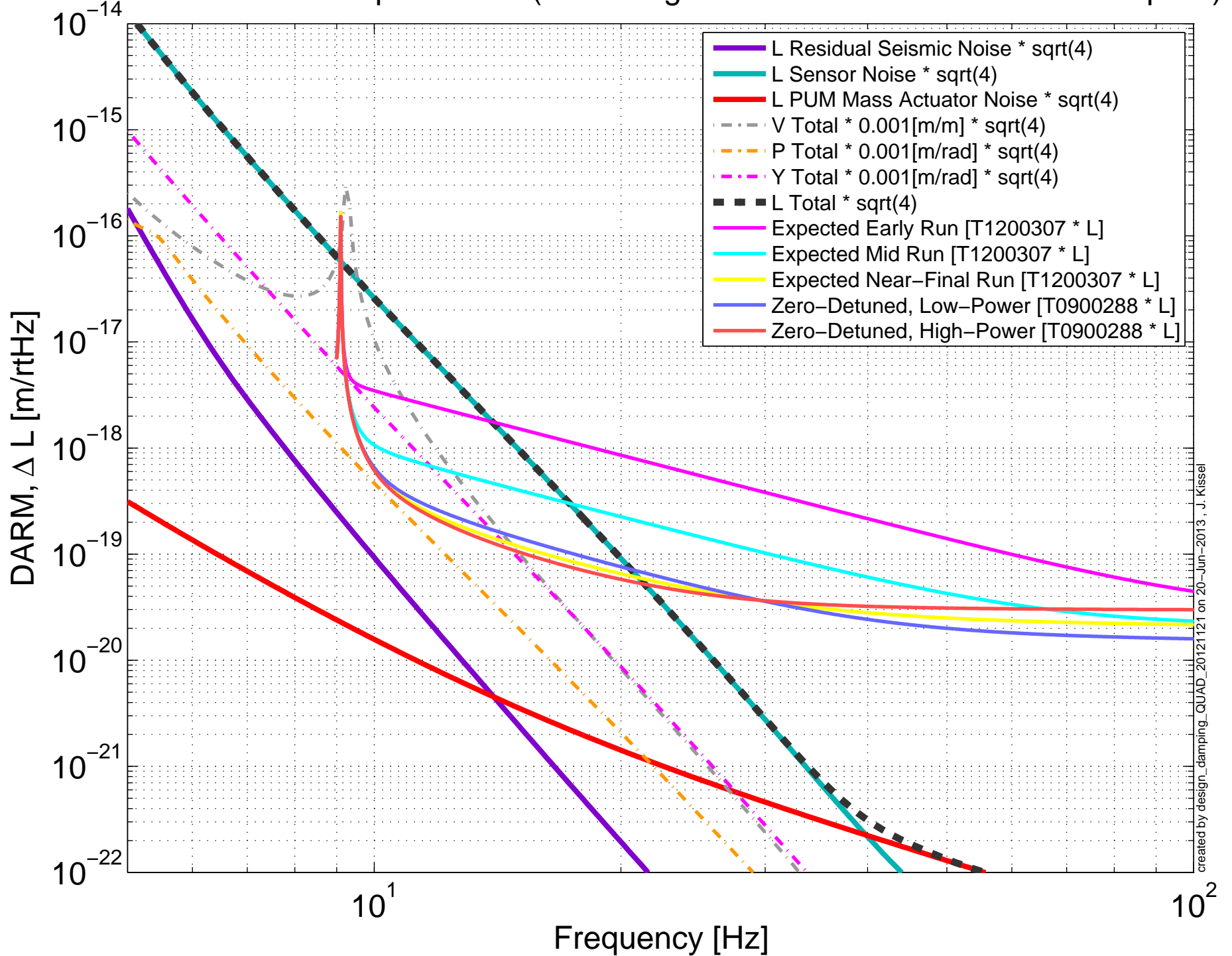


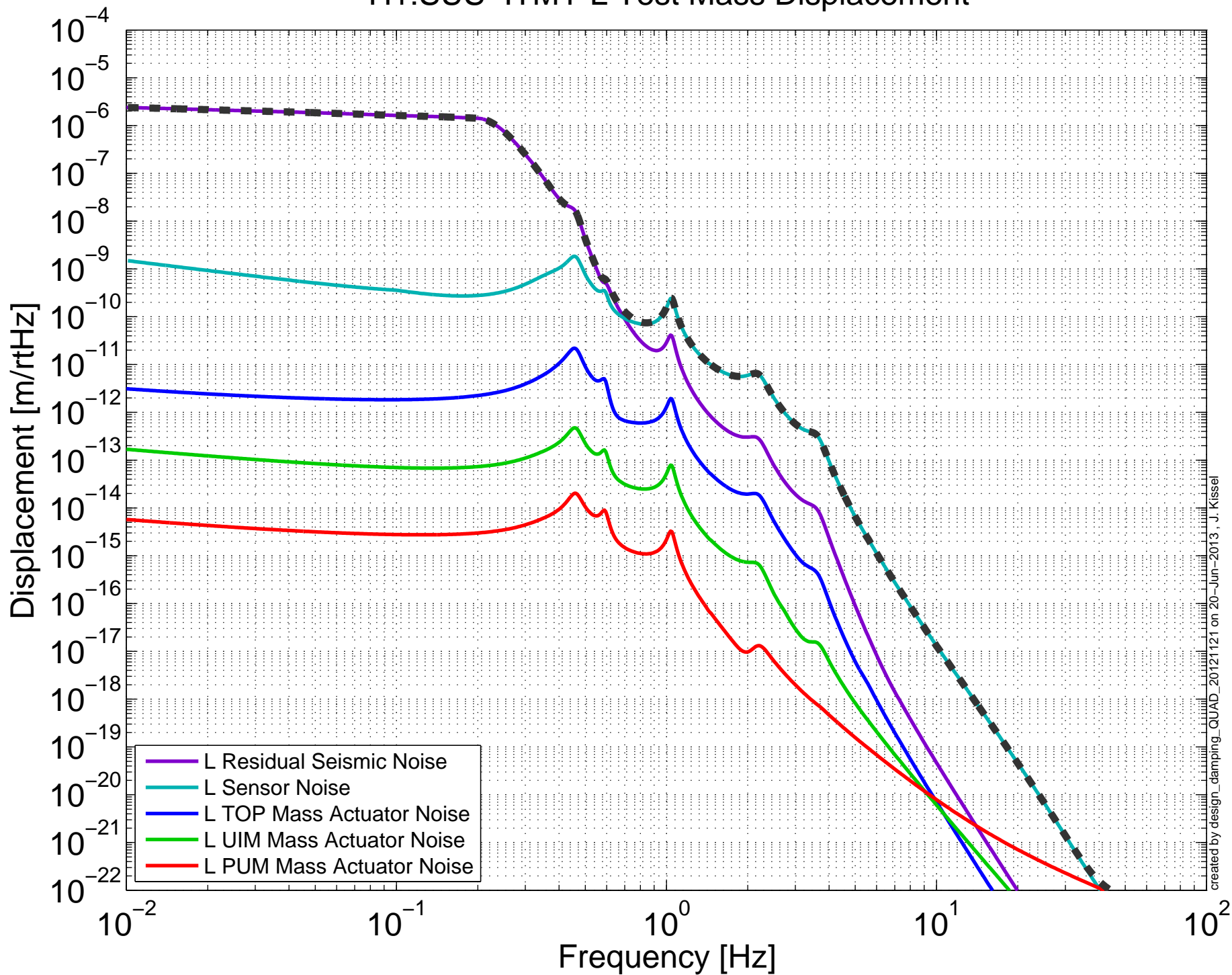
Damping Loop Performance

Differential Arm Displacement (Assuming Identical Performance for all 4 Optics)

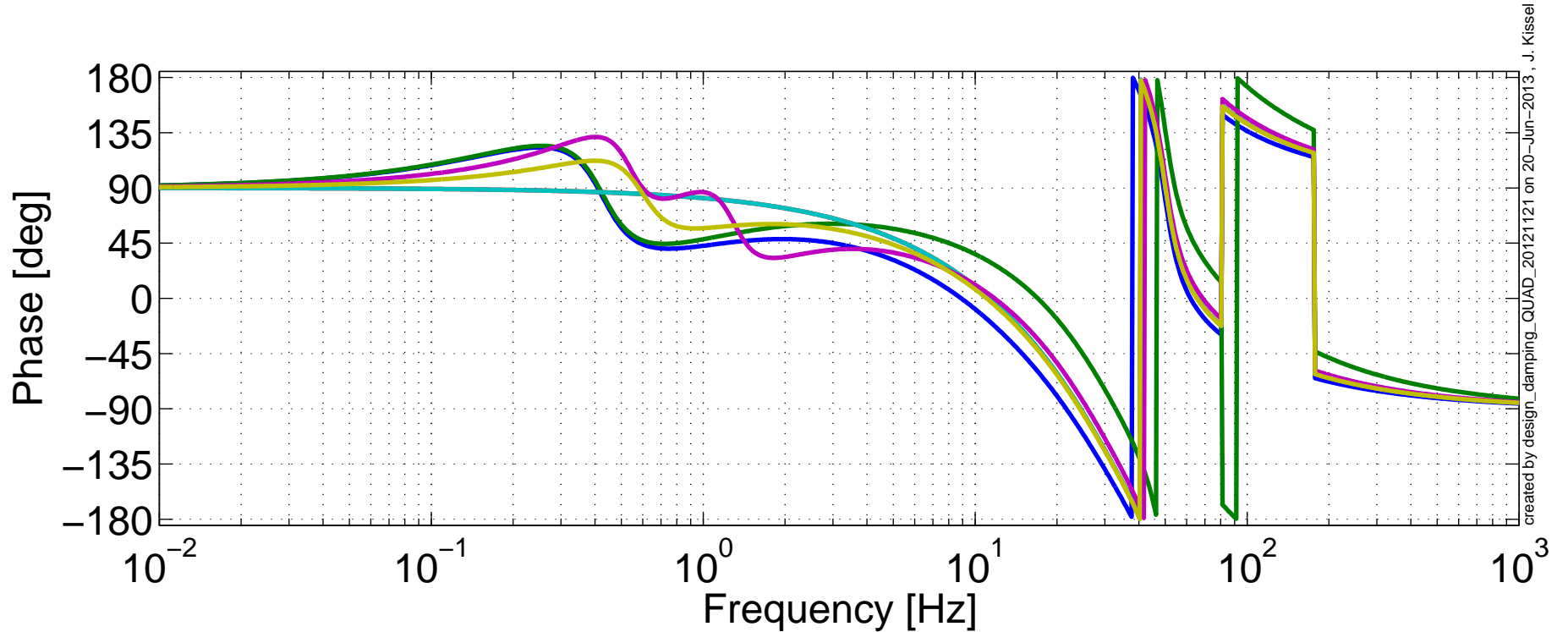
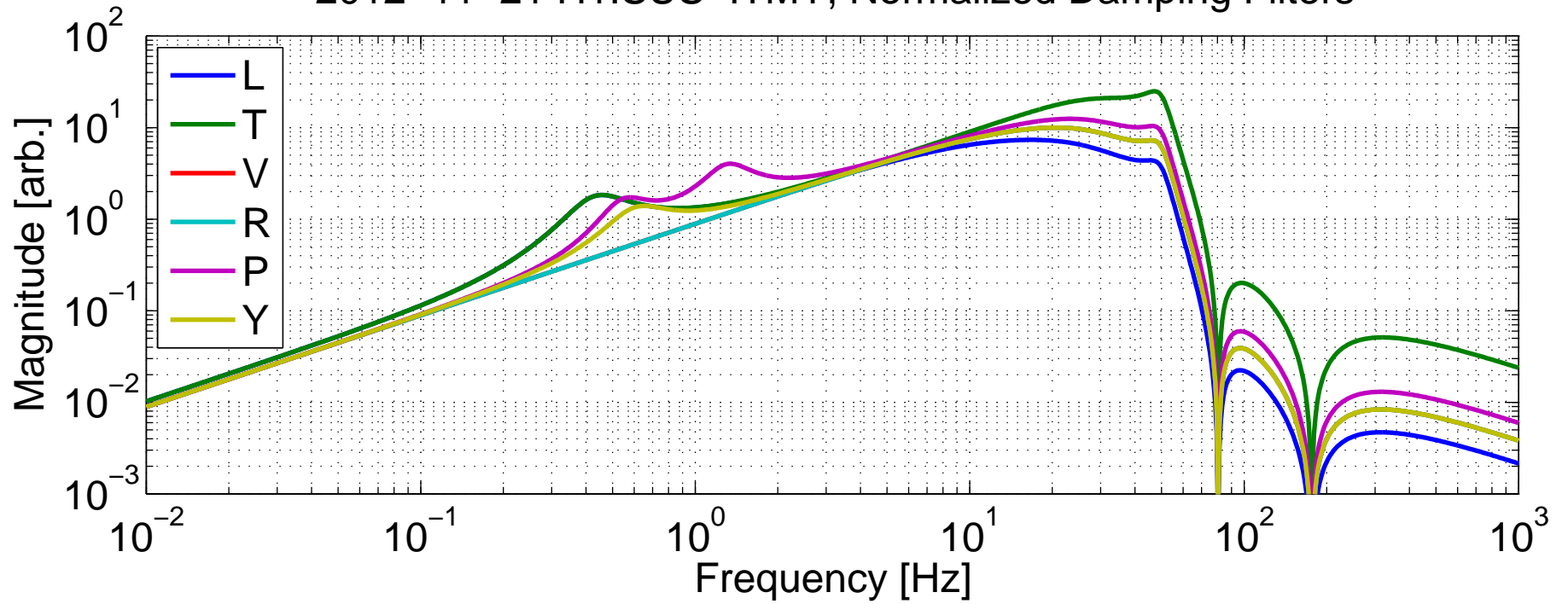


Damping Loop Performance

H1:SUS-ITMY L Test Mass Displacement

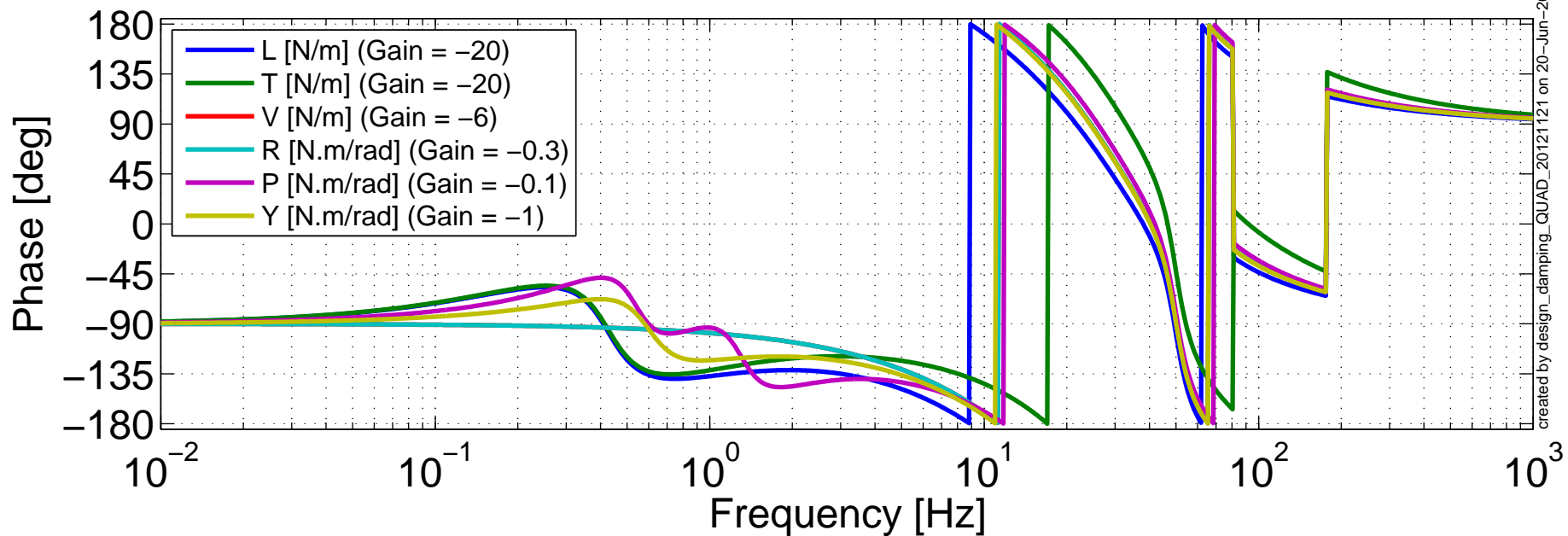
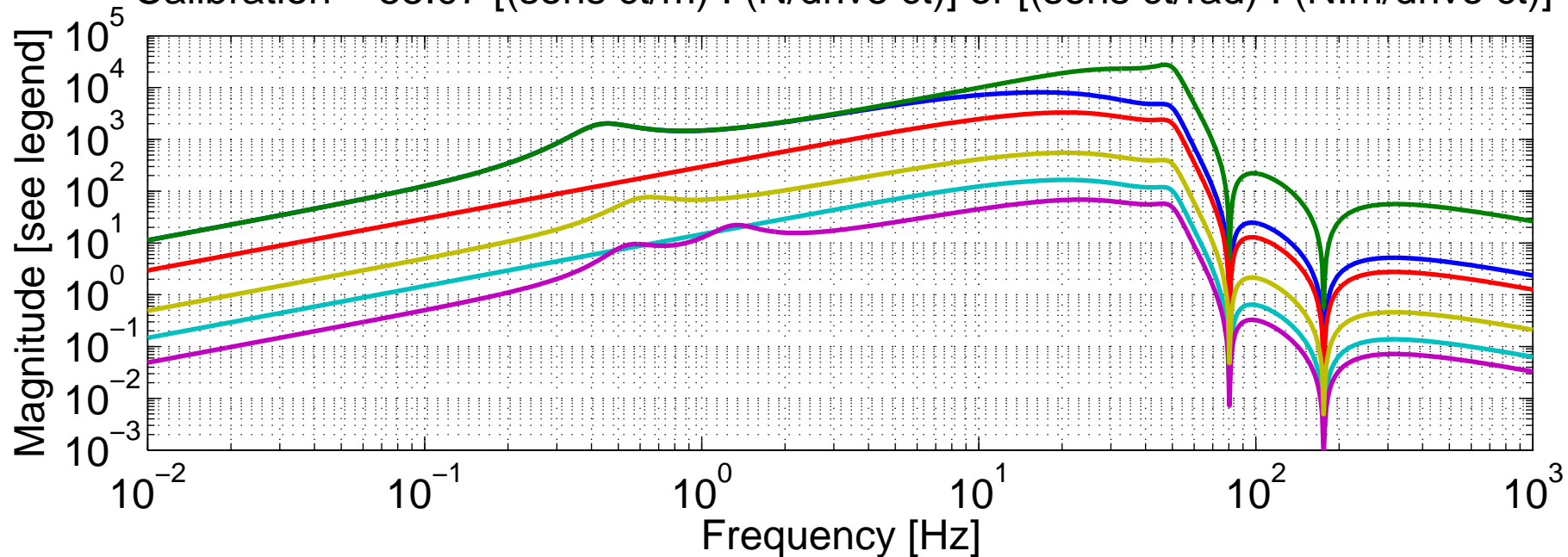


2012-11-21 H1:SUS-ITMY, Normalized Damping Filters

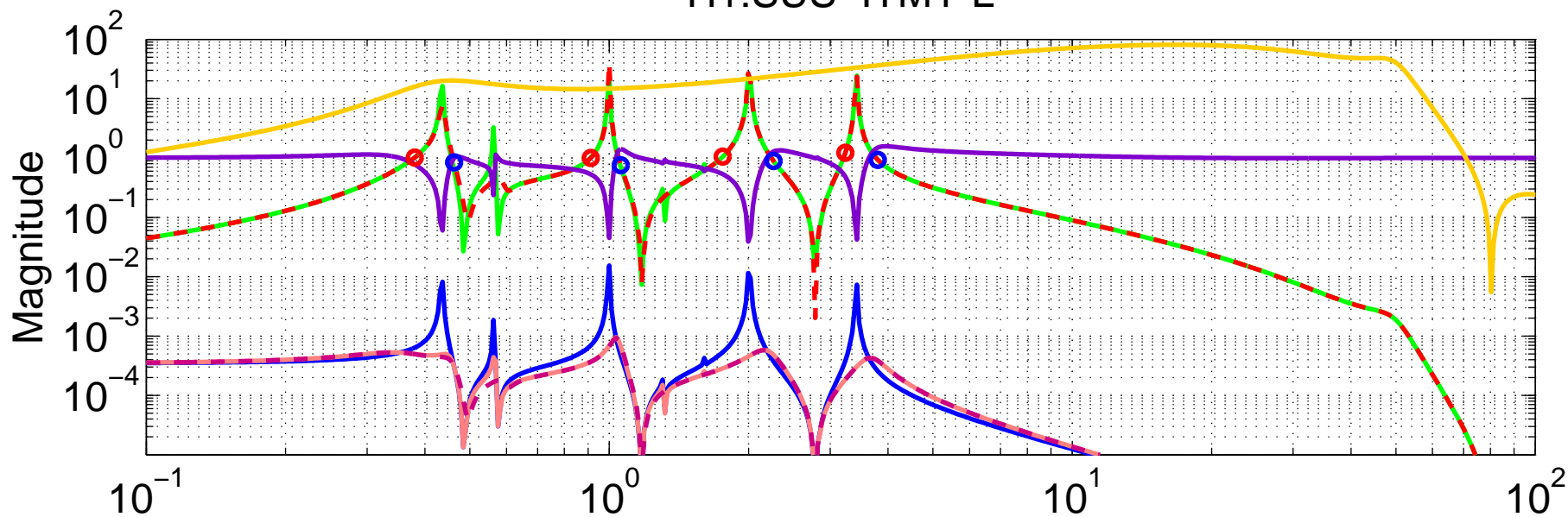


2012-11-21 H1:SUS-ITMY, Calibrated Damping Filters

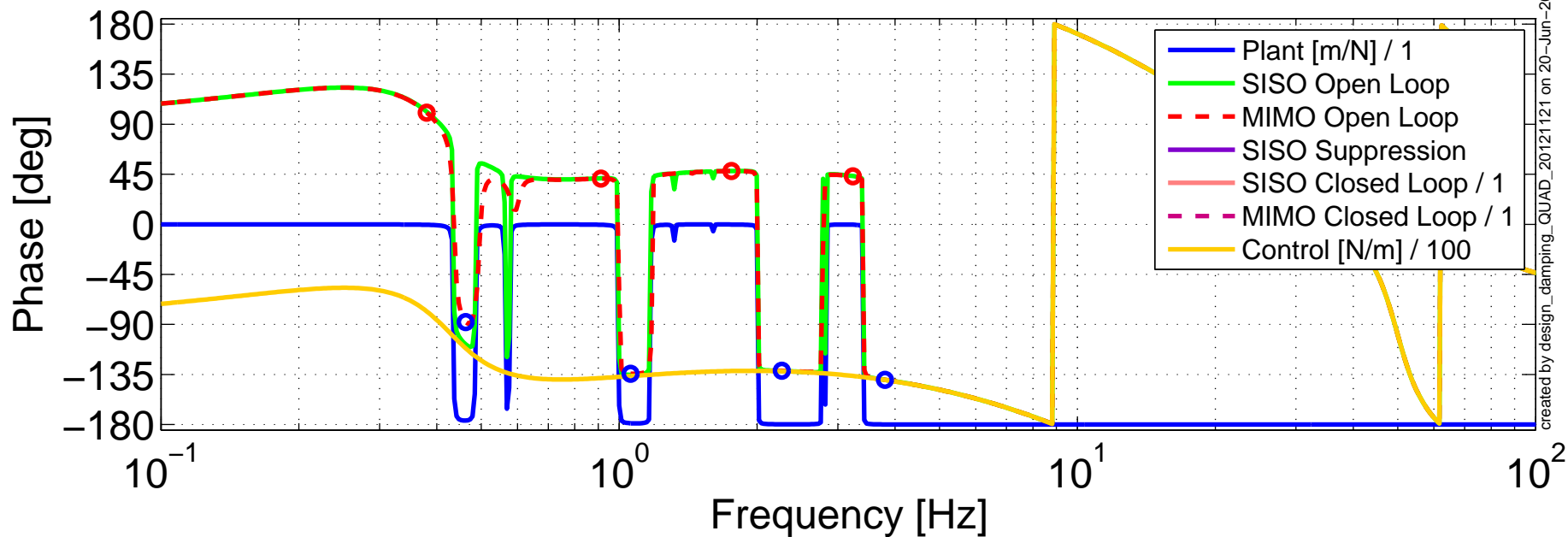
Calibration = 55.07 [(sens ct/m) . (N/drive ct)] or [(sens ct/rad) . (N.m/drive ct)]



Damping Loop Design H1:SUS-ITMY L



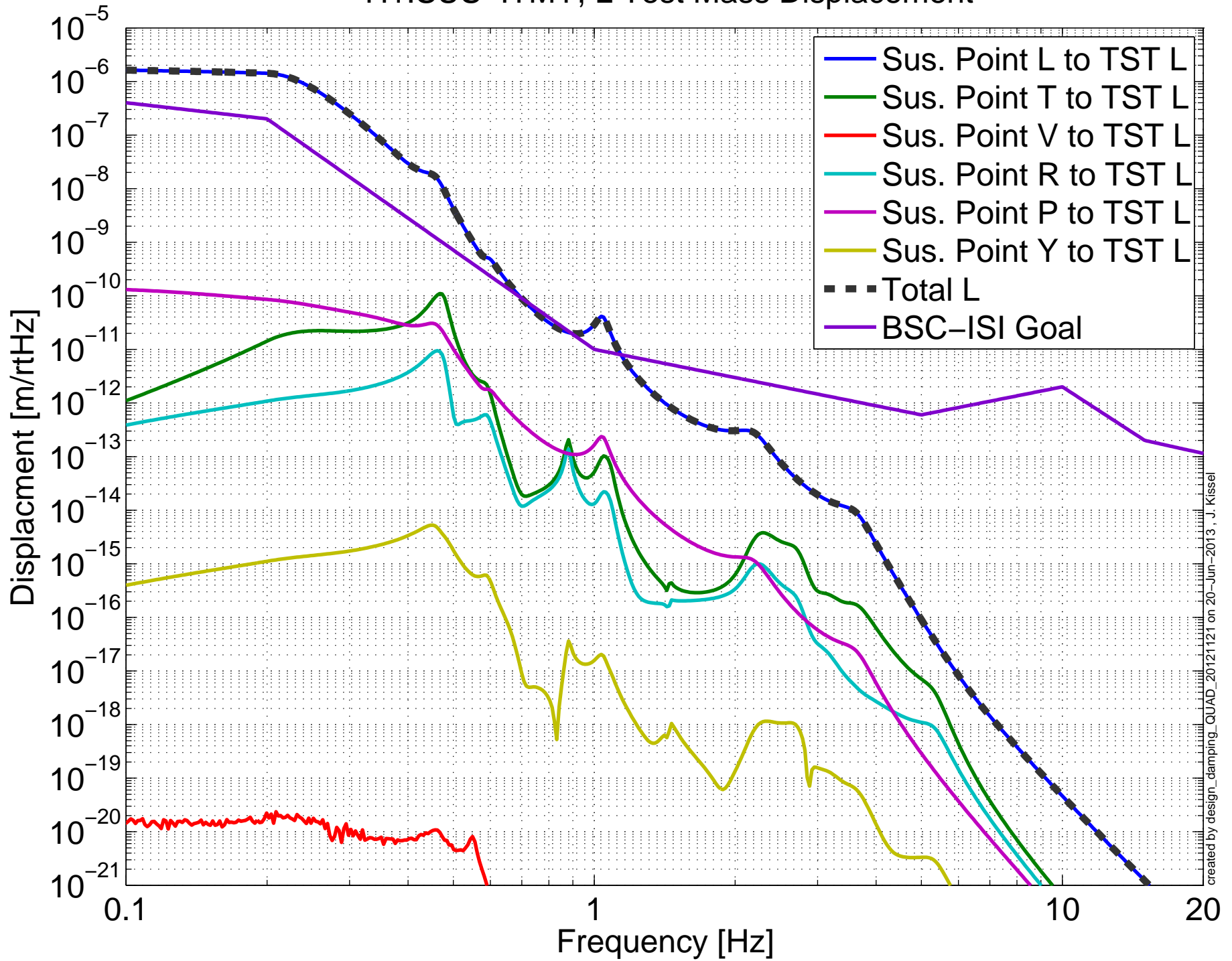
MIMO LUGF Phase Margins (red): [79.6 139 132 137] [deg]
MIMO UUGF Phase Margins (blue): [92.1 45.6 48.3 40.3] [deg]



- Plant [m/N] / 1
- SISO Open Loop
- - - MIMO Open Loop
- SISO Suppression
- SISO Closed Loop / 1
- - - MIMO Closed Loop / 1
- Control [N/m] / 100

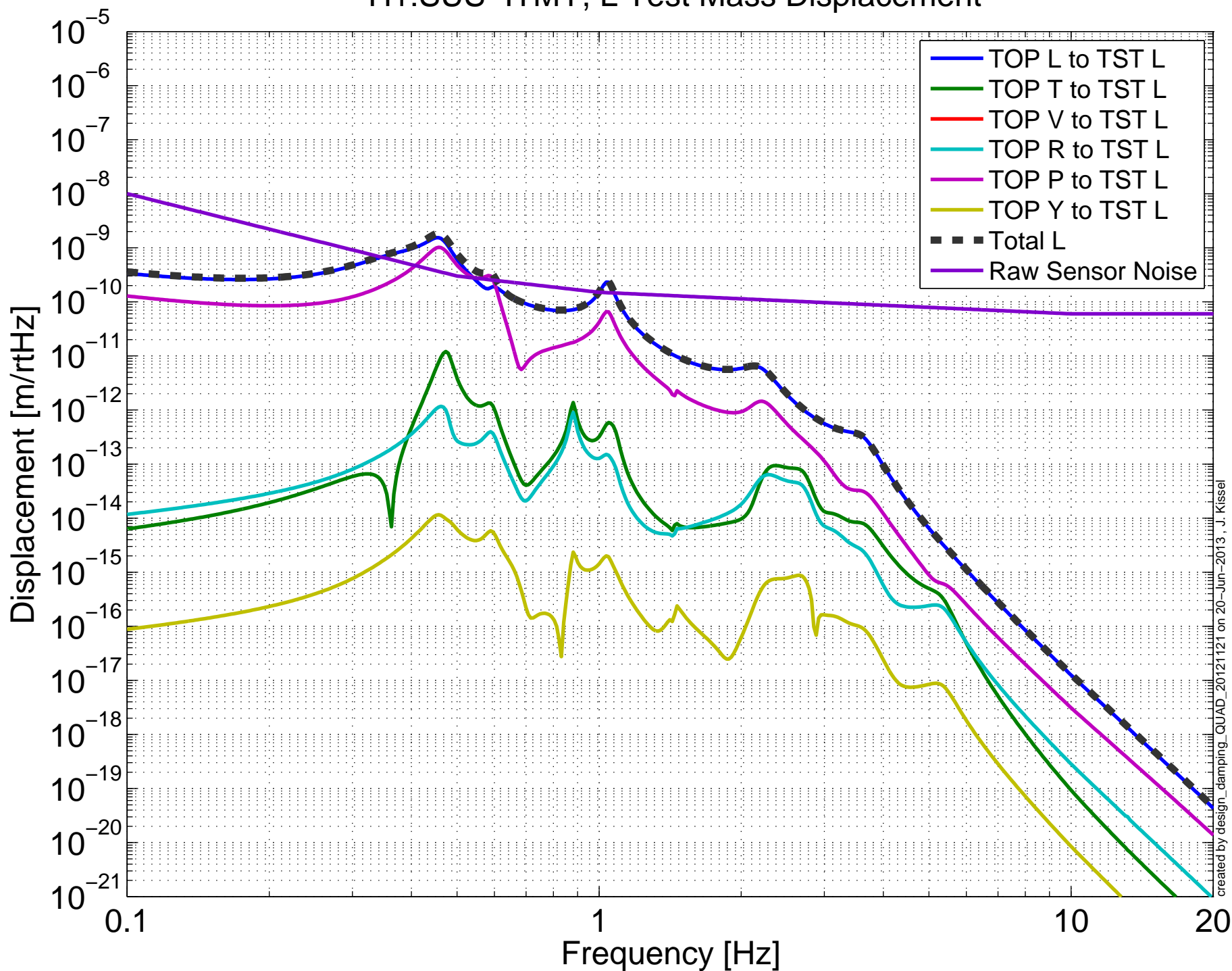
created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

Projected Sus. Point > Test Mass Seismic Noise Budget H1:SUS-ITMY, L Test Mass Displacement

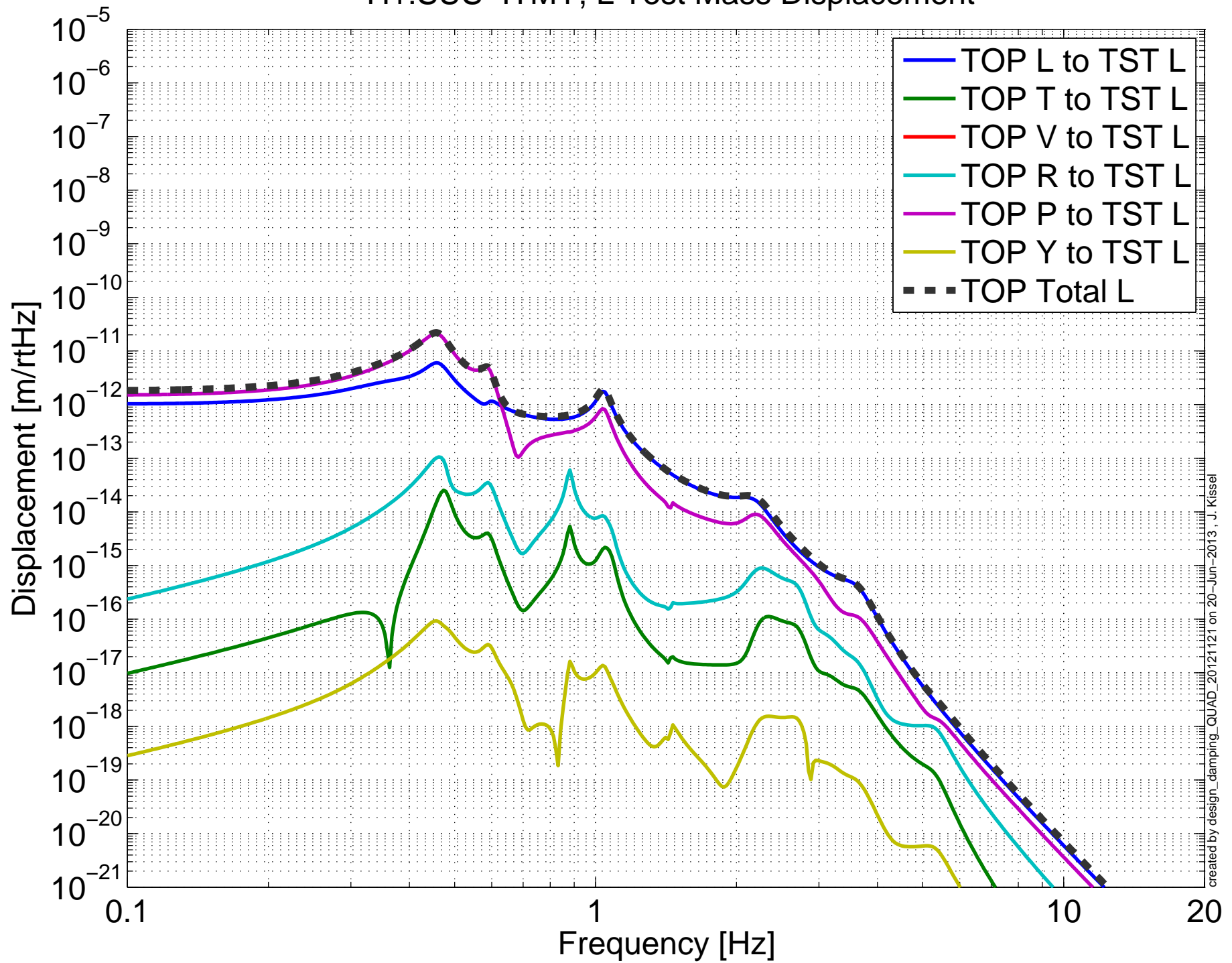


created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

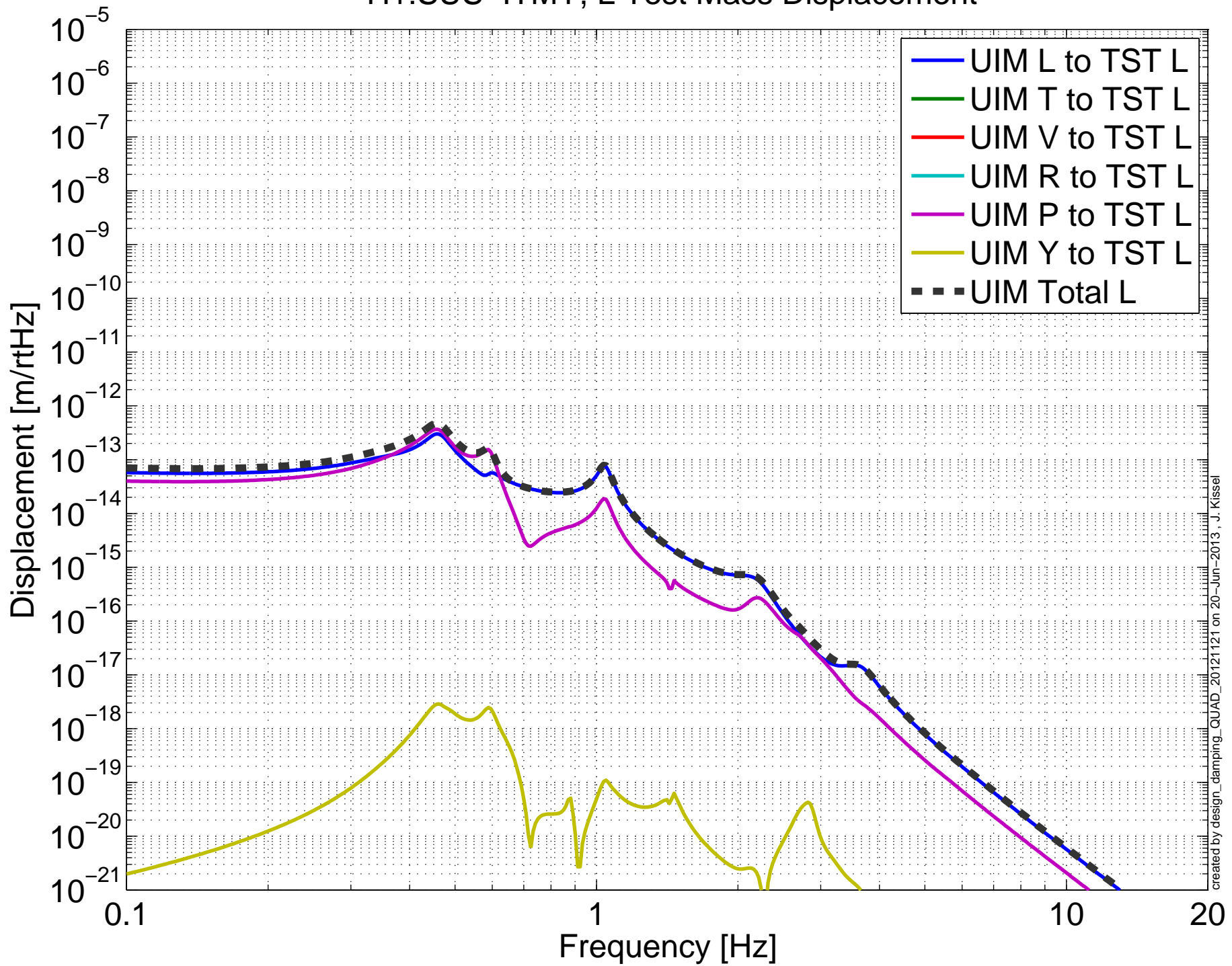
Projected Top Mass Sensor > Test Mass Noise Budget H1:SUS-ITMY, L Test Mass Displacement



Projected Top Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, L Test Mass Displacement

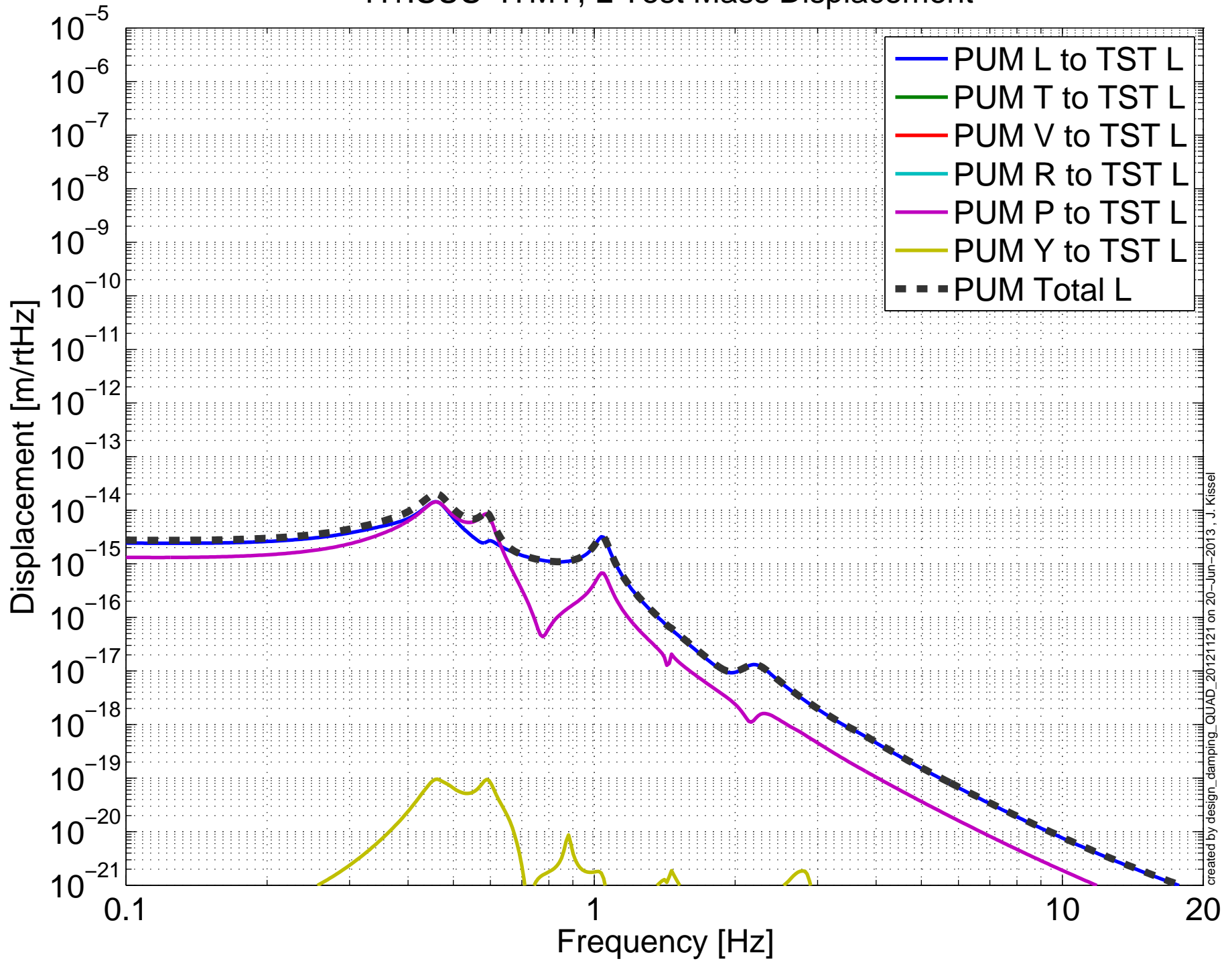


Projected UIM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, L Test Mass Displacement



created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

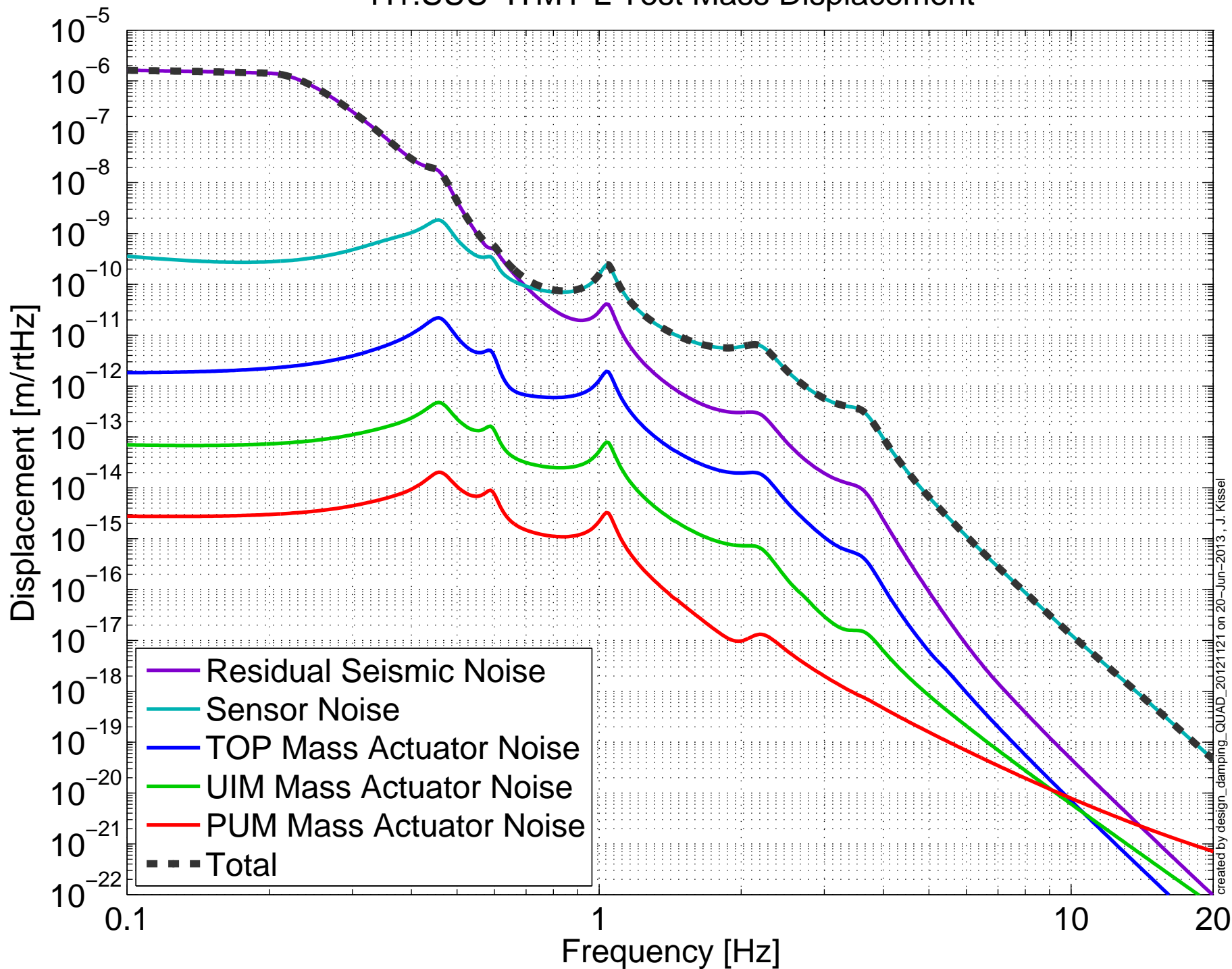
Projected PUM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, L Test Mass Displacement



created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

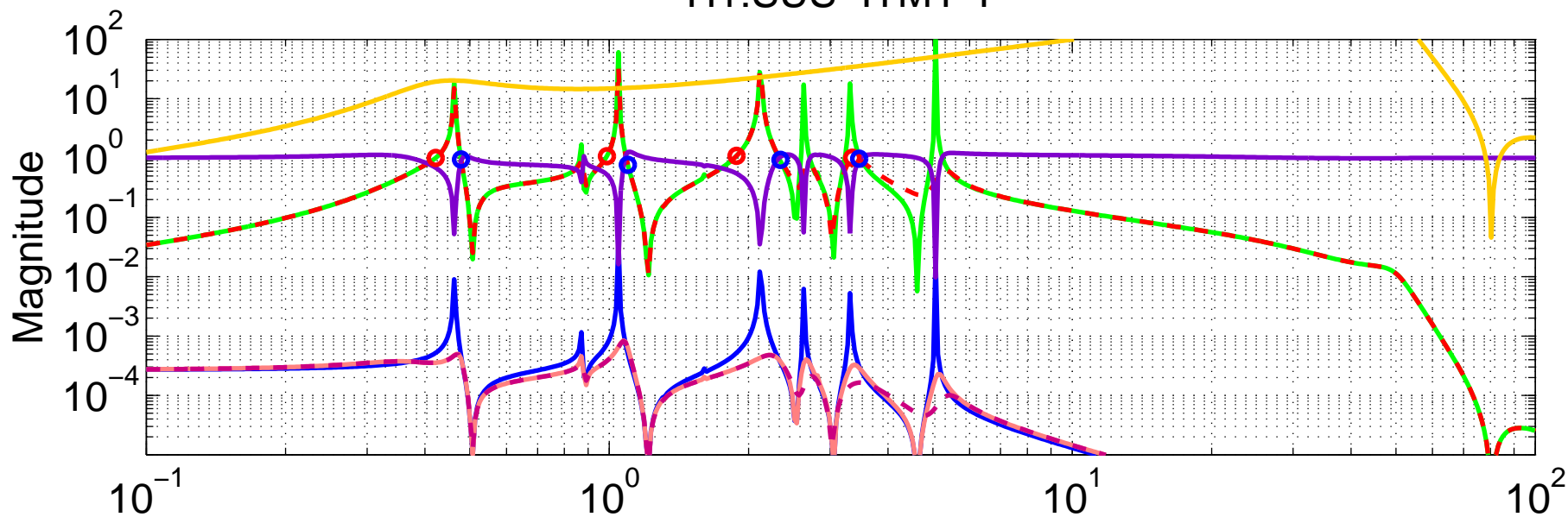
Damping Loop Performance

H1:SUS-ITMY L Test Mass Displacement

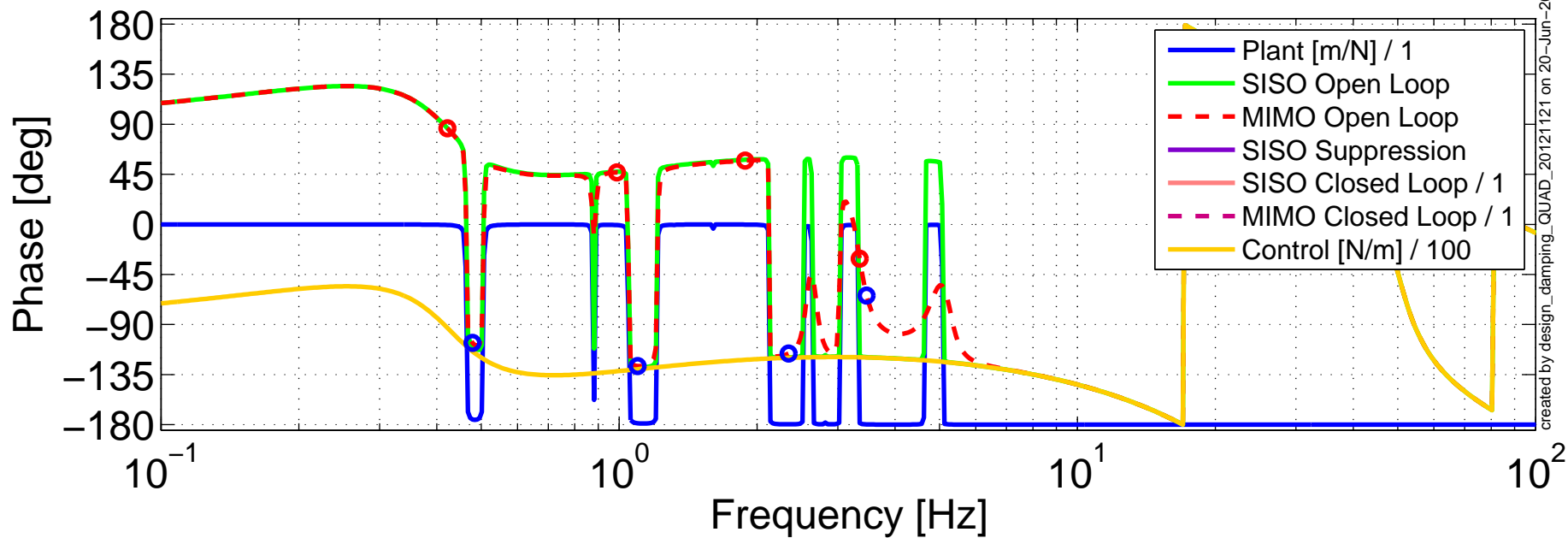


created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

Damping Loop Design H1:SUS-ITMY T

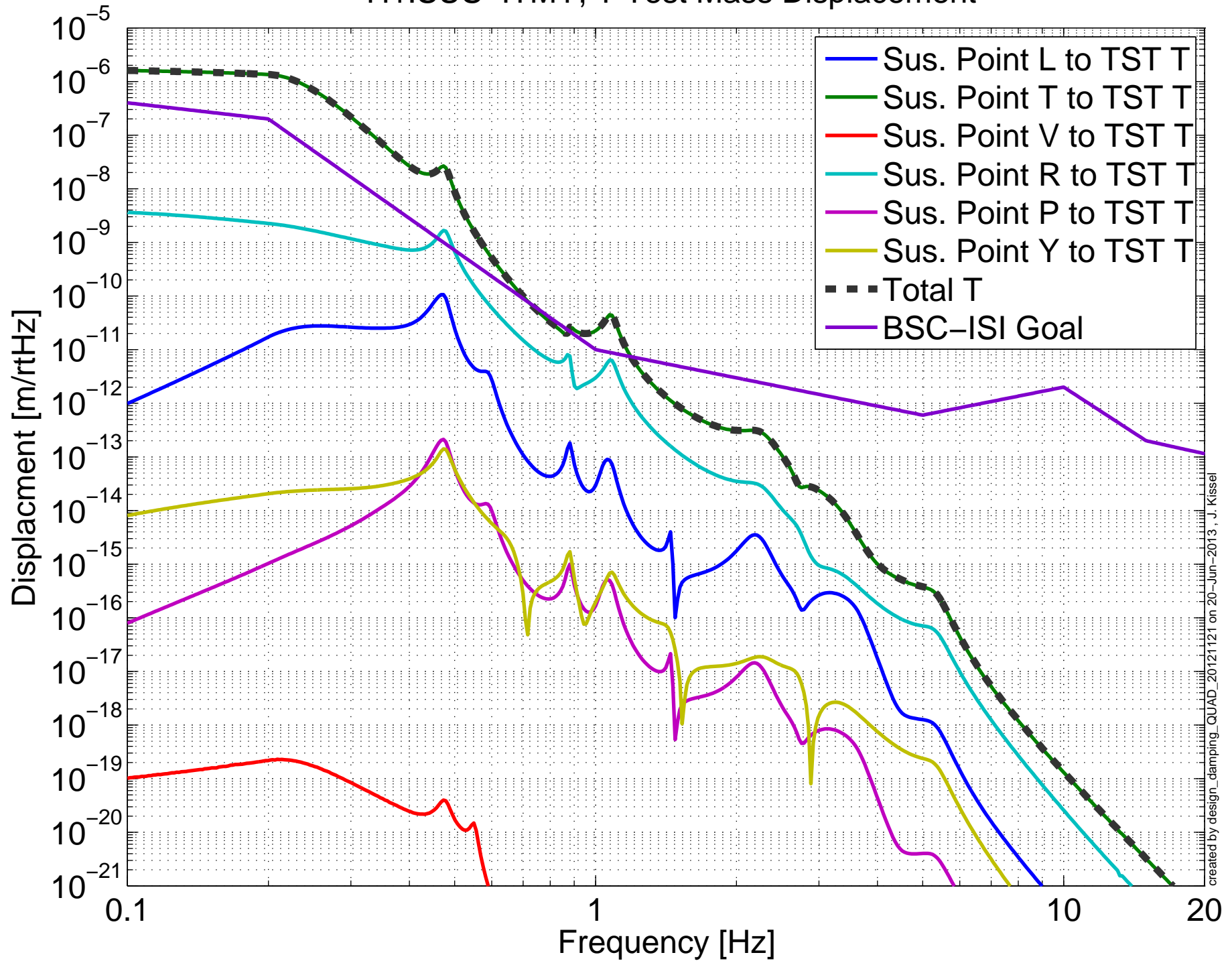


MIMO LUGF Phase Margins (red): [93.7 133 123 211] [deg]
MIMO UUGF Phase Margins (blue): [73.5 52.7 63.9 116] [deg]

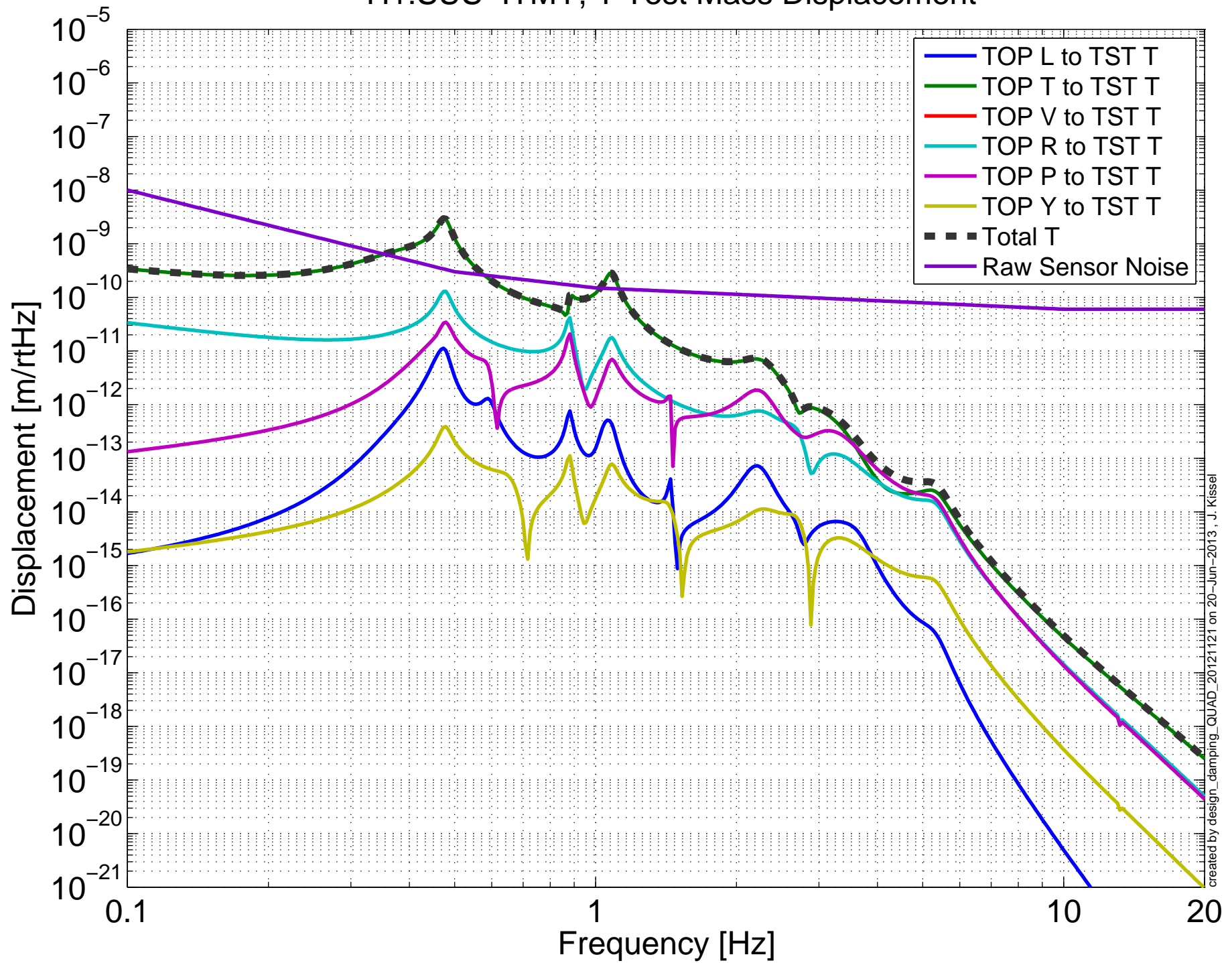


created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

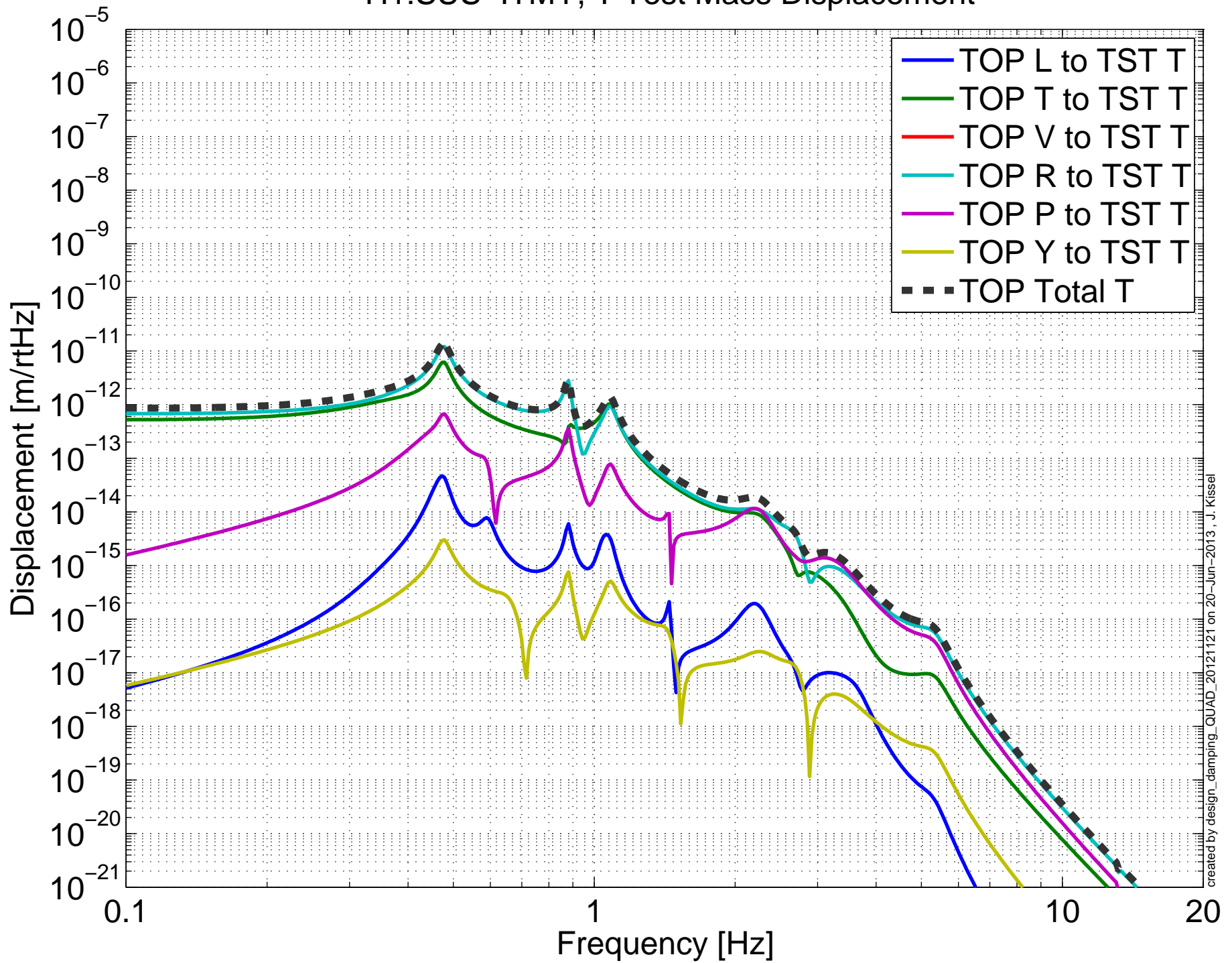
Projected Sus. Point > Test Mass Seismic Noise Budget H1:SUS-ITMY, T Test Mass Displacement



Projected Top Mass Sensor > Test Mass Noise Budget H1:SUS-ITMY, T Test Mass Displacement

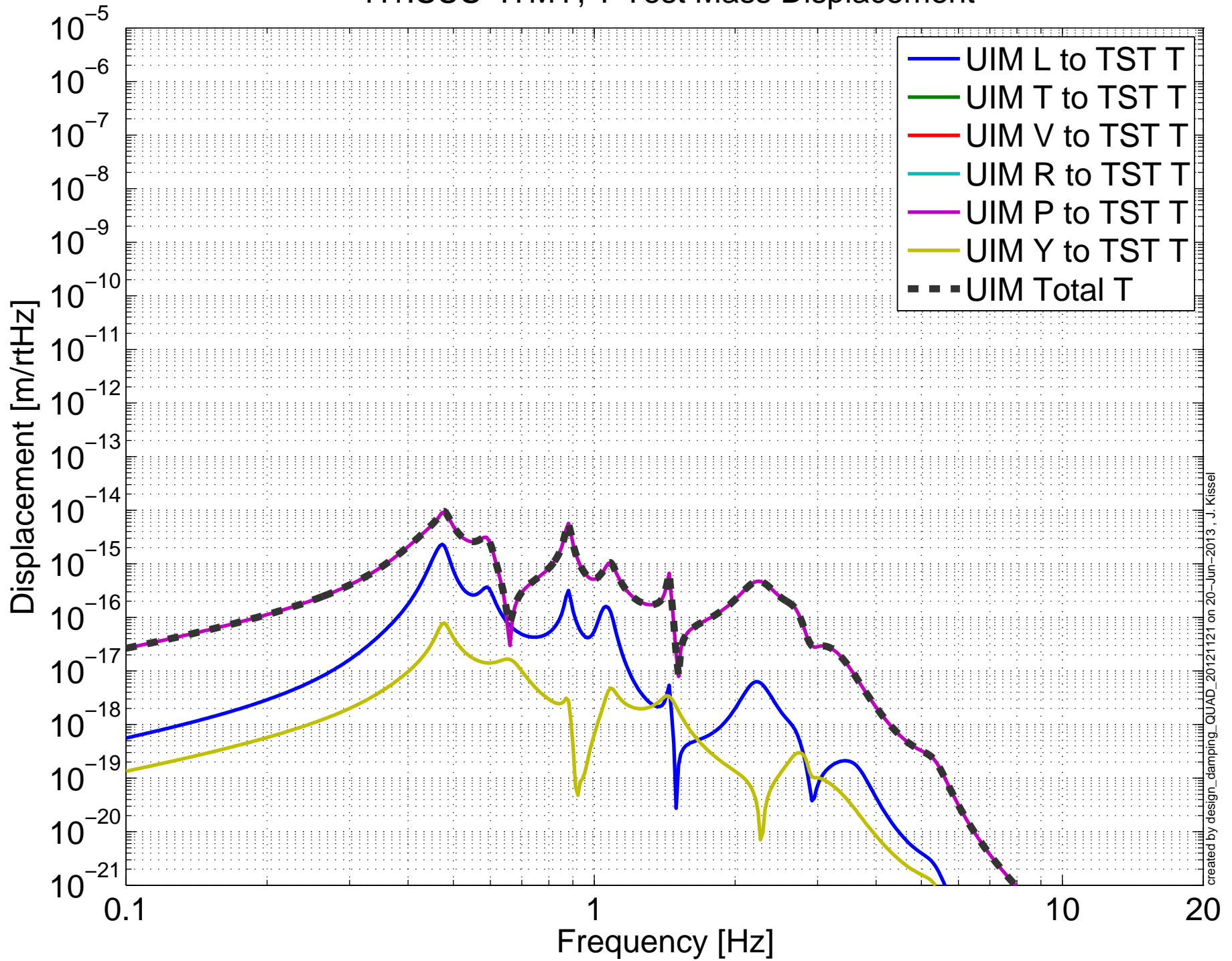


Projected Top Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, T Test Mass Displacement

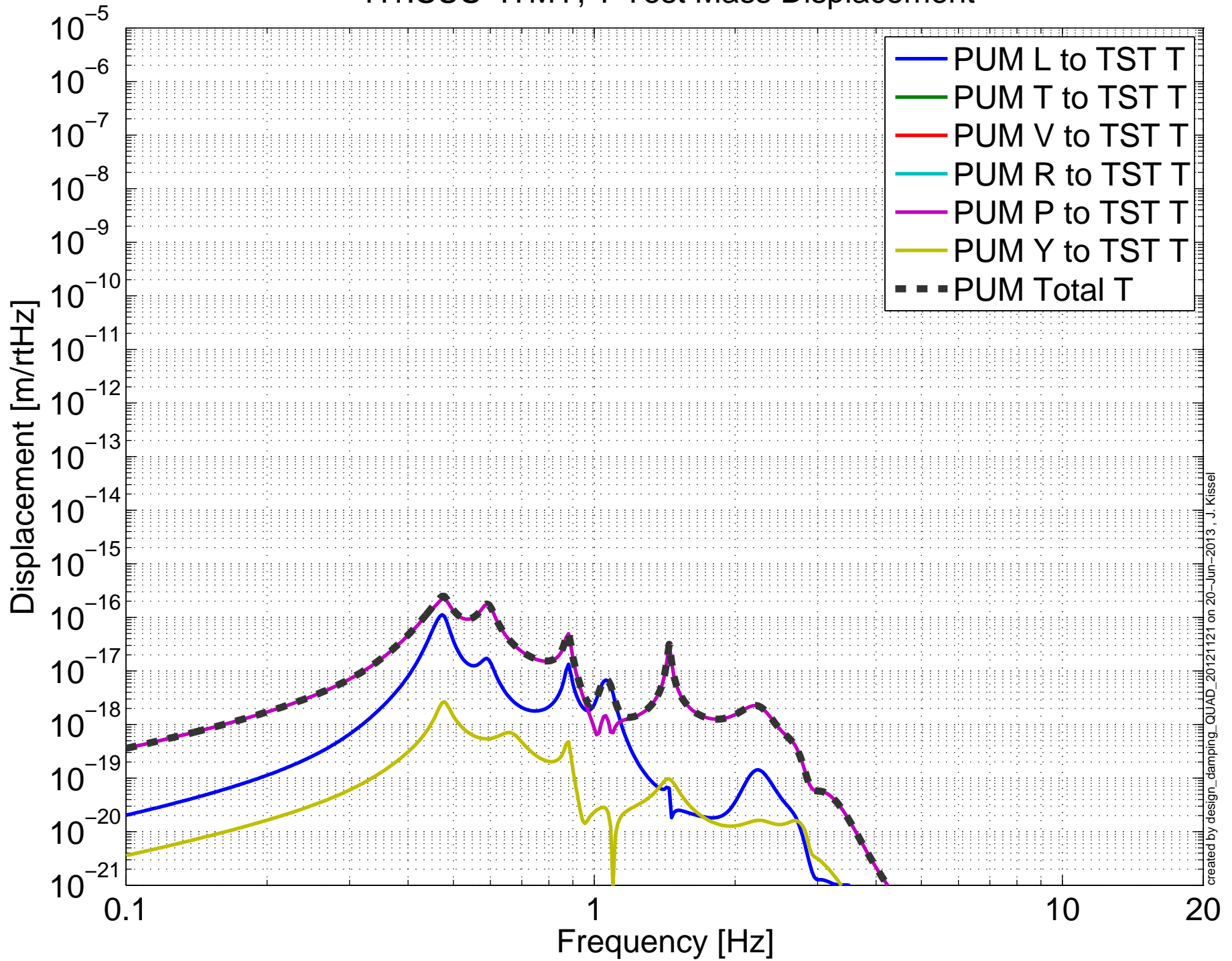


created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

Projected UIM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, T Test Mass Displacement



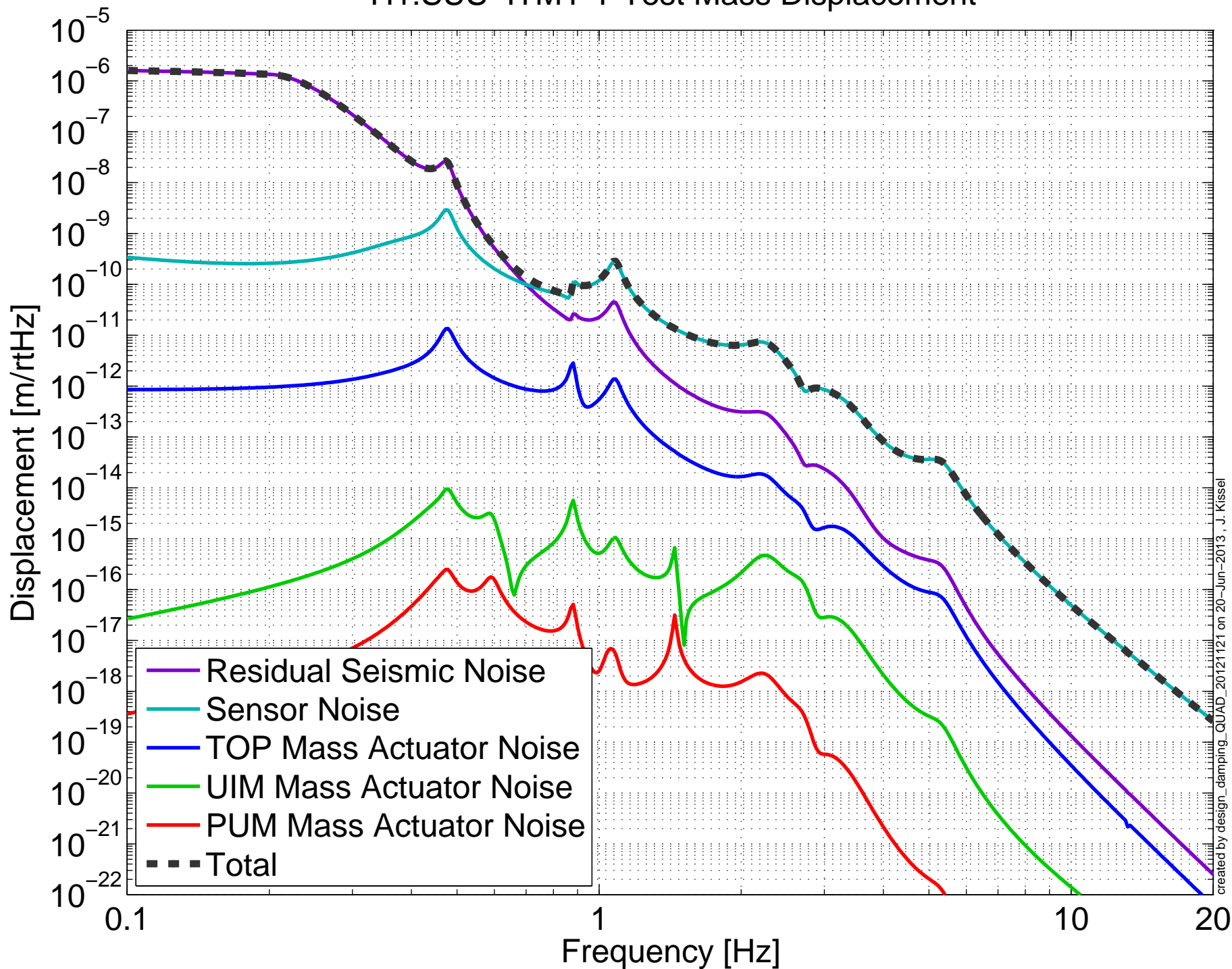
Projected PUM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, T Test Mass Displacement



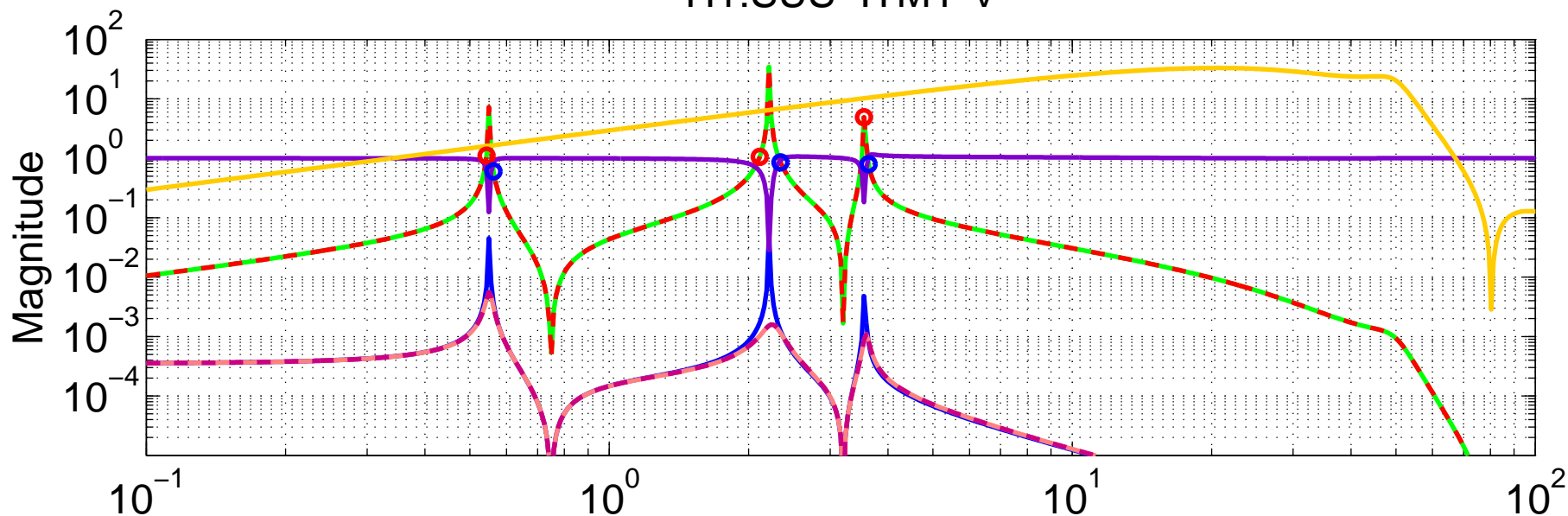
created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

Damping Loop Performance

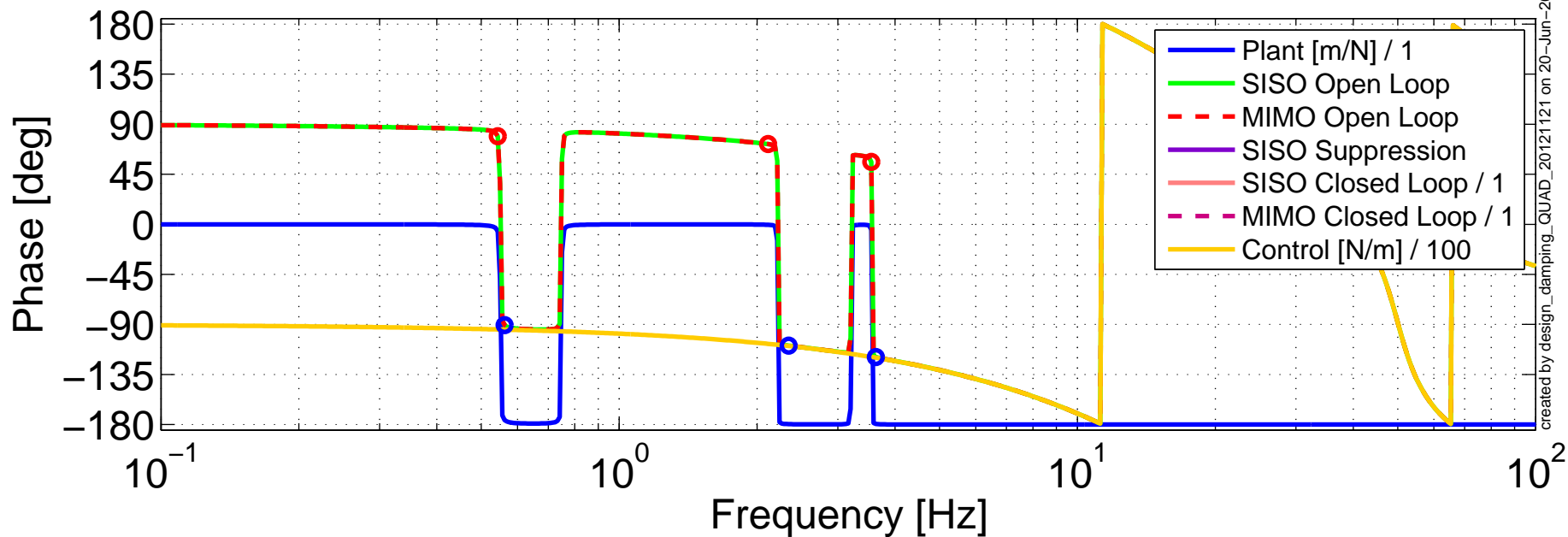
H1:SUS-ITMY T Test Mass Displacement



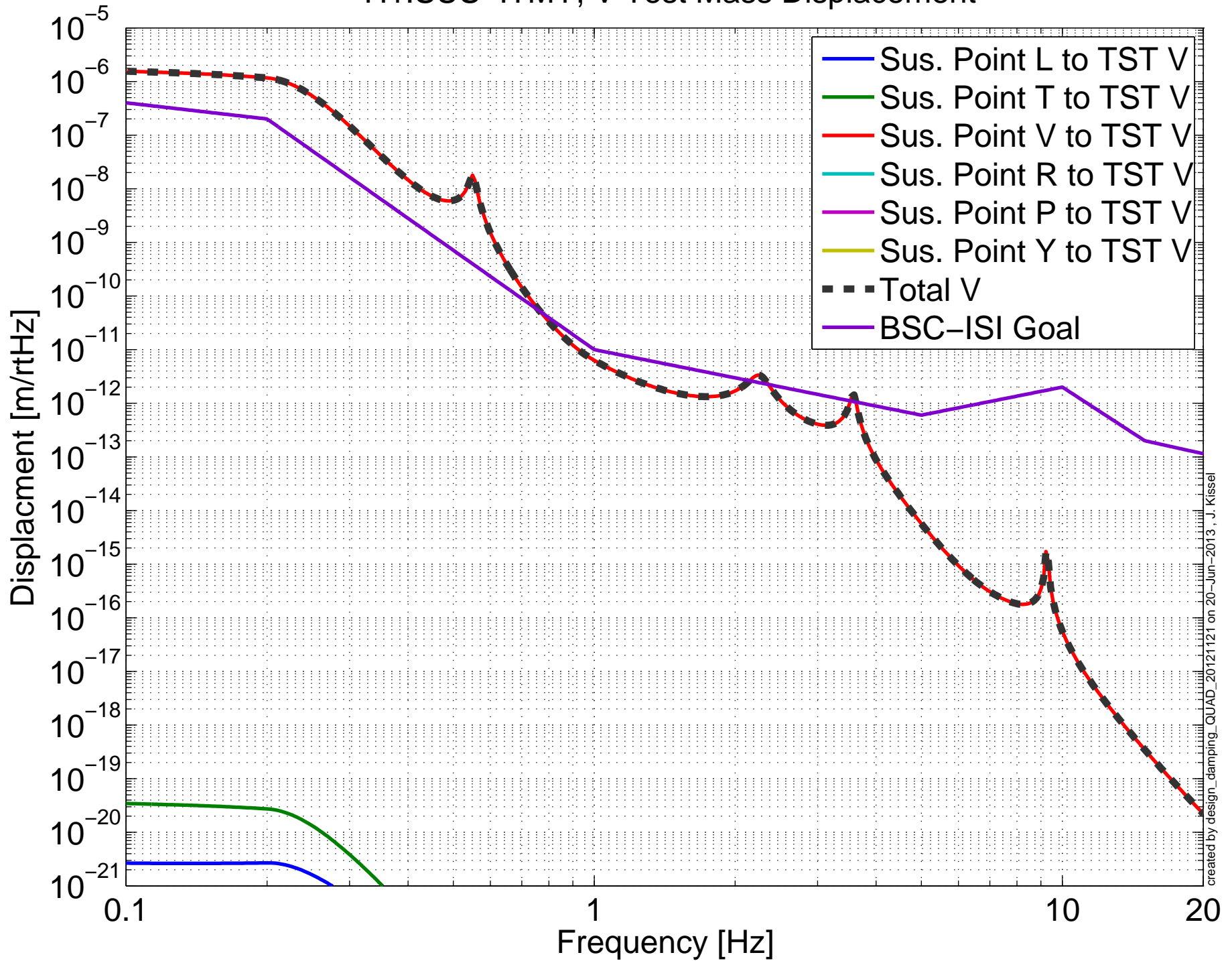
Damping Loop Design H1:SUS-ITMY V



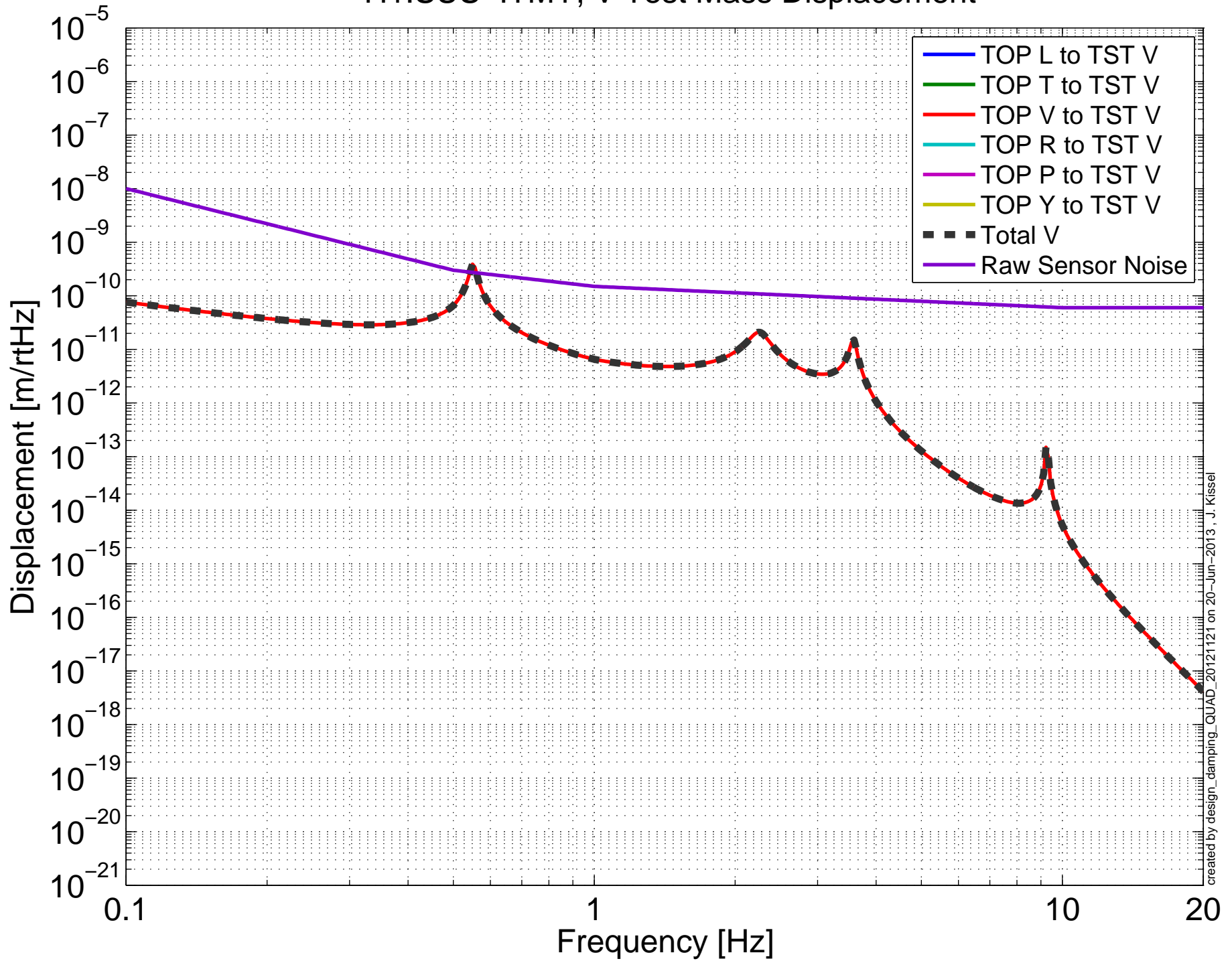
MIMO LUGF Phase Margins (red): [101 108 124] [deg]
MIMO UUGF Phase Margins (blue): [89.3 71 60.7] [deg]



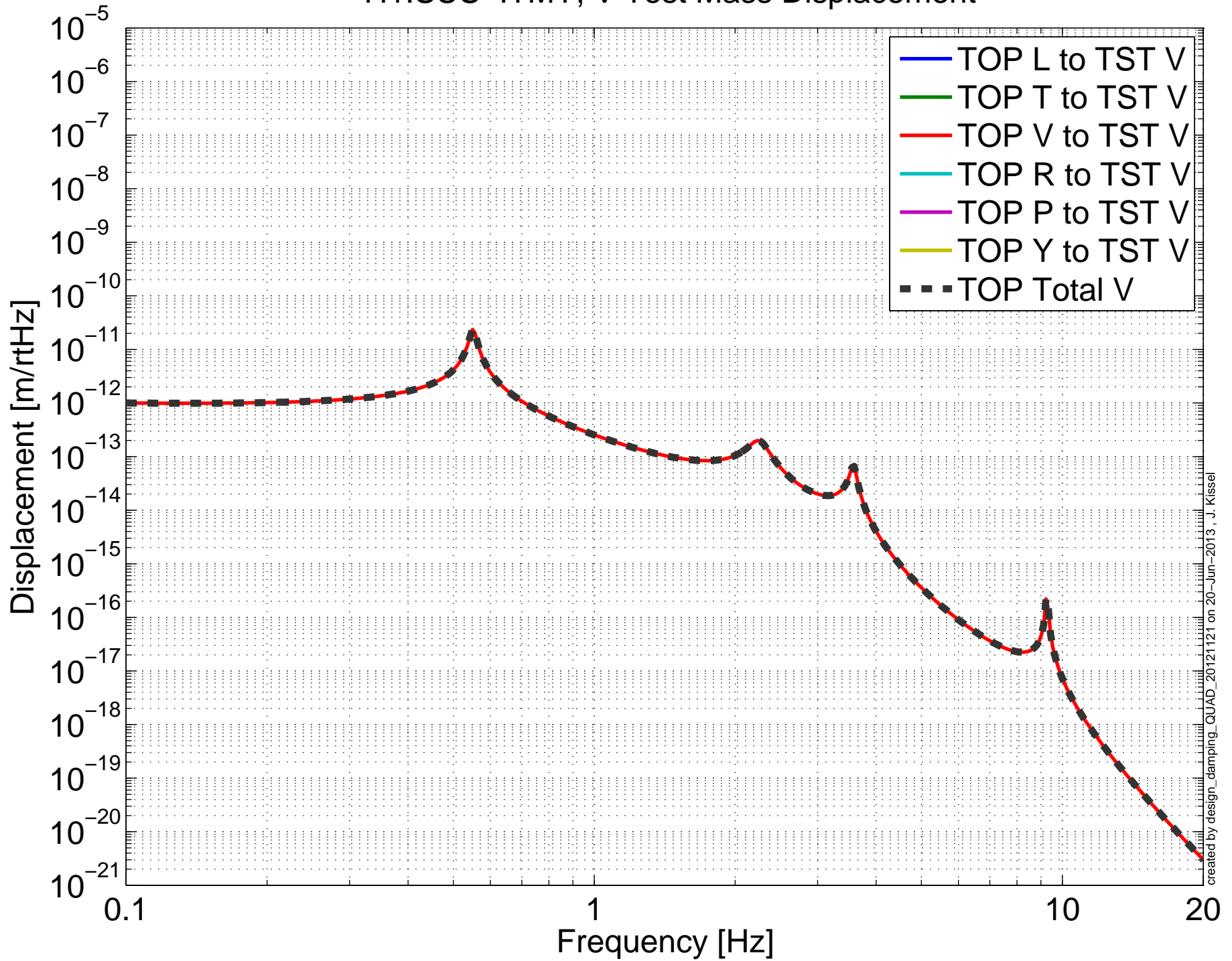
Projected Sus. Point > Test Mass Seismic Noise Budget H1:SUS-ITMY, V Test Mass Displacement



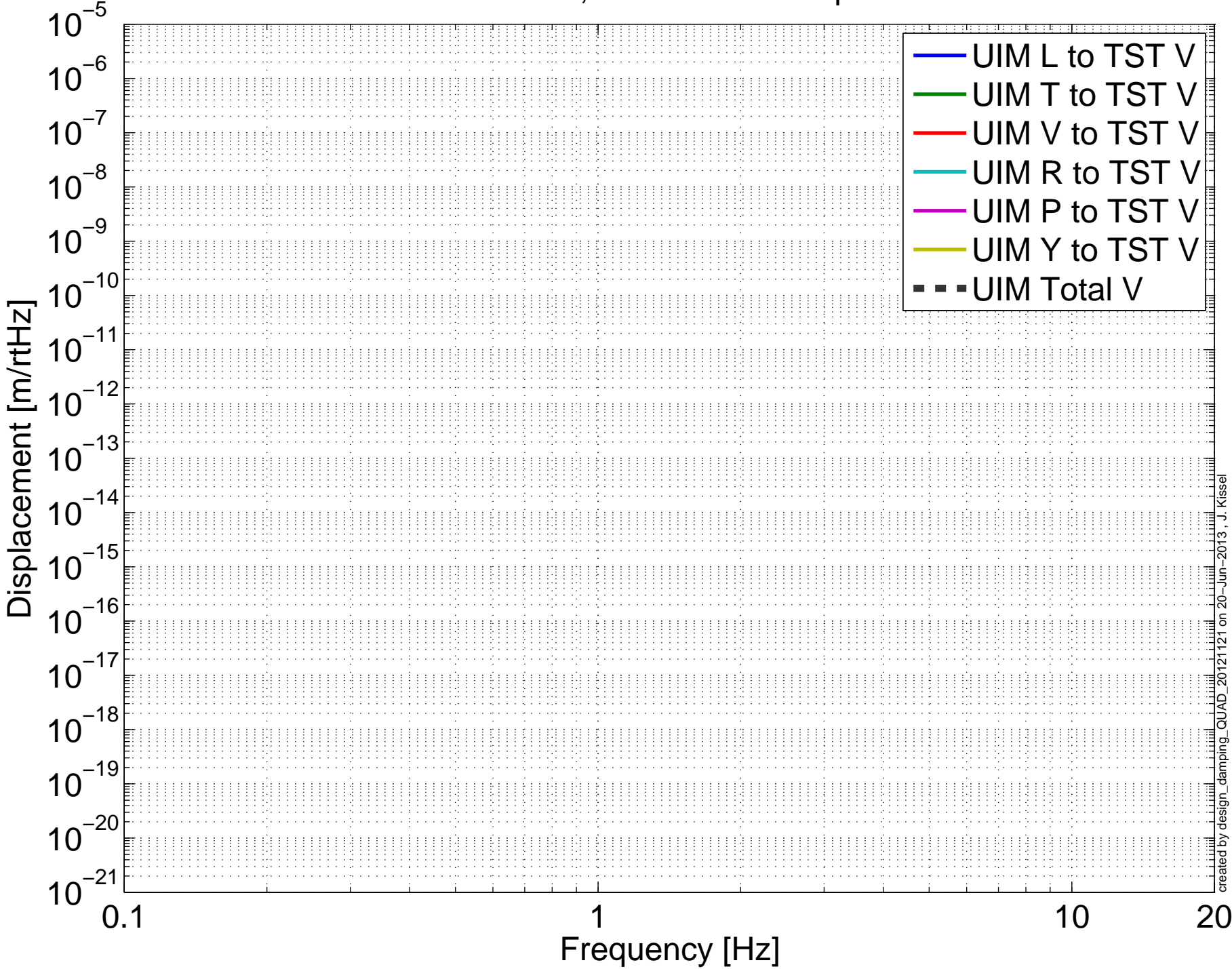
Projected Top Mass Sensor > Test Mass Noise Budget H1:SUS-ITMY, V Test Mass Displacement



Projected Top Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, V Test Mass Displacement

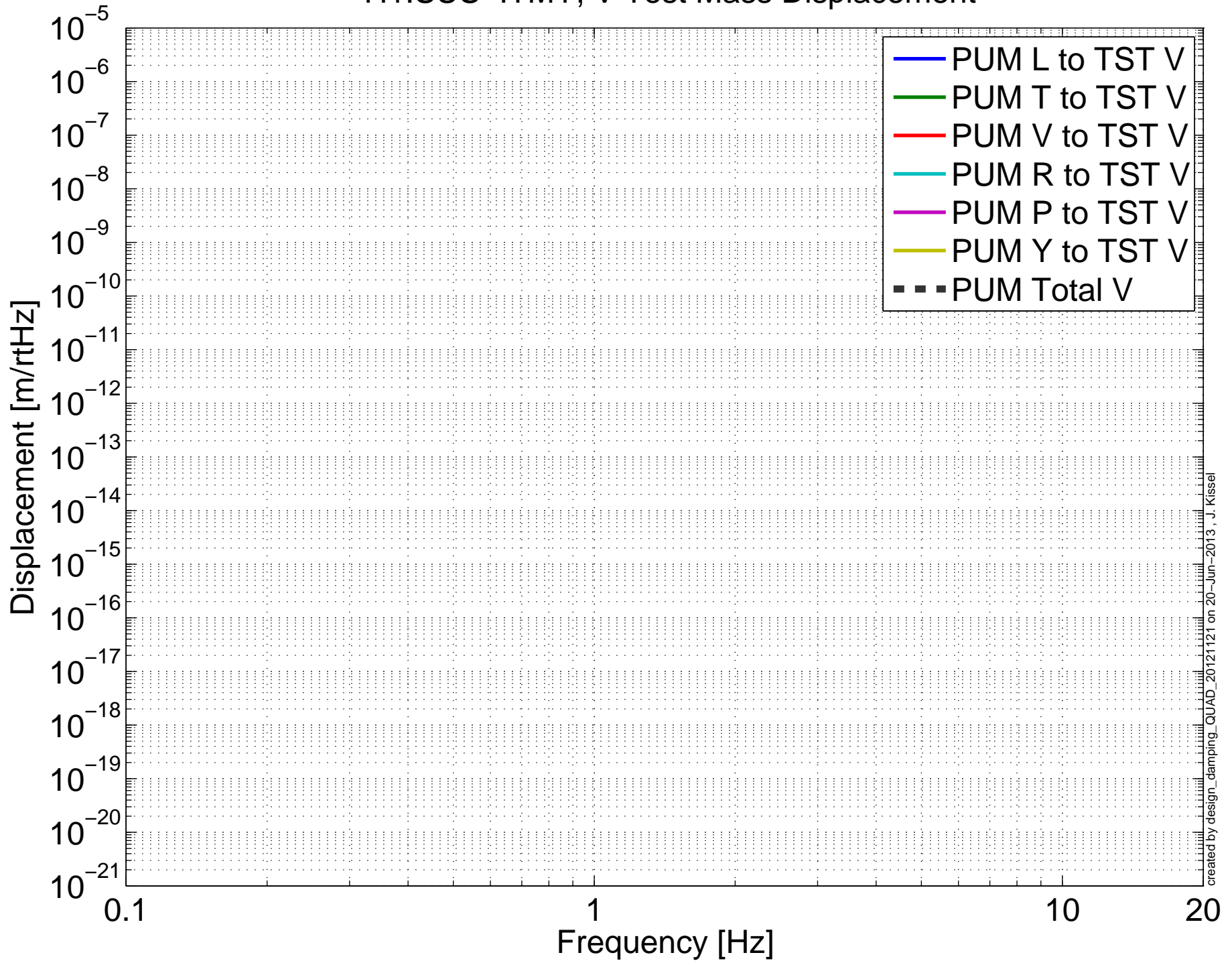


Projected UIM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, V Test Mass Displacement



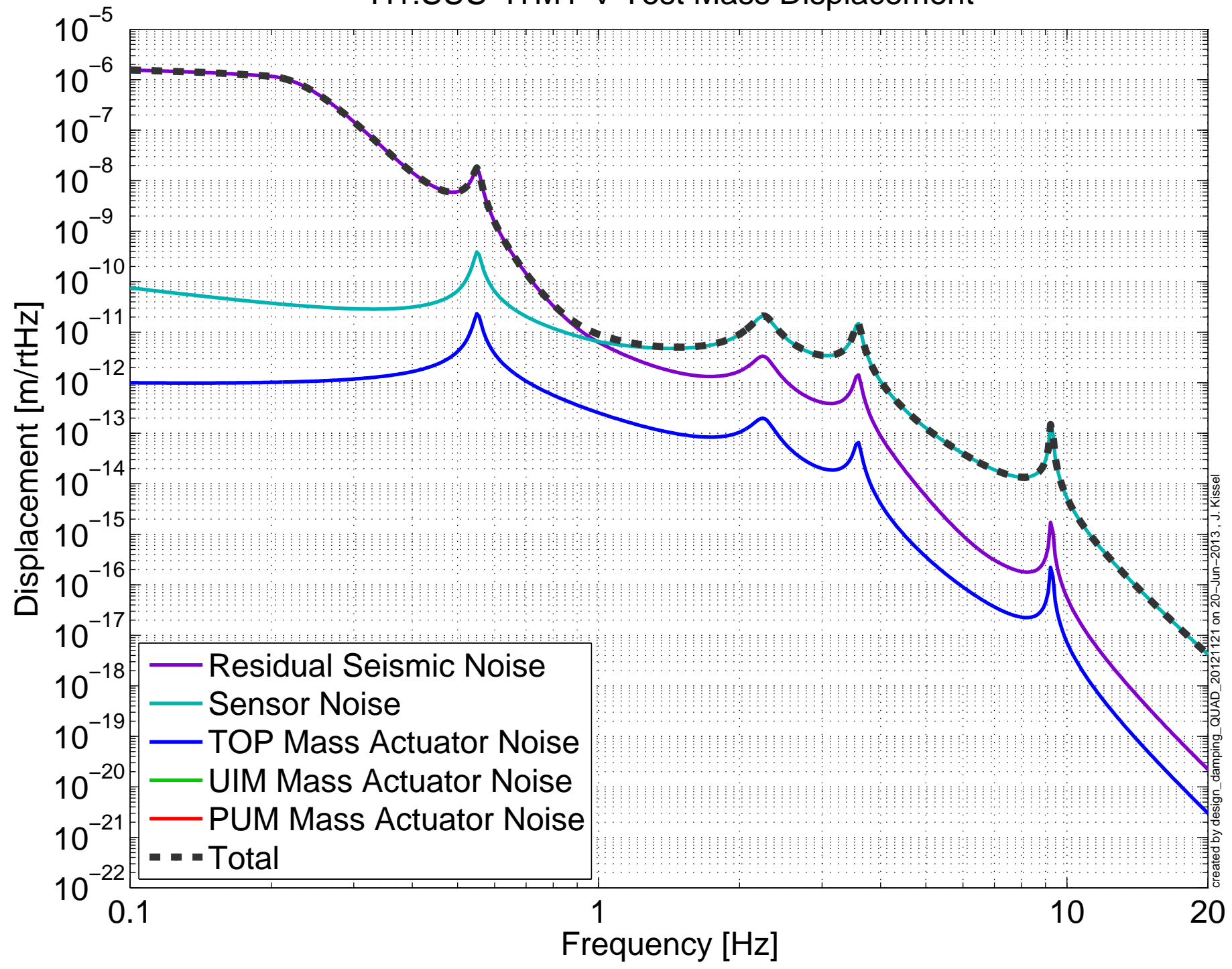
created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

Projected PUM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, V Test Mass Displacement



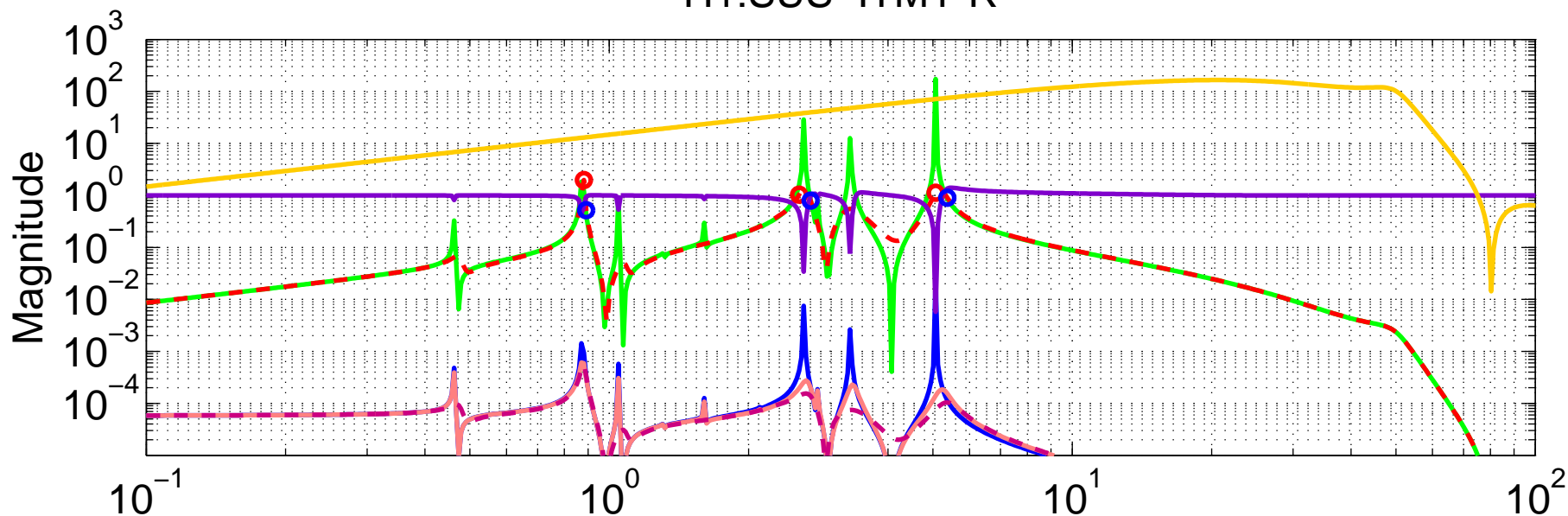
Damping Loop Performance

H1:SUS-ITMY V Test Mass Displacement

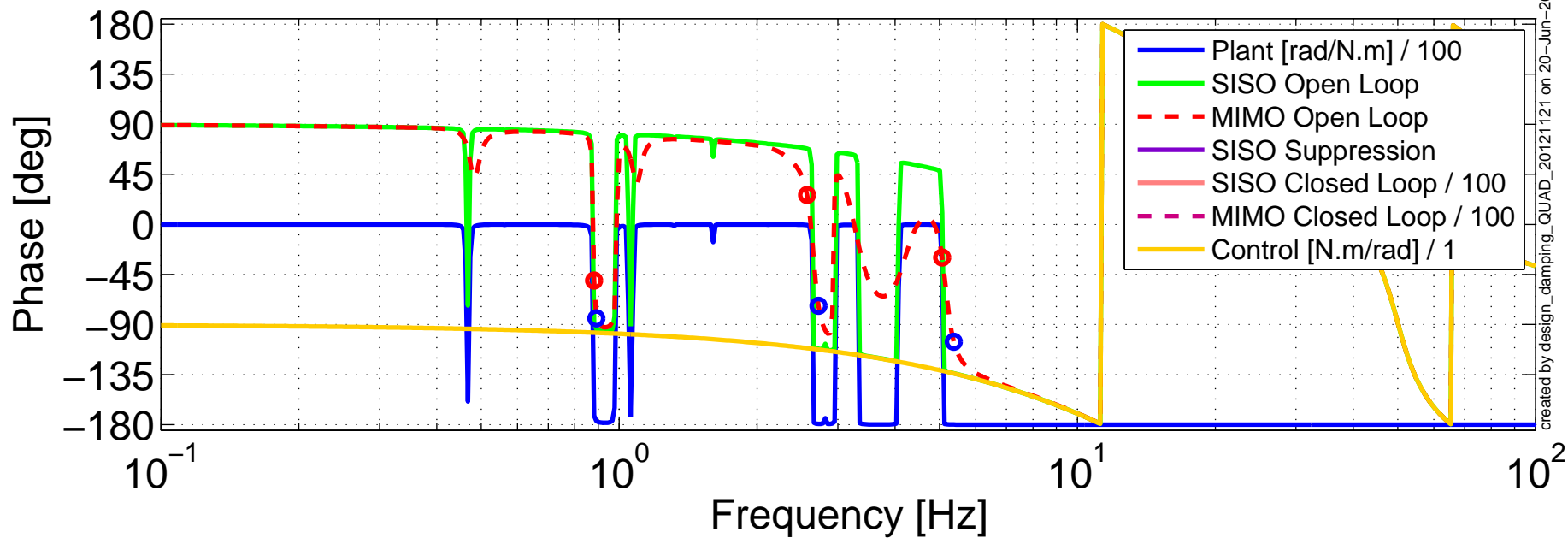


created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

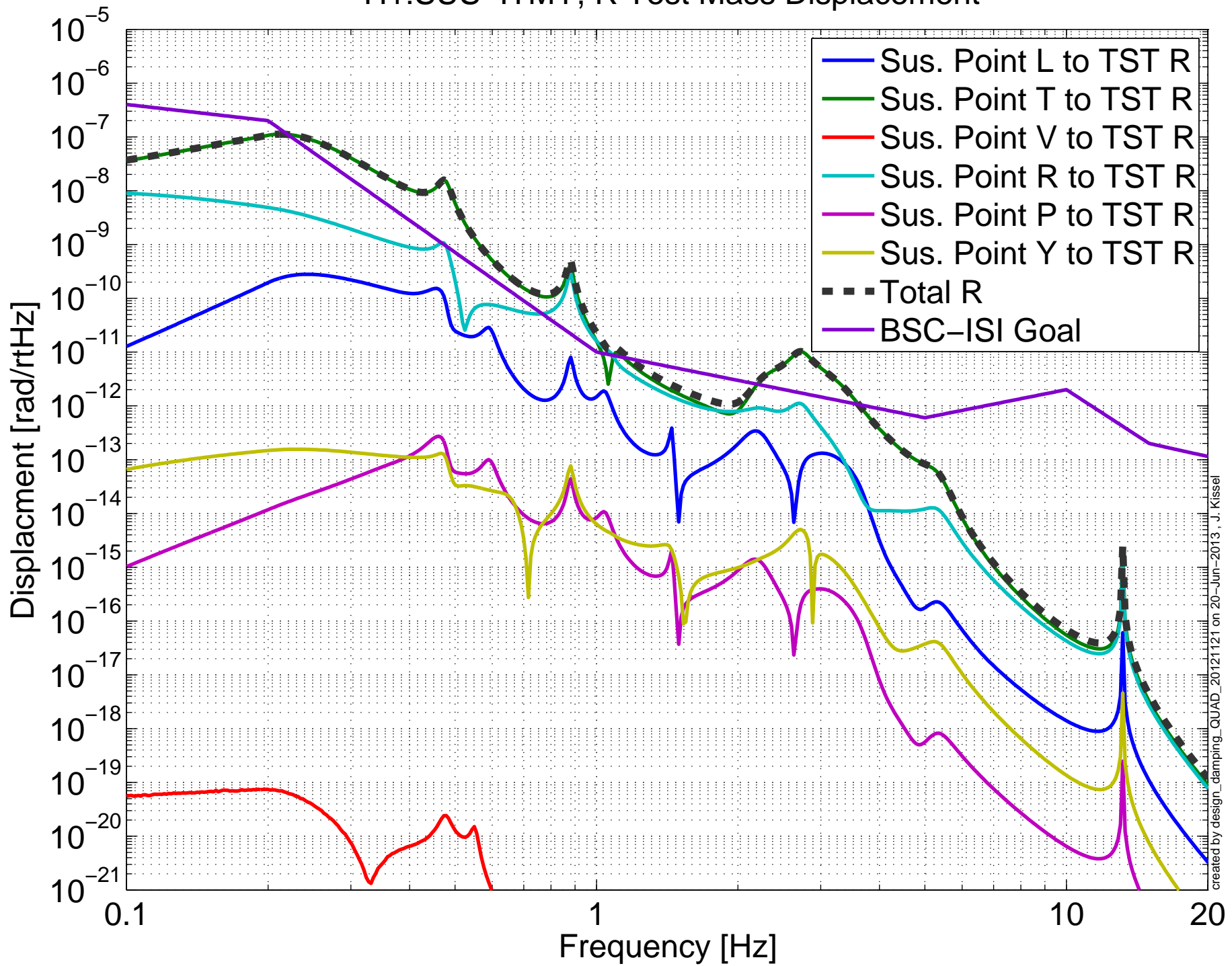
Damping Loop Design H1:SUS-ITMY R



MIMO LUGF Phase Margins (red): [231 154 210] [deg]
MIMO UUGF Phase Margins (blue): [95.5 107 74.5] [deg]

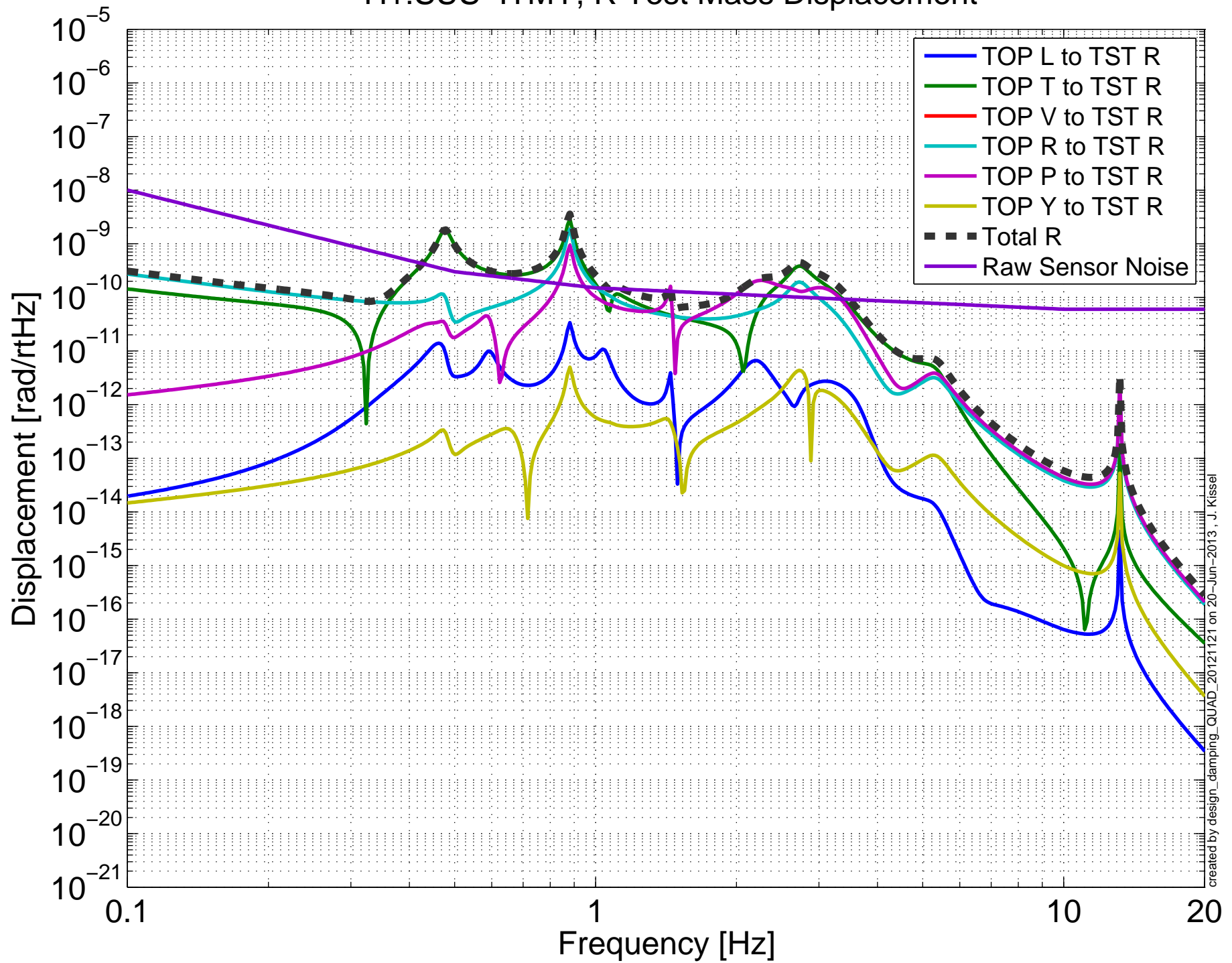


Projected Sus. Point > Test Mass Seismic Noise Budget H1:SUS-ITMY, R Test Mass Displacement

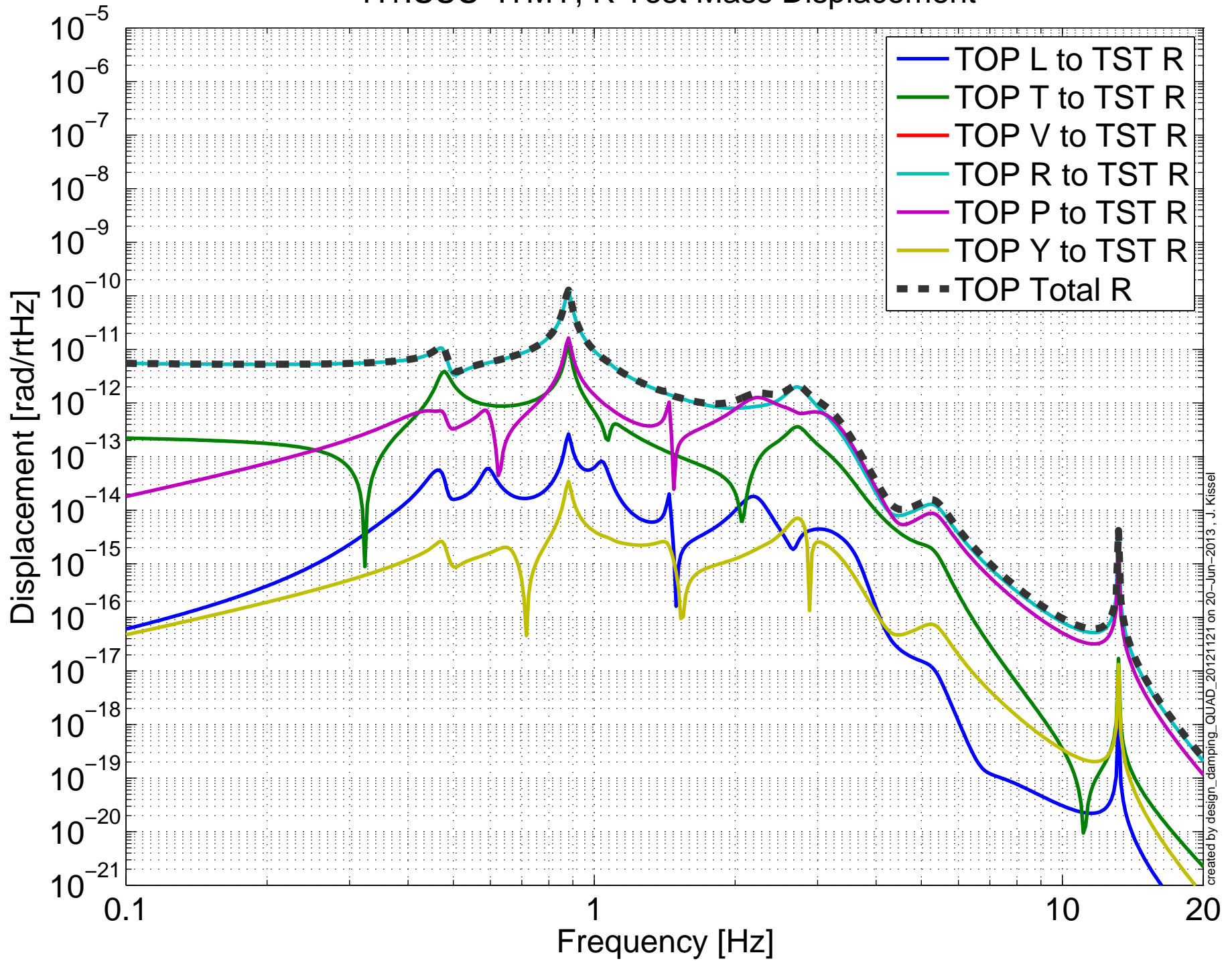


created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

Projected Top Mass Sensor > Test Mass Noise Budget H1:SUS-ITMY, R Test Mass Displacement

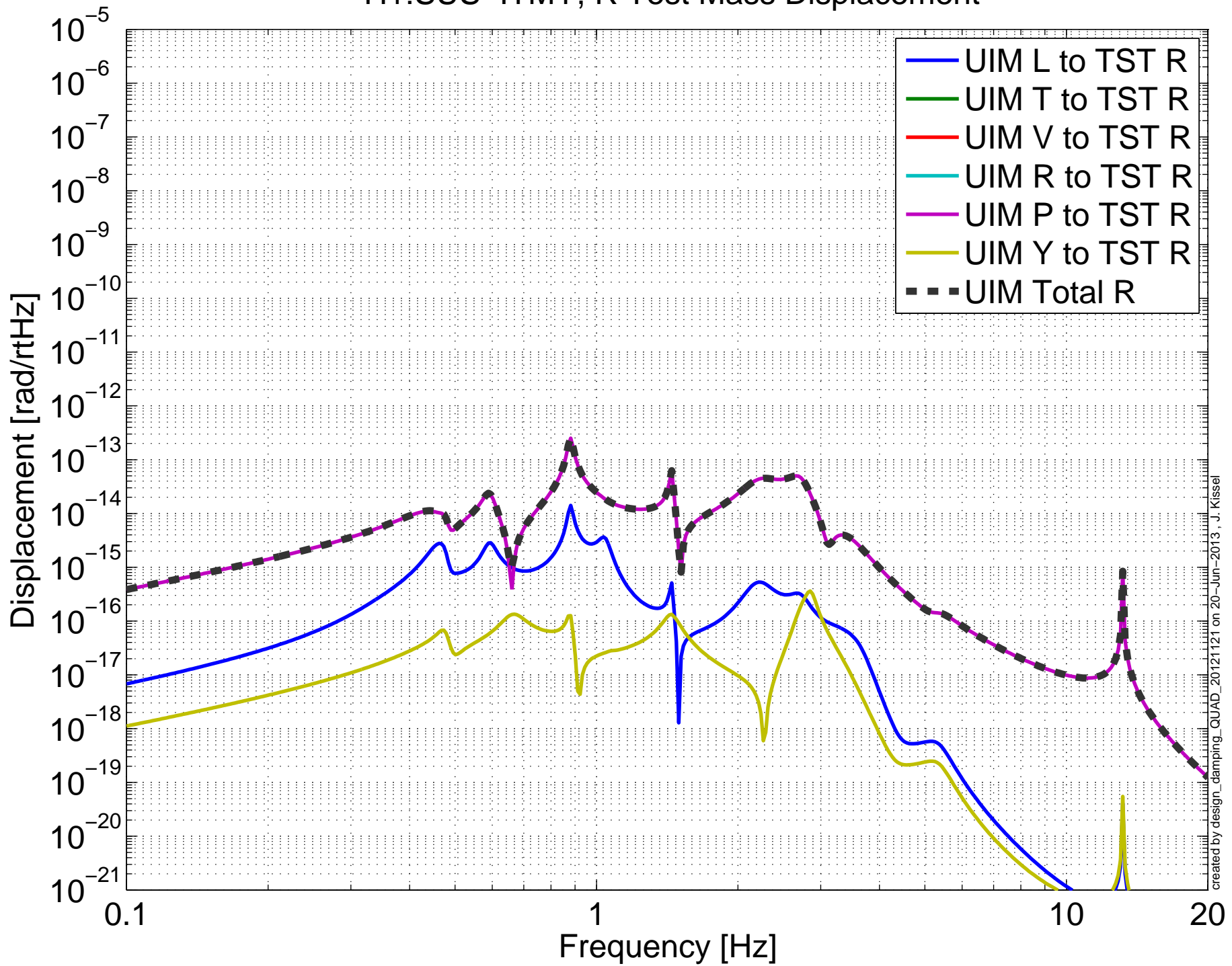


Projected Top Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, R Test Mass Displacement



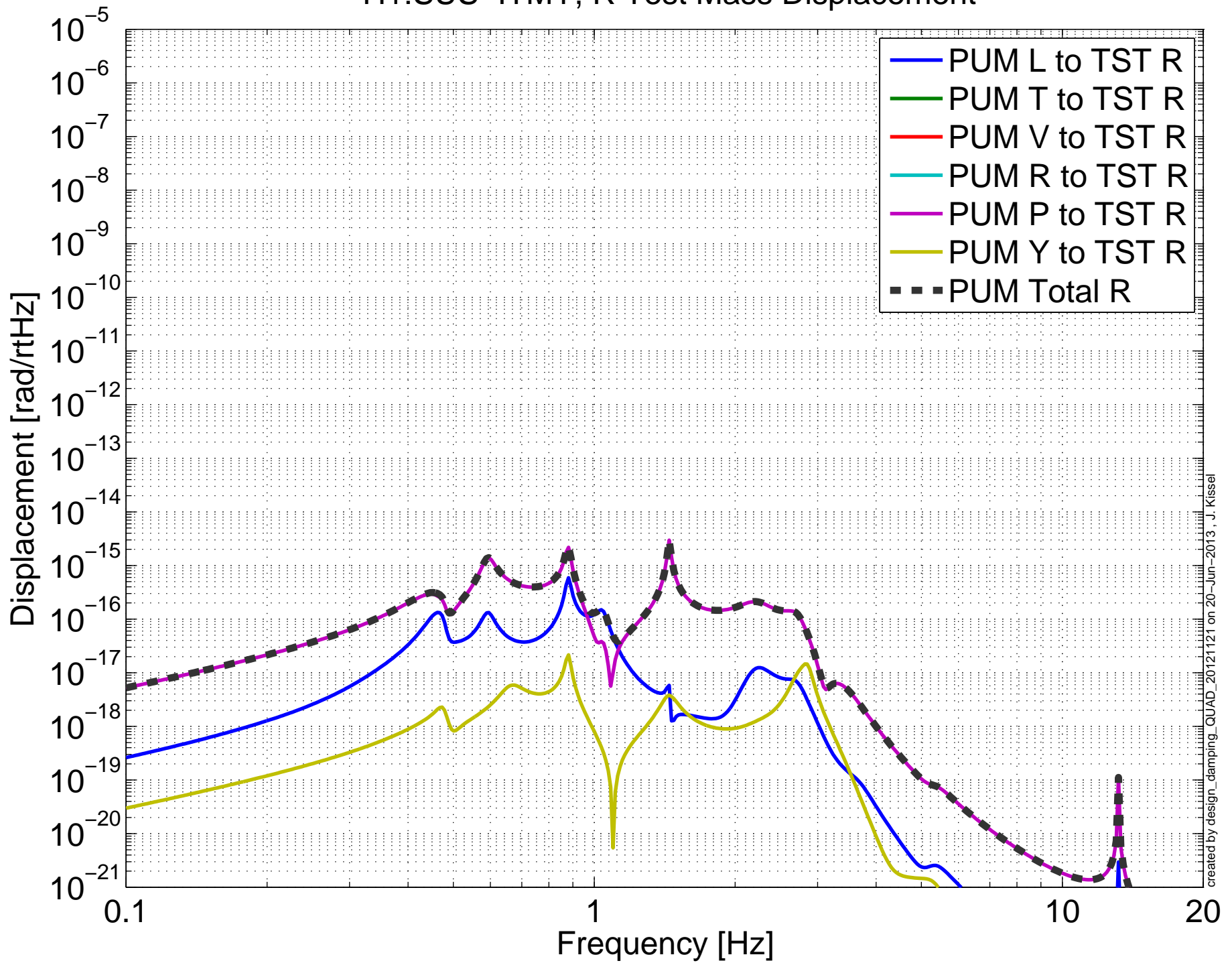
created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

Projected UIM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, R Test Mass Displacement



created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

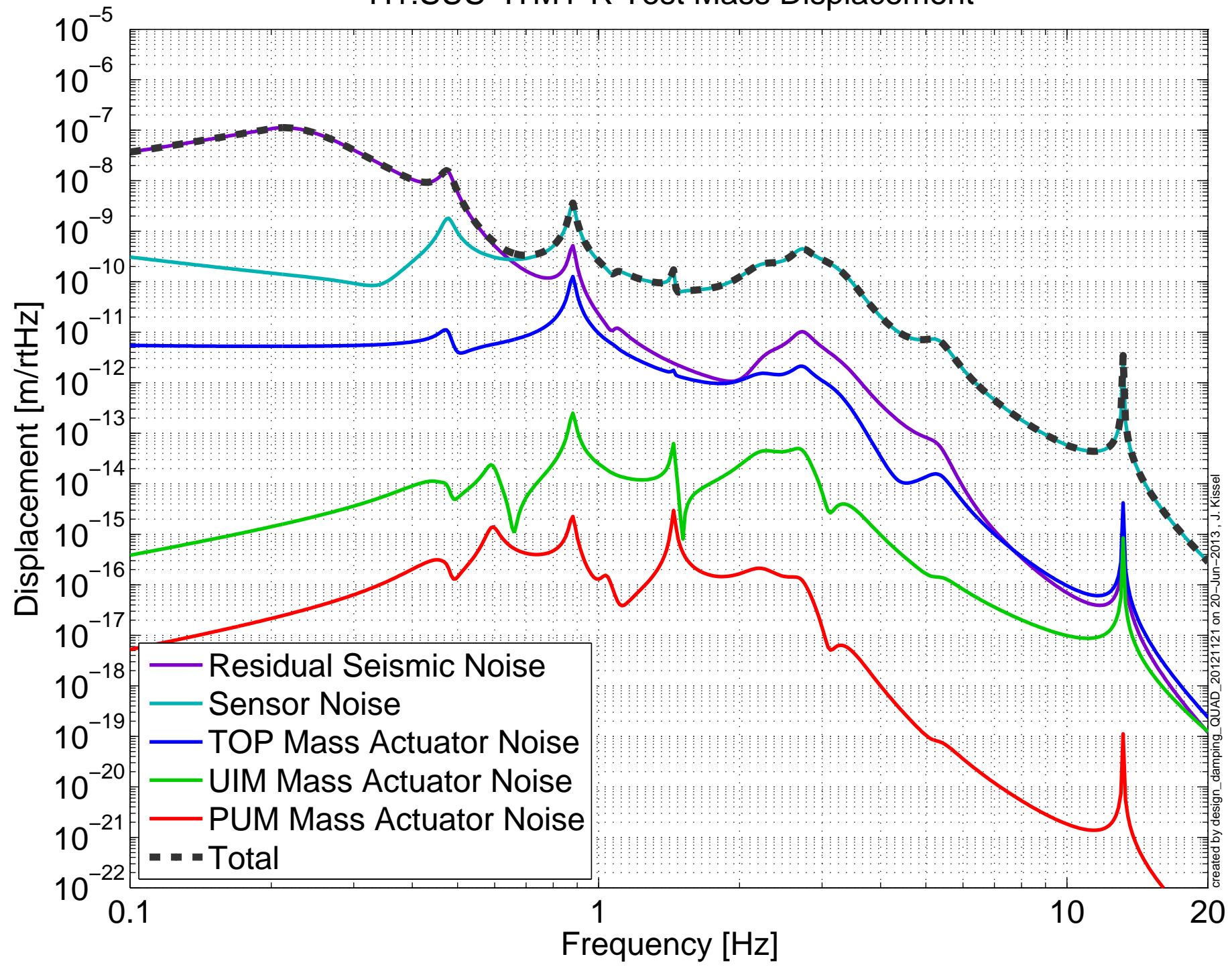
Projected PUM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, R Test Mass Displacement



created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

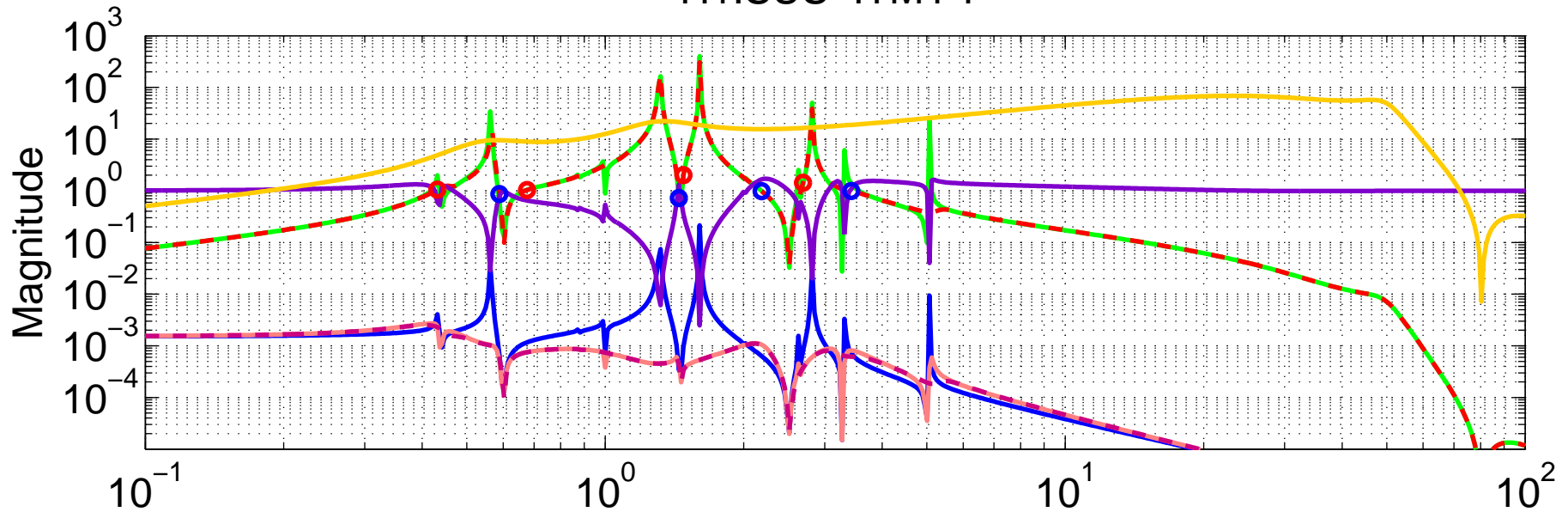
Damping Loop Performance

H1:SUS-ITMY R Test Mass Displacement

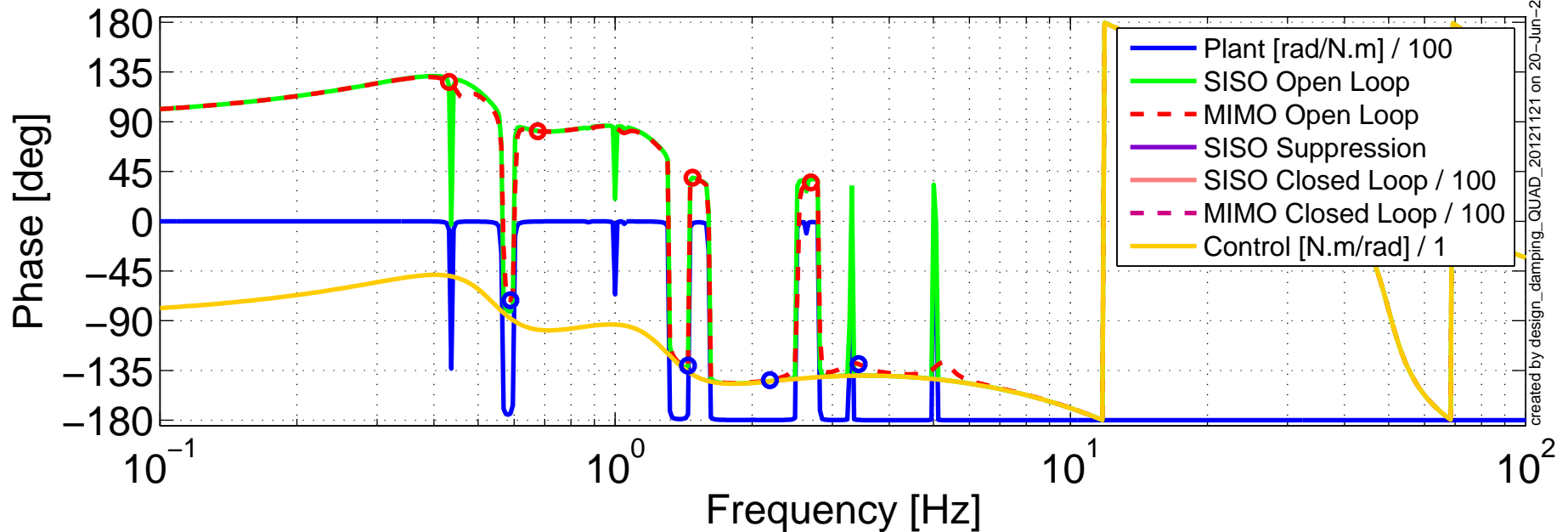


created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

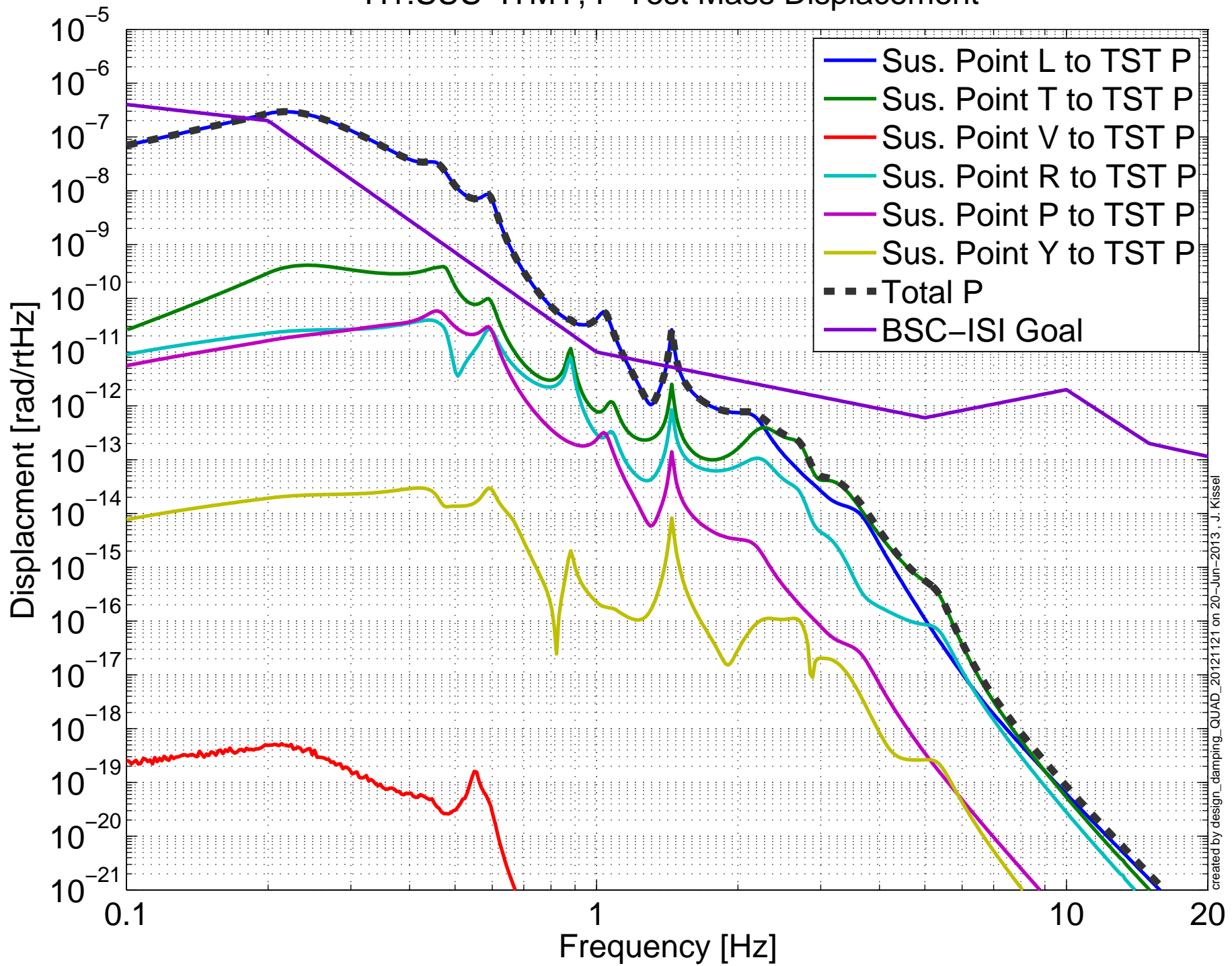
Damping Loop Design H1:SUS-ITMY P



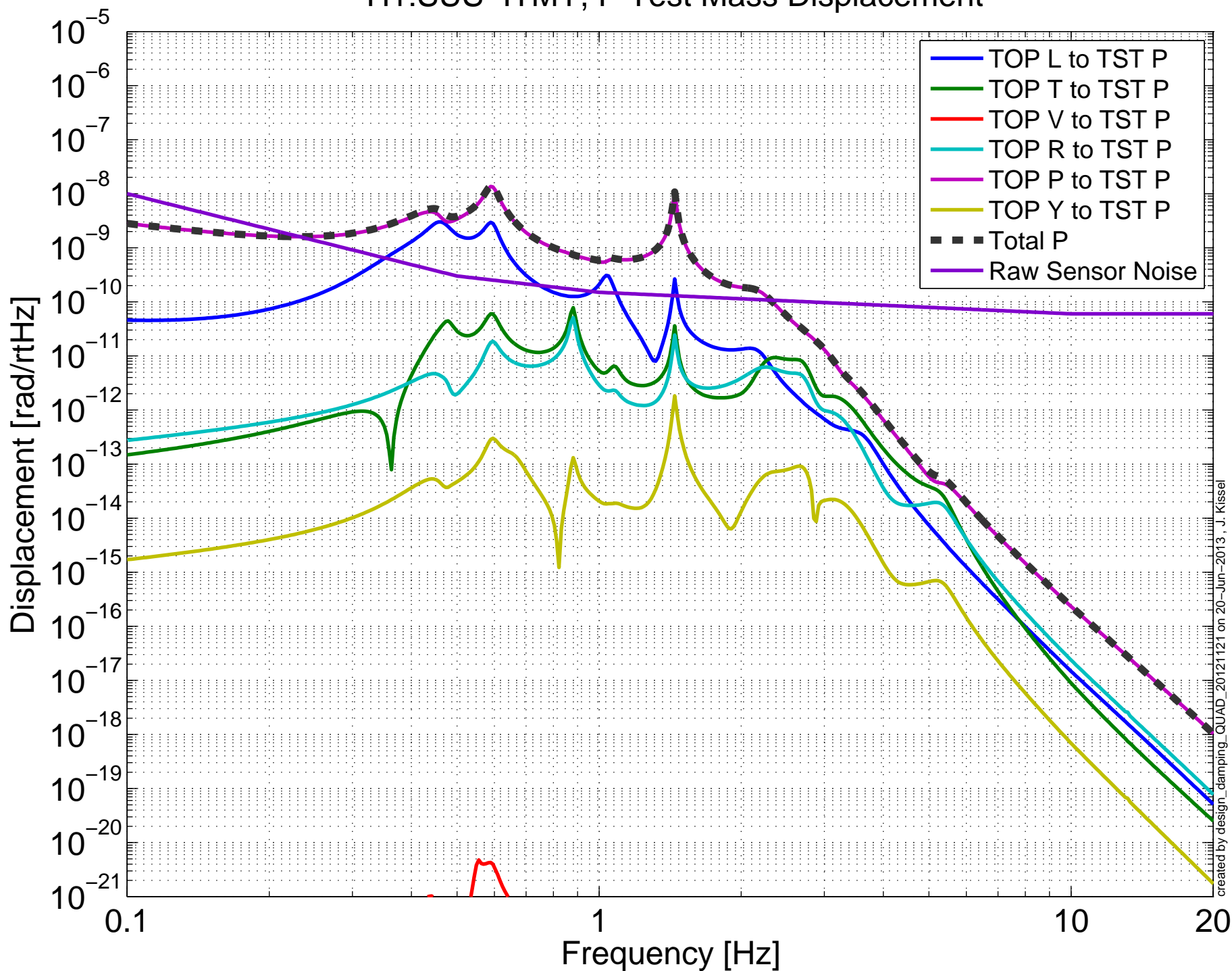
MIMO LUGF Phase Margins (red): [54 98.6 141 145] [deg]
MIMO UUGF Phase Margins (blue): [109 49.5 36.3 50.8] [deg]



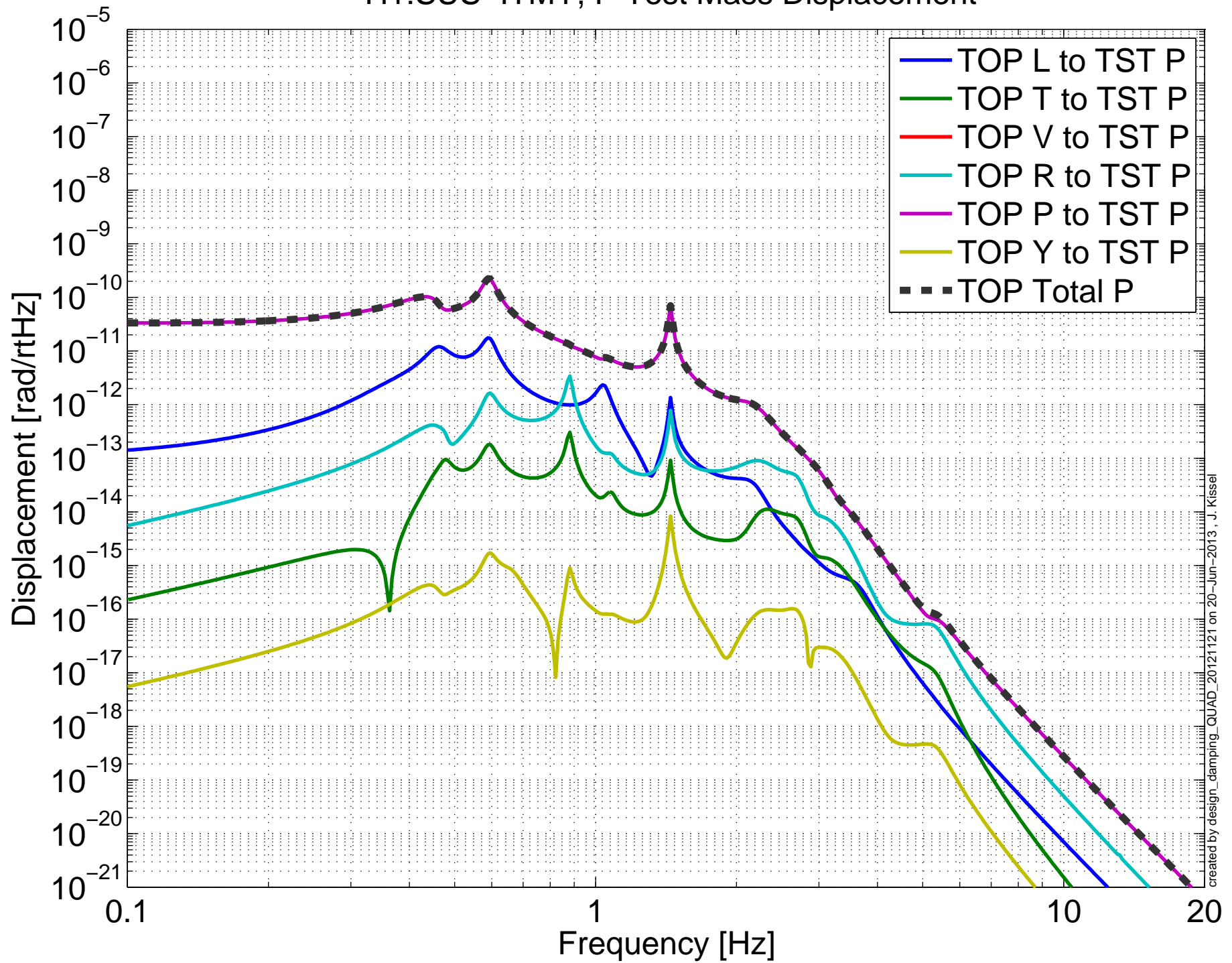
Projected Sus. Point > Test Mass Seismic Noise Budget H1:SUS-ITMY, P Test Mass Displacement



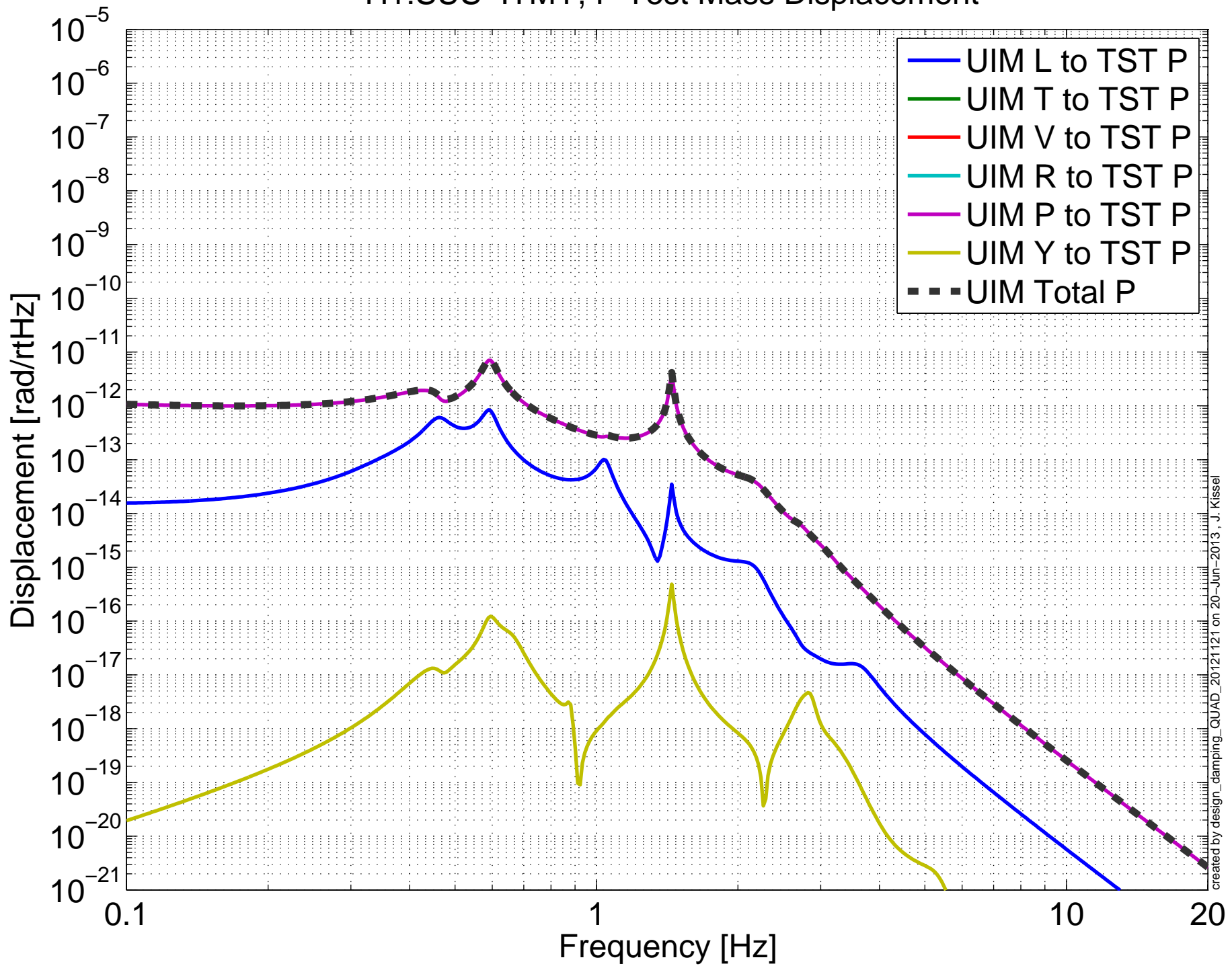
Projected Top Mass Sensor > Test Mass Noise Budget H1:SUS-ITMY, P Test Mass Displacement



Projected Top Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, P Test Mass Displacement

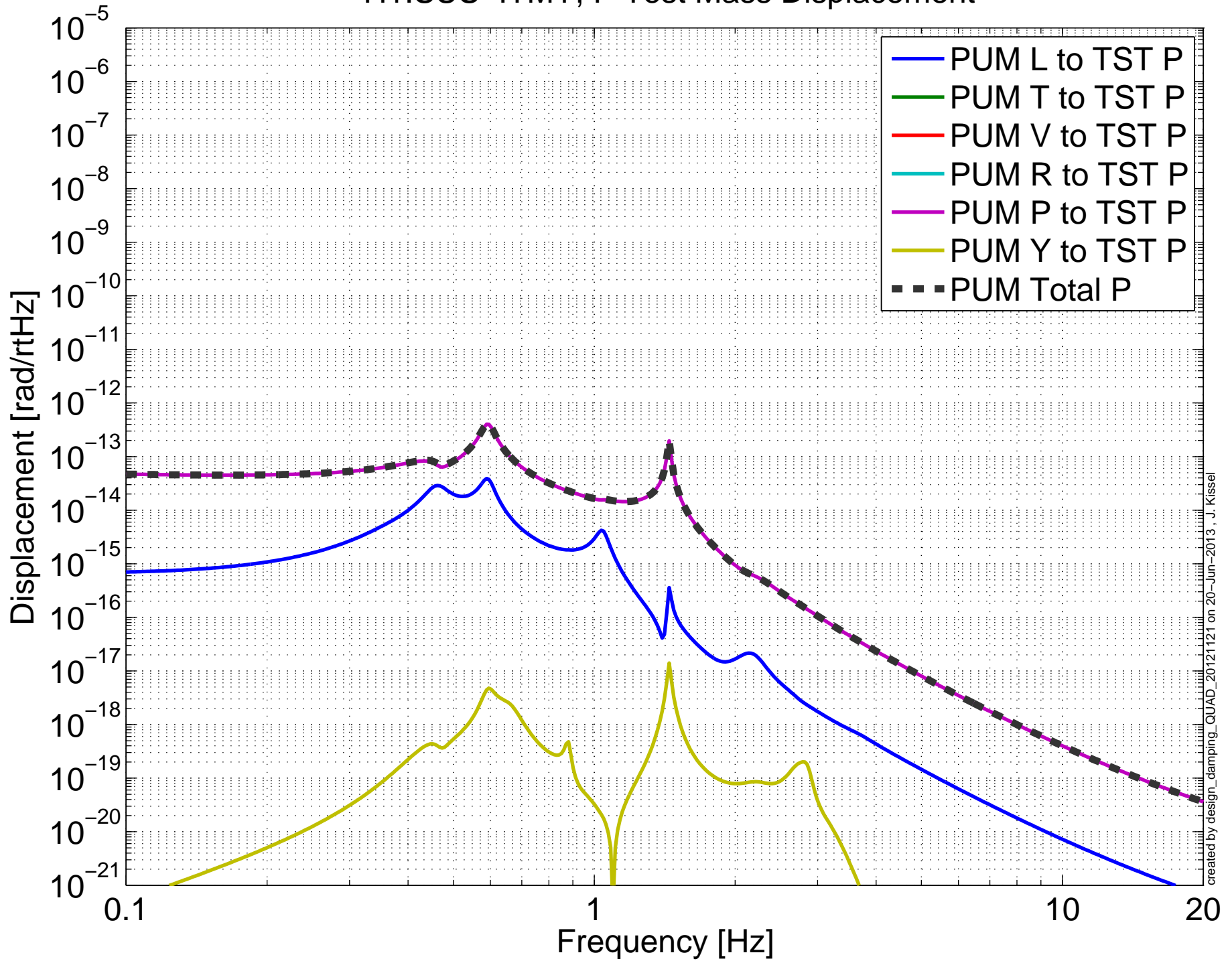


Projected UIM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, P Test Mass Displacement



created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

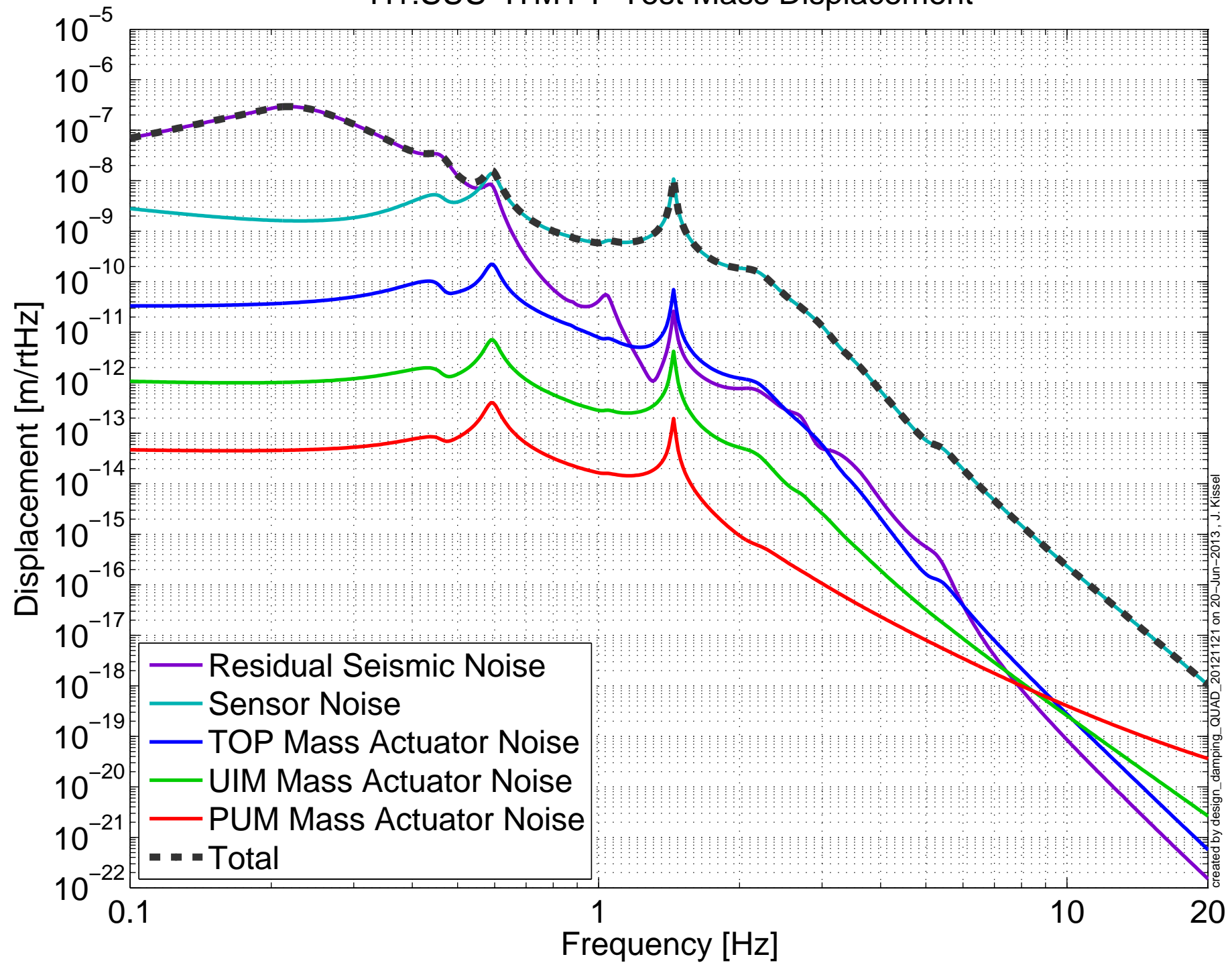
Projected PUM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, P Test Mass Displacement



created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

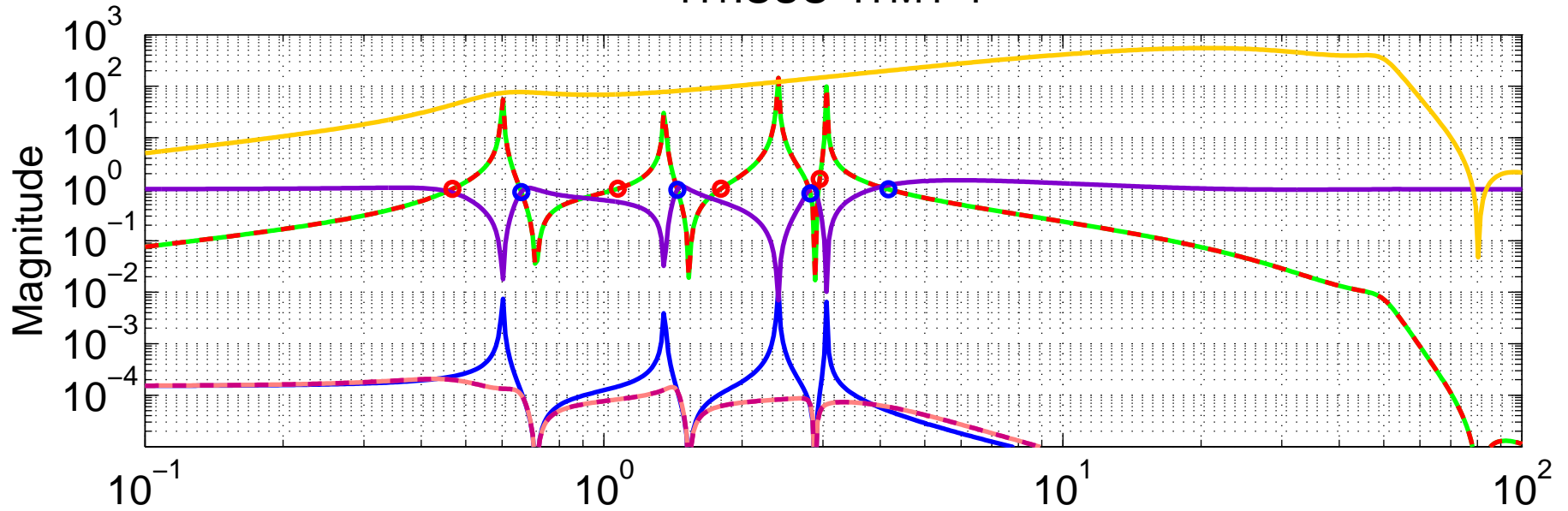
Damping Loop Performance

H1:SUS-ITMY P Test Mass Displacement

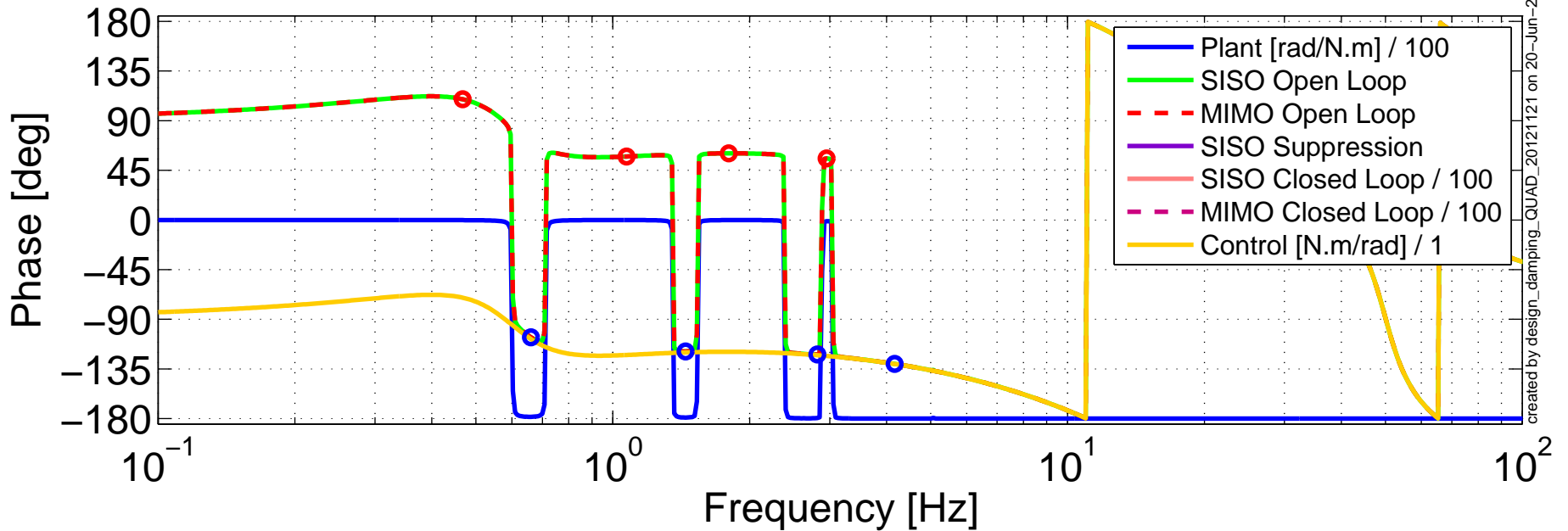


created by design_damping_QUAD_20121121 on 20-Jun-2013 - J. Kissel

Damping Loop Design H1:SUS-ITMY Y

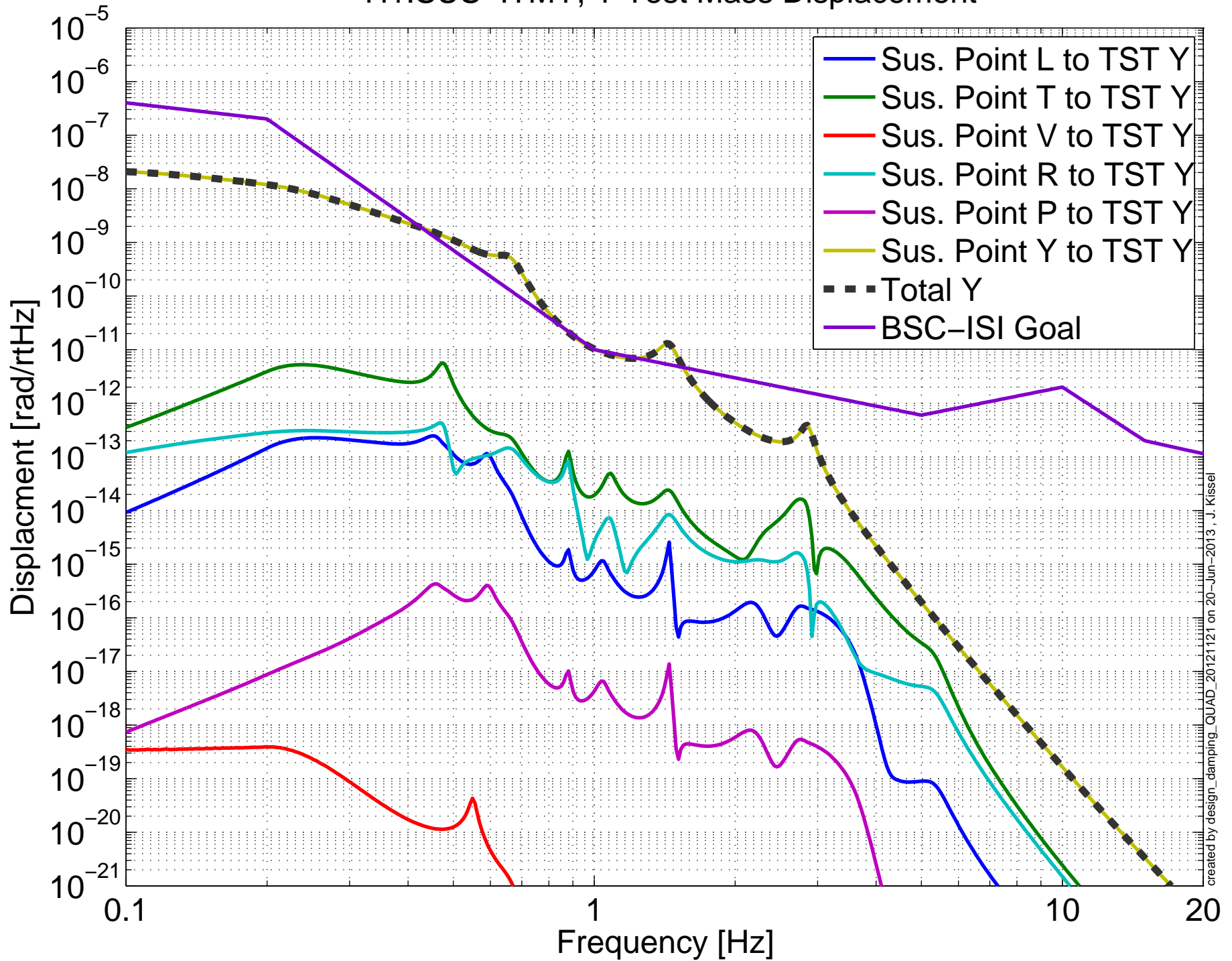


MIMO LUGF Phase Margins (red): [70.6 122 120 124] [deg]
MIMO UUGF Phase Margins (blue): [73.7 60.9 58.1 49.5] [deg]

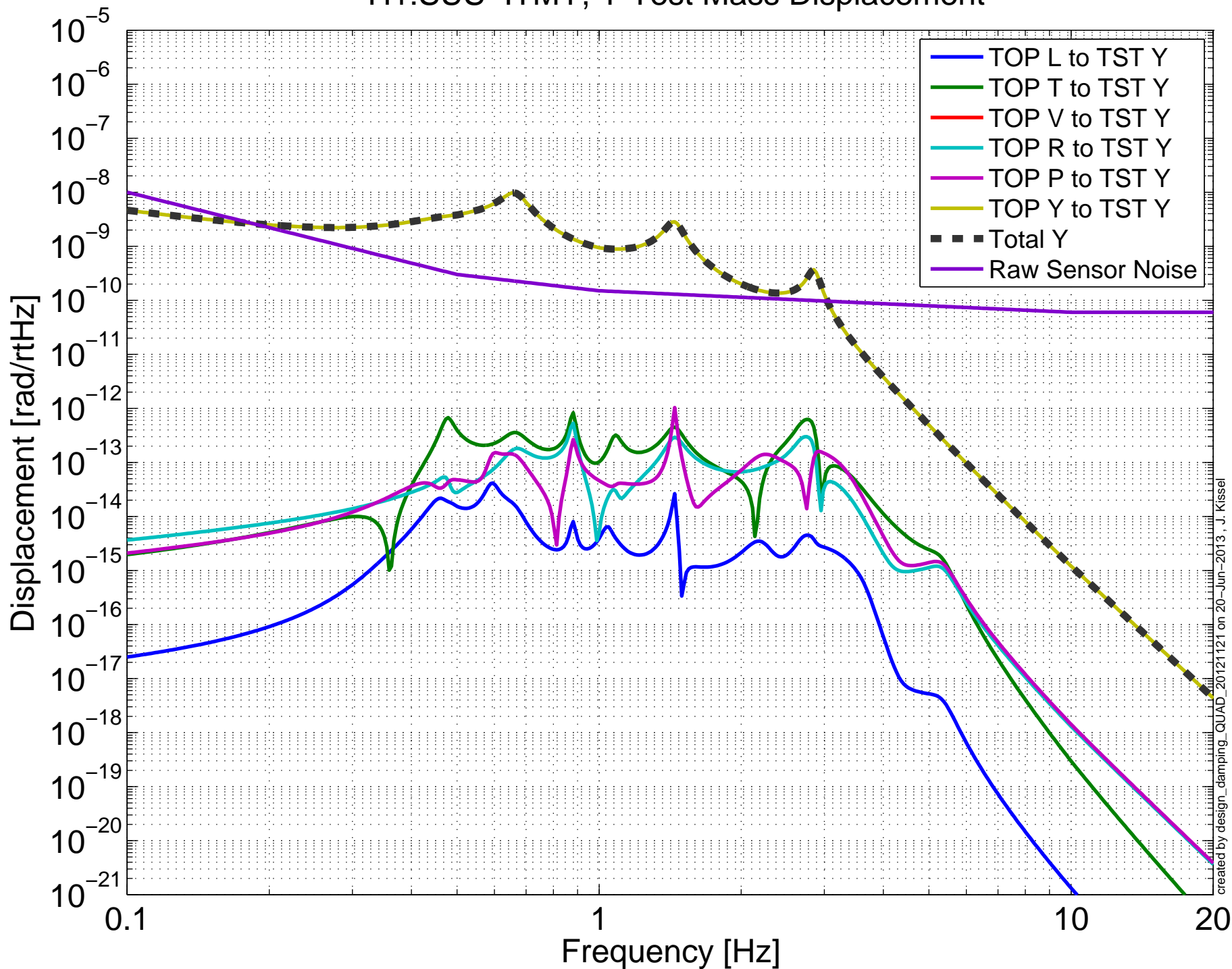


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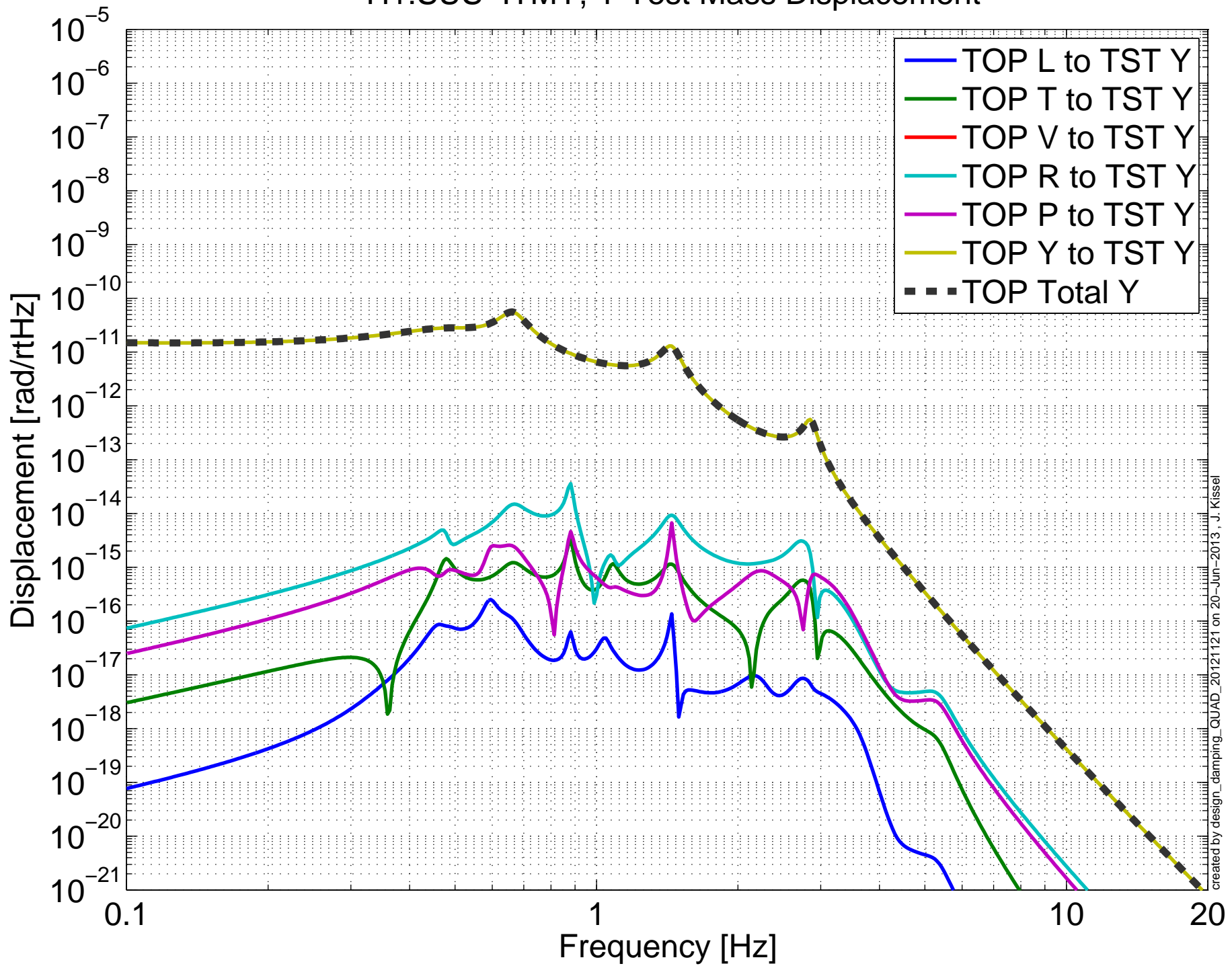
Projected Sus. Point > Test Mass Seismic Noise Budget H1:SUS-ITMY, Y Test Mass Displacement



Projected Top Mass Sensor > Test Mass Noise Budget H1:SUS-ITMY, Y Test Mass Displacement

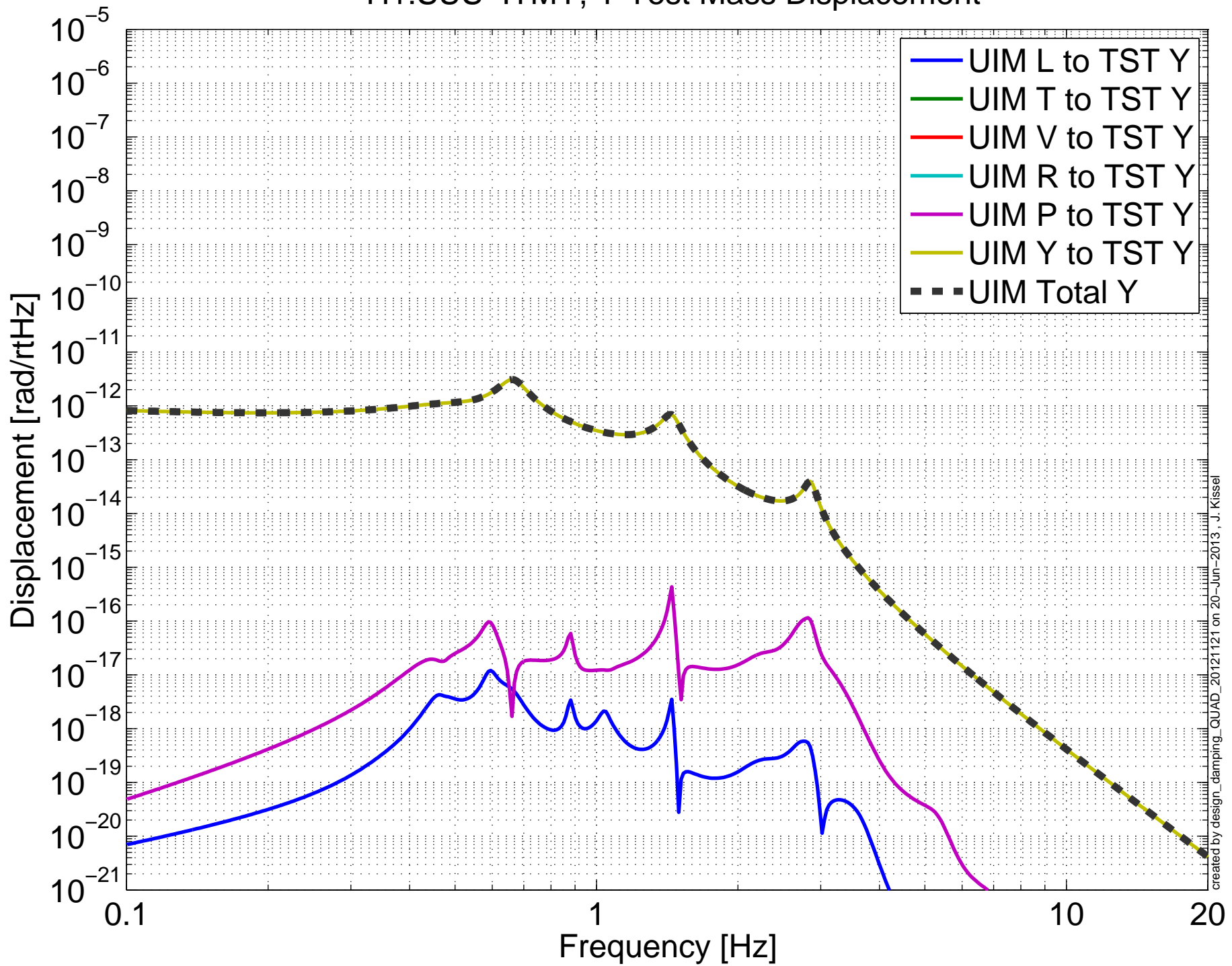


Projected Top Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, Y Test Mass Displacement



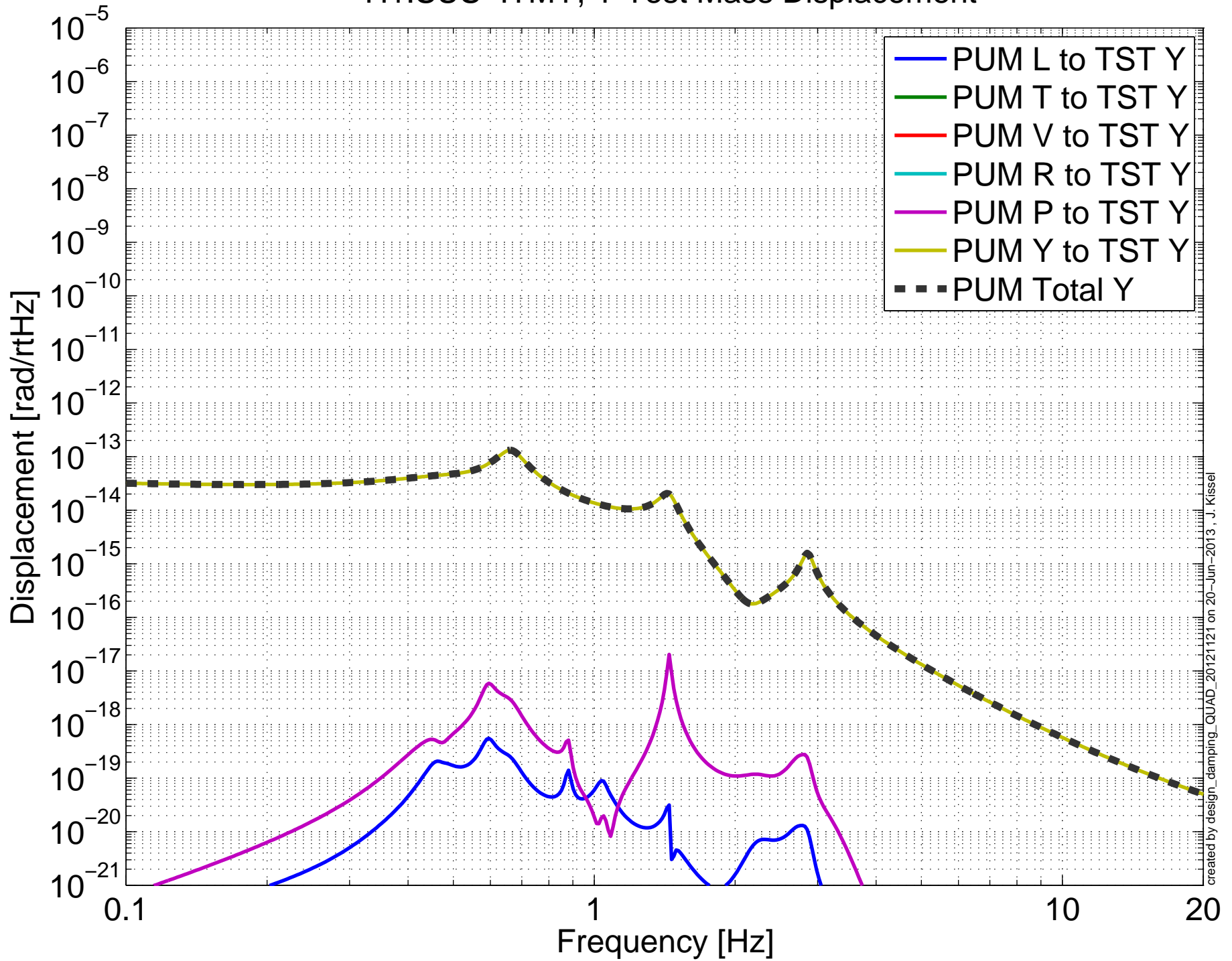
created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

Projected UIM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, Y Test Mass Displacement



created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

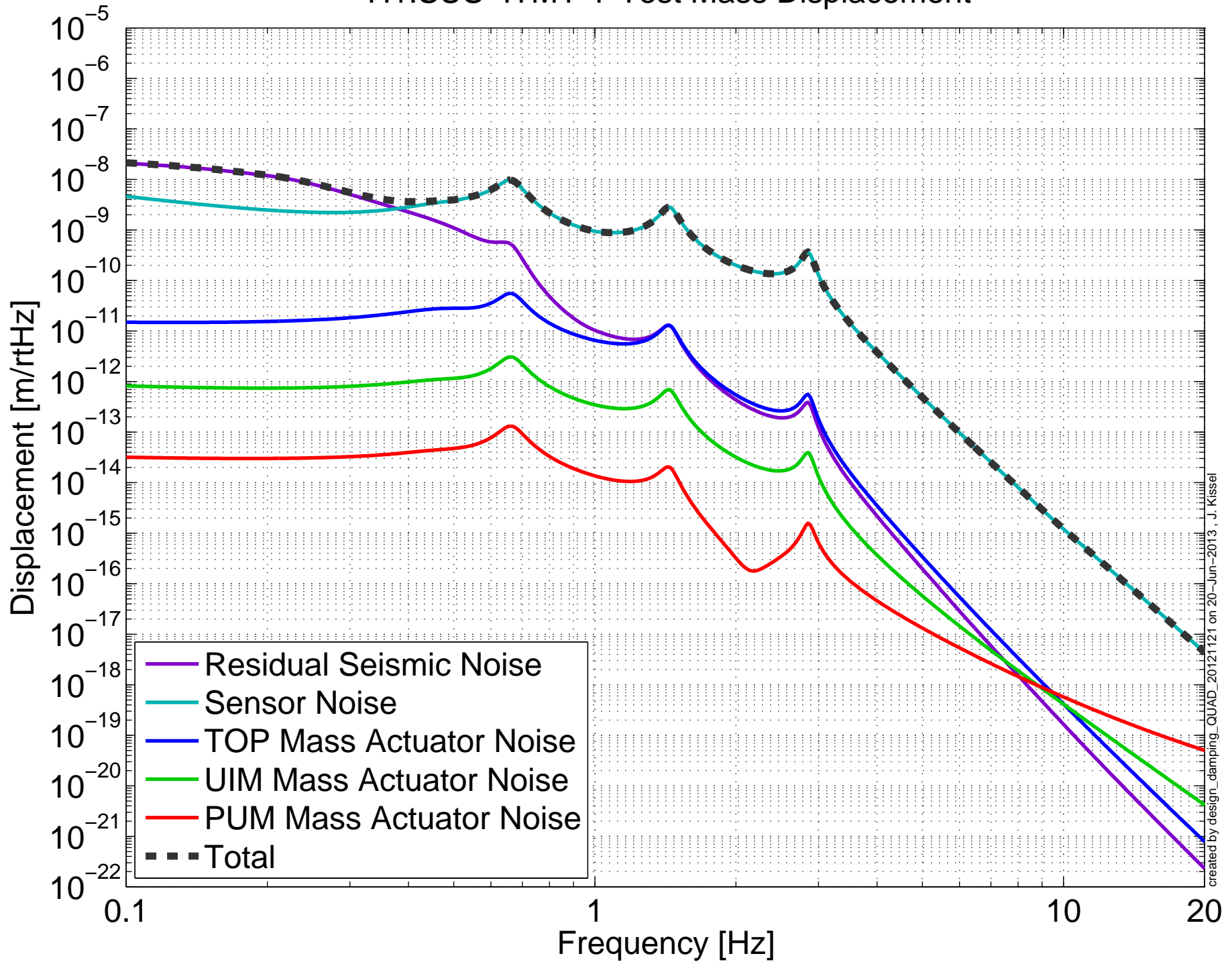
Projected PUM Mass Actuator > Test Mass Noise Budget H1:SUS-ITMY, Y Test Mass Displacement



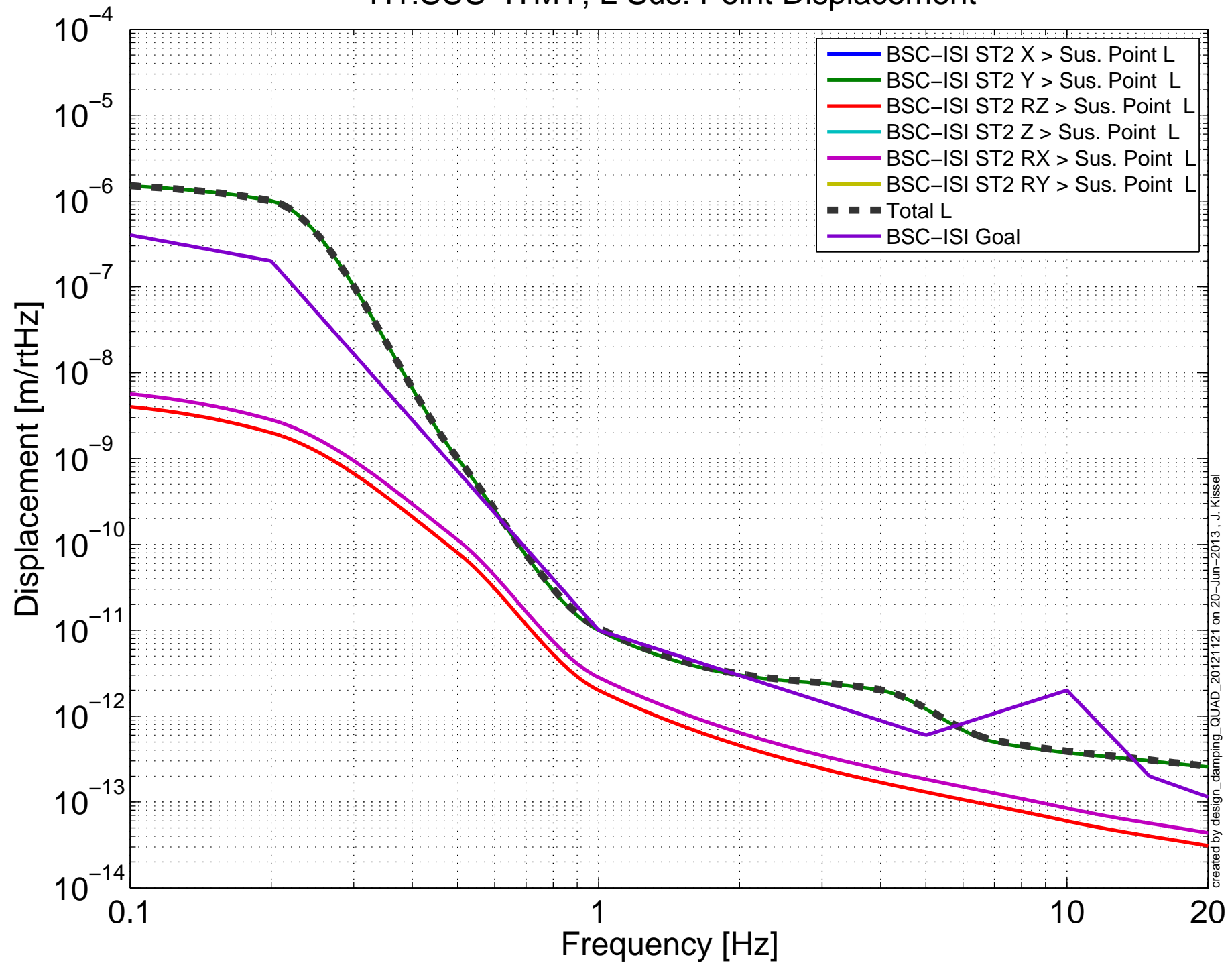
created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

Damping Loop Performance

H1:SUS-ITMY Y Test Mass Displacement

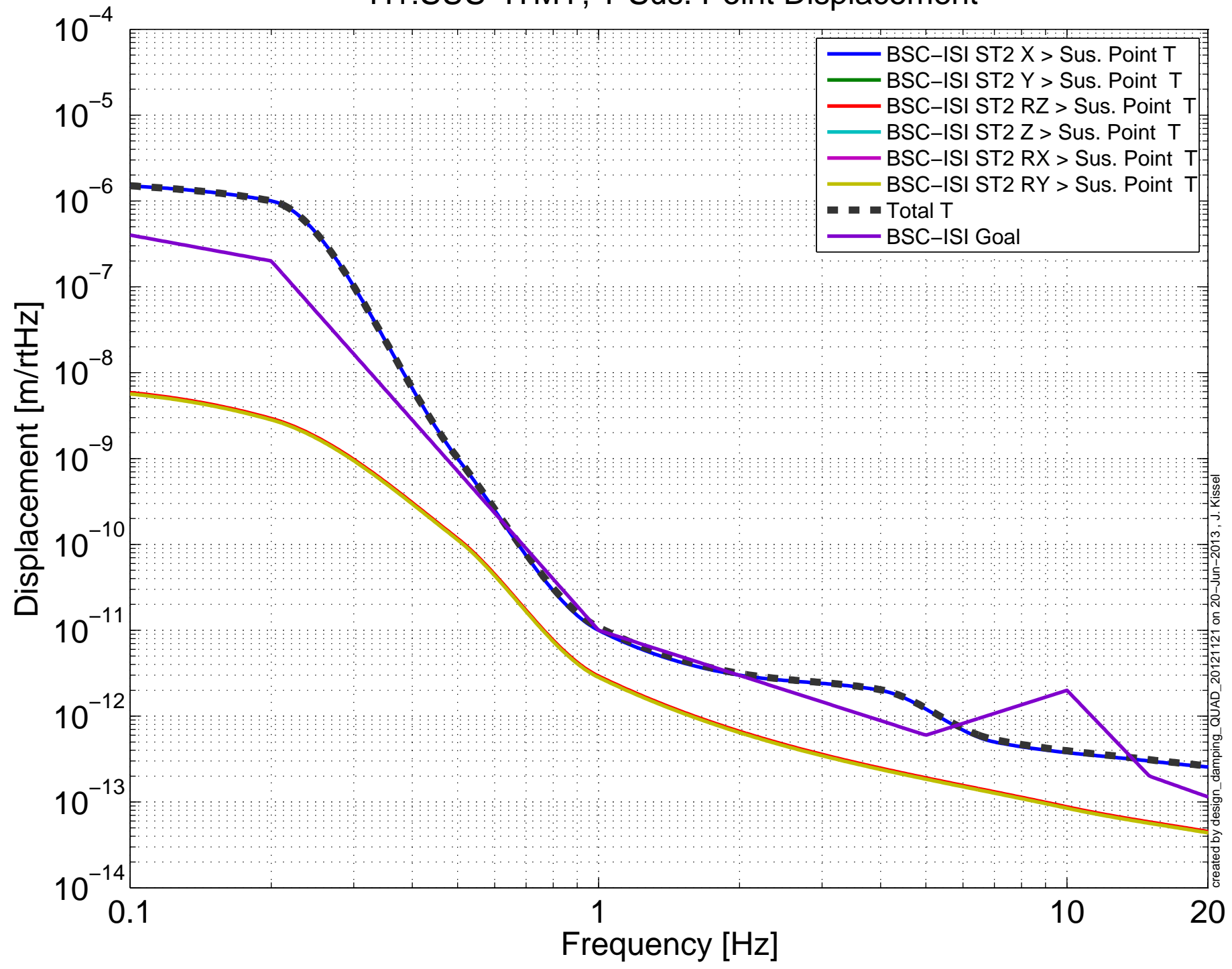


Projected ISI Seismic Noise Budget H1:SUS-ITMY, L Sus. Point Displacement



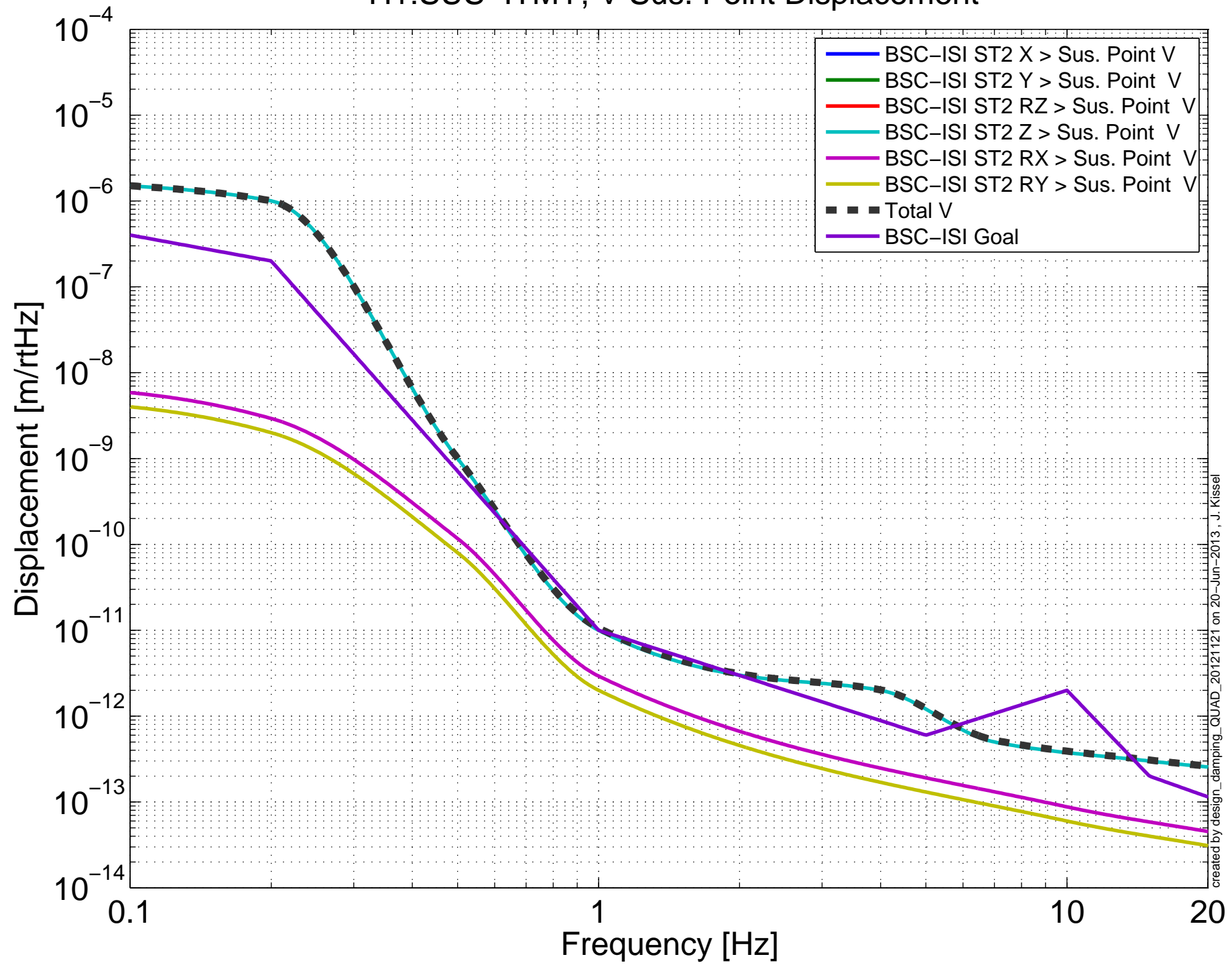
created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

Projected ISI Seismic Noise Budget H1:SUS-ITMY, T Sus. Point Displacement



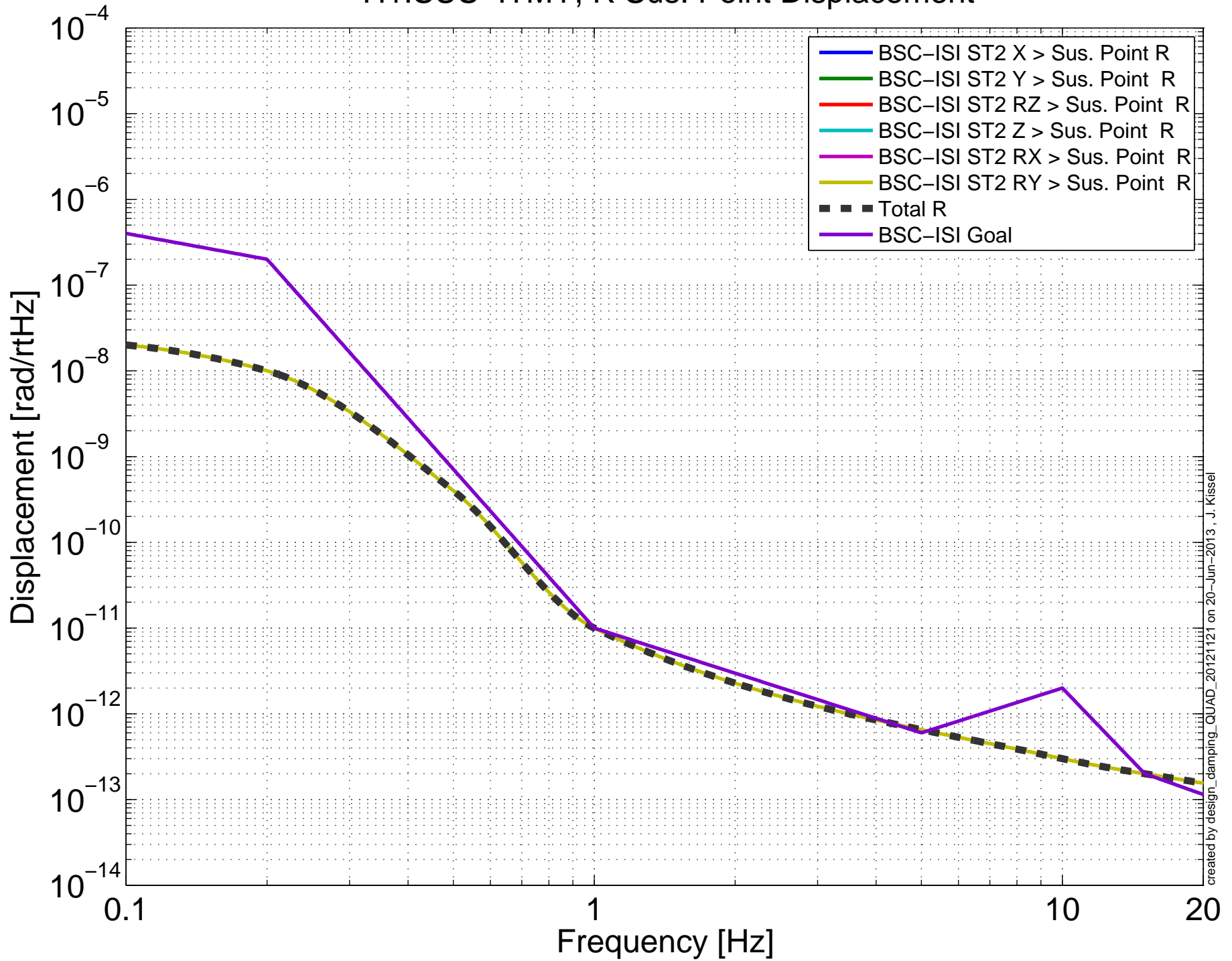
created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

Projected ISI Seismic Noise Budget H1:SUS-ITMY, V Sus. Point Displacement



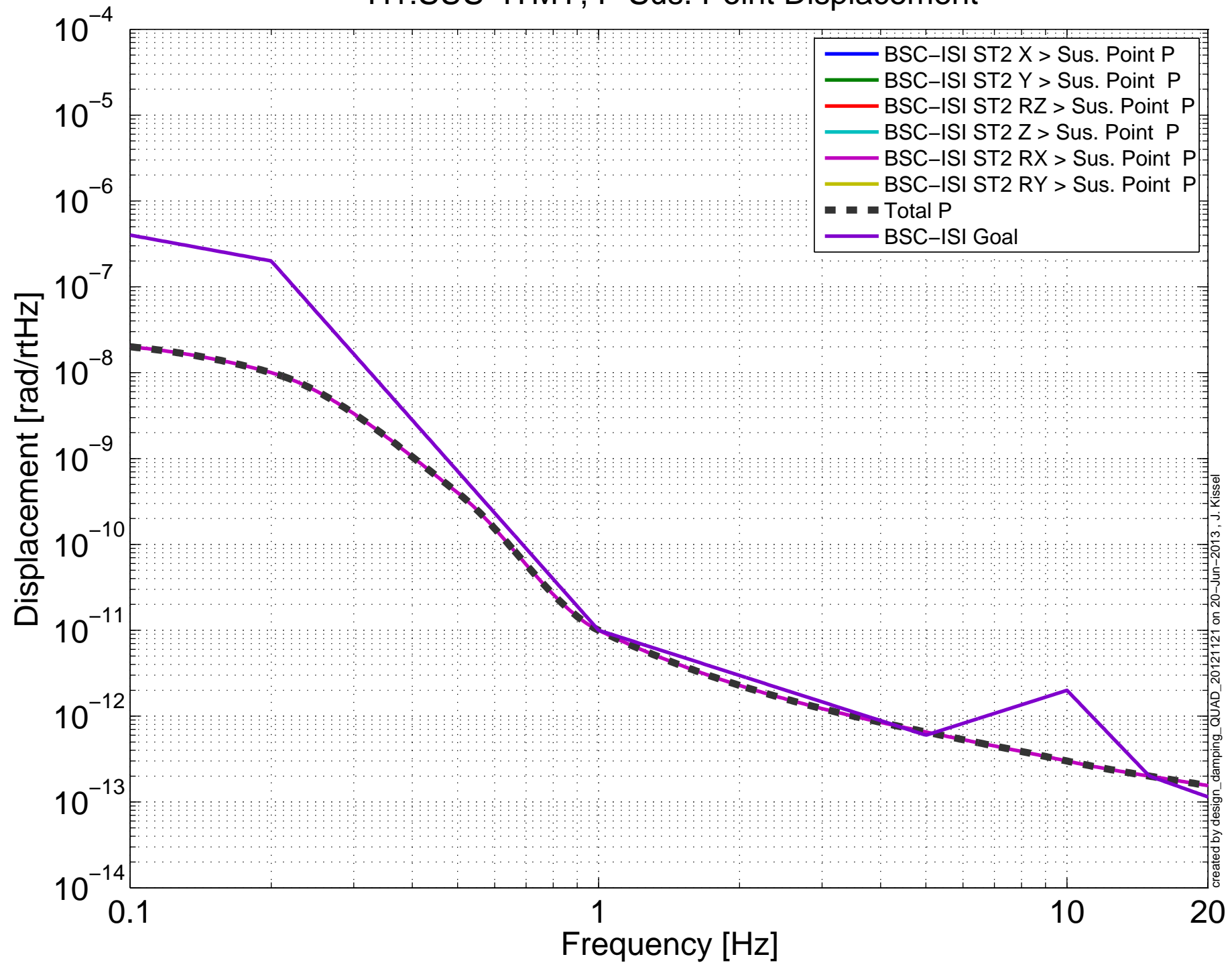
created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

Projected ISI Seismic Noise Budget H1:SUS-ITMY, R Sus. Point Displacement



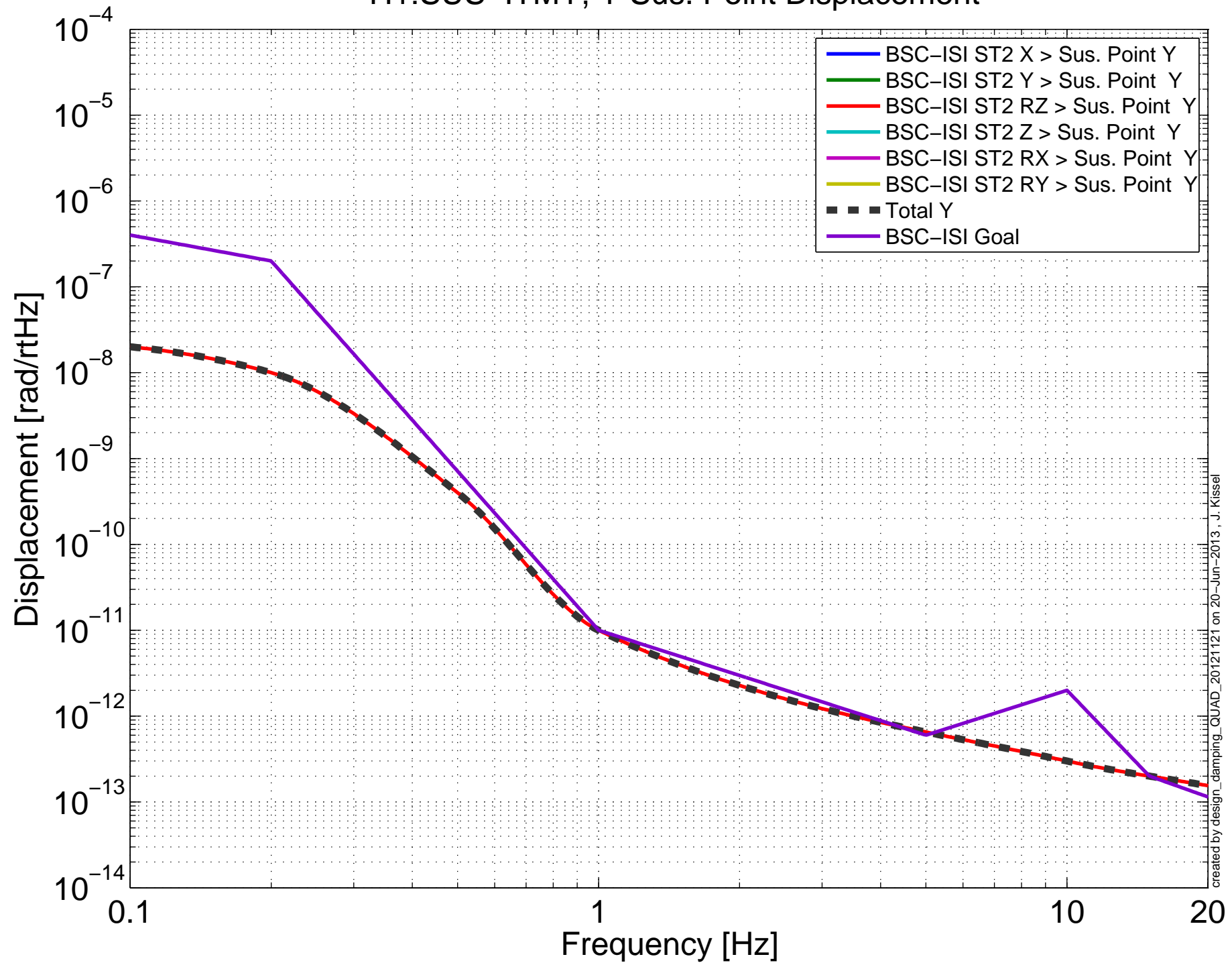
created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

Projected ISI Seismic Noise Budget H1:SUS-ITMY, P Sus. Point Displacement



created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel

Projected ISI Seismic Noise Budget H1:SUS-ITMY, Y Sus. Point Displacement



created by design_damping_QUAD_20121121 on 20-Jun-2013, J. Kissel