ADM-Aeolus L2a processor for aerosols optical properties

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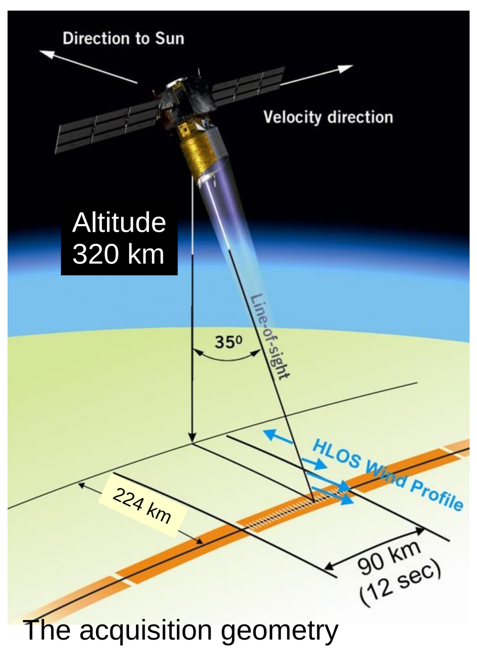
The Aladin instrument

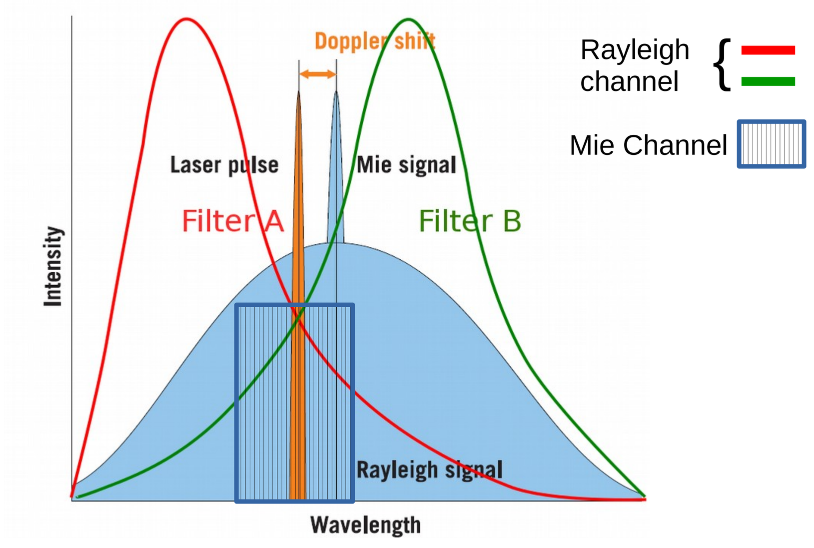
2 channels :

- “Mie channel “ : 16-pixel sensor behind a Fizeau interferometer (Mie scattering, particles, 100MHz resolution)
- “Rayleigh channel” : Dual Fabry-Perrot interferometer (Rayleigh scattering, molecules)

Altitude 320 km, slanted line of sight.
Wavelength : 354.8 nm (frequency tripled Nd-YAG laser)
Energy 80 mJ per pulse, 1 “observation” is made of 30 “measurements” of 20 pulses each (1 Obs = 600 pulses).



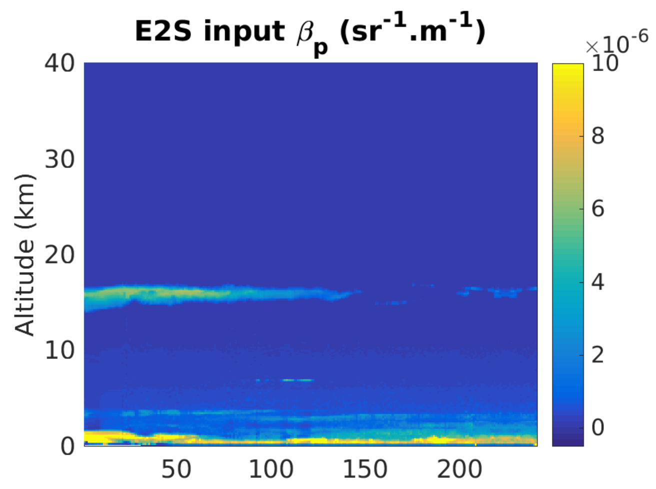
The acquisition geometry



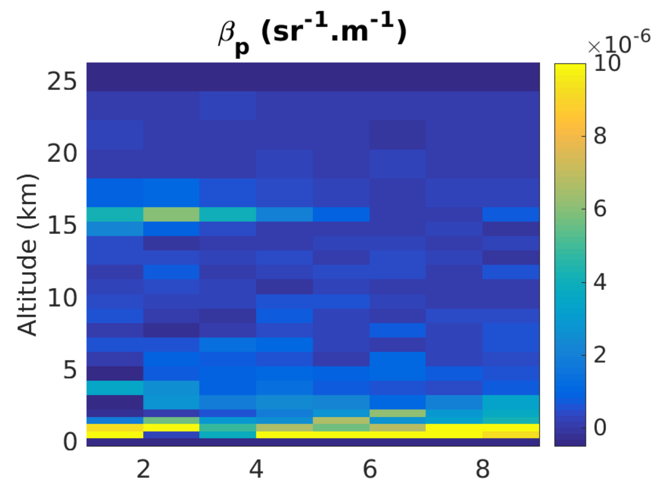
Spectral sensitivity of the two channels of Aladin

Standard Correct Algorithm (SCA) at 90 km resolution : The main product

The main product of the L2A is the output of the Standard Correct Algorithm ran over the 90-km averaged signals. This resolution enables the instrument to accumulate enough signal to obtain accurate optical properties.
Advantage : strong SNR leading good quality of inversions
Drawback : coarse horizontal resolution



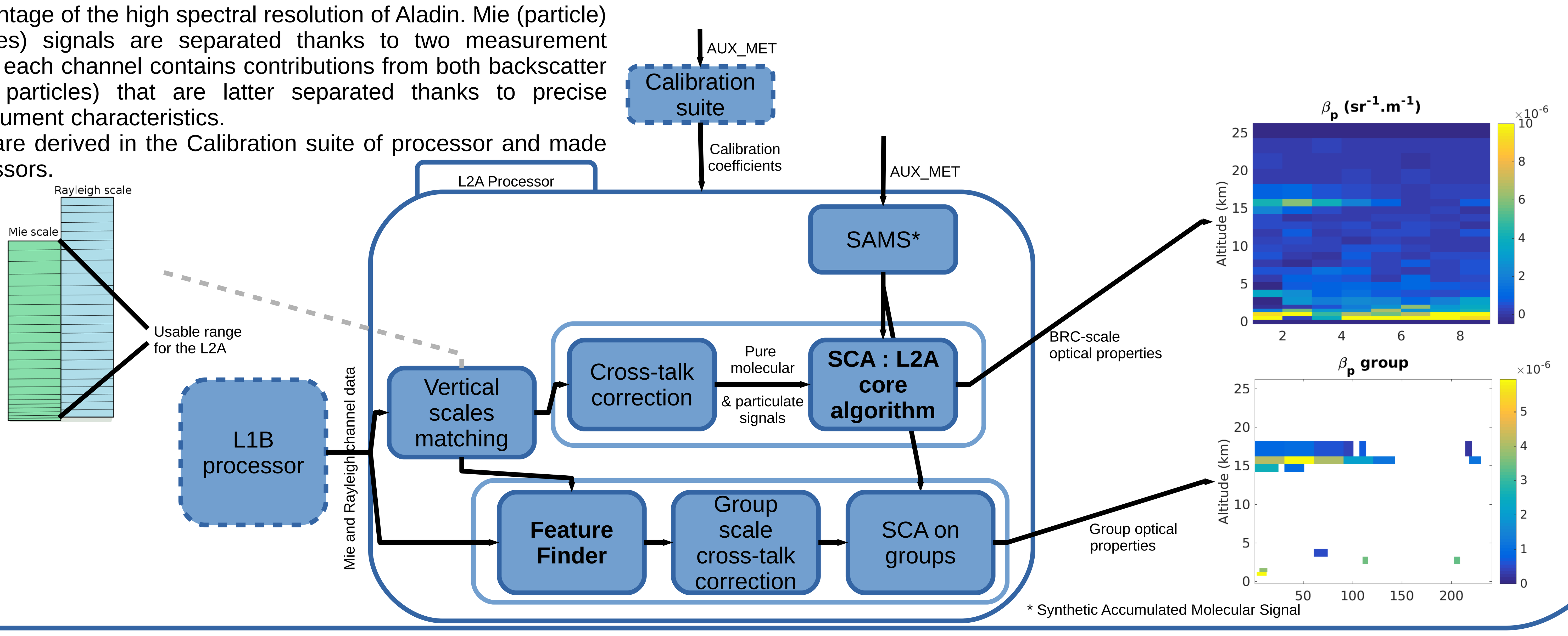
Back scatter from the input scene



L2A retrieved backscatter

The principle behind the L2A:

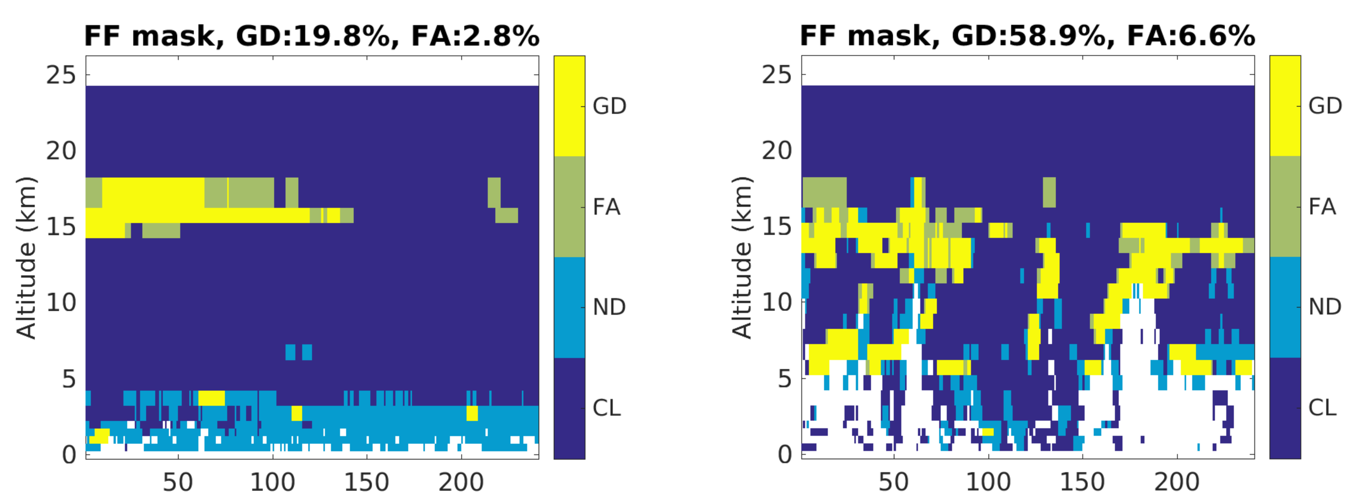
The retrieval takes advantage of the high spectral resolution of Aladin. Mie (particle) and Rayleigh (molecules) signals are separated thanks to two measurement channels. The signal on each channel contains contributions from both backscatter types (molecules and particles) that are latter separated thanks to precise knowledge of of the instrument characteristics.
Calibration coefficients are derived in the Calibration suite of processor and made available to all L2 processors.



* Synthetic Accumulated Molecular Signal

Feature finder : finer resolution

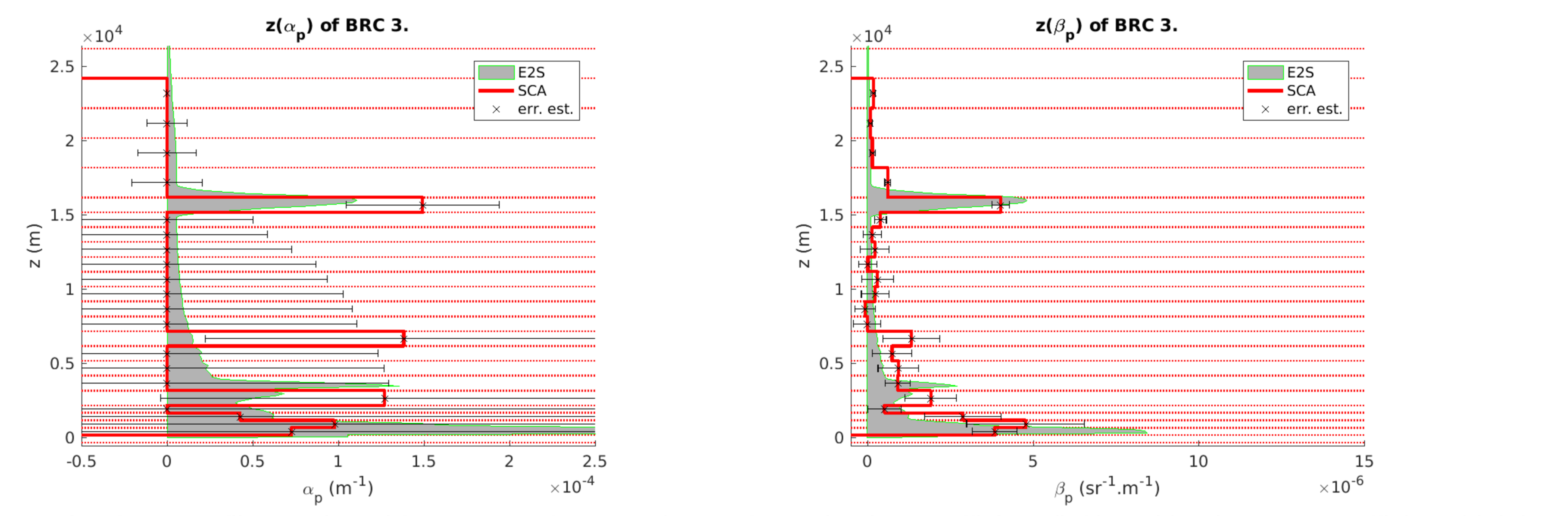
The finer resolution product is computed in two stages. First, in order to identify structures at sub-90-km resolution, the L2A uses a feature finder.
The feature finder is filters the Mie channel SNR and identifies « groups » of lidar bins that are consistently above a given threshold. Groups span a minimum of 5 horizontal bins and only one horizontal level.
Groups identified by the feature finder are processed using the same SCA as described above.
The feature finder performs better at finding clouds than planetary boundary layer aerosols. These faint targets require long accumulation times and are better retrieved through the BRC-scale algorithm.



Exemple score for the feature finder on two realistic scenes derived from LiTE data (LiTE A, left and LiTE C right).
GD: Good detection, FA: false alarm, ND: not detected, CL: clear sky, white pixels: two-way transmission below limits

Errors estimates

Along with the values for the optical properties, the L2A provides estimates of the standard deviation of the error. They are derived by error propagation from the values of the parameters and the SNR of each channel.



Example of two profiles retrieved for BRC 3 of scene LiTE A, for extinction coefficient (left) and backscatter coefficient (right).

The error estimates are useful for the assimilation of data in weather forecast systems

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