



COMPANY PRESENTATION

LAMBDA Spa is involved since years in the design, development and implementation of laser equipment for specific use in medical, dental and restoration fields. In 1987 LAMBDA begins its activity in the field of cultural heritage conservation in Italy, as a part of R&C Scientifica, when it carries out its first microclimatic studies in the cultural heritage field. In 1996 LAMBDA become an independent company that produces laser equipment for medical and for restoration, beside the hi-tech monitoring systems for the recording of the parameters that make up the microclimate of museums and other historical sites. Thanks to the research and development, LAMBDA begins in 1998/99 the production of laser equipment for restoration in collaboration with the University of Padua, Quantum Electronics Department. The ARTLASER is meant to be the revolutionary cleaning system for in site work. Between 2000 and 2001 LAMBDA impose itself also in the dentistry field with the design of Nd:YAG and diode lasers. In 2002 a new laser equipment for restoration with optical fiber is produced, the ARTLIGHT.



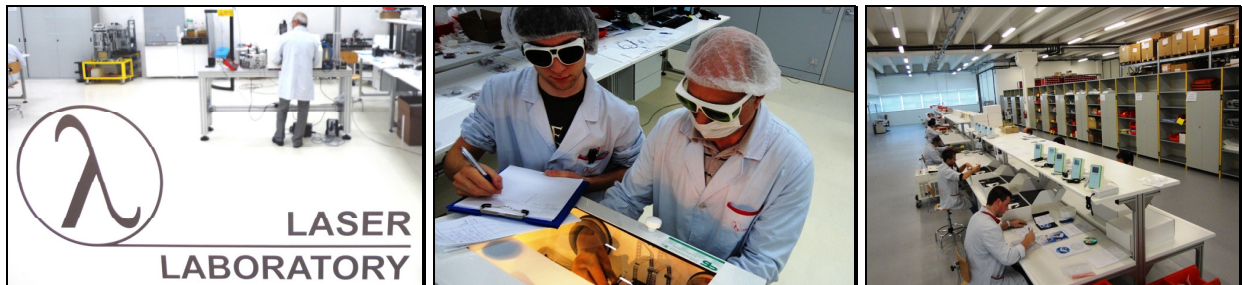
2003 is the year of the creation of Doctor Smile brand for the dental division. By the end of 2007 the company opens up its business to the international market with its first participation at the IDS dental fair in Colonia (Germany), where is presented the Erbium&Diode laser. From the most recent research is created in 2008 the ARTDUO, the first laser for restoration with double wavelength and articulated arm. During 2009 LAMBDA moves to a new bigger structure and increases the number of employees, by engaging more engineers and technicians. In this years the international market keeps growing up, not only in Europe but also in Asia and in the USA, thanks to the introduction of the new Pluser and Wiser lasers. In 2010 the company starts some important collaborations with the most brilliant Italian universities (University of Genoa, University La Sapienza of Rome and University Bicocca of Milan).

DOCTOR ART DIVISION

Nowadays LAMBDA is a part of a holding group which is involved in cultural heritage conservation. Each company is specialized in one specific sector: from the lab analysis (R&C LAB), the commerce of traditional restoration equipment (CTS) until the production of hi technology laser systems (LAMBDA). LAMBDA, with 30 employees, is one of the leading company of the holding group.

LASER CLEANING SYSTEMS

LAMBDA is also specialized in laser applications for the cultural heritage field: many private conservators and institutions all over Europe are using our lasers for the cleaning of the most diverse and delicate materials, from stone façades to feathers. In the field of cultural heritage conservation, the laser is an innovative tool that can selectively remove dirt or decay on artwork, without touching the surface directly. LAMBDA SpA has been working for many years in collaboration with conservators, research institutes and government institutions in order to discover new technologies that can satisfy conservator's needs.



ARTDUO LASER guarantees selective cleaning and preserves the substrate. It can be used on a wide range of materials:

- Stone and plaster
- Wall painting
- Metal
- Wood
- Paper and parchment

The beam shot is absorbed by the superficial dirt which is removed without affecting the stone substrate and therefore it guarantees: selectivity, self limitation and no alteration of the chemical characteristics of the underlying material. Thanks to its technology it is therefore possible to work on highly decayed materials by performing cleaning without the need for pre-consolidation.

Our lasers equipment for restoration have worked and are working in:

- Restoration Laboratory of the Vatican Museums
- Royal Armory of Turin
- Prado Museum
- Alhambra - Granada
- Museum of Louvre - Paris
- Hermitage Museum in St. Petersburg

and many private conservators.



For different needs there are different products:

ARTLASER

It is a well-established conviction that cleaning systems must be selective, must consent a preventive evaluation of the effects produced by the intervention, be harmless both for the restorer and the environment as well as for the work of art. All these conditions are equally necessary, and Artlaser combines all these different requirements.

LAMBDA, always attentive to collect the requirements of people involved in conservation and restoration, has developed ArtLaser, an instrument able to guarantee the cleaning of stone surfaces without harming the original surface.

The compact size and shape, its easy of use and sturdiness designed for intense work, make ArtLaser a suitable instrument for sites that require a rapid and uniform cleaning.



ARTDUO

Q-switch technology and double wavelength make the ARTDUO the ideal machine for the cleaning of various types of materials.

The laser beam is transported through an articulated arm thus allowing full power and easy directioning of the beam, without the weight of a pistol. Practical touch screen control panel.

Cleaning can be performed on decayed surfaces without pre-consolidation. The cleaning process is gradual, therefore a precise level of cleaning can be achieved.



ARTDUO Laser can be used with two different wavelengths, according to the material that needs to be removed. The 1064 nm ray targets dark colours and the 532 nm wavelength is ideal for removing tones of red.

ARTLIGHT II

ArtLightII is a Nd:YAG laser that joins in a single machine two different modes: Q-switch or Normal Mode.

The operator can choose the mode directly from the display according to his/her needs.

The output of ArtLightII is in optic fiber, with an ergonomic handpiece. The equipment is very easy to use and it can be used for the cleaning of many kinds of objects.

ArtLightII can operate on extremely degraded substrates without pre-consolidation. The pointing system allows the restorer to work with high precision and control. The reduced dimensions and the versatile handpiece make it an equipment suitable for all workplaces.

ArtLightII guarantees selective cleaning without damaging the substrate. It can be used on a wide range of materials: stone, stucco, wall paintings, metal and wood.



PREVENTIVE CONSERVATION AND MICROCLIMATE MONITORING

LAMBDA SpA, active in Cultural Heritage conservation for many years, offers quality instruments for the monitoring of the microclimate of unique places, along with complete data elaboration and interpretation services, because competence and reliability are a priority.

General aspects

The objects, buildings and places that a society considers special for aesthetic, artistic, documentary, environmental, historic, scientific, social, or spiritual values are commonly designated Cultural Heritage and constitutes a material and cultural legacy that must be passed on to future generations.

Preserving this heritage means protecting it against the most diverse causes of deterioration: climatic changes, both indoors and out, pollution, increases in the number of visitors inside museums and special sites.



Leonardo's Last Supper monitored by LAMBDA SpA since 1993



**Patio de los Leones and Salas de Los Reyes,
Alhambra-Granada (Spain).**

Monitoring microclimates is the right step in this direction: it is the fundamental starting point for the analysis of the nature of the causes of material degradation. Only with this knowledge is it possible to slow down the degradation process and deter the onset of new damage.

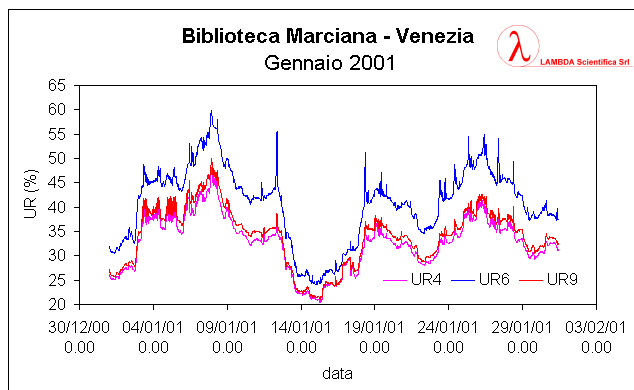
Through statistical and punctual analysis of microclimatic data it is possible to know the entity and frequency at which critical conservation conditions are reached, whether daily, seasonally or occasionally. This knowledge allows us to correlate these conditions with events such as opening hours of museums, malfunctions of HVAC systems, insufficient isolation, illumination, etc.

Preliminary monitoring is therefore an essential step towards finding the best way to improve conservation conditions, be it through passive measures (isolation, proper lighting, closures, etc) or active air conditioning.

The data acquired by our monitoring systems can be analyzed through statistic elaboration and graphic visualization.

Data collection and processing

Graph of the relative humidity data acquired over one month in the Sansovino Hall of the Marciana Library, Venice, Italy.



L'elaborazione dei dati acquisiti

Our monitoring service is tailored to the specific needs of our customers and to the characteristics of the site. The data acquired are then processed statistically and displayed in graphs, in order to underline the peculiarities of the monitored environment, identifying possible risks and offering solutions.

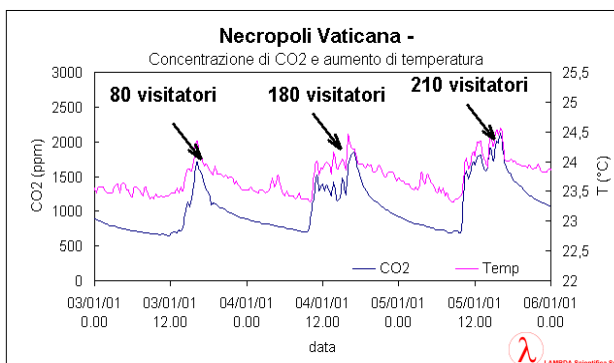
Though we can limit our service to data or graph printout, we recommend a complete statistical analysis and its interpretation so as to reveal potential risks that may not be immediately noticed. Thermo-hygrometric data are the basis for the calculation of other parameters such as dew point or specific humidity: these parameters complete the array of information necessary for a thorough and detailed study.

Along with temperature and relative humidity our systems support various types of other sensors, ranging from the measurement of light intensity over the entire spectrum, to air quality (CO₂), or movement over fissures for static monitoring.

Our technical and scientific knowledge is at your disposal, to help you search for the best solutions to conservation problems.

CO₂ concentration and temperature measurements carried out in the Necropolis under the Basilica of S. Peter, Vatican City- Rome.

Graphic display of the correlation between temperature, number of visitors and carbon dioxide concentration.



The study of microclimate is the basis for the creation of favourable conditions for the conservation of our priceless cultural heritage.

Thanks to years of collaboration with the main research institutions in Italy, our company has been able to gain accurate and thorough scientific knowledge, always at our client's disposal to guarantee sound advice and offer effective monitoring and conservation solutions.

➤ **Digital environmental monitoring system.**

WireClimArt

Central Unit:



Applications:

WireClimArt is a flexible system for the monitoring of microclimates.

System connection

The central station is connected to the sensors by RS 485 communication standard. This means that there are no limits in cable length, and no electrical disturbance.

WireClimart can support a great number of sensors. Sensors can be added or removed at any time.

Sensors

La centrale WireClimArt riconosce automaticamente il sensore connesso. I sensori disponibili sono:

- T/UR per interno ed esterno
- temperatura a contatto
- velocità e direzione del vento
- anemometro bidirezionale per interni
- luxmetro, sensori UV (UVA, UVB, UVC)
- ossigeno
- anidride carbonica
- fessurimetro

Sensor control

The back lit display shows the current value measured from each sensor connected to the system.

Data recording

Data is recorded on an internal Memory Card or directly on a PC connected to the WireClimArt system

- WireClimArt has a 512 kb (standard), 1Mb or 2Mb (optional) Memory Card.
- WireClimArt can be connected to a host PC by a RS 232 serial connection. The recorded data is directly visualised and memorized on the PC.

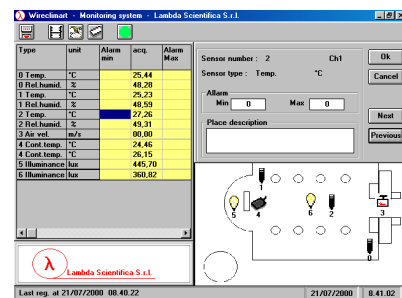
Modem connection

You can control the system remotely with an analogic or GSM modem to check the state of the system at any time and download the recorded data.

Software

The software allows you to record, verify and archive your data in any moment.

- Runs on Windows; especially designed with the Italian Conservation Institute for maximum compatibility with their research team.
- allows communication with the central unit for data retrieval and parameter setting
- You can choose alarm values for your sensors
- You can see a graphic time trend of the parameters recorded.
- You can see sensor and probes locations on a graphic map of the site



TECHNICAL DATA

Central unit- sensors digital by RS 485

Communication standard

Sensor connection All sensors are attached to a single cable (2x0,22 + 2x0,5)

Central unit – PC RS 232 Serial Port

Communication

Sensors All WireClimArt sensors

AD Converter 12 bit

Recording system 512kb Memory Card (optional 1Mb or 2Mb)

Recording capacity 130.000 values on 512kb Memory Card

Clock HW, Lithium Battery

Display back lit LCD

Power Supply 220Vca

Work Operating Condition -10 ÷ 50 °C

External Case In ABS

Dimensions (mm) 260 x 250 x 100

Weight 2 kg

Central unit- sensors digital by RS 485

Communication standard

Sensor connection All sensors are attached to a single cable (2x0,22 + 2x0,5)

Central unit – PC RS 232 Serial Port

Communication

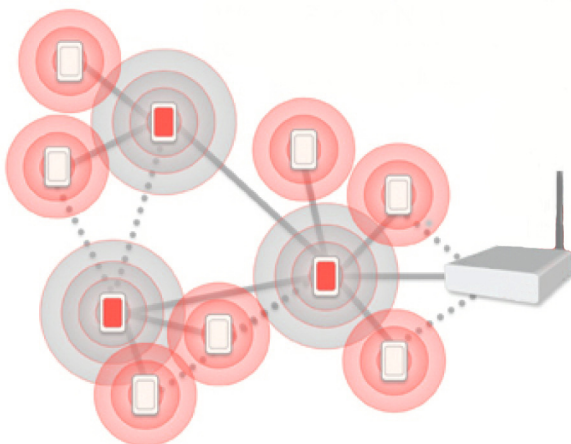
➤ **Wireless system with WEB connectivity for environmental monitoring**

RadioClimArtWEB

The Radioclimart WEB central unit allows the WIRELESS connection with the sensors for the measurement of environmental parameters such as temperature, relative humidity etc., collecting data in the central unit.

The RadioClimArt WEB central unit can be connected to the WEB in order to verify the system from any web browser. Wherever a web connection is not allowed, is possible to connect the central unit to the ethernet, WIFI, LAN o GSM modem.

Ideal for monitoring inside museums, archives, churches and everywhere is required continuous environmental data recording.



Any additional software is required: you can visualize and export collected data from your own PC through any browser (Explorer, Firefox, Safari..) thanks to web connection.

Data collected from the sensors are recorded in the central unit. In case of alarm conditions the central unit will provide to send notifications by text message or e-mail.



TECHNICAL DATA

- Sensors wireless communication through a radio frequency ISM band at 868Mhz
- Simple configuration and installation
- The system can be modified , increased or reduced in any moment
- Repeaters to increase the signal
- Amd geode lx mother board; GNU/linux operating system
- 200.000 measurements memory per sensor
- Lan ethernet 100mbits
- Wireless lan 802.11b/g (optional)
- Internal gsm module modem
- Antenna interface wsn, antenna wlan (optional), ethernet, rs-232
- Dimensions 175 x 113 x 30 mm
- External case in aluminium
- Power supply 7 ... 18v dc o power over ethernet passive, consumption <12w
- Work operating condition 0 ... 50 °C
- Clock: lithium battery – up to 5 years for a 10 sensors system (acquisition rate 10 minutes)

SENSORS

RadioClimArt WEB sensors are powered by 1,5V lithium batteries.

A 10 sensors system with 30 minutes acquisition rate can last up to 5 years*.

IP30 or 67 degree for external sensors. Dimensions 105 x 65 x 19 mm e 160x90x50mm.

External case ABS

Internal datalogger capacity: 8000 measurements; RadioClimArt WEB central unit capacity: 200.000 measurements per sensor.

Measurement interval 5 min ... 7 days. Two alarm level for text message or e-mail notifications.

Sensors can be fixed to the wall by a two screw system or display case support.

Range of sensor:

- T/UR sensors for internal or external use
- Surface temperature
- Light meter
- fissuremeter (linear position sensor)

RadioClimArt WEB can also actively control humidifiers, dehumidifiers etc..



LAMBDA SpA also offers a full-service survey microclimatic:

- Installation of monitoring systems and maintenance of measuring instruments;
- Recording and real-time consultation of the environmental variables: temperature, relative humidity, UV radiation, lighting, air velocity, carbon dioxide, solar radiation, wind direction and wind speed.
- Data analysis and study from processing with dedicated software and calculation of derived parameters: specific humidity, away from the dew point;
- Preparation of periodic reports with color graphs and analysis of the risk to be retained under the UNI 10829;
- Drafting of reports of microclimate for loaning;
- Drafting of reports of environmental quality microclimate for conservation purposes;
- Analysis of the degradation and the drafting of guidelines for decisive interventions;
- Support the design of protective structures and buildings of private construction in protected archaeological areas;
- Consulting in environmental redevelopment.



LAMBDA Spa also offers diagnostic tools for cultural heritage, such as:

- Infrared cameras
- CCD camera for Infrared Reflectography
- Inclinometers
- Portable light meters
- Portable hygrometer
- Data loggers
- Linear potentiometers

CCD CAMERA FOR INFRARED REFLECTOGRAPHY

The CCD camera MICRO IR10 is an essential instrument for non-destructive analysis of paintings. Thanks to its high performance CCD sensor, it can show the surface of the ground layer of ancient paintings, hidden by the paint layers. It is possible to see underlying elements such as:

- preparing drawing
- “pentimenti”
- restoration intervention

The equipment is very easy to use, and anyone can obtain extraordinary results. By means of two different filters it is possible to make a direct comparison between the visible and the infrared image.



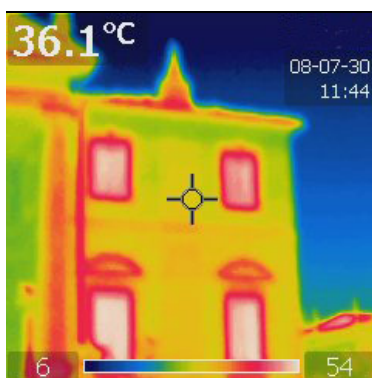
Visible Image



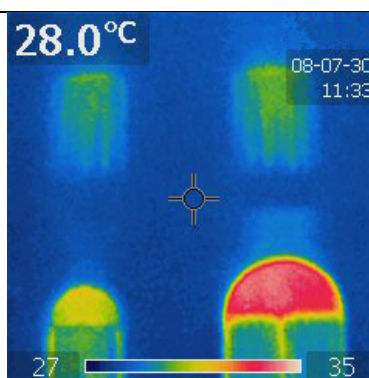
Infrared Image

TERMOCAMERA A INFRAROSSO

Infrared cameras are an invaluable tool for fast and precise analysis of various aspects linked with building conservation and restoration such as: the identification of heat sources that menace the stability of internal microclimates; water infiltrations and structural analysis. Internal recording of images allows precise documentation of cases studied before and after intervention.



The stone elements of the façade are highlighted because of the different heating compared to the brick structure.



The Infrared camera can spot the different capacity of the drapes on the window to provide insulation from the strong outside heat.

REFERENCES

LAMBDA has monitored many of the world's most important artistic and archaeological sites, and through collaboration with major research centers such as the Central Institute of Restoration in Rome and the National Research Council and numerous institutions in Italy and abroad, our company has been able to develop the scientific knowledge necessary to provide, not only the tools, but also a consulting service of high level for the conservation of works of art and historic buildings.

<i>Site</i>	<i>Years</i>	<i>Description</i>	<i>Client</i>
LEONARDO'S LAST SUPPER, MILAN, ITALY 	Monitored since 1993	LAMBDA has carried out microclimatic measurements before and during the restoration of the world famous painting by Leonardo. We are currently active today on site with a 14 sensor system.	Soprintendenza di Milano
PALAZZO GRASSI, VENICE, ITALY 	2006-2008	A permanent data acquisition system comprised of 45 temperature and relative humidity sensors has been installed inside the newly refurbished international exhibition hall.	Palazzo Grassi SpA
NECROPOLIS UNDER S.PETER'S BASILICA, VATICAN CITY 	Since 1992	Since initial investigation, begun in 1992, in 2006 a new 35 sensor system has been installed in this extraordinary hypogean site. Air quality sensors that measure the concentration of carbon dioxide and oxygen are also present.	Fabbrica di S. Pietro, Città del Vaticano

**MARCIANA LIBRARY, SANSOVINO
HALL, VENICE**



Since 2003

After an initial monitoring campaign with a wireless system to identify the causes of the ongoing degradation of the decorations of the Sansovino Hall, the existing heating system was integrated with humidifiers that are directly controlled by the monitoring system.

Soprintendenza
di Venezia

MITREO, CITTÀ DI MARINO (RM)

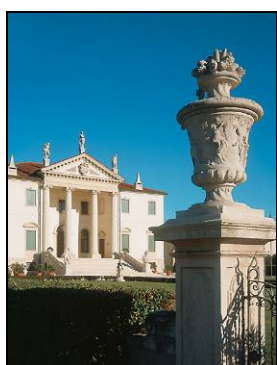


2007-2008

Annual monitoring and
conservation campaign.

Istituto Centrale
del Restauro

**VILLA CORDELLINA-LOMBARDI,
VICENZA**



2006-2009

Thermohygrometric
monitoring system

Provincia di
Vicenza

**CHIESA DI SS FELICE
E FORTUNATO, VICENZA**



2007-2008 Thermohygrometric and
crack monitoring system R&C Scientifica Srl

**TABERNACOLO DI LEGOLI,
COMUNE DI PECCIOLI (PI)**



2005 Microclimatic monitoring Comune di
before and after the Peccioli, Istituto
restoration of the frescoes Centrale del
by Benozzo Gozzoli Restauro

GIPSOTECA DI POSSAGNO (TV)



2005 System of continuous
monitoring of the exhibition
rooms. Soprintendenza del
Veneto

**DUOMO DI ORVIETO,
CAPPELLA DI S. BRIZIO**



1987-90;
1992 Preliminary study on the
restoration (150 sensors) on
the Signorelli frescoes;
Evaluation of chimney inlet
on the outer walls of the
chapel. Soprintendenza
dell'Umbria

DUOMO DI ORVIETO



1999

Evaluating the effect of
controvetrate on medieval
stained glass.

Soprintendenza
dell'Umbria

DUOMO DI ANCONA



1993

Microclimatic monitoring of
the Portico of St. Ciriaco.

Soprintendenza
delle Marche

DUOMO DI ANAGNI



1996; 1999

Microclimatic monitoring of
the Crypt of St. Thomas
Crypt of the Cathedral.

Istituto Centrale
del Restauro

**CORDERIE DELL'ARSENALE,
VENEZIA**



1993

Thermohygrometric and
tides level monitoring.

Soprintendenza di
Venezia

**PATIO DE LOS LEONES; SALA DE LOS
REYES, ALHAMBRA, GRANADA
(SPAGNA)**



2001

Environmental monitoring
of the Patio de los Leones
and Sala de los Reyes at the
Alhambra.

Istituto del
Patrimonio Storico
dell'Andalusia

Other sites:

- VILLA ARIANNA, Castellammare di Stabia (Naples), 2005; client: Istituto Centrale per il Restauro
- CATHEDRAL TODI, 1990; client: Soprintendenza dell'Umbria
- MUSEUM OF THE ROYAL CHAPEL OF GRANADA (SPAIN), 1992; client: Istituto del Patrimonio Storico dell'Andalusia
- ARCHAEOLOGICAL MUSEUM OF RABAT (MOROCCO), 1996; client: UNESCO
- CASTLE OF BLOIS (FRANCE) 1997
- ROOM OF THE SICILIAN THEATRE at The EMBASSY OF ITALY IN PARIS, 1999; client: Istituto Centrale del Restauro
- PAPER RISK OF ITALIAN MONUMENTS, 1995-1998; Monitoring of the Monastery of S. Scholastica, Subiaco (RM); Mausoleum Munazio Planco (Gaeta), Arch of Septimius Severus dei Fori Imperiali (RM) client: Istituto Centrale del Restauro
- MUSEUM OF PALAZZO VENEZIA (RM), client: Soprintendenza di Roma
- Galleria Doria Pamphili (RM), 2002; client: Soprintendenza di Roma
- MUSEUM OF MEDIEVAL AND MODERN ART, AREZZO, since 1995; client: Soprintendenza di Arezzo
- MUSEUM OF HOUSE MASACCIO S. Giovanni Valdarno (AR), since 2002; client: Soprintendenza di Arezzo
- CASA VASARI, AREZZO, since 1997; client: Soprintendenza di Arezzo

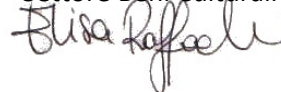
- MUSEUM OF THE CHURCH OF S. JOHN VALDARNO, since 2004; client: Soprintendenza di Arezzo
- CHURCH OF S. CLEMENTE, 1998; client: Soprintendenza di Roma
- MONASTERY PATRIARCHATE PEC / PEJA, KOSOVO, since 2006; client: InterSOS
- ROYAL PALACE, BELGRADE, SERBIA, since 2006
- ROYAL PALACE, NAPLES, since 2006
- Darzo, CHURCH OF ST. MICHAEL, 1996-2001; client: Provincia autonoma di Trento
- HOSPITAL S. JOHN PAUL, VENICE, client: Soprintendenza di Venezia
- CASTLE FENIS (AO), 2005; client: Soprintendenza d'Aosta
- MUSEUM BARGELLO (FI), 1987-88
- SACRED MOUNT VARALLO (VC); 1986-2002
- ARCHAEOLOGICAL MUSEUM OF CATANZARO, 1987
- CATHEDRAL VICENZA, crypt, 2005-2007
- CAMERA DEGLI SPOSI (MN), flow visitors monitoring 1998; client: Soprintendenza di Mantova
- WINERIES BUON CONSIGLIO CASTLE (TN), 1998
- VILLA CATTOLICA, BAGHERIA (PA), 1998
- OLD CATHEDRAL OF BRESCIA, south transept, 2009-2011
- DOMUS OF THE REPUBLICAN SANCTUARY OF BRESCIA, since 2009
- DOMUS CASA BELLEZZA, (RM) since 2009; client: Soprintendenza di Roma
- MITREO DI SANTA PRISCA, (RM) since 2009, client: Soprintendenza di Roma
- SPANISH FORT, L'AQUILA, 2011 crack monitoring
- VILLA SARACENO, AGUGLIARO (VI) 2012, client: The LandMark Trust
- BAPTISTRY OF NEON, RAVENNA (RA), 2012, client: ISCR

For any further information, please do not hesitate to contact us.



Dr.ssa Elisa Raffaelli

Settore Beni Culturali



Azienda con Sistema di Gestione
per la Qualità certificato secondo



UNI EN ISO 9001:2008
UNI EN ISO 13485:2004