



*Innovating
Energy Technology*

Field test of the aerosol particle combined analyzer

- A new PM2.5 analyzer-

February 13, 2014

Fuji Electric Co., Ltd.

In energy management

■ Cluster Energy Management System



In automobiles

■ System for EV



In railways

■ Traction converter



In power stations

■ Steam turbines



In factories

■ Industrial inverters



In shops

■ Freezer and refrigerated showcases



In office buildings

■ IDC



Valuable components and services creator
Customer satisfaction provider

Improving infrastructures, industry and transportation.

FA components providing business.

Most Valuable Service Provider

Most Valuable Components Provider

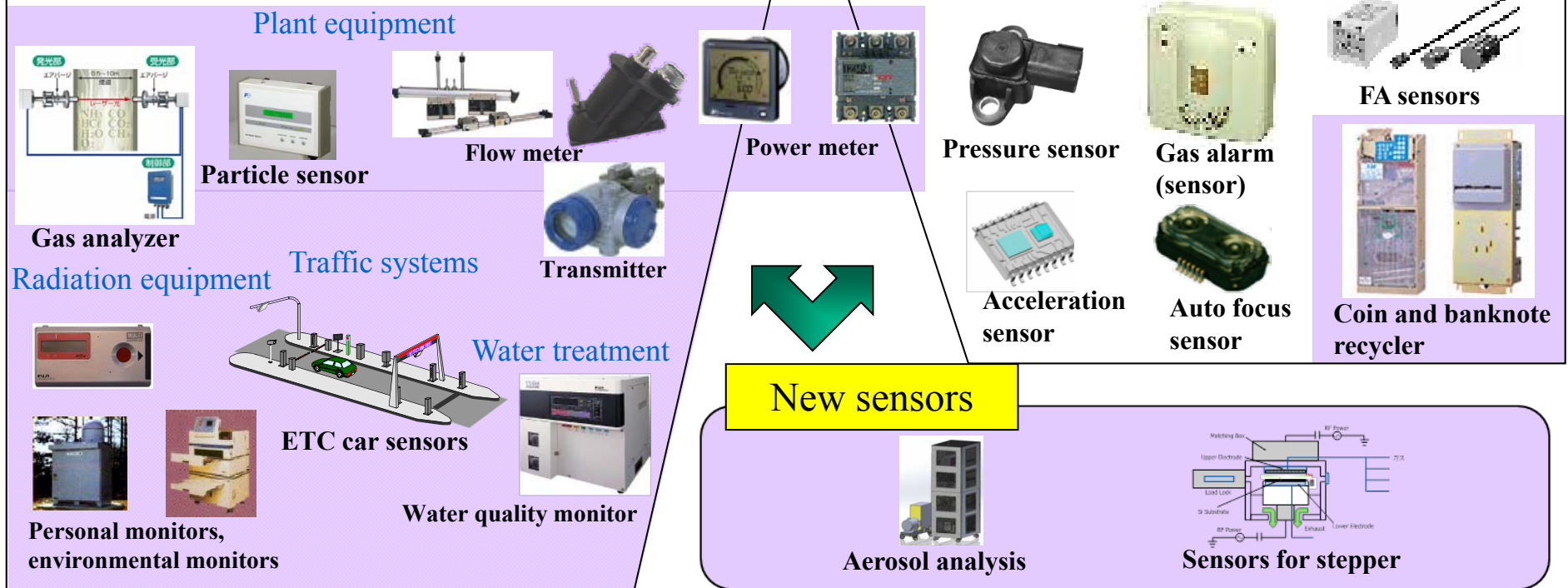


For system solutions

• Specific sensors, high sensitivity sensors (for plant control).

Sensor components

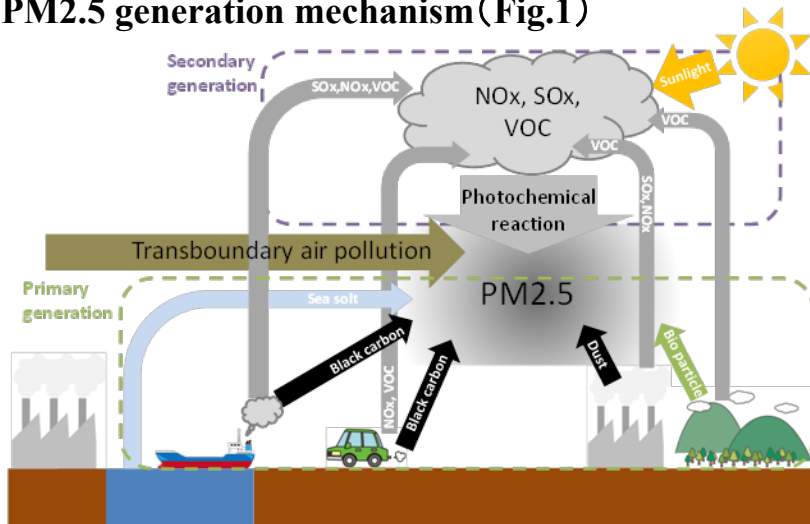
• MEMS technology applied sensors.



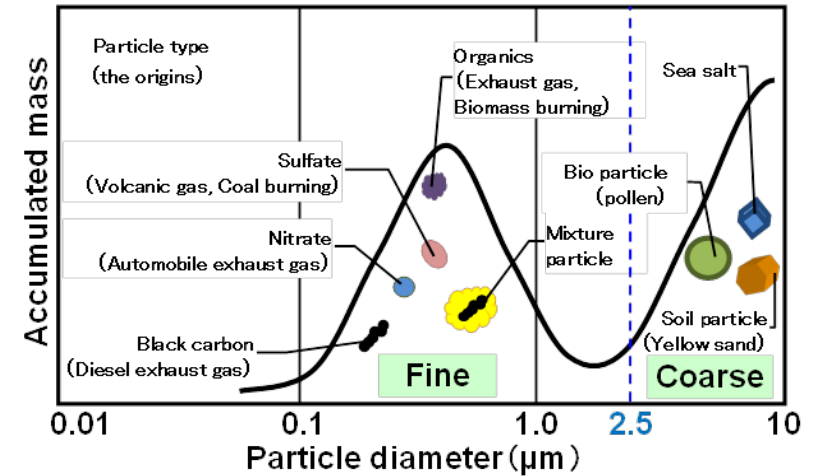
About PM2.5

- PM2.5 has **various origins, sizes and chemical compositions** (Fig.1, Fig.2).
- There are growing concerns about **health effects** (Fig.3) and **meteorological effects** (Fig.4).
- Reducing PM2.5 requests more detailed information (sizes, origins...).

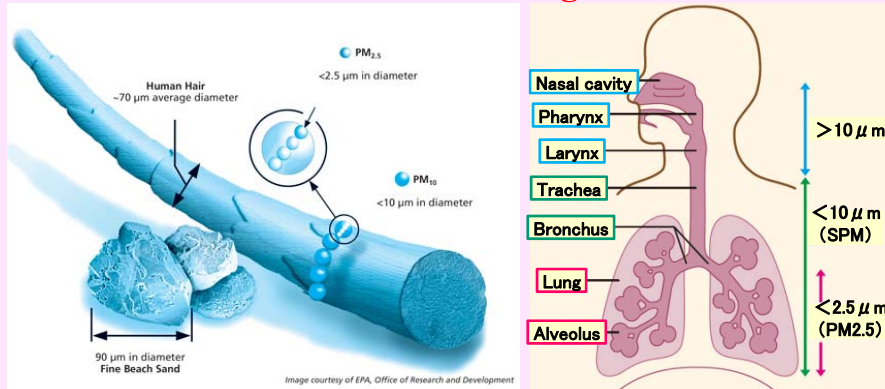
■ PM2.5 generation mechanism (Fig.1)



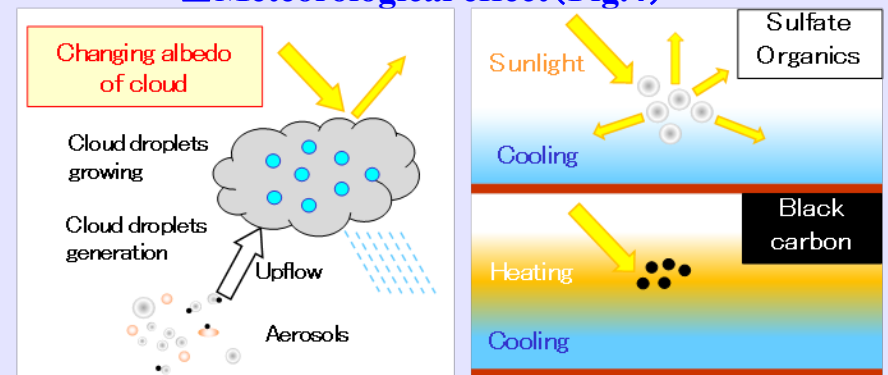
■ Aerosol Particle Size distribution (Fig.2)



■ Health effect (Fig.3)



■ Meteorological effect (Fig.4)



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Aerosol particle combined analyzer

Hourly mass concentration monitoring only

Particle size, number and composition real-time (every 15min) analysis.
Possible applications : Inferring PM2.5 origins, improving PM2.5 forecast

Existing method

PM2.5 monitor

Mass concentration monitoring only.
Composition analysis is impossible.



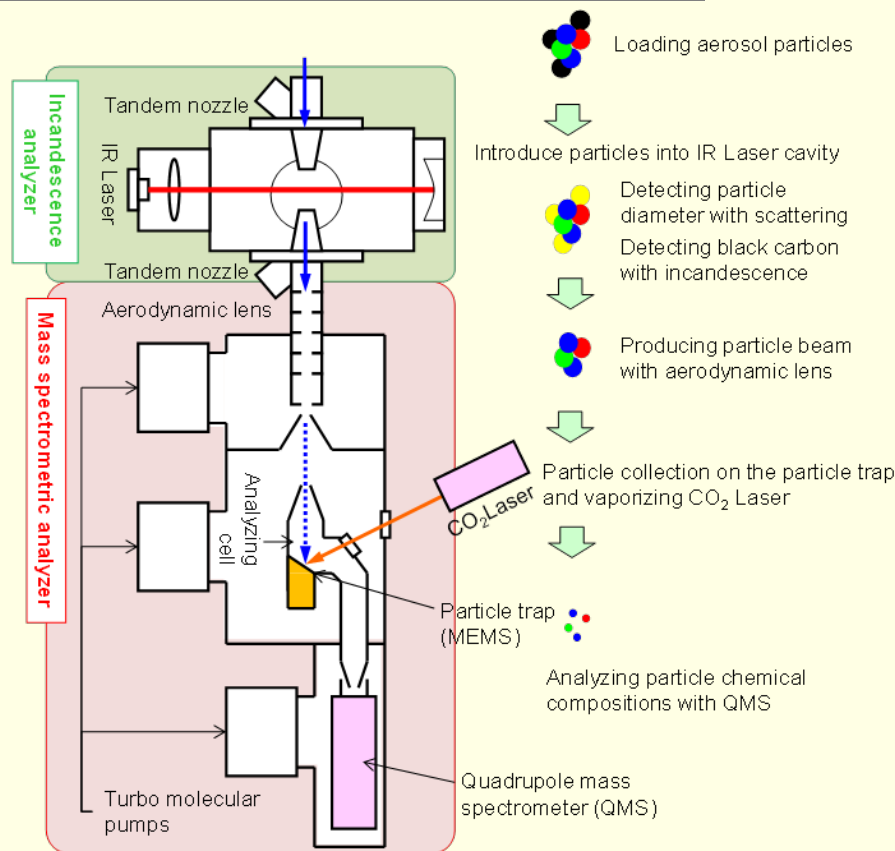
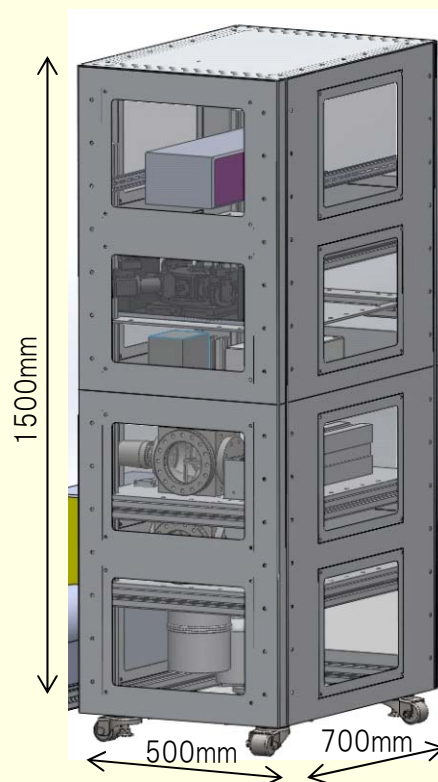
PM2.5 manual analysis

8-12 hours per analysis
Real-time measurement is impossible.



Fuji Electric's aerosol particle combined analyzer

Prototype



This research was supported by Japan Science and Technology agency (2008~2012).
The member of the joint research are The University of Tokyo, Japan Agency for Marine-Earth Science and Technology and Fuji Electric Co., Ltd.

Field test at Kawasaki

Joint study between Kawasaki city and Fuji Electric

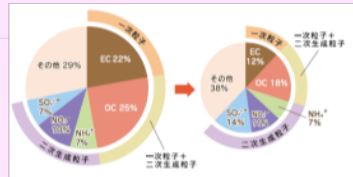
Kawasaki city



Takatsu general station

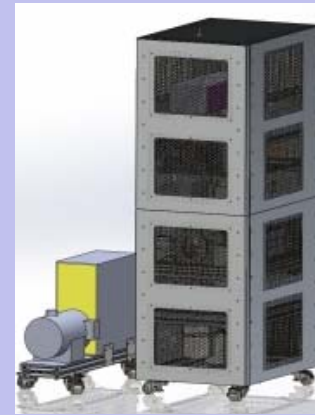


PM2.5 monitoring

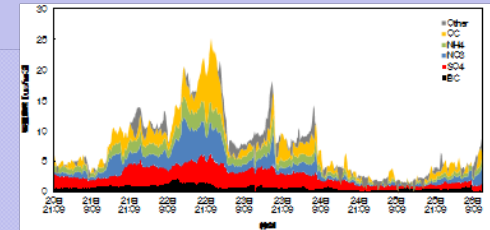


Manual analysis

Fuji Electric



Prototype



Field observation

【Resources】

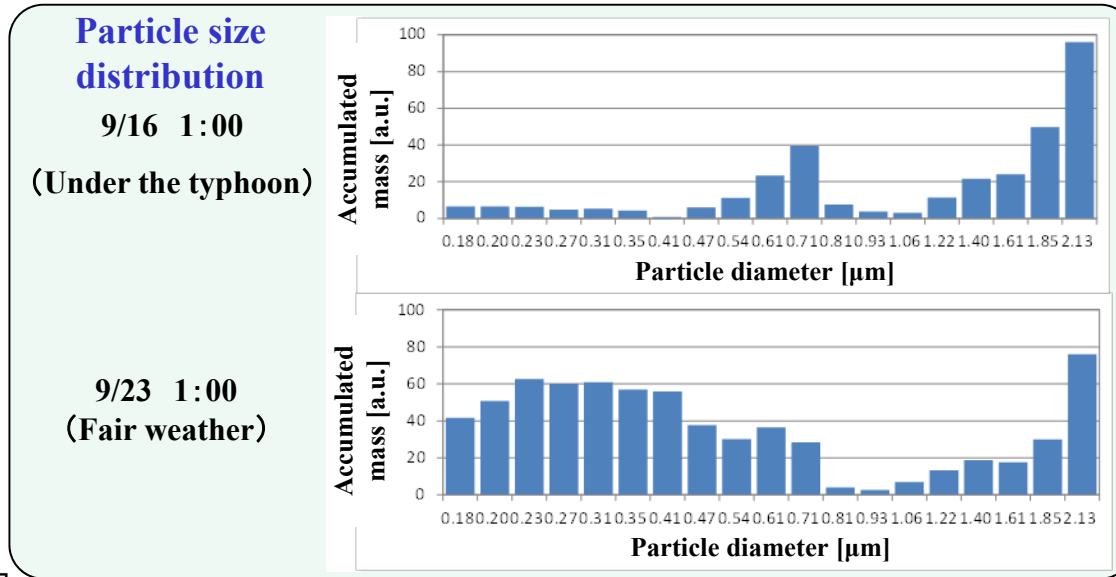
- PM2.5 monitoring data
- PM2.5 manual analysis data
- Weather data
- Air pollutant data

【Resources】

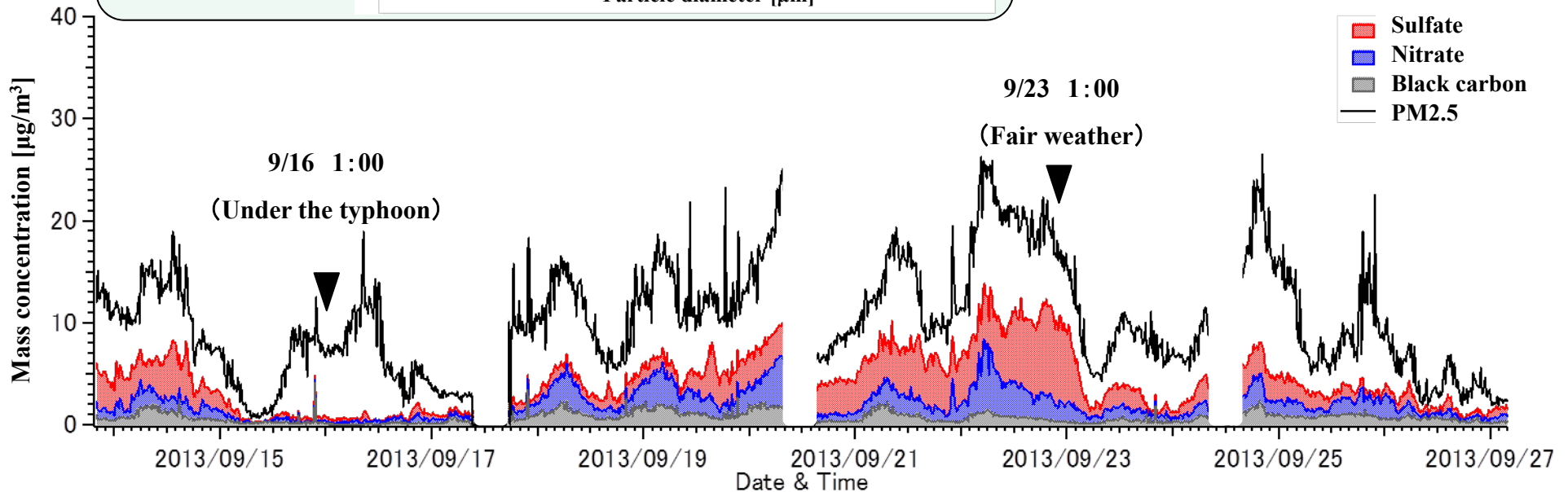
- PM2.5 mass concentration data
- PM2.5 real-time analysis data (particle chemical composition, size and number)



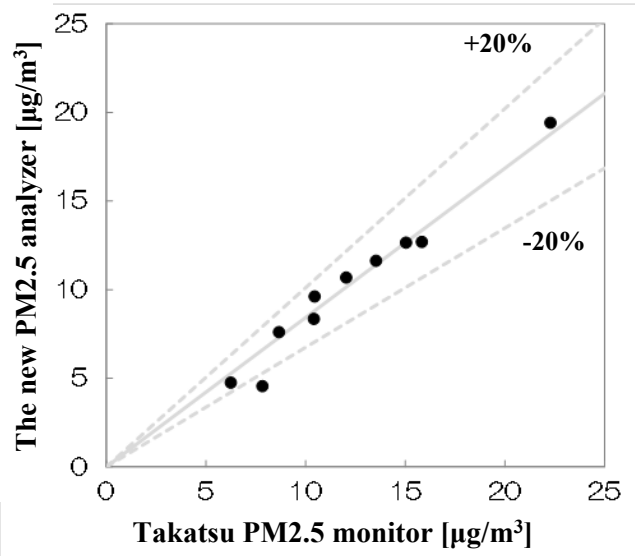
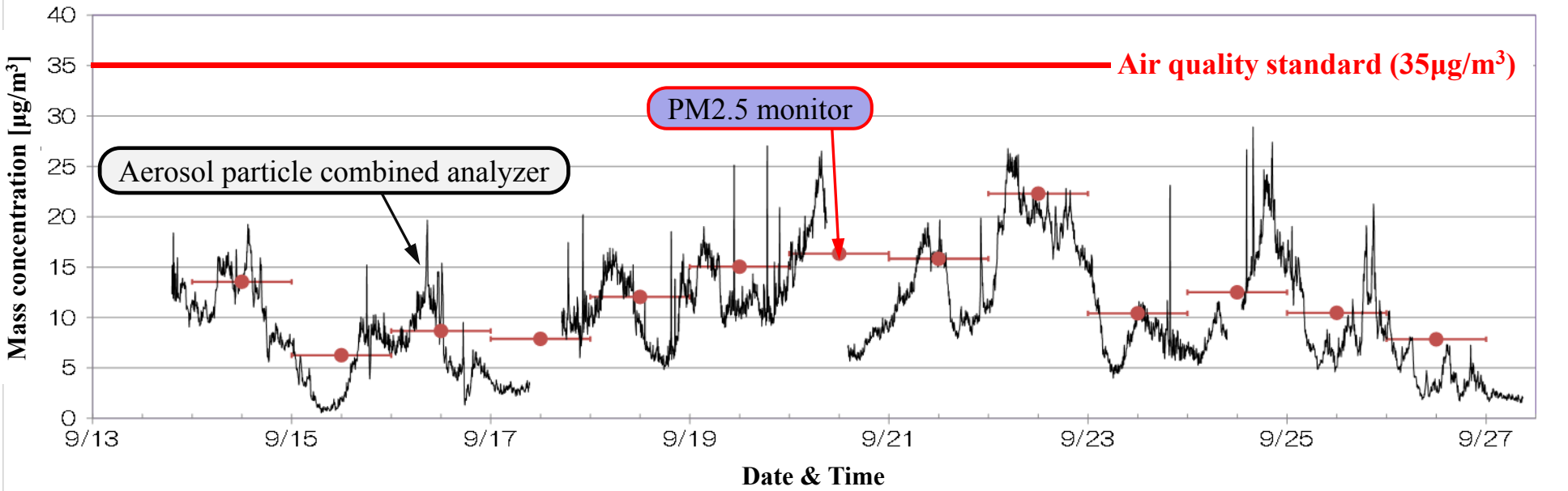
Example – Field test at Kawasaki general station



The prototype of aerosol particle combined analyzer in the Takatsu general station



Intercomparison



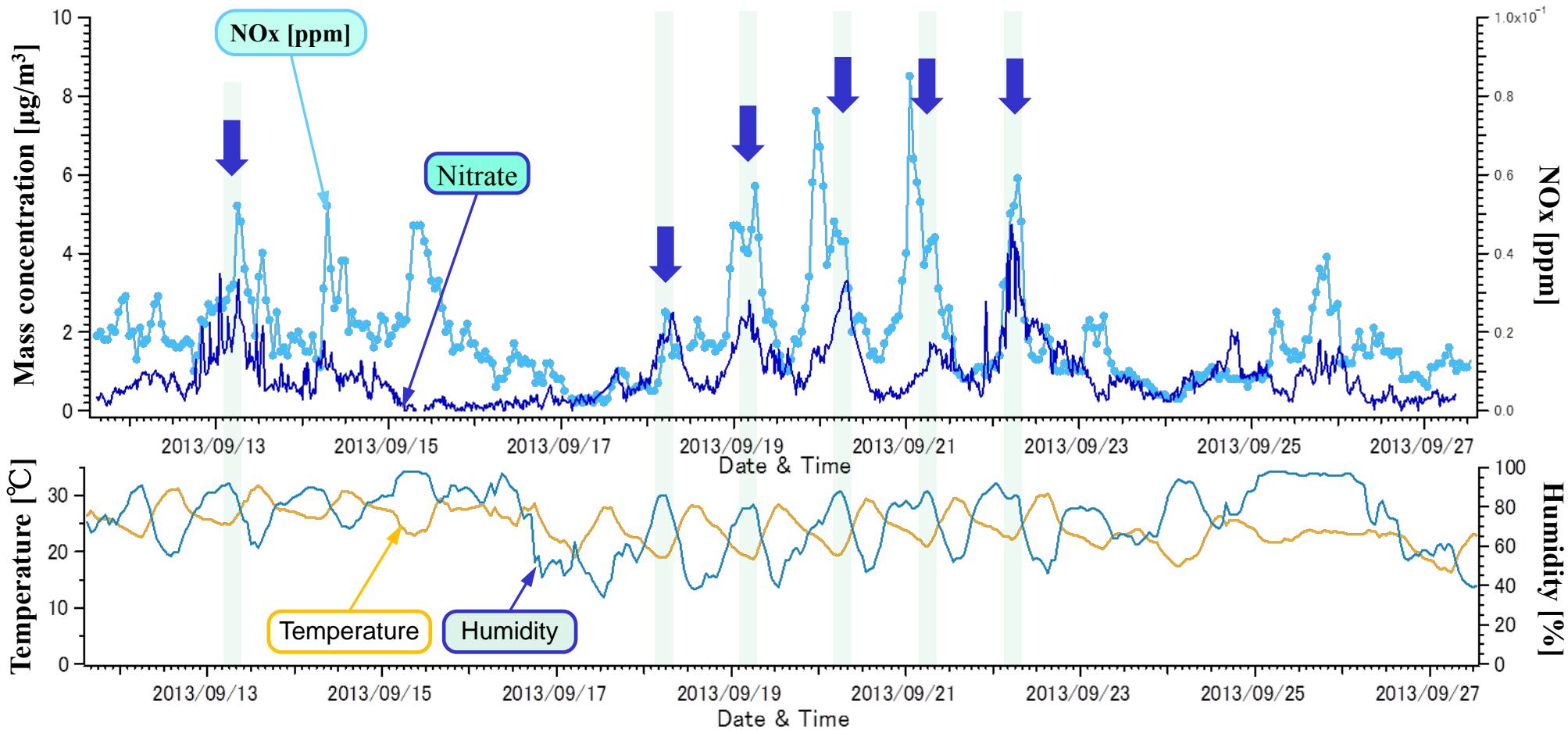
Intercomparison between results of PM2.5 monitor and results of aerosol particle combined analyzer (daily data).

Trends show good correlation
(approximately ±20%)

Data analysis1—Nitrate vs NO_x

- There is a correlation between nitrate and NO_x gas.
- NO_x gas rapidly changes into nitrate.

The origin of nitrate could be around here.



Data analysis2—Nitrate vs black carbon

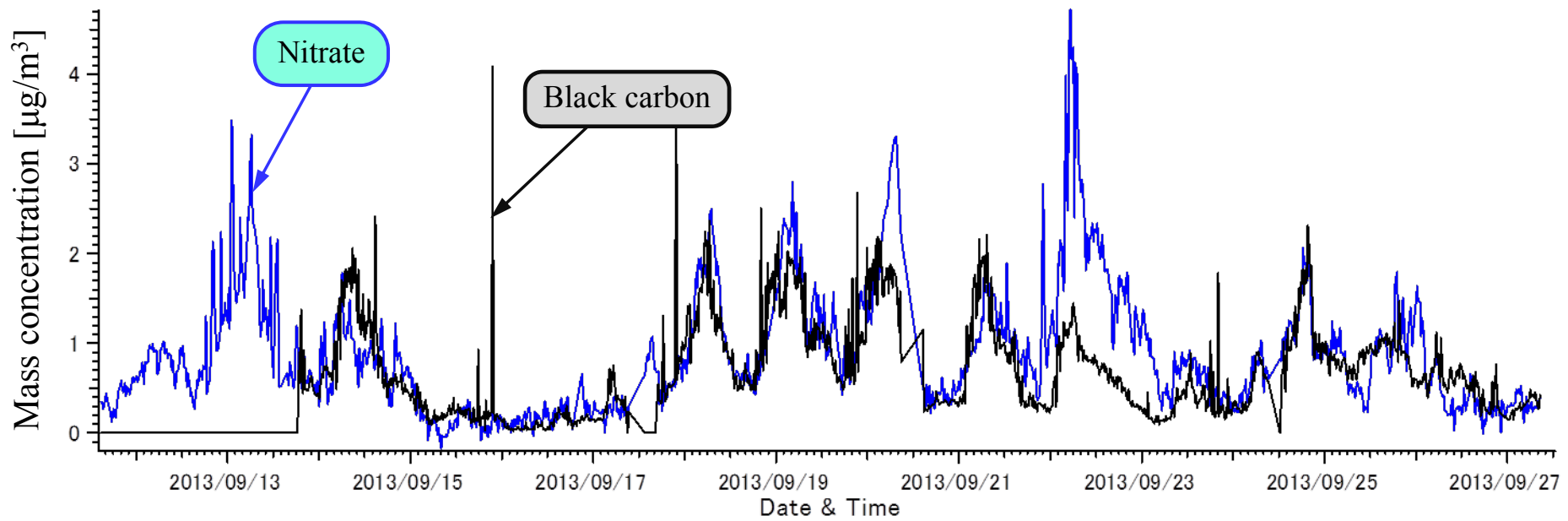
Measurement results of nitrate

- There is a correlation between nitrate and NO_x gas.
- NO_x gas rapidly changes into nitrate.

Measurement results of black carbon

- There is a correlation between nitrate and black carbon.

The origin of nitrate and black carbon could be automobiles around here.



Aerosol particle combined analyzer can provide PM_{2.5} origin information.

空気の、テイスティング。



それぞれどんな成分がふくまれているのか、空気中のPM2.5の特性をリアルタイム分析。微小粒子の生まれた場所と原因の特定に、道を拓きます。

PM2.5発生源特定を可能にする

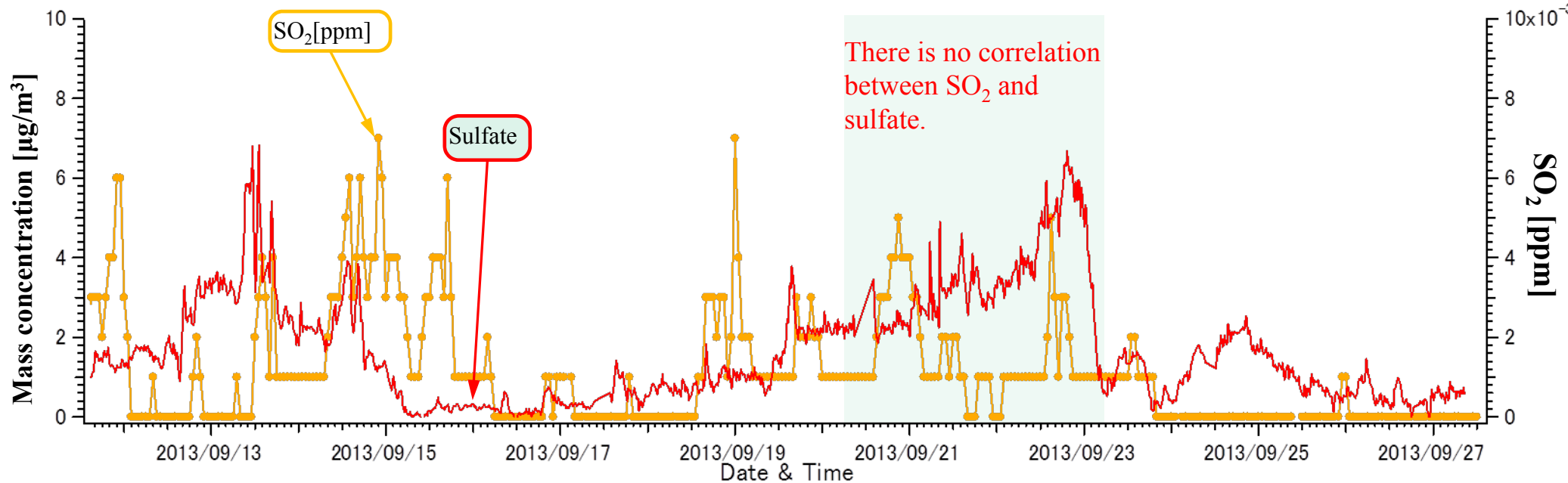
富士電機のエアロゾル複合分析技術

【第27回独創性を拓く先端技術大賞】企業・産学部門 特別賞受賞

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- There is no correlation between SO₂ and sulfate.
- Sulfate is stable and easily transported long distance.

The origin of sulfate could be far from here.



Sulfate data implied wide area air pollution.