



AquaMark3™

Special Features

www.aquamark3.com

Dear Reader!

Creating a state of the art benchmark like the AquaMark3 means to take a deep look into today's most important system performance issues.

- What brings a system to its knees?
- How should the average user as well as the professional user get information both reliable and understandable to analyze and optimize computer systems?
- What exactly should be tested?

These were but some of the questions we faced when designing AquaMark3. Out came some design decisions which set AquaMark3 pretty much apart from other benchmark programs not as focussed on game benchmarking as AquaMark3.

This document will list the most important features of AquaMark3 you will most likely not find in other benchmark programs of today.

AquaMark3 FAAS™

DirectX9 handles full screen anti aliasing quite different than its predecessors. DX8 only had one setting variable: the number of times anti-aliasing was performed. DX9 adds an additional "Quality Level" to each of the former settings. Though current drivers usually only support one quality level this might change in the near future. In addition, DX9 introduced a new mode called "Non-maskable", bringing down all available modes with all available quality settings to one slider. The full FSAA support of AquaMark3 is referred as **AquaMark3 FAAS™**.

Special Tests

As geometry loses importance when it comes to performance problems new heads of the graphical Hydra are raising: heavy use of pixel shaders of all kind leave the blame of a slow system to the pixel rendering process. So it seems to become necessary to take a much closer look to the pixelshader pipeline than in former times and benchmarks.

Why Special Tests?

Before we designed the tests, we had to survey the formerly, the current and the future use of pixelshaders. We found out some very interesting facts.

- It's **NOT** the number of implemented pixelshaders which is determining the workload, **but** the number of pixel finally **RENDERED** in the output. If you have 100 pixelshaders written in 2.0 which are responsible for only 10% of the rendered output, the amount of shaders has no information. This obvious fact has often been unnoticed.
- Due to this fact it is necessary to detect the number of pixel which finally come through the pipeline and contribute to the framebuffer result. This is difficult, because in nowadays pixel pipelines many pixels are rejected at different stages of the pipeline by z/α -tests. We invented a new testing method which exactly counts the number of pixel contributing to the framebuffer. The special thing about this is, that it does **NOT** change any setting of the pixel pipeline, so that the counting pass delivers **EXACTLY** the same number than the original rendering passes.
- It's **NOT** usually necessary or recommended to implement the pixelshader in the highest shading version available. There are many uses for pixelshaders in the lower versions. For instance the rendering of alpha-blended particles does not necessitate pixelshader2.0 - it is much more purposeful to implement it through a classical texturestage. For this reason, we implemented a test which counts the pixel rendered through a specific pixelshader version. All game engines available today support DX7 and DX8. There are only a few effects implemented manually in the higher version. For that reason this pixelshader test is very important to get a representative overview about the shader versions used in AquaMark3.

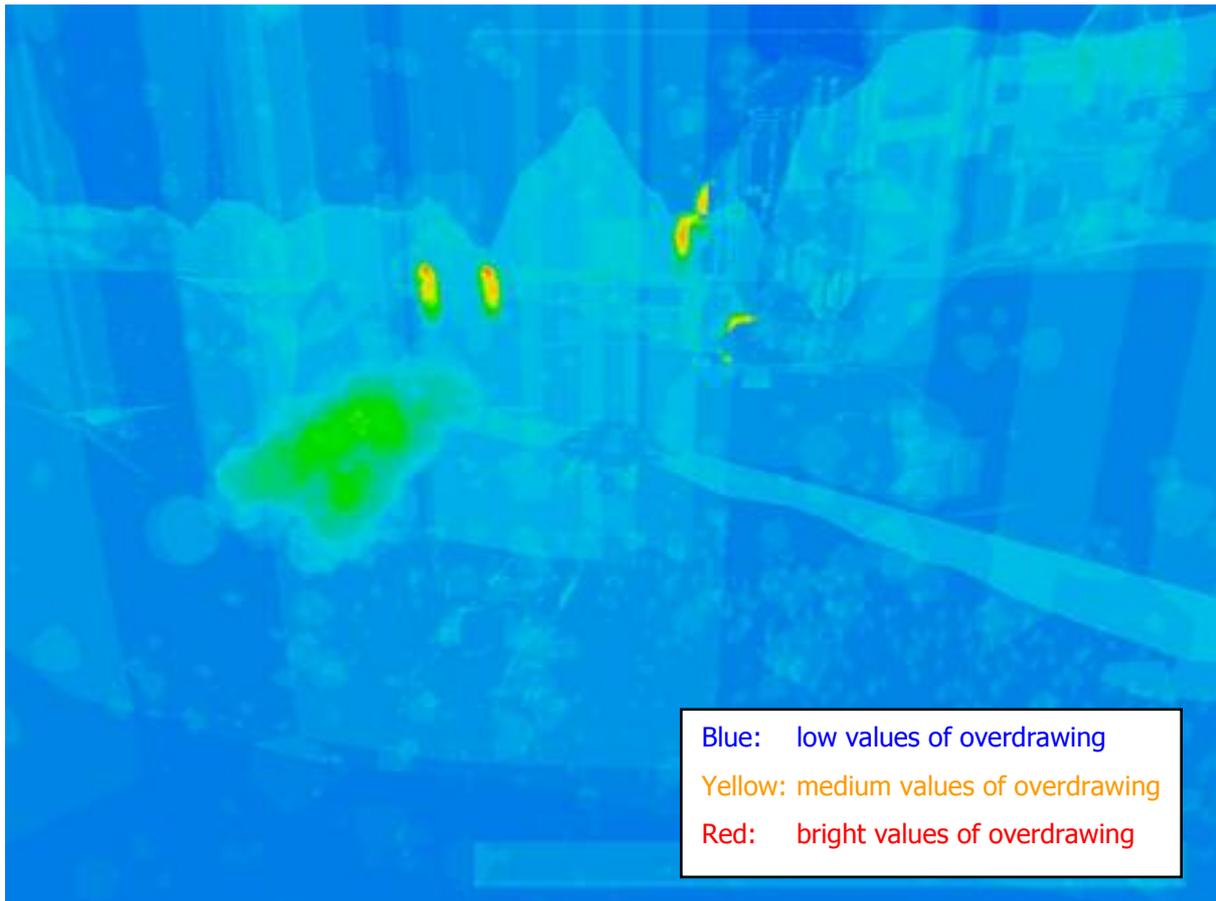
With this in mind we created *three tests formerly not introduced to benchmark programs*:

- Overdraw Visualisation Technique (**AquaMark3 OVIST™**)
- Shader Visualisation Technique (**AquaMark3 SVIST™**)
- Pixel Performance Measurement (**AquaMark3 PIXPM™**)

These tests use a different kind of drawing thus creating abnormal looking screen results. But nevertheless they are very informative. The test detects how often a pixel is drawn during the render process. Each time it is drawn the brightness value of the pixel will be increased by 1. At the beginning a pixel is rendered black. The more often it is drawn the brighter it will be displayed.

AquaMark3 OVIST™ (Overdraw Visualisation Technique)

The overdraw visualization fills the frame buffer with a brightness value according to the numbers of times of writing procedures per pixel. It is important to notice that this procedure uses exactly the same shaders as used for the standard test with an additional post pixel colorization. Subsequent to this shading process the pseudocolor for the respective pixels is calculated and rendered. The overdraw visualisation creates results like this one:



Overdraw Visualisation Screenshot

AquaMark3 SVIST™ (Shader Visualisation Technique)

The shader visualization test fills the frame buffer with a color and a brightness value according to the numbers of times and the kind of pixel shader used per pixel. As in the overdraw test the respective pixels will be rendered in pseudocolors afterwards. In the final picture, the color of a pixel indicates the shader responsible for the pixel's creation, while its brightness indicates the number of overdraws for each pixel. The Pixel Shader Visualization Test creates results like this one:



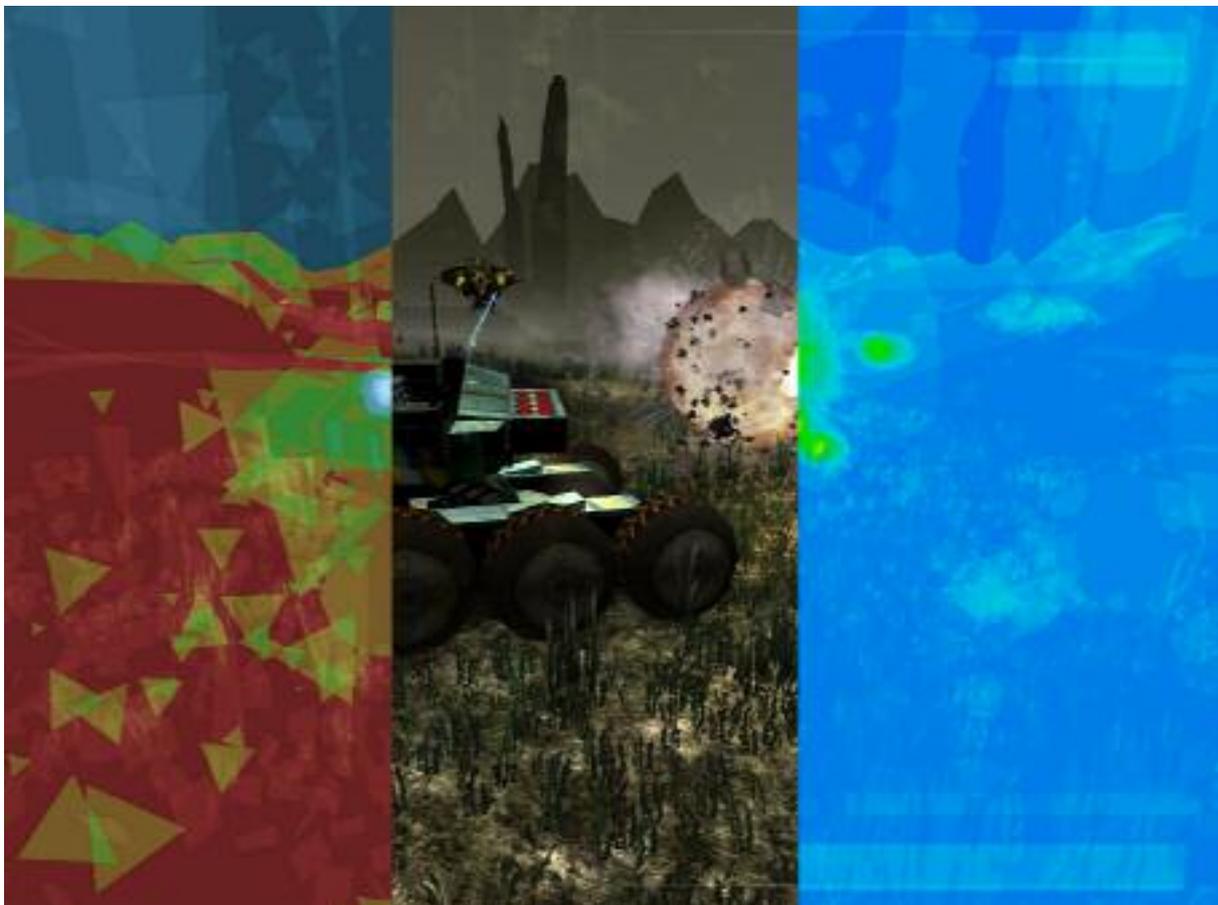
Pixel Shader Visualization Screenshot

AquaMark3 PIXPM™ (Pixel Performance Measurement)

This test consists out of two individual runs.

- The first run creates the overdraw of each frame. Each frame will be measured and a sum will be created of how many overall pixels have been drawn in this frame.
- The second run is a normal benchmark run and the results of the first run will be taken to calculate the drawn pixel per second.

The result is the average number of drawn pixel per second. It's kind of a "real life fillrate test", with the difference that this fillrate test contains complex pixel shaders as well as different texture and blending modes.



Same Frame, three different tests

AquaMark3 TRISCORE™

The score system of AquaMark3 consists out of three different values (**AquaMark3 TRISCORE™**) which are derived from the most important measurement in game-based benchmarks like AquaMark, which is the average number of frames per second (AvgFPS). This is simply calculated by dividing the total number of frames in the benchmark by the time the benchmark needed to complete.

But in AquaMark3 two other AvgFPS values can be found in the output files: The AvgFPS CPU and the AvgFPS GFX. These are based on single frame measurements. Each frame takes a certain amount of time to complete. One part of each frame calculation is spent on simulating the game physics and artificial intelligence on the CPU. The other part is spent on rendering the graphics on screen. Both parts of each frame are measured independently, and based on these values the two theoretical AvgFPS values are computed, as if only that part of the frame would have been processed. Note that the absolute value of these two measurements is of theoretical nature, but considering these values in relation to values on other test system allows a performance judgment of the two mainly stressed components.

The AvgFPS CPU is fairly precise indication of the performance of the CPU in combination with the motherboard and system memory. However the AvgFPS GFX does not solely judge the performance of the graphic card, as it also depends on the CPU and system memory, since graphic card drivers and the operating system contribute to the measurement. Graphic card drivers, though running on the CPU, are seen as part of the creation of graphical content and don't contribute to the CPU score.

Where the AvgFPS result should serve as an indicator for buying completely new systems the results of AvgFPS CPU and AvgFPS GFX should serve as an indicator, whether CPU and GPU fit together well in a system. Or if one is the weak link in the system's chain of hardware units and should be exchanged.

AquaMark3 AUTT™ (Automated Test Technique)

AquaMark3 will be capable to run automated test series (AquaMark3 AUTT™) including the automatically change of all parameters over all possible settings. This approach is referred as **AquaMark3 AUTT™**, the AquaMark3 Automated Test Technique. This technique adds up to more than 3000 tests if you want (which probably would last a couple of days to execute). So of course these test series can be defined in terms of included parameters and possible settings to give you exact the data you need. This will be done for a number of reasons, such are

Comfort

Don't restart your benchmark with the new settings manually each time you changed something. Define which settings you want to have tested once and get started.

Comparability

Well, it's hard to compare results, if a couple of settings are different on other computers all the time. Don't bother trying to find the correct settings. Just give an automated series enough time and it's easy to compare to all settings used by others.

Overall analysis

Which are the features that cost framerate? And at which setting does it start to drop significantly? That's easy to diagnose now. One automated test run is enough to get all the data you need.

Disclosure of weak spots

Which of course means it's easy to detect the weak spots of your system. Is it FSAA? Or direct lighting? The massive usage of particles?

Simplifying of result check in our Online Result Browser

Compare the results of your automated test runs online in our Online Result Browser called **ARC**, which is the *AquaMark3 Result Comparator*. How this is going to work will be disclosed in a short time with the next release of the AquaMark3 Info packs.