



ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop

13 – 17 November 2023 | ESA-ESRIN, Frascati (Rome), Italy

LITES: cal/val with lidar in Hatfield, UK

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Lidar Innovations for Technologies and Environmental Sciences (LITES) facility

- Multi-wavelength lidar (1064 nm, 532 nm, 355 nm)
- Multi-channel spectroscopic Raman lidar
- High spectral resolution lidar (HSRL)
- Polarization lidar



Lidar Innovations for Technologies and Environmental Sciences (LITES) – An Remote Sensing Infrastructure Facility: Setup and Measurements Examples. Boyan Tatarov, Detlef Müller, Matthias Tesche, Sung-Kyun Shin. *EPJ Web Conf.* 237 07017 (2020). DOI: 10.1051/epjconf/202023707017

Multi-channel Lidar Spectrometer as part of LITES

→ Lidar Innovations for Technologies and Environmental Sciences (LITES)

design, construction, operational: 2013 - 2023

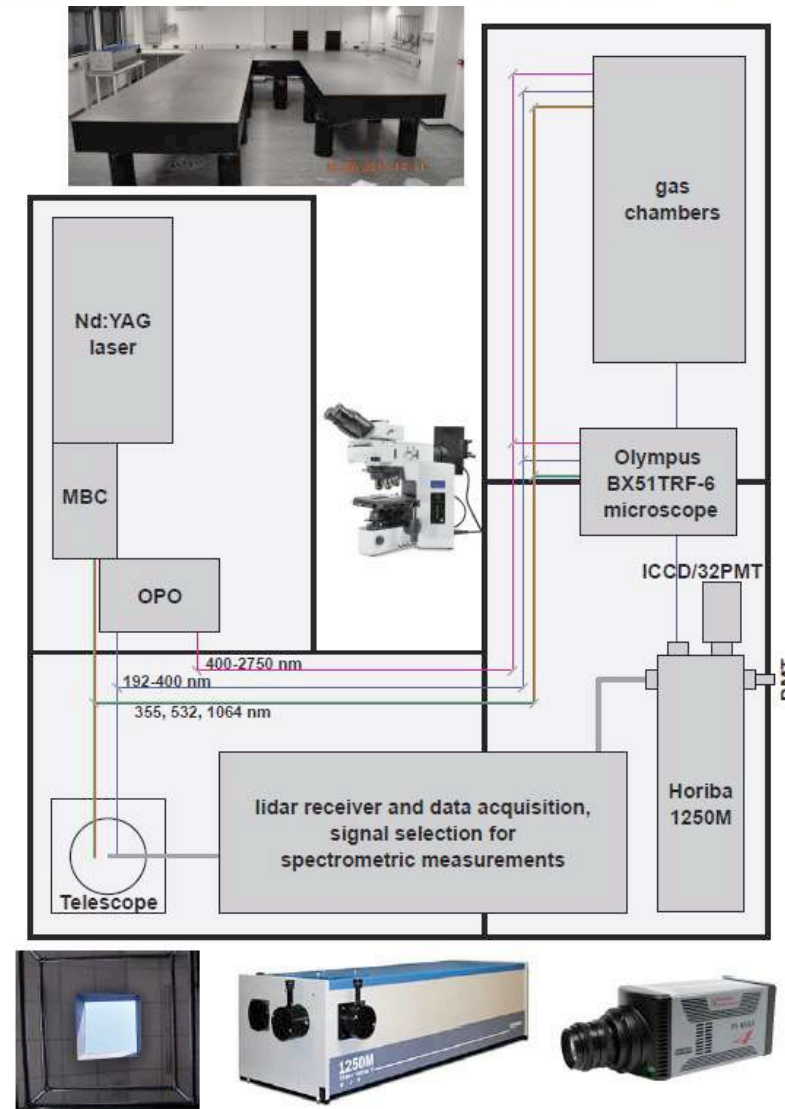
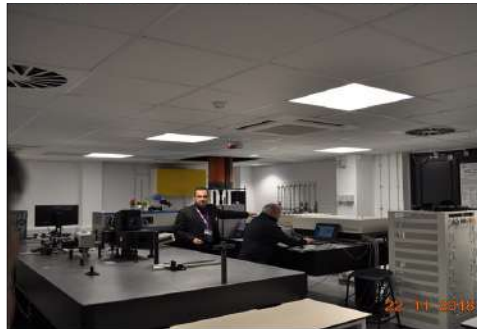


LITES: rotational Raman spectra of air molecules measured by high-resolution-spectroscopy lidar

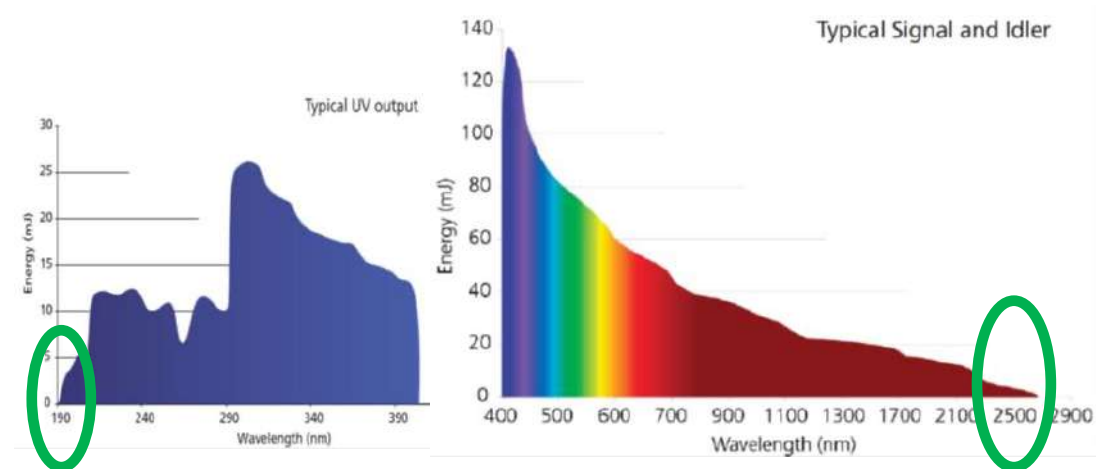
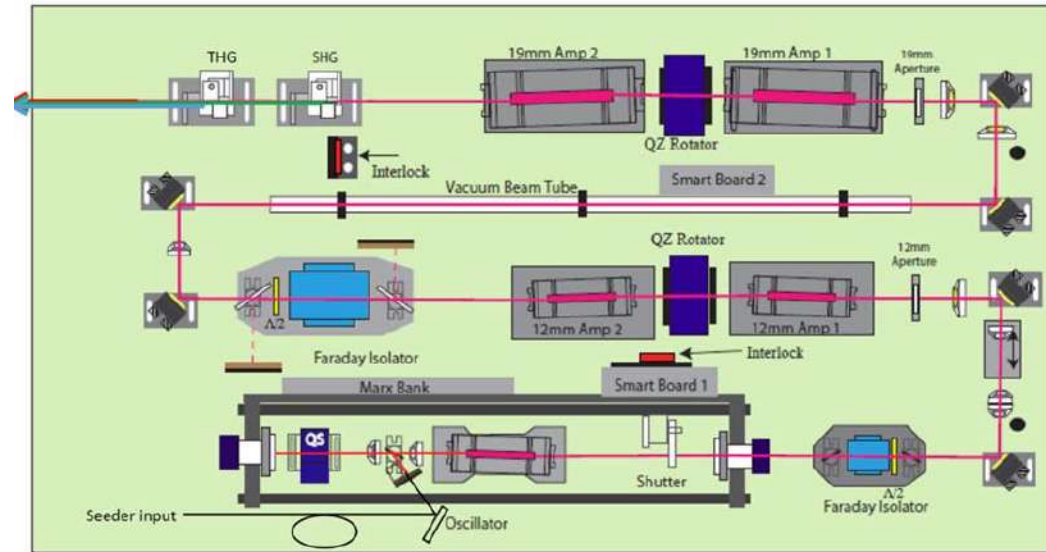
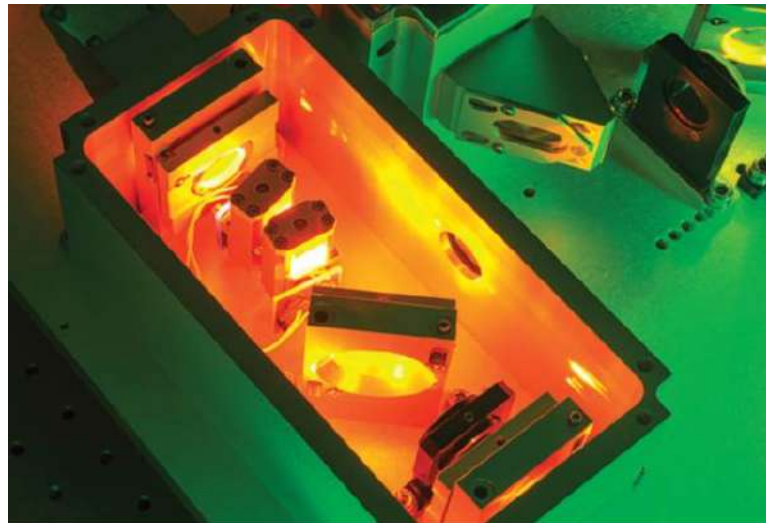
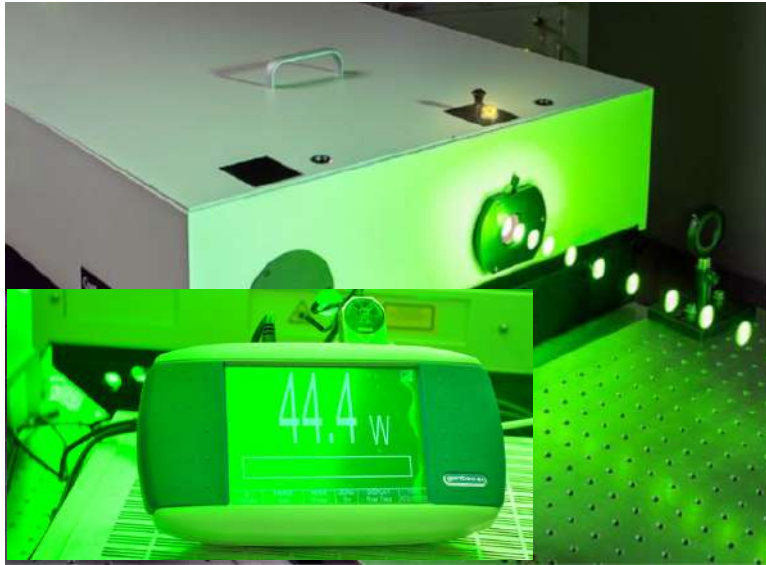
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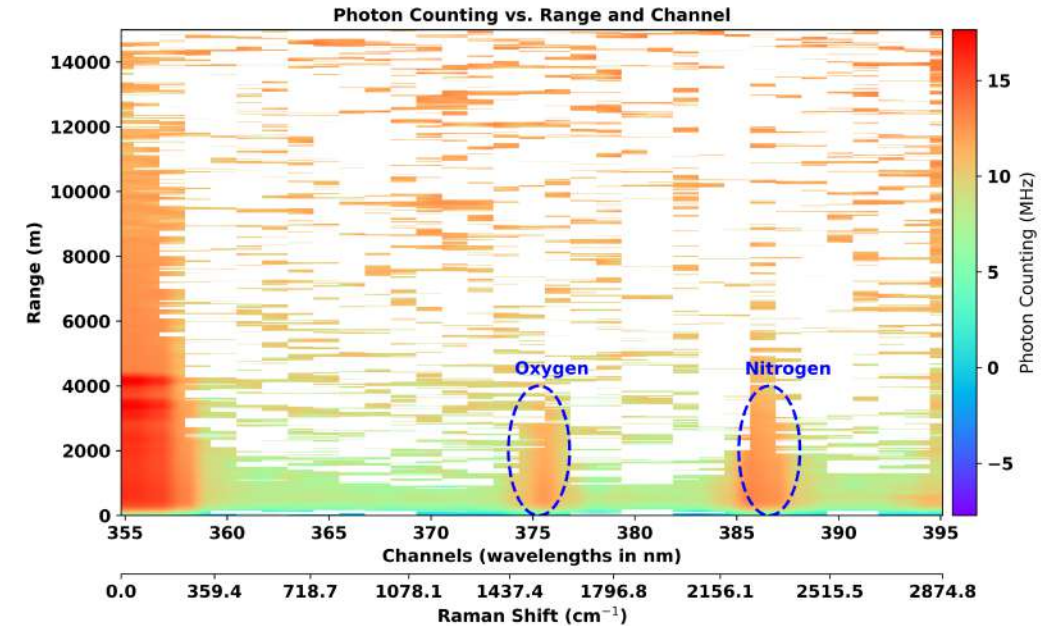


Main Laser System: Nd:YAG + OPO up to 7 J at 1064 nm (10 Hz)



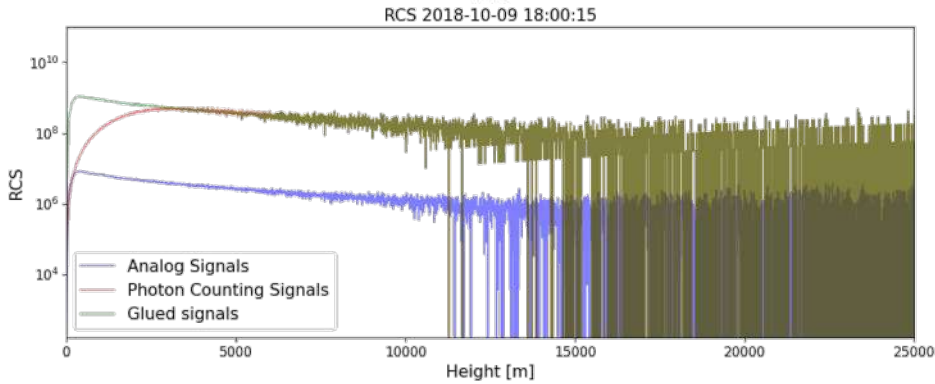
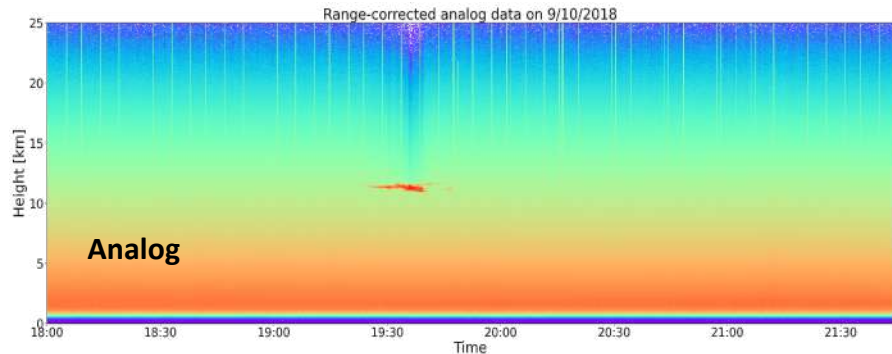
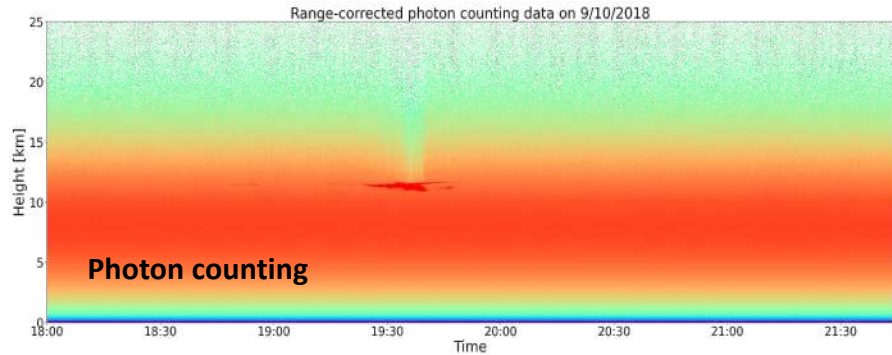
Provides both elastic and a range of inelastic return signals based on molecular vibrational and/or rotational state

- Identifies the Raman scattering and luminescence characteristics for aerosols and gases
- Allows for identification of chemical composition of atmospheric pollution

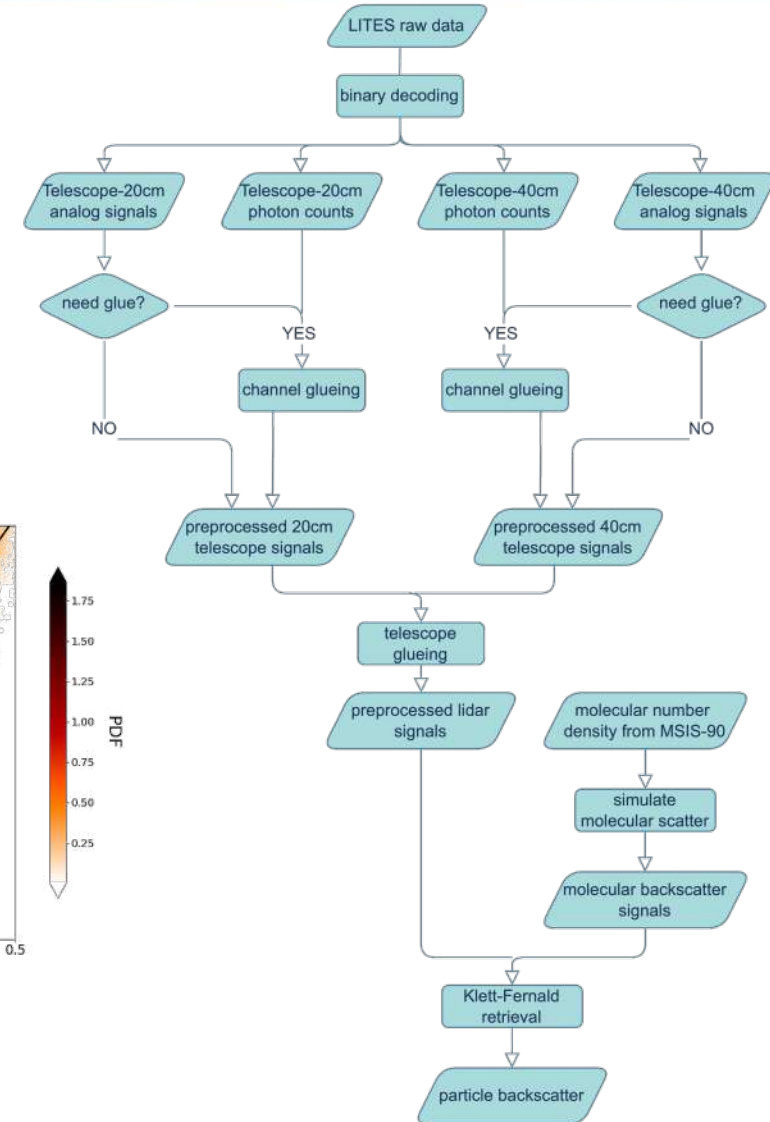
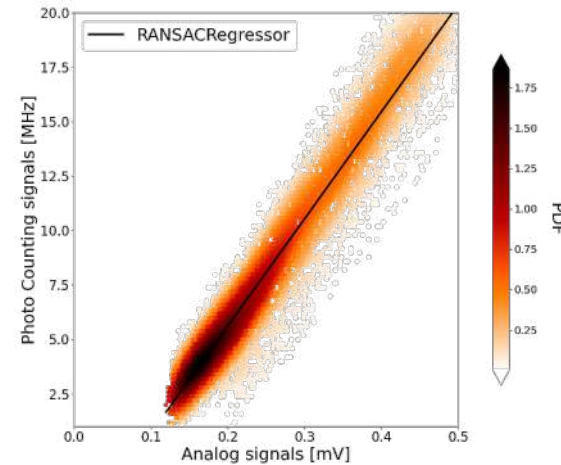


The spectral signature of atmospheric components including elastic (355 nm) and 31 inelastic channels was recorded on 15 Feb 2023 between UTC 15:00 and 19:30.

Hertfordshire ground lidar processing chain



AEOLUS CAL/VAL



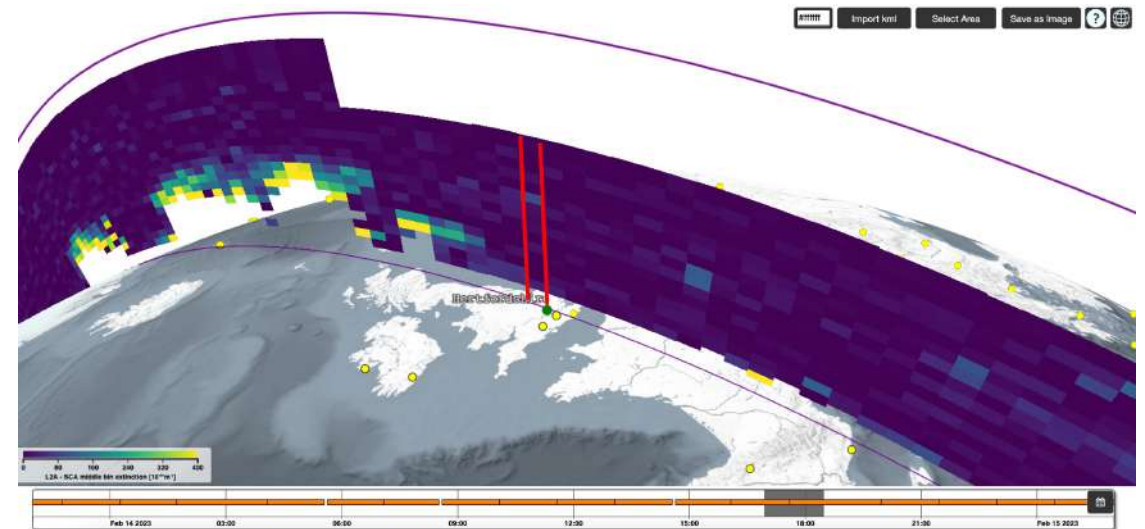
Ground Observation summary:

- Observation time: 17:00 – 01:30 (UTC).
- Atmospheric condition: thin clouds at 11 km.
- Data condition: 32PMT (Raman channel) has good measurements after sunset.
- Background atmosphere: radiosonde measurements from (51.20N, 1.80W).
- Aerosol/cloud retrieval: 32PMT Raman channel is used.

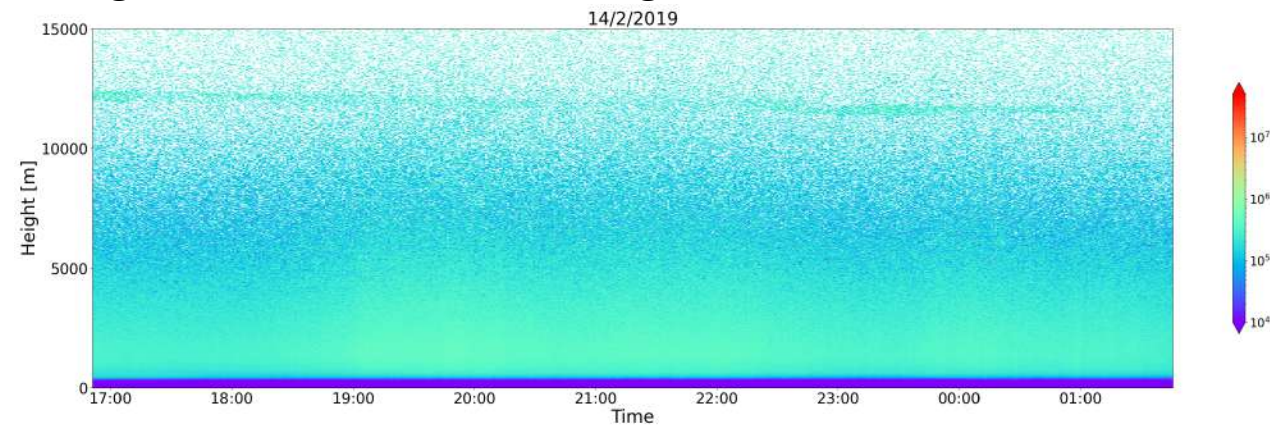
AEOLUS observation summary:

- Overpass time: 17:33 UTC
- Aerosol products: baseline-15 SCA-Midbin products, and MLE products, with cloud filtering implemented for both.

Overpass quick view:



Range corrected elastic lidar signals:

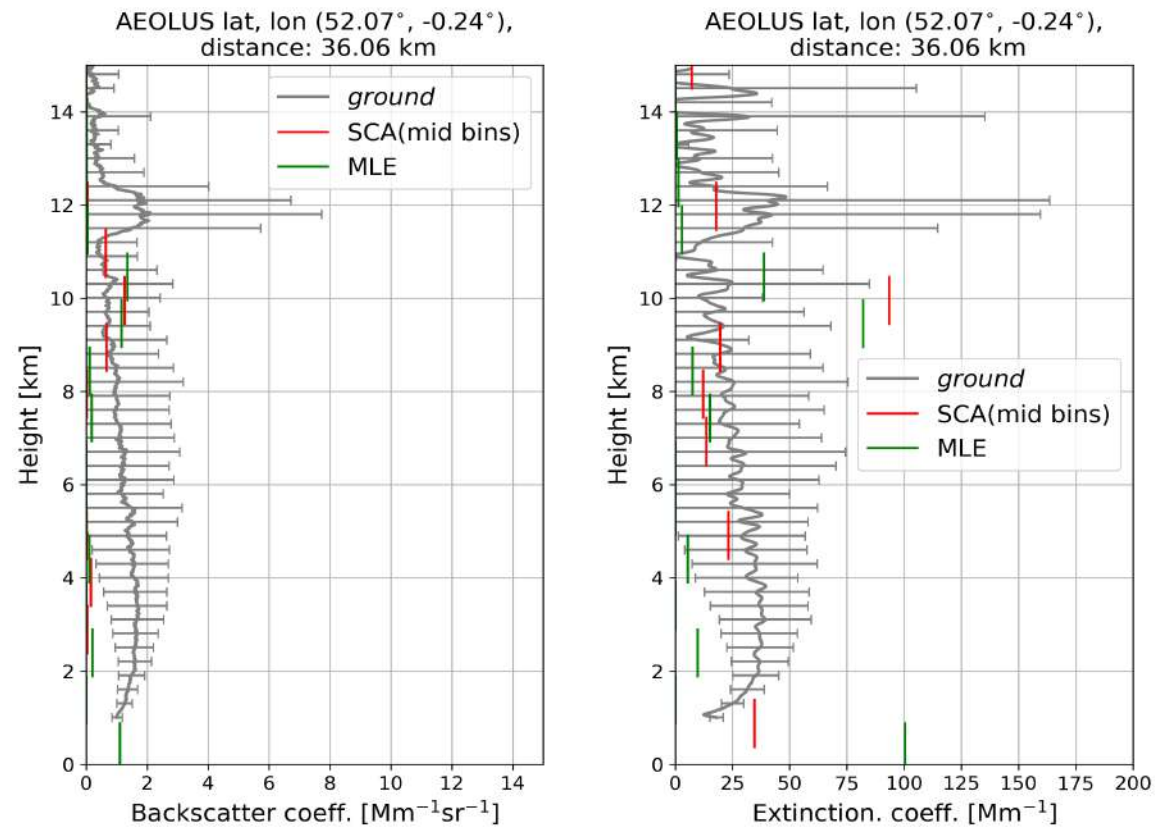


Observation Date: 14th Feb 2023

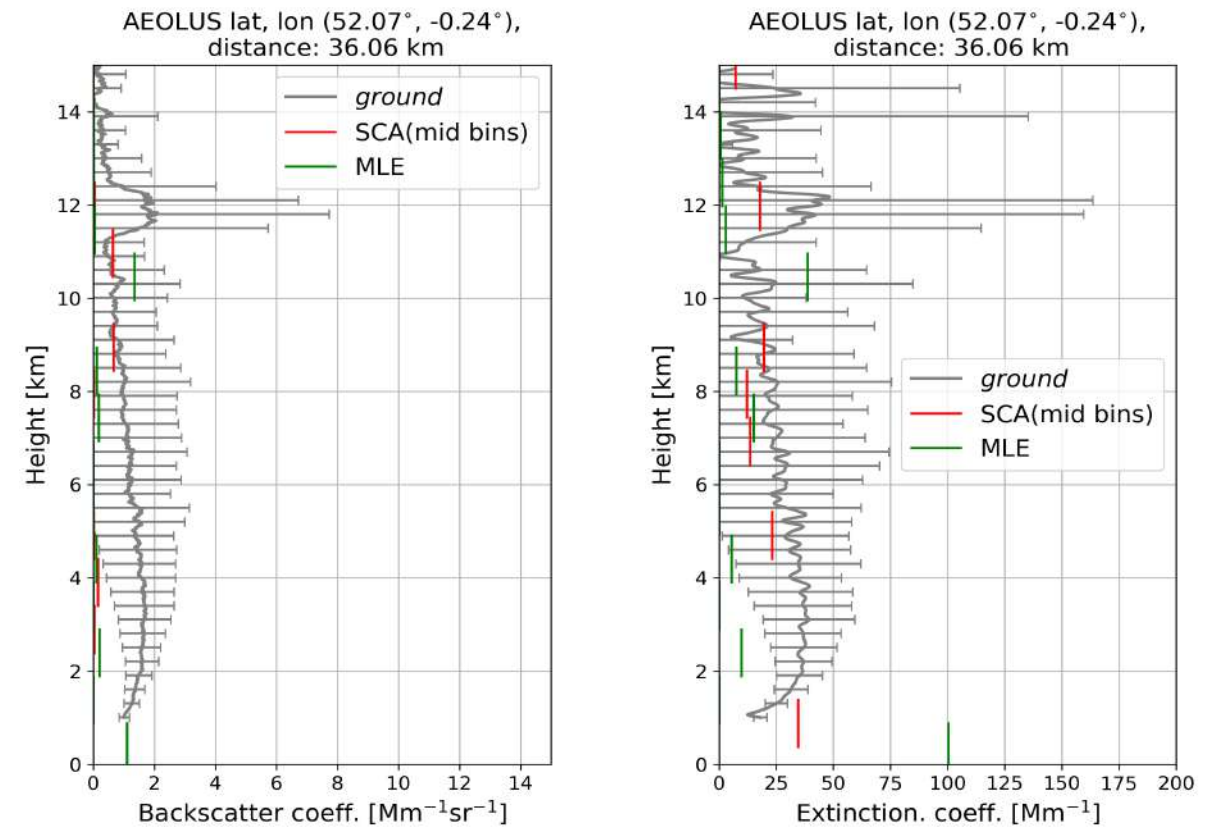


- AEOLUS overpass at 52.07°, -0.24°, distance to site: 36 km

➤ Without cloud screening:



➤ After cloud screening:



LITES lidar in UK for validation of ATLID Profiles (LUK-AP) 😊

Summary:

- Regular validation measurements during EarthCARE overpasses
- Validation measurements will be performed within a time window of about 3 h around an EarthCARE overpass.
- Co-location will be assured using the trajectory approach outlined in the CALIPSO validation study of Tesche et al. (2013).
- The measurements of elastically and inelastically scattered light will be analysed using standard retrieval method and provide aerosol profile products for the validation of ATLID measurements.
- Aerosol and cloud base and top heights will be obtained by detecting strong gradients in the range-corrected signal at 1064 nm using the wavelet covariance transform method of Brooks (2003).