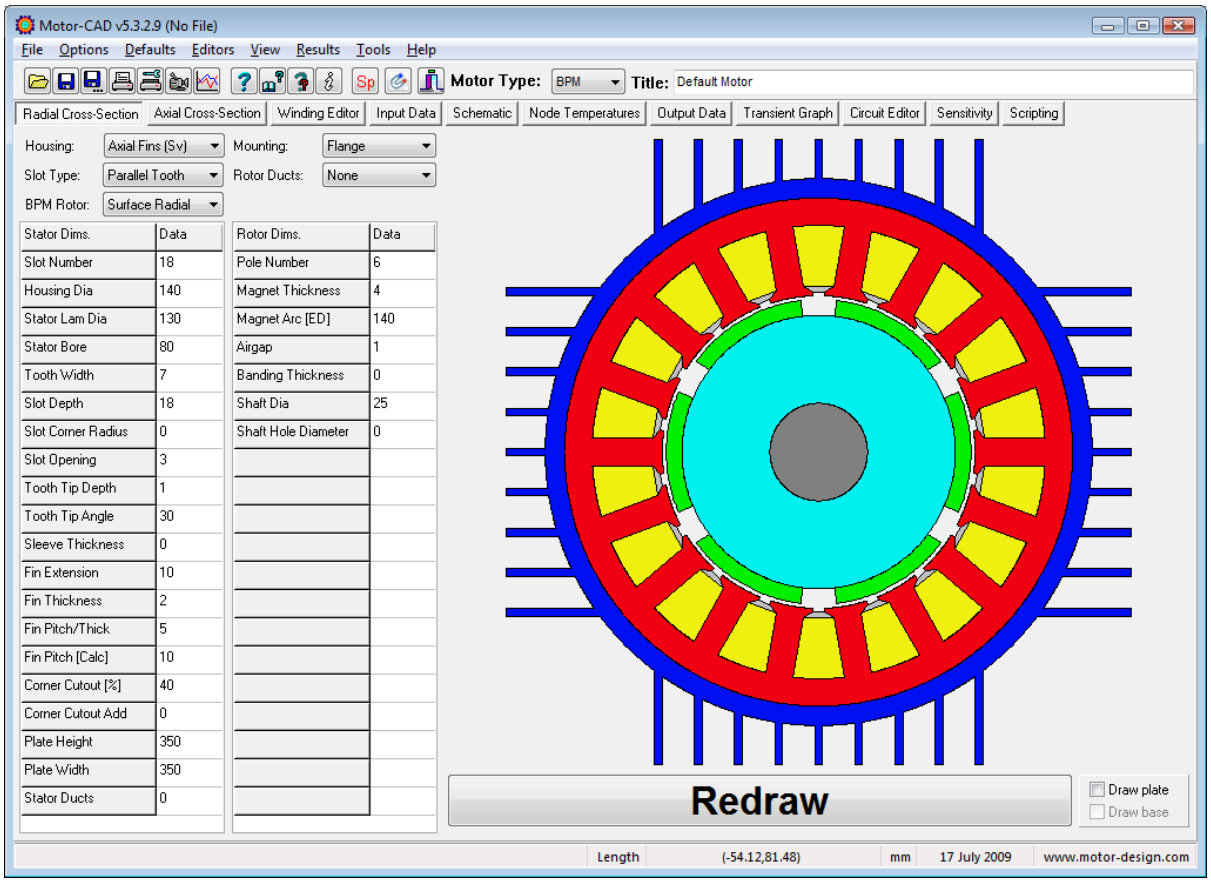
Transient Analysis

Description

This document gives a brief description of how to set up a Motor-CAD model for a transient analysis. The Motor-CAD duty cycle options allow for simple transient, duty cycle and soak-back transient calculations.

Machine Geometry

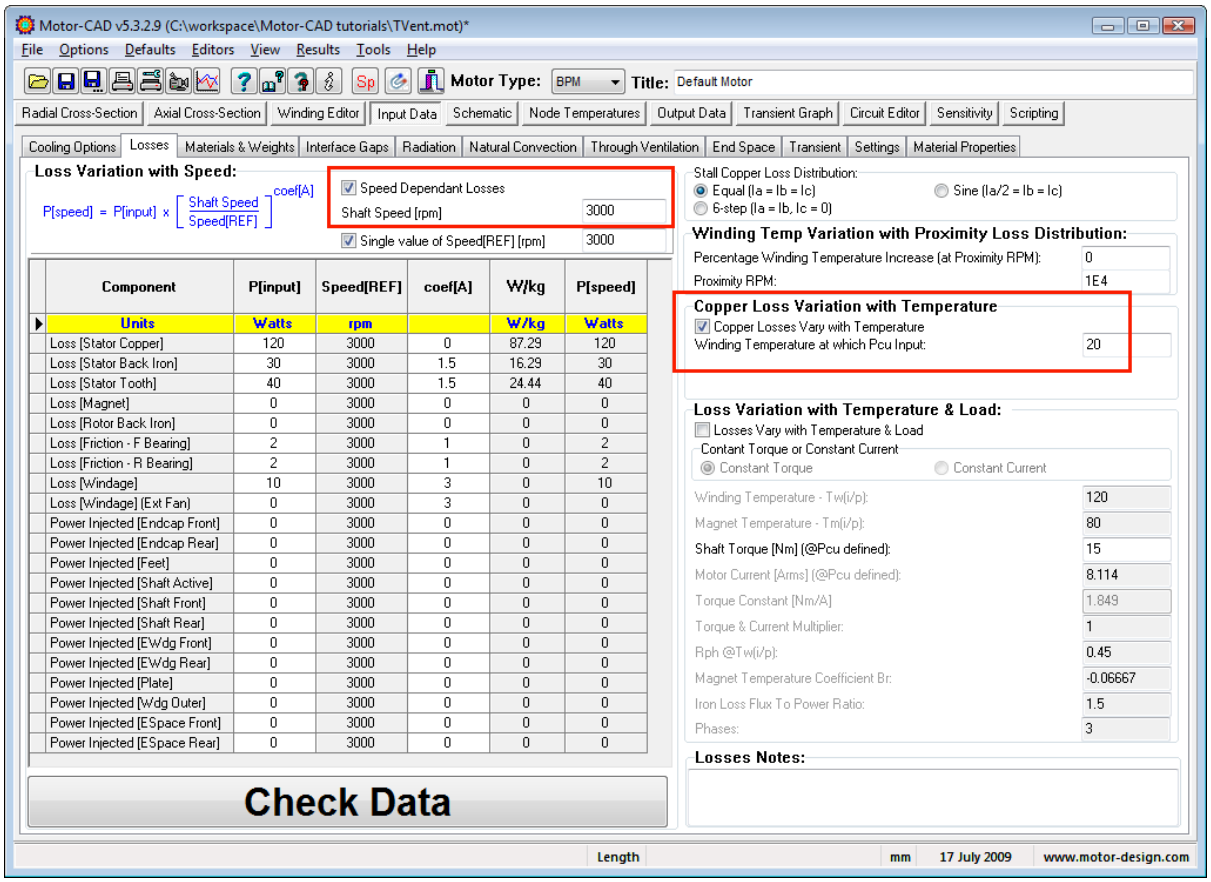
For this example the standard machine will be used as shown below.



Setting the machine losses

The losses of the machine are defined in the losses page as shown below. The default losses are used in this example.

There are different loss models allowing for the losses to vary with speed, temperature and load.



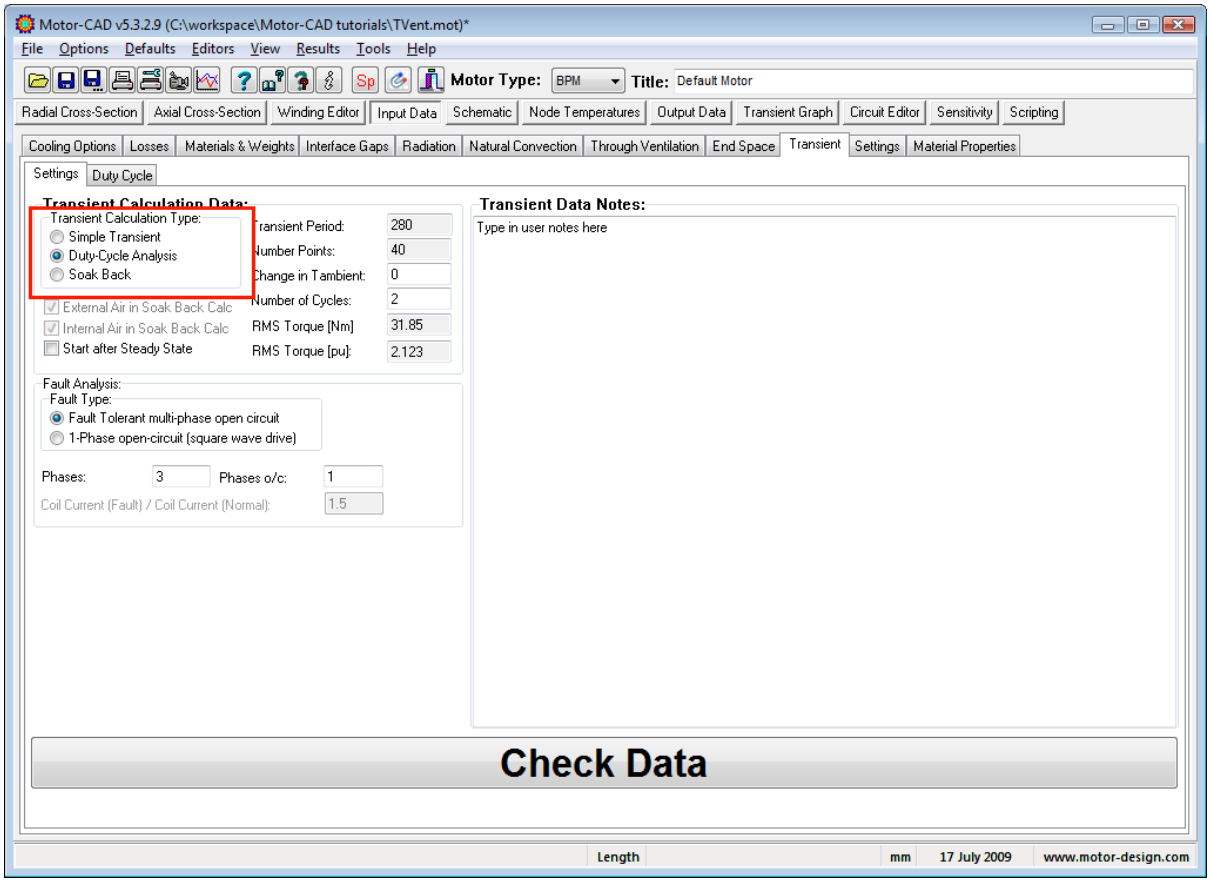
Transient Analysis

You can also run a transient analysis on the machine to model the thermal performance over complex duty cycles.

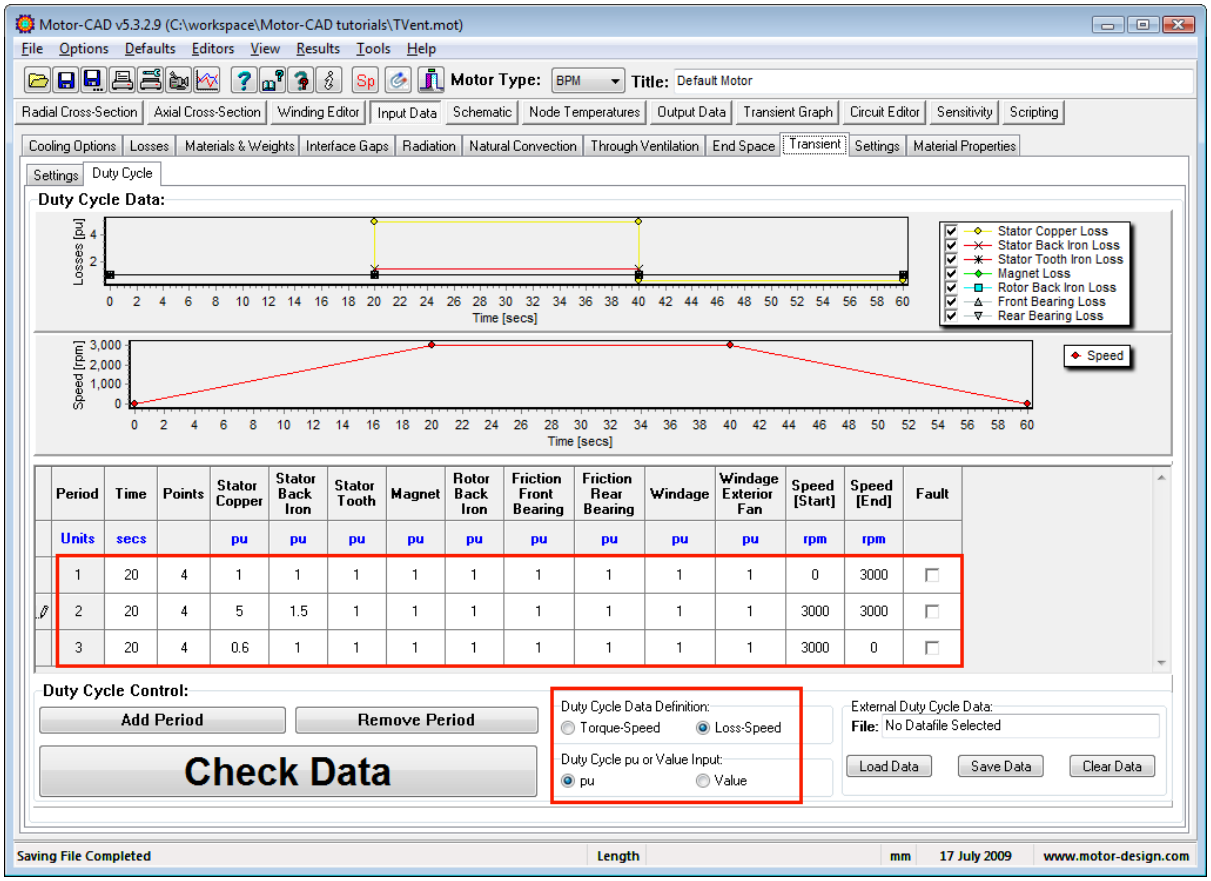
There are 3 different duty cycle options available:

- Simple Transient – where the machine runs with a fixed load.
- Duty Cycle – where the load and losses of the machine vary over time
- Soak back – where the forced convection flow rate is removed when the machine is switched off.

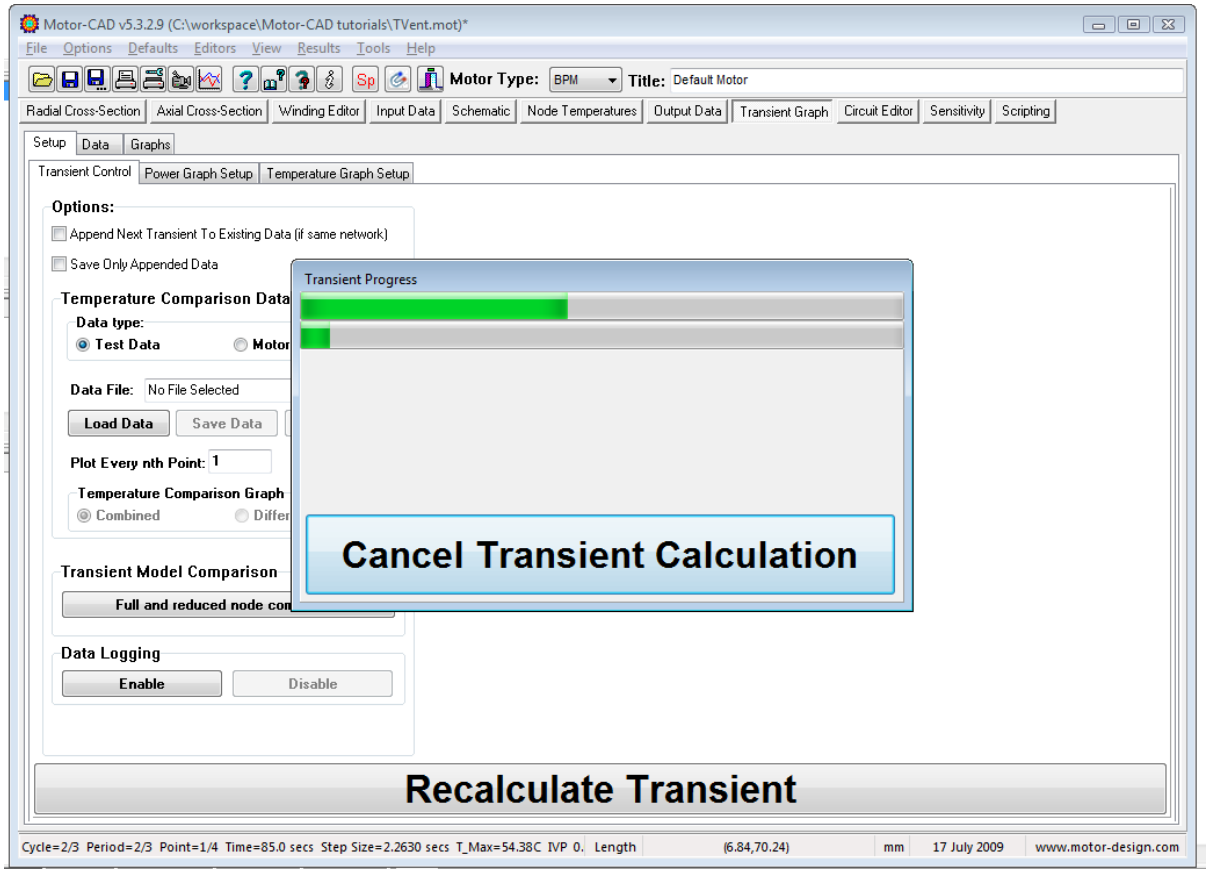
In this case select to run a complex duty cycle as shown below.



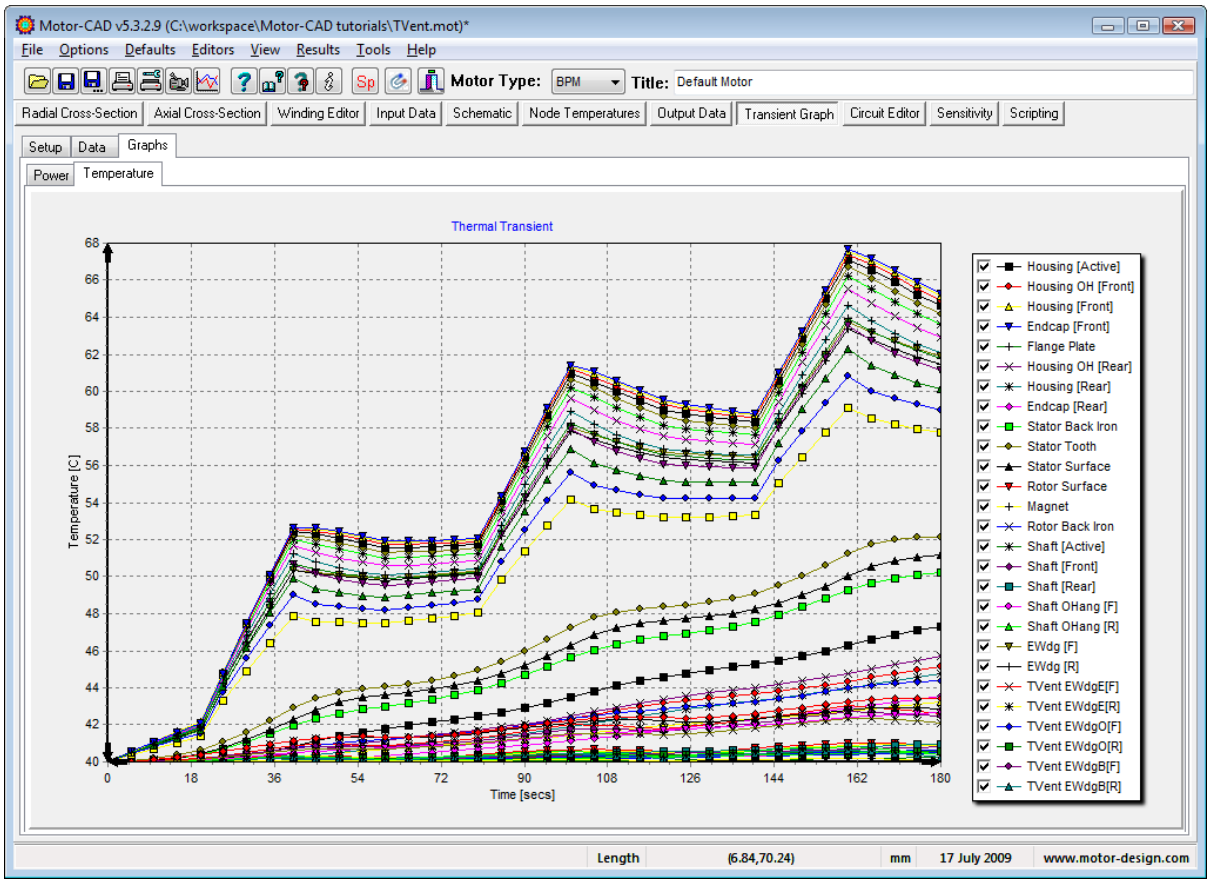
The duty cycle is then specified using the pu (per unit) values of the losses given in the losses editor as shown below. The use of the pu values allows the losses to vary as given in the duty cycle and also to take into account the variation in losses with speed and temperature.



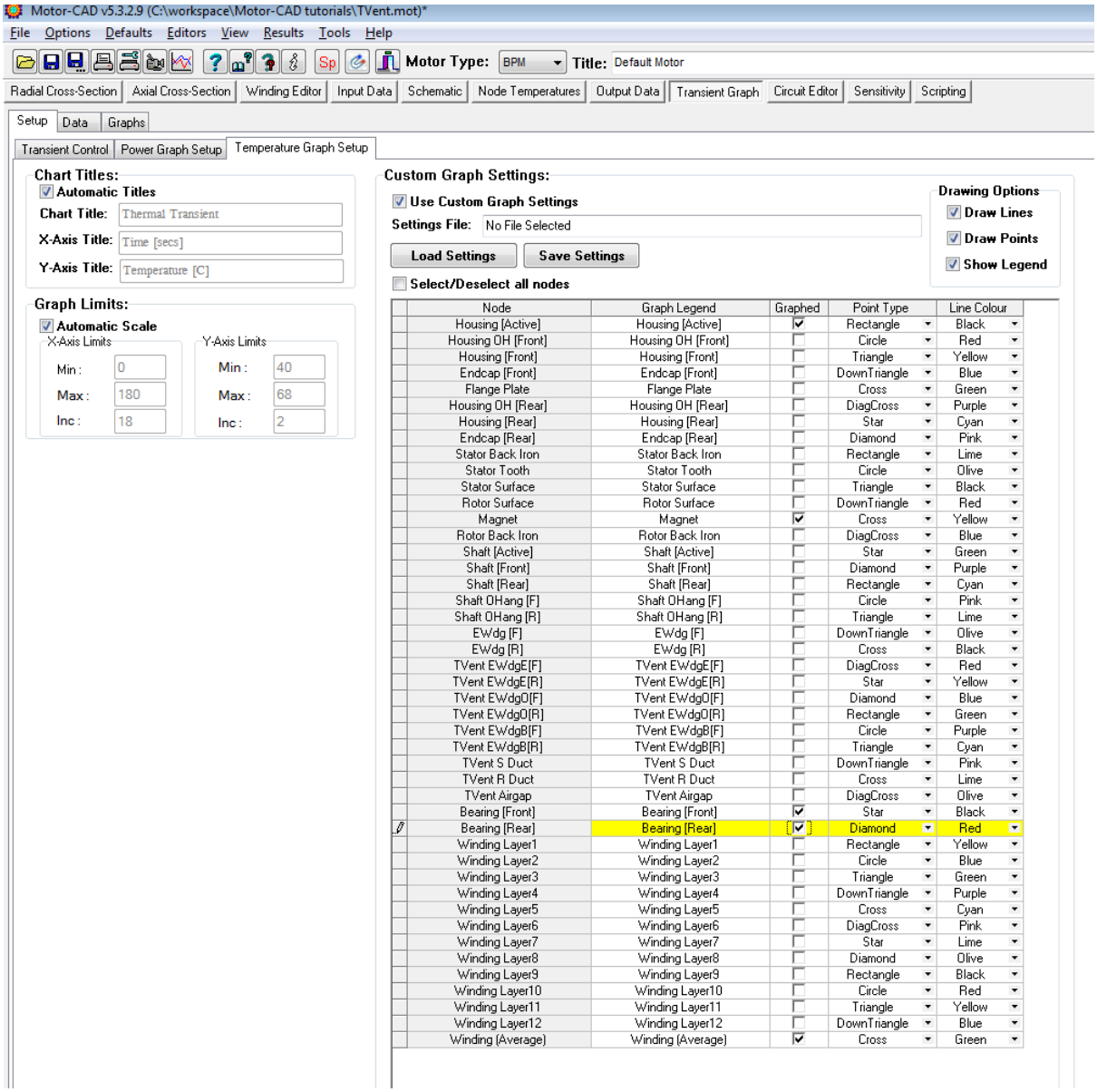
The transient calculation is then started by selecting the ‘Transient Graph’ tab as shown below.



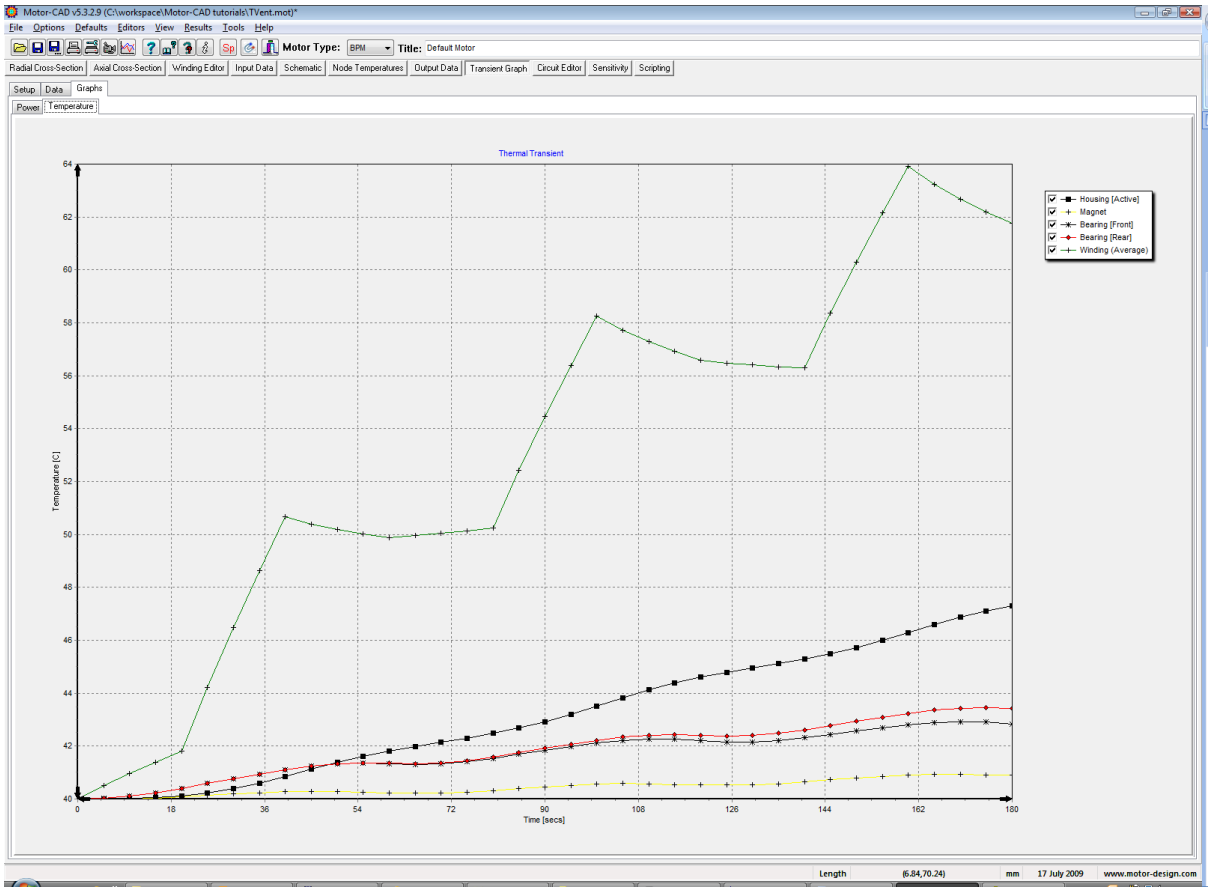
The transient results graph will be displayed as shown below. This has all the nodes in the model.



The interested nodes can be selected to view and the graph setup modified in the ‘Temperature Graph Setup’ tab as shown below.



The temperature graphs below show the different node temperatures vary during the duty cycle.



Similarily the power graph shows how the losses in the machine vary with the duty cycle losses, speed and temperature of the winding.

After solving the transient the final transient circuit can also be viewed in the ‘Schematic’ tab as shown below.