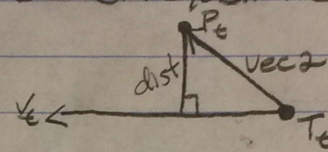
Targeting Error Math

↳ distance from V_t to P_t (dist. line and point)

T_t is the tip of the drill in tracker coordinates (also a point on the line/vector V_t)

Step 1: find the vector of a line from a point on V_t (T_t) to the point P_t

$vec2 = P_t - T_t$



Step 2: take the cross product of V_t and vec 2 to find a vector that is perpendicular to both vectors (so long as both vectors are linearly independent)

↳ if cross prod. $=0$ then the distance is 0 because the lines are parallel & ∴ the point P_t is on the line

Step 3: calculate the norm of the cross product to have the euclidean length of the cross product vector

Step 4: divide the euclidean length of the cross product vector by the norm of V_t (this gives the ordinary/euclidean perpendicular distance of the point P_t to the line/vector V_t

$$\underset{(V_t, P_t)}{dist} = \frac{\| V_t \times vec2 \|}{\| V_t \|} = \frac{\| cross \|}{\| V_t \|} = \frac{\sqrt{cross_x^2 + cross_y^2 + cross_z^2}}{\sqrt{V_{tx}^2 + V_{ty}^2 + V_{tz}^2}}$$

$$\therefore \underset{(V_t, P_t)}{dist} = \frac{\sqrt{cross_x^2 + cross_y^2 + cross_z^2}}{\sqrt{V_{tx}^2 + V_{ty}^2 + V_{tz}^2}}$$