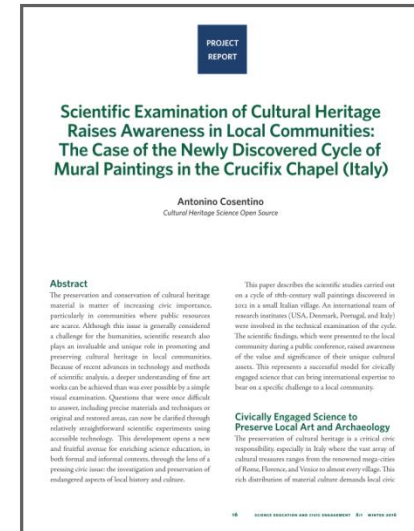


Onsite, non-invasive and non-destructive  
Technical Examination  
for  
Wall paintings



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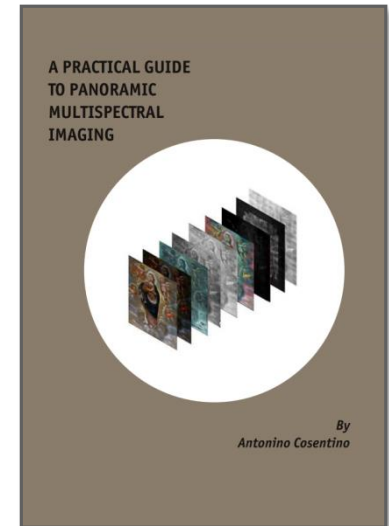
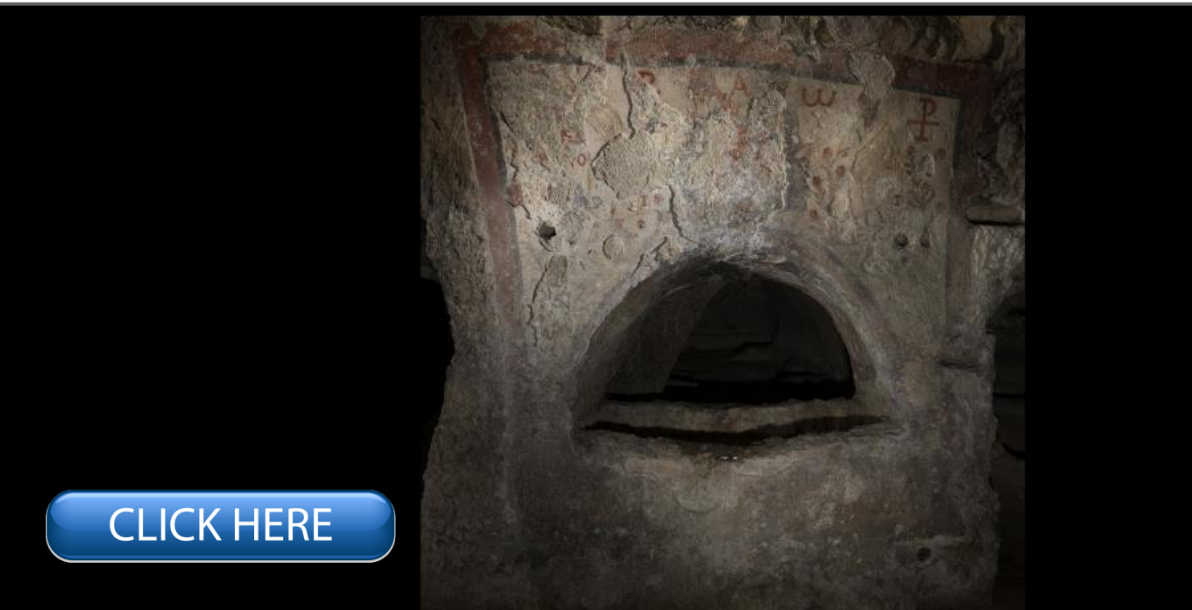
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# Panoramic Photography

High Resolution Photography

*“A practical guide to Panoramic Multispectral Imaging”*



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High resolution documentation of large wall paintings

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# 3D modeling

“Innovative Imaging Techniques for Examination and Documentation of mural paintings and historical graffiti in the catacombs of San Giovanni, Syracuse”



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Photomodeling allows rapid and low-cost 3D modeling for the web

# Reflectance Transformation Imaging (RTI)

“Innovative Imaging Techniques for Examination and Documentation of mural paintings and historical graffiti in the catacombs of San Giovanni, Syracuse”



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**INNOVATIVE IMAGING TECHNIQUES FOR EXAMINATION AND DOCUMENTATION OF MURAL PAINTINGS AND HISTORICAL GRAFFITI IN THE CATACOMBS OF SAN GIOVANNI, SYRACUSE**

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**Abstract**

This paper presents scientific and technical examination of two mural paintings and their historical graffiti located in the catacombs of San Giovanni in Syracuse, Sicily. Reflectance Transformation Imaging (RTI), Infrared Photography, 3D Photomodelling are presented as innovative imaging techniques to capture significant details of the paintings, along with XRF non-invasive point analysis. These methods were performed on the Philadelphia papyrus and on the crucifixion of the Madonna. RTI technique was used as a valid tool to enhance the readability and documentation of the numerous historical graffiti covering some of the mural, which are of high interest to scholars since they are useful to reconstruct the cultural history of the site. The results of the infrared RTI were particularly powerful in their ability to document graffiti on decorative surfaces painted with earth pigments. 3D Photomodelling also proved to be a successful and handy tool to document the position of paintings and graffiti to compare with one another. The examination of the two paintings was integrated with an analytical study of the pigments realized with non-invasive XRF.

**Keywords:** Reflectance Transformation Imaging; Infrared photography; 3D Photomodelling; XRF; Syracuse; catacombs; graffiti

**Introduction**

This paper presents the technical and scientific examination of two mural paintings and some of their historical graffiti in the catacombs of San Giovanni (St. John the Evangelist) in Syracuse, Sicily. RTI (Reflectance Transformation Imaging) was tested and applied in order to enhance the readability and documentation of some of the historical graffiti covering one of the paintings. Scholars have a keen interest in the study of historical graffiti [1, 2] since they provide unique information on the uses and frequentations of the site over the centuries, and thus become documentation used to reconstruct the cultural history of these catacombs. Some of the graffiti of the catacombs of San Giovanni are contemporary with the epoch of the paintings that bear them. They mainly comprise fragments of devotional texts and symbols that

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RTI (Reflectance Transformation Imaging) allows a high quality documentation of historical graffiti

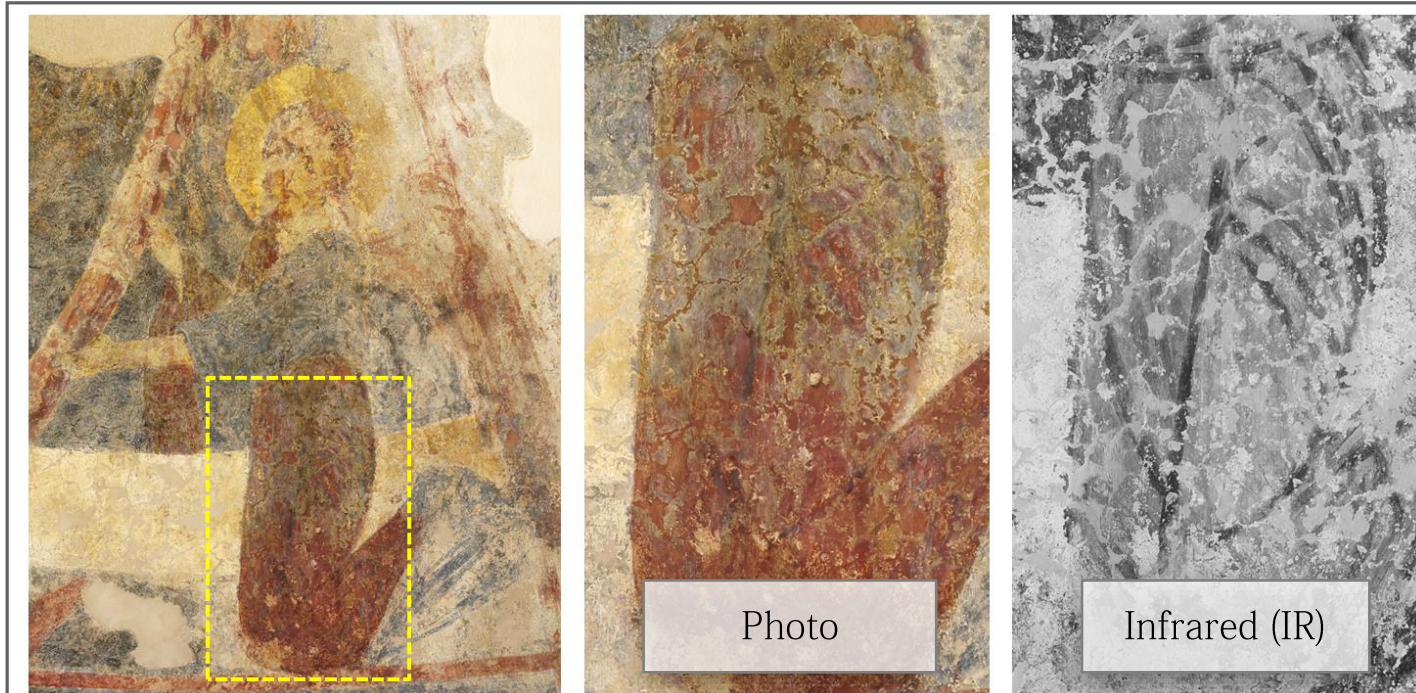






# Infrared photography (IR)

“Indagine diagnostica  
multispettrale sugli affreschi”

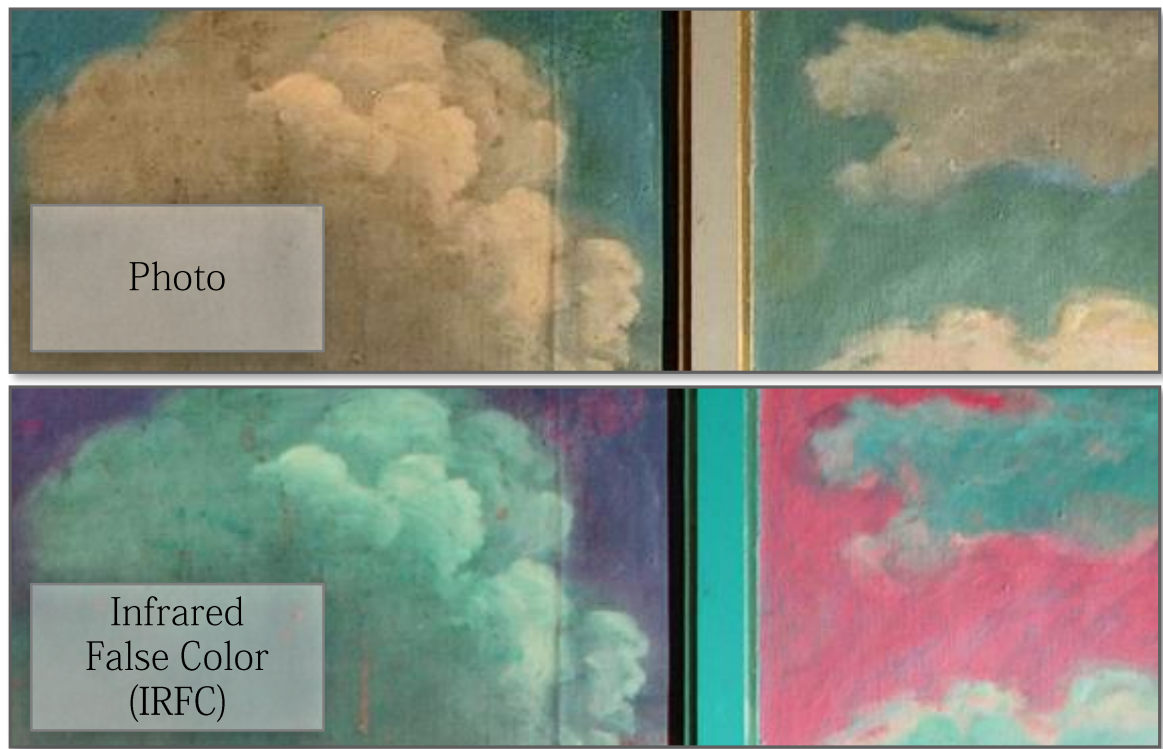


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Infrared photography makes visible underdrawing and changes (*pentimenti*)



# Infrared False Color (IRFC)



“Infrared Technical Photography for Art Examination”

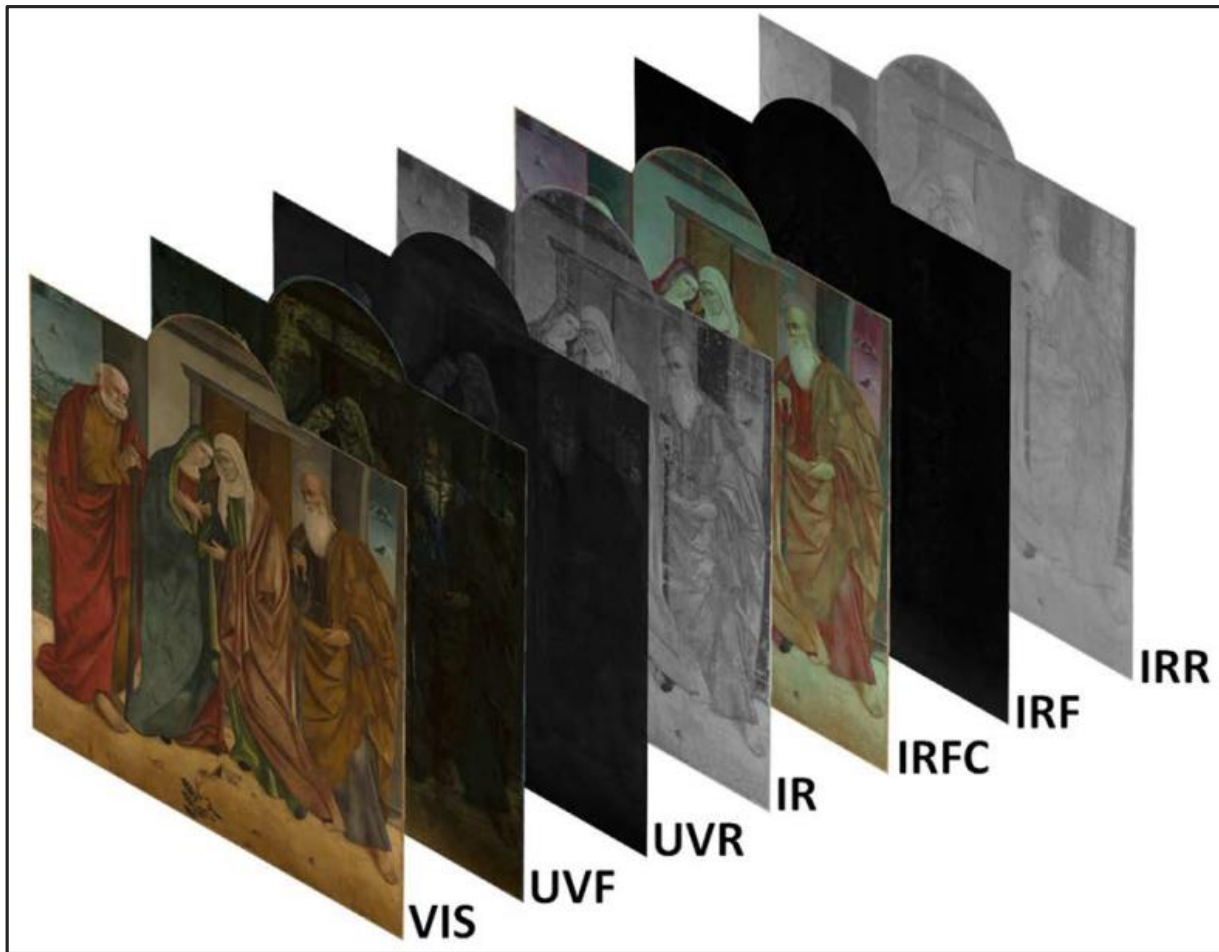


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Infrared False Color photography locates inpaints with modern pigments



# Technical Photography



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A complete Technical Photography (TP) documentation allows a preliminary identification of pigments

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# CHSOS Technical Photography kit

We designed a *Technical Photography* kit specifically for art professionals and educational institutions.

It's the best compromise among Quality, Adaptability and Costs and it allows to realize a complete set of 7 technical photo documentation methods: VIS (visible photography), UVF (Ultraviolet Fluorescence), UVR (Reflected Ultraviolet), IR (Infrared), IRF (Infrared Fluorescence), IRFC (Infrared False Color), IRT (Infrared Transmitted)

This is a kit for art professionals: conservators, art appraisers, archaeologists, art historians.

Use it for fast and informative examination of easel paintings, wall paintings, manuscripts and historical documents.



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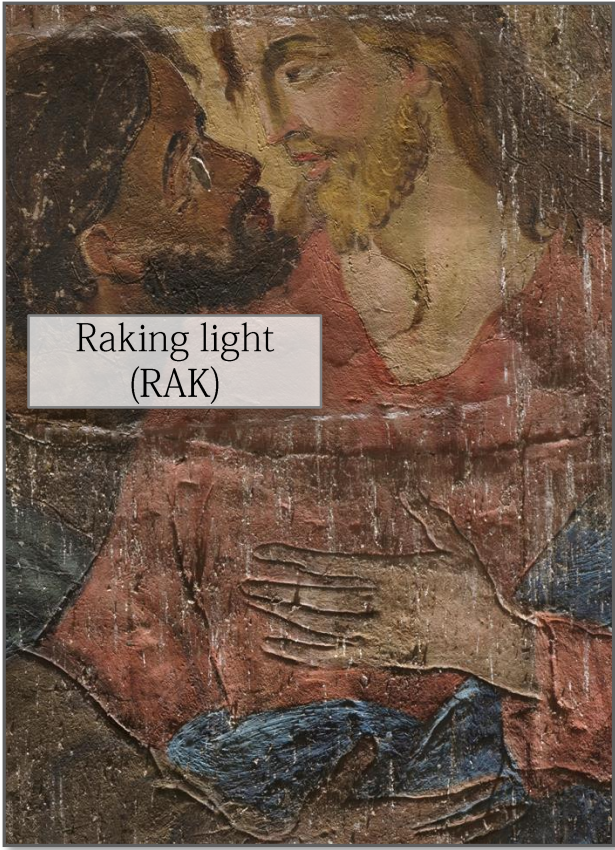
## Technical Photography KIT



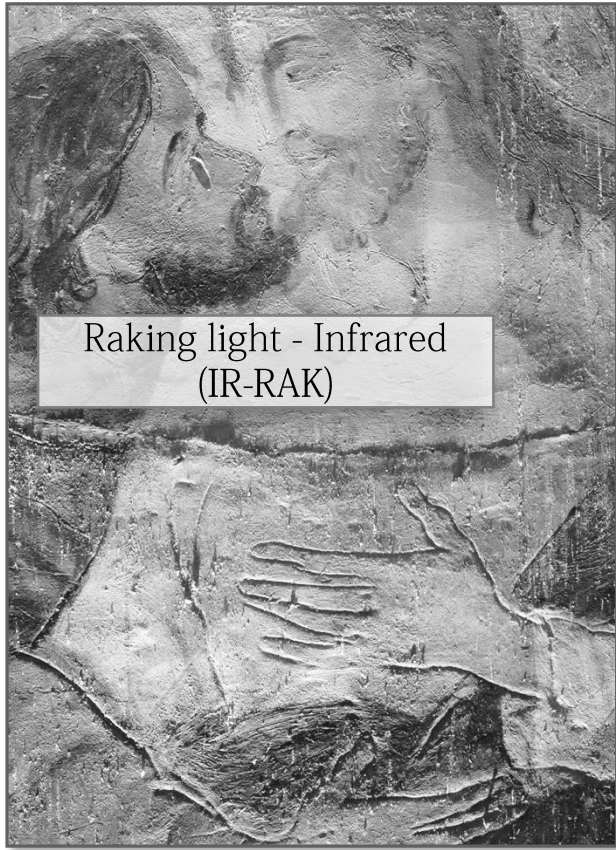


# Raking light photography

“Technical Photography for mural paintings: the newly discovered frescoes in Aci Sant’Antonio (Sicily, Italy)”



Raking light (RAK)



Raking light - Infrared (IR-RAK)

Article Article

**Technical photography for mural paintings: the newly discovered frescoes in Aci Sant’Antonio (Sicily, Italy)**

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**Abstract**  
A cycle of 18th century Frescos, depicting the last days of Christ on earth, were recently discovered in Aci Sant’Antonio (Sicily, Italy). The paintings survive along the corner of an original square chapel that was altered in the early 20th century, requiring the current conservation plan. This paper presents the results of the technical photography documentation of these wall paintings and illustrates the methodological challenges that were posed during their conservation. Raking light photography was used to reveal the painting’s state of conservation, study of the plaster work and painting techniques. Ultraviolet fluorescence and infrared false color photography were also performed to evaluate areas of concern for further analytical and diagnostic studies. The first striking evidence to the lack of genuine. Only paintings are clearly seen in all the scenes thus indicating that in the larger part area, a series of traces and signs techniques would have been used.

**Keywords**  
Technical photography  
Infrared photography  
Ultraviolet photography  
False color photography  
Infrared false color  
Raking light photography

**Palabras clave**  
Fotografía por infrarrojo  
Fotografía de ultravioleta  
Fotografía de falsa color  
Fotografía de raking light  
Fotografía de luz blanca

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AHF - Associação Profissional de Conservadores-Beniculturalistas de Portugal  
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Raking Light photography documents incisions which are indicative of the painting techniques.



# Multispectral Imaging



[ARTICLE](#)  
**Multispectral imaging and the art expert**  
 Antonino Casavola  
 Cultural Heritage Science Open Source, Phoenicia, Acq. San'Antonio, Italy. E-mail: [acasa@chso.org](mailto:acasa@chso.org)

Multispectral imaging (MSI) systems are being used more and more often by art conservators and restoration teams. They are used to map and identify pigments, binders and residues on works of art. They are also used to identify varnish and faded documents. These systems are becoming popular in the field because they are simple, affordable, lightweight and small. Scanning an important work of art is not possible, and this is the main reason why only non-invasive techniques, such as MSI, are becoming increasingly popular to assist with understanding conservation decisions.

MSI for an examination is performed with a variety of equipment, it is fairly simple, that is spreading in the field would be limited by its most affordable option: a monochromator, camera and a light source. This equipment is portable and can be applied to different tasks in terms of the use of the objects to be examined and discussed. In MSI camera can be used with a camera head to study large objects such as a range of frescoes, as well as with macro lenses to study such as small historical objects or a conservation and also with a computer microscope to examine a high grade of pigments.

It must be noted, however, that when pigments are mixed or aged, the method does not provide conclusive identification and based on forensic and analytical examinations are necessary to obtain more detailed and conclusive information. The use of MSI to identify similar pigments has an important advantage, allowing to apply the rapid and low-cost survey of large areas.

The spectral cube  
 A reference spectrum chosen for each wavelength of the light between the intensity of the reflected light and the reflectance measured with respect to a dark and white reference. This ratio is called reflectance and is given in percentage (%). Reflectance spectra can provide information useful for the identification of pigments since the light that is not reflected is absorbed or transmitted depending on the chemical composition of the material tested. The reflective spectral features of materials in the UV range are related to electronic transitions while those in the near infrared (NIR) range to fundamental vibrational overtones and combination modes. Analysis by reflective spectroscopy is based on building up an appropriate reference spectra database, in the case of laboratory or field applications. Reflectance spectra are acquired with a non-destructive camera, which can be either a charge-coupled device (CCD) or a camera

**Figure 1.** Spectral cube. The 3D spectral image is related to the spectral cube where the first axis represents a point on the image and the two others are different wavelengths. The second axis represents the intensity of the light and the third axis represents the reflectance. The reflectance spectra of the objects are related to the point on the image. The reflectance spectra of the objects are related to the point on the image. The reflectance spectra of the objects are related to the point on the image.

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Pigments can be mapped with multispectral imaging to locate inpaints and differentiate among pigments with the same hue and tone but different chemical composition.



# Antonello – Multispectral Imaging system for Art

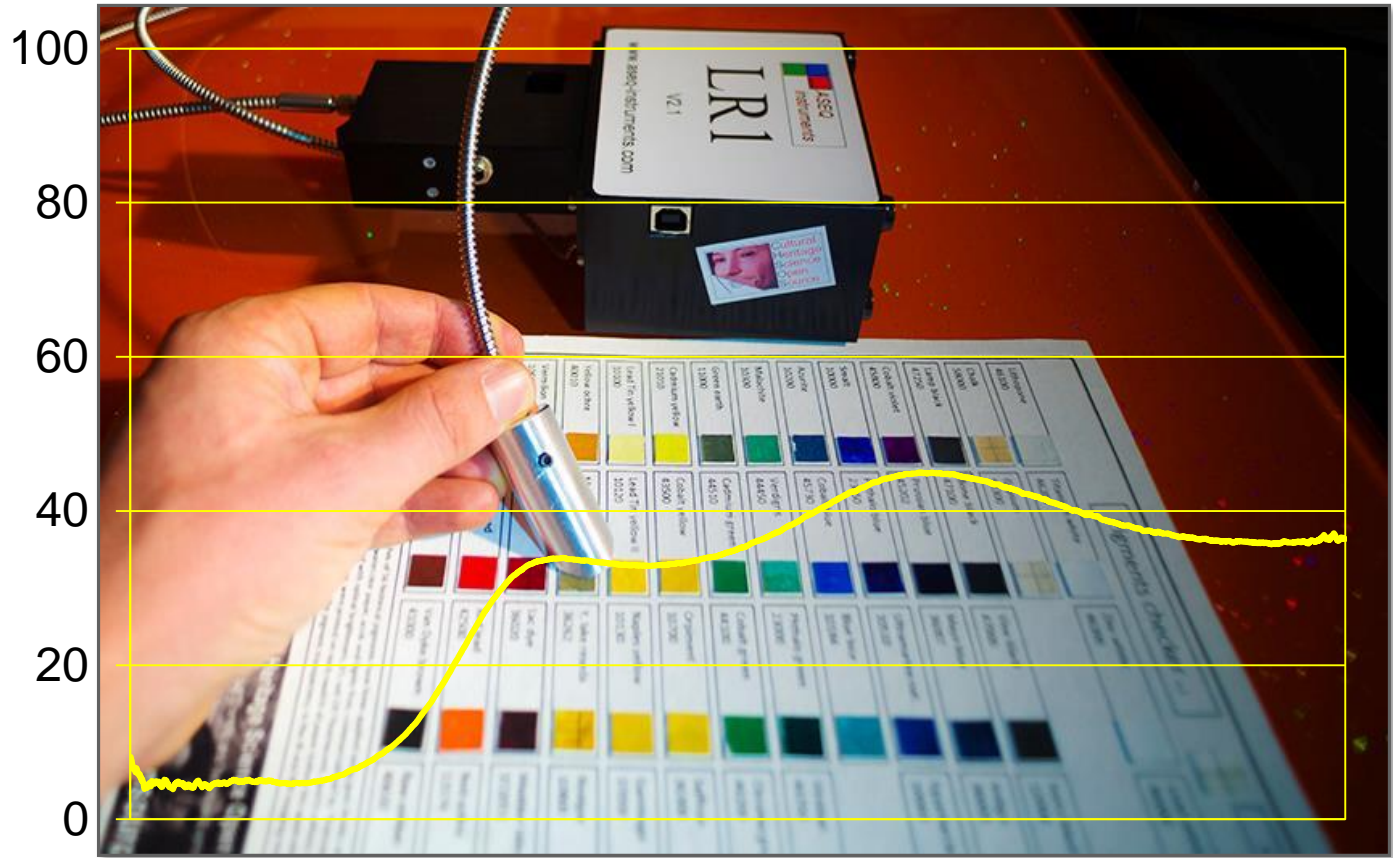
*Antonello* is a simple MSI system composed of 18 bandpass filters and a full spectrum DSLR camera, covering the 400-925 nm spectral range.

Conservators and art historians need non-invasive methodologies to identify and map pigments on works of art and archaeology. These tools allow them to select appropriate conservation procedures, acquire information on the workshop practices, distinguish original sections from inpaints and to enhance visualization of faded pigments and inks.



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# Reflectance Spectroscopy

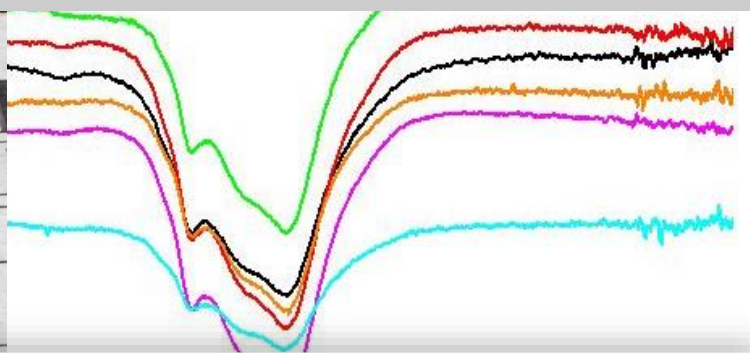


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Pigments identification with onsite, non-invasive and non-destructive Reflectance Spectroscopy (RS).



# Gorgias – Reflectance Spectrometer for Art



Reflectance spectrometer for art  
Gorgias

The Gorgias reflectance spectrometer is shown with its probe and a color calibration chart. The device is black and has a silver probe. The chart is a "Pigments Checker" with various color swatches. A marble bust of a man's head is also visible in the foreground. The device has a label that reads "Gorgias Reflectance Spectrometer for Art Examination chsopensource.org".

## On-site

We provide these methods on-site with our traveling equipment

- (IP)
- Multispectral Imaging (MSI)
- Infrared Reflectography (IRR)
- RTI, Reflectance Transformation Imaging
- Reflectance Spectroscopy (RS)

## Off-site

We take tiny samples to analyze them in our Studio

- 360 virtual tours  
3D modeling
- Raman Spectroscopy (RS)
- Cross-section Optical microscopy (OM)

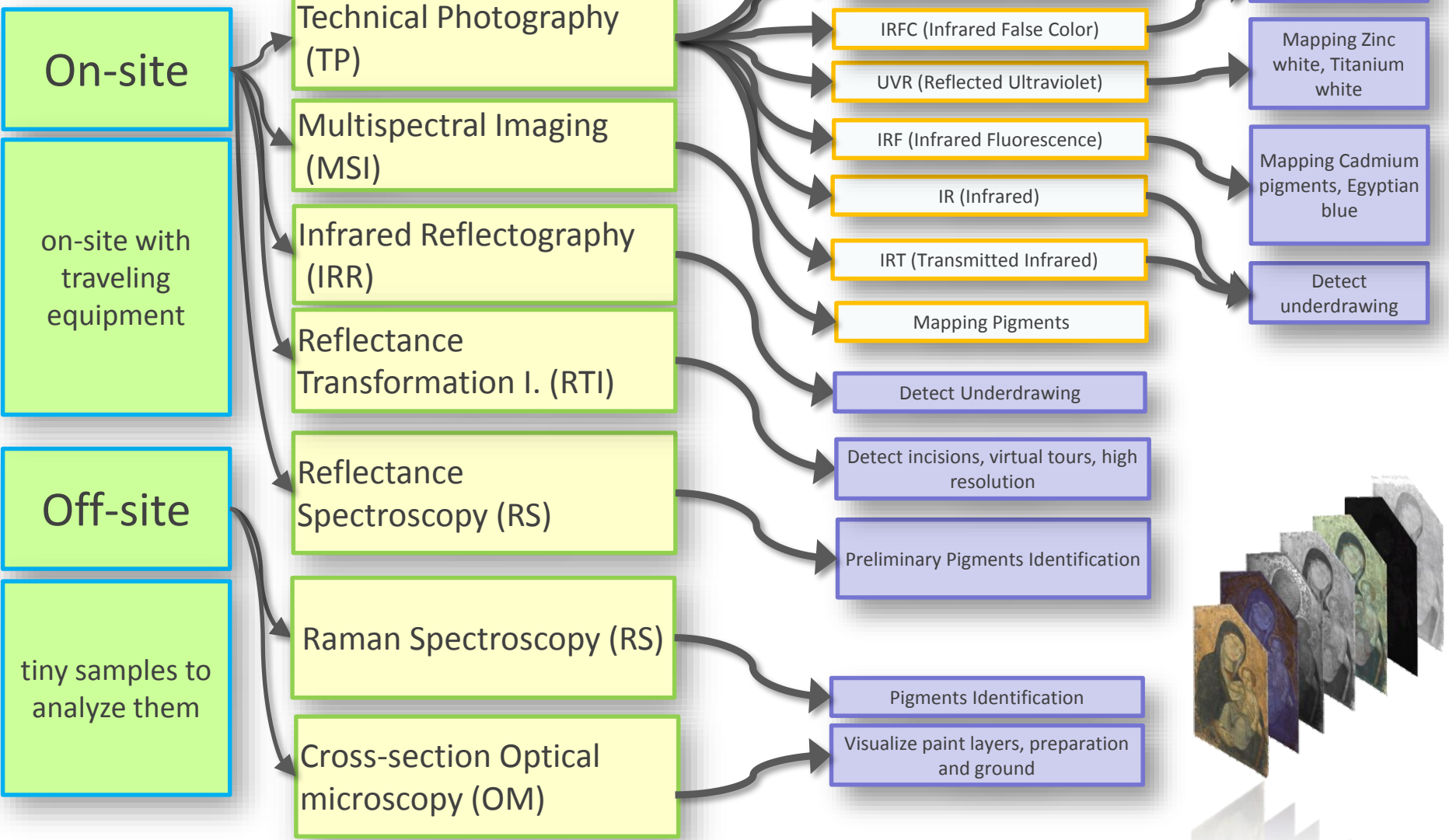
- UVF (Ultraviolet Fluorescence)
- IRFC (Infrared False Color)
- UVR (Reflected Ultraviolet)
- IRF (Infrared Fluorescence)
- IR (Infrared)
- IRT (Transmitted Infrared)
- Mapping Pigments
- Detect Underdrawing
- Detect incisions, graffiti, giornate
- Preliminary Pigments Identification
- Pigments Identification
- Visualize paint layers, preparation and ground

- Detect inpaints, map consolidants and binders
- Mapping Zinc white, Titanium white
- Mapping Cadmium pigments, Egyptian blue
- Detect underdrawing





# CHSOS – art examination methods



# Any questions?

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