DISABLING TEMPORAL DITHERING

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INTRODUCTION

Dithering is a technique to compensate for missing color values to increase the perceived amount of color and shading.
It allows for example to display a 10 bit per color picture on an 8 bit per color system.
Temporal dithering can lead to very high bandwidth usage and thus to limited performance.
When transmitting a dithered video via IHSE extenders the lower compression rate may cause frame drops or reduced video quality.

PURPOSE OF THIS DOCUMENT

This Technology Briefing gives a short introduction to dithering and explains how temporal dithering can be disabled to improve performance and prevent frame drops.

TEMPORAL DITHERING

Dithering is a technique to compensate for missing color values to increase the perceived amount of color and shading. Missing color values are represented by two adjacent color values arranged in a specific grid. This way, missing colors or softer color transitions can be visualized. In summary, dithering creates the illusion of greater color depth.

Figure 1: Color gradient with 300 colors (without dithering)
Source: https://de.wikipedia.org/w/index.php?curid=703068

Figure 2: Color gradient with 16 colors (with dithering)
Source: https://commons.wikimedia.org/w/index.php?curid=62424540

Figure 3: Color gradient with 4 colors (with dithering)
Source: https://de.wikipedia.org/w/index.php?curid=703071
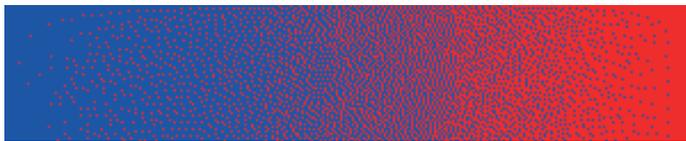
Figure 4: Color gradient with 2 colors (with dithering)
Source: https://de.wikipedia.org/w/index.php?curid=1396883
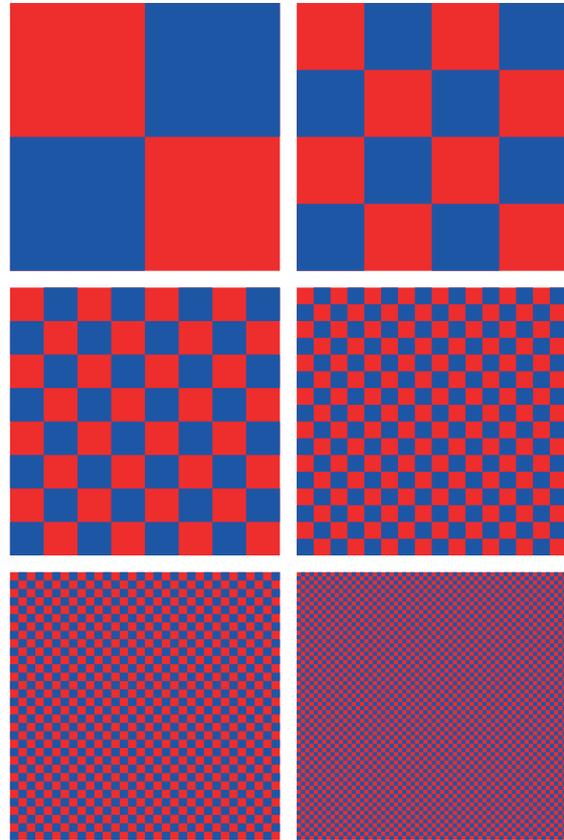
*Figure 5: An illustration of dithering. Red and blue are the only colors used but, as the red and blue squares are made smaller, the patch appears purple. Source: By Gutten på Hemsen - Own work, CC0, https://commons.wikimedia.org/w/index.php?curid=78730833*

When using temporal dithering a graphics card alternates a pixel between two adjacent color values to generate intermediate colors. Changing the color value of a pixel happens so fast that it is not perceptible to the human eye, but only the intermediate color. This technique allows a lower color depth but also entails a lower compression rate.
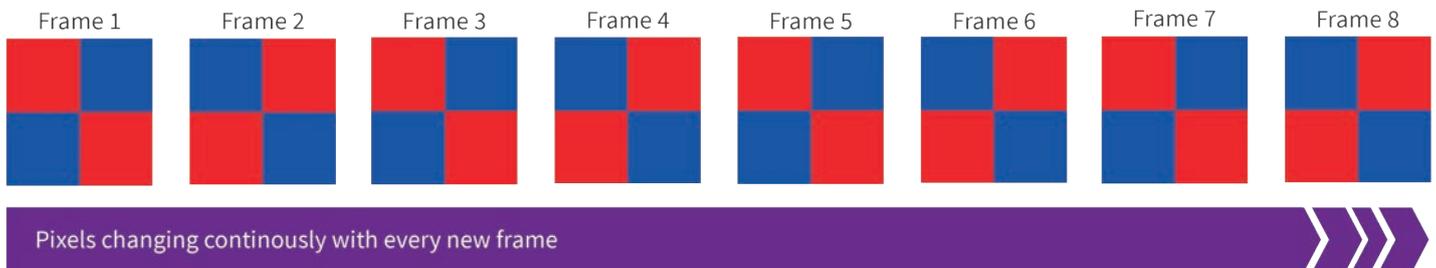

Figure 6: This example illustrates how temporal dithering allows the patch to be perceived as purple. For this purpose, pixels in blue and red are arranged in a specific pattern. With every new frame these pixels are continuously alternating between red and blue.
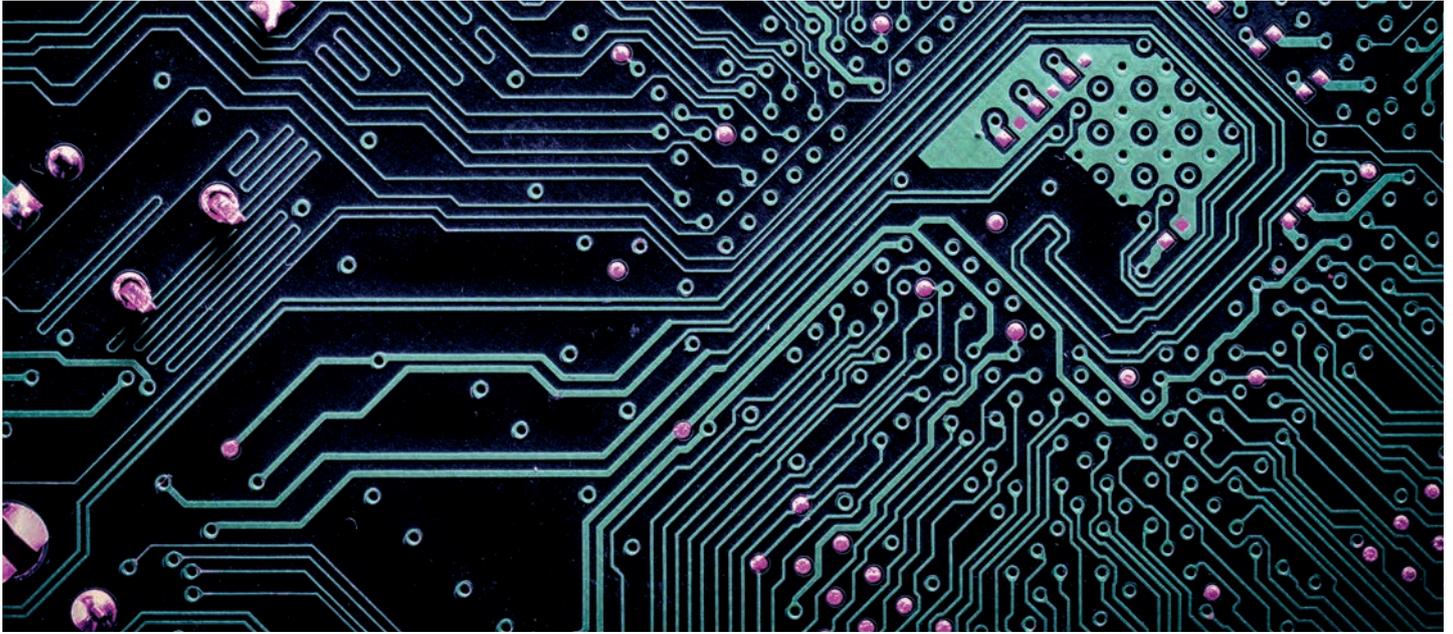
IMPACT OF TEMPORAL DITHERING ON VIDEO COMPRESSION OF KVM SYSTEMS

Most state-of-the-art KVM Systems use some kind of video encoding in order to control bandwidth usage during transmission. This allows to save cost for infrastructure and bandwidth.
 All algorithms for video encoding exploit regularities in the video data. Temporal dithering reduces regularities in the video data by continuously changing color values.

Thus temporal dithering can lead to very high bandwidth usage and thus to limited performance. This reduction in performance also occurs with static images as the temporal dithering causes pixels to change continuously.
When transmitting a dithered video via KVM extenders the lower compression rate may cause frame drops or reduced video quality. As a result, it may be necessary for operators of KVM systems to disable temporal dithering as it may be enabled by default, for example on Apple Macs.

HOW TO DISABLE TEMPORAL DITHERING ON WINDOWS PCS

AMD graphics cards:

1. Open the **AMD Catalyst Control Center.**

2. Enable **Advanced View**. This setting can be found in Preferences.

3. Open the menu item **Information** and select **Software**.

4. Note the 2D Driver File Path, which should look like this:
    /REGISTRY/MACHINE/SYSTEM/ControlSet001/Control/Class/ ****{YOUR GUID}/ 0000****

5. Open the **Windows Registry Editor** and navigate to the registry key location via 2D Driver File Path.
    MACHINE is equivalent to HKEY_LOCAL_MACHINE. Substitute the green text with the one found in step 4.

6. Create a new 32-bit DWORD registry value in the target registry depending on the type of port connection.
    Example for disabling dithering on a display port connection:
    Name: DP_DisableDither,
    Value: 0 (1= disabled, 0=enabled)

7. A restart of the PC is required.

NVIDIA graphics card:

In general temporal dithering is disabled by default on a Windows-based NVIDIA driver and cannot be disabled manually. It might be that temporal dithering is enabled if the color bit depth is set incorrectly. It is recommended to apply the following settings in the NVIDIA Control Panel:

- Desktop NVIDIA color depth to "Highest (32-bit)",
- Output color depth to "8 bpc" and
- Output dynamic range on "Full".
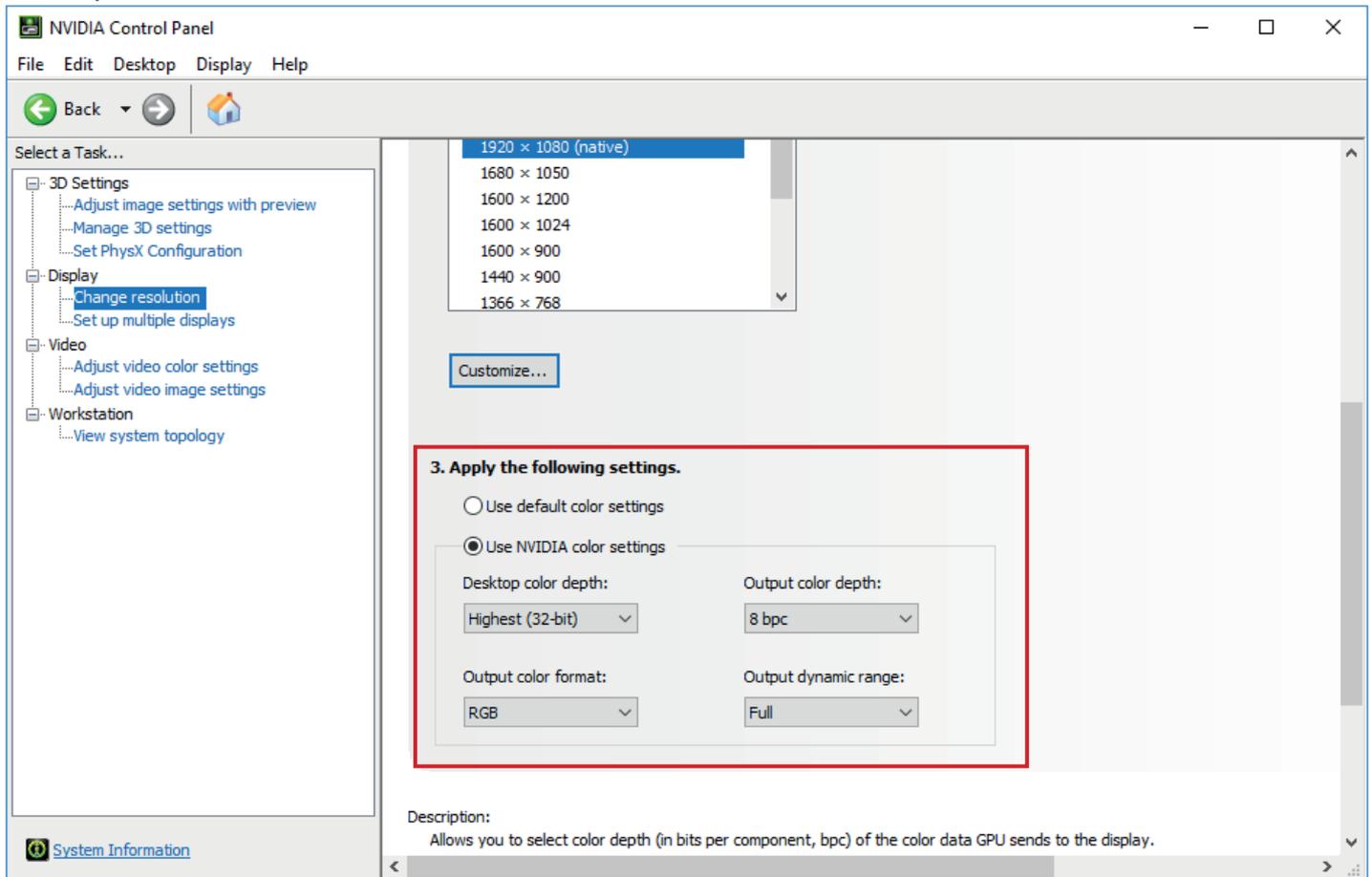
Figure 7: How do I turn off temporal dithering on a NVIDIA graphics card?
Source: Screenshot NVIDIA Control Panel Settings

HOW TO DISABLE TEMPORAL DITHERING ON APPLE MACS

The tool "SwitchResX Control" offers the possibility to change the color depth manually. A free trial version can be downloaded following the link below. Please set the color depth to "16.7 million colors" which is 24Bit.
SwitchResX - Download
https://www.madrau.com/srx_download/download.html

HOW TO DISABLE TEMPORAL DITHERING ON LINUX PCS

AMD graphics cards:

1. Switch to runlevel 3 (telinit 3)

2. Run the following as Root:
    `aticonfig --set-pcs-val=MCIL,DP_DisableDither,1`

    Note that if this command does not turn off dithering, it might be necessary to use this command instead:
    `aticonfig --set-pcs-val=TMDS_DisableDither,1`

3. Save the changes.

4. Switch back to runlevel 5 (`telinit 5`).

NVIDIA graphics card:

Dithering can be disabled in the "NVIDIA X Server Settings". This setting can be found by selecting the monitor in question and navigating to the "Controls" tab.
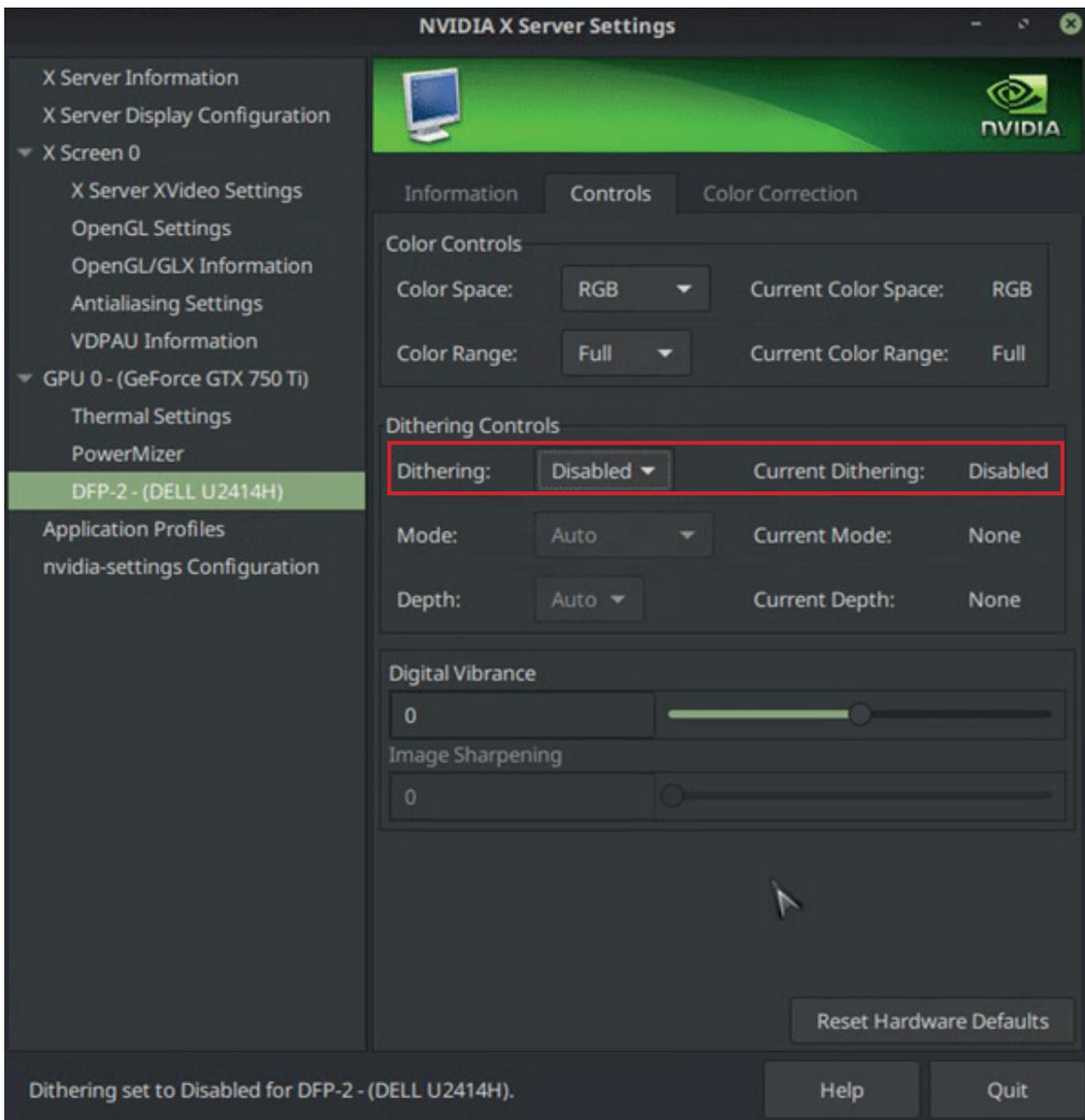

Figure 8: NVIDIA X Server Settings
Source: https://ledstrain.org/d/161-nvidia-dithering/

HOW HIGH-PERFORMANCE KEYBOARD VIDEO MOUSE
EXTENDER AND SWITCHING TECHNOLOGY ENABLES IMPROVED
PRODUCTION WORKFLOWS AND PRISTINE VIDEO DISPLAY
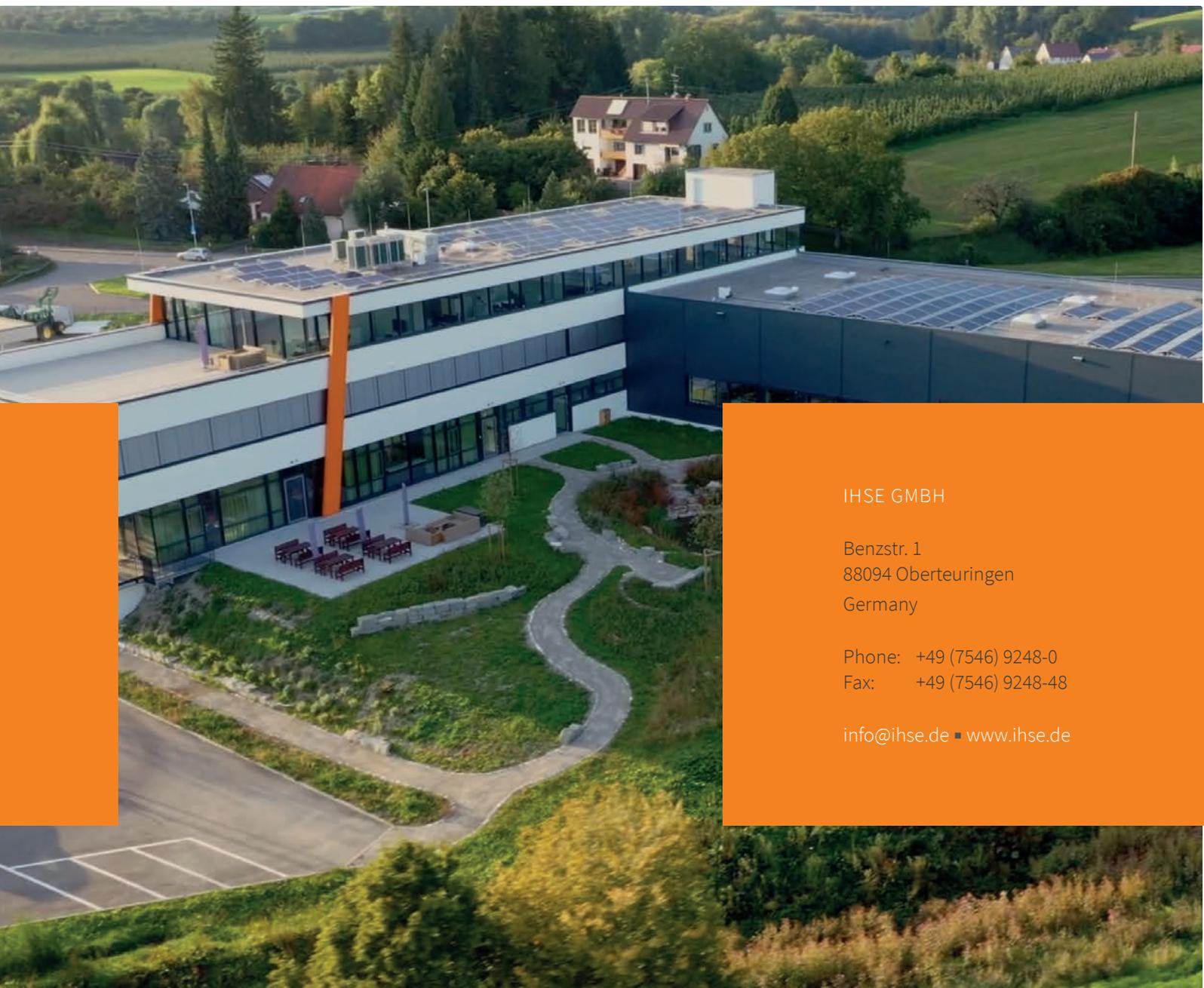
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