

Test case 2d transient solution - initial data

- 100 – initial temperature
- 500 – simulation time [s],
- 50 – simulation step time [s],
- 1200 – ambient temperature [C],
- 300 – α [$\text{W}/\text{m}^2\text{K}$],
- 0.100 – H [m],
- 0.100 – B [m],
- 4 – N_H ,
- 4 – N_B ,
- 700 – specific heat [$\text{J}/(\text{kg}^\circ\text{C})$],
- 25 – conductivity [$\text{W}/(\text{m}^\circ\text{C})$],
- 7800 – density [kg/m^3].

Martix [C]

```
_____ Iteration 0 _____  
_____ Matrix [C] _____  
674.074 337.037 0 0 337.037 168.519 0 0 0 0 0 0 0 0 0  
337.037 1348.15 337.037 0 168.519 674.074 168.519 0 0 0 0 0 0 0  
0 337.037 1348.15 337.037 0 168.519 674.074 168.519 0 0 0 0 0 0  
0 0 337.037 674.074 0 0 168.519 337.037 0 0 0 0 0 0  
337.037 168.519 0 0 1348.15 674.074 0 0 337.037 168.519 0 0 0 0  
168.519 674.074 168.519 0 674.074 2696.3 674.074 0 168.519 674.074 168.519 0 0 0  
0 168.519 674.074 168.519 0 674.074 2696.3 674.074 0 168.519 674.074 168.519 0 0  
0 0 168.519 337.037 0 0 674.074 1348.15 0 0 168.519 337.037 0 0  
0 0 0 0 337.037 168.519 0 0 1348.15 674.074 0 0 337.037 168.519 0  
0 0 0 0 168.519 674.074 168.519 0 674.074 2696.3 674.074 0 168.519 674.074 168.519  
0 0 0 0 0 168.519 674.074 168.519 0 674.074 2696.3 674.074 0 168.519 674.074 168.519  
0 0 0 0 0 0 168.519 337.037 0 0 674.074 1348.15 0 0 168.519 337.037  
0 0 0 0 0 0 0 337.037 168.519 0 0 674.074 337.037 0 0  
0 0 0 0 0 0 0 168.519 674.074 168.519 0 337.037 1348.15 337.037 0  
0 0 0 0 0 0 0 168.519 674.074 168.519 0 337.037 1348.15 337.037  
0 0 0 0 0 0 0 0 168.519 337.037 0 0 337.037 674.074
```

Martix [H]

```

_____ Iteration 0 _____
_____ Matrix [H] _____
16.6667 -4.16667 0 0 -4.16667 -8.33333 0 0 0 0 0 0 0 0 0
-4.16667 33.3333 -4.16667 0 -8.33333 -8.33333 -8.33333 0 0 0 0 0 0 0 0
0 -4.16667 33.3333 -4.16667 0 -8.33333 -8.33333 -8.33333 0 0 0 0 0 0 0 0
0 0 -4.16667 16.6667 0 0 -8.33333 -4.16667 0 0 0 0 0 0 0 0
-4.16667 -8.33333 0 0 33.3333 -8.33333 0 0 -4.16667 -8.33333 0 0 0 0 0 0
-8.33333 -8.33333 -8.33333 0 -8.33333 66.6667 -8.33333 0 -8.33333 -8.33333 -8.33333 0 0 0 0 0
0 -8.33333 -8.33333 -8.33333 0 -8.33333 66.6667 -8.33333 0 -8.33333 -8.33333 -8.33333 0 0 0 0
0 0 -8.33333 -4.16667 0 0 -8.33333 33.3333 0 0 -8.33333 -4.16667 0 0 0 0
0 0 0 0 -4.16667 -8.33333 0 0 33.3333 -8.33333 0 0 -4.16667 -8.33333 0 0
0 0 0 0 -8.33333 -8.33333 -8.33333 0 -8.33333 66.6667 -8.33333 0 -8.33333 -8.33333 -8.33333 0
0 0 0 0 0 -8.33333 -8.33333 -8.33333 0 -8.33333 66.6667 -8.33333 0 -8.33333 -8.33333 -8.33333
0 0 0 0 0 0 -8.33333 -4.16667 0 0 -8.33333 33.3333 0 0 -8.33333 -4.16667
0 0 0 0 0 0 0 0 -4.16667 -8.33333 0 0 16.6667 -4.16667 0 0
0 0 0 0 0 0 0 0 -8.33333 -8.33333 -8.33333 0 -4.16667 33.3333 -4.16667 0
0 0 0 0 0 0 0 0 -8.33333 -8.33333 -8.33333 0 -4.16667 33.3333 -4.16667
0 0 0 0 0 0 0 0 0 -8.33333 -4.16667 0 0 -4.16667 16.6667
```

$$\text{Matrix } [H] = [H] + [C]/dT \text{ and } \{P\} = \{P\} + \{[C]/dT\} * \{T0\}$$

Iteration 0

Matrix ($[H] + [C]/dT$)

```
36.8148 4.24074 0 0 4.24074 -4.96296 0 0 0 0 0 0 0 0 0
4.24074 66.963 4.24074 0 -4.96296 5.14815 -4.96296 0 0 0 0 0 0 0
0 4.24074 66.963 4.24074 0 -4.96296 5.14815 -4.96296 0 0 0 0 0 0
0 0 4.24074 36.8148 0 0 -4.96296 4.24074 0 0 0 0 0 0
4.24074 -4.96296 0 0 66.963 5.14815 0 0 4.24074 -4.96296 0 0 0 0
-4.96296 5.14815 -4.96296 0 5.14815 120.593 5.14815 0 -4.96296 5.14815 -4.96296 0 0 0
0 -4.96296 5.14815 -4.96296 0 5.14815 120.593 5.14815 0 -4.96296 5.14815 -4.96296 0 0
0 0 -4.96296 4.24074 0 0 5.14815 66.963 0 0 -4.96296 4.24074 0 0
0 0 0 4.24074 -4.96296 0 0 66.963 5.14815 0 0 4.24074 -4.96296 0
0 0 0 0 -4.96296 5.14815 -4.96296 0 5.14815 120.593 5.14815 0 -4.96296 5.14815
0 0 0 0 0 -4.96296 5.14815 -4.96296 0 5.14815 120.593 5.14815 0 -4.96296 5.14815
0 0 0 0 0 0 -4.96296 4.24074 0 0 5.14815 66.963 0 0 -4.96296 4.24074
0 0 0 0 0 0 0 4.24074 -4.96296 0 0 36.8148 4.24074 0 0
0 0 0 0 0 0 0 0 -4.96296 5.14815 -4.96296 0 4.24074 66.963 4.24074 0
0 0 0 0 0 0 0 0 0 -4.96296 5.14815 -4.96296 0 4.24074 66.963 4.24074
0 0 0 0 0 0 0 0 0 0 -4.96296 4.24074 0 0 4.24074 36.8148
```

Vector ($\{P\} + \{[C]/dT\} * \{T0\}$)

```
15033.3 18066.7 18066.7 15033.3 18066.7 12133.3 12133.3 18066.7 18066.7 12133.3 12133.3 18066.7 15033.3 18066.7 18066.7 15033.350 110.04 365.82
```

Iteration 1

H Matrix ($[H]+[C]/dT$)

36.815 4.2407 0 0 4.2407 -4.963 0 0 0 0 0 0 0 0 0
4.2407 66.963 4.2407 0 -4.963 5.1481 -4.963 0 0 0 0 0 0 0 0
0 4.2407 66.963 4.2407 0 -4.963 5.1481 -4.963 0 0 0 0 0 0 0
0 0 4.2407 36.815 0 0 -4.963 4.2407 0 0 0 0 0 0 0
4.2407 -4.963 0 0 66.963 5.1481 0 0 4.2407 -4.963 0 0 0 0 0
-4.963 5.1481 -4.963 0 5.1481 120.59 5.1481 0 -4.963 5.1481 -4.963 0 0 0 0
0 -4.963 5.1481 -4.963 0 5.1481 120.59 5.1481 0 -4.963 5.1481 -4.963 0 0 0
0 0 -4.963 4.2407 0 0 5.1481 66.963 0 0 -4.963 4.2407 0 0 0
0 0 0 0 4.2407 -4.963 0 0 66.963 5.1481 0 0 4.2407 -4.963 0 0
0 0 0 0 -4.963 5.1481 -4.963 0 5.1481 120.59 5.1481 0 -4.963 5.1481 -4.963 0
0 0 0 0 0 -4.963 5.1481 -4.963 0 5.1481 120.59 5.1481 0 -4.963 5.1481 -4.963
0 0 0 0 0 0 -4.963 4.2407 0 0 5.1481 66.963 0 0 -4.963 4.2407
0 0 0 0 0 0 0 4.2407 -4.963 0 0 36.815 4.2407 0 0
0 0 0 0 0 0 0 -4.963 5.1481 -4.963 0 4.2407 66.963 4.2407 0
0 0 0 0 0 0 0 0 -4.963 5.1481 -4.963 0 4.2407 66.963 4.2407
0 0 0 0 0 0 0 0 0 -4.963 4.2407 0 0 4.2407 36.815

P_Vector ($\{P\}+\{[C]/dT\}\{T0\}$)

20660 25552 25552 20660 25552 18897 18897 25552 25552 18897 18897 25552 20660 25552 25552 20660

Max and min temperature in each step

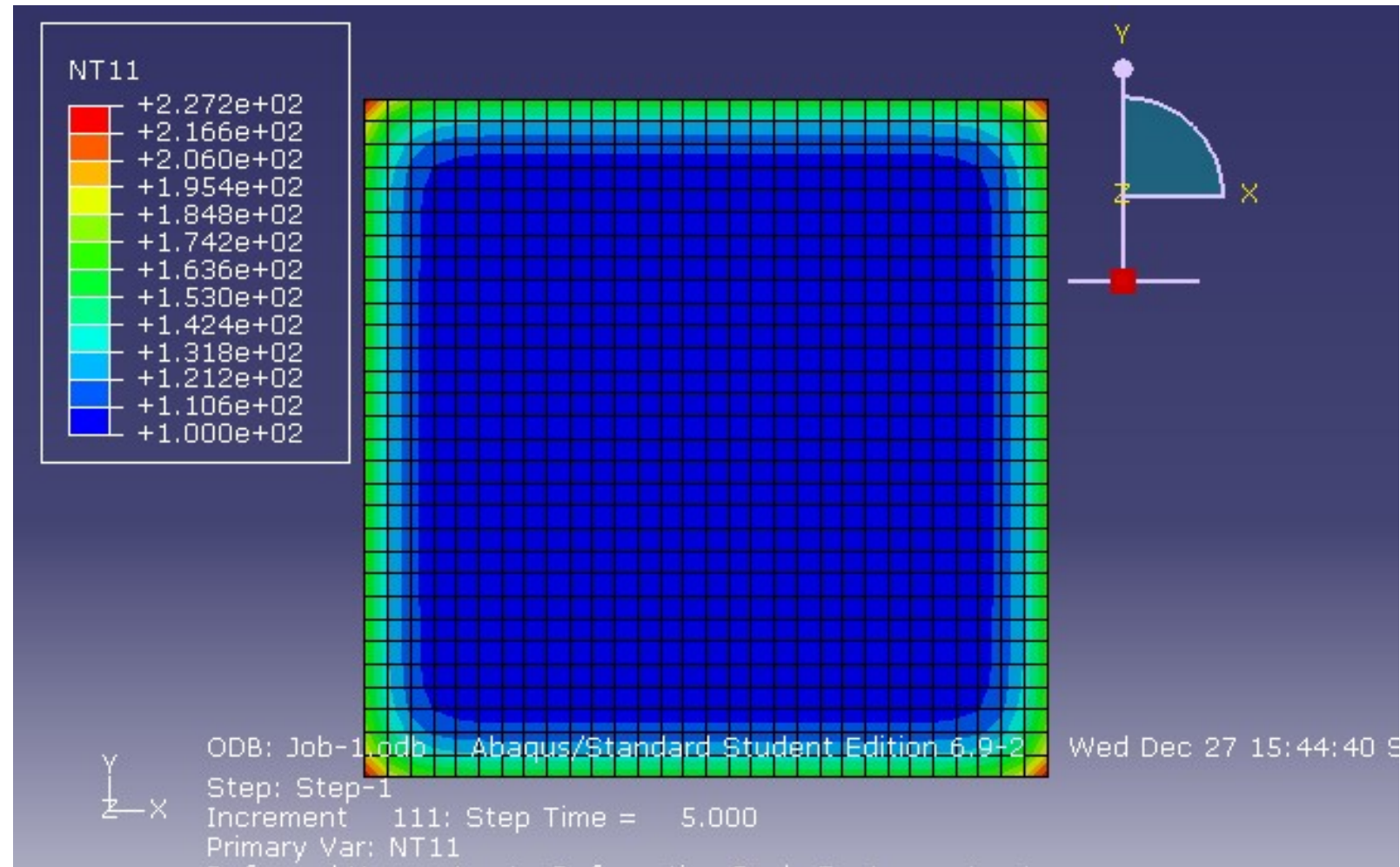
Time[s]	MinTemp[s]	MaxTemp[s]
50	110.038	365.815
100	168.837	502.592
150	242.801	587.373
200	318.615	649.387
250	391.256	700.068
300	459.037	744.063
350	521.586	783.383
400	579.034	818.992
450	631.689	851.431
500	679.908	881.058

Test case 2d transient solution - initial data

- 100 – initial temperature
- 100 – simulation time [s],
- 1 – simulation step time [s],
- 1200 – ambient temperature [C],
- 300 – alfa [W/m²K],
- 0.100 – H [m],
- 0.100 – B [m],
- 31 – N_H,
- 31 – N_B,
- 700 – specific heat [J/(kg°C)],
- 25 – conductivity [W/(m°C)],
- 7800 – density [kg/m³].

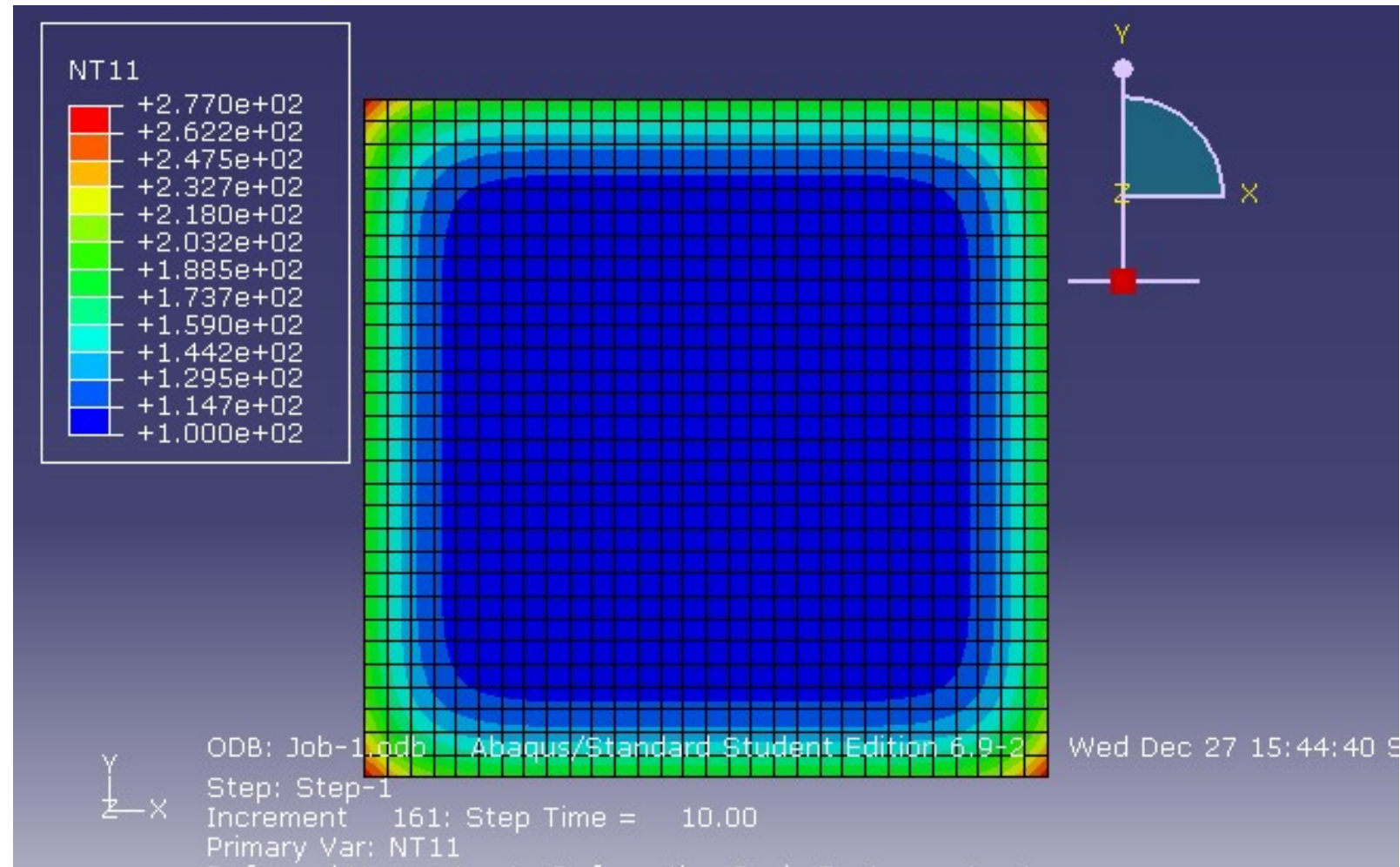
After 5 s

Time[s]	MinTemp	MaxTemp
1	100	149.56
2	100	177.44
3	100	197.27
4	100	213.15
5	100	226.68
6	100	238.61
7	100	249.35
8	100	259.17
9	100	268.24
10	100	276.7
11	100	284.64
12	100	292.13
13	100	299.24
14	100.01	306
15	100.01	312.45
16	100.01	318.63
17	100.02	324.56
18	100.03	330.27
19	100.05	335.77
20	100.06	341.08



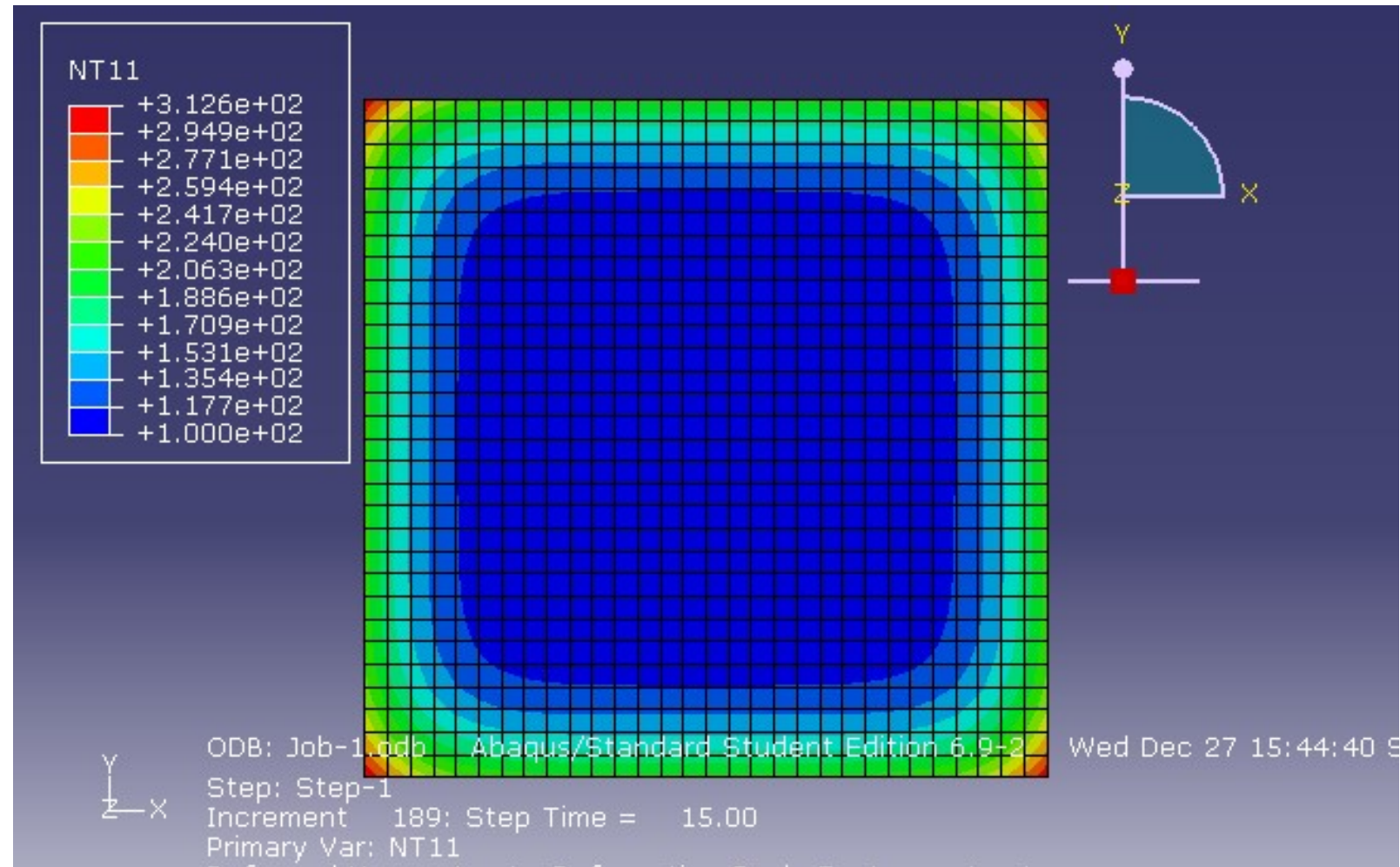
After 10 s

Time[s]	MinTemp	MaxTemp
1	100	149.56
2	100	177.44
3	100	197.27
4	100	213.15
5	100	226.68
6	100	238.61
7	100	249.35
8	100	259.17
9	100	268.24
10	100	276.7
11	100	284.64
12	100	292.13
13	100	299.24
14	100.01	306
15	100.01	312.45
16	100.01	318.63
17	100.02	324.56
18	100.03	330.27
19	100.05	335.77
20	100.06	341.08



After 15 s

Time[s]	MinTemp	MaxTemp
1	100	149.56
2	100	177.44
3	100	197.27
4	100	213.15
5	100	226.68
6	100	238.61
7	100	249.35
8	100	259.17
9	100	268.24
10	100	276.7
11	100	284.64
12	100	292.13
13	100	299.24
14	100.01	306
15	100.01	312.45
16	100.01	318.63
17	100.02	324.56
18	100.03	330.27
19	100.05	335.77
20	100.06	341.08



After 20 s

Time[s]	MinTemp	MaxTemp
1	100	149.56
2	100	177.44
3	100	197.27
4	100	213.15
5	100	226.68
6	100	238.61
7	100	249.35
8	100	259.17
9	100	268.24
10	100	276.7
11	100	284.64
12	100	292.13
13	100	299.24
14	100.01	306
15	100.01	312.45
16	100.01	318.63
17	100.02	324.56
18	100.03	330.27
19	100.05	335.77
20	100.06	341.08

