Chapter 36
Monitoring and Controlling the Treatment

Note: *Screen representations throughout this chapter and throughout this part may show 'Control Mode: EMR-Centric' or 'Control Mode: DEV-Centric' at the bottom. When working in Standalone mode, you will notice that the mode indication reads 'Stand-Alone'.*

Proceeding to the Treatment Step

Click the **Next** button from the EQUIPMENT PREPARATION SCREEN and the TREATMENT SCREEN appears. When needed, you can press the **Previous** button to return to the EQUIPMENT PREPARATION SCREEN, until you request to start the irradiation.

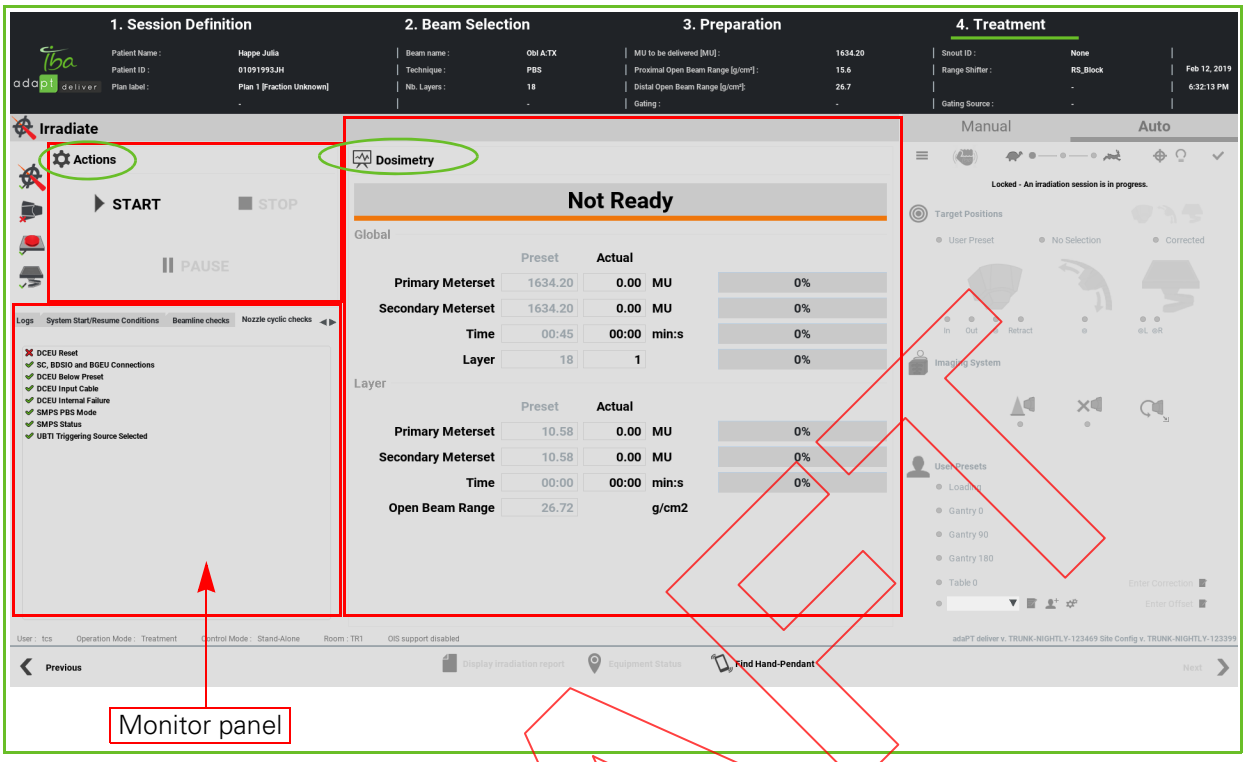

Figure 36-1. Treatment Screen

Panels, tabs and buttons on the TREATMENT SCREEN enable you to monitor and control the treatment process. The screen elements are:

- **Actions panel**: contains buttons with which you can control the irradiation. For detailed information, refer to Section "*Performing Functions From the Actions Panel*" on page 36-3.
- **Dosimetry panel**: enables you to monitor the administered dose. For detailed information, refer to Section "*Working With the Dosimetry Panel*" on page 36-4.
- **Monitor panel**: enables you to monitor the scanning controller and other subsystems and to perform miscellaneous checks. For detailed information, refer to Section "*Performing Functions From the Monitor Panel*" on page 36-6.

Detailed information on how to monitor an irradiation is contained in Chapter 50, "Monitoring an Irradiation".

Performing Functions From the Actions Panel

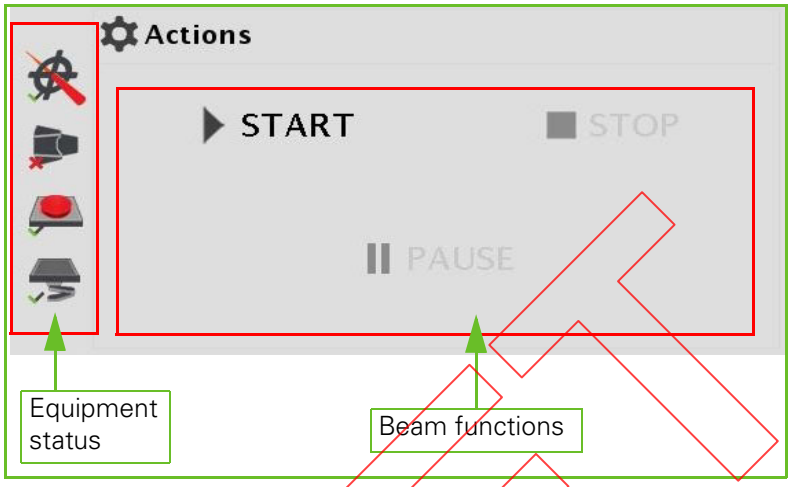

Figure 36-2. Treatment Screen - Actions Panel

From the Actions panel of the TREATMENT SCREEN you can:

- **View the Equipment status**: When the treatment room is configured with the Remote Positioning Device option, adaPT*deliver* displays an 'Equipment status' button in the navigation bar to provide access to the status panel. This allows the user to have a view on the position of devices whenever necessary.

  The status of the equipment is indicated by a green check mark ( ) or a red cross ( ) next to the following icons:

building safety devices (door, emergency stop buttons, keys)	
patient positioner	
nozzle	
beam preparation	

  The Equipment status button is enabled during the following phases of the workflow:

  - Appointment Selection
  - Session Definition
  - Beam Selection
  - Irradiation

In the *Irradiation* phase, the Equipment status button is disabled during actual irradiation. To avoid redundancy of displayed data, access to the status panel during *Preparation* phase is not provided.

The status panel is closed when the 'Next' button is clicked during *Appointment Selection*, *Session Definition*, *Beam Selection* or *Irradiation* phases

- Perform beam functions: buttons enable you to perform the following functions:
  - Start irradiation: for detailed information, refer to Chapter "Starting Irradiation" on page 37-1 .
  - Stop irradiation: for detailed information, refer to Chapter "Pausing and Stopping an Irradiation" on page 38-1 .
  - Pause irradiation: for detailed information, refer to Chapter "Pausing and Stopping an Irradiation" on page 38-1 .
  - Resuming after partial irradiation: for detailed information, refer to Chapter "*Resuming after a Partial Irradiation*" on page 39-1 .

Working With the Dosimetry Panel

Note: *To enable the Dosimetry state to progress, the Dose Counter Electronic Unit (DCEU) must be reset.*

Figure 36-3. Treatment Screen - Dosimetry Panel (typical)

In the case of Pencil Beam Scanning, an icon next to the status bar displays the multiple repainting type.

- Treatment progress: the current status appears in the status bar of the Dosimetry panel. The status indicator progressively moves to the following states:
  - Not ready
  - Ready
  - Preparing
  - Tuning IC1
  - Pausing IC1 Tuning (optionally)
  - Paused IC1 Tuning (optionally)
  - Resuming IC1 Tuning
  - Paused IC2/3 Tuning (optionally)
  - Irradiating: the state appears with a green background, which temporarily changes to yellow during the actual irradiation (Figure 36-4).
    - Beam Hold (optional, while the beam is gated, for detailed information, refer to Chapter 48 "Using the Universal Beam Triggering Interface")
  - Done

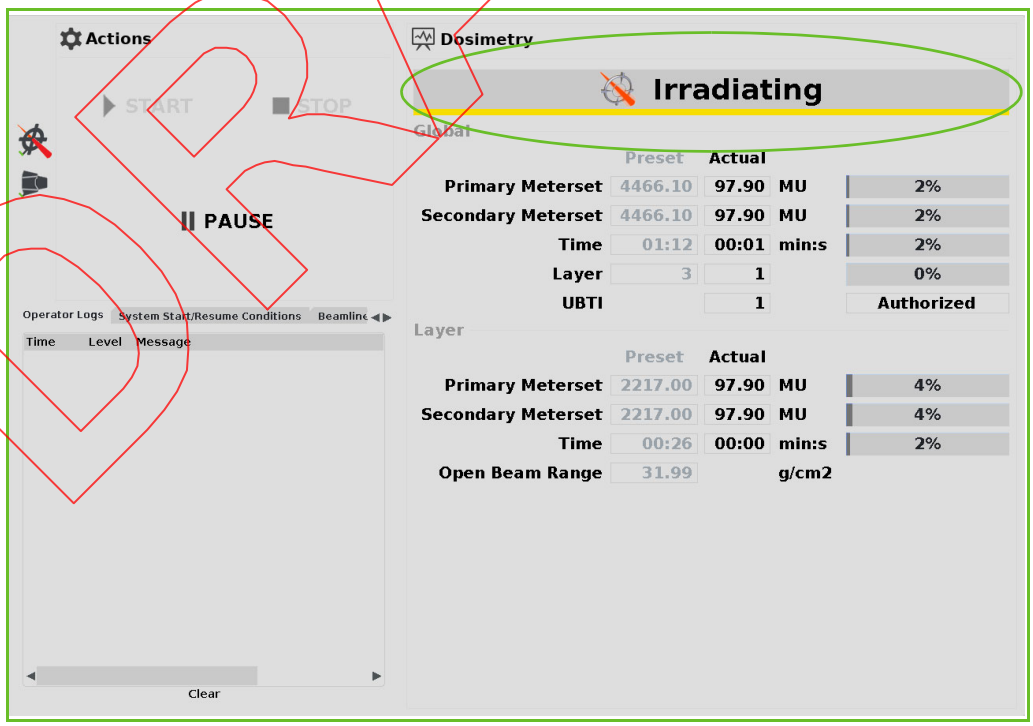

Figure 36-4. Treatment Screen - Dosimetry Panel - Irradiating screen (typical)

- Dosimetry values: the Preset and Actual values are displayed for the following:
  - Global: meaning the entire beam, comprising all layers.
  - Layer

  Both at the global level and the layer level preset and actual values are displayed for the following:
  - Primary Meterset: expressed in Monitor Units
  - Secondary Meterset: expressed in Monitor Units
  - Time: expressed in seconds
  - Layer

  Specifically for the Layer level a preset and actual value is displayed for the following:
  - Open beam range: expressed in g/cm^2

  In addition, progress for most activities is also visually indicated by the progress bars to the right.

Performing Functions From the Monitor Panel

The Monitor panel is located at the bottom of the TREATMENT SCREEN, at the left hand side. The panel contains a number of tabs from which you can monitor several functions:

- **Logs**: for detailed information, refer to Section "*Viewing Operator Logs*" on page 36-8.
- **System Start/Resume Conditions**: for detailed information, refer to Section "*Monitoring System Start/Resume Conditions*" on page 36-8.
- **Beam Line Checks**: for detailed information, refer to Section "*Monitoring Beam Line Checks*" on page 36-8.
- **Nozzle cyclic checks**: for detailed information, refer to Section "*Monitoring Nozzle Cyclic Checks*" on page 36-10.
- **TSS Interlocks**: for detailed information, refer to Section "*Monitoring TSS Interlocks*" on page 36-11.
- **Positioning system status**: for detailed information, refer to Section "*Monitoring the Positioning System Status*" on page 36-12.

Use the arrow buttons at the top right to scroll through the horizontal list of tabs.

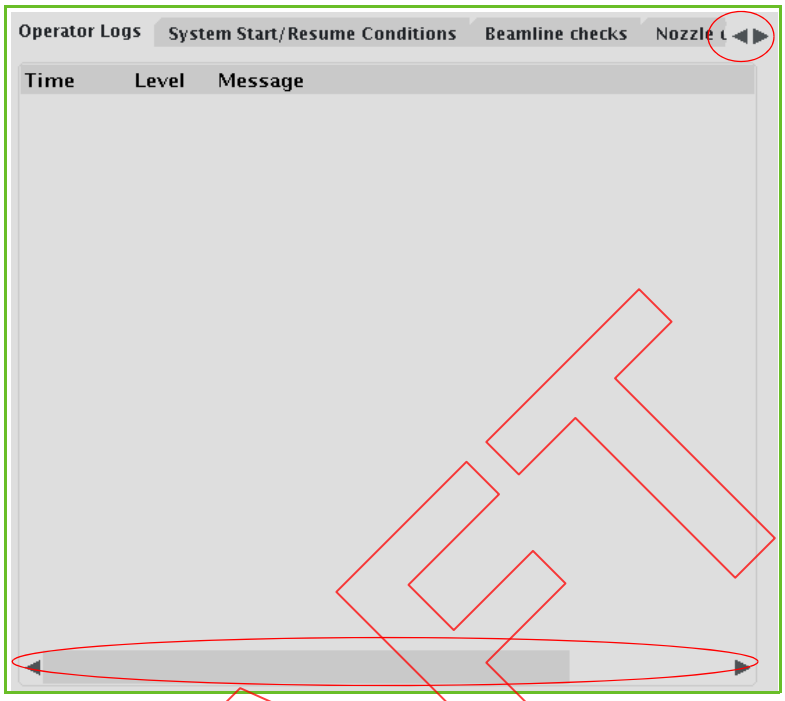

Figure 36-5. Treatment Screen - Monitor Panel (Typical)

Some tabs may contain more columns than what is on display in the Monitor Panel. To view these columns, use the scroll bar at the bottom of the panel.

Monitor Panel GUI Conventions

The different tabs that are available on the Monitor panel all feature the following Graphical User Interface (GUI) conventions:

- All checks are listed alphabetically
- The group of failed checks is listed at the top of the list
- Icons and colors indicate the current status, as indicated in Table 36-1.

Table 36-1. Monitor Panel Icons and Colors Legend

Icon	Color	Meaning
	none	Check not active
	green	Check active and OK

Table 36-1. Monitor Panel Icons and Colors Legend (Cont'd)

Icon	Color	Meaning
	red	Check active but not OK
	yellow	Check active and not OK, but overridable

Viewing Operator Logs

This tab lists the reason(s) why irradiation got paused, if any, in addition to some miscellaneous errors.

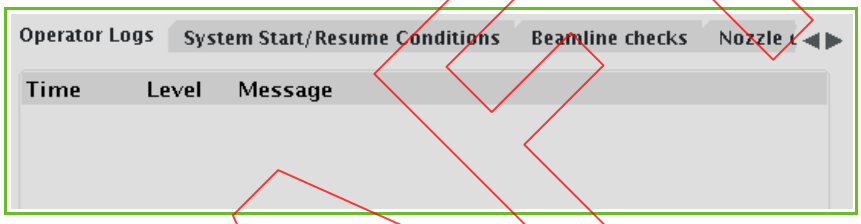

Figure 36-6. Monitor Panel - Operator Logs

Monitoring System Start/Resume Conditions

The SYSTEM START/RESUME TAB displays high level information about the startup and resume conditions.

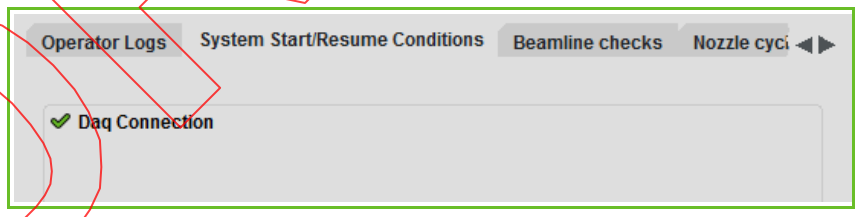

Figure 36-7. System Start/Resume Tab
Pencil Beam Scanning

Monitoring Beam Line Checks

The BEAM LINE CHECKS TAB enables you to monitor the checks that are performed on the status of beam line elements such as beam stops, Beam Profile Monitors, the degrader, magnets, slits, etc. You can visually monitor the status of the check. For instance, the Beam Stop In condition is activated only during a Pause, whereas the Beam Stop Out condition is activated only during Irradiation.

You can access the BEAM LINE CHECKS TAB also by clicking the beam line icon ( ) from the Equipment panel of the TREATMENT SCREEN.

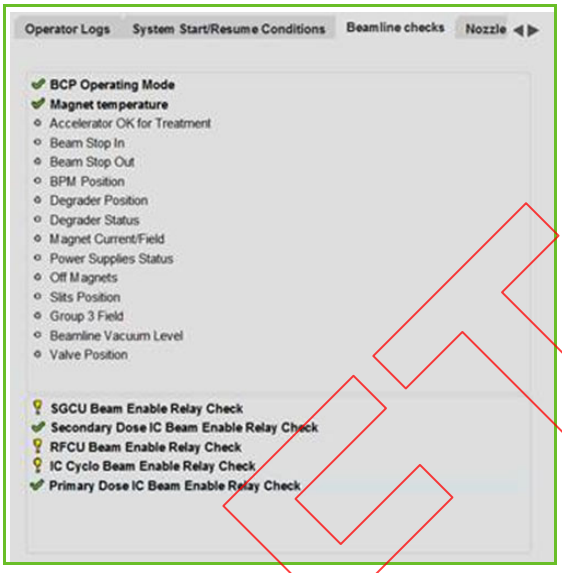

Figure 36-8. Beam Line Checks Tab (Typical)

CAUTION

In case the Beam Line Checks tab shows the SGCU, RFCU, Primary or Secondary dose IC relay check is failed, request (from the maintenance team) a verification of the structural integrity and the proper functioning of the BDCU related equipment (i.e. RTCBs and/or nozzle EMIOs electrical wiring).

If the maintenance operation cannot be performed immediately as recommended, it is possible to postpone the maintenance operation and to proceed with the treatment by entering a specific password (click on the failed check for instructions). In this case, treatment will be delivered with loss of redundancy for beam interruption in case of failure.

In any case, verification must be performed within 24 hours.

CAUTION	In case the Beam Line Checks tab shows that one of the BAEU or BIREU relay check is failed, request (from the maintenance team) a verification of the structural integrity and the proper functioning of the IC cyclo related equipment (i.e. IC cyclo related electrical wiring). If the maintenance operation cannot be performed immediately as recommended, it is possible to postpone the maintenance operation and to proceed with the treatment by entering a specific password (click on the failed check for instructions). In this case, treatment will be delivered with degraded beam presence detection at the exit of the cyclotron. In any case, verification must be performed within 24 hours.

Monitoring Nozzle Cyclic Checks

The NOZZLE CYCLIC CHECKS TAB enables you to monitor the checks that are performed on the status of miscellaneous nozzle components such as the DCEU, etc. You can visually monitor the status of the check. For instance, the Beam Stop In condition is activated only during a Pause, whereas the Beam Stop Out condition is activated only during Irradiation.

You can access the NOZZLE CYCLIC CHECKS TAB also by clicking the nozzle icon ( ) from the Equipment panel of the TREATMENT SCREEN.

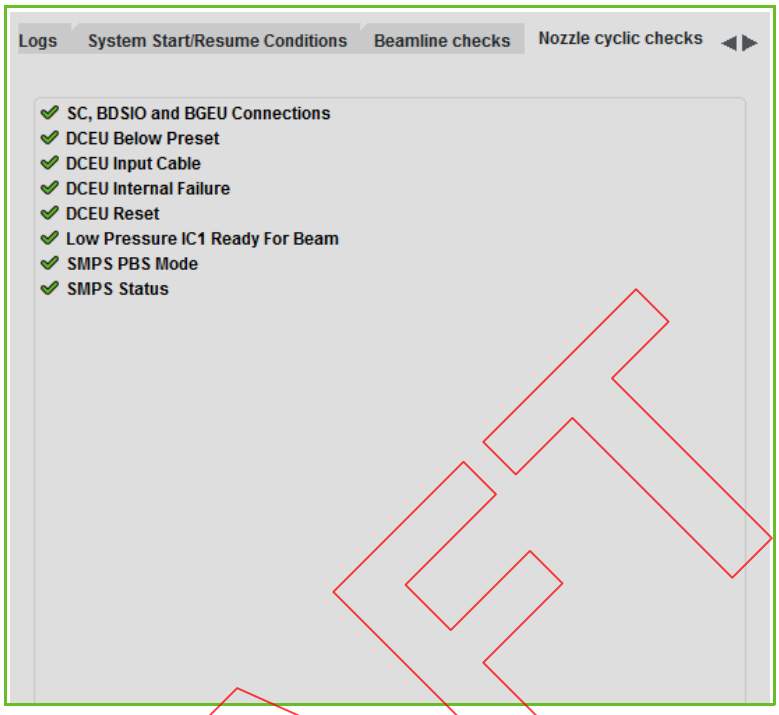

Figure 36-9. Nozzle Cyclic Checks Tab Pencil Beam Scanning

Monitoring TSS Interlocks

The TSS INTERLOCKS TAB displays the status of the following TSS interlocks:

- Room master key switch
- Session mode control switch
- Room search secured
- Room emergency stop buttons
- Global emergency stop buttons

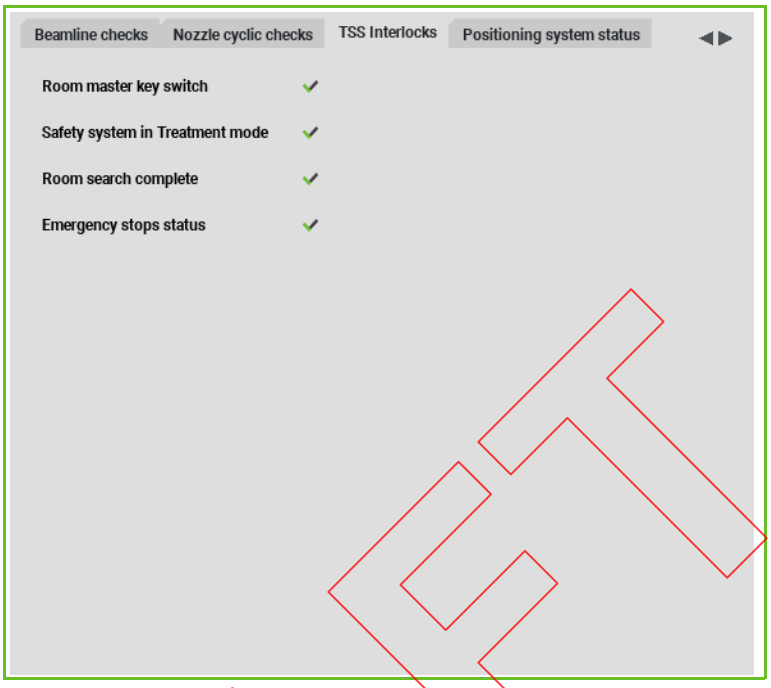

Figure 36-10. TSS Interlocks Tab

If the status of any of these interlocks is not OK, proceed as described in Section "*Verifying the Room Interlocks*".

Monitoring the Positioning System Status

The POSITIONING SYSTEM STATUS TAB displays positioning information on the following:

- Gantry, and PPS
- X-ray system
- Accessories drawer

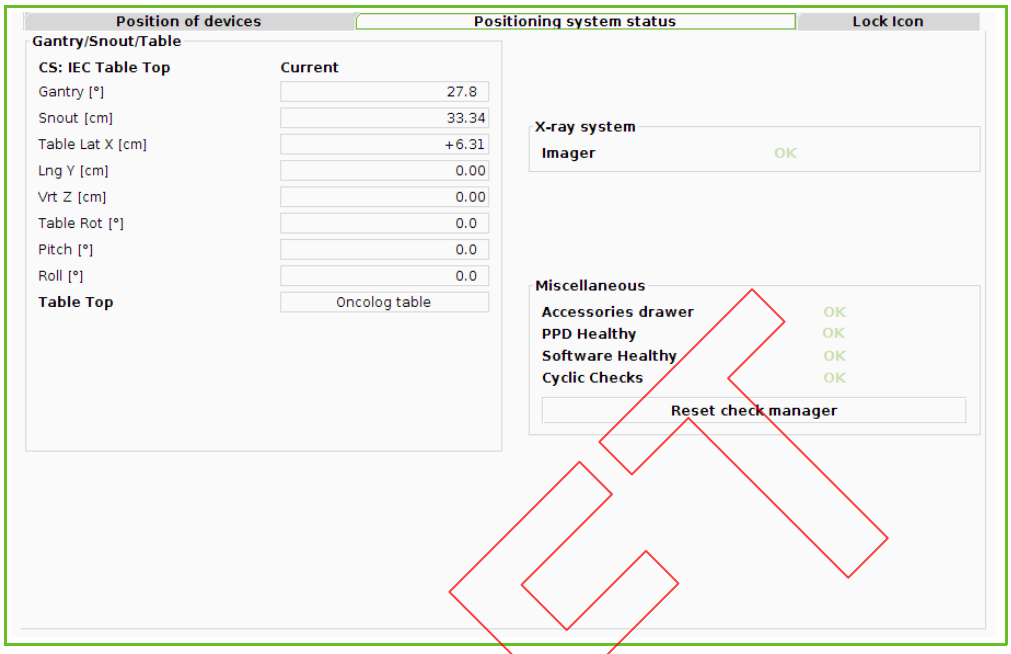

Figure 36-11. Positioning System Status Tab

Resuming Irradiation After a Positioning Check Manager Halt

Irradiation may get paused in case the Positioning Check Manager has insufficient response from one or more devices. To resume irradiation, click **Reset check manager** (see Figure 36-11).

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Chapter 37
Starting Irradiation

Note: *Screen representations throughout this chapter and throughout this part may show 'Control Mode: EMR-Centric' or 'Control Mode: DEV-Centric' at the bottom. When working in Standalone mode, you will notice that the mode indication reads 'Stand-Alone'.*

Process

Before starting the irradiation you must reset the DCEU (refer to Chapter 15, "Resetting a Dose Counter Electronic Unit").

Important	Make sure there is not too much noise/vibrations in the treatment room during irradiation. A high level of vibrations or sounds can cause inappropriate counting of MU to the DCEU.

Important	As a Radiation Therapy Technologist (RTT), make sure to visually inspect that the accessory (accessories) is (are) correctly in place when required for the current treatment (i.e., correctly inserted and not semi-inserted, in the correct orientation, etc.), as required by the procedure established by the administration of your center.

During irradiation, the movement of any Patient Positioning Device (PPD) is prevented and power to the drive is interrupted.

If you intend to perform treatment with a gated beam, pay attention to the following warning message:

WARNING

As a Radiation Therapy Technologist (RTT), before allowing irradiation with a triggered treatment beam, you are recommended to check the patient file to see that the selected gating source is the prescribed one.

When the beam line is tuned, click **Start** from the Actions panel of the Treatment Screen to allow the beam to be delivered continuously. Feedback is provided to the Radiation Therapy Technologist (RTT) in the Treatment Control Room (TCR) to monitor the irradiation.

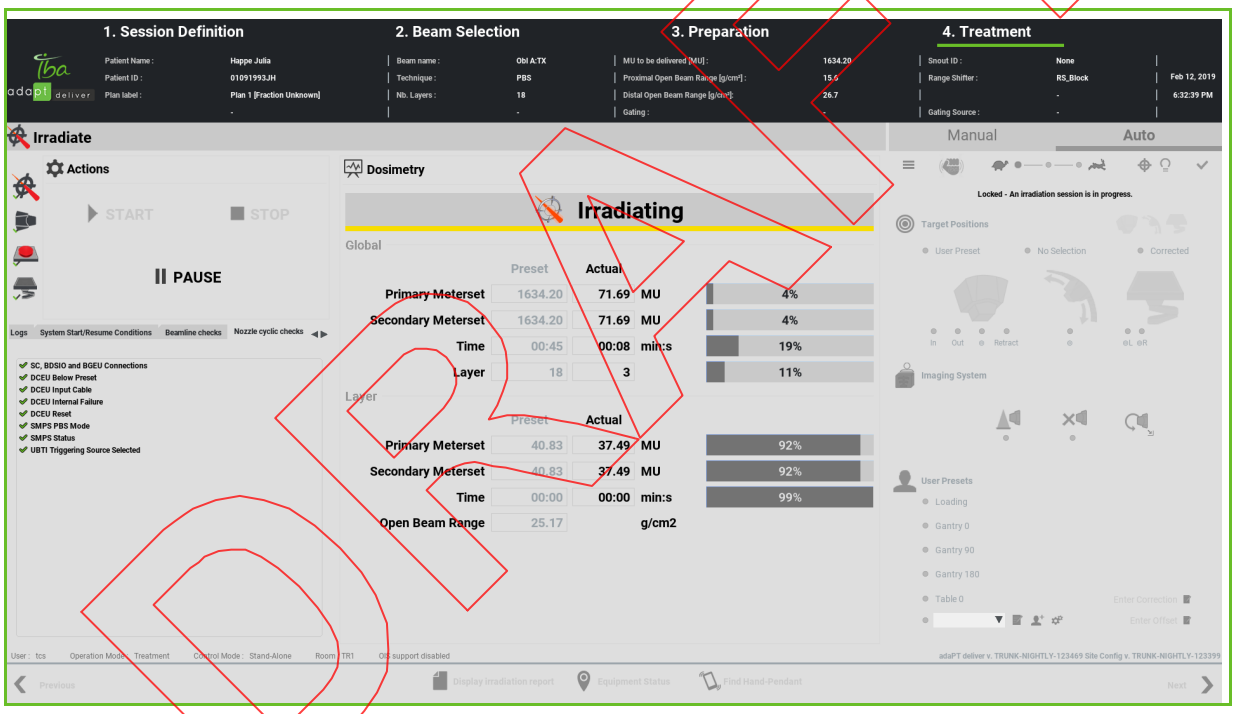

Figure 37-1. Irradiation Screen: Irradiating

WARNING

To carefully monitor both the patient and the information displayed on the screen, two Radiation Therapy Technologists (RTTs) must supervise the treatment in the Treatment Control Room (TCR).

WARNING	The Radiation Therapy Technologist (RTT) must be aware of the progress of the treatment at all times.

WARNING	As a Radiation Therapy Technologist (RTT) you are recommended to monitor the patient behavior during irradiation. In case of patient movement, pause the beam immediately.

Partially Delivered Prescribed Dose

Whenever the irradiation is stopped either by the Radiation Therapy Technologist (RTT) or the system or other means, whereby the prescribed dose is only partially delivered, a system message appears to inform you explicitly of any such partial delivery.

Note: *Several kinds of 'partial' warnings exist. Figure 37-2 represents one example.*

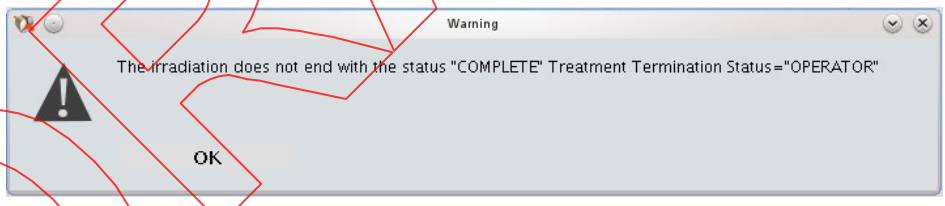

Figure 37-2. Partial Delivery - System Message

Error Message "Delivered MU of layer should be less than prescribed MU"

The complete error message typically reads `Delivered MU of layer should be less than prescribed MU 0,288 of *(1+0.05) in BeamResult layer 32.`

At the end of irradiation, the delivered MU for each layer is compared with the prescription (in the above case 0.288MU for layer 32).

The aforementioned error message appears if the following is encountered:

```
Delivered MU of layer i > prescribed MU of layer i + X%
```

Where X is a configurable tolerance (in the above case 5% of prescribed dose); this value may be different at your treatment center.

In case this message appears, verify that the Delivered MU on the DCEU corresponds to both the prescribed and the recorded value. In case there is a discrepancy, contact IBA and request to verify the calibration; otherwise, report the warning to IBA.

Chapter 38
Pausing and Stopping an Irradiation

Note: *Screen representations throughout this chapter and throughout this part may show 'Control Mode: EMR-Centric' or 'Control Mode: DEV-Centric' at the bottom. When working in Standalone mode, you will notice that the Control Mode indication reads 'Stand-Alone'.*

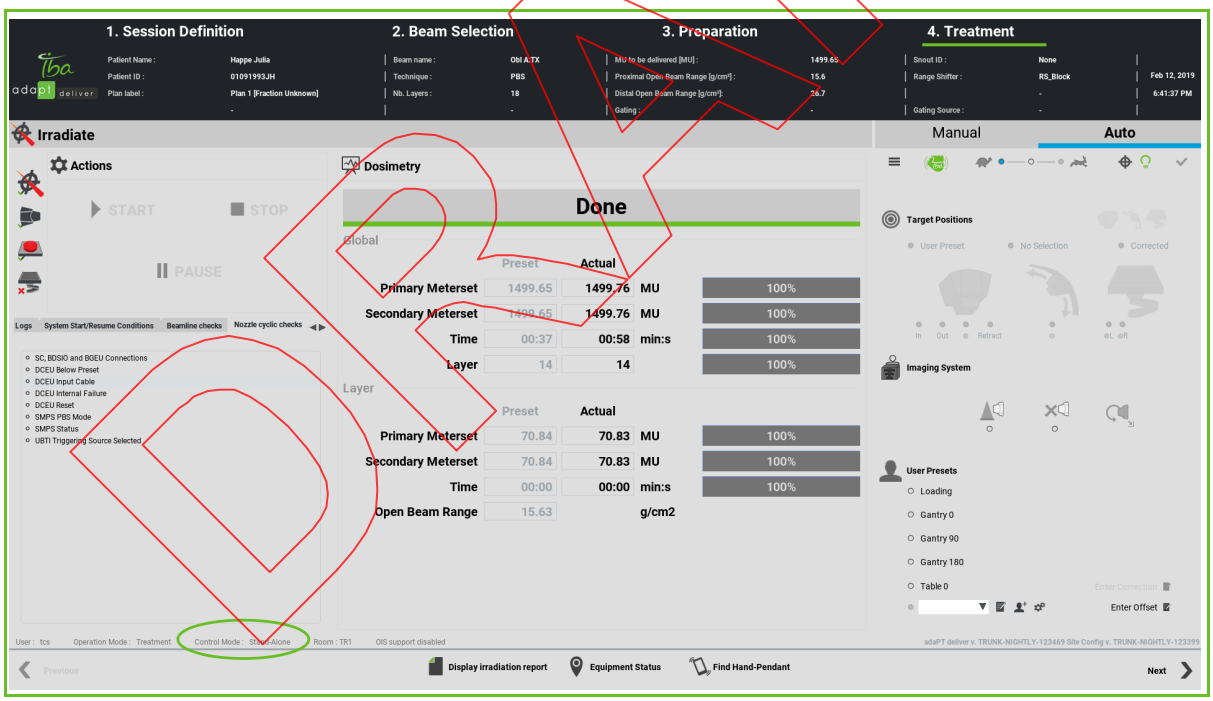

*Figure 38-1. Mode Indication (OIS/Standalone) on adaPT*deliver *Screens*

Introduction

The normal end to an irradiation occurs when all elements of the prescribed irradiation (spots) have been delivered.

WARNING	Press the hardware emergency stop button if the irradiation fails to halt when the software PAUSE or STOP button is clicked or when the hardware PAUSE button is pressed.

WARNING	Emergency stop buttons shut off energy to most components in the Proton Therapy System (PTS). However, the electrical power to some components will not be interrupted, so be aware that electrical hazards and faults (faulty parts made live or induced fire) may still be present.

One reason that necessitates a beam pause is patient movement during irradiation.

Exceptionally, an abnormal end to an irradiation may occur due to a software crash.

WARNING	As a Radiation Therapy Technologist (RTT) you are recommended to monitor the patient behavior during irradiation. In case of patient movement, pause the beam immediately.

Gating the Beam

If you are using a gating system, you can perform manual or automatic beam gating, if desired. For detailed information on beam gating, refer to Chapter 48, "Using the Universal Beam Triggering Interface".

WARNING	As a Radiation Therapy Technologist (RTT), during irradiation, you are recommended to check the gating signal (on the gating equipment) against the presence of the triggering request (i.e., the 'Beam On Trigger requested by source' LED on the UBTI). In case a mismatch occurs, pause the beam immediately.

Whether you are using the Universal Beam Triggering Interface (UBTI) in manual mode or in automatic mode, you are always capable of pausing the irradiation following the procedure described in Section "*Pausing Irradiation*" on page 38-3.

WARNING

As a Radiation Therapy Technologist (RTT), when the treatment is interrupted (e.g., the treatment is stopped after a pause, the software crashes, etc.), you have to manually record the value reported by the hardware Monitor Unit (MU) counter, which is located on the front panel of the Dose Counter Electronic Unit (DCEU).

If applicable, i.e., in the Single Scattering, Double Scattering, and Uniform Scanning treatment modes ONLY, a correction shall manually be applied to this value to take into account the dose correction parameters encoded in the Dosimetry Manager (ambient temperature, atmospheric pressure, and dose correction factor).

Check that the value reported by the hardware MU counter (after correction) matches the delivered MU value recorded in the Oncology Information System (OIS) for this irradiation.

When the irradiation is resumed, if the system (Oncology Information System or Proton Therapy System) proposes a MU value for the delivered dose (MUd), you shall verify that this value matches the value reported by the hardware MU counter (after correction), within the foreseen precision. If the values are not in agreement, you shall use the value reported by the hardware MU counter (after correction).

Pausing Irradiation

A pause halts the beam and prevents it from entering the Treatment Room (TR). The dose counters are still active.

If you need to pause the irradiation, from the Treatment Control Room (TCR), click **Pause** from the TREATMENT SCREEN.

WARNING

Press the hardware emergency stop button if the irradiation fails to halt when the software PAUSE or STOP button is clicked or when the hardware PAUSE button is pressed.

WARNING	Emergency stop buttons shut off energy to most components in the Proton Therapy System (PTS). However, the electrical power to some components will not be interrupted, so be aware that electrical hazards and faults (faulty parts made live or induced fire) may still be present.

When the beam is paused, you may:

- Re-enter the TR and attend to the patient if necessary.
- Resume the treatment.
- End the treatment.

The Accelerator Operator located in the Main Control Room (MCR) can also pause the beam.

The Accelerator Operator cannot resume beam delivery. Resuming the treatment can only be initiated from the TCR.

The PTS can also invoke a beam pause if the beam characteristics move outside specified tolerances or if Patient Positioning Devices (Patient Positioning System, gantry) motion is detected.

Resuming Irradiation After a Pause

The Radiation Therapy Technologist (RTT) can resume treatment by clicking **Start** from the Actions panel of the TREATMENT SCREEN. Beam line tuning that may be required is embedded in the Start functionality.

Treatment is resumed without automatically tuning the beam line if:

- The Treatment Room (TR) has not been entered.
- The Treatment Control Room (TCR) master switch is in the **ON** position.
- The Service switch is in the **OFF** position.
- An emergency stop button has not been pressed.

As mentioned before, when needed, beam line tuning automatically occurs when you click **Start**.

Stopping Irradiation

The normal end of an irradiation occurs when each layer is completed, i.e., when the ICs have read the complete dose for each layer. (The ICs are reset to 0 between each layer and loaded with a new target criteria). The PTS stops the irradiation and archives irradiation parameters (referred to as received parameters).

When the beam is paused and you do not intend to resume the treatment, click **Stop Irradiation** from the TREATMENT SCREEN.

WARNING

Press the hardware emergency stop button if the irradiation fails to halt when the software PAUSE or STOP button is clicked or when the hardware PAUSE button is pressed.

WARNING

Emergency stop buttons shut off energy to most components in the Proton Therapy System (PTS). However, the electrical power to some components will not be interrupted, so be aware that electrical hazards and faults (faulty parts made live or induced fire) may still be present.

WARNING	
	As a Radiation Therapy Technologist (RTT), when the treatment is interrupted (e.g., the treatment is stopped after a pause, the software crashes, etc.), you have to manually record the value reported by the hardware Monitor Unit (MU) counter, which is located on the front panel of the Dose Counter Electronic Unit (DCEU). If applicable, i.e., in the Single Scattering, Double Scattering, and Uniform Scanning treatment modes ONLY, a correction shall manually be applied to this value to take into account the dose correction parameters encoded in the Dosimetry Manager (ambient temperature, atmospheric pressure, and dose correction factor). Check that the value reported by the hardware MU counter (after correction) matches the delivered MU value recorded in the Oncology Information System (OIS) for this irradiation. When the irradiation is resumed, if the system (Oncology Information System or Proton Therapy System) proposes a MU value for the delivered dose (MUd), you shall verify that this value matches the value reported by the hardware MU counter (after correction), within the foreseen precision. If the values are not in agreement, you shall use the value reported by the hardware MU counter (after correction).

The PTS terminates the field irradiation and archives the received parameters.

CAUTION	
	When irradiation has terminated, provide any type of assistance that may be required by the patient before leading the patient away from the couch and the treatment room.

Chapter 39
Resuming after a Partial Irradiation

Note: *Screen representations throughout this chapter and throughout this part may show 'Control Mode: EMR-Centric' or 'Control Mode: DEV-Centric' at the bottom. When working in Standalone mode, you will notice that the Control Mode indication reads 'Stand-Alone'.*

WARNING

When a partial irradiation occurs (treatment session ended by the user or by the system, in which the intended number of MU for a beam has not been completely delivered), the Radiation Therapist shall manually record the value reported by the hardware MU counter (situated on the DCEU front panel), and this value (called MUdceu) shall be used as reference for the activities that follow to resume the irradiation.

At each step, check that the total MU in the different records matches MUdceu within the foreseen precision (+/- 0.5 % or +/- 0.5 MU).

After the partial irradiation, check that the total MU in the Dicom record sent to the OIS matches the MU from the hardware MU counter. Do this in all partial irradiation cases, be the Dicom record produced by the PTS directly after the end of the irradiation, after an online recovery procedure or after an offline recovery procedure

Use of the MU values from the hardware counter to generate a treatment record with simulated dose distribution data must be a last resort option, used only in cases when recording via the recovery of irradiation logs is impossible (as made clear via the corresponding system messages in those scenarios).

WARNING	When working in Standalone mode, after a partial irradiation, the user must record the cumulative MU value delivered for that beam according to the center's best practices (may be on paper or other method). The goal is to be able to use that value for the event of a resumption in a different session. Not doing this entails a serious risk of under or over-irradiation of the patient.

WARNING	When working in Standalone mode, the user must ensure that in every new session, beams that were partially irradiated in a previous session are handled correctly. This means: - Identifying a partial beam as such, taking into account the record done of any previous partial irradiations according to the center's best practices (may be on paper or other method). -Taking the appropriate actions according to the instructions in the user documentation to continue a partial irradiation in a new session in Standalone mode. Not doing this entails a serious risk of under or over-irradiation of the patient.

WARNING	Whenever the system prompts the user to manually input the DCEU value or the MUd value (MU delivered) corresponding to a partial irradiation, the user must follow the instructions in the user documentation and be extremely careful not to commit any typos or input any false values. After inputting the value manually, the user must double-check the value displayed by the system to ensure the input is correct. Any fault in the manually input values entails a serious risk of under or over-irradiation of the patient.

Summary of the steps for Resuming from a Partial treatment

1. Partial Irradiation

There are several situations that can lead to partial irradiation:

- **Therapist** (user abort)

  The therapist can choose to do so for many reasons such as patient's condition, safety, motion etc.

- **PTS** (machine abort)

  - adaPT*deliver* session is maintained: This can arise due to fault in hardware, communication or another software malfunction.
  - adaPT*deliver* session crashes: There is a fault in the adaPT*deliver* software or communication which may lead to aborting of the current session. This can also be due to a fault in hardware, communication or another software malfunction. An adaPT*deliver* session crash does not necessarily mean that the beam is aborted. If there is no machine issue, the beam will be delivered even if user interface is freezing. If adaPT*deliver* crashes, there will be a disconnection with OIS.

2. Irradiation data recovery

The records of the partial irradiation are retrieved to know the layers and spots already delivered, and to update the values in the adaPT*deliver*. These situation have been identified:

- **No recovery needed**

  This happens after a beam termination is done by the therapist. It is also valid for cases of beam termination by the PTS when all data is recorded correctly. When the system encounters an issue with the recording of an irradiation, two recovery processes are available.

- **Online recovery**

  Online means data recovery procedure happens when therapist is in front of the irradiation screen and the OIS session is still open (if in OIS mode). This is possible when the termination is done by the therapist or PTS and the adaPT*deliver* session is maintained.

- **Offline recovery**

  Offline means data recovery is happening after the OIS treatment session is closed. This occurs when the termination is done by the PTS and the adaPT*deliver* session crashes.

In either case, there are three recovery methods.

- Automatic: adaPT*deliver* software is able to retrieve all available irradiation records from the Beam Management System (BMS) software automatically and provides detailed records. In automatic recovery, if the DCEU value entered is higher than the irradiation records, the remaining is simulated.
- Manual recovery from file: adaPT*deliver* software is not able to retrieve irradiation records from the BMS software. A manual intervention by the IBA Operator is needed. This can provide detailed records.
- Manual recovery from DCEU values: The delivered dose measured by the DCEU is used to simulate the corresponding dose distribution (layers and spots). This should be the last resort since the distribution of the dose is not 'true' but simulated.

3. Resuming irradiation

The irradiation can be resumed either in the same session or in a new one.

- In the **same session**: This is possible for online recovery only.
- In a **new session:** This is possible for offline recovery, or when it is not possible to continue the treatment due to other reasons (patient's conditions, schedule, etc).

A flowchart of the summary of the above steps necessary for the resumption of the irradiation is given in Figure 39-1.

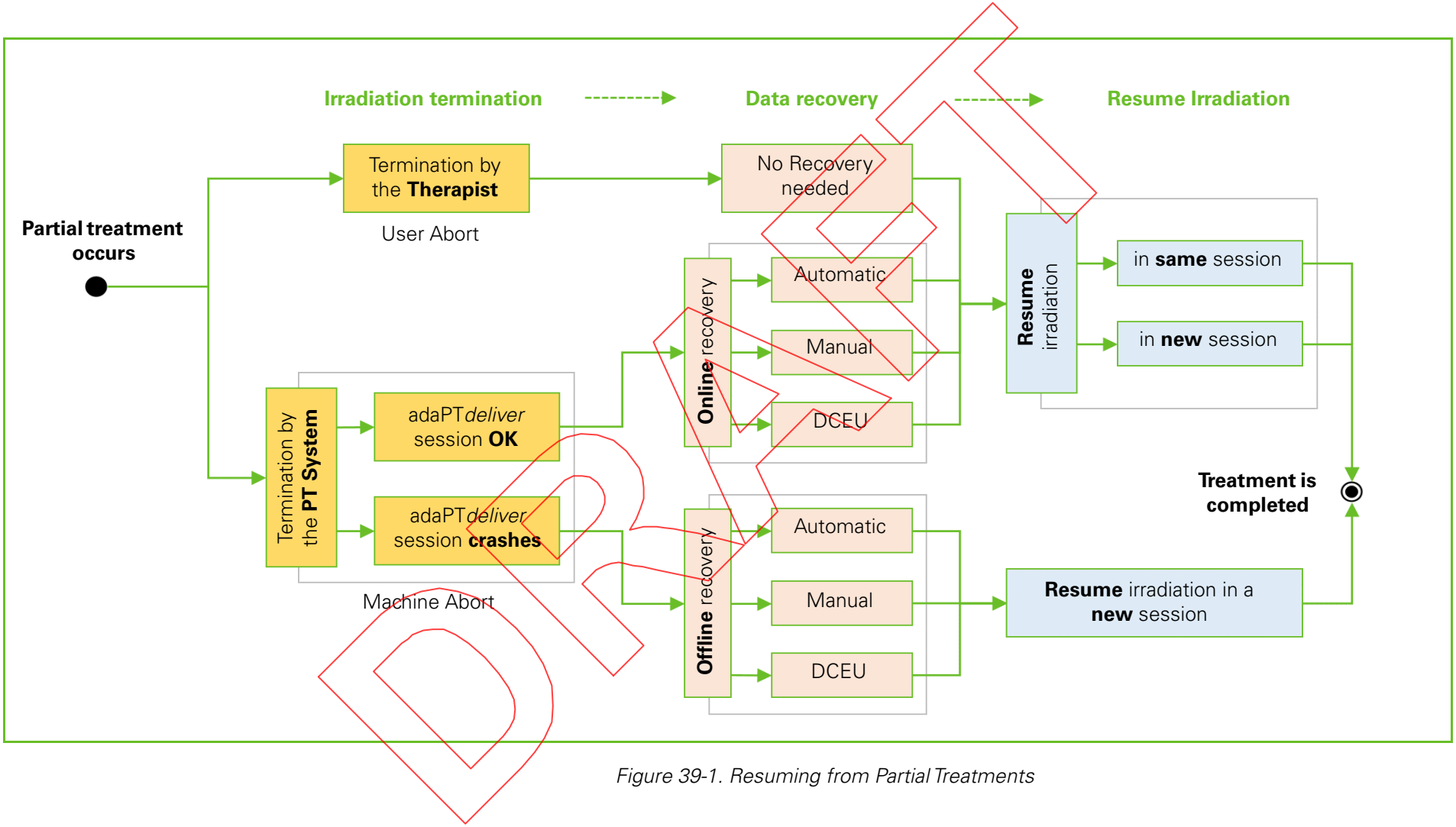

Figure 39-1. Resuming from Partial Treatments

Termination by the Therapist: No Recovery needed

When the irradiation is manually terminated by the therapist, a popup message appears informing the user that the irradiation is not complete (Figure 39-2).

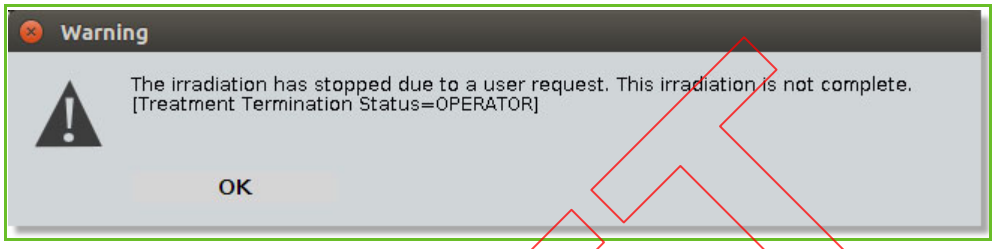

Figure 39-2. Recovery after Termination by Therapist - Warning message

adaPT*deliver* builds an irradiation record and stores it in its database.

1. In the TREATMENT SCREEN, click **Next**.
2. On coming back to the BEAM SELECTION SCREEN, the user can chose to resume the irradiation (immediately or at a later point of time)
   - Resume in the same session: This is described in section "*Resuming Irradiation in the Same Session*".
   - Resume in a new session: This is described in section "*Resuming Irradiation in a New Session*".

Specific warnings

When working in Standalone mode, the User will see specific warning pop-ups to potentially prevent actions that might result in loss of data.

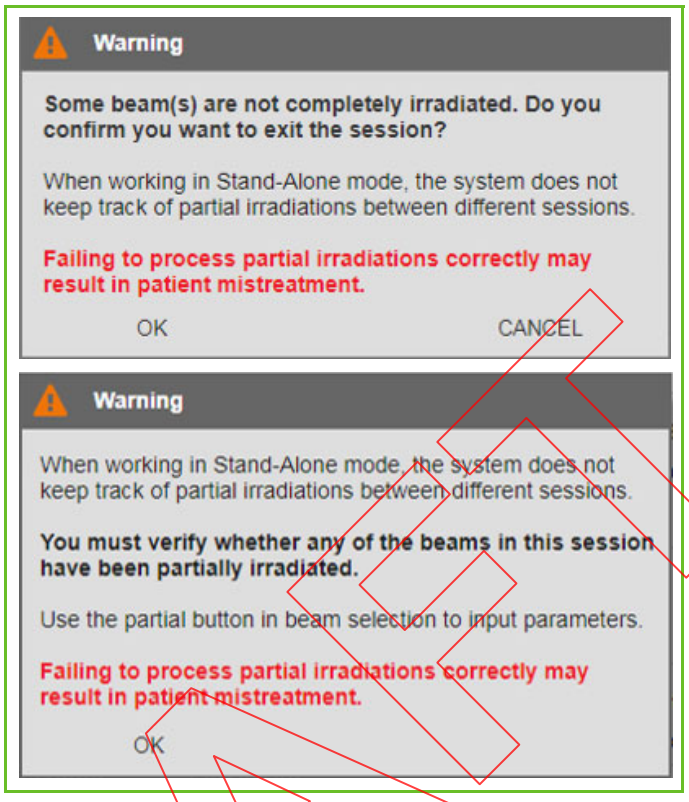

Figure 39-3. Resuming irradiation - Standalone mode: Warning messages

Important

In case the User exits a Standalone session before having completed a partial irradiation, adaPT*deliver* does not keep track of the partial irradiation and will not inform the User about this partial irradiation in the next session. The User will have to keep track of the partial irradiation and use the Partial menu to complete the partial irradiation correctly (see section *Resuming Irradiation in a New Session*).

Termination by the Proton Therapy System

Online recovery - adaPTdeliver session maintained

When the irradiation is terminated by the PTS, popup appears indicating the cause of termination (Figure 39-4). Click **OK** to continue.

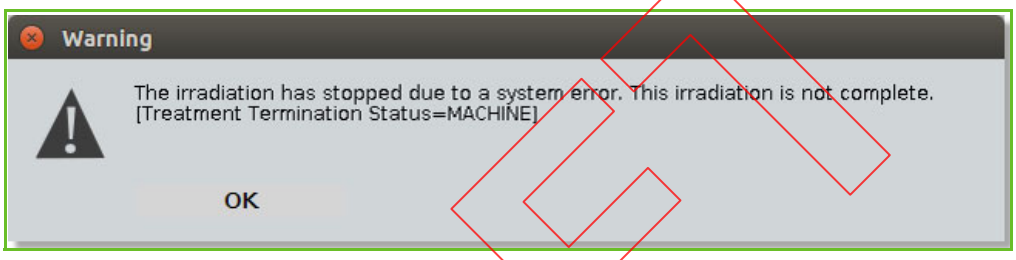

Figure 39-4. Recovery after termination by PTS - Warning message

The recovery of the data can be performed through one of the following methods:

1. Automatic recovery
2. Manual recovery from file
3. Manual recovery from DCEU values

Automatic recovery

1. In the popup message, type in the values of the MU delivered and dose counts from the DCEU (Figure 39-5). Click **OK** to continue and proceed to section "*Resuming Irradiation*".

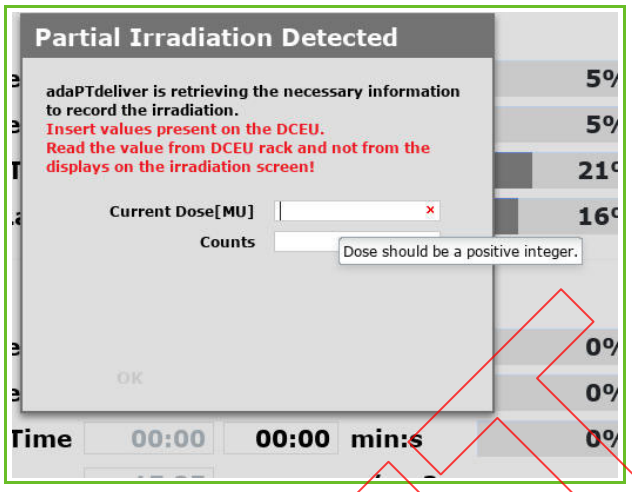

Figure 39-5. Recovery after termination by PTS - Automatic recovery process (online)

2. In case the process is not successful, proceed to section "*Retry and Troubleshoot*".

Retry and Troubleshoot

The automatic process can fail for various reasons, including software crashes, communication faults, hardware problems, etc. In such case, the User shall ask the IBA Operator to investigate the cause of the automatic process failure and to attempt to troubleshoot it (Figure 39-6).

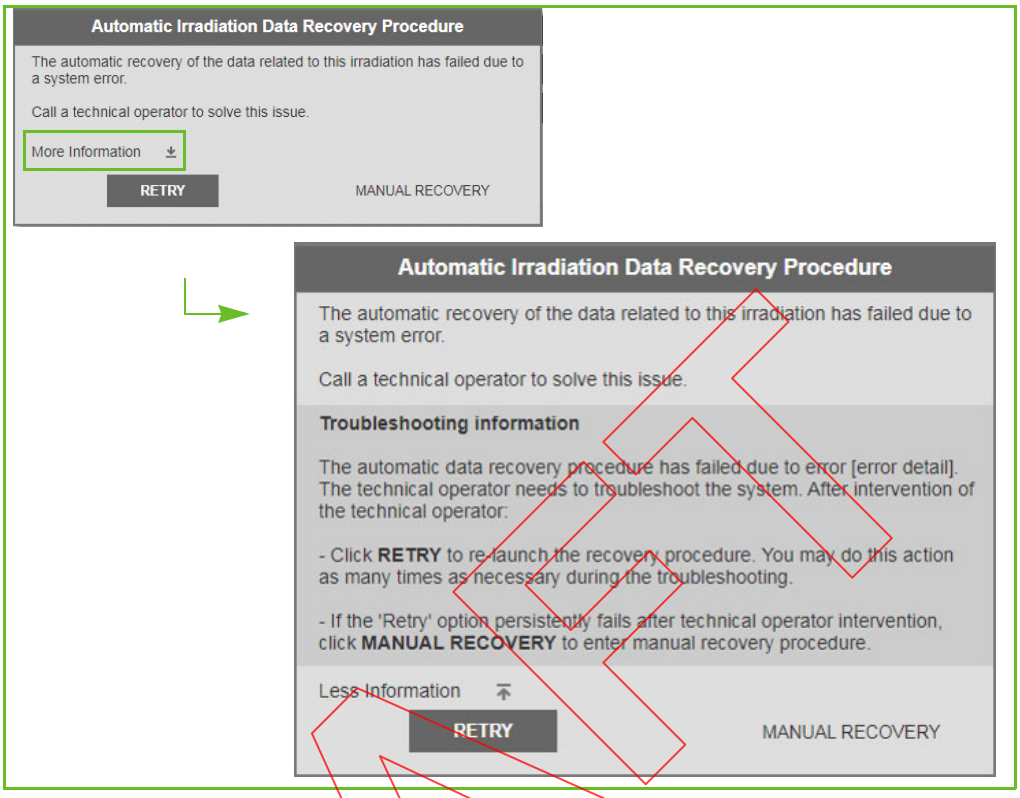

Figure 39-6. Recovery after termination by PTS - Automatic data recovery information (online)

1. In case the Automatic process fails, a new popup appears giving you the possibility to Retry or to attempt the **Manual Recovery** (Figure 39-7a).

   You can click on **More Information** to know more (Figure 39-6).

2. Click in **Retry**. A message **Recovery in Progress** is displayed (Figure 39-7b).

3. In case the **Retry** fails, a message is displayed in red under the button to inform the user, including the number of failed attempts (Figure 39-7c).

4. If the **Retry** succeeds, a new popup appears (Figure 39-7d). Click **Next** to continue and proceed to section "*Resuming Irradiation*".

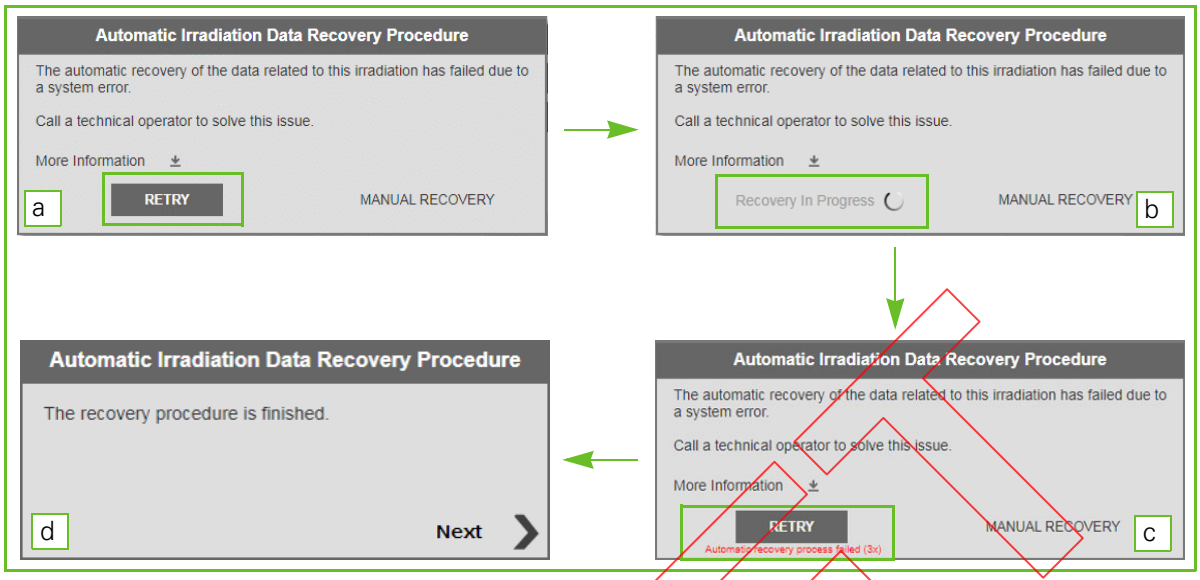

Figure 39-7. Recovery after termination by PTS - Retrying automatic recovery process (online)

5. In case the process is not successful, proceed to section *Manual recovery from File*.

   Note: *It is recommended to retry the automatic process until all reasonable options have been investigated by the Operator*

Manual recovery from File

1. When the automatic recovery procedure fails, click **Manual Recovery** in the popup message.

   In the popup message, you can click on **More Information** to know more (Figure 39-8).

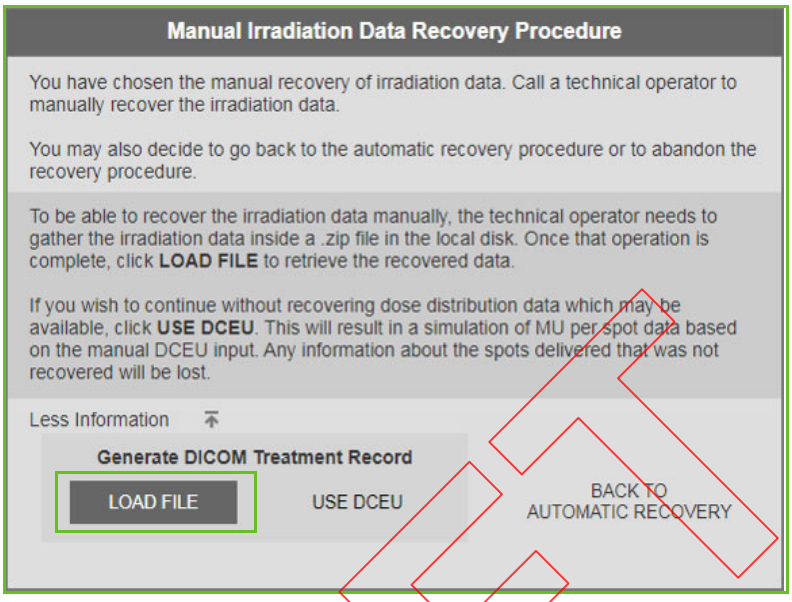

Figure 39-8. Recovery after termination by PTS - Manual data recovery information (online)

2. Call an operator to gather the irradiation data inside a .zip file in the local disk.
3. Once the operation is complete, click **LOAD FILE** (Figure 39-9a).

   Note: *In case the Operator cannot recover files manually, the recovery based on the DCEU values must be performed. See section "Manual Recovery from DCEU values".*

4. In file explorer popup, browse and select the file as indicated by the Operator. Click **Open**.
5. In the Manual Recovery popup, the button turns green and now reads **File Loaded**. Click **Next** to continue (Figure 39-9b).
6. In case the process is successful, click **OK** to continue and proceed to section "*Resuming Irradiation*".

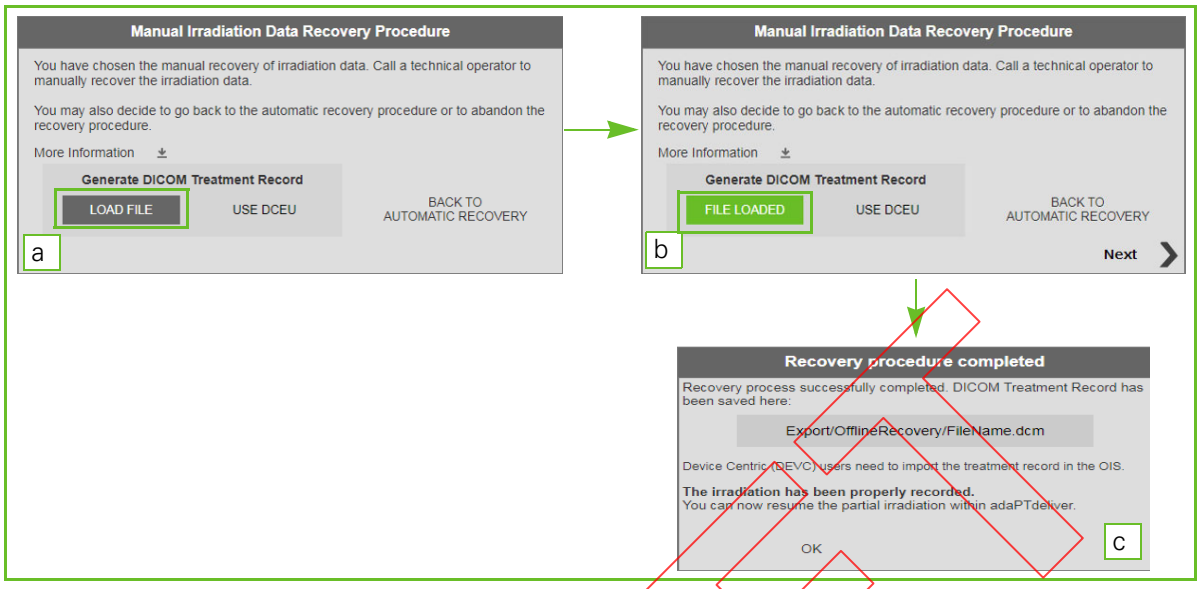

Figure 39-9. Recovery after termination by PTS - Manual recovery process (online)

7. In case the process is not successful, proceed to section "*Manual Recovery from DCEU values*".

Manual Recovery from DCEU values

In case the loading of the file cannot be performed, the last resort is the use of the DCEU values.

1. Enter the delivered cumulative MUd value related to that beam, taking into account all previous partial irradiations of that beam and click search for partial irradiation continuation (Figure 39-10).
2. When the search is done, the signature of a physicist is required to resume the irradiation.

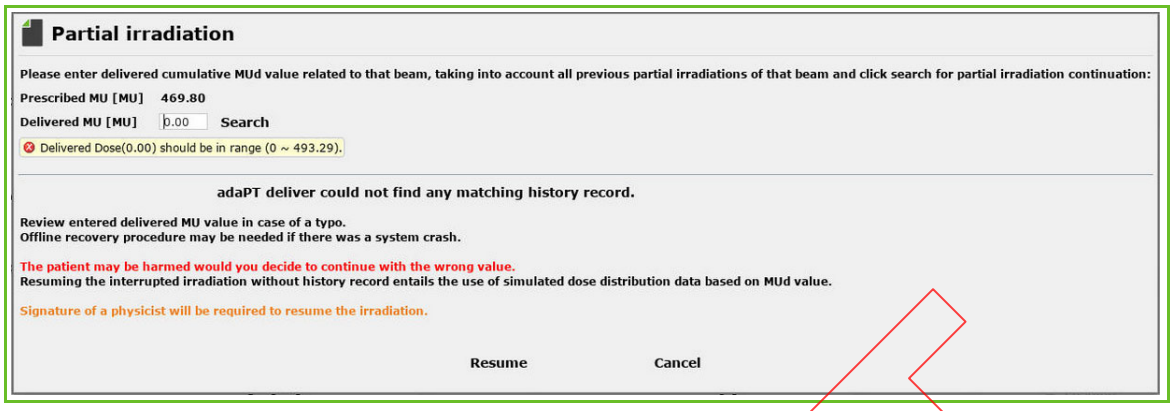

Figure 39-10. Recovery after termination by PTS - Recovery from DCEU values

Resuming Irradiation

Note: *In case of resuming from the irradiation records containing simulated values, a signature will be needed to proceed (Figure 39-11).*

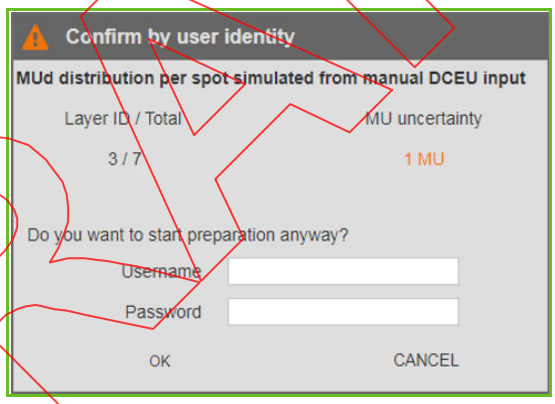

Figure 39-11. Confirmation to the use of simulated data for resuming irradiation

Once the irradiation data has been recovered, the irradiation can be resumed by the User in two ways:

- In the same session: See section "*Resuming Irradiation in the Same Session*".
- In a new session: See section "*Resuming Irradiation in a New Session*"

Offline recovery - adaPTdeliver session crashes

WARNING	When performing the offline recovery procedure, when the system prompts the user to input the MU and counts values, the user must be careful to input the values corresponding to the irradiation they want to recover. The values displayed on the DCEU at that time may not be the ones needed for the procedure (e.g., if there has been another irradiation in the meantime). They must refer to the MU and counts values that they noted once the irradiation stopped, following a software issue. Any fault in the manually input value entails a serious risk of under or over-irradiation of the patient.

WARNING	If ever a software issue occurs during an irradiation (the GUI freezes or there is any kind of software crash), the user must take note of the values on the DCEU (both MU and counts) once the irradiation stops. These values will be required to recover the irradiation data offline. Not recording these values correctly for later use entails a serious risk of under or over-irradiation of the patient.

Important	Offline recovery is mandatory as soon as adaPT*deliver* software crash occurs. Offline recovery enables the reconciliation of available irradiation data in the adaPT*deliver* software

When the irradiation is terminated by the PTS and the adaPT*deliver* session crashes,

- The Offline Recovery method is available in the SESSION DEFINITION SCREEN in adaPT*deliver*.
- This screen has the button **Offline Recovery** (Figure 39-12), which is the starting point of the recovery process.

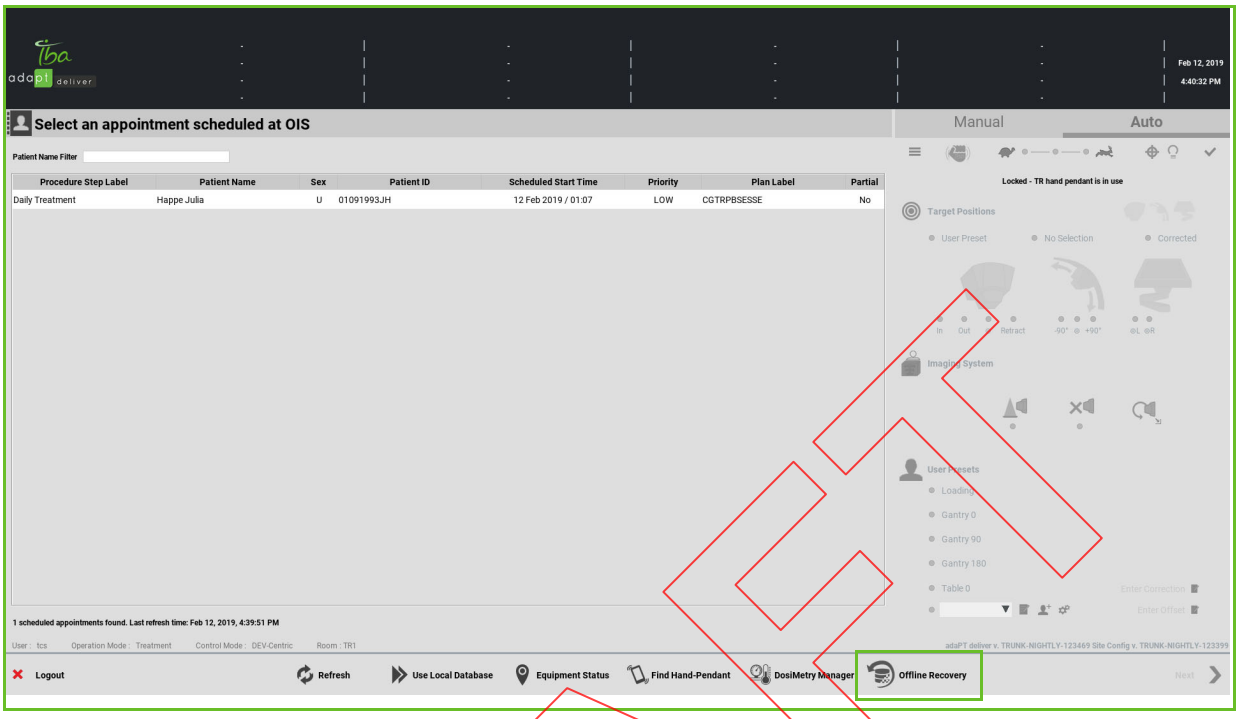

Figure 39-12. Recovery after termination by PTS - Offline recovery

The recovery of the data can be through one of the following methods:

1. Automatic recovery
2. Manual recovery from file
3. Manual recovery from DCEU values

Automatic recovery

1. Click **Offline Recovery** in the Session Definition screen (Figure 39-12).
2. The popup **Offline Recovery Process** appears (Figure 39-13), showing the list of unrecovered partial irradiations in the adaPT*deliver* database.

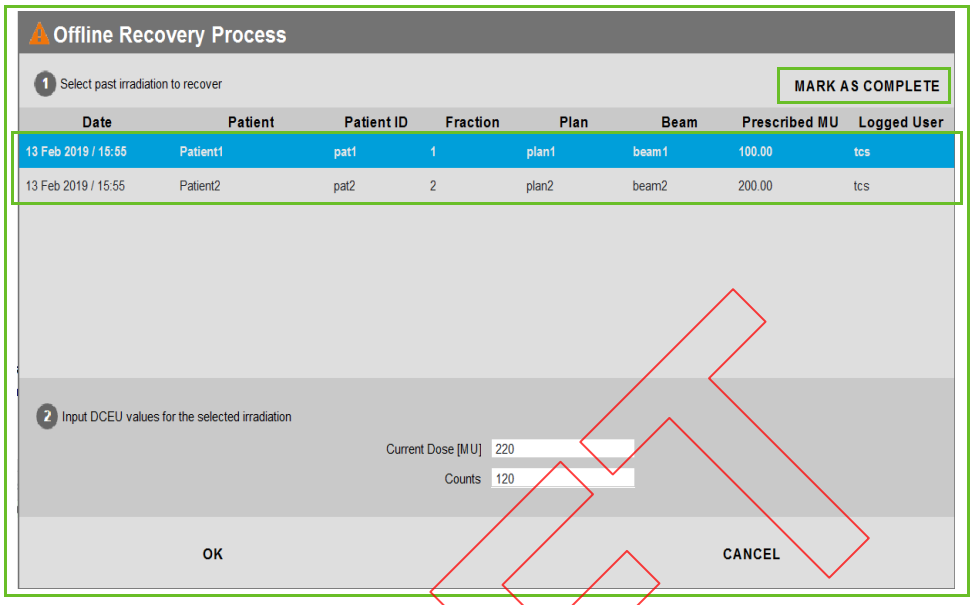

Figure 39-13. Recovery after termination by PTS - Automatic data recovery information (offline)

Note: *In case the prescribed dose was delivered and the irradiation does not need to be resumed, the corresponding beam can be marked off as complete using the* **Mark As Complete** *button. The beam will be recorded in the PTS database.*

3. Select the line that corresponds to the irradiation you want to recover.

WARNING

The user must only proceed to mark a Beam Report as complete using the Offline Recovery dialogue if the irradiation was completely delivered (the prescribed dose was delivered according to the DCEU, so the irradiation does not need to be resumed) and is correctly recorded as complete in the OIS or the paper charts. The irradiation will be recorded in the PTS Database using a simulation based on the specified meterset for the irradiation and not on the actual delivered values.

This action is irreversible. Marking an incomplete Beam Report as complete when the irradiation was not completely delivered entails a serious risk of under-irradiation of the patient.

Note: *A value of 300 counts on the DCEU corresponds to 1 MU. See Chapter 17, Resetting a Dose Counter Electronic Unit for details.*

4. If the selected irradiation is partial, enter the corresponding **DCEU values** that you have saved at the time of the partial treatment. Click **OK**.

5. In case the automatic recovery process is successful, click **OK** to continue and proceed to section "*Resuming Irradiation*".

6. In case the process is not successful, proceed to section "*Manual recovery from File*"

Manual recovery from File

1. When the automatic recovery procedure fails, click **Manual Recovery** in the popup message (Figure 39-14).

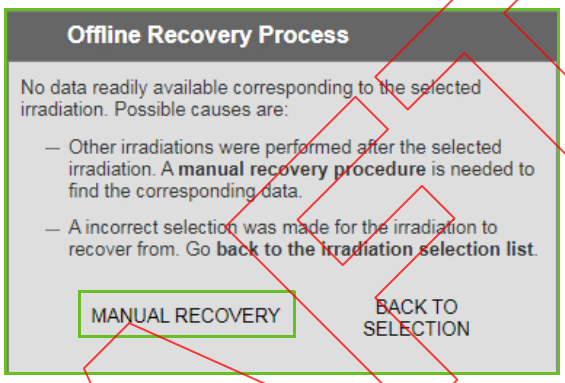

Figure 39-14. Recovery after termination by adaPTdeliver - Manual data recovery message (offline)

You can click on **More Information** to know more (Figure 39-15).

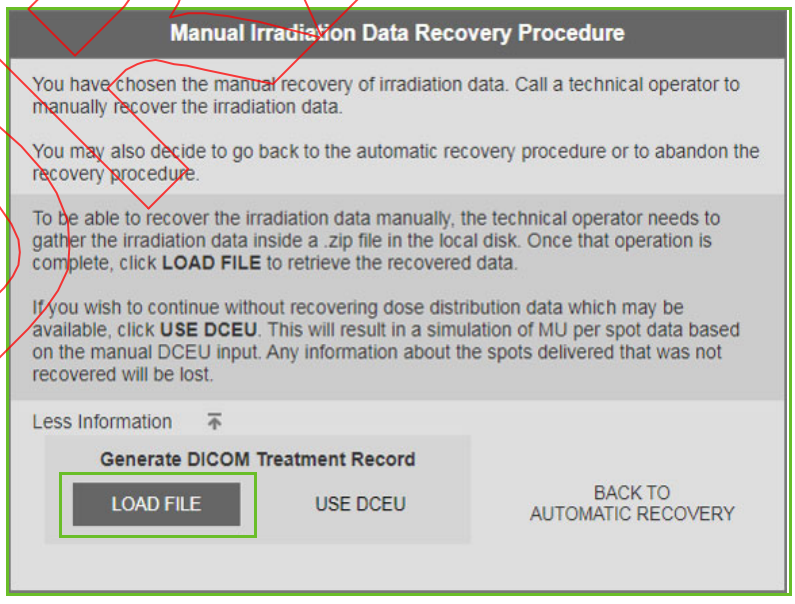

Figure 39-15. Recovery after termination by PTS - Manual data recovery information (offline)

2. Then, click **LOAD FILE** (Figure 39-16a).

   Note: *In case the Operator cannot recover files manually, the recovery based on the DCEU values must be performed. See section "Manual Recovery from DCEU values".*

3. In file explorer popup, browse and select the file as indicated by the Operator. Click **Open**.

4. In the Manual Recovery popup, the button turns green and now reads **File Loaded**. Click **Next** to continue (Figure 39-16b).

5. In case the process is successful (Figure 39-16c), click **OK** to continue and proceed to section "*Resuming Irradiation*".

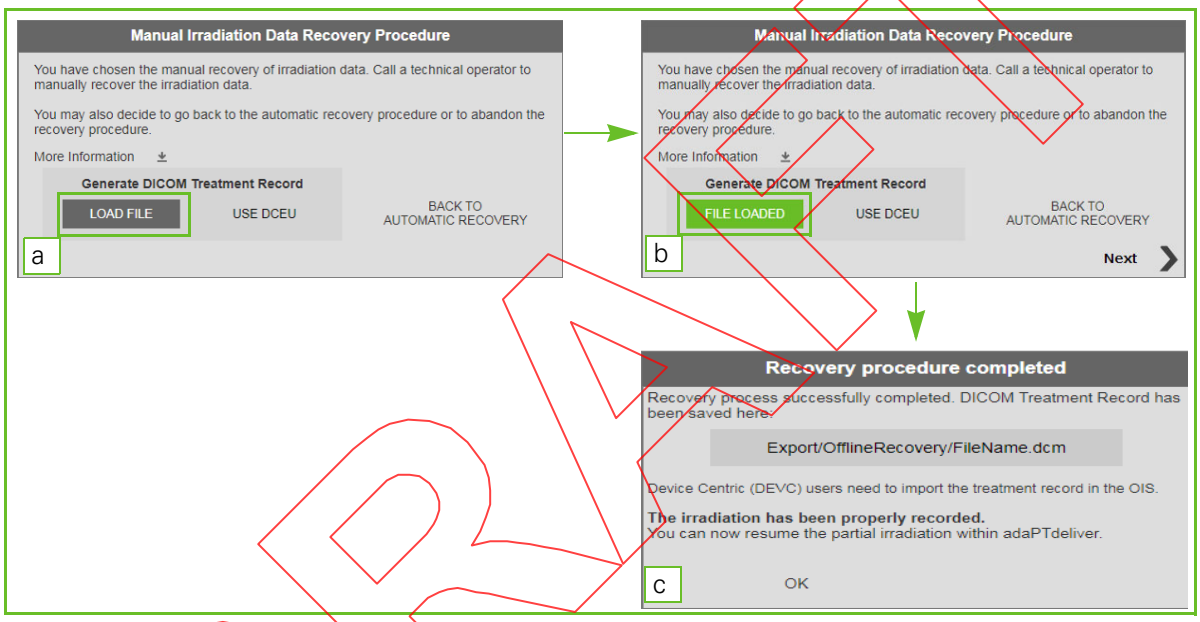

Figure 39-16. Recovery after termination by PTS - Manual recovery process (offline)

WARNING

Once the system constructs a DICOM Treatment Record and stores it on disk as a result of the Offline Recovery procedure in a system that functions in DEVC mode, the user needs to import the recovered DICOM record in the OIS (with caution to avoid any double recordings).

Making a double recording in the OIS entails a serious risk of under-irradiation of the patient.

6. In case the process is not successful, proceed to section "*Manual Recovery from DCEU values*".

Manual Recovery from DCEU values

In case the loading of the file cannot be performed, the last resort is the use of the DCEU values.

1. Enter the delivered cumulative MUd value related to that beam, taking into account all previous partial irradiations of that beam and click search for partial irradiation continuation (Figure 39-17).
2. When the search is done, the signature of a physicist is required to resume the irradiation.

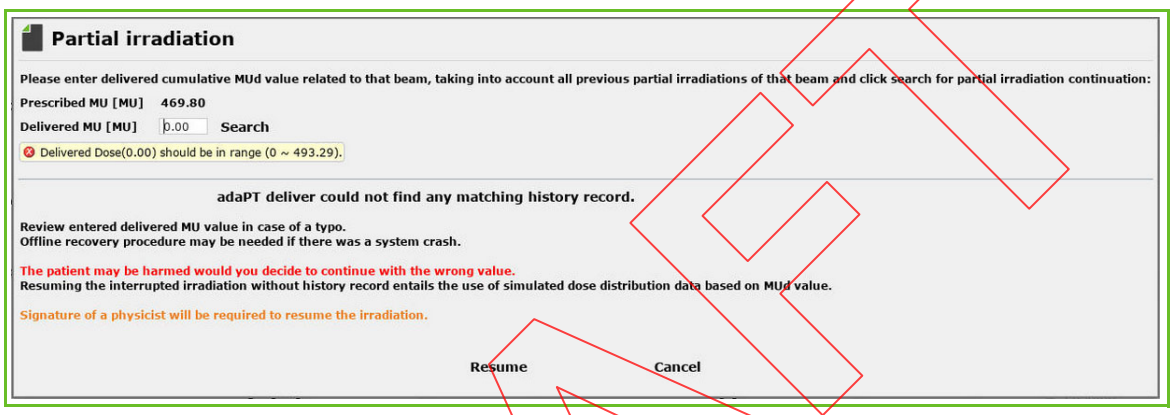

Figure 39-17. Recovery after termination by PTS - Recovery from DCEU values

Resuming Irradiation

Once the irradiation data has been recovered, in case of Offline Recovery, the irradiation can only be resumed in a new session (See section "*Resuming Irradiation in a New Session*").

Note: *In case of resuming from the irradiation records containing simulated values, a signature will be needed to proceed (Figure 39-18).*

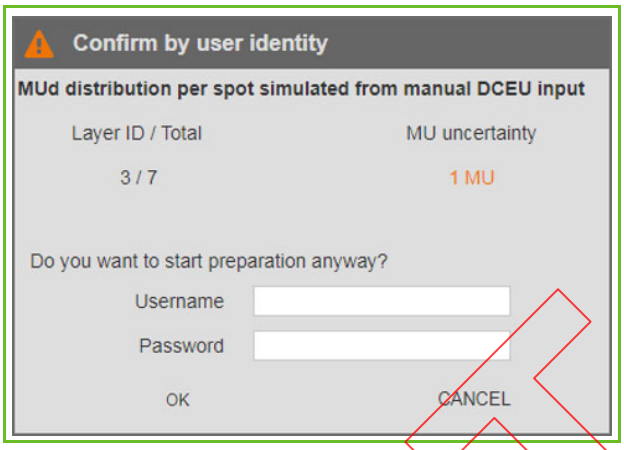

Figure 39-18. Confirmation to the use of simulated data for resuming irradiation

Resuming Irradiation in the Same Session

The user can resume the irradiation in the same session when there is:

- Termination by the Therapist, or
- Termination by the PTS where the adaPT*deliver* session is maintained

The irradiation can be resumed in the same session only after an **online recovery**.

Note: *Resuming the irradiation in a new session is possible in both the Standalone and the OIS mode.*

1. In the BEAM SELECTION SCREEN, select the partial treatment beam manually.

   Beams marked as partial are indicated by an orange checkmark  .

2. In the **Dose panel** (Figure 39-19), the user can see that:
   - The delivered MU is non-zero.
   - The MU to be delivered is the difference between prescribed and delivered MU.
   - A banner below the Dose panel gives information about the partial irradiation.

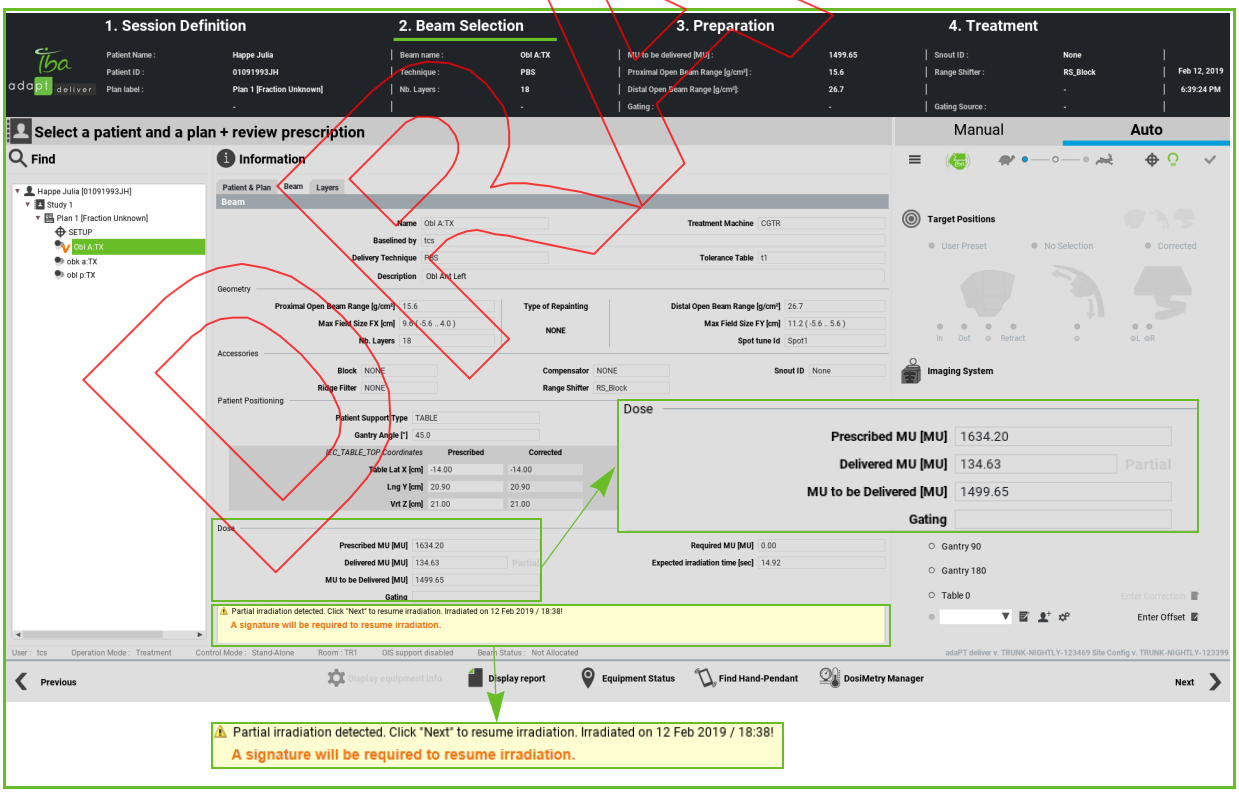

Figure 39-19. Resuming irradiation after partial treatment

Resuming irradiation

Ensure the partial beam is selected as indicated above. Click **Next** to proceed to the PREPARATION SCREEN and complete the irradiation of the selected beam.

Note: *In case of resuming from the irradiation records containing simulated values, a signature will be needed to proceed (Figure 39-20).*

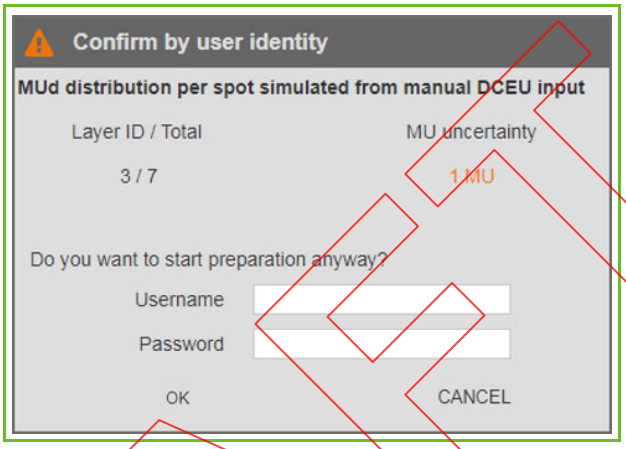

Figure 39-20. Confirmation to the use of simulated data for resuming irradiation

Resuming Irradiation in a New Session

The user needs to resume the irradiation in a new session when there is:

- Termination by the PTS where the adaPT*deliver* session crashes, or
- Closing of the adaPT*deliver* session by the Therapist

Note: *Resuming the irradiation in a new session is possible in both the Standalone and the OIS mode.*

Using the Standalone mode

WARNING	When working in Standalone mode, after a partial irradiation, the user must record the cumulative MU value delivered for that beam according to the center's best practices (may be on paper or other method). The goal is to be able to use that value for the event of a resumption in a different session. Not doing this entails a serious risk of under or over-irradiation of the patient.

Partial treatment record found

1. In the SESSION DEFINITION SCREEN (Figure 35-2), **load** the desired patient and plan.
2. Select the beam to be resumed.
3. Search the adaPT*deliver* database manually for data about partial treatments. To do so, in the **Dose panel**, click on **Partial** (Figure 39-21).

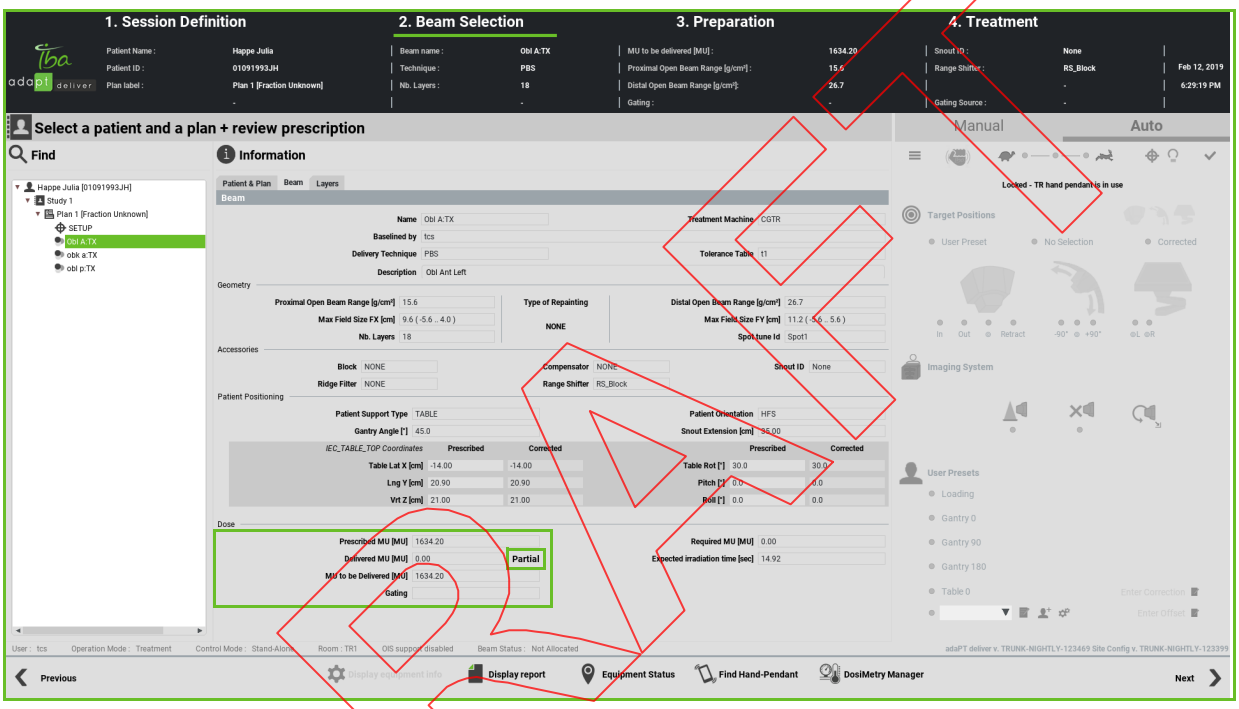

Figure 39-21. Resuming irradiation after partial treatment in Standalone mode

4. In the popup, enter the delivered MU of the partial irradiation to be resumed, and click **Search** (Figure 39-22).
5. Click **RESUME** to continue.

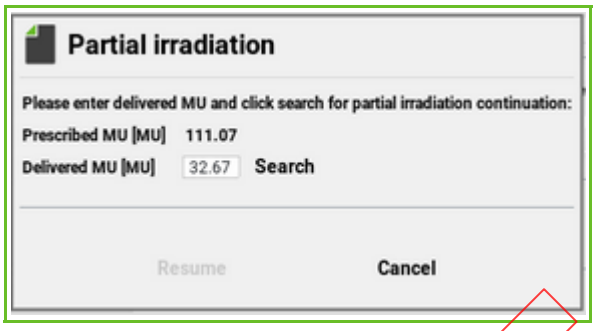

Figure 39-22. Resuming irradiation

6. In the Beam Selection screen (Figure 39-23), the beams marked as partial are indicated by an orange checkmark .

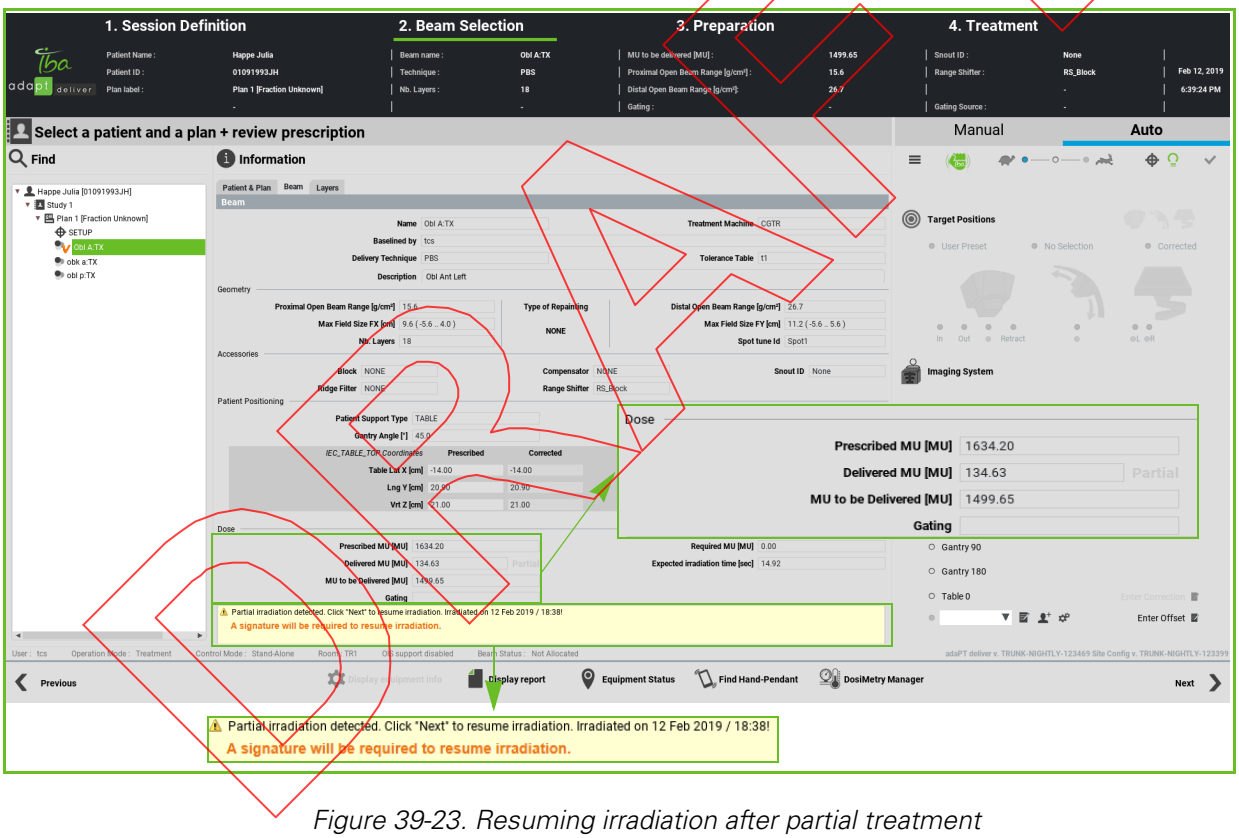

Figure 39-23. Resuming irradiation after partial treatment

Note: *In case of resuming from the irradiation records containing simulated values, a signature will be needed to proceed. The user will receive a message (Figure 39-24) to confirm the use of simulated data. The message shows which layer contains the simulated data, and the uncertainty of the MUs.*

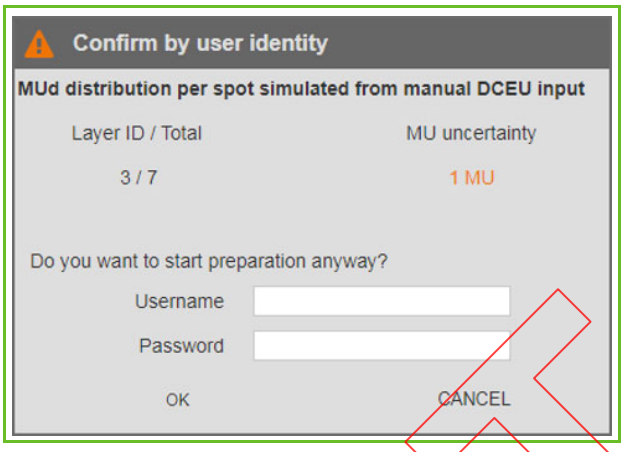

Figure 39-24. Confirmation to the use of simulated data for resuming irradiation

7. In the **Dose panel** (Figure 39-23), the user can see that:
   - The Delivered MU is non-zero.
   - The MU to be delivered is the difference between prescribed and delivered MU.
   - A banner below the Dose panel gives info about the partial irradiation.
8. Click **Next** and complete the irradiation of the selected beam.

Multiple partial treatment records found

In case adaPT*deliver* finds more than one record that matches the irradiation to be resumed (same patient data and same MU), a popup is displayed when the Beam Selection screen appears (Figure 39-25).

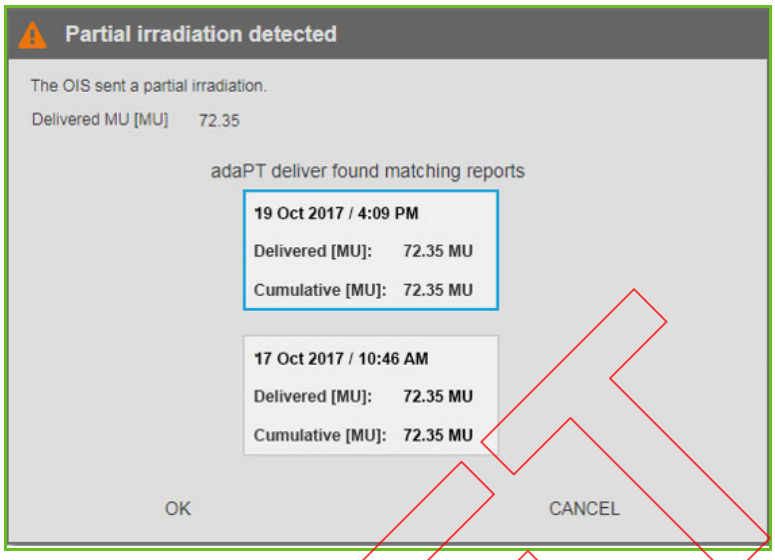

Figure 39-25. Resuming irradiation - Partial treatment records found

The user must **choose** the correct report based on the date and time of the partial irradiation to be resumed, and click **OK** to continue to proceed to the Preparation screen.

No partial records found

In case adaPT*deliver* finds no record that matches the irradiation to be resumed, a popup is displayed when the Beam Selection screen appears. There are two possibilities:

- The system did find an unfinished irradiation, but the delivered MU did not match: In this case, the data has not been recovered yet and the User can proceed to an **offline recovery**. (See section "*Offline recovery - adaPTdeliver session crashes*")
- The system did not find any matching report: The data has not been recovered yet and the User can proceed to a recovery based on the **DCEU values**. (See section "*Manual Recovery from DCEU values*")

Using an OIS

DEV-Centric mode

1. In the OIS, create a continuation fraction.
2. Then create an **Appointment** and proceed to **Check-in** the patient.

3. Click on the corresponding line in adaPT*deliver* to select it, and then click **Next** (Figure 40-1).

4. Select the corresponding plan and beam in the OIS. (The data is sent by the OIS to adaPT*deliver*.)

5. The Beam Selection screen appears directly with the chosen beam selected.

   In the Beam Selection screen (Figure 39-26), the beams marked as partial are indicated by an orange checkmark  .

Figure 39-26. Resuming irradiation after partial treatment

Note: *In case of resuming from the irradiation records containing simulated values, a signature will be needed to proceed. The user will receive a message (Figure 39-27) to confirm the use of simulated data. The message shows which layer contains the simulated data, and the uncertainty of the MUs.*

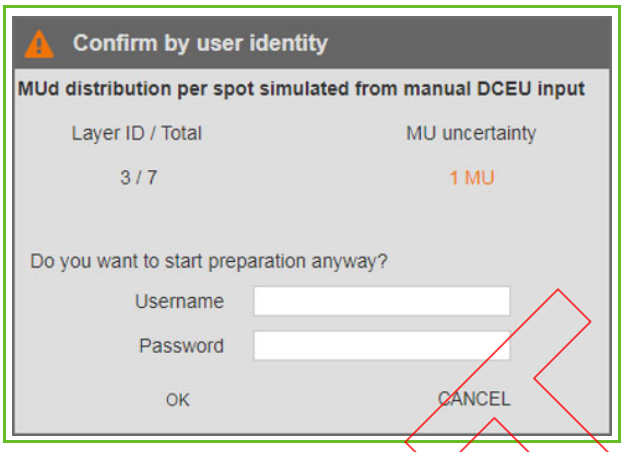

Figure 39-27. Confirmation to the use of simulated data for resuming irradiation

6. In the **Dose panel** (Figure 39-26), the user can see that:
   - The Delivered MU is non-zero.
   - The MU to be delivered is the difference between prescribed and delivered MU.
   - A banner below the Dose panel gives info about the partial irradiation.
7. Click **Next** and complete the irradiation of the selected beam.

Note:

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Part VII

Using adaPT*deliver* in Worklist Mode

Chapter 40
Operating in Worklist Mode

Selecting an Appointment

Using adaPT*deliver* in a **Treatment** session, the first screen to appear is the APPOINTMENT SELECTION SCREEN.

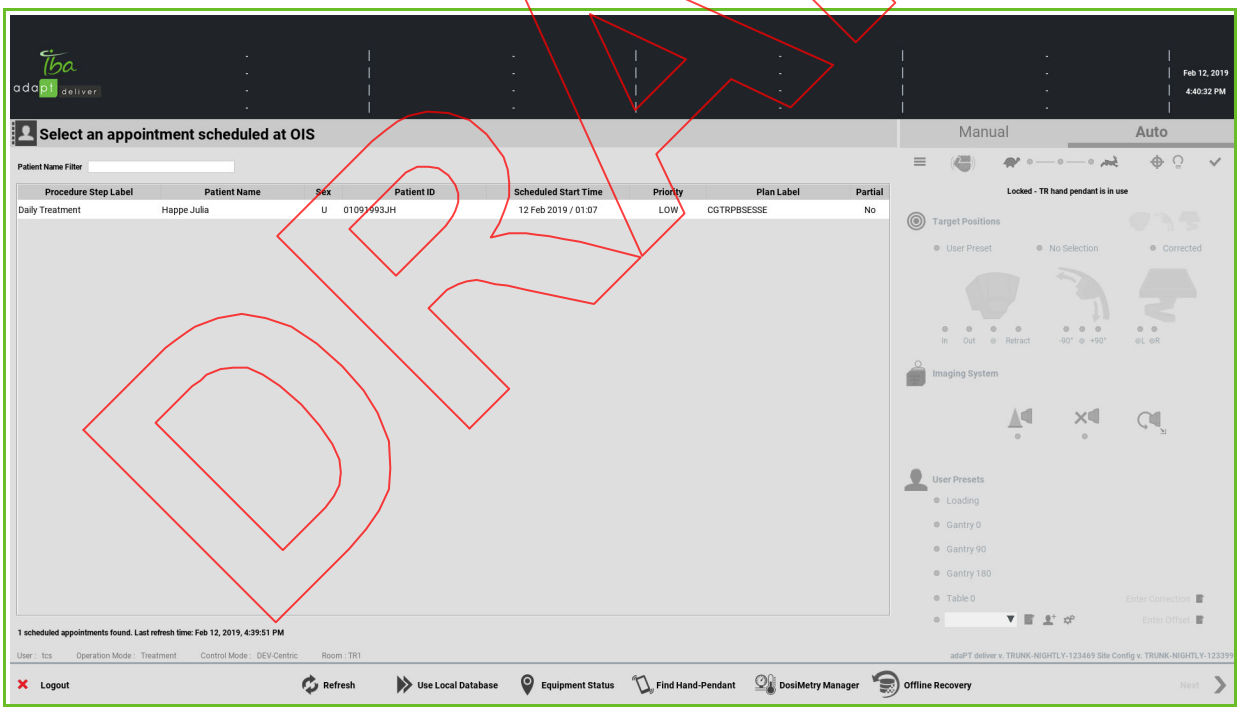

Figure 40-1. Appointment Selection Screen

From the APPOINTMENT SELECTION SCREEN you can select the desired appointment. Upon selection of an appointment, the list of beams appears. You can process each beam through the subsequent steps of beam selection, preparation, and treatment.

If the plan contains more than one isocenter, the system will trigger a consistency check between the isocenters positions and the PPS positions. If there are inconsistencies (i.e. for at least one pair of isocenters, distance between PPS positions is different than distance between isocenters), the system displays a detailed message featuring the pair(s) of positions of the PPS and the isocenters that are inconsistent, for the user to decide whether to continue with the workflow or not.

Two scenarios are possible:

a. The system cannot perform the consistency check on a multiple isocenter plan because some beams contain pitch and roll PPS positions. A pop-up message prompts you for continuation.

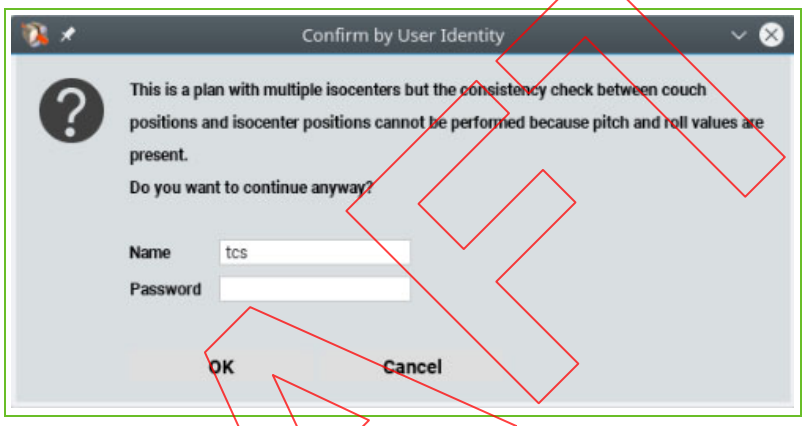

Figure 40-2. Consistency Check Pitch/Roll PPS Positions Pop-Up Message

Click **OK** if you want to proceed with your selection, else click **Cancel**.

WARNING

If pitch and roll positions are defined for all or some of the beams in a multiple isocenters plan, the system will not perform the consistency check of the Patient Positioning System (PPS) positions with respect to the different isocenters.

As a user, it is your responsibility to check that the PPS positions in the plan are correct ant to decide whether to continue with the workflow or not under these circumstances.

b. There is a system message in case of failure of the check between inter-isocenter and inter-PPS positions, with an interface for override with credentials by an authorized user if the user decides to continue with the workflow.

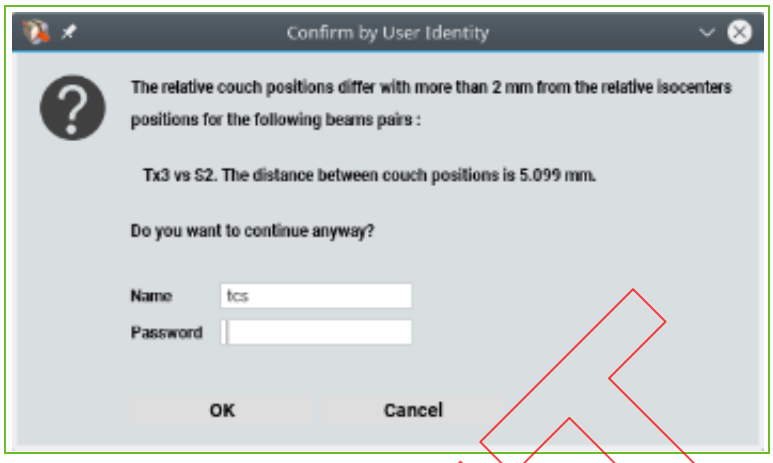

Figure 40-3. Couch Positions Check - Pop-Up Message

There is a configurable tolerance for the check (default value 2 mm), which can be modified by IBA following a user request.

Click **OK** if you want to proceed with your selection, else click **Cancel**.

There is a user right: ISOCENTER_CHECK_OVERRIDE to authorize users to continue with the workflow despite the consistency check finding an inconsistency.

For the configuration of the user rights, refer to **Appendix B** "*Managing PTS Users*" on page B-1

Appointment Selection: Dose Limits Check

When you select an appointment, a dose limits check is performed to verify that the daily and total dose limit is not surpassed. You can perform as follows:

- Any of the dose limits are surpassed: you can opt to override that/those limit(s) with the appropriate user rights: there is a right for each type of limit (daily/total): enter your user name and password and click **OK**. Else click **Cancel**.
- Not all data is available to perform the dose limit checks: the `OIS provides incomplete data for the computation, the dose limits check will be ignored. Do you want to proceed anyway? (Yes/No` message appears. Click **Yes** to acknowledge or **No** to stop.

Grayed Out Appointments

Invalid appointments appear grayed out. Mouse (hover) over any such grayed out appointment to see more information about the issue with that specific appointment.

When no Appointments Appear

Note: *Condition for an appointment to appear is that the appointment has been checked in in OIS.*

For patients with no plan defined no appointments appear in the APPOINTMENT SELECTION SCREEN.

The APPOINTMENT SELECTION SCREEN is automatically refreshed after a predefined time. If you want to manually refresh the list of appointments, press **Refresh**.

Procedure

To navigate through the adaPT*deliver* screens, click **Next** to proceed to a next step, or **Previous** if you want to return to a previous step or if you want to cancel the process.

Selecting a Beam

The BEAM SELECTION SCREEN appears.

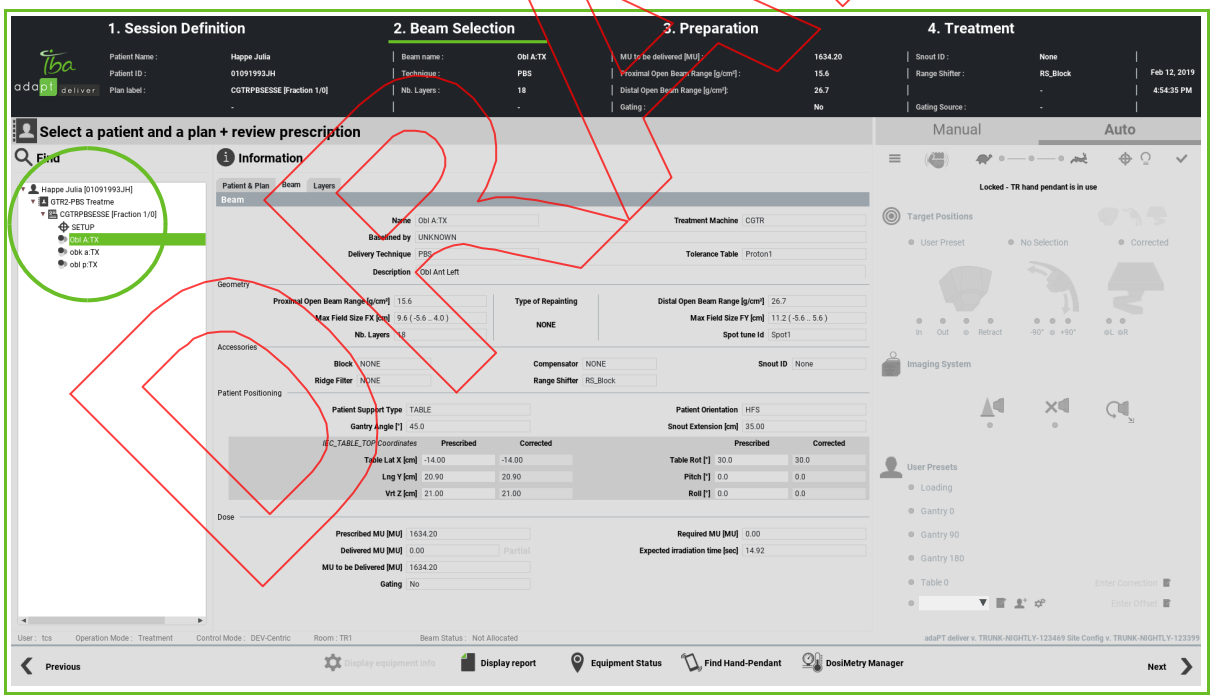

Figure 40-4. Beam Selection Screen

The header of the BEAM SELECTION SCREEN now displays the type of accessory, if any, and its identifier, as follows:

- Pencil Beam Scanning:
  - No accessory: no accessory type
  - One accessory: accessory type and identifier

The list area is now filled with the beam(s) that you selected from the SESSION DEFINITION SCREEN.

If there are multiple beams in the list, click the beam that you want to process first. The selected beam appears in a highlighted box.

The associated data appear in the information area. You have to complete all remaining treatment session steps with this beam and then you can select a next beam from the list area.

Important	In treatment mode, the approval to deliver a treatment beam to the patient is under the responsibility of the Radiation Therapy Technologist (RTT) as at Proton Therapy System (PTS) level no distinction can be made between a calibrated/approved and a non-calibrated/non-approved beam.

Similar to the SESSION DEFINITION SCREEN, the Patient & Plan, Beam, and Layers tabs are also available on the information area of the BEAM SELECTION SCREEN.

Initially, most of the fields in the information area of the BEAM SELECTION SCREEN are blank; only the patient name, study, plan, and beam are listed in the list area. To have the fields on the information area filled out, click the required beam in the list area. Fields are filled in up to the lowest level that you select in the list area. E.g., if you click the plan in the list area, only the patient, study, and plan information appear, not the beam information.

To proceed to the next step in the irradiation process, i.e., to actually prepare the equipment for irradiation, double-click the desired beam (or click the beam and click **Next** in the rightmost corner at the bottom of the screen). You will proceed to the Preparation step. For information, refer to chapter "*Preparing the Equipment for Irradiation*" on page 33-1.

How to Proceed From Here?

The remainder of the process in Worklist mode is identical to the process in Standalone mode. For information, refer to the following chapters:

- Chapter 35, "Preparing the Equipment for Irradiation"
- Chapter 36, "Monitoring and Controlling the Treatment"
- Chapter 37, "Starting Irradiation"
- Chapter 38, "Pausing and Stopping an Irradiation"

For resuming after a partial irradiation in OIS mode, refer to page 43-11, "Resuming Irradiation after a PBS Partial Irradiation".

Chapter 41
Resuming after a Partial Irradiation

Note: *Screen representations throughout this chapter and throughout this part may show 'Control Mode: EMR-Centric' or 'Control Mode: DEV-Centric' at the bottom. When working in Standalone mode, you will notice that the Control Mode indication reads 'Stand-Alone'.*

WARNING	
	Whenever the system prompts the user to manually input the DCEU value or the MUd value (MU delivered) corresponding to a partial irradiation, the user must follow the instructions in the user documentation and be extremely careful not to commit any typos or input any false values. After inputting the value manually, the user must double-check the value displayed by the system to ensure the input is correct. Any fault in the manually input values entails a serious risk of under or over-irradiation of the patient.

Summary of the steps for Resuming from a Partial treatment

1. Partial Irradiation

There are several situations that can lead to partial irradiation:

- **Therapist** (user abort)

  The therapist can choose to do so for many reasons such as patient's condition, safety, motion etc.

- **PTS** (machine abort)

  - adaPT*deliver* session is maintained: This can arise due to fault in hardware, communication or another software malfunction.
  - adaPT*deliver* session crashes: There is a fault in the adaPT*deliver* software or communication which may lead to aborting of the current session. This can also be due to a fault in hardware, communication or another software malfunction. An adaPT*deliver* session crash does not necessarily mean that the beam is aborted. If there is no machine issue, the beam will be delivered even if user interface is freezing. If adaPT*deliver* crashes, there will be a disconnection with OIS.

2. Irradiation data recovery

The records of the partial irradiation are retrieved to know the layers and spots already delivered, and to update the values in the adaPT*deliver* and OIS. These situation have been identified:

- **No recovery needed**

  This happens after a beam termination is done by the therapist. It is also valid for cases of beam termination by the PTS when all data is recorded correctly. When the system encounters an issue with the recording of an irradiation, two recovery processes are available.

- **Online recovery**

  Online means data recovery procedure happens when therapist is in front of the irradiation screen and the OIS session is still open (if in OIS mode). This is possible when the termination is done by the therapist or PTS and the adaPT*deliver* session is maintained.

- **Offline recovery**

  Offline means data recovery is happening after the OIS treatment session is closed. This occurs when the termination is done by the PTS and the adaPT*deliver* session crashes.

In either case, there are three recovery methods.

- Automatic: adaPT*deliver* software is able to retrieve all available irradiation records from the Beam Management System (BMS) software automatically and provides detailed records. In automatic recovery, if the DCEU value entered is higher than the irradiation records, the remaining is simulated.
- Manual recovery from file: adaPT*deliver* software is not able to retrieve irradiation records from the BMS software. A manual intervention by the IBA Operator is needed. This can provide detailed records.
- Manual recovery from DCEU values: The delivered dose measured by the DCEU is used to simulate the corresponding dose distribution (layers and spots). This should be the last resort since the distribution of the dose is not 'true' but simulated.

3. Resuming irradiation

The irradiation can be resumed either in the same session or in a new one.

- In the **same session**: This is possible for online recovery only.
- In a **new session:** This is possible for offline recovery, or when it is not possible to continue the treatment due to other reasons (patient's conditions, schedule, etc).

A flowchart of the summary of the above steps necessary for the resumption of the irradiation is given in Figure 41-1.

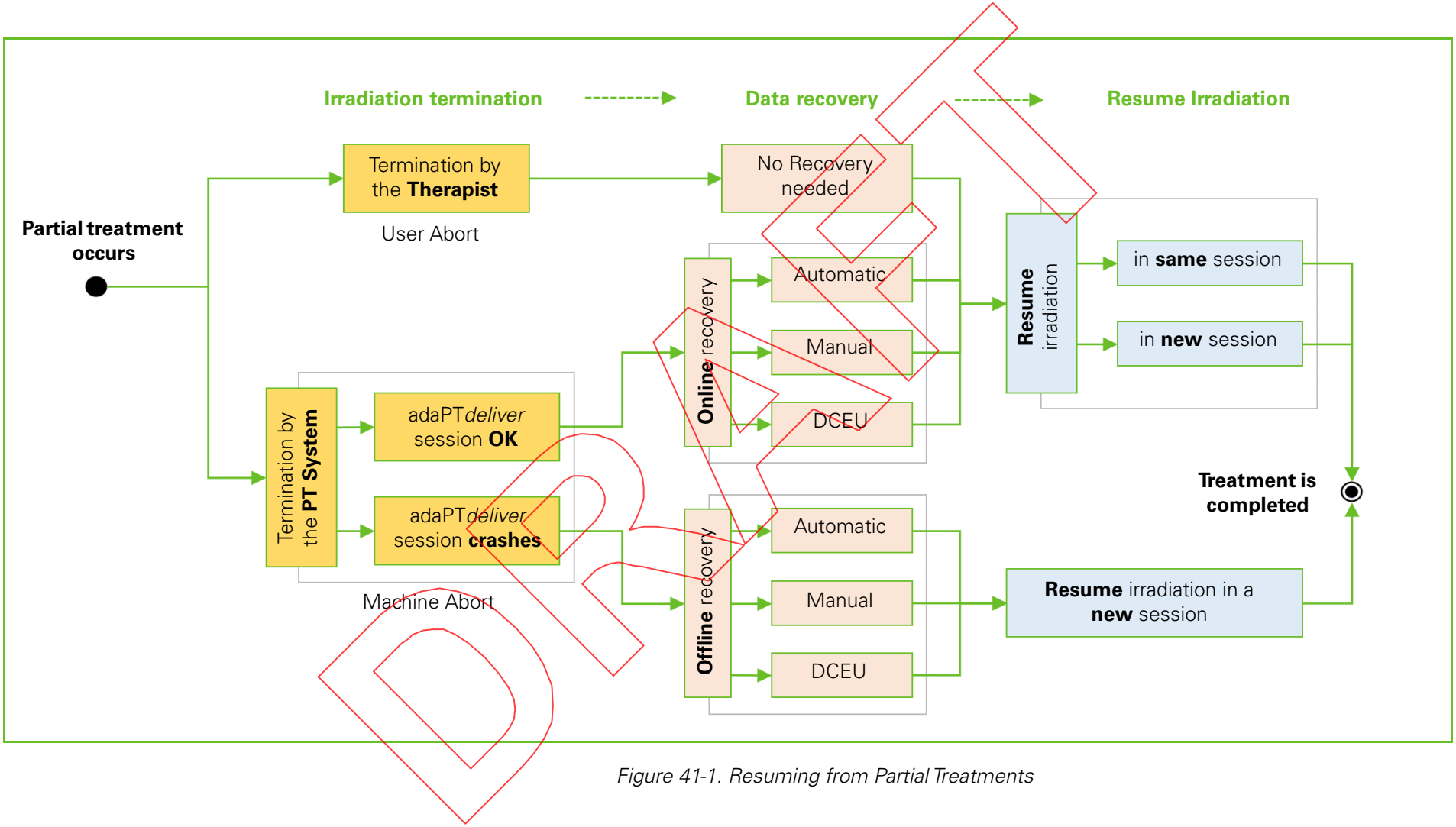

Figure 41-1. Resuming from Partial Treatments

Termination by the Therapist: No Recovery needed

When the irradiation is manually terminated by the therapist, a popup message appears informing the user that the irradiation is not complete (Figure 41-2).

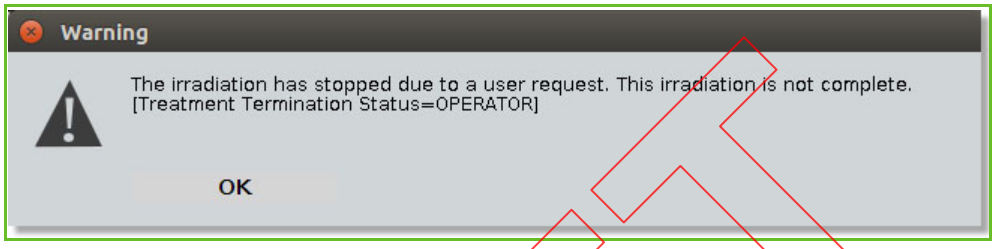

Figure 41-2. Recovery after Termination by Therapist - Warning message

adaPT*deliver* builds an irradiation record and stores it in its database.

1. adaPT*deliver* sends a Dicom record for the irradiation to the OIS.
2. The OIS asks the user if he/she wishes to resume the beam in the same session .
   - YES: adaPT*deliver* switches directly to screen Beam Selection (Figure 41-18). This is illustrated in section "*Resuming Irradiation in the Same Session*".
   - NO: the user will be able to manually select the partial beam again in the current session (same case as YES after the selection) or resume the irradiation in another session, at a later point of time. This is illustrated in section "*Resuming Irradiation in a New Session*".

Termination by the Proton Therapy System

Online recovery - adaPTdeliver session maintained

When the irradiation is terminated by the PTS, popup appears indicating the cause of termination (Figure 41-3). Click **OK** to continue.

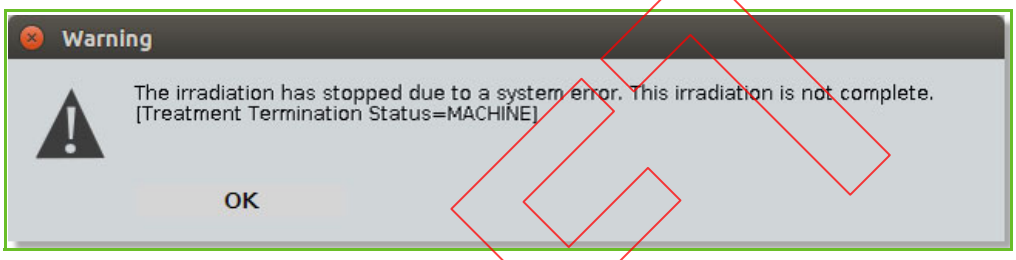

Figure 41-3. Recovery after termination by PTS - Warning message

The recovery of the data can be performed through one of the following methods:

1. Automatic recovery
2. Manual recovery from file
3. Manual recovery from DCEU values

Automatic recovery

1. In the popup message, type in the values of the MU delivered and dose counts from the DCEU (Figure 41-4). Click **OK** to continue and proceed to section "*Resuming Irradiation*".

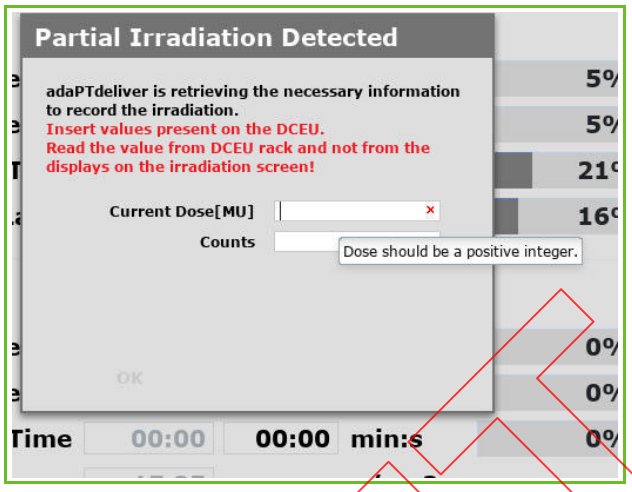

Figure 41-4. Recovery after termination by PTS - Automatic recovery process (online)

2. In case the process is not successful, proceed to section "*Retry and Troubleshoot*".

Retry and Troubleshoot

The automatic process can fail for various reasons, including software crashes, communication faults, hardware problems, etc. In such case, the User shall ask the IBA Operator to investigate the cause of the automatic process failure and to attempt to troubleshoot it (Figure 41-5).

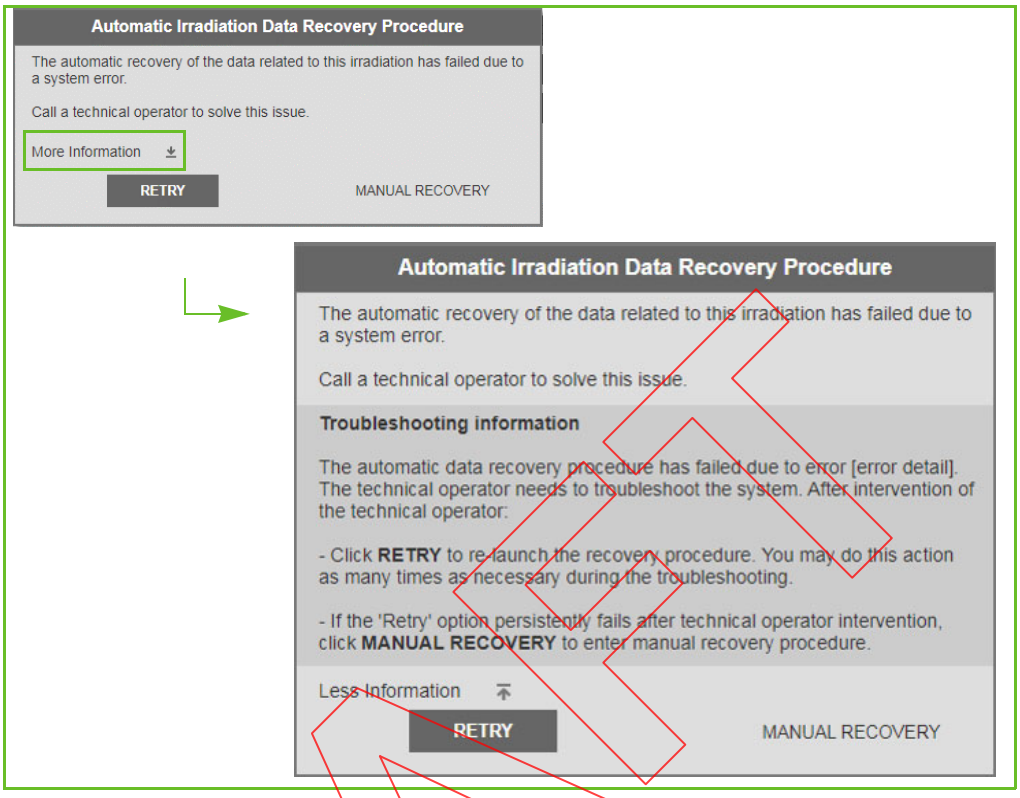

Figure 41-5. Recovery after termination by PTS - Automatic data recovery information (online)

1. In case the Automatic process fails, a new popup appears giving you the possibility to Retry or to attempt the **Manual Recovery** (Figure 41-6a).

   You can click on **More Information** to know more (Figure 41-5).

2. Click in **Retry**. A message **Recovery in Progress** is displayed (Figure 41-6b).

3. In case the **Retry** fails, a message is displayed in red under the button to inform the user, including the number of failed attempts (Figure 41-6c).

4. If the **Retry** succeeds, a new popup appears (Figure 41-6d). Click **Next** to continue and proceed to section "*Resuming Irradiation*".

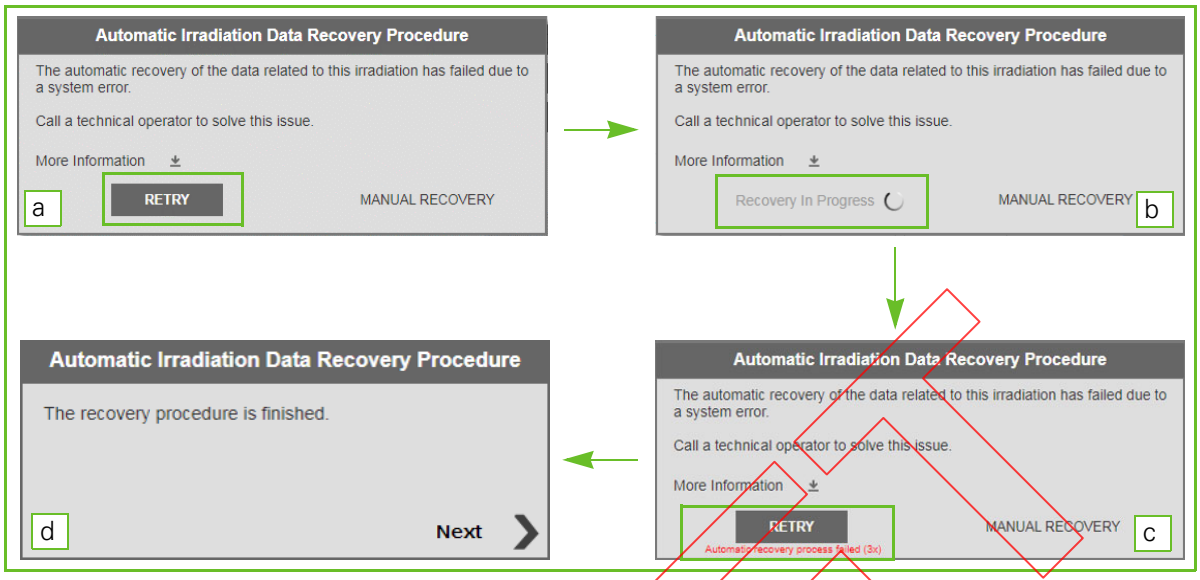

Figure 41-6. Recovery after termination by PTS - Retrying automatic recovery process (online)

5. In case the process is not successful, proceed to section *Manual recovery from File*.

   Note: *It is recommended to retry the automatic process until all reasonable options have been investigated by the Operator*

Manual recovery from File

1. When the automatic recovery procedure fails, click **Manual Recovery** in the popup message.

   In the popup message, you can click on **More Information** to know more (Figure 41-7).

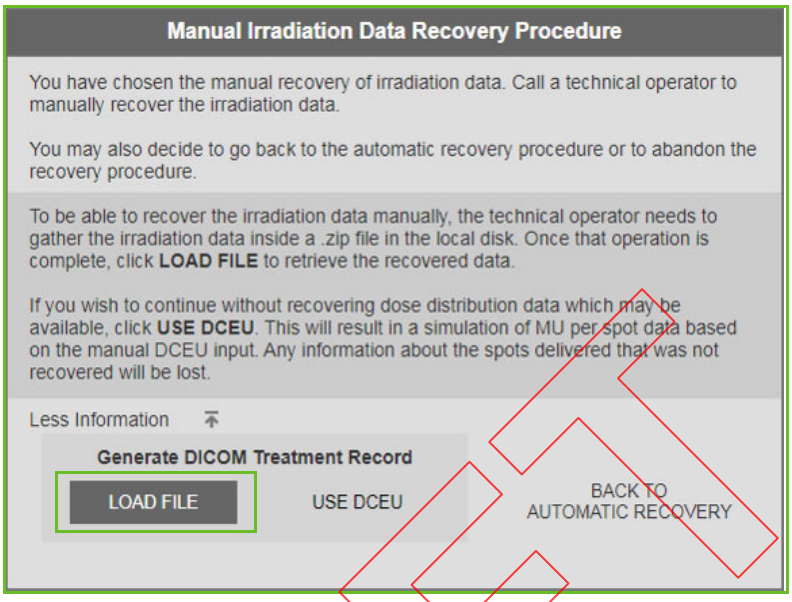

Figure 41-7. Recovery after termination by PTS - Manual data recovery information (online)

2. Call an operator to gather the irradiation data inside a .zip file in the local disk.
3. Once the operation is complete, click **LOAD FILE** (Figure 41-8a).

   Note: *In case the Operator cannot recover files manually, the recovery based on the DCEU values must be performed. See section "Manual Recovery from DCEU values".*

4. In file explorer popup, browse and select the file as indicated by the Operator. Click **Open**.
5. In the Manual Recovery popup, the button turns green and now reads **File Loaded**. Click **Next** to continue (Figure 41-8b).
6. In case the process is successful, click **OK** to continue and proceed to section "*Resuming Irradiation*".

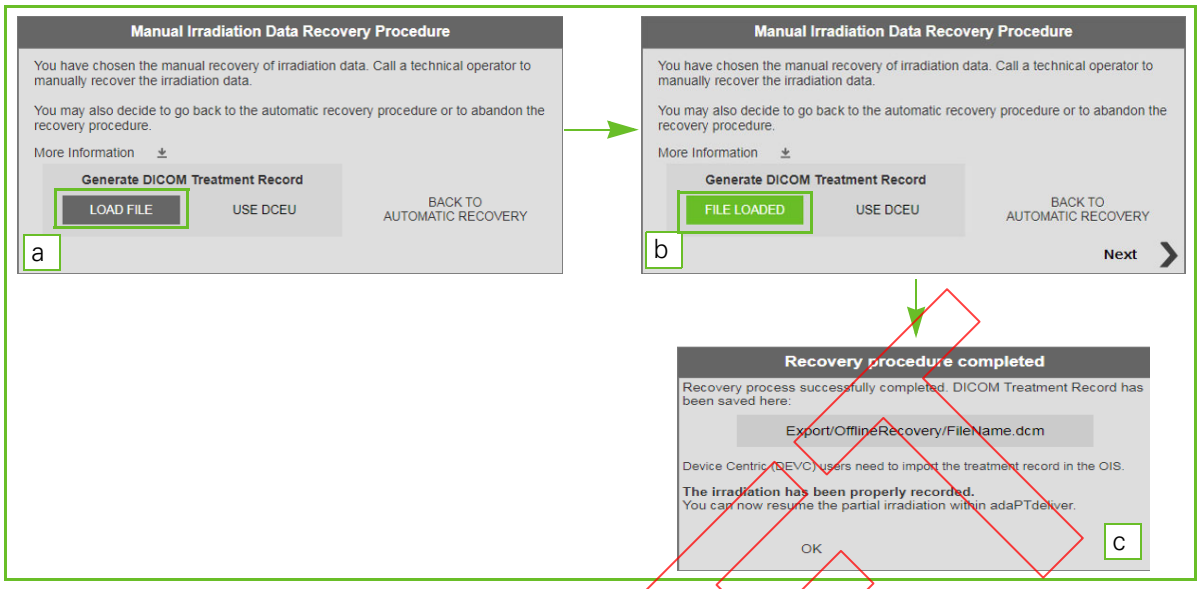

Figure 41-8. Recovery after termination by PTS - Manual recovery process (online)

7. In case the process is not successful, proceed to section "*Manual Recovery from DCEU values*".

Manual Recovery from DCEU values

In case the loading of the file cannot be performed, the last resort is the use of the DCEU values.

1. Enter the delivered cumulative MUd value related to that beam, taking into account all previous partial irradiations of that beam and click search for partial irradiation continuation (Figure 41-9).
2. When the search is done, the signature of a physicist is required to resume the irradiation.

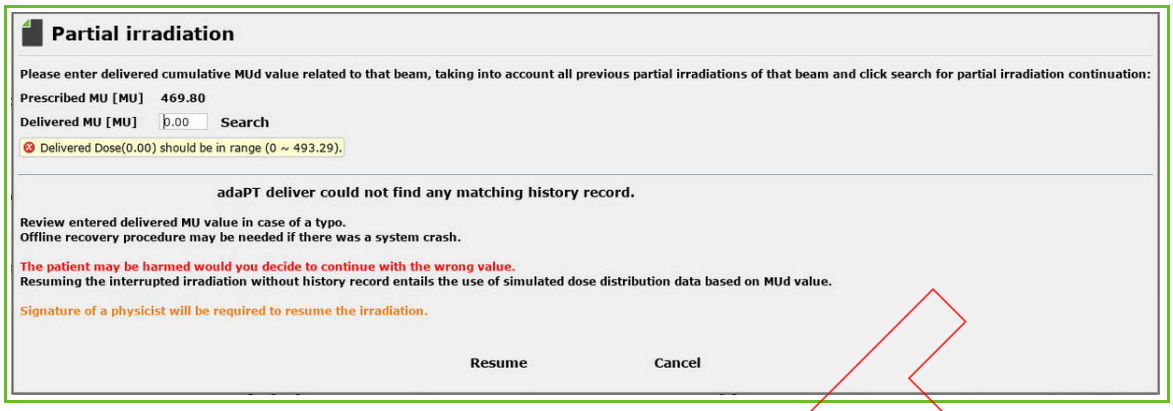

Figure 41-9. Recovery after termination by PTS - Recovery from DCEU values

Resuming Irradiation

Note: *In case of resuming from the irradiation records containing simulated values, a signature will be needed to proceed (Figure 41-10).*

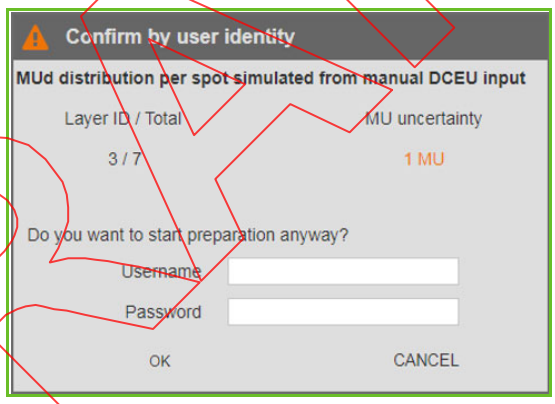

Figure 41-10. Confirmation to the use of simulated data for resuming irradiation

Once the irradiation data has been recovered, the irradiation can be resumed by the User in two ways:

- In the same session: See section "*Resuming Irradiation in the Same Session*".
- In a new session: See section "*Resuming Irradiation in a New Session*"

Offline recovery - adaPTdeliver session crashes

WARNING	When performing the offline recovery procedure, when the system prompts the user to input the MU and counts values, the user must be careful to input the values corresponding to the irradiation they want to recover. The values displayed on the DCEU at that time may not be the ones needed for the procedure (e.g., if there has been another irradiation in the meantime). They must refer to the MU and counts values that they noted once the irradiation stopped, following a software issue. Any fault in the manually input value entails a serious risk of under or over-irradiation of the patient.

WARNING	If ever a software issue occurs during an irradiation (the GUI freezes or there is any kind of software crash), the user must take note of the values on the DCEU (both MU and counts) once the irradiation stops. These values will be required to recover the irradiation data offline. Not recording these values correctly for later use entails a serious risk of under or over-irradiation of the patient.

Important	Offline recovery is mandatory as soon as adaPT*deliver* software crash occurs. Offline recovery enables the reconciliation of available irradiation data in the adaPT*deliver* software

When the irradiation is terminated by the PTS and the adaPT*deliver* session crashes,

- The Offline Recovery method is available in the SESSION DEFINITION SCREEN in adaPT*deliver*.
- This screen has the button **Offline Recovery** (Figure 41-11), which is the starting point of the recovery process.

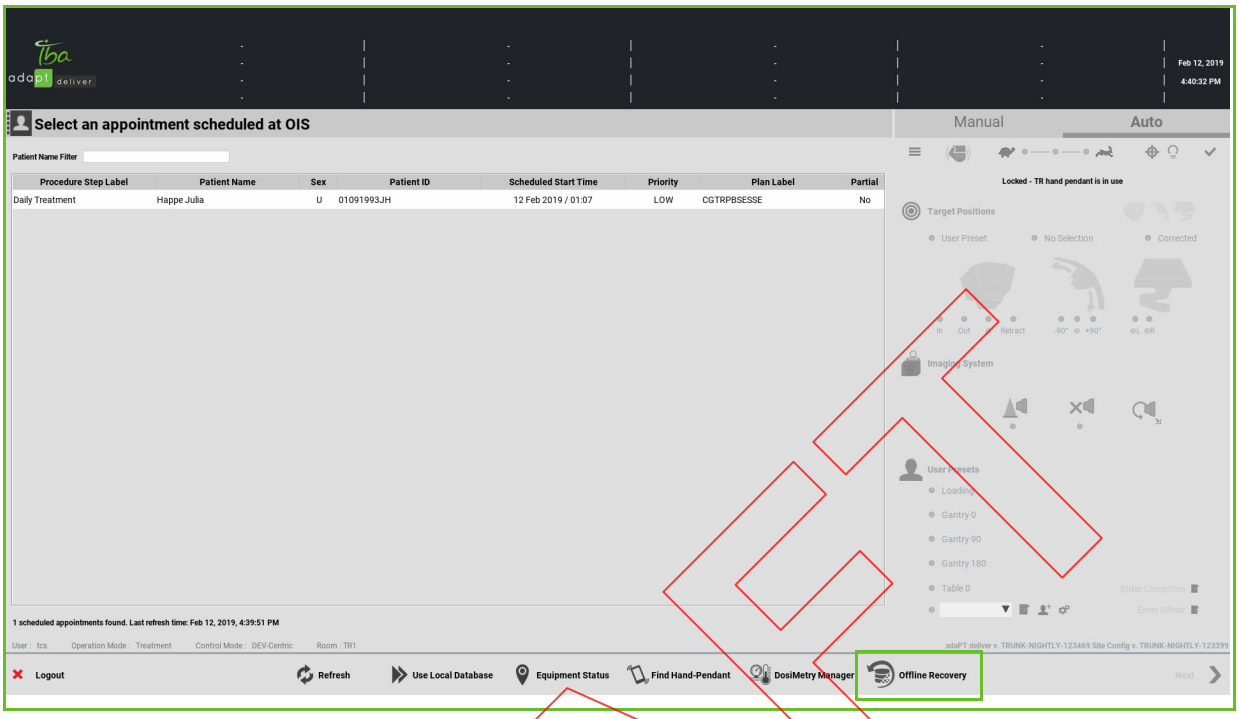

Figure 41-11. Recovery after termination by PTS - Offline recovery

The recovery of the data can be through one of the following methods:

1. Automatic recovery
2. Manual recovery from file
3. Manual recovery from DCEU values

Automatic recovery

1. Click **Offline Recovery** in the Session Definition screen (Figure 41-11).
2. The popup **Offline Recovery Process** appears (Figure 41-12), showing the list of unrecovered partial irradiations in the adaPT*deliver* database.

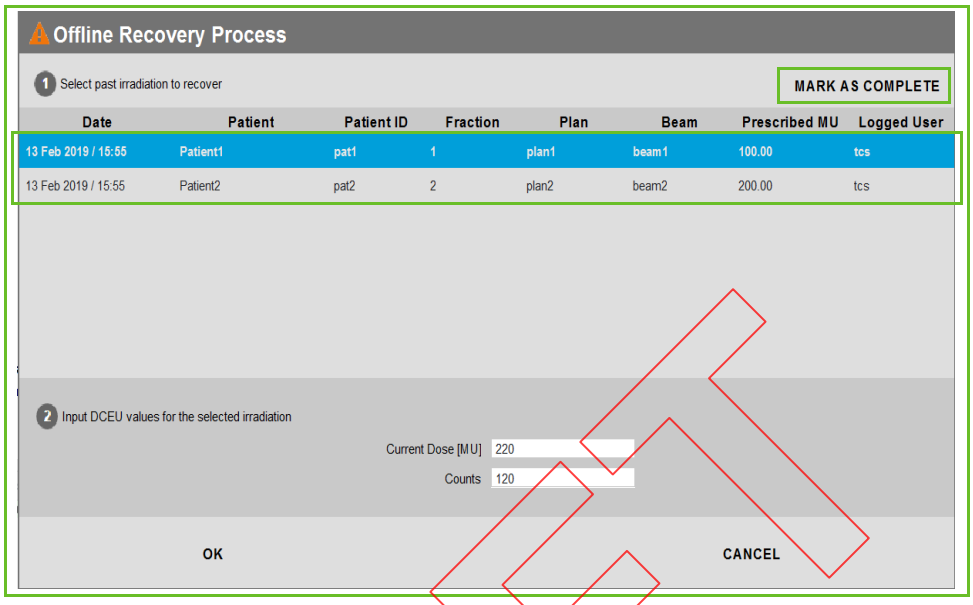

Figure 41-12. Recovery after termination by PTS - Automatic data recovery information (offline)

Note: *In case the prescribed dose was delivered and the irradiation does not need to be resumed, the corresponding beam can be marked off as complete using the* **Mark As Complete** *button. The beam will be recorded in the PTS database.*

3. Select the line that corresponds to the irradiation you want to recover.

WARNING

The user must only proceed to mark a Beam Report as complete using the Offline Recovery dialogue if the irradiation was completely delivered (the prescribed dose was delivered according to the DCEU, so the irradiation does not need to be resumed) and is correctly recorded as complete in the OIS or the paper charts. The irradiation will be recorded in the PTS Database using a simulation based on the specified meterset for the irradiation and not on the actual delivered values.

This action is irreversible. Marking an incomplete Beam Report as complete when the irradiation was not completely delivered entails a serious risk of under-irradiation of the patient.

Note: *A value of 300 counts on the DCEU corresponds to 1 MU. See Chapter 17, Resetting a Dose Counter Electronic Unit for details.*

4. If the selected irradiation is partial, enter the corresponding **DCEU values** that you have saved at the time of the partial treatment. Click **OK**.

5. In case the automatic recovery process is successful, click **OK** to continue and proceed to section "*Resuming Irradiation*".

6. In case the process is not successful, proceed to section "*Manual recovery from File*"

Manual recovery from File

1. When the automatic recovery procedure fails, click **Manual Recovery** in the popup message (Figure 41-13).

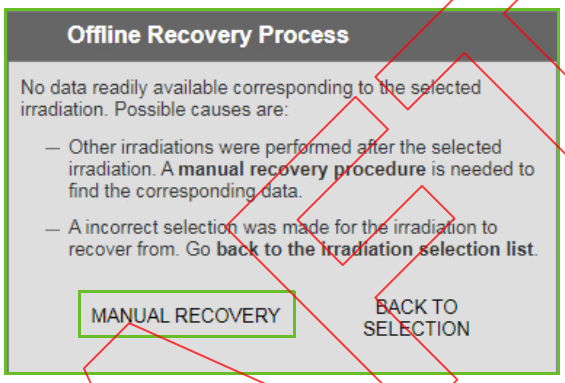

Figure 41-13. Recovery after termination by adaPTdeliver - Manual data recovery message (offline)

You can click on **More Information** to know more (Figure 41-14).

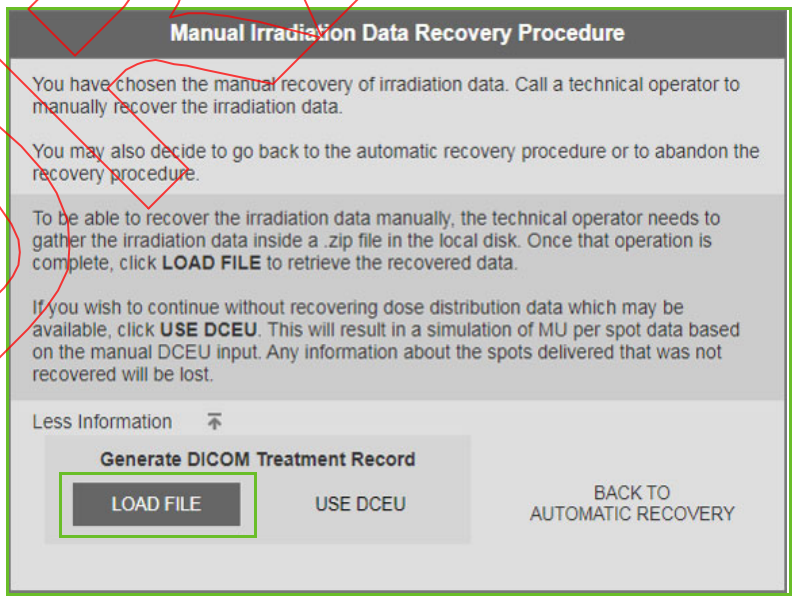

Figure 41-14. Recovery after termination by PTS - Manual data recovery information (offline)

2. Then, click **LOAD FILE** (Figure 41-15a).

   Note: *In case the Operator cannot recover files manually, the recovery based on the DCEU values must be performed. See section "Manual Recovery from DCEU values".*

3. In file explorer popup, browse and select the file as indicated by the Operator. Click **Open**.

4. In the Manual Recovery popup, the button turns green and now reads **File Loaded**. Click **Next** to continue (Figure 41-15b).

5. In case the process is successful (Figure 41-15c), click **OK** to continue and proceed to section "*Resuming Irradiation*".

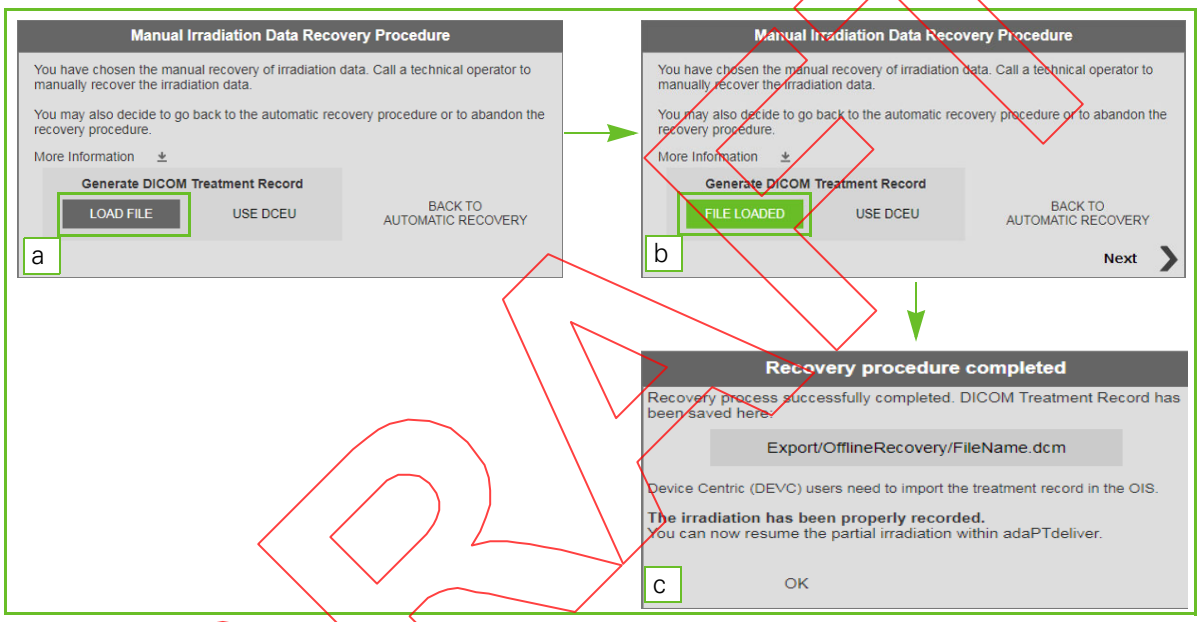

Figure 41-15. Recovery after termination by PTS - Manual recovery process (offline)

WARNING

Once the system constructs a DICOM Treatment Record and stores it on disk as a result of the Offline Recovery procedure in a system that functions in DEVC mode, the user needs to import the recovered DICOM record in the OIS (with caution to avoid any double recordings).

Making a double recording in the OIS entails a serious risk of under-irradiation of the patient.

6. In case the process is not successful, proceed to section "*Manual Recovery from DCEU values*".

Manual Recovery from DCEU values

In case the loading of the file cannot be performed, the last resort is the use of the DCEU values.

1. Enter the delivered cumulative MUd value related to that beam, taking into account all previous partial irradiations of that beam and click search for partial irradiation continuation (Figure 41-16).
2. When the search is done, the signature of a physicist is required to resume the irradiation.

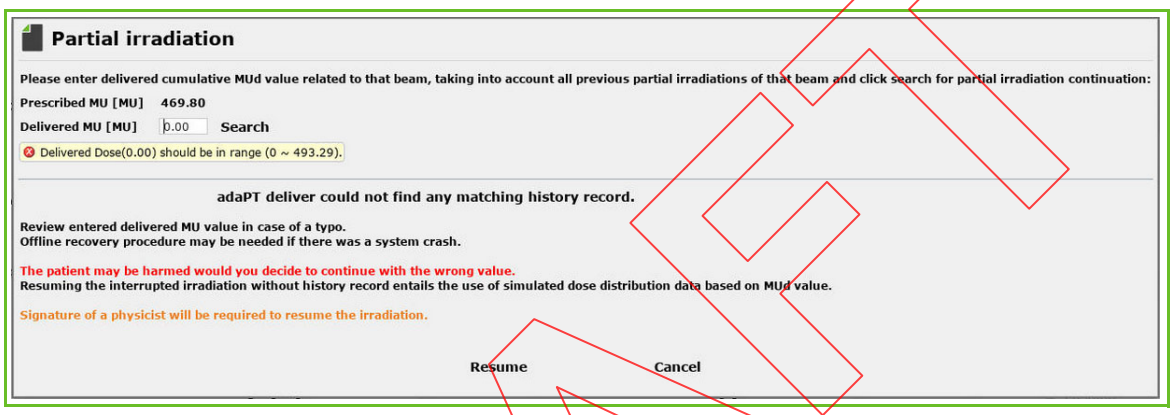

Figure 41-16. Recovery after termination by PTS - Recovery from DCEU values

Resuming Irradiation

Once the irradiation data has been recovered, in case of Offline Recovery, the irradiation can only be resumed in a new session (See section "*Resuming Irradiation in a New Session*").

Note: *In case of resuming from the irradiation records containing simulated values, a signature will be needed to proceed (Figure 41-17).*

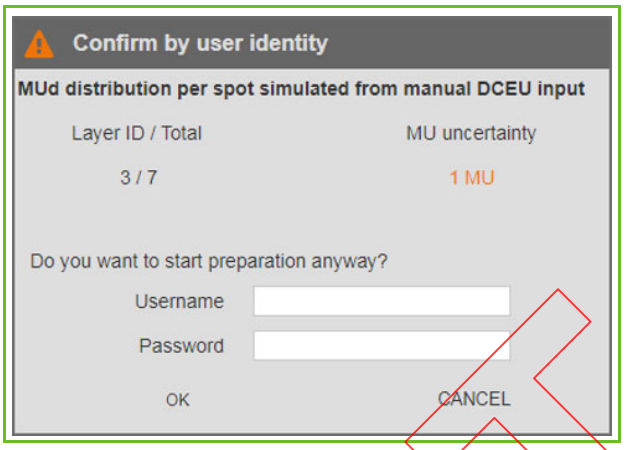

Figure 41-17. Confirmation to the use of simulated data for resuming irradiation

Resuming Irradiation in the Same Session

The user can resume the irradiation in the same session when there is:

- Termination by the Therapist, or
- Termination by the PTS where the adaPT*deliver* session is maintained

The irradiation can be resumed in the same session only after an **online recovery**.

Note: *Resuming the irradiation in a new session is possible in both the Standalone and the OIS mode.*

1. In the BEAM SELECTION SCREEN, select the partial treatment beam manually.

   Beams marked as partial are indicated by an orange checkmark  .

2. In the **Dose panel** (Figure 41-18), the user can see that:
   - The delivered MU is non-zero.
   - The MU to be delivered is the difference between prescribed and delivered MU.
   - A banner below the Dose panel gives information about the partial irradiation.

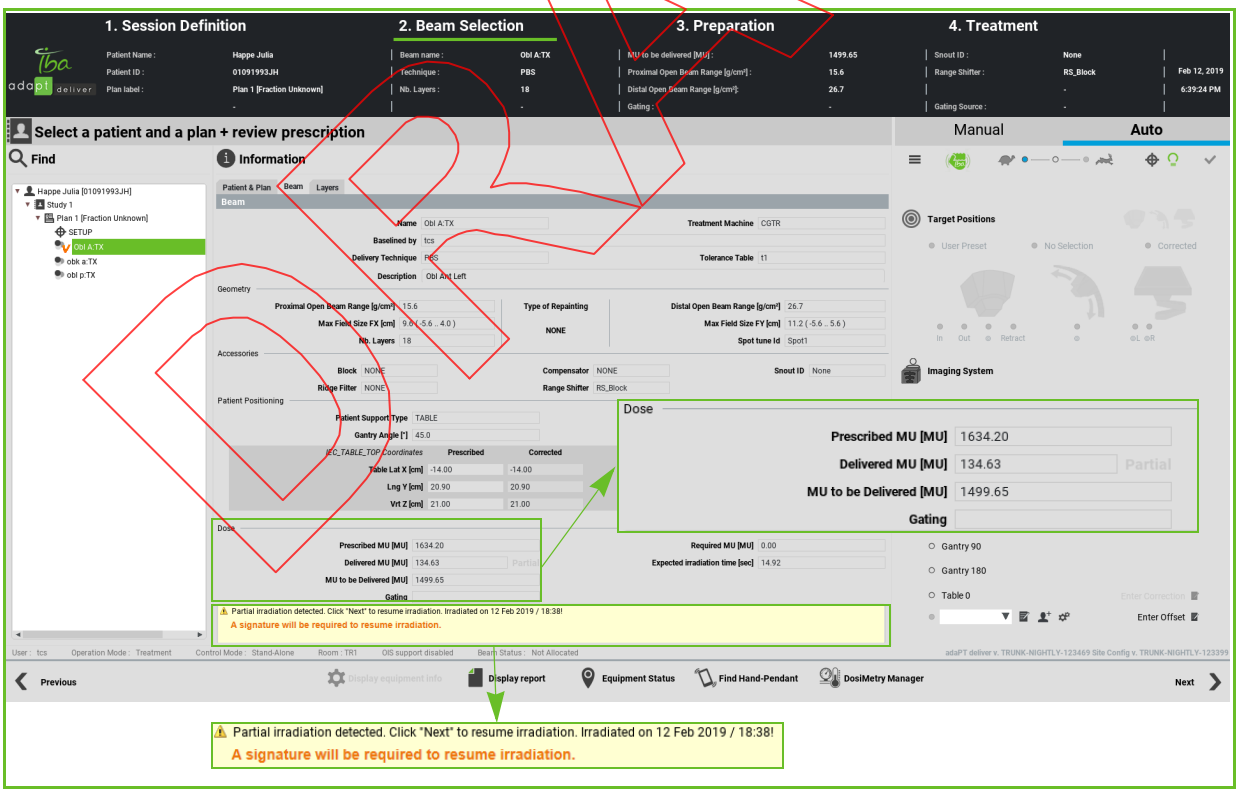

Figure 41-18. Resuming irradiation after partial treatment

Resuming irradiation

Ensure the partial beam is selected as indicated above. Click **Next** to proceed to the PREPARATION SCREEN and complete the irradiation of the selected beam.

Note: *In case of resuming from the irradiation records containing simulated values, a signature will be needed to proceed (Figure 41-19).*

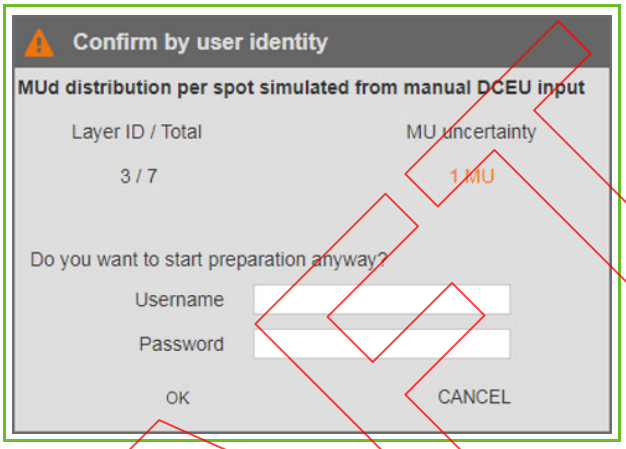

Figure 41-19. Confirmation to the use of simulated data for resuming irradiation

Resuming Irradiation in a New Session

The user needs to resume the irradiation in a new session when there is:

- Termination by the PTS where the adaPT*deliver* session crashes, or
- Closing of the adaPT*deliver* session by the Therapist

Note: *Resuming the irradiation in a new session is possible in both the Standalone and the OIS mode.*

Using an OIS

DEV-Centric mode

1. In the OIS, create a continuation fraction.
2. Then create an **Appointment** and proceed to **Check-in** the patient**.**
3. Click on the corresponding line in adaPT*deliver* to select it, and then click **Next** (Figure 40-1).

4. Select the corresponding plan and beam in the OIS. (The data is sent by the OIS to adaPT*deliver*.)

5. The Beam Selection screen appears directly with the chosen beam selected.

   In the Beam Selection screen (Figure 41-20), the beams marked as partial are indicated by an orange checkmark .

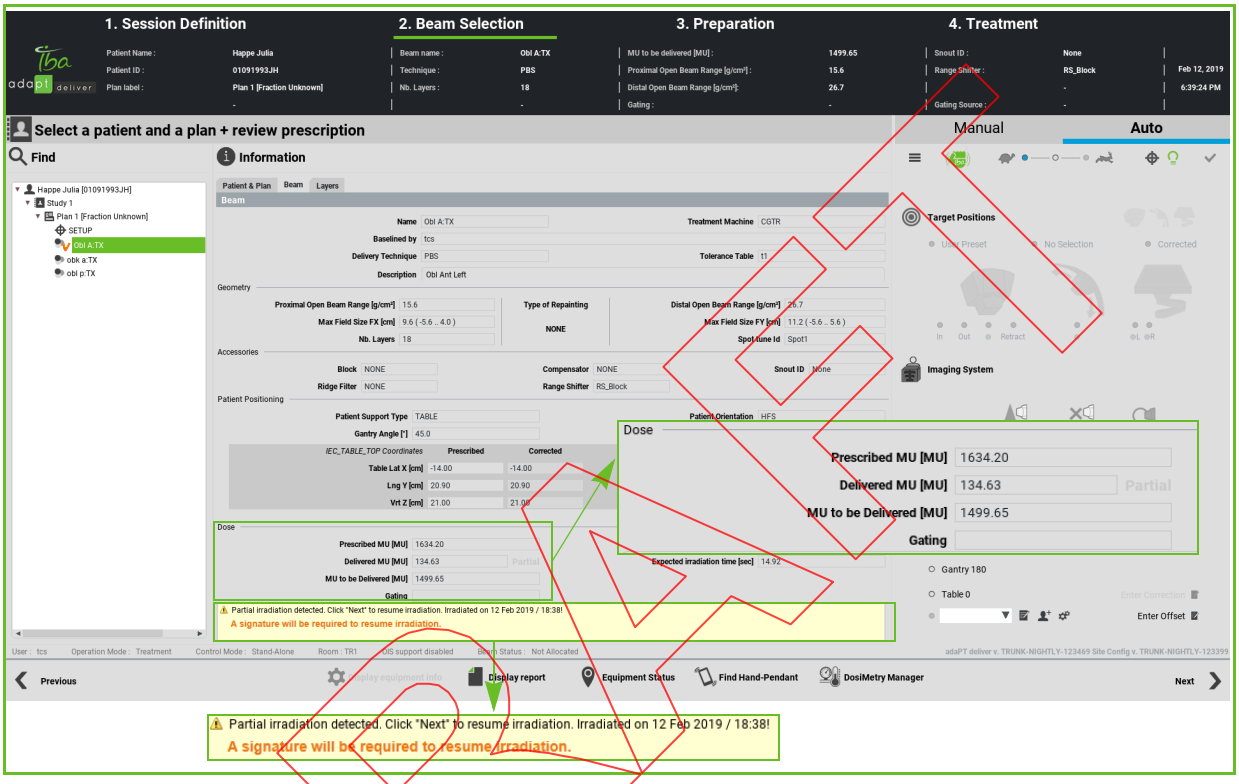

Figure 41-20. Resuming irradiation after partial treatment

Note: *In case of resuming from the irradiation records containing simulated values, a signature will be needed to proceed. The user will receive a message (Figure 41-21) to confirm the use of simulated data. The message shows which layer contains the simulated data, and the uncertainty of the MUs.*

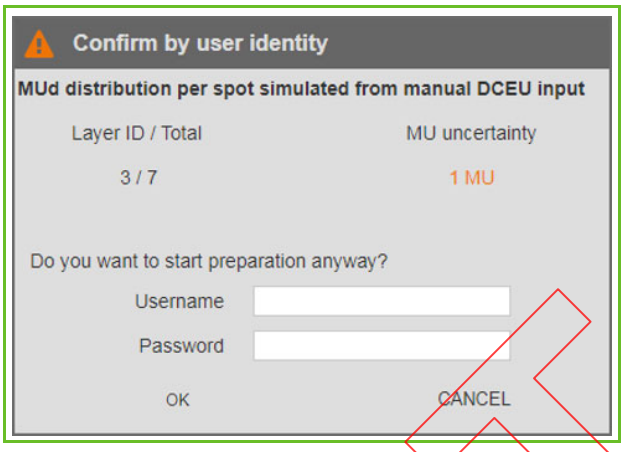

Figure 41-21. Confirmation to the use of simulated data for resuming irradiation

6. In the **Dose panel** (Figure 41-20), the user can see that:
   - The Delivered MU is non-zero.
   - The MU to be delivered is the difference between prescribed and delivered MU.
   - A banner below the Dose panel gives info about the partial irradiation.
7. Click **Next** and complete the irradiation of the selected beam.

Note:

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End of an Irradiation

Once the irradiation is complete, the status bar of the IRRADIATION SCREEN becomes green and a pop-up appears mentioning 'Irradiation Done'.

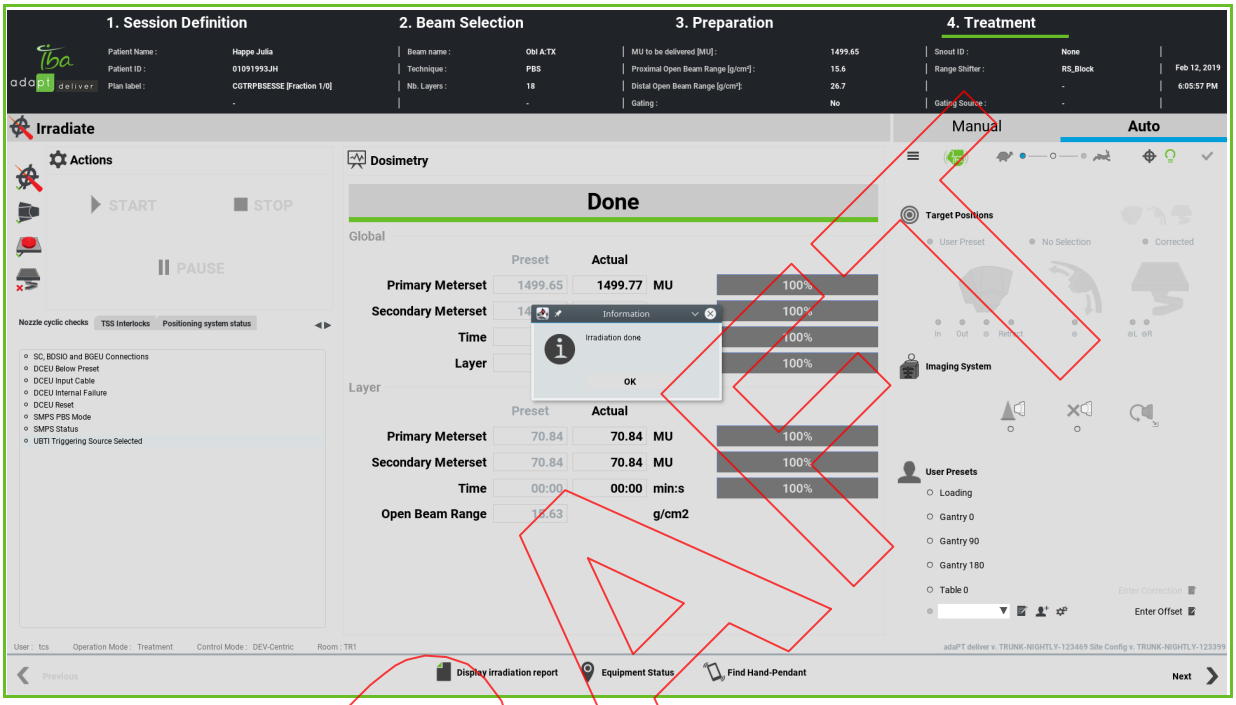

Figure 41-22. Irradiation Screen: Irradiation Complete (typical)

It is possible to print or save an irradiation report (in PDF format) containing the delivery information before leaving the irradiation screen.

After all treatment beams have been delivered, you can leave the session after irradiation by clicking **Next** on the bottom right of the irradiation screen.

Disconnection of the OIS-adaPT*deliver* Link

In the case the OIS suffers a loss of connection, the record is stored on disk and you will be informed of its location.

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Part VIII

Browsing adaPT*deliver* Reports

Chapter 42
Browsing Reports

History reports get created at the patient level. The adaPT*deliver* application enables you to browse standalone history reports when no treatment is going on in the TR.

Using Reports

To display the list of reports that exist for a patient:

1. Click the ID or the icon of the patient, study, plan, or a beam of the desired patient.

   Note: *Do not click the green handle to the left of the instance: this only expands or collapses an instance without making any selection.*

2. Click **Display report** at the bottom of the SESSION DEFINITION SCREEN or the BEAM SELECTION SCREEN.

   The REPORT LIST SCREEN appears.

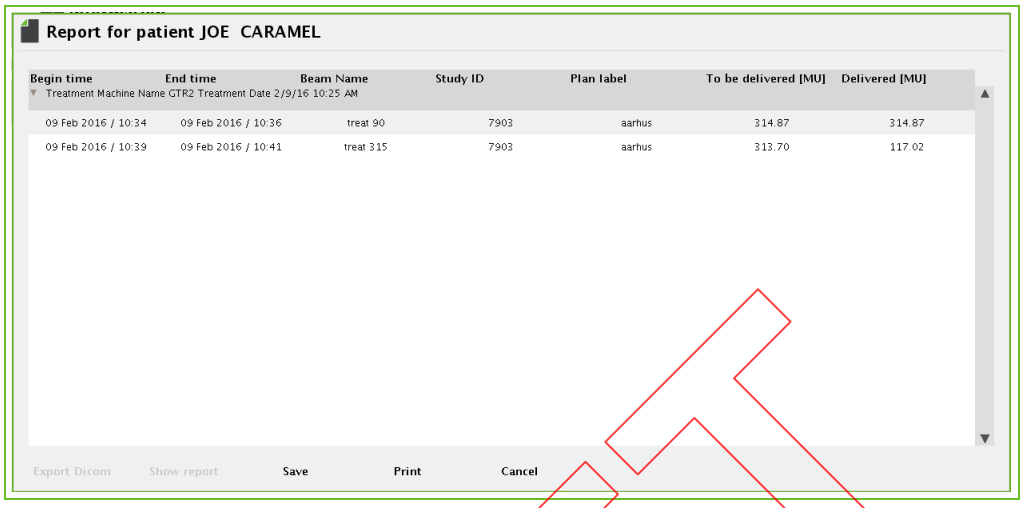

Figure 42-1. Report List Screen

Sessions are listed with a gray background, **beams** are listed with a white background.

The buttons at the bottom of the REPORT LIST SCREEN enable you to perform the following functions:

- Show a report: for detailed information, refer to Section "*Display an Irradiation Report*" on page 42-3.
- Print a report (for beams only).
- Export to DICOM (for sessions only): to save the record in DICOM format. For detailed information, refer to Section "*Exporting a Session Report to DICOM*" on page 42-4.
- Cancel: to stop displaying the REPORT LIST SCREEN.

Session Report Entry Characteristics

You can expand or collapse a session by clicking the arrow at the beginning of the session line.

The session report entry provides the following information:

1. TR
2. Date and time

Beam Report Entry Characteristics

The beam report entry provides the following information:

- Begin date and time
- End date and time
- Beam name
- Study ID
- Plan label
- To be delivered (MU)
- Delivered (MU)

You can sort these reports by any of these column headings: click in the required column heading and the reports get sorted accordingly, in ascending or descending order.

Display an Irradiation Report

To display a specific irradiation report for a patient, double-click that report from the list, or select it and click **Show report**. The IRRADIATION REPORT SCREEN appears.

Note: *An irradiation report typically spans several pages.*

Groups of buttons at the top of the screen offer the following options:

- **Output options**: to print or save the report.
- **Browsing options**: to browse to another page in the report. Page number information is located at the bottom of the page.
- **Viewing options**: to select bigger or smaller display.

An irradiation report summarizes patient, fraction, study and plan information.

In addition, it contains detailed information on the:

- Setup position
- Beam
- Treatment position

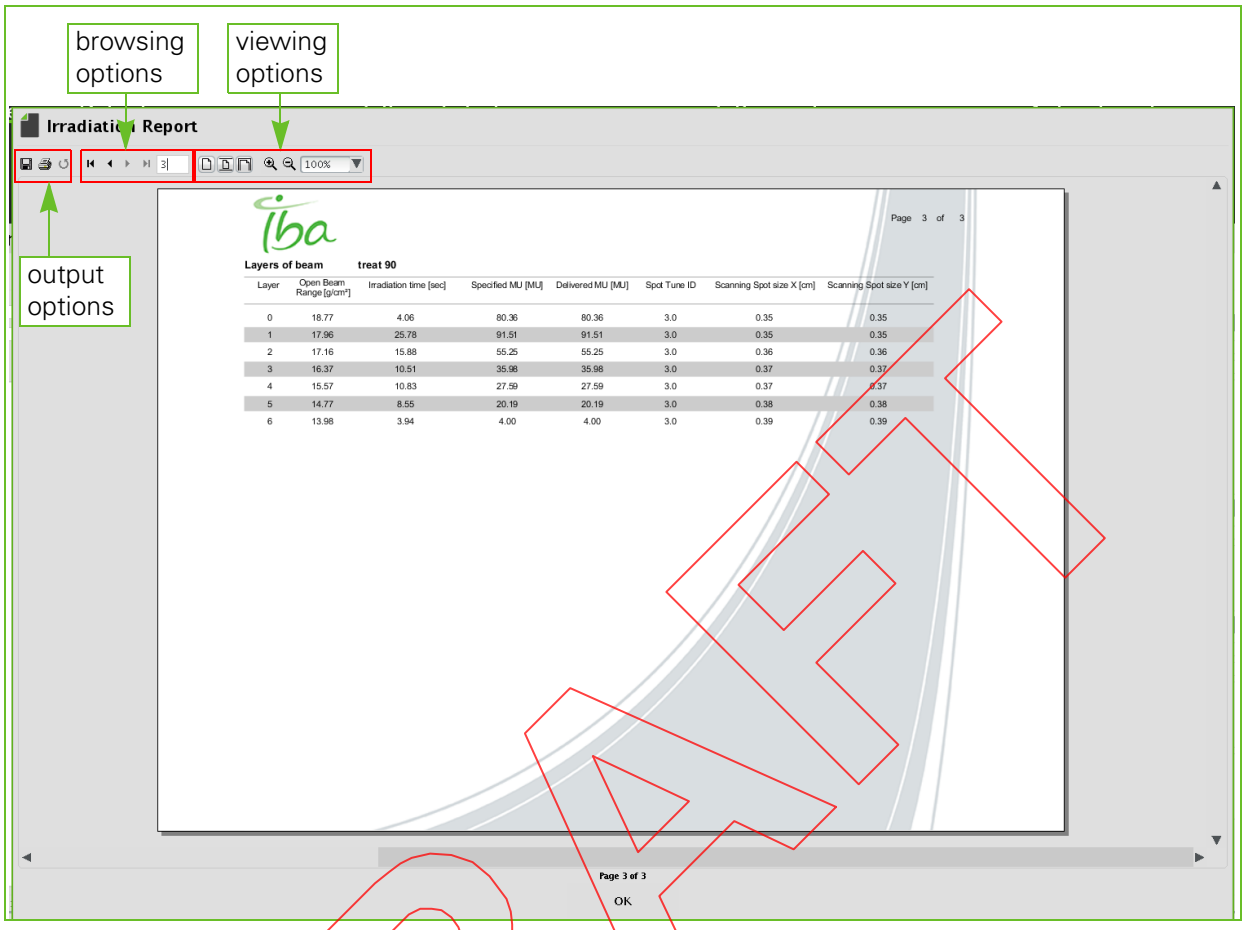

Figure 42-2. Irradiation Report Screen

From the IRRADIATION REPORT SCREEN you can perform the following functions:

- Return to the REPORT LIST SCREEN: click **OK** at the bottom of the screen.
- Print the report: click the printer icon at the top of the screen
- Save the report: click the save icon at the top of the screen.

Exporting a Session Report to DICOM

To export a session report of a patient, select the report from the list and click **Export DICOM**. The DICOM EXPORT SCREEN appears.

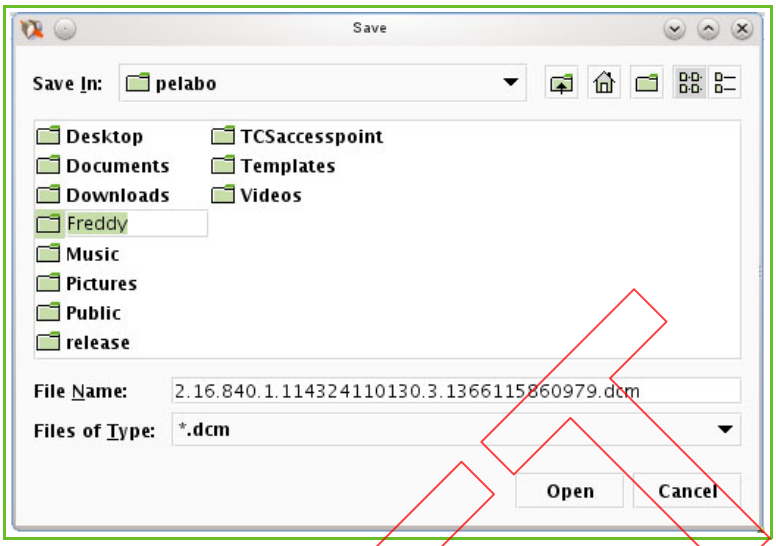

Figure 42-3. DICOM Export Screen

From the DICOM EXPORT SCREEN you can browse to the location where you want to store the export file.

At the selected location, exported DICOM files are identified by their .DCM extension.

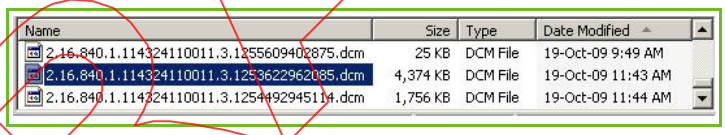

Figure 42-4. DICOM File List

These exported DICOM files contain all relevant irradiation data, which can be imported into the OIS or the Treatment Planning System (TPS). Treatment records are sent to the TPS when a re-computation of the treatment plan is needed. The import action must be performed from the TPS.

Note: *Not all Treatment Planning Systems support this feature. For more information on the TPS used by your system, refer to the OEM documentation.*

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Part IX

adaPT*deliver* in Physics Mode

Chapter 43
Using adaPTdeliver in Physics Mode

Purpose of Physics mode is to perform Quality Assurance (QA) and calibration activities.

WARNING	In Physics mode, patient treatment is absolutely forbidden at all times.

Note: *Make sure that you have obtained the right to use Physics mode. For detailed information on the User Manager, refer to* **Appendix B**, *"Managing PTS Users".*

The login in adaPT*deliver* is as follows:

- **Clinical**: to perform clinical operations.
- **Physics**: to perform QA and calibration activities.

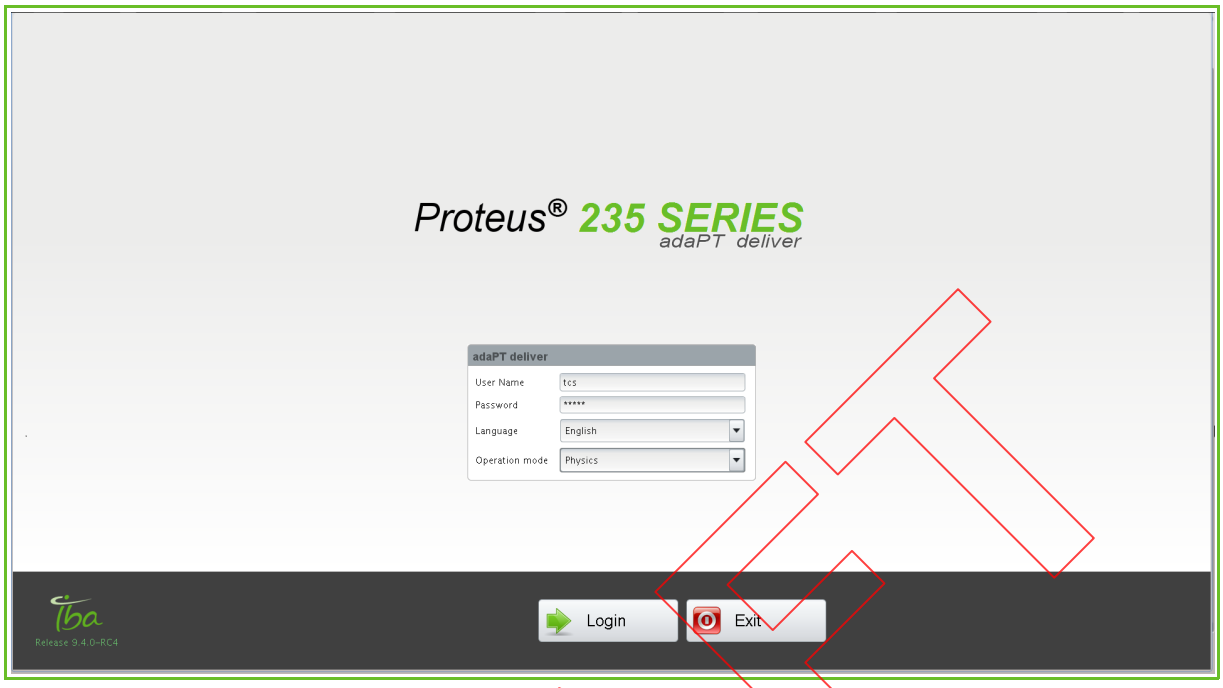

Figure 43-1. adaPTdeliver Login Screen

The presence of **purple** elements on the screen indicates that you are logged in in Physics mode. Be aware that this color is a clear indication that you are working in an environment that is not suited nor intended for patient treatment.

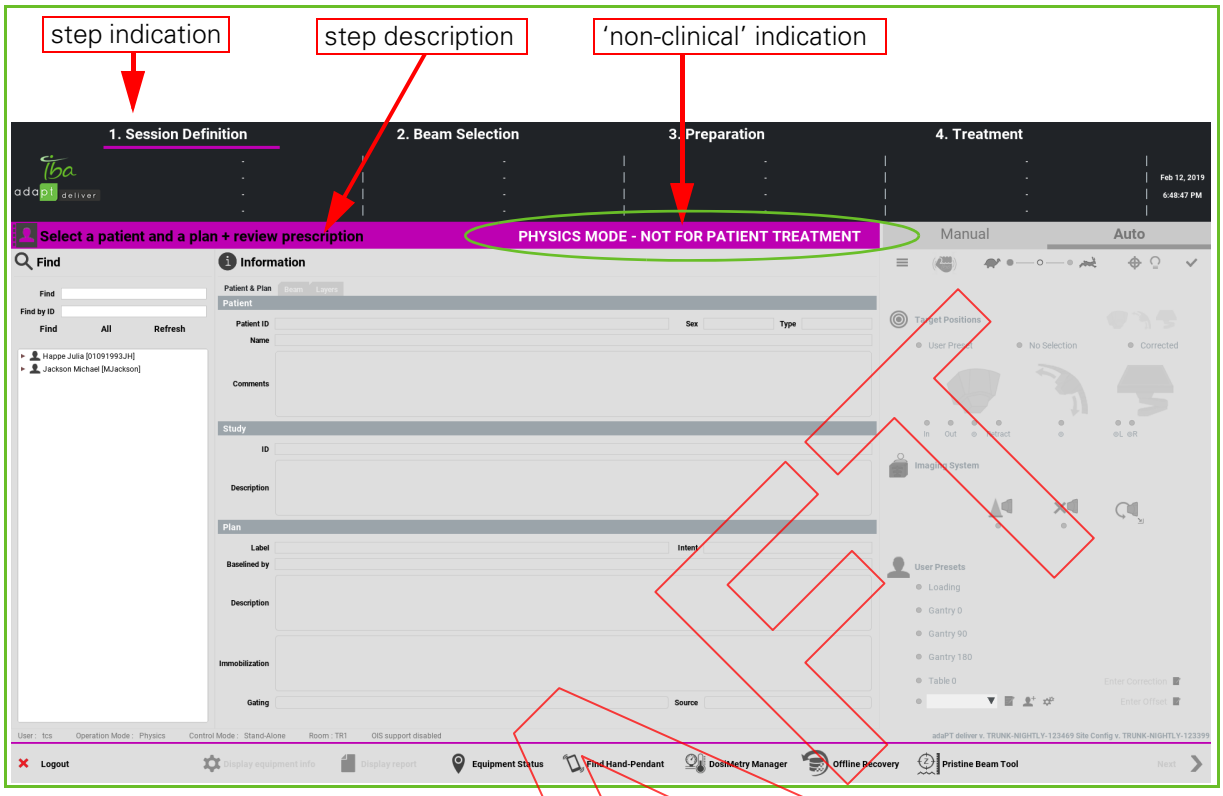

*Figure 43-2. adaPT*deliver *in Physics Mode (Typical)*

In adaPT*deliver,* at sites where Physics mode is deployed, active QA patients no longer appear in the selection area in Clinical mode. QA patients can be accessed in Physics mode only.

Table 43-1. Patient and Plan Availability

Clinical mode	
Physics mode available in TR	■ All clinical patients ■ No Verification plans ■ No QA patients
Physics mode not available in TR	■ All clinical patients ■ All QA patients
Physics mode	
	■ All clinical patients ■ All QA patients

It is important to know that unlike in Clinical mode, in Physics mode error messages and pop-up messages are **prevented** and treatment records are **not stored**.

For information generic to both Clinical mode and Physics mode, refer to **Part V**, "*Using* ada*PTdeliver*".

Session Definition

In Physics mode, the background color of the step indication and the step description of adaPT*deliver* screens is violet.

In addition, at login, the `You logged into Physics mode. Clinical treatments are not allowed in this mode` pop-up message appears. Click **OK** to continue.

Note: *The PTS can be connected to the OIS. The PTS will receive the plan from the OIS but will not take charge of the session in OIS. From then on the PTS is mastering the workflow.*

The OIS can work in QA mode or in Clinical mode.

As for adaPT*insight*, the behavior of the PTS in Physics mode when connected to the OIS will be identical to its behavior in Clinical mode, for DICOM prescriptions.

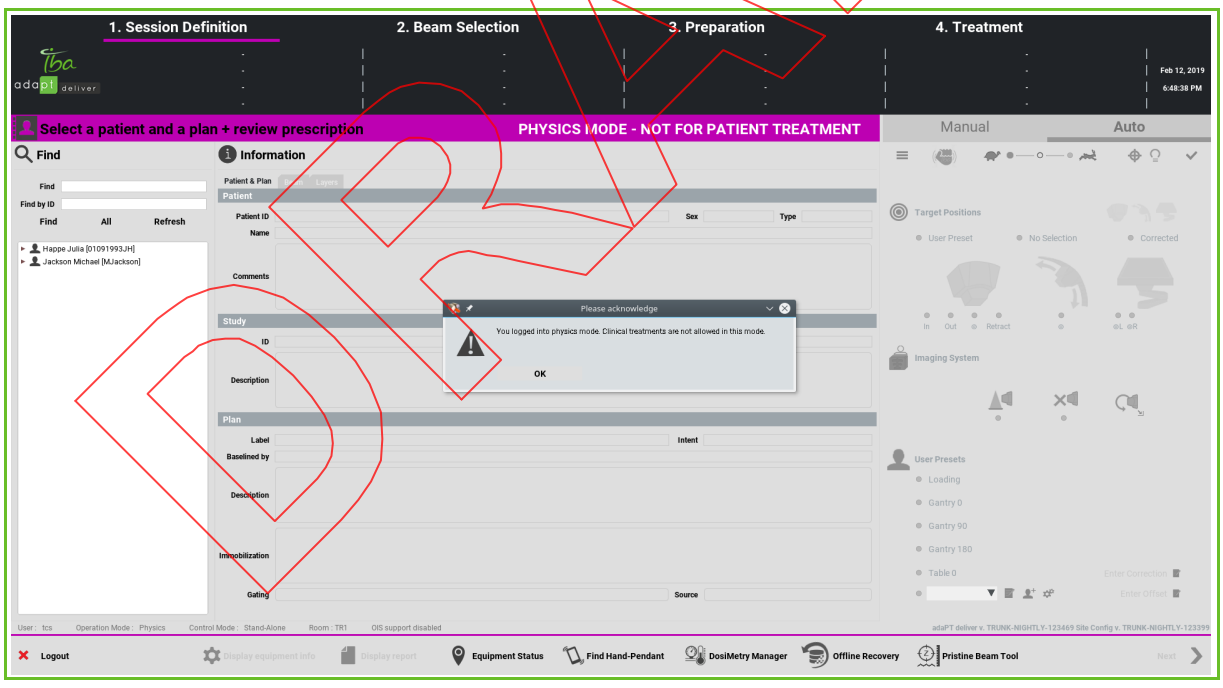

Figure 43-3. Physics Mode Acknowledgment Message

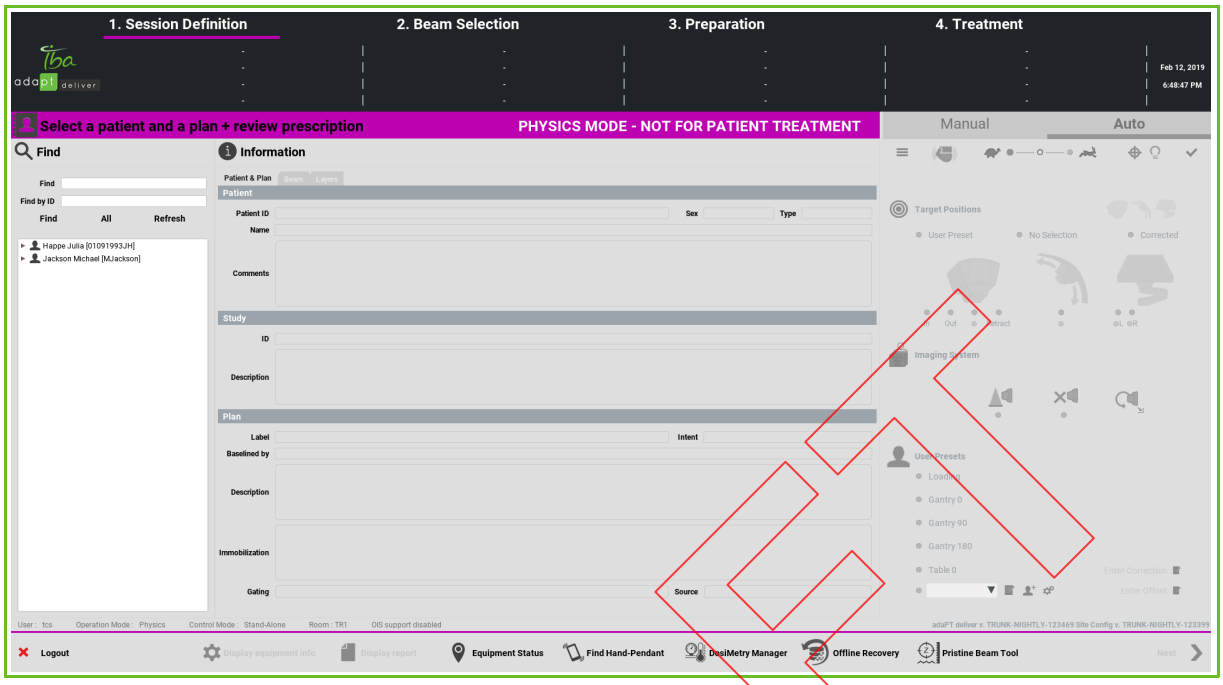

Figure 43-4. Session Definition Screen - Physics Mode

A message appears at the bottom of the screen when certain beam related information is missing.

At the bottom of the screen, the following buttons are available:

- **Display report**: displays clinical information.

Important

Be aware that in Physics mode no treatment record is stored in the database nor sent to the Oncology Information System (OIS). Data in Physics mode is not of a clinical nature whatsoever and therefore none of this data is stored.

If you want to store this data, do record it using any other alternative tool.

- **Pristine Beam Tool**: for information, refer to section "*Using the Pristine Beam Tool*" on page 43-7. Close this tool before proceeding to the Preparation stage.

Baselining Aspects in Clinical and Physics Mode

As beams in Physics mode are to be used exclusively for QA and calibration purposes, there is no need to baseline beams in adaPT*prescribe*. Baselining is only needed for clinical beams intended to be used for patient irradiation and therefore needs to be done in Clinical mode only.

Table 43-2. Baselining Aspects in Clinical and Physics Mode

Clinical mode
Only baselined plans appear; baselining all the beams is a condition to be able to baseline a plan
Physics mode
Both baselined and unbaselined plans and beams appear

Using the Pristine Beam Tool

As part of the PTS software package, IBA provides the Pristine Beam Tool. Its functions are as follows:

- It facilitates the execution by physicists of certain machine QA procedures that require depth dose curve acquisition, such as the regular verification of the machine's tolerance.
- It facilitates the execution by physicists of the commissioning process and the definition of the beam model in the Treatment Planning System.

To access this tool, click **Pristine Beam Tool** from the SESSION DEFINITION SCREEN - PHYSICS MODE (see Figure 43-8) or the BEAM SELECTION SCREEN (see Figure 43-9) in Physics mode.

Important	The Pristine Beam Tool must be closed before proceeding to Preparation.

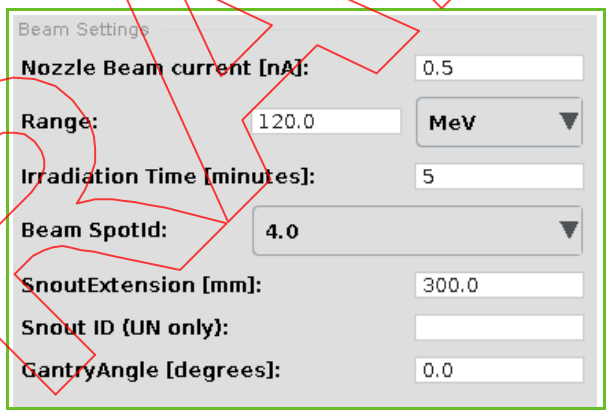

Figure 43-5. Pristine Beam Tool - Beam Settings

The Pristine beam tool allows the hospital physicists to perform a single spot characterization by irradiating the isocentric spot using certain defined beam settings (such as a particular beam energy and beam current).

After double-clicking the desktop icon, the BEAM SETTINGS SCREEN appears. This screen allows the user to specify the beam settings required for the single spot characterization.

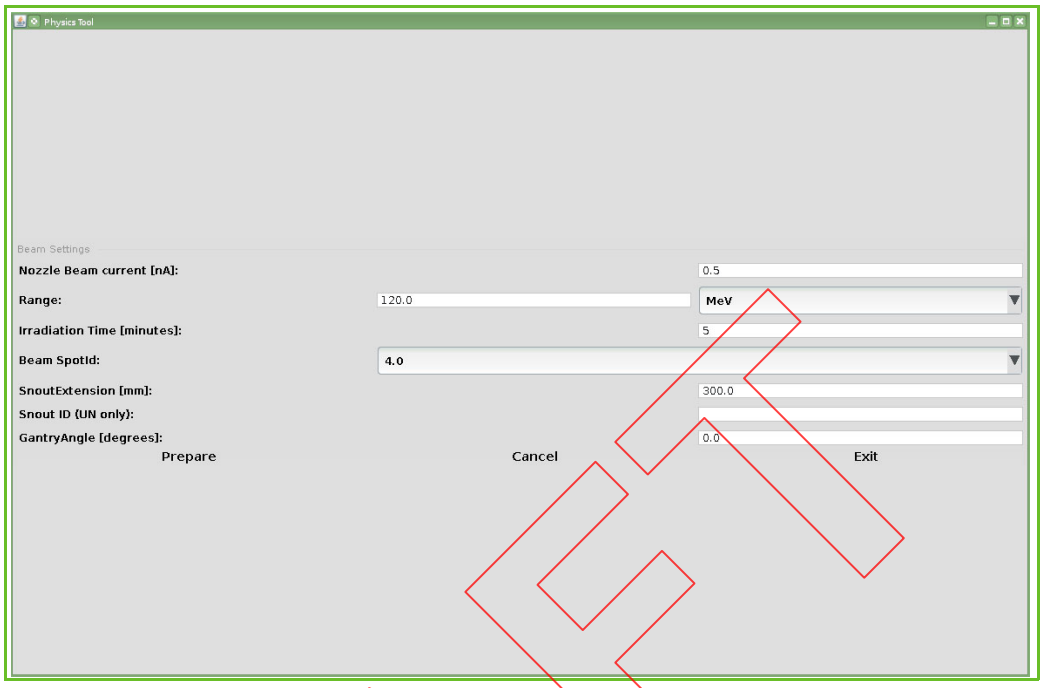

Figure 43-6. Pristine Beam Tool - BEAM SETTINGS SCREEN

The beam settings which need to be specified before performing an irradiation with the Pristine beam tool are the following:

- Nozzle Beam Current (nA): this parameter indicates the proton beam current as measured in the nozzle (note that this is not the same as the cyclotron current). It can be modulated in order to avoid saturation of the dosimetry equipment used to perform the measurement.
- Range (MeV or mm): this parameter characterizes the depth of penetration, which is specified in g/cm², corresponds to the penetration depth of the proton beam in a water equivalent material. As such, the range may be measured as a linear distance in water (mm). When measuring the depth dose distribution, the range corresponds to the depth of the distal 90% isodose in water. Conversely, the beam may be characterized by the proton beam energy (MeV).
- Irradiation time (minutes): this parameter is used to limit the irradiation time, as an irradiation which is excessively long could be harmful for the ICs.
- Beam Spot ID
- Snout extension (mm)
- Gantry angle (degrees)

By clicking the **Prepare** button on the BEAM SETTINGS SCREEN, the PREPARATION SCREEN appears. This screen allows the user to prepare the nozzle and monitor beam allocation in preparation for irradiation.

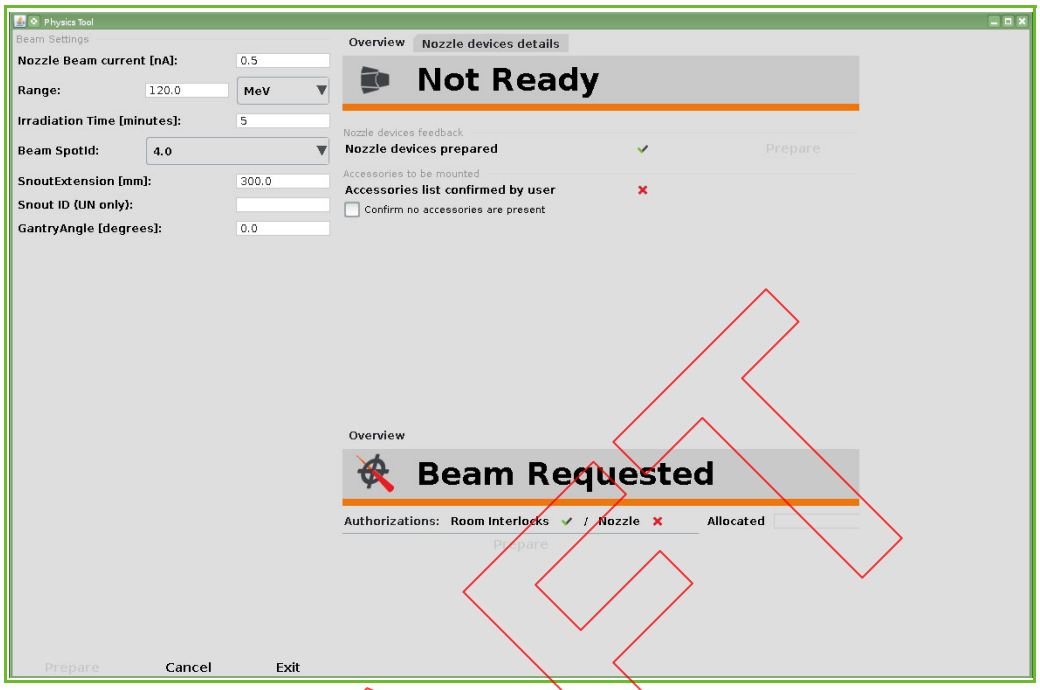

Figure 43-7. Pristine Beam Tool - Preparation Screen

Once the nozzle and the beam are ready, you can proceed to irradiate the central spot from the IRRADIATION SCREEN. The commands on the left side of the irradiation screen enable you to control the irradiation whereas the information on the right side of the screens enables you to closely monitor the irradiation progress.

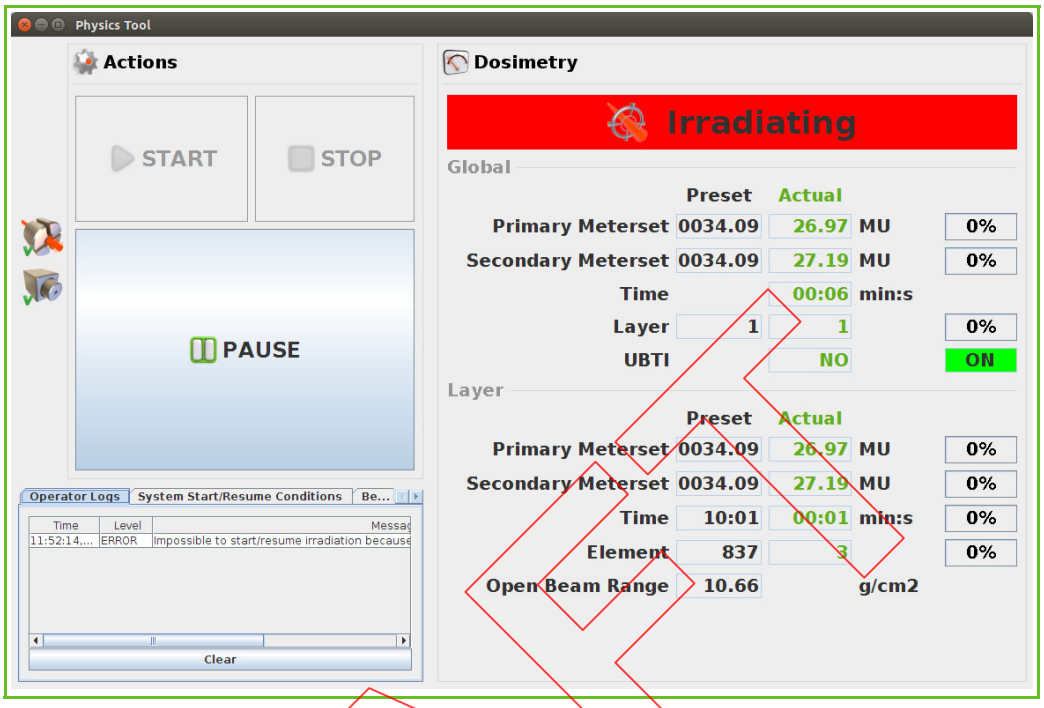

Figure 43-8. Pristine Beam Tool - Irradiation Screen

The data produced by this irradiation is gathered and processed using the dosimetry tools available at your center.

Beam Selection

As mentioned in Table 43-1 and Table 43-2, both baselined and unbaselined plans and beams of both clinical and QA patients appear in the list.

To enable you to modify certain beam characteristics in Physics mode, the following fields are editable:

- **Gantry angle**
- **Delivered MU**: any partially delivered MU appear here.
- **Required MU**: this enables you to override the prescribed MU and rescale the weights of the spots accordingly.

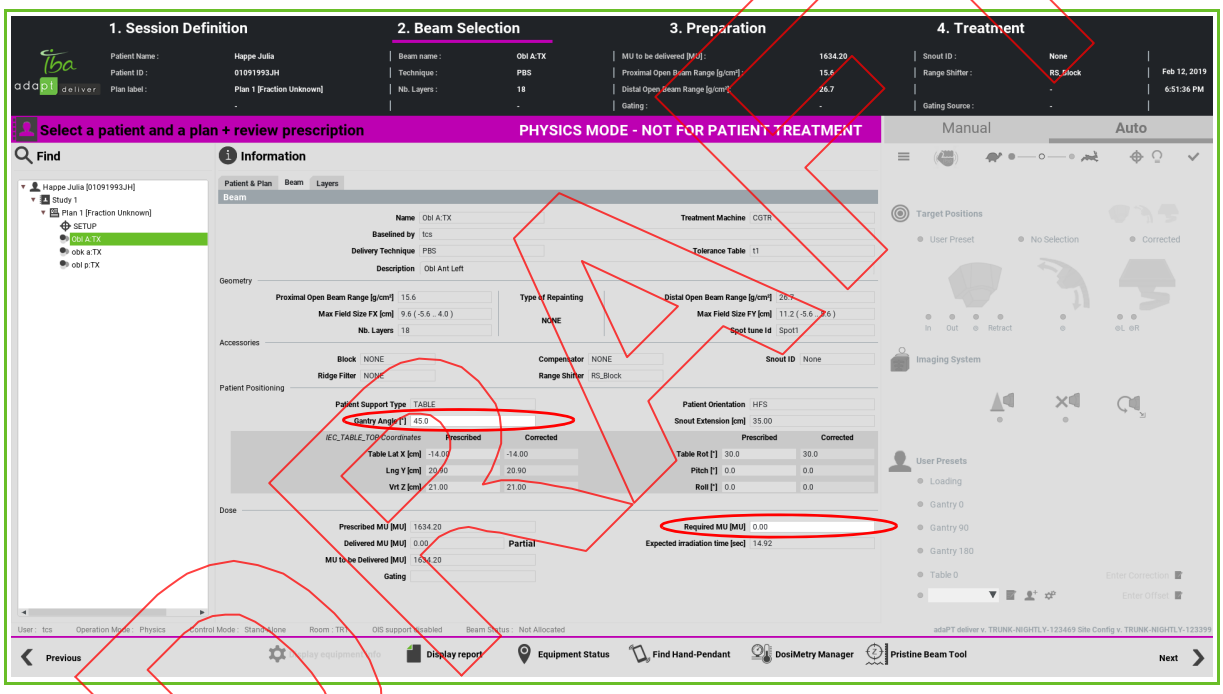

Figure 43-9. Beam Selection Screen

Preparation

The behavior on the following panels of the EQUIPMENT PREPARATION SCREEN in Physics mode is different from Clinical mode:

- **PMS interface panel**: refer to section "*Verifying the Position of Devices*" on page 43-12.
- **Room interlocks**: refer to section "*Verifying the Room Interlocks*" on page 43-14.