<u>Formulas used:</u>

Relative coordinates x_{rel}, y_{rel} and z_{rel}:

$$x_{rel}(t) = x(t) - x(ref)$$

$$y_{rel}(t) = y(t) - y(ref)$$

$$z_{rel}(t) = z(t) - z(ref)$$

$x(t)$, $y(t)$ and $z(t)$, are the bead's coordinates at frame interval t, $x(ref)$, $y(ref)$ and $z(ref)$ is the bead position at the reference frame (currently the first frame t=0).

Normalized coordinates x_{norm}, y_{norm} and z_{norm}:

$x_{norm}(t) = \frac{x_{rel}(t) - mean_x}{\sigma_x}$ with $mean_x$ and σ_x being the mean and standard deviation of the x relative coordinates across the timelapse.

$y_{norm}(t) = \frac{y_{rel}(t) - mean_y}{\sigma_y}$ with $mean_y$ and σ_y being the mean and standard deviation of the y relative coordinates across the timelapse.

$z_{norm}(t) = \frac{z_{rel}(t) - mean_z}{\sigma_z}$ with $mean_z$ and σ_z being the mean and standard deviation of the z relative coordinates across the timelapse.

Mean Squared Displacement:

$$MSD_X (frame) = x_{rel}^2(t)$$

$$MSD_Y (frame) = y_{rel}^2(t)$$

$$MSD_Z (frame) = z_{rel}^2(t)$$

$$MSD_{3D} (frame) = x_{rel}^2(t) + y_{rel}^2(t) + z_{rel}^2(t)$$

Elapsed time:

$$elapsed\ time\ (frame) = frame * frame\ interval$$