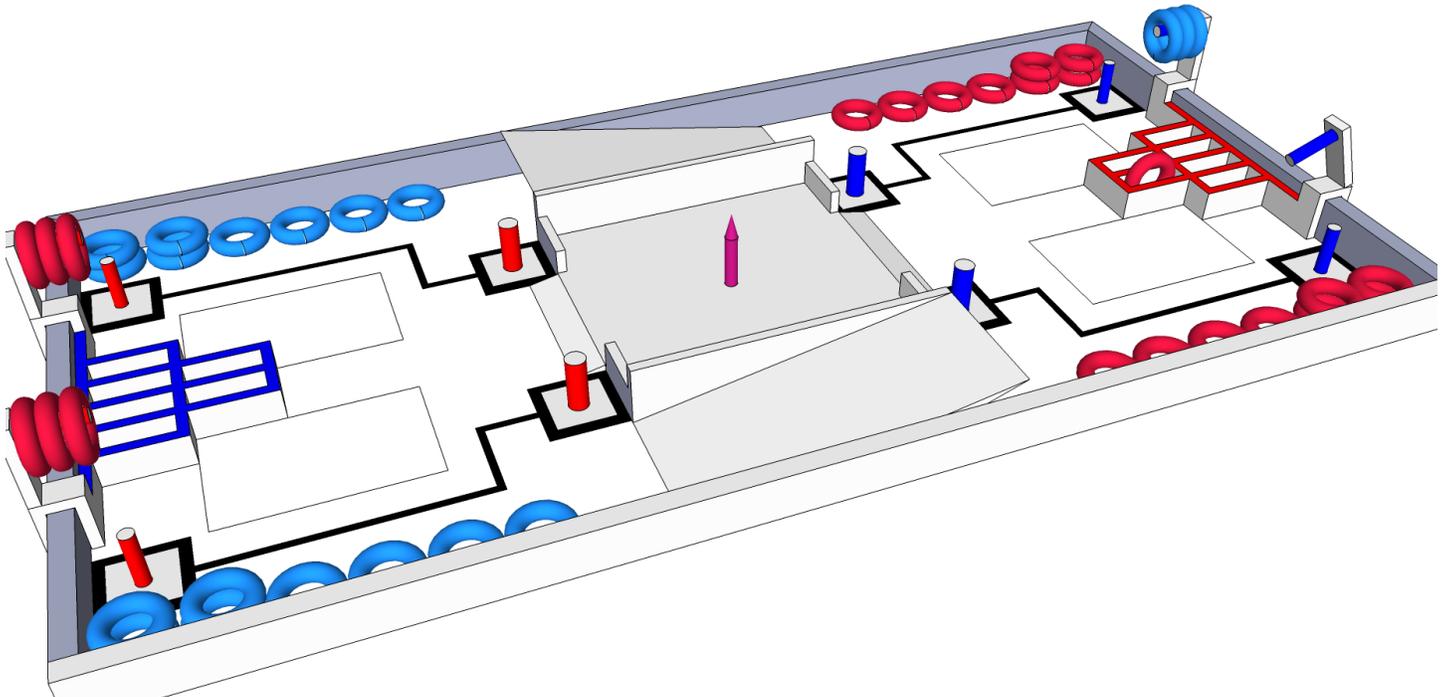# "Unleash the Rings" (v0.3)

In this challenge, the club members will design a robot which will first run a program written by the club member ("autonomous" mode), followed by a period of time where the club members will be controlling the robot ("teleoperated" mode).

I. Summary

There will be two sides per match, a Red team and a Blue team. Each team will have two club members. Each team member will earn a score based on the total points earned or lost by that team in that match.

The field has two sides – a Red side, and a Blue side – plus an "obstacle zone" in the middle. The Red team will start on the same side as the Red slots, and the Blue team will start on the same side as the Blue slots. The goals: place as many rings as possible onto vertical pillars on the field ('ringers'), and/or to get rings to touch the vertical pillars ('leaners'), and/or insert rings vertically into the slots ('toasteds'), and/or put rings back onto the horizontal pillars ('caps') AFTER "unleashing" the rings from them. *[more on "unleashing" in a moment…]*

During the autonomous period, the robots may start off with one ring from their quadrant loaded onto (or placed so that it's touching) the robot. The bots can run a program created by the club member where the robot will try to load one (or more) rings onto the pillars on the *same* side of the field (and in the same quadrant) and/or into the vertical slots on the *same* side of the field. Scores during the autonomous period are worth <u>double</u>!

After autonomous, a teleoperated period will start during which the robots will be remotely driven by the club members. While the club members are driving, they will be trying to manipulate the rings from their side and score them on *same*-colored game targets and/or the *purple* spindle in the middle.

'Leaners' – where a ring is touching a Red or Blue vertical pillar (but **NOT** the purple needle!) – will be worth 1 point. 'Ringers' on the Blue or Red vertical pillars will be 3 points, while on the central Purple pillar will be 5 points. 'Toasteds' – when a ring is put vertically into a matching slot – are also worth 5 points. 'Caps' – when a ring is put back onto a horizontal spindle – are worth 10 points. BUT! Any scores using the extra-heavy "unleashed" rings will score double! ***The players trigger 'unleashing' by filling vertical pillars or the slots.***

I. Field
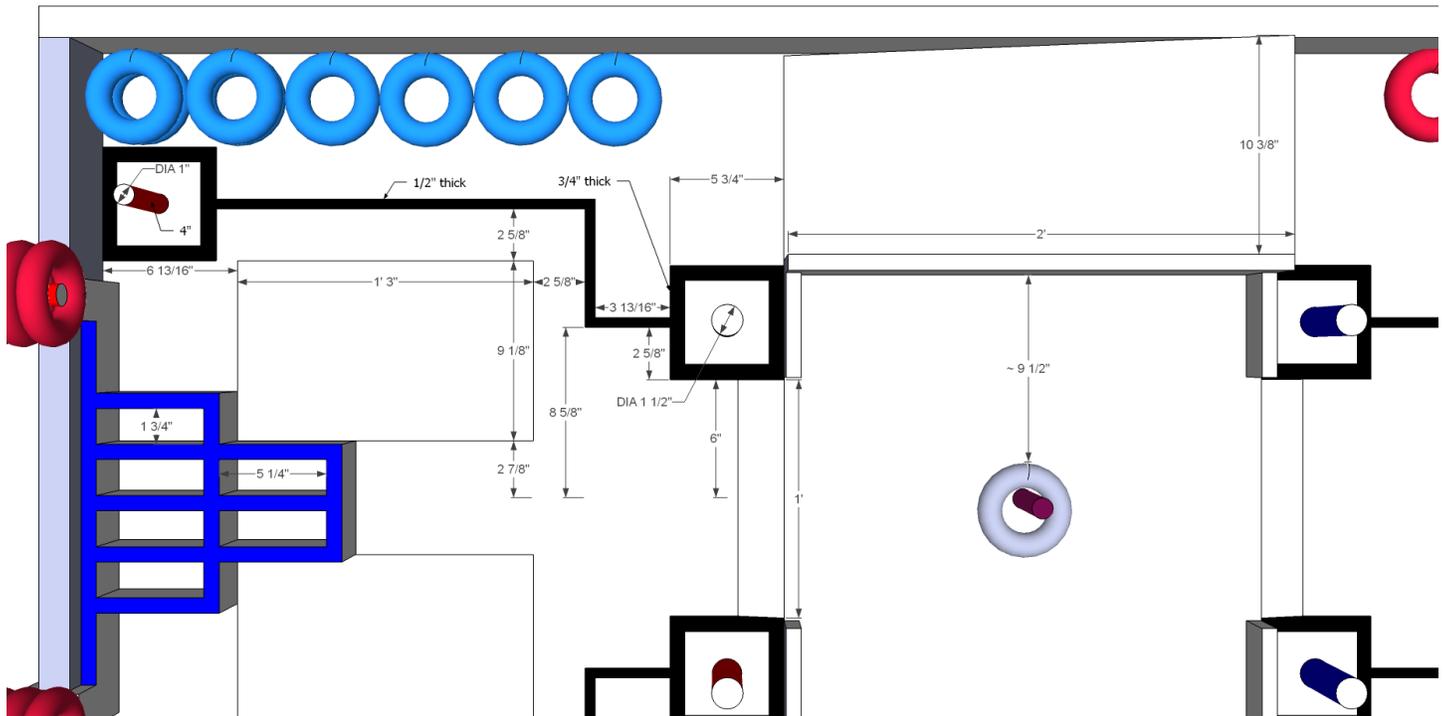
A. Key measurements

1. The overall field size is 4' wide by 8' long. The walls are 1 1/2" thick and 3 1/2" tall [standard 2x4s], leaving an interior field size of 45" wide by 93" long.

2. The rings are the same as the ones used in the 2013 FTC competition. They have an outside diameter of 4 3/4", an inside diameter of 2 1/4", and are 1 1/4" tall. They lighter rings weigh approximately 0.05 pounds, or about the same as four (4) U.S. quarter coins.

3. There will be two teams (a Red team and a Blue team). The Red side starts on the same side as the Red rings, and the Blue side starts on the side with the Blue rings.

4. The Red and Blue scoring pillars & spindles are 4" long cylinders (mounted securely).

5. The Purple scoring pillar in the center of the field is a 4 1/4" tall cylinder @ 1" diameter, with a 2" conic section on top of it (for a total height of 6 1/4").

6. The squares that the Red and Blue scoring pillars are mounted within are 5 3/4" square (outside measurement), with a 3/4" wide outline. The pillars are mounted in the center of each square.

7. The lines linking the scoring pillars and outlining the starting zones are 3/4" thick.

8. The angled areas on either side of the central square zone are "teeter-totters". Whenever a side is 'up', it is about 4 1/2" high off the ground. The slope is a ~20% grade.

II. Matches

Each match will be a total of 3:00 minutes. The first part of the match will be a thirty-second (0:30) autonomous period, followed by a two-and-a-half minute (2:30) teleoperated period.

After the club members start their autonomous program, they should not touch their robot again until after the match is over. If the club member touches the robot after the start, or if a referee has to touch the robot to

resolve an issue, that team will incur a touch penalty (see below for details). *Exception: A referee clearing accidental entanglement between two robots does not incur any touch penalties.*

Matches will have two referees, each one watching either the Red side or the Blue side of the field. They will score and remove rings from the field in specific situations (see below). The referees will also perform other duties as directed by the rules.

A. Scoring & "UNLEASHING"

1. A 'ringer' or 'cap' counts when the pillar breaks the plane on <u>both</u> sides of the ring.

2. Rings placed onto the vertical Red or Blue pillars will be worth **3 points.**

    a. A maximum of three (3) 'ringers' total can be scored on each of the Red and Blue pillars.

    b. Red and Blue 'ringers' scored in the autonomous mode will be worth **double** – <u>6 points</u>

3. Rings placed onto the central Purple pillar are also 'ringers' but will be worth **5 points.**

    a. A maximum of five (5) 'ringers' total can be scored on the central Purple pillar.

4. Rings which are touching a target Red or Blue vertical pillar – **or** rings that are touching a ring that has been placed onto that pillar – can be 'leaners' which <u>could</u> be worth **1 point.**

    a. A team member can call out **"Leaners!"** at which point the referee for that side will determine which rings can be scored and remove those rings. Scored 'leaners' will be kept aside and counted at the end of the match.

    b. If a ring is in a 'leaner' position and is then moved such that it is no longer a 'leaner', it will no longer be eligible to be counted as a scoring ring.

    c. Rings which are partially hooked on scoring pillars but where the pillar doesn't go all the way through will be counted as 'leaners'.

5. Rings which are inserted vertically into the *matching-colored* slot, such that the ring is touching the bottom of the slot, are considered 'toasted' and are worth **5 points.**

6. <u>*UNLEASHING:*</u> If a vertical pillar is filled (with 3 matching-colored rings) <u>or</u> the 3 vertical slots in a quadrant have been filled, the loaded rings of the same color on the left or right side [matching the pillar or slots] will be allowed to cascade onto the board.

    a. The rings loaded onto the horizontal spindles are *extra-heavy* and will be marked so they can be differentiated from the normal lighter rings.

    b. Any scoring done with these heavier rings will **count double.**

    c. Robots should NOT interfere with the pre-loaded rings on the spindles! Removing the rings outside of "unleashing" will incur a touch penalty and the rings will be replaced.

    d. After the construction has been tipped forward to unleash the rings, the ref will tilt it back so the spindle can be scored on.

7. Rings placed onto a horizontal spindle *after the rings there have been unleashed* are worth **10 points.**

B. Touch penalties

1. If a club member touches a robot or field element during a game (either during the autonomous period or during the teleoperated period), they will incur a **'touch penalty'** worth **minus 5 points.** *A robot which was touched will be returned by a referee to its home base, and any of that team's rings that the robot was touching will be returned to the ring starting positions on the field.*

2. In some cases, a referee may have to move a robot or field element. This may also incur a touch penalty for one of the teams. The specific circumstances when referees might need to move robots are listed in the sections below.

C. Autonomous mode

1. At the start, a robot must be entirely within the outline of their "start box" (see the diagram – the area 9 1/8" wide by 1' 3" long), as if there were glass walls around the box.

2. The club member may pre-load one ring from their quadrant onto the robot prior to the start of the autonomous period (or alternatively, may place one ring on the field such that it is touching the robot).

    a. Any additional rings must be picked up or handled by the robot from the field.

3. The club member must be able to initiate the main program execution without lifting the robot, by doing one of the following:

    a. Set up the robot program selector such that the desired autonomous program is selected, so pushing an NXT / EV3 button will start the program; or,

    b. Write a program which, when started, waits on a touch sensor before proceeding with the primary autonomous operation.

4. During autonomous mode, the robots score 'ringers', 'leaners', and 'toasteds' on the field elements on their **own** side of the field.

    a. Each robot should try to score on the elements in the same quadrant that the robot started in. Robots are advised not to enter their partner's quadrant, otherwise they might crash into their partner! (Crashing into your partner doesn't incur a penalty [unless someone touches a robot])

    b. The central pillar does not score any points during the autonomous period.

    c. Robots should not enter into the other team's side during the autonomous period. If any part of a robot partially intrudes into the other team's side of the field during the autonomous period, a referee will move it back to its home base and that team will incur a *touch penalty*.

5. Scores earned during autonomous mode are worth **double.**

6. At the end of the autonomous period, the referees will total the scores and then reset the rings for teleop.

    a. 'Leaners' will count even if they are touching a robot in some fashion, so long as they are also touching a scoring pillar.

Regarding ultrasonic sensors: Be aware that if multiple robots try to use ultrasonic sensors at the same time, they might cause interference and disrupt the operation of the autonomous program. Club members who choose to use an ultrasonic are accepting this potential risk.

Also… **Note that the field quadrants are "handed"**, i.e. there is a 'left-hand' side and a 'right-hand' side for each team. Club members are going to be paired with different people over the course of the event, so they will need autonomous programs which will work for either the "left" side or the "right" side. Two suggestions:

A. The club member creates a suitable program for one side of the field; then, a leader assists them in making a copy of that program, changing all the turning commands in the copy to go in the opposite direction.

B. The club member might instead write a single program which can do either the "left" side or the "right" side, and then enable the program to be told which side it's on when it's run (either using two touch sensors, or using different NXT / EV3 buttons, etc.)

C. Teleoperated mode

1. When the autonomous period is over, there will be a short pause as the referees perform scoring duties and ring resets, and then the team members will begin remotely controlling the robots using the game controllers.

   a. Remote operation of robots can be done only by way of the game controllers. No using infrared controllers or other methods to influence the robots! **Doing so would result in being removed from the match.**

   b. If there is a problem with the start of the teleoperated period such that one or more robots are not responding to the assigned game controllers, that player should immediately let the Director know; the Director will halt the match and the referees will (to the best of their ability) return robots back to where they were at the end of the Autonomous period.

2. During the teleoperated period, the robots score the rings from their team on field elements of the *same* color, as well as 'ringers' on the Purple pillar in the center of the obstacle zone.

   a. Don't score red rings on Blue elements, or blue rings on Red elements! Non-'leaner' scores on different-colored Red or Blue elements during the teleoperated mode will be removed by a referee, and that robot will be put back into its home base incurring a touch penalty for that team.

   b. 'Leaners' on same-colored pillars can be removed during play anytime a member of that team calls out "Leaners!"

   c. Players can't score 'leaners' against different-colored pillars or against the Purple pillar. Rings in those positions will remain where they are.

3. Robots should **not** remove scored rings which are already on pillars or spindles or in slots! If a ring is removed, a referee will replace the ring and put that robot back in its home base, incurring a touch penalty for that team.

4. Any 'leaners' still on the field at the end of the match will be removed by the referees to be counted with the rest of the 'leaners'.

Things to keep in mind #1: This is intended to be a **non-contact game.** Some accidental bumping is expected to occur, but in general the robots should not physically interfere with each other.

Things to keep in mind #2: Sometimes two robots may both want to go through the same space at the same time. Note that the goal is not just to win the match, but for each team to get the highest score they can! It could be a strategic move to temporarily back up and let someone go by, instead of waiting there stuck in a traffic jam (and thus not getting more scoring done!)

Things to keep in mind #3: Everybody is there to have fun. Just remember that sometimes, what one person thinks is funny isn't fun for the other person!

D. Construction & technical requirements

1. Robots must be built only out of parts manufactured by LEGO, *except:*

    a. The batteries which power the robot do not need to be manufactured by LEGO

    b. Robots have the option to use string supplied by the 4H Robotics Division

    c. Robots can be decorated with stickers, flags, etc. so long as those decorations do not have an effect on the robot's performance (i.e., they can't be helpful).

    d. Also: Robots are limited to using one (1) NXT/EV3 brick and no more motors than outputs.

        i. The driving motors must be plugged into the "B" and "C" outputs.

        ii. If there are action motors, they should be plugged into the "A" and/or "D" outputs.

2. Robots must be able to fit entirely within the outline of a "start box" (see the diagram – the area 9 1/8" wide by 1' 3" long) as if there were glass walls around the box.

    a. <u>Height limitation:</u> When positioned within the Start Box, no part of the robot can extend more than 15" above the surface of the field

3. **Required:** Each robot must have a 4H clover visible on it somewhere!

4. **Recommended:** Each robot should be labeled with the club member's name and their club name (so if a robot needs to get to its owner, we know who to find!)

5. **Required:** Each NXT / EV3 brick must have a unique name.

III. Tournament organization

Tournaments will be played in a round-robin style for several rounds, followed by the top four scorers choosing teammates and facing off in a set of playoffs. [Details may be subject to change at the Tournament Director's discretion based on circumstances]

A. Eligibility to play in the finals

1. For a club member to be able to play in the playoffs in a tournament, they need to be a member in good standing as per the Robotics Fair Exhibitor Guide.

2. The playoffs in each tournament will be played out by the top four scoring members in good standing and the team partners they choose.

B. Number of tournaments

1. There will be a 'Junior' tournament [on Wednesday night] and a 'Senior' tournament [on Thursday night].

   a. If one of these nights is canceled due to weather, the make-up night will be Friday.

   b. If no make-up is required, Friday night will be an 'Open' tournament. In the 'Open', all 4H Robotics club members, alumni, leaders, and parents may participate.

2. Generally, the 'Junior' competition is for members with less experience and 'Senior' for more experienced members.

   a. Club leaders should determine the roster lists in advance, taking care to keep them reasonably balanced (i.e., the number of members in the Junior tournament should be around the same as the number of members in the Senior tournament).

   b. Leaders should exercise their judgment if a newer club member should probably be promoted into the Senior tournament (due to their high skill level), or if a long-time club member might be better suited to compete in the Junior tournament.

C. Round-robin

At the start of the tournament, all club members present and competing will be listed in the "4H 2018 Tournament" spreadsheet. **The spreadsheet will be used to manage team pairings and track cumulative scores.**

1. During the round-robin, each member will play in four (4) matches.

2. After each match, each team member on a team will earn the total score that their team achieved (in both the autonomous and the teleoperated periods).

3. Throughout the tournament, club members will earn a total score which will be the sum of all the scores they earned during the round-robin matches.

4. In any given match, members could be either Red or Blue, and could be placed in either the left quadrant or the right quadrant of their side of the field.

5. Members will be paired with different partners in each match (unless instructed otherwise by the tournament director).

6. Members will not play successive matches back-to-back (unless instructed otherwise by the tournament director).

7. If any competitors have played in at least one (1) match but for whatever reason cannot compete in all of their remaining matches, then other competitors will be randomly selected to stand-in for them in those slots so the round-robin can be completed.

8. At the end of the round-robin period, members will be ranked as follows:

   a. Total win/tie points – 1 point for each win, 0.5 points for each tie. Higher is better.

   b. If two members are tied for win/tie points, then whoever has the **most** total points scored *for*. Higher is better.

   c. If two members are also tied for points scored for, then whoever has the **fewer** total points scored *against*. Lower is better.

   d. If two members are still tied at this point, then the higher ranking is pseudo-randomly determined by the spreadsheet.

D. Playoffs

After the round-robin rounds are completed and the tournament director has determined the four players moving on, those members will compete in the playoff rounds to determine 1st, 2nd, and 3rd place.

Each face-off will be settled in a single match.

1. The four players will be the #1 through #4 "seeds" (#1 will be the player with the highest round-robin rank, followed by the other members in descending order).

2. The members going on to the playoffs will choose partners from the remaining pool of participants (unless instructed otherwise by the tournament director).

   a. They will play all the remaining matches with the same partner.

   b. The #1 seed will choose a partner **first**; followed by the #2 seed; then the #3 seed; and lastly, the #4 seed will choose his or her partner.

3. The first two sets of matches will be the #1 and #4 seeds facing off, and the #2 and #3 seeds facing off.

   a. The #1 seed gets to choose whether he or she wants to play the #1–#4 match sets first, or if the #2 & #3 seeds will play first.

4. After those two matches are completed, there will be a 3rd place of match followed by the final.

   a. The seeds who lost the #1–#4 match and the #2–#3 match will face off for 3rd place

   b. The seeds who won the #1–#4 match and the #2–#3 match will then face off in the final for 1st and 2nd place (winner of that match gets 1st, the other seed will get 2nd)

IV. Referee Guide [NOT YET UPDATED FOR 2018]

GENERAL GUIDELINES
- Each match should have **two (2) referees** – one for the Blue side (i.e., where the blue rings are stacked up) and one for the Red side (i.e., with the red rings)
- **Touch penalties:** If a player touches a robot or a field element during a match (i.e., after autonomous mode starts and before the Director says the match is over), that team incurs a Touch Penalty.
  - Return that player's robot to its home base; return *any of that team's rings* that the robot was touching to the ring starting positions on the field; and put a marker on that team's 'Touch Penalty' spindle.
- Players can only drive robots using the USB controllers. If someone uses an infrared controller or other device to manipulate a robot, remove that robot from the field for the rest of the match.

BEFORE A MATCH
- The field should be set up as in the diagrams, with eight (8) rings lined & stacked up in each corner. The rings placed in each side should be the opposite colors of the scoring pillars on that side.
- Player's robots should fit entirely within their respective start boxes. There's no limit on how tall they can be. Players may pre-set a ring either loaded onto, or placed touching, their robot.
  - If part of the robot goes outside of its 'start box', that team starts with a Touch Penalty marker.
  - If a robot fits entirely within the inside of the black outline, put a bonus ring on the Autonomous spindle.
- If a player is going to run an autonomous mode program, they must be able to start it moving on cue by either (a) pushing a button on the brick to start the autonomous program running, or (b) starting a program which then waits for the player to push a touch sensor attached to the robot to signal the robot to start moving.

DURING AUTONOMOUS MODE
- If a player <u>on your side</u> calls out "Leaners!", look <u>on your side</u> and pick up all rings (EXCEPT for Ringers) which are touching a Red or Blue scoring pillar – or which are touching a Ringer on a Red or Blue scoring pillar – and place them on the '**Autonomous**' spindle <u>on your side</u>. Purple pillar doesn't count!
- If a robot <u>from your side</u> goes through the central obstacle zone and any part of that robot intrudes <u>into the other side</u>, that player incurs a touch penalty. Move the robot & assess the penalty as described above.

AFTER AUTONOMOUS MODE FINISHES, BUT BEFORE TELEOPERATED BEGINS
- <u>On your side</u>, identify and score any rings which qualify as Leaners. This includes rings which are partially hooked on scoring pillars but not otherwise Ringers. Put those on the '**Autonomous**' spindle <u>on your side</u>.
- Make a mental note of where the two robots <u>on your side</u> are and any rings they're manipulating, in case something goes wrong with starting teleoperated mode and the robots & rings need to be put back.

DURING TELEOPERATED MODE
- If a player <u>on the other side</u> calls out "Leaners!", look <u>on your side</u> and pick up all rings (EXCEPT for Ringers) which are touching *a scoring pillar of the same color* – or which are touching a "ringer" on *a scoring pillar of the same color* – and place them on the '**Teleoperated**' spindle <u>on the other side</u>. Purple pillar doesn't count!
- If a robot <u>on your side</u> puts a Ringer onto a *different-colored pillar* (not counting the Purple pillar), put that ring back into a starting position & that team gets hit with a Touch Penalty.
- Robots should not remove rings which are already "Ringers". If a robot does so to a Ringer <u>on your side</u>, put that ring back as a Ringer and that team gets hit with a Touch Penalty.
- You can clear accidental entanglement between two robots without anyone incurring any touch penalties.

AFTER TELEOPERATED MODE FINISHES
- Remove the robots. If a robot is touching a legal Ringer, make sure the Ringer stays behind.
- <u>On your side</u>, identify and score any rings which qualify as Leaners. This includes rings which are partially hooked on scoring pillars but not otherwise Ringers. Put those on the '**Teleoperated**' spindle <u>on the other side</u>.
- Add up the total score <u>for your side</u> (i.e., count your side's scoring rings):
  - Opposite-colored ringers <u>on your side</u>: 8 for the thick pillars, 6 for the thin pillars
  - Same-colored ringers <u>on the other side</u>: 4 for the thick pillars, 3 for the thin pillars
  - Rings <u>from your side</u> on the Purple pillar: 2 points each
  - Rings <u>on your side's</u> 'Autonomous' spindle: 2 points each; 'Teleoperated' spindle: 1 point each
  - Markers <u>on your side's</u> 'Touch Penalty' spindle: -5 points each