

Laser based techniques for a multidisciplinary action aimed at the restitutive restoration of S. Costanzo church in Ronciglione (Italy)

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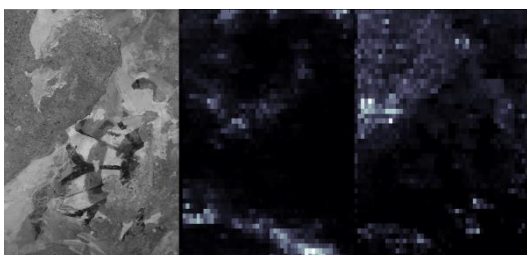
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In the frame of the COBRA (Development and diffusion of methods, technologies and advanced instruments for the conservation of Cultural Heritages, based on the application of radiations and enabling technologies) project a multidisciplinary study has been carried out in order to restore the mural painting of the cupola of the S.Costanzo church in Ronciglione (Italy). Large difficulties have been met during the restitutive restoration of the original renaissance fresco decorating the cupola. In fact, two and sometimes three layers of paint, which lays on an extremely crumbled substrate have been detected on the surface, in addition to large, deep and complex degradation forms with the presence of efflorescence. Tests have been conducted in restricted areas, in order to understand the quantity and quality of the fresco decoration. Moreover, pre-consolidation action aimed to give solidity to the plaster also resulted in the consolidation of the upper paint layers, making the operation of cleaning even harder. To solve such a critique situation researchers, restorers and suppliers of lasers for cleaning have collaborated to plan the most appropriate intervention.

Laser based diagnostics have been employed to characterize different surface areas before and after cleaning tests. In particular, ENEA has offered its prototypes of LIF (Laser Induced Fluorescence) and RGB-ITR (Red Green Blue Imaging Topological Radar, an innovative 3D colour laser scanner) and a laser Raman system for both the material and degradation recognition and a micro-structural study. LIF data processing, exploiting the fluorescence emission bands and the images obtained both in reflectance and in fluorescence configuration, allowed for the identification of small areas where the presence of the consolidant is more massive and/or biodegradation effects appear. On the other hand, first analyses of the RGB-ITR data show the possibility to obtain a high-quality, high-resolution 3D colour model of the mural painting for a highly precise digital reproduction of the artwork that allows for the evaluation of the conservation state of the painting and the effects of restoration works and cleaning tests.

The cleaning tests have been performed with both classical methods and lasers made available by El.En. group. Different operative parameters such as pulse duration, repetition rate, energy, have been tested. The removal capabilities have been evaluated thanks to remote fluorescence and colorimetry measurements and local Raman analyses.



Conventional picture (left) compared to fluorescence images at 320 nm (center) and at 700 nm (right).

The laser employed has made possible to overpass the difficulties encountered by other techniques: painting layers have been removed selectively, allowing conservators to bring to light the original surface. The remote colorimetry results obtained by RGB-ITR on areas already treated with chemical approaches show that the colors obtained after the laser cleaning are much more saturated than before the intervention, highlighting the ability of the laser cleaning to remove thin patinas, impossible to eliminate by means of other techniques.