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Atmospheric Measurement Techniques Discussions

Interactive comment on "First correlated measurements of the shape and scattering properties of cloud particles using the new Particle Habit Imaging and Polar Scattering (PHIPS) probe" *by* A. Abdelmonem et al.

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The Referee #1 Wrote:

"Astimatic errors

Due to the fact that the sampling volume has a finite size, the optical system is not stimatic. Therefore, a particle located outside the focal point in the sampling volume scatters energy following a certain angle which may not reach the corresponding detector. Numerical simulations could be made in order to evaluate the subsequent errors

on the measurements. These simulations may use a ray tracing technique for the characteristic determination of the light beams which emanate from the sampling volume and reach one considered detector. For a given detector, the statistical distribution of the polar scattering angle provides information on the subsequent astigmatism error for each detector."

And, related, Referee #1 also wrote:

"End of page 9 and Fig. 4: Some discussion should be useful for the comparison between the measured scattering function and the theory. Should a mean scattering function from numerous quasi-monodisperse particles more relevant for calibration purposes ???"

Authors' response:

During covering this comment we found accidently that the detection volume value was written wrong in the discussion version of the paper (p2892 – L12). However the correct value (about 0.1mmˆ3) will be written in the final version of the paper with some more details about the particle detector pinhole diameter. However, it (the detection volume) is a quasi cylinder of base diameter 0.5mm and height of 0.5mm.

The effect of the final scattering volume (results from Monte-Carlo GO ray-tracing simulations):

1-10 degree detectors:

Due to the final dimension of the scattering volume 24.16% of the bin intensity is lost (rays of appropriate scattering angles do not reach the detector). However, the same amount is gained from outside: The maximum acceptance half angle is effectively increased from 0.143 degree to 0.242 degree (however only 12.86% of rays in this

extra angular region hit the detector).

18-170 degree detectors:

Due to the final dimension of the scattering volume 4.87% of the bin intensity is lost (rays of appropriate scattering angles do not reach the detector). However, the same amount is gained from outside: The maximum acceptance half angle is effectively increased from 2.386 degree to 2.715 degree (however only 16.52% of rays in this extra angular region hit the detector).

A specific, related, example:

For the water droplet (94um) shown in Figure (4) of the discussion paper, we calculated the effect of the final detection volume on the scattering signal. We assumed three cases:

1.The centre of the water droplet is coincident with the centre of scattering (see attached Fig.1. - up). 2.The centre of water droplet is shifted away from the centre of scattering (close to the edge of the detection volume, so it is still detectable, see attached Fig.1. - down) 3.The centre of water droplet is shifted to the opposite edge of the detection volume.

The evaluated scattering functions for the centred particle, shift +0.297mm and -0.297mm (particle shift to opposite side) are shown in the attached Fig.2. One can see how weak is the effect of particle displacement, within the detection volume, on the scattered signal. Please note that due to the integration over the detector area the values for shift 0 are slightly different from those in Figure (4) (of the discussion paper).

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 2883, 2011.

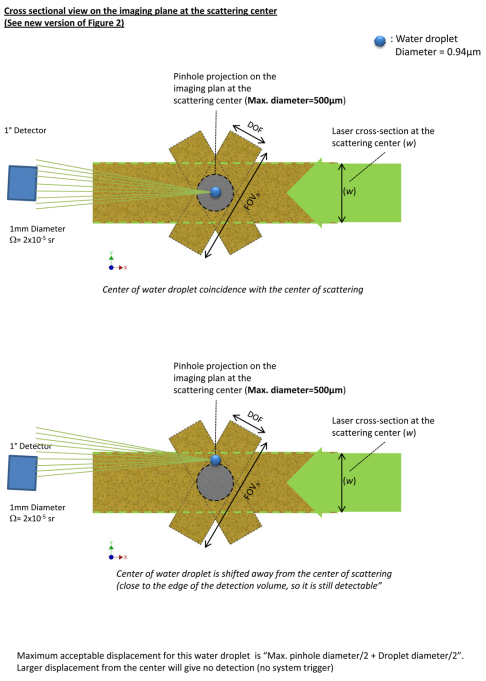
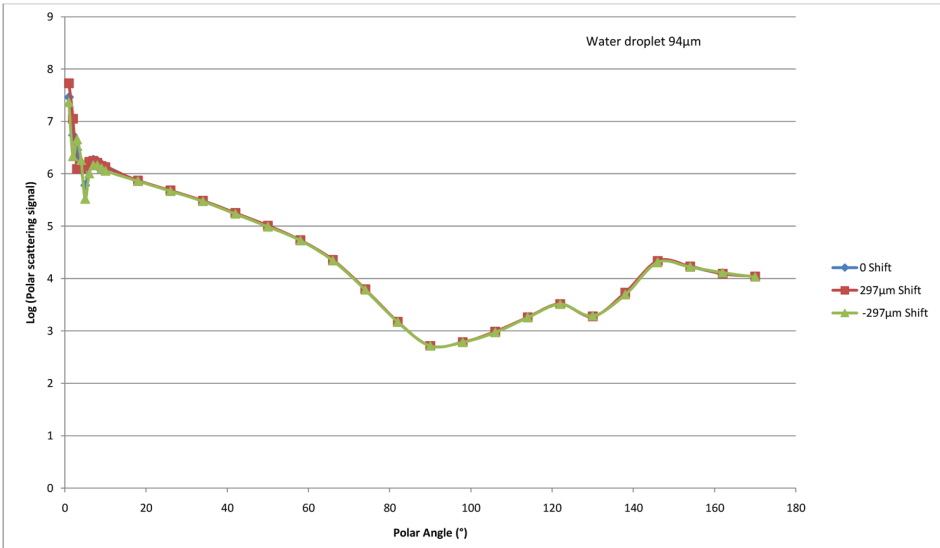


Fig. 1.



The calculated scattering functions for the centred particle, shift +0.297mm and -0.297mm (particle shift to opposite side).

Fig. 2.