Design, performance, and analysis of a measurement of optical properties of Antarctic ice below 400 nm

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What is this contribution about?

- For the future IceCube detector extensions several new optical modules are being developed
- One new module, the Wavelength-shifting Optical Module (WOM) uses wavelength shifting technology to extend the wavelength sensitivity into the deep UV
- To understand the improvements of UV sensitive optical modules the optical properties of the Antarctic ice in this wavelength range have to be measured
- In this work the measurement and data analysis plan of a newly developed in-situ calibration device will be presented

Why is it relevant / interesting?

- Current calibrations ranges from the visible down to 330 nm
- For future detectors in the Antarctic ice it is very relevant to know, if light in the UV-range behaves as expected

What has been done?

- The UV Calibration device (see ICRC 2019) was improved with additional brighter light sources at 245 nm, 278 nm, 310 nm and 370 nm
- With the improved calibration device in total 4 days of in-situ measurement were taken in the SPICEcore hole at 4 depths (3 in the IceCube depth range)
- A simulation was written to model the experiment and the results compared with a binned maximum likelihood to the experimental data
- For each wavelength a 2D scan was performed in order to retrieve an absorption and scattering coefficient with a reasonable confidence interval

What is the result?

- Several 2D grids could be simulated and a minimum could be found for some measurements
- Several issues occurred during the analysis, which have to be resolved in a future analysis:
  - The confidence intervals around the minima are not overlapping for different channels of the same measurement, so no combined result can be found
  - Some confidence intervals are spanning over one order of magnitude
  - By using a restricted time window an attempt was made to decouple the absorption from the scattering, which did not yet work