

# First measurements of a prototype Stripline BPM for PETRA IV and comparison with simulation

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We present signal and thermal measurements from the first prototype of a stripline Beam Position Monitor (BPM) intended for the PETRA IV synchrotron ring. The monitor was installed at the PETRA III testbed for evaluation and compared against CST Studio Suite simulation results. Initial measurements revealed unexpected signal oscillations and significant heating (up to 135 °C), which were not reproduced in ideal models. For a smooth beam pipe, the expected power loss based on the wake-loss factor would only be 5 W. Including mechanical details such as flanges and copper gaskets in the simulation revealed cavity-induced resonances, which increased the power loss up to 96 W. The updated model showed good agreement with the measured signals in both time (TD) and frequency domains (FD), as well as with thermal data. Replacing the gasket with a RF-sealing variant lowered the measured temperature to 65 °C. This study highlights that multiple mechanical and electromagnetic factors must be understood and included in simulations to predict beam-induced effects in high-frequency diagnostics.

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