

NEWSLETTER

Project iPhotoCult

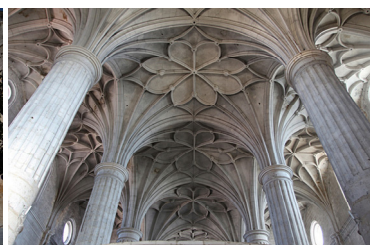
Intelligent advanced photonics tools for remote and/or on-site monitoring of cultural heritage monuments and artefacts



Funded by
the European Union



iPHOTOCULT



BUILDING A GREEN CLUSTER FOR CULTURAL HERITAGE

iPhotoCult joined the workshop "Towards a Green Cluster for Cultural Heritage" (CAA 2025, Athens), contributing to discussions on sustainable monitoring and preservation of cultural heritage, and reinforcing collaborations among EU-funded projects.

iPhotoCult AT THE EXPERT GROUP "LASERS FOR CULTURAL HERITAGE" MEETING in the framework of the Laserlab-Europe Annual Meeting 2025, Central Laser Facility (CLF), STFC Rutherford Appleton Laboratory (RAL), Didcot, UK

iPhotoCult participated in the International Conservation Week at CCR "La Venaria Reale", Savoy Royal Residence, Italy

TESTING iPhotoCult SOLUTIONS

Just one year after its launch, iPhotoCult tools have been preliminarily tested at cultural heritage pilot sites, addressing significant conservation challenges through remote mapping and structural analysis of areas that are physically inaccessible or have restricted access

THE PARTNERSHIP

Public and private subjects from 6 EU countries participate in the project iPhotoCult, which was approved within HORIZON-CL2-2023-HERITAGE-01-01 call

FORTH - Foundation for Research and Technology-Hellas (Coordinator)
CNR - National Research Council of Italy
CARTIF Foundation (ES)
INOE-National Institute for Research and Development in Optoelectronics (RO)
Tecreando B.V. (NL)
EAGLEprojects S.p.A. (IT)
UNIWA – University of West Attica (GR)

CCR Foundation - Centro Conservazione e Restauro "La Venaria Reale" (IT)

LSA GmbH – Laser Analytical Systems & Automation (DE)

Associated Partners

NGN - National Gallery – Museum of Alexandros Soutsos (EL)

CRRS-Consorzio delle Residenze Reali Sabaude,

AMTh-Archaeological Museum of Thessaloniki

HCYL - Consejería De Cultura y Turismo De La Junta De Castilla Y León

TECN - Technopolis, the Industrial Gas Museum of Athens

WORKSHOP #1: TOWARDS A GREEN CLUSTER FOR CULTURAL HERITAGE



iPhotoCult participated at the workshop "Towards a Green Cluster for Cultural Heritage" held on the 5th of May 2025 during the 52nd International Conference on Computer Applications and Quantitative Methods in Archaeology (CAA) at the University of West Attica, Athens, Greece. The workshop aimed to foster dialogue, networking, and future collaboration among participants within the Green Cluster framework, by exchanging ideas and future perspectives.

Vasilike Argyropoulos, Professor of Metals Conservation at UNIWA, and Dr. Ioannis Vezakis, engineer at TECREANDO, presented iPhotoCult's goals and ambitions. They presented the status of the Project, its opportunities and challenges, and discussed potential synergies among projects and participating subjects. This workshop was also an opportunity to showcase the interaction between ARGUS, NERITES, ChemiNova and iPhotoCult, four EU-funded projects which started collaborating to deliver innovative, non-destructive solutions for monitoring and preserving cultural heritage, addressing diagnostic monitoring challenges and data accessibility. "Green Cluster for Cultural Heritage" represents a pioneering collaboration fostered by the European Commission to address the pressing challenges of preserving cultural heritage from environmental and anthropic risks.

iPhotoCult AT THE EXPERT GROUP "LASERS FOR CULTURAL HERITAGE" MEETING



iPhotoCult project was presented at the Expert Group "Laser Science for Cultural Heritage" meeting (<https://laserlab-europe.eu/expert-groups/cultural-heritage/>) in the framework of the Laserlab-Europe Annual Meeting 2025 on the 13th of May 2025 at the Central Laser Facility (CLF), STFC Rutherford Appleton Laboratory (RAL), Didcot, UK. The Laser Science for Cultural Heritage expert group brings together leading experts within the Laserlab-Europe network, which share the common mission to advance the application of laser-based techniques in the study, conservation, and preservation of cultural assets.

In addition, FORTH's expertise on cultural heritage was presented encompassing among others photoacoustic imaging spectroscopy, non-linear microscopy imaging, digital holographic speckle pattern interferometry, laser spectroscopy (such

as Raman, Laser-Induced Fluorescence, Laser-Induced Breakdown Spectroscopy), laser cleaning as well as remote sensing applications.

Through the Lasers4EU access program, this expert group offers researchers across Europe and globally the opportunity to access specialized facilities, thus fostering interdisciplinary research projects, knowledge exchange and capacity-building in the field of cultural heritage science.

iPhotoCult JOINS THE INTERNATIONAL CONSERVATION WEEK IN TURIN, ITALY

A. Giakoumaki (FORTH) presented iPhotoCult at the "International Conservation Week, Conservation, Research, Innovation Open Meetings" held at the Centro Conservazione e Restauro (CCR) "La Venaria Reale" in Turin, Italy, from 17-21 March, 2025. During this CCR's 20 years conference week, the planned application of iPhotoCult technologies to 19 use cases, spanning monuments and artifacts from 9 pilot sites across 5 European countries, was announced and discussed. These cases address a range of environmental and human-induced threats affecting outdoor stone and marble structures (such as the Fountain of Hercules Colossus), as well as metal, painting, paper, and parchment objects.



The presentation also highlighted how iPhotoCult aligns with key EU priorities, including:

- Innovative methods for protecting cultural heritage threatened by climate change;
- High-resolution documentation and monitoring;
- Risk assessment and conservation planning;
- Evaluation of diagnostic tools across environmental, social, and economic criteria;
- Integration of ICT and AI to manage complex, heterogeneous data;
- Assessing the impact of EU policies (e.g., energy rationing in museums) and proposing adaptation strategies.

TESTING IPHOTO CULT SOLUTIONS

REMOTE MAPPING AND STRUCTURAL ANALYSIS AT THE FORMER COLLEGIATE GOTHIC CHURCH IN ROA, SPAIN



The diagnostics of historic structures located in rural settings and with restricted access represents a critical challenge for the preventive conservation of cultural heritage. The pilot site CHP1, the Church of Nuestra Señora de la Asunción in Roa, Spain, provides an ideal study environment to evaluate non-invasive tools applied to the analysis of roof structures and the detection of moisture and soluble salts in stone materials. In the specialized literature, studies focused on historic structures have mostly addressed the assessment of pathologies using traditional techniques and, to a lesser extent, remote acquisition technologies. However, there is a growing integration of non-destructive diagnostic methods in heritage buildings for the identification of hidden pathologies, moisture, material loss, and structural failures associated with material aging. The present pilot site of iPhotoCult serves as a representative case for monitoring structural issues and the inspection of defects in areas that are hard-to-reach or even physically inaccessible (such as the extrados of vaults and roof frameworks) and potentially unsafe for a human operator. Thanks to the inspection strategies developed by CARTIF, based on the use of Unmanned Ground Vehicles (UGV), it is possible to reduce defect detections times and collect digital data automatically, making it easier for multidisciplinary teams to make decisions without needing to be physically present on site at the same time.

R&D RESULTS

Publications in peer-reviewed journals

M. Xu, J. Cong, Y. Shen, M. Chen, V. Tornari, I. Vezakis, **ATCM-Net: A deep learning method for phase unwrapping based on perception optimization and learning enhancement**, Optics & Laser Technology 2025, 190, 113185. <https://doi.org/10.1016/j.optlastec.2025.113185>

Researchers have developed ATCM-Net, an advanced deep learning model designed to improve phase unwrapping, a crucial step in making sense of complex optical images, especially in scientific and industrial applications like measuring tiny deformations or surface shapes.

Traditional methods often struggle when images are noisy or distorted (as in speckle-based techniques), but ATCM-Net uses a combination of smart perception tuning and enhanced training strategies to handle these challenges more accurately and efficiently.

The result is a more reliable way to extract meaningful data from optical measurements—potentially benefiting fields like non-destructive testing, precision manufacturing, and cultural heritage diagnostics

L.M. Angheluță, A. Ignuța Acimov, C. Gora, A.I. Chiricuță, A.I. Popovici, V. Obradovici, **Documenting Romania's Wooden Churches: Integrating Modern Digital Platforms with Vernacular Conservation**, Heritage 8(3), 103. <https://doi.org/10.3390/heritage8030103>

Romania has over 1,400 historic wooden churches, but many are poorly documented and at risk of deterioration. This paper describes two digital platforms developed to address this gap:

- Biserici Înlemnitate: an online inventory system that gathers and visualizes basic data on each church's architecture, history, condition, and value, helping prioritize conservation efforts.
- 3D-VIMM: a multimodal imaging and 3D visualization platform that creates digital twins by integrating visible, thermal, multispectral, and other data onto three-dimensional models.

Through a case study of a church in Arad County (Tisa), the authors show how combining these platforms enables better documentation, analysis, and decision-making. They argue that such integrated, interdisciplinary methods are key to safeguarding not only the physical structures but also their cultural, historical, and communal significance

D. Ciofini, J. Agresti, M. Giamello, et al., “ **Thermally Optimised Raman Spectroscopy for Safe Analysis of Wall Paintings and Application to Lorenzetti's Masterpiece**,” Journal of Raman Spectroscopy 56, no. 9 (2025). 882–894, <https://doi.org/10.1002/jrs.6821>

The study presents a thermally optimized Raman spectroscopy tool designed and developed within iPhotoCult project to safely analyze wall paintings without causing heat-related damage to sensitive pigments. By combining dual-wavelength laser excitation (785 nm and 1064 nm) with real-time thermal monitoring, the researchers were able to assess and minimize surface heating during analysis. After a thorough laboratory optimization phase, the system was successfully applied to one of the most iconic fresco cycles in Italy: Ambrogio Lorenzetti's “Allegory and Effects of Good and Bad Government” (1338–1339), located in Siena's Palazzo Pubblico. This work represents the first real-world use of thermally optimized, dual-wavelength Raman spectroscopy on mural paintings. The results highlight how advanced diagnostics can reveal detailed information on pigments, restoration layers, and alteration products, while ensuring the preservation of fragile surfaces.

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