

Project Design Specification—Stereotactic Frame

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Function:

The purpose of the non-invasive stereotactic frame is to hold the canine's head in a fixed position for repeated dosage of intensity modulated radiation therapy (IMRT). The positioning for each dog should be reproducible for each treatment. The device should be reusable and adjustable for different species of dogs with varying body size. The materials used should be able to withstand and not interfere with the radiation therapy procedures.

Client Requirements:

- The frame should be reusable for all dogs
- The device should be non-invasive
- Adjustable parts that allow the canines to be moved over a 10° range
- Reproducible positioning for each dog for every treatment
- The device should not interfere with the radiation treatment
- The device should be cost efficient

Design Requirements:

- 1) Physical and Operational Characteristics
 - a) *Performance requirements* – The device should hold the subjects in a fixed position during IMRT treatment for up to ten uses a day.
 - b) *Safety* – The device should not hurt the canine during IMRT. Also, there should be no interactions between the radiation and the prototype's material.
 - c) *Accuracy and Reliability* – The device should be able to repeatedly position each canine to within 0.5° in pitch and yaw for every treatment.
 - d) *Life in Service* – The device will be used for several years, with multiple uses each day.
 - e) *Shelf Life* – The device should be able to withstand everyday laboratory and radiation therapy environment.
 - f) *Operating Environment* – The device will be sterilized after each use and it should be able to withstand the IMRT without degrading or interfering with the radiation treatment.
 - g) *Ergonomics* – The device should not interfere with regular IMRT procedures.
 - h) *Size* – The device should be able to fit inside the tomotherapy machine, which has a diameter of .838 m
 - i) *Weight* – The device should be as lightweight as possible.
 - j) *Materials* – The device should be constructed using cost-efficient material. The material should have a low atomic number, preferably carbon fiber. The materials should be able to withstand IMRT and follow animal care policies.
 - k) *Aesthetics* – The device should not affect the radiation procedure.

2) Production Characteristics

- a) *Quantity* – The goal is to produce two devices, one for the CT machine and one for the tomotherapy machine. However, it should be designed with the intent of mass production in the future.
- b) *Target Product Cost* – The device should cost under \$1,500

3) Miscellaneous

- a) *Standards and Specifications* – The device should not harm the canine during the IMRT. It should also be animal friendly.
- b) *Customer* – This device will be used by the veterinary community when treating canines, and possibly felines as well, who have tumors in their head
- c) *Patient-related concerns* – The device should be non-invasive and should not harm the canine's well-being.
- d) *Competition* – Other stereotactic frames currently exist. However, they are used with smaller animals and are invasive and non-reusable.