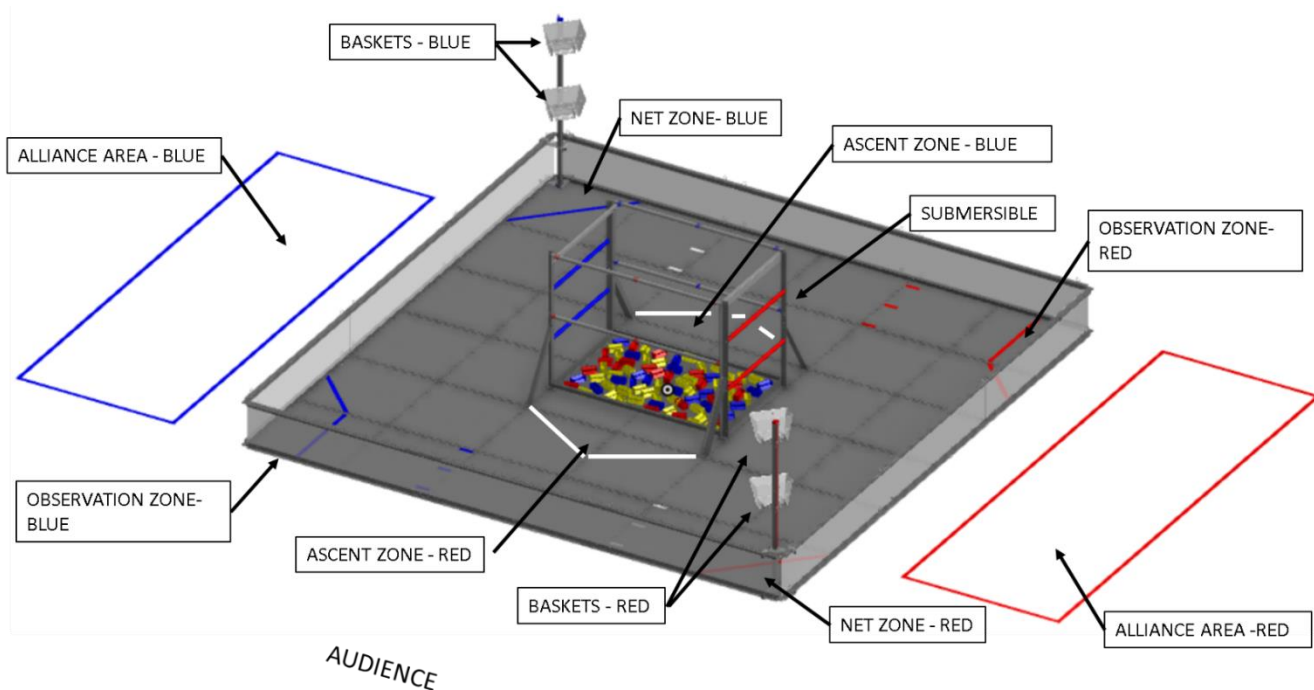


## 9 ARENA

The ARENA includes all elements of the game infrastructure that are required to play INTO THE DEEP: the FIELD, SCORING ELEMENTS, queue area, team media area, and all equipment needed for event management.

Figure 9-1 INTO THE DEEP ARENA (queue area, field display, and optional media area not pictured)



The ARENA is modular and is assembled, used, disassembled, and transported many times during the competition season. It undergoes wear and tear. The ARENA is designed to withstand rigorous play and frequent reassembly. Every effort is made to ensure that ARENAS are consistent from event to event. However, ARENAS are assembled in different venues by different event staff and some small variations occur. For details regarding assembly tolerances, please refer to the ARENA Layout and Marking Diagram. Successful teams will design ROBOTS that are insensitive to these variations.

Illustrations included in this section are for a general visual understanding of the INTO THE DEEP ARENA, and dimensions included in the manual are nominal. Please refer to the official drawings for exact dimensions, tolerances, and construction details. The official drawings, CAD models, and drawings for low-cost versions of important elements of the INTO THE DEEP FIELD are posted on [the Game and Season page](#) on the FIRST website.

## 9.1 FIELD

Each FIELD for INTO THE DEEP is an approximately 12 ft. (3.66m) by 12 ft. (3.66m) area bounded by the outside edge of the extrusion that frames the walls of the FIELD perimeter. The flooring surface of the FIELD is made of 36 (nominal) 24 in. x 24 in. x 5/8 in. interlocking soft foam TILES.

The FIELD is populated with the following elements:

- 2 BASKETS per ALLIANCE, and
- 1 SUBMERSIBLE per FIELD.

Official events use the full INTO THE DEEP FIELD manufactured and sold by AndyMark (am-5400\_Full).

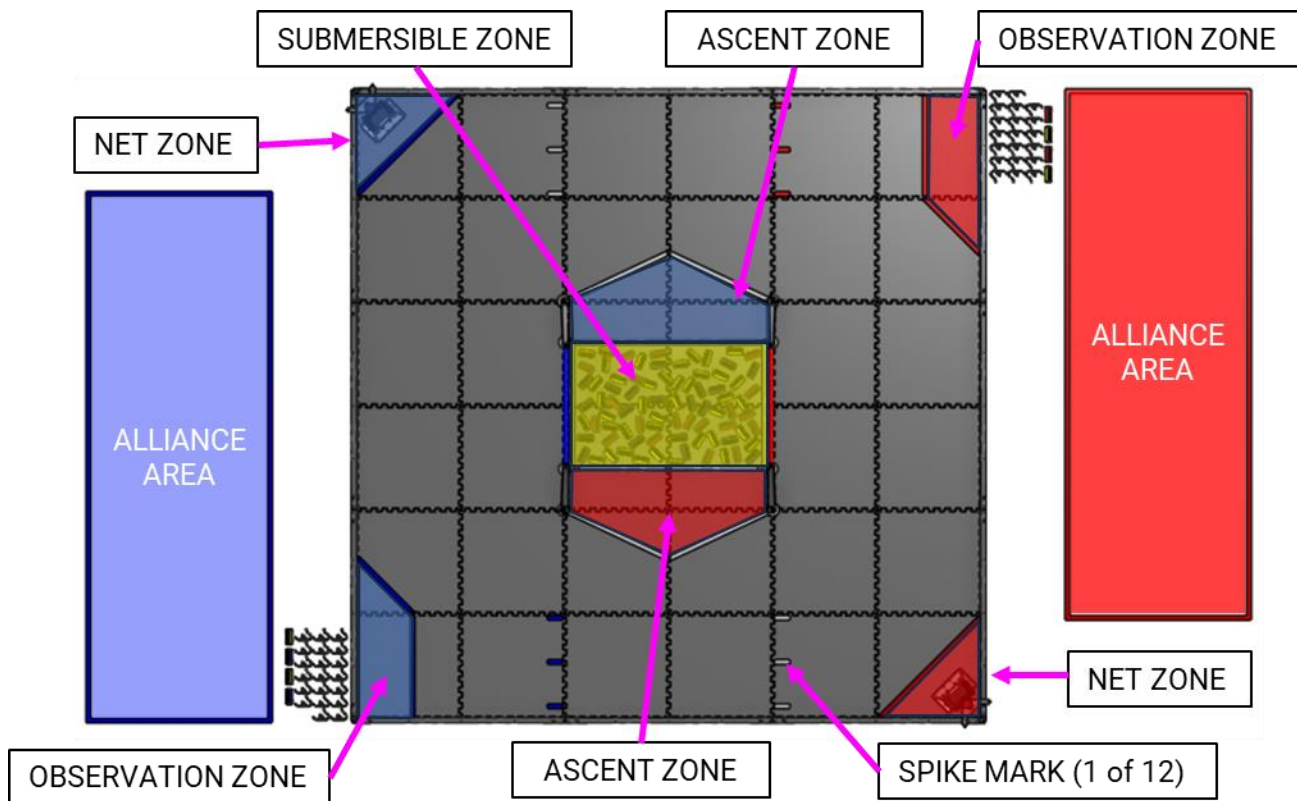
The surface of the FIELD is [FIRST Tech Challenge Field Soft Tiles](#) (am-2499).

There are 2 versions of FIELD perimeter used for competitions. One of the options is the IFI Field Perimeter (discontinued, 278-1501) and the other is the [FIRST Tech Challenge Perimeter Kit](#) (am-0481) sold by AndyMark. All illustrations in this manual show the am-0481 version of the FIELD design.

## 9.2 Areas, Zones, & Markings

FIELD areas, zones, and markings of consequence are described below. Zones identify spaces within the FIELD, while areas are spaces outside of the FIELD. Unless otherwise specified, the tape used to mark lines and zones throughout the FIELD is 1-in. (25 mm) wide [3M™ Premium Matte Cloth \(Gaffers\) Tape \(GT1\)](#), [ProGaff® Premium Professional Grade Gaffer Tape](#), or comparable gaffers tape.

Figure 9-2 Areas, markings, and zones



- **ALLIANCE AREA:** a 120 in. (~304.8 cm) wide by 42 in. (~106.7 cm) deep by infinitely tall volume formed by placing ALLIANCE colored tape onto the flooring surface outside of the FIELD. The ALLIANCE AREA includes the taped lines.
- **ASCENT ZONE:** an infinitely tall 5-sided polygon that is formed from two 9.25 in. (~23.5 cm) long sides bounded by the SUBMERSIBLE outriggers, one 44.75 in. (~113.7 cm) long side bounded by the barrier of the SUBMERSIBLE, and the two 26 in. (~66 cm) long sides bounded by white tape that extend from the outriggers to a point 20 in. (~50.8 cm) from the barrier. The ASCENT ZONE includes the taped lines. ASCENT ZONES are only ALLIANCE SPECIFIC ZONES during the last 30 seconds of a MATCH.
- **NET ZONE:** an infinitely tall triangle bounded by the FIELD walls located beneath the BASKETS and ALLIANCE colored tape that is diagonal from corner to corner across the TILE. The outside edge of the tape is 22.75 in. (~57.8 cm) away from the FIELD corner when measured at the FIELD wall. The NET ZONE includes the taped lines.
- **OBSERVATION ZONE:** an infinitely tall 4-sided polygon which is 36.6 in. (~92.9 cm) at the widest point by 13.1 in. (~33.3 cm) long bounded by ALLIANCE colored tape and the adjoining FIELD wall. The OBSERVATION ZONE includes the taped lines.
- **SPIKE MARK:** one of twelve 3.5 in. (~8.9 cm) long marks used to identify the placement of SAMPLES before the MATCH. The 3 marks in front of the OBSERVATION ZONES are of ALLIANCE colored tape and the 3 marks in front of each NET ZONE are made of white tape.
- **SUBMERSIBLE ZONE:** a 27.5 in. (~69.9 cm) wide by 42.75 in. (~108.6 cm) long, infinitely tall volume bounded by the inner most edge of the barriers of the SUBMERSIBLE.

### 9.3 TILE Coordinates

TILE coordinates are used to assist with FIELD setup. Figure 9-3 defines the intersections of each of the TILES on the FIELD where the TILE tabs interlock. Figure 9-4 defines the grid coordinate system for each of the TILES.

Figure 9-3: TILE tab-line locations

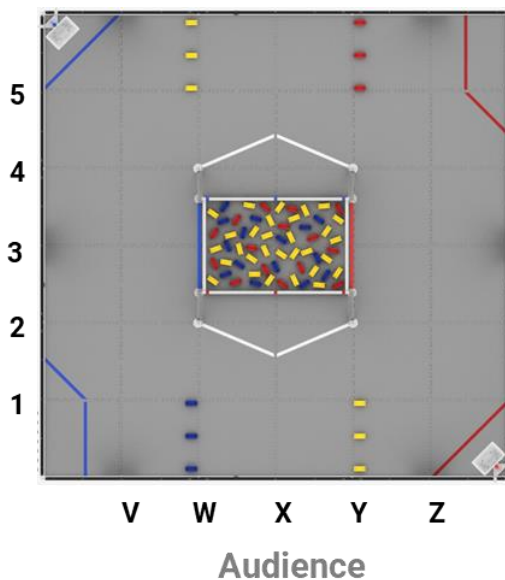
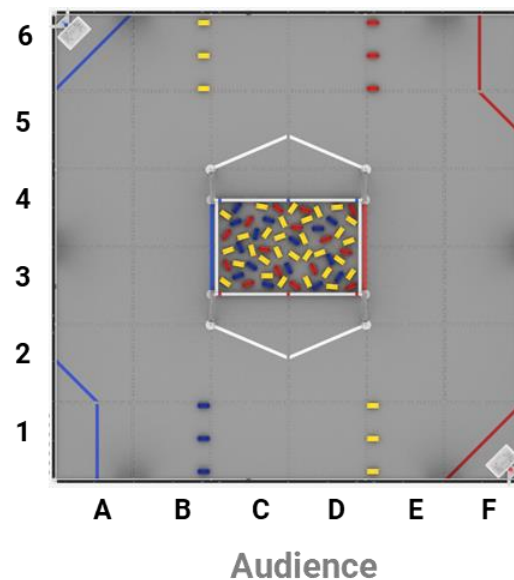


Figure 9-4: TILE locations

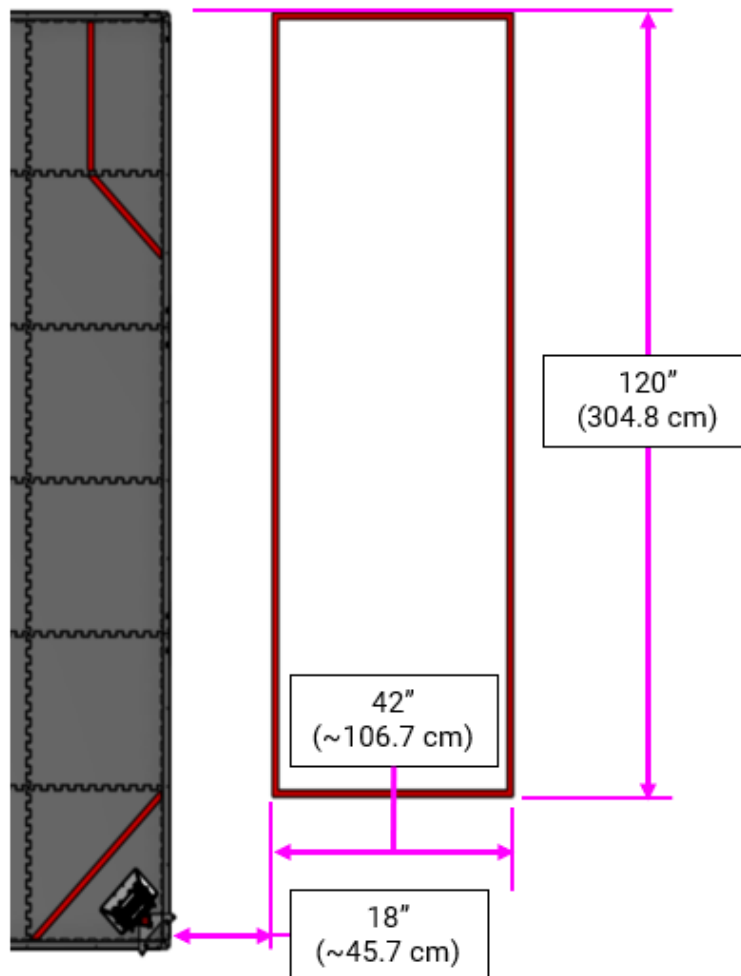


## 9.4 ALLIANCE AREA

An ALLIANCE AREA is the designated red or blue ALLIANCE AREA adjacent to the FIELD where the DRIVE TEAMS stand during a MATCH.

Short tables, stands, or stools may be provided by the event which will sit near the FIELD wall in front of or partially inside the ALLIANCE AREA. These tables are provided for teams to place their OPERATOR CONSOLES. If provided by the event these tables may not be removed or rearranged by the teams without permission from the head REFEREE, FIELD supervisor or FTA.

Figure 9-5: ALLIANCE AREA



## 9.5 SUBMERSIBLE

A SUBMERSIBLE is a structure where ROBOTS collect SAMPLES, score SPECIMENS onto the CHAMBERS, and ASCEND using RUNGS. The SUBMERSIBLE is made up of aluminum framing, round extruded aluminum RUNGS, and High Impact Polystyrene (HIPS) plastic pipe.

The LOW CHAMBERS and HIGH CHAMBERS, made of red and blue HIPS pipes, run on opposite sides of the SUBMERSIBLE, with two red CHAMBERS facing the red ALLIANCE AREA, and two blue CHAMBERS adjacent to the blue ALLIANCE AREA.

The LOW RUNG and HIGH RUNG are round aluminum extrusions that are on the sides of the SUBMERSIBLE perpendicular to the ALLIANCE AREAS.

The approximate exterior dimensions for the SUBMERSIBLE with the outriggers are shown in Figure 9-6.

Figure 9-6: Exterior measurements of the SUBMERSIBLE

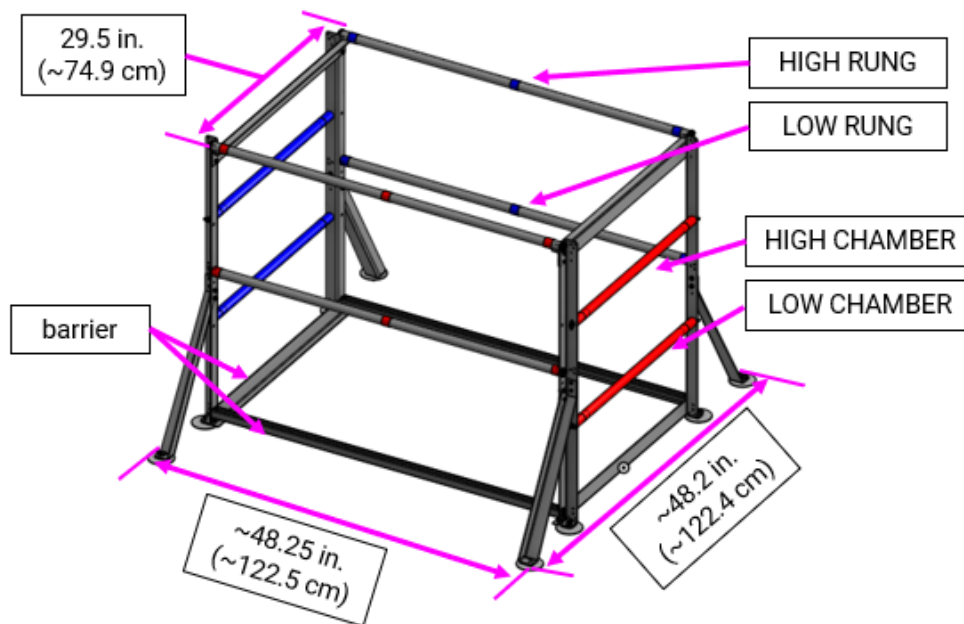
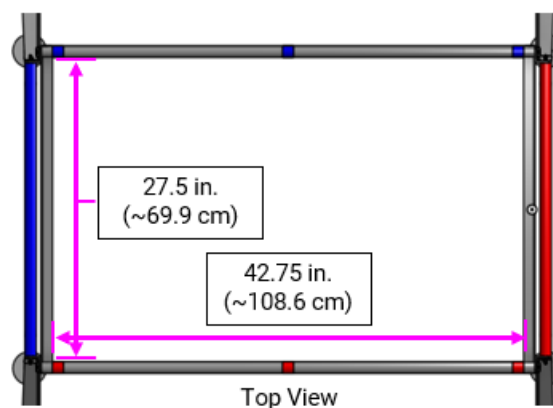


Figure 9-7: SUBMERSIBLE ZONE Measurements

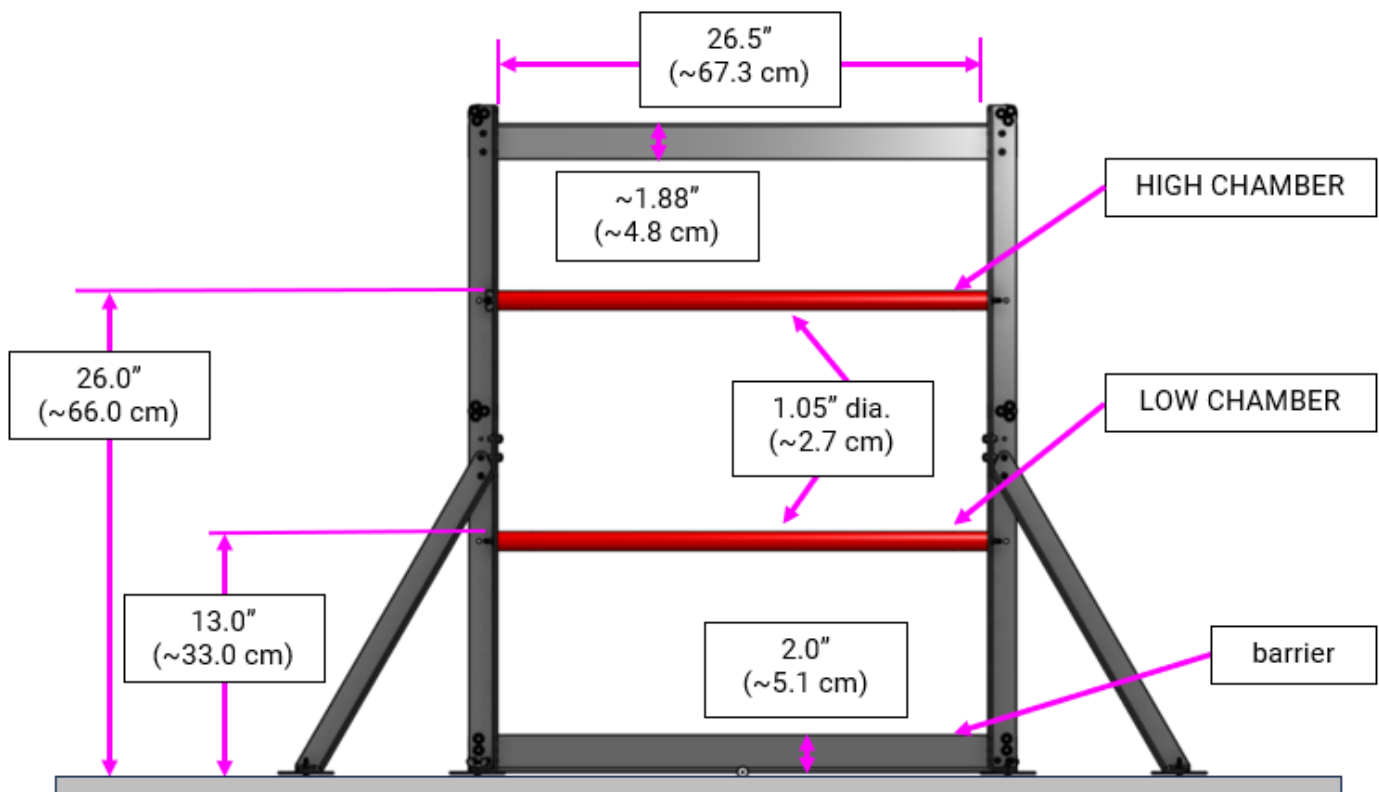


### 9.5.1 CHAMBERS

There are two CHAMBERS per ALLIANCE in the SUBMERSIBLE. The LOW CHAMBER is made of HIPS plastic pipe and is 13 in. (~33.0 cm) from the FIELD floor to the top of the 1.05 in. (~2.7 cm) pipe. The HIGH CHAMBER is made of the same plastic pipe and is 26 in. (~66 cm) from the FIELD floor to the top of the pipe. Both the red and the blue CHAMBERS are 26.5 in. (~67.3 cm) wide and are attached to vertical metal frame of the SUBMERSIBLE.

Below the CHAMBERS and sitting on top of the FIELD TILES is a 2 in. (~5 cm) tall metal barrier. This barrier helps to keep SCORING ELEMENTS inside the SUBMERSIBLE during gameplay.

Figure 9-8: SUBMERSIBLE CHAMBERS

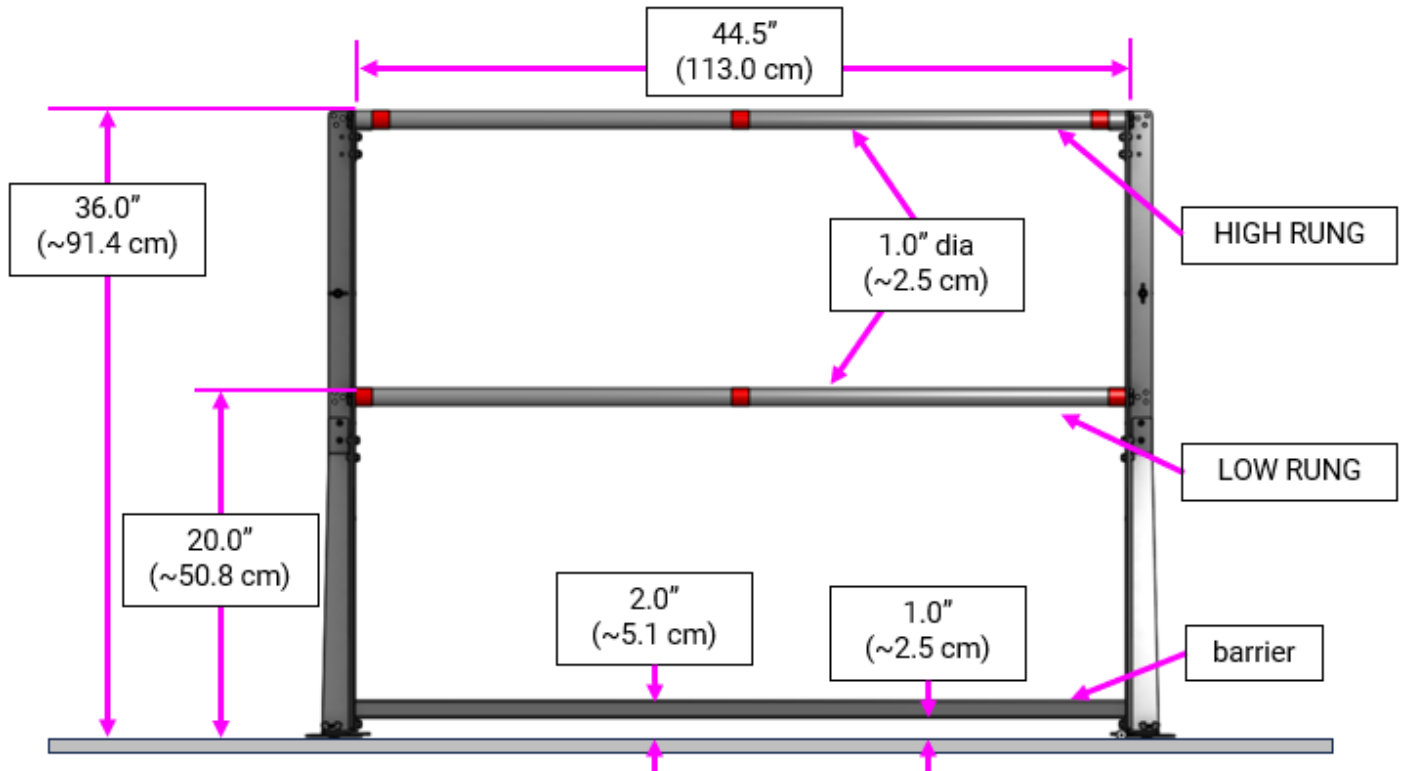


### 9.5.2 RUNGS

The RUNGS are 1in. (~2.5 cm) diameter aluminum extrusion which are 44.5 in. (~113 cm) long and are attached to vertical metal extrusions that make up the SUBMERSIBLE frame. There are two different height RUNGS on either side of the SUBMERSIBLE. The top of the LOW RUNG is 20 in. (~50.8 cm) from the FIELD floor, and the top of the HIGH RUNG is 36 in. (~91.4 cm) from the FIELD floor.

There is a metal barrier below the RUNGS and above the TILES to help contain SCORING ELEMENTS.

Figure 9-9: SUBMERSIBLE RUNGS and barrier



## 9.6 BASKETS

The BASKETS are molded plastic containers which have an 8.85 in. (~22.5 cm) wide by 5.5 in. (~14.0 cm) top opening. BASKETS are secured to a metal extrusion using zip ties, and the entire metal extrusion attaches to the FIELD perimeter wall and is secured to the wall with thumb screws.

There are two BASKETS per ALLIANCE: a LOW BASKET and a HIGH BASKET. The lowest lip of the LOW BASKET is 25.75 in. (~65.4 cm) from the FIELD floor. The lowest lip of the HIGH BASKET is 43.0 in. (109.2 cm) from the FIELD floor.

Figure 9-10: BASKETS

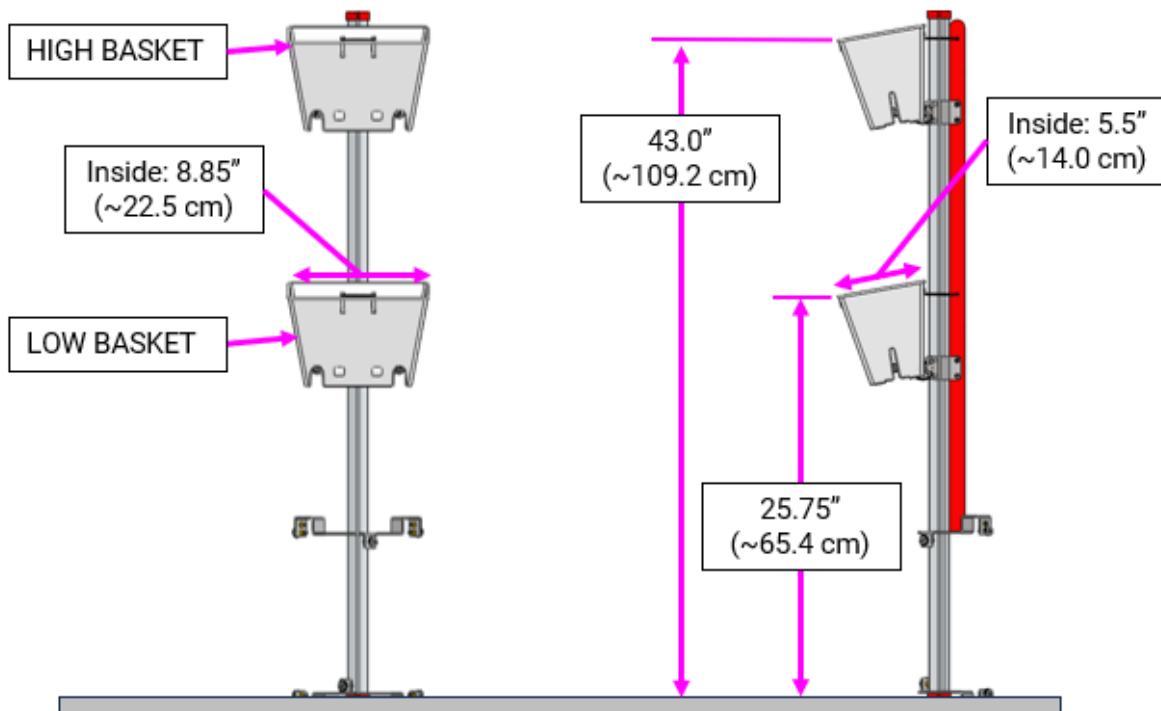
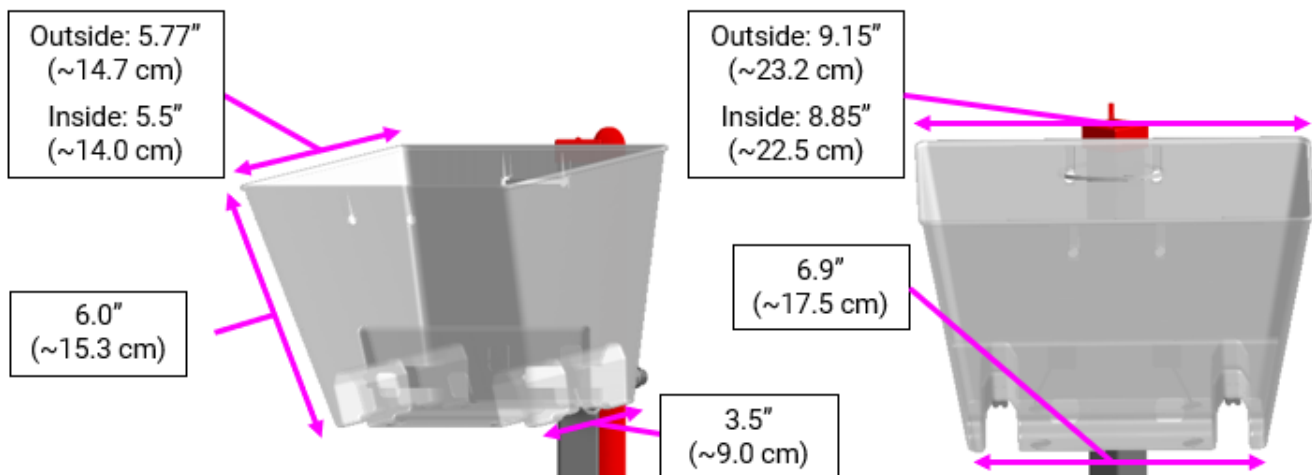


Figure 9-11: BASKET Dimensions





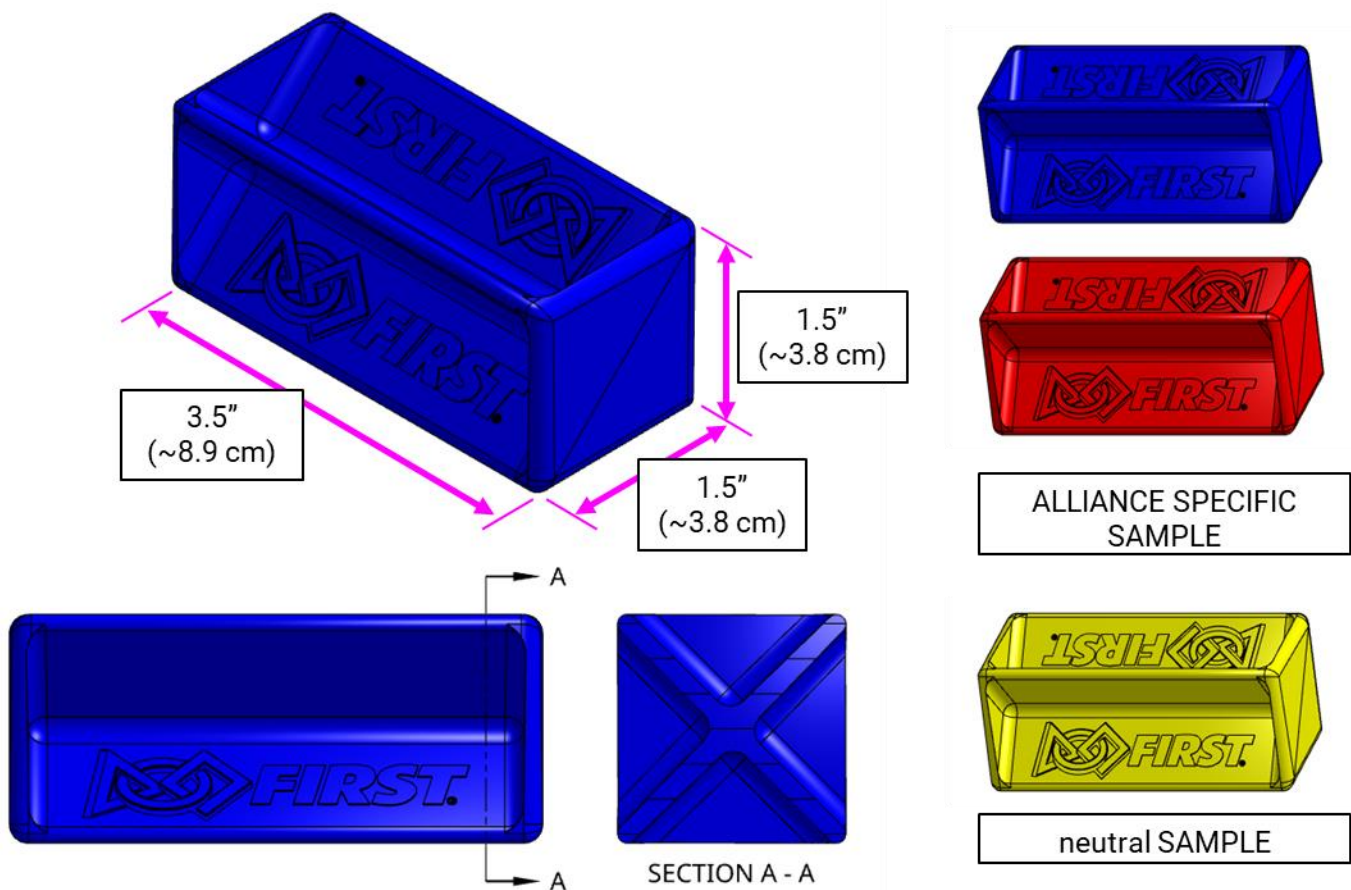
## 9.7 SCORING ELEMENTS

There are two different physical elements used in INTO THE DEEP: the SAMPLE and the CLIP. Red or blue ALLIANCE SPECIFIC SAMPLES can be combined with a CLIP to create a SPECIMEN. The SAMPLE and the SPECIMEN can be used to score points.

### 9.7.1 SAMPLES

A SAMPLE is a 3.5 in. (8.9 cm) long by 1.5 in. (3.8 cm) wide by 1.5 in. (3.8 cm) high rectangular prism shaped SCORING ELEMENT. There are forty (40) yellow SAMPLES, twenty (20) red SAMPLES, and twenty (20) blue SAMPLES. A SAMPLE with a CLIP attached is no longer a SAMPLE and is now a SPECIMEN.

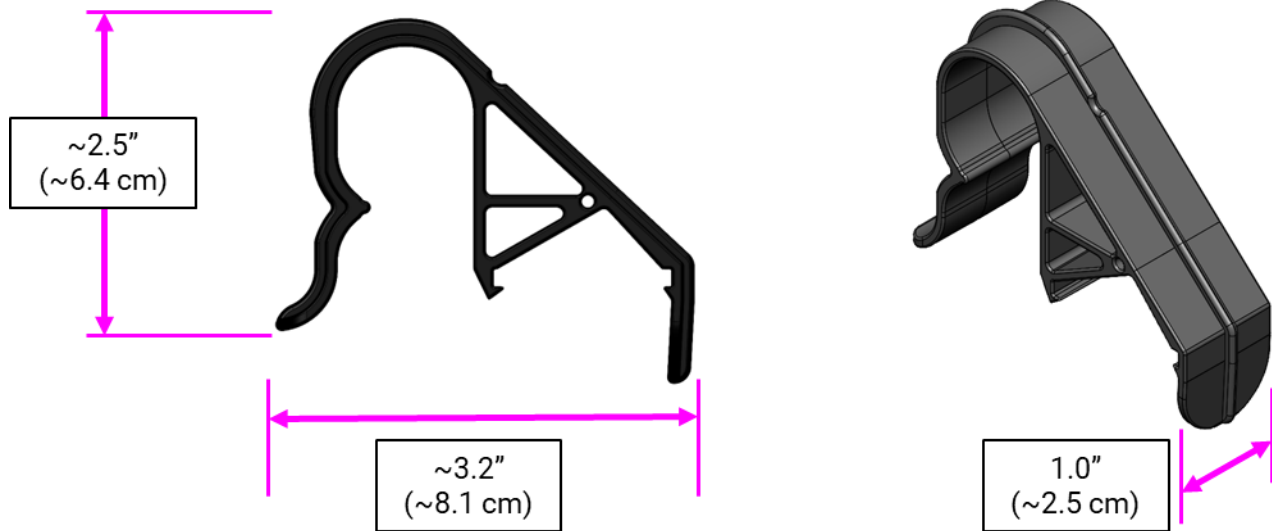
Figure 9-12: SAMPLE



### 9.7.2 CLIP

The CLIP is a black plastic SCORING ELEMENT which is designed to be connected to a SAMPLE by a HUMAN PLAYER or ROBOT to create a SPECIMEN. The CLIP is a 2.5 in. (~6.4 cm) high by ~3.2 in. (~8.1 cm) long by 1 in. (~2.5 cm) wide.

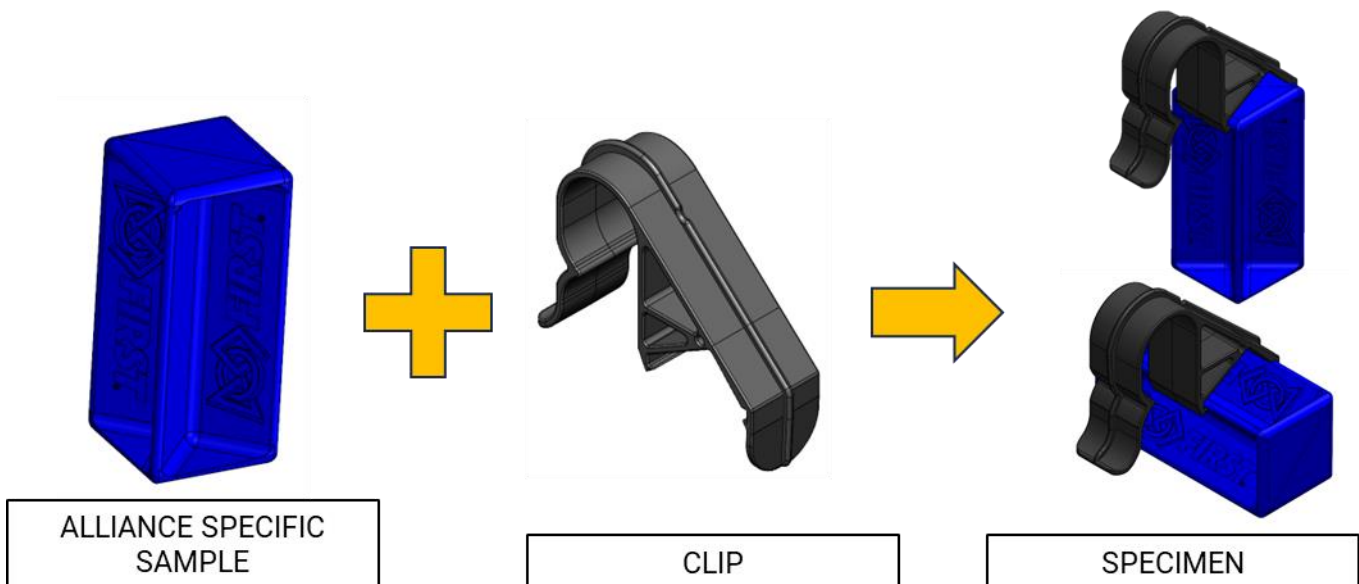
Figure 9-13: CLIP Dimensions



### 9.7.3 SPECIMEN

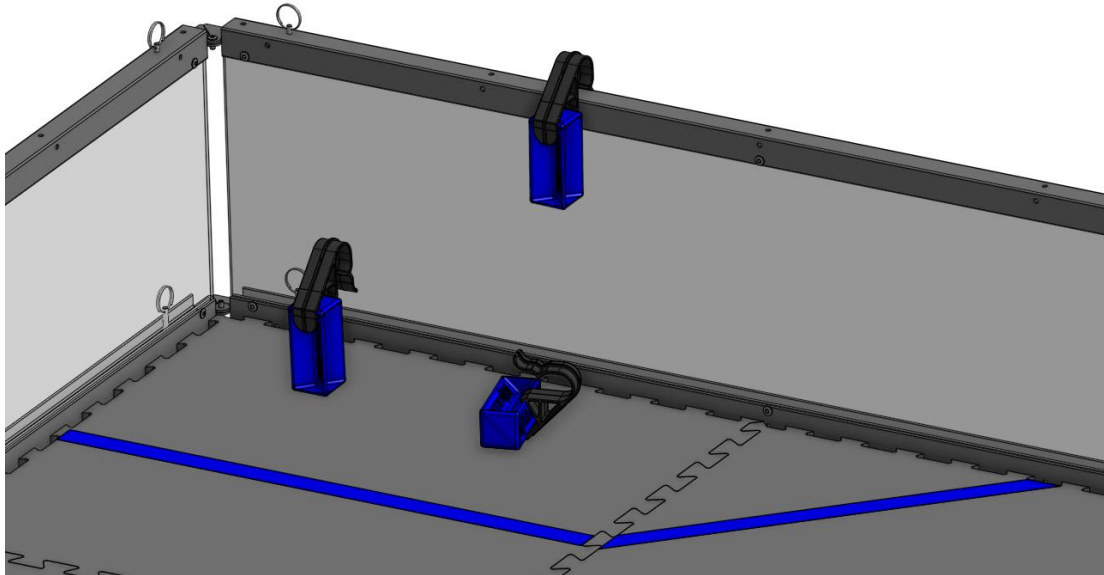
A SPECIMEN is a SCORING ELEMENT that is made up of one ALLIANCE SPECIFIC SAMPLE and at least one CLIP. The CLIP can be connected to the SAMPLE on the long or short side to create a SPECIMEN as shown in Figure 9-14.

Figure 9-14: Creating a SPECIMEN using an ALLIANCE SPECIFIC SAMPLE and a CLIP



HUMAN PLAYERS may stage the SPECIMENS in any orientation in the OBSERVATION ZONE. This include hanging them from the adjacent FIELD wall or placing them on the TILES as shown in Figure 9-15.

Figure 9-15: SPECIMENS staged in the OBSERVATION ZONE



## 9.8 AprilTags

AprilTags are placed outside of the FIELD perimeter walls facing inward to help aid in ROBOT navigation. AprilTags for INTO THE DEEP are six 4 in. (~10.16 cm) square targets from the 36h11 tag family, IDs 11-16. Each marker has an identifying “TAG ID” text label.

Figure 9-16: AprilTag Locations

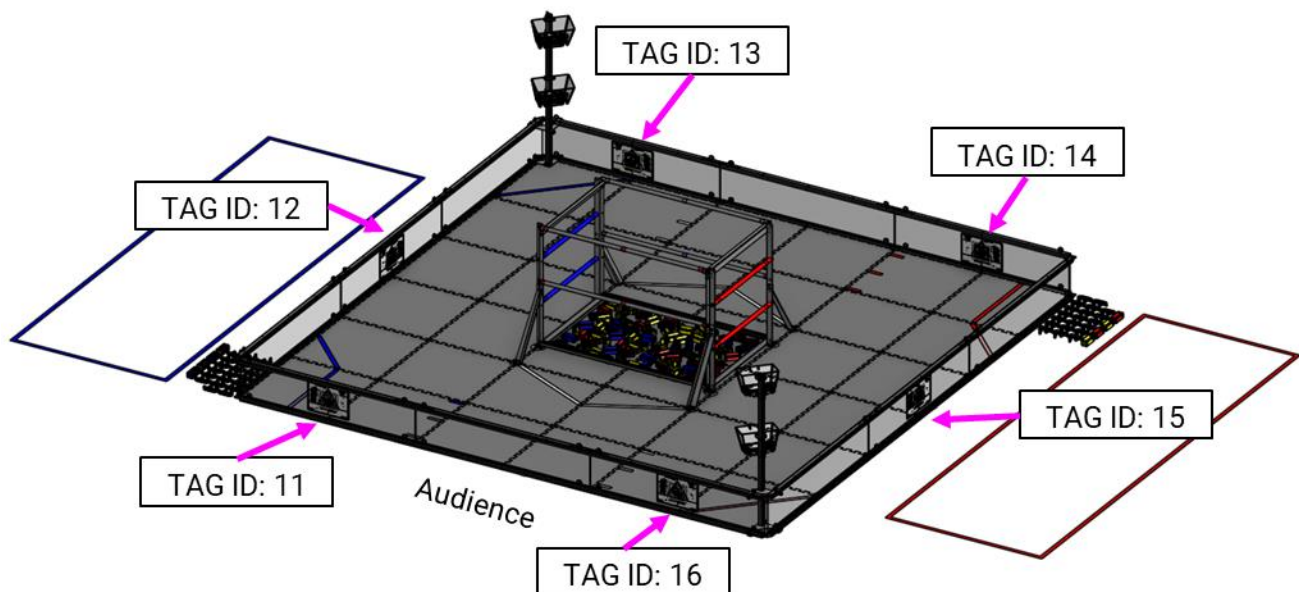
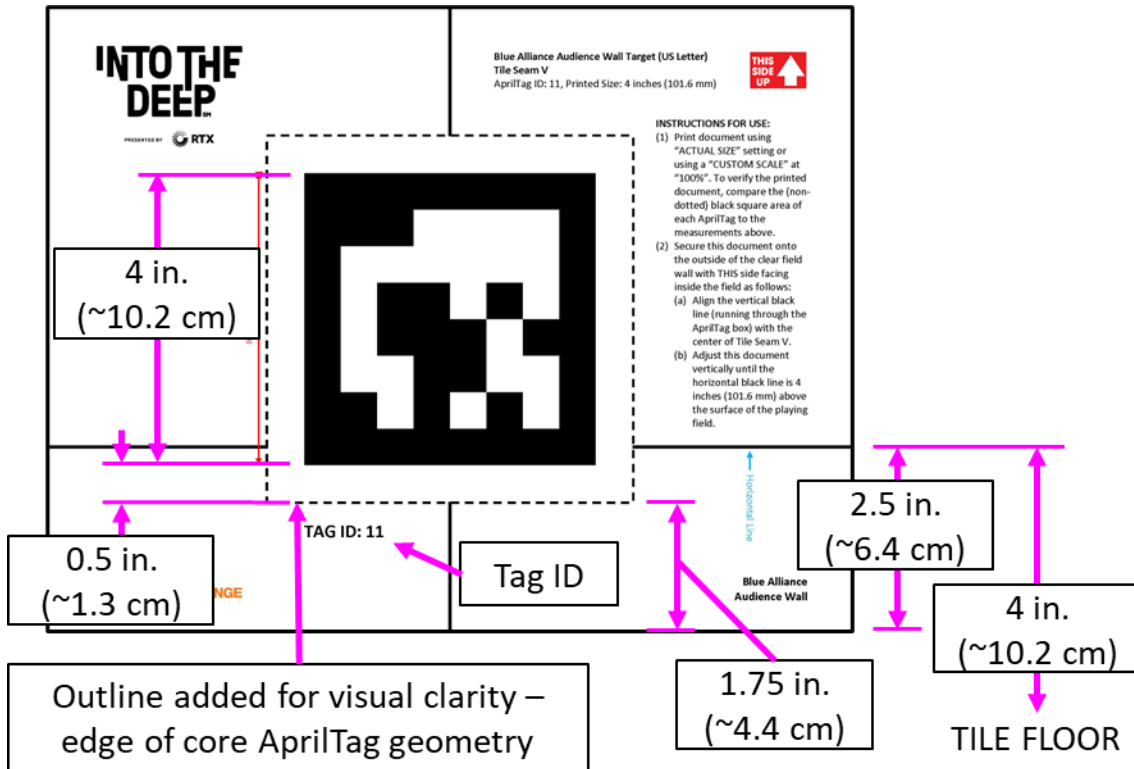


Figure 9-17: AprilTag sizing (placed in plastic sheet protectors)



Do not print the images from this manual for practice purposes, they are examples only and are not the same size as those used in the ARENA. Please refer to the [FIRST Tech Challenge Game and Season page](#) for printable versions of these images, including instructions on how to place the images correctly around the FIELD.

## 9.9 FIELD STAFF

FIELD STAFF are volunteers present in and around the ARENA that are responsible for making sure the MATCHES are cycled through efficiently, fairly, safely, and with a spirit of cooperation, *Gracious Professionalism*<sup>®</sup>, and generosity of spirit. FIELD STAFF roles are filled by volunteers from the community who prepare for the event with thorough training and certification. There are 3 FIELD-side key volunteer roles with whom teams should be familiar with and are encouraged to use as resources to make their event experience valuable.

- Head REFEREE – trains, directs, and supervises REFEREES. They oversee all scoring processes and procedures in collaboration with other FIELD STAFF. They interact with STUDENTS, volunteers, and event staff. The head REFEREE has final authority for decisions regarding MATCH scores, FOULS, and YELLOW and RED CARD assignments.
- FIRST technical advisor (FTA) - ensures events run smoothly, safely, and in accordance with FIRST requirements. The FTA collaborates with FIRST staff, event staff, and other event volunteers in many

different areas at events. The FTA focuses on all technical things related to the FIELD, ROBOTS, and game, and acts as a team advocate for all teams competing at the event.

- FIELD supervisor - (may be the same as the FTA or head REFEREE at smaller events) directs activity on the FIELD to ensure efficient execution of the MATCHES, pacing of the event, and smooth flow of MATCH play. FIELD supervisors are responsible for ensuring the FIELD is intact and lead FIELD reset teams, who are responsible for resetting the FIELD after each MATCH in preparation for the subsequent MATCH.

For additional details about each of these roles, as well as other *FIRST* Tech Challenge volunteer roles, please refer to our [volunteer role descriptions](#).

### 9.10 Event Management System

The *FIRST* event management system is the software responsible for managing the MATCH scores and other event inputs. The system encompasses all FIELD electronics, including computers, displays, REFEREE and other volunteer electronic devices, the wireless access point, ethernet cables, etc.

The *FIRST* event management system alerts participants to milestones in the MATCH using audio cues detailed in Table 9-1. Please note that audio cues are intended as a courtesy to participants and not intended as official MATCH markers. If there is a discrepancy between an audio cue and the visual FIELD timers, the visual FIELD timers are the authority.

Table 9-1 Audio cues

Event	Timer Value	Audio Cue
<b>MATCH start</b>	2:30	“Cavalry Charge”
<b>AUTO ends</b>	2:00	“Buzzer x 3”
<b>AUTO to TELEOP Transition</b>	0:07 → 0:01	“Drivers, pick up your controllers, 3-2-1”
<b>TELEOP begins</b>	2:00	“3 Bells”
<b>Final 30 seconds</b>	0:30	“Train Whistle”
<b>MATCH end</b>	0:00	“3-second Buzzer”
<b>MATCH stopped</b>	N/A	“Foghorn”

