



Eurobot 2010

# Feed the world



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Rules 2010

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## Feed the World

*The robot who collect the most of fruits, vegetable and seeds  
will be declared the winner !*





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## 1. Introduction

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Eurobot is an amateur robotics contest open to groups of young people from around the world, organised in teams. These teams could be formed from students as part of their studies or as independent clubs or non-profit organizations. A team must be made up of two or more active participants. Team members may be up to 30 years old, each team may have one supervisor for which this age limit does not apply.

The aims of the contest are to favour the public interest in robotics and encourage hands-on practice of science by young people. Eurobot is intended to take place in a friendly and sporting spirit.

More than a simple championship for young people or a competition, Eurobot is a friendly opportunity to unleash technical imagination and exchange ideas, know-how, hints and engineering knowledge around a common challenge. Creativity and interdisciplinary is necessary. Eurobot values fair play, solidarity, creativity and sharing of technical knowledge, whether it is across technical realisations or project management.

Eurobot takes place in Europe, but is open to teams from other continents. Countries with more than three teams interested in participating must organise a national qualification in order to select the three teams which will participate to Eurobot finals. The selection will typically include the two best teams (in terms of competition score), but it is left to each national organisation committee to agree on a possible alternative to competition for selecting its last team. For example, the third team can be chosen by a jury according to other qualities valued by the contest, such as: best concept, most creative, fair-play, etc. Note that for countries failing to establish a national qualification event, but with more than 3 teams registered to Eurobot, the refereeing committee will accept only the three teams to the event, selecting based on the order of registration.

Eurobot was born in 1998, in the wake of the French Cup of Robotics, following the constitution of a similar competition in Switzerland. To deal with the expansion of the contest and to maintain the original spirit of exchange and cooperation between the different organisers, an association was founded.

This association, officially born on May 24th 2004, is named EUROBOT. You can find its statutes on our website ([www.eurobot.org](http://www.eurobot.org)). Individuals or organisations sharing our values are most welcome to support us either financially, or by joining us as volunteers in one of the different organising groups.

Eurobot and the national qualifications are prepared with passion throughout the year by persons of many nationalities, volunteers for most of them, which believe in the educational values of this experience and are themselves, often former participants.

Welcome!

And have a nice adventure!



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## 2. General notes

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### 2.1. Rules scope

The following rules apply to all national qualifications and to the finale of the 2010 edition of the Eurobot autonomous robots competition.

In addition, Eurobot Association has the right to issue more detailed specifications and restrictions to the rules for a specific country (based on its National organizer request), and the teams competing in that country have to adhere them. We would like to alert the teams that this applies both to their local cups as well to the international finale - all teams which promote to the finale have to meet the specifications issued for the country where the finale is held; if they do not follow them, they would not be allowed to compete. As an advice, it would be very wise to study this before the works on the robot start and build the robot in conformance with both at local national level and at current year country host of the European final.

### 2.2. Event schedule

The qualified teams from the national cups of Algeria, Austria, Belgium, Czech Republic, France, Germany, Great Britain, Italy, Romania, Russia, Serbia, Spain, Switzerland and of all other new national qualifications born in 2010, will meet their international counterparts (multinational teams and teams from countries without qualifications) during the Eurobot final from **Wednesday, May 26th to Sunday, May 30th, 2010, in the city of Rapperswil-Jona (Switzerland).**

It is important to note that most of the national competitions, within the limits of their means, are opened to the foreign teams. Moreover, numerous teams organize their own friendly competitions. Multinational teams are obviously very welcome.

### 2.3. Refereeing

Each match is supervised by two referees. For all the matches of the Eurobot finals, at least one of the two referees will be from a country different from both of the competing teams.

The referees are intended to interpret and apply the rules during the approvals and the competition but they are also there to help the teams, by clarifying points for instance. You are encouraged to contact the referees with questions about the rules or the competition process.

Participating to the competition implies the acceptance of the rules and the interpretations of them made by the refereeing committee throughout the year and by the referees during competition matches. The referees' decisions are final and may not be challenged unless the agreement between all parties involved.



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## 3. The 2010 theme

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### 3.1. The theme

After playing rugby, bowling, have sorted waste, have collected samples on Mars, and built temples, this year we collect food, fruits, cereals and vegetables to make reservations and redistribute them to those in need.

Our robots will have to collect as much as possible cereals, fruits or vegetables.

The matches involve two teams, one playing **blue**, and the other **yellow**. Each team may enter only one robot. **The matches last 90 seconds.**

The robots begin in the starting zones of their colour, located in one of the back corners of the table. The playing elements are available for the robots in different places on the table, either on the ground in predefined and random positions or in elevated positions. All the playing elements are common to both teams.

The collected elements have to be put in the containers in front of the table (one container per team). These containers could be equipped (each country will define its own system) with a balance that gives in real-time the tendency of the winner.

**Only the results after counting of arbitrators will be official, even if it contradicts what is stated balance.**

The most difficult elements to catch are the heaviest.

Thus, the robot that wins will be the one that will put the most weight in its container.

### 3.2. Playing elements

The playing elements of this year represents samples of the earth biodiversity: the fruits (oranges), cereals (corns) and vegetables (tomatoes):

- Vegetables on the soil are red juggling balls, they represent the tomatoes.
- Ears of corn "planted" in the soil are yellow cylinders of polypropylene.
- Fruit on trees are orange juggling balls, they represent the oranges. Their weight is higher than the balls representing the tomatoes.

The references of the colours are given in section "References of the paints" on page 30.

Size, weight and manufacturing plans for game items are available in annex.



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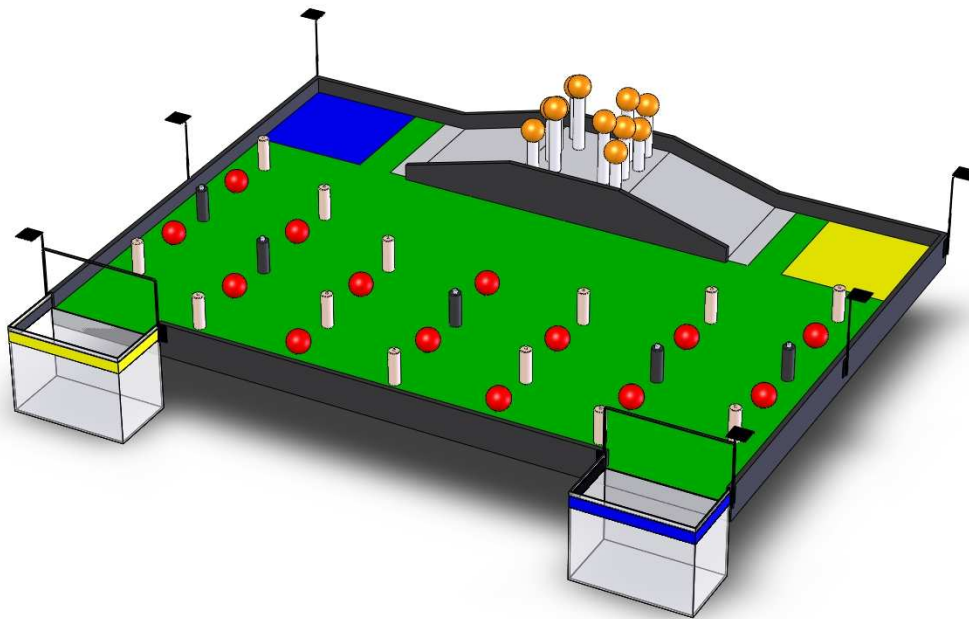
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The game play elements are available in areas of distribution (for more details these areas, see the section "Distribution zones" on page 10):

- 14 tomatoes
- 18 ears of corn
- 12 oranges

### 3.3. Playing area



The scoring areas are two containers, one per team, located at the front corners of the table, facing the audience. The teams have to score in container at the opposite of their starting area.

#### 3.3.1. *Starting zones*

The starting zones are placed in the back corners of the table. Each zone is a square, painted in the colour of the team (yellow or blue). At the beginning of the match, the robots must be placed fully contained within these zones. This means that the vertical projection of the robot's convex envelope must fully fit into the starting zone.

- No obligation is made for the robots to be in contact with the table borders.



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#### 3.3.2. Beacon supports

Robots can make use of beacons to help in localization, game elements or else,... These beacons are detailed in section “Beacons” on page 26. If used, the beacons must be placed on dedicated supports.

All supports are square platforms. The platform is covered with Velcro (rough “hook” side).

The vertical projection of the beacon supports is outside the playing field perimeter.

#### Terrain supports

- 6 of them are available
- They are placed **350 mm** above the table level
- They are located at the table angles and in the middle of each of the shorter sides,
- Assignment to the teams is illustrated by the drawing on the right

They are entirely painted in black

All the dimensions are detailed in the technical drawings.



### 3.4. Dispensing zones

Robots can collect playing elements from different zones.

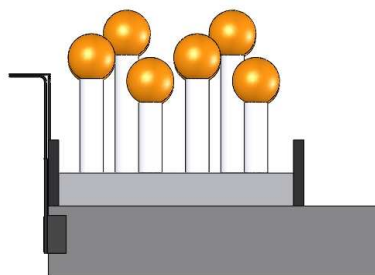
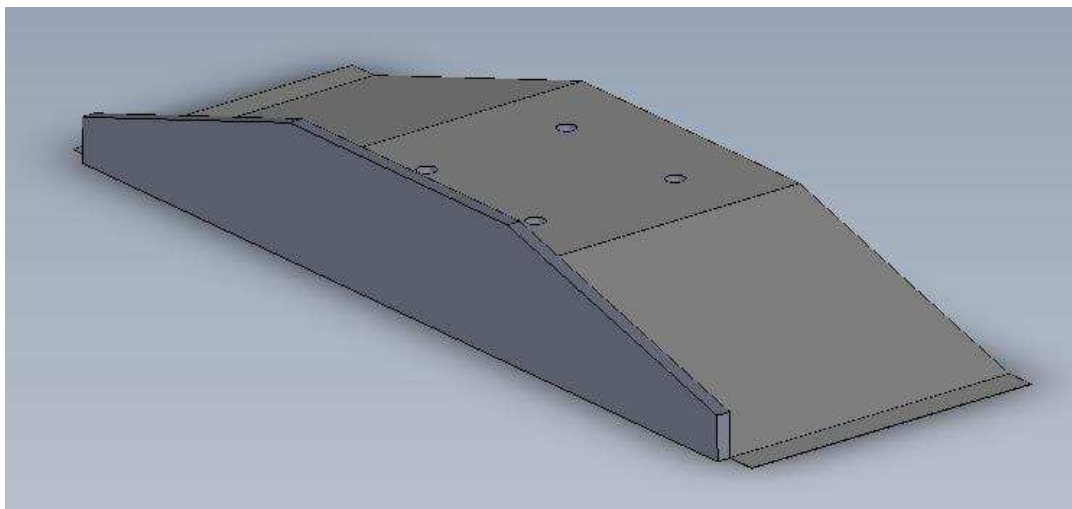
At the beginning of the match, the playing elements are placed on different places, on the ground and on supports.

- 14 tomatoes, represented by juggling balls, are disposed on the ground
- 18 ears of corn represented by polypropylene cylinders, are located on the playground plant in holes.
- 12 oranges represented by juggling balls, disposed on « trees » located on the raised zone at the back of the table.

#### 3.4.1. The raised zone and the trees



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At the back of the table is located a raised zone, accessible by slopes, where there are 4 trees composed of 3 tubes which represent 3 branches.

Play elements are placed on these trees in a number of 3 per tree. A total of 12 elements of playing elements.

The raised area, the slopes of access and the border that lies between the slope and the rest of the playground are painted white. A strip at the feet of two slopes is also painted in white to signify the robots they approach the raised area.

Each tree has 3 “branches” with 3 different heights.

All dimensions are detailed in the technical drawings.

### 3.4.2. Ears of corn

18 ears of corn are disposed on the playing field. These ears are placed in holes provided therefore.

Among these 18 playing elements, 7 are fake elements and will be painted in black and screwed into the table. The position of this fake elements will be random. The different configurations are given in annexes. Before the match, the referees select randomly the distribution of the random locations, using a card game defining the possible configurations (see "Appendix B - Random cards" on page 36).

The random locations are symmetrical with respect to the median axe of the table, in order not to favour either of the teams.





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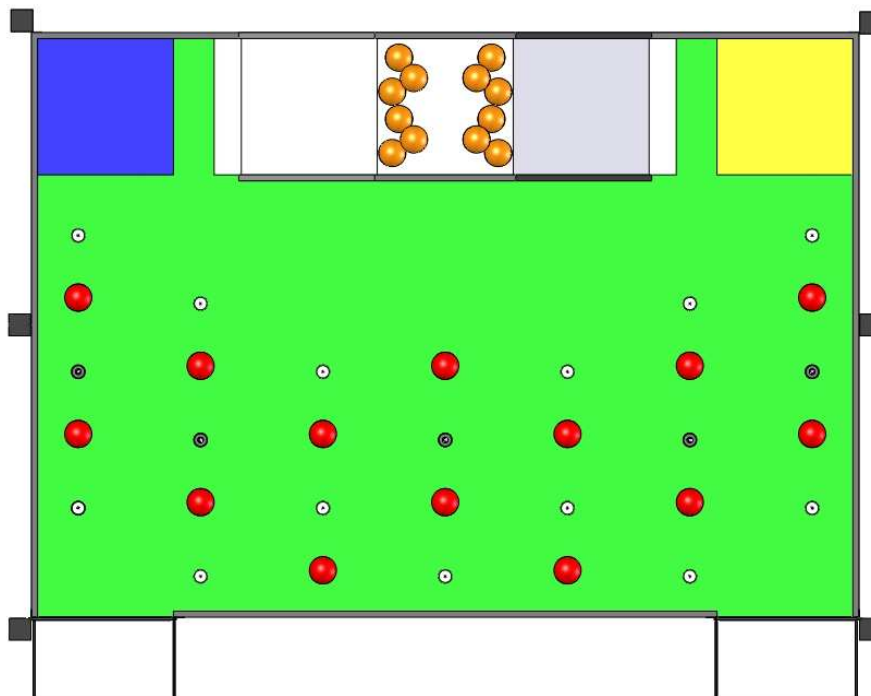
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A facsimile of the cards used for the selection is included in “Appendix B - Random cards” on page 36.

#### 3.4.3. *The tomatoes*

14 locations for juggling balls representing the tomatoes are defined on the table.

Example of configuration:



### 3.5. Scoring

Points are always counted once the match is over. The score is calculated from points scored during the match (see “Game points” - page 13) to which shall be subtracted any applied Penalties as described below.

The team with the higher score is the winner of the match. In qualification rounds additional Match points are awarded depending on the match result.

The different scoring components are detailed in the following sections.

#### 3.5.1. *Game points*

- Only playing elements fully fallen in the containers located in front of the table will be counted. If an element goes out the container it is not available.

The score is calculated with playing elements in the scoring zone as follows:



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- One tomato count 150g
- One ear of corn count 250g
- One orange count 300g

The referee count the number of elements in each container and multiply it by the weight indicated above, depending of the nature of the playing element.

#### Example :


**The blue team's** container contains 3 tomatoes, 4 ears of corn and 2 oranges

$$3 \times 150g + 4 \times 250g + 2 \times 300g = 2\,050\,g$$


**The yellow team's** container contains 5 oranges, 3 ears of corn and 0 vegetables

$$5 \times 300g + 3 \times 250g + 0 \times 150g = 2\,250\,g$$

Each collected gram count for 1 point : The yellow team have 2 250 points.



*The yellow team wins because they put more weight in their container, even if there are less playing elements.*




The weights we count are fixed, it pays no importance to the real weight of playing elements.

### 3.5.2. Penalties

Every action that is not fully in line with the rules or the spirit of the competition, namely some of the points noted in paragraph "Penalty points" on page 28 will be penalized.

A penalty consists of subtracting 20% points from the total of points of the team with a minimum of 150 points, at the end of the match, more than one penalty can be issued during one match.



*It must be noted that negatives scores are possible if penalties exceed the number of points scored during the match.*

### 3.5.3. Bonus points

A **preliminary total** for the match is calculated by adding the bonus Points and subtracting the Penalties. The total sets the result (victory, defeat, scratch, ...) of the game.

Bonus points will then be added to these points, based on the following rules:

- 200 points for victory
- 100 points for a draw
- 50 points for a defeat



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- 0 point for a scratch.

A score of 0/0 (or below) is considered as a double defeat. Thus, each team gets only 50 match points.



*A null score against a negative score (because of penalties) does not award a victory. It is a double defeat. The team which scored a null score is considered as a defeat and as a consequence is awarded only 50 points for the match.*



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## 4. The robots

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### 4.1. General conditions

Each team is allowed to compete with only one robot.

They are not allowed to enter several robots that are **different** (*for example, presenting a different robot according to the colour attributed to the team for each match*).

Every structural modification during the competition implies another approval phase.

The robot is a fully autonomous machine. It shall carry its own power source, actuators and control system.

The robot is only allowed to communicate with the localization beacons (see section "Beacons" on page 21).

All parts of the robot must remain physically connected - therefore the robot cannot leave parts of itself on the playing area.


### 4.2. Robot dimensions

Robot can have deployable extensions, their deployment is allowed after the match start signal only.

The perimeter of the robots is defined as the convex envelope which fits the vertical projection of the robot on the ground.

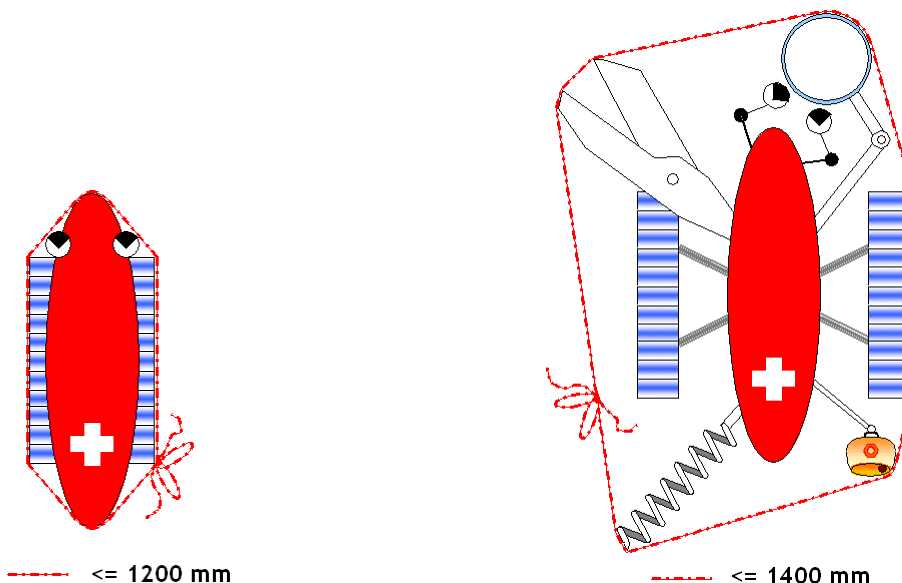
The perimeter of the robot, in its starting configuration shall not exceed **1200 mm**. The perimeter of the robot in a fully deployed configuration shall not exceed **1400 mm** at any time during the match. The playing elements controlled by the robot during the game are not included in these dimension limits.

The height of the robot shall not exceed **350 mm**, excluding the beacon supporting mast.




**Unlike the perimeter of the robot, the limitation in height includes all the carried elements. This restriction is set in order for these objects not to interfere with the opponent robot communicating with its beacons.**

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Starting configuration

Deployed configuration



**Important notice :** Since it has been observed that every year some robots are slightly above the allowed dimensions because designed too close to the limits, teams are strongly advised to keep some safety margin, and stay several millimetres under the above mentioned limits, so that no “bad surprises” occur during approval.

### 4.3. Visibility

The purpose of this advice is educational; it is to allow public and other participants to see how the transport of elements works inside the robot.

Two areas of 100 mm x 70 mm must be available on the robot for the placement of stickers (number of the team and logos of the sponsors of the event, printed by the organizer). The areas should be placed on two different sides of the robot.

### 4.4. Limitations

The aim is to share a friendly time and play as many matches as possible. Therefore, any action not directly in line with the match spirit as laid out in this document or harmful for match development is not welcome and may be penalised.



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#### 4.4.1. *Fair-play*

In the spirit of fair-play, a robot's strategy may not be:

- to block the opponent robot's access to an element or to an area of the playing field,
- to use objects of colours or shapes when designing the robot in order to confuse the opponent. None of the colours mentioned in these rules for the playing field elements or elements of play may be used on the robot,
- the robot causing intentional damage to the opponent robot, the playing area, or any of the playing field elements,
- to use a fixing system to attach the robot to the field (e.g. suction cups). At any time during the match, the effort required to lift the robot must not exceed its own weight,
- to use systems designed to make the table vibrate.

#### 4.4.2. *Using blowers or vacuum systems*

The use of blowers to move the playing on the table is not allowed. The use of vacuum systems is allowed for gripping and manipulating playing elements.

### 4.5. Mandatory equipments

All robots must include the following systems, or they will not be approved for competition.

#### 4.5.1. *Starting cord*

The Robot must include a starting device, easily accessible on the robot. It shall be triggered by pulling a cord at **least 500 mm long**. This cord shall not remain attached to the robot after it has been started. Any other system to start the robot (remote control, toggle switch directly activated by hand, etc...) will not be approved.

#### 4.5.2. *Emergency stop button*

The robot must include an emergency off button, with a diameter of at least 20 mm and painted in red. It shall be placed on the top of the robot, in a conspicuous position and in a zone that is not dangerous and that is immediately accessible to the referee at any time during the match. The stop button must be activated by a simple downwards pushing motion.

Pressing the emergency button must result in the immediate shut down of all of the robot's actuators, leaving them limp (neither actively braked nor energized). This includes all drive motors, actuator motors, internal systems and all other moving parts of the robot.

The emergency stop button must also immediately shut down all laser devices used in the robot.

#### 4.5.3. *Automatic shut down*

Each robot shall accommodate a system which shall stop the robot automatically at the end of the 90 second match duration. "Stop" implies complete shut down of all actuation



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including internal devices. Robots moving after the end of the match will be penalized or disqualified.

#### **4.5.4. Obstacle avoidance system**

Teams are required to equip their robots with an obstacle avoidance system. The system is intended to prevent collisions and damages between robots during a match.

The robot must be able to avoid at least a fake robot, as described in paragraph “*Practical trials*” on page 26.

#### **4.5.5. Robot localization beacon support**

It is strongly recommended to design the robot with a support to accommodate a localization beacon prepared by the opponent team.

If desired, the support can be designed to be detachable, so that it is only used if the opponent needs it. In this case the design must allow the support to be quickly attached before the match.

Finally, a team may choose not to include a beacon support. In this case, if the opponent provides a beacon and wants to use it during the match, the team will be disqualified for not having the support.

The beacon support shall at all times comply with the following constraints:

- It is a **80x80 mm** square surface, located **430 mm above the floor level**. The structure supporting this platform must stay within the vertical projection of this platform. This mast cannot host any parts of the robot other than sensors. The mast shall be robust and rigid enough to support the opponent's beacon in a stable fashion. The team is responsible for the robustness of its mast.
- The platform surface of the support shall be fully covered with Velcro™ (rough "hook" side)
- The support shall be located close to the horizontal centre of the robot. In the robot's not deployed configuration, the distance between the support and the maximum robot extension on one side shall not be less than 50% of the equivalent distance on the opposite side.

#### **4.5.6. Technical poster**

Each team is required to provide a technical poster at the refereeing Committee during the year by the date specified in the conditions of participation.

This poster should present information related to the design of the robot (drawings, technical references, design specifications, etc...). It should be at least DIN A1 in size, and ideally should be printed. The poster is intended to promote exchange and communication between teams.

Effort should be made to make the poster understandable to a non-technical audience. Ideally the poster should include pictures and diagrams to help explain the concepts.

The poster must also include:

- the name of the team,
- the names of the team members,





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- the nationality of the team.

This poster will be displayed in the team's pit. An English version of the poster must be supplied. Optionally, the team can provide other language versions as well.

The poster shall be supplied to the Eurobot association in **PDF Format**. The chosen resolution of the PDF must guarantee that all texts on the poster will remain readable. If possible, the file size of the PDF should remain below **25 MB**. The PDF Version of the poster may be sent to Eurobot beforehand via your National Organisation Committee, or may be provided on CD-ROM or USB key at the competition, during the approval for your robot.

In general Eurobot encourages the teams to communicate about their projects, for example by posting it on Internet, in the Eurobot forums etc.

## 4.6. Energy sources

Allowed energy sources include springs, pressurised gas, solar cells (note that the competition will be held indoors) and most types of commercially available batteries and power cells.

Prohibited energy sources include all types of combustion engines, rocket engines, hydrogen fuel cells, any other type of burning or pyrotechnics, living beings and radioactive energy sources of all types.

If in doubt about your unusual energy source, ask the refereeing committee ahead of time.

With respect to batteries, use only models with solid electrolyte in order to prevent any problem with corrosive liquids.

It is strongly recommended for teams to possess several battery sets and to design for easy access in the robot for their replacement. The teams are reminded to have spare, fully-charged batteries available at all times.

Teams are required to be capable of playing two matches in succession. Note that this includes the necessary "set-up time", when the robot is powered on and waiting to start, but the match has not yet begun.

## 4.7. Control systems

The teams may use any kind of robot control system (analogue, microprocessors, micro-controllers, computers, programmable logic, etc.).

Those systems must be fully integrated into the robot.

The control system must permit the robot to play a match as either colour. The colour of each team will be decided just prior to the match.

The control system must permit the robot to pass the approval phase.



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## 4.8. Safety

One of the design goals for your robot should be to develop systems that are safe for people, both during the competition and during the construction and experimentation phase of your project. This is also why you must ensure that your systems comply with applicable regulations for technical devices.

The robots must not have any protruding or sharp parts that may be able to inflict injury while casually handling the robot. The use of liquid products, corrosive products, pyrotechnic materials or living beings in the robot is also forbidden. Each of these points will be checked during the approval phase of the competition, before the robot is allowed to participate to matches.

As a general rule, any device or system considered as potentially dangerous by the referees will be rejected, and must be removed from the robot prior to competition, or result in the team's disqualification.

All the systems on the robots shall respect existing national and European laws and specifications. Specifically, the systems used shall comply with legal safety regulations and must not endanger the participants or the public both during matches and backstage.

Hereafter are listed some safety regulations. This list is not exhaustive - the referees' decisions are final on what is dangerous, and what is not.

**Teams not complying to these rules (by providing incorrect documentation for instance) will be held responsible in front of the justice in case of any damage resulting from their system.**

### 4.8.1. *On-board voltage*

All robots must comply with the legal standards concerning "low voltage". Therefore, the internal voltage of the robots **shall not exceed 48 V**.

Internal voltage is defined as the electrical potential between any two parts of the robot, with or without its casing in place. This includes components insulated by the teams themselves, using adhesive tape, thermo-shrinking tubing, or any similar non industrial process.

It is permitted that potentials higher than 48V exist, but only inside sealed commercial devices (such as lasers or LCD display back lighting) and only if these devices have been left unmodified, and themselves comply to national and European regulations.

### 4.8.2. *Lasers*

Only considerations based on laser class definition (in the "EN 60825-1:2007, Edition 2 - Safety of laser products - Part 1: Equipment classification and requirements" standard) will be taken in account. Teams using a laser will have to provide the classification notice of the equipment, or the data sheet of the laser component. Not being able to provide such documents will prevent the robot to be approved as is.

Based on the classification, it is allowed to use lasers of Class 1, 1M, 2, 2M. All other classes (3R, 3B and 4) are strictly forbidden.




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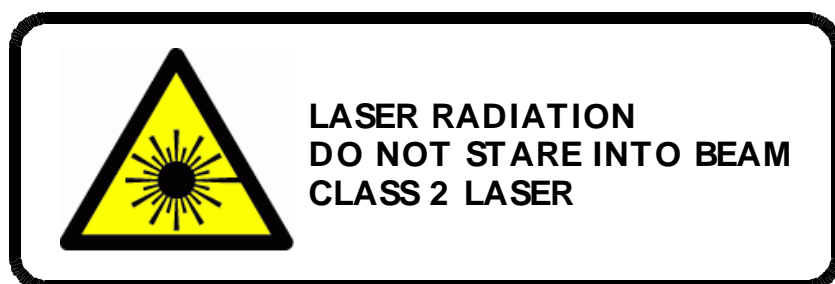


**Additional constraints for robots competing in France : Lasers class 2 and 2M are accepted if and only if the laser beam is never projected outside the table.**

For safety reasons, laser components salvaged from CD/DVD readers or writers are not allowed. Even if these consumer devices are classified as class 1 laser devices, this classification is valid only if the device is kept unmodified and with its casing in place. Lasers components included in such devices can be class 3 because of its wavelength and/or energy used. Therefore it is not permitted to use these components in the competition.

**CAUTION :** disassembling such products and have them operate without their casing can be extremely harmful (this is indicated by the stickers that should be present on the casing of the device)

Robots using class 2 and 2M lasers must show on their casing a laser caution label according to the official laser products users guide (IEC TR 60825-14: 2004 Safety of laser products. A user's guide), such as the following one :



#### 4.8.3. Powerful lights

When high intensity light sources are used, be aware that the light intensity can be dangerous for the human eye. Note that some commercially available high power LED devices can exceed this limit.

#### 4.8.4. Compressed air systems



**This paragraph applies to robots competing in France (all French Cup robots).**

All pressure systems must comply with the "Conseil Général des Mines" Decree 63 of January 18, 1943 and Ministerial Order of July 25, 1943 :

- Maximum service pressure : 4 bars
- Maximum pressure x Tank volume  $\leq$  80 bar.liter

Further information can be found on <http://www.industrie.gouv.fr/sdsi/>

## 4.9. Other systems

All other systems are, in principle, allowed, provided of course they comply with the rules outlined above. Use your imagination !



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For example, in order to encourage innovation and provide an interesting show for the public and media it is suggested to implement sound or emotive behaviours into your robot.



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## 5. Beacons

### 5.1. General comments

Beacons are not allowed to obstruct the opposing robot. If there is any doubt that they may deliberately disturb the development of the match, the team will not be allowed to use them.

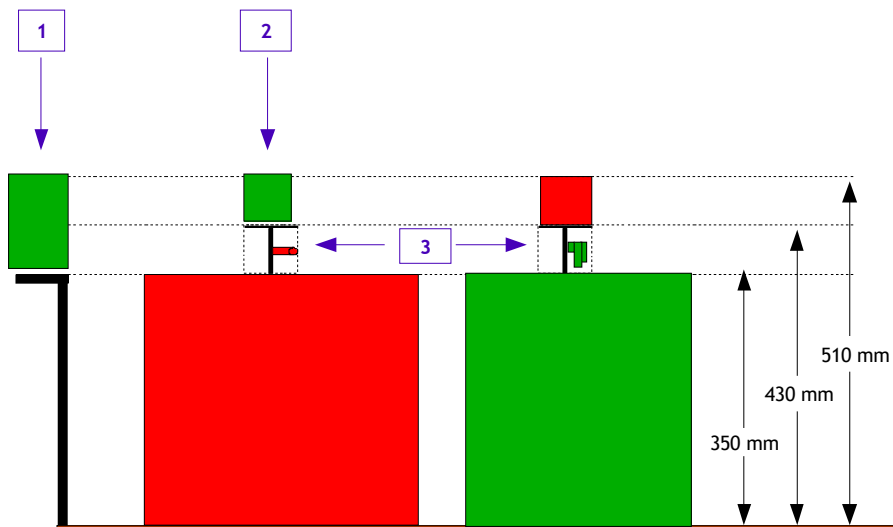
The beacon supports are placed in the locations detailed in paragraph “*Beacon supports*” on page 10. They are placed on the outside of the table.

The beacons undersides are covered with Velcro (soft “loop” side) as a way to fasten them on their assigned support.

The beacons (robot localization or fixed ones) shall remain on their support throughout the matches.

The use of beacons is optional.

All safety standards applicable to robots are also applicable to the beacons.



#### Legend :

1 : Fixed beacon (maximum dimensions L x W x H: 80x80x160 mm)

2 : Robot localisation beacons (maximum dimensions L x W x H: 80x80x80 mm)

3 : Mast (area for sensors and associated components only, provided that they remain within the vertical projection of the support of the beacons)



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### 5.2. Robot localization beacon

One localization beacon can be fitted onto the other robot, in order to locate it. This beacon will be fitted on the beacon support provided for this purpose by the opponent robot.

Only one localization beacon is allowed per team.

The maximum size for a robot localization beacon is a **cube with 80 mm sides**.

The elements used for the beacon design shall be useful. If necessary, the referee may request that the team opens its beacon casing for inspection and verification.

The robot localization beacon top shall be covered with Velcro (rough “hook” side) able to support the flag module identifying the robot's allocated colour.


### 5.3. Fixed beacons

Each team can put a beacon on any of the fixed beacon supports placed around the playing area. See paragraph “**Beacon supports**” on page 10 for details.

The fixed beacons must remain within a square base of **80x80 mm** and can be up to **160 mm high**.

The fixed beacons can be linked together by a wire. This optional wire must not disturb the development of the match and the team must be able to install it during the 3 minutes for match preparation without disturbing the opponent team.

Temporary wire connection between the beacon and the robot is allowed during the preparation phase before the match, but on the definite condition that it doesn't disturb the preparation of the opposing team. In case of a justified complaint from the opponent, the team will have to cease using this equipment.



*Given that the 3 minutes time period allowed for the preparation is very short, and that any team not respecting it will be penalised, we strongly advise against the use of such equipment.*

### 5.4. Communication signals

In order to avoid interference between the teams, it is recommended to encode the communication signals. We strongly recommend that teams using infra-red devices take into account the strong ambient light used during the competition. Moreover, this illumination may vary over time and location during the competition.

We also mention that the competition staff uses high frequency radio devices during the contest.

No complaint regarding interference problems will be taken into account. The beacons must be able to cope with the conditions that may change depending on the moment and their location during the contest.



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## 6. Match timeline

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### 6.1. Robot identification

For each match, the robots are allocated a team colour marker, built as a small flag module in yellow or blue. The marker is to help the public recognize which robot belongs to which team.

The flag module mass is negligible. It is placed directly on the robot beacon support, or directly on the robot. If the robot does not provide a beacon support, it must provide a **80x80mm square** surface covered with Velcro™ (rough “hook” side) at the top of the robot to place the flag marker on.

### 6.2. Starting procedure

- A colour (yellow or blue) and therefore a side of the playing area is allocated to the team before each match.
- Only 2 members from each team are allowed to access to the stage area for robot preparation.
- Both teams have 3 minutes to put their robot on the starting position, to prepare it and to install all beacons.
- The robots are placed on the table, entirely within their starting areas.
- After the **3 minutes** preparation time, no more intervention or transmission of external information to the robot is allowed.
- When both teams and the referees indicate they are ready, the referee will determine the random positions for the playing elements to be placed on the table. This is done by drawing from a set of cards. These cards are provided in the Appendix of this document (“*Appendix B - Random cards*” on page 35). During this procedure, the teams are not allowed to touch their robot nor communicate with it.
- The referee asks the participants if they have any remark about the placement of all the game elements. No objection regarding the placement will be accepted after this point.
- At the start signal given by the referee, the robot is activated by one of the team members using the starting cord. The robot shall then run on its own in a fully autonomous way.

Any team which does not scrupulously follow this starting procedure is charged with a false start. A new start shall be given with a new random layout for the game elements. Penalties may be applied for causing the false start.



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## 6.3. Match sequence

Robots have **90 seconds** to score as many points as possible. This must be accomplished in complete autonomy.

The team members are not allowed, in any way, to touch the robots, the playing area or any of the fixed game elements during a match. **Any such action made without the referees consent will lead to disqualification for the current match. The team will then lose all the points it may have scored during the match.**

If the robot leaves the playing area it may not be put back in. The match is not replayed and the other robot is allowed to finish the match normally.

A robot that deliberately pushes its opponent out of the playing area is disqualified.

At the end of the match, the robots must stop (shut down of all actuation) by themselves. If the robot does not shut down by itself, a referee will push the emergency stop button to stop the robot.

The referees will count the points without touching the robots. Then they will announce the score.

The team members are allowed to touch the robots and leave the game only with the explicit consent of the referees after common agreement on the score. They must ensure that no element of play remains inside the robot.

## 6.4. Calculation of the score

### 6.4.1. *Game points*

Game Points (see “Scoring” on page 12) are awarded at the end of the match for the game actions connected to the playing elements.

### 6.4.2. *Penalty points*

A penalty results in the removal of points from the score of the team at the end of the match. Any action not compatible with the spirit of the rules may be penalized by the referees. For example, the referees may assign penalties in the following cases:

- When a robot violently collides with its opponent.
- When a robot is considered dangerous for the table, the audience or its opponent.
- When a robot deliberately prevents its opponent to access a game element.
- If a robot’s shut-down system fails to work.
- If the robot puts systematically playing elements off the table.
- If the robot deliberately prevents opponent to access to its scoring area.
- Whose robot shows a deployment or an action that has not been previously approved by the referees, or any deliberate action not in line with the rules.

Additional penalties can be applied if the referees consider this justified. For instance, if a team has been warned about some negative point during a match, and the same point is





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noticed during a subsequent match, this will turn into a penalty. The electronic scoring system used for the competition sports a feature to record such warnings, so that the referees can know about past problems with the teams and take them in account accordingly.

Multiple penalties can be applied for one offence, if the referee feels the offence justifies it.

#### **6.4.3. Bonus points**

Additional points are awarded in the qualification rounds to the teams accordingly to the result of a match. The system of bonus points is described in paragraph “**Bonus points**” on page 12.

#### **6.4.4. Scratch and match disqualification**

The team is declared scratched (i.e. disqualified from the current match) when some of the following conditions occur:

- it does not come on time to the backstage waiting room for matches;
- it takes more than 3 minutes to get ready on the playing area;
- its robot has not completely left its start area during a match;
- its robot doesn't have a mobile beacon support, when its opponent requests and requires one.

In case of a scratch, no points are given to the team (whether positive or negative).

#### **6.4.5. Competition disqualification**

The referees may disqualify a team for the competition:

- When the robot makes the same penalized actions systematically
- For unacceptable behaviour
- Failure to comply with safety regulations



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## 7. Competition phases

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### 7.1. Approval phase

A robot must be approved before being allowed to participate in the tournament. For logistical reasons, and reasons of fairness, there is a deadline for approval. All teams must approve their robots before this deadline. Robots that are not approved will not be allowed to participate in the tournament.

#### 7.1.1. *Physical examination and team interview*

The referee examines the robot and interviews the team to check the following:

- That the robot complies with the rules (the robot should be capable of demonstrating all of its possible actions and deployment configurations to help verification).
- That the team provides a required technical documentation of components (e.g. lasers).
- That the team provides a technical poster.
- That the team understands the rules and the spirit of the tournament.
- That the emergency stop button works, and all actuators are shut down when it is pressed.
- The organizer's logo (if required) is placed on the robot so it is visible by the public.

#### 7.1.2. *Practical trials*

In addition, the robot must pass the following tests:

1. That under match conditions, without opponent:
  - The robot is capable of leaving the start area
  - The robot is able to score at least 150 points.
  - The robot's shut down system works properly
2. A test that the robot's obstacle avoidance system works.

The system should be able to successfully avoid a static dummy obstacle, put in the path of the robot. This obstacle is a fake robot made of a 300 mm high and 200 mm diameter cylinder, weighting between 2kg and 3kg. This fake robot has a beacon platform, so that it is possible to place a beacon on it. The robot must not touch the obstacle, demonstrating to the referees in a convincing manner that it properly takes the obstacle in account.

3. For competitions held in France, in case of class II lasers (be it in the robot or in the beacons) the laser system is tested to ensure that the spot is never projected outside the table.



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### 7.1.3. *Modifications after approval*

It is mandatory to keep referees informed of any major modifications (functionality, size, etc.) performed after the robot's approval. The referees will check the modifications and re-approve the robot.

Actions used during the match which were not demonstrated during the approval process can lead to penalties or disqualification.

Referees can require a robot to subject itself to another approval process at any time during the competition, if in doubt about its conformance to the rules.

## 7.2. Qualification rounds

The qualifying rounds consist of at least 5 matches for each team during the qualification round. The results of the qualification rounds decide which teams go to the final round.

When the qualification rounds are over, the teams are sorted using their cumulative qualification point count. The teams that have the same points count are sorted by comparing the points accumulated during each match without adding the bonus points for match result.

In case of ties, the organisers may request the teams to play extra matches. Pairs of teams competing for the same rank will be randomly drawn, and resulting matches will be played on a knock-out basis. In case of odd number of teams, an additional random match will be played, on the same basis.

## 7.3. Final round

At Eurobot, the first 16 teams from the qualifying phase are selected for the final round. In a national competition the final round may be smaller, depending on the number of registered teams.

The matches for the final round are organised as shown in the diagram here after.

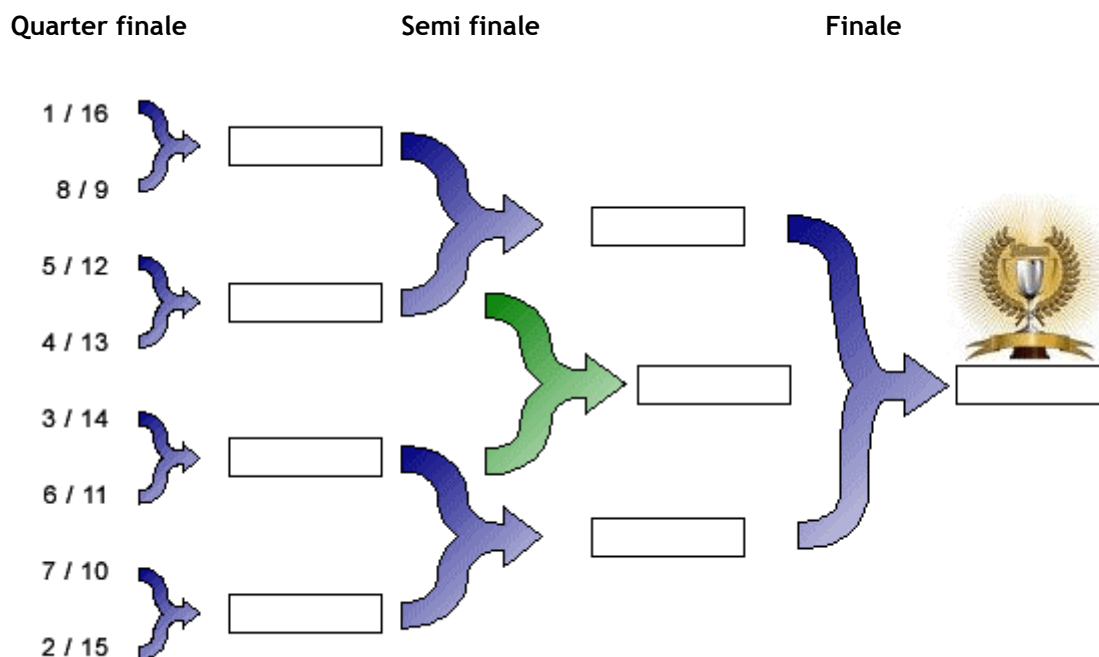


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During the final phase, matches are on a knock-out basis.

In the event of a double defeat, a draw or a double disqualification the match is replayed immediately. If this second match is also a double defeat, a draw or a double disqualification, the winner will be determined by the position at the end of the qualification rounds.

The final match is played in **two winning sets**.



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## 8. Appendix A - Playing area and elements specifications

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The following section provides all the details necessary for playing area construction.

### 8.1. Tolerances

The organisers are committed to build the playing area to the highest degree of accuracy. But they do allow for the following fabrication tolerances:

- 2% with respect to the playing field construction,
- 5% with respect to the playing element construction,
- 10% with respect to painted markings.

No complaints related to fabrication variations within the above tolerances will be accepted. The teams are warned that the paint finish of the table may vary from one playing area to another and may degrade during the competition.

If problems with the rules are discovered, the definition of the field and game components may be modified over the course of the year. We strongly advise participating teams to regularly consult our web site <http://www.eurobot.org/> in the 'FAQ' section for potential amendments and to follow the discussion and the information on the forum <http://www.planete-sciences.org/forum>.

#### **Important notes:**

*Be aware that the flatness of the table is also subject to some variation. While some tables are made of very stiff materials, and perfectly flat, some are softer and may have some degree of warping. The tables may also be made from two or more sections, resulting in a small ridge at some locations on the table surface. For these reasons it is urgently recommended to allow enough flexibility in the robot's drive system, and the robot's clearance to accommodate such variations.*

*Above tolerances apply to the playing field and other components of the game only. They do not apply to robots and localization beacons prepared by the participating teams, which are required to respect the limitations described in this document, without tolerances.*

### 8.2. Technical drawings of the table and the playing elements

Because of their size, the detailed technical drawings with dimensions are gathered in "Appendix C - Technical drawings" on page 34.



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### 8.3. References of the paints

Element	Colour	Type of paint	Reference
Playing table	Green	Acrylique, mate	RAL 6018
Corn ears	Pearl white if they are painted	Acrylique, mate	RAL 1013
Blue departing area	Bleu	Acrylique, mate	RAL 5005
Yellow departing area	Yellow	Acrylique, mate	RAL 1023

### 8.4. References of playing elements

The references of balls will be communicate on the forum as soon as possible.



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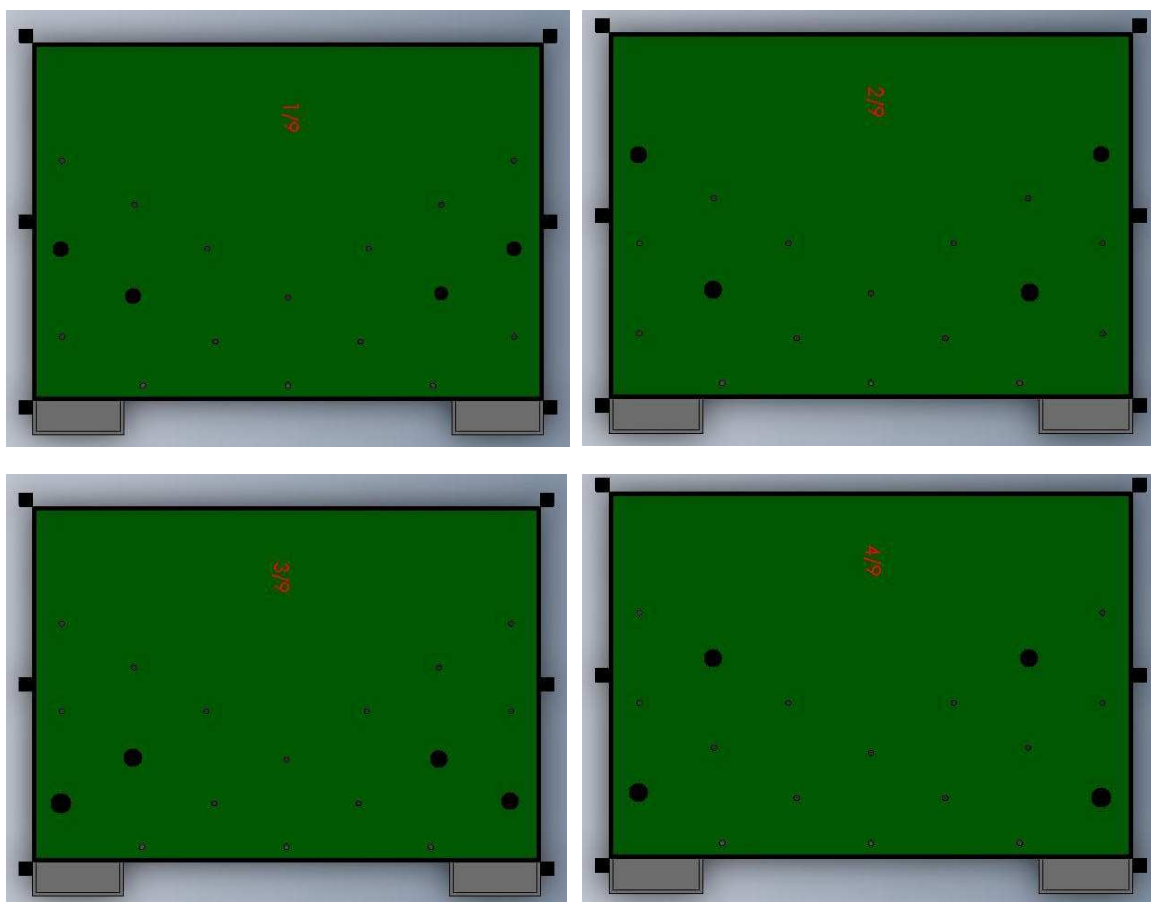
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## 9. Appendix B - Random cards

The card game for the terrain is composed of two parts:

- 9 cards for the placement of fake lateral corn
- 4 cards for the placement of central fake corn

Configurations for corn ears side:





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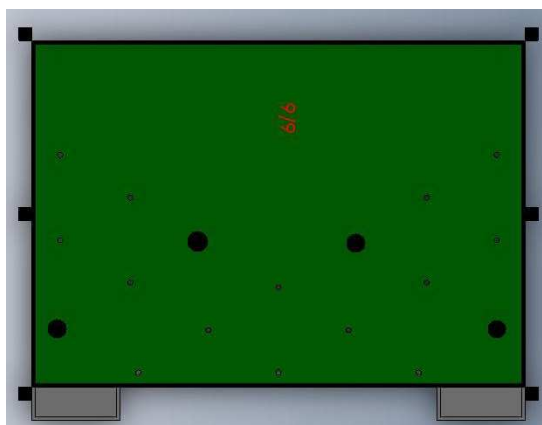
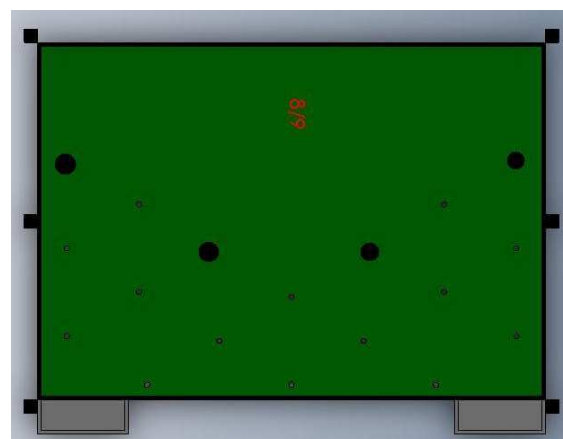
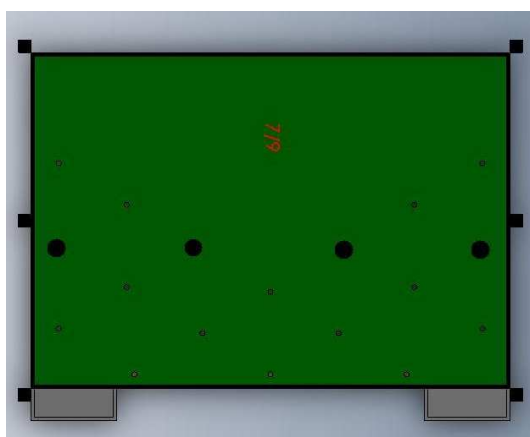
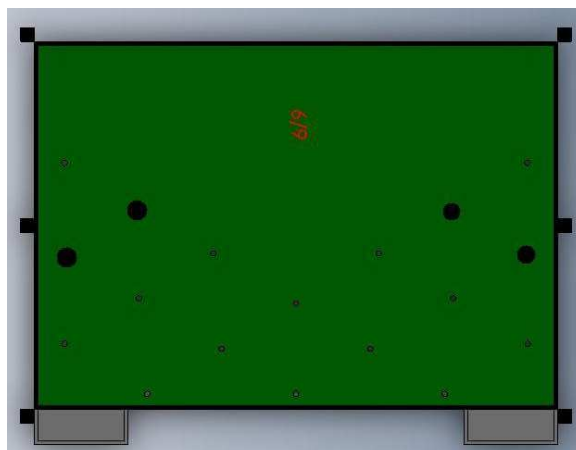
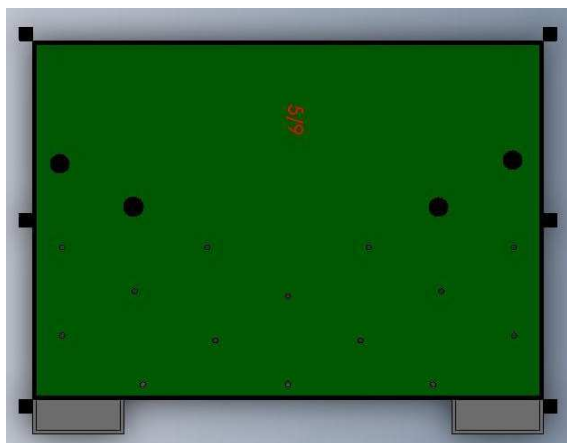
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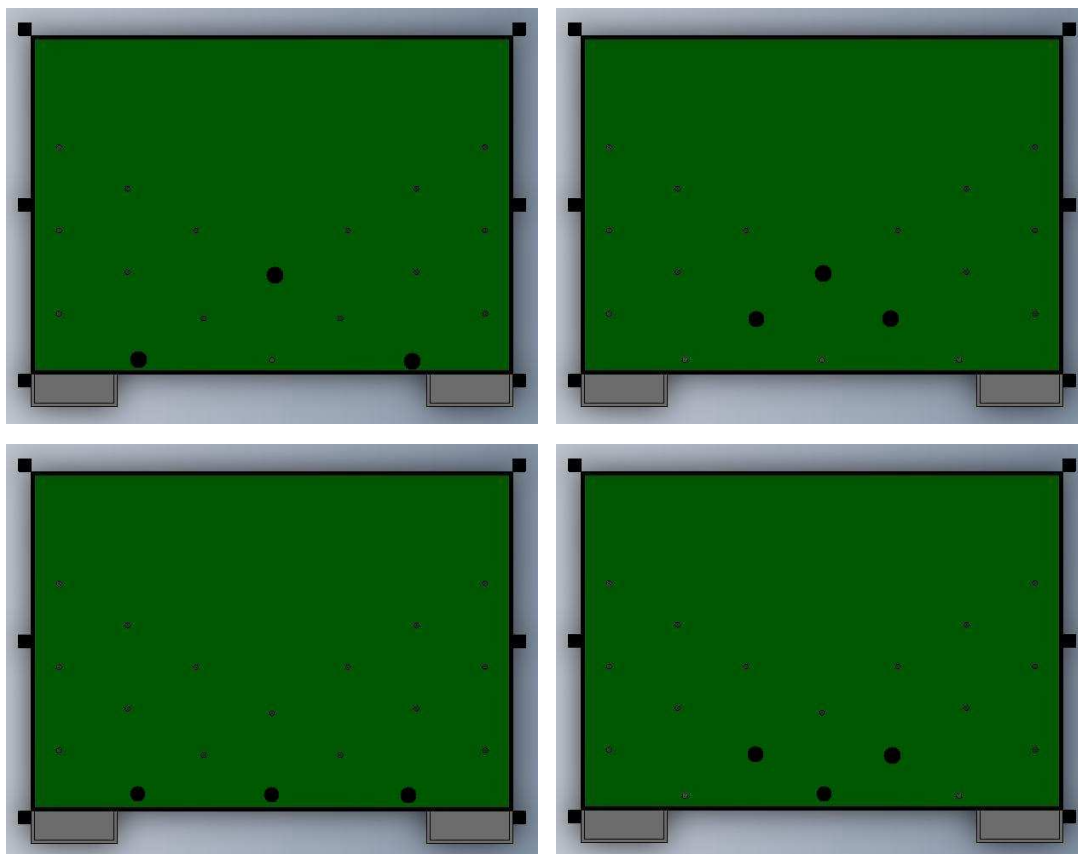


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Configuration for the central corn ears:





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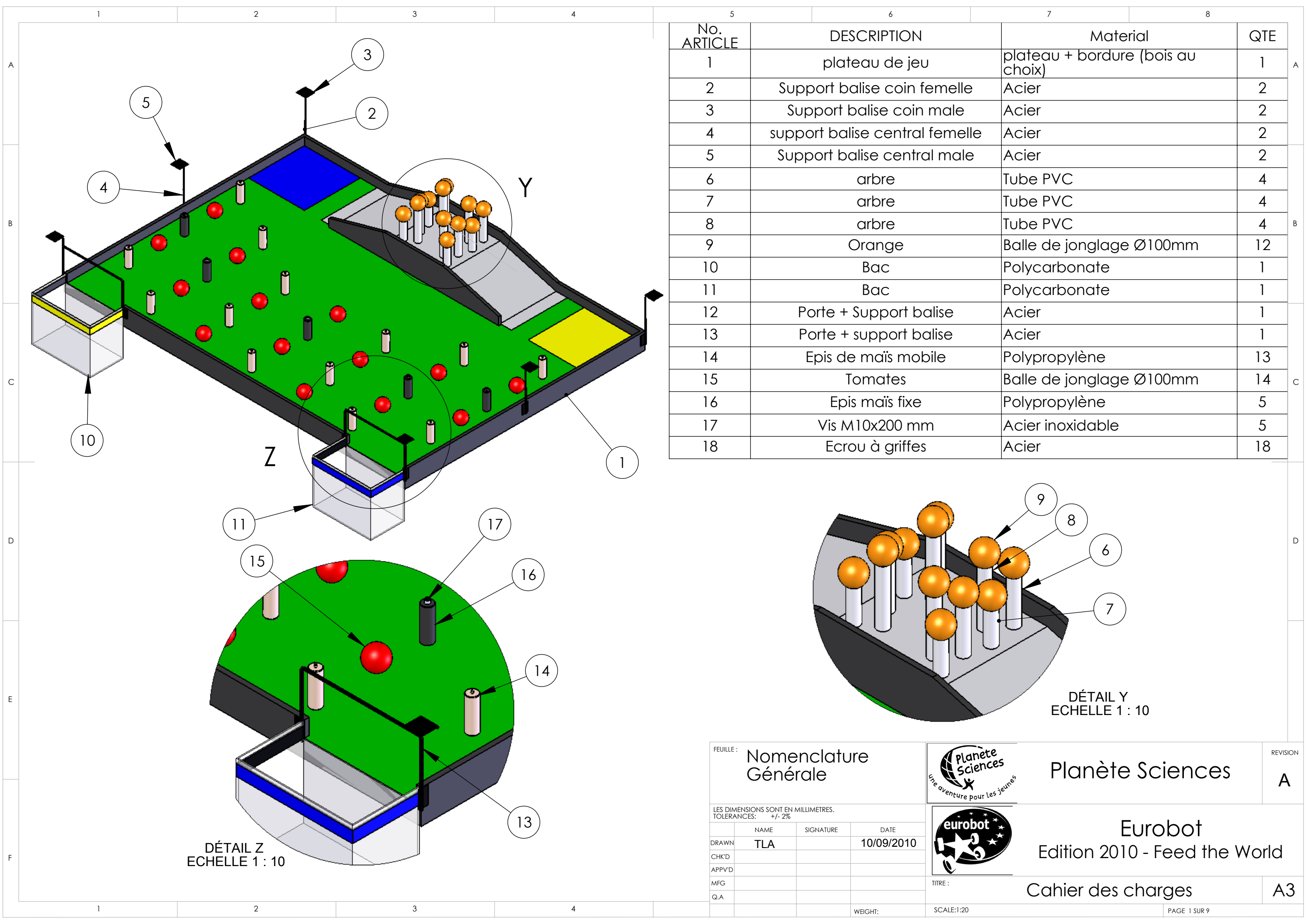
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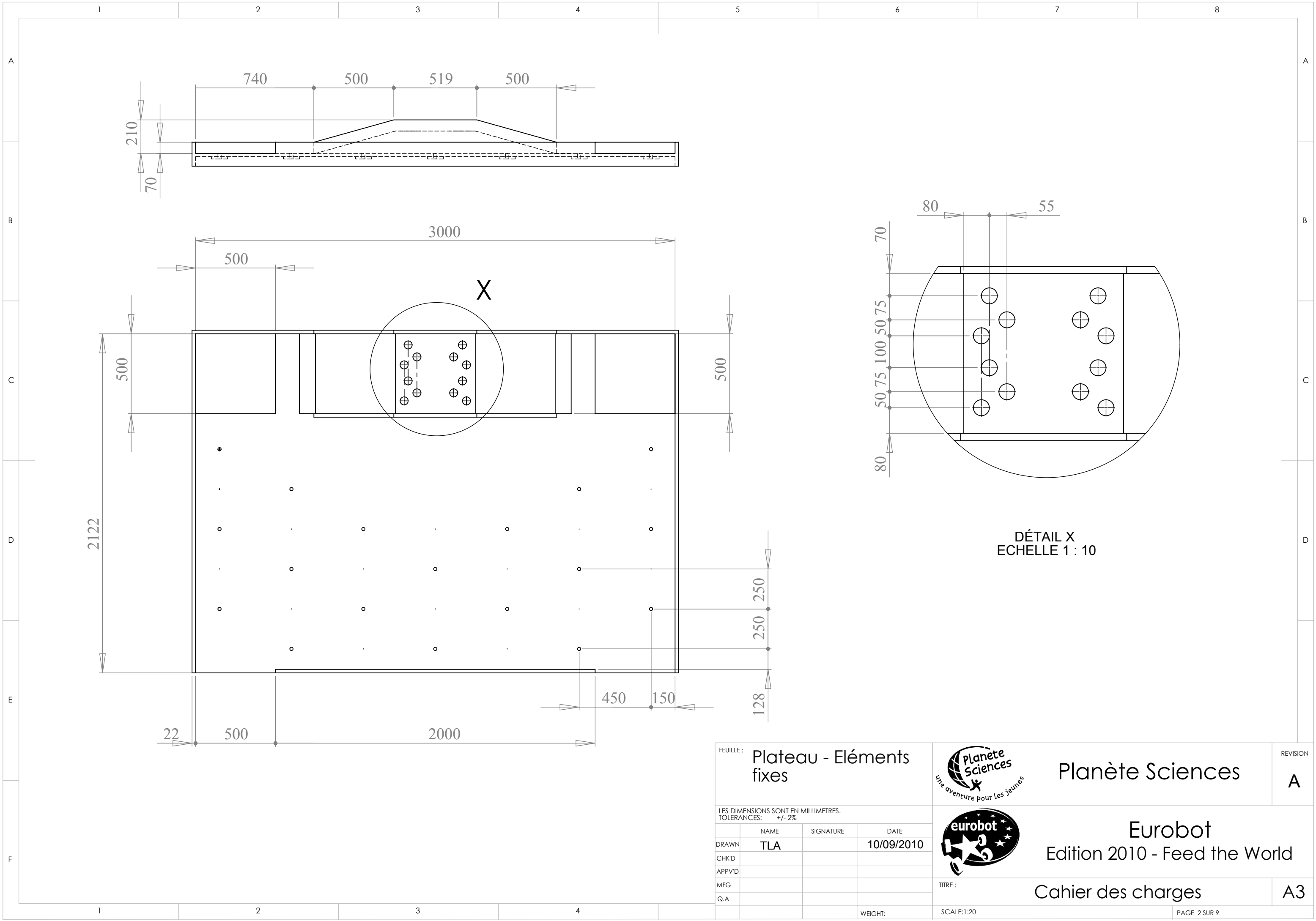
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## 10. Appendix C - Technical drawings

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FEUILLE : Plateau - Eléments fixes

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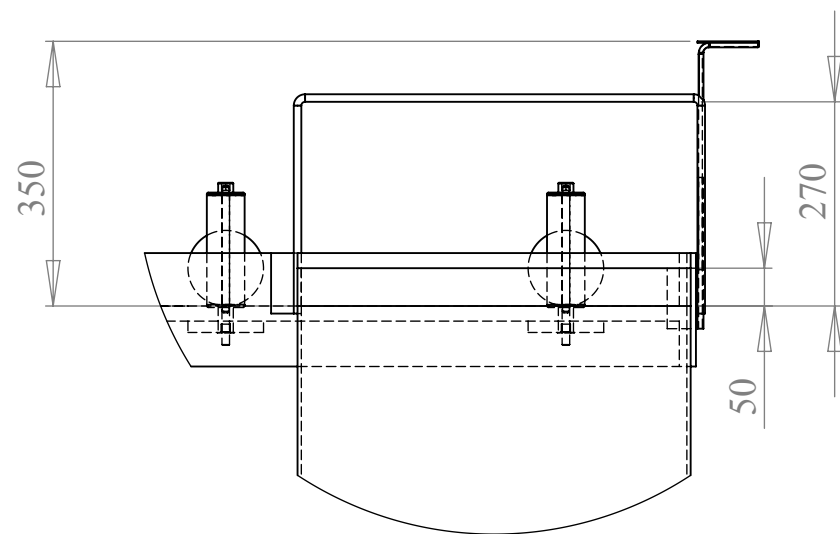
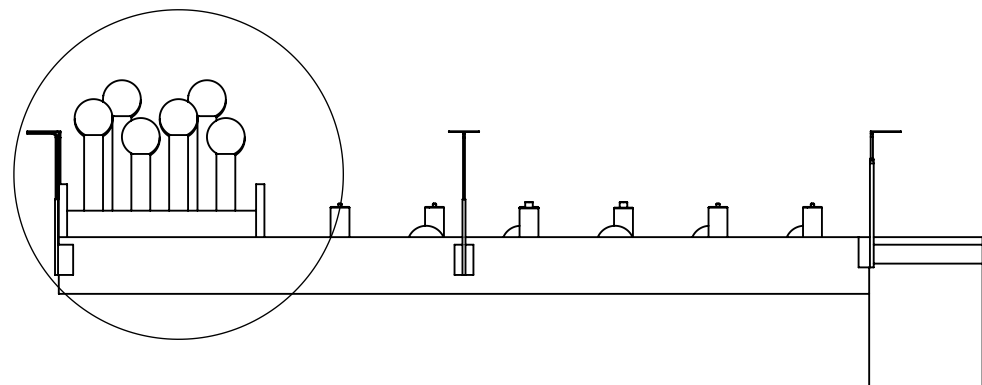
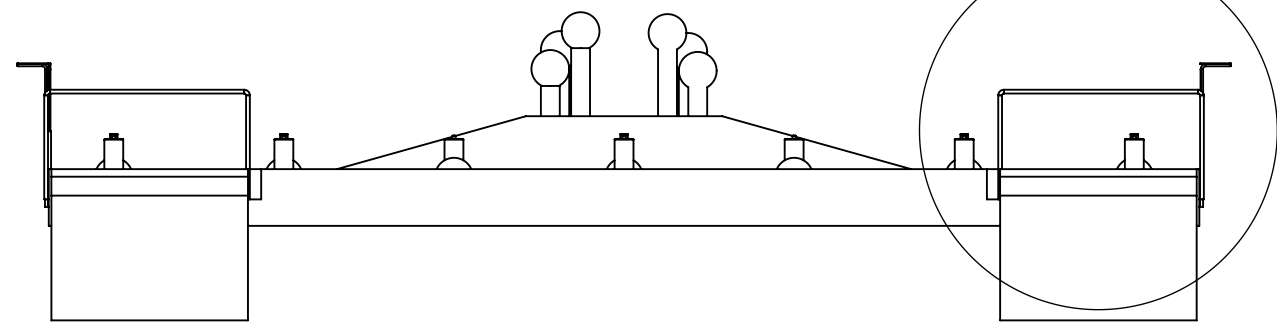
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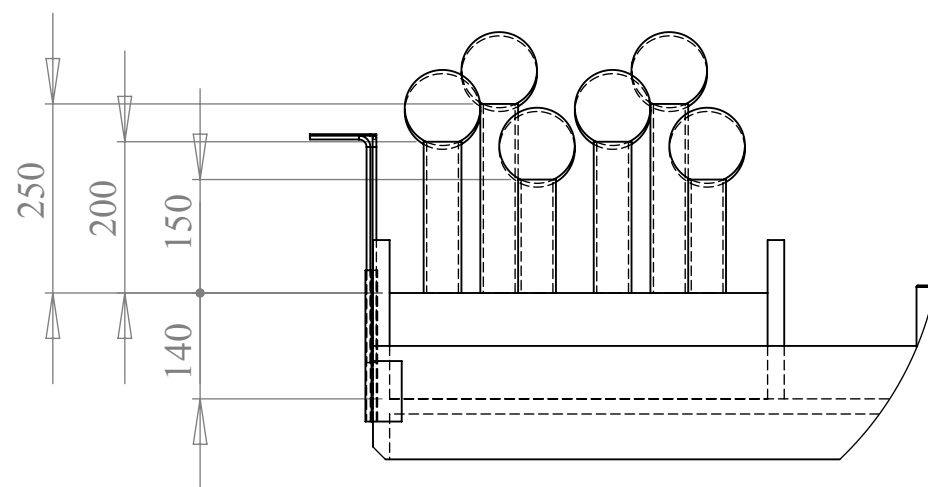
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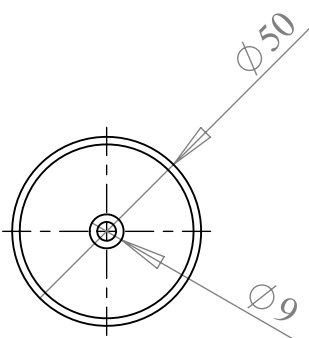
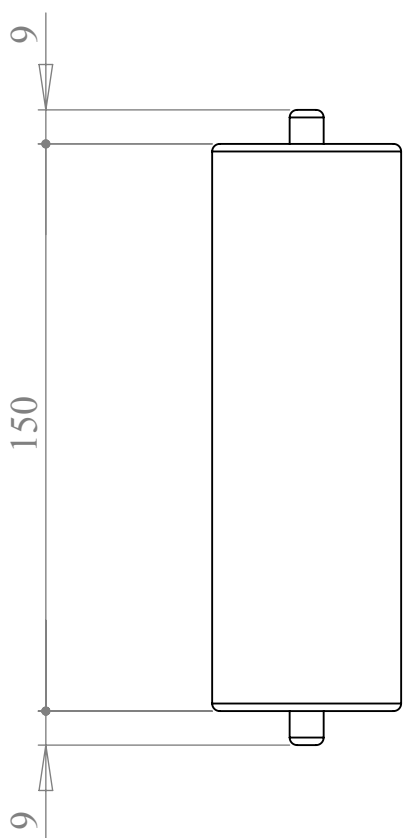




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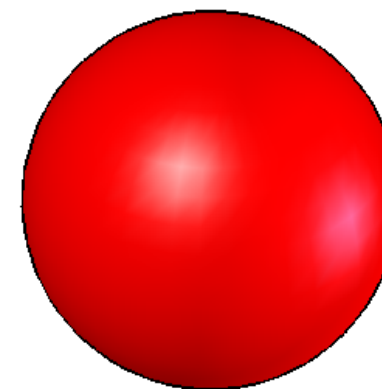
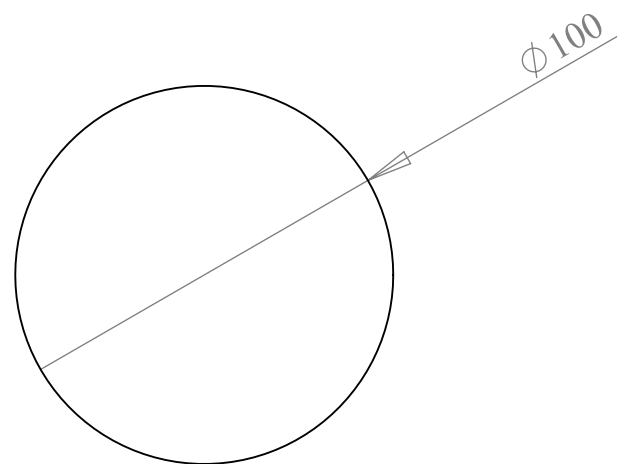
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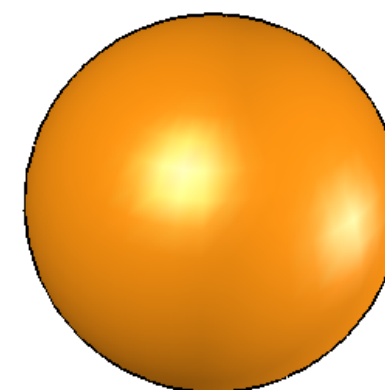
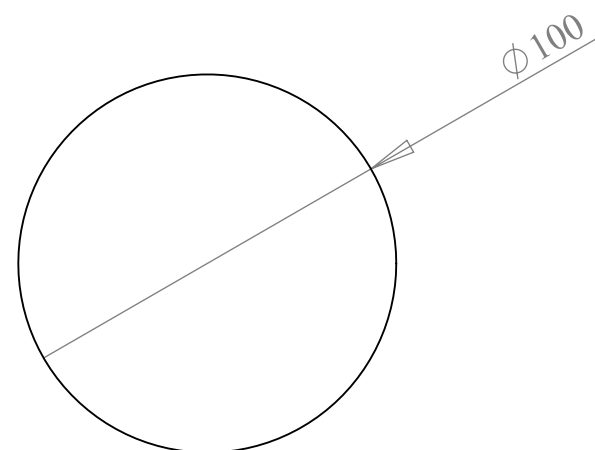
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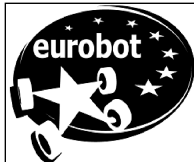
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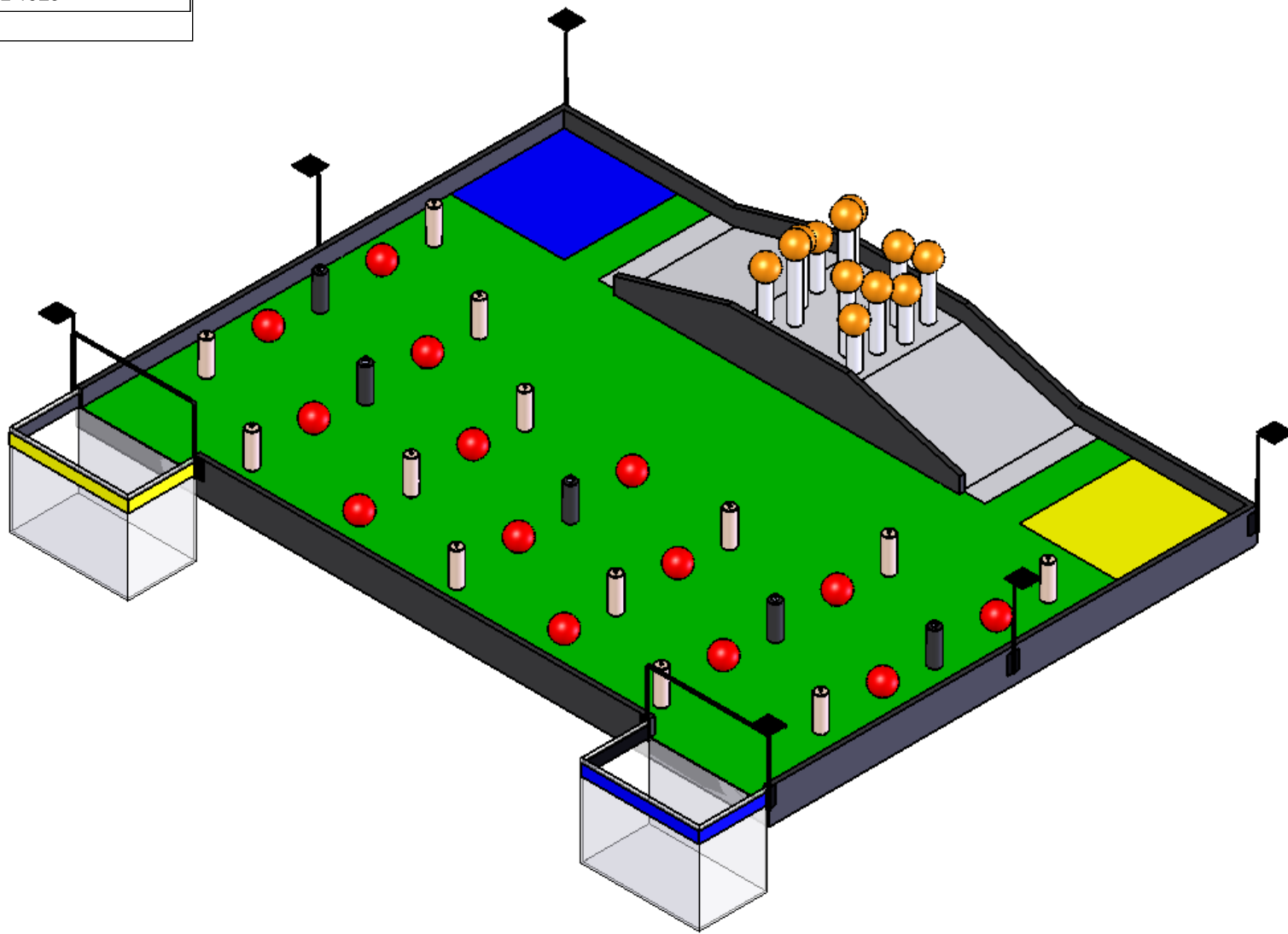
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Epis de maïs	Blanc perle (si peint)	Acrylique mat	RAL 1013
Zone de départ bleue	Bleu	Acrylique mat	RAL 5005
Zone de départ jaune	Jaune	Acrylique mat	RAL 1023



FEUILLE : Peinture - Couleurs



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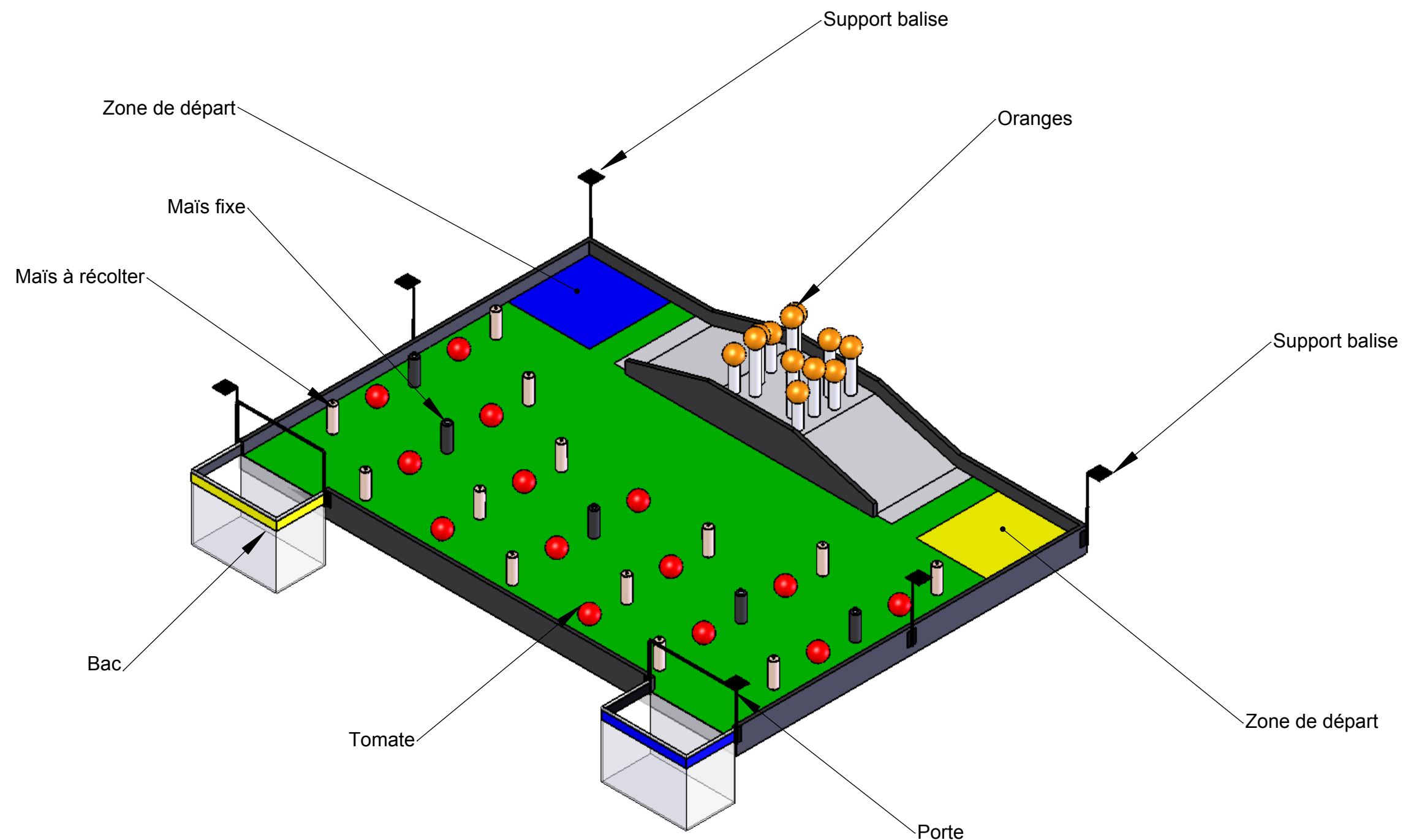
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