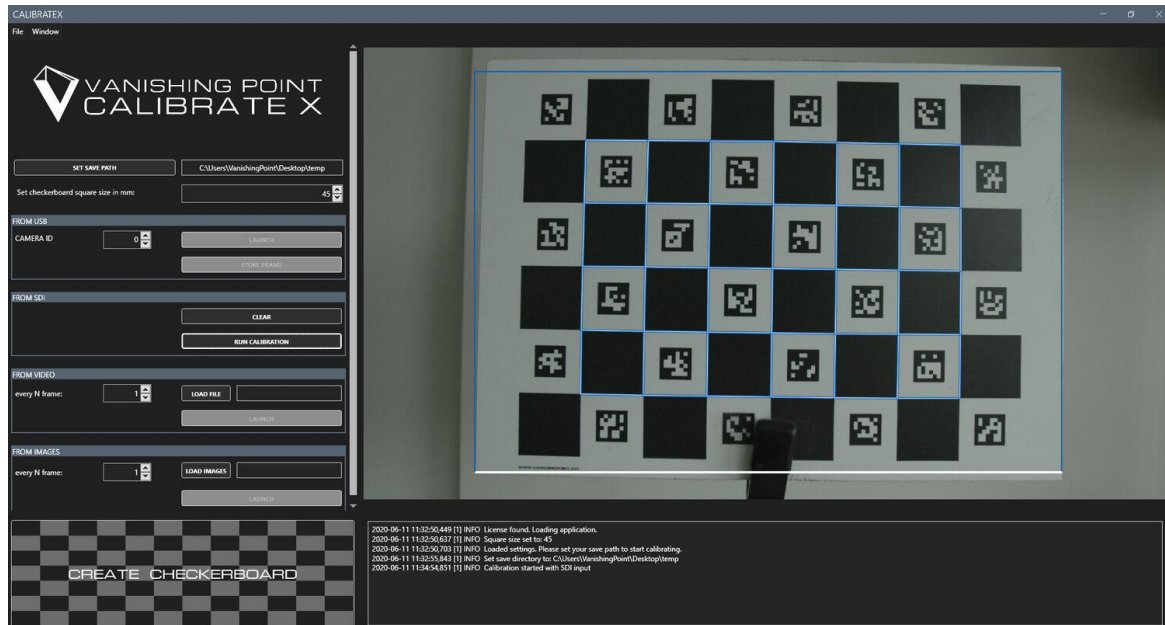
This is as easy as a lego assembling game!

## Optical calibration

Backdrop needs to receive a CSV file that is a lookup table for matching a Free-D value to a focal value. It interpolates values between entries.

Backdrop comes with a set of lenses already known by the system, but you can easily create your own using a solution like [Vanish Point Calibrate X](#).

It is a calibration wizard that you will use with a printed checkerboard. This pattern is recognized by the software and a few measures with different distances and angles help to generate a file that is converted for Backdrop import.



Lens calibration needs to be more or less accurate, depending on the usage.

- **xR with only background projection:**  
Positional tracking ++  
Lens calibration -
- **xR with AR overlay:**  
Positional tracking ++  
Lens calibration +
- **xR with Set Extension:**  
Positional tracking +++  
Lens calibration +++

Backdrop supports AR but doesn't support Set Extension yet.

# Hardware specifications

We deliver BACKDROP with a dedicated 4U rack mountable server.



Dimensions: 482mm (19") W x 133mm (4U) H x 300mm D

Weight: 11 kg

<b>Graphic Card</b> 	Geforce RTX Series (3090)
<b>Video inputs/outputs</b>	Four HD-SDI (in/out)
<b>Network</b>	1 Gigabit LAN
<b>CPU</b>	Intel i7 8700
<b>RAM</b>	8GB DDR4 ECC
<b>Voltage</b>	220V 50-60Hz
<b>Data/Peripherals</b>	<ul style="list-style-type: none"><li>• One 128GB SSD Hard Drive (System)</li></ul>

	<ul style="list-style-type: none"> <li>● One 1TB 7200rpm Hard Drive</li> <li>● Two USB 2.0</li> <li>● Four USB 3.0</li> <li>● One ¼" Headphones Jack</li> </ul>
<b>OS</b>	Windows 10 Pro 64 bits

This configuration is the standard package. We can offer custom servers for setup requiring more than one 4K output, using Quadro series.

## Support

The standard Backdrop package includes 1 year of free upgrades. Upgrades include new versions of Unreal Engine. The actual version is 4.27. It takes up to 48h for us to deliver a new version. Some versions show minor changes that don't need any upgrade. For example, the 4.24 to 4.25 transitions were effortless for us.

Backdrop is not a Vanilla version. It uses the Open Source code directly and adds functionality to it. This is one of the reasons that gives us responsiveness to deliver upgrades.

Unreal Engine 5 is at beta stage and doesn't support xR workflow yet.

You can subscribe into our Premium program for extending support and upgrades for a 3-years plan.

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## BACKDROP Solution

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