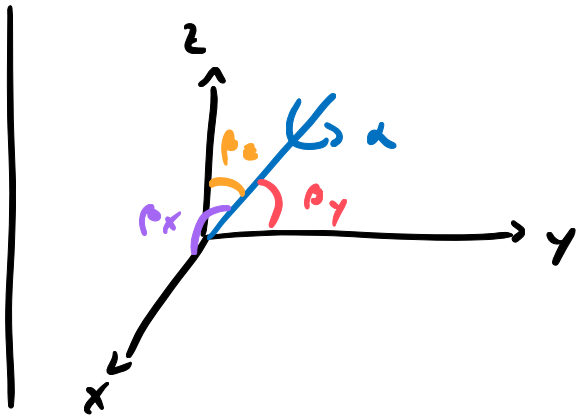
Task: Measure the orientation of the Beaglebone blue and display it by setting the position of a servo motor.

Solution: In the file HWConfigBBBlue.json we can see, that we can get the orientation of the Beaglebone blue as a quaternion. We can look at a quaternion as a rotation around an axis:

$$q_0 = \cos\left(\frac{\alpha}{2}\right)$$
$$q_1 = \sin\left(\frac{\alpha}{2}\right) \cdot \cos(\beta_x)$$
$$q_2 = \sin\left(\frac{\alpha}{2}\right) \cdot \cos(\beta_y)$$
$$q_3 = \sin\left(\frac{\alpha}{2}\right) \cdot \cos(\beta_z)$$



, with α : rotation around the axis

and $\beta_{x,y,z}$: angles between the 3 coordinate axes and the axis of rotation

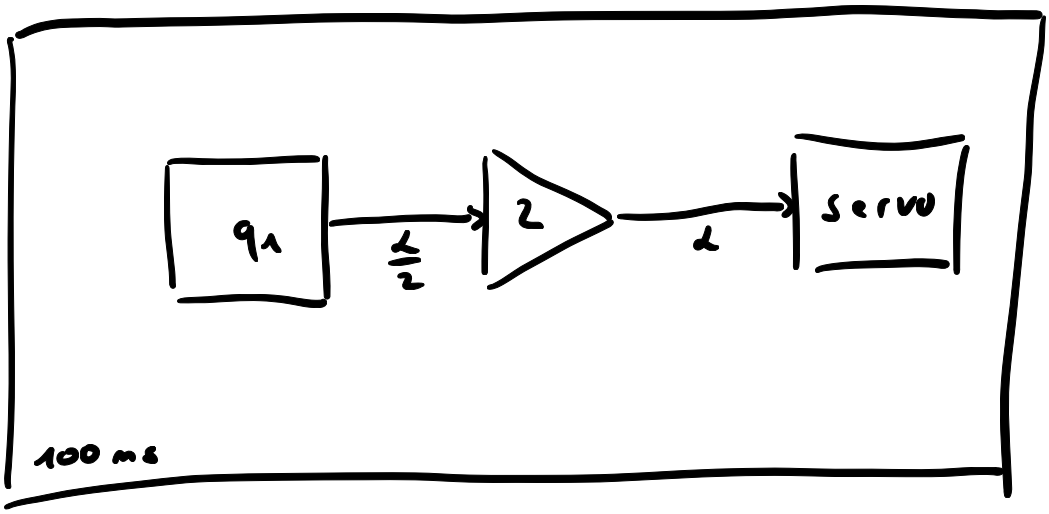
With a single servo motor we can only display the rotation of the Beaglebone blue around one axis. Let's go with the x-axis.

The quaternion will then be

$$q_0 = \cos\left(\frac{\alpha}{2}\right)$$
$$q_1 = \sin\left(\frac{\alpha}{2}\right) \approx \frac{\alpha}{2} \text{ , for small } \alpha$$
$$q_2 = q_3 = 0$$

For small angles α, we can directly use q_1, multiply it by 2 and send this value to the servo motor.

We therefore get the following control system:



Since the IMU and the servo have slow update rates, it is sufficient to let these blocks run in a time domaine with 100 ms.