

# PROTECTION PROVIDED BY ERROR CORRECTING CODE MEMORY

ECC Explained.



## Detecting Faults

The main memory systems of modern processors use Dynamic Random Access Memory (DRAM) technology. DRAM is vulnerable to faults that may lead to a bit stored in memory being flipped spuriously (e.g., a '1' turns into a '0' or vice-versa). A memory Error Correcting Code (ECC) is a mathematical function that allows faults to be detected and potentially corrected before any data stored in memory is consumed by the processor.

## Fault Causes

DRAM is composed of memory cells that store information and logic circuitry required to preserve the data and provide access to them from the processor. Both the memory cells and the peripheral circuitry can be vulnerable to a variety of faults, from transient faults from terrestrial sub-atomic particles that are ever-present in earth's atmosphere, to permanent faults that occur as a result of usage and time in the field. DRAM technology scaling increases the likelihood of these faults. AMD's 2015 field studies have shown that DRAM was vulnerable to both faults that impact a single bit and those that impact multiple bits<sup>1</sup>.

## Professional Graphics Cards

ECC memory is best known for its use in servers and workstations, where system reliability is critical, and data is considered 'high value'. However, it is also used in high-performance professional graphics cards (GPUs), especially AMD Radeon™ PRO GPUs that have a compute function - for example, to solve complex engineering simulation or raytracing rendering calculations.

## ECC Offers Protection

Workstations and professional GPUs are used to run critical applications in many sectors including architecture, engineering, construction, manufacturing, medical, finance and media and entertainment. Software includes CAD, simulation, visualization, point cloud processing, medical imaging, visual effects, and post-production.

When data corruption occurs and is not remediated, it can not only lead to errors in calculations but can also cause software to crash. Enabling ECC in memory can offer protection against the effects of faults in DRAM.

## Professional Software Effects

Spurious bit flips in memory can impact your workstation in several ways. Applications might crash, files might become corrupted, and it can also cause operating systems to suffer from critical errors. The consequences can be huge. If an error occurs part way through a lengthy calculation, such as those used in engineering simulation or point cloud processing, hours or even days of work can be lost. ECC memory can offer protection by detecting and trying to correct faults when data is accessed in memory so that the software does not consume erroneous data. In many ways, ECC memory adds a layer of security for your workstation.



**Professional Graphics for Exceptional Performance with Reliability, Stability and Software Certifications at its Core.**

## GPU Memory

The hardware ECC implemented in the Radeon PRO W6800 graphics for GDDR6 DRAM is designed to correct single-bit faults in a DRAM chip and provide robust detection of multi-bit faults. Any ECC algorithm requires additional bits, known as “check bits”, to store the result of the mathematical function implemented by the ECC. The combination of the ECC algorithm, the data bits being scrutinized by the ECC, and the check bits facilitate detecting and correcting certain errors in memory. The Radeon PRO W6800 ECC algorithm reserves a portion of the capacity on each DRAM chip to store the check bits used by the ECC algorithm to provide the data capability feature when it is enabled.



## The Latest AMD GPU Supporting ECC



### RADEON PRO W6800 GRAPHICS

#### THE GPU TO CRUSH COMPUTE INTENSIVE PROJECTS

Gigantic 32 GB of GDDR6 Memory.  
Error Correction Code Support.  
Six Display Outputs. 8K, HDR Support.  
Remote Environment Ready.

[amd.com/RadeonPROW6800](https://amd.com/RadeonPROW6800)

Learn more about VR capabilities of Radeon PRO Graphics at [amd.com/PRO-VR](https://amd.com/PRO-VR)

## Don't Overpay For Exceptional Performance

When considering a compute heavy GPU with ECC support, you should first look at your workloads. Investing in the right GPU for your workload allows you to reinvest that saving into more RAM, a NVMe™ drive, a better CPU or an additional monitor. A well composed system gives a great balance of performance with ECC capability. With the AMD Radeon PRO W6800 graphics card, up to six ultra high definition (UHD) resolution displays are supported along with many popular software certifications as standard, giving you further peace of mind.

## Boost Performance Further

GPU's that support ECC, like the Radeon PRO W6800, are typically paired with high performing processors, with many CPU cores. AMD Ryzen™ Threadripper™ PRO Processors deliver up to 64 cores for multithreaded simulation and rendering along with high frequency cores for lightly threaded workloads. AMD Threadripper PRO Processors can help you rip through the most demanding of projects.

[amd.com/Workstation](https://amd.com/Workstation)



To learn more about AMD professional graphics with ECC support visit: [amd.com/RadeonPROW6800](https://amd.com/RadeonPROW6800)

<sup>1</sup>Source: V. Sridharan, N. DeBardeleben, S. Blanchard, K. Ferreira, J. Stearley, J. Shalf, S. Gurumurthi, Memory Errors in Modern Systems: The Good, The Bad, and the Ugly, Proceedings of International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLoS), March 2015.

<sup>2</sup>Learn more at [www.amd.com/en/technologies/remote-workstation](https://www.amd.com/en/technologies/remote-workstation)