User Manual

Radiation Safety & Dosimetry VR Instructions

Summary

The Virtual Medical Coaching Radiation Safety & Dosimetry solution runs on the Skilitics Health XR Content Delivery Platform, and is an excellent, easy-to-use next-generation way to train or educate existing or potential Operating Room (OR) staff.

The simulation software aids in training staff on using fluoroscopy equipment in the safest manner possible, emphasizing ALARA practices and optimizing exposure levels to staff through intelligent management of Time, Distance, and Shielding.

Purpose
The purpose of this document is to provide users with instructions for the interactive Radiation Safety Dosimetry Virtual Reality Simulation software solution.

The sections covered are:
1. Quick reference guide
2. Introduction to the Dosimetry Simulation Software and its use through the Concierge
3. Common misunderstandings in radiation knowledge
4. Troubleshooting guide

We will use Radiation Safety or Radiation Protection interchangeably in relation to Dosimetry safety/protection.

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First Steps

The Operating Room within the Virtual Reality (VR) environment automatically adapts based on the procedure chosen in the Concierge - either Cerebral, Cardiology, or Hepatic Angiography procedures.The images displayed on monitors, staff members present in the OR, and available pre-set configurations for the (-arms, all correspond to the procedure selected by the user.

Upon entering the VR environment, the user will find themselves positioned to the side of the surgical table, wearing a personal dosimeter attached to their right wrist and a lead shield coat/Pb apron under or above their scrubs depending on their selected role and sterility requirements. Additional shielding in the form of lead glasses can be equipped by selecting them from the table in the OR and removed again by bringing the VR hand controllers to the user's face and selecting them again.

Navigating around the OR can be done using the teleport feature by pointing the VR hand controller at the ground in the direction you wish to move and then pressing and releasing the teleport button. It is also possible to move other staff, lead shields, and furniture present in the OR by aiming the VR hand controller at them, pressing down on the select button, and aiming at a clear location before releasing.

Controls

The following controllers are indicative of the most common VR hand controllers. For further details please refer to the instructions associated with your hardware.
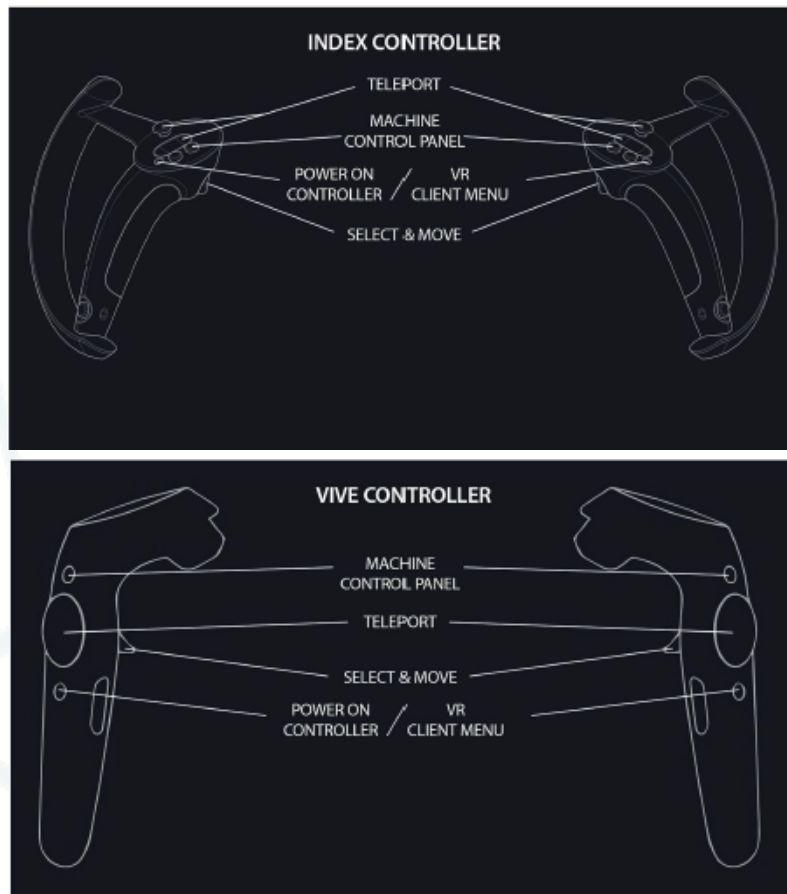
Machine Control Panel

The user can access the Machine Control Panel by pressing the Menu button on the VR hand controller

Through the Machine Control Panel, the user can activate the Fluoroscope, turn planes on and off, vary the exposure settings, choose from a selection of pre-set Fluoroscope setups, change the radiation visualization, and select other patient types.

Note: The control panel attached to the surgical table does not function. Machine settings are only reached through the VR Controller buttons for improved user experience.
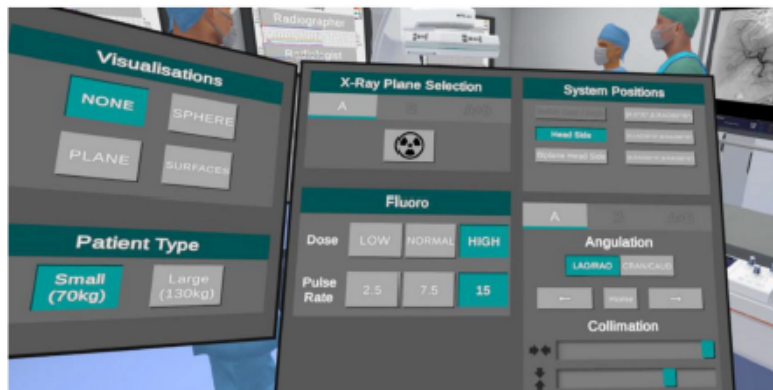

X-Ray Plane Selection

Here users can turn the radiation on and off using the 'radiation symbol' button.

Planes can be enabled individually using the 'A' and 'B' buttons or together using the 'A+B' button.

Fluoro (Fluoroscopy)

This section allows a Radiographer or Physician to access the technical aspects of the Fluoroscope, such as pulse rate and dose settings.

Dose modifiers for low normal and high are 0.55, 0.78 and 1 respectively. These are determined by predefined kVp and mAs in the Fluoroscopes operating settings.
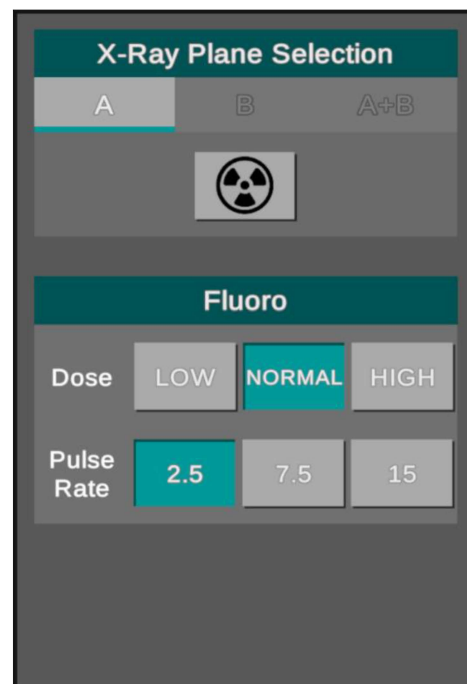
System Positions

Various pre-set system setups based on common configurations can be selected using the buttons available in the System Positions section. There is also the ability to manually set any position and collimate the beam using the controls in the lower section.

The 'A', 'B', and 'A+B' buttons select which plane(s) are controlled by the movement buttons and collimation sliders.

While the 'LAO/RAO' button is selected the left and right arrow buttons rotate the plane by 30 degrees each selection. This rotation occurs around the longitudinal axis of the patient.

The 'CRAN/CAUD' button enables rotation around the horizontal axis to access cranial and caudad imaging views.

The home button will reset the selected plane(s) to their default system position based on the prior system position selected.
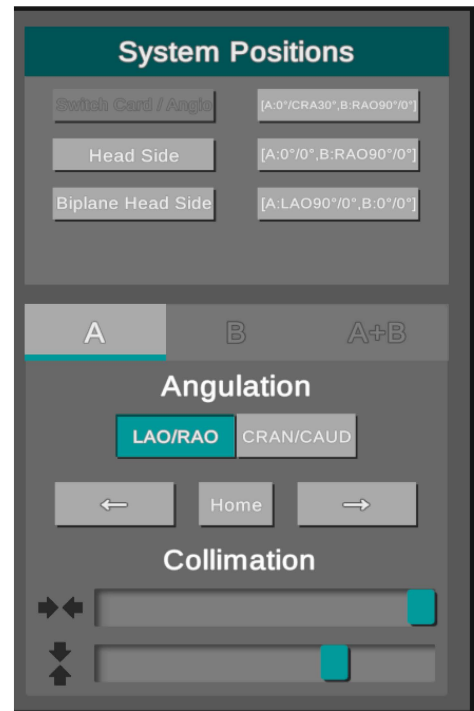
Note: The movement of the Fluoroscopes C-arms can be obstructed by people and objects around the Operating Theatre. If this occurs while trying to reposition a C-arm, a red flashing outline will indicate the person or object blocking the movement of the plane

Visualization

Different visualizations of radiation dose can be selected from the visualizations section.

These visualizations show the dose rate and relative risk throughout the OR using a range of color values; black at the primary beam, red for high levels of scattered radiation diminishing through orange, yellow, green, and blue with decreasing dose rates.

The 'Sphere" visualisation shows colored dose values in an expanding sphere emanating from the primary scattering source on the patient.

The 'Plane' visualization shows colored dose values in a transverse plane of the room ascending upwards, and the 'Surfaces' visualization shows colored dose values on the surfaces of all solid matter in the room.
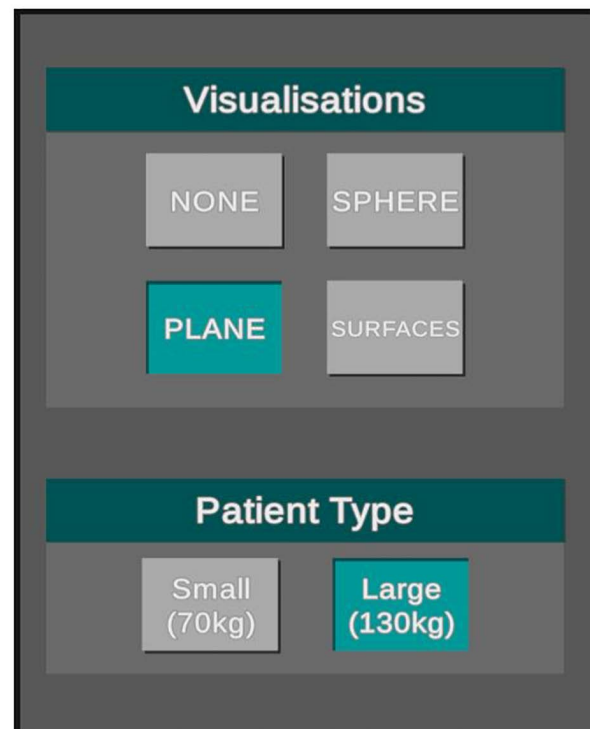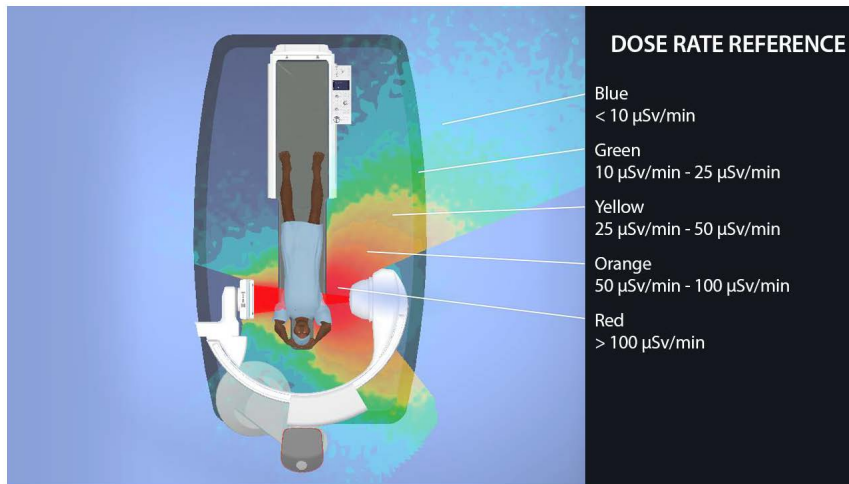
Patient Type
The user can select different patient types varying in size and weight to observe how scattering patterns differ.

Radiation Dose Recording
Once the Fluoroscope has been turned on in the Machine Control Panel, dose readings for the theater personnel and user will be recorded and displayed on graphs attached to the wall of the OR. There are three recording locations for each person: one at eye/lens height, one at chest height, and one at waist height. Dose at these locations is measured and displayed on the graph in mSv/min. There is also a dosimeter on the users' right wrist measuring the dose of that location in µSv/min. This allows the data to be used for benchmarking and evidence that all the OR staff have been provided with adequate radiation safety training.
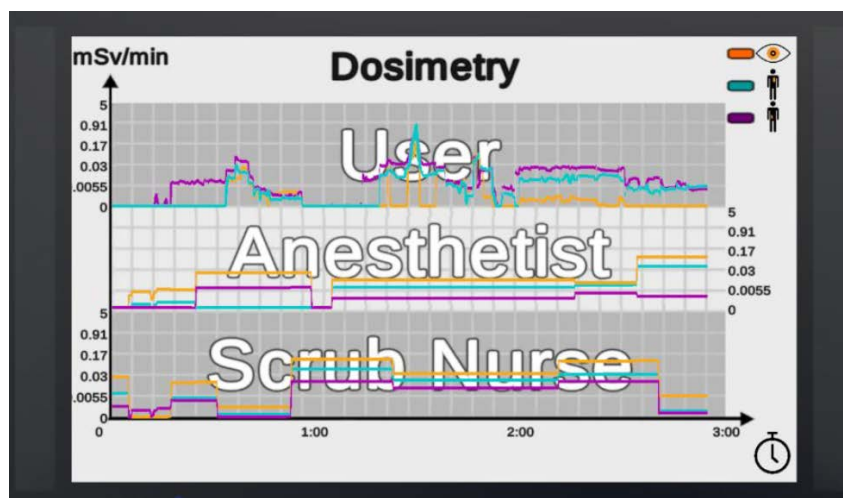

Important: Your individualized dosage report

- Exit through the door in the corner of the room by reaching out for the handle. This will end the simulation and you can now take off your head-mounted display.
- The dosage report is emailed to the user, via their registered email address, when they exit through the door at the end of their VR training session.
- The report details the radiation dose rates received by the user and other theatre staff.
- Remember, users *must* exit through the door to trigger the report being emailed.

Quick Walkthrough

1. Log in to your Skilitics Health Concierge and select 'Dosimetry'
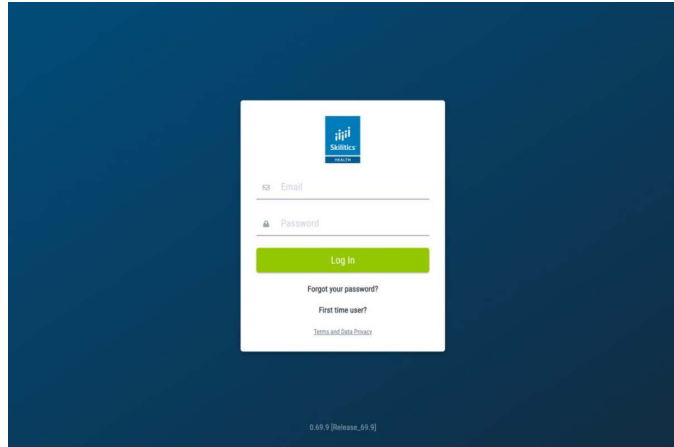
2. Choose your operating procedure.

Note: The options available will depend on your profession as selected during your registration process.
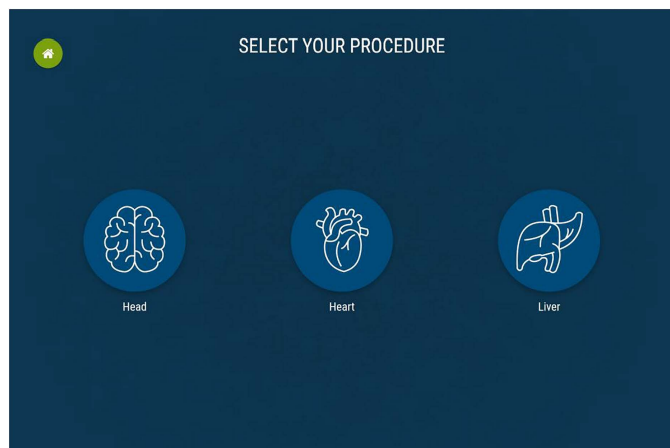
3. Choose your VR space

On selection of your VR space, a windowed application will open displaying the VR environment. You can now put on your VR device to experience the virtual environment. You will see an operating theatre set up for Cerebral/Hepatic/Cardiac Angiography based on your procedure selection.
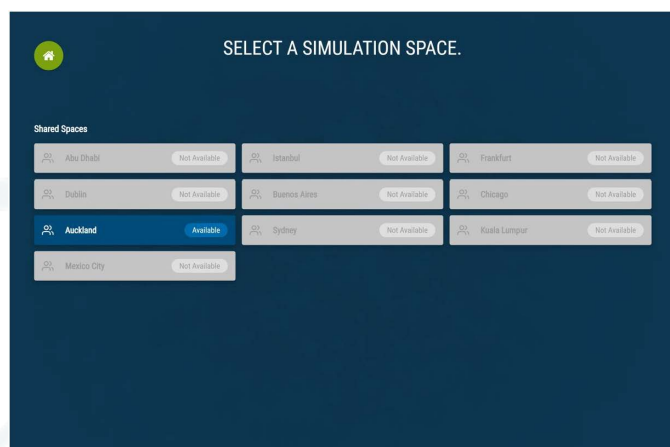
4. As a new user you should familiarize yourself with the operating theatre environment. On the wall is an image detailing instruction on which VR hand controller buttons to press to teleport and access the menu.

5. Practice moving around the room using the teleport feature if your physical space is limited, to get comfortable with movement in the VR environment.

6. When you are ready, use the menu button to open the Machine Control Panel.

7. Activate the radiation button under X-Ray Plane Selection to turn the radiation on/off.

8. Select your preferred radiation visualization style.

9. You will see visualizations of radiation around the room emitted by the current set-up of the Fluoroscope and various scatterers around the room. The most intense radiation will appear as bright red, fading to orange, yellow, green, and blue as the intensity and ambient dose rate decreases.

10. There is an audio cue associated with the radiation intensity.

11. The theatre staff will be standing in positions relative to their roles. You have the ability to move other theatre staff to observe the difference positions can have on their dose. Dose values can be viewed on the wall monitors as well as on the users' right wrist.

12. Try moving the lead glass shield in front of the theatre staff to see the drop in radiation received by that NPC. A similar effect can be seen by positioning the theatre staff behind the anesthetic machine and sterile trollies.

13. Don't forget to put your lead protected glasses on - then observe the impact of wearing lead glasses to your lens dose.

14. When you are finished, exit through the door in the corner of the room by reaching out for the handle. This will end the simulation and you can now take off your head-mounted display.

15. Once you have exited through the door, a report detailing the radiation dose rates received by the user and other theatre staff for the simulation will be emailed to your registered email address.

Common Misunderstandings in Radiation Knowledge

Even for more experienced Operating Theatre Staff, there are interactions which can be observed in the Dosimetry simulation which are often misunderstood in conventional training.

Because of the inverse square relationship radiation dose has with distance, staff positioned closer to the source of radiation experience a larger decrease in absolute dose rate when moving away from the source than compared to the same movement applied further away from the source.

This is also reflected in the comparison of the waist, chest, and eye measurements. The closer measurements (typically the waist and chest) experience higher dose rates than the eyes.

Depending on the specific position of the X-ray tube and patient, deviation from this trend can be characterized by the specific scattering profile inherent to the location being imaged. This deviation is due to geometries, such as a patient's limbs or other personnel and shielding equipment leading to additional localized absorption and scattering.

It is because of these characteristics that the Dosimetry Simulation Software provides unparalleled insight into the intricacies of Radiation Scatter which cannot be experienced by any other radiation safety training.

Other Knowledge

Over time other information will be added to the Virtual Medical Coaching and Skilitics Health websites. Additionally, specific short-form pro-tips will be produced and made available on the Virtual Medical Coaching's YouTube channel.

Frequently Asked Questions (FAQs)

1. I haven't received the dosage report
If you did not "Exit" the simulation by using the door in the VR environment this will not be sent to you.

2. I exited the theatre through the door in the VR environment but I still haven't received my report.
If you did exit by pressing the push plate on this door it will have been sent - please try your spam folder in the email account where you logged in.

3. My headset (HMD) is totally black.
This sounds like a hardware issue and could be a power failure to the HMO - try plugging all the cables back in and make sure they are connected well.

4. I feel like a giant in VR.
This is likely because the room set of yourVR environment was not done correctly. Please run the Steam VR room set up protocol again. You can access this via the Steam VR icon in your taskbar.

5. My simulation space is greyed out
A prior simulation is running in the simulation space, exit the simulation and try again.

6. The simulation computer is offline
Please turn the computer on and try again.

7. The Control Panel attached to the surgical table is not working.
Yes, it does not function. For a better user experience in VR, a bigger format control panel has been created. To access the Radiation Control Panel press the Machine Control Panel button on your VR hand controller.

8. My simulation space isn't visible
A simulation space may not be setup in your network so re-open the concierge and select "First Time User?" and follow the prompts to set up a simulation space.
If you are using a local space, the Skilitics Health Realities service application wasn't running when you logged into the concierge launch this from your simulation computer and then relog in through the concierge.

Visit help.virtualmedicalcoaching.com for more information.

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