

Cargo Smoke Detector Challenges

FIRE

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International Aircraft Systems Fire Protection Working Group Meeting
16 -17 Nov 2011 – Atlantic City

False Alarm Rejection Standard - Update

every
is only as
good as
its test
methods.

Presented by
Dr. André Freiling

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Cargo Smoke

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EN 54 smoke detector fire test standard: Particle size maxima between 0,1 and 1 μm

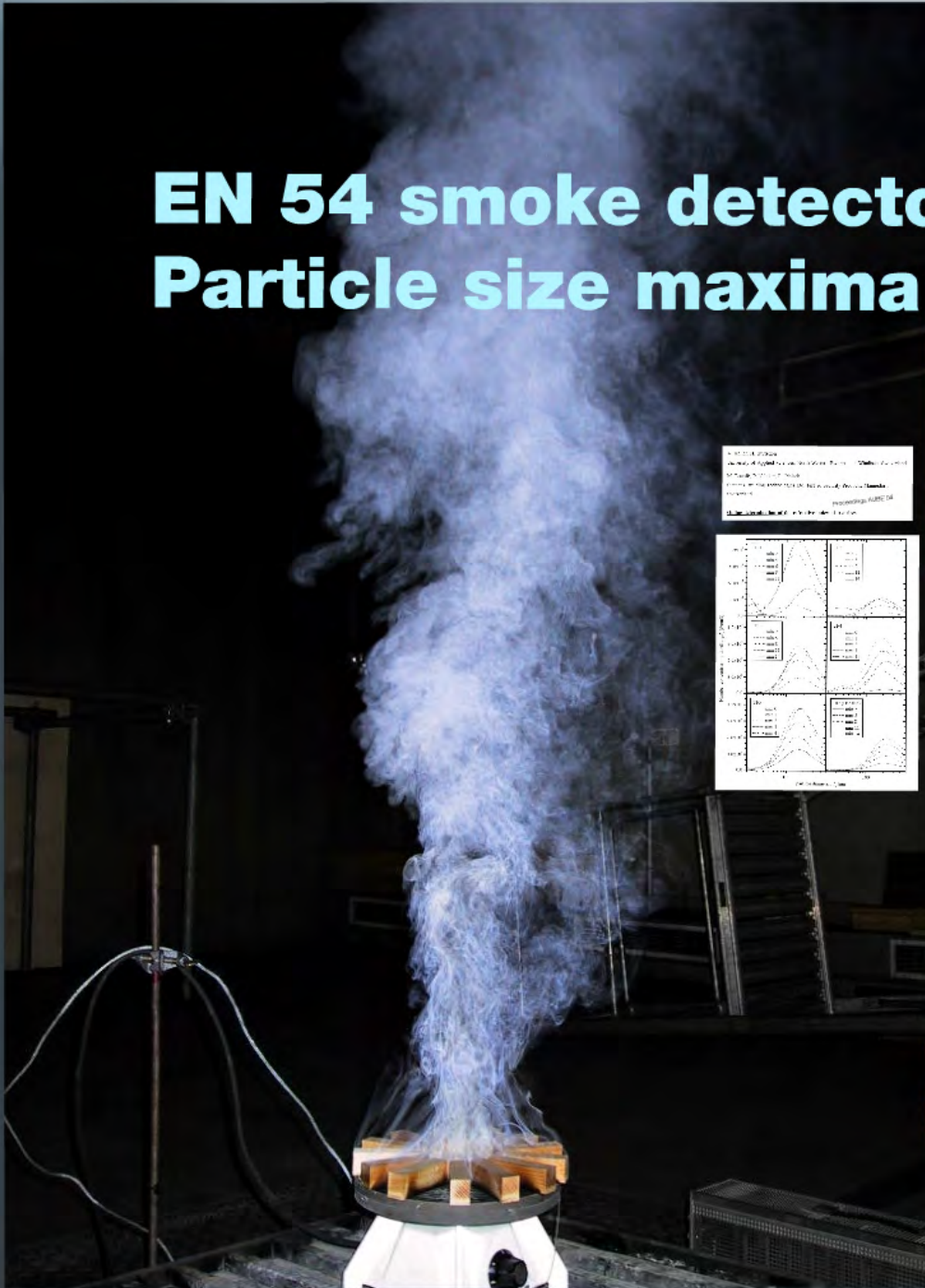


Fig. 1. Smoke detector fire test standard: Particle size maxima between 0,1 and 1 μm

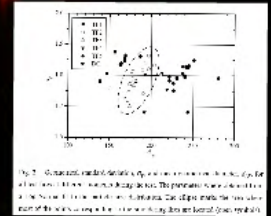
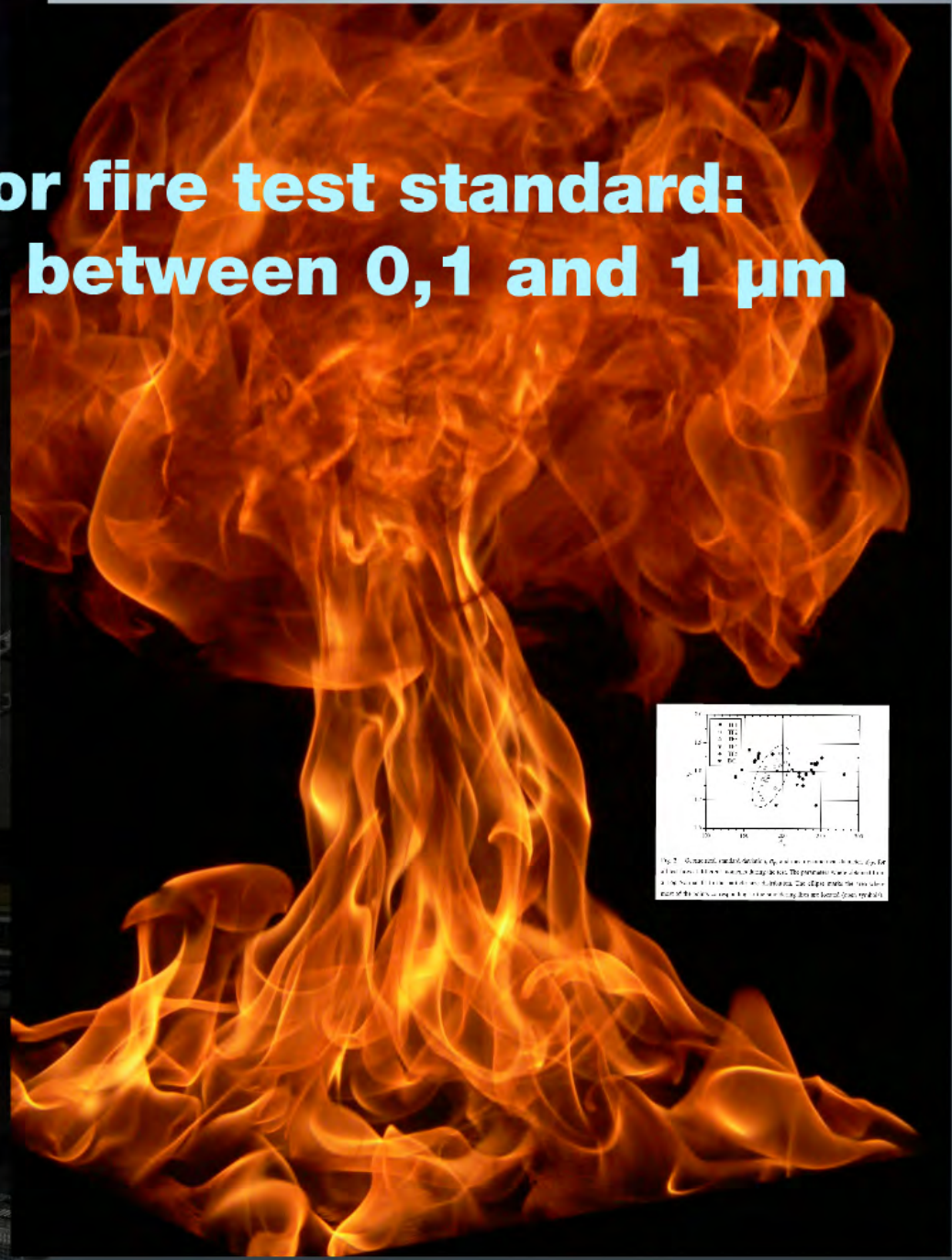
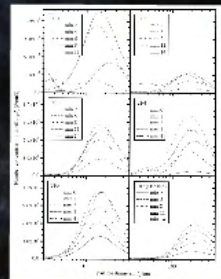


Fig. 2. Relationship between particle size and concentration. The maximum concentration is reached between 0,1 and 1 μm .

A. Keller, H. Burtscher

University of Applied Sciences, North-Western Switzerland, Windisch, Switzerland

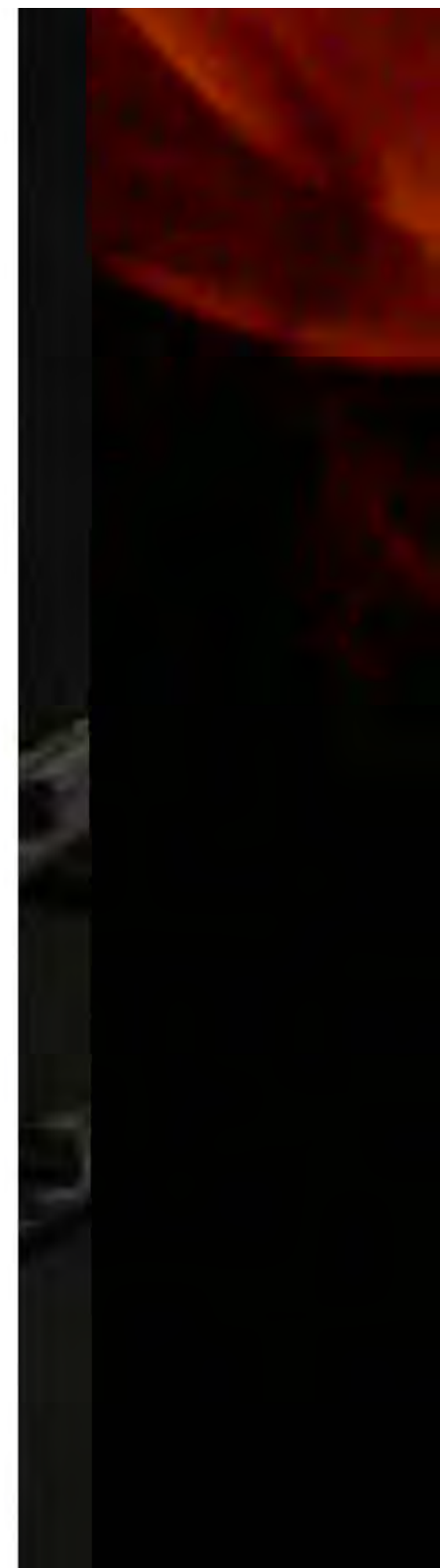
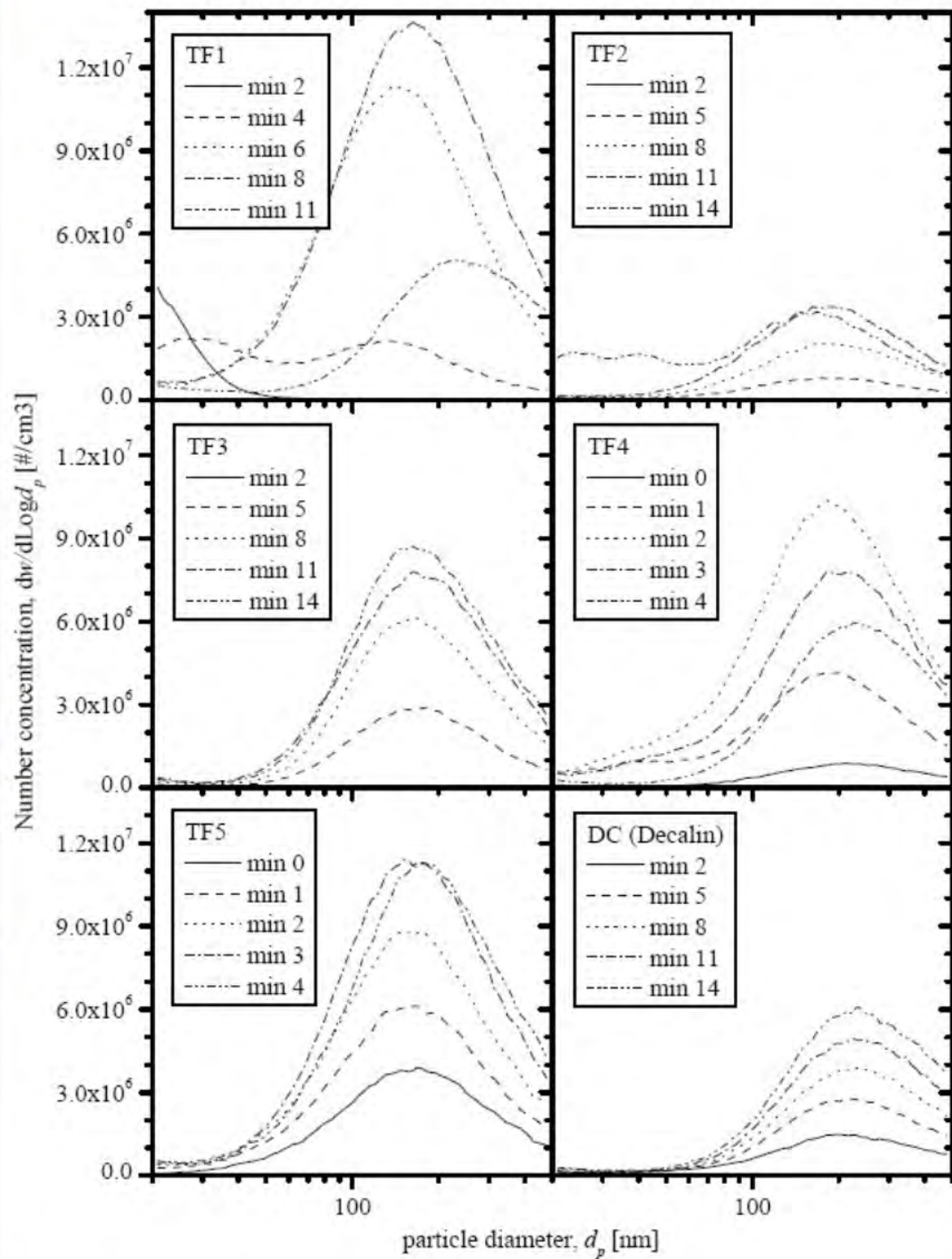
M. Loepfe, P. Nebiker, R. Pleisch

Siemens Building Technologies Ltd, Fire & Security Products, Männedorf,
Switzerland

Proceedings AUBE'04

Online determination of the refractive index of test fires





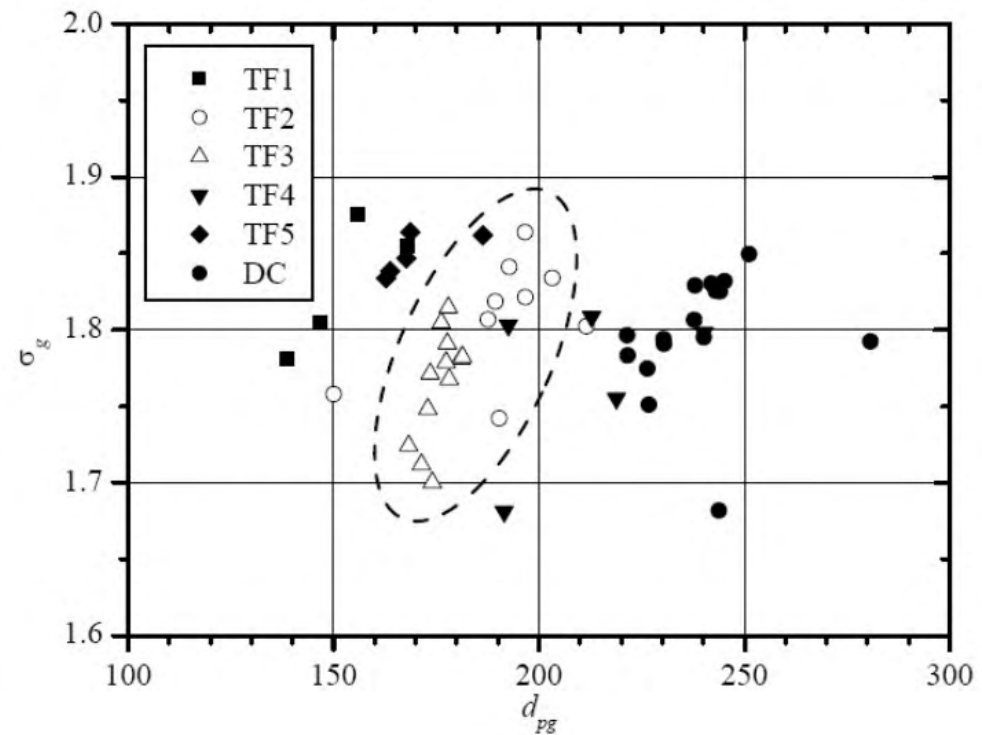


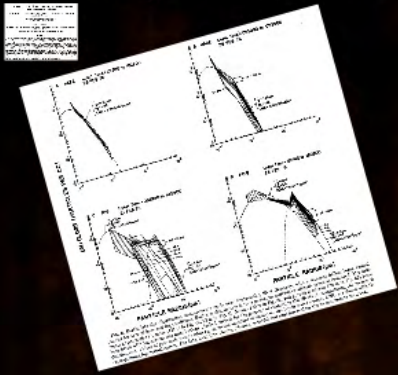
Fig. 2. Geometrical standard deviation, σ_g , and mean geometrical diameter, d_{pg} , for all test fires at different moments during the test. The parameters were obtained from a Log-Normal fit to the particle size distribution. The ellipse marks the area where most of the points corresponding to the smoldering fires are located (open symbols).

Smoke De

FOG



Particle sizes are in the range of test fires



Test procedure to be defined



Vertical Structure in Atmospheric Fog and Haze and Its Effects on Visible and Infrared Extinction

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(Manuscript received 14 February 1978, in final form 5 June 1978)

ABSTRACT

Vertical structure of the size distribution and number concentration of particulates in atmospheric fog and haze near Grafenwöhr, West Germany, were measured with a balloonborne light-scattering aerosol counter for periods spanning parts of eight days in February 1976. For haze (~ 5 km visibility) conditions, little vertical variation is seen; but for low visibility (< 1 km) fog conditions, significant vertical increases in concentration of droplets with radii larger than $4 \mu\text{m}$ are seen over the first 150 m altitude. For haze, the particle size distribution is approximated by a log-normal with geometric mean radius $r_g \approx 0.2 \mu\text{m}$ and geometric standard deviation $\sigma_g \approx 1.9$. For fog, a bimodal distribution is found with a relative maximum for the larger particle mode at radii of 4 to $6 \mu\text{m}$ and corresponding values $r_g \approx 5 \mu\text{m}$ and $\sigma_g \approx 1.6$; the smaller particle mode has values of $r_g \approx 0.3 \mu\text{m}$ to $r_g \approx 0.6 \mu\text{m}$ and $\sigma_g \approx 1.8$ to $\sigma_g \approx 2.5$. Liquid water content values for haze and fog range from 10^{-4} to 0.45 g m^{-3} . Extinction calculated from the particle size distributions shows an approximate $1/\lambda$ wavelength dependence for haze conditions, but nearly neutral (wavelength independent) extinction for heavy fog. A correlation exists between calculated particulate extinction and calculated liquid water content, independent of particle size distribution, for the fogs and hazes studied.

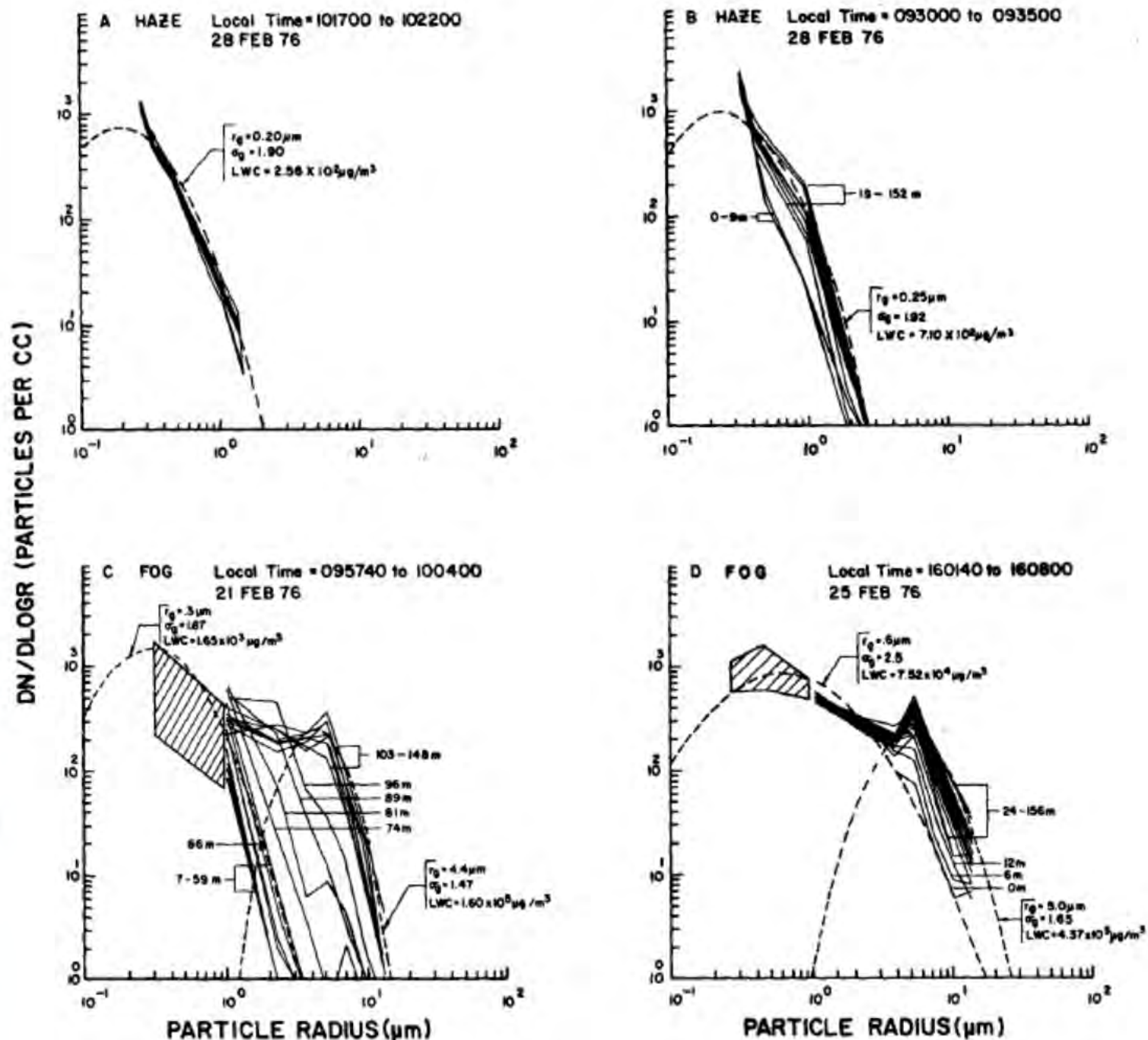


FIG. 6. Particulate size distribution measurements made near Grafenwöhr, West Germany, with a tethered balloonborne aerosol counter for several haze and fog conditions. Each size distribution is for a particular altitude or altitude range as indicated. Measurements at particular altitudes (121 m in Fig. 6a, 95 m in Fig. 6b, 59 and 126 m in Fig. 6c, and ground level and 135 m in Fig. 6d) have been fitted with log-normal size distributions (dashed curves) for the purpose of estimating the effects of extrapolating the measured distributions. Values of geometric mean radius r_g , geometric standard deviation σ_g and liquid water content LWC are shown with the corresponding log-normal curves. The date, local time (hours, minutes, seconds) and time interval for the measurements are given.

Test procedure to be defined





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The Fog Shower

Electrolux

Smoke Detector Challenge

FOG



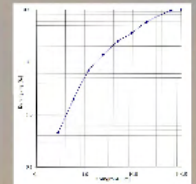
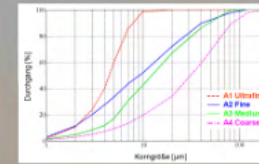
DUST



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Chose a representative dust that is a smoke detector nuisance



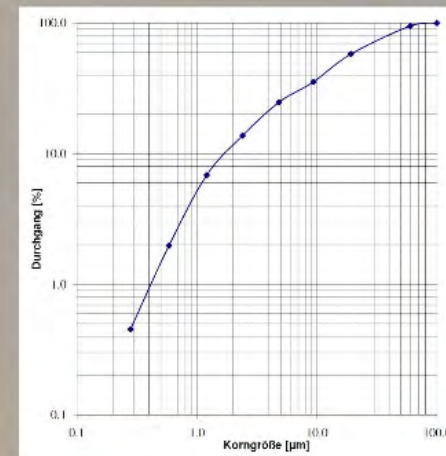
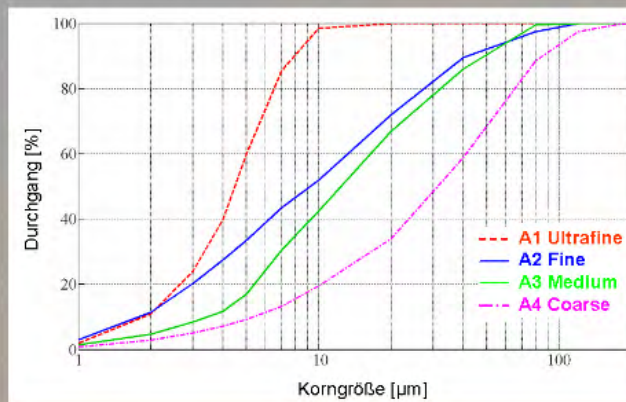
Test setup prototype



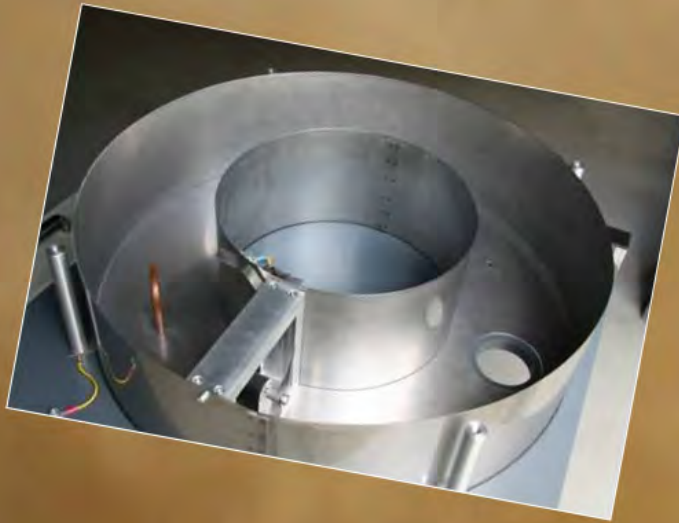
Important:

- reproducible slope
- controlled dust injection
- rotational air speed
- laminar flow

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Test setup prototype



Important:

- **reproducible slope**
- **controlled dust injection**
- **rotational air speed**
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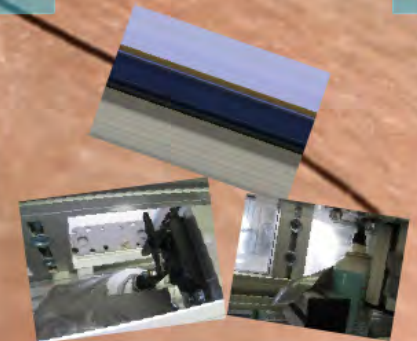
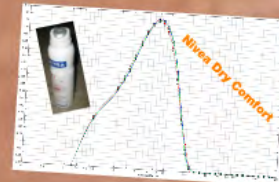
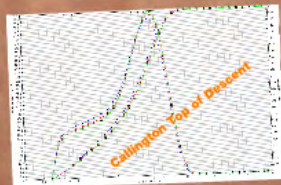
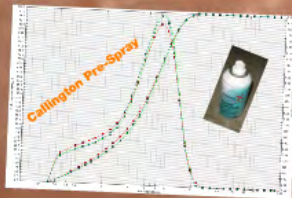
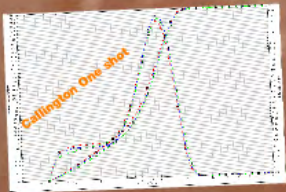
Major Challenges

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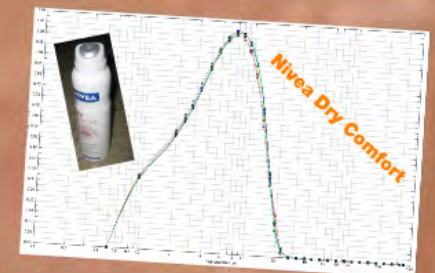
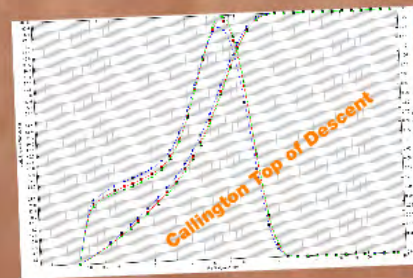
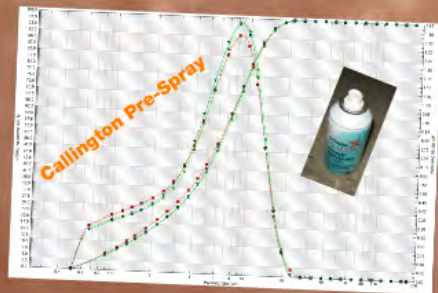
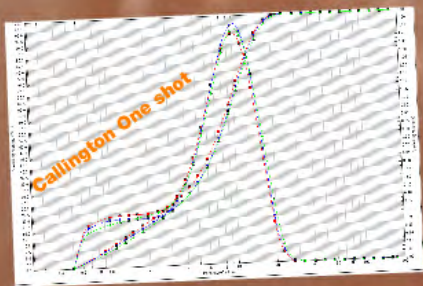
Particle size distribution:
canned aerosols: maximum at appr. $8\mu\text{m}$



Test setup prototype

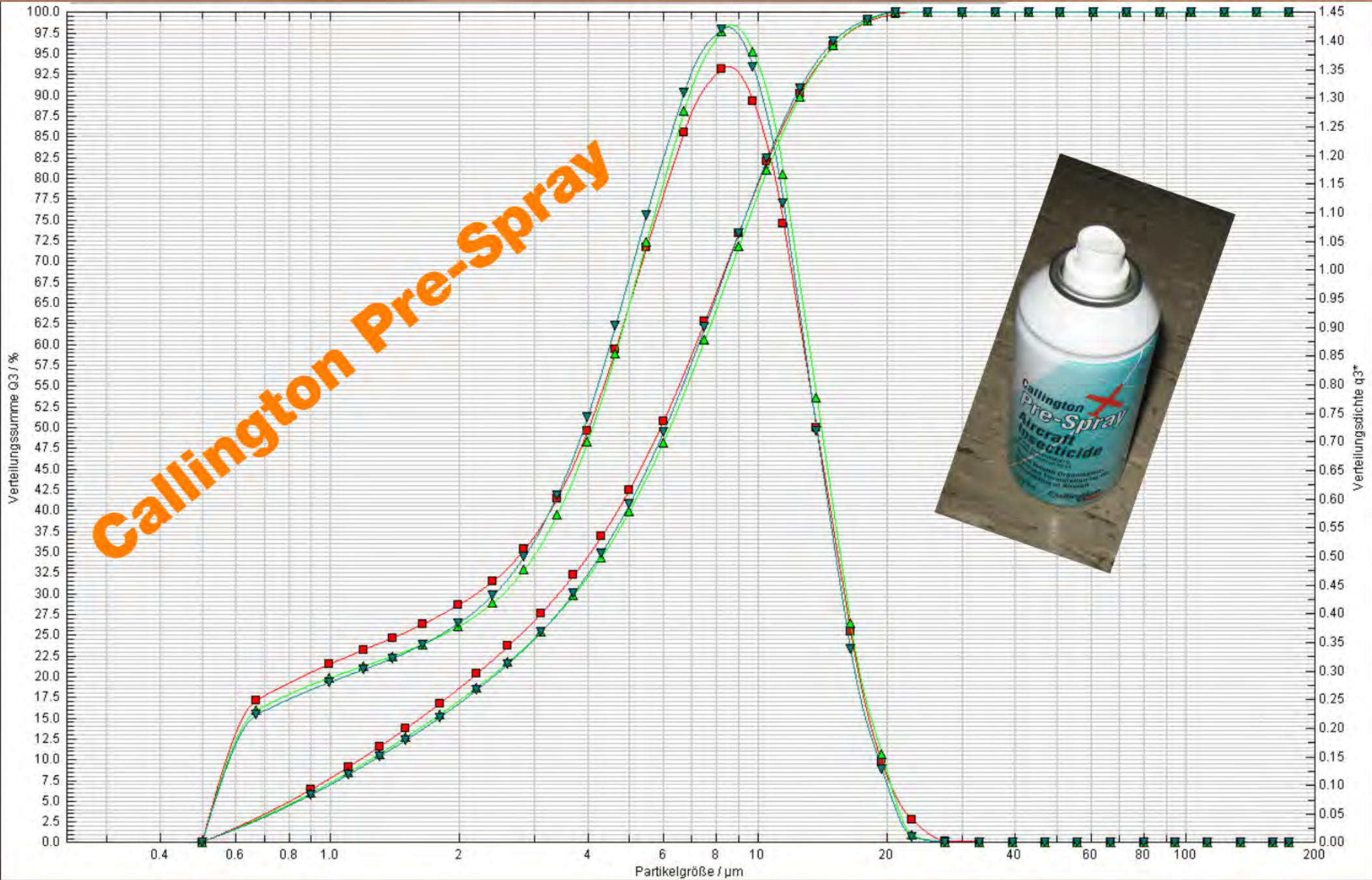
Computer controlled servo
Spray interval / pause can be controlled

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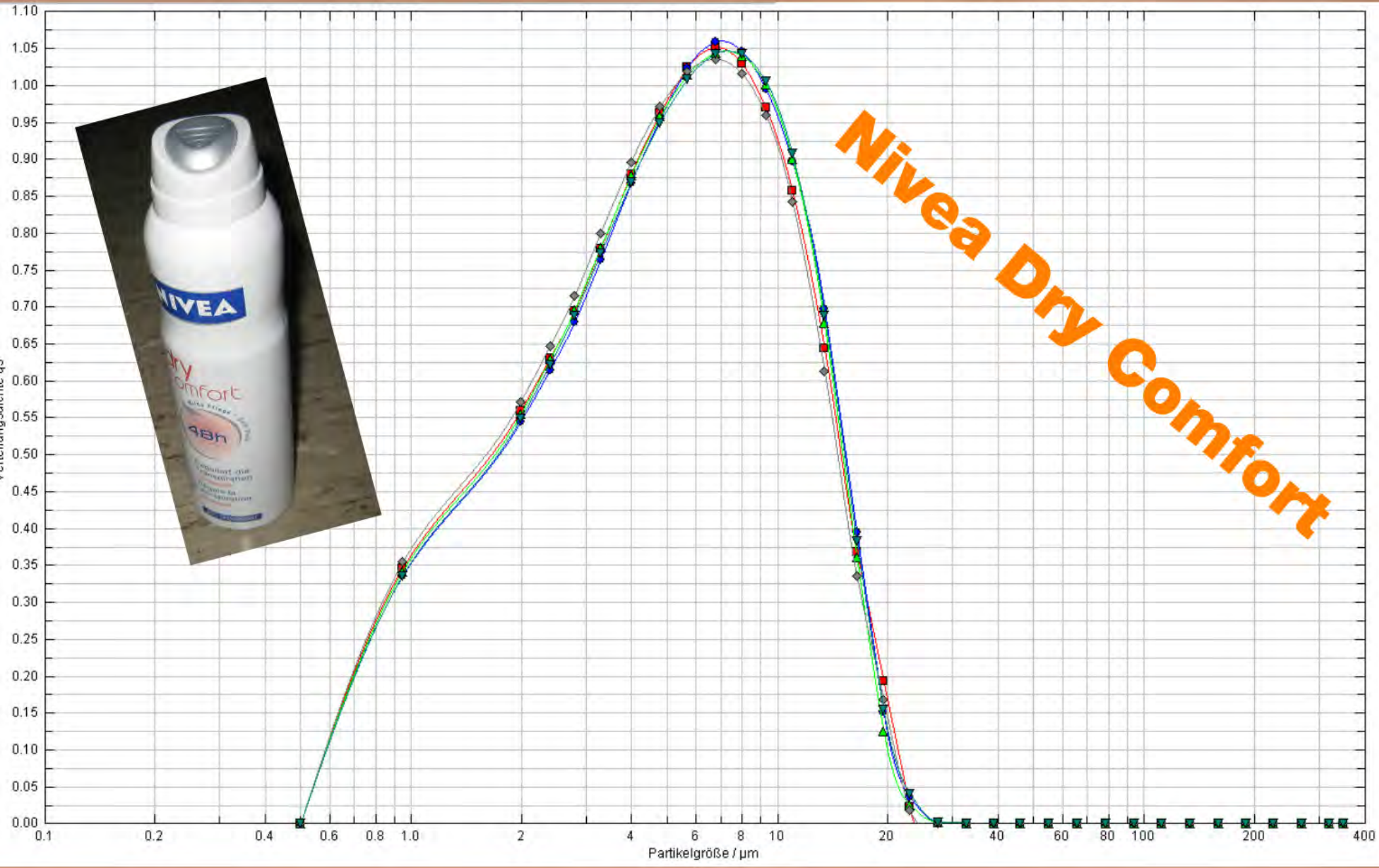




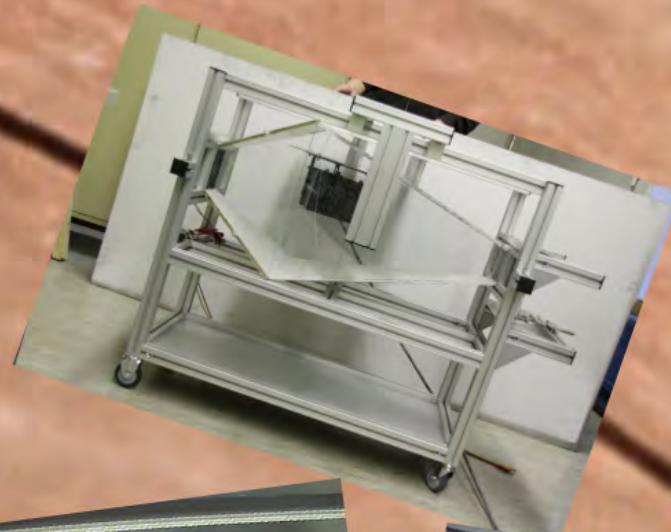
Callington Pre-Spray







Nivea Dry Comfort



Test setup prototype

Computer controlled servo

Spray interval / pause can be controlled







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