Lens Transmission issues for two different HR-AMS:
How to diagnose it and how to fix it (in software)

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AMS Transmission for larger particles

http://cires1.colorado.edu/jimenez-group/wiki/index.php/FAQ_for_AMS_Data_Users

Liu et al is NOT how a good lens should look like, you will have serious losses in submicron ambient aerosol in most scenarios.
No matter what we did, we always got 2 modes in ptof
And since this was an aircraft study, a smaller slit chopper wheel was not an option
Strange Mass Ratio! (expected 5-6, in reality ≈2)

Plotting the IEs from analyzing each mode separately should roughly give you the mass ratio of both modes. If they were doubly charged particles, that means:

\[
\frac{m_2}{m_1} \sim \frac{(2D_1)^3}{D_1^3} \frac{C_S}{C_S} (2D_1)
\]

Less work to analyze, but equally telling are the PToF size of those modes and the ion signal size.
In cases such as this, trusting your own AMS size calibration is the way to go...

You did size calibrate your AMS at the beginning of your last field study, didn’t you?
Summary of “full size” and “half size” calibration
Old vs New PCI Volume

- No obstruction between critical orifice and expansion volume
- Shorter
- Improved mechanical design
- Smoother valve bore, but different pressure sensor point
Some actual confirmation...

By mocking the extra tubing from the old PCI volume with the new PCI volume, I was able to prove that the number of “halfs” increased with the length of the tube.

- Old PCI Volume: 80% halves
- Middle Fitting: 90% halves
- Right Fitting: 30-40% halves
- Proper Fitting (not shown): < 5% halves
However, something was strange...

PToF and DMA sizes agreed now, BUT
• BFSP and CPC counts for AN sizes above 350 nm did not agree
• Ambient PToF did not look right
Procedure: Measure relative CEs (SMPS/AMS Mass) of Ammonium Nitrate and Ammonium Sulfate between 200 and 450 nm and normalize to the average of the 200-250 nm region.
After retrofitting the old volume top fitting to look like the new one

So using the old PCI Volume with the std AMS valve gets us very close to the bare lens transmission. No idea why!
7 months later, ESML instrument, T3 site, GoAmazon2014 Campaign

Again, the first symptom was insufficient BFSP counts relative to CPC during IE Cal!
The end of the tale...

- Taking the lens out and reassembling it did not help
- We took a lens from a different AMS, which showed reference transmission
- With this lens, the new PCI volume worked!
So how to correct?

InletRatio = \frac{\int (\text{Volume Size Distribution} \cdot \text{AMS Calc Density} \cdot \text{Experimental Transmission})}{\int (\text{Volume Size Distribution} \cdot \text{AMS Calc Density} \cdot \text{Reference Transmission})}
Example: RF08 (before the change)
Example: RF15 (after the change)

Density = 1.4472
UHSAS PSL Correction = 1.12
LAS PSL Correction = 1.12
Steps (III): Manual corrections

- Smoothing and interpolating
- Accounting for number noise at high Dopt at low concentrations and ICE artifacts
- Artifacts at altitude changes
- Dust
Example of LAS/AMS Timetrace
pre/post correction

Graph showing time trace data with volume on the y-axis and time on the x-axis, with color-coded altitude tracks.
Different flight, correlation

UHSAS/AMS Volume

![Graphs showing correlation between large UHSAS volume and AMS volume with regression lines and correlation coefficients.](image)

Variable CE, Slope = 0.51456

$r^2 = 0.73004$

Variable CE, Slope = 0.83605

$r^2 = 0.82695$