

Test installation of a germanium detector at the San Antonio mine, Mineral del Chico, Hidalgo

Summary of the activity

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On November 20 and 21, 2018, a preliminary installation of the high purity germanium detector (HPGe) of the Detectors Laboratory of the Instituto de Ciencias Nucleares (ICN) of UNAM was carried out in the San Antonio mine located at the El Milagro mining complex in the municipality of Mineral del Chico in the state of Hidalgo. El Milagro is one of the geosites that make up the Comarca Minera de Hidalgo UNESCO Global Geopark. This test is part of a series of efforts aimed at installing an underground laboratory for education and research purposes in the region, which has been named LabChico. The activity was carried out in the context of the 7th National Knowledge Festival in Hidalgo, where one of the members of the working group, Dr. Adiv González Muñoz, gave the talk "Particles of the cosmos and underground laboratories" in the session of 1:00 to 1:45 pm on November 20th at Teatro Hidalgo in the city of Pachuca, which was attended by the entire group before proceeding to the site. Likewise, a guided visit to the installation of participants to the Festival took place on the 21st to publicize the project.

Authorization to carry out this test was provided by Comarca Minera de Hidalgo Geopark management within the framework of a cooperation agreement with the CONANP (Biol. Fermina Tavera, 2016), in coordination with local authorities and the administrators of the mine. Previous visits to inspect the Guadalupe and San Antonio mines that make up the El Milagro complex were carried out in the weeks and days that preceded to perform topographic surveys and to carry out the installation of a dedicated electric power line.

The transportation of the equipment from the UNAM to the San Antonio mine proceeded without eventualities aboard a van provided by the Center for Atmospheric Sciences (CCA) of UNAM. The group of 6 researchers, technicians and students from the Nuclear and Physical Sciences institutes of the UNAM, arrived at the San Antonio mine at approximately 5:00 pm on the 20th and proceeded immediately to download the equipment and install the detector in the inside of the mine. The installation of the dewar with liquid nitrogen (LN₂), HPGe detector, shielding and a plastic tent to protect from leaks due to water leaks, was completed at 8:00 pm, with only the installation of the electronic instrumentation to operate the detector (power source, high voltage source, amplifier and computer), which was done the next morning. It should be noted that a group of professors and students from the Autonomous University of the State of Hidalgo interested in the LabChico project helped with the installation of the detector. The group restarted activities at 7:30 am on the 21st, realizing immediately that there was no electricity supply to the interior of the mine. The electrical installation was inspected and it was determined that the problem came from the main supply to the El Milagro area. The installation of the instrumentation was completed pending the restoration of electric power. The experiment was ready to operate at 9:00 am. Later staff of the Federal Electricity Commission had been alerted of the problem and had identified that a supply line had fallen in the Unión de Dos Ríos region, a few kilometers from the site. Some attempts were made to obtain a gasoline electric generator, but the available options were discarded as risky to operate the electronics.

Between 11 am and 2 pm there were 5 guided tours with between 5 and 7 people participating in the Festival and interested in knowing about the detector and the LabChico project, who arrived at the site on board one of a transport operated by the Geopark. Despite not being able to operate the instrument, the visitors received an explanation of its operation and applications, as well as its role in the underground laboratory. When the Festival group left, around 2:00 pm, the decision was made to begin dismantling the detector, since there was no concrete time for the restoration of electric power.

When the dismantling was practically finished, at 4:00 pm the electric service in the area was restored. The group proceeded to finish loading the van and return to Mexico City at 6:00 pm, after stopping for dinner in Mineral del Chico. The transport arrived at UNAM around 9:30 pm, the equipment was unloaded and placed back in the ICN Detectors Laboratory. Around 10:15 pm the van left ICN to be stored at CCA.

Despite not being able to operate the detector and not taking data of the energy spectra of the radiation inside the mine, this experience provided valuable information about logistical details, installation time, operating and working conditions, for a future location of this instrument in a mine such as those found in the El Milagro complex.

We are grateful to the Comarca Minera de Hidalgo Geopark management and the local authorities of the Mineral del Chico municipality for the authorization to carry out this activity; to the administrators of the San Antonio mine for their consent and for the logistical support we enjoyed on their part. We thank the Center for Atmospheric Sciences and the Institute of Geophysics of UNAM for providing the transportation, housing and other logistics. We also thank the organizers of the 7th National Knowledge Festival for the support of travel expenses we received to carry out this activity. We acknowledge support for Dr. Adiv González and Dr. Estela Garcés from STFC-GCRF, United Kingdom.

Participants:

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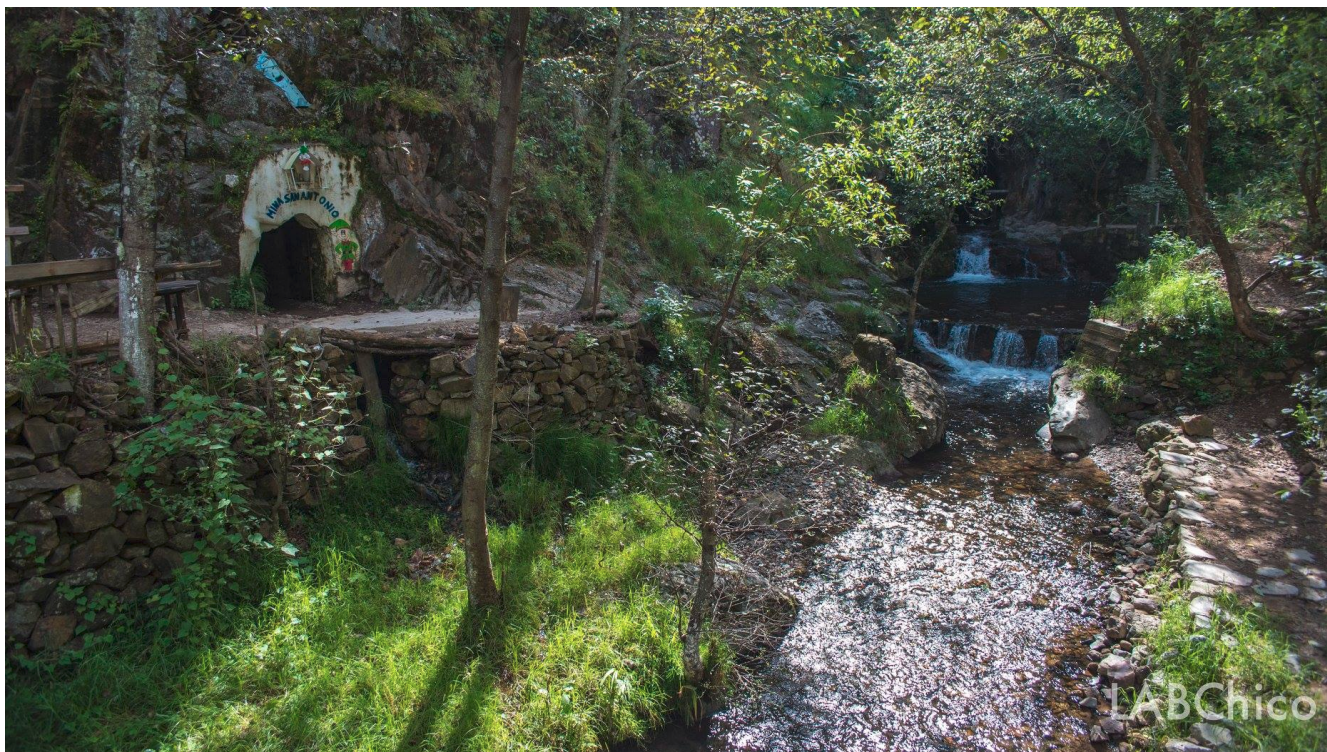
Marcelo



Dr. Adiv González Muñoz delivering his talk at the 7th Festival of Knowledge in Hidalgo.



View of the San Antonio mine entrance and the hanging bridge.



Access to the San Antonio mine across the Los Milagros river. Transporting the LN2 dewar across the hanging bridge. Dr. Estela Garcés on the hanging bridge.



The hanging bridge. The mine is to the left..



Mauricio Marinez and Eric Vázquez Jáuregui transporting the LN2 Dewar into the mine.



Mauricio Martínez extracting the HPGe detector from its case. In the background, Postdoc Estela Garcés and faculty from Universidad Autónoma del Estado de Hidalgo (UAEH).



Dr. Alexis Aguilar Arévalo inserting the HPGe detector into the LN2 dewar.



Complete installation of the detector, shielding and electronics inside the leak-proof tent.



Dr. Eric Vázquez Jáuregui explaining visitors how a HPGe detector works.



From left to right: Miguel Cruz (Comarca Minera Geopark and Institute of Geophysics), Estela Garcés (Institute of Physics, UNAM), Mauricio Martínez Montero and Alexis Aguilar Arévalo (Institute for Nuclear Sciences, UNAM).

More photos available at: https://www.facebook.com/pg/LABChico/posts/?ref=page_internal