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EARLINET Raman Lidar PollyXT: the neXT generation

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When discussing the overlap correction and its possible effects on products of signal ratios, my mind had obviously been trapped for some time in the problems of the receiver optics, and my criticism is partly wrong – on the one hand. On the other hand I forgot to mention the real problem.

While the mentioned problems with the receiver optics do exist in principle, the angular distribution of the light beam in the receiving optics is actually limited by the field stop of the telescope with 1 mrad field of view. If the field stop, the collimating lens, and the following optical elements are well aligned, the small 1° divergence of the light beam resulting from the 1 mrad field of view of the telescope is reasonable, and considerable range dependent signal distortions or significant differences between the signals of signal ratios are not to be expected.

Therefore the sentences in the original review text (highlighted below) can be deleted as shown.

P7754 L10 *Figure 10 shows the simulated and experimentally determined overlap functions for the far-range and near-range receiving telescopes.*

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The basic assumption for the determination of the overlap function according to Wandinger and Ansmann (2002) is that the overlap functions for the Raman and elastic channels are the same. While for 532 nm the overlap function of the large telescope retrieved with the Wandinger and Ansmann (2002) method can be checked with the 532 nm near range telescope (it would be nice to see this in Figure 10), this is not possible for 355 nm and 1064 nm. But Figure 11 shows backscatter coefficients at 355 and 1064 nm down to about 300 m, and linear depolarization ratios at 532 and 355 nm down to about 100 m.

How is this possible with a field of view of 1 mrad for the large telescope?

According to Table 2 different interference filter bandwidths are used with 1 nm bandwidth for the elastic and 0.3 nm for the Raman channels. Furthermore, the spectral transmission of dichroic beam-splitters with steep filter edges is sensitive to the incidence angle, and also polarizing beam splitters can exhibit such an angle sensitivity. On P7753 L18 the maximal incidence angle in the parallel beam path is given as 1° for the large telescope. Is this the value for the nominal 1 mrad field of view?

~~Estimating the distance of the telescope and laser axes with 250 mm, the backscattered laser light from 100 m range has an incidence angle at the telescope of 0.25 m / 100 m = 2.5 mrad. With the telescope magnification of Ftelescope / Fcollimator = 900 mm / 50 mm = 18 (with estimated focal length F of the collimating lens of 50 mm) we get an incidence angle of 2.5 mrad * 18 = 2.9° at the interference filters in the receiver optics. Depending on the laser alignment it could be more.~~

However, Fig. 10 shows that the overlap function is close to zero below 200 m, but Fig. 11 and 7 show values down to about 100 m for the linear depolarization ratio and even lower for the water vapor mixing ratio. It should be discussed how trustworthy these values are.

The problem in the overlap range I forgot to mention is that the cross-sectional intensity distribution of the emitted laser beam is different for different emission wavelengths. This is an effect of the

SHG and THG, because the SHG depletes the intensity of the 1064 nm where 532 nm is generated, and the THG depletes 1064 nm and 532 nm where 355 nm is generated.

Because the telescope images the laser beam around the telescope focus, the field stop truncates the beam at different wavelengths differently, which results in different overlap functions. Therefore it is not possible to transfer the overlap function from one emission wavelength to another, and it should be explained how accurate the overlap function for the 1064 nm backscatter coefficient can be achieved, for which no Raman channel or near range telescope exists.