

Neck Extender

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Abstract

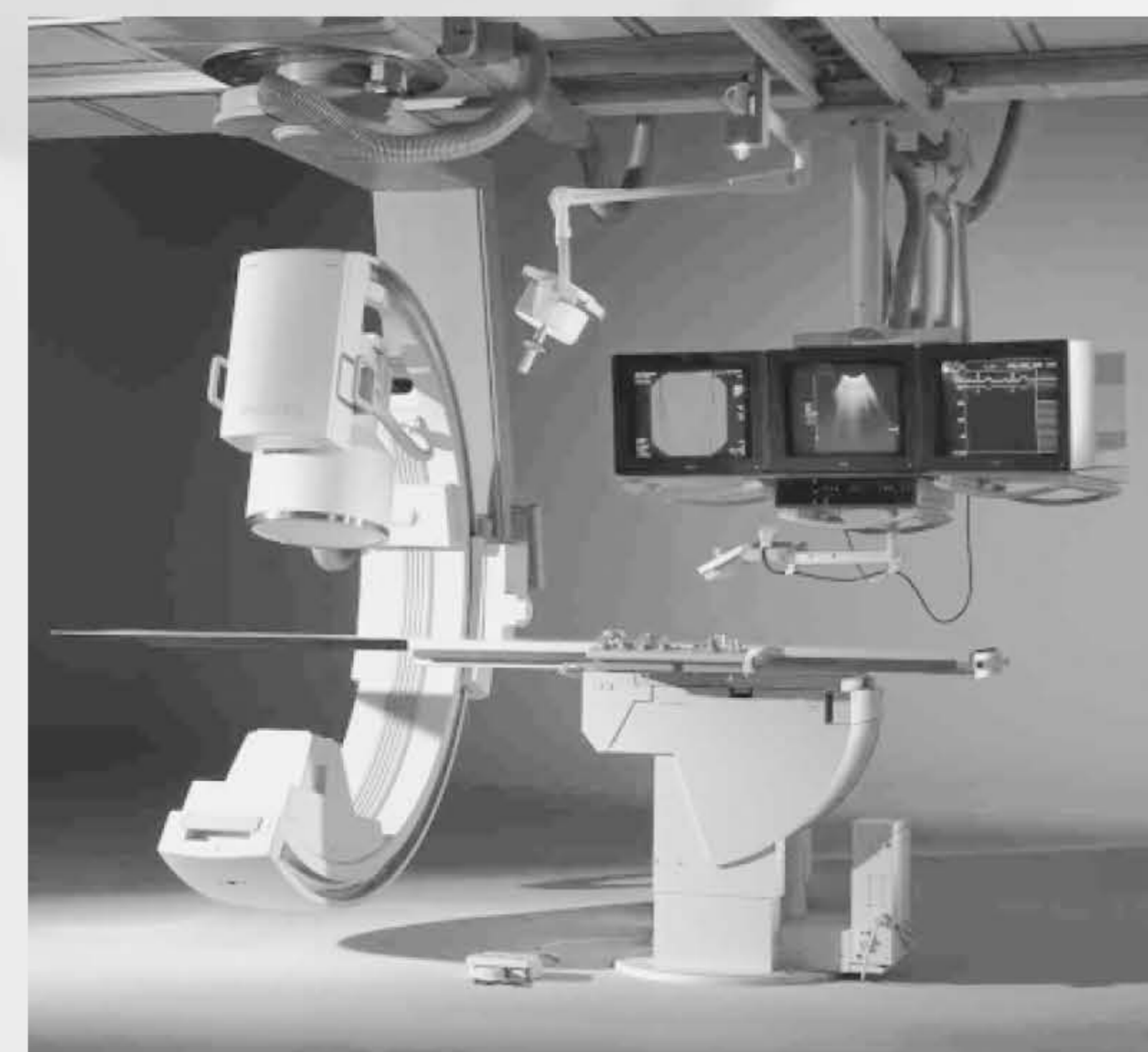
A device was developed that flexes and extends the head about the neck under a fluoroscope. It will be used to examine patients with neck injuries. A prototype was developed to provide a mechanical reference for a future, refined device.

Problem Statement

Current methods for observing a patient's neck under a fluoroscope are inefficient and dangerous. Technicians must move the patient's head in various positions with their hands while the examination is taking place. This is time consuming and dangerous to both the patient and technician. A device was required to provide flexion and extension of the head about the neck without obstructing x-ray imaging.

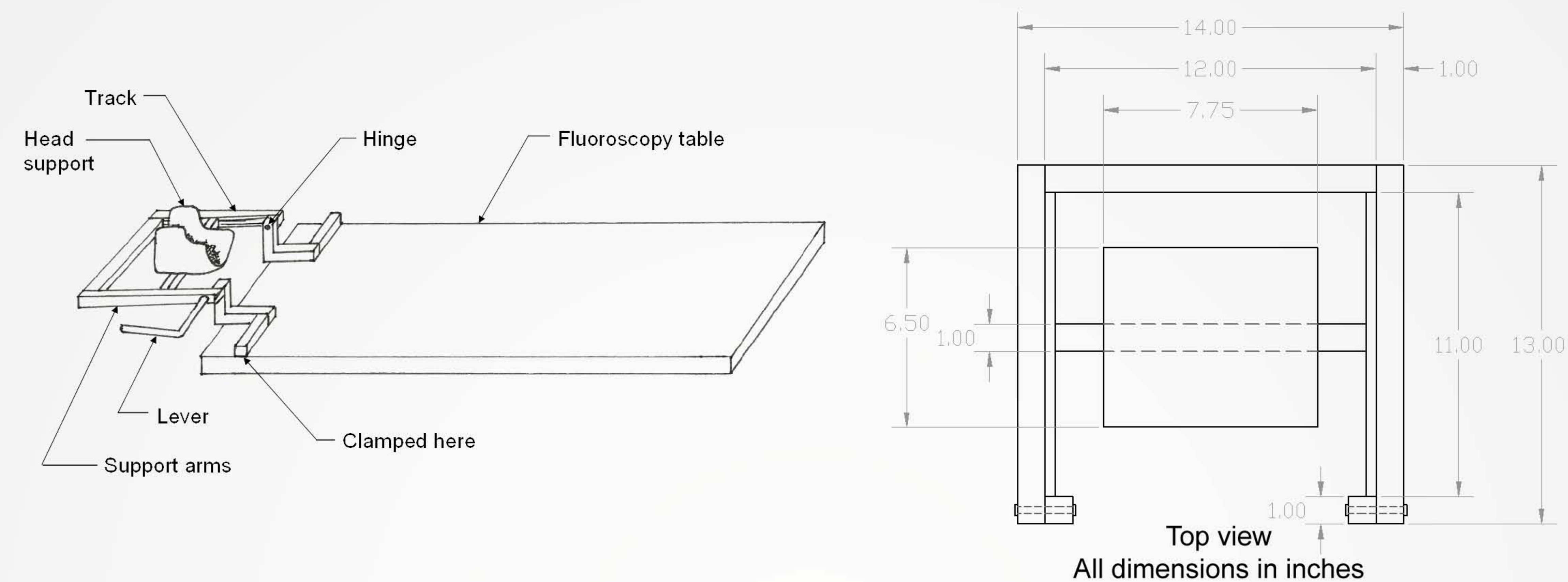
Background

Fluoroscopy provides real-time x-ray imaging [1]. In this application, fluoroscopy is used for the diagnosis of neck or spinal fractures, which may be undetectable by other methods. A typical C-arm fluoroscope is depicted below:



C-arm fluoroscope [2]

Final Design



Design Components

Head Support

- GE Healthcare metal-free carbon fiber axial head-holder, part # E8004TK.
- Donated by GE.
- Max load: 75 lbs.



Head support before modification

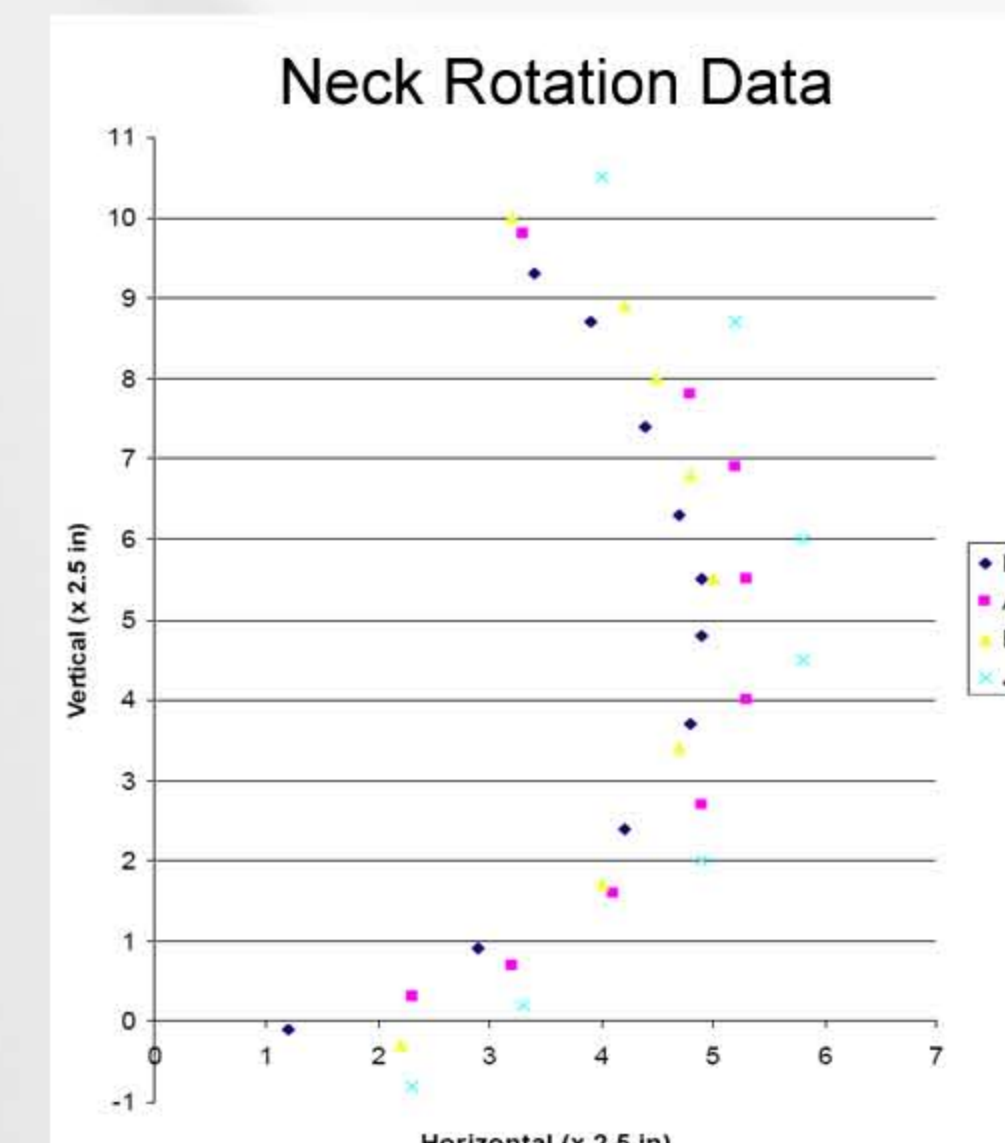
Support Arms & Track

Support Arms

- Machined from McMaster Carr part # 8660K43.
- Material: PVC, type 1.

Track

- Track material: steel; Wheel material: plastic.
- Necessary since neck rotation is not circular:



Neck rotation data collection

Power Transmission

- Prototype requires manual power.
- Future and ideal power source is a gear motor providing 1 RPM output and > 100 in-lbs of torque.
- Future design would utilize a worm gear assembly to allow a motor to be positioned behind or underneath the table.

Hinge and Table Connection

- The prototype hinge is a steel bolt, operated manually by a lever.
- Two C-clamps hold device securely to the table.
- Clamps allow for better portability.

Requirements

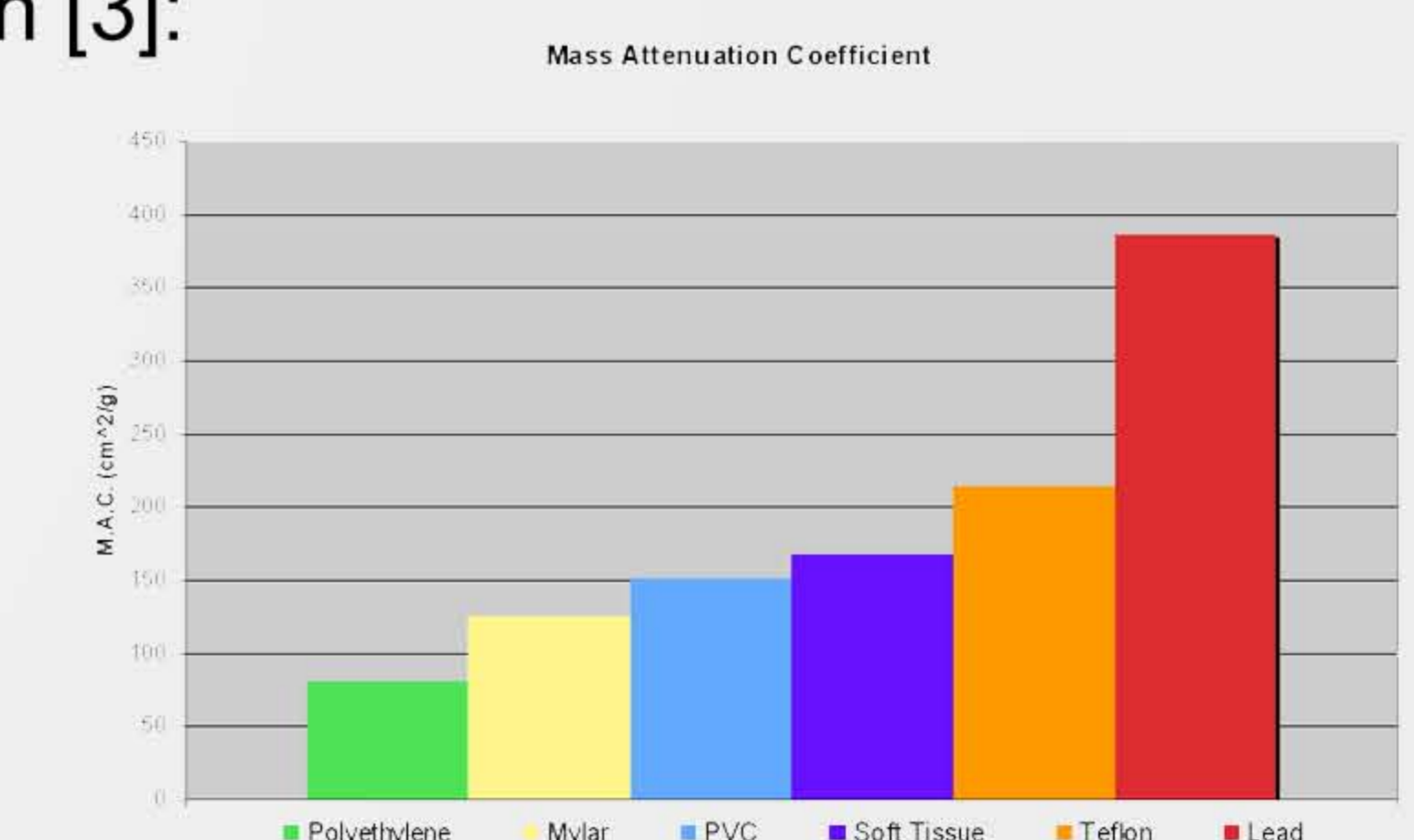
- The device must provide slow, controlled rotation, 25° forwards and 45° backwards.
- The device must not obstruct x-ray imaging.
- The device should provide one person operation, preferably remote-controlled.

Cost Analysis

Component	Supplier	Total
Head support	GE Healthcare	* \$0
PVC	McMaster Carr	\$51.64
Track	Menards	\$11.48
Hardware	Menards	\$5.71
* Donation, valued at \$601.		\$68.83

Future Work

- Implement a motor to allow for remote operation.
- Implement a worm gear assembly for motor interface.
- Obtain IRB certification for human testing.
- Replace metal components with materials of low mass attenuation [3]:



References

1. "Fluoroscopy." WebMD. 22 February 2006 <http://www.webmd.com/hw/health_guide_atoz/aa88492.asp>
2. Schueler, Beth A. PhD. "General Overview of Fluoroscopic Imaging." The AAPM/RSNA Physics Tutorial for Residents 20.4 (July-August, 2000): 1115-1126.
3. "X-Ray Mass Attenuation Coefficients." National Institute of Standards and Technology. 20 February 2006 <<http://physics.nist.gov/PhysRefData/XrayMassCoef/tab4.html>>