In the following experiment, participants are tasked with launching a ball across a water current in a virtual environment (VE), with the goal of hitting a target. To succeed, participants must learn the physics parameters of the VE and how these forces interact with the ball’s trajectory to refine their launch parameters (angle and speed). Initially, participants are exposed to the still-water trials, in which the two environmental forces effecting the ball’s trajectory are the drag force (Equation 1), and the deceleration from drag (Equation 2).

During the still-water trials, participants should primarily focus on refining the angle of their launches, as the drag and deceleration’s effect on the ball’s trajectory is minimal (Figure 1). As we can see from the solution space in Figure 1, to overcome the drag and deceleration forces, participants must throw the ball with a minimum launch speed of 0.5 m/s, and a launch angle between 87 and 93 degrees, for a target (radius = 0.1 meters) 90 degrees relative to the participant and 1.5 meters forward on the z axis.

**Equation 1: Deceleration**

Where:

* = drag coefficient
* = Density of water/air
* = Area of the ball
* = Velocity magnitude of launch

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| Figure 1: Minimum distance (in meters) to target surface based on launch angle and speed for still-water trials. Environment and target parameters are specified above the plot. |