RAYDOSE®

2DMap

User Manual

2DMap User Manual

Revision Date: August 15, 2025

i. Statement

This manual is the user guide for 2DMap and its accessories. It is intended to guide users in correctly operating the device while ensuring optimal performance and safe usage. This manual should be kept with the device for easy reference at any time.

2DMap and its accessories are strictly limited to the applications explicitly mentioned in this manual and accompanying documentation. Unauthorized or undefined usage is strictly prohibited. Users must strictly adhere to the operational guidelines and safety precautions provided in this manual. Unauthorized use beyond the specified scope will result in the automatic invalidation of authorization and may lead to unforeseen risks.

ii. Product Information

- **Product Name:** 2DMap
- **Model:** 2DMap-I
- **Production Date:** Refer to the product label
- **Expected Hardware Lifespan:** 5 years

iii. Registration Information

- **Registrant:** Guangzhou Raydose Medical Technology Co., Ltd.
- **Registered Address:** Room 203, No. 6 Lianhuayan Road, Huangpu District, Guangzhou, Guangdong Province, China
- **Manufacturer:** Guangzhou Raydose Medical Technology Co., Ltd.
- **Supplier:** Guangzhou Raydose Medical Technology Co., Ltd.
- **Distributor:** Guangzhou Raydose Medical Technology Co., Ltd.
- **After-sales Service Provider:** Guangzhou Raydose Medical Technology Co., Ltd.
- **Production Address:** Room 203, No. 6 Lianhuayan Road, Huangpu District, Guangzhou, Guangdong Province, China
- **Postal Code:** 510700
- **Email:** info@raydose.com
- **Website:** https://www.raydose.com/

Table of Contents

1. Introduction

1.1. Product Description

2DMap is a detector matrix used to measure the dose distribution of radiation beams, consisting of 1,261 air ionization chambers. The accompanying RayMap software is used to display and analyze the measurement data obtained by 2DMap and compare it with the imported treatment plan, helping to verify the quality of the treatment plan and ensure accuracy and safety during the treatment process.

1.2. Intended Use

2DMap is primarily intended for quality assurance (QA) before Intensity-Modulated Radiation Therapy (IMRT) and Volumetric Modulated Arc Therapy (VMAT). By accurately measuring the dose distribution of radiation, the measurement results obtained from 2DMap can be compared with the planned data from the treatment planning system, thereby verifying whether the patient's treatment plan is being executed as expected.

1.3. Intended Users

Personnel using 2DMap must undergo training based on this user manual and possess relevant professional knowledge in the field of radiotherapy.

1.4. Contraindications

2DMap is intended for patient QA purposes only and must not be used directly on patients. Its measurement data is intended solely for the verification of patient treatment plans and cannot be used to directly control radiation therapy equipment.

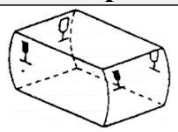
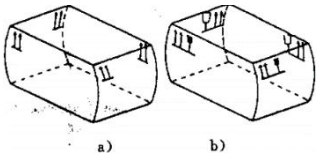
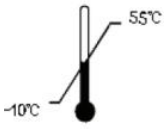
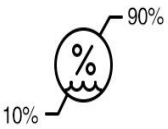
1.5. Copyright Notice

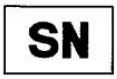
2. Health and Safety Information

2.1. Overview

This chapter outlines potential hazards associated with the device. Before installation, operation, or maintenance, all personnel must carefully read and fully understand the contents of this chapter. It is essential to strictly follow all signs, prompts, and warnings and operate the device correctly according to the instructions in this manual to prevent accidents.

2.2. Symbols and Labels

No.	Name	Graphic	Meaning	Examples
1	Fragile Items		The package contains fragile items; handle with care.	
2	This Side Up		The package must be kept upright, with the arrows pointing upwards.	
3	Keep Dry		Protect the package from rain or exposure to a humid environment.	/
4	Do Not Roll		The package must not be rolled during transportation.	/
5	Do Not Stack		Do not stack packages; no items should be placed on top.	/
6	Temperature Limit		Suitable transportation temperature range: -10℃~55℃.	/
7	Humidity Limit		Suitable transportation humidity range: 10%~90%.	/
8	Warning		Alerts users to important warnings in the user manual to	/

			prevent accidents.	
9	AC Power		Indicates alternating current (AC).	/
10	Special Disposal		The product must not be disposed of as regular waste and requires special disposal handling.	/
11	Refer to Instructions		Users should refer to the manual for operational guidance and information.	/
12	Serial Number		Identifies the manufacturer's serial number for tracking specific medical devices.	/
13	Manufacturer		Indicates information about the manufacturer.	/
14	Non-Ionizing Radiation		Indicates that the device emits or involves non-ionizing radiation.	/
15	Grounding		Indicates that the device must be connected to protective grounding for safe operation.	/

2.3. Responsibilities

- **General Responsibility:** Raydose is not liable for any incidental or indirect losses caused by improper operation or other factors during the use of the device. This includes, but is not limited to, data loss, revenue loss, and business interruption.
- **Usage Responsibility:** This device is intended for use only by personnel with specialized knowledge in radiotherapy, such as medical physicists or engineers. Users must undergo relevant training and possess the necessary qualifications. Unauthorized personnel are strictly prohibited from operating the device.
- **Safety Responsibility:** Users must strictly adhere to the safety warnings and precautions outlined in this manual. Failure to comply may result in personal injury or device damage, for which Raydose assumes no liability.

2.4. Assembly, Maintenance, and Accessories

- Only Raydose or personnel authorized by Raydose with sufficient technical expertise are qualified to assemble, expand, modify, or repair the device.
- During maintenance, only original spare parts provided by Raydose or parts approved by Raydose may be used. The use of unauthorized components may compromise user safety, measurement accuracy, and operational stability. Violating this provision will result in the voiding of the warranty.
- Raydose assumes no responsibility for any hazards or issues arising from the use of unauthorized accessories or consumables not supplied or approved by Raydose.

2.5. Power Supply

The power input module consists of the following components:

- Power input standard: Complies with IEC/EN 60320-1/C14, protection class I.
- Fuse: The power adapter is equipped with dual fuses internally, installed on both the neutral and live wires.

Specifications of the power adapter input and output:

- Input: 100-220V~, 47-63Hz 1.62-0.72A
- Output: 24V⎓ 2.62A max

Specifications of the power cable input and output:

- Output: 24V
- Input: 220V 50Hz

Data connection:

- The ionization chamber matrix requires both a network cable and a power cable.
- The network cable is 25 meters long, with one end connected to the ionization chamber matrix and the other end directly connected to the computer.

2.6. Electromagnetic Compatibility (EMC)

⚠ **Note:**

- This device complies with the electromagnetic compatibility requirements of YY 9706.102-2021 standards.
- Users should install and operate the device according to the EMC information provided in this document.
- Portable and mobile RF communication equipment may affect device performance. Avoid strong electromagnetic interference, especially when using the device near mobile phones, microwave ovens, or similar equipment.

⚠ **Warning:**

- Even if other devices comply with national emission standards, this device may still be subject to interference from them.
- This device should not be placed too close to or stacked with other equipment. If such placement is necessary, verification must be conducted to ensure proper operation under the given configuration.

- Class A equipment is primarily designed for industrial environments. Ensuring electromagnetic compatibility in non-industrial environments may be challenging due to potential conducted and radiated emissions.
- Unless using spare internal components provided by the device manufacturer, the use of non-compliant accessories and cables may increase emissions or reduce the device's resistance to interference.
- Cable Specifications:

No.	Name	Cable Length (m)	Shielded (Yes/No)
1	Power Cable	1.8	No
2	Adapter Cable	1.2	No
3	Network Cable	25	No

Note: Cables include external connection wires (such as power cables, adapter cables, port connection wires, and terminal wires) as well as internal connection wires between components of the product.

2.6.1. Electromagnetic Emissions

The operator of the device should ensure its use under the following electromagnetic environmental conditions.

Emissions Test	Compliance	Electromagnetic Environment Guidelines
RF Emissions GB4824	Group 1	This device is used only for internal functions and generates minimal RF energy, causing negligible interference to surrounding electronic equipment.
RF Emissions GB4824	Class A	The device is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions GB17625.1	Not applicable	
Voltage Fluctuations/ Flicker Emissions GB17625.2	Not applicable	

2.6.2. Electromagnetic Immunity

The operator of the device should ensure its use under the following electromagnetic environmental conditions.

Immunity Test	IEC60601 Test Level	Compliance Levels	Electromagnetic Environment Guidelines
Electrostatic discharge (ESD) GB/T 17626.2	±6kV contact ±8kV air	±6kV contact ±8kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst GB/T 17626.4	±2kV for power supply lines ±1kV for input/output	±2kV for power supply lines ±1kV for input/output	Mains power should have the quality typically used in commercial or hospital

	lines	lines	environments.
Surge GB/T 17626.5	±1kV Differential Mode Voltage ±2kV Common Mode Voltage	±1kV Differential Mode Voltage ±2kV Common Mode Voltage	Mains power should have the quality typically used in commercial or hospital environments.
Voltage dips, short interruptions, and voltage variations on the power supply input lines GB/T 17626.11	<5% U_T, for 0.5 cycles (>95% voltage dip on U_T) 40% U_T, for 5 cycles (60% voltage dip on U_T) 70% U_T, for 25 cycles (30% voltage dip on U_T) <5% U_T, for 5 seconds (>95% voltage dip on U_T)	<5% U_T, for 0.5 cycles (>95% voltage dip on U_T) 40% U_T, for 5 cycles (60% voltage dip on U_T) 70% U_T, for 25 cycles (30% voltage dip on U_T) <5% U_T, for 5 seconds (>95% voltage dip on U_T)	Mains power should have the quality typically used in commercial or hospital environments. If continuous operation is required during power interruptions, it is recommended that the device use an uninterruptible power supply (UPS) or battery power.
Power frequency magnetic field (50/60Hz) GB/T 17626.8	3A/m	3A/m	The power frequency magnetic field should at typical levels found in commercial or hospital environments.
Note: U_T refers to the AC mains voltage before applying the test voltage.			
Conducted RF GB/T 17625.6 Radiated RF GB/T 17626.3	3Vrms 150kHz to 80MHz 3V/m 80MHz to 2.5GHz	3 Vrms 3 V/m	Portable and mobile RF communication devices should not be used closer to any part of the equipment, including cables, than the recommended separation distance. This distance should be calculated using the corresponding formula for the transmitter's frequency. Recommended separation distance: $d=1.2\sqrt{P}$ $d=1.2\sqrt{P}$ 80MHz - 800MHz $d=2.3\sqrt{P}$ 800MHz - 2.5GHz Where P is the maximum output rated power of the transmitter, as provided by the manufacturer, in watts (W), and d is the recommended separation distance, in meters (m). The field strength of fixed RF transmitters is determined by

			conducting an electromagnetic site survey.[a] In each frequency range, the field strength should be below the compliance level.[b] Interference may occur near devices marked with the following symbols: 

Note 1: For frequencies of 80 MHz and 800 MHz, use the formula for the higher frequency range.

Note 2: These guidelines may not be suitable for all situations, as electromagnetic propagation is influenced by building structures, objects, and the absorption and reflection from the human body.

a. Fixed RF transmitters, such as wireless (cellular/cordless) phones, ground-based mobile radio stations, amateur radio, AM (Amplitude Modulation) and FM (Frequency Modulation) radio broadcasting, and television broadcasting, may have field strengths that cannot be accurately predicted theoretically. To assess the electromagnetic environment of a fixed RF transmitter, an electromagnetic site survey should be considered. If the field strength at the location where the device is used exceeds the RF compliance levels mentioned above, the device should be observed to ensure proper operation. If abnormal performance is observed, additional measures may be necessary, such as realigning or repositioning the device.

b. For the frequency range of 150 kHz to 80 MHz, the field strength should be below 3 V/m.

2.6.3. Recommended Separation Distances

The device is intended for use in the electromagnetic environment where radiated RF disturbances are controlled. Based on the maximum rated output power of communication equipment, the user of the device can prevent electromagnetic interference by maintaining the minimum distance between portable and mobile RF communications equipment (transmitters) and this device, as recommended below.

Maximum Rated Output Power of Transmitter (W)	Corresponding Separation Distance for Different Frequencies (m)		
	150kHz～80MHz $d=1.2\sqrt{P}$	80MHz～800MHz $d=1.2\sqrt{P}$	800MHz～2.5GHz $d=2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters with a maximum rated output power not listed in the above table, the recommended separation distance d, in meters (m), can be determined using the formula from the corresponding transmitter frequency section. Here, P is the maximum rated output power provided by the transmitter manufacturer, in watts (W).

Note 1: For frequencies of 80 MHz and 800 MHz, use the formula for the higher frequency range.

Note 2: These guidelines may not be suitable for all situations, as electromagnetic propagation is influenced by building structures, objects, and the absorption and reflection from the human body.

2.7. Regulatory Requirements

Guangzhou Raydose Medical Technology Co., Ltd., as the manufacturer, follows the quality management system standard YY/T 0287-2017 IDT ISO 13485:2016 "Medical Device Quality Management System — Requirements for Regulatory Purposes" for product manufacturing and management.

2.8. Safety Precautions

2.8.1. Electrical Equipment

The electrical equipment must comply with relevant IEC regulations. The room housing the system and its connected equipment must adhere to corresponding electrical safety standards. The device is typically grounded through the power cord to ensure safe use.

2.8.2. Operators

The device should only be operated by the following personnel:

- Professionals who are familiar with the device's radiation measurement limitations.
- Personnel who are capable of following the safety procedures for operating Co-60 or linear accelerators.
- Personnel who have the necessary ability to take safety precautions when using electrical or electronic equipment to avoid potential hazards.

Before using the device, operators must confirm that the device is properly connected and in normal working condition, and perform the following checks:

- Ensure that the device's routine functions are normal, and that all safety devices are functioning properly.
- Check the data cables and power cords to ensure they are intact and undamaged.

2.8.3. Operating Procedures

- When handling the system and connected equipment, care should be taken to avoid any impacts, especially to prevent surface pressure or strong vibrations on the device. The maximum load capacity of the device is 25 g/cm², and overload may cause damage.
- Do not operate the device with wet hands. Moisture may cause internal short circuits or damage to the device.
- The radiation field size must not exceed the irradiable area marked on the device to prevent radiation damage to internal circuits. In the event of an emergency or device malfunction, immediately stop using the device, and perform a thorough check before the next use to ensure the device is in normal working condition.
- The device is equipped with an exhaust vent; ensure that the vent is unobstructed during use. Avoid allowing liquids or other contaminants to enter the device to prevent damage or impact on its normal function.

- The device should be cleaned regularly to maintain good working condition. If the environment where the device is stored has significant dirt or dust accumulation, the cleaning frequency should be increased.

2.8.4. Transportation and Storage

(1) Transportation Requirements

- The device packaging should use environmentally friendly, non-toxic materials and be equipped with shockproof and moisture-proof devices to ensure the safety of transportation and storage.
- During transportation, the device should be kept stable to avoid rolling, collisions, or severe shaking. Professional equipment should be used for loading and unloading, and operations must be performed according to regulations.
- For long-distance transportation or extreme environments, additional protections such as insulation, moisture-proofing, or reinforced packaging should be added to ensure the device remains intact and undamaged.

(2) Storage Requirements

- The device should be stored in an environment free of corrosive gases, with good ventilation, and away from strong magnetic fields and radiation protection areas. It is not recommended to store the device in an accelerator room for extended periods to avoid radiation damage.
- When the device is not in use, the power plug should be unplugged. The device should be placed flat on its own with the front facing up, avoiding stacking or collisions to prevent damage.
- The device should be kept away from dust, liquids, or other contaminants. It is recommended to store it in a dedicated storage box.

(3) Environmental Requirements

The transportation and storage environment should meet the following requirements:

Temperature	-10℃ ~ +55℃
Pressure	760hPa ~ 1100hPa
Relative Humidity	10% ~ 90%

2.8.5. Operating Environment

- The device must be used in a clean, dry environment with an appropriate room temperature.
- The device should be kept away from low temperatures, high pressure, unnecessary moisture, solvents, or steam.
- If temperature fluctuations cause humidity changes, do not use the device directly until it is completely dry.
- The operating environment should meet the following requirements:

Temperature	+10℃ ~ +40℃
Pressure	760hPa ~ 1100hPa

Relative Humidity	30% ~ 75%

2.8.6. Emergency Measures

- When the device experiences external shocks, vibrations, or overload, first check for visible damage on the exterior to ensure there is no internal damage. If severe damage is found, immediately stop using the device, document its condition, and contact professional personnel for repairs or replacement.
- If the device shows signs of overheating, abnormal noise, or other malfunction symptoms during operation, immediately stop using it, disconnect the power, and then contact technical support for troubleshooting.
- If the device is submerged in water, immediately disconnect the power and wait for about one minute before making contact or performing any checks.
- When cleaning the device, if any components are loose or detached, immediately stop cleaning and check that all connections are secure. If there are issues, contact technical support for inspection and repair.
- If the device experiences a system failure or operational abnormality, perform a preliminary check to see if the device is affected by moisture or water, or if any parts show signs of obvious wear. For further diagnosis, please contact technical support.

2.9. User Suggestions and Complaint Handling

Users can provide feedback through the following channels:

- **Email:** service@raydose.com
- **Feedback via Agents:** Users can also directly report device issues or file complaints with Raydose's authorized agents.

We will respond to your feedback as soon as possible and provide you with full support and solutions.

3. Product Description

3.1. Composition

Device Configuration List			
Core Components	**Name**	**Quantity**	**Configuration**
Detector Matrix	2DMap	1	Standard
Solid Water	RD Cube	1	
	RD Beam	1	Optional
Plugins	Solid Sleeve	1	
	0.65cc Ion Chamber Sleeve	1	
	0.13cc Ion Chamber Sleeve	1	
Software	RayMap (2DMap Module)	1	Standard
Note: The actual delivered accessories are subject to the configuration specified in the customer's order.			

3.2. Terminology Description

Terminology	Description
QA	Quality Assurance
TPS	Treatment Planning System
MLC	Multi-Leaf Collimator
IP	Internet Protocol Address
DICOM	Digital Imaging and Communications in Medicine
SN	Serial Number
MU	Monitor Unit
ID	Identifier
AAPM	American Association of Physicists in Medicine
IAEA	International Atomic Energy Agency
IEC	International Electrotechnical Commission

3.3. Data Interface Instructions

Item	Description
DICOM Import	**Purpose:** Receive DICOM format files sent by TPS. **Users:** Physicists, maintenance personnel, authorized personnel. **Device Control:** No **Specifications:** Supports or is compatible with DICOM 3.0 standard planning and dose files. **Data Type:** DICOM files **Verified Planning Systems:** Manaco, Eclipse, Pinnacle **Standard:** DICOM 3.0 **Time Synchronization:** Not applicable

	Possible Issues: • Port or IP configuration errors may cause file reception failure. • Incompatibility with the DICOM 3.0 standard may cause file reception failure. **Prohibited:** None **Recommended Method:** None **Configuration:** IP and port need to be set, and the port must not be occupied by other applications. After configuration, restart RayMap to take effect. **Safety Requirements:** None **Others:** This method is not recommended, as it requires changing the network IP configuration, which makes the operation complex.
File Import	**Purpose:** Import DICOM format files exported from the TPS, and also supports the import of measurement files in RayMap format. **Users:** Physicists, maintenance personnel, authorized personnel. **Device Control:** No **Specifications:** Compatible with DICOM 3.0 standard planning and dose files, and measurement files exported by RayMap software. **Data Type:** DICOM files, RayMap measurement files **Verified Planning Systems:** Manaco, Eclipse, Pinnacle **Standard:** DICOM 3.0 **Time Synchronization:** Not applicable **Possible Issues:** • Planning files that are not compatible with the DICOM 3.0 standard may fail to parse. • Measurement files that are not in RayMap export format may fail to import. **Prohibited:** None **Recommended Method:** None **Configuration:** None **Safety Requirements:** None
File Export	**Purpose:** Export plan data and measurement data from RayMap. **Users:** Physicists, maintenance personnel, authorized personnel. **Device Control:** No **Specifications:** • Exported plan files remain identical to the imported ones; RayMap software does not make any modifications. • Exported measurement files are in a proprietary RayMap format and are recommended to be imported and viewed using RayMap software. **Data Type:** DICOM files, RayMap measurement files **Standard:** None **Time Synchronization:** Not applicable **Possible Issues:**

	• The computer must have enough storage space to export the file. • RayMap must have permission to write files. **Prohibited:** None **Recommended Method:** None **Configuration:** None **Safety Requirements:** None
Print Report	**Purpose:** To call the printer for printing reports. **Users:** Physicists, maintenance personnel, authorized personnel. **Device Control:** Yes, used to call the printer to perform document printing operations. **Specifications:** None **Data Type:** Reports generated by RayMap **Verified Devices:** HP OfficeJet Pro 7730 Series, EPSON L6170 Series, HP Color LaserJet MFP M277dw. **Standard:** None **Time Synchronization:** Not applicable **Possible Issues:** The computer may not have the printer driver installed or may not be connected to the printer's network. **Prohibited:** • It is not recommended to connect the printer to a non-internal network. • If the printer is on a non-internal network, it is recommended to first export the document as a PDF, then transfer it to the target network for printing. **Recommended Method:** None **Configuration:** None **Safety Requirements:** None **Others:** This method is not recommended, as it requires changing the network IP configuration, which makes the operation complex.
Export Report as PDF	**Purpose:** To export the report as a PDF document for electronic archiving or printing. **Users:** Physicists, maintenance personnel, authorized personnel. **Device Control:** No **Specifications:** PDF document format **Data Type:** Reports generated by RayMap **Verified Devices:** Edge browser, WPS software. **Standard:** PDF format **Time Synchronization:** Not applicable **Possible Issues:** • The computer must have enough storage space to export the file. • RayMap must have permission to write files. **Prohibited:** None **Recommended Method:** Use Edge browser to open the PDF file. **Configuration:** None

	Safety Requirements: None

3.4. Network Security Instructions

Item	Description
Network Environment	• RayMap should only operate in an internal network environment. It is recommended to avoid connecting to external networks to ensure data security. • Network conditions: Local Area Network (100 Mbps), Local Area Network (1 Gbps)
Antivirus Software and Firewall	To ensure system security and stability, it is recommended that users install antivirus software and enable the system firewall for regular protection. • Firewall Settings: If the firewall is enabled, ensure that the relevant ports are not blocked by the firewall. • Antivirus Software: When installing antivirus software, make sure it does not mistakenly flag RayMap as malicious. It has been verified that RayMap software passes checks with 360 Antivirus and contains no malicious code.
Receiving Network Port	RayMap supports the DICOM interface.
Sending Network Port	RayMap supports calling the printer to print reports.
SBOM List	In most cases, the components in the SBOM list do not require upgrading. The list includes compiled DLL and Lib files. If any vulnerabilities affecting system security are identified, Raydose's after-sales team will promptly provide software updates.
Available Identification	RayMap authorization is bound to the computer through the License. If the user can log in to the software successfully, it indicates that the software has been successfully authorized and is ready for use. Otherwise, it may mean that the authorization has not been activated or the trial period has expired. In this case, please contact the Raydose after-sales team promptly for assistance.
Possible Issues and Solutions	1) Unable to receive DICOM files: • Check if the network IP configuration is correct. • Check if the DICOM configured port conflicts with other services. • Check if the DICOM port is allowed through the firewall. 2) Unable to find the printer for printing reports: • Check if the network IP configuration is correct.

	• Check if the printer driver is correctly installed and running normally.
Performance Impact	None
Restore Configuration	Users can restore the system to its factory default configuration when needed.
User Retained Configuration	The software's default configuration is set to factory settings, but users can personalize the configuration during use. All real-time configuration changes will be saved in the configuration file. Users can restore the initial configuration at any time using the "Restore to Factory Settings" feature.
Problem Logging	Network communication issues will be logged in the log files. The log files are stored in the LogInfo folder within the program's execution directory.
Support	If the software's operating environment no longer supports network security updates or technical support, Raydose's after-sales team will notify users promptly. At that point, the system may still function, but due to the lack of security updates, it may be at higher risk.
Data Handling when Disabled	Data is stored locally by default. Users can back up or delete the data as needed.
Updates	When vulnerabilities affecting network security are identified, Raydose's after-sales team will provide software update packages to help users upgrade and ensure the system's security.
Network Unavailable	1) 1)Import: measurement files can be loaded via local import. 2) Print Report: Users can export reports as PDF documents and copy them to a device with an available network for printing.
Unresolved Issues	If users encounter unresolved network issues or security vulnerabilities, they should contact Raydose's after-sales team for assistance.

3.5. Operating Environment Requirements

- Software Environment:
  - Win10
  - Win11
- Hardware Environment:
  - CPU: Intel I5/Intel I6/Intel I7
  - Memory: 4GB/8GB
  - Hard Drive: 500GB/1TB/2TB
- Network Conditions:
  - Local Area Network (100 Mbps Ethernet)

- Local Area Network (1 Gbps Ethernet)

3.6. User Access Control Requirements

Once the License is bound to the computer, it can be used directly, and an account login is required. If the license file is accidentally deleted, please contact Raydose's after-sales team for assistance in recovery.

4. Hardware

4.1. Composition

Category	Name
Detector Matrix	2DMap
Solid Water	RD Cube
	RD Beam
Plugins	Solid Sleeve
	0.65cc Ion Chamber Sleeve
	0.13cc Ion Chamber Sleeve

4.2. Detector Matrix

Figure 1. 2DMap

4.2.1. Working Principle

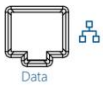
2DMap utilizes air ionization chambers as detectors, featuring a total of 1,261 chambers uniformly distributed across a 26 cm × 26 cm detection area. When exposed to radiation, the incoming rays ionize the air within the sensitive volumes of the chambers. The resulting charged particles drift under an external electric field, generating output signals. These signals are then transmitted to a PC via a gigabit Ethernet interface for further processing.

4.2.2. Technical Specifications

Detector Matrix	
Detector Type	Ionization chamber
Number of Detectors	1,261
Field Size	26 cm × 26 cm
Water-Equivalent Thickness of the Housing	11.6 mm
Ionization Chamber Diameter	5.6 mm
Ionization Chamber Height	4.8 mm
Ionization Chamber Sensitive Volume	0.118 cc
Ionization Chamber Spacing	7.07 mm (Center to Center)

Nominal Sensitivity	3.6 nC/Gy ± 0.2 nC/Gy
Background Signal Deviation	≤ 1%
Minimum Sampling Time	≤ 120ms
Maximum Dose Rate	14 Gy/min ± 2 Gy/min
Minimum Dose Rate	0.2 Gy/min ± 0.1 Gy/min
Dimensions (L×W×H)	441 mm × 296 mm× 20 mm
Weight	3.6 kg
Repeatability	• Used alone: ≤ ± 0.5% • Used with RD Cube: ≤ ± 0.5%
Non-linearity	• Used alone: ≤ ± 0.5% • Used with RD Cube: ≤ ± 0.5%
Measurement Consistency	• Used alone: ≤ 1.5% • Used with RD Cube: ≤ 1.5%

4.2.3. Interfaces and Indicator Lights

Label		Description
Power Interface		Used to connect the power supply.
Network Interface		Used to connect the network cable. One end of the cable connects to the 2DMap, and the other end connects to the computer.
Power Indicator		• Green light off: 2DMap is not powered on. • Green light blinking: 2DMap is powered on but not connected to the network. • Green light steady: 2DMap is powered on and connected to the network.
Start Measurement Indicator		• Green light off: 2DMap is shut down. • Green light blinking: Network connected, measurement starting.
Connection Indicator		• Green light off: 2DMap is shut down. • Green light blinking: Not connected. • Green light steady: Connected.

4.2.4. Power Supply and Adapter

(1) Power Input Module

- The power input module complies with the IEC/EN 60320-1/C14 standard and has protection class 1.
- The power adapter is equipped with dual fuses, installed on the neutral and live lines, to ensure safety.

(2) Power Adapter

- Input: 100-240V~, 47-63Hz, 1.62-0.72A
- Output: 24V⎓ 2.62A (max)

4.3. Solid Water

The solid water section consists of RD Cube and RD Beam. Both the RD Cube and the RD Beam are made of water-equivalent materials, with symmetrical material thickness on the top, bottom, left, and right, providing radiation absorption characteristics similar to water.

4.3.1. RD Cube

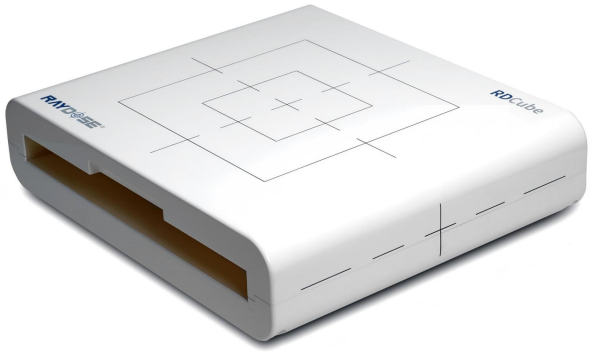


Figure 2. RD Cube

- RD Cube can be used together with 2DMap for plan QA verification. During measurement, the 2DMap needs to be inserted into the RD Cube.
- Additionally, RD Cube can be combined with RD Beam, plugins, and film to support point dose measurement and film dose measurement.
- Technical specifications:

RD Cube	
Dimensions (L × W × H)	357.1 mm × 320 mm × 81.2 mm
Weight	7.2 kg
Material	ABS
Density	1.04~1.06 g/cm^3

4.3.2. RD Beam

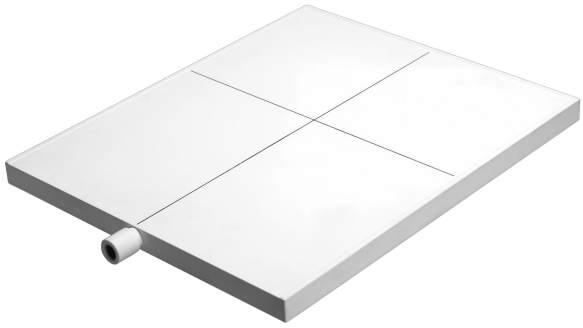


Figure 3. RD Beam

- When using RD Beam for point dose measurement, it must be inserted into the RD Cube and used together with plugins and an ionization chamber.

- When using RD Beam for film dose measurement, it also needs to be inserted into the RD Cube and used with film and film analysis software.
- Technical specifications:

RD Beam	
Dimensions (L × W × H)	350.5 mm × 296.1 mm × 21.1 mm

4.4. Plugins

- When using the plugin, it must first be inserted into the RD Beam and used together with the electrometer and ionization chamber to complete point dose measurement.
- Technical specifications:

Plugin	Dimensions
Solid Sleeve	Φ15.8 mm × 238 mm
0.65cc Ion Chamber Sleeve	Φ15.8 mm × 238 mm
0.13cc Ion Chamber Sleeve	Φ15.8 mm × 238 mm

4.5. Maintenance and Cleaning

4.5.1. Routine Maintenance

- Handle the device with care to avoid drops or impacts.
- When not in use, store the device in a designated storage case and keep it away from radiation sources.
- Regularly inspect the power cord, plug, and battery to ensure they are not aged or damaged.
- Ensure the device casing remains intact and free from physical damage.

4.5.2. Cleaning and Disinfection

- **Cleaning Tools:** Use a soft cloth, lint-free cloth, or cleaning sponge to wipe the device's surface. Avoid using abrasive materials to prevent scratches.
- **Cleaning Agents:** Use only neutral cleaning agents. Avoid corrosive or harsh chemicals.
- **Cleaning Procedure:**
  - Before cleaning, turn off the device and unplug the power cord.
  - Dampen a cloth with clean water, wring it out, and gently wipe the device's surface.
  - For stubborn stains, use a small amount of neutral detergent, then wipe dry with a clean cloth.
  - Ensure the device is completely dry before reuse.
- **Disinfection Procedure:** Regular disinfection is necessary to maintain hygiene. Use 75% medical-grade alcohol to wipe the device's surface.
- **Precautions:** Avoid letting any liquid seep into the device during cleaning and disinfection.

5. RayMap

5.1. Login, Lock Screen, and Exit

(1) Login

- Before using RayMap, users must log in by correctly entering their username and password. Multiple consecutive incorrect attempts may result in RayMap being temporarily locked.
- By default, RayMap is shipped with a preset user account:
  - Username: raydose
  - Password: raydose

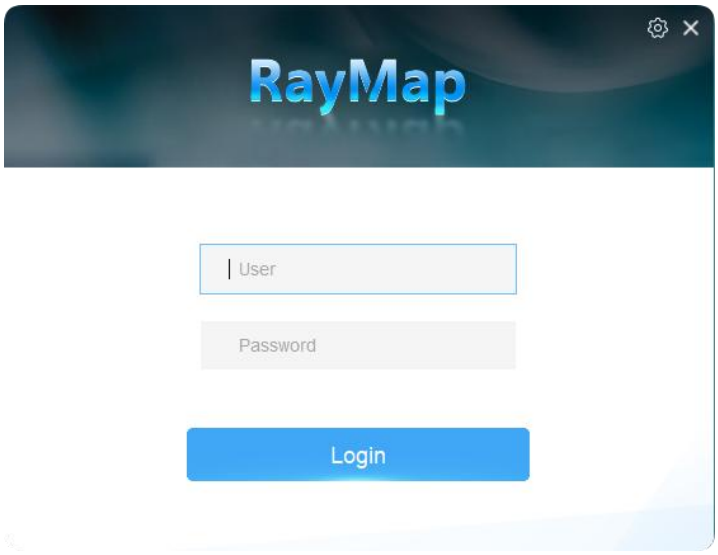


Figure 4. Login interface

(2) Lock Screen

- If there is no activity for 10 minutes, RayMap will automatically lock the screen. To unlock it, the user must re-enter their username and password.
- Users can also lock the screen manually using the shortcut key “CTRL+L”.

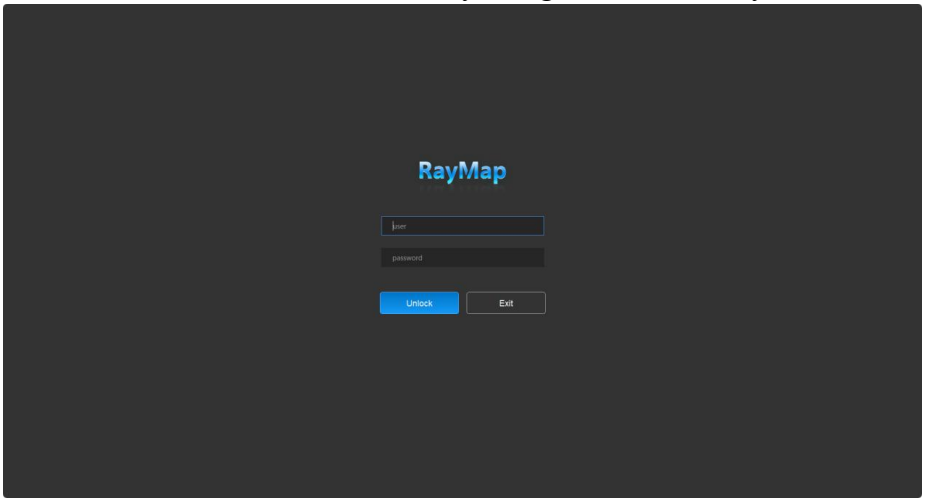


Figure 5. Lock screen interface

(3) Exit

- Clicking the “Exit” button will close the RayMap.

5.2. Main interface

The main interface of RayMap provides access to most of the essential functions, including measurements, reviewing gamma results of plans, printing reports, ect.

5.2.1. Overview

After a successful login, RayMap will automatically enter the main interface.

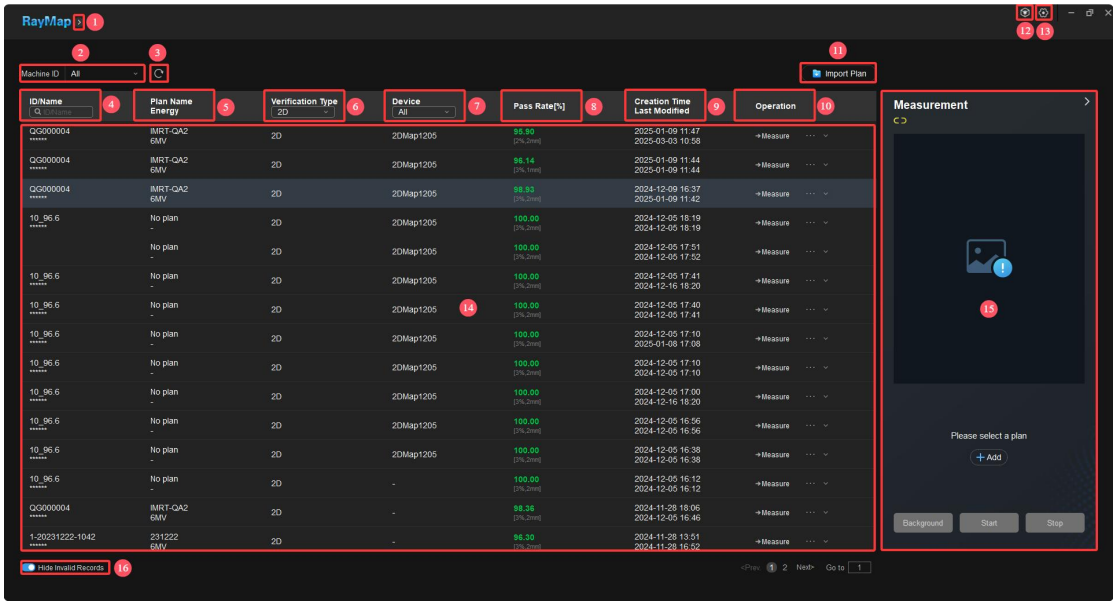


Figure 6. RayMap main interface

① Click this button to navigate to RayMap’s analysis interface.

② Filter patient records by machine ID.

③ Refresh the current interface.

④ This column displays the patient ID and name. Users can enter the ID or name in the input field to search.

⑤ This column shows the plan name and energy.

⑥ This column shows the verification type of the plan. Users can click the dropdown button to filter by type.

⑦ This column shows the measurement device. Users can click the dropdown button to filter by device.

⑧ This column displays the gamma pass rate for the record.

⑨ This column displays the creation time and last modified time of the record.

⑩ Perform additional actions on the record.

⑪ Click this button to import plans.

⑫ Enter the device interface to perform related operations.

⑬ Enter the settings interface for configuration.

⑭ Display information related to the record.

⑮ Display measurement information.

⑯ Click this button to hide invalid records.

5.2.2. Specific Operations

(1) Importing Plan

Step 1： Click 

on the main interface to open the import window.

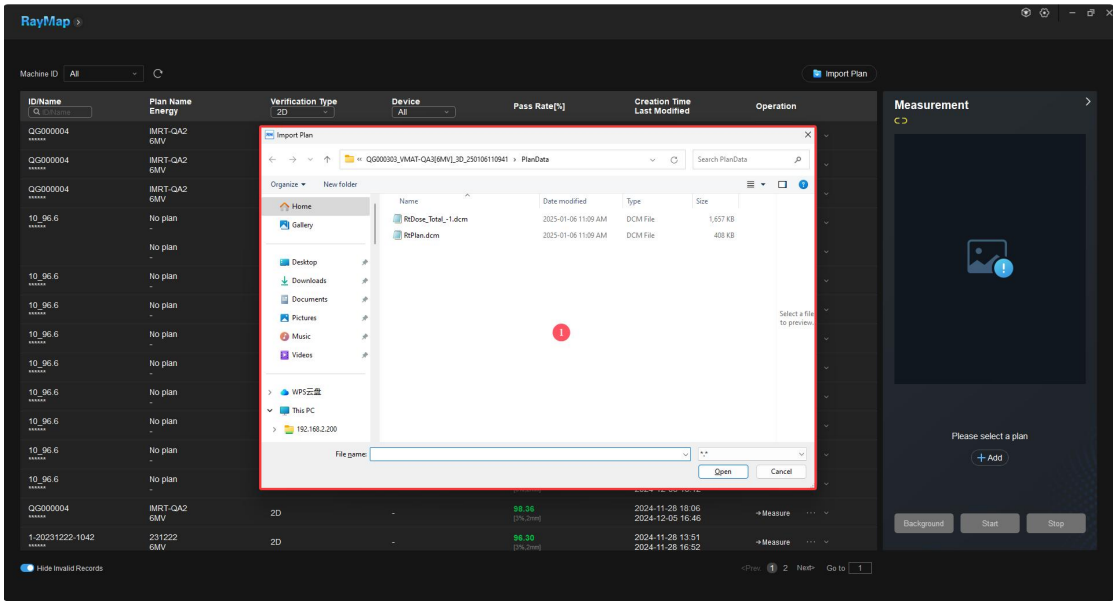
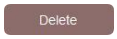


Figure 7. Import window

① In this window, select the plan to import and click the “Open” button.

Step 2： RayMap will then display the “Import Plan” window.

- Click 

to import multiple plans simultaneously.
- Click 

to clear the data in the window.
- Click 

to complete the plan import.

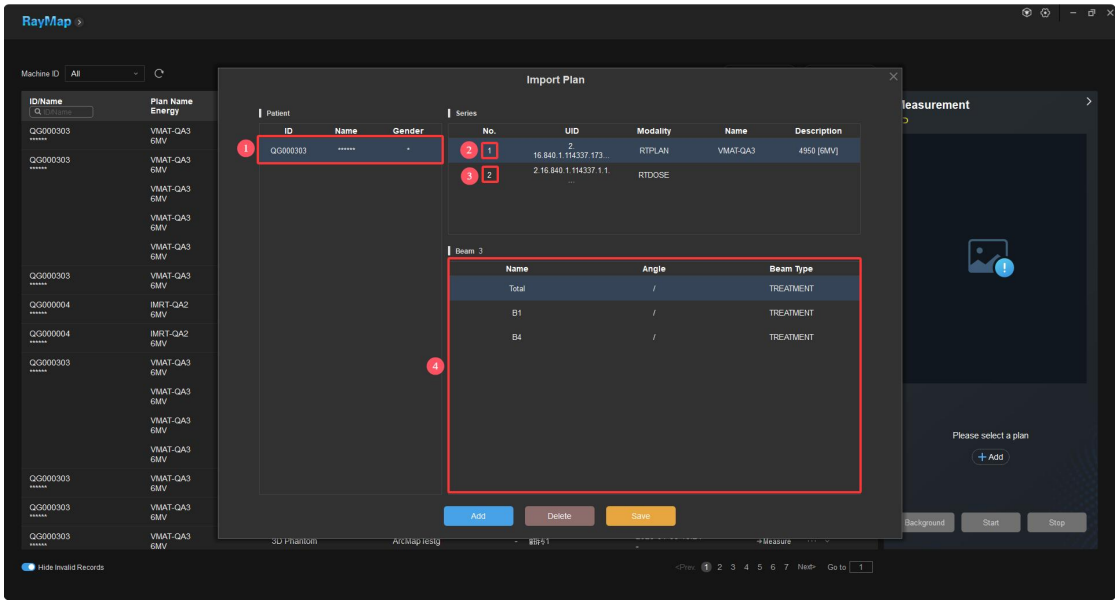


Figure 8. Import Plan window

① Patient record section: shows patient ID, name, and gender information.

② Patient plan file.

③ Patient dose file.
④ Display area: clicking ②~③ will display corresponding information.

Step 3： Double-click the patient record section to open the “Edit Patient Information” window, where users can edit patient details.

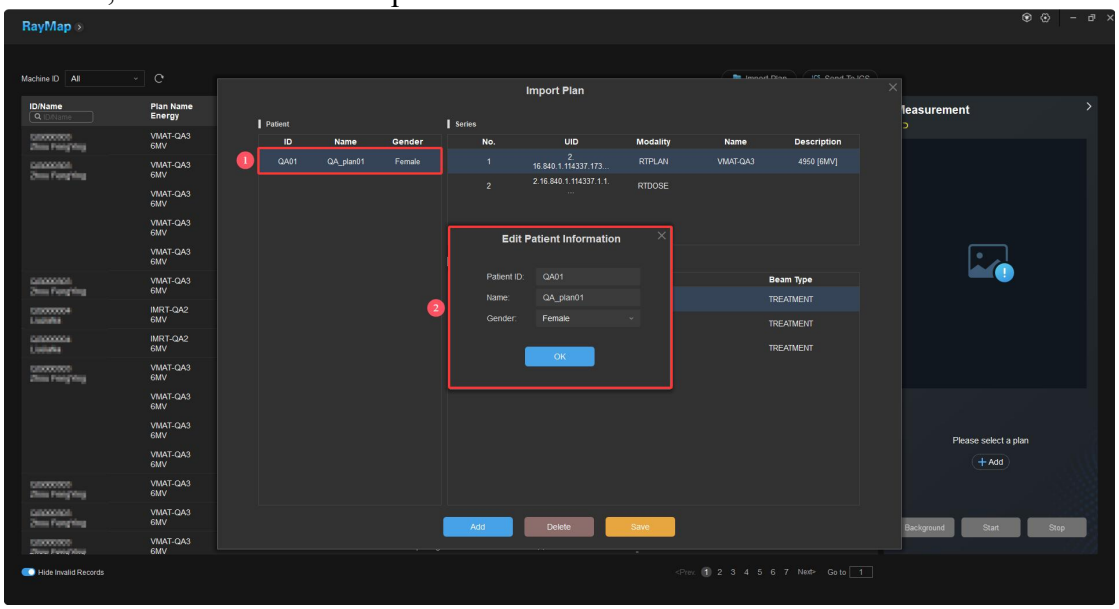


Figure 9. Edit Patient Information window

① Double-click this area to open the Edit Patient Information window (②).
② In this pop-up window, users can edit the patient ID, name, and gender. Click OK to save.

Step 4： Double-click the patient plan section to open the “Edit Plan Information” window, where users can edit plan details.

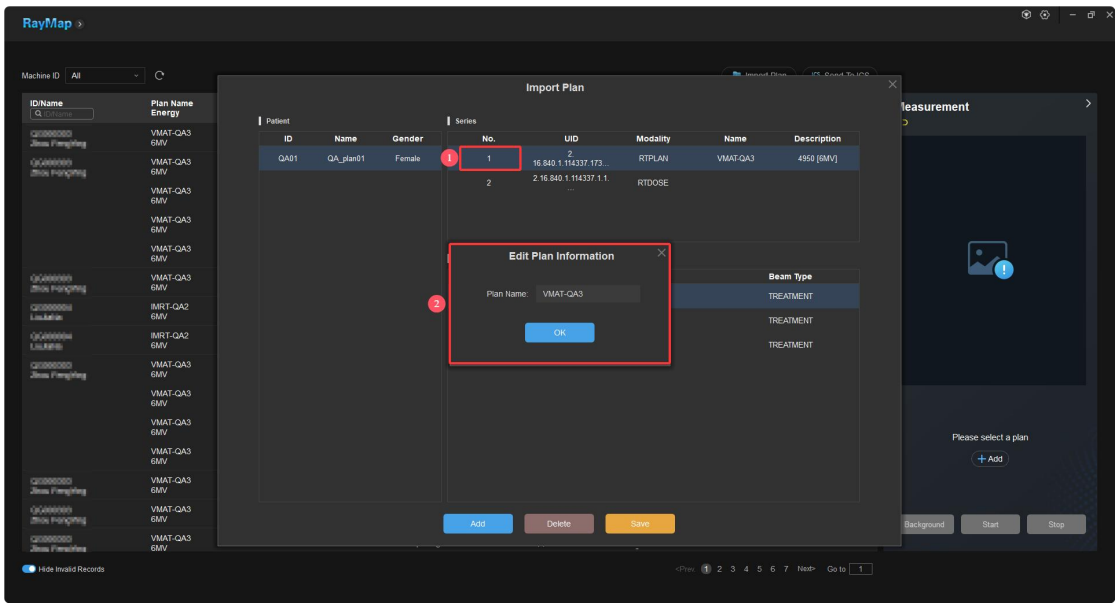


Figure 10. Edit Plan Information window

① Double-click this area to open the Edit Plan Information window (②).

② In this pop-up window, users can edit the plan name. Click OK to save.

(2) Perform Operations on Records

- Each record can represent either a patient plan or a measurement data.
- When a plan is imported or a measurement is performed, RayMap will automatically create a corresponding record.
- After performing operations such as measurement or calculation on the record, related information will be updated automatically.

Click ··· to expand the menu bar, allowing for additional operations on the record.

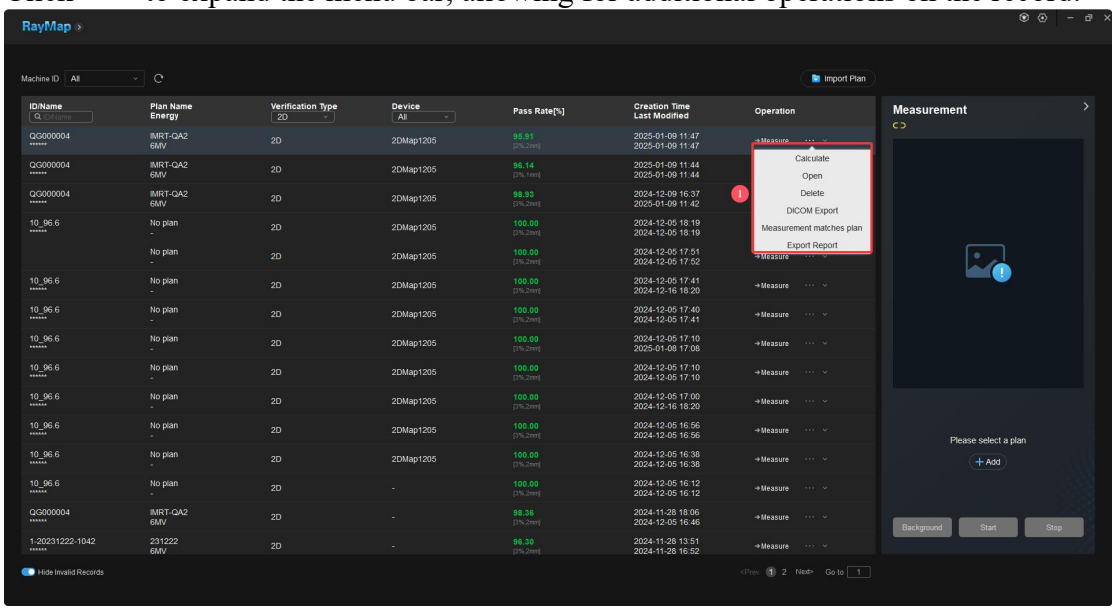


Figure 11. Perform operations on records_Menu bar

① Menu bar, allowing the user to perform operations on the selected record. The available operations are described below:

➢ Calculate
  - When the record is matched with measurement data, click "Calculate" to perform analysis based on the calculation settings under "Calculation" in "Settings".
  - If the record is not matched with any measurement data, this option will not appear in the menu bar.
  - Once the calculation is complete, the result will be automatically updated in the "Pass Rate [%]" column.

➢ Open
  - Click "Open" in the menu bar, or double-click the record to enter the detailed analysis interface of the record.

➢ Delete
  - If the record is a patient plan and has been matched with measurement data, this operation will delete the matched measurement data. Click OK to delete, or click Cancel to cancel the operation.

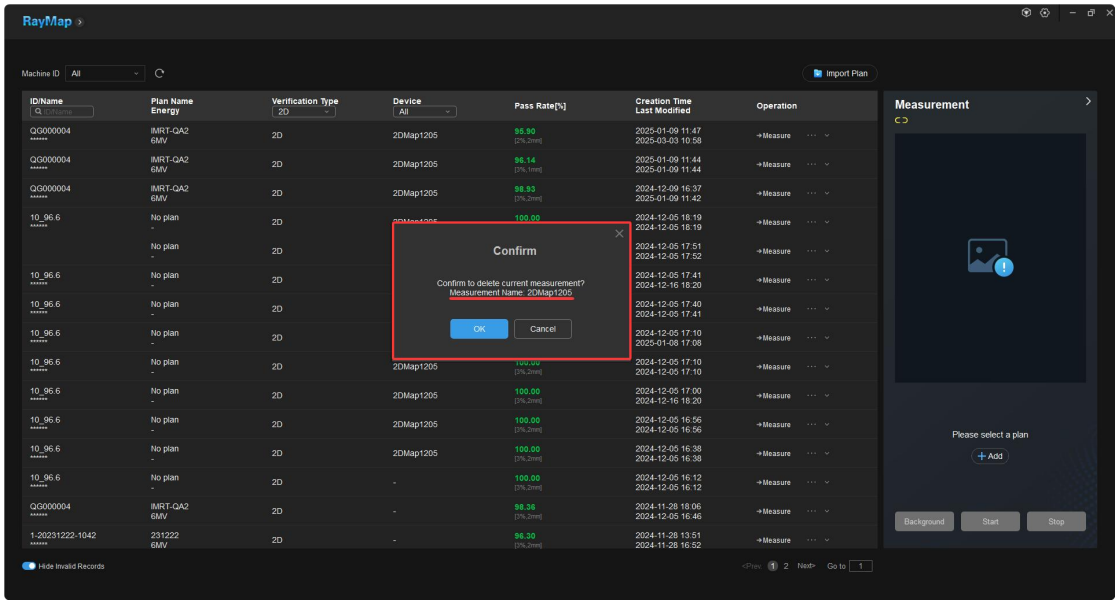


Figure 12. Perform operations on records_Delete measurement data

- If the record is a patient plan and has not been matched with measurement data, the delete operation will directly remove the patient plan.

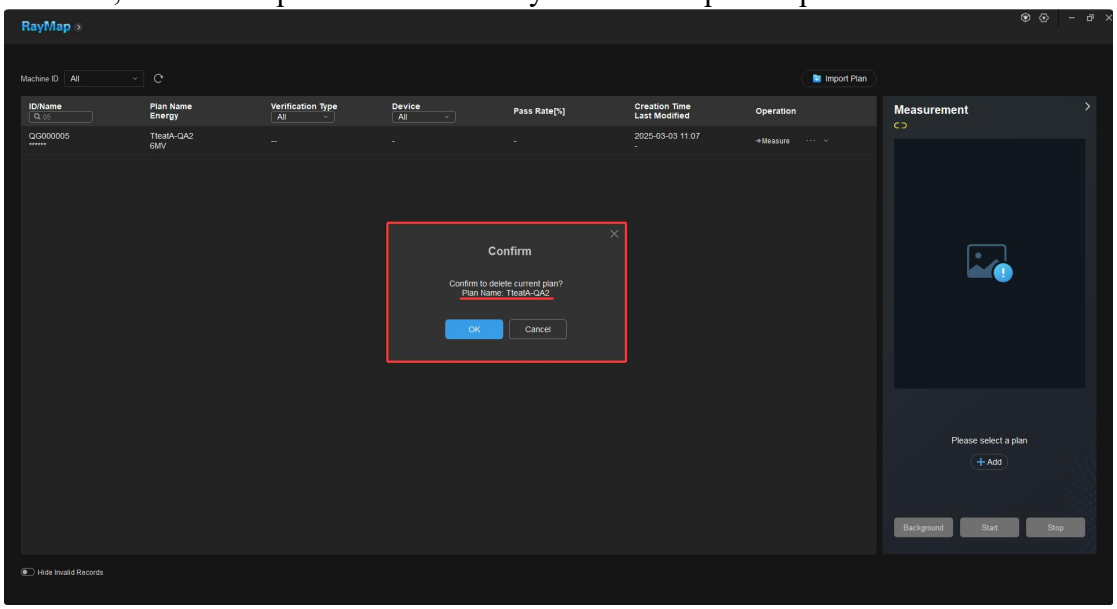


Figure 13. Perform operations on records_Delete patient plan

➢ DICOM Export

- This operation allows exporting the patient plan data and measurement data of the record to the local computer.
- After clicking the “DICOM Export” button in the menu bar, a pop-up window will appear, as shown below. Users can save the data to a local folder. The saved files may include: plan file – PlanData, measurement file – Measurement (if available), and analysis results – CalData (if available).

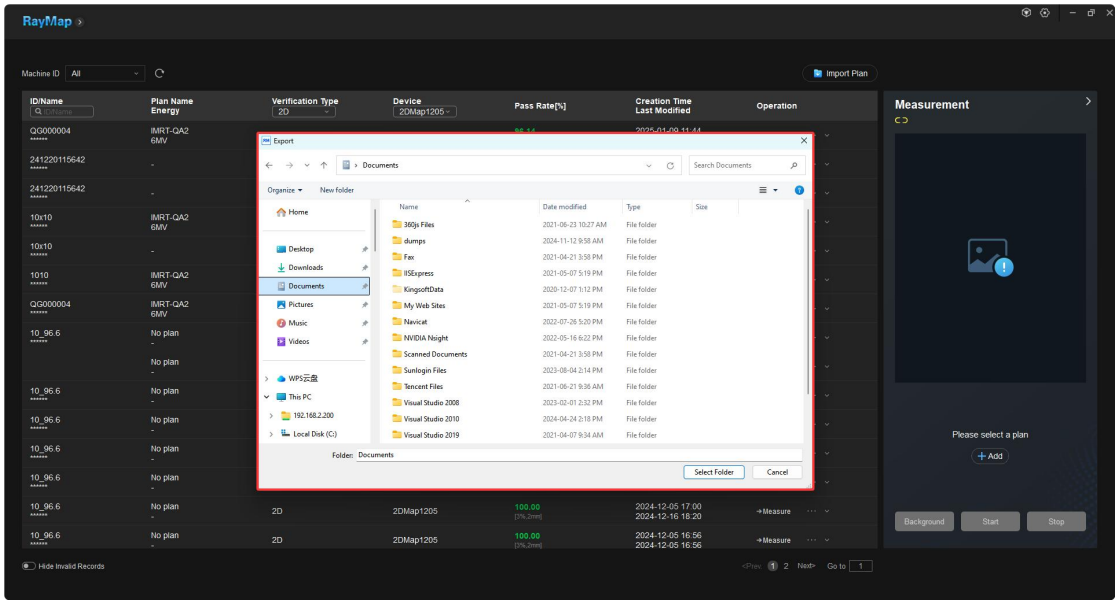


Figure 14. Perform operations on records_Data export

➢ Measurement matches plan

- This operation allows the measurement data to be matched with a patient plan.
- After clicking the “Measurement matches plan” button, a pop-up window will appear, as shown below.
- In the pop-up window, users can select an imported plan and click Match to match the measurement data with the selected plan. After matching, the main interface will generate a new record.
- If the plan that matches the measurement data is not displayed on the page, users can enter the full patient ID in the input box to search.
- If the record is a plan rather than measurement data, the “Measurement matches plan” option will not appear in the menu bar.

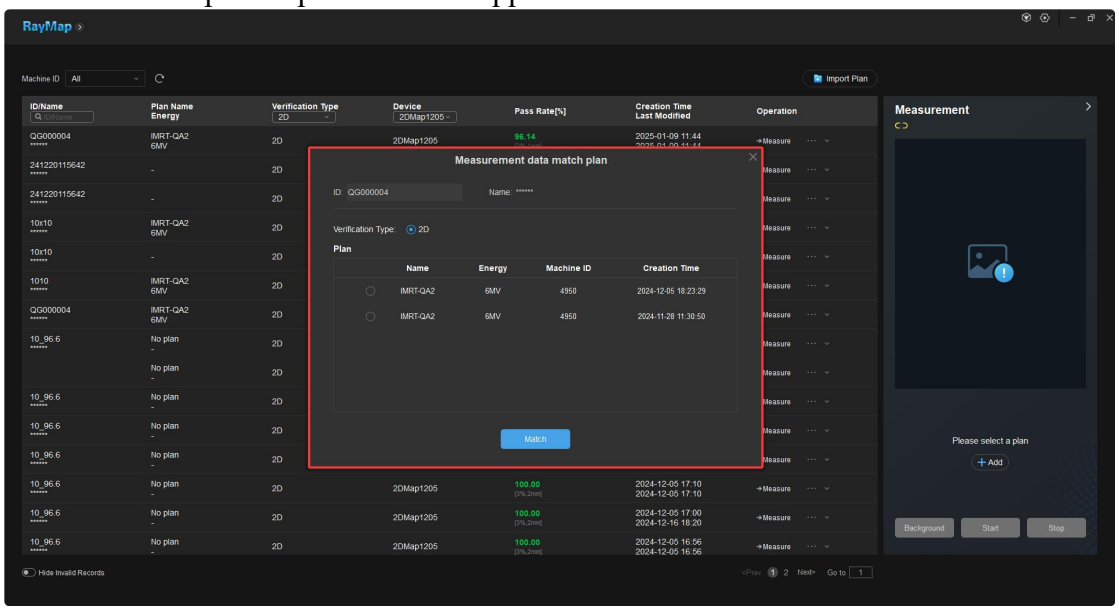


Figure 15. Perform operations on records_Match measurement data with plan

➢ Export Report

- This operation allows exporting a report in PDF format.
- After clicking the “Export Report” button, a pop-up window will appear, as shown below. Users can choose a folder to save the PDF report.
- If the current plan is not matched with measurement data, or if the matched plan has not undergone calculation analysis, the “Export Report” option will not appear in the menu bar.

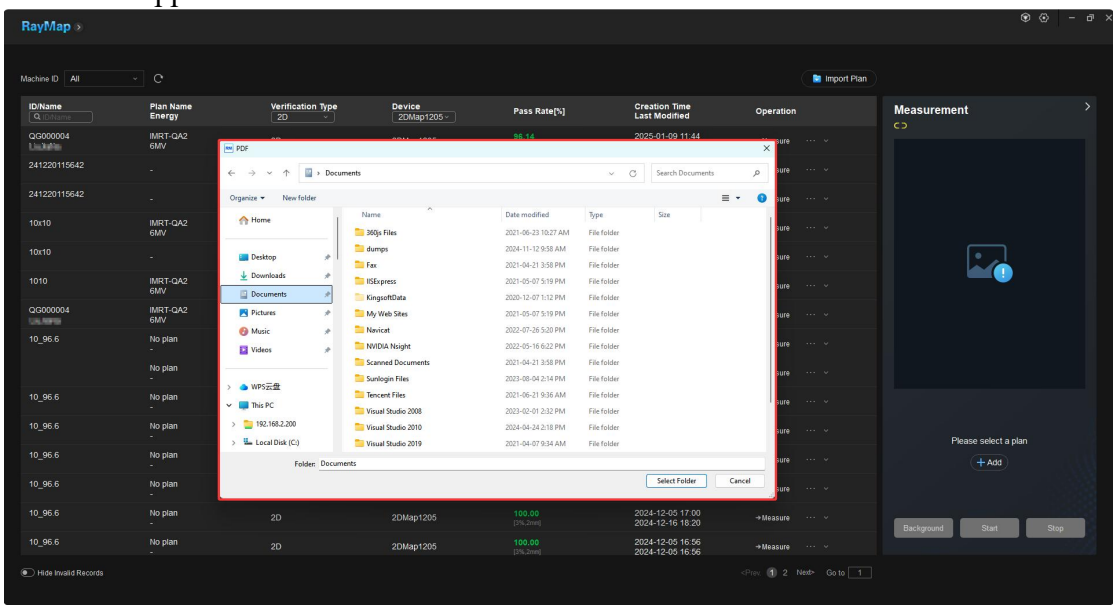


Figure 16. Perform operations on records_Export report

(3) Expand Record Image Information

Click any record or the button on the right side to display detailed information.

- When using the 2DMap for measurement, the interface will display the following contents from left to right: measurement image, profile image, and gamma analysis image, as shown below.

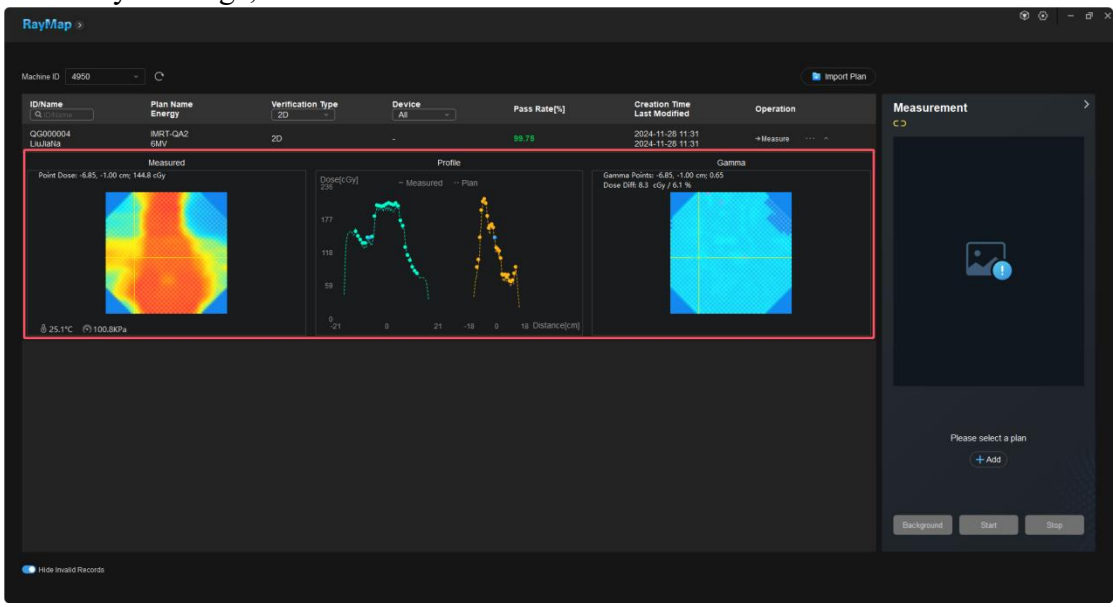


Figure 17. Expand record image information_2DMap

(4) View the Pass Rate of a Record

- When the mouse hovers over the “Pass Rate [%]” column of a record, the pass rate of the current plan will be displayed.
- Click on this column will display a pop-up window showing the total pass rate.
- Below the pass rate display, users can add remarks.

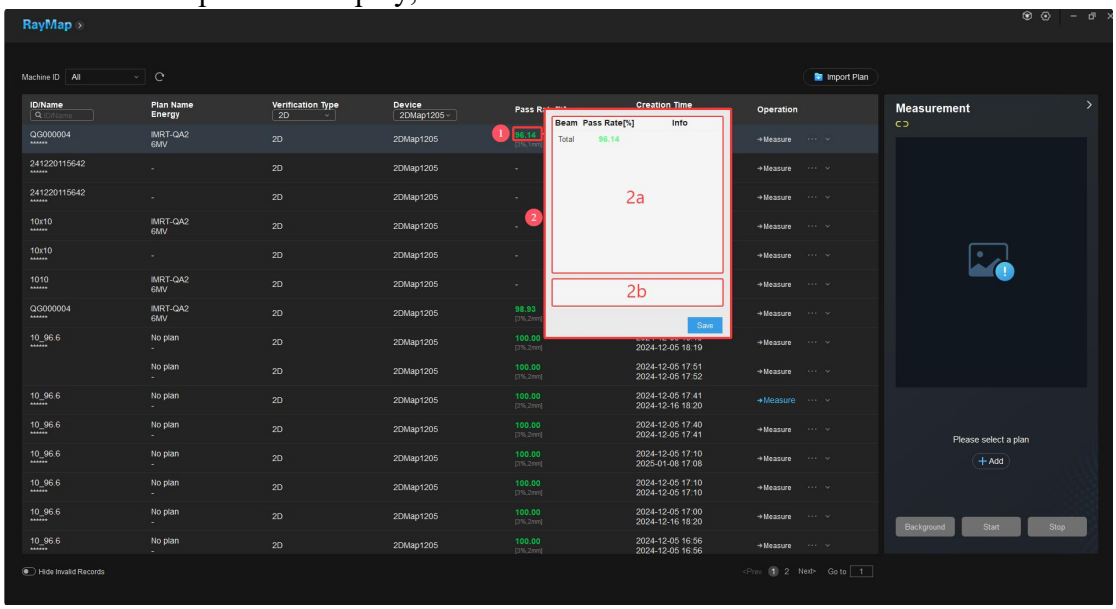


Figure 18. View the pass rate of a record

① Click the pass rate of a record to display pop-up window ②.

2a: This area shows the pass rate of each radiation field.

2b: In this area, users can add remarks and click Save to save.

(5) Perform Measurement Operation on a Record

This operation allows performing measurements on an imported plan.

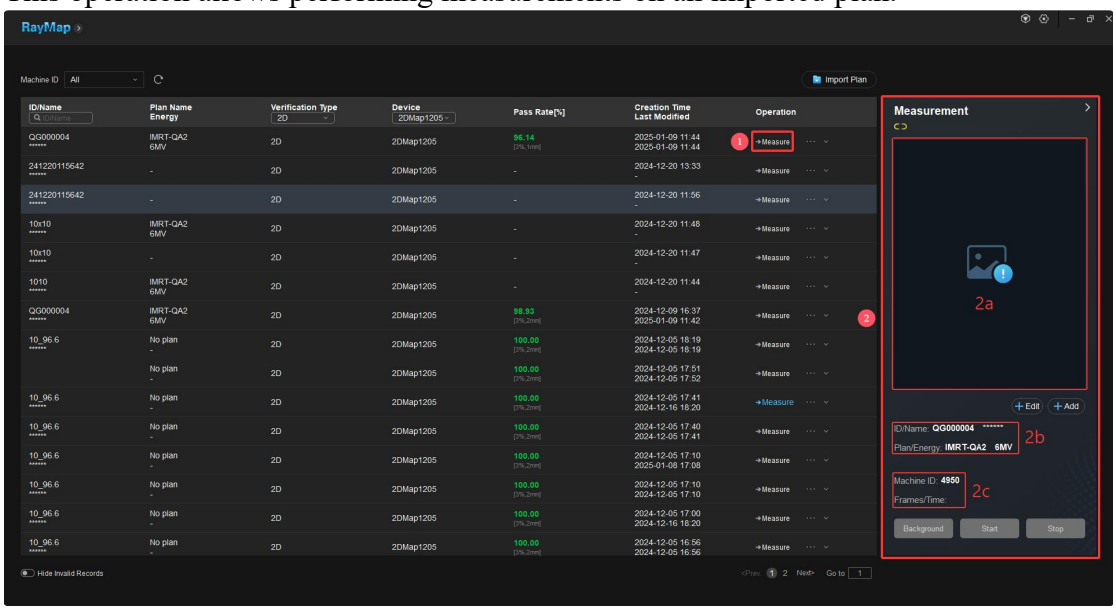


Figure 19. Perform measurement operation on a record

① Measurement button: Transfers the plan information of the selected record to the measurement area.

② Measurement area: Displays measurement-related information.
2a: Measurement image display area. Once measurement begins, relevant images will appear in this area.
2b: Measurement information display area.
2c: Displays the current frame count and measurement duration.

Details of section ②:

- View the device connection status. When the status icon appears as , it indicates RayMap is successfully connected to the device; when the icon appears as , it indicates the connection to the device has been lost.
- Edit measurement information. After clicking Edit, an edit window will pop up, as shown below. Users can only edit the energy type in this window.

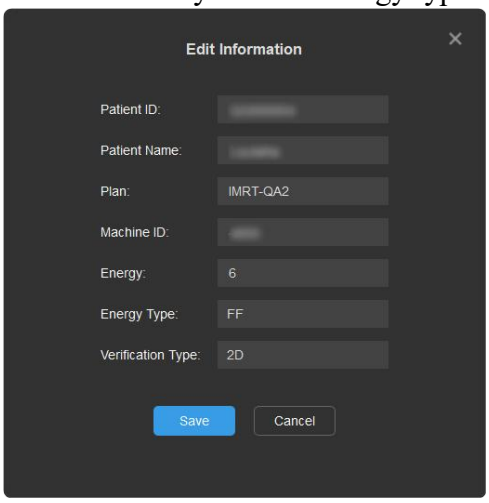


Figure 20. Perform measurement operation on a record_Edit measurement information

- Add new measurement. After clicking Add, a new window will pop up, as shown below. Users can edit all information in this pop-up window.

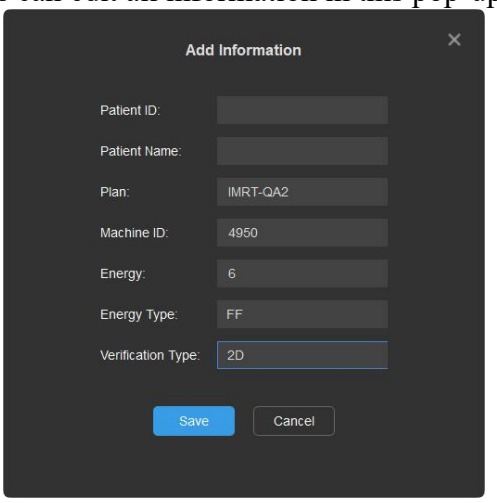


Figure 21. Perform measurement operation on a record_Add new measurement

(6) Enter the Analysis Interface

- Click RayMap on the main interface to enter the initial analysis interface.

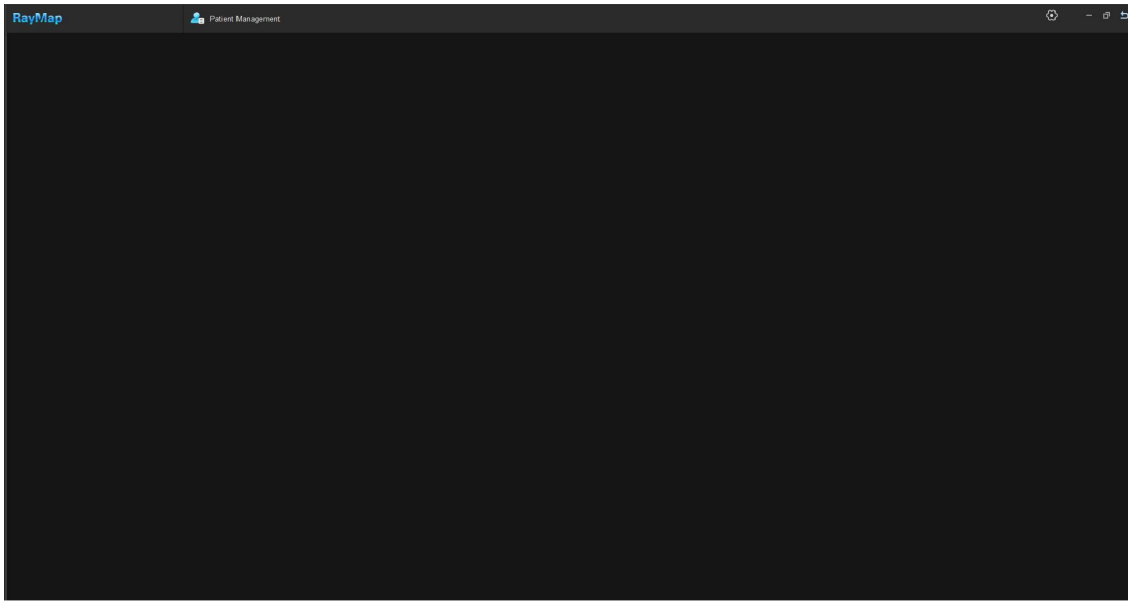


Figure 22. Enter the analysis interface_Initial analysis interface

- Users can enter the detailed analysis interface by double-clicking a record.

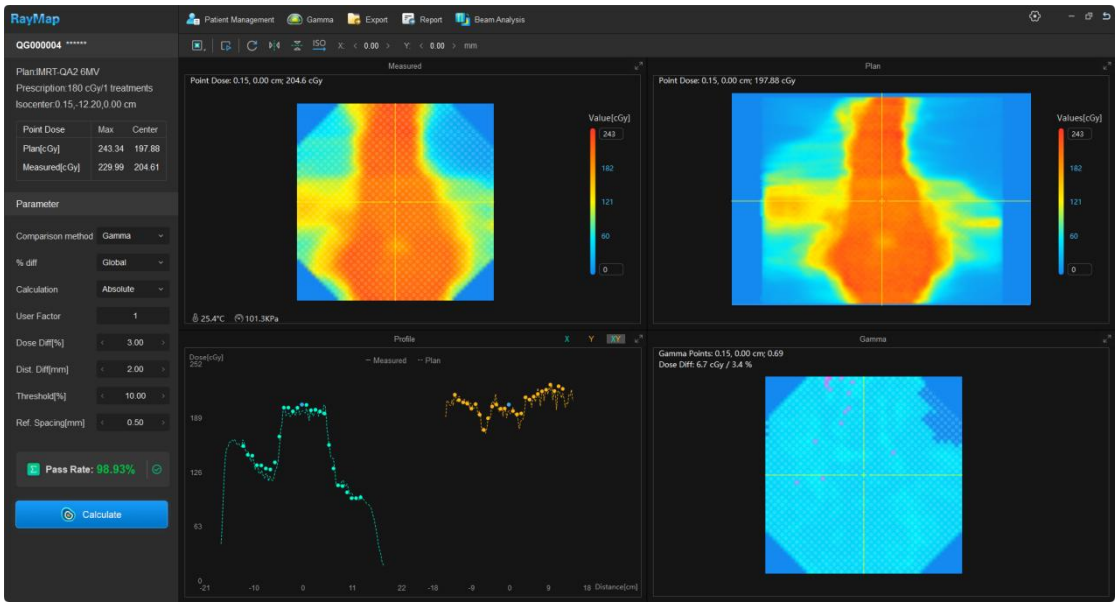


Figure 23. Enter the analysis interface_Detailed analysis interface

5.2.3. Device

Click  in the upper right corner of the main interface to enter the device interface.

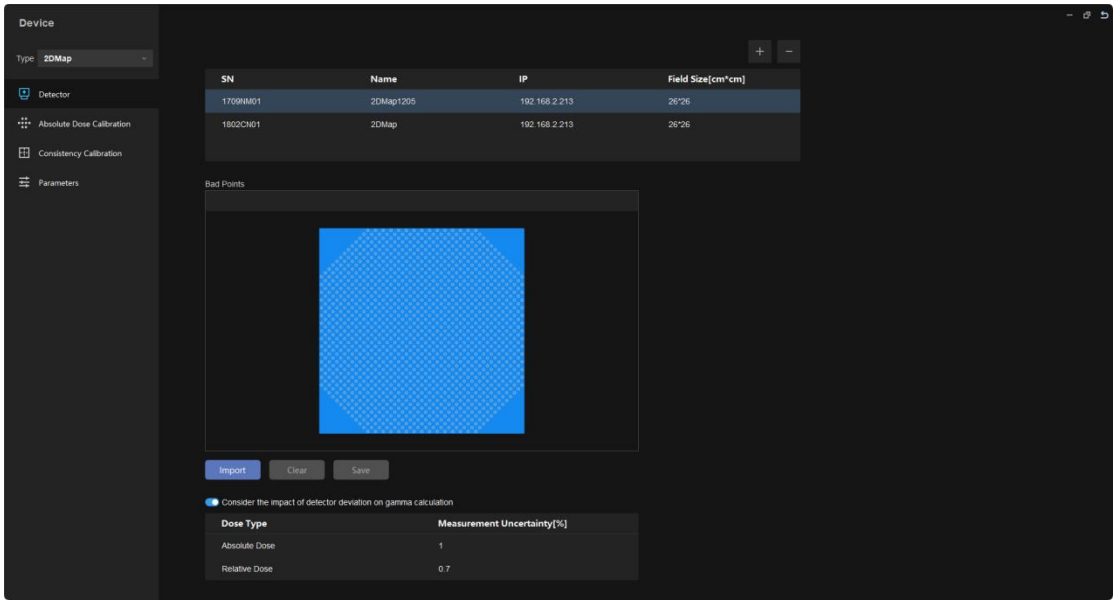


Figure 24. Device_Interface

(1) Detector

Click “Detector” on the left side of the interface to enter the detector interface.

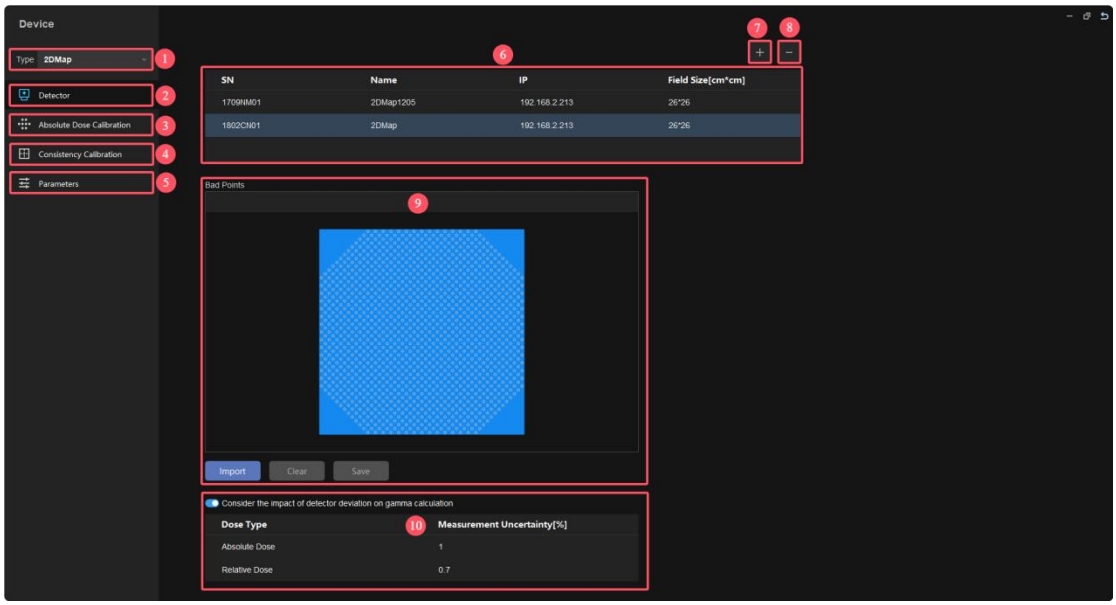


Figure 25. Device_Detector

① Device type: Select 2DMap from the dropdown menu.
② Detector: Detector interface.
③ Absolute dose calibration: Interface for absolute dose calibration.
④ Consistency calibration: Interface for consistency calibration.
⑤ Parameter: Parameter interface.
⑥ Detector device list. Descriptions of each item are as follows:

Item	Description
SN	Device serial number
Name	Device name
IP	Device IP address
Beam Size	Field size

⑦ Add device: Click this button to open a pop-up window where users can add a new 2DMap device.

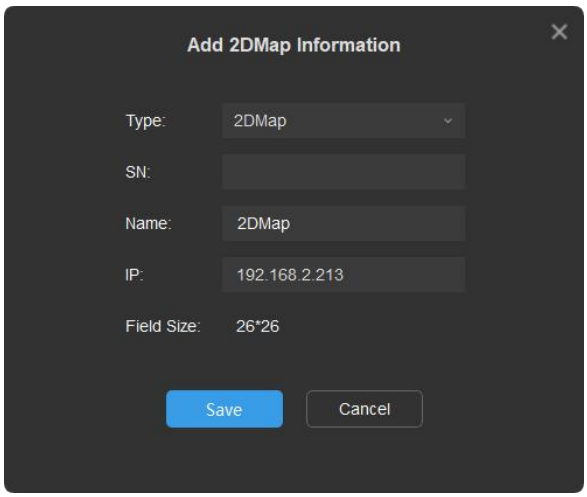


Figure 26. Device_Detector_Add 2DMap device

Descriptions of each item are as follows:

Item	Description
Type	Product type: 2DMap
SN	Device serial number
Name	Device name
IP	Device IP address
Beam Size	Field size

⑧ Delete device: Click this button to delete the selected device. To prevent accidental deletion, the password of the currently logged-in account must be entered to confirm the operation.

⑨ Mark bad points: Each circle in the image represents an ionization chamber. Click a circle to mark that chamber as a bad point.

- Before marking bad points, a measurement image must be imported to clearly identify bad points. Click Import to open the "Select Measurement" window, as shown below, and select the measurement image.
- Users can click Clear to clear marked bad points and click Save to save the markings.

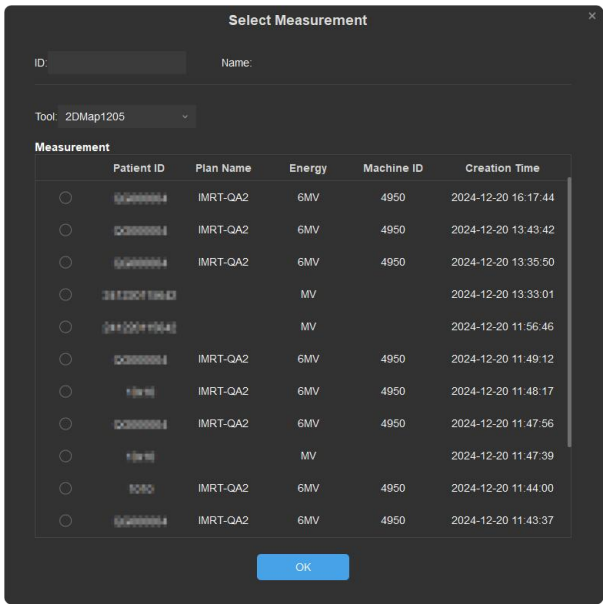


Figure 27. Device_Detector_Select measurement

⑩ Consider the impact of detector deviation on gamma calculation. When this option is enabled:

- If the gamma calculation type is “Absolute Dose”, an additional 1% deviation will be added to the actual dose deviation.
- If the gamma calculation type is “Relative Dose”, an additional 0.7% deviation will be added to the actual dose deviation.

(2) Absolute Dose Calibration

Click “Absolute Dose Calibration” to enter the absolute dose calibration interface.

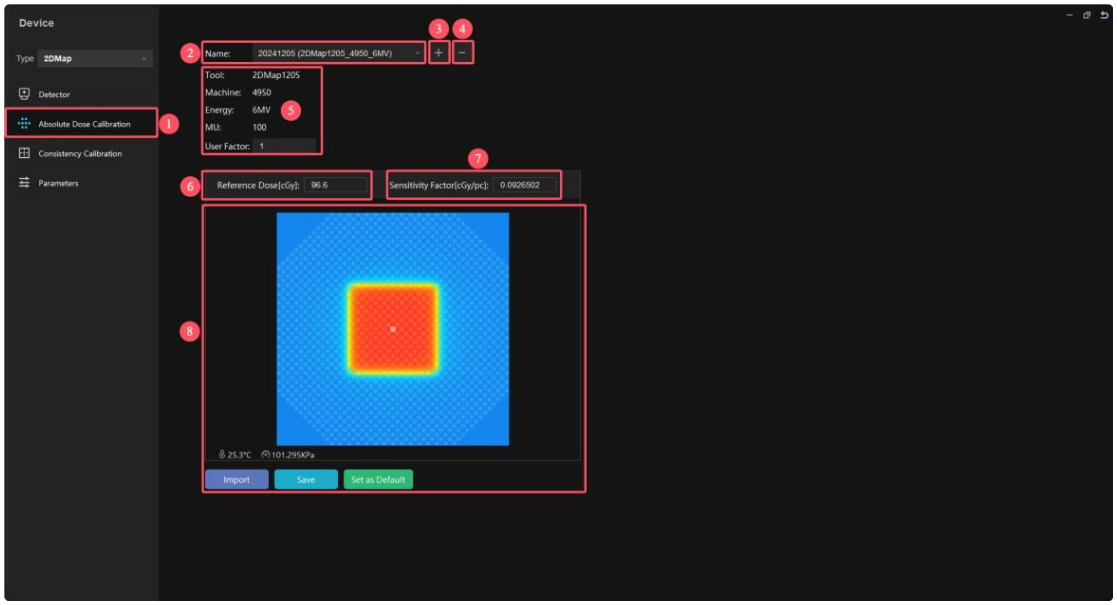


Figure 28. Device_Absolute dose calibration

① Absolute dose calibration.

② Name of the current absolute dose calibration.

③ Add button: Clicking this button will open the “Add absolute dose calibration” window, allowing users to add a new absolute dose calibration.

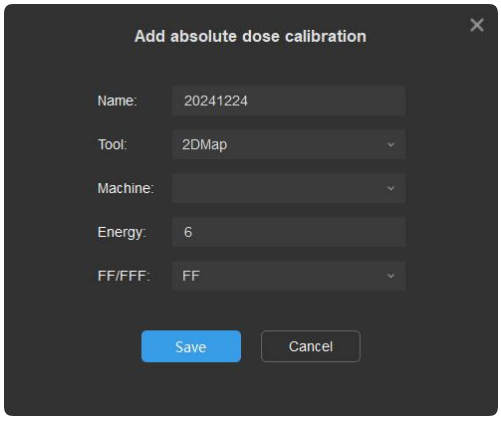


Figure 29. Device_Absolute dose calibration_Add absolute dose calibration

Descriptions of each item are as follows:

Item	Description
Name	Name of the absolute dose calibration.
Tool	Device. Calibrate each device separately if multiple exist.
Machine	Accelerator. Calibrate each accelerator separately if multiple exist.
Energy	Energy.
FF/FFF	Option to select either FF or FFF.

④ Delete button: Click this button to delete the current absolute dose calibration. To prevent accidental deletion, the password of the currently logged-in account must be entered to confirm the operation.

⑤ Basic information of the current absolute dose calibration.

⑥ Reference dose: Please input the dose value from the TPS.

⑦ Sensitivity factor: After entering the reference dose, the software will automatically calculate the sensitivity factor.

⑧ Calibration image display area: Click Import to open the “Select Measurement” window and choose the corresponding measurement image. Click Save to save. Click Set as Default to set the absolute dose calibration as the default.

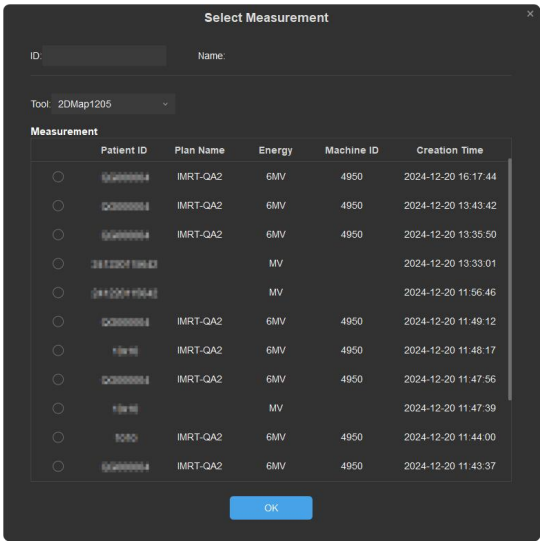


Figure 30. Device_Absolute dose calibration_Select measurement

(3) Consistency Calibration

Click “Consistency Calibration” to enter the consistency calibration interface.

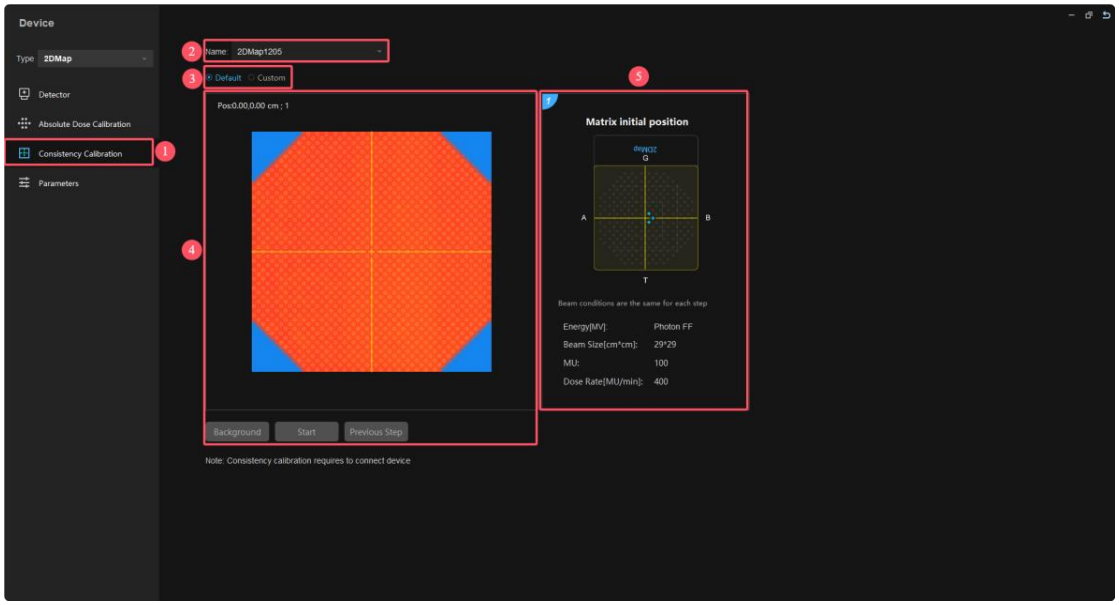


Figure 31. Device_Consistency calibration

① Consistency calibration.

② If multiple 2DMap devices are available, different devices can be selected from the dropdown menu.

③ Two consistency calibration modes are available: “Default” and “Custom”.

- “Default” uses the factory calibration parameters.
- “Custom” allows users to perform a new consistency calibration.

④ Image display and operation area:

- Before performing consistency calibration, click Background to measure the background.
- Once the background measurement is complete, click Start to initiate consistency calibration. The calibration process includes five steps, each requiring two beam deliveries from the accelerator.
- Clicking Previous Step will return to the previous step and allow you to repeat the consistency calibration for that step.

⑤ Consistency calibration step indicator diagram. The upper left corner shows the step number; in this example, it is Step 1.

(4) Parameters

Click “Parameters” to enter the parameters interface.

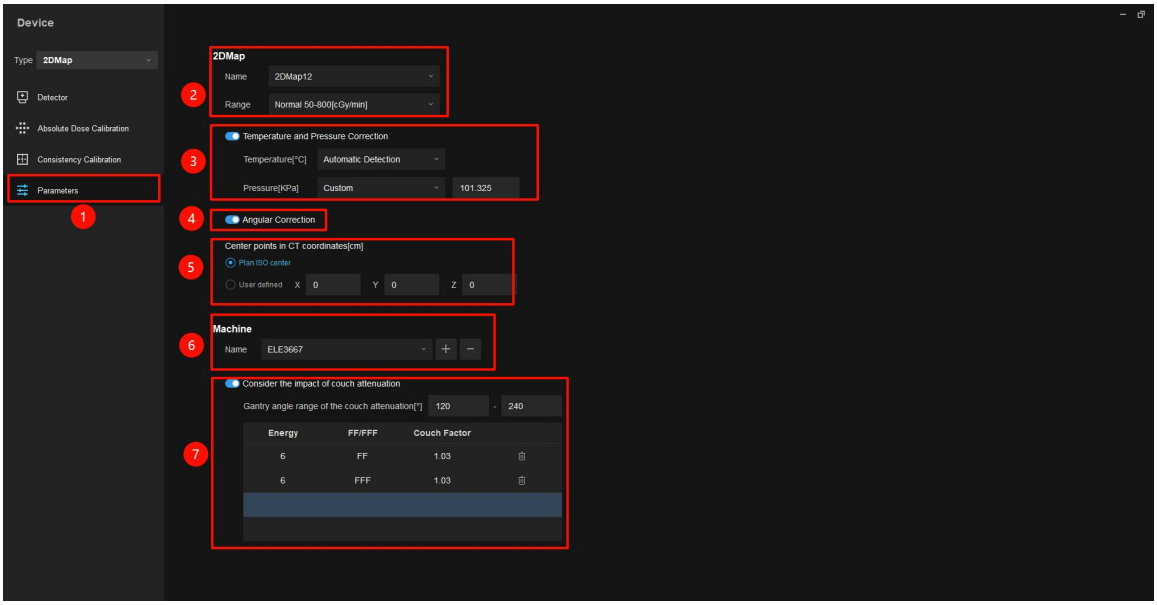


Figure 32. Device_Parameters

① Parameters.

② 2DMap Basic Information.

- In the “Name” field, the user can select the corresponding 2DMap device.
- In the “Range” field, the user can select the measurement range. Two modes are available: “Normal” and “High”.

③ Temperature and pressure correction switch: The 2DMap includes built-in temperature and pressure sensors.

- When “Automatic detection” is selected, 2DMap automatically measures temperature and pressure and applies corrections during measurement.
- When “Custom” is selected, users can manually input temperature and pressure values for correction.

④ Angle correction switch. This function is only applicable to IMRT plans with field dose data imported from the TPS.

- When enabled, the software will consider the effects of each irradiation angle during measurement and apply correction factors to adjust the dose data.
- When disabled, no angle correction will be applied during measurement.

⑤ Center points in CT coordinates: Users can choose between “Plan ISO center” and “User defined”.

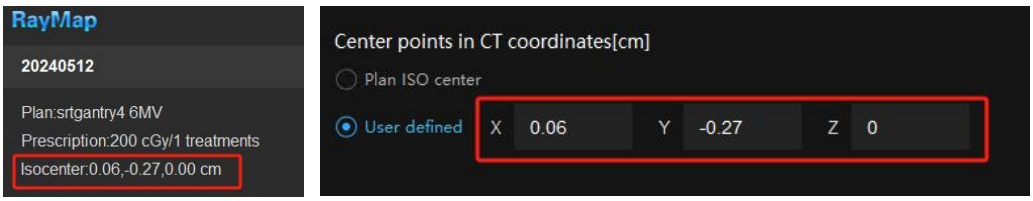
- Selecting “Plan ISO center” aligns the phantom’s isocenter with the plan’s isocenter.
- Selecting “User defined” allows manual input of the isocenter.

Note: RayMap uses the DICOM coordinate system. If the TPS uses the IEC coordinate system, convert the coordinates as follows before entering:

DICOM_X = IEC_X, **DICOM_Y** = −IEC_Z, **DICOM_Z** = IEC_Y

- It is recommended to use the “User defined” setting and create a QA plan with the isocenter at the phantom's CT center. Import the plan into RayMap, open it,

and refer to the isocenter value in the top-left corner. Enter this value under “User defined” to allow measurement of plans where the isocenter is not at the phantom center, as shown below.



⑥ Machine name settings. Users can select different accelerators in the "Name" field, click + to add a new accelerator, or click − to delete the current accelerator.

⑦ Consideration the impact of couch attenuation.

- Users can customize the gantry angle range for couch attenuation, with the default range set to 120°–240°.
- Users can also add different energy types and configure the couch factors.

5.2.4. Settings

Click in the upper right corner of the main interface to enter the Settings interface.

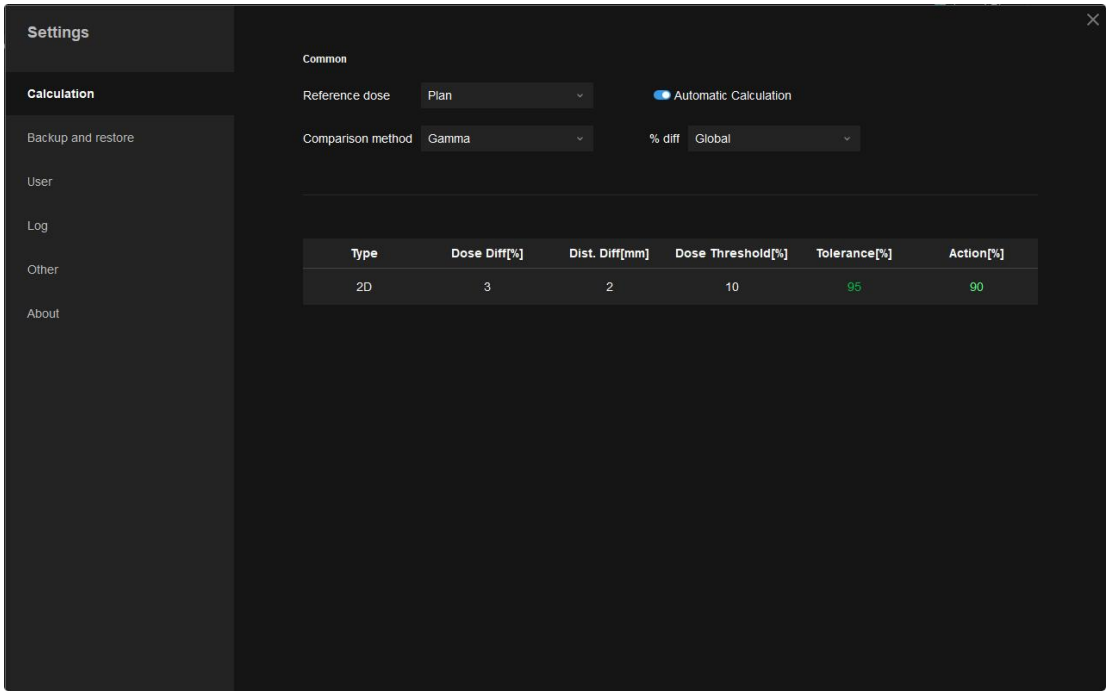


Figure 33. Settings

(1) Calculation

Click “Calculation” to enter the Calculation interface.

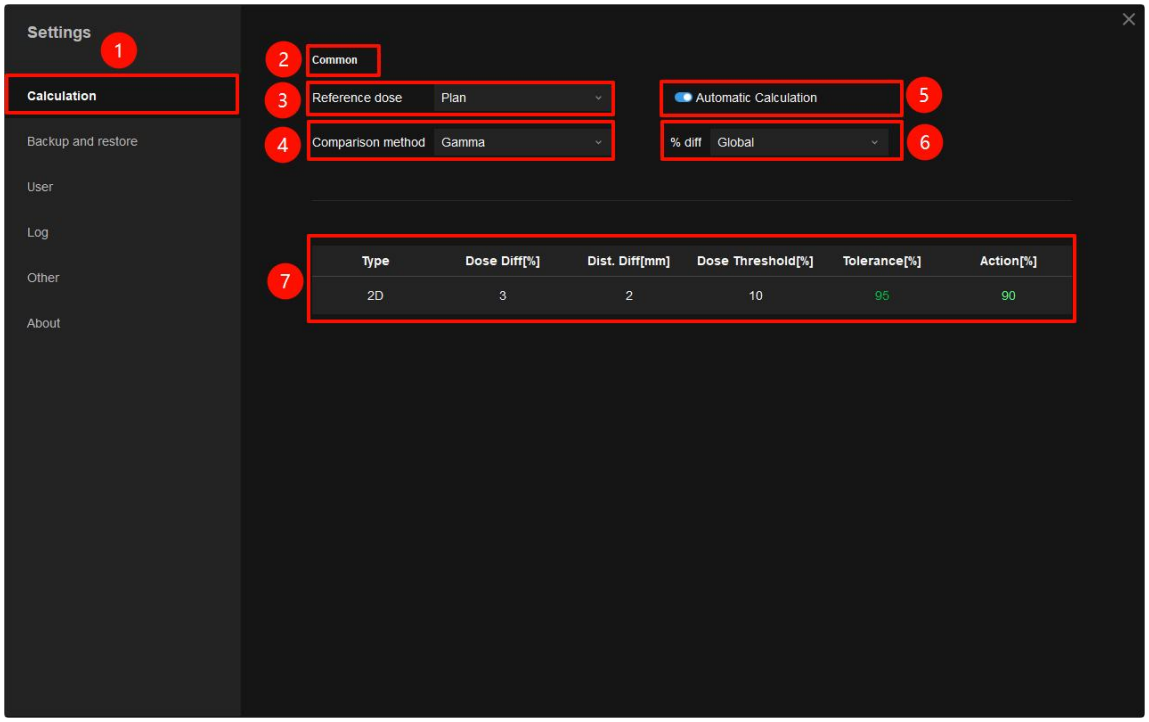


Figure 34. Settings_Calculation

① This interface is used to configure default settings for RayMap’s automatic calculations.

② General Settings.

③ Only “Plan” can be selected as the reference dose for calculations.

④ Comparison Method: Options include “gamma” or “DTA”.

⑤ Automatic Calculation:

- When checked: RayMap will automatically calculate the record in the main interface after the measurement is completed.
- When unchecked: User needs to manually click the calculate button to calculate the measurement results.

⑥ Dose Difference: Choose between “Global” or “Local”.

⑦ Values in the table can be edited by double-clicking. RayMap will use these values as the criteria for evaluation. Descriptions of each item are as follows:

Item	Description
Type	Verification type.
Dose Diff[%]	Double-click to set dose difference for gamma calculation.
Dis Diff[mm]	Double-click to set distance difference for gamma calculation.
Dose threshold[%]	Double-click to set the dose threshold. Gamma analysis is performed only on dose values exceeding the threshold.
Tolerance[%]	Double-click to set gamma tolerance for automatic calculation.
Action[%]	Double-click to set the action level; must be less than or equal to Tolerance [%].

(2) Backup and restore

Click “Backup and restore” to enter the Backup and restore interface.

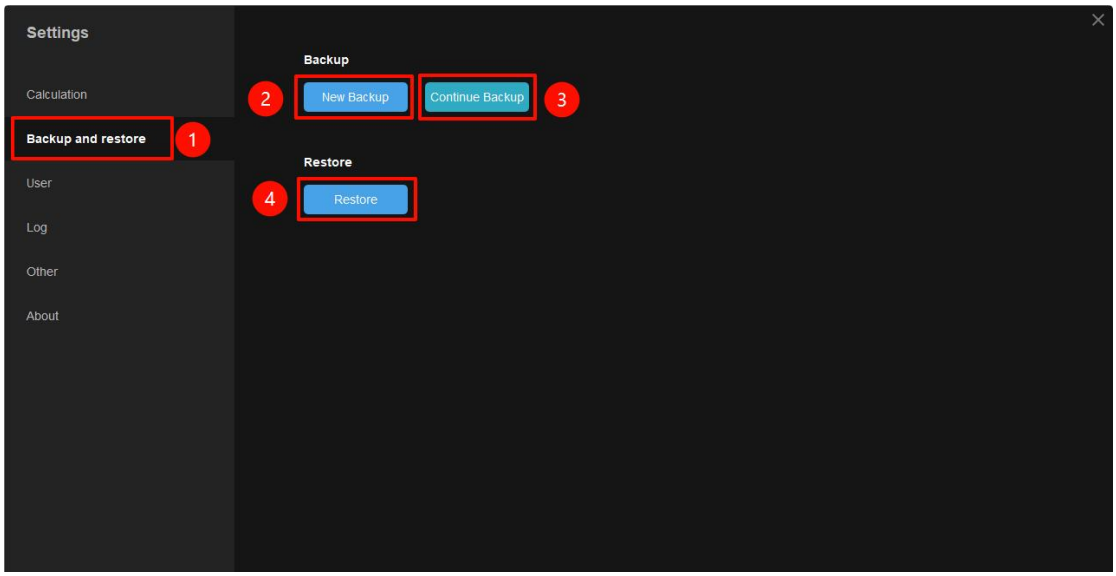


Figure 35. Settings_Backup and restore

① Backup and restore interface.

② New backup: Back up the current data to a specified location.

③ Continue backup: If the backup process is interrupted, click this button to continue the unfinished backup task.

④ Restore: Click this button and select the previously backed-up data to restore it in RayMap.

(3) User

Click “User” to enter the User interface.

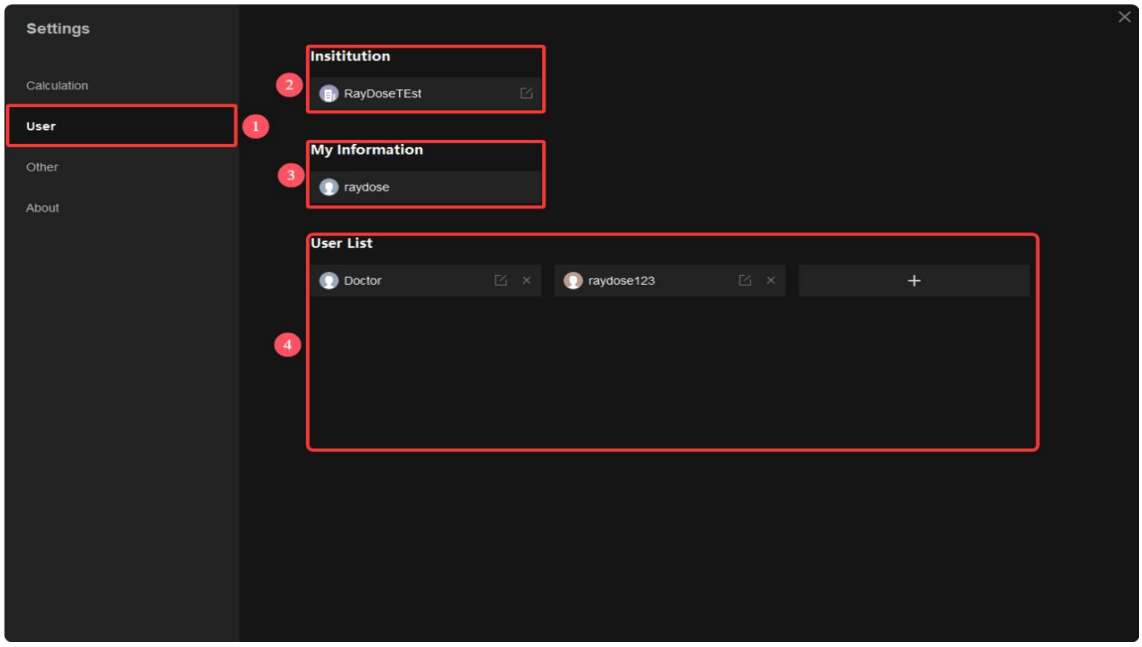


Figure 36. Settings_User

① User interface: Provides functions for adding, deleting, and editing users.

② Institution information: Displays the current user's institution information. Click to modify the institution name. Password authentication is required before making changes.

③ Displays the user information of the currently logged-in account.

④ User list: Shows information for all users.

- Only the super administrator can view all user information, regular accounts can only view their own.
- The super administrator can edit or delete users. Click to modify, or click to remove a user. Password authentication is required before making changes.
- Click + to create a new user.

(4) Log

Click "Log" to enter the Log interface.

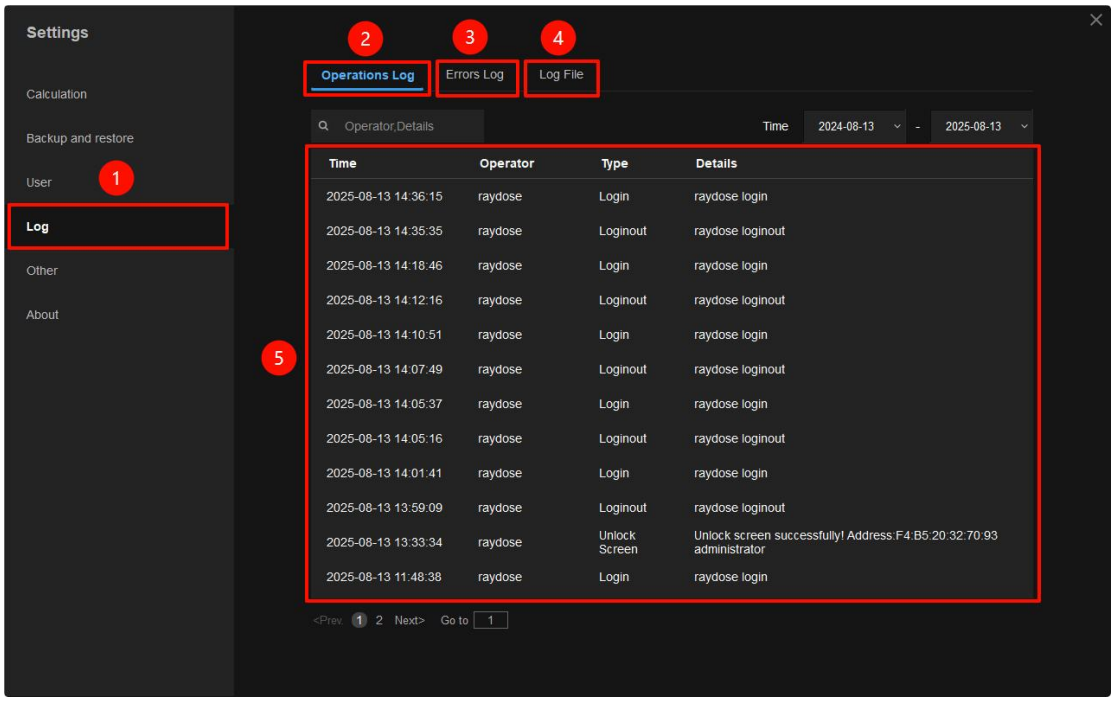


Figure 37. Settings_Log

① Log Interface: Displays system-related logs.

② Operation Log: Click to view the system's operation records.

③ Error Log: Click to view the system's error records.

④ Log File: Click Export on this page to export all logs.

⑤ Log display area: Shows the content of the currently selected log.

(5) Other

Click “Other” to enter the Other interface.

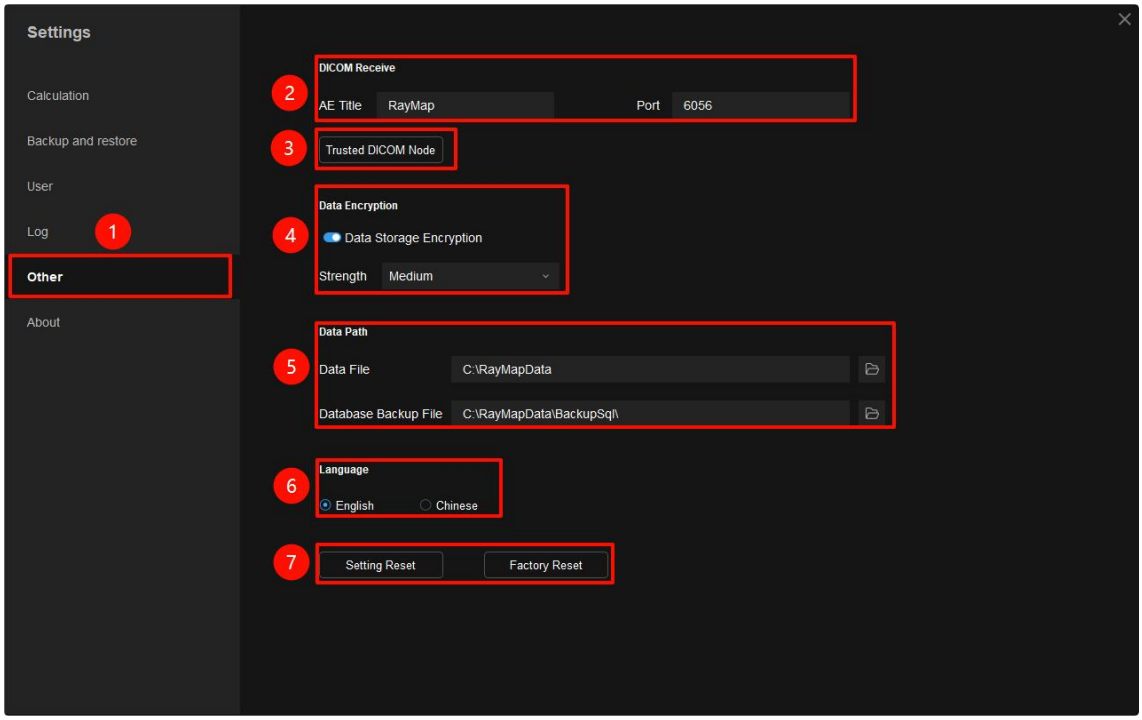


Figure 38. Settings_Others

① Others interface: Contains additional settings.

② DICOM receive: Allows users to transfer plan from the TPS to RayMap via a specific AE Title and port. Note: Ensure that RayMap and TPS are on the same network when using this function.

③ Data encryption: Offers three encryption levels—Low, Medium, and High—to prevent unauthorized data access.

④ Measurement data save path: When enabled, measurement records will be automatically saved to the specified path.

⑤ Log file: Click the “Export” button to export all log files.

⑥ Language selection: Supports both Chinese and English.

⑦ Reset options:

- Setting Reset: Restores default settings.
- Factory Reset: Completely resets the system, clearing all data including the database. This operation is irreversible and requires account password authentication. Please operate with caution.

(6) About

Click “About” to enter the About interface.

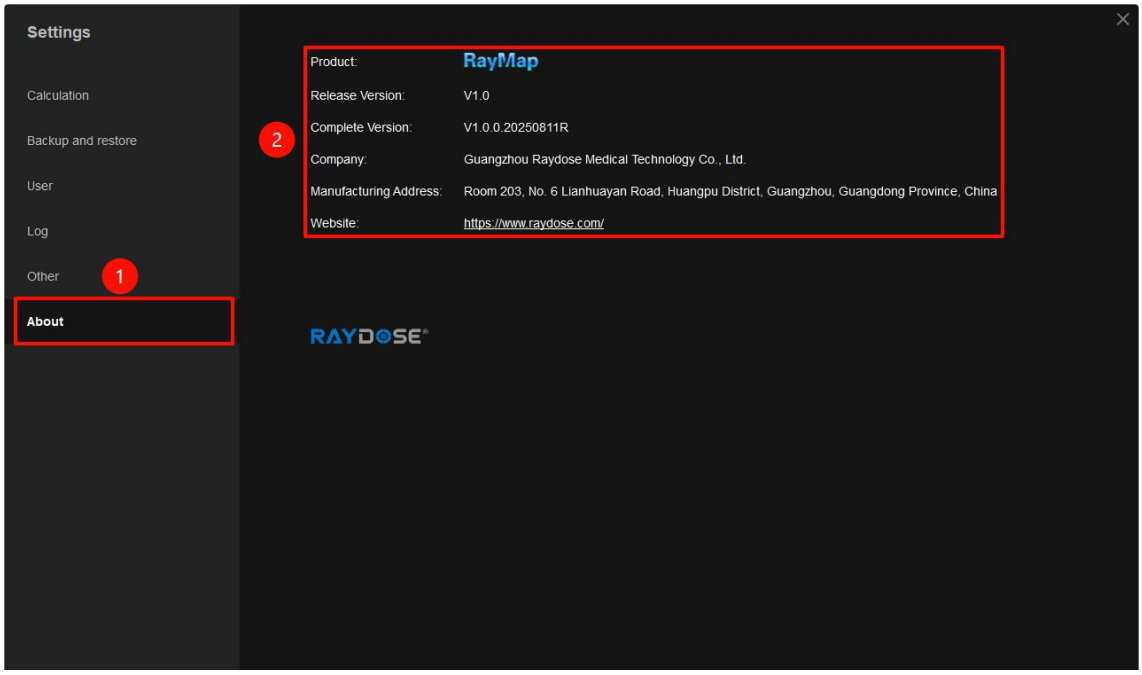


Figure 39. Settings_About

① About: This interface provides information about the product.

② Displays the product name, release version, and complete version. Manufacturer information includes manufacturer name, address, and website.

5.3. 2DMap Module

5.3.1. Interface Overview

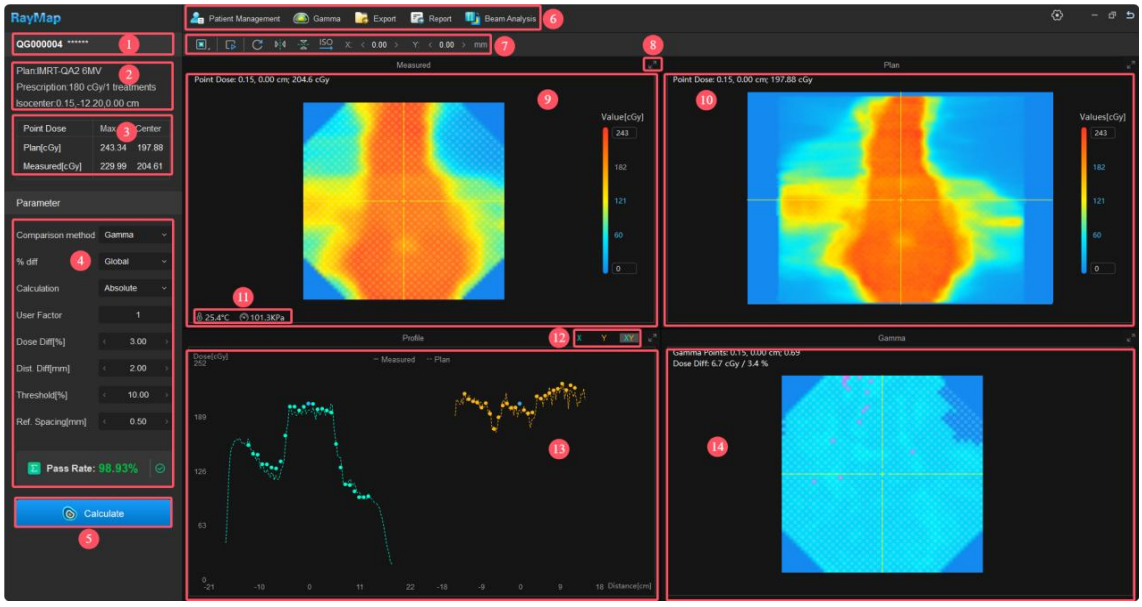


Figure 40. 2DMap module_Interface overview

① Displays the patient ID and patient name.

② Displays plan information.
③ Displays the maximum and center point dose values from both the patient plan and the measurement.
④ Gamma calculation parameter settings area. Details are provided in Section 5.3.2.
⑤ Click 

to perform gamma analysis.
⑥ Function area. Details are provided in Section 5.3.3.
⑦ Image operation area. Details are provided in Section 5.3.4.
⑧ Image zoom: click this button to expand the image to fullscreen.
⑨ Measured image.
⑩ Plan image.
⑪ Temperature and pressure information.
⑫ Profile display toggle: You can choose to display only the “X” profile, only the “Y” profile, or both “XY” profiles simultaneously.
⑬ Profile image.
⑭ Gamma image.

5.3.2. Gamma Calculation Parameter Settings Area

This section introduces the gamma calculation parameter settings area referenced in item ④ of Section 5.3.1.

Item	Description
Comparison method	Two comparison methods are available: Gamma and DTA.
% diff	Two percent difference types are available: Global and Local.
Calculation	Three calculation types are available: Absolute (absolute dose), Relative to max (relative to maximum value), Relative to center (relative to center point value).
User Factor	Used to apply a user-defined correction factor. The default value is “1”, meaning no additional correction is applied.
Dose diff[%]	Sets the dose difference for gamma calculation.
Dist. Diff[mm]	Sets the distance difference for gamma calculation.
Threshold[%]	Comparison threshold. During gamma analysis, only dose values above this threshold will be compared.
Ref.Spacing[mm]	Sets the reference grid spacing.
	Click this area to calculate the gamma passing rate. Use the button on the right to confirm or cancel the calculation.

5.3.3. Function Area

This section introduces the function area referenced in item ⑥ of Section 5.3.1.

(1) Patient Management

Click to enter the patient management interface.

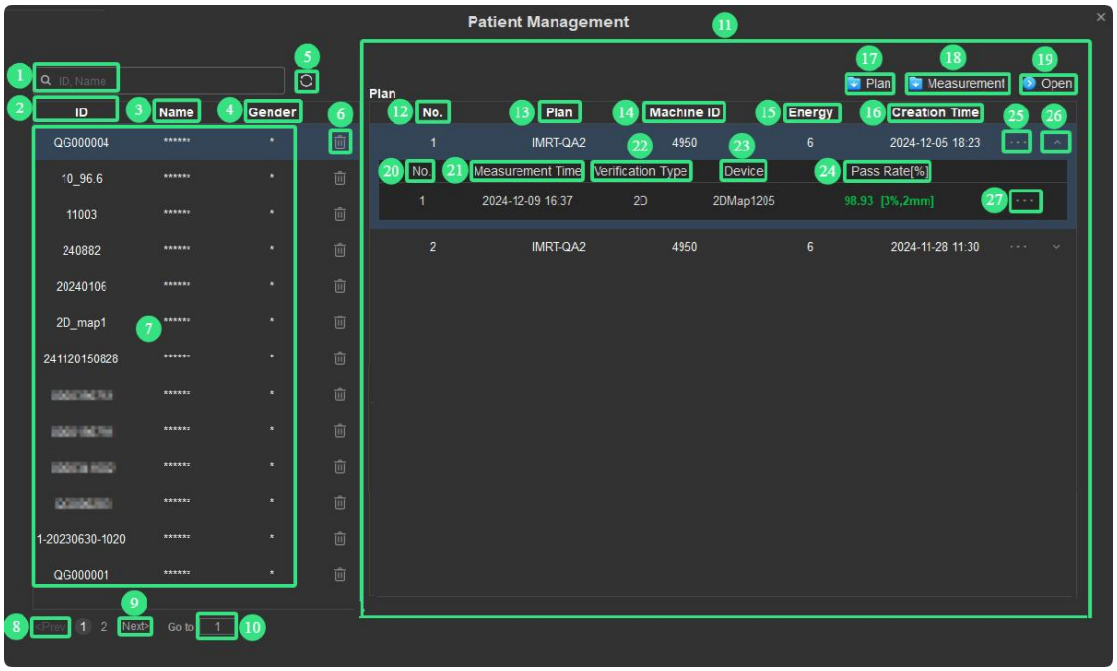


Figure 41. 2DMap Module_Patient management

① Patient search bar: Enter the patient ID or name to search for the corresponding record.

② Patient ID column.

③ Patient name column.

④ Patient gender column.

⑤ Refresh button: Click to refresh the patient records.

⑥ Delete button: Click to delete selected patient records.

⑦ Patient record display area.

⑧ Previous page button: Displays the previous page of patient records.

⑨ Next page button: Displays the next page of patient records.

⑩ Page number input: Jump to a specific page by entering a page number.

⑪ Plan and measurement record display area.

⑫ Plan number column.

⑬ Plan name column.

⑭ Machine ID column.

⑮ Plan energy column.

⑯ Plan creation time column.

⑰ Import patient plan button.

⑱ Import patient measurement button.

⑲ Open selected plan or measurement.

⑳ Measurement number column.

㉑ Measurement creation time column.

㉒ Verification type column.

㉓ Device name column.

㉔ Gamma passing rate column.

㉕ Plan operation button: Opens a pop-up window as shown below.

- Click “Open” to open the selected patient plan.

- Click “Delete” to delete the selected plan and its associated measurements.

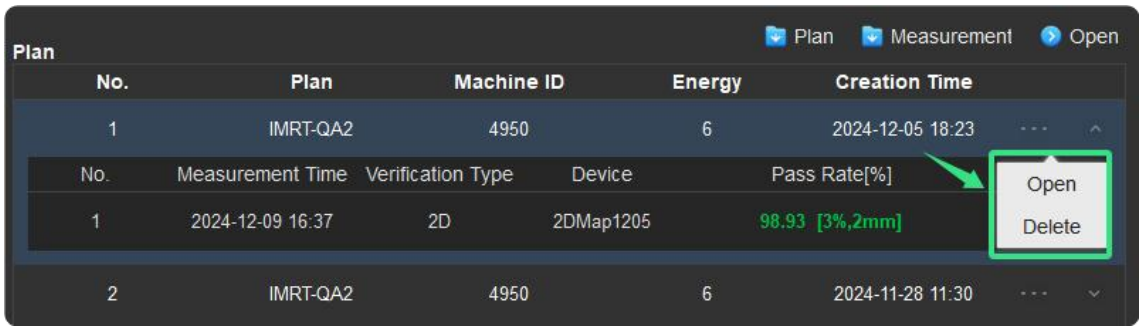


Figure 42. 2DMap Module_Patient management_Plan operations

㉖ Expand/Collapse button: Click to expand or collapse all measurements under a plan.

㉗ Measurement record operation button: Click to pop up the window shown below.

- Click “Open” to open the selected measurement and its corresponding plan.
- Click “Delete”to delete the selected measurement.
- Click “Match Measurement” and a window will pop up. For specific operations, please refer to *5.2.2. Specific Operations> (2)Perform Operations on Records > Measurement matches plan.*

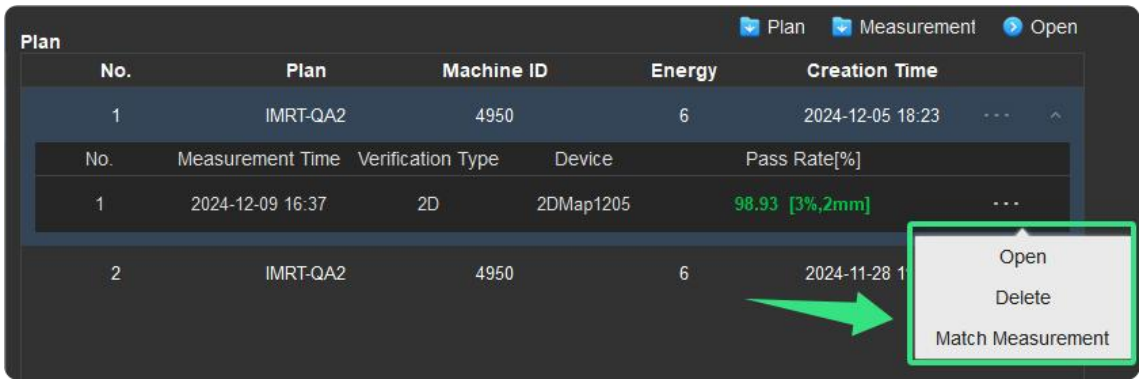


Figure 43. 2DMap Module_Patient management_Measurement operations

(2) Gamma

Click to open the Gamma Details window, as shown below.

- The top of the window displays the gamma passing rate, average gamma value, and standard deviation.
- The center of the window displays the gamma distribution. The top-left shows the crosshair’s coordinates and corresponding gamma value. Users can move the crosshair to view values at different positions.
- The bottom of the window displays the gamma histogram, with the Y-axis toggleable between absolute and relative.

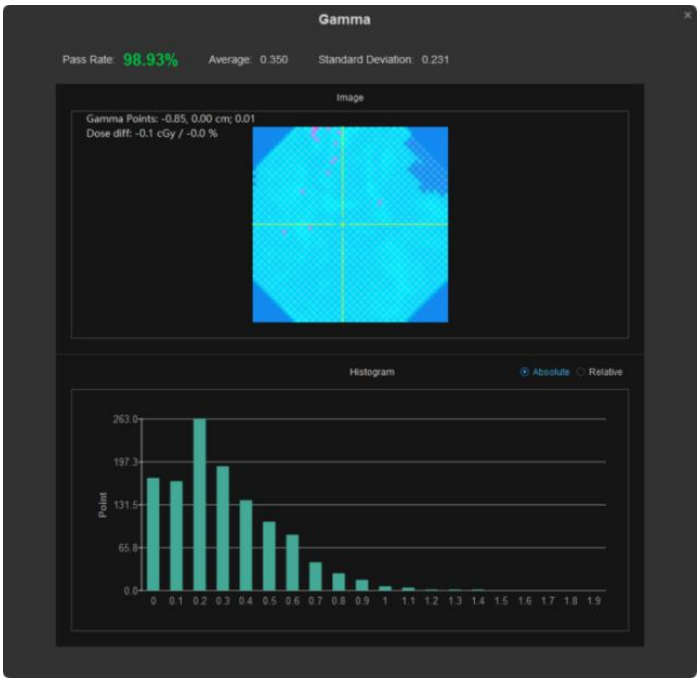


Figure 44. 2DMap Module_Gamma_Gamma details

(3) Export

Click to perform the export operation.

- If gamma analysis has been completed for the current record, the analysis data (CalData), measurement image (Measurement), and plan data (PlanData) will be exported.
- If gamma analysis has not been completed for the current record, only the measurement image (Measurement) and plan data (PlanData) will be exported.

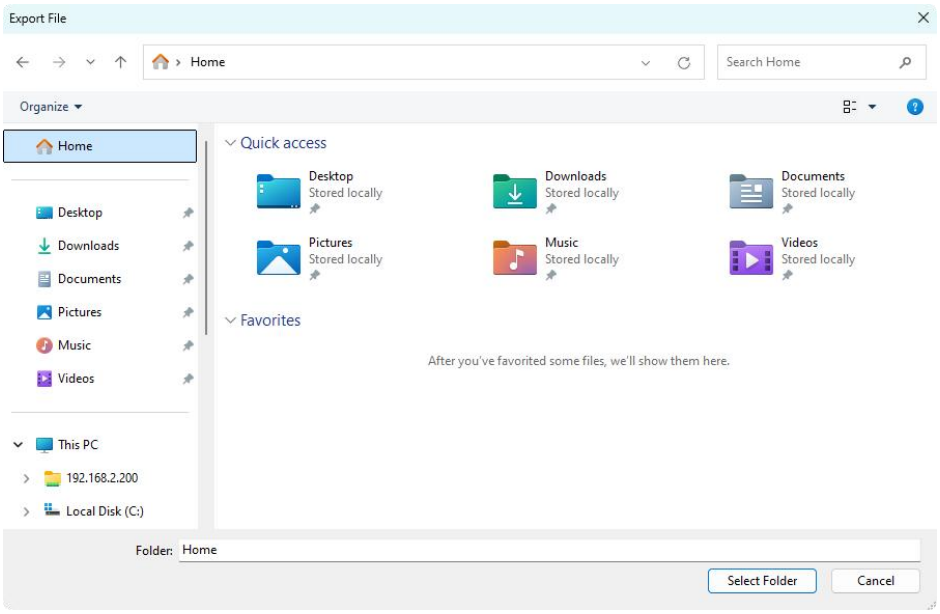


Figure 45. 2DMap Module_Export

(4) Report

Click to print a report. The report mode can be selected as either "Basic" (summary version) or "Details" (detailed version).

- Click Print to go directly to the printer interface.
- Click PDF to generate a PDF report and save it locally.

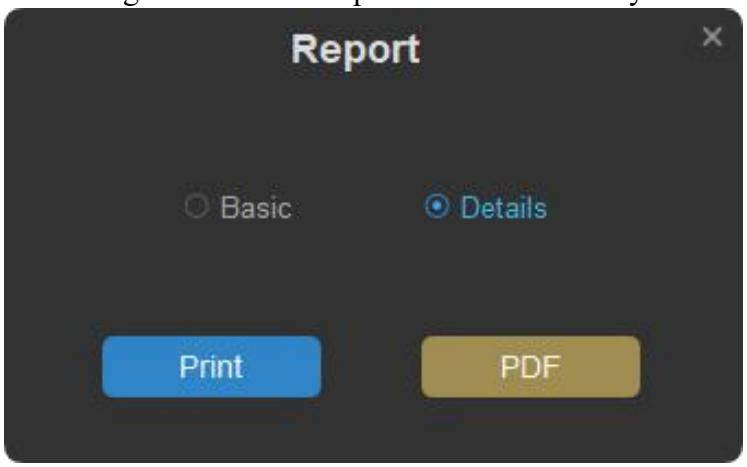


Figure 46. 2DMap Module_Report

(5) Beam Analysis

Click to perform beam analysis.

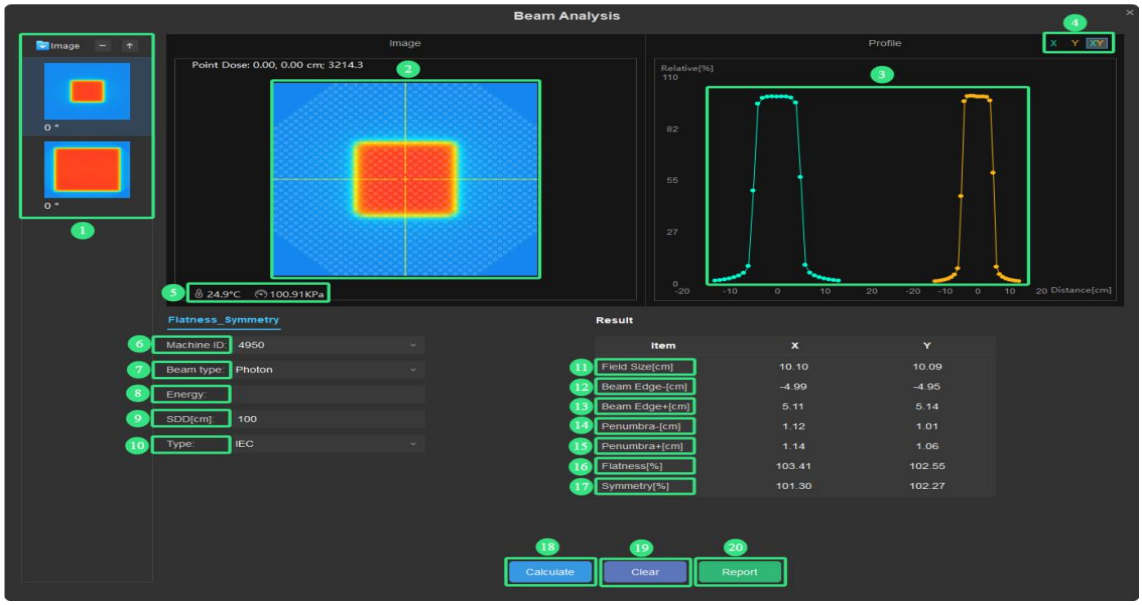


Figure 47. 2DMap Module_Beam analysis

① Image preview list: If multiple images are available, you can switch between them for display.

② Square field image display area.

③ Profile image display area.

④ Profile display toggle: You can choose to display only the "X" profile, only the "Y" profile, or both "XY" profiles simultaneously.

⑤ Display the temperature and pressure during measurement.

⑥ Machine ID.

⑦ Beam type: with options "Photon" and "Electron."

⑧ Energy: Beam energy level.
⑨ SDD: The distance from the source to the detector isocenter.
⑩ Type: Analysis protocol, supports AAPM and IEC.
⑪ Field Size.
⑫ Beam Edge-.
⑬ Beam Edge+.
⑭ Penumbra-.
⑮ Penumbra+.
⑯ Flatness.
⑰ Symmetry.
⑱ Calculate: Calculation button, click to compute the results.
⑲ Clear: Clear button, click to clear the current results.
⑳ Report: Report button, click to go to the report interface.

Flatness and Symmetry Calculation Formulas:

Type	Protocol	Procedure	Calculation Formula
Photon	AAPM	Flatness	|Dmax-Dmin|/（Dmax+Dmin）
		Symmetry	100*Max[|PointLT/PointRT|,|PointRT/PointLT|]
	IEC	Flatness	Dmax/Dmin
		Symmetry	100*Max[|PointLT/PointRT|,|PointRT/PointLT|]
Electron	AAPM	Flatness	|Dmax-Dmin|/（Dmax+Dmin）
		Symmetry	100*Max[|PointLT/PointRT|,|PointRT/PointLT|]
	IEC	Flatness	1) Dmax/DCAX 2) 80%-50% distance (L/R) 3) 90%-50% distance (L/R)
		Flatness	100*Max[|PointLT/PointRT|,|PointRT/PointLT|]

5.3.4. Image Operation Area

This section introduces the image operation area referenced in item⑦of Section 5.3.1.

Item	Description
	Display type: User can switch between “Point” and “Plane”.
	• Click this button to draw a region within the measured image. After clicking the "Calculate" button, the software will compute the gamma passing rate of the selected region. • On first click, the entire image is selected by default. Click and drag to freely adjust the size of the selected region.
	Rotate the image 90° counterclockwise.
	Flip the measured image horizontally.
	Flip the measured image vertically.

	Align the measured image to the isocenter of the treatment plan.
	Move tool (X-axis): Used to move the image along the X direction.
	Move tool (Y-axis): Used to move the image along the Y direction.

6. User Guide

6.1. Overview

This section will guide users on how to use 2DMap. First, preparation before use is required, followed by consistency calibration and absolute dose calibration. Once these steps are completed, patient QA operations can commence.

6.2. Preparation Before Use

6.2.1. QA Phantom Preparation

(1) Overview

This step aims to generate a QA phantom required for plan verification by performing a CT scan of the 2DMap. Users may conduct their own CT scanning or use the CT phantom image file provided by Raydose.

(2) CT Scanning Procedure

Step 1: Preparation

- Use a dedicated treatment couch and ensure it is in a horizontal position.
- Insert the 2DMap into the RD Cube and place it horizontally on the treatment couch. Connect all cables, ensure the device is powered on, and check that the indicator light is functioning normally.
- Affix lead markers to the center of the crosshairs located on the left, right, and top surfaces of the RD Cube.

Step 2: Positioning

- Use the laser to position the RD Cube, ensuring the lasers align with the crosshairs on the RD Cube's side.

Step 3: CT Scanning

- Once positioning is complete, perform a CT scan. The scan range should cover all ionization chambers, but avoid including the non-irradiation region marked on the 2DMap surface.
- A recommended slice thickness is 2 mm.

Step 4: Output and Saving

- Transfer the scanned image set to the TPS and save it as the QA phantom.

(3) Using Raydose-Provided Phantom Images

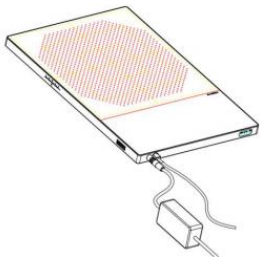
Alternatively, users may choose to directly use the CT phantom image file provided by Raydose as the QA phantom.

6.2.2. First Connection of 2DMap to a Computer

(1) Overview

If 2DMap is being connected to a computer for the first time, network settings for both the computer and 2DMap must be configured to ensure proper communication.

(2) Operation Steps



- Connect the 2DMap to a power supply and use a network cable to connect it to the computer.
- Log in to the RayMap account. If the connection icon in the Measurement module shows  , it means that 2DMap is not yet connected to the computer.
- On the computer, go to [Settings] → [Network & Internet] → [Ethernet].
- Click [IP Settings] → [Edit] → Select [Manual] → Enable [IPv4].
- Enter the following parameters:
  IP Address: [192.168.2.xxx] (where xxx is any number between 2 and 255, except 213; 10 is recommended).
  Subnet Mask: [255.255.255.0] (fixed value).

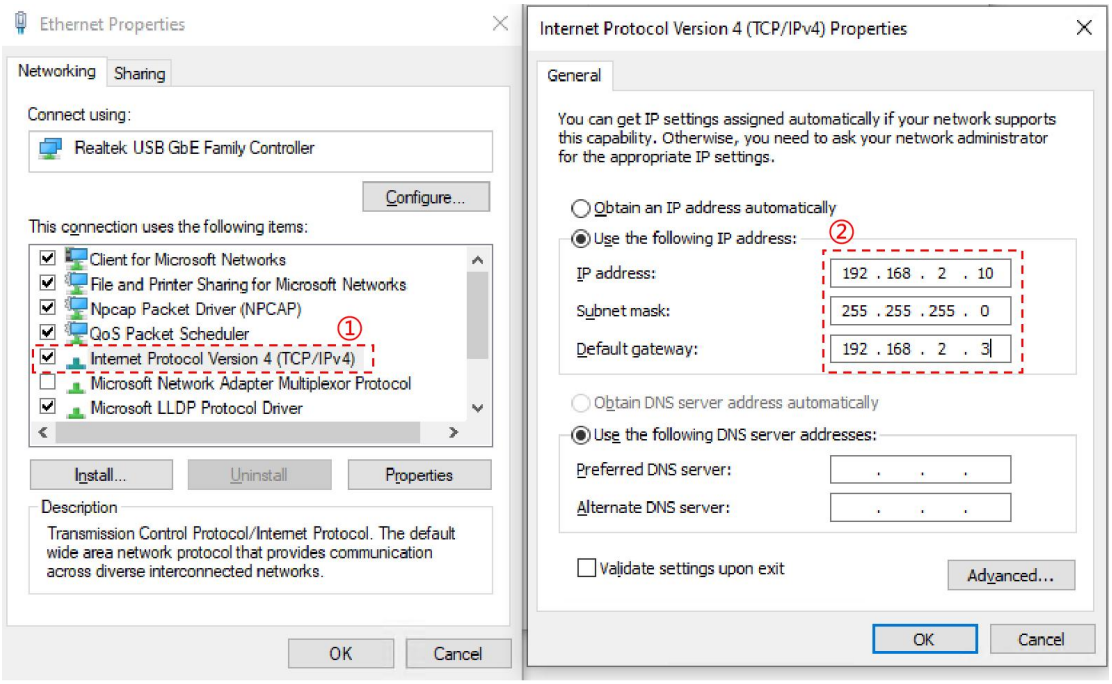


Figure 48. IP settings

- Save the settings. Return to the RayMap main interface and check the connection icon. If the connection icon in the Measurement module shows  , it means that 2DMap is successfully connected to the computer.

6.2.3. Consistency Calibration

(1) Overview

- The 2DMap undergoes consistency calibration before leaving the factory. Users may perform an additional calibration before first use.
- It is recommended to perform consistency calibration once a year to ensure measurement accuracy and device performance.
- If there are significant differences between the measured values and plan values in the Profile, users should check configuration parameters and assess whether re-calibration is needed.

(2) Operation Steps

Step 1: Positioning

- Set the LINAC gantry and collimator to zero degrees (0°) and ensure the treatment couch is level.
- Place the 2DMap flat on the couch (without inserting it into the RD Cube). Connect all cables, ensure the 2DMap is powered on, and check that the indicator lights are on.
- Turn on the lasers and adjust the couch height so that the laser lines align with the crosshairs on the side of the 2DMap.
- Set the light field size large enough to ensure its crosshairs aligns with the crosshairs on the surface of the 2DMap.

Step 2: Stabilization and Pre-irradiation

- After starting 2DMap, let it sit for at least 10 minutes to stabilize temperature and air pressure.
- Ensure the MLC is fully open. Adjust the field size to fully cover all ion chambers within 2DMap (field size should be at least 26cm×26cm but no larger than 29cm×29cm).
- Set the LINAC output dose to 200 MU and perform a single delivery. Wait for one minute after completion.

Step 3: Consistency Calibration

- Open the RayMap software on the computer connected to the 2DMap.
- Click the icon  in the top-right corner of RayMap to enter the Device interface. Select 2DMap as the device and go to the “Consistency Calibration” interface.
- Select the “Custom”, then click the “Background” button to begin background measurement.
- After background measurement is complete, set the field size to 29 cm × 29 cm. Ensure that the beam conditions match exactly with those specified in the interface.
- Click the “Start” button in the interface, then initiate beam delivery on the linac. Note: Each step requires two repeated measurements. The number of completed measurements will be indicated in the lower right corner of the interface.

- Once the beam delivery is finished, click the “Stop” button in the interface. The system will automatically proceed to the next step. Follow the on-screen instructions to complete all measurement steps until consistency calibration is finished.
- To return to the previous step, click “Previous Step”. Users can review the measurement image in that step. If re-execution is needed, simply deliver the beam again according to the specified measurement conditions.

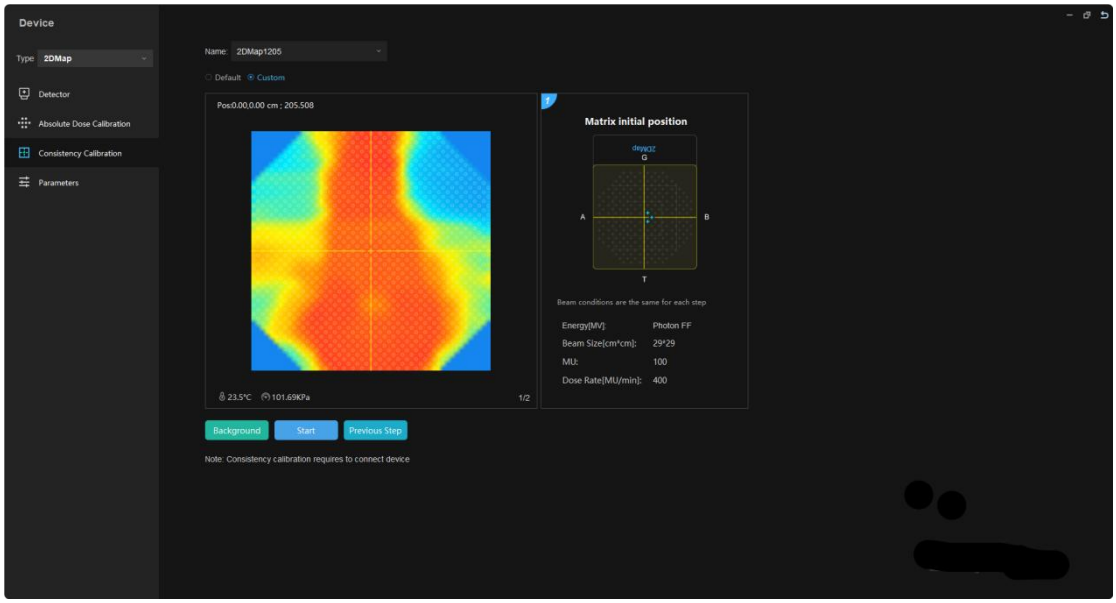


Figure 49. Device_Consistency Calibration_Interface

6.2.4. Absolute Dose Calibration

(1) Overview

After completing consistency calibration, users may perform absolute dose calibration before official measurements to ensure accuracy and reliability.

Note: An absolute dose calibration must be performed for each accelerator. The accelerator's name, energy, and FF/FFF settings must exactly match those defined in the plan.

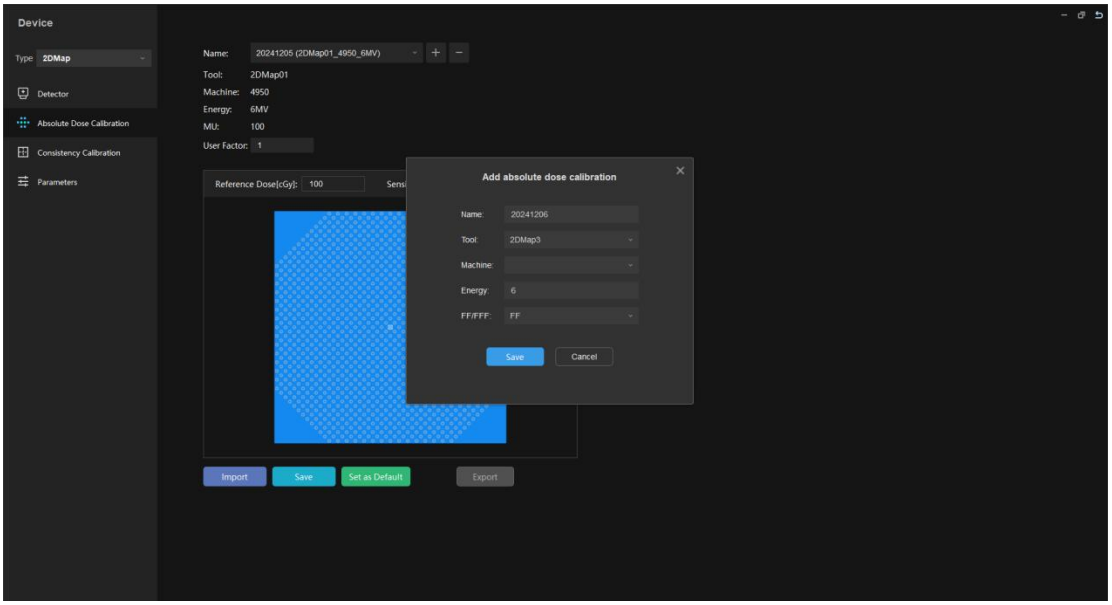


Figure 50. Device_Absolute dose calibration_Add absolute dose calibration

(2) Operation Steps

Step 1: Positioning

- Set the LINAC gantry and collimator to zero degrees (0°) and ensure the treatment couch is level.
- Insert the 2DMap into the RD Cube for combination. Connect all cables, ensure the 2DMap is powered on, and check that the indicator lights are on.
- Turn on the lasers and adjust the couch height so that the laser lines align with the crosshairs on the side of the RD Cube.
- Set the light field size large enough to ensure its crosshairs aligns with the crosshairs on the surface of the RD Cube.

Step 2: Stabilization and Pre-irradiation

- After starting 2DMap, let it sit for at least 10 minutes to stabilize temperature and air pressure.
- Ensure the MLC is fully open. Adjust the field size to fully cover all ion chambers within 2DMap (field size should be at least 26cm×26cm but no larger than 29cm×29cm).
- Set the LINAC output dose to 200 MU and perform a single delivery. Wait for one minute after completion.

Step 3: Absolute Dose Calibration

- Open the RayMap software on the computer connected to 2DMap.
- After completing the background measurement in the measurement module on the main interface, add a new measurement record and click “Start”. Then, set the accelerator's field size to 10 cm × 10 cm, dose rate to 400 MU/min, and deliver 100 MU. After the LINAC finishes the beam delivery, click “Stop”. A new measurement record will be generated on the main interface.
- Click  in the upper right corner to enter the Device interface, switch the device to 2DMap, and enter the “Absolute Dose Calibration” interface.
- Click the “Import” button, and the “Select Measurement” window will pop up. Select the measurement record just completed and import it.
- Enter the reference dose value in the “Reference Dose” input field. There are two ways to fill in this value:

  ① Manual Entry: Create a plan for the QA phantom in the TPS, setting the beam delivery to 100 MU and field size to 10 cm × 10 cm. Then, check the dose value at the center ion chamber in the plan and input this value into the “Reference Dose” field in RayMap.

  ② Automatic Entry: Create a plan for the QA phantom in the TPS, setting the beam delivery to 100 MU and field size to 10 cm × 10 cm, and import the plan into RayMap. Match this plan with the completed measurement record, and the main interface will generate the matched plan record. Import this plan record into the “Absolute Dose Calibration” interface, and RayMap will automatically fill in the reference dose value.
- Click the “Save” button. RayMap will automatically calculate and save the sensitivity factor.
- If you want to set the current calibration result as the default absolute dose calibration, click the “Set as default” button. Once set, RayMap will apply this factor as the default for subsequent measurements.

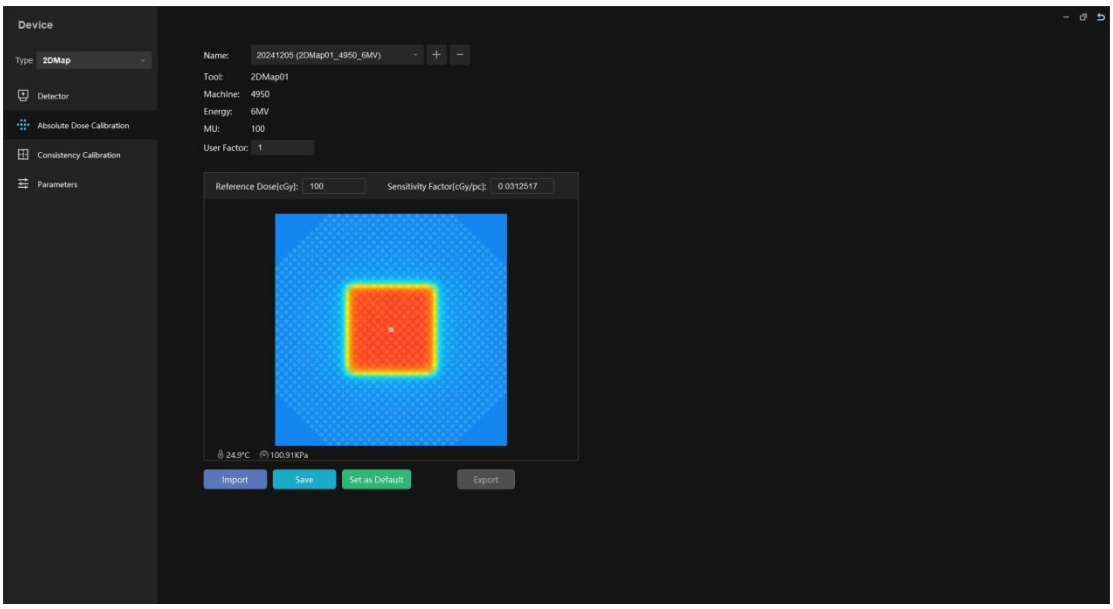


Figure 51. Device_Absolute dose calibration_Complete absolute dose calibration

6.2.5. Other Custom Settings

To perform custom settings, click icons and in the top-right corner of the software to complete the configurations. Once finished, 2DMap is ready for use.

6.3. Plan QA

Step 1: Positioning

- Set the LINAC gantry and collimator to zero degrees (0°) and ensure the treatment couch is level.
- Insert the 2DMap into the RD Cube for combination. Connect all cables, ensure the 2DMap is powered on, and check that the indicator lights are on.
- Turn on the lasers and adjust the couch height so that the laser lines align with the crosshairs on the side of the RD Cube.
- Set the light field size large enough to ensure its crosshairs aligns with the crosshairs on the surface of the RD Cube.

Step 2: Stabilization and Pre-irradiation

- After starting 2DMap, let it sit for at least 10 minutes to stabilize temperature and air pressure.
- Ensure the MLC is fully open. Adjust the field size to fully cover all ion chambers within 2DMap (field size should be at least 26cm×26cm but no larger than 29cm×29cm).
- Set the LINAC output dose to 200 MU and perform a single delivery. Wait for one minute after completion.

Step 3: Generate QA Plan in TPS

- Open the patient plan to be verified in the TPS.
- When creating the QA plan, set the isocenter to the position of the central ionization chamber on the QA phantom, and set the dose calculation grid to 2 mm.
- When calculating the QA plan, the gantry angle and collimator angle can either be set to 0° or remain consistent with the actual plan.

Note: If the gantry and collimator angles are set to 0° during calculation, they must also be set to 0° during plan measurements. If the actual treatment angles are used in the calculation, no angle adjustment is required during measurements.

- After the calculation is complete, export the QA plan as RT Plan and RT Dose files in DICOM format.

Step 4: Import QA Plan into RayMap

- On the RayMap main interface, click the “Import Plan” button and import the RT Plan and RT Dose files exported from the TPS.
- Once successfully imported, a corresponding plan record will appear on the main interface.

Step 5: Perform Measurement

- In the “Measurement” section of the main interface, click the “Background”

button to perform a background measurement.

Note: Only one background measurement is required after connecting the 2DMap to the computer. If the 2DMap is disconnected and reconnected, a new background measurement must be performed.

- After background measurement is complete, drag the QA plan into the "Measurement" area using the mouse, or click the "Measure" button on the right side of the plan record to add it to the measurement area for measurement.
- Click "Start" to enter measurement mode, then deliver the corresponding QA plan on the LINAC.
- Once delivery is complete, click "Stop" to end the measurement process.

Step 6: Calculation and Analysis

- Upon completion of the measurement, RayMap will automatically calculate and display the gamma passing rate on the main interface.
- Double-click the plan record to enter the detailed analysis interface. In the "Gamma Calculation Parameter Settings Area" on the left, you can adjust the gamma analysis parameters and click "Calculate" to recalculate the passing rate.
- Additional settings and operations for the QA plan can also be performed in the detailed analysis interface.

7. Service and Support

7.1. Frequently Asked Questions (FAQ)

Issue	Possible Cause	Solution
Device cannot be found on the computer or network share	Incorrect IP/subnet mask input	Power on the device and verify the IP/subnet mask settings
	Device and computer have different gateway settings	Check and correct the gateway settings
	Damaged or disconnected Ethernet cable/port; disconnected network socket	Replace the cable or repair the network socket
	Firewall is enabled, blocking communication	Disable the firewall
	Laptop has an active Wi-Fi connection	Ensure that the Wi-Fi connection is disabled
Unable to install/ modify/ configure the device on the computer	Operator lacks administrative privileges	Obtain administrator privileges before proceeding

7.2. Software Updates and Fixes

(1) Obtaining the Installation Package

Raydose regularly maintains the software. When a new version is released, users can contact Raydose's sales or distributors to obtain the update. We will also notify users in a timely manner and inquire whether they need a version update.

(2) Installation Steps

- Download the latest update package.
- Run the installer and follow the installation wizard to complete the update.
- Restart the software for the changes to take effect.

(3) Update Contents

- Feature Enhancements: New or optimized features to improve user experience.
- Bug Fixes: Resolutions for known software issues to enhance system stability.
- Performance Optimization: Faster and more efficient operation.

(4) Precautions

- Ensure a stable power connection during the update process.
- It is recommended to back up important data before updating.

7.3. Technical Support

For technical support, please contact your local distributor or sales, or reach out to Raydose's after-sales team through the following channels:

- Website: https://www.raydose.com/
- Email: service@raydose.com