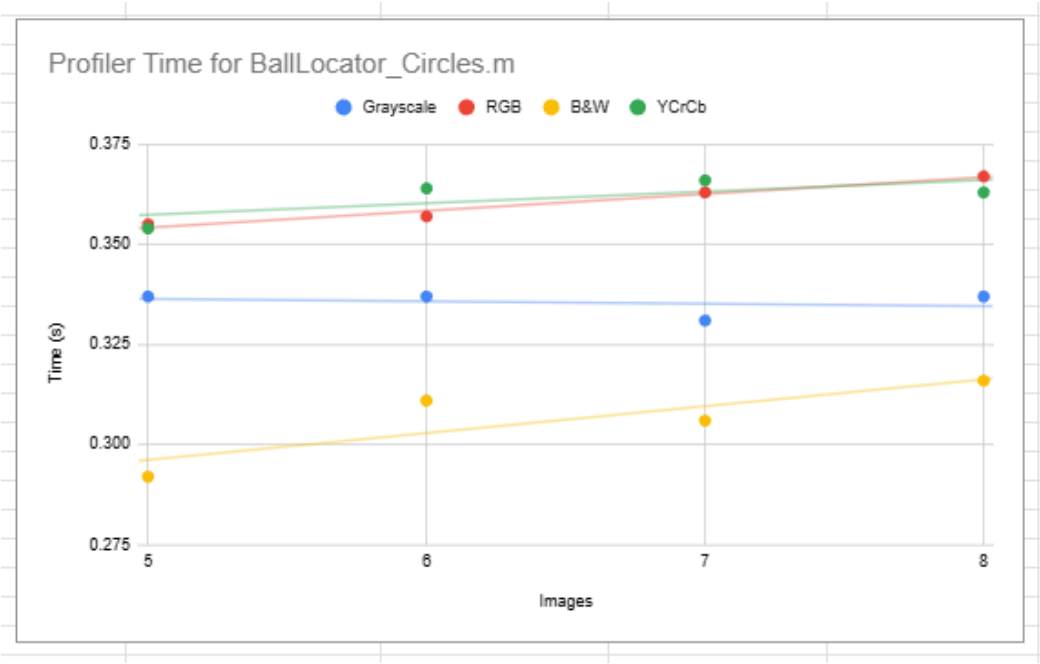
XYZ Positions of the Ball (mm)

Images	Grayscale	RGB	B&W	YCrCb
5	(80.21, -75.95, 409.9)	(80.21, -75.95, 409.9)	(80.24, -76.76, 412.1)	(80.43, -76.11, 410.9)
6	(62.01, -68.10, 385.0)	(62.01, -68.10, 385.0)	(61.43, -68.10, 382.4)	(62.01, -67.94, 384.7)
7	(63.09, -130.9, 865.0)	(63.09, -130.9, 865.0)	(24.18, -50.8, 333.8)	(62.73, -130.3, 861.5)
8	(-14.25, -29.2, 284.9)	(-14.25, -29.2, 284.9)	(-14.44, -29.32, 285.6)	(-14.36, -29.19, 285.3)
9	Err	Err	Err	Err

Profiler Time for BallLocator_Circles.m (sec)

Images	Grayscale	RGB	B&W	YCrCb
5	0.337	0.355	0.292	0.354
6	0.337	0.357	0.311	0.364
7	0.331	0.363	0.306	0.366
8	0.337	0.367	0.316	0.363
9	Err	Err	Err	Err
Average	**0.3355**	**0.3605**	**0.30625**	**0.36175**



Results:
After testing the various color spaces whilst using the found circle method for the circle detection, it was found that Grayscale seems to be the best balance between position accuracy and time consumption. By running the profiler during the BallLocator_Circles.m script, which takes imfindcircles images that are converted to a desired color space and locates circles using the imFindCircles function, the speed of which colorspace allows for the center of the circle to be calculated the fastest is found. The imfindcircles function was set to a radius range parameter of 10 to 100. By using the original RGB colorspace as a baseline for positioning and calculation timing, the best method for accuracy and time reduction can be found. The RGB colorway had an average calculation time of 0.3605 seconds.

Note that Image 9 has errors for all the colorspaces, as it is functionally too close to the camera for the imfindcircles function to calculate without setting the radius range higher, which creates the potential for more false circle detections. Settings with the radius maximum increased up to 175 were attempted, and still produced functional errors.

A black and white colorspace converted using the imbinarize function was statistically the fastest out of all four methods, coming in at an average time of 0.3063 seconds. However, this method showed various issues with positioning the ball, being slightly off from the RGB XYZ positioning, with the biggest error being the false detection of a circle in image 7. The YCrCb colorspace, converted using rgb2ycbcr was the slowest at an average time of 0.3618 seconds, and also exhibited minor positioning errors in the XYZ positions compared to the RGB positioning. Grayscale provided the most accurate XYZ positioning of the ball, being exactly the same as the RGB positioning in most cases. While not as fast as the black and white calculations, the grayscale images averaged a calculation time of 0.3355, which is faster than the RGB and YCrCb colorspaces. As a result, without compromising the accuracy of the positioning while still maintaining a decently fast processing time, Grayscale is the most desired colorway for calculating the XYZ position of the center of the circle.