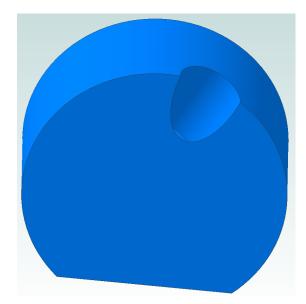# Alibre CAD: Placing a Plane at a Compound Angle, version 1.1

By R. G. Sparber

Copyleft protects this document.[1]

This article is intended for those that use the Alibre Computer Aided Design[2] program although it might apply to other CAD programs.
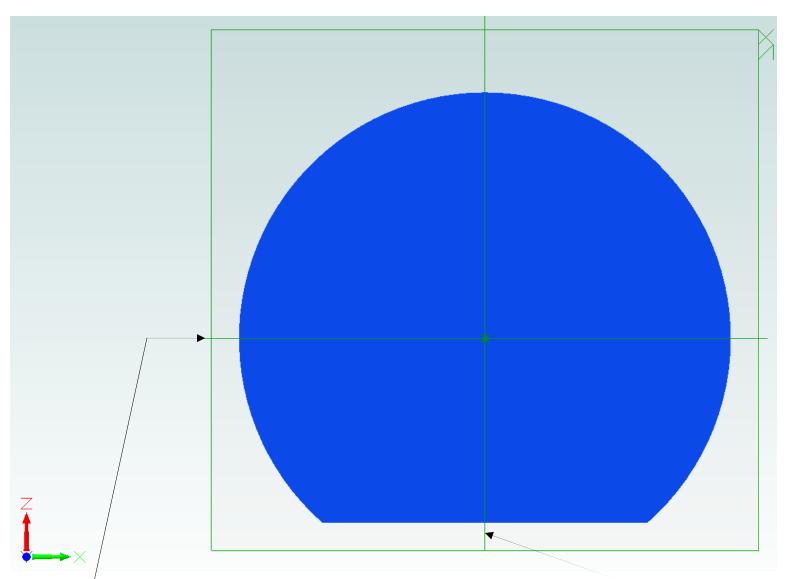

If you are at all familiar with CAD, you must know that there are many ways to do the same thing. I am presenting only one way to accomplish a single task: to drill a hole at an angle into the edge of a cylinder. The cylinder has a flat on it to help us see its orientation.

Drilling this hole into my "puck" would be easy if I had a plane angled just right at the edge of the object. So how do we do that?

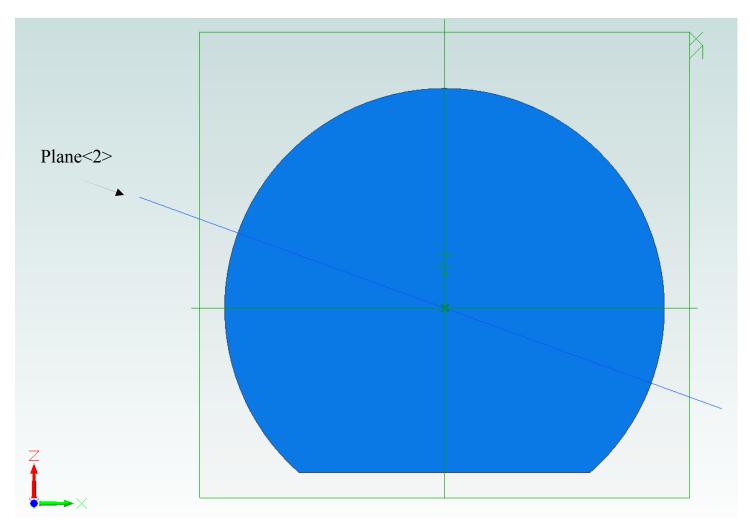[1] You are free to copy and distribute this document but not change it.
[2] I own Alibre PE 2011

The first thing to do is turn on the axes. I can now see that vertical is the Z axis, horizontal is the X axis, and pointing out of the page is the Y axis. The origin is at the center of the puck if it didn't have that flat.
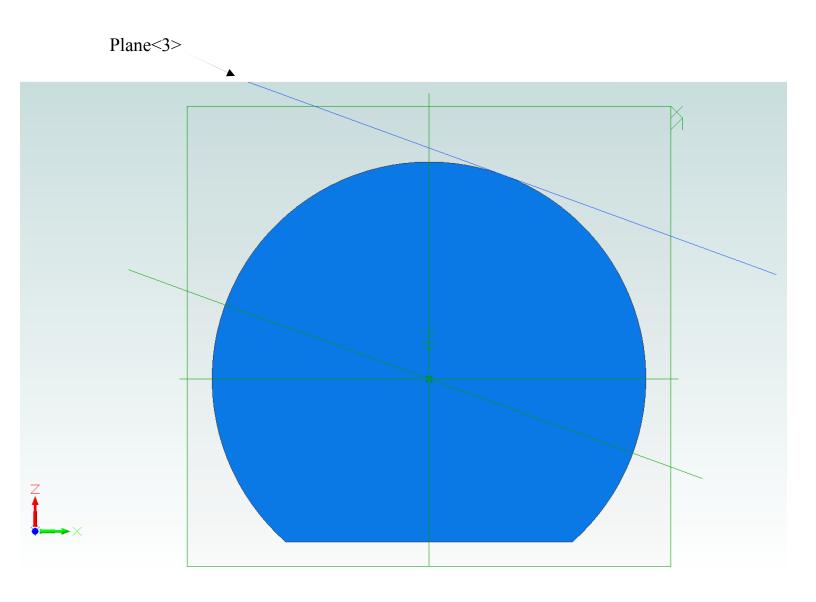
The face of the puck is in the XZ plane.

Thinking only about the XZ plane , I want the hole to be 20° off the Z axis. I have the XY plane running horizontally through the puck. Pointing out of the
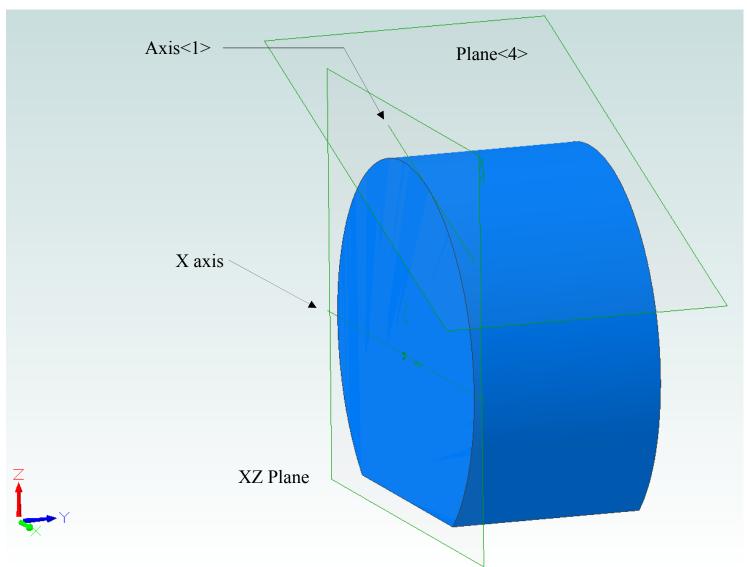
Plane<2>

page is the Y axis. Picture the Y axis as a fulcrum and the XY axis as a board. I can tilt the board on the fulcrum: tilt the XY axis on the Y axis. That is what you see here. I have defined a new plane, called Plane<2>, which rests on the Y axis but is tilted by 20° from horizontal. If I were to drill a hole perpendicularly through this plane, it would be 20° from vertical which is what I want.

OK, the angle is right but the position is wrong. I really want the plane up on the perimeter of the puck.
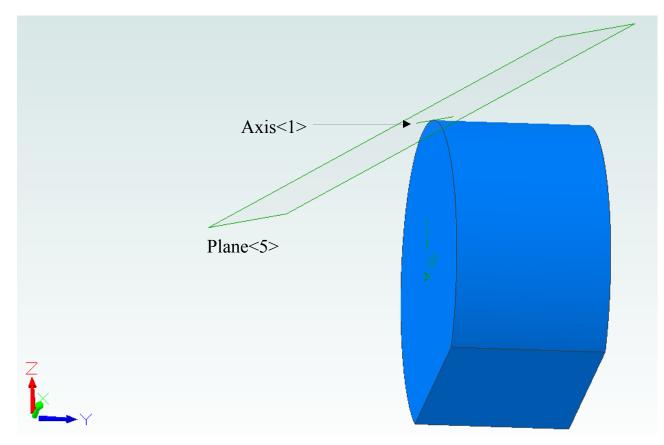
Plane<3>

I just created a new plane called Plane<3> which is parallel to Plane<2> but offset by the radius of the puck. We are about half way home now.

If I could tilt Plane<3> towards me, I would be done. To do that, I need an axis right on the edge of the puck. Then I could use the pivot trick employed in making Plane<2> .

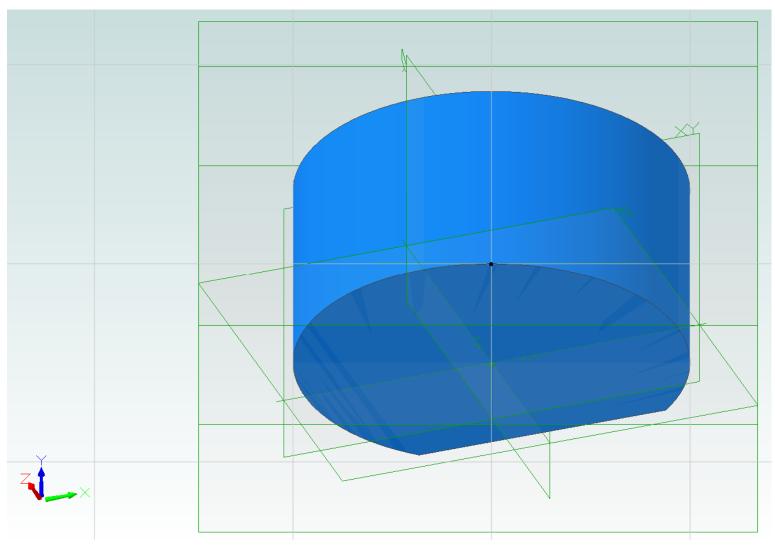Axis<1>   Plane<4>

X axis

XZ Plane

Only the XZ plane and Plane<4> are shown here along with the X axis running
horizontally across the face of the puck. I defined a new axis, Axis<1>. The trick is
to choose Plane<4> and the X axis from within the axis defining tool. This tells
Alibre that I want to project the X axis onto Plane<4>. Since my puck was drawn
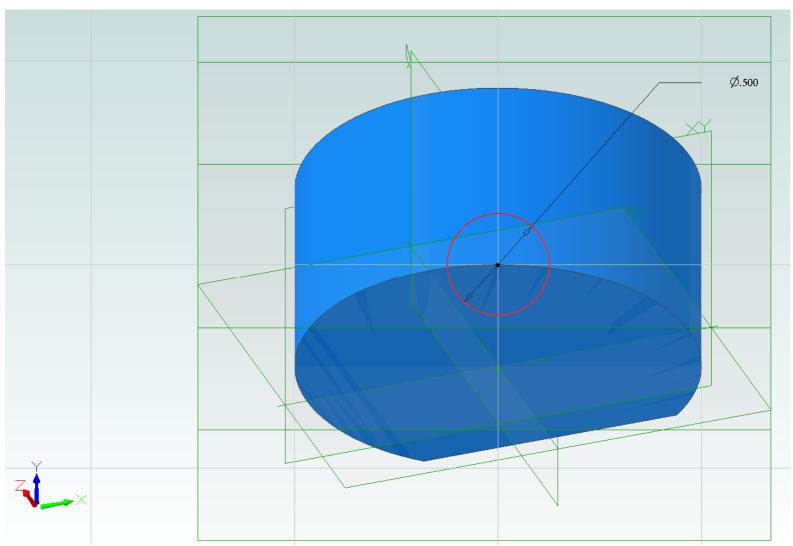with its visible face on the XZ plane, the X axis is right on this face.

All the bits are now ready to go. I have Plane<4> angled at 20° from horizontal
and Axis<1> as my pivot line.

Axis<1>

Plane<5>

Here you see the puck rotated so the new plane is easier to see. Starting with Plane<4> and Axis<1>, I created Plane<5> which has been rotated by 30° from horizontal.
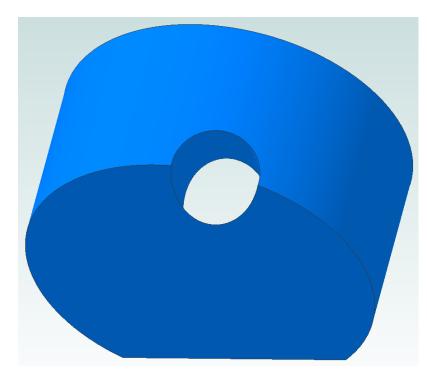
This rather confusing picture is what you get when Plane<5> is activated for 2D sketching.

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I draw my ½" diameter circle at the center point of Plane<5>. The horizontal axis is Axis<1> which we created by projecting the X axis onto Plane<4>. It contacts the edge of the puck at a single point. Alibre defined the vertical axis by using this same point. This axis also lines up with the center of the puck.

With the circle defined, I used the extrude cut tool to drill the hole. It is positioned 20° off vertical and tilted back 30° from vertical.

The basic strategy here was to break the problem into parts. I first positioned a plane to satisfy the 20° off horizontal need. Then I moved it up to the perimeter.

Building on this new plane, I defined a new axis that would let me pivot the plane by 30° from horizontal.

Once I had a plane at the correct compound angle, it was a simple matter to draw the circle and extrude it into a hole that is perpendicular to this plane.

I have done my best to explain this process but am the least qualified to judge if it is clear. Please let me know what is confusing or downright wrong. If you see a better way to do this, bring it on.

I spent a few days, on and off, scratching my head over how to do this plane positioning. You have been spared the numerous false starts and dead ends. Don't think, for a minute, that this was intuitively obvious to me right from the start.

I welcome your comments and questions.

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