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Muographies of the Giza's Great Pyramid with Micromegas trackers

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The recent development concerning MPGDs, in particular with the work done by the R&D51 collaboration, makes the industry able to build large and robust detectors. These characteristics suit well the needs of a lot of applications which use the cosmic rays muons to make the tomography of large objects. However, these applications need the muon telescope to be run in the field and with a low energy consumption. After multiplexing the readout of micromegas and miniaturizing the electronics needed to operate them, we made the very first micromegas-based muon telescope which was operated outside.

Three of these telescopes were brought at Giza's plateau, tracking muon that passed through the north-east edge of the Khufu's pyramid. During three month of data taking starting from early June 2016, the delicate operation of these instruments have been dealt with, including environmental instabilities and monitoring through 3G connection.

The five 5L gas bottles, each containing 110bars of T2K-gas, came to exhaustion after three month of data taking, at the end of August.

The analysis of the rock density showed a cavity known since 1819. Moreover, an extra cavity was revealed, this muography being the first proof of its existence. The remaining work is let to the egyptologists who have to find its original function.

Using the experience accumulated during this first campaign, the gas tightness of the detectors and the monitoring of the thermodynamic quantities of the gas were improved in order to smoothen the variability of the efficiency and gain through time and P/T variations.
After these enhancements, the tree telescopes were put again into operation at the end of January 2017. Each of them scanning one of the remaining edge, searching for unknown cavities.

Authors: BOUTEILLE, Simon (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR)); Dr PROCUREUR, Sébastien (CEA-Saclay); MANDJAVIDZE, Irakli (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR)); ATTIE, David (CEA/DSM/DAPNIA/SPP); Dr CALVET, Denis (CEA-Saclay); Mr RIALLOT, Marc (CEA-Saclay); Mr MAGNIER, Patrick (CEA-Saclay)

Presenter: BOUTEILLE, Simon (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

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