



International conference  
on analytical techniques  
in art and cultural heritage  
**LISBON | 07-12 MAY**



**BOOK OF ABSTRACTS**

# TECHNICAL INFORMATION

## TECHNART2023 BOOK OF ABSTRACTS

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TECHNART2023

Non-destructive and Microanalytical Techniques in Art and Cultural Heritage. Book of Abstracts

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### NOTE

Authors are responsible for the text included in the abstracts, for the reliability and truthfulness of the information and for the rights to publish any material included in the text

# FOREWORD

The first **TECHNART** conference was held in Lisbon in 2007 by the initiative of the Atomic Physics Center from the University of Lisbon, current Laboratory for Instrumentation, Biomedical Engineering and Radiation Physics (LIBPhys). The conference aimed to provide a cultural heritage science forum where the use of analytical techniques in art and cultural heritage were presented and discussed.

After five editions held in different European cities and a hiatus of four years due to COVID, it is a privilege to welcome in 2023, once more in Lisbon, the **TECHNART** conference.

The conference topics covers the application of a large range of analytical methods to art and cultural heritage investigations, namely X-ray analysis, confocal X-ray microscopy, synchrotron, ion beam and neutron-based techniques, FT-IR and Raman spectroscopy and microscopy, UV-Vis and NIR absorption/reflectance and fluorescence, laser-based analytical methods, magnetic resonance techniques, chromatography and mass spectrometry, optical and coherent imaging techniques, remote sensing and hyperspectral imaging.

The **TECHNART2023** program is organized in thematic sessions on analytical methods and their application to art and cultural heritage. Eight invited speakers will open thematic sessions on analytical methodologies, textiles, pigments and dyes, varnishes and resins, and metals. For four days, **TECHNART2023** brings in over 180 oral communications in three parallel sessions and more than 260 posters distributed in four sessions. The abstracts from oral and poster communications are collected in this book.

The conference accounts circa 400 participants representing around 50 countries from all over the world, offering an outstanding opportunity for exchanging knowledge and establishing new networks with other cultural heritage science researchers.

**TECHNART2023** results from the straight collaboration between LIBPhys and the other organizing institutions (NOVA School of Science and Technology, Faculdade de Ciências da Universidade de Lisboa, Universidade de Coimbra, Associação para o Desenvolvimento do Departamento de Física da Universidade de Coimbra) with the support from the TECHNART International Scientific Committee. It was equally important the partnership with Centro HERCULES, Museu Nacional do Azulejo, Microchemical Journal, and Journal of Cultural Heritage, as well as the participation of the commercial companies (HIROX Europe, OPUS instruments, NIREOS, BRUKER, FORENSCOPE) and the sponsoring of Heritage journal, Xpecam commercial company and the European X-ray Spectrometry Association (EXSA).

*Marta Manso and Maria Luísa Carvalho, May 2023 (Chairs)*

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# Application of spectroscopic and imaging techniques for the study of historical natural dyes.

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The Michelangelo Guggenheim's textile collection has been studied using a multi analytical approach. Specifically, False color imaging, Fiber Optics reflectance spectroscopy (VIS range) and Surface Enhanced Raman Scattering (SERS) spectroscopy were used to identify the dyestuff in the perspective of checking their compatibility with both declared historical period and the origin. Most of them are dated to the XVI century, while the stylistic analysis together with the technical characteristics traced them back to an Italian manufacture.

The cross checking of spectroscopic data allowed to confirm most of the results acquired in a previous non-invasive investigation. However, new data obtained in micro-invasive mode resulted fundamental to understand the complexity characterizing some of the sampled threads. In many cases colors were obtained by mixing several dyes: all the presented methodologies have well known limitations but they often compensate each other allowing for the identification of different components co-existing in the same sample. In particular, in FORS, absorption bands of natural dyes are often broad, tend to overlap or to generate new structures; in parallel, SERS is often blind to some dyes, especially when mixtures involve components with very different cross sections. Finally, in FCI colours deriving from the contemporary presence of several compounds can interfere creating new shades difficult to interpret.

Raman spectra of the Guggenheim collection mainly showed cochineal in red-based artefacts and indigo in blue ones. Additionally, other interesting dyes such as orcein or annatto were identified in many samples. At the same way, VISRS spectral profiles were affected by indigotin on green textile fragments, on which SERS gave information about the yellow dye. However, yellow dyes are particularly challenging and despite the application of a multi-technique approach, in some of the fragments it was not possible to recognize any specific compound.

In some cases, equivalent results were obtained for the three tested techniques, while in others more complex situations emerged, showing the utilization of mixture instead of single dyes as previously assumed based on pure non-invasive results. This highlights the importance of utilizing a set of complementary analytical techniques when approaching historical textiles.

FCI can also be a very interesting technique to obtain preliminary non-invasive data, but the study highlighted the need for the creation of a complete database of historical dyes employed with different dyeing procedures, substrates, mordants, and as mixtures with different proportions.