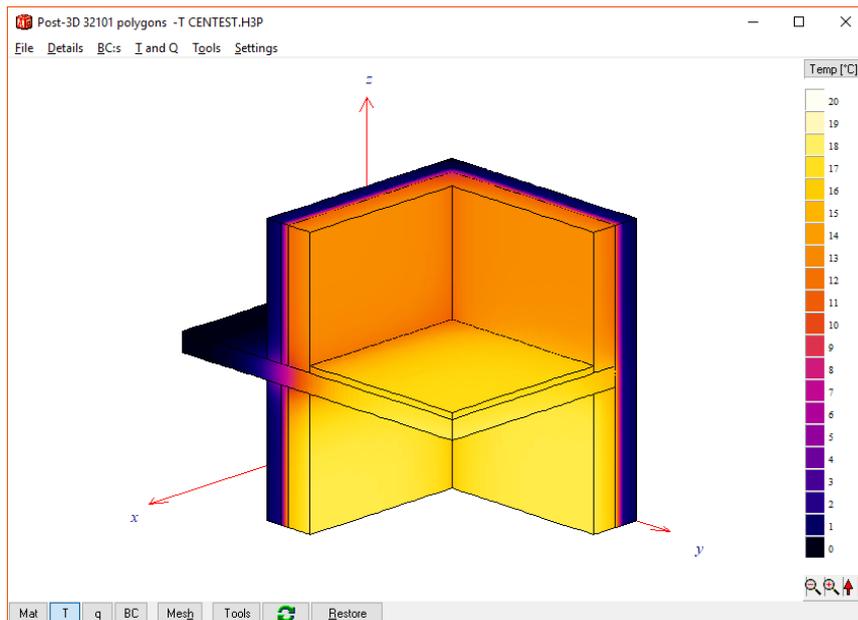


HEAT3 version 9

A PC-program for heat transfer in three dimensions

Update manual



March 17, 2024

First edition	v9.0	Jan 15, 2019
Revision 1	v9.1	Sept 10, 2020
Revision 2	v9.2	March 17, 2024

See Appendix A for update news

The latest version of this document is available at
https://www.buildingphysics.com/manuals/HEAT3_9_update.pdf

Contents

1.	INTRODUCTION.....	4
1.1	NEW FEATURES.....	4
1.2	REQUIREMENTS	4
1.3	LIGHT VERSION.....	4
1.4	INSTALLATION.....	5
2.	EASIER INPUT FOR BOUNDARY CONDITIONS	9
2.1	INTRODUCTION	9
2.2	EXAMPLE V9_EXAMPLE1.H3P	9
2.3	EXAMPLE V9_EXAMPLE_CYLINDER.H3P	11
2.4	OVERLAPPING BC BOXES – V9_EXAMPLE_CYLINDER_2.H3P.....	12
2.5	CALCULATED HEAT FLOWS	15
2.6	STOP CRITERION FOR STEADY-STATE CALCULATIONS	15
2.7	SOME MORE EXAMPLES	16
2.8	SCRIPT FILES NEEDS OPTION FOR WHAT BC BOX TYPE IS USED	23
3.	MISCELLANEOUS NEW FEATURES.....	24
3.1	MATERIAL TEXT FILES CAN BE USED.....	24
3.2	PATH TO MATERIAL FILES CAN NOW BE GIVEN	25
3.3	FASTER CALCULATIONS.....	26
3.4	OTHER NEW FEATURES	26
4.	NEW BATCH JOB FEATURES.....	27
4.1	INTRODUCTION	27
4.2	EXAMPLE: RUNNING A H3P-FILE USING A BATCH FILE	27
4.3	EXAMPLE: RUNNING A CASE WITH SCRIPT FILE USING A BATCH FILE	28
5.	IMPROVEMENTS IN POST-PROCESSOR.....	32
5.1	NEW COLOR SCHEMES ADDED	32
5.1.1	<i>Introduction.....</i>	<i>32</i>
5.1.2	<i>Own-defined schemes.....</i>	<i>36</i>
5.2	EDGES CAN NOW BE OUTLINED	37
5.3	FASTER AND FLICKER-FREE DRAWING	38
6.	APPENDIX A. LIST OF NEW UPDATE FEATURES	39

1. Introduction

Blocon is proud to present a new version of HEAT3. Many new important features have been added. Up-to-date information is given on www.buildingphysics.com.

This update manual covers the new features that have been added since version 8. New users should also read the update manuals for version 7, 6, 5, and the full manual for version 4 at

https://www.buildingphysics.com/manuals/HEAT3_8_update.pdf

https://www.buildingphysics.com/manuals/HEAT3_7_update.pdf

https://www.buildingphysics.com/manuals/HEAT3_6_update.pdf

https://www.buildingphysics.com/manuals/HEAT3_5_update_manual.pdf

https://www.buildingphysics.com/manuals/HEAT3_4.pdf

Tips for reading for beginners:

See examples in section 2.5 in this document which will also show how script files can be used.

See examples in section 2.6 and 2.7 in

https://www.buildingphysics.com/manuals/HEAT3_8_update.pdf

For a quick start, read Chapter 4 in Manual [HEAT3 4.0](#). The examples in Chapter 5 would also be useful. After this, look at [Update manual for HEAT3 5.0](#) and [Update manual for HEAT3 6.0](#). Also see the examples for the test cases: [ISO 10211 validation test cases](#).

1.1 New features

Many improvements are made since version 8. The most important are shown below:

- Easier input for boundary conditions
- Stop criterion for steady-state calculations calculated automatically
- Material files (.mtl) can now be pure text-files (.txt)
- Faster calculations, up to 7 times faster for steady-state calculations and up to 3 times faster for dynamic calculations
- New batch job features
- New color schemes added. Color scales can e.g be similar to those used in thermography. It is also possible to define own colors.
- Post-processor images: edges can now be outlined
- Post-processor images: faster and flicker-free drawing

1.2 Requirements

HEAT3 runs on both 32-bit and 64-bit Windows 7, 8, and 10, and compatibles. Only about 40 MB hard disk space is needed.

HEAT3 needs about 1.8 GB RAM allocated space when all nodes (50 million) are used. A PC with 4 GB RAM is recommended in that case.

Version	Max number of nodes	Required memory RAM	Recommended RAM for PC
HEAT3_v9.exe	50,653,000 (370·370·370)	1.8 GB	4 GB

A good tip is to close other applications to increase the available memory (if insufficient). If HEAT3 is swapping data to/from the hard disk it is a sign that virtual memory beyond the installed RAM is used. This will happen if you try to run large cases on a PC with too little memory. This can cause very long calculation time since the hard disk will be used for some of the memory for the allocated matrices. It should not be any problem unless the PC has less than 4 GB RAM.

1.3 Light version

The light (demo) version has the following restrictions:

- Data cannot be saved.
- Materials cannot be added or changed.

- Max 1,000,000 (100·100·100) nodes.
- Results for heat flows are hidden for larger problems with more than 25,000 nodes and with more than 30 nodes in each direction.
- Thermal coupling coefficients (L2D) will not be calculated.
- Report preview is disabled.
- Some other restrictions apply.

1.4 Installation

HEAT3 v9 is fully adapted for Windows 7, 8, and 10 and works on both 32- and 64-bit machines. Use the setup program to install HEAT3. This will install the HEAT3 exe-file and some other files to folder “C:\Program Files (x86)\BLOCON\HEAT3_v9”.

 HEAT3_v9_2.exe	2024-03-13 11:17	Program	12 275 kB
 TurboActivate.dat	2015-03-30 14:15	DAT-fil	4 kB
 TurboActivate.dll	2021-05-11 16:03	Programtillägg	1 098 kB
 TurboActivate.exe	2021-05-11 16:06	Program	287 kB
 unins000.dat	2024-03-13 17:09	DAT-fil	9 kB
 unins000.exe	2024-03-13 17:09	Program	3 149 kB

Files installed to C:\Program Files (x86)\BLOCON\HEAT3_v9

Note: From version 9.2 the setup file will install material files (and some other files) to the shared folder “C:\Users\Public\Documents\BLOCON\HEAT3 9” by default. This is also the folder where the user stores project data files.

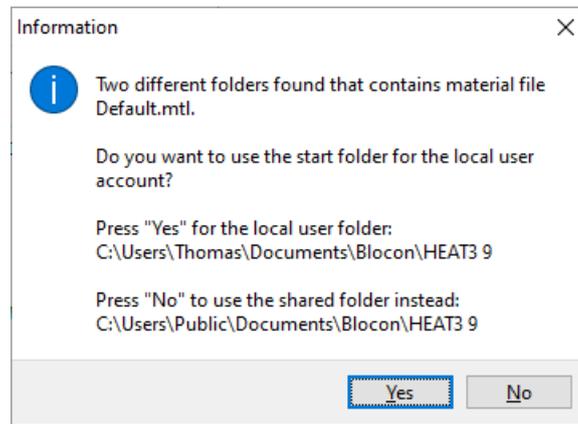
 Examples	2024-03-13 17:09	Filmapp	
 HEAT3_Batch	2024-03-13 17:09	Filmapp	
 Projects	2024-03-13 17:09	Filmapp	
 Colorscheme.bmp	2018-11-05 09:36	BMP-fil	29 kB
 HEAT3.DES	2024-03-14 18:19	DES-fil	1 kB
 default.MTL	2015-06-14 10:14	MTL-fil	19 kB
 DEFAULT_ISO_TESTCASES.MTL	2009-02-28 16:37	MTL-fil	21 kB
 DIN 4108-4.MTL	2003-10-18 10:35	MTL-fil	106 kB
 DIN no cap.MTL	2000-05-17 13:15	MTL-fil	20 kB
 general.MTL	2000-04-16 12:36	MTL-fil	107 kB
 Slab_example.MTL	2017-03-22 14:24	MTL-fil	1 kB
 _DIN 4108-4 DATABASE_.txt	2003-10-18 10:01	Textdokument	2 kB
 Default_MTL_Filename.txt	2015-04-08 09:45	Textdokument	1 kB
 Material_test.txt	2018-03-23 11:12	Textdokument	1 kB

Files installed to C:\Users\Public\Documents\BLOCON\HEAT3 9

Before v9.2, the setup file installed these files to the local user documents folder “My documents\Blocon\HEAT3 9” (e.g. ”C:\Users\[user name]\Documents\Blocon\HEAT3 9”).

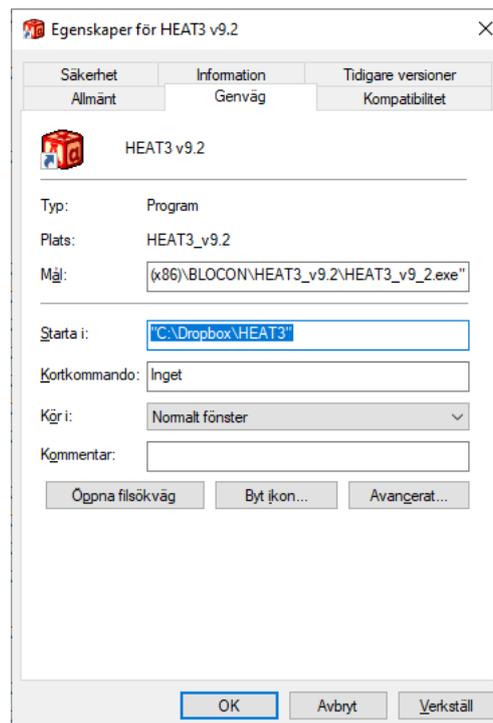
This could be a problem when an admin account was used for installation and another local user account was running the program and had no access to the (admin) document folder (where material files and data files were present). With v9.2 different users on the same machine can now access shared files.

This means that when you update your old version to v9.2 there may be two document folders (the old local document folder and the new shared document folder). If HEAT3 detects both folders upon start (it will actually search for the file “Default.mtl”) it will ask what folder you want to start in, see picture below. Simply erase the folder you don’t want to use and HEAT3 will use the other one upon start. Remember to move your input files first if applicable.



The used folder name is shown in the header for the material pick list window. It is also shown by the menu item Info/System info in HEAT3.

It is also possible to change to another start up folder (e.g. to Dropbox folder). To do this open the shortcut for HEAT3 that is located in "C:\ProgramData\Microsoft\Windows\Start Menu\Programs\BLOCON". Right-click on the shortcut for "HEAT3 v9.2" and choose Properties and set folder name in the "Start in" field. See picture below. Make sure you copy all the files (with sub-directories) to the new folder. However, if HEAT3 finds the default shared or local user folders it will try to use them first so make sure you delete (or rename) these folders.



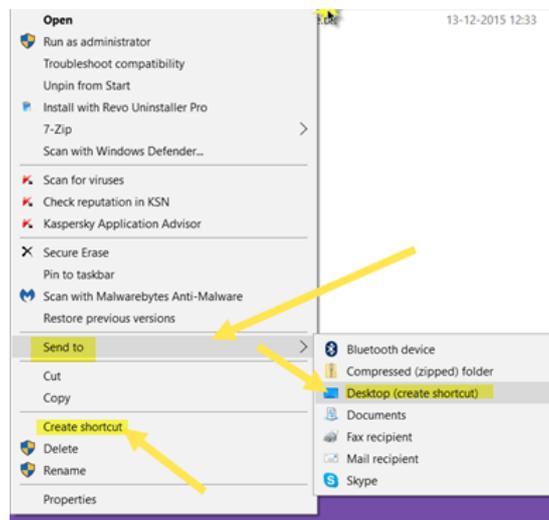
Note that it is possible to use specify another path for the material directory, see section 3.2.

The setup program will create a shortcut on the start menu, e.g. "HEAT3 v9.2" with the correct startup folder specified. To start HEAT3, press the windows key and write e.g. "HEAT3 v9". The icon for the installed version should then be displayed.

The startup folder is always assumed to be "My Documents\Blocon\HEAT3 9". The user can however change this in the properties of the shortcut to any other folder. The user can also create an own desktop shortcut, see next section.

Create desktop shortcut in Windows 10

The simplest way to create a desktop shortcut for HEAT3 is to right-click on the exe file (normally located in C:\Program Files (x86)\BLOCON\HEAT3_v9) and select Send To > Desktop (Create shortcut). You will see that its shortcut has been created on your Windows desktop.



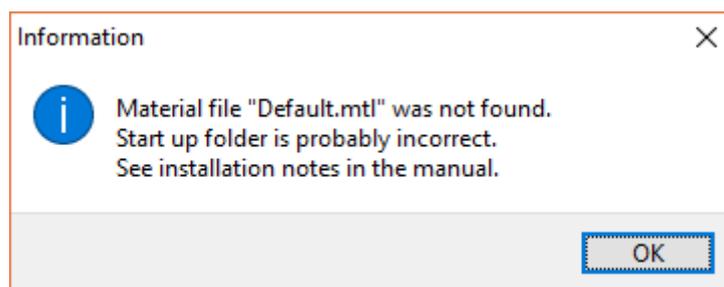
A desktop shortcut can also be created by right-clicking on your desktop, selecting New > Shortcut, and choosing the HEAT3 exe-file. When the shortcut has been created, right-click on it and choose Properties. Make sure that "target" is set to "C:\Program Files (x86)\BLOCON\HEAT3_v9\HEAT3_v9.exe" (or wherever the file is located)

The startup folder ("Start in") can be set to

"...My Documents\Blocon\HEAT3 9" (or wherever the material files are located)

The startup folder should not be in the Program files folder. This is because HEAT2 needs write/read permission for both material files and desktop file (HEAT3.DES).

If you get this error when HEAT3 is started:



Then, make sure that you start HEAT3 via the Windows start menu "HEAT3...".

By default, the setup program installs the material files (*.mtl) and some other user files to "C:\Documents and Settings*username*\My Documents\BLOCON\HEAT3 9"

DEFAULT.MTL should be located here. Check this. This folder contains also user projects files. It needs local write/read rights. Installation using the setup file will automatically create correct folders. Administrators rights are needed for the setup since the setup-program writes in the registry and program folders.

Using old versions together with new versions

HEAT3 v9 can be installed and used on the same PC that has HEAT3 v8 installed. However, it is not possible to use HEAT3 v7 (or earlier versions) together with v9 (or v8). HEAT3 v7 (and v6) **MUST BE UNINSTALLED IN THE WINDOWS CONTROL PANEL BEFORE V9 IS INSTALLED.**

Note that HEAT3 has backward compatibility but not forward compatibility: Newer major versions can read projects files that have been saved with older versions, but older versions cannot read projects files that have been saved with newer versions (i.e. v8 cannot read files saved with v9, V9 can read files save with v8).

2. Easier input for boundary conditions

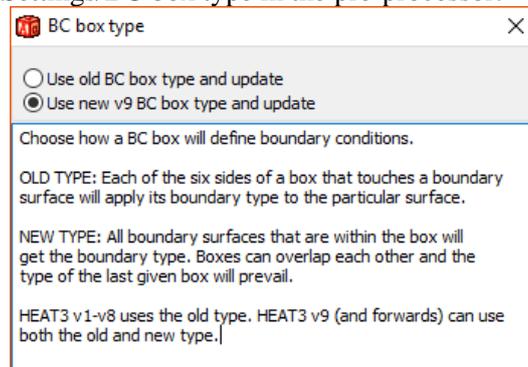
2.1 Introduction

A quicker way of specifying boundary conditions is now available by using a new style of BC boxes (*boundary condition boxes*). HEAT3 v1-v8 uses the old type. HEAT3 v9 (and forwards) can use both the old and the new type. The difference is as follows:

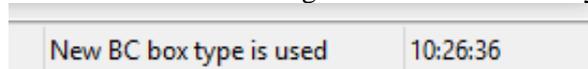
OLD TYPE: Each of the six sides of a box that touches a boundary surface will apply its boundary condition to the particular surface. More information how to use the old style BC box is given in chapter 4.2 in https://www.buildingphysics.com/manuals/HEAT3_4.pdf

NEW TYPE: All boundary surfaces that are within the box will be assigned the boundary condition. Boxes can overlap each other, and the type of the last given box will prevail.

The type is chosen in menu Settings/BC box type in the pre-processor:

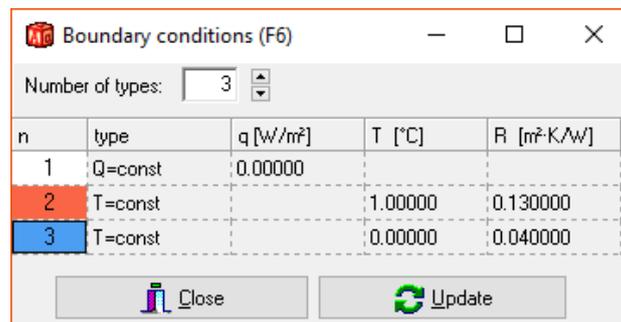


It is also possible to click on the text at the lower right that indicates what type is being used:

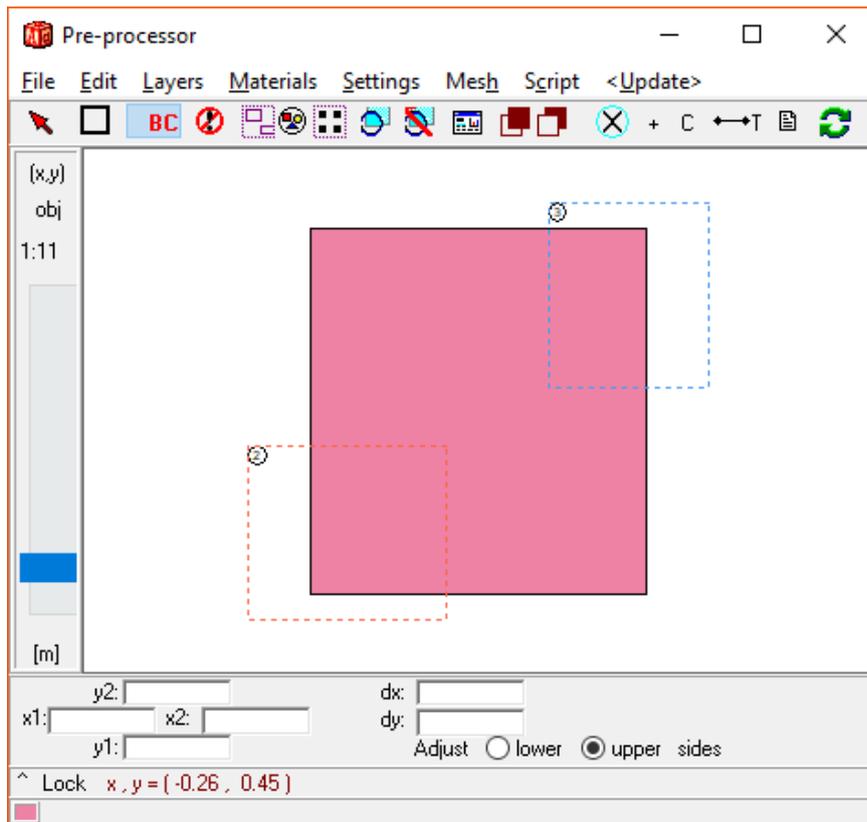


2.2 Example V9_Example1.h3p

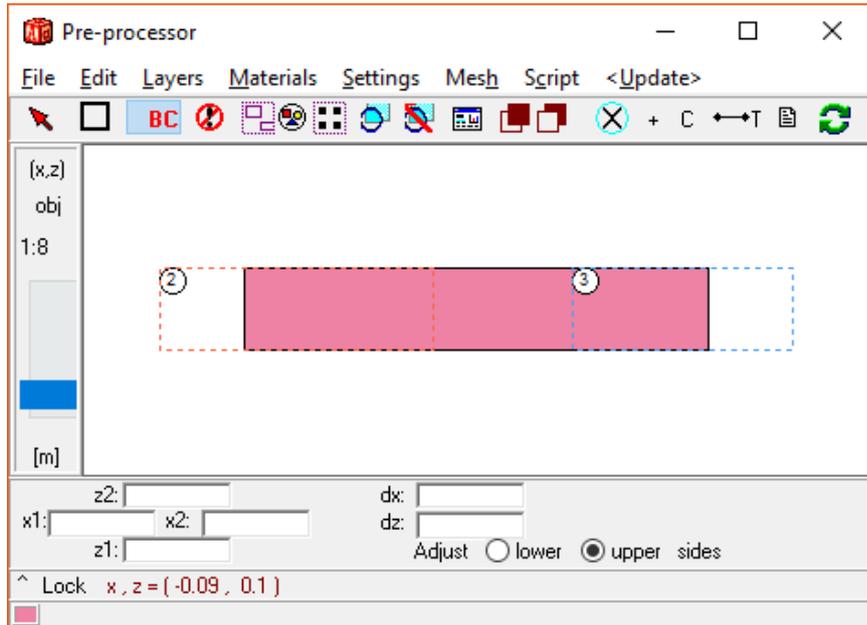
Consider the following simple example with three boundary conditions. The input file is located in folder ...Documents\Blocon\HEAT3 9\Examples.



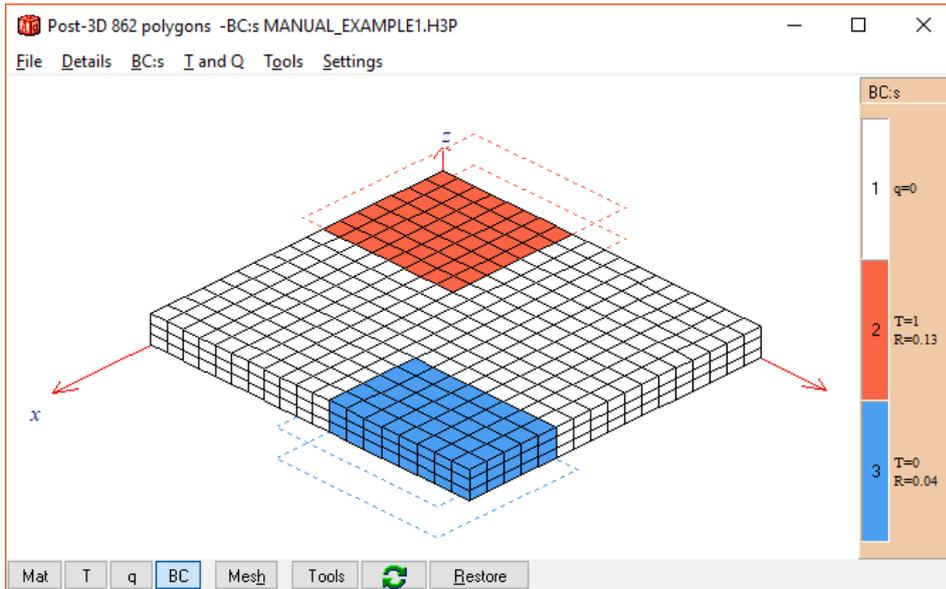
Note that the first boundary condition type (here adiabatic i.e. $q=0$) will apply to all surfaces not defined by any BC boxes. The first type may of course be changed from the default $q=0$. Now we draw two BC boxes, one using type #2 ($T=1$) and one using type #3 ($T=0$):



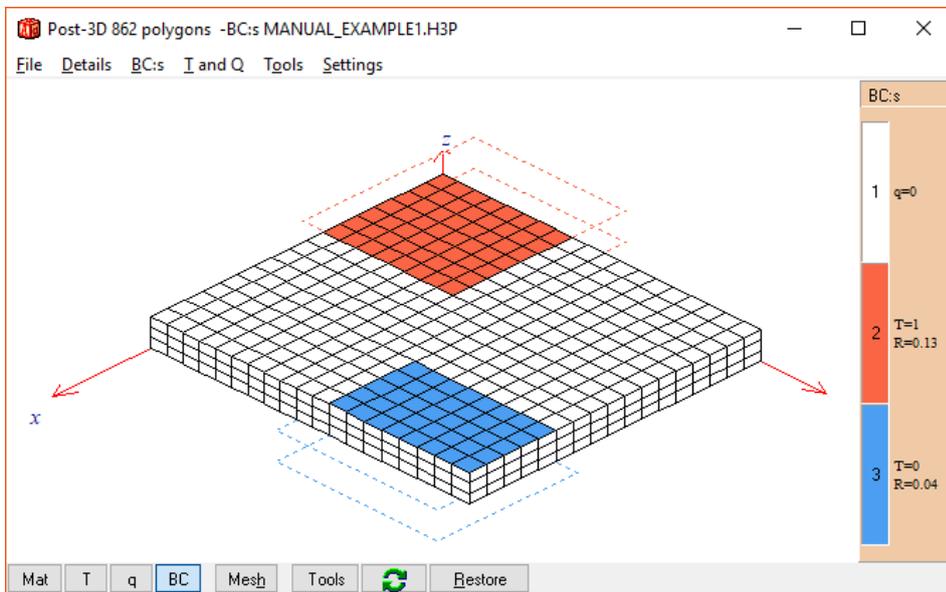
(x,y-plane)



(x,z-plane)



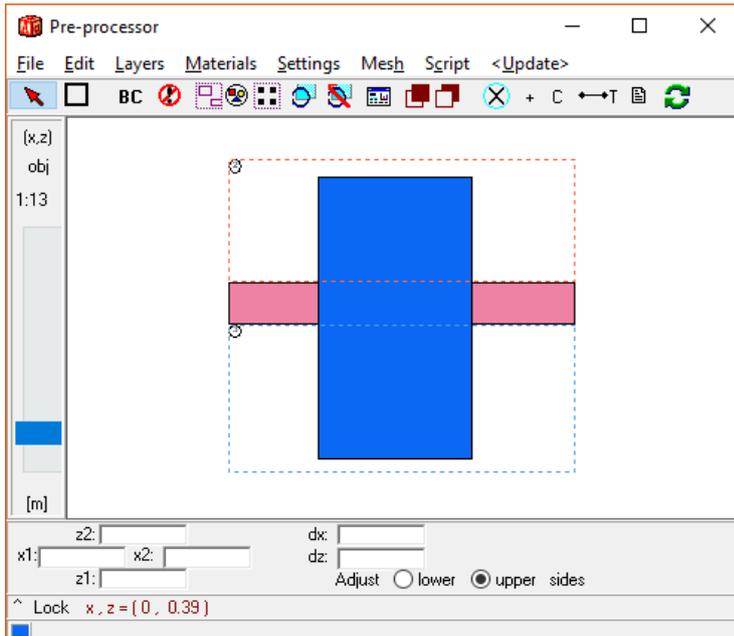
Result using new style BC box. All surfaces within the volume is affected.



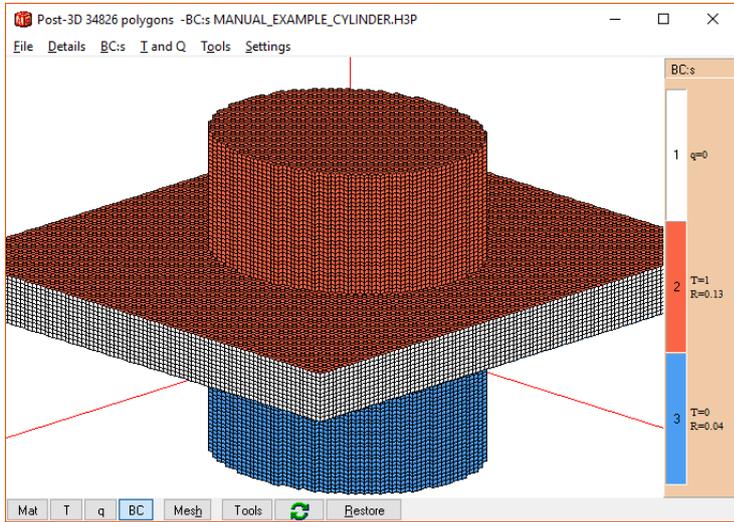
Result using old style BC box. Only surfaces touching the sides are affected.

2.3 Example V9_Example_Cylinder.h3p

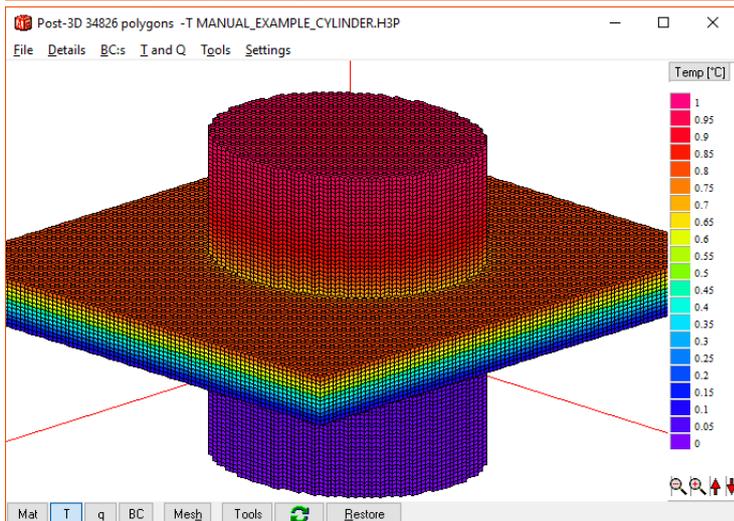
Below is an example with a rod where two new style BC boxes are used (it would have impossible to specify the BC:s using old style BC boxes). The rod is generated by drawing a material box (blue) using the material "Test_Mat_*CYLZ" which generates a cylinder in the z-direction.



Two new style BC-boxes



Resulted BC:s



Calculated temperatures

2.4 Overlapping BC boxes – V9_Example_Cylinder_2.h3p

New style BC boxes can overlap each other, and the type of the last given box will prevail. Consider the rod example in previous section. First, a new BC type is added:

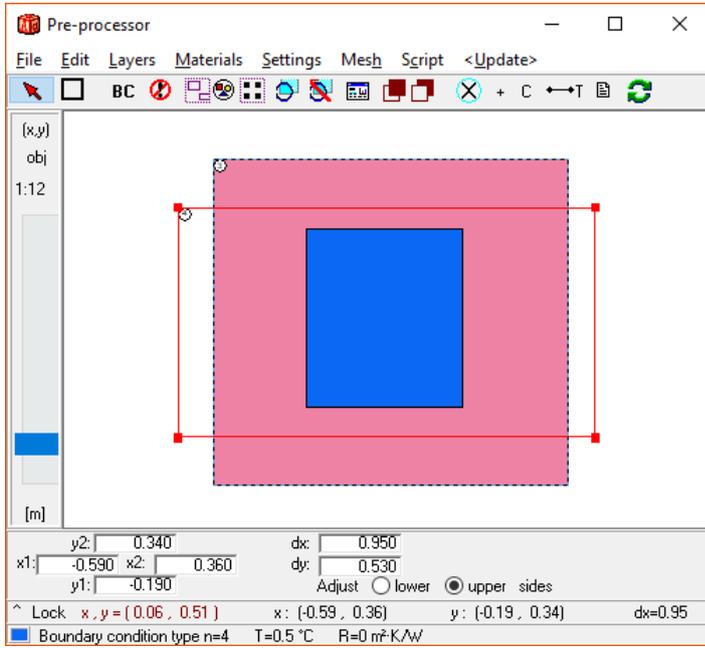
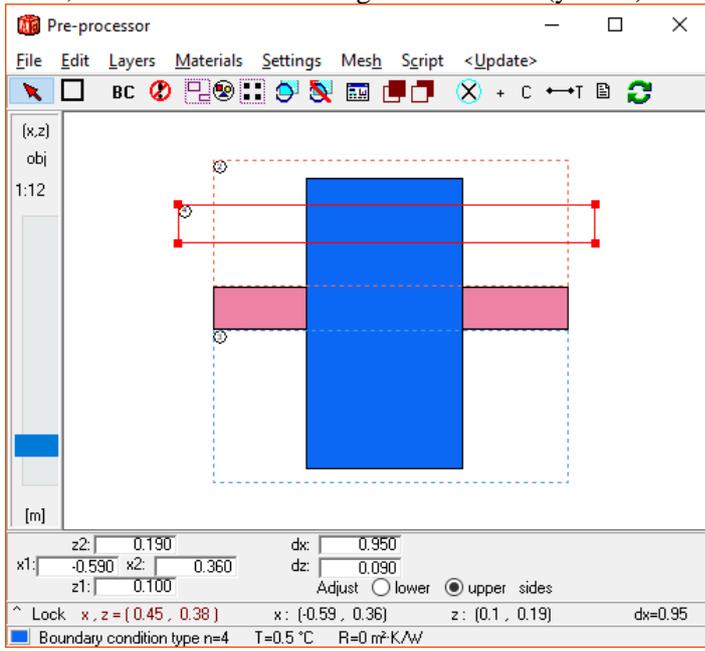
Boundary conditions (F6)

Number of types: 4

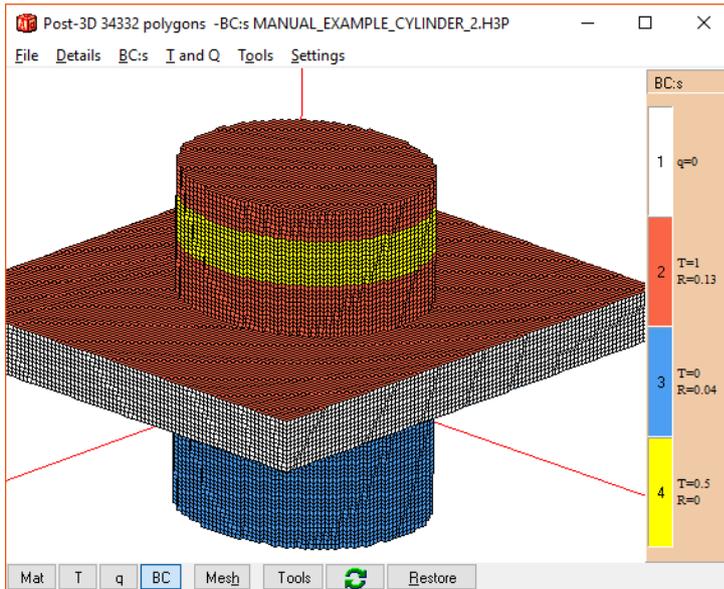
n	type	q [W/m²]	T [°C]	R [m²·K/W]
1	Q=const	0.00000		
2	T=const		1.00000	0.130000
3	T=const		0.00000	0.040000
4	T=const		0.50000	0.000000

Close Update

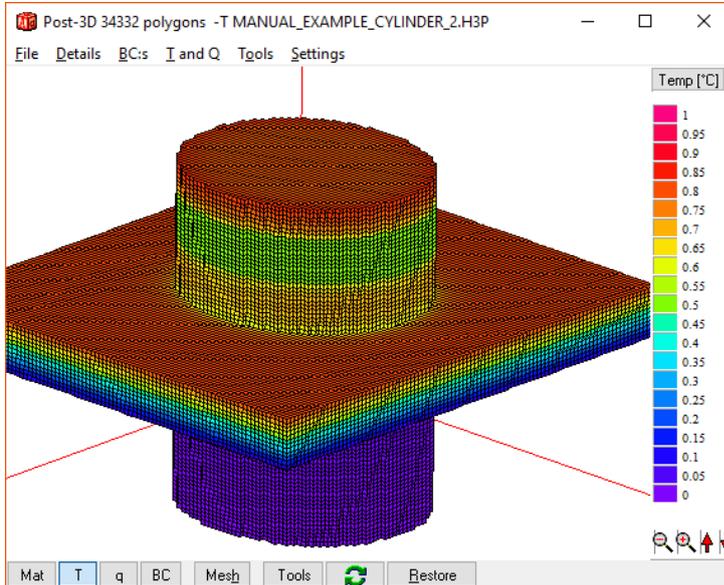
Then, we draw a BC box using BC number 4 (yellow):



The BC box overlaps earlier given BC boxes and the resulting boundary conditions are shown below.



Resulting boundary conditions



Calculated temperatures

Use the tools Bring to front/Send to back to change the order of overlapping (just as in the case with material boxes).

Tip: Turn off BC layer (menu item Layers/BC) to be able to adjust material boxes.

2.5 Calculated heat flows

Calculated heat flows are shown by pressing F11 (or menu item Output/View sets). The heat flows for the last rod example are shown below.

```

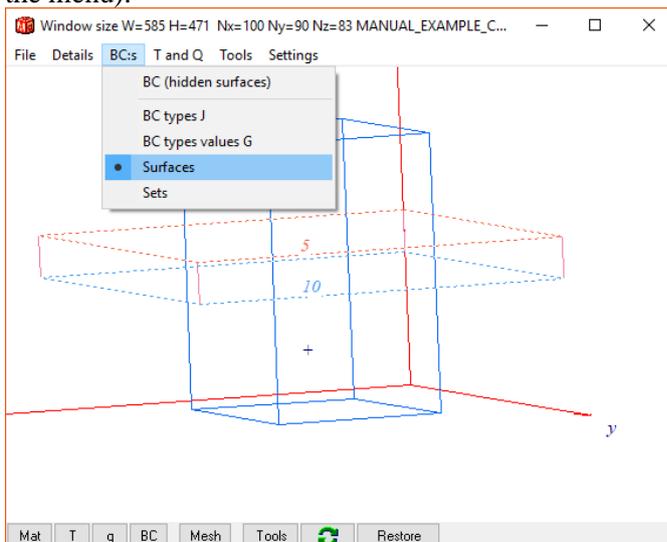
Flows and temperatures for sets (F11)
Copy to clipboard  Details
Sum pos flows through boundaries: 1.542 W
Net heat flow through boundaries: 1.04E-010 W

Set  Q[W]  q[W/m²]  Tmin  Tmax
5    0.7714 1.5718  0.5786 0.806
10   -0.74  -1.5078 0.0579 0.1591
Sum: 0.0314

Heat flow through surfaces of BC type:
2: 1.542 W  2: T=1°C, R=0.13 m²·K/W
3: -1.0581 W 3: T=0°C, R=0.04 m²·K/W
4: -0.4838 W 4: T=0.5°C, R=0 m²·K/W
  
```

The first row shows the total heat flow passing through the boundaries (1.542 W).

There are two sets defined which means that two sides of the BC boxes touch the material surface. Go to menu item BC:s/Surfaces in the post-processor to see these sets (“surfaces” are numbered the same as “sets” but only those used are shown as surfaces – you can see the difference by choosing “Sets” in the menu).



So, for surface (or set) #5 the heat flow is 0.7714 W entering the warm upper plane exposed to the air with $T=1$. For surface (or set) #10 the heat flow is 0.74 W through the cold lower plane exposed to the air with $T=0$. Note that the sum of these sets is not zero, this is because thermal interaction with the rod.

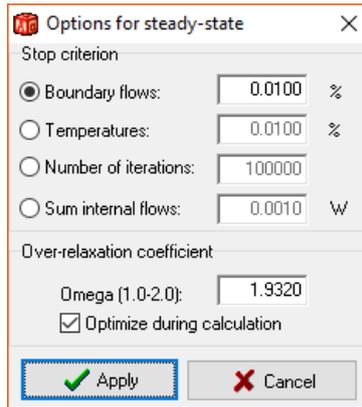
Also, the total heat flow for each BC type is also shown (the sum is zero for steady-state):

- 2: 1.542 W 2: $T=1^{\circ}\text{C}$, $R=0.13 \text{ m}^2 \cdot \text{K/W}$
- 3: -1.0581 W 3: $T=0^{\circ}\text{C}$, $R=0.04 \text{ m}^2 \cdot \text{K/W}$ (negative value means flow out from material)
- 4: -0.4838 W 4: $T=0.5^{\circ}\text{C}$, $R=0 \text{ m}^2 \cdot \text{K/W}$

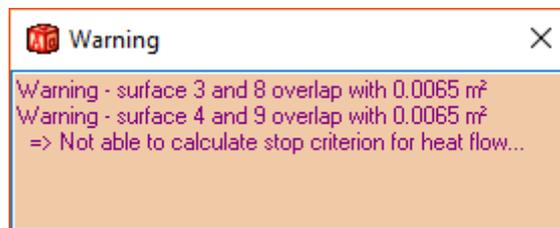
2.6 Stop criterion for steady-state calculations

Using the new style BC boxes will make it easier regarding the stop criterion for a steady-state calculation.

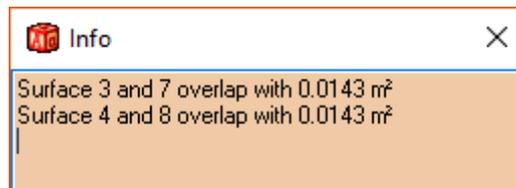
The steady-state stop criterion is normally based on boundary flows:



In older versions of HEAT3 there were a strict requirement for this criterion to work: The criterion is calculated for all surfaces. This means that all surfaces with a nonzero heat flow must be defined (drawn) when this criterion is used, and also that each surface does not overlap another surface. See chapter 5.7.1 in https://www.buildingphysics.com/manuals/HEAT3_4.pdf. There would come a warning if BC surfaces overlapped:

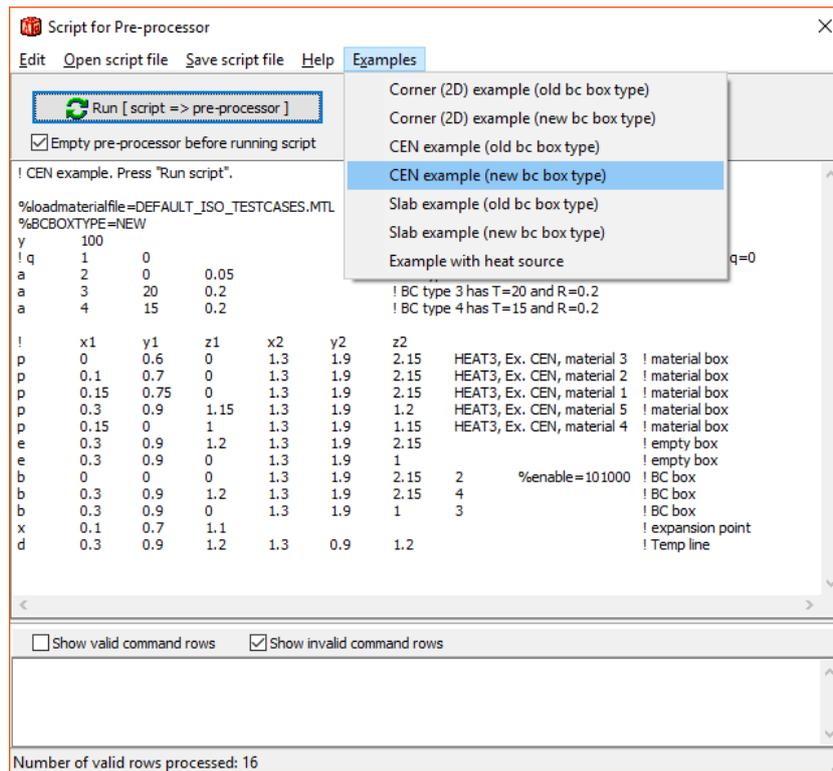


This requirement is still needed in HEAT3 v9 when old style BC boxes are used. However, it is not required when new style BC boxes are used. HEAT3 will be able to calculate flows used for the stop criterion automatically and the user does not have to worry about this. If surfaces overlap, there will still be a message about this just for info (not a warning):



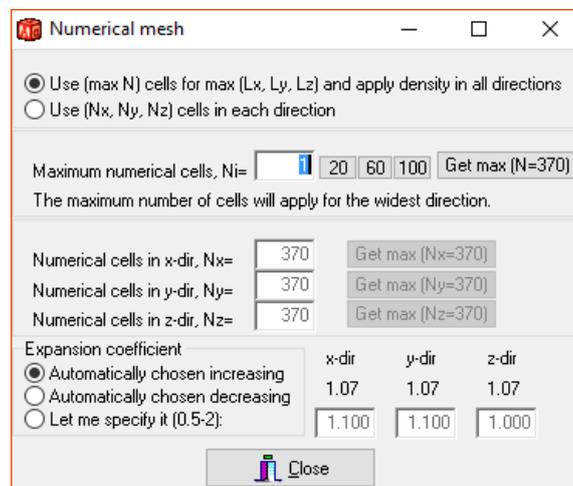
2.7 Some more examples

Several examples that shows how to give boundary conditions using both new and old style BC boxes can be found in the pre-processor script window under menu item “Examples”:

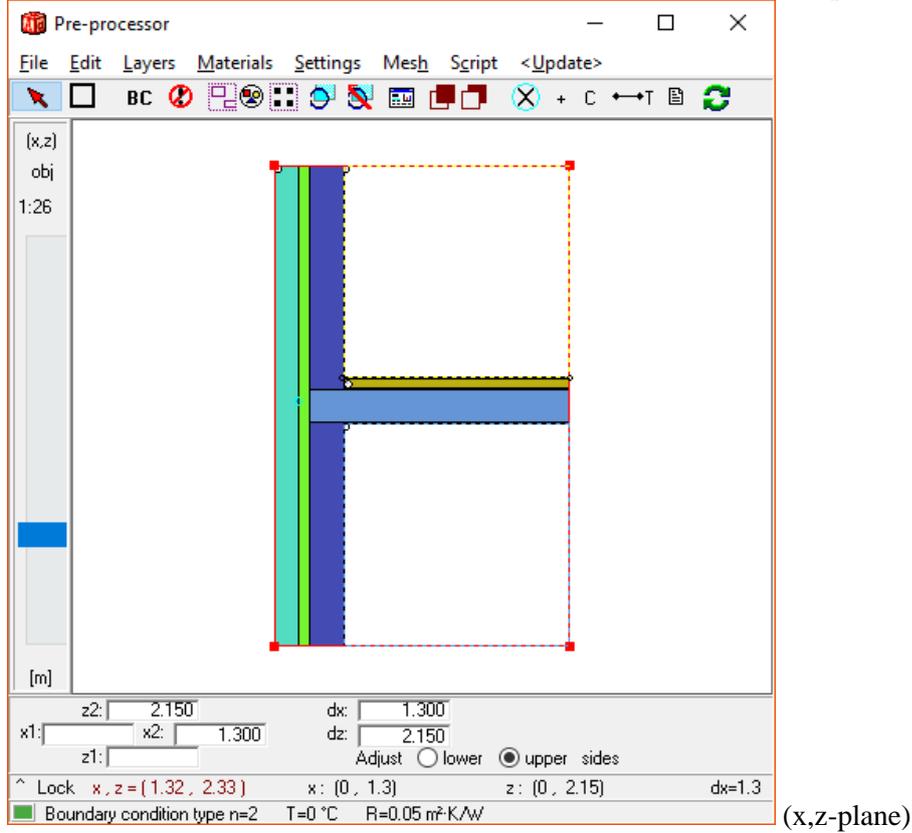
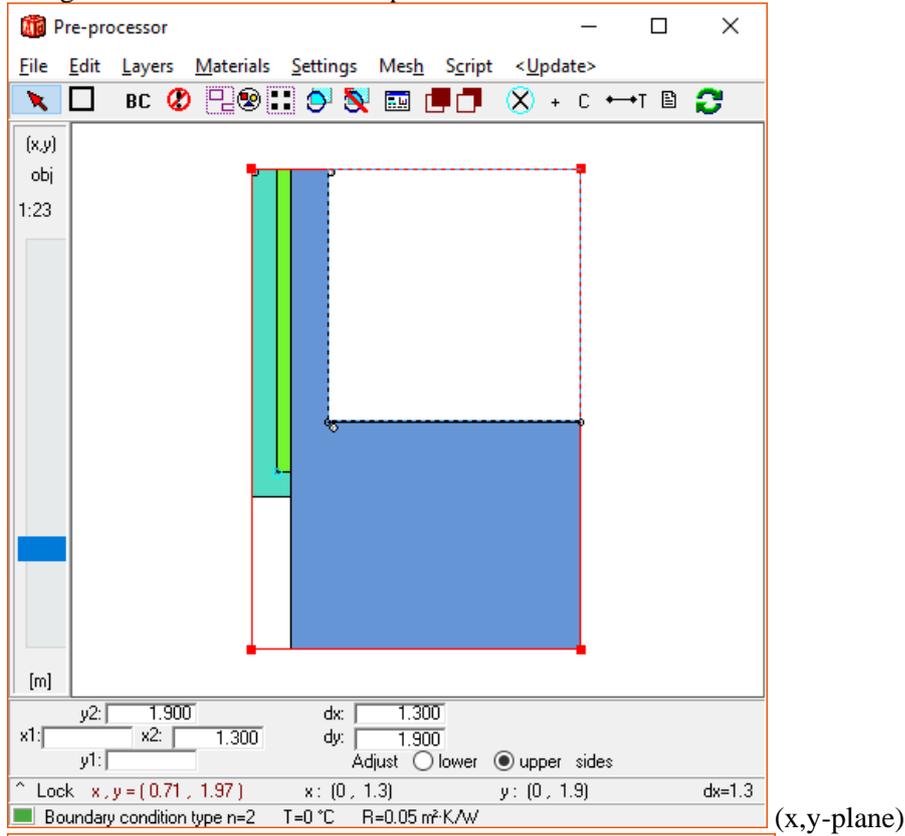


CEN example

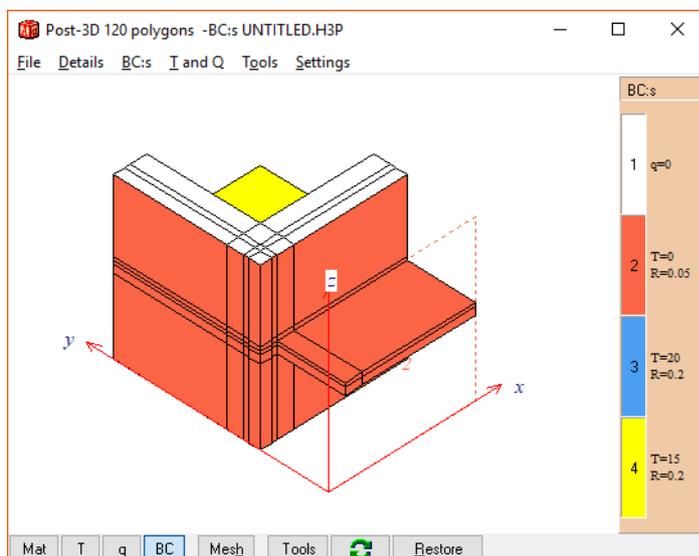
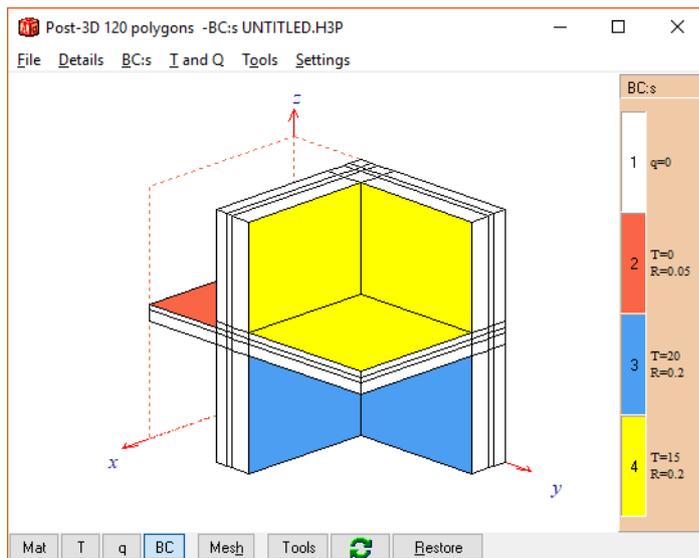
Open e.g. the script “CEN example (new BC box type)”. Run the script. Change the “Maximum numerical cells” from 100 to 1 in the mesh dialog in the pre-processor. This will give a quicker response in the post-processor when looking at e.g. boundary conditions.



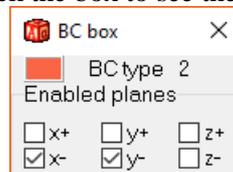
The generated data from the script is shown below.



There are three BC boxes: one for the yellow BC, one for the blue BC and one for the red BC.

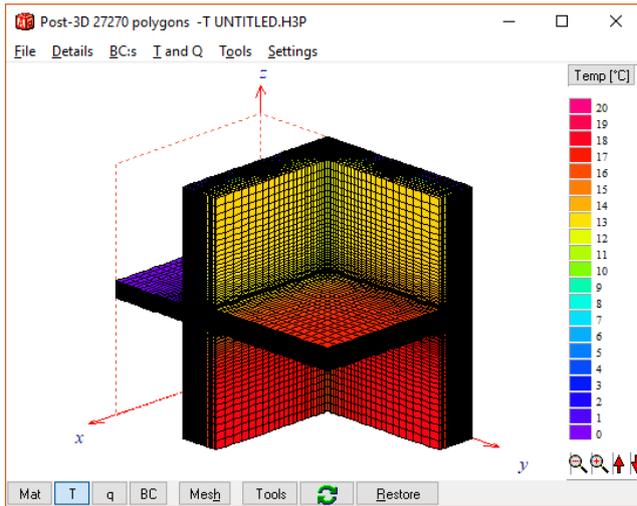


The BC box for the red BC has 4 of the 6 sides disabled since we do not want the BC to overwrite the white ($q=0$) one at the edges. Double click the box to see the settings:

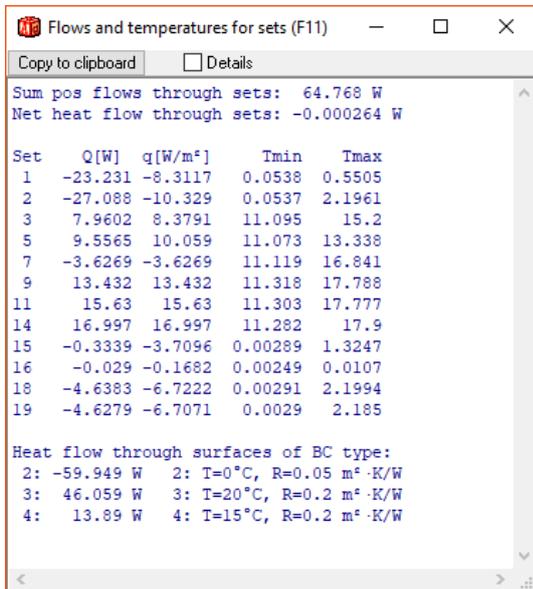


The planes are here enabled/disabled by the script commando “%enable=101000”, see p. 7 in https://www.buildingphysics.com/manuals/HEAT3_8_update.pdf

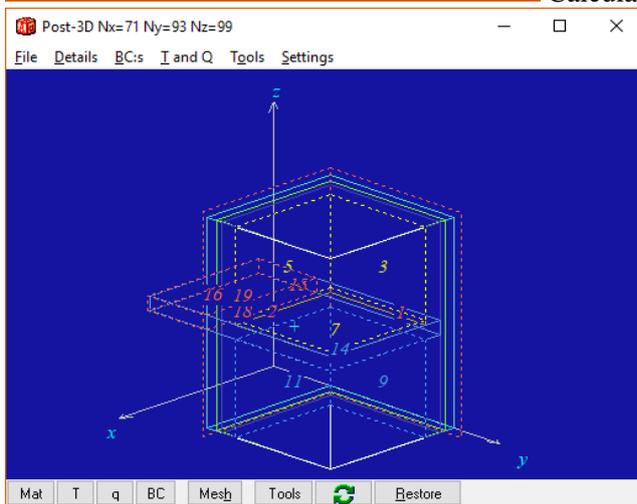
Now change the numerical mesh back to 100 (or run the script again). Run for steady-state (F9).



Calculated temperatures.



Calculated heat flows.



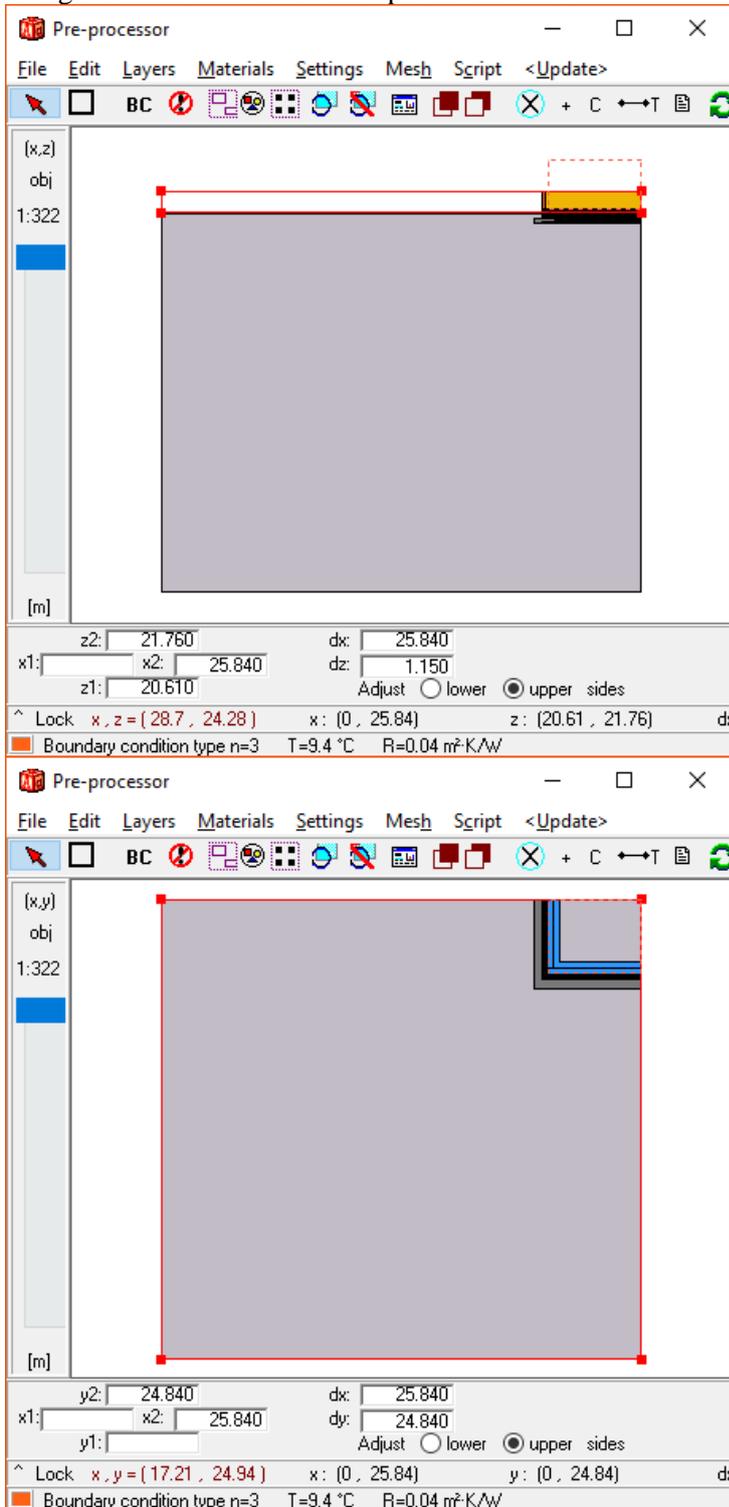
Surfaces (sets) shown in the post-processor.

Open the script “CEN example (old BC box type)” and examine that data. Note that 4 BC boxes are required here.

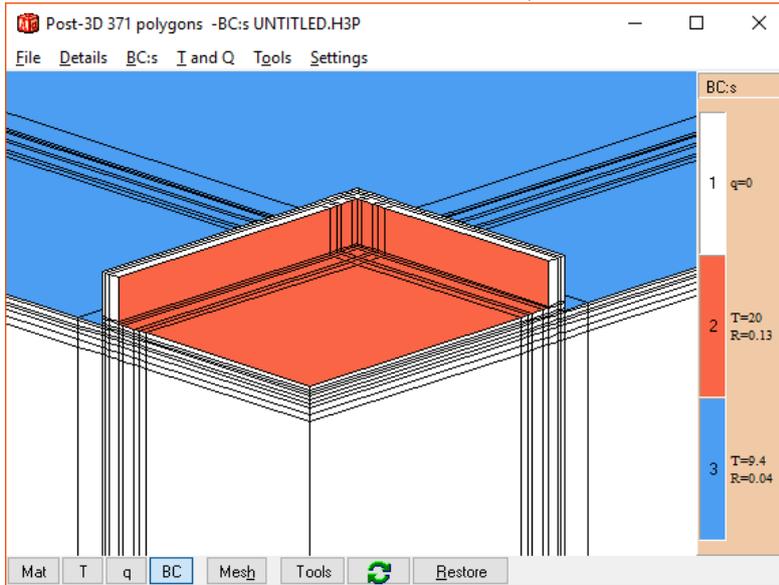
Slab example

Open e.g. the script “Slab example (new BC box type)”. Run the script. Change the “Maximum numerical cells” from 120 to 1 in the mesh dialog in the pre-processor.

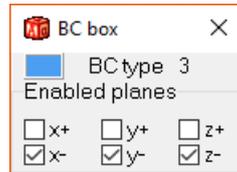
The generated data from the script is shown below.



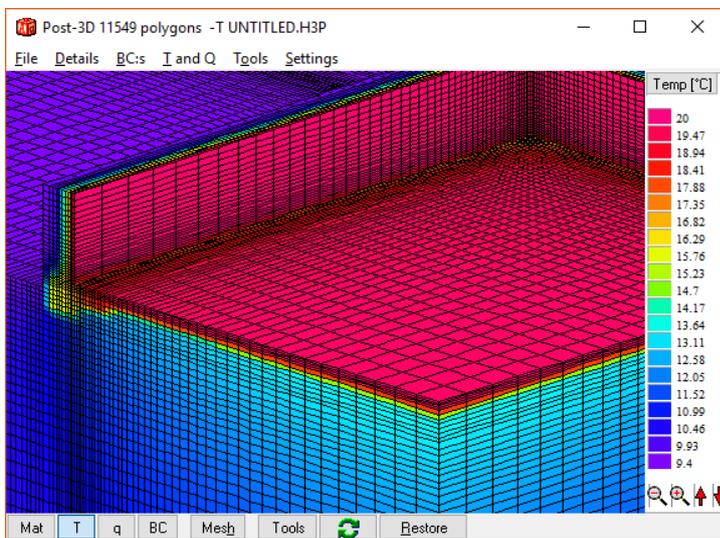
There are two BC boxes: one for the red BC, and one for the blue.



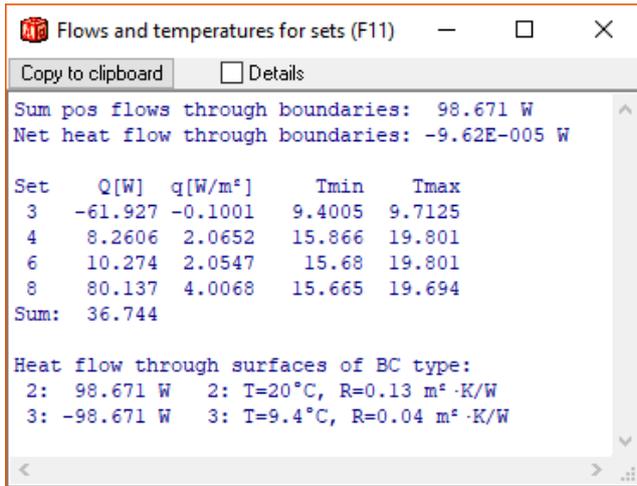
The BC box for the blue BC has 3 sides disabled since we do not want the blue BC to overwrite the white (q=0) one at the edges. Double click the box to see the settings:



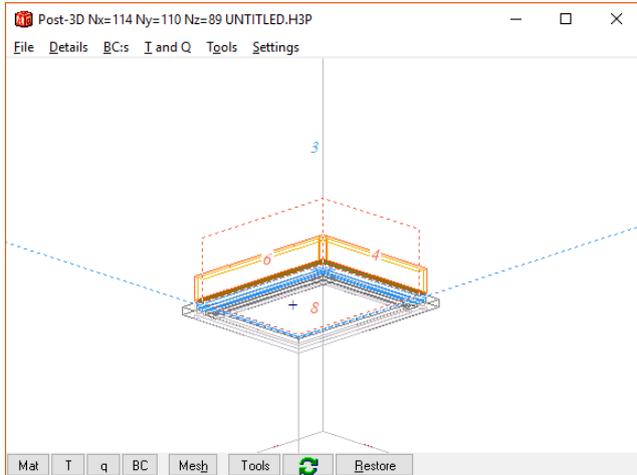
Now change the numerical mesh back to 120 (or run the script again). Run for steady-state (F9).



Calculated temperatures.



Calculated heat flows.



Surfaces (sets) shown in the post-processor.

Open the script “SLAB example (old BC box type)” and examine that data. Note that 3 BC boxes are required here.

2.8 Script files needs option for what BC box type is used

When using script files:

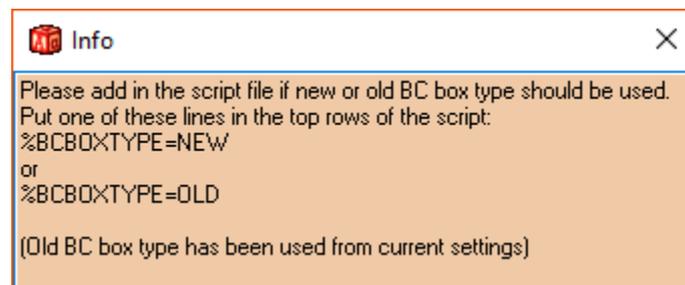
Add in the script file if new or old BC box type should be used. Put one of these lines in the top rows of the script:

`%BCBOXTYPE=NEW`

or

`%BCBOXTYPE=OLD`

If the option is missing the type is chosen to be the one currently given in HEAT3 and a window will be shown for info:



3. Miscellaneous new features

3.1 Material text files can be used

First, some short info how material properties are assigned: Every time updating occurs for the solver (<Update> in the pre-processor), each material box will search for its name (e.g. “concrete, lightweight”) in the material list (the current loaded material file .mtl). If a match is found it will use the defined material properties that has been loaded from the material file.

The name of the material file is stored in the input data file (.h3p) and is loaded when a h3p-file is opened. If the list does not contain the material name (e.g. if a rectangle is drawn and then the material name is deleted from the list), a warning will be issued and the drawn rectangles without a valid reference will be marked in black. See also chapter 5.2 in

https://www.buildingphysics.com/manuals/HEAT3_4.pdf

A new feature for reading materials from pure txt-files (instead of from mtl-files) has been added in HEAT3 v9. The format for each row in a txt-file is as follows:

```
“name;thermal conductivity (W/mK);volumetric heat capacity (J/m3K)”
```

Example:

```
“Airspace 101mm;0.7769;1”
```

The color for each material is randomly assigned whenever this txt-file is loaded. This has no importance if you only work with batch files, but it makes it possible see the different materials in the HEAT3 user interface. So, optionally, RGB-values can be assigned in the text file as follows:

```
“concrete, lightweight;0.81;1; R=100 G=50 B=150”
```

The resulting colors for an RGB-value can be seen in the material editor item “Pick”. Also, the RGB-values are shown for any arbitrary graphically chosen color in the pick list.

So, this example (see “Material_txt.txt”) would define a color for the first two materials and get a random color for the three last ones:

```
“  
concrete, lightweight;0.81 ;1; R=100 G=50 B=150  
acrylic resin, no cap., CEN ; 0.55 ; 0.9 ; R=77 G=133 B=97  
Airspace 101mm;0.7769;1  
Airspace 102mm;0.7846;1  
Airspace 103mm;0.7923;1  
“
```

Note that the syntax above is valid, spaces are allowed.

Tip: A good idea is to make a material file (.mtl or .txt) to be used for your company (e.g. mycompany_materials.mtl or mycompany_materials.txt). Then edit the file “Default_MTL_Filename.txt” that tells HEAT3 what material file should be opened for new problems. Put the default file name in the first row, such as “mycompany_materials.txt”.

Now, this file will be used whenever a new instance of HEAT3 is started.

As mentioned before, the HEAT3 project file (.h3p) contains the material file name. In HEAT3 v1-v8 only .mtl is used. From v9, the name can be both .mtl and .txt.

When a h3p-file is loaded (by user interface or by batch), the material file will automatically be loaded (mtl or txt). If the h3p-files refers to a mtl-file (e.g. “material.mtl”), and this file does not exist

in the “HEAT3 9” folder, HEAT3 will try to load a txt-file with the same name (“material.txt”) instead. You will see when this happen in the “Message windows”:

“

...

Loading material file:C:\Users\[username]\Documents\Blocon\HEAT3 9\material.mtl

-> changing to :C:\Users\[username]\Documents\Blocon\HEAT3 9\material.txt

“

As a summary, it is now also possible to open a txt-based material file in the material editor in HEAT3 (and this data will be loaded in the current session of HEAT3). The materials can be edited and saved as a mtl-file, but cannot be saved to a txt-file. So, a txt-file is always created/edited outside HEAT3 e.g. using Notepad.

3.2 Path to material files can now be given

Material files are normally located in the startup folder (“...My Documents\Blocon\HEAT3 9”) but this can now be changed. Make a file “*path_materialfiles.txt*” in the same folder as the HEAT3 exe-file (“C:\Program Files (x86)\BLOCON\HEAT3_v9.x”). Write the material path in this file, e.g. “C:\Dropbox\TestPath”

If *path_materialfiles.txt* does not exist (or if the path is incorrect), the standard folder (“...My Documents\Blocon\HEAT3 9”) is used.

Some other comments:

- HEAT3 always expects to find “default.mtl” so copy this file to the new material files folder (e.g. “C:\Dropbox\TestPath”).
- If “Default_MTL_Filename.txt” is used, this file must also be located in the new material files folder. The first row in this file gives what material file that is used (this could be .mtl or .txt, such as “mycompany_materials.txt”).

3.3 Faster calculations

Steady-state calculations will be faster for most cases. Dynamic (or transient) calculations will be much faster for all cases. This is due to improved multi-core routines.

The table below shows the benchmarks on a PC with Intel(R) Core(TM) i7-3770K CPU @ 3.50GHz.

Open the script examples to re-run the cases on your PC. Other files are in the examples folder.

	Nodes	Calculation	HEAT3 v9	HEAT3 v8	Increase
CEN example (script)	447378	Steady-state	4s	6s	1.5
	447378	Dynamic (1 hour)	20s	51s	2.6
Slab example (script)	789500	Steady-state	13s	17s	1.3
	789500	Dynamic (24 hours)	11s	17s	1.5
ISO10211_CASE2.H3P	25026	Steady-state	15s	112s	7.5

Note: The CPU-load (current value and peak value) will be shown in the main window (lower left).

3.4 Other new features

- BC boxes are now drawn in BC colors in the pre-processor (can be turned on/off in the pre-processor settings menu).
- A red label with the text “Update needed” will be shown in the pre-processor if the input needs to be validated and used by the solver/post-processor. In that case, just press the red label (or use menu item (<Update>)).

4. New batch job features

4.1 Introduction

There are new batch features for loading and running a text script file. For all regular batch parameter options see p. 24 at

https://www.buildingphysics.com/manuals/HEAT3_5_update_manual.pdf

First, we will show below how to run a h3p-file using a batch file in Windows 10.

4.2 Example: running a h3p-file using a batch file

This example shows how to run a steady-state case (ISO10211_CASE3) from a batch file **mybatch1.bat** located in folder My Documents\Blocon\HEAT3 9\HEAT3_Batch. The batch file has one row:

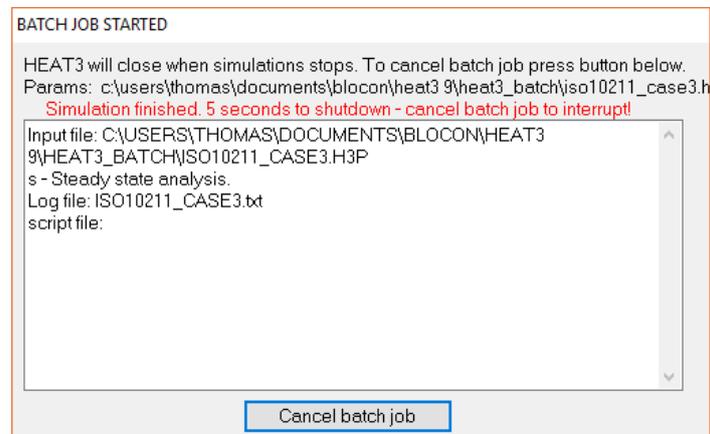
```
start "Title" "C:\Program Files (x86)\BLOCON\HEAT3_v9.01\HEAT3_v9_01.exe"  
"%userprofile%\documents\Blocon\HEAT3 9\HEAT3_Batch\ISO10211_CASE3.H3P" s
```

(Note that you might need to update the names for folders and exe-file version)

The syntax to start an application using batch files is described in

<https://ss64.com/nt/start.html>

The above batch line will start an instance of HEAT3 which will open file ISO10211_CASE3.H3P and solve it for steady-state. The following window will be displayed during/after the simulation:



When the simulation is done, a log file *filename.txt* (in this case ISO10211_CASE3.H3P.txt) that shows calculated heat flow will be created. The log file will be appended to if it already exists, so you might want to delete the file in your bat-file between runs in that case if needed. Here is the content of the log file:

```

ISO10211_CASE3.txt - Anteckningar
Arkiv Redigera Format Visa Hjälp

C:\USERS\THOMAS\DOCUMENTS\BLOCON\HEAT3 9\HEAT3_BATCH\ISO10211_CASE3.H3P S
Calculation started at 13:19:06, 2018-10-31
Calculation stopped at 13:19:07, CPU time=1s ICPS=56839518 (iterated cells per second) Iter=110
Sum pos flows through sets: 64.708 W
Net heat flow through sets: -2.74E-005 W

Set  Q[W]  q[W/m²]  Tmin  Tmax
1    -23.22 -8.3083  0.0571 0.5506
2    -27.03 -10.308  0.0571 2.2085
3     7.9581 8.3771  11.106 15.194
5     9.5455 10.048  11.003 13.339
7    -3.6352 -3.6353  11.134 16.842
9    13.422 13.423  11.333 17.788
11   15.61  15.61  11.316 17.778
14   16.989 16.989  11.296 17.902
15   -0.3357 -3.7298  0.00265 1.3317
16   -0.0289 -0.1674  0.00265 0.0106
18   -4.6422 -6.7279  0.00266 2.217
19   -4.6317 -6.7127  0.00265 2.202
Sum: -3.15E-005

Heat flow through surfaces of BC type:
2: -59.889 W  2: T=0°C, R=0.05 m²·K/W
3: 46.021 W  3: T=20°C, R=0.2 m²·K/W
4: 13.868 W  4: T=15°C, R=0.2 m²·K/W
Calculation stopped at 13:19:08, CPU time=2s ICPS=58179181 (iterated cells per second) Iter=249

```

Some that may come in handy:

"min" - minimize HEAT3 when started

"nowait" - HEAT3 will by default wait 10 seconds after a batch job to allow the user to interrupt a new batch job. The "nowait" parameter makes HEAT3 close down immediately after the simulation.

Example:

```

start "Title" "C:\Program Files (x86)\BLOCON\HEAT3_v9.01\HEAT3_v9_01.exe"
"%userprofile%\documents\Blocon\HEAT3 9\HEAT3_Batch\ISO10211_CASE3.H3P" s nowait min

```

Several simulations can be running in the same time. These two command rows will actually start two calculations that will run in parallel:

```

start "Title" "C:\Program Files (x86)\BLOCON\HEAT3_v9.01\HEAT3_v9_01.exe"
"%userprofile%\documents\Blocon\HEAT3 9\HEAT3_Batch\TestFile.H3P" s nowait
start "Title" "C:\Program Files (x86)\BLOCON\HEAT3_v9.01\HEAT3_v9_01.exe"
"%userprofile%\documents\Blocon\HEAT3 9\HEAT3_Batch\TestFile2.H3P" s nowait min

```

Use "start /wait "Title"..." in order to execute one row at a time. A scenario would e.g. be to start a dynamic calculation for a case and after simulation write the calculated temperatures to a file. Then start a second calculation with same geometry (and mesh) but perhaps with some other material defined using the saved temperature field as initial temperatures (and so on). How to write/read the temperature is given in p. 24 at

https://www.buildingphysics.com/manuals/HEAT3_5_update_manual.pdf

4.3 Example: running a case with script file using a batch file

A new feature for loading and running a text script file for the pre-processor has been added. The following batch parameters are new:

"c scriptfilename" loads a script file
 "saveh3p" will save new geometry to input data file .h3p on exit
 "i imagename.bmp" will save four types of images in bmp format, see below

A material text file (*.txt) can now also be used in a script file (see also section 3.1 and 3.2):

```
%loadmaterialfile=Material_test.txt
```

Consider example **mybatch2.bat** that has the following row:

```
start "Title" "C:\Program Files (x86)\BLOCON\HEAT3_v9.01\HEAT3_v9_01.exe"
"%userprofile%\documents\Blocon\HEAT3 9\HEAT3_Batch\TestFile.H3P" s c example_script.txt i image1.bmp
```

Executing this batch file will cause the following:

1. HEAT3 will open batchtest.h3p

Note that this h3p-file could just be an empty dummy file with no geometry in the pre-processor since this will be defined by the script. However, all settings (such as stop criteria) that are defined in this file will be used for the simulation.

2. The script file example_script.txt will generate new geometry (mesh etc.)

Note that the script file here will use a text based material file Material_test.txt that is located in ...documents\Blocon\HEAT3 9 where material files (.mtl and .txt) normally is (this can however be changed; see section 3.2).

```
example_script.txt - Anteckningar
Arkiv Redigera Format Visa Hjälp
%loadmaterialfile=Material_test.txt
%BCBOXTYPE=OLD

y      100
a      2      0      0.05      ! max number of cells in each direction
a      3      20      0.2      ! BC type 2 has T=0 and R=0.05
a      4      15      0.2      ! BC type 3 has T=20 and R=0.2
a      4      15      0.2      ! BC type 4 has T=15 and R=0.2

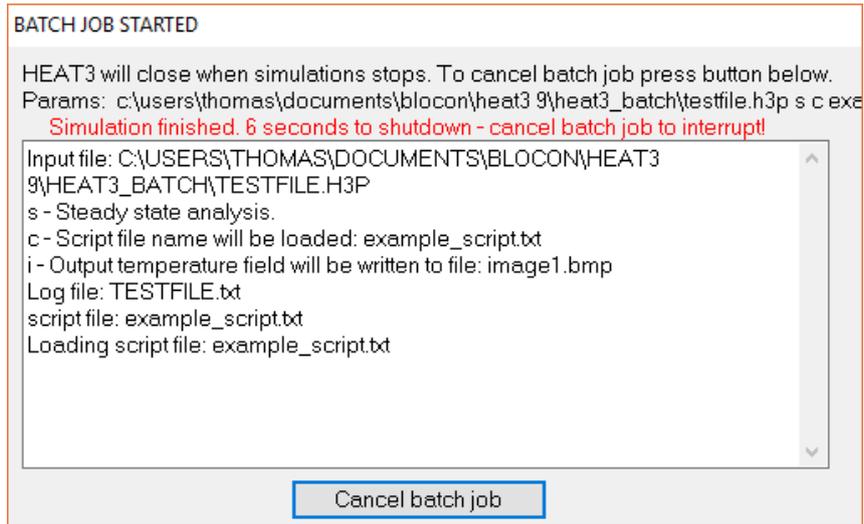
!      x1      y1      z1      x2      y2      z2
p      0      0.6      0      1.3      1.9      2.15      Airspace 101mm
p      0.1      0.7      0      1.3      1.9      2.15      Airspace 102mm
p      0.15      0.75      0      1.3      1.9      2.15      Airspace 103mm
p      0.3      0.9      1.15      1.3      1.9      1.2      concrete, lightweight
p      0.15      0      1      1.3      1.9      1.15      acrylic resin, no cap., CEN
e      0.3      0.9      1.2      1.3      1.9      2.15      ! empty box
e      0.3      0.9      0      1.3      1.9      1      ! empty box
b      0      0.6      -0.08      1.34      1.97      2.22      2      ! BC box
b      0.3      0.9      1.2      1.3      1.9      2.15      4      ! BC box
b      0.3      0.9      0      1.3      1.9      1      3      ! BC box
b      0.15      0      1      1.32      0.6      1.15      2      ! BC box
x      0.1      0.7      1.1      ! expansion point
d      0.3      0.9      1.2      1.3      0.9      1.2      ! Temp line
```

example_script.txt

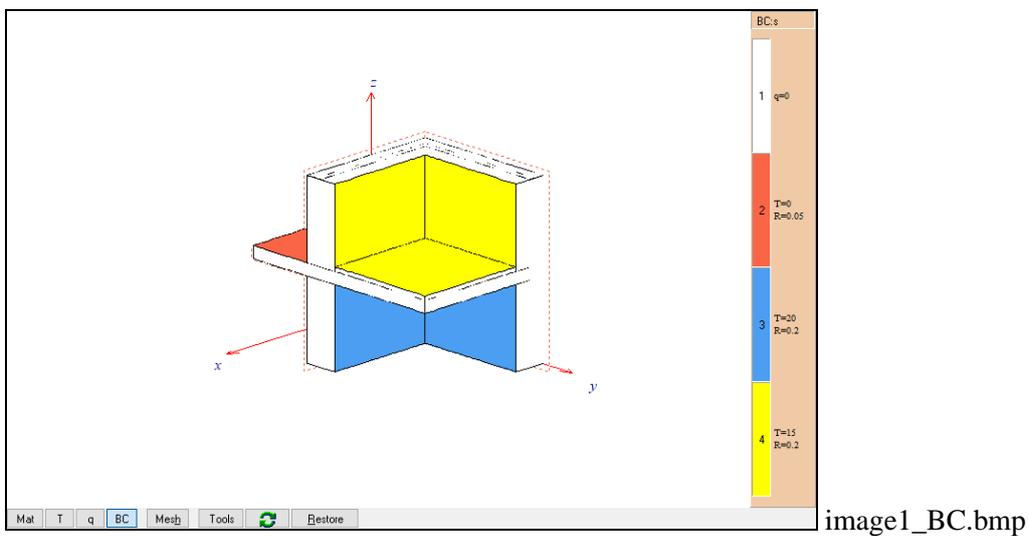
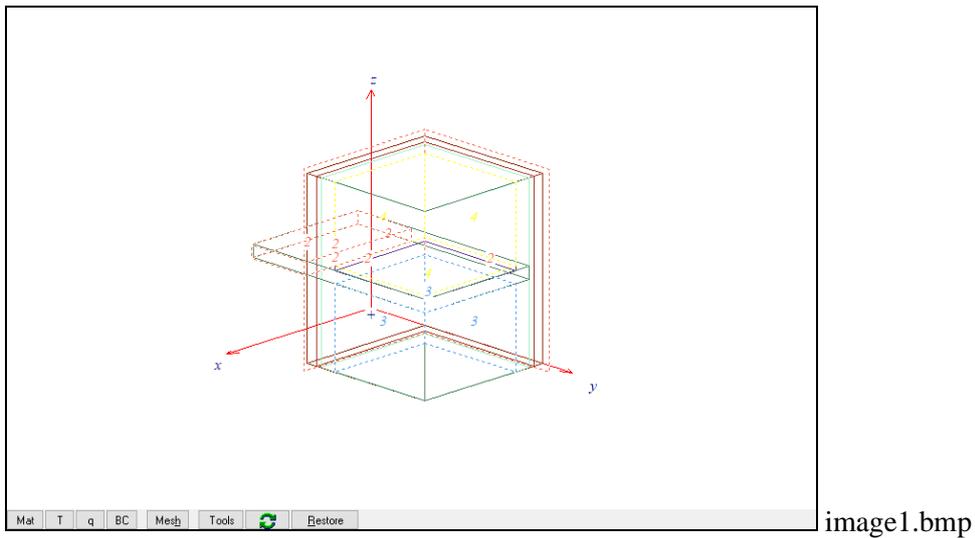
```
Material_test.txt - Anteckningar
Arkiv Redigera Format Visa Hjälp
concrete, lightweight;0.81 ;1; R=100 G=50 B=150
acrylic resin, no cap., CEN ; 0.55 ; 0.9 ; R=77 G=133 B=97
Airspace 101mm;0.7769;1
Airspace 102mm;0.7846;1
Airspace 103mm;0.7923;1
```

Material_test.txt with dummy materials

3. Simulation is started



4. When simulation is done, the following image files will be created and saved in the folder where the batch was started:
 Image1.bmp, Image1_BC.bmp, Image1_M.bmp, Image1_M_Mesh.bmp, Image1_T.bmp



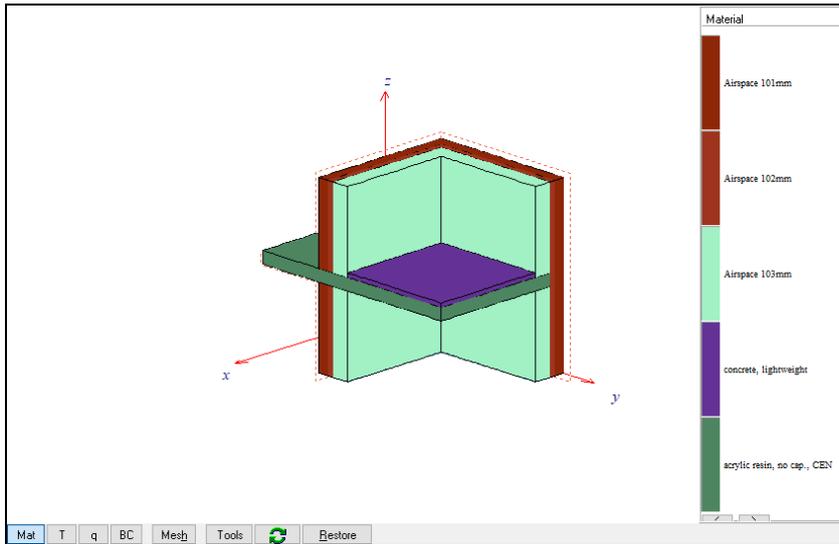


image1_M.bmp

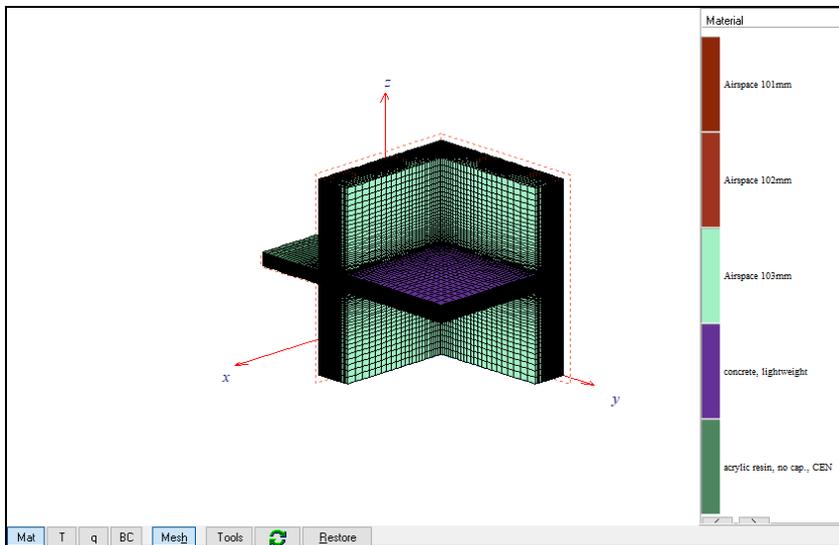


image1_M_Mesh.bmp

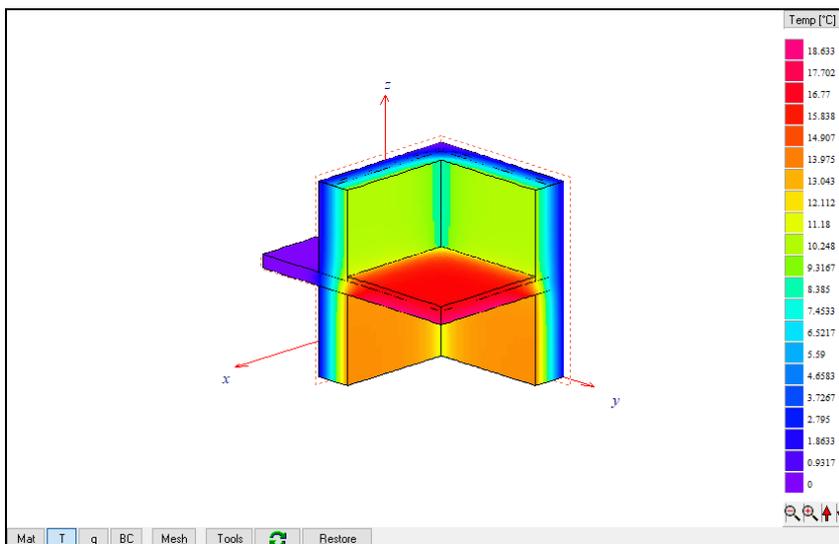


image1_T.bmp

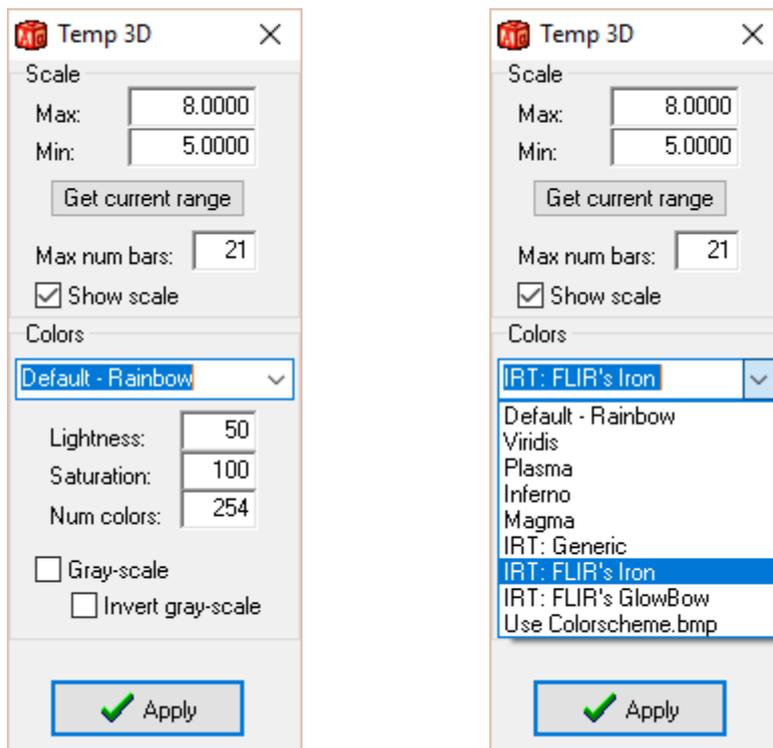
(with min/max temperatures)

5. Improvements in post-processor

5.1 New color schemes added

5.1.1 Introduction

New color schemes have been added. It is e.g. possible to produce images that look like infrared thermography pictures (that's right, now you don't have to leave the office to get them pictures ☺). The color scheme is chosen in the scale options window (menu item "T and Q/Options for scale" in the post-processor menu, or just click in the white area of the scale window). Use the drop-down list "Colors". Note that it is only possible to change lightness, saturation and number of colors for the first color scheme which is called "Default - Rainbow".



The available schemes are shown in the right-hand figure.

Some schemes are taken from

https://matplotlib.org/examples/color/colormaps_reference.html



There are some schemes that typically is used for Infrared thermography (IRT) :

IRT: Generic



Some color palettes are taken from FLIR Systems (www.flir.com):

IRT: FLIR's iron palette



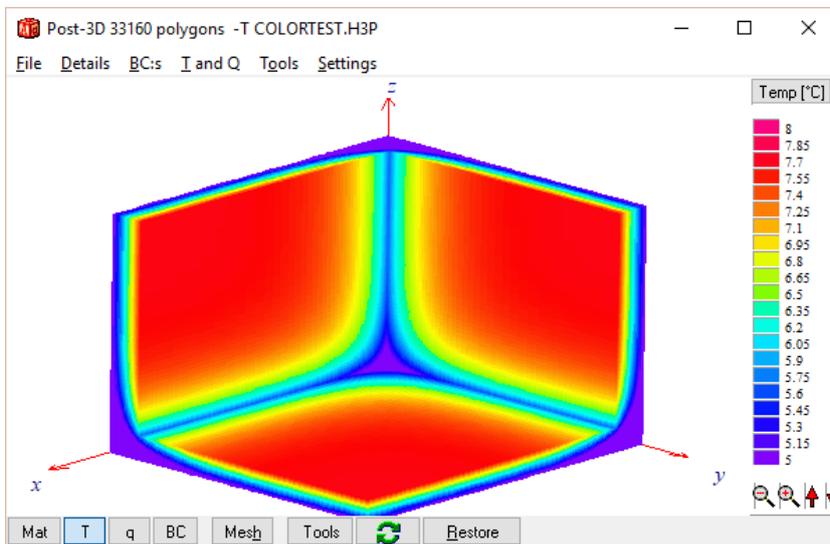
IRT: FLIR's GlowBlow palette



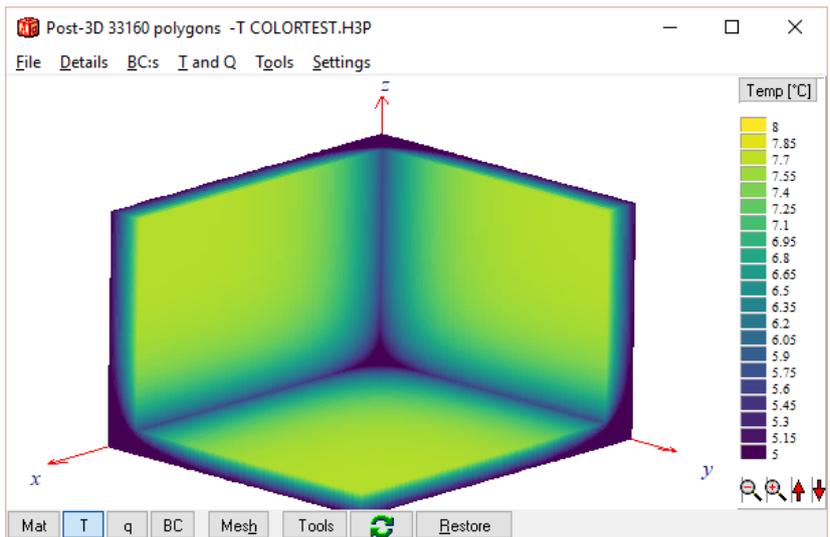
IRT:FLIR's Yellow palette:



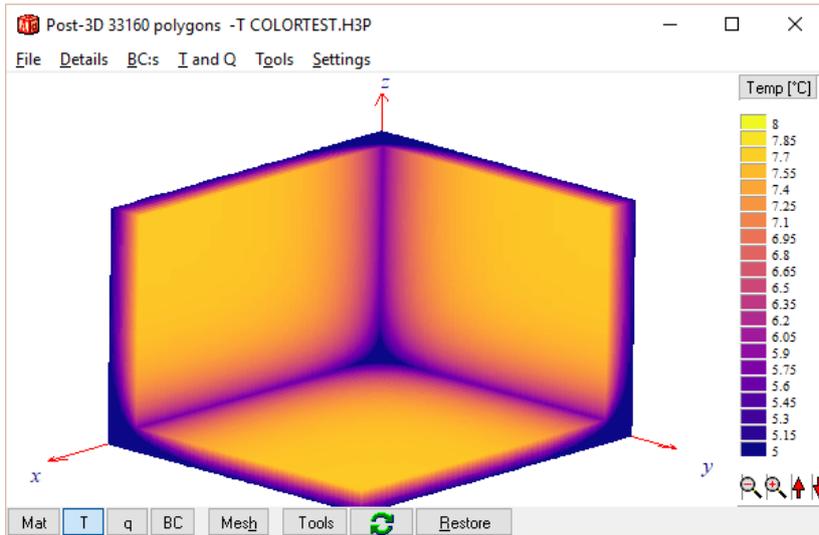
The result from different color schemes are shown below for a simple corner example.



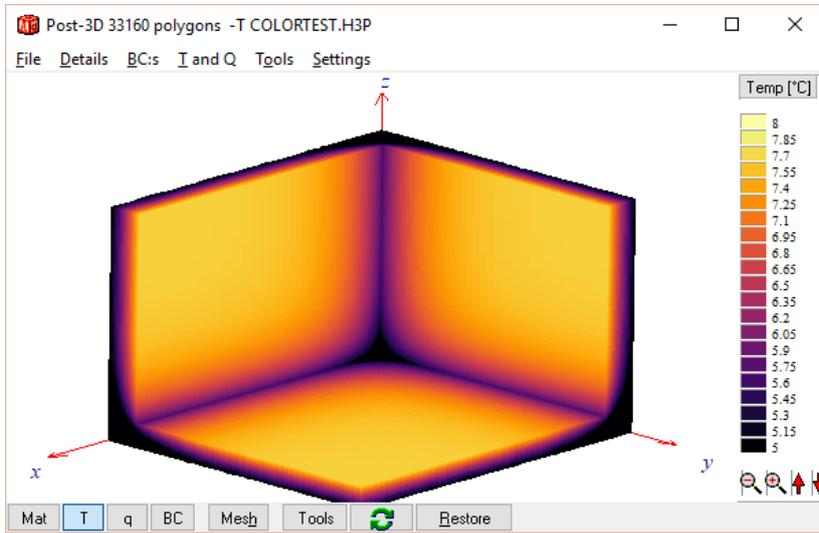
Default Rainbow



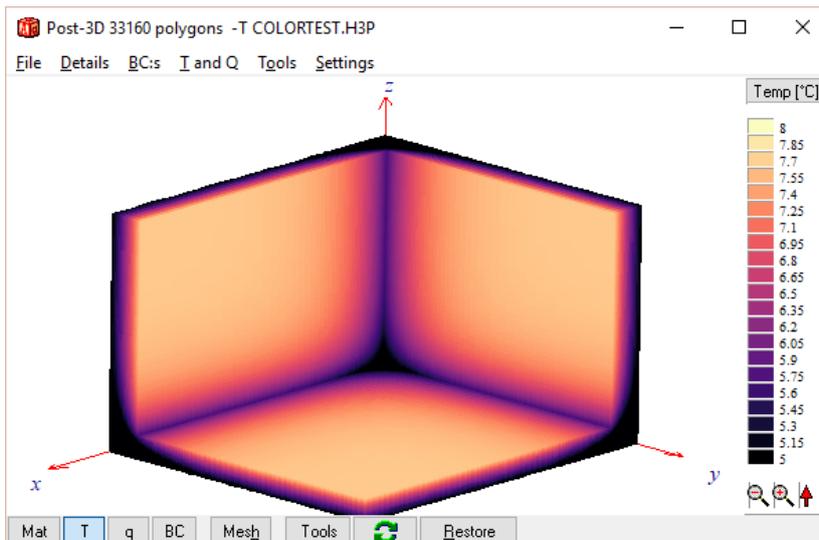
Viridis



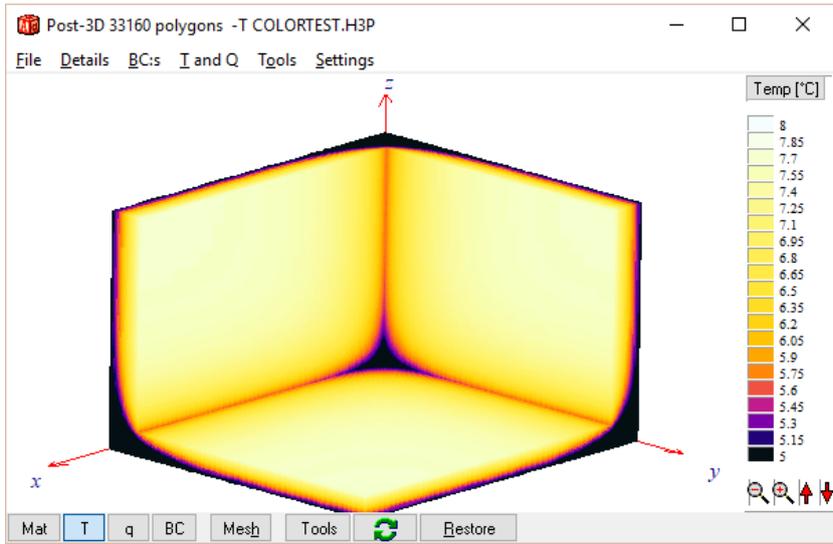
Plasma



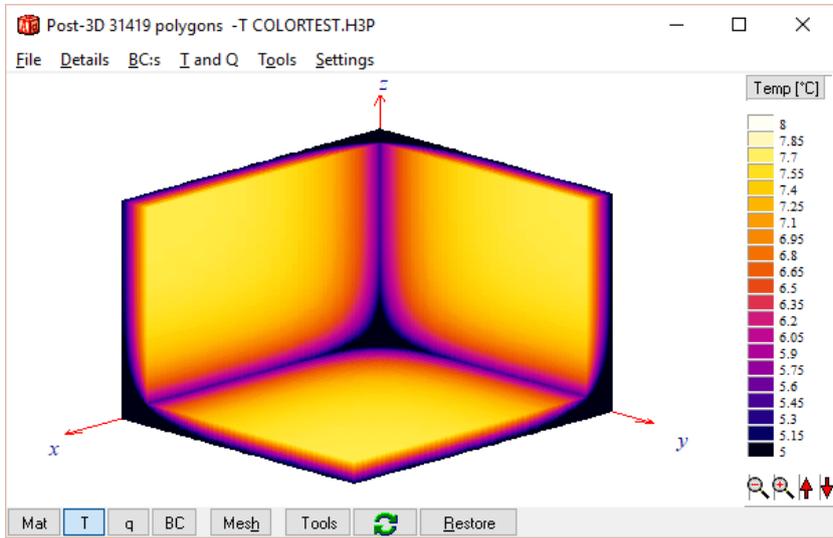
Inferno



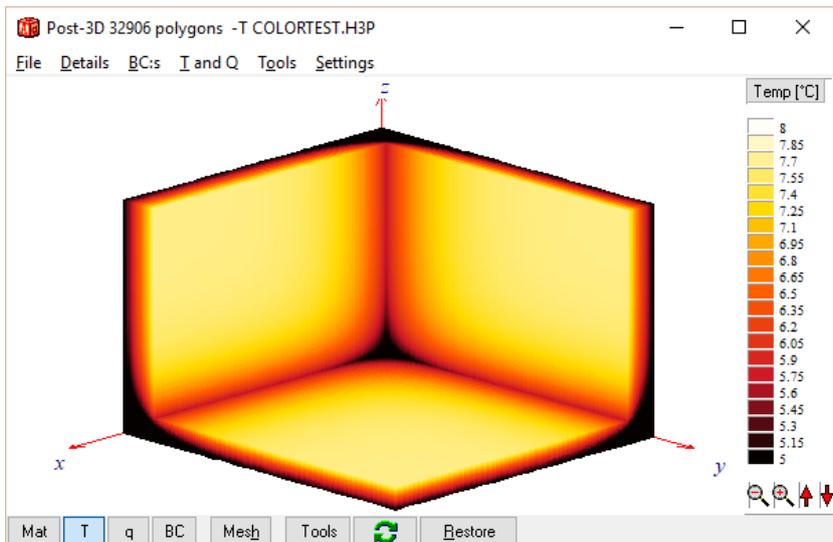
Magma



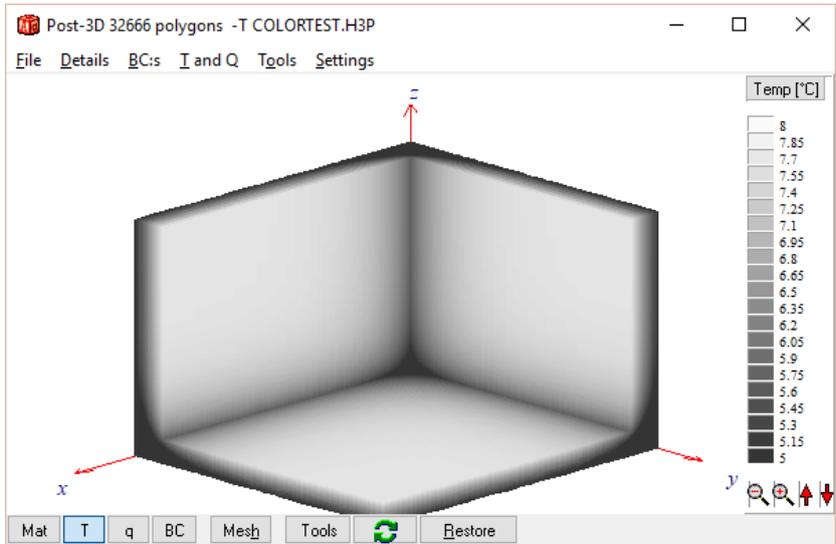
IRT: Generic



IRT: FLIR's iron



IRT: FLIR's GlowBlow



Gray-scale (see check-box)

5.1.2 Own-defined schemes

It is also possible to use own-defined schemes. To do this place/replace the file called “ColorScheme.bmp” in the startup folder (where the .mtl files are placed as default).

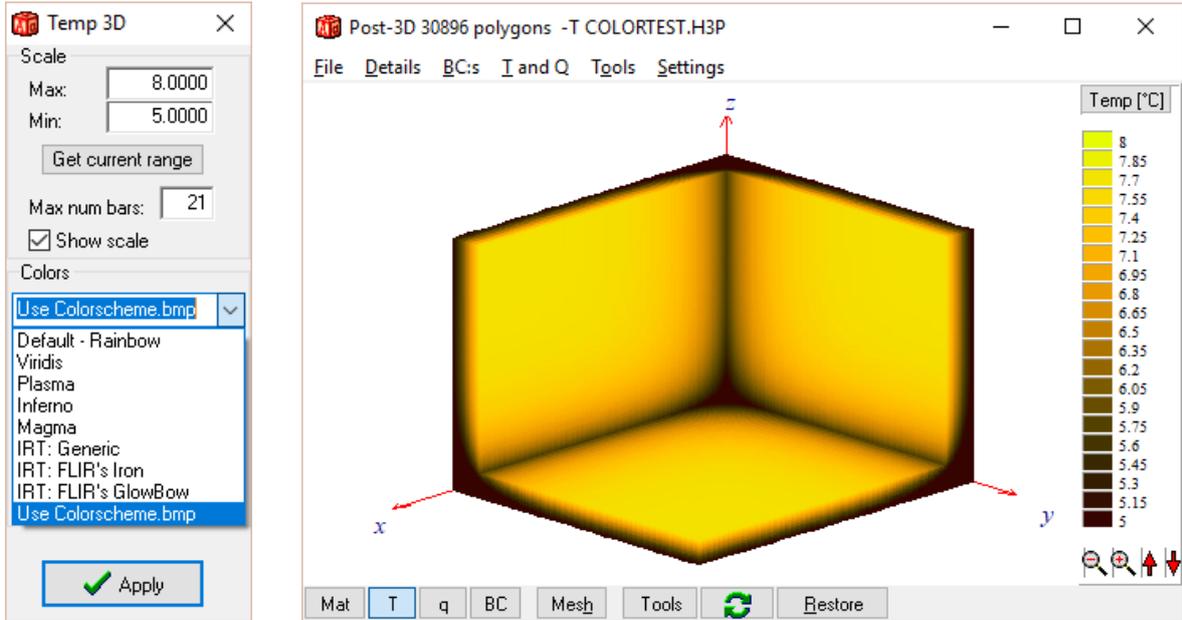
The current file “ColorScheme.bmp” contains the FLIR’s Yellow palette:



When “Use colorscheme.bmp” is selected, this file will be loaded and scanned using 255 points along the image width located at half the height (see red line below):



The result is shown below.



FLIR’s Yellow palette

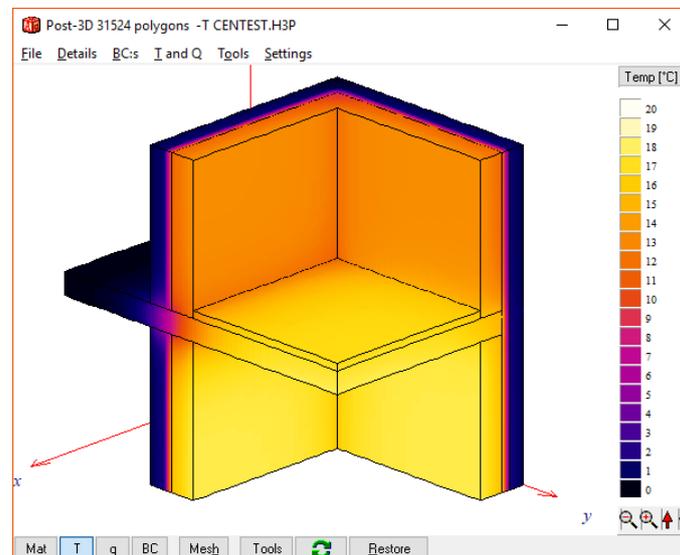
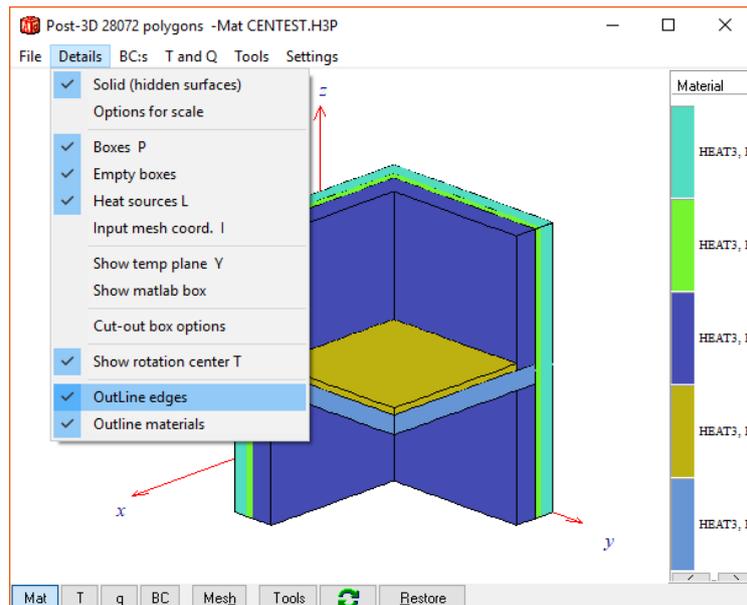
So, place your own color scheme picture in “Use colorscheme.bmp” to define new scales.

Ps. If you have a vertical placed scale this could easily be horizontally rotated using a paint program (e.g. with Windows Paint).

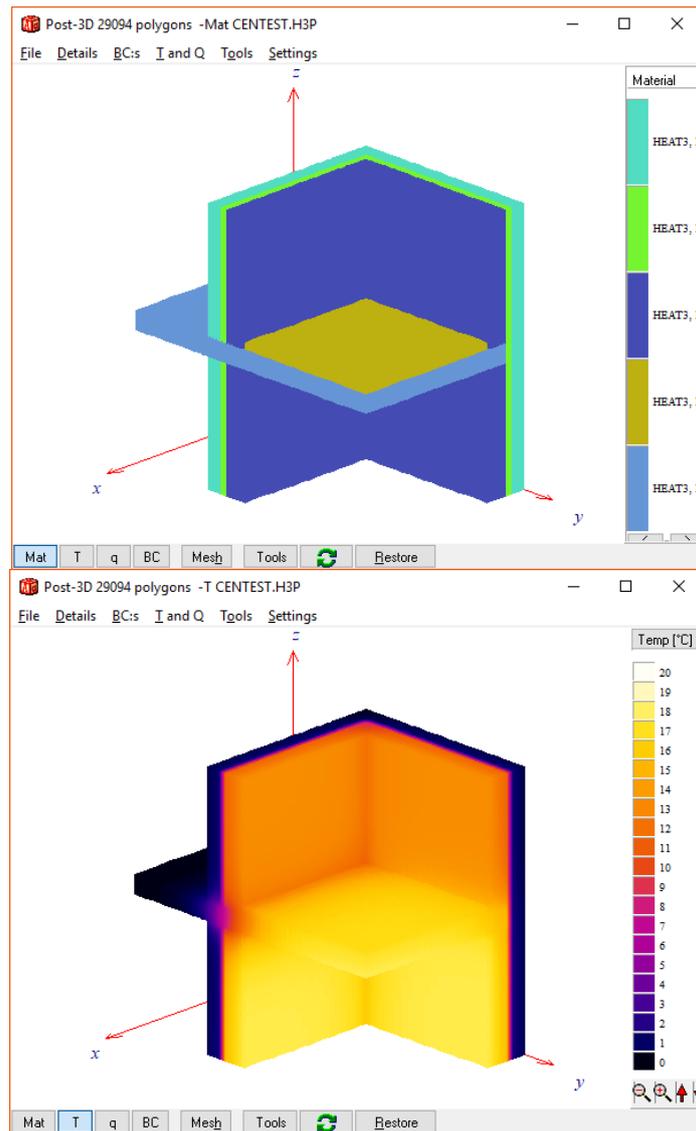
5.2 Edges can now be outlined

Two options are added in the Details menu:

- Outline edges: A black line is drawn at corners facing inwards and outwards
- Outline materials: A black line separates materials (or more precise: areas of different thermal conductivities)



Compare the above figures with the ones below where these options are turned off.



5.3 Faster and flicker-free drawing

An option for faster and flicker-free drawing is now added. This option can be turned off in menu item Details/Quick draw.

6. Appendix A. List of new update features

For update info, see also section “Version update info” at <https://buildingphysics.com/heat3-3/>

Update 9.1 (Sept 10, 2020)

Improved report preview

There is now a better layout for generated reports. The string for “Projects notes” was sometimes corrupt in v9.01 and is now fixed.

```
HEAT3 report: ISO10211 CASE3 SLASK
Input file: ISO10211_CASE3_SLASK.H3P, last saved on 2020-09-09 07:27:34

Project notes: 1
               2
               3

Boundary flows: Sum pos flows through sets: 64.708 W
                Net heat flow through sets: 1.27E-005 W

Set  Q[W]  q[W/m²]  Tmin  Tmax
 1  -23.22 -8.3083  0.0571  0.5506
 2  -27.03 -10.308  0.0571  2.2085
 3   7.9581  8.3771  11.106  15.194
 5   9.6455  10.048  11.053  13.339
 7  -3.6352 -3.6353  11.134  16.842
 9   13.422  13.423  11.333  17.788
11   15.61  15.61  11.316  17.778
14  16.989  16.989  11.296  17.902
15  -0.3357 -3.7292  0.00266  1.3317
16  -0.0289 -0.1674  0.00266  0.0106
18  -4.6422 -6.7279  0.00267  2.217
19  -4.6317 -6.7126  0.00266  2.202
Sum: 1.19E-005

Heat flow through surfaces of BC type:
2: -59.889 W  2: T=0°C, R=0.05 m²·K/W
3: 46.021 W  3: T=20°C, R=0.2 m²·K/W
4: 13.668 W  4: T=15°C, R=0.2 m²·K/W

Calculation: Steady-state simulation, 259 iterations
              Stable time step: 1 s
              Number of computational cells=385992, Nx=78 Ny=114 Nz=129

Boundary conditions: 4 types
1: q=0 W/m²
2: T=0°C, R=0.05 m²·K/W
3: T=20°C, R=0.2 m²·K/W
4: T=15°C, R=0.2 m²·K/W
```

Writing results to output file gave error

Version 9.1 handles this correctly now. The format for output results is also updated, see below.

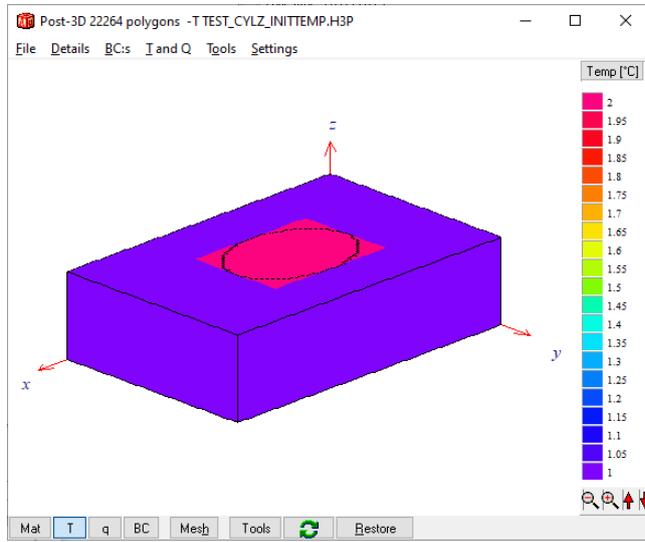
```
Output file ISO10211_CASE3_SLASK.OUT
Copy
Sum pos flows through sets: 128.73 W
Net heat flow through sets: 98.159 W

Set  Q[W]  q[W/m²]  Tmin  Tmax
 1  -10.031 -3.589  0.0155  0.2495
 2  -13.651 -5.2057  0.0155  1.5971
 3   19.429  20.453  8.2925  12.102
 5   20.056  21.112  8.279  11.092
 7   4.7953  4.7954  8.3429  15.436
 9   28.387  28.388  8.5259  14.789
11   29.37  29.371  8.5155  14.789
14   26.31  26.311  8.4861  16.359
15  -0.2005 -2.2281  0.00142  0.8026
16  -0.0167 -0.0969  0.00142  0.00636
18  -3.1485 -4.563  0.00142  1.6042
19  -3.1406 -4.5516  0.00142  1.5929
Sum: 98.159

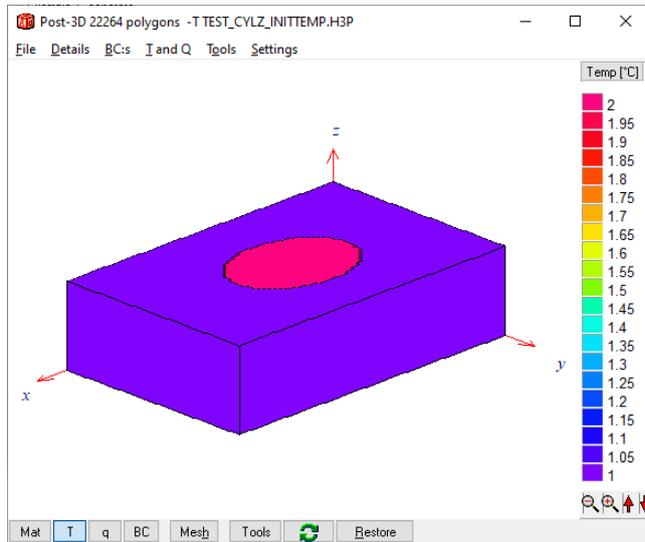
Heat flow through surfaces of BC type:
2: -30.188 W  2: T=0°C, R=0.05 m²·K/W
3: 84.067 W  3: T=20°C, R=0.2 m²·K/W
4: 44.28 W  4: T=15°C, R=0.2 m²·K/W
sum Q (all sets)=98.159 W 7.5743 W/m2
Iter=2800 (100000), (R)=0 (0.0001), (F)=0.6162 (2E-006)
Time=51800 sec, (3.1536E007 sec), 14h23m20s days, (1y days)
```

Initial temperatures of cylindrical and spherical shapes were set for the whole bounding area around the shape

Version 9.1 now handles this correctly, see images below. Note that initial temperatures only are used for transient calculations. It does not matter for steady-state calculations. So, if you have used cylindrical and spherical shapes in transient analysis and if different initial temperatures are of importance to the end results, we recommend that you re-calculate the case with v9.1.



v9.01



v9.1

The Post-2D view of cylindrical and spherical shapes was showing only the bounding rectangle in v9.01. This is also fixed in v9.1.

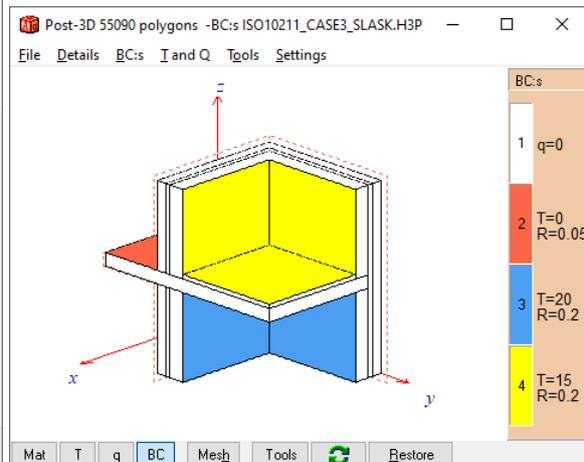
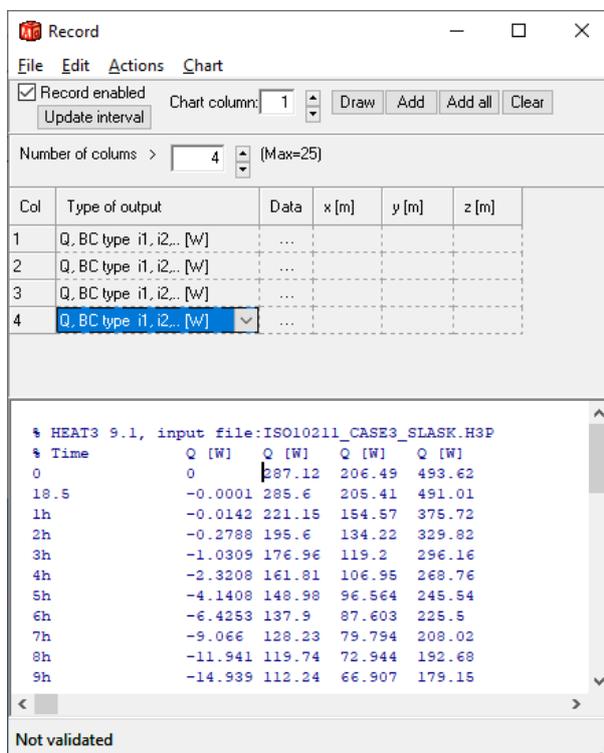
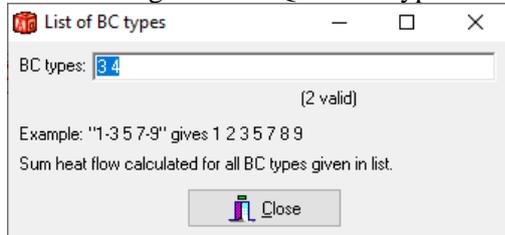
New type added for recorder options where heat flow through surfaces of each BC type will be shown.

The recorder below shows heat flows for four columns:

- Column 1 gives sum Q for BC type 2 (T=0) which is given in the "Data" field ("BC type=2")
- Column 2 gives sum Q for BC type 3 (T=20) which is given in the "Data" field ("BC type=3")
- Column 3 gives sum Q for BC type 4 (T=15) which is given in the "Data" field ("BC type=4")

It is also possible to sum the flows for multiple BC types:

- Column 4 gives sum Q for BC types 3+4 which is given in the "Data" field as ("3 4")



Floating point error in rare cases with few numerical cells and multi-core calculation fixed

Text font for right panel in Post-3D window fixed (menu item "Settings/Text font in right panel")

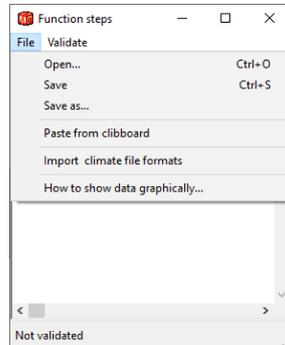
Update 9.2 (March 17, 2024)

Updated license manager

The license manager has been updated with many performance improvements.

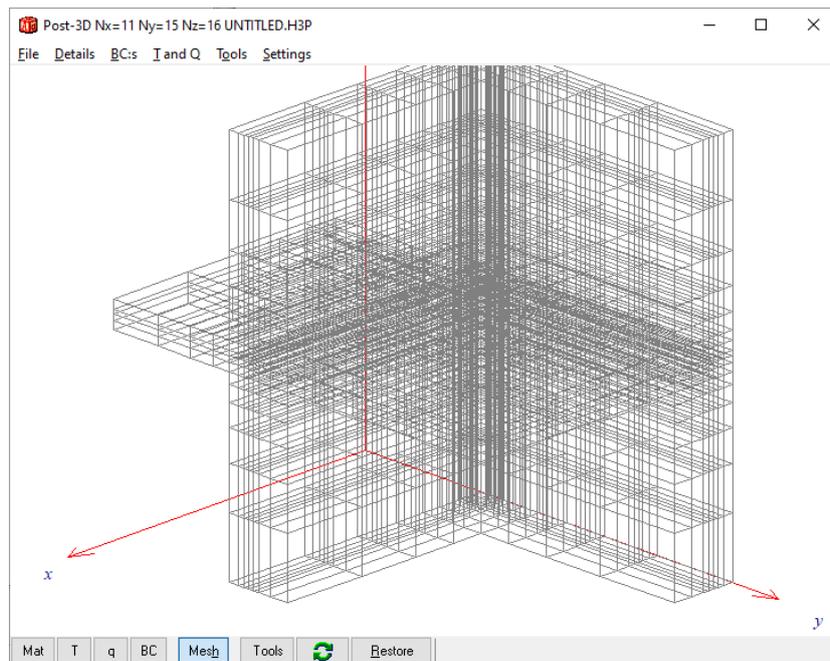
Function

Paste from clipboard added to import data into function steps window:



Wire frame numerical cells

It is now possible to draw a wire frame mesh in x,y,z-view:



Increased data size for drawn polygons

The maximum number of polygons shown in the post-processor has been increased from 150,000 to 300,000.

Installation to common folder

HEAT3 now install material files (and some other files) to the common folder C:\Users\Public\Documents\BLOCON\HEAT3 9 by default so that the files can be shared by different users. See also Section 1.4 "Installation".

Initial mesh

The initial mesh number is changed from 20 cells to 60 cells.