

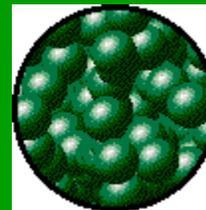
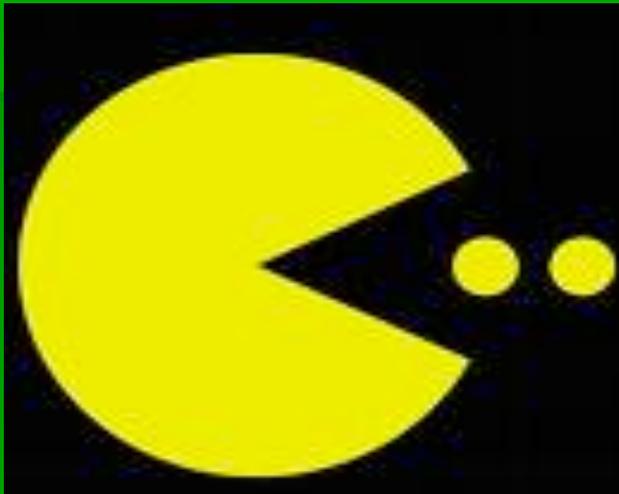
# Purity Monitors



By Patrick Swanson

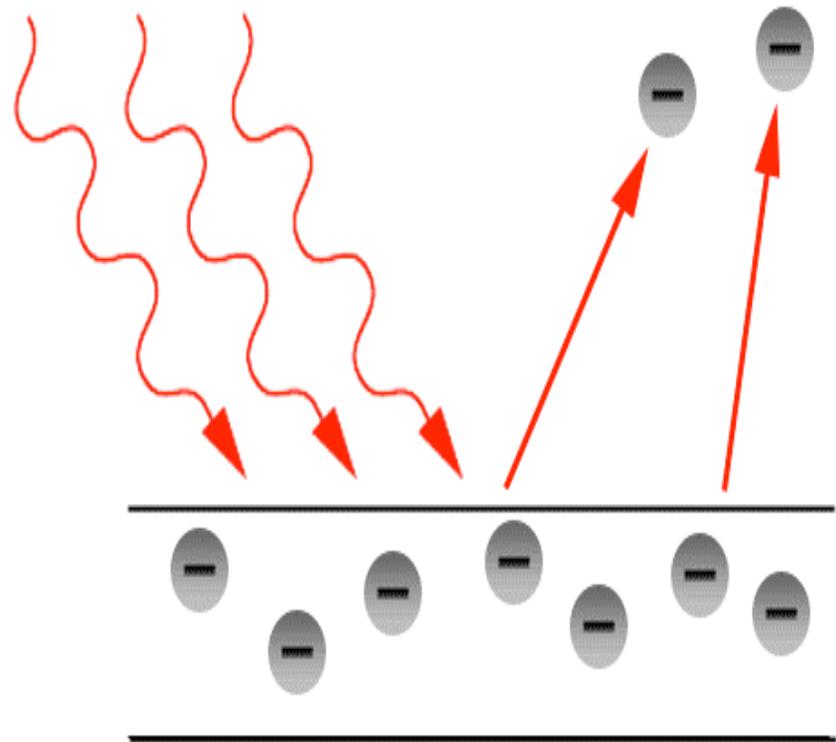
# Purpose

- TPC is filled with liquid argon
- Needs to be pure
- If not, electrons will be eaten up by the other molecules



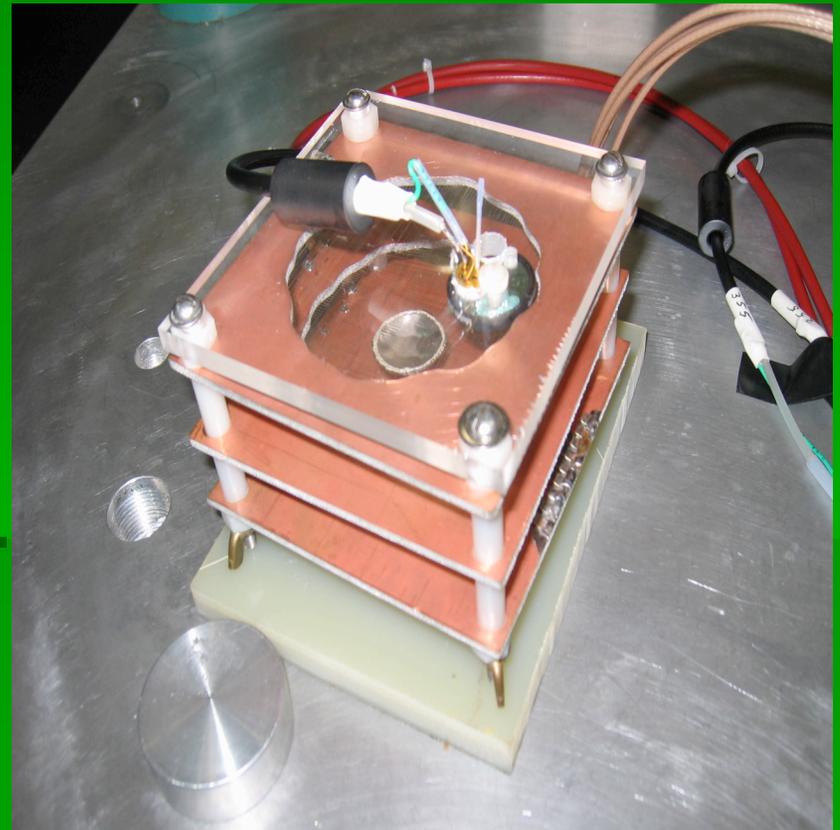
# How it works

- Use of photoelectric effect
- Depending on work function, photons kick out electrons



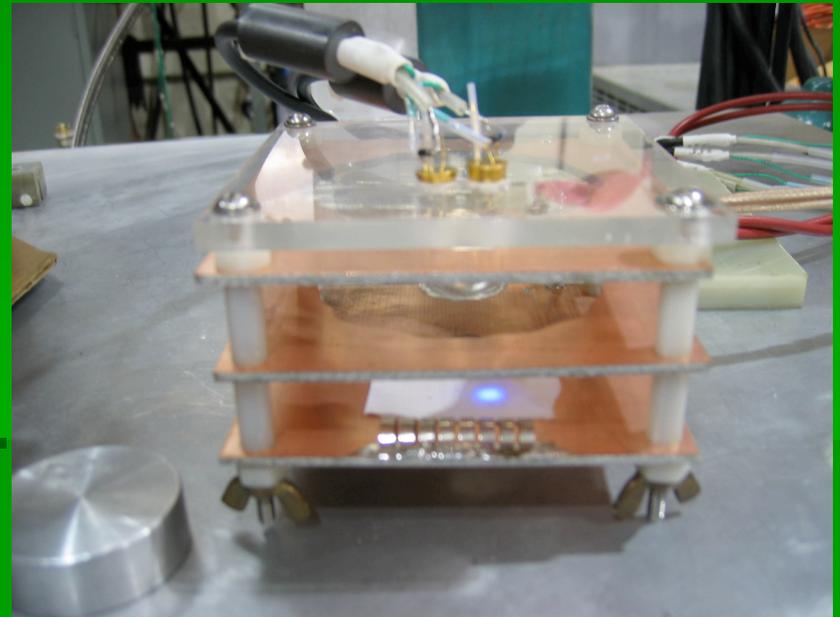
# How it works

- Light shined at a photocathode, starts to emit electrons
- Potential difference applied across copper plates
- Electrons emitted accelerated to anode and collected there



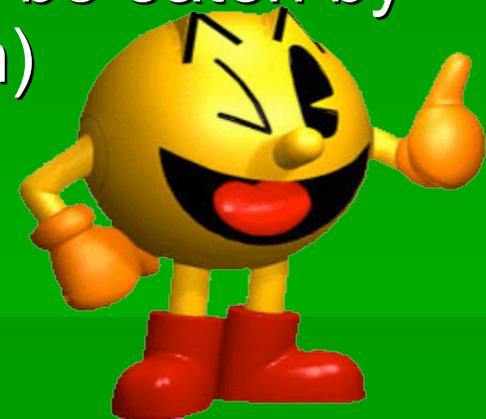
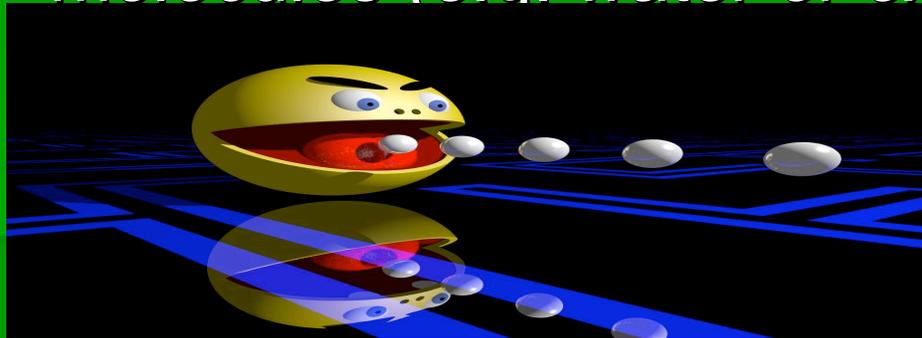
# How it works

- Quantum efficiency of cathode must be measured so we know theoretical number of electrons emitted
- Electrons drift to anode, current is measured



# How it works

- Theoretical number of electrons emitted is known, compared to actual number received
- If argon is impure, electrons will be eaten by molecules (e.g. water or oxygen)



- Electrons absorbed will not get to anode
- In TPC, no events would be recorded

# Why Argon?

- Argon does not ionize or combine with other elements
- Sending electrons through it doesn't change any of its properties
- Makes \$en\$e



# Light sources

- Italian scientists (ICARUS) have performed a similar experiment
- Fiber and flashlamp used as light source
- We investigated a similar fiber



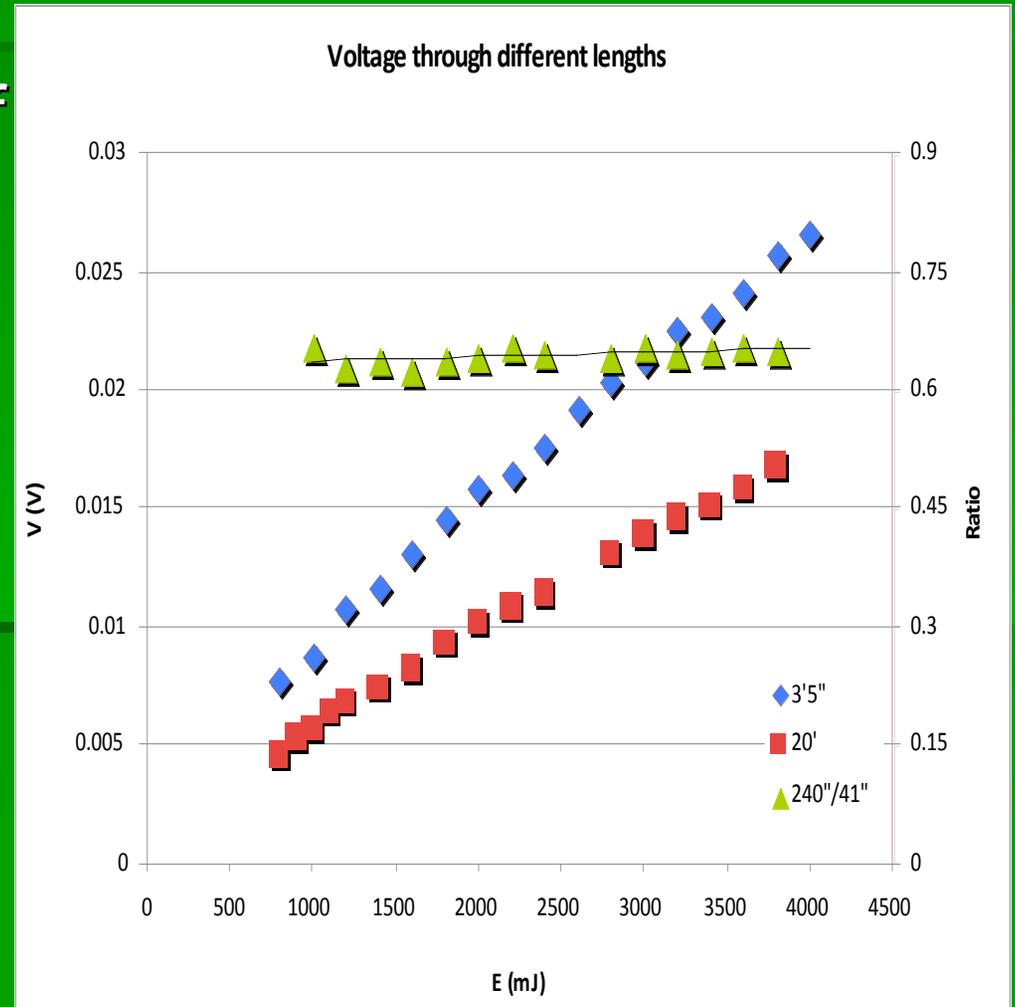
# The Fiber



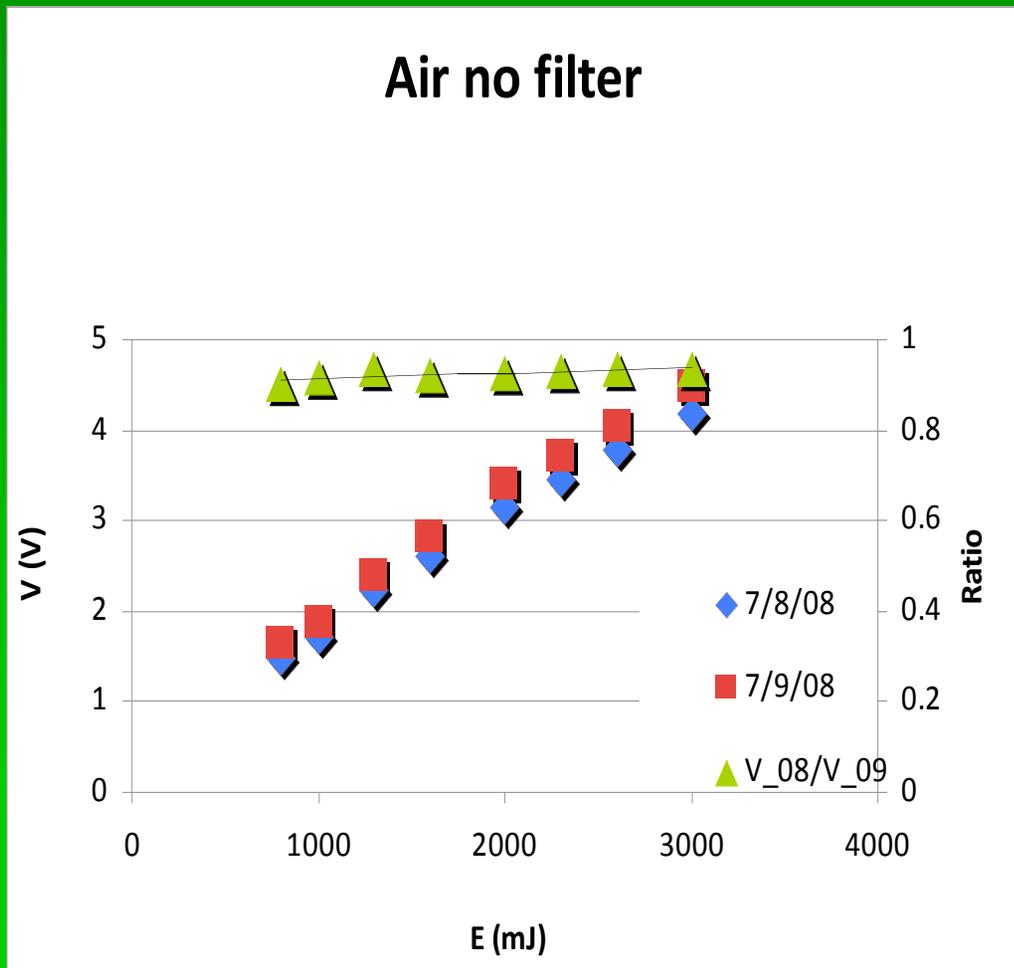
- Special quartz fiber used (others absorb UV wavelengths)
- Fiber is brittle and may wear out, length may be a factor as well
- Replacement in detector is difficult

# Fiber tests

- Different lengths of fiber tested
- Conclusion: more light absorbed by wire as length increases, or more light may escape



# More fiber tests



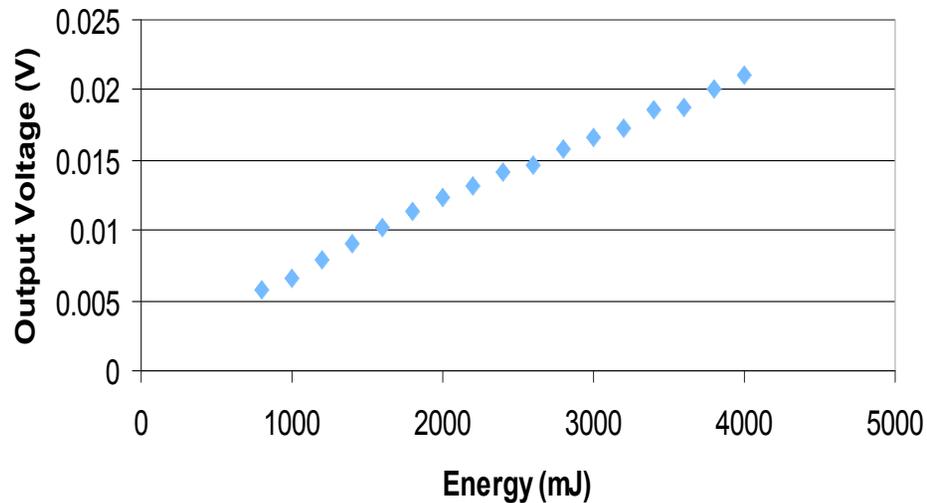
Fiber tested in phototube, pulsed overnight

Conclusion: Fiber does not wear out easily

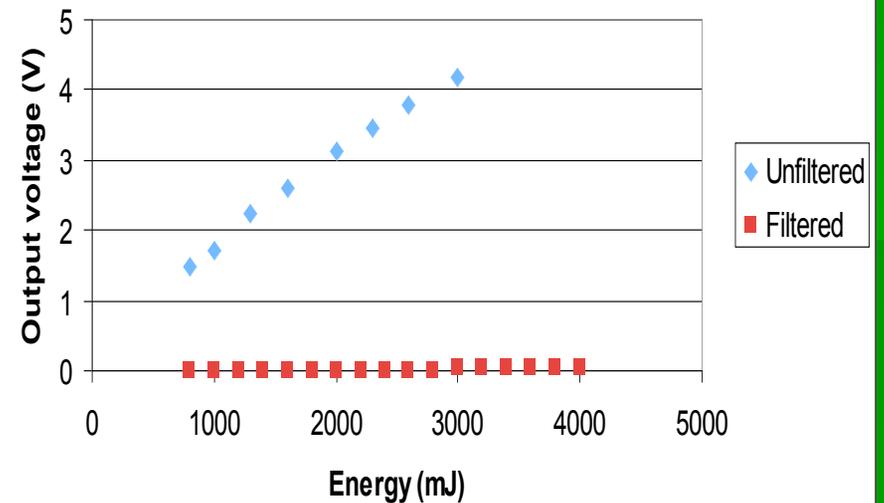
# More fiber tests

- Tested in phototube with filter (~255 nm), pulsed overnight
- Conclusion: output voltage less than unfiltered, but still linear

Filtered light in air

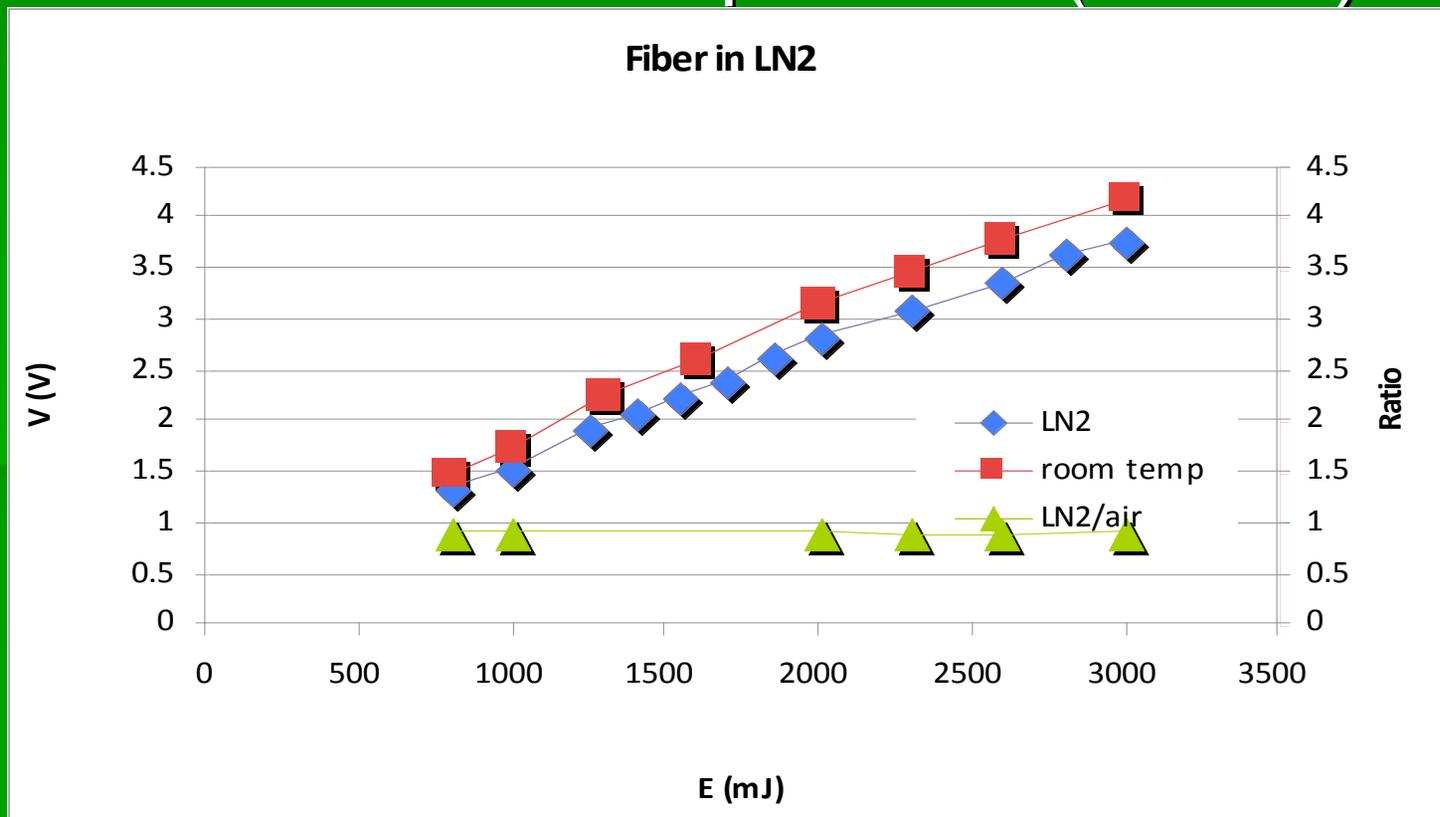


Filtered vs. unfiltered in air



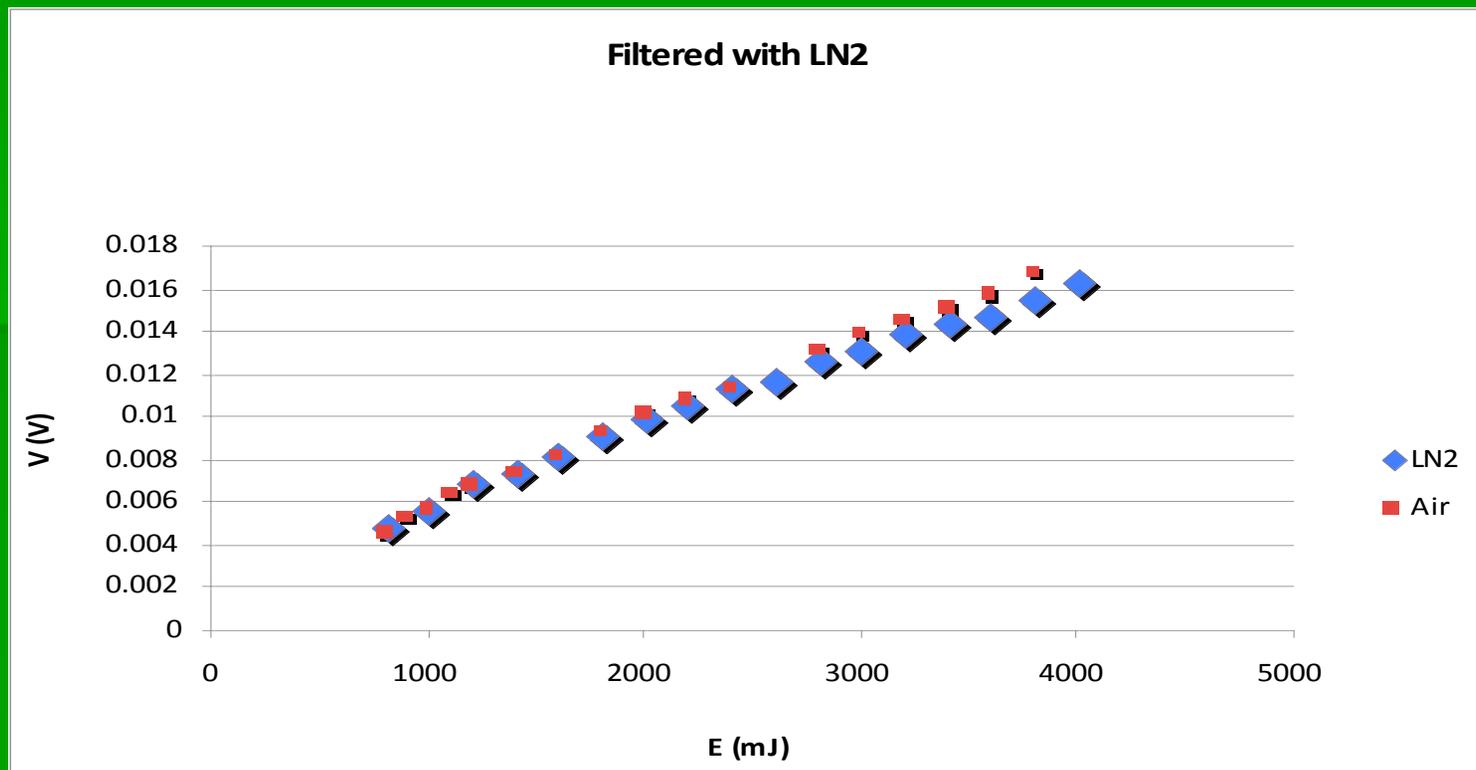
# More fiber tests

- Tested at cold temperature (in LN2)

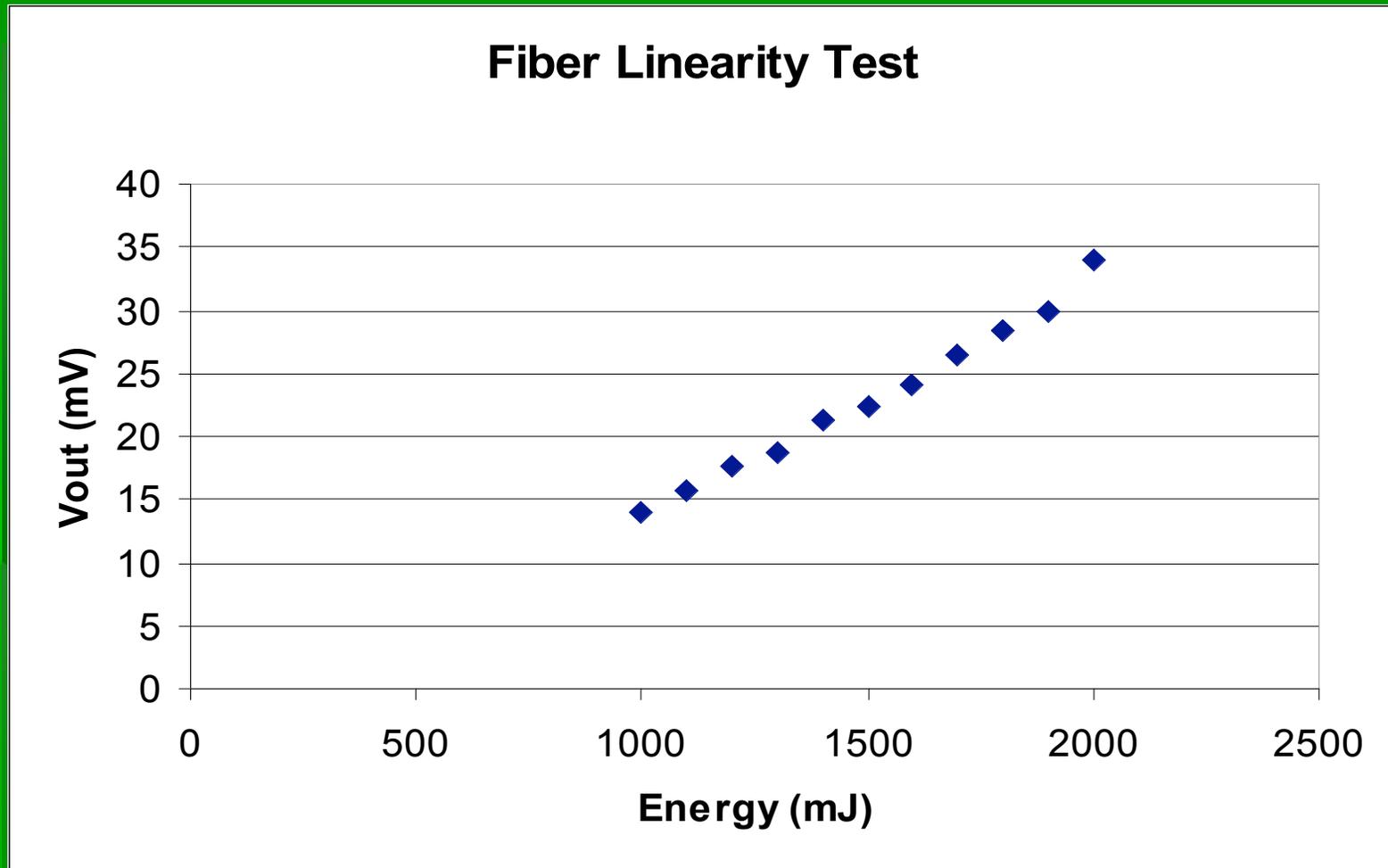


# More fiber tests

- Tested with filter in cold temperature
- Conclusion: Filter makes big difference in output voltage, temperature does not



# Fiber test with gold cathode



# Conclusions on fiber

- Fiber efficiency depends on length but not on temperature
- Gives relatively small signal for the wavelengths we're interested in



# Our Experiment

- Is fiber or UV LED better?
- Gold, gallium arsenide, silver, CsI, and niobium have all been used as cathodes
- Many tests done with 255 nm and 355 nm LED's, only the 255 is of interest since it is more energetic

# Thanks!

- Thanks to Andrea Albert, Walter Jaskierny, Hans Jostlein, Jamie Molaro, Stephen Pordes, and Leonel Villanueva

