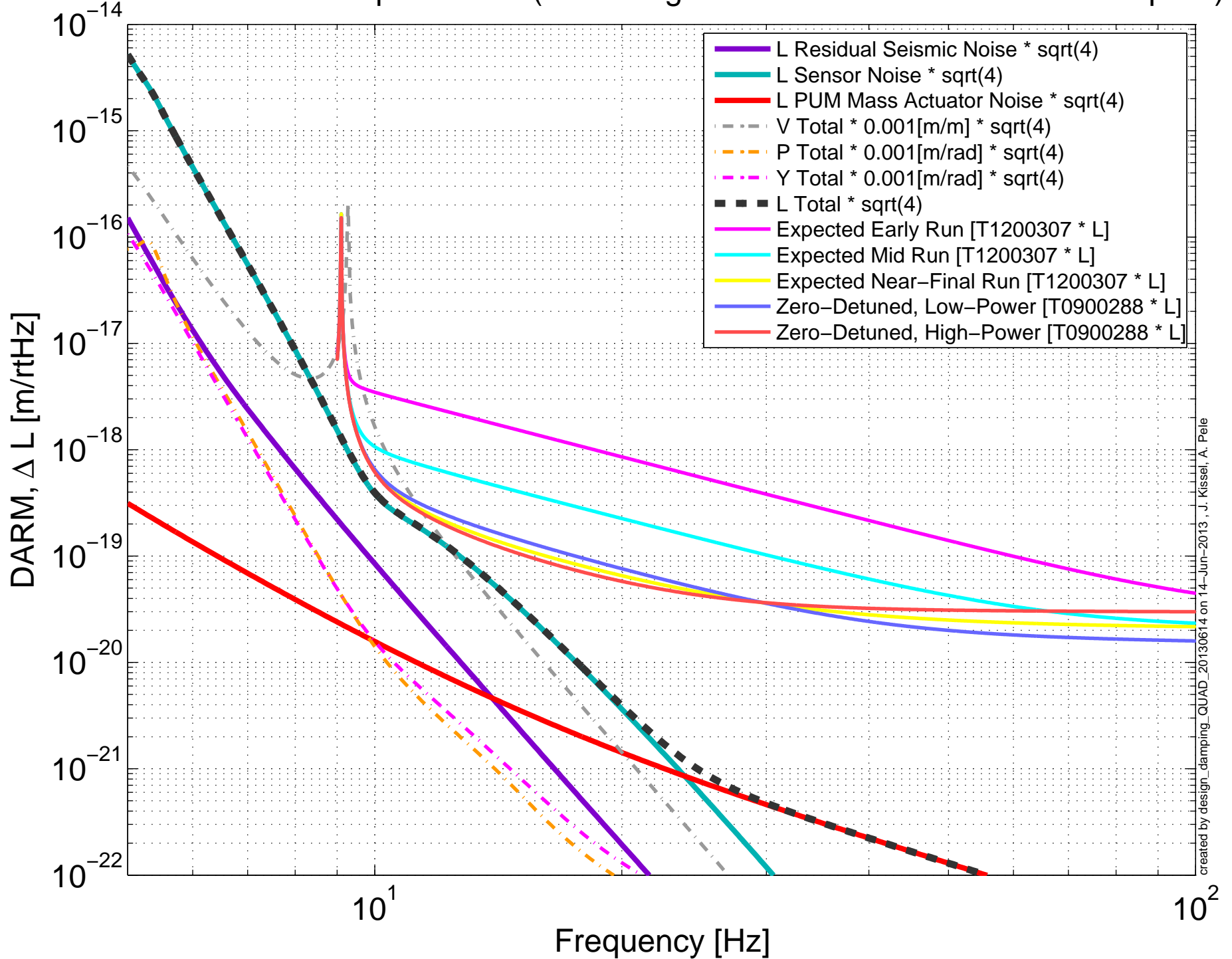


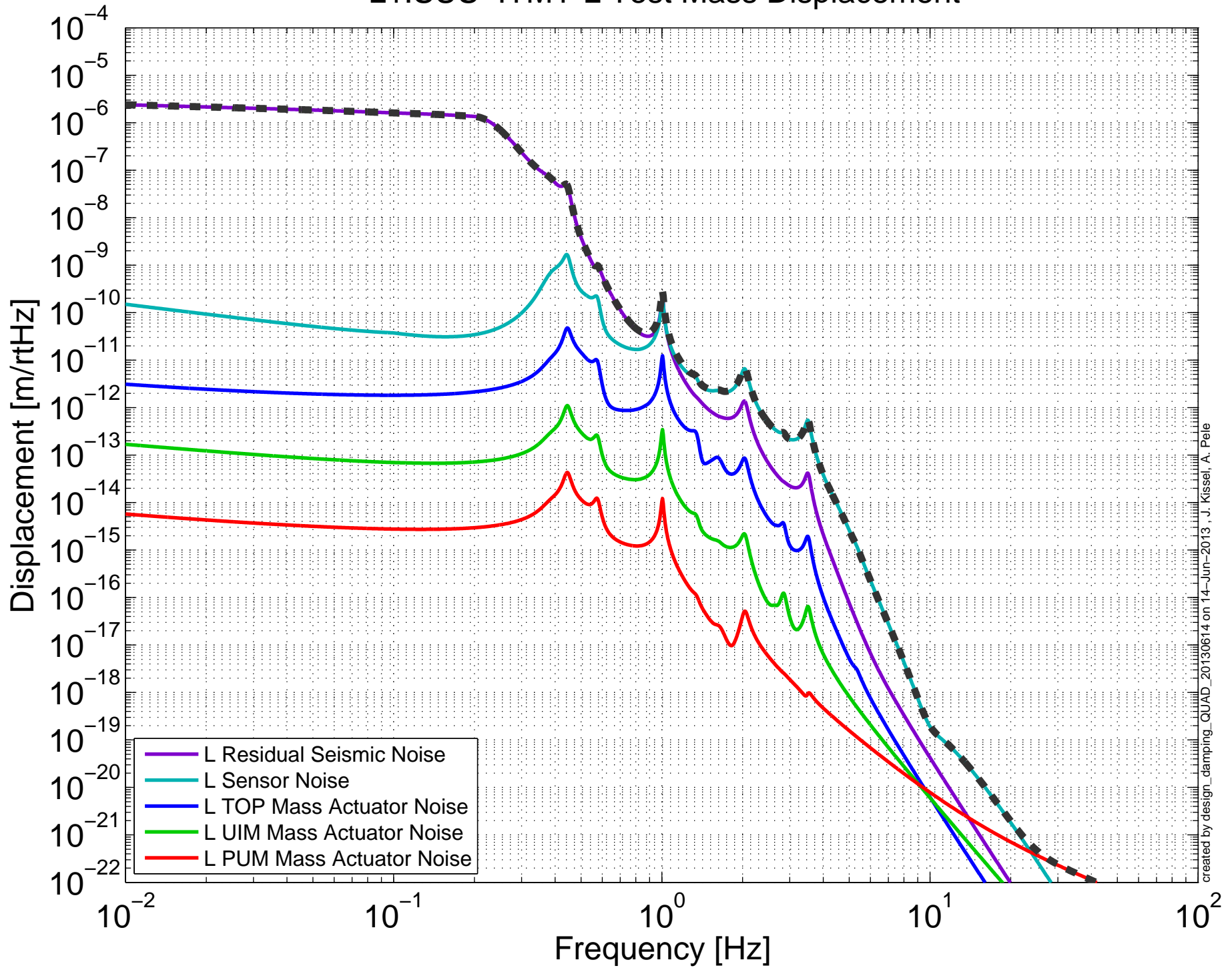
# Damping Loop Performance

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

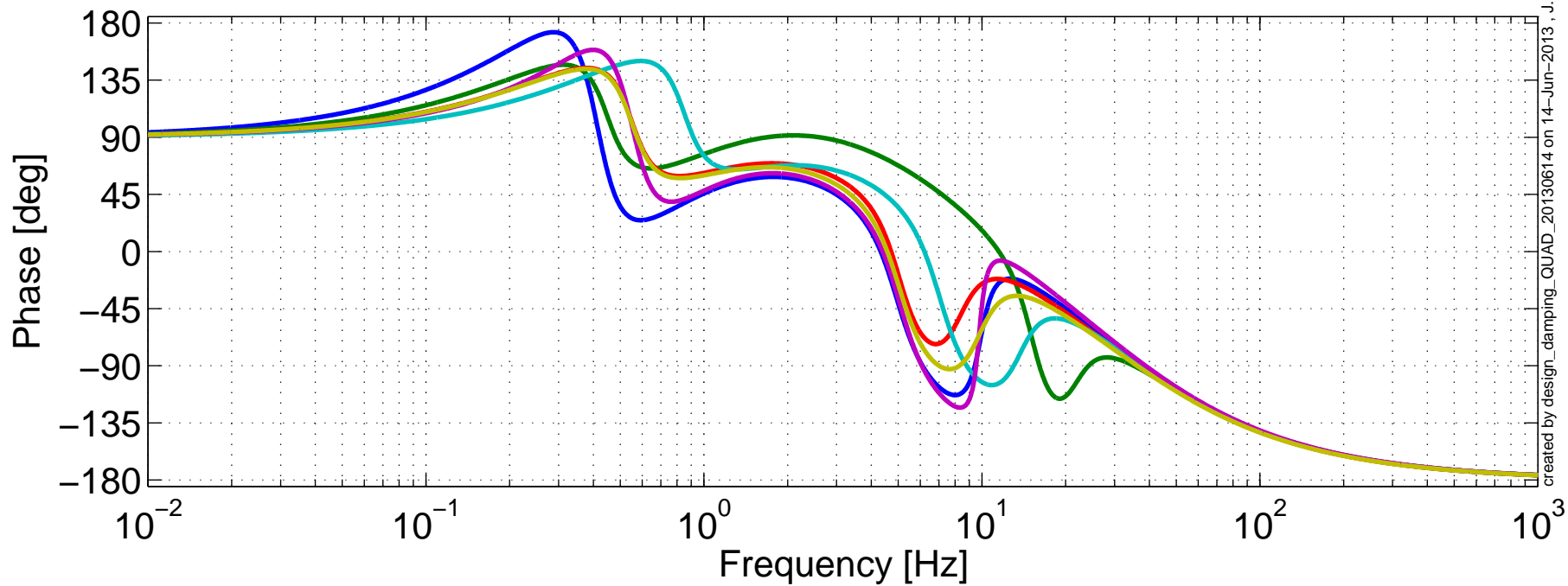
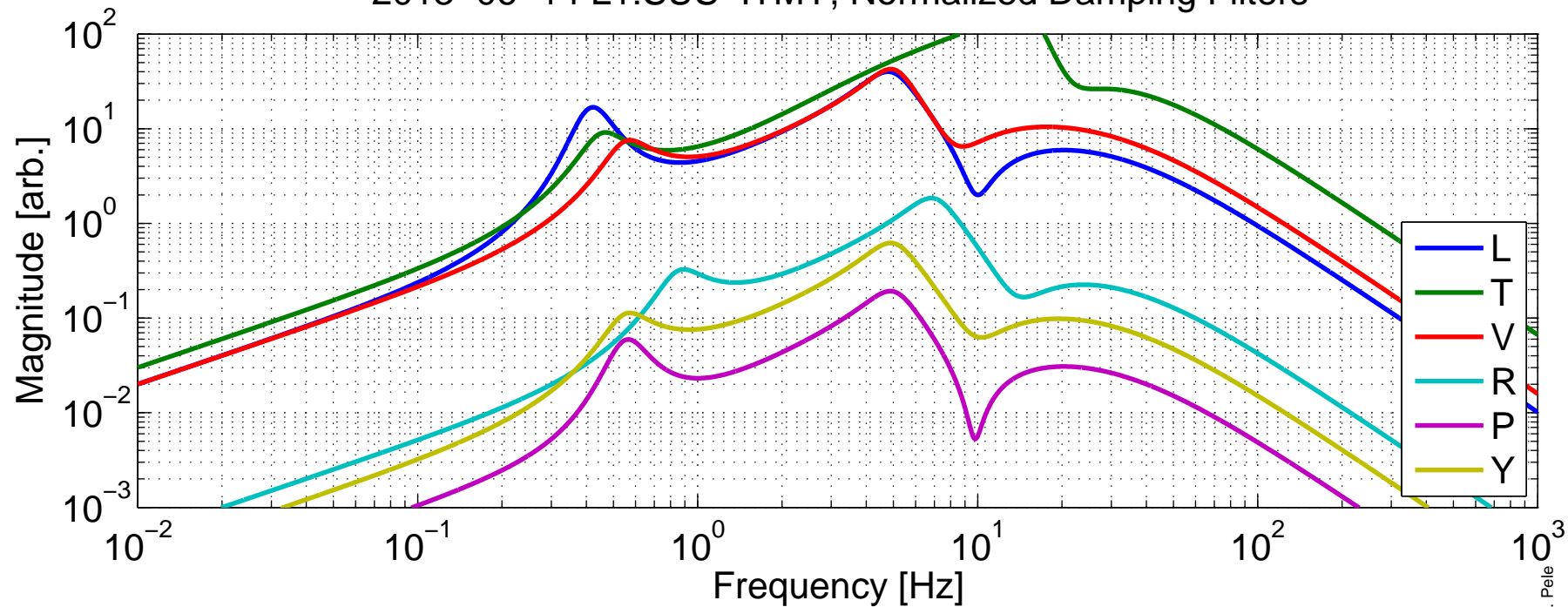


# Damping Loop Performance

## L1:SUS-ITMY L Test Mass Displacement



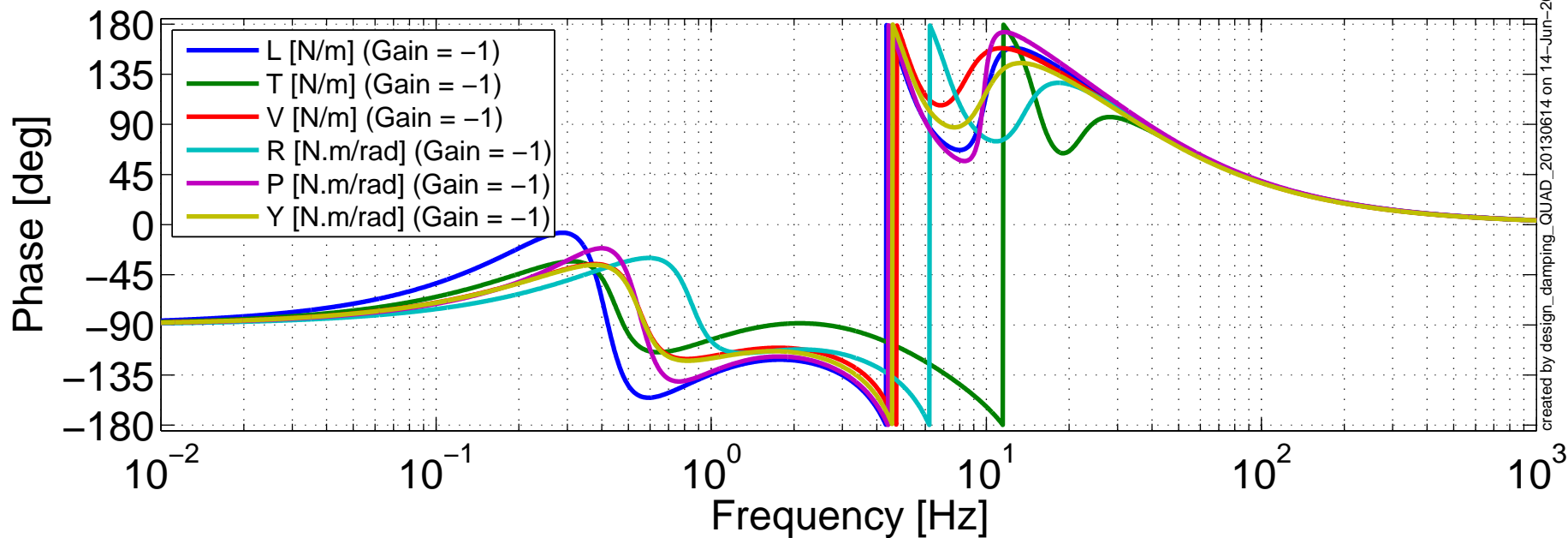
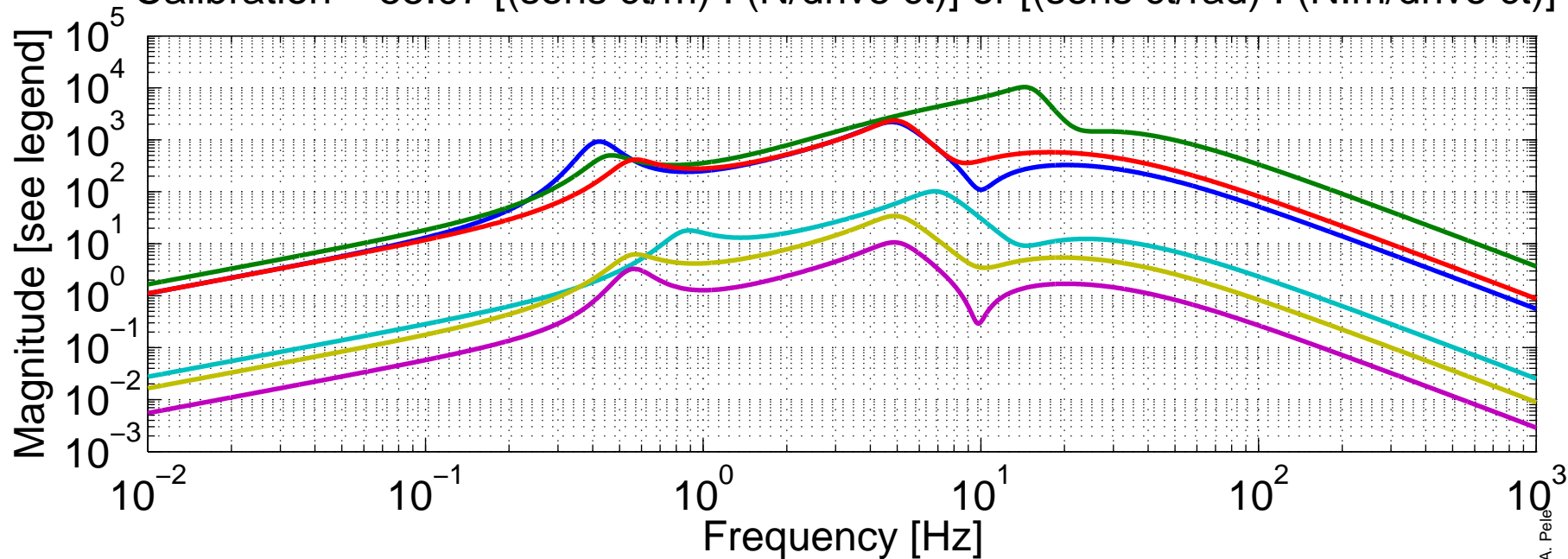
2013-06-14 L1:SUS-ITMY, Normalized Damping Filters



created by design\_damping\_QUAD\_20130614 on 14-Jun-2013, J. Kissel, A. Pele

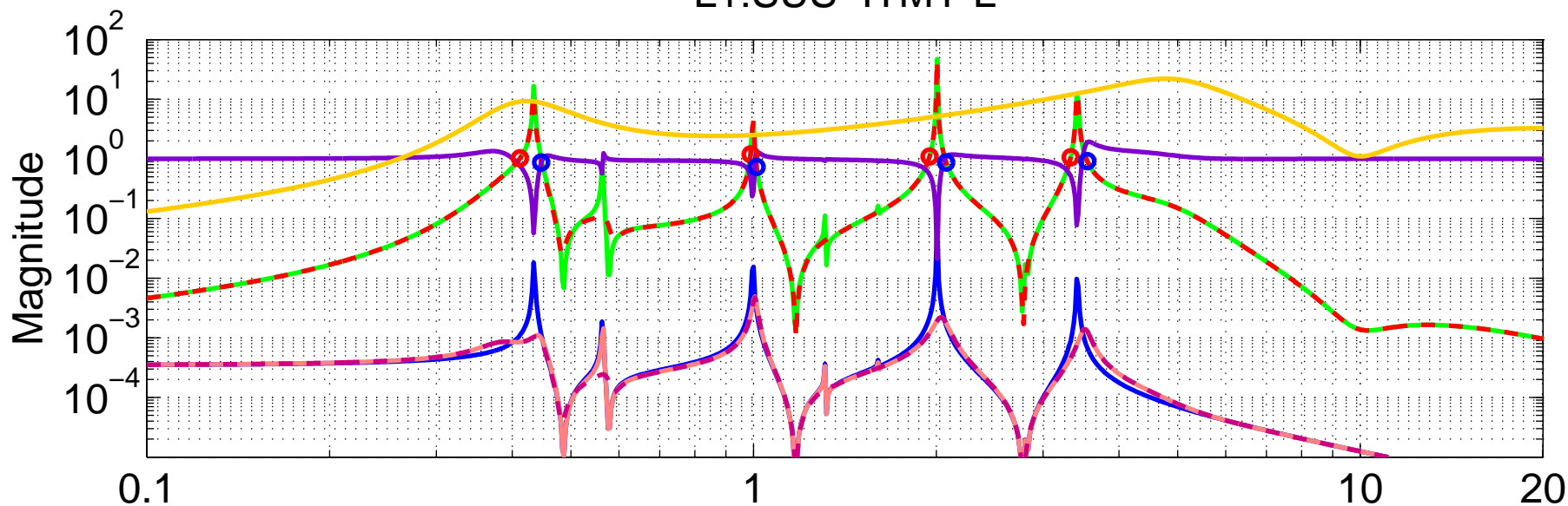
# 2013-06-14 L1:SUS-ITMY, Calibrated Damping Filters

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

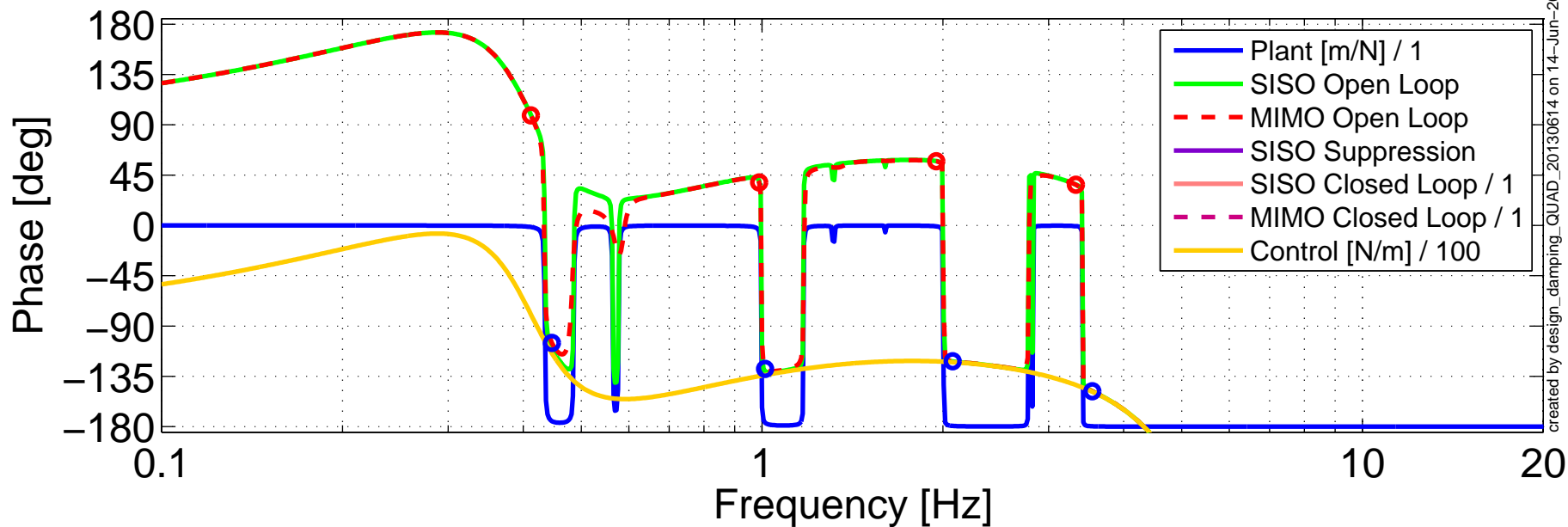


# Damping Loop Design

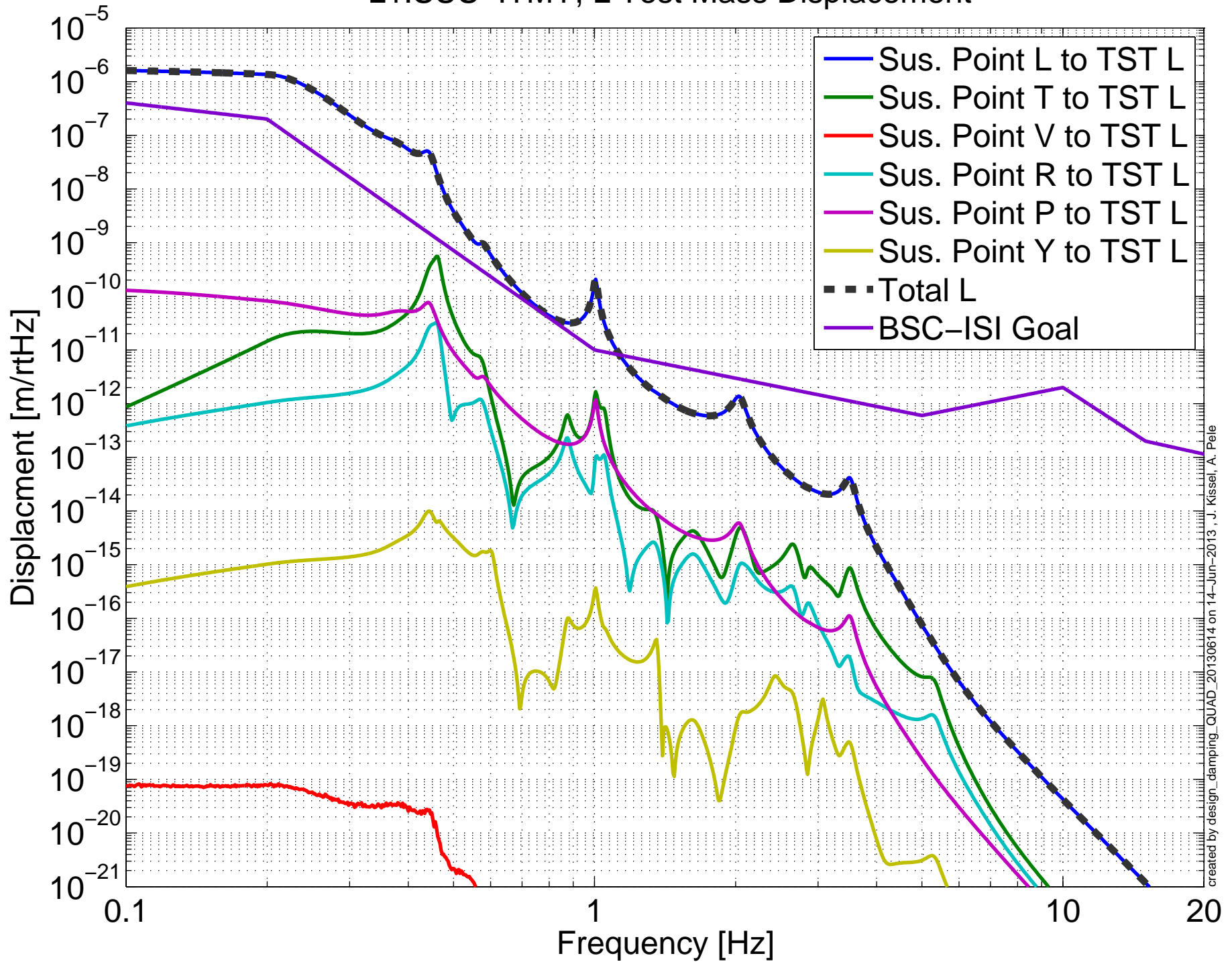
## L1:SUS-ITMY L



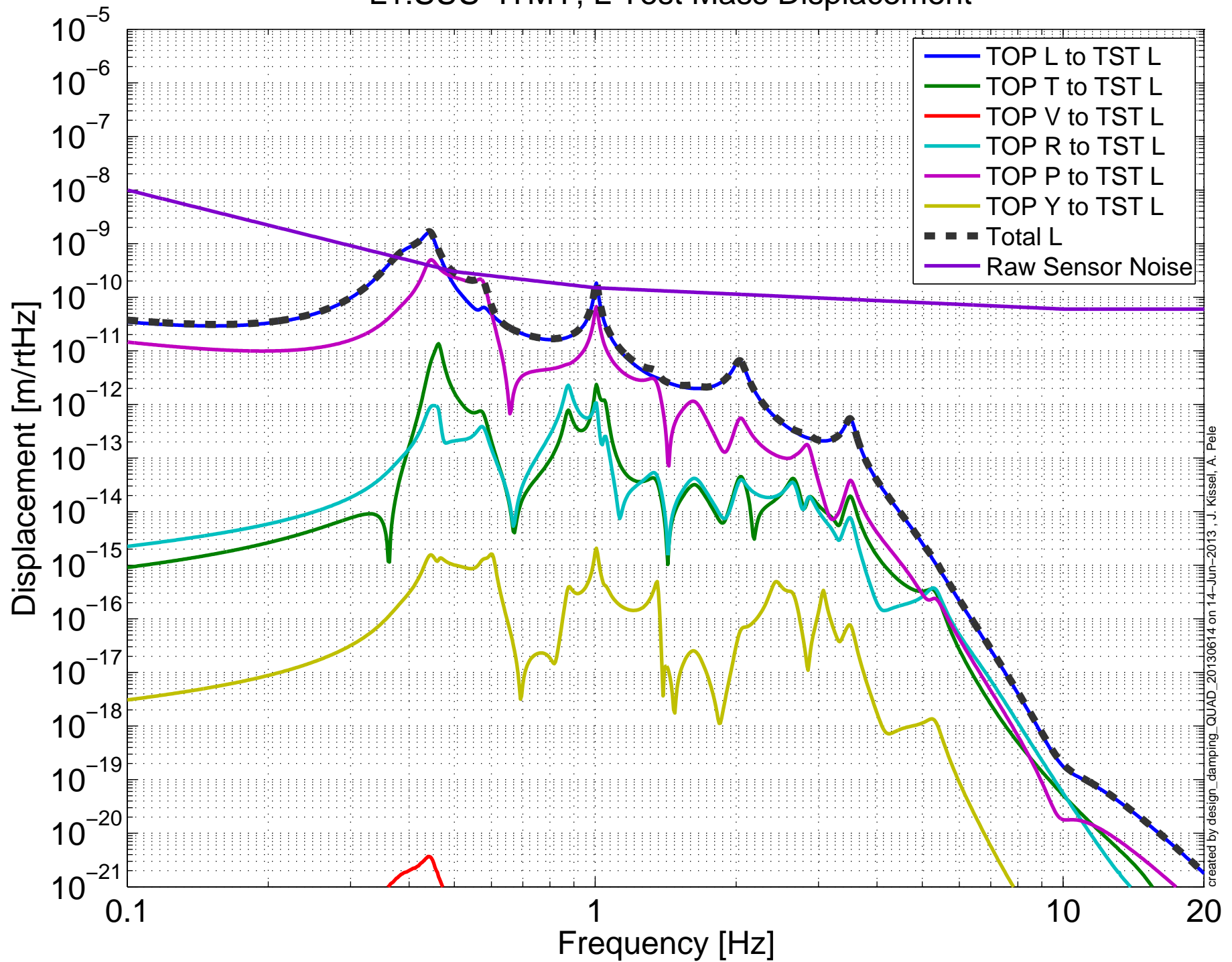
MIMO LUGF Phase Margins (red): [81.6    142    123    144] [deg]  
MIMO UUGF Phase Margins (blue): [74.9    51.6    58.5    31.7] [deg]



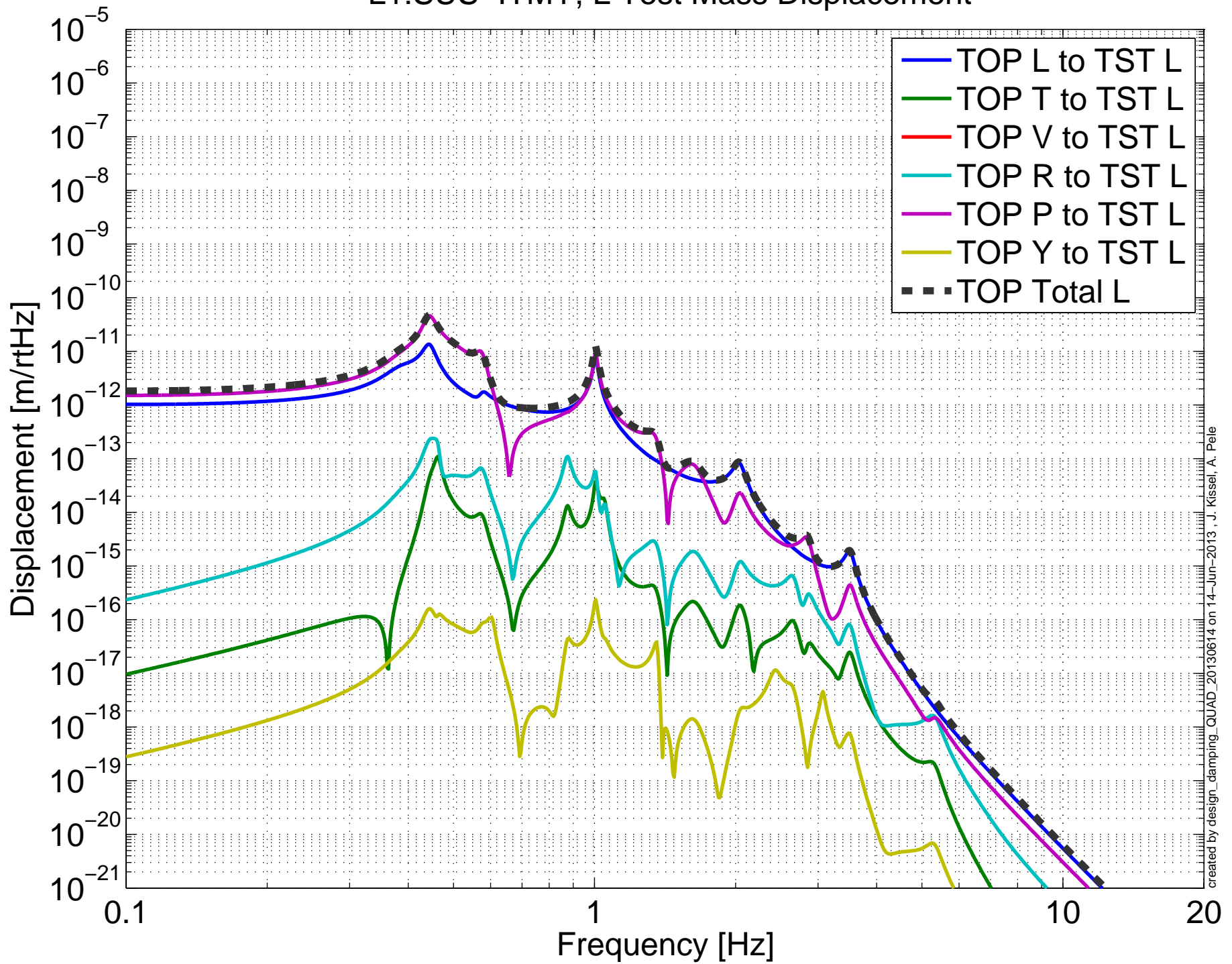
# Projected Sus. Point > Test Mass Seismic Noise Budget L1:SUS-ITMY, L Test Mass Displacement



# Projected Top Mass Sensor > Test Mass Noise Budget L1:SUS-ITMY, L Test Mass Displacement

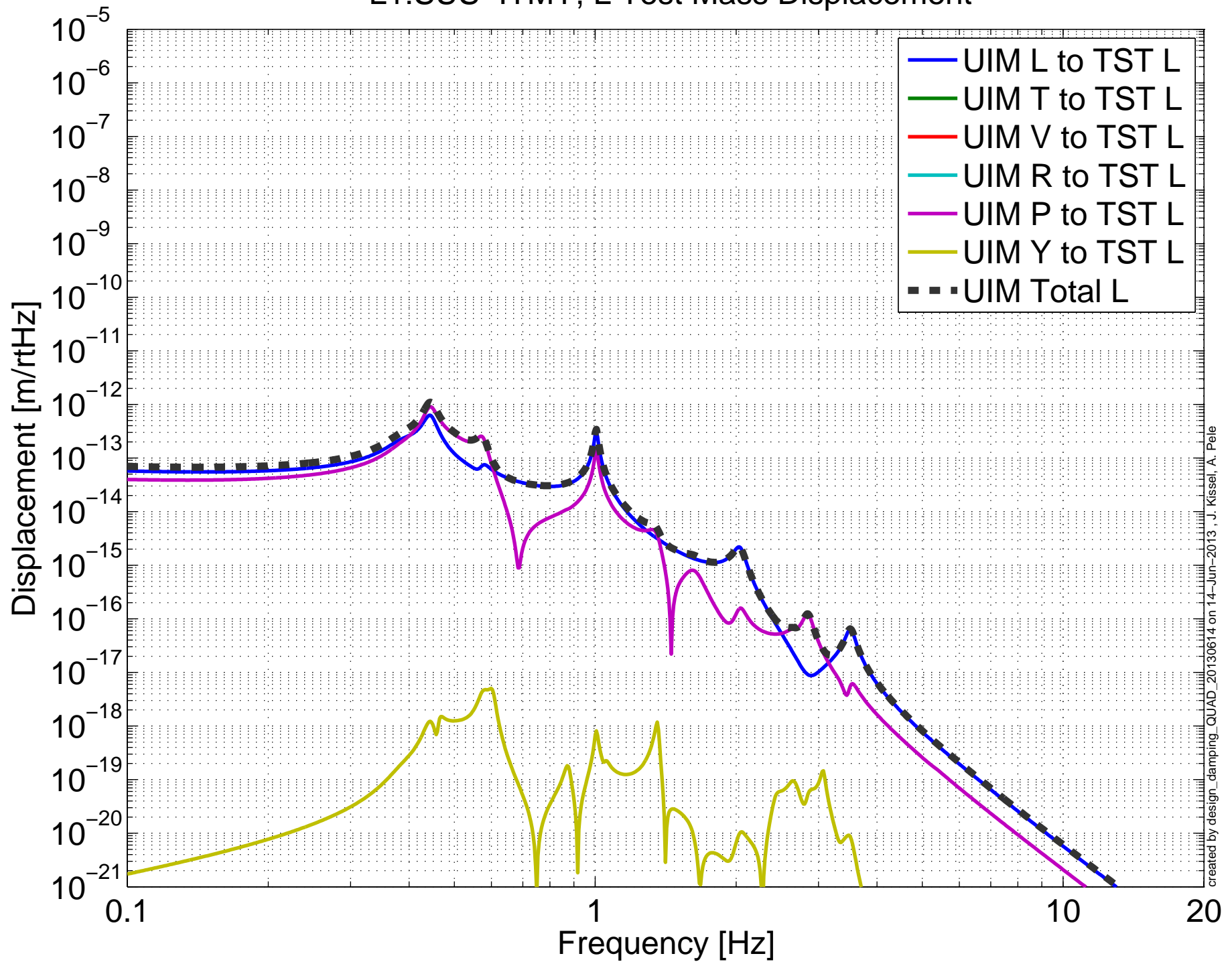


# Projected Top Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, L Test Mass Displacement

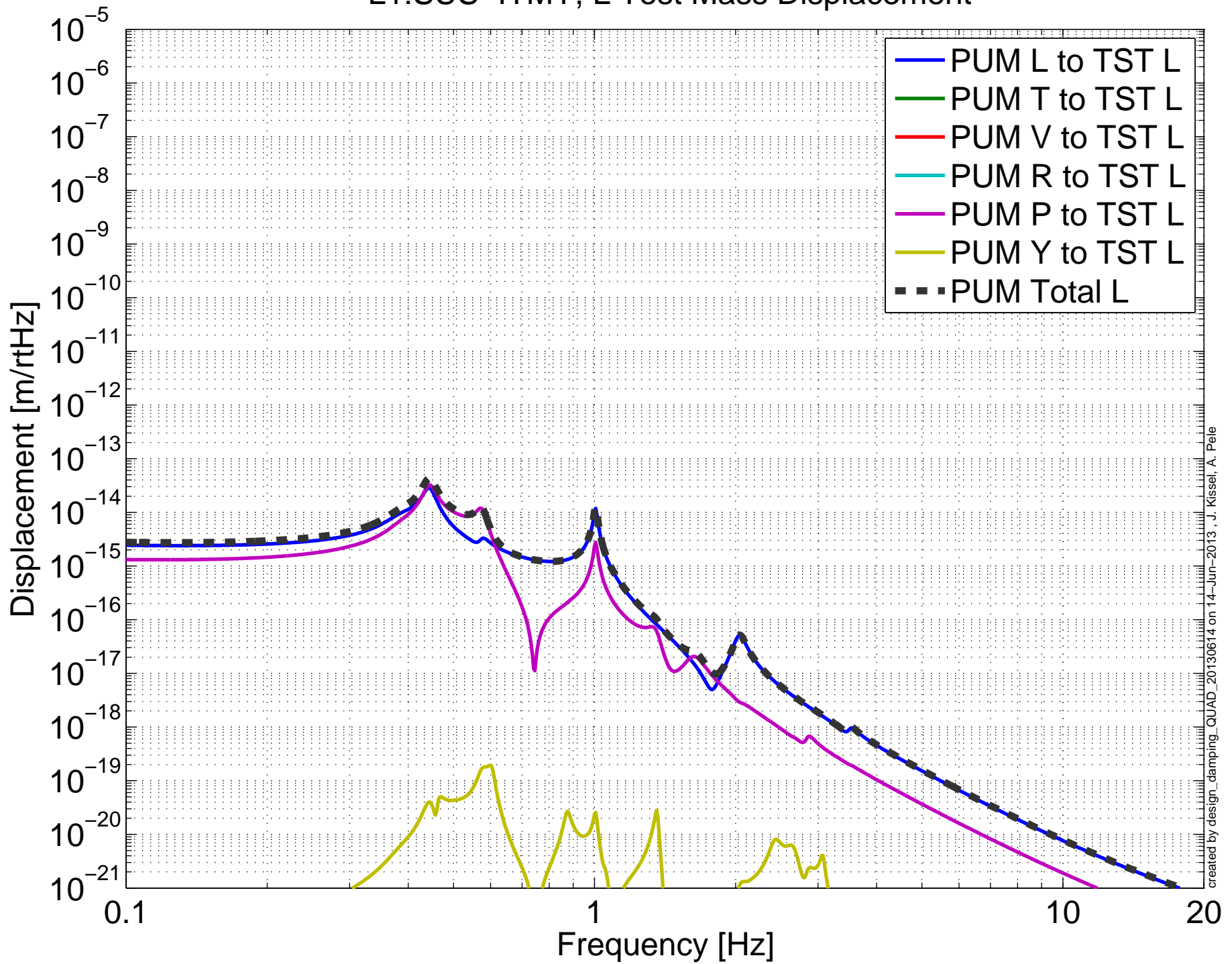




# Projected UIM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, L Test Mass Displacement

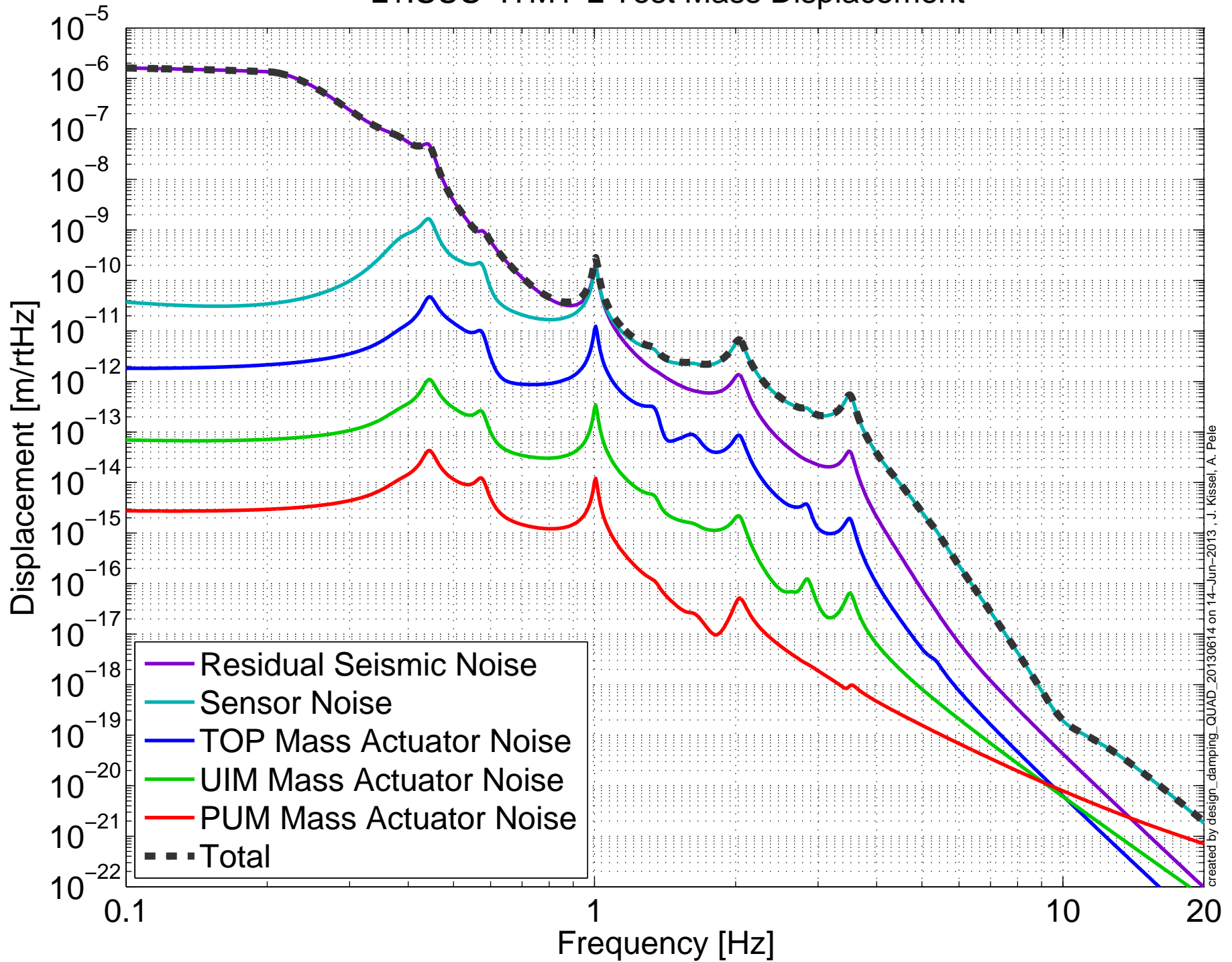


# Projected PUM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, L Test Mass Displacement

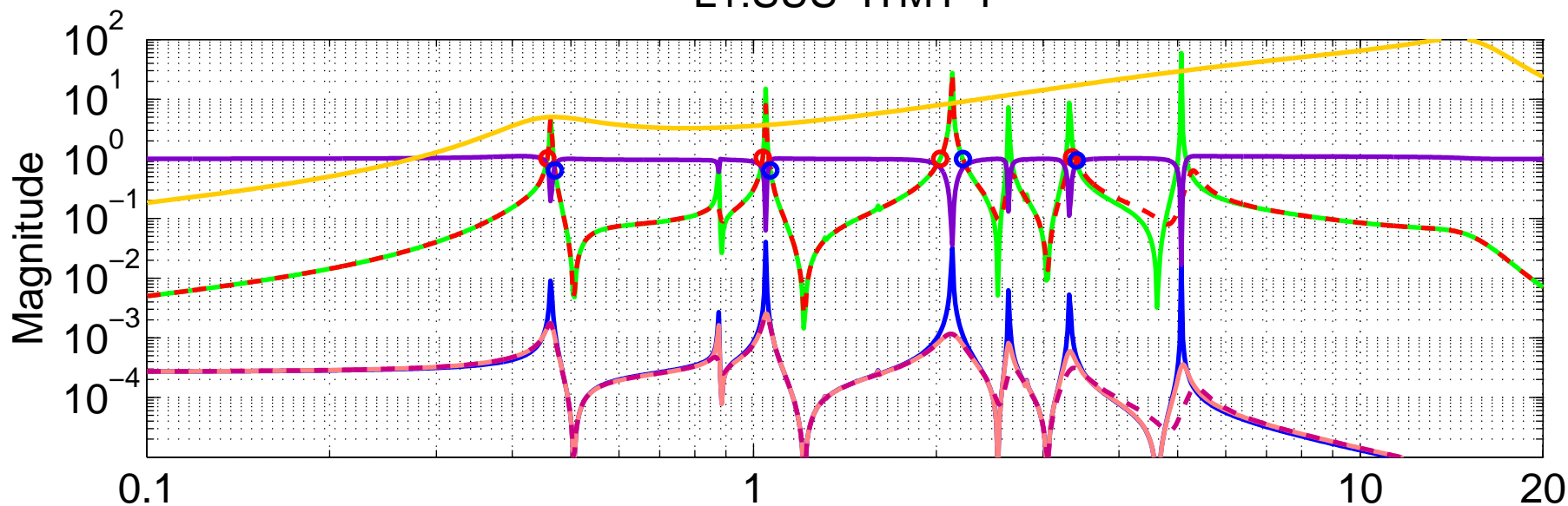


# Damping Loop Performance

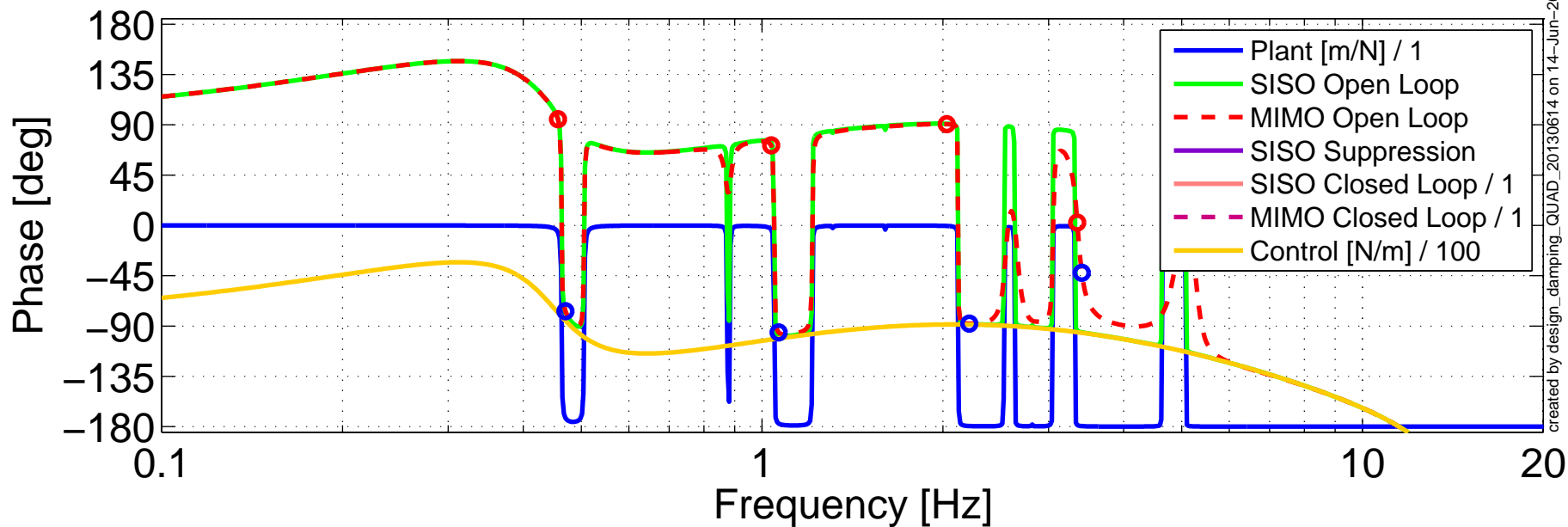
## L1:SUS-ITMY L Test Mass Displacement



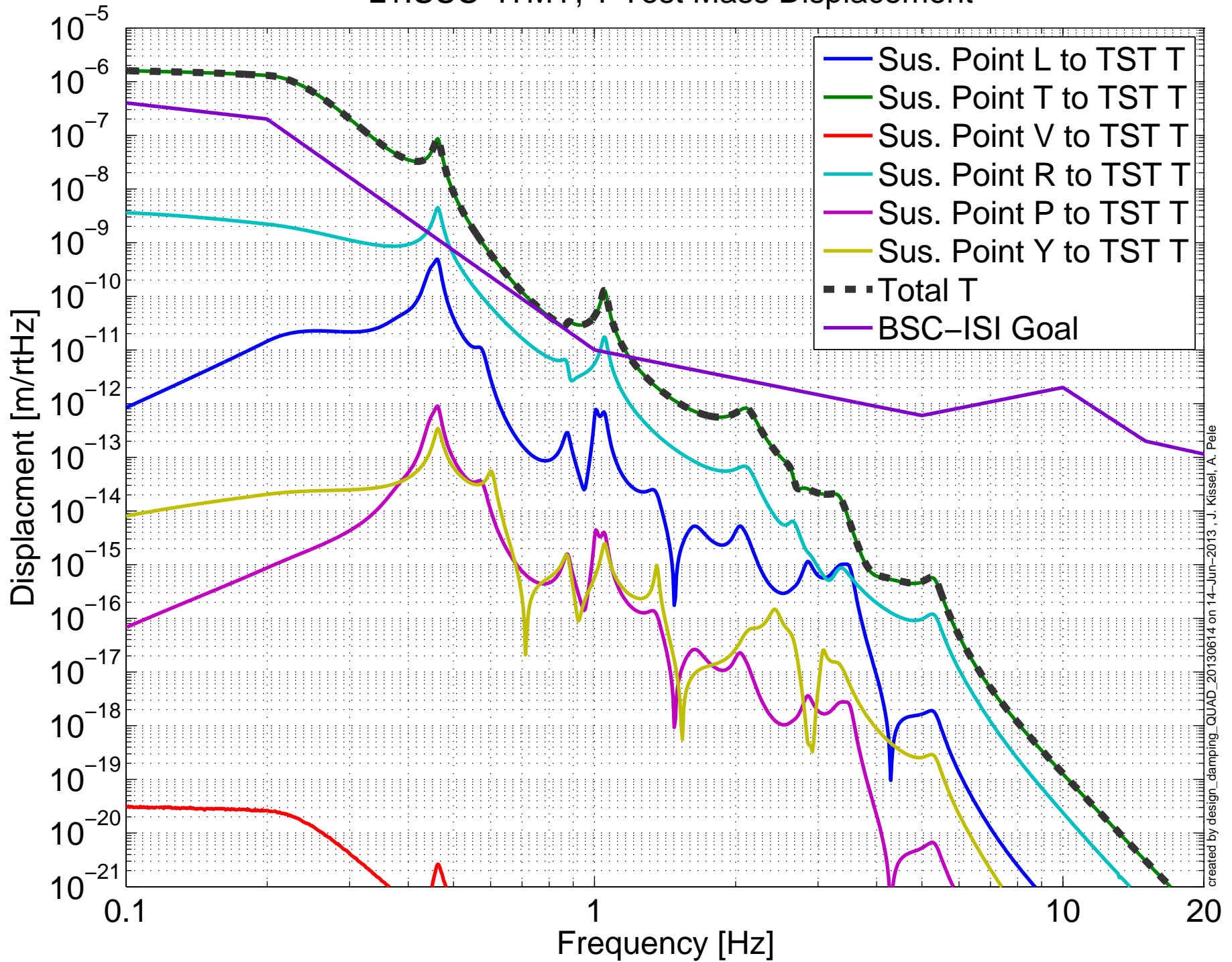
# Damping Loop Design L1:SUS-ITMY T



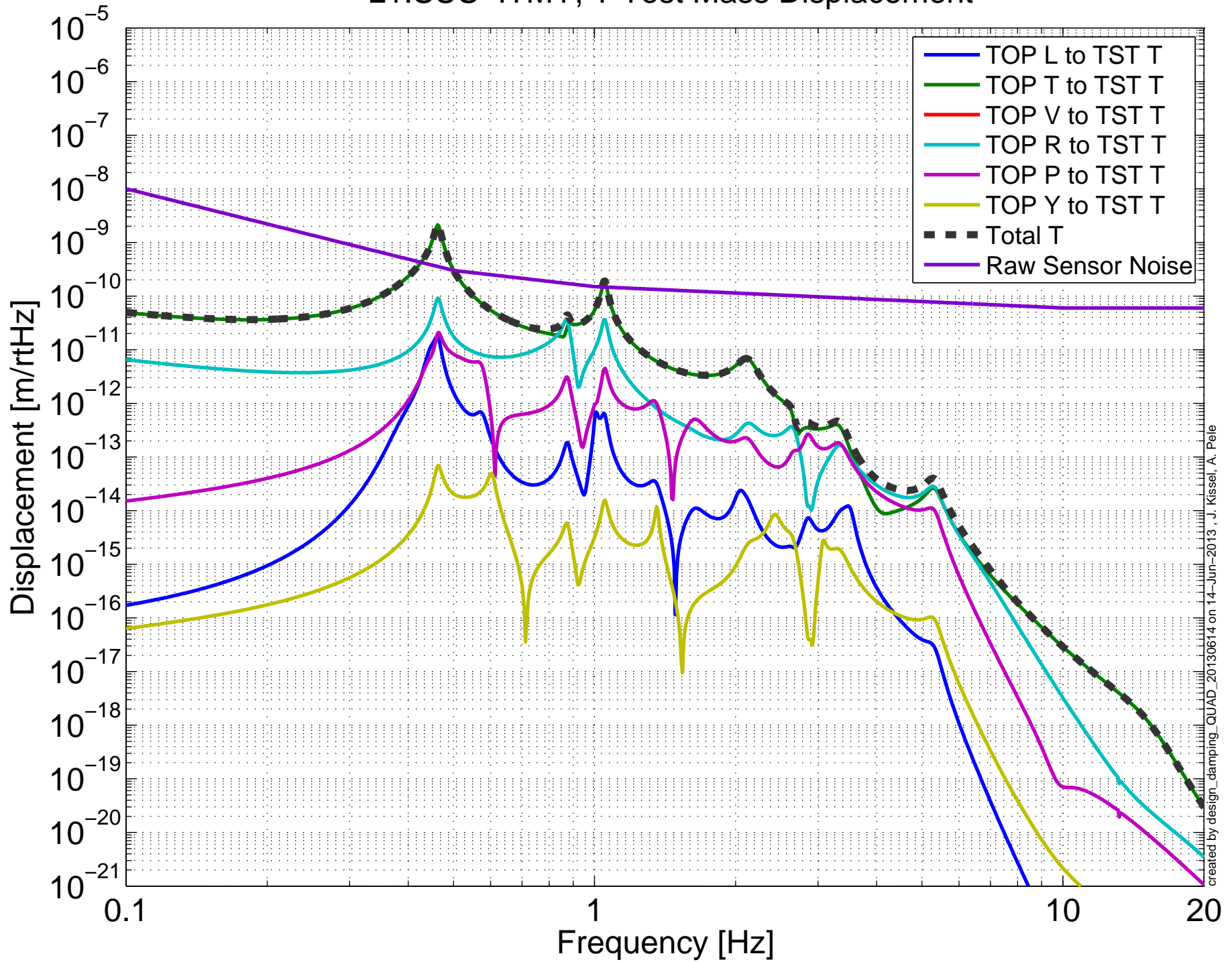
MIMO LUGF Phase Margins (red): [85      108      89.4      177] [deg]  
MIMO UUGF Phase Margins (blue): [103      84.2      92.2      138] [deg]



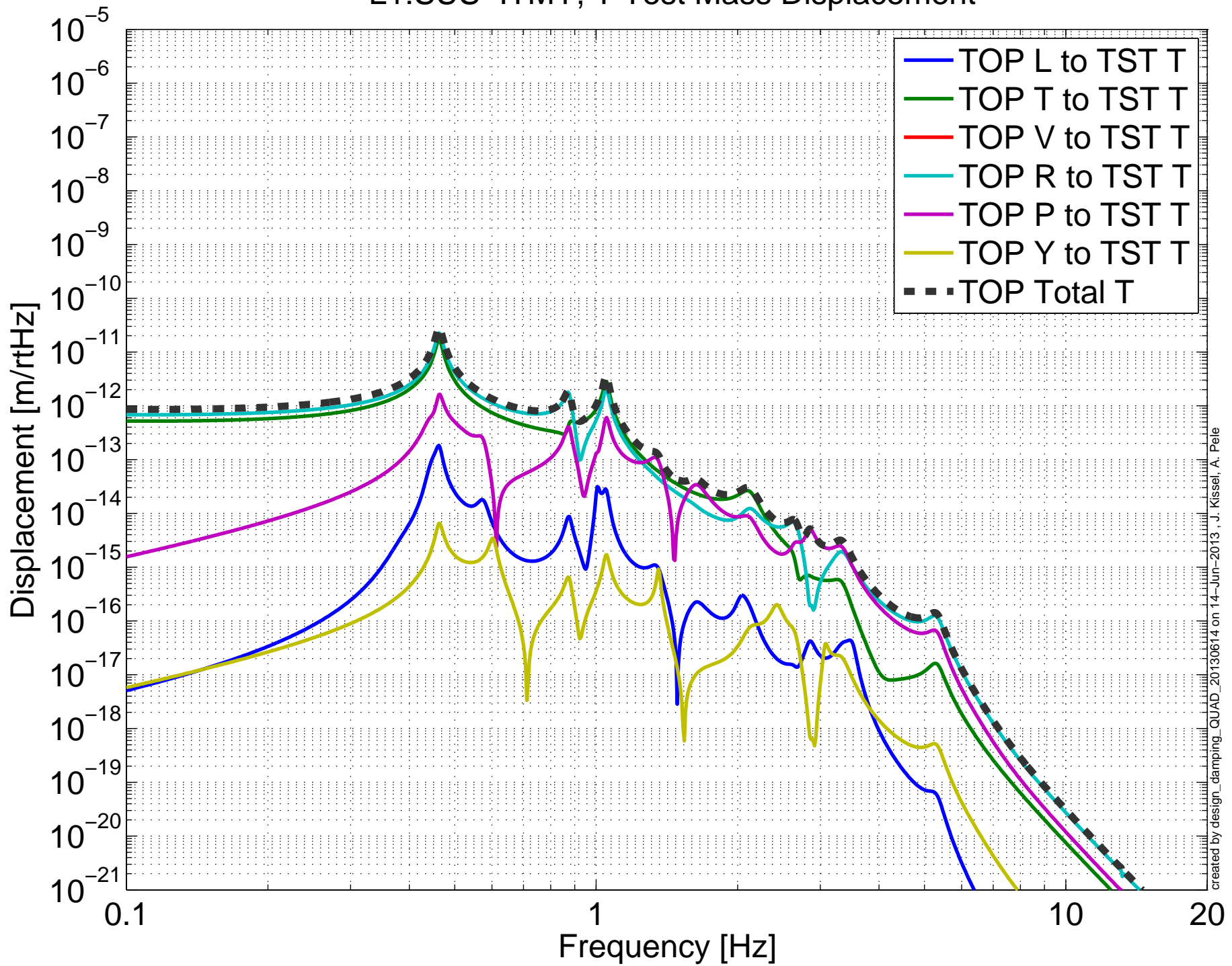
# Projected Sus. Point > Test Mass Seismic Noise Budget L1:SUS-ITMY, T Test Mass Displacement



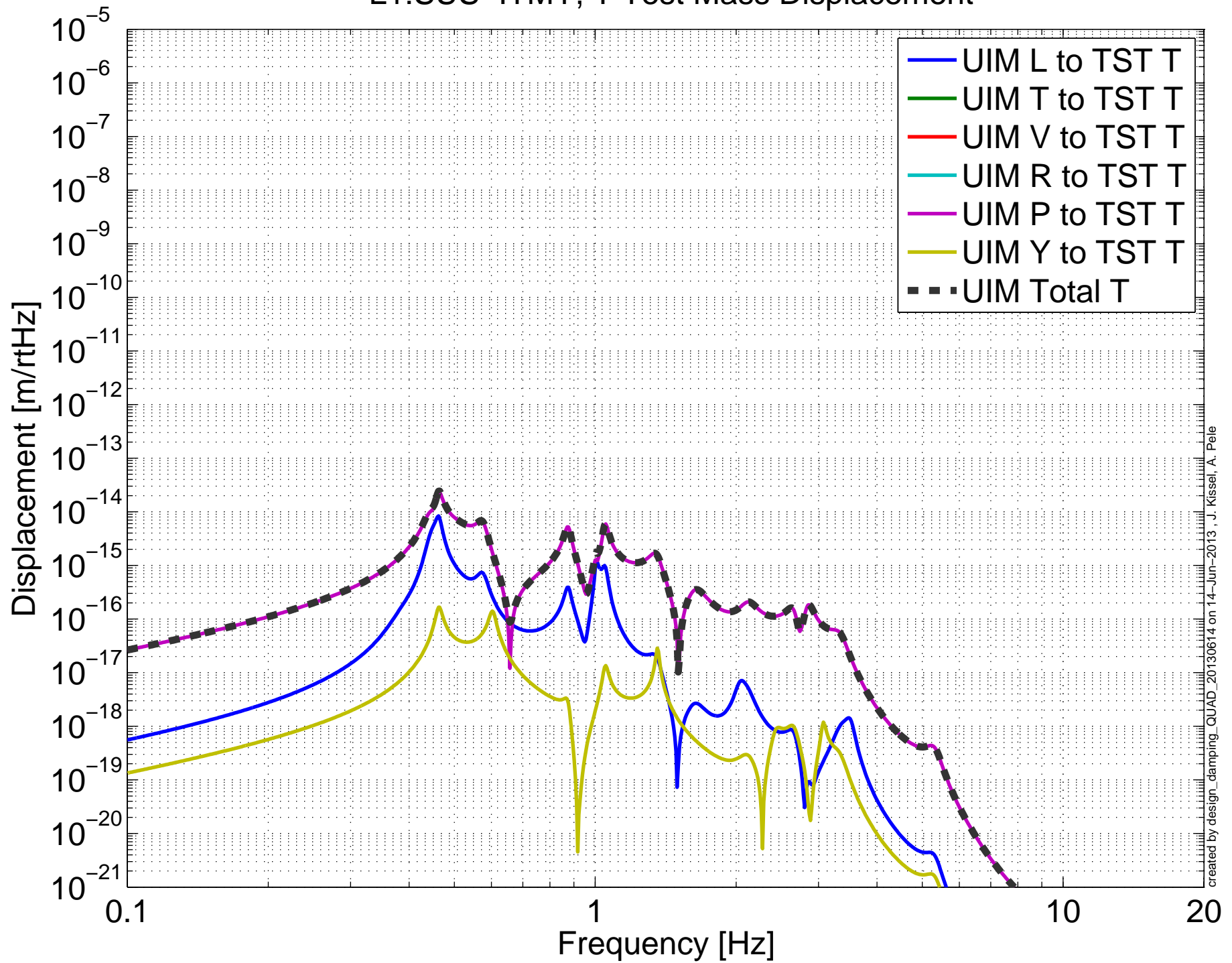
# Projected Top Mass Sensor > Test Mass Noise Budget L1:SUS-ITMY, T Test Mass Displacement



# Projected Top Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, T Test Mass Displacement

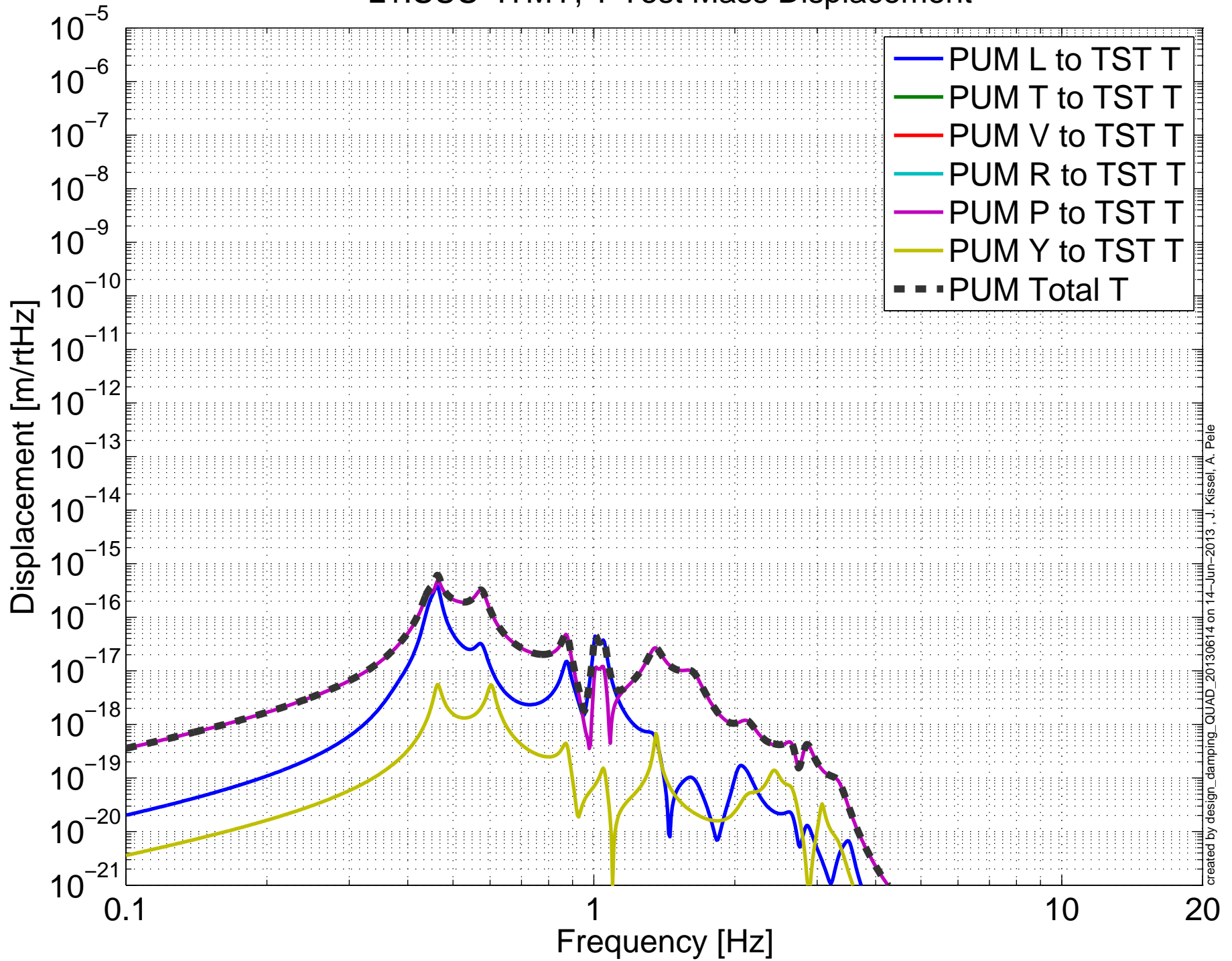


# Projected UIM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, T Test Mass Displacement





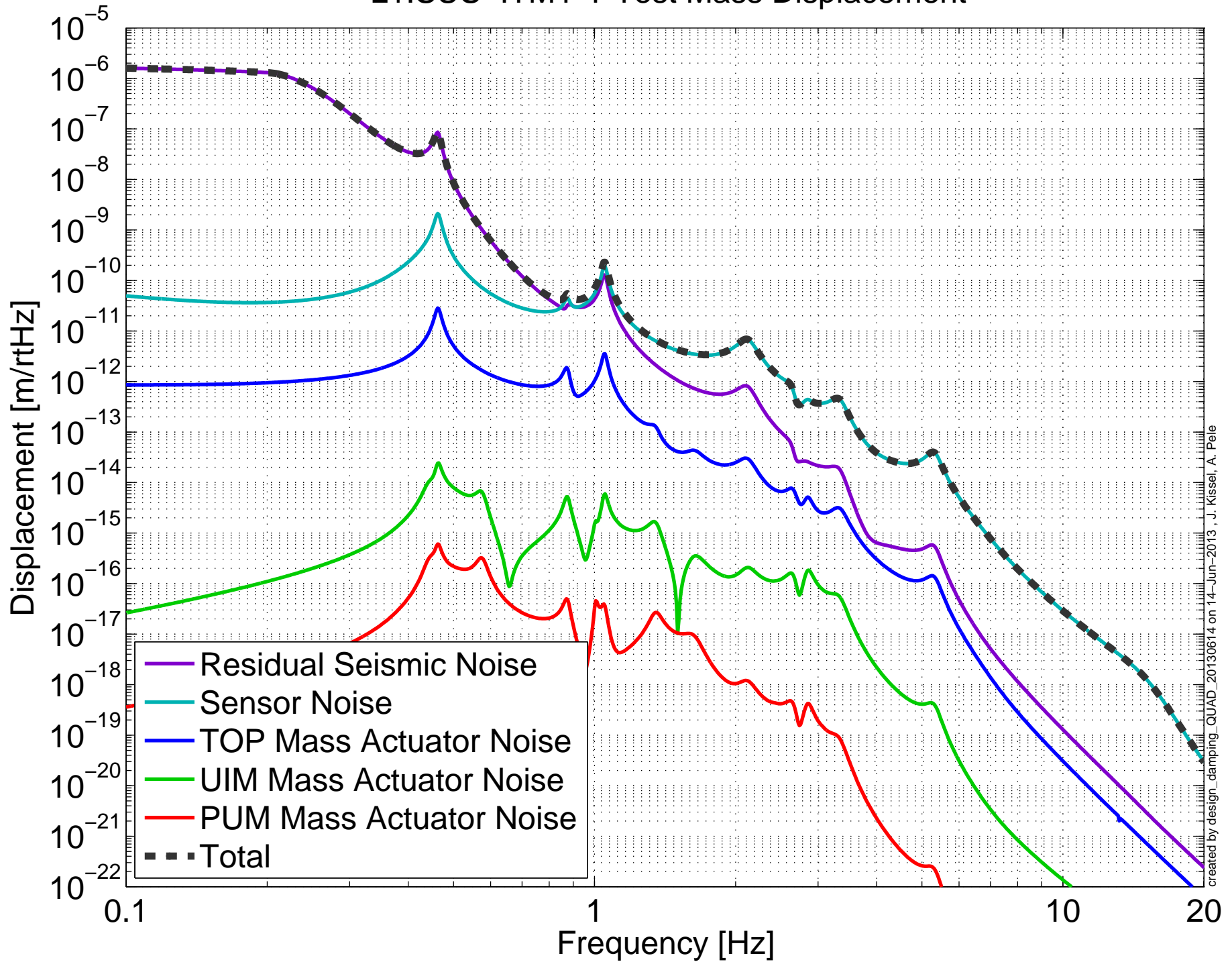
# Projected PUM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, T Test Mass Displacement



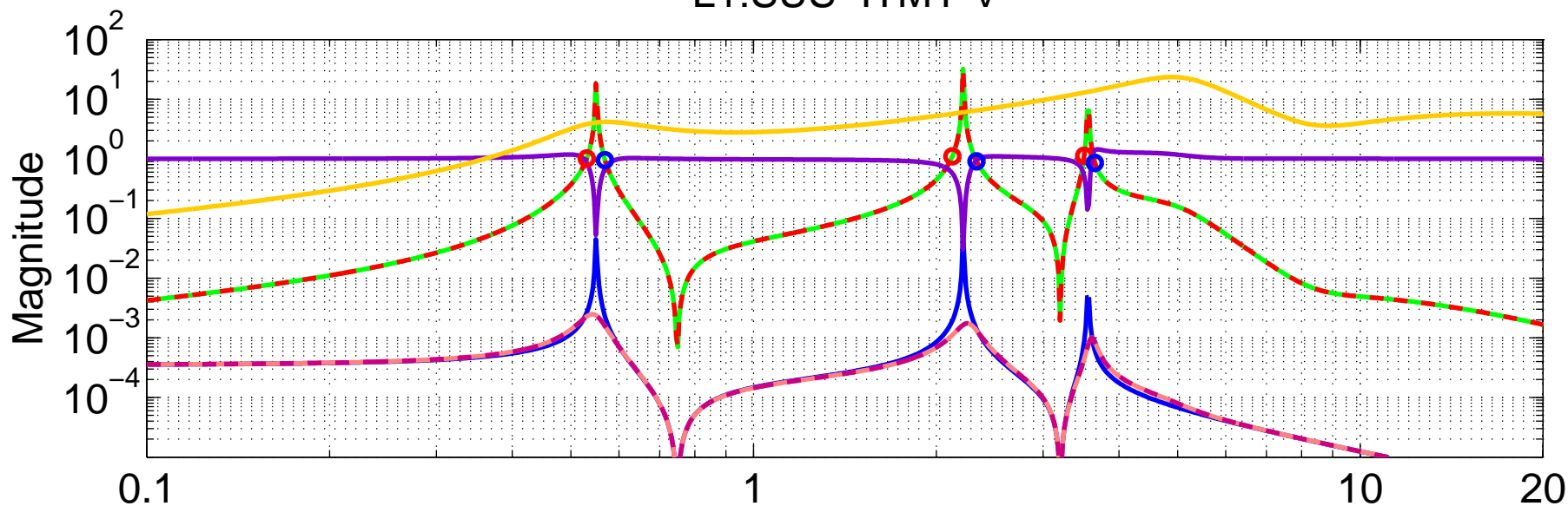
created by design\_damping\_QUAD\_20130614 on 14-Jun-2013, J. Kissel, A. Pele

# Damping Loop Performance

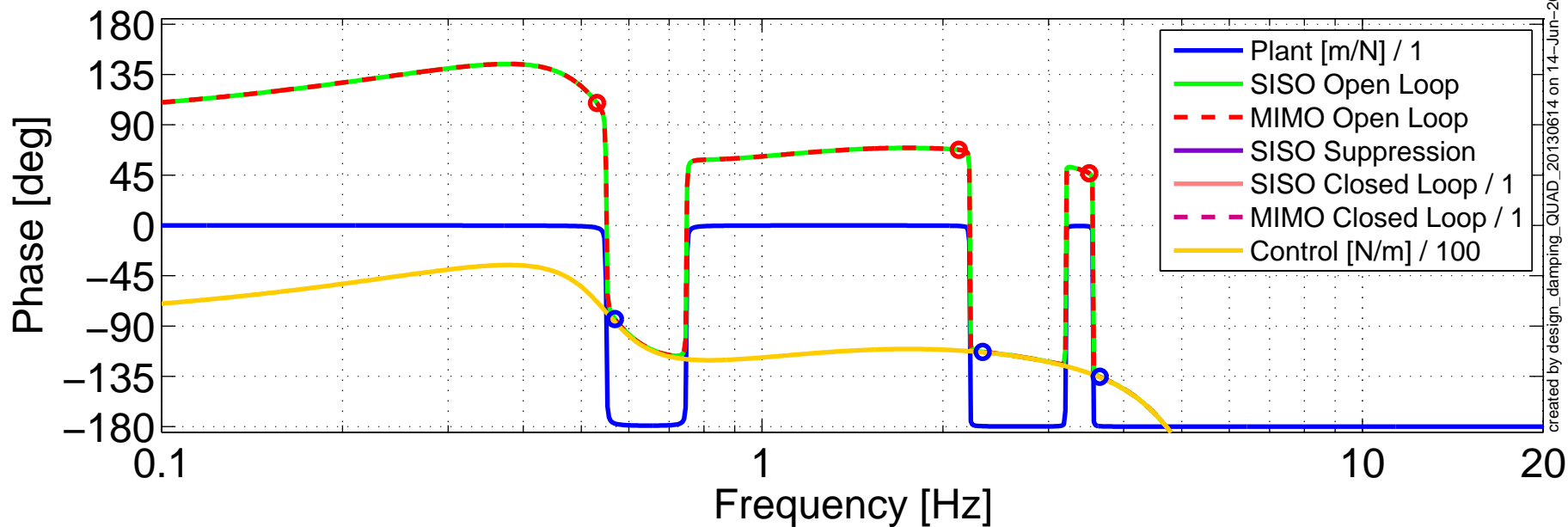
## L1:SUS-ITMY T Test Mass Displacement



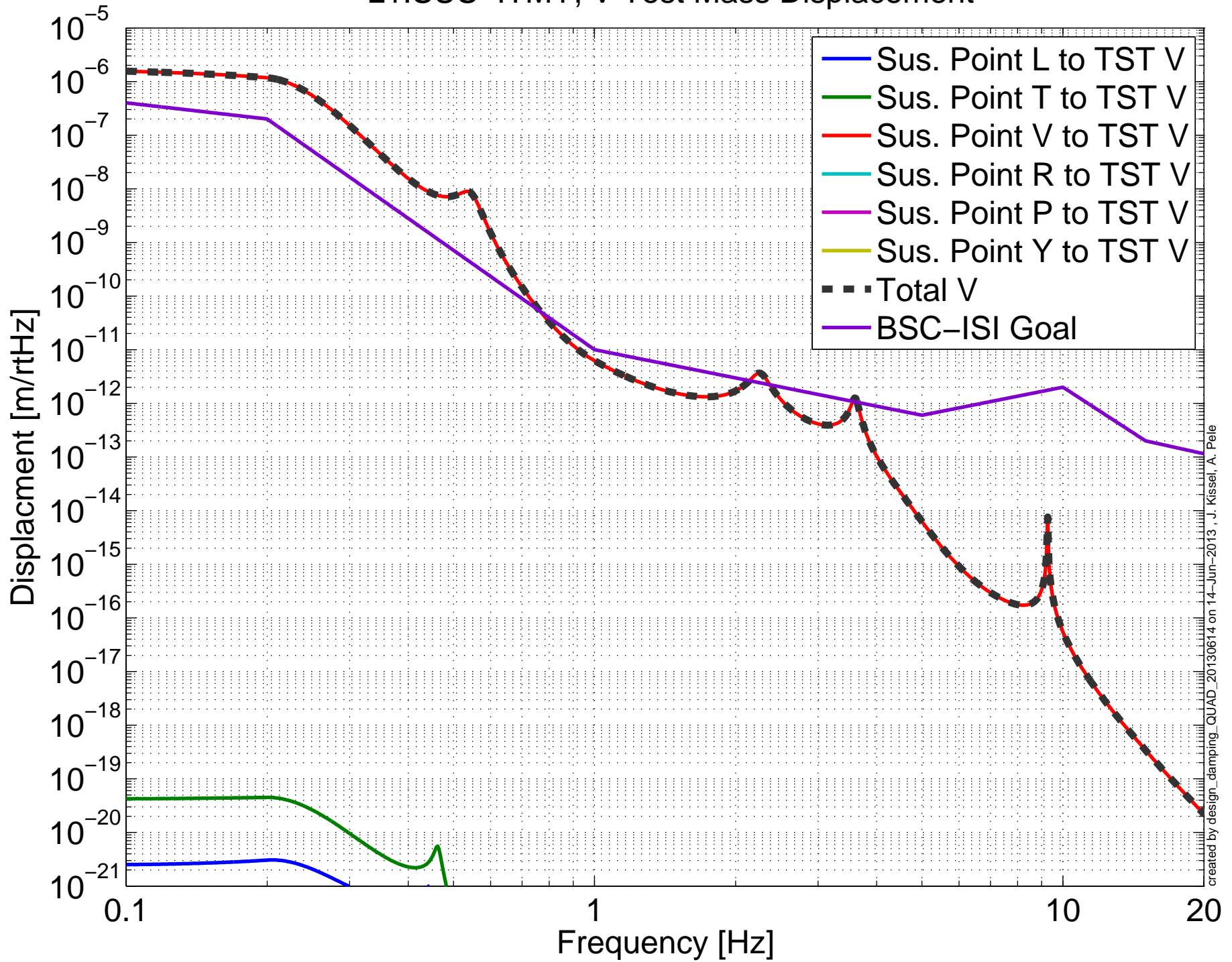
# Damping Loop Design L1:SUS-ITMY V



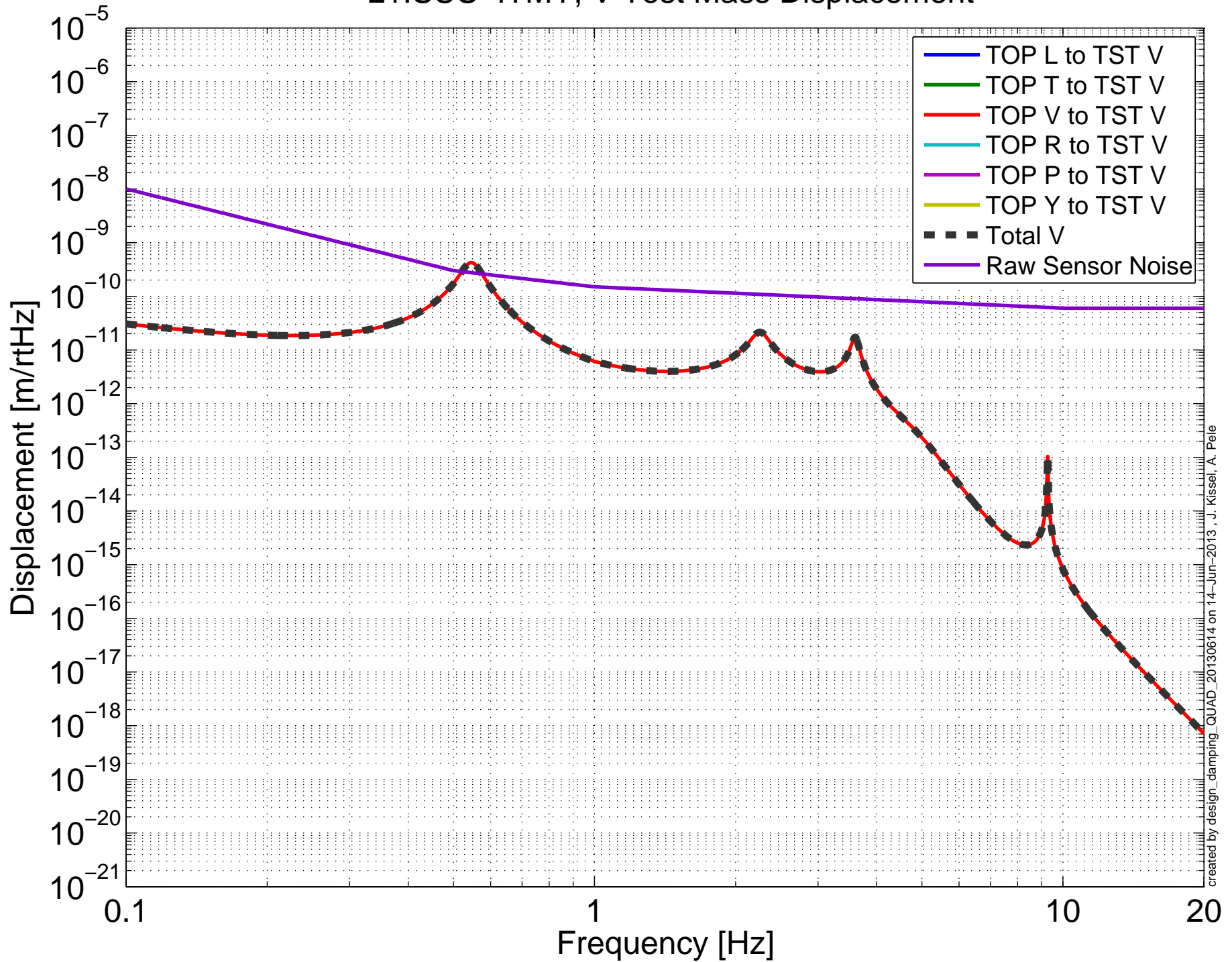
MIMO LUGF Phase Margins (red): [70.5    112    133] [deg]  
 MIMO UUGF Phase Margins (blue): [96.2    66.9    44.6] [deg]



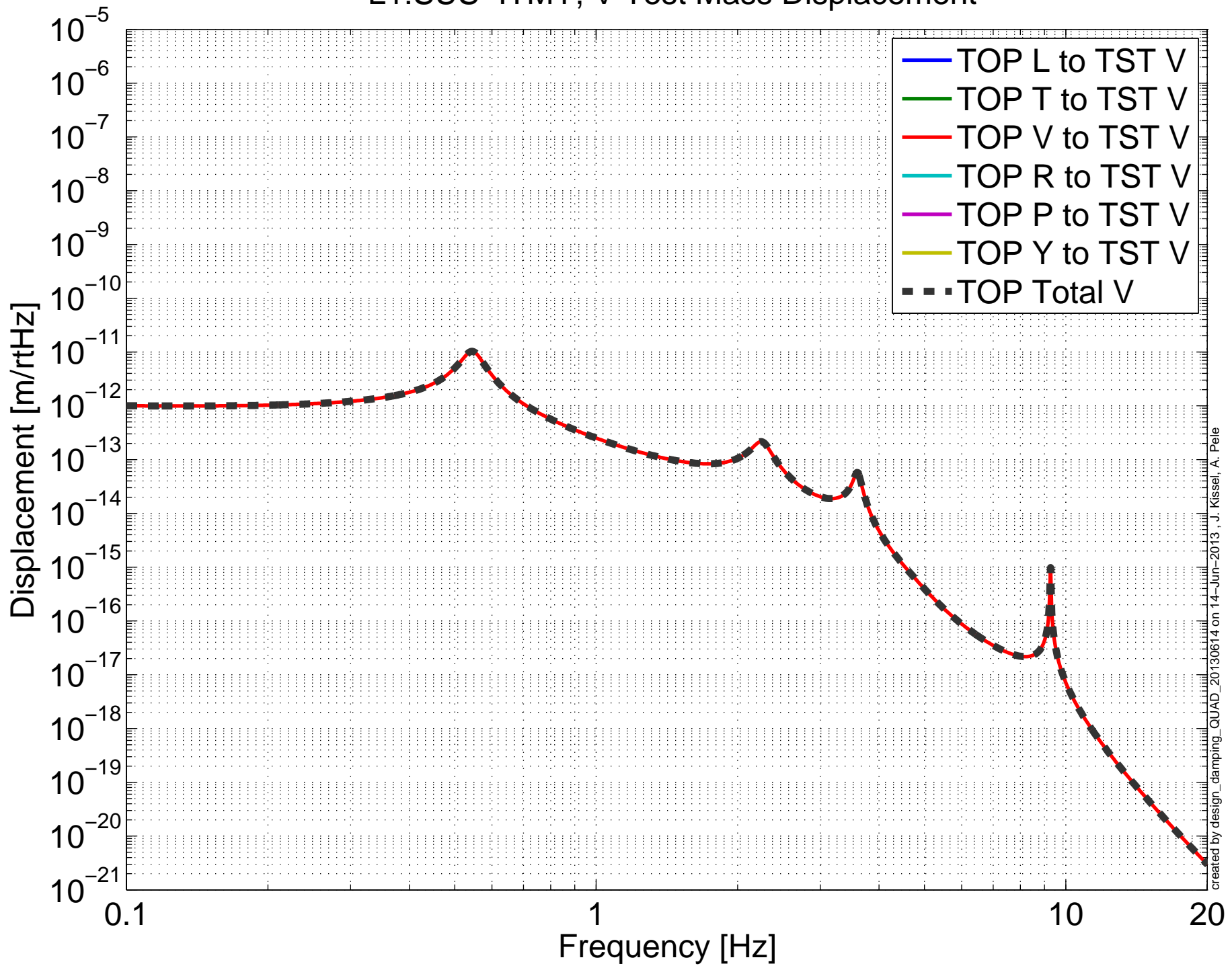
# Projected Sus. Point > Test Mass Seismic Noise Budget L1:SUS-ITMY, V Test Mass Displacement



# Projected Top Mass Sensor > Test Mass Noise Budget L1:SUS-ITMY, V Test Mass Displacement

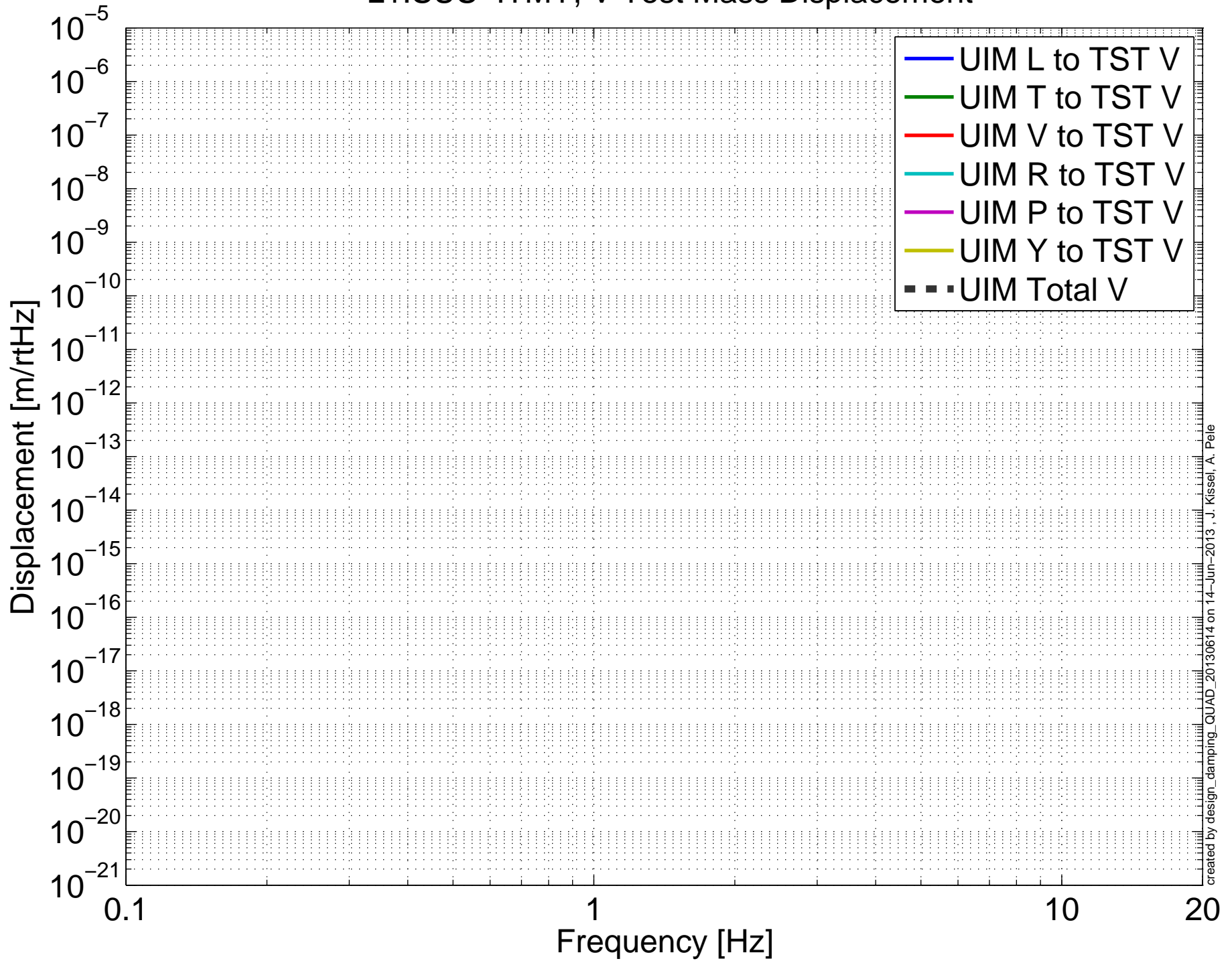


# Projected Top Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, V Test Mass Displacement



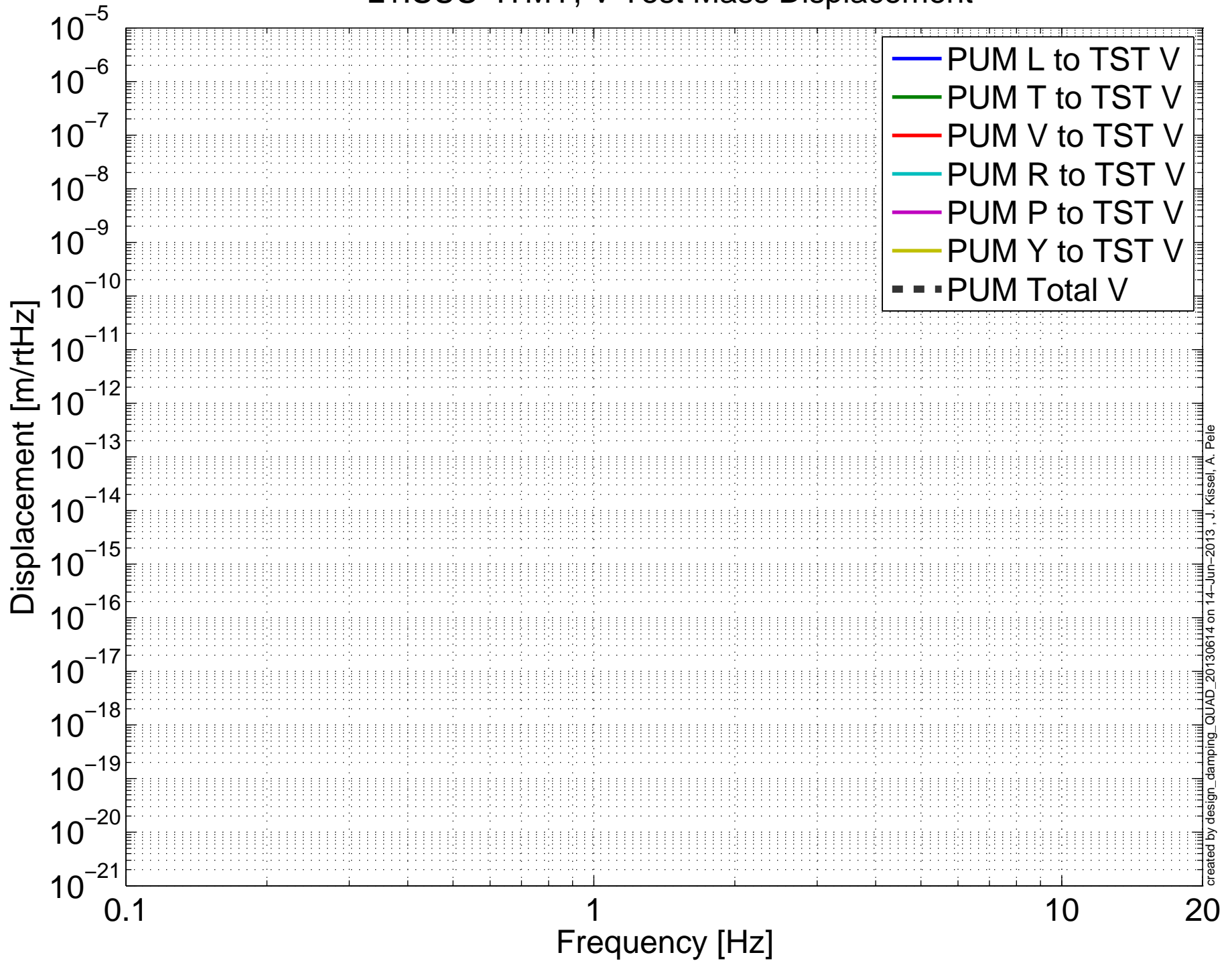
created by design\_damping\_QUAD\_20130614 on 14-Jun-2013, J. Kissel, A. Pele

# Projected UIM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, V Test Mass Displacement



created by design\_damping\_QUAD\_20130614 on 14-Jun-2013, J. Kissel, A. Pele

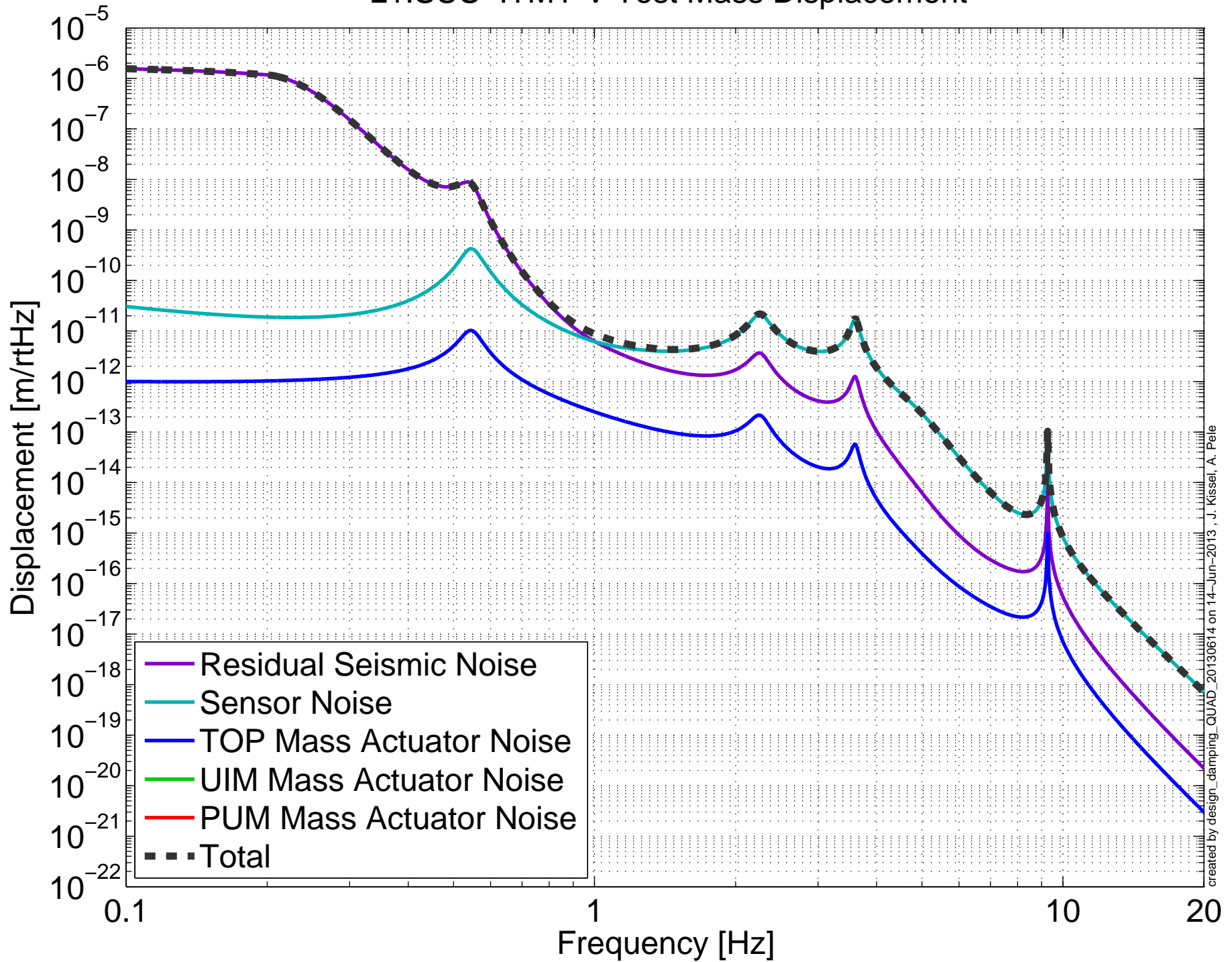
# Projected PUM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, V Test Mass Displacement





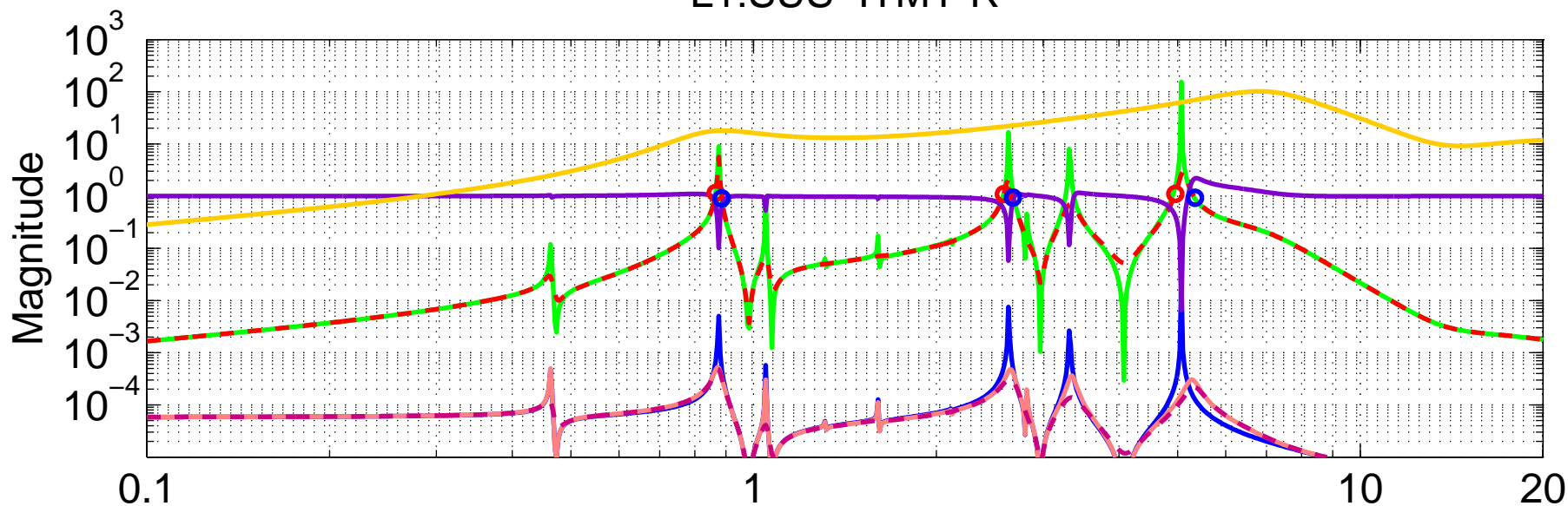
# Damping Loop Performance

## L1:SUS-ITMY V Test Mass Displacement

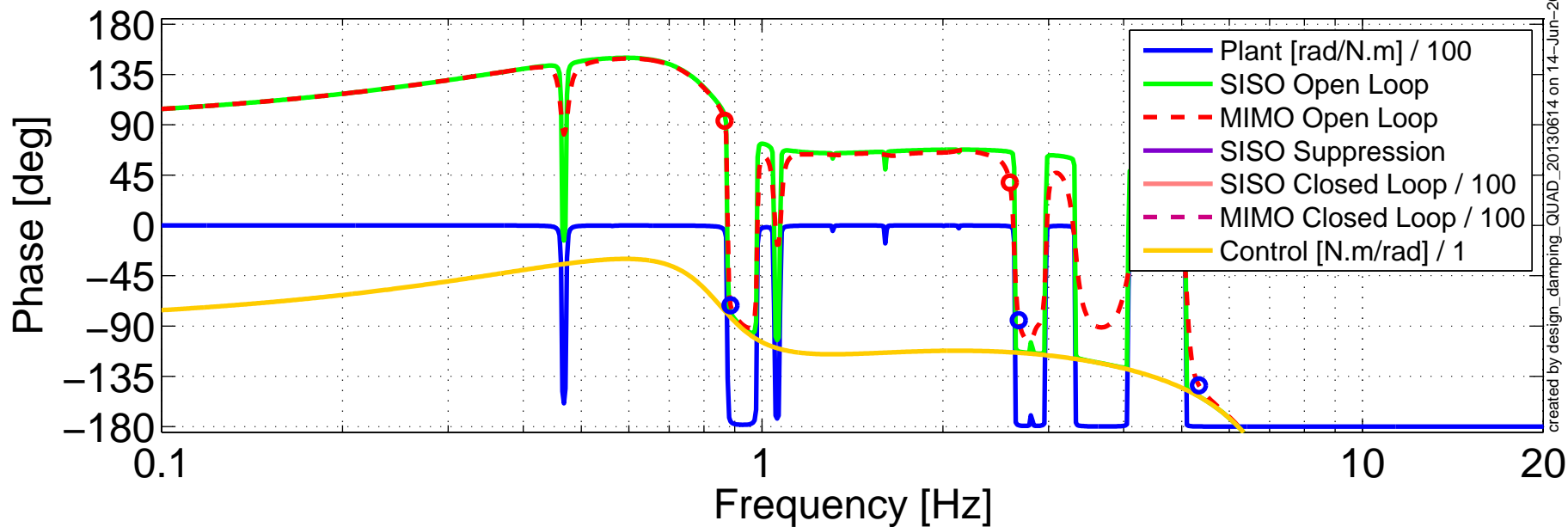


# Damping Loop Design

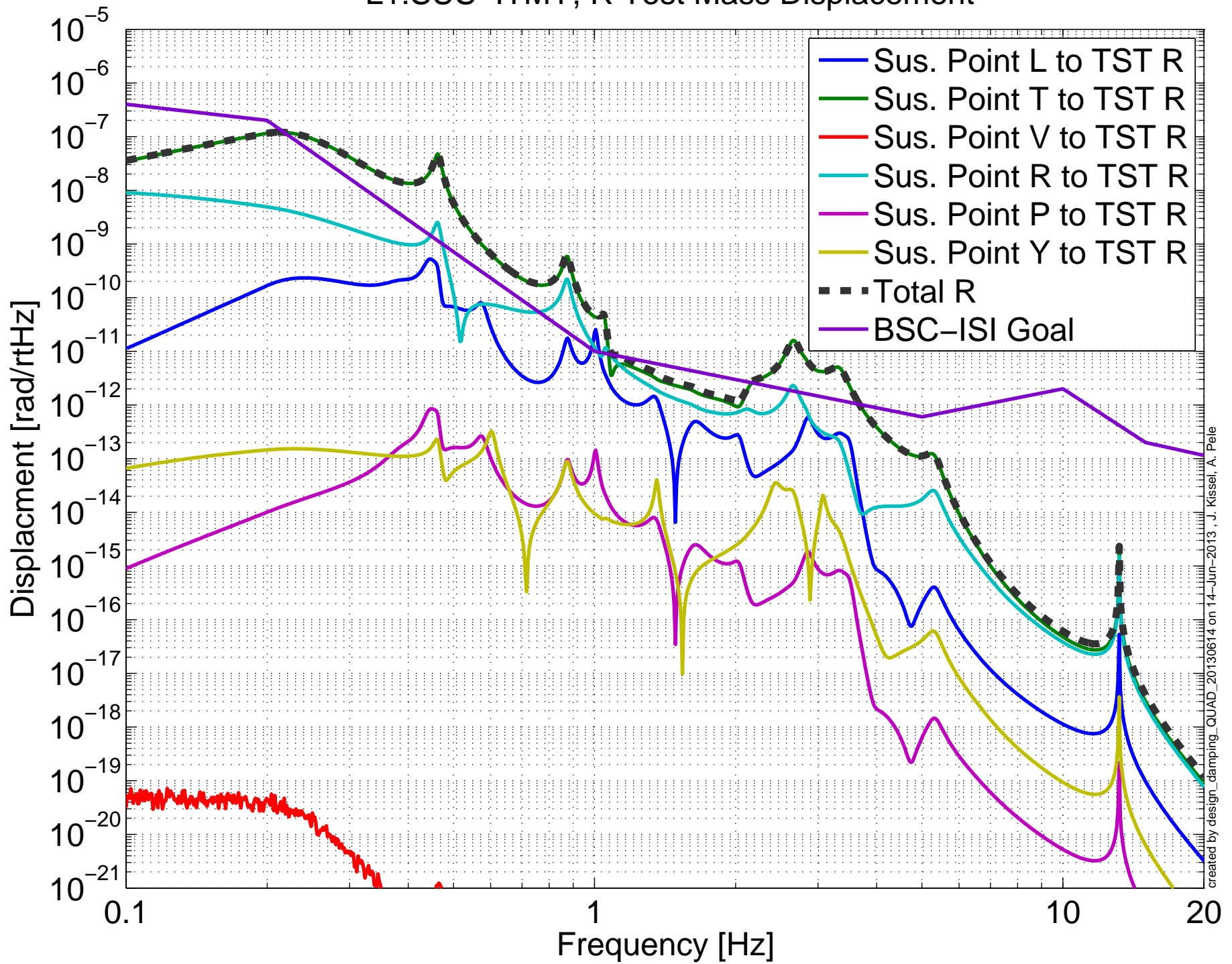
## L1:SUS-ITMY R



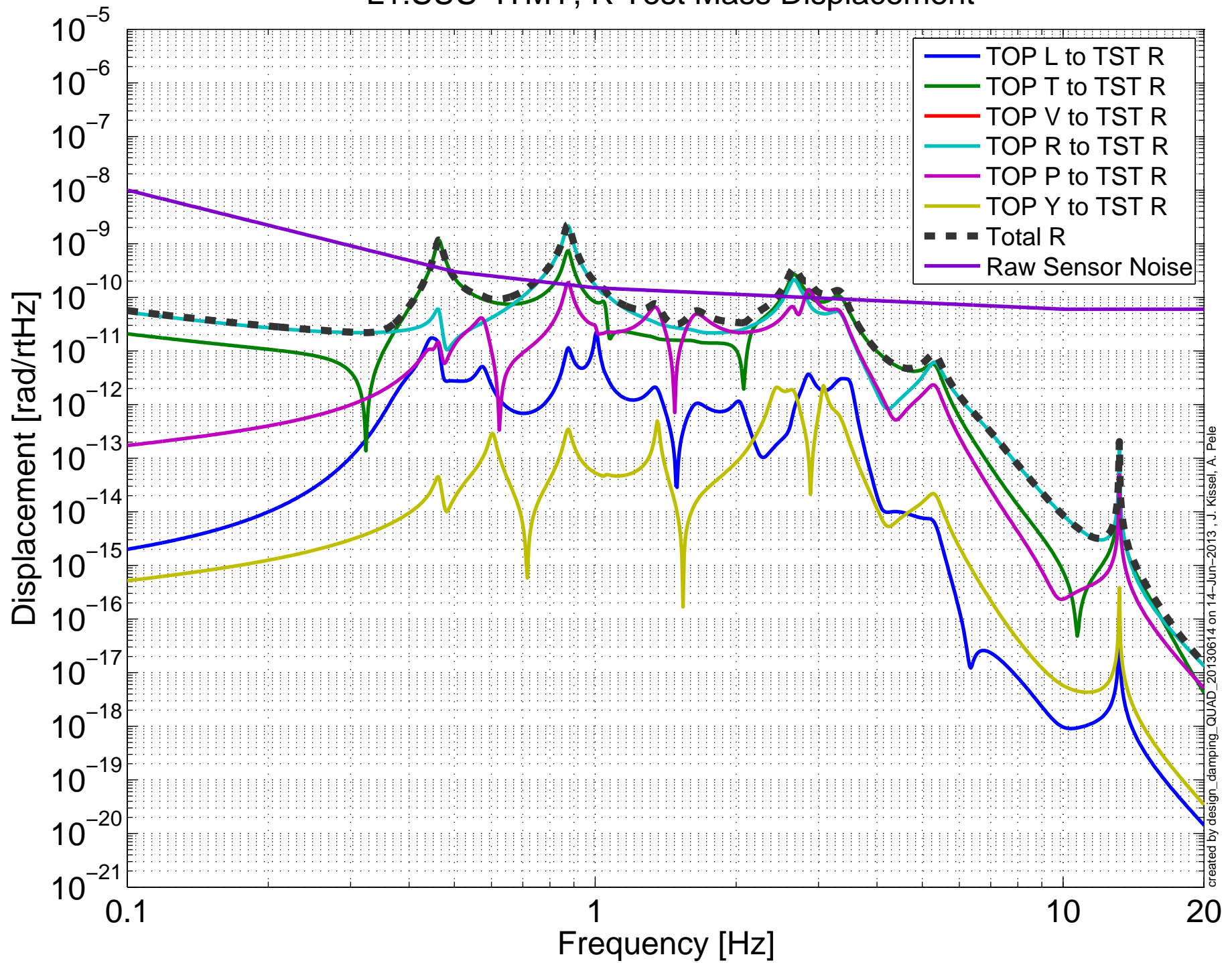
MIMO LUGF Phase Margins (red): [86.3    142    178] [deg]  
 MIMO UUGF Phase Margins (blue): [109    95.3    37] [deg]



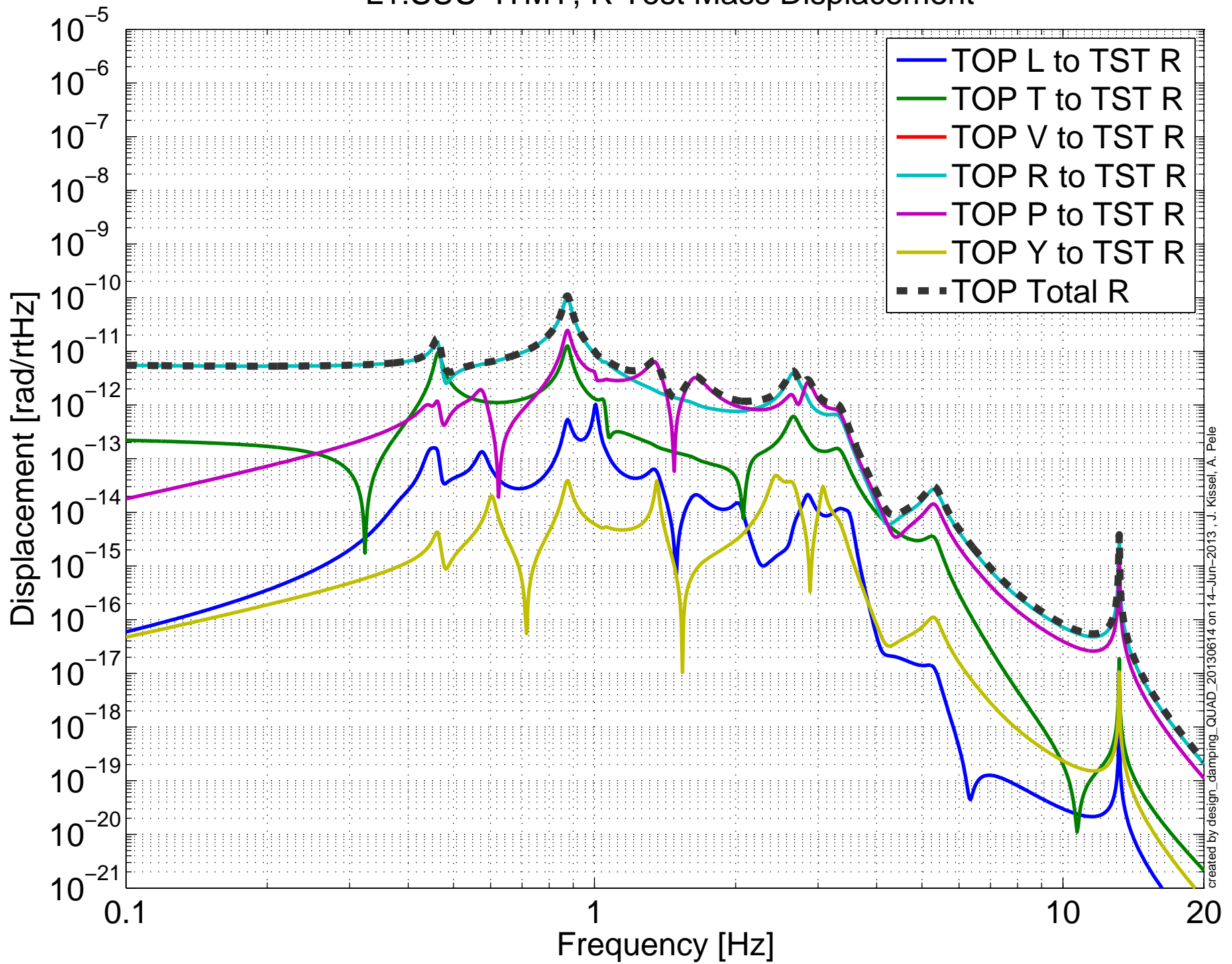
# Projected Sus. Point > Test Mass Seismic Noise Budget L1:SUS-ITMY, R Test Mass Displacement



# Projected Top Mass Sensor > Test Mass Noise Budget L1:SUS-ITMY, R Test Mass Displacement

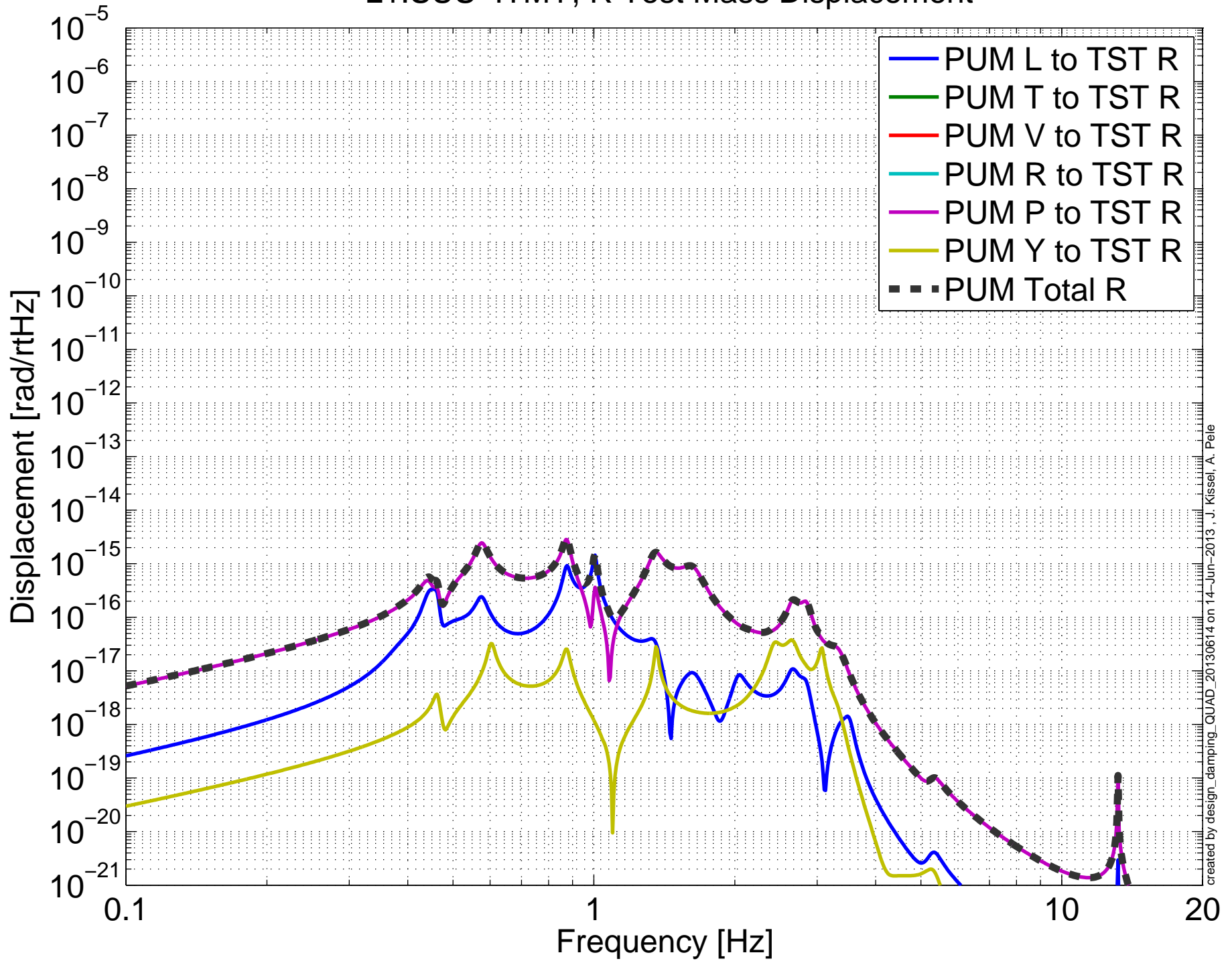


# Projected Top Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, R Test Mass Displacement





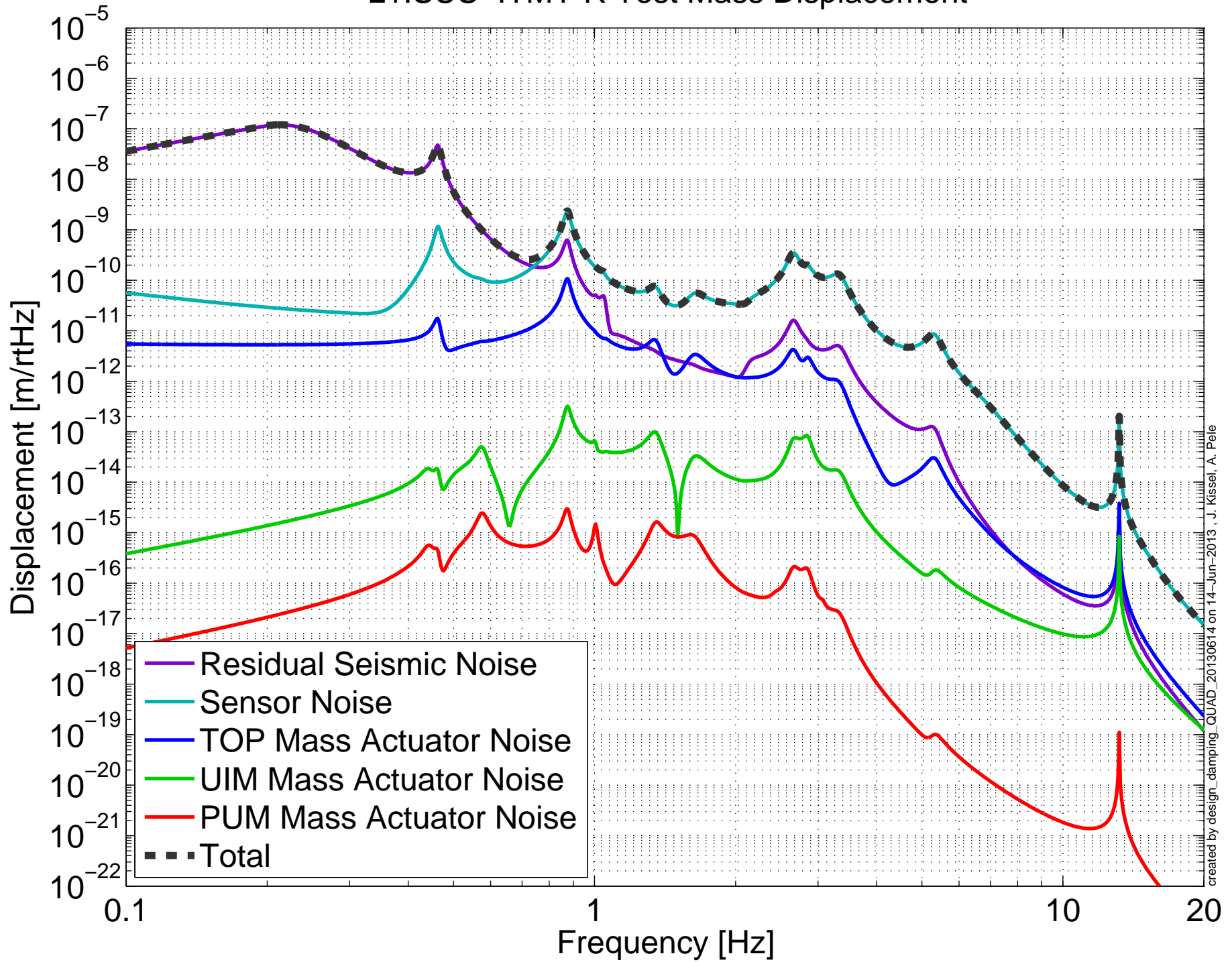
# Projected PUM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, R Test Mass Displacement



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# Damping Loop Performance

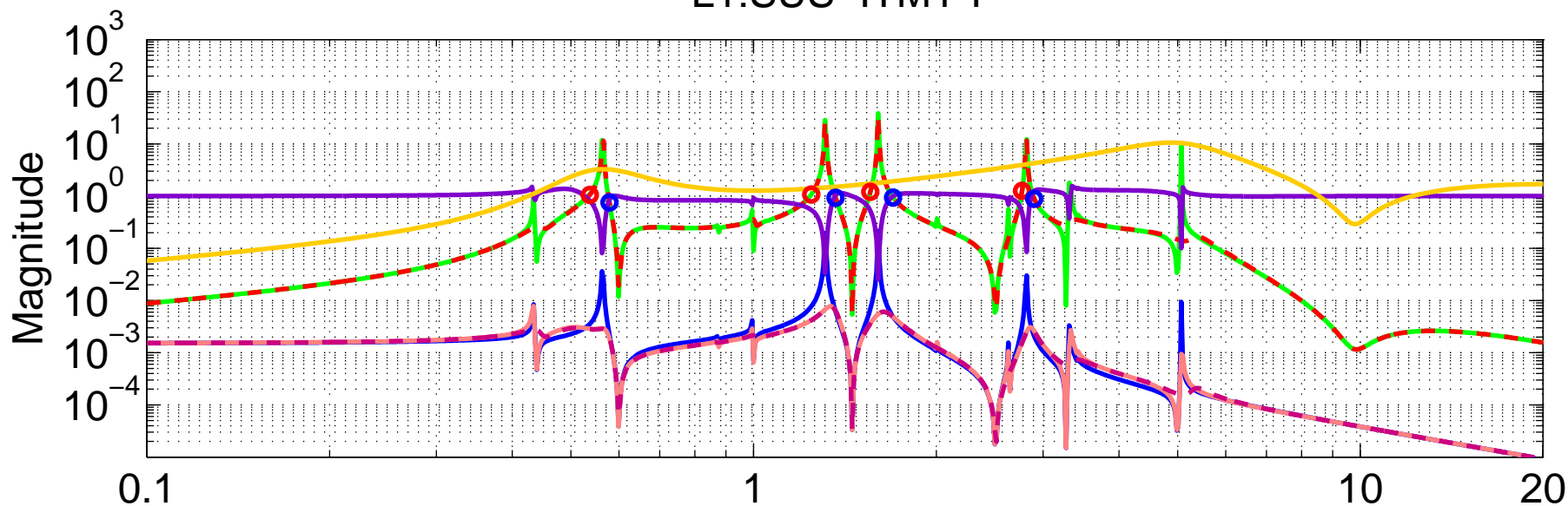
## L1:SUS-ITMY R Test Mass Displacement



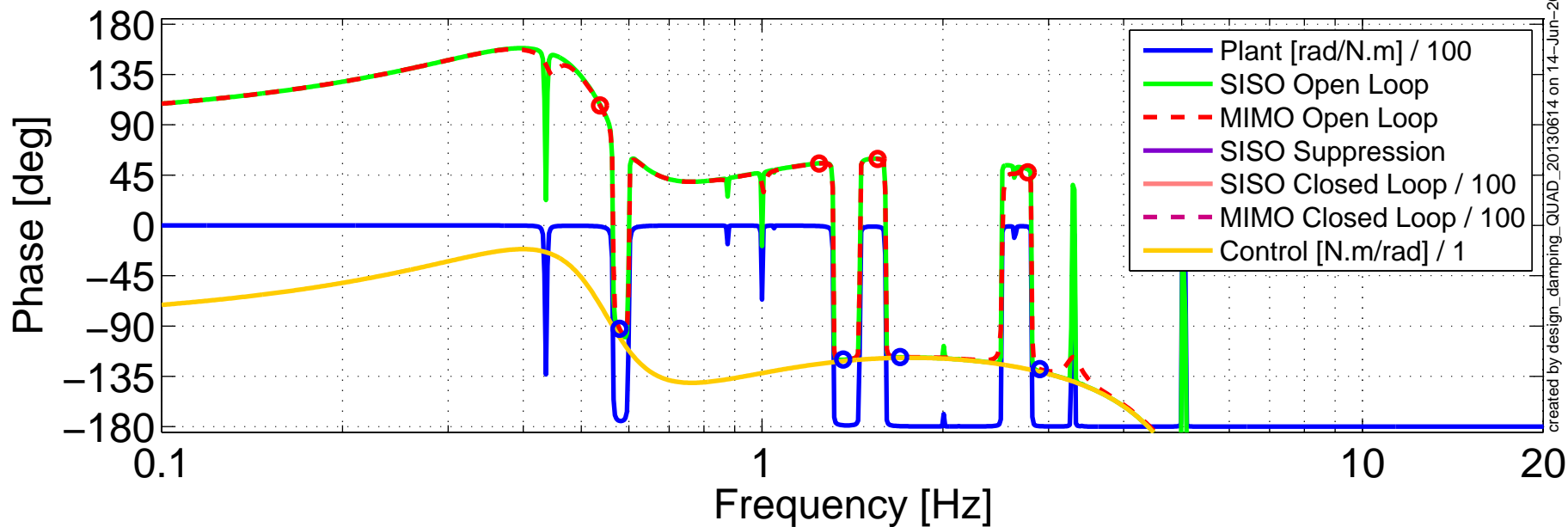


# Damping Loop Design

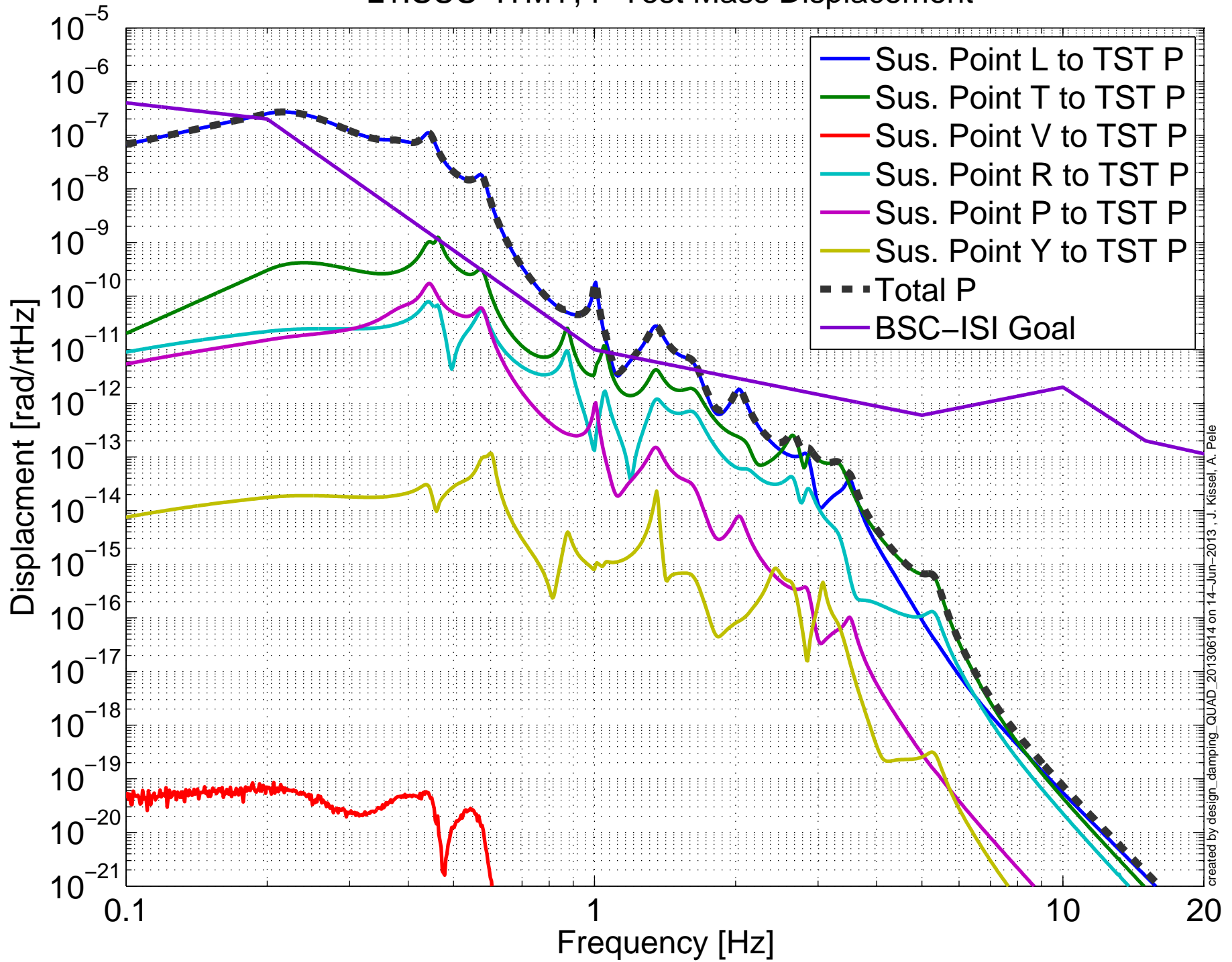
## L1:SUS-ITMY P



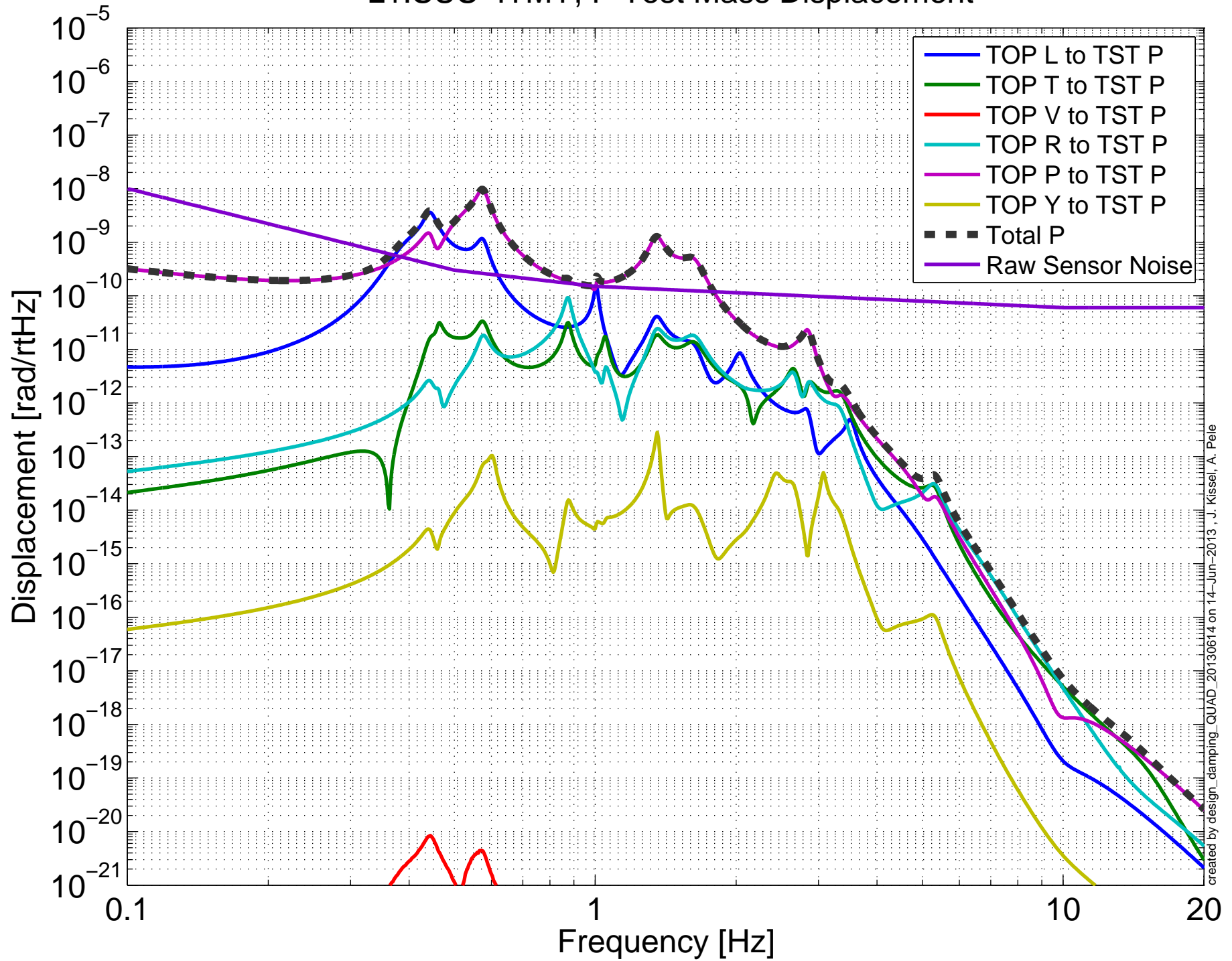
MIMO LUGF Phase Margins (red): [72.8    125    120    133] [deg]  
MIMO UUGF Phase Margins (blue): [87.5    60    62.3    51.4] [deg]



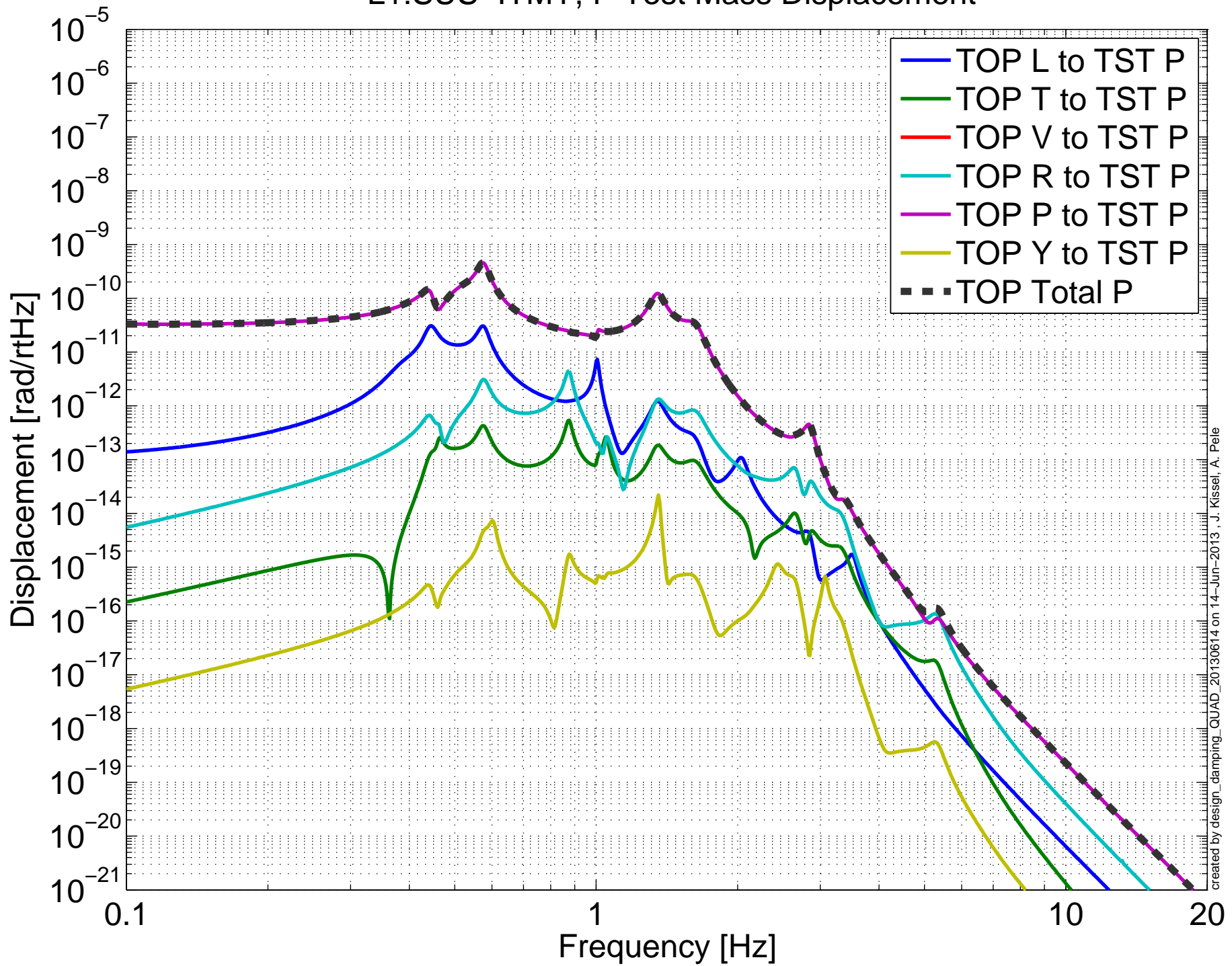
# Projected Sus. Point > Test Mass Seismic Noise Budget L1:SUS-ITMY, P Test Mass Displacement



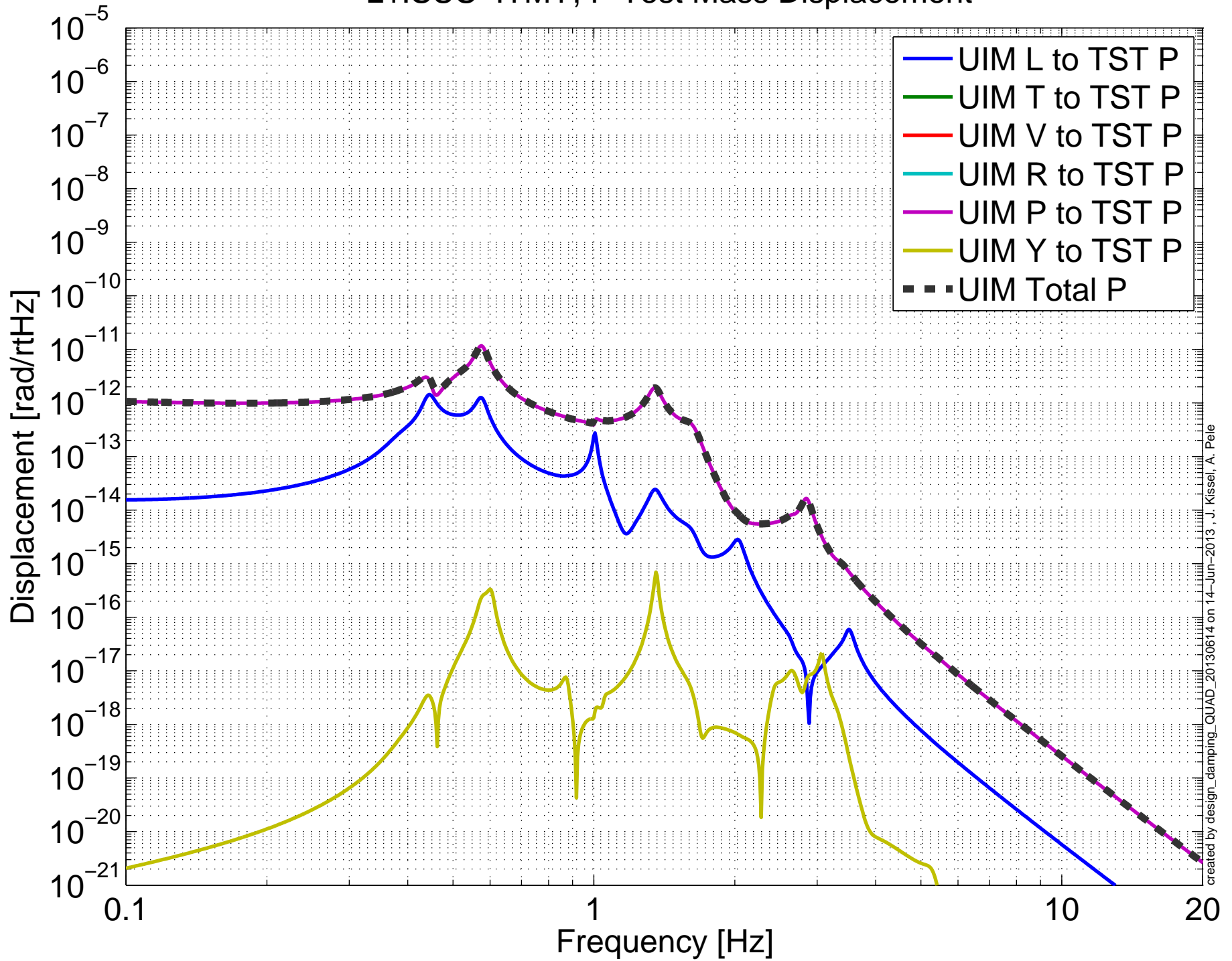
# Projected Top Mass Sensor > Test Mass Noise Budget L1:SUS-ITMY, P Test Mass Displacement



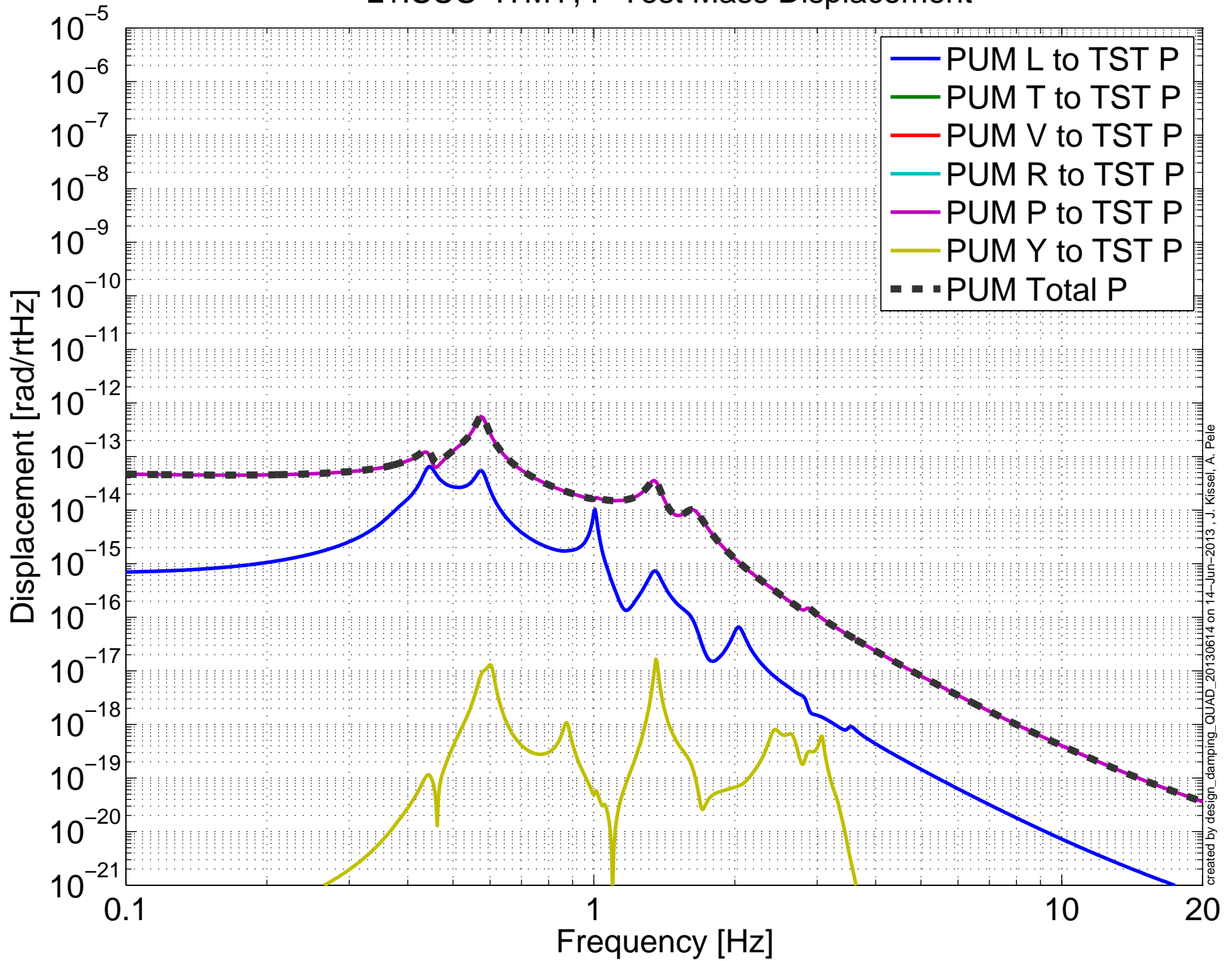
# Projected Top Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, P Test Mass Displacement



# Projected UIM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, P Test Mass Displacement



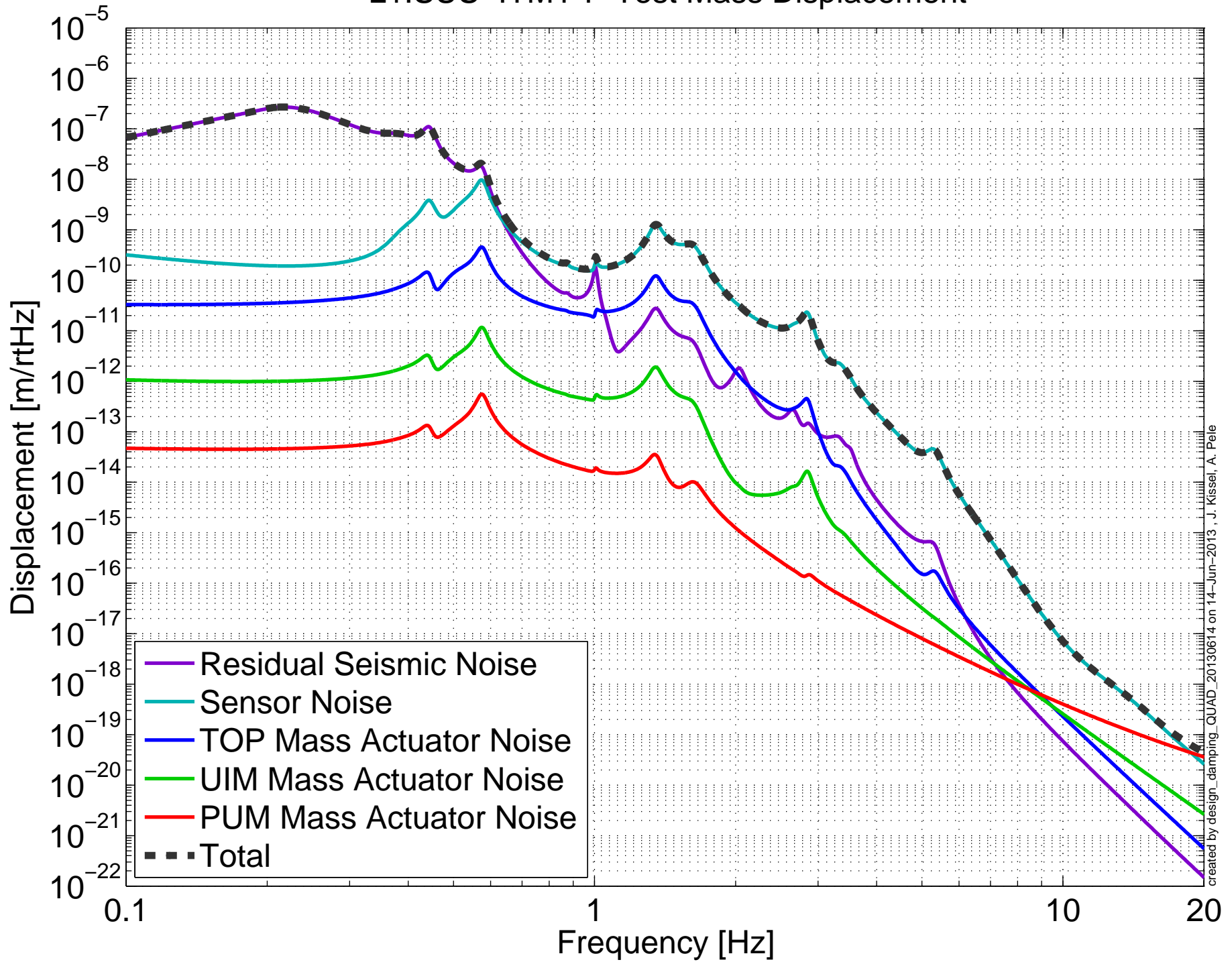
# Projected PUM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, P Test Mass Displacement



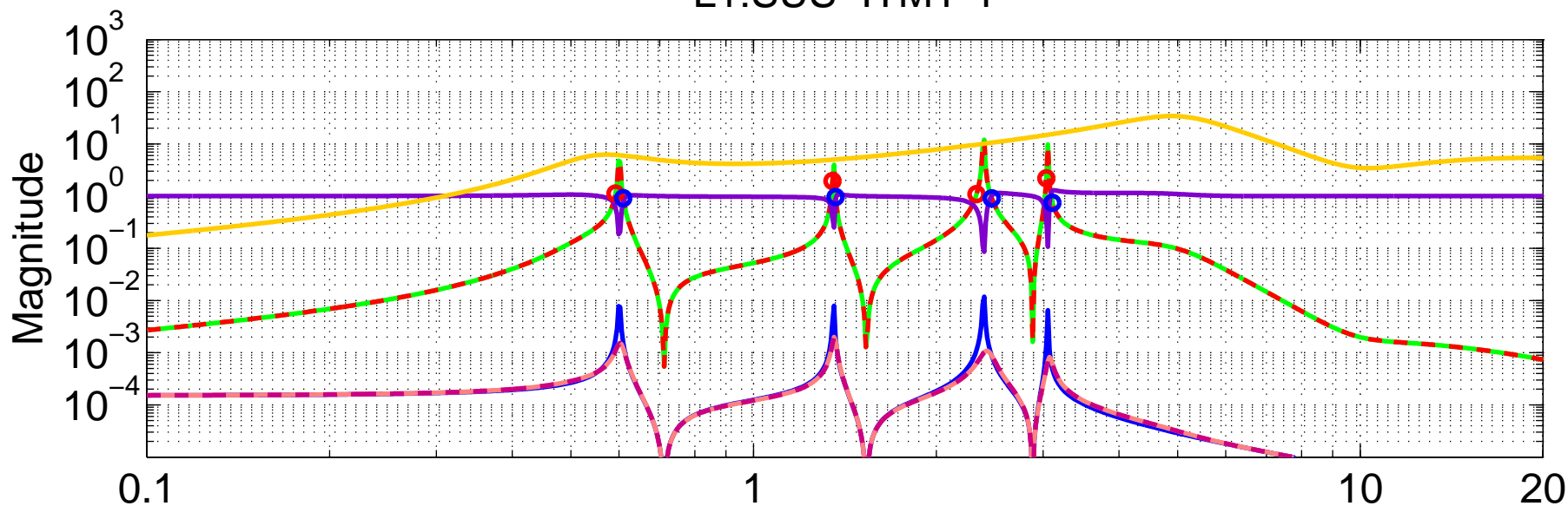
created by design\_damping\_QUAD\_20130614 on 14-Jun-2013, J. Kissel, A. Pele

# Damping Loop Performance

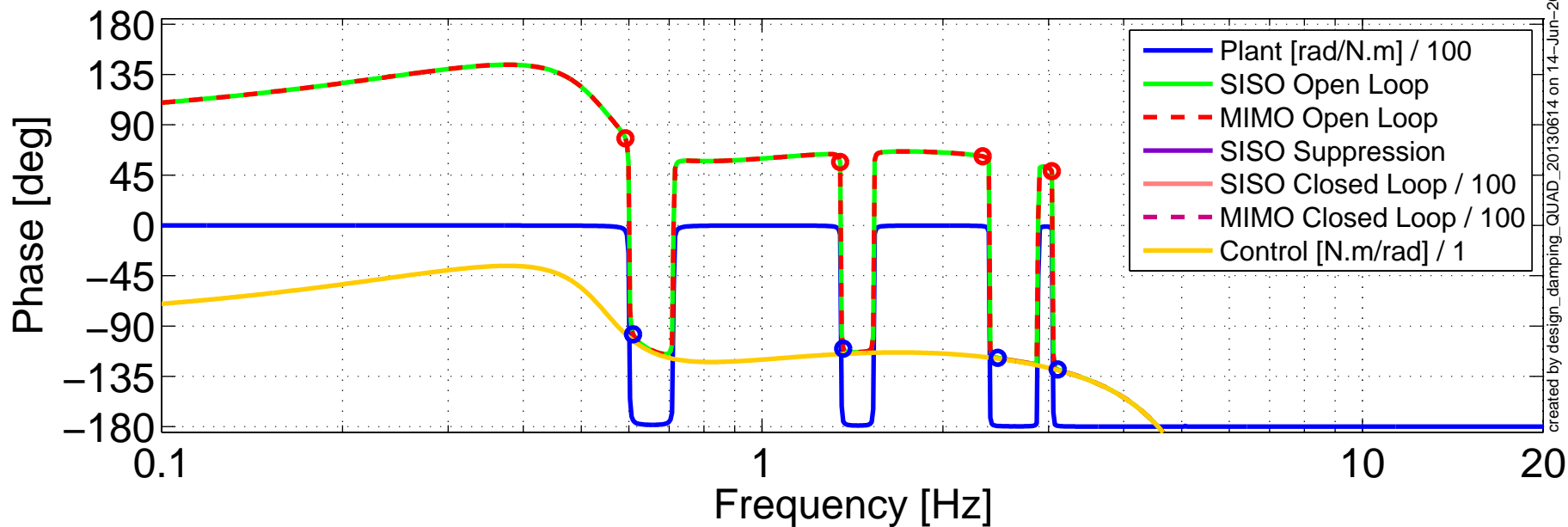
## L1:SUS-ITMY P Test Mass Displacement



# Damping Loop Design L1:SUS-ITMY Y

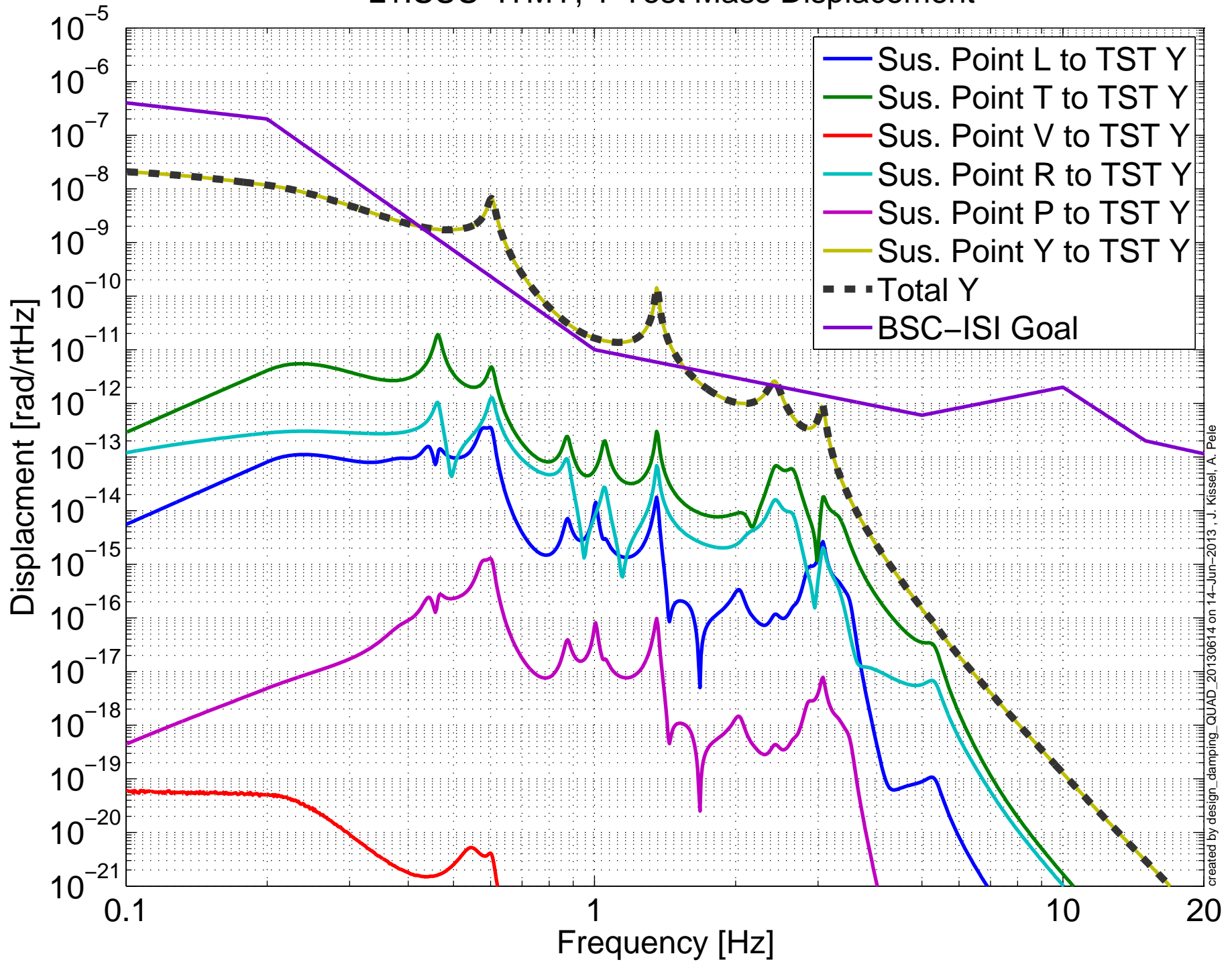


MIMO LUGF Phase Margins (red): [102    123    118    132] [deg]  
 MIMO UUGF Phase Margins (blue): [82.6    69.7    61.5    51.2] [deg]

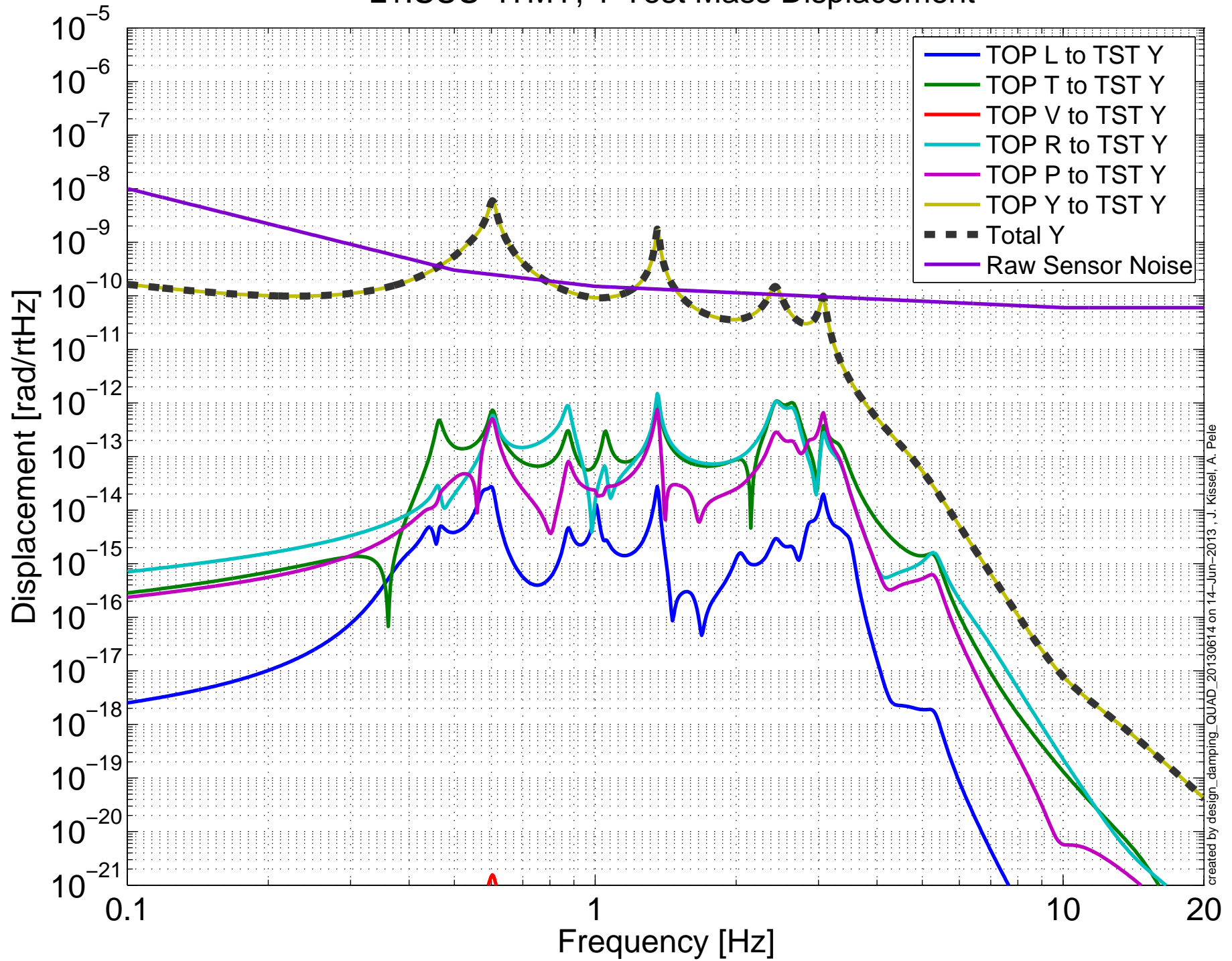




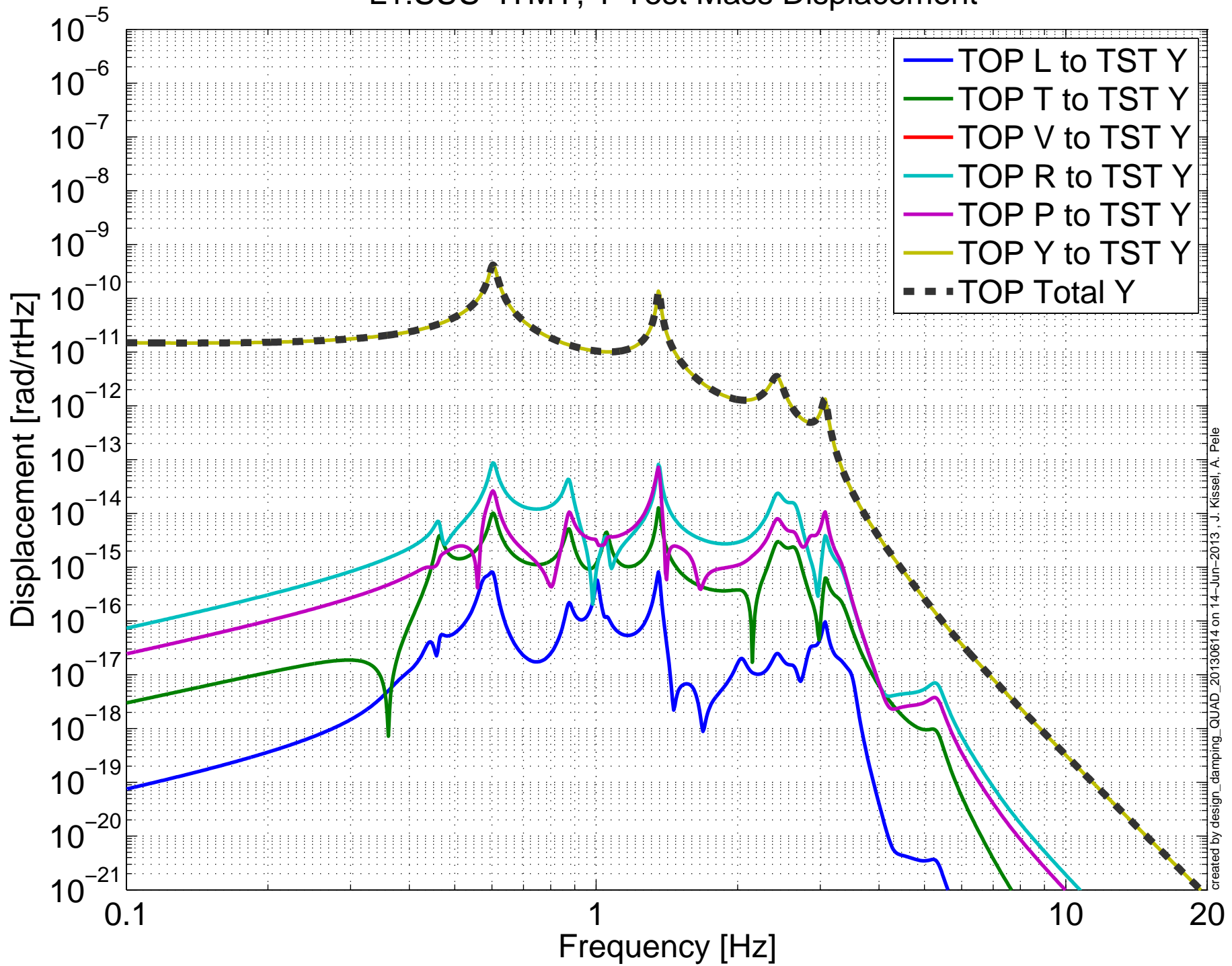
# Projected Sus. Point > Test Mass Seismic Noise Budget L1:SUS-ITMY, Y Test Mass Displacement



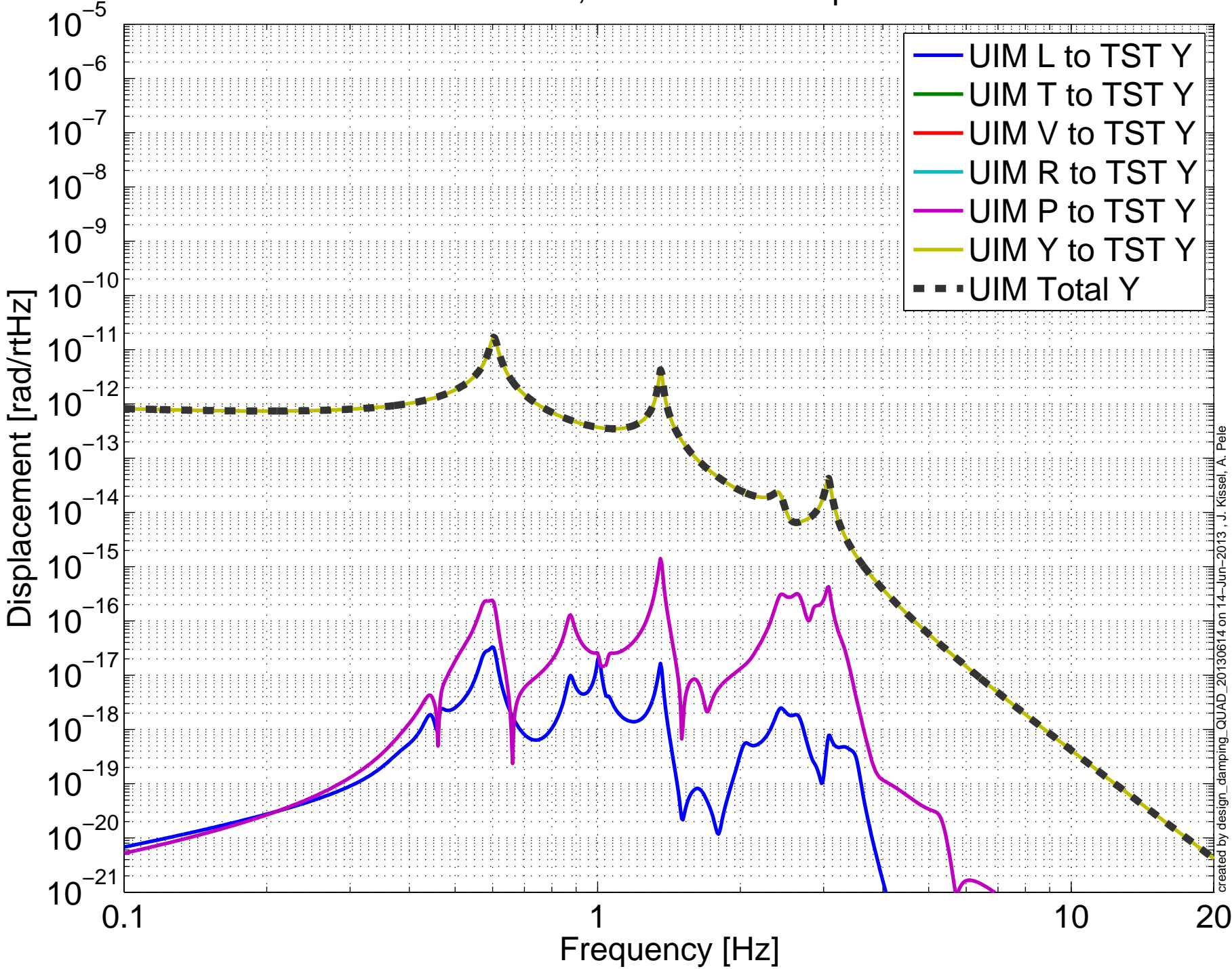
# Projected Top Mass Sensor > Test Mass Noise Budget L1:SUS-ITMY, Y Test Mass Displacement



# Projected Top Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, Y Test Mass Displacement

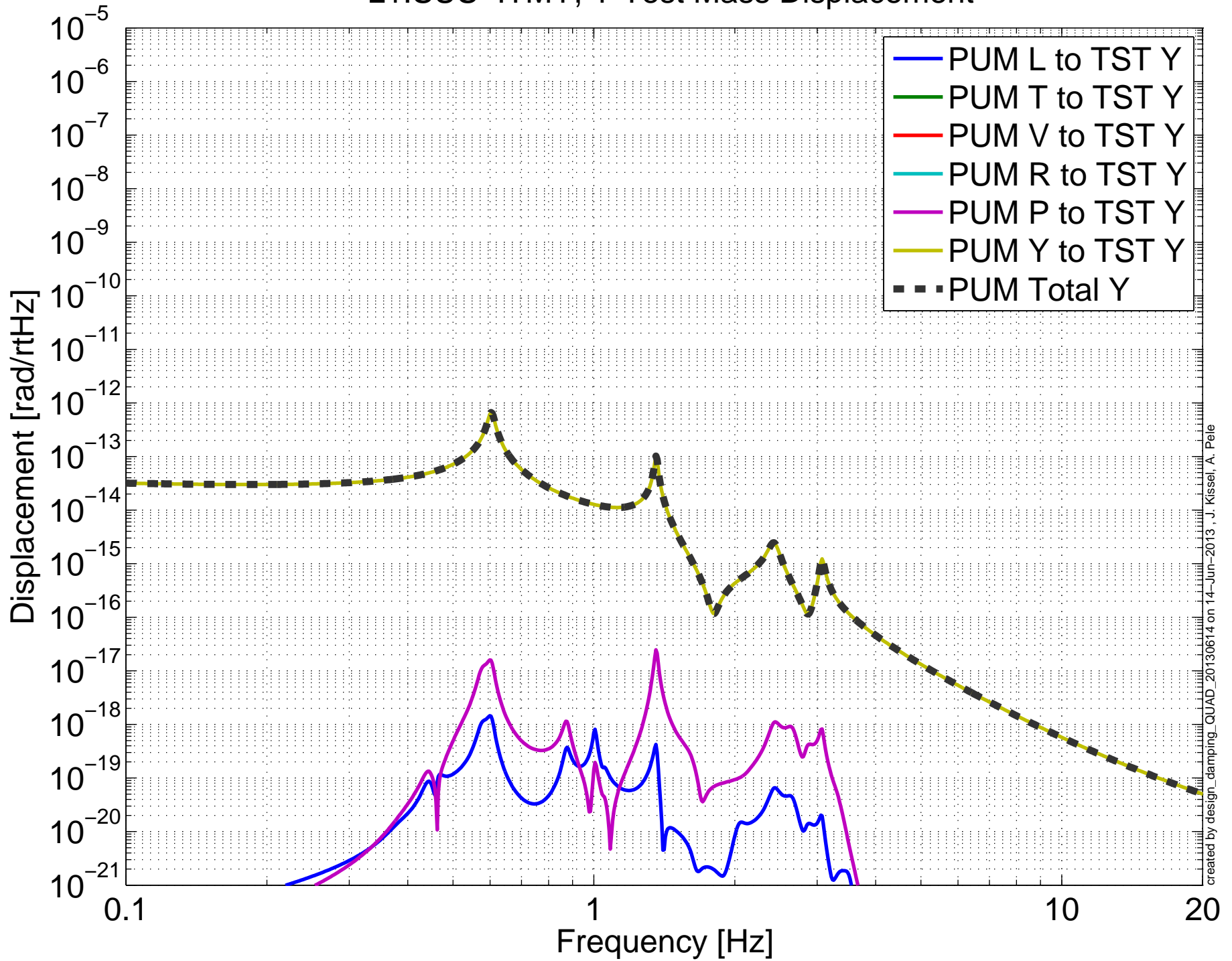


# Projected UIM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, Y Test Mass Displacement



created by design\_damping\_QUAD\_20130614 on 14-Jun-2013, J. Kissel, A. Pele

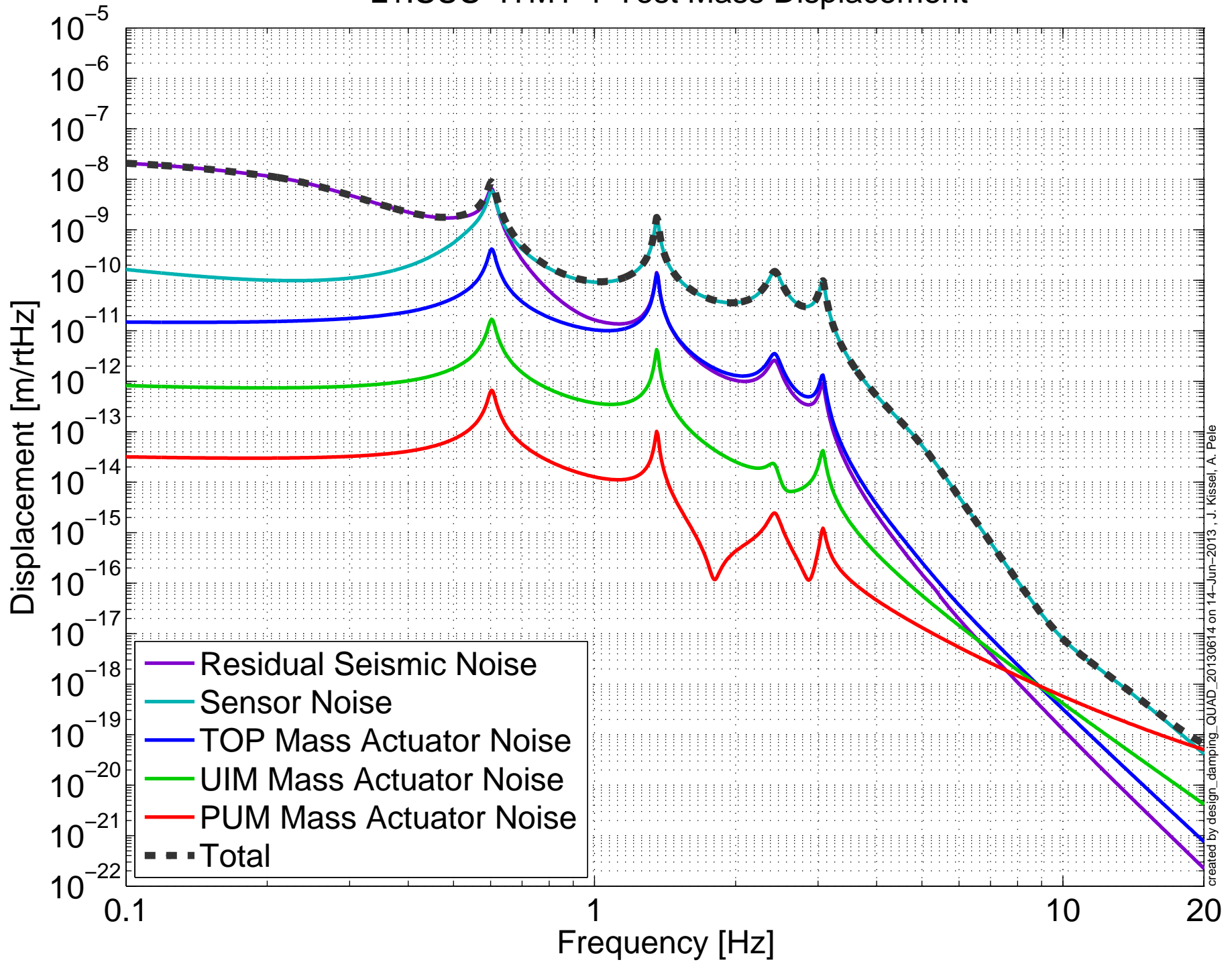
# Projected PUM Mass Actuator > Test Mass Noise Budget L1:SUS-ITMY, Y Test Mass Displacement



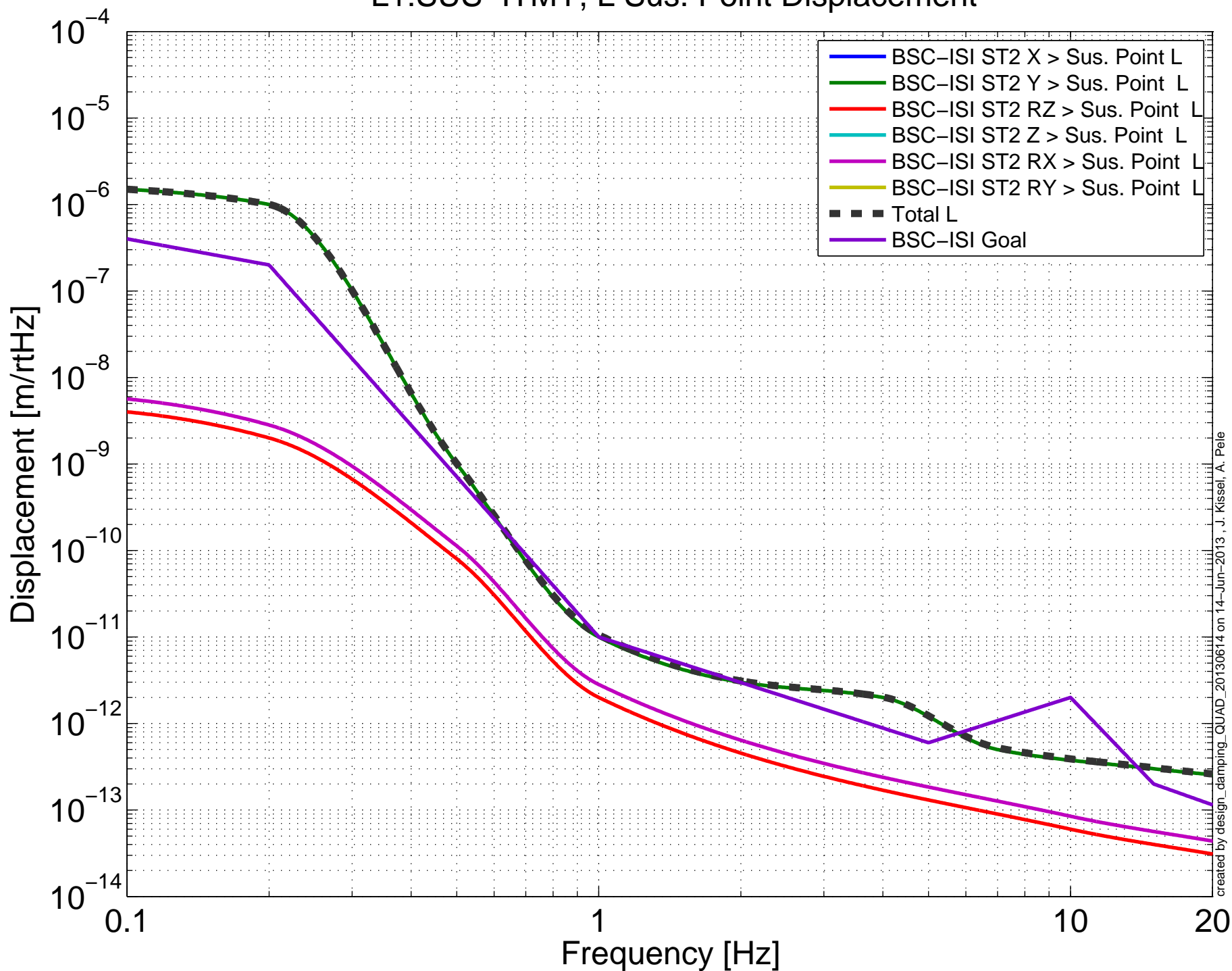
created by design\_damping\_QUAD\_20130614 on 14-Jun-2013, J. Kissel, A. Pele

# Damping Loop Performance

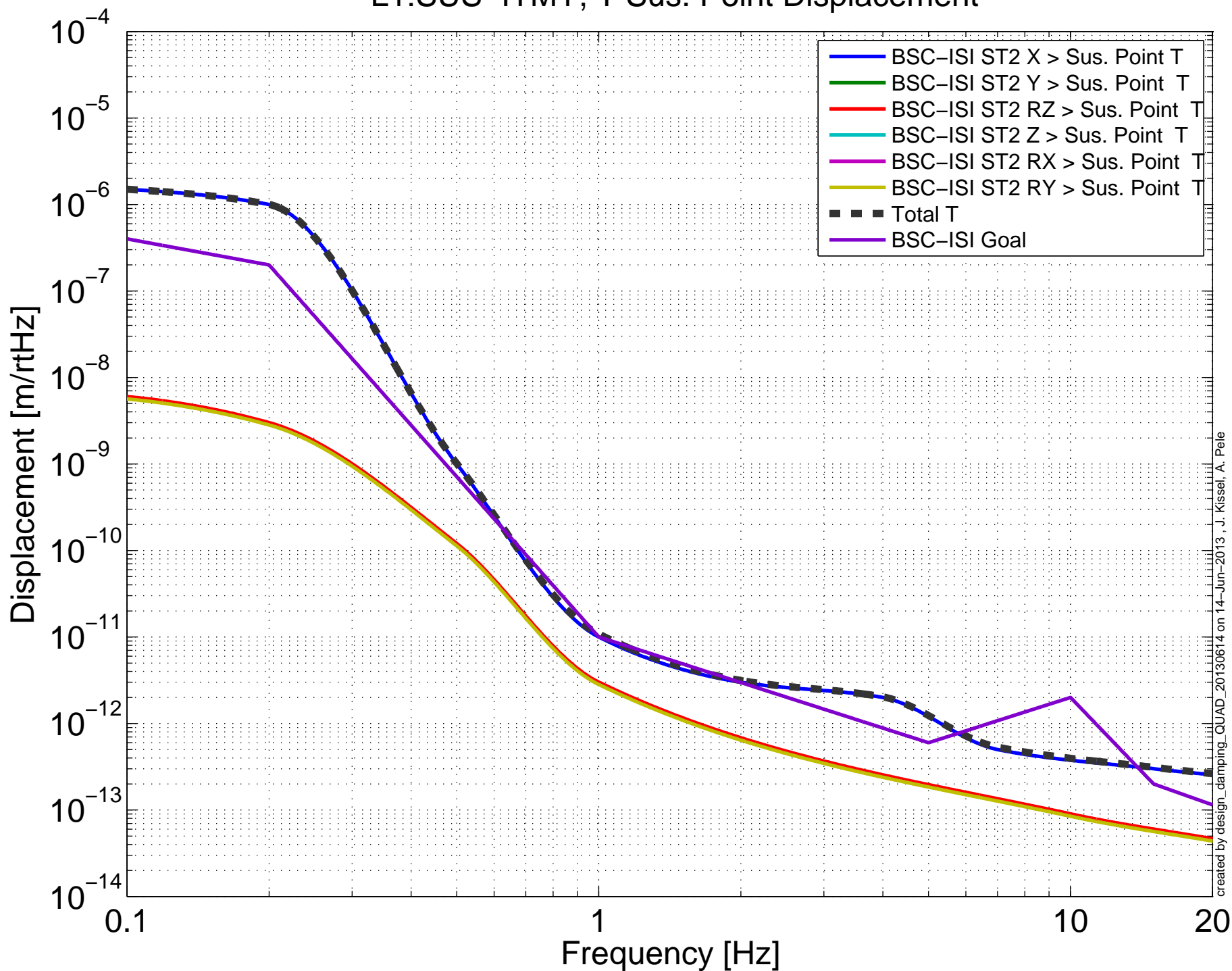
## L1:SUS-ITMY Y Test Mass Displacement



# Projected ISI Seismic Noise Budget L1:SUS-ITMY, L Sus. Point Displacement

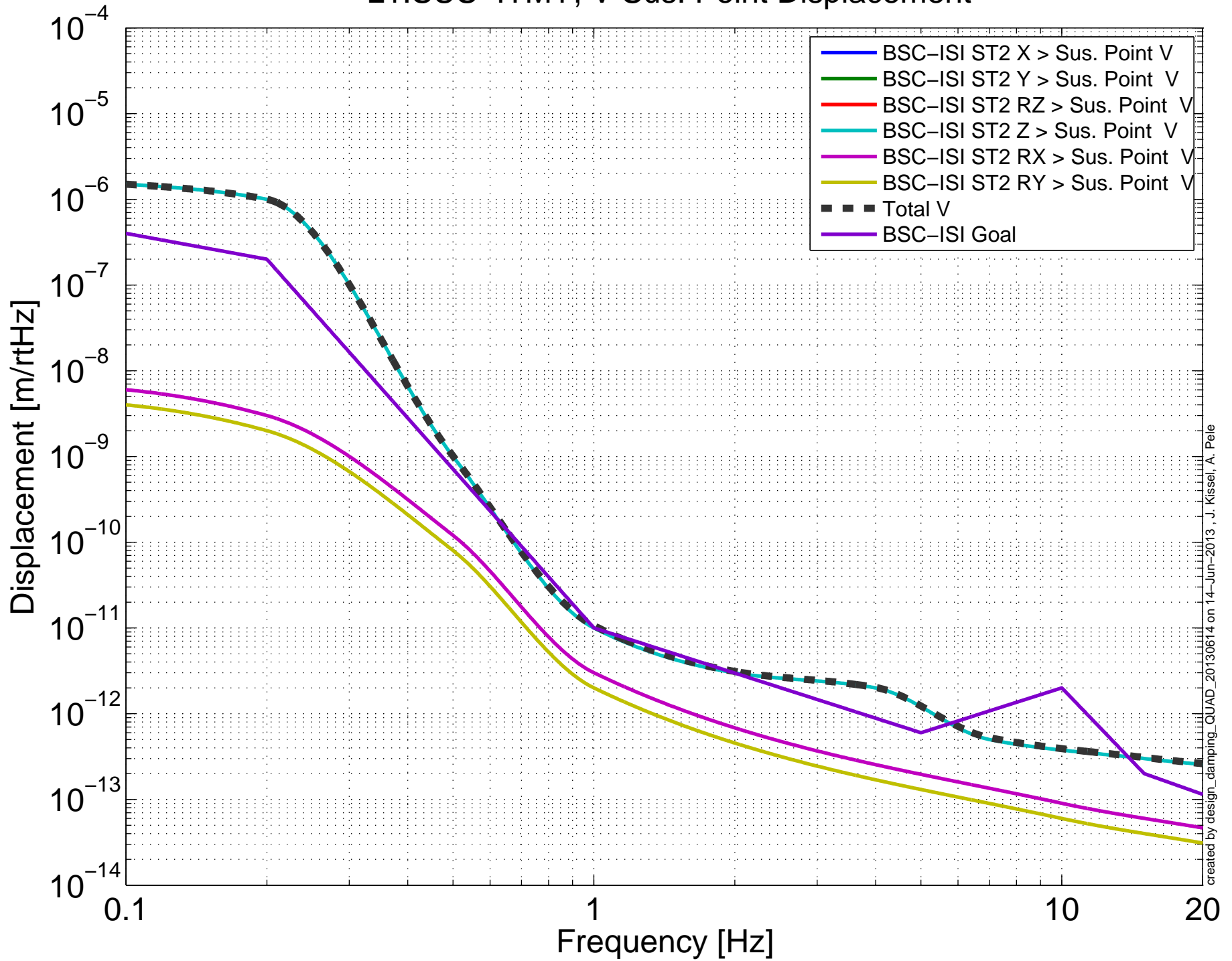


# Projected ISI Seismic Noise Budget L1:SUS-ITMY, T Sus. Point Displacement

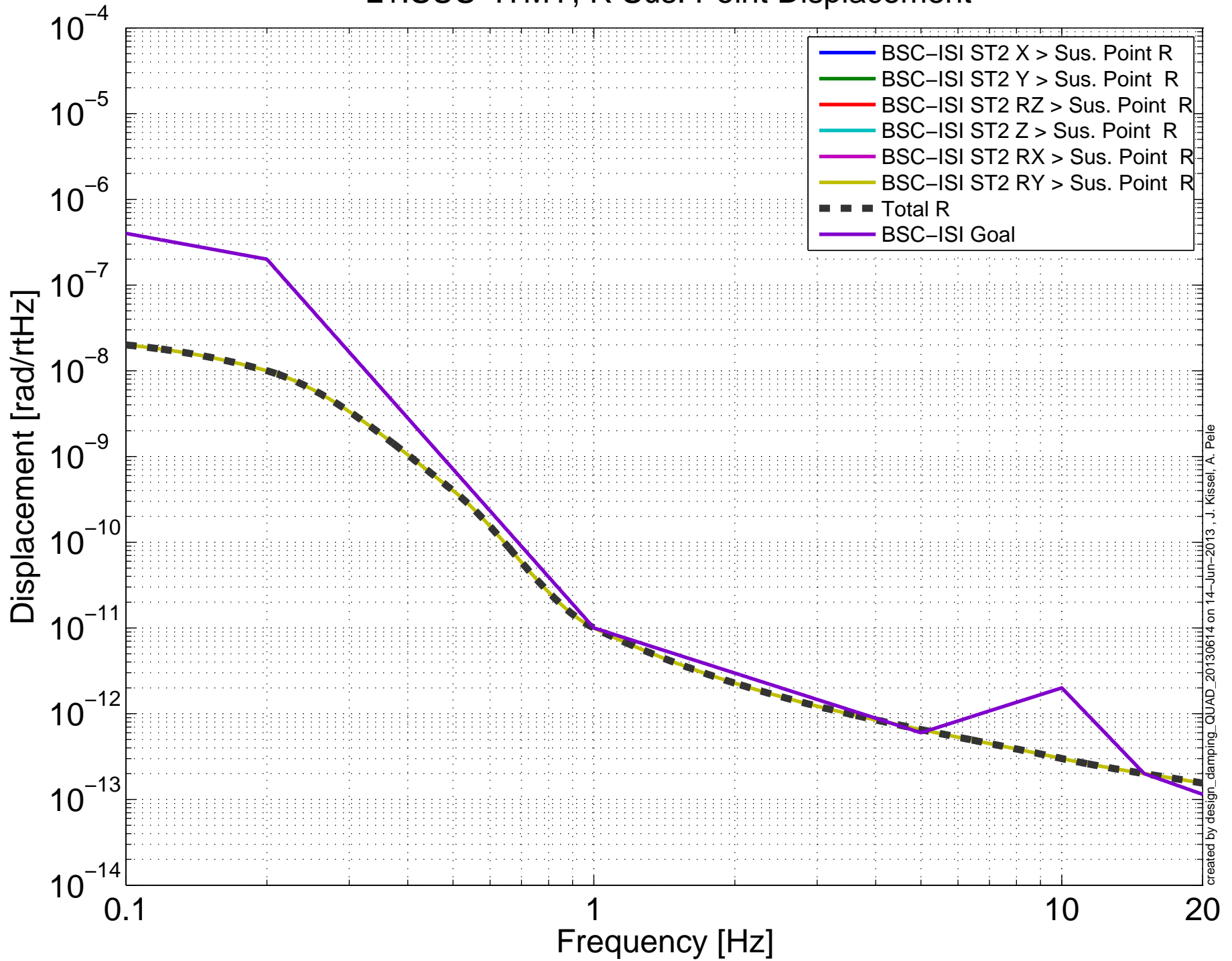




# Projected ISI Seismic Noise Budget L1:SUS-ITMY, V Sus. Point Displacement

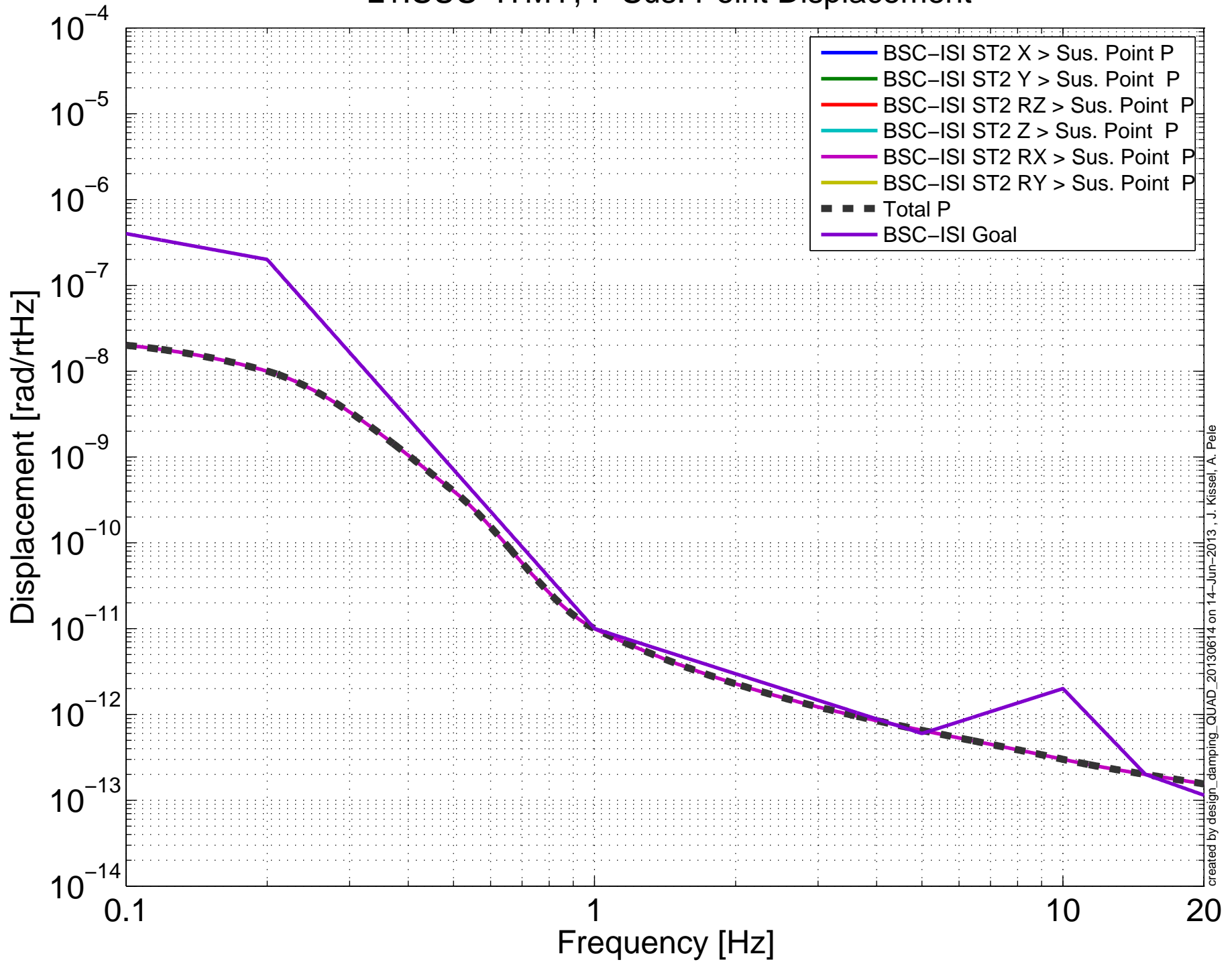


# Projected ISI Seismic Noise Budget L1:SUS-ITMY, R Sus. Point Displacement



created by design\_damping\_QUAD\_20130614 on 14-Jun-2013, J. Kissel, A. Pele

# Projected ISI Seismic Noise Budget L1:SUS-ITMY, P Sus. Point Displacement



# Projected ISI Seismic Noise Budget L1:SUS-ITMY, Y Sus. Point Displacement

