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

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

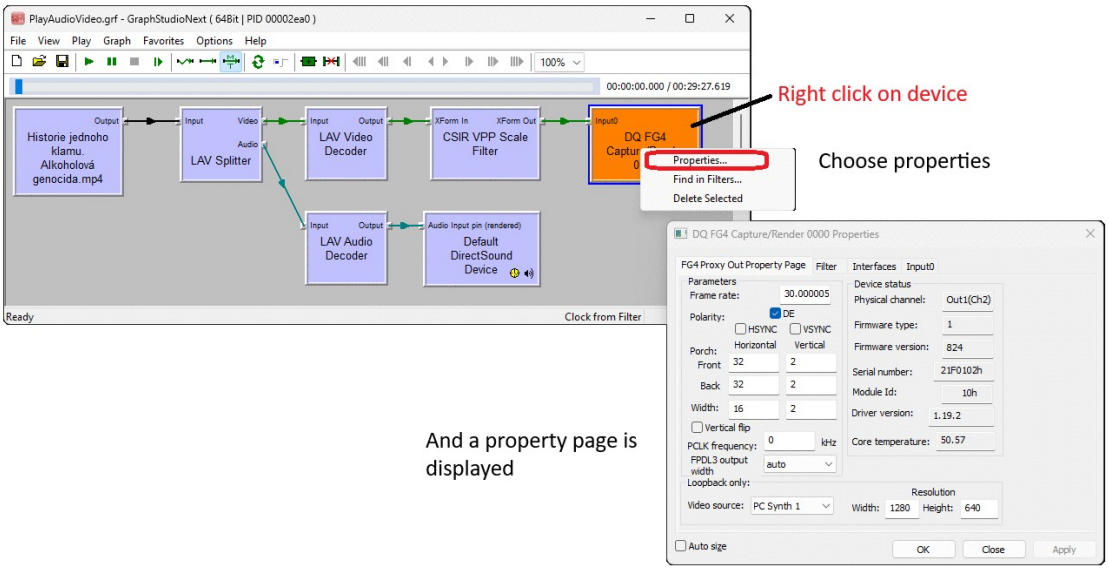
Please note that there are 2 variants 32bit and 64bit. On 64 bit system you can use both of them. But on 32 bit system you can use only 32 bit variant.

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

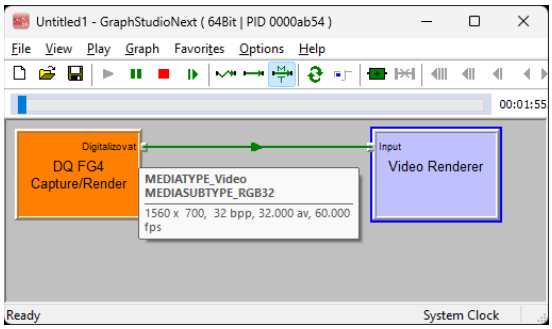
All necessary options could be set through driver's property page. No special application like DQviewer needed.



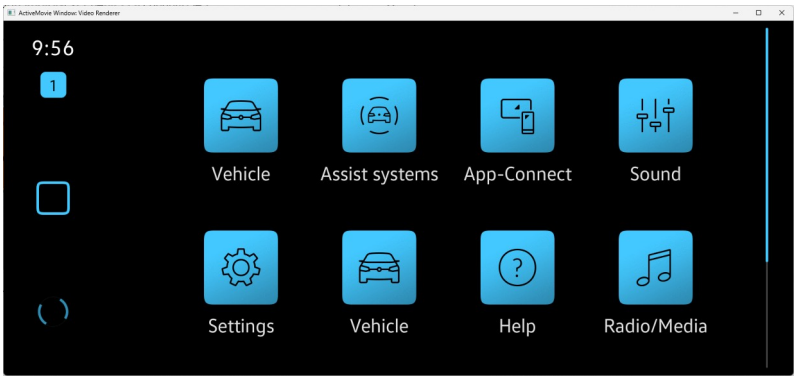
4 Recommended configurations

4.1 Simple rendering

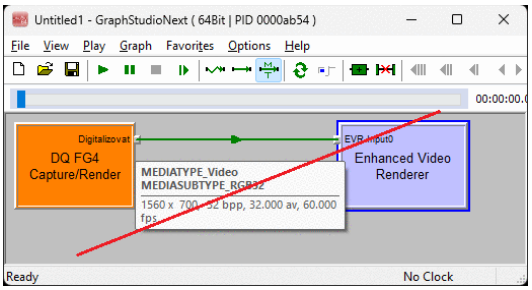
Insert block FG4 signal source and a standard Video renderer:

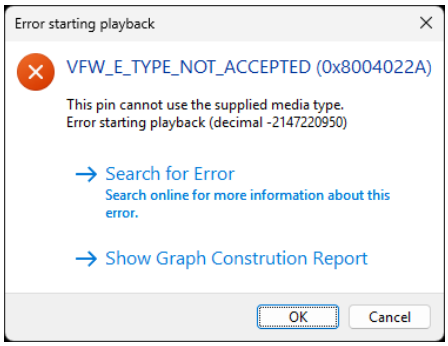


It should produce following result:

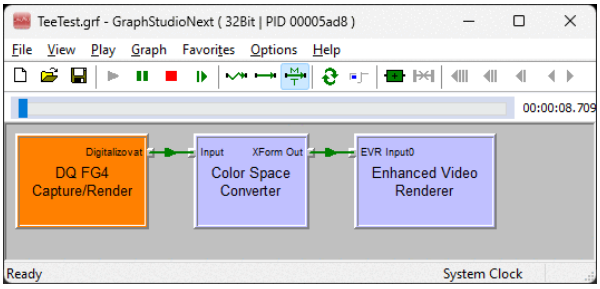


There is one pitfall. Enhanced Microsoft's renderer sometimes does not connect to a lower filter:

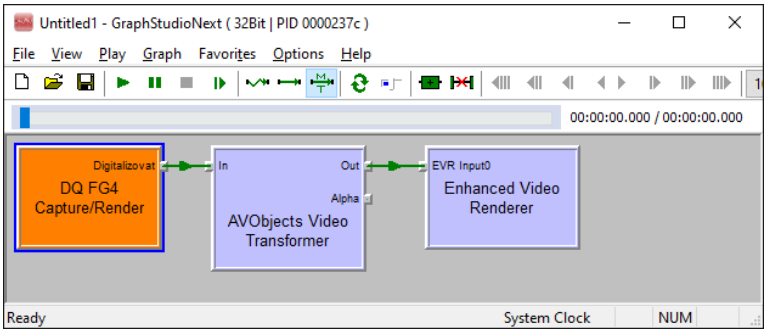


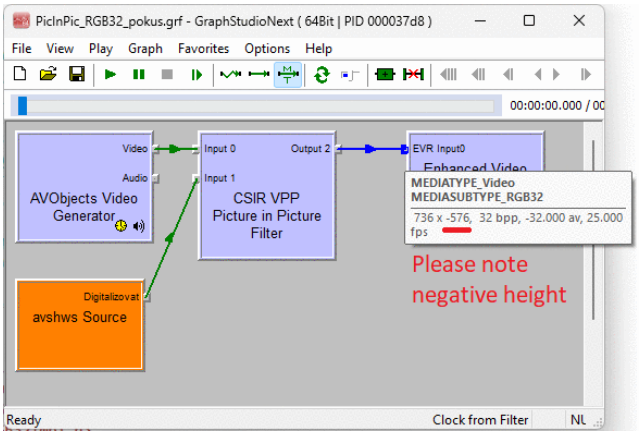


When this occurs, use middle **colorspace converter filter**, and everything works:



Or you can use free AV transform filter that provides a same job. http://www.avobjects.com/products/freeware_filters/video_transformer.html

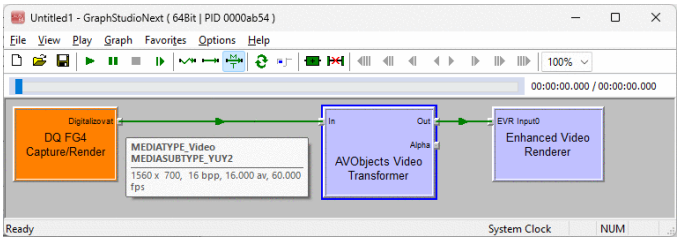




The problem behind is that Microsoft's renderer sometimes forces to use negative height or asks for different geometry, that lower driver/filter does not provide.

4.2 Rendering YUYV stream

FG4 device can optionally output YUYV stream. No Microsoft's renderer can directly render YUYV. The conversion filter before rendering must be provided. We recommend free filter from AV objects named **Video transformer**. It is downloadable from here: http://www.avobjects.com/download

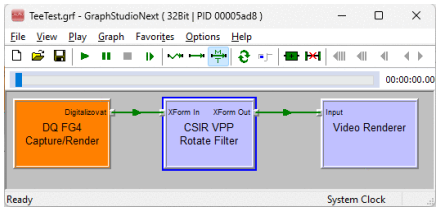


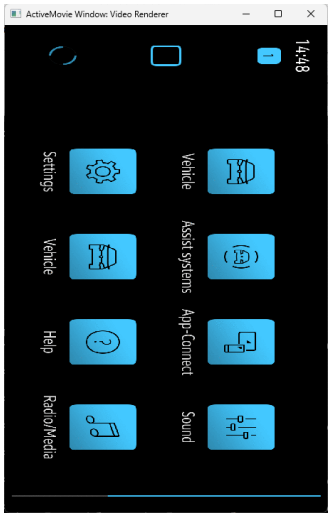
Standard Microsoft's colorspace converter is not capable of accepting YUYV format, see documentation here:
https://learn.microsoft.com/en-us/windows/win32/directshow/color-space-converter-filter

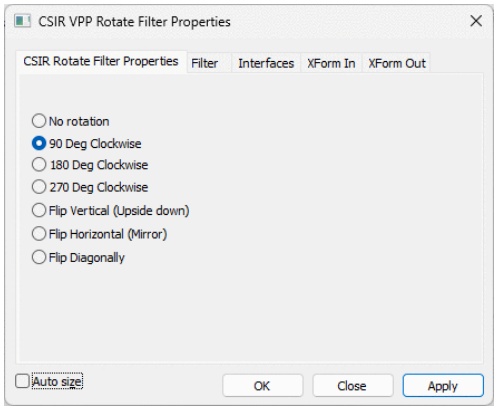
4.3 Rotated view

It is available free rotation DQ filter, installation is downloadable from here:
https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/

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







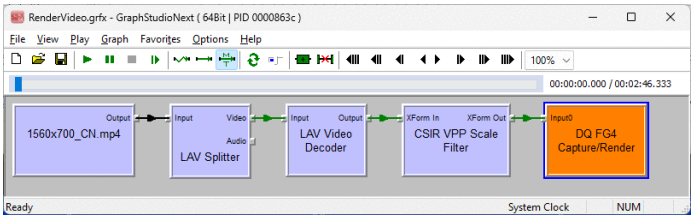
4.4 Playing a video on display

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

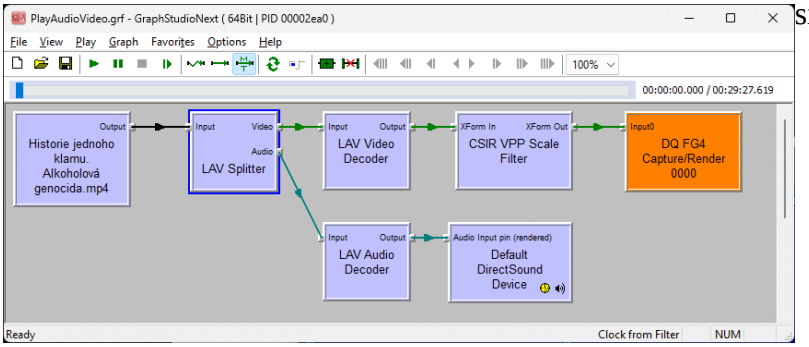
accessible from here:
https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/

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

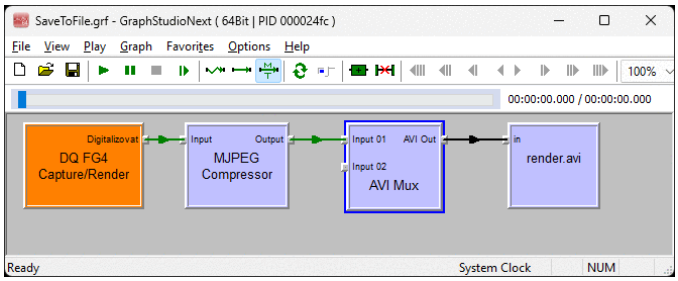
First filter **File Source (async)** is a part of Microsoft's Windows DShow. But the video stream must be decoded. We recommend to use LAV filters accessible from here:
https://www.videohelp.com/software/LAV-Filters



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

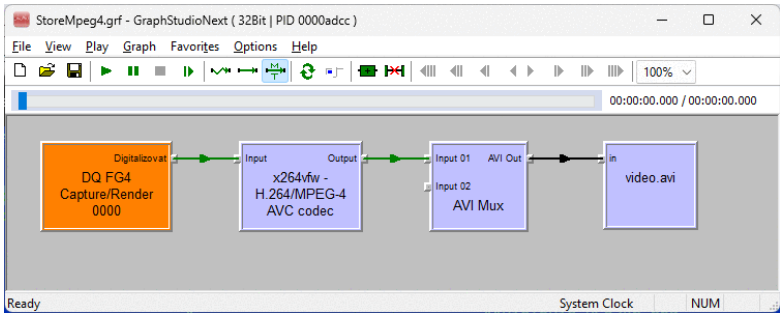


4.5 Rendering a video to the file

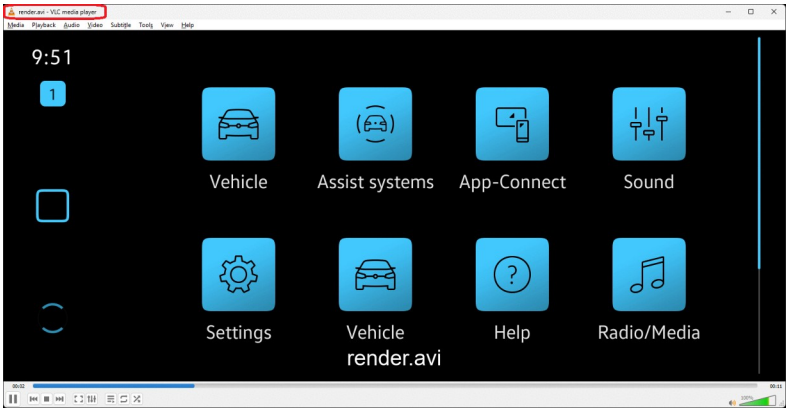


File writer needs some effective storage format. Microsoft's MJPEG is used for demonstration. It is possible to use commercial filter with H264 format:
http://www.avobjects.com/products/encoders/h_264_encoder.html
http://www.avobjects.com/products/encoders/qs_encoder.html
Free H264 codec also exists: https://sourceforge.net/projects/x264vfw/
https://hax264.sourceforge.net/

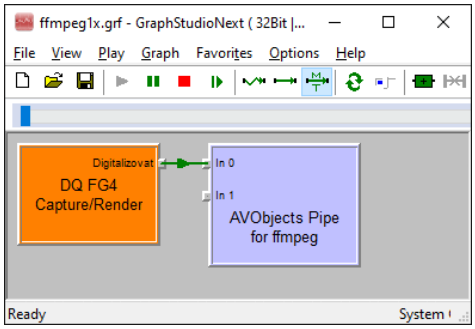
Generate H264 MPEG-4:

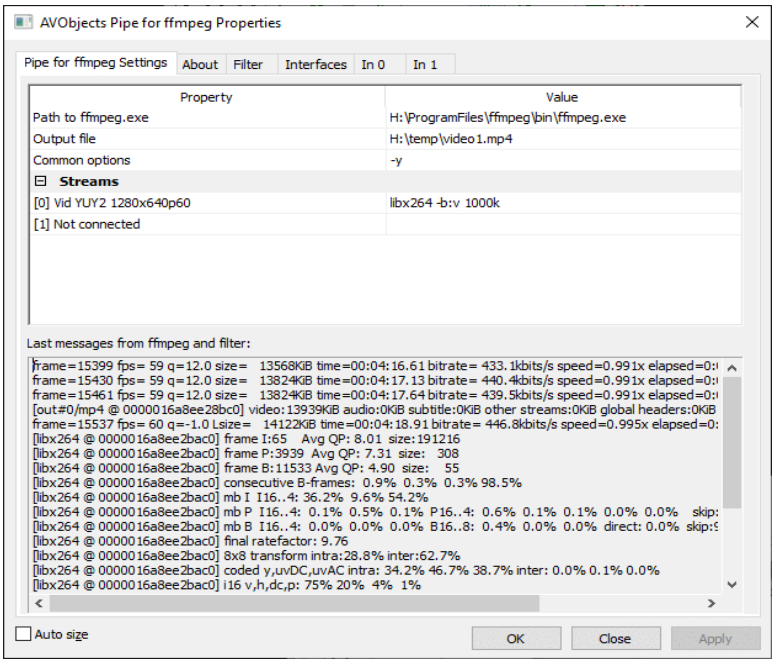


The file recorded could be played using VLC media player



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



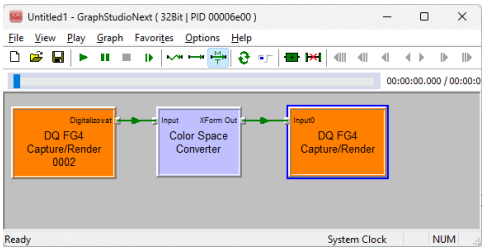


This DirectShow filter wraps ffmpeg. You will need to fill encoder manually (mpeg2video, mpeg4, libxvid, libx264, libx265, etc.) like "*libx264 -b:v 1000k*". File type could be mp4, mov, avi, mkv, mpg or else. Additional parameter should be ("-y").

Filter could be downloaded from here:
http://www.avobjects.com/products/special_filters/Pipe_for_ffmpeg.html
ffmpeg codecs are described here: https://ffmpeg.org/ffmpeg-codecs.html

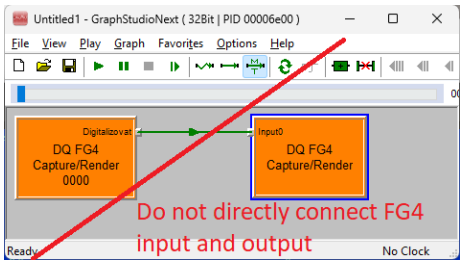
4.6 Feedback

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.

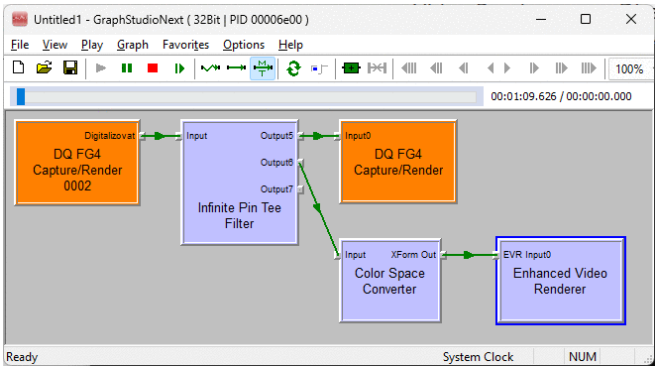


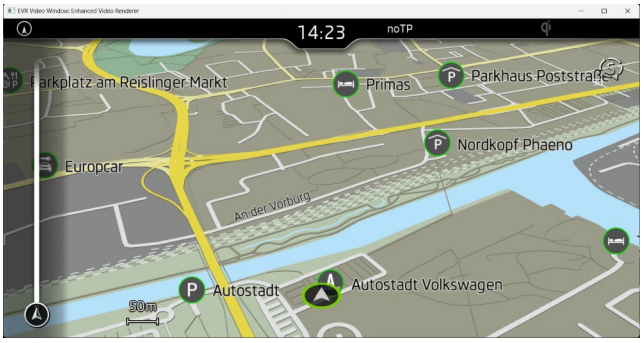
4.7 Feedback with preview

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.

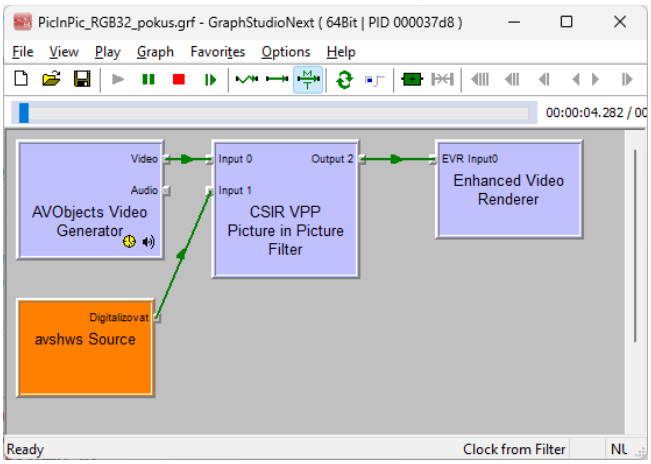


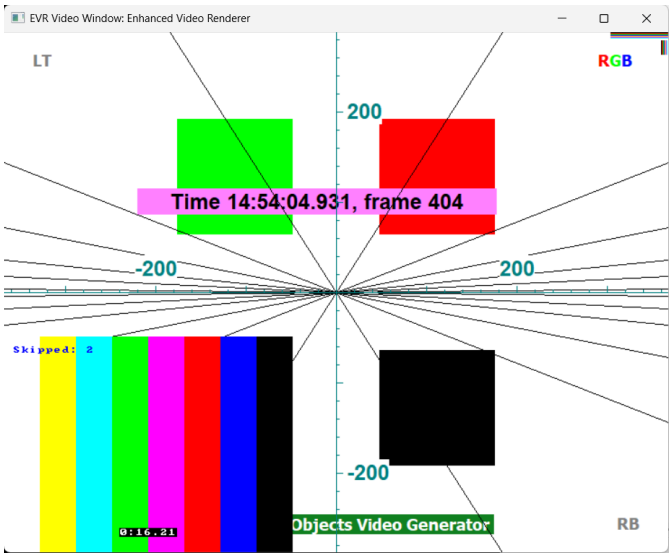


From unknown reason the direct connection is sometimes refused, thus Enhanced video renderer is connected through Color Space Converter as a workaround.

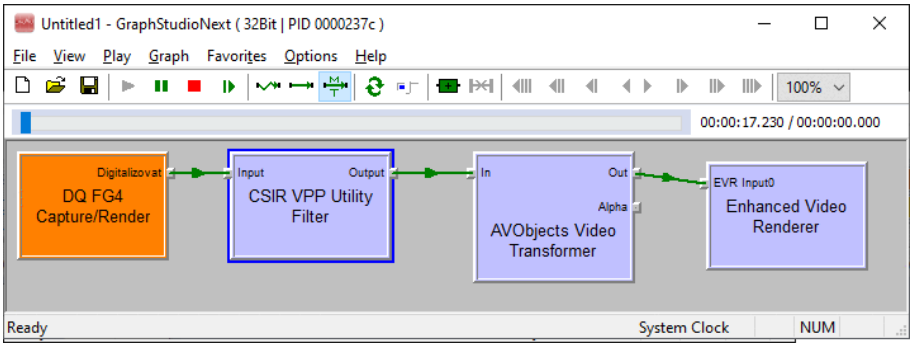
4.8 Mixing videos

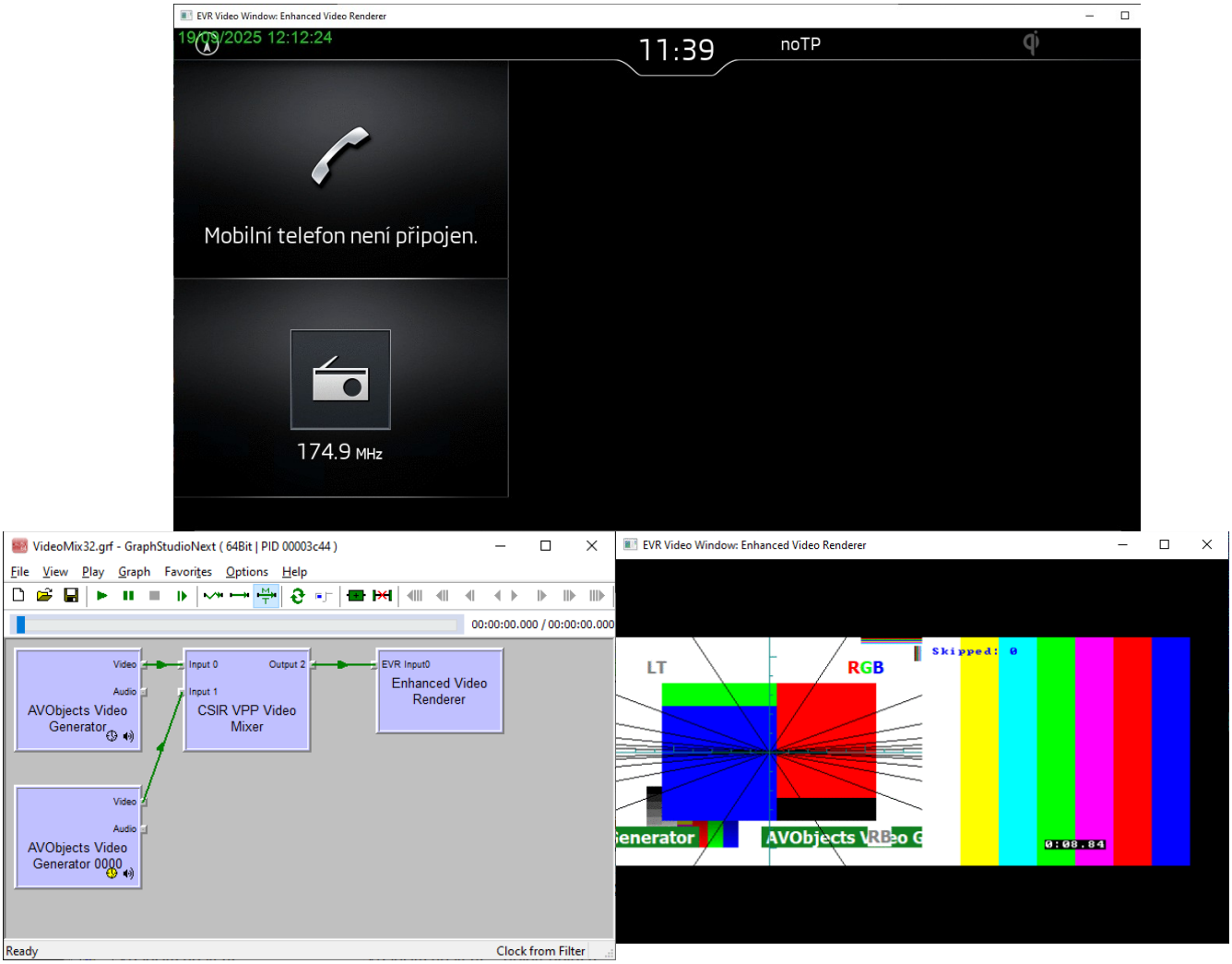
It is possible to mix video from multiple sources, see image. This could be used for outputting something on display.





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 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 / free	This renderer is good to render FG4 videostream. It has no extra feature requirements https://learn.microsoft.com/en-us/windows/win32/directshow/video-renderer-filter

Enhanced Video Renderers	Microsoft / free	This filter sometimes requires special DirectShow features https://learn.microsoft.com/en-us/windows/win32/directshow/enhanced-video-renderer-filter
Color Space Converter filter	Microsoft / free	Sometimes this filter is necessary to modify videostream https://learn.microsoft.com/en-us/windows/win32/directshow/color-space-converter-filter
Infinite Pin Tee Filter	Microsoft / free	This filter allows to split video to 2 or more identical videos. https://learn.microsoft.com/en-us/windows/win32/directshow/infinite-pin-tee-filter
AVI Mux Filter	Microsoft / free	Helper for generating AVI videostream https://learn.microsoft.com/en-us/windows/win32/directshow/avi-mux-filter
File Source (Async) Filter	Microsoft / free	The Async File Source filter opens and reads local files of many different data formats and passes the data to a parser filter. https://learn.microsoft.com/en-us/windows/win32/directshow/file-source--async--filter
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. https://learn.microsoft.com/en-us/windows/win32/directshow/file-writer-filter
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. https://learn.microsoft.com/en-us/windows/win32/directshow/mjpeg-decompressor-filter
Ball	Microsoft SDK compilled J.Fojtik / free	Very simple video source filter that is intended for programmers to learn how to write these filters. https://sourceforge.net/projects/direct-show-demo-filters/files/1.09/
AVSHWS	Microsoft DDK compilled J.Fojtik/ free	Very simple Windows kernel video source filter that is intended for programmers to learn how to write these filters. http://ftsoft.com.cz/CamView/AVSHWS/index.htm
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. http://www.avobjects.com/products/freeware_filters/video_generator.html
AV Object pipe for ffmpeg	AVObject / commercial	Pipe for ffmpeg uses the ffmpeg.exe external module to encode video and audio streams and write them to files. The encoding and

		file types depend on the ffmpeg.exe used. http://www.avobjects.com/products/special_filters/Pipe_for_ffmpeg.html
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. http://www.avobjects.com/products/encoders/qs_encoder.html
AV Video Transformer	AVObject / free	DirectShow filter for conversions of uncompressed video stream. http://www.avobjects.com/products/freeware_filters/video_transformer.html
X264vfw	Masternobody / free	Compression video to H246 stream https://sourceforge.net/projects/x264vfw/
LAV Splitter	LAV / free	Splits audio and video from AVI https://www.videohelp.com/software/LAV-Filters
LAV Video Decoder	LAV / free	Decodes compressed videoformat from video file. https://www.videohelp.com/software/LAV-Filters
DQ/CSIR Scale Filter	CSIR reworked in DQ / free	Allows to scale video resolution. https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/
DQ/CSIR Rotate filter	CSIR reworked in DQ / free	Allows to rotate video. https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/
DQ/CSIR Picture in Picture Filter	CSIR reworked in DQ / free	Allows to insert 2nd video video as thumb. https://sourceforge.net/projects/direct-show-demo-filters/files/CSIR_VPP_VIDEOPROCESSING/
DQ/CSIR Utility Filter	CSIR reworked in DQ / free	Allows to add watermark text to video. https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/
DQ/CSIR Crop Filter	CSIR reworked in DQ / free	Allows to crop video. https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/
DQ/CSIR Video Mixing Filter	CSIR reworked in DQ / free	Allows to mix 2 videos horizontally or vertically. https://sourceforge.net/projects/direct-show-demo-filters/files/DQ_VPP_VIDEOPROCESSING/

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