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Press Release - Cairo - the 17th of December 2015

Muons Detectors plates installed at Bent Pyramid and under sensitivity calibration in Khufu's Pyramid

Background

Under the authority of the Egyptian Ministry of Antiquities, Faculty of Engineering, Cairo University, and HIP.Institute (Heritage, Innovation and Preservation Institute) launched, on 25 October 2015, the #ScanPyramids project (www.scanpyramids.org) aiming at scanning over a year, some of the Egyptian Pyramids: Khufu, Khafre, the Bent and the Red Pyramids. #ScanPyramids combines several non-invasive and non-destructive scanning techniques in order to try to detect the presence of any unknown internal structures and cavities in ancient monuments, which may lead to a better understanding of their structure and their construction processes / techniques.

The used technologies are a mix of infrared thermography, muon radiography and 3D reconstruction.(Cf.http://www.scanpyramids.org/layout/spm/press/About_ScanPyramids-en.pdf)

It worth mentioning that the first phase of the project of short infrared thermography survey has been completed on 8 November 2015 while its results, and technical analysis of its findings will be announced in January 2016.

Muons radiography survey has begun in Bent Pyramid in Dahshour

Following a test session in November that allowed #ScanPyramids team to calibrate the sensitivity of Muons emulsion films to the local environment inside the Bent Pyramid (temperature and humidity), Dr Kunihiro Morishima and his team from Nagoya University have just completed the installation of the Muons detector plates in the lower chamber of Bent Pyramid in Dahshour. They are composed of 40 “regular” plates representing a surface of 3m² containing 2 emulsion films that are sensitive to Muons. Those emulsion films will allow the detection of various types of muons naturally penetrating the pyramid.



In parallel to that, the #ScanPyramids team has also installed a “regular” plates sample in the Queen Chamber of Khufu’s Pyramid in order to find out the best chemical formula of the emulsion films suitable for the local environment inside the Pyramid (as what has been done inside the Bent Pyramid). The complete installation of the muon detector films inside Khufu pyramid is expected to be done in a later stage in 2016.

The analysis of the Bent Pyramids Muons emulsion films will be taking place in Cairo and in Japan during the first weeks of 2016.



Minister Dr. Mamdouh Eldamaty surrounded by Muons ScanPyramids team

More information about Muons Radiography

Muons radiography principle

Muons come naturally from the upper layers of Earth's atmosphere where they were created from collisions between cosmic rays of our Galactic environment and the nuclei of atoms in the atmosphere. They fall to the ground at nearly the speed of light with a constant rate of about 10,000 per m² per minute. As for the X-rays passing through our bodies allowing to visualize our skeleton, these elementary particles, like heavy electrons, can very easily pass through any structure, even large and thick rocks, such as mountains. Detectors, placed at appropriate places (e.g. inside the pyramid, under a possible yet undetected chamber) allow, by accumulation of muons over time, to discern the void areas (that muons crossed without problem) from denser areas where some of them were absorbed or deflected. The difficult aspect of this technique is to create highly sensitive detectors - either gels like the ones used for silver prints or scintillators. Then to accumulate enough data (in several days or months) to emphasize the contrasts. Muons radiography is now frequently used for the observation of volcanoes, including research teams from the University of Nagoya. More recently KEK developed a detection approach based on electronic scintillators which are resistant to nuclear radiation, unlike chemical emulsions, in order to scan inside the Fukushima nuclear plant reactors.

PICTURES

Phase 1 Muons detectors campaign, pictures available here:

http://www.hip.institute/press/pictures/Pictures_HIP.Institute_MuonsPhase1.zip

VIDEOS

A video clip summarizing the 2015 ScanPyramids events is available here:

www.vimeo.com/hipinstitute/ScanPyramids2015

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