

Mouse Restraint Device

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Problem Statement:

The Small Animals Imaging Lab located in the Wisconsin Institutes for Medical Research is in need of a solid, adjustable device that will restrain mice during Positron Emission Tomography and Computerized Tomography (PET/CT) scans. These scans are used to pinpoint cancerous growths within the animal prior to treatment. The device must restrain the animal's extremities to prevent movement and must include a quantitative analysis device to replicate the animal's exact anatomical position. The device should improve efficiency for animal restraint compared to the current cardboard restraint device.

Client Requirements:

- Adjustable device to fit mice and accommodate 20-50 grams
- Device should be 5"- 6" in length to fit a mouse
- Device should not interfere with nose cone
- Device should include measurement device to replicate exact position of mouse
- Material should not interfere with imaging from PET/CT machine and should not include cloth
- Method of restraining animal should take no longer than 10 minutes
- Device should prevent the animal from leaving the bed in the event that it wakes up
- Must attach to carbon fiber bed

Design Restraints:

1. Physical and Operational Requirements

- Performance requirements:* The device should accommodate mice ranging in size from 5"-6" in length and 20-50 grams. The mouse should be restrained in less than 10 minutes. 3-10 mice will be scanned several times over a period of roughly two weeks. 100 animals per year are scanned by the PET/CT machines. The device should be securely attached to the bed.
- Safety:* The device should conform to RARC and lab protocol. No animals should be harmed by the device. Absorbent material should not be used as to prevent retention of radioactive substances.
- Accuracy and Reliability:* The device should allow for the exact alignment of the anatomical position of each mouse over the duration of the study within 1 mm of the original position of the animal. Lasers are used to help align the position of the animal once it is attached to the bed.
- Life in Service:* The device will be used for approximately 400 hours each year.
- Shelf life:* If sliders are incorporated in the design, lubrication of the device may be necessary. Depending on the type of attachment, attachment material may need to be replaced once worn.
- Operating Environment:* The device will be used in the research laboratory. There may be corrosion of materials due to lubrication of the device and radioactive liquids.

- g. *Ergonomics*: The device should be attached with minimal effort in a matter of 5-10 minutes. The size settings should not cause eye strain. Animal position should be easy to replicate.
- h. *Size*: The device should be no more than 0.5" thick or 3" wide. The length should not exceed 12".
- i. *Weight*: The device weight should be less than one pound.
- j. *Materials*: The materials used in the device should not interfere with the imaging procedures. Cloth should not be used. Carbon fiber would be the preferred material.
- k. *Aesthetics, Appearance, and Finish*: The device should be neutral in color, smooth, and have no sharp edges.

2. Product Characteristics

- a. *Quantity*: The client requires one device.
- b. *Target Product Cost*: \$100

3. Miscellaneous

- a. *Standards and Specifications*: The device must comply with RARC and lab protocol for animal safety.
- b. *Customer*: The device will be used in the Small Animal Imaging Lab at UW-Madison for PET/CT scans.
- c. *Patient (animal)-related concerns*: The device must be wiped down between animals.
- d. *Competition*: Due to the fact that the device is custom to this specific research lab, there is no foreseen competition.