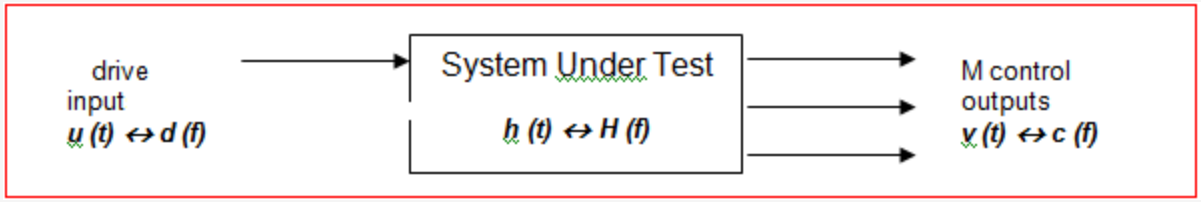
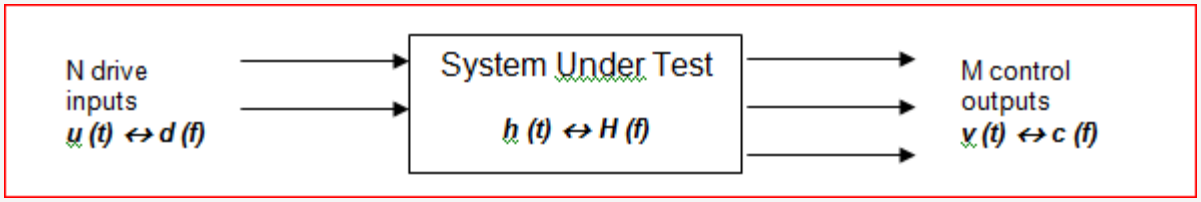
Multi-Axis Random

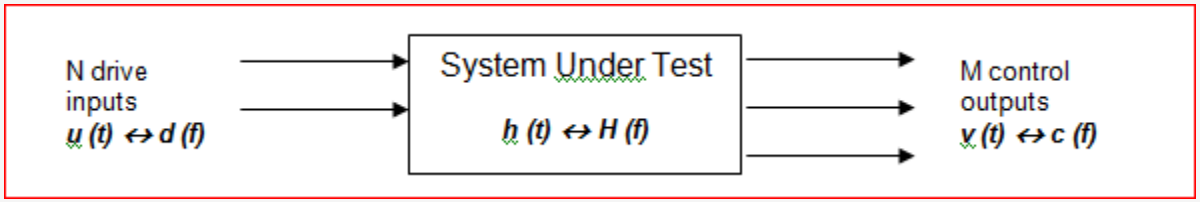
- Ein Achsig
  - In mehre Richtungen anwendbar (nacheinander)



- Multi-Axis
  - Gleichzeitige Anregung
  - Mehrere Achsen,



Multi-Axis Random



$$c_i(f) = \sum_j c_i^j = \sum_j \{H_{ij}(f) \bullet d_j(f)\}$$

$$\begin{bmatrix} c_1(f) \\ c_2(f) \\ \vdots \\ \vdots \\ c_M(f) \end{bmatrix} = \begin{bmatrix} H_{11}(f) & H_{12}(f) & \cdots & H_{1N}(f) \\ H_{21}(f) & H_{22}(f) & \cdots & H_{2N}(f) \\ \vdots & \vdots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ H_{M1}(f) & H_{M2}(f) & \cdots & H_{MN}(f) \end{bmatrix} \bullet \begin{bmatrix} d_1(f) \\ d_2(f) \\ \vdots \\ d_N(f) \end{bmatrix}$$

$$c(f) = H(f) \bullet d(f)$$

Multi-Axis Random

- $c(f) = H(f) \bullet d(f)$

- **c**(f) : Referenzspektren
- **H**(f) : Übertragungsfunktionsmatrix
  - Bestimmung aus „Vortest“ , Systemidentifikation
- **d**(f) : Drive Signale
  - Berechnung aus „Vortest“ , Systemidentifikation

Multi-Axis Random

t Results

Coherence: 1.000

Selftest Results

Channel	Gain rms		Sensitivity	Coherence	Selftest		Remarks
	Defined	Current			Noise rms	Meas. rms	
Shaker 1:							
1 (CP 1)	10.00 g/V	3.65 g/V	50.00 mV/g	1.000	0.038 mV	4.58 mV	Gain error
2 (CP 2)	10.00 g/V	4.83 g/V	50.00 mV/g	0.974	0.129 mV	6.07 mV	Ok
3	0.00 V/V	1.00 V/V	1000.00 mV/V	-	0.020 mV	25.06 mV	-
4	0.00 V/V	0.00 V/V	1000.00 mV/V	-	0.015 mV	0.01 mV	-
5	0.00 mm...	1.04 mm...	27.50 mV/mm	-	0.019 mV	0.72 mV	-
6	0.00 mm...	0.28 mm...	500.00 mV/mm	-	0.097 mV	3.51 mV	-
8	0.00 g/V	4.85 g/V	100.00 mV/g	-	0.119 mV	12.18 mV	-
Shaker 2:							
1 (CP 1)	10.00 g/V	4.41 g/V	50.00 mV/g	1.000	0.038 mV	31.18 mV	Gain error
2 (CP 2)	10.00 g/V	10.31 g/V	50.00 mV/g	1.000	0.129 mV	72.82 mV	Ok
3	0.00 V/V	0.00 V/V	1000.00 mV/V	-	0.020 mV	0.02 mV	-
4	0.00 V/V	1.00 V/V	1000.00 mV/V	-	0.015 mV	140.91 mV	-
5	0.00 mm...	0.41 mm...	27.50 mV/mm	-	0.019 mV	1.61 mV	-
6	0.00 mm...	0.75 mm...	500.00 mV/mm	-	0.097 mV	52.87 mV	-
8	0.00 g/V	9.03 g/V	100.00 mV/g	-	0.119 mV	127.53 mV	-

OK

Cancel

Print

Save as...

File: C:\VcpNT_211_28_MultAxis\Daten\BEAM_NewShaker\Shaker_Beam_ COH_1_Phase_180_001.rr2

Multi-Axis Random, unkorreliert

- Reference (Soll-) PSD Matrix
- $$R(f) = \begin{bmatrix} r_1(f) \bullet r_1^*(f) & & \underline{0} \\ & r_2(f) \bullet r_2^*(f) & \\ \underline{0} & & r_M(f) \bullet r_M^*(f) \end{bmatrix}$$
- Diagonal Elemente Autoleistungsdichten (PSDs)
- Ausserdiagonal Elemente gleich Null

Multi-Axis Random

- Reference (Soll-) PSD Matrix (Erwartungswert-bildung)

$$R(f) = E\left[r(f) \bullet r^{*T}(f)\right]$$

$$R(f) = \begin{bmatrix} r_1(f) \bullet r_1^*(f) & r_1(f) \bullet r_2^*(f) & r_1(f) \bullet r_M^*(f) \\ r_2(f) \bullet r_1^*(f) & r_2(f) \bullet r_2^*(f) & r_2(f) \bullet r_M^*(f) \\ \\ r_M(f) \bullet r_1^*(f) & r_M(f) \bullet r_2^*(f) & r_M(f) \bullet r_M^*(f) \end{bmatrix}$$

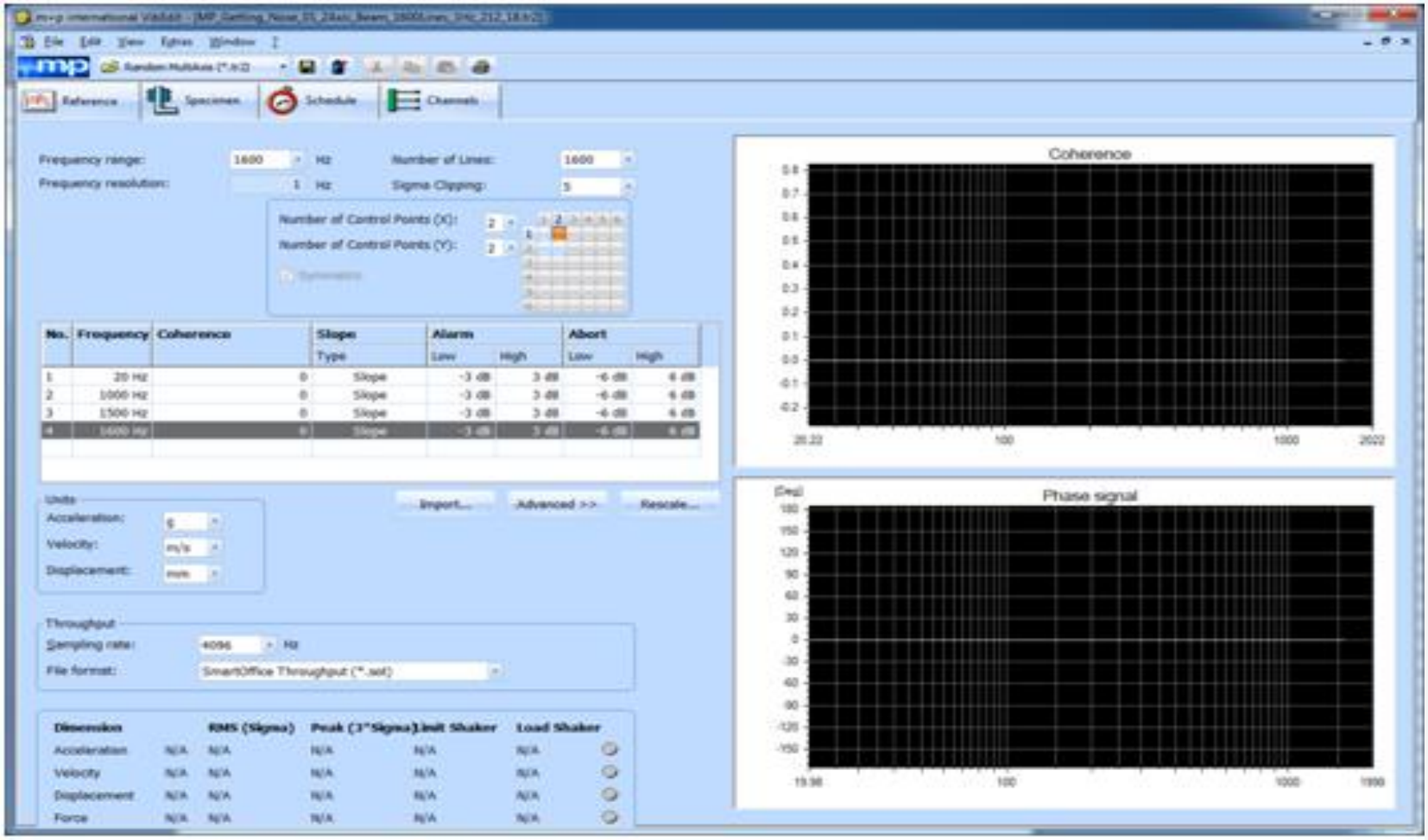
Multi-Axis Random

- Reference (Soll-) PSD Matrix
-

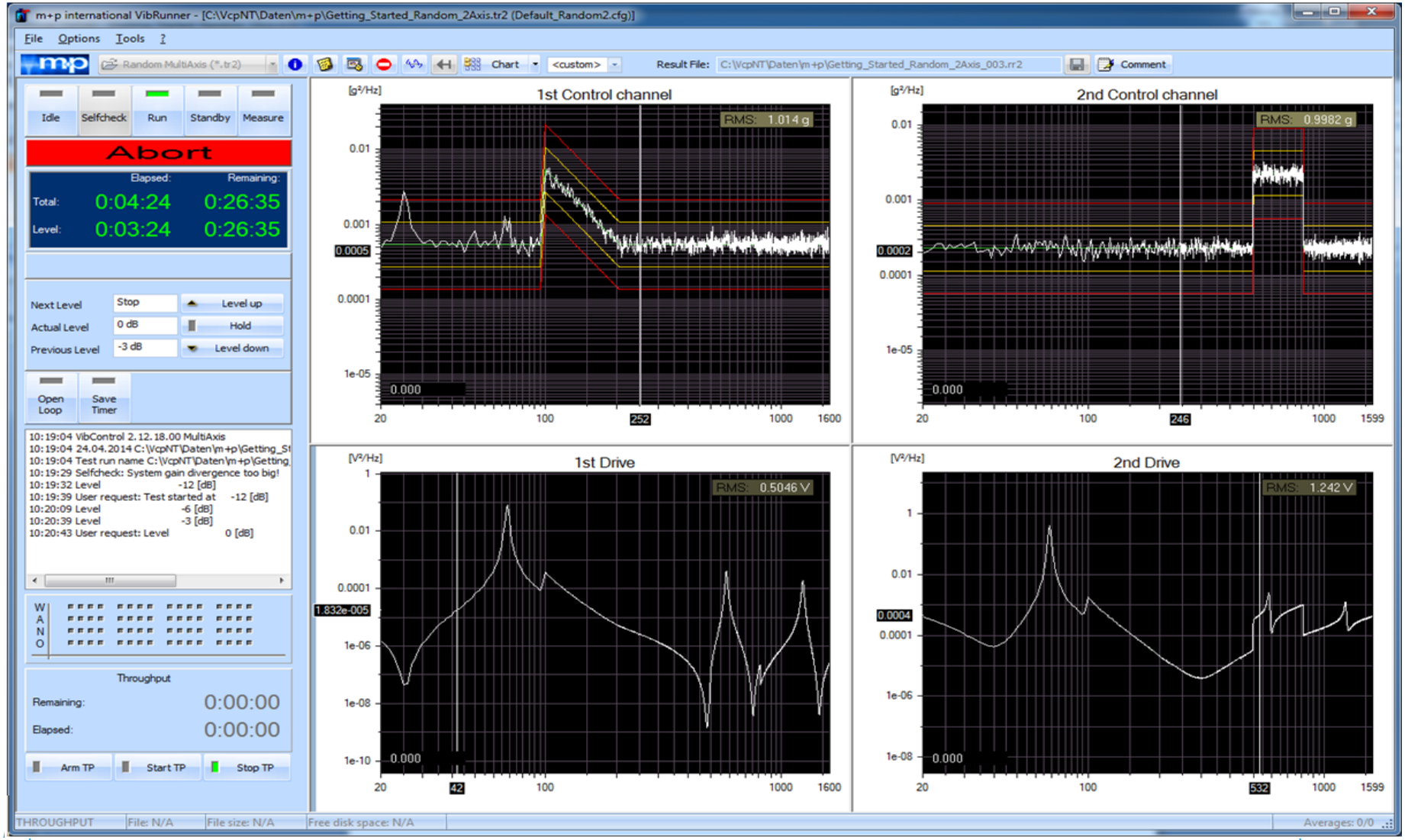
$$R(f) = \begin{bmatrix} r_1(f) \bullet r_1^*(f) & r_1(f) \bullet r_2^*(f) & r_1(f) \bullet r_M^*(f) \\ r_2(f) \bullet r_1^*(f) & r_2(f) \bullet r_2^*(f) & r_2(f) \bullet r_M^*(f) \\ \\ r_M(f) \bullet r_1^*(f) & r_M(f) \bullet r_2^*(f) & r_M(f) \bullet r_M^*(f) \end{bmatrix}$$

- Diagonal Elemente Autoleistungsdichten (PSDs)
- Ausserdiagonal Elemente Kreuzleistungsdichten
  - Auch als Kohärenz und Phase darstellbar

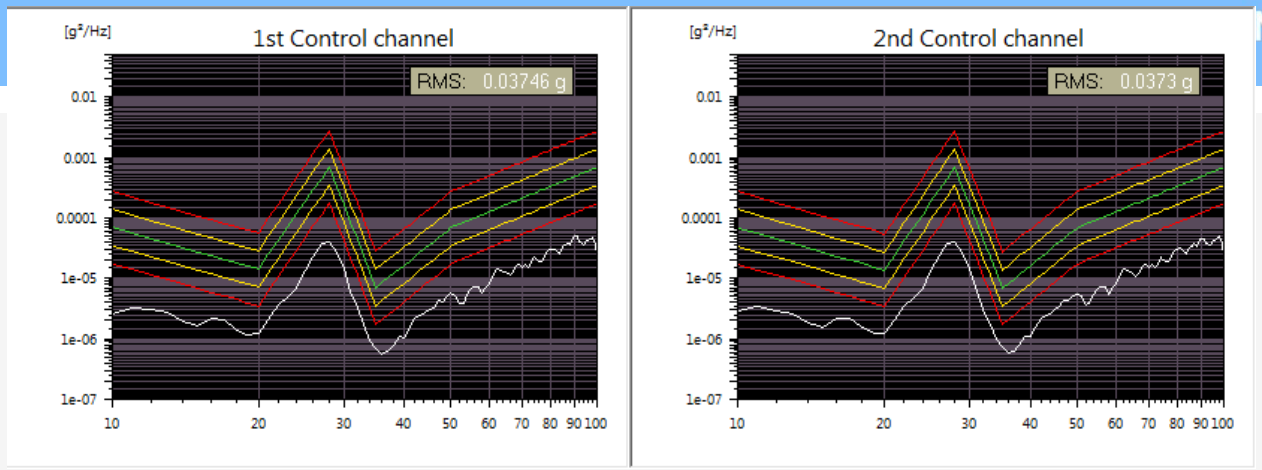
Multi-Axis Random

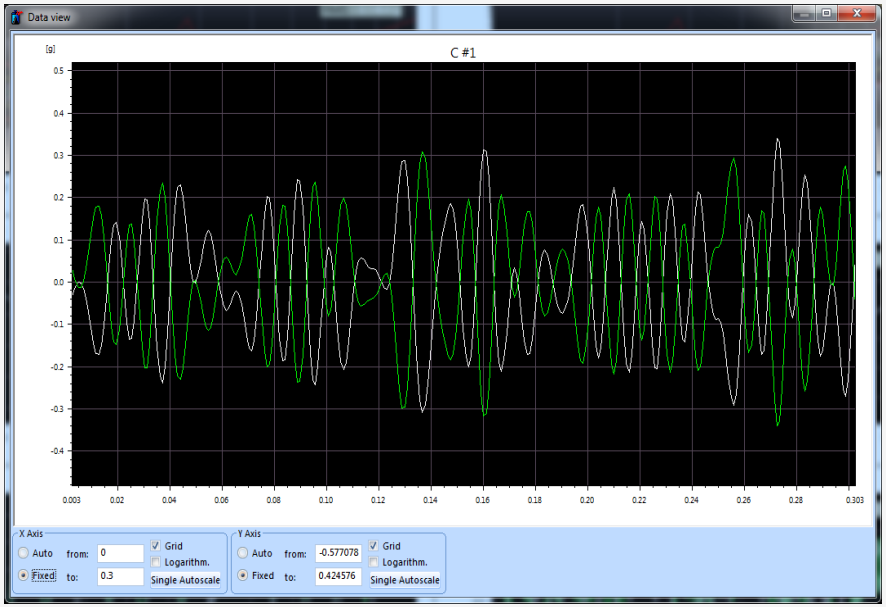


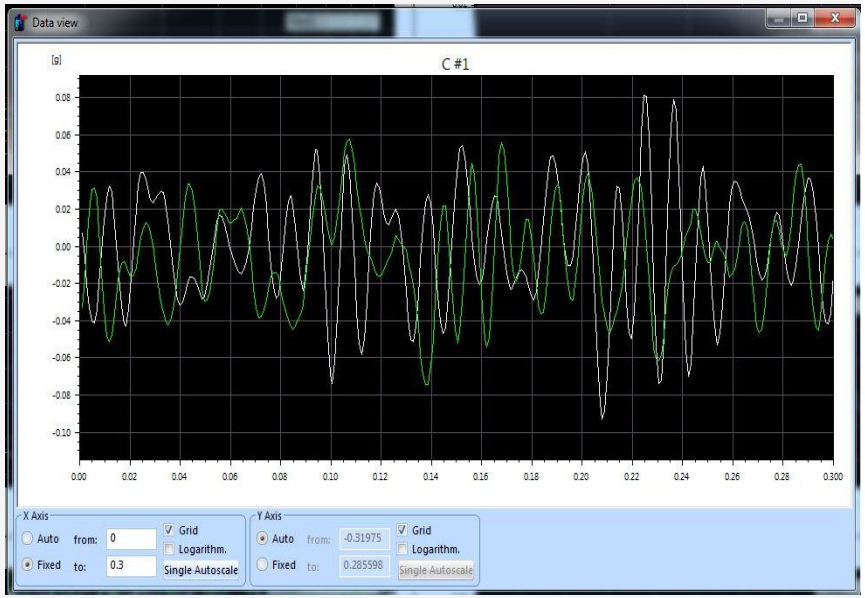
Multi-Axis Random



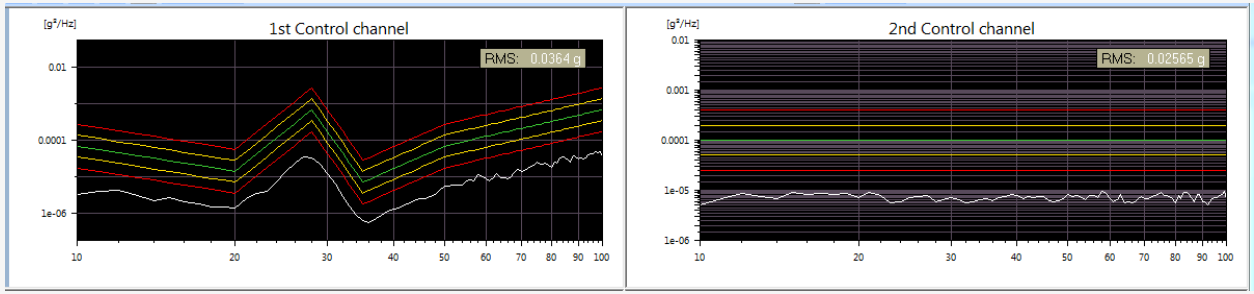
Multi-Axis Random

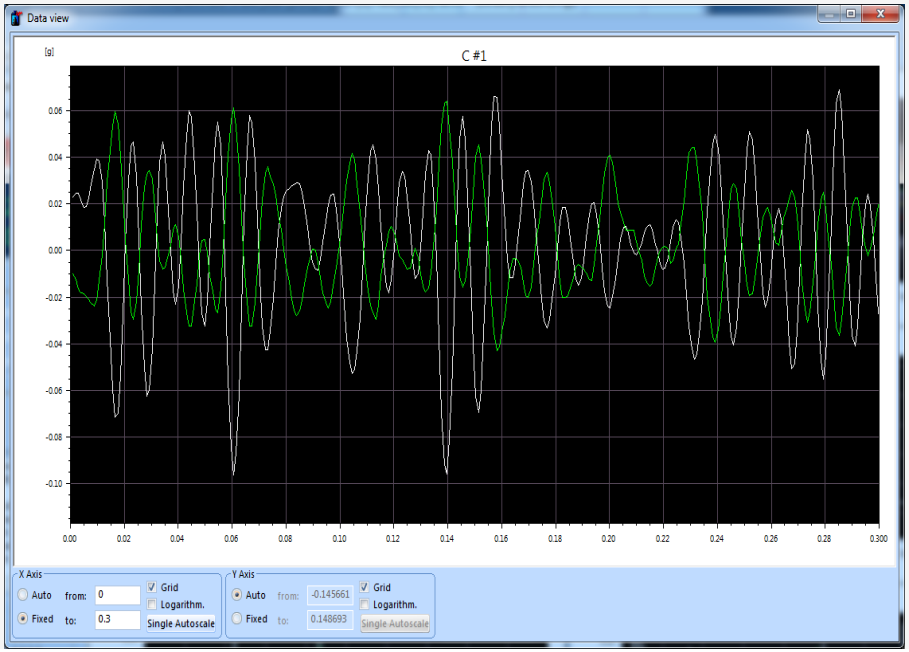


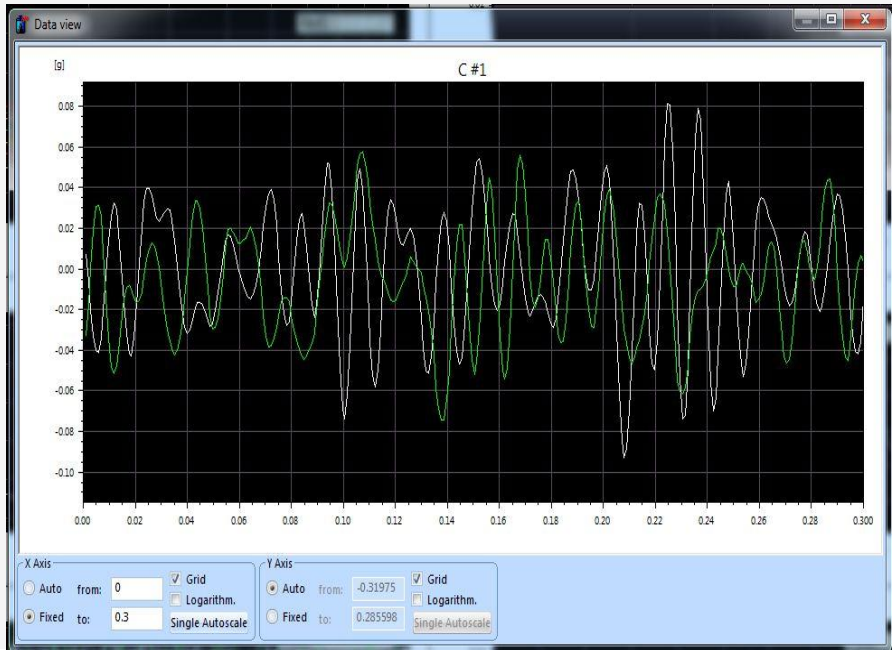




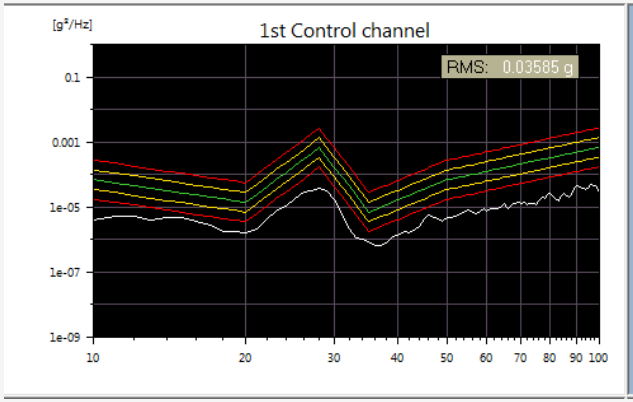
Multi-Axis Random

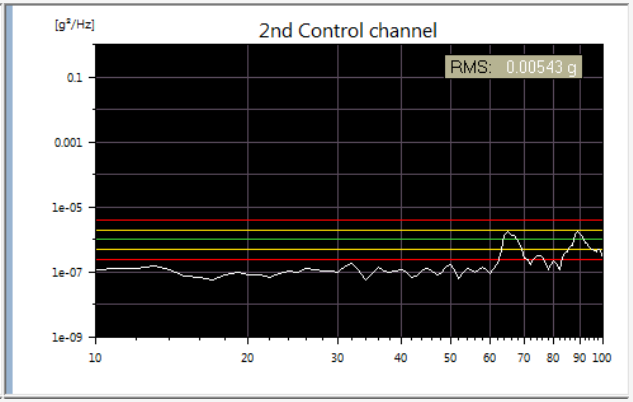


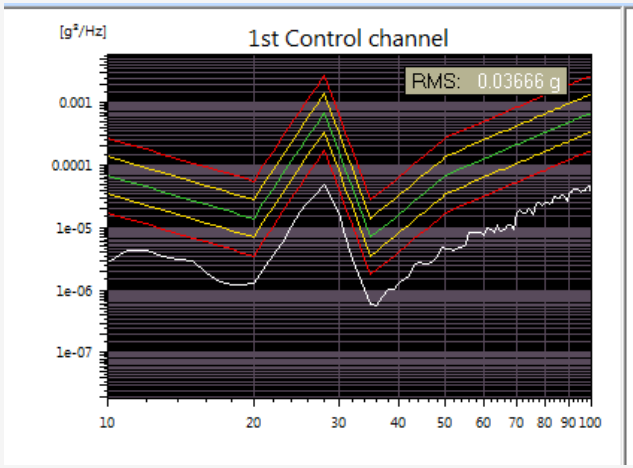


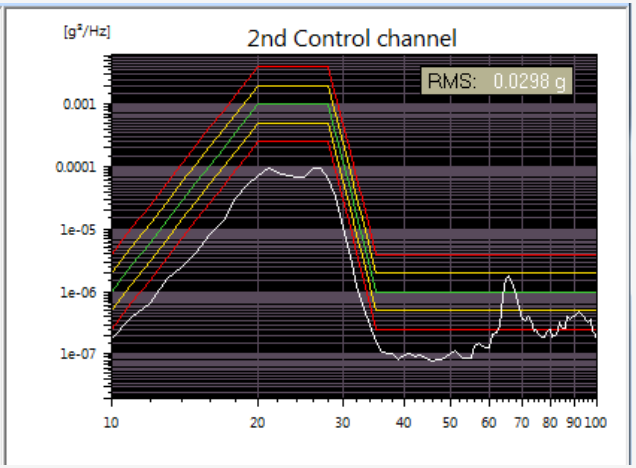


Multi-Axis Random









Multi-Axis Random

- Fehlende, unvollständige Testspezifikation. Keine Kreuzleistungsdichten, Kohärenzen bekannt.
- Nichtlinearitäten. Langsameres Regelverhalten
  - Immer wenn Phasenlagen ins Spiel kommen, wird Regelung schwieriger (besonders Schock und Sinus)

- Grundkenntnisse Modalanalyse sind vorteilhaft (erforderlich)

Multi-Axis Random

- END