

Monitoring Of Atmospheric Particulate Matter for Cultural Heritage Preservation: The Case of the "Grande Brera" Museum Complex in Milan

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GRANDE BRERA MILANO

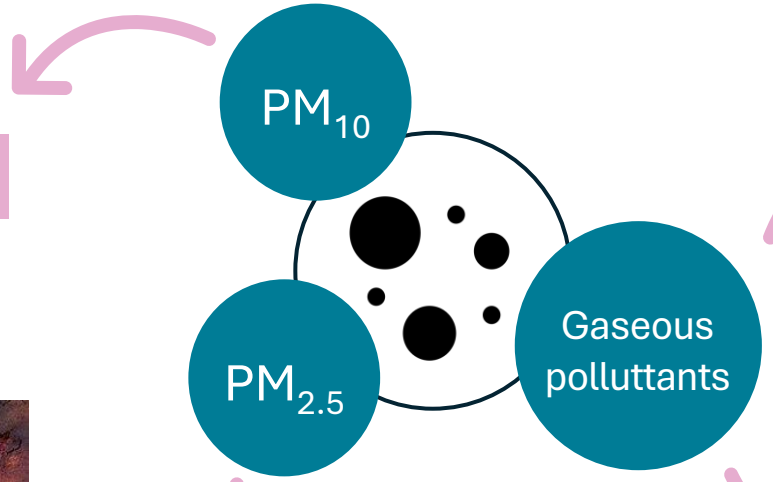
UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

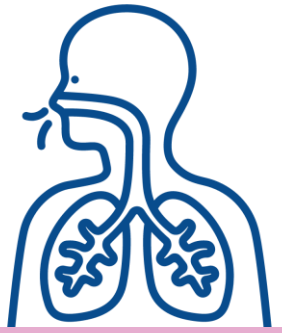
POLITECNICO MILANO 1863

Introduction

Physical degradation

ATMOSPHERIC POLLUTTANTS





Health effects

Chemical degradation

Darkening/Optical changes

PM monitoring in museum environments

AIM

- Monitoring of particle concentrations in the selected museum environments to explore average values, critical issues, sources and potential damaging effects
- Focus on cultural heritage preservation, study of damaging processes caused or facilitated by particulate matter or gaseous phase pollutants
- Based on collected data, set up the ventilation system in the most energy-efficient and heritage-preserving way

GRANDE BRERA
MILANO

Cenacolo Vinciano

Pinacoteca di Brera

Palazzo Citterio

PM monitoring in museum environments

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Cenacolo Vinciano

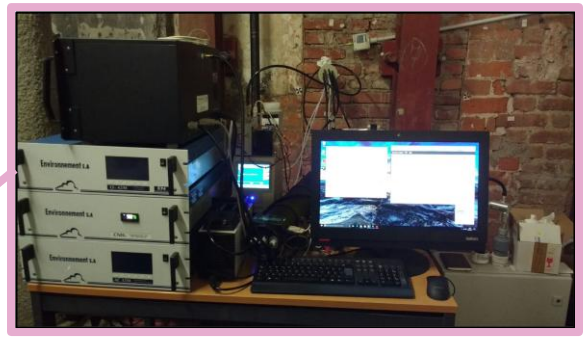
- Constant monitoring of particle concentrations inside the refectory
- Chemical composition analisys of PM
- Study of particle DRH/CRH cycles

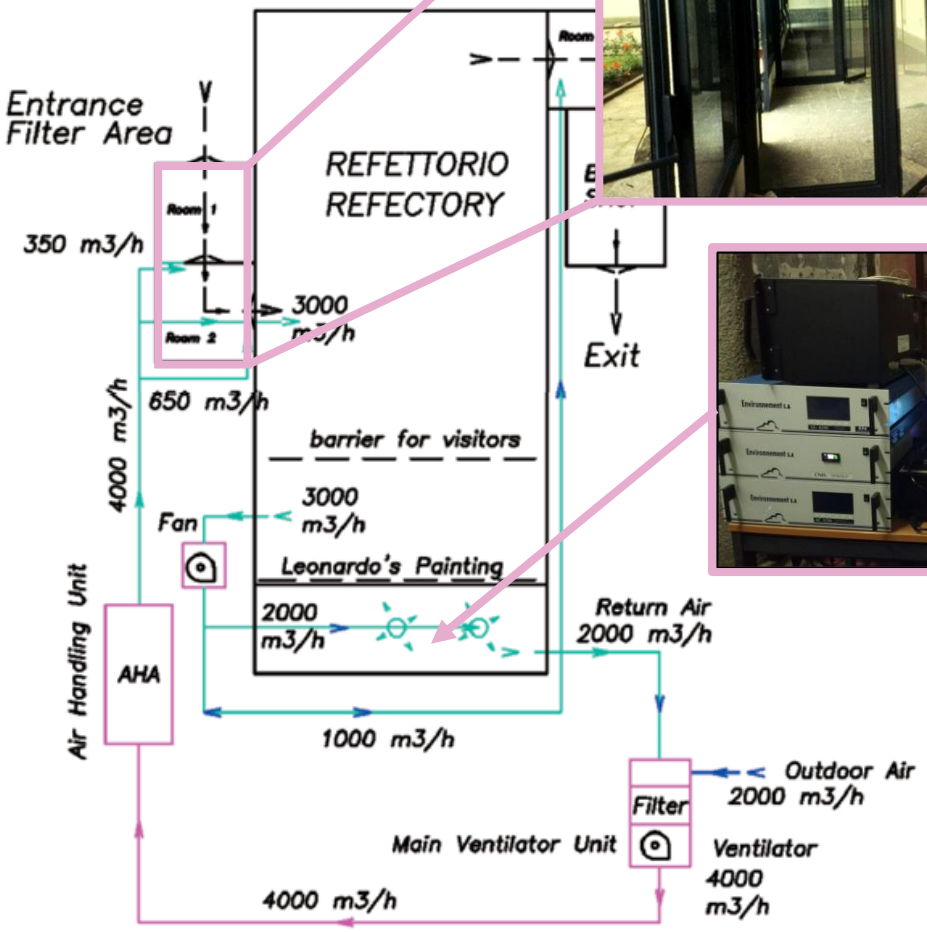
Pinacoteca di Brera - Palazzo Citterio

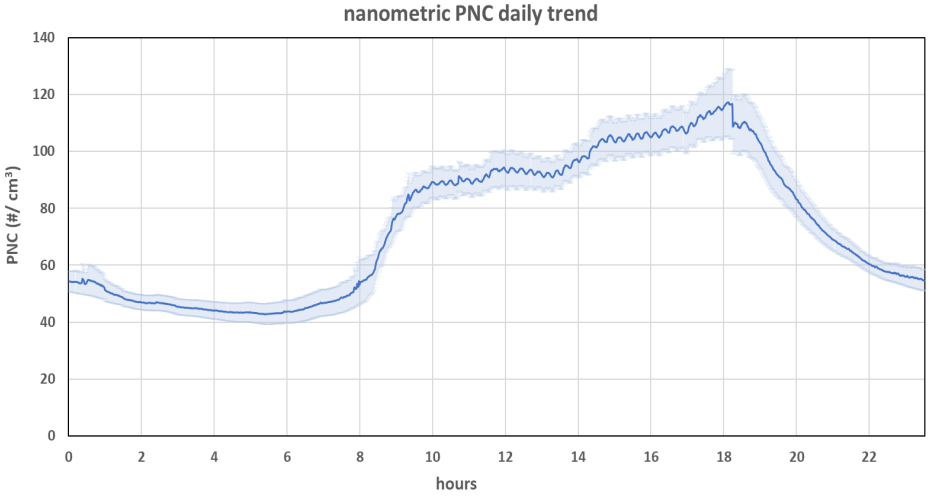
- Explorative campaign to asses particle concentration in each room
- Identify critical environments and emission sources
- Act on the ventilation system

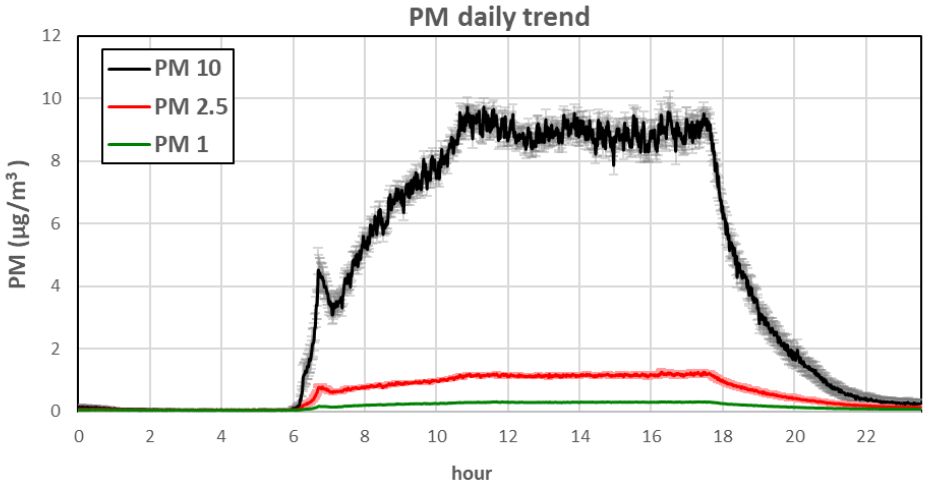
Cenacolo Vinciano

HVAC system

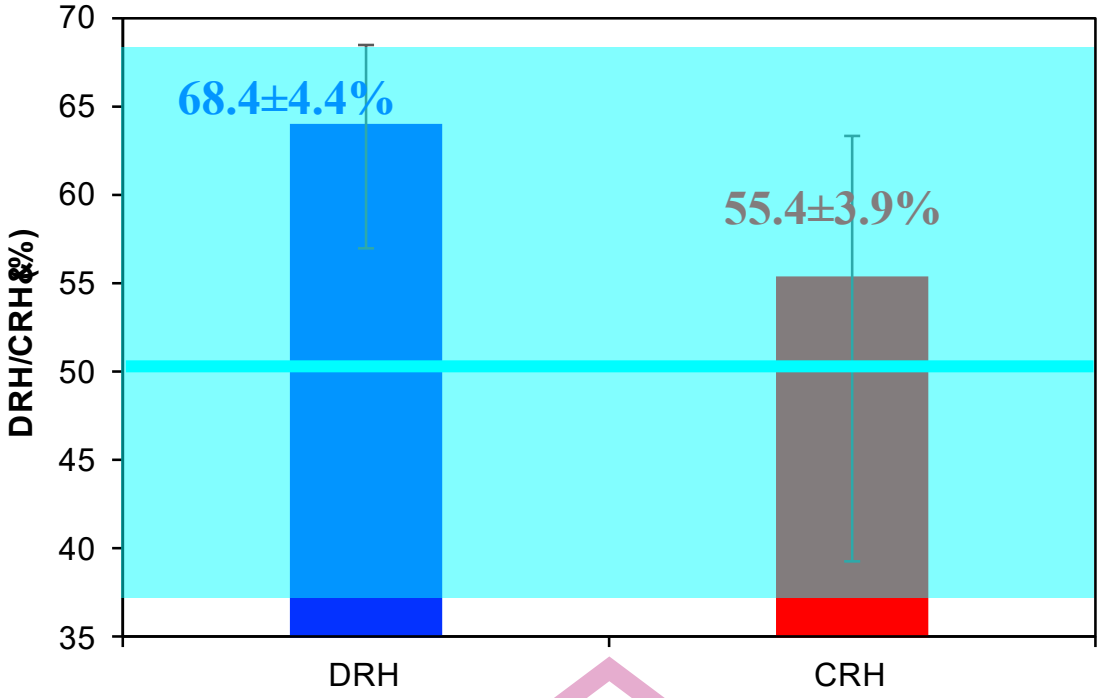


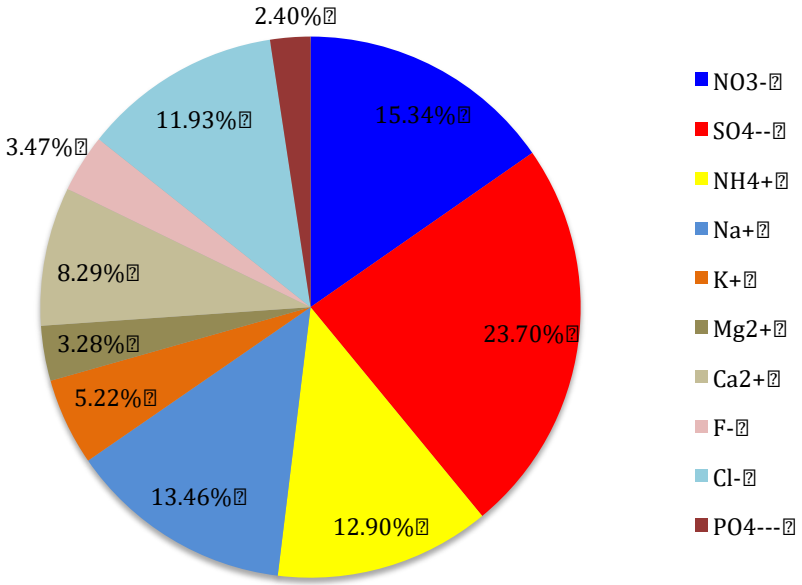


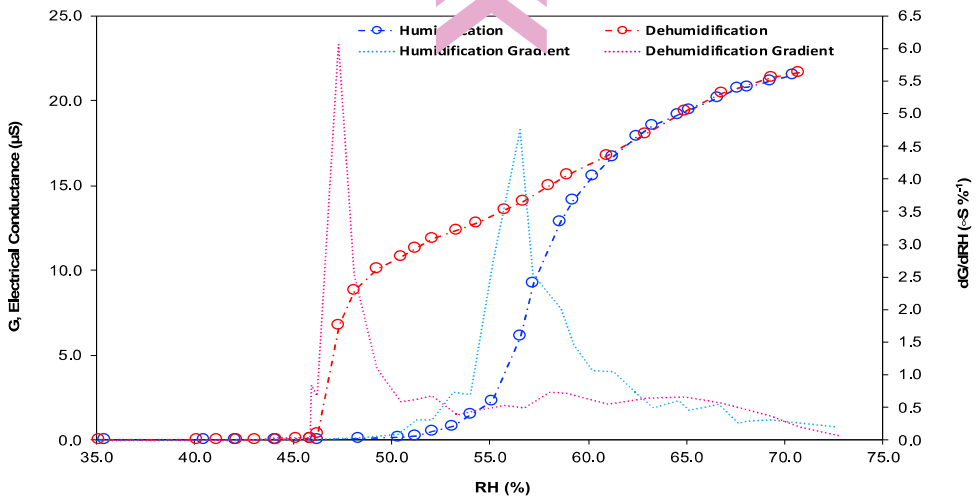




Cenacolo Vinciano - Experimental DRH and CRH

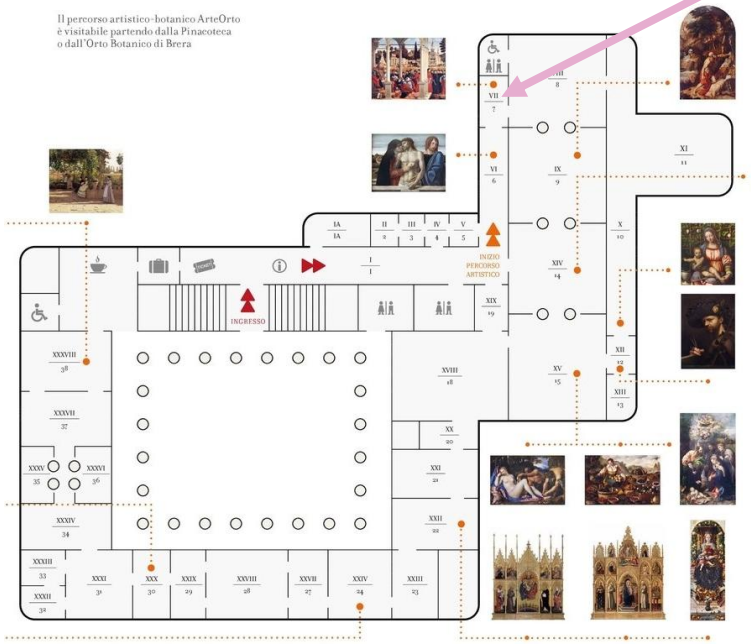






Experimental setup

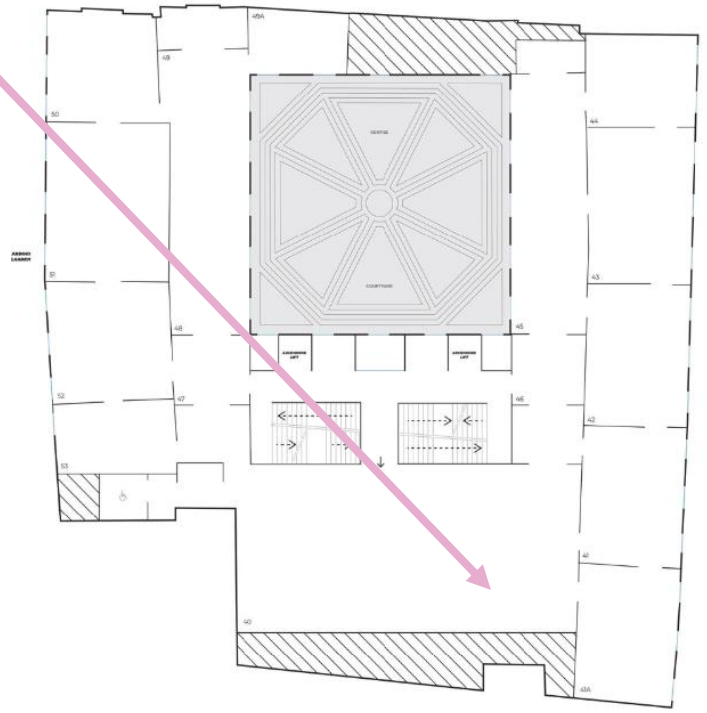
Pinacoteca di Brera



bcMeter
Low-cost aethalometer

Alphasense OPC-N3
Low-cost optical particle counter

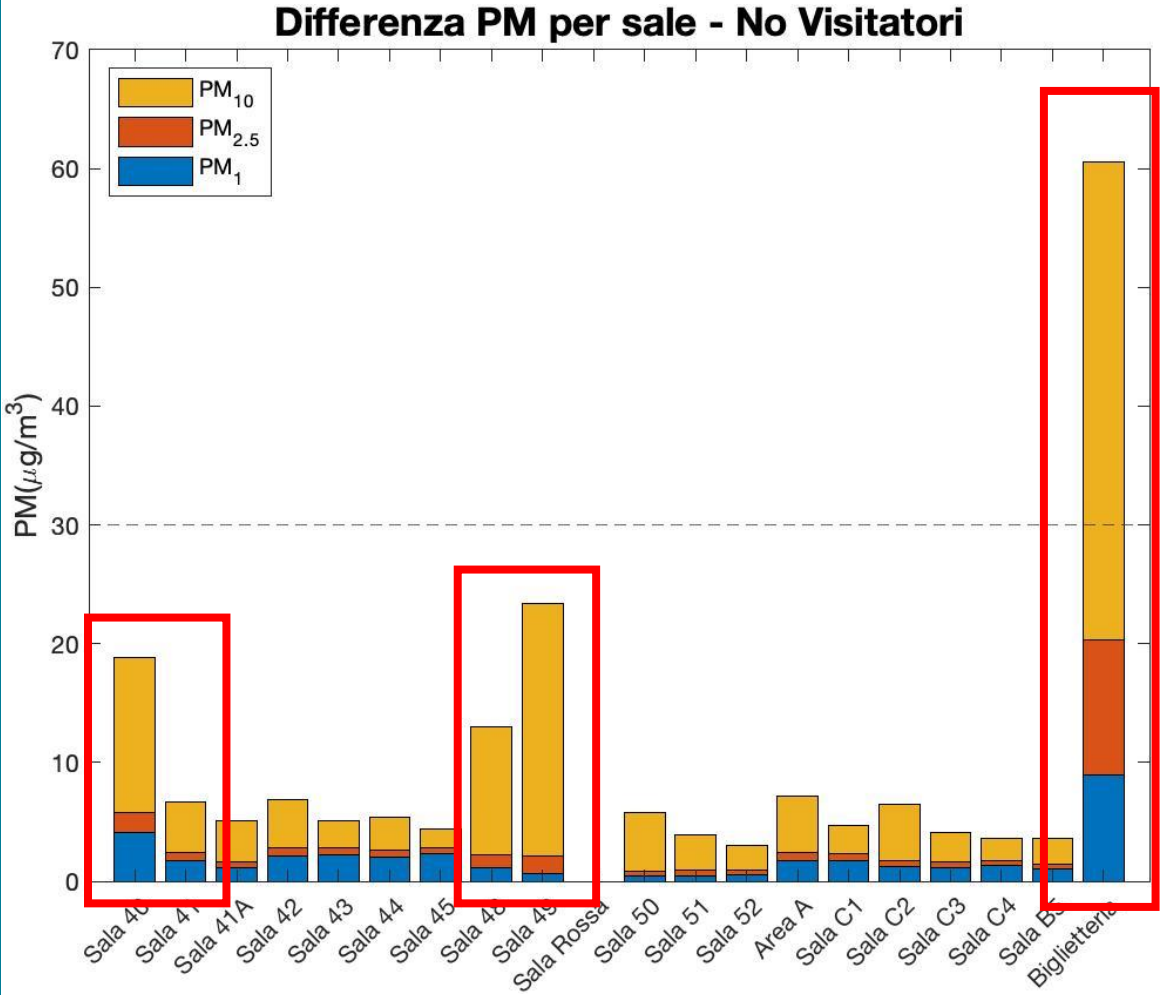
Palazzo Citterio

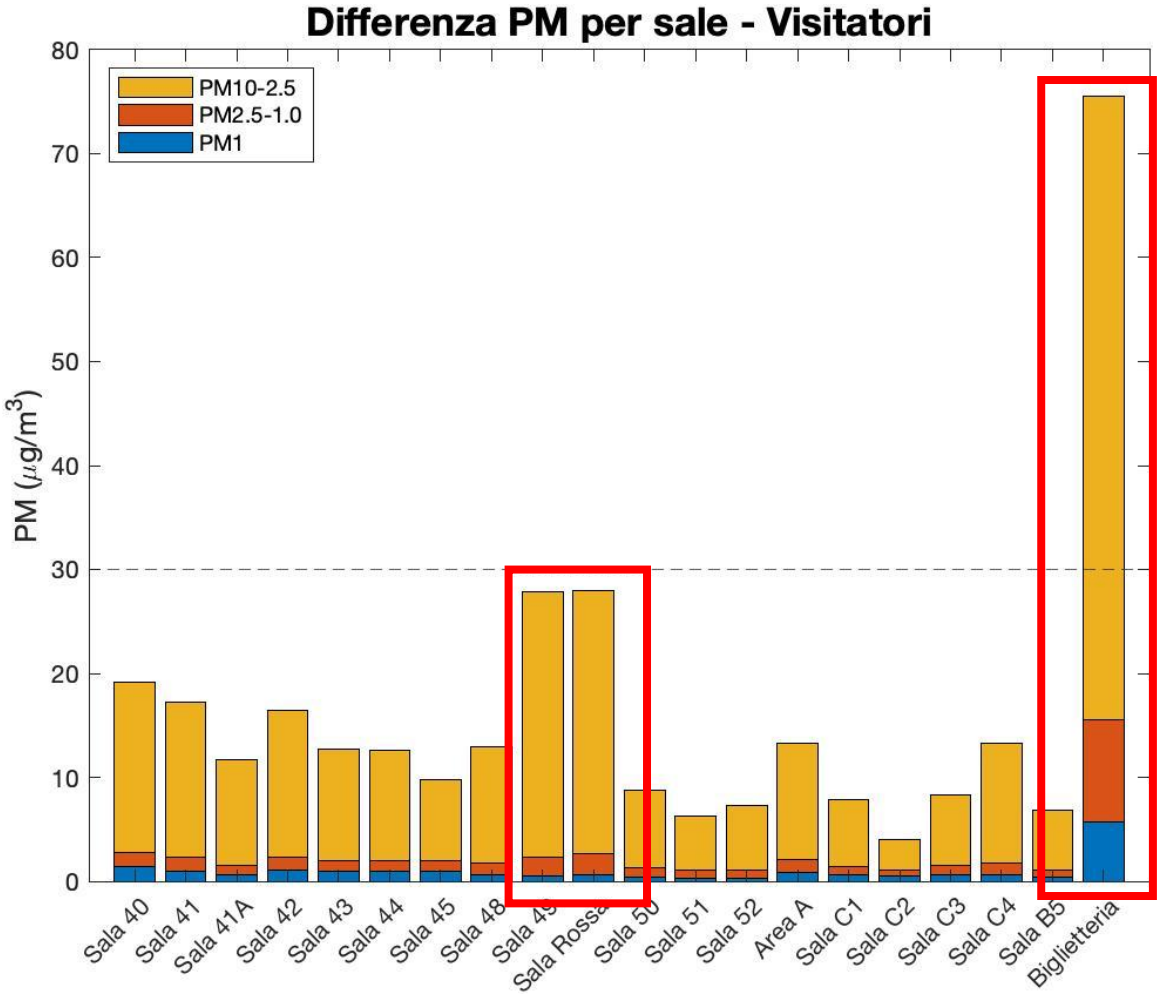


- Mobile monitoring following visitors route
- Three monitoring days per museum, following opening hours

- Nanoscan SMPS (TSI)
- Partector-2 (Naneos)
- Opctical particle counter 1.107 (GRIMM)

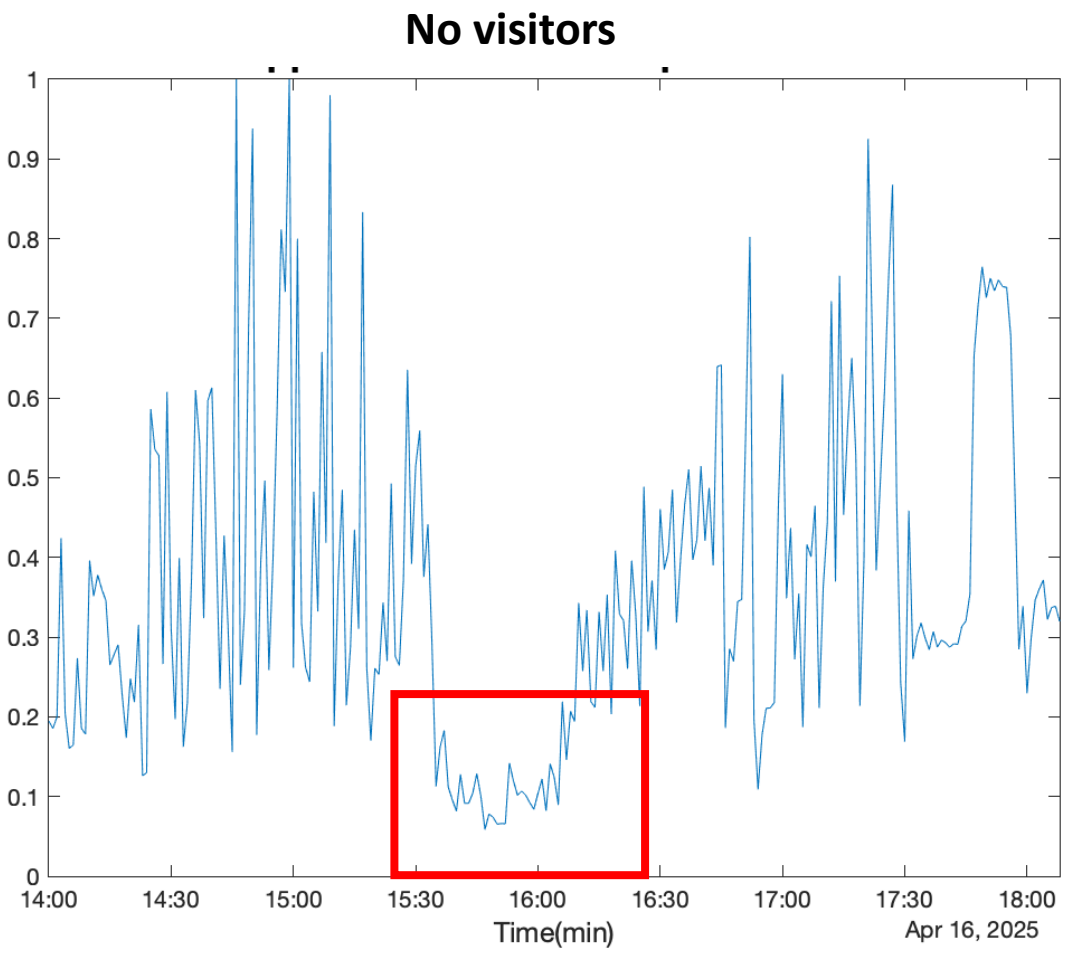
Palazzo Citterio

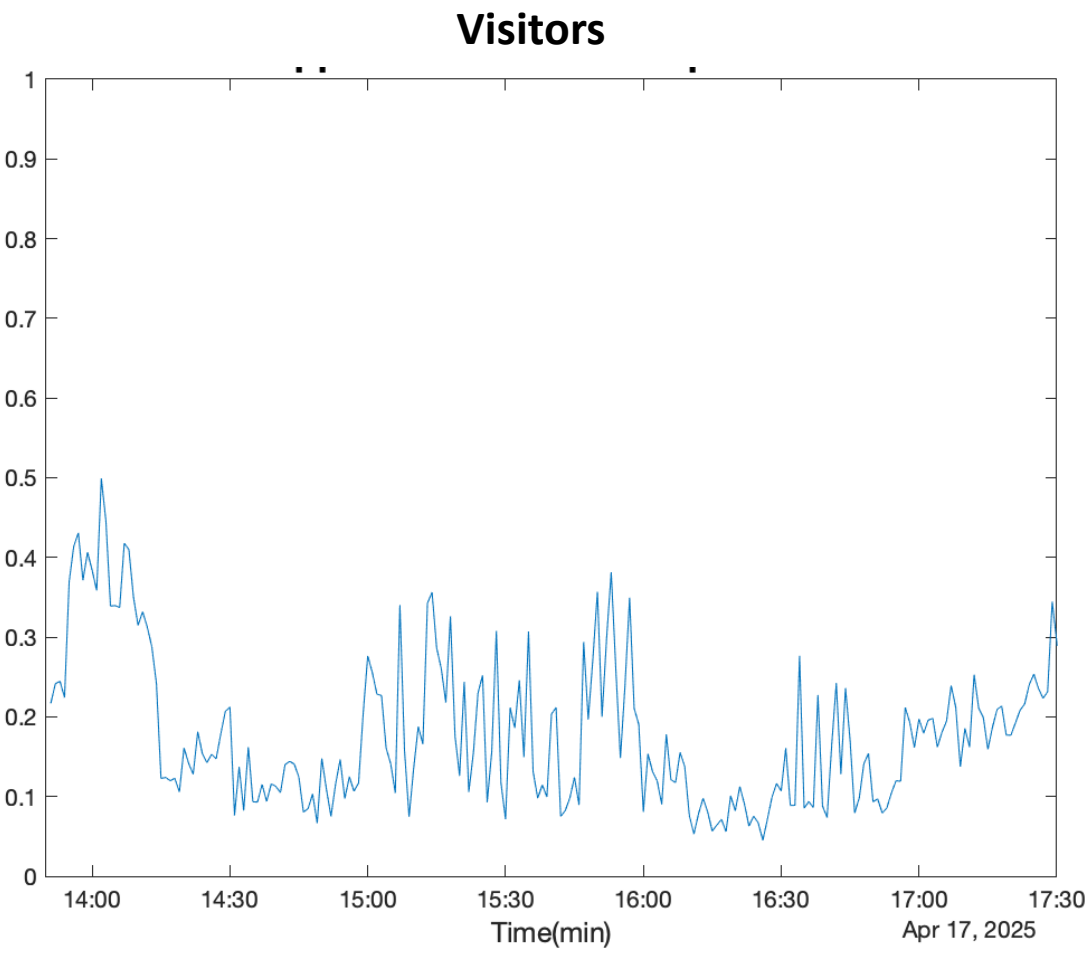




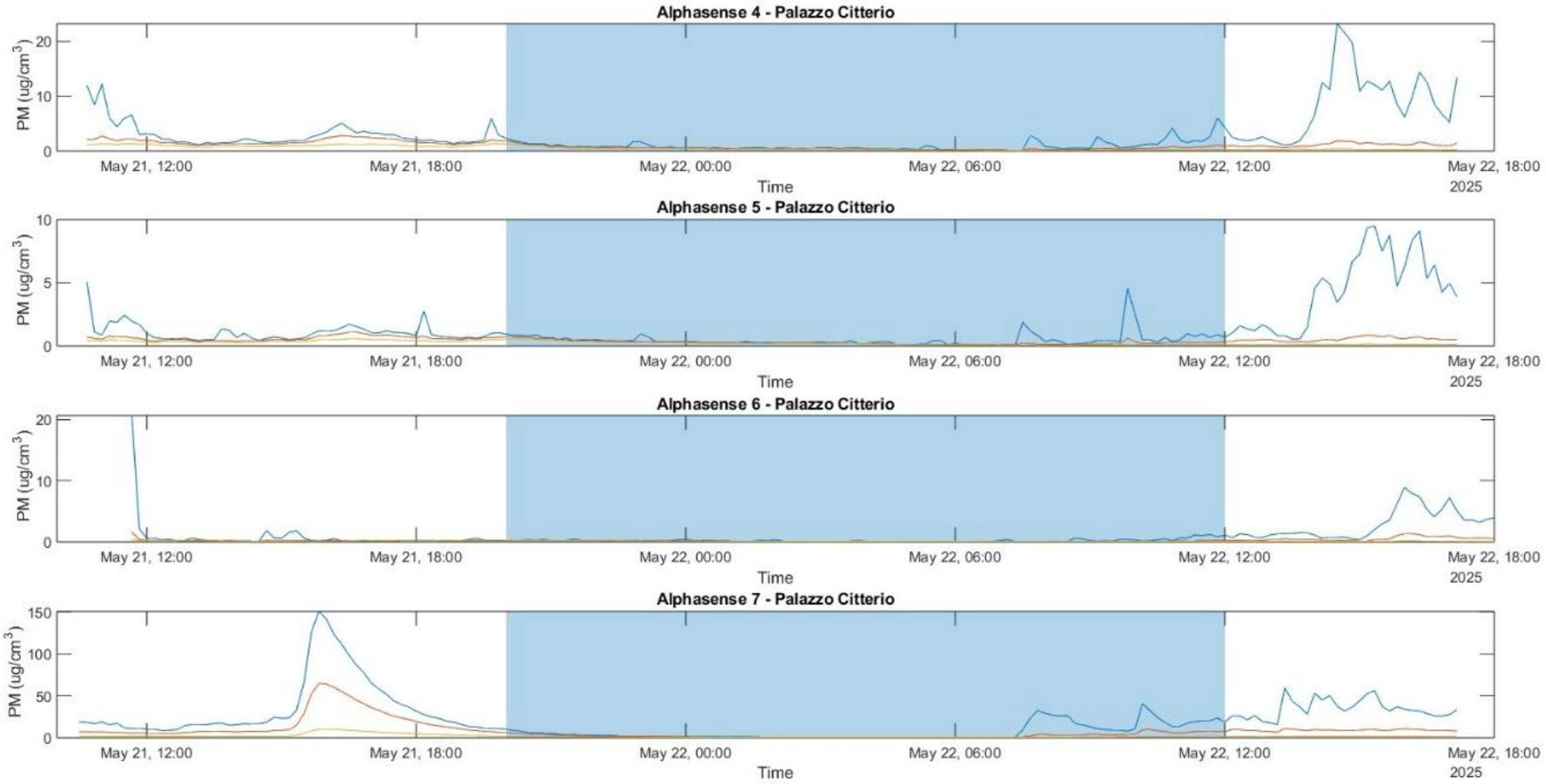
Palazzo Citterio

$PM_{2.5}/PM_{10}$ ratio

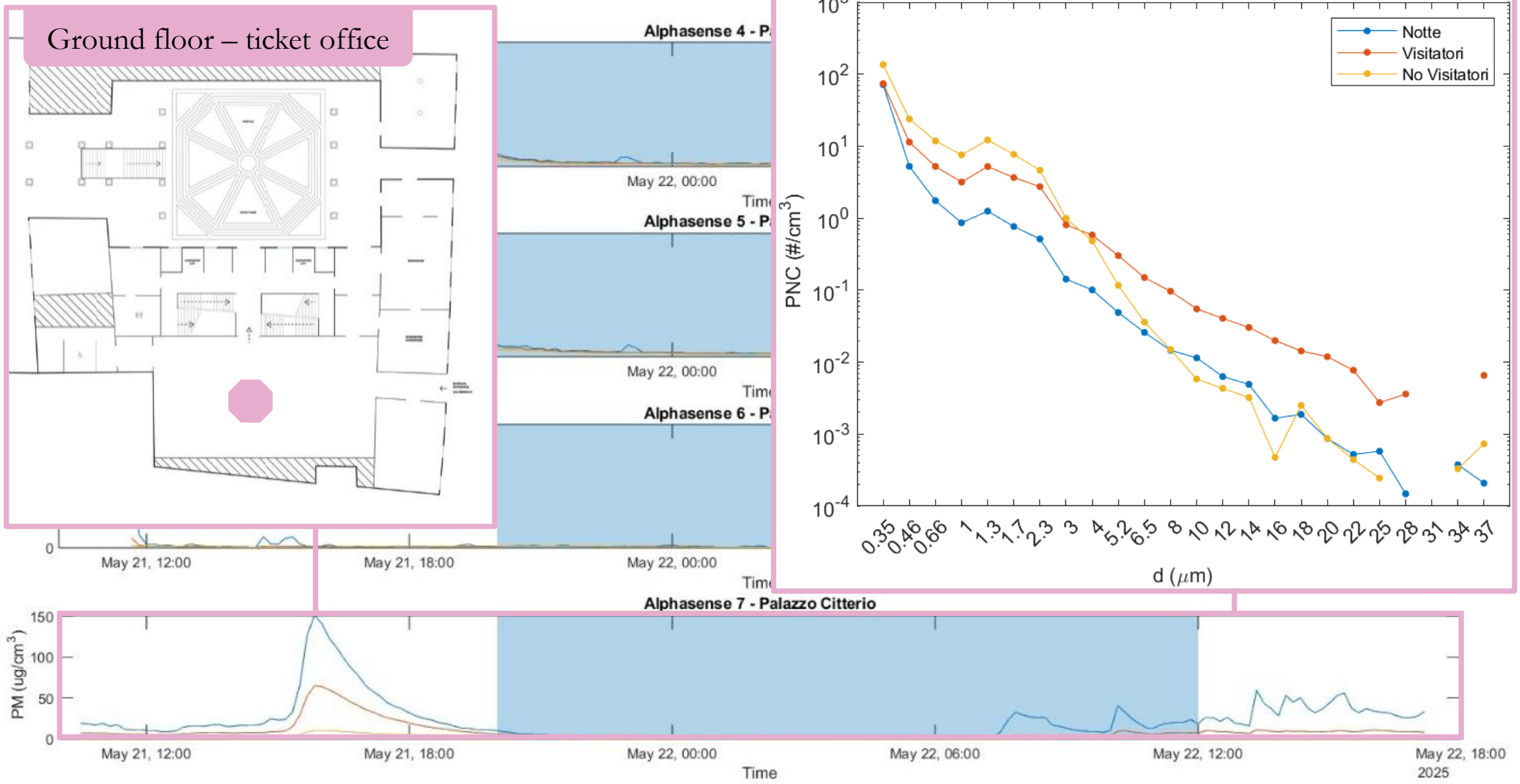




Palazzo Citterio



Palazzo Citterio



Summary and future steps

The HVAC system in the Leonardo's *Last Supper* museum has been in operation for years, ensuring removal of most of atmospheric pollutants. Experimental determination of DRH and CRH values has allowed the implementation of optimal environmental conditions for artwork preservation.

Explorative campaigns at *Pinacoteca di Brera* and *Palazzo Citterio* allowed for an initial quantification of particulate concentrations within the environments, highlighting the main critical issues and sources.

The main critical issues observed are related to the resuspension of particulate matter (particularly coarse particles) and routine or extraordinary operations carried out (cleaning activities, maintenance work).

Next steps:

- monitoring of gaseous pollutants
- precise quantification of particle concentrations and sources
- Tuning of HVAC system in the monitored environments

Thank you for your attention

Acknowledgements