AMD

The Power of Video

Offload everything for better power

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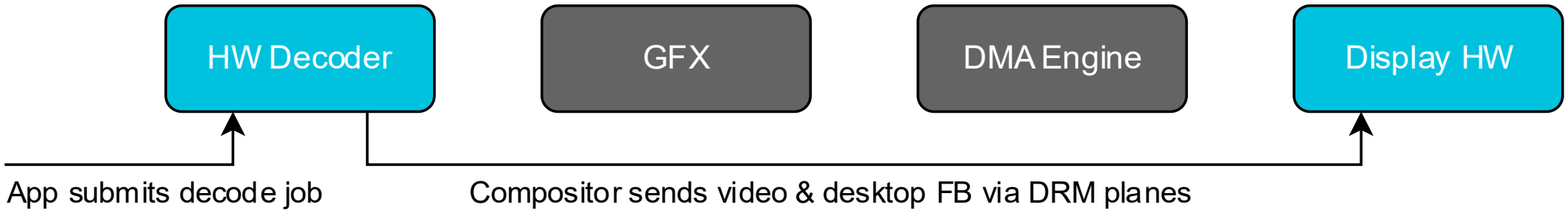
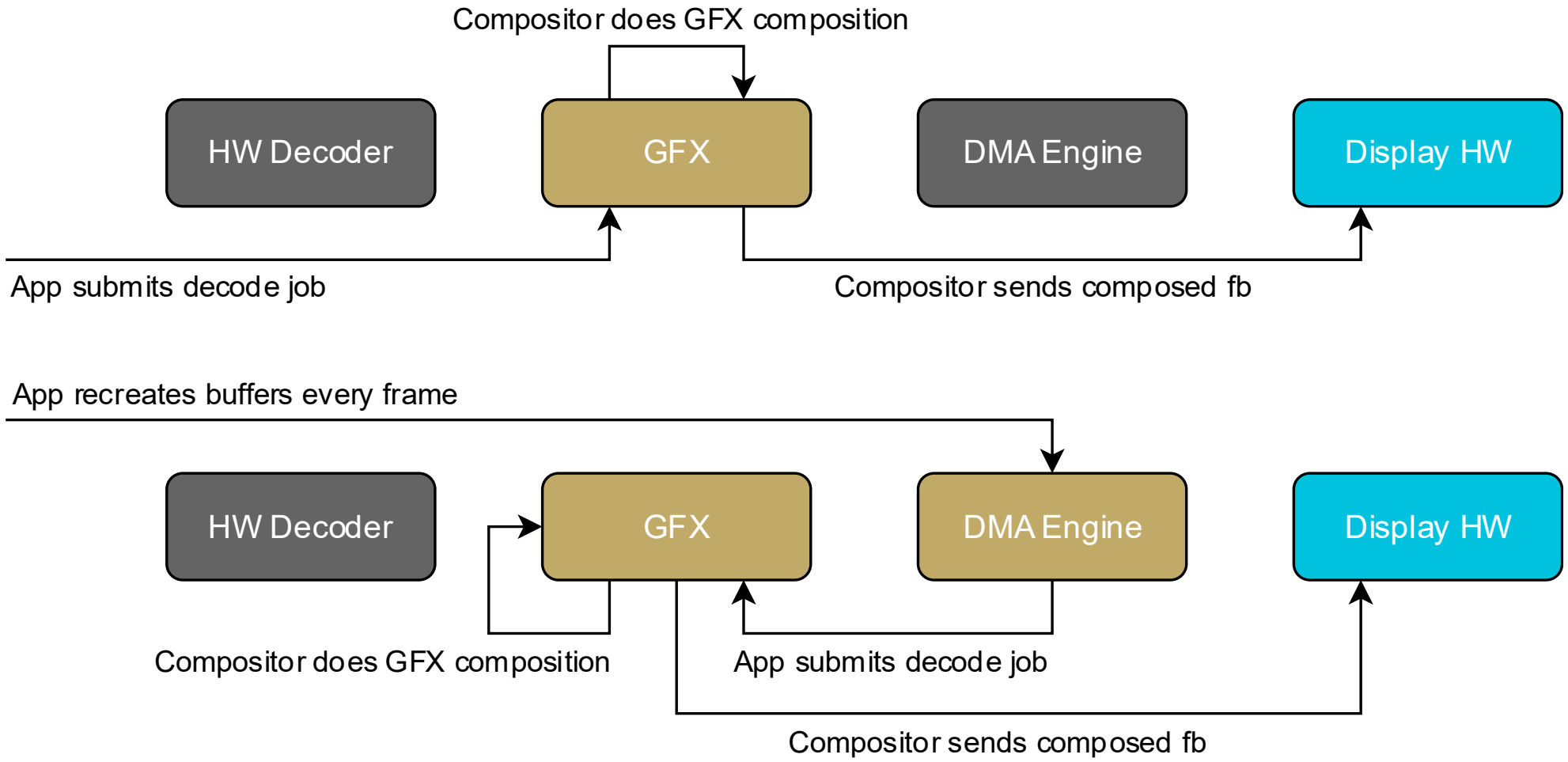
Agenda

1. How to save power?
2. 2025 state of affairs
3. Case Study: Firefox
4. Key takeaways
5. Q/A

How to Save Power – The Ideal



How to Save Power – The Frequent Reality



Compositors' State of Affairs (2024 Q4→2025 Q4)

		Kwin	Mutter	Weston
Offload Strategy	Overlay	● → ● MR	● → ● MR	● → ●
	Underlay	○ → ● MR	○ → ○	● → ● MR
	Fullscreen	● → ●	● → ●	● → ●
Offloaded Shader Op	Scale	● → ●	● → ●	● → ●
	CSC	● → ●	● → ●	● → ●
	Color Pipeline	● → ● MR	○ → ● MR	○ → ● MR

○ MR not created
● MR exists – work in progress
● Merged – experimental or requires config
● Merged – enabled by default

Apps' State of Affairs (2024 Q4→2025 Q4)

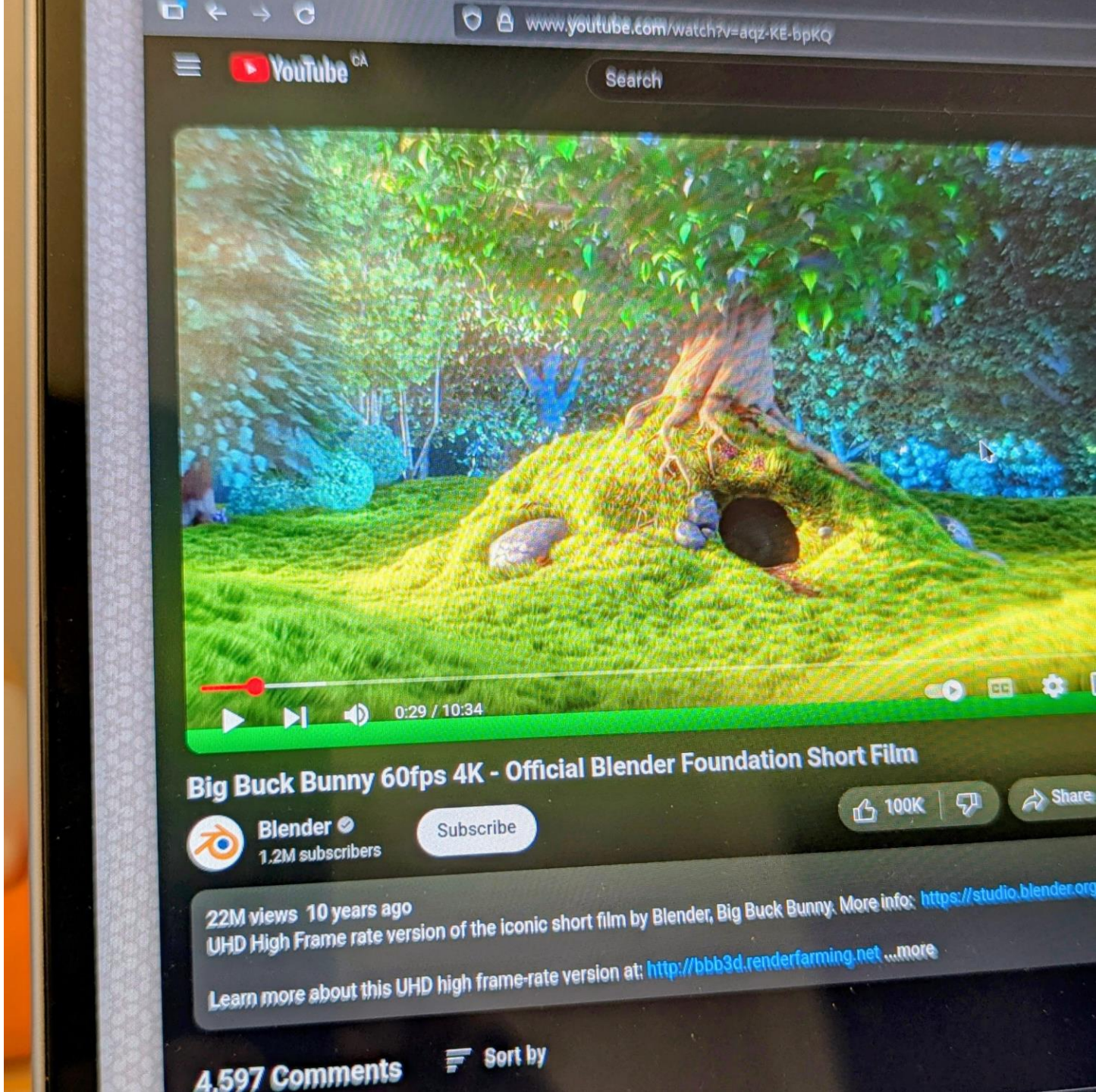
- Focusing on MPV, Firefox, and Chromium
- MPV HW Decode enabled on some distros by default via config file with *--hwdec=auto*
- Firefox HW Decode enabled by default on amdgpu as of v136 with mesa >= 24.2

	MPV	Firefox	Chromium
HW Decode	● → ●	● → ● Bugzilla	● → ● Chromium issues
Zero-Copy	● → ●	○ → ● Bugzilla	● → ● Chromium source
Color Management	● → ● PR1 PR2	○ → ● Bugzilla1 Bugzilla2	○ → ● Gerrit1 Gerrit2
Color Representation	● → ● PR	○ → ○ Bugzilla	○ → ○

○ MR not created
● MR exists – work in progress
● Merged – experimental or requires config
● Merged – enabled by default

Case Study: Firefox

Direct scanout of HW decoded buffer in Weston using the underlay strategy



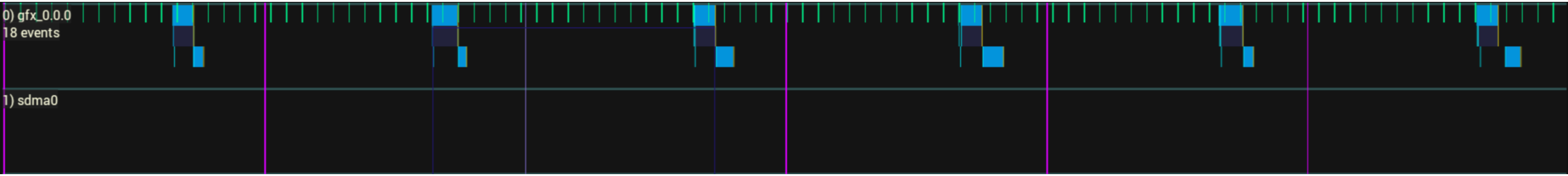
Measurement Methodology

- Framework 13 Laptop – AMD Ryzen AI 9 HX 370
- 2800x1920 120Hz panel
- EndeavourOS
- Firefox release channel
- YouTube, Big Buck Bunny, 1080p60 fullscreen
- Backlight 80%
- `powerprofilesctl set balanced`
- Battery measurement sampled over 10min
  - `cat /sys/class/power_supply/BAT1/uevent` every 1s
  - Calculate power: `watts = current_now * voltage_now`
- Trace-cmd command used for gpuvis plot:
  - ```
    trace-cmd record --file-version 6 \
    -e "amdgpu:amdgpu_cs_ioctl" \
    -e "amdgpu:amdgpu_sched_run_job" \
    -e "*fence:*fence_signaled" \
    -e "drm:drm_vblank_event"
    ```
    ```

The Beginning – v135

-0.0W (0%)

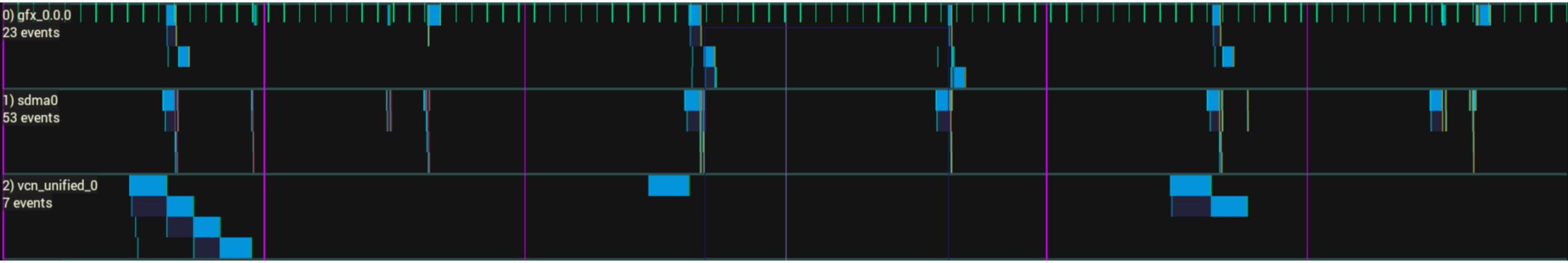
- AMDGPU VAAPI decode disabled by default
- GFX used for everything



HW Decode – v136

-0.7w (6%)

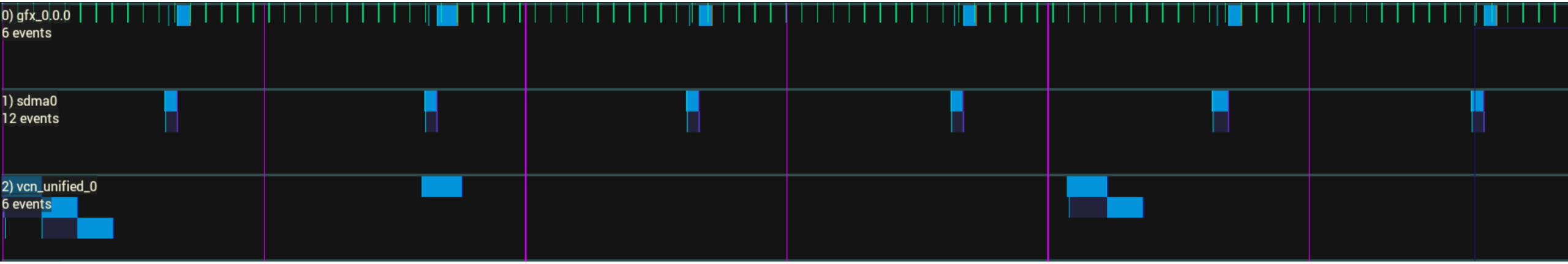
- AMDGPU VAAPI decode enabled by default
- GFX does scaling, CSC, blending
- SDMA active??
  - Lots of needless buffer create/destroys



GFX/SDMA Optimizations – v142

-1.0W (9%)

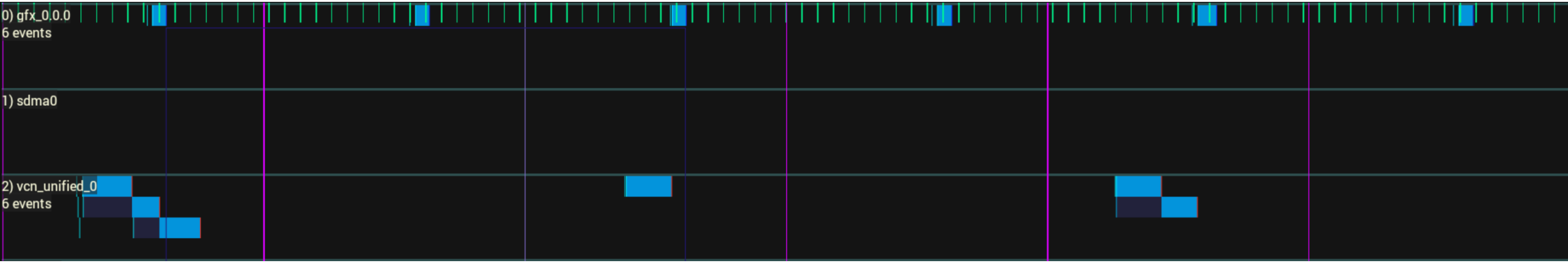
- Free ffmpeg surfaces are calculated incorrectly for CONFIG_VAAPI_1
- [HDR] Don't create EGLImage for external dmabuf surfaces
- [HDR] Recycle wl_buffers if possible for direct composition
- [HDR] Investigate extra GL operations while video direct rendering from external surfaces
- Possible redundant flush operation



Underlay Direct Scanout – v142

-1.5W (13%)

- Enable by setting *gfx.wayland.hdr=true* in Firefox's about:config page
- SDMA now quiet – no more needless buffer ops
- One more GFX event remaining – it shouldn't be necessary
  - [HDR] Possible unnecessary calling update_texture_cache()
- Visual glitches can occur, hence not enabled by default



Key Takeaways

- Linux desktop is becoming increasingly power-optimized
- Use fixed-function hardware where possible
  - BTW, any interest in a 2D composition engine? (VPE)
- Analyze ring traces for needless operations, especially on GFX and SDMA
- Slow and steady does *not* win the race – Prefer bursts with longer periods of idle

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Q&A

Aside – Overlay vs Underlay Composition