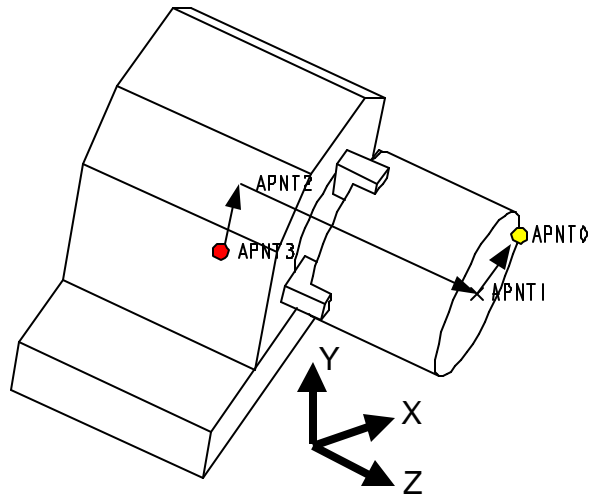


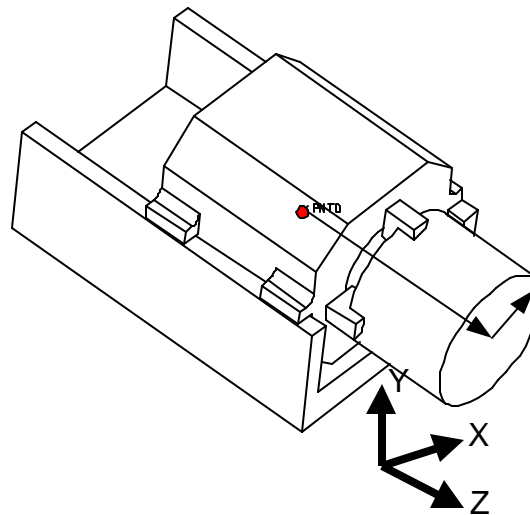
## Spindle Housing COM

A rotational error of 0.001 radians is applied to each point. And the errors induced in each direction are recorded. This error is much larger than the expected error. Its magnitude allows the second order error effects to be observed.

There are two extremes of possible locations of the COM of the spindle housing, the bottom of the spindle housing (Figure 1) and inline with the spindle shaft (Figure 2). How much will moving the COM to inline with the shaft reduce the motion errors? (We know a priori that it will be small because the distance between the work point and COM is shorter in the inline case.)



**Figure 1** Errors applied to the red dot.  
Representing the COM of the spindle axis at the bottom of the housing.



**Figure 2** Errors applied to the red dot.  
Representing the COM of the spindle axis is inline with the spindle shaft.

	Error applied about X		Error applied about Y		Error applied about Z	
Figure 1	Y: 0.572	Z: 0.228	X: 0.571	Z: 0.191	X: 0.0001	Y: 0.19
Figure 2	Y: 0.559	Z: 0.0003	X: 0.559	Z: 0.191	X: 0.229	Y: 0.19
Fig 2/ Fig 1	Y: 0.977	Z: 0.0012	X: 0.978	Z: 1.000	X: 0.0004	Y: 1.001

The results of the error calculations are tabulated above. The significant line in the table is the ratio of the errors for COM in the two locations. The sensitive errors are in the X and Z directions. The error ratios show that moving the COM to the inline with the shaft can reduce the errors due to rotation about the Z axis by a factor of about 2500 and the errors due to rotation about the X axis in the Z direction by a factor of over 800. Moving the COM from the bottom of the housing to inline with the shaft does not have much of an effect on the errors in the Y and Z directions caused by rotations about the Y axis. The dramatic reduction in error motions is because locating the COM inline with the spindle shaft dramatically reduces the sensitivity to second order motions.

**SUMMARY:** If the spindle housing is going to be moved to provide one of the axes of motion, then a large reduction in errors can be achieved by having the COM inline with the spindle shaft (Figure 2) as compared to the having the COM on the bottom of the house.