Nordic Neuro Lab

VisualSystem HD

Display Setup for VisualSystem HD



0 Index

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03 1 Introduction

03 2 How to identify display ID

04 3 Tube orientation and flipped display

05 4 Display setup options for VSHD

05 4.1 Setup 1M: Monoscopic setup with HDMI splitter

06 4.2 Setup 2M: Monoscopic setup without HDMI splitter

07 4.3 Setup 2S Dual: Stereoscopic setup with dual displays

08 4.4 Setup 2S Combined: Stereoscopic setup with combined displays

12 5 References

Definitions

VSHD	VisualSystem HD
CRI	Control Room Interface
VPS	VisualSystem HD Power Supply

1 Introduction

There are two separate displays in the VSHD Goggles. They are located together with the optical system and eye-tracker camera inside a tube, one for each eye. In short, this means we have two external monitors connected to the computer on which we can display stimuli. This leaves us the option to either display the same image to both eyes/monitors (monoscopic) or show separate images (stereoscopic). For 3D stimuli, a stereoscopic setup is required. In this article we will look at how to set up the displays, showing how to do both stereo- and monoscopic.

2 How to identify display ID

As there are two separate displays in the VSHD Goggles, they will appear on the computer as two monitors with different IDs. Which ID Windows gives to which of the two displays may vary, thus it is important to be able to identify which display ID corresponds to which tube/eye.

To do so, open Window's display settings by right-clicking on the dashboard and select *Display* settings. This will open a window as shown in Figure 1.

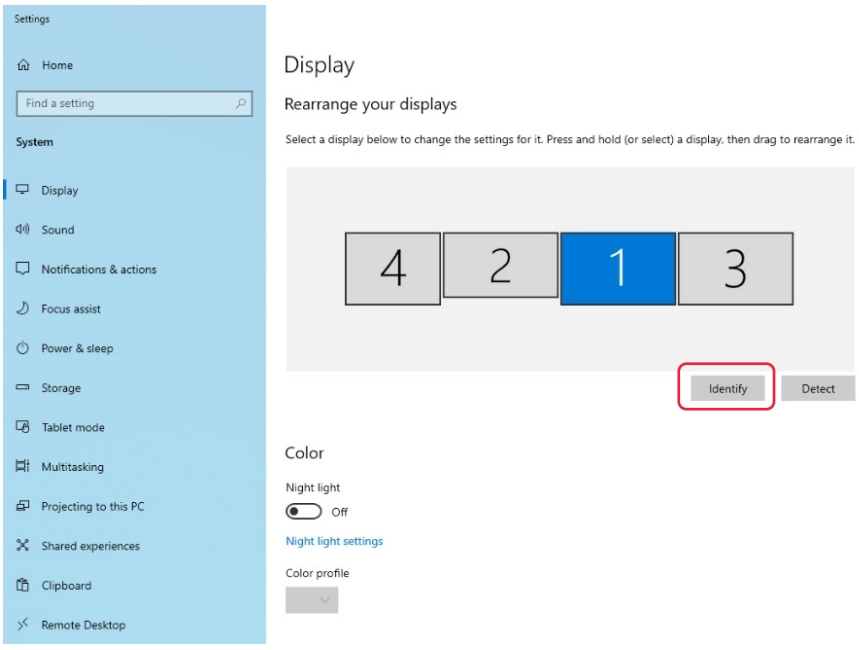

Figure 1: Display settings. Here displays can be identified and rearranged.

From here you can press *Identify*, as shown in Figure 1. This will display the IDs on their respective screens. This is shown in Figure 2.

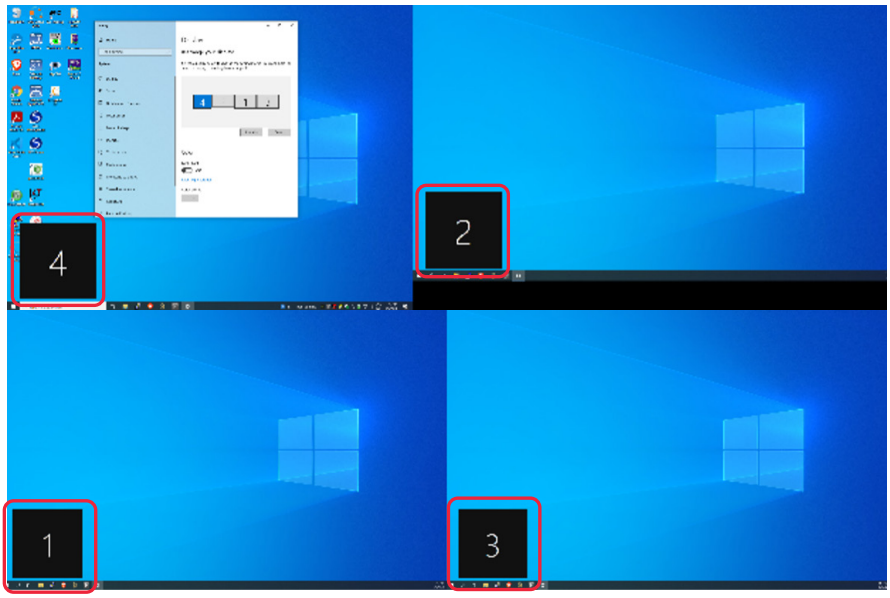

Figure 2: Display IDs shown on the respective monitors.

Looking into the VSHD Goggles will then reveal which display ID corresponds to which tube. Here the VSHD displays correspond to display ID 1 and 3, but this may vary depending on the setup/computer.

3 Tube orientation and flipped display

VSHD Goggles use the designations GT1/GT2 for the tubes instead of left/right since which tube is displayed to which eye depends on the orientation of the goggles. The tube at the cable connection side of the goggles is GT2. The video input on 1B will be displayed on this tube. Likewise, the video input on port 1A will be displayed on GT1. This is illustrated in Figure 3.

Depending on the orientation of the goggles relative to the head, the displayed image may be upside down. This can be accounted for by flipping the image in the display settings. Here is a guide showing several ways on how to flip the display: How to Rotate Your Screen in Windows 10 – Techlicious (1). This will work for duplicated and combined displays as well.

4 Display setup options for VSHD

VSHD can display both mono- and stereoscopic stimuli (2D/3D). The following setup options are described in this article:

- **Setup 1M: Monoscopic setup with HDMI splitter**
- **Setup 2M: Monoscopic setup without HDMI splitter**
- **Setup 2S Dual: Stereoscopic setup with dual displays**
- **Setup 2S Combined: Stereoscopic setup with combined displays**

The number in the setup names indicates which hardware setup is used (hardware setup 1 or 2), while the letter indicates whether it is for monoscopic (M) or stereoscopic (S) view. While programs like Unity can display stereoscopic stimuli by choosing two screen IDs to display the stimuli on, there are programs like Psychtoolbox that can only display on one display ID. Thus, there are two different display setup options for stereoscopic view. One with two separate displays, and one where two displays are merged to a combined display.

4.1 Setup 1M: Monoscopic setup with HDMI splitter

This setup will display the same image to both eyes. It is the easiest way to set up the VSHD Goggles for monoscopic view, as it does not require any software settings. It does however require an HDMI splitter and an extra HDMI cable compared to setup 2M. This also means that it uses one less HDMI output from the computer. The hardware is connected as shown in Figure 3.

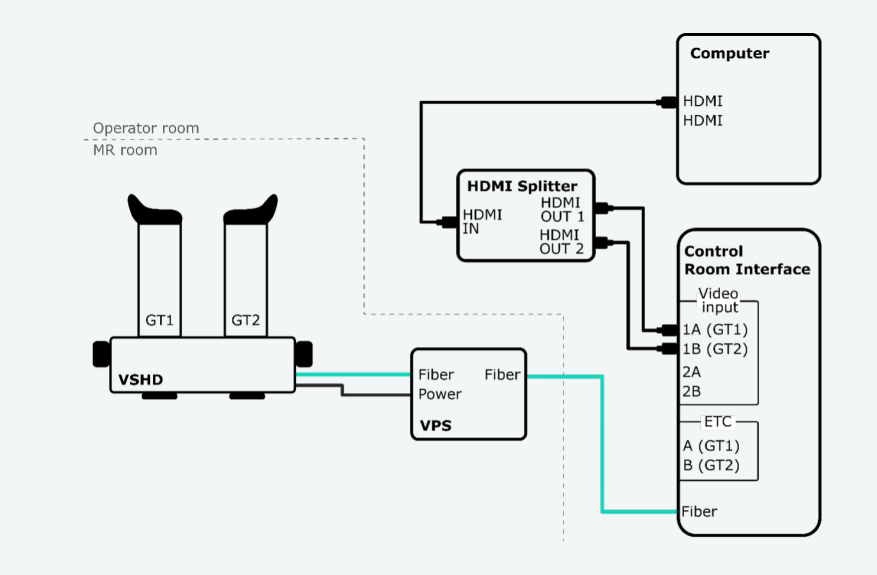

Figure 3: Hardware setup 1. This setup gives monoscopic view by using an HDMI splitter.

The HDMI signal from the computer goes through the HDMI splitter and into the video inputs on the Control Room Interface (CRI). Test This way the same image is displayed on both eyes without having to change any software settings.

4.2 Setup 2M: Monoscopic setup without HDMI splitter

As with setup 1M, this setup also displays the same image on both eyes. It does however not require an HDMI splitter, but display settings are used to duplicate the monitors. The hardware is set up as shown in Figure 4.

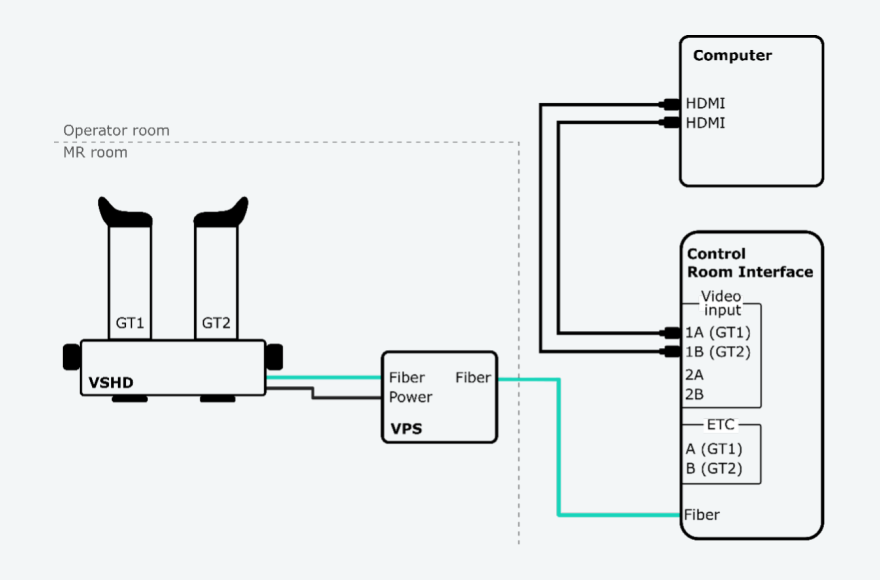

Figure 4: Hardware setup 2 capable for both mono- and stereoscopic view. Note that the video input on 1B is displayed on Goggle Tube 2 (GT2), which is the tube at the cable connection side of the VSHD Goggles. The video input on 1A is displayed on GT1.

As can be seen in Figure 4, two HDMI cables are connected from the computer to the CRI. This way the VSHD displays will appear as two individual monitors on the computer.

In order to duplicate the displays, open display settings. To do so, right click on the dashboard and select *Display settings*. It should look like in Figure 5.

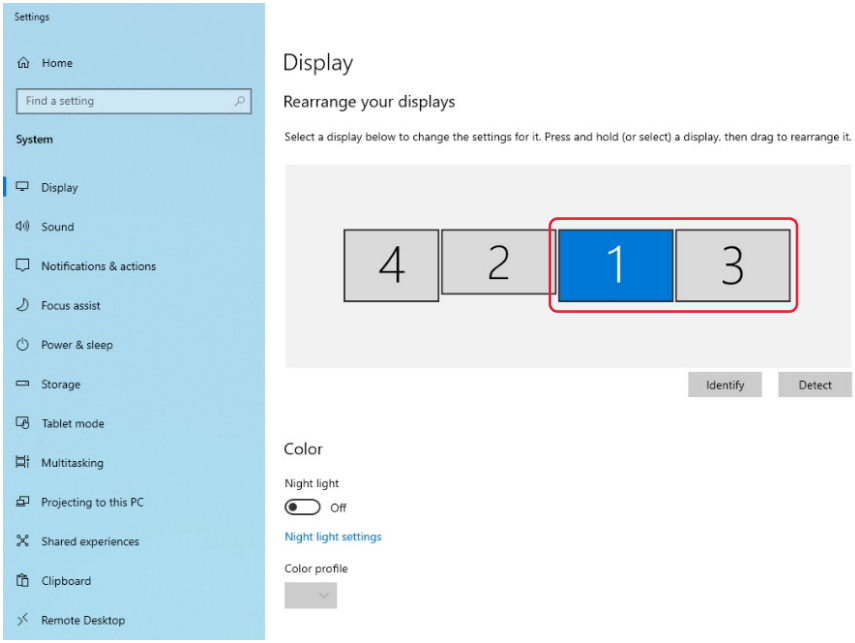

Figure 5: Display settings.

Then, identify the VSHD displays as described in section 2. In the example in Figure 5, they are number 1 and 3. Click on one of them such that it appears blue as in Figure 5. Scroll down and localize *Display orientation*. This is shown in Figure 6.

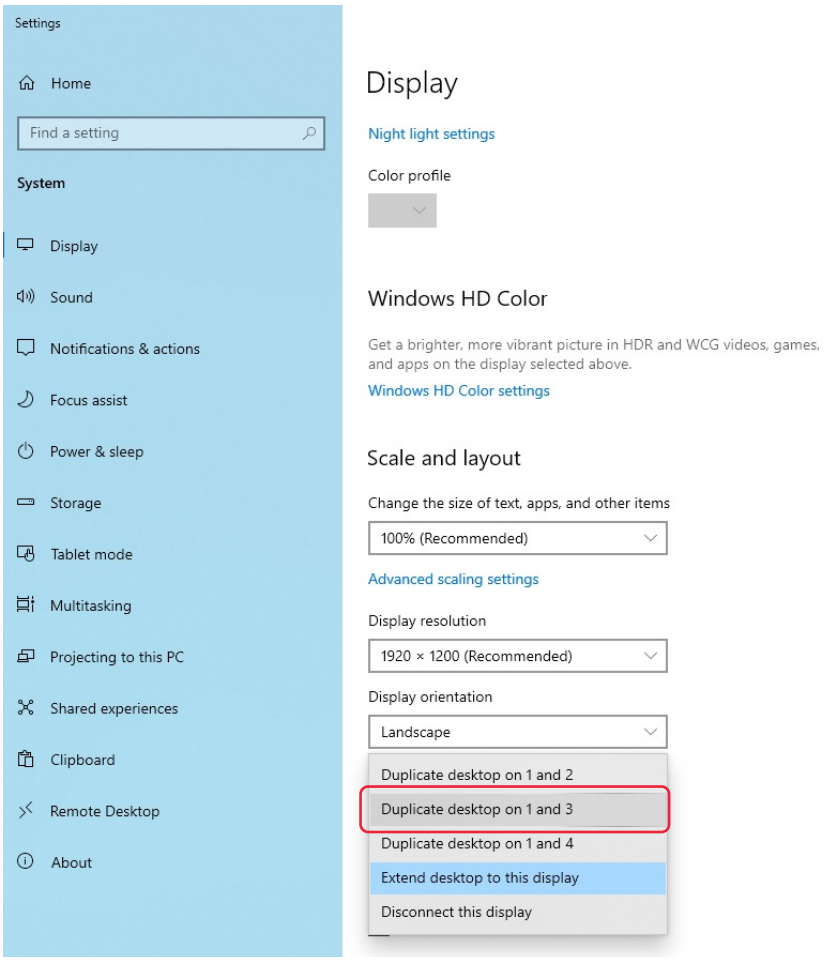

Figure 6: Display orientation.

Finally, choose to duplicate the two VSHD displays, which in this example will be *Duplicate desktop on 1 and 3*. Now the two displays will show as one single display, and the same image will be displayed to both eyes.

4.3 Setup 2S Dual: Stereoscopic setup with dual displays

This setup is suitable when you want to display stereoscopic/3D stimuli in a program that lets you choose which monitor corresponds to which eye, e.g., Unity. The setup in this case is quite simple. Hardware setup 2 is used, which is shown in Figure 4. Two HDMI cables from the computer connect to the video input on the control room interface. This way the displays in the VSHD Goggles will appear as two monitors. This is shown in Figure 5, where monitor 1 and 3 corresponds to the VSHD displays. The VSHD monitors can then be chosen directly as the displays in the program.

4.4 Setup 2S Combined: Stereoscopic setup with combined displays

This setup can be used when displaying stereoscopic/3D stimuli in programs which can only display the stimuli on one monitor ID, e.g., PsychoPy and Psychtoolbox. To display different images to each eye, the left eye image is shown on the left half of the screen and the right eye image is shown on the right half of the screen. For this to work with the VSHD Goggles, combined displays must be set up. With combined displays, the two VSHD monitors will be merged and appear as one monitor with double width.

Hardware setup 2 is used here. This is shown in Figure 4.

How the combined display is set up depends on your computer graphics processor brand. The following instructions show how it is done on a NVIDIA [2] and an Intel [3] graphics setup. For instructions on how to do it with AMD (Eyefinity) see their documentation [4].

With Nvidia, we need to enable Nvidia Surround. To do so, open *Nvidia Control Panel*. The control panel is shown in Figure 7.

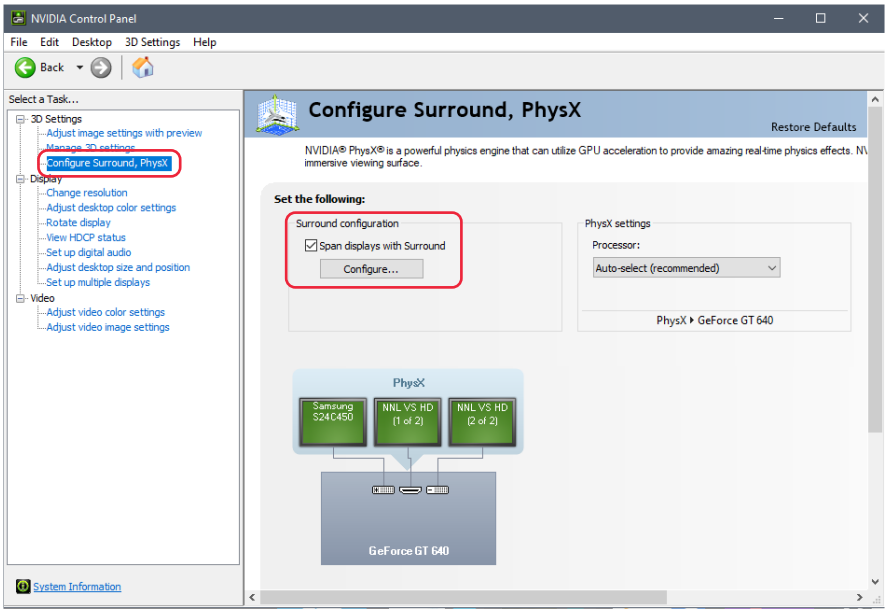

Figure 7: NVIDIA Control Panel.

Select *Configure Surround* under 3D Settings. Enable *Span displays* with *Surround* and click *Apply*, then quickly click *Configure*. This should avoid the unnecessary dialog about closing several applications before you can proceed. The window shown in Figure 8 will appear.

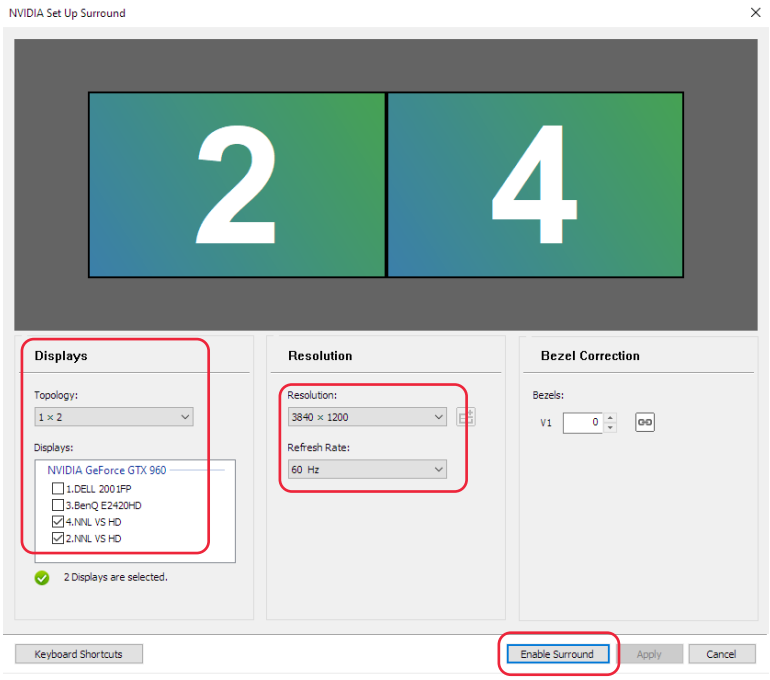

Figure 8: NVIDIA Set Up Surround window.

Choose *1x2* under Topology. Select the NNL VSHD displays and arrange them in the correct order (left to right) at the top. The combined resolution should be 3840x1200. Set the refresh rate to 60 Hz. There is no need to perform bezel correction for VSHD. Bezel correction is used to compensate for the monitor frame for adjacent monitors, which is not an issue for VSHD. Once all this is done, click *Enable Surround*.

Lastly, set up multiple displays again. Setting up the surround displays will unfortunately remove any multiple display setup that you had. This can be done in the Windows' settings as well as in the Nvidia control panel. The surround display you have just set up will show here as a single display. This is shown in Figure 9.

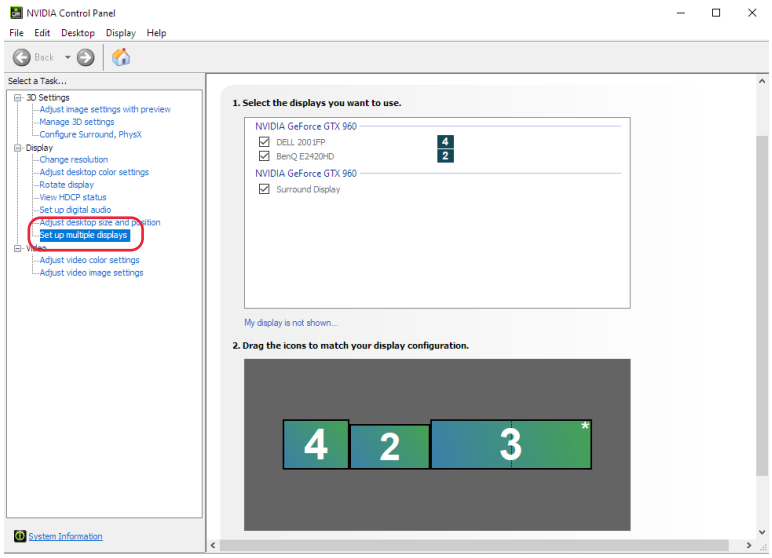

Figure 9: Multiple display setup.

With Intel, we need to enable Intel Combined Displays. Open the Intel Graphics Command Center and click *Connected Displays*. It is shown as a display icon in the left-hand side menu bar. An overview window of your connected displays will appear. Locate the NNL VSHD display IDs by clicking on the *Identify* button, and sort them in the correct order by dragging them around in the overview window as shown in Figure 10.

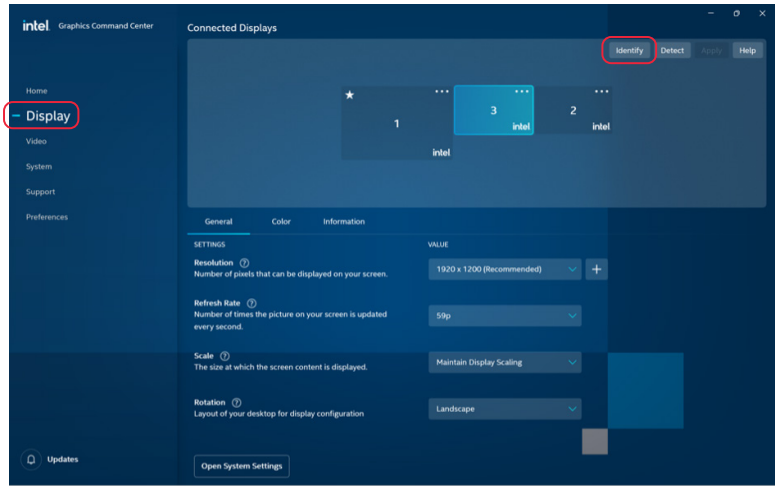

Figure 10: Sorting displays in Intel Graphics Command Center

Select one of the VSHD displays by clicking on the three dots in the top right corner. *Choose Combine Displays* and click on the monitor that is displayed and choose *Horizontal* as shown in Figure 11. Click *Apply* and then you will get a combined display where the left half of the screen is displayed to the left eye and the right half is displayed to the right eye on VSHD.

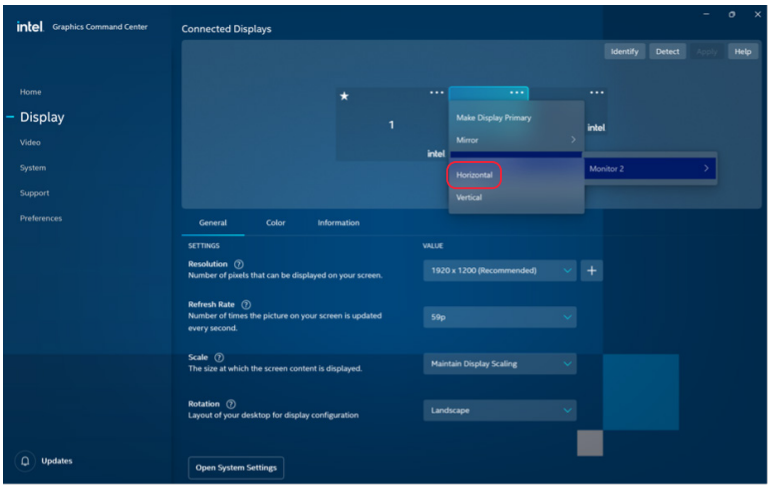

Figure 11: Intel Combined Displays setup

If a window later opens on the wrong display, select the window on the taskbar and use *Windows key + Shift key + Left arrow or Right arrow* key to move the selected window to the left or right display. Snap windows must be enabled for this to work. This setting can be found by clicking Start menu –> Settings –> System –> Multitasking. The multitasking setting is shown in Figure 12.

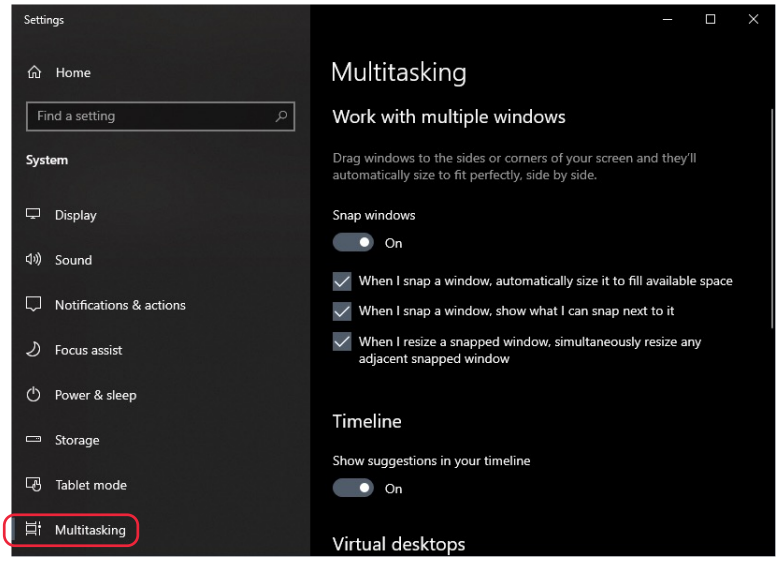

Figure 12: Multitasking settings.

5 References

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