THz imaging in the frame of the Archaeological Urban Park of Naples project

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The Archaeological Urban Park of Naples (PAUN) project aims at addressing the need of analytical information relating to cultural heritage with modalities that encourage innovation systems of protection and enhancement. In this frame, one of the specific goals is the testing of multiple non-invasive or only minimally invasive investigation techniques, aimed at identifying a permanent diagnostic system calibrated to the specific context of the Urban Archaeological Park of Piazza Municipio, Napoli, Italy.

Among the electromagnetic sensing technologies, those exploiting Terahertz waves ($1 \text{THz} = 10^{12} \text{Hz}$) are the newest among the imaging techniques, which offers the attractive chance of characterizing the inner features of manmade objects with a sub-millimeter spatial resolution in a non-invasive way while assuring negligible long-term risks to the molecular stability of the exposed objects.

This possibility together with the recent development of compact, transportable and easily reconfigurable devices make THz imaging a more and more widespread considered investigation tool in the frame of cultural heritage. THz imaging allows, indeed, the gaining of information useful to improve knowledge about the design technique adopted by the artist and to detect possible damages affecting the conservation state of precious artworks [1].

In the frame of PAUN project, THz imaging is considered as part of the sensor network, which is dedicated to the material characterization and supports the conservation and use of the assets of the Urban Archaeological Park of Piazza Municipio. Specifically, THz imaging is adopted to analyze ancient decorated mortar specimens and gather information on their stratigraphy. At this regard, it is worth pointing out that the effectiveness of THz imaging, i.e. the capability of obtaining high resolution images of the object under test, is dependent not only on the performances of the hardware technology but also on the data processing approaches. Herein, we consider the time domain Z-Omega Fiber-Coupled Terahertz Time Domain (FICO) system, which is available at IREA-CNR, and a data processing chain specifically designed to improve the discrimination of different material layers and to reconstruct the inner features characterizing the investigated artworks [2].


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