MEASUREMENTS OF AIRBORNE FINE DUST AND ULTRAFINE PARTICLES AT A SEAPORT IN SOUTHERN ITALY

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Agenda

01 Introduction / Motivation

02 Method / Structure

03 Results

04 Summary

Introduction / Motivation

Project Description

Determine impact of UFP emissions from ferries on urban areas in Brindisi (South Italy)

GRIMALDI LINES — Client

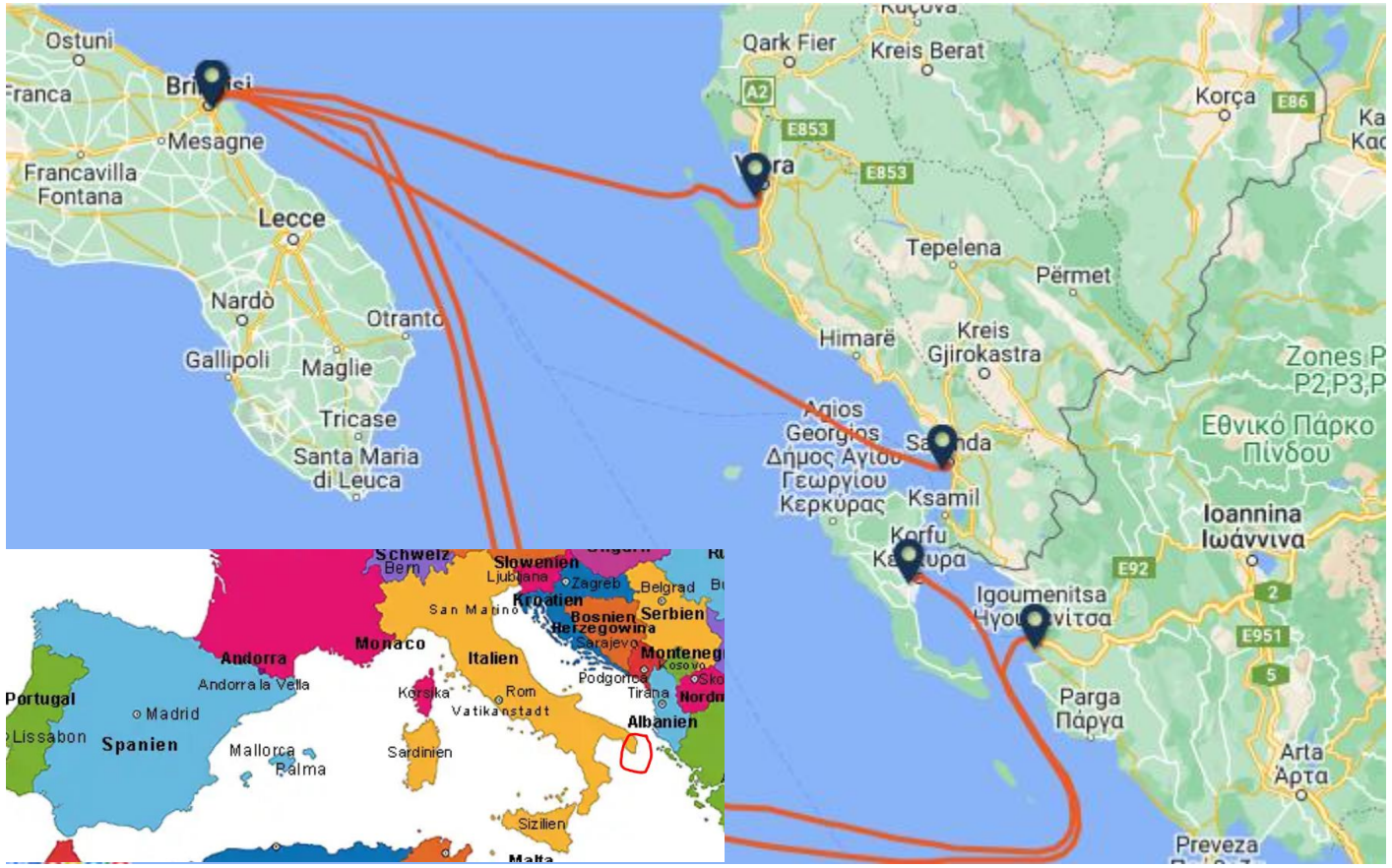
Lab Service Analytica — Contractor

University of Salento — Scientific support

PALAS — Technical support

Introduction / Motivation

Local Conditions



Brindisi Ferries

- **Grimaldi Lines**, **Starlines** and **A-Ships Management S.A.** operate ferries from Brindisi that connect the port of Brindisi with **4 destinations**.
- Connecting Italy with: **Greece, Albania and Corfu via Adriatic Sea**.
- **4 times a day** and up to **25 times a week (peak times)**

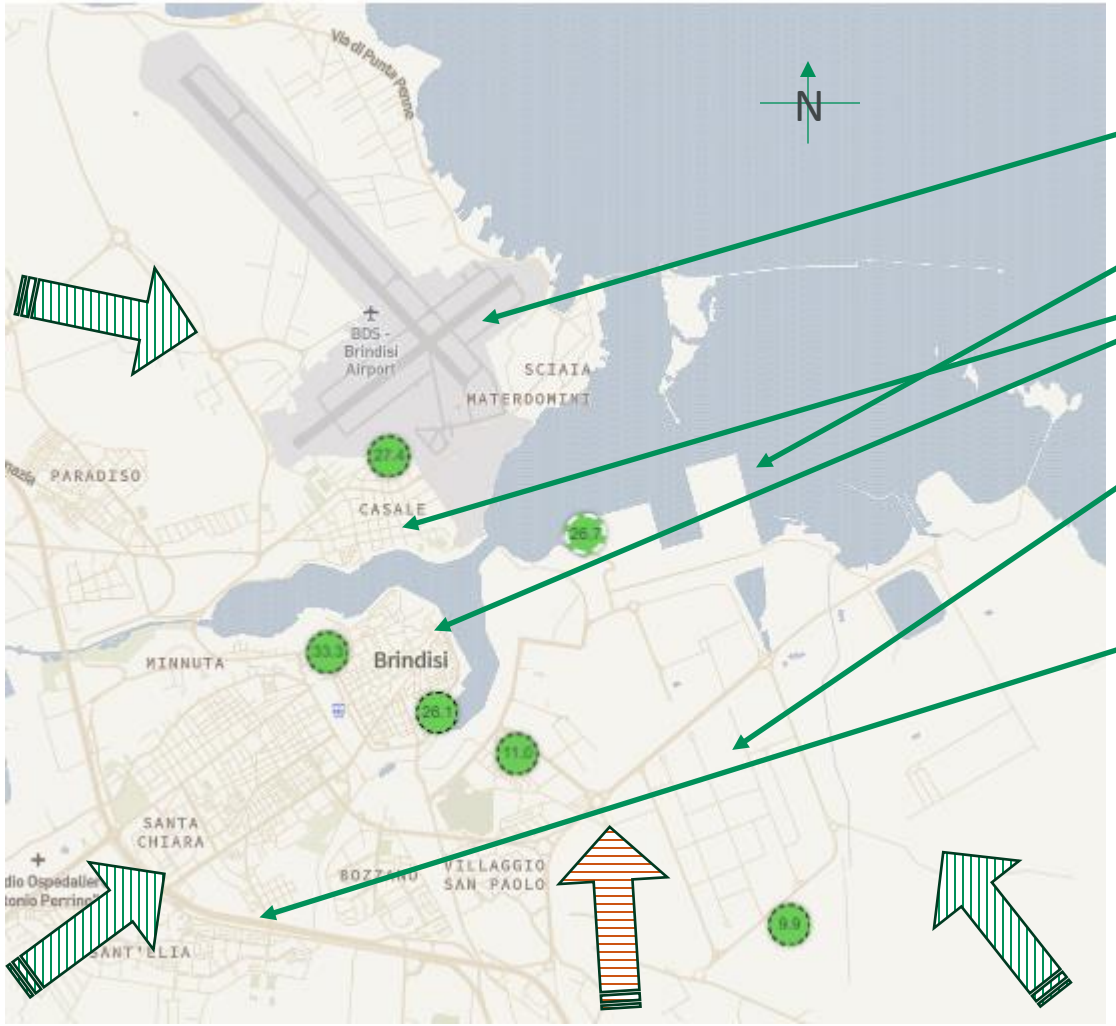
Port address

Stazione Marittima "Brindisi Terminal" - **Costa Morena** Terrare, Brindisi 72100 (BR) - Italy

https://www.directferries.de/brindisi_faehre.htm#map

Introduction / Motivation

Local Conditions



International Airport

Ferry port

City center

Industrial area

(chlorine and petrochemicals, dismantling activities)

Motorway/Transportation (Lecce, Bari, Talent, Naples)

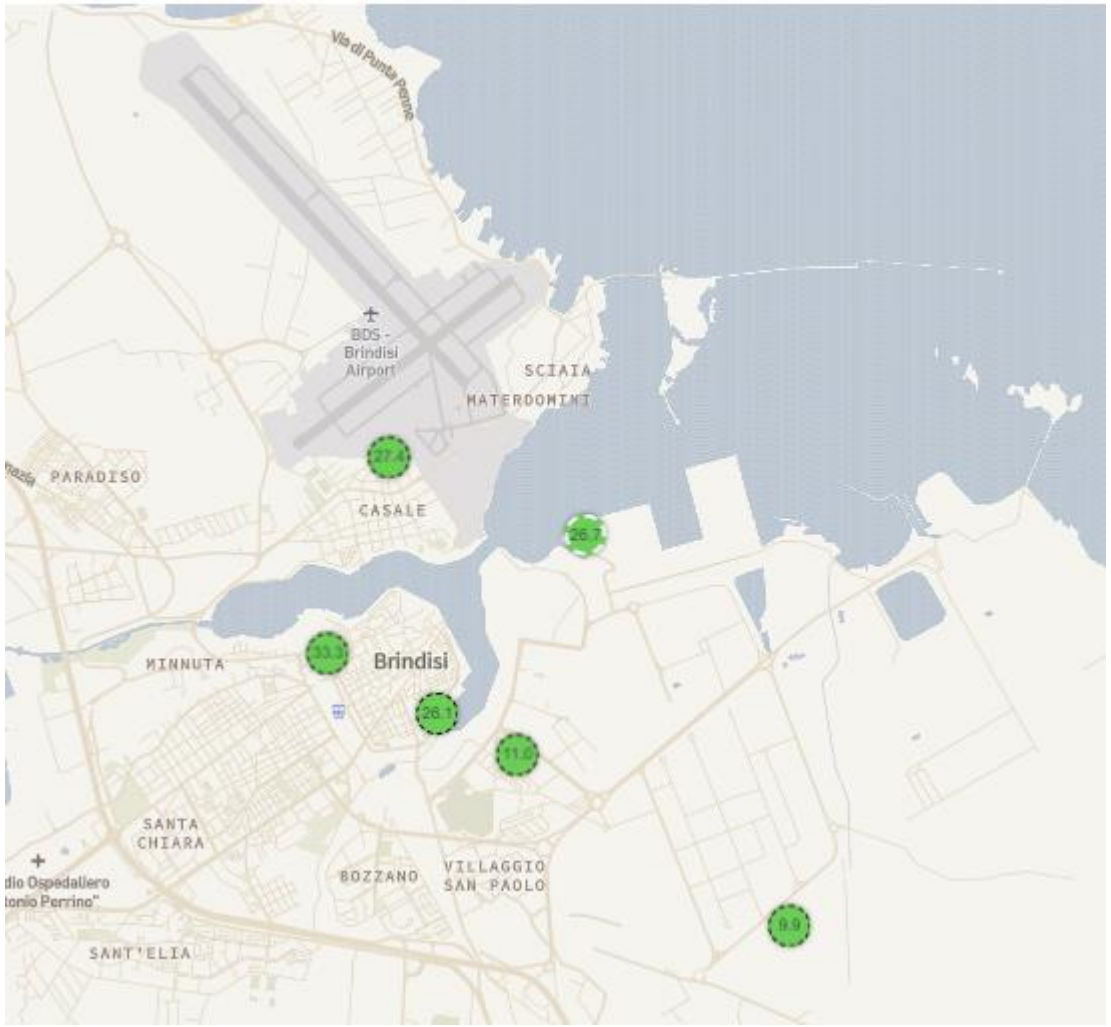
Tirana, Venice, Bologna, Geneva, Paris, London, Palermo, Brussels, Stockholm, Madrid

<u>Other environmental sources (transboundary):</u>

Agriculture
Sahara dust

Method / Structure

Measurement Infrastructure



Official measuring network:

Measured values:

NO_2 in 6 stations

SO_2 in 2 stations

CO in 3 stations

O_3 in 1 station

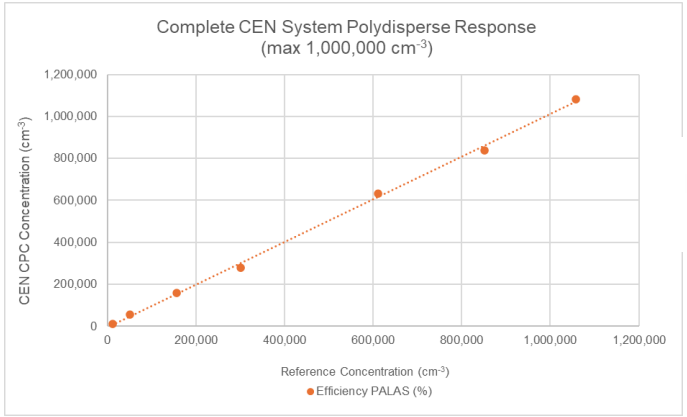
PM_{10} in 1 station

Method / Structure

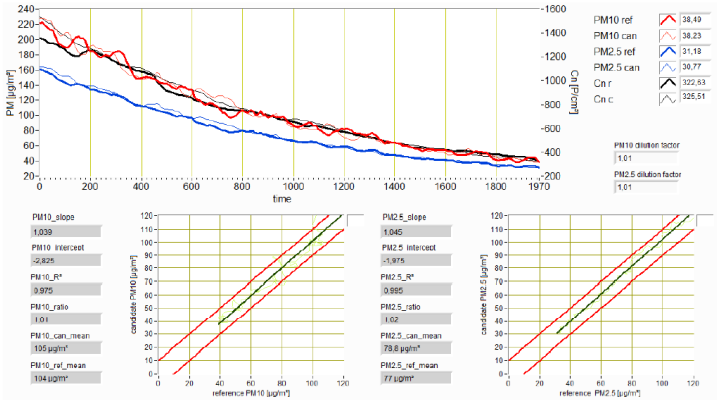
Measurement Infrastructure

Measuring instruments:

- **AQ Guard Smart 2000**
  - Diffusion charging (diffusion charger)
  - Measuring range 10 nm to approx. 1 µm
  - PNC up to approx. 10 million particles/cm³
  - PN, mean diameter, LDSA, temp, rH, p

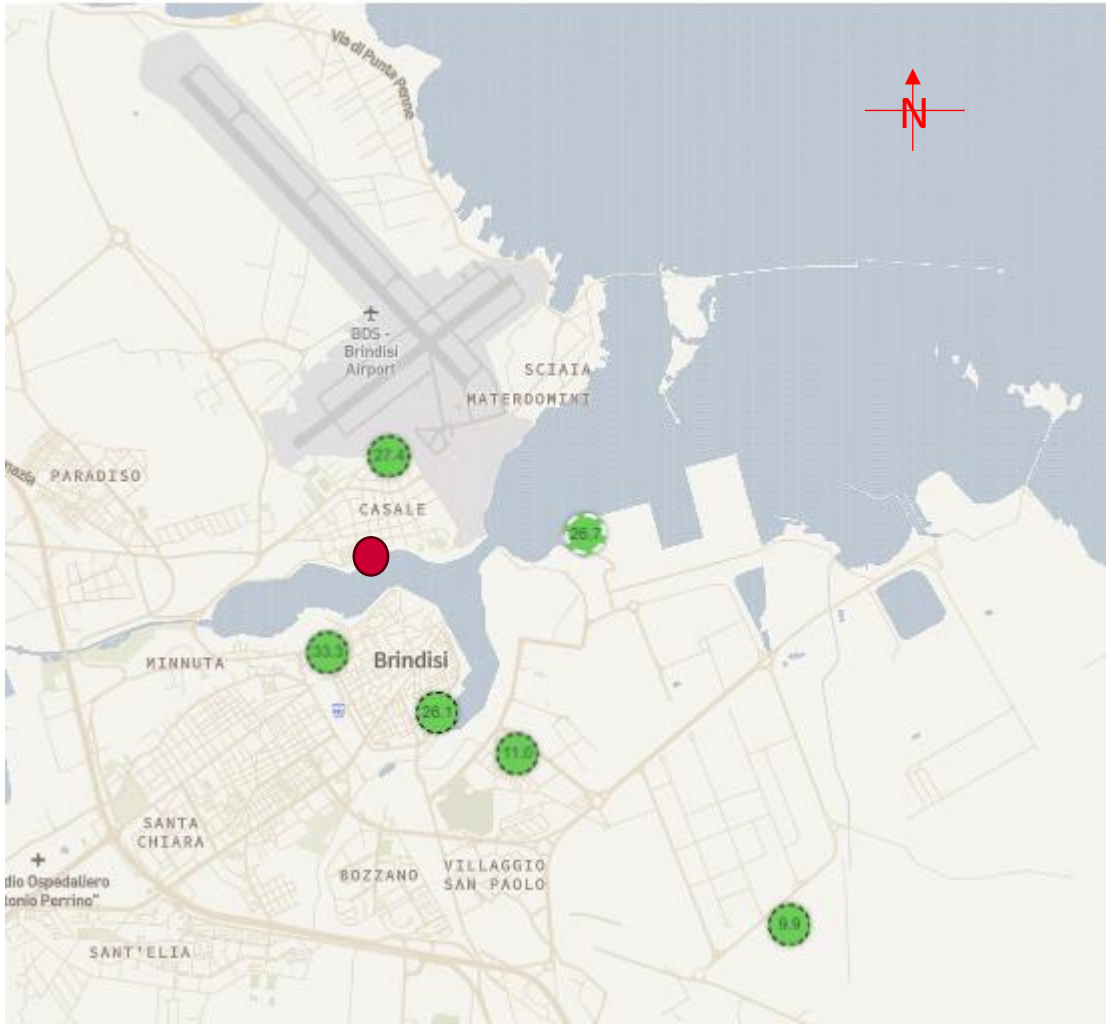


- **AQ Guard Smart 1000**
  - OPC (Single particle count, White light LEI
  - Measuring range 0.18 µm to 18 µm
  - PN, PSD, PM_1 to TSP, temp, rH, p, ...

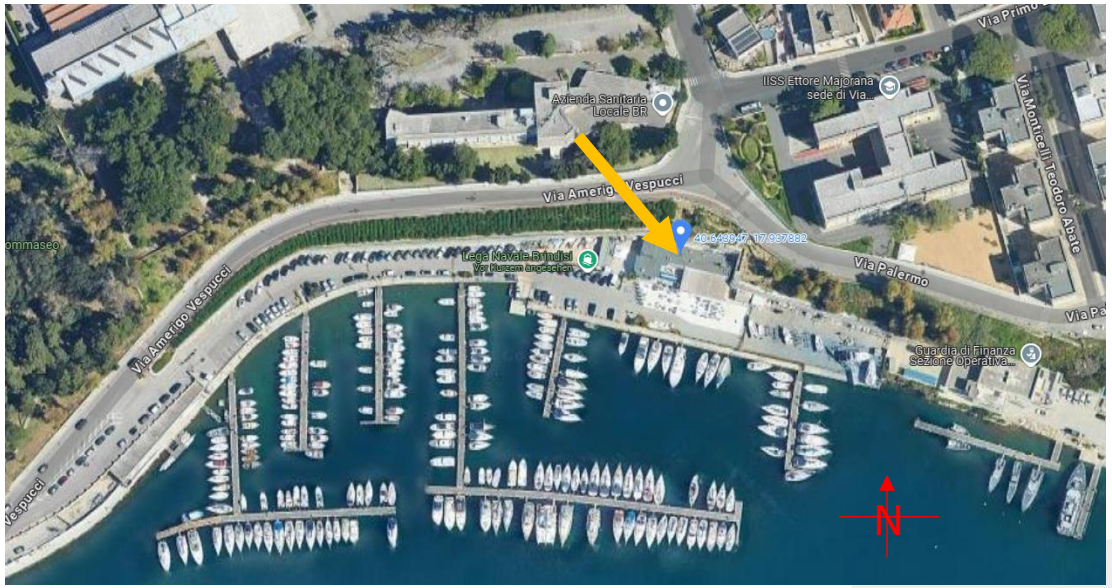


Results

Measurement of Ultrafine Particles and Fine Dust

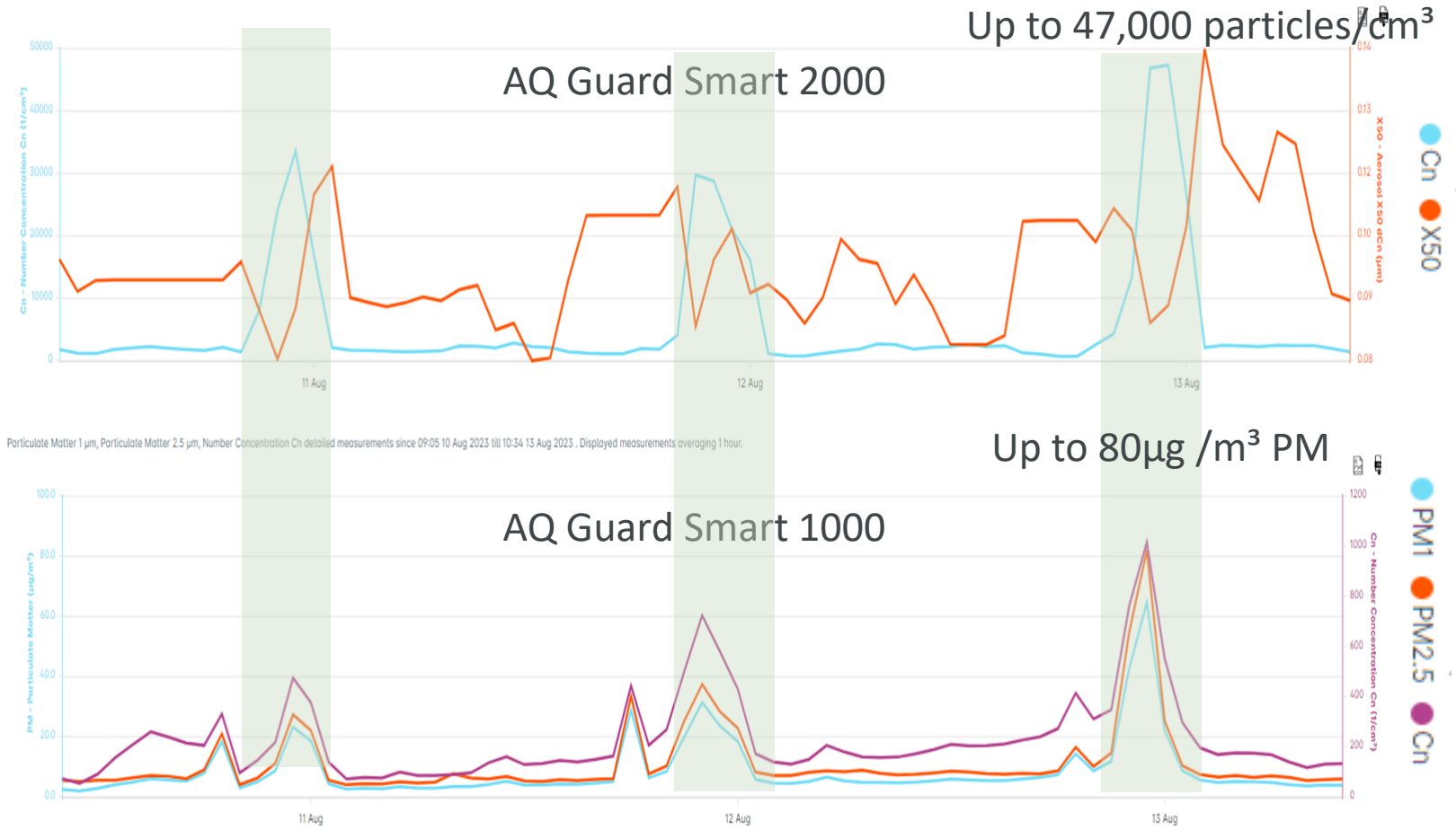


- First installation "Brindisi city harbor"
  - West of the ferry port
  - Close to the city
  - At a height of approx. 4 m (roof)



Results

Measurement of ultrafine particles and fine dust (data exemplary from August 11-13 - hourly values)



- Periodic daily fluctuations of UFP concentrations and mean diameter
- Recurring every 19:45 - 24:00
- Increase in particle number concentration and PM values
- Good correlation between UFP and PM
- big mean diameters at peaks (not really typic for mineral fuels?)

Results

Measurement of Ultrafine Particles and Particulate Matter (data from August 11-13)

Autorità di Sistema Portuale
del Mare Adriatico Meridionale
Bari, Brindisi, Manfredonia, Barletta, Monopoli, Termoli

26/07/2023	mercoledi	EMERALD AZZURRA	EMERALD CRUISE	MONOPOLI	FISKARDO	17:00	19:00
31/07/2023	lunedì	MSC SINFONIA	MSC CROCIERE	VENEZIA	MYCONOS	16:00	22:00
07/08/2023	lunedì	MSC SINFONIA	MSC CROCIERE	VENEZIA	MYCONOS	16:00	22:00
14/08/2023	lunedì	MSC SINFONIA	MSC CROCIERE	VENEZIA	MYCONOS	16:00	22:00
19/08/2023	sabato	CLUB MED 2	CLUB MED			07:00	23:00
21/08/2023	lunedì	MSC SINFONIA	MSC CROCIERE	VENEZIA	MYCONOS	16:00	22:00
24/08/2023	giovedì	SEABOURN ENCORE	SEABOURN CRUISE LINE			08:00	18:00
28/08/2023	lunedì	MSC SINFONIA	MSC CROCIERE	VENEZIA	MYCONOS	16:00	22:00

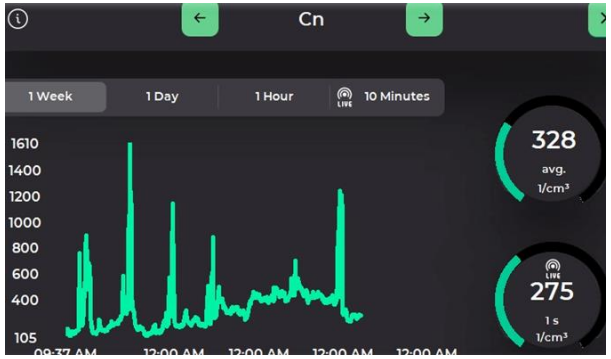
- No correlation to ship, flight or other activities.
- No shipping traffic during this period at all!

➔ Other source!

Results

Measurement of Ultrafine Particles and Particulate Matter (data from August 11-13)

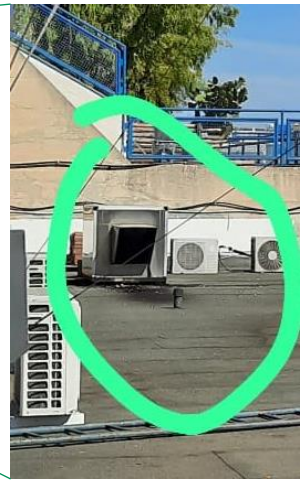
Very good correlation with



!! PIZZA Time !!!

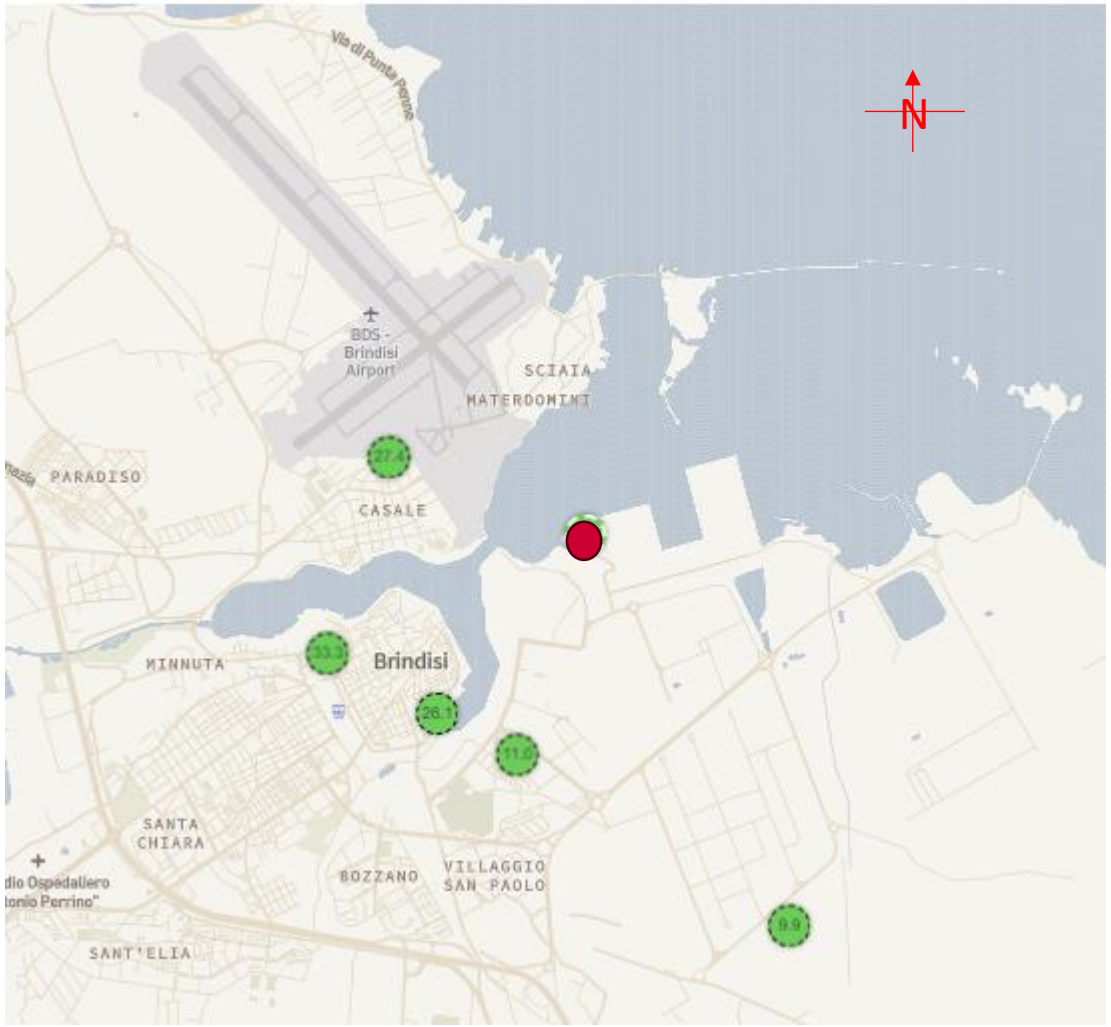
Exhaust air from nearby restaurant - Weekend evenings !

➔ Not active during installation; explains bigger mean diameter of UFPs

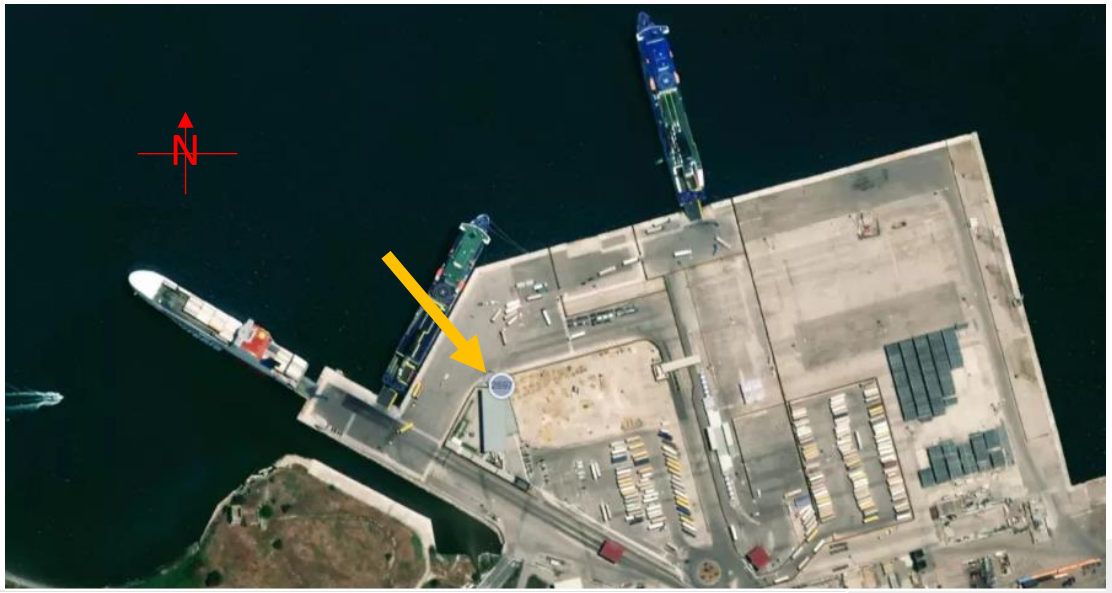


Results

Measurement of Ultrafine Particles and Fine Dust



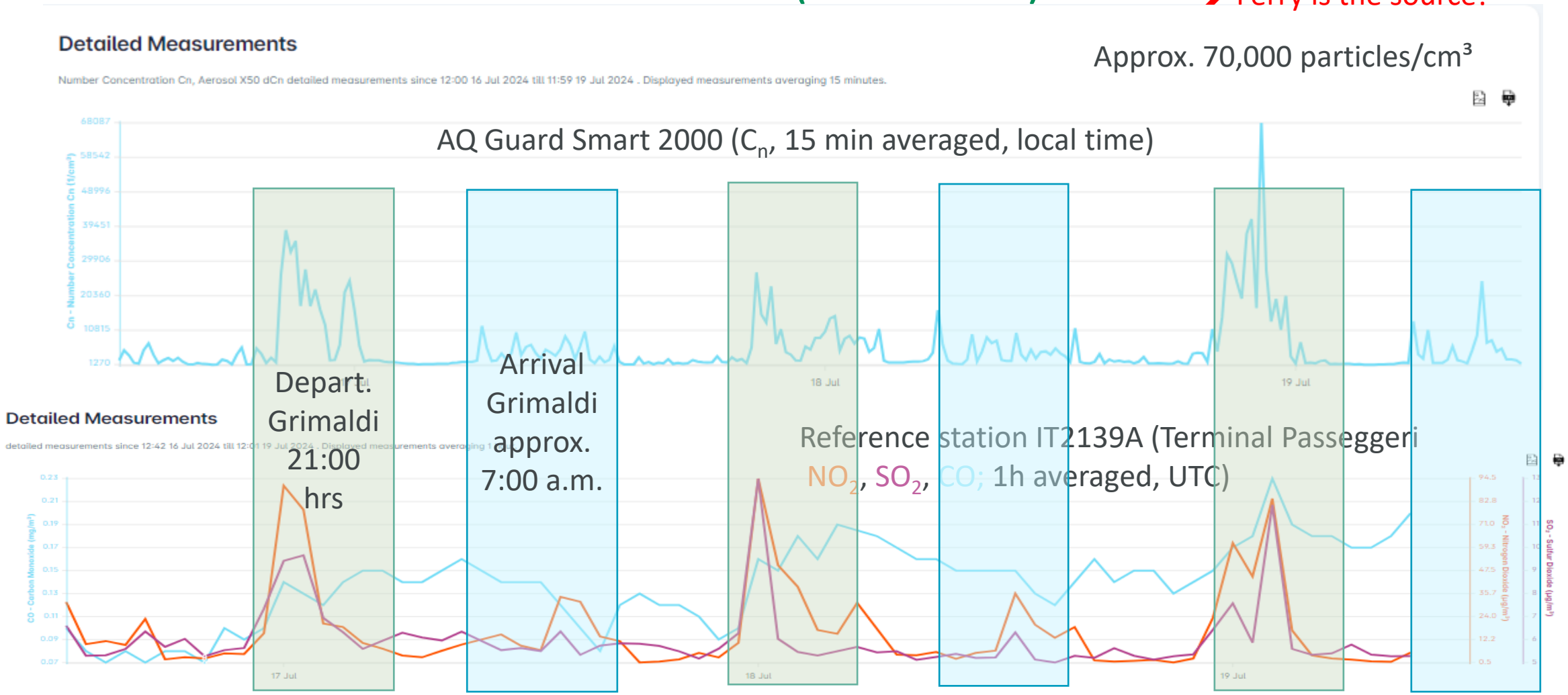
- Second installation "Ferry port"
  - Dropped off at the feeder
  - At a height of approx. 2 m
  - Next to the local measuring station IT2139A



Results

Measurement of Ultrafine Particles and Fine Dust (17.-19.07.2024)

Excellent correlation between peaks and timetable!
➔ Ferry is the source!



Summary

- **DC systems** (here AQ Guard Smart 2000 from Palas)
  - are **well suited for indicative measurement** of UFP
  - **Suitable for high concentrations** without dilution (>10^6 particles/cm^3)
  - give **good results even over long periods** without maintenance and can be installed easily and without great effort.
- **Hotspot measurements must be validated** (causality - origin - sources - wind direction („pizza time“ effect))
- Always **all available information** have to be taken in consideration **for source determination** (surrounding must be checked visually for other possible sources at different times)
- **Next steps:**
  - Long-term measurements at locations with high cyclical load (at least 6 months)
  - Additional meteorological information (windspeed)
  - Additional parameters (eg BC, etc.)

  ➔ Only then it is possible to clearly show a possible link between emissions by the ferry vessels and urban exposure situations!

Thank you for your attention

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Director Sales & Business Development

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Introduction / Motivation

Local Conditions

Other environmental influences due to:

- Transportation (Lecce, Bari, Talent, Naples)
- Agriculture
- Sahara dust

Brindisi, an industrial history that dates back to the 1960s ...

- founded in 1960 with the commissioning of the **Montedison plants for cracking and chlor-alkali**

- Transfer to EniChimica in the early 1980s, which was then responsible for the site

- 1991, after the transfer of the Enimont business to **Enichem Anic**.

- Enichem (**Syndial** since 2003 and now **Eni Rewind**) also took over the territories of **Dow**, **Polimeri Europa (Versalis)** and **EniPower** from **1999**.

- The petrochemical area extends over **450 hectares** and is one of the areas of national interest in Brindisi.

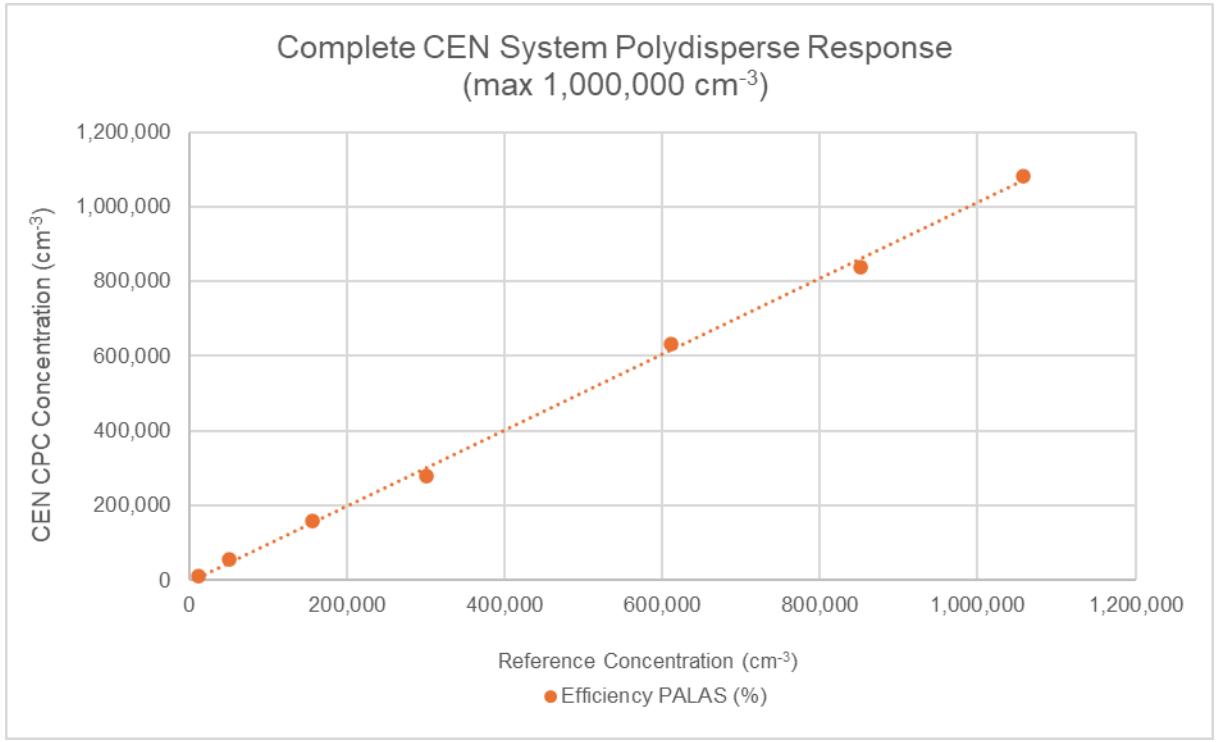
https://www.eni.com/enirewind/en-IT/remediation/remediation-projects-brindisi.html

Method / Structure

Measurement of Ultrafine Particles and Fine Dust

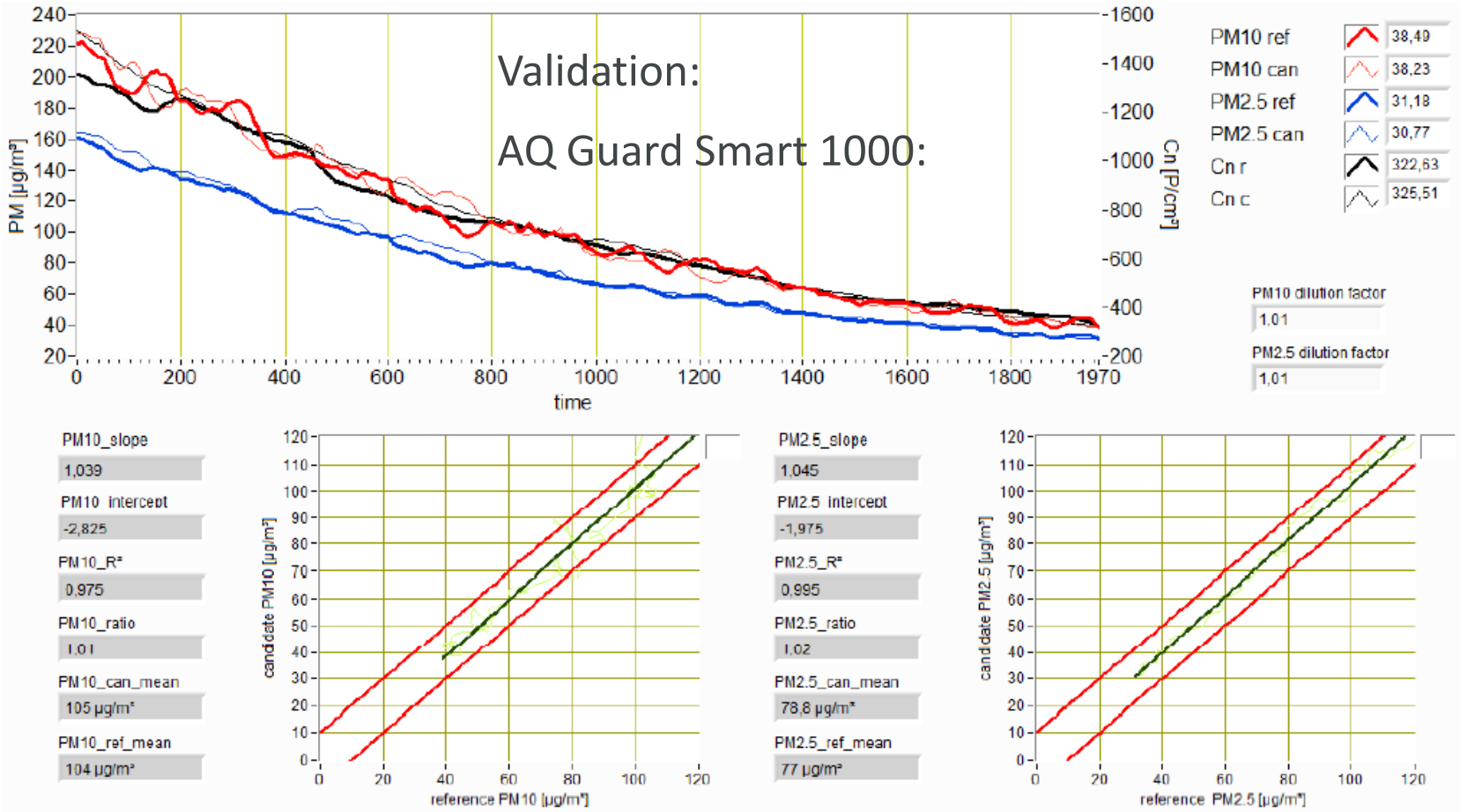
Validation:

AQ Guard Smart 2000:



Method / Structure

Measurement of Ultrafine Particles and Fine Dust

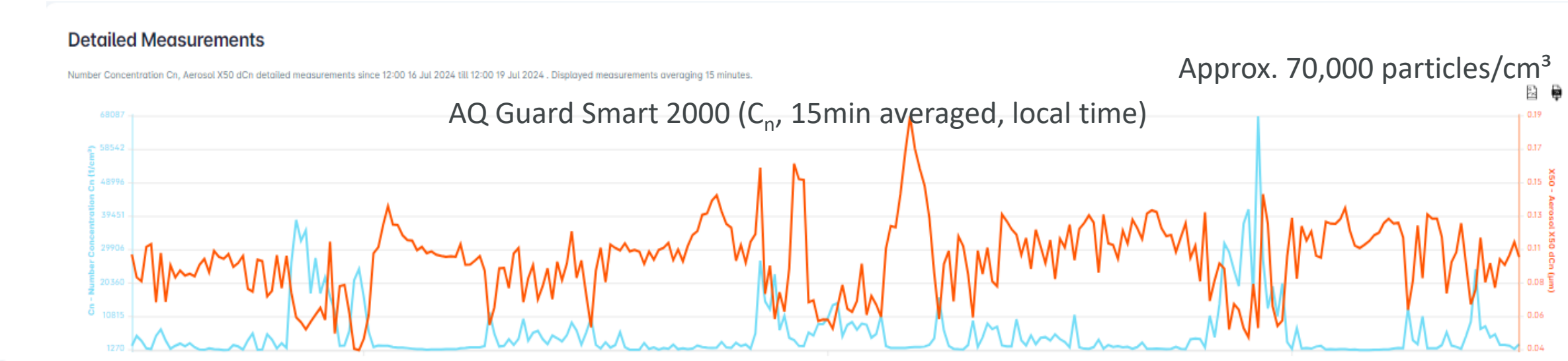


Results

Measurement of Ultrafine Particles and Fine Dust (17.-19.07.2024)

Approx. 70,000 particles/cm³

AQ Guard Smart 2000 (C_n, 15min averaged, local time)



Reference station IT2139A (Terminal Passeggeri

NO_2, SO_2, CO; 1h averaged, UTC)