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Standardisation of False Alarm Rejection Capability Assessment

- Proposal -

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Motivation

- **Increasing demand** for false alarm rejection in aeronautics and standardisation of test methods.
- False alarm rejection performance is not standardized.
- The “False Alarm Rejection Ratio” as an **objective value** for rejection capabilities assessment of fire-/smoke detectors is proposed.
- A standardized test setup is introduced.

Reference: Standardisation of Detection Performance Testing

- Standards for sensitivity of smoke detectors to detect a fire are well defined, e.g. EN54 defines the fire types as well as the smoke levels to be detected

- Smouldering wood
- Smouldering cotton
- Flaming polyurethane
- Flaming n-heptane

→ Long tradition and good sophistication of performance test standards

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False Alarm Rejection - Standardisation Proposal

- So far, unlike for smoke detection performance, false alarm rejection testing conducted by Airbus and its suppliers was only based on comparisons to standard optical smoke detectors.

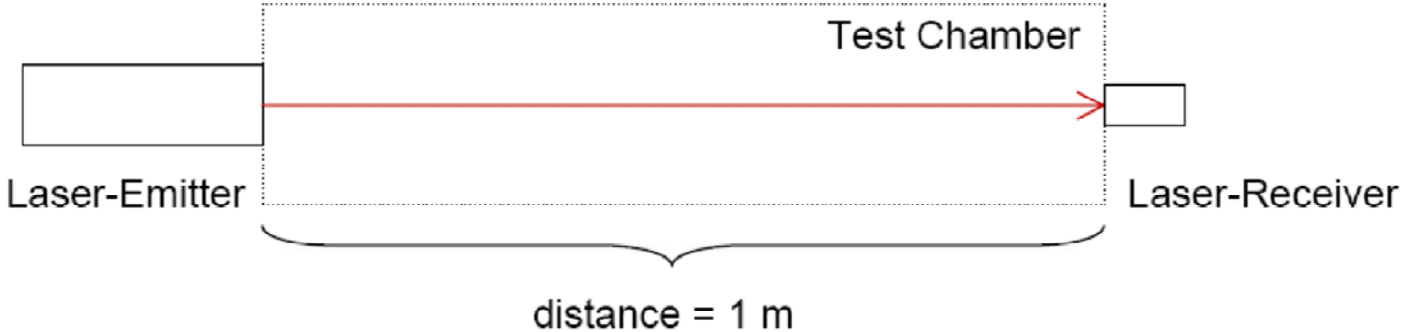
→ Proposed "False Alarm Rejection Ratio":

Ratio of the smoke detector response to a

- false alarm stimulus to
- a real smoke scenario stimulus

which should be determined in a standardised environment.

- Reference Value: Light Obscuration (in %/m) at Alarm:



False Alarm Rejection Ratio: Equation

$$R = \frac{LO_{amb}\ (\text{False Alarm})}{LO_{amb}\ (\text{Real Alarm})}$$

False Alarm Rejection Ratio

with:

R:	False Alarm Rejection Ratio
LO_{amb} (False Alarm):	Externally (ambient) measured light obscuration (in %/m) at transit to alarm caused by false alarm scenario.
LO_{amb} (Real Alarm):	Externally (ambient) measured light obscuration (in %/m) at transit to alarm caused by real alarm scenario (e. g. EN54-7 test fire).

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False Alarm Rejection Ratio: Outlook

- False Alarm Rejection Ratio could be determined for different false- and real-alarm-scenarios in a standardised test environment.

- Outlook: Minimum false alarm rejection ratio values could be specified in fire-/ smoke detector specifications for **e. g**.

  R = 8 for

  - standardized mineral dust according to ISO12103-1 vs.
  - EN54 TF2 (smouldering wood),

  R = 5 for

  - standardized mineral dust according to ISO12103-1 vs.
  - EN54 TF5 (n-heptane, flaming).

Standardized test setup

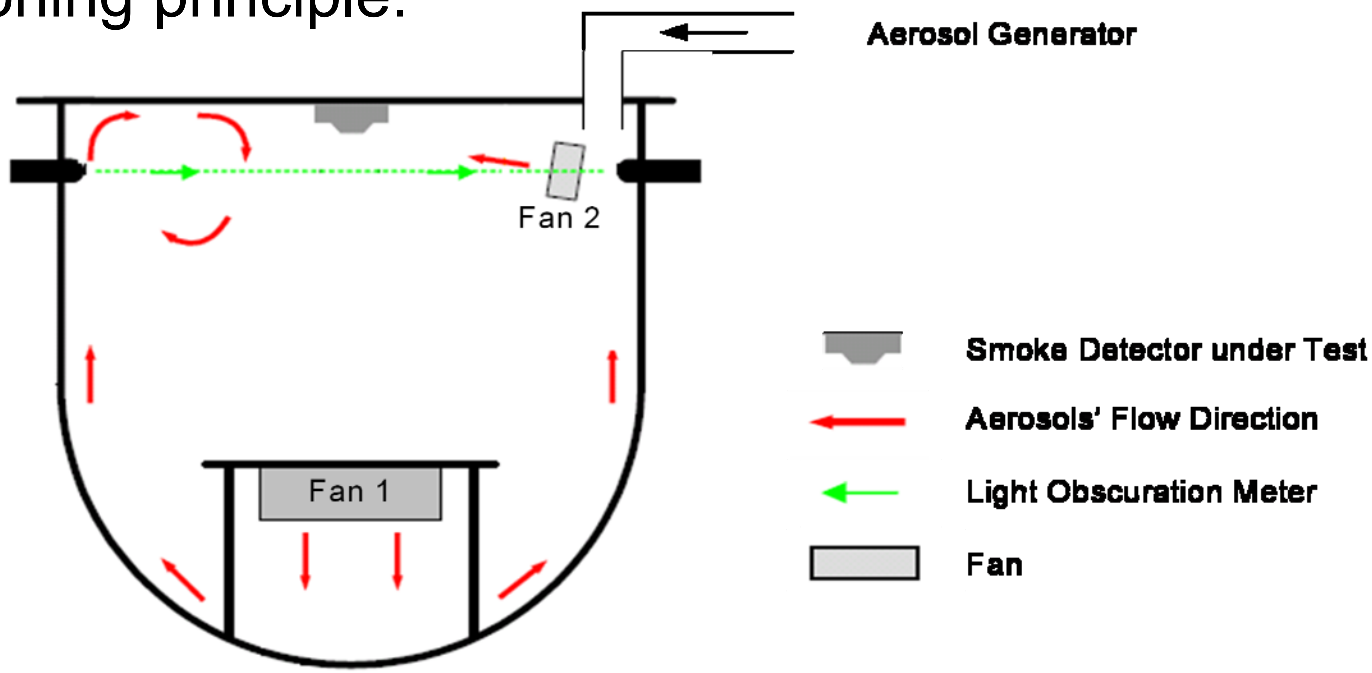
Approach for a standardized test setup

Test chamber invented by SIEMENS

Test chamber of University Duisburg

False Alarm Rejection Ratio: Test Chamber

- Functioning principle:

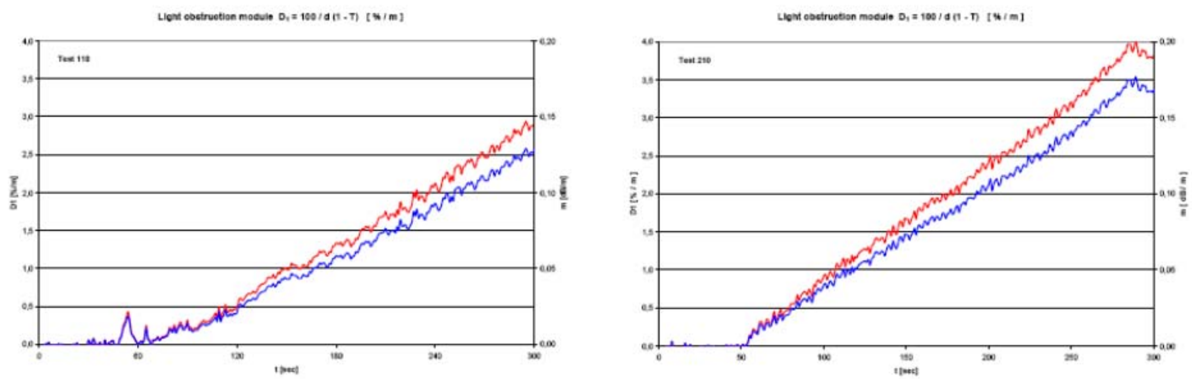


Targets:

- Homogenous distribution of aerosols throughout chamber
- Continuous increase of aerosol concentration
- Application of various stimuli: dust, fog, smouldering wood etc.

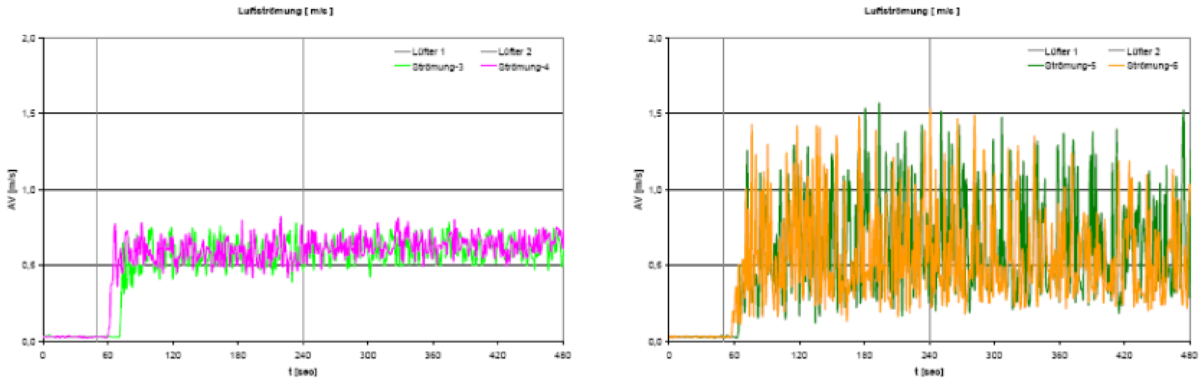
Characterisation of Test Chamber

- Reproducibility not satisfactory



2 Tests performed with same parameter setting for dust production

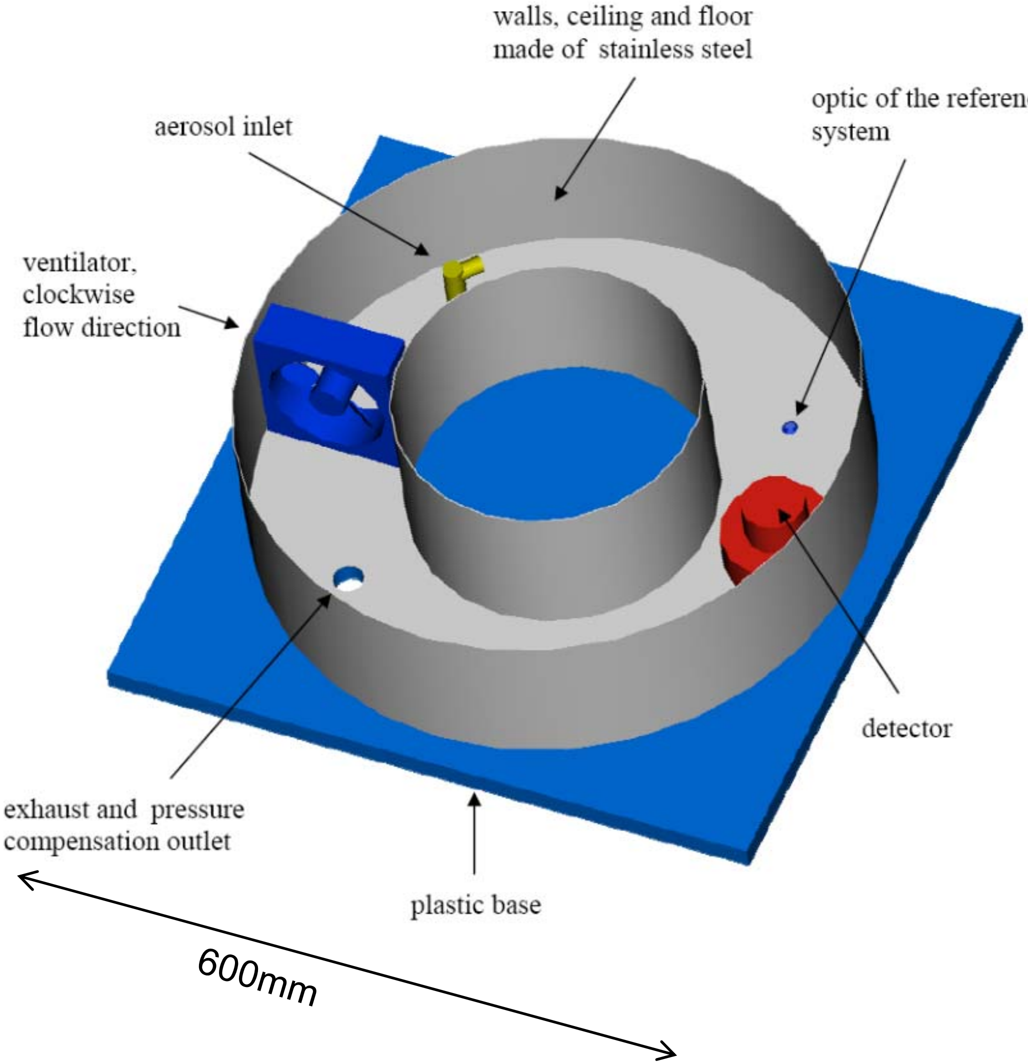
- High signal fluctuation

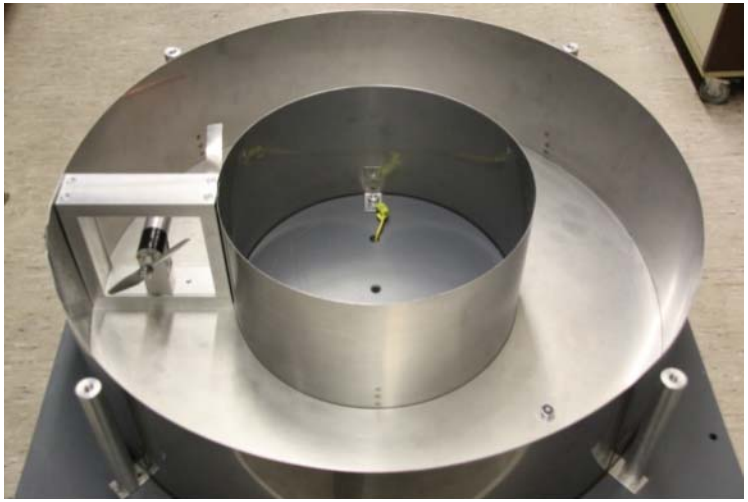


Air flow close to the side walls

Air flow at the detectors' position

Standardized setup



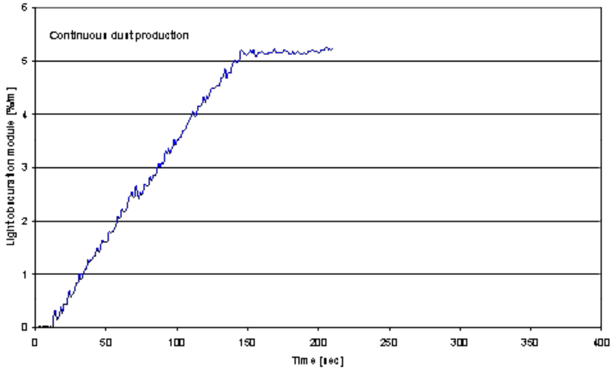


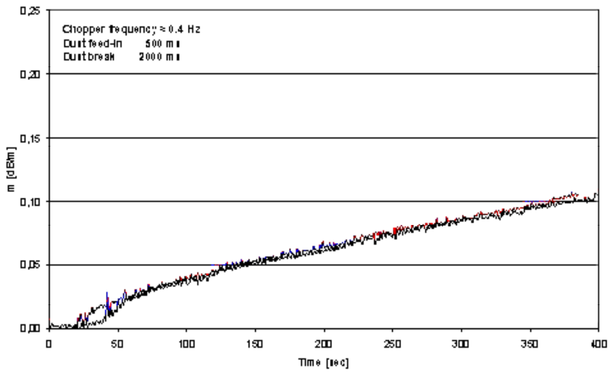
Test duct for Smoke Detector nuisance sources

Highlights and advantages:

- Compact, lightweight, easy transportation
- Easy cleaning due to quick disassembly and small volume (32l)
- PC-controlled reproducible particle dispersion
- Laminar flow at smoke detector position
- Accurately adjustable flow direction and air speed (0.2 m/s ... 1 m/s)
- No electrostic charge within the duct due to metallic construction – tests with combustible (hazardous) materials possible
- Especially developed precision light extinction reference measurement

Test duct characterization





2 dust feed modes are possible:

Continuous mode:

slope ≈ 0,1 dB m^{-1} min^{-1}

Chopped mode:

slope down to ≈ 0,016 dB m^{-1} min^{-1}

Note: requirement for EN54 smoke channel:

$$0{,}015 \leq \frac{\Delta m}{\Delta t} \leq 0{,}1 \qquad [\text{dB m}^{-1}\ \text{min}^{-1}]$$

Summary and outlook

- A test duct for dust and other nuisance sources has been proposed

Next steps

- Further characterisation
- Detailed test definition in correlation to false alarm rejection ratio
- Characterisation of different smoke detectors
- Extension from dust to other nuisance sources (e.g. cosmetic spray, insecticides, fog)

→Airbus is willing to support a standardisation committee

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Interaction

Questions and Feedback?

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