

Performance & evaluation criteria for calibration workshops & ACTRIS compatibility

ACTRIS aerosol in-situ variable: Particle number size distribution > 2 nm

Responsible CAIS-ECAC units: CCC

Instrument type: Neutral cluster and Air Ion Spectrometer (NAIS)

Manufacturers & instrument models: Airel NAIS (generations 4 and newer)

Technical checks & calibration:

ACTRIS compatible NAIS (generations 4 and newer)

Leak check

Flow verification (sample and sheath flow rates are measured)

Barometric pressure sensor verification

DMA voltage verification (at least from built-in diagnostics)

Electrometer background verification (at least from built-in diagnostics)

Polarity balance check

Built-in diagnostics check

Sizing accuracy check (at least for ion mode)

Detection efficiency check (at least for ion mode)

Comparison of the ion and particle number concentrations against a reference NAIS

Criteria for evaluation:

The criteria are size-dependent and ion/particle mode dependent.

Flow rates should be correct within $\pm 5\%$

Barometric pressure should be correct within $\pm 1 \text{ hPa}$

Electrometer currents during offset should be $< 10 \text{ nA}$

At 100 mbar overpressure the total leak should be $< 10 \text{ lpm}$

Positive and negative spectra similar within 10% below $1 \text{ cm}^2/\text{V/s}$ (ions) and above 2.5 nm (particles)

No diagnostic errors

0.8-2 nm (ion mode only):

sizing accuracy target value: within $\pm 20\%$

number concentration target value: $\pm 50\%$

2-20 nm (2-7 nm and 7-20 nm size ranges):

sizing accuracy target value: within $\pm 20\%$

number concentration target value (ion mode): $\pm 20\%$

number concentration target value (particle mode): $\pm 50\%$

Information for the user: These criteria might change once more instruments have been tested.

Literature:

Manninen, H. E., et al. (2016). "How to reliably detect molecular clusters and nucleation mode particles with Neutral cluster and Air Ion Spectrometer (NAIS)." *Atmos. Meas. Tech.*, 9, 3577-3605.

Wagner, R., et al. (2016). "On the accuracy of ion measurements using a Neutral cluster and Air Ion Spectrometer." *Boreal Env. Res.* 21: 230–241.