KISSsoft
Drivetrain Design Solutions

KISSsys 2019 – Instruction 010

Positioning of shafts and groups

KISSsoft AG
A Gleason Company
Rosengartenstr. 4, 8608 Bubikon
Switzerland

T. +41 55 254 20 50
F. +41 55 254 20 51
info@KISSsoft.com
www.KISSsoft.com

Sharing Knowledge

Contents

1 Introduction

Machine elements must be positioned in space correctly to assure a proper positioning of the forces and the correct layout in 3D representation. This instruction will explain how to position the most important elements. There are several ways to set, create or evaluate the positions in a KISSsys model. There is no right and wrong way to do it. The approach depends on the model itself, but also on the user.

2 Summary

There are mainly two kinds of positioning procedures: The positioning of the shafts in the layout and the positioning of the machine elements on the shafts.
Every KISSsys main element (shaft, group and casing) can be positioned manually in space. This method is not very user-friendly and should be avoided if possible. Although now it is the only possibility to position a casing in a model. It is either possible to define a parallel orientation of two shafts or to define the position with the meshing e.g. the coaxial shaft elements can be moved on the parent shaft either by drag and drop in the shaft editor or by using the variable “position” in KISSsys.

3 Positioning techniques

This section describes the positioning of single elements and the difference in positioning complete coaxial shaft groups and their integrated elements.

4 Coordinate system

4.1 Main coordinate system

The main coordinates system can be shown / hidden in the icon bar:

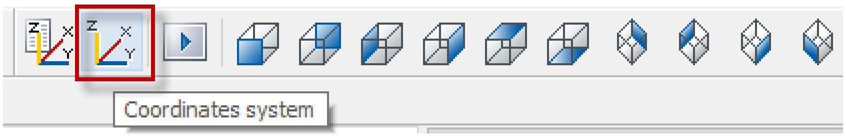

Figure 1. Show coordinate system

The representation in the kSys3DView looks as shown in the following figure. Right-click -> properties window; will show the default position [x/y/z] -> [0/0/0] and the default orientation of the unit vectors of the axis system (x-axis = [1,0,0], y-axis = [0,1,0]). Generally, this definition will remain unchanged while building a model in KISSsys.

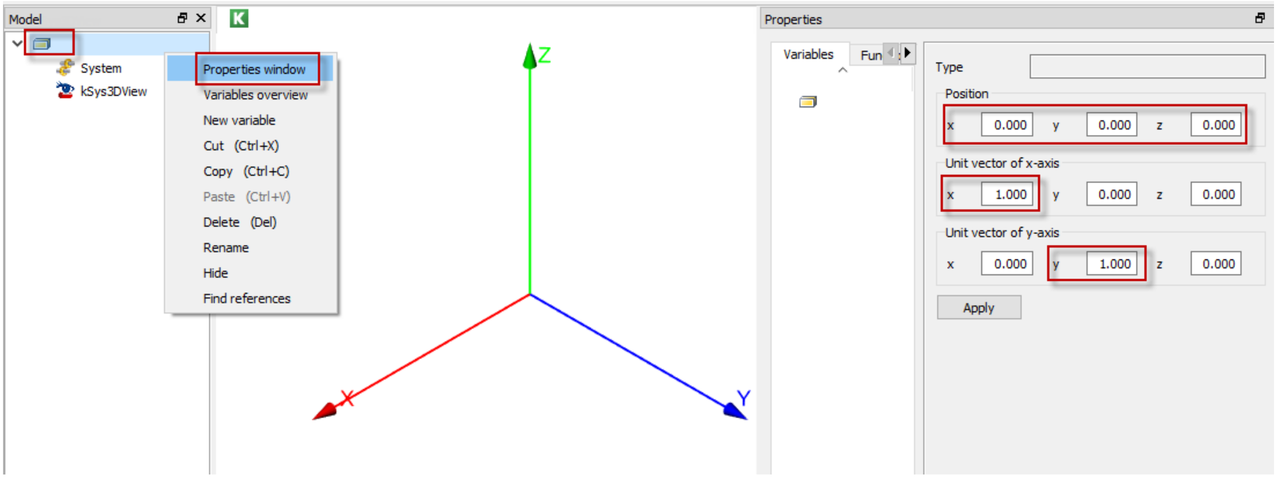

Figure 2. Definitoin of the golbal position of the main coordinate system

The size of the coordinates system can be adjusted with a click on the following icon:

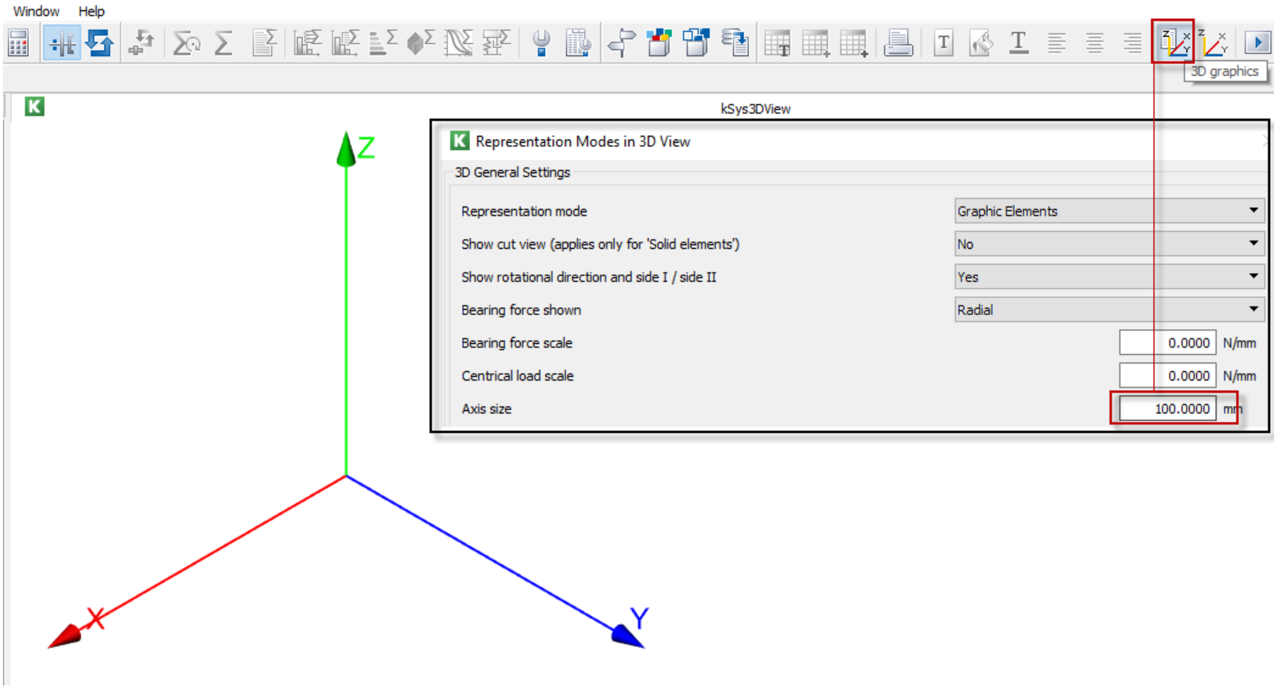

Figure 3. Definition of the axis size

4.2 Group coordinate system

Once you enter a group into the tree structure in KISSsys e.g. named “GroupBox” the positioning of this group will be according to the default definition of the main coordinates system (can be changed; will be shown later).

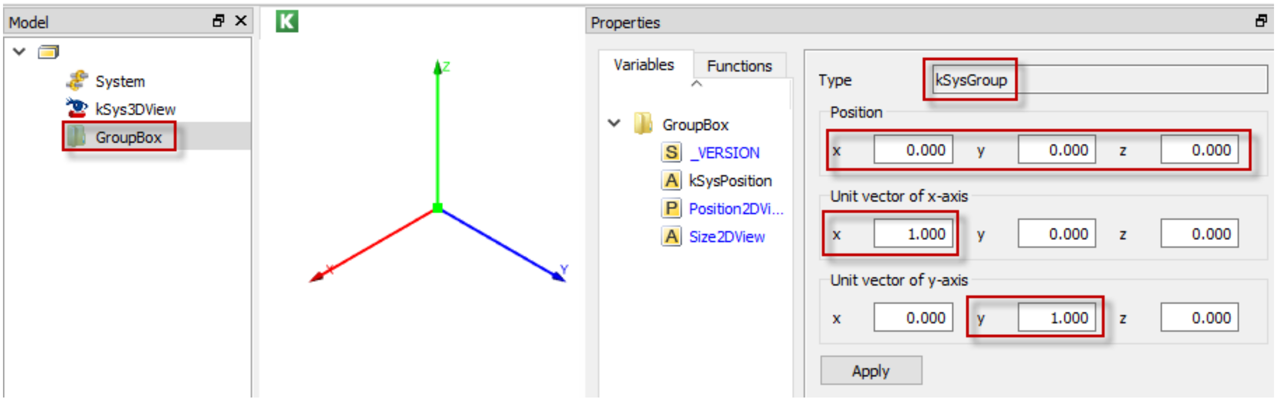

Figure 4. Positioning of the group “GroupBox” according to main coordinate system

5 Example 1: Helical gearbox

To start, add the helical gear box from the templates according to the following figure.

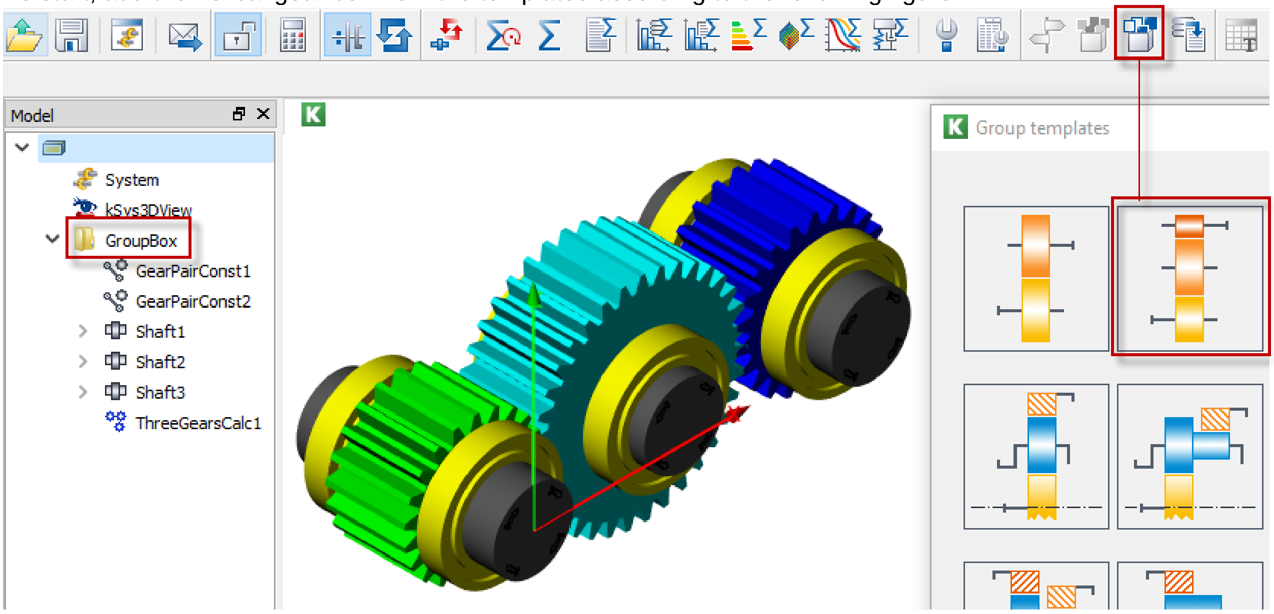

Figure 5. Opening the helical gearbox template

5.1 Orientation of the group

The position of the group can be set according to the main coordinates system. As default the position corresponds to the default definition of the group “gearbox”. To change the orientation, either the displacement in x-, y- and z-direction can be entered manually. In the following figure e.g. the group is displaced in positive y-direction.

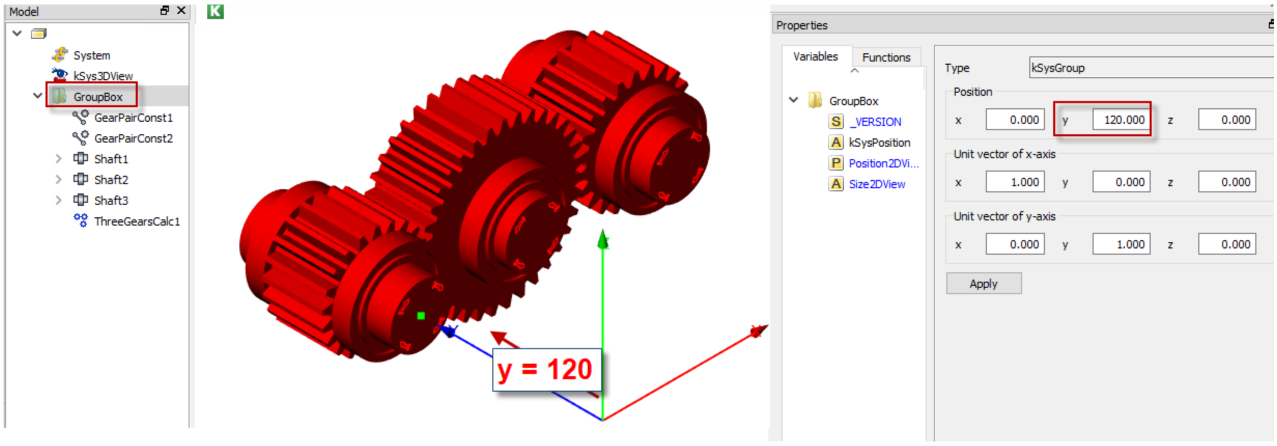

Figure 6. Axial displacement of the group “Groupbox”

To change the orientation of the group according to the main coordinates system, the definition of the unit-vector can be adjusted.

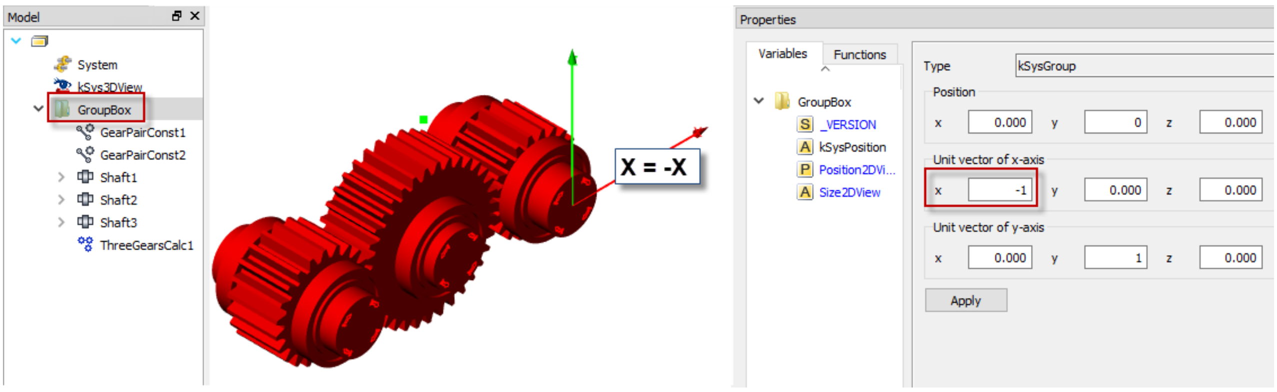

Figure 7. Inverted unit vector of the group

For this example, the position and orientation of the group coordinates system will correspond to the definition of the the main coordinates system.

Hint: To show the immediate changes while positioning the elements in the 3DViewer in KISSsys, press the following icon in the icon-bar:

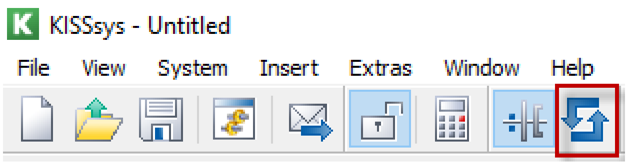

Figure 8. Refresh button

5.2 Shaft coordinate systems

Selecting a shaft in the tree structure e.g. “Shaft1” will highlight the corresponding element in the 3DViewer with red and the local shaft coordinate system will appear.

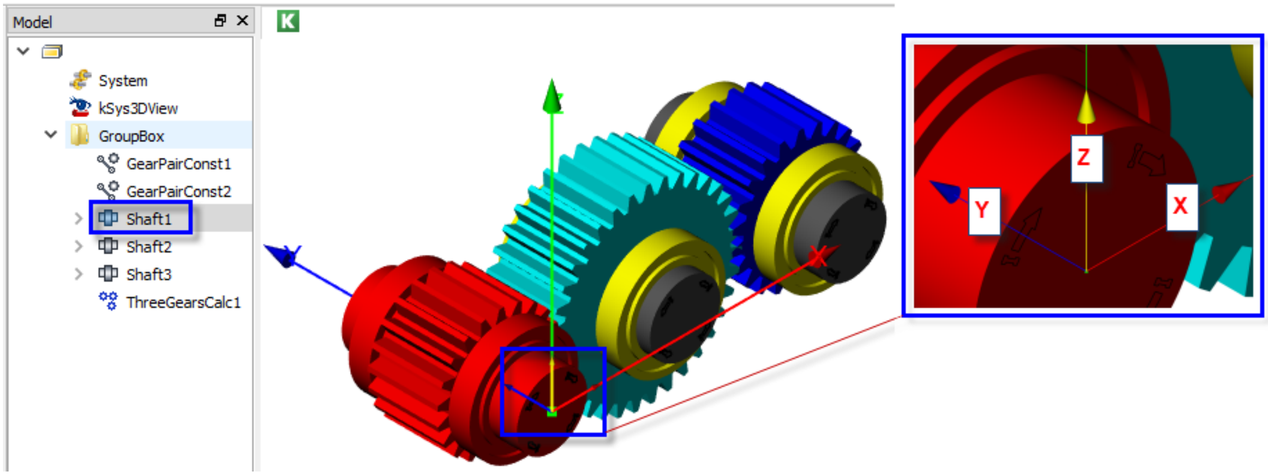

Figure 9. Shaft coordinate system

Right click on “Shaft1” in the tree structure -> properties; will show the position and the orientation of the local coordinate system of the shaft.

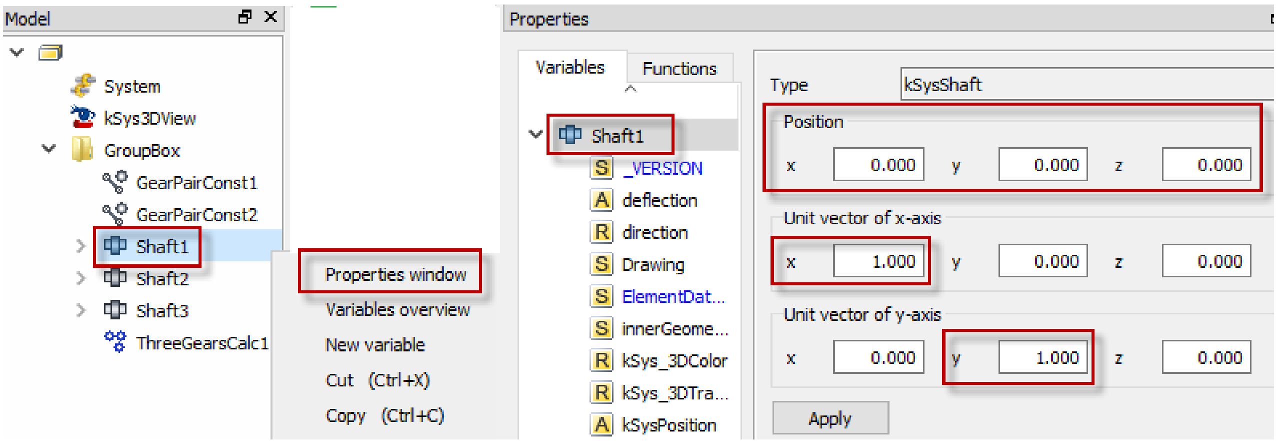

Figure 10. Positioning «Shaft1» according to the group

To start positioning the shafts inside the groups, one shaft always must be defined as a “reference shaft”. In our example, the reference shaft will be “Shaft1”. To do so, “right-click” on “Shaft1” and choose: “reset position” -> “own input” (“own input” is the command, which activates the manual positioning).

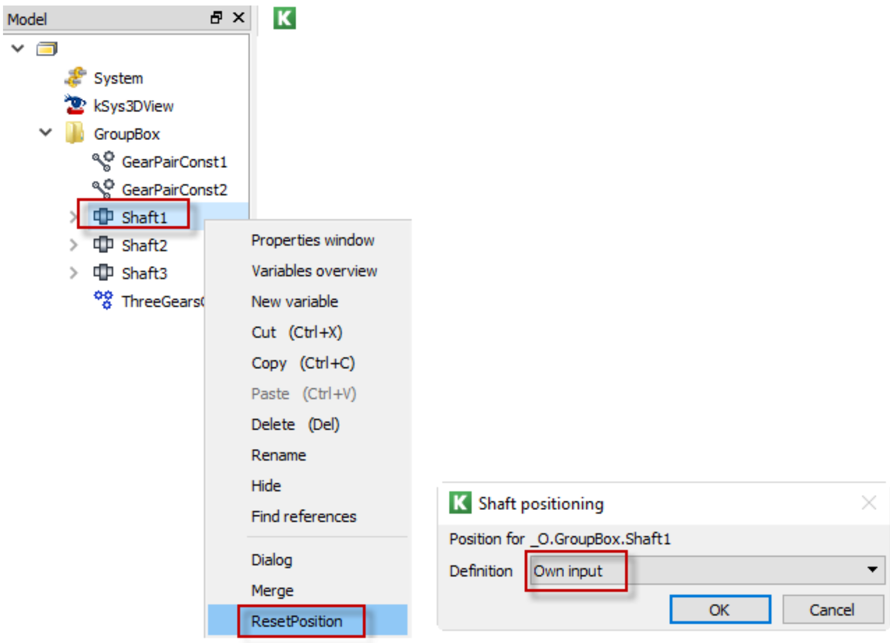

Figure 11. Manual positioning of the shaft

We now e.g. define an offset of +50 mm in positive y-direction for this reference “shaft1”:

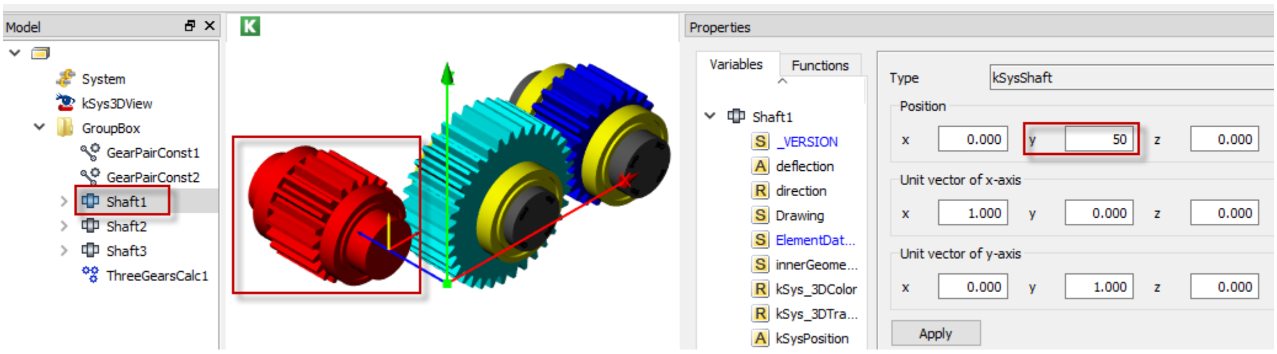

Figure 12. Axial offset of «Shaft1»

5.3 Relative positioning of shafts

To define the position of “Shaft2” there are several options. Right-click on “Shaft 2” -> “ResetPosition” will open the following dialog:

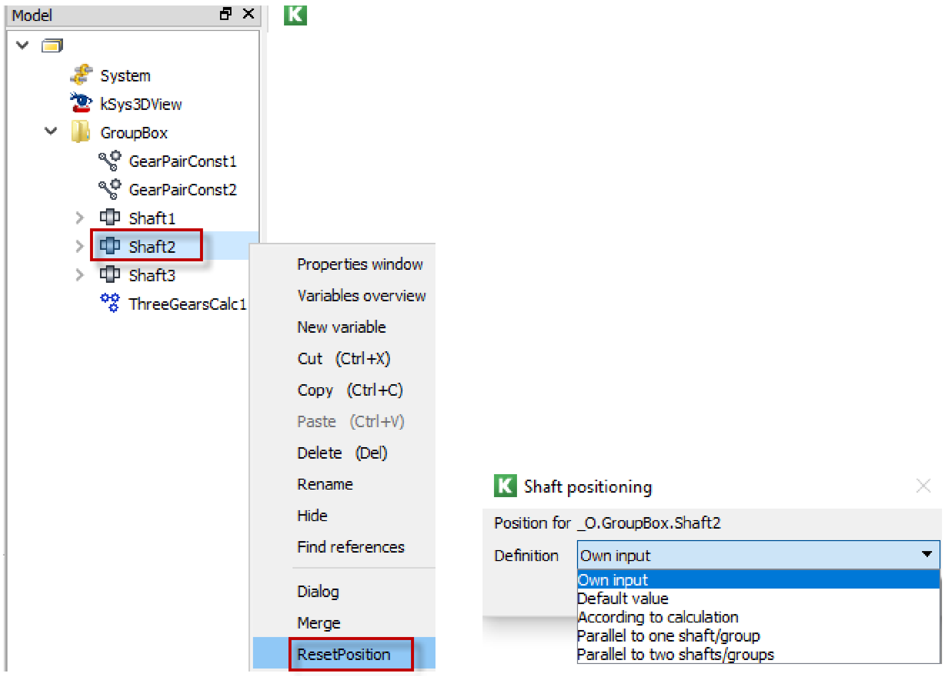

Figure 13. Selection menu for the position of “Shaft2”

The user can choose between the following options:

1) Default value
2) According to calculation
3) Parallel to one shaft / group
4) Parallel to two shafts / groups

5.3.1 «Default value»

This option can be used, if the exact position of the gear is known. The coordinates can be manually entered directly in the field “position”:

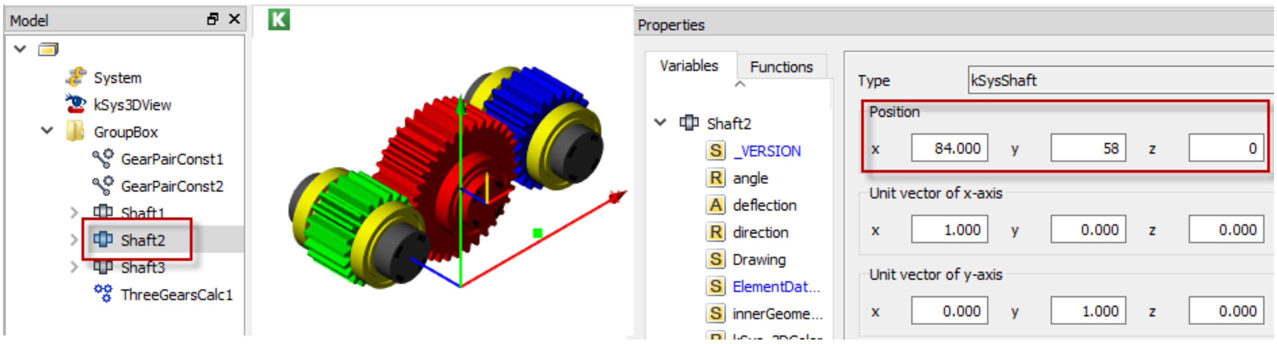

Figure 14. Manual positioning of «Shaft2»

5.3.2 “According to calculation”

5.3.2.1 Positioning of “Shaft2”

Once the gear-pair connection is defined the shafts can be positioned according to the gear-pair calculation. “Right-click” on “Shaft2” -> ResetPosition; The following dialog will appear.

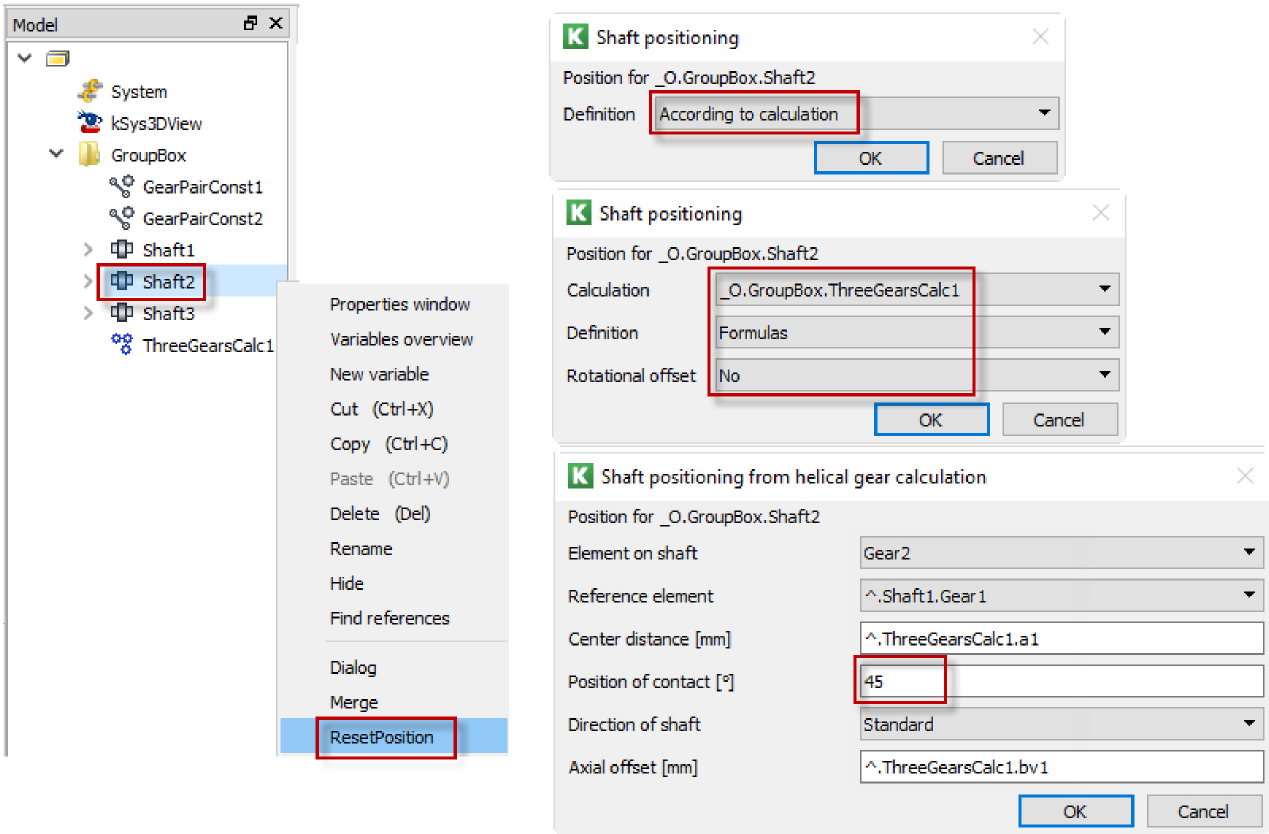

Figure 15. Function «According to calculation»

The “Shaft2” is positioned according to the “ThreegearsCalc”. In the dialog above the corresponding element will be selected (Gear2). The Reference element is “Gear1” from “Shaft1”. The centerdistance will be taken from the gearpair calculation (path is inserted automatically).

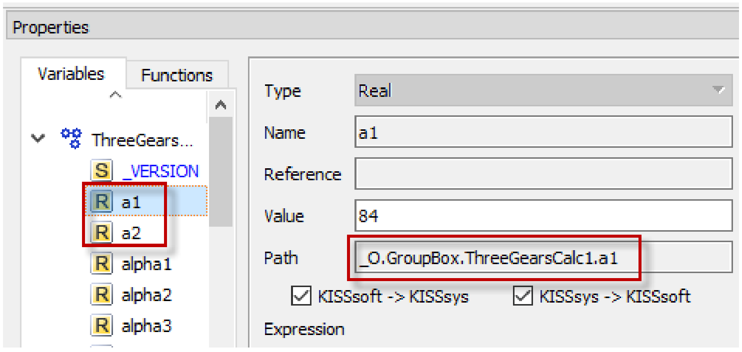

Figure 16. Centerdistance from the the gear calculation

The position of contact can be entered with reference to “Gear1” and the coordinate system of the reference element.

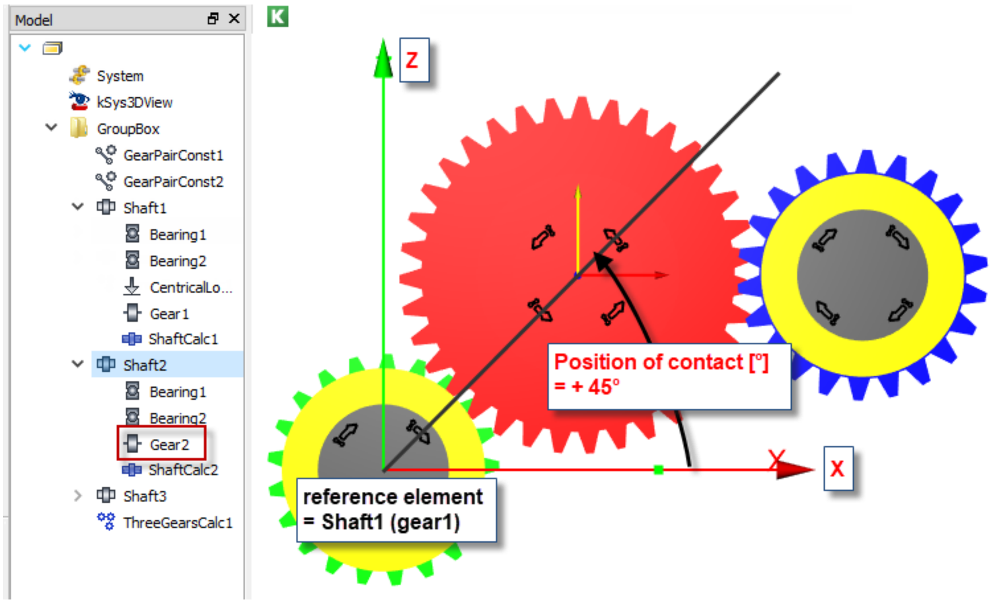

Figure 17. Position of contact

5.3.2.2 Positioning of “Shaft3”

After defining «Shaft2», «Shaft3» will be defined with reference to “Shaft2”. Right-click on “Shaft3” and select “RestPosition”.

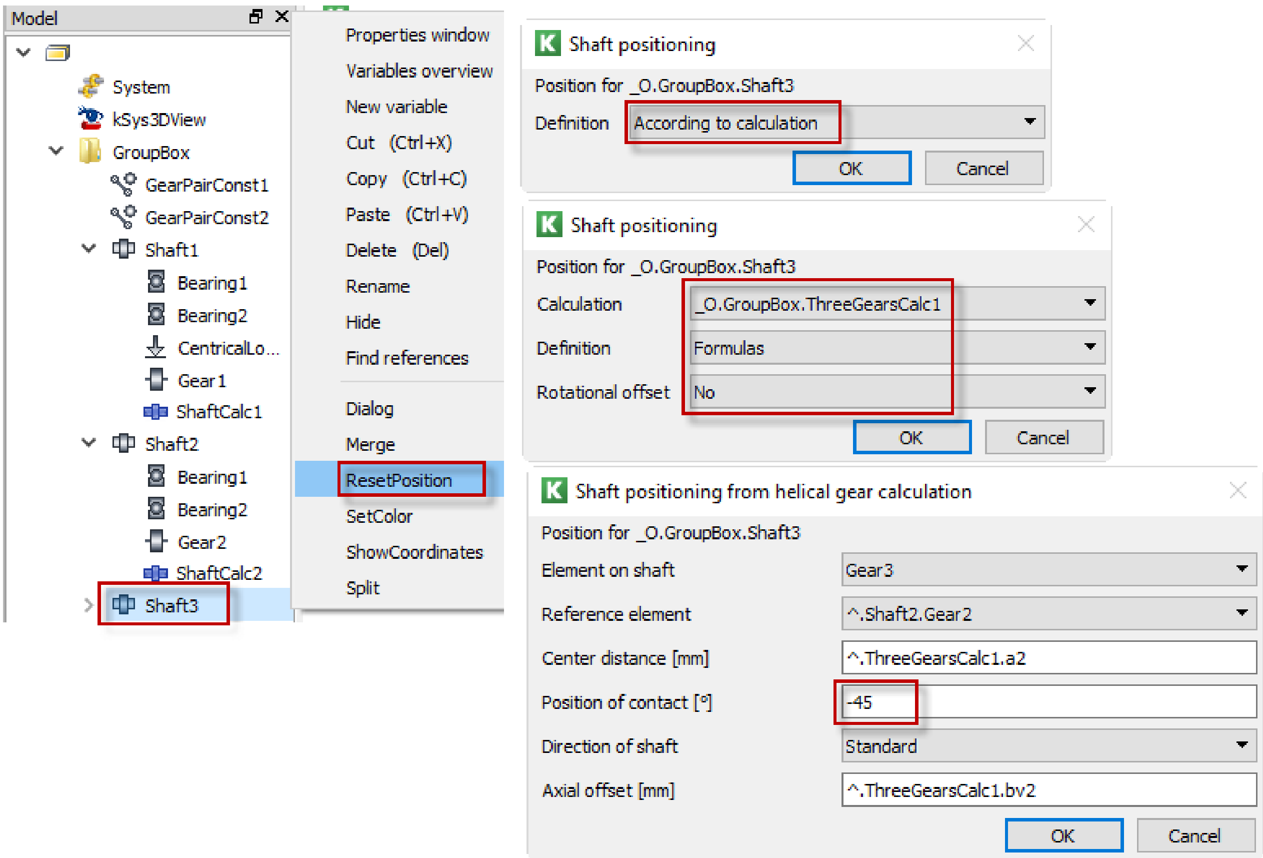

Figure 18. ResetPosition (Position of contact)

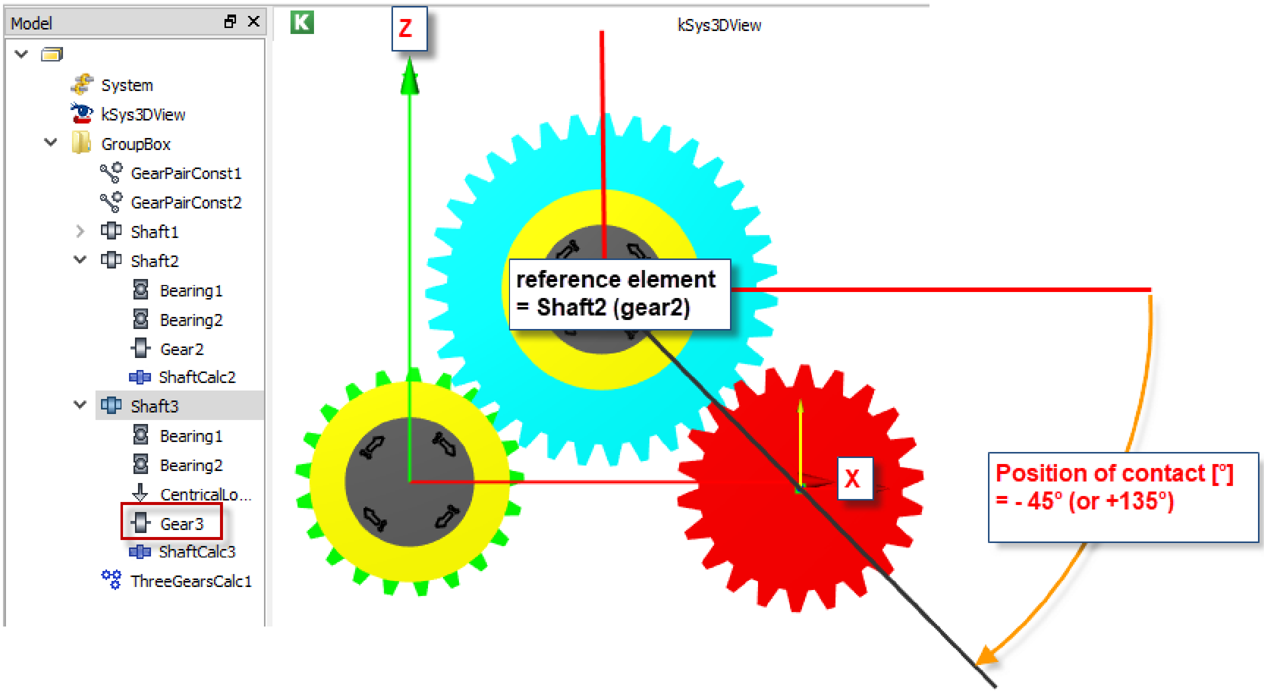

Figure 19. Negative value for «position of contact"

The position of contact for both meshings will be transferred to the KISSsoft shaft calculations. For e.g. "Gear2" contains meshings with "Gear1" and "Gear3". This definition will be shown in the shaftcalculation (ShaftCalc2) as well.

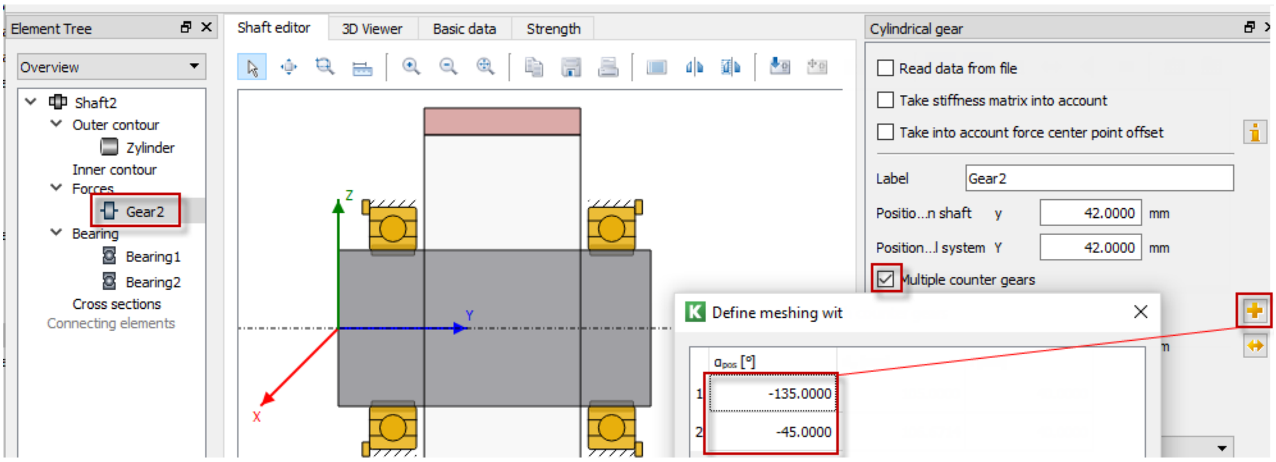

Figure 20. «Position of contact» in the shaft calculation

5.3.2.3 Rotational offset

The rotational offset can be used in order to rotate the positioned, local shaft coordinate system as shown in the following figure.

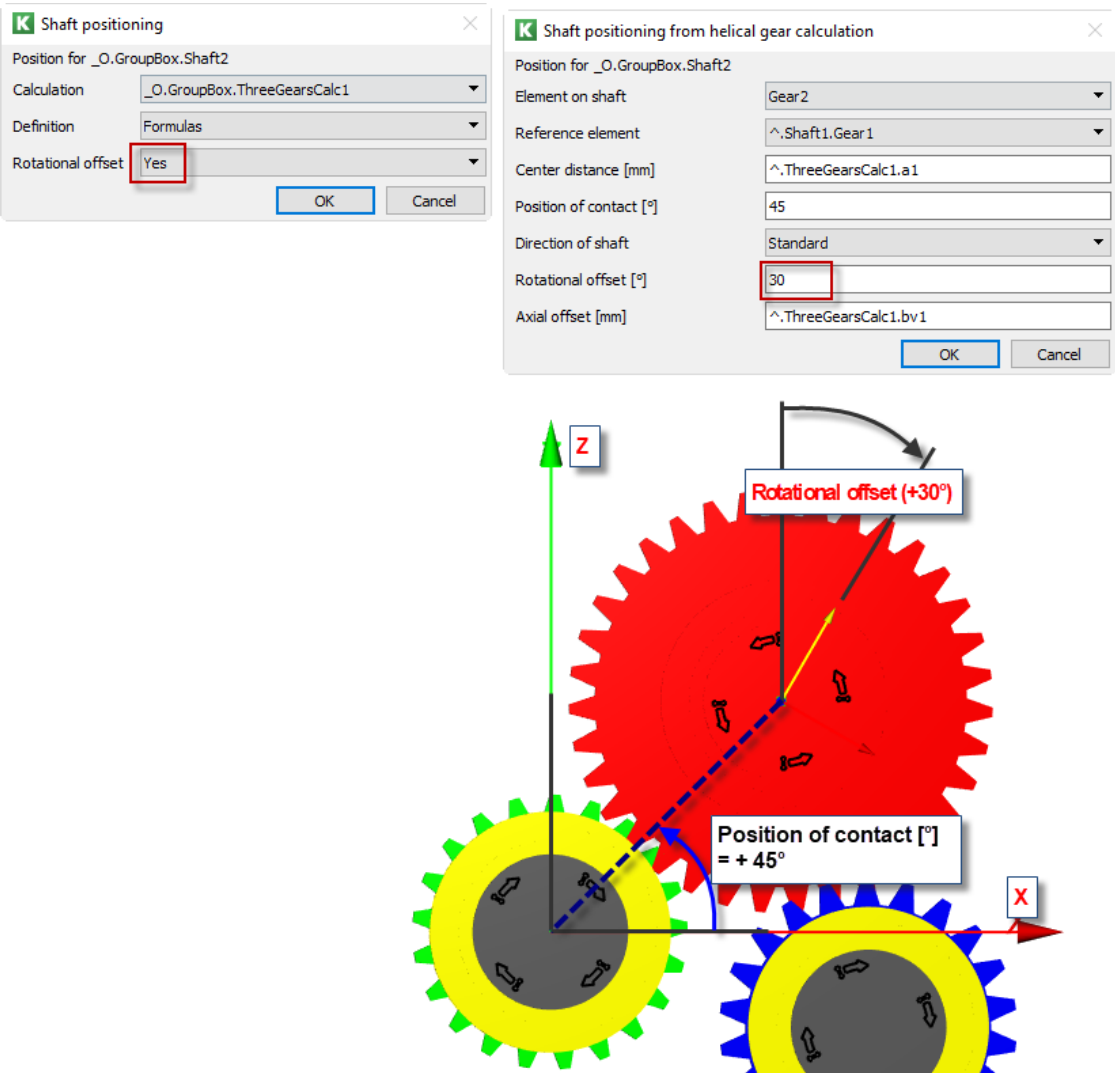

Figure 21. Rotational offset definition

5.3.2.4 Axial offset definition

In the dialog of the positioning process, an axial offset “bv” can be entered.

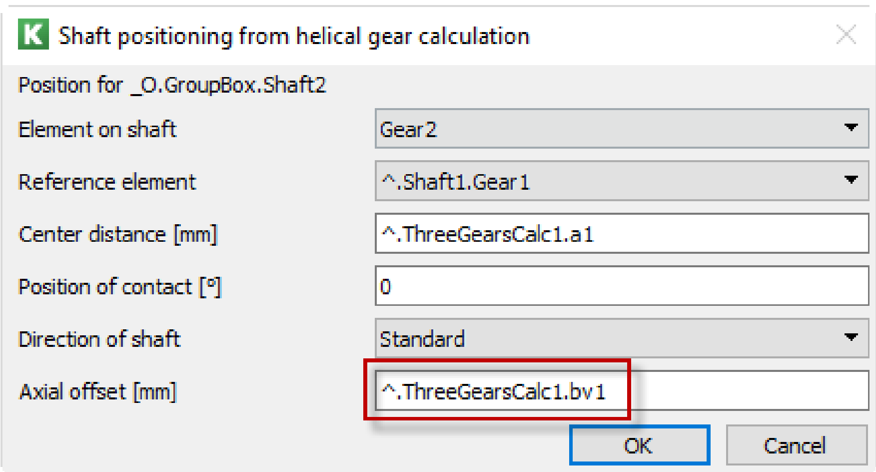

Figure 22. Axial offset definition

This value can either be entered directly in KISSsys or in the gear-calculation itself. To set this parameter in KISSsys; right-click on "ThreeGearsCalc" -> Properties. Be aware the flags "KISSsys -> KISSsoft" are set, if you want to set the value from KISSsys.

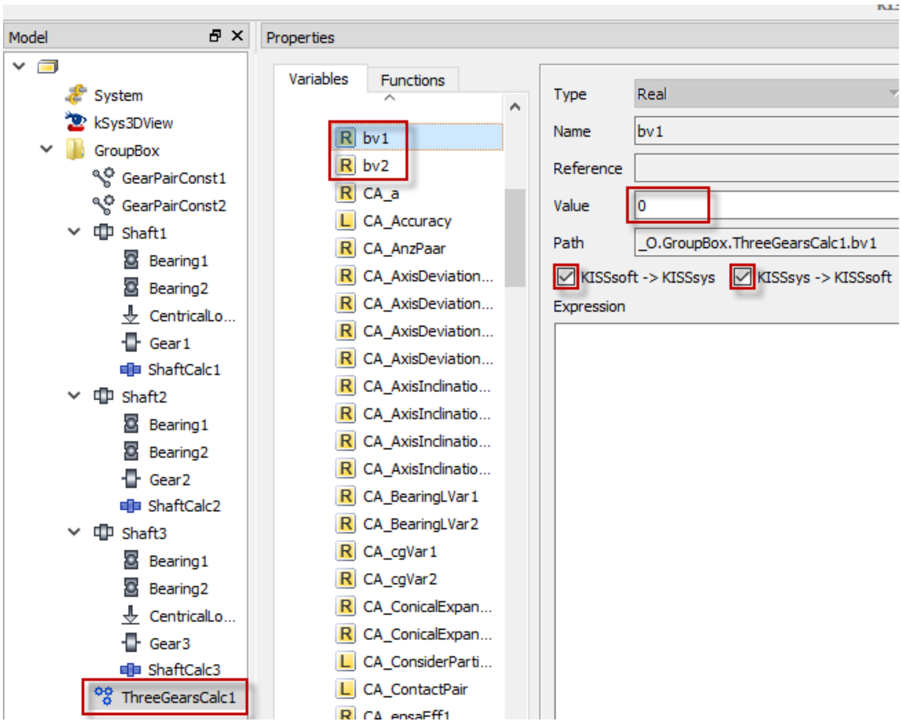

Figure 23. Axial offset defition in KISSsys/KISSsoft variable

A positive value for "bv" represents the axial offset in the local + Y-direction of the shaft coordinate system. "bv1" is defined between "gear1" and "gear2". E.g. an offset of +20 mm for "bv1" results in the following displacement:

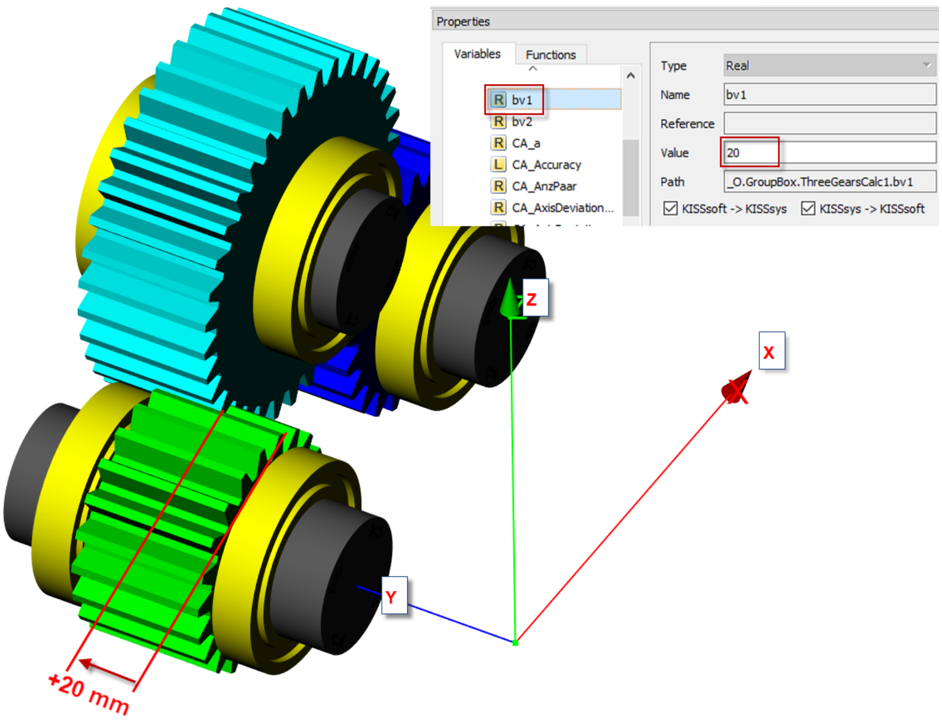

Figure 24. Graphical visualization in 3DViewer (axial displacement

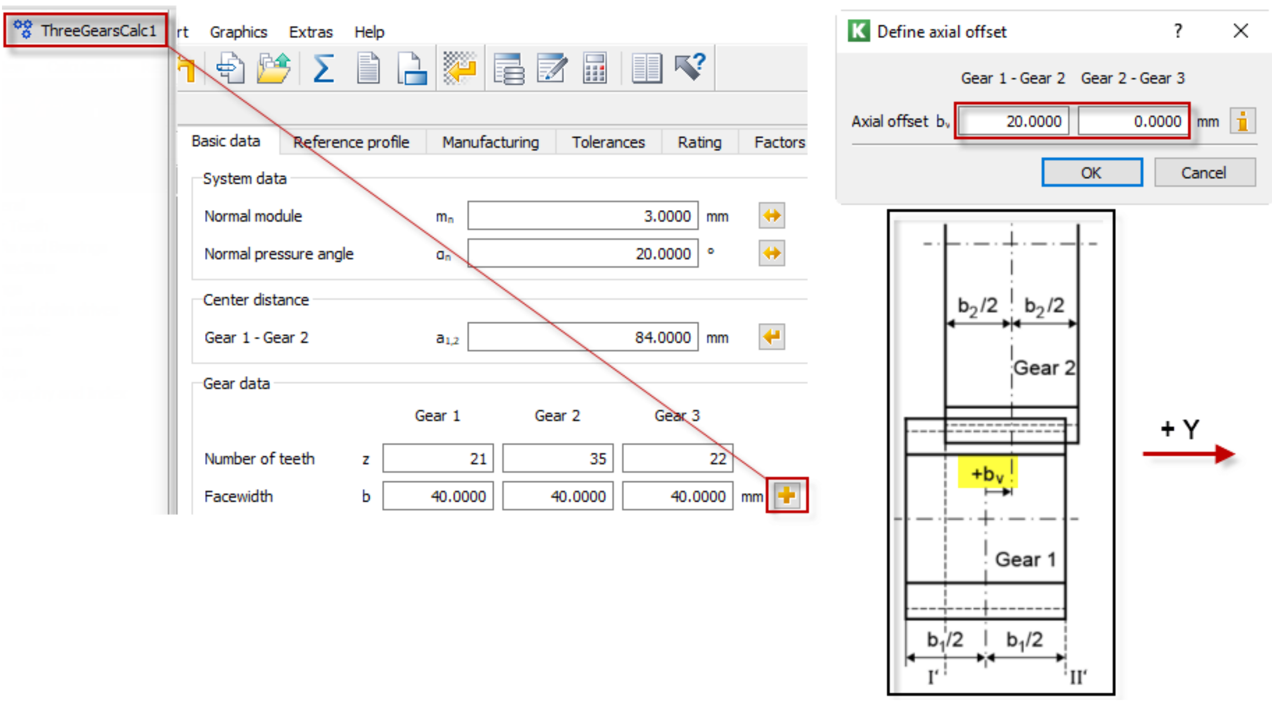

Figure 25. Axial Displacement in KISSsoft interface

5.3.3 “Parallel to one shaft / group”

User can choose “parallel to one shaft / group” in order to position a shaft according to a reference element (group / shaft). In the prompting dialog user can specify the position for “shaft2”. To define, he needs to select the reference element (in our case this will be “shaft1”). There is either a possibility to enter the distances to the reference coordinates system in cartesian or in polar coordinates. Furthermore, a shaft can also be inverted in its orientation (direction of shaft -> “reverserd”).

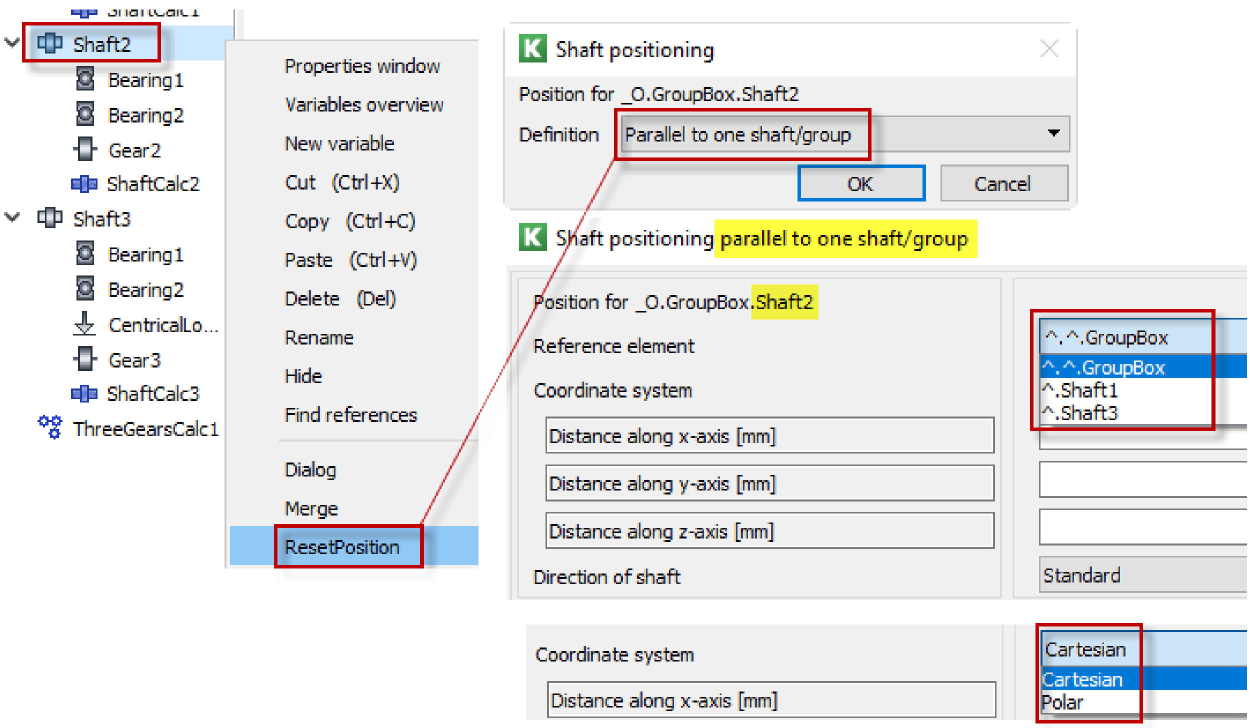

Figure 26. Positioning according to “Parallel to one shaft / group”

The following figures shows the definition in polar (left image) and cartesian coordinates system (right image).

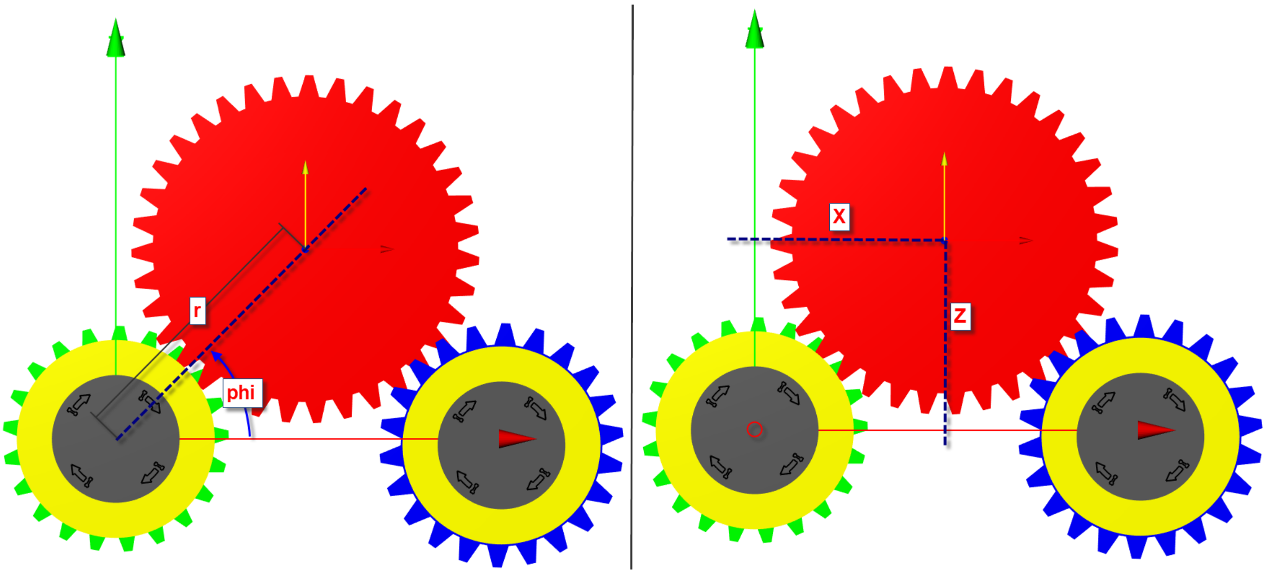

Figure 27. Position of contact in polar / cartesian coordinate system

Note: This solution might be necessary in some specific cases, but in general it is recommended to work with the function “according to calculation”.

5.3.4 “Parallel to two shafts / groups”

One shaft can also be positioned according to two reference elements. This may be the case, when two shafts are positioned (fixed) in space and you want to position another shaft relatively to them.

To start, both shafts (“shaft1” and “shaft2”) need to be defined. Selecting own input and e.g. defining shaft 1 to be fixed at the origin point [x/y/z] = [0/0/0]. Now for “shaft3” we e.g. set “own input” with the following position: [x/y/z] = [90/0/0].

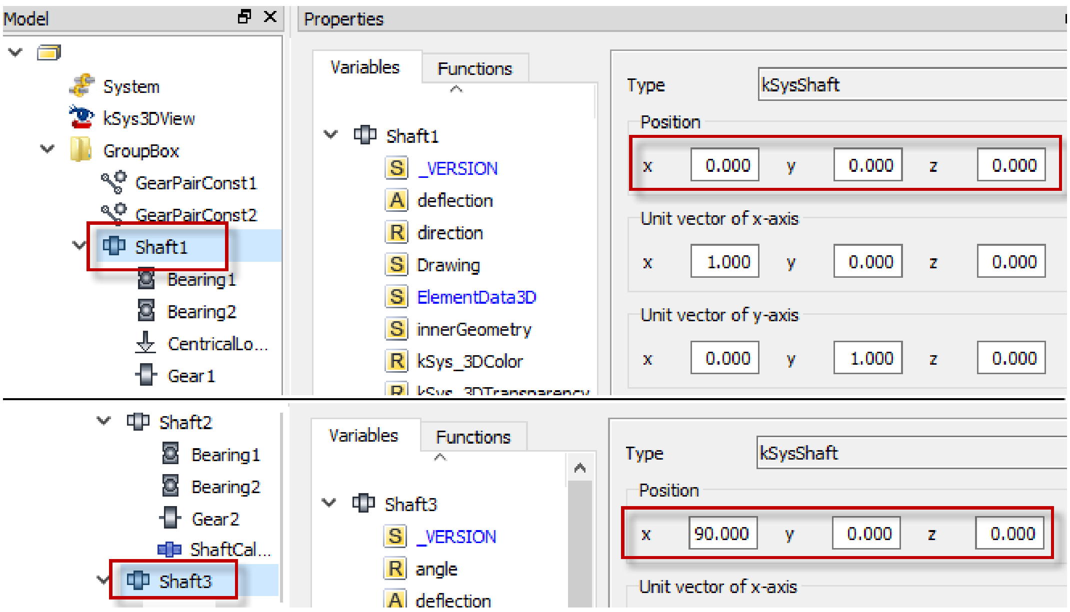

Figure 28. Positioning according to “parallel to two shafts / groups”

In this example, the middle shaft “Shaft2” will be positioned according to “Shaft1” respectively “Shaft3”. As an input, user either must insert the center distance manually, or he can copy the actual center distance from the gear pair calculation.

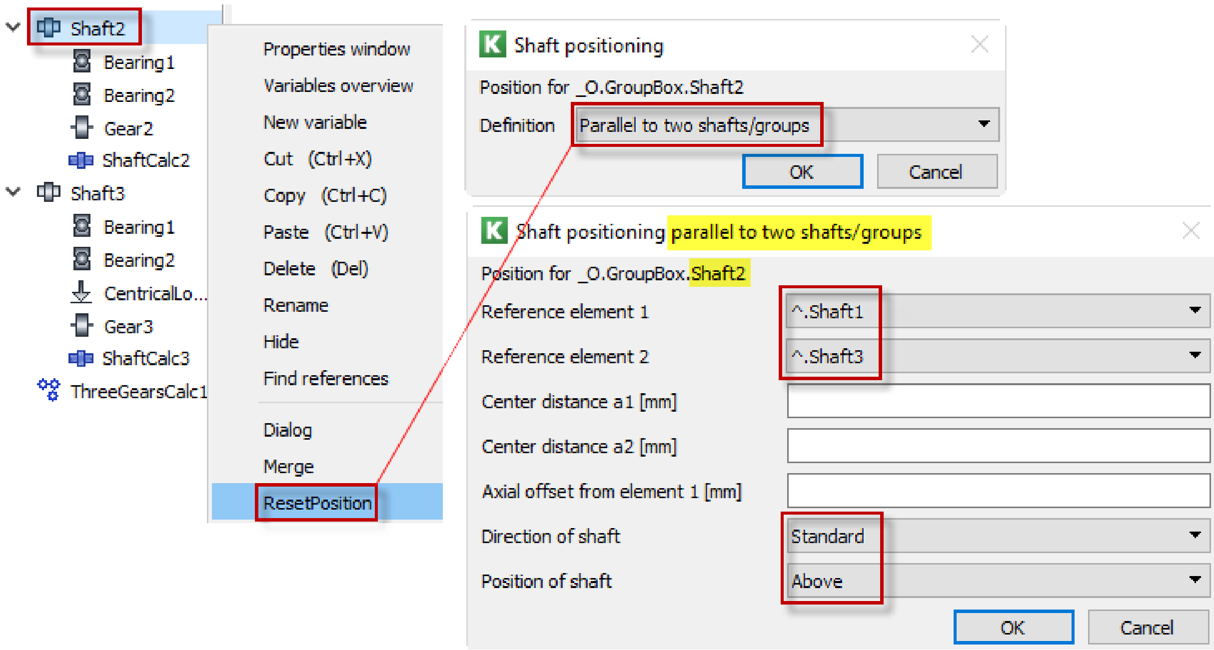

Figure 29. Positioning according to “parallel to two shafts / groups”

To get the reference from the “ThreeGearsCalc” go to properties and copy / paste the reference path into the corresponding input field.

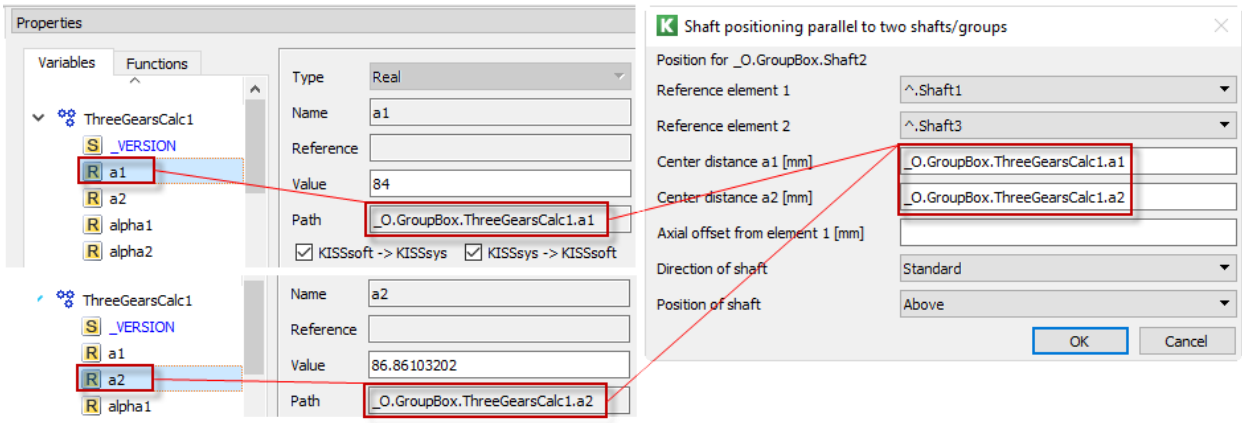

Figure 30. Centerdistance from KISSsys variable

User can select in the dialog either “position of shaft = above”:

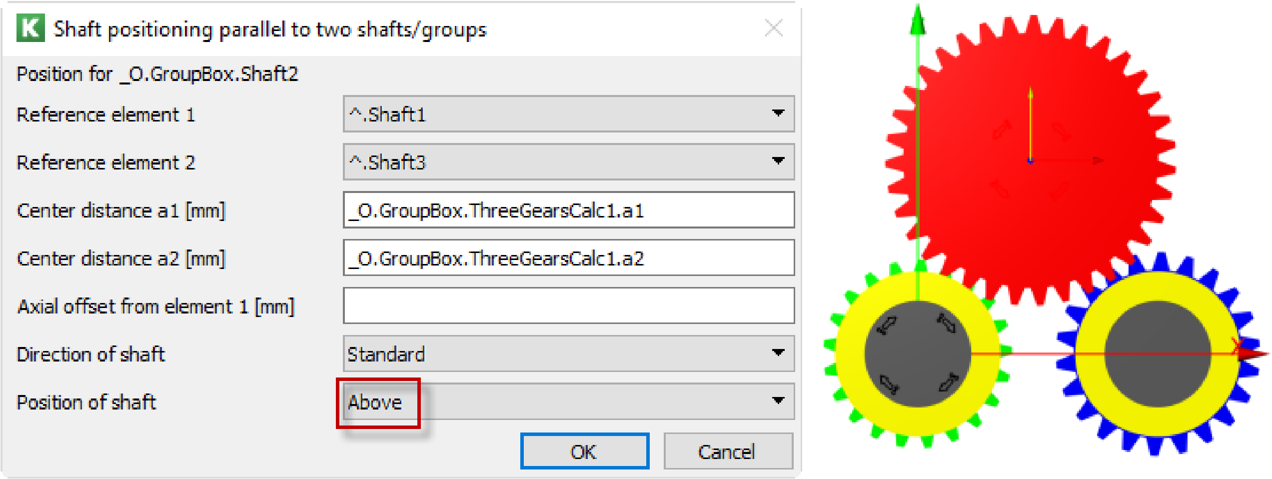

Figure 31. Definition “above”

or “position of shaft = below”:

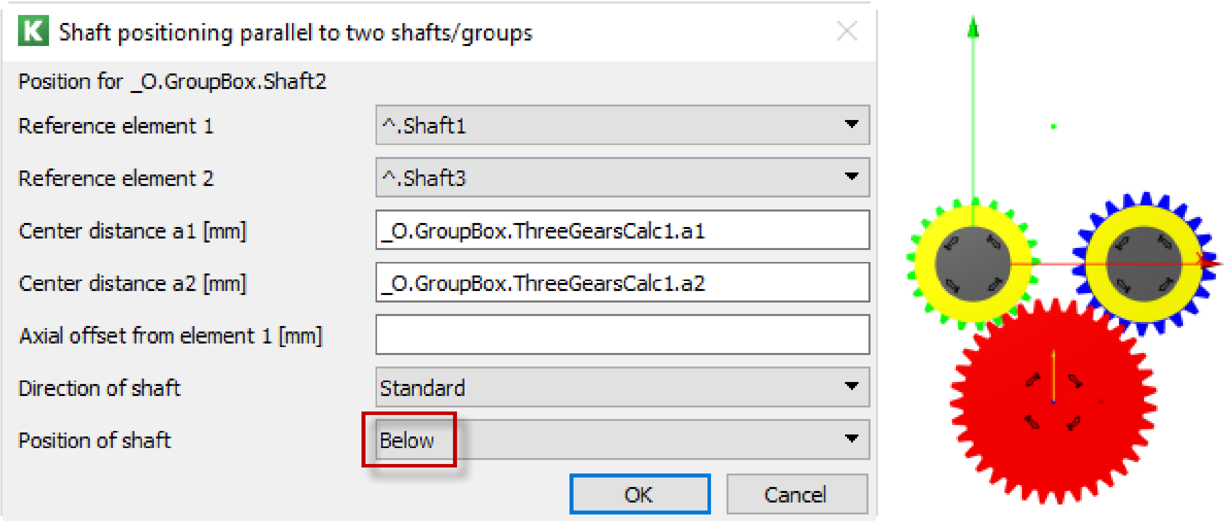

Figure 32. Definition “below”

6 Example 2: Planetary gears (Coaxial shaft groups)

The positioning of coaxial shafts must be performed in the corresponding groups they belong to. These “kSysgroups” are defined one level higher than the coaxial shafts in the model tree hierarchy.

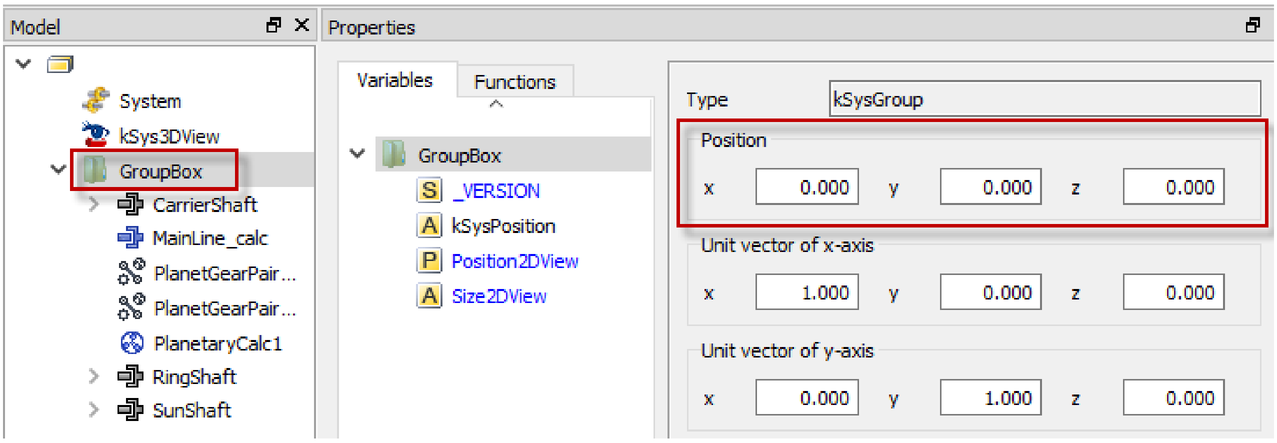

Figure 33. Position of “GroupBox”

The positioning of these coaxial shafts inside the group is based on the variable “position”, which is saved in the properties of each coaxial shaft.

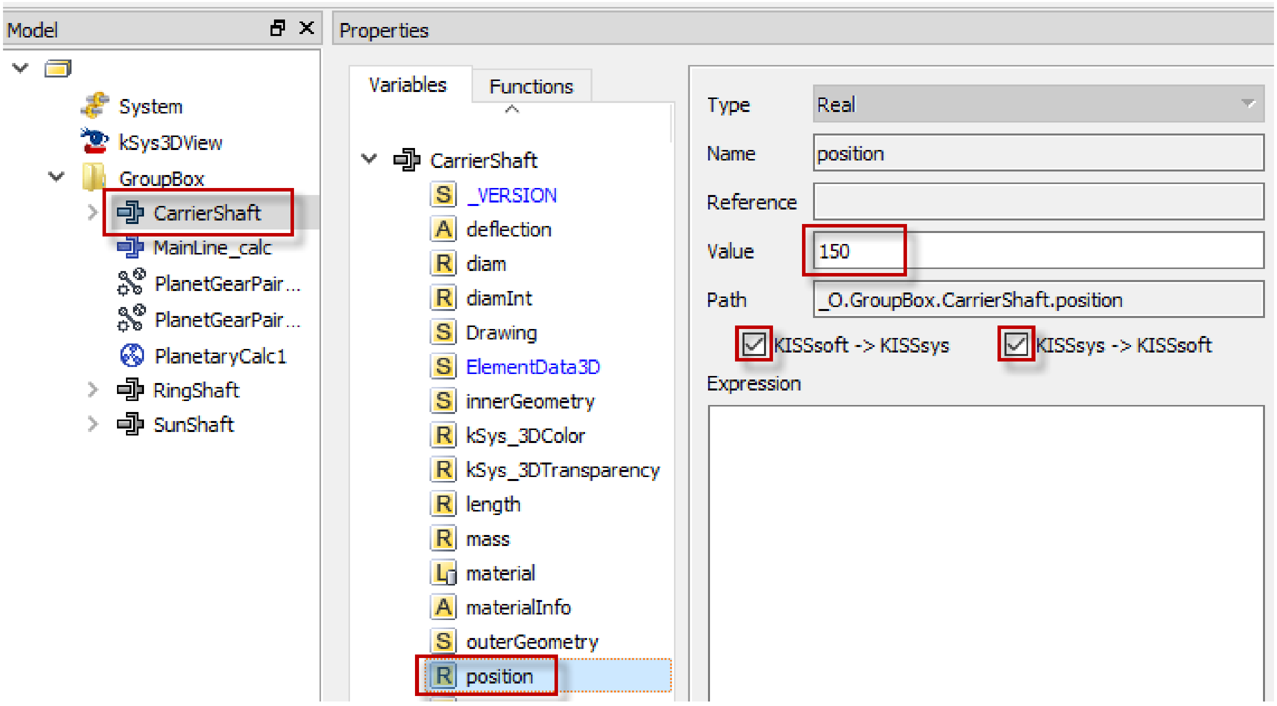

Figure 34. Axial position of the variable “position”

The “position value” zero (0) means that the shaft is starting at the same global position where the group is defined.

Note: If the flag “KISSsoft-KISSsys” is activated, the adjusted position in the shaft editor will influence the value in KISSsys as well.

When opening the ShaftCalculation “MainLine_calc” and selecting the shaft e.g. “CarrierShaft” in the element tree, the global position resp. the starting point of this shaft according to the group is shown.

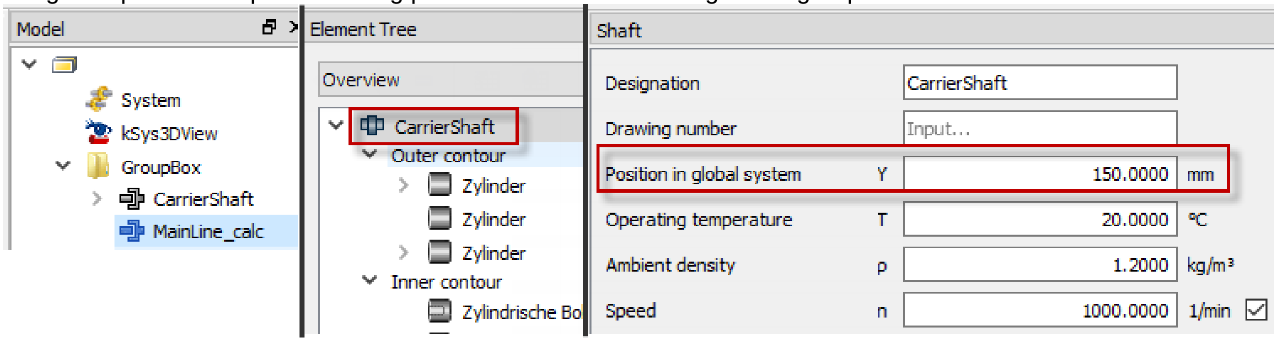

Figure 35. Position in the global system

Loading a “group template” (Planetary gearbox).

Open a “new” model and add the below group template of a planetary gearbox to the root of the tree structure hierarchy.

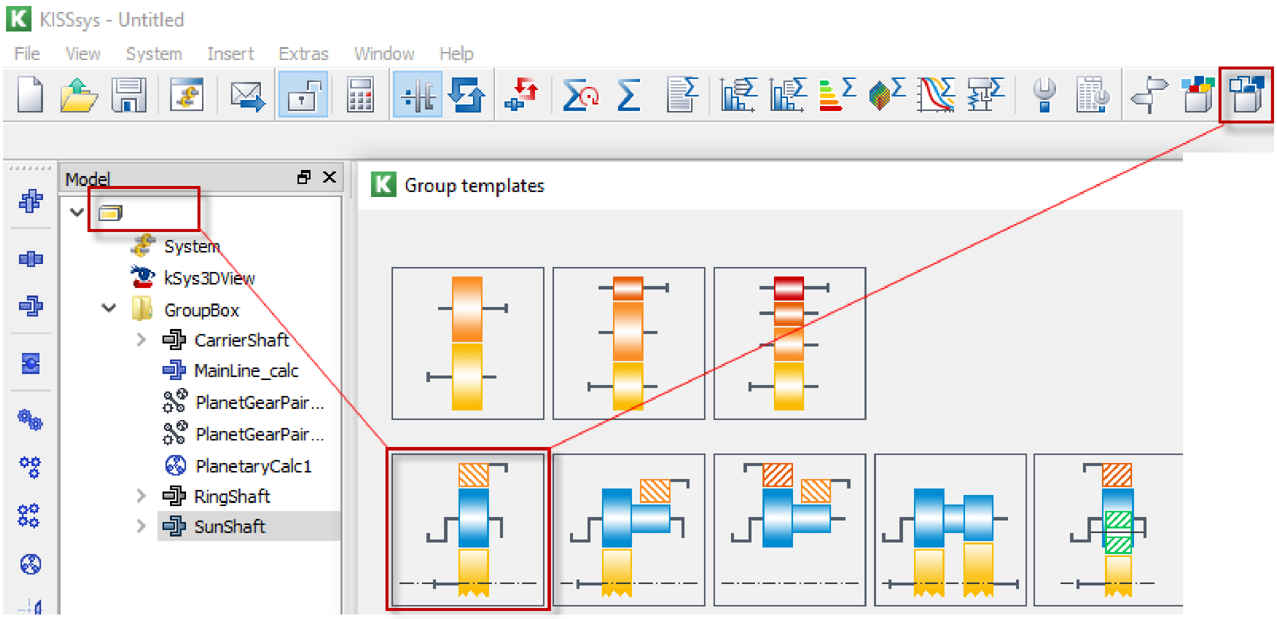

Figure 36. GroupBox-template

Then, activate the coordinates system with clicking the following icon in the icon bar.

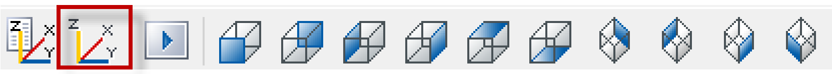

Figure 37. Show axis system in 3DViewer

Activate the 3DViewer from the model tree (double-click on the element). Choose the following representation mode “in the front”.

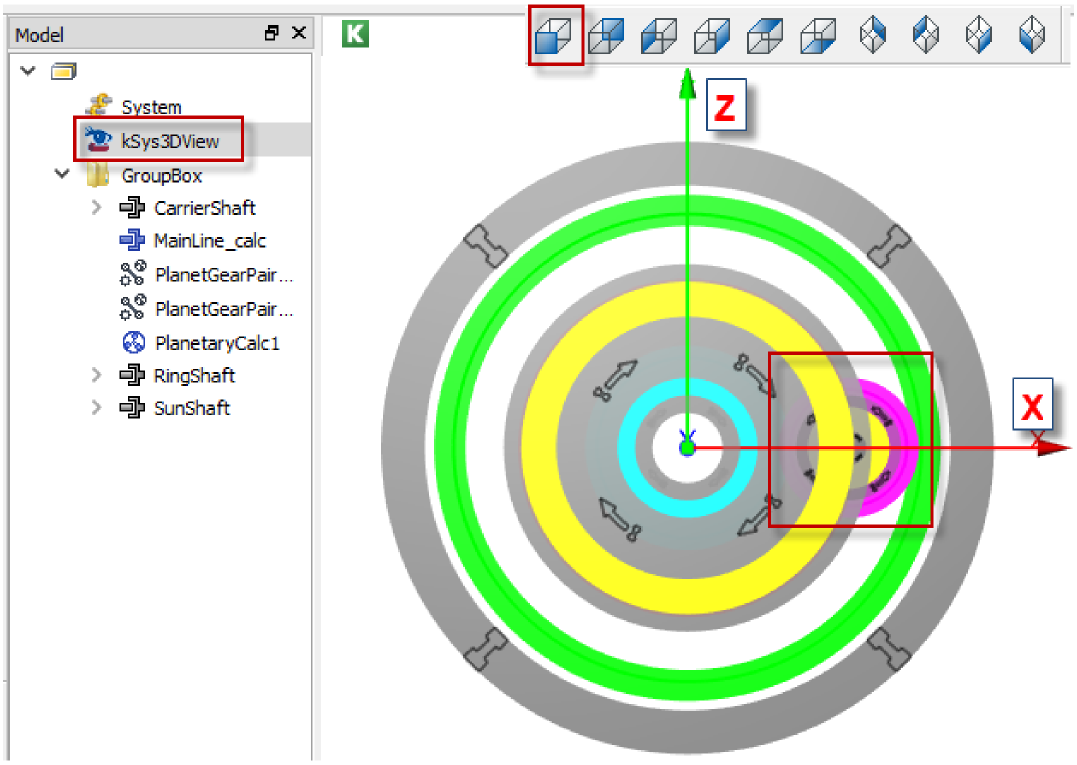

Figure 38. Position of planet gear in 3DViewer

In this example the position of the planet is already defined.

To show you the positioning procedure in a planetary gear, right-click on the planet-group and choose “reset position” and then select “own input”. After set the position at origin point of the main group.

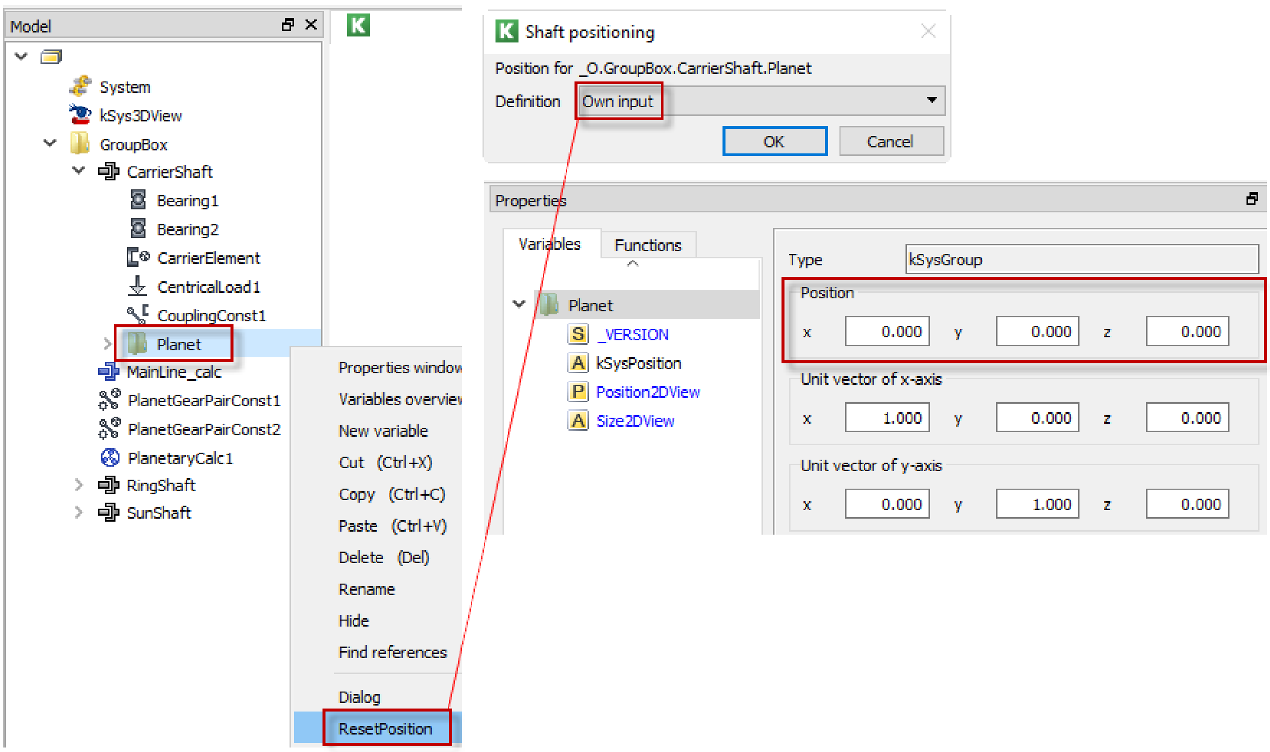

Figure 39. Reset the position of the planet group and set back to [0/0/0]

To position this coaxial planetary group, right-click again on the planetary group “Planet” and select “ResetPosition”.

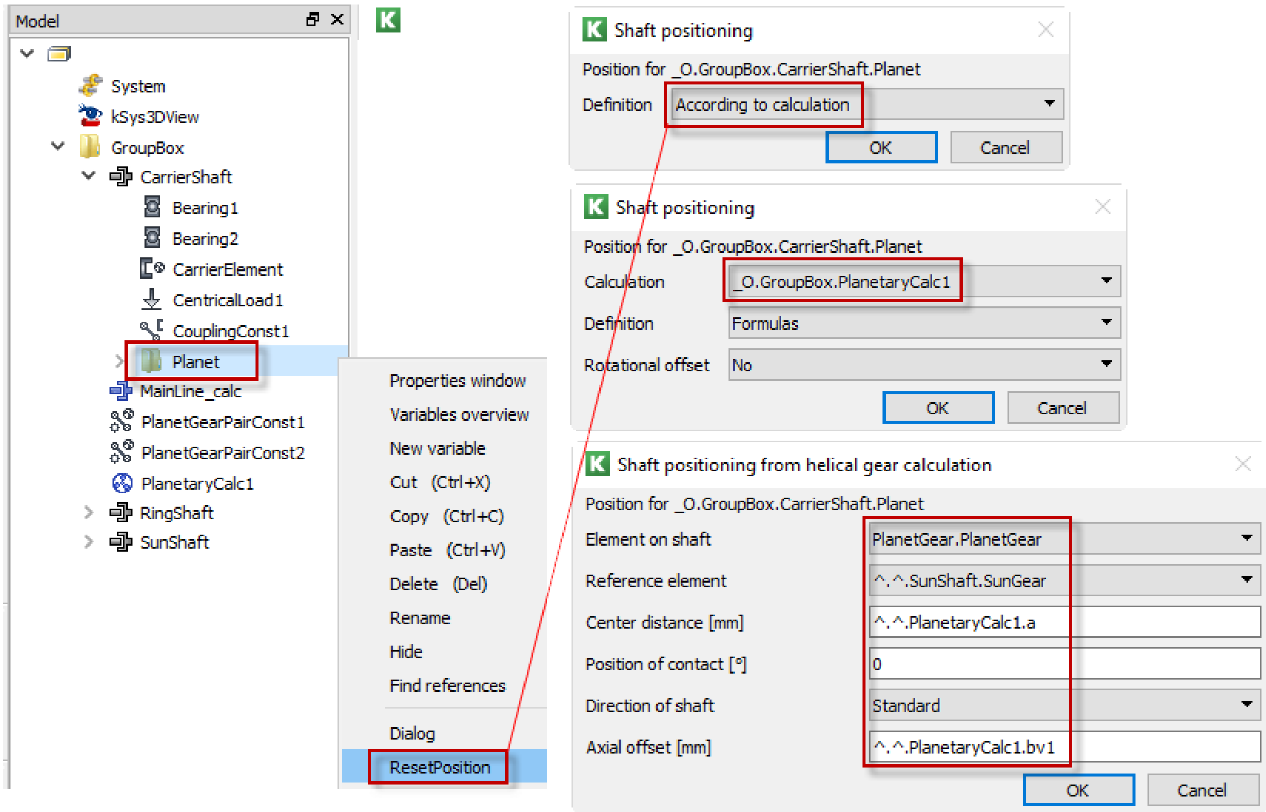

Figure 40. Set the planetary group “according to calculation”

As default, the position of contact is defined to 0°. selecting e.g. 45° results in the following change of display.

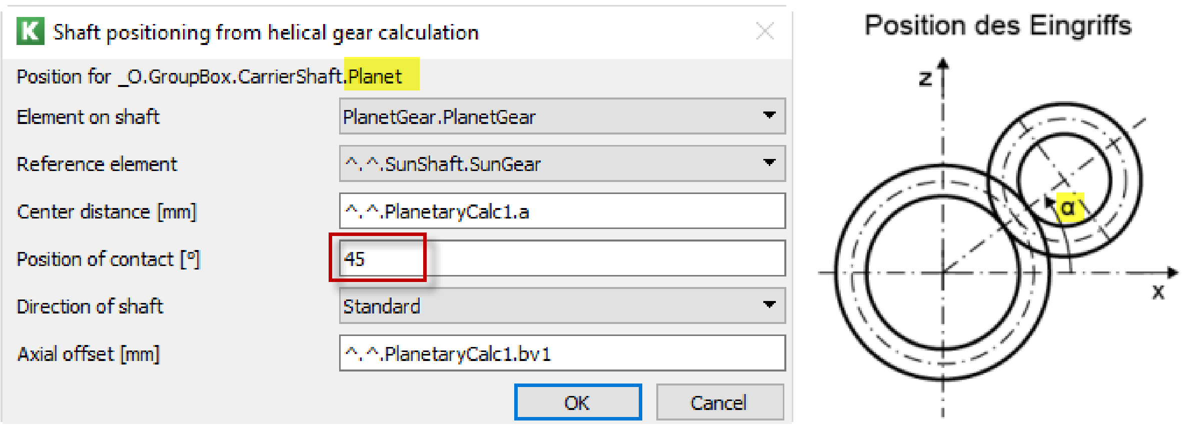

Figure 41. position of contact

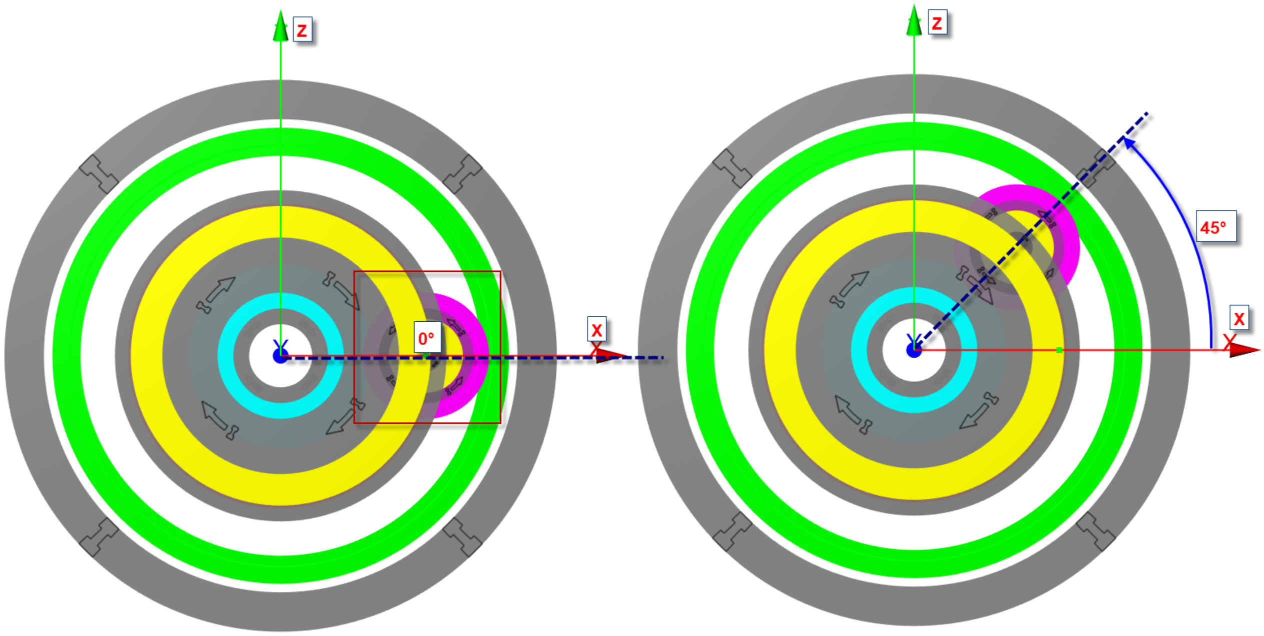

Figure 42. Position of contact in 3DViewer

To set the number of planets, “right-click” on the “PlanetaryGearPairConst” and select “dialog”. Then set the required number of planets (in this example npl. = 3)

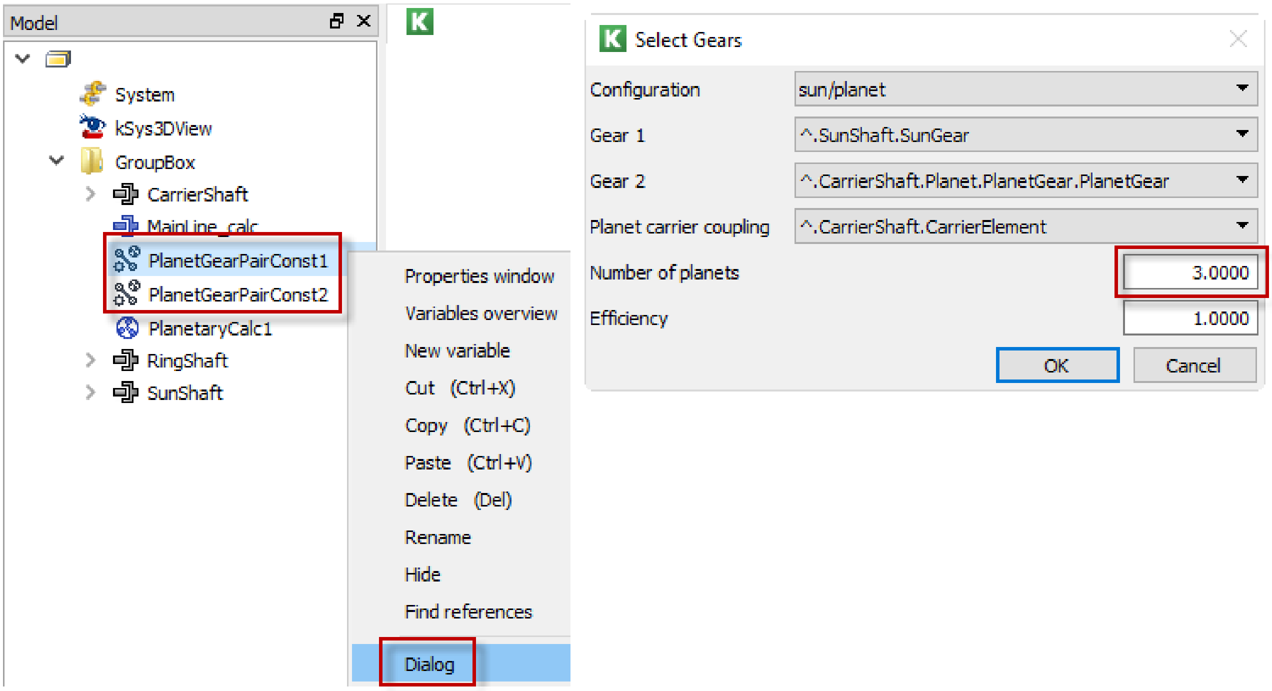

Figure 43. Definition of number of planets

To show all 3 planets in the 3DView; right-click on kSys3DView and select “ShowPlanets”.

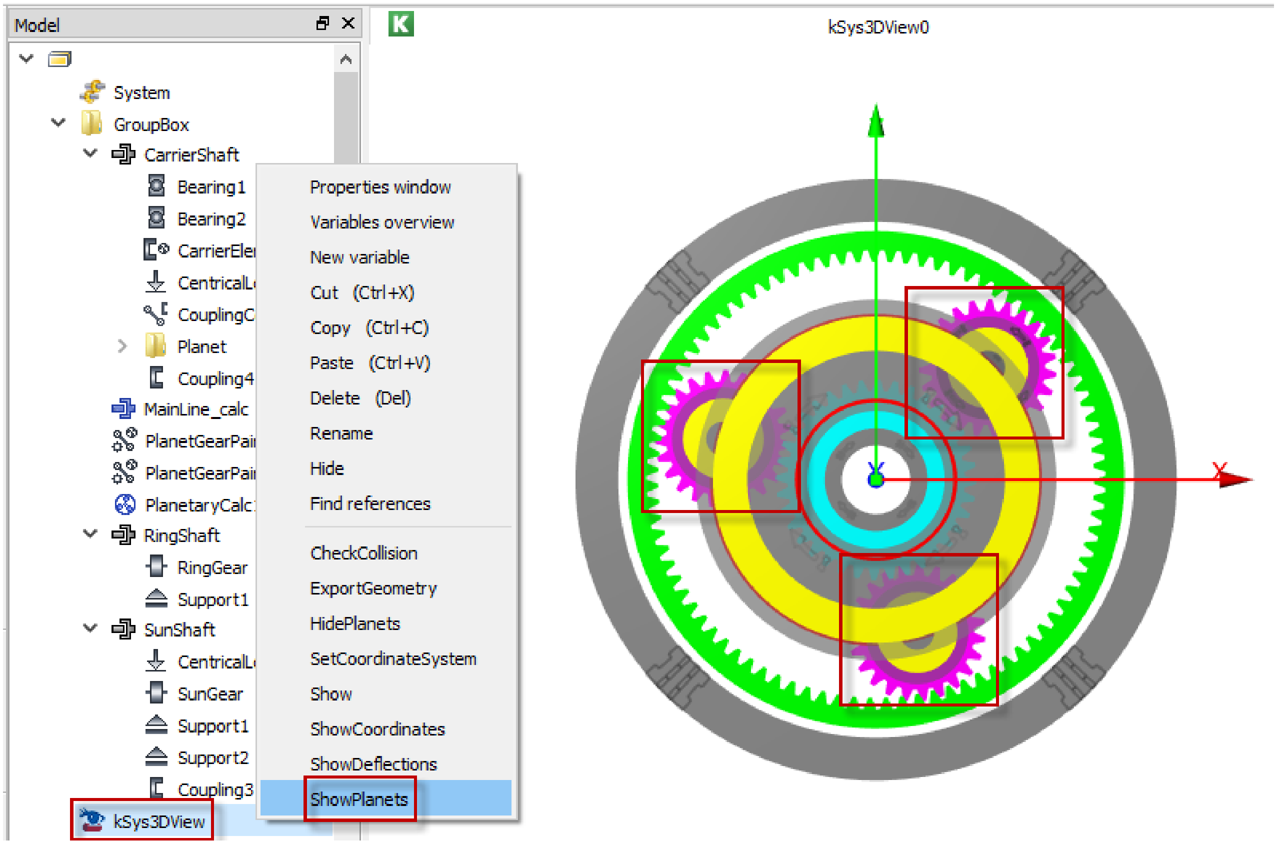

Figure 44. Function “show planets”

7 Positioning according to other gear calculations

The relative positioning process of bevel gears, face gears, worm gears etc. is similar to the procedure described in chapter 5.3.