$R \cdot T = Tr$

$$R = \begin{bmatrix} R_{11} & R_{12} & R_{13} & 0 \\ R_{21} & R_{22} & R_{23} & 0 \\ R_{31} & R_{32} & R_{33} & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T = \begin{bmatrix} 1 & 0 & 0 & X \\ 0 & 1 & 0 & Y \\ 0 & 0 & 1 & Z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$Tr = \begin{bmatrix} R_{11} & R_{12} & R_{13} & R_{11}X + R_{12}Y + R_{13}Z \\ R_{21} & R_{22} & R_{23} & R_{21}X + R_{22}Y + R_{23}Z \\ R_{31} & R_{32} & R_{33} & R_{31}X + R_{32}Y + R_{33}Z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Other Ways to Build a Rotation Matrix

$$R_{Xrot} = \begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\phi & -\sin\phi & 0 \\ 0 & \sin\phi & \cos\phi & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$

$$R_{Yrot} = \begin{vmatrix} \cos\theta & 0 & \sin\theta & 0 \\ 0 & 1 & 0 & 0 \\ -\sin\theta & 0 & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$

$$R_{Zrot} = \begin{vmatrix} \cos\varphi & -\sin\varphi & 0 & 0 \\ \sin\varphi & \cos\varphi & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$

Where θ, ϕ(phi), and ψ(psi) are the rotations around the X, Y and Z axes. Notice these are the rotation matrices for a left handed system. To change them for a right handed system, just remember the sine function is an odd function, so

$$\sin(-\theta) = -\sin(\theta)$$

Change the signs of all the sine terms to change the handedness.

```
###
trans=trans.to_a
    scalex=Math.sqrt(trans[0]**2+trans[1]**2+trans[2]**2)
    scaley=Math.sqrt(trans[4]**2+trans[5]**2+trans[6]**2)
    scalez=Math.sqrt(trans[8]**2+trans[9]**2+trans[10]**2)
    scale=scalex
    scale=scaley if scaley>scale
    scale=scalez if scalez>scale
    puts "        <pos>#{trans[12]} #{trans[13]} #{trans[14]}</pos>\n"
    puts "        <scale>#{scale}</scale>\n"
    puts "        <rotation>\n"
    puts "          <matrix>\n"
    puts "            #{trans[0]/scalex} #{trans[4]/scaley} #{trans[8]/scalez} #{trans[1]/scalex} #{trans[5]/scaley} #{trans[9]/scalez} #{trans[2]/scalex} #{trans[6]/scaley} #{trans[10]/scalez}\n"
    puts "          </matrix>\n"
    puts "        </rotation>\n"
###
```