Effect of thresholding on calculated mass concentrations

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Outline

- The Helsinki nano-AMS
- Single/multiple ion detection
- Running with different thresholds
- Example data

The problem

Searching for the solution
The Helsinki C-ToF AMS

- Joint acquisition by University of Helsinki and Finnish Meteorological Institute
  - Although related, Doug was acquired through a separate deal

- The "Nano-AMS" was designed to be able to measure as small particles as possible
  - P-ToF flight path only ~11 cm long
  - Addition of He to remove the huge airbeam

- Arrived in Hyytiälä in March 2007, measured until May, returned to Aerodyne for "final" modifications

Single/multiple ion detection

- Issues:
  - Response of the ToF is not linear for small signals
  - The influence of thresholding becomes relevant for small signals

- With the Helsinki AMS we want to look at nucleation mode particles in a clean environment
  - Small signals expected
  - Need to be able to correct for the non-linearity

From Joels poster at 2006 users meeting
Running with different thresholds

- A second menu was added for the second half of the measurements, with a lower threshold
  - **Menu 1:** Threshold = 4, duty cycle ~80% (MS + PToF)
  - **Menu 2:** Threshold = 2, duty cycle ~20% (only MS)

- Threshold off would give the “most correct” results for a comparison, but we couldn’t go lower than threshold = 2 since the electronic noise was too high to be able to distinguish any true signal

Example data
Example data II

Averaging noisy data
Averaging noisy data II

Averaging noisy data III

A discussed correction made with only menu 1 data, is to multiply small signals with the ratio of Ar to N₂, divided by their relative mean concentration (~2.2%).
Time-dependent corrections with menu 2 and with “40/28”