Transfer functions of type-Bpp SAS

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1 Transfer functions of the Type-Bpp SAS

All the measurable transfer functions of the type-Bpp SAS which were measured at the center room of the KAGRA site in the PR3 vacuum are shown in this section. The measured frequency responses are shown in this report in terms of forced transfer functions of the suspension system, from the implemented actuators to the sensors. Following Figures show the Bode plots of the measured transfer functions. The red curves show the predictions by 3 dimensional rigid-body model, while the blue curves and dots denote the measured ones.

Measurement setup

The measurement was done after pumping down. The suspension had 2 unoptimized systems due to some constraints. First, 3 OSEMs were implemented into the TM level instead of 4 OSEMs. This is because one OSEM flag came off from the TM surface in final period of the assembling and there was no mechanics to fix the problem. Also this was because it was possible to control 3 DoFs (longitudinal, pitch and yaw) of the TM by using the 3 OSEMs in principle. Secondly, an aluminum sheet was installed at one of the suspension points of the TM, because one part which touched directly to the piano-wire did not have proper groove on it. Then, the sheet was attached to make enough friction at the suspension point.

The frequency responses of the type-Bpp system were explained by rigid-body vibrations of the suspension bodies in a Cartesian coordinate system. Virtual sensors and actuators were constructed in the digital system with linear combination of the actual sensors and actuators. They measure and excite the rigid-body vibration in certain DoFs. The measurement was conducted by injecting broadband Gaussian noise from a virtual actuator in a certain DoF and taking the excited displacements measured by virtual sensors. The virtual actuators were geometrically diagonalized beforehand. The amplitude and the excitation signal were adjusted so that enough signal to noise ratio was obtained in the whole frequency band but do not excite the mechanical resonances so much, so as to keep the sensors in the linear regimes. The measurements at the TM and IM level were conducted by using OSEMs and the optical lever. The vertical transfer function of the GAS filter was measured by using the LVDTs and the coil-magnet actuators.

LIM excited transfer functions

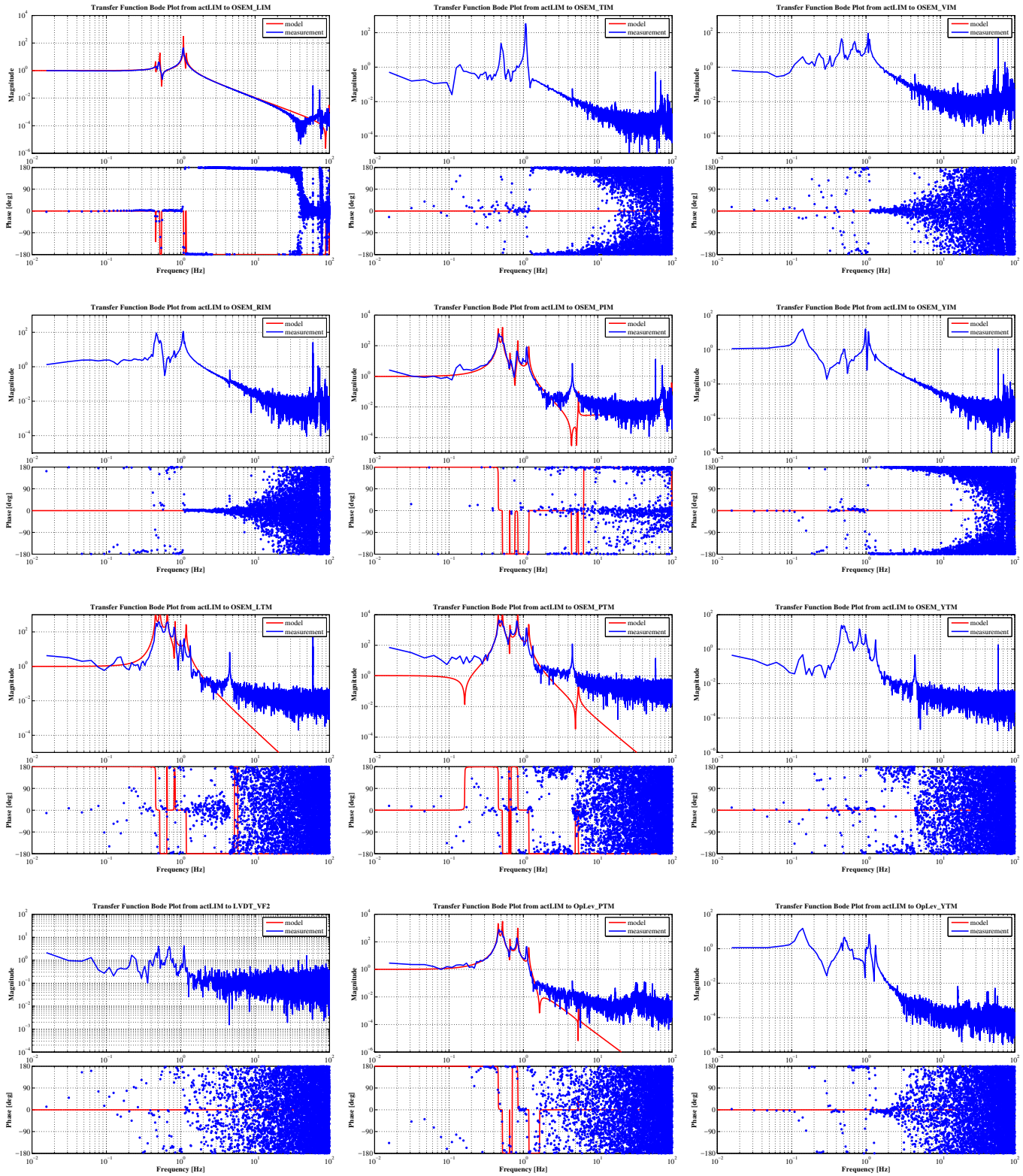

Figure 1.1: LIM-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev

TIM excited transfer functions

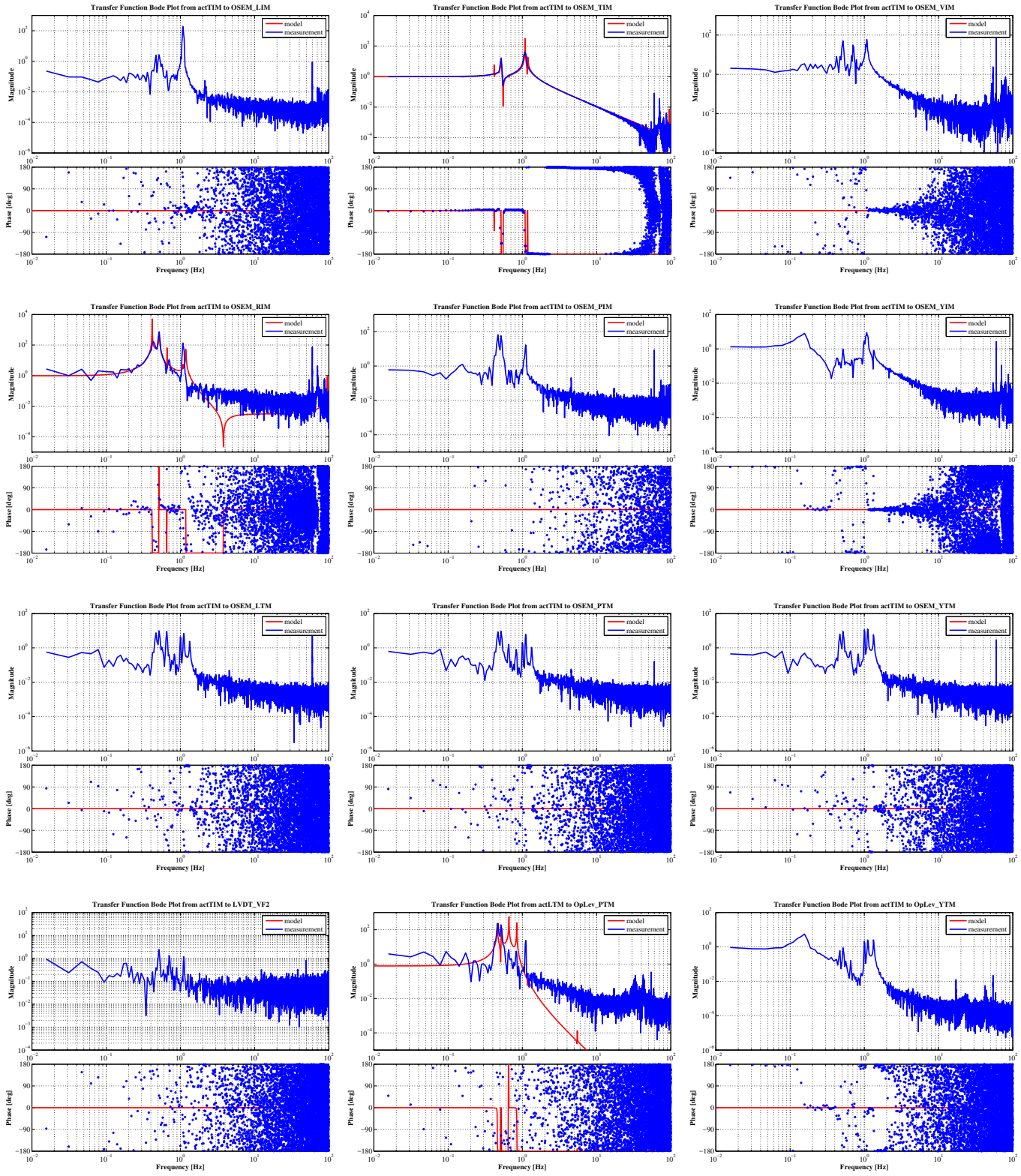

Figure 1.2: TIM-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev

VIM excited transfer functions

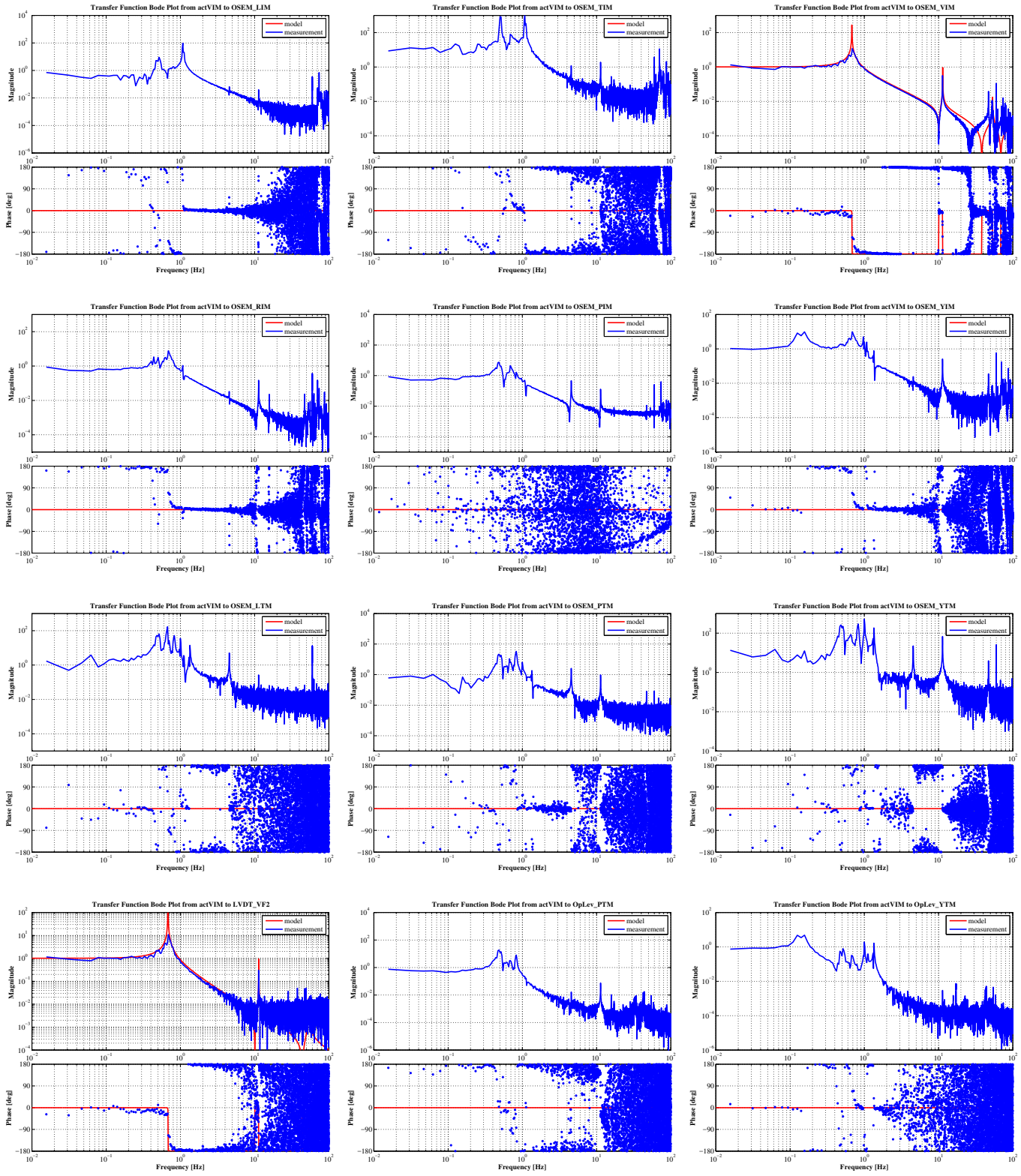

Figure 1.3: VIM-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev

RIM excited transfer functions

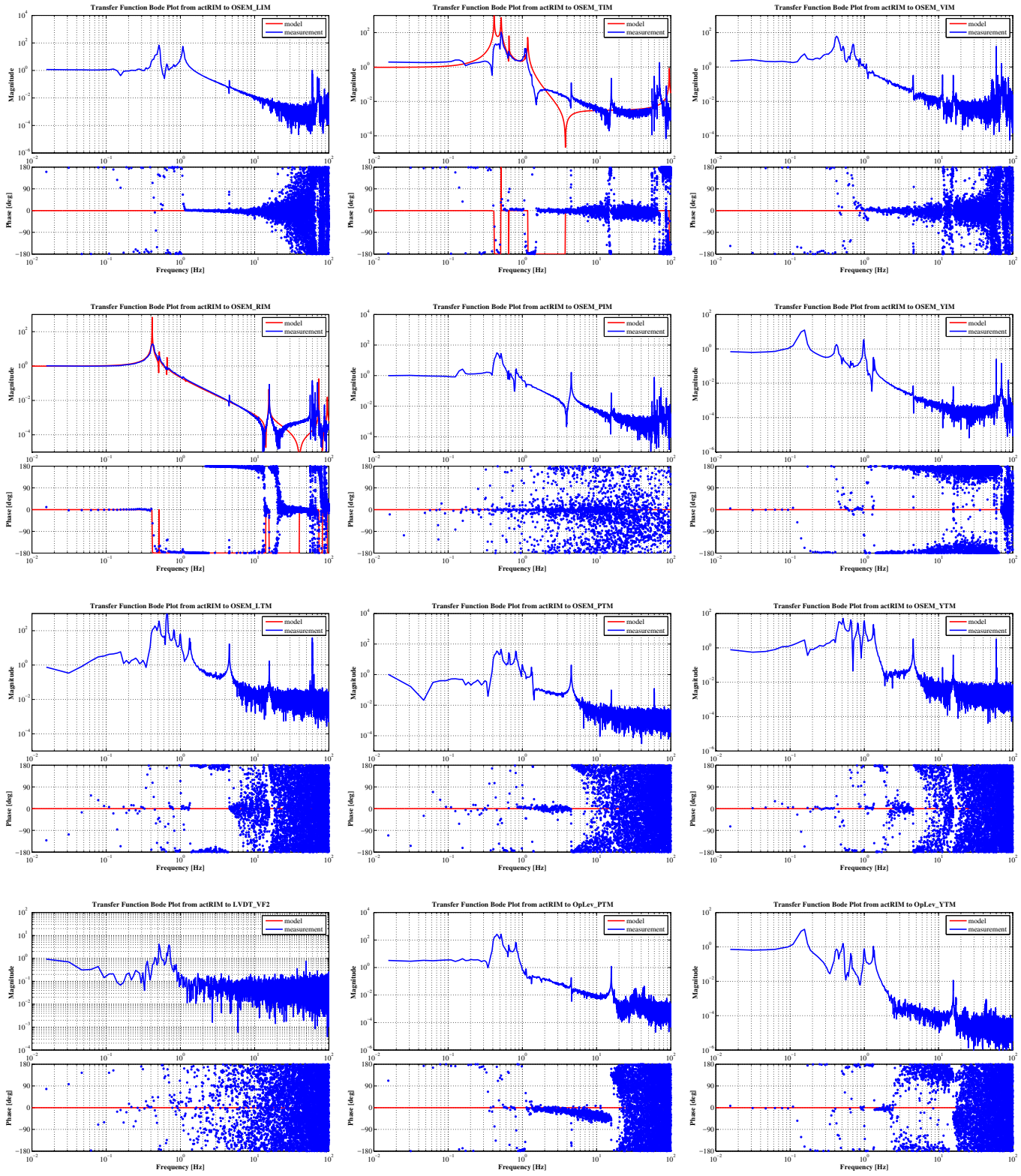

Figure 1.4: RIM-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev

PIM excited transfer functions

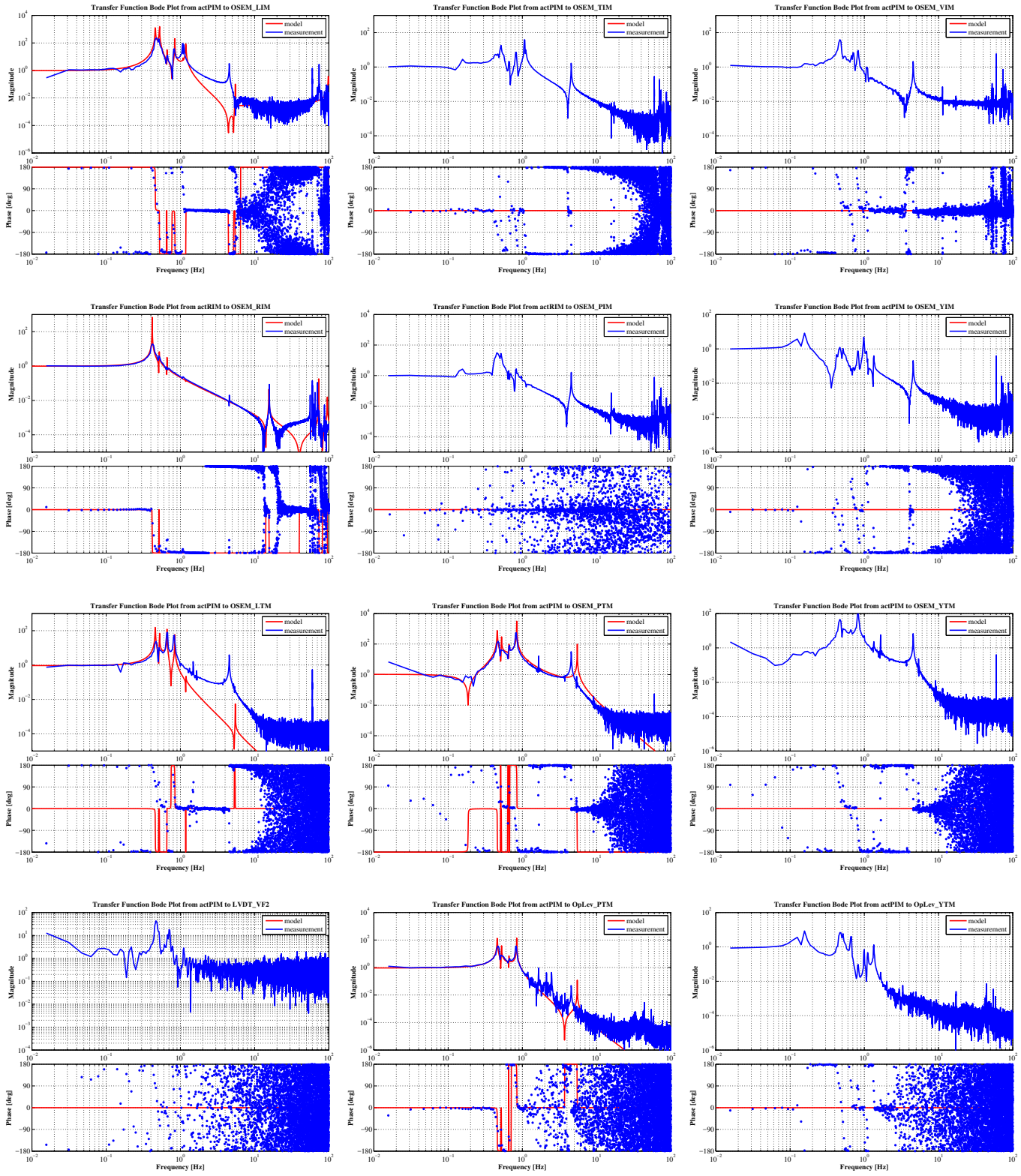

Figure 1.5: PIM-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev

YIM excited transfer functions

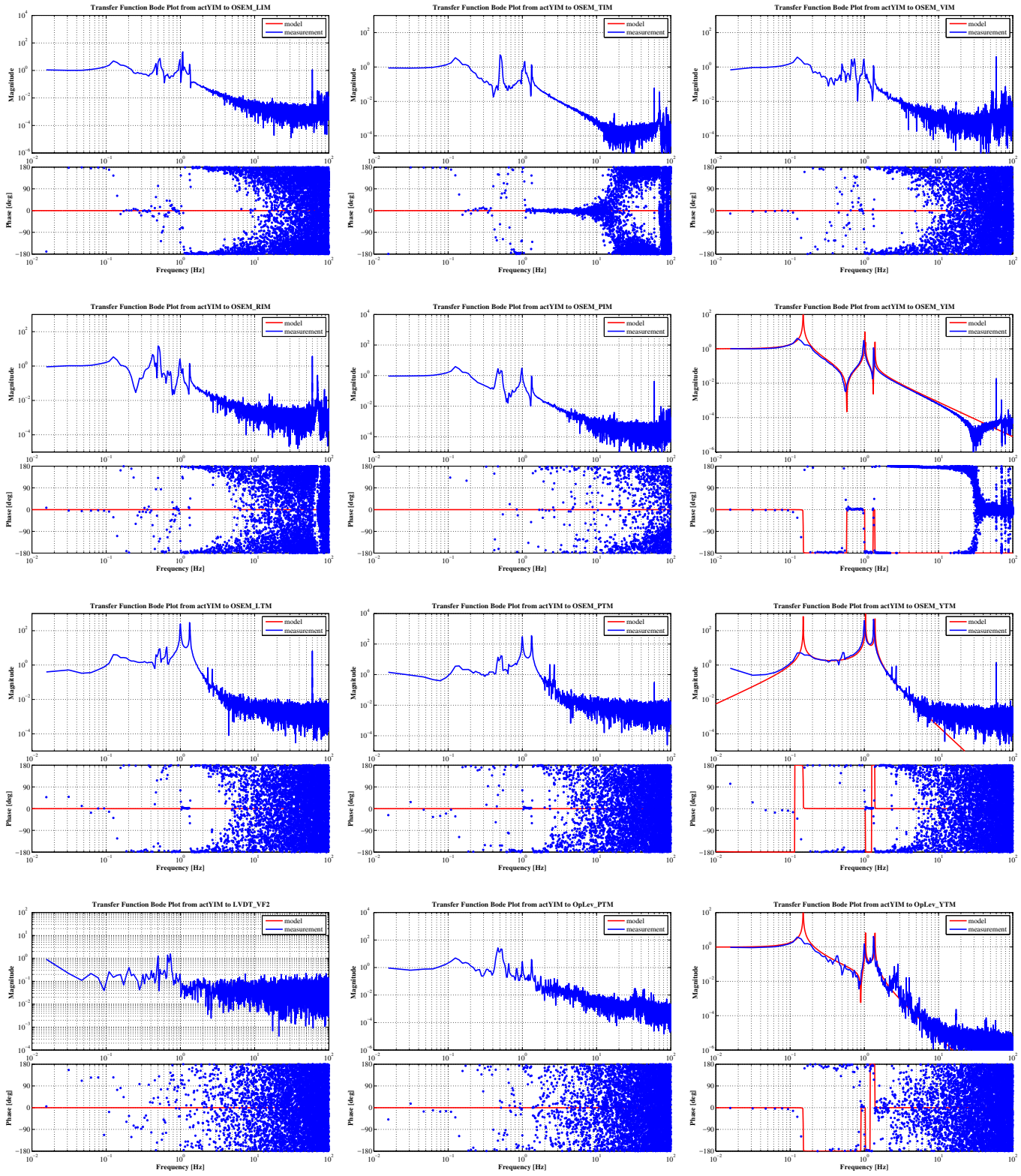

Figure 1.6: YIM-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev

LTM excited transfer functions

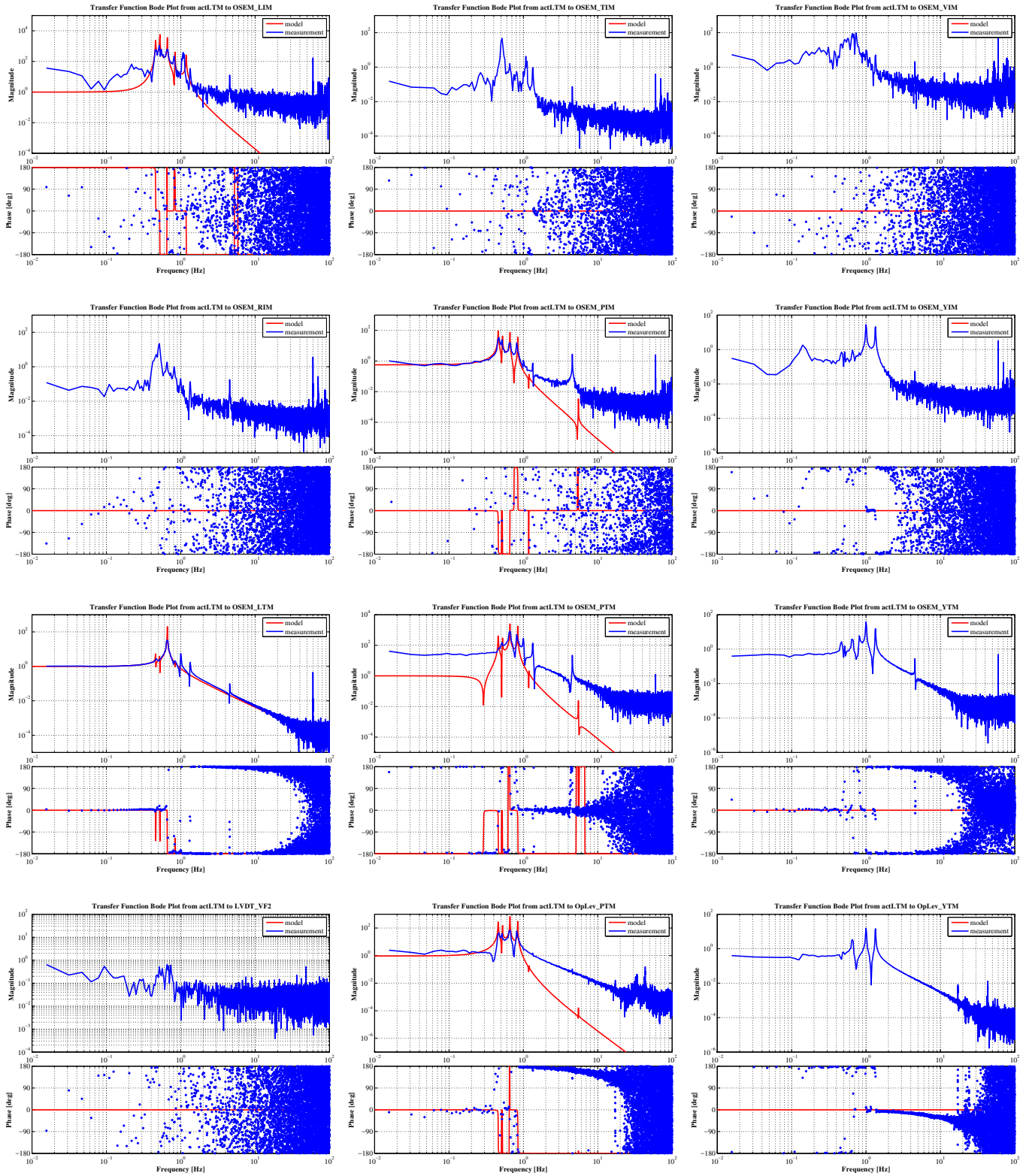

Figure 1.7: LTM-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev

PTM excited transfer functions

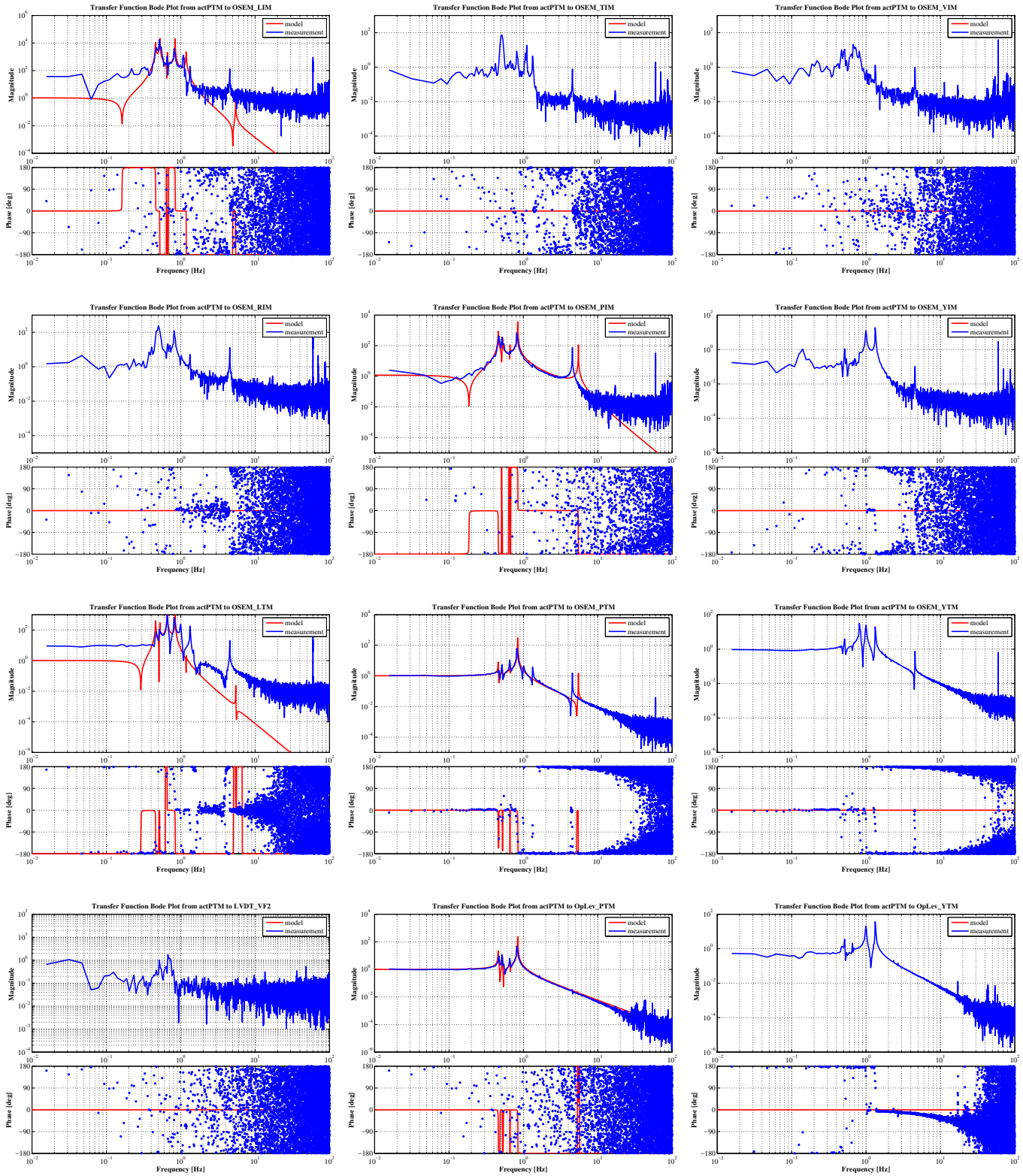

Figure 1.8: PTM-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev

YTM excited transfer functions

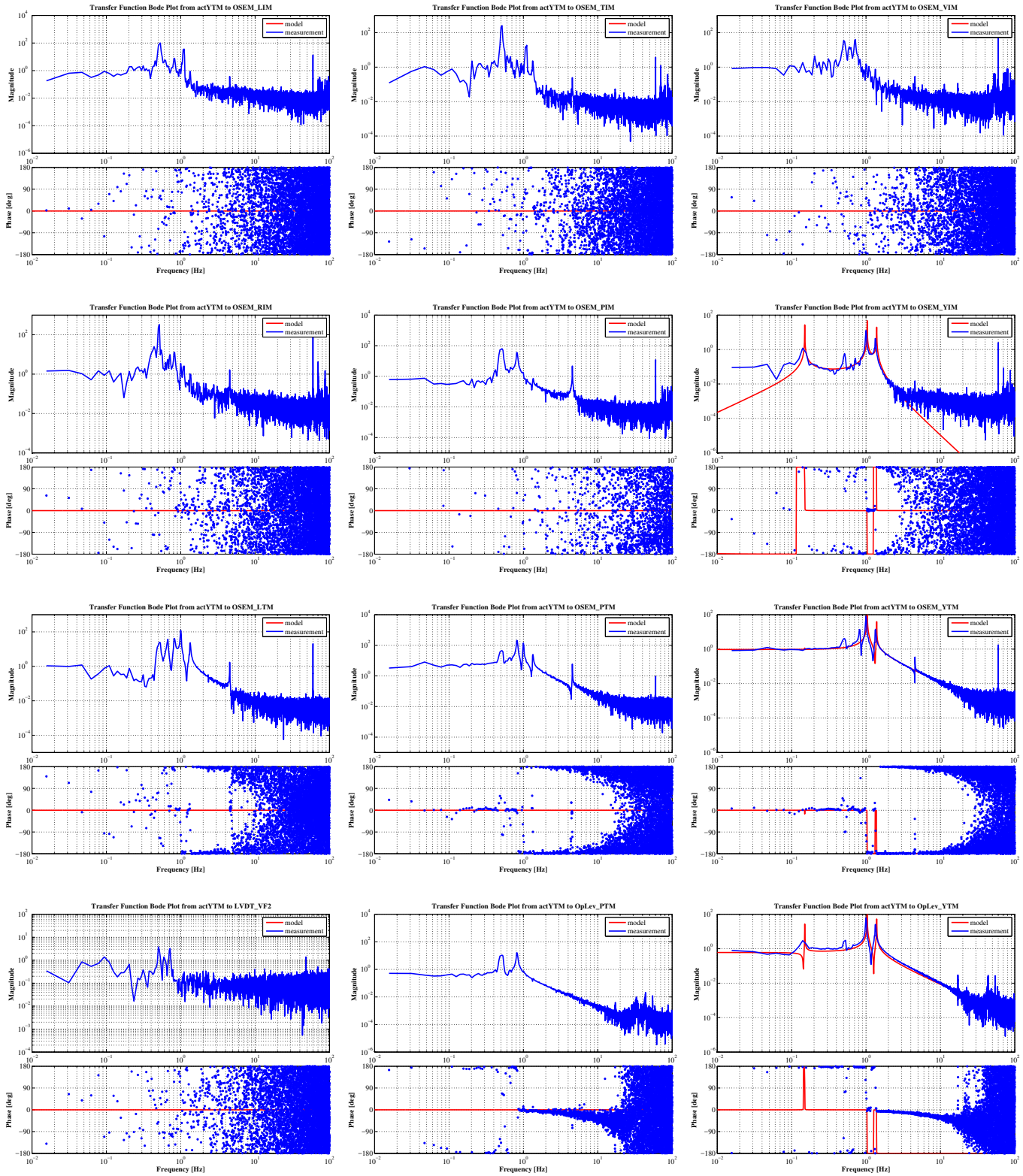

Figure 1.9: YTM-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev

VF2 excited transfer functions

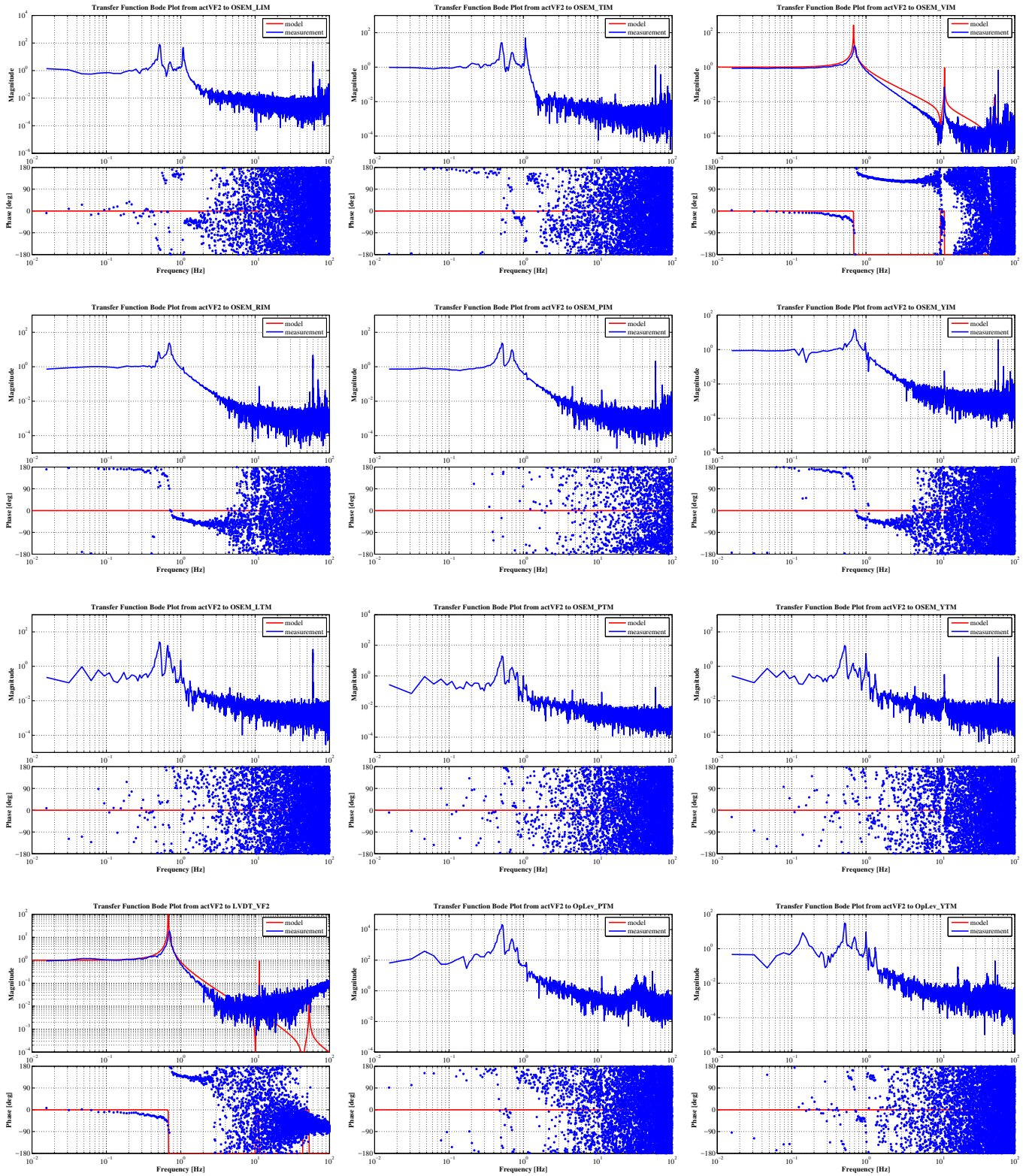

Figure 1.10: VBF-excited transfer functions sensed at: LIM, TIM, VIM; RIM, PIM, YIM; LTM, PTM, YTM; VF2, PTMoplev, YTMoplev