

TIME (DO NOT FILL IN)

**Phase-Sensitive Terahertz Imaging  
for**

**Cultural Heritage Diagnostics**

G.P. Gallerano<sup>a</sup>, A. Doria<sup>a</sup>, E. Giovenale<sup>a</sup>, , G. Messina<sup>a</sup>, A. Petralia<sup>a</sup>,  
I. Spassovsky<sup>a</sup>, V. Surrenti<sup>a</sup>, K. Fukunaga<sup>b</sup>, B. Bisceglia<sup>c</sup>

<sup>a</sup>*ENEA - Dipartimento Tecnologie Fisiche e Nuovi Materiali, 00044 Italy*

<sup>b</sup>*National Institute of Information and Communication Technology –Tokyo – Japan*

<sup>c</sup>*Università di Salerno, Department of Information and Electrical Engineering , Salerno, Italy*

THz imaging is a rapidly developing technique with many applications in a variety of fields from biomedicine to material science, from security to environmental studies. When compared with other techniques currently applied to the characterization of materials used in art, like mid infrared spectroscopy and X-ray analysis, which are used to identify organic and inorganic materials respectively, Terahertz spectroscopy is expected to identify composites themselves and to give clear and direct information for art conservation. The combination of spectroscopy and reflective terahertz imaging can result in a new non-destructive analysis tools of art objects, including paintings, murals, colored or varnished sculpture and colored furniture. The technique has proven to be a powerful tool for the the investigation of hidden, stratified and plaster covered paintings and may lead to the complete characterization of the original layers.

In this paper we will review the activity carried out by various groups around the world and will present a phase-sensitive THz imaging system developed at ENEA Frascati, which has been employed in the investigation of art samples of different nature in the frame of collaborations with NICT-Tokyo and with the University of Salerno. The extension of this imaging technique to remote sensing at lower frequencies (20 – 40 GHz) will also allow monitoring of humidity on wall surfaces and mural paintings.