

Conquering the Sensor-Tissue Contact

-- *for* A Breast Cancer Detector

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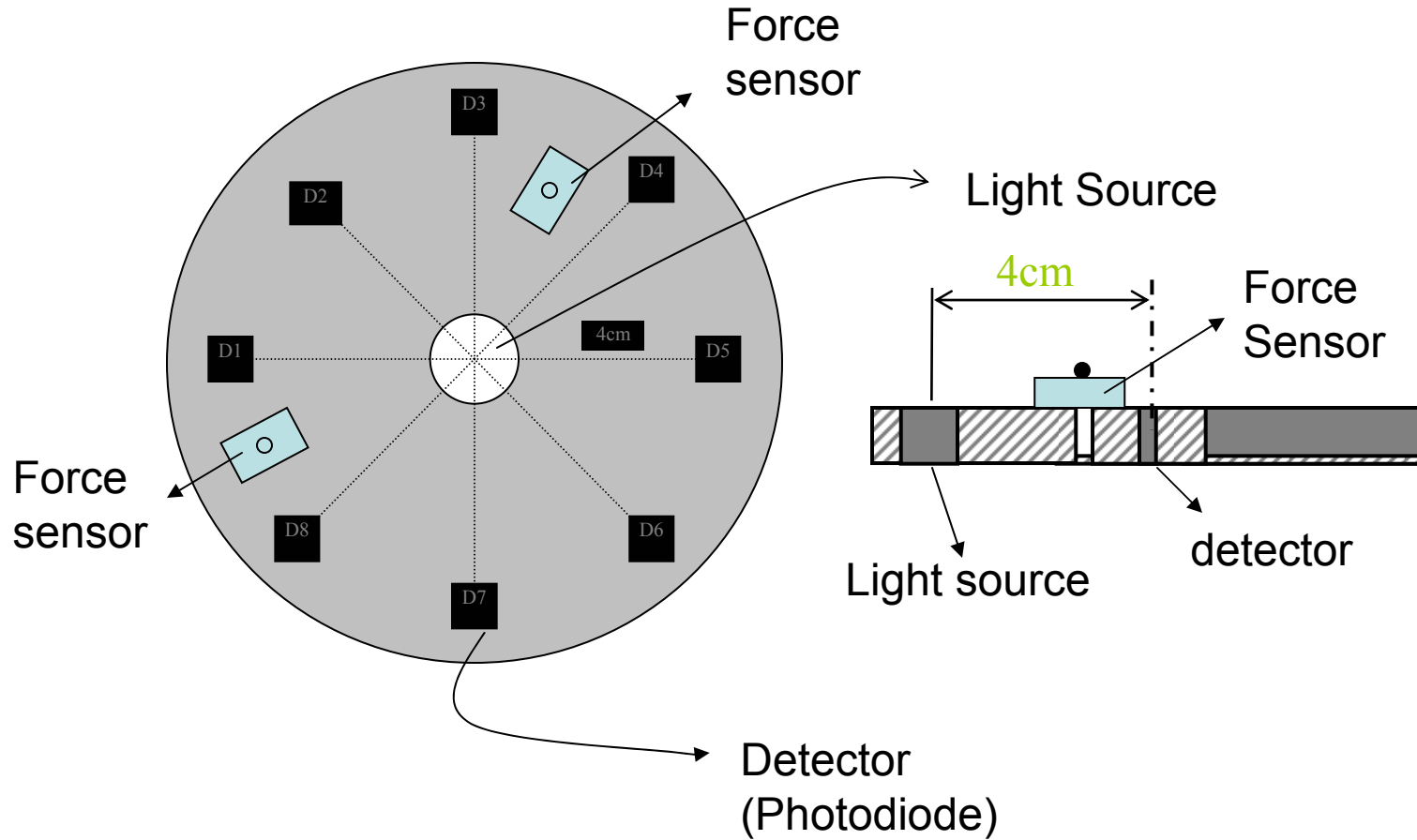
Distinguishing Two Projects

- His Project
 - Navigation
 - Improving the Circuit
- My Project
 - Stabilized detection
 - Mechanical Aspect
- Common Goal
 - Detect the cancerous tumors non-invasively

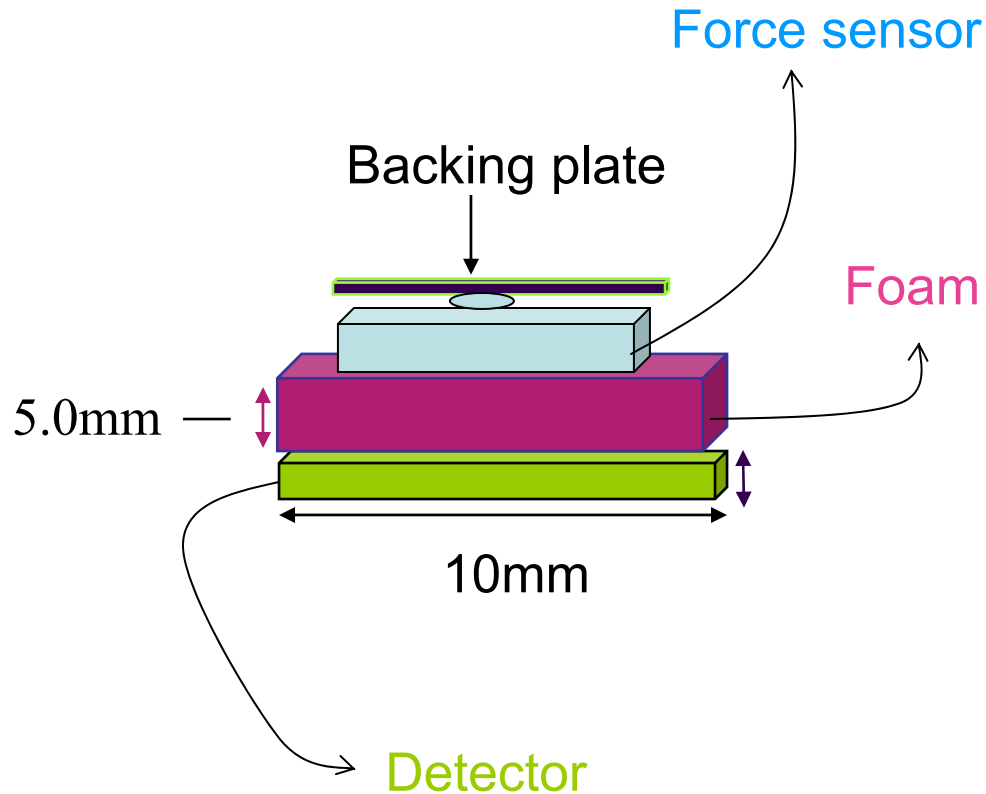
Big Picture

- Primary goal of the group
 - Use NIR light as a source to non-invasively monitor angiogenesis with diffuse spectroscopic techniques.
- Challenges addressed under this project
 - Optode-tissue coupling
 - Pressure equalization throughout the surface of interest

Current Probe



Alignment

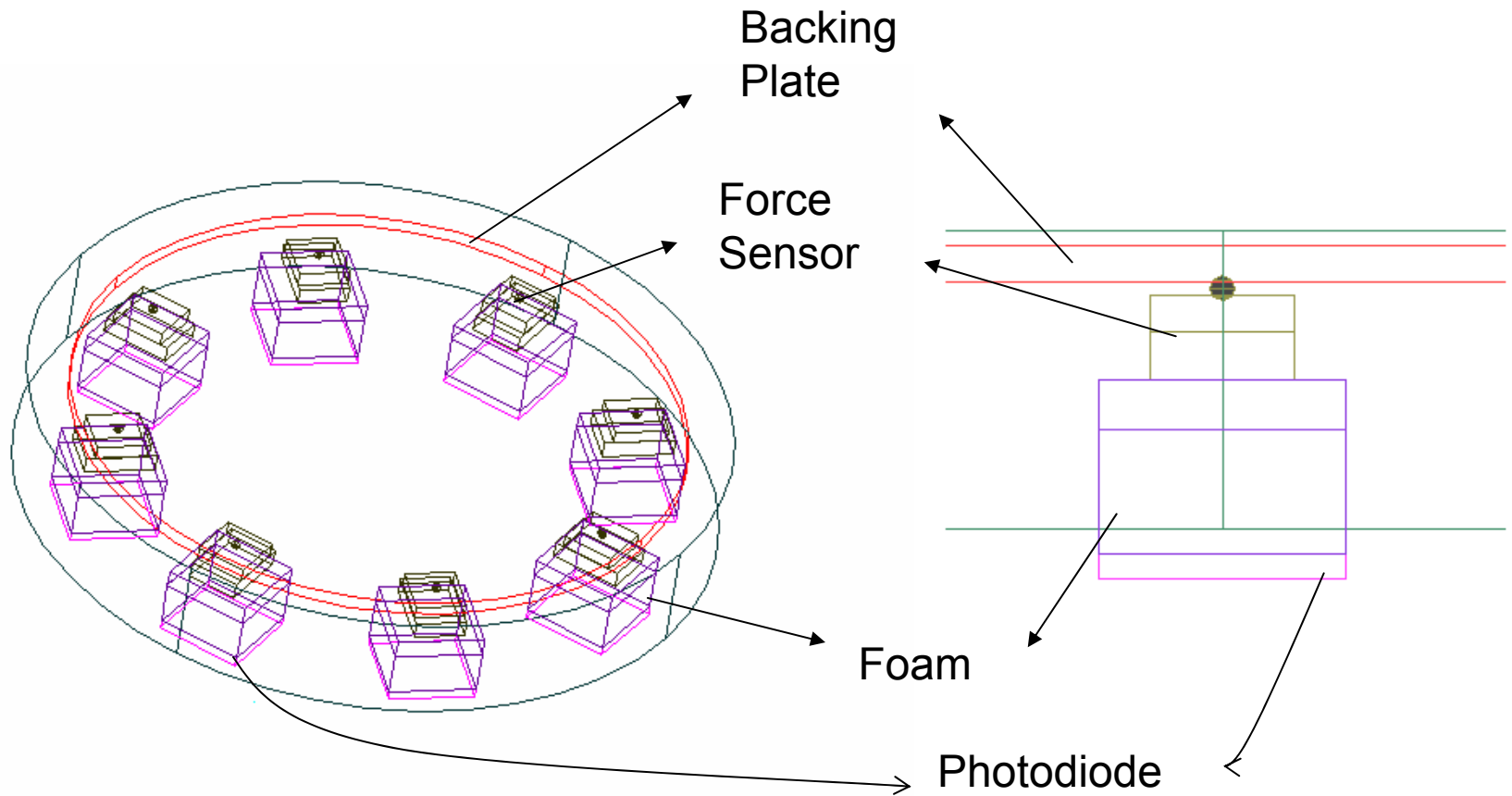


- Foam
 - Tilt the detectors to fit the contours of the breast
- Rigid Plate
 - Equalization

Materials Used

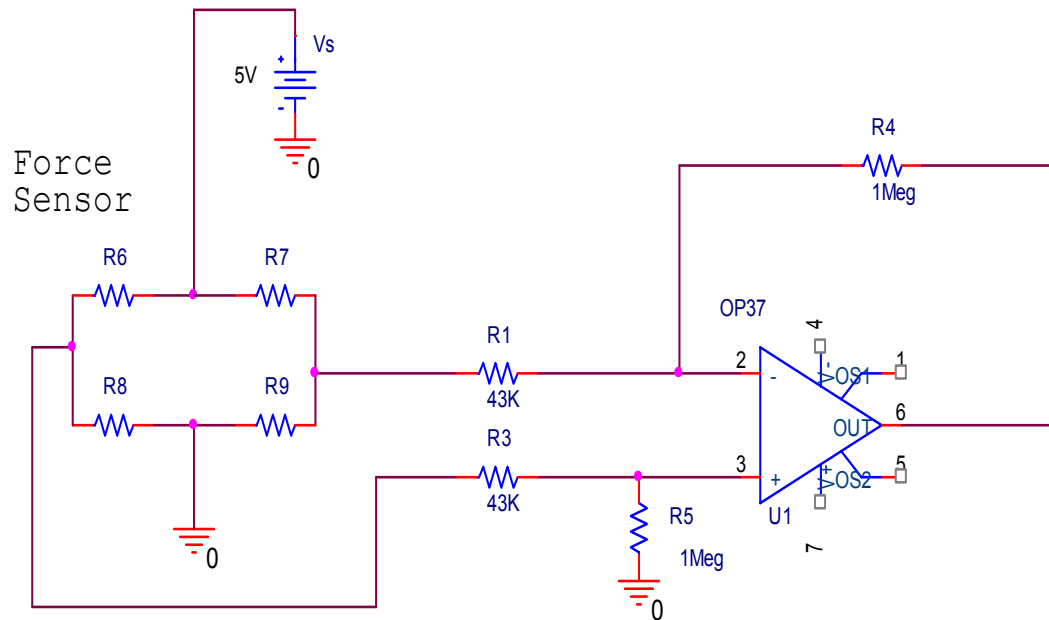
- Foam
 - Poron Quick Recovery Polyurethane Foam
 - Instant recovery
 - Compliance: 1-5psi
- Force sensor (same as before)
- Backing Plate
 - Delrin
- Photodiode
 - 9.7mm * 9.7mm VS 2.3mm*2.3mm active area
 - Higher SN ratio than the previous

My Probe



Sensor Circuitry

- Differential Circuit

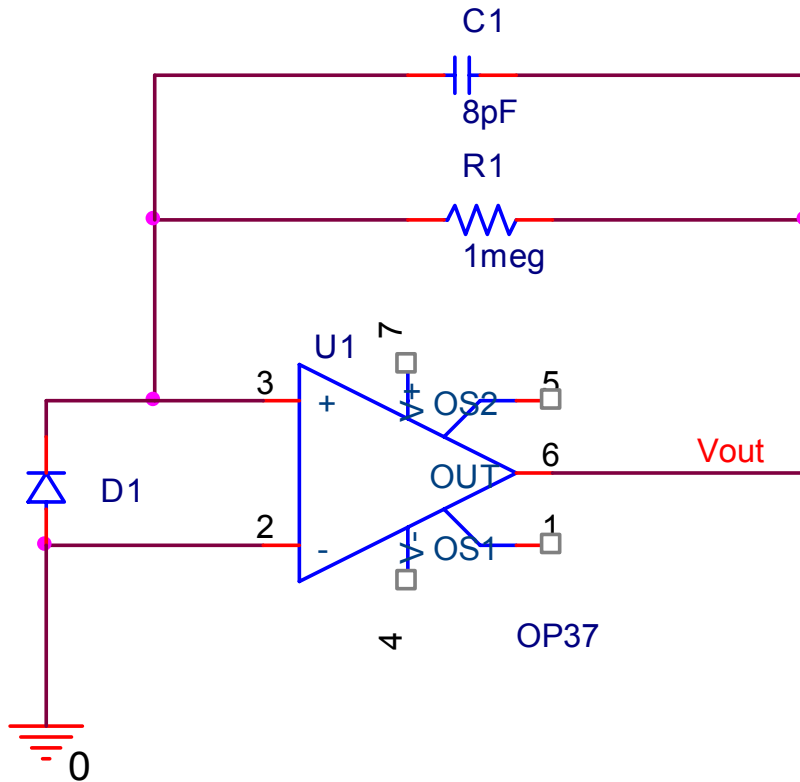


$$R_f = 1\text{M Ohm}$$

$$R_i = 40\text{K Ohm}$$

$$\text{Gain} \sim 20\text{X}$$

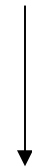
Diode Circuitry



Current

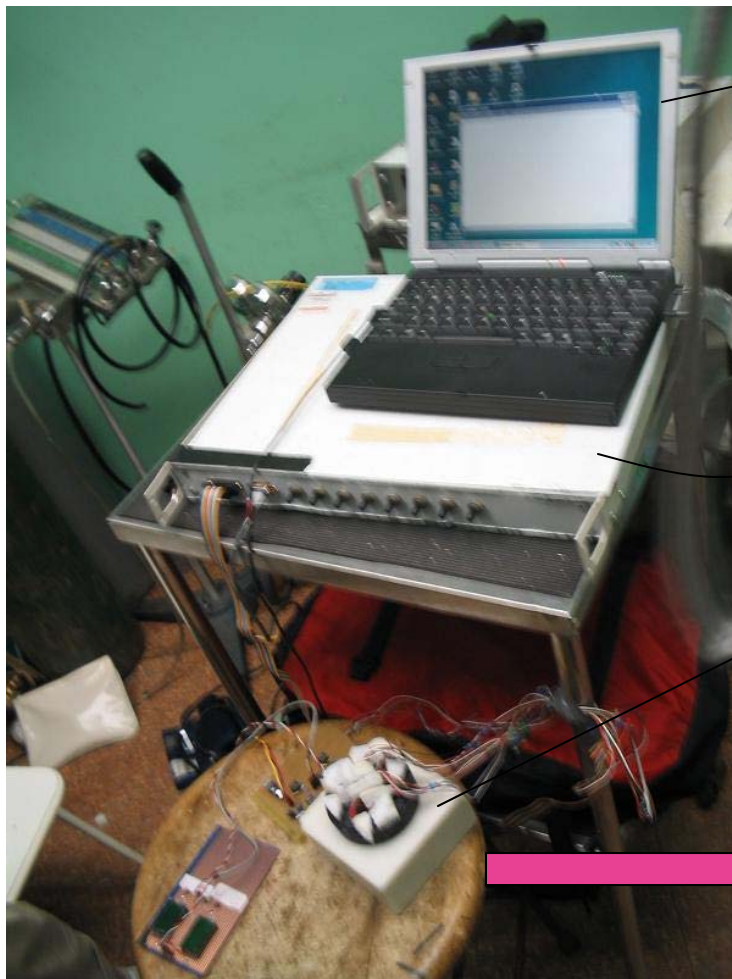


Voltage



Amplify

Experimental Setup



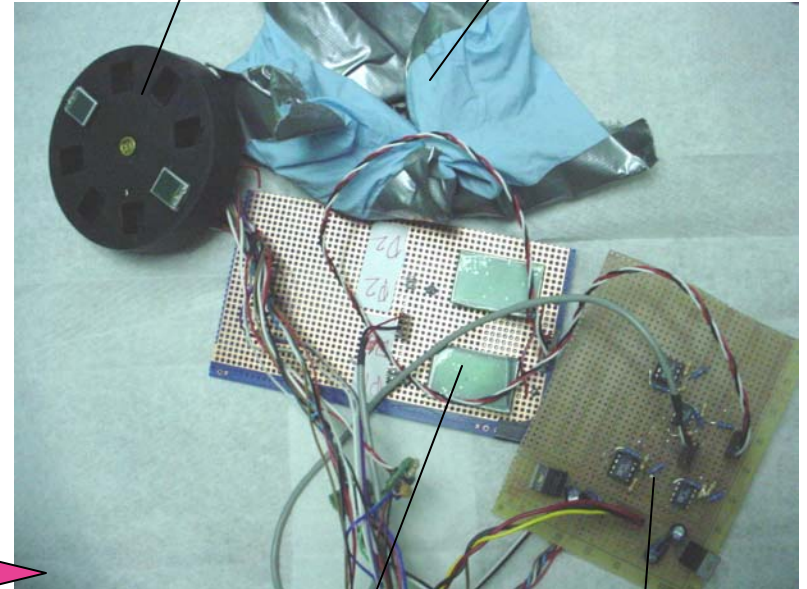
Laptop for display

Control Box

Probe

Sand Bags

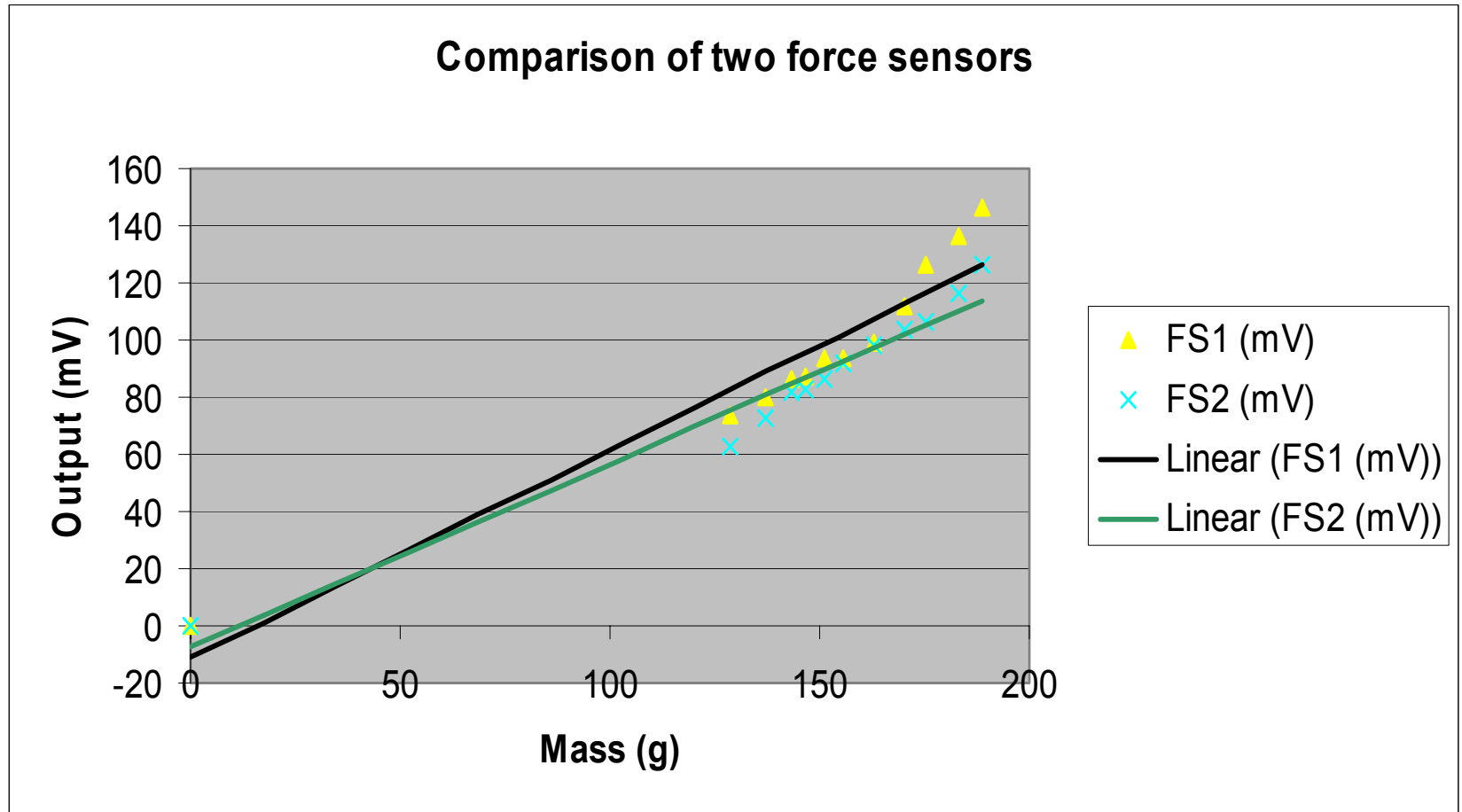
Phantom



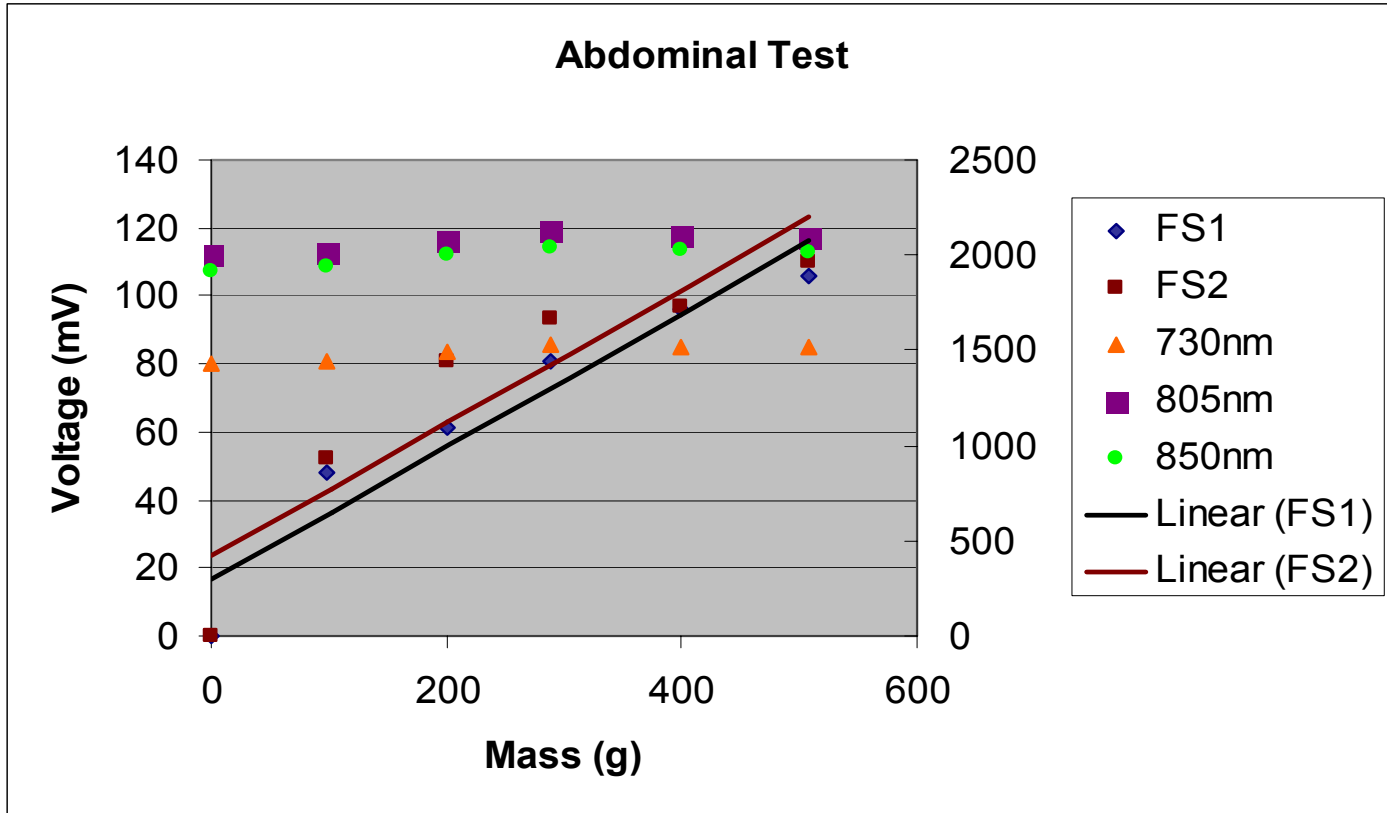
Output voltage

Circuit Board

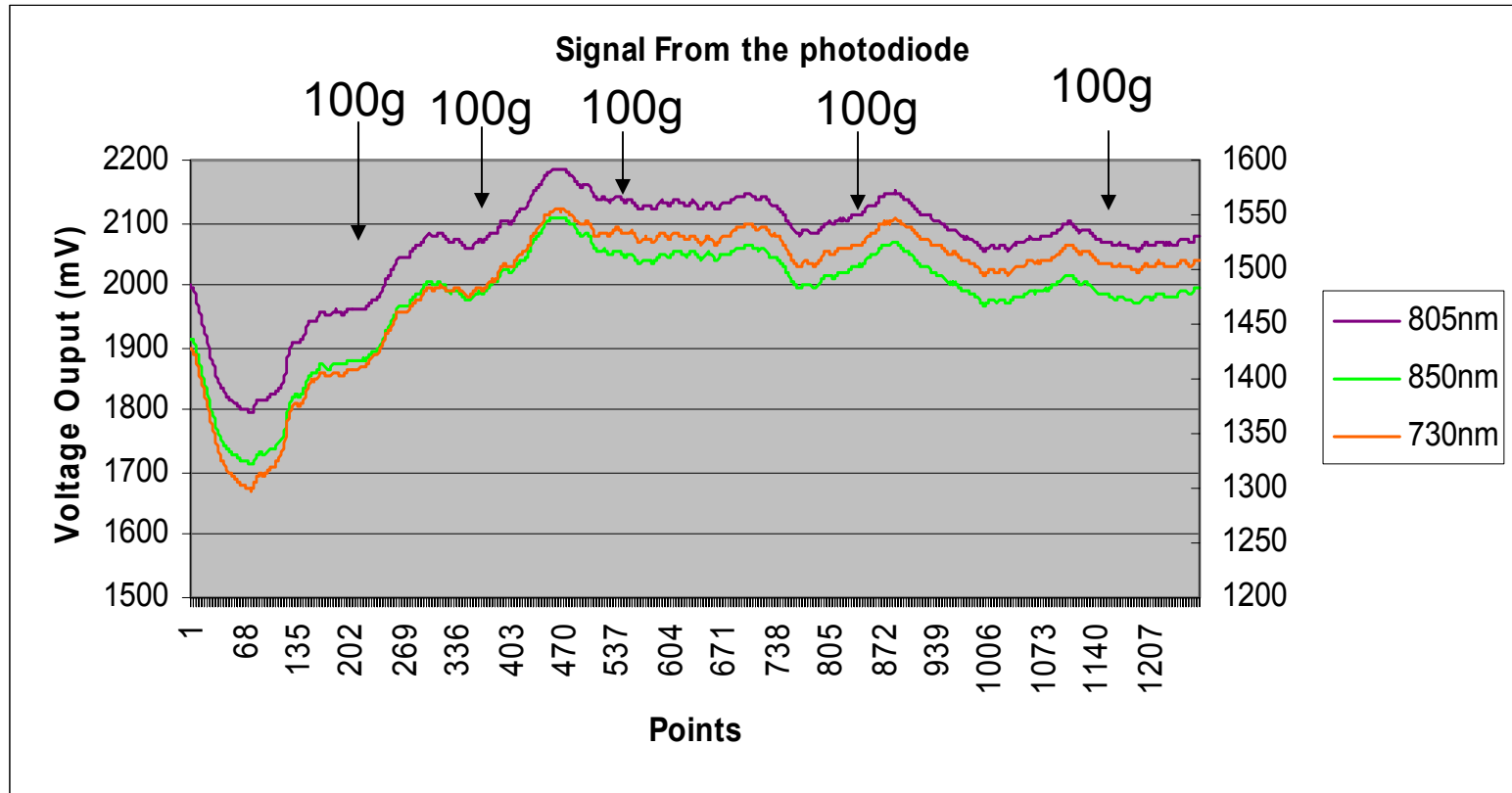
Experimental Results



More Results



Closer Look at the Signal Output



Improvements Made

- Change the point-contact from skin to plate
- Permit localized articulation
 - Elasticity of Foam
- Allow equalization with the aid of a rigid backing plate

In The Future...

- Future Work
 - Complete fabrication
 - Circuitries
- Recommendations
 - Minimize Friction
 - Use an improved differential amplifier
 - Packaging (more presentable to patients)