

# A Sort-of Tissue Equivalent Proportional Counter (STEPC) for Space Radiation Dosimetry Applications

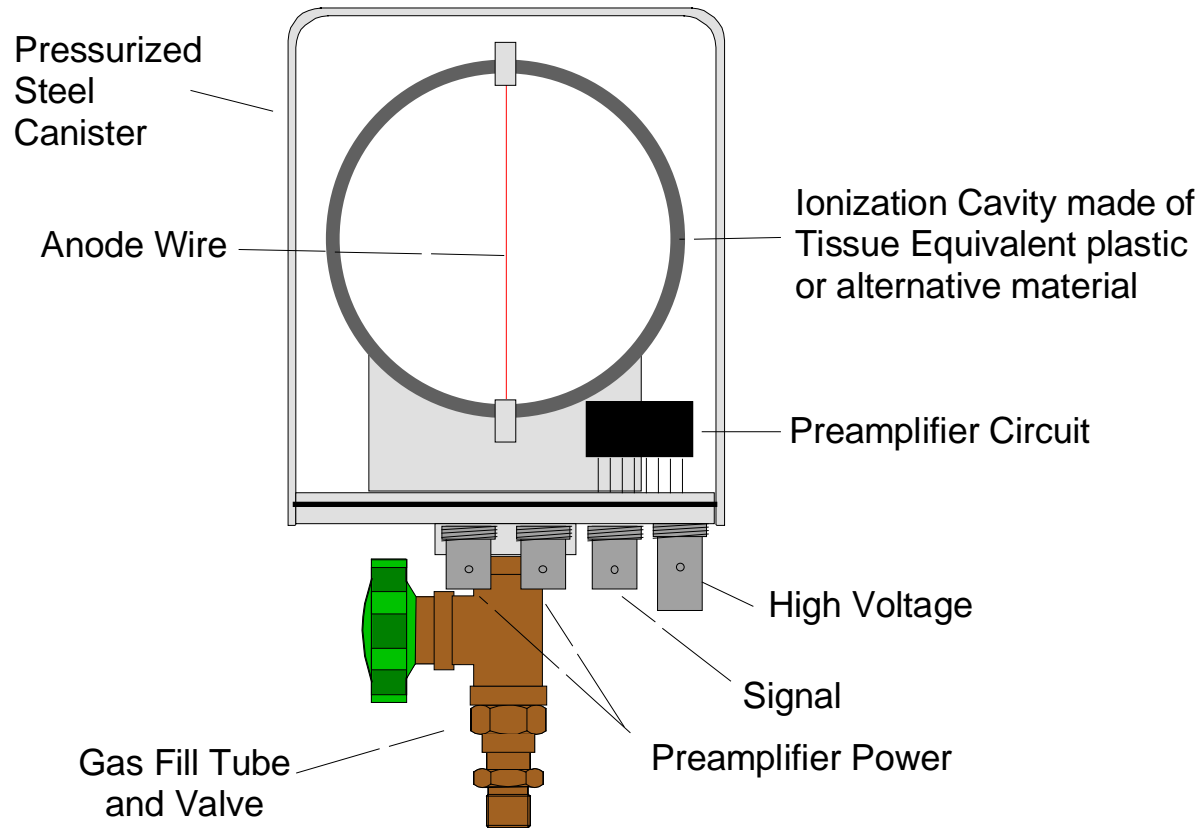
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# Research Objectives

- Evolutionary approach to TE ionization chamber and proportional counter design, fabrication, and testing
- Common 2”  $\phi$  spherical chamber design
- Alternative Detector/Spectrometer Electronics
- Alternative TE plastics
- Alternatives in fill gas composition and pressure
- Testing of instruments on Near-Space Balloon flights

# Design of STEPC



# STEPC Features

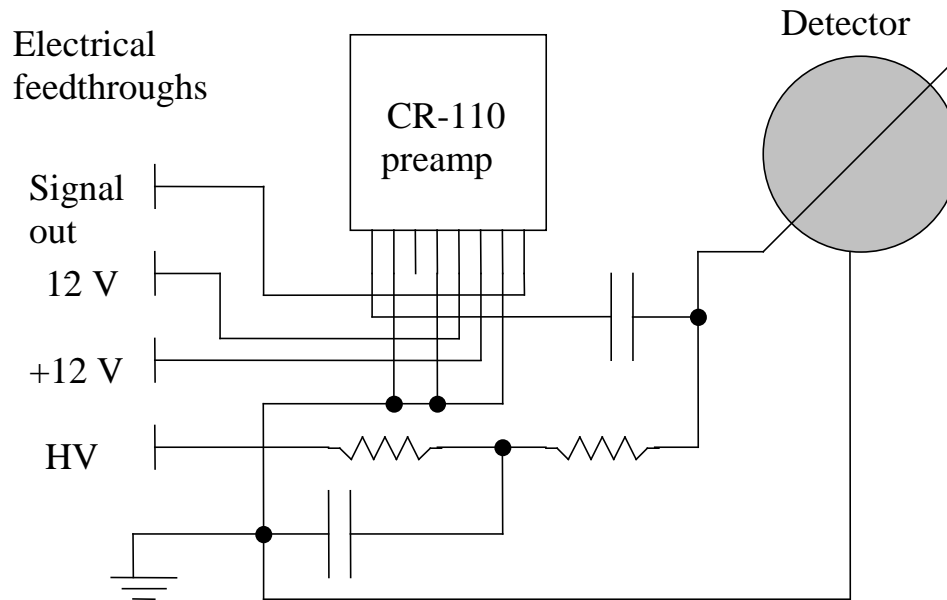
Similar in design to FarWest LET-SW2 2” single wire counter, but includes:

- built in preamplifier (Cremat CR-110),
- double o-ring resealable container,
- removable  $^{241}\text{Am}$  check source.

Currently five versions of STEPC:

- A-150 Tissue Equivalent Plastic,
- Nylon,
- Acrylic,
- Polyethylene,
- Polystyrene.

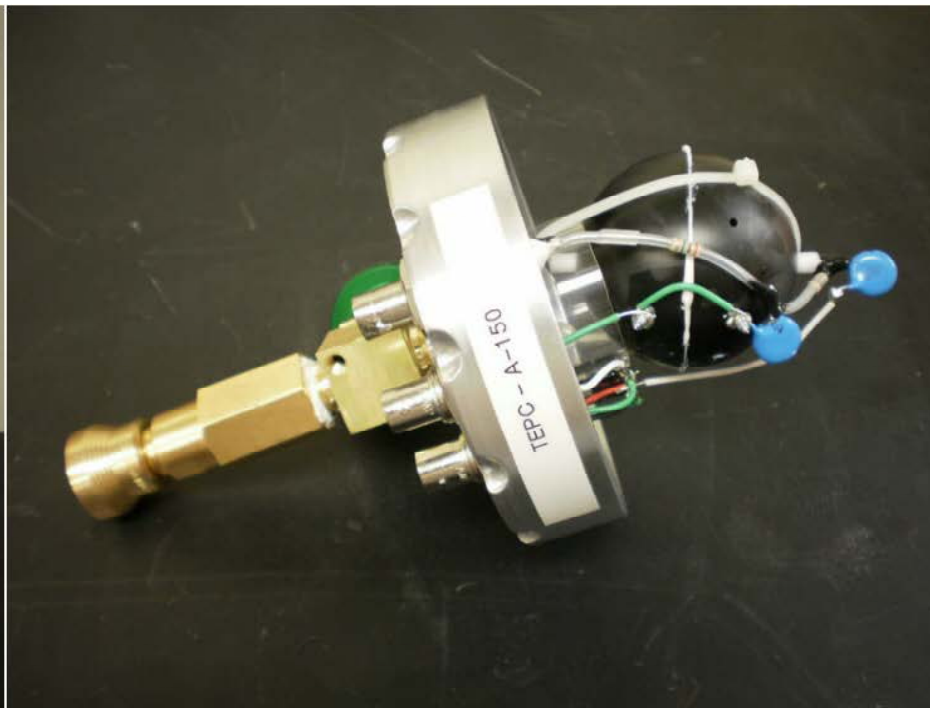
# STEPC Prototype Circuitry



# STEPC Prototype



exterior

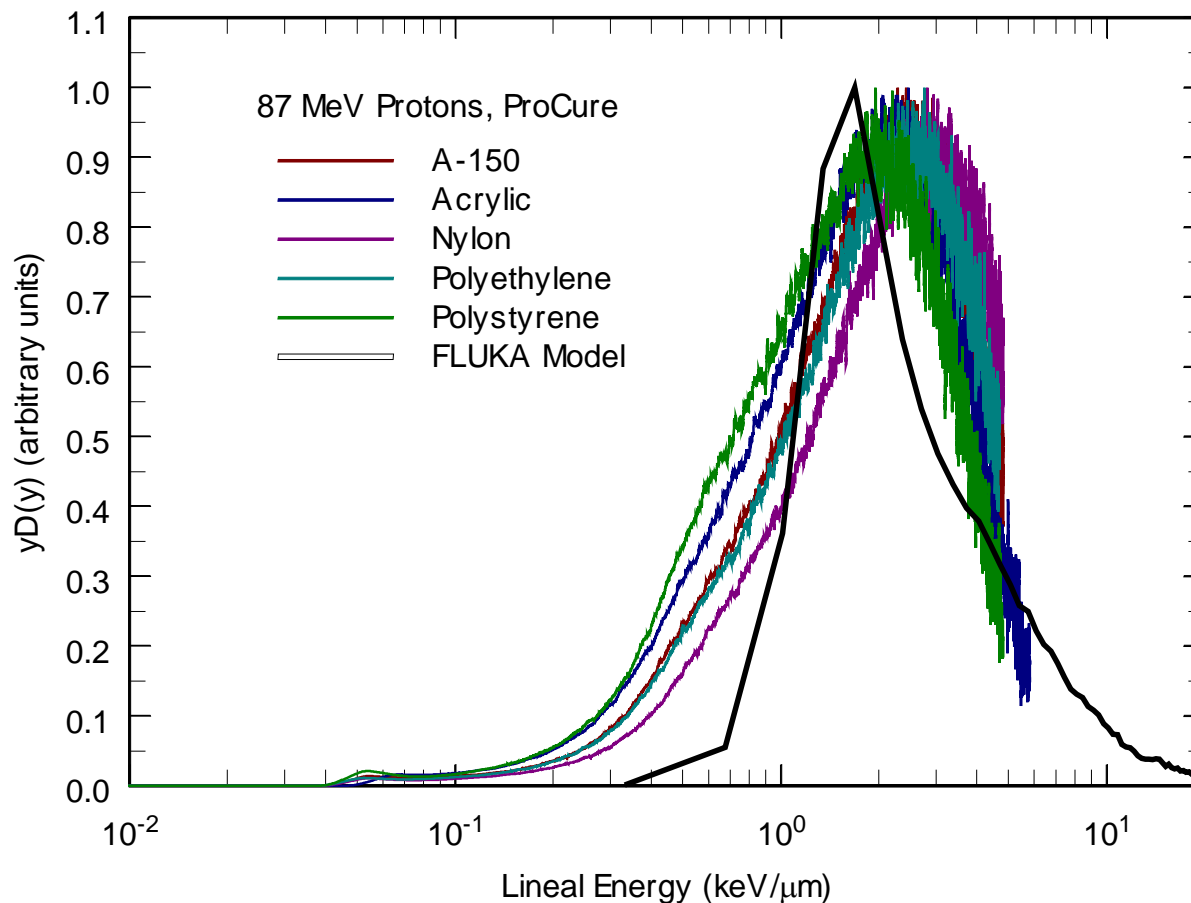


guts

# Characterizing STEP-Cs at the 230 MeV proton beam at the ProCure Treatment Center, Oklahoma City

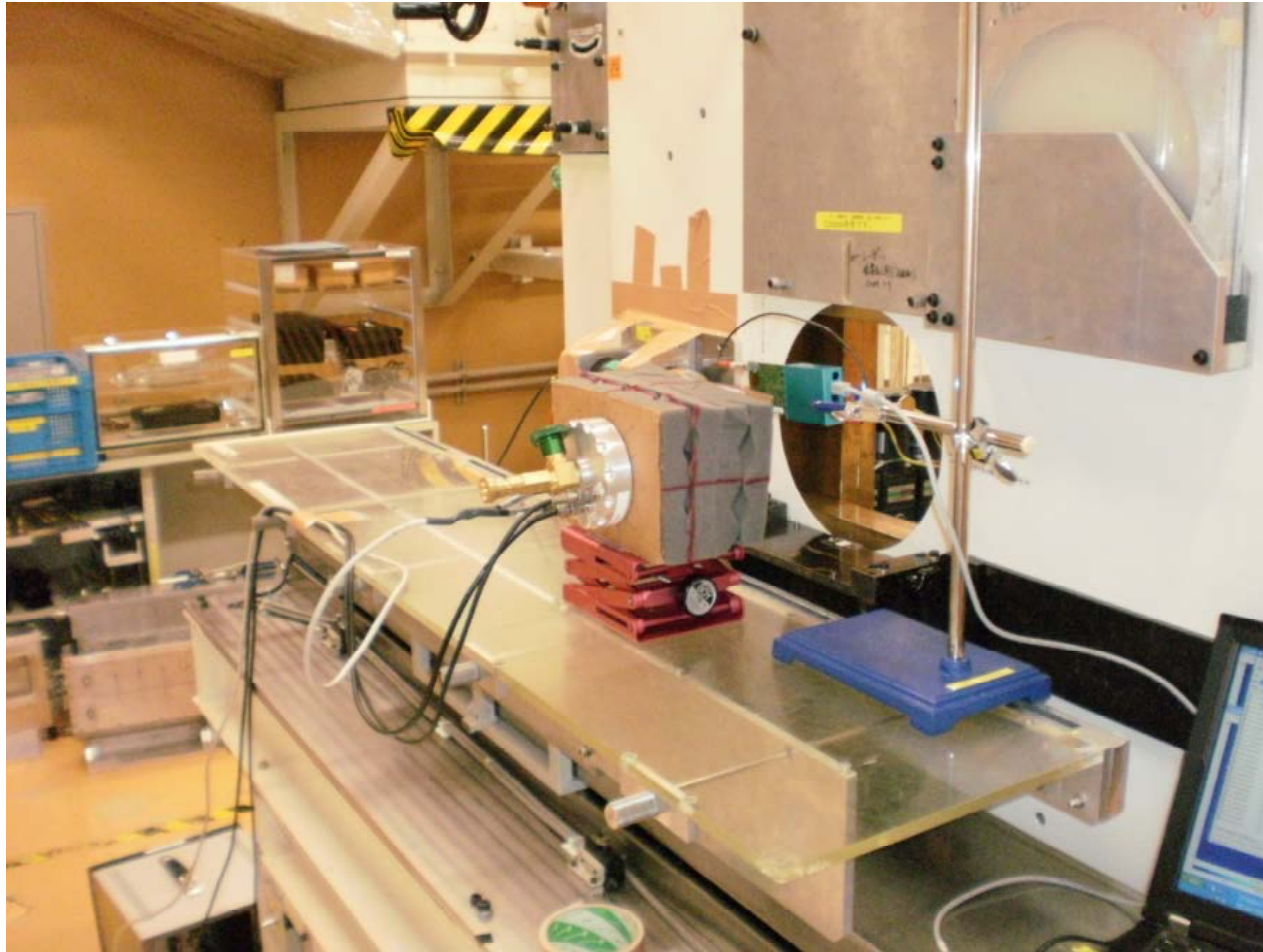


# yD(y) spectra measured by the five STEPCs during exposures to 87 MeV protons at ProCure, comparison with FLUKA Monte Carlo Simulation

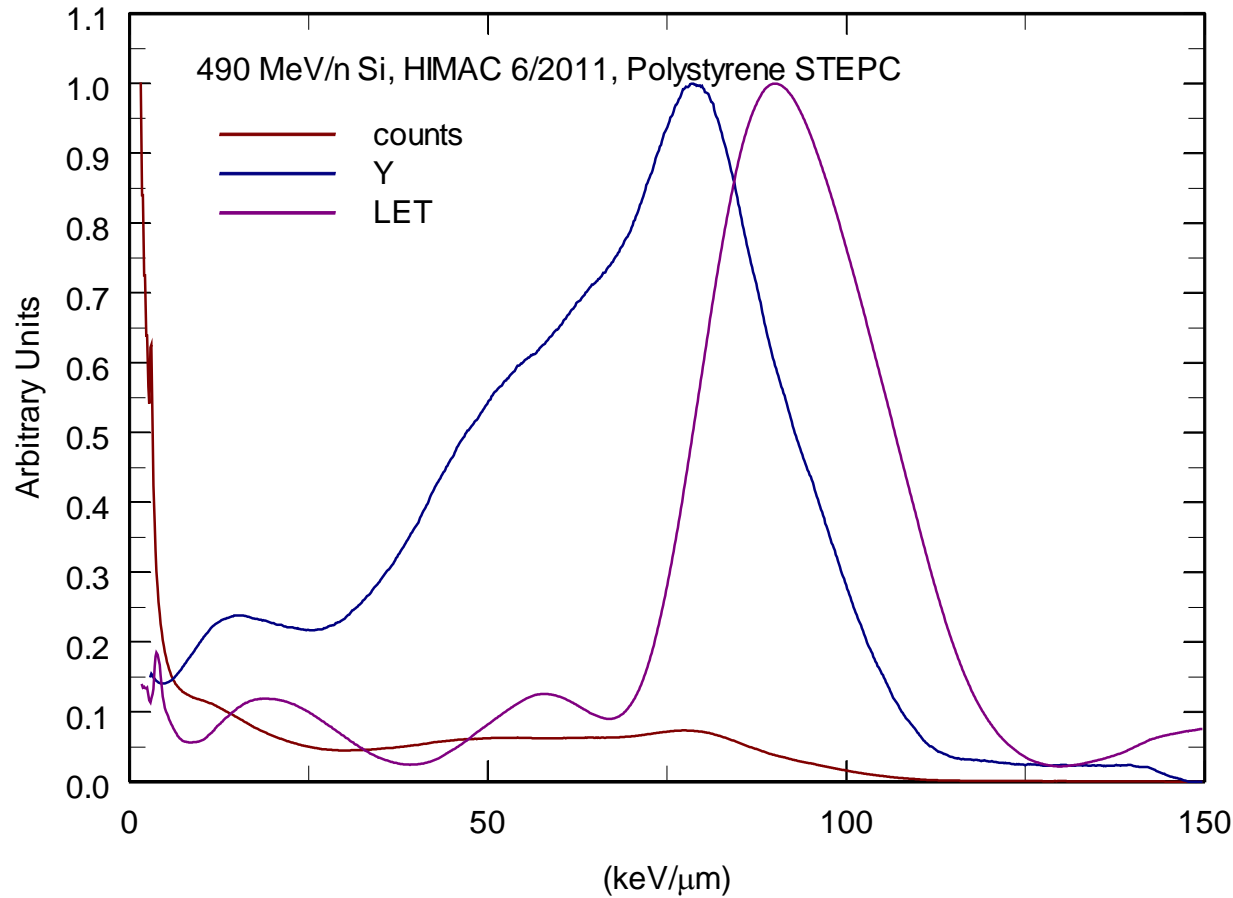




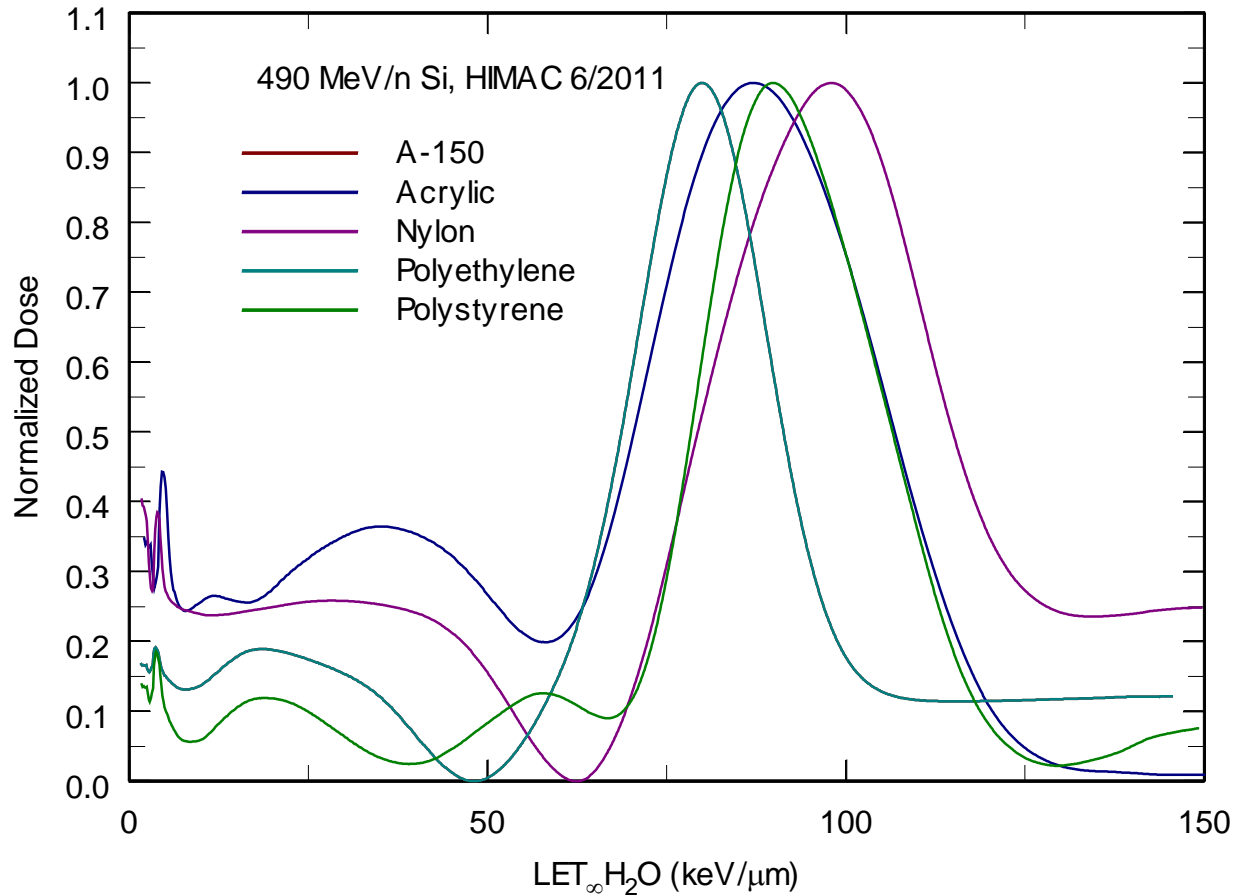
# Characterizing STEPCs to 500 MeV/n $^{56}\text{Fe}$ and 490 MeV/n $^{28}\text{Si}$ beams at HIMAC



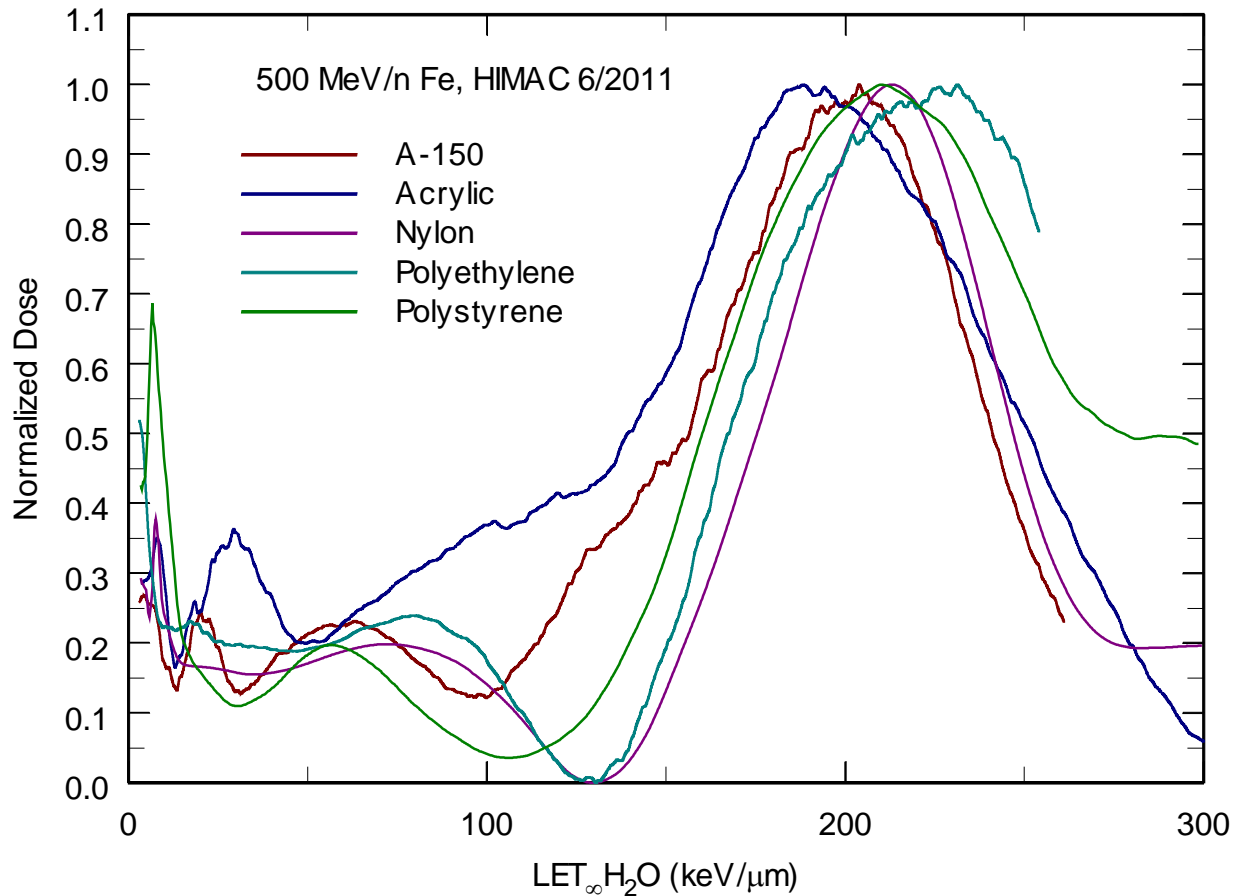
# Exposures of Polystyrene STEPC to 490 MeV/n $^{28}\text{Si}$ beams at HIMAC: Raw, Lineal Energy, and LET Spectra



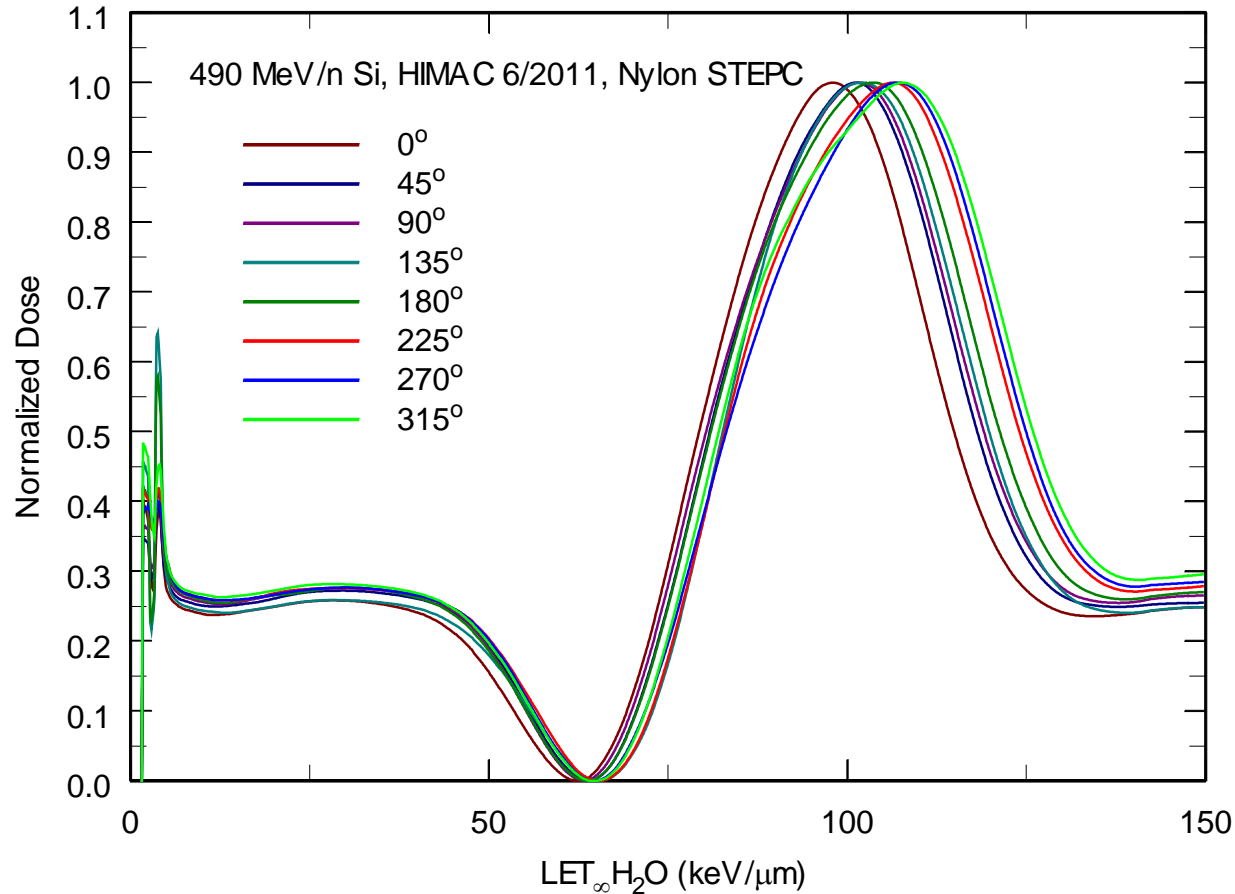
# LET spectra measured by the five STEP-Cs during exposures to 490 MeV/n $^{28}\text{Si}$ beams at HIMAC.

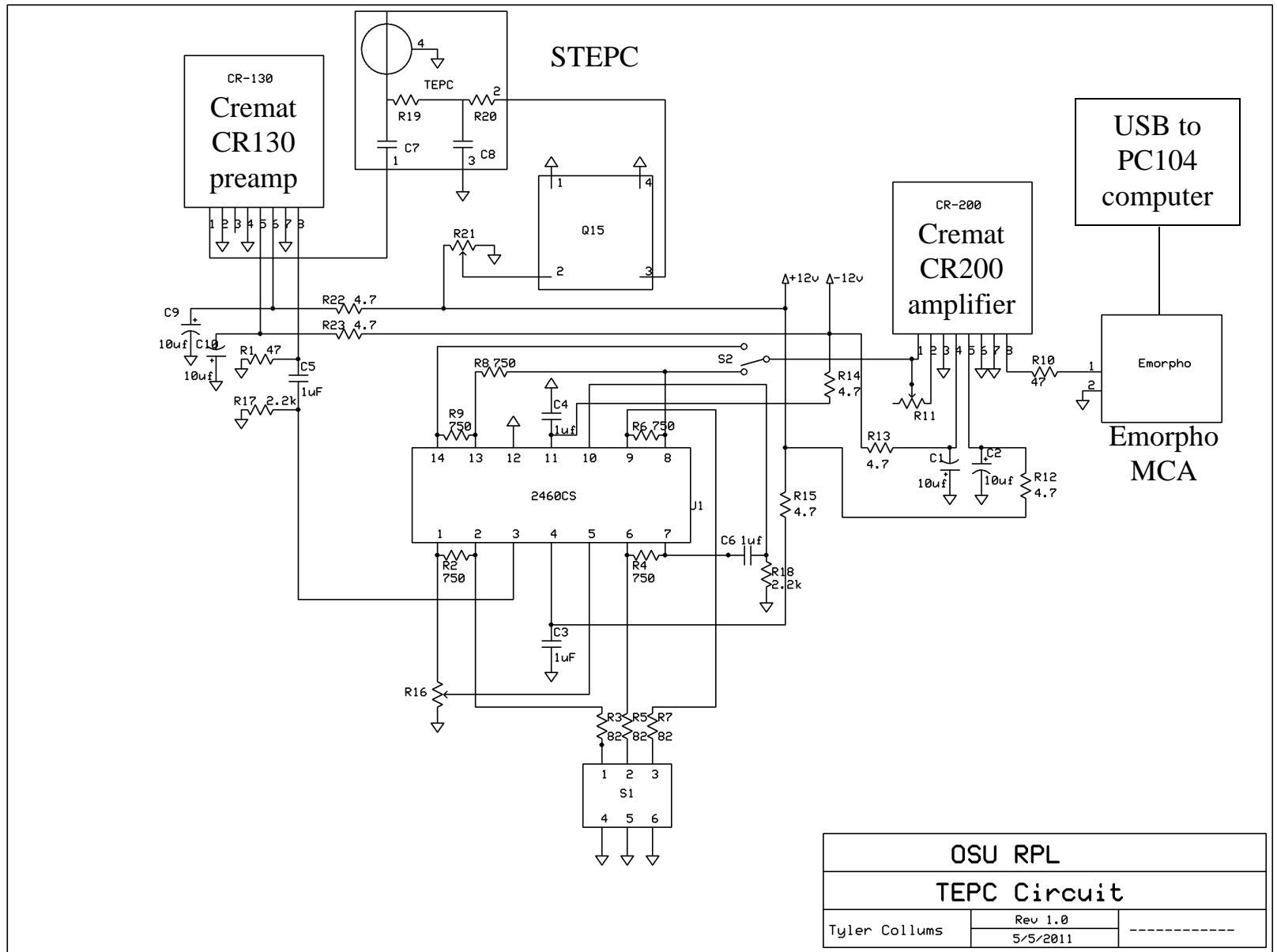


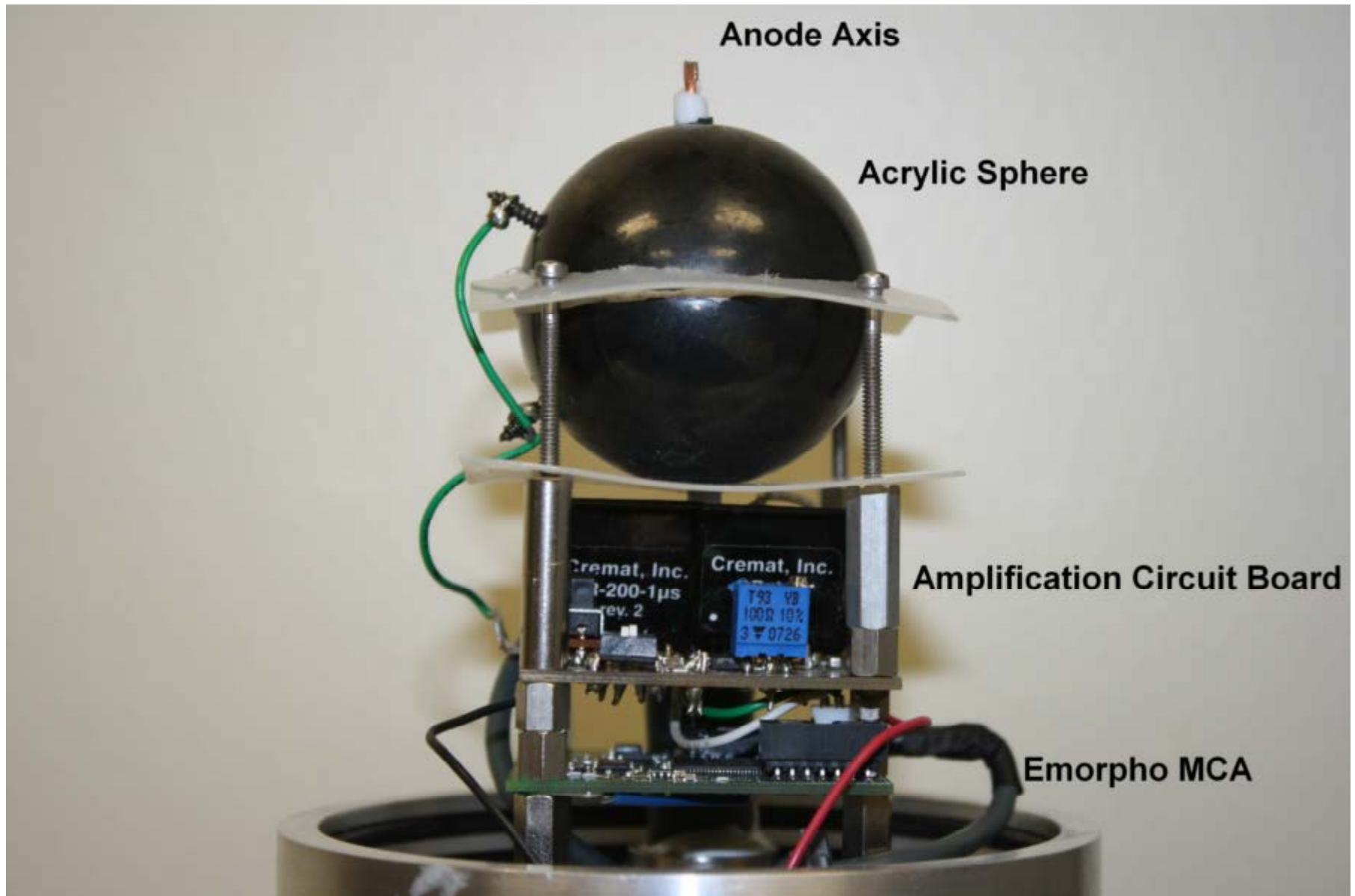
# LET spectra measured by the five STEP-Cs during exposures to 500 MeV/n $^{56}\text{Fe}$ beams at HIMAC.

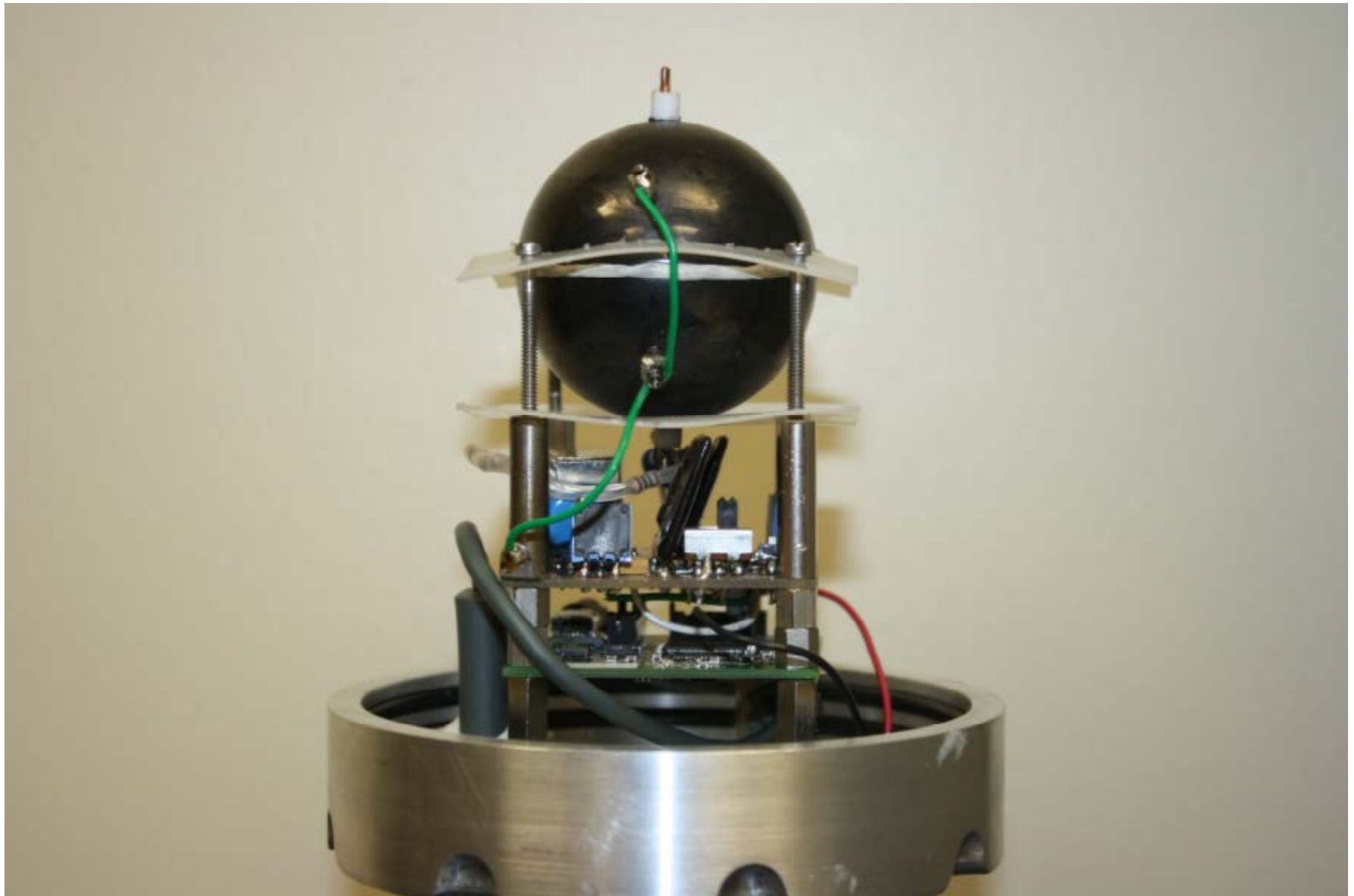


# LET spectra measured by the Nylon STEPC during exposures to 490 MeV/n $^{28}\text{Si}$ beams at HIMAC, rotation about anode wire axis













# Conclusions

- Prototype STEPCs have been designed, fabricated and continue to be characterized and calibrated at HIMAC and ProCure.
- Comparison of STEPCs with ionization cavities made of different materials appear to show little difference in response.
- Designed and fabricated self-contained STEPC with acrylic ionization cavity, amplifier + preamp circuit, spectrometer, and HVPS inside container, USB connection to PC104 computer.
- Self-contained STEPC now being characterized and calibrated at HIMAC and ProCure.
- Self-contained STEPC will be tested on a high altitude balloon mission.

# Acknowledgements

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