



Proton Therapy Device Manager

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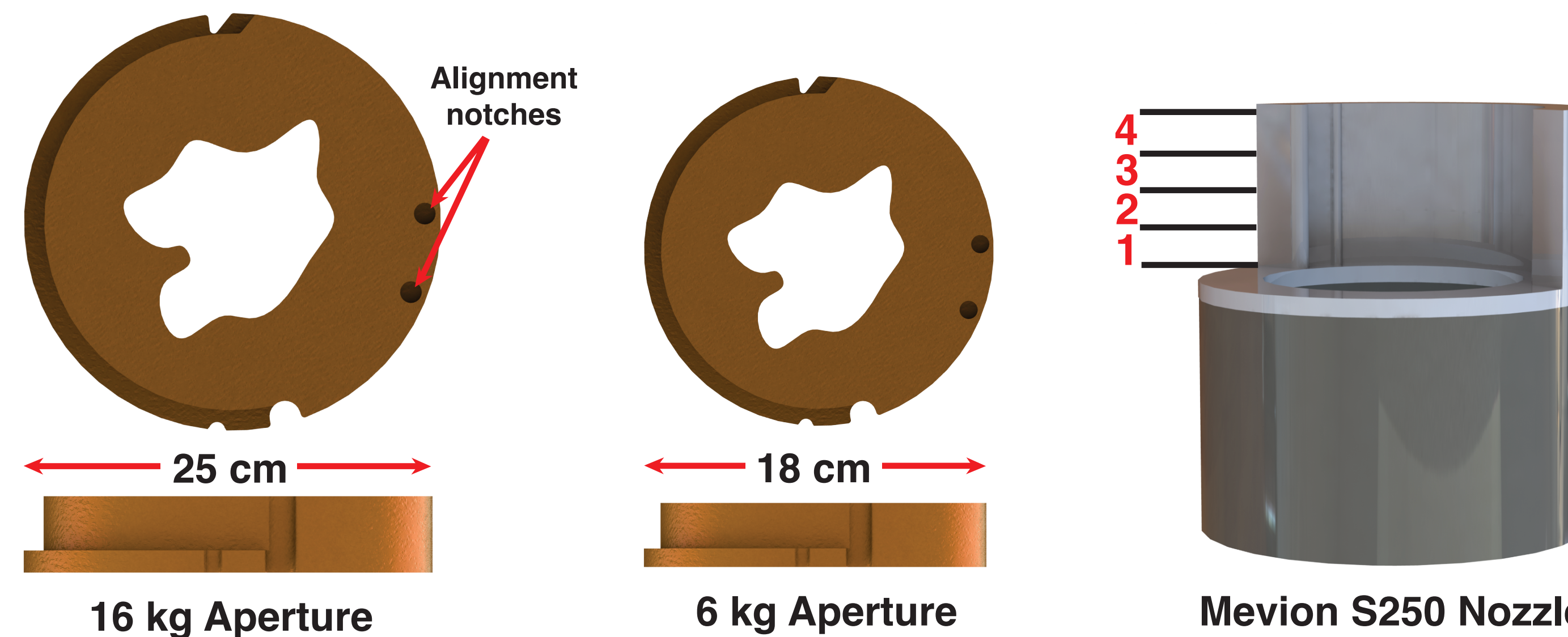
Introduction

Proton therapy is a form of radiation treatment that allows physicians to precisely deliver a high dose of radiation to target specific tumors. This precise form of radiation is due to custom machined brass apertures that are loaded in the nozzle of the Mevion S250 proton therapy system. The apertures are designed to guide the radiation to the affected area while blocking radiation from hitting healthy tissue.

Dot Decimal, a Florida based radiation therapy company, is the manufacturer of these patient specific apertures. The brass aperture cut-outs are designed according to the Treatment Plan parameters designated by hospital personnel and then transmitted to the Dot Decimal manufacturing center for delivery back to the hospital. Each aperture can weigh up to 16 kg.

Apertures & Nozzle

An aperture is a patient-specific radiation therapy product. The cut-out in the center of the aperture is determined by the geometry and location of the patient's tumor. The automated system must accommodate for a 25 cm and an 18 cm aperture. Four apertures will be loaded and stacked into the nozzle of the Mevion S250.



Project Scope

Provide proof of concept by designing and building a 1:4 scale model of the automated system and provide a cost estimate of the system.

Future Implementations

Mechanical:

1. Materials selection
2. Motor selection
3. Optimize tool design
4. Failure mode effects analysis
5. Finite element analysis
6. Determine lifecycles for the mechanisms

Software:

1. Barcode scanning system
2. Program automated system

Motivation

Dot Decimal has determined the time it takes to complete the loading process for the apertures is too lengthy and therefore undesirable for the patient's proton therapy experience. Optimizing the procedure will:

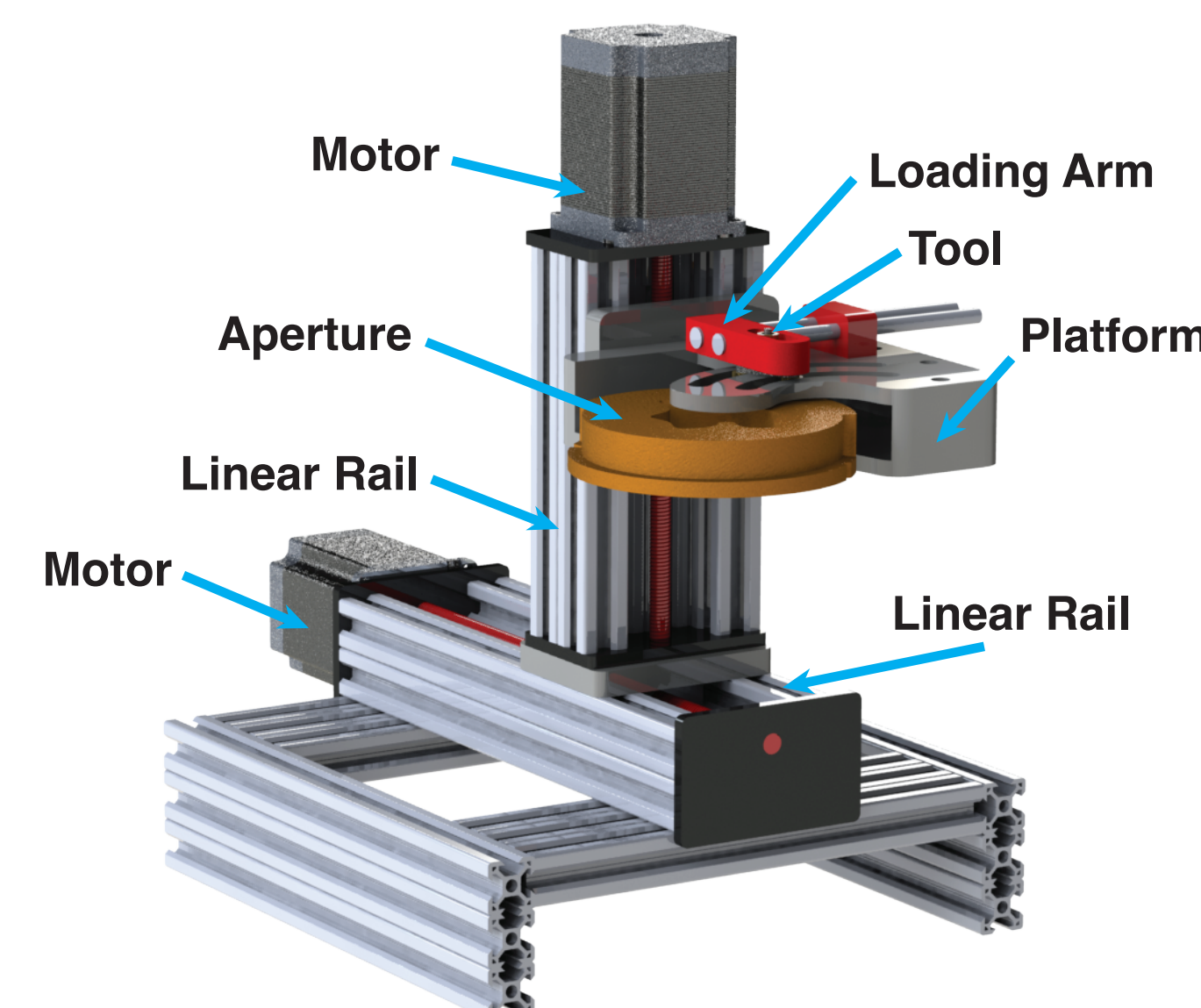
- Allow more patients to be treated each year
- Improve therapy experience for patient
- Increase Dot Decimal's yearly revenue
- Decrease patient treatment time
- Reduce physical effort of technician

Needs Statement

Develop an automated device that safely loads and unloads apertures from the nozzle of the Mevion S250 proton therapy system.

Design Concept

The machine will use a linear rail system to dock the platform next to the nozzle. A loading arm will guide the aperture along a slot mechanism into the nozzle.



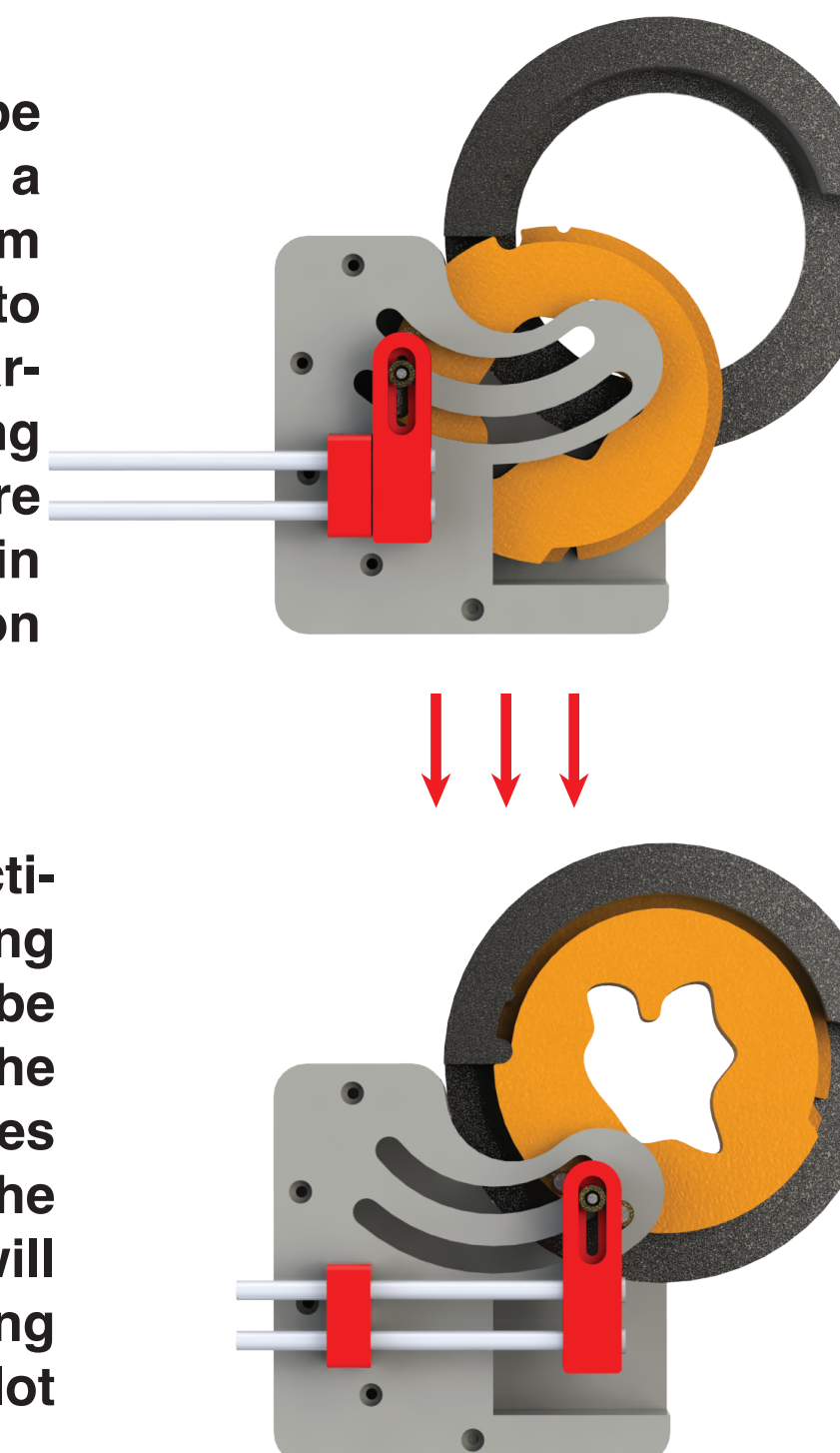
Loading Process

Step 1:

The platform will be guided along a linear rail system and docked next to the nozzle. A barcode scanning system will insure the aperture is in the correct location in the nozzle.

Step 2:

A motor will activate the loading arm. A tool will be inserted into the alignment notches on the aperture. The loading arm will guide the tool along the functional slot mechanism.



Summary

An automation system is being developed by senior design team 14 at Florida State University, in conjunction with Dot Decimal, in order to improve the process of proton therapy treatment. The ideal system will be faster and safer than current methods. By optimizing the loading and unloading procedure more patients can be treated each year, patients will have an improved proton therapy experience, technician effort is reduced, and Dot Decimal will increase their yearly revenue by manufacturing larger quantities of the patient-specific apertures.

The team plans on providing proof of concept by designing and building a 1:4 scale model of the automation system and a cost estimate of the system by April 2016.