

Hand-held Breast Cancer Detector



**Inexpensive
and
convenient!**

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Electrical Engineering
Advised by Dr. Britton Chance

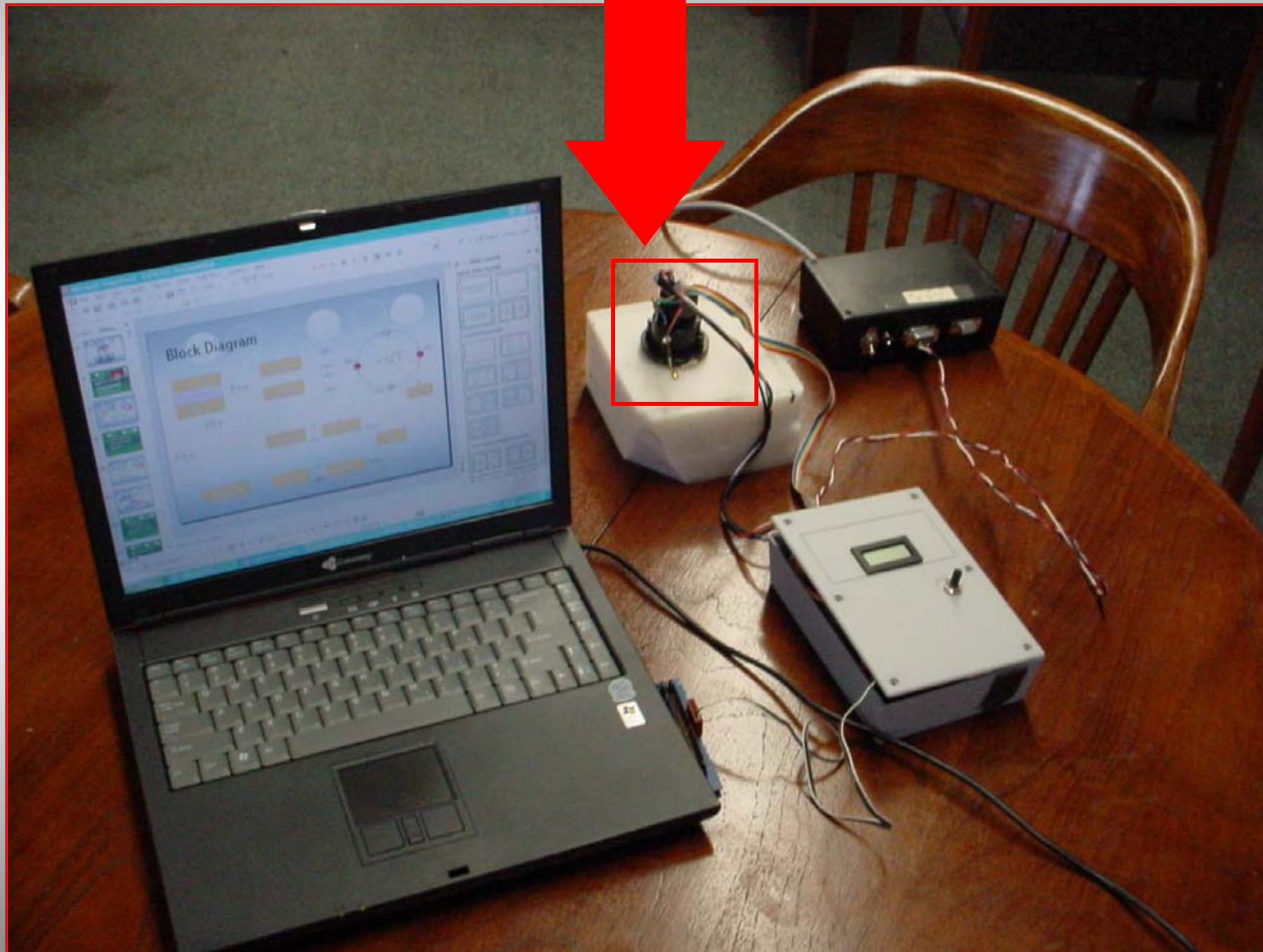
Breast cancer and methods for its detection

- Breast cancer is the most commonly diagnosed cancer: 40,000 women in the U.S. died from the disease in 2002.
- Early detection essential for reducing chance of death.
- Most common methods of detection:
 - X-Ray Mammography.
 - MRI Mammography.
 - Ultra-sound Mammography.



Device Look...

● Probe: Light and detector

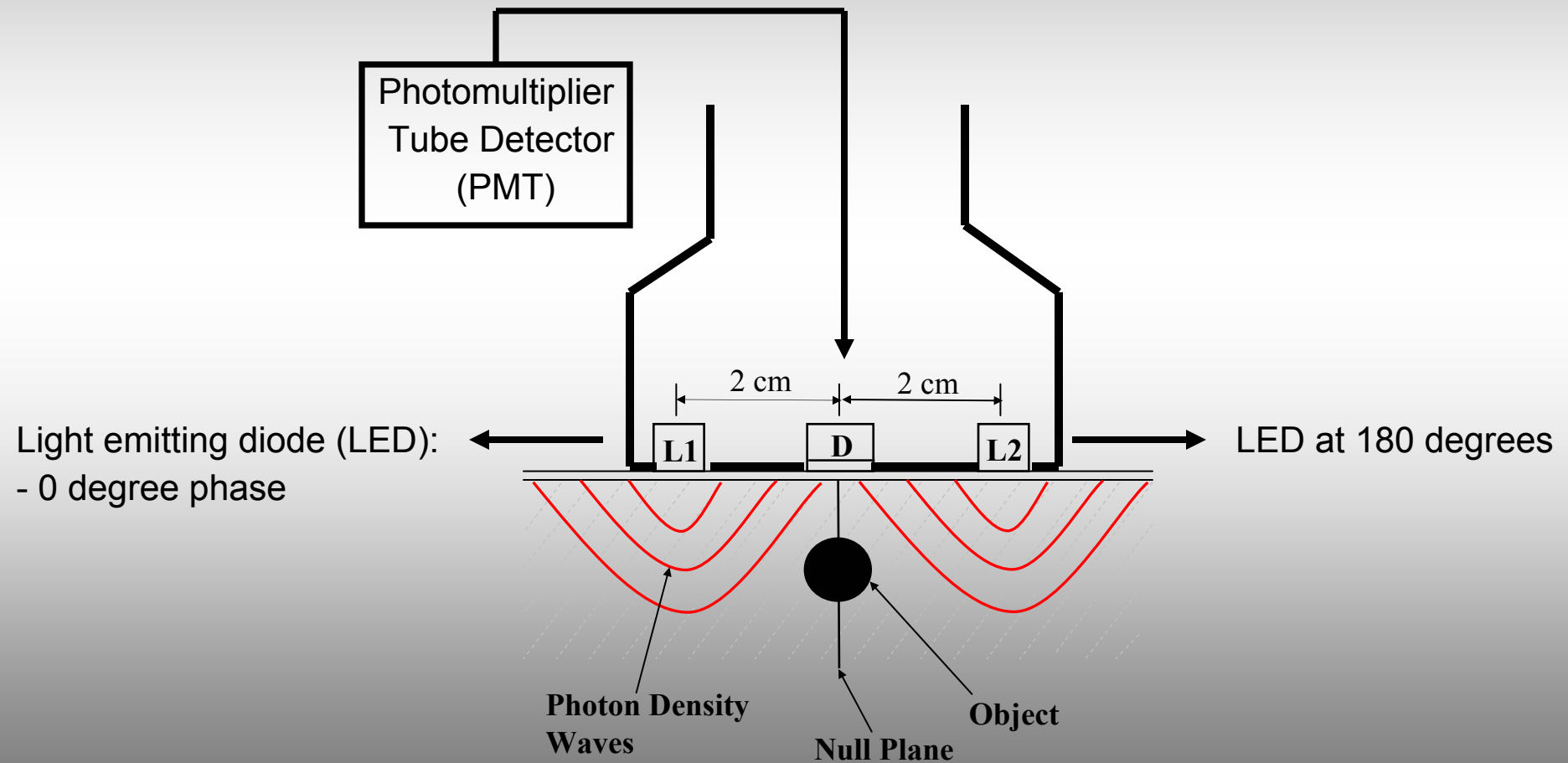


Objective for Hand-Held Breast Cancer Device

- Detect a tumor of a few millimeters in size at a distance of up to **3 cm** from the breast surface.
- Commercial uses would include:
 - Tumor Localization.
 - Preliminary Screening.
 - Mass and Home Screening.

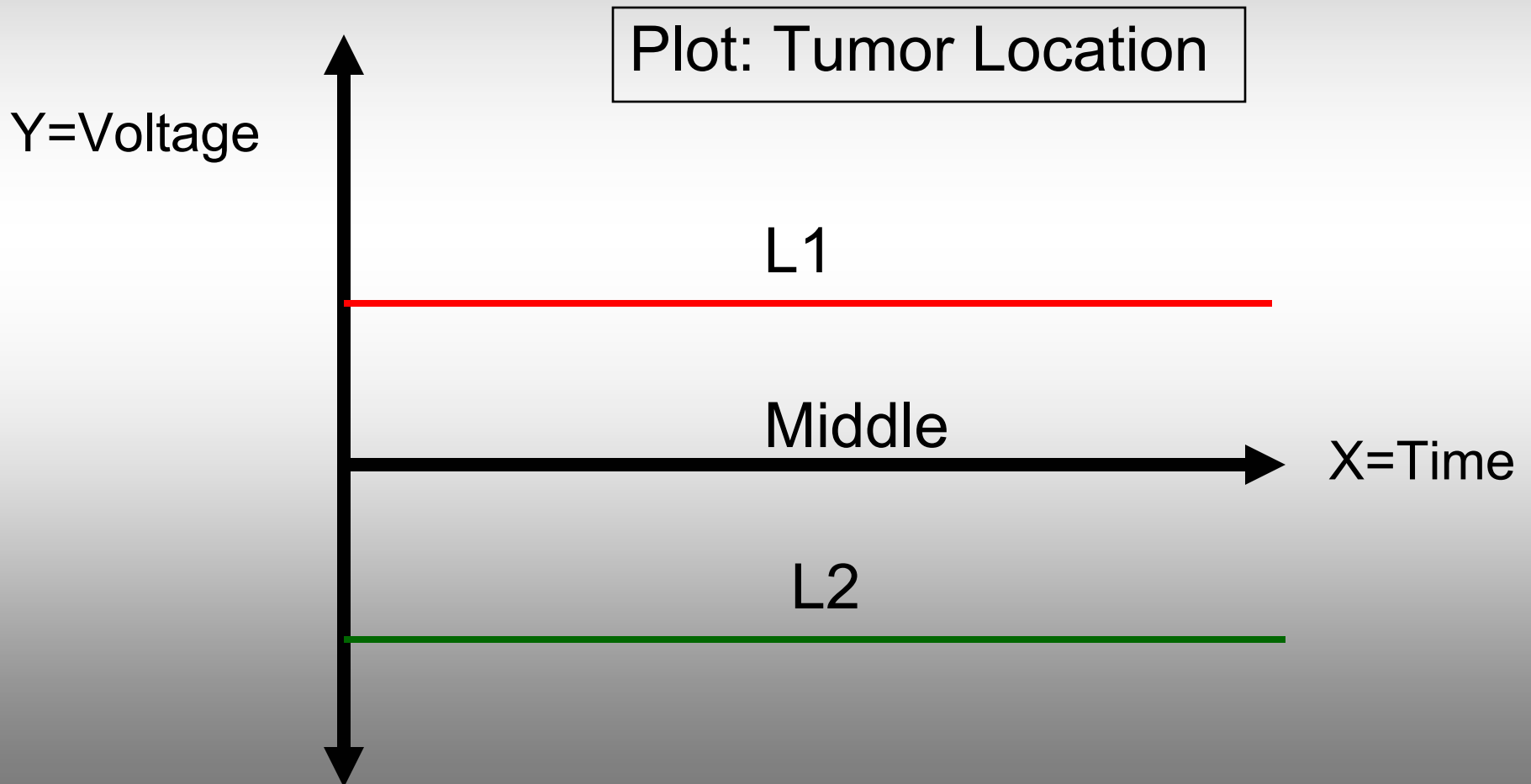
Detection Method...

- Amplitude Cancellation in the Null Plane

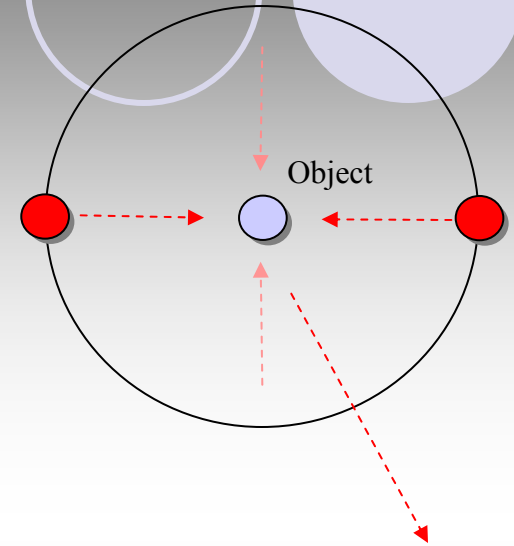
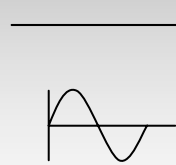
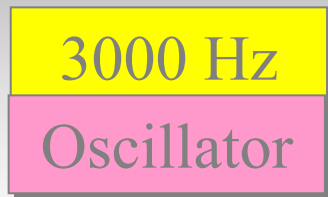


Detection Method...

- Monitor Display



Block Diagram Analysis



1st Section



2nd Section



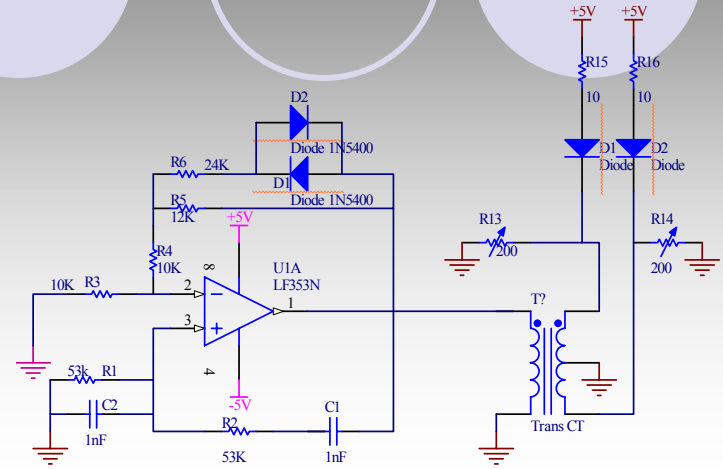
0°C
180°C

Two horizontal arrows pointing left, one labeled "0°C" and the other "180°C".



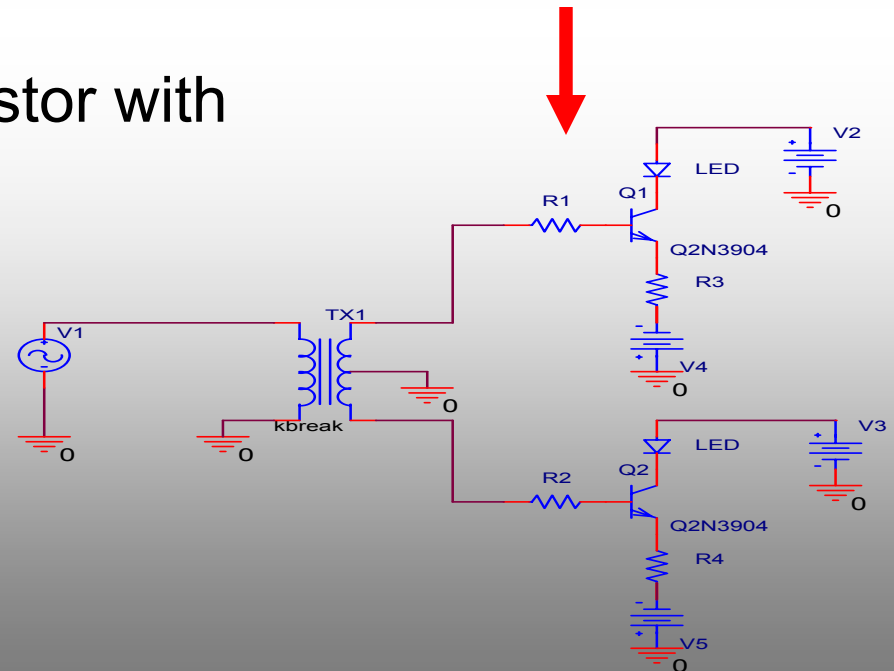
Problem and Resolution: 1st Section

- **Problem:** Insufficient Intensity and Modulation.



- **Resolution:** Added Transistor with high base resistance.

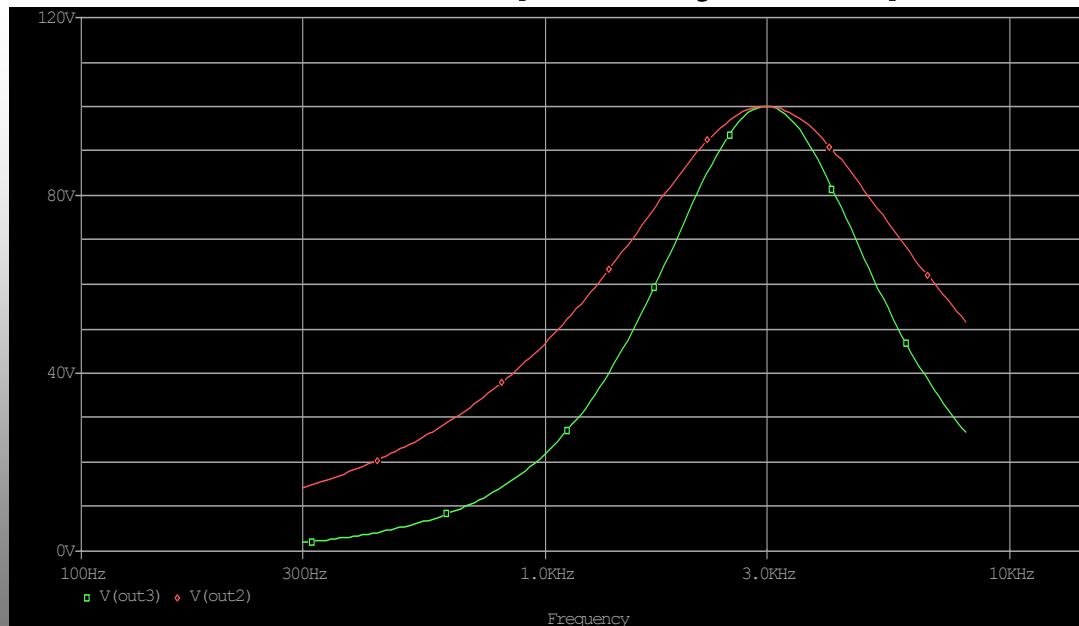
- **Results:**
 - 20-100 mA swing.
 - Clearer signal.



Problem and Resolution: 2nd Section

- **Problem:** Noise.
- **Resolution:**
 - Replaced noisy transformer.
 - Implemented higher order bandpass filter.

PLOT: Frequency Response



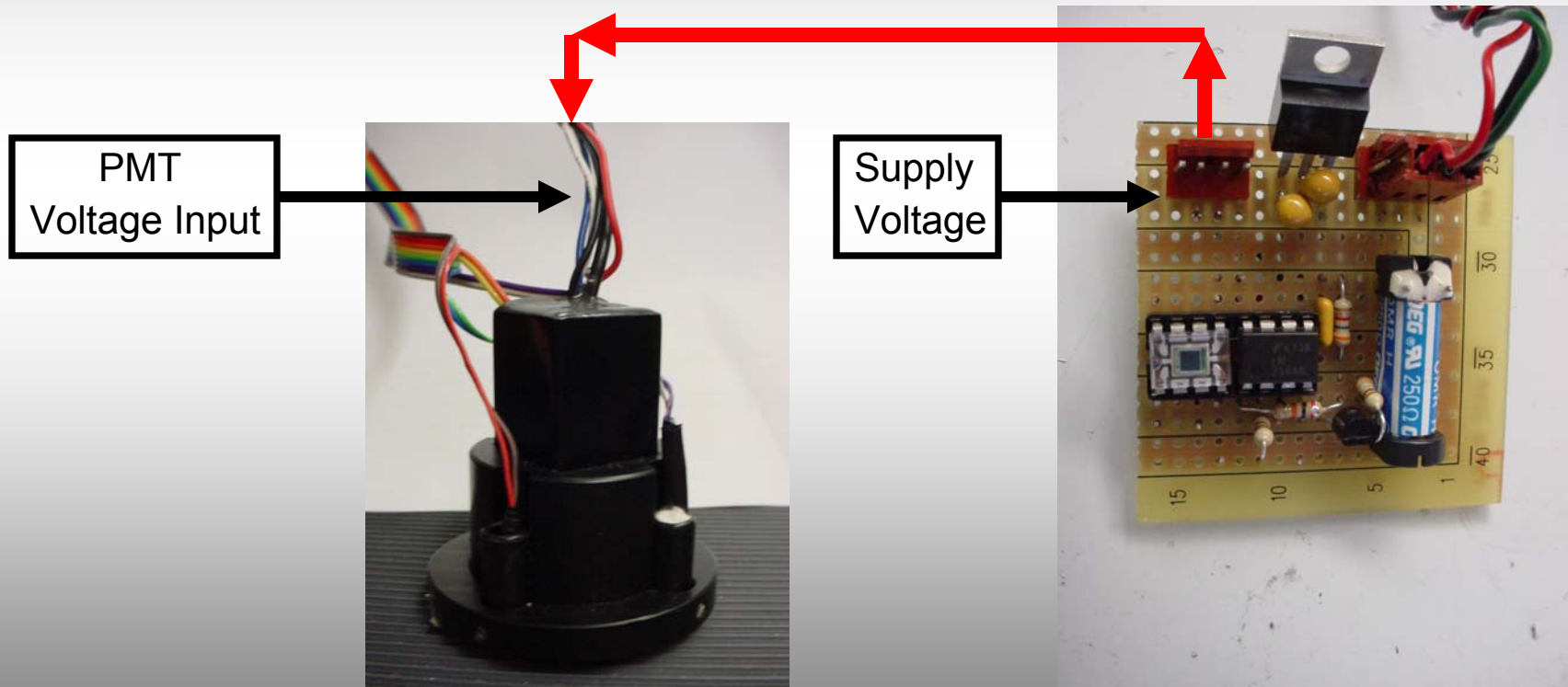
Room for Improvement

- I. Protect PMT from light overexposure.
- II. Make better contact during breast navigation and physically protect PMT.
- III. Eliminate Noise from LED sources themselves.



Innovations in Breast Cancer Detector

I. Shut-off Protection System.



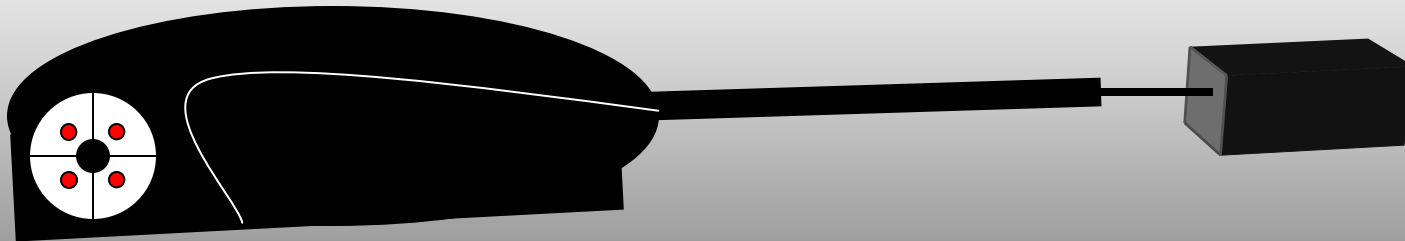
Innovations in Breast Cancer Detector

II. New Case Design Idea:

- Better design for navigation.
- Physically Protect PMT by using Fiber Optics.

Computer Mouse Design

PMT

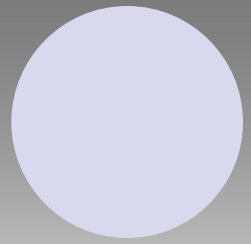
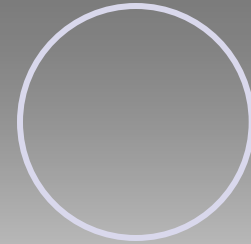
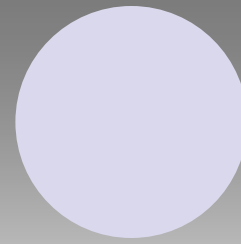


Steps for Completion

- Assemble new system on Circuit Board or PC Board.
- Finish program for Time-Shared System.
- **Test** new completed system on Breast phantom.

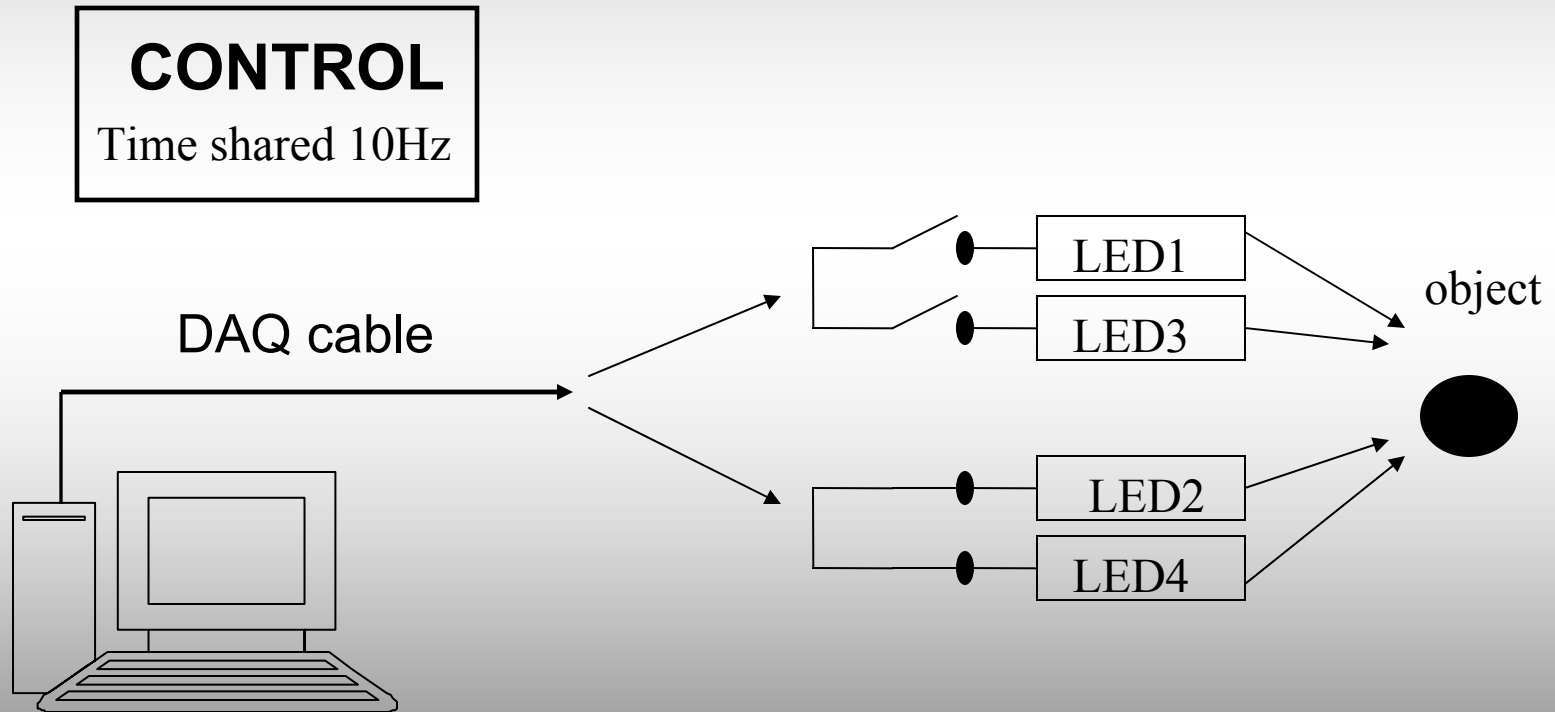


Q & A



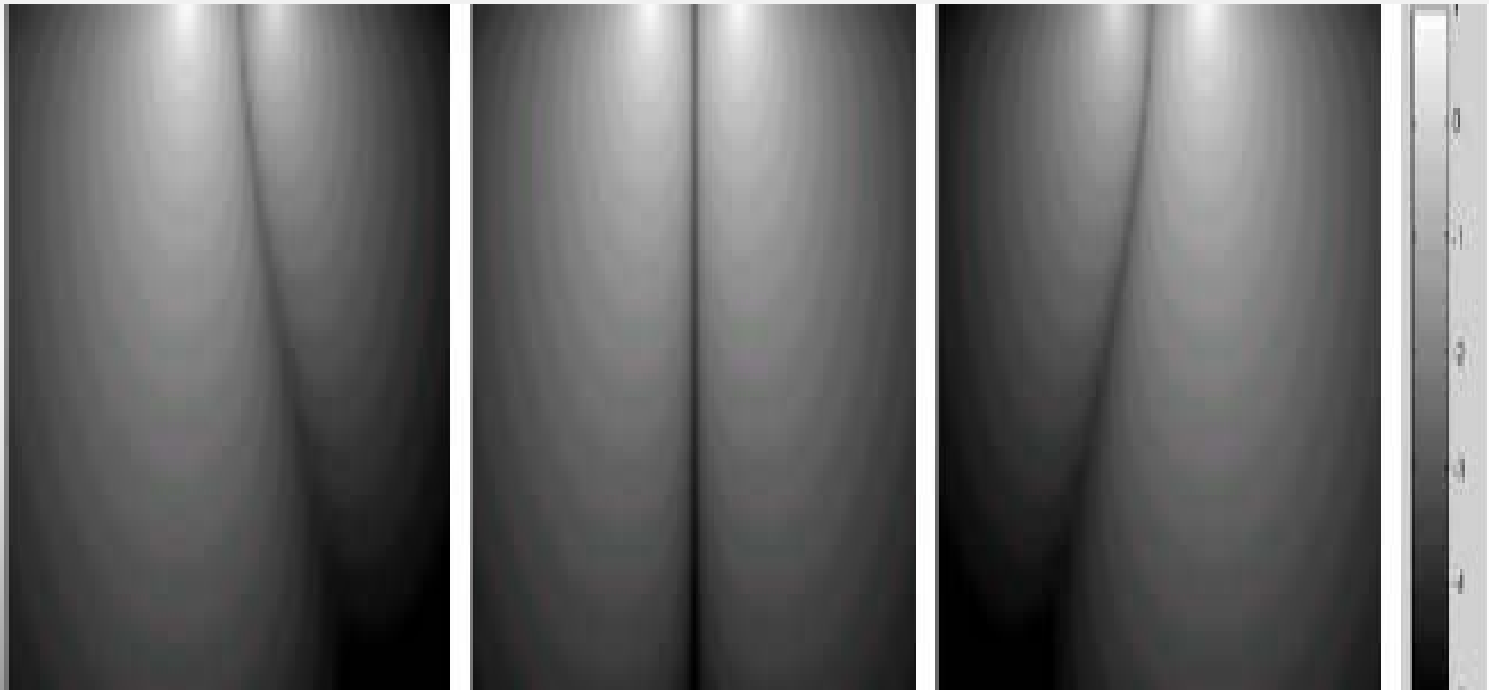
Innovations in Breast Cancer Detector

I. Time-Shared System

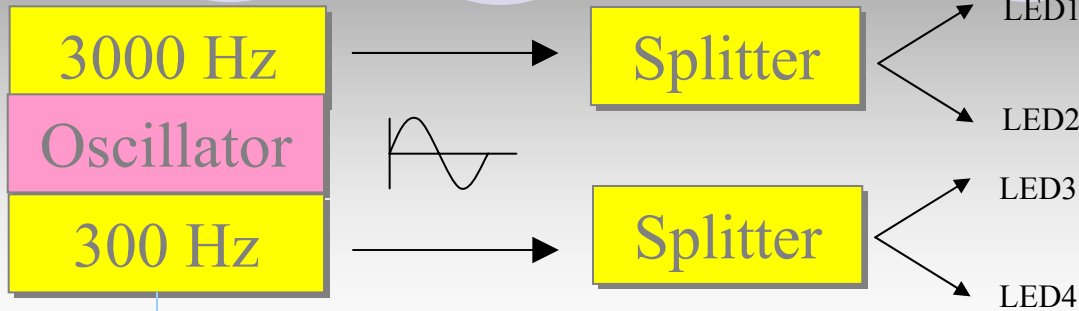


How we can detect tumors...

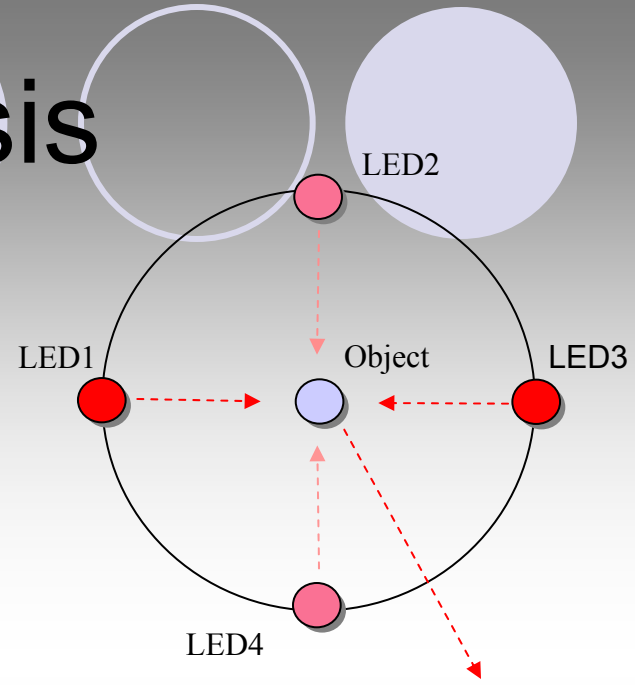
- High Absorption in Tumors



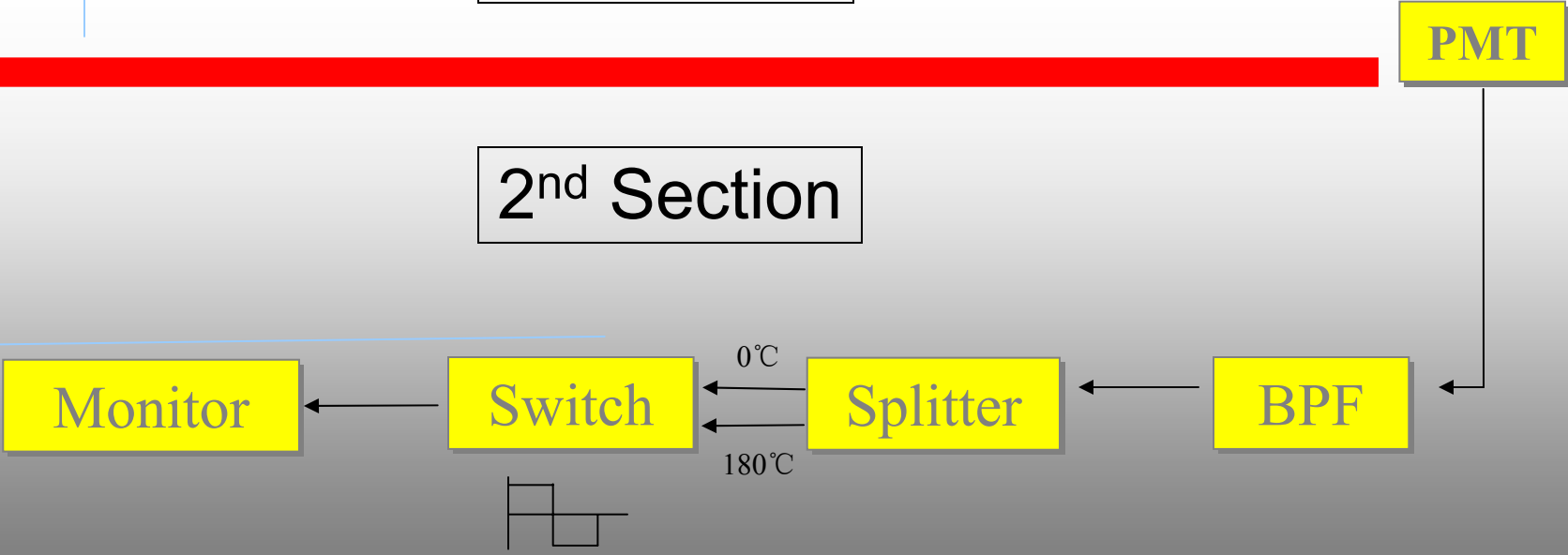
Block Diagram Analysis



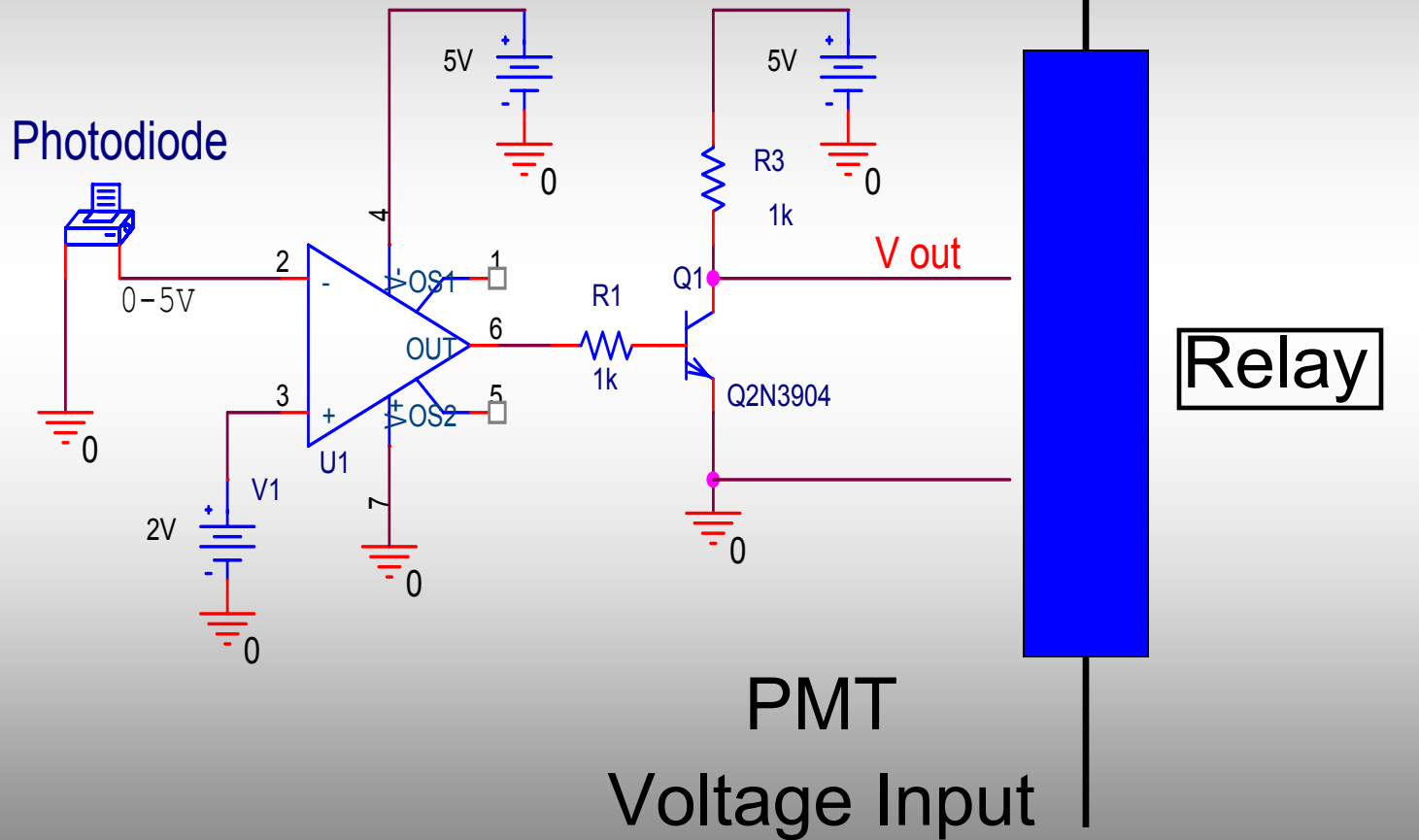
1st Section



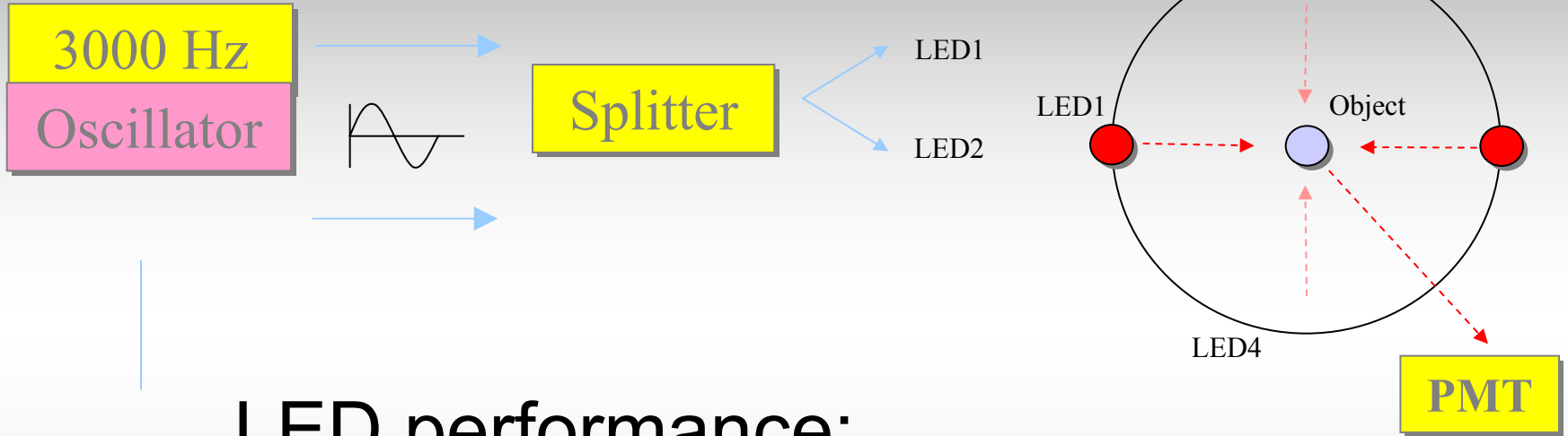
2nd Section



Shut-off Schematic



Problem discovered



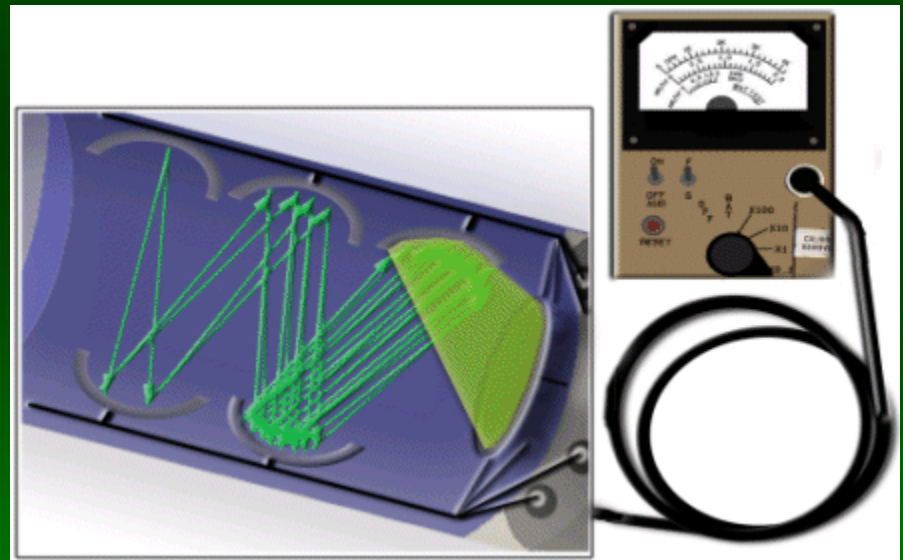
LED performance:

- Low Intensity.
- Low Modulation swing.

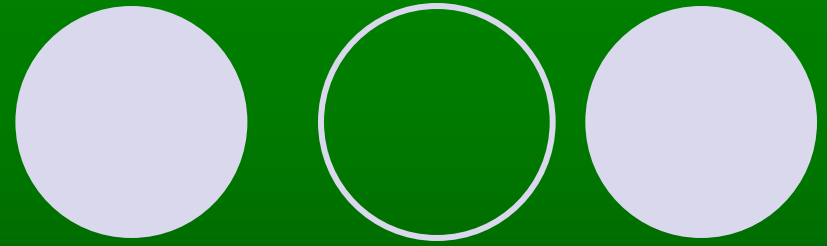
How it works ...

II. Photomultiplier Tube (PMT)

- Photocathode
- Dynodes
- Anode



How it works....



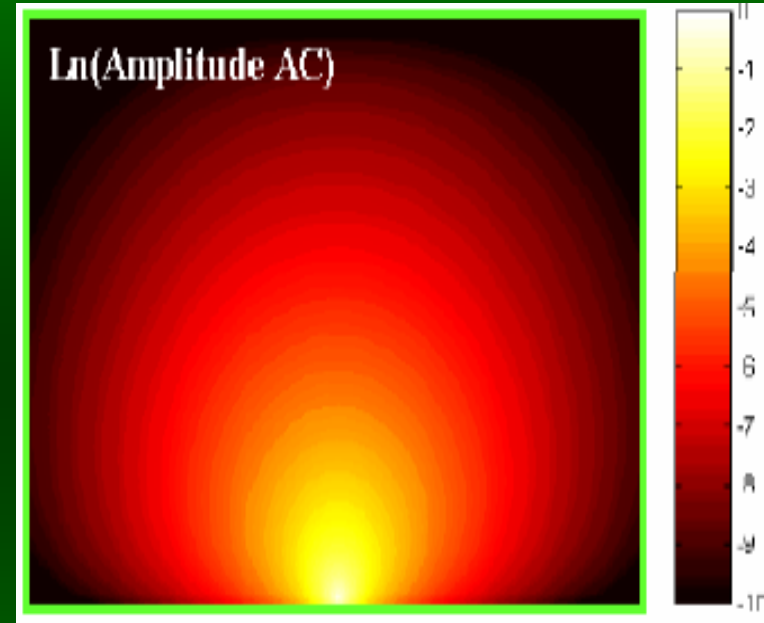
I. Light Emitting Diodes (LED)

- Near Infrared Light (780 nm wavelength).

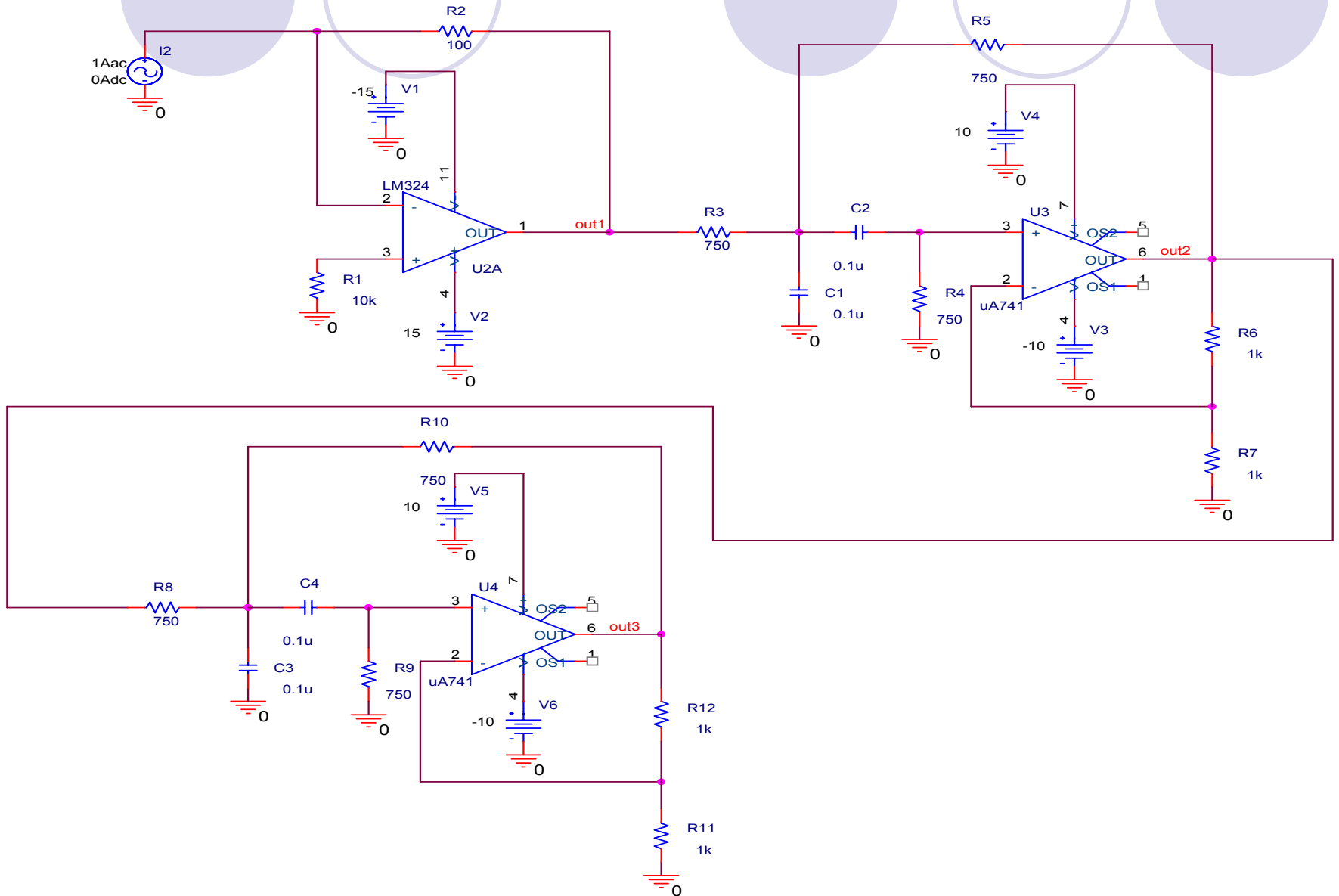
- High Scattering and Low Absorption mediums:

- Microscopically, a random walk.

- Macroscopically, outgoing spherical wave referred to as the diffuse photon density wave (DPDW).



PMT Output Signal Filtering Circuit



Frequency Response

