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Muon radiography of an Etruscan mine: the San Silvestro archaeological park near Campiglia Marittima (Tuscany)

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Muon radiography is an imaging technique based on the measurement of the absorption of cosmic ray muons. This technique has recently been used successfully to investigate the presence of unknown cavities in the Galleria Borbonica in Naples and in the Cheops Pyramid at Cairo.

The MIMA detector (Muon Imaging for Mining and Archeology) is a muon tracker prototype for the application of muon radiography in the archaeological and mining fields. It is made of three couples of X-Y planes each consisting of 21 scintillator bars with silicon photomultiplier read-out. The detector is compact, robust, easily transportable and has a low power consumption: all of that makes the detector ideal for measurements in narrow and isolated environments.

With this detector we have performed a measurement from inside the Temperino archaeological park in Tuscany. The park was used as a mine since Etruscans time and it is composed of a series of tunnels on multiple levels. In order to obtain information on the average density of the rock the measured absorption was compared to the simulated one, obtained from the information provided by the laser scanner measurements and the cartographic maps of the mountain above the mine. This allowed to confirm the presence of a partially accessible cavity and gave some hints on the presence of a high density vein within the rock.

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