Guide for CTR RC3

(Bios guide now included!)

🔥 CTR Guide - What's new? (a lot!)

- **BIOS guide is now included in CTR guide.**
- **BIOS guide updated (new section about "Finding the right LLC")**
- **Reworked completely the "RAM stability test" section. It will now use LinX and TM5 instead of memtest**
- **Reworked section "Diagnostic" - added infos about the new PX + P1 + P2 calculation**
- **Modified section "Fighting the droop" (adapted to the new RC3, added a info about Vdroop deviations)**
- **Removed section "PX troubleshooting" - not needed anymore**
- **Removed the OCCT section for stability testing PX profile (OCCT's is unrealistically demanding!)**
- **Added new section "Stability testing the PX profile" (new version, using IBT)**
- **Added new section "Tweaking P1 + P2 profile" which includes a voltage comparison for each CPU**
- **Added new section "Finetuning PX + P2"**
- **Added new section "Stress test the profiles for heavier tasks"**
- **Added new section "Thermal impact of SoC voltage"**
- **Added a hint about the "WHEA counter"**
- **Added a slide called "Another word about CPPC"**
- **Clicking the CTR logo 🔥 will bring you back to the index page**

🔥 CTR Guide - Content

🔥 Basic Bios Guide for CTR - Finding the right LLC

- **Before we can start to configure the recommended BIOS settings for CTR we have to find the right LLC setting.**

- **Unfortunately the optimal setting is different for every motherboard / cpu combination so I am not able to tell you "5800X on ASUS? Take LLC4!"**

- **So we have to do a measurement and a calculation. I will guide you through this!**

    I want my BIOS being set up, not a math lesson...

- **Trust me, it won't hurt!**

- **At first the measurement to find out if your current setting (in most cases Auto) is sufficient**

- **Open CTR and make sure ALL profiles are deactivated**

- **Go into your CTR folder. Go into "CB20" folder and open Cinebench R20**

    cb_ranking
    corelibs
    resource
    Cinebench
    libmmd.dll
    msvcp140.dll
    vcruntime140.dll

- **Accept the license agreement**

- **Start a benchmark by clicking "Run"**

CINEBENCH
Release 20

CPU   --- Run

🔥 Basic Bios Guide for CTR - Finding the right LLC

- Now go back to CTR and observe the two values "CPU TEL (V)" and "CPU VID (V)"

| CPU TEL (V) | 1.125 | CPU VID (V) | 1.175 |

- You can stop / close Cinebench or let it run to the end - it's up to you.

- Now we have to calculate the Vdroop.

- The formula is
  (VID/TEL-1)*100=Vdroop%

  … ??? ....

- OK, step by step

- In this example we have a VID of 1175mV and a TEL of 1125mV.

- Divide VID by TEL
  1175 / 1125 = 1,044

- Now subtract 1
  1,044 - 1 = 0,044

- Multiply by 100
  0,044 * 100 = 4,4 %

- So we have a Vdroop of 4,4 %

- Recommended is a value of 1,5 - 3,5 %

- So our Vdroop is a little bit on the high side. We want to lower it.

- Now how do we get this translated into a proper BIOS setting?
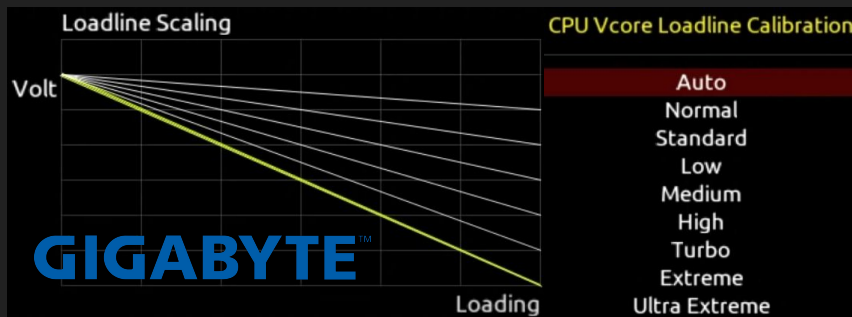
🔥 Basic Bios Guide for CTR - Finding the right LLC

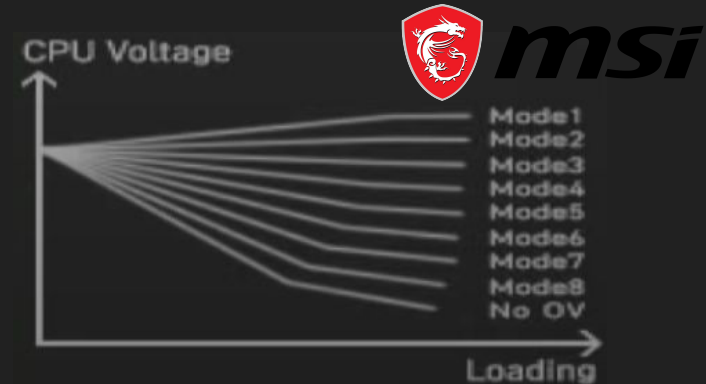- Unfortunately (again) there are different terms of LLC.

- We have...

- ...and…

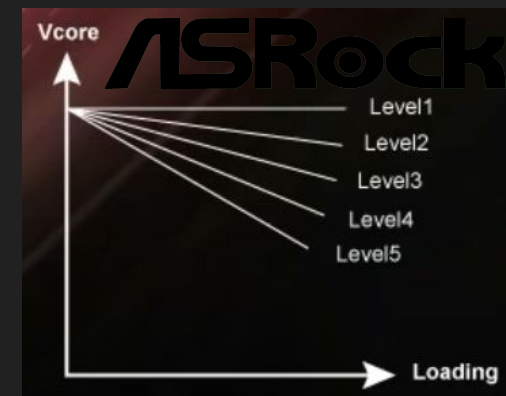- ...who are counting downwards, which means: The higher the level the lower the Vdroop.

- And we have…

- ...and…

- who are counting in the opposite direction, which means the higher the level the higher the Vdroop

- Makes sense… *facepalm*

🔥 Basic Bios Guide for CTR - Finding the right LLC

- A good starting point for every motherboard is the middle setting.
  - ASUS   -> Level 4
  - ASRock   -> Level 3
  - Gigabyte -> Medium
  - MSI   -> Level 4

- Set this corresponding to your motherboard and return to windows.

- Do the same test from the beginning of this section again. (CB20 / observe TEL + VID / calculate the new Vdroop)

- Now we got this:

CPU TEL (V)	1.156	CPU VID (V)	1.175

- This means a Vdroop of 1,6 %

- It is in the tolerance but really near to the min value of 1,5 %. You can leave it how it is now. If you want to bring it in the middle of the tolerance we need a bit more droop.

- This means for our board, we have to change...
  - ASUS: from Level 4 to Level 3
  - ASRock: from Level 3 to Level 4
  - Gigabyte: from Medium to Low
  - MSI: from Level 4 to Level 5

- Just in case we need less Vdroop, we have to change…
  - ASUS: from Level 4 to Level 5
  - ASRock: from Level 3 to Level 2
  - Gigabyte: from Medium to High
  - MSI: from Level 4 to Level 3

- Repeat these steps until you are within the tolerance of 1,5-3,5 %

# 🔥 Basic Bios Guide for CTR - Finding the right LLC

> When I set 1175 mV, I want my CPU to get 1175 mV!!!

- **This would make things easier. Easier for you, because you wouldn't have to calculate and test. And easier for AMD to reach their profit expectations, because you will buy a new CPU much sooner!**

- **What I want to say is, the following settings could be dangerous (!) for your CPU:**
  - **ASUS: Level 7 + Level 8**
  - **ASRock: Level 1**
  - **Gigabyte: Extreme + Ultra Extreme**
  - **MSI: Level 2 + Level 1**

Avoid these settings at all costs, unless you know what you are doing!

- **A quick example, why the right amount of Vdroop is your friend, because it's protecting your CPU from dangerous voltage overshoots.**
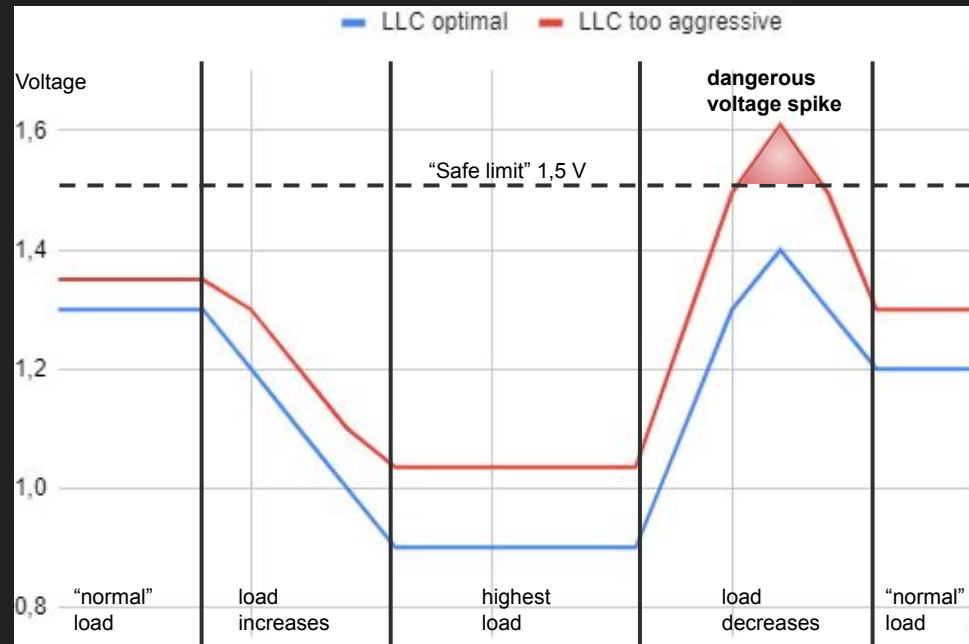
- **too aggressive LLC = overall higher voltages, lower voltage drop but higher voltage spikes during load transition.**

For the experts who are reading this:
I know the graph is not physically correct! I just wanted to simplify this topic as most as possible!

🔥 Basic Bios Guide for CTR - Finding the right LLC

- Another thing I encountered while helping one of you, was the difference of the LLC behavior with the same motherboard manufacturer.

- His setup:
  5900X on a MSI X570 Ace
  My setup:
  5900X on a MSI X570 Tomahawk
  So I recommended him straightforward tu use my LLC setting (Level 4) which I know works good (~2 % Vdroop).

- It turns out that he got around 5 % Vdroop during the Cinebench test… WTF?

- So he changed it to Level 3, which would give me a droop of only 0,5 %.

- With Level 3 he is getting 2,8 %

- That's why it is not possible to give a recommendation like "this LLC works for me, you are on MSI too, set this...!"

- What is absolutely fine for his configuration (2,8 %) turns out to be on a dangerously region for my configuration (0,5%).

Always calibrate the LLC on your own!

🔥 Basic BIOS Guide for CTR

- **Step by step guide (for the absolute beginner)**

ASUS	page 3-11
ASRock	page 12-20
GIGABYTE	page 21-28
msi	page 29-36

- **Summary of BIOS settings (more experienced user)**

ASUS	page 11
ASRock	page 20
GIGABYTE	page 28
msi	page 36

🔥 Basic Bios Guide for CTR

ASUS

UEFI BIOS Utility – Advanced Mode (19:40)

My Favorites | Main | Extreme Tweaker | Advanced | Monitor | Boot | Tool | Exit

Target FCLK Frequency : 1866MHz

Setting	Value
Ai Overclock Tuner	Auto
Memory Frequency	DDR4-3733MHz
FCLK Frequency	1866MHz
Core Performance Boost	Auto
CPU Core Ratio	Auto
CPU Core Ratio (Per CCX)	
TPU	Keep Current Settings
Performance Bias	Auto
Precision Boost Overdrive	
DRAM Timing Control	
External Digi+ Power Control	

Automatically overclock the CPU and DRAM to enhance system performance.

Hardware Monitor

CPU — Frequency 3700 MHz — Temperature 48°C — BCLK 100.00 MHz — Core Voltage 1.473 V — Ratio 37x

Memory — Frequency 3733 MHz — Voltage 1.360 V — Capacity 32768 MB

Voltage — +12V 12.208 V — +5V 5.000 V — +3.3V 3.328 V

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Go into "Extreme Tweaker" slide

On some Asus boards it is called "AI Tweaker"!

Set following settings to…

- **Core Performance Boost** -> Auto
- **CPU Core Ratio** -> Auto
- **Performance Bias** -> Auto

Scroll down

UEFI BIOS Utility – Advanced Mode (19:41)

My Favorites | Main | Extreme Tweaker | Advanced | Monitor | Boot | Tool | Exit

Setting		Value
DRAM Timing Control		
External Digi+ Power Control		
Tweaker's Paradise		
CPU Core Voltage	1.481V	Auto
CPU SOC Voltage	1.176V	Manual
- VDDSOC Voltage Override		1.20000
DRAM Voltage	1.360V	1.36000
VDDG CCD Voltage Control		0.975
VDDG IOD Voltage Control		1.050
CLDO VDDP voltage		0.900
1.00V SB Voltage	1.000V	1.00000
1.8V PLL Voltage	1.793V	1.80000

Increase to help CPU Core Frequency overclock.

Hardware Monitor

CPU — Frequency 3700 MHz — Temperature 50°C — BCLK 100.00 MHz — Core Voltage 1.473 V — Ratio 37x

Memory — Frequency 3733 MHz — Voltage 1.360 V — Capacity 32768 MB

Voltage — +12V 12.208 V — +5V 5.000 V — +3.3V 3.328 V

Version 2.20.1271. Copyright (C) 2021 American Megatrends, Inc.

Set following settings to…

- **CPU Core Voltage -> Auto**
- **CPU SOC Voltage -> Manual**
  - Set VDDSOC Voltage Override to 1.15 - 1.20 V
- **VDDG CCD Voltage Control -> 0,95 - 0,975 V**

Scroll up

Hint for voltages: start with the lower value and check stability!

🔥 Basic Bios Guide for CTR

Go into "Precision Boost Overdrive" menu

Set ALL options to Auto

Go back to "Extreme Tweaker" slide

Go into "External Digi+ Power Control"

🔥 Basic Bios Guide for CTR

/ISUS

Set following settings to...

- **CPU Load-line Calibration: According to the section about "Finding the right LLC" ([page 42-46](#))**
  - **Starting point: Level 4**

- **CPU Current Capability   -> 130%**
- **CPU Power Duty Control   -> T.Probe**
- **CPU Power Phase Control   -> Power Phase Response**
  - **Manual Adjustment -> Ultra Fast**

Go back to "Extreme Tweaker" slide

Go into "Precision Boost Overdrive" menu

Set ALL options to Auto

Switch to "Advanced" slide

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🔥 Basic Bios Guide for CTR

/ISUS
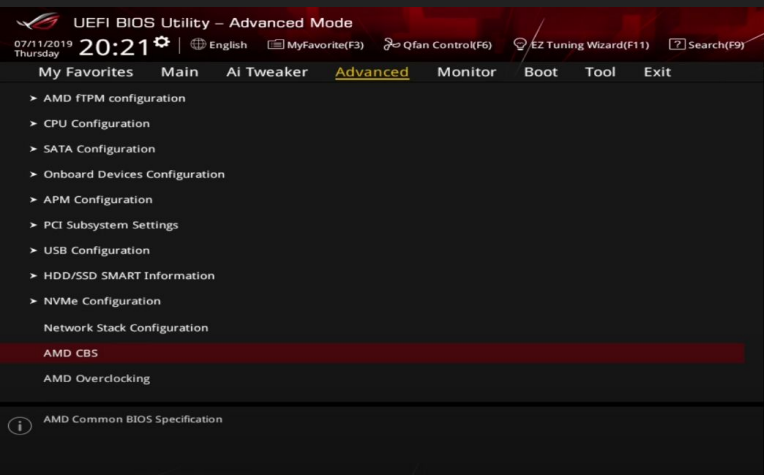
Go into "AMD CBS" menu
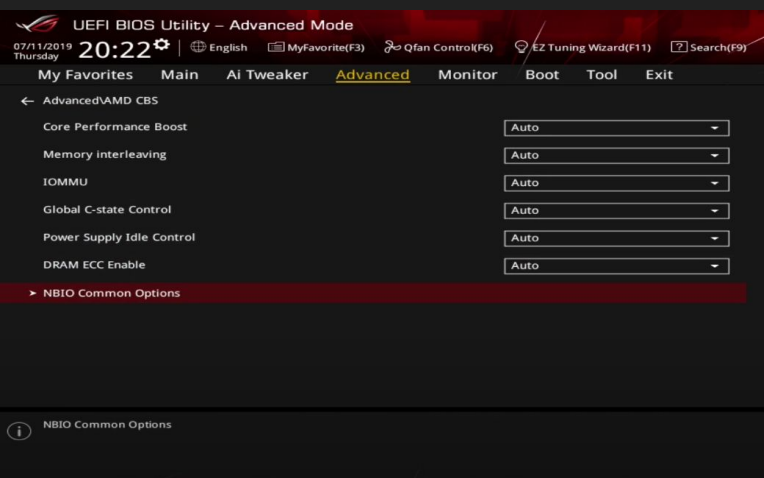
Set "Global C-state Control" to Enabled

Go into "NBIO Common Options"

🔥 Basic Bios Guide for CTR

ASUS

Set following settings to...

- **CPPC**   **-> Enabled**
- **CPPC Preferred Cores**   **-> Enabled**

Go back to "Advanced" slide

Go into "AMD Overclocking" menu

🔥 Basic Bios Guide for CTR

/SUS
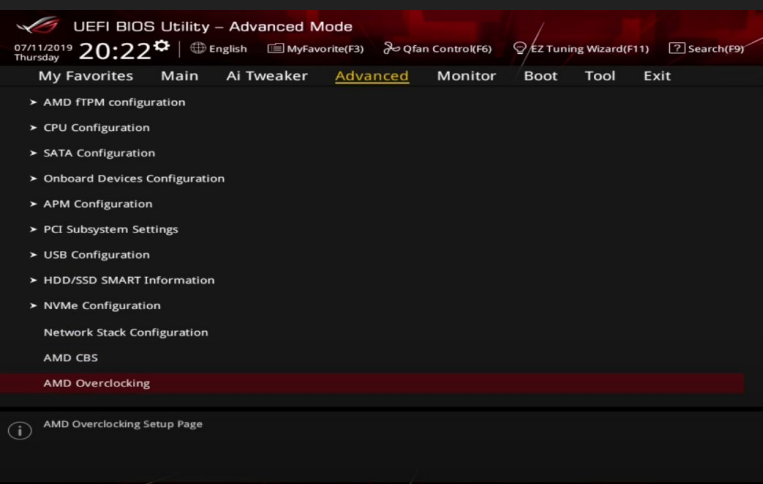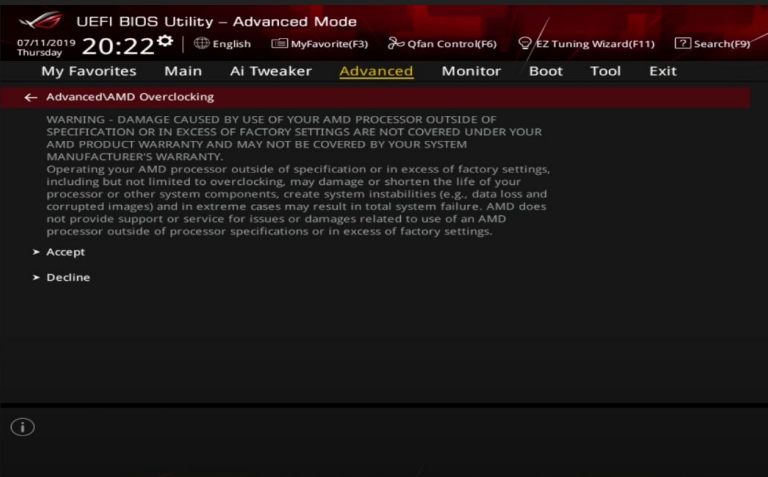
Accept the warning!
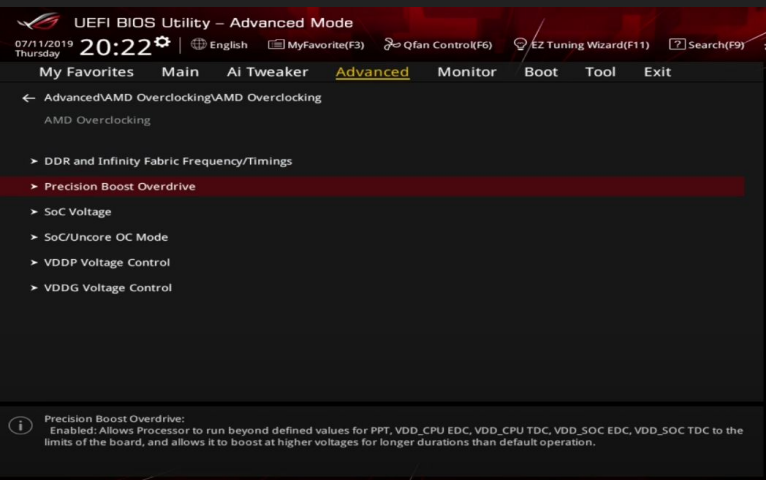
Go into "Precision Boost Overdrive" menu

🔥 Basic Bios Guide for CTR

/ISUS

Set following settings to...

- **Precision Boost Overdrive**   **-> Advanced**
- **PBO Limits**   **-> Auto**
- **Precision Boost Scalar**   **-> Auto**
- **Max CPU Boost Override**   **-> 0Mhz**
- **Platform Thermal Throttle Limit**   **-> Auto**

Go into "Curve Optimizer" menu

Set "Curve Optimizer" to All Cores

Make sure the "All Core Curve Optimizer Magnitude" is 0

"All Core Curve Optimizer Sign" doesn't matter!

Set "Curve Optimzer" to Per Core

Make sure all of the "Core Curve Optimizer Magnitude" are 0

Set "Curve Optimizer" to disabled

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🔥 Basic Bios Guide for CTR

ASUS

Go back to "Precision Boost Overdrive" menu

Set "Precision Boost Overdrive" to disabled

You are done!

🔥 Summary of BIOS settings for   /ISUS

Hint for voltages:
start with the lower value and check stability!

Extreme Tweaker

- Core Performance Boost   -> Auto
- CPU Core Ratio   -> Auto
- Performance Bias   -> Auto
- CPU Core Voltage   -> Auto
- CPU SOC Voltage   -> Manual
  - Set VDDSOC Voltage Override to 1.15 - 1.20 V
- VDDG CCD Voltage Control   -> 0,95 - 0,975 V

External Digi+ Power Control menu

- CPU Load-line Calibration   -> 1,5-3,5 % Vdroop
- CPU Current Capability   -> 130%
- CPU Power Duty Control   -> T.Probe
- CPU Power Phase Control   -> Power Phase Response
  - Manual Adjustment -> Ultra Fast

Curve Optimizer and PBO

- All options to Auto!
- Make sure all Curve Optimizer values are 0 in both menus (All Core and Per Core). Due to a bug it can be that these settings are still activated even though Curve Optimizer is set to disabled!
- After that, set PBO to disabled

AMD CBS menu

- Set Global C-state Control to Enabled
- Set CPPC to Enabled
- Set CPPC Preferred Cores to Enabled

🔥 Basic Bios Guide for CTR

ASRock
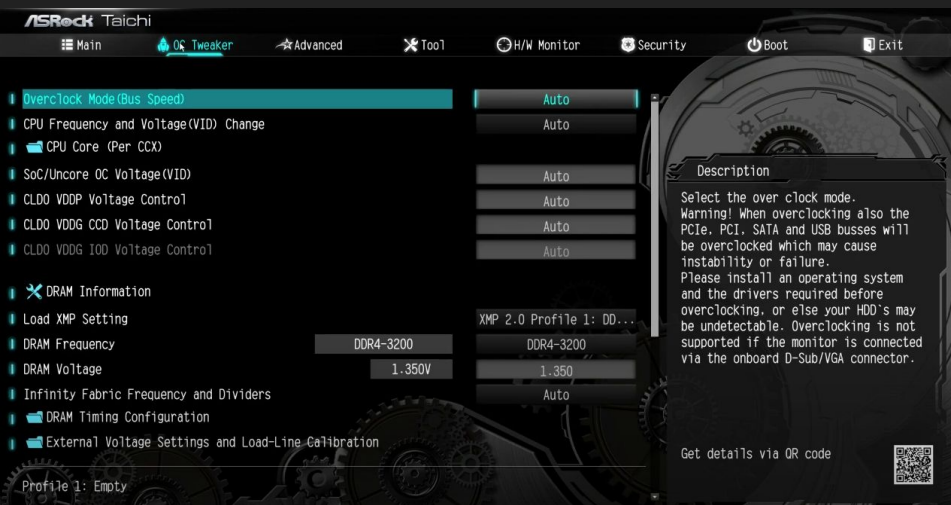
Go into "OC Tweaker" slide

Set following settings to…

- **CPU Frequency and Voltage (VID)** -> Auto
- **Soc/Uncore OC Voltage(VID)** -> 1,15-1,20 V
- **VDDG CCD Voltage Control** -> Manual
  - **Set voltage to 0,95-0,975 V**

Go into "External Voltage Settings and Load-Line Calibration"

- **CPU Load-line Calibration: According to the section about "Finding the right LLC" (page 42-46)**
  - **Starting point: Level 3**

Go back and switch to the "Advanced" slide

🔥 Basic Bios Guide for CTR

ASRock

Go into "AMD Overclocking menu"
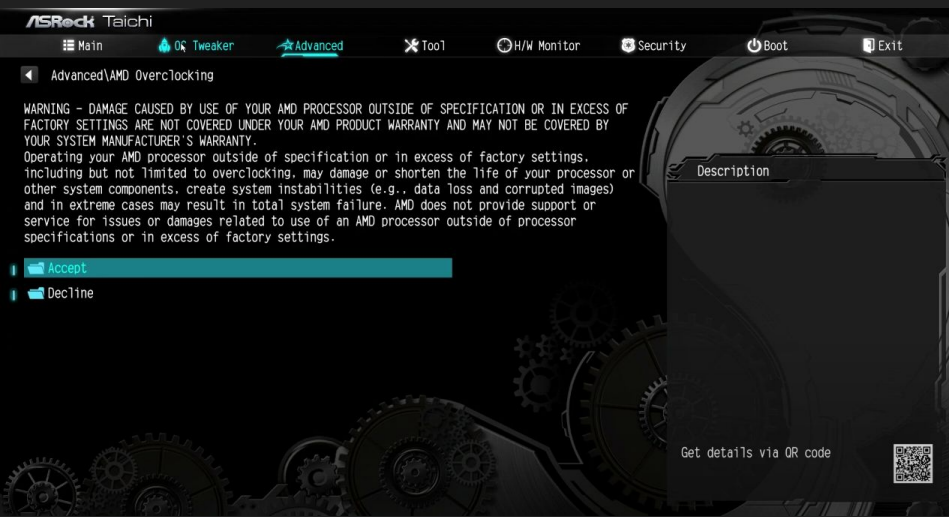
Accept the warning

🔥 Basic Bios Guide for CTR
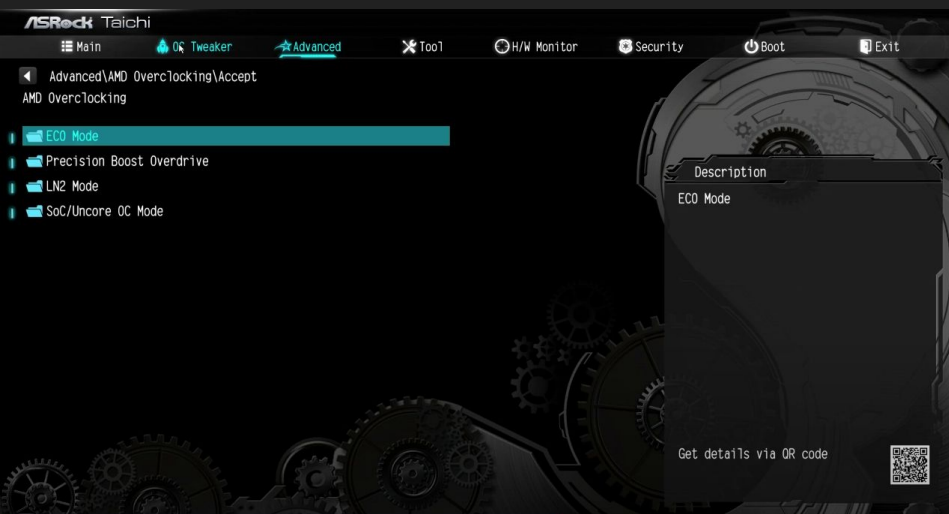
Go into "Precision Boost Overdrive" menu

Switch "Precision Boost Overdrive" from Auto to Advanced

🔥 Basic Bios Guide for CTR

/ISRock

Set the following settings to…

- **PBO Limits** **-> Auto**
- **Precision Boost Overdrive Scalar** **-> Auto**
- **Max CPU Boost Clock Override** **-> Auto / 0 Mhz**
- **Platform Thermal Throttle Limit** **-> Auto**

Go into "Curve Optimizer" menu

Please ignore the values of the screenshot - it is only for demonstration!

Set "Curve Optimizer" to All Cores

Make sure the "All Core Curve Optimizer Magnitude" is 0

"All Core Curve Optimizer Sign" doesn't matter!

Set "Curve Optimizer" to Per Core

🔥 Basic Bios Guide for CTR

ASRock
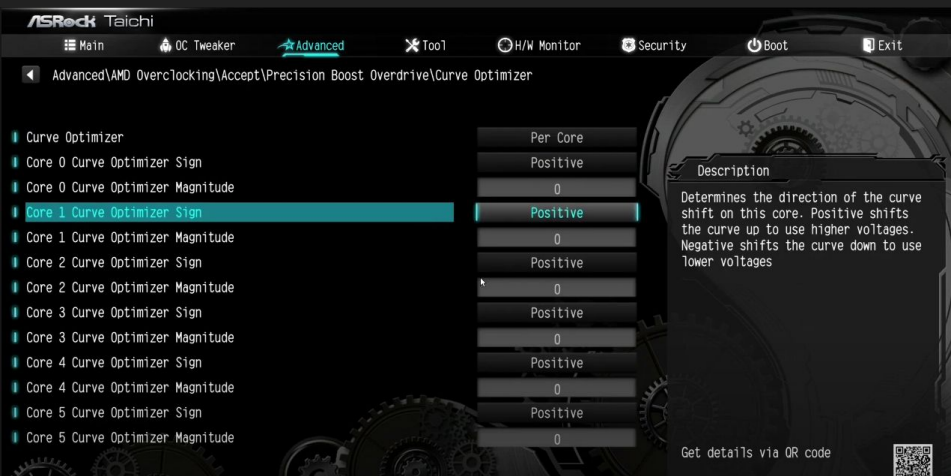
Make sure that all of the "Curve Optimizer Magnitude" are 0

"All Core Curve Optimizer Sign" doesn't matter!

Set "Curve Optimizer" to disabled

Go back to "Precision Boost Overdrive"

Please ignore the values of the screenshot - it is only for demonstration!

Set "Precision Boost Overdrive" to disabled

(If there is no disabled option, set it to Auto)

Go back twice to the Advanced slide

🔥 Basic Bios Guide for CTR
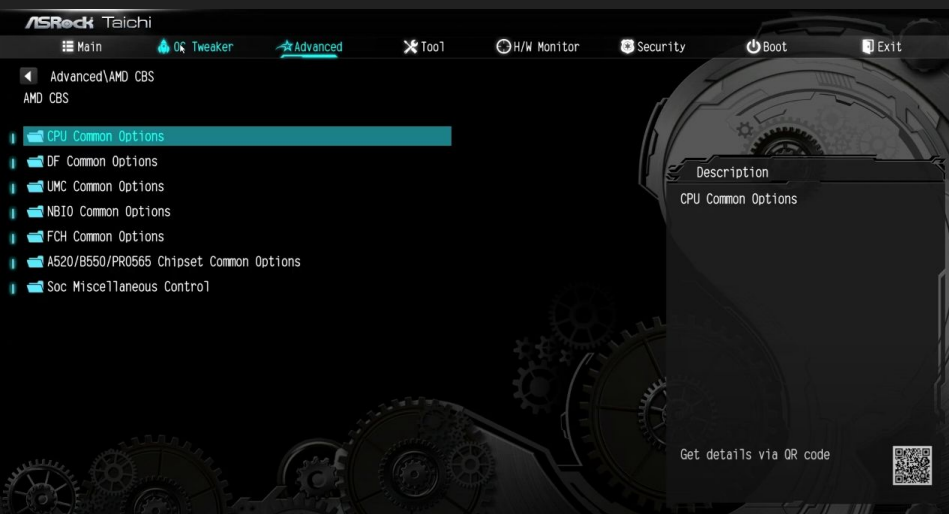
Go into "AMD CBS" menu

Go into "CPU Common Options"

🔥 Basic Bios Guide for CTR

ASRock

Set the following settings to…

- **Core Performance Boost**   **-> Auto**
- **Global C-state Control**   **-> enabled**

Go back to "AMD CBS" menu
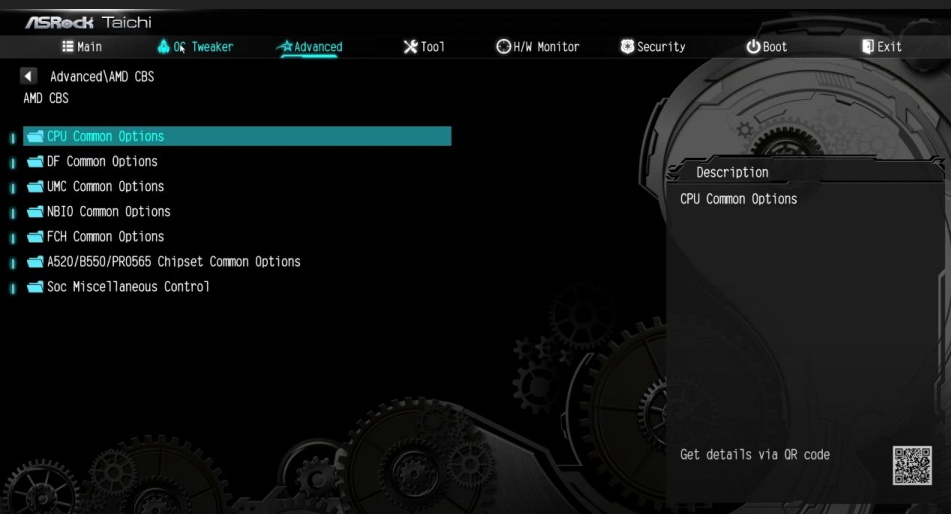
Go into "NBIO Common Options"

🔥 Basic Bios Guide for CTR

ASRock

Go into "SMU Common Options" menu

Set the following settings to…

- **CPPC** -> **Enabled**
- **CPPC Preferred Cores** -> **Auto**
- **BoostFmaxEn** -> **disabled**

You are done!

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🔥 Summary of BIOS settings for

ASRock

OC Tweaker menu

- CPU Frequency and Voltage (VID)   -> Auto
- Soc/Uncore OC Voltage(VID)   -> 1,15-1,20 V
- VDDG CCD Voltage Control   -> Manual
  - Set voltage to 0,95-0,975 V
- Load-Line Calibration   -> 1,5-3,5 % Vdroop

Hint for voltages: start with the lower value and check stability!

AMD CBS menu

- Core Performance Boost   -> Auto
- Global C-state Control   -> enabled

AMD CBS / NBIO / SMU Common Options

- CPPC   -> Enabled
- CPPC Preferred Cores   -> Auto
- BoostFmaxEn   -> disabled

Curve Optimizer and PBO

- All options to Auto!
- Make sure all Curve Optimizer values are 0 in both menus (All Core and Per Core). Due to a bug it can be that these settings are still activated even though Curve Optimizer is set to disabled!
- After that, set PBO to disabled

🔥 Basic Bios Guide for CTR

GIGABYTE™

If it doesn't look like this: press F7

Go into "Tweaker" menu

Hint for voltages: start with the lower value and check stability!
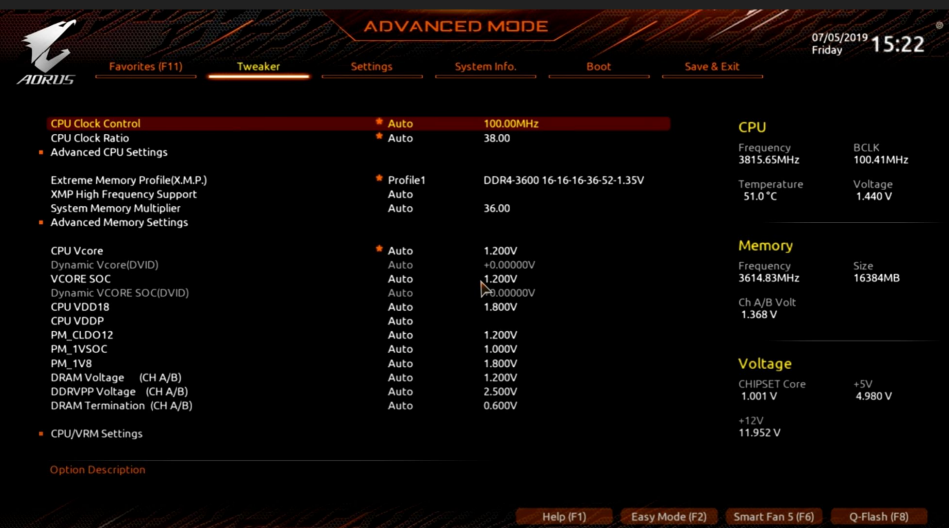
Set following settings to…

- **CPU Clock Control   -> Auto**
- **CPU Clock Ratio   -> Auto**
- **CPU Vcore   -> Auto**
- **Vcore SOC   -> 1.15 V - 1.20 V**

Go into "Advanced CPU Settings" menu

🔥 Basic Bios Guide for CTR

GIGABYTE™

Set following settings to...

- **Core Performance Boost** -> Auto
- **AMD Cool&Quiet function** -> Enabled
- **Global C-State Control** -> Enabled
- **CPPC** -> Enabled
- **CPPC Preferred Cores** -> Enabled

Go back and into "CPU / VRM Settings"

- **CPU Load-line Calibration: According to the section about "Finding the right LLC" (page 42-46)**
  - **Starting point: Medium**

Go back and switch the tab to "Settings"

🔥 Basic Bios Guide for CTR

GIGABYTE™

Go into "AMD CBS"

Go into "XFR Enhancement"

🔥 Basic Bios Guide for CTR

GIGABYTE™

Set the following settings to...

- **VDDG Voltage Control   -> Manual**
- **VDDG Voltage   -> 0,95 - 0,975 V**
  - **Here you have to enter mV, so 0,95 V would be a value of 950**

Go back to "Settings" tab

Hint for voltages: start with the lower value and check stability!

Go into "AMD Overclocking"

🔥 Basic Bios Guide for CTR
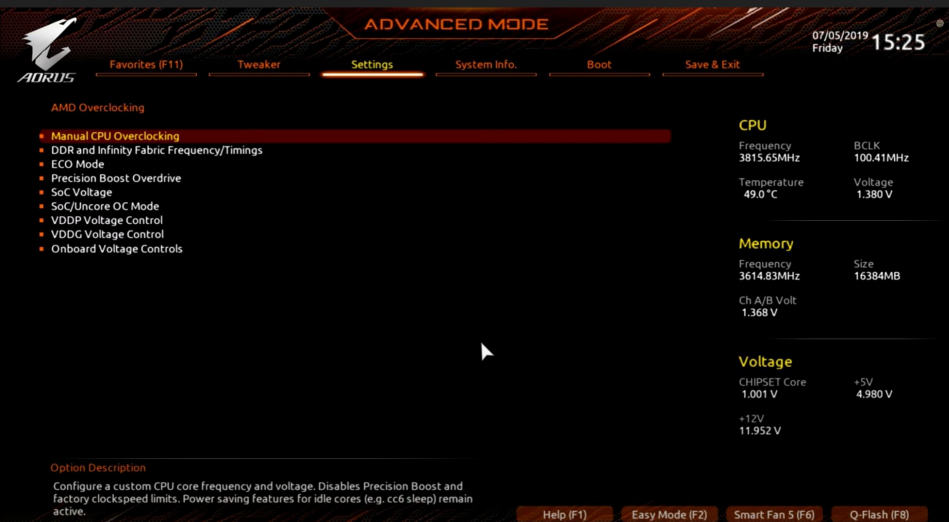
GIGABYTE™

Go into "Precision Boost Overdrive" menu
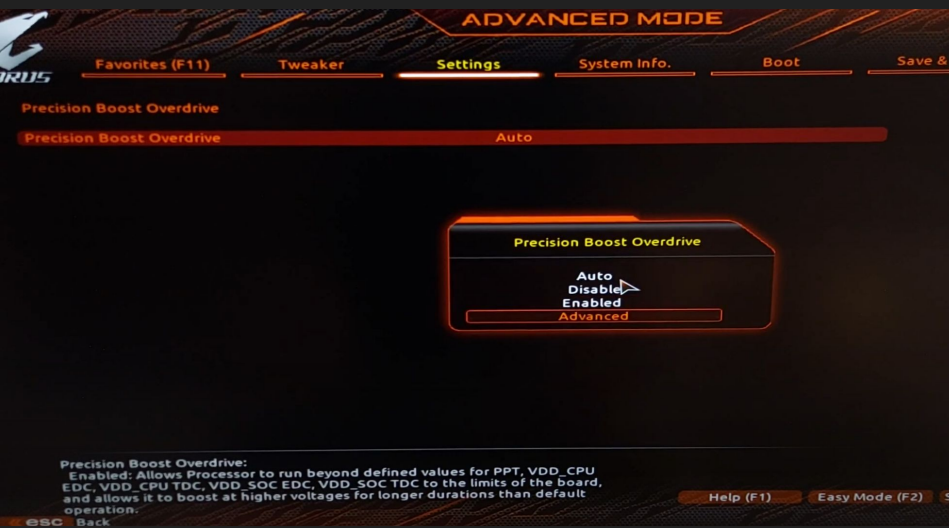
Select "Precision Boost Overdrive" and set it to "Advanced"

🔥 Basic Bios Guide for CTR

GIGABYTE™

Set following settings to…

- **PBO Limits -> Disabled / Auto**
- **Precision Boost Overdrive Scalar   -> Auto**
- **Max CPU Boost Clock Overdrive   -> 0Mhz**
- **Platform Thermal Throttle Limit   -> Auto**

Then go into "Curve Optimizer" menu
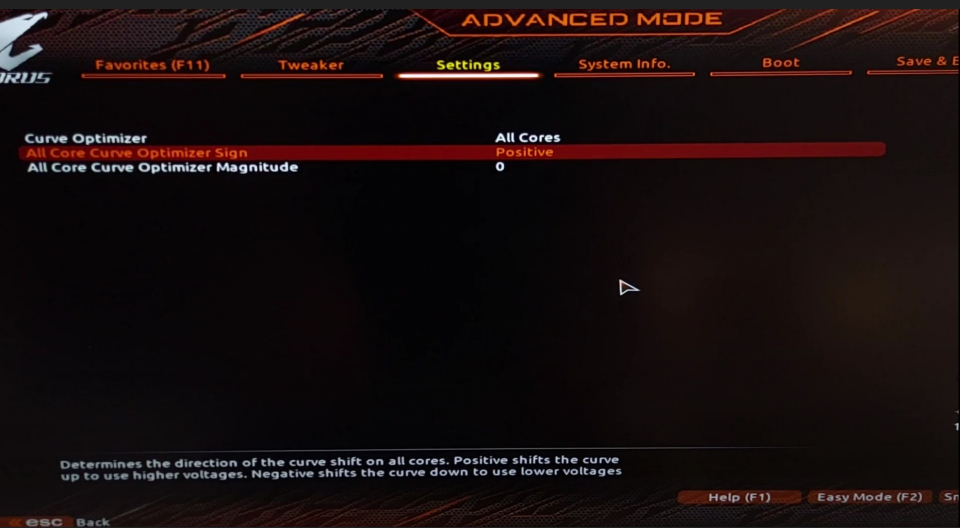
Set "Curve Optimizer" to "All Cores" and make sure that "All Core Curve Optimizer Magnitude" is set to 0.

"All Core Curve Optimizer Sign" doesn't matter.

Switch "Curve Optimizer" from "All Cores" to "Per Core"

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🔥 Basic Bios Guide for CTR
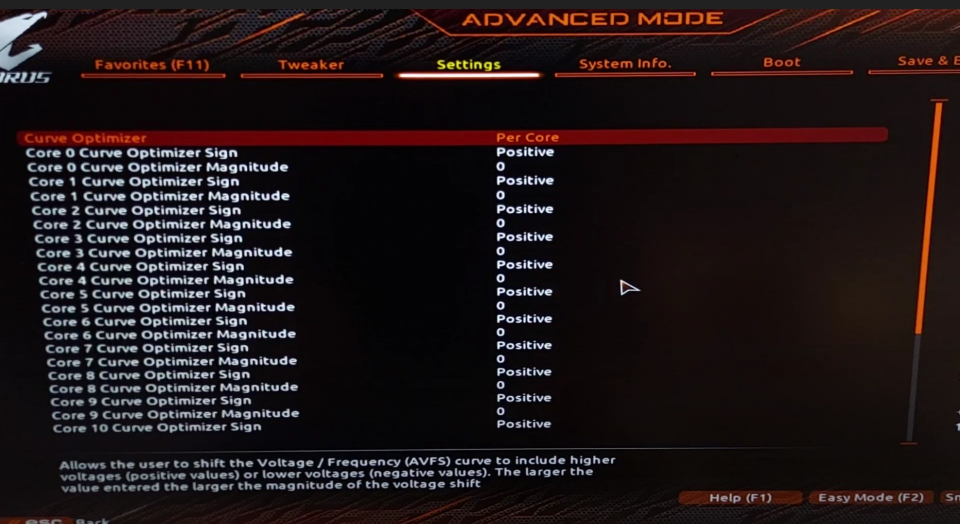
GIGABYTE™

Make sure that "All Core Curve Optimizer Magnitudes" are set to 0.

"All Core Curve Optimizer Sign" doesn't matter.

Select "Curve Optimizer" again and set it to disabled

You are done!

🔥 Summary of BIOS settings for

GIGABYTE™

Tweaker menu

- CPU Clock Control -> Auto
- CPU Clock Ratio -> Auto
- CPU Vcore -> Auto
- Vcore SOC -> 1.15 V - 1.20 V
- Core Performance Boost -> Auto
- AMD Cool&Quiet function -> Enabled
- Global C-State Control -> Enabled
- CPPC -> Enabled
- CPPC Preferred Cores -> Enabled
- CPU Vcore Loadline Calibration -> 1,5-3,5 % Vdroop

Hint for voltages:
start with the lower value and check stability!

Settings / AMD CBS / XFR Enhancement

- VDDG Voltage Control -> Manual
- VDDG Voltage -> 0,95 - 0,975 V

Curve Optimizer and PBO

- All options to Auto!
- Make sure all Curve Optimizer values are 0 in both menus (All Core and Per Core). Due to a bug it can be that these settings are still activated even though Curve Optimizer is set to disabled!
- After that, set PBO to disabled

🔥 Basic Bios Guide for CTR

If it doesn't look like this: press F7

Go into "OC" menu

Set following settings to…

- **CPU Ratio Apply Mode** -> **All Core**
- **CPU Ratio** -> **Auto**

🔥 Basic Bios Guide for CTR

Scroll down

Set following settings to…

- **CPU Core Voltage**   **-> Auto**
- **CPU NB/SoC Voltage**   **-> Override Mode**
- **Override CPU NB/Soc Voltage**   **-> 1.15 V - 1.20 V**
- **VDDG IOD Voltage**   **-> 0,95 V - 0,975 V**

Go into "DigitALL Power" menu

Hint for voltages: start with the lower value and check stability!
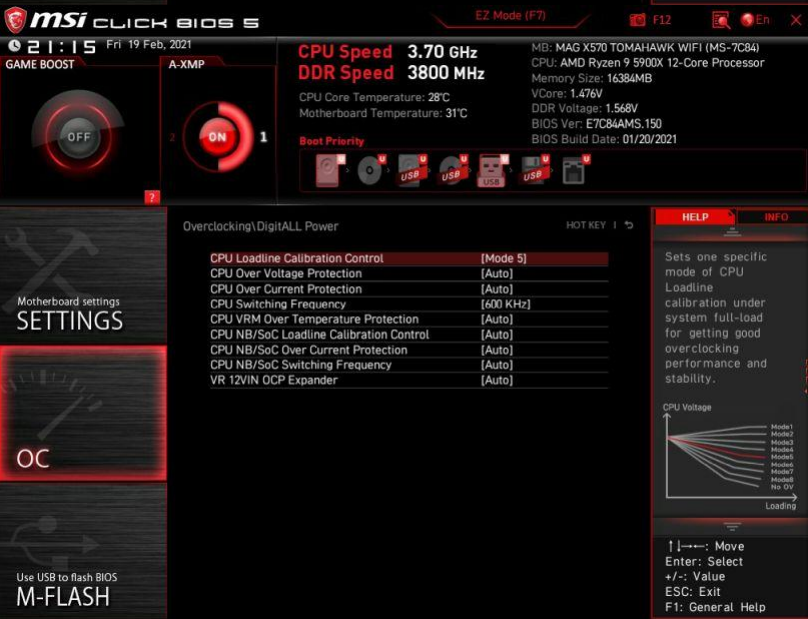
Set following settings to…

- **CPU Load-line Calibration: According to the section about "Finding the right LLC" ([page 42-46](#))**

- **CPU Switching Frequency**   **-> 600 KHz**
- **CPU NB/SoC Switching Frequency** **-> 600 KHz**

Go back to "OC" menu

🔥 Basic Bios Guide for CTR

Go into "Advanced CPU Configuration" menu

Go into "AMD Overclocking" menu

🔥 Basic Bios Guide for CTR

Select "Precision Boost Overdrive" and set it to "Advanced"

Make sure ALL options are set to Auto

🔥 Basic Bios Guide for CTR

Change "Curve Optimizer" from "All Cores" to "Per Core" and make sure everything is set to 0

(Curve Optimizer Sign does not matter!)

Go into "Curve Optimizer" menu and make sure that ALL "All Core Curve Optimizer Magnitude" are set to 0

(All Core Curve Optimizer Sign does not matter!)

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🔥 Basic Bios Guide for CTR

Go back to "AMD Overclocking" and change "Precision Boost Overdrive" back to Auto

(Auto = disabled)

Go back to "Advanced CPU Configuration" and go into "AMD CBS" menu

🔥 Basic Bios Guide for CTR

Set the following settings to...

- **Set Core Performance Boost to Auto**
- **Set Global C-state Control to Enabled**
- **Set CPPC to Enabled**
- **Set CPPC Preferred Cores to Enabled**

You are done!

🔥 Summary of BIOS settings for

OC menu

- CPU Ratio Apply Mode   -> All Core
- CPU Ratio   -> Auto
- CPU Core Voltage   -> Auto
- CPU NB/SoC Voltage   -> Override Mode
- Override CPU NB/Soc Voltage   -> 1.15 V - 1.20 V
- VDDG IOD Voltage   -> 0,95 V - 0,975 V

> **Hint for voltages:**
> start with the lower value and check stability!

Digit All Power menu

- CPU Loadline Calibration Control   -> 1,5-3,5 % Vdroop
- CPU Switching Frequency   -> 600 KHz
- CPU NB/SoC Switching Frequency   -> 600 KHz

Curve Optimizer and PBO

- All options to Auto!
- Make sure all Curve Optimizer values are 0 in both menus (All Core and Per Core). Due to a bug it can be that these settings are still activated even though Curve Optimizer is set to disabled!
- After that, set PBO to disabled

AMD CBS menu

- Set Core Performance Boost to Auto
- Set Global C-state Control to Enabled
- Set CPPC to Enabled
- Set CPPC Preferred Cores to Enabled

🔥 CTR Guide - BIOS Preparation + RAM stability

- **BIOS: Make sure you have your BIOS configured properly, either following the "Basic BIOS Guide for CTR" or by being 100% sure you're an expert enough to judge that your settings are compatible with CTR**

Unsure? Back to BIOS guide

- **RAM: Make sure that your RAM is stable.**

Nah I wanna get going, cause I am using XMP

- **Just because i read it several times, now extra BIG…**

XMP is not equal to "stable"!!!

- **So do yourself a favor and stability check your RAM!**
(if you know how - skip the next 3 slides)

Skip the section about RAM stability testing

🔥 CTR Guide - RAM Stability check - LinX & TM5

- **In the previous version it was recommended to use memtest of the DRAM Calculator. Unfortunately it turned out that this test was not enough to check your RAM's stability. It will find the instability, but therefore it has to run literally all night long. Of course I don't want to ask anyone who is excited to try out CTR to do a 12-24h test run.**

- **I think we found a good solution, to stress your RAM, the IMC (integrated memory controller) and the stability of your Infinity Fabric Clock (FCLK)**

- **In the following, I will explain how to use LinX and TM5.**

> OMG, two apps?
> How long does it take?

- **Each test will take 30 minutes. So one hour in total instead of three hours with the memtest from the previous version.**

- **Let's begin with LinX.**

- **Go to your CTR folder. There you will find a folder called "LinX v0.7.0"**

- **Open the folder and start LinX by open it with** ⚙ LinX

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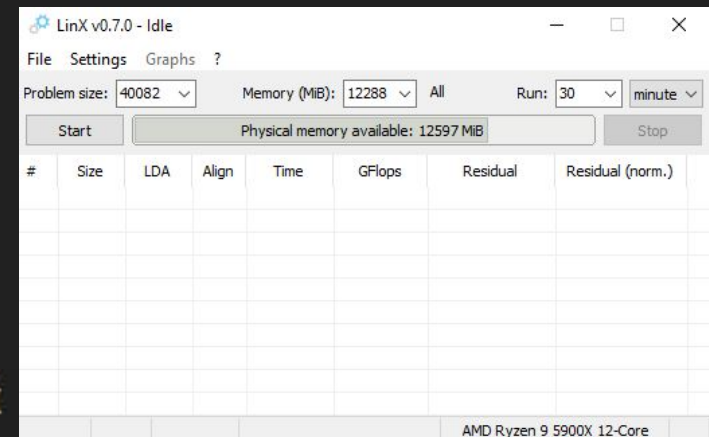
🔥 CTR Guide - RAM Stability check - LinX & TM5

- **All you have to do is to select "Memory (MiB)" and set it to 12288**

- **Next you change "Run" from 5 to 30 and "times" to "minutes"**

- **Press "Start" and LinX will start to hammer your RAM but in addition it will try to rip your IMC and Infinity Fabric apart. :-)**

- **Don't panic - it was meant funny... ...but it is also real.**

- **It is a very intensive test of the above mentioned components. But I suggest to use it only while your CPU is not overclocked, because if so temperature could become a problem.**
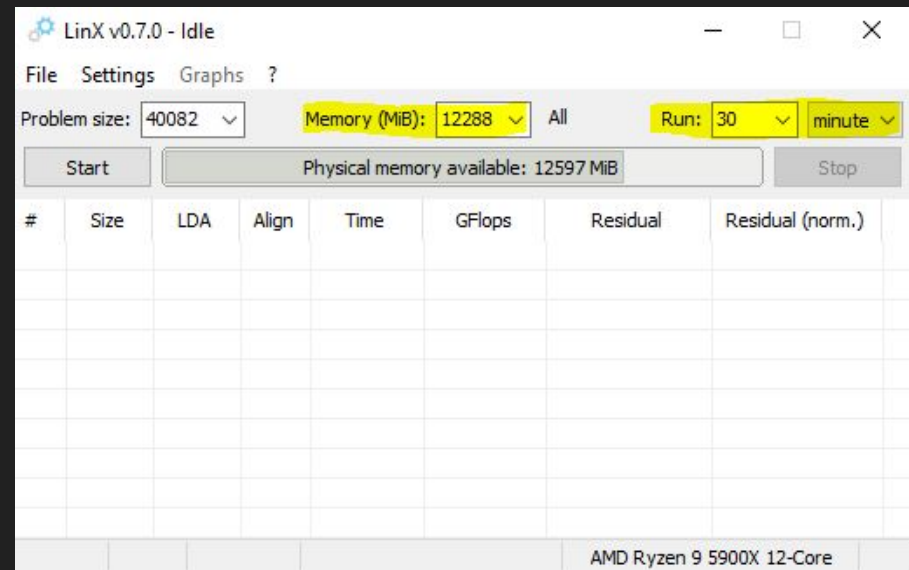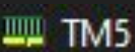
- **If you have already tuned your profiles with CTR - it could make sense to deactivate your profiles - or watch your temperatures!**

- **After 30 minutes you will get a message: Finished without errors in which can come in different colours. The text is important...**

🔥 CTR Guide - RAM Stability check - LinX & TM5

- **Next on the list is TM5.**

Wait dude! I got an error on LinX...

- **I don't want to cover errors of LinX or TM5 here in the guide. Cause it is about CTR and not about RAM OC.**

- **Go into your CTR folder and search for a folder called "TM5" and open it.**

- **Right-click** 〓 TM5 **and select "Run as administrator. If you don't do it, TM5 will complain about it like so:**

Customize: Default @1usmus_v3
The program in compatibility mode,
need to run with Administrator privileges!

- **It will automatically start to test your RAM right after you start TM5.**

- **It is already pre configured so you have nothing to change.**

- **The test will take about 30 minutes.**
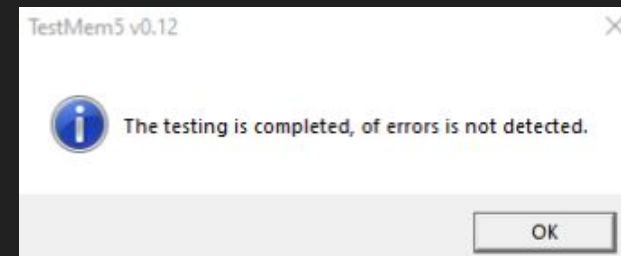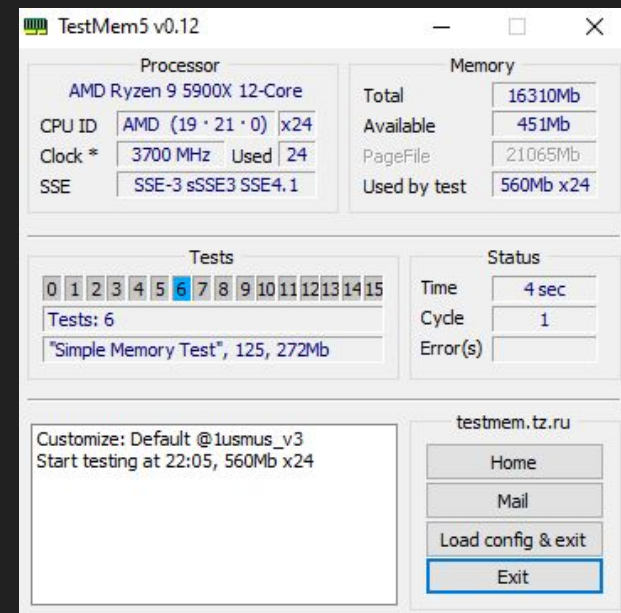
🔥 CTR Guide - RAM Stability + Windows integrity

- When you have completed both tests without errors it will indicate that your RAM is high likely stable.

- Now we will address another point, that doesn't hurt to check.

- Your Windows system files could be damaged / corrupted. I will show you how to fix it - if so…

- On your keyboard press the "Windows" key and the "R" key. The "Run window" will open:
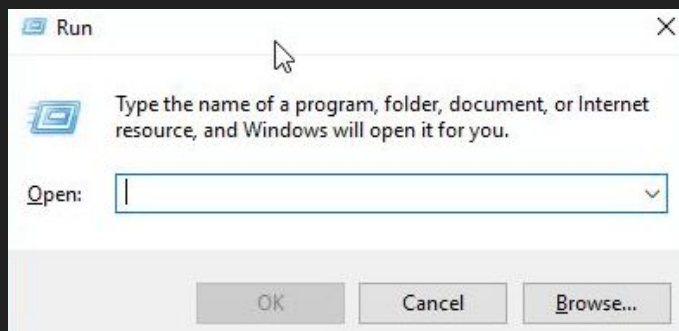
- Now type "cmd" and (important!) press "CTRL" + "Shift" + "Enter" to open a command prompt with administrator privileges. If done right you will see this on top of your command prompt:

Administrator: C:\WINDOWS\system32\cmd.exe

C:\WINDOWS\system32\cmd.exe

- Type in "sfc /scannow". This will start the scan process. It can take up to several minutes to complete.

- After it has finished, it will tell you either that it did not find corrupted files or it will tell you that it has found and repaired corrupted files.

- In case it displays other messages, please ask aunt google. It would go too far to explain here.

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🔥 CTR Guide - Windows integrity

- After the successful finished sfc command we will check another possible damage of windows.

- Type in the command prompt: "Dism /Online /Cleanup-Image /ScanHealth"

- If it has found some errors you can try to repair them with the following command line: "Dism /Online /Cleanup-Image /RestoreHealth"

- In addition it doesn't hurt to run a check of your file system. To do it, type "chkdsk /f /r". It will complain like this:

- Just accept with Y and enter. After this you need to restart windows.

- If this doesn't work please check google for further information. Again, too much for this guide.

Hours and hours of setting, testing, preparing… Can we finally start now with CTR?!?


```
Administrator: Command Prompt - chkdsk /f

C:\WINDOWS\system32>chkdsk /f
The type of the file system is NTFS.
Cannot lock current drive.

Chkdsk cannot run because the volume is in use by another
process.  Would you like to schedule this volume to be
checked the next time the system restarts? (Y/N)
```

🔥 CTR Guide - First Start and diagnostic

- **Start CTR**
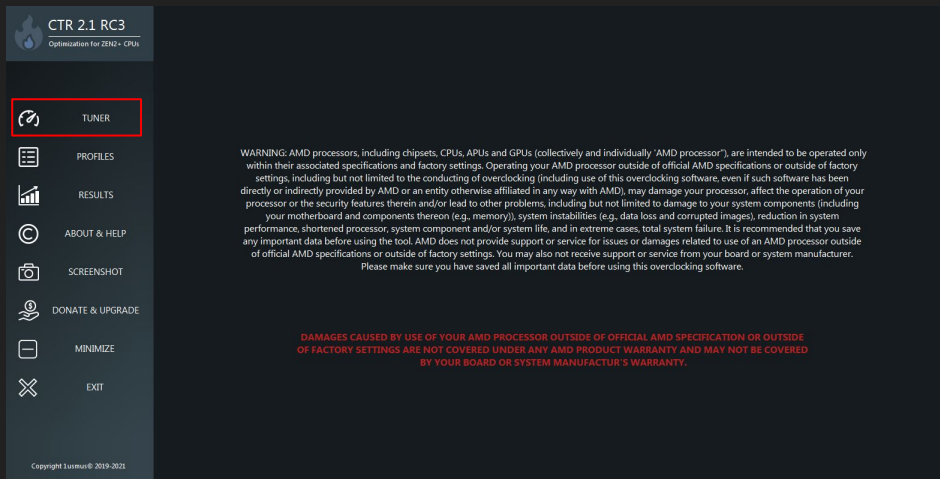
- **Click on** DIAGNOSTIC

- **The diagnostic process will start**

- **For Zen3 users: Do not wonder - Cinebench will start and close a lot! :-)**

- **For Zen2 users: The "classic" diagnostic will start as you knew it before.**

- **Click on** 🕐 TUNER

🔥 CTR Guide - Diagnostic - new profile calculator

only Zen3!

- CTR will start the calculation of your PX profile.

- CTR is measuring how high your cores are able to boost at stock.

- The gathered data is afterwards used by CTR to calculate two presets for your PX profile -> SAFE and FAST

- SAFE PX preset is meant to be stable in 99,9 % of cases

- FAST PX preset can be stable but does not have to. How we test this and even tweak it a little bit more will be covered in the section "Stability testing the PX profile"

- What you get displayed during diagnostic:

```
06:41:18: Test 1 started!
Calculation results for PX HIGH
SAFE:    4950MHz
FAST:    4975MHz
Basic statistics
CORE / FREQUENCY / VID / dLDO / POWER / TEMP
C01 F 31      V 1.49   L 0.972 W 0.13   T 27.06
C02 F 16      V 1.49   L 0.967 W 0.13   T 27.09
C03 F 4898    V 1.49   L 1.399 W 13.11  T 53.03
C04 F 4898    V 1.49   L 1.388 W 12.92  T 52.52
C05 F 37      V 1.49   L 0.966 W 0.17   T 31.25
C06 F 36      V 1.49   L 0.973 W 0.15   T 31.8
C07 F 8       V 1.49   L 0.926 W 0.11   T 23.25
C08 F 357     V 1.49   L 0.984 W 1.14   T 25.62
C09 F 11      V 1.49   L 0.926 W 0.11   T 23.78
C10 F 10      V 1.49   L 0.928 W 0.1    T 21.83
C11 F 12      V 1.49   L 0.922 W 0.11   T 23.42
C12 F 22      V 1.49   L 0.928 W 0.12   T 21.26
06:41:53: Cinebench stopped!
06:41:53: Test 1 finished!
```

- CTR has tested your PX High profile with 2 threads (your 2 best cores). As you can see the cores are reaching 4898 Mhz. This is used to calculate the following presets for PX High:

  SAFE = 4950 Mhz and FAST = 4975 Mhz

- The value of the SAFE preset will be waiting for you prefilled in the profile tab.

🔥 CTR Guide - Diagnostic

- **After finishing the PX calculation (Zen3 only), CTR will now test all of your cores to calculate P1 and P2 profile which will be waiting for you right after the diagnostic. [Zen3 only!]**

```
20:12:00: CCX1 (158): 4375 MHz, 1187 mV
20:12:00: CCX2 (133): 4375 MHz, 1187 mV
20:12:00: Step# 1. Diagnostic VID: 1187 mV
20:12:01: Stress test 1 started...
20:12:07: CCX1 VID injection: 100%  CCX2 VID injection: 0%
20:12:07: Vdroop 4,3 %
20:12:07: Recommended to increase the voltage compensation!
20:12:37: Stress test stopped.
```

- **After finishing the calculations of P1 + P2 your CPU will be tested with a defined clock speed and a defined voltage. "Classic diagnostic" :-)**

- **CTR will do two tests of each voltage setting. If your chip is able to handle this load CTR will decrease the voltage by 6 mV as a next step and test again.**

OMG!!!!!!
This is taking forever!!!

- **No, not anymore. Based on the previous PX and P1 + P2 calculation CTR can assume at which voltage your CPU will fail. So the amount of time is especially for golden+ samples massively reduced.**

- **This will be continued until one of your cores isn't able to hold the frequency at the set voltage.**

- **CTR now comes with a crash protection during diagnostic. In the very unusual case that your PC crashed, CTR will start automatically some time after the reboot. This is nothing to worry about!**

DON'T PANIC

🔥 CTR Guide - First Start - Diagnostic result

- The goal of the classic diagnostic is to determine the lowest voltage at which your CPU is stable at the diagnostic frequency

- This information is used by CTR to define the following things:
  - Category of your sample
    - Platinum / Gold / Silver / Bronze
  - CCX Delta = How much MHz your CCX1 will be able to clock higher than your CCX2 (estimation!)
  - Recommendation of…
    - Voltage and reference frequency settings for P1 (Profile 1)
    - Voltage and reference frequency settings for P2 (Profile 2)
    - Voltage and reference frequency settings for undervolting

Phoenix - hello there :)
CTR completed diagnostic in alternative mode

DIAGNOSTIC RESULTS
AMD Ryzen 9 5900X 12-Core Processor
Max temperature: 42.4°
Energy efficient: 4.05
Your CPU is SILVER SAMPLE
Recomended CCX delta: 100
Theoretical maximum CCX delta: 125
Recomended values for overclocking (P1 profile):
Reference voltage: 1175 mV
Reference frequency: 4525 MHz
Recomended values for overclocking (P2 profile):
Reference voltage: 1275 mV
Reference frequency: 4675 MHz
Recomended values for undervolting:
Reference voltage: 1000 mV
Reference frequency: 4175 MHz

I HIGHLY RECOMMEND TO TAKE A SCREENSHOT OR TO NOTE DOWN THE DIAGNOSTIC RESULTS! !!!

CTR has a screenshot function -> its named: "SCREENSHOT" :-)

🔥 CTR Guide - First Start - Tuning P1 profile

Wall of text! Show me tuning!

- **The tuning of your profiles will only be necessary for Zen2! So if you are on Zen3 you can skip this section! Or if you want a little more accurate result for your P2 + P1 profile on Zen3...**

- **OK… the next step is the tuning process. The diagnostic recommendation of P1 have been already loaded.**

- **All you have to do is to click on** **TUNE**

- **This process will take some time.**
  - **In most cases about 20-25 min**
  - **5600X / 5800X will be faster**
  - **5900X / 5950X will be slower**
    - **(each CCX gets tested)**

- **CTR will test your processor in a similar way as diagnostic. But now each CCX will be tested at a given frequency**

Recomended CCX delta: 100
Theoretical maximum CCX delta: 125
Recomended values for overclocking (P1 profile):
Reference voltage: 1175 mV
Reference frequency: 4525 MHz

Testing mode	AVX Light	Reference voltage (mV)	1175	Max PPT (W)	200
Cycle time (s)	360	Reference frequency (MHz)	4525	Max EDC (A)	200
CCX delta (MHz)	100	Max frequency (MHz)	4900	Max TDC (A)	150
Polling period (ms)	500	Diagnostic voltage (mV)	1187	Max temperature (°C)	85

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🔥 CTR Guide - First Start - Tuning P1 profile

- **When the tuning process has finished you will get a result like this:**

```
Penalties for the final profile: level 3
23:40:01: CCX1 (158): 4475 MHz, 1181 mV  OC=
23:40:01: CCX2 (133): 4425 MHz, 1181 mV  OC+
Cinebench R20 started
Phoenix deactivated!
Cinebench R20 finished with result: 8347
Voltage: 1.211 V  PPT: 139.2 W  Temperature: 49.2°
```

- **What does that mean?**
  - **CCX1 will run at 4475 Mhz**
  - **CCX2 will run at 4425 Mhz**
  - **with a voltage of 1181 mV**

- **This is your first profile, which is called "P1"**
  - **by default CTR will use the P1 profile for loads that will have a CPU usage of 75-100 %.**

FAQ time!

- **"My P1 recommended voltage is different!"**
  - **CTR will recommend the following voltages for your CPU running P1:**
    - **5600X - 1150 mV**
    - **5800X - 1250 mV**
    - **5900X - 1175 mV**
    - **5950X - 1050 mV**

- **"What is this 1181 mV - i thought it has tested at 1175 mV"**
  - **CTR is trying to find a compromise between max clock speed and lowest possible voltage for this clock speed. To make the clock speed of 4475 Mhz / 4425 Mhz reliable, CTR has added 6 mV**

🔥 CTR Guide - First Start - Tuning P1 profile

- **How to save your profile P1?**

- **Go into** 📋 PROFILES

- **The profiles section will look like this**

- **Just click on** FILL & SAVE P1 PROFILE

🔥 CTR Guide - First Start - Tuning P1 profile

- **Now the P1 section will look like this**

P1 PROFILE : filled and saved!						
VID (mV)	1181	CPU usage min (%)	75	Holding time (ms)	750	SAVE P1 PROFILE
CCX1 (MHz)	4475	CCX3 (MHz)	0	CCX5 (MHz)	0	CCX7 (MHz) 0
CCX2 (MHz)	4425	CCX4 (MHz)	0	CCX6 (MHz)	0	CCX8 (MHz) 0 ACTIVATE P1 PROFILE

- **The message "filled and saved!" next to P1 Profile is important!**

- **In addition CTR has already determined the values for your PX Profile.**

WOW, a "X" in the name - should be fast!

- **Yeah! The new PX profile is the so called low thread profile which comes into play especially during gaming and one threaded loads**

- **What does PX?**

- **loads with up to 2 threads will activate**

  HIGH STATE (MHz)   4975

- **loads with up to 4 threads will activate**

  MID STATE (MHz)   4925

- **on 5600X and 5900X loads with up to 6 threads will activate**

  LOW STATE (MHz)   4850

- **on 5800X and 5950X it will be able to boost up to 8 threaded loads to the low state**

- **For now you can save your PX profile If you encounter stability problems with PX check the "PX troubleshooting" section of the guide!**

🔥 CTR Guide - First Start - Tuning

- You can now activate P1 by clicking on **ACTIVATE P1 PROFILE** but this will act like a manual OC, so you will have P1 applied all the time.

- Therefore it is better to use "Hybrid OC" All of the workloads that exceed the PX profile but doesn't reach the the minimum CPU usage of P1 (75% by default) the standard boost pattern of the CPU will be applied

- To activate this AWESOME feature you simply have to check **CTR HYBRID OC**

- I recommend to also check **Autoload profile with OS** to autoload the profiles

- If you don't want CTR to autoload the profiles with OS you can skip to the next slide!

- Now click the buttons in the following order:
  - (Make sure CTR Hybrid OC is checked)
  - ACTIVATE P1
  - ACTIVATE PX
  - SAVE PX
  - SAVE P1

Save again?!?

- Yes, with the first saving you simply saved the values of the profile, with the saving after the activation, you saved the activation ;-)

🔥 CTR Guide - First Start - Tuning

Wait! What is with loads between PX and P1?

- **This is your P2!**

- **Did you took a screenshot or notes about the diagnostic results? No? And you had a reboot since the diagnostic?**

- **You can look in the CTR folder. There is a folder named "CTR logs". You have to work through the files.**

- **To begin with the tuning process of P2 you have to enter the diag. results manually. Go into** ⊘ **TUNER**

Recomended values for overclocking (P2 profile):
Reference voltage: 1275 mV
Reference frequency: 4675 MHz

- **Enter these values as followed:**

Reference voltage (mV)	1275
Reference frequency (MHz)	4675

- **Click** **TUNE**

- **You can return to slide 11 for step-by-step through the tuning process. It is the same as setting up P1!**

- **A hint about the displayed WHEA counter while the tuning process: As long as it is like this**

```
Step# 1
05:47:36: WHEA-counter: 1
```
...
```
Step# 1234
05:47:36: WHEA-counter: 1
```

Just ignore it! :-)

🔥 CTR Guide - Don't hunt a category

FUCK, I lost the silicon lottery!!! Only got Bronze...

- **To be honest, there are many of these factors that you cannot change**
  - **At least not right now**

This is only luck - or you buy 10 samples and start to binning them by yourself ;-)

- **Maybe you have, but there are so many factors which come into play during diagnostic…**
  - **Quality of your CPU**
  - **Power supply getting old (keyword ripple)**
  - **Number and quality of your VRM phases**
  - **AGESA (!!!) / BIOS version**
  - **BIOS configuration**
  - **Background processes**
  - **RAM / FCLK stability**
  - **CPU Temperature**
  - **...**

Getting a new PSU?

Getting a better motherboard? Improve cooling of VRM's somehow?

Hope that someday AMD will fix their shit? (USB… or "L3 Cache Aida Hotfix")

Only the last three can be influenced at short term IMO
Background processes should be clear and you RAM should already be checked for stability!

🔥 CTR Guide - Don't hunt a category - Temps

- So the temperature remains…

- Quick example of what of an impact the temperature can have:

DIAGNOSTIC RESULTS	DIAGNOSTIC RESULTS
AMD Ryzen 9 5900X 12-Core Processor	AMD Ryzen 9 5900X 12-Core Processor
Max temperature: 47.8°	Max temperature: 35.3°
Energy efficient: 4.12	Energy efficient: 4.17
Your CPU is GOLDEN SAMPLE	Your CPU is GOLDEN SAMPLE
Recomended CCX delta: 75	Recomended CCX delta: 100
Theoretical maximum CCX delta: 100	Theoretical maximum CCX delta: 125
Recomended values for overclocking (P1 profile):	Recomended values for overclocking (P1 profile):
Reference voltage: 1175 mV	Reference voltage: 1175 mV
Reference frequency: 4550 MHz	Reference frequency: 4575 MHz
Recomended values for overclocking (P2 profile):	Recomended values for overclocking (P2 profile):
Reference voltage: 1275 mV	Reference voltage: 1275 mV
Reference frequency: 4700 MHz	Reference frequency: 4725 MHz
Recomended values for undervolting:	Recomended values for undervolting:
Reference voltage: 1000 mV	Reference voltage: 1000 mV
Reference frequency: 4200 MHz	Reference frequency: 4225 MHz

Avg. temperature during diagnostic = 38°C
Diagnostic voltage = 1043 mV

Avg. temperature during diagnostic = 27°C
Diagnostic voltage = 1025 mV

🔥 CTR Guide - Don't hunt a category - Temps

- **Another example: 5950X** (Special thanks to Drejfuss)

00:17:31: Step# 14. Diagnostic VID: 1121 mV

DIAGNOSTIC RESULTS
AMD Ryzen 9 5950X 16-Core Processor
Max temperature: 62,4°
Energy efficient: 3,9
Your CPU is SILVER SAMPLE
Recomended CCX delta: 100
Theoretical maximum CCX delta: 125
Recomended values for overclocking (P1 profile):
Reference voltage: 1100 mV
Reference frequency: 4225 MHz

Cooling setup:
Arctic Liquid 280MM - standard mount, MX-4, Push config (2x140MM) max curve 1150 RPM

01:29:13: Step# 16. Diagnostic VID: 1109 mV

DIAGNOSTIC RESULTS
AMD Ryzen 9 5950X 16-Core Processor
Max temperature: 54,7°
Energy efficient: 3,94
Your CPU is SILVER SAMPLE
Recomended CCX delta: 125
Theoretical maximum CCX delta: 150
Recomended values for overclocking (P1 profile):
Reference voltage: 1100 mV
Reference frequency: 4300 MHz

Cooling setup:
Arctic Liquid 360MM - offset mount, Kryonaut, Push-Pull config (6x120MM) max curve 950 RPM

- **So temperature is important. It won't make a platinum sample out of a bronze one, but it will improve your diagnostic + tuning results and your stability**

- **Consider to**
  - **clean you cooler / radiator**
  - **repaste and remount it**
  - **get a cooler with a offset mounting or get a offset mounting kit (it works wonders)**

🔥 CTR Guide - Another word about categories

I've done all I could, now I will RMA this crappy bronze sample…!

- **Of course you can, wouldn't be fair to the vendor, but it's you sample…**

- **Here you can see what to expect from what kind of samples...**

- **Let's say, you have a bronze 5900X (makes it easier for me to bench…)**

- **You RMA or sell it and get another one. The chances are 16,1 % to get a golden, 65,2 % a silver or 18,8 % to get again a bronze sample**

Ryzen 5 - 5600X

Samples tested:	606
Best Diag-Voltage:	911
Avg. Mhz @1150mV:	4396
Avg. Mhz @1300mV:	4583

Bronze 15,8% — Platinum 1,0% — Gold 34,2% — Silver 49,0%
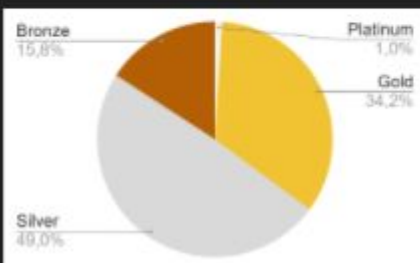
Ryzen 7 - 5800X

Samples tested:	594
Best Diag-Voltage:	881
Avg. Mhz @1250mV:	4564
Avg. Mhz @1325mV:	4622

Bronze 25,0% — Platinum 0,2% — Gold 46,7% — Silver 28,1%
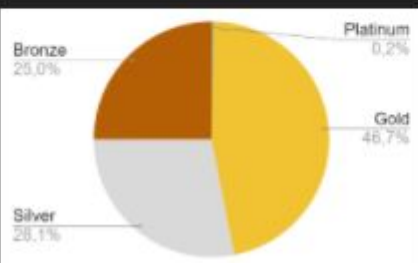
Ryzen 9 - 5900X

Samples tested:	543
Best Diag-Voltage:	1037
Avg. Mhz @1175mV:	4471/4368
Avg. Mhz @1275mV:	4628/4515

Bronze 25,0% — Gold 15,3% — Silver 59,7%
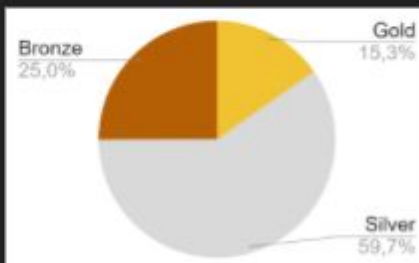
Ryzen 9 - 5950X

Samples tested:	336
Best Diag-Voltage:	1019
Avg. Mhz @1150mV:	4315/4234
Avg. Mhz @1250mV:	4611/4518

Bronze 18,8% — Gold 16,1% — Silver 65,2%
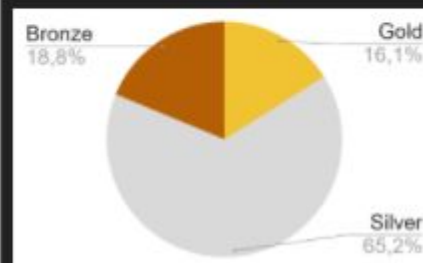
🔥 CTR Guide - Another word about categories

- So let's say you got a silver sample, which will be most likely. What will be the benefit of the whole procedure?

- According to my research in the CTR stats, here are the average clock speeds that each sample will get (remember: in average!)

- So instead of P1 @ 4400/4275 Mhz (bronze) you will get to 4425/4375 Mhz.

- Isn't that much… +25 CCX1 / +100 CCX2

- Or you get really lucky to get a golden 5900X -> P1 @ 4575/4525 Mhz

- That would be a gain of +175 CCX1 / + 250 CCX2

Category	5600X		5800X		5900X			5950X		
					Voltage	Mhz		Voltage	Mhz	
	Voltage	Mhz	Voltage	Mhz		CCD1	CCD2		CCD1	CCD2
Platinum	1150	4600	1250	4775	-	-	-	-	-	-
Gold	1150	4500	1250	4650	1175	4575	4525	1100	4425	4375
	1300	4650	1325	4700	1275	4700	4650	1250	4650	4600
Silver	1150	4375	1250	4550	1175	4425	4375	1100	4350	4250
	1300	4550	1325	4600	1275	4600	4500	1250	4600	4500
Bronze	1150	4250	1250	4450	1175	4400	4275	1100	4250	4125
	1300	4475	1325	4475	1275	4575	4400	1250	4350	4300

🔥 CTR Guide - Another word about categories

- **So we know the candidates, now we will look at how a bronze, silver and a golden 5900X compete against each other**

- **In addition, as I have unfortunately no data of the possible PX settings of each category, I will assume them as followed:**

Sample	PX High	PX Mid	PX Low
Gold	5.050 Mhz	5.000 Mhz	4.950 Mhz
Silver	5.000 Mhz	4.950 Mhz	4.900 Mhz
Bronze	4.950 Mhz	4.900 Mhz	4.850 Mhz

Legend: ■ stock ■ CO ■ Bronze ■ Silver ■ Gold

CO = a golden 5900X with maxed out curve optimizer

1T (PX-H): 636, 640, 639, 645, 652

2T (PX-H): 1259, 1269, 1265, 1277, 1290

4T (PX-M): 2424, 2463, 2518, 2544, 2556

6T (PX-L): 3559, 3592, 3736, 3773, 3791

18T (P2): 7216, 7617, 7459, 7533, 7790

24T (P1): 8112, 9006, 8494, 8618, 8870

220 W @ 1,334 V :-)

155 W @ 1,175 V :-)
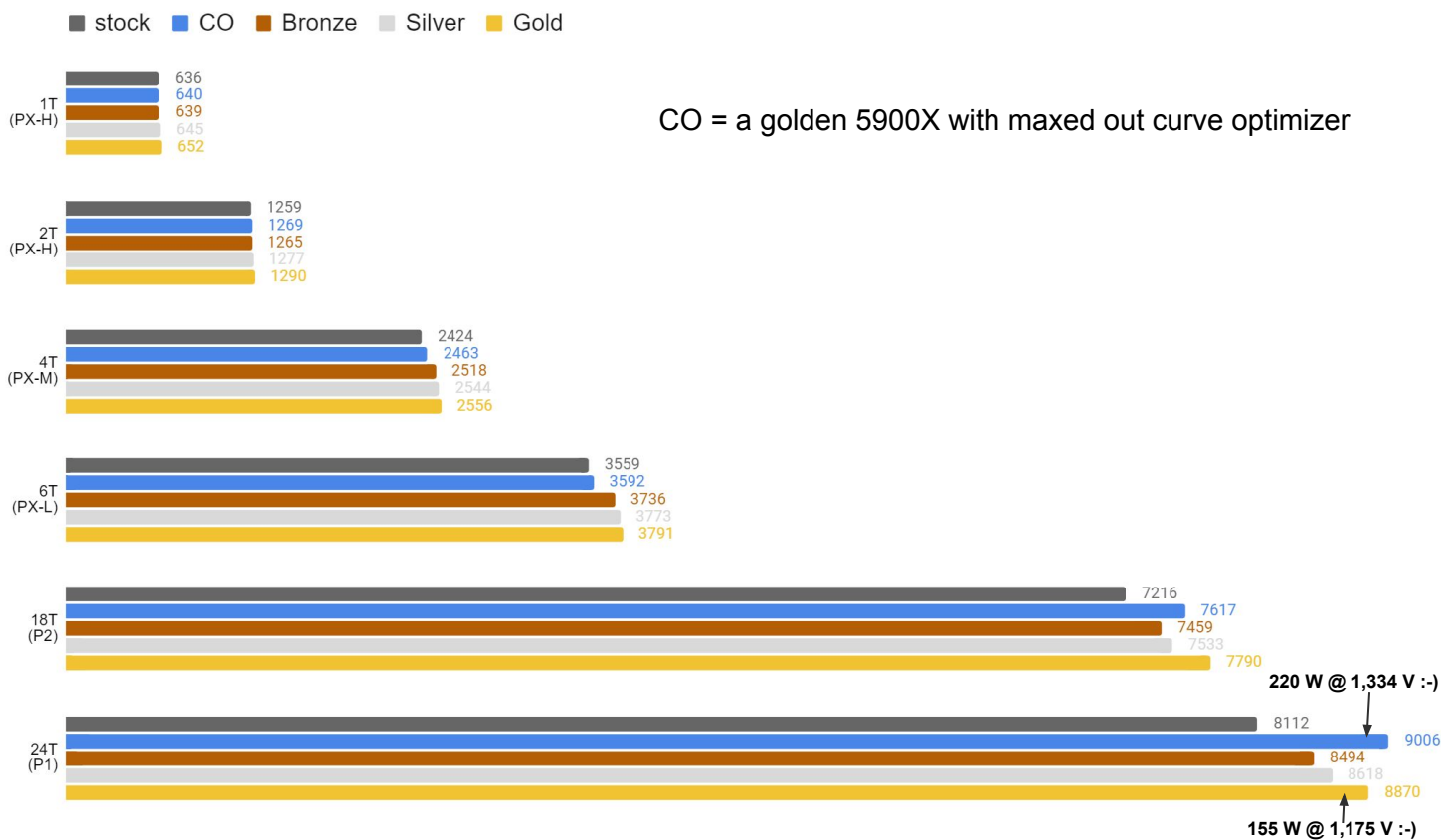
🔥 CTR Guide - Another word about CPPC

The 5950X of a friend has MUCH higher CPPC values than my 5600X…!!!!

- **Yepp - fact!**

- **Does it mean anything? NO!**

- **For example the CPPC tags of 3 different 5900X:**

	#1	#2	#3
Core1	174	162	162
Core2	158	166	158
Core3	174	174	170
Core4	162	174	166
Core5	170	170	174
Core6	166	158	174
Core7	137	150	141
Core8	145	133	145
Core9	150	154	154
Core10	141	141	133
Core11	133	137	150
Core12	154	145	137

- **Do you see it?**

- **No? Ok, I will solve the "mystery"...**

- **The CPPC tags are ALL the same, just in a different order!**

- **You don't believe me? Try it - sum up all of the values for each CPU. It will always be 1864.**

  CPPC tags of a 5600X: 125-140
  CPPC tags of a 5950X: 149-212

- **Does it mean the worst 5950X core (149) is even better than the best of the 5600X (140)? NO IT DOESN'T**

- **It's just a mark for Windows scheduler and says NOTHING AT ALL about performance or boost capability!**

🔥 CTR Guide - Another word about categories

- So we are talking about a difference of 0,9 - 1,2 % (bronze / silver) or 1,5 - 4,4 % (bronze / gold)

- For example even with a bronze 5900X you are constantly over stock performance by a good amount

- And you are practically on par with the values of a golden 5900X with maxed out curve optimizer.

- If you think this (IMO) negligible differences are worth the effort, then please play it fair and sell you sample to the private market and buy another one.

Don't RMA it…

…tune it properly...

...but don't be that guy!

🔥 CTR Guide - Fighting the droop :-)

Hello?!? I still lost the lottery!!! What can I do?

- **Yeah we can do something about this**

- **WARNING: If you do not know what LLC by general is and what Vdroop is for: Please watch buildzoid's great videos**

LLC ->

and Vdroop ->

- **Activate your P1 profile and start an all core Cinebench run while you watch the tuner page of CTR.**

- **It's about those two values:**

| CPU TEL (V) | 1.156 | CPU VID (V) | 1.175 |

- **After watching the videos I recommended, you know about Vdroop!**

- **So here we have CPU VID of 1175 mV and a CPU TEL of 1156 mV (which is the voltage that the processor effectively gets). To calculate the droop you can go like this:**
  (VID / TEL - 1) * 100
  1175 / 1156 (= 1,016) - 1 (= 0,16) * 100 = 1,6

- **So your Vdroop is 1,6 %**

🔥 CTR Guide - Fighting the droop :-)

> Good! I have droop, you have droop… And now?!?

- **We can compensate the droop!**

- **So we got 1,6 % and now we can calculate the higher CPU VID value we have to set to get effectively 1175 mV to our CPU.**

- **Because you watched the videos I have not to tell you, that it is absolutely not dangerous for your cpu, or? :-)**

- **1175 mV * 1,6 / 100 ~ 19 mV**

- **Add this to 1175 mV -> 1194 mV**

Please use this method only for P1 and P2! NOT for PX!!!

- **Use this as your new P1 voltage**

- **REMEMBER: Do not use my values - calculate your own!!!**

- **Run Cinebench all core again and watch the voltage readings! Now it should look like this:**

  CPU TEL (V) **1.174** (+/- 5 mV is OK!)

- **Now it's time for another tune!**

- **To keep the tuning duration short raise you P1 frequency by 25 Mhz**

- **Dig out your diagnostic recommendation of P1 or run another diagnostic.**

- **Enter the new calculated voltage in** Reference voltage (mV) Reference frequency (MHz) **set your and click tune!**

🔥 CTR Guide - Fighting the droop - Ahhhhhhhh...

| CPU TEL (V) | 1.182 |
| CPU VID (V) | 1.194 |

Running a CTR stability check - NOW MY CPU GETS MORE VOLTAGE - IT SHOULD BE 1175!!!

DON'T PANIC
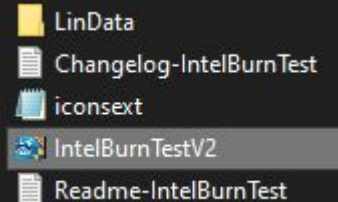
- **This is absolutely normal! The Vdroop is mainly depending on the amount of threads that are used and the intensity of the load.**

- **An example of a "constant" type of load: Cinebench 1T-6T, but different amounts of cores**

- **An example of a "constant" amount of threads: all core usage, but different intensity of load**

Chart values (% Vdroop):
- Cinebench 1T: 0,14%
- Cinebench 2T: 0,42%
- Cinebench 4T: 0,42%
- Cinebench 6T: 0,70%
- CTR stability test 24T: 1,01%
- Cinebench 24T: 1,96%
- Prime95 SSE 24T: 2,20%
- Prime95 AVX2 24T: 2,89%
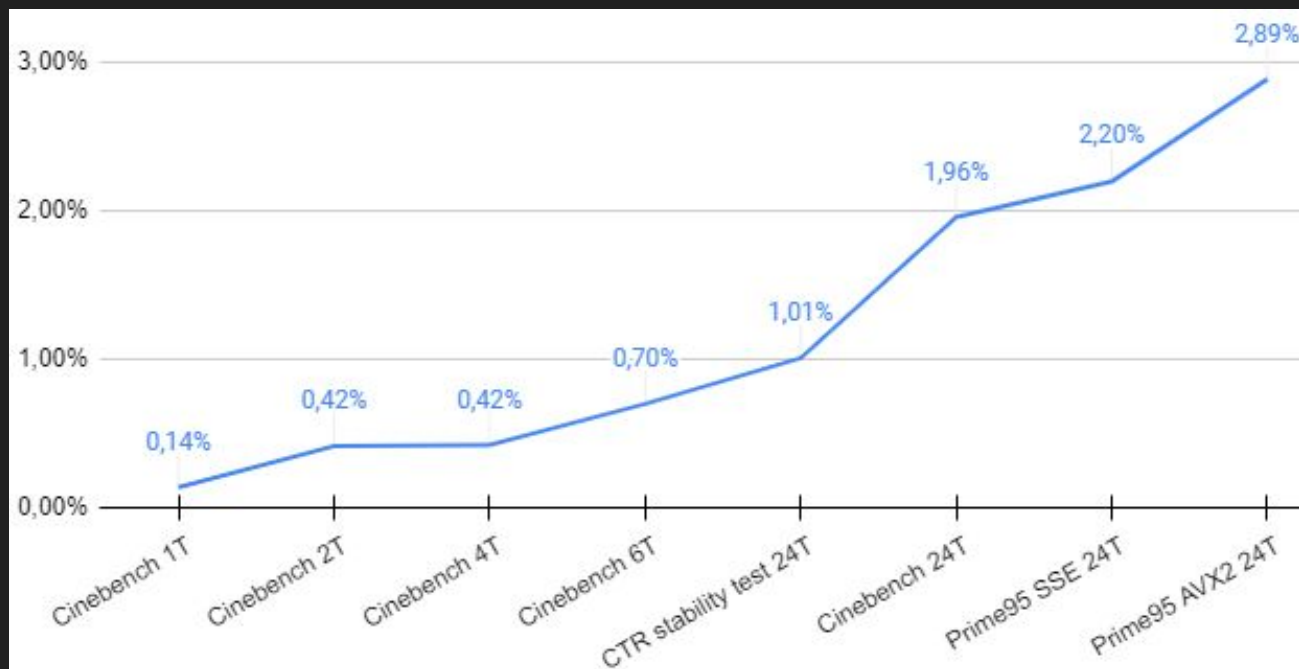
If you are unsure, just repeat the Cinebench run. This is our benchmark for calibrating the Vdroop. If it is unchanged in Cinebench, then everything is fine!

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🔥 CTR Guide - Stability testing the PX Profile

- **I didn't like the results when testing with OCCT. On the one hand the frequencies achieved are extremely reliable in terms of stability but on the other hand they are also low. You won't encounter a load in daily usage that is similar to PX testing with OCCT.**

- **In addition OCCT is not using the CPPC tags -> therefore you have to manually set which cores to test.**

- **There is a solution that will take a little longer than OCCT. It will be not as reliable as it (IMO we are talking about 99% stable VS 100% stable), but way more comfortable to use.**

- **We will be testing with a combination of Intel burn test .**
  (Intel?!? -> it's only a name)

- **At first, download IBT**

- **Unpack the file to a folder you want.**

- **Open IBT by clicking**

  LinData
  Changelog-IntelBurnTest
  iconsext
  IntelBurnTestV2
  Readme-IntelBurnTest

- **Now all you have to do is to change to following settings:**
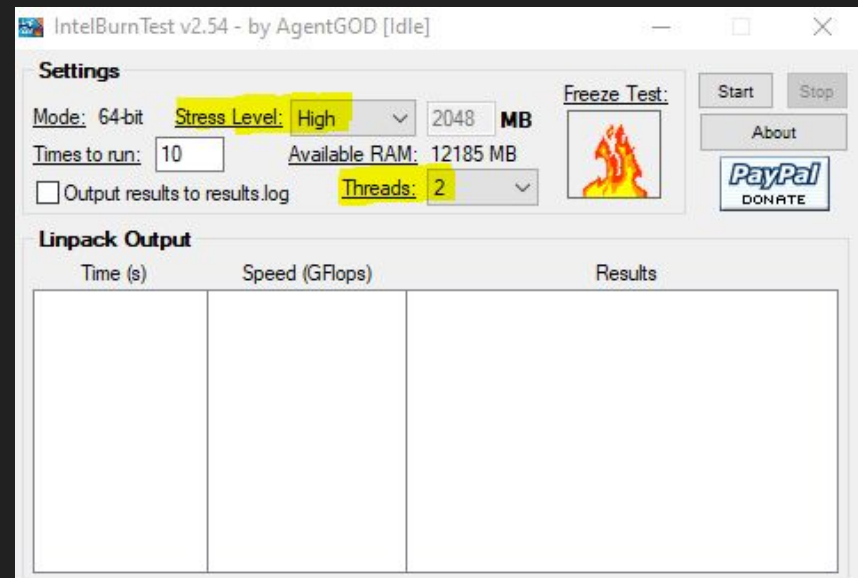
🔥 CTR Guide - Stability testing the PX Profile

- Didn't I say it would be comfortable? :-)

- IBT will now start to test your PX High profile. And because it uses the CPPC tags of you CPU, there is no need to select the cores manually.

- Make sure that "active profile" of CTR is showing the corresponding profile which you want to test.

- I recommend to test each PX profile for around 15 min. To do so, you have to change the "Times to run" value
  - PX High   2T test - 10 runs
  - PX Mid   4T test - 20 runs
  - PX Low   6T test - 30 runs
  - PX Low   8T test - 40 runs
    (8T only for 5800X / 5950X)

- Here is what IBT will show when the first of 10 runs of a 2T test is completed.
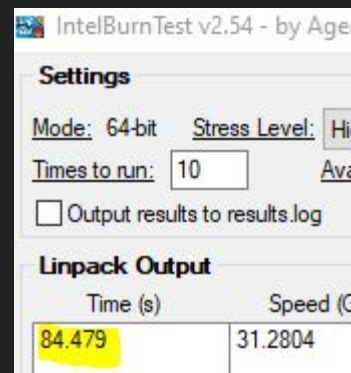
- You can test all PX profiles like this. Just change the amount of threads you want to test!

- To test more / longer you can experiment with the stress level and the amount of runs. (Lower stress level = lower chance to catch a instability)
- For example
  - 1h 2T test at high =   40 runs
  - 1h 2T test at very high =   14-15 runs
  - 1h 4T test at very high =   27-28 runs

🔥 CTR Guide - Stability testing the PX Profile

- **What will be the feedback of IBT and what to do with it?**
  You will get up to four different kinds of it!

Success ➡️
> Success! Your system was able to maintain its stability while running IntelBurnTest. This is usually an indication that your CPU is fully stable, if at least tested with the "Standard" stress level. If you are testing with memory size below Standard,
> please re-test with "Standard" or higher stress level.

Warning ➡️
> WARNING! Your system was found to be unstable under IntelBurnTest!
> Please check your cooling system and/or lower your overclock! You
> may or may not encounter instability while working with other pro-
> -grams, but failing this test indicates that your CPU cannot main-
> tain stability (produce correct results) in all situations!

Blue screen ➡️ Could be that a WHEA error got logged in event viewer

Black screen ➡️ Too high PX frequency (by a lot)

🔥 CTR Guide - Stability testing the PX Profile

Test

Success → Rise PX frequency by 25 Mhz

Warning → Decrease PX frequency by 25 Mhz

Blue screen → Decrease PX frequency by 25 Mhz

Black screen → Decrease PX frequency by 50 Mhz
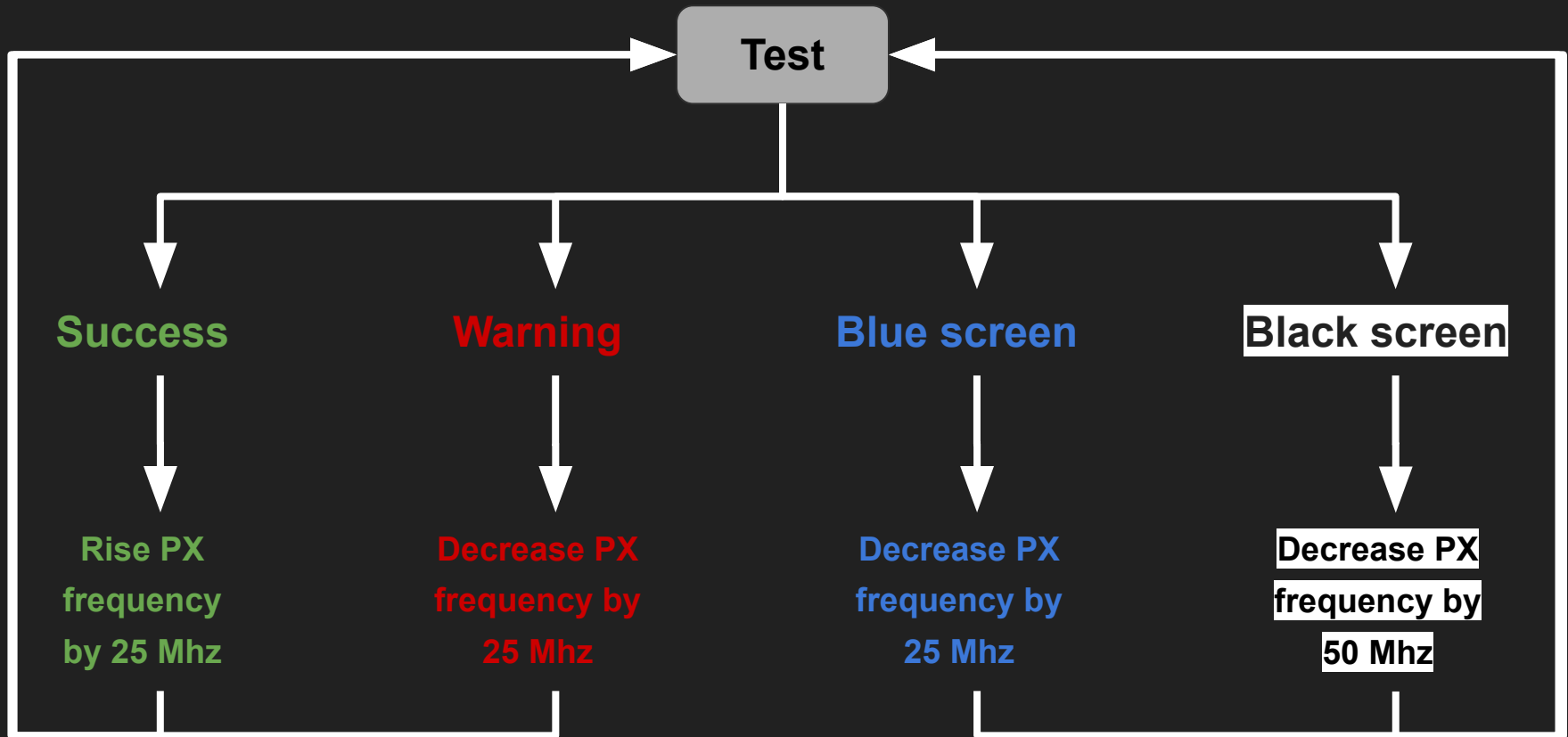
🔥 CTR Guide - Tweaking P1 + P2 profile

- **If you are not happy about the performance of your CPU you can rise the voltage and therefore the frequencies.**

- **Keep in mind:**
  - **Higher voltage = Higher temps**
  - **Higher frequency = Higher temps**

- **So have an eye on your temperatures. If you already reaching 80+ degrees with the voltage level CTR recommends by default, I wouldn't recommend to rise the voltage any further.**

- **The voltage levels CTR recommends are meant to allow the CPU to reach quite a bit more performance than stock while staying at a "super safe" level.**

- **If you want more performance you have to leave "super safe" regions and you have to enter into "safe only" regions.**

- **What is considered to be safe? If you ask 5 people, you will get 6 different answers about safe voltages.**

- **For one more than 1,30 V will definitely destroy your CPU within milliseconds. For others 1,35+ V is still fine.**

- **In my opinion (!) safe is what AMD is using at stock. They are using a lot more voltage than a chip actually needs. We can use this margin.**

- **Therefore let's have a look at the voltage level of each CPU while it is at stock and compare it with the recommended voltages of CTR.**

🔥 CTR Guide - "Safe" voltages 5600X

- **The 5600X is a special case because the poor CPU is hold back by AMD. Presumably to keep the distance to the 5800X, because a "unlocked" 5600X would come dangerously close to a 5800X in low threaded loads.**

- **As you can see, the stock voltage at low threads is kept artificially low because it only has to reach 4650 Mhz.**

- **If you let the CPU do what it can, you would certainly see similar voltages as with the 5800X. There are enough 5600X out there, which are reaching the same PX frequencies as a 5800X.**

5600X: stock voltage VS PBO voltage VS "CTR voltage"

Legend: stock voltage — without power limits — 5800X for example — CTR voltage
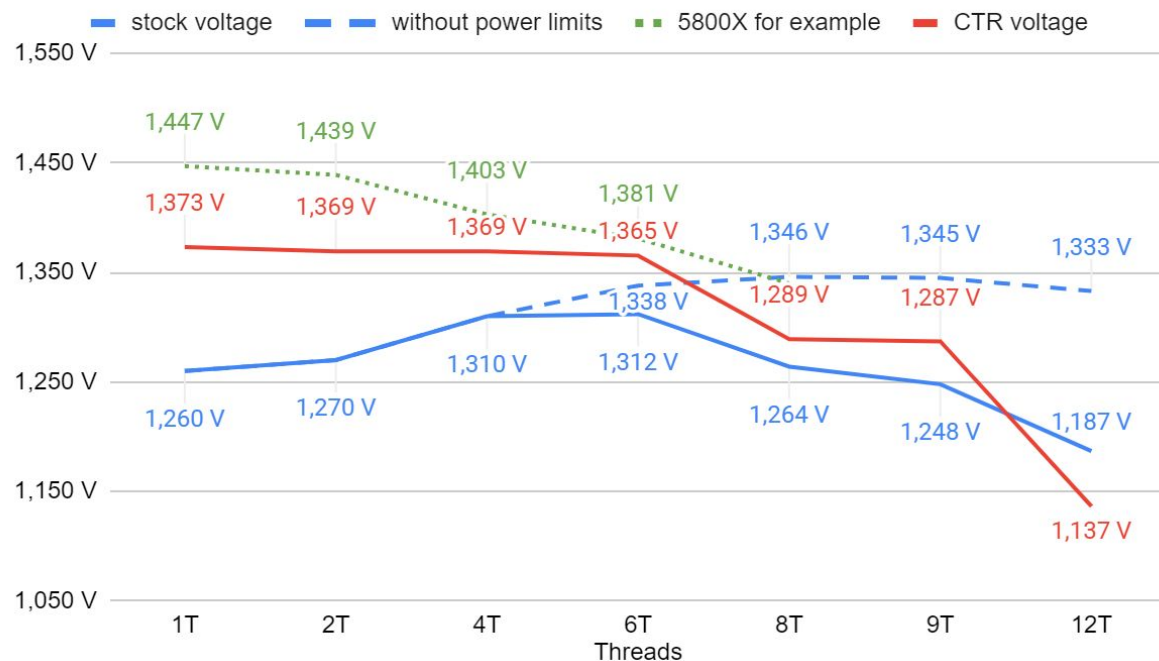
- **The high threaded voltage level is basically the same. If you unlock the power limits in BIOS you see very similar voltages as a 5800X.**

- **My opinion of safe voltages:**
  - **P2 -> up to 1,350 V (CPU TEL)**
  - **P1 -> up to 1,275 V (CPU TEL)**

🔥 CTR Guide - "Safe" voltages 5800X

- **Using the example of a 5800X, you can clearly see that this CPU is not held back in the low thread area and that it makes perfect use of the power limit.**

- **As it turns out, the 5800X doesn't really take advantage of overriding the power limits.**

- **You can see that CTR's voltage curve is designed to be very conservative, as always. "Safety first!"**

- **That gives us some leeway to increase the voltage**

- **But keep an eye on your temperature. Because of its design, the 5800X is the hardest-to-cool processor in the Zen3 family**
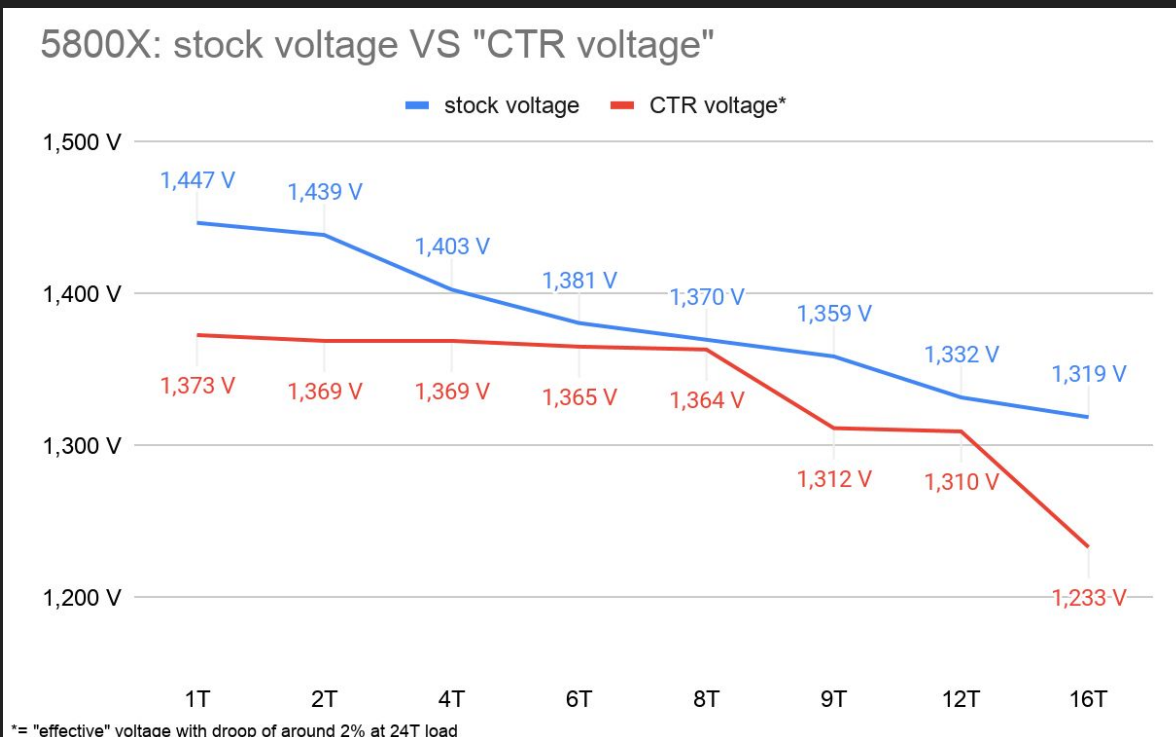
5800X: stock voltage VS "CTR voltage"

stock voltage — CTR voltage*

	1T	2T	4T	6T	8T	9T	12T	16T
stock voltage	1,447 V	1,439 V	1,403 V	1,381 V	1,370 V	1,359 V	1,332 V	1,319 V
CTR voltage*	1,373 V	1,369 V	1,369 V	1,365 V	1,364 V	1,312 V	1,310 V	1,233 V

*= "effective" voltage with droop of around 2% at 24T load

- **My opinion of safe voltages:**
  - **P2 -> up to 1,350 V (CPU TEL)**
  - **P1 -> up to 1,275 V (CPU TEL)**

🔥 CTR Guide - "Safe" voltages 5900X

- Now we take a look at the 5900X.

- This CPU uses the same power limit of 142 W as a 5800X.

- So it is another CPU which is hold back.

- The throttling starts quite early with 8 threads (see the dashed line)

- When you allow the 5900X to receive the power and the voltage the CPU wants it can consume up to 200-220 W.

- While the motherboard power limits are active all of the CPU safety features are still active, so it will only pull the voltage that its thinks it is safe.

5900X: stock voltage VS stock (mb limits) VS "CTR voltage"

Legend: — 5900X stock limits   - - 5900X motherboard limits   — CTR voltage*

	1T	2T	4T	6T	8T	9T	12T	16T	18T	24T
5900X stock limits	1,481 V	1,470 V	1,436 V	1,411 V	1,394 V	1,368 V	1,293 V	1,246 V	1,224 V	1,155 V
5900X motherboard limits				1,405 V	1,398 V	1,384 V	1,367 V	1,354 V	1,347 V	
CTR voltage*	1,373 V	1,369 V	1,369 V	1,365 V	1,264 V	1,262 V	1,260 V	1,258 V	1,256 V	1,152 V

*= "effective" voltage with droop of around 2% at 24T load
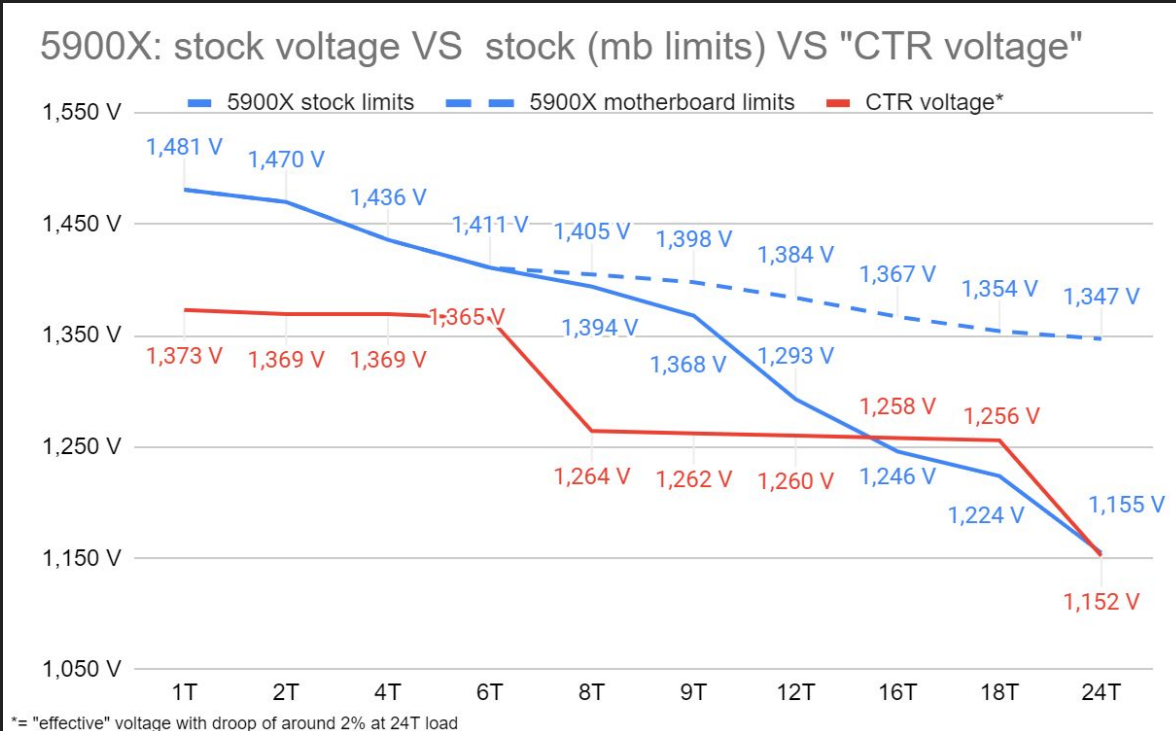
- CTR follows the factory voltage curve, so in the case of the 5900X we have a lot of leeway in terms of voltage.

- My opinion of safe voltages:
    - P2 -> up to 1,325 V (CPU TEL)
    - P1 -> up to 1,250 V (CPU TEL)

- But remember, cooling 12 cores at 1,250 V can already be a challenge for a mediocre cooling solution

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🔥 CTR Guide - "Safe" voltages 5950X

- **It is the turn of the 5950X.**

- **This CPU uses the same power limit of 142 W as a 5800X.**

- **So it is another CPU which is massively hold back by power limits. Even more than a 5900X because if its 4 additional cores.**

- **The throttling starts quite early with 8 threads (see the dashed line)**

5950X: stock limits VS stock (mb limits) VS "CTR voltage"

Legend: — stock limits — — motherboard limits — CTR voltage*

stock limits values: 1,491 V, 1,472 V, 1,433 V, 1,422 V, 1,413 V, 1,331 V, 1,238 V, 1,185 V, 1,172 V, 1,097 V, 1,056 V

motherboard limits values: 1,408 V, 1,404 V, 1,394 V, 1,392 V, 1,391 V, 1,335 V

CTR voltage values: 1,373 V, 1,369 V, 1,369 V, 1,365 V, 1,364 V, 1,139 V, 1,137 V, 1,135 V, 1,133 V, 1,128 V, 1,030 V

X-axis: 1T 2T 4T 6T 8T 9T 12T 16T 18T 24T 32T

*= "effective" voltage with droop of around 2% at 24T load

- **When you allow the 5950X to receive the power and the voltage the CPU wants it can consume up to 230-250 W.**

- **While the motherboard power limits are active all of the CPU safety features are still active, so it will only pull the voltage that its thinks it is safe.**
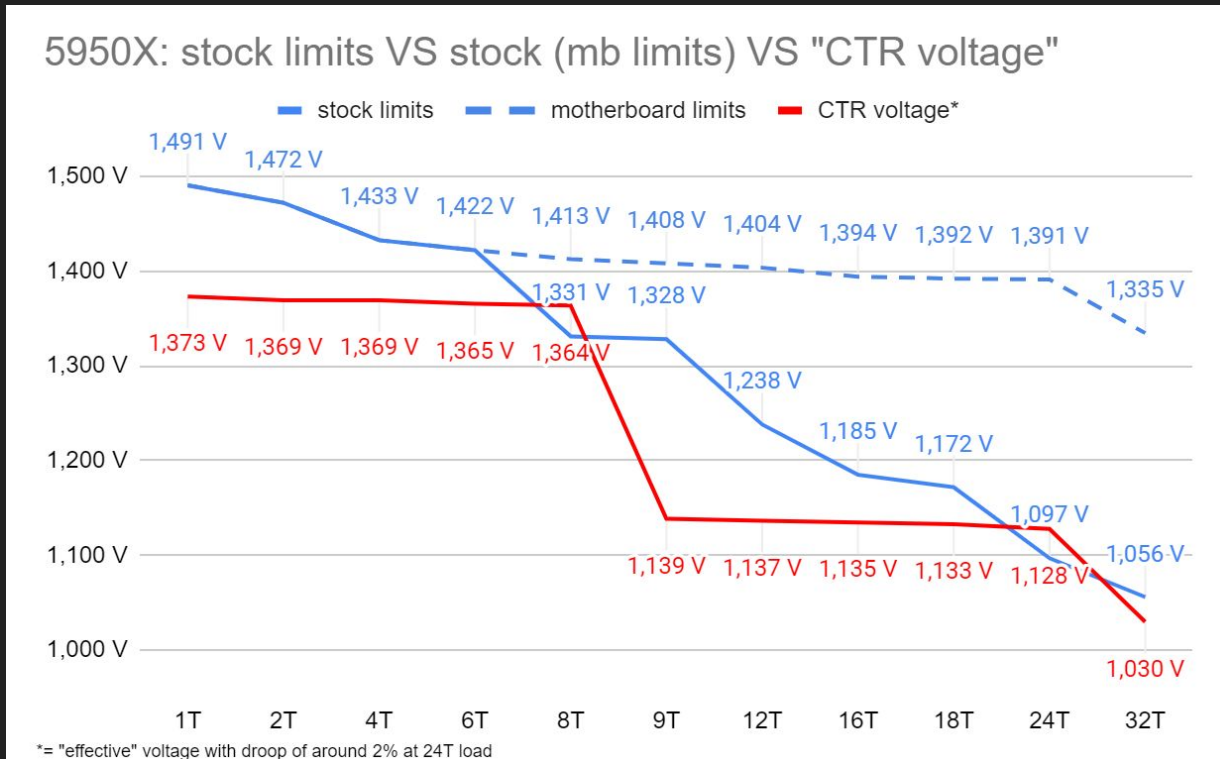
- **CTR follows the factory voltage curve, so in the case of the 5950X we have a lot of leeway in terms of voltage.**

- **My opinion of safe voltages:**
  - **P2 -> up to 1,300 V (CPU TEL)**
  - **P1 -> up to 1,225 V (CPU TEL)**

- **But remember, cooling 16 cores at 1,225 V can already be a challenge for a mediocre cooling solution**

🔥 CTR Guide - "Safe" voltages summary

- So here are my opinions of safe voltages for each CPU

CPU	P2	P1
5600X	1350 mV	1275 mV
5800X	1350 mV	1275 mV
5900X	1325 mV	1250 mV
5950X	1300 mV	1225 mV

- All you have to do with is to enter these voltages in the voltage entry for your profiles (on profile page) and run a new diagnostic. CTR will suggest a new set of frequencies.

- Or you can enter them on the tuner pager in "reference voltage" and run a tuning, which will be a little more accurate than the calculations during diagnostic.

- As I mentioned before, look after your temperatures. A slight bump in voltages can have a huge impact on temperatures. Especially when you are already near the temperature limit with the default recommended voltages.

🔥 CTR Guide - Finetuning PX and P2

- In some cases it can be beneficial to fine tune the P2 trigger.

- For example my 5900X can reach up to 4975 Mhz on PX Mid and up to 4900 Mhz on PX Low.

- PX Low = 6 Threads = all of the physical cores of the CCX1

- The PX profile calculation is based on the weakest core of the group. So in my case the cores 1-5 are able to reach 4975 Mhz (same as PX Mid), but my core 6 only can reach 4900 Mhz. So my PX Low profile will be limited to 4900 Mhz.

- You can counter this behavior by changing the P2 trigger.

- Per default the trigger is set to 30%. This means if the CPU utilisation is equal or greater than 30% P2 will be activated instead of PX Low.

- 5900X = 24 Threads x 30% = 7,2 Threads. (One thread in "reserve" for not constantly switching between PX Low and P2)

- To make CTR to ignore my weak 6th core i set the trigger to 25%. So anything equal or greater than a 6 thread load will switch to P2, which is set to 4850 Mhz for CCX1.

- Now I can set my PX Low to 4975 Mhz. So I gained 75 MHz on 5 5hreads and lost 25 Mhz on 6 threaded loads.
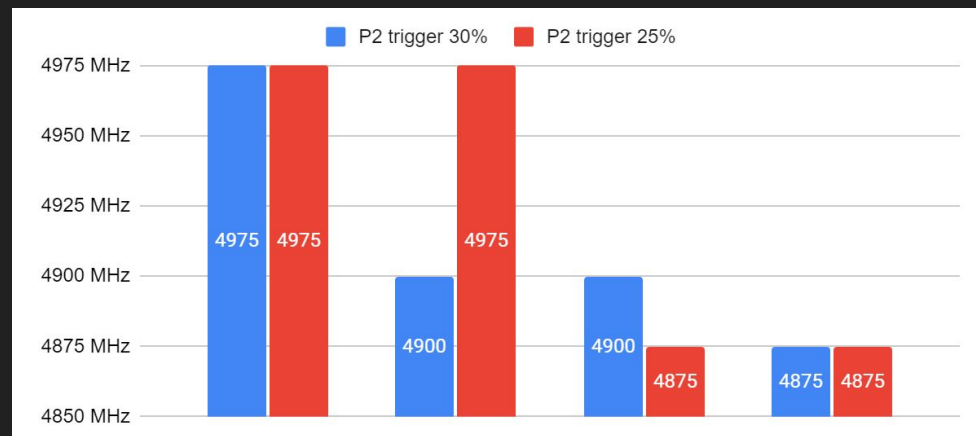
🔥 CTR Guide - Stress test the profiles for heavier tasks

- Right now CTR is calculation or tuning the frequencies for the usage at AVX light scenarios.

- If you are not only playing games but also doing some rendering or other heavier tasks you will need to stress test your P1 + P2 profiles.

- For rendering for example I recommend blender and the classroom scene.

- If it survives a intensive run like this, it will high likely be stable on other heavy tasks like encoding.

- I prefer blender because it is very sensitive of instabilities and in 99% of cases blender will simply crash -> close itself rather then crashing the whole PC.

- Of course you can stress test your PX profiles too. But in my opinion you won't encounter a load scenario like blender running on only 2-6 threads in daily usage. But of course if you want even more stability from your PX profiles it doesn't hurt to throw some rendering at them.

- At first download

- After downloading it, install blender

- And of course you need the demo file of the mentioned classroom scene:

🔥 CTR Guide - Stress test the profiles for heavier tasks

- **After the installation of blender, you simply have to double click the classroom scene file to open it.**

- **Under "render properties" (which should be selected by default) on the right side select "Performance"**

- **Change "Threads Mode" from "Auto-Detect" to "fixed"**

- **Afterwards you can select the amount of threads which are used for the render process**
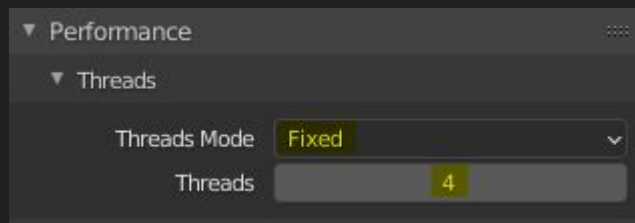
- **On the bottom of blenders window you can select the amount of frames to be rendered.**
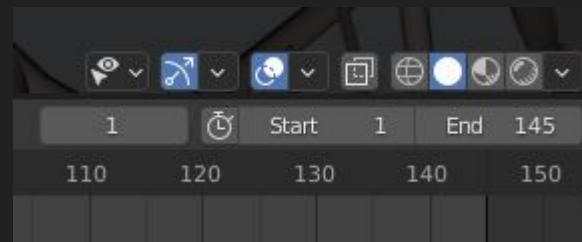
- **As it is now, all of the 145 frames would be rendered which takes almost 11 hours on a 5900X…**

- **On the next page I will explain which scenario will roughly take which time.**

- **To start to render a single frame press F12**

- **To start to render all selected frames press CTRL + F12**

🔥 CTR Guide - Stress test the profiles for heavier tasks

- The duration of a render run is dependant of the amount of threads and the frequency.

- As a rough estimation it will take the following time to complete <u>one frame</u> of the classroom scene (all threads used):
    - 5600X ~ 9,5 minutes
    - 5800X ~ 7,0 minutes
    - 5900X ~ 4,5 minutes
    - 5950X ~ 3,5 minutes

- A rough estimation for low thread runs (PX testing) for one frame is the following:
    - 1 thread   ~ 70,0 minutes
    - 2 threads ~ 35,0 minutes
    - 4 threads ~ 17,5 minutes
    - 6 threads ~ 11,5 minutes
    - 8 threads ~ 8,75 minutes

- So you want to test your P1 profile for 1h. For this we will use blender to render not only one frame, but several in a animation.

- As an example a 1 hour run for a 5900X

- For rendering for at least one hour you have to select the following amount frames:
    - 5600X ~ 7 frames
    - 5800X ~ 9 frames
    - 5900X ~ 14 frames
    - 5950X ~ 18 frames
    - for PX testing:
        - threads = frames

🔥 CTR Guide - BSOD - how to know which core crashed

- **If you are struggling with instability, whether it is PX, P2 or P1 and you encounter a BSOD (Blue screen of death) chances are high that windows will log it.**

- **To check if, go to your "windows event viewer" (just search in the field near to windows logo after "event").**

- **Go to Actions and click Create Custom View**
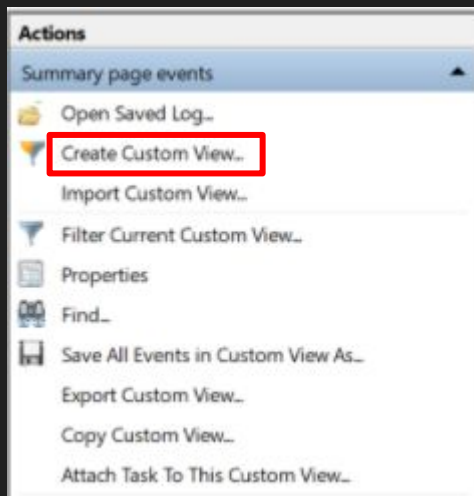
- **Enter / change these values in the new window**
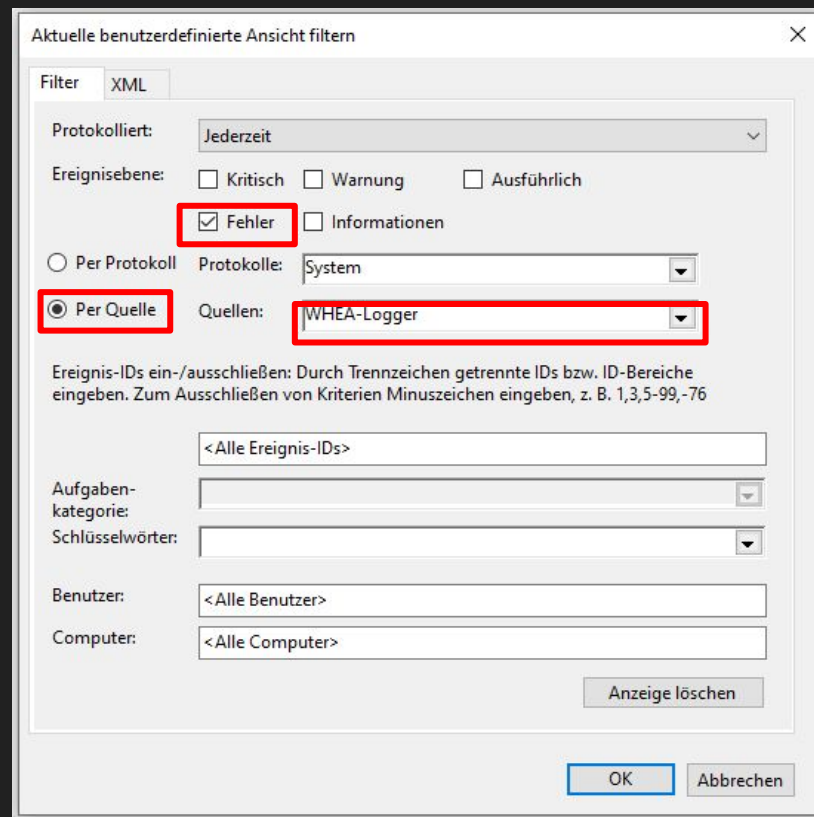
(sorry - I only got it in german…)

All you have to change is checking "errors" and checking "by source" and select WHEA-Logger and click ok!

🔥 CTR Guide - BSOD - how to know which core crashed

- **Back to the main window of the event viewer you will see under custom views your created view. (You can right click it and rename it if you want)**

- **Now open this new view!**
  What's exactly in there is not that important, cause we are looking for this:

- **Processor-APIC-ID: 17…**
  This is telling us that the thread with the APIC-ID 17 was the cause of the BOSD. All clear? :-)

- **To make sure AMD / windows doesn't screwed the relationship of thread number and APIC-ID you can use CPU-Z to get this information.**

- **Open CPU-Z, got to About-slide and click on "Save Report (.HTML)**
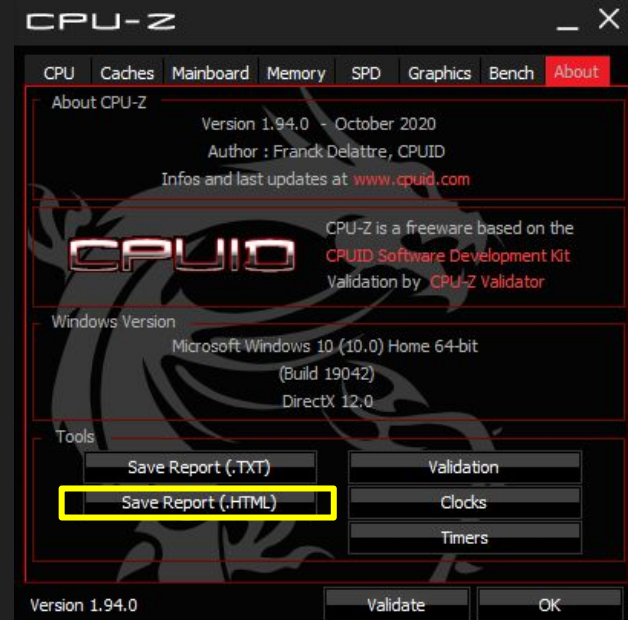
🔥 CTR Guide - BSOD - how to know which core crashed

- Open the created CPU-Z report (under documents by default) and you will see this:

```
APICs
--------------------------------------

Socket 0
        -- Node 0
                -- CCX 0
                        -- Core 0 (ID 0)
                                -- Thread 0      0
                                -- Thread 1      1
                        -- Core 1 (ID 1)
                                -- Thread 2      2
                                -- Thread 3      3
                        -- Core 2 (ID 2)
                                -- Thread 4      4
                                -- Thread 5      5
                        -- Core 3 (ID 3)
                                -- Thread 6      6
                                -- Thread 7      7
                        -- Core 4 (ID 4)
                                -- Thread 8      8
                                -- Thread 9      9
                        -- Core 5 (ID 5)
                                -- Thread 10     10
                                -- Thread 11     11
                -- CCX 1
                        -- Core 6 (ID 8)
                                -- Thread 12     16
                                -- Thread 13     17
                        -- Core 7 (ID 9)
                                -- Thread 14     18
                                -- Thread 15     19
                        -- Core 8 (ID 10)
                                -- Thread 16     20
                                -- Thread 17     21
                        -- Core 9 (ID 11)
                                -- Thread 18     22
                                -- Thread 19     23
                        -- Core 10 (ID 12)
                                -- Thread 20     24
                                -- Thread 21     25
                        -- Core 11 (ID 13)
                                -- Thread 22     26
                                -- Thread 23     27
```

- So in our example it was APIC-ID 17 which has crashed. Now we see that it is the second thread of Core 6 -> in CTR it would be named as Core 7 (starting to count at 1 instead of 0).

- For example - you were stress testing all cores (P1) with programm XYZ - now you know that it was CCX2 which failed. So I would lower the frequency of CCX2 by 25 Mhz and try again to provoke this kind of failure.

🔥 CTR Guide - Thermal impact of SoC voltage

- After much testing with the tools mentioned in the memory stability testing section of this guide, I was thinking of a optimization of the SoC voltage.

- As recommended it was set to 1,150 V.

- After completing (!) to setup CTR to your wishes you can use these tools to test how much you can lower your SoC voltage. Start with a decrease of 25 mV and have a look on hwinfo's WHEA counter.

- Will it have an effect on power consumption and even temps? Yes, it will - assuming you are able to lower the SoC voltage while keeping the system stable. (Depends heavily on the silicon quality of your IOD and the FCLK frequency you are using)

- As with my CPU sample in general, I was very happy to find out, that even with a SoC voltage of only 1,025 V my system is fully stable as with 1,150 V. (FCLK 1900 Mhz)

SoC Power Consumption

	SoC 1,200 V	SoC 1,100 V	SoC 1,025 V
Cinebench R20	19,6	16,1	13,8
Aida64 cache+mem	22,2	17,9	14,9
OCCT Linpack	23,4	18,6	15
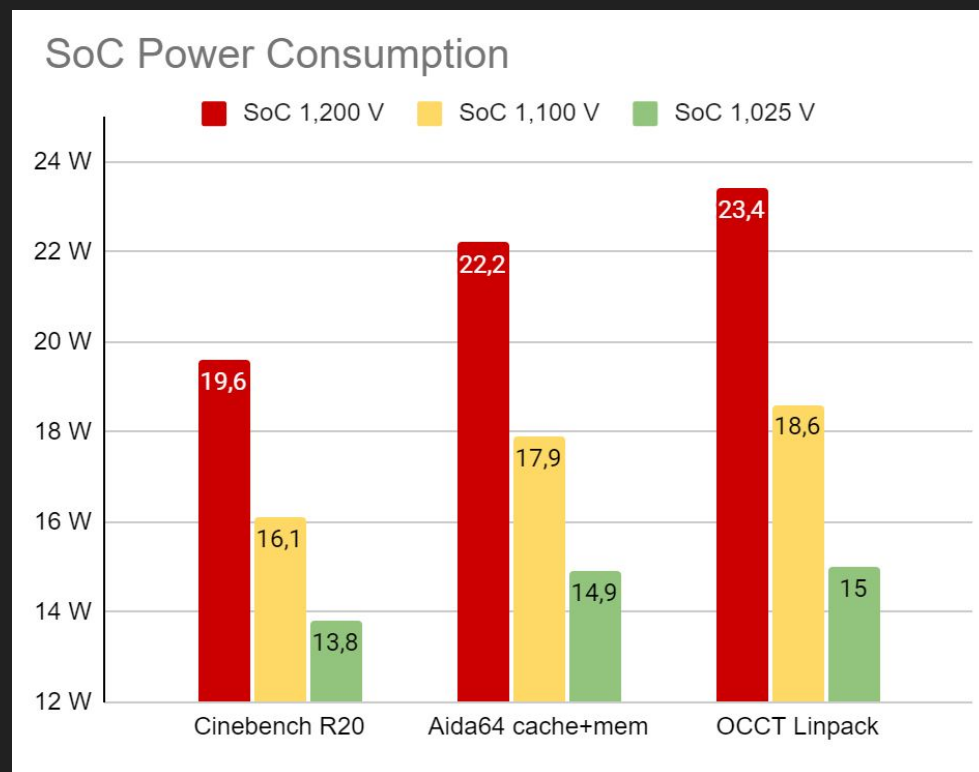
🔥 CTR Guide - Thermal impact of SoC voltage

- **Ok, to save around 6 W during a Cinebench run or even around 8 W during a run with OCCT Linpack won't save the world.**

- **But will it have an impact on temperatures?**

> 1,1 degrees less in Cinebench? Are you kidding me???

- **Yeah, isn't that much on the first look.**

- **End even on the second look a difference of 1,8 % is not impressive at all.**

- **But when you assume the following…**
  - **my cooling is not that regular (1260 mm rad = 9x140 mm)**
  - **our hotrunner, a 5800X at stock consumes up to 142 W during a Cinebench run**
  - **5,8 W difference is around 4% of the whole PPT budget of a 5800X**

- **… you could be interested to test it on your own. Especially when you have a hot running CPU under your cooler or you are general limited by your cooling.**

Average temperature (10 min)

Legend: SoC 1,200 V (red), SoC 1,100 V (yellow), SoC 1,025 V (green)

	Cinebench R20	Aida64 cache+mem	OCCT Linpack
SoC 1,200 V	61,5	49,5	56,1
SoC 1,100 V	61	48,9	55,3
SoC 1,025 V	60,4	48,1	54,6

90

🔥 CTR Guide - A stretchy topic...

- **After tuning as I described before, I got for example a PX High frequency of 5000 Mhz**

  + 50 Mhz? LOL! A 5900X does 1T 4950 Mhz by default!

- **Yes and no...**

  YES -> It is boosting up to 4950 Mhz with a very (!!!) light load. And yes it will show you a clock speed of 4950 Mhz during Cinebench single core bench.

  NO -> I've forced Cinebench (not a very light load at all!) to use one of the preferred cores of my CPU and run a single core bench. Here is the result of the average clock speed (effective) during the run:

  Average 4,899.7 MHz **with this it scored 632 p.**

- **With the mentioned 5000 Mhz it scored 646 points. And here is the average clock speed (effective) during this run:** Average 4,999.4 MHz

Ok, but my curve optimizer boost is up to 5050 Mhz during Cinebench 1T - I will lose performance with CTR PX High set to 5000 Mhz.

- **No, you won't. There is quite some clock stretching happening when using curve optimizer. Yeah it shows 5050 Mhz...**

- **The relation of frequency to points in Cinebench R20 single core bench is almost linear. So it is really simple to calculate with the rule of three how much points to expect with a given frequency. The CO guy above scored 640 points but he should have scored 652 points because of 5050 Mhz. What happened?**

  This: Average 4,944.6 MHz

- **Welcome to clockstrech-city!**
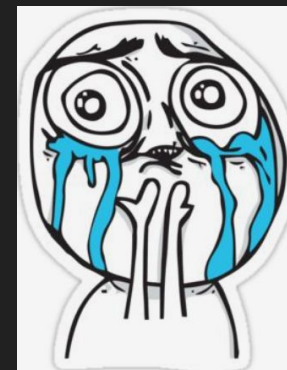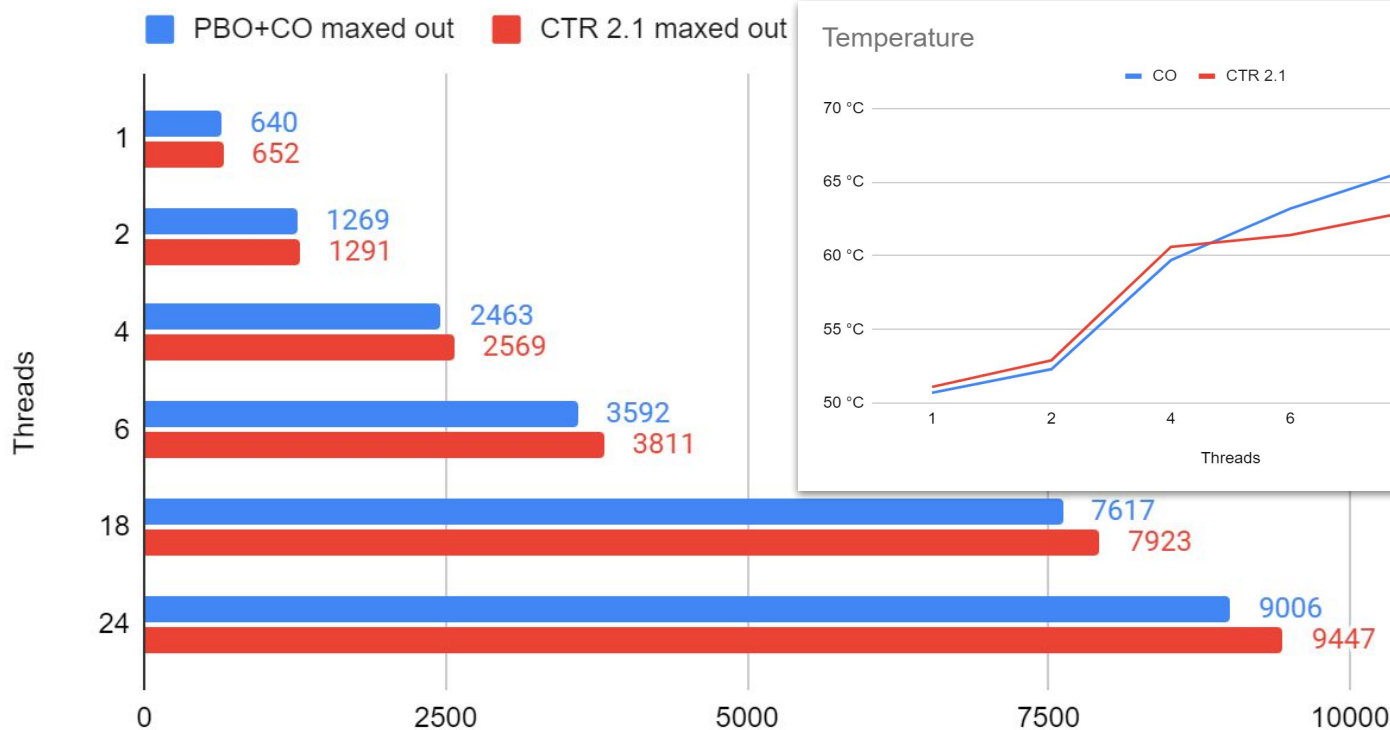
🔥 CTR Guide - Performance Mythbusting

But the experts on Reddit said also stuff like...

CENSORED CENSORED CENSORED s ago

With CTR, anything heavier than CB20 is **a risk to your processor**. And before you say "well most people don't do anything heavy, they'll be playing games etc", let me turn around and point out that **you are sacrificing single core performance with an all-core OC like this.**

There is no real benefit.

CENSORED 16 days ago

CTR didn't do as good as my manual CO tune.

So curve optimizer has more performance to offer?

Well let's bench!

Cinebench R20 performance - 5900X

■ PBO+CO maxed out   ■ CTR 2.1 maxed out

Threads	PBO+CO maxed out	CTR 2.1 maxed out
1	640	652
2	1269	1291
4	2463	2569
6	3592	3811
18	7617	7923
24	9006	9447

Temperature

— CO   — CTR 2.1

🔥 CTR Guide - Performance Mythbusting

Rendering?
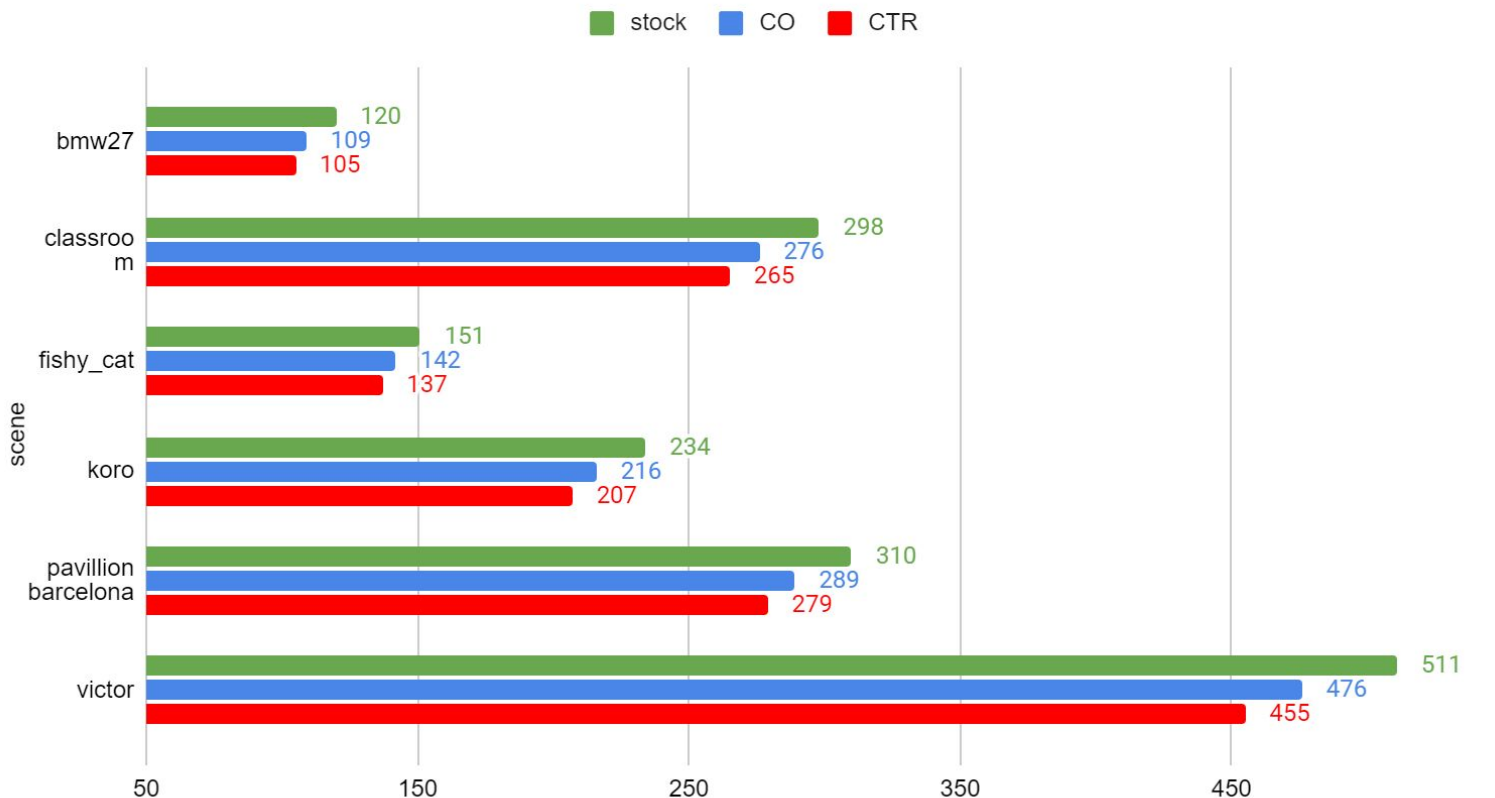
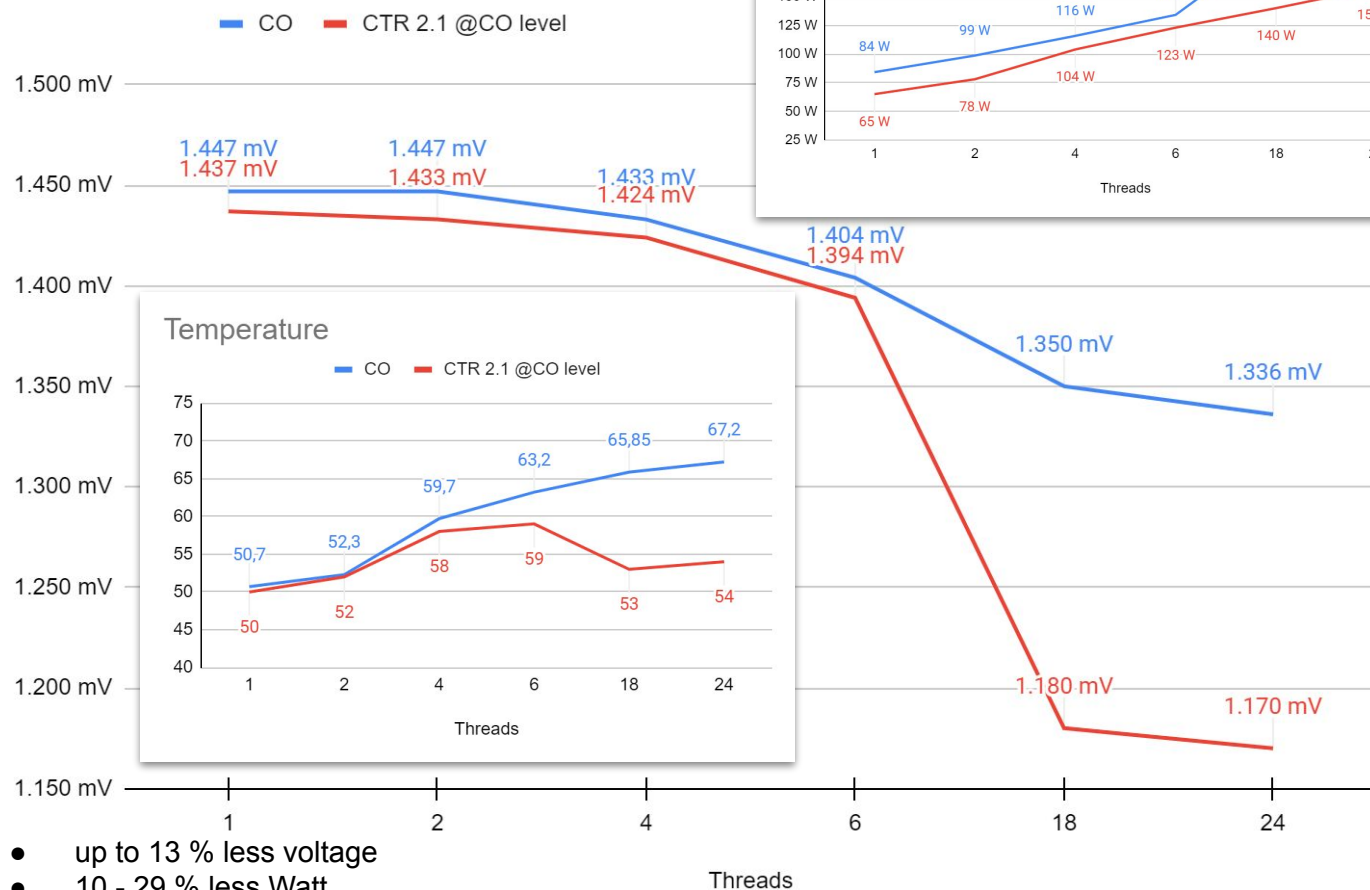# 🔥 CTR Guide - And again, Voltage Mythbusting

> But it will use more voltage to keep up with a probable tuned PBO + CO!!!

- **… NO!**

- **To keep up with PBO + CO I configured CTR to match the CO clock speeds and Cinebench points for each scenario (as before against stock)**

CTR at CO performance level

Power consumption

Temperature

- up to 13 % less voltage
- 10 - 29 % less Watt
- up to 19 % less temperature

🔥 CTR Guide - The last word...

Please keep in mind that CTR is constantly being developed.

When I think about what else Yuri has planned with it, I get dizzy. And I think he told me just a bit of it...

We should perhaps call what comes out Zen3.1usmus!

Because of the constantly development it can be that something isn't working as it should. Or your special configuration (CPU / motherboard / BIOS / …) is unique and causes you to struggle.

If it is like that, please do not hesitate to use the "problem-solving " channel of 1usmus patreon club @ discord.

There are always users online which could help.

If not - there are the "CTR Experts" (ACE, Ann Martiné, arcanazen, DayDreamer, Gadfly, rizlah and myself Riwwelorsch) who will try to help.

If that doesn't help either, there's still Yuri - but please follow these steps before you direct mail Yuri. He is putting all of his time (and more) in this project. So help yourself, don't disturb him by involving him directly in a question that can be solved by the other users or the CTR experts.

Remember - don't be that guy! ;-)

Actual build is shit!!! Gonna go back to Beta 5!