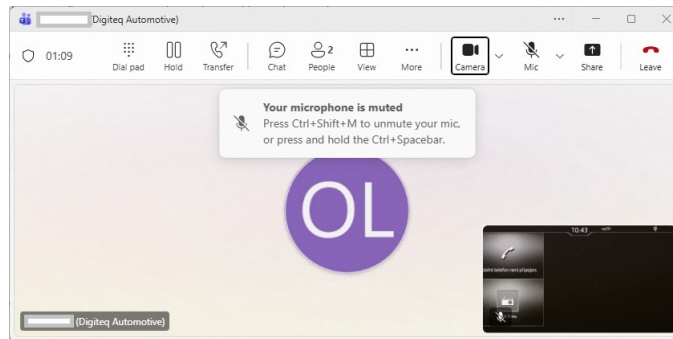


# FG4 DirectShow CookBook

Please note that FG4 Frame grabber implements generic video source and video renderer. It means that even applications not designed for FG4, can work with it without problems. E.g. you can display FG4 video in Microsoft Teams, VLC, OBS Studio and many others.

Special application like DQ Viewer is not necessary.



The drawback of this approach is that standardized API is more complex in comparison with custom library.

User can develop video processing filter without FG4 because of a standard API used. And after full debugging the filter will work with FG4.

## Table of Contents

1 Direct Show concept.....	2
2 Direct Show components.....	2
3 Device configuration.....	2
4 Recommended configurations.....	3
4.1 Simple rendering.....	3
4.2 Rendering YUYV stream.....	5
4.3 Rotated view.....	5
4.4 Playing a video on display.....	6
4.5 Rendering a video to the file.....	6
4.6 Feedback.....	8
4.7 Feedback with preview.....	9
4.8 Mixing videos.....	10
5 Erata.....	12

5.1 Microsoft's *AVI/WAV File Source* filter does not support flawless video framerate.....12  
6 Direct Show Filter list.....12

## 1 Direct Show concept

A main concept of DirectShow is that any application that needs to support multimedia needs to run a graph.

Graph could be created in GUI application or directly in C++.

## 2 Direct Show components

Assembling Direct Show graph

There exists *GraphEdt.exe* application from Microsoft that could be found elsewhere

C:\Program Files (x86)\Microsoft SDKs\Windows\v7.0A\Bin\graphedt.exe

C:\Program Files (x86)\Microsoft SDKs\Windows\v7.0A\Bin\x64\graphedt.exe

We recommend to use freeware *GraphStudioNext*

<https://www.videohelp.com/software/GraphStudio>

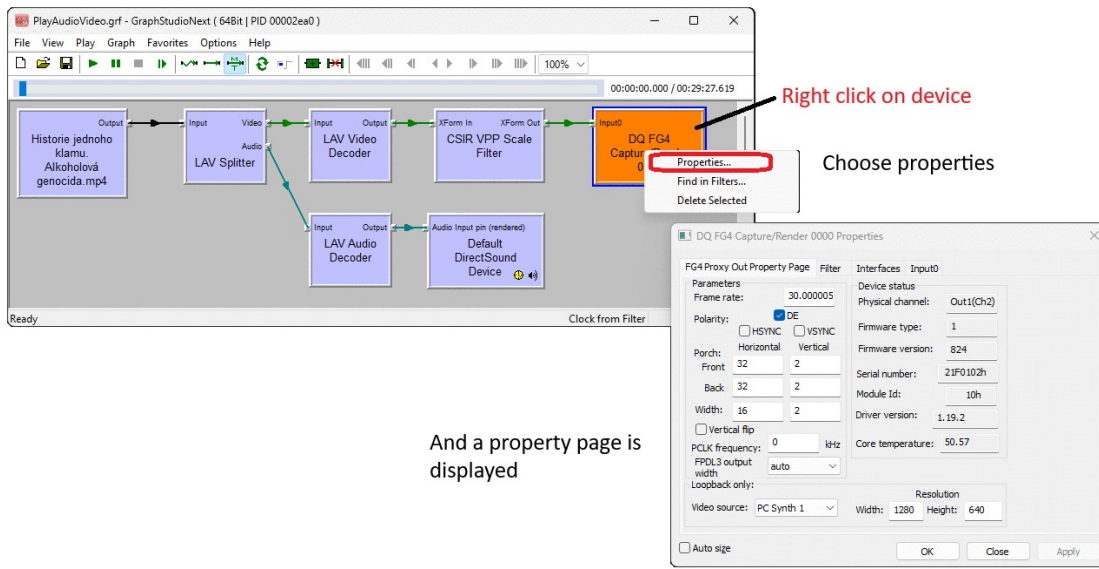
Please note that there are 2 variants 32bit and 64bit. On 64 bit system you can use both of them. But on 32 bit system you can use only 32 bit variant.

Microsoft standard renderers that are bundled in Windows:

<https://learn.microsoft.com/en-us/windows/win32/directshow/about-video-rendering-in-directshow>

## 3 Device configuration

All necessary options could be set through driver's property page. No special application like DQviewer needed.

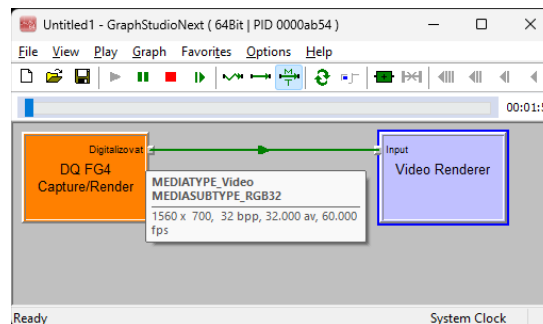


And a property page is displayed

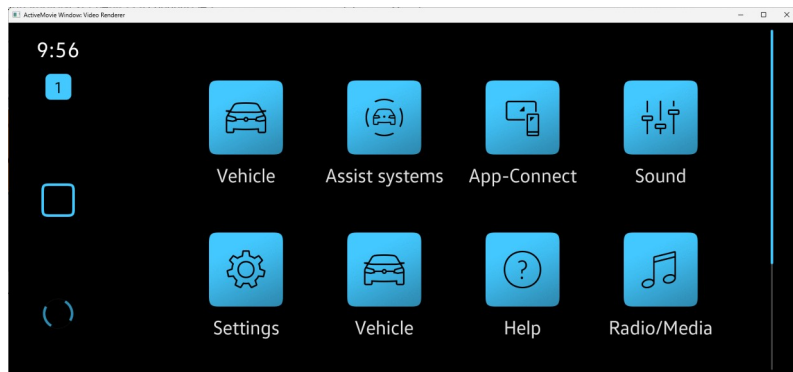
## 4 Recommended configurations

### 4.1 Simple rendering

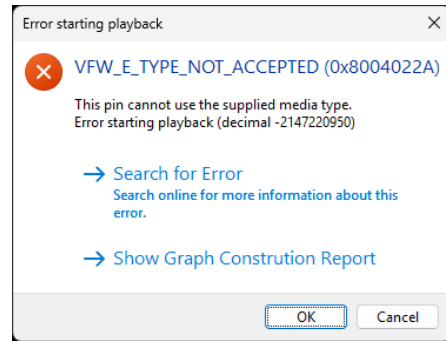
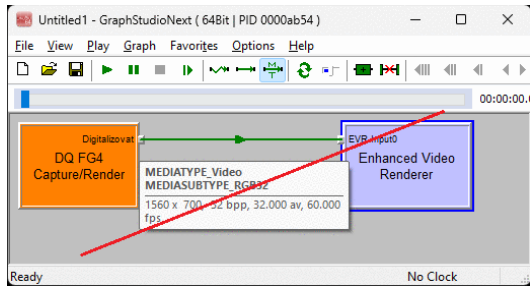
Insert block FG4 signal source and a standard Video renderer:



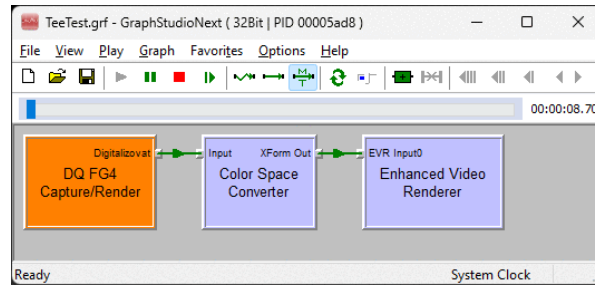
It should produce following result:



There is one pitfall. Enhanced Microsoft's renderer sometimes does not connect to a lower filter:

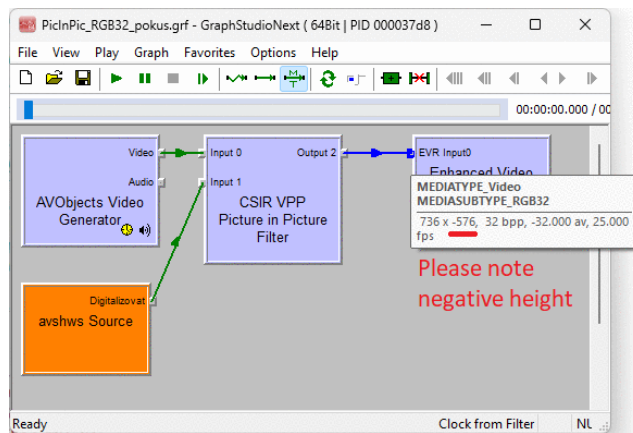
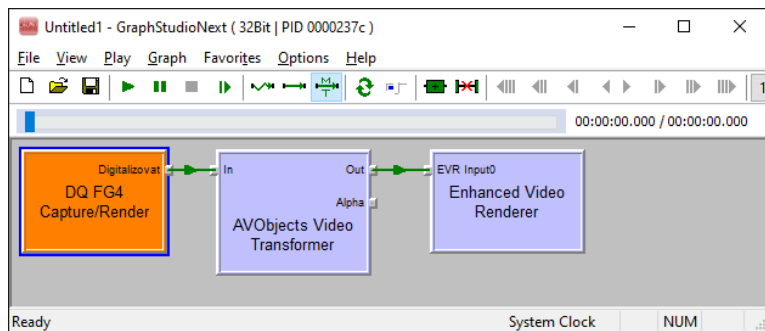


When this occurs, use middle **colorspace converter filter**, and everything works:



Or you can use free AV transform filter that provides a same job.

[http://www.avobjects.com/products/freeware\\_filters/video\\_transformer.html](http://www.avobjects.com/products/freeware_filters/video_transformer.html)



The problem behind is that Microsoft's renderer sometimes forces to use negative height or asks for different geometry, that lower driver/filter does not provide.

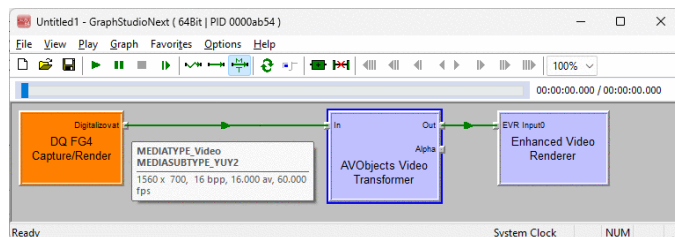
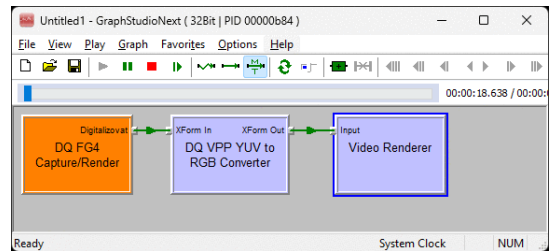
## 4.2 Rendering YUYV stream

FG4 device can optionally output YUYV stream. No Microsoft's renderer can directly render YUYV.

Standard Microsoft's colorspace converter is not capable of accepting YUYV format, see documentation here:

<https://learn.microsoft.com/en-us/windows/win32/directshow/color-space-converter-filter>

The conversion filter before rendering must be provided.  
We recommend DQ VPP YUV to RGB Converter.



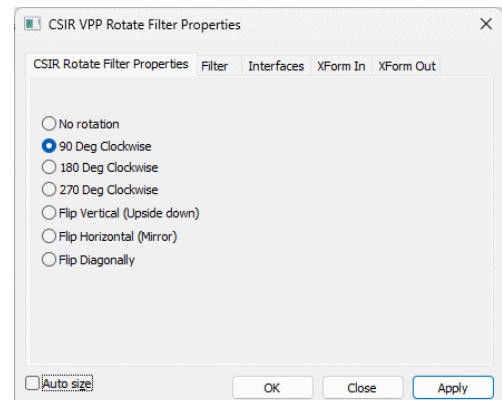
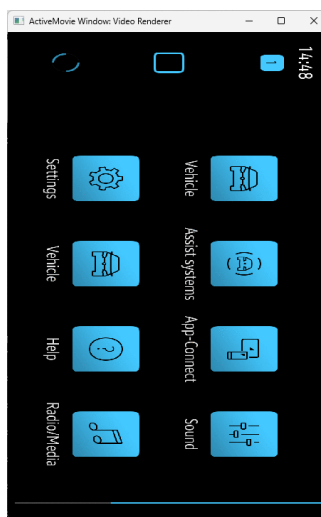
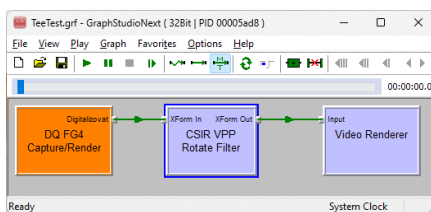
It is also possible to use free filter from AV objects named **Video transformer**. It is downloadable from here: <http://www.avobjects.com/download>

## 4.3 Rotated view

It is available free rotation DQ filter, installation is downloadable from here:

[https://sourceforge.net/projects/direct-show-demo-filters/files/DQ\\_VPP\\_VIDEOPROCESSING/](https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/)

There also exists commercial **VideoRotator from AV Objects**: <http://www.avobjects.com/download>



## 4.4 Playing a video on display

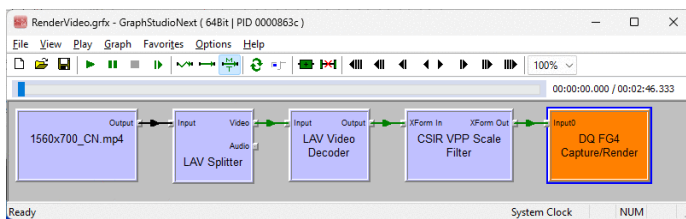
Rendering a videostream is a more complex task. Videostream usually does not have suitable resolution, so resize filter must be used. We recommend our modified DQ VPP scale filter. It is accessible from here:

[https://sourceforge.net/projects/direct-show-demo-filters/files/DQ\\_VPP\\_VIDEOPROCESSING/](https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/)

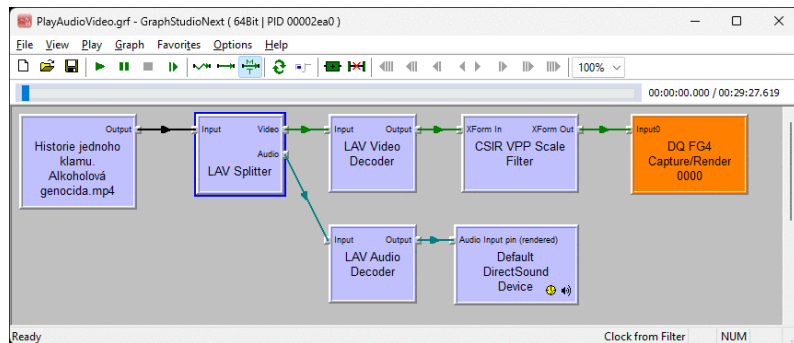
**Do not use original CSIR filters <https://sourceforge.net/projects/ffmpeg/> , they do not support RGB32 format needed by FG4.**

First filter **File Source (async)** is a part of Microsoft's Windows DShow. But the video stream must be decoded. We recommend to use LAV filters accessible from here:

<https://www.videohelp.com/software/LAV-Filters>

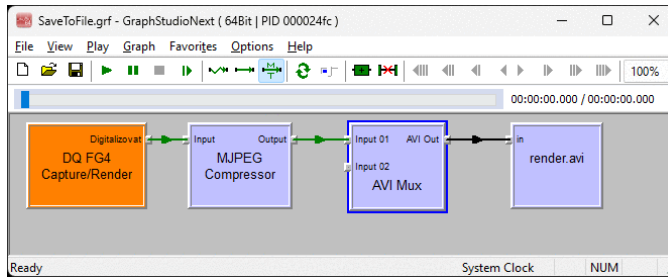


Just for a case when you want to play audio and video



simultaneously:

## 4.5 Rendering a video to the file



File writer needs some effective storage format. Microsoft’s MJPEG is used for demonstration. It is possible to use commercial filter with H264 format:

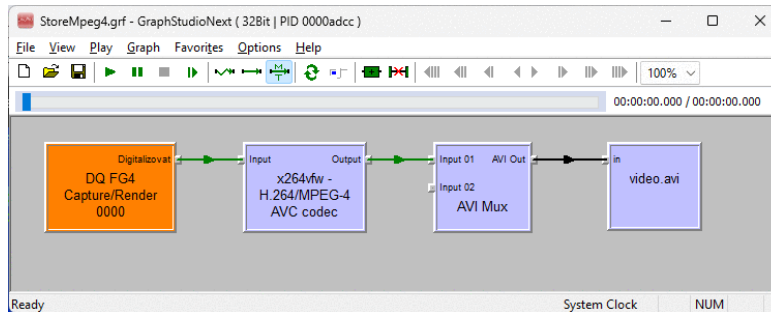
[http://www.avobjects.com/products/encoders/h\\_264\\_encoder.html](http://www.avobjects.com/products/encoders/h_264_encoder.html)

[http://www.avobjects.com/products/encoders/qs\\_encoder.html](http://www.avobjects.com/products/encoders/qs_encoder.html)

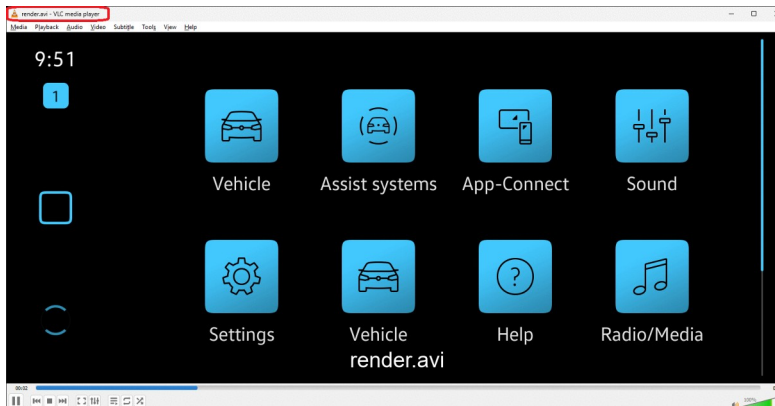
Free H264 codec also exists: <https://sourceforge.net/projects/x264vfw/>

<https://hax264.sourceforge.net/>

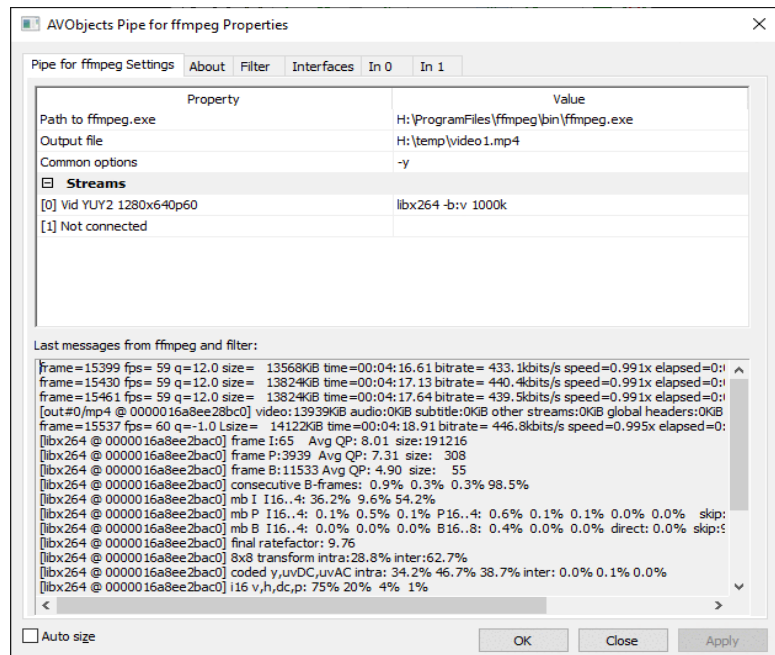
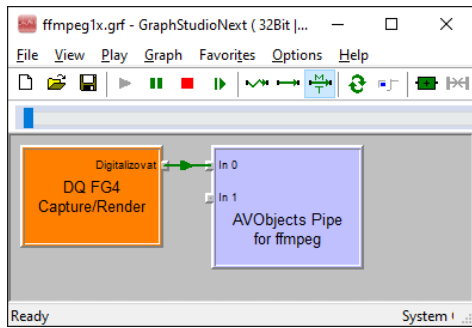
Generate H264 MPEG-4:



The file recorded could be played using VLC media player



Another possibility is to use “AV Objects Pipe for ffmpeg” as depicted on following images.



This DirectShow filter wraps ffmpeg. You will need to fill encoder manually (mpeg2video, mpeg4, libxvid, libx264, libx265, etc.) like “*libx264 -b:v 1000k*”. File type could be mp4, mov, avi, mkv, mpg or else. Additional parameter should be (“-y”).

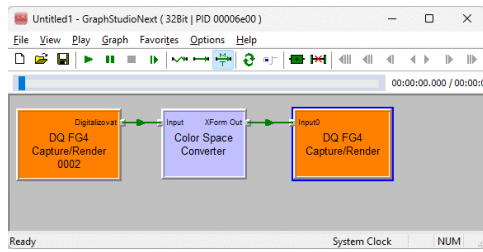
Filter could be downloaded from here:

[http://www.avobjects.com/products/special\\_filters/Pipe\\_for\\_ffmpeg.html](http://www.avobjects.com/products/special_filters/Pipe_for_ffmpeg.html)

ffmpeg codecs are described here: <https://ffmpeg.org/ffmpeg-codecs.html>

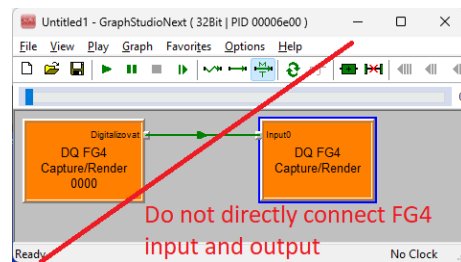
## 4.6 Feedback

This might be useful when you want to feed video from one FG4 card input to the output on different physical FG4 card. It is recommended to use internal FG4 loopback feature for video on one card.



**There is some flaw in DirectShow and 2 kernel based filters should not be interconnected this way.** It randomly crashes during video stop.

If you implement this connection in C++, you should stop video source first and then renderer. It works.

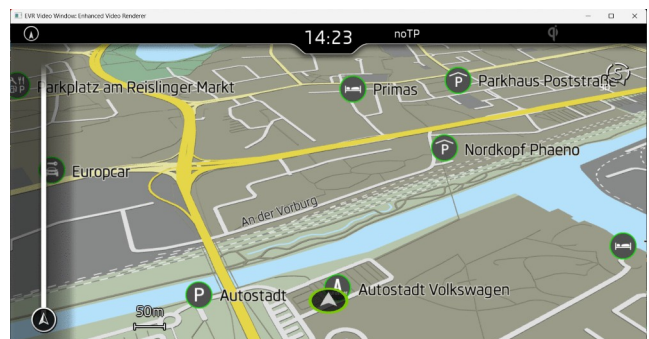
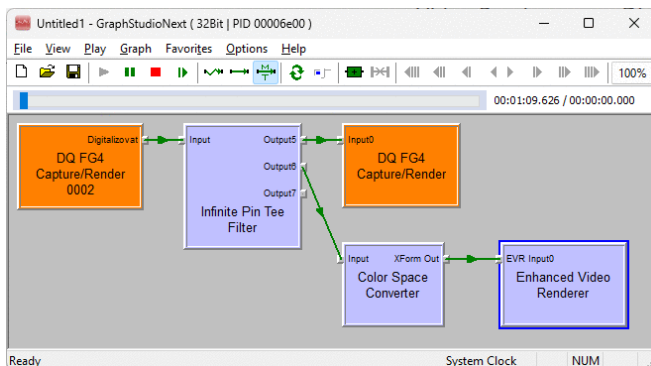


## 4.7 Feedback with preview

This grants that video grabbed from FG4 is displayed on screen and simultaneously sent to display.

Please note that Infinite Tee pin filter is a standard part of DirectShow and it is preinstalled on Windows. <https://learn.microsoft.com/en-us/windows/win32/directshow/infinite-pin-tee-filter>

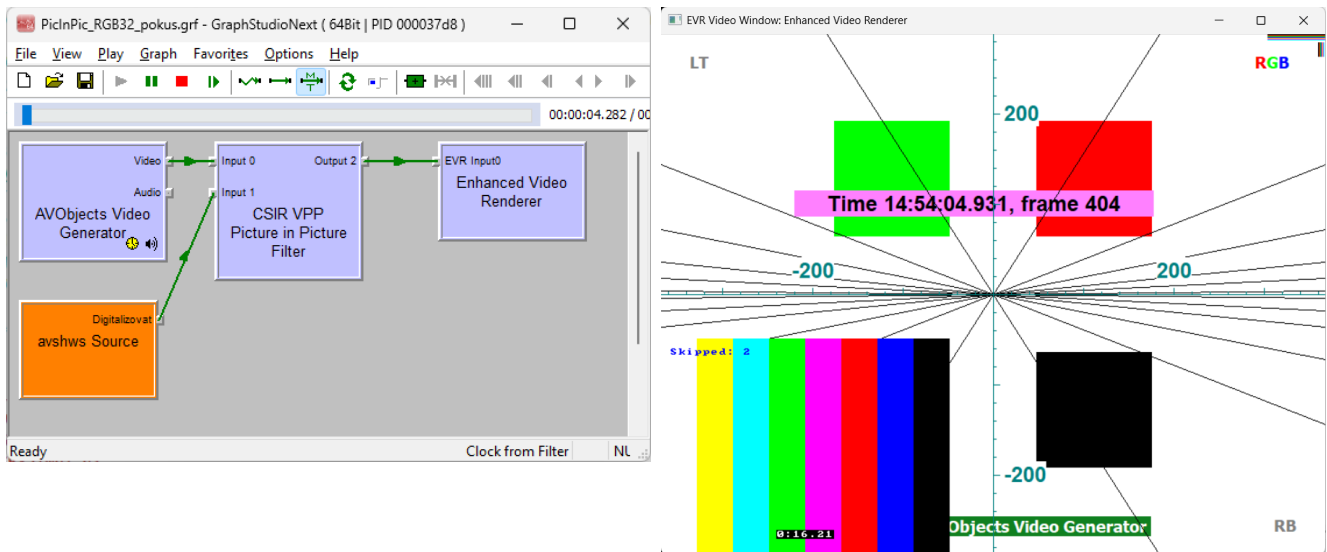
No external component is needed for this setup.



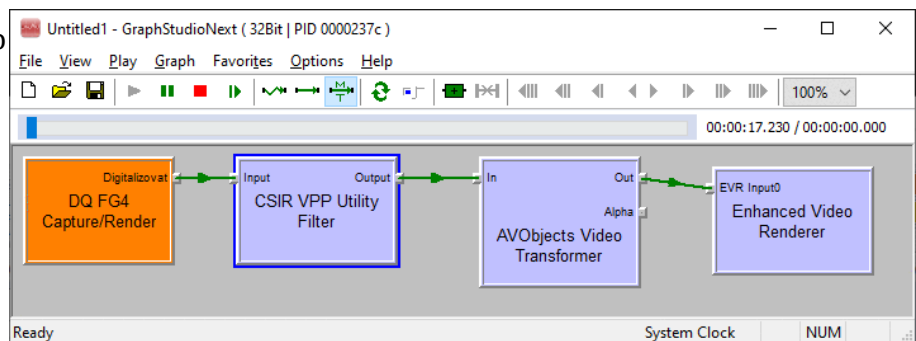
From unknown reason the direct connection is sometimes refused, thus Enhanced video renderer is connected through Color Space Converter as a workaround.

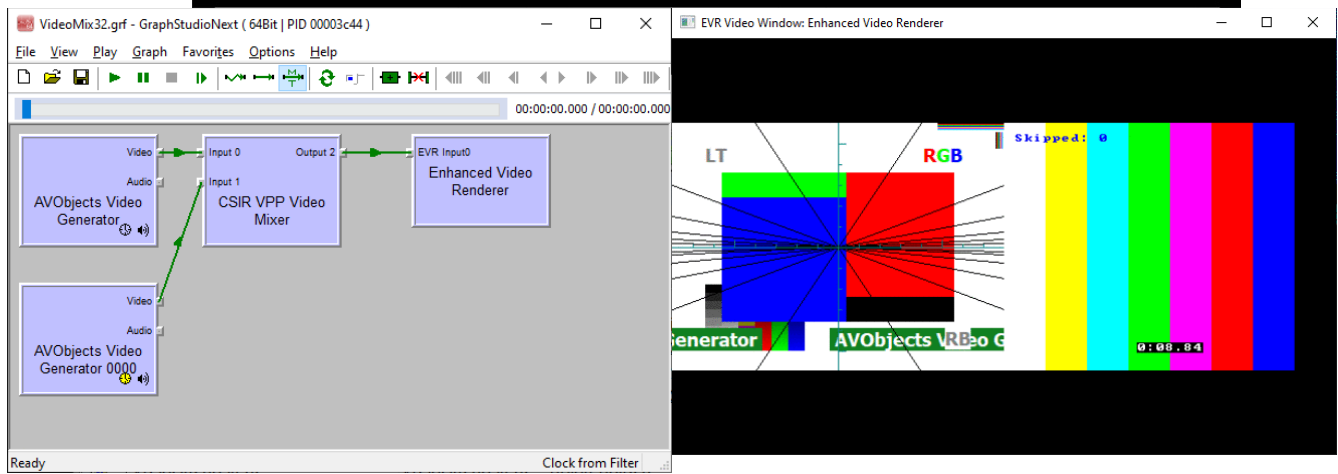
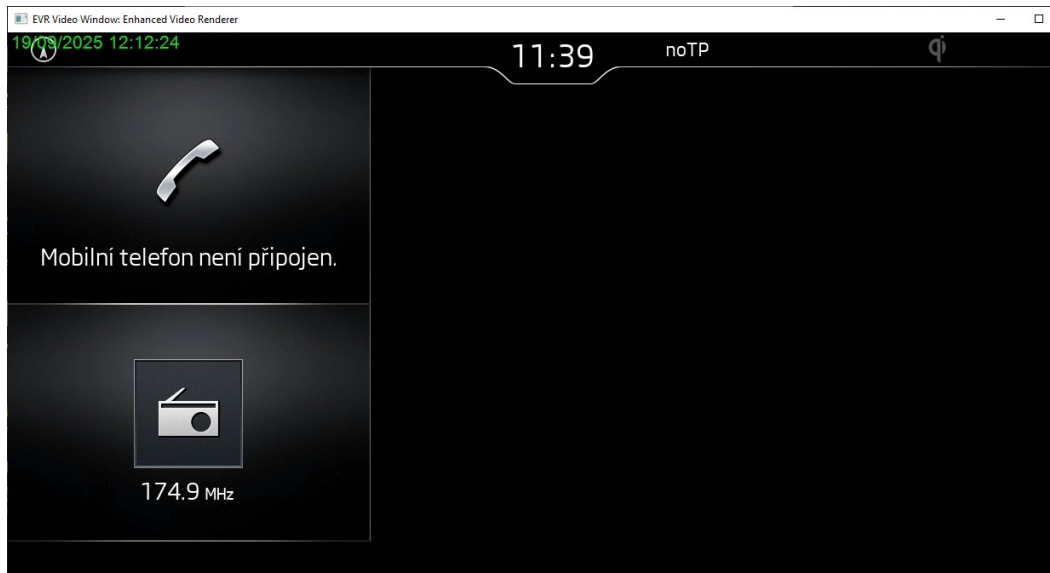
## 4.8 Mixing videos

It is possible to mix video from multiple sources, see image. This could be used for outputting something on display.



It is possible to insert timestamp or any debug information to the video. Please note a green text on a following image.





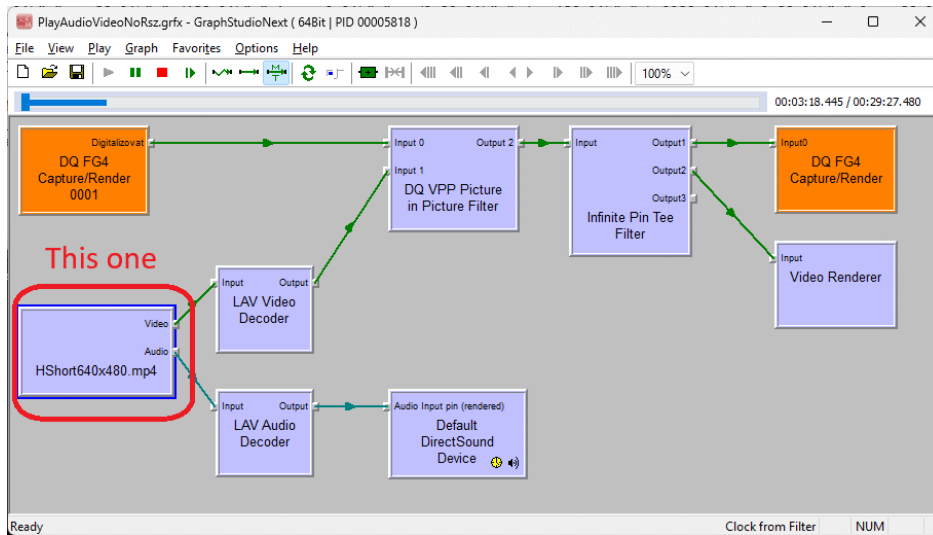
Another possibility is to mix 2 videos horizontally or vertically.

## 5 Erata

### 5.1 Microsoft's AVI/WAV File Source filter does not support flawless video framerate

It is generating lags.

<https://learn.microsoft.com/en-us/windows/win32/directshow/avi-wav-file-source>



Prefer *LAV Splitter Source filter* instead.

## 6 Direct Show Filter list

There exists much more filters available. These ones has been chosen for demonstration what could be done with FG4 video.

Video Renderer	Microsoft / <b>free</b>	This renderer is good to render FG4 videostream. It has no extra feature requirements <a href="https://learn.microsoft.com/en-us/windows/win32/directshow/video-renderer-filter">https://learn.microsoft.com/en-us/windows/win32/directshow/video-renderer-filter</a>
Enhanced Video Renderers	Microsoft / <b>free</b>	This filter sometimes requires special DirectShow features <a href="https://learn.microsoft.com/en-us/windows/win32/directshow/enhanced-video-renderer-filter">https://learn.microsoft.com/en-us/windows/win32/directshow/enhanced-video-renderer-filter</a>
Color Space Converter filter	Microsoft / <b>free</b>	Sometimes this filter is necessary to modify videostream <a href="https://learn.microsoft.com/en-us/windows/win32/directshow/color-space-converter-filter">https://learn.microsoft.com/en-us/windows/win32/directshow/color-space-converter-filter</a>
Infinite Pin Tee Filter	Microsoft / <b>free</b>	This filter allows to split video to 2 or more identical videos. <a href="https://learn.microsoft.com/en-us/windows/win32/directshow/infinite-pin-tee-filter">https://learn.microsoft.com/en-us/windows/win32/directshow/infinite-pin-tee-filter</a>
AVI Mux Filter	Microsoft / <b>free</b>	Helper for generating AVI videostream <a href="https://learn.microsoft.com/en-us/windows/win32/directshow/avi-mux-filter">https://learn.microsoft.com/en-us/windows/win32/directshow/avi-mux-filter</a>
File Source (Async) Filter	Microsoft / <b>free</b>	The Async File Source filter opens and reads local files of many different data formats and passes the data to a parser filter. <a href="https://learn.microsoft.com/en-us/windows/win32/directshow/file-source--async--filter">https://learn.microsoft.com/en-us/windows/win32/directshow/file-source--async--filter</a>

File Writer Filter	Microsoft / free	The File Writer filter can be used to write files to disc regardless of format. The filter simply writes to disc whatever it receives on its input pin, so it must be connected upstream to a multiplexer that can format the file correctly. <a href="https://learn.microsoft.com/en-us/windows/win32/directshow/file-writer-filter">https://learn.microsoft.com/en-us/windows/win32/directshow/file-writer-filter</a>
MJPEG Decompressor Filter	Microsoft / free	This filter decodes a video stream from motion JPEG to uncompressed video. Some digital video cameras produce a motion JPEG video stream. <a href="https://learn.microsoft.com/en-us/windows/win32/directshow/mjpeg-decompressor-filter">https://learn.microsoft.com/en-us/windows/win32/directshow/mjpeg-decompressor-filter</a>
Ball	Microsoft SDK compiled J.Fojtik / free	Very simple video source filter that is intended for programmers to learn how to write these filters. <a href="https://sourceforge.net/projects/direct-show-demo-filters/files/1.09/">https://sourceforge.net/projects/direct-show-demo-filters/files/1.09/</a>
AVSHWS	Microsoft DDK compiled J.Fojtik/ free	Very simple Windows kernel video source filter that is intended for programmers to learn how to write these filters. <a href="http://ftsoft.com.cz/CamView/AVSHWS/index.htm">http://ftsoft.com.cz/CamView/AVSHWS/index.htm</a>
AV Video Generator	AVObject / free	DirectShow filter for generating a video stream with the necessary parameters, for creating video frames for checking chroma key, for outputting an audio stream synchronized with video, and much more. <a href="http://www.avobjects.com/products/freeware_filters/video_generator.html">http://www.avobjects.com/products/freeware_filters/video_generator.html</a>
AV Object pipe for ffmpeg	AVObject / commercial	Pipe for ffmpeg uses the <i>ffmpeg.exe</i> external module to encode video and audio streams and write them to files. The encoding and file types depend on the <i>ffmpeg.exe</i> used. <a href="http://www.avobjects.com/products/special_filters/Pipe_for_ffmpeg.html">http://www.avobjects.com/products/special_filters/Pipe_for_ffmpeg.html</a>
AV QS encoder	AVObject / commercial	DirectShow filter for encoding 8-bit 4:2:0 progressive or interlaced video frames in HEVC, H264 or MPEG-2 formats. <a href="http://www.avobjects.com/products/encoders/qs_encoder.html">http://www.avobjects.com/products/encoders/qs_encoder.html</a>
AV Video Transformer	AVObject / free	DirectShow filter for conversions of uncompressed video stream. <a href="http://www.avobjects.com/products/freeware_filters/video_transformer.html">http://www.avobjects.com/products/freeware_filters/video_transformer.html</a>
<a href="#">X264vfw</a>	Masternobody / free	Compression video to H246 stream <a href="https://sourceforge.net/projects/x264vfw/">https://sourceforge.net/projects/x264vfw/</a>
LAV Splitter	LAV / free	Splits audio and video from AVI <a href="https://www.videohelp.com/software/LAV-Filters">https://www.videohelp.com/software/LAV-Filters</a>

LAV Video Decoder	LAV / <b>free</b>	Decodes compressed videoformat from video file. <a href="https://www.videohelp.com/software/LAV-Filters">https://www.videohelp.com/software/LAV-Filters</a>
LAV Splitter Source filter	LAV / <b>free</b>	Reads input file and splits audio and video from AVI <a href="https://www.videohelp.com/software/LAV-Filters">https://www.videohelp.com/software/LAV-Filters</a>
DQ/CSIR Scale Filter	CSIR reworked in DQ / <b>free</b>	Allows to scale video resolution. <a href="https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/">https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/</a>
DQ/CSIR Rotate filter	CSIR reworked in DQ / <b>free</b>	Allows to rotate video. <a href="https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/">https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/</a>
DQ/CSIR Picture in Picture Filter	CSIR reworked in DQ / <b>free</b>	Allows to insert 2 <sup>nd</sup> video video as thumb. <a href="https://sourceforge.net/projects/direct-show-demo-filters/files/CSIR_VPP_VIDEOPROCESSING/">https://sourceforge.net/projects/direct-show-demo-filters/files/CSIR_VPP_VIDEOPROCESSING/</a>
DQ/CSIR Utility Filter	CSIR reworked in DQ / <b>free</b>	Allows to add watermark text to video. <a href="https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/">https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/</a>
DQ/CSIR Crop Filter	CSIR reworked in DQ / <b>free</b>	Allows to crop video. <a href="https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/">https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/</a>
DQ/CSIR Video Mixing Filter	CSIR reworked in DQ / <b>free</b>	Allows to mix 2 videos horizontally or vertically. <a href="https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/">https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/</a>
DQ YUV to RGB Converter	DQ / <b>free</b>	Converts many YUV based formats to RGB24 or RGB32. <a href="https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/">https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/</a>

**Original CSIR filters are located here <https://sourceforge.net/projects/videoprocessing/> , they do not support RGB32 format needed by FG4. They do not support persistence, that allows to save filter state or any 3<sup>rd</sup> party software. They have a lot of bugs that are causing to crash.**