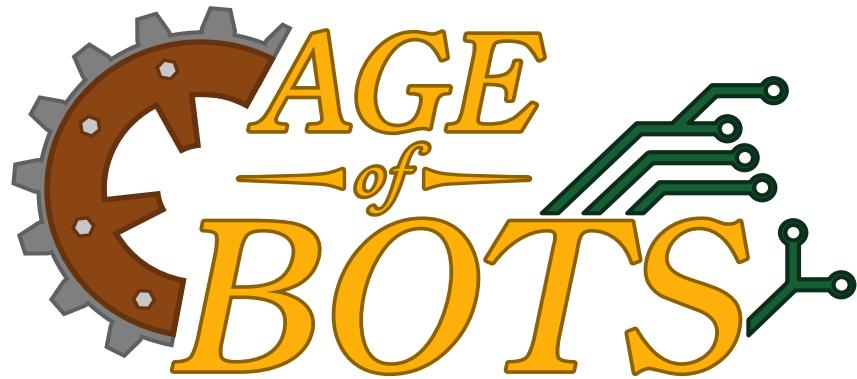




Eurobot^{Open} 2022 Rules

29th edition of the robotic contest - Eurobot
OFFICIAL version



NOTE: all images in this document are provided as a guide to illustrate the various paragraphs. In no case they can serve as a reference. Only the dimensions, colors and materials indicated in the appendix shall be taken into consideration.

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A. NOTICE

WARNING!

General remarks are annotated in the document. Please, pay special attention to these points.

This year the rules have been split up. Most parts remain the same for the Eurobot^{Open} and Eurobot^{Open} Junior contests, but to avoid confusion, each contest has its own rules as a single document.

Thus the particular cases specific to one of the competitions appear only in the document concerning it.

You will find the Eurobot^{Open} and the Eurobot^{Open} Junior rules and other information on the Eurobot^{Open} website (<http://www.eurobot.org/>)

Please note that the version of this release is noted down at the end of this page. For any inquiry, only an official version should be considered.

Changes or clarifications of the rules may be made during the year. We therefore strongly encourage all participants to check our website regularly (<http://www.eurobot.org/>) as well as your NOC's own website for news. You can also follow discussions, ask questions or get further assistance on our forum (<http://www.planete-sciences.org/forums/>).

Possible changes of the technical specifications will be announced on the Eurobot website, (<http://www.eurobot.org/>) or on the website of the National Organization Committee (NOC) in your country.

The forum responses from a referee are official responses taken into account for match refereeing and homologation stages.

In case of doubt regarding any point of the rules or the approval of robots, the referee committee may also be contacted at referee@planete-sciences.org.

Have a good reading!

B. CONTEST PRESENTATION

Eurobot^{Open} and Eurobot^{Open} Junior are two events addressed to young people interested in robotics. Teams are usually composed of students involved in an Eurobot^{Open} school project, a group of friends, or independent robotics clubs. They share the same goal: to offer young people an active learning process, to put into practice their knowledge and soft skills during a fun and friendly event.

The rules for both events (Eurobot^{Open} and Eurobot^{Open} Junior) are based on the same concept. As organisers, we intend to provide a common platform for the Eurobot^{Open} event. This platform is dedicated to autonomous robots for Eurobot^{Open} while for Eurobot^{Open} Junior, the robots are remote controlled. In this way, a Eurobot^{Open} organiser can easily set up a Eurobot^{Open} Junior contest and vice versa. Remember this when you will be organizing your official or unofficial event.

You're currently reading version
Eurobot^{Open} OFFICIAL
of 2022rules
(this version concerns fully autonomous robots)

The age limit for participating in the Eurobot^{Open} finals is 30 years. However, each team may have a supervisor whose age limit exceeds 30. It is important to note that teams that do not respect the age limit, will not be allowed to participate in the Eurobot^{Open} finals.

The technical challenge of Eurobot^{Open} is to build an autonomous robot alongside with an optional secondary autonomous robot.

A team is a group of young people who have built one or two robots for the event. A person can only represent one team. However, we encourage teams to share their expertise and knowledge.

An organization (club, school, etc.) can supervise and register several teams, if allowed by the registration requirements set by your National Organizing Committee. The acceptance of these requirements is compulsory to validate your registration and your entry.

The project can be supervised by someone over the age limit (teacher, parent, group leader, etc.), but all elements of the robot(s) must be designed by the participants. In this context, robots manufactured from a commercially purchased chassis or rolling base will not be accepted.

In the event that a robot was imagined, built or modified by the tutor alone, organisers can disqualify or reject the participation of the team in the competition. Students must be capable of describing and explaining the manufacturing process of their robots. It is strictly forbidden that the tutor modifies the robot during the competition. He can in exchange advise the students and guide them.

Eurobot^{Open} and Eurobot^{Open} Junior must take place in a friendly, fair-play spirit. As for every sport event, referees' decisions are pronounced without a possible recourse, except if an agreement between all stakeholders is met.

Eurobot^{Open} and Eurobot^{Open} Junior European finals gather teams selected after national qualifications. European finals take place in Europe, but all countries can participate. Countries where more than three teams are registered have to organize a national qualification to select teams that will attend the European finals.

Common parameters can change from one year to another. Accordingly, please read the rules carefully even if the chapters may seem familiar to you (playing area dimensions, robots dimensions, starting area dimensions etc.).

Robotics contests are public events. Therefore, we ask the teams to respect our rules of decency and safety (electrical, sound level, manners, etc.). These rules apply to the participants, their supporters and all the equipment they bring.

C. THEME PRESENTATION

After many years of exploring the world and the universe, our friends - the robots - have decided to explore their past. In 2022, the robots will go to search the ruins of an ancient robotic civilization for the forgotten fragments of their origin.

Our experienced archaeologists are expecting excavation squares, hidden treasures and sacred statues and nothing will stop them from recovering their past. .

So get out the shovels and pickaxes, because adventure is waiting for us!

Our missions will be:

- **Discovering the excavation square.**
- **Researching and analysing samples.**
- **Storing samples in the work shed.**
- **Proudly displaying your discoveries in the museum.**
- **Preserving and exhibiting the statuette.**
- **Returning to the campsite, at the end of the day.**
- **Estimating your performance.**

Warning! All actions are independent from one another and no specific sequence is imposed whatsoever. No single action is compulsory. Give careful thoughts to your strategy. It is strongly recommended to design simple and reliable systems with a limited number of actions.



Figure 1 – Overview of the playing area

D. PLAYING AREA AND ACTIONS

D.1. IMPORTANT INFORMATION

The organisers are committed to building the playing area with as much accuracy as possible. Nevertheless, they reserve the right to do minor modifications and adjustments.

No complaints regarding dimensional deviations will be taken into account.

Teams are warned that the surface condition may differ from one playing area to another and may also degrade over time.

D.2. PLAYING AREA

The playing area is a horizontal rectangular plan of 3000 mm by 2000 mm with borders of 70 mm height on each side. Depending on the building process, it may consist of one or more pieces (eg 3 pieces of 1000 mm per 2000 mm).

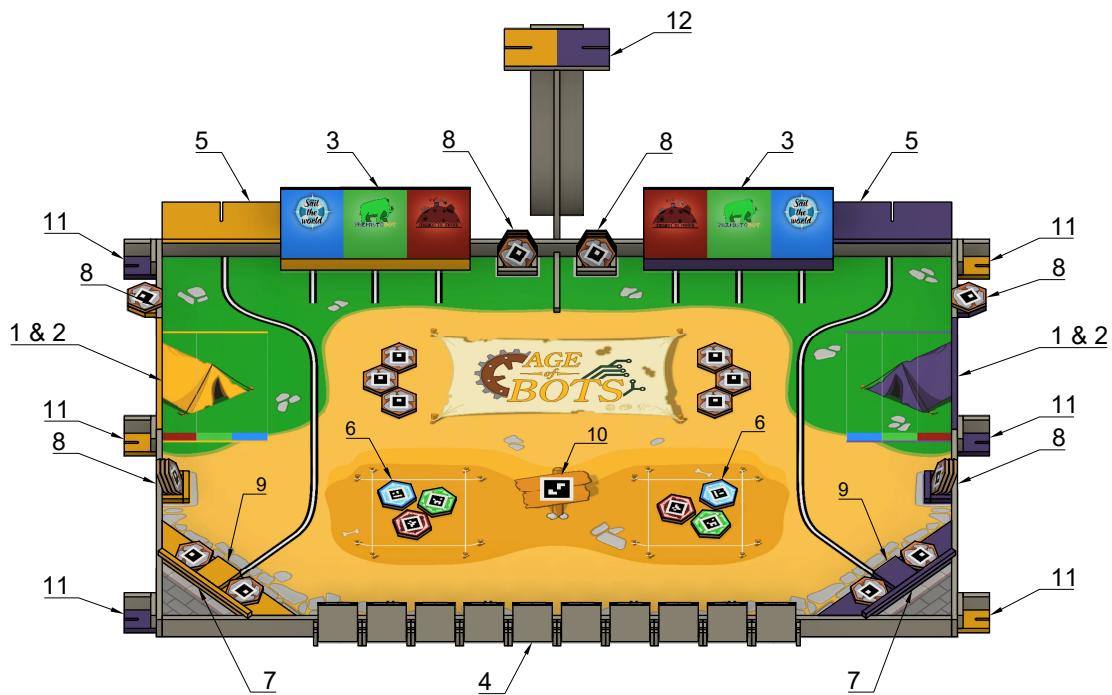


Figure 2 – Detailed view of the playing area

- | | |
|-----------------------|-----------------------------|
| 1. Starting areas | 7. Work shed |
| 2. Campsite | 8. Dispensers |
| 3. Gallery | 9. Pedestal |
| 4. Excavation squares | 10. ArUco marker number 42 |
| 5. Exhibition hall | 11. Fixed beacon supports |
| 6. Excavation site | 12. Central tracking device |

Full specifications of the playing area and game elements (dimensions, positions at the beginning of the match, colors and other references) are listed in the appendix.

In the remainder of this document, horizontal and vertical directions are stated relative to the playing area. Notions of “left”, “right”, “front” and “back” are stated with respect to the spectator’s point of view, located on excavation squares side.

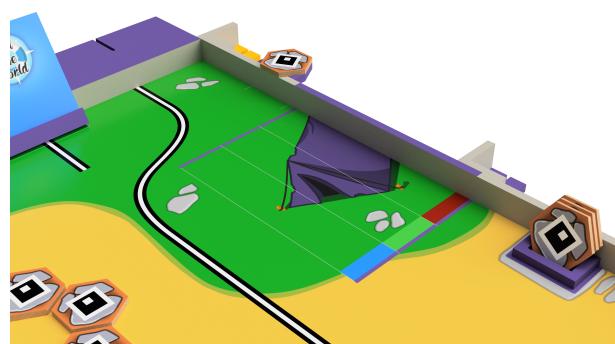
D.3. STARTING AREAS

D.3.a. DESCRIPTION

Each team has a starting area for their robots. It is a rectangular surface delimited by a border of the team's color (the border is included in this zone).



(a) yellow starting area



(b) purple starting area

D.3.b. CONSTRAINTS

At the end of the setup time, the vertical projection of the robots must not exceed the limits of the starting area.

Make sure your robots can fully enter the starting area. Overtaking above the lateral border but not beyond the playing area is allowed.

The starting area does include the color lines.

Robots are not allowed to enter the starting area of the opposing team during the entire match.

D.4. DESCRIPTION AND LAYOUT OF THE PLAYING ELEMENTS

Samples : The samples are solid hexagons with 150 mm of outer diameter, 15 mm of thickness and a maximal weight of 150 g. A sample got two faces: a treasure face, and a rock face. There are 30 samples on the table, and they are initially placed on predefined positions (each time with one of each color):

- 3 on the surface of the playing area in front of the starting areas; they are positioned with the "rock" side facing up, and enable for both teams.
- 3 on the surface of the playing area inside the excavation site; they are positioned with the "treasure" side facing up, and enable for both teams.
- 1 in the horizontal dispenser placed on the lateral side close to the campsite, and reserved for one team according to its color.
- 2 in the horizontal dispensers placed close to the Statuette (genuine), included on the work shed, and reserved for one team according to its color.
- 3 in the vertical dispensers placed beside the galleries, and enable for both teams.
- 3 in the vertical dispensers placed beside the campsite and reserved for one team according to its color.
- The order of the samples in horizontal dispensers is defined once for all : red one is touching the border, green one is the intermediary sample and blue one is located on the playing side.

ArUco 4x4 tags are printed at the center of the hexagonal faces of the samples in the following way:

- Tag number **47** on the **treasure** face of the **red** samples.
- Tag number **13** on the **treasure** face of the **blue** samples.
- Tag number **36** on the **treasure** face of the **green** samples.
- Tag number **17** on the **rock** face of **all samples**.

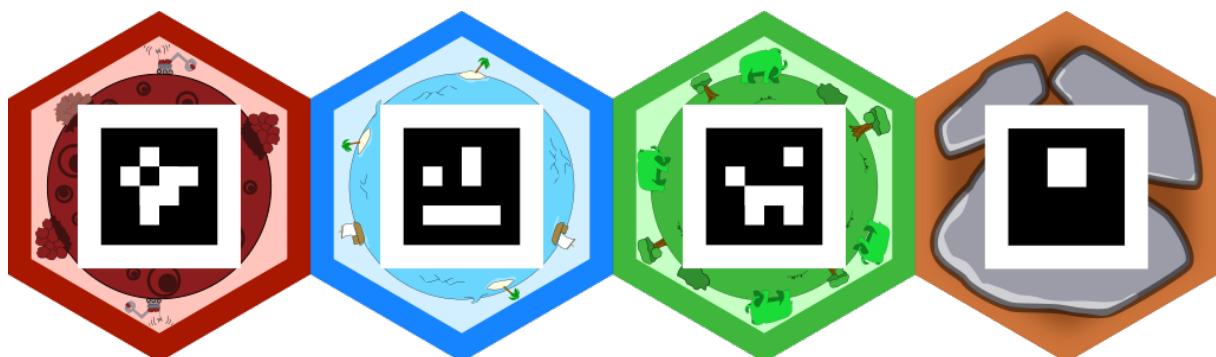
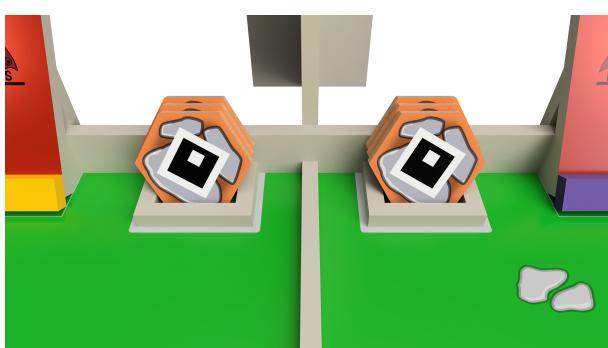
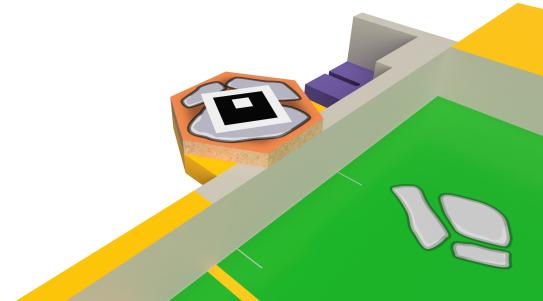


Figure 4 – The 3 face "treasure", and the face rock



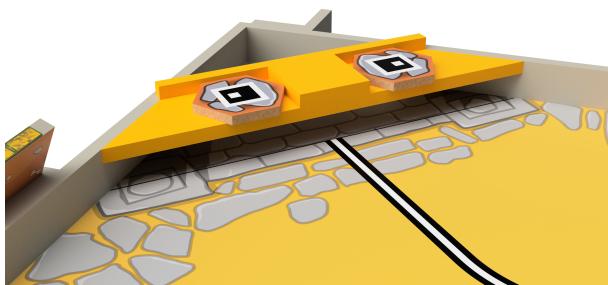
(a) Dispensers



(b) Dispensers

Campsites: These are the colored zones for each team located along the lateral side of the playing area, and split in 3 colored area, one for each historical period. The campsites are the start zone of each team.

Work shed: The work shed is the area under the statuette support, forming a triangle delimited by a red line and by the closest table corner. Each teams work shed is located on the same side as their starting area.



(a) Work Shed and Pedestal (inner view)



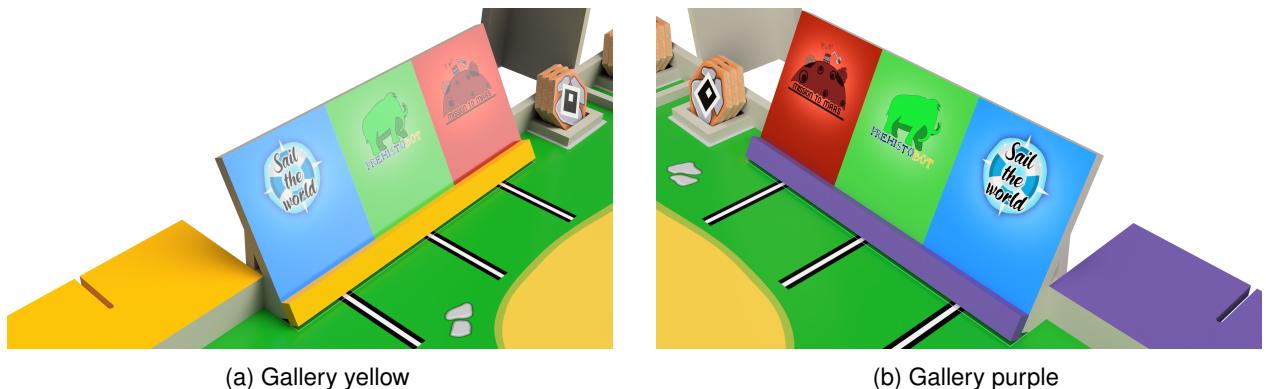
(b) Work Shed and Pedestal (outer view)

Excavation site: The excavation site is shared by the two teams and the samples are randomly scattered inside.



Figure 7 – Excavation site

The galleries: The gallery is the support at 60° placed on the font of the table and split in 3 colored area, one for each historical period, and located near the display cabinet. Each team has its own gallery on its table side.



(a) Gallery yellow

(b) Gallery purple

Excavation square: The excavation square are solid square placed on the front side of the table, and must be toggle by the robots. The excavation square are distinguished by a marker on the upper side, and by a vinyl of each face.

On inner face, a vinyl is placed with the team's color and its treasure, or a red cross.



Figure 9 – Excavation square

The excavation square can be placed according to the configuration:



Figure 10 – Excavation square possible configurations

Markers: Located on the top side of the excavation square, the markers are PCB linking the excavation square to a team according to the resistance which can be measured across their surface.

The markers with a resistance of 470 Ohm are associated with the team purple .

The markers with a resistance of 1 kOhm are associated with the team yellow .

The markers with a resistance of 4,7 kOhm are not associated with any team. They must not be flipped.

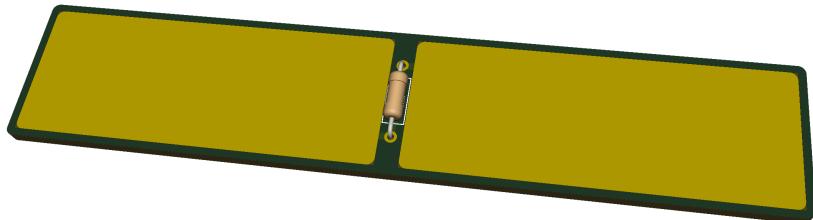


Figure 11 – marker

Statuette (genuine): Made by the team, the statuette is an element placed on the pedestal of the team before the match.

Replica (of the statuette) : Provided by the organisation, the replica is an element pre-loaded in a team's robot or placed in the display cabinet before the match.

Pedestal: Support of the statuette, in the colour of each team, positioned at the center of the diagonal beam above the work shed.

Exhibition hall: The horizontal surface of the exhibition hall is at the level of the top of the playing area border, located at the back of the table, on the same side of the starting area of the team.

Display cabinet: Made by the teams, the display cabinet is the place to deposit the statuette after the swap. It must be fixed on the exhibition hall before the match.

D.5. FINDING THE EXCAVATION SQUARE

During their researches, robots can have some surprises! After their arrival on the site, they must detect the most promising squares before revealing their treasures. And be careful not to be too greedy, at the risk of having unpleasant surprises.

D.5.a. DESCRIPTION AND LAYOUT OF THE PLAYING ELEMENTS

For this action, only the excavation squares are used.

D.5.b. ACTIONS AND CONSTRAINTS

Actions:

- Robots have to identify the excavation squares associated to their team, and flip them.

Constraints:

- The square already flipped can not be raised.
- An excavation square is considered as flipped when its marker is under the playground level.
- The reveal of a team's red square invalidate all the team's excavation squares.
- Robots are not allowed to lift the excavation square: they must remain in contact with their support at all times during the match.
- The square are split in 3 sections:
 - 3 squares on right reserved to the team purple
 - 3 squares on left reserved to the team yellow
 - 4 central squares for both teamsThe robot are not allowed to use the squares of the other team.

D.5.c. POINTS

- **5 points** for each revealed excavation square at the team's colour;
- **5 points additional** if a least a excavation square at the team's colour is revealed, and the red square at the team's side is not revealed;

D.6. RESEARCH AND ANALYSIS OF SAMPLES AT THE CAMP SITE

The archaeology-robots set out on a mission to reveal buried riches. Once they have brought their discoveries to light, they will be able to analyse them.

D.6.a. DESCRIPTION AND LAYOUT OF THE PLAYING ELEMENTS

The samples and campsites are used for this action.

D.6.b. ACTIONS AND CONSTRAINTS

Actions:

- Collect the samples to bring them to the campsite
- Sort the samples inside the campsite, in function of the color of the treasure side of the sample and the color of the campsite zone.

Constraints:

- To be considered as valid on the campsite, a sample must be in the vertical projection of the campsite surface, regardless of its position.
- A sample is considered as sorted over its historical period if it is facing "treasure" side up (the colors of the area and the treasure side must be the same) and at least three of its corners are included in the vertical projection of the corresponding period.
- Each campsite is assigned to a team. They are not accessible to the opposite team, which must not under any circumstances move the samples that are already placed there.
- If a sample is still under a robot's control at the end of the match, it will not be counted.
- A sample is considered out from the dispenser when its vertical projection is not intersecting the vertical projection of the dispenser.

D.6.c. POINTS

- **1 point** for each sample removed from a distributor on the team side (including the shared distributor and the work shed);
- **1 point** for each sample inside the camp;
- **1 additional point** for each revealed and sorted sample inside the camp;

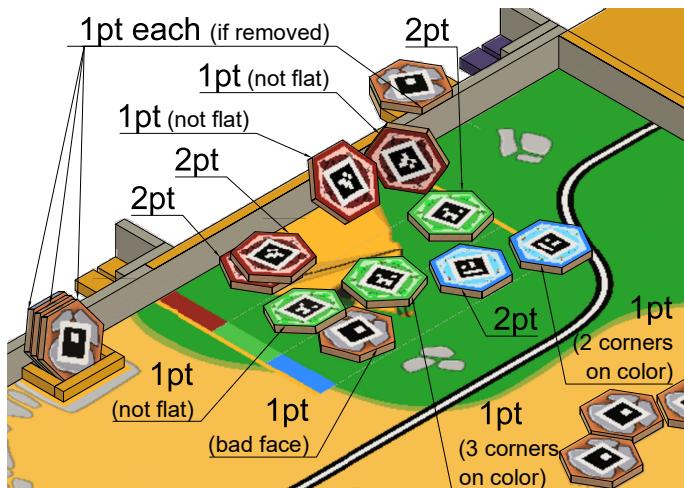


Figure 12 – Sample's validity within the camp

D.7. EXHIBITION GALLERY

In a museum with a large gallery, the archaeology-robots will have the task of exhibiting the most beautiful samples.

D.7.a. DESCRIPTION AND LAYOUT OF THE PLAYING ELEMENTS

For this action, the robots will interact with the samples and the gallery.

D.7.b. ACTIONS AND CONSTRAINTS

Actions:

- Collect the samples to place them on the gallery.
- Sort the samples in the gallery.

Constraints:

- For a sample to be considered valid on the gallery, it must be in contact with the surface of one of the historical periods.
- A sample is considered as sorted on its period if its "treasure" side is facing the public (the colors of the area and the treasure side must be the same) and at least three of its corner are touching the period.
- Each gallery is assigned to a team. They are not accessible to the opposite team, which must not under any circumstances move the samples that are already placed there.
- If a sample is still under a robot's control at the end of the match, it will not be counted.
- Only 9 samples will be scored, starting with the ones with the lower score greater to 0.

D.7.c. POINTS

- **3 points** for each sample inside the gallery;
- **3 additional points** for each revealed and sorted sample inside the gallery;

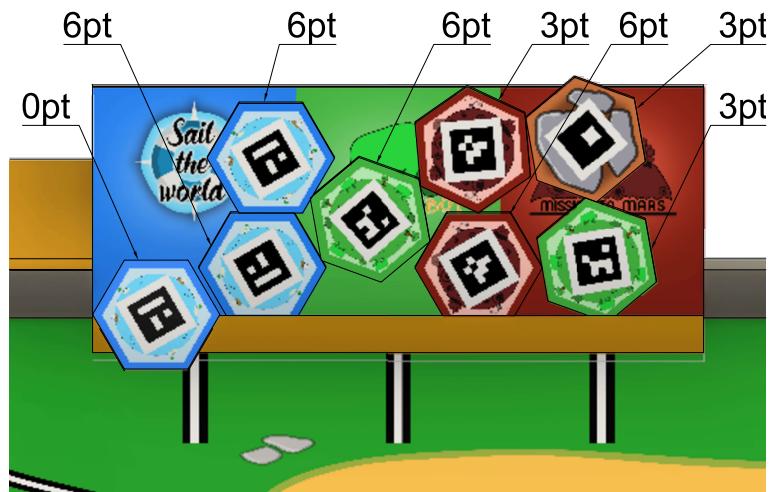


Figure 13 – Sample's validity within the gallery

D.8. STORING SAMPLES IN THE WORK SHED

D.8.a. DESCRIPTION AND LAYOUT OF THE PLAYING ELEMENTS

For this action, the robots will interact with samples and the work shed.

D.8.b. ACTIONS AND CONSTRAINTS

Actions:

- Send/drop the samples in the work shed

Constraints:

- For a sample to be considered as valid in the work shed, at least 3 of the corners of one of its hexagonal faces must be in contact with the surface of the playground, and in the triangle constituting the work shed, delimited by the field borders and the red line.
- If a sample is still under a robot's control at the end of the match, it will not be counted.
- Each work shed is assigned to a team. They are not accessible to the opposite team, which must not under any circumstances move the samples that are already placed there.

D.8.c. POINTS

- **5 points** for each sample inside the work shed;

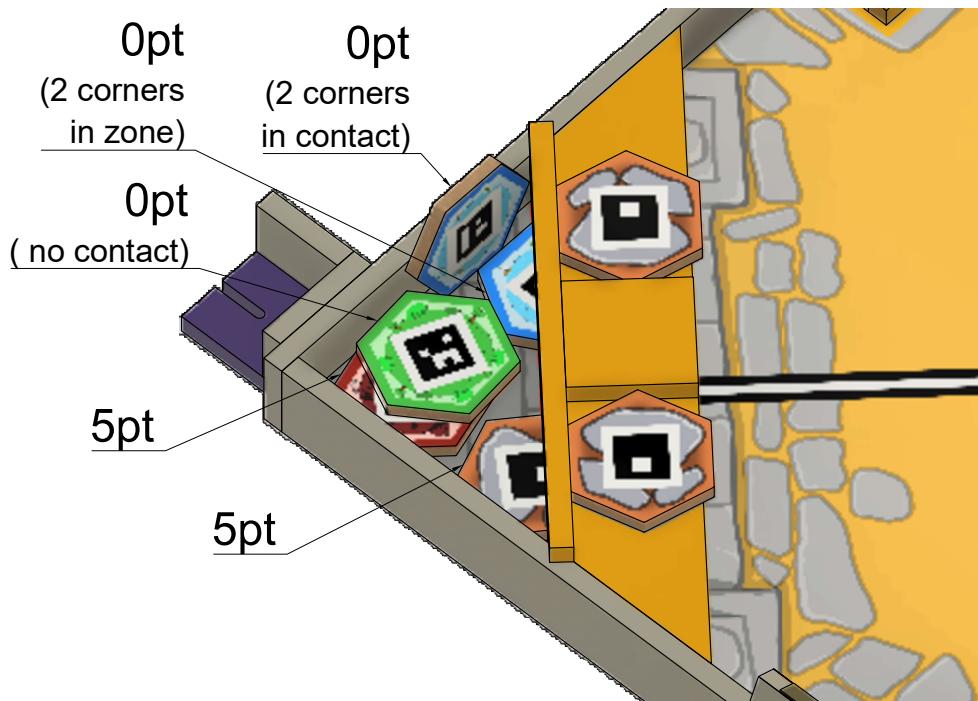


Figure 14 – Sample's validity within the work shed

D.9. TO PRESERVE AND EXHIBIT THE STATUETTE

A statuette, a wonderful treasure of the history, was found by a previous expedition. To preserve it, the robots have to protect it from the elements and exhibit it in the display cabinet, and swap it with the replica on the original site.

D.9.a. DESCRIPTION AND LAYOUT OF THE PLAYING ELEMENTS

The statuette, replica, pedestal and display cabinet are used for this action.

D.9.b. ACTIONS AND CONSTRAINTS

Actions:

- The team has to put its statuette on its pedestal during the preparation time.
- During the preparation time, the team must preload the replica in one of those places:
 - in one of their robots;
 - in the display cabinet;
- During the match, the robots have to collect the statuette from the pedestal.
- Once the statuette has been collected, the robots have to put it in the display cabinet.
- The robots have to put the replica on the pedestal in place of the statuette.

Constraints:

- The replica and the statuette cannot be stacked.
- The replica is considered as valid on the pedestal only if it is on the pedestal at the end of the match.
- The replica is a cube of 60 mm of side made of wood with a maximum weight of 200 g.
- The statuette is considered as valid in the display cabinet when its entire volume is included in the dimensions of the display cabinet.

- The statuette cannot move by itself, neither inside the display cabinet nor on the playing area.
- The statuette built by the team has the following dimensional constraints:
 - It needs to fit inside a cube with 120 mm sides.
 - It needs to be larger than a cube with 60 mm sides.
- The weight of the statuette must not exceed 600 g.
- The statuette can incorporate a power supply. In this case, it must include an emergency stop button reachable at any moment.
 - It is tolerated to have a simple toggle switch as the emergency stop button.
 - The button must be visible and accessible by the referees at all times.
- A statuette still under a robot's control at the end of the match will not be counted.
- A replica still under a robot's control at the end of the match will not be counted.

D.9.c. POINTS

- **2 points** for installing the statuette on the pedestal during preparation time;
- **5 points** if the statuette is missing from the pedestal at the end of the game;
- **10 points** if the replica is on the pedestal at the end of the game;
- **15 points** if the statuette is inside the display cabinet at the end of the game;



Figure 15 – Displacements of the statuette and the replica

D.10. DISPLAY CABINET

D.10.a. DESCRIPTION AND LAYOUT OF THE PLAYING ELEMENTS

The display cabinet and statuette are used for this action.

D.10.b. ACTIONS AND CONSTRAINTS

Actions:

- The team must setup its display cabinet in the dedicated zone during the preparation time.
- The display cabinet will be activated during the match by placing the statuette inside it. The aim is to highlight the statuette with at least one luminous element.

Constraints:

- The activation of the display cabinet must be done at the moment the statuette is placed. The activation can be done by any means, wireless included.
- The display cabinet must have at least one luminous element activated by the statuette being placed. This element must be visible by the public but must not dazzle anyone. This luminous element can be contained inside the statuette, in this case the electrical supply must depend on the cabinet one.
- The display cabinet is considered as activated if it has clearly changed in form or aspect compared to the beginning of the match.
- The vertical projection of the display cabinet is not allowed to cross the limits of the exhibition hall at any time.
- The display cabinet has the following dimensional constraints (statuette included) :
 - Maximum depth : 222 mm.
 - Maximum width : 450 mm.
 - Maximum height : 430 mm.
- The weight of the display cabinet must not exceed 3 kg.
- The horizontal plane of the exhibition hall has a 10 mm wide groove running from the center of the support to the center of the back side. The groove must be used to fix the display cabinet to the exhibition hall by using a threaded rod of 8 mm diameter and a wing nut.
- Apart from the fixing screw and nut, no system or element of the display cabinet is allowed to protrude under the exhibition hall. The screw size is not counted in the height measurement of the display cabinet.
- The display cabinet must remain lit after the end of the match.
- The display cabinet can contain an electric power supply. In that case an emergency stop button which directly turns off the display cabinet must be present. The emergency stop button has the same specification as the emergency stop button of the robot. The switch must be visible, easily accessible and stay at the same height. The display cabinet can be powered before the match, without being activated.
- The action must not be dangerous for the public, the peoples around the table, the playground or the robots.
- The display cabinet cannot be activated by an external element (team crew, remote control, ...)

D.10.c. POINTS

- **2 points** for installing a display cabinet during preparation time;
- **5 additional points** if the display cabinet is activated;

D.11. RETURN TO THE EXCAVATION SITE OR THE CAMP

D.11.a. DESCRIPTION AND LAYOUT OF THE PLAYING ELEMENTS

The campsites and excavation sites are used for this action.

D.11.b. ACTIONS AND CONSTRAINTS

Actions:

- After the end of the match the robot must be stopped in their own campsite or on excavation site on their side.

Constraints:

- To be considered valid a robots vertical projection must be at least partially inside the limits of the campsite or the excavation site.
- A team with multiple robots can only validate this action if both robots are in the campsite or the excavation site.

D.11.c. POINTS

- **20 points** if all the team robots are inside either the camp either the excavation site;

D.12. ESTIMATE THE PERFORMANCE

D.12.a. DESCRIPTION AND LAYOUT OF THE PLAYING ELEMENTS

The device for displaying the score estimation during the match must be made by the team:

- It can be static (sheet of paper, slate, etc.).
- Or dynamic (electronic display); located either on the robot or on the display cabinet (please make sure that the display cabinet is activated).

D.12.b. ACTIONS AND CONSTRAINTS

- The team must evaluate the number of points scored in the match by its robot(s). For this, two exclusive options:
 - Pre-match evaluation on a static display: the team writes the score it intends to make during the match.
 - Evaluation during a match on a dynamic display device.
- The display area and its reading orientation must be easily visible and identifiable by the referees.
- The estimated score is an integer and must be expressed in decimal.
- It is allowed for a team with two robots to design a display for each robot. In this case, the score assessment will be the sum of the values of the two displays, or by a composition of the two display if the two robots are side by side at the end of the match; the type of reading and the order must be explained to the referees at the beginning of the match.
- In the case of dynamic displays, the estimated score must still be displayed after the end of the match.
- Under no circumstances should the score change once the match has ended, otherwise the bonus will be lost!

D.12.c. POINTS

The assessment is based on all the previous actions.

The estimation bonus is calculated as follows: **Bonus = (0.3 x Score) - Delta**

- The score is the one scored by the team during the match on standard actions.
- The delta is the difference between the score made by the team during the match and the score estimated by the team. This one is always positive (Absolute value).
- The bonus is an integer value (rounded up).
- The bonus is added to the points of the team.
- A negative bonus is reduced to 0.
- A score of zero cannot give right to any bonus.
- The bonus for not "forfeit" is not include in the performance estimation.
- The penalties are not include in the performance estimation.

E. PROJECT PRESENTATION

Both Eurobot^{Open} and Eurobot^{Open} Junior encourage participants to practice science in a funny and original way. Our main objective is to assist and value your projects conceived during the year. To achieve this, the teams must conceive a poster, and, organizers may require the teams to create a technical documentation of their robots.

We expect to see attractive, innovative robots that respect this edition's technical constraints and rules. Being creative and original will add value to your work as much as the performance of your robot(s) during the matches. By doing this presentation, you will increase the communication value of your project and the visual effect of your robots, for both the public coming to the events as well as for your own satisfaction. Having created something aesthetically and functionally complete, will strengthen your work attitude during and after the competition.

TECHNICAL POSTER

Each team is required to provide a technical poster of their robot. This poster should present information related to the design of the robot (drawings, technical references, design specifications, etc.). It should be at least size A1 (594x841 mm) and ideally it should be printed. This poster is intended to encourage exchange and communication between teams.

Special vulgarization efforts should be made to make the content of the poster accessible to the general public. Ideally, the poster should include pictures and charts to explain the concept.

The poster must also include:

- the name of the team.
- the names of team members.
- the country of the team.
- the country flag of the team.

This poster will be posted on the booth of each team during the competition. For the international Finals, an English version is requested. The chosen resolution must guarantee the legibility of all texts. The resulting PDF file must not exceed 25 MB. The PDF version of the poster may be sent to the organization prior to the meeting via your National Organizing Committee.

In general, the organization encourages teams to communicate around their projects on the Internet, social media, via forums, etc.

F. THE ROBOTS

F.1. FOREWORDS

Each team is allowed to register a maximum of two robots, called respectively "main robot" and "secondary robot". Each one have identical dimensional constraints. The set of both robots have additional dimensional constraints.

For Eurobot^{Open}, both robots are autonomous.

The construction of a secondary robot is optional. The aim is to allow teams with a large number of members to work on a second project. It is recommended for beginning teams to concentrate on building a single functional machine. Having one robot that works well is better than having two that do not move.

A secondary robot can compete only with the main robot with which it was designed and approved. However it can compete alone if the main robot cannot participate. It cannot be re-approved with another main robot.

A team's main or secondary robot must not block the other team's robots. In the event of a voluntary action of this type indicated by the referee, the team may be penalized.

A robot must not intentionally cause damage to the opposing robots or to the playing area and its elements.

Only two team members are allowed to enter the backstage and on stage. They transport all the equipment (robots, beacons, etc.). The path to the playground may include stairs, especially when entering the stage. It is therefore recommended to design easily transportable equipment.

The main and secondary robots must be made up of elements that are fixed to each other (so robots cannot leave parts or elements on the playing area), with the exception of the playing elements.

Robots must not attach themselves to the playing area (e.g. with a suction cup).

A robot must not prevent the opponent from scoring points. A robot that remains static (e.g. if it has finished all its actions) must move to a location that does not disturb the opponent, otherwise it risks getting penalties!

A game element can be moved:

- for the purpose of scoring points with;
- if justified by performing another game action (e.g. if a common game element is located on the robot's path). The number of elements that are then moved (especially from their position at the beginning of the game) must remain minimal.

Deliberately vibrating the table or any other irregular action exposes the team to a refusal of approval.

Each team must design a unique and original set of robots under risk of disqualification. It is therefore not allowed to design robots that are significantly similar to robots of other teams (e. g. identical rolling bases or actuators). In case of doubt, contact the refereeing committee.

Be imaginative! For example, as an innovation but also to offer the public and the media an attractive show, your robot can use sounds, display expressions, etc.!

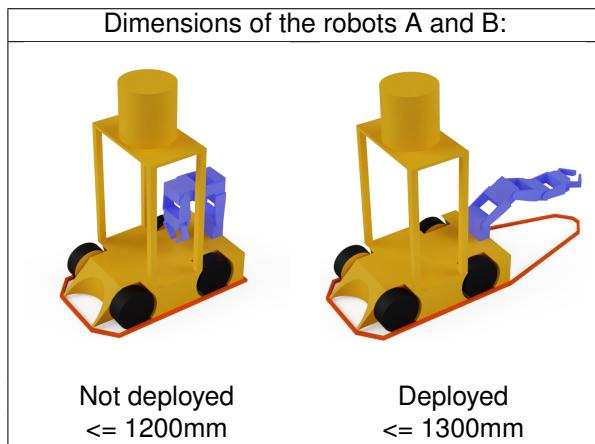
F.2. DIMENSIONS

Warning: the dimensions of Eurobot^{Open} robots are identical to those of Eurobot^{Open} Junior. Eurobot^{Open} Junior participants can more easily access the Eurobot^{Open} meetings. The Eurobot^{Open} Junior robot will only need

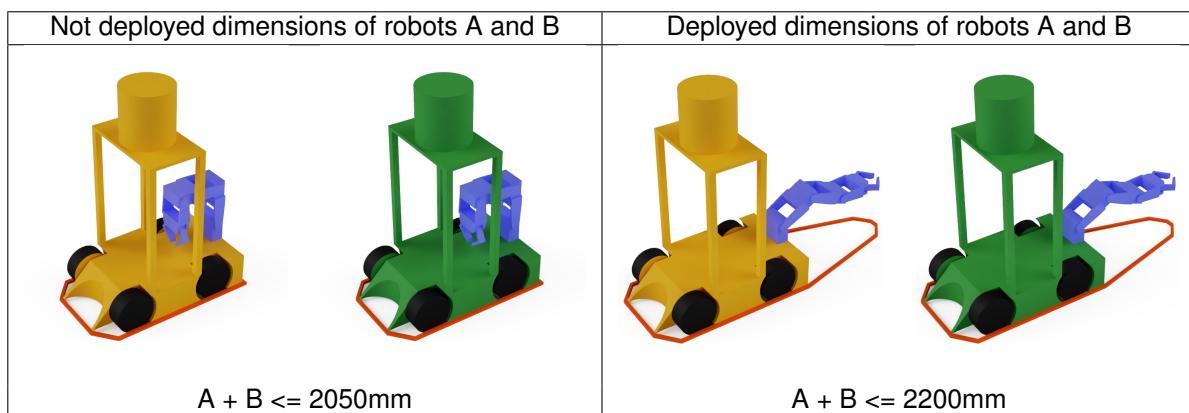
modifications to make it autonomous.

Dimensions of the robots :

The perimeter of a robot is the perimeter of the convex shell of its vertical projection on the ground. It is measured by surrounding it as shown in the illustrations below:



The perimeter of a robot must not exceed 1200 mm at the departure time. The perimeter of the fully deployed robot shall not exceed 1300 mm during the match. It is allowed to change the convex hull shape during the game, as long as the perimeter of this one always respects the maximum perimeter constraint.



The sum of the perimeters of the two robots at the start of the match must not exceed 2050 mm. The sum of the deployed perimeters of the two robots must not exceed 2200 mm. Be careful, the sum of the deployed perimeters is equal to the sum of the maximum of the deployment perimeter of each of the two robots during the entire duration of the match. A robot cannot therefore reduce its perimeter during the match to allow a second robot to deploy more.

If a physical connection (mechanical, electrical, magnetic,...) exists between two robots of the same team, then the group formed by the two robots is in fact considered, for the perimeter constraints, as a single robot, until the group is dissociated. Note that a simple contact is not considered a physical connection.

At any time during the match the height of each robot must not exceed 350 mm. However, it can be tolerated that the emergency stop button exceeds this limit height to reach 375 mm.

This height excludes the beacon support mast, any sensors and electronic circuits integrated under the beacon holder mast.

When the robot manipulates an object, the height of this object cannot exceed 350mm in order not to disturb the use of beacons.

F.3. ENERGY SOURCES

All potential sources of energy stored in the robots and other secondary systems are permitted (batteries, springs, compressed air, gravitational energy, etc.), with the exception of sources of energy using chemical reactions such as combustion or pyrotechnics processes, which are prohibited for safety reasons. It is obvious that the use of living beings is strictly forbidden.

In addition, the use of corrosive products is strictly prohibited and liquid splashes are not permitted.

If you have any doubt about unconventional energy sources, ask the referees' committee as soon as possible, providing the corresponding datasheets.

In order to avoid any risk of fire, attention should be paid to the diameters of the wires, depending on the intensity of the currents flowing through them. It is also strongly advised to protect the electrical installation with a fuse, wired close to the batteries.

Batteries:

If the team chooses a battery power supply, we remind that only unmodified batteries can be used.

Teams must be able to play three games in a row. Note that this includes the time required to set up, during which the robot will be powered and awaiting the start.

Therefore, we strongly recommend that teams bring several sets of batteries and provide easy access to them in the robot for their replacement. Teams are reminded that it is essential to have a set of spare batteries, fully charged and available at all times.

Note on the use of Lithium-based batteries:

Lithium batteries are known for their lack of stability and can easily ignite when certain precautions are not taken.

This type of battery is therefore authorized under the following conditions:

- Suitable battery charger, which must be submitted for approval.
- Batteries kept in certified and unmodified fireproof bags (whether in the robot or on the stand, even in storage).
- A system for detecting underloads is highly recommended.
- Exception in the case of the following batteries, authorized without the conditions listed above:
 - Lithium batteries for LEGO Mindstorm / laptop / mobile phone / power tools, provided that they have not been dismantled and are used for the intended purpose of the manufacturer.
 - Lithium-Iron batteries (LiFePo4)

F.4. OTHER DESIGN CONSTRAINTS

Visibility: A rectangular space of 100 x 70 mm per robot must be left free on one of the side faces. As far as possible, this space must be visible from a camera located at the height of the playing field. It must also be visually accessible during the majority of the match. The teams will receive stickers printed by the organization (team number, sponsors etc), which they have to place on these open spaces.

Teams are strongly encouraged to make all element manipulations visible from the outside. By doing this, you allow the audience and the cameras that film the event to see how the transport of your game elements works. It is also highly recommended (but not mandatory) to close empty spaces inside the robots to facilitate their detection by other robots.

Starting cord of autonomous robots: Robots must be equipped with a starting device easily accessible. This device has to be triggered by pulling the end of a cord at least 500 mm long. This cord must not stay attached to the robot after departure.

No other starting system (remote control, manual rocker switch, etc.) will be approved.

The start of one robot can launch the other robot.

Emergency stop button of autonomous robots Autonomous robots must be equipped with a red emergency stop button of at least 20 mm in diameter. It must be placed on the top of the robot in a visible position and in a non-risking area to be immediately accessible by the referees at any time during the match.

In its higher state, the button may exceed the robot's height by 25 mm. The emergency stop button must be operated by a simple downward movement (for example, by hitting it with the fist).

Pressing this button must stop all robot actuators immediately !

Automatic shutdown Each robot must be equipped with a system that stops the movement of the robot and all its actuators automatically at the end of the 100 seconds (a match's duration). The dynamic displays that are present on the robots, can remain on.

Avoidance system (optional for Eurobot^{Open} Junior) All teams are required to equip their robot(s) with a system for detecting opposing team's robots.

This system is intended to prevent collisions between robots, during a match. This point will be systematically checked during the approval. Referees will pay special attention to non-fairplay teams that deliberately deactivate their avoidance systems after passing the approval stage.

Voluntary deactivation of robot avoidance systems may result in complete disqualification of the team !

Warning: As most of the events are filmed, please adapt your avoidance systems so that it is not disturbed by autofocus cameras and filming.

Embedded/ on-board beacon support system In order to facilitate robot identification in the field, robots must integrate an embedded beacon support system to identify the beacon of the opposing team. This support system must respect the following points:

- have a convex hull, in any altitude, with a minimal size of a 70 mm diameter circle and with a maximum size of a 100 mm square;
- be solid and opaque (a material able to intercept the light at least in the infrared spectrum; and opaque for the visible spectrum too, except in case of a justification needed);
- have its upper surface flat and positioned at a height of 430 mm above the playing area to allow the beacon of the opposing team to be placed in good conditions;
- the top of surface of the platform will be fully covered of VelcroTM (hook side);
- the vertical projection of the on-board beacon support must be located as centrally as possible and within a circle of 20 cm diameter around the center of the robot;
- the embedded beacon support must only accommodate sensor systems. The beacon support must be as hollow as possible. For teams using rotating devices, make sure that the portion of cylinder removed has a height of less than 2 cm (except for the minimum size of the envelope convex).
- the on-board beacon support must be stable, motionless regarding the robot structure and must be able to support a minimum weight of 400 g (the opposing team's beacon and the aruco tag)

However, a team may choose not to equip their robot with an embedded beacon support system. In this case, if the opposing team requires a beacon support, and the use of it (either to detect the mast or to place a beacon), the team or the robot concerned may be revoked for that particular game.

Wifi networks:

At multiple contest locations, the number of active Wifi devices can disturb the robots implementing this technology for communication. To answer this issue, it's recommended (but not mandatory) to use the 5 GHz frequency rather than the 2.4 GHz one.

F.5. SECURITY CONSTRAINTS

F.5.a. GENERAL ASPECTS

All systems (robots, beacons and accessories) must comply with the European standards. This is also mandatory for the countries outside the EU that are organizing national meetings or send independent teams for the European Finals. Among other things, these security standards must respect safety rules and must not endanger participants, organizers nor public.

Robots must not have protruding or pointed parts that could be dangerous or cause damage.

The use of liquid, corrosive, pyrotechnic and living beings is prohibited.

All robots must comply with standard "low voltage" regulations. As a result, **the on-board voltages must not exceed 48 V.**

Potential differences greater than 48 V may exist, but only within closed commercial devices (eg lasers, LCD backlights, etc.) and only if these devices have not been modified and comply with national and European regulations.

In general, any system deemed by the referees' committee as dangerous will not be approved, and must be replaced, in order to be accepted in the competition.

F.5.b. LASERS

Only laser systems and classes defined according to the IEC60825 international standards are accepted. Teams using lasers must provide the manufacturer's document mentioning **the class of the device** (this information is normally always available on the system itself).

On the basis of this classification, class lasers:

- 1 and 1M are accepted without restriction
- 2 are tolerated only in case the laser beam do not exceed the play area
- 2M, 3R, 3B and 4 are strictly forbidden.

WARNING: Disassembling or modifying devices using laser sources often results in a change of class. Laser devices must not be altered and only be used in the state of their commercialization (laser device = source + optics + electronics).

F.5.c. HIGH POWER LIGHT SOURCES

When using a high intensity light source, the light intensity must not be dangerous to the human eye in case of direct contact. Note that some types of LEDs have warnings. Be responsible, as your machines are evolving

in front of a general audience!

In the case of slightest doubt, the organization reserves the right to request the manufacturer's specifications to verify the non-dangerous nature of the lighting system used. If it turns out that the system is potentially dangerous, it may result in revocation of lasers class 2M and more.

F.5.d. COMPRESSED AIR SYSTEMS

Compressed air systems should not exceed 4 bars, except in pre-assembled commercial products, and only if :

1. these devices have not been modified.
2. They are compliant with european safety regulations.
3. they are safe.

The use of pressurised gas cartridges such as CO2 cartridges is prohibited

G. BEACON TRACKING SYSTEM

G.1. GENERAL POINTS

Teams can develop a complete beacon localisation system; in this extent there are specific zones on the playing area where these beacons can be fixed.

At the opponent's request and only if justified, the robots could be equipped with a flagpole to fix an opponent's beacon above (see subsection F.4.).

All beacons (fixed beacons, embedded beacons and central tracking device) must remain in place on their supports throughout the duration of the match. All robot safety instructions equally apply to beacons.

Fixed beacons, center marker, beacons, embedded beacons and their respective supports are described below.

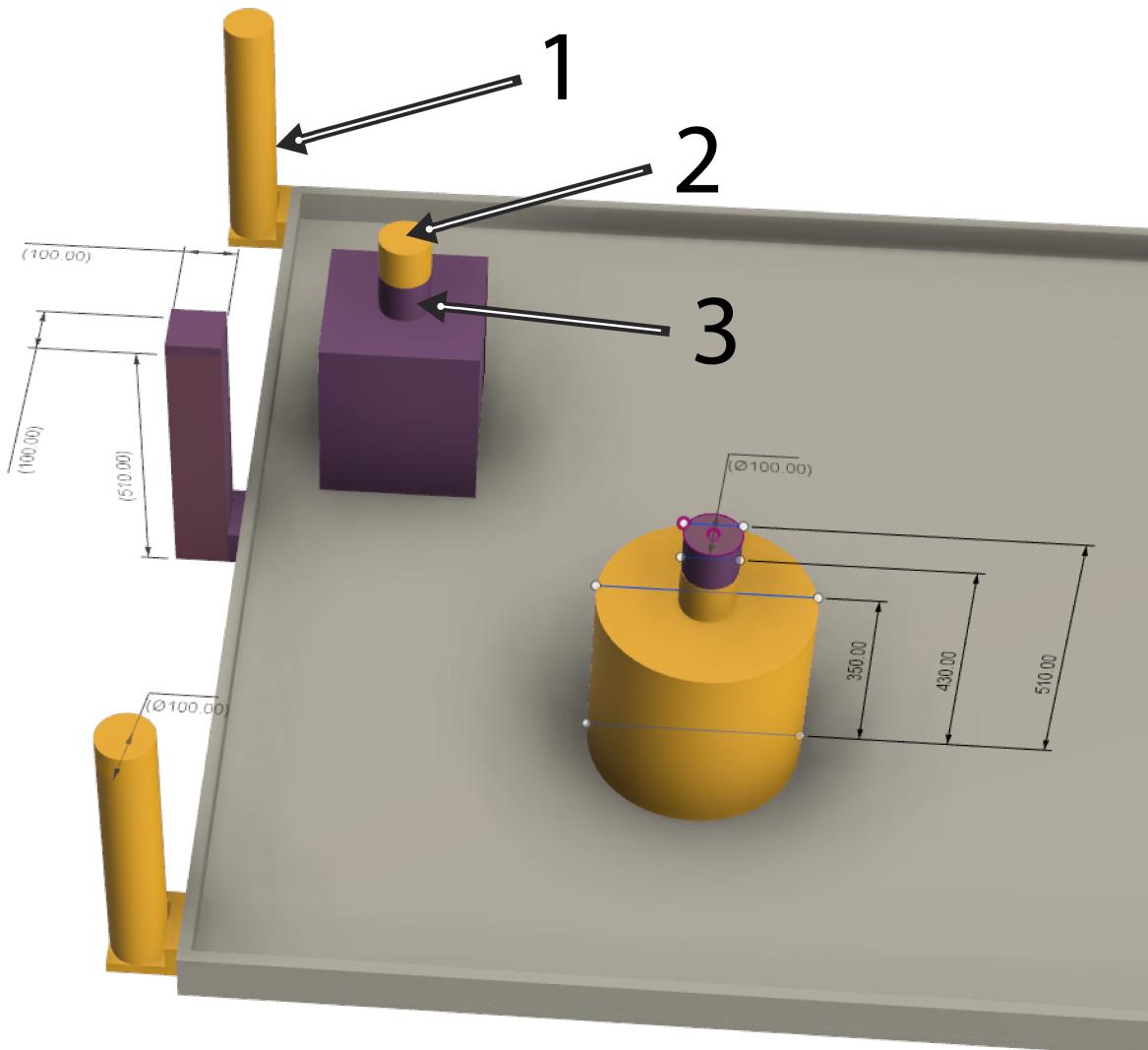


Figure 11 - Example of beacons positioning

Caption:

1. fixed beacons (maximum dimensions W x W x H: 100 x 100 x 510 mm)

2. embedded beacon (maximum dimensions L x W x H: 100 x 100 x 80 mm)
3. mast of the support (cf. subsection F.4.)

G.2. EMBEDDED/ON-BOARD BEACONS

A beacon can be placed on each of the adverse robots, in order to locate it. It must be placed on a dedicated mast, at an height of 430 mm above the playing area. The maximum size for an on-board location beacon is a square based parallelepiped of 100 mm side and 80 mm height.

The upper side of the on-board beacon must be flat and covered with VelcroTM on the hook side in order to receive the identification mark of the robot, respecting the color of the team.

The underside of the beacons must be covered with velvet VelcroTM.

It is recommended that the color of the beacons be mainly white or very clear, so as to favor their detection on a dark background.

In the name of fair play, the elements used for this beacon must have real utility. Any "useless" or weighted beacon will be refused by the organization.

An embedded beacon must not exceed 300 g

G.3. FIXED BEACONS

Each team can place up to three fixed beacons on fixed supports. These fixed supports are allocated to the team upon demand and will be placed around the playing area.

Action-cams not useful for the course of the game are prohibited in fixed beacons.

G.3.a. DIMENSIONS

The fixed beacons shall be integrally contained in a square rectangular parallelepiped of 100 mm side and 510 mm height.

A fixed beacon must not exceed 1.5 kg.

G.3.b. FIXATION

Given the potential height of the fixed beacons, they must have a solid fixing system.

The fixed beacon supports are located at the level of the playing area.

The horizontal plane of the fixed beacon support has a 10 mm wide groove. This groove must be used to secure the fixed beacons using an 8 mm diameter threaded rod and a wing nut.

The screw size is not counted into the dimensional constraints of the fixed beacons.

The absence of this fixing system will forbid the approval of the fixed beacons.

G.4. CENTRAL TRACKING DEVICE

In order to help identify the robots during the matches, a common platform located on the central symmetrical axis of the ground will be placed 1 m above the surface of the playing area (see plan). This platform can be used to place a robot tracking device with a top view.

The central tracking device should be placed on the area that corresponds to the color of the team. It must not exceed beyond a horizontal plane of 6 cm above the platform's upper surface. It must also not surpass a horizontal plane of 60mm below the platform's lower surface. On the sides, an offset of 6 cm is allowed: forward, at the edge not shared with the opponent and at the back. This offset allows: placing sensors above the ground, connecting the parts situated above and underneath the platform and setting up a slid fixing for the central tracking device. Its weight must be less than 2 kg.

It is forbidden to overpass on the opponent's area.

Please note that the central tracking device can be subject to vibrations due to the movements of robots on the playing area.

In appendix, the drawing of a mast supporting the platform are represented. However, only the dimensions and the position of the platform are contractual, the mast itself may be different from one meeting to another. Its design is left free to the organizer of the meeting.

Fixation:

The thickness of the fixing platform for the central tracking device is 22 mm.

The fixing device can surround the fastening platform from above, from below and from all three sides of the support so that it can be assembled and positioned quickly and without the risk of falling.

The mounting platform has a 10 mm wide groove from the center of the beacon support to the middle of the side. This groove must be used to secure the central tracking device using an 8 mm diameter threaded rod and a wing nut.

The absence of this fastening system will prevent the approval of the tracking system.

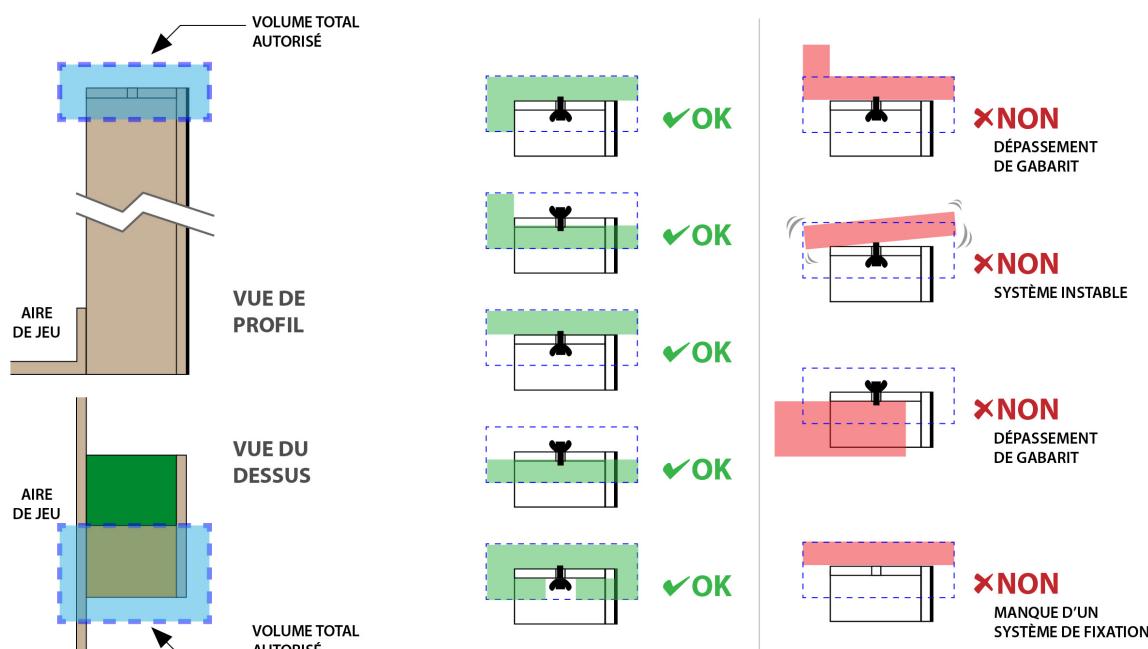


Figure 13 - How to install a central tracking device

G.5. CONNECTIONS

The fixed beacons and the central platform can be connected by a wired link. This connection must under no circumstances disturb the match. The installation of the whole system must be carried out before the match,

during the preparation time. It should not disturb the opposing team's preparation.

During the preparation time, a temporary wired link may be pulled in between the robot and one or several beacons. This case scenario is accepted only if it doesn't cause any inconvenience for the opposing team.

G.6. COMMUNICATION SIGNALS

To avoid interference between teams, it is recommended to encode the communication signals. We strongly recommend teams using infrared devices, to take into account the strong ambient light used during the encounters. In addition, this luminosity may vary in time and according to the emplacement of the playground in the hall.

We also remind teams that the organizing staff uses high-frequency radio devices and under no circumstances can they be held responsible for the malfunctions encountered by the robots.

CAUTION: Beyond the edges of the playing area, there may be elements that may interfere with color detection or communications signals such as:

- decor, lights and objects of the playing area
- people (referees, teams, etc.)
- electronic systems (microphones, cameras, etc.)

It is strictly forbidden to ask people to go away or move away objects/decors around the playing area !.

G.7. ROBOT IDENTIFICATION

During each match, the robots will be assigned a marker (provided by the organizer) placed at the top of the beacon holder, or at the top of the on-board beacon (if present)(Figure 16b). This marker has two purposes:

- allow the public to identify the team to which a robot belongs;
- allow a vision system on the central mast to identify and locate each robot.

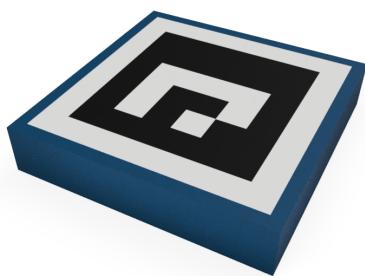
The marker is a square 10cm wide, 2cm thick ($\pm 2\text{mm}$) and with a mass less than or equal to 100g. Its upper side is covered with a vinyl with a 7cm ArUco 4x4 tag (centered). A 1cm wide white outline is drawn around the ArUco tag to facilitate its detection. A 0.5cm wide contour in the same colour as the team is drawn at the edge of the upper surface. The team's color also occupies the edge of the marker.(Figure 16a)

- Team purple robots will receive ArUco 4x4 tags between 1 and 5.
- Team yellow robots will receive ArUco 4x4 tags between 6 and 10.
- All robots will receive distinct markers. It will not be possible to choose them, nor to choose on which robot they will be placed.
- ArUco 4x4 tags from 11 to 50 are reserved for the playing area, but not all of them are necessarily used.

WARNING : to avoid visual disturbances, the teams are not allowed to use ArUco 4x4 tags from 0 to 50.

- ArUco 4x4 tags between 51 and 70 are reserved for team purple .
- ArUco 4x4 tags between 71 and 90 are reserved for team yellow .

However, other tag numbers over 90 and other dimensions than 4x4 are allowed.



(a) Robot identification marker (Tag n°1).



(b) Marker on the on-board beacon support.

H. MATCHES

The matches have a duration of 100 seconds.

Only two persons per team are permitted to go backstage and on stage to play the matches.

To ensure that the contest runs smoothly, we ask the teams to be present on their booth with the robot(s) and ready to go 30 minutes before the start of the series and until that the game is played.

In case of a problem, it is tolerated by the organization to ask for a delay to go to the match but this delay can never exceed the end of the current series. If the team cannot do its match before the end of the series, a forfeit will be applied. In case of abuse, a warning will be applied, and if the problem recurs in a subsequent series, a penalty may be awarded.

In any case, the team must be present on its booth when the organization comes to pick it up for a game. In the event of non-compliance with this rule, an official may initially give the team a warning, and if the absence is repeated on a subsequent series, a penalty may be awarded.

H.1. PREPARATION TIME

At the start of a match, the elements of the playing area and the playing area itself are installed as indicated in the diagrams in the appendix.

Upon arrival on the playing area, each team has a maximum of three minutes to proceed with the placement of the robots, the beacons and other equipment.

A robot which is not ready at the end of this period exposes the team to a forfeit for the match.

Besides, the other team's robots will still play their own game on the playing area. The team will have to score points to be declared the winner.

When both teams have finished setting up, or when the preparation time is over, the referee asks the participants if they are ready. From this moment, teams are no longer allowed to touch their robots. No dispute can be made on the disposition of the elements of play after the beginning of the match.

H.2. THE MATCH

At the signal of the referee, each robot is switched on. In no case may robots, playing elements and playing area be allowed to be touched during the match. In case of absolute necessity, the referee may authorize such action.

Any manual intervention on a robot, a playing element or the playing area, without the explicit authorization of the referee, may justify the application of a forfeit or a penalty for the match.

No elements taken out of the playing area can be put back on the table before the end of the match and the validation of the scores.

At the end of the match, the robots must stop and turn off all their actuators. It is allowed to keep on any dynamic displays.

At the end of the match, **no one except the referee** can touch the robots and the playing elements unless expressly indicated by the referees. The referees count the points; they give the result of the match, including the points to the teams. If they both agree, they validate the match sheet, can take back their robot(s) and join their booth. If the teams do not agree, they refer calmly to the referees. The robots remain in place until the dispute is resolved. Refereeing decisions are final.

In the event of a situation that is difficult to judge, the referees reserve the right to decide whether or not to

replay the match.

The referees are allowed to pronounce the end of a game in advance, before the end of the regular time if both teams agree (if the robots are blocked for example).

A team is considered to be **forfeit** for the match:

- if none of the robots have completely left the starting area during the match,
- following refereeing decisions.

Pressing the emergency button of a robot during a match may expose the team to a penalty or a forfeit.

H.3. COUNTING POINTS

At the end of the match, the referees count the points of each team according to the following.

Points summary

H.3.a. FINDING EXCAVATION SQUARE

- **5 points** for each revealed excavation square at the team's colour;
- **5 points additional** if a least a excavation square at the team's colour is revealed, and the red square at the team's side is not revealed;

H.3.b. RESEARCH AND ANALYSIS OF SAMPLES AT THE CAMP SITE

- **1 point** for each sample removed from a distributor on the team side (including the shared distributor and the work shed);
- **3 points** for each sample inside the gallery;
- **3 additional points** for each revealed and sorted sample inside the gallery;
- **1 point** for each sample inside the camp;
- **1 additional point** for each revealed and sorted sample inside the camp;

H.3.c. STORING SAMPLES IN THE WORK SHED

- **5 points** for each sample inside the work shed;

H.3.d. RETURN TO THE EXCAVATION SITE OR THE CAMP

- **20 points** if all the team robots are inside either the camp either the excavation site;

H.3.e. TO PRESERVE AND EXHIBIT THE STATUETTE

- **2 points** for installing the statuette on the pedestal during preparation time;
- **5 points** if the statuette is missing from the pedestal at the end of the game;
- **10 points** if the replica is on the pedestal at the end of the game;
- **15 points** if the statuette is inside the display cabinet at the end of the game;

H.3.f. DISPLAY CABINET

- **2 points** for installing a display cabinet during preparation time;
- **5 additional points** if the display cabinet is activated;

H.3.g. ESTIMATE THE PERFORMANCE (BONUS POINTS)

The assessment is based on all the previous actions.

The estimation bonus is calculated as follows: **Bonus = (0.3 x Score) - Delta**

- The score is the one scored by the team during the match on standard actions.
- The delta is the difference between the score made by the team during the match and the score estimated by the team. This one is always positive (Absolute value).
- The bonus is an integer value (rounded up).
- The bonus is added to the points of the team.
- A negative bonus is reduced to 0.
- A score of zero cannot give right to any bonus.
- The bonus for not "forfeit" is not include in the performance estimation.
- The penalties are not include in the performance estimation.

Warning! An element controlled by a robot, does not yield points. An element is considered to be controlled by a robot, if by moving the robot along its natural axis of movement the element is moved.

H.3.h. THE PENALTIES

A penalty is a **loss of 20 points** on the result of the match. Several penalties can be applied.

A negative score will be reset to 0.

RECALL:

The penalties are intended to compensate for damage after a possible incident during the course of the game. A penalty situation is considered as non-respect of the rules of the game, this type of situation must remain exceptional!!! A penalty may result in the team's forfeit. The referees' committee will also be attentive to the penalties distributed between several levels of meeting (regional/national/European).

H.3.i. BONUS POINTS

1 bonus point is awarded to all teams that are not "forfeit", this point is not included in the performance estimation.

H.3.j. FORFEIT CASES

The score of a forfeit team is reset to zero.

I. THE CONTESTS

I.1. GENERAL INFORMATION

The Eurobot^{Open} meetings can be organized on three levels:

- regional: when they exist (e.g. in France, Eurobot^{Open} Junior), qualify a number of teams for the national meeting,
- national: it allows to qualify the teams for the European meeting,
- European: this last stage brings together, in the same friendly spirit, teams from different countries in Europe and elsewhere.

Each meeting has several successive steps:

- The static and dynamic approvals of all the robots;
- A qualification phase;
- An optional play-off phase;
- A final phase.

I.2. APPROVAL

I.2.a. STATIC APPROVAL

Before the start of the matches, robots are subject to the supervision of a referee who checks their compliance with the rules. Robots must be able to easily show all their mechanisms.

The ancillary systems (accessories, beacons, central tracking device, etc.) will also be subject to static control (size, mass, presence of mandatory elements, etc.).

I.2.b. DYNAMIC APPROVAL

The robots must, within 100 seconds, validate at least one action. The robots are put in a game situation but without the presence of an opposing team. Certain specific features provided for in the regulation can also be checked (timer, avoidance of opponents, etc.).

If the assembly consisting of the main robot and the secondary robot fulfills these conditions, it is declared approved. If one of the two robots is not approved, the other robot can play the match alone.

I.2.c. SIGNIFICANT TECHNICAL MODIFICATIONS AFTER THE APPROVAL

It is essential to inform the referees of any significant modifications (functional, structural, dimensional ...) brought to the robot(s) or any other element after approval. The referees will then check the modifications made and re-approve the robot if they deem it necessary. In the event of a breach, the team may be declared disqualified from the contest.

I.3. QUALIFICATION PHASE

During the qualification phase, the registered teams will have the possibility to play at least three games (often more, depending on the local organizers).

A ranking is established according to the accumulated points in order to select the qualified teams for the next phase.

The tied teams are tied by comparing their scores without taking into account their bonus points. Organizers may also use additional matches.

At the end of the qualifying phase, the 4, 8 or 16 first teams (according to the matches) are qualified for the next phase.

I.4. THE PLAY-OFF PHASE

An additional play-off phase may be set up in the event that a meeting hosts two contests, the first of which qualifies for the second. For example:

- a regional meeting (A) and its national meeting (B)
- or a national meeting (A) and the European meeting (B)

The organizer may carry out the qualifying phase of both matches (A) and (B) either in parallel fashion or in a mixed fashion. In this case, a play-off phase may be organised in order to allow teams from the match (A) to qualify for the match (B), exempting them from having to catch up on all the matches from the qualifying phase of (B) in favour of this play-off phase.

The teams participating in this play-off phase are:

- the teams of the match (A), in a number corresponding to its qualification quota, and chosen in the order of ranking at the end of the qualification phase of (A) or through the award of a jury prize.
- the teams of the match (B), in a number equivalent to the participants in this phase from (A), chosen from among the last teams normally qualified for the final phase of the match (B).

Example for a national meeting qualifying three teams for its European final with two teams qualified in the ranking and one per jury prize and whose European final phase has 16 teams. The teams participating in the play-off phase are:

- the first two teams of the national meeting at the end of the final phase of the national meeting, as well as the team that received the jury prize;
- and the teams ranked 16th, 15th and 14th in the qualifying phase of the European meeting.

In this play-off phase, one match will be played for each participating team. The participating teams from the match (A) qualified through the ranking will play, in order of their ranking, with the teams from the match (B) with the lowest ranking. And the team(s) of (A) qualified for this play-off phase through a jury prize will play against the top-ranked teams of (B) in a random order.

Each team that wins its play-off match will be included in the main draw of the final phase of the match (B). At the end of the play-off phase, the tree of the final phase of the match (B) presented in Figure 17 may be revised to more accurately represent the level of each team.

I.5. THE FINAL PHASE

At the end of the previous phase, the qualified teams form the table of the matches of the final phase. Depending on the meeting, only the teams composed of members less than 30 years of age will be able to enter the final stages.

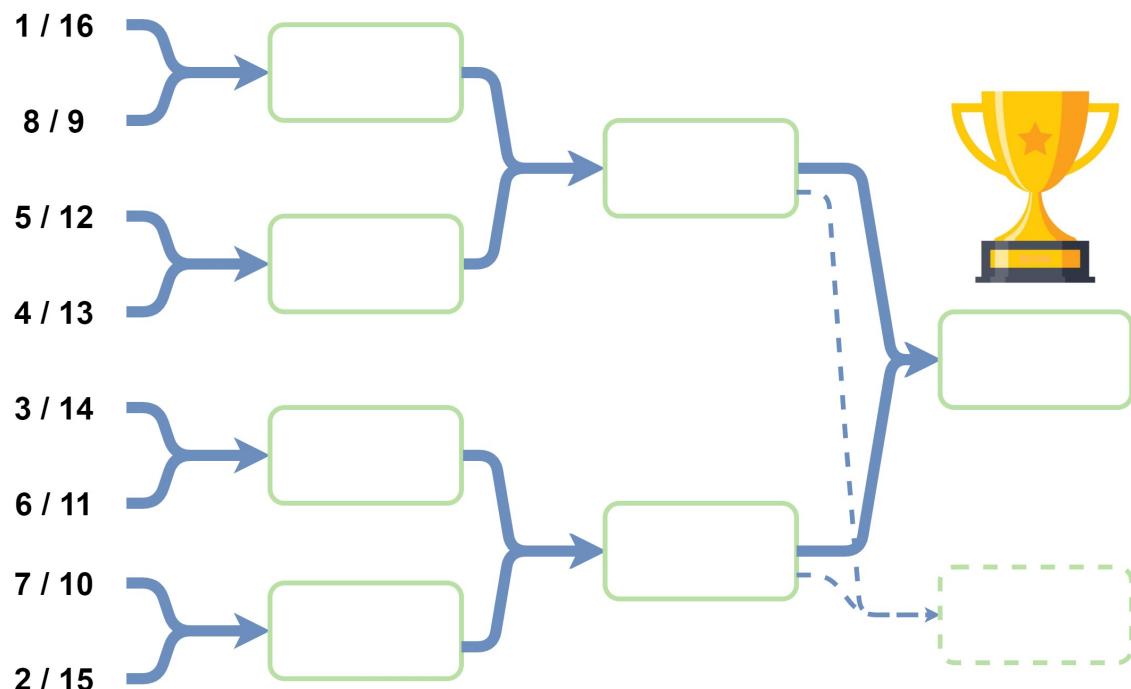


Figure 17 – Tree of the final phase

The matches of the final phase are with knockout, unless otherwise organized on some meetings. In the event of double forfeit, double defeat or tie, the match is replayed immediately; if this second match is still a case of double forfeit, double defeat or equality, the winner is determined according to the points acquired at the end of the qualifying phase.

The final is played in two winning games. Be careful to provide batteries accordingly for autonomous robots.

I.6. QUALIFICATION FOR THE NATIONAL MEETING

When there are regional meetings, the number of teams qualified per regional meeting is proportional to the total number of teams registered at the national level.

The best teams in the ranking established at the end of the qualifying phase of each regional meeting, as well as at least one team chosen by the organizers from the special prizes (e.g. creativity, fair play, presentation, etc.).

I.7. QUALIFICATION FOR THE EUROPEAN MEETING

Each country participating in Eurobot^{Open} organizes a national meeting to determine the qualified teams for the international meeting.

The two finalist teams and a special jury award will qualify to take part in the European meeting.

For questions and comments, feel free to visit the Planète Sciences Forum.

<http://www.planete-sciences.org/forums/>

News and more information about Eurobot^{Open} and Eurobot^{Open} Junior are available on our website

www.eurobot.org

(It also contains links to your local organization)

The whole organization team of Eurobot^{Open} and Eurobot^{Open} Junior wishes you a lot of fun and success in the coming months, and looks forward to seeing you soon around our playing areas!

Robotic Regards,

The Eurobot^{Open} Eurobot^{Open} Junior organization committee.

J. APPENDIX

J.1. GENERAL DRAWINGS

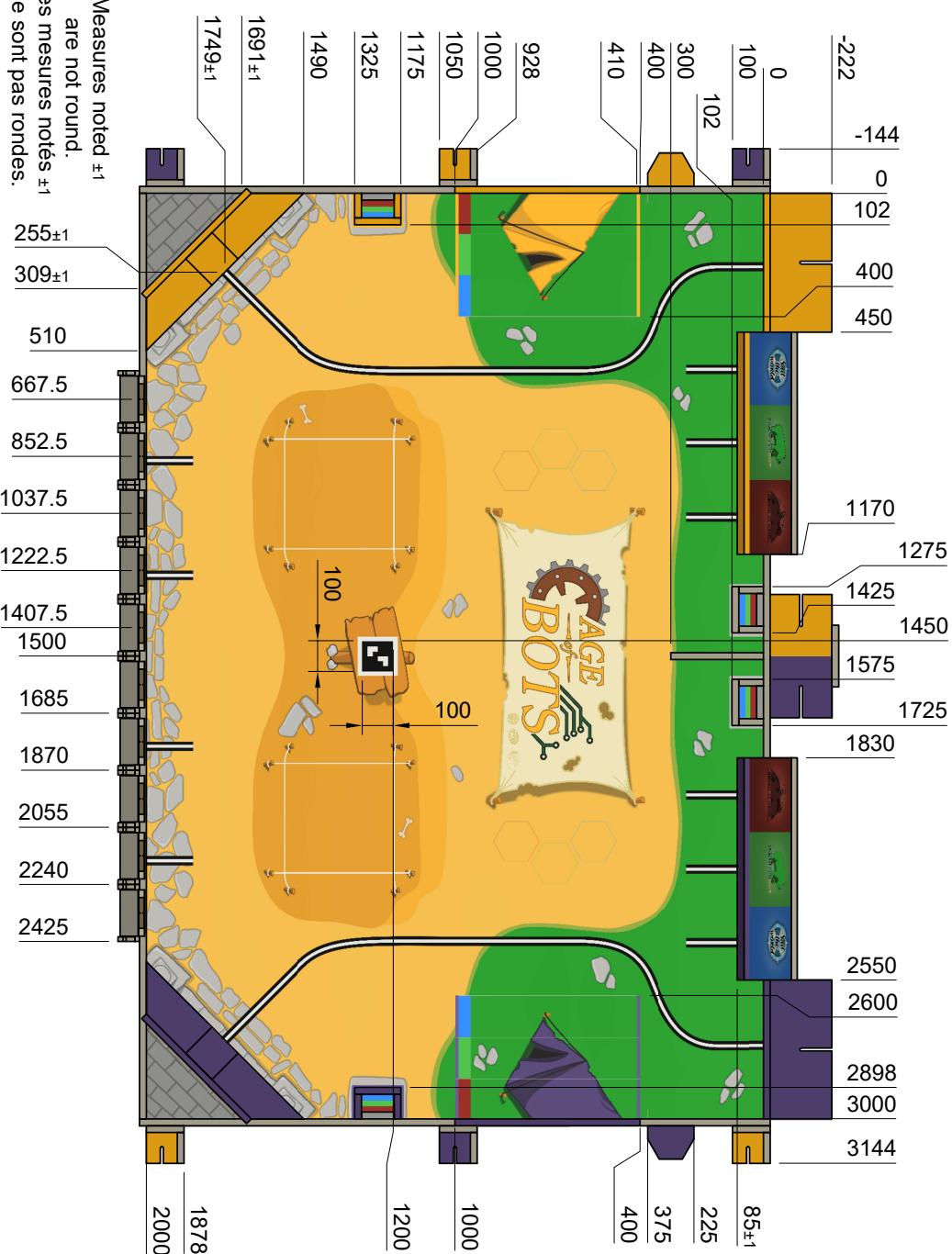


Figure 18 – Top view of the playing area without the samples

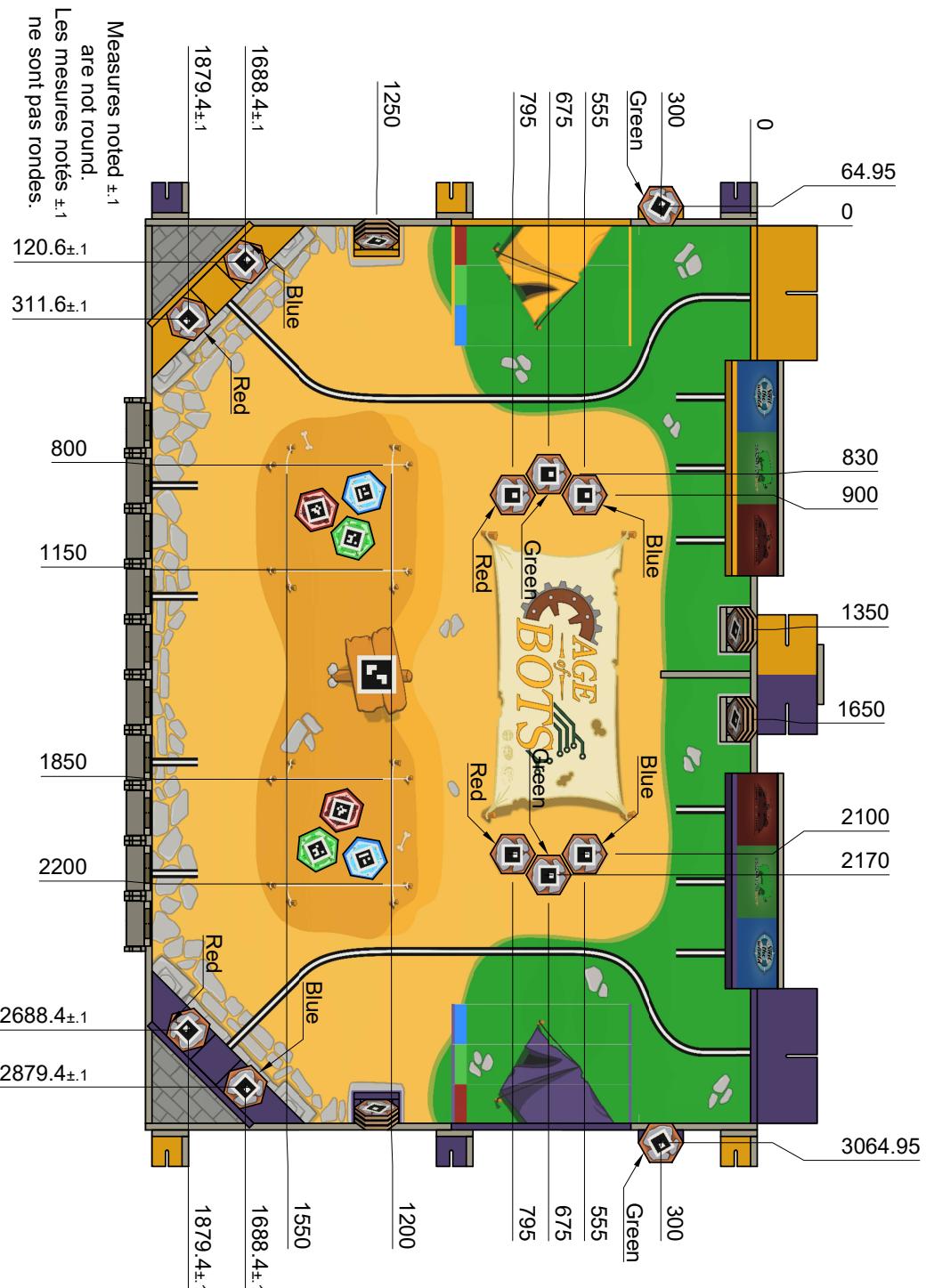


Figure 19 – Top view of the playing area with the fixed samples at their initial positions

J.1.a. SAMPLE

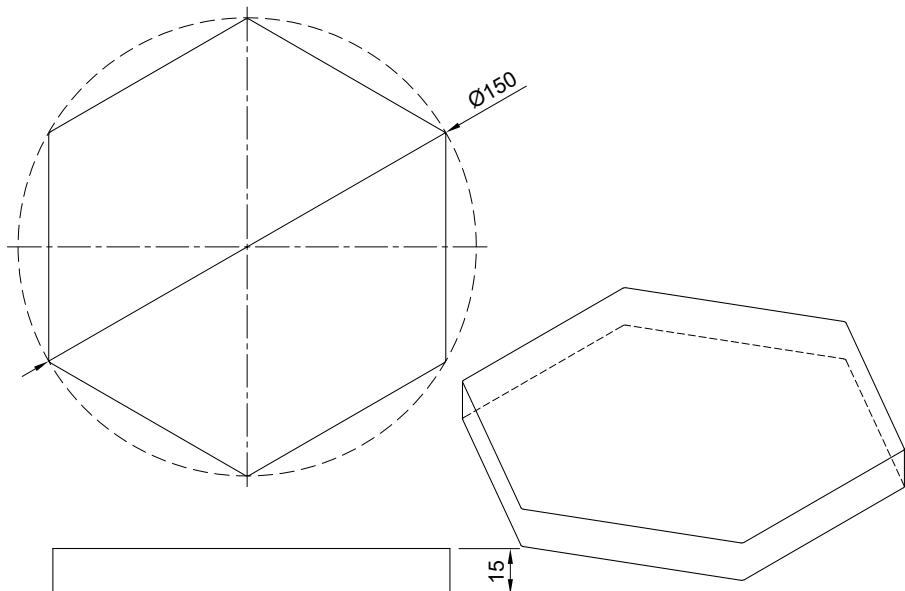


Figure 20 – Sample

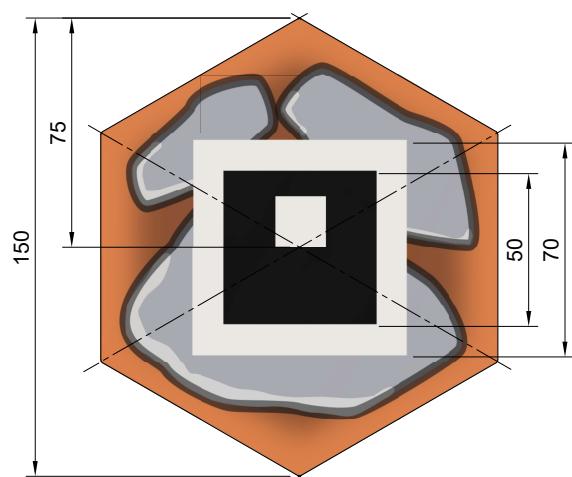


Figure 21 – Sample and ArUco tag

J.1.b. EXHIBITION GALLERY

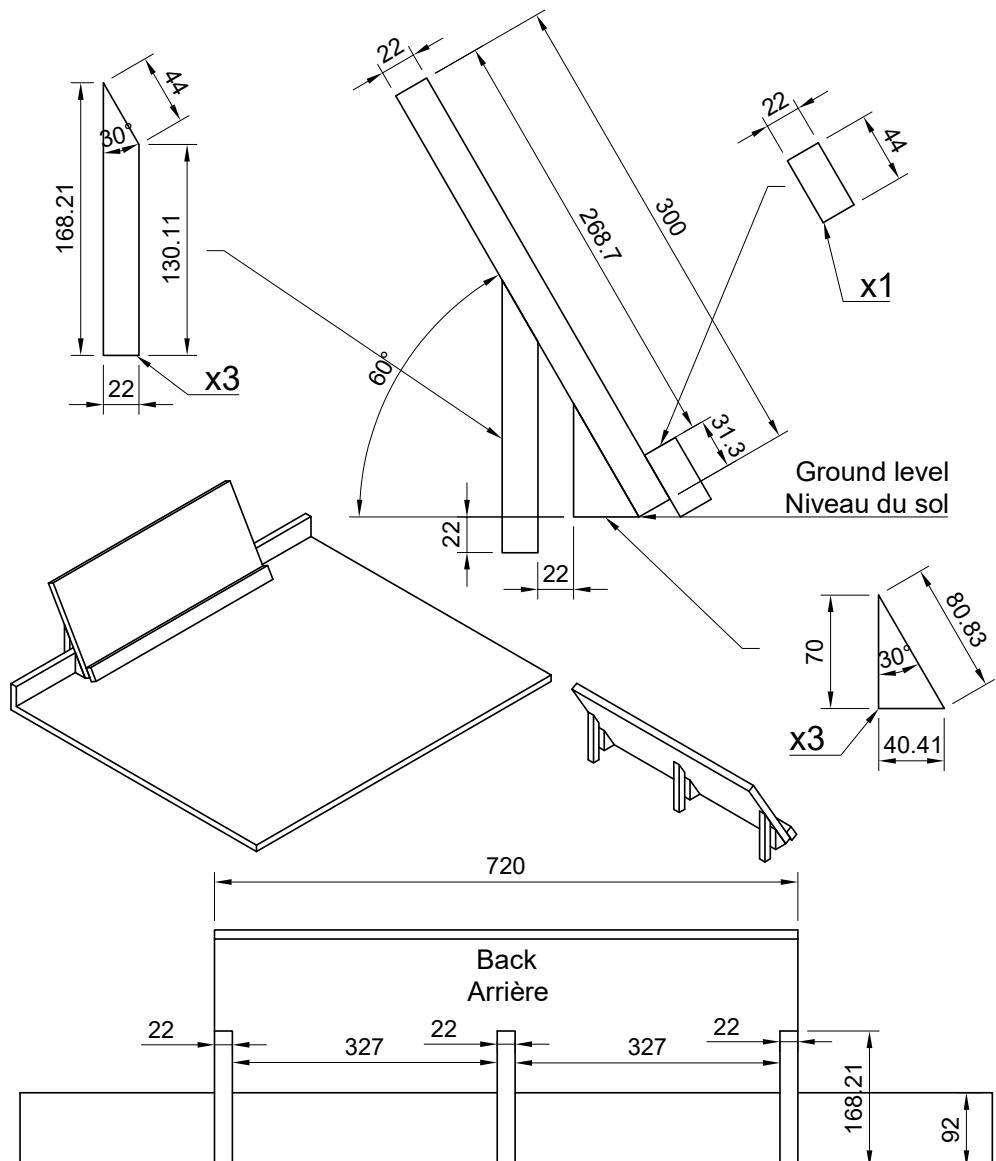


Figure 22 – Exhibition gallery

J.1.c. SAMPLE SUPPORT

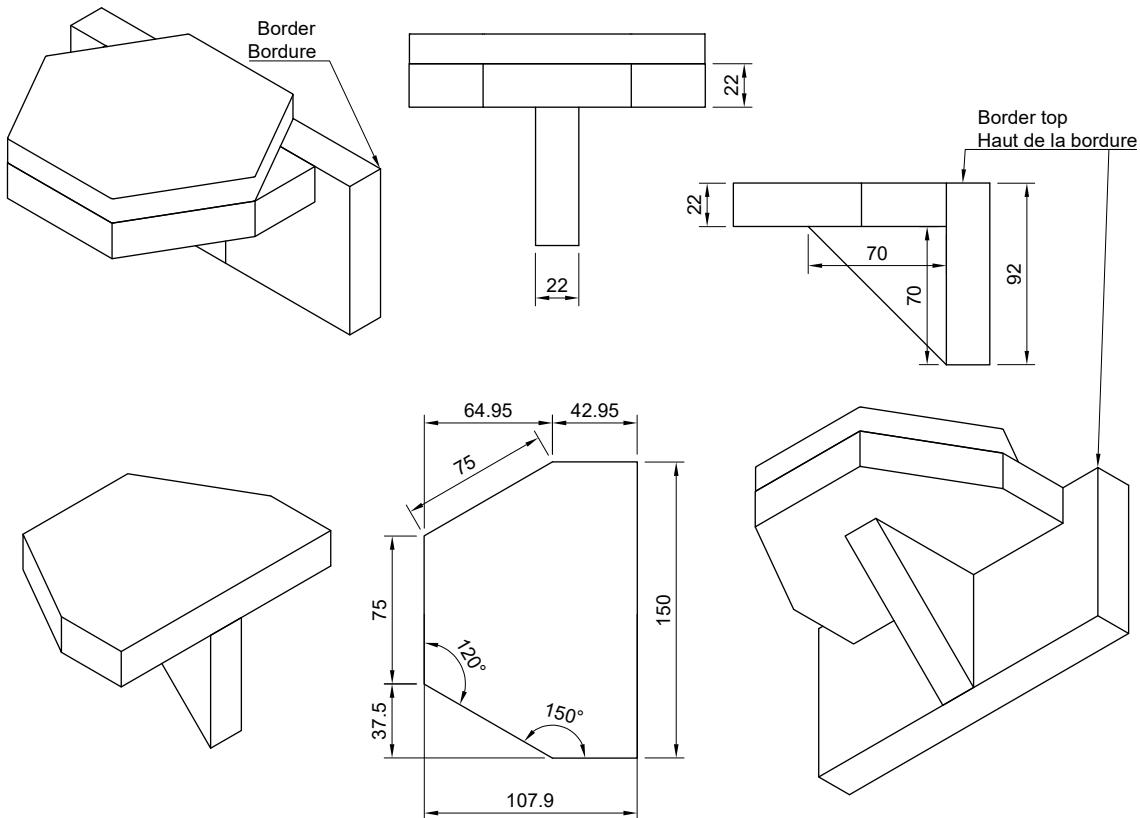


Figure 23 – Sample support on side

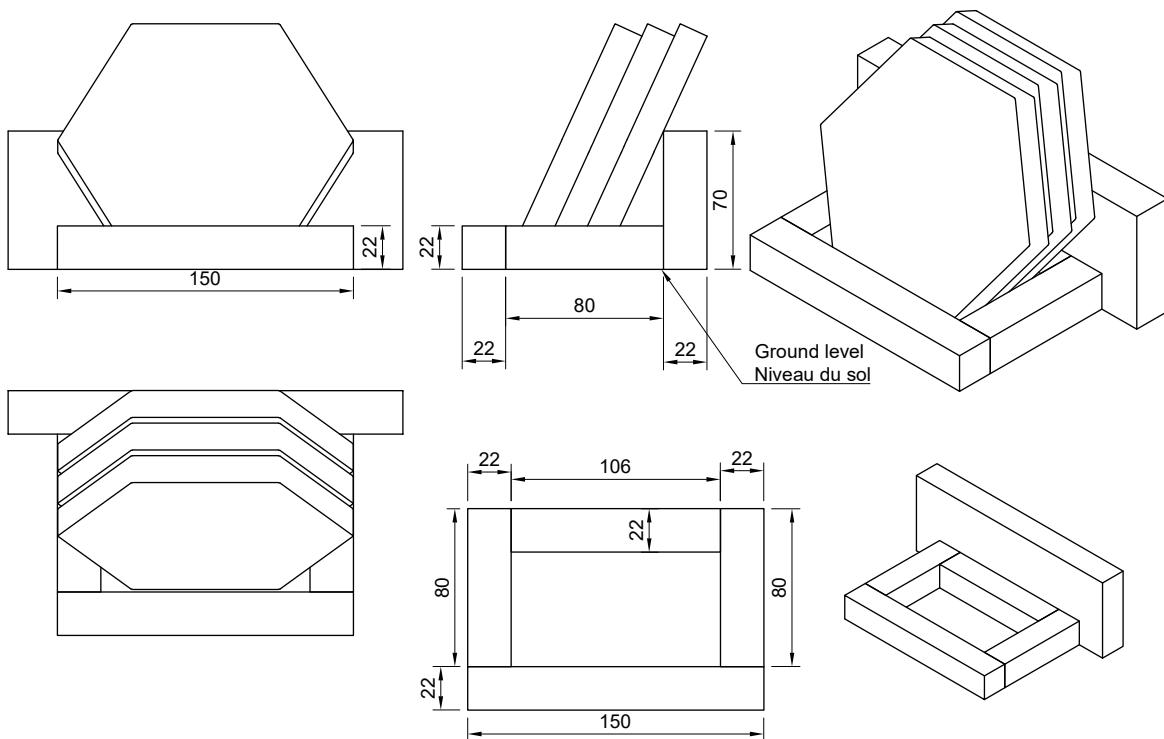


Figure 24 – Sample support on table

J.1.d. DISPLAY CABINET

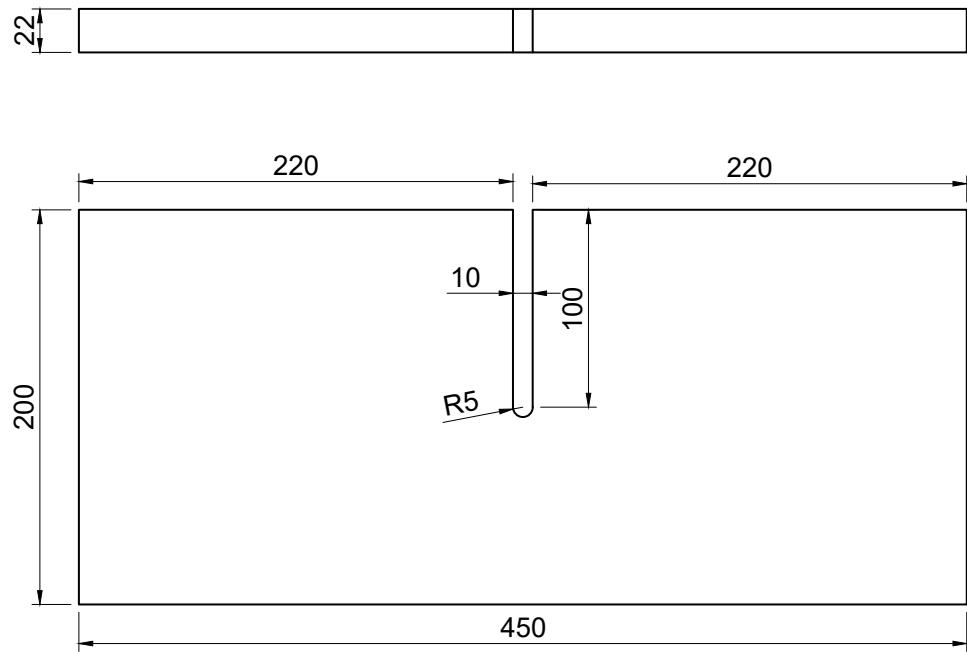


Figure 25 – Display cabinet

J.1.e. STATUETTE SUPPORT

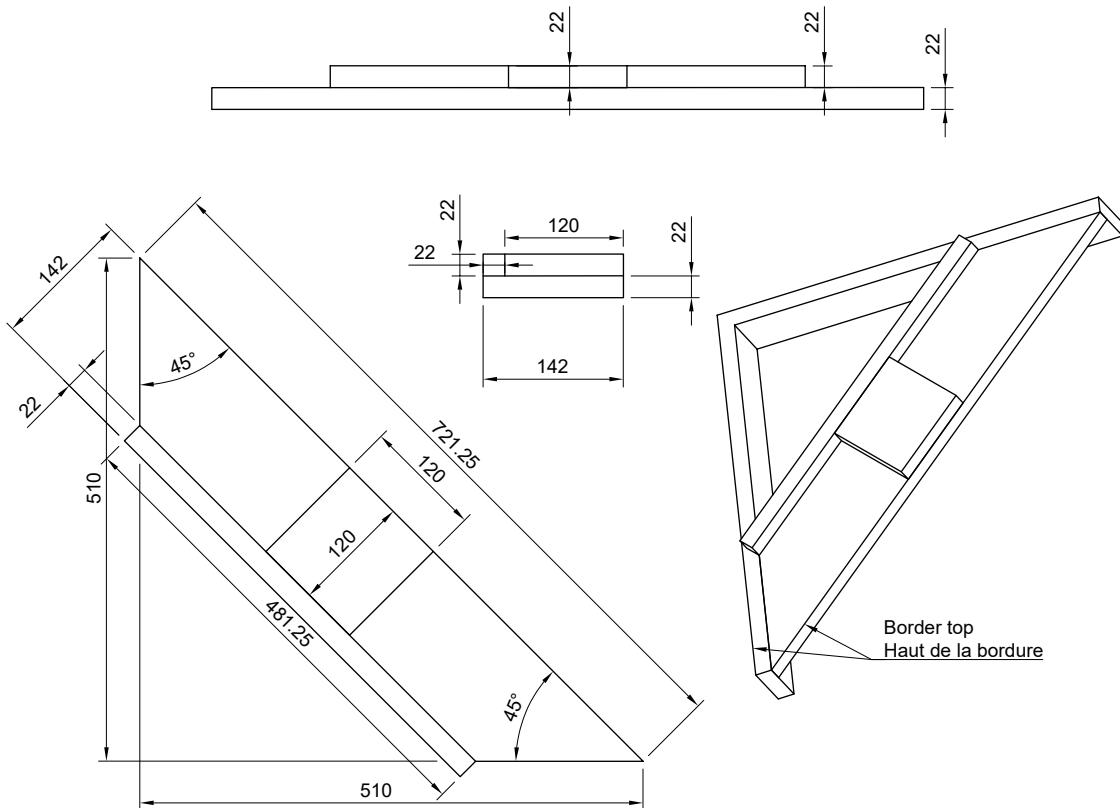


Figure 26 – Statuette support

J.1.f. EXCAVATION SQUARE

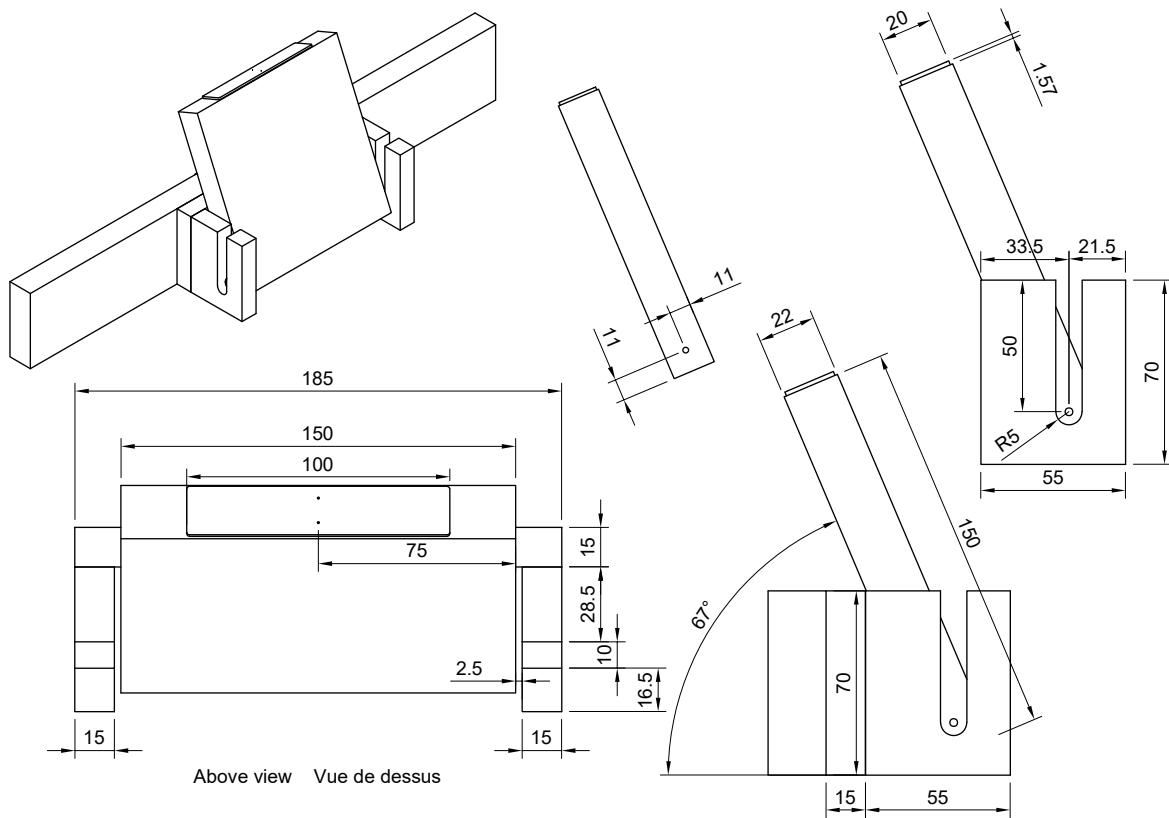


Figure 27 – Excavation square

Notice: the inner faces is covered by a vinyle whereas the slices and the outer face are painted in grey. A wood screw is recommended for the rotation axis of the excavation square, however this choice is left to the organization.

J.1.g. GALLERY SPLIT CLEATS

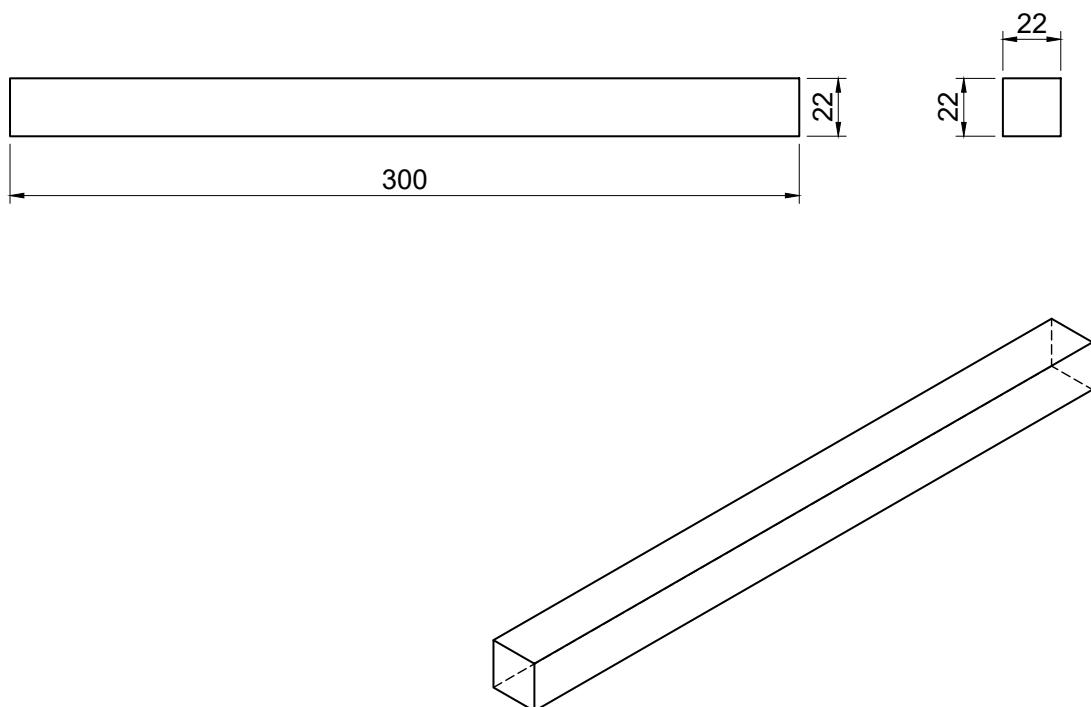


Figure 28 – Cleat

J.1.h. BEACONS SUPPORTS

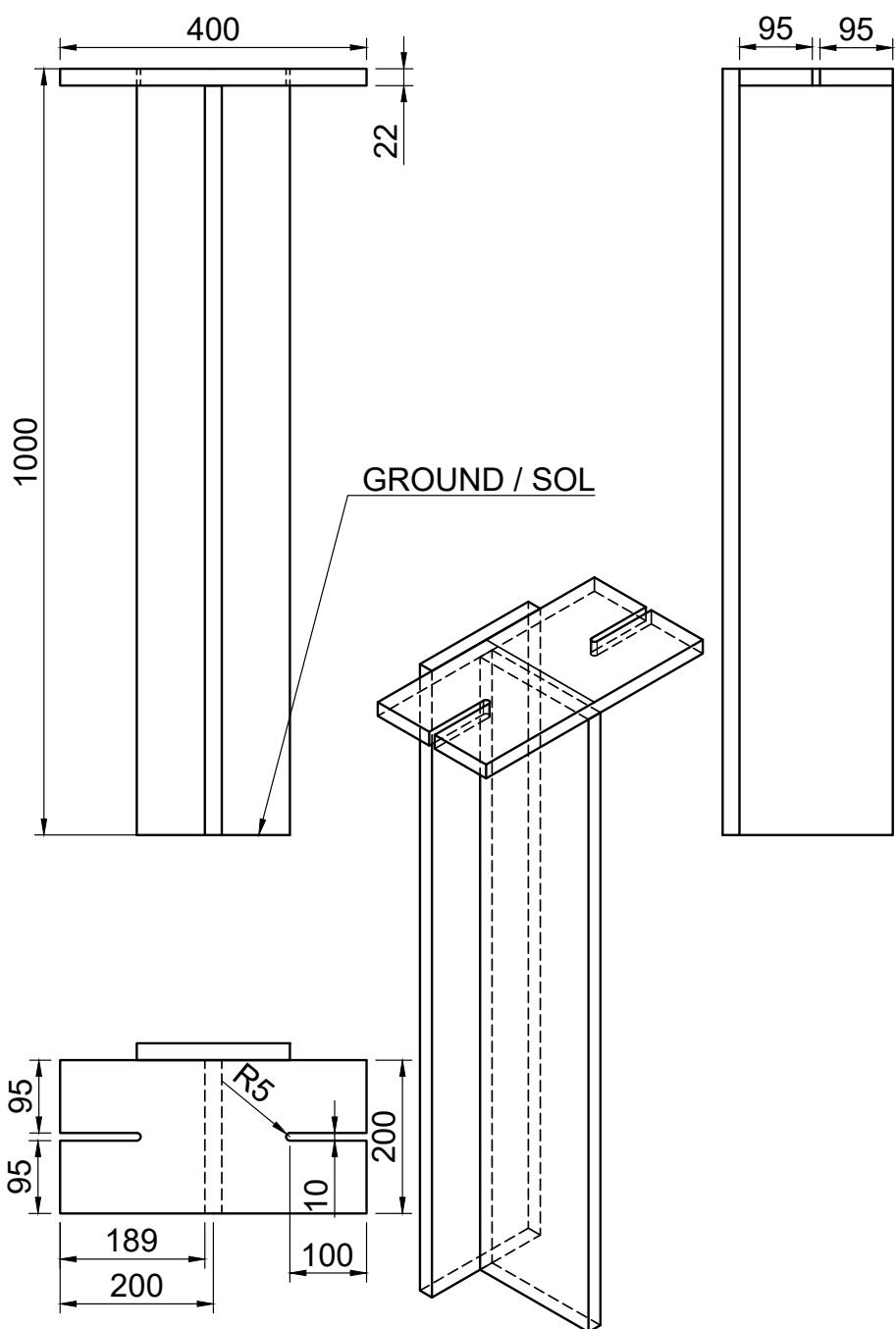


Figure 29 – Central tracking device platform

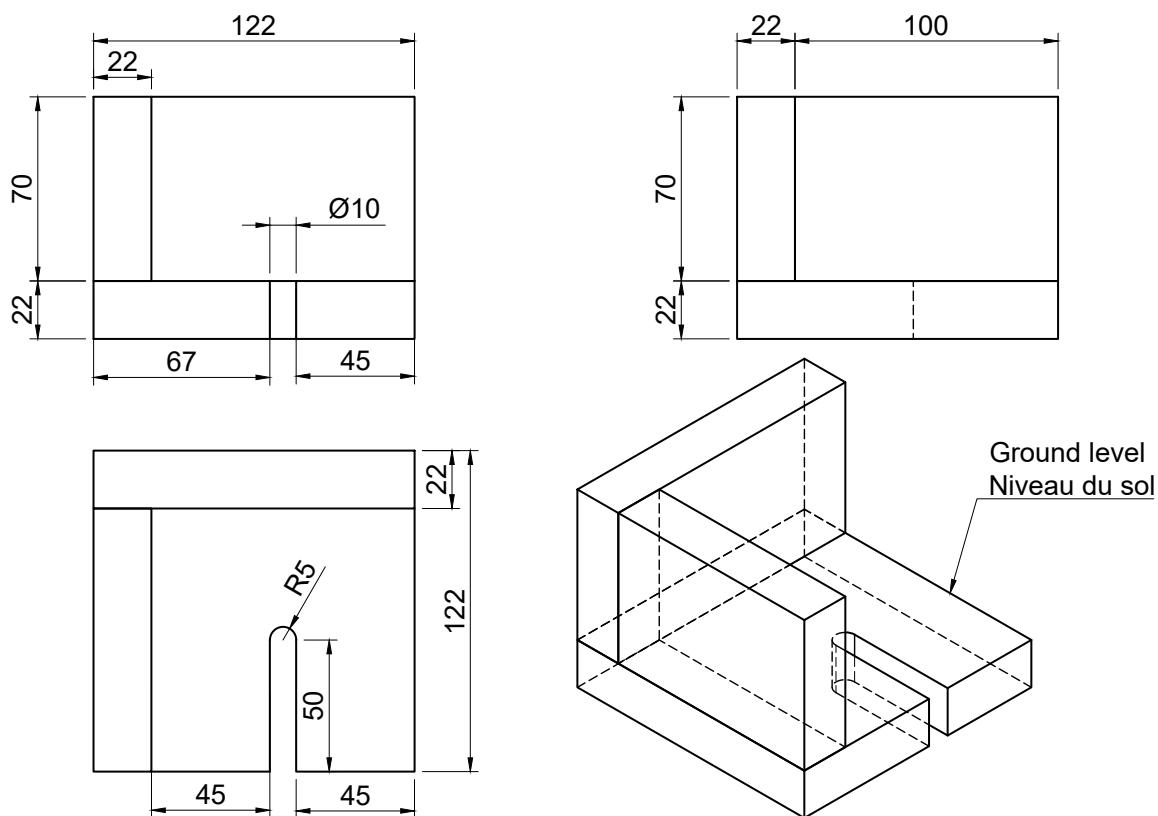


Figure 30 – Left fixed beacon support

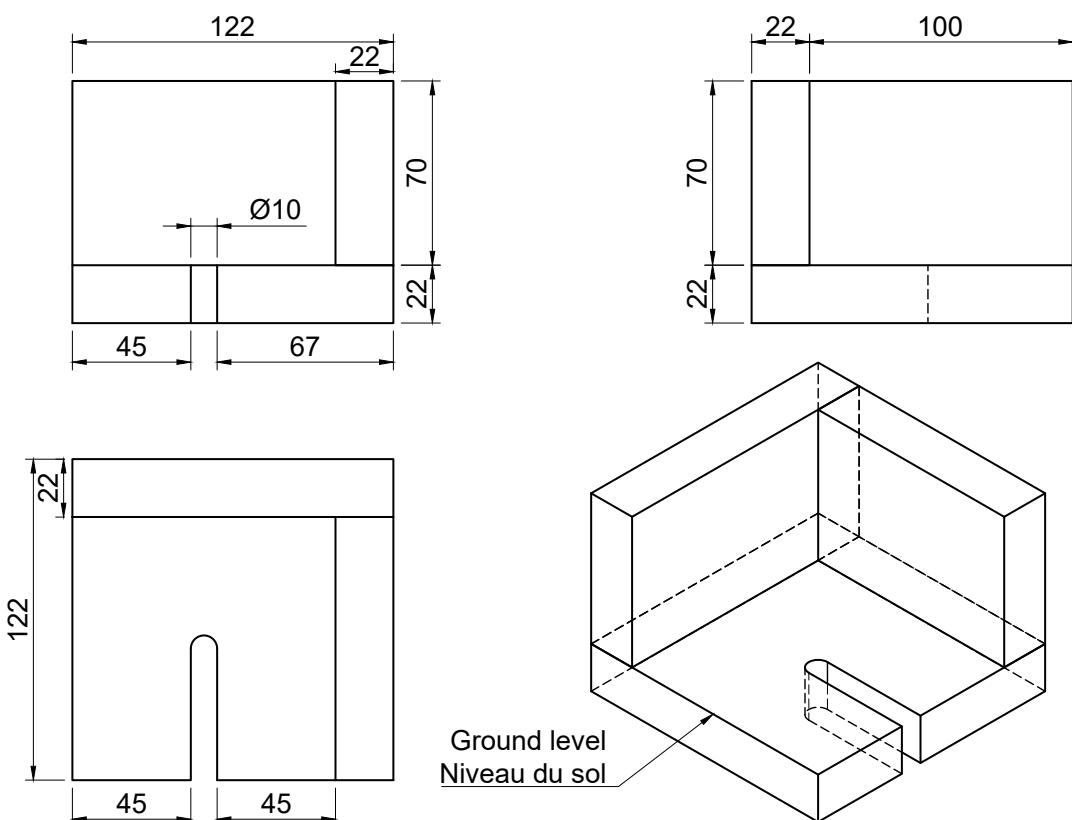


Figure 31 – Right fixed beacon support

J.2. MATERIAL REFERENCES

Elements	Material or reference	Comments
Samples	Wood - Printed monomeric gripping vinyl	
Game floor	Printed monomeric gripping vinyl	Ordering information will be provided by Planète Sciences
Replica	Wood	
Showroom	Wood	
Central separators	Wood	
Distributors	Wood	
Excavation square	Wood - Printed monomeric gripping vinyl - Printed circuit	Ordering information will be provided by Planète Sciences or in Annex
Robot marker identification	Polystyrene - Plastic - Vinyl - Velcro TM	

J.3. MANUFACTURING TOLERANCES

All dimensions are in millimeters (or mm). Manufacturing tolerances shall comply with the following rules, unless otherwise specified directly on the drawings.

Dimensions	General Tolerances
≤ 20	± 1.50
$> 20 \text{ and } \leq 70$	± 2.50
$> 70 \text{ and } \leq 150$	± 4.00
> 150	± 5.00

No objections regarding differences in dimensions will be taken into account.

The material's density can change from one country to another. It is highly recommended that the teams try different types of wood since the weight may differ significantly.

J.4. COLOUR REFERENCES

	Colors	References	CMYK
Team purple	Signal Violet	RAL 4008 Mat	50%, 90% , 0% , 5%
Team yellow	Traffic yellow	RAL 1023 Mat	0% , 25% , 100% , 0%
Borders and non-colored elements	Pebble grey	RAL 7032 Mat	15% , 10% , 25% , 20%

RAL hues can vary from a printed soil mat to another.