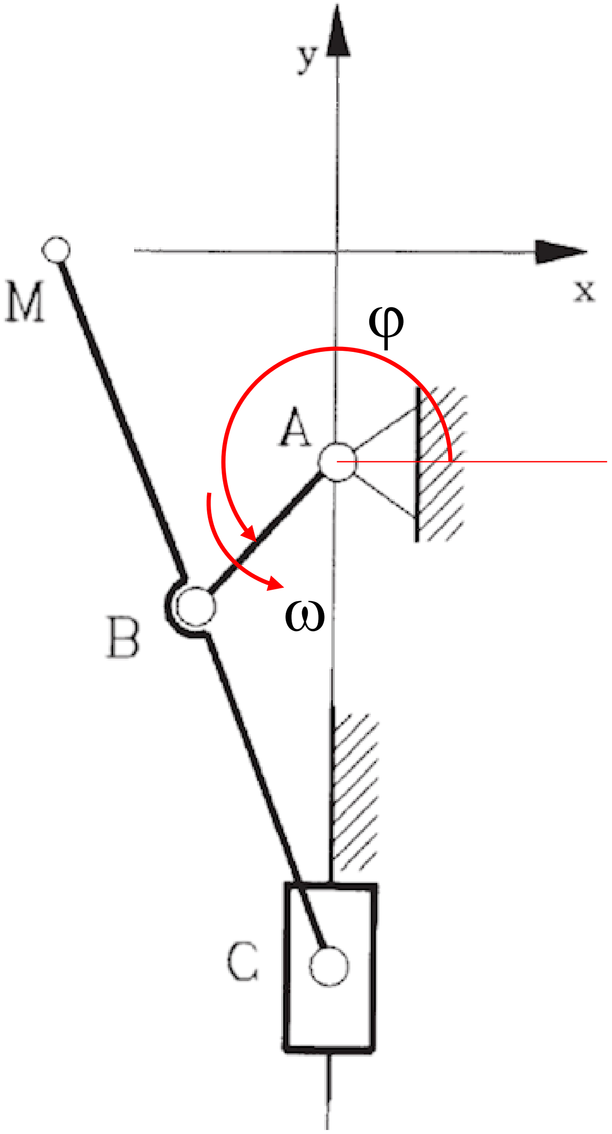
The task is to model given mechanism, as can be noticed, support point is not defined so it can be set anywhere e.g (0,0)



Data:

AB = 0,1m

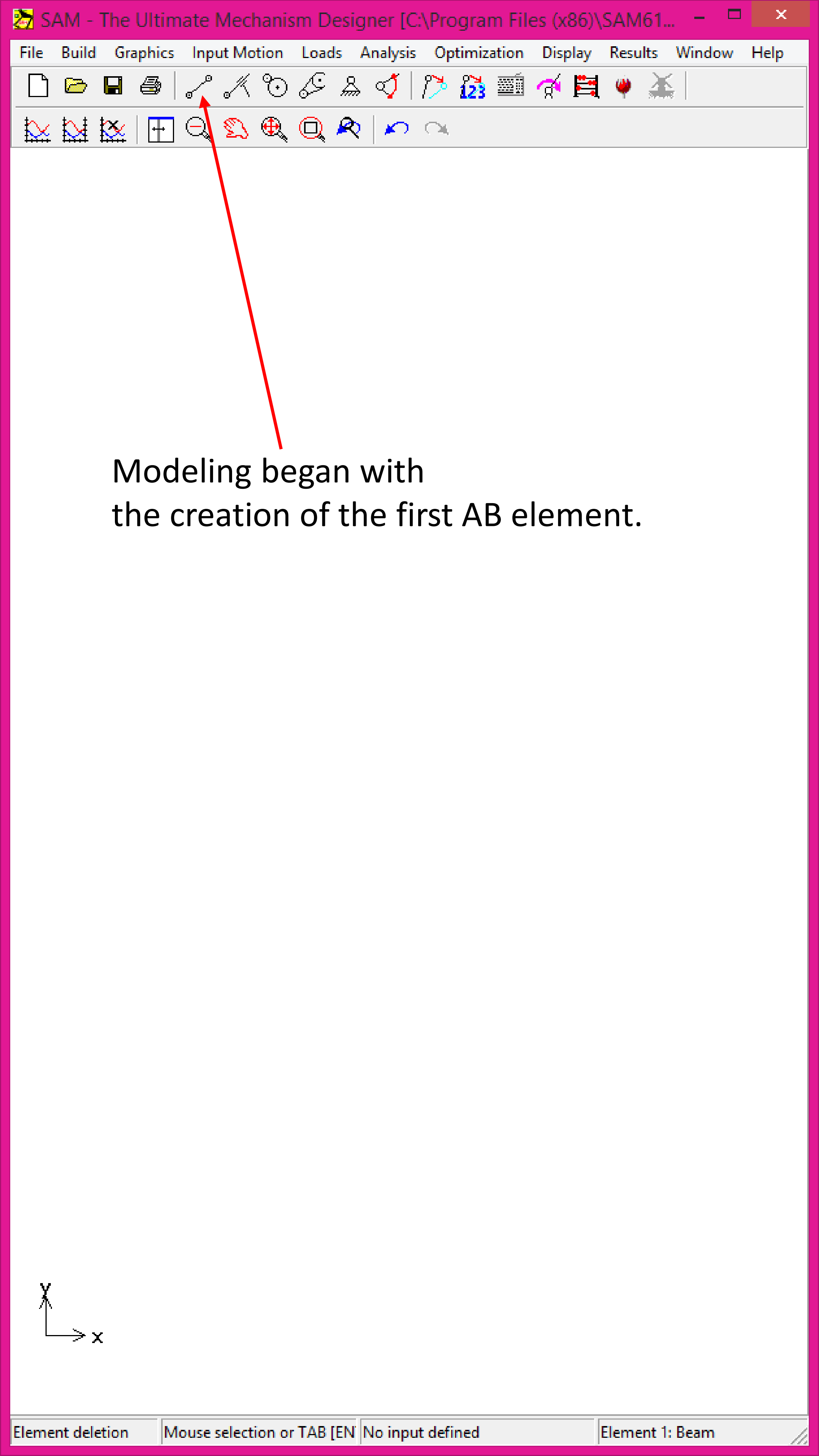
BC = 0,2m

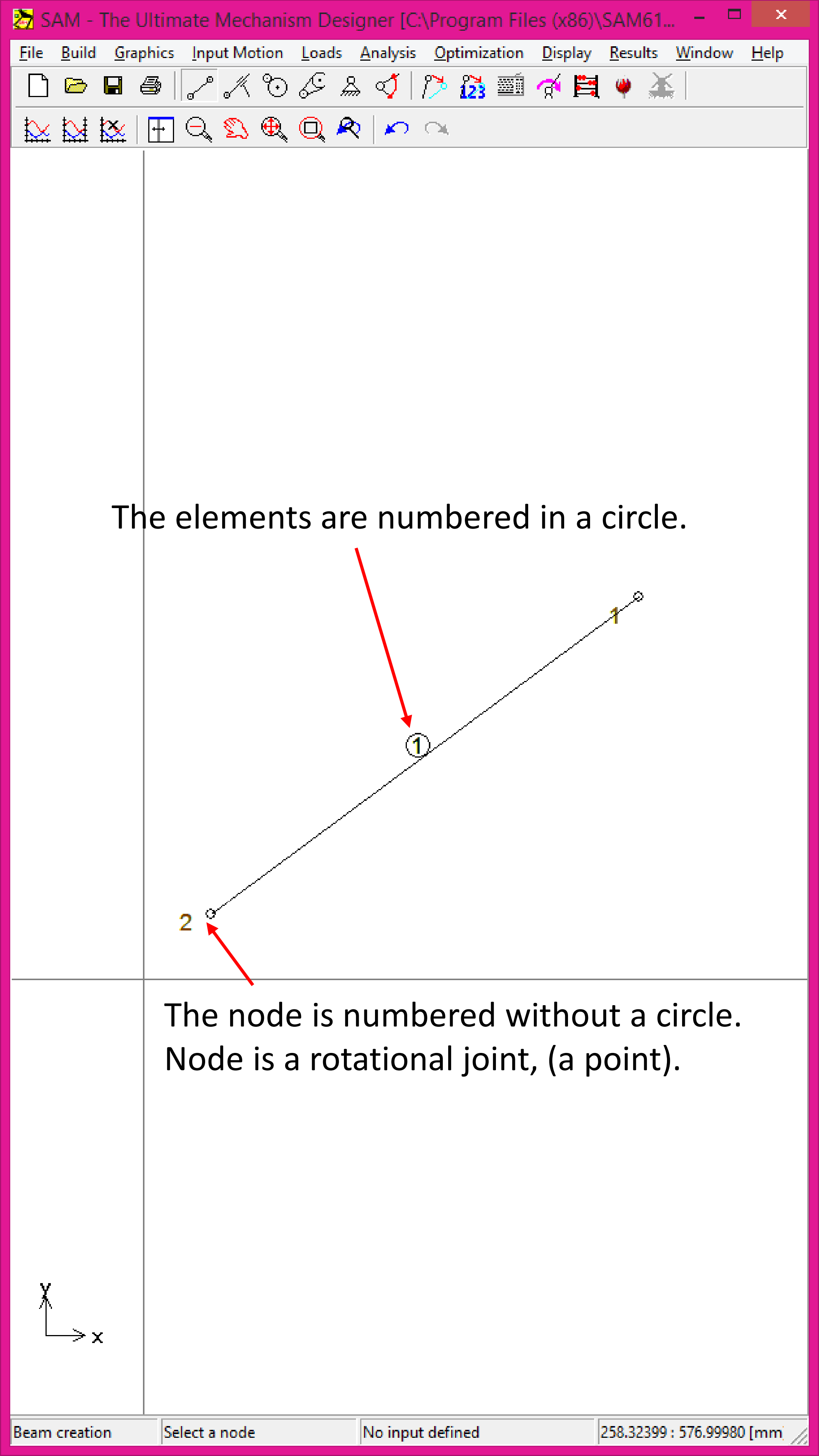
BM = 0,15m

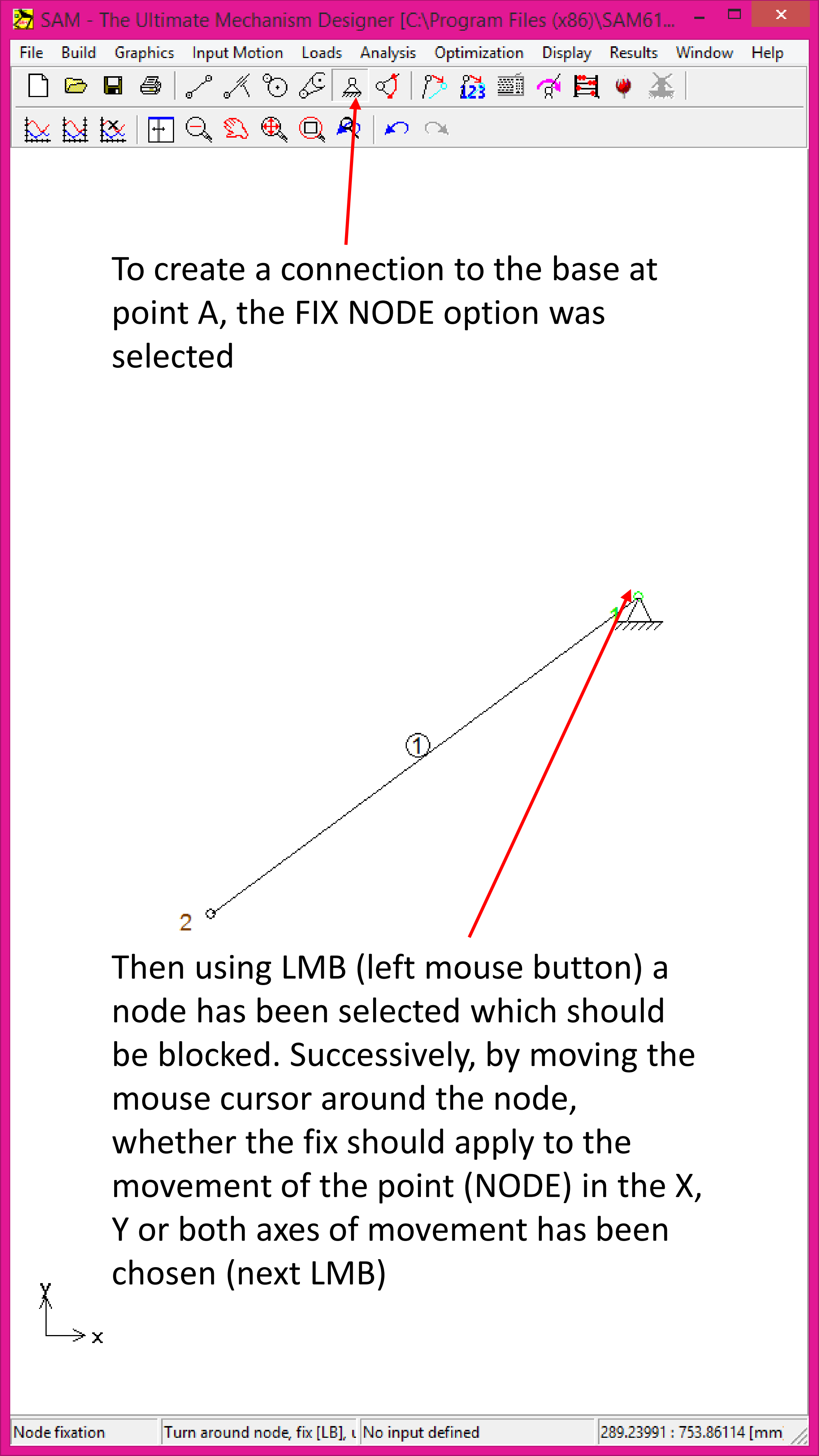
∠CBM = π

$\varphi(0) = 230°$

ω = 60 RPM


SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
Modeling began with
the creation of the first AB element.
Y
X
Element deletion
Mouse selection or TAB [EN
No input defined
Element 1: Beam

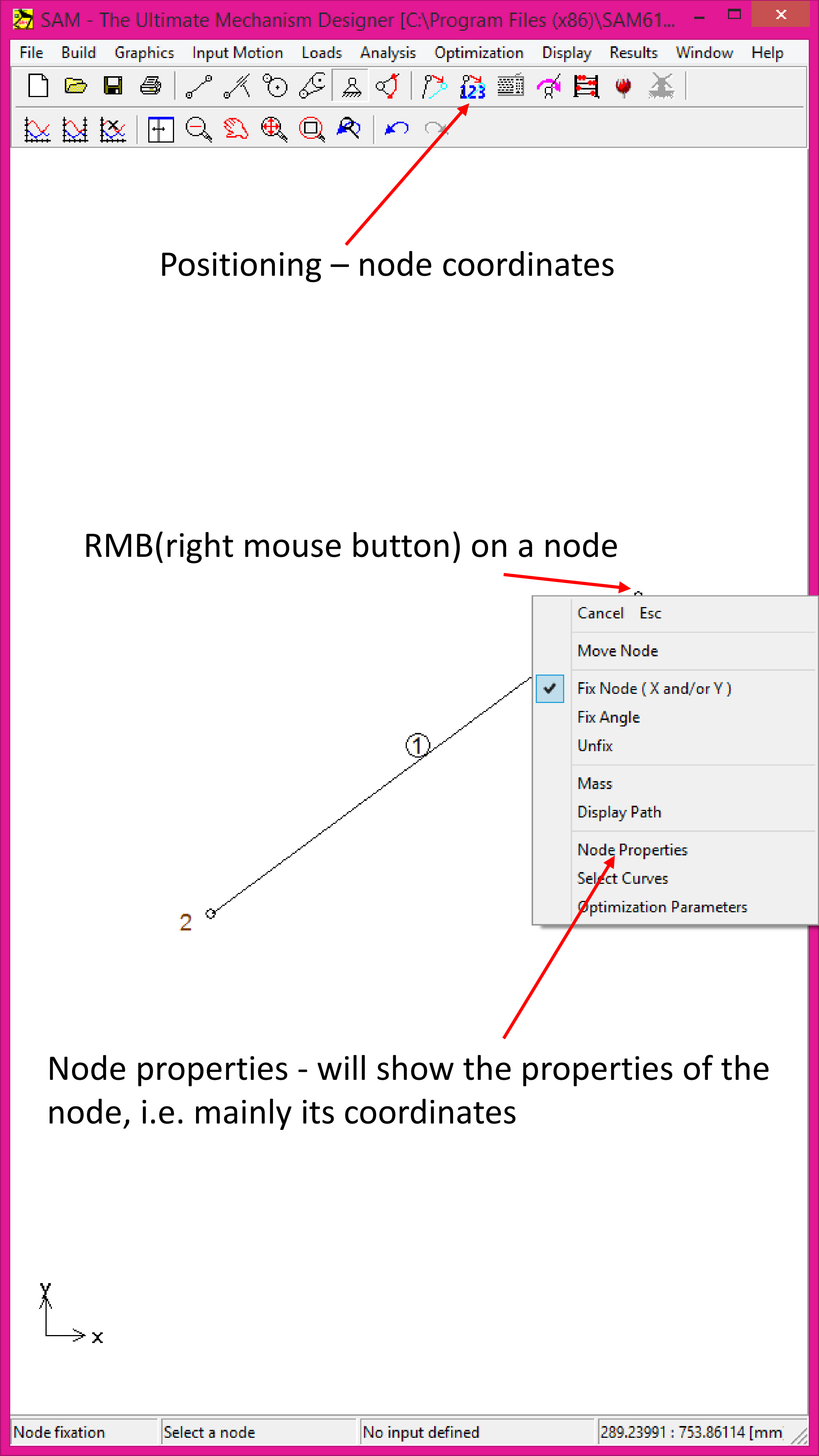

SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
The elements are numbered in a circle.
1
1
2
The node is numbered without a circle.
Node is a rotational joint, (a point).
Y
X
Beam creation
Select a node
No input defined
258.32399 : 576.99980 [mm

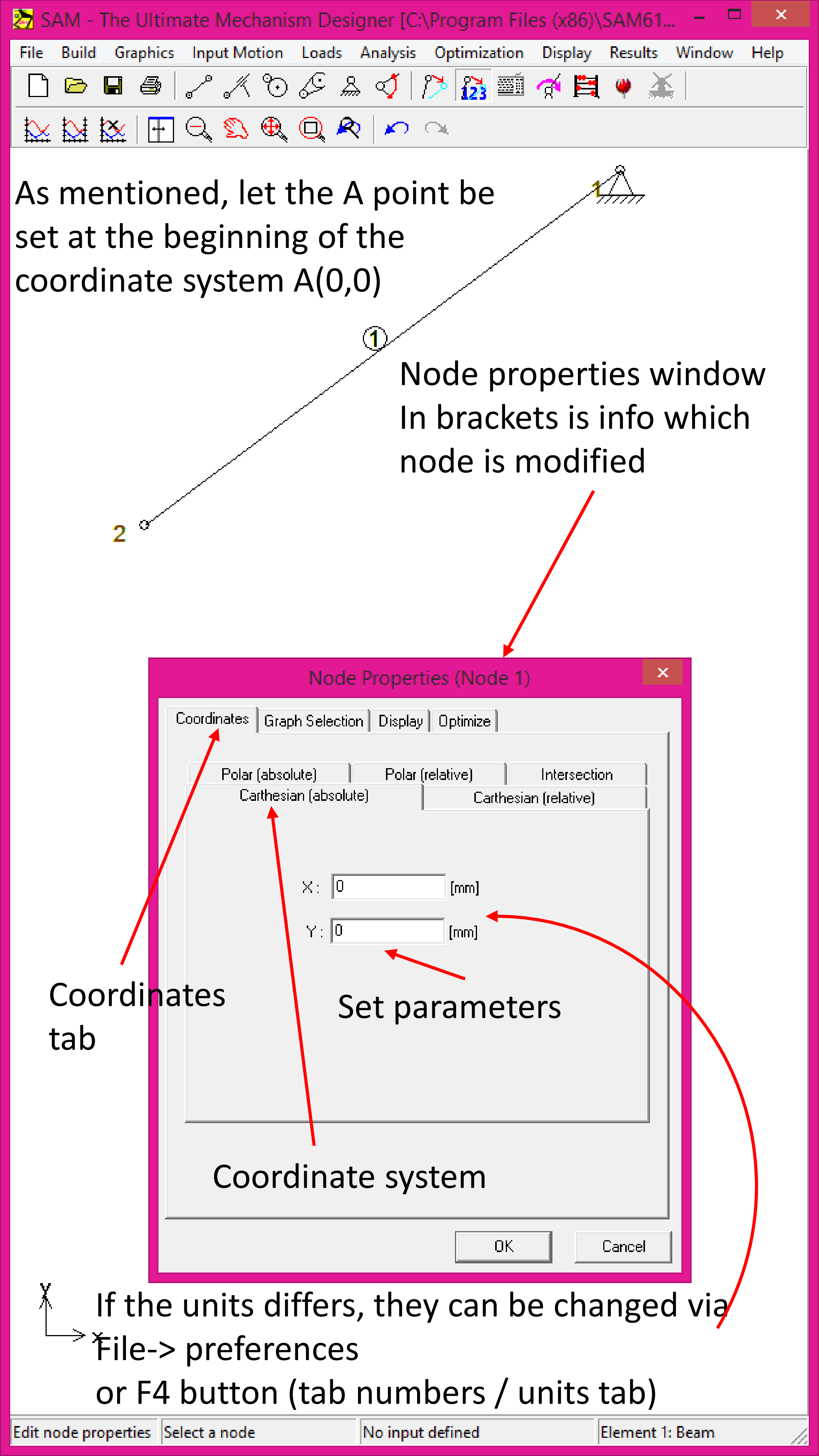

SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
To create a connection to the base at point A, the FIX NODE option was selected
1
2
Then using LMB (left mouse button) a node has been selected which should be blocked. Successively, by moving the mouse cursor around the node, whether the fix should apply to the movement of the point (NODE) in the X, Y or both axes of movement has been chosen (next LMB)
Y
X
Node fixation
Turn around node, fix [LB], ι
No input defined
289.23991 : 753.86114 [mm

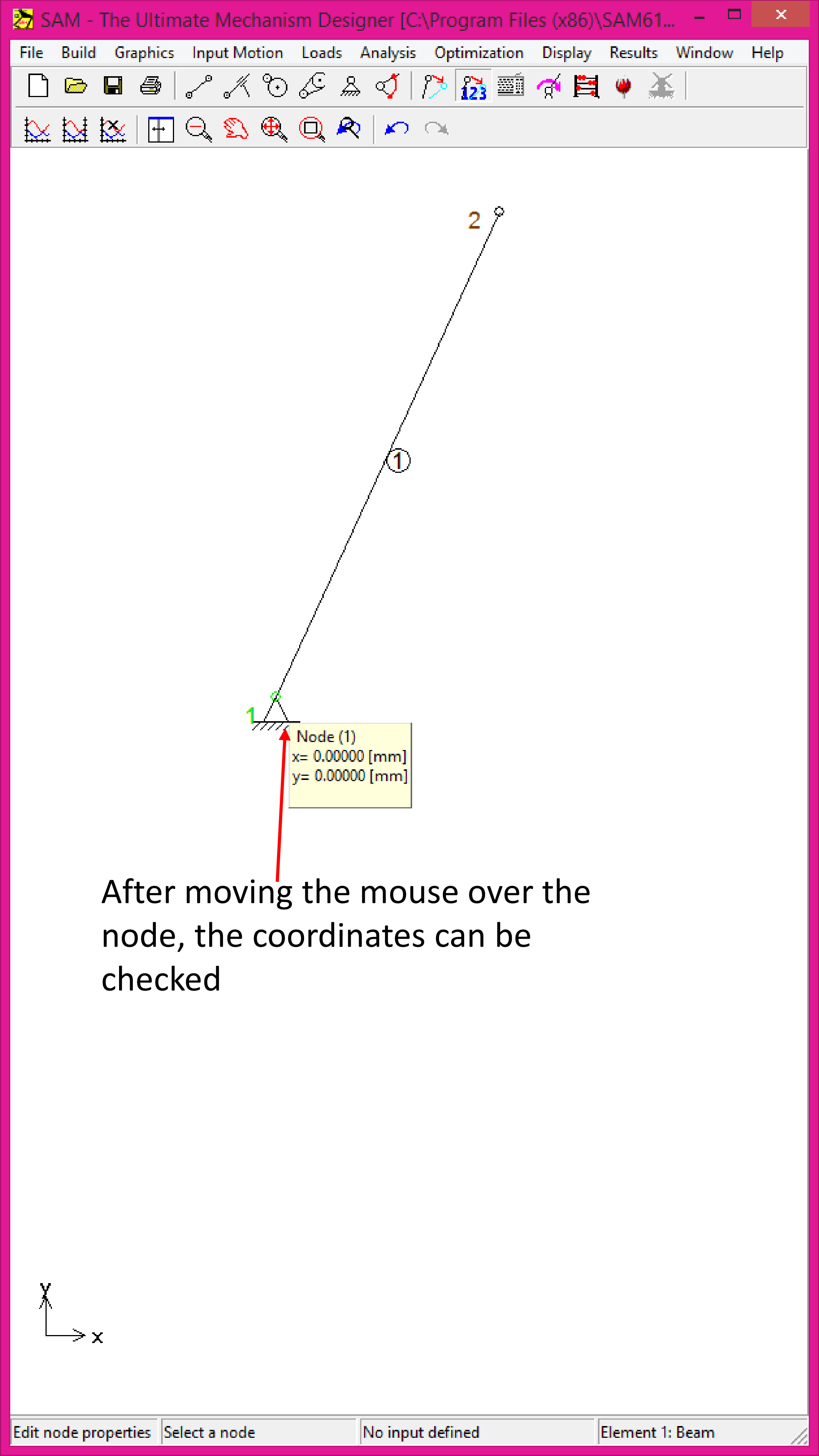
Positioning – node coordinates

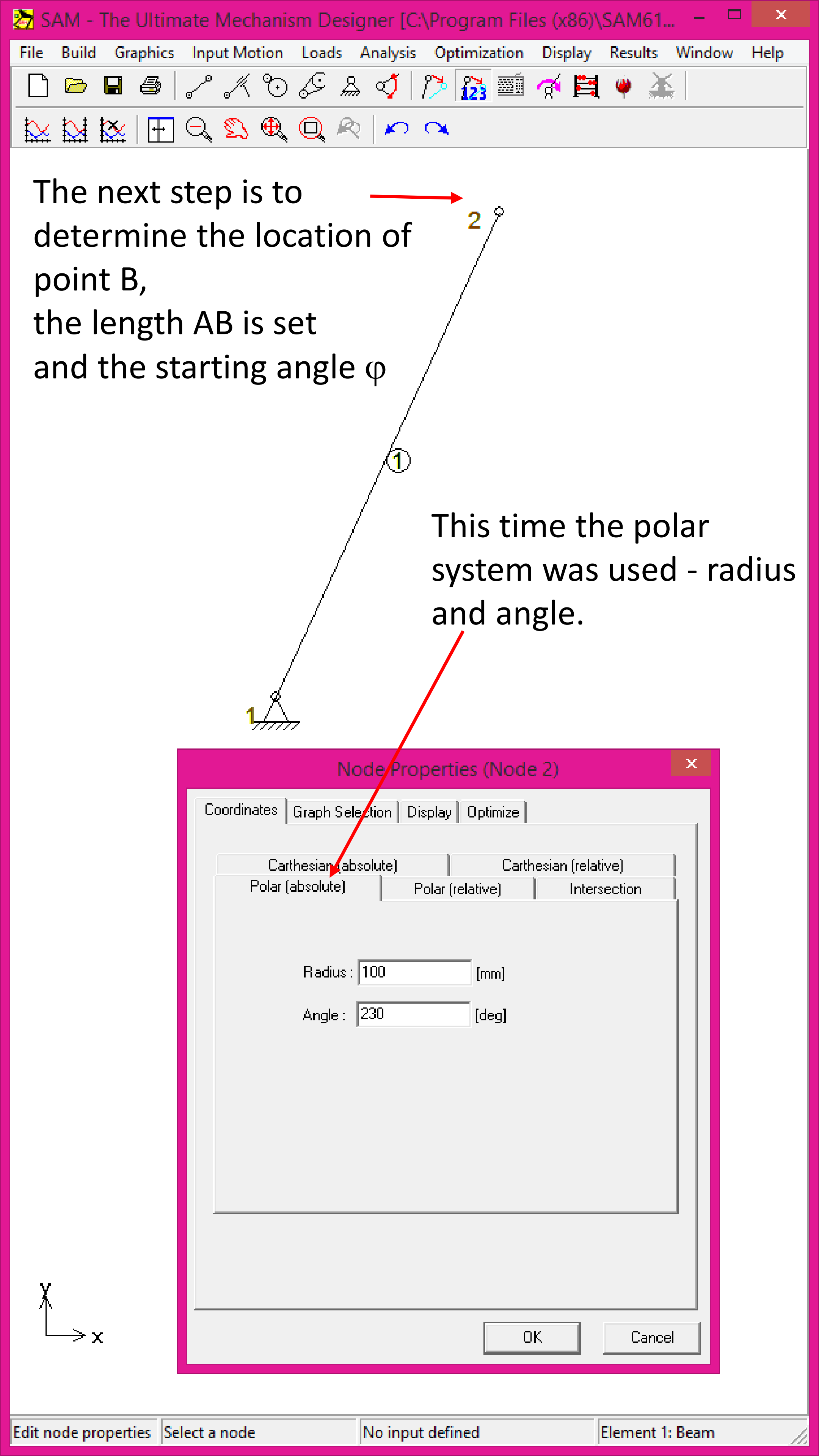
RMB(right mouse button) on a node

Node properties - will show the properties of the node, i.e. mainly its coordinates




SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
As mentioned, let the A point be set at the beginning of the coordinate system A(0,0)
1
2
Node properties window
In brackets is info which node is modified
Node Properties (Node 1)
Coordinates
Graph Selection
Display
Optimize
Polar (absolute)
Polar (relative)
Intersection
Carthesian (absolute)
Carthesian (relative)
X : 0 [mm]
Y : 0 [mm]
Set parameters
Coordinates tab
Coordinate system
OK
Cancel
If the units differs, they can be changed via File-> preferences
or F4 button (tab numbers / units tab)
Edit node properties
Select a node
No input defined
Element 1: Beam


SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
2
1
1
Node (1)
x= 0.00000 [mm]
y= 0.00000 [mm]
After moving the mouse over the node, the coordinates can be checked
Y
x
Edit node properties
Select a node
No input defined
Element 1: Beam

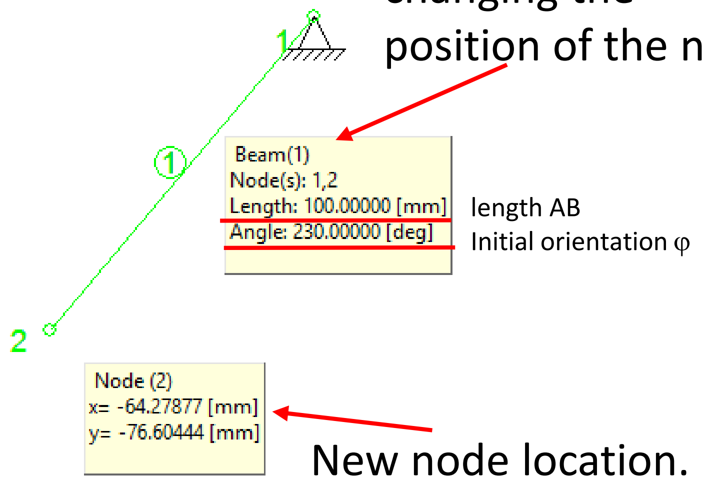


SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File
Build
Graphics
Input Motion
Loads
Analysis
Optimization
Display
Results
Window
Help
The next step is to determine the location of point B,
the length AB is set
and the starting angle φ
2
1
1
This time the polar system was used - radius and angle.
Node Properties (Node 2)
Coordinates
Graph Selection
Display
Optimize
Carthesian (absolute)
Carthesian (relative)
Polar (absolute)
Polar (relative)
Intersection
Radius : 100 [mm]
Angle : 230 [deg]
OK
Cancel
Y
X
Edit node properties
Select a node
No input defined
Element 1: Beam

SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...

File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help

Element parameters determined by changing the position of the nodes

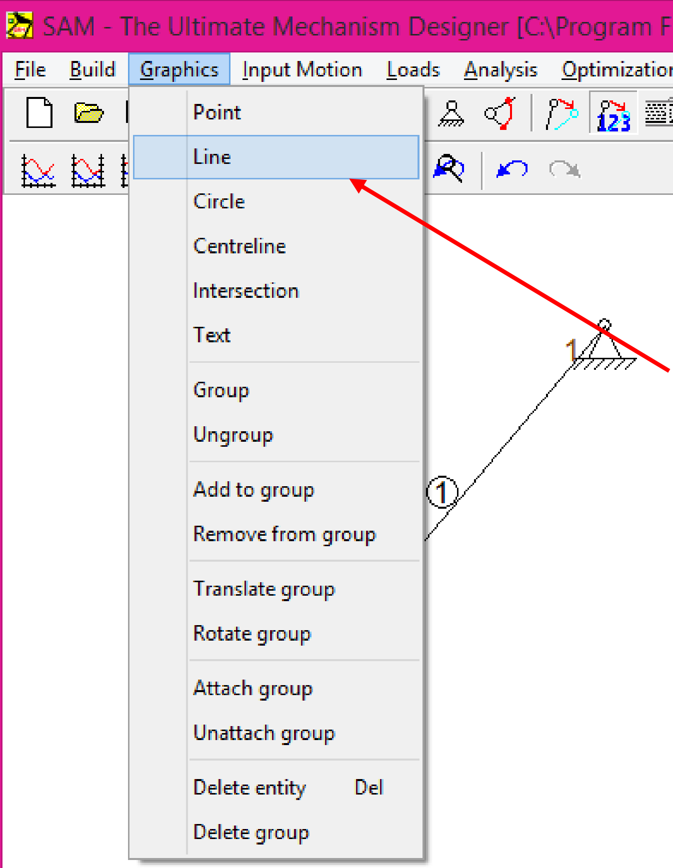


New node location.

The next step will be to determine the C point - as the intersection of the vertical line OY and the circle with the radius of the BC element length and the center at the B point

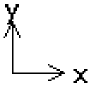
One of the most important information about the mobility of the system and the number of drives

Edit node properties | Select a node | No input defined | Element 1: Beam



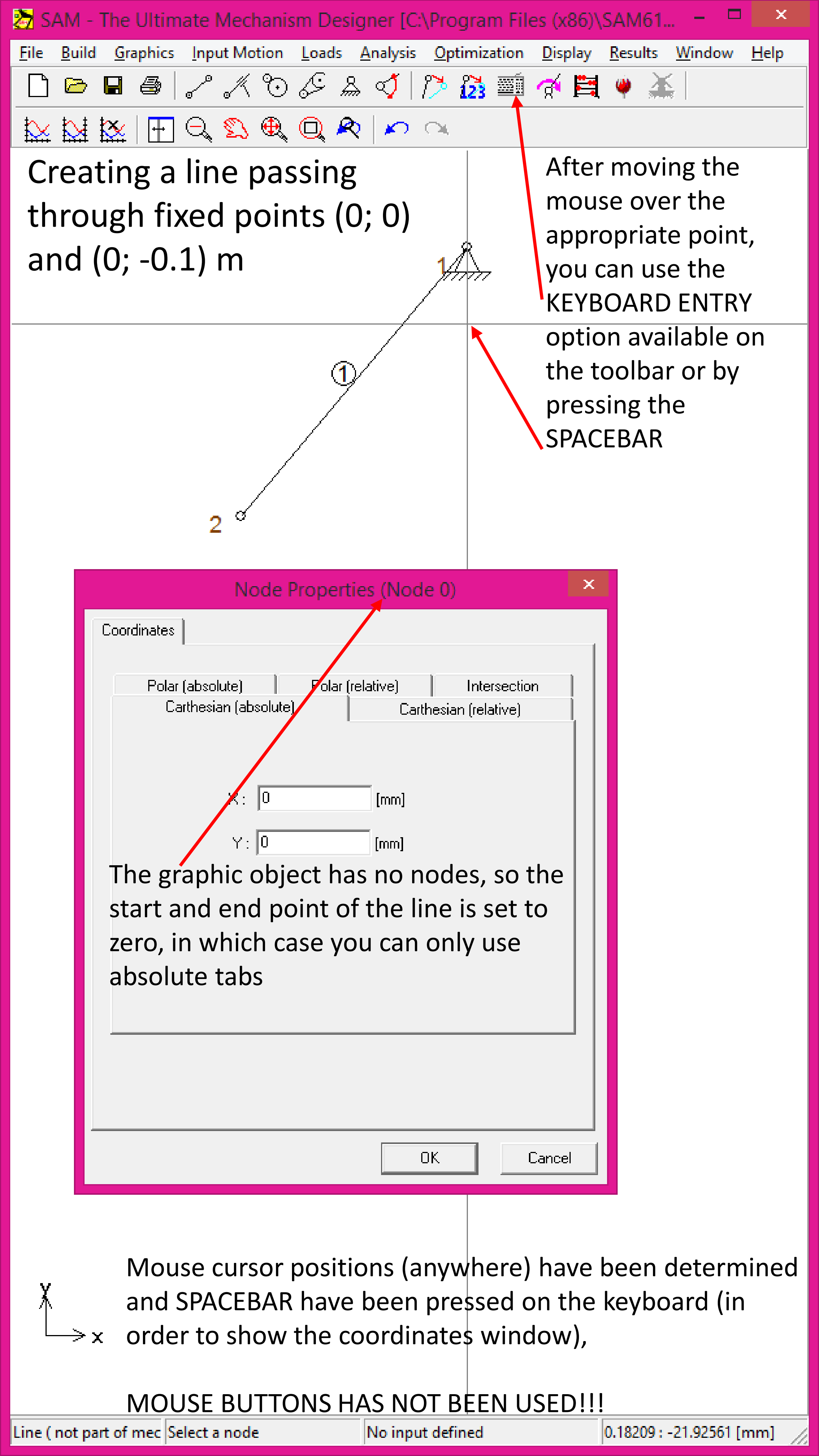
Lets start with drawing the OY vertical line – the slider movement axis

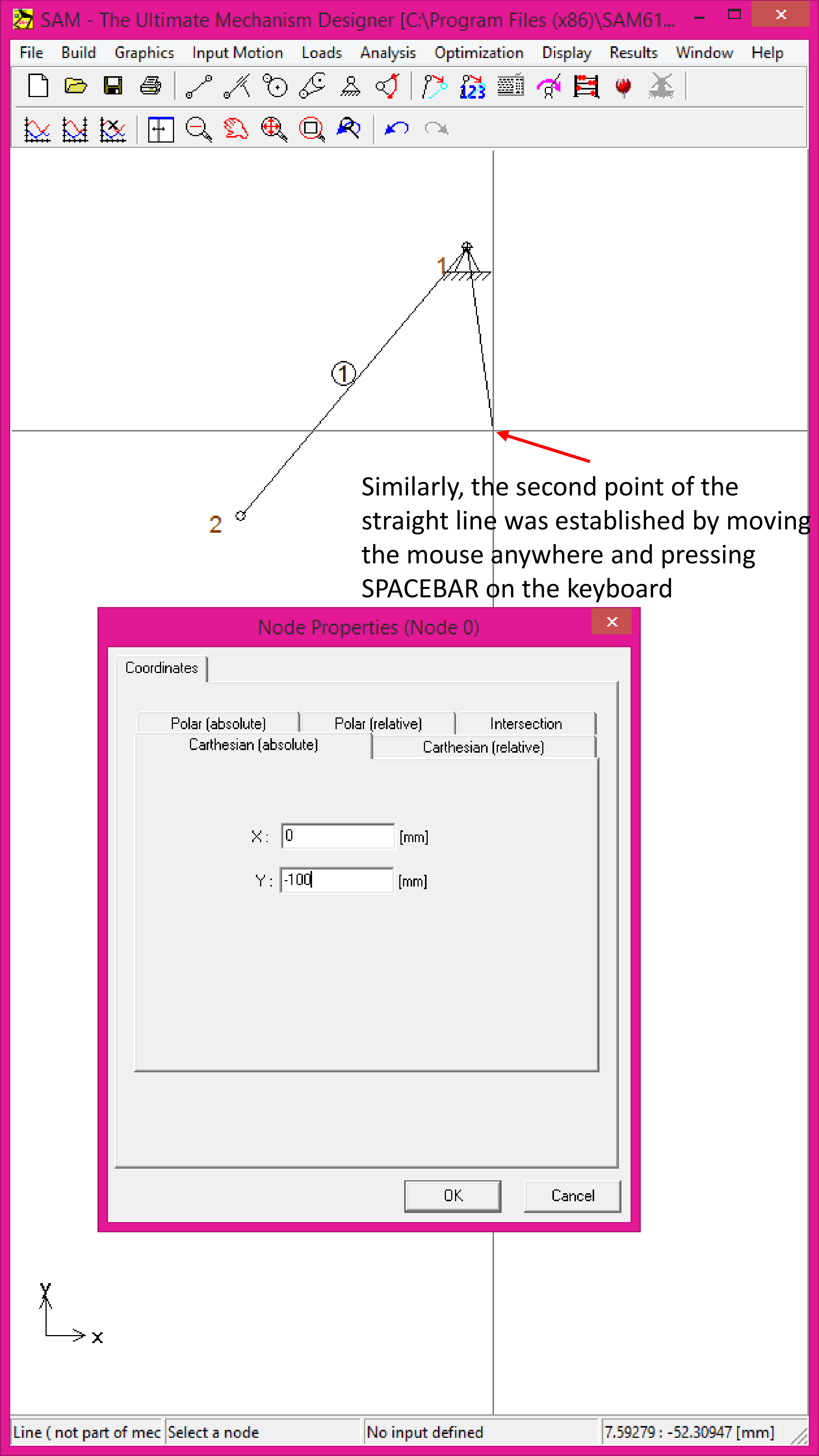
A useful option in modeling is to attract(snap) the mouse to points in the model.
The point is a node or graphics object (graphics->point).
This mouse snapping only works when a new item is being created.
The point object can be obtained using the intersection operation
(intersection of 2 graphics objects)

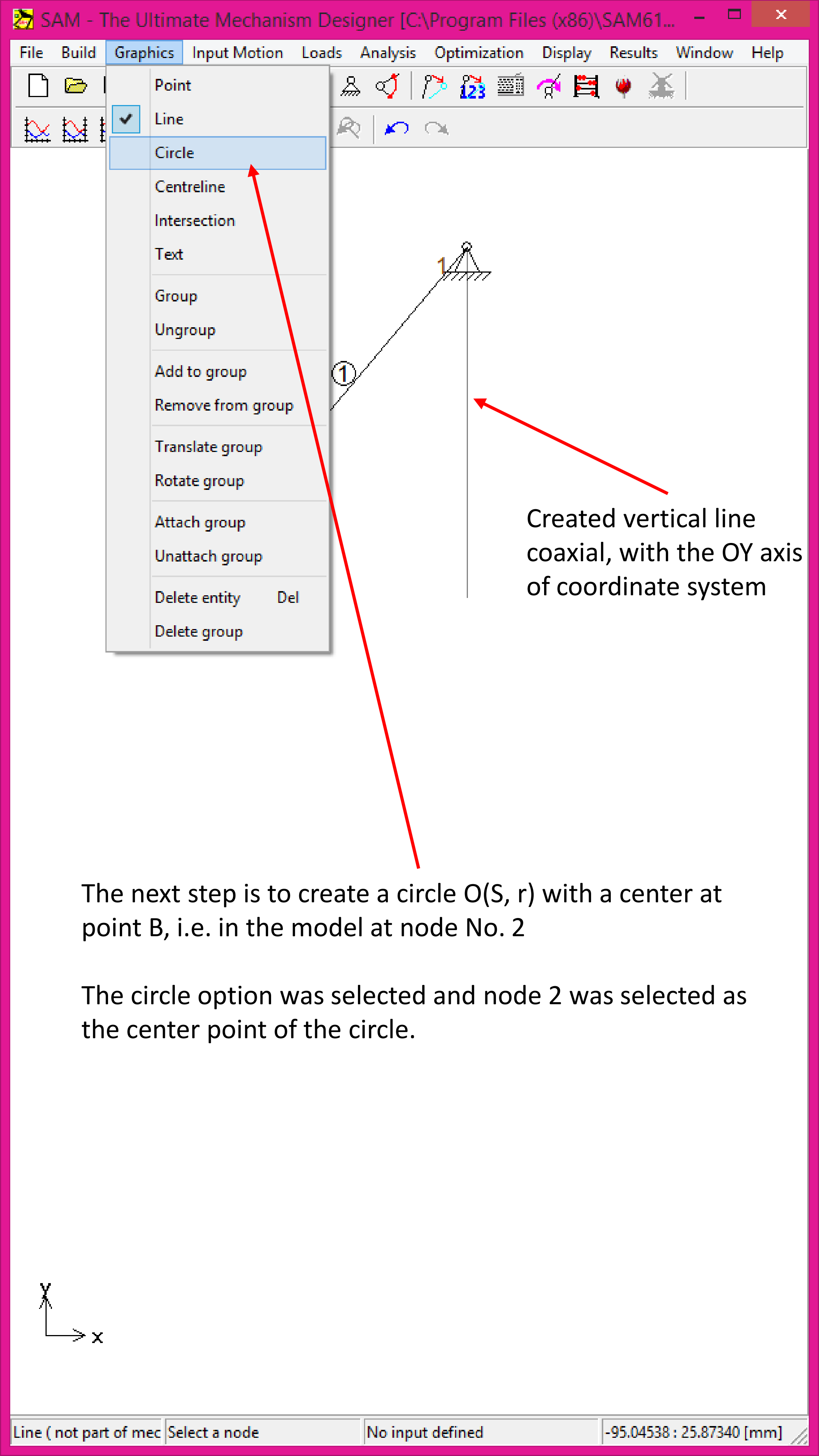


Determining the location of the vertex at the intersection of two circles is available in the node properties window (in such case there is no need to use graphics->intersection)

Edit node properties | Select a node | No input defined | Element 1: Beam


SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
Creating a line passing through fixed points (0; 0) and (0; -0.1) m
After moving the mouse over the appropriate point, you can use the KEYBOARD ENTRY option available on the toolbar or by pressing the SPACEBAR
1
1
2
Node Properties (Node 0)
Coordinates
Polar (absolute)
Polar (relative)
Intersection
Carthesian (absolute)
Carthesian (relative)
X : 0 [mm]
Y : 0 [mm]
The graphic object has no nodes, so the start and end point of the line is set to zero, in which case you can only use absolute tabs
OK
Cancel
Y
X
Mouse cursor positions (anywhere) have been determined and SPACEBAR have been pressed on the keyboard (in order to show the coordinates window),
MOUSE BUTTONS HAS NOT BEEN USED!!!
Line (not part of mec
Select a node
No input defined
0.18209 : -21.92561 [mm]

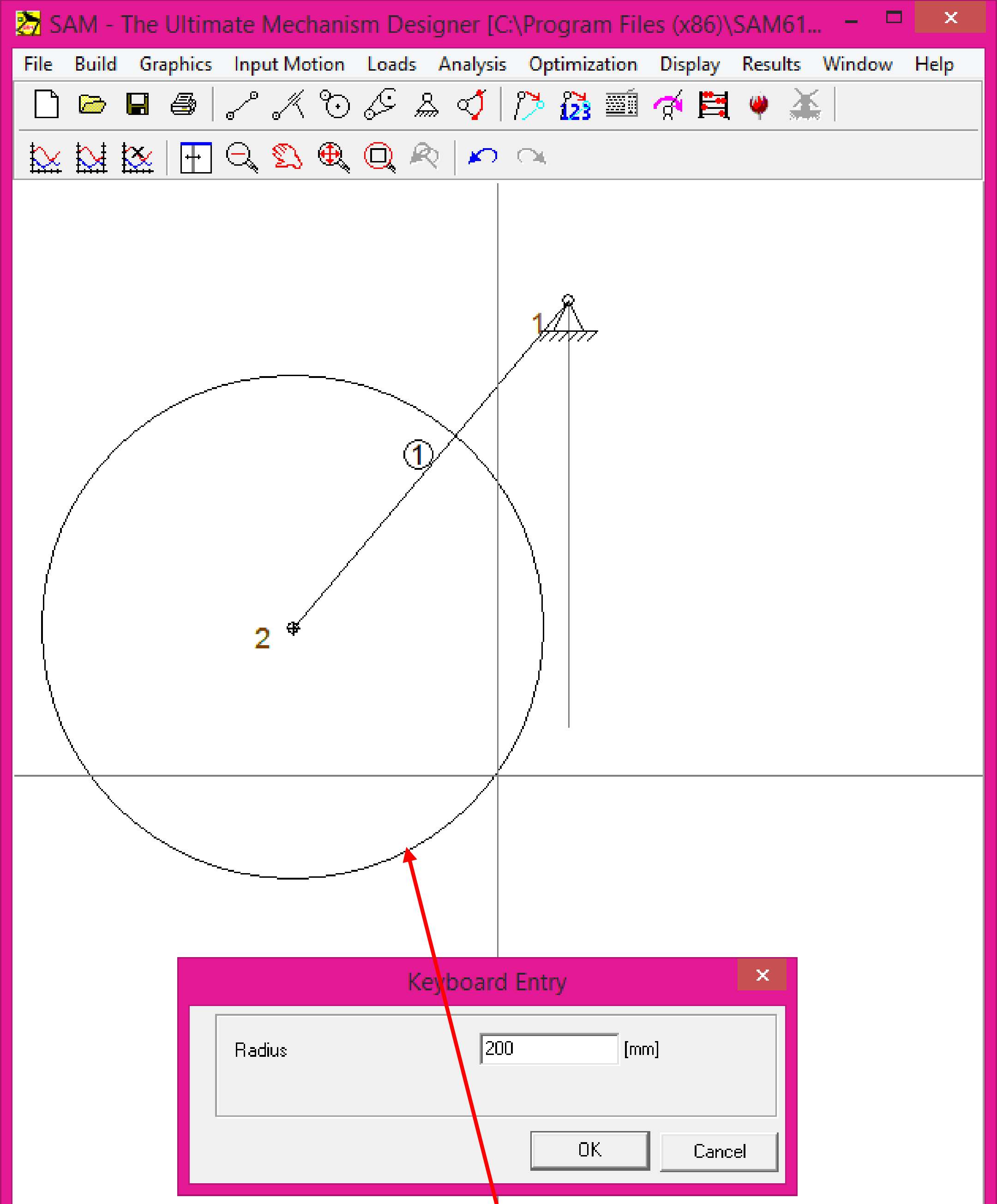

SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
1
1
2
Similarly, the second point of the straight line was established by moving the mouse anywhere and pressing SPACEBAR on the keyboard
Node Properties (Node 0)
Coordinates
Polar (absolute)
Polar (relative)
Intersection
Carthesian (absolute)
Carthesian (relative)
X : 0 [mm]
Y : -100 [mm]
OK
Cancel
Y
X
Line (not part of mec
Select a node
No input defined
7.59279 : -52.30947 [mm]



Created vertical line coaxial, with the OY axis of coordinate system

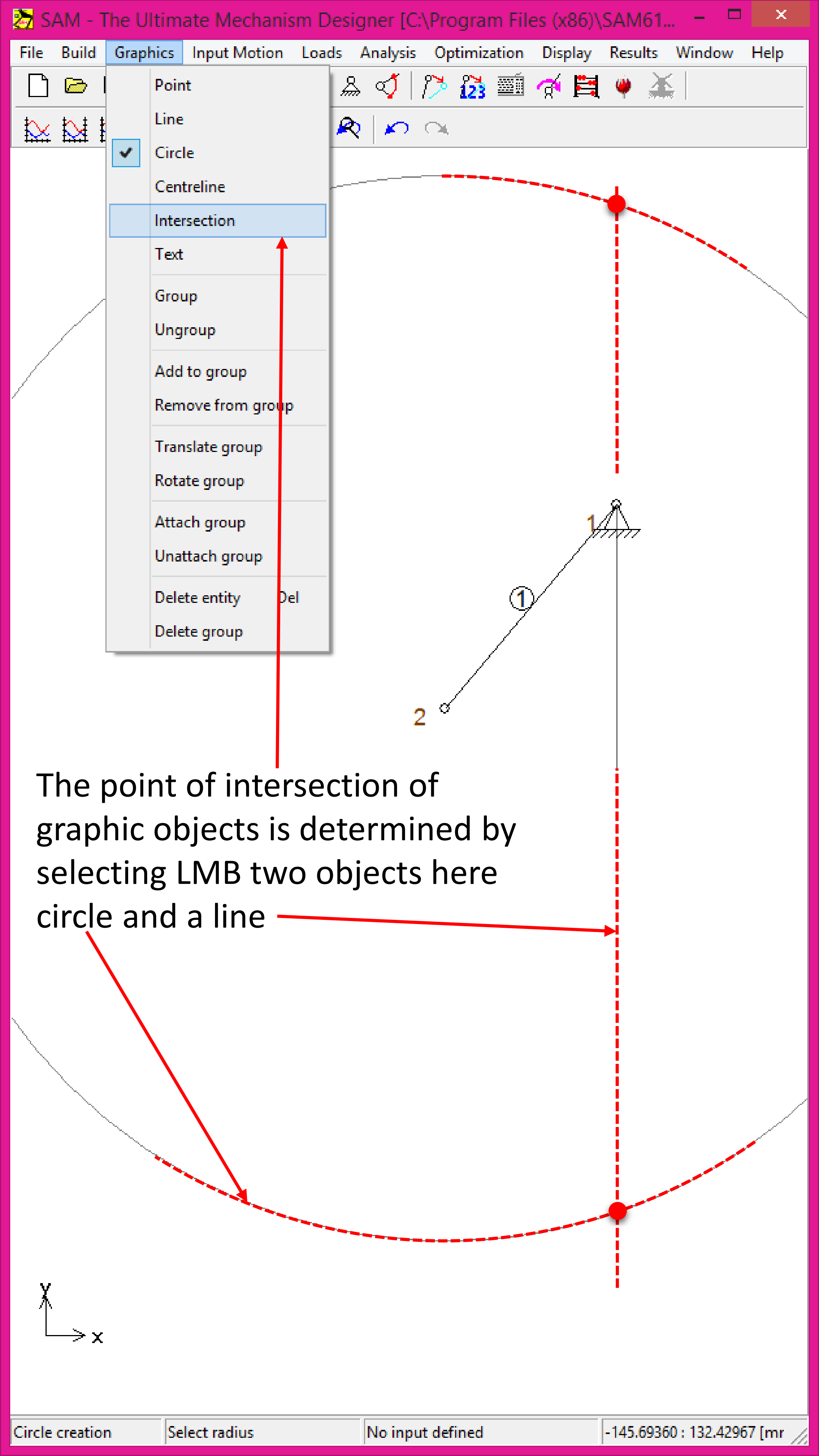
The next step is to create a circle O(S, r) with a center at point B, i.e. in the model at node No. 2

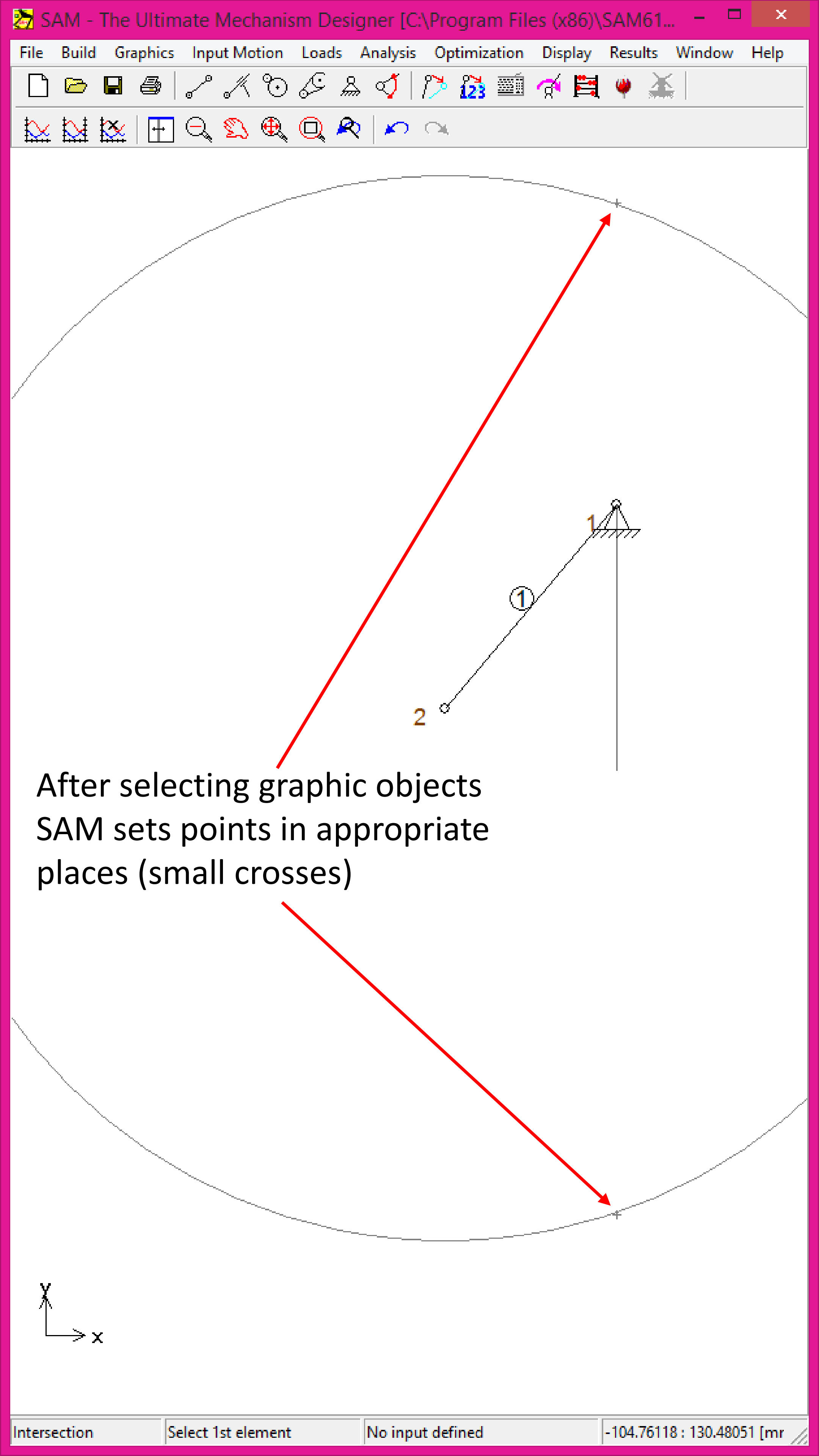
The circle option was selected and node 2 was selected as the center point of the circle.



After selecting the center point, the radius needs to be defined. To set the radius value do not use the mouse but KEYBOARD ENTRY by pressing the SPACEBAR on the keyboard.

The radius definition window will appear.
BC length has been entered.


SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
Point
Line
Circle
Centreline
Intersection
Text
Group
Ungroup
Add to group
Remove from group
Translate group
Rotate group
Attach group
Unattach group
Delete entity Del
Delete group
The point of intersection of graphic objects is determined by selecting LMB two objects here circle and a line
Circle creation
Select radius
No input defined
-145.69360 : 132.42967 [mr

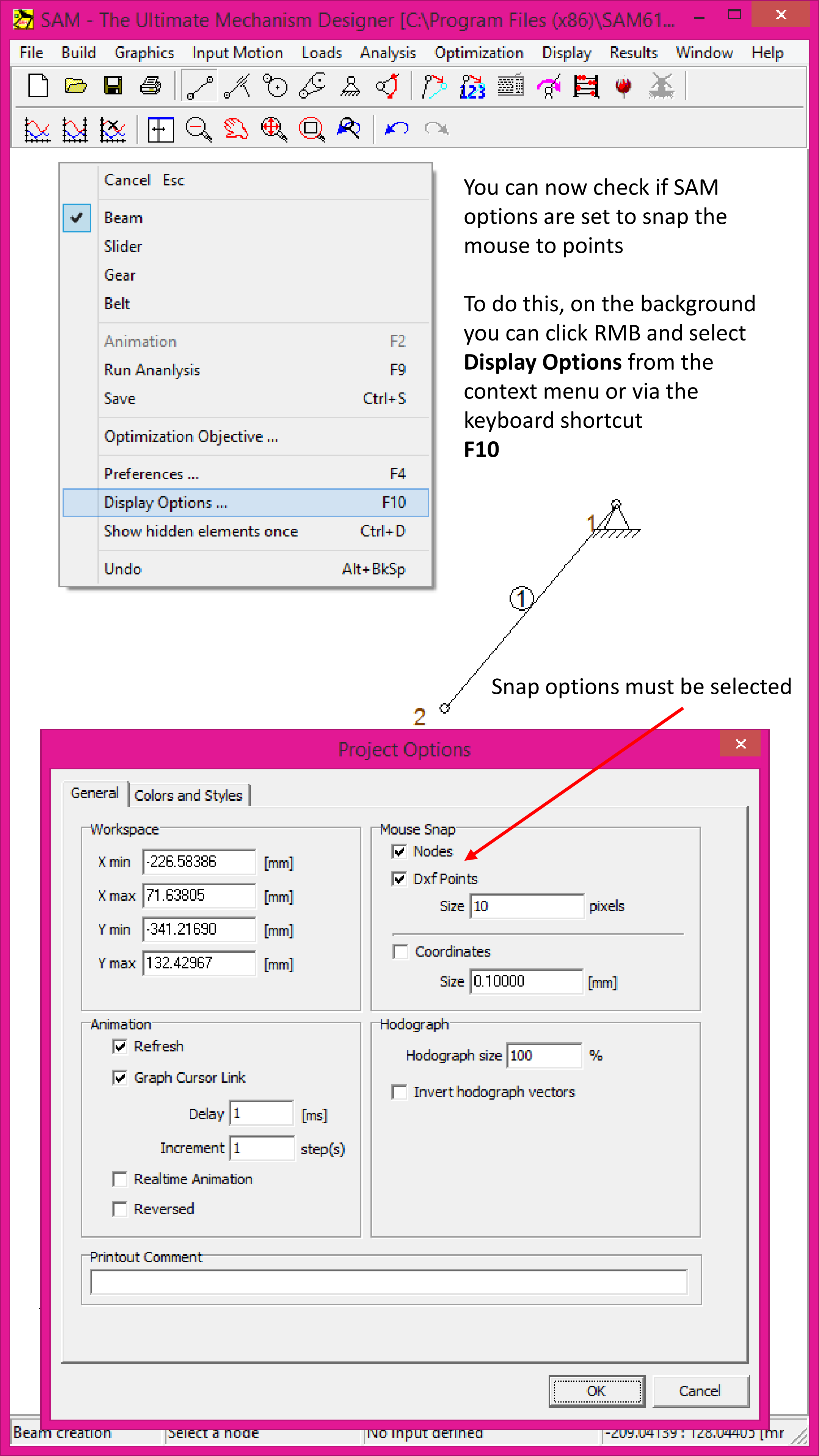


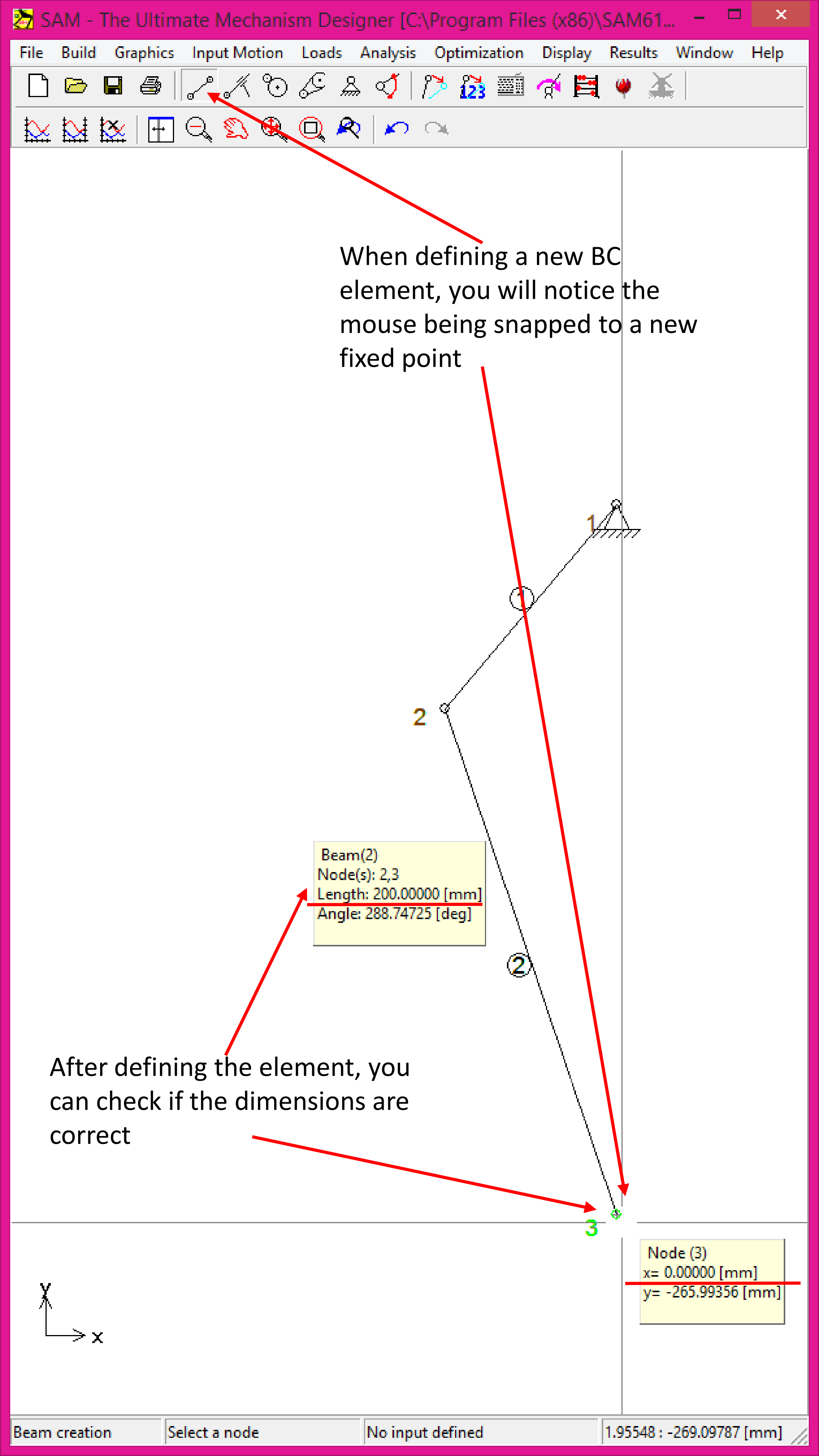
After selecting graphic objects SAM sets points in appropriate places (small crosses)

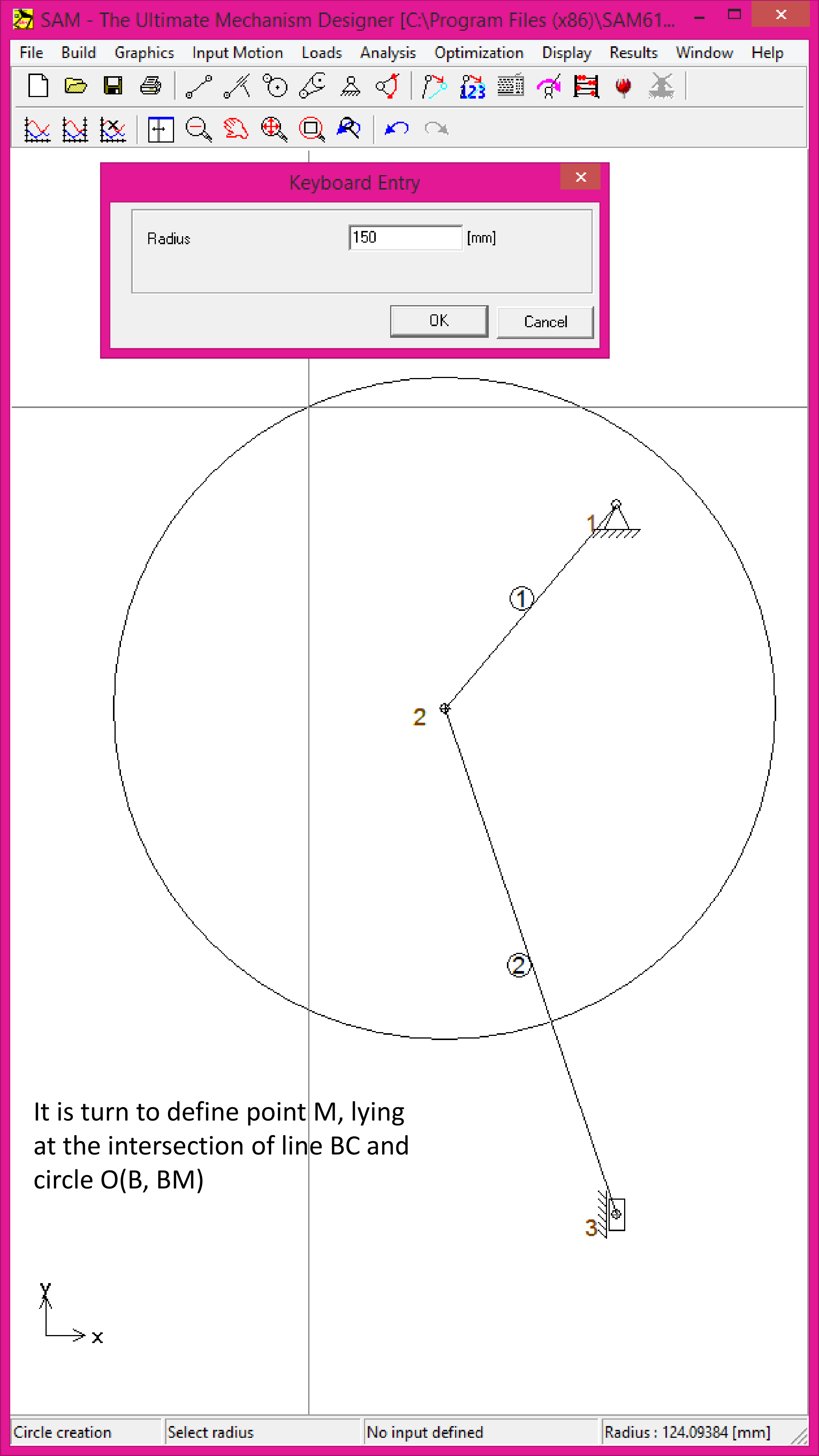
You can now check if SAM options are set to snap the mouse to points

To do this, on the background you can click RMB and select **Display Options** from the context menu or via the keyboard shortcut **F10**

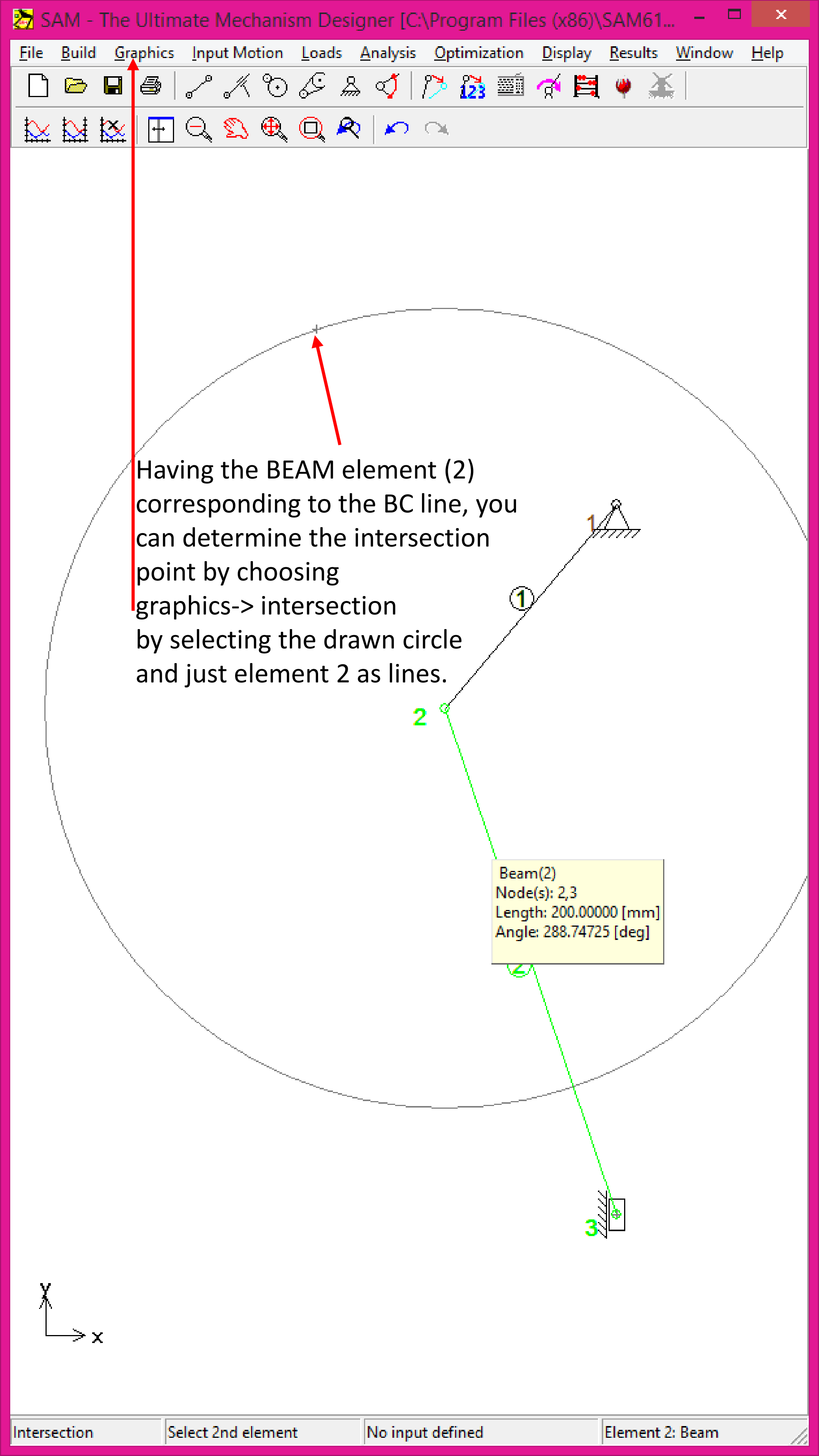
Snap options must be selected




SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
When defining a new BC element, you will notice the mouse being snapped to a new fixed point
1
2
Beam(2)
Node(s): 2,3
Length: 200.00000 [mm]
Angle: 288.74725 [deg]
After defining the element, you can check if the dimensions are correct
3
Node (3)
x= 0.00000 [mm]
y= -265.99356 [mm]
Y
X
Beam creation
Select a node
No input defined
1.95548 : -269.09787 [mm]

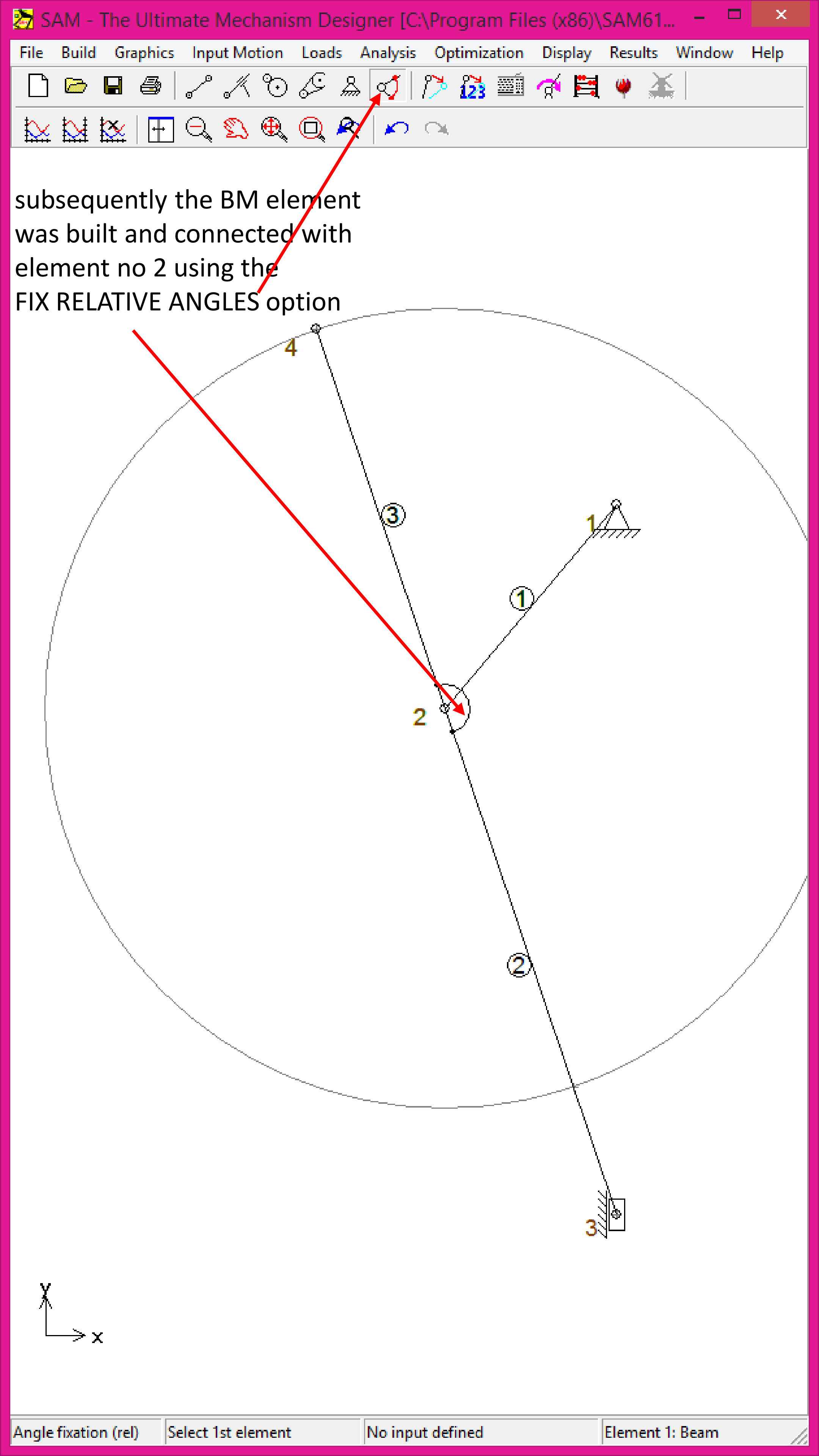


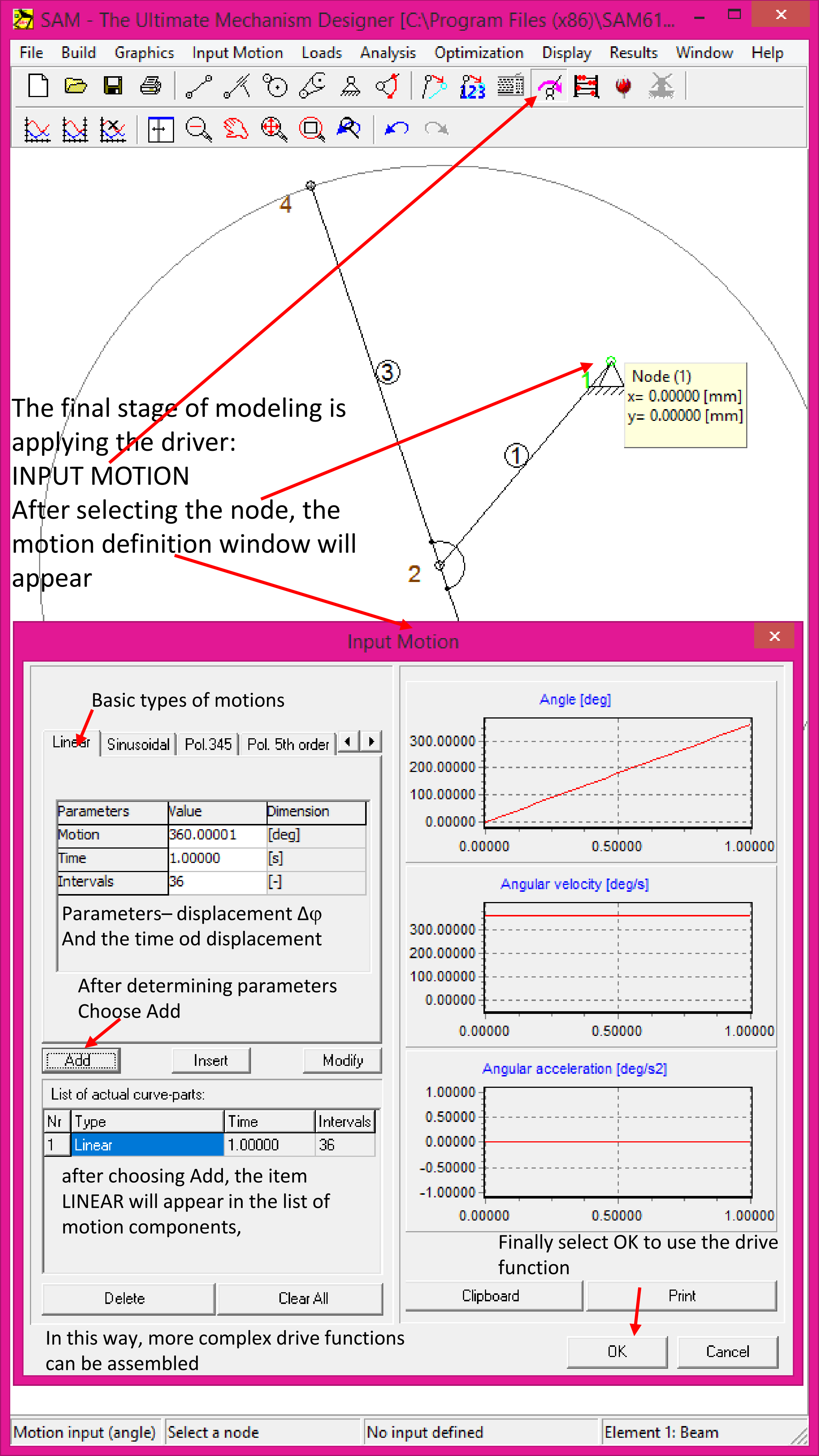
It is turn to define point M, lying at the intersection of line BC and circle O(B, BM)



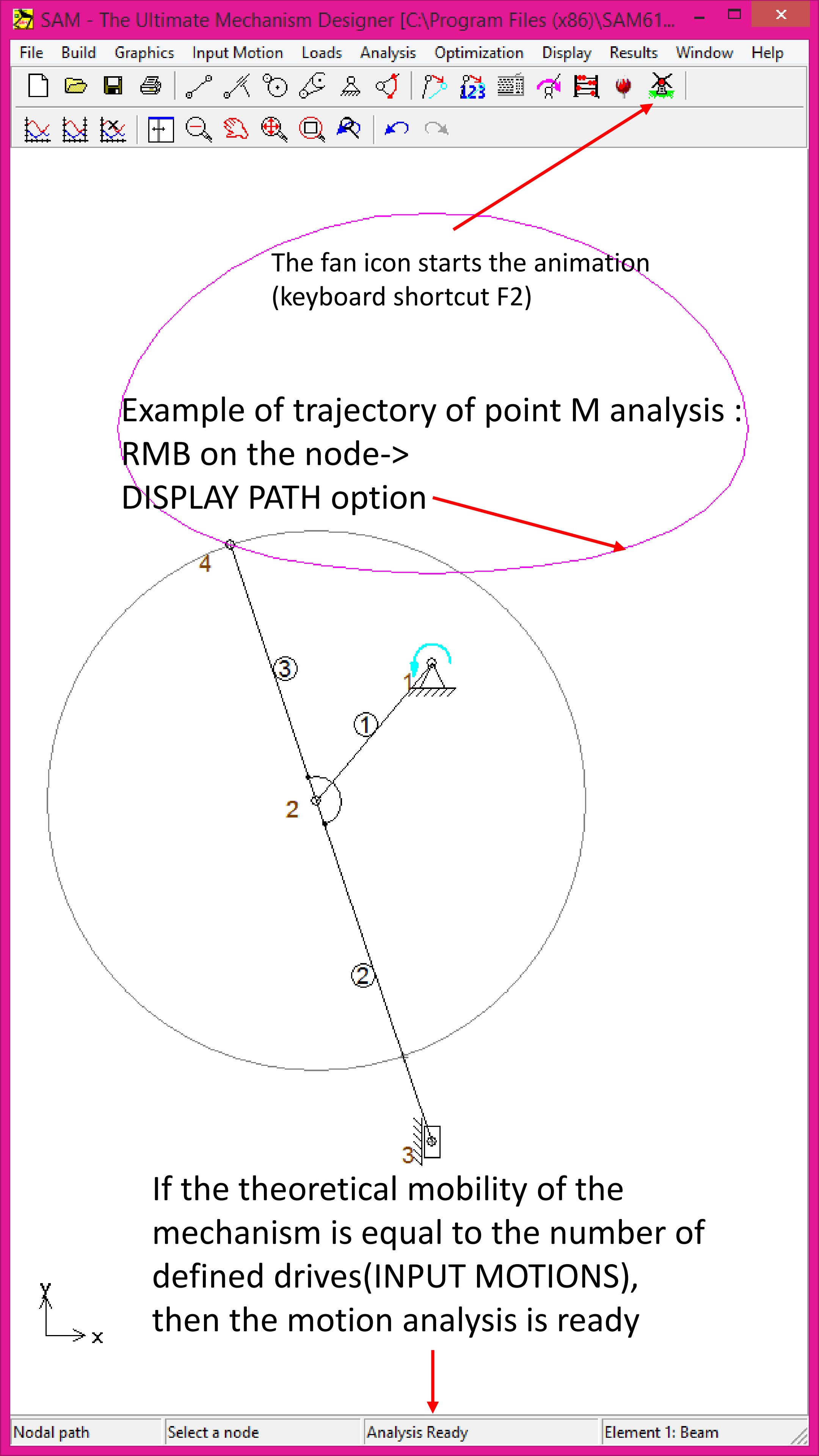
Having the BEAM element (2) corresponding to the BC line, you can determine the intersection point by choosing graphics-> intersection by selecting the drawn circle and just element 2 as lines.

subsequently the BM element was built and connected with element no 2 using the FIX RELATIVE ANGLES option





SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
4
3
1
2
Node (1)
x= 0.00000 [mm]
y= 0.00000 [mm]
The final stage of modeling is applying the driver:
INPUT MOTION
After selecting the node, the motion definition window will appear
Input Motion
Basic types of motions
Linear
Sinusoidal
Pol.345
Pol. 5th order
Parameters | Value | Dimension
Motion | 360.00001 | [deg]
Time | 1.00000 | [s]
Intervals | 36 | [-]
Parameters– displacement Δφ
And the time od displacement
After determining parameters
Choose Add
Add
Insert
Modify
List of actual curve-parts:
Nr | Type | Time | Intervals
1 | Linear | 1.00000 | 36
after choosing Add, the item LINEAR will appear in the list of motion components,
Delete
Clear All
Angle [deg]
300.00000
200.00000
100.00000
0.00000
0.00000
0.50000
1.00000
Angular velocity [deg/s]
300.00000
200.00000
100.00000
0.00000
0.00000
0.50000
1.00000
Angular acceleration [deg/s2]
1.00000
0.50000
0.00000
-0.50000
-1.00000
0.00000
0.50000
1.00000
Finally select OK to use the drive function
Clipboard
Print
In this way, more complex drive functions can be assembled
OK
Cancel
Motion input (angle)
Select a node
No input defined
Element 1: Beam


SAM - The Ultimate Mechanism Designer [C:\Program Files (x86)\SAM61...
File Build Graphics Input Motion Loads Analysis Optimization Display Results Window Help
The fan icon starts the animation
(keyboard shortcut F2)
Example of trajectory of point M analysis :
RMB on the node->
DISPLAY PATH option
4
3
1
1
2
2
3
If the theoretical mobility of the
mechanism is equal to the number of
defined drives(INPUT MOTIONS),
then the motion analysis is ready
Y
X
Nodal path
Select a node
Analysis Ready
Element 1: Beam