

Development and Production of Modular Cosmic Ray Telescopes

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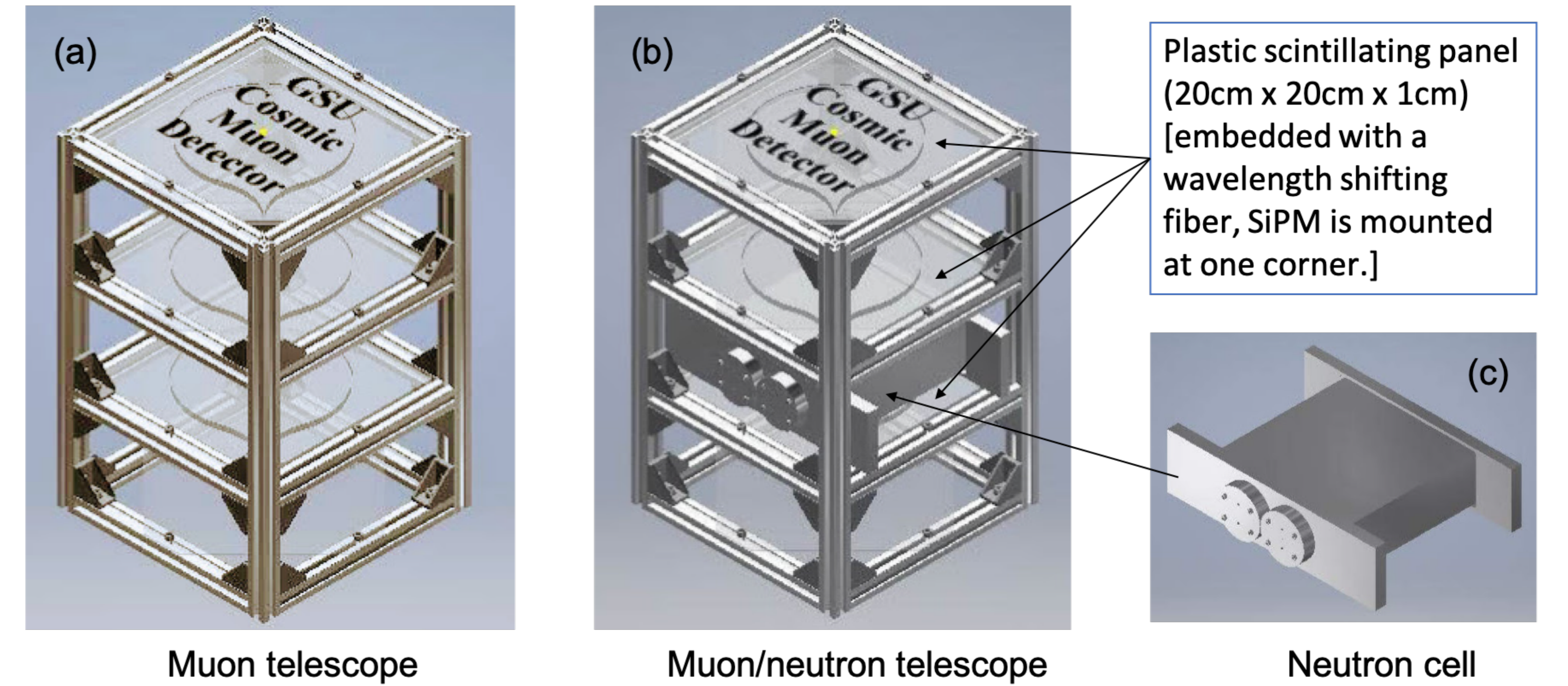
Executive Summary

While the quest of searching for the origins of the most energetic cosmic rays and the associated dynamics continues, there is a growing interest in recent years of the use of the cosmic rays for practical applications following the advancement of particle detection technologies. One of these important applications is to study the correlations between the cosmic ray flux variations and the space and earth weather at a global scale in real-time at low cost. Key to these efforts is improving the understanding of the correlation patterns to increase the accuracy, reliability, and timeliness of space-earth-weather forecasts.

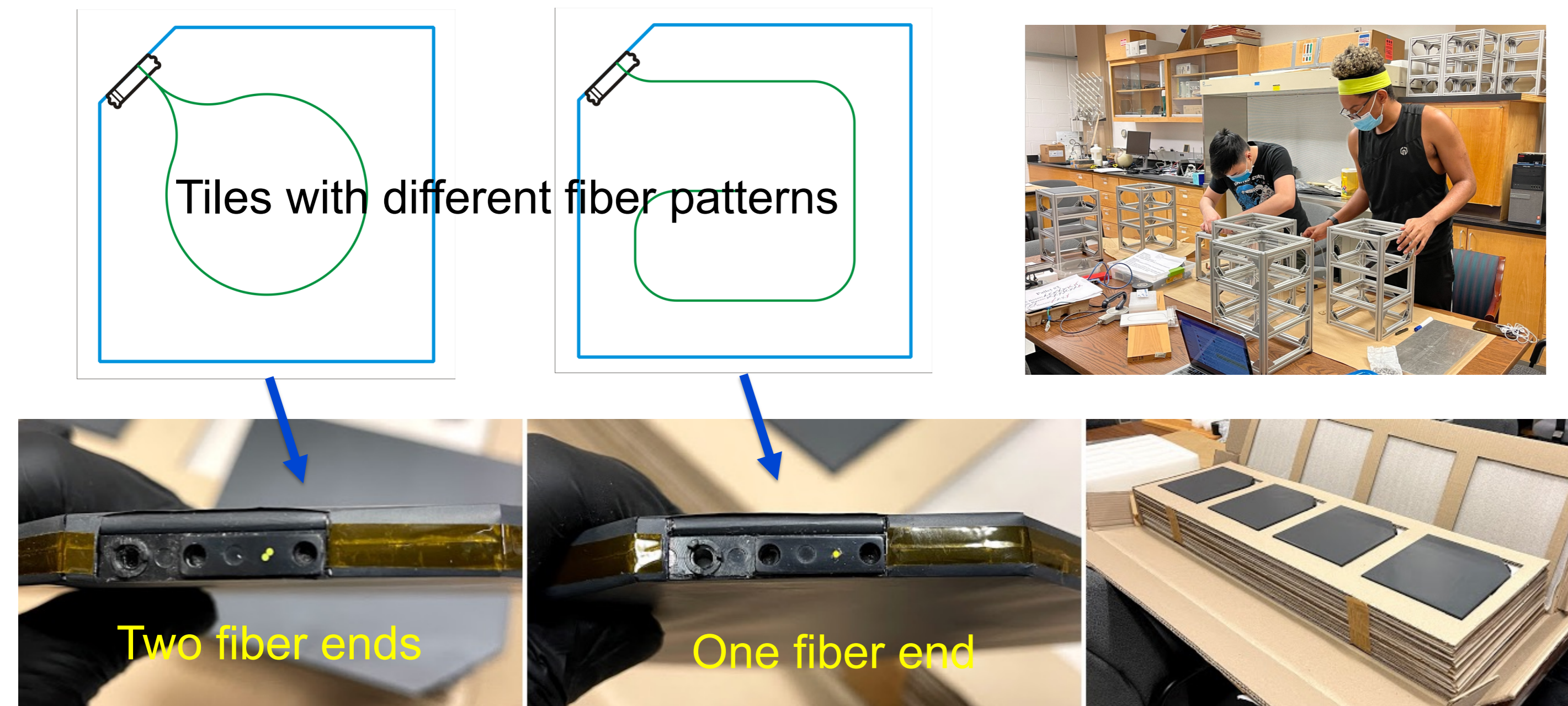
A state-of-the-art portable and modular cosmic ray muon and neutron detector prototype has been developed at Georgia State University (GSU) for the measurement of cosmic ray muon and neutron flux variations simultaneously. The detector consists of three layers of plastic scintillator and a neutron-cell with liquid scintillator mounted on an extruded aluminum frame. The scintillation light is collected through embedded wavelength shifting fibers which are coupled to silicon photomultipliers (SiPM) for signal readout. The modular, portable and low-cost nature of this cosmic ray telescope provides a technological choice to quantify the cosmic ray flux variation around the globe in an unprecedented spacial and temporal resolution.

At the present time, we are seeking collaborators for hosting muon telescopes and building a network of identical cosmic ray muon detectors around the globe. Please contact Xiaochun He (xhe@gsu.edu) for details.

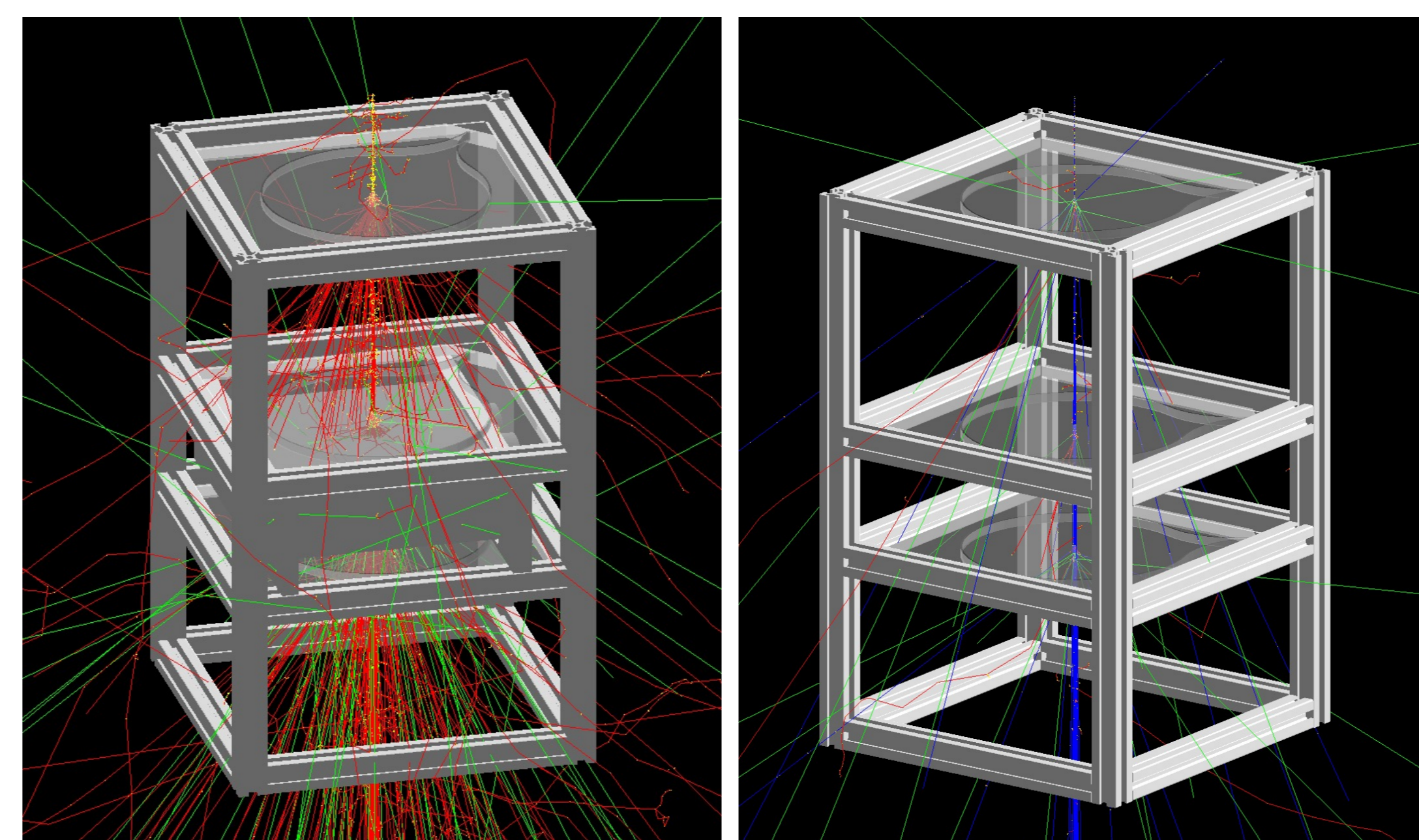
Cosmic Ray Telescope Designs



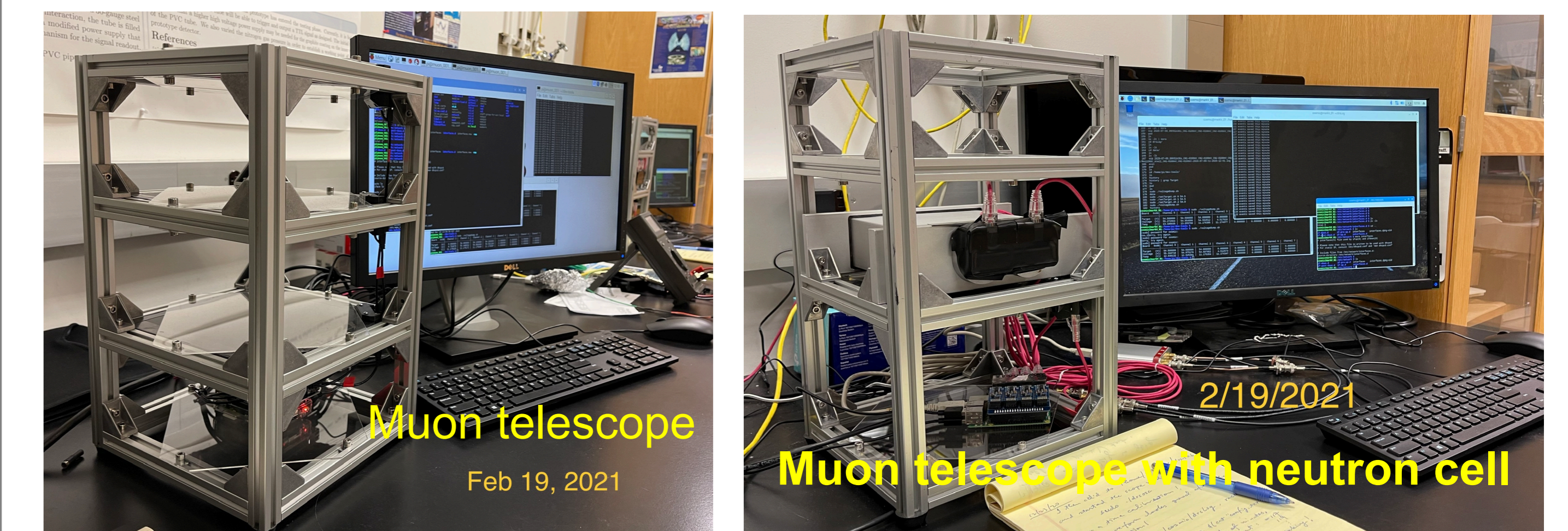
Scintillator Tile and Frame Design & Production



Acceptance Study via Simulation

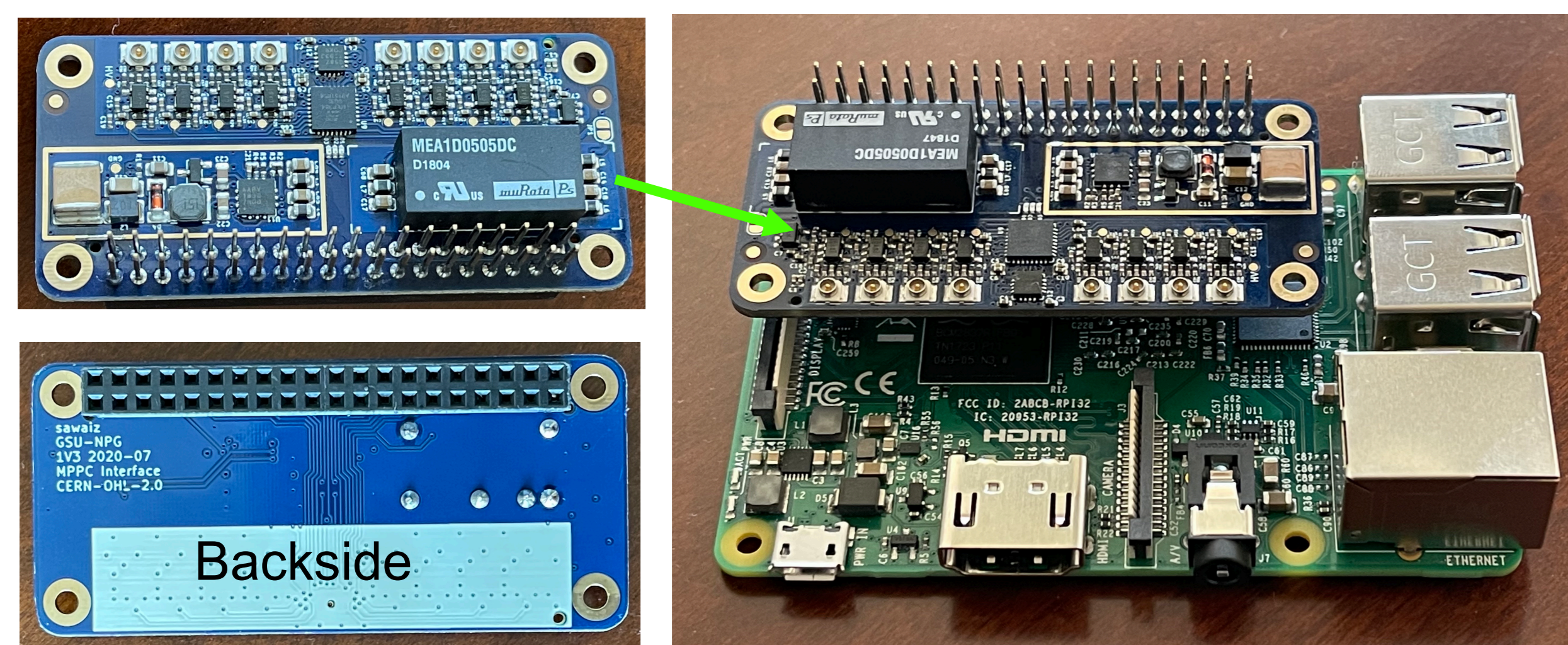


Test Setup @ GSU



These are examples of assembled telescopes which are under testing at GSU. A plan to installed them at selected sites around the globe.

Raspberry PI + FPGA Readout



An 8-channel FPGA board is developed for the raspberry PI based readout. This PCB also supplies the bias voltage for the SiPMs. More sensors can be added, e.g. GPS sensor, etc

Example of Time Series of Percentage Change of Hourly Muon Flux, Pressure and Temperature (for monitoring the Earth Weather Pattern)

