Commissioning Guide

The purpose of this commissioning guide is to describe the process of configuring the eRT application for clinical use. This requires modeling the actual electron treatment machines in terms of physical geometry (e.g. SAD, rotation directions and limitations, applicator sizes/names), beam parameters (e.g. treatment energies, energy spectrum, beam flatness), and other facility information/preferences (e.g. CT Curves, location/shipping address, planning defaults). As the beam modeling/commissioning steps are critical to ensuring the safety and quality of patient treatments, it is also essential that the qualified medical physicist (QMP) responsible for the facility has a sufficient understanding of the dose calculation technique used by the eRT application. As such, this guide also serves to provide this information.

Site / Facility Modeling

The first step in preparing eRT for clinical use will be to gather the data needed to create a model of the local treatment facility. This model will include the follow information:

decimal eRT Site Data Model

The following section describes the hierarchy of data used to define an Organization within the decimal eRT application.

There are three main levels for how decimal eRT stores its organization configuration data:

1. **Organization**
    1. A legal entity that provides electron radiation treatments to patient. An Organization may be a network / group or individual and the data stored at this level contains preferences and basic information that applies broadly to the entity.
    2. This is where preferences that improve organization wide standardization are stored, such as dose map colors, treatment plan report settings, and material properties.
    3. An Organization will contain 1 or more Sites.
2. **Site(s)**
    1. A site is an individual treatment facility. The site stores the shipping address, CT curves, dicom export/import settings, QA options, and a list of physicians and treatment (disease) sites.
    2. A Site contains one or more Treatment Machines.
3. **Treatment Machine**
    1. A detailed model of an electron therapy treatment machine. The majority of the configuration data, including all commissioning data, is stored within a treatment machine.
    2. The treatment machine defines all physical machine geometry, as well as the electronic machine model (e.g. name, accessory IDs).
    3. The treatment machine also stores the list of available electron treatment energies and the commissioning data necessary to ensure accurate dose calculations are achieved.

Hierarchy

A single Organization can have one or multiple [1 - n] Sites (locations where treatments occur), and a Site can have one or multiple [1 - n] Treatment Machines. This relationship is detailed in the table below:

Organization Data Model			
[1]	**Organization**		
	- Organization Name		
	- High Level Preferences (report settings, material properties, dose colors)		
	[1 - n]	**Site**	
		- Facility metadata (name, shipping address)	
		- Site-wide data (CT curves, dicom export/import options, list of physicians & disease sites)	
		[1 - n]	**Treatment Machine**
			- Machine metadata (name, serial number, description)
			- Machine Geometry (SAD, rotation directions, position references, tolerance tables)
			- Electron Applicator List (sizes, jaw positions, IDs)
			- Commissioning Data List (one entry per treatment energy)
			- - Nominal Energy
			- - Beam model parameters (virtual source, scattering moment)
			- - PDDs (per field size and SSD)
			- - Lateral profile data (per field size)
			- - Photon lateral profile data (per field size)

Dose Calculation Engine

decimal eRT dose calculations follow the pencil beam redefinition algorithm as described in Pencil-beam redefinition algorithm for electron dose distributions that allows for electron dose calculations using beam limiting devices. It is recommended that users familiarize themselves with the PBRA as described in the above reference as it provides critical information regarding the equations used in the dose engine, how tissue heterogeneities are handled, and the value ranges for the modeling parameters. A description of the model accuracy and a set of calculation inputs and expected outputs can be found in the Acceptance Testing section of this user guide.

Commissioning Data

As a semi-analytical calculation model, the PBRA requires only simple measurement data results in order to fully commissioning the system. Th