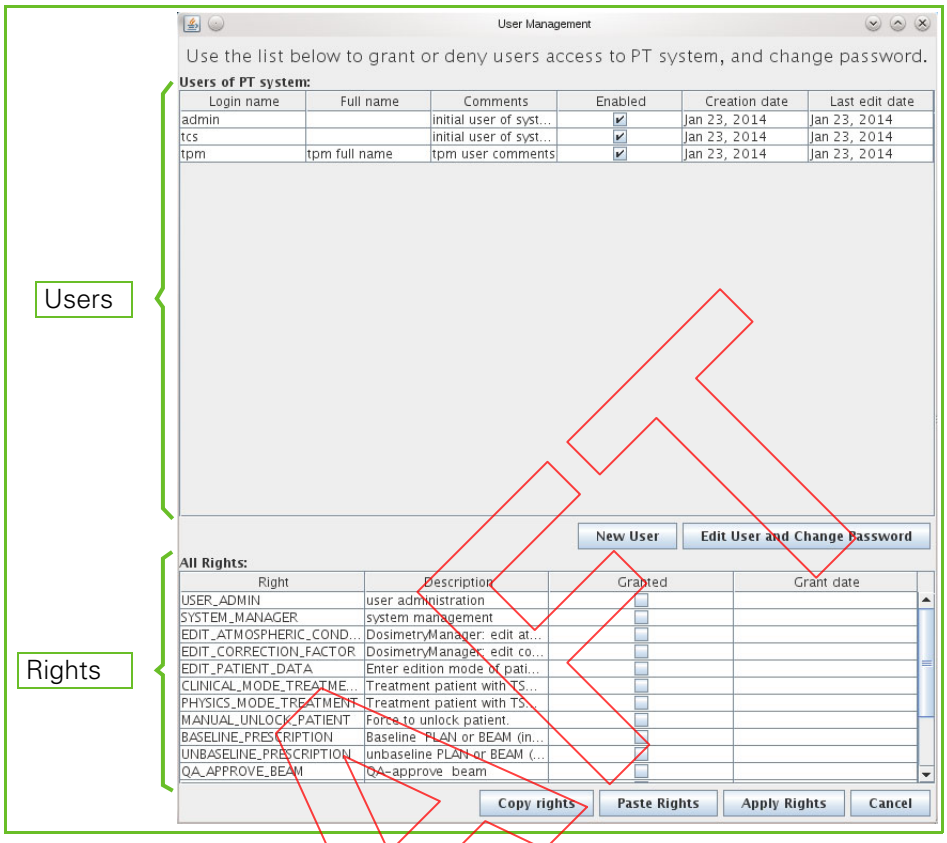

Figure C-2. User Manager Main Screen

The USER MANAGER MAIN SCREEN comprises the following panels:

- Users of the PT system: this list displays the list of all users of the PT system that are currently defined.
- Rights: various rights have been defined and any of these rights can be granted to users.

From the Users panel you can:

- **Enable or disable a user**. To enable a user, put the checkmark in the Enabled column. To disable a user, remove the checkmark. In addition, you are informed of the creation date and the latest edit date of the user.
- **Create a new user**: for detailed information, refer to Section "*Creating a New User*" on page B-3.
- **Edit the user and change the password**: for detailed information, refer to Section "*Editing a User and Changing the Password*" on page B-4.

Creating a New User

To create a new user, click **New user** from the USER MANAGER MAIN SCREEN. The NEW USER SCREEN appears.

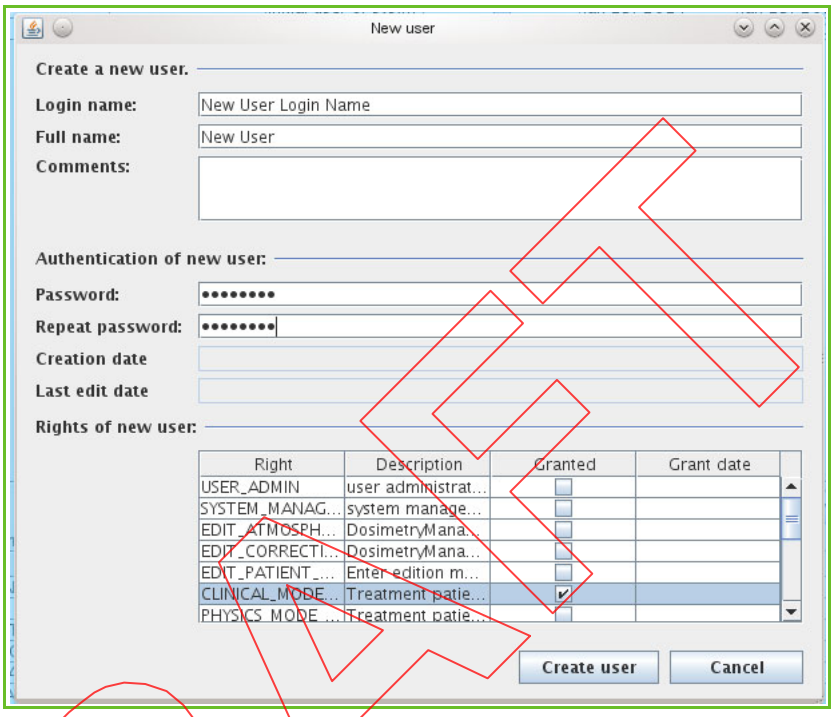

Figure C-3. New User Screen

The fields on the NEW USER SCREEN are as follows:

- New user data:
  - Login name: the login name of the user.
  - Full name
  - Comments
- New user authentication data:
- Password
- Repeat password

Select any of the rights that you want to grant to this newly defined user.

When finished creating the user, click **Create User** and the user appears on the USER MANAGER MAIN SCREEN.

Editing a User and Changing the Password

Any user who wants to change his or her password needs to request so to you as an administrator.

To edit data of a user, including his or her password:

1. Select the user from the USER MANAGER MAIN SCREEN.
2. Click **Edit User and Change Password**. The USER UPDATE SCREEN appears.

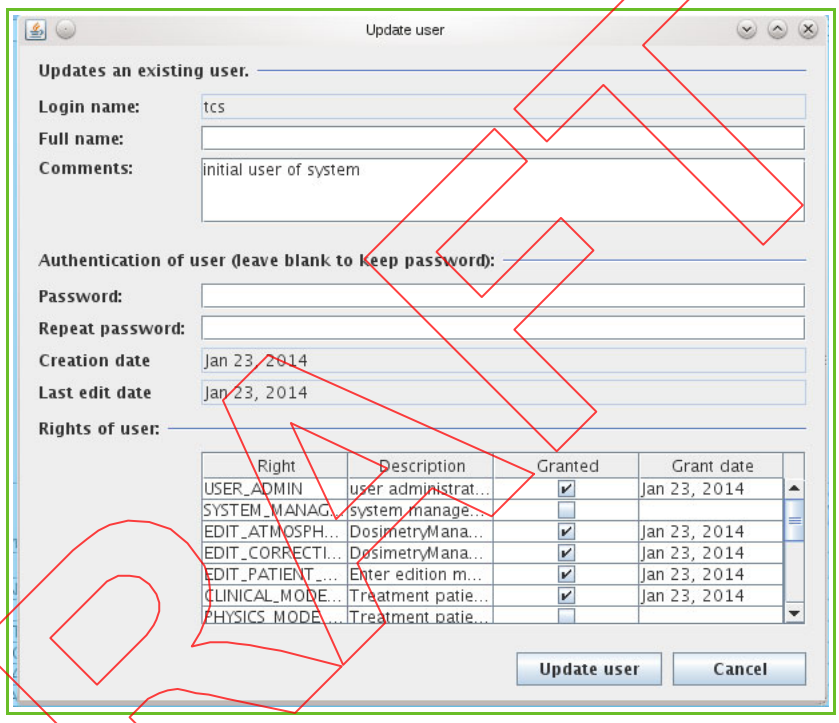

Figure C-4. User Update Screen

3. Modify the data of the user.
4. Click **Update User**. The USER MANAGER MAIN SCREEN reappears.

Managing Overrides

The User Manager features the following rights that enable an override activity:

- MULIMIT_CHECK_OVERRIDE: to override the message in case of MU higher than the clinical limit (defined in adaPTprescribe) in adaPTdeliver.
- POSITION_OVERRIDE: to override the position-out-of-tolerance check in adaPTdeliver.

Non-Clinical Mode

Whenever you log in to the User Manager in a mode other than clinical, a red banner and a 'Non Clinical' indication appear at the bottom of the screen.

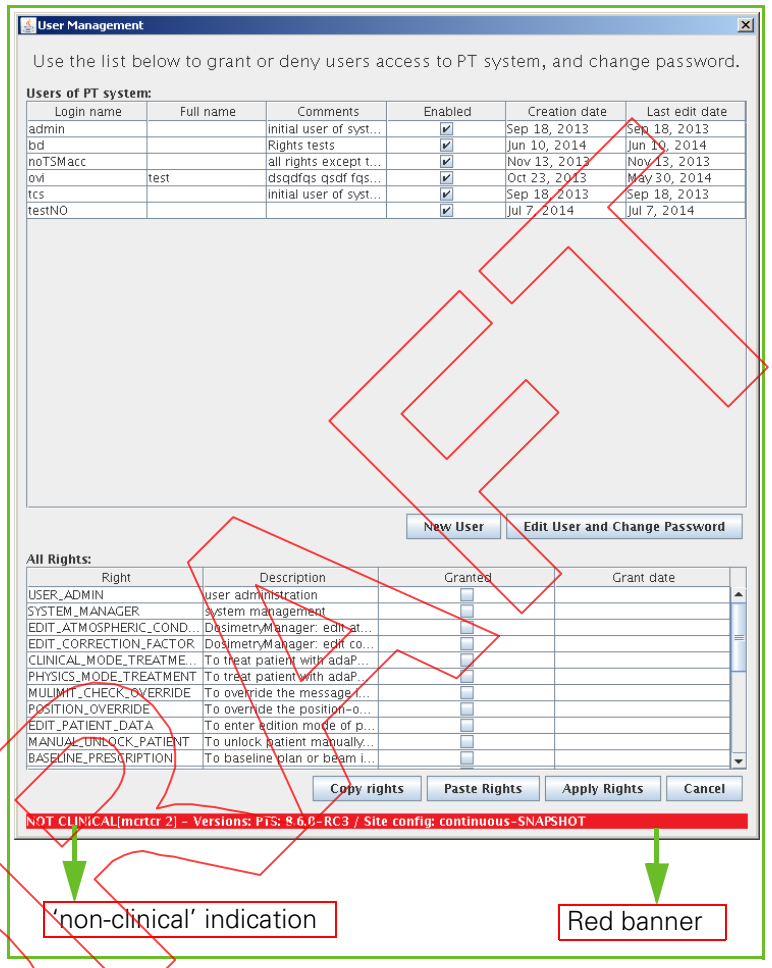

Figure C-5. User Manager in a non-clinical Mode

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Appendix D
Managing adaPTprescribe Settings

When you use adaPT*prescribe* in **Administration** mode, you can perform any of the following functions:

- Manage tolerance tables
- Manage MU clinical ranges
- Manage Accessories

For information on how to start an adaPT*prescribe* session and how to login, refer to Chapter 24, "Getting Started With adaPT*prescribe*"

Figure D-1. adaPT*prescribe Login Screen - Administration*

Managing Tolerance Tables

Tolerance tables are associated with a type of tumor. Tolerance tables are used to provide checks on positioning parameters used in a prescription. When creating a new setup or treatment beam in the Prescription part of adaPT*prescribe*, the user can select which tolerance table will be used.

A defined Tolerance table is not patient specific and may be used by other RTTs.

These tables define tolerances on the following positioning parameters:

- PPS X, Y, and Z, expressed in cm.
- PPS Rotation, Pitch, and Roll, expressed in degrees.
- Gantry rotation, expressed in degrees.
- PBS dedicated snout position (when a snout is present), expressed in cm.

Two types of tolerance tables exist:

- **Internal tolerance table**: these get created and are managed using adaPT*prescribe*.
- **External tolerance table**: these get imported when an external prescription is imported, through the batch importer, the adaPT*prescribe* Import Patient' function, or the OIS.

The Tolerance table is called when you define the beam, in standalone mode.

Performing Functions With Tolerance Tables

From the TOLERANCE TABLE MANAGEMENT SCREEN you can perform any of the following:

- **View** the existing tolerance tables.
- **Create** a new tolerance table: the tolerance table label must be unique.

Making changes to the tolerance tables may have important consequences on clinical operations.

WARNING	Any changes made to tolerance tables may cause death, bodily injury, or poor therapeutic results if not performed correctly.

Important: The treatment center will issue and enforce a procedure requesting the responsible medical physicist to print, verify, sign, and file the list of software stored Tolerance tables at specific intervals.

Internal Tolerance Tables

When you click an internal tolerance table, the buttons at the bottom of the TOLERANCE TABLE MANAGEMENT SCREEN enable you to perform the following functions:

- **Copy**: you can copy all the values of the existing tolerance table, except the tolerance table label. You have to enter a new and unique label before being allowed to save the table.
- **Edit**: you can edit an existing tolerance table only if the tolerance table has never been linked to a setup or treatment beam.
- **Delete**. you can delete an existing tolerance table only if the tolerance table has never been linked to a setup or treatment beam.

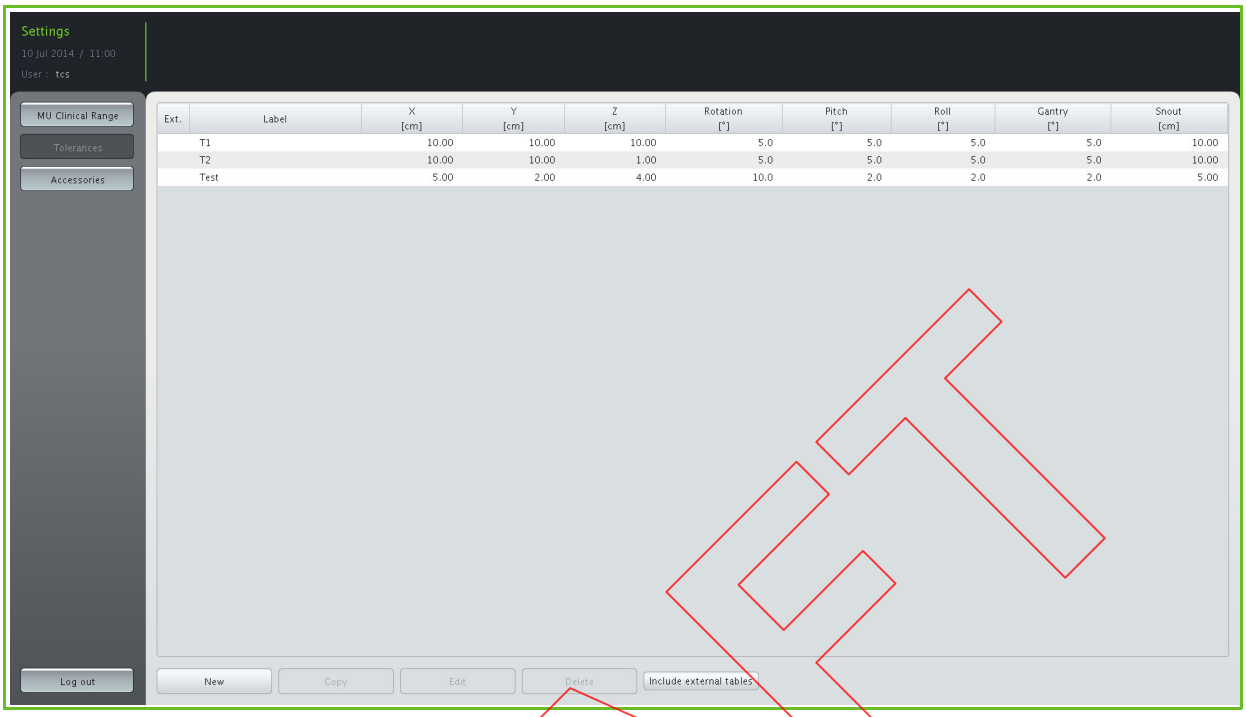

Figure D-2. Tolerance Table Management Screen

External Tolerance Tables

In addition, you can click **Include external tables** to display tolerance tables that got imported. External tolerance tables are identified by the green checkmark (✔) in the **Ext** column.

You can copy an external tolerance table but they cannot be edited nor deleted.

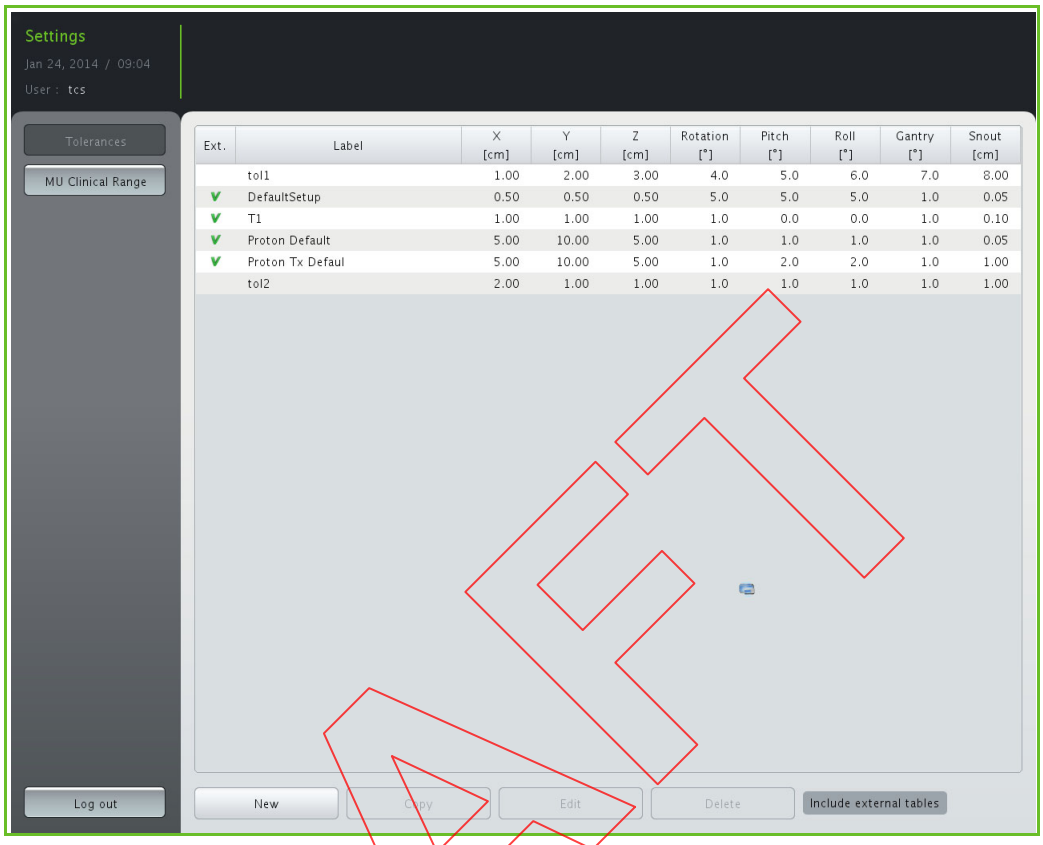

Figure D-3. Tolerance Table Management Screen - with External Tables

Managing MU Clinical Ranges

If a beam requires an MU (Monitor Unit) above the MU Clinical Range defined on the MONITOR UNIT (MU) CLINICAL RANGE DEFINITION SCREEN, the user is prompted to confirm that he or she wants to proceed with the requested MU value.

Each TR is listed on the MONITOR UNIT (MU) CLINICAL RANGE DEFINITION SCREEN along with the delivery technique. The default threshold[1] differs by treatment mode, as follows:

- PBS: the MU/Spot threshold is set to 2 MU/Spot. This limits the dose of a Single Field Uniform Dose (SFUD) to 2 Gy approximately.

Users who have the right to edit this section can change this threshold.

1. The listed values are applicable to treatment mode only, not in physics nor service mode.

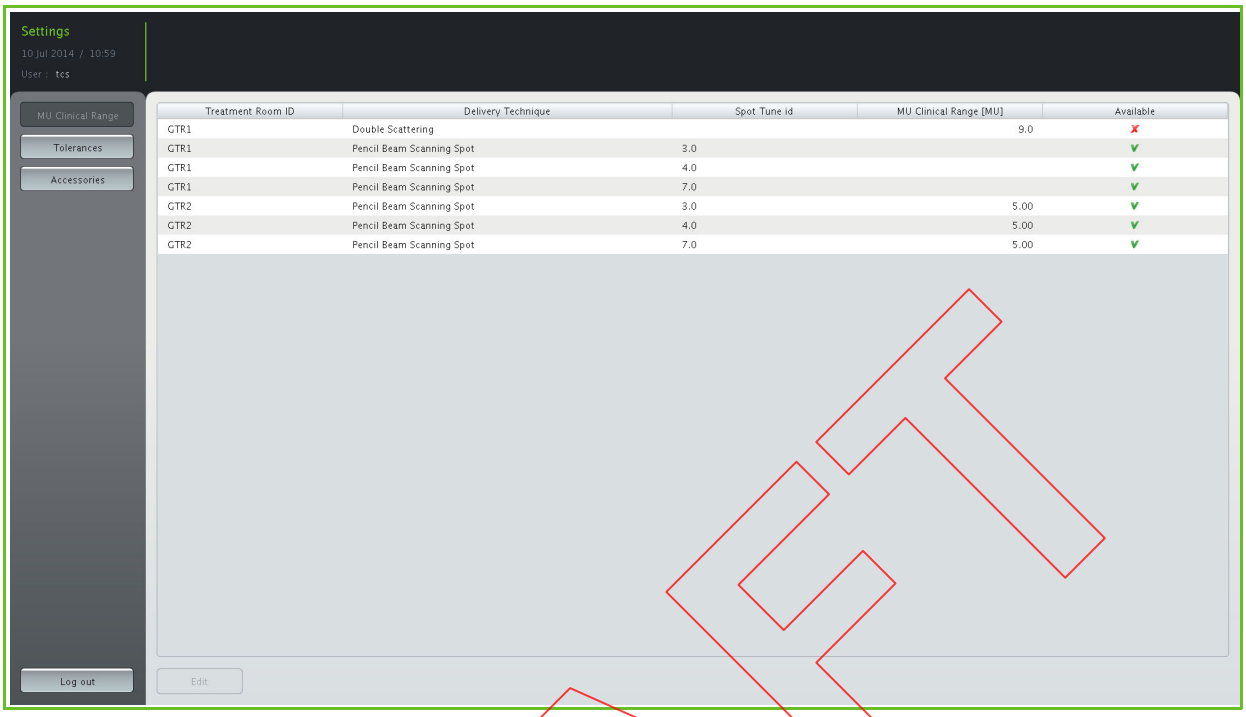

Figure D-4. Monitor Unit (MU) Clinical Range Definition Screen

For each TR the PBS Spot Tune ID(s) is (are) listed. Each of these Spot Tune IDs can have its own MU clinical range.

If a beam has an MU above the clinical range defined on the MONITOR UNIT (MU) CLINICAL RANGE DEFINITION SCREEN:

- adaPT*prescribe* will warn the user and request an override with credentials to the user when the user requests to baseline and to save the beam.
- adaPT*deliver* will warn the user and request an override with credentials to the user when the user selects the beam from the BEAM SELECTION SCREEN, and clicks **Next** to proceed to the preparation phase.

Managing Accessories

Accessories that may be required for treatment are managed from the ACCESSORIES MANAGEMENT SCREEN.

Currently, the Snout Management tab is available, from which you can manage snouts.

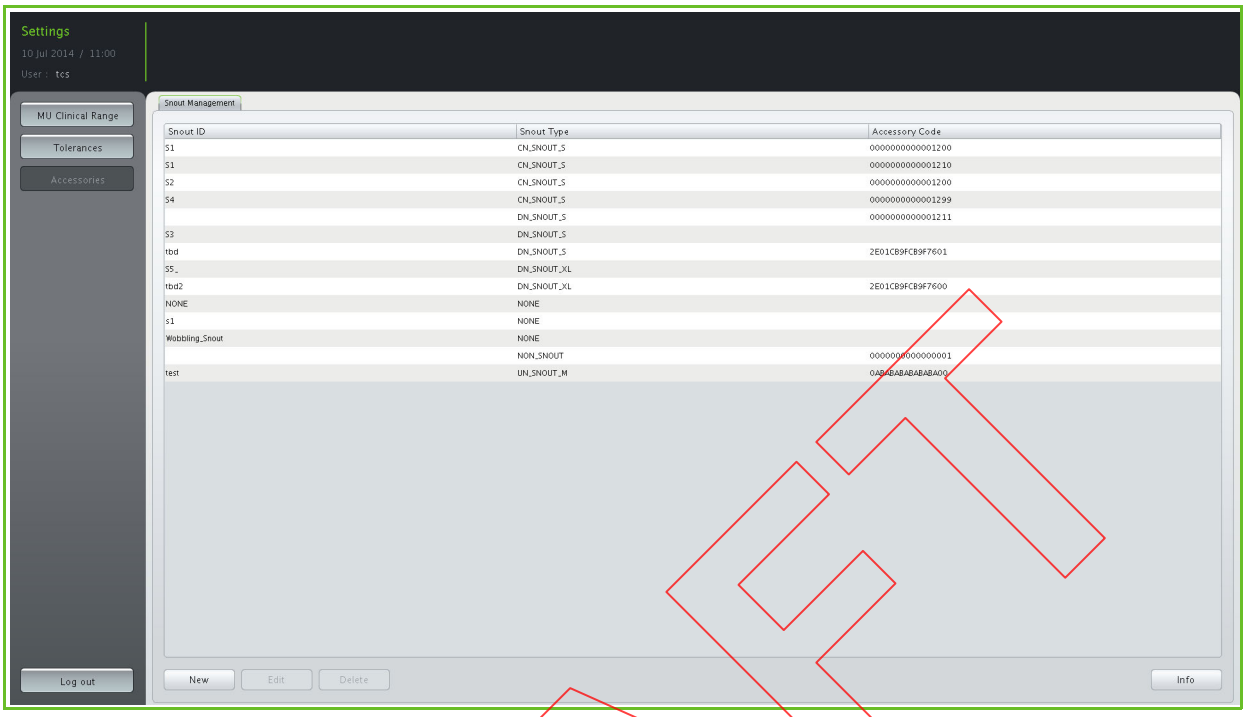

Figure D-5. Accessories Management Screen

From the Snout Management tab of the ACCESSORIES MANAGEMENT SCREEN you can click any of the following buttons:

- **New**: to create a new accessory. You can define the ID and type of any new snout. The snout ID that you define here will be available for selection in adaPT*prescribe*. The definition is as follows:
  - Snout ID: the identification of the snout as known in the treatment plan.
  - Snout Type: the identification of the snout as known by the PT system.
  - Accessory code: the identification of the snout as encoded by the electronic circuitry that is encapsulated and attached to the snout. The eID is communicated to adaPT*prescribe* via the eIDEU.

  Note: *It is IBA responsibility to couple the Accessory Code to the new snout ID. The IBA engineer therefore will read the snout's electronic identification (eID) code using an eID reader.*

- **Edit**: to view the definition of the selected accessory.
- **Delete**: to remove an accessory from the list.

In addition, you can click **Info** to display the SNOUT TYPE LEGEND. This SNOUT TYPE LEGEND lists all snout types that exist.

Note: *Not all snouts types listed in the* SNOUT TYPE LEGEND *may be present at your center.*

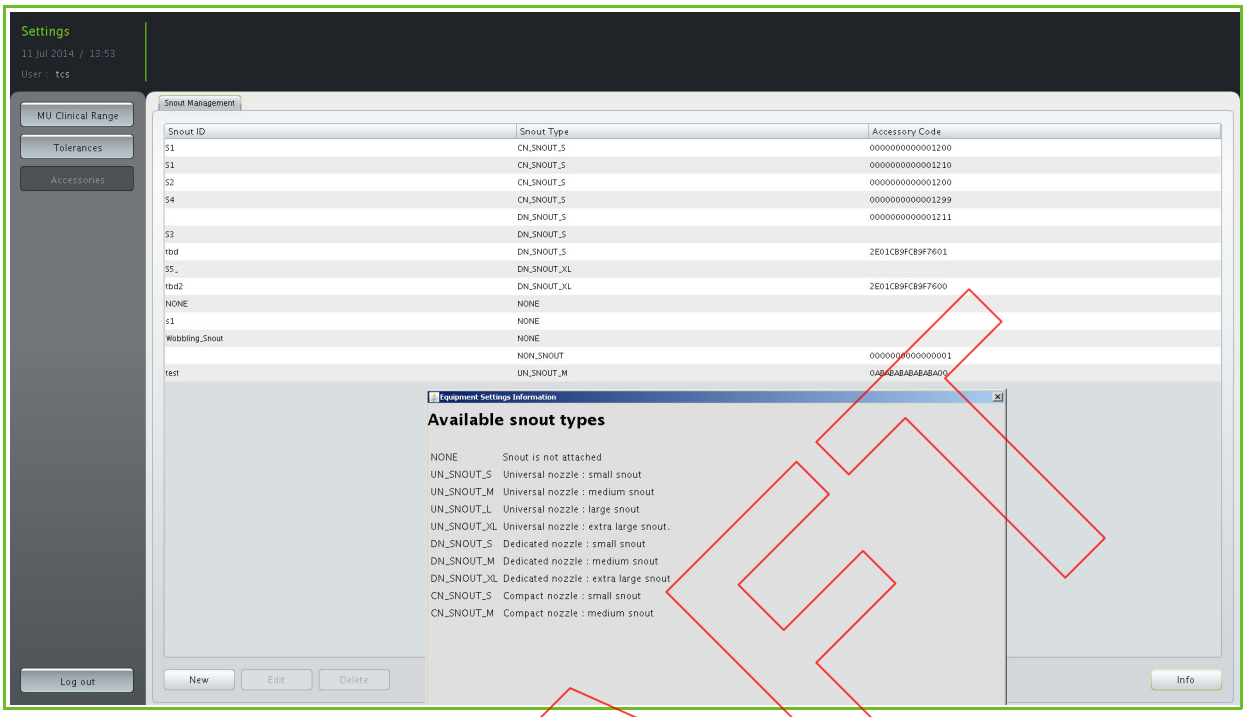

Figure D-6. Snout Type Legend

Appendix E
Emergency Stop Button Locations

Table D-1 lists all emergency stop buttons and the Safety Redundant Control Unit (SRCU) to which they are connected.

Figure D-1 illustrates the location of all safety and emergency devices.

Note: *The switch depicted on the hand-pendant represents the pressure sensitive switches at the bottom of the hand pendant that enable or disable the movement of the Patient Positioning Devices (refer to the* Clinical User's Guide *for the use of the hand-pendant).*

Table E-1. Emergency Stop Button Data

Location		Quantity	Operated by
Main Control Room		1	SRCU0
Cyclotron & Beam Transportation Vault	Subzone 1	5	
	Subzone 2	5	
Gantry Treatment Room 1	Vault	4	SRCU1
	Catwalk	2	
	X-ray Booth	1	
	Treatment Room	5	
	Treatment Control Room	1	
PPS maintenance hand pendant; no electrical power shut off		1	

Table E-1. Emergency Stop Button Data (Cont'd)

Location		Quantity	Operated by
Gantry Treatment Room 2	Vault	4	SRCU2
	Catwalk	2	
	X-ray Booth	1	
	Treatment Room	5	
	Treatment Control Room	1	
PPS maintenance hand pendant; no electrical power shut off		1	

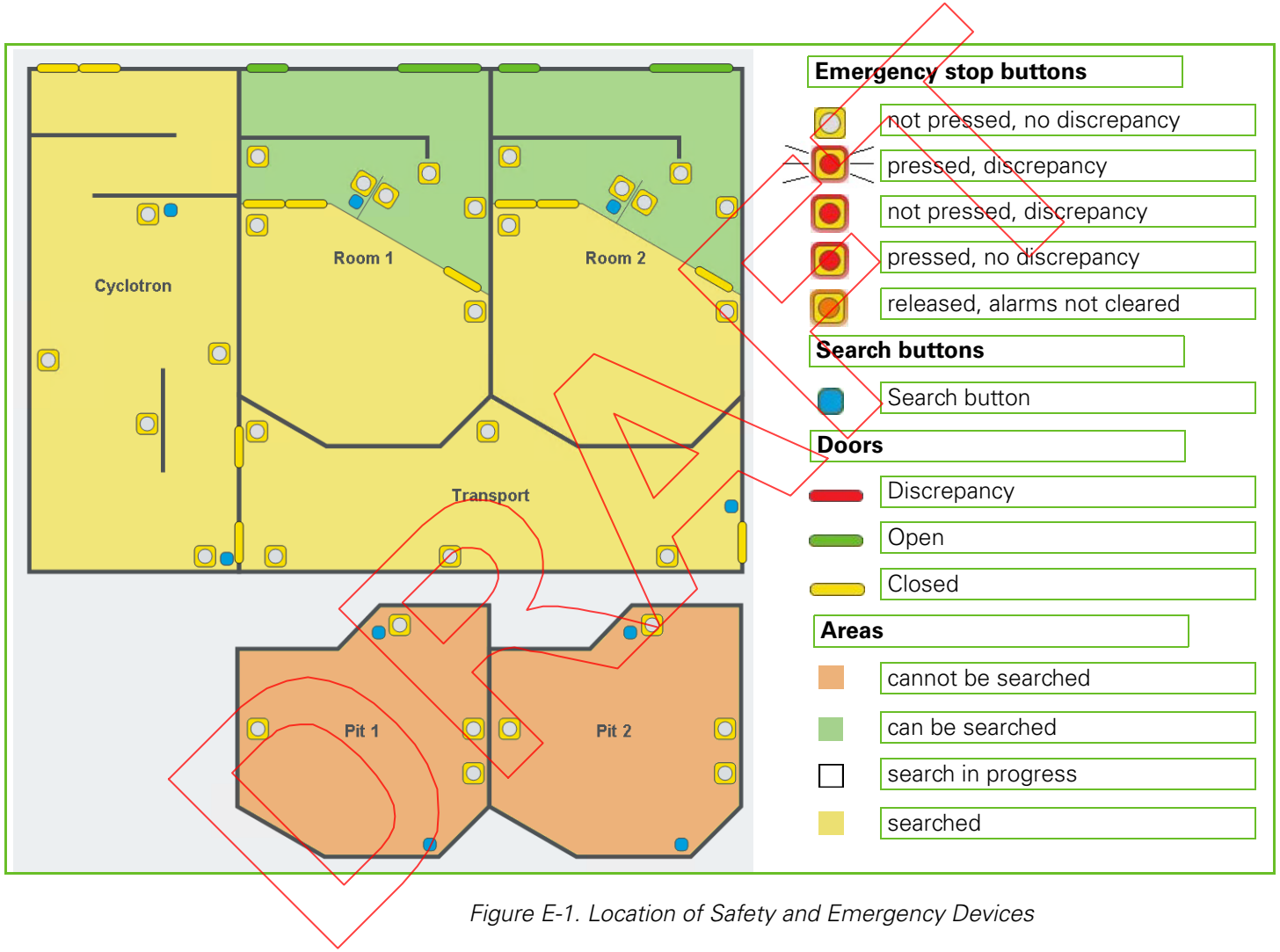

Figure E-1. Location of Safety and Emergency Devices

Motion Stop Buttons

Each of the following devices features a motion stop button:

- Hand pendant: features two Motion Enable Buttons (MEB), one on each side. As long as both buttons are pressed, movement of the Patient Positioning Devices is possible.
- Maintenance hand pendant of the Patient Positioning System (PPS), which is located in the gantry pit.
- Maintenance hand pendant of the Large Field of View (LFOV) Control Unit (FOVCU).
- Maintenance hand pendant of the Dedicated Nozzle Snout Holder.

Appendix F
System Messages

The appendix explains the different system messages intended for the clinical operator that require a decision to be taken with respect to the patient treatment.

The messages are characterized as follows, according to the circumstances under which they may appear:

- Software: according to the software in which they appear.
  - adaPT*prescribe*
  - adaPT*deliver*
  - Any of the above
- Environment: according to the Therapy Center environment regarding the use of an OIS, and according to the use of Clinical or Physics mode of adaPT*deliver*.
  - Device Centric (DEVC)
  - Standalone (no OIS)
  - Physics mode
  - Any of the OIS modes mentioned (DEVC or EMRC)
- Delivery: according to the type of beam delivery technique available in the TR.
  - Pencil Beam Scanning (PBS)
  - Any beam delivery technique

Note: *The different options and messages depend on the features available on your site. As such, all the messages enlisted may not be applicable for your site.*

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
Any	DEVC	Any	*Failure to store Dicom object to Dicom server.SopClassUID={0}SopInstanceUID ={1}*	This message informs the user that the system has failed to store a DICOM object into the DICOM server. Following this message, the user may need to manually record the treatment.
Any	DEVC	Any	*This prescription has been partially delivered but detailed delivery history cannot be fully retrieved. As a result, partial information will need to be manually cross-checked.*	This message informs the user that they need to manually cross-check the information related to a partial irradiation, as the system could not retrieve its detailed delivery history.
Any	DEVC	Any	*A Treatment record was referenced but could not be retrieved.UID={0}, user must check the tx history to manually enter partial information, Do you want to continue?*	This message informs the user that they need to check the treatment history and manually enter partial information if they want to continue with an irradiation for which the system could not retrieve a treatment record.
Any	DEVC	Any	*Do you really want to cancel current appointment?*	This message prompts the user to confirm they wish to cancel the selected appointment and close the session.
Any	DEVC	Any	*OIS provides incomplete data for the computation, the dose limits check will be ignored.*	This message informs the user that, as the OIS has provided data that is not sufficient for the system to perform dose limit checks, these checks will not be performed.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
Any	DEVC	Any	*The data received to resume from last partial irradiation is not consistent. The proposed MUd value might be incorrect. Double check this value before deciding to resume the irradiation.*	This message informs the user that there are inconsistencies between the data that the system has in the database and the data it receives from the OIS, to resume a partial irradiation. In consequence, the user should double check the resumption MUd value proposed by the system versus the resumption values available in the OIS to decide which value should be used.
adaPT-*prescribe*	StandAlone	Any	*There is an active patient with the same patient ID. Do you want to deactivate the other patient and activate the current patient?*	This message informs the user that, by activating the selected patient, other active patients with the same patient ID which the system has detected will be set to inactive. Indeed, the system does not accept to have several active patients with the same patient ID.
adaPT-*prescribe*	StandAlone	Any	*There is an active study with the same study ID. Do you want to deactivate the other study and activate the current study?*	This message informs the user that, by activating the selected study, other active studies with the same study ID which the system has detected will be set to inactive. Indeed, the system does not accept to have several active studies with the same study ID.
adaPT-*prescribe*	StandAlone	Any	*There are other active plans with same instance UID or plan label. Do you want to activate this plan? Other active plans with same instance UID or plan label will be set to inactive.*	This message informs the user that, by activating the selected plan, other active plans with the same instance UID or plan label which the system has detected will be set to inactive. Indeed, the system does not accept to have several active plans with the same instance UID or plan label.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*prescribe*	StandAlone	Any	*The patient data cannot be saved. Check the database status.*	This message informs the user that there is an issue in the connection to the database and advices them to check the status of the connection. Contact an operator to check the database status.
adaPT-*prescribe*	StandAlone	Any	*Patient cannot be unlocked because the database is not accessible.*	This message informs the user that there is an issue in the connection to the database. Contact an operator to fix this issue.
adaPT-*prescribe*	StandAlone	Any	*Saving MU clinical range value is canceled because of other user is editing the value, please try later.*	This message informs the user that changes to the MU clinical range value were not saved to avoid conflicting changes. The message advices the user to try again later.
adaPT-*prescribe*	StandAlone	Any	*No Dicom plan associated to this beam (plan origin is standalone), not possible to generate a Dicom record.*	This message informs the user that it is not possible to generate a DICOM record for a plan whose origin is Standalone. This is because plans with a Standalone origin (i.e. created manually using adaPT*prescribe*) are not DICOM objects.
adaPT-*prescribe*	StandAlone	Any	*The plan that you want to import belongs to a patient who already exists in the database. The selected plan will be imported in this patient.Do you want to import this plan?*	This message informs the user that when they import a plan that belongs to a patient who already exists in the database, the plan will be imported in that patient. The message prompts the user to confirm that they want to import the plan.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	Any	PBS	In the 'Partial Irradiation' dialogue, the system displays the following message: *Note that resuming from the beam total MUd is less accurate due to the lack of spot delivered information.*	The goal of this message is to inform the user that, if an appropriate record is available for resuming an interrupted irradiation, they should privilege using that record instead of an MUd value.
adaPT-*deliver*	Any	PBS	*Total delivered MU ({0}) of selected beam reports is larger than prescribed MU ({1}). Do you want to continue anyway?*	In the context of the 'Partial Irradiation' dialogue, this message informs the user that the treatment record they have chosen to resume a partial irradiation has a total delivered MU value that is larger than the MU value prescribed for that irradiation. The message prompts them to decide, once aware of that fact, whether they want to continue to irradiation with this data or not.
adaPT-*deliver*	Standalone	Any	*No tolerance table is defined for this beam. The system will use ZERO tolerance to treat.*	This message informs the user that, in the absence of a tolerance table defined for the selected beam, the system will use a conservative 'zero' tolerance for this treatment. This happens in standalone when they want to re-use a plan sent from OIS before.
adaPT-*deliver*	DevC	Any	*The data received to resume from last partial irradiation is not consistent. The proposed MUd value might be incorrect. Double check this value before deciding to resume the irradiation.*	This message informs the user that there are inconsistencies in the data that the system has received from the OIS to resume a partial irradiation. In consequence, the user should double check the resumption MUd value proposed by the system versus the resumption values available in the OIS to decide which value should be used.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	DevC Standalone	Any	*Warning: modified MU*	This message confirms to the user that they have successfully modified the MU value.
adaPT-*deliver*	Any	PBS	*Not enough information to resume a partial PBS beam. Click on [Partial] button to resume from local database or to explicitly proceed with inaccurate data.*	This message informs the user that they need to use the 'Partial' menu. There, they should select the appropriate treatment record from the local database for resuming a partial PBS beam, if available. Selecting the appropriate treatment record from the database, if available, is more accurate than resuming using an MUd value only.
adaPT-*deliver*	Any	Any	*The following problems were detected: Beam [{0}] has already been treated today. If you want to confirm this selection, please enter your credentials.*	This message informs the user that the beam they have selected has already been fully or partially treated. The message prompts them to sign with their credentials if, despite being aware of that fact, they decide to confirm the selection.
adaPT-*deliver*	DevC	Any	*For DoseReferenceNumber ({0})/For {0} reference point, the dose ({0} Gy) goes over the daily dose ({1} Gy). Do you want to start treatment anyway?*	This message informs the user that for a particular dose reference point, the dose prescribed exceeds the daily dose limit. The message prompts them to confirm, once aware of that fact, whether or not they want to start the treatment.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	Any	Any	*For DoseReferenceNumber ({0})/For {0} reference point, the dose ({0} Gy) goes over the total dose ({1} Gy). Do you want to start treatment anyway?*	This message informs the user that for a particular dose reference number or reference point, the dose prescribed exceeds the total dose limit. The message prompts them to confirm, once aware of that fact, whether or not they want to start the treatment.
adaPT-*deliver*	Any	Any	*For DoseReferenceNumber ({0})/For {0} reference point,the dose ({0} Gy) might go over the daily dose ({1} Gy) based on internal computation (due to missing history record). Do you want to start treatment anyway?*	This message informs the user that for a particular dose reference number or reference point, the dose prescribed may possibly exceed the daily dose limit. This information is based on an internal computation. The message prompts them to confirm, once aware of that fact, whether or not they want to start the treatment.
adaPT-*deliver*	Any	Any	*For DoseReferenceNumber ({0})/For {0} reference point, The dose ({0} Gy) might go over the total dose ({1} Gy) based on internal computation (due to missing history record). Do you want to start treatment anyway?*	This message informs the user that for a particular dose reference number or reference point, the dose prescribed may possibly exceed the total dose limit. This information is based on an internal computation. The message prompts them to confirm, once aware of that fact, whether or not they want to start the treatment.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	Any	Any	*You specified a previously delivered MU for this beam. This can only be done in the context of a previously interrupted irradiation, and value must be carefully set and checked. Are you sure you want to proceed?*	This message informs the user that specifying a previously delivered MU is an action that is not trivial (the value must be carefully checked) and that is only pertinent in the case of a partial irradiation. The message prompts the user to confirm, after this information, if they want to proceed with a manually specified previously delivered MU value.
adaPT-*deliver*	Physics mode	PBS	*Specifying such value can only be in the context of a previously interrupted irradiation, and Required MU must be carefully set and checked. If you confirm this, press OK. Or press Cancel, the value will be reset.*	This message informs the user that specifying a required MU value is an action that is not trivial (the value must be carefully checked) and that is only pertinent in the case of a partial irradiation. The message prompts the user to confirm, after this information, whether they want to proceed with a manually specified required MU value or whether they want to cancel and reset the value. This message may appear for Eye treatments or in PBS Physics mode.
adaPT-*deliver*	Physics Mode	Any	*You are entering the Physics mode. Treatment of patients is not allowed in this mode. Would you like to continue?*	This message informs the user that they are logging into adaPT*deliver* in Physics mode and that patient treatment is not allowed in this mode. The message prompts the user to acknowledge they will log into adaPT*deliver* in Physics mode.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	Any	Any	*Some beam(s) are not completely irradiated. Do you confirm you want to cancel the session?*	This message informs the user that at least one of the beams in the current session have not been completely irradiated. The message prompts the user to confirm if they want to cancel the session regardless of that fact.
adaPT-*deliver*	DevC Standalone	Any	*The selected beam has been partially treated. You must check the 'Delivered MU [MU]' if you want to proceed to irradiation with this beam.*	This message informs the user that the beam they have just selected was partially irradiated in the past, and that they must check the delivered MU value before proceeding to irradiate the remainder.
adaPT-*deliver*	DevC Standalone	Any	*Do you confirm to treat a partially delivered beam?*	This message prompts the user to confirm whether they want to proceed with the irradiation of a partially delivered beam.
adaPT-*deliver*	Any	Any	*Do you want to disconnect from OIS?*	This message prompts the user to confirm whether they wish to disconnect adaPT*deliver* from the OIS.
adaPT-*deliver*	Any	Any	*The irradiation has stopped due to a user request. This irradiation is not complete.\n[Treatment Termination Status={0}]*	This message informs the user that the irradiation was stopped before being complete, due to a user request. The message also provides the Treatment termination Status of the irradiation.
adaPT-*deliver*	Any	Any	*The irradiation has stopped due to a system error. This irradiation is not complete.\n[Treatment Termination Status={0}]*	This message informs the user that the irradiation was stopped before being complete, due to a system error. The message also provides the Treatment termination Status of the irradiation.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	Any	Any	*The irradiation has stopped abnormally. The reason of the termination is unknown.\n[Treatment Termination Status={0}]*	This message informs the user that the irradiation was stopped before being complete, due to an unknown reason. The message also provides the Treatment termination Status of the irradiation.
adaPT-*deliver*	Any	Any	*PMS seems busy. Do you want to start preparation anyway?*	This message informs the user that the PMS is busy and to confirms whether the system should start the preparation anyway.
adaPT-*deliver*	DevC	Any	*Unable to store the plan data because:{0}*	This message appears when the plan cannot be saved into the database.
adaPT-*deliver*	DEVC	Any	*The system encountered an issue recording the session in the OIS. A treatment record has been saved to local disk:{0} . Please collect the treatment record file saved on disk and manually import it in the OIS.*	This message informs the user that the system could not record the session in the OIS and that it saved a treatment record in the local disk. the message instructs the user to manually import the treatment record saved on disk in the OIS.
adaPT-*deliver*	OIS	Any	*The system encountered an issue recording the irradiation in the OIS. Please refer to the Dose Counter Electronic Unit and manually record this irradiation in the OIS.*	This message informs the user that the system does not have information about the dose to record the irradiation in the OIS. The message instructs the user to refer to the Dose Counter Electronic Unit to manually record the irradiation in the OIS.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	OIS	Any	*Unable to send treatment record to OIS and failed to save local disk.*	This message informs the user that the system could not record the irradiation in the OIS or save a treatment record in the local disk. In this case, the user should refer to the Dose Counter Electronic Unit to manually record the irradiation in the OIS.
adaPT-*deliver*	Any	Any	*This beam has been partially irradiated; are you sure you do not want to enter a previously delivered MU?*	This message informs the user that, despite the fact that the current beam has been partially irradiated in the past, they have not entered an MUd value to resume from. The message prompts them to confirm whether this corresponds to their needs for the current irradiation.
adaPT-*deliver*	Any	Any	*Unable to save the current setup record into database due to database access exception. You are recommended to check database connection and abort this session.*	This message informs the user that the current setup could not be recorded in the database. The message recommends that they do not continue with the session and that they fix the issue (with IBA support if necessary) before proceeding with treatment.
adaPT-*deliver*	DevC Standalone	Any	*No setup beam has been delivered yet. Do you confirm selection of the treatment beam?*	This message prompts the user to confirm the selection of a treatment beam, bringing to their attention that no setup beam has been delivered in the current session.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	Any	Any	*Unable to generate DICOM treatment record because of an internal error! Please check log messages for details.*	This message informs the user that the system was unable to generate a DICOM record and advices them to investigate the issue by accessing the logs. The user can record the DCEU values manually in the OIS. Contact an operator to fix this issue.
adaPT-*deliver*	Any	Any	*Unable to write user action log into database.Please check database connection!*	This message informs the user that there may be a database connection issue and advices them to check the status of the connection.
adaPT-*deliver*	Any	Any	*The current PPD positions are not in tolerance.If you want to enter irradiation, please input valid user name and password, and your action will be recorded.*	This message informs the user that the positions of the Patient Positioning Devices are out of tolerance. It prompts them to sign with their credentials (which will be recorded) if they wish to enter irradiation using those PPD positions. The user may also choose to modify the tolerances from the OIS or adaPT*prescribe* (depending on which one is relevant in the current situation).
adaPT-*deliver*	Any	Any	*For further analysis, you are strongly recommended acquire a heap dump at this moment! Heap dump can be created by VisualVM(jvisualvm.exe) which should be found under <$JDK>/bin folder. If you don't want this reminding, please set trcs.debugMemoryLeak=false*	This message reminds the user to create a heap dump for further analysis using VisualVM. This reminder can be deactivated by setting the parameter `trcs.debugMemoryLeak` to `false`. This parameter is set to `false` by default.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	DevC	Any	*The system encountered an issue recording the irradiation in the OIS.Please refer to the Dose Counter Electronic Unit and manually record this irradiation in the OIS.*	This message informs the user that the system could not record the irradiation in the OIS and it instructs the user to manually record the irradiation in the OIS using the data on the DCEU.
adaPT-*deliver*	Standalone	Any	*The system encountered an issue recording this irradiation in the local database.Please refer to the Dose Counter Electronic Unit and manually record this irradiation in the patient file.*	This message informs the user that the system could not record the irradiation in the database and it instructs the user to manually record the irradiation in the patient file using the data on the DCEU.
adaPT-*deliver*	Physics Mode	Any	*You logged into physics mode. Clinical treatments are not allowed in this mode.*	This message informs the user that they have logged into adaPT*deliver* in Physics mode and that patient treatment is not allowed in this mode.
adaPT-*deliver*	Any	Any	*Warning, the system (seems to) encounter a problem, it is recommended to stop the treatment and to contact an IBA Technician!*	This message indicates that, for the third time within the last 15 seconds, a treatment interruption (due to a failed periodical check) has occurred. In such a case, it is strongly recommended to the user to terminate the treatment.
adaPT-*deliver*	Any	Any	*Irradiation done. Please contact beam operator to perform a new RF lookup.*	This message indicates that the last treatment has been performed in such conditions that require the performance of a new "RF lookup" sequence prior to starting the next treatment. The user must contact an operator to complete the task needed.

Table F-1. System messages

Software	Environment(s)	Delivery	Message	Description
adaPT-*deliver*	Any	Any	*Too many set range failures due to field regulation. Please inform the Service team. Sign in if you want to disable field regulation and continue irradiation in degraded mode.*	The system has been unable to correctly reach the expected magnetic fields for some magnets (for which automatic field regulation is applicable) after 3 consecutive attempts. As a result, it is recommended to the user to switch the system into a "degraded mode" for which the field regulation is not activated or to request for a verification of the equipment by the service team.
adaPT-*deliver*	Any	Any	*The 'beam on' consistency check on ICcyclo failed. Please inform the Service team.\nIf you agree to override it, a redundant beam check might be ineffective.*	When some beam is being extracted from the accelerator, a discrepancy has been detected between the beam presence signals provided by the Ion Chambers located at the cyclotron exit (IC cyclo: small gap and large gap). Such an discrepancy indicates a potential failure of one of these Ion Chambers and requires a verification by the service team. Nevertheless it is possible to proceed with the current treatment by means of an "override" procedure (using a specific password). As long as the issue is not fixed, a message shall inform the user of this issue prior to each treatment.

Appendix E
PTS Acronyms & Abbreviations

- AA (Axis Arm) (see GAPS)
- ABS (Automatic Beam Scheduler)
- ACU (Accelerator Control Unit)
- AE (Application Entity)
- ANS (Automatic Nozzle Switching)
- BAEU (Beam Absence Electronic Unit)
- BCM (Beam Current Monitor)
- BCMEU (Beam Current Measurement Electronic Unit)
- BCP (Beam Common Process)
- BCREU (Beam Current Regulation Electronic Unit)
- BDS (Beam Delivery System)
- BGEU (Beam Gating Electronic Unit)
- BMD (Beam Modifying Device)
- BMEU (Beam Monitor Electronic Unit)
- BMS (Beam Management System)
- BOM (Beam Operation Manager)
- BPM (Beam Profile Monitor)
- BPMEU (Beam Profile Monitor Electronic Unit)
- BPS (Beam Production System)
- BSS (Beam Supply System)
- BTS (Beam Transport System)

- CAS (Caterpillar System)
- CBCT (Cone Beam Computed Tomography)
- CBTV (Cyclotron/Beam Transport Vault)
- CCW (CounterClockWise)
- CDE (Common Desktop Environment)
- CG (Center of Gravity)
- CMMS (Computerized Maintenance Management System)
- CNSH (Compact Nozzle Snout Holder)
- CS (Coordinate System)
- CT (Computed Tomography)
- CTDi (Computed Tomography Dose Index)
- CTDI100 (Computed Tomography Dose Index 100)
- CTDIcenter (Computed Tomography Dose Index Center)
- CTDIfree (Computed Tomography Dose Index Free)
- CTDIperiph (Computed Tomography Dose Index Peripheral)
- CTDIvol (Computed Tomography Dose Index Volumetric)
- CU (Control Unit)
- CV (Correction Vector)
- CW (ClockWise)
- DB (Database)
- DC (Direct Current)
- DCEU (Dosimetry Counter Electronic Unit)
- DEVC (Device Centric Mode)
- DICOM® (Digital Imaging and Communications in Medicine)
- DID (Digital Imaging Device)
- DIP (Dual in-line Package) switch
- DLP (Dose Length Product)
- DMFCEU (Dipole Magnet Flux Coil Electronic Unit)
- DNSH (Dedicated Nozzle Snout Holder)
- DR (Digital Radiograph)
- DRR (Digitally Reconstructed Radiographs)
- DS (Double Scattering)

- DSP (Digital Signal Processor)
- DVM (Digital Voltmeter)
- ECQ (External Coil Quadrupole)
- ECR (Engineering Change Request)
- EEPROM (Electrically Erasable PROM)
- EMC (Electromagnetic Compatibility)
- EMF (Electromagnetic Field)
- EMI (Electromagnetic Interference)
- EMR (Electronic Medical Record)
- EOT (End-of-Travel)
- ESBTS (Energy Selection and Beam Transport System)
- ESD (Entrance Skin Dose)
- ESS (Energy Selection System)
- EU (Electronic Unit)
- FBL (Fixed Beam Line)
- FBQAR (Fixed Beam Quality Assurance Room)
- FBTR (Fixed Beam Treatment Room)
- FCEU (Flux Coil Electronic Unit)
- FCU (Functionally Redundant Verifier Control Unit)
- FE (Falling Edge) (see RE)
- FOV (Field Of View)
- FOVCU (Field Of View Control Unit)
- FPA (Final Power Amplifier)
- FPMEU (Flat Panel Motion Electronic Unit)
- FPSEU (Flat Panel Synchronization Electronic Unit)
- FRS (Fixed Reference System)
- FS (First Scatterer)
- FSEU (First Scatterer Electronic Unit)
- FSTR (Fixed Small beam Treatment Room)
- GCF (Gantry Correction File)
- GCS (Gantry Coordinate System)
- GRF (Gantry Rolling Floor)

- GTR (Gantry Treatment Room)
- GTS (Gantry Beam Transport System)
- GUI (Graphical User Interface)
- HCPS (Harmonic Coils Power Supply)
- HKCB (Hook-Up Control Box)
- HMI (Human Machine Interface)
- HS (High Speed)
- HV (High Voltage)
- HVAC (Heating Ventilation Air Cooling)
- IBA (Ion Beam Applications)
- IBD (Interface Building Document)
- IC (Ionization Chamber)
- ICEU (Ionization Chamber Electronic Unit)
- IEC (International Electrotechnical Commission)
- IEC-FRS ((International Electrotechnical Commission Fixed Reference System)
- IGBT (Insulated Gate Bipolar Transistor)
- IGPT (Image Guided Particle Therapy)
- IMPA lintermediate Power Amplifier)
- I/O (Input/Output)
- ISAPS (Ion Source Arc Power Supply)
- INS (Insert)
- IS (Ion Source)
- ISEU (Ionization Source Electronic Unit)
- ISO (International Standardization Organization)
- ISPS (Ion Source Power Supply)
- LCD (Liquid Crystal Display)
- LDPE (Low Density Polyethylene)
- LED (Light Emitting Diode)
- LF (Light Field)
- LFOV (Large Field Of View)
- LFPS (Light Field Power Supply)
- LOTO (Lock Out Tag Out)

- LLRF (Low Level Radio Frequency)
- LPPS (Laser Pair Power Supply)
- LS (Low Speed)
- LUT (Look-Up-Table)
- MCPS (Main Coil Power Supply)
- MCR (Main Control Room)
- MCRS (Main Control Room Server)
- MEB (Motion Enable Button)
- MEWP (Mobile Elevating Work Platform)
- MFOV (Medium Field Of View)
- MID (Metadoc ID)
- MLIC (Multilayer Ionisation Chamber)
- MMS (Milling Machine System)
- MSDS (Material Safety Data Sheet)
- MU (Monitor Unit)
- MUd (Monitor Unit Delivered)
- NA (Nozzle Arm) (see GAPS)
- NEU (Nozzle Electronic Unit)
- NMR (Nuclear Magnetic Resonance)
- ODP (Oil Diffusion Pump)
- OEM (Original Equipment Manufacturer)
- OIS (Oncology Information System)
- PALI (Patient Alignment)
- PCB (Printed Circuit Board)
- PCU (Positioning Control Unit)
- PE (Patient Enclosure)
- PIG (Penning Ion Gauge)
- PLC (Programmable Logic Controller)
- PMMA (Polymethyl methacrylate)
- PMQ (Permanent Magnet Quadrupole)
- PMS (Positioning Management System)
- PPCA (Patient Positioning Correction Algorithm)

- PPD (Patient Positioning Device)
- PPE (Personal Protective Equipment)
- PPS (Patient Positioning System)
- PPSCU (Patient Positioning System Control Unit)
- PPVD (Patient Positioning Verification Device)
- PPVS (Patient Positioning Verification System)
- PROM (Programmable ROM)
- PS (Power Supply)
- PSR (Power Supply Room)
- PTS (Proton Therapy System)
- PWM (Pulse Width Modulation)
- QA (Quality Assurance)
- QACS (Quality Assurance Calibration System)
- RA (Research Area)
- RC (Range Compensator)
- RE (Rising Edge) (see FE)
- RCU (Redundant Verifier Control Unit)
- RF (Radio Frequency)
- RM (Range Modulator)
- RMEU (Range Modulator Electronic Unit)
- ROI (Region Of Interest)
- RP (Rotary Pump)
- RS (Retractable Snout)
- RSD (Range Shifter Drawer)
- RT (Radiation Therapy)
- RTT (Radiation Therapy Technologist)
- RV (Range Verifier)
- RVEU (Range Verifier Electronic Unit)
- SCS (Squirrel Cage System)
- SFOV (Small Field Of View)
- SHEU (Snout Holder Electronic Unit)
- SIS (Single Scattering)

- SLD (Snout Lifting Device)
- SM (Scanning Magnet)
- SMEU (Scanning Magnet Electronic Unit)
- SMPS (Scanning Magnet Power Supply)
- SMPSEU (Scanning Magnet Power Supply Electronic Unit)
- SOBP (Spread-Out Bragg Peak)
- SP (Set point)
- SREU (Snout Rotation Electronic Unit)
- SROB (Spatial Registration Object)
- SSA (Solid State Amplifier)
- SSEU (Second Scatterer Electronic Unit)
- STEU (Snout Translation Electronic Unit)
- TAN (Total Acid Number)
- TCP (Transmission Control Protocol)
- TCR (Treatment Control Room)
- TCU (Treatment Control Unit)
- TPG (Total Pressure Gauge)
- TPM (Treatment Prescription Manager)
- TPR (Treatment Planning Room)
- TPS (Treatment Planning System)
- TR (Treatment Room)
- TRCS (Treatment Control System)
- TRI (Treatment Room Interface)
- TSM (Treatment Session Manager)
- TSS (Therapy Safety System)
- TTCS (Table Top Coordinate System)
- UN (Universal Nozzle)
- UPS (Uninterruptible Power Supply)
- US (Uniform Scanning)
- USG (Uniform Scanning Generator)
- UTEU (Universal Triggering Electronic Unit)
- VC (Variable Collimator)

- VCEU (Variable Collimator Electronic Unit)
- VME (Versamodule Eurocard) (for example, VMEbus cards or VME cards)
- Vreg (Voltage regulation)
- WCR (Water Cooling Room)
- XR (X-Ray)
- XREU (x-Ray Electronic Unit)
- XRPS (x-Ray Power Supply)
- YTEU (Yoke Temperature Electronic Unit)
- YTMEU (Yoke Temperature Measurement Electronic Unit)
- YUM (Ynternet Uplink Monitor)

Appendix H
Glossary of Terms

Absorber

A material or device placed in the beam path to scatter, block, or degrade the beam energy. Whether the absorber blocks some of the beam energy or all of the beam energy depends on the amount of the material used. *See also: Degrader, First Scatterer, Second Scatterer.*

Accelerator

A device that uses electric or magnetic fields to increase the speed (and thus the energy) of charged particles. Includes those subsystems between the ion source injection system and the beginning of the Energy Selection and Beam Transport System. The Treatment Control System (TRCS) interfaces with the accelerator to produce a beam at a current given by the dose rate required to treat each patient. *See also: Energy Selection and Beam Transport System, Treatment Control System.*

Accelerator Control Unit (ACU)

Located in the PSR. Controls devices and systems associated with the accelerator (cyclotron). *See also: Safety Redundant Control Unit, Treatment Control Unit Programmable Logic Controller.*

adaPTinsight

The software program with which the alignment corrections can be calculated that must be applied to the PPS to ensure a correct alignment of the patient in respect to isocenter and the coordinate system of the TR.

Adsorption

The process by which a gas or vapor accumulates on the surface of a solid or liquid.

Ampere (A)

The basic unit of electric current in the International System of Units (SI).

Amplification

The ratio of output magnitude to input magnitude in a device intended to produce an output that is an enlarged reproduction of its input. *See also: Intermediate Power Amplifier, Solid State Amplifier.*

Amplification Factor

The voltage gain of an amplifier with no load on the output. *See also: Intermediate Power Amplifier, Solid State Amplifier.*

Amplitude Distortion

Distortion that is present in an amplifier when the amplitude of the output signal fails to follow exactly any increase or decrease in the amplitude of the input signal. *See also: Intermediate Power Amplifier, Solid State Amplifier.*

Analog Digital Converter (ADC)

An electronic device used in the PTS to convert analog to digital signals.

Anode

A positive electrode (such as a primary or secondary electric cell) toward which the negative ions are drawn. *See also: Anode Power Supply.*

Anode Power Supply

Located in the Power Supply Room (PSR). A component of the radio frequency system that provides power to the final power amplifier. *See also: Intermediate Power Amplifier, Solid State Amplifier, Final Power Amplifier.*

Area Emergency Stop Button

Located throughout the facility. Switches off electrical power to most equipment in the area where the button is located. *See also: Global Emergency Stop Button, Local Emergency Stop Button.*

Beam Current Regulation Electronic Unit (BCREU)

An electronic device that interfaces with the ion source. *See also: Electronic Unit.*

Beam Line Control Unit (BLCU)

A Programmable Logic Controller (PLC) that is the main control unit of the Beam Supply System. The BLCU is basically responsible for control of the following devices: power supplies of the beam line (and extraction) magnets, scanning magnet power supplies, switching cabinets for the switched beam line power supplies, vacuum valves and controller, primary and turbo pumps, insertable devices (Beam Profiles Monitors, Beam Stops, RA Neutron Shutter), etc.

Beam Modifying Device (BMD)

A device placed in or out of the beam in the Energy Selection and Beam Transport System (ESBTS) and nozzle used to effect, define, or modify beam characteristics.

For the ESBTS, they alter the beam energy and define the beam emittance. They include the degrader, divergence limiting collimator, diversion limiting slit, momentum limiting slit, and final collimator.

Beam Profile Monitor (BPM)

A device located along the beam line allowing characterization of the beam without blocking the beam. Each BPM includes two grids of vertical and horizontal conductors on which the beam current is measured. *See also: Energy Selection and Beam Transport System.*

Block

One of the patient specific BMDs. The block is used to shape the transverse extension of the proton beam to the shape of the target. Each block is supported and positioned by a snout. *See also: Beam Modifying Device*

Cathode

The general name for any negative electrode.

Center of Gravity (CoG)

That point in a body or system around which its weight is evenly distributed or balanced and may be assumed to act.

Celsius (C), degree

A unit of measure used to indicate temperature.

Central Management Workstation (CMW)

The computer workstation located in the MCR. *See also: Main Control Room, Treatment Room, Treatment Control Room.*

Choke

An inductor used to impede the flow of pulsating dc or ac by means of self-inductance.

Clockwise (CW)

Rotation in the direction in which the hands of a clock move.

Common Desktop Environment (CDE)

The Hewlett Packard user interface that coexists on Central Management Workstation 1 with the PTS user interface. *See also: Central Management Workstation, Proton Therapy System.*

Configuration Table (CT)

A software tool used to update clinical parameters and system parameters.

Continuous Wave

Proton beam that is provided unmodulated.

Coordinate System (CS)

Depending on the release deployed at your center, the Treatment Control System (TRCS) supports the Fixed Reference System, IEC Table Top coordinate system, Table Top Coordinate System, Gantry Coordinate System, X-ray A Coordinate System, X-ray B Coordinate System, and X-ray C Coordinate System. *See also: Treatment Control System, Fixed Reference System, Table Top Coordinate System, Gantry Coordinate System.*

Counterclockwise (CCW)

Rotation in a direction opposite to that in which the hands of a clock move.

Counter dee

Counter dees are attached to the magnet sector on each side of each dee. Counter dees resonate at the 4th harmonic of the ion orbital frequency. *See also: Accelerator, Dee.*

Crowbar

An electrical shorting device installed on the output of some power supplies. When tripped, a crowbar clamps the output voltage to common. *See also: Radio Frequency, Final Power Amplifier.*

Cubic Feet per Minute at Standard Conditions (scfm)

Referenced to a pre-specified pressure, temperature, and relative humidity. In most cases, SCFM is referenced to 14.7 PSIA, 68°F, and 0% relative humidity. By specifying these parameters, the mass flow of compressed air and gas systems is clearly defined.

Cyclotron / Beam Transport Vault (CBTV)

The shielded room where the accelerator (cyclotron), Energy Selection and Beam Transport System (ESBTS), and static beam line are located. The Switchyard is an area of the CBTV where the static beam line and some of the electronics interfaced by the Treatment Control System (TRCS) are located. *See also: Accelerator.*

Dee

Dees are located in opposite valleys of the accelerator with counter dees attached to the magnet sector on each side of each dee. Dees resonate at the 4th harmonic of the ion orbital frequency. *See also: Accelerator, Counter Dee.*

Degrader

A device located downstream from quadrupole Q2 used to transform the 230-MeV fixed energy beam exiting the cyclotron into a beam having an energy level range of 70 MeV–230 MeV. *See also: Absorber, First Scatterer, Second Scatterer.*

Digital Imaging Device (DID)

A device used to digitally acquire the radiographic images required to verify the position of each patient. The PPVS interfaces with each DID to ensure proper movement. A DID is composed of a fluoroscent layer (converting the X-ray light into a visible light) combined with a CCD (Charge Coupled Device) layer recording the image.

Digital Signal Processor (DSP)

Refers to various techniques for improving the accuracy and reliability of digital communications. An intelligent Integrated Circuit (IC) specialized in processing digital signals. The theory behind DSP is quite complex. Basically though, DSP works by clarifying, or standardizing, the levels or states of a digital signal. A DSP circuit is able to differentiate between human-made signals, which are orderly, and noise, which is inherently chaotic.

Digital Volt Meter (DVM)

A piece of equipment used to measure electrical voltage.

Directly Heated Cathode

A wire, or filament, designed to emit electrons that flow from cathode to plate. This is done by passing a current through the filament; the current heats the filament to the point where electrons are emitted.

Direct Current (DC)

A form of electrical current that flows in one direction.

Dose Monitor

A device located inside the nozzle used to monitor the proton beam delivered to each patient. The system includes two dosimetry pads, located in the two downstream ionization chambers, and related electronics. A dosimetry pad is a circular (diameter 2cm) parallel plate ionization chamber with a 1cm gap. *See also: Ionization Chamber.*

Dose Counter Electronic Unit (DCEU)

An electronic device that interfaces with a dosimetry counter located in each TCR. *See also: Electronic Unit.*

Dosimetry Device

Allows for the calibration of a dose monitor. Dosimetry devices are used to allow correlation of dosimetry data between the beam production into the nozzle, dosimetry device operation, and acquisition of data for visualization. Among the dosimetry devices are the ion chamber with electrometers and water phantoms. *See also: Dose Monitor, Nozzle.*

Dual In-line Package (DIP)

Refers to standard Integrated Circuit (IC) packaged parts. A type of electrical switch used in the PTS. *See also: Proton Therapy System.*

E_p-I_p Curve

The characteristic curve of an electron tube used to graphically depict the relationship between plate voltage (E_p) and plate current (I_p).

Electrically Erasable PROM (EEPROM)

A user-modifiable Read-only Memory (ROM) that can be erased and reprogrammed (written to) repeatedly through the application of higher than normal electrical voltage. Unlike EPROM chips, EEPROMs do not need to be removed from the computer to be modified. However, an EEPROM chip has to be erased and reprogrammed in its entirety, not selectively. It also has a limited life — that is, the number of times it can be reprogrammed is limited to tens or hundreds of thousands of times. In an EEPROM that is frequently reprogrammed while the computer is in use, the life of the EEPROM can be an important design consideration.
A special form of EEPROM is flash memory, which uses normal PC voltages for erasure and reprogramming.

Electromagnetic Field (EMF)

A condition present in the area of electrical devices.

Electromagnetic Interference (EMI)

A condition present in the area of electrical devices.

Electronic Unit (EU)

One of many electronic devices used throughout the PTS. *See also: Proton Therapy System.*

End-of-travel (EOT)

A specified travel limit of a device. *See also: Patient Positioning System.*

Energy Selection and Beam Transport System (ESBTS)

Includes those subsystems located between the degrader wheel and the entrance of each nozzle. The Treatment Control System (TRCS) interfaces with the Energy Selection and Beam Transport System both to degrade the beam up to the energy defined by the range required to treat each patient and to correctly direct the beam to the appropriate nozzle. The ESBTS includes 60º bending sections, straight beam line sections, and Gantry sections. *See also: Beam Profile Monitor, Energy Selection and Beam Transport System, Treatment Control System.*

Erasable PROM (EPROM)

Memory technology used to protect data from being lost even in the event of a power failure.

External Coil Quadrupole (ECQ)

A type of magnet located in the Energy Selection and Beam Transport System. *See also: Energy Selection and Beam Transport System.*

Facility

Includes the equipment as supplied by Ion Beam Applications (IBA), the building as supplied by other subcontractors, and any other equipment installed by the treatment center.

Fahrenheit (F)

A unit of measure used to indicate temperature.

Filter

A selective network of resistors, capacitors, and inductors that offer comparatively little opposition to certain frequencies or to direct current, while blocking or attenuating other frequencies. Alternatively, it could also be a piece of transparent material that selectively absorbs some part of the light spectrum and transmits some other part of the light spectrum.

Final Power Amplifier (FPA)

A component of the radio frequency system located upstream of the accelerator (cyclotron). *See also: Accelerator, Intermediate Power Amplifier.*

First Scatterer (FS)

(Also known as fixed scatterer)

A BMD located downstream of ionization chamber no. 1 (IC1). It allows a combination of six scatterers and/or three range shifters to be inserted or withdrawn from the beam path. The thickness of each of the six scatterers and/or three range shifters is arranged in a binary sequence so that, within limits, any required thickness may be obtained by combination. *See also: Nozzle, Beam Modifying Device.*

Fixed Reference System (FRS)

One of the coordinate systems supported by the Treatment Control System (TRCS). *See also: Treatment Control System, Coordinate System.*

Flux Coil Electronic Unit (FCEU)

An electronic device that interfaces with a flux coil. *See also: Electronic Unit.*

First Scatterer Electronic Unit (FSEU)

Located on the rotating catwalk of the gantry. An electronic device that interfaces with a first scatterer. *See also: Nozzle, Electronic Unit.*

Full-wave Rectifier

A circuit that uses both positive and negative alternations in an alternating current to produce direct current.

Gantry

The rotating mechanical structure that supports the Gantry Beam Transport System, Gantry Accessory Positioning System, and nozzle. The Treatment Control System (TRCS) interfaces with the gantry motor drivers, via the PMS, to orient the gantry at the appropriate angle. *See also: Gantry Beam Transport System, Nozzle, Treatment Control System.*

Gantry Beam Transport System (GTS)

The subsystem of the Beam Transport System located between the rotary feedthrough and the entrance of each nozzle The Gantry Beam Transport System includes the optical beam transport elements that are supported by and move with the gantry structure. *See also: Beam Transport System, Gantry, Nozzle.*

Gantry Coordinate System (GCS)

One of the coordinate systems supported by the Treatment Control System (TRCS). *See also: Treatment Control System, Coordinate System.*

Gantry Correction File

A file that is defined to take into account the displacement of the proton beam as a function of the gantry angle.

Gantry Rolling Floor (GRF)

A non-motorized rolling floor that covers the patient enclosure pit in a GTR.

Global Emergency Stop Button

Located in select areas within the facility. Switches off electrical power to most PTS equipment. *See also: Area Emergency Stop Button, Local Emergency Stop Button.*

Graphical User Interface (GUI)

See also: User Interface.

Half-wave Rectifier

A rectifier using only one-half of each cycle to change ac into pulsating dc.

Hand-Pendant (HP)

A **Hardware hand-pendant** is present in each TR to enable positioning any of the devices that may require positioning.

See also: Patient Positioning Device, Treatment Room, Gantry, Patient Positioning System, Nozzle.

Heating, Ventilation, & Air Conditioning (HVAC)

A generic description of the heating, ventilation, and air conditioning system installed in the PTS. *See also: Proton Therapy System.*

High-Voltage (HV)

Having, carrying, or operating under a high-voltage.

Horizontal Steering Magnet

A small, separate, air cooled, dipole magnet deflecting the beam in the horizontal plane providing minor trajectory adjustment. The amplitude of deflection is relatively small compared to a full-sized dipole magnet. *See also: Trim Coil.*

Input/output (I/O)

An abbreviation used on PTS electrical and computer equipment.

Insulated Gate Bipolar Transistor (IGBT)

An electrical device used in the PTS power supplies. *See also: Power Supply.*

Intermediate Power Amplifier (IMPA)

A component of the radio frequency system located in the Power Supply Room (PSR) upstream of the Final Power Amplifier. *See also: Final Power Amplifier.*

International Standards Organization (ISO)

A worldwide federation of national standards bodies promoting standardization with a view to facilitating the international exchange of goods and services.

Ion Source (IS)

Inserted through the bottom of the cyclotron. Delivers ions to the accelerator (cyclotron) enabling beam production. *See also: Accelerator.*

Ionization

The interaction of radiation (UV, X-ray, etc.) with atoms can result in the loss of electrons by the atom. The atom becomes a charged ion.

Ionization Chamber (IC)

One of the three ionization chambers included in the PTS. *See also: Ionization Chamber no. 1, Ionization Chambers n. 2 & no. 3.*

Ionization Chamber no. 1 (IC1)

Located downstream from the 135°quadrupole magnet on each gantry. Serves as a beam-centering monitor and a reference for the intensity of the unscattered beam. *See also: Ionization Chamber.*

Ionization Chambers no. 2 & no. 3 (IC2 & IC3)

Located downstream from the variable collimator (Y-jaws). Measures the profile and position of the beam in the "X" direction and as a dosimetry monitor for the dosimetry channel. Also used to measure the profile and position of the beam in the "Y" direction. *See also: Ionization Chamber.*

Ionization Chamber Electronic Unit (ICEU)

Located on the rotating catwalk of the gantry. An electronic device that interfaces with an ionization chamber. *See also: Ionization Chamber.*

Ionization Point

The potential required to ionize the gas of a gas-filled tube. Sometimes called firing tube.

Kilovolt (kV)

A unit of electrical power equal to one thousand volts. *See also: Ampere, Kilowatt.*

Kilowatt (kW)

A unit of electrical power equal to one thousand watts. *See also: Ampere, Kilovolt.*

Light Emitting Diode (LED)

A semiconductor diode that emits light when voltage is applied.

Linear

Having an output that varies in direct proportion to the input.

Liquid Crystal Display (LCD)

A device for alphanumeric and graphical displays using a liquid crystal typically sealed between two pieces of glass and polarizers and activated by an external light source.

Local Emergency Stop Button

Located in select areas within the facility. Switches off electrical power to most PTS equipment in the area where the button is located. *See also: Area Emergency Stop Button, Local Emergency Stop Button.*

Lookup Table (LUT)

A lookup table is generated before each irradiation in order to "teach" the BCREU the relationship between the beam current and the arc current.

Low-level RF (LLRF)

A lower level of radio frequency. *See also: Radio Frequency.*

Main Coil Power Supply (MCPS)

Located in the Power Supply Room (PSR). Provides electrical power to the main coils of the accelerator (cyclotron). *See also: Accelerator, Power Supply.*

Main Control Room (MCR)

Where the majority of the accelerator (cyclotron) controls are located. Mainly used for operations, development, and beam line commissioning purposes. *See also: Treatment Control Room.*

Main Control Room Server (MCRS)

The computer server located in the MCR and networked to the Central Management Workstation. *See also: Central Management Workstation, Main Control Room.*

Material Safety Data Sheet (MSDS)

A document that provides identification, composition, hazard, and other information regarding a specific chemical.

Milliampere (mA)

One thousandth of an ampere. *See also: Ampere, Kilovolt, Kilowatt.*

Mega Electron Volts (MeV)

A unit of energy equal to one million (10^6) electron-volts. *See also: Ampere, Kilovolt, Kilowatt, Milliampere.*

Monitor Units (MU)

A unit of measure used to describe radiation levels. *See also: Dosimetry Counter.*

Multipactor Effect

As soon as an RF field is in the RF cavity, some electrons are pulled free from the surfaces of the cavity and are accelerated by the field. If these electrons are accelerated to approximately 100 electron volts and impact another surface of the RF cavity, depending on the secondary electron emission coefficient, they may produce one or more secondary electrons. The RF field may then accelerate those secondary electrons when the polarity of the field changes. This may lead to a positive feedback effect if certain conditions of RF field frequency and the distance between surfaces of the RF cavity are appropriate. If this happens, the electrons bouncing back and forth between the facing surfaces of the RF cavity may carry a current strong enough to prevent the RF from achieving its nominal value. This phenomenon is known as the multipactor effect. Its electrical consequence is a short circuit.

Nozzle

A group of subsystems located between the exit of the Gantry Beam Transport System and the Patient. The Treatment Control System (TRCS) interfaces with the nozzle, via the PMS, to direct the beam at the treatment area and control the irradiation. *See also: Gantry, Gantry Beam Transport System, Treatment Control System.*

Ohm

A unit which measures the resistance to electric current flow. In the meter-kilogram-second system, a resistance (R) of 1 ohm produces a 1 ampere (A) flow of current in a wire with a potential drop of 1 volt (V). The formula governing flow of current in a resistor is known as Ohm's law: V = I * R.

Oil Diffusion Pump

A type of vacuum pump used on the accelerator (cyclotron). *See also: Adsorbtion.*

Original Equipment Manufacturer (OEM)

Describes the equipment manufacturer rather than the equipment supplier.

Patient Positioning Verification System (PPVS)

The PPVS comprises hardware and software (e.g., adaPT*insight*) to ensure the proper positioning and alignment of the tumor to be treated by the beam.

Patient Positioning Device (PPD)

The PPS, gantry, PBS Dedicated snout. *See also: Nozzle, Gantry, Patient Positioning System.*

Patient Positioning System (PPS)

The six axes mechanical structure that supports and positions the patient. The Treatment Control System (TRCS) interfaces with the PPS, via the PMS, to accurately position the patient. *See also: Treatment Control System.*

Peak Current

The maximum current that flows during a complete cycle.

Peak-reverse Voltage

The peak ac voltage that a rectifier tube will withstand in the reverse direction.

Peak Voltage

The maximum value present in a varying or alternating voltage. This may be positive or negative.

Penning Gauge

A type of vacuum gauge used within the PTS. *See also: Pirani gauge.*

Permanent Magnet Quadrupole (PMQ)

A quadrupole magnet located downstream of the gradient corrector, which steers the beam toward the degrader. *See also: Trim Coil.*

Pitch and Roll (P/R)

Two of the six axes on the PPS. *See also: Patient Positioning System.*

Pirani Gauge

A type of vacuum gauge used within the PTS. *See also: Penning gauge.*

Plasma

A plasma is an ionized gas. A state of matter characterized by unbound negative electrons and positive ions that may conduct electrical current. In a plasma, the electrons have been stripped away from the central nucleus. Therefore, a plasma consists of a sea of ions and electrons, is a very good conductor of electricity, and is affected by magnetic fields. Plasma is often called the "fourth state of matter," along with the other states of matter: solids, liquids and gases. Examples of plasma can be found in lightning, the Aurora borealis, fluorescent and neon-type lighting, arc welding, and machines built to study nuclear fusion.

Polyvinyl Chloride (PVC)

Material used for a type of water pipe used throughout the PTS.

Positioning Control Unit (PCU)

Located in the gantry pit. Computer system responsible for controlling the moving devices and systems associated with the Patient Positioning Device. *See also: Patient Positioning Device.*

Power Amplifier (PA)

A component of the RF system located upstream of the accelerator (cyclotron). *See also: Accelerator, Radio Frequency.*

Power Supply (PS)

Provides electrical power to PTS equipment.

Power Supply Room (PSR)

Where the majority of the power supplies, controllers, and Treatment Control System (TRCS) components, which control the equipment, are located. *See also: Power Supply.*

Printed Circuit Board (PCB)

An electrical circuit formed by applying conductive material in fine lines or other shapes to an insulating sheet. A component used in many electrical devices used throughout the PTS. *See also: Electronic Unit.*

Programmable Logic Controller (PLC)

An electronic device used in the PTS. *See also: Accelerator Control Unit.*

Programmable ROM (PROM)

A type of computer memory technology. *See also: Random Access Memory, Read-only Memory.*

Proton

A proton is a subatomic particle found in the nucleus of every atom. The particle has a positive electrical charge, equal and opposite to that of the electron. If isolated, a single proton would have a mass of only 1.673×10^{-27} kilogram, just slightly less than the mass of a neutron.
The number of protons in an element's nucleus is called the atomic number. This number gives each element its unique identity. In the atoms of any particular element, the number of protons in the nuclei is always the same. An atom of simple hydrogen has a nucleus consisting of a single proton all by itself. The nuclei of all other elements nearly always contain neutrons in addition to protons.
Protons need not be confined to the nuclei of atoms. When protons are found outside atomic nuclei, they acquire fascinating, bizarre, and potentially dangerous properties, similar to those of neutrons in similar circumstances. But protons have an additional property. Because they carry an electric charge, they can be accelerated by electric and/or magnetic fields. High-speed protons, and atomic nuclei containing them, are emitted in large numbers during solar flares. The particles are accelerated by the earth's magnetic field, causing ionospheric disturbances known as geomagnetic storms.

Proton Therapy Equipment (PTE)

Any component of the PTS. *See also: Proton Therapy System.*

Proton Therapy System (PTS)

The equipment provided by IBA that aligns patients, and produces and delivers proton beam. This system includes all equipment within the treatment facility, the Treatment Control System (TRCS), and Therapy Safety System. *See also: Treatment Control System, Therapy Safety System.*

Pulse Width Modulation (PWM)

The Accelerator Operator uses Pulse Width Modulation to verify the duty cycle of a train of pulses.

Quiescence

The operating condition of a circuit when no input signal is being applied to the circuit.

Radiation Therapy Technologist (RTT)

A clinical worker of the treatment center.

Radio Frequency (RF)

Any frequency between normally audible sound waves and the infrared light portion of the spectrum, lying between ~10 kilohertz and ~one million (10^6) megahertz.

Random Access Memory (RAM)

A type of computer memory technology. *See also: Programmable ROM, Read-only Memory.*

Range Compensator

A patient-specific item attached to the block when required and used to modify the beam range as required by the treatment plan for the patient. A block of range shifting material, shaped on one face (normally the upstream face) in such a way that the distal end of the proton field in the patient takes the shape of the distal end of the target volume. . The range compensator is supported and positioned by the PBS Dedicated snout and is normally located downstream of the block. *See also: Nozzle, Snout.*

Range Verifier

Located inside the jaws of the variable collimator (Y-jaws) and inserted into the beam path when needed. Only used to detect large discrepancies in beam range or range modulation. *See also: Nozzle, Ionization Chamber.*

Range Verifier Electronic Unit (RVEU)

Located on the rotating catwalk of the gantry. An electronic device that interfaces with a range verifier and integrates the current from 29 brass plates of the range verifier. *See also: Electronic Unit.*

Read-only Memory (ROM)

A type of computer memory. *See also: Programmable ROM, Random Access Memory.*

Rectifier

A device, which, by its construction characteristics, converts alternating current into a pulsating direct current.

Regulator

The section in a power supply that maintains the output of the power supply at a constant level even if experiencing changes in load current or input line voltage.

Revolutions per Minute (rpm)

A metric used to track the number of times per minute an object makes a complete revolution.

Ripple Frequency

The frequency of the ripple current. In a full-wave rectifier, it is twice the input line frequency.

Ripple Voltage

The alternating component of unidirectional voltage. The alternating component is small compared to the direct component.

Safety Redundant Control Unit (SRCU)

There is one SRCU dedicated to the cyclotron, the ESS beam stop, and the CBTV, and one SRCU for each TR. Controls devices and systems associated with the safety system. *See also: Accelerator Control Unit, Treatment Control Unit.*

Saturation

The point in a tube where a further increase in plate voltage no longer produces an increase in plate current. At this point, the upper limit of the conduction capabilities of the tube has been reached.

Screen Grid

A grid placed between a control grid and the plate. Usually maintained at a positive potential.

Segment

A segment is a single patient irradiation, corresponding to a unique equipment configuration, including a specified dose, which will be delivered generally without interruption, with no motion of any Patient Positioning Device (PPD).

Setpoint (SP)

Value entered on UI screens of the TRCS. The entered value correlates to a voltage, current, or distance. *See also: Treatment Control System.*

Solid State Amplifier (SSA)

Located in the Power Supply Room (PSR) downstream from the low-level RF 1W amplifier. The pre-driver amplifier that is part of the RF system. *See also: Accelerator, Low-level RF, Final Power Amplifier, Intermediate Power Amplifier.*

Space Charge

An electrical charge distributed throughout a volume or space.

Spread-out Bragg Peak (SOBP)

Indicates the area where the radiation dose is delivered to a target.

Table Top Coordinate System (TTCS)

One of the coordinate systems supported by the Treatment Control System (TRCS). *See also: Treatment Control System, Coordinate System.*

Tetrode Tube

A four-electrode electron tube containing a plate, cathode, control grid, and screen grid.

Therapy Safety System (TSS)

Ensures the safety of any people (patients and/or facility personnel) by monitoring all facility equipment (for example, proton beam, etc.) that may cause injury to any people (patients and/or facility personnel) and has the primary function of preventing injury to any people (patients and/or facility personnel). *See also: Treatment Control System.*

Thermionic Emission

Emission of electrons from a solid body as a result of elevated temperature.

Transconductance

A measure of the change in plate current to a change in grid voltage with the plate voltage held constant. Transconductance (gm) is usually expressed in microhms or milliohms.

Mathematically, gm = $\frac{I_p}{E_g}$

Transit Time

The time an electron takes to cross the distance between the cathode and the plate.

Treatment Control Room (TCR)

Located next to each TR and used by the Radiation Therapy Technologist (RTT) to control and monitor patient treatments or by the Medical Physicist to perform Dose Monitor Calibrations. *See also: Treatment Room, Radiation Therapy Technologist (RTT).*

Treatment Control System (TRCS)

This system includes high level software that coordinates and supervises the complete treatment session, using the services offered by the Beam Management System (BMS) and the PMS. The clinical workflow is implemented at this level.

Treatment Control Unit (TCU)

Controls devices and systems associated with the Treatment Control System (TRCS). *See also: Accelerator Control Unit, Safety Redundant Control Unit, Treatment Control System, Therapy Safety System.*

Treatment Planning Room (TPR)

The room where the treatment plan is compiled.

Treatment Planning System (TPS)

The system that enables you to compile treatment plans and to download prescription data from the TPS database into the PTS database.

Treatment Room (TR)

Where a patient receives proton therapy treatment The TR is used mainly to control and monitor patient positioning before treatment. TRs may or may not have a gantry. *See also: Treatment Control Room.*

Trim Coil

A coil embedded in a dipole magnet main coil to provide minor adjustments to its magnetic field when used in a pair (or more) of identical magnets driven in series by the same power supply. *See also: Horizontal Steering Magnet.*

Uninterruptible Power Supply (UPS)

Located in the Power Supply Room (PSR). A power supply temporarily used when standard power is lost. *See also: Power Supply.*

User Interface (UI)

The graphical representation of the PTS software that allows a user to manipulate the PTS equipment.

Variable Collimator (VC)

One of the BMDs located inside the nozzle downstream from the retractable X-ray tube. The VC provides the ability to limit the transversal size of the proton beam by using a pair of symmetric jaws in the X direction and another pair of symmetric jaws in Y direction. The jaws are used to circumscribe the beam field in order to limit the neutron field received by a patient. *See also: Nozzle, Gantry, Range Verifier.*

Variable Collimator Electronic Unit (VCEU)

Located on the rotating catwalk of the gantry. An electronic device that interfaces with a variable collimator. *See also: Electronic Unit.*

VersaModule Eurocard (VME)

(for example, VMEbus cards or VME cards).

A VersaModule Eurocard is a bus or computer data path device that can be integrated into different hardware systems.

Vertical Steering Magnet

A small, separate dipole magnet deflecting the beam in the vertical plane providing minor trajectory adjustment. The amplitude of deflection is relatively small compared to a full-sized dipole magnet. *See also: Horizontal Steering Magnet, Trim Coil.*

Volt (V)

The standard unit of potential difference and electromotive force in the International System of Units (SI).

Voltage Gain

Ratio of voltage across a specified load.

Voltage Regulation (Vreg)

Voltage regulation is achieved when the output voltage reaches a stable value determined from input and feedback parameters.

Watt (W)

A unit of electrical energy equal to 1 joule per second.

X-ray (XR)

Radiation of extremely short wavelength. Typically between 0.1nm and 1nm.

X-ray Electronic Unit (XREU)

Located on the rotating catwalk of the gantry. An electronic device that interfaces with the motion actuator of an x-ray tube. *See also: Electronic Unit.*

X-ray Power Supply (XRPS)

Provides electrical power to X-ray tubes. Sometimes also called the "X-ray generator".
See also: Power Supply.

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