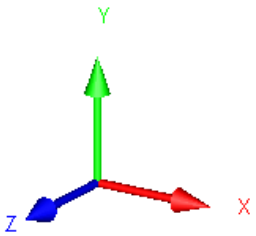
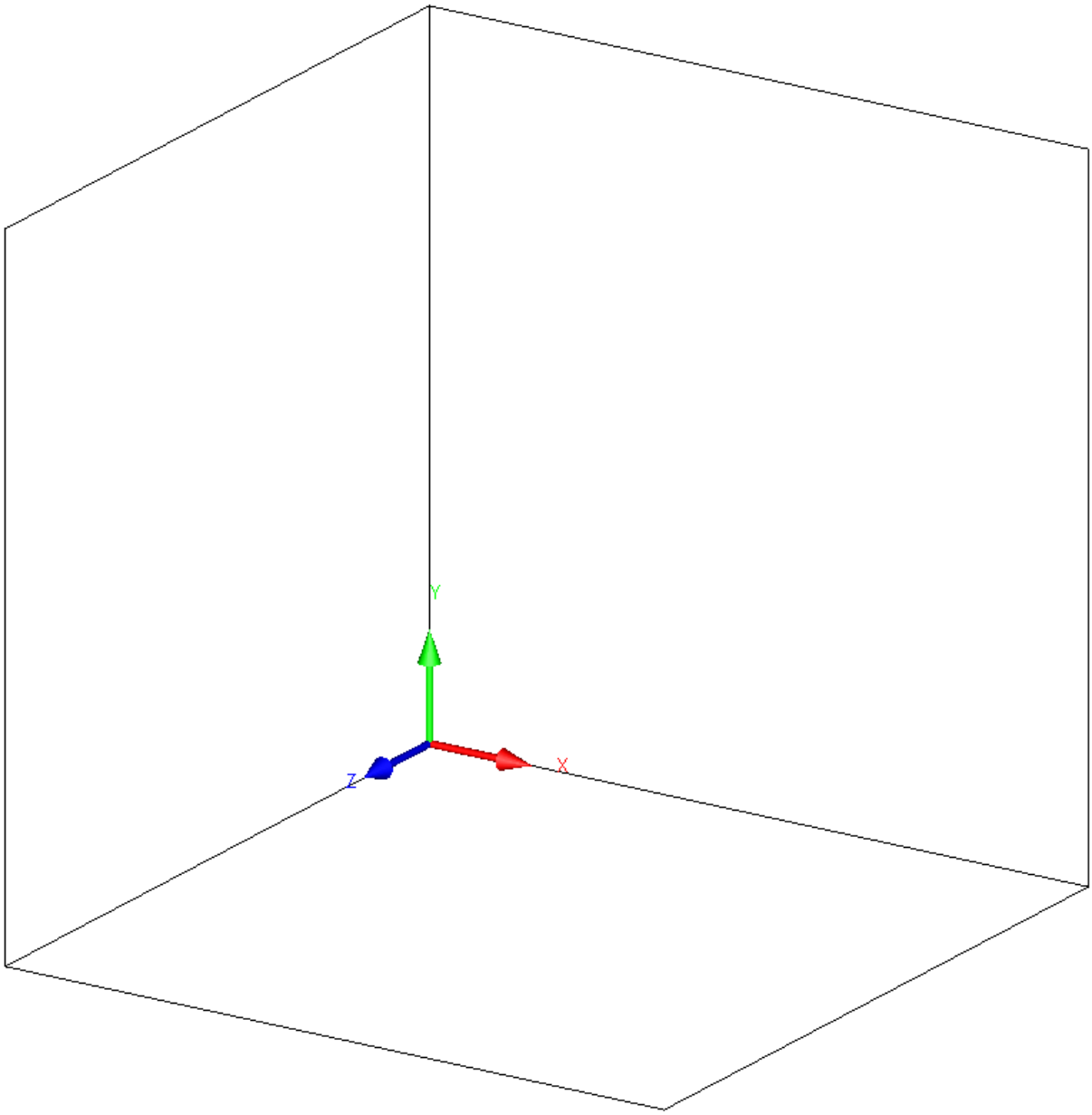
Projection Angles in Calypso

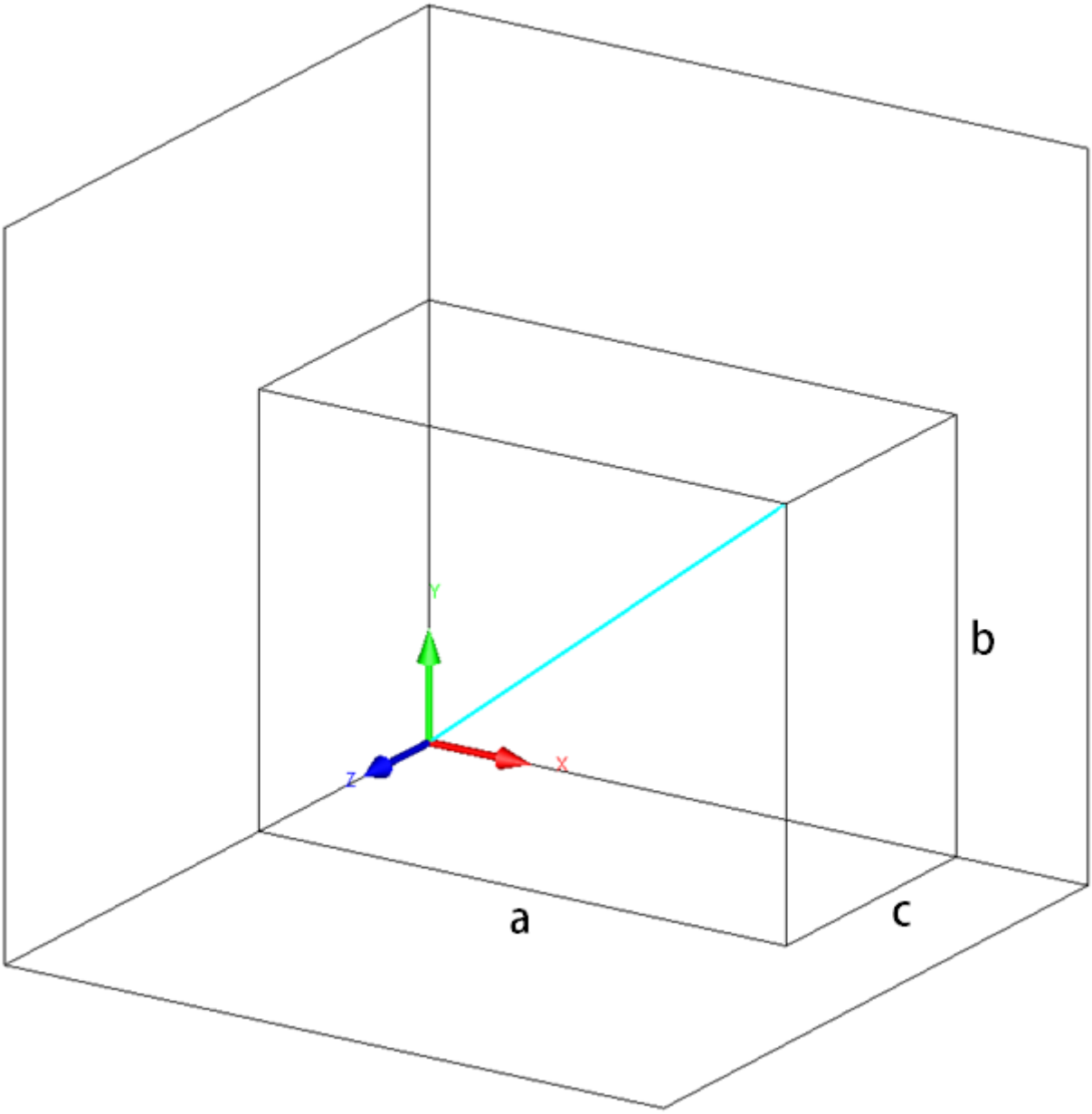
As I understand them



Start with a traditional right hand coordinate system.
X-axis to the right, Y-axis up, Z-axis toward you.
Approximately isometric view.
Like in math class.

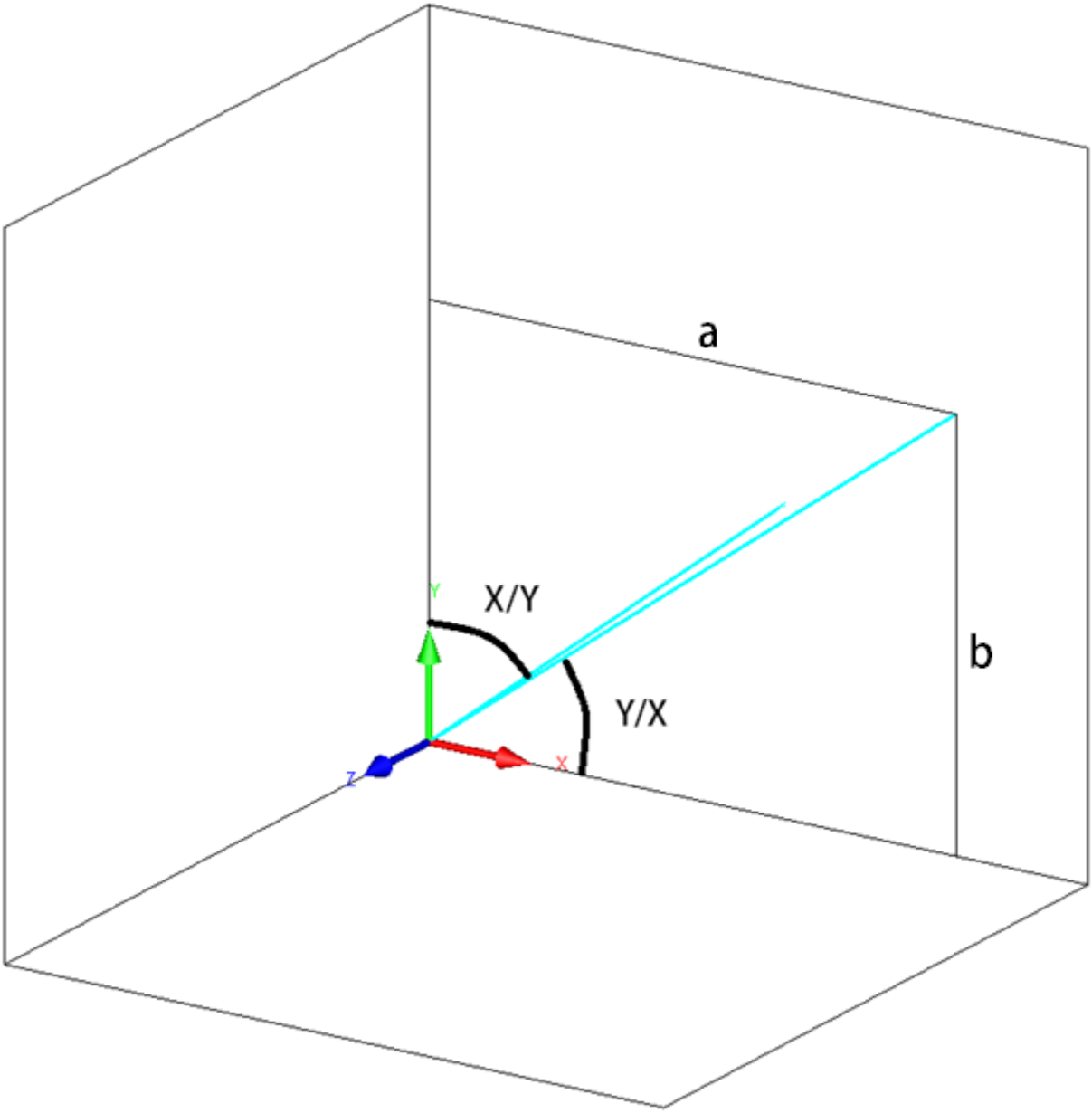


Add some coordinate planes to help with visualization.



Add a point at (X,Y,Z) coordinates (a,b,c) and connect it to the origin with a line.

Let's call this a vector: $\vec{A} = a\vec{i} + b\vec{j} + c\vec{k}$



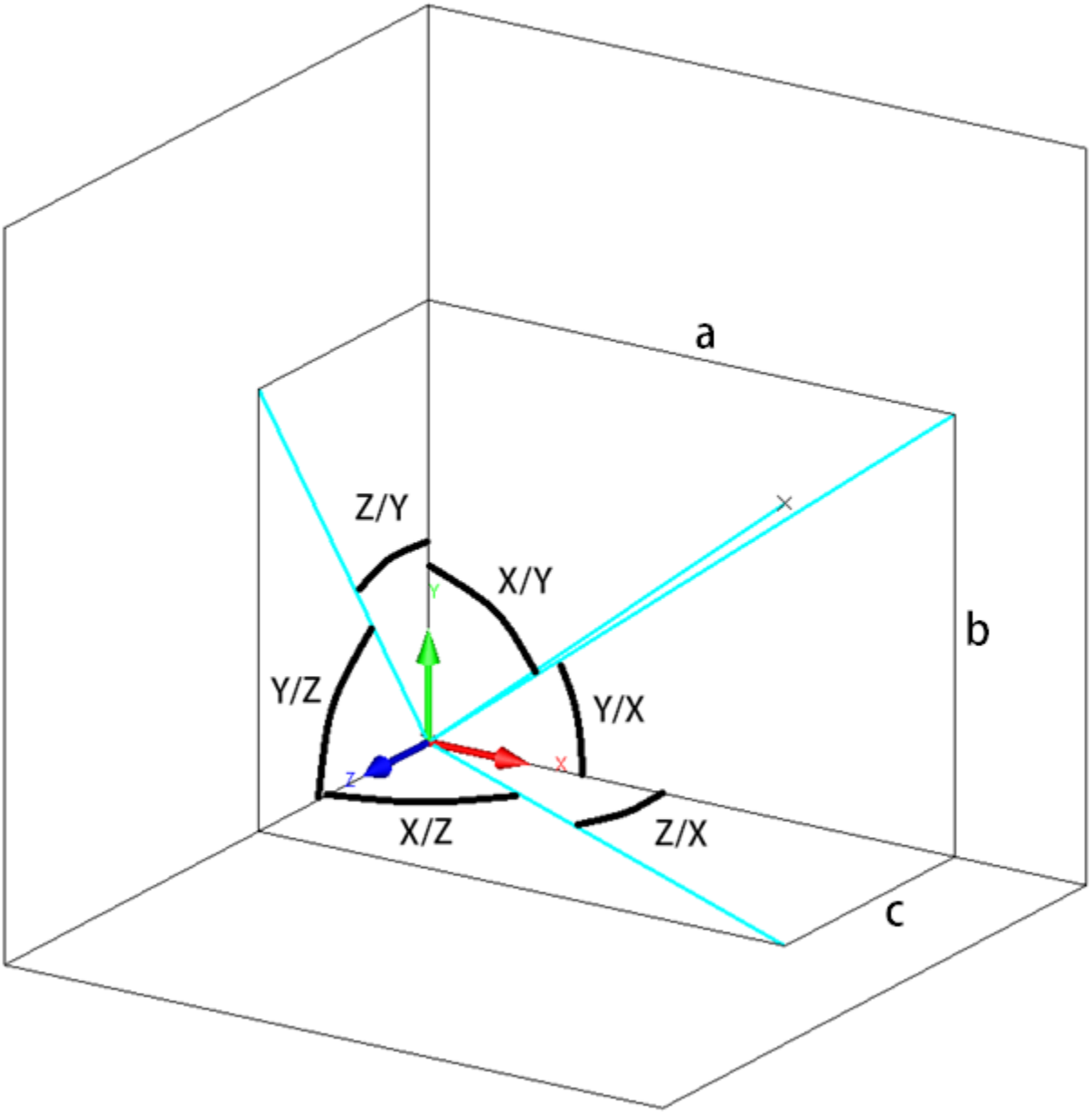
Project the vector onto the XY plane to get vector

$$\vec{A}_{XY} = a\vec{\imath} + b\vec{\jmath} + 0\vec{k}$$

Derive two projection angles from this:

$$X/Y = \tan^{-1}\frac{a}{b} \quad and \quad Y/X = \tan^{-1}\frac{b}{a}$$

"X/Y" is the angle toward the X-axis, starting from the Y-axis.
"Y/X" is the angle toward the Y-axis, starting from the X-axis.



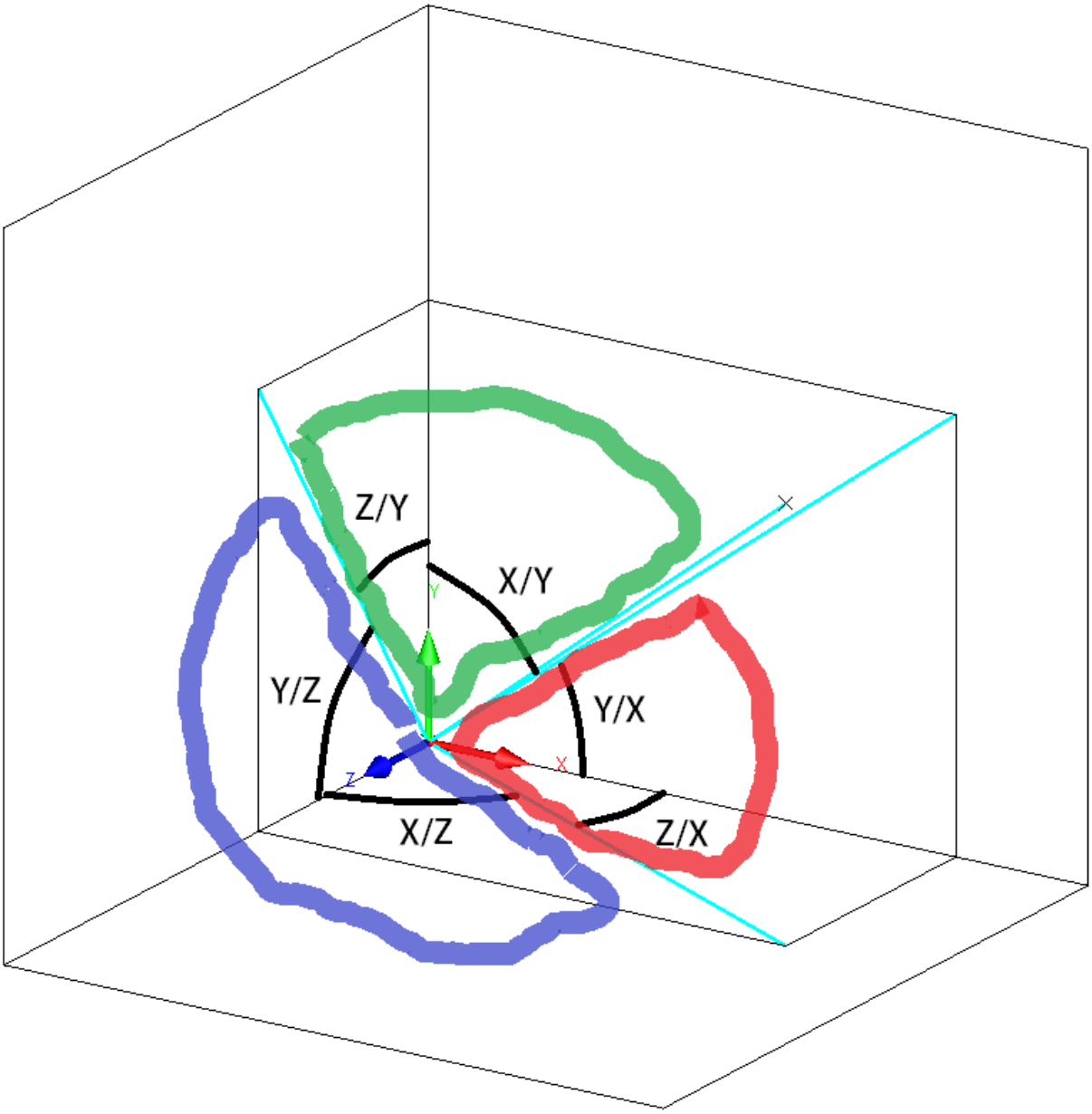
Similarly, project $\vec{A}$ onto the YZ and ZX planes.

$$\vec{A}_{YZ} = 0\vec{\imath} + b\vec{\jmath} + c\vec{k}$$

$$Y/Z = \tan^{-1}\frac{b}{c} \quad and \quad Z/Y = \tan^{-1}\frac{c}{b}$$

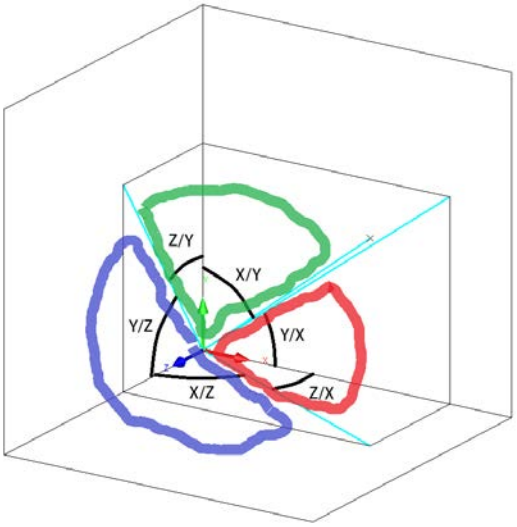
$$\vec{A}_{ZX} = a\vec{\imath} + 0\vec{\jmath} + c\vec{k}$$

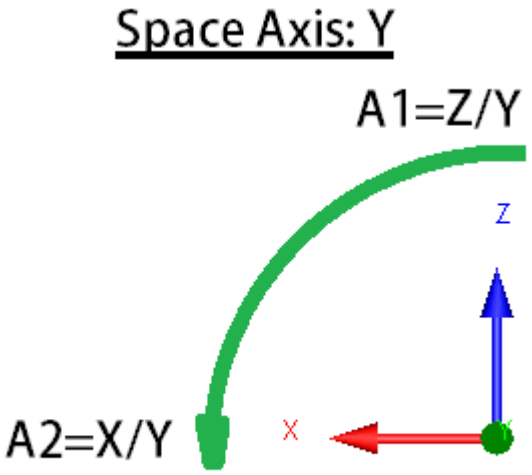
$$Z/X = \tan^{-1}\frac{c}{a} \quad and \quad X/Z = \tan^{-1}\frac{a}{c}$$

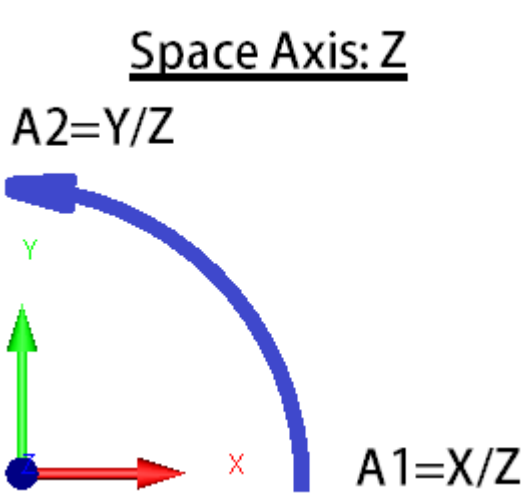


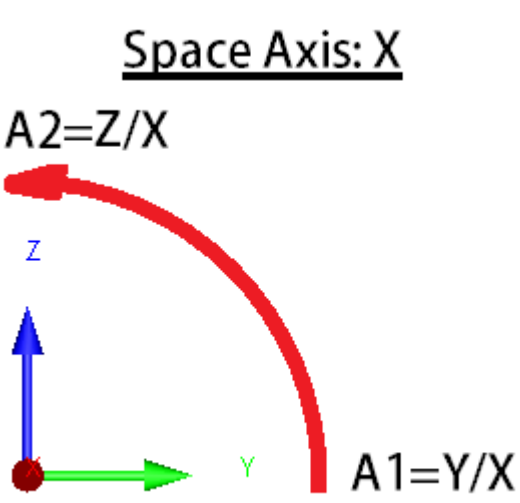
The original vector is completely defined by its length and any two of these projection angles so long as the angles aren't in the same plane.

The convention within Calypso is to group each axis with the two adjacent angles. Thus if the chosen reference axis is X then the Y/X and Z/X angles are provided, and so on.









When looking down the selected reference axis, the first projection angle corresponds to the first axis encountered following a counter clockwise rotation (like the familiar right hand rule).

The same principles apply when the reference axis is negative. In that case the positive ends of the other two axes are used. For instance, when –X is chosen as the reference axis, Calypso provides the projection angles A1:Z/-X (the angle toward +Z from –X) and A2:Y/-X (the angle toward +Y from –X).

By default Calypso calculates the projection angles to all six axes and selects the one to which both projection angles are less than or equal to 45° (absolute value). If a different angle is needed for a report, you can usually change the axis and Calypso will provide the larger projection angles.

Side note: the bit about defaulting to the axis where the projection angles are less 45° comes in handy when you're qualifying angled probes for the first time and Calypso asks you for the projection angles. If you know the angles from one of the axes, make sure your first manual point on the qualification sphere is within 45° of that axis. Then when the window pops up to type in the angles, it will refer to your desired axis.

Angle A/B means, "The angle toward A from B."

Reference Axis	A1	A2
+X	Y/X	Z/X
+Y	Z/Y	X/Y
+Z	X/Z	Y/Z
-X	Z/-X	Y/-X
-Y	X/-Y	Z/-Y
-Z	Y/-Z	X/-Z