An open source imaging/therapy platform for small animals

Jay Sekhon (Leader/Communicator)
Jon Seaton (BSAC/BWIG)

Client: Robert Jeraj & Rock Mackie
Advisor: Dr. Thomas Yen

Overview

- Background
  - Previous Work & Plan
  - Multi-Leaf Collimators
- Design Matrix
- MLC Design
- Prototype Work
- Timeline & Future Work

Background-Previous Wor[k]

- Project initiated in January 2010
- Open Source Concept & Morgridge Institute
- System Requirements & Specs: Spring 2010
- OSMD Business Plan: Summer 2010
- Solidworks Model & Vendors: Fall 2010

Background-Project Pla

- Combination of CT, PET, and RT
- User-defined implementation
- Online database of parts
- Can order components and DIY
- Order pre-built from Morgridge
- Modularity

Background-Multi-Leaf Collimators

- Major component of radiation therapy system
- Composed of interlocking "leaves"
- Leaves connected to actuators
- Each leaf is independently open or closed
- Specific beam shaping
- Rapid response
- Similar type of technology used for TomoTherapy

Design Matrix

	Flexinol	Solenoid	DC Motor
Size (30)	**30**	20	15
Speed (25)	20	**25**	20
Stoke (20)	15	10	**20**
Durability (15)	10	**15**	13
Cost (10)	**10**	5	5
Total (100)	**85**	75	73

Benefits of Design

- Up to 90% excess radiation dose reduction compared to current models based on geometry
- Ability for fine positioning and control (micron range)
- Low cost (some models for humans cost up to $85,000)

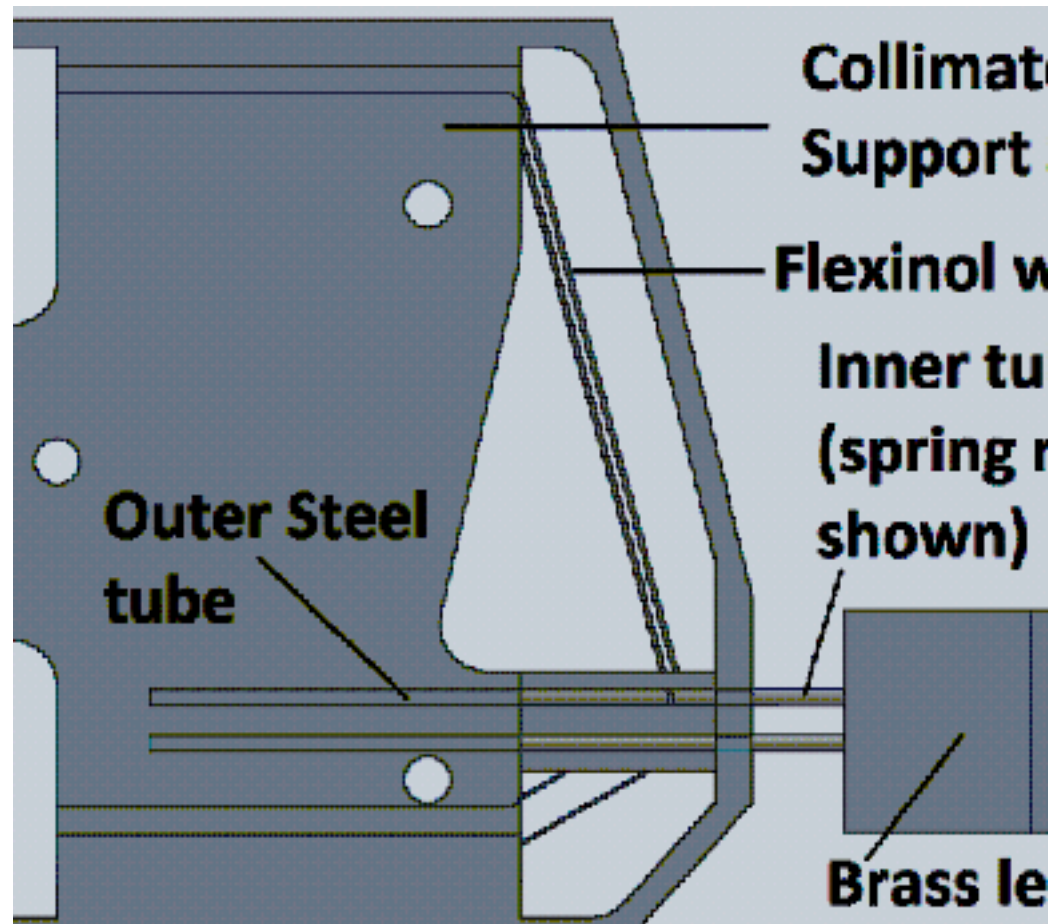# Multi-Leaf Collimator Design Specifications

- Leaves are 0.5 mm thick
- Collimation area is 2.0 x 1.0 cm
- Each leaf must move a minimum of 1.0 cm
- Minimum speed should be 1.0 cm/s
- Desired speed is around 10 cm/s
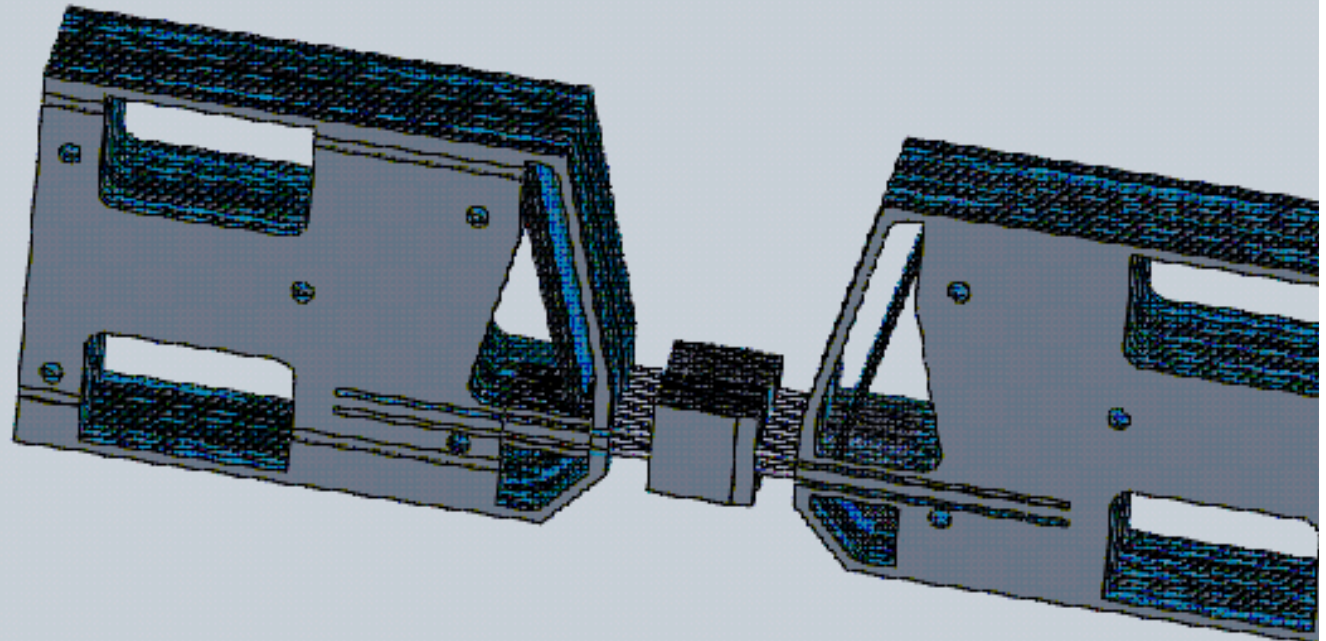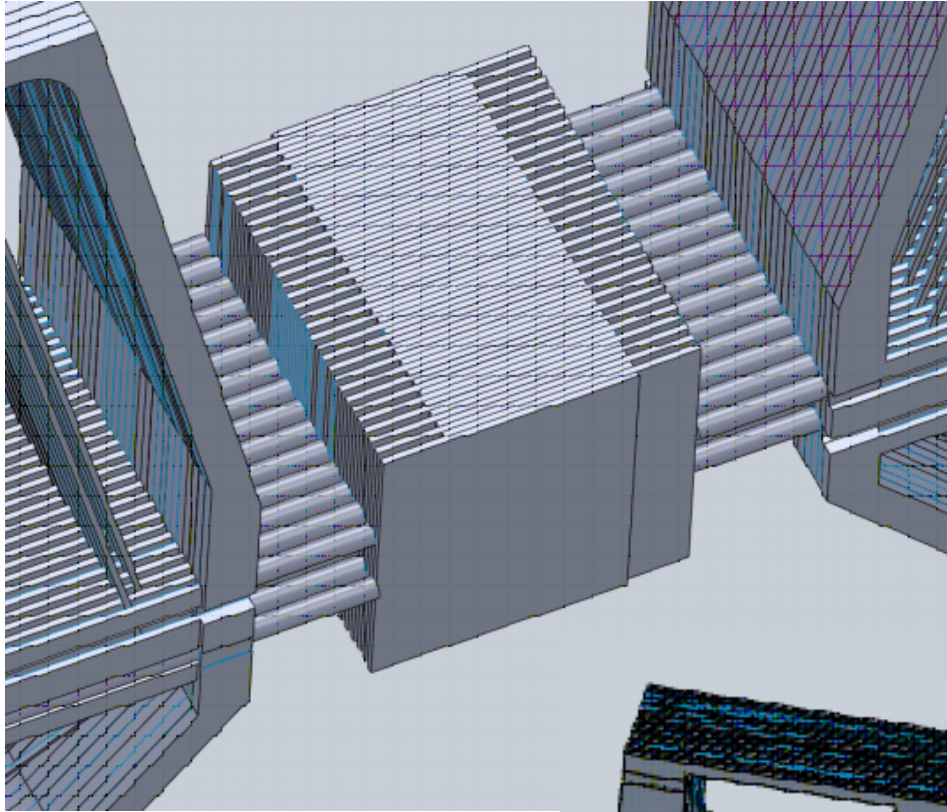- 99% of x-rays at 250 keV should be attenuated
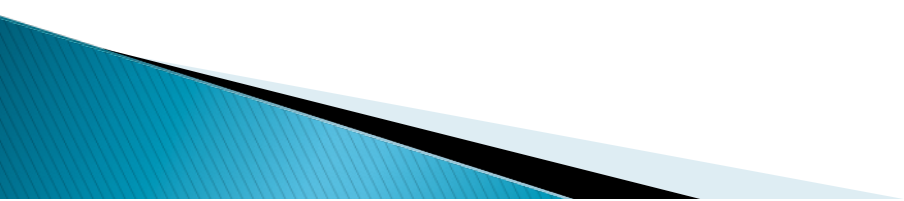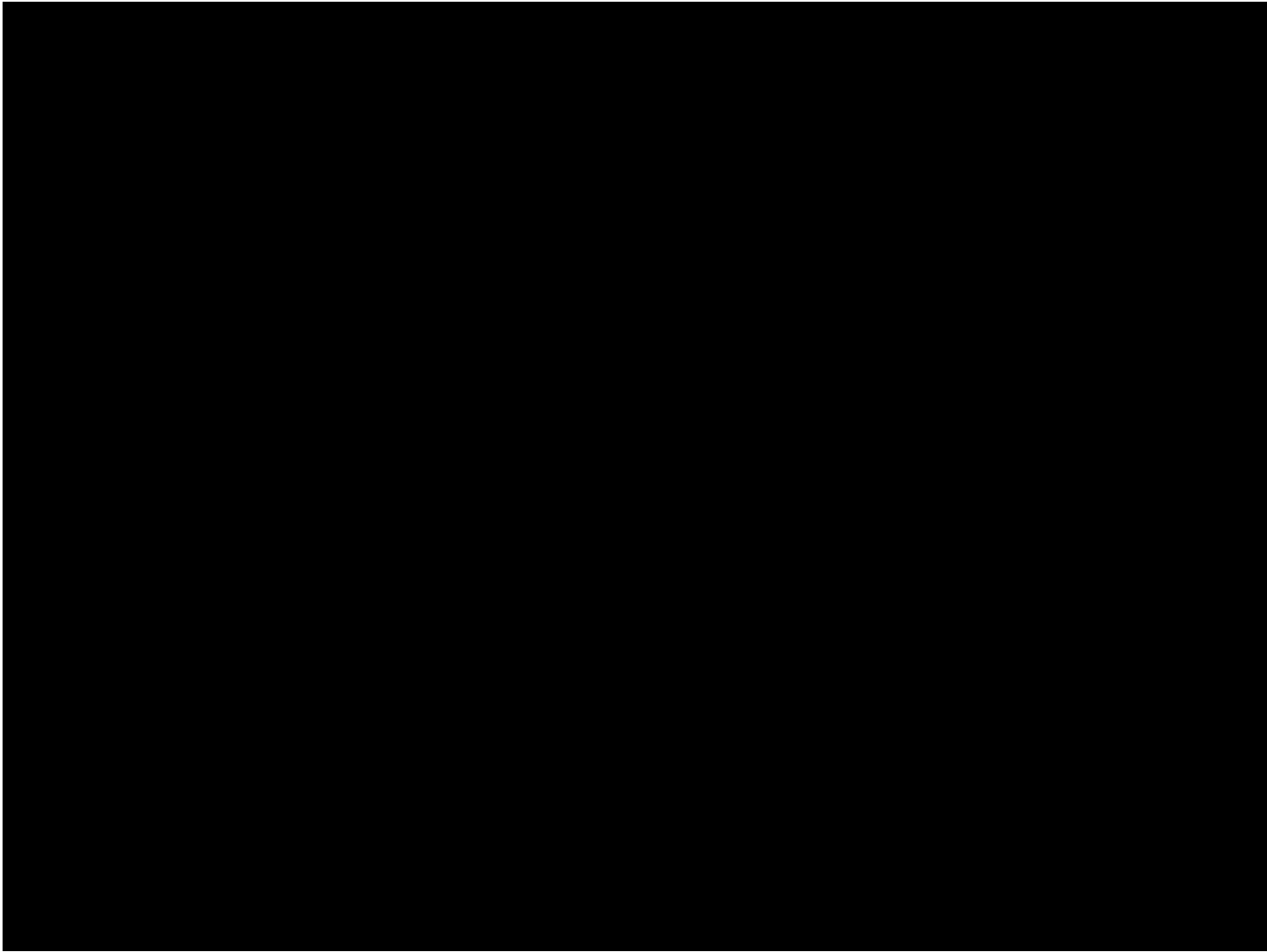
Multi-Leaf Collimator Design

- Use of Flexinol wire as actuator
- Small steel tube inside a larger diameter tube
- Brass for leaves
- Spring used to push leaves closed
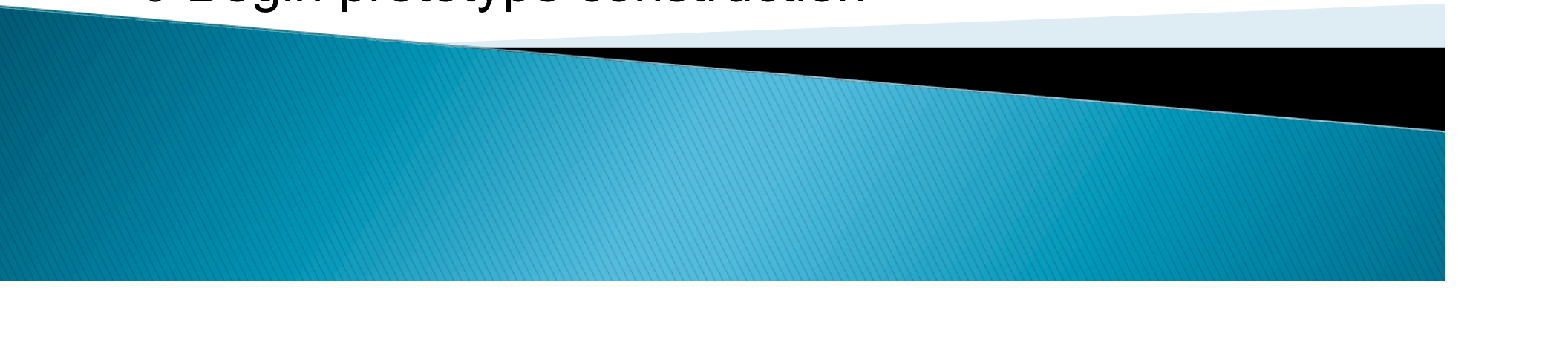- Support structure rapid prototyped
- Fan cooling

Multi-Leaf Collimator Design

Prototype

Timeline & Future Wor

- By the end of the semester...
  - o Complete multi-leaf design
  - o Demonstrate competency for collimation
  - o Stress test
  - o Build website for OSMD conference
- Over summer...
  - o Potentially attend AAPM conference
  - o Continue finding vendors for system prototype
- Next fall...
  - o Host OSMD conference in Madison
  - o Begin prototype construction

Acknowledgements & Question