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Acoustic Calibration for the KM3NeT Pre-Production Module

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The design of the KM3NeT neutrino telescope is based on flexible structures - the detection units. The highly dynamic environment in the deep sea necessitates a continuous monitoring of their exact position.

A common way to perform this is the use of acoustic emitters and receivers based on the piezoelectric effect. The receivers are attached to detection units whereas the emitters are located at fixed positions on the sea floor. Either commercial or custom-built devices are able to withstand the high ambient pressure in the deep sea while still sensitive to small pressure variations, e.g. caused by acoustic signals. With this system it is possible to determine the position of the detection unit with respect to the emitter on a centimetre scale, corresponding to a nanosecond precision for an optical device.

The KM3NeT Pre-Production Module (PPM) is a test system to verify the correct operation and interoperability of the major involved hardware and software components. The proposed solution presented here is the use of a small piezoelectric element equipped with preamplifiers inside the optical module in the same housing as the optical sensors. This custom-built solution also holds the possibility to extend the application area from only positioning to additional tasks like acoustic particle detection or monitoring of the barely known deep-sea acoustic environment.

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