Tracking Sagittarius A* with Cosmic Ray Tracking Detector

Nkeiru Ubadike, SUNY Schenectady County Community College
Dr. Raul Armendariz, Queensborough Community College
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Introduction

There are galactic cosmic rays (GCR) that reach high energies of 1PeV and some scientists propose that they originate from the black hole in the center of our galaxy: Sagittarius A*[1]. In light of these proposals, the cosmic ray tracking detector (Figure 1) is being configured to track Sagittarius A*.

Tracking Detector Arrangement

- Three plastic scintillators connected to photomultiplier tube fitted into aluminum box frame.
- Frame mounted on Yaesu G5500 azimuth and elevation rotator.

Figure 1 Tracking Detector (will get better picture once finished)

Detector Mechanism

- The kinetic energy of a muon is converted to a photon by the scintillator.
- The PMT converts this to an electrical signal from which meaningful data about the particle can be obtained.

Computerized Control

- The computer- rotator interface is the ARS USB. DIN-8 connector of the rotator was wired to the RCI-USB circuit board of ARS-USB (Fig. 2)

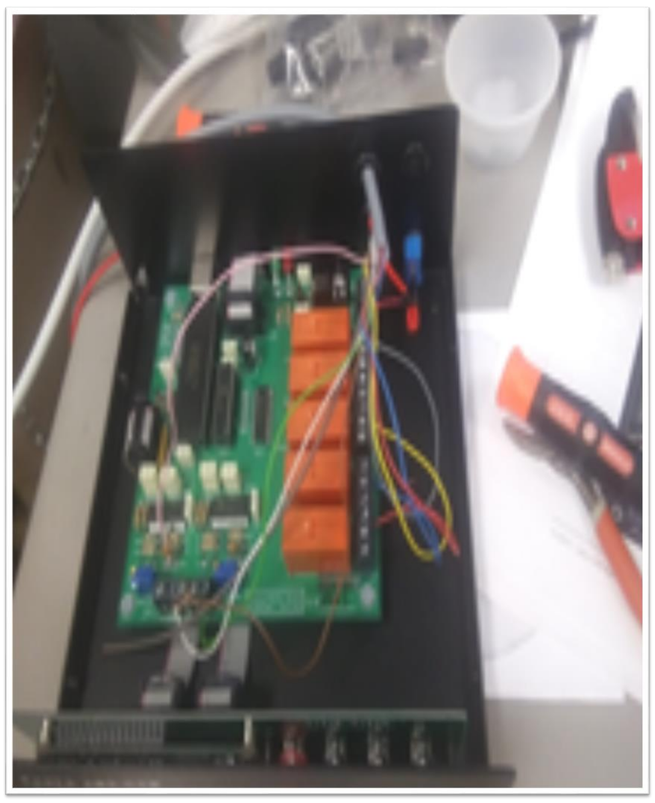

Figure 2: RCI-USB circuit board of ARS-USB

- Voltage feedback changes when rotator turns the detector.
- The circuit board reads the voltage present on the rotator potentiometer and thus calculates the rotator position.
- The circuit board accepts 5V as the maximum voltage. The Yaesu G5500 output was 3.91V. This signal had to be amplified in order to avoid loss of resolution by adjusting the RCI-USB internal potentiometer.

Automatic Control

- The ARS- USB comes with software that creates a virtual COM port through which 3rd party software can control the rotator.
- Tracking software selected is Nova for Windows.

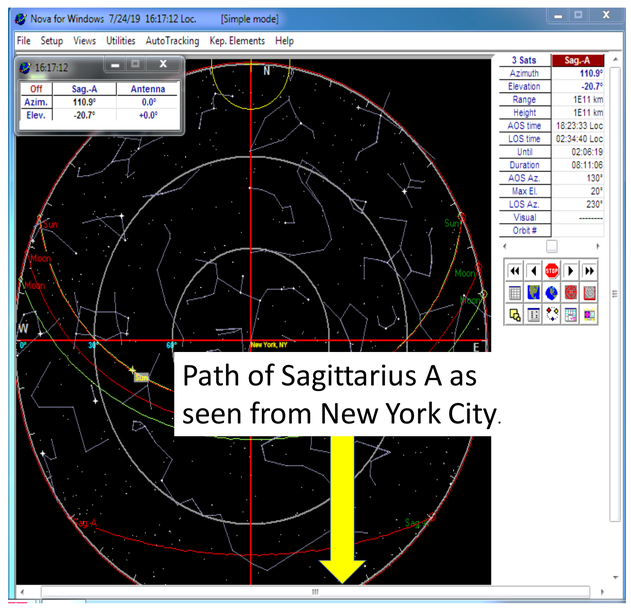

Figure 3: Screenshot off Nova for Windows tracking software

- Before setting Nova to track, the detector had to be calibrated to true north.
- The Meade LX200 GSP telescope will be used to verify the tracking accuracy of detector.

Sagittarius A*

- Sagittarius A* is a supermassive black hole in the Galactic Center, located on the border of the constellation Sagittarius near Scorpio. Celestial coordinates: RA 17h 45m 40s |Dec. -29° 0’ 28
- From our northerly latitude, the path of Sag A* will be close to the horizon, never rising above 30 degrees elevation.
- In 2016, the HESS collaboration published a study proposing that Sagittarius A* is linked to petaelectronvolt (10^15) cosmic rays.

References

1. Acceleration of petaelectronvolt protons in the Galactic Centre H.E.S.S. collaboration Nature 531, 476 (2016)

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