Fitted Models to Measured S38A:[HV]3 Corrector Response with Delay removed

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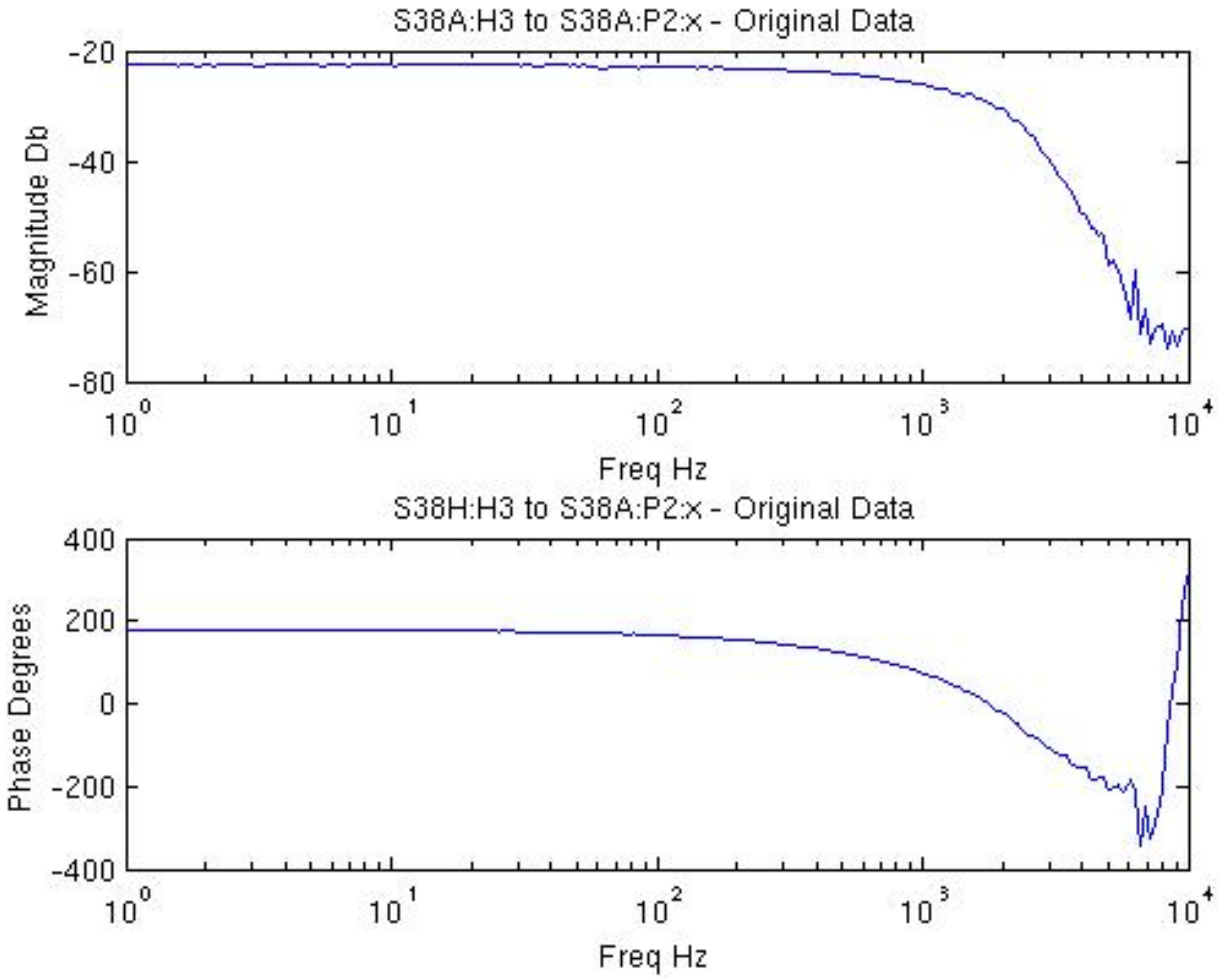
Background

- Data taken at S38 on 7/26/2011
  - S38A:H3 and S38A:V3 correctors measured
- Agilent 35670A Dynamic Signal Analyzer used to make measurements
- Measurement setup at S38
  - Corrector driven with +/- 1 Amp with 10 Amp offset
    - To avoid going through 0 Amps
  - Swept Sine
    - 1 Hz to 10 kHz
  - 324 bunch fill pattern with RTFB and orbit control disabled
  - BPM signal taken from cable that feeds analog position to BSP100
- Matlab Output Error (OE) Model Parameter Estimation function used to generate transfer function models from S38 measured data
- Original data refitted with delays of 88 usec, 132 usec and 176 usec removed from measured response

S38A:H3 to S38A:P2x Raw

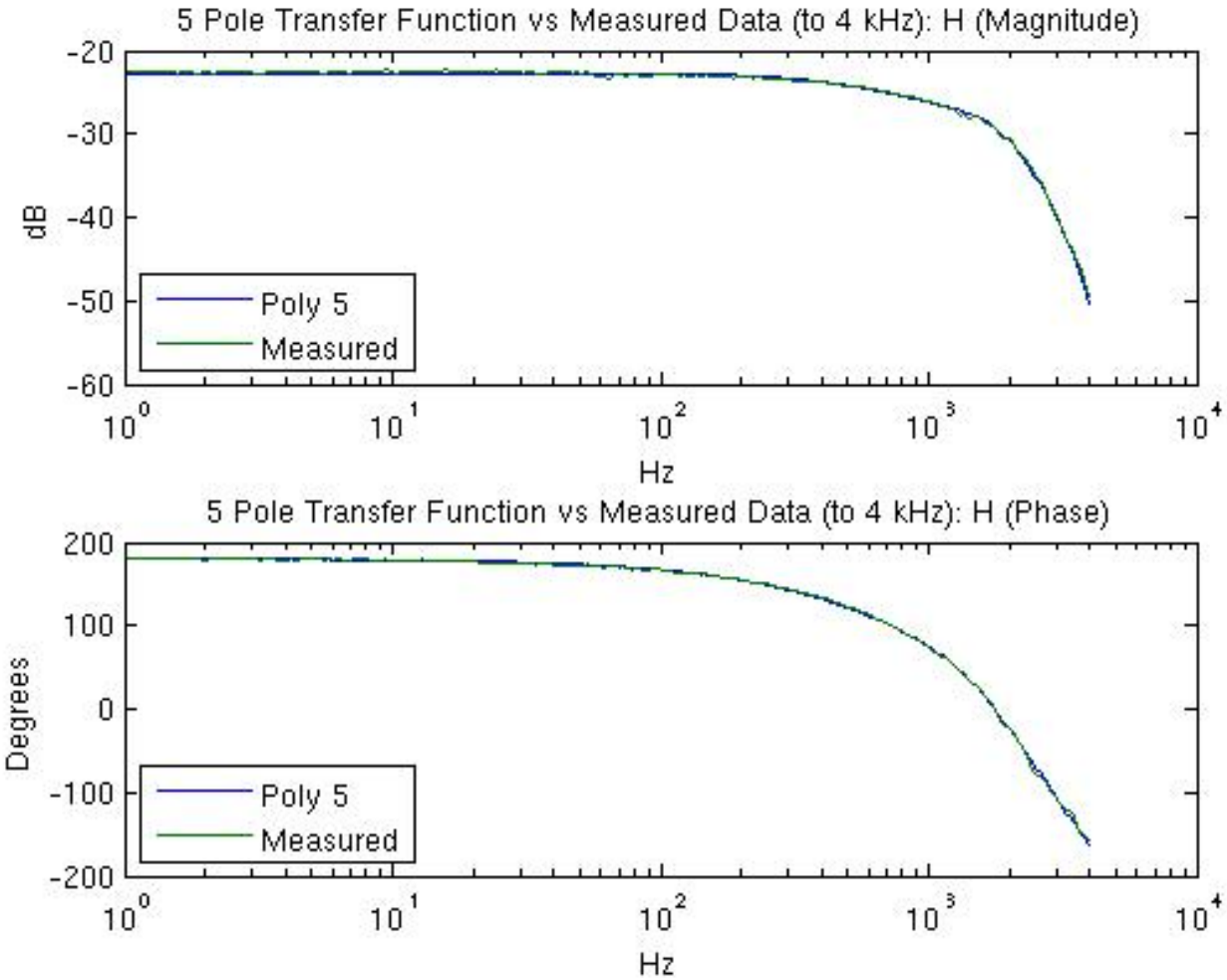


Fit: 5 pole to 4 kHz

ROOTS =

1.0e+03 *

-1.3567 + 3.1091i
-1.3567 - 3.1091i
-0.9015 + 1.6857i
-0.9015 - 1.6857i
-0.6614



Fit: 3-pole 2-zero to 4 kHz

POLES =

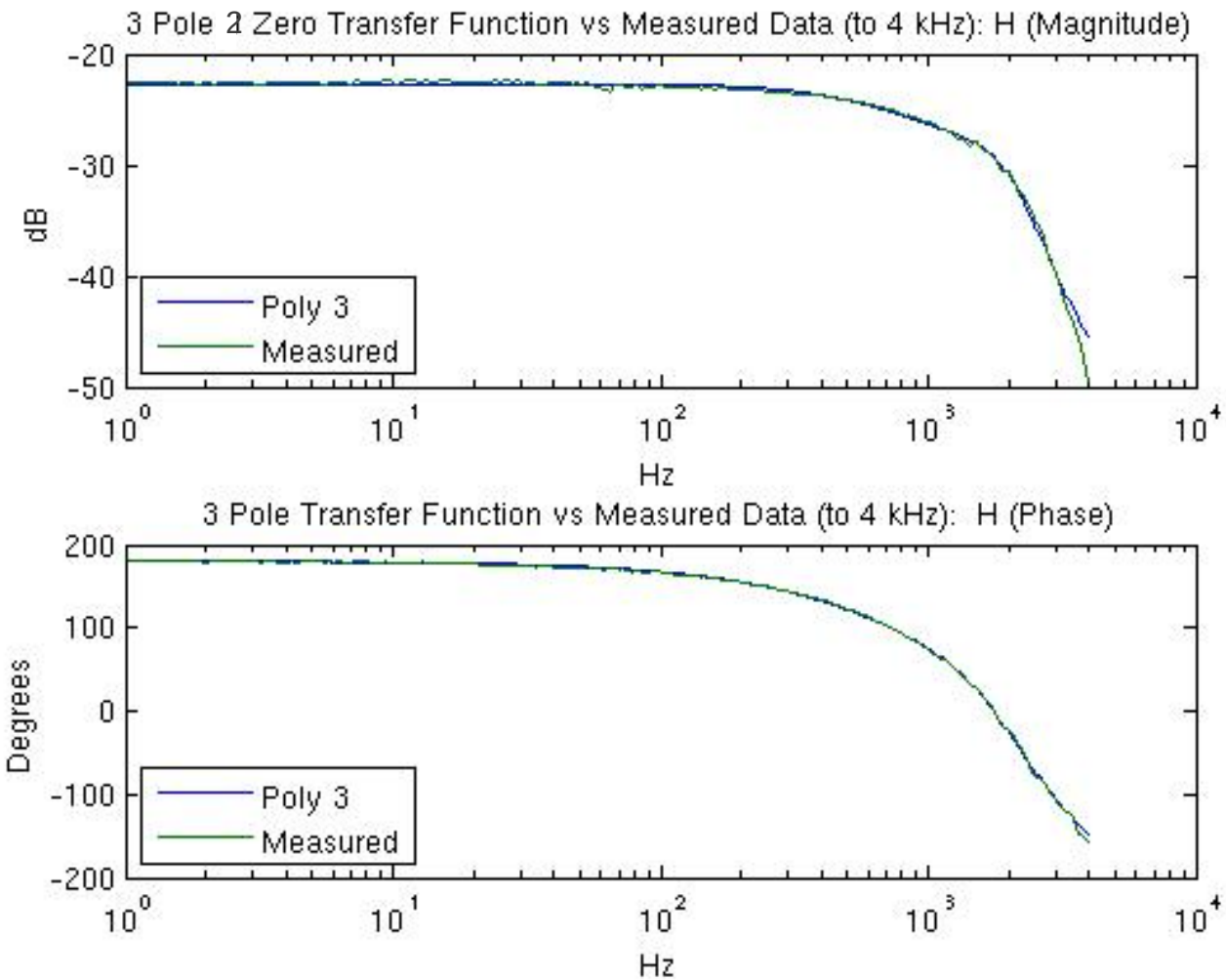
1.0e+03 *

-0.8393 + 1.8290i
-0.8393 - 1.8290i
-0.6932

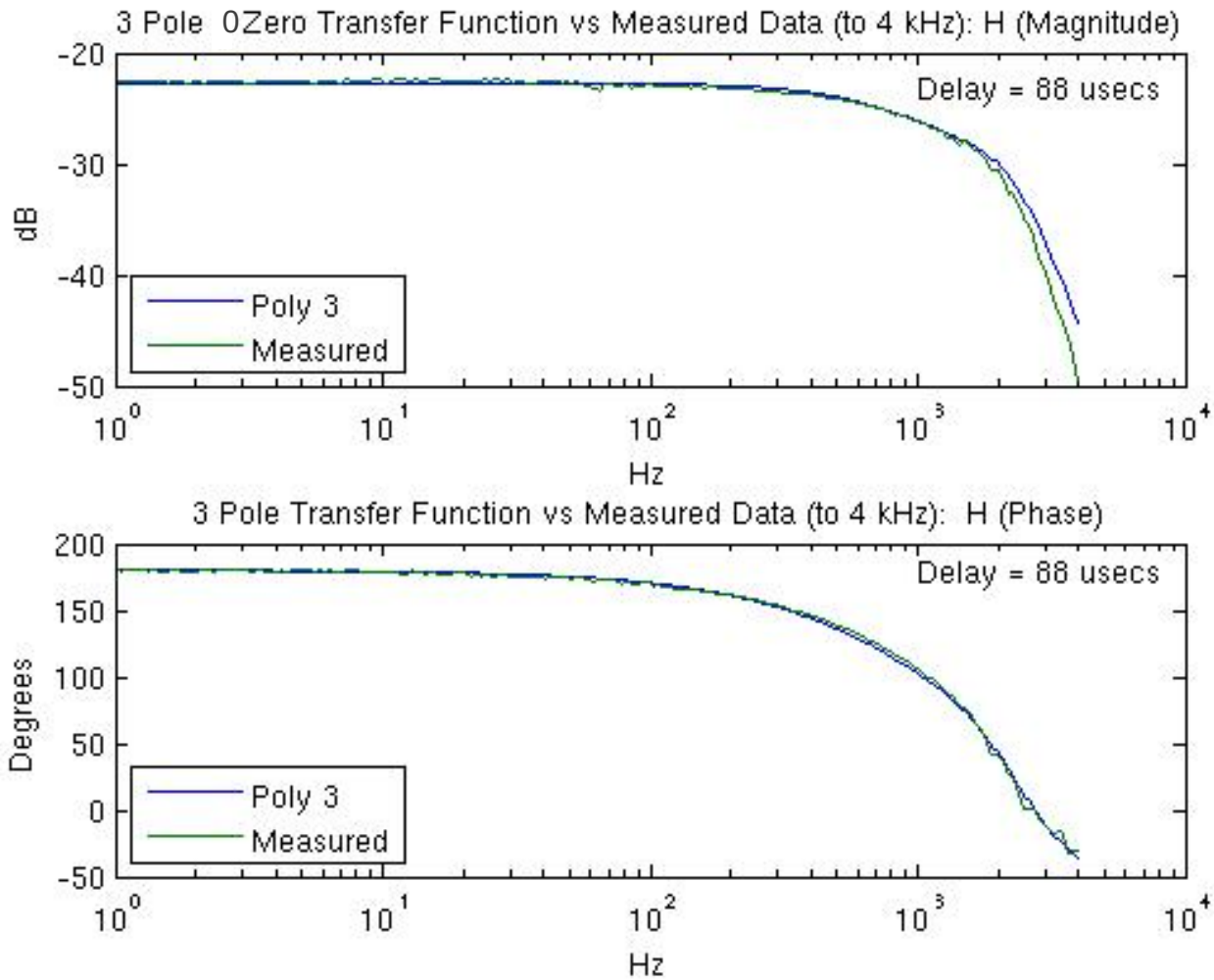
ZEROS =

1.0e+03 *

2.3146 + 2.8039i
2.3146 - 2.8039i



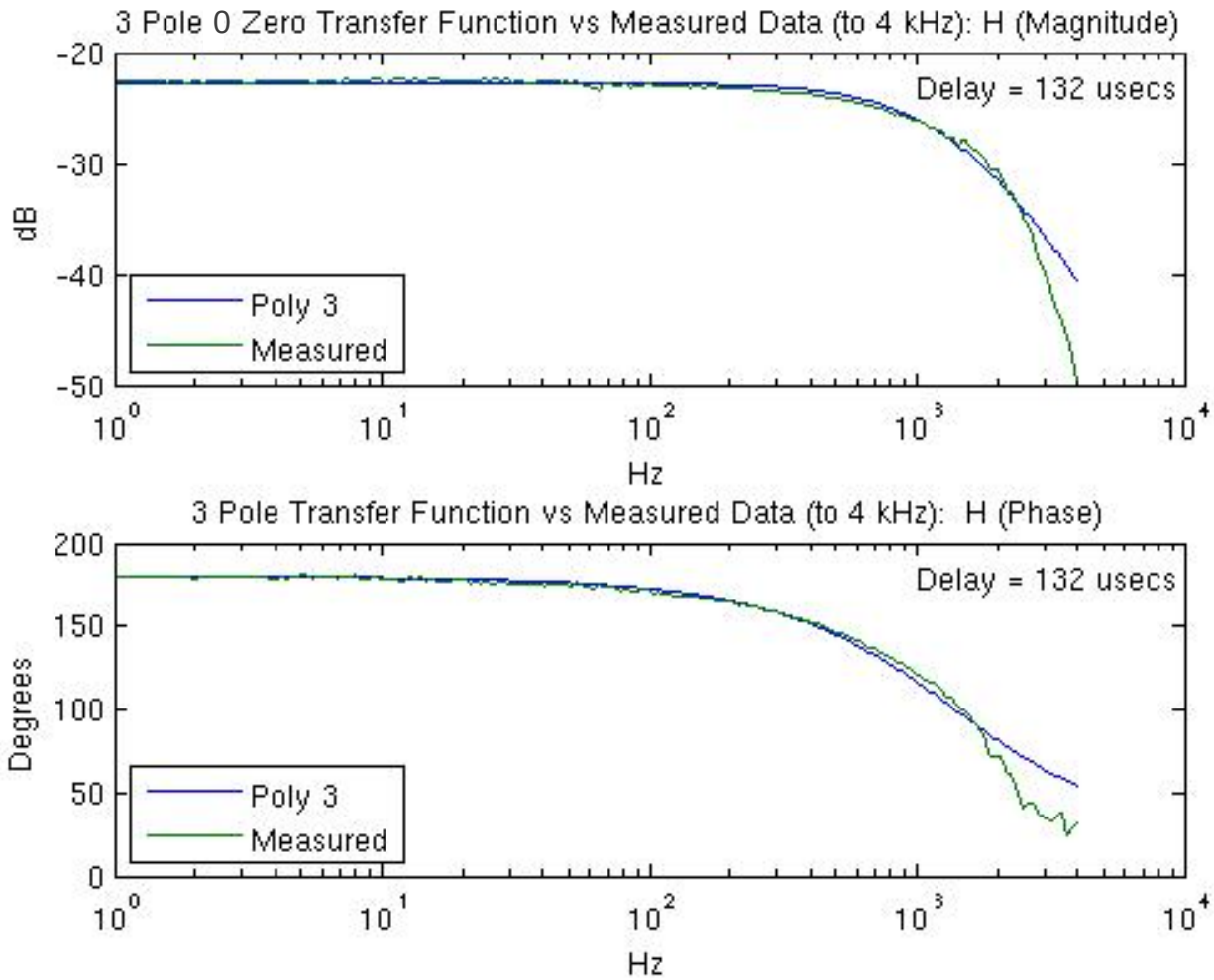
Fit: 3-pole to 4 kHz with 88 usec delay removed



Fit: 3-pole to 4 kHz with 88 usec delay removed

```
MFIT =
Continuous-time OE model:  y(t) = [B(s)/F(s)]u(t) + e(t)
  B(s) = -3.325e08

  F(s) = s^3 + 3071 s^2 + 7.575e06 s + 4.549e09

Parameterization:
   Polynomial orders:   nb=1   nf=3   nk=0
   Number of free coefficients: 4
   Use "polydata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using OE on frequency response data "HRD".
Fit to estimation data: 92.93% (prediction focus)
FPE: 6.271e-06, MSE: 6.221e-06

POLES =

   1.0e+03 *

  -1.1418 + 2.1150i
  -1.1418 - 2.1150i
  -0.7875


ZEROS =

   Empty matrix: 0-by-1
```

Fit: 3-pole to 4 kHz with 132 usec delay removed

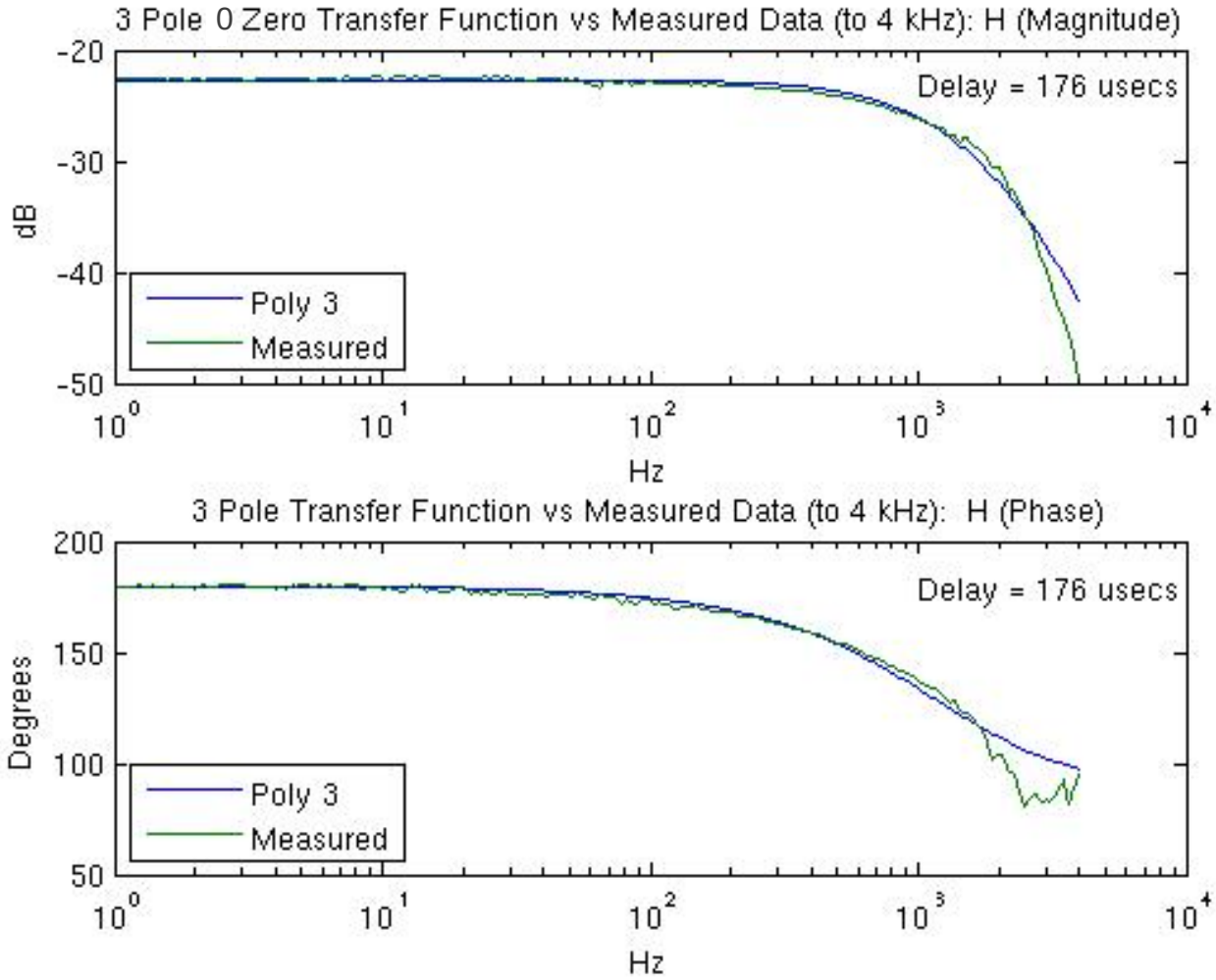


Fit: 3-pole to 4 kHz with 132 usec delay removed

```
FIT =
Continuous-time OE model:  y(t) = [B(s)/F(s)]u(t) + e(t)
  B(s) = 3.848e09

  F(s) = s^3 - 1.847e04 s^2 - 6.794e07 s - 5.286e10

Parameterization:
   Polynomial orders:   nb=1   nf=3   nk=0
   Number of free coefficients: 4
   Use "polydata", "getpvec", "getcov" for parameters and their
uncertainties.

Status:
Estimated using OE on frequency response data "HRD".
Fit to estimation data: 88.75% (prediction focus)
FPE: 1.238e-05, MSE: 1.232e-05

POLES =

   1.0e+04 *

    2.1714
   -0.2059
   -0.1182


ZEROS =

   Empty matrix: 0-by-1
```

Right-hand Plane!!

Fit: 3-pole to 4 kHz with 178 usec delay removed

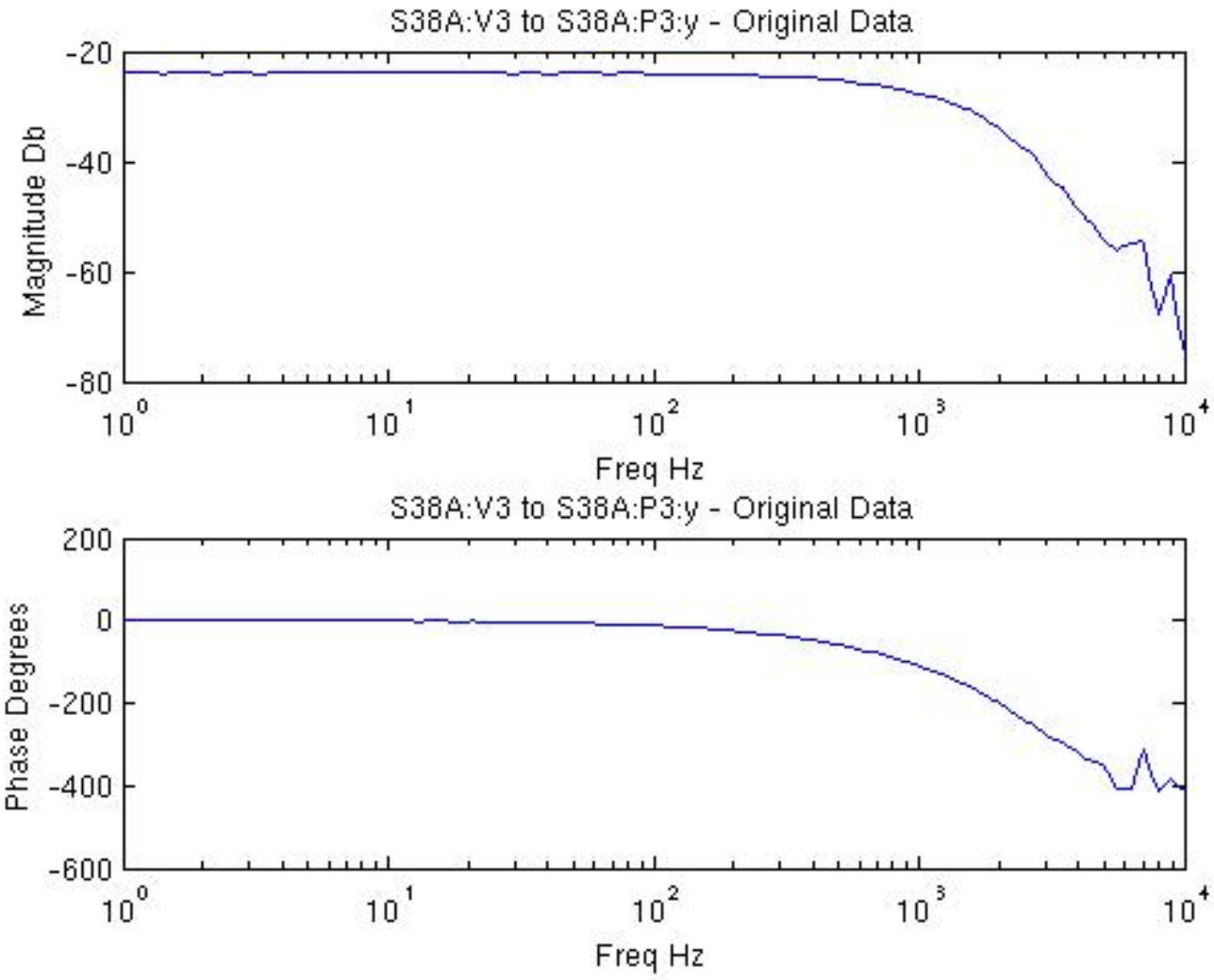


Fit: 3-pole to 4 kHz with 178 usec delay removed

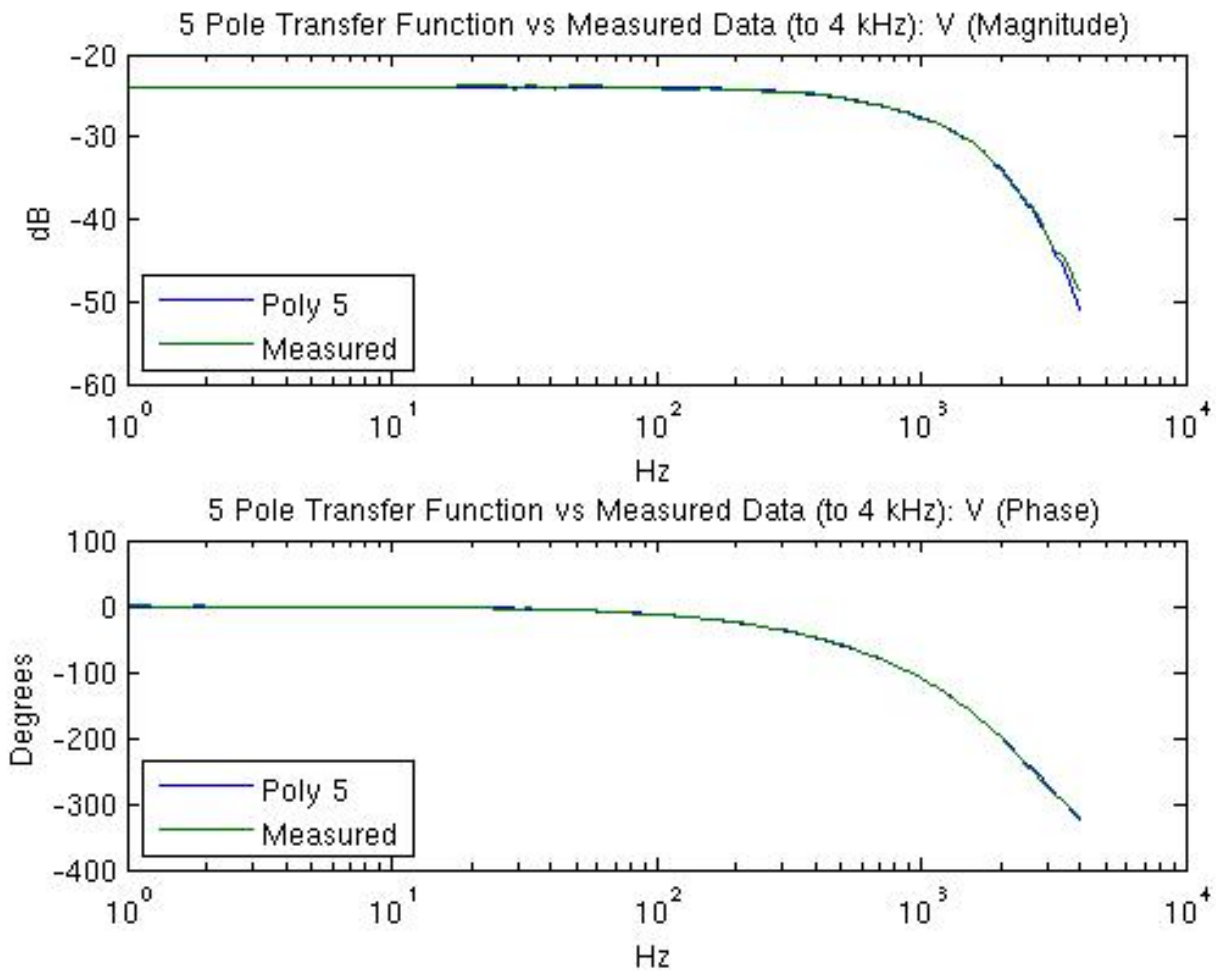
```
MFIT =
Continuous-time OE model:  y(t) = [B(s)/F(s)]u(t) + e(t)
  B(s) = 7.876e08

  F(s) = s^3 + 207.3 s^2 - 1.05e07 s - 1.079e10

Parameterization:
   Polynomial orders:   nb=1   nf=3   nk=0
   Number of free coefficients: 4
   Use "polydata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using OE on frequency response data "HRD".
Fit to estimation data: 88.29% (prediction focus)
FPE: 9.566e-06, MSE: 9.497e-06

POLES =

   1.0e+03 *

    3.5752
   -2.6379
   -1.1446


ZEROS =

   Empty matrix: 0-by-1
```

Right-hand Plane!!

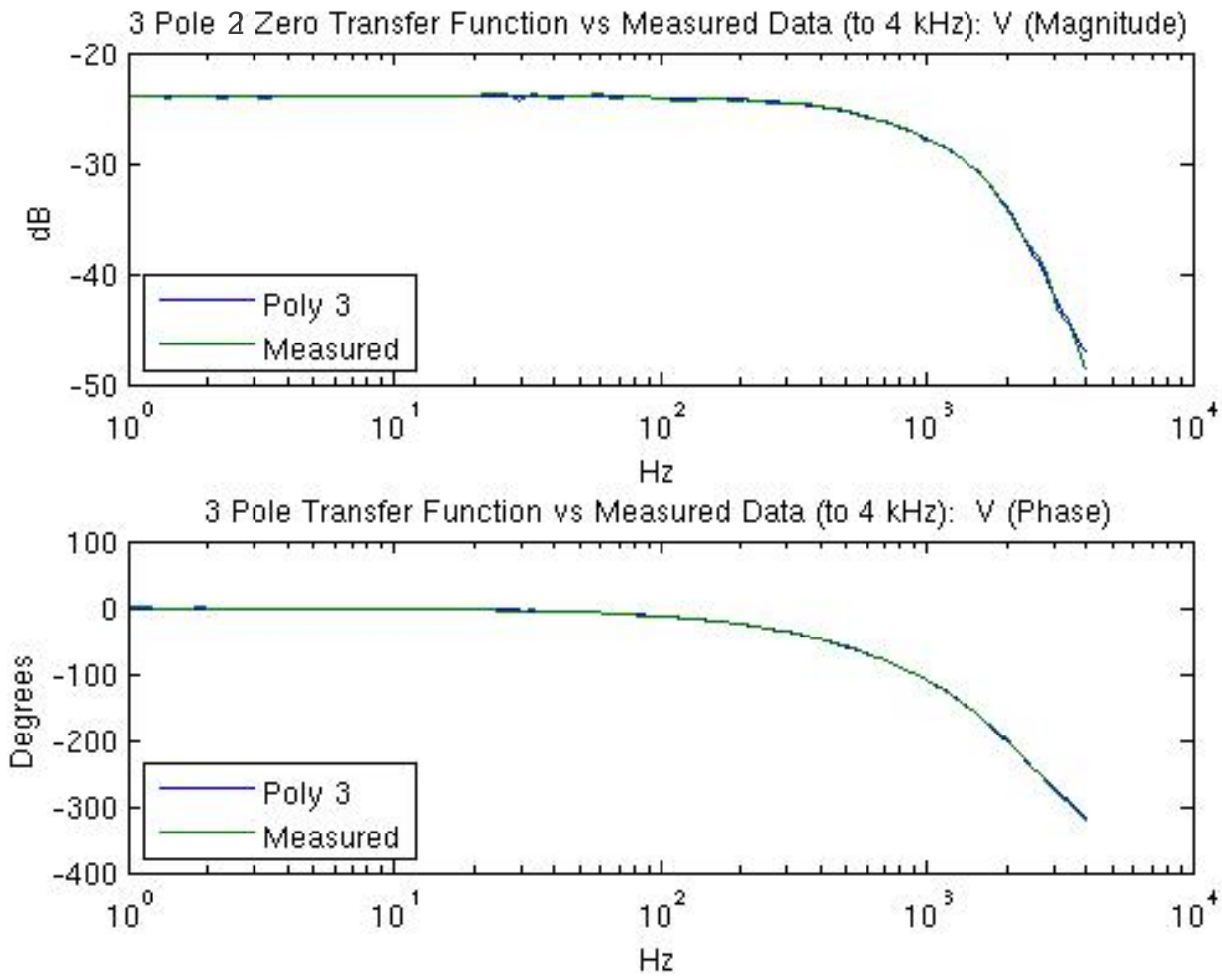
S38A:V3 to S38A:P3y Raw



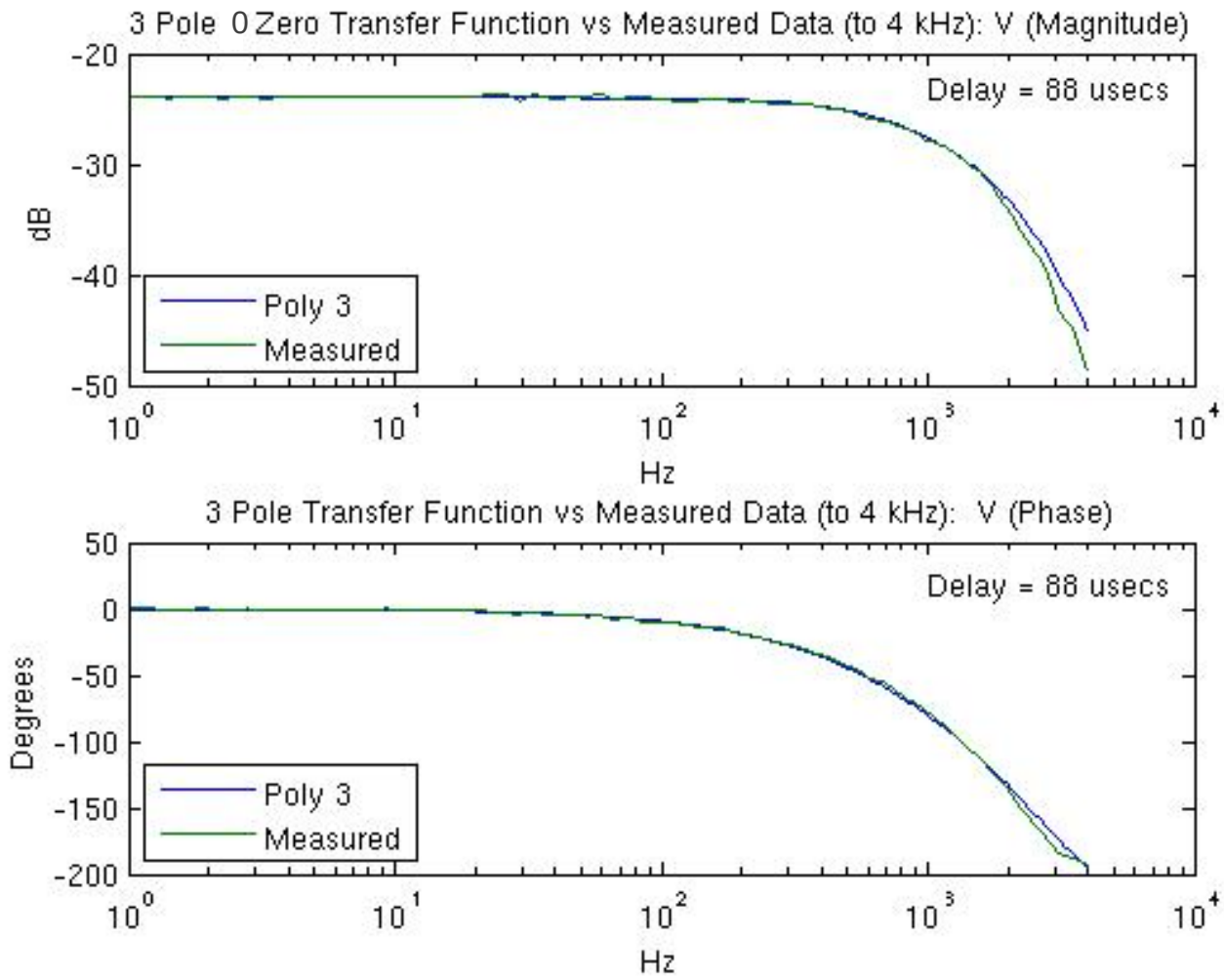
Fit: 5-pole to 4 kHz



Fit: 3-pole 2-zero to 4 kHz



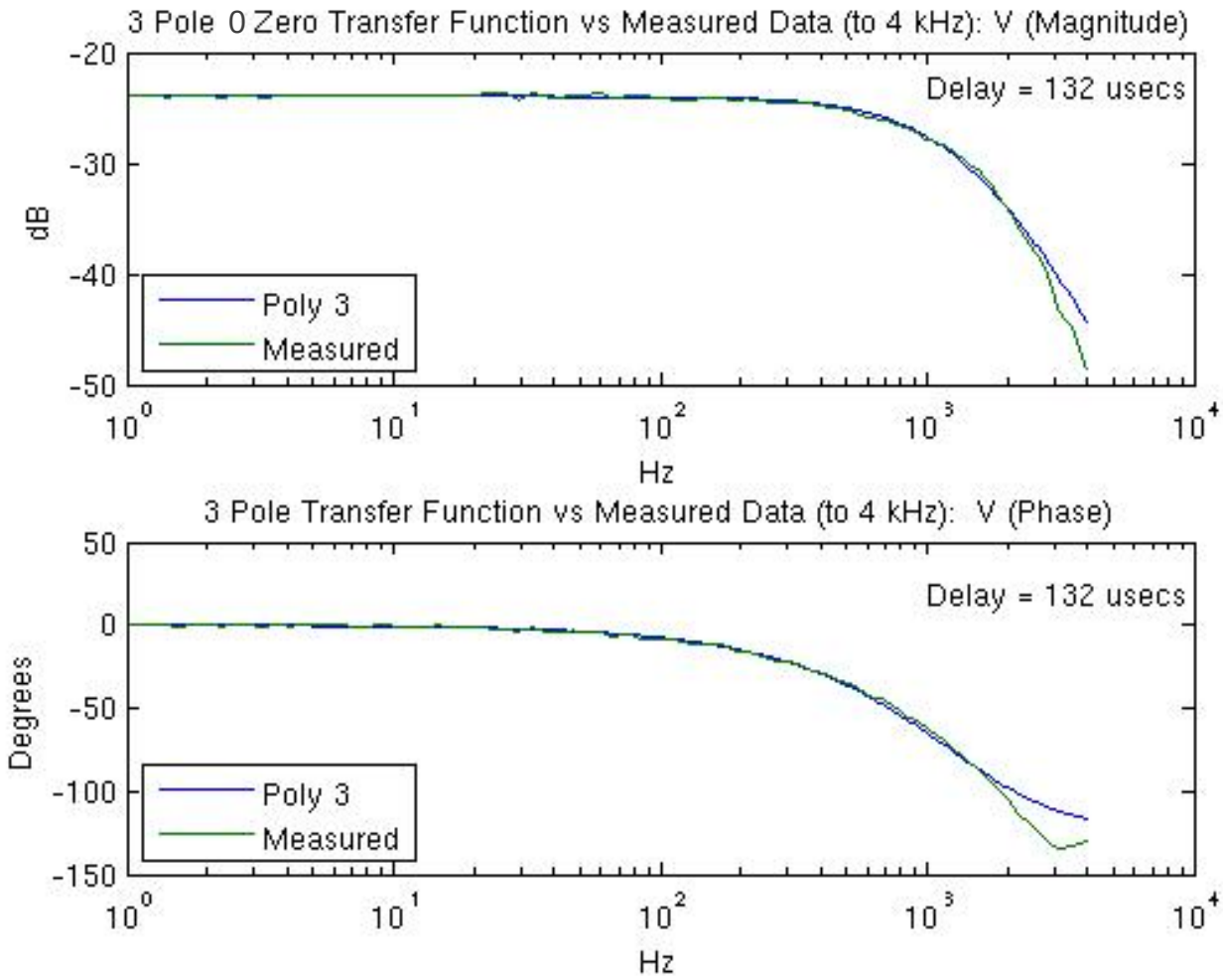
Fit: 3 pole to 4 kHz with 88 usec delay removed



Fit: 3 pole to 4 kHz with 88 usec delay removed

```
MFIT =
Continuous-time OE model:  y(t) = [B(s)/F(s)]u(t) + e(t)
  B(s) = 4.236e08

  F(s) = s^3 + 5012 s^2 + 1.102e07 s + 6.704e09

Parameterization:
   Polynomial orders:   nb=1   nf=3   nk=0
   Number of free coefficients: 4
   Use "polydata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using OE on frequency response data "HRD".
Fit to estimation data: 95.13% (prediction focus)
FPE: 2.206e-06, MSE: 2.19e-06

POLES =

   1.0e+03 *

  -2.0426 + 1.7504i
  -2.0426 - 1.7504i
  -0.9265


ZEROS =

   Empty matrix: 0-by-1
```

Fit: 3-pole to 4 kHz with 132 usec delay removed

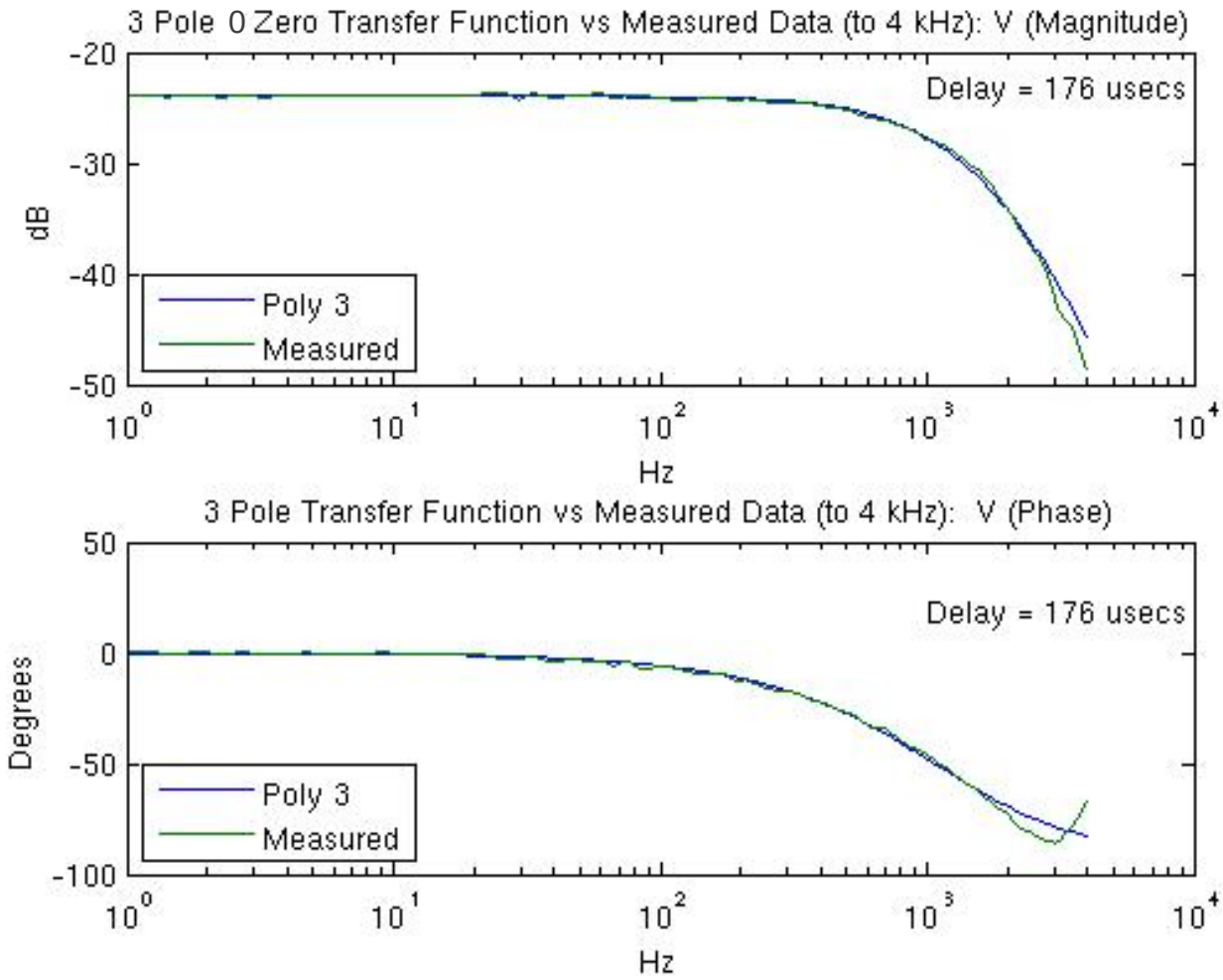


Fit: 3-pole to 4 kHz with 132 usec delay removed

```
MFIT =
Continuous-time OE model:  y(t) = [B(s)/F(s)]u(t) + e(t)
  B(s) = -9.632e08

  F(s) = s^3 - 5444 s^2 - 2.004e07 s - 1.525e10

Parameterization:
   Polynomial orders:   nb=1   nf=3   nk=0
   Number of free coefficients: 4
   Use "polydata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using OE on frequency response data "HRD".
Fit to estimation data: 93.68% (prediction focus)
FPE: 2.91e-06, MSE: 2.892e-06

POLES =

   1.0e+03 *

   8.1370
  -1.3467 + 0.2469i
  -1.3467 - 0.2469i


ZEROS =

   Empty matrix: 0-by-1
```

Right-hand Plane!!

Fit: 3-pole to 4 kHz with 176 usec delay removed



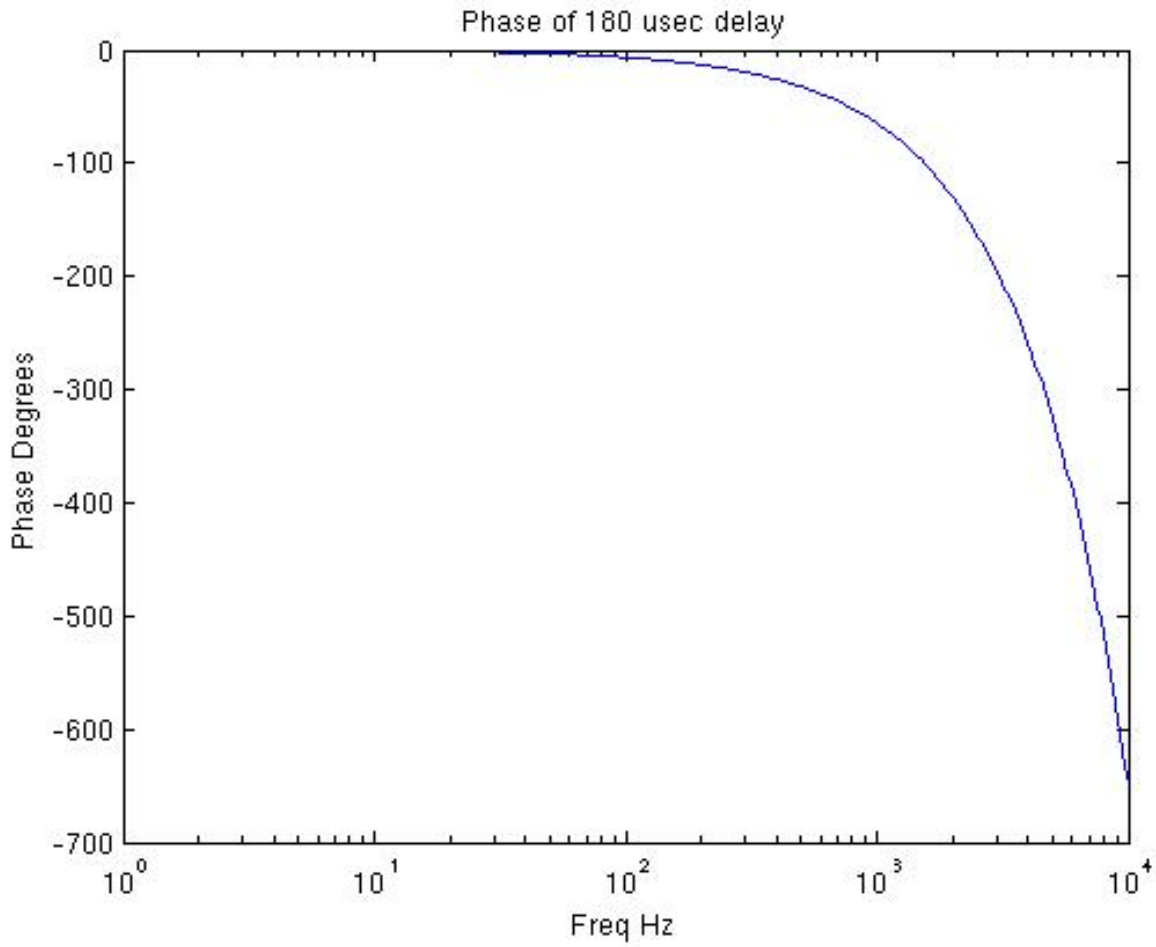
Fit: 3-pole to 4 kHz with 176 usec delay removed

```
MFIT =
Continuous-time OE model:  y(t) = [B(s)/F(s)]u(t) + e(t)
  B(s) = -5.079e08

  F(s) = s^3 + 282.5 s^2 - 8.208e06 s - 8.024e09

Parameterization:
   Polynomial orders:   nb=1   nf=3   nk=0
   Number of free coefficients: 4
   Use "polydata", "getpvec", "getcov" for parameters and their uncertainties.

Status:
Estimated using OE on frequency response data "HRD".
Fit to estimation data: 94.28% (prediction focus)
FPE: 1.729e-06, MSE: 1.718e-06

POLES =

   1.0e+03 *

    3.1423
   -2.3279
   -1.0969


ZEROS =

   Empty matrix: 0-by-1
```

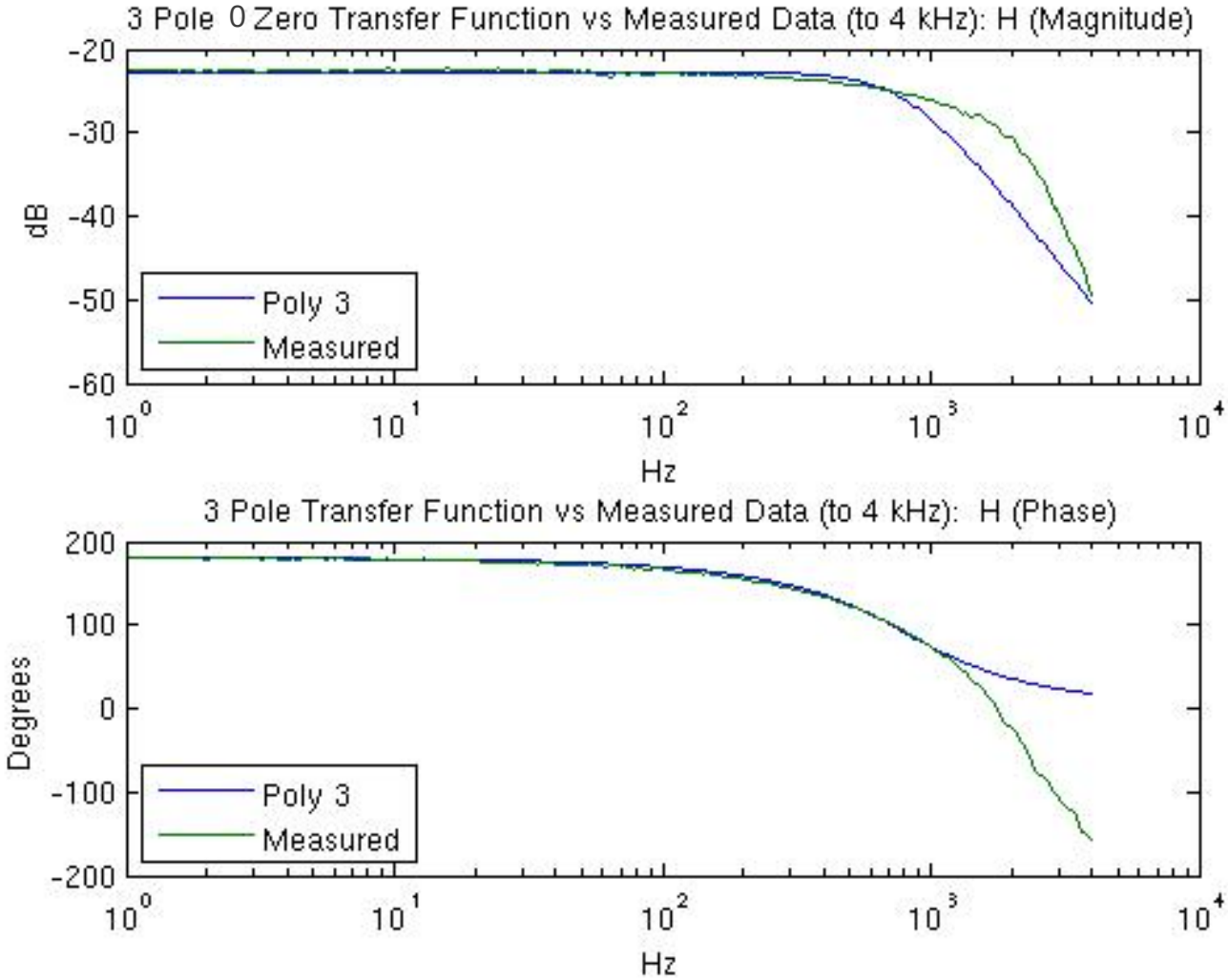
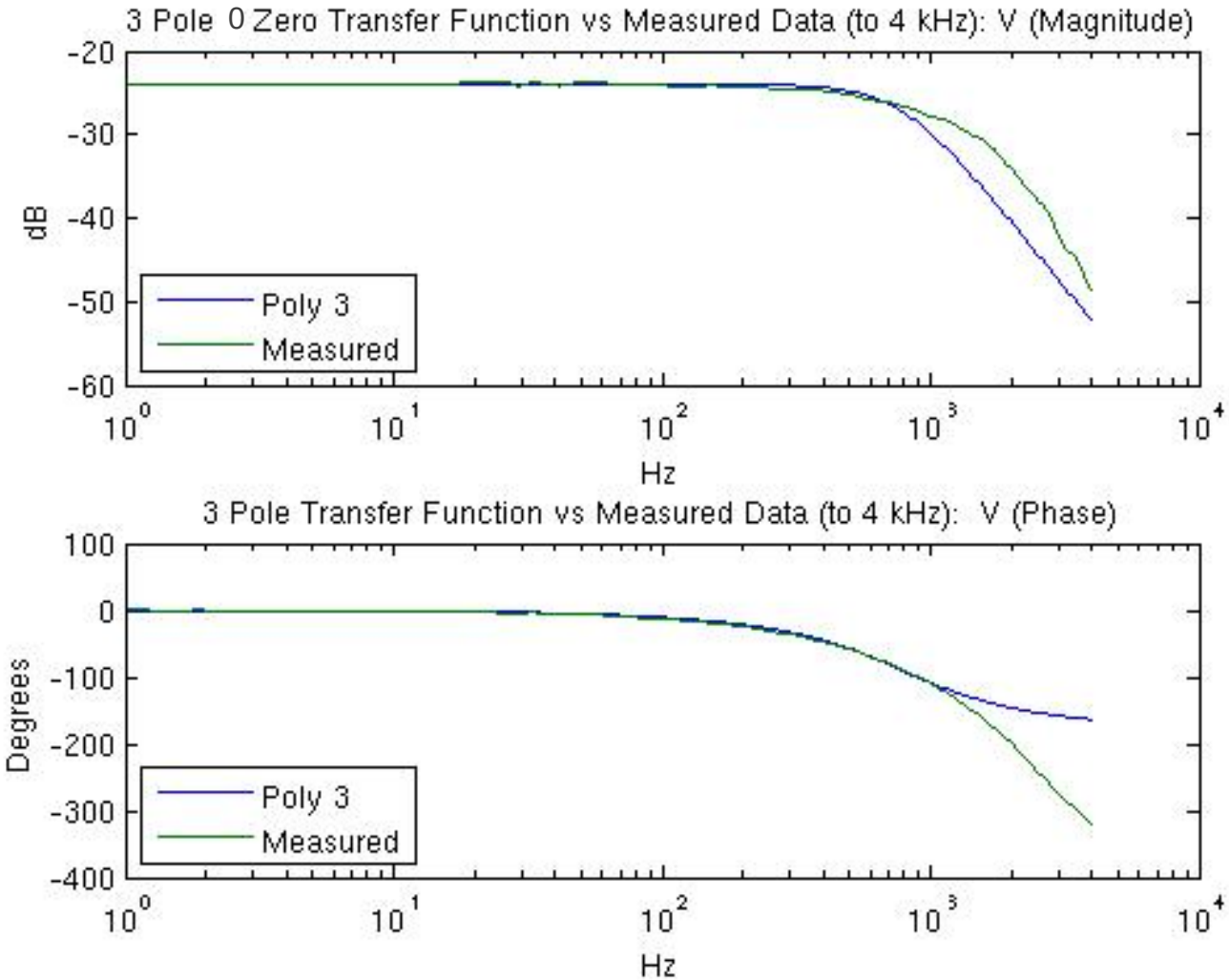
Right-hand Plane!!

Backup Slides

Phase of 180 usec Delay



Fit: 3-pole to 4 kHz



Fit: 3-pole to 4 kHz