The Wavelength-shifting optical module for the IceCube upgrade

IceCube Collaboration (John Rack-Helleis, Anna Pollmann, Martin Rongen), ICRC 2021

What is this contribution about?

- Discussion of the Status of a novel photosensor - The Wavelength-shifting Optical Module (WOM) for IceCube Upgrade planned for the 2022/2023 south pole season.
- Results from measurement and simulation on the sensitivity and noise characteristics of the sensor.
- First draft of the complete assembly for deployment.

Why is it relevant / interesting?

- WOM offers a low cost low noise option to the challenge of instrumenting large volumes with single photon detectors.
- Inherent UV sensitivity makes it especially attractive for Cherenkov based detectors.
- Reduced average noise also improves the sensitivity to supernova neutrinos, which are not individually resolvable but result in a small temporal rate increase over the noise expectation, rendering the WOM an attractive module for supernova physics.

What has been done?

- Production and characterization the main components of the WOM using Measurements and a raytracing simulation.
- Design of harness and pressure housing based on experience with deployment in IceCube

What is the result?

- WOM concept has been developed for the IceCube Upgrade.
- The characteristics of the module in Terms of Effective Area, Timing and Wavelength dependent sensitivity have been investigated in measurement and simulation and are well understood.
- Effective area of the WOM for the planned filling material is approximately 19 cm^2 and the module is sensitive between 280 nm and 400 nm.
- PMTs dominate the noise of the module, other contributions are in the scope of 100 Hz.

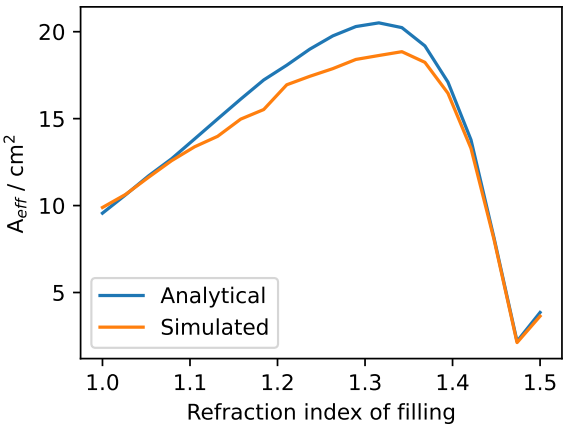

Figure 1: Effective area of the WOM as a function of the refraction index n of the filling material.

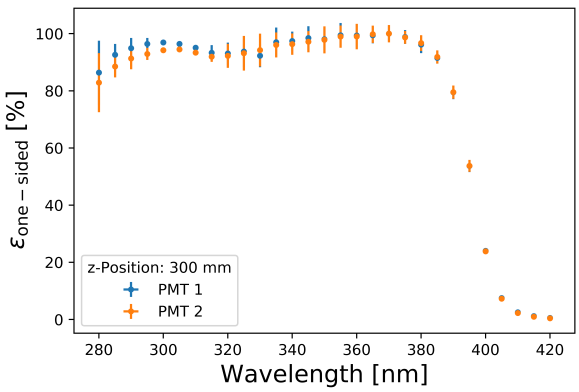

Figure 2: Quantum efficiency of the WOM as a function if the incident lights wavelength.