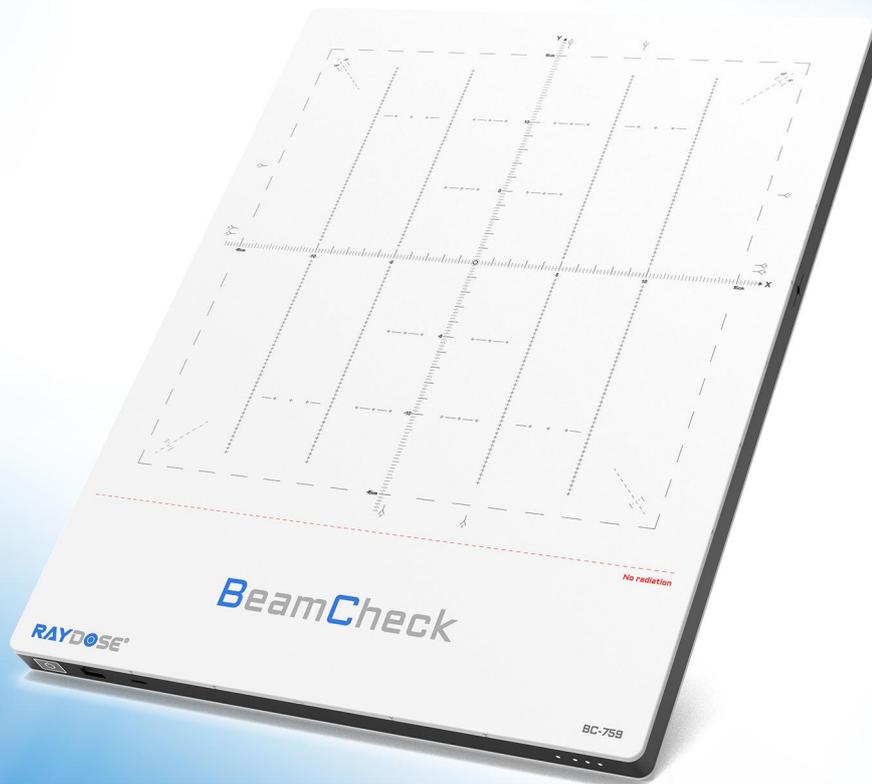


BeamCheck

User Manual



BeamCheck User Manual

Revision Date: July 24, 2025

i. Statement

This manual serves as the user guide for BeamCheck and its software XBeam. It is intended to assist users in the proper operation of the product, ensuring optimal performance and safe usage. The manual should be kept with the device for convenient reference at all times.

BeamCheck and XBeam are intended solely for the applications explicitly specified in this manual and the accompanying documentation. Any unauthorized or unspecified use is strictly prohibited. Users must comply fully with the operational guidelines and safety precautions outlined in this manual. Use beyond the specified scope will result in automatic revocation of authorization and may pose potential risks.

ii. Product Information

- **Product Name:** BeamCheck
- **Model:** BC-759
- **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/>

Copyright © 2025 Guangzhou Raydose Medical Technology Co., Ltd.

All rights reserved.

Table of Contents

1. Introduction	1
1.1. Product Description	1
1.2. Intended Use	1
1.3. Intended Users	1
1.4. Contraindications	1
1.5. Copyright Notice	1
2. Health and Safety Information	2
2.1. Overview	2
2.2. Symbols and Labels	2
2.3. Responsibilities	3
2.4. Assembly, Maintenance, and Accessories	4
2.5. Power Supply	4
2.6. Electromagnetic Compatibility (EMC)	4
2.6.1. Electromagnetic Emissions	5
2.6.2. Electromagnetic Immunity	5
2.6.3. Recommended Separation Distances	7
2.7. Regulatory Requirements	8
2.8. Safety Precautions	8
2.8.1. Electrical Equipment	8
2.8.2. Operators	8
2.8.3. Operating Procedures	8
2.8.4. Transportation and Storage	9
2.8.5. Operating Environment	9
2.8.6. Emergency Measures	10
2.9. User Suggestions and Complaint Handling	10
3. Product Description	11
3.1. Composition	11
3.2. Terminology Description	11
3.3. Data Interface Instructions	11
3.4. Network Security Instructions	14
3.5. Operating Environment Requirements	15
3.6. User Access Control Requirements	15
4. Hardware	16
4.1. Composition	16
4.2. Detector Matrix	16
4.2.1. Working Principle	16
4.2.2. Structural Description	16
4.2.3. Technical Specifications	17
4.2.4. Interfaces and Indicator Lights	17
4.2.5. BeamCheck Surface Markings	18
4.3. Accessories	19
4.4. Maintenance and Cleaning	21

4.4.1. Routine Maintenance	21
4.4.2. Cleaning and Disinfection	21
5. XBeam Software	22
5.1. Installation and Execution	22
5.2. Main Page	22
5.3. Data Management Page	23
5.4. Functional Module	24
5.4.1. Settings	24
5.4.2. Import	33
5.4.3. Report	33
5.5. Toolbar	34
5.5.1. Measurement	34
5.5.2. Curve Post-Processing	34
5.5.3. Curve Display	35
5.5.4. Baseline	37
5.5.5. Analysis	38
5.6. Curve Display Area	39
5.6.1. Single Project	39
5.6.2. Dual Project	41
5.7. Measurement Condition Settings Area	42
5.8. Measurement Result Analysis Area	44
6. User Guide	46
6.1. Overview	46
6.2. Preparation Before Use	46
6.2.1. Connect the BeamCheck and Computer	46
6.2.2. Consistency Calibration	47
6.2.3. Absolute Dose Calibration	48
6.2.4. MLC Model Establishment	49
6.2.5. Parameter Settings	50
6.3. Machine QA	51
7. Service and Support	52
7.1. Frequently Asked Questions (FAQ)	52
7.2. Software Updates and Fixes	52
7.3. Technical Support	52

1. Introduction

1.1. Product Description

BeamCheck is a detector matrix specifically designed to measure radiation beam dose distribution. It is equipped with 759 air ionization chambers. The accompanying XBeam software allows for real-time display and analysis of measurement data. By accurately detecting beam dose distribution and analyzing relevant machine parameters, BeamCheck assists in evaluating the operational status of LINAC, ensuring the safety and accuracy of treatment processes.

1.2. Intended Use

BeamCheck is primarily used for quality assurance (QA) in radiotherapy. It can be utilized to assess beam dose distribution, verify the accuracy of multi-leaf collimator (MLC) motion, and evaluate beam consistency. By analyzing these results, BeamCheck helps evaluate whether the LINAC can accurately execute treatment plans, thereby enhancing the safety and effectiveness of treatment.

1.3. Intended Users

Personnel operating BeamCheck must be trained in accordance with this user manual and possess relevant professional knowledge in the field of radiotherapy.

1.4. Contraindications

BeamCheck is intended solely for machine QA purposes and must not be used directly on patients. The measured data are intended exclusively for evaluating the operational status of the LINAC and must not be used for direct control of the system.

1.5. Copyright Notice

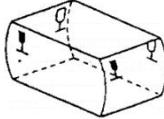
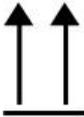
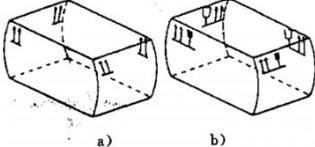
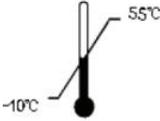
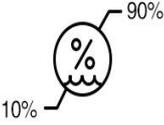
- This manual and all accompanying documents (including electronic and printed versions) are the proprietary property of Guangzhou Raydose Medical Technology Co., Ltd. (hereinafter referred to as "Raydose") and its suppliers, and are protected by intellectual property laws.
- Without written permission from Raydose, modification, translation, or reproduction of this document is prohibited, except for limited internal reference within the same department.
- Raydose retains ultimate ownership of this manual and its accompanying documents. Any infringement will be subject to legal action.

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°C~55°C.	/
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 shall not be held liable for any incidental, indirect, or consequential losses arising from improper operation or other factors during the use of this device. Such losses may include, but are not limited to, data loss, loss of revenue, or business interruption.

- **Usage Responsibility**

This device is intended to be operated only by personnel with specialized knowledge in radiotherapy, such as medical physicists or engineers. All users must have received appropriate training and hold the necessary qualifications. Operation by unauthorized personnel is strictly prohibited.

- **Safety Responsibility**

Users must strictly comply with all safety warnings and precautions provided in this manual. Failure to do so may result in personal injury or damage to the device, for which Raydose accepts no liability.

2.4. Assembly, Maintenance, and Accessories

- **Assembly and Maintenance Authorization**

Only Raydose or personnel authorized by Raydose with adequate technical expertise are permitted to assemble, modify, expand, or repair the device.

- **Use of Spare Parts**

During maintenance, only original spare parts supplied by Raydose or parts explicitly approved by Raydose may be used. The use of unauthorized components may compromise user safety, measurement accuracy, and operational stability. Any violation of this provision will result in the voiding of the product warranty.

- **Responsibility for Third-Party Components**

Raydose accepts no responsibility for any hazards, malfunctions, or damages resulting from the use of accessories or consumables not supplied or approved by Raydose.

2.5. Power Supply

The BeamCheck device is equipped with a built-in battery and does not require a charger during operation. To recharge the device, use a Type-C charging cable to connect the charging port to an appropriate power source.

(1) Built-in Battery Specifications:

- Voltage: 3.8V
- Capacity: 9200mAh

(2) Power Adapter Specifications:

- Input: 100-240V~, 50/60Hz, 0.7A
- Output: 5V== 3A/9V== 3A/12V== 2.25A/20V== 1.35A/11V== 3A Max

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 the accompanying documents.
- 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	1.0	No
2	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 lines	±2kV for power supply lines ±1kV for input/output lines	Mains power should have the quality typically used in commercial or hospital 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	3Vrms 150kHz to 80MHz	3 Vrms	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
Radiated RF GB/T 17626.3	3V/m 80MHz to 2.5GHz	3 V/m	

			<p>rated power of the transmitter, as provided by the manufacturer, in watts (W), and d is the recommended separation distance, in meters (m).</p> <p>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</p> <p>Interference may occur near devices marked with the following symbols: </p>
<p>Note 1: For frequencies of 80 MHz and 800 MHz, use the formula for the higher frequency range.</p> <p>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.</p> <p>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.</p> <p>b. For the frequency range of 150 kHz to 80 MHz, the field strength should be below 3 V/m.</p>			

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 devices - Quality Management Systems - 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°C ~ +55°C
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°C ~ +40°C
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 promptly as possible and provide comprehensive support and appropriate solutions.

3. Product Description

3.1. Composition

Device Configuration List			
Configuration Type	Name	Quantity	Configuration Type
Detector Matrix	BeamCheck (BC-759)	1	Standard
Software	XBeam	1	
Accessories	BeamCheck Wedge (BCW-I)	1	Optional
	BeamCheck Fixture(BCFE-I)	1	
	BeamCheck Fixture(BCFV-I)	1	
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
IP	Internet Protocol
MU	Monitor Unit (LINAC Output Unit)
MLC	Multi-Leaf Collimator
AAPM	American Association of Physicists in Medicine (Refers to the calculation standard in the software)
IEC	International Electrotechnical Commission (Refers to the calculation standard in the software)
IAEA	International Atomic Energy Agency (Refers to the calculation standard in the software)
Elekta	(Refers to the calculation standard in the software)
Varian	(Refers to the calculation standard in the software)

3.3. Data Interface Instructions

Item	Description
File Import	<p>Purpose: Import files measured by XBeam for analysis.</p> <p>Users: Physicists, maintenance personnel, authorized personnel.</p> <p>Device Control: No</p> <p>Specification: Import and view the measurement files exported by XBeam.</p> <p>Data Type: CSV format.</p> <p>Standard: XBeam data format.</p> <p>Time Synchronization: Not applicable.</p> <p>Possible Issues: If the file format does not comply with the XBeam data type, the import will fail.</p>

	<p>Prohibited: None</p> <p>Recommended Method: Import using XBeam software.</p> <p>Configuration: None</p> <p>Security Requirements: None</p>
File Export	<p>Purpose: Export measurement files from XBeam software.</p> <p>Users: Physicists, maintenance personnel, authorized personnel.</p> <p>Device Control: No</p> <p>Specification:</p> <ul style="list-style-type: none"> • The exported measurement data includes measurement conditions, raw data, post-processed data, and analysis results. • The exported CSV file is compatible with software such as WPS and Excel, allowing users to process and analyze data. <p>Data Type: CSV format.</p> <p>Verified Devices: XBeam, WPS, Excel, Notepad.</p> <p>Standard: None</p> <p>Time Synchronization: Not applicable.</p> <p>Possible Issues:</p> <ul style="list-style-type: none"> • The computer must have enough storage space to export the file. • XBeam must have permission to write files. <p>Prohibited: None</p> <p>Recommended Method: Import using XBeam for viewing.</p> <p>Configuration: None</p> <p>Security Requirements: None</p>
Export Report as PDF	<p>Purpose: XBeam can generate detailed reports based on the displayed curves, measurement conditions, and analysis results in the current project. These reports are suitable for archiving or printing as paper reports.</p> <p>Users: Physicists, maintenance personnel, authorized personnel.</p> <p>Device Control: No</p> <p>Specification:</p> <ul style="list-style-type: none"> • The exported data includes measurement conditions, curves, and analysis results. • The export file format is PDF, which can be viewed using Edge browser, WPS, etc. <p>Data Type: PDF</p> <p>Verified Devices: Edge browser, WPS software.</p> <p>Standard: None</p> <p>Time Synchronization: Not applicable.</p> <p>Possible Issues:</p> <ul style="list-style-type: none"> • The computer must have enough storage space to export the file. • XBeam must have permission to write files.

	<p>Prohibited: None</p> <p>Recommended Method: Open the PDF file using the Edge browser.</p> <p>Configuration: None</p> <p>Security Requirements: None</p>
<p>Import Consistency Calibration File</p>	<p>Purpose: XBeam supports importing consistency calibration files from local computer. If anomalies are detected in the used consistency calibration file, user can correct it by importing the correct calibration file.</p> <p>Users: Physicists, maintenance personnel, authorized personnel.</p> <p>Device Control: No</p> <p>Specification: The imported file must comply with XBeam's standard consistency calibration file format.</p> <p>Data Type: CSV format.</p> <p>Verified Devices: None</p> <p>Standard: CSV format.</p> <p>Time Synchronization: Not applicable.</p> <p>Possible Issues:</p> <ul style="list-style-type: none"> • It is recommended to perform consistency calibration on the BeamCheck device regularly. If the imported calibration file is older than a certain period (e.g., one year), it may no longer be valid. In such cases, recalibration is required to ensure measurement accuracy. • Each BeamCheck device has its own unique consistency calibration file, and these files cannot be used interchangeably. <p>Prohibited: None</p> <p>Recommended Method: None</p> <p>Configuration: None</p> <p>Security Requirements: None</p>
<p>Export Consistency Calibration File</p>	<p>Purpose: XBeam supports exporting consistency calibration files to local computer. Users can analyze the differences between detectors based on calibration factors or re-import the file to perform consistency calibration.</p> <p>Users: Physicists, maintenance personnel, authorized personnel.</p> <p>Device Control: No</p> <p>Specification:</p> <ul style="list-style-type: none"> • The exported data includes the calibration factor files for each detector after consistency calibration calculations. • The exported CSV file is compatible with software like WPS, Excel, etc. <p>Data Type: CSV format.</p> <p>Verified Devices: Edge browser, WPS, Excel, Notepad.</p> <p>Standard: CSV format.</p>

	<p>Time Synchronization: Not applicable.</p> <p>Possible Issues:</p> <ul style="list-style-type: none"> • The computer must have enough storage space to export the file. • XBeam must have permission to write files. <p>Prohibited: None</p> <p>Recommended Method: Use Excel to view the CSV file.</p> <p>Configuration: None</p> <p>Security Requirements: None</p>
--	---

3.4. Network Security Instructions

Item	Description
Network Environment	<ul style="list-style-type: none"> • The system 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	<p>To ensure system security and stability, it is recommended that users install antivirus software and enable the system firewall for regular protection.</p> <ul style="list-style-type: none"> • 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 XBeam as malicious. It has been verified that XBeam software passes checks with 360 Antivirus and contains no malicious code.
Receiving Network Port	The device uses a specified port for data reception.
Sending Network Port	The device uses a specified port for measurement control.
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	None
Possible Issues and Solutions	<p>Unable to connect to XBeam software:</p> <ul style="list-style-type: none"> • Check the network IP configuration to ensure XBeam and BeamCheck are on the same LAN, with different IPs. • Ensure that XBeam software is allowed through the firewall.
Performance	None

Impact	
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 of XBeam 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) 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

As the designated software for BeamCheck, XBeam communicates with and controls the device via a specified network communication protocol.

4. Hardware

4.1. Composition

Configuration Type	Name	Quantity	Configuration Type
Detector Matrix	BeamCheck (BC-759)	1	Standard
Accessories	BeamCheck Wedge (BCW-I)	1	Optional
	BeamCheck Fixture(BCFE-I)	1	
	BeamCheck Fixture(BCFV-I)	1	
Note: The actual delivered accessories are subject to the configuration specified in the customer's order.			

4.2. Detector Matrix

4.2.1. Working Principle

The detector matrix uses ionization chambers as detectors, with a total of 759 ionization chambers distributed within a 31.4cm×31.4cm area. When exposed to radiation, the radiation enters the ionization chamber, ionizing the air in the sensitive volume. The charged particles drift under the influence of the external electric field, generating output signals. These signals are transmitted to the PC for processing via a Ethernet port.

4.2.2. Structural Description

The structure of the ionization chamber matrix in BeamCheck primarily uses a double-layer staggered arrangement. The ionization chambers in the upper and lower layers do not overlap along the Z-axis and maintain a certain gap.

- The ionization chamber structure along the X-axis and Y-axis on the radiation field central axis is arranged in a double-layer staggered pattern. There are 157 ionization chambers along the X-axis and 150 ionization chambers along the Y-axis, primarily used for detecting flatness and symmetry.
- There are 4 columns of ionization chambers parallel to the Y-axis, arranged in a double-layer staggered pattern. Each column contains 104 ionization chambers, with two columns located on the left side of the Y-axis and the other two columns on the right side, primarily used to verify the accuracy of MLC movement.
- There are 4 columns of ionization chambers parallel to the X-axis, arranged in a single layer, located in the upper layer. The number of ionization chambers in each column is 12, 6, 6, and 12, primarily used for detecting coincidence of light field and radiation field.

4.2.3. Technical Specifications

Detector Matrix	
Detector Type	Ionization chamber
Number of Detectors	759
Effective Field Size	30 cm×30 cm
Maximum Field Size	31.4 cm×31.4 cm
Ionization Chamber Volume	0.051 cc
Number of Ionization Chambers (X-Axis)	157
Ionization Chamber Spacing (X-Axis, Center to Center)	2 mm
Number of Ionization Chambers (Y-Axis)	150
Ionization Chamber Spacing (Y-Axis, Center to Center)	2 mm
Number of Ionization Chambers Parallel to Y-Axis	104 per column, 4 columns in total
Ionization Chamber Spacing Parallel to Y-Axis (Center to Center)	2.5 mm
Dimensions (L×W×H)	435mm×341mm×22mm
Upper Shell Water Equivalent	8.1 mm ± 1mm
Lower Shell Water Equivalent	14.1 mm ± 1mm
Built-in High Voltage	300 V
Non-linearity	≤ ± 0.5%
Repeatability	≤ ± 0.5%
Measurement Consistency	≤ 1.5%
Total Power Consumption	4 W
Maximum Charging Power	20 W
Built-in Battery Capacity	9200 mAh
Maximum Continuous Operating Time (fully charged)	9 hours

4.2.4. Interfaces and Indicator Lights



Figure 1. Interfaces and indicator lights

- ① **Power Button.** Long press to turn BeamCheck device on or off.
 - Blue light on: Device is operating.
 - Blue light flashing: Device is charging.
 - No light: Device is off or the battery is fully charged.
- ② **Ethernet Interface.** Used to connect the network cable for data transmission.
- ③ **Charging Interface.** Used to connect the power supply for charging.
- ④ **Status Indicator Light.** Used to indicate the operating status of the device.
 - Green flashing: Not connected to the computer.
 - Blue flashing: Connected to the computer but not connected to the XBeam.
 - Blue steady: Successfully connected to the XBeam.

- ⑤ **Battery Indicator Light.** Used to display the battery level.
 - Does not light up when the device is off.
 - Shows remaining battery level when powered on.
 - Flashes while charging.

4.2.5. BeamCheck Surface Markings

(1) Overview

The surface of the BeamCheck device is covered with various markings to assist users in performing mechanical checks. The overall structure is shown in the figure below.

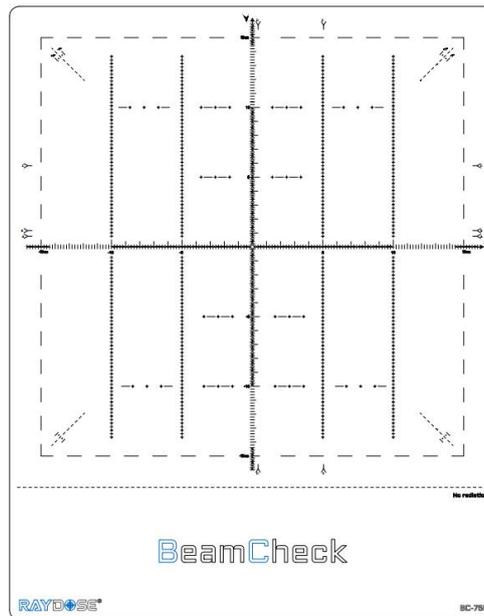


Figure 2. Overview of BeamCheck Surface Markings

(2) Functional Description

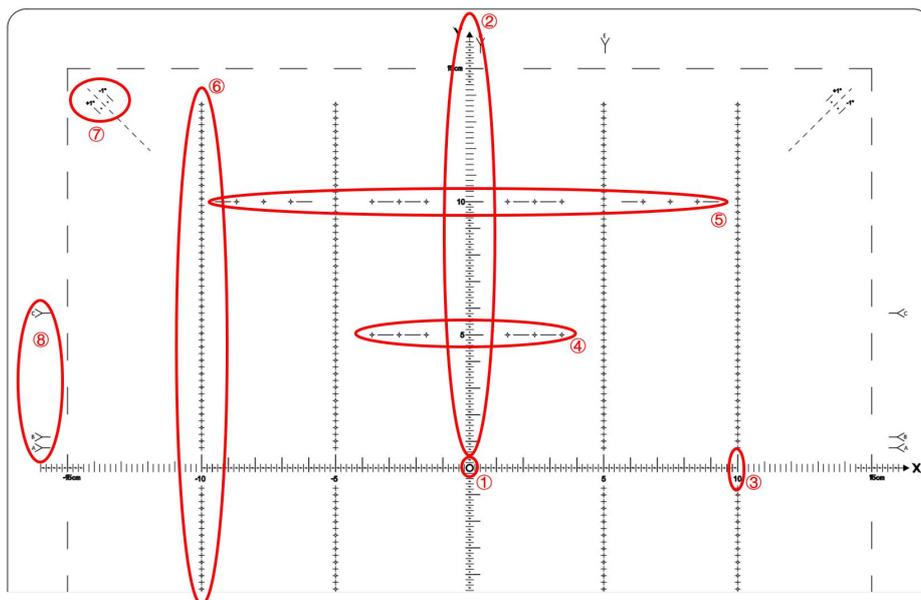


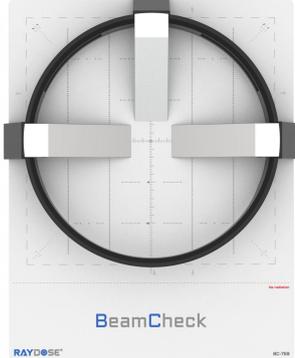
Figure 3. Introduction to BeamCheck Surface Markings

- ① **Center 1mm Circular Mark:** Located at the center of the coordinate axis, it assists in checking the rotation range of the collimator.
- ② **Coordinate Axis Scale Mark:** Used for marking dimensions, the reading on the scaled ruler indicates the actual distance of the radiation field's exposure to BeamCheck's ionization chamber.
- ③ **5cm Scale Mark:** Used for marking dimensions, the reading on the scaled ruler indicates the actual distance of the radiation field's exposure to the BeamCheck's ionization chamber.
- ④ **10×10 Boundary Mark:** Represents the boundary of a 10cm×10cm radiation field, with the hollow dot indicating that the ionization chamber at this position is located on the upper layer.
- ⑤ **20×20 Boundary Mark:** Represents the boundary of a 20cm×20cm radiation field, with the hollow dot indicating that the ionization chamber at this position is located on the upper layer.
- ⑥ **Ionization Chamber Column Mark:** There are four columns of ionization chambers, located at -10cm, -5cm, 5cm, and 10cm along the X-axis. The hollow dot indicates that the ionization chamber at this position is located on the upper layer, while the solid dot indicates that the ionization chamber is on the lower layer. This is used for field size detection and MIC position accuracy verification.
- ⑦ **45°Rotation Angle Mark:** Used to assist in verifying the irradiation field angle after rotating the collimator by 45° or for diagonal field measurements using the detector on the central axis after rotating the BeamCheck by 45°.
- ⑧ **Consistency Calibration Position Mark:** Used to mark the position of BeamCheck during consistency calibration. Marks such as A, B, C, D, etc., indicate the measurement sequence. Specific operations can be referenced in the consistency calibration guide in the XBeam software.

4.3. Accessories

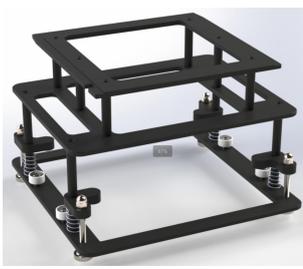
(1) BeamCheck Wedge

BeamCheck Wedge			
No.	Image	Model	Description
1		BCW-I	<ul style="list-style-type: none"> • The BeamCheck Wedge consists of two copper wedge blocks and one aluminum wedge block, all mounted on a circular base. • When in use, secure the circular base onto the BeamCheck, ensuring the two copper wedge blocks are aligned along the X-axis and the aluminum wedge block is positioned in the positive Y-axis direction. It is recommended to set the field size to 30cm×30cm (adjustable as needed) to ensure the

			<p>beam penetrates sufficiently thick metal layers.</p> 
--	--	--	--

Technical Parameters	
Overall dimensions	Φ297 mm× 40 mm
Wedge dimensions(L×W×H)	96 mm× 40 mm× 40 mm
Total weight	2.5 kg
Weight of a single copper wedge	0.8 kg
Weight of a single aluminum wedge	0.25 kg
Water-equivalent depth for photon beams	28 cm
Water-equivalent depth for electron beams	9 cm

(2) BeamCheck Fixture

BeamCheck Fixture			
No.	Image	Model	Description
1		BCFE-I	<ul style="list-style-type: none"> Suitable for Elekta accelerators. When in use, attach one end of the BeamCheck Fixture to the gantry and clamp the BeamCheck at the other end. As the gantry rotates, BeamCheck can be used to measure beam dose at different angles.
2		BCFV-I	<ul style="list-style-type: none"> Suitable for Varian accelerators. When in use, attach one end of the BeamCheck Fixture to the gantry and clamp the BeamCheck at the other end. As the gantry rotates, BeamCheck can be used to measure beam dose at different angles.
<p>Note: The actual delivered accessories are subject to the configuration specified in the customer's order.</p>			

4.4. Maintenance and Cleaning

4.4.1. 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.

4.4.2. 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. XBeam Software

5.1. Installation and Execution

(1) Installation and Initialization

- Double-click the "XBeam.exe" installation file.
- Select "BeamCheck."
- Follow the on-screen instructions to complete the installation process.

(2) Running the Software

Once the installation is complete, double-click the software icon to launch XBeam.

5.2. Main Page

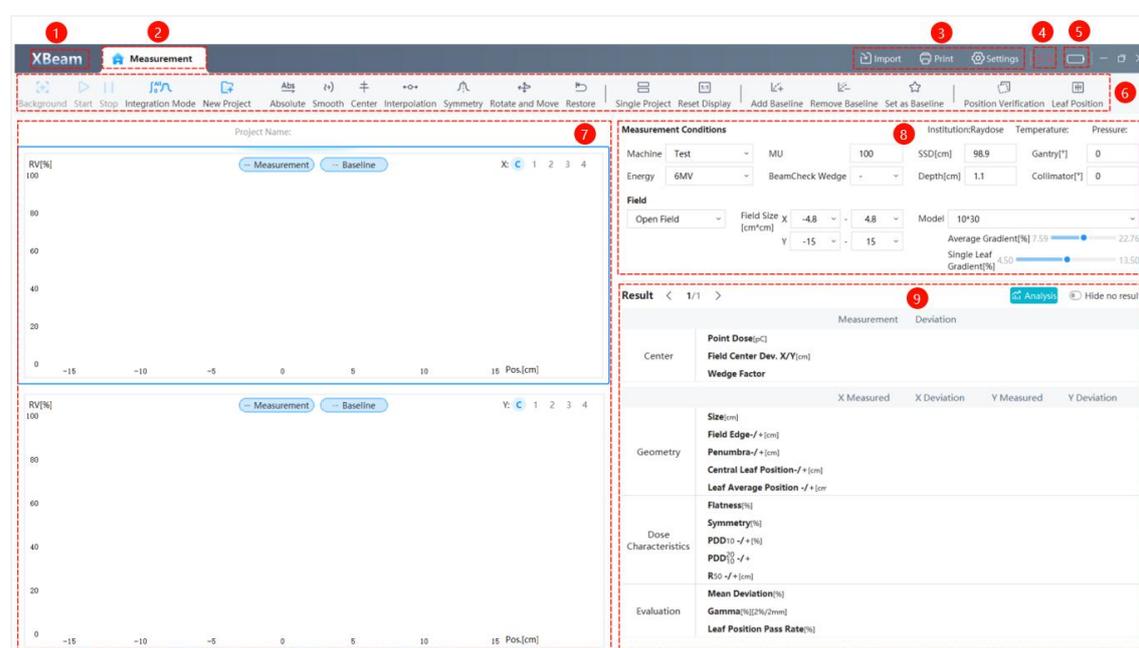


Figure 4. Main Page

- ① Click this button to enter the data management page. For detailed information, see section 5.3.
- ② Click this button to return to the main page.
- ③ Function module. For detailed information, see section 5.4.
- ④ Displays the connection status between BeamCheck and computer:
 - Connected:
 - Disconnected:
- ⑤ Display of BeamCheck remaining battery level:
 - Connected: (Shows the current remaining battery level of the device.)
 - Disconnected:
- ⑥ Toolbar. For detailed information, see section 5.5.
- ⑦ Curve Display Area. For detailed information, see section 5.6.
- ⑧ Measurement Condition Settings Area. For detailed information, see section 5.7.
- ⑨ Measurement Result Analysis Area. For detailed information, see section 5.8.

5.3. Data Management Page

Click **XBeam** button to enter the management page.

- Management is organized by projects. Each project can contain one or more measurement records.



Figure 5. Management_Measurement

- ① Clicking this button will return to the main page.
- ② Here, user can switch between viewing "Measurement" and "Baseline."
 - Measurement: A new project can be created by clicking **"New Project"** on the main page. Each project can contain multiple measurement records. Users can add measurement records by importing data or conducting measurements within the project.
 - Baseline: Measurement records set as baselines within a project will be saved here. Deleting data from the "Baseline" section will not affect the corresponding data in the "Measurement" section.
- ③ Filtering helps users quickly locate the desired records. Filtering criteria include:
 - Institution/Machine: The system manages machines by institution, with each institution able to configure multiple machines. Users must first select an institution before choosing a specific machine from the associated machine list.
 - Name/Energy/Field: Filter measurement records by project name, energy, or field size.
 - Time Range: Filter measurement records by setting a specific time range.
- ④ Operations on projects and measurement records are as follows:

Operations on Projects	
Open	Click the "Open" button or double-click a project to open it in the main page.
Export	Click the "Export" button to export the current project and all its measurement records locally as a CSV file.

Delete	Click the “Delete” button to delete the current project and all its measurement records.
Click Project	Clicking a project expands to show all its measurement records. Clicking a specific measurement record will display its X/Y measurement curves on the right.
Notes	Click  to add a note to the project (up to 100 characters). Note colors indicate whether a note has been added:  indicates a note exists;  indicates no note.
Operations on Measurement Records	
<div style="border: 1px solid #ccc; padding: 5px; width: fit-content;"> <p style="margin: 0;">Open</p> <p style="margin: 0;">Delete</p> <p style="margin: 0;">Report</p> </div>	<p>Right-click a selected measurement record to perform the following operations:</p> <ul style="list-style-type: none"> • Open: Open the project in the main page. • Delete: Delete the selected measurement record. • Report: Generate a report file containing the selected measurement record and its analysis.

Notes:

- The operational functions of "Baseline" and "Measurement" are the same.
- When a measurement record is set as a baseline for another project, any changes to it may affect the analysis results of the project that reference it.

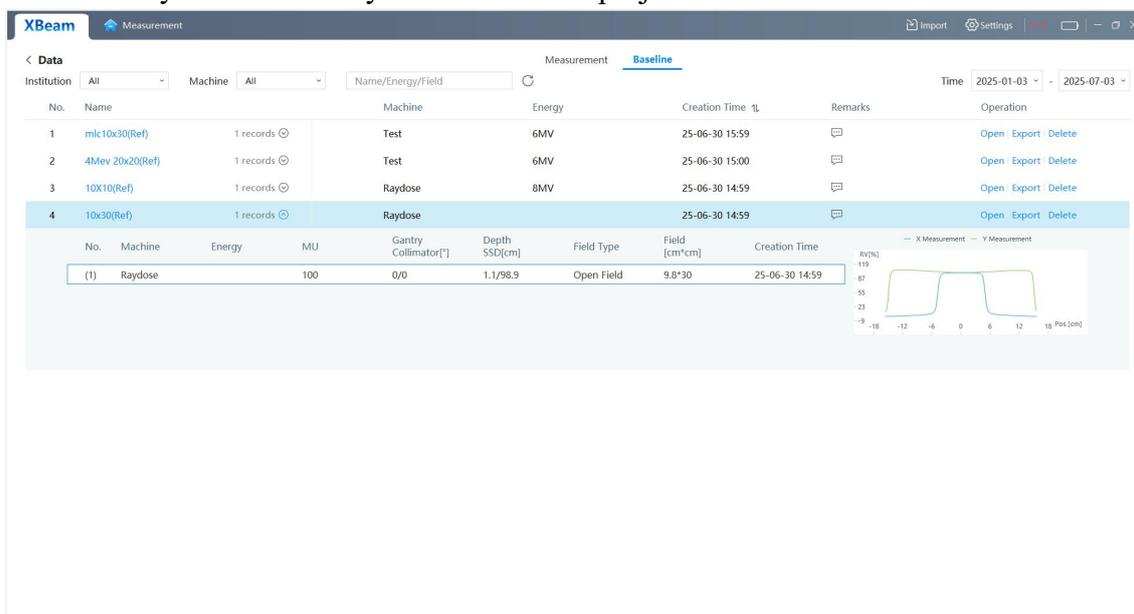


Figure 6. Management_Baseline

5.4. Functional Module

5.4.1. Settings

Click  to enter the settings page, where users can configure custom settings.

(1) User and Device

Click "User and Device" in the left sidebar to access the page.

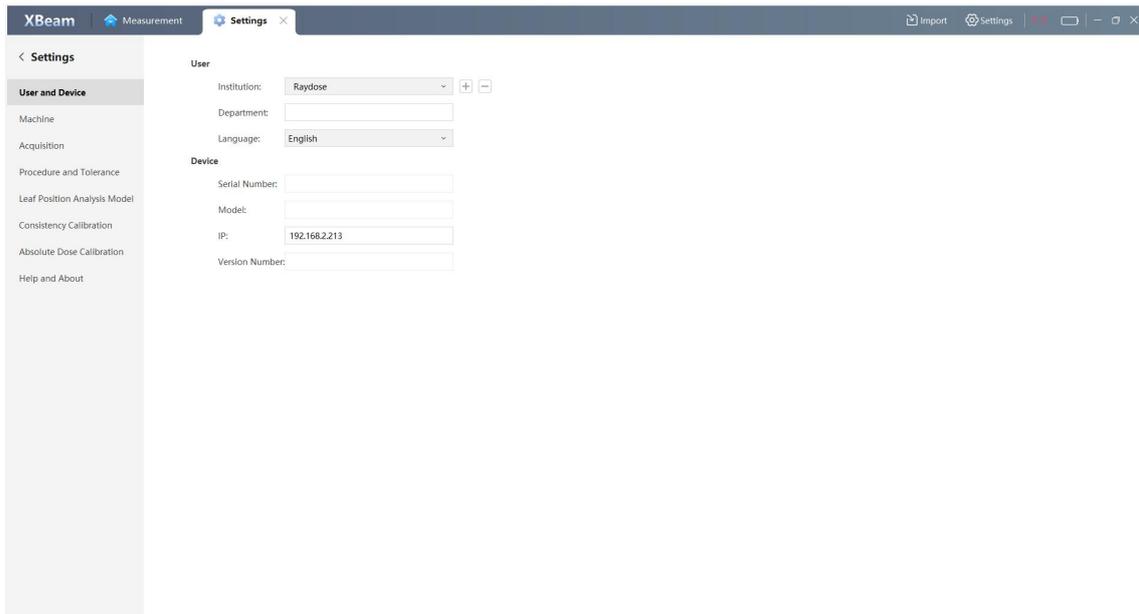


Figure 7. Settings_User and Device

- User: Click to add an institution, and click to delete the selected institution. Additionally, users can switch between the Chinese and English versions in the language section. *Note: The XBeam software must be restarted for the language change to take effect.*
- Device: Once the BeamCheck device is successfully connected to the XBeam software, XBeam will automatically read and display its serial number, model, IP, and version number.

(2) Machine

Click "Machine" in the left sidebar to access the page.

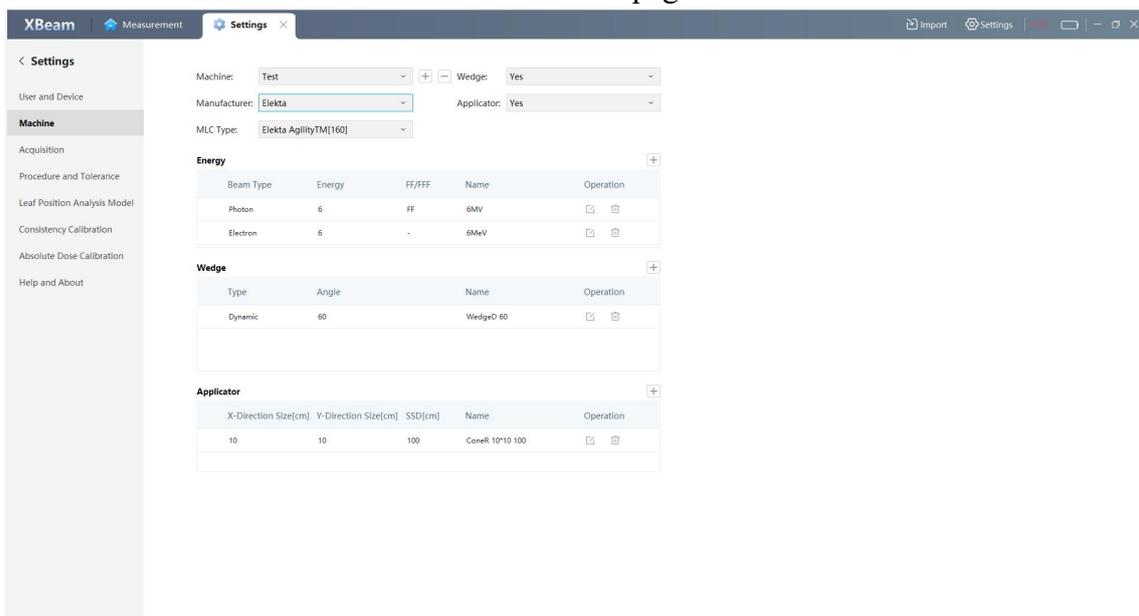


Figure 8. Settings_Machine

- Click to add a new machine, and click to delete the selected machine.

- Click  to edit the data, and click  to delete the corresponding data. Once in edit mode, the icons will change to  and  : click  to save changes, click  to cancel changes.

- The currently supported MLC types are as follows:

Brand	Supported MLC Types
Elekta	Elekta AgilityTM[160] Elekta MLC[80] Elekta ML Ci2[80]
Varian	Varian HD[120] Varian Millennium[120] Varian Millennium[80]
SHINVA	SHINVA MLC[80]
Siemens	Siemens[82]

- Note: The applicator table will only appear when an electron beam type is added.

(3) Acquisition

Click "Acquisition" in the left sidebar to access the page.

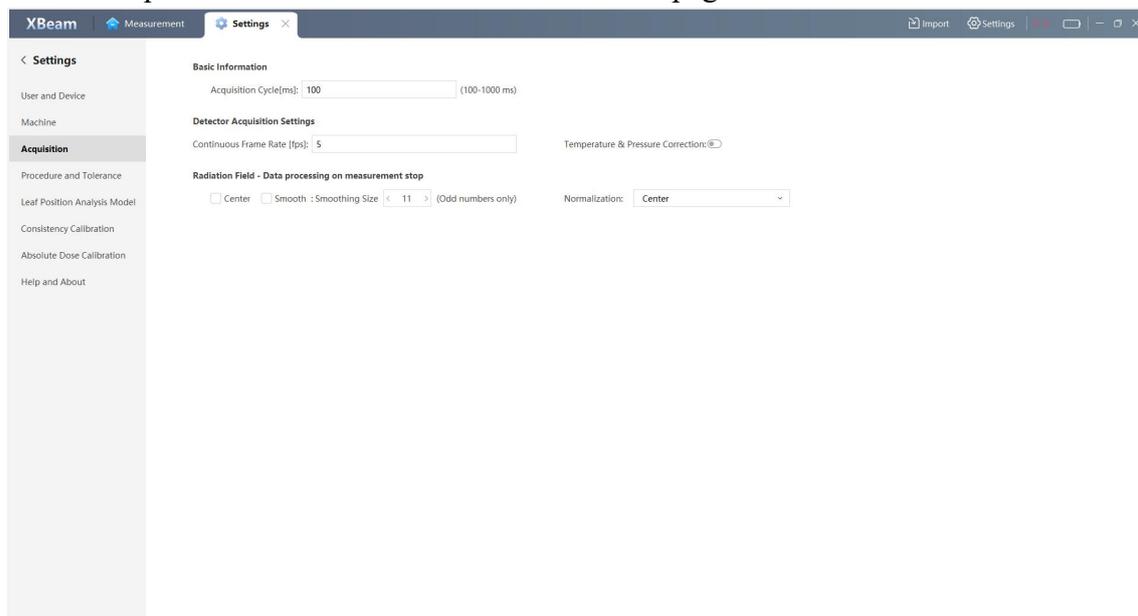


Figure 9. Settings_Acquisition

Function	Description
Basic Information	Used to set the data acquisition cycle, with a configurable range of 100 - 1000 ms.
Detector Acquisition Settings	<ul style="list-style-type: none"> ➤ Continuous Frame Rate: <ul style="list-style-type: none"> • Used to set the number of data acquisition frames; effective only when continuous mode is enabled. ➤ Temperature & Pressure Correction: <ul style="list-style-type: none"> • The BeamCheck device includes temperature and pressure sensors to automatically measure ambient temperature and pressure.

	<ul style="list-style-type: none"> When this function is enabled, the software will automatically apply temperature and pressure correction to the data after each measurement; when disabled, the measurement records will retain their original values without correction. Note: If the measurement data has already been corrected for temperature and pressure, and the user wants to view the uncorrected data, they can disable the temperature and pressure correction function and reanalyze the data on the main page. This operation will display all data in the current project as "uncorrected." If the function is enabled again and the data is reanalyzed, it will revert to the "corrected" state.
<p>Radiation Field - Data processing on measurement stop</p>	<p>Used to automatically process data after measurement completion. Users can enable the following options as needed:</p> <ul style="list-style-type: none"> Center: Automatically aligns the center of the measurement curve with the coordinate center. Smooth: Apply Gaussian smoothing to the measurement records. Supported smoothing sizes are 3, 5, 7, 9, and 11. Normalization: Automatically normalizes the measurement records, supporting two modes: "Center" (normalized to the center point value) and "Maximum Value" (normalized to the maximum value). After normalization, the measurement data is displayed as a percentage.

(4) Procedure and Tolerance

Click "Procedure and Tolerance" in the left sidebar to access the page.

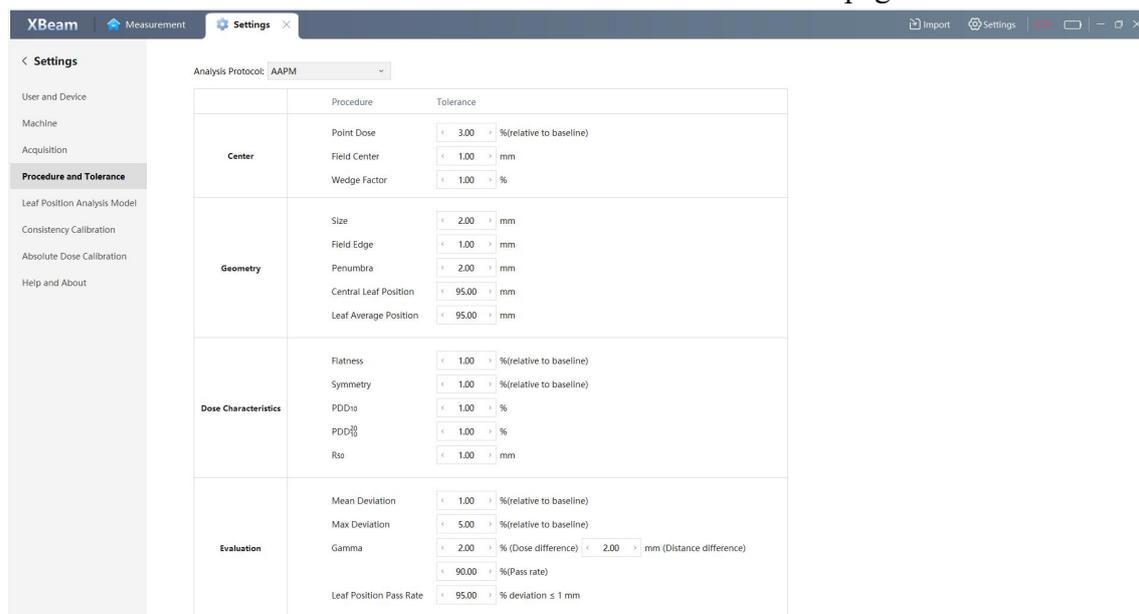


Figure 10. Settings_Procedure and Tolerance

- If the difference between the measurement and the baseline exceeds the tolerance, the deviation will be highlighted in yellow in the analysis results area on the main page. If the deviation is within or equal to the tolerance, the deviation result will be displayed in green.
- When tolerance settings are modified, historical analysis results will be updated accordingly based on the new tolerance standards.
- Supported analysis protocols: AAPM, IAEA, IEC, Varian, Elekta, and GB.

(5) Leaf Position Analysis Model

Click "Leaf Position Analysis Model" in the left sidebar to access the page.

- XBeam calculates the MLC model based on the selected measurement records. Users can choose an appropriate model in the measurement condition settings area for analysis.
- After the analysis is completed, the “Leaf Position” button in the toolbar, along with the central leaf position, leaf average position, and leaf position pass rate in the measurement result analysis area, will display the corresponding results.

The recommended model scheme is as follows:

Scheme	Field Sizes (5 Groups)	Baseline Field	MU
Scheme 1	9.6cm×30cm, 9.8cm×30cm, 10cm×30cm, 10.2cm×30cm, 10.4cm×30cm	10cm×30cm	100MU
Scheme 2	19.6cm×30cm, 19.8cm×30cm, 20cm×30cm, 20.2cm×30cm, 20.4cm×30cm	20cm×30cm	100MU

Important Notes

- MLC model construction must use raw, unprocessed measurement records. If the records have been processed (e.g., smoothed), it may result in analysis errors.
- This model is only applicable to MLC types with a leaf width of 5mm or multiples of 5mm.

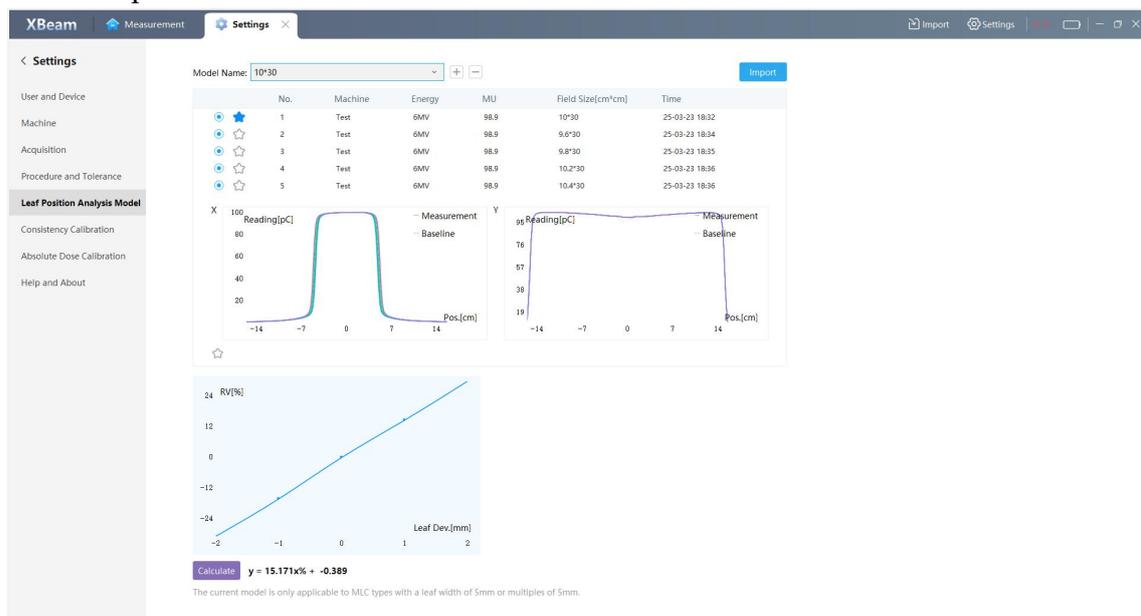


Figure 11. Settings_Leaf Position Analysis Model

Operation Introduction

- Click button to create a new MLC leaf position model. Click button to delete the selected model.
- Click button to import measurement records.
- After importing the measurement records, you can select the data to be used for MLC model by clicking the icon in front of each record. Once selected, the icon will change to . (Each model requires at least 2 records and allows up to 5 records to be selected.)
- Each model requires one baseline to be set. Click the icon in front of the desired record, when the icon changes to , it indicates that the record has been set as the baseline.
- X Chart and Y Chart display the Profile curves of the selected records along the X-axis and Y-axis, respectively. Users can zoom in and out using the mouse scroll wheel.
- Click button to calculate and save the MLC leaf position model. The saved model can be selected and used in the measurement condition settings area on the main page.

(6) Consistency Calibration

Click "Consistency Calibration" in the left sidebar to access the page. Here, users can configure the software's consistency calibration settings. This feature offers two modes: "Default" and "User-Defined".

➤ Default

- The BeamCheck device is factory-calibrated before shipment. In default mode, XBeam will use this factory calibration data for calibration.
- Users can click button in this page to export the default calibration data to their local computer.

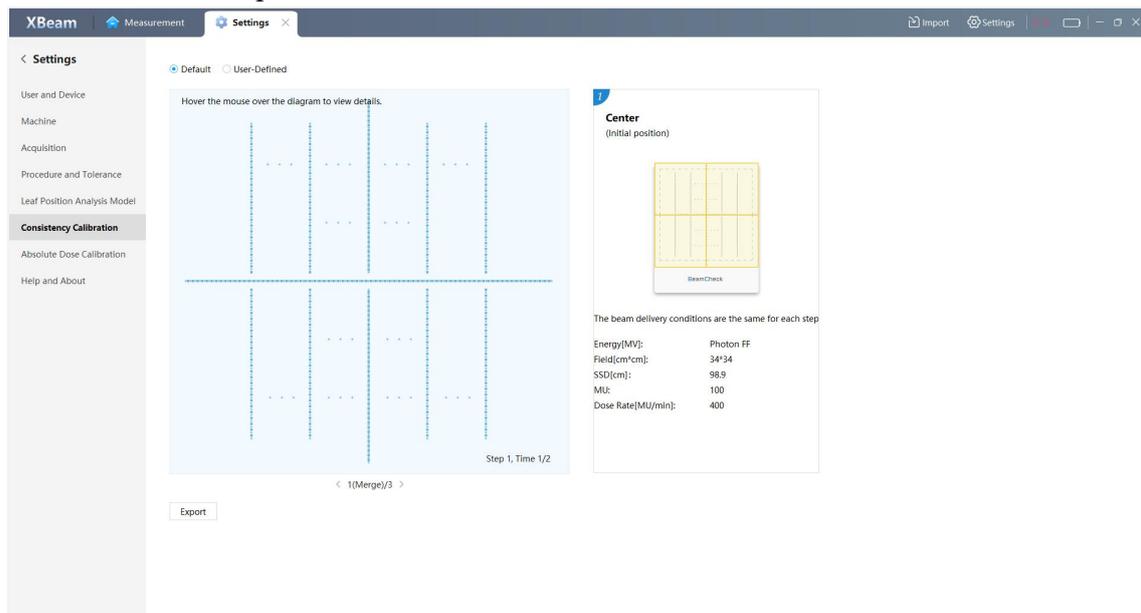


Figure 12. Settings_Consistency Calibration (Default)

➤ User-Defined

If users need to perform consistency calibration using their own accelerator, follow these steps:

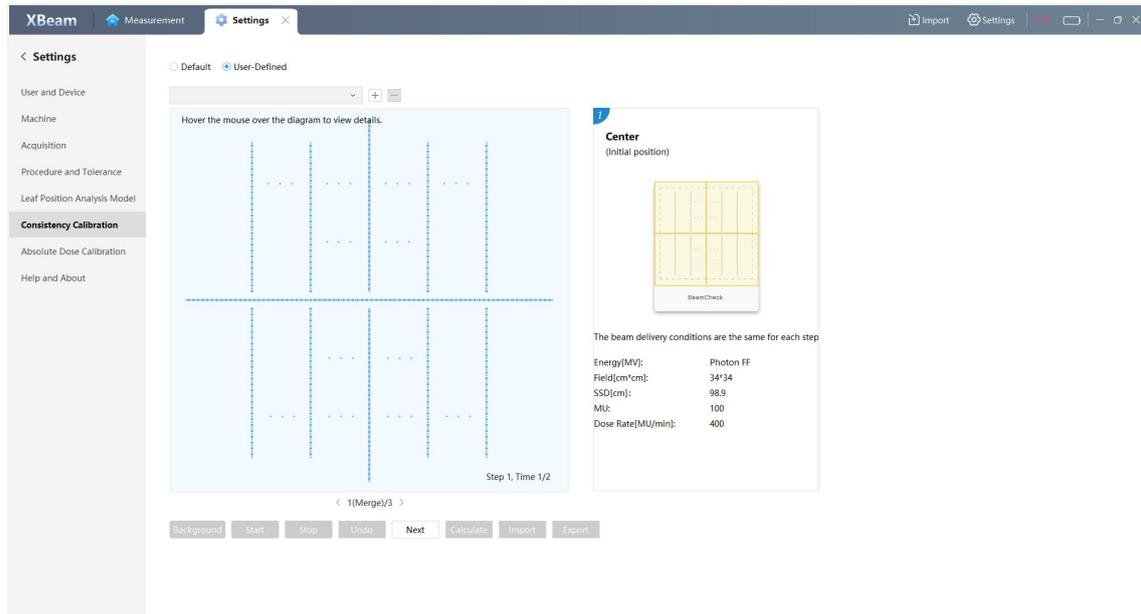


Figure 13. Settings_Consistency Calibration (User-Defined)

Step 1: Device Preparation

- Ensure the BeamCheck device is connected to the computer.
- In the XBeam consistency calibration page, select "User-Defined".

Step 2: Background Measurement

- Click **Background** button to perform a background measurement.
- *Note: If background measurement was already completed in another step, this step can be skipped.*

Step 3: Set Measurement Conditions

- Follow the illustrated guidance on the page to configure the accelerator's measurement conditions.
- After clicking **Start** button, control the accelerator to deliver beam.

Step 4: Perform Measurement

- After the accelerator finishes beam delivery, click **Next** button to proceed to the next step and continue the measurement.
- Click **Stop** button to end the current measurement and save the data.
- The entire consistency calibration process consists of 8 steps, with 2 measurements required for each step. Please complete each measurement sequentially according to the positioning instructions and beam delivery conditions shown on the page.
- Users can switch between measurements using the **Previous** or **Next** buttons or to view data from each measurement, or to redo the measurement for the current step.
- *Note: If you restart the measurement in the current step, the new data will overwrite the existing data. Please proceed with caution.*

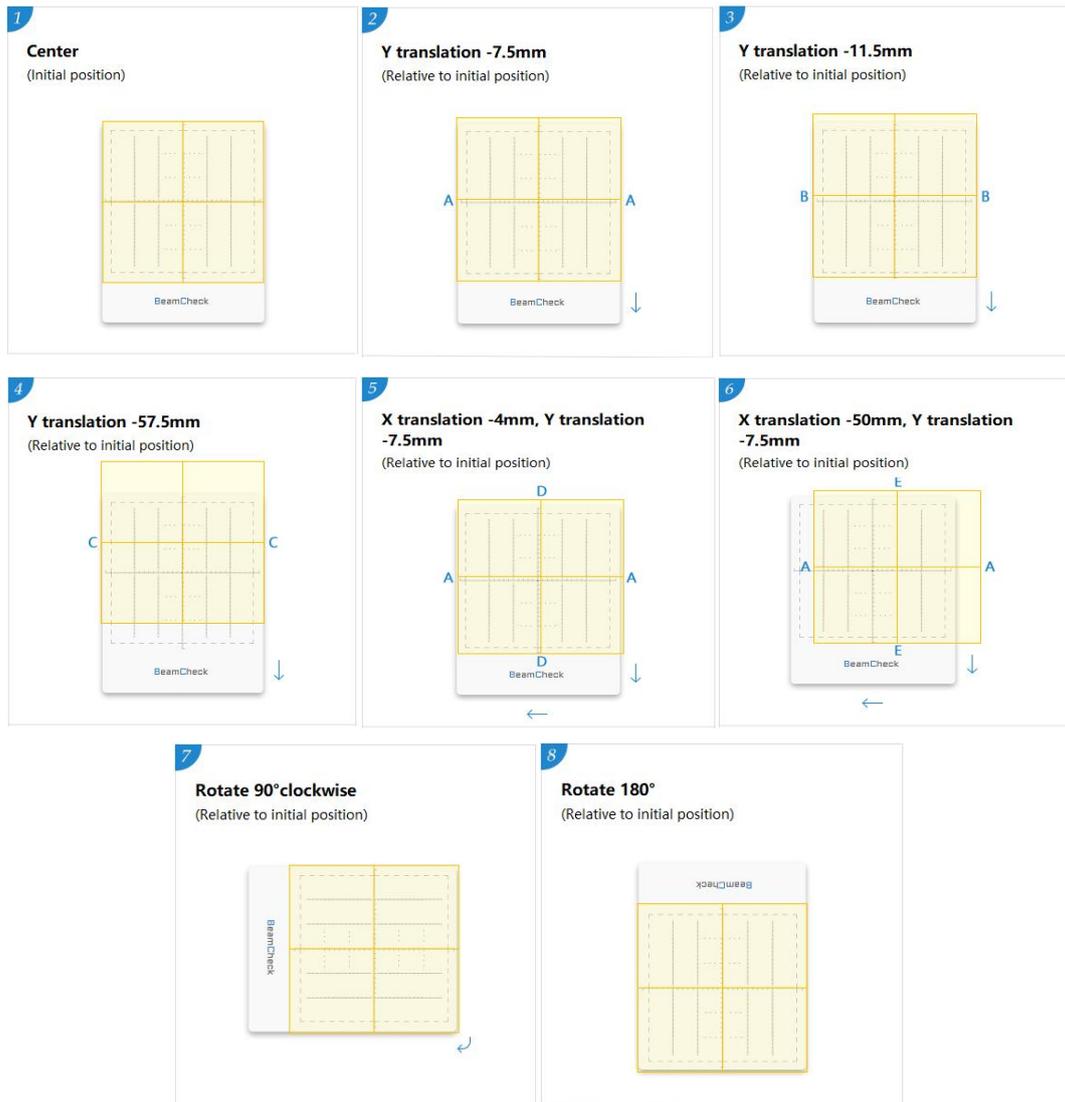


Figure 14. Settings_Consistency Calibration Steps

Step 5: Calculate Consistency Calibration Factor

- After completing the measurements, click button. The software will automatically calculate the consistency calibration factor based on the measured data. Once the calculation is finished, the calibration factor will be saved automatically to the device.

Step 6: Data Import & Export

- Click button to import a consistency calibration factor from local computer into XBeam.
- Click button to export the current consistency calibration factor to local computer.
- *Note: Each time consistency calibration is performed, the existing data will be overwritten. It is recommended to export the data promptly after calibration for archiving purposes.*

(7) Absolute Dose Calibration

Click "Absolute Dose Calibration" in the left sidebar to access the page.

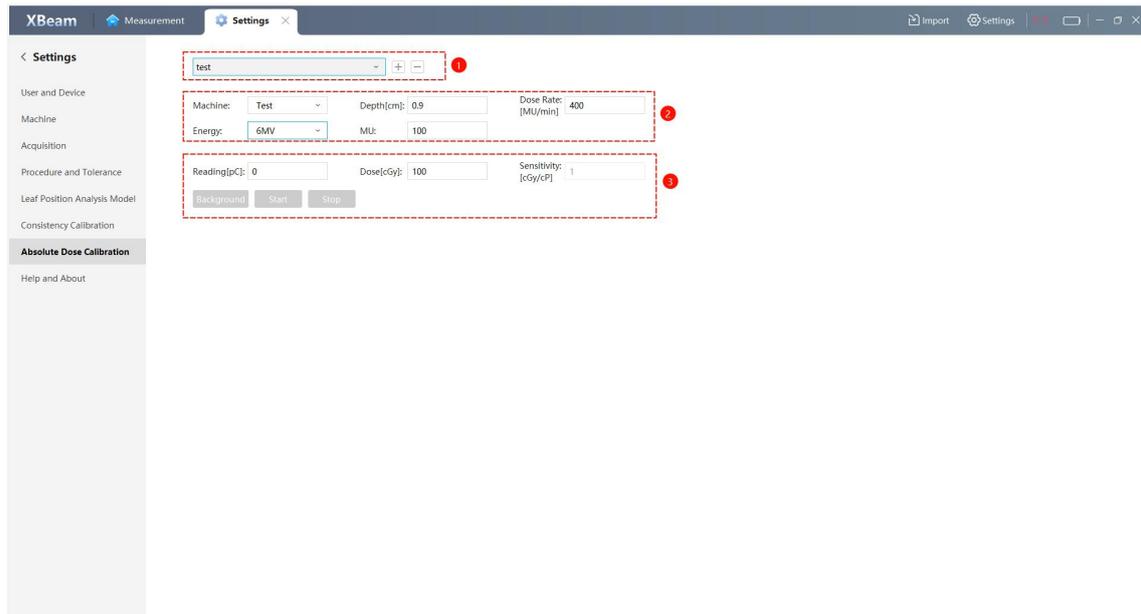


Figure 15. Settings_Absolute Dose Calibration

- ① Absolute Dose Calibration Management Area
 - Users can select an existing absolute dose calibration from the dropdown menu for modification.
 - To add a new calibration, click button , to delete the selected calibration, click button .
- ② Machine Information Editing Area
 - This area is used to record and edit measurement conditions.
 - Users can select a machine and energy from the dropdown menu and input values for depth, MU, and dose rate.
 - Users can click to edit the machine type, energy and wedge. After making changes, click to confirm the modifications or click to cancel them.
 - Any modifications made here will be automatically saved by the software.
- ③ Calibration Calculation Area
 - The steps for absolute dose calibration are as follows:

Step 1. Background Measurement

Click to perform a background measurement.

Note: If background measurement was already completed in another step, this step can be skipped.

Step 2. Dose

Use a dosimeter and solid water to measure the absolute dose output of the accelerator set in ②, and enter the result in the "Dose" field.

Step 3. Beam Delivery

Configure the beam delivery parameters according to the settings in ②.

Click button, then control the accelerator to deliver the beam.

Step 4. Reading

After the accelerator finishes beam delivery, click .

Then the software will automatically populate the "Reading" field and calculate the sensitivity.

(8) Help and About

- Click "Help and About" in the left sidebar to access the page. Users can view detailed information about the product.
- Click  button to export a compressed package containing complete program data. This is primarily used for after-sales service support and troubleshooting of complex issues.

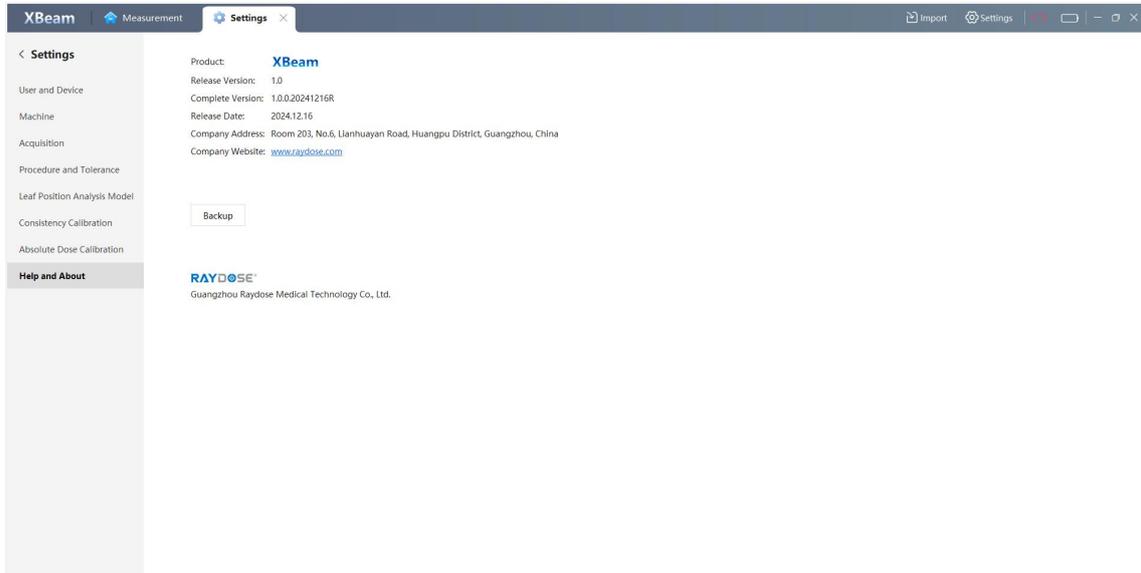


Figure 16. Settings_Help and About

5.4.2. Import

Click  to import measurement data from the computer for analysis. Note that the imported file format must be compatible with the XBeam software.

5.4.3. Report

Click  to generate a report, which will be exported in PDF format.

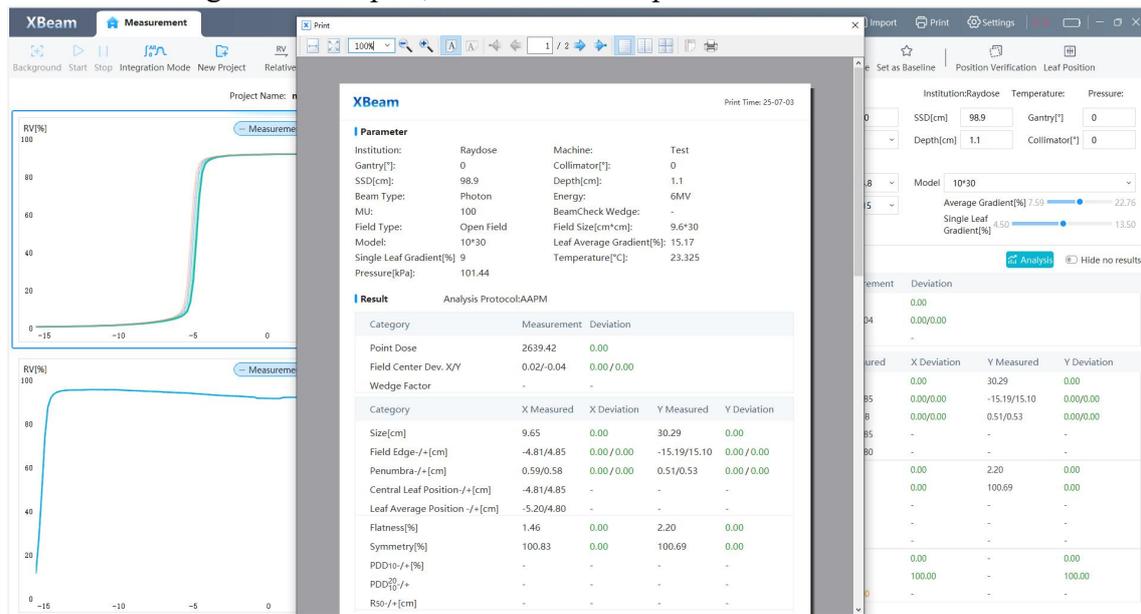


Figure 17. Report

5.5. Toolbar

Based on different functionalities, the toolbar is divided into five categories: Measurement, Curve Post-Processing, Curve Display, Baseline and Analysis.

5.5.1. Measurement

The buttons are used to perform measurement operations, some of which are only available when the BeamCheck is connected.

Button		Description
	Background	Available only after the device is connected, used to measure background radiation. The default measurement duration is 120 seconds.
	Start	This button can only be clicked after background measurement is completed. It is recommended to click it before the accelerator begins beam delivery.
	Stop	It is recommended to click the next button after beam delivery ends. Once clicked, the measurement data will be saved automatically.
	Integration Mode	<ul style="list-style-type: none"> Integration Mode: During measurement, data from each frame is continuously accumulated, causing the measurement curve to steadily rise until it displays the total sum of all frames. The interface updates in real-time to show the analysis results of the cumulative data. Continuous Mode: During measurement, only the accumulated data within the set number of continuous frames are displayed, causing the measurement curve to change dynamically. After measurement ends, the total sum of all frames is displayed. The number of frames can be adjusted in the [Settings → Acquisition] . Both modes can be switched using the same button and support switching during measurement.
	Continuous Mode	
	New Project	After creating a new blank project, users can perform measurements within it to generate new measurement records, or copy and paste measurement records from other open projects into this project.

5.5.2. Curve Post-Processing

These buttons are used to edit the measurement curves.

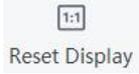
Button		Description
	Absolute Value	<ul style="list-style-type: none"> Absolute Value: Uses the raw readings as the Y-axis of the graph.

 Relative	Relative Value	<ul style="list-style-type: none"> Relative Value: Uses the normalized values as the Y-axis of the graph. Both modes can be switched using the same button.
 Smooth	Smooth	<ul style="list-style-type: none"> Applies smoothing to the measurement curve based on the specified smoothing size. The smoothing size can be adjusted in [Settings → Acquisition] under the "Smoothing Size" option.
 Center	Center	<ul style="list-style-type: none"> Aligns the center of the measurement curve with the coordinate center.
 Interpolation	Interpolation	<ul style="list-style-type: none"> Performs interpolation on the X and Y axes. Clicking the button opens the "Interpolation Spacing" settings window, where users can define the interpolation spacing. Interpolation does not delete the original data but fills in new points between existing points based on current data.
 Symmetry	Symmetry	<ul style="list-style-type: none"> Applies symmetry operations to the measurement curve. Clicking the button opens a selection window with three symmetry modes: "Left", "Right", and "Left-Right Average".
 Rotate and Move	Rotate and Move	<ul style="list-style-type: none"> Allows rotation and translation of the curve. Clicking the button opens a settings window where users can specify translation distances along the X and Y axes and set the rotation angle (only 0° and 180° are supported).
 Restore	Restore	<ul style="list-style-type: none"> Cancels all adjustments made to the curve and restores it to its original acquired state.

5.5.3. Curve Display

These buttons are used to adjust the display effect of the main page.

Button	Description
 Single Project	<ul style="list-style-type: none"> Single Project: Displays all records of one measurement project. The X-axis image is shown at the top, and the Y-axis image at the bottom. Dual Project: Simultaneously displays two measurement projects. The upper window shows the X and Y axis images of one project, while the lower window shows those of the other project. In these two modes, after selecting an area (blue border appears at the edges), you can perform operations on the measurement curves within that area. Both modes can be switched using the same button.
 Dual Project	

	<h3>Reset Display</h3>	<ul style="list-style-type: none"> Restores the current window to its default display scale. This operation only affects the display zoom level and does not affect other curve processing operations such as symmetry or interpolation.
---	------------------------	--

➤ Single Project

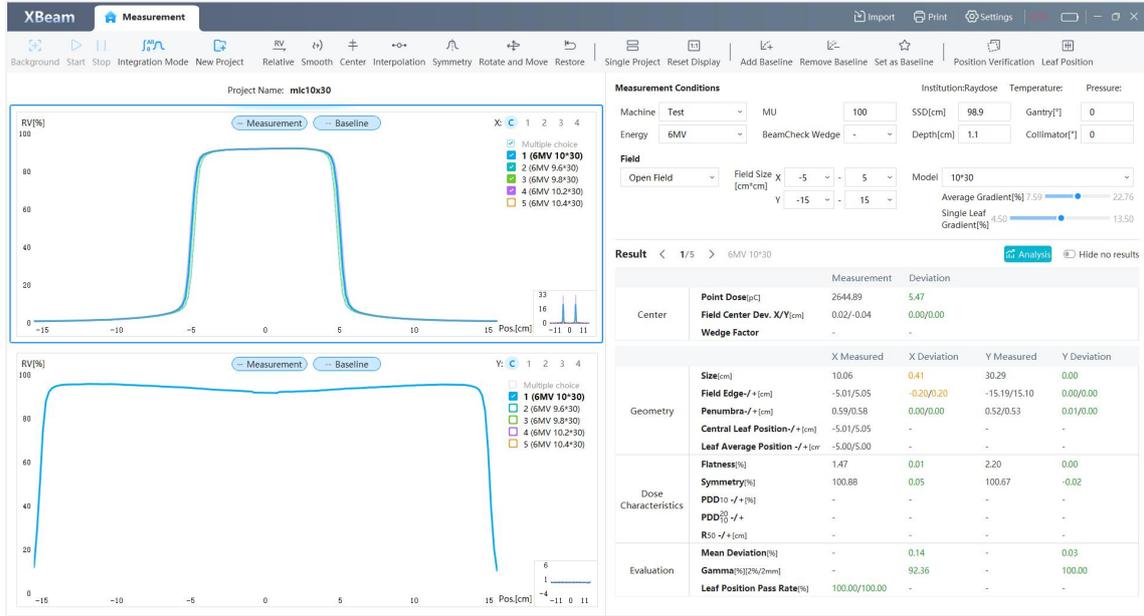


Figure 18. Toolbar_Curve Display (Single Project)

➤ Dual Project

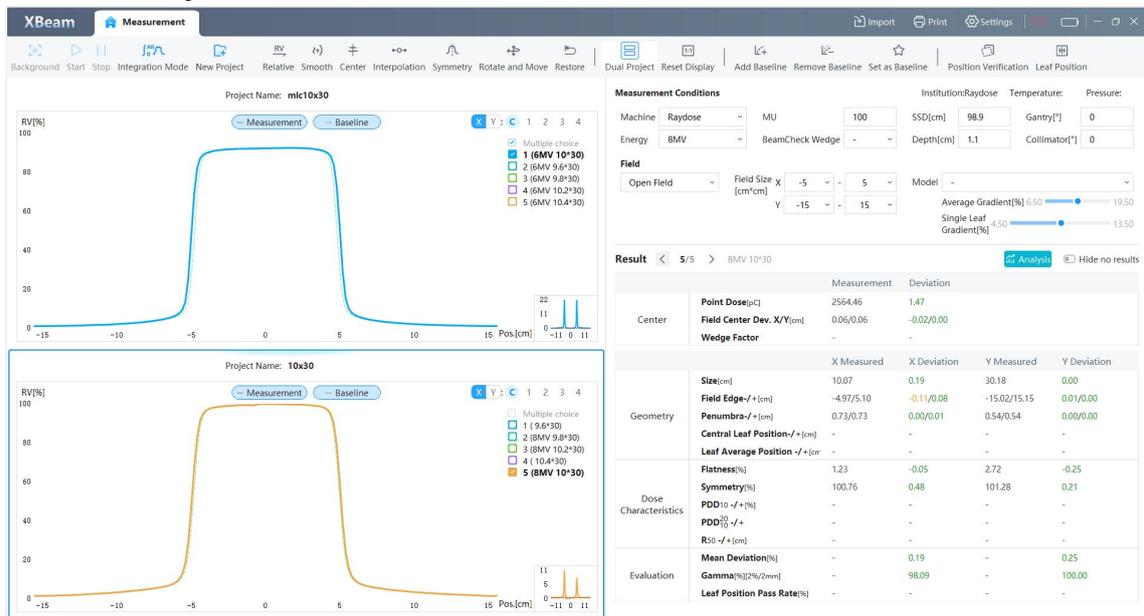
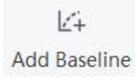


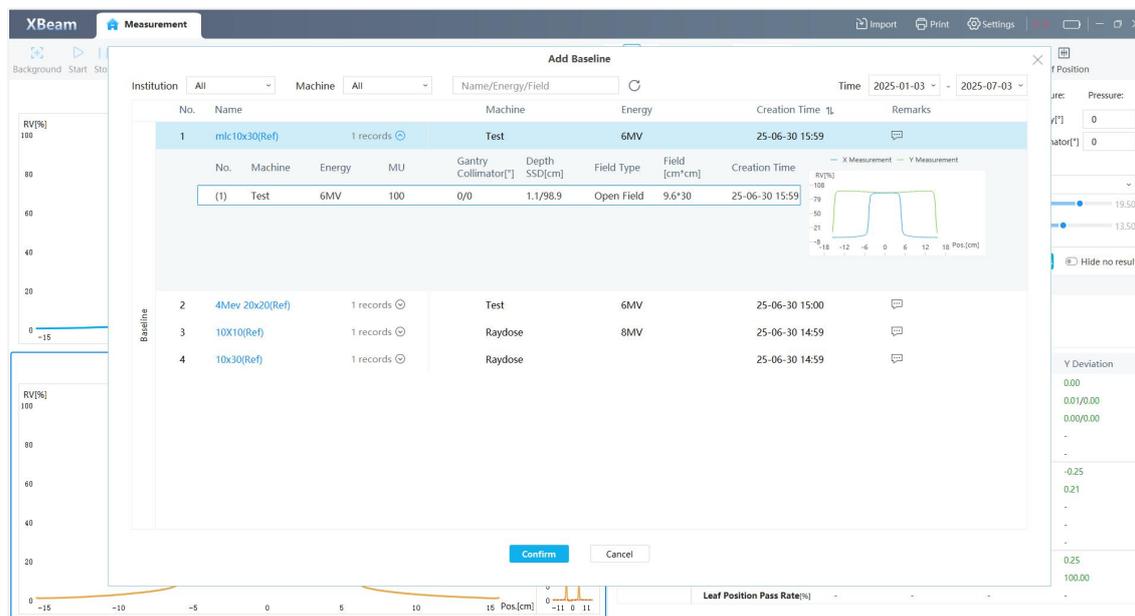
Figure 19. Toolbar_Curve Display (Dual Project)

5.5.4. Baseline

These buttons are used to set the baseline.

Button		Description
	Add Baseline	<ul style="list-style-type: none"> Click this button to select a measurement record and import it as a baseline. Once added, the software will automatically perform the analysis. Each project supports only one baseline. If a baseline already exists, importing a new one will overwrite the previous baseline. Note: Baseline added through this operation will not be stored in the [XBeam → Baseline].
	Remove Baseline	<ul style="list-style-type: none"> Click this button to remove the added baseline. After removal, the software will reanalyze the data and automatically save the results.
	Set as Baseline	<ul style="list-style-type: none"> Click this button to save the selected measurement curve to the [XBeam → Baseline]. Saved baseline can be viewed and managed in the [XBeam → Baseline].

➤ Add Baseline



The screenshot shows the 'Add Baseline' dialog box in the XBeam software. The dialog contains a table of measurement records:

No.	Name	Machine	Energy	MU	Gantry Collimator[*]	Depth SSD[cm]	Field Type	Field [cm*cm]	Creation Time
1	mic10x30(Ref)	Test	6MV	100	0/0	1.1/98.9	Open Field	9.6*30	25-06-30 15:59
2	4Mev 20x20(Ref)	Test	6MV						25-06-30 15:00
3	10X10(Ref)	Raydose	8MV						25-06-30 14:59
4	10x30(Ref)	Raydose							25-06-30 14:59

The dialog also features a graph showing RV[%] vs Pos[cm] for X and Y measurements, and 'Confirm' and 'Cancel' buttons at the bottom.

Figure 20. Toolbar_Baseline (Add Baseline)

5.5.5. Analysis

These buttons are used to assist analysis.

Button		Description
	Positioning Verification	<ul style="list-style-type: none"> Click this button to view the positioning information of the selected measurement record, including position offset and angular deviation.
	Leaf Position	<ul style="list-style-type: none"> Click this button to open the MLC Details window, where users can check MLC-related information for the selected measurement record, including: mean deviation, max deviation, min deviation, leaf position pass rate and MLC leaf position deviations. In the MLC leaf position deviation area, clicking on data in the table or on ion chamber points in the image will display the corresponding leaf number and physical position in the top-left corner of the image. Click the buttons  and  to switch and view between measurement data of different layers: upper layer (upper), lower layer (lower), and merged layer (Merge). After switching, the corresponding images and analysis results will be updated in real time on the main interface.

➤ Positioning Verification

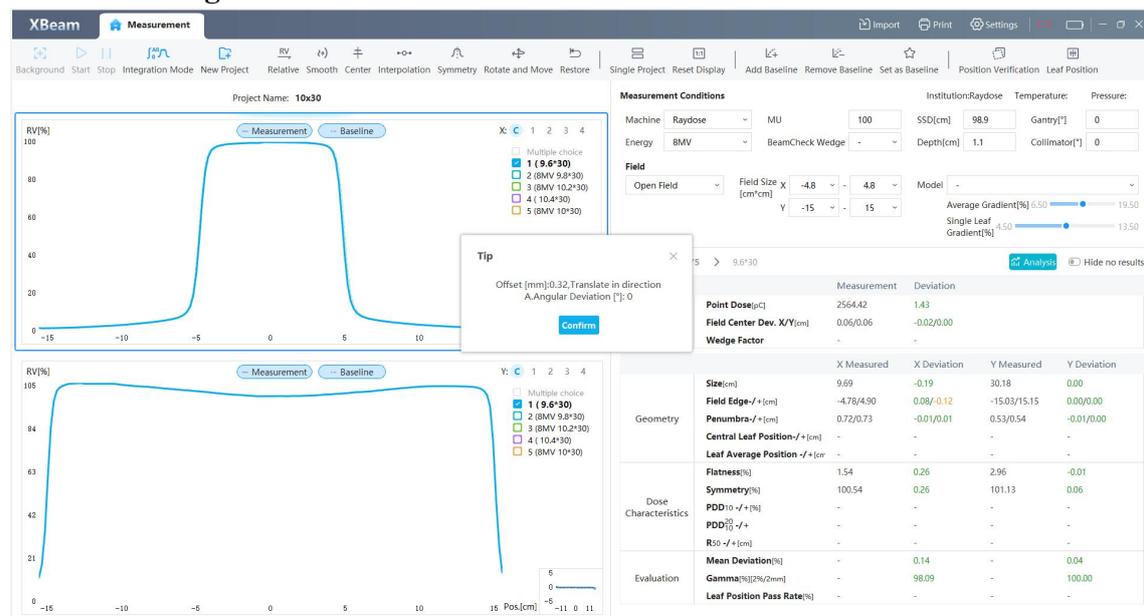


Figure 21. Toolbar_Analysis (Positioning Verification)

- Relative values: Displayed as normalized values in %, with the normalization method configurable under [Settings → Acquisition].
 - Absolute values: Displayed as actual readings. If absolute dose calibration has been completed for the selected machine during measurement, the unit is cGy; otherwise, it is pC.
 - Note: Changing the machine after measurement will not affect the unit display of already generated data.
- ③ Curve Display Type: Click to choose which curves to display (measurement only, baseline only, or both.)
- Solid line: Represents the measurement curve.
 - Dashed line: Represents the baseline curve.
- ④ Indicating X-Direction Measurement Results.
- Click the C, 1, 2, 3, 4 icons to switch between different measurement curves.
 - Each column is explained in the diagram below.

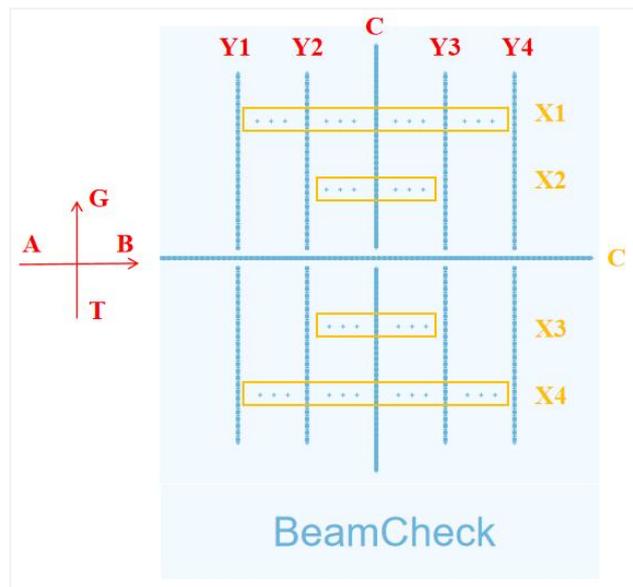


Figure 24. BeamCheck Coordinates Explanation

- ⑤ Curve display control: After selecting the corresponding column in ④, you can control the display of measurement curves by clicking the legend.
- When “Multiple choice” is not checked: Clicking a legend item switches the display to the selected curve only.
 - When “Multiple choice” is checked: Clicking a legend item adds the corresponding curve to the chart. To remove a curve, simply uncheck the box in front of the legend item.
- ⑥ Baseline vs. Measurement Deviation Chart
- This chart appears only after clicking “Add Baseline” in the toolbar. If “Remove Baseline” is clicked, the chart disappears.
 - Clicking on the chart enlarges the deviation view. Clicking again switches back to the measurement curve view.
- ⑦ Curve Operations Area

- Moving the mouse over this area displays the X and Y coordinate values of the selected curve.
- Right-clicking a selected curve opens a menu with the following options:

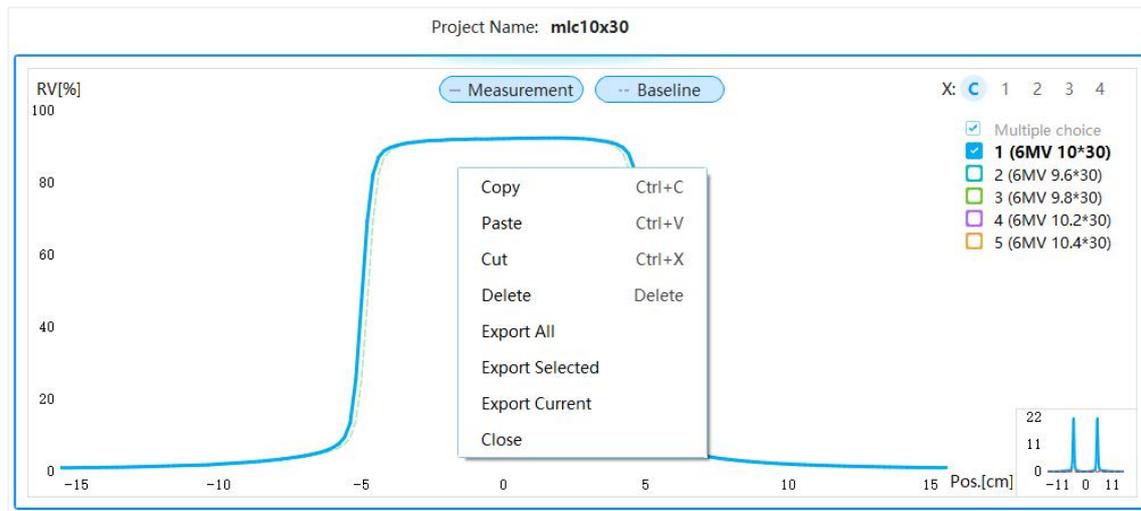


Figure 25. Curve Display Area_Right-Click Functions

Function	Shortcut	Description
Copy	Ctrl + C	Copies the selected curve, which can be pasted into another project.
Paste	Ctrl + V	Pastes a previously cut/copied curve.
Cut	Ctrl + X	Cuts the selected curve, removes it from the image, and allows it to be pasted into another project.
Delete	Delete	Deletes the selected curve.
Export All	-	Exports all records under the current project.
Export Selected	-	Exports all checked records in the project.
Export Current	-	Exports only the currently selected record.
Close	-	Closes the current project.

5.6.2. Dual Project

The dual project view mode allows users to perform cross-project comparisons and analysis. Its operation is similar to the single project view. There are three ways to open another project in dual project view:

- **Open imported data:** Select a section, then click  in the upper left corner to enter the data management page and double-click a project to open.
- **Open unimported data:** Select a section, then click  in the upper right corner to import and open a project from the local computer.
- **Create a new project:** Select a section, then click  in the toolbar to create a new project. After creation, you can use the right-click menu to copy measurement curves from other projects into the new one.

5.7. Measurement Condition Settings Area

Users can set measurement conditions in this area. After configuration, click button  in the toolbar to start the measurement.

Measurement Conditions Institution: Raydose Temperature: Pressure:

Machine: Test MU: 100 SSD[cm]: 98.9 Gantry[°]: 0

Energy: 6MV BeamCheck Wedge: - Depth[cm]: 1.1 Collimator[°]: 0.1

Field

Open Field Field Size [cm*cm] X: -5 - 5 Model: -

Y: -5 - 5

Average Gradient[%]: 6.50 — 19.50

Single Leaf Gradient[%]: 4.50 — 13.50

Figure 26. Measurement Condition Settings Area

Name		Description
Basic Information	Institution	Displays the current institution associated with the measurement. It can be modified in [Settings → User and Device].
	Temperature	The BeamCheck device has a built-in temperature sensor that automatically records the temperature during measurement. Users can configure automatic temperature correction in [Settings → Acquisition].
	Pressure	The BeamCheck device has a built-in pressure sensor that automatically records the air pressure during measurement. Users can configure automatic pressure correction in [Settings → Acquisition].
Measurement Conditions	Machine	Records the type of accelerator being used. It can be configured in [Settings → Machine].
	MU	Records the beam output (unit: MU).
	SSD	Records SSD (unit: cm).
	Gantry	Records the gantry angle (unit: °).
	Energy	Records the energy. It can be configured in [Settings → Machine].
	BeamCheck Wedge	Records whether a BeamCheck Wedge was used during measurement. Users can select "Yes" or "-"(No) from the dropdown menu.
	Depth	Records the equivalent water depth (unit: cm).
	Collimator	Records the collimator angle (unit: °).
Field	Open Field	Selecting "Open Field" indicates that no wedge was used during the measurement. Under this condition, users can choose whether to apply the MLC model for analysis.

		<ul style="list-style-type: none"> ➤ Without MLC Model • In the "Model" dropdown menu, selecting "-" means the MLC model is not used for analysis. ➤ With MLC Model • In the "Model" dropdown menu, select the corresponding MLC model. The MLC model can be configured in [Settings → Leaf Position Analysis Model]. • If MLC model is selected, users can manually adjust the average leaf gradient and individual leaf gradient. These adjustment ranges are calculated based on the selected MLC model. • Average Gradient: Adjust the gradient of all leaves at the same time. • Single Leaf Gradient: Adjusts the gradient only for failed leaves. • Leaf Pass Rate: Click the "Leaf Position" button in the toolbar to view the pass rate of each leaf pair. Green indicates the pass rate is within tolerance, while orange indicates it is out of tolerance.
	Wedge	<ul style="list-style-type: none"> • Select the wedge from the dropdown menu. The wedge can be configured in [Settings → Machine]. • When measuring with a wedge, the corresponding open field must be imported. Click <input type="button" value="Add Field"/> to select and import the field.
	Field Size	Records the field size.

5.8. Measurement Result Analysis Area

		Measurement	Deviation		
Center	Point Dose[pC]	2639.42	0.00		
	Field Center Dev. X/Y[cm]	0.02/-0.04	0.00/0.00		
	Wedge Factor	-	-		
		X Measured	X Deviation	Y Measured	Y Deviation
Geometry	Size[cm]	9.65	0.00	30.29	0.00
	Field Edge-/+ [cm]	-4.81/4.85	0.00/0.00	-15.19/15.10	0.00/0.00
	Penumbra-/+ [cm]	0.59/0.58	0.00/0.00	0.51/0.53	0.00/0.00
	Central Leaf Position-/+ [cm]	-	-	-	-
	Leaf Average Position -/+ [cm]	-	-	-	-
Dose Characteristics	Flatness[%]	1.46	0.00	2.20	0.00
	Symmetry[%]	100.83	0.00	100.69	0.00
	PDD ₁₀ -/+ [%]	-	-	-	-
	PDD ₁₀ ²⁰ -/+	-	-	-	-
	R50 -/+ [cm]	-	-	-	-
Evaluation	Mean Deviation[%]	-	0.00	-	0.00
	Gamma[%][2%/2mm]	-	100.00	-	100.00
	Leaf Position Pass Rate[%]	-	-	-	-

Figure 27. Measurement Result Analysis Area

- ① Switching Measurement Records in This Area.
 - The gray number (e.g., "5") indicates the total number of measurement records under the current project. The black number (e.g., "2") represents the number of the currently viewed measurement record.
 - User can switch between different measurement records by clicking < and >.
 - ★ indicates the baseline record.
- ② Display of the Current Measurement Record Name. This area shows the name of the measurement record currently being viewed.
- ③ Measurement Result Analysis Button
 - If a baseline has been added, clicking will analyze the selected measurement record.
 - Supported analysis protocols include AAPM, IAEA, IEC, Varian, Elekta, and GB, which can be configured in [Settings - Procedure and Tolerance].
- ④ Hide No Results Button. The software analyzes the measurement results based on measurement conditions. If a procedure cannot be analyzed, you can hide it by clicking this button.
- ⑤ Display of Measurement Result Analysis.
 - Without a baseline: Only the measured values are displayed, and deviation analysis is not provided.
 - With a baseline: Clicking to analyze all measurement records of the current project.

- Yellow values: The deviation between the measured value and the baseline value exceeds the tolerance range.
- Green values: The deviation between the measured value and the baseline value is within the tolerance range.
- The tolerance can be adjusted in [Settings → Procedure and Tolerance].
- The description of each procedure is as follows:

Procedure	Description
Point Dose	<ul style="list-style-type: none"> • The dose value at the center of the BeamCheck device, calculated as the average of five measurement points at the center position along the X-axis. • If the machine has completed absolute dose calibration, the point dose will be displayed as an absolute dose (unit: cGy), otherwise, it will be shown as a raw reading (unit: pC).
Field Center Dev. X/Y	The position deviation of the radiation field center relative to the device center in the X and Y directions (unit: cm).
Wedge Factor	The transmission factor of the accelerator's wedge filter.
Size	The radiation field size (unit: cm).
Field Edge-/+	The position of the radiation field edges along the coordinate axes (unit: cm).
Penumbra-/+	(unit: cm).
Central Leaf Position-/+	The position of the MLC leaves along the X-axis (unit: cm).
Leaf Average Position-/+	The average position of all MLC leaves (unit: cm).
Flatness	(Unit: %).
Symmetry	(Unit: %).
$PDD_{10-/+}$	Under photon beam irradiation, the measured data after passing through the BeamCheck Wedge is converted into a PDD curve. The dose percentage at an equivalent depth of 10 cm is taken (unit: %).
PDD_{10}^{20}	Under photon beam irradiation, the measured data after passing through the BeamCheck Wedge is converted into a PDD curve. The ratio of dose percentages at equivalent depths of 20 cm and 10 cm is calculated (unit: %).
$R_{50-/+}$	Under electron beam irradiation, the measured data after passing through the BeamCheck Wedge is converted into a PDD curve. The depth corresponding to 50% of the maximum dose is taken (unit: cm).
Mean Deviation	The average percentage deviation of the measured values relative to the baseline values within the flat region.
Gamma [2%/2mm]	The percentage of measurement points within the flat region where the dose difference between measured and baseline values is within 2%, and the distance difference is within 2 mm (unit: %).
Leaf Position Pass Rate	The percentage of MLC positions deviations within the tolerance range (unit: %).

6. User Guide

6.1. Overview

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

6.2. Preparation Before Use

6.2.1. Connect the BeamCheck and Computer

(1) Overview

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

(2) Operating Instructions

- Power on BeamCheck and connect it to the computer or local network via an Ethernet cable.
- Open the Xbeam software. If the top icon indicates no connection, there are two methods to establish a connection.
 - Method 1:
 - Open Xbeam software: [Settings → User and Device].
 - Enter the default IP address: 192.168.2.213 under the device settings.
 - After modification, verify that the device information is populated and check if the icon  changes  to the connected state. If the icon remains unchanged, try Method 2.
 - Method 2:
 - Open the computer's [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, excluding 213; 10 is recommended).
 - Subnet Mask: [255.255.255.0] (fixed value).
 - Save the settings and return to the Xbeam main page to check the connection status. If the icon shows , it means that BeamCheck is successfully connected to the computer.
 - If the icon still shows , it means BeamCheck has failed to connect to the computer. Please contact Raydose technical support for assistance.

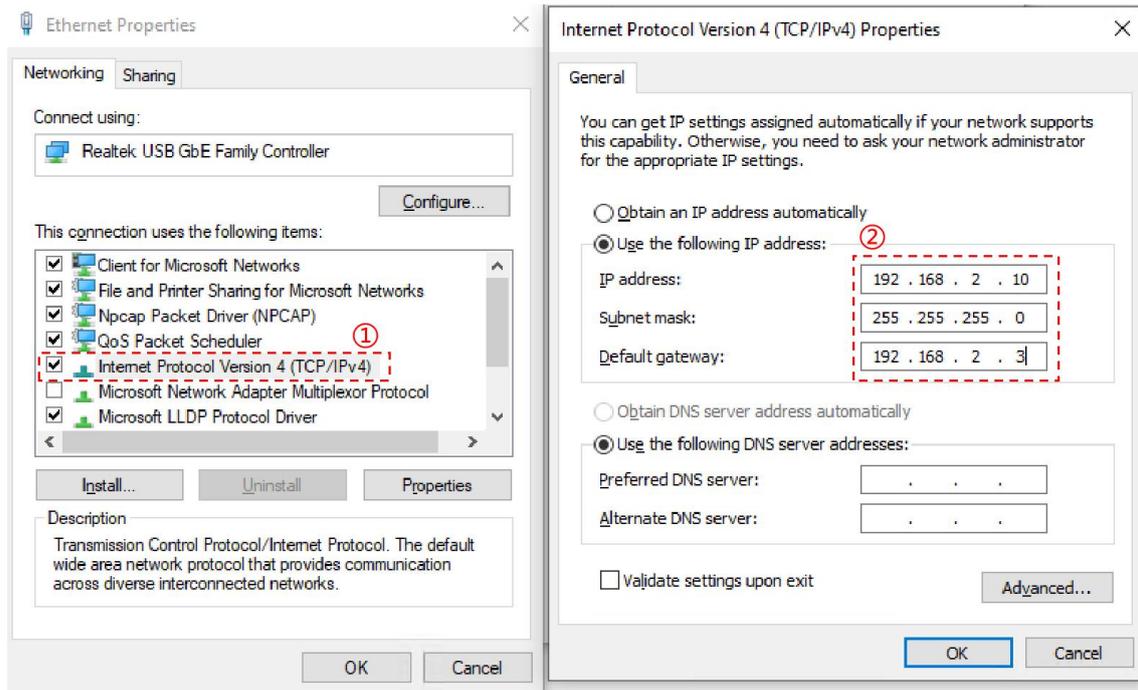


Figure 28. Network connection settings

6.2.2. Consistency Calibration

(1) Overview

- The BeamCheck undergoes consistency calibration before leaving the factory. The user can also perform a user-defined calibration before use.
- It is recommended to perform consistency calibration once a year to ensure measurement accuracy and device performance.
- If significant differences are observed between the measurement and the baseline in the Profile, users should check the configuration parameters and determine whether recalibration is necessary.

(2) Operating Instructions

Step 1: Positioning

- Set the gantry and collimator of the linear accelerator to 0°, and ensure the treatment couch is in a horizontal position.
- Place the BeamCheck steadily on the treatment couch, connect all cables, and confirm that the device is powered on.
- Turn on the room lasers and adjust the couch height to align the lasers precisely with the crosshairs on the side of BeamCheck.
- Open the accelerator's light field and ensure that the crosshair at the center of the field precisely aligns with the coordinate axes on BeamCheck.

Step 2: Stabilization and Pre-irradiation

- After powering on BeamCheck, allow it to remain stationary for at least 30 minutes to stabilize internal temperature and pressure.
- Ensure the MLC of the accelerator is fully opened. Adjust the field size to fully cover all ion chambers in BeamCheck (a recommended field size is 34

cm × 34 cm).

- Set the beam output to 400 MU and perform a pre-irradiation. After the pre-irradiation is complete, wait for 1 minute before proceeding.

Step 3: Consistency Calibration

- Open the Xbeam software on a computer connected to BeamCheck.
- Navigate to [Settings → Consistency Calibration] and click "User-Defined".
- Click **Background** button to perform a background measurement.
- *Note: If background measurement was already completed in another step, this step can be skipped.*
- Follow the illustrated guidance on the page to configure the accelerator's measurement conditions.
- After clicking **Start** button, control the accelerator to deliver beam.
- After the accelerator finishes beam delivery, click **Next** button to proceed to the next step and continue the measurement.
- Click **Stop** button to end the current measurement and save the data.
- The entire consistency calibration process consists of 8 steps, with 2 measurements required for each step. Please complete each measurement sequentially according to the positioning instructions and beam delivery conditions shown on the page.
- Users can switch between measurements using the **Previous** or **Next** buttons or to view data from each measurement, or to redo the measurement for the current step.
- *Note: If you restart the measurement in the current step, the new data will overwrite the existing data. Please proceed with caution.*
- After completing the measurements, click **Calculate** button. The software will automatically calculate the consistency calibration factor based on the measured data. Once the calculation is finished, the calibration factor will be saved automatically to the device.

6.2.3. Absolute Dose Calibration

(1) Overview

After completing the consistency calibration, it is recommended to perform absolute dose calibration on BeamCheck before starting measurements.

(2) Operating Instructions

Step 1: Positioning

- Set the gantry and collimator of the linear accelerator to 0°, and ensure the treatment couch is in a horizontal position.
- Place the BeamCheck steadily on the treatment couch, connect all cables, and confirm that the device is powered on.
- Turn on the room lasers and adjust the couch height to align the lasers precisely with the crosshairs on the side of BeamCheck.
- Open the accelerator's light field and ensure that the crosshair at the center of the field precisely aligns with the coordinate axes on BeamCheck.

Step 2: Stabilization and Pre-irradiation

- After powering on BeamCheck, allow it to remain stationary for at least 30 minutes to stabilize internal temperature and pressure.
- Ensure the MLC of the accelerator is fully opened. Adjust the field size to fully cover all ion chambers in BeamCheck (a recommended field size is 34 cm × 34 cm).
- Set the beam output to 400 MU and perform a pre-irradiation. After the pre-irradiation is complete, wait for 1 minute before proceeding.

Step 3: Absolute Dose Calibration

- Open the Xbeam software on the computer connected to BeamCheck.
- Navigate to [Settings → Absolute Dose Calibration], then click  to create a new calibration. Enter a calibration name and record the beam delivery conditions, including accelerator name, energy, depth, output, and dose rate.
- Use a dosimeter and solid water to measure the absolute dose. The accelerator should deliver the beam according to the conditions specified on the page. Enter the measured result into the “Dose” field.
- Click  to perform a background measurement.
- *Note: If background measurement was already completed in another step, this step can be skipped.*
- Configure the beam delivery parameters according to the settings on the page.
- Click  button, then control the accelerator to deliver the beam.
- After the accelerator finishes beam delivery, click  button.
- Then the software will automatically populate the "Reading" field and calculate the sensitivity.

6.2.4. MLC Model Establishment

(1) Overview

To use BeamCheck for analyzing the MLC positioning accuracy, the corresponding MLC model must be established first.

(2) Operating Instructions

Step 1: Positioning

- Set the gantry and collimator of the linear accelerator to 0°, and ensure the treatment couch is in a horizontal position.
- Place the BeamCheck steadily on the treatment couch, connect all cables, and confirm that the device is powered on.
- Turn on the room lasers and adjust the couch height to align the lasers precisely with the crosshairs on the side of BeamCheck.
- Open the accelerator’s light field and ensure that the crosshair at the center of the field precisely aligns with the coordinate axes on BeamCheck.

Step 2: Stabilization and Pre-irradiation

- After powering on BeamCheck, allow it to remain stationary for at least 30 minutes to stabilize internal temperature and pressure.

- Ensure the MLC of the accelerator is fully opened. Adjust the field size to fully cover all ion chambers in BeamCheck (a recommended field size is 34 cm × 34 cm).
- Set the beam output to 400 MU and perform a pre-irradiation. After the pre-irradiation is complete, wait for 1 minute before proceeding.

Step 3: Establishing a Leaf Position Analysis Model

- Open the Xbeam software on the computer connected to BeamCheck.
- It is recommended to use the following beam delivery conditions:

Scheme	Field Sizes (5 Groups)	Baseline Field	MU
Scheme 1	9.6cm×30cm, 9.8cm×30cm, 10cm×30cm, 10.2cm×30cm, 10.4cm×30cm	10cm×30cm	100MU
Scheme 2	19.6cm×30cm, 19.8cm×30cm, 20cm×30cm, 20.2cm×30cm, 20.4cm×30cm	20cm×30cm	100MU

- Navigate to [Settings → Leaf Position Analysis Model], click  button to create a new MLC model.
- Click  button to import measurement records.
- After importing the measurement records, you can select the data to be used for MLC model by clicking the icon  in front of each record. Once selected, the icon will change to . (Each model requires at least 2 records and allows up to 5 records to be selected.)
- Each model requires one baseline to be set. Click the icon  in front of the desired record, when the icon changes to , it indicates that the record has been set as the baseline.
- Click  button to calculate and save the MLC leaf position model. The saved model can be selected and used in the measurement condition settings area on the main page.

6.2.5. Parameter Settings

To perform additional configurations (such as modifying analysis protocols or adjusting tolerances), click the  button to access the corresponding settings page. Once all settings are completed, BeamCheck is ready for use.

6.3. Machine QA

Step 1: Positioning

- Set the gantry and collimator of the linear accelerator to 0°, and ensure the treatment couch is in a horizontal position.
- Place the BeamCheck steadily on the treatment couch, connect all cables, and confirm that the device is powered on.
- Turn on the room lasers and adjust the couch height to align the lasers precisely with the crosshairs on the side of BeamCheck.
- Open the accelerator's light field and ensure that the crosshair at the center of the field precisely aligns with the coordinate axes on BeamCheck.

Step 2: Stabilization and Pre-irradiation

- After powering on BeamCheck, allow it to remain stationary for at least 30 minutes to stabilize internal temperature and pressure.
- Ensure the MLC of the accelerator is fully opened. Adjust the field size to fully cover all ion chambers in BeamCheck (a recommended field size is 34 cm × 34 cm).
- Set the beam output to 400 MU and perform a pre-irradiation. After the pre-irradiation is complete, wait for 1 minute before proceeding.

Step 3: Measurement

- Click on  in the main page to perform background measurement.
- *After connecting BeamCheck to the computer, only one background measurement is needed. If the device is powered off or the software is restarted, a new background measurement is required.*
- Click  button, then control the accelerator to deliver the beam.
- After the accelerator stops beam delivery, click  to stop measurement.

Step 4: Analysis

- Before starting the measurement, please enter the actual measurement conditions in the upper right corner of the main page, including options such as whether to use the MLC model and whether to use the BeamCheck Wedge.
- During the measurement, the software will display real-time updates of the analysis results.
- After the measurement is complete, click  button to analyze all measurement records under the current project.

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 service department through the following channels:

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