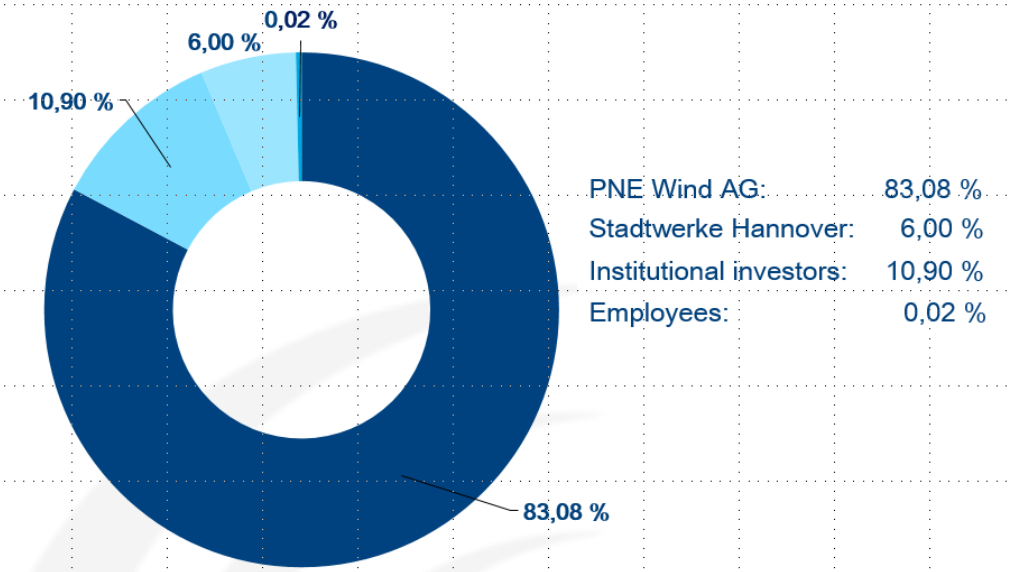
Test of CFD with Hyperthreading

Eva-Maria Nikolai and Karsten Busch

Content

- Foundation in 1990
- Fields of competence: Development, planning and construction of turn-key wind farms
- Installed output to date of around 1,250 megawatts
- 700 installed wind turbines

Location of WKN AG in Husum-based house of Future Energies



Who we are

Idea:

Speed up the calculations with hyperthreading

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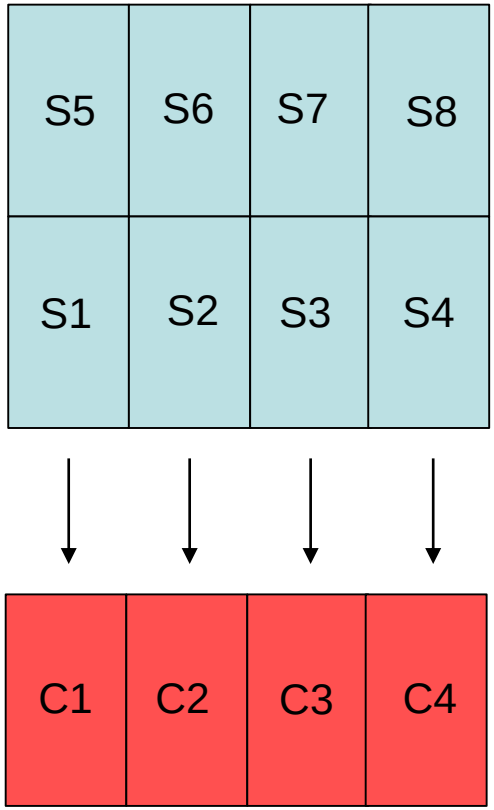
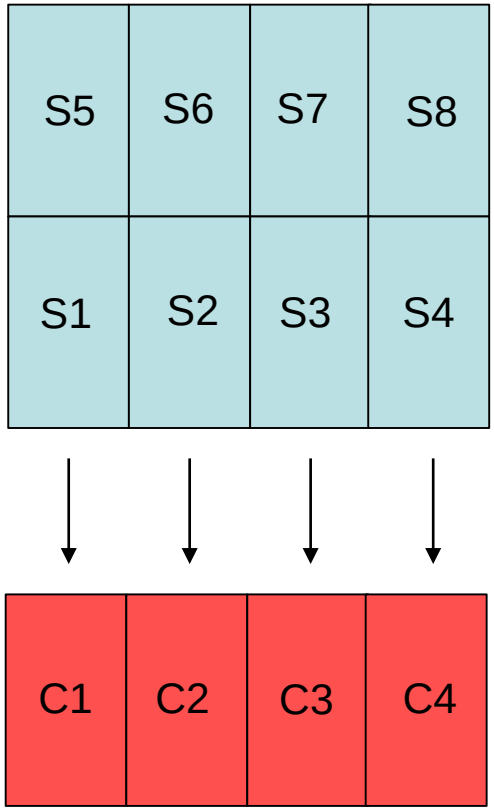
no HT

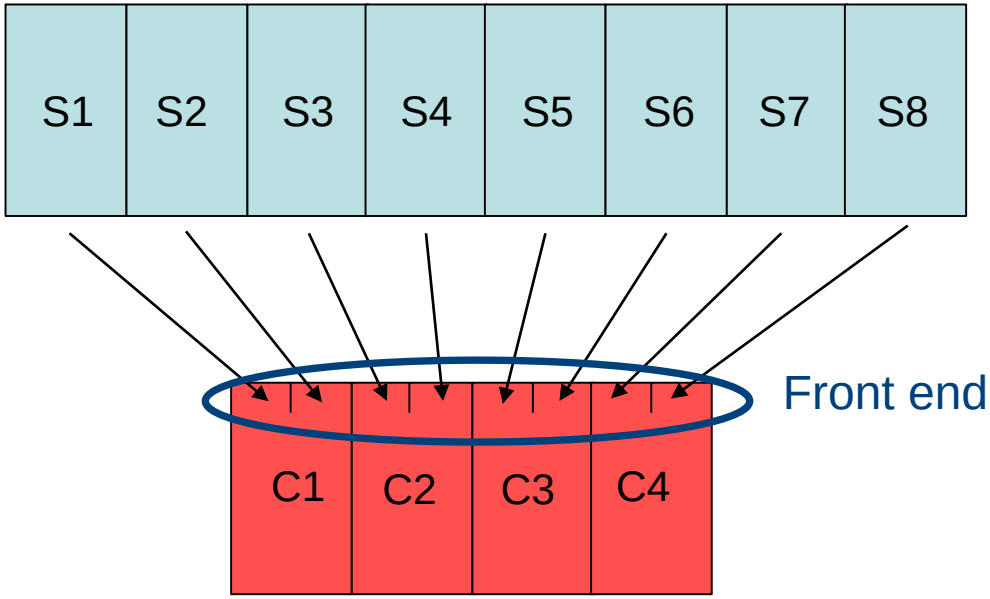


Defintion: Hyperthreading

no HT



HT (intelligent scheduling)



Defintion: Hyperthreading

Workstation - Dell Precision R5500

RAID 5 Hardware controller

Source: http://www.desktopreview.com/assets/9216.jpg (22/06/2015)

Processor #	: X5687
Intel® Smart Cache	: 12 MB
Instruction Set	: 64-bit
# of cores	: 4 (Quadcore)
# of threads	: 8
Processor base frequency	: 3600 MHz
Max. turbo frequency	: 3867 MHz (1 or 2 cores) 3733 MHz (3 or 4 cores)
Thermal design power	: 130 W
Microarchitecture	: Nehalem

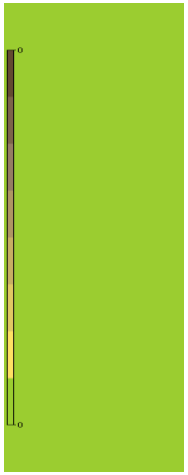
Soruce: http://pc-wholesale.ecomm-search.com/search?catalog=yhst-10634168652522&query=x5687&x=0&y=0 (22/06/2015)

- ✓ Deactivation of (process demanding) background processes (f.e. Windows Search Indexing, Antivirus-services off, Auto-Update-Services)

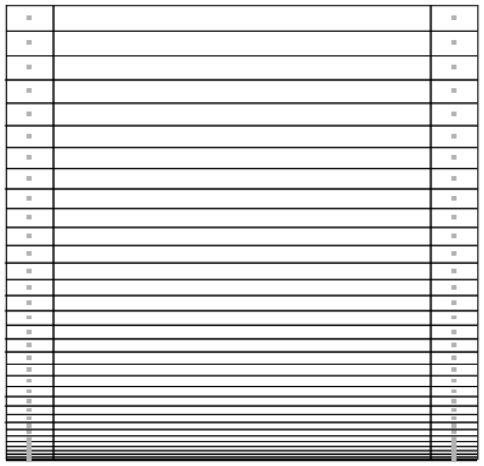
- ✓ Windows induced services limited to the essentials

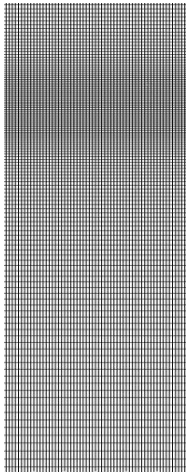
  -> Command: services.msc -> deactivation of windows updates

- ✓ WindSim 7.0 & WindSim Queue



	Min (m)	Max (m)	Extension (m)	Resolution Terrain Data (m)
Easting (m)	0.0	2000.0	2000.0	10.1
Northing (m)	0.0	9000.0	9000.0	10.0

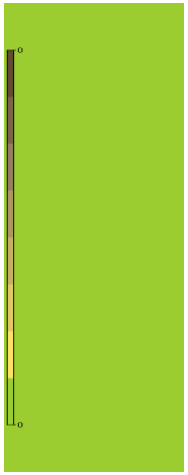




Height of boundary layer (m)	**500.0**
Speed above boundary layer (m/s)	10.0
Boundary condition at the top	wall
Potential temperature	No
Turbulence model	Standard
Solver	GCV
Maximum iterations	300 (at 100 C)

	Easting	Northing	z	Total
Grid spacing (m)	32.3-33.3	33.3-155.1	Variable	-
Number of cells	60	125	35	262500

Benchmark-Model: first try



	Min (m)	Max (m)	Extension (m)	Resolution Terrain Data (m)
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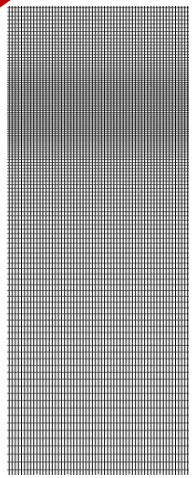
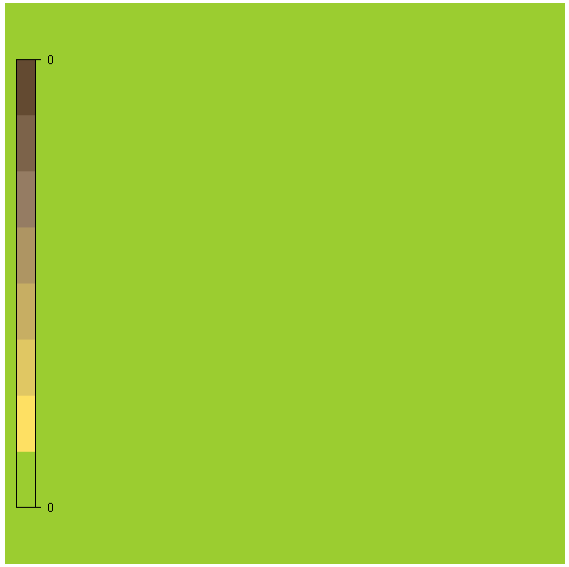


Height of boundary layer (m)	[illegible].0
Speed above boundary layer (m/[illegible]	10.0
Boundary condition at the [illegible]	wall
Potential temperatur[illegible]	No
Turbulence model	Standard
Solver	GCV
Maximum iterations	300 (at 100 C)

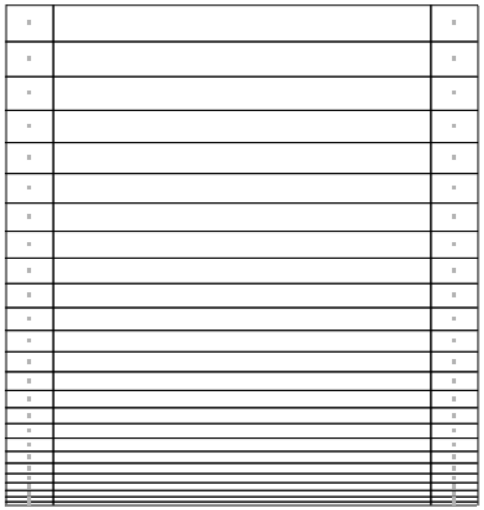
	Easting	[illegible]thing	z	Total
Grid spacing (m)	32.3-33.3	33[illegible]	Variable	-
Number of cells	60	125	35	262500

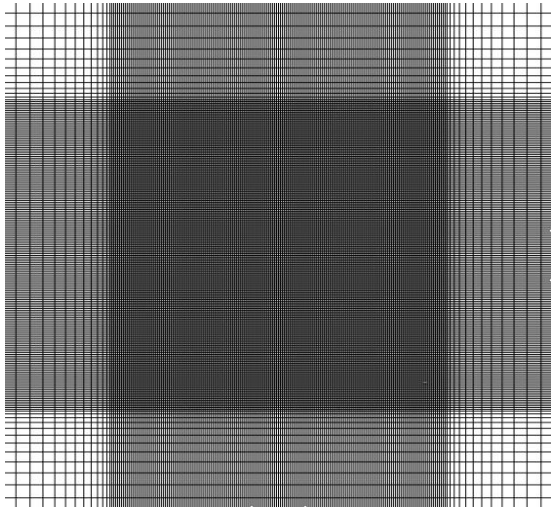
no full working load of the PC

Benchmark-Model: first try



	Min (m)	Max (m)	Extension (m)	Resolution Terrain Data (m)
Easting (m)	0.0	5000.0	5000.0	25.1
Northing (m)	0.0	5000.0	5000.0	25.1

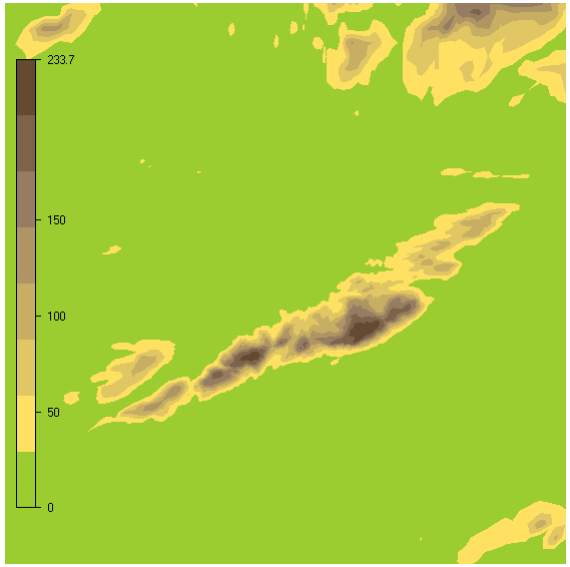




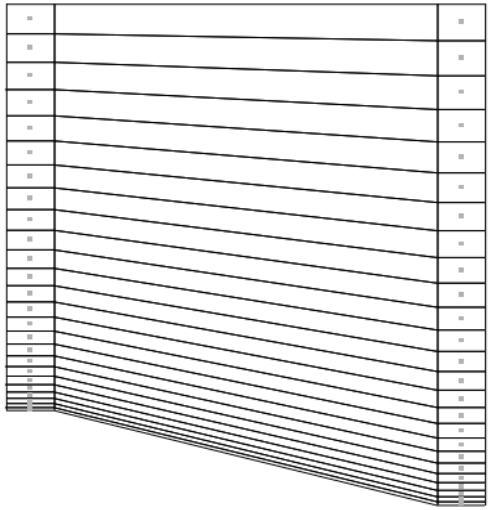
Height of boundary layer (m)	**500.0**
Speed above boundary layer (m/s)	10.0
Boundary condition at the top	fix pres.
Potential temperature	No
Turbulence model	Standard
Solver	GCV
Maximum iterations	50 (no C)
Sectors	72

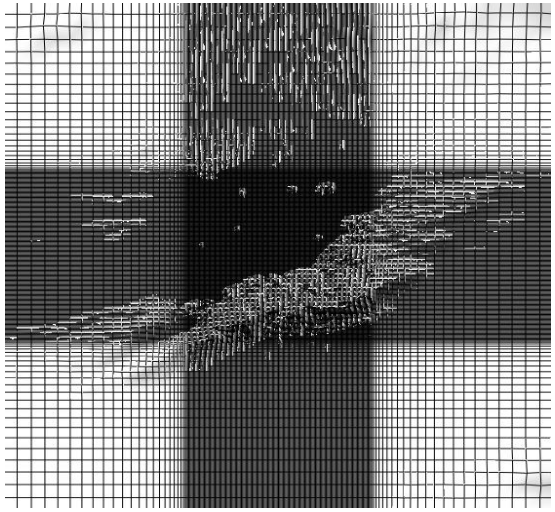
	Easting	Northing	z	Total
Grid spacing (m)	17.2- 136.6	17.2-136.6	Variable	-
Number of cells	200	200	25	1000000

Benchmark-Model: flat square



	Min (m)	Max (m)	Extension (m)	Resolution Terrain Data (m)
Easting (m)	318000.0	332975.0	14975.0	25.0
Northing (m)	7180000.0	7194975.0	14975.0	25.0





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Maximum iterations	50 (no C)
Sectors	72

	Easting	Northing	z	Total
Grid spacing (m)	32.4-401.6	32.4-401.6	Variable	-
Number of cells	200	200	25	1000000

Benchmark-Model: sample square

flat square	sample square
4 of 4 (no HT)	4 of 4 (no HT)
8 of 8 (HT)	8 of 8 (HT)
3 of 4 (no HT)	3 of 4 (no HT)
7 of 8 (HT)	7 of 8 (HT)

Problem: important to keep the PC full loaded while calculating 72 sectors

Solution: copy the project and put it in the queue

Time	Flat 4 of 4	Sample 4 of 4	Δ
Total project	03:52:51	03:42:39	- 4.4 %
Time per sector	00:03:14	00:03:06	

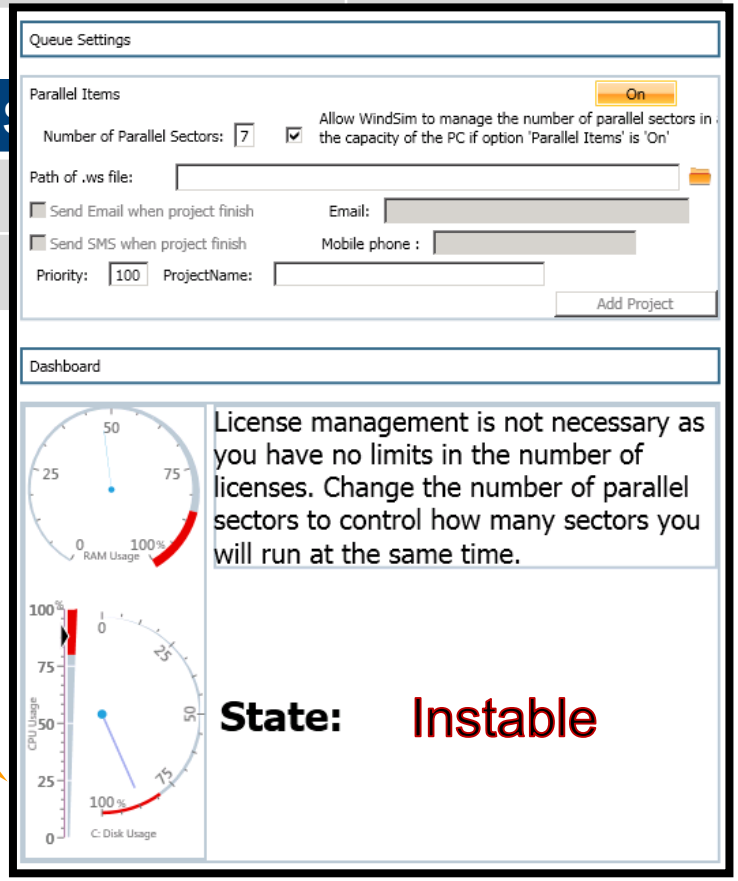
Evaluation complexity

Time	Flat 4 of 4	Sample 4 of 4	Δ
Total project	03:52:51	03:42:39	- 4.4 %
Time per sector	00:03:14	00:03:06	

Time	Flat 8 of 8	Sample 8 of 8	Δ
Total project	03:25:14	03:18:52	- 3.1 %
Time per sector	00:02:51	00:02:46	

Time	Flat 4 of 4	Sample 4 of 4	Δ
Total project	03:52:51	03:42:39	- 4.4 %
Time per sector	00:03:14	00:03:06	

Time	Flat 8 of 8	S
Total project	03:25:14	
Time per sector	00:02:51	



- complexity low influence

Evaluation complexity

Time	Flat 4 of 4	Flat 8 of 8	Δ
Total project	03:52:51	03:25:14	- 13.5 %
Time per sector	00:03:14	00:02:51	

Time	Sample 4 of 4	Sample 8 of 8	Δ
Total project	03:42:39	03:18:52	- 12.0 %
Time per sector	00:03:06	00:02:46	

- HT considerably faster

Time	Flat 4 of 4	Flat 3 of 4	Δ
Total project	03:52:51	05:00:43	+ 22.6 %

Time	Sample 4 of 4	Sample 3 of 4	Δ
Total project	03:42:39	04:47:57	+ 22.7 %

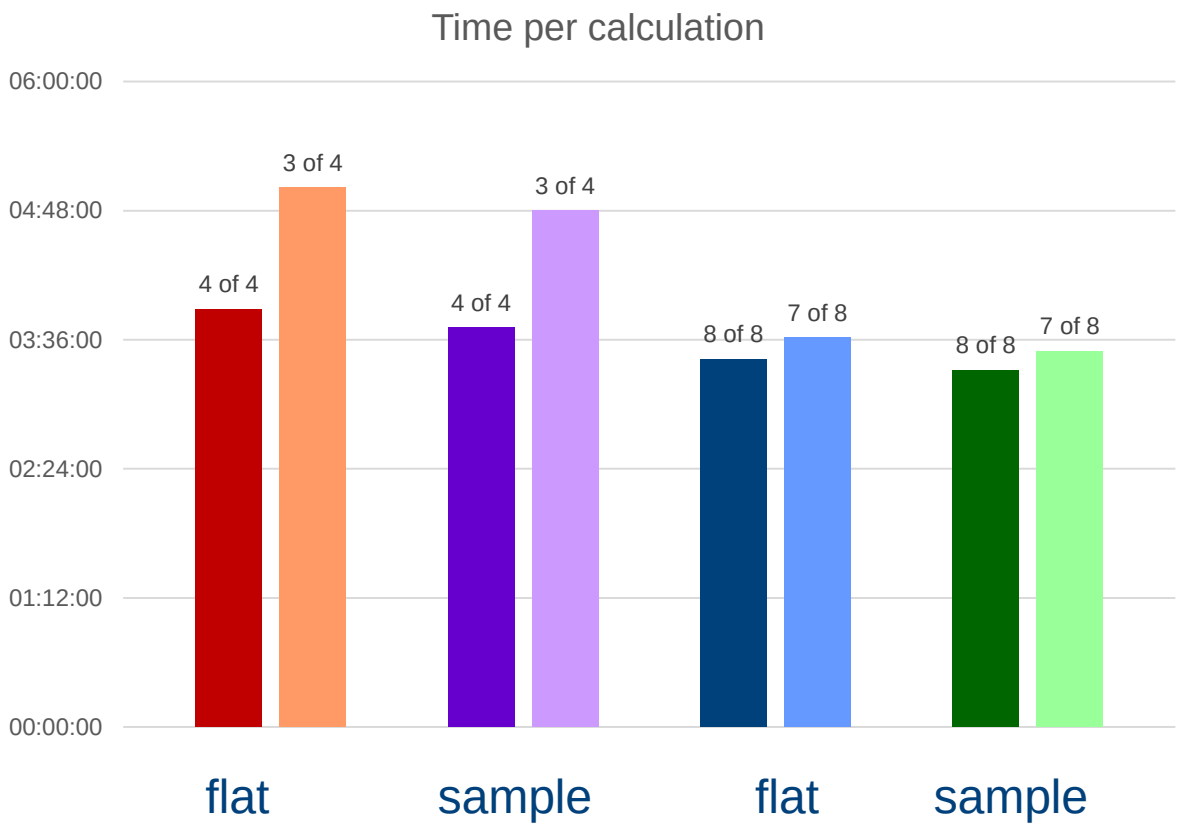
Time	Flat 4 of 4	Flat 3 of 4	Δ
Total project	03:52:51	05:00:43	+ 22.6 %

Time	Sample 4 of 4	Sample 3 of 4	Δ
Total project	03:42:39	04:47:57	+ 22.7 %

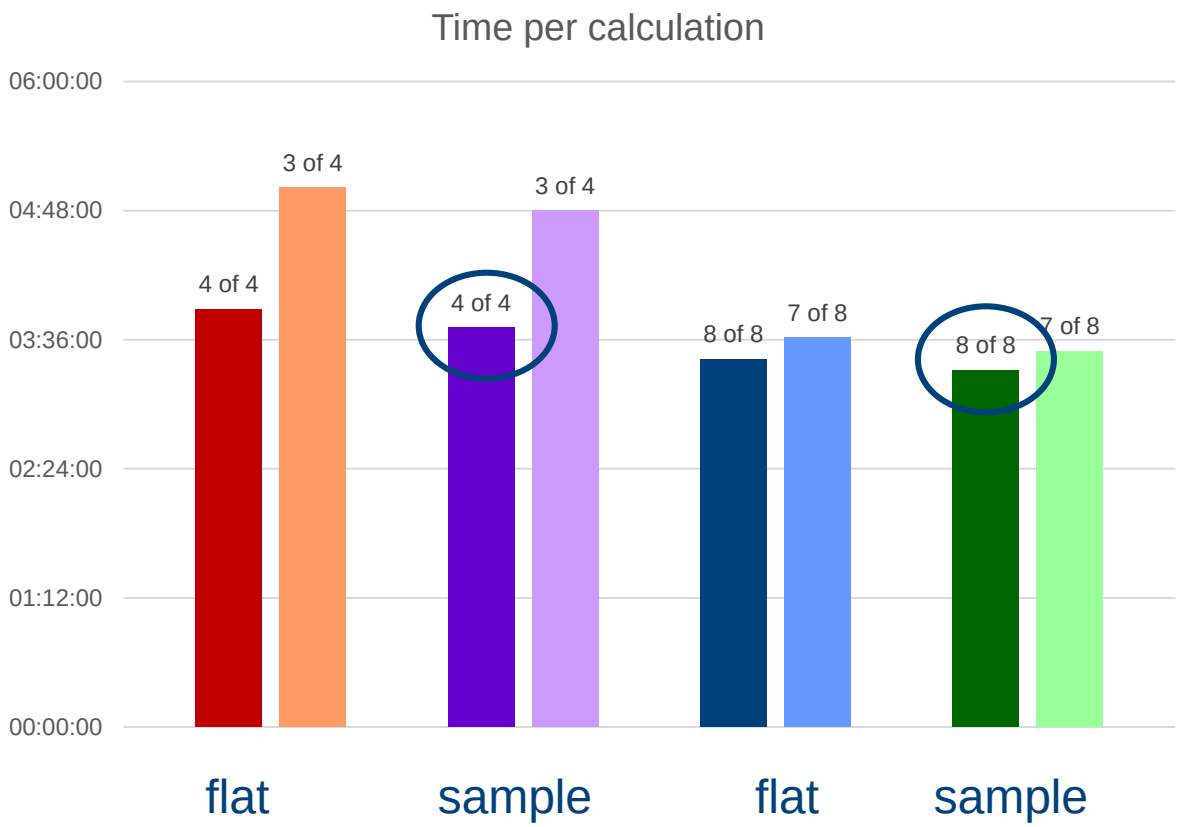
Time	Flat 8 of 8	Flat 7 of 8	Δ
Total project	03:25:14	03:37:06	+ 5.5 %

Time	Sample 8 of 8	Sample 7 of 8	Δ
Total project	03:18:52	03:29:39	+ 5.5 %

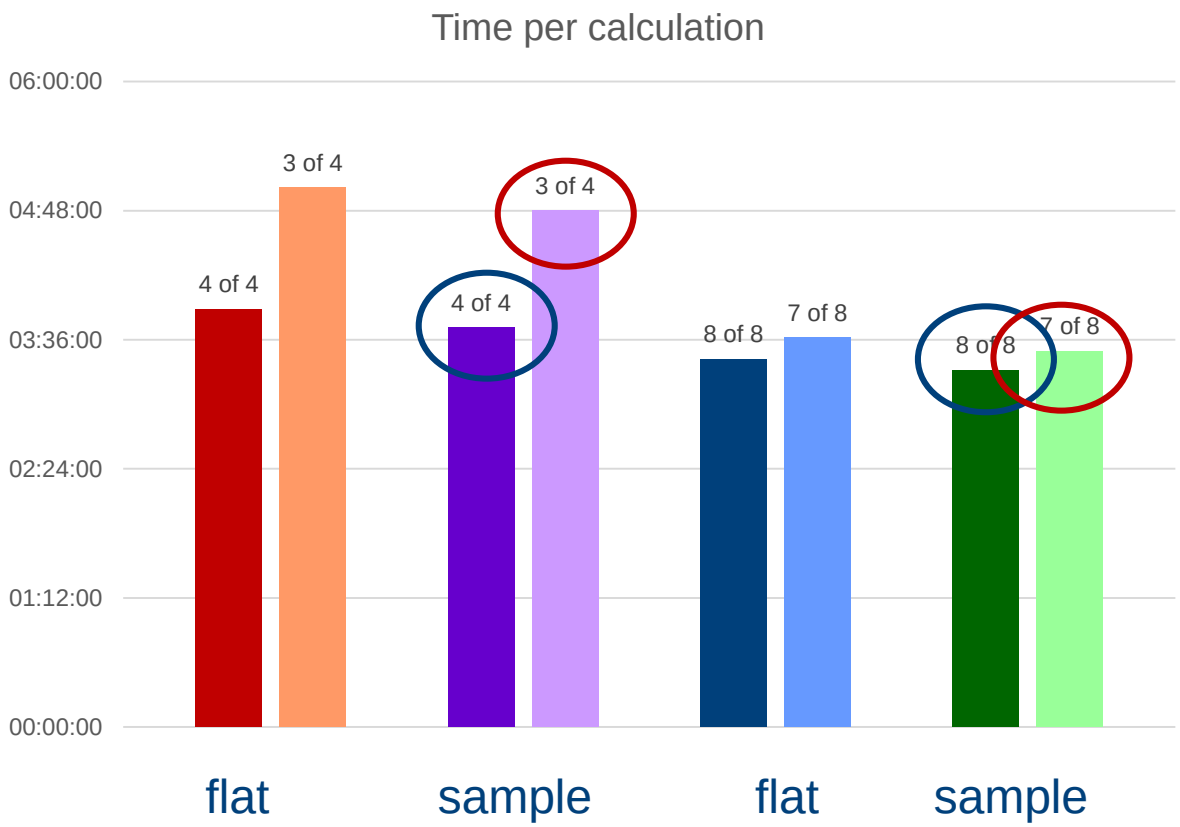
Evaluation load



Evaluation load



Evaluation load



Evaluation load

Time	Flat 4 of 4	Flat 4 of 8 (HT)	Δ
Total project	03:53:43	04:32:35	+ 14.3 %
Time per sector	00:03:15	00:03:47	

- ?

Summary:

HT activated in UEFI/BIOS-settings

- HT is a benefit of time consumption

If choice between HT or multiple cores

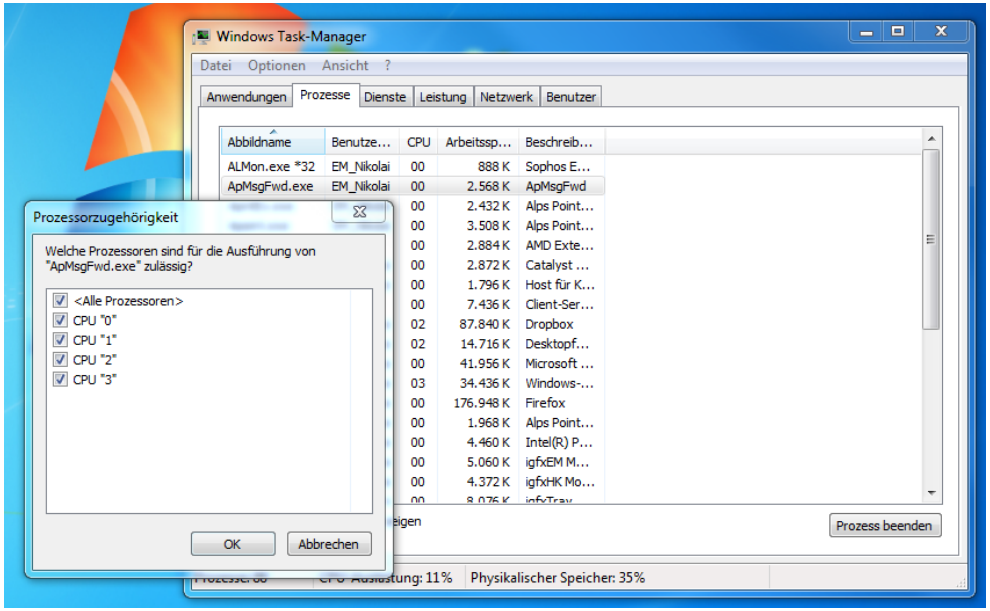
- Doubling cores (time halved for same # sectors)

Outlook:

Windows 8 & Windows 10:

- Operation system controls usage of the cores in a different manner
- Capable of parking physical cores, too
- Speed depends on the operation system

Possibility to dedicate the threads to cores:



- swapping data between cores is time consuming…
- Windows schedules better
- Prioritization and dedication may cause instability of OS

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Thank you for your attention!

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