

# CASE STUDY

## Plumbing the mysteries of the universe kilometres below the earth

### The Challenge

Neutrinos are one of the smallest particles in our Universe, but studying them calls for massive data sets that range up to ten terabytes in size. Moving that data from SNO to research partners at universities across Ontario and internationally, from the U.S. to the U.K. calls for a high-bandwidth network that is robust, reliable and globally connected.

### Background

Called “Canada’s Eye on the universe”, the Sudbury Neutrino Observatory is a \$100 million international particle astrophysics project located two kilometres underground in Vale INCO’s Creighton Mine, near Sudbury. SNO is the lowest-radioactivity experimental location in the world. The international team of SNO scientists are working together to uncover the mysteries of the sun using tiny fundamental particles called neutrinos that are produced by the nuclear reactions that power the sun.



### ORION and CANARIE Make a Difference

As one of the very first scientific institutions connecting to the ORION network, SNO has been able to ensure the transmittal and sharing of massive amount of research data generated by the global scientific collaboration. This global-scale collaboration involves several Ontario partners, including Queen’s, Carleton, Laurentian and Guelph Universities, as well as the involvement of other colleagues in Canada, the US and the UK. With new facilities opening this year, the SNO provides Canada with a permanent, world-class facility for underground scientific research and expands Canada’s capacity in the search for dark matter and greater understanding of the universe.

SNO uses also ORION to facilitate high-speed communication for many initiatives including “Supernova Watch.” Under this program, SNO members monitor events that could arise from neutrinos created in a supernova (a star collapsing through gravity) in our galaxy, allowing an international team to inspect the data on-site over the network and participate in a discussion of whether the astronomical community should be alerted. SNO’s response time for establishing this discussion is typically 10 minutes – and would be impossible without the high-speed connectivity provided by ORION. The success of Supernova Watch and other underground experimental techniques was a major factor in the award of almost \$40 million from the Canada Foundation for Innovation to create a permanent, world-class facility for underground science research.

### Results

Through ORION advanced networking links, 130 international scientists are able to measure flux, energy and direction of electron-neutrinos produced in the sun, to receive data directly from the experiment to their desktops, to monitor equipment remotely and to perform complex calculations using high-performance computing resources.

### The Impact

*“Finding answers to the big questions in science today is an international team effort. Canada is recognized as a valued partner that can make a significant contribution to the search for answers. Quite simply, ORION makes our participation possible.”*

- Alain Bellerive, SNO, Canada Research Chair, Carleton University

