

Preventive conservation and flood risk management: the microclimatic monitoring of the new outfitting in Santa Croce Museum in Florence - Italy



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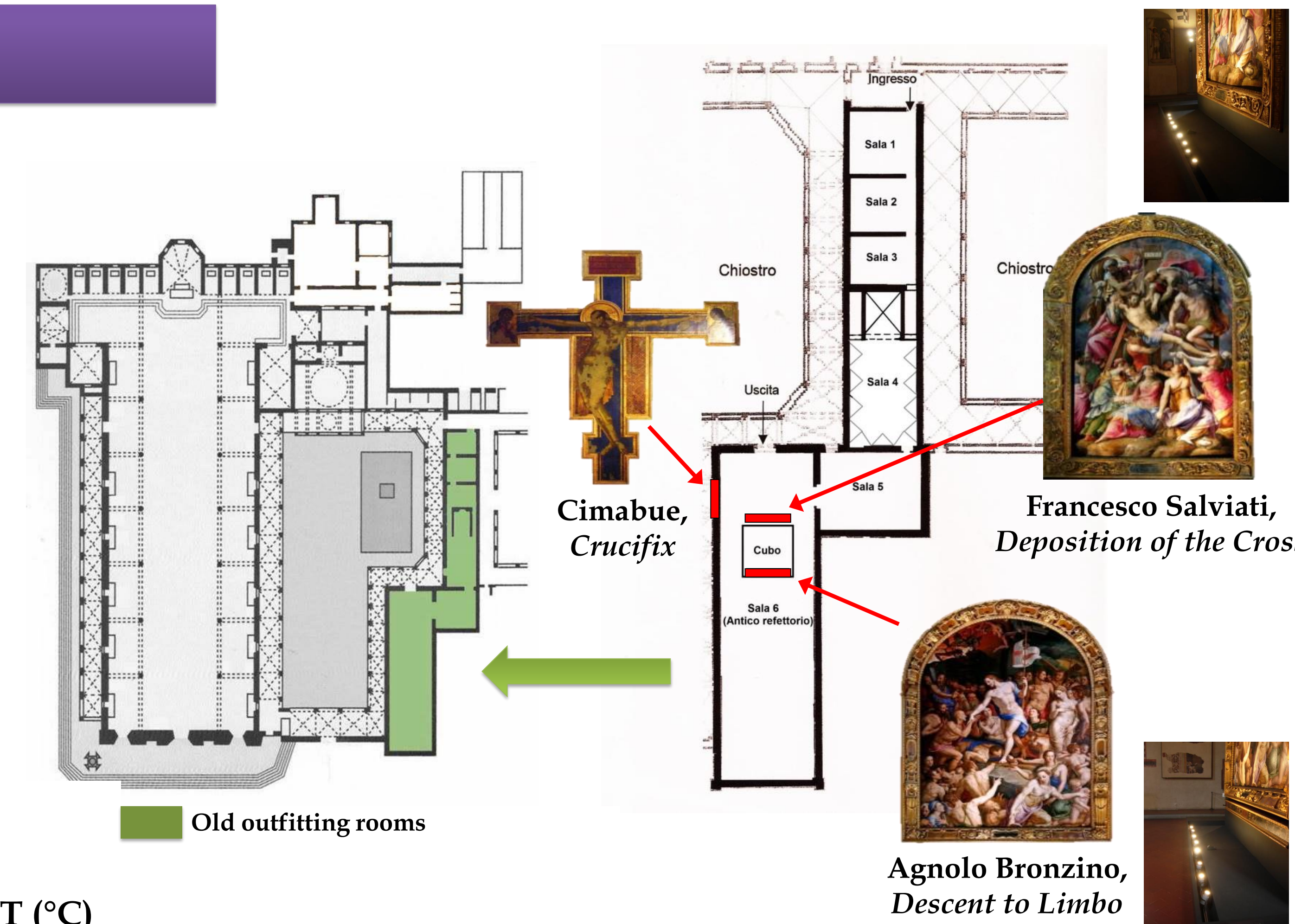
FIRST PHASE: 2009-2010

OBJECTIVE

- Microclimatic monitoring of the museum to study the effect of:
- artificial and natural lighting
 - management of the doors
 - heating system
 - cleaning system
 - presence of public
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- Microclimatic dynamics within the museum
 - Influence of the management on the conservation conditions of the works of art

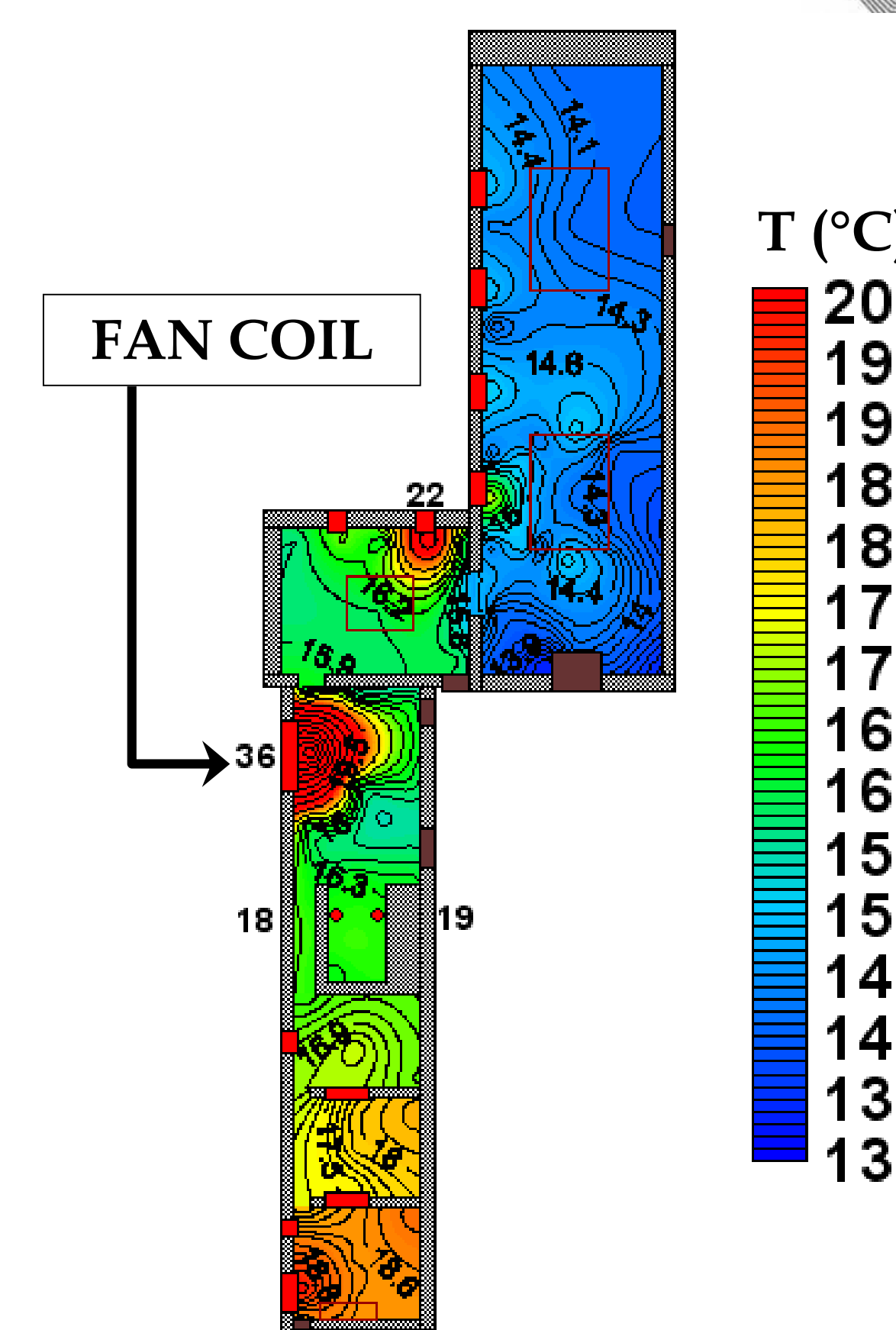
METHODOLOGY

- Continuous measurements with wired sensors:
- air temperature
 - relative humidity
 - surface temperature of wooden paintings
- Seasonal manual campaigns:
- psychrometric measurements before, during and after the opening to the public
 - radiometric measurements on wooden paintings

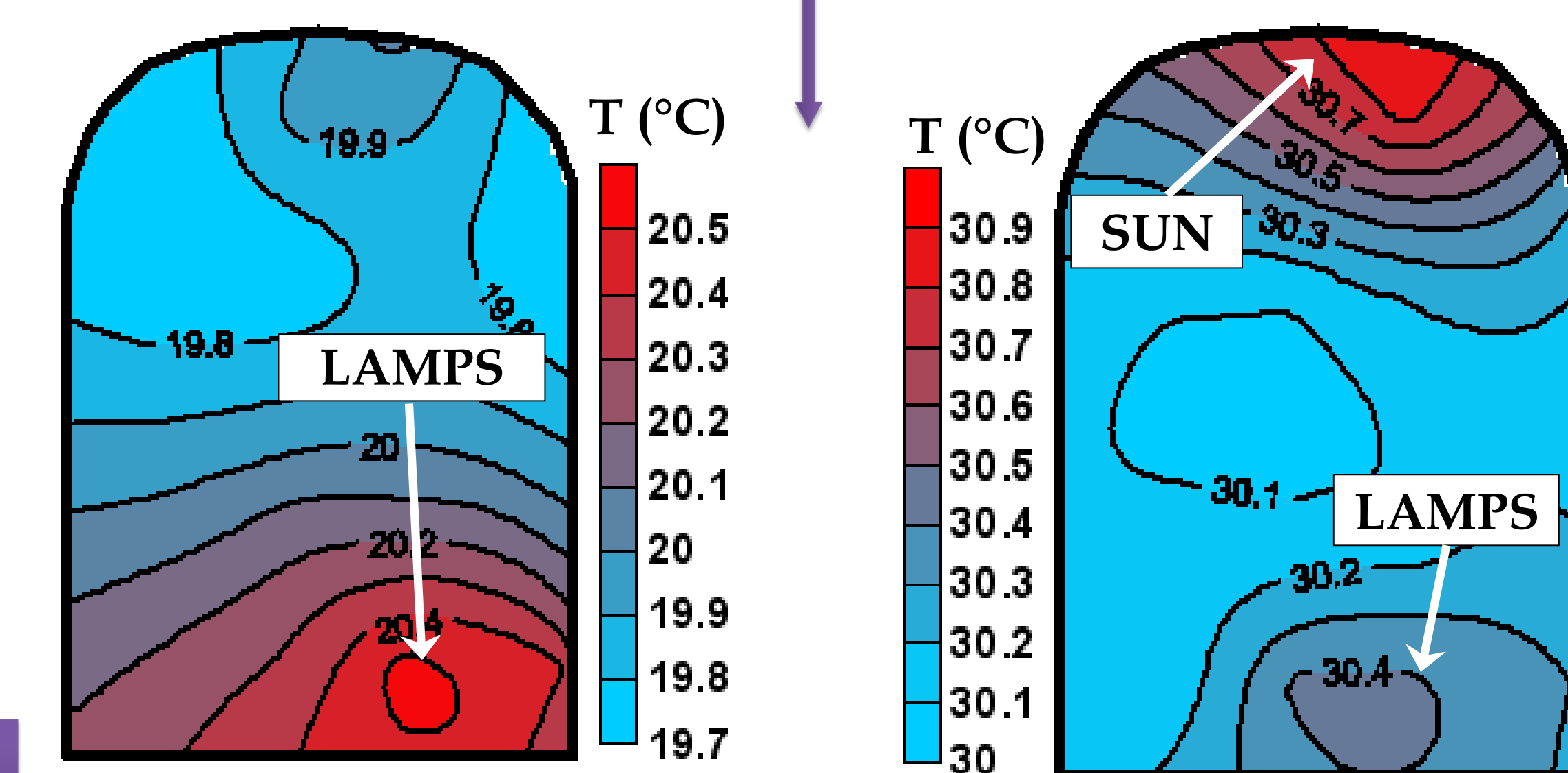


RESULTS

ANTHROPIC FACTORS	INFLUENCE ON MICROCLIMATIC CONDITIONS	POSSIBLE RISKS FOR THE CONSERVATION OF WORKS OF ART
Heating system with fan coils	Variations of T (up to 20°C) and RH (up to 40%), formation of convective cells, increase of particles deposition risk	T-RH values out of the ranges recommended for conservation, variation of equilibrium moisture content (EMC), physical-mechanical stresses
Opening of external doors	Entrance of air at different thermo-hygrometric levels	
Cleaning system with use of water	Increase of specific humidity	
Artificial (direct spotlight) and natural (solar radiation from the windows) lighting on painted wood	Surface heating	Physical stresses (top/bottom and surface/internal layers), EMC variations, degradation of the paint layer (e.g. discoloration due to UV rays)



Influence of the management:
increase of T near the heating source
increase of surface T due to artificial and natural lighting



SECOND PHASE: 2014-2015

OBJECTIVE

- Preventive actions and mitigation risk strategy against floods:
- Emergency management plan
 - Moving of threatened works of art in safer locations.
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- Microclimatic monitoring of the new outfitting



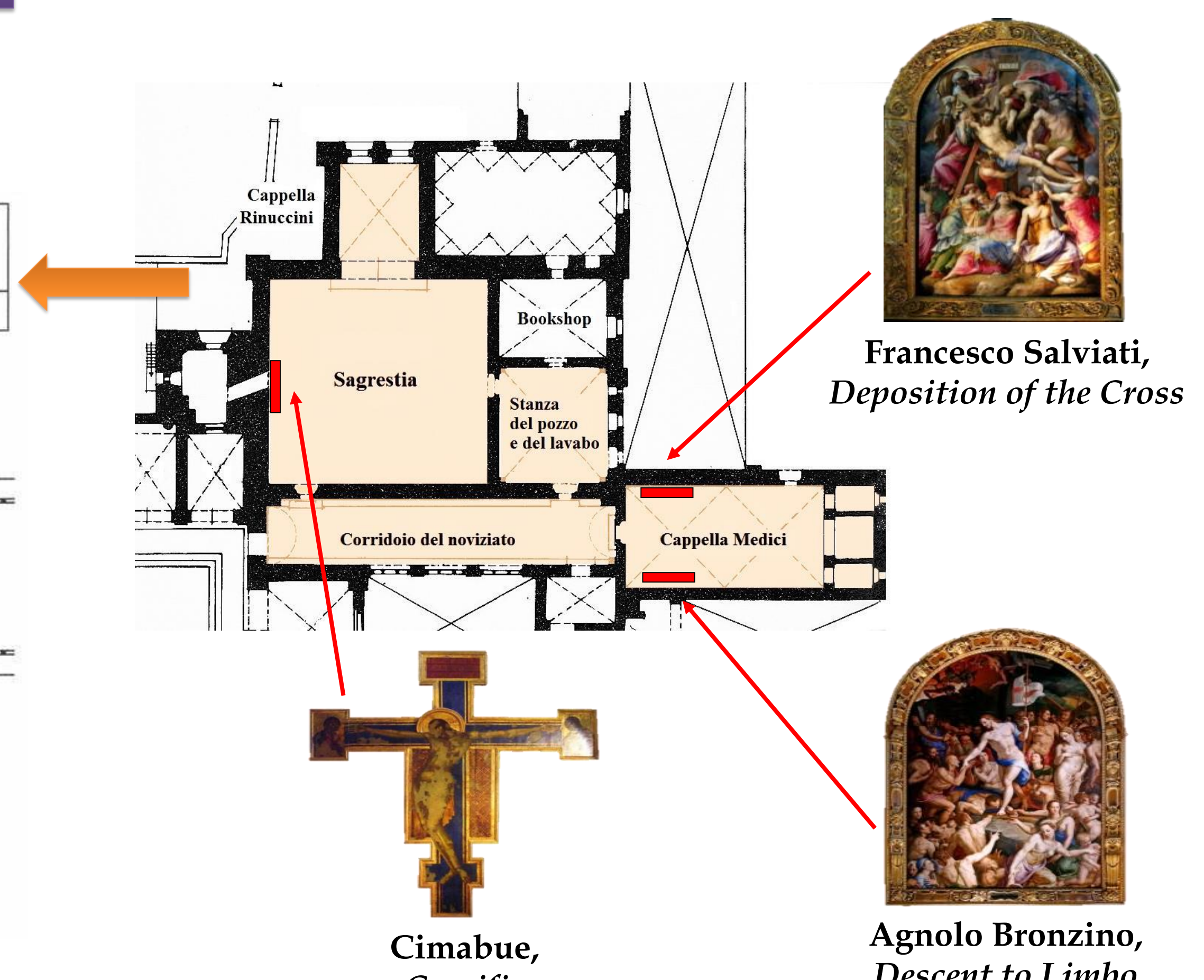
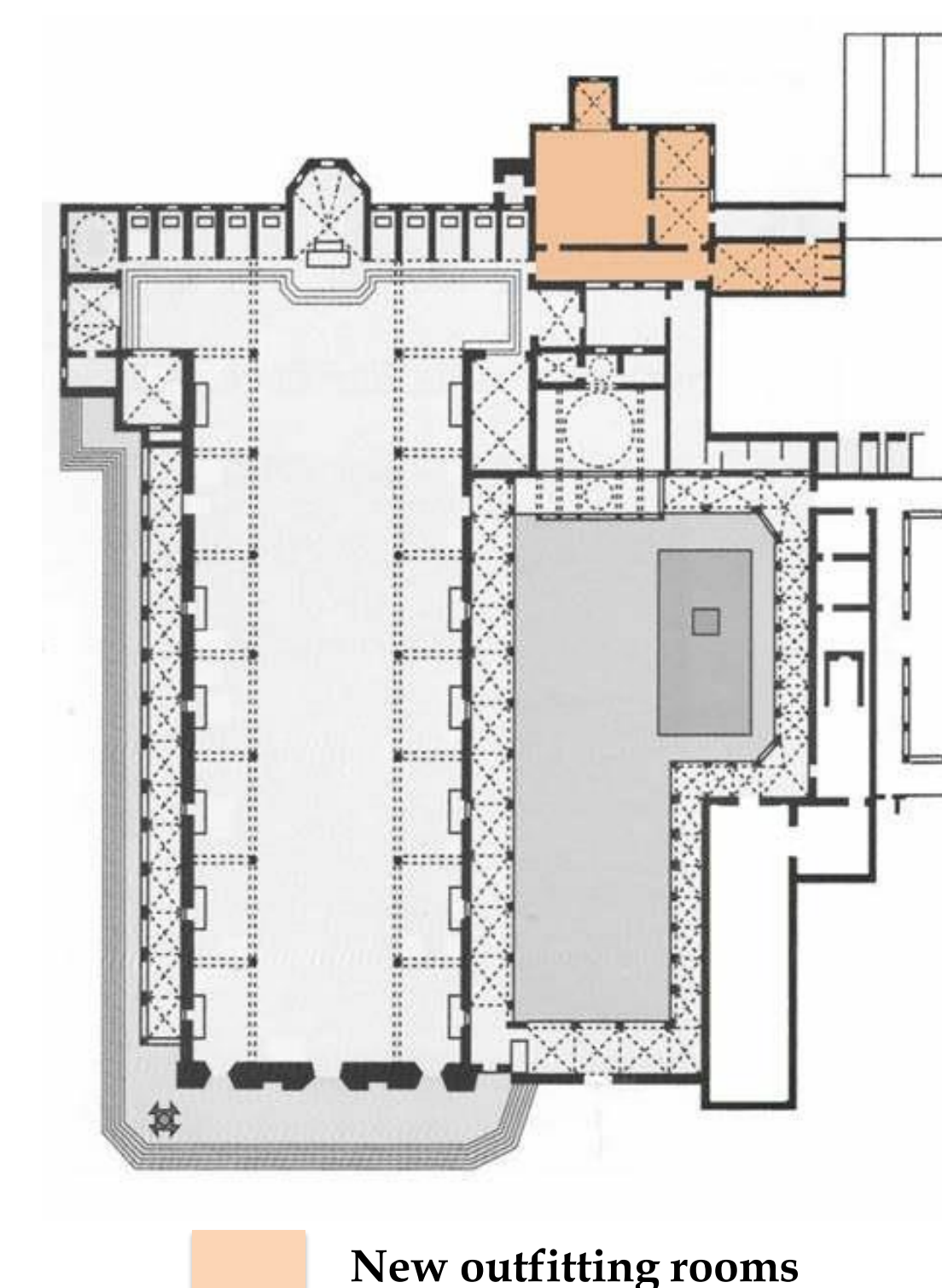
Flood of November 4th, 1966

METHODOLOGY

- Continuous measurements with wireless sensors:
- air temperature
 - relative humidity

Evaluation of results:

- compliance with the T-RH ranges recommended for wood by UNI 10829 & Ministerial Decree n. 112/98 of 5th May 2001
- daily thermo-hygrometric variations
- respect of "historic climate" established by EN 15757-2010: comparison with previous environmental conditions



RESULTS

Ranges recommended for wood conservation

Wooden paintings	Year	T=19÷24°C	ΔT daily max ≤1,5°C	RH=45÷65% (M.D. 112/98)	RH=50÷60% (UNI10829)	ΔRH daily max ≤2% (M.D. 112/98)	ΔRH daily max ≤4% (UNI10829)
Crucifix	2010	40%	9%	94%	77%	0%	12%
	2014	30%	97%	98%	78%	20%	66%
Deposition of the Cross	2010	40%	8%	94%	77%	0%	12%
	2014	27%	97%	90%	57%	9%	62%

Percentage of time with respect to the total time of monitoring when the measured T-RH values and daily variations were included within the recommended ranges

CONCLUSIONS

- Reasonable level of compliance with the recommended T-RH ranges
- Reduction of T-RH daily variations respect to the past
- Comparison with the "historic climate": conservation conditions of the wooden paintings almost unchanged

The moving of the paintings in safer locations did not cause stress adaptation in the wooden support

