

Molten Metal Safety VR

Immersive Virtual Reality Training



**TRAINING
MANUAL**



Constellium

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A VIRTUAL REALITY TRAINING

What is virtual reality?

The Molten Metal Safety VR application is a **virtual reality** training.

Virtual reality (VR) involves immersing the user in a digital world using a VR headset. **Immersed in a hyper-realistic 3D environment**, the user explores an interactive and virtual world, using both hearing and vision. Thanks to sensors that detect head movements, the immersive experience is total. It also does not occur visual disturbance.



Benefits of VR in training

Virtual reality is nowadays recognized for its fun aspects, but also for its numerous interests in the field of training, in particular thanks to its **innovative educational possibilities**.

Indeed, virtual reality allows people to practice in a **virtual environment** before going into the field and facing real situations.

The training experience is interactive and realistic, allowing for a very rich learning scenario. The active engagement of the learner promotes **enhanced memorization**. Learners can make many mistakes without any consequences afterwards, especially when working in risky or stressful environments.

The advantages of the training

- With the **realistic immersion** offered by the headset and the 3D environment, you will explore a Constellium facility as if you were there!
- Thanks to the many **interactive situations**, you will be able to carry out inspection operations, furnace loading, chemical corrections, etc. yourself.
- Each step of the procedure is clearly identified.
- The operation sheet is permanently accessible in order to easily make the link between the operations and the procedure.
- Are you afraid of making a mistake? That's not a problem! You can repeat **as many times as necessary, without risk**.
- The application also offers a **realistic assessment of your knowledge**, in which you can apply the complete lockout/tagout procedures independently.
- In short, you will be able to learn by doing, with the right to make mistakes, in an immersive, realistic and safe environment.



Figure 1 - Realistic environment (ex: casthouse)



Figure 2 - Realistic equipment (view from the forklift)



Figure 3 - Use of realistic tools (ex: grabbing a shovel)

PRESENTATION OF THE COURSE

Presentation video

A video presentation is available at the following link:



Figure 4 - <https://numix.fr/mmvr-presentation/>

A digital version of this user guide is also available for download.

Required Equipment

Molten Metal VR is a virtual reality training application, accessible through a **Meta Quest 2** (formerly Oculus Quest 2). The Meta Quest 2 is the most advanced all-in-one VR system. Every detail has been designed to reflect your movements in the virtual world. You'll enjoy breathtaking experiences with unparalleled freedom. No PC or console required.

The application is updated regularly using the ArborXR deployment platform that we have already installed on the headset. We do not use your personal data.



Figure 5 - The Meta Quest 2 headset with the Elite strap
Note: Some headsets might have soft adjustable straps instead



Figure 6 - Meta Quest 2 controllers

A video explaining the headset is available on the following URL. You can access it directly by scanning the QR code below or by going here:



Figure 7 - <https://numix.fr/mmvr-support/>



WARNING!

The VR headset lenses are very sensitive to sunlight. Never put a helmet in direct sunlight, as this could damage the headset.

The people targeted by the training

The training application and the material required to consult it are made available mainly for training usage for all Constellium sites.

The objectives of the training

At the end of this course, the student will be able to carry out a complete control of containers and to load a furnace without error, taking care of possible contaminants and tool conditions. He will also be able to correct a furnace, but also to sample a pawn to know the chemical composition at the furnace exit. He will be made aware of his mistakes through vivid experiences such as realistic explosions.

It is intended to be used with an accompanying facilitator who is responsible for setting up the session and following up to carry out a positive assessment at the end of the session.

To be effective, it must be carried out in a suitable environment (quiet and free of external stress and with enough space to move) and repeated several times in order to consolidate what has been learned.

It is essential to complement this approach by "real" practical training: indeed, nothing can replace experience in the field.

Depending of the maturity and experience of the trainee in casthouse processes, it is recommended to adjust the level of difficulty to ensure a positive outcome of the first experience. (eg no explosion)

Content of the scenario 1

Structure

Training configuration

The facilitator sets up the session, chooses the scenario and the state of the furnace. Then the learner can join the session and discover the objectives.

Duration: about 3 minutes

Furnace inspection

The learner must understand the furnace status by opening the door using the control command, have a look at the temperature and check whether it is empty or half full.

Duration: about 2 minutes

Inspection procedure

The learner moves to the containers area and must visually inspect each container before validating as safe to be loaded. They must remove contaminants or replace containers with dangerous defects.

Duration: about 10 minutes

Loading procedure

The learner must get into the forklift and load the scrap one by one into the furnace, in the safest order.

Duration: about 5 minutes

The total duration is 20 to 30 minutes maximum. We recommend a maximum of 30 minutes of consecutive use.

Detailed procedure

- Furnace Inspection
- Open and close the furnace (not mandatory to proceed to next steps)
- Containers inspection (inspection order up to trainee)
- Inspection of divided waste 1
- Inspection of divided waste 2
- Inspection of divided waste 3
- Inspection of ingots
- Inspection of massive waste
- Inspection of billettes
- Inspection of bars
- Loading the containers into the furnace (loading sequence up to trainee)
- Loading divided waste 1
- Loading divided waste 2
- Loading divided waste 3
- Loading ingots
- Loading massive waste
- Loading billettes
- Loading bars

Consequence matrices

You can find below the details of the consequences of scenario 1 depending on the state of the furnace, the loading order and the loading of defects. Minor explosions are shown in orange and major explosions in red.

COLD FURNACE	Covered			Not covered			Consequence	
	Groupe 1: Low risk scrap			Groupe 2: Medium risk scrap		Groupe 3: Higher risk scrap		
	1	2	3	4	5	6	7	
Type of scrap	Divided waste	Divided waste 2	Divided waste 3	Massive waste	22kg ingot pile	3 T bars	T+P billettes	Sequence of charging is free for operator
Basic test case First scenario to play					Low risk contaminant			No impact on consequences No explosion but warning for container not being properly checked
normal case Summer 30°C easy	Low risk contaminant		Low risk contaminant	Low risk contaminant				
Summer 30°C medium		High risk contaminant		High risk contaminant	High risk contaminant			
Summer 30°C hard			Compressed pipes			Large cracks	Large cracks	
Weather of the day change in summer temperature drop by 20°C to 10°C and small rain					Droplet of water	Droplet of water	Droplet of water	
Weather of the day change in winter temperature drop by 20°C to -10°C, condensation appearing when arriving inside the casthouse on uncovered scrap					Droplet water when prep is done	Droplet water when prep is done	Droplet water when prep is done	

Figure 8 – Scenario 1 consequences for COLD FURNACE

HOT & EMPTY FURNACE	Covered			Not covered			Consequence	
	Groupe 1: Low risk scrap			Groupe 2: Medium risk scrap		Groupe 3: Higher risk scrap		
	1	2	3	4	5	6	7	
Type of scrap	Divided waste 1	Divided waste 2	Divided waste 3	Massive waste	22kg ingot pile	3 T bars	T+P billettes	Sequence of charging is free for operator
Basic test case First scenario to play					Low risk contaminant			If all bins/scrap have been controlled and contaminant being removed >> No explosion regardless of loading sequence if contaminant remain in one or more bin as per matrix case >> explosion if that bin is charged 1-2-3-4, if contaminant remain in one or more bin as per matrix case >> NO explosion if that bin is charged 5-6-7
normal case Summer 30°C easy	Low risk contaminant		Low risk contaminant	Low risk contaminant				
Summer 30°C medium		High risk contaminant		High risk contaminant	High risk contaminant			
Summer 30°C hard			Compressed pipes			Large cracks	Large cracks	
Weather of the day change in summer temperature drop by 20°C to 10°C and small rain					Droplet of water	Droplet of water	Droplet of water	
Weather of the day change in winter temperature drop by 20°C to -10°C, condensation appearing when arriving inside the casthouse on uncovered scrap					Droplet water when prep is done	Droplet water when prep is done	Droplet water when prep is done	

Figure 9 – Scenario 1 consequences for HOT & EMPTY FURNACE

HOT & half FULL FURNACE	Covered			Not covered			Consequence	
	Groupe 1: Low risk scrap			Groupe 2: Medium risk scrap		Groupe 3: Higher risk scrap		
	1	2	3	4	5	6	7	
Type of scrap	Divided waste 1	Divided waste 2	Divided waste 3	Massive waste	22kg ingot pile	3 T bars	T+P billettes	Sequence of charging is free for operator
Basic test case First scenario to play					Low risk contaminant			If all bins/scrap have been controlled and contaminant being removed >> No explosion; minor explosion for massive+billet+Tbar if one of this bin/material is charged 1-2-3-4 if contaminant remain in one or more bin as per matrix case >> explosion regardless of loading sequence
normal case Summer 30°C easy	Low risk contaminant		Low risk contaminant	Low risk contaminant				
Summer 30°C medium		High risk contaminant		High risk contaminant	High risk contaminant			
Summer 30°C hard			Compressed pipes			Large cracks	Large cracks	Same consequences as above except if the scrap has been replaced by an oven sure dry one, no explosion regardless of the loading order
Weather of the day change in summer temperature drop by 20°C to 10°C and small rain					Droplet of water	Droplet of water	Droplet of water	
Weather of the day change in winter temperature drop by 20°C to -10°C, condensation appearing when arriving inside the casthouse on uncovered scrap					Droplet water when prep is done	Droplet water when prep is done	Droplet water when prep is done	

Figure 10 – Scenario 1 consequences for HOT & half FULL FURNACE

Content of the scenario 2

Structure

Training configuration

The facilitator sets up the session, chooses the scenario and the recipe with the hardeners to load into the furnace. Then the learner can join the session and discover the objectives.

Duration: about 3 minutes

Inspection procedure

The learner moves to the pallets areas and must visually inspect each hardener before weighing them on the scale and validating as safe to be loaded. They must replace hardeners that contain dangerous defects.

Duration: about 10 minutes

Loading procedure

The learner must get into the forklift and load the container that contains every hardener previously inspected and weighed.

Duration: about 1 minute

Skimming procedure (optional)

If the learner loaded wrong shaped copper, this alternative step will appear, prompting the user to skim the metal in the furnace. The user will have to open the furnace one last time after a time ellipsis.

Duration: about 2 minutes

The total duration is about 15 minutes. We recommend a maximum of 30 minutes of consecutive use.

Detailed procedure

- 1) Hardener inspection
 - Inspect and add manganese to the container
 - Inspect and add iron to the container
 - Inspect and add magnesium to the container
 - Inspect and add copper to the container
- 2) Loading into the furnace

Consequence matrix

You will find below the consequences of scenario 2 according to the loaded hardeners. Minor explosions are shown in orange and major explosions in red. Note: If a minor explosion generating element is loaded with a major explosion generating element are loaded at the same time, the major explosion will happen.

HOT & FULL FURNACE					
Type of fastener	Manganese	Iron	Magnesium	Copper	Consequence
Recipe 1					If all materials have been controlled and contaminant being removed >> No explosion
Recipe 2	Oxidation				
Recipe 3		Oxidation			if contaminant is loaded in the bin as per matrix case >> explosion
Recipe 4	Oxidation		Oxidation		
Recipe 5		Oxidation	Cavities		For last case "Cu not right shape" operator being prompt to skim the furnace by going in forklift, door re-open Explosion
Recipe 6	Oxidation			Oxidation	
Recipe 7		Oxidation		Incorrect shape	

Figure 11 - Scenario 2 consequences

Content of the scenario 3

Structure

Mold inspection procedure

The learner moves to the mold teleportation point and must visually inspect the two molds to choose which one is suitable for the sampling.

Duration: about 2 minutes

Spoon inspection procedure

The learner moves to the spoon teleportation point and must visually inspect the three spoons to choose which one is suitable for the sampling.

Duration: about 3 minutes

Equipment (optional)

The learner can move near the PPE racks and equip himself with the PPE he thinks are the best for the sampling procedure.

Duration: about 1 minutes

Sampling procedure

The learner has to take the spoon, preheat it above the hot metal. Then gently dip the spoon into the liquid metal to fill it, then pour the metal into the mold.

Duration: about 3 minutes

The total duration is about 10 minutes. We recommend a maximum of 30 minutes of consecutive use.

Detailed procedure

- 1) Select the correct mold (left one)
- 2) Select the correct spoon (left one)
- 3) Equip yourself with the correct PPE
 - Protection hood (left one)
 - Jacket
 - Heat protection gloves (left one)
- 4) Sample the metal
 - Preheat the spoon
 - Fill the spoon
 - Pour the liquid metal

Consequence matrix

Sampling (putting the spoon inside the metal)	Time of preheating	Way introduction	Consequence
Good spoon	As defined (complete)	As defined	Successful step in scenario
Good spoon	As defined (complete)	Too quick or too deep or both	Explosion minor
Good spoon	Too quick	As defined	Explosion minor
Good spoon	Too quick	Too quick or too deep or both	Major explosion
Bad spoon	As defined (complete)	As defined	Successful step in scenario
Bad spoon	As defined (complete)	Too quick or too deep or both	Explosion minor
Bad spoon	Too quick	As defined	Major explosion
Bad spoon	Too quick	Too quick or too deep or both	Major explosion

Figure 12 - Scenario 3 consequences

GENERAL OPERATION OF THE EQUIPMENT

Presentation of the VR Kit

Contents of the kit

The Molten Metal VR kit consists of the following items:

- 1 or more Meta Quest 2 case (which contains the Quest 2, a USB charger, and the two controllers)
- 1 Samsung Galaxy S6 tablet (with USB charger)

Details of the components



Figure 13 - Meta Quest 2 case



Figure 14 - Meta Quest 2



Figure 15 - Meta Quest 2 controllers



Figure 16 - Meta Quest 2 charger with USB-C cable



Figure 17 - Samsung Galaxy S6 tablet lite

Getting started

Starting up the tablet

To start the Samsung tablet, press and hold the start button on the right side.

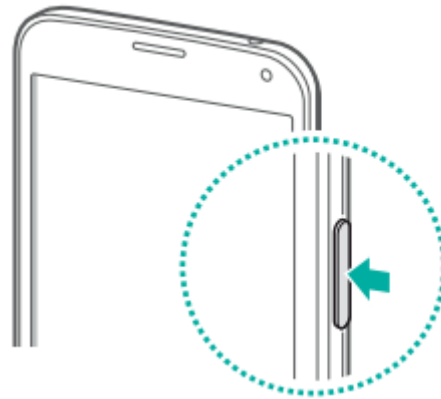


Figure 18 - The tablet power button

IMPORTANT: The PIN code for the tablet is **012345**

Starting the Quest 2 headset

To start the headset, press and hold the on/off button for a few seconds, then put on the headset. Then follow the instructions in the next section (Setting up the Guardian).

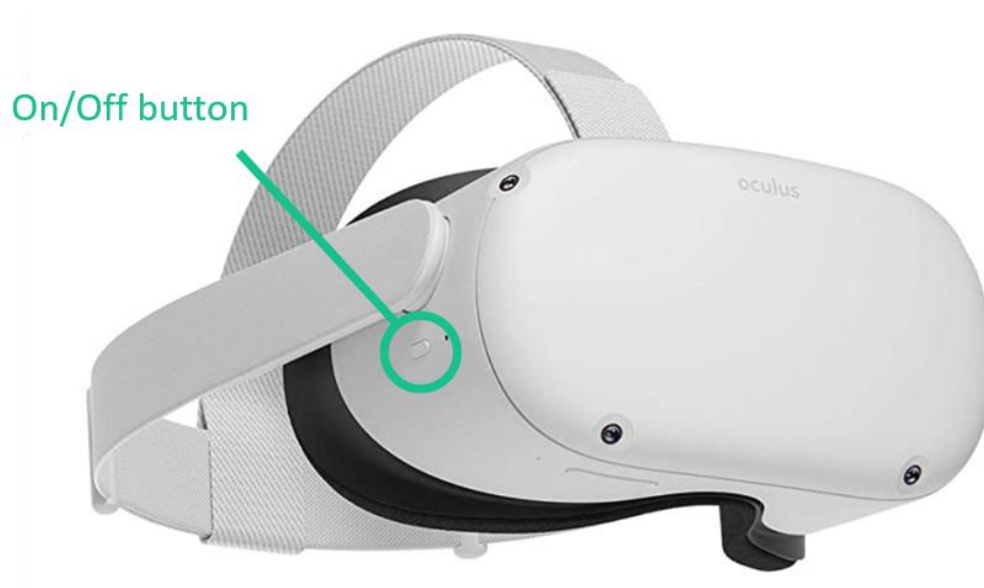


Figure 19 - The VR headset power button

Adjusting the headset volume

To adjust the volume of the headset, click on the buttons on the bottom of the headset.



Volume buttons

Figure 20 - The VR headset volume buttons

Home description

By default, when you start the headset you will arrive on this screen. This is the home screen of the headset (ArborXR platform) which lists the available applications. On this screen, only one application is listed: MoltenMetalVR.

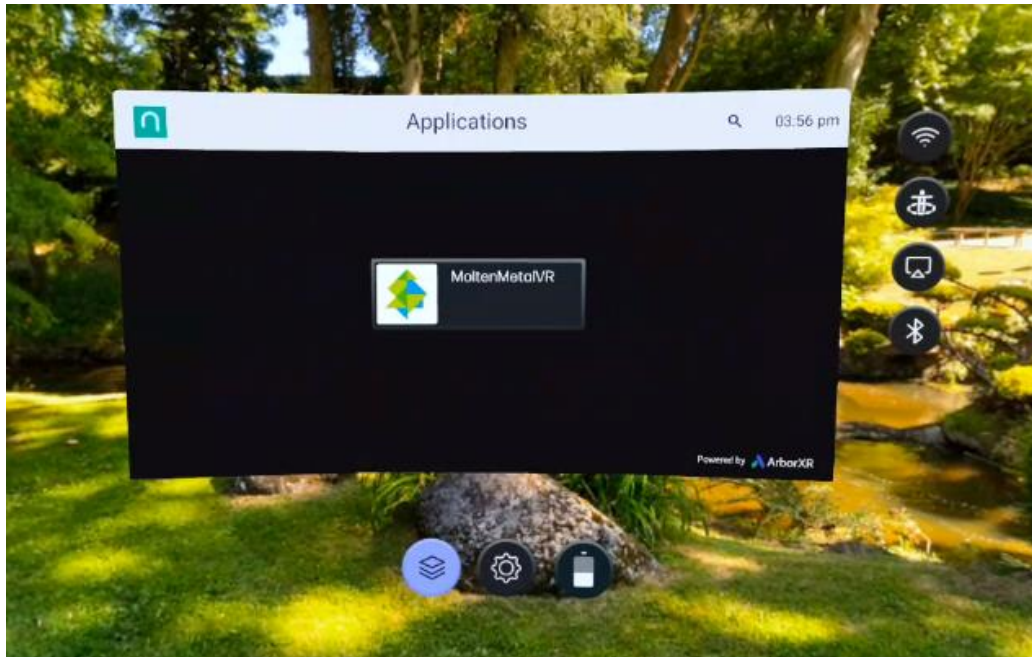


Figure 21 - Home screen with the list of available applications

Launching the application

To start the application, click on the desired application's button in the application list. Then click on the "Launch" button:



Figure 22 - Molten Metal VR application was selected

Guardian configuration

Guardian is a built-in safety feature that lets you set up boundaries in VR that appear when you get too close to the edge of your play area.

It is important to configure the Guardian before starting a new session. **By default, the configuration is launched automatically when you put on the headset** (see <https://numix.fr/mmvr-support/>). If this is not the case, you can start the configuration manually by doing the following:

Put on the headset and press the Oculus Home button on the right controller.



Figure 23 - The Oculus home button that displays the ArborXR Menu

If you have already launched an application, you will see the menu on the right image with the possibility to return to the application. Otherwise you will see the menu as on the left image:

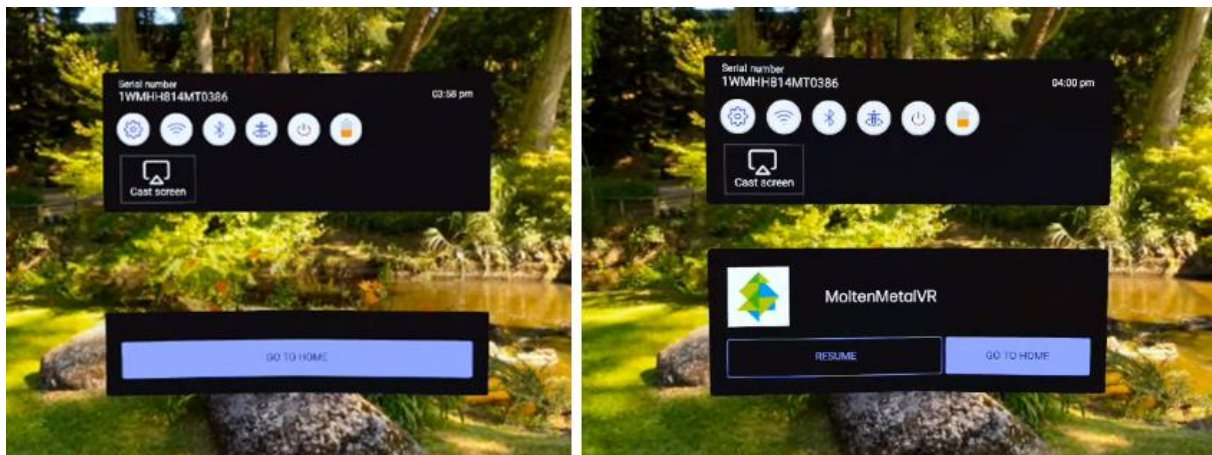


Figure 24 - Menus appearing after pressing the Oculus button



You can now click on this button to start the Guardian setup. The setup will ask you to level the ground and then choose between a stationary or roomscale movement area (prefer the roomscale option). For more information about Guardian setup, please refer to the support video here: <https://numix.fr/mmvr-support/>

Wi-fi configuration

The wi-fi network is already configured on the headsets and tablets on CWF-Mobile. However, if you wish to change this network, please follow the instructions below.

First, put on the headset and press the Oculus Home button on the right controller.



Figure 25 - The Oculus home button that displays the ArborXR Menu

If you have already launched an application, you will see the menu on the right image with the possibility to return to the application. Otherwise you will see the menu as on the left image:

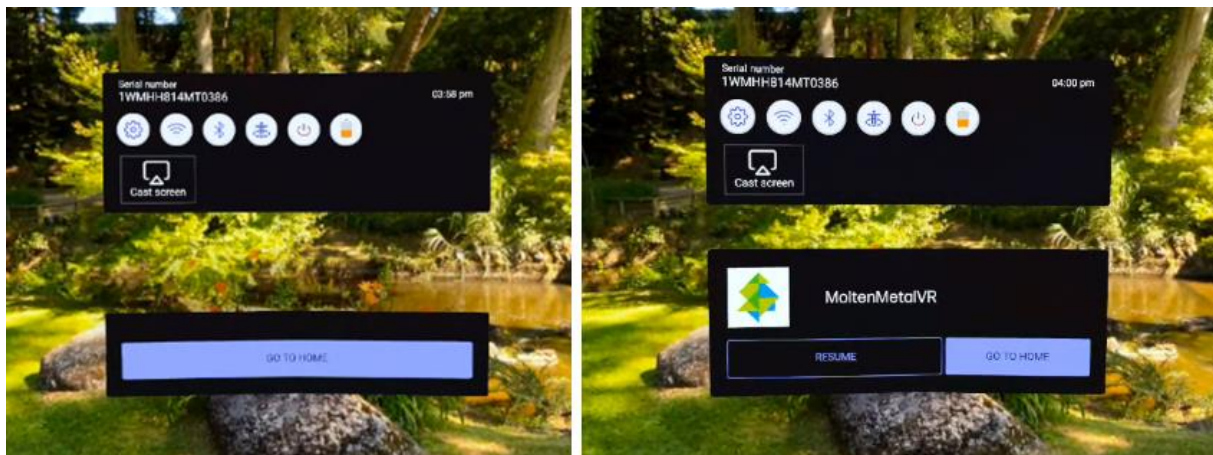


Figure 26 - Menus appearing after pressing the Oculus button



You can now click on this button to setup the wi-fi on the headset. You will be redirected to another environment, which is the Oculus default home. A panel will be displayed in front of you, you can select the new wi-fi and enter the password if necessary. Once the configuration is complete, you will be automatically redirected to the ArborXR home.

Screen sharing

You can see the headset screen sharing on a computer. To do so, go to <https://www.oculus.com/casting/> on the desired computer and log in with the account provided on the headset. It is necessary that the Facebook account used on the VR headset is the same as the one on the PC. You can find your Facebook e-mail and password inside the VR kit.

To start the screen sharing, put on the headset and press the Oculus Home button on the right controller.



Figure 27 - The Oculus home button that displays the ArborXR Menu

If you have already launched an application, you will see the menu on the right image with the possibility to return to the application. Otherwise, you will see the menu as on the left image:

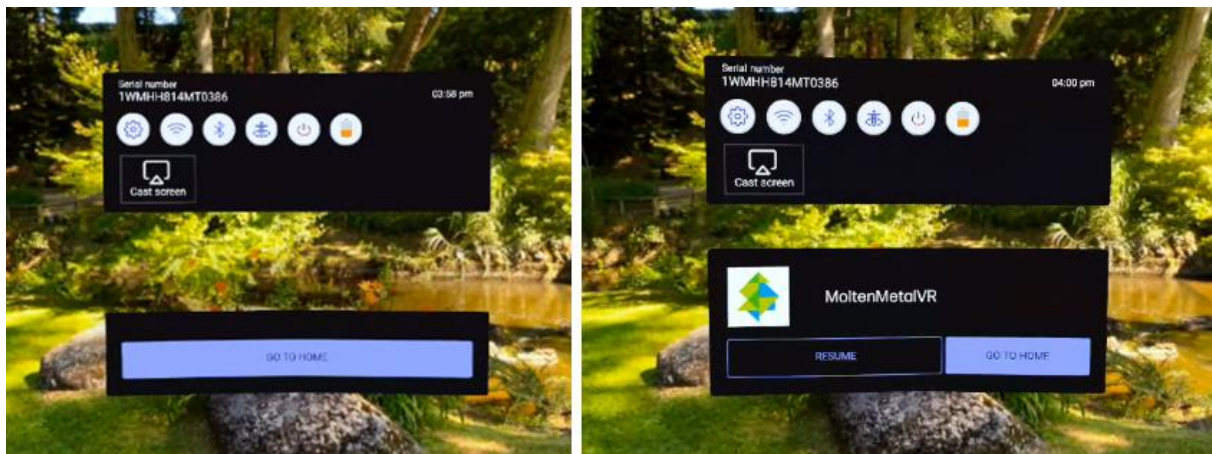


Figure 28 - Menus appearing after pressing the Oculus button



You can now click on this button to configure the screen sharing. You will be redirected to another environment, which is the Oculus default home. A panel will be displayed in front of you. Select **“Computer”** then click on the **“Next”** button.

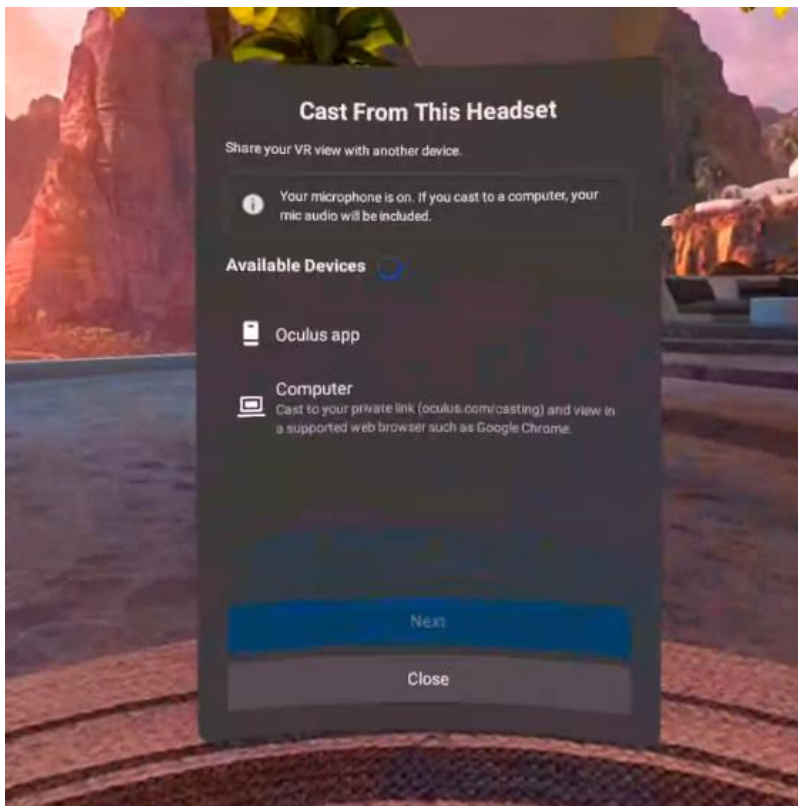


Figure 29 - Screen sharing menu in the Oculus environment

A red dot will appear on the top right corner in the headset, indicating the screen sharing is working properly. You will be able to have the screen sharing on the computer.

 **During a screen sharing, it sometimes happens that you see a degraded image on the computer at the beginning. In this case, simply wait a few seconds to allow time for the connection to stabilize.**

To stop the screen sharing, simply close the <https://www.oculus.com/casting/> page from your web browser.

Turning off the equipment

- To turn off the headset, press and hold the power button for more than three seconds.
- To turn off the tablet, press and hold the volume down button and the power button, then click turn off.

GENERAL OPERATION OF THE APPLICATION

Note: The following section explains in details the interface of the application. The Deeptwin module allows to deploy the application on multiple devices.

The capture images you will see in this section are the ones from the Meta/Oculus Quest 2, and the interface is exactly the same on tablet. You will be able to perform the same steps on your tablet than on the VR headset (ex: start/join a session, configure the scenario).

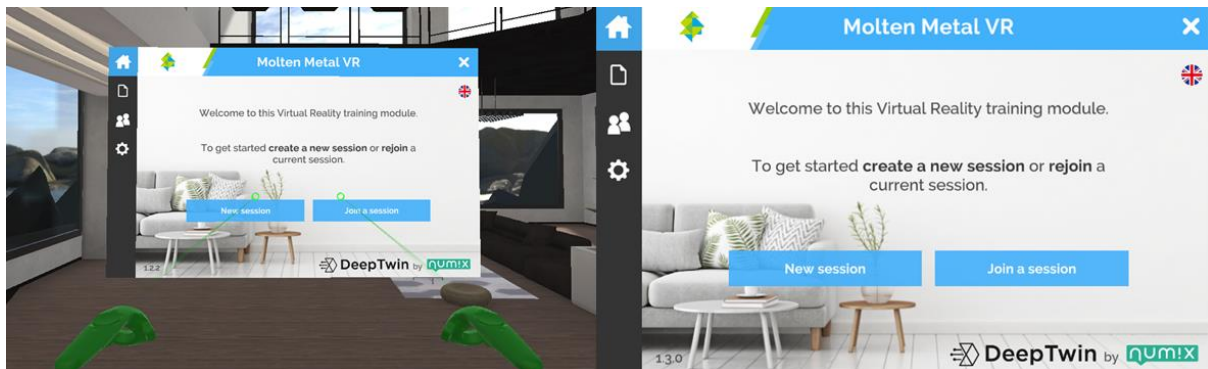


Figure 30 - Home page on Quest 2 (left) vs Home page on Tablet (right)

Starting a new session

When starting the application, you should see the following menu:



Figure 31 - The home menu of the application

Click on the **"New Session"** button by pointing one of the controllers at the button and pressing the trigger on the controller.



Figure 32 - The controller trigger allows you to interact with the menus and tools



WARNING!

The previous user may not have finished their session, so you will need to leave the session first before you can start a new one. Please refer to the section "Leaving a session in progress".

Creating a solo session

To start a solo session, click on the **"Start"** button under the Solo section:

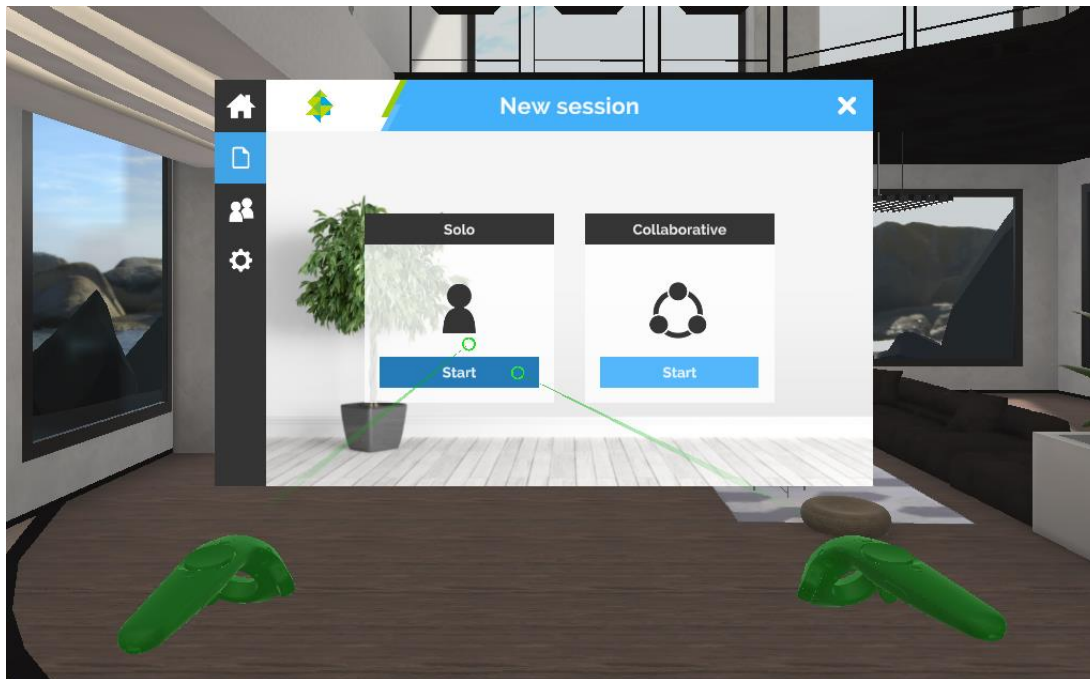


Figure 33 - New session panel

On the next panel, select the desired Scenario and click on the **"Next"** button:

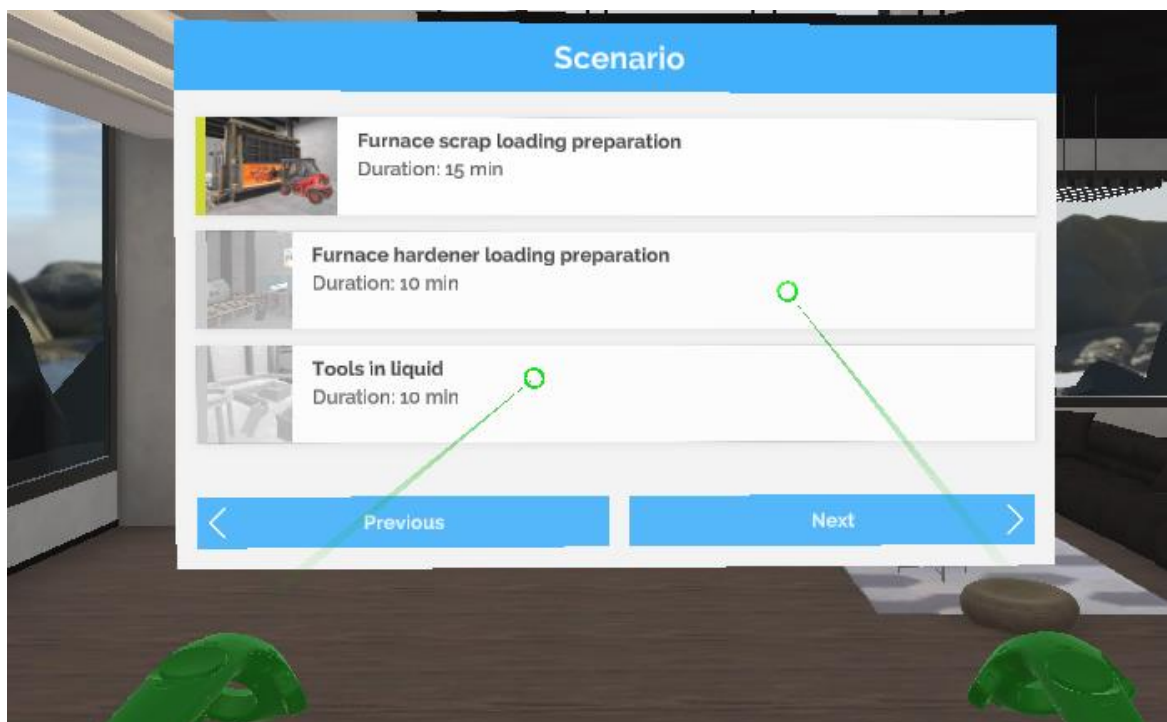


Figure 34 - Scenario selection

You will arrive on the Scenario configuration page. You can then follow the instruction from the section **"Scenario X – Session configuration"**.

Creating a collaborative session

To start a multiplayer session, click on the “**Start**” button under the Collaborative section:

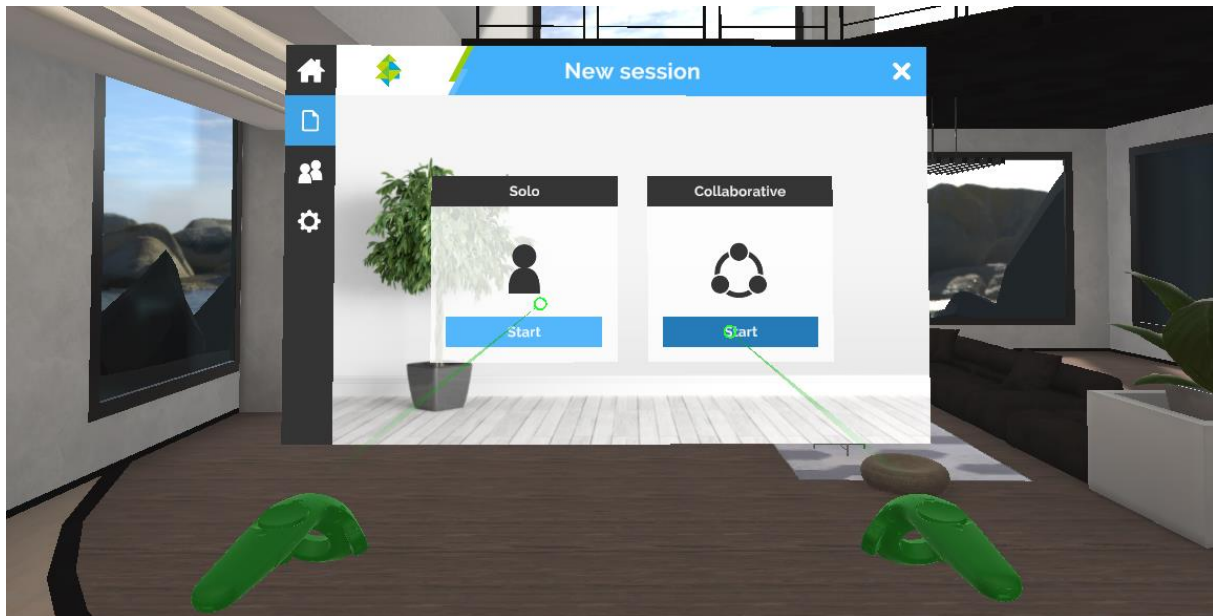


Figure 35 - New session panel

You can then select the type of session at the bottom left under the **Network** section. Select **Remote** to create a session on one of Numix servers online. You can also select **Local** if you want to create a local session (Warning: restrictions related to the type of network, generally does not work on professional networks). Click on the “**Start**” button to create the session.

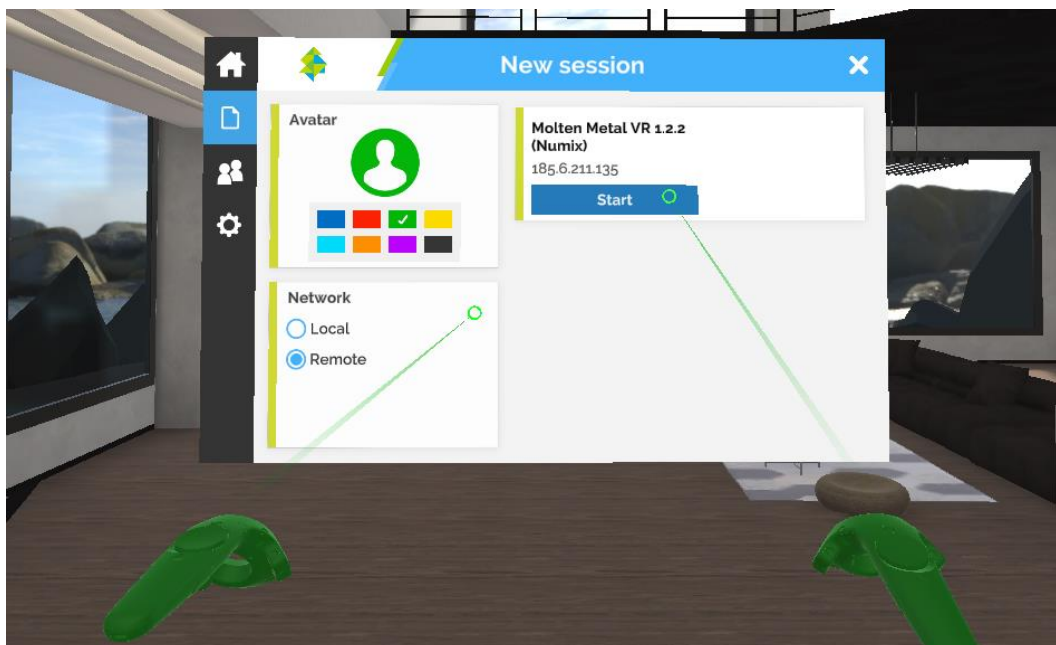


Figure 36 - Create a session panel with Remote setting

On the next panel, select the desired Scenario and click on the “**Next**” button:

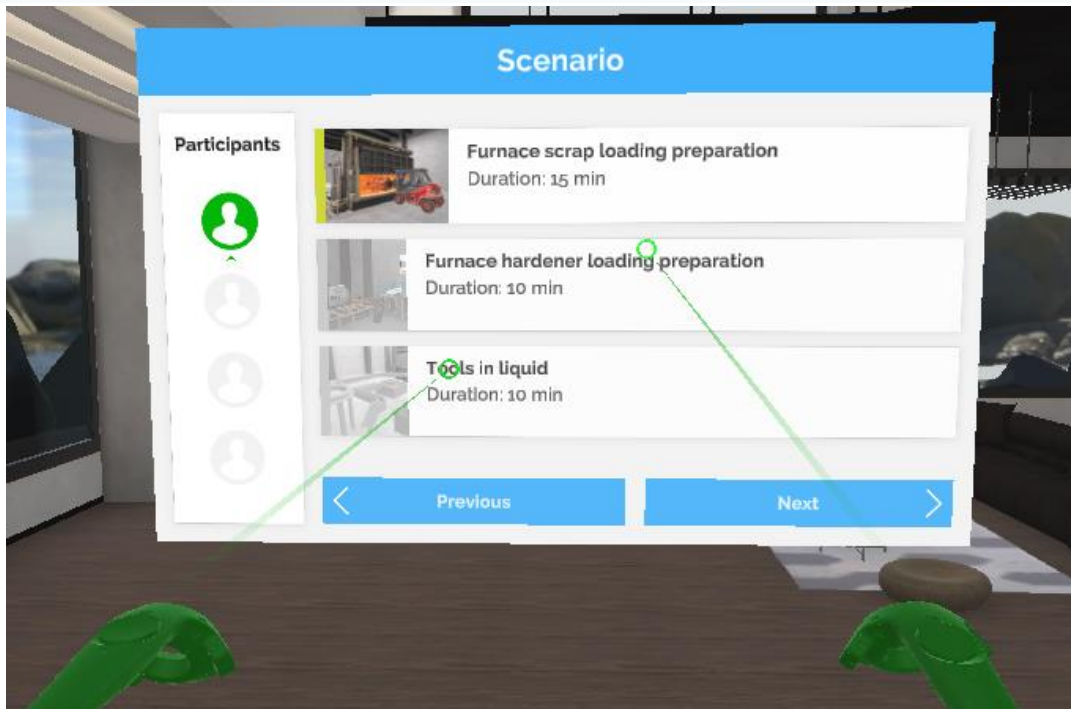


Figure 37 - Scenario selection

You will then arrive on the Scenario configuration page. You can then follow the instruction from the section “Scenario X – Session configuration”.

Joining a collaborative session

To join an existing session, click on the “Join a session” button in the home menu of the application:

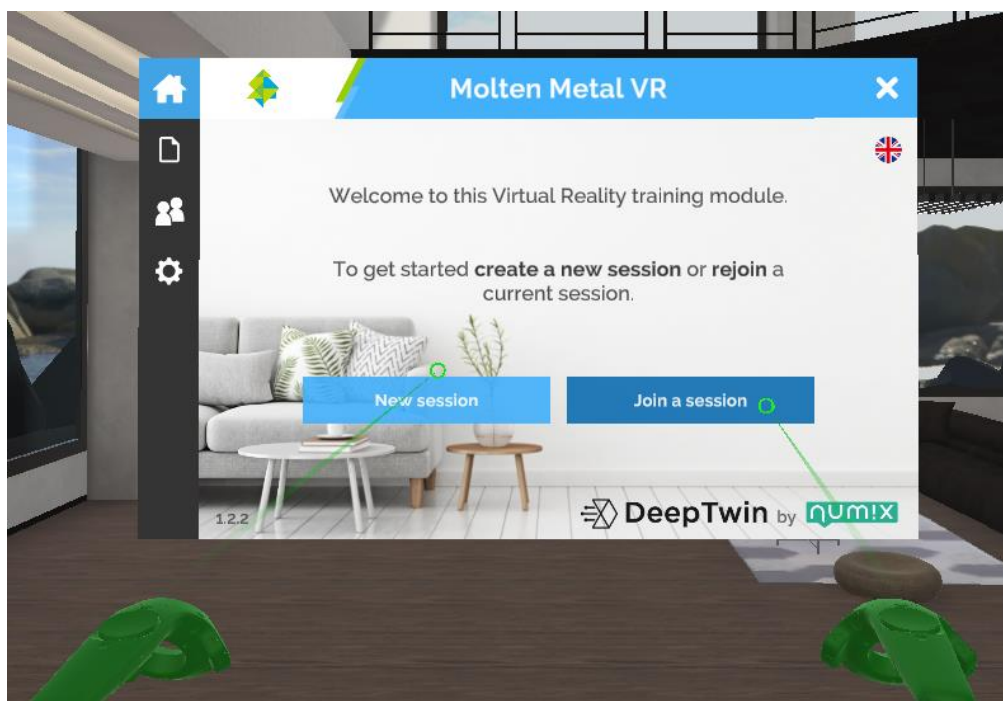


Figure 38 - Application Home menu

You can then select the type of session at the bottom left under the **Network** section. Select **Remote** to join a session from one of Numix servers online. You can also select **Local** if you want to join a local session (Warning: restrictions related to the type of network, generally does not work on professional networks).

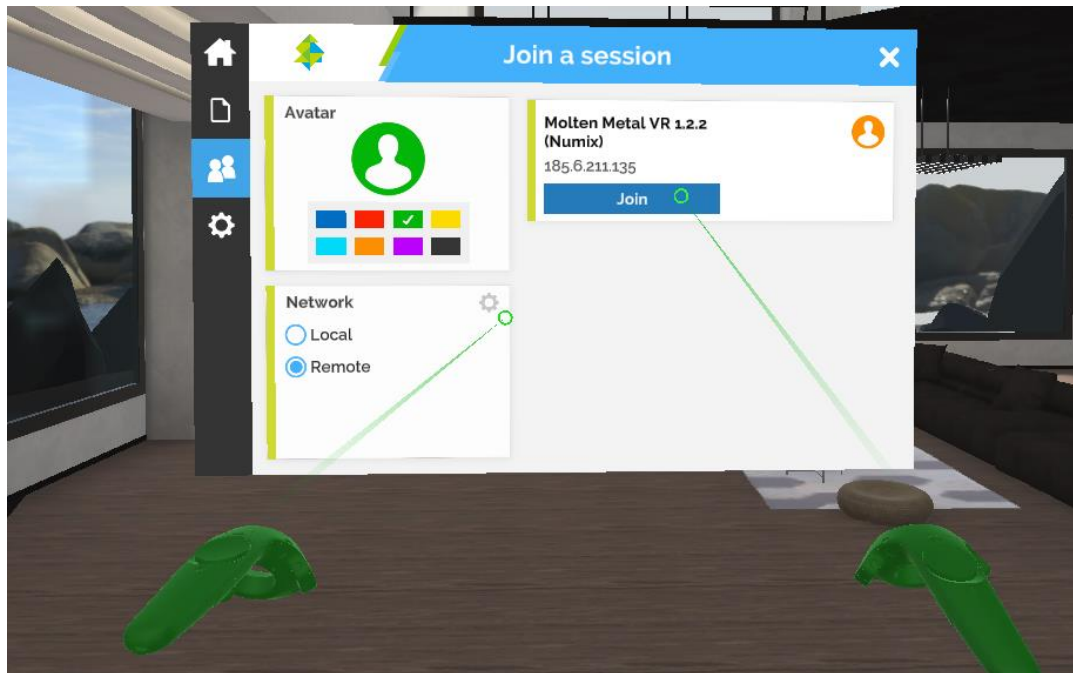


Figure 39 - Join a session panel with Remote setting

By clicking on the “Join” Button, you will arrive on the Scenario configuration page and be added to the list of participants on the left. You can then follow the instruction from the section “Scenario X – Session configuration”.



Figure 40 - Scenario selection

Presentation menu

Display the menu on tablet

On tablet, the menu can be accessed through the buttons on the left at any time:

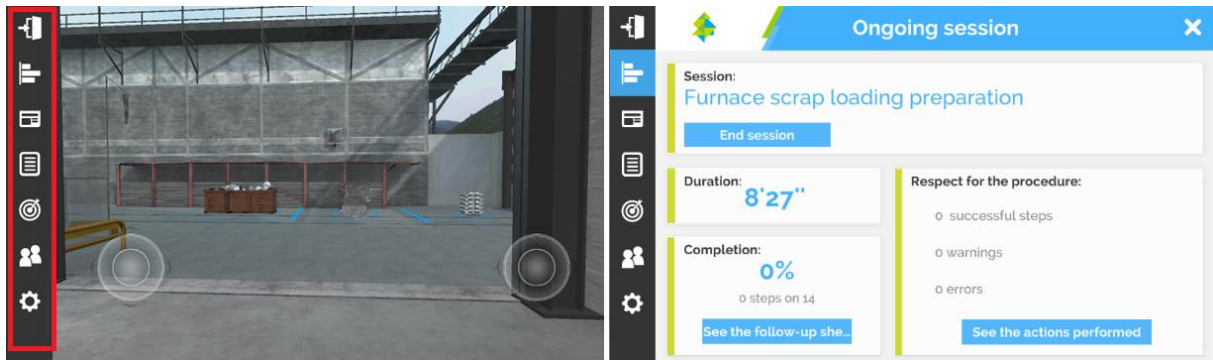


Figure 41 - The buttons on the left are always visible on the Tablet version

The panel will appear on top of the 3D session. You can decide to close it by pressing the [X] button on the top-left corner of the panel.

Display the menu in VR

In VR, the menu can be accessed at any time by pressing one of the buttons (A, B, X or Y) on each controller.

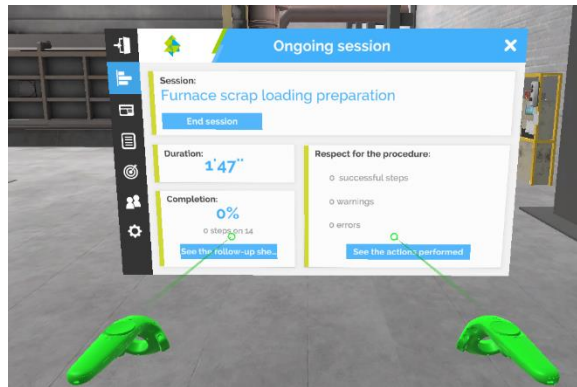


Figure 42 - The VR controller buttons open the menu

The panel will appear in front of you and will not move in the environment. You can decide to close it by pressing the [X] button on the top-left corner of the panel.

Session statistics

The current session tab displays a set of statistics for the current session, namely the time elapsed since the start of the session, the current percentage completion of the procedure, and a summary of successful and unsuccessful steps.

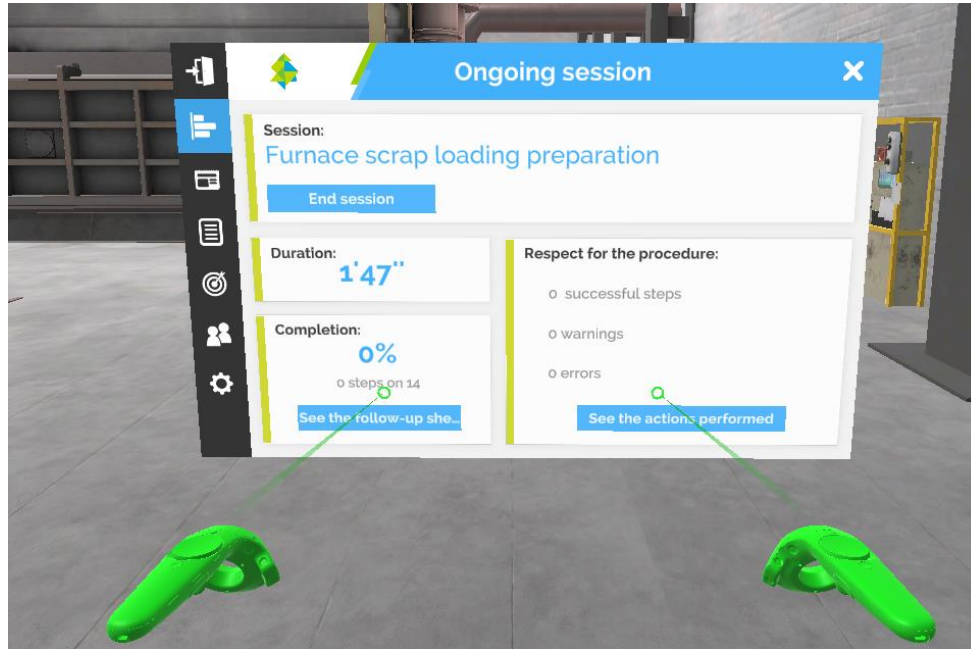


Figure 43 - Session information panel

Scorecard

All the steps to be completed are present in this tab. Each completed step is ticked. The learner can refer to this menu if he/she forgets the procedure.

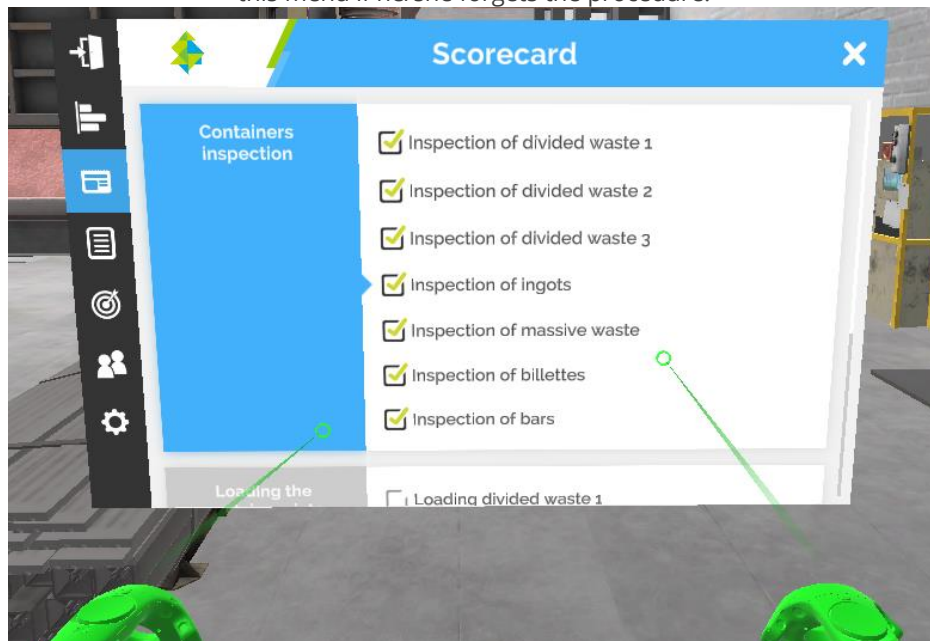


Figure 44 - Scorecard panel (session objectives)

Actions performed

This is the list of actions taken by the learner. Filters allow the actions to be displayed according to their type (Sections, Steps, Warnings, Errors).

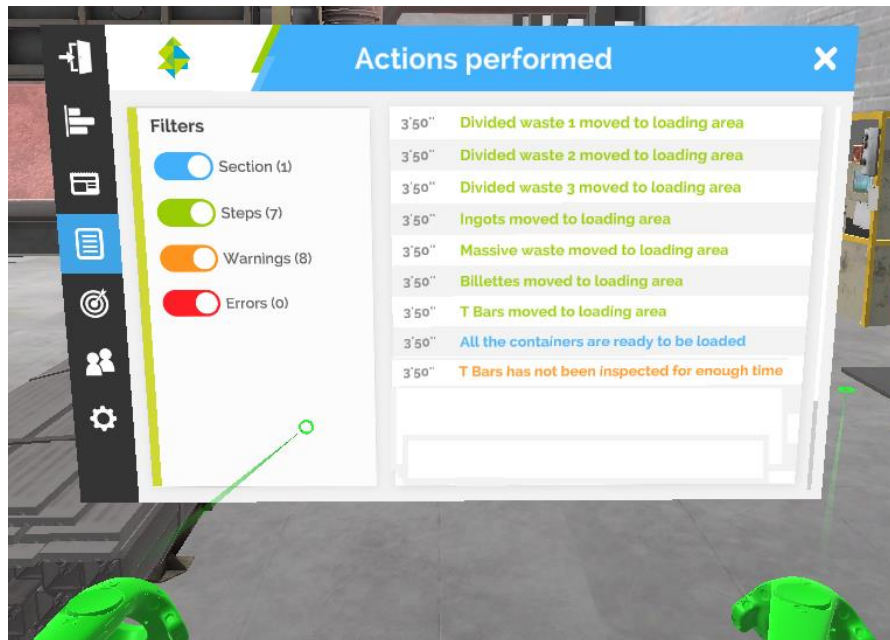


Figure 45 - Actions performed panel


You may have logs with a picture, it will allow to understand the potential error the user made during the scenario. To display/hide the picture, click on the picture icon next the log text description.



Figure 46 - Pictures in logs

Settings

Corresponds to the various parameters of the application that can be modified during the session.

 **WARNING!** We recommend not to change the default settings.

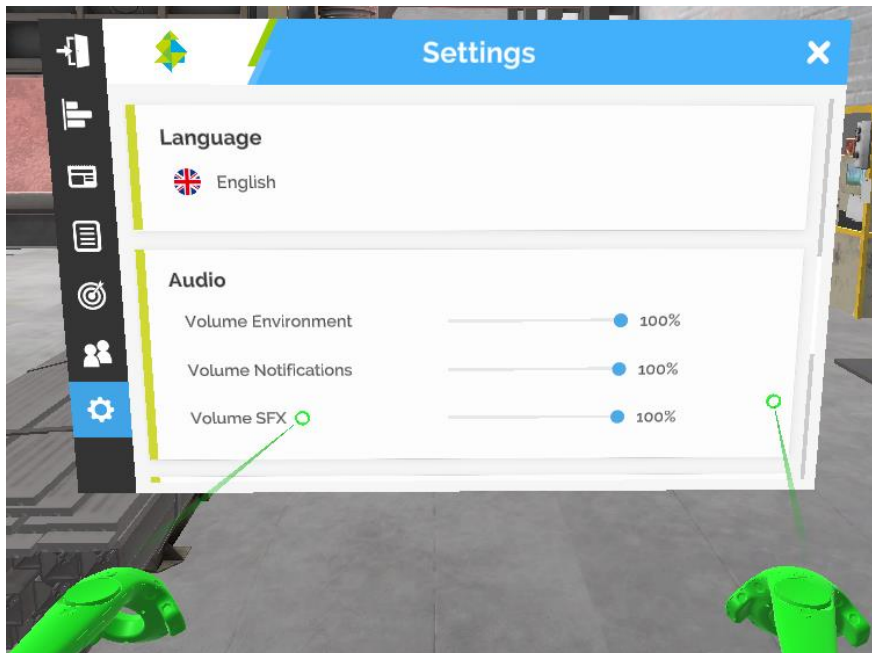


Figure 47 - Settings panel

Quit a session

To leave a session, simply go to the first tab with the exit door icon and click on the **“Quit”** button. You will be back on the main menu and you can start a new session.

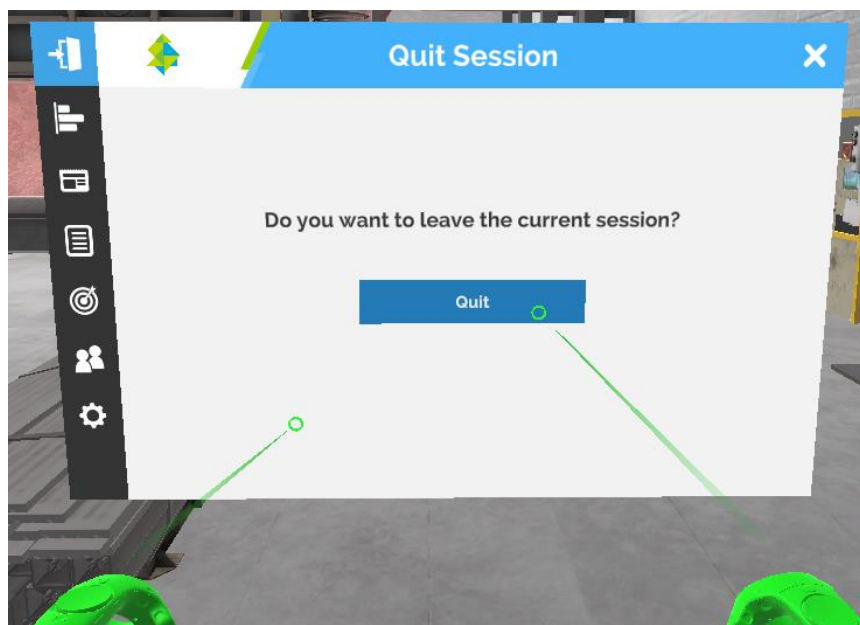


Figure 48 - Leaving a session panel

Moving around on tablet



Figure 49 - Tablet interface

In multiplayer mode, the buttons at the top right will be displayed. They allow you to follow a player's view. This is what they are for:

- (1) Orbital view (recommended) – allows to follow a user view as a 3rd person camera. You can rotate around the user by sliding across the tablet screen.
- (2) Immersive view – allows to see the camera of a user.
- (3) Free view – allows to move around the 3D environment, using the touch-sensitive joysticks on the bottom of the screen. The right joystick is used to turn the camera and direct the direction of movement. The left joystick is used to move forward/backward and sideways.

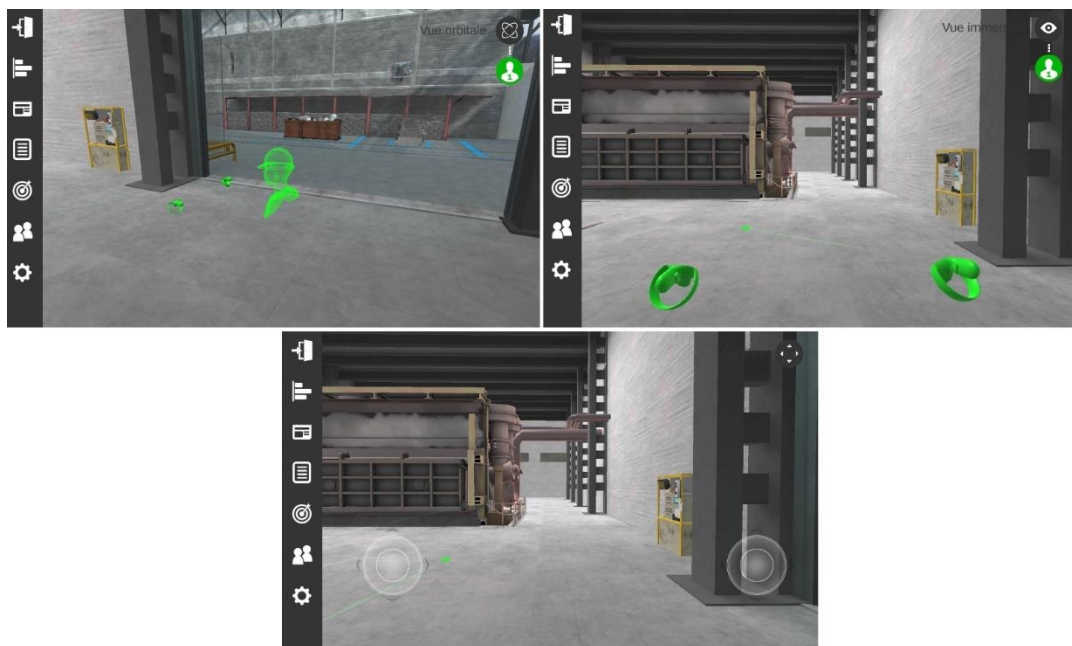


Figure 50 - Orbital view (top left) vs Immersive view (top right) vs Free view (bottom)

Moving around in VR

To move around the virtual environment, **click and hold the joystick** of either the left or right controller, **aim at the location** you wish to teleport to, then **release** the joystick.



Figure 51 - The joystick allows you to teleport

By clicking on the joystick, you will be able to have a preview on the teleportation area:

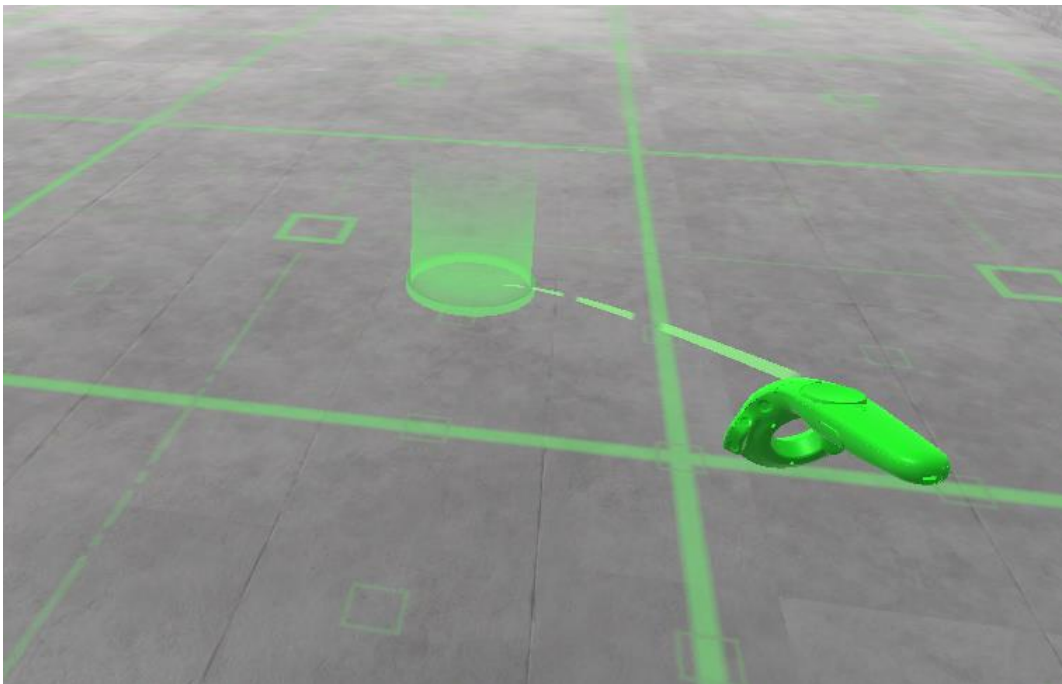


Figure 52 - Teleportation area (green grid)

If you cannot teleport, the beam will appear in red:

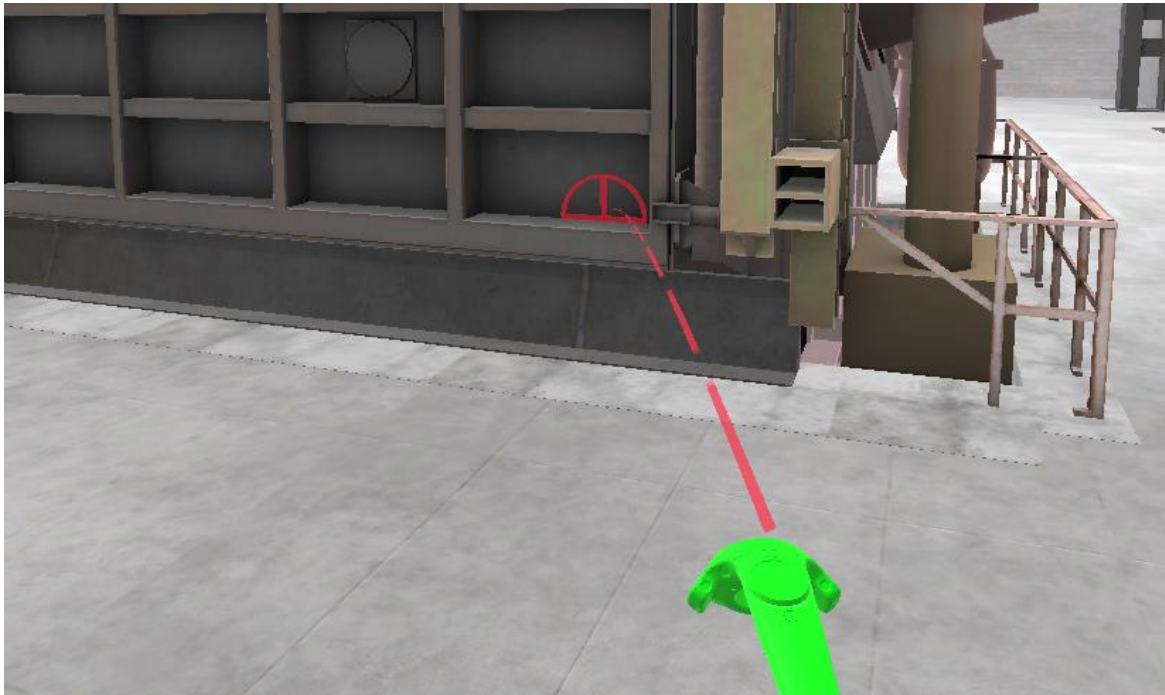


Figure 53 - Non-teleportable area

Interactions in VR

To interact with a button (e.g. the oven control button), aim the controller laser towards the button and press the trigger button on the controller:



Figure 54 - User aiming at the top button to open the furnace door

You can interact the same way with interface buttons, the contaminants in the containers or the anomalies on the trash.

Scenario 1 - Session configuration

This is the configuration page for scenario 1. The settings on the left-hand side update the details of the containers.

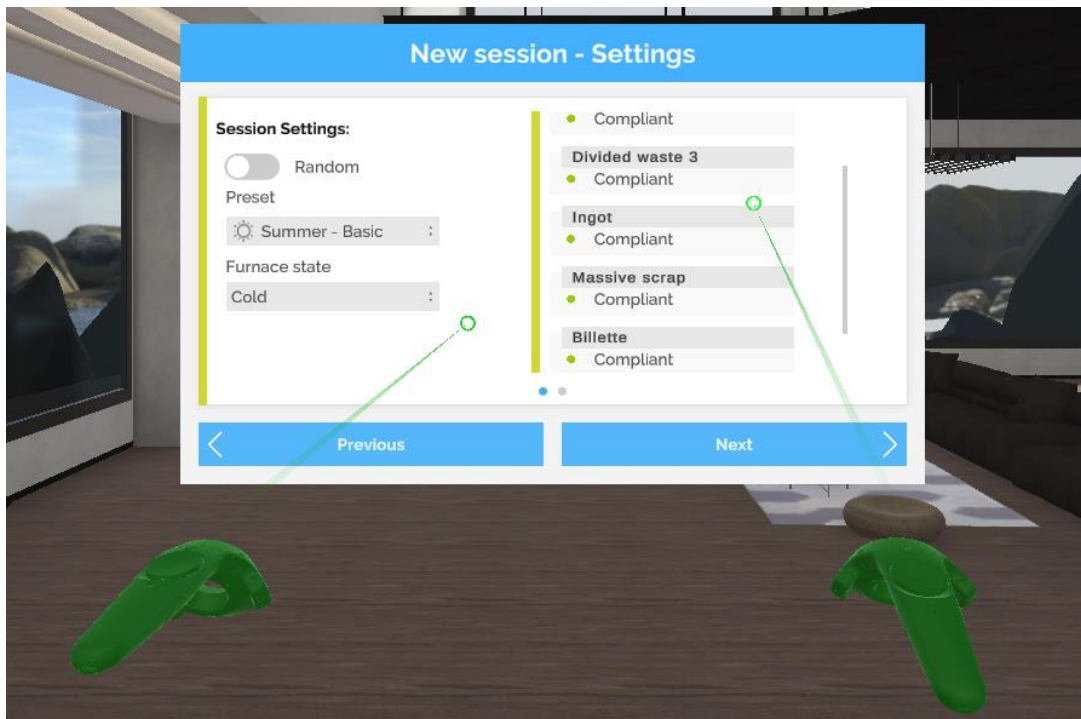


Figure 55 - Configuration set on Summer Basic and cold furnace

By changing the preset (7 presets available), the details of the containers (possible contaminants and defects) will be updated on the right. You can also change the furnace state that will be used in the session.

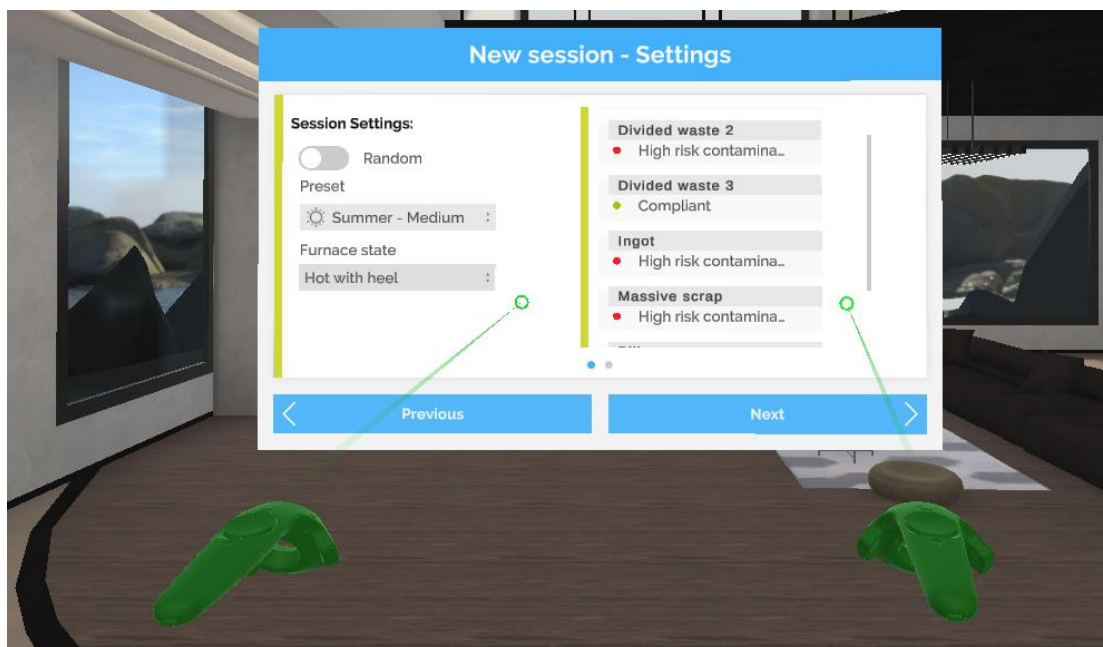


Figure 56 - Configuration set on Summer Medium and hot furnace with heel

You can also choose to select "Random" by clicking this button. This will select a random preset and furnace state configuration from those available.

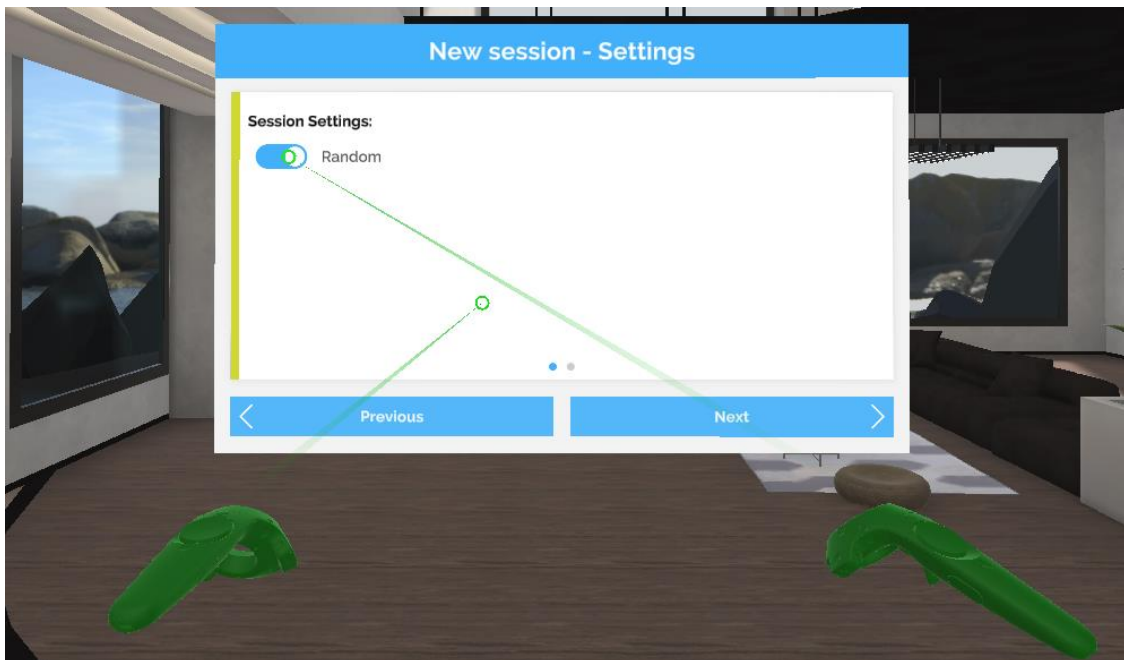


Figure 57 - Random configuration activated

By clicking on the "Next" button you will arrive on the scenario description. For a collaborative session, we recommend that the learner joins at this point to avoid them being aware of the session setup.

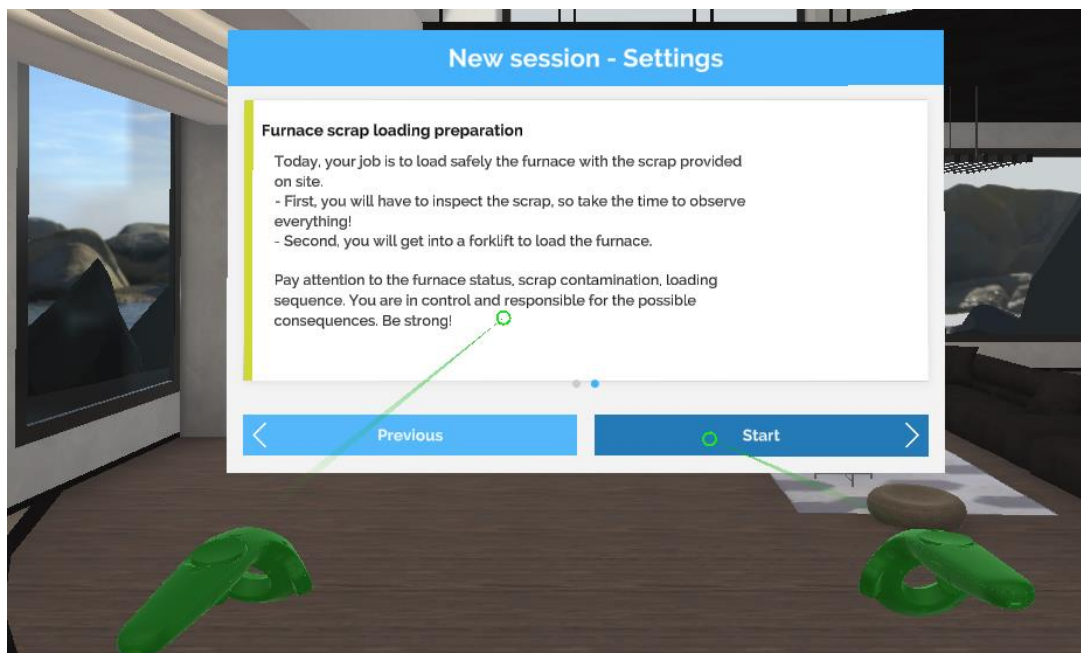


Figure 58 - Scenario objectives

Once you have read the scenario details, you can start the session by clicking on the start button.

WARNING! It is very important to adjust your VR headset for a comfortable experience (see <https://numix.fr/mmvr-support/>).

Scenario 1 - Gameplay and interactions

The user arrives at the start in the cast house. The first thing to do is to look at the temperature of the oven and check its state (empty, full, ...). If the user forgets to check the status of the oven, he will get a warning in the scenario.

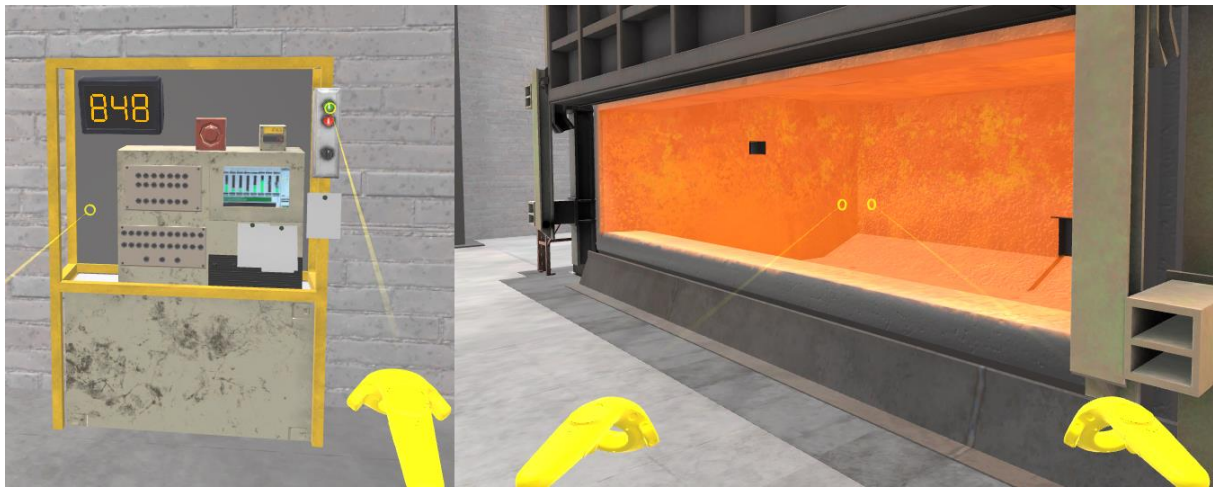


Figure 59 - Here the furnace temperature is 848°C. The furnace is empty.

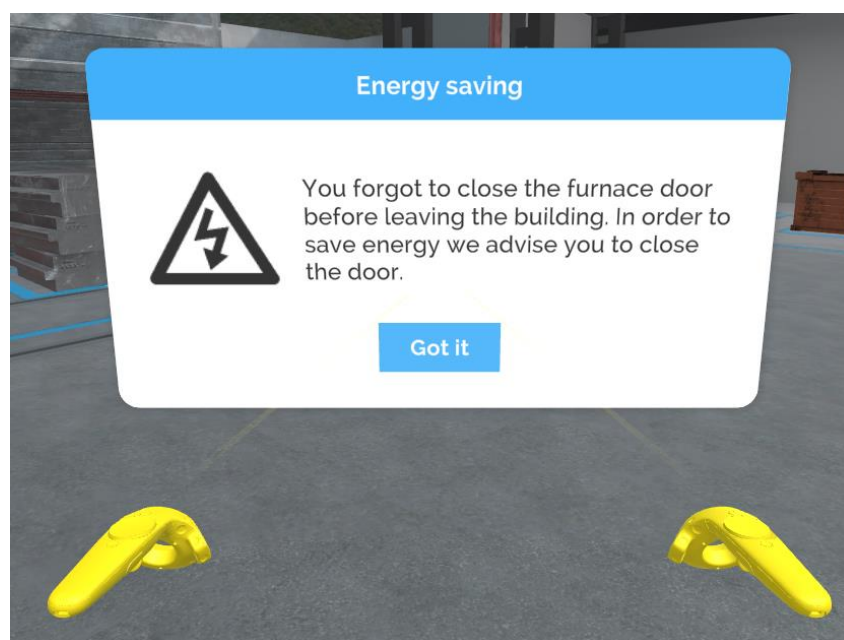


Figure 60 - Warning popup if the learner forgets to close the furnace before leaving the cast house

There are multiple containers in the outside area. Each container has a blue area around it. Teleporting inside a blue area will display custom buttons related to the container.



Figure 61 - Left: teleportation areas on the ground. Right: container buttons have appeared

The gauge of the button on the right will rise little by little until the button is completed. This is an inspection gauge that validates that the learner has inspected the container enough. It fills up when you look into a container. Once filled, the information of the container appears with the details of the content.



Figure 62 - Left: inspection complete. Right: the container has been validated and moved to the cast house

The button on the left allows you to validate the container and send it inside the cast house. The validation of a container is not reversible.

Contaminants/Defects

If a contaminant is found in the container (bottle, can, deodorant, etc), simply point the laser at it and press the trigger button. The contaminant will be removed.

Be careful, there may be more than one contaminant in a container!



Figure 63 - Left: A lighter has been found on the massive scrap. Right: The lighter has been removed.

If a defect is found on the metal itself, simply point at the defect and press the trigger button. The defect will be circled by an orange outline and a new button will appear. If you click this new button, the part will be replaced by a new one. Do not forget to inspect this new part as it may contain contaminants/defects as well.

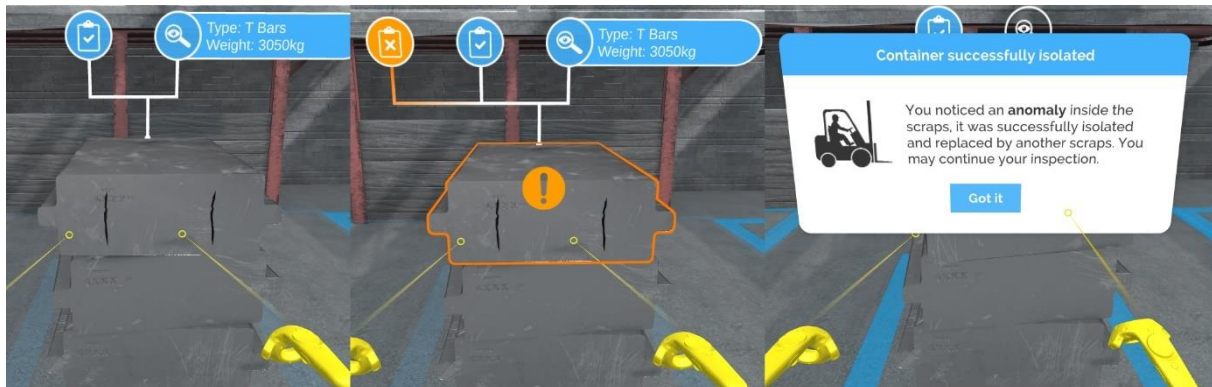


Figure 64 - Left: T-Bars contain cracks. Middle: Cracks have been detected. Right: T-Bars have been replaced

Once all containers have been inspected and moved to the cast house, you can enter by teleporting the forklift and load the containers one by one.



Figure 65 - Left: Teleport into the forklift. Right: Select one of the metal scraps

To do so, once you have selected a container, click on the lever to start the loading animation.



Figure 66 - Left: Metal scrap has been loaded onto the fork. Right: Loading animation

Scenario 2 - Session configuration

This is the configuration page for scenario 2. The settings on the left-hand side update the details of the defects you can find in the hardeners.

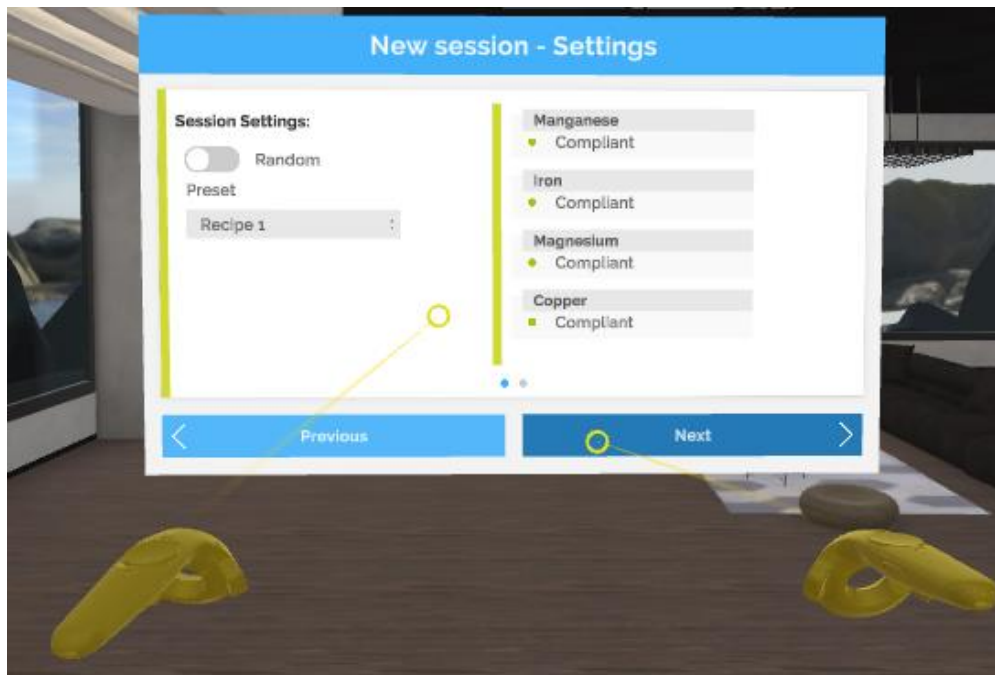


Figure 67 - Scenario configuration set on the first recipe

By changing the recipe (7 recipes available), the details of the recipe (possible defects in the hardeners) will be updated on the right.

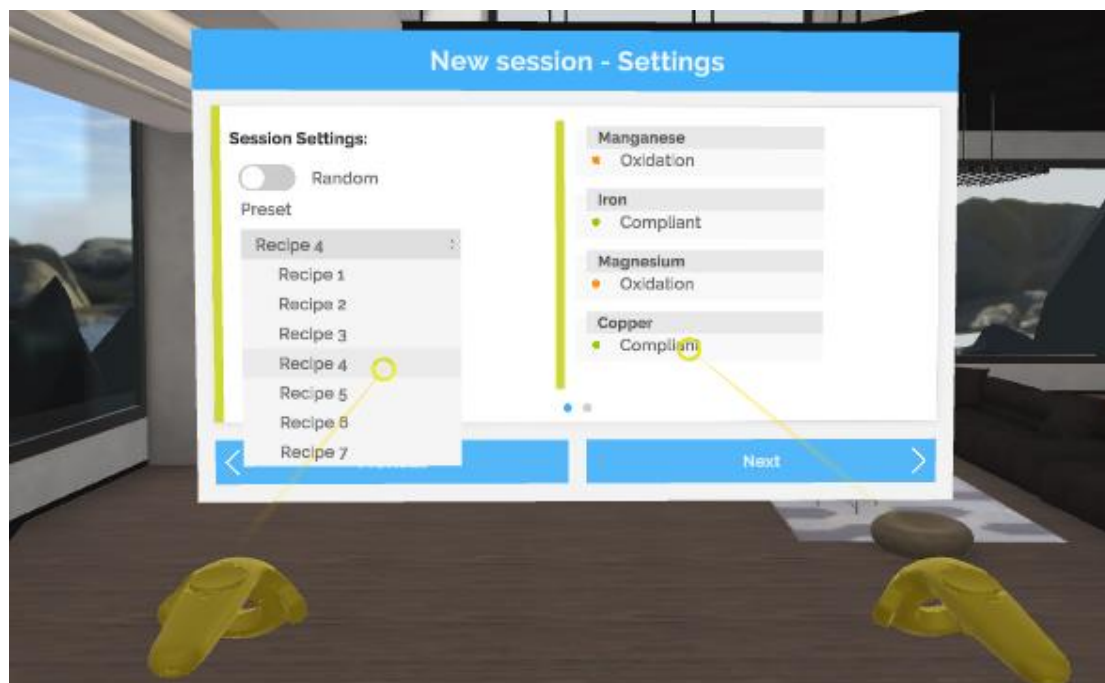


Figure 68 - Scenario configuration set on the 4th recipe

By clicking on the “Next” button you will arrive on the scenario description. For a collaborative session, we recommend that the learner joins at this point to avoid them being aware of the session setup.

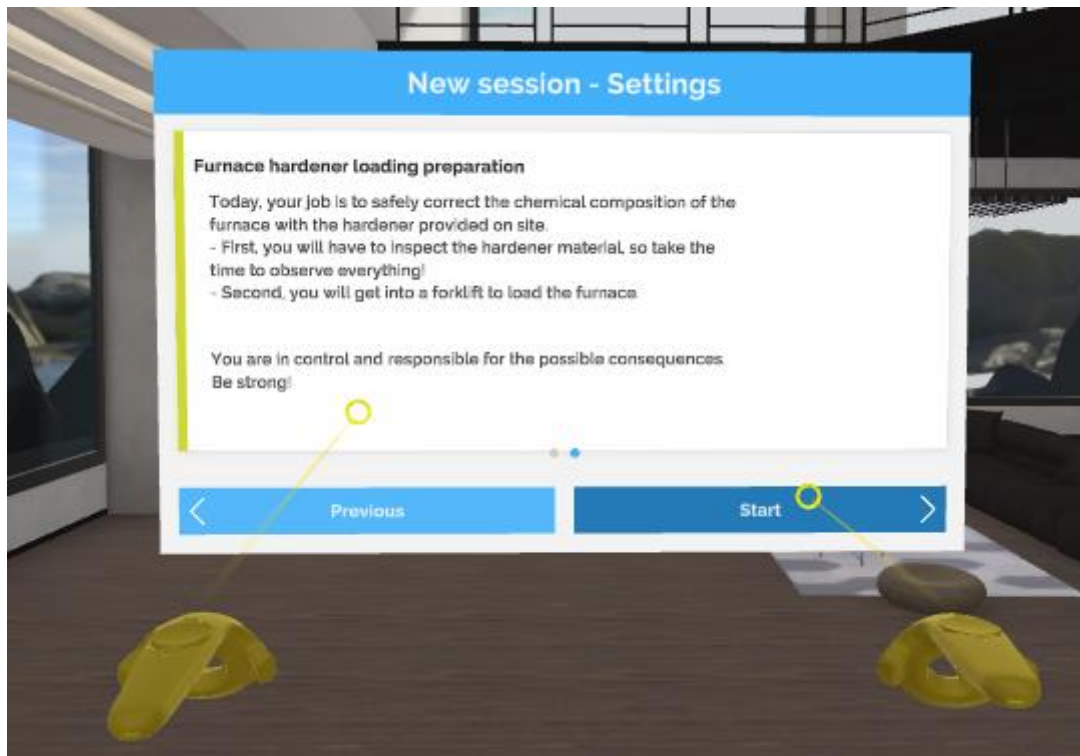


Figure 69 - Scenario 2 objectives

Once you have read the scenario details, you can start the session by clicking on the start button.

WARNING! It is very important to adjust your VR headset for a comfortable experience (see <https://numix.fr/mmvr-support/>).

Scenario 2 - Gameplay and interactions

The user arrives in the cast house, in the hardener preparation zone. He will find the recipe description with the weights associated with each hardener that he will have to weigh and put in the furnace. There are teleportation areas that display buttons on the elements when you teleport inside.

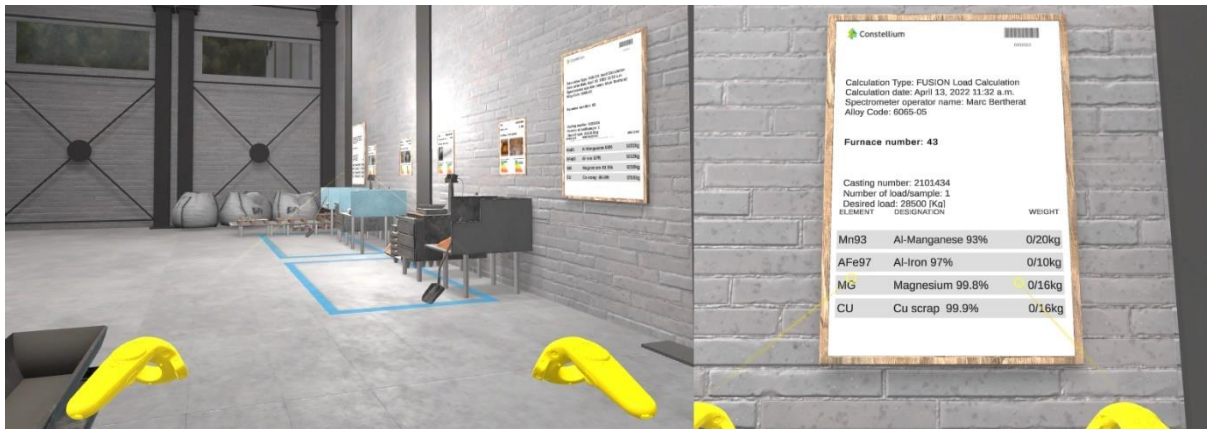


Figure 70 - Left: Hardener prep zone. Right: Recipe to follow

An area includes 2 elements and a scale. Above each item is a poster detailing the item and the unit weight.



Figure 71 - Left: Buttons after teleporting to the blue area. Right: Details on the magnesium hardener

During the inspection, if a defect has been found on a hardener (oxidation, rust, etc), just aim and press the orange button on top of the pallet. It will replace the whole pallet. Be careful to not replace elements that are in good condition.

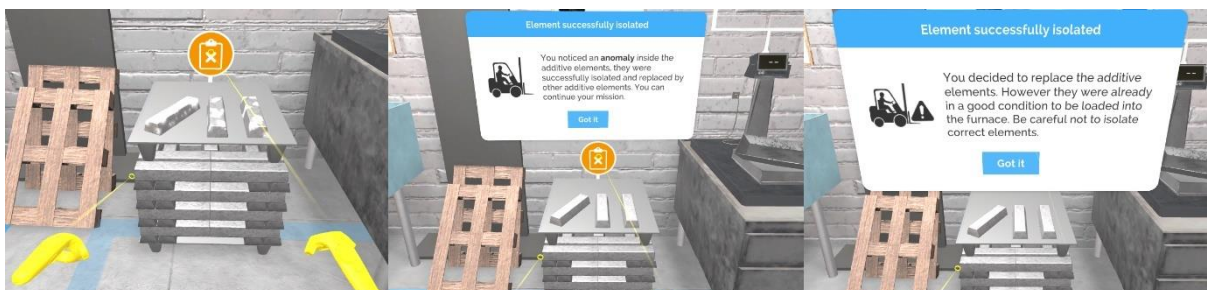


Figure 72 - Left: Magnesium contains oxidation. Middle: Magnesium has been isolated and replaced. Right: Magnesium has been unnecessarily replaced a second time => Warning

To add magnesium to the scale, grab the bar by pointing and pressing the trigger button to select the hardener, then move it on the scale plate until a blue outline is visible. Press the trigger button to validate and the bar will be added to the scale. The weight will be updated as well.

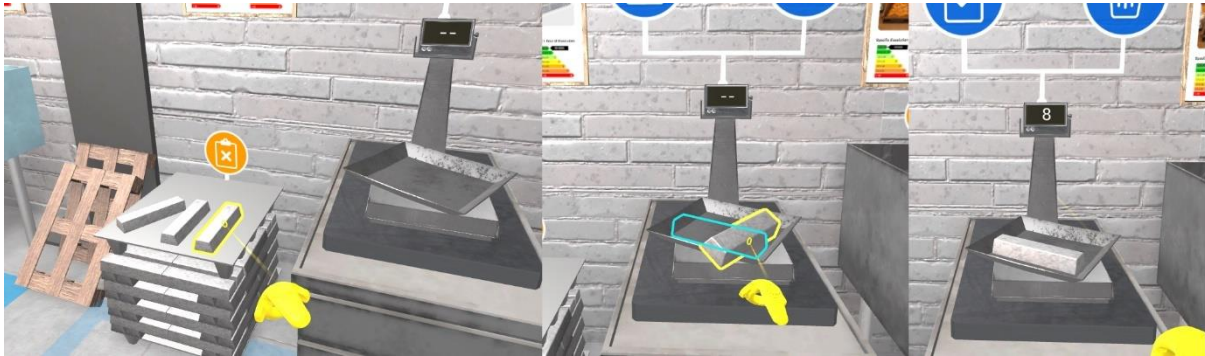


Figure 73 - Left: Aiming at the magnesium. Middle: Magnesium near the scale, blue outline visible. Right: Magnesium has been dropped on the scale, current weight: 8kg.

Once you are satisfied with the content of the scale, press the blue button on the left above the scale. If you wish to empty the scale, press the blue button on the right above the scale.

To add other elements to the scale, grab a shovel (there are two shovels in the environment), place it near the element and it will automatically fill the shovel. To pour the element in the shovel plate, place the shovel near the scale plate and it will automatically pour itself and update the displayed weight.

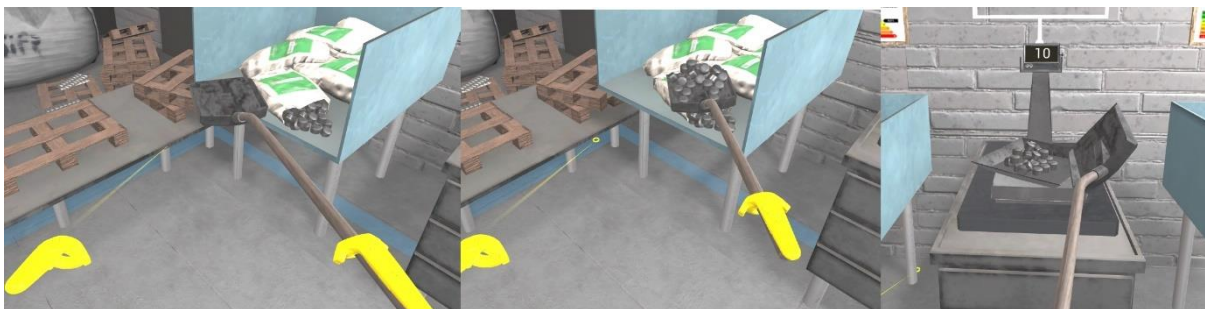


Figure 74 - Left: shovel grabbed. Middle: Shovel inside manganese is filled. Right: Manganese dropped on the scale, current weight: 10kg

Same as before, once you are satisfied with the content of the scale, press the blue button on the left above the scale. If you wish to empty the scale, press the blue button on the right above the scale.

Once all the elements are weighed, they will be visible in the skip in front of the forklift. Go to the forklift and click on the levers to start the loading.



Figure 75 - Left: Hardeners in the skip. Middle: Teleportation inside forklift. Right: Starting the loading with the levers

If the user loaded wrong shaped copper along with good hardeners, a special ending will appear. The furnace will close and the user will think that the loading was successful. However, a popup will appear prompting him to reopen the furnace a little later to skim the metal. This is when a major explosion will be triggered.

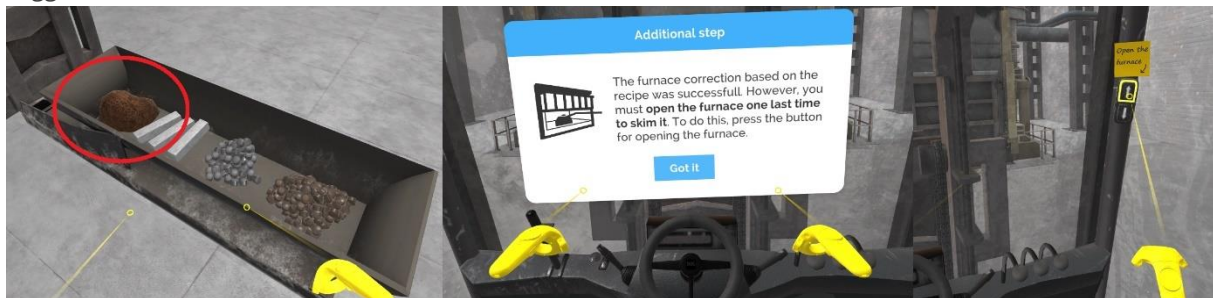


Figure 76 - Left: wrong shaped copper in the skip. Middle: Popup asking the user to skim. Right: Button to open the furnace from the forklift

Scenario 3 - Session configuration

The third scenario is the only one that does not require any configuration. After selecting this scenario you will directly arrive on the scenario description.

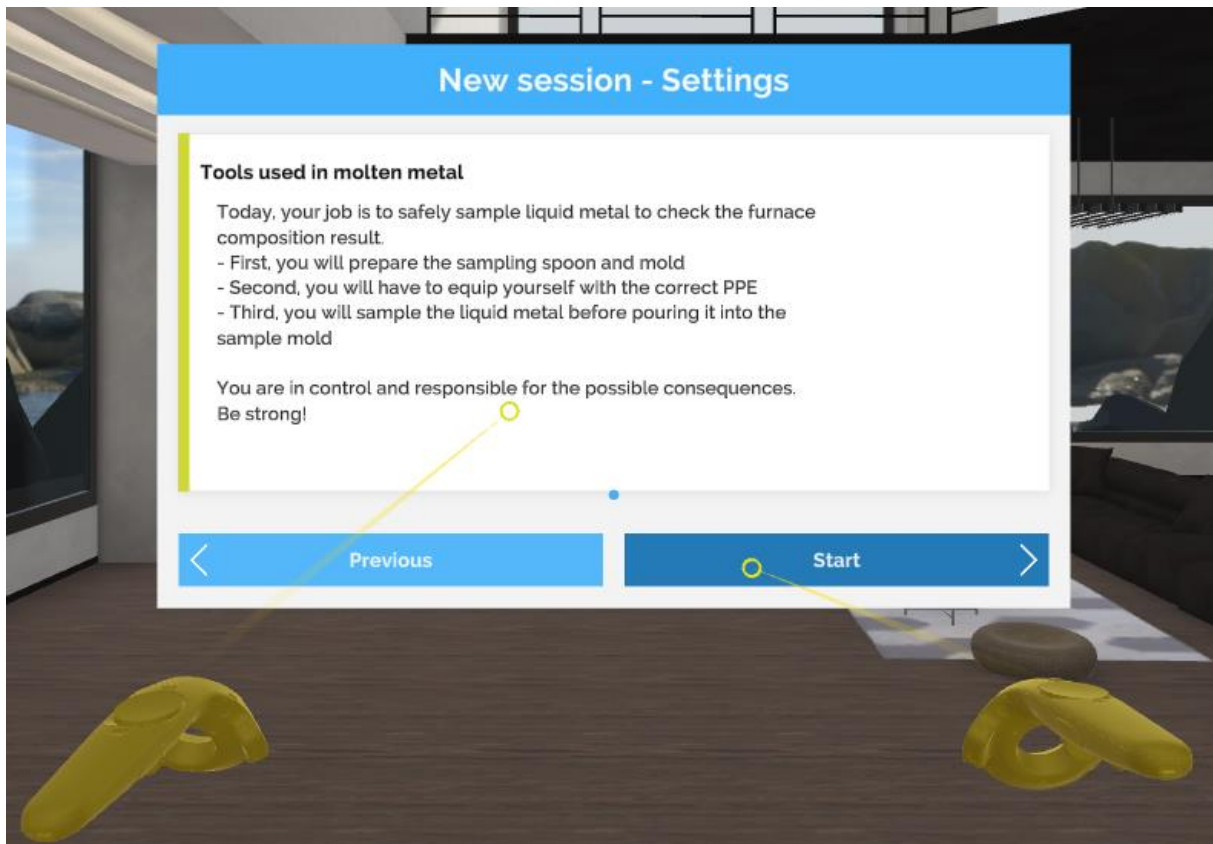


Figure 77 - Scenario 3 objectives

Once you have read the scenario details, you can start the session by clicking on the start button.

WARNING! It is very important to adjust your VR headset for a comfortable experience (see <https://numix.fr/mmvr-support/>).

Scenario 3 - Gameplay and interactions

The learner arrives behind the furnace. They have to teleport near the mold table to inspect them. To select a mold, just aim at the mold and press the trigger button. You can open the mold by using the other hand and clicking on the second handle.

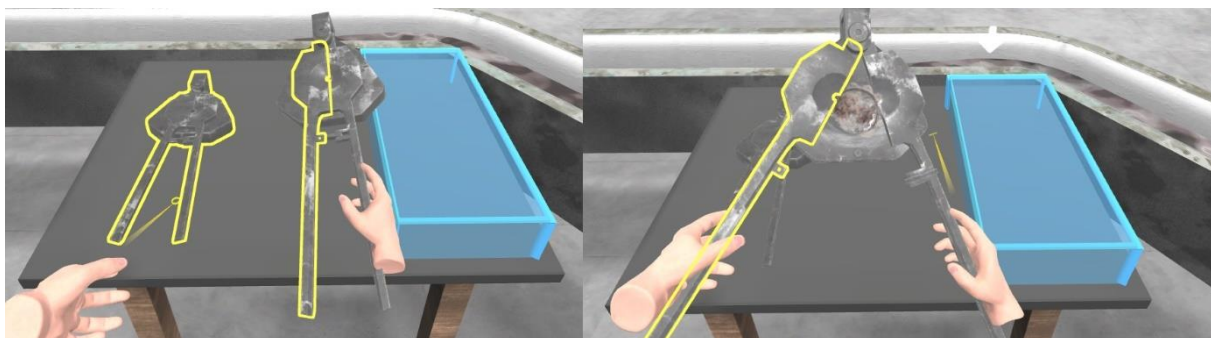


Figure 78 - Left: User is grabbing the right mold. Right: User has opened the mold to inspect the inside part

To select a mold you have inspected, move the mold near the blue box until a blue outline is visible. Press the trigger button to validate and the mold selection will be complete.

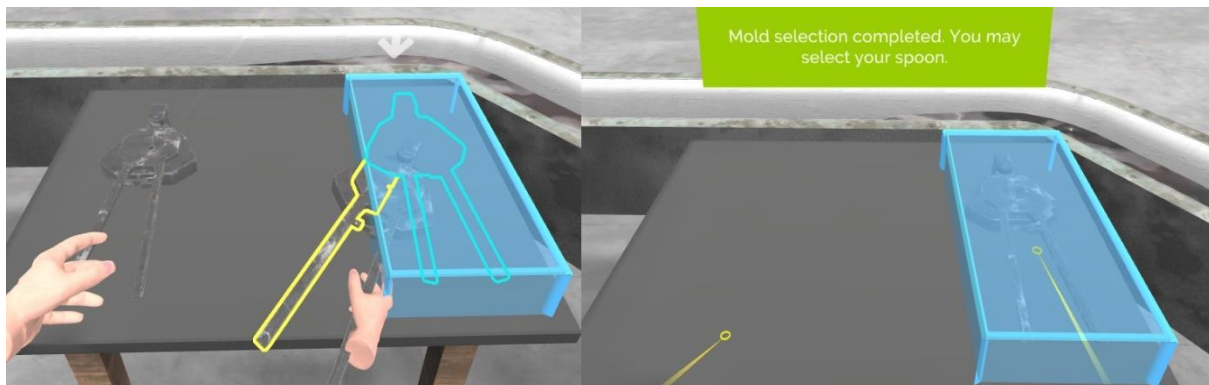


Figure 79 - Left: User approaching the mold to the selection box. Right: Mold selected

The same should be applied to inspect and select a spoon. Once the spoon has been selected, simply drop it into the blue selection box.

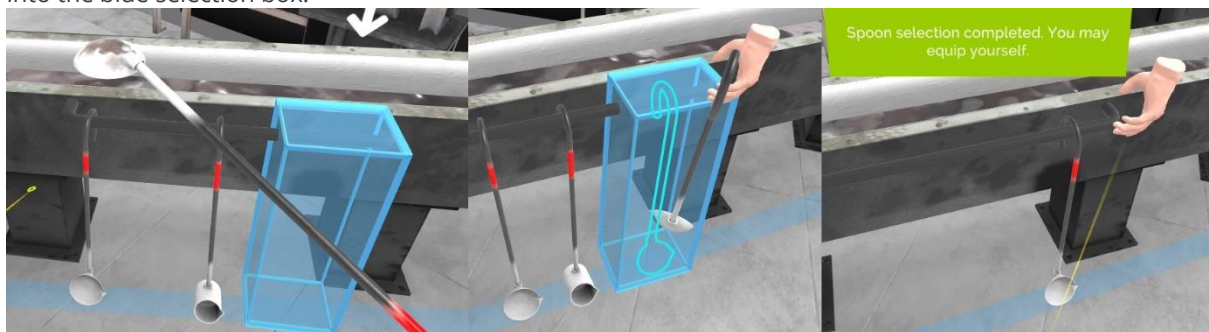


Figure 80 - Left: User inspecting a wrong spoon. Middle: User approaching the spoon to the selection box. Right: Spoon selected

The user can then go and get equipped with PPE. This is an optional step but it will cause the user to have warnings and lose points at the end of the scenario if he has not equipped himself. To select a PPE, just aim and press the trigger button on the selected one. The PPE will appear in light transparent blue if it is equipped.

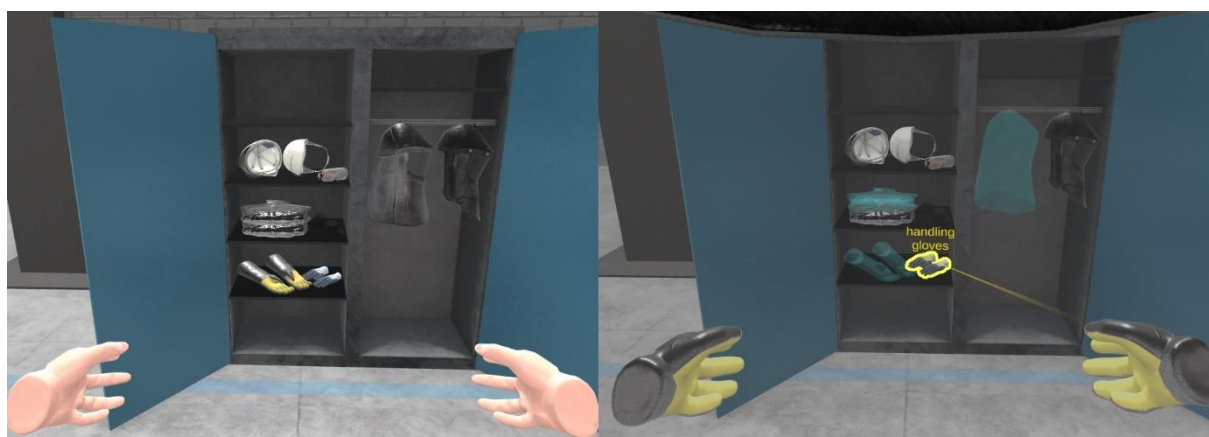


Figure 81 - Left: The PPE rack. Right: All the PPE are properly equipped

To preheat the spoon, grab it and place it above the liquid metal or just at the surface. During the preheating, the controller will vibrate and the spoon will become progressively red. If you dip it inside the liquid metal without proper preheating, it will trigger an explosion. Once the spoon is preheated, you may sample the liquid metal by dipping the spoon (not too deeply).

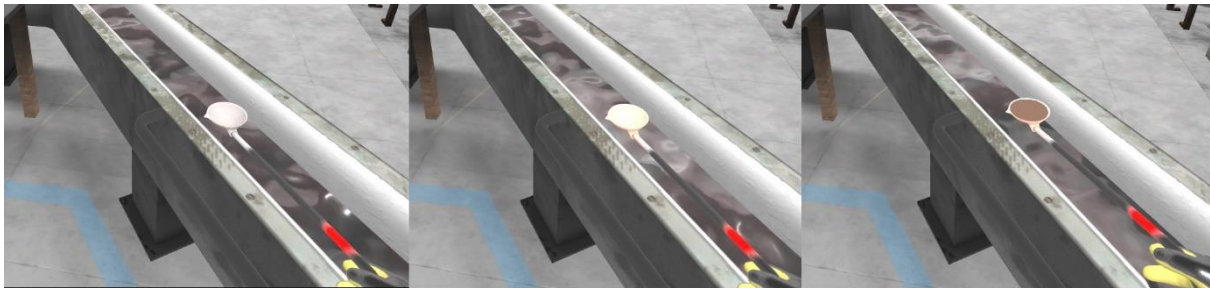


Figure 82 - Left: Preheating the spoon. Middle: Spoon preheated (red). Right: Metal has been sampled

The metal is now ready to be poured inside the mold. To do so, rotate the spoon toward the opening of the mold to pour the liquid metal. If the mold contains rust, an explosion will be triggered.

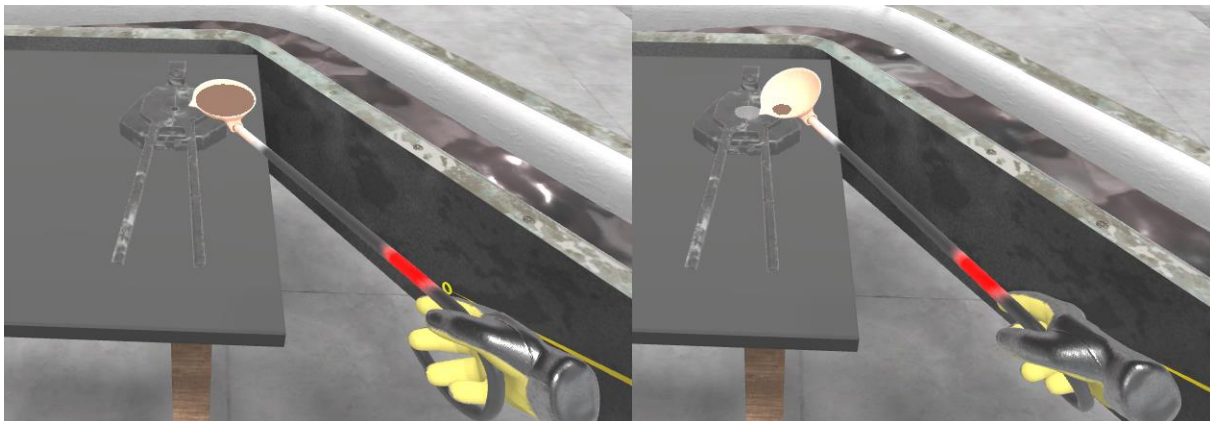


Figure 83 - Left: Spoon ready to pour the liquid metal. Right: Spoon pouring the metal

The scenario 3 will end once the mold has been filled with liquid metal.

HOW TO ORGANIZE A TRAINING SESSION

In this section we will propose a list of tasks to be carried out to plan a smooth training session.

Day before the session:

- Charge the devices (VR headsets and tablets) and make sure they are connected to the internet to retrieve any updates
- Ensure that the version on the tablet and VR headset are identical by creating a test session with the tablet and joining it with the VR headset to ensure that everything is working well.
- Watch the presentation video again, and replay the scenario yourself. Note: operators may get stuck at some steps so the facilitator should be able to know the menus and steps of the procedure in order to properly guide them.
- Review the presets content
- Turn the VR headsets and tablets off after use, otherwise they will discharge

2 hours before the session:

- Turn on the tablets and VR headsets
- Check the batteries in the controllers (30% battery min)
- Check the headset battery and additional battery (charge them if under 80%)
- Define the guardian area for each headset (check <https://numix.fr/mmvr-support/>) and move around to test the tracking. Note: Each VR participant should have at least 4m² to evolve in the session
- Charge the devices while not in use

After the session:

- Turn the VR headsets and tablets off after use, otherwise they will discharge
- Charge the devices
- Clean/Disinfect the devices. Note: Use a dry microfiber lens cloth to clean the lenses of your headset. Do not use liquid or chemical cleaning products.

TROUBLESHOOTING

I cannot see the headset controllers

If you do not see your controllers, make sure the numbers (label on the controller and on the headset) are the same. You may also change the batteries as it is likely that the battery is flat.

The VR headset lost the tracking

The 'Tracking Lost' error often appears on Quest when you've turned the headset on or when it's adjusting to a new environment, right before guardian setup. Pay attention to the light conditions in the room, do not use the headset in a very dark room. Clean the four exterior cameras on the headset that could have scratches or smudges. Then restart the Quest.

The VR headset is not connected to the internet

Check that the CWF-Mobile or IoT network is available nearby. If it is not, you can connect the VR headset to another network as long as it is not a business network or a network with a captive portal. To do this, follow the instructions in the section [Wi-fi configuration](#).

I cannot create/join a multiplayer session

Check that your headset is connected to the internet. If you want to join a session that has already been created but you don't see the server available, it is possible that your version is not the same as the other players. To check the version number, go to the first page of the application. The number is at the bottom left.



Figure 84 - Version number at the bottom left

I cannot cast my screen

Make sure to connect to the Facebook account before going to <https://www.oculus.com/casting/>. If you do not see the red dot on the top right corner of the view inside the headset, try refreshing the page.

CONTACTS

If you have any queries or problems with the application, please contact us at: <mailto:support@numix.fr>

Ticket support CST IT Service desk

NOTES
