RAYDOSE®

EDose

User Manual

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1. Introduction

1.1 About

EDose User Manual is applicable to the EDose developed by Guangzhou Raydose Medical Technology Co., Ltd. This manual mainly introduces the operation and usage methods of the EDose, aiming to assist users in correctly and effectively operating it.

If you encounter any problems during use, please feel free to contact us:

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

1.2 System Modules

This software adopts a Client/Server (C/S) architecture, comprising two parts: the client-side (EDoseC) and the server-side (EDoseS). Additionally, it includes a Data Acquisition System (DAS).

1.3 Application

EDose is designed for patient QA in radiation therapy, with the following features:

1) SDC (Secondary dose check)
2) 2D-P (2D Pre-treatment): 2D Pre-treatment dose verification
3) 3D-P (3D Pre-treatment): 3D Pre-treatment dose verification
4) 3D-IV (3D in vivo): 3D In-treatment dose verification

1.4 Terminology and Meaning

Table 1-1 Terminology and Meaning

Terminology	Meaning
Dicom	Digital Imaging and Communications in Medicine
EPID	Electronic Portal Imaging Device
RT	Radiation Therapy
CT	Computed Tomography
DVH	Dose-Volume Histogram
OAR	Off-Axis Ratio
OF	Output Factor
PDD	Percentage Depth Dose

2. Configuration

2.1 Server

After the computer with EDose server is started, the EDose server will start automatically. If the server is shut down unexpectedly, it needs to be manually restarted. Double-click the "EDoseS" icon on the desktop to open it.

Once the EDose server is successfully started, it will be as shown in Figure 2-1.

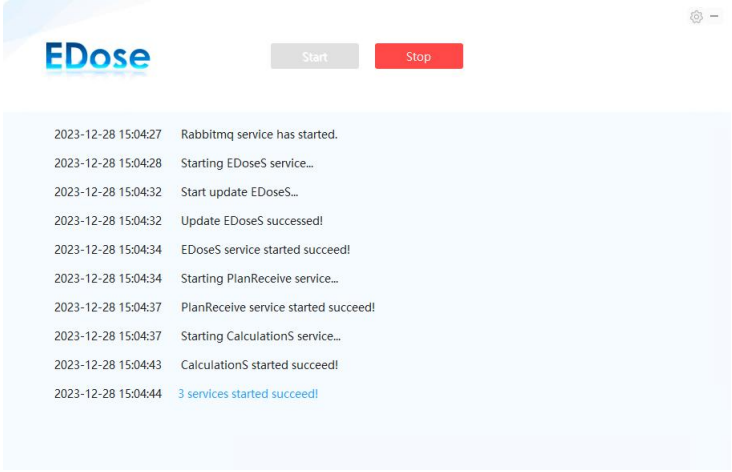


Figure 2-1 EDose server startup interface

Only after the server has started successfully can the client be operated. If any service fails to start or a red error message prompts, please contact the manufacturer's professionals. Do not make arbitrary changes to the server-side configuration.

Click the "Settings" icon  on the upper right side of the interface to change the following settings.

(1) Click "Common":

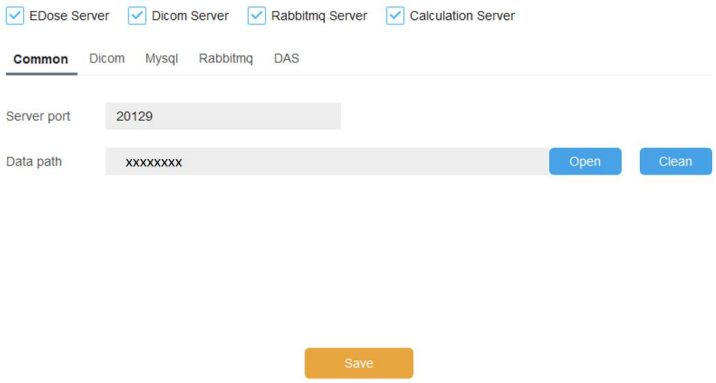


Figure 2-2 Common

Click  to manually modify the storage path to the specified folder.

Click  to clean cache files.

(2) Click "Dicom":

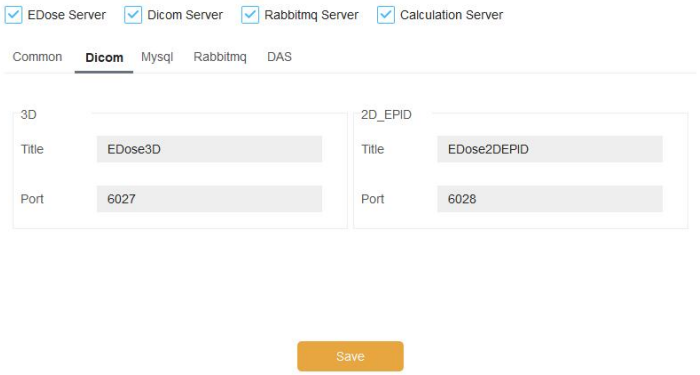


Figure 2-3 Dicom

① 3D section:

- "Title": AE Title used for receiving 3D dose verification files;
- "Port": Port used for receiving 3D dose verification files.

② 2D_EPID section:

- "Title": AE Title used for receiving EPID 2D dose verification files;
- "Port": Port used for receiving EPID 2D dose verification files.

(3) Click "Mysql":

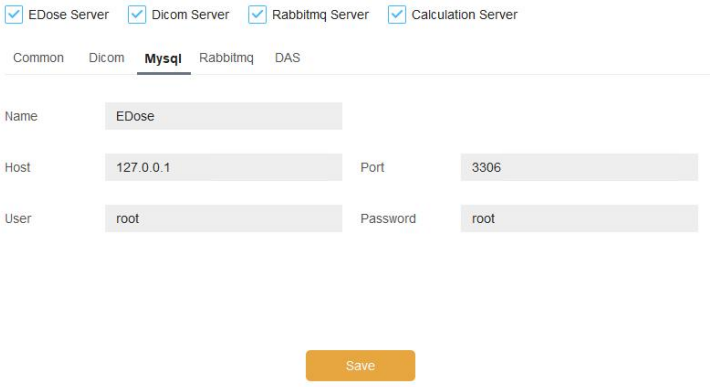


Figure 2-4 Mysql

- "Name": Database name;
- "Host": Database host IP address;
- "Port": Database server port;
- "User": Username.

(4) Click "Rabbitmq":

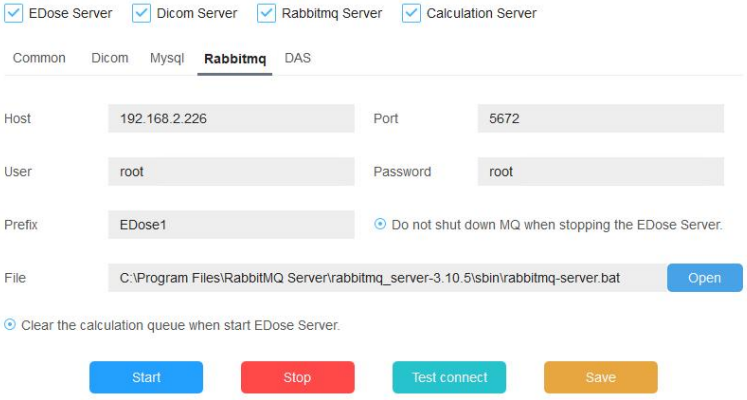


Figure 2-5 Rabbitmq

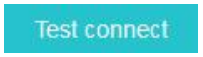
- "Host": IP address of the host where the Rabbitmq server is located, typically found locally;
- "Port": Port of the Rabbitmq server;
- "User" and "Password": Username and password for logging into the Rabbitmq service;
- "Prefix": Prefix for Rabbitmq queue names;
- "File": Path where the Rabbitmq server startup file is stored, users manually select based on the Rabbitmq installation directory;
- "Do not shut down MQ when stopping the EDose Server": Users can manually choose whether to shut down Rabbitmq when stopping the EDose server.
- "Clear the calculation queue when starting EDose Server": Users can choose to clear the queue when restarting the server.

① Click 

to start the Rabbitmq service;

② Click 

to stop the Rabbitmq service;

③ Click 

to test if the Rabbitmq connection is successful;

④ Click 

to save the settings.

(5) Click "DAS":

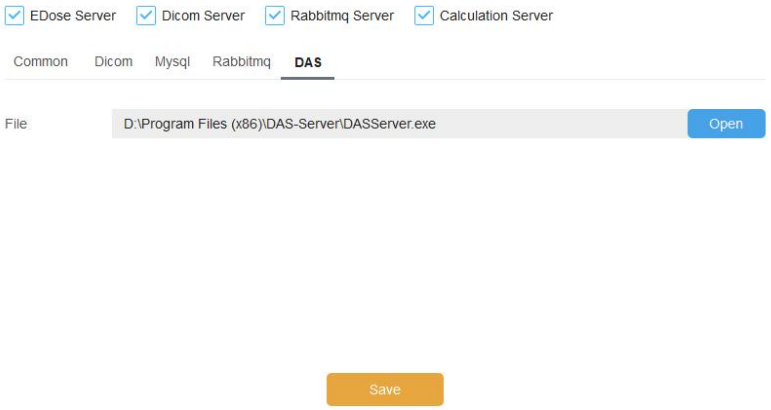


Figure 2-6 DAS

Click "File" to displays the path where the DAS Server is located.
Click "Open" to select other files.

2.2 Client

Double-click the "EDoseC" icon to open the EDose client, enter your username and password and click "Login" to log in.

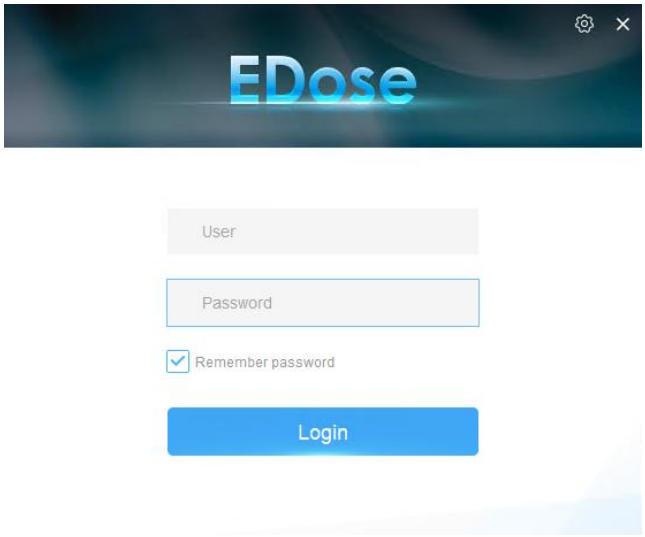


Figure 2-7 EDose user login interface

The EDose requires the client and server to be on the same local area network (LAN). Therefore, if the server network changes, the server's IP and Port need to be reconfigured. To do this, you can click  in the upper right corner of Figure 2-7.

In the popup window, you can modify the server's network IP address accordingly, and the Port can be left as the default (20128).

Figure 2-8 IP and Port settings of the Server in the Client

If the client login fails, there will be the following different prompts.

(1) If it prompts that no server available, the reasons and solutions are as follows:

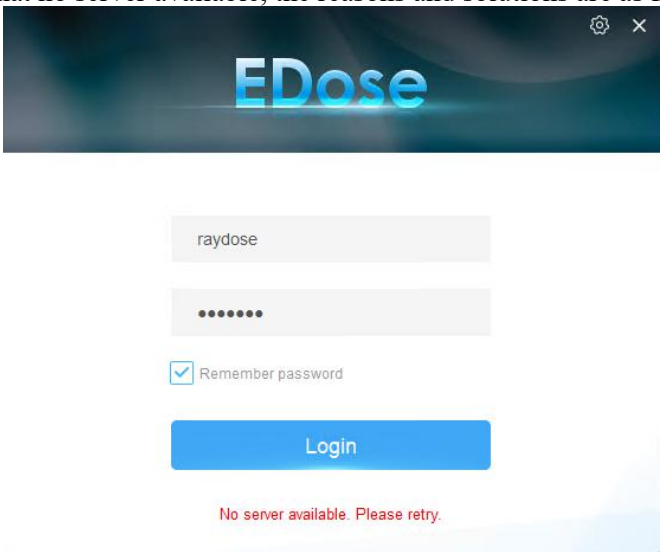


Figure 2-9 Prompt for no server available

① Server not started: Start the server manually. Refer to 2.1.
② Server startup failure: Contact the relevant personnel for assistance.
③ Incorrect IP address configured on the client: Reconfigure the IP address. Refer to Figure 2-8.

(2) If you receive a prompt indicating incorrect account or password, please re-enter the correct username and password.

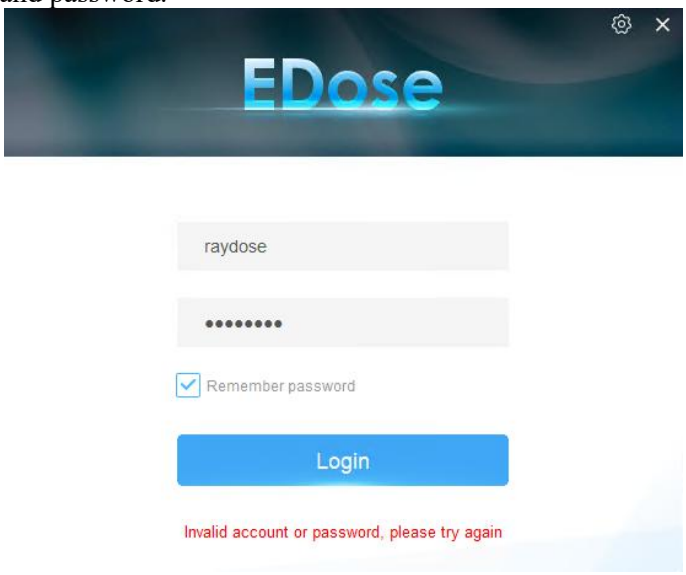


Figure 2-10 Prompt for invalid account or password

2.3 Data Acquisition System (DAS)

The EDose is equipped with an independent data acquisition system, consisting of two applications: DAS Server and DAS, as shown in Figure 2-11 and Figure 2-12.

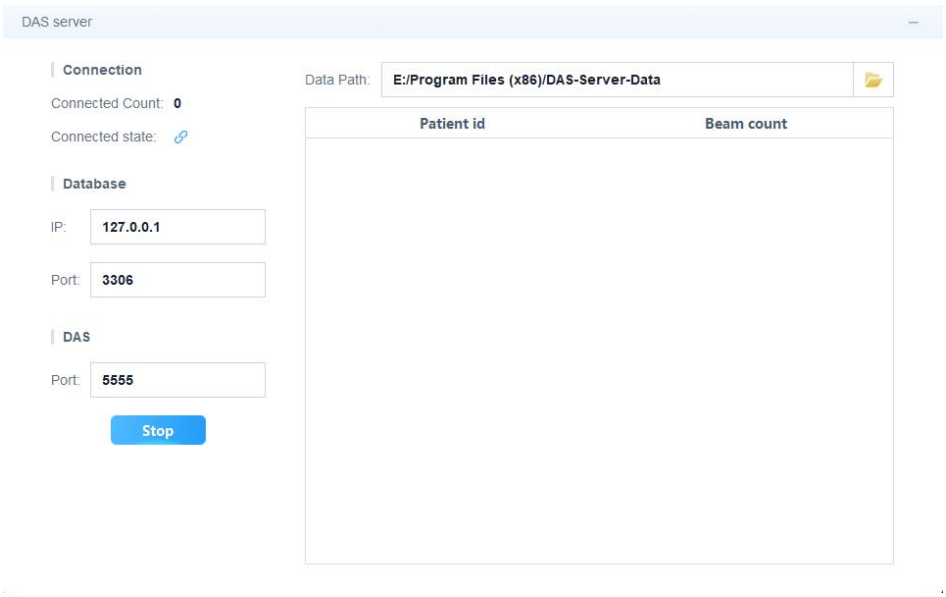


Figure 2-11 DAS Server

Table 2-1 Descriptions of the DAS Server

Item	Description
Connected Count	Number of connections to DAS
Connected state	Connection status with MQ queue
IP	IP address of the host where MySQL server resides
Database-Port	Port of the MySQL server
DAS-Port	Port of the DAS Server
Data Path	Path for saving measurement data, the path can be customized
Patient id	Patient ID
Beam count	Number of radiation fields
Stop	Disconnect the DAS Server from the server

DAS Server is installed on the same computer as the server, and runs synchronously with the server.
DAS is divided into four main modules: "EDose-P", "EDose-IV", "iQA", and "Custom".

2.3.1 EDose-P

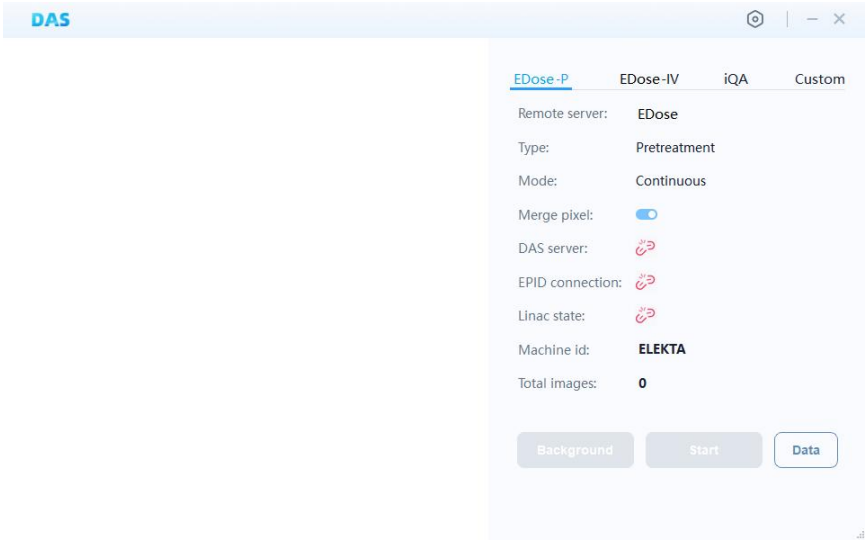


Figure 2-12 DAS_EDose-P

Table 2-2 Descriptions of the EDose-P

Item	Description
Remote server	Send the collected data to the EDose server
Type	Collection type
Mode	Collection mode, divided into Continuous and Integrated
Merge pixel	Merge images (default merge image pixel is 256×256)
DAS server	Connection status with the DAS server

EPID connection	Connection status with the EPID
Linac state	Connection status with the LINAC
Machine id	LINAC ID
Total images	Number of images collected
Background	Background measurement
Start	Start collecting
Data	Select the path to save the collected images

2.3.2 EDose-IV

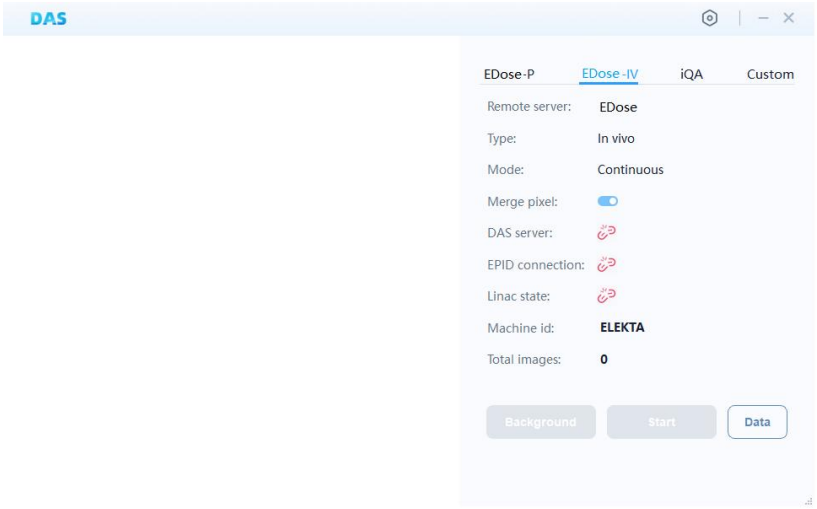


Figure 2-13 EDose-IV

Table 2-3 Descriptions of the EDose-IV

Item	Description
Remote server	Send the collected data to the EDose server
Type	Collection type
Mode	Collection mode, divided into Continuous and Integrated
Merge pixel	Merge images (default merge image pixel is 256×256)
DAS server	Connection status with the DAS server
EPID connection	Connection status with the EPID
Linac state	Connection status with the LINAC
Machine id	LINAC ID
Total images	Number of images collected
Background	Background measurement
Start	Start collecting
Data	Select the path to save the collected images

2.3.3 iQA

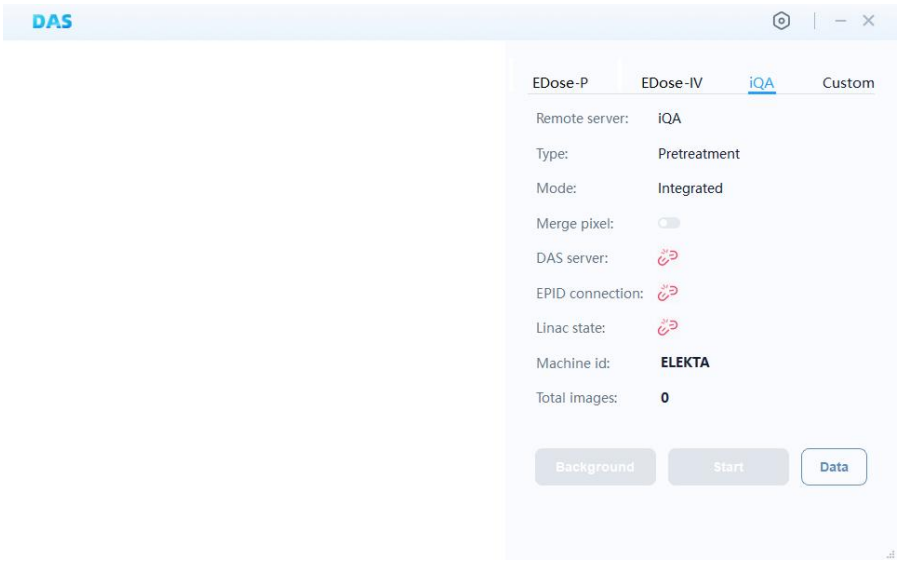


Figure 2-14 iQA

Table 2-4 Descriptions of the iQA

Item	Description
Remote server	Send collected data to iQA
Type	Collection type
Mode	Collection mode, divided into Continuous and Integrated
Merge pixel	Merge images (default merge image pixel is 256×256)
DAS server	Connection status with the DAS server
EPID connection	Connection status with the EPID
Linac state	Connection status with the LINAC
Machine id	LINAC ID
Total images	Number of images collected
Background	Background measurement
Start	Start collecting
Data	Select the path to save the collected images

2.3.4 Custom

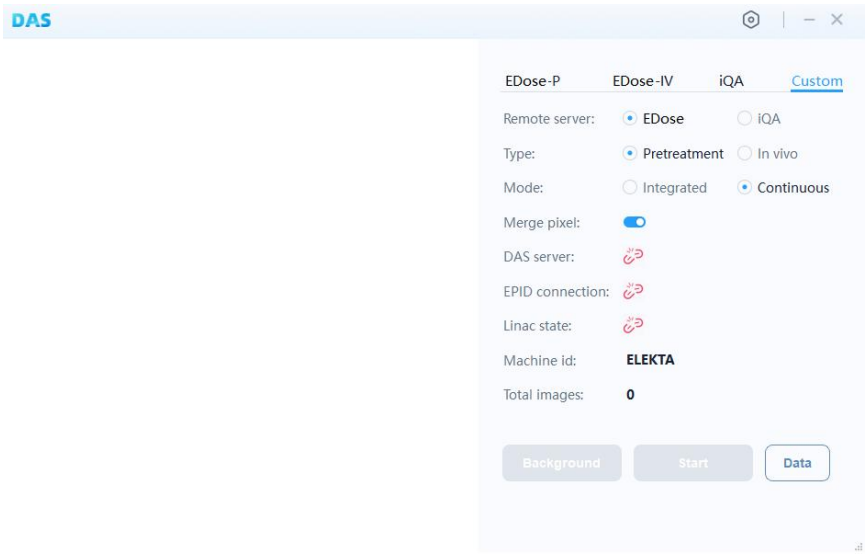


Figure 2-15 Custom

"Custom" is a user-defined module where users can select custom parameters such as Type and Mode.

2.3.5 DAS Settings

DAS needs to be configured before it can run normally. Click the "Setting" in the upper right corner to enter the configuration interface. Switch to the Elekta parameter interface, as shown in Figure 2-16 below.

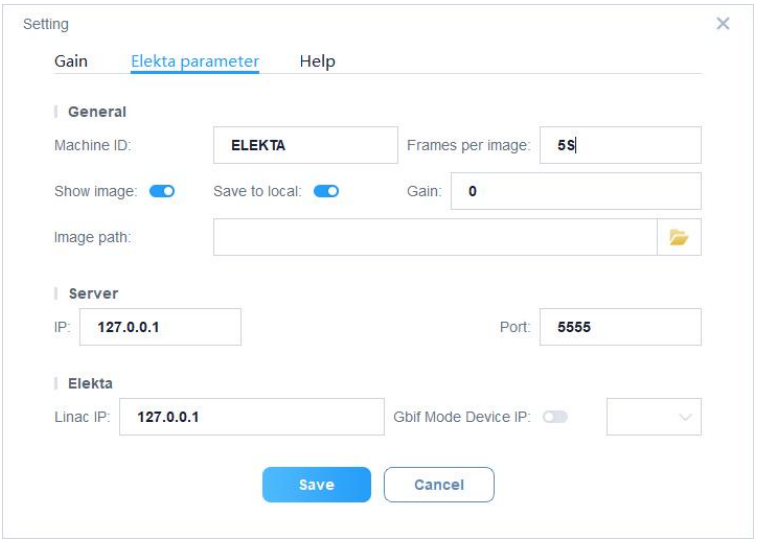


Figure 2-16 Elekta parameter setting

1) Image path: The path for saving files locally.
2) Server-IP: DAM/EDoseS host IP.
3) Elekta-LinacIP: LINAC IP.
4) GbiF Mode Device IP: When opened, it will automatically obtain IP of the EPID.

After configuring, click "Save". The DAS will attempt to connect to the server, LINAC, and EPID. Connection may take about half a minute. Once successful, proceed to the next step.

2.3.6 EPID Calibration

EPID needs to be calibrated before measure. Click the "Gain" button to enter the calibration interface.

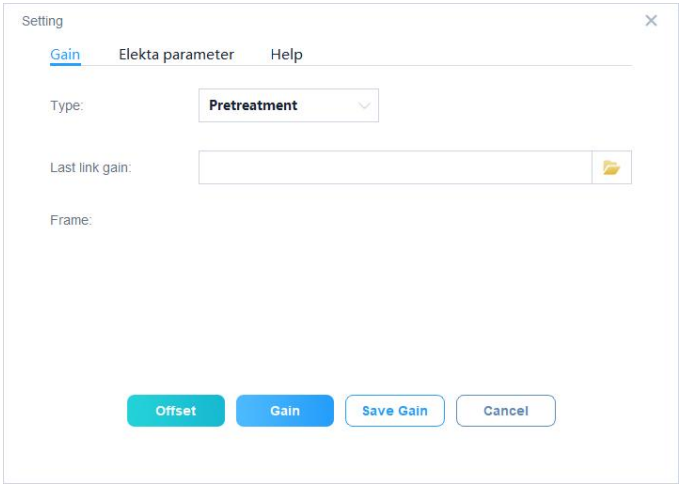


Figure 2-17 EPID calibration interface

There are two types of calibration, Pretreatment and Online. The differences are as follows:

1) Pretreatment type is performed with no obstructions between the source and the EPID.
2) Online type requires placing a 20cm solid water phantom at the isocenter to simulate the beams passing through the human body.

The calibration steps are as follows:

1) Select Pretreatment or Online in Type.
2) Without beam-on, click "Offset" to capture background images, typically 100 frames. The frame count is displayed in "Frame". When the frame count stops increasing, that means the offset is complete, and you can proceed to the next step.
3) Deliver a full-field covering the EPID. Start the beam delivery first, then click "Gain" to capture images, capture 100 frames in total. Ensure the beam is on during the capture. For example, with Elekta, it is recommended to deliver 100 MUs at a dose rate of 400 MU/min with a field size of 27x27 (or larger). Wait for the capture to complete before proceeding to the next step.
4) Click "Save Gain" to save the captured calibration file locally.
5) Upon successful saving, the latest calibration file will be automatically linked and displayed in the "Last Link Gain". This calibration file will be loaded by default each time EDose starts.

The DAS needs to be installed on a computer that can connect to the EPID. For example, when used with an Elekta accelerator, EDose needs to be installed on a computer with iViewGT software installed.

2.4 Create/Transmit Plan

2.4.1 Functional Overview

EDose provides comprehensive plan dose verification, which can be divided into two types based on dose distribution: 2D and 3D. The creation and transmission of plans differ for these two types.

2.4.2 Create Plan

① 2D Dose Verification (2D-P)
2D pretreatment refers to the measurement and verification of a certain plane dose provided by TPS. EDose provides a virtual water phantom called the EDoseR12L30, which is a cylinder with a radius of 12 cm and a height of 30 cm. The center of the cylinder serves as the isocenter, located at the coordinate point (0,0,0). This phantom is shown in Figure 2-18.

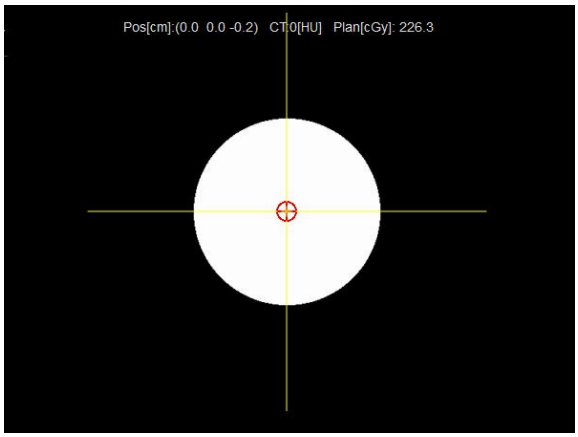


Figure 2-18 Virtual water phantom

According to the requirements of different plans, make QA plans for the virtual water phantom and send them to EDose. Users can create a plan based on the actual angle of the radiation field and calculate the dose distribution, or they can normalize the gantry angle to zero for dose calculation. As the EPID is always perpendicular to the beam axis, dose calculations in EDose can be normalized to zero degrees after measurement.

② 3D Dose Verification (SDC, 3D-P, 3D-IV)
Patient plans can be sent directly from the TPS system into EDose.

2.4.3 Transmit Plan

① 2D Dose Verification (2D-P)
EDose supports receiving files from the TPS in DICOM format. This can be configured in the TPS settings by adding an export option for EDose. In this configuration, set the AETitle to "EDose2DEPID," the port to "6028," and the IP to the EDose server's host IP, as shown in Figure 2-19.

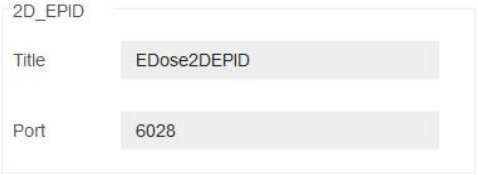


Figure 2-19 2D_EPID setting

After opening the plan in TPS, send the plan and dose files through DICOM Export. The plan file is a required file, while the dose file can be either the total field dose or individual field doses. After successfully sending, the EDose server will automatically receive and archive the files according to patient and plan.

EDose also supports transmission through other methods, such as USB. For example, plan and dose files in the TPS can be exported locally first, and then imported from the local computer into EDoseC.

② 3D Dose Verification (SDC, 3D-P, 3D-IV)

For 3D dose verification, EDose similarly supports receiving plan and dose files in DICOM format. set the AETitle to "EDose3D," the port to "6027," and the IP to the EDose server's host IP, as shown in Figure 2-20.

Figure 2-20 3D setting

When exporting a DICOM file, the items that can be sent include: RtPlan, Rt_Structure, CT and RtDose.

3. EDose Homepage

3.1 Function

Most of the work can be completed through the client's homepage, including browsing plan dose calculations and evaluation results, matching plans with measurement results, and reporting. Various functional interfaces can be accessed through the homepage entry points, assisting users in conducting more detailed data analysis and evaluation.

3.2 Overview

The main page is primarily divided into the following parts, as shown in Figure 3-1:

1) The left sidebar is the functional modules.
2) The middle part is the information panel, where you can browse and operate measurements.
3) The upper right corner of the home page shows the calculation queue, system settings, and user settings, respectively.

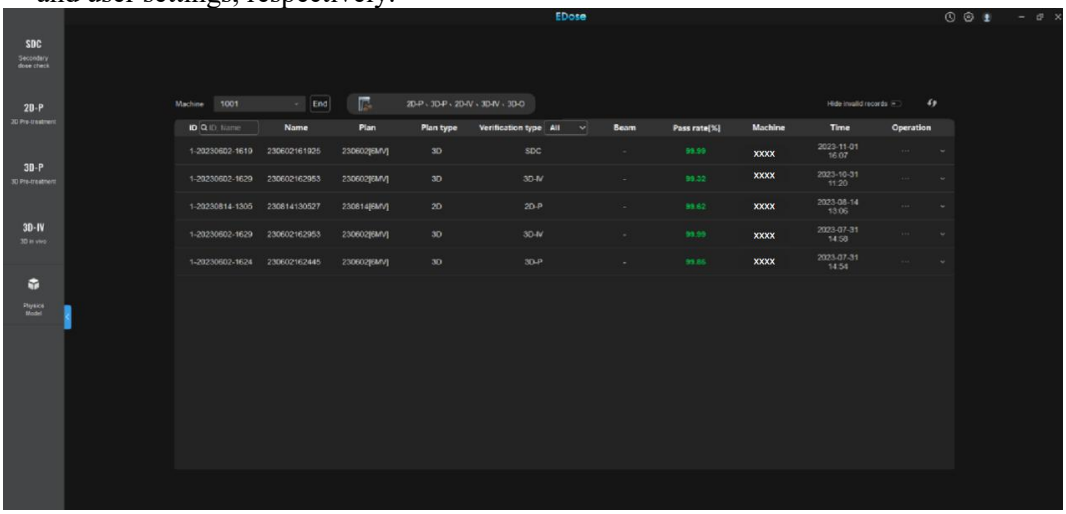


Figure 3-1 Homepage

3.3 Functional Modules

Table 3-1 Function module description

Item	Description
SDC Secondary dose check	Enter the detailed interface for secondary dose checks
2D-P 2D Pre-treatment	Enter the detailed interface for 2D Pre-treatment
3D-P 3D Pre-treatment	Enter the detailed interface for 3D Pre-treatment
3D-IV 3D in vivo	Enter the detailed interface for 3D in vivo
Physics Model	Enter the detailed interface for the physical model

3.4 Information Panel

3.4.1 Form Content

In the form, each patient plan serves as a unit of measurement.

1) Upon importing a new plan, a new measurement will be added to the form. After the plan is operated, corresponding measurement information will be added under the plan. Measurement are automatically updated as operations are performed.
2) Hovering the mouse over the "Pass rate [%]" of a specific measurement will display the overall pass rate of the plan. Clicking on it will then cause a pop-up window to appear, showing the pass rate of each field under the plan, as shown in Figure 3-2.

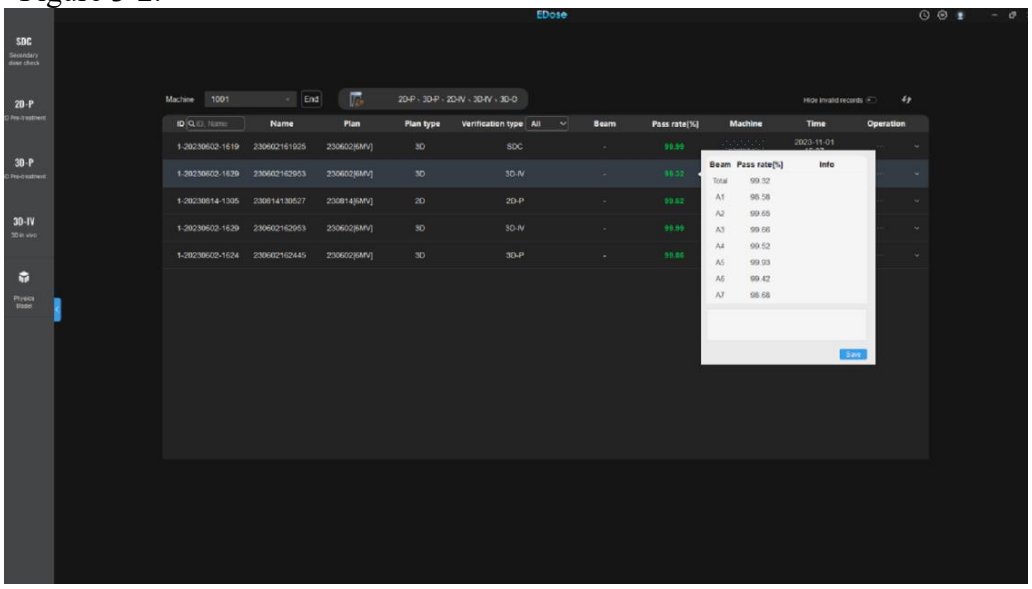


Figure 3-2 Plan pass rate

3.4.2 Operations on All Measurements

Here are the operations that can be performed on measurements:

1) "Machine": Filter measurements related to a specified machine ID.
2) "ID & Name": Search measurements based on ID or Name.
3) "Verification type": Filter measurements based on specified function modules.
4) "Prev, next, go to": Navigate through pages or jump to a specific page.
5) "Hide invalid records": Hide measurement records that haven't matched any plans for over 24 hours.
6) "Auto update": Automatically refresh measurement.

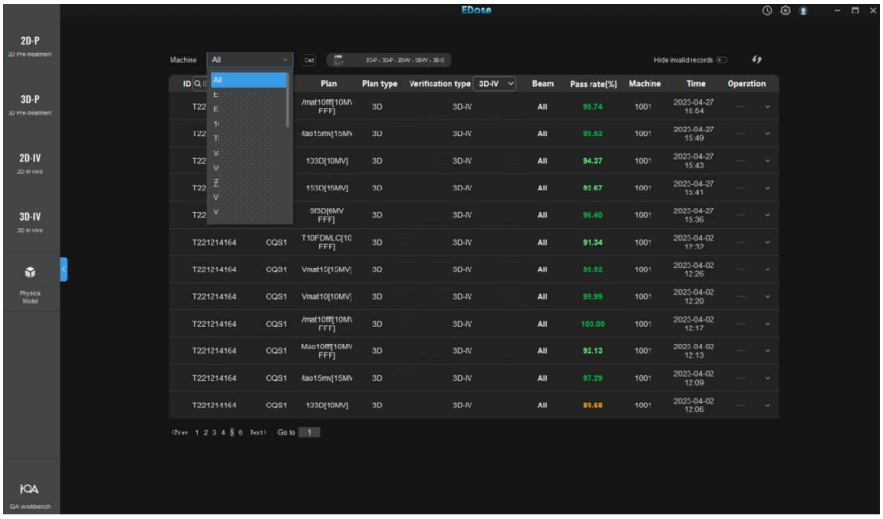


Figure 3-3 Operations on all measurement

3.4.3 Operations on Individual Measurement

Clicking on a measurement displays detailed information, and on this page, you can directly move the crosshair for simple dose analysis, as shown in Figure 3-4 below.

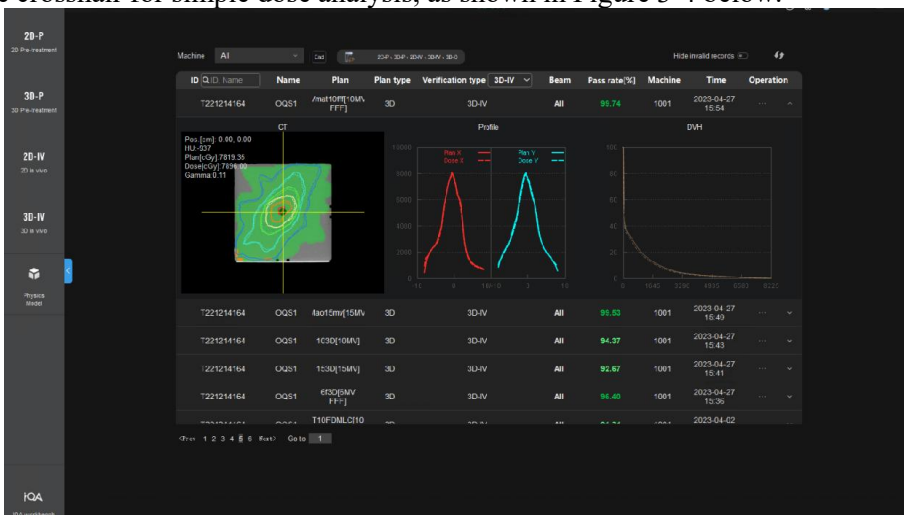


Figure 3-4 Operations on individual measurement

Click  on the right side of the measurement to pop up the menu bar, which displays the following shortcut operations.

1) "Open": Click "Open" or double-clicking on a measurement will take you to the detailed interface of the measurement, for example, the sub-window of SDC as shown in Figure 3-5.

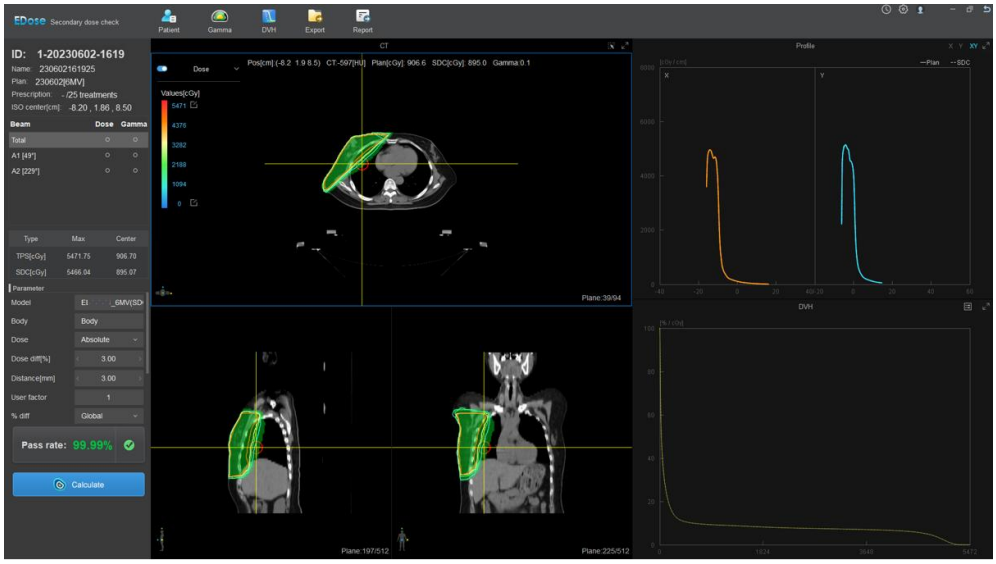


Figure 3-5 Sub-window of SDC

2) "Export": Click "Export" to export the file. The saved file content includes: plan file - PlanData, measurement file - Measurement, calculation result - CalData.

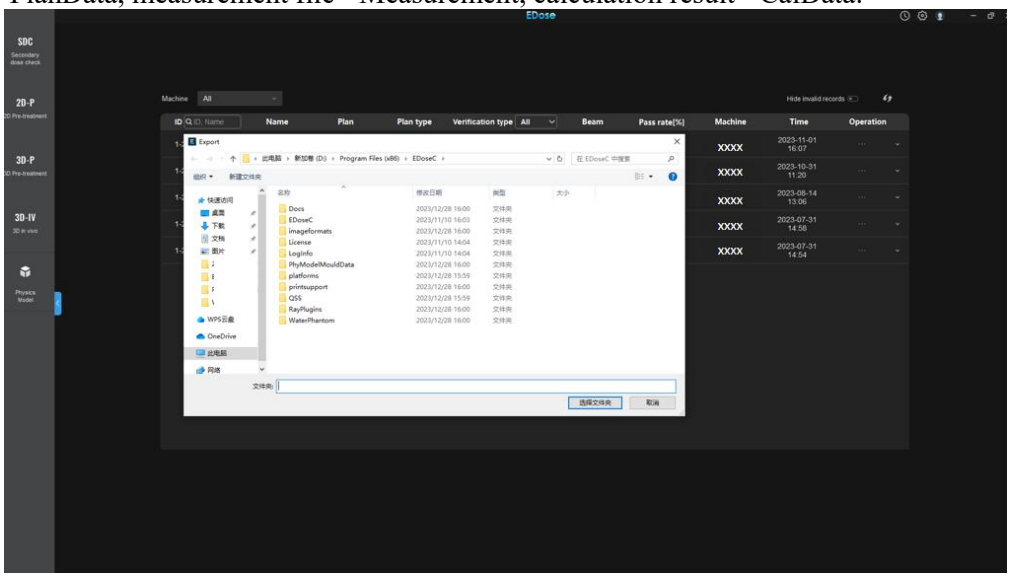


Figure 3-6 Export

3) "Delete": Deletes the measurement.

4) "Match": Select the plan corresponding to the measurement, then click the "OK" button to complete the matching of the measurement with that plan.

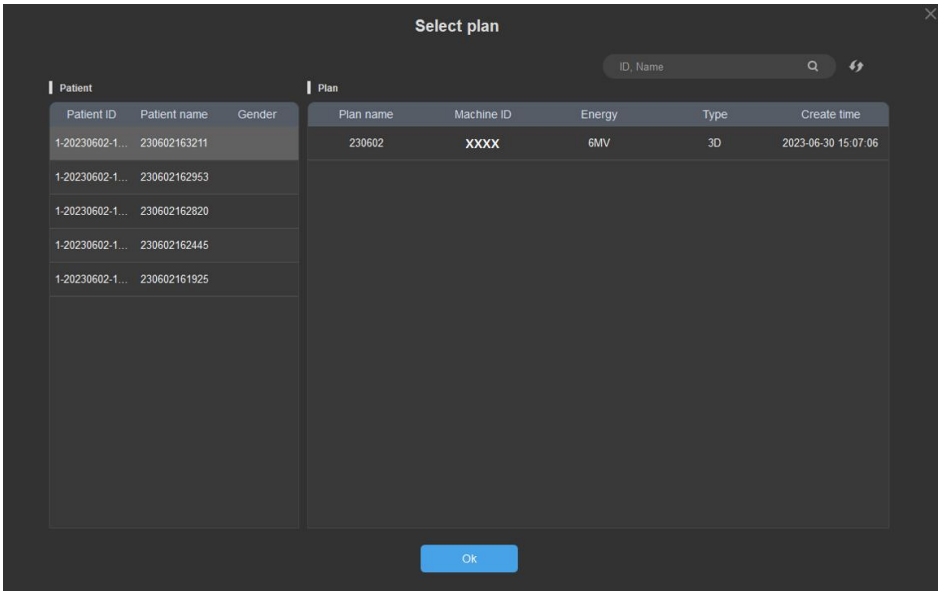


Figure 3-7 Match_Select plan

5) "Report": Save this report as a PDF file to a specific folder.

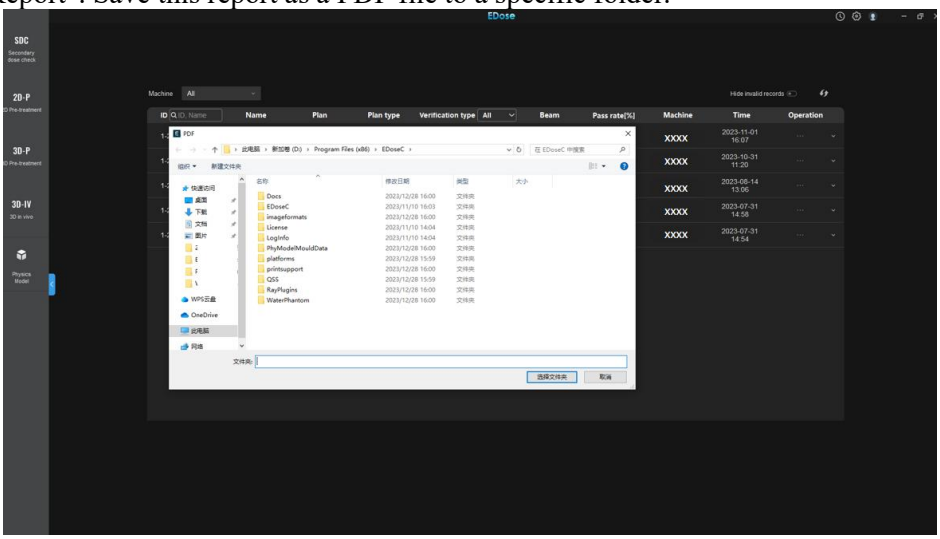


Figure 3-8 Report

3.4.4 Status Display

(1) When DAS is successfully started and connected to EPID and LINAC, the accelerator connection status is displayed above the form:

EDose connected to the accelerator successfully.

EDose not connected to the accelerator.

Beam on.

The gantry is rotating.

 Connection timeout.

(2) "End": Click  to finish the measurement for the entire accelerator.

(3) The current verification type is displayed to the right of the accelerator connection status.

(4) Color description of gamma pass rate:

Color	Calculated Pass Rate	Description
Dark Green	Pass Rate ≥ Tolerance[%]	Refer to 10.1
Light Green	Action[%] ≤ Pass Rate < Tolerance[%]	Refer to 10.1
Yellow	Pass Rate < Action[%]	Fail
White	/	The machine corresponding to this plan does not match the machine model used to calculate the pass rate. It is recommended to recalculate after manual matching.

4. Secondary Dose Check (SDC)

4.1 Functional Overview

The SDC performs independent dose calculations for plans and compares them with planned doses to minimize potential errors.

4.2 Overview

After loading the patient plan, the "SDC" interface is shown in Figure 4-1.

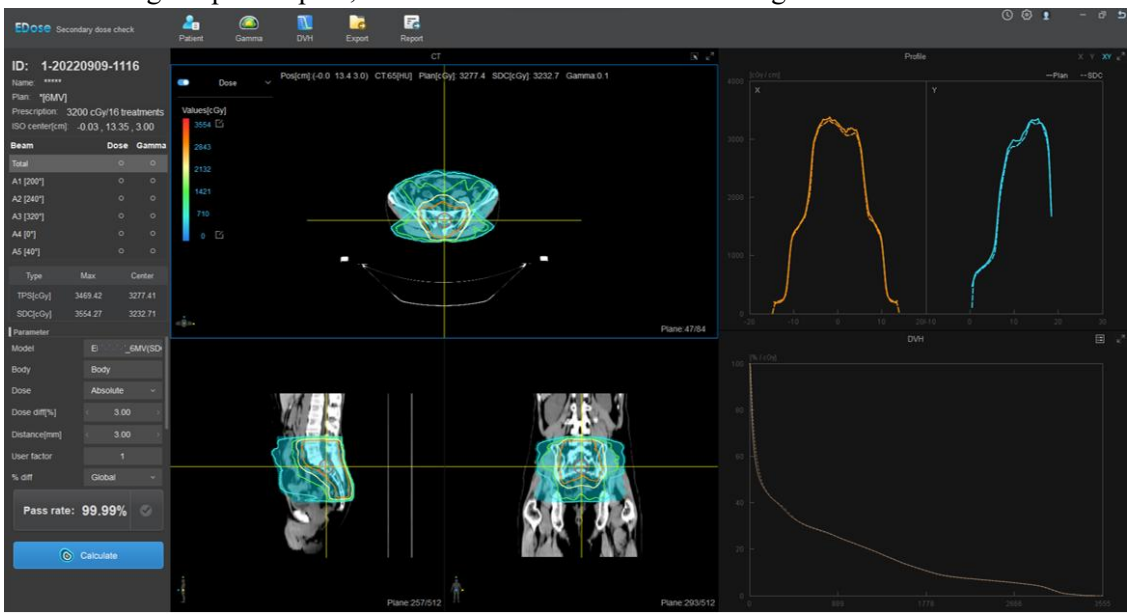


Figure 4-1 SDC interface

4.2.1 Left Sidebar

（1）ID

ID section displays basic patient and plan information.

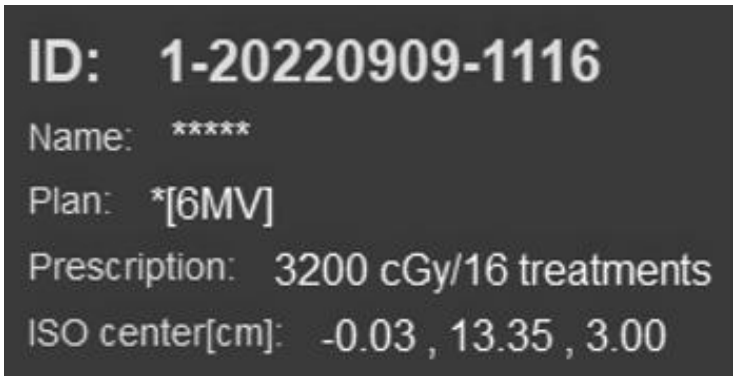


Table 4-1 Basic patient and plan information

Item	Description
ID	Patient ID
Name	Patient name
Plan	Plan name
Prescription	Prescription dose/number of fractions for the plan
ISO center[cm]	Isocenter position for the plan

（2）Beam

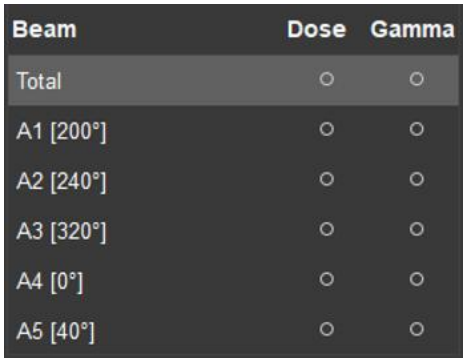


Table 4-2 Beam_Description

Item	Description
Beam	Display the field name, while "Total" indicates the cumulative dose for all fields (A1, A2, etc.).
Dose	Indicate whether the field has a dose. If there is, it displays  , otherwise it is blank.
Gamma	Indicate whether the field has a gamma distribution. If there is, it displays  , otherwise it is blank.

（3）Point dose

Table 4-3 Point dose_Description

Item	Description
Type	Dose originate from these two types: TPS plan and SDC calculation
Max	Maximum dose
Center	Isocenter

（4）Gamma calculation parameters

For details, refer to "4.6 Gamma Analysis".

4.2.2 Middle Part

(1) CT, 3D dose and gamma distribution images

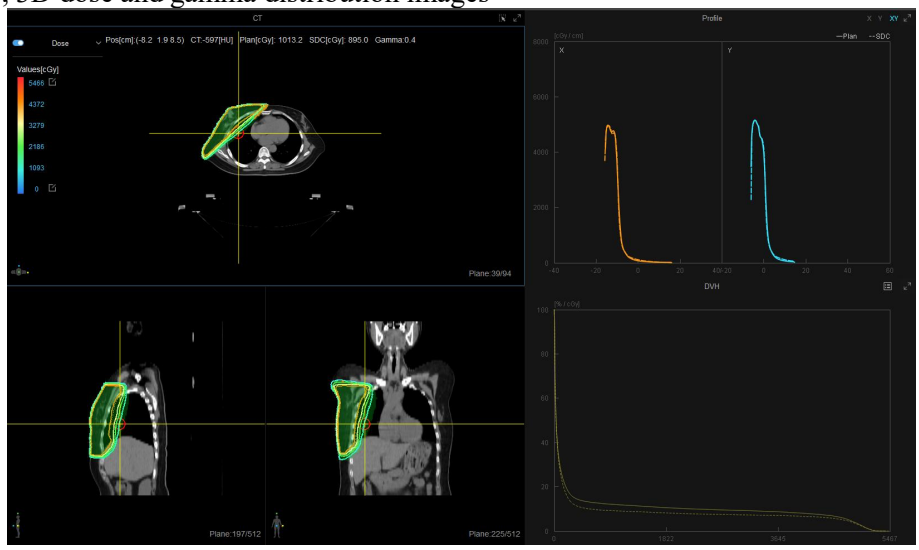


Figure 4-2 Middle part image_SDC

Click  to display the size of calculation area in the image. Hold down the left mouse button to draw the size of the calculation area. Refer to the yellow dotted line in Figure 4-3.

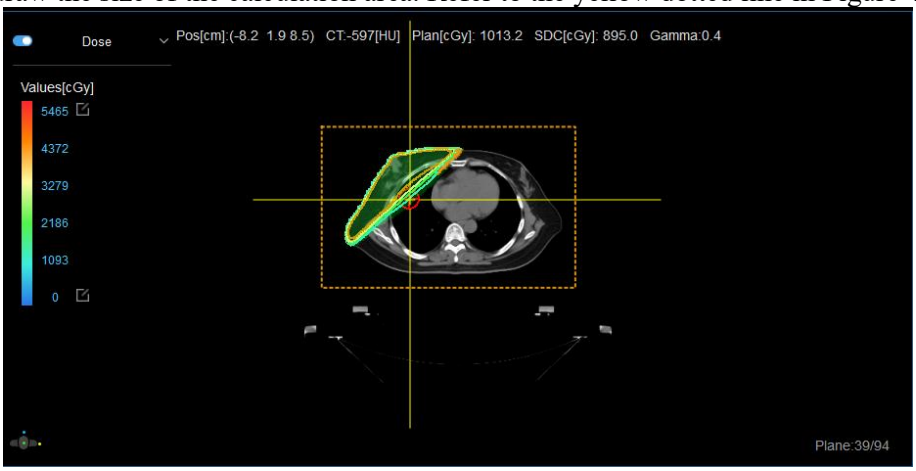


Figure 4-3 Calculation area_SDC

Click  to enlarge the area and display it in an independent window, as shown in Figure 4-4.

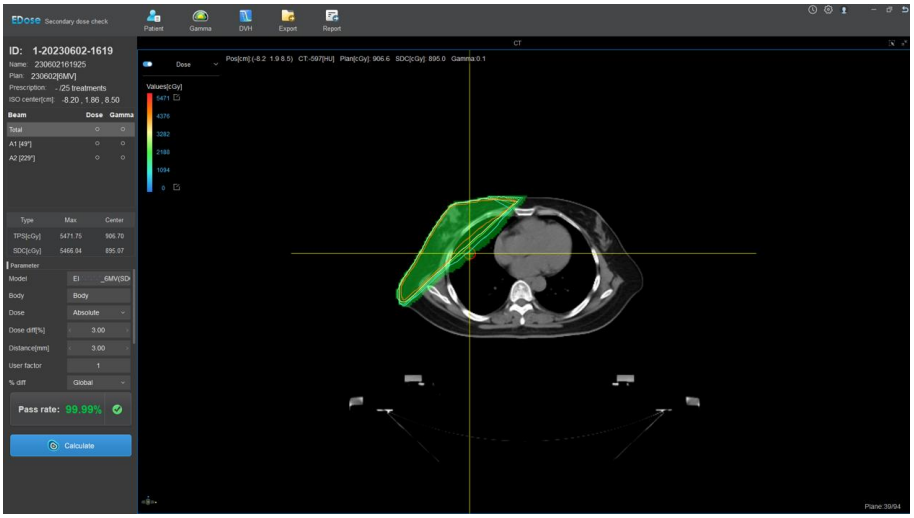


Figure 4-4 Independent window_Calculation area_SDC

(2) Profile

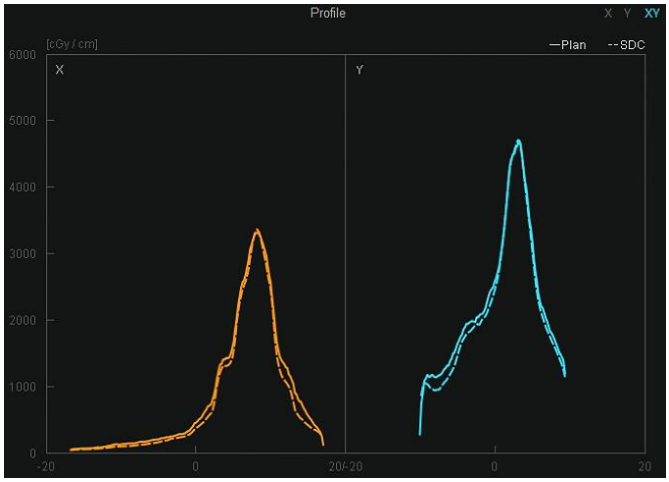


Figure 4-5 Profile comparison_SDC

In the Figure 4-5 DVH Profile, the solid line is the plan dose and the dotted line is the SDC dose. Click X, Y and XY in the upper right corner to switch the view: display only the X direction curve, only the Y direction curve, or display the curves in both X and Y directions simultaneously.

(3) DVH

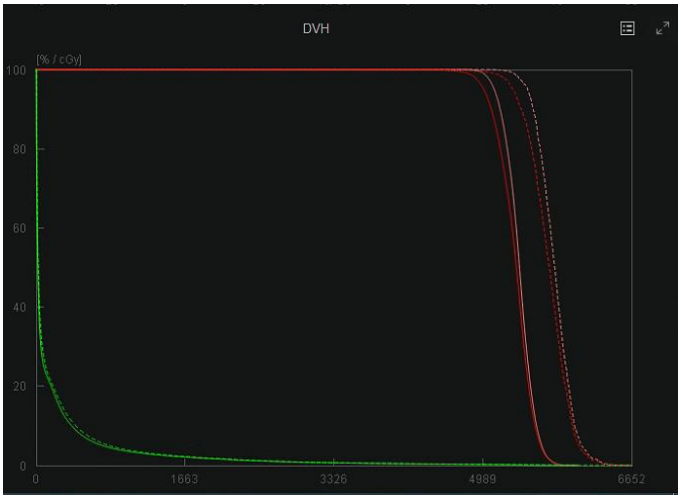


Figure 4-6 DVH_SDC

In the Figure 4-6 DVH, dashed lines represent the SDC results, while solid lines represent the planned results. The horizontal axis is in cGy units, and the vertical axis represents percentages.

Click  in the upper right corner to pop up a panel where you can adjust the display.

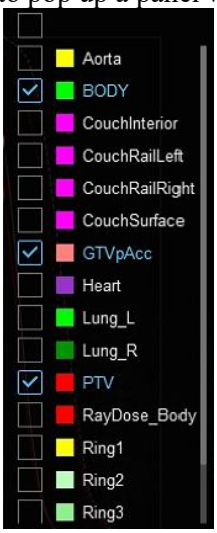


Figure 4-7 DVH panel_SDC

4.3 Features

4.3.1 Patient

(1) Patient interface

Click 

to enter the "Patient" interface.

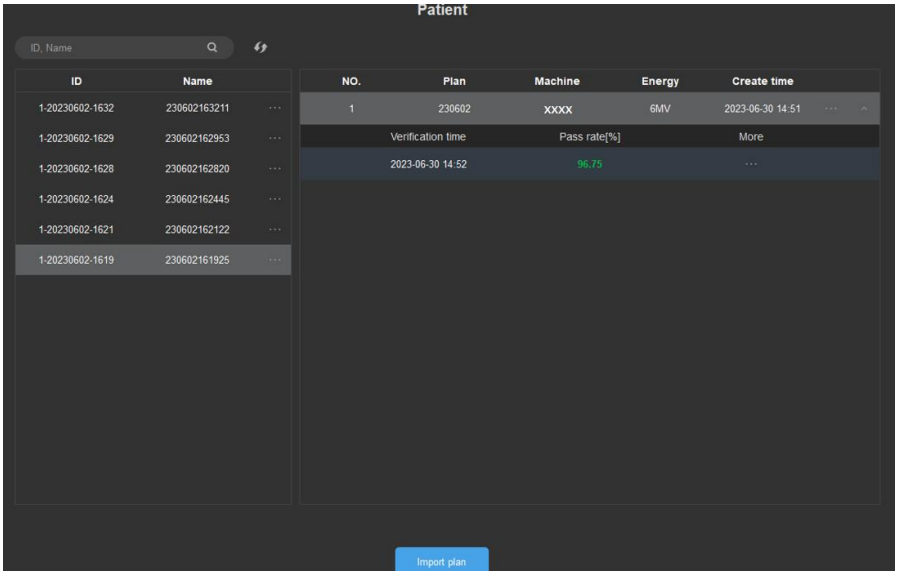
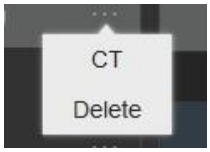


Figure 4-8 Patient interface_SDC

(2) Edit patient

Click the icon on the left to display the following operation menu.



Click "CT > Match Plan" allows user to change the CT image that matches the plan.

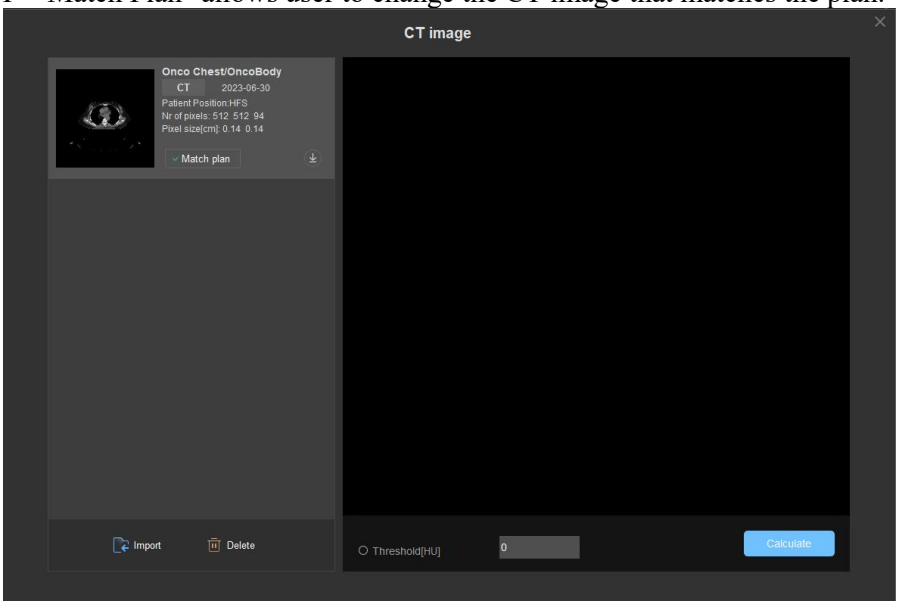


Figure 4-9 CT Image_SDC

Click "Import" to import CT files, as shown in Figure 4-10.

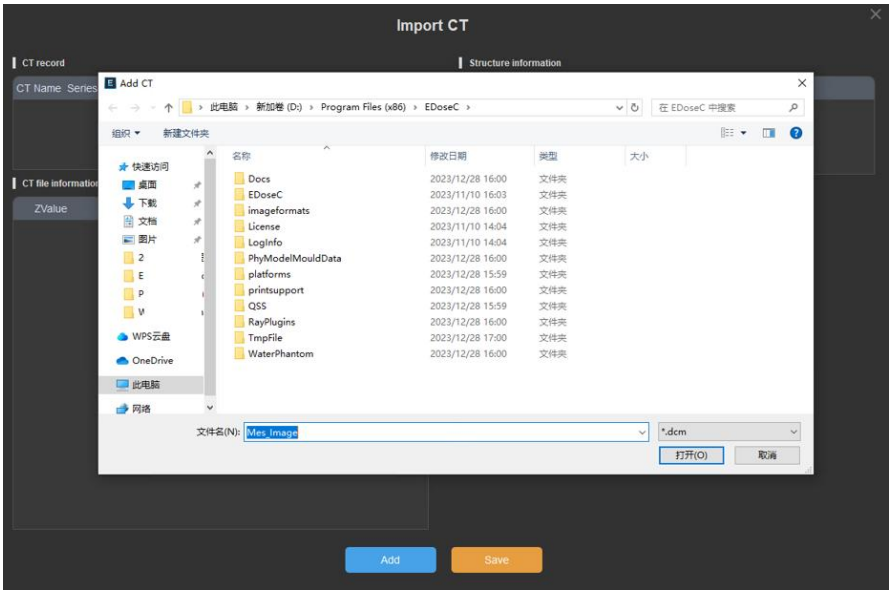


Figure 4-10 Import CT files_SDC

After successful import, specific file information will be displayed on the left, and corresponding CT images for each slice will be shown on the right, as shown in Figure 4-11.

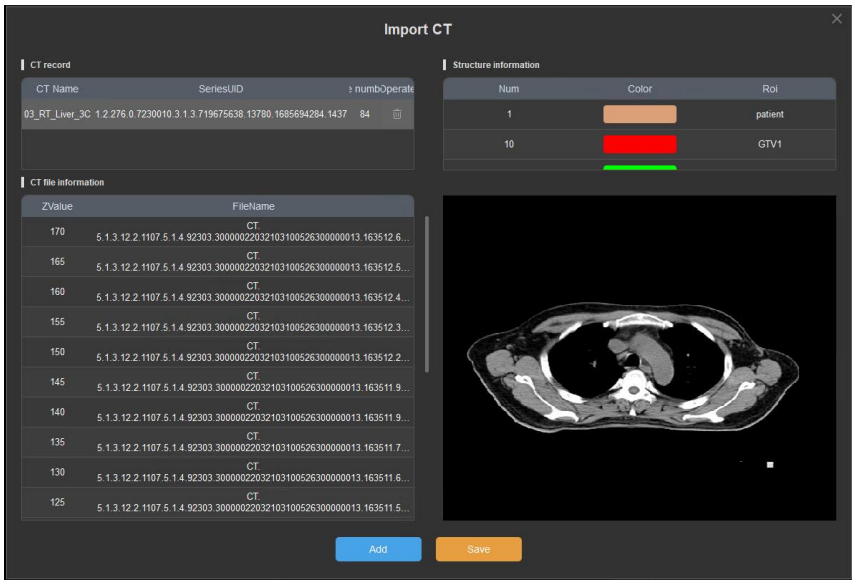


Figure 4-11 CT images for each slice_SDC

After clicking "Save", a new set of CT images will be displayed on the left. If you click the "Calculate", the calculated outer contour will be shown on the CT images. By adjusting the "Threshold", you can fine-tune the calculation results of the outer contour, as shown in Figure 4-12.

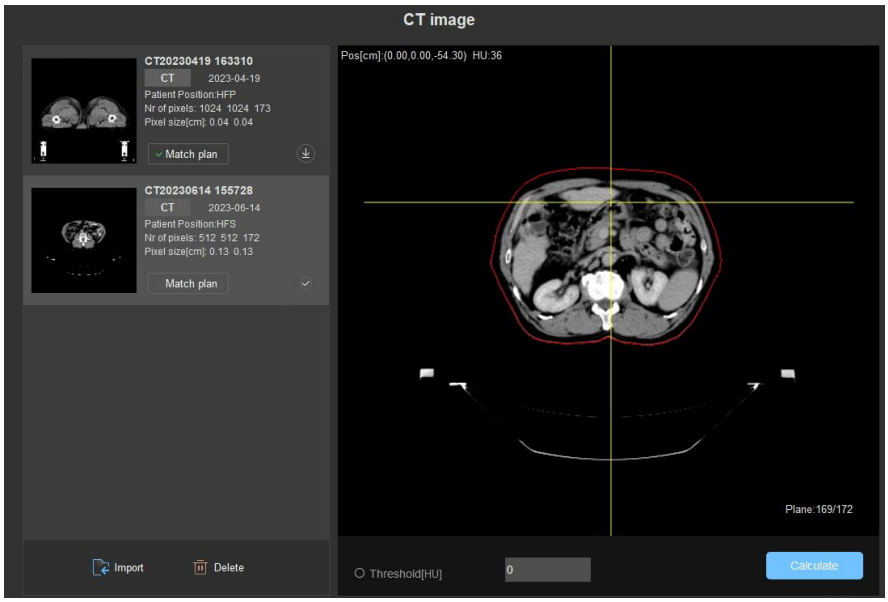


Figure 4-12 Calculate & Threshold_SDC

(3) Edit plan

Click the "..." icon of the plan and the display is as shown in Figure 4-13.

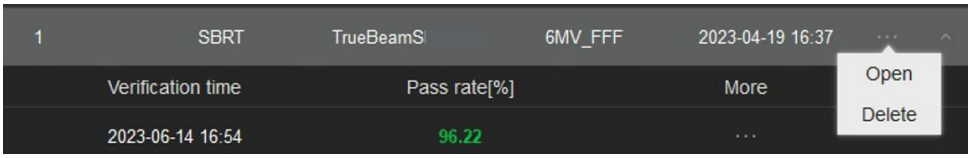


Figure 4-13 Edit plan_SDC

Click "Open" or double-click on the plan will load the plan's information. Click "Delete" will delete the plan.

(4) Edit measurement

Click the "..." icon of a measurement under the plan and the display is as shown in Figure 4-14.

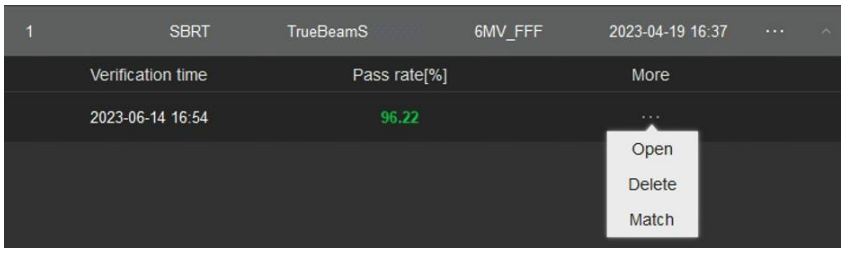


Figure 4-14 Edit measurement_SDC

Click "Open" or double-click will load the measurement. Click "Delete" will delete the measurement. Click "Match" will match the measurement to another plan.

(5) Import Plan

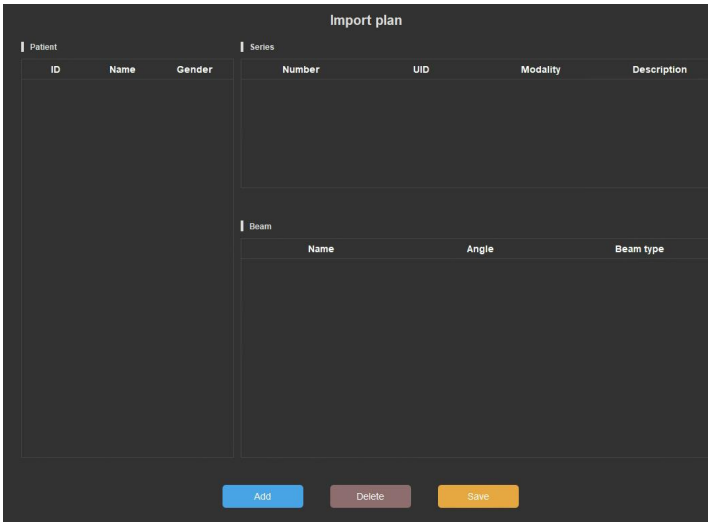


Figure 4-15 Import plan_SDC

Click "Add" and select a plan to import. You can delete the plan through "Delete" or save it through "Save".

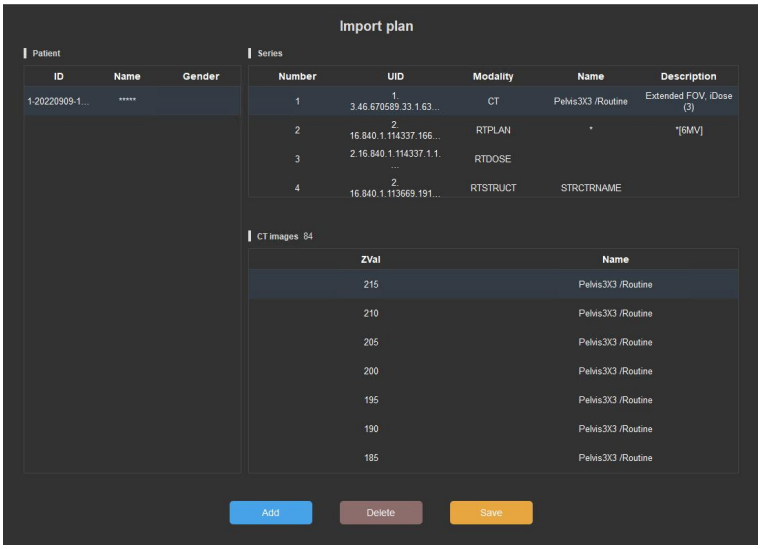


Figure 4-16 Deletion and Save of plans_SDC

4.3.2 Gamma

Click 

will display gamma details.

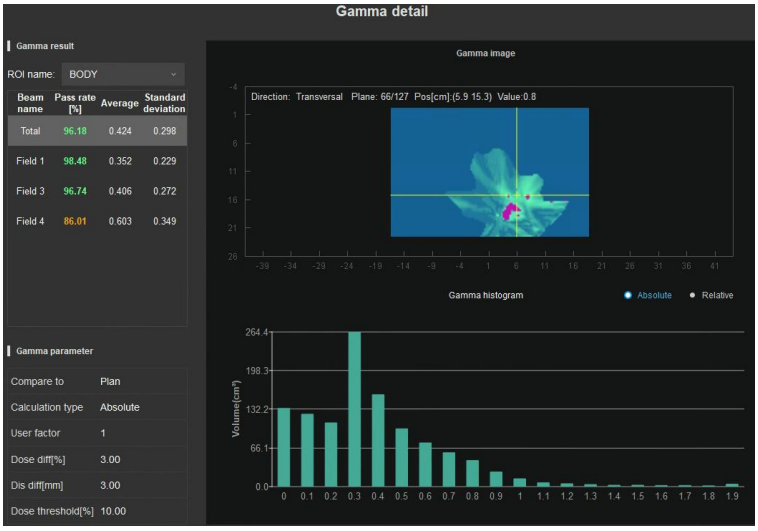


Figure 4-17 Gamma detail_SDC

Gamma results are shown on the left, where "Total" represents the gamma results calculated by cumulating the doses of all fields, while "Field 1" and others represent the gamma results of individual fields. On the right side, in the "Gamma image," user can calculate the gamma value at a specific location by moving the crosshair. When the gamma value is greater than 1, the corresponding point in the image will be displayed in purple.

4.3.3 DVH

Click 

will enter the "DVH evaluation" interface.
Click "Curve" to display the DVH curve. The dotted line represents the result of the SDC, while the solid line represents the result of the original plan.

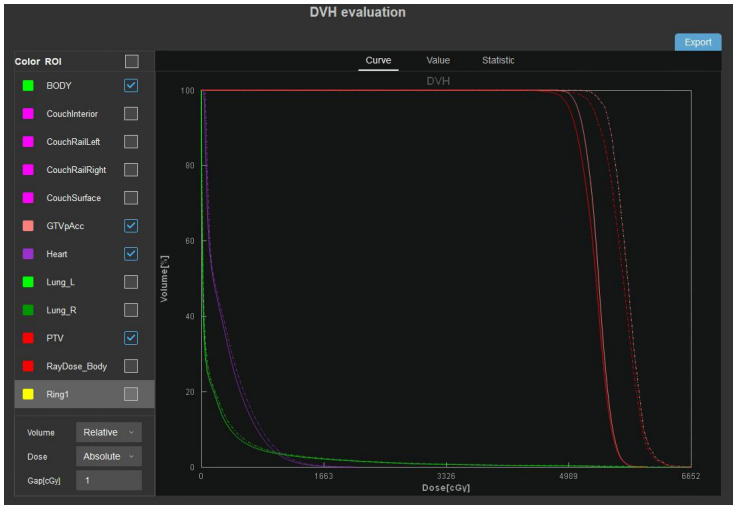


Figure 4-18 DVH evaluation_Curve_SDC

Click "Value" to display the DVH value of the selected ROI.

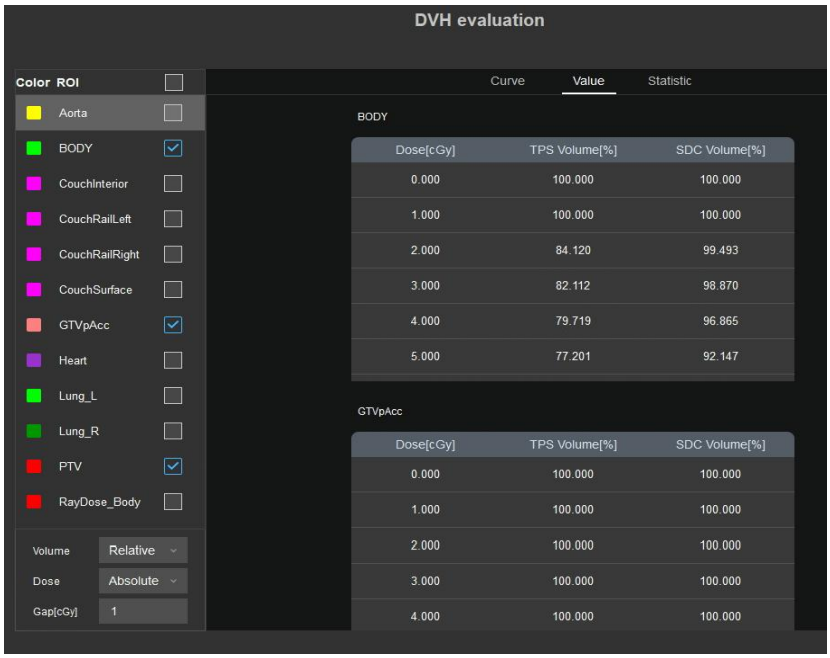


Figure 4-19 DVH evaluation_Value_SDC

Click "Statistic" to display the DVH statistics of the selected ROI.

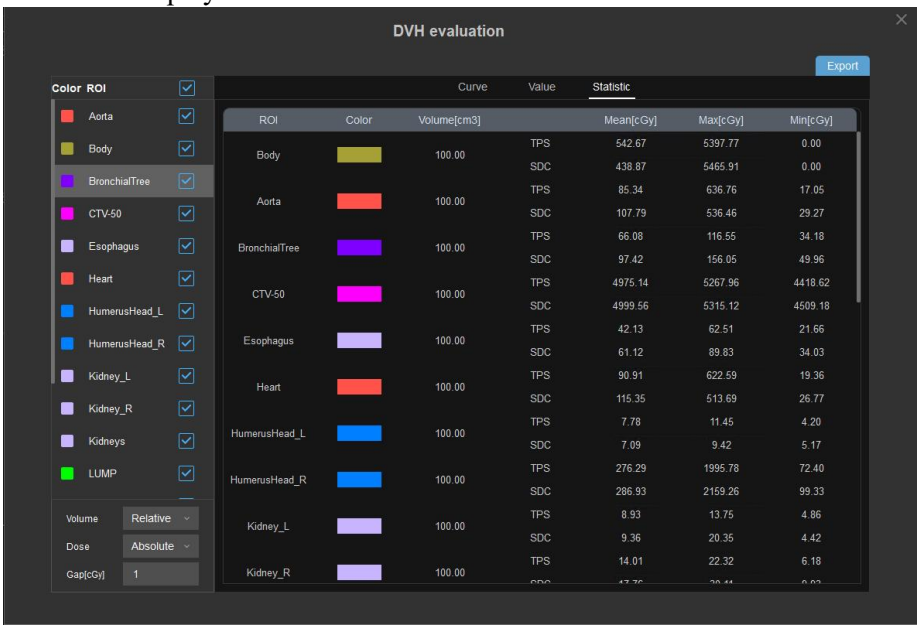


Figure 4-20 DVH evaluation_Statistic_SDC

4.3.4 Export

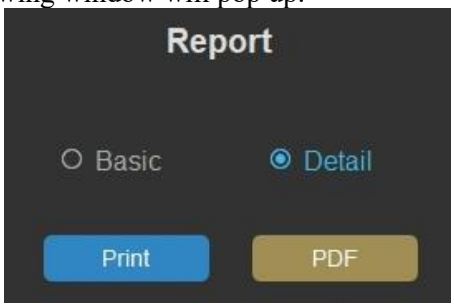
Click 

to export files. The file names and contents are as follows: plan data - PlanData, calculation results - CalData. The file format is ".dcm".

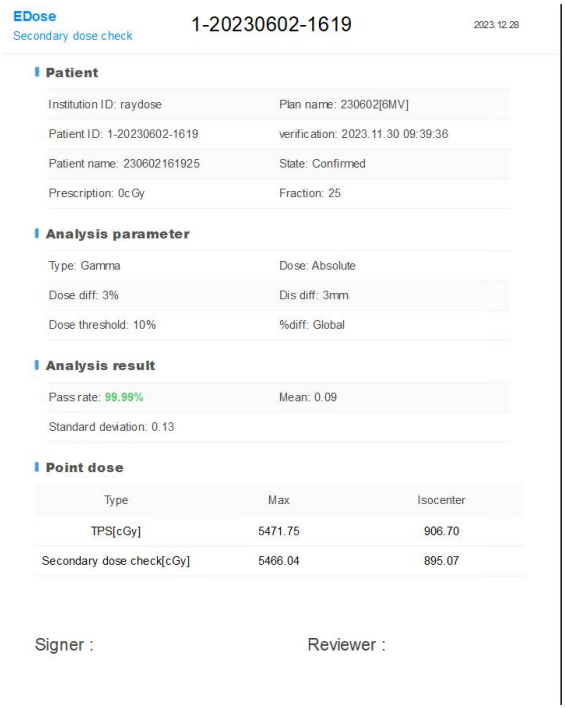
4.3.5 Report

Click 

and the following window will pop up.



The report comes in two formats: Basic and Detail. Clicking "Print" will directly print the report using a printer, while clicking "PDF" will export the report in PDF format.



EDose
Secondary dose check

1-20230602-1619

2023.12.28

Patient

Institution ID: raydose	Plan name: 230602[6MV]
Patient ID: 1-20230602-1619	verification: 2023.11.30 09:39:36
Patient name: 230602161925	State: Confirmed
Prescription: 0cGy	Fraction: 25

Analysis parameter

Type: Gamma	Dose: Absolute
Dose diff: 3%	Dis diff: 3mm
Dose threshold: 10%	%diff: Global

Analysis result

Pass rate: 99.99%	Mean: 0.09
Standard deviation: 0.13	

Point dose

Type	Max	Isocenter
TPS[cGy]	5471.75	906.70
Secondary dose check[cGy]	5466.04	895.07

Signer : Reviewer :

Figure 4-21 Report_SDC

4.4. View Individual Field

Click on any field on the left side of the interface to toggle the display of individual field.

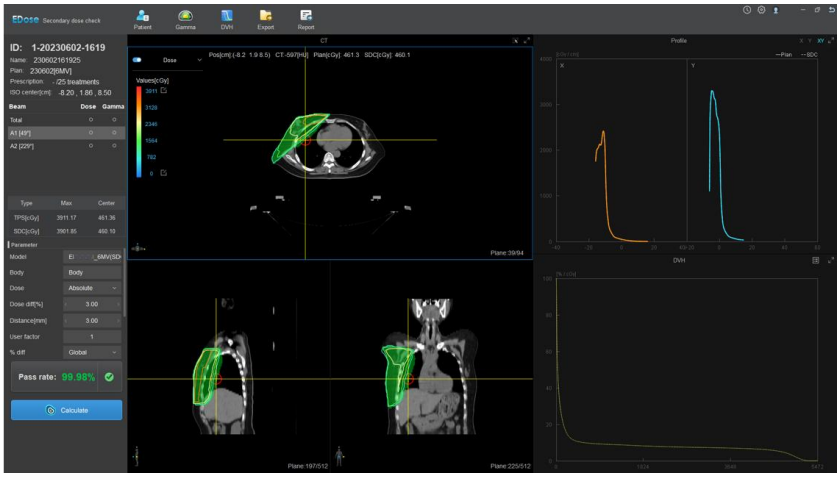
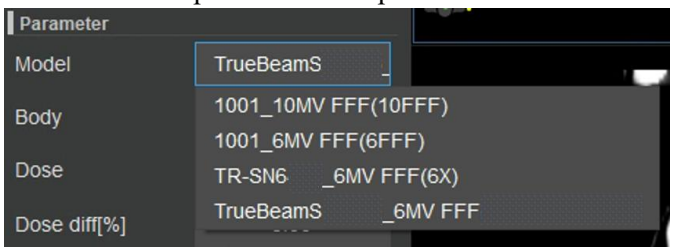


Figure 4-22 View individual field_SDC

4.5 Dose Calculation

In the left side of the interface, select the calculation model and click 

to calculate the 3D dose and Gamma pass rate of the plan.

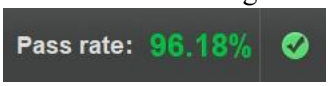


4.6 Gamma Analysis

Choose parameters for gamma calculation.

① "Dose": Calculate Gamma based on absolute dose or relative dose.
② "Dose diff[%]": Dose difference.
③ "Distance[mm]": Distance difference.
④ "User factor": Set the user's correction factor. The default is "1", which means no other corrections will be made.

Click gamma calculation result also can calculate the gamma pass rate.



5. 2D Pre-treatment (2D-P)

5.1 Functional Overview

2D Pre-treatment refers to the measurement of the plan dose based on EPID before treatment, and comparing and evaluating it with 2D plan to minimize potential errors.

5.2 Overview

Click 

to access the 2D Pre-treatment interface. Once the plan and measurement are successfully loaded, the interface shown in Figure 5-1 will appear. Alternatively, double-clicking on a measurement of "2D-P" will also take you to its 2D Pre-treatment interface.

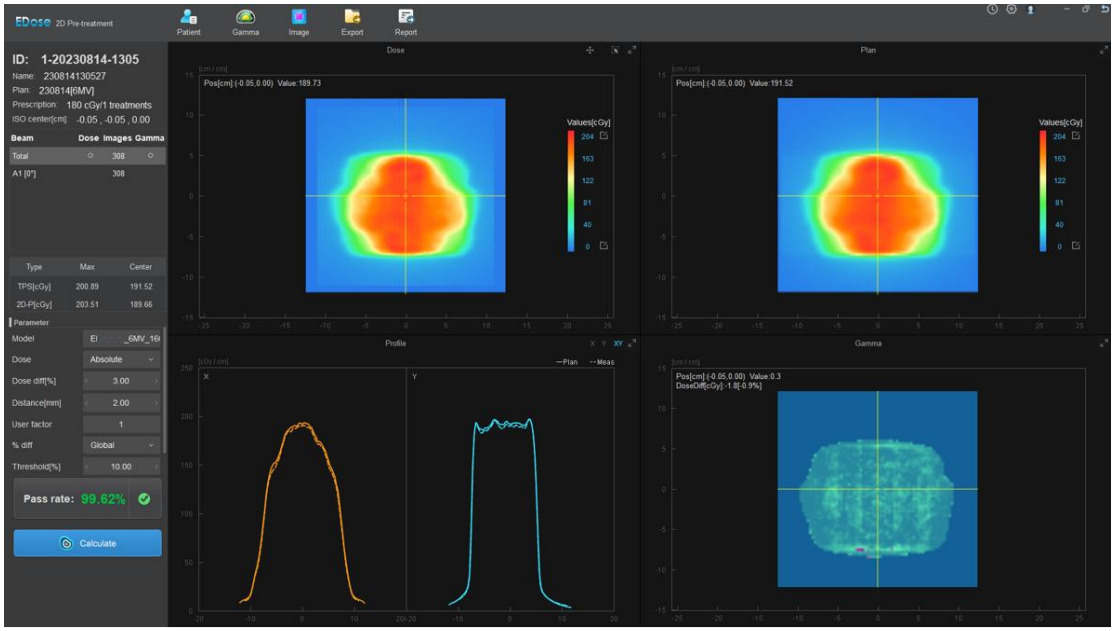


Figure 5-1 2D Pre-treatment interface

5.2.1 Left Sidebar

(1) ID
The same as the SDC, refer to 4.2.1.
(2) Beam
Compared to SDC, the "Beam" section has an additional "Image" which represents the number of image files for different fields. All other contents remain the same as the SDC, refer to 4.2.1.
(3) Point dose
The same as the SDC, refer to 4.2.1.
(4) Gamma calculation parameters
For details, refer to "4.6 Gamma Analysis".

5.2.2 Middle Part

In the middle part of the 2DP interface, you can see Figure 5-2.

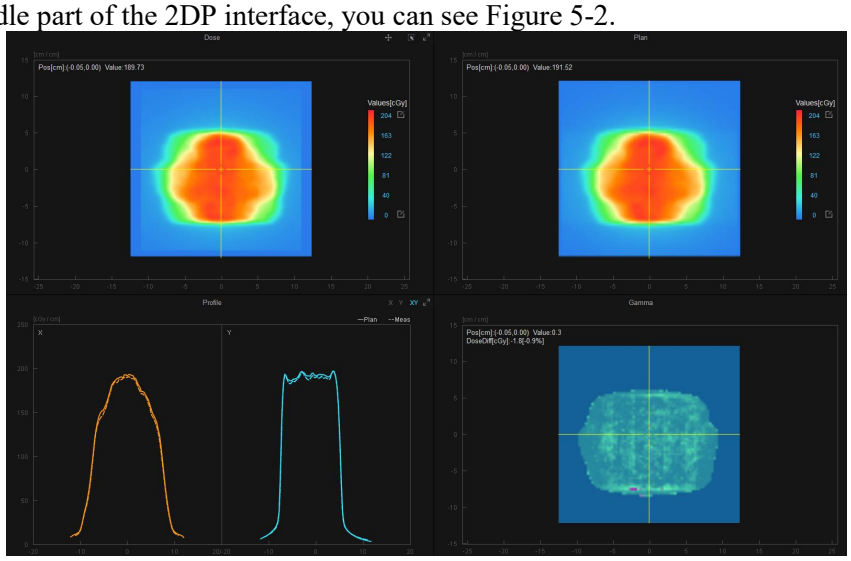


Figure 5-2 Middle part image_2DP

When the dose calculation has not been performed, the title of "Dose" will be displayed as "Image," indicating that it represents the EPID image.

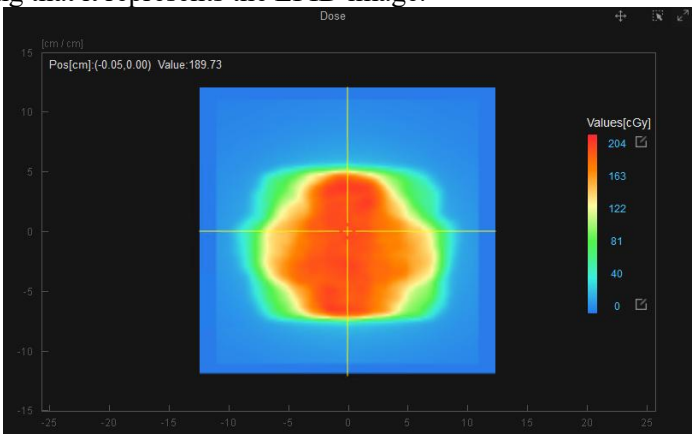
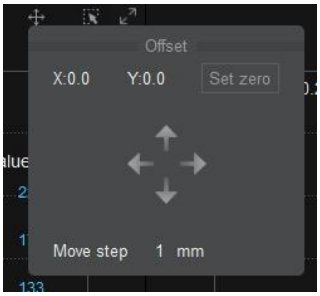


Figure 5-3 Dose view_2DP

Clicking  can adjust the position of the image. You can set the step size for each movement using "Move step," while "Set zero" resets the current movement and returns the image to its initial position.



Click  to display the size of calculation area in the image. Hold down the left mouse button to draw the size of the calculation area. Refer to the yellow dotted line in Figure 5-4.

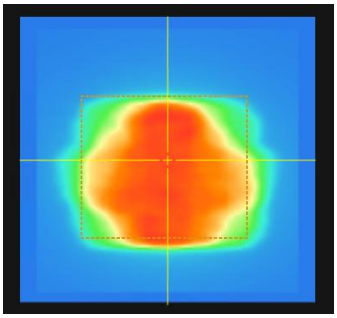


Figure 5-4 Calculation area_2DP

(1) Plan

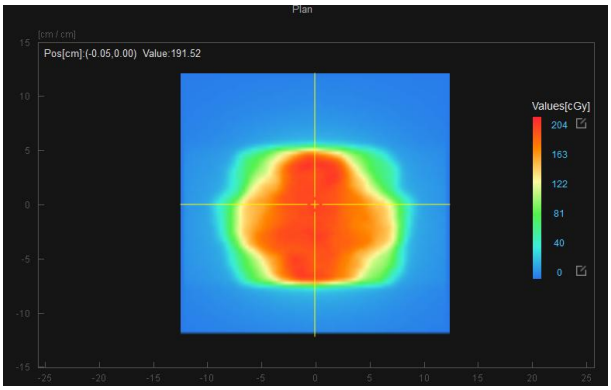


Figure 5-5 Plan_2DP

(2) Profile

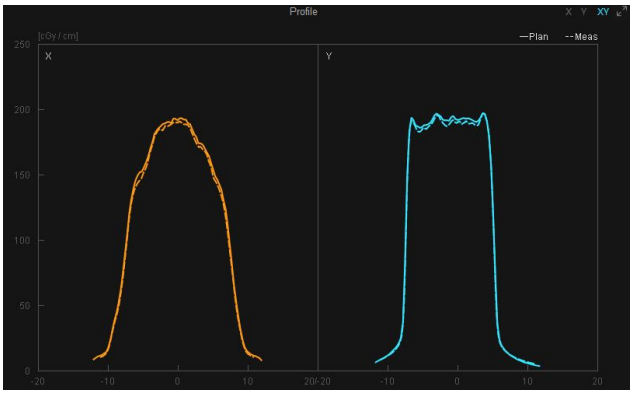


Figure 5-6 Profile_2DP

As shown in Figure 5-6, solid lines represent plann dose, while dashed lines represent measured dose. You can adjust the displayed images by clicking on the top-right buttons labeled X, Y, and XY.

(3) Gamma

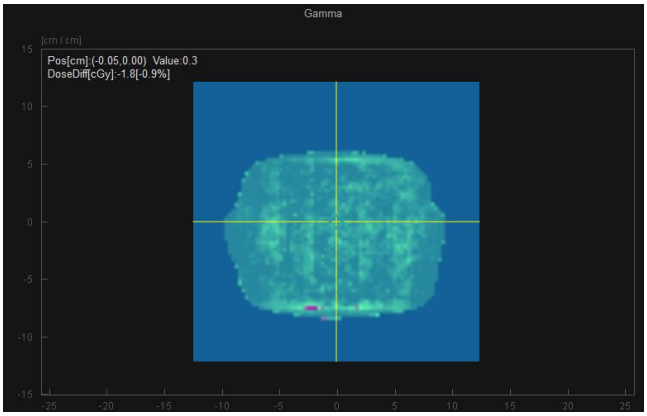


Figure 5-7 Gamma_2DP

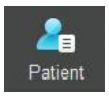
Figure 5-7 displays the gamma distribution. In the top-left corner, "DoseDiff" indicates the dose difference between the plan and measurement at the intersection of the crosshair.

5.3 Features

5.3.1 Patient

The overall operation is similar to SDC, refer to 4.3. But there are some differences.

(1) Patient interface

Click 

to enter the "Patient" interface. "Import Measurement" allows importing measurement under the selected plan.

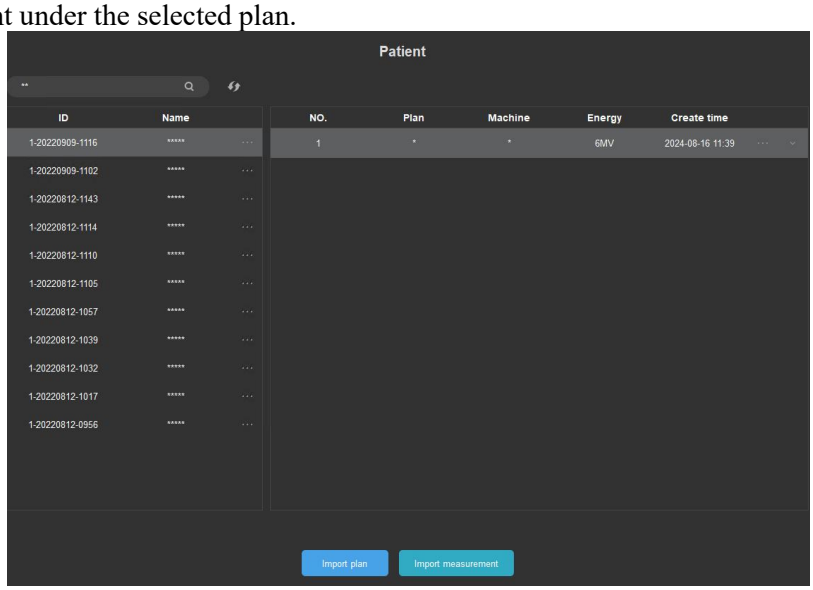
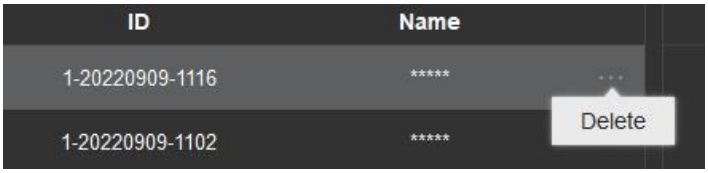


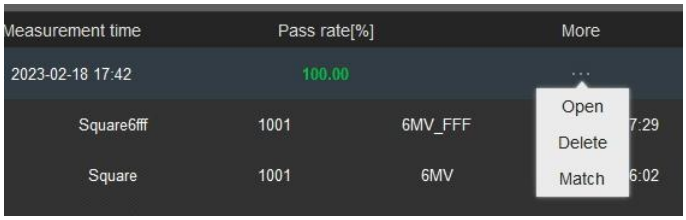
Figure 5-8 Patient_2DP

(2) Edit patient



(3) Edit plan

(4) Edit measurement



Click "Match" can select and match the measurement to another plan.

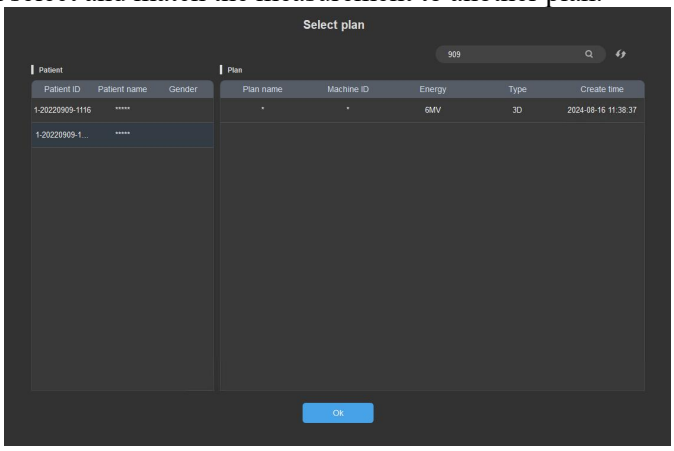


Figure 5-9 Select plan_2DP

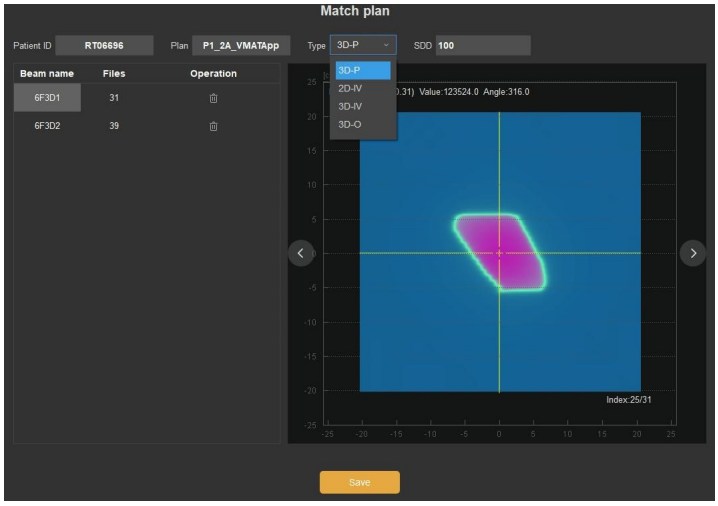


Figure 5-10 Match plan_2DP

(5) Import plan

Refer to 4.3 (5).

(6) Import measurement

Click Import measurement to display the following image.

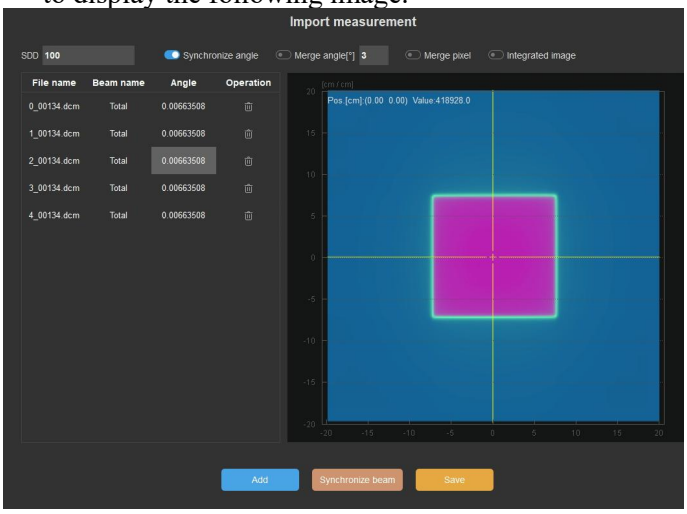


Figure 5-11 Import measurement_2DP

Table 5-1 Import measurement_Description

Item	Description
SDD	Distance between source and EPID
Synchronize angle	Once selected, the measured angle will be based on the field angle of the plan rather than the actual angle of the image
Merge angle	Once selected, EPID images will be merged by angle
Merge pixel	Merge image pixels (the default merged image pixels are 256×256)
Operation	Delete
Integrated image	Once selected, subtraction will be performed on images acquired using the Integrated mode (only applicable to some Varian machines)
Beam name	If the beam name in the EPID file does not match that in the plan, it will be displayed in yellow. At this time, you need to manually switch to the beam that exist in the plan.
Add	Add EPID images
Synchronize beam	EPID images can be assigned to fields with the same angle in the plan based on the EPID angle (default 3-degree tolerance, only applicable to IMRT plans).

5.3.2 Gamma

Refer to 4.3.2.

5.3.3 View EPID Image

Click "Image" to enter the "Measurement image" to view the detailed EPID image.

Figure 5-13 View EPID image_2DP

5.3.4 Export and Report

The same as the SDC, refer to 4.3.4 and 4.3.5.

5.4 View Individual Field

Click on any field on the left side of the interface to toggle the display of individual field..

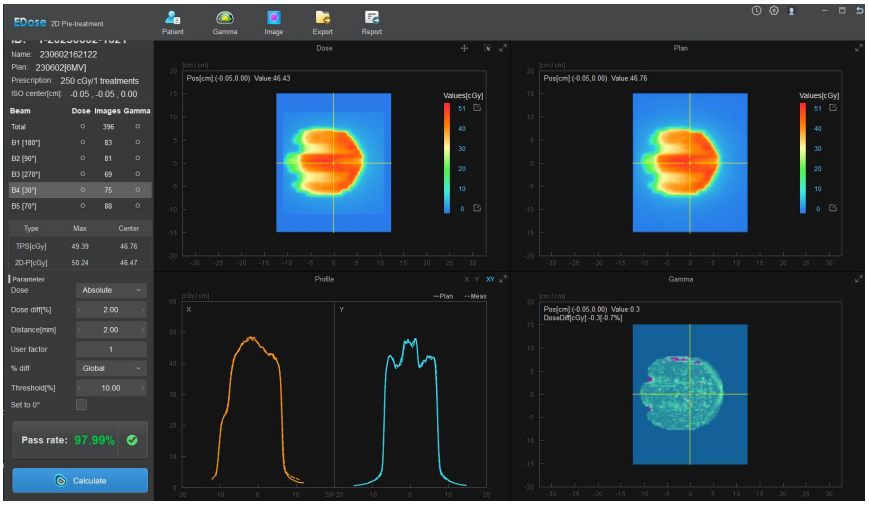


Figure 5-14 View individual field_2DP

5.5 Dose Calculation

The same as the SDC, refer to 4.5.

5.6 Gamma Analysis

For details, refer to "4.6 Gamma Analysis".

6. 3D Pre-treatment (3D-P)

6.1 Functional Overview

3D Pre-treatment refers to the measurement of the plan dose based on EPID before treatment, and comparing and evaluating it with 3D plan to minimize potential errors.

6.2 Overview

Double-clicking on a measurement of "3D-P" will take you to its 3D Pre-treatment interface.

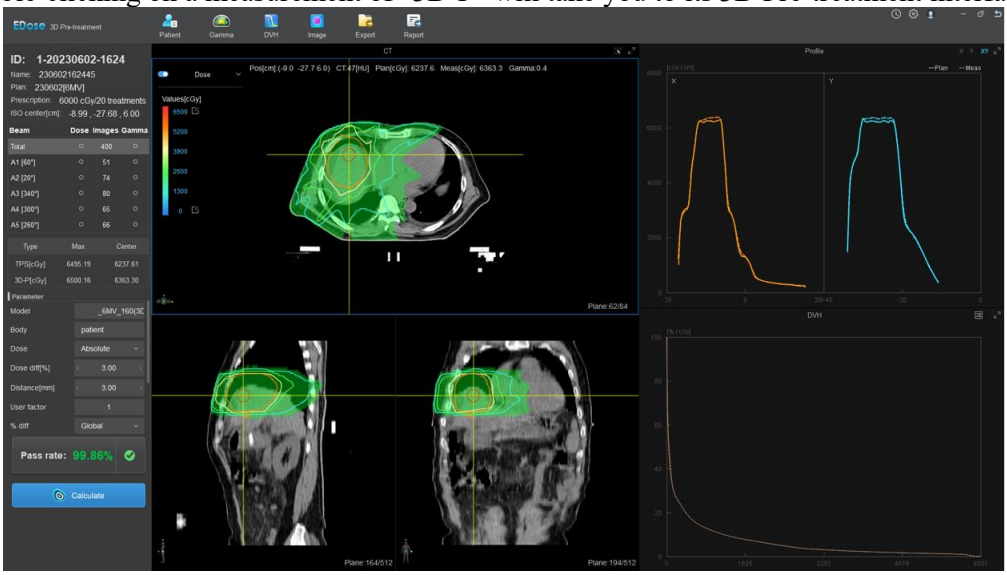


Figure 6-1 3D Pre-treatment interface

6.2.1 Left Sidebar

(1) ID

The same as the SDC, refer to 4.2.1 (1).

(2) Beam

Compared to SDC, the "Beam" section has an additional "Image" which represents the number of image files for different fields. All other contents remain the same as the SDC, refer to 4.2.1 (2).

(3) Point dose

The same as the SDC, refer to 4.2.1 (3).

(4) Gamma calculation parameters

For details, refer to "4.6 Gamma Analysis".

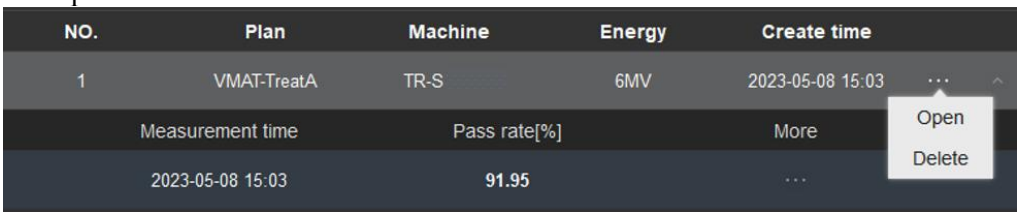
6.2.2 Middle Part

The same as the SDC, refer to 4.2.2.

6.3 Features

6.3.1 Patient

(1) Patient interface
The same as the 2D-P, refer to 5.3.1 (1).
(2) Edit patient
The same as the SDC, refer to 4.3.1 (2).
(3) Edit plan



(4) Edit measurement
The same as the 2D-P, refer to 5.3.1 (3).
(5) Import plan
The same as the SDC, refer to 4.3.1 (4).
(6) Import measurement
The same as the 2D-P, refer to 5.3.1 (5).

6.3.2 Gamma

The same as the SDC, refer to 4.3.2.

6.3.3 DVH

The same as the SDC, refer to 4.3.3.

6.3.4 Image

The same as the 2D-P, refer to 5.3.3.

6.3.5 Export and Report

The same as the SDC, refer to 4.3.4 and 4.3.5.

6.4 View Individual Field

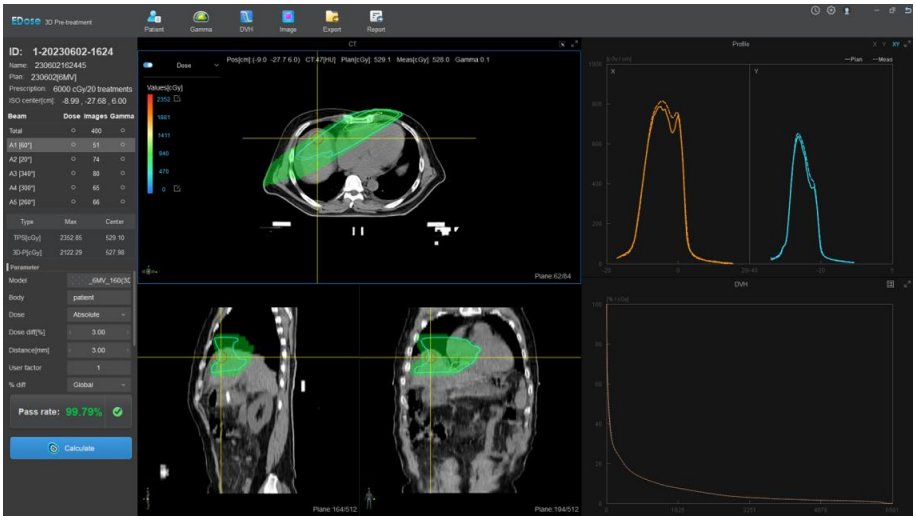


Figure 6-2 View individual field_3DP

6.5 Dose Calculation

The same as the SDC, refer to 4.5.

6.6 Gamma Analysis

For details, refer to "4.6 Gamma Analysis".

7. 3D In Vivo (3D-IV)

7.1 Functional Overview

3D in vivo refers to real-time measurement of the plan dose based on EPID during treatment, and comparing and evaluating it with the 3D plan dose to monitor the treatment.

7.2 Overview

Click 

or double-click on a measurement of "3D-IV" will take you to its interface.

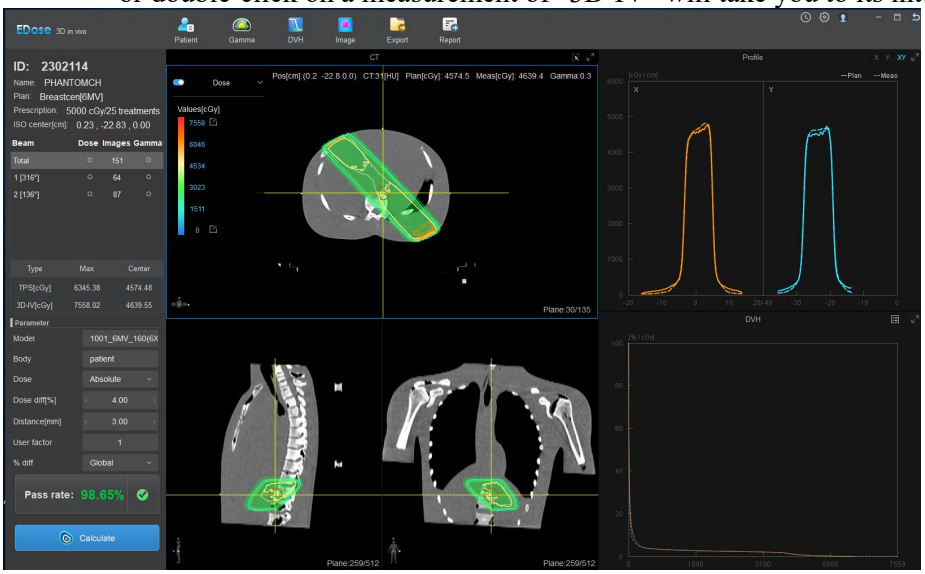


Figure 7-1 3D-IV interface

7.2.1 Left Sidebar

The same as the "SDC", refer to 4.2.1.

7.2.2 Middle Part

The same as the "SDC", refer to 4.2.2.

7.3 Features

7.3.1 Patient

The same as the 2D-P, refer to 5.3.1.

7.3.2 Gamma

The same as the SDC, refer to 4.3.2.

7.3.3 DVH

The same as the SDC, refer to 4.3.3.

7.3.4 Image

The same as the 2D-P, refer to 5.3.3.

7.3.5 Export and Report

The same as the SDC, refer to 4.3.4 and 4.3.5.

7.4 View Individual Field

The same as the "SDC", refer to 4.4.

7.5 Dose Calculation

The same as the "SDC", refer to 4.5.

7.6 Gamma Analysis

The same as the "SDC", refer to 4.6.

8. Physics Model

8.1 Functional Overview

Before using EDose, the following models must be completed in order: refer to section 8.2 to build a reference physical model, section 8.3 to build a tool model, section 8.4 to build a specific physical model. Only after completing these three models can you proceed to the functional modules (SDC, 2D-P, 3D-P, 3D-IV) to start using EDose for plan verification.

8.2 How to Build a Reference Physical Model

8.2.1 Step

STEP 1. Click  to enter the physics model interface. Click  to create a new LINAC record, the default name is "New machine". Click  will delete it.

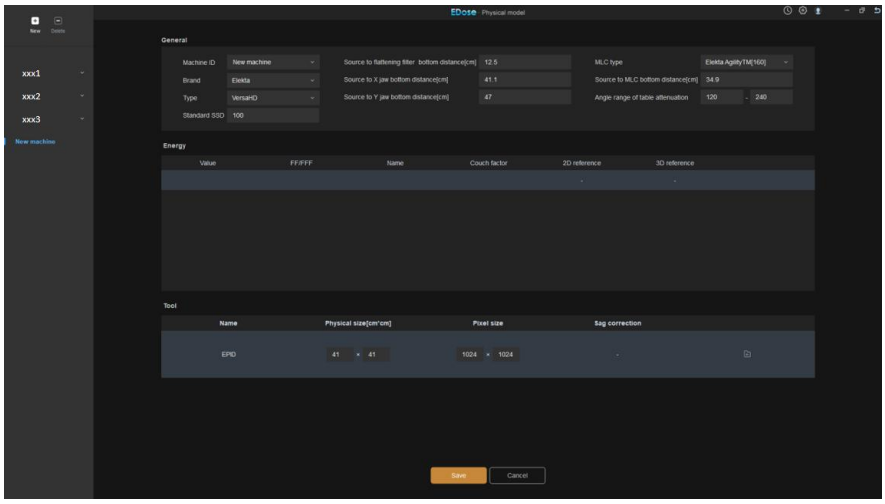


Figure 8-1 Physics model interface & Create a new LINAC record

STEP 2. Find "*Energy>Value*" and double-click the blank area to create a new energy record.

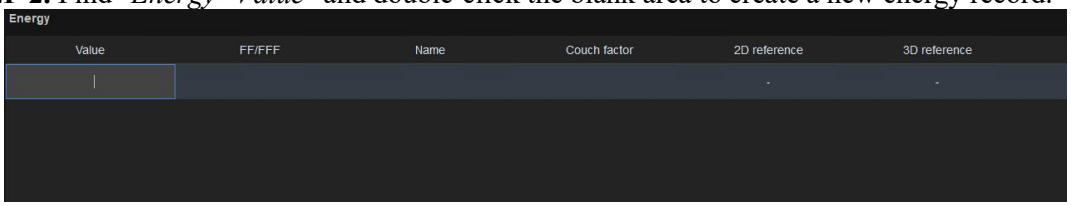


Figure 8-2 Create a new energy record

A LINAC can create multiple different energies.

Figure 8-3 Energy list

Table 8-1 Energy list description

Item	Description
Value	Energy Value
FF/FFF	Energy Type
Couch factor	Couch attenuation factor. Only relevant to 3D-IV.
2D reference	If there is a 2D reference, display ✓, if not, display -.
3D reference	If there is a 3D reference, display ✓, if not, display -.
2D	Click the button will open the "2D reference" window.
3D	Click this button will open the "3D reference" window.

STEP 3. If there is no 2D reference (displayed -), then click 2D to enter the 2D reference window.

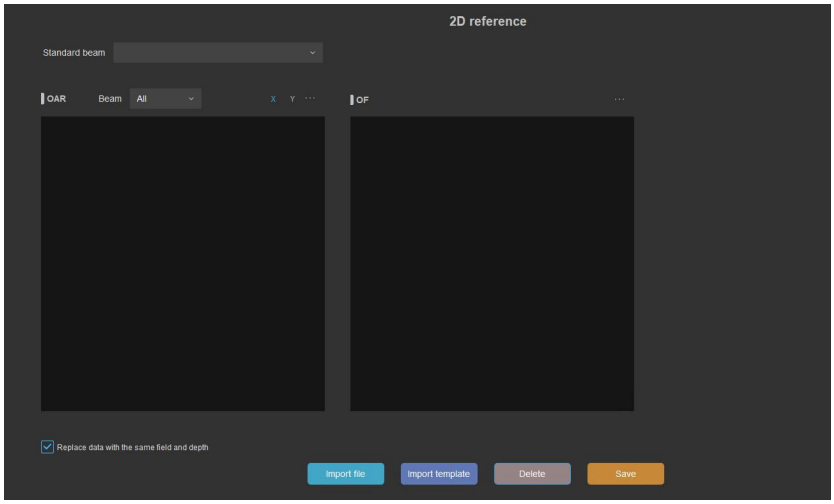


Figure 8-4 2D reference window_Blank

In this window, you can choose to *Import file* (QA plans measured by user, refer to 8.2.2) or *Import template* (built-in in the EDose). Click *Save* to complete the 2D reference establishment, and ✓ will be displayed.

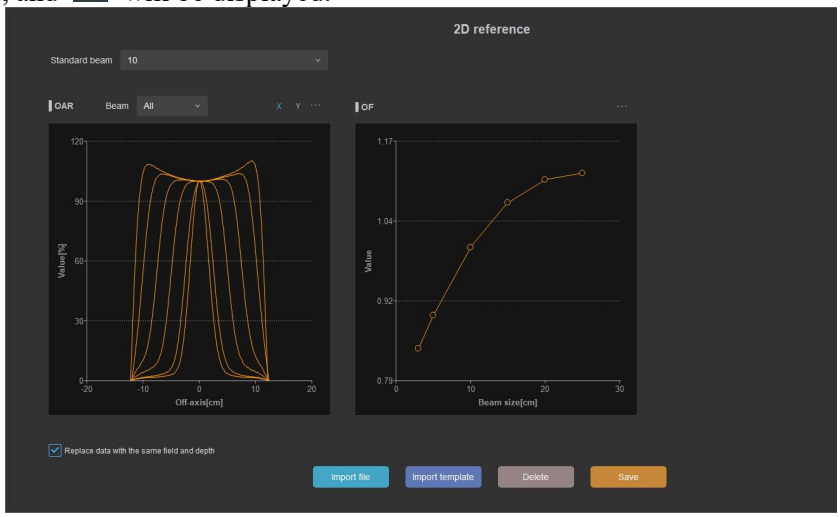


Figure 8-5 2D reference window_Completed

The step for 3D reference are the same and will not be explained here.

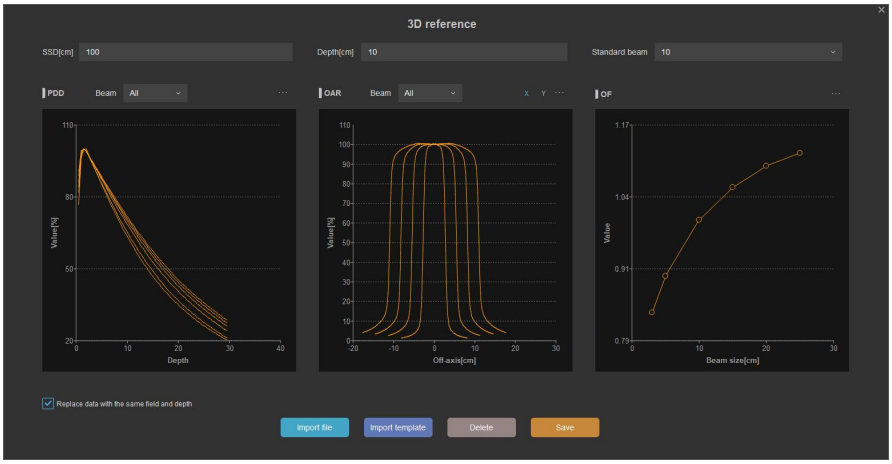


Figure 8-6 3D reference window_Completed

STEP 4. Establish models according to the following steps. Note that models can be built under 2D Pre-treatment only after 2D reference is completed, and models can be modeled under SDC, 3D Pre-treatment and 3D in vivo only after 3D reference is completed.

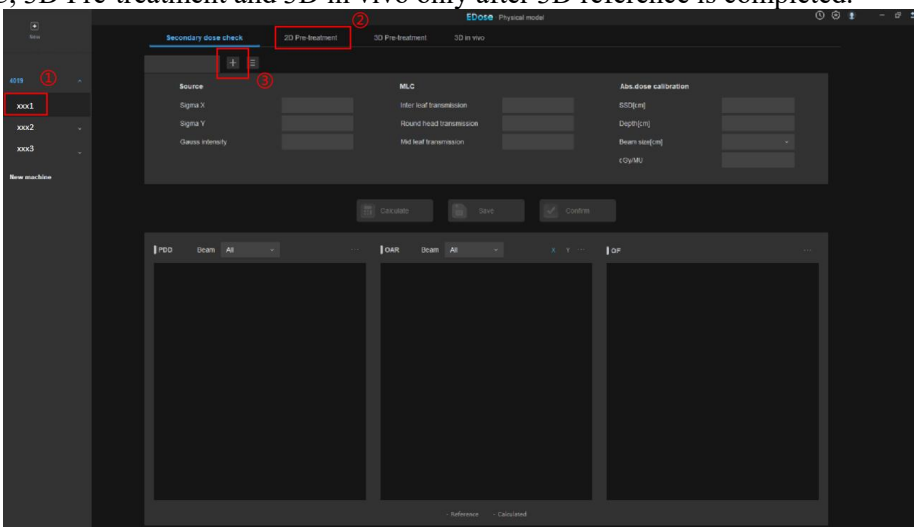


Figure 8-7 Modeling in 2D Pre-treatment (2D reference example)_Step

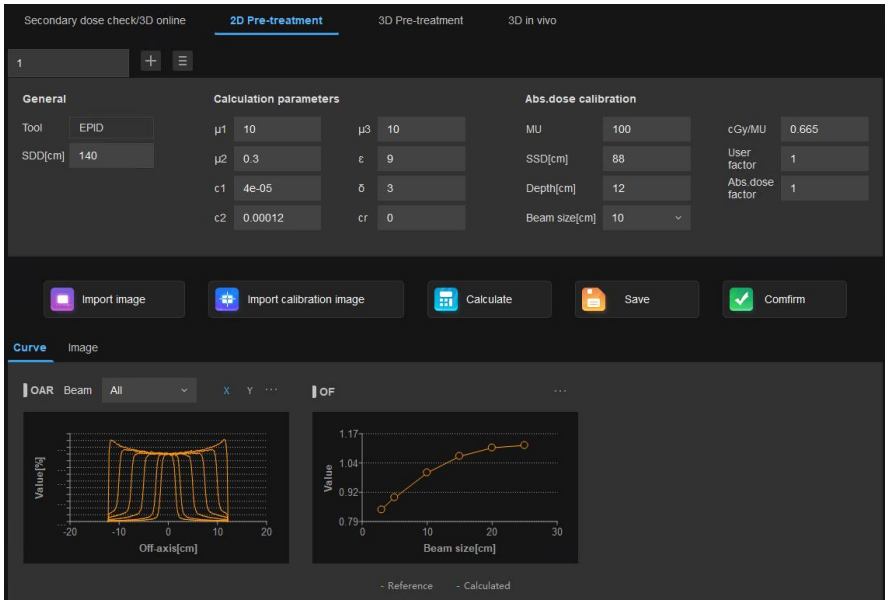


Figure 8-8 Modeling in 2D Pre-treatment (2D reference example)_Completed

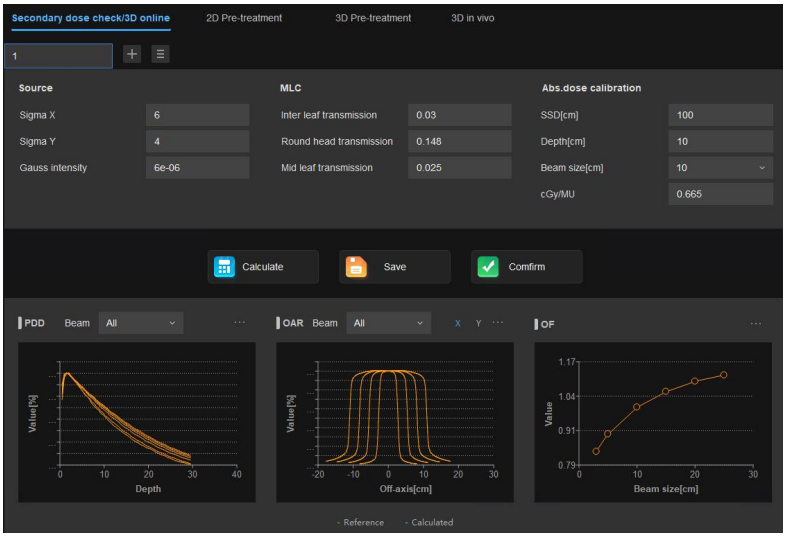


Figure 8-9 Modeling in SDC (3D reference example)_Completed

8.2.2 Detailed Description of 2D Reference "*Import file*"

If opting not to use a template(*Import template*), users can import their own measured QA plans via "*Import file*". It's recommended to use R12L30 for measurements (a cylindrical phantom with a radius of 12cm and a length of 30cm), with a total of 6 fields to be measured (the dose files for each field must be named 3/5/10/15/20/25). The file format must be ".dcm".

Table 8-2 Image operation description of 2D reference

Measurement Conditions	Phantom: R12L30	
	MU=100 (recommended)	
	SAD=100cm, Isocenter layer depth＝12cm	
R12L30 / Plan	Field Name	Field Size(cm×cm)
	3	3×3
	5	5×5
	10	10×10
	15	15×15
	20	20×20
	25	25×25
File Format	.dcm	

Table 8-3 "*Import file*" description of 2D reference

Item	Description
Standard beam	A specific field can be selected as the standard field for calibration.
Replace data with the same field and depth	Once selected, each time a new file is imported, if the new file contains data with the same field size and depth as the original file, it will replace the corresponding data in the original file.
OAR	
Beam	Toggles the displayed field view.
X	Display only X-axis images.
Y	Display only Y-axis images.

	Perform smoothing, centering, or normalization operations on the images.
OF	
	Click it will bring up a pop-up window, where you can modify field data or delete fields by double-clicking.

8.2.3 Detailed Description of 3D Reference "*Import file*"

In the 3D reference, it is recommended to use a water tank for measurements.

Table 8-4 Image operation description of 3D reference

Measurement Conditions	Phantom: Water Tank							
	MU=100 (recommended)							
	SSD=100cm							
Water Tank / Plan	PDD		OAR(Crossline/Inline)			OF		
	SSD(cm)	Field Size(cm)	SSD(cm)	Depth (cm)	Field Size(cm)	SSD(cm)	Depth (cm)	Field Size(cm)
	100	3×3	100	10	3×3	100	10	3×3
	100	5×5	100	10	5×5	100	10	5×5
	100	10×10	100	10	10×10	100	10	10×10
	100	15×15	100	10	15×15	100	10	15×15
	100	20×20	100	10	20×20	100	10	20×20
	100	25×25	100	10	25×25	100	10	25×25
File Format	PDDS(.csv)		Crossline/Inline(.csv)			SCP(.csv)		
	Only ".csv", ".asc" or ".mcc" files are supported							

Table 8-5 "*Import file*" description of 3D reference

Item	Description
Standard beam	A specific field can be selected as the standard field for calibration.
Replace data with the same field and depth	Once selected, each time a new file is imported, if the new file contains data with the same field size and depth as the original file, it will replace the corresponding data in the original file.
PDD	
Beam	Toggles the displayed field view.
	Perform smoothing, centering, or normalization operations on the images.
OAR	
Beam	Toggles the displayed field view.
X	Display only X-axis images.
Y	Display only Y-axis images.
	Perform smoothing, centering, or normalization operations on the images.
OF	
	Click it will bring up a pop-up window, where you can modify field data or delete fields by double-clicking.

8.3 How to Build a Tool Model

This section is for setting up position correction. At the bottom of the physics model interface, locate the "Tool". If position correction already exists, "Sag correction" will display .

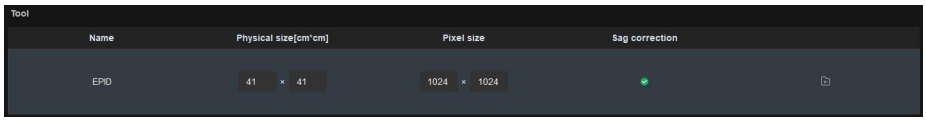


Figure 8-10 Tool

If there is no position correction, click on the right side of the "Tool" to enter the "Position correction" window.

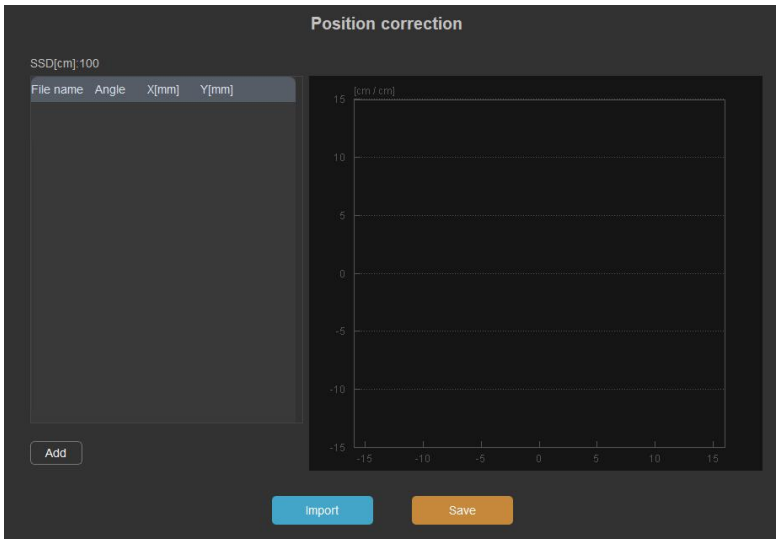


Figure 8-11 Position correction window_Blank

Click "Import" to import EPID images, only ".dcm" files are supported. It is recommended that the imported EPID images are obtained by rotating the gantry angle from 0 to 360 degrees, with images acquired at intervals of 45 degrees. As shown in Figure 8-12.

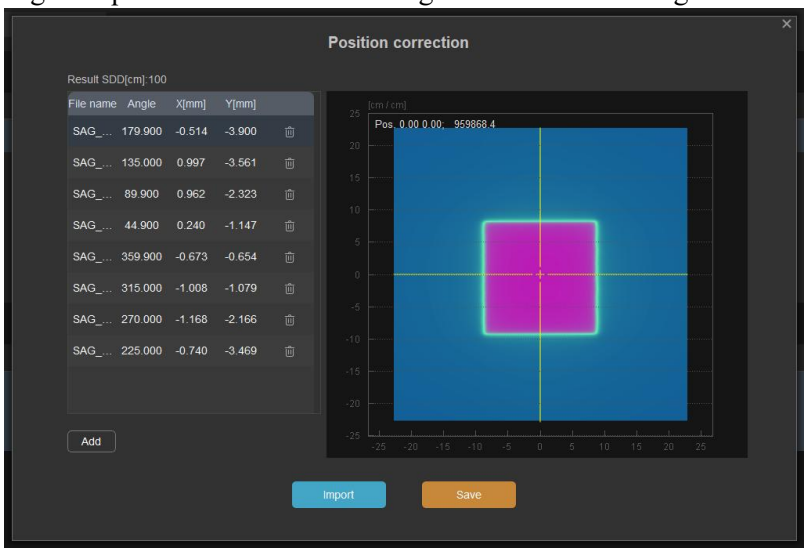


Figure 8-12 Position correction window_Completed

Table 8-6 Description of position correction

Item	Description
Angle	LINAC gantry angle
X[mm]	Position deviation in the X direction (mm)
Y[mm]	Position deviation in the Y direction (mm)
Add	Click on the blank area to manually enter field data

8.4 How to Build a Specific Physical Model

8.4.1 SDC

STEP 1. Ensure that the selected energy record under the machine has completed the 3D reference.

STEP 2. Select "Secondary dose check" and click  to create a model of the SDC. Note that multiple models can be created in one functional module. Click  can delete the selected model.

STEP 3. Fill in the parameters for the new model and click "*Save*" to save the changes, then click "*Calculate*". The calculated curve (calculated based on the parameters filled in) and the reference curve (based on 3D reference) will be shown in the figure.

STEP 4. User can make the calculated curve close to the reference curve by fine-tuning the parameters on the page or operating on curves. When the error between these two curves is considered acceptable, the SDC model can be considered finished.

STEP 5. Click "*Confirm*", and the selected physical model will be set as the calibration model of the functional module. A functional module can only have one calibration model.

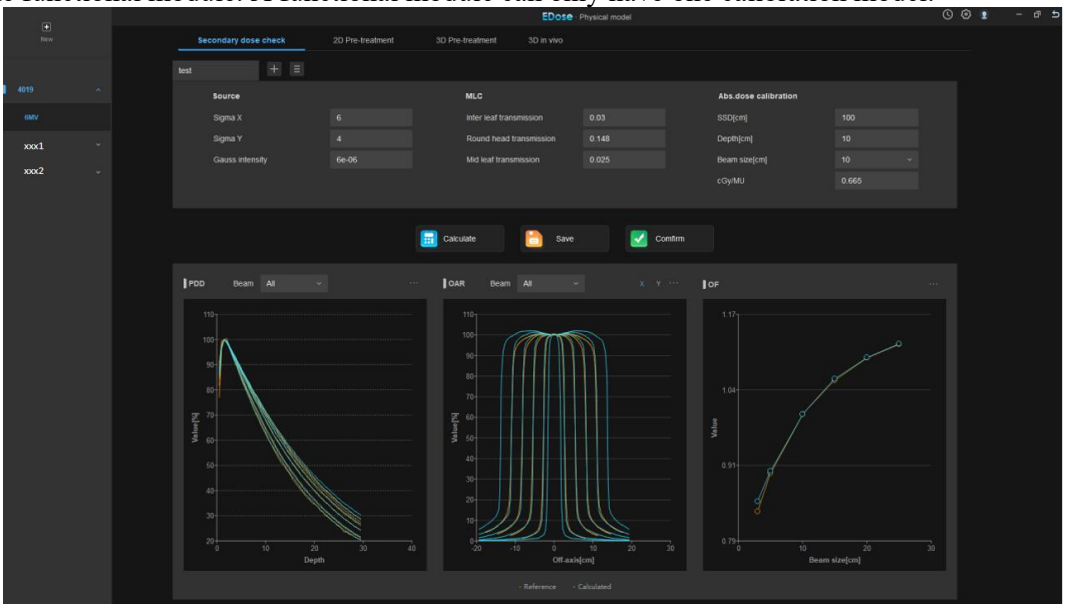


Figure 8-13 Physical model_SDC

8.4.2 2D-P

Preparation: Use EPID to capture images of 6 fields (recommended sizes, cm^2: 3×3, 5×5, 10×10, 15×15, 20×20, 25×25), and the file format is [.dcm]. It is recommended to use 100MU or 200MU when capturing.

STEP 1. Ensure that the selected energy record under the machine has completed the 2D

reference.

STEP 2. Select "2D-Pretreatment" and click  to create a model. Note that multiple models can be created in one functional module. Click  can delete the selected model.

STEP 3. Click "*Import image*" to import captured images. The software will automatically identify the field sizes and name them 3.dcm, 5.dcm, 10.dcm, 15.dcm, 20.dcm, 25.dcm respectively. Meanwhile, users can modify it by double-clicking the name. Click "*Save*" to complete the import.

STEP 4. Click *"Import calibration image*" to import a calibration image. Generally, it is recommended to use 10×10 cm^2 field image as the calibration.

STEP 5. Fill in the parameters for the new model and click "*Save*" to save the changes, then click "*Calculate*". The calculated curve (calculated based on parameters and imported images) and the reference curve (based on 2D reference) will be shown in the figure.

STEP 6. User can make the calculated curve close to the reference curve by fine-tuning the parameters on the page or operating on curves. When the error between these two curves is considered acceptable, the 2D-P model can be considered finished.

STEP 7. Click "*Confirm*", and the selected physical model will be set as the calibration model of the functional module. A functional module can only have one calibration model.

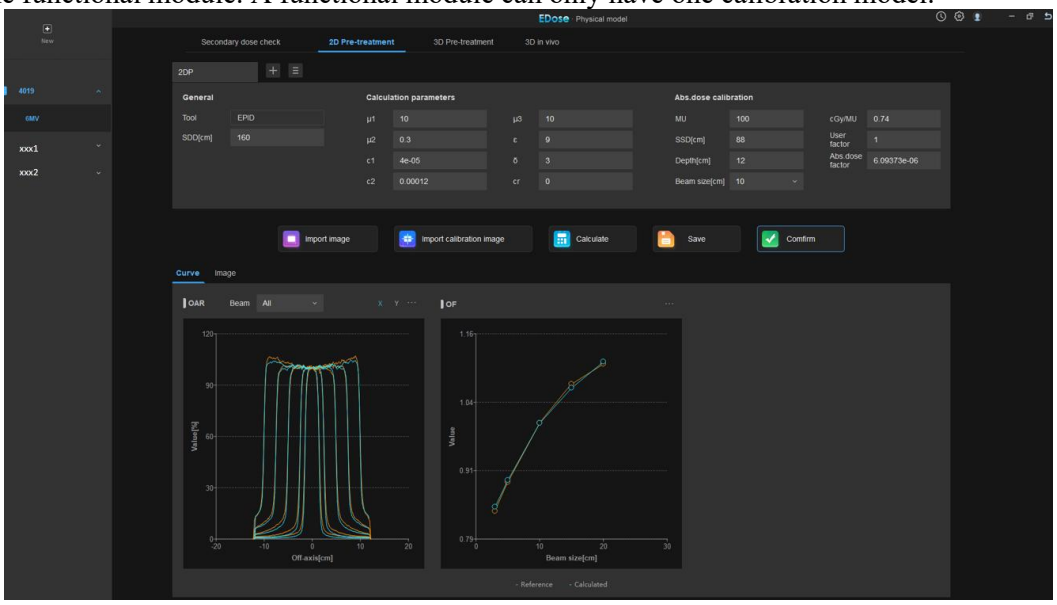


Figure 8-14 Physical model_2D-P

8.4.3 3D-P

Preparation: Use EPID to capture images of 6 fields (recommended sizes, cm^2: 3×3, 5×5, 10×10, 15×15, 20×20, 25×25), and the file format is [.dcm]. It is recommended to use 100MU or 200MU when capturing.

STEP 1. Ensure that the selected energy record under the machine has completed the 3D reference.

STEP 2. Select "3D-Pretreatment" and click  to create a model. Note that multiple models can be created in one functional module. Click  can delete the selected model.

STEP 3. Click "*Import image*" to import captured images. The software will automatically identify the field sizes and name them 3.dcm, 5.dcm, 10.dcm, 15.dcm, 20.dcm, 25.dcm respectively. Meanwhile, users can modify it by double-clicking the name. Click "*Save*" to complete the import.

STEP 4. Click *"Import calibration image*" to import a calibration image. Generally, it is

recommended to use 10×10 cm^2 field image as the calibration.
STEP 5. Fill in the parameters for the new model and click "*Save*" to save the changes, then click "*Calculate*". The calculated curve (calculated based on parameters and imported images) and the reference curve (based on 3D reference) will be shown in the figure.
STEP 6. User can make the calculated curve close to the reference curve by fine-tuning the parameters on the page or operating on curves. When the error between these two curves is considered acceptable, the 3D-P model can be considered finished.
STEP 7. Click "*Confirm*", and the selected physical model will be set as the calibration model of the functional module. A functional module can only have one calibration model.

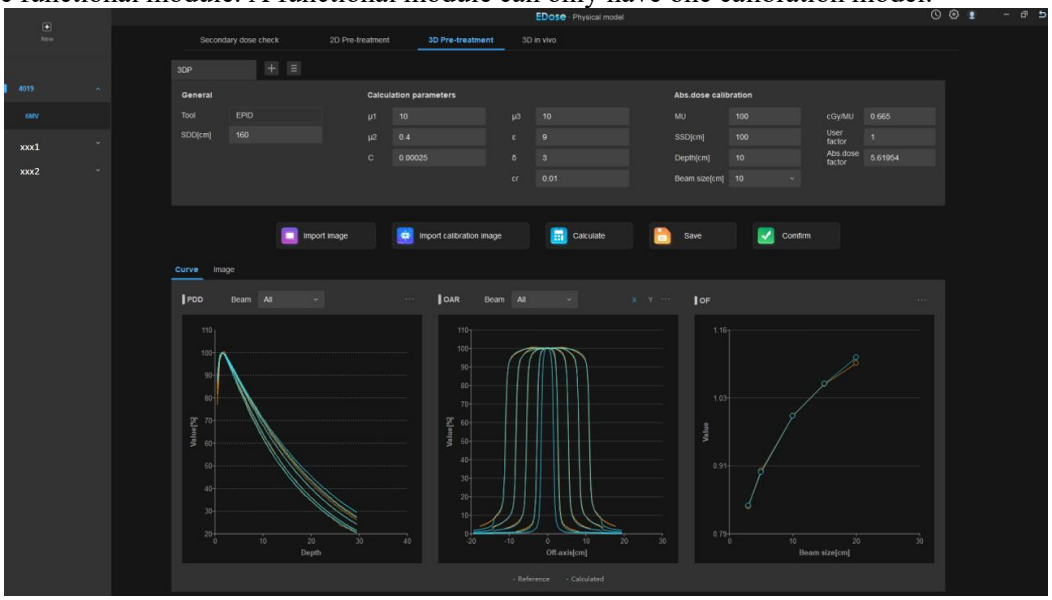


Figure 8-15 Physical model_3D-P

8.4.3 3D-IV

Preparation: Place a 20cm thick solid water phantom between the source and EPID, and capture images of 6 fields (recommended sizes, cm^2: 3×3, 5×5, 10×10, 15×15, 20×20, 25×25). The file format is [.dcm]. It is recommended to use 100MU or 200MU when capturing.
STEP 1. Ensure that the selected energy record under the machine has completed the 3D reference.
STEP 2. Select "3D in vivo" and click  to create a model. Note that multiple models can be created in one functional module. Click  can delete the selected model.
STEP 3. Click "*Import image*" to import captured images. The software will automatically identify the field sizes and name them 3.dcm, 5.dcm, 10.dcm, 15.dcm, 20.dcm, 25.dcm respectively. Meanwhile, users can modify it by double-clicking the name. Click "*Save*" to complete the import.
STEP 4. Click *"Import calibration image*" to import a calibration image. Generally, it is recommended to use 10×10 cm^2 field image as the calibration.
STEP 5. Fill in the parameters for the new model and click "*Save*" to save the changes, then click "*Calculate*". The calculated curve (calculated based on parameters and imported images) and the reference curve (based on 3D reference) will be shown in the figure.
STEP 6. User can make the calculated curve close to the reference curve by fine-tuning the parameters on the page or operating on curves. When the error between these two curves is considered acceptable, the 3D-IV model can be considered finished.
STEP 7. Click "*Confirm*", and the selected physical model will be set as the calibration model of the functional module. A functional module can only have one calibration model.

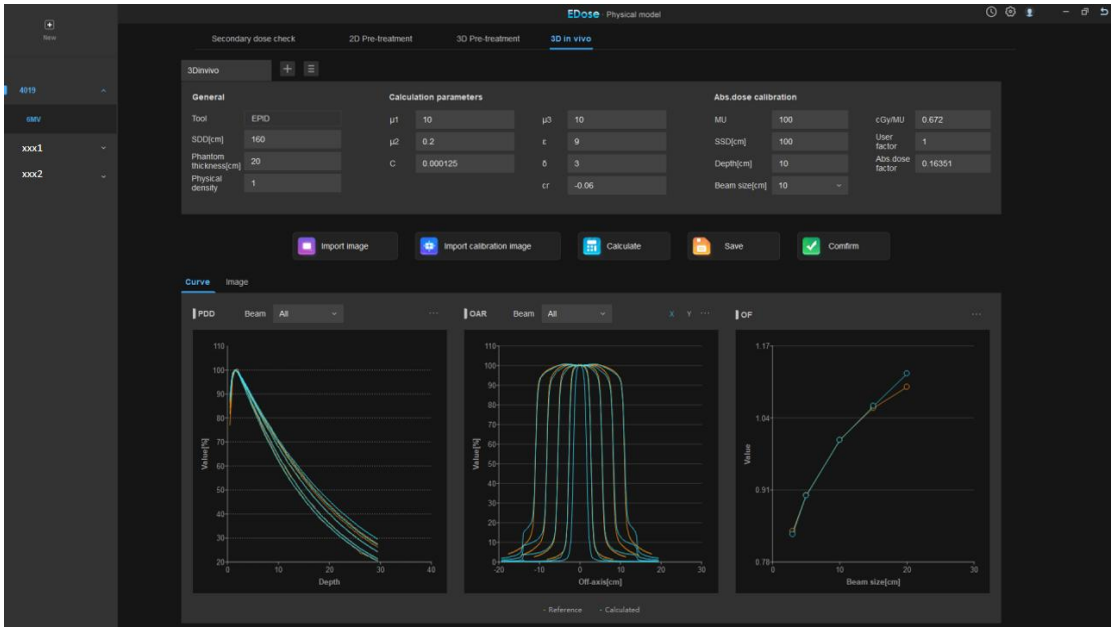


Figure 8-16 Physical model_3D-IV

General description is as follows.

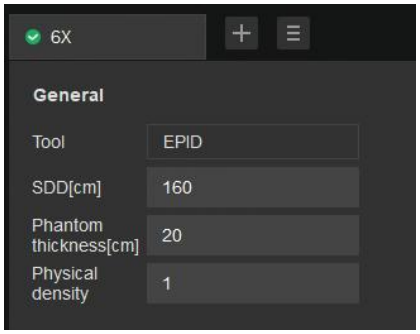


Figure 8-17 General

Table 8-7 Description_General

Item	Description
Phantom thickness[cm]	The thickness of the phantom placed between the source and EPID when measuring.
Physics density	The physical density of the phantom, measured in g/cm^2.

9. Compute Queue

Click  in the upper right corner of the homepage to enter the Compute queue.

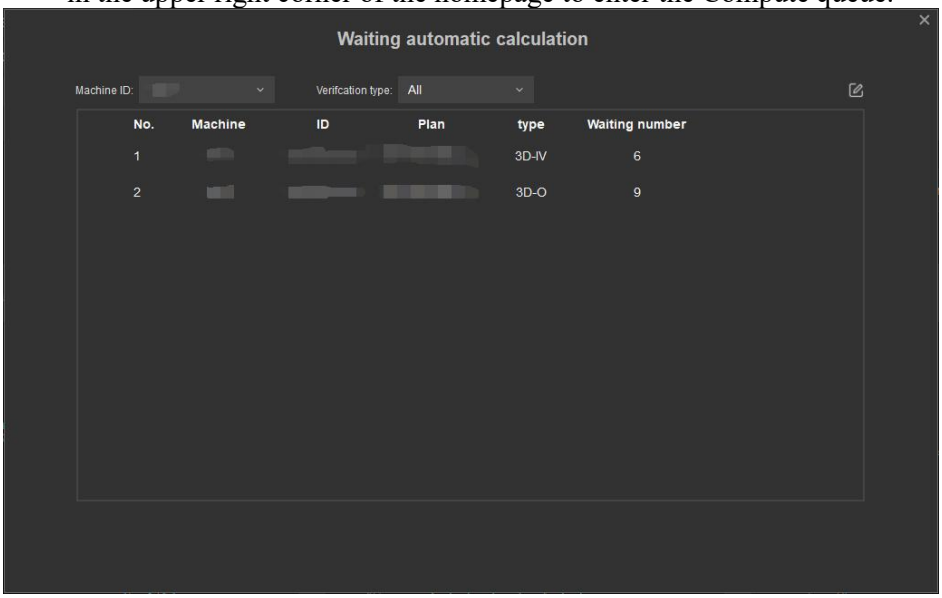


Figure 9-1 Waiting automatic calculation

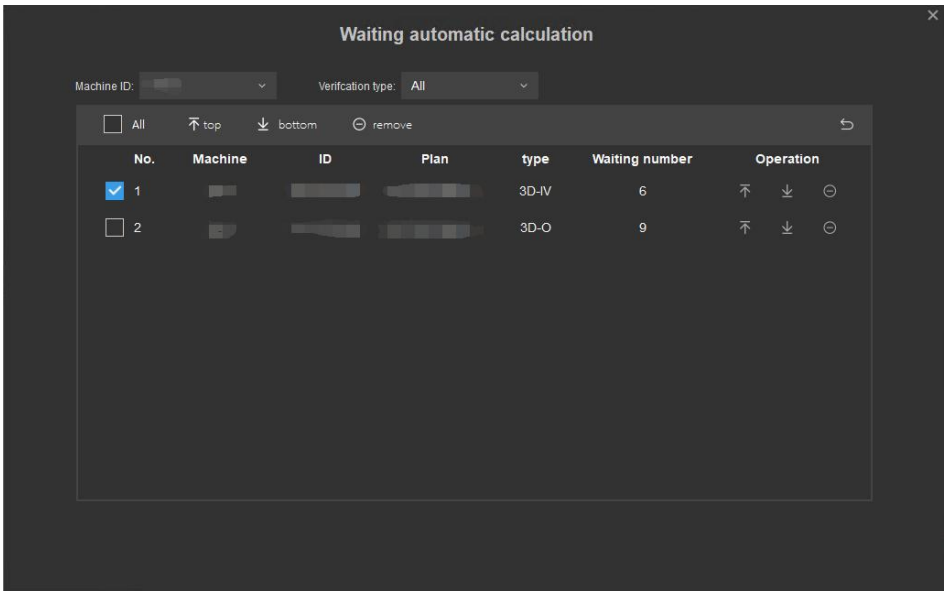


Figure 9-2 Edit status

10. Setting

Click  in the upper right corner of the homepage to enter the setting.

10.1 Calculation

Click "Machine ID" to perform calculation settings on the selected machine.

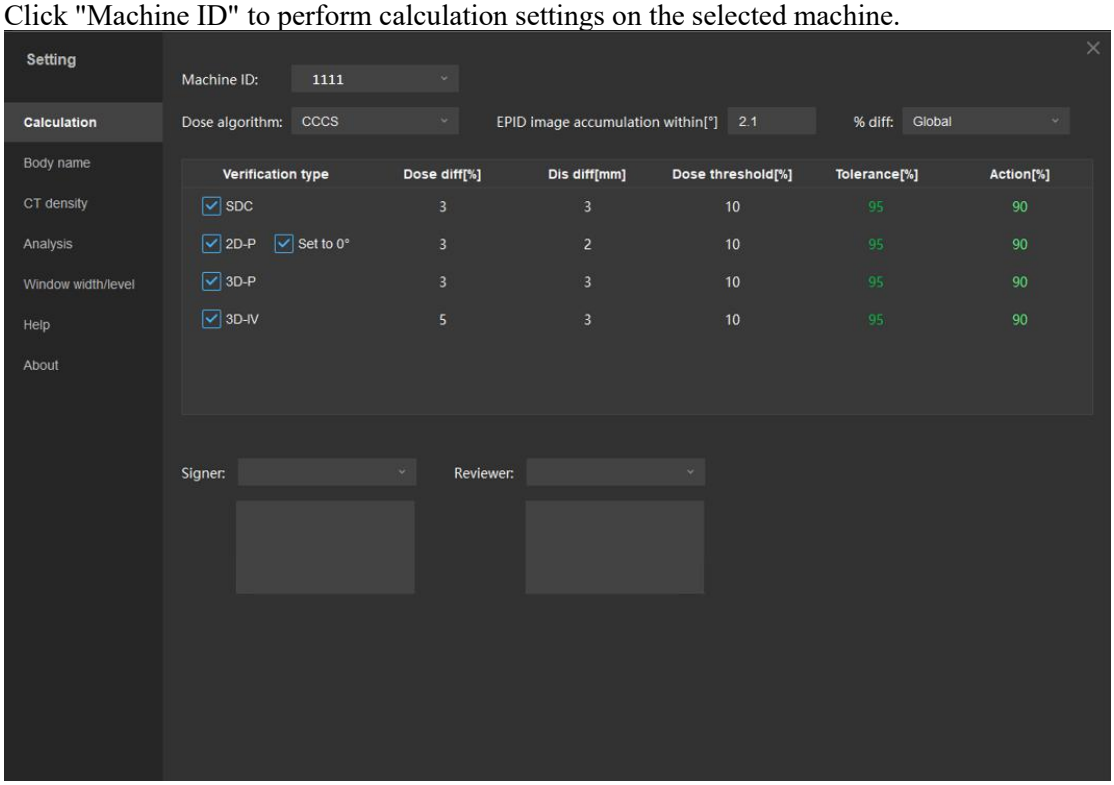


Figure 10-1 Calculation settings

Descriptions of each section are as follows:

① Back scatter: Apply back scatter correction. Only applicable to Varian.

② Dose algorithm: Choose the dose algorithm, currently only supporting CCCS algorithm.

③ EPID image accumulation within[°]: Merge EPID images based on the set angle to speed up calculations. The range is [1.0-4.0°].

④ % diff: Currently only supports "Global", meaning the maximum dose within the calculation area is selected as the relative reference dose. Only applicable to "Absolute dose".

⑤ Table: Set default parameters for Gamma calculation.

Item	Description
Verification type	Once selected, EDose will automatically calculate based on the selected functional modules after accepting the plan. If "Set to 0°" is checked, it means that the angles of the EPID images are set to zero under 2D-P and then calculated.
Dose diff[%]	Dose difference
Dis diff[mm]	Distance difference
Dose threshold[%]	Dose threshold
Tolerance[%]	Tolerance limits, the color of the calculated pass rate is dark green
Action[%]	Action limits (≤ Tolerance limits), the color of the calculated pass

	rate is light green

⑥ Signer: Set default signature for reports generated under the selected machine.

⑦ Reviewer: Set default signature of reviewer for reports generated under the selected machine.

10.2 Body Name

Patient external contour ROI name, add "Body name" for different planning systems. EDose will automatically obtain the corresponding external contour ROI data in the Structure file based on the name of these names.

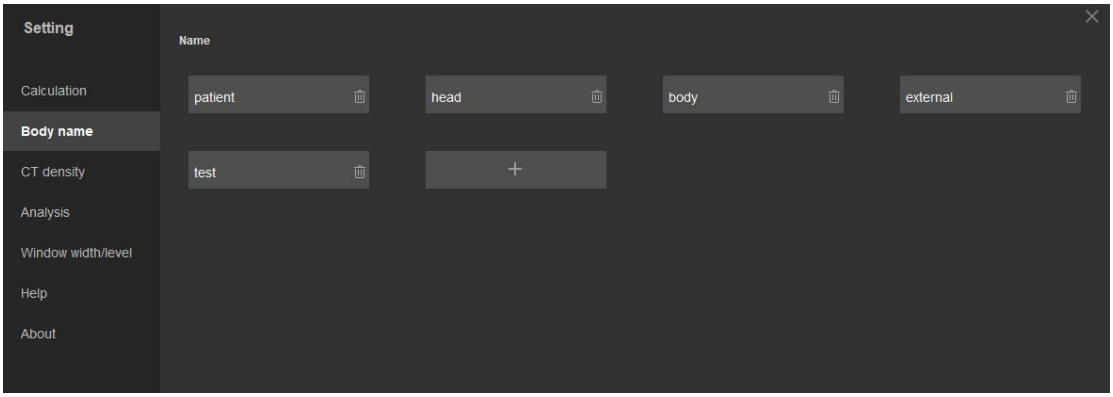


Figure 10-2 Body name

10.3 CT Density

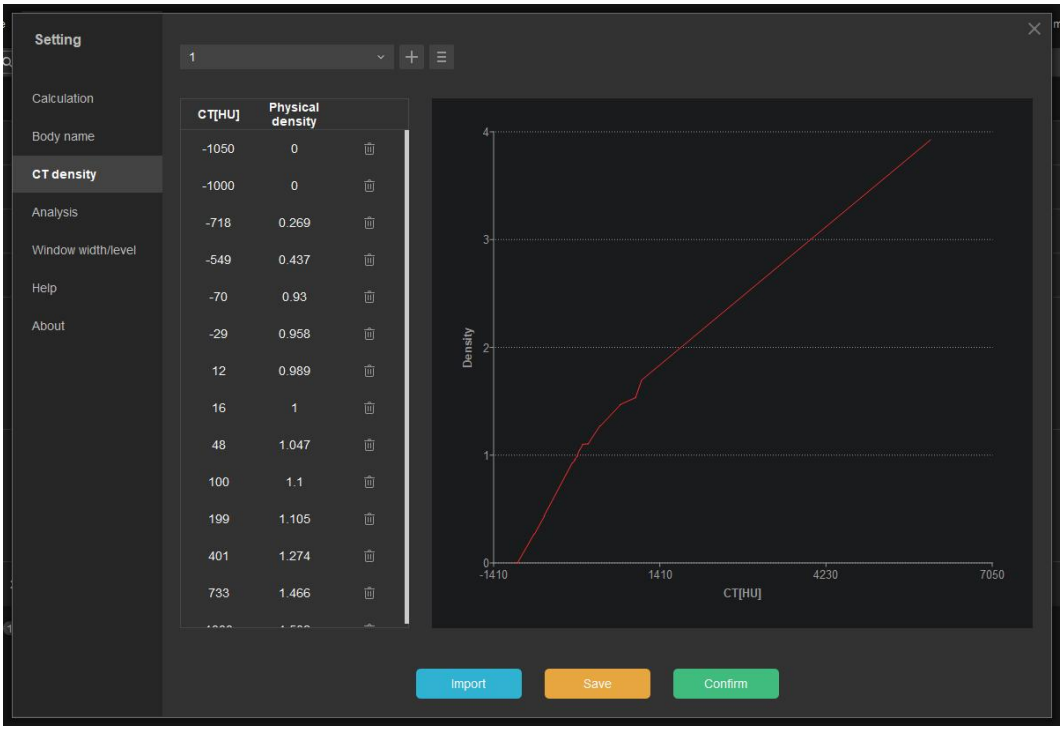


Figure 10-3 CT density curve

To calculate the dose, it's essential to configure the CT (HU)-Density curve (users can import it themselves). This setup can be seen in Figure 10-3. Below are descriptions for each

component.

①  : Add a new CT density record.

②  : Open the management panel to delete the specified density.

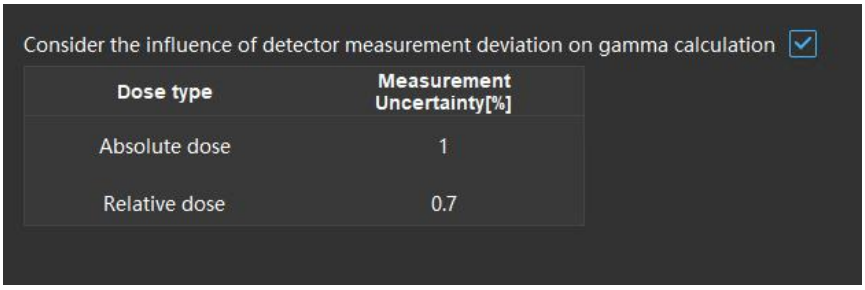
③ Import: Import CT density.

④ Save: Save changes.

⑤ Confirm: Set the current CT-density curve as default, at this point the content of the table cannot be modified. Click "Unconfirm" to cancel the confirmation.

⑥ CT Density Table: When "Unconfirm", double-click on the blank section of the table to add a new CT density value, click on a section with a value to modify the data.

10.4 Analysis



Checking this option means that the influence of EPID measurement deviation is considered when calculating the gamma pass rate:

① When select "Absolute dose", an additional 1% deviation will be added to the actual dose difference. That is: if Dose diff[%]=3% is selected and this option is checked, the pass rate will be calculated based on Dose diff[%]=4%.

② When select "Relative dose", an additional 0.7% deviation will be added to the actual dose difference. That is: if Dose diff[%]=3% is selected and this option is checked, the pass rate will be calculated based on Dose diff[%]=3.7%.

10.5 Window Width / Level

Window width/level can be set on this page. Click the save or undo button to save or cancel the added information. Note that the default Window width/level cannot be edited or deleted.

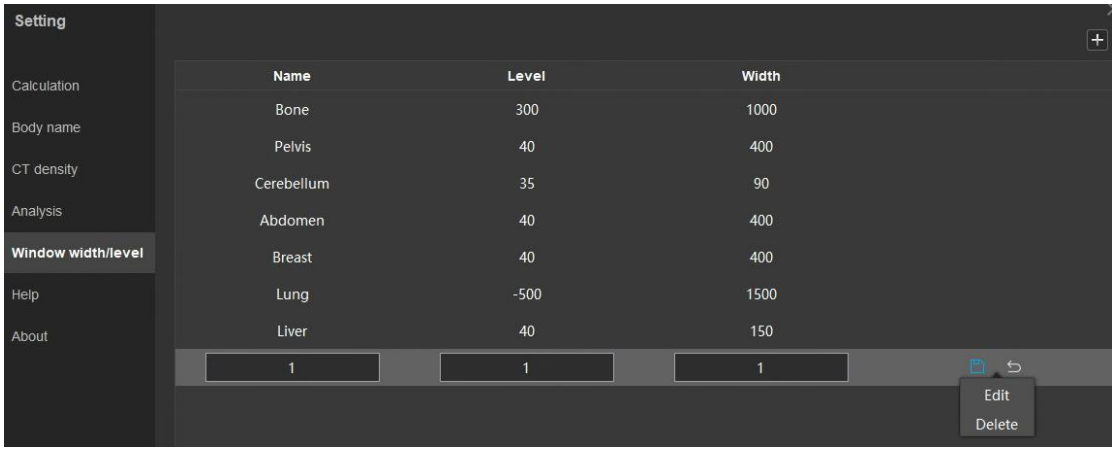


Figure 10-4 Window width/level

10.6 Help

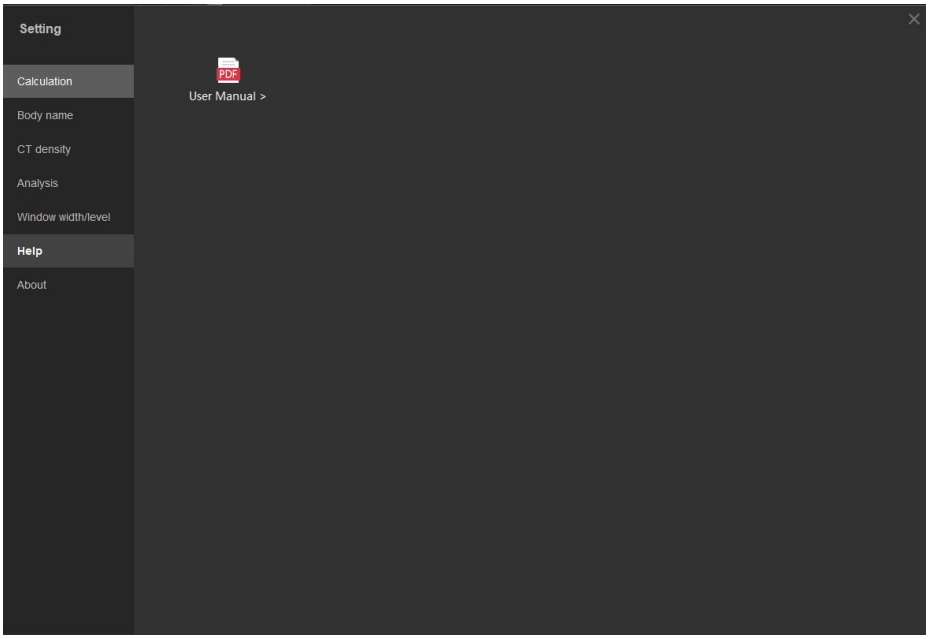


Figure 10-5 Help

10.7 About

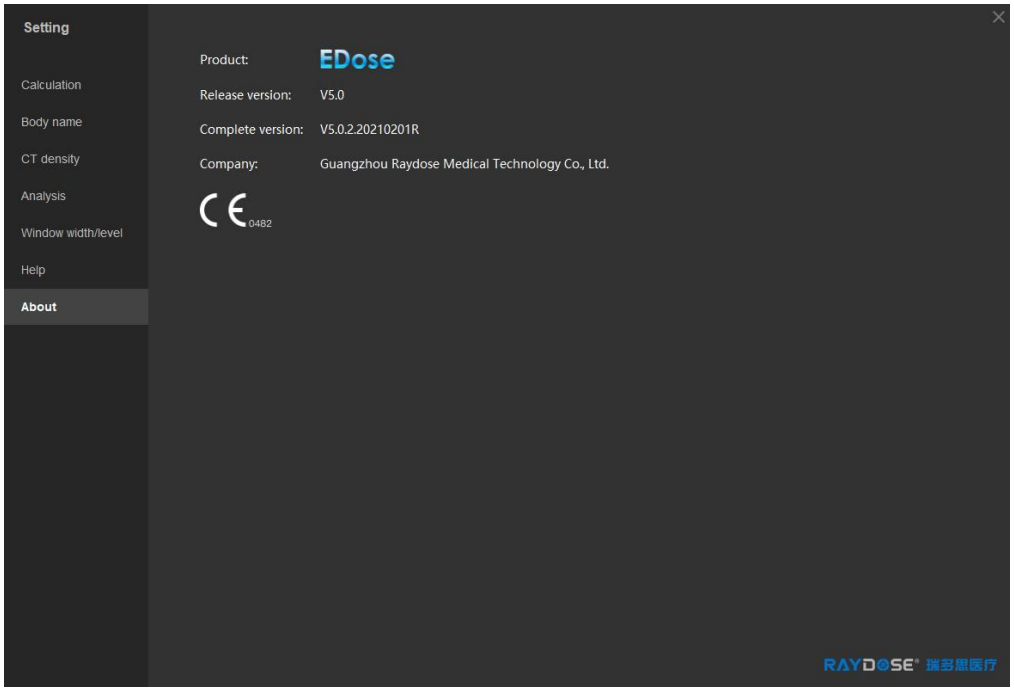


Figure 10-6 About

11. User Setting

Click  to open the user settings. Note that administrators can modify institutional information and manage all users within the institution, while regular users can only modify their personal information.

The administrator interface is shown in Figure 11-1.

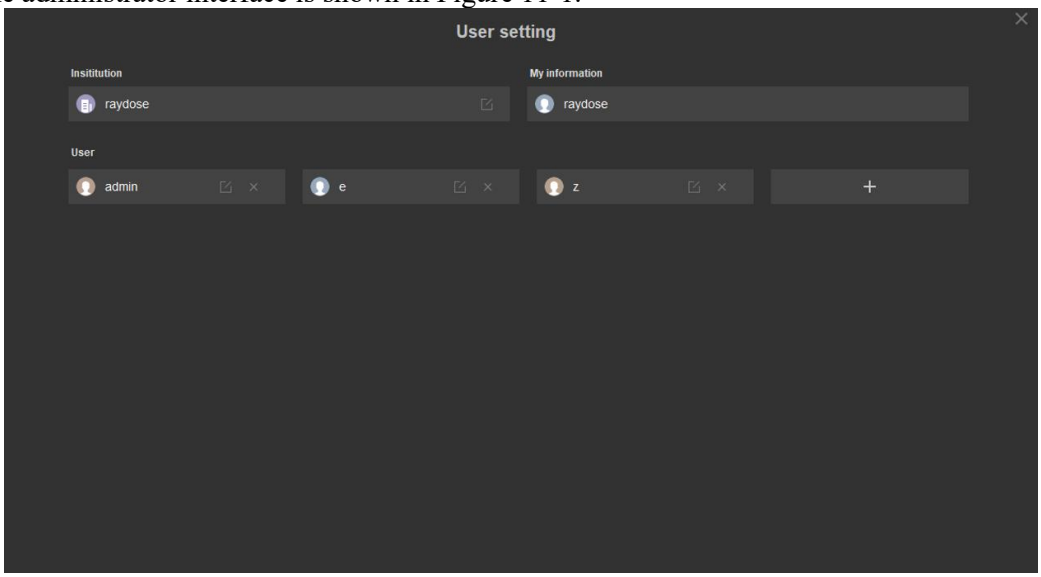


Figure 11-1 Administrator interface

The regular user interface is shown in Figure 11-2.

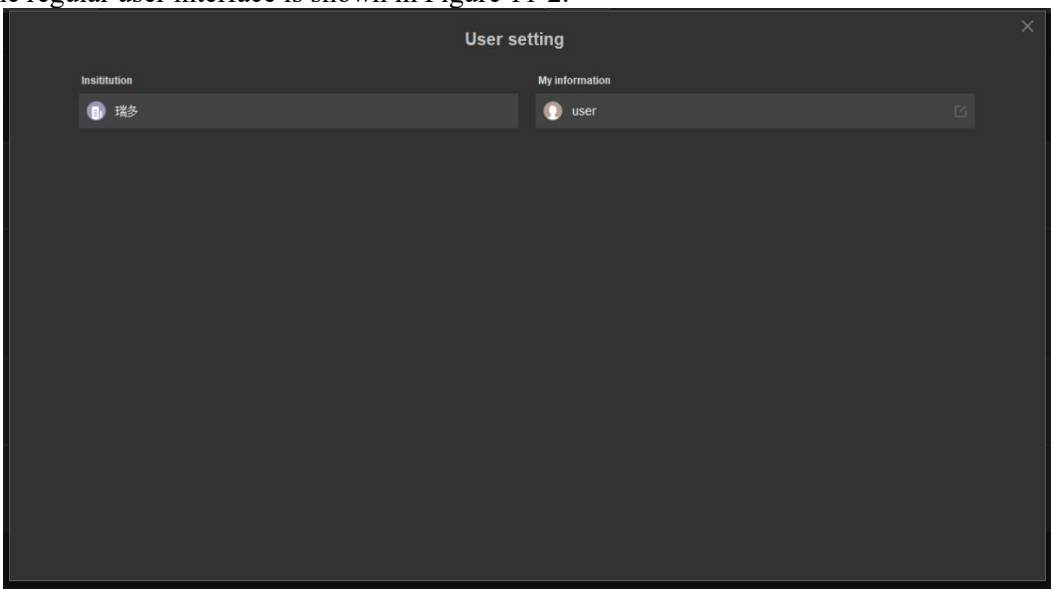


Figure 11-2 Regular user interface