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## Improving long-term stability and $1/f$ amplitude noise using pilot-tone compensation technique in Beam Position Monitors

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In this contribution, we describe the advantages of the pilot tone compensation technique that we have implemented in a new BPM system for Elettra 2.0. The injection of a fixed reference tone upstream of the cables allows for a continuous calibration of the system, compensating for the different behaviour of each channel due to thermal drifts, variations in cable characteristics, mismatches and components tolerances. Moreover, this approach also reduces the  $1/f$  amplitude noise introduced by the ADCs. Our results show a dramatic improvement over calculated positions, both in terms of long-term stability (slow data with low bandwidth), and noise performance on fast data (10 kHz to 1 MHz data rate), reaching sub-micrometer accuracy over a 24-hour time window, and RMS noise below 100 nm, on a scale factor of 10 mm with 10 kHz data rate.

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