

# GÉANT and ORIENTplus – delivering cosmic results by studying gamma rays

## Transferring terabytes of real-time data between China and Italy through research networks

High-speed cross-continental research and education networks are helping European and Chinese scientists study one of the most puzzling phenomena known to science.

About once a day, the sky is lit up by a brilliant flash of energy. These are gamma-ray bursts – violently energetic eruptions of high-frequency electromagnetic radiation, caused predominately by the explosion of massive stars in distant galaxies billions of light-years away.

Understanding these striking phenomena is data-intensive work and calls for a joint effort between scientists across the world. The GÉANT and ORIENTplus high-speed networks are essential for this type of bandwidth-hungry collaborative research. GÉANT provides high capacity pan-European connections, while ORIENTplus links scientists in China and Europe.

### Understanding 'cosmic showers'

This research is not solely about revealing the deep mysteries of the universe. There are clear practical benefits in understanding how these showers affect the world around us.

Any solar disturbance, for instance, magnetic storms or flares, react with the atmosphere, and become 'cosmic showers', which may play a role in cloud formation and climate change, and could be responsible for radiation exposure on long-distance high-altitude flights. They can also seriously damage sensitive electronics on-board the large number of satellites circling our planet which are responsible for important communications and geo-monitoring.

Since first observed in the 1960s, scientists have been struggling to fully understand these exotic events and using a variety of sophisticated technologies they are gradually laying bare the details of this fundamental process of nature.



Image courtesy of NASA/SkyWorks Digital

### The Challenge

To improve understanding of cosmic radiation, based on data-intensive collaborative research between astrophysicists in China and Italy.

### The Solution

Through high speed research networks data is seamlessly transmitted from the ARGO-YBJ telescope facility in Tibet to INFN-CNAF, a dedicated computing centre for high-energy physics experiments in Bologna, Italy for analysis.

### Key Benefits

The power of the GÉANT and ORIENTplus networks are essential in enabling cutting-edge international scientific collaboration between physicists in a remote Tibetan location and in Italy, providing insights into the mysteries of the universe.

## China and Italy – connecting, collaborating

One of the latest of these initiatives is the **ARGO – YBJ** project (**A**strophysical **R**adiation with **G**round-based **O**bservatory at **Y**ang**B**a**J**ing), a collaboration between the National Institute of Nuclear Physics (INFN) in Italy and the Institute of High Energy Physics (IHEP) of the Chinese Academy of Science.

As with all research in astrophysics, studying gamma-ray showers produces terabytes of data every year. At the end of the 1990's data from the telescope had to be recorded on tapes and dispatched to processing centres by bus and plane. Today only research and education networks can provide the extremely stable, high-capacity connections necessary for the reliable transfer of these large volumes of data in real time for analysis around the world.

The combination of the pan-European GÉANT network and ORIENTplus (and its predecessor ORIENT), along with Sino-European computing collaboration through the Eucchinagrid computing grid, allow transfer and collaboration in real-time, with data now routed the shortest and fastest way rather than taking a lengthy and uncertain route to its destination in Europe.

## Revealing the secrets of the universe

The YangBajing laboratory is connected to the Chinese research and academic network CSTNET. ORIENTplus is the essential link between CSTNET and GÉANT through which the data is transferred to Bologna, Italy, via its Italian counterpart GARR. The result is a direct link between YangBaJing and the INFN-CNAF supercomputing centre in the heart of Europe – enabling continuous transfer of some hundreds of terabytes of data every year, and making cost-effective scientific collaboration on this scale a practical possibility.



Cutting edge science on top of the world – made possible by ORIENTplus and GÉANT



The only places in the world where we can site the telescope are remote and difficult to work in. So we need to be able to transport terabytes of data every year from the telescope to the processing centre in Italy for analysis and study. It used to be that the only way of doing this was to get our scientists to fly to Italy with suitcases full of data tapes – hardly cutting edge science! Stable, high-capacity networks are therefore absolutely fundamental to our success. GÉANT and ORIENTplus fit the bill and are, frankly, a godsend. Without them, carrying out this research would be nothing more than a scientist's pipe-dream. We have recently upgraded the telescope and we are now producing outgoing traffic that peaks at over 100 Mbps – and it looks like we are going to be making even higher demands on GÉANT and ORIENTplus in the future.

*Professor Benedetto D'Ettorre Piazzoli, former Vice President of the National Institute of Nuclear Physics (INFN) in Italy and the Italian spokesman of the ARGO-YBJ collaboration.*



International collaboration between scientists is the only way to achieve a project like this and the combination of GÉANT and ORIENTplus makes that a reality for us. We maintain and operate the telescope facility – and all the processing takes place in near-real time thousands of miles away.

*Professor Cao Zhen, the Chinese spokesman for ARGO-YBJ*

## connect • communicate • collaborate

The world is criss-crossed with high-capacity data communications networks, connecting and serving research and academic institutions across the globe. The most advanced of these is GÉANT, serving Europe. GÉANT interconnects with counterparts across the world, such as ORIENTplus which links Chinese and European researchers.

Separate from the public internet for reasons of security and performance, these networks make an enormous practical contribution to research in a wide variety of areas – saving lives, building knowledge, establishing real-time collaboration between scientists all over the world.

GÉANT and ORIENTplus provide ARGO-YBJ with the stable, high capacity connections needed to transfer hundreds of terabytes of gamma ray data every year from China to the Italian supercomputing centre where it can be analysed in real-time. This vital scientific collaboration, which aims to find out more about gamma rays, would be impossible without access to the GÉANT and ORIENTplus networks to transfer data across the world.



### For more information:

GÉANT: <http://www.geant.net>

GARR: <http://www.garr.it>

ORIENTplus: <http://www.orientplus.eu>

ARGO-YBJ: <http://argo.na.infn.it>

