IceCube Particle Astrophysics Center Strengthens Ties to Ghostly Particles By Using Ruggedized Fiber Jumpers from Clearfield®

In the heart of Antarctica (the South Pole), the Wisconsin IceCube Particle Astrophysics Center (WIPAC) at the University of Wisconsin is conducting project experiments to detect tiny and elusive sub-atomic particles, called neutrinos. The sensors constructed to detect these particles provide an exclusive way to find and study neutrinos and what they can tell us about unexplained cosmic events in the universe, such as exploding stars and black holes.

Two individual projects, the "IceCube Project" and the "ARA Project" have been created by WIPAC to gather information from these sensors placed deep under the Antarctic ice. Scientists have built a communications network that transports the gathered data from the detector elements bored deep into the Antarctic ice back to a central aggregation point.

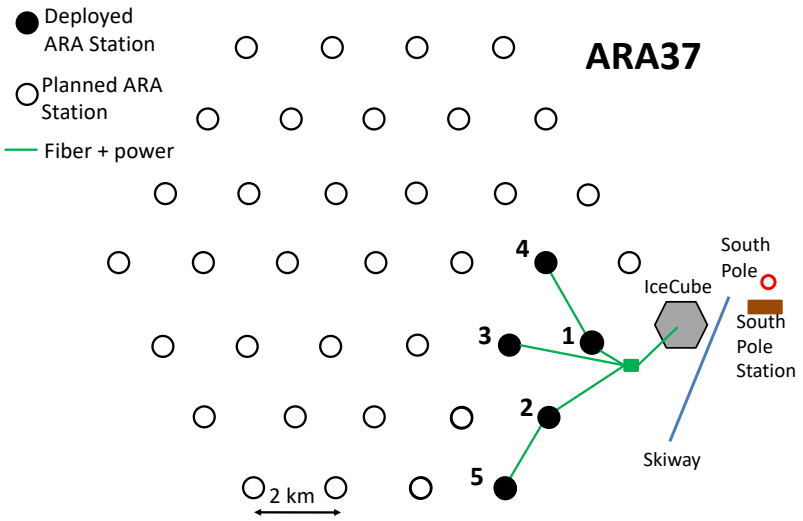
About the IceCube Project

The IceCube Neutrino Observatory is a particle detector at the South Pole that records the interactions of a nearly massless subatomic particle called the neutrino. IceCube searches for neutrinos from the most violent astrophysical sources: events like exploding stars, gamma-ray bursts and cataclysmic phenomena involving black holes and neutron stars.

The original IceCube network was constructed using a copper backbone to feed the data to the aggregation point. Now, an expansion of the detector currently under development, the IceCube Upgrade, will use a fiber optic network for communications and precision timing. Fiber optics will replace the copper surface cabling and will lay the foundation for larger extensions in the future.

About the ARA Project

The Askaryan Radio Array (ARA) is a radio detector array, currently under development at the South Pole, designed for the detection of ultra-high-energy cosmic neutrinos. The goal is to detect the cosmogenic neutrino flux at energies above 10^17 eV. Plans are underway for further construction at the South Pole, utilizing fiber optics to provide faster communications.



This schematic shows the layout of the ARA.

The project encompasses a huge area of instrumented ice, with the furthest station being nearly 14 kilometers away from the South Pole Station. This large scale deployment and the subsequent expansion (up to 100 sq. kilometers) requires the use of fiber optics to make it feasible.

Project Challenges

With Antarctic winter temperatures falling to -104°F in winter (and even summer temps as low as a bone chilling -15°F), managing and maintaining a fiber optic network at the South Pole is especially challenging. The successes of the IceCube Neutrino Observatory projects rely on products that stand up to extremely harsh environmental conditions as well as the capability to transport this data over long distances.

> *"Having truly ruggedized products is incredibly crucial in an extremely cold South Pole environment. A faulty product is the Achilles' heel of networks...and a harsh environmental condition makes this even more difficult to fix. Clearfield's ruggedized fiber jumper cables have amazing quality and stand up to every challenge." — Dr. John Kelley, IceCube Manager of Detector Operations, Wisconsin IceCube Particle Astrophysics Center (WIPAC), University of Wisconsin—Madison*

Traditional copper solutions require multiple signal regeneration sites and the ability to power each of these sites. This requirement makes deploying an antenna array of this scale virtually impossible. So, scientists turned to fiber optics. They discovered early on that using standard fiber optic jumpers with advertised temperature ratings typically down to -40°F did not perform without failures of the outer sheath and subsequent fiber failures.

Searching for Answers

To prototype next-generation communication and timing networks, the IceCube project developed a small scale test bed at the South Pole using Clearfield ruggedized fiber jumpers for both indoor and outdoor applications. They deployed these ruggedized fibers in optical junction and electronics boxes buried beneath the icy surface. The cold weather performance of Clearfield's ruggedized fiber jumpers proved successful and a driving factor for their use in the project. Providing protection in temperatures as cold as -104°F while still remaining flexible and adding no measurable attenuation to the fiber link were critical factors for their deployment to succeed. These factors made it feasible to use fiber to move beyond copper to fiber in the IceCube Upgrade and to deploy the large scale antenna array called the Askaryan Radio Array (ARA).

"Having truly ruggedized products is incredibly crucial in an extremely cold South Pole environment. A faulty product is the Achilles' heel of networks...and a harsh environmental condition makes this even more difficult to fix. Clearfield's ruggedized fiber jumper cables have amazing quality and stand up to every challenge," says Dr. John Kelley, IceCube Manager of Detector Operations, Wisconsin IceCube Particle Astrophysics Center (WIPAC), University of Wisconsin—Madison.

Results

Given the size and scope of the expected expansion of the neutrino array, having confidence in the supporting fiber network and its associated components is critical. With antenna arrays spaced 2 Km or more apart and with some 30+ sites planned for future deployment, the performance of Clearfield's fiber jumpers ensure data will flow from these sites to the DAQ. This gives scientists of the ARA station a better understanding of objects in space that were previously unreachable—shedding a new "light" on those mysterious black holes.

About Wisconsin IceCube Particle Astrophysics Center

For more information on the work being done, visit https://wipac.wisc.edu/science/projects.

About Clearfield, Inc.

Clearfield, Inc. (NASDAQ: CLFD) designs, manufactures and distributes fiber optic management, protection and delivery products for communications networks. Our "fiber to anywhere" platform serves the unique requirements of leading incumbent local exchange carriers (traditional carriers), competitive local exchange carriers (alternative carriers), and MSO/cable TV companies, while also catering to the broadband needs of the utility/municipality, enterprise, data center and military markets. Headquartered in Minneapolis, MN, Clearfield deploys more than a million fiber ports each year. For more information, visit www.SeeClearfield.com or @ClearfieldFiber.