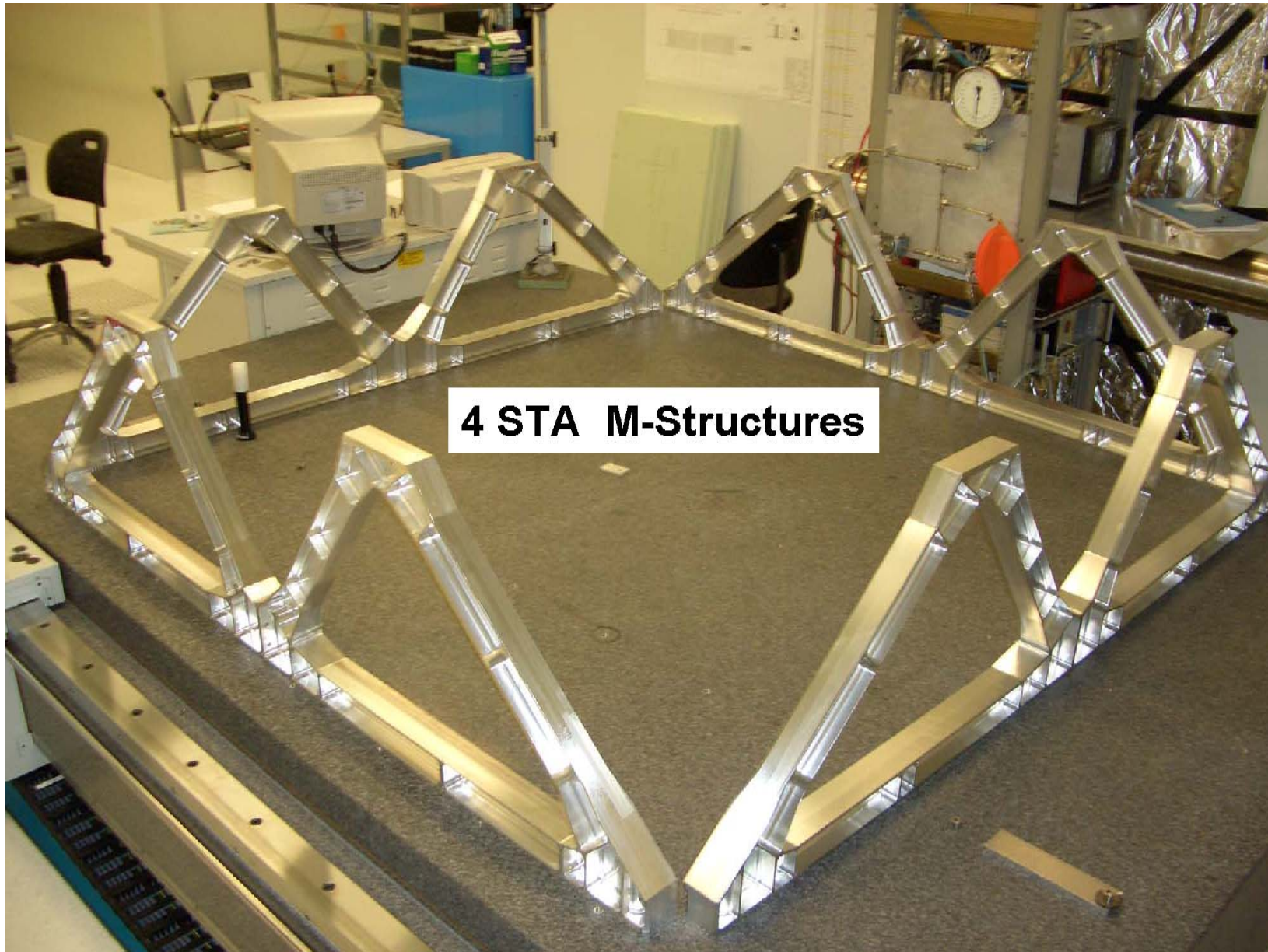


AMS-02: TRDTN6

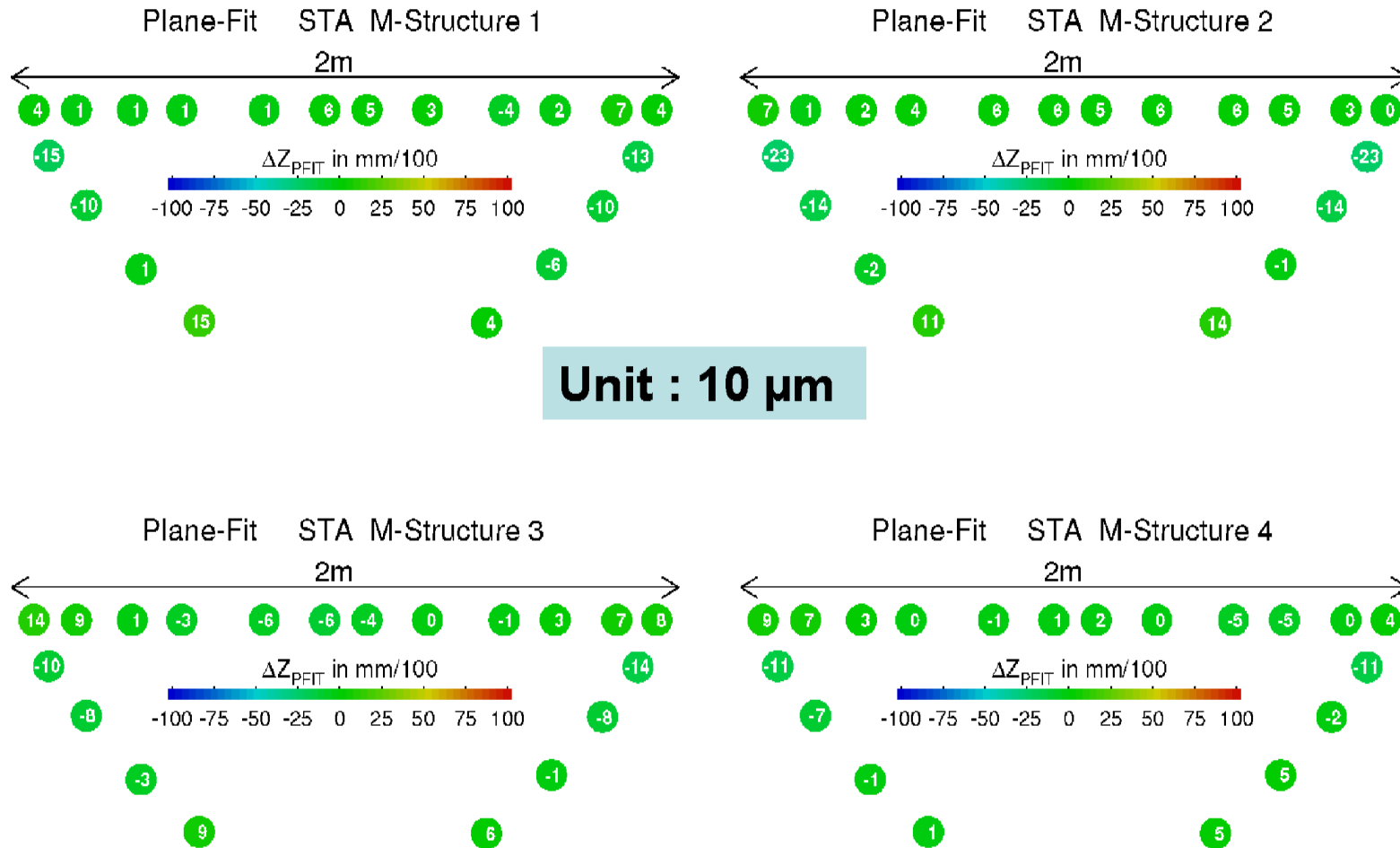
Octagon M-Structure

**Author: Th. Kirn, Ch. Chung, K. Lübelmeyer, A. Schultz v. Dratzig
I. Phys. Institute B, RWTH Aachen
Aachen, 13th January 2009**

TRD Octagon M-Structure Dimensional and Modal Tests (STA Model)



TRD M-Structure Planarity Measurement



Unit : 10 μm

Overall Dimensions: Nominal - Measured (μm)

	Nominal	M-str #1	M-str #2	M-str #3	M-str #4
Total length	1880,00	100	50	90	230
Left upper side	472,11	-100	0	50	80
Right upper side	472,11	220	60	100	100
Total height left	526,93	50	50	20	150
Total height right	526,93	90	50	70	100

Parallelity of Interface Planes (mrad)

	M-str #1	M-str #2	M-str #3	M-str #4
Lower left nX	Ref.Plane			
Lower left nZ				
Lower right nX	0	0	0	0
Lower right nZ	0	1	0	0
Upper left nX	0	0	0	0
Upper left nZ	4	-1	0	4
Upper right nX	0	1	0	0
Upper right nZ	4	0	0	4

AMS-02

M-Structure

MODAL-TEST

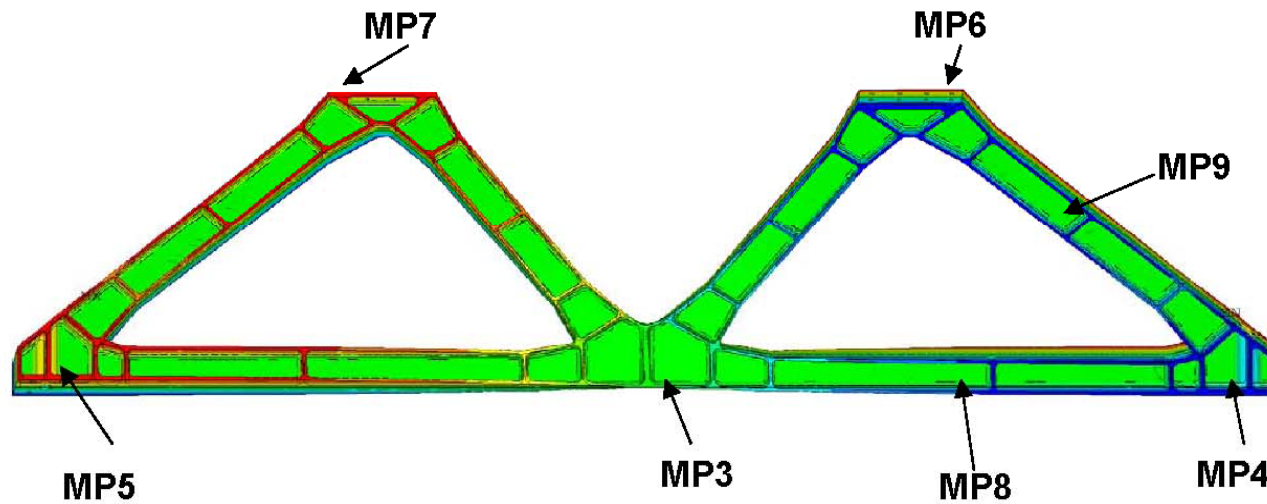
AC I PHYSIK
RWTH AACHEN

30. Nov. 2005
6

1

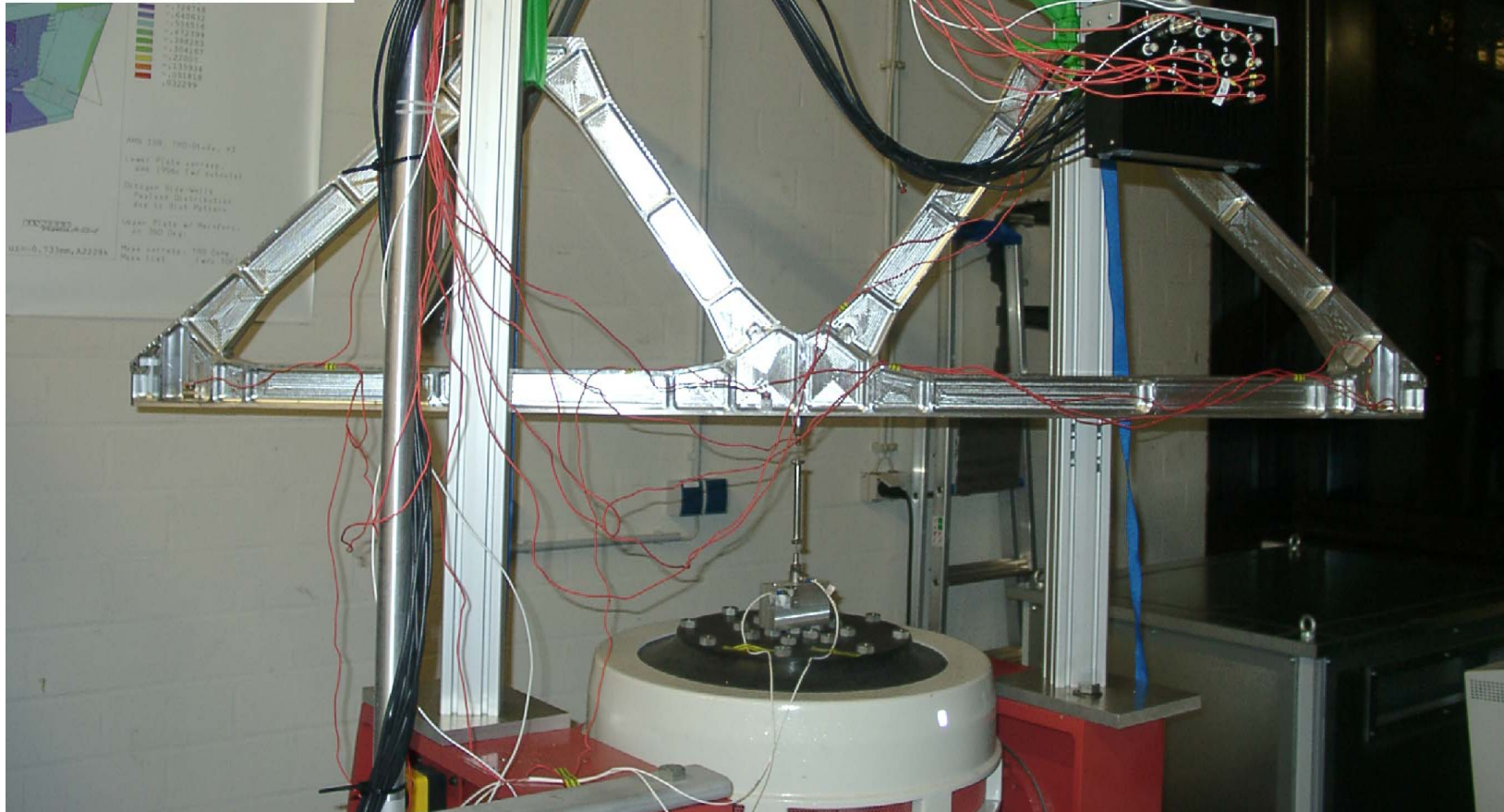
MODAL TEST

AMS-02 M-Structure



**AMS-02
M-Structure
Z-Direction**

Run 05-25-03

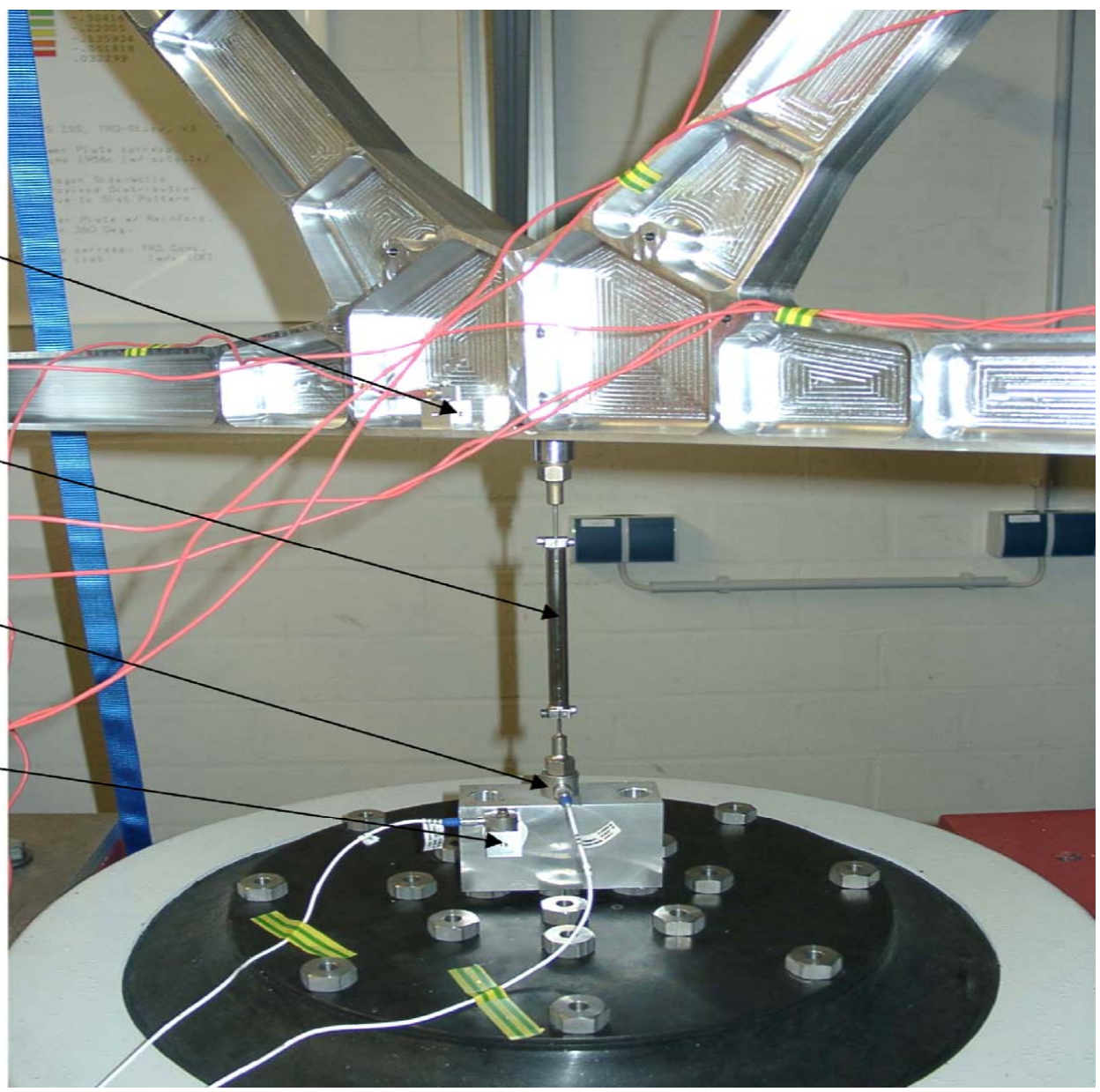


**g-Accelerometer
MP3 +Z Ch3**

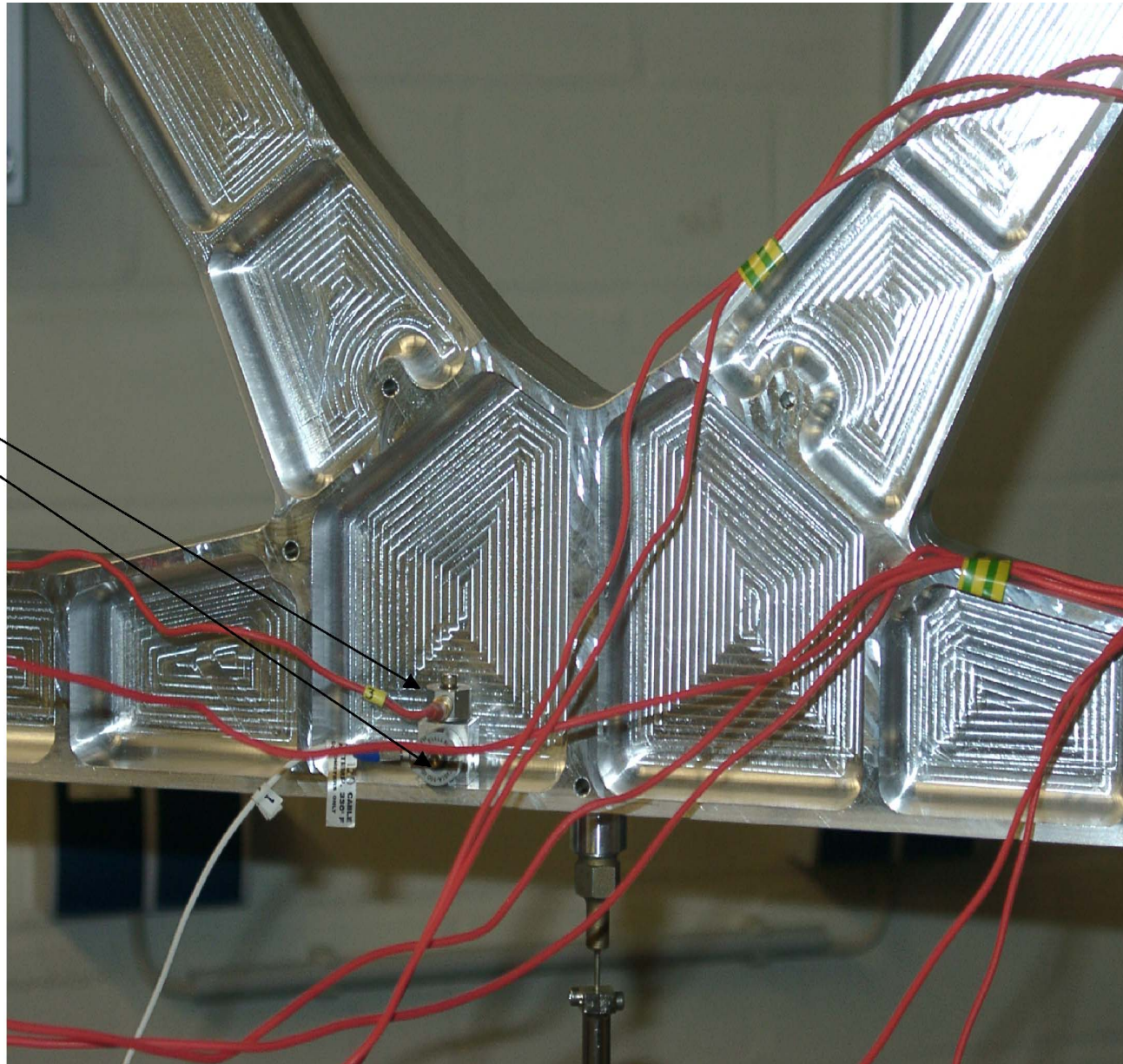
**Force
Transmitter**

**Force Meter
MP2 +Z Ch2**

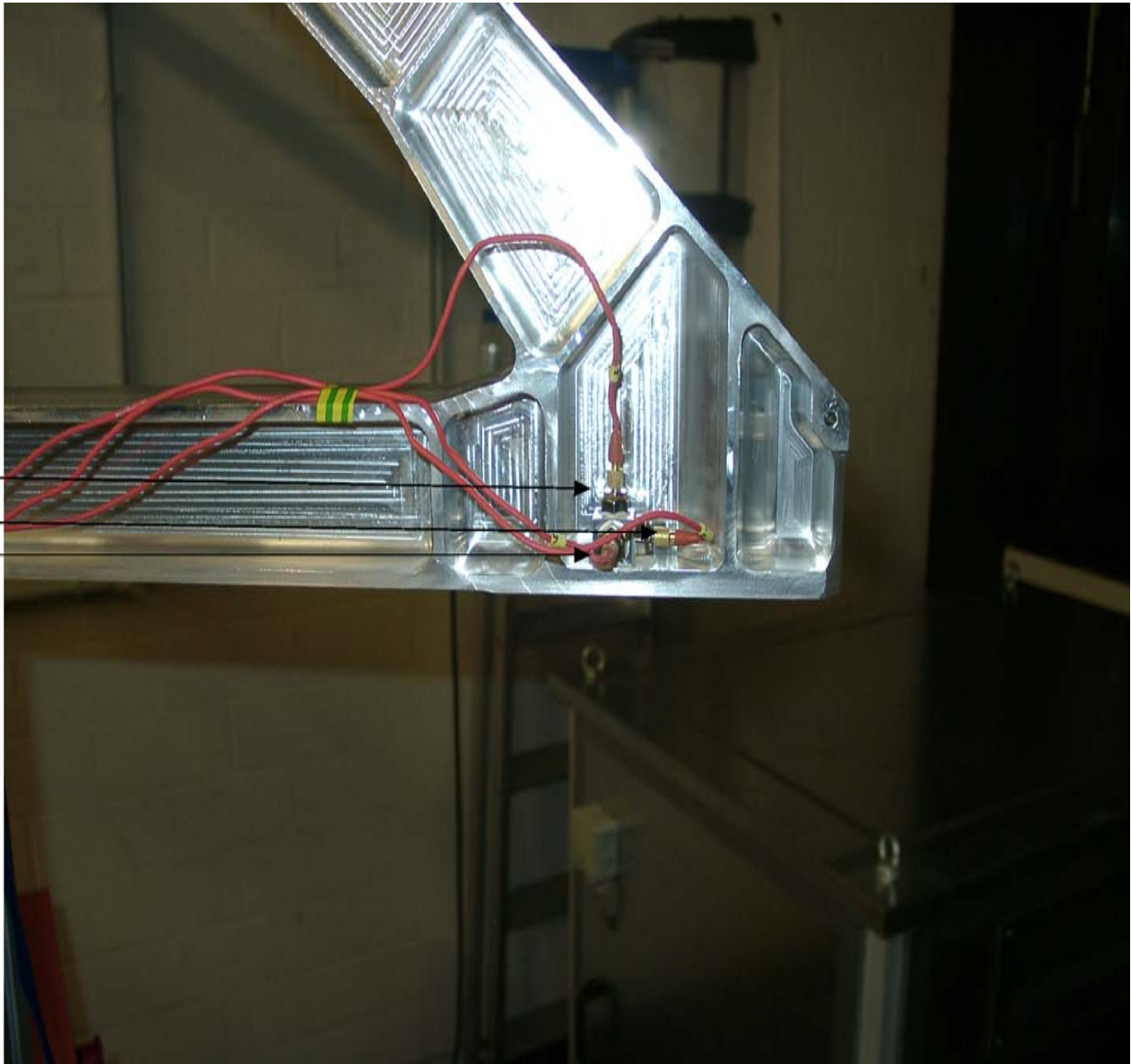
**g-Accelerometer
MP1 +Z Ch1**



MP3
+Z Ch 3
+X Ch 1

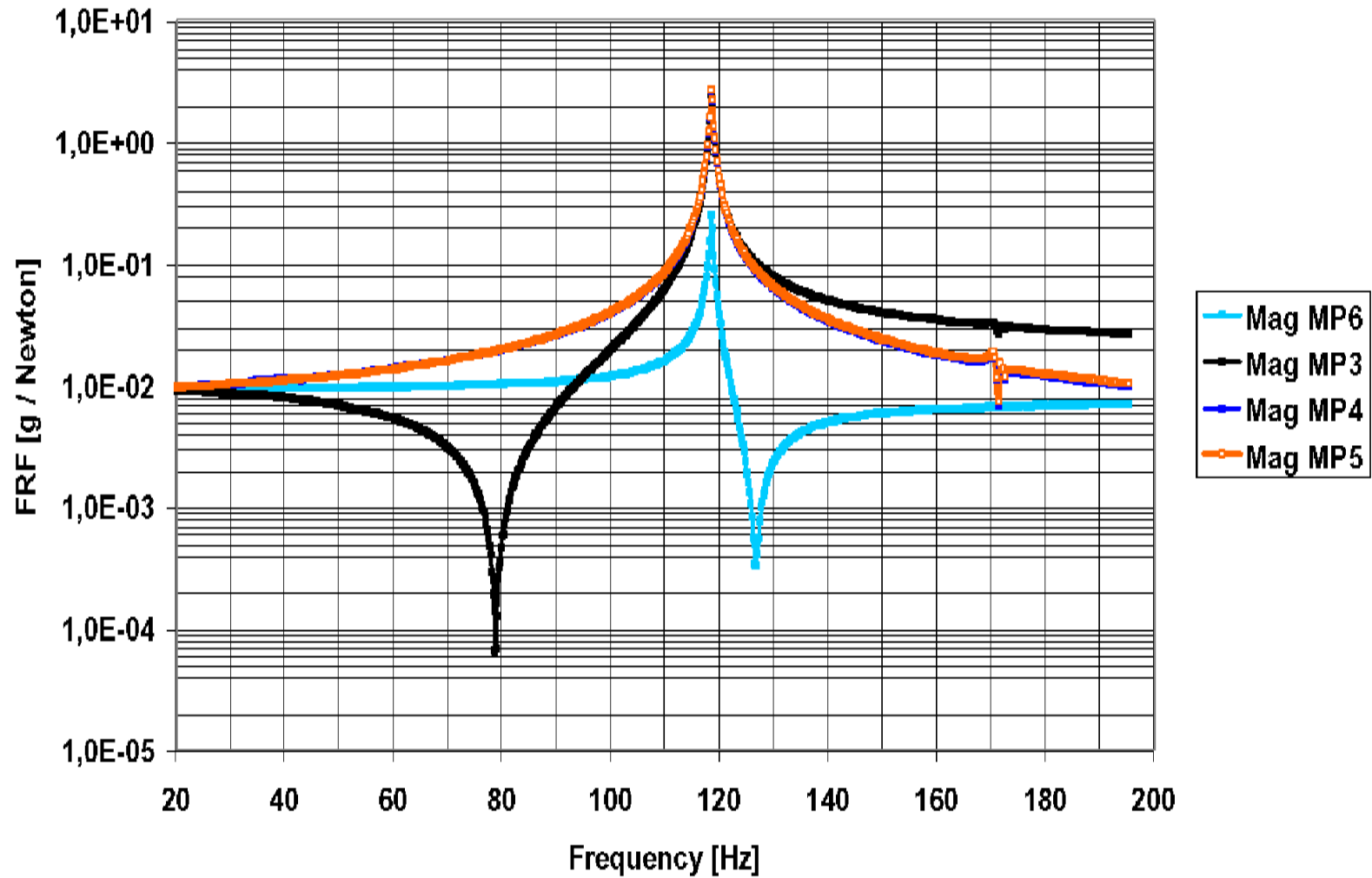


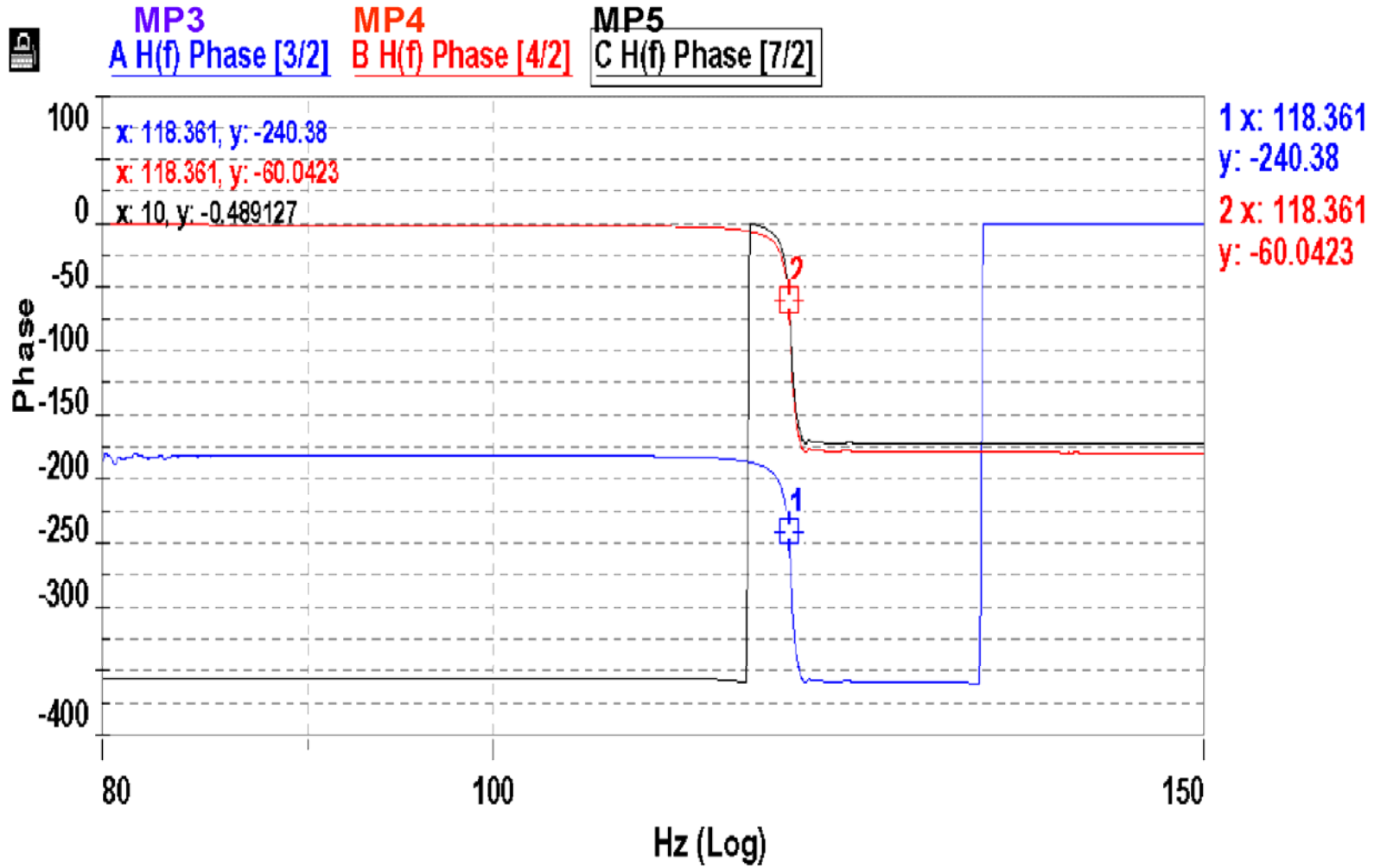
MP4
+Z Ch 4
+Y Ch 5
+X Ch 6



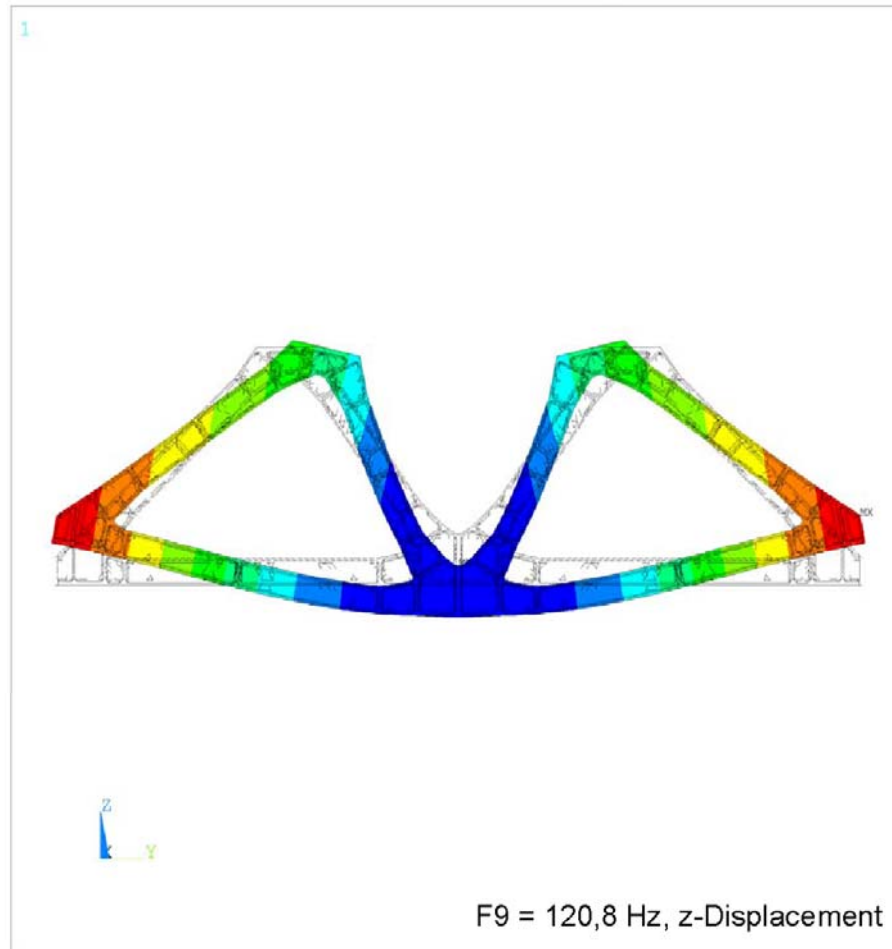
M - Structure

FRF 05-25-03 Z





FE MODAL-ANALYSE



```

ANSYS 10.0
NOV 7 2005
17:19:40
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =9
FREQ=125.775
UZ (AVG)
RSYS=20
PowerGraphics
EFACET=1
AVRES=Mat
DMX =1.031
SMN =-.770656
SMX =1.028
DSYS=20
-.770656
-.570855
-.371055
-.171255
.028545
.228346
.428146
.627946
.827746
1.028
    
```

Modal FEA, 1 M, w/o Fixations

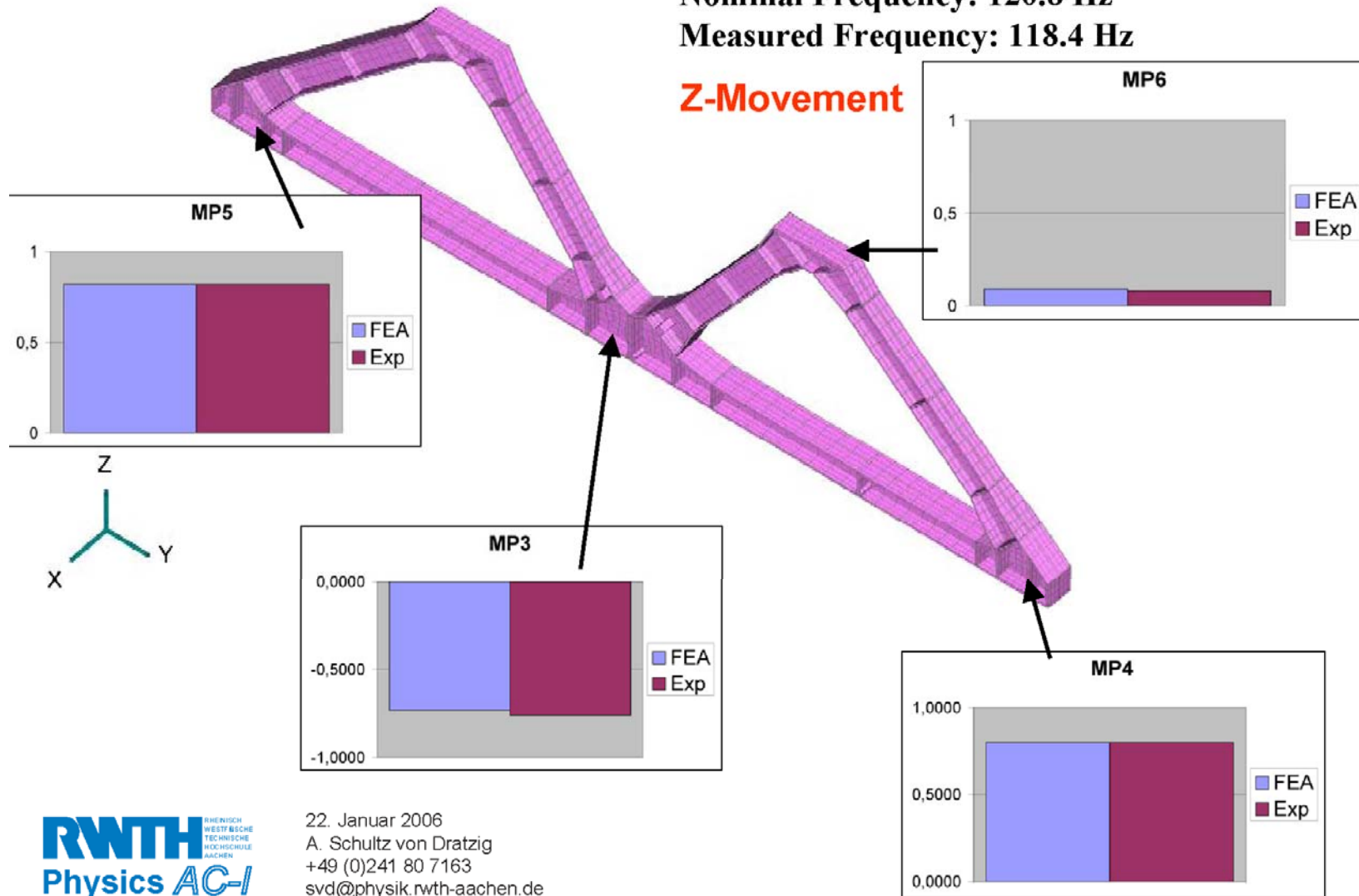
17. Nov. 2005
15

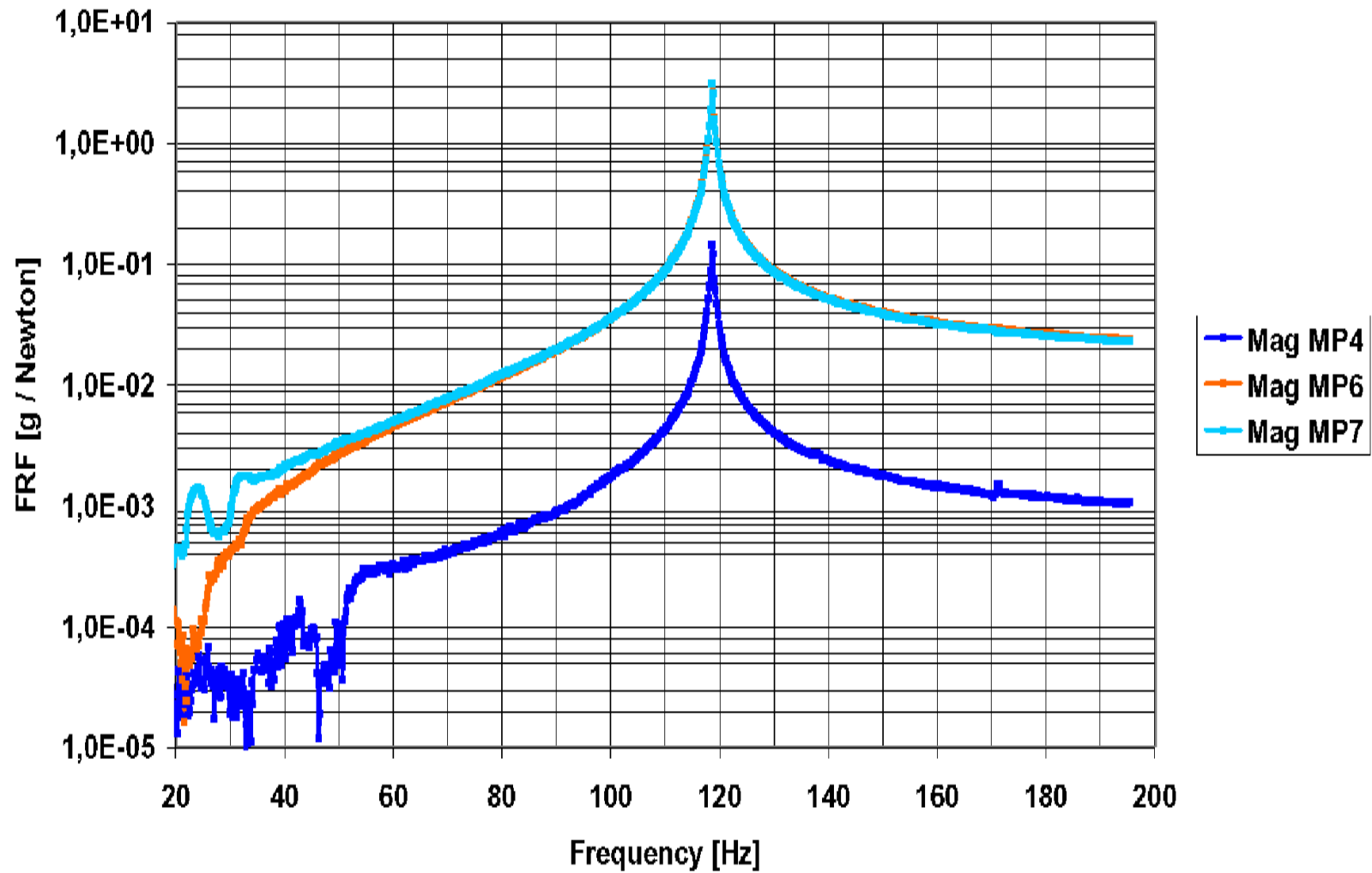
Frequency Response: z Excitation

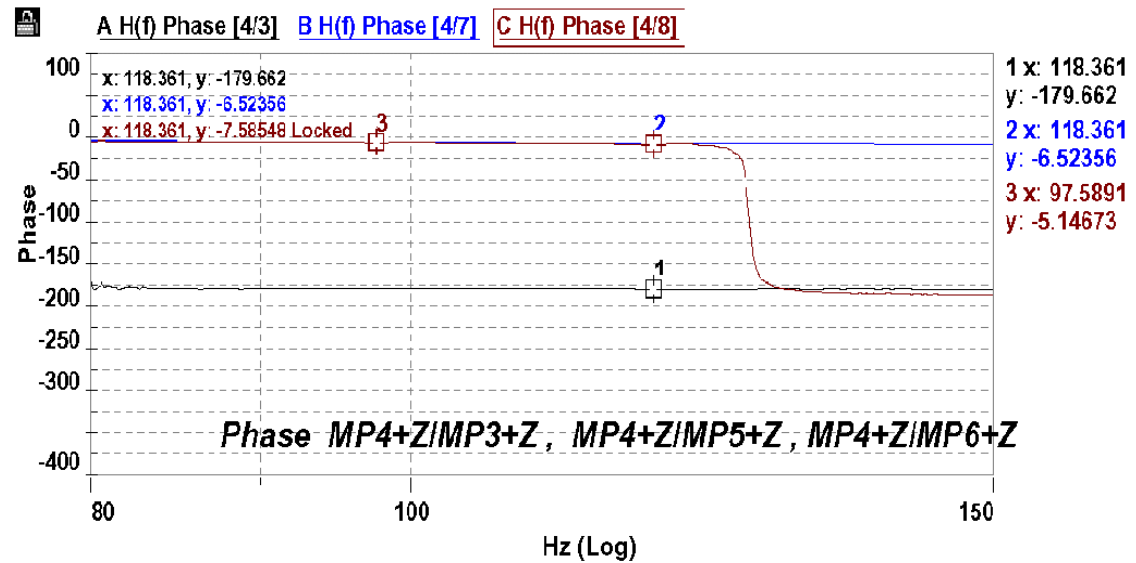
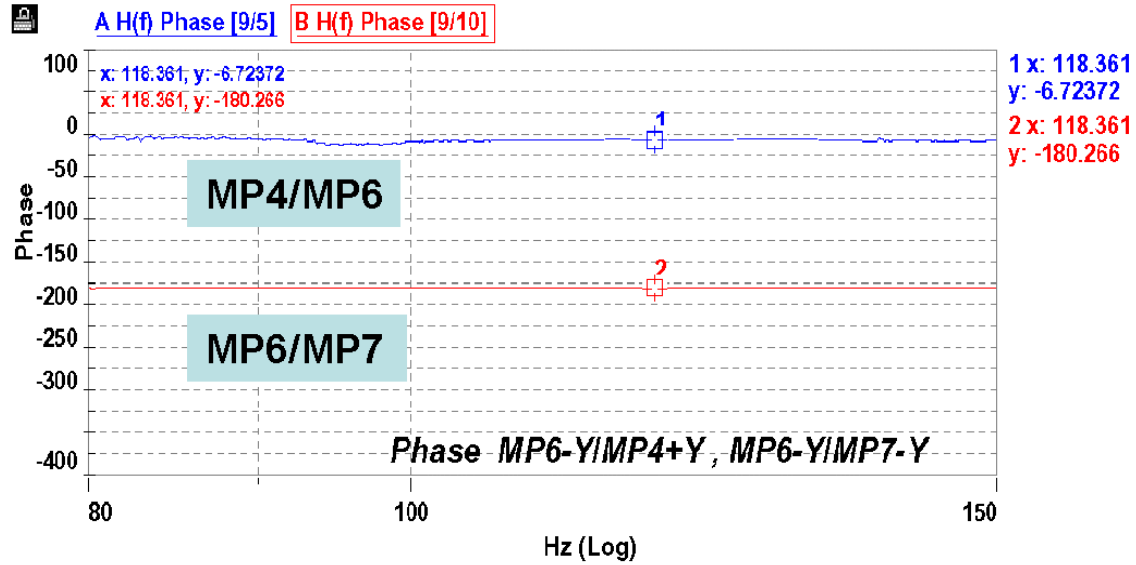
Nominal Frequency: 120.8 Hz

Measured Frequency: 118.4 Hz

Z-Movement





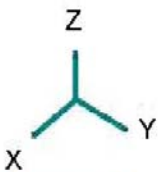
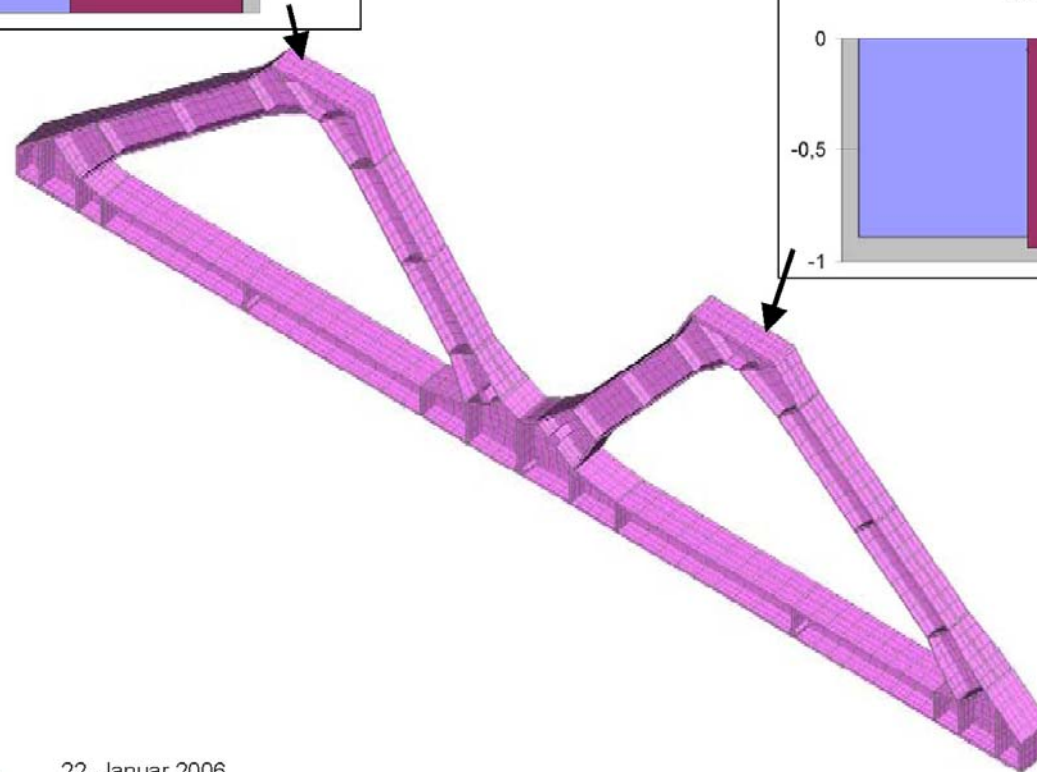
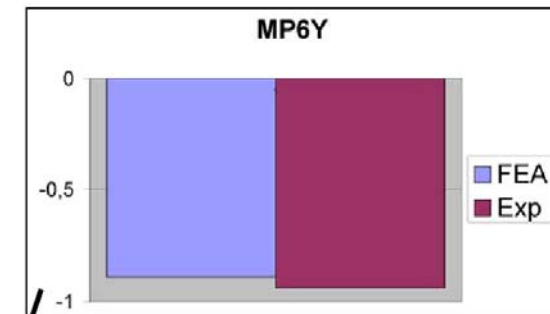
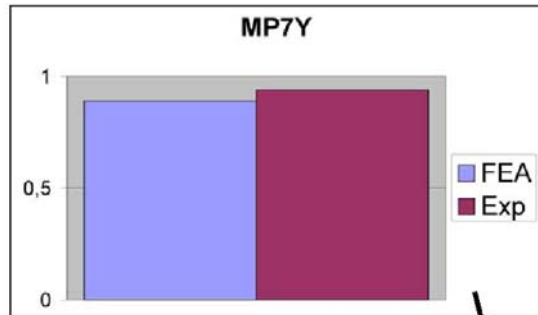


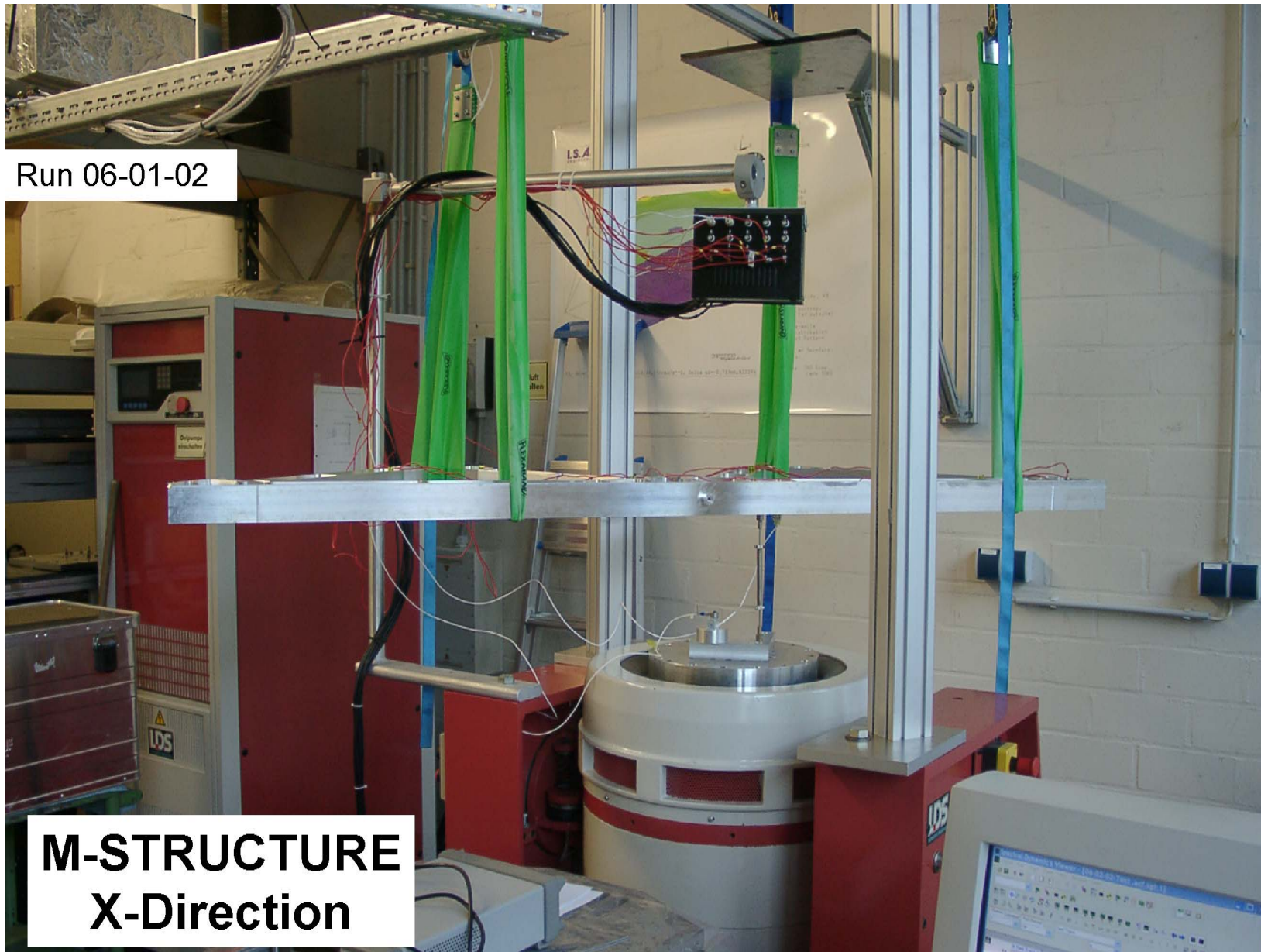
Frequency Response: z Excitation

Nominal Frequency: 120.8 Hz

Measured Frequency: 118.4 Hz

Y-Movement





Run 06-01-02

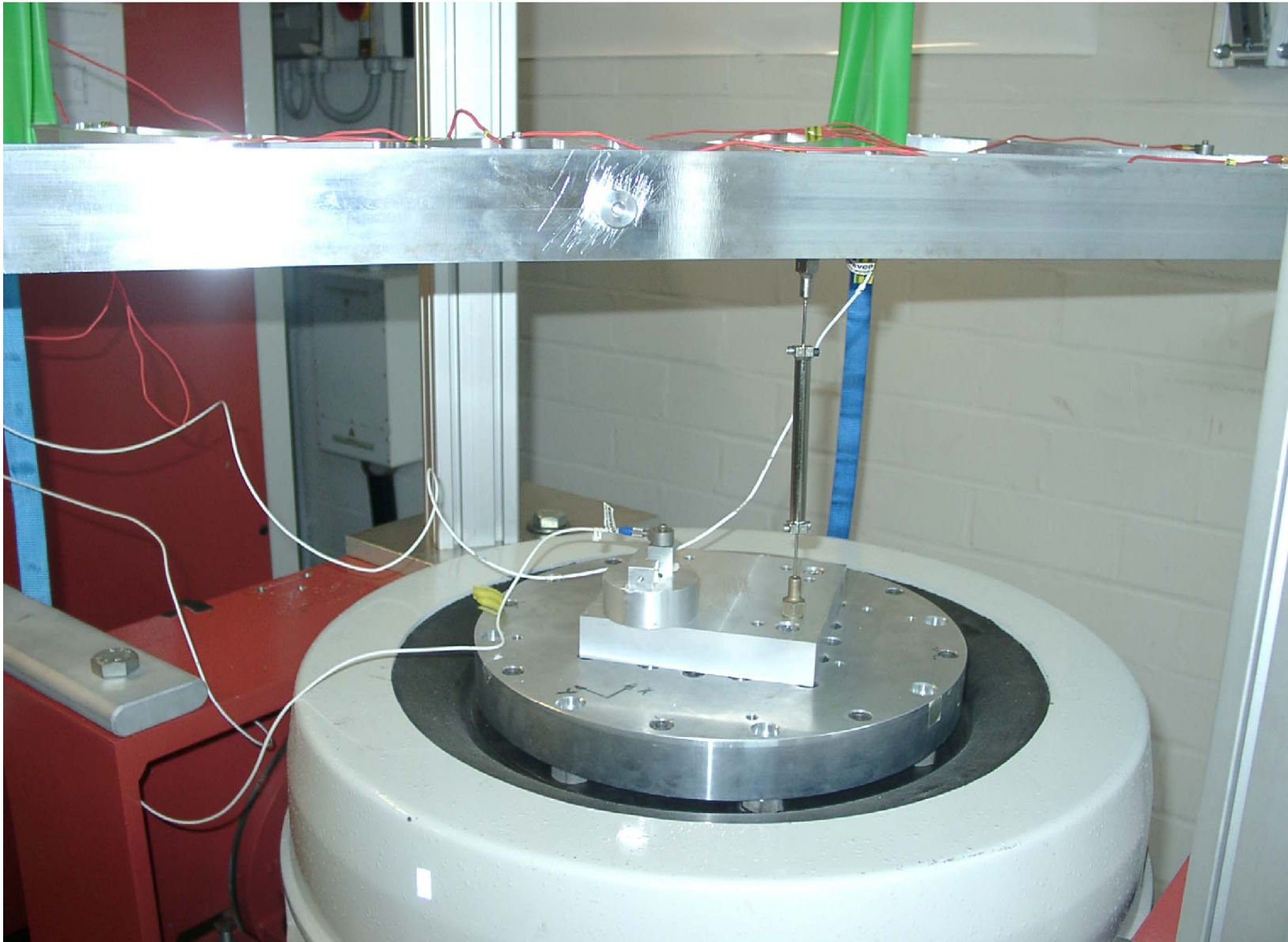
**M-STRUCTURE
X-Direction**



TRDTN 6

Aachen, 18th February 2009

21

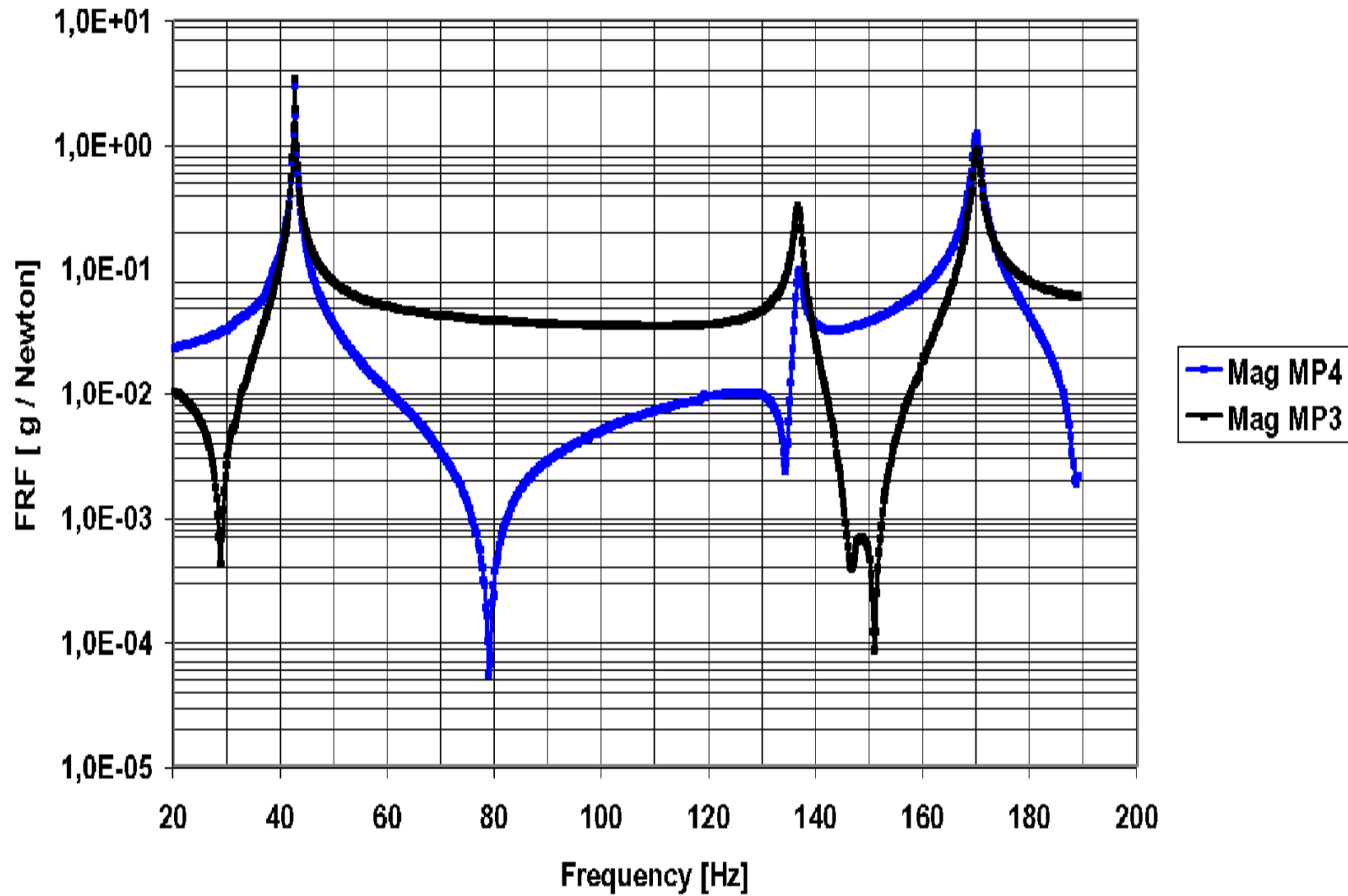


TRDTN 6

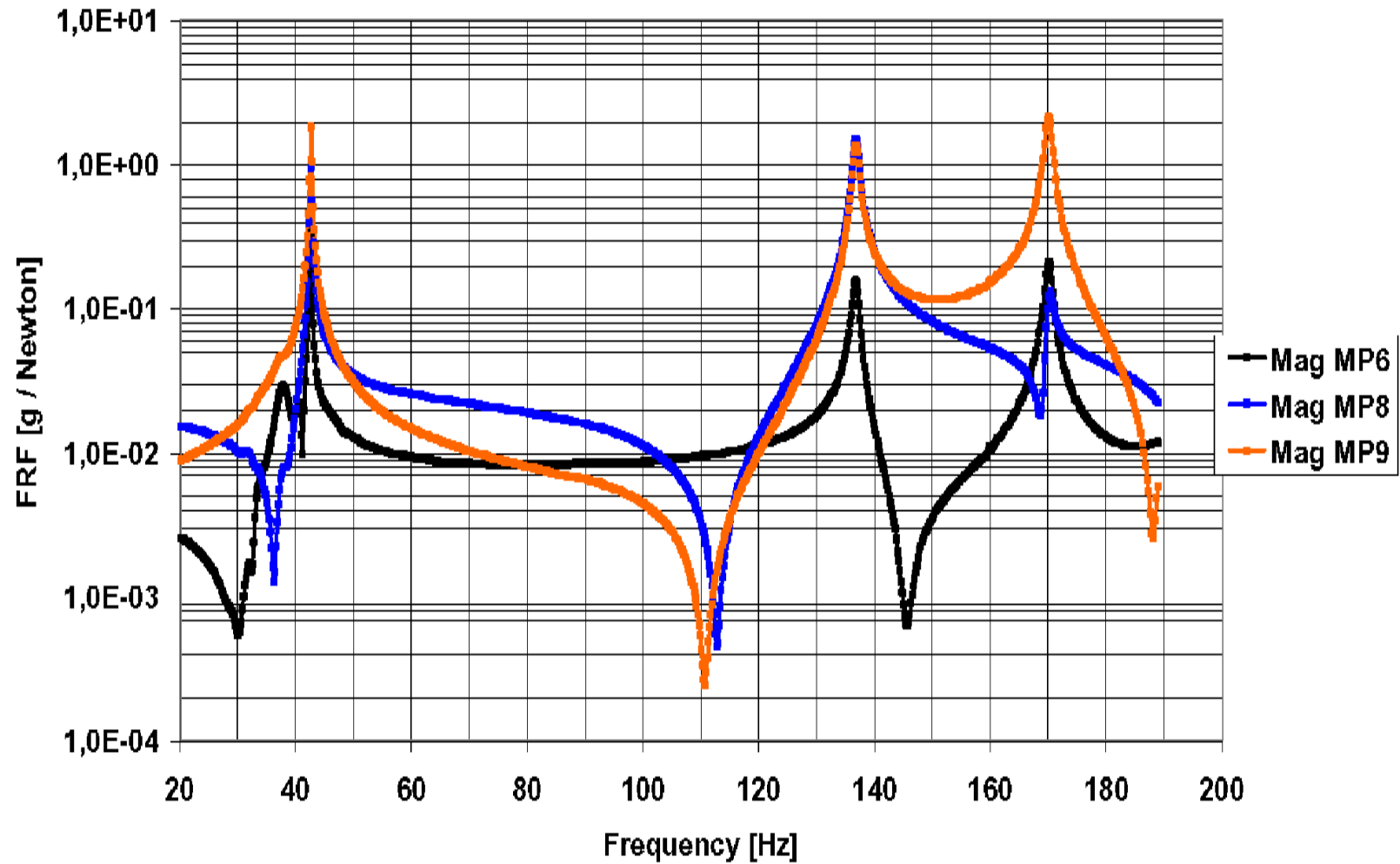
Aachen, 18th February 2009

22

M-Structure FRF 06-01-02 X



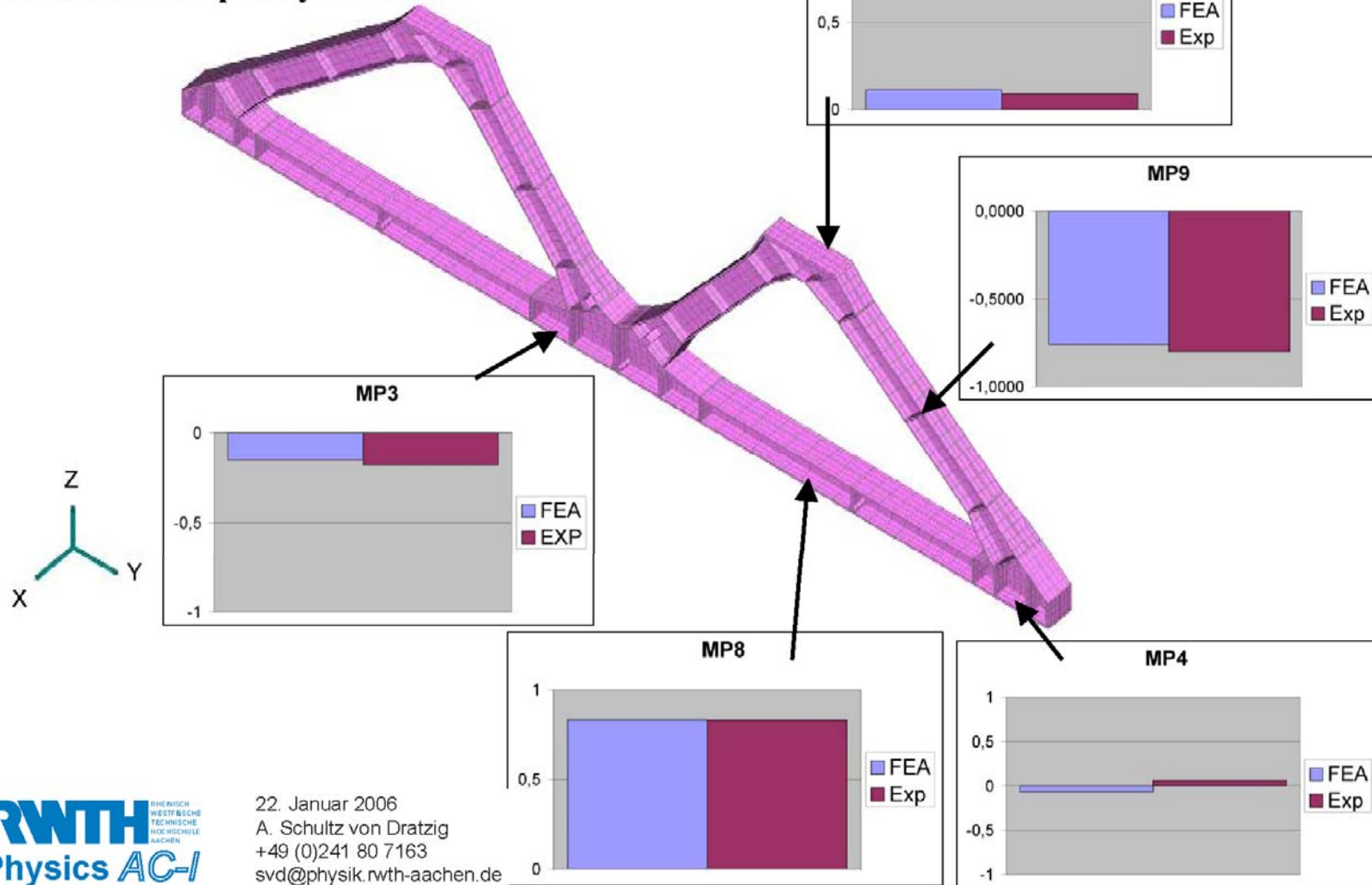
M-Structure FRF 06-01-02 X



Frequency Response: x Excitation

Nominal Frequency: 133.2 Hz

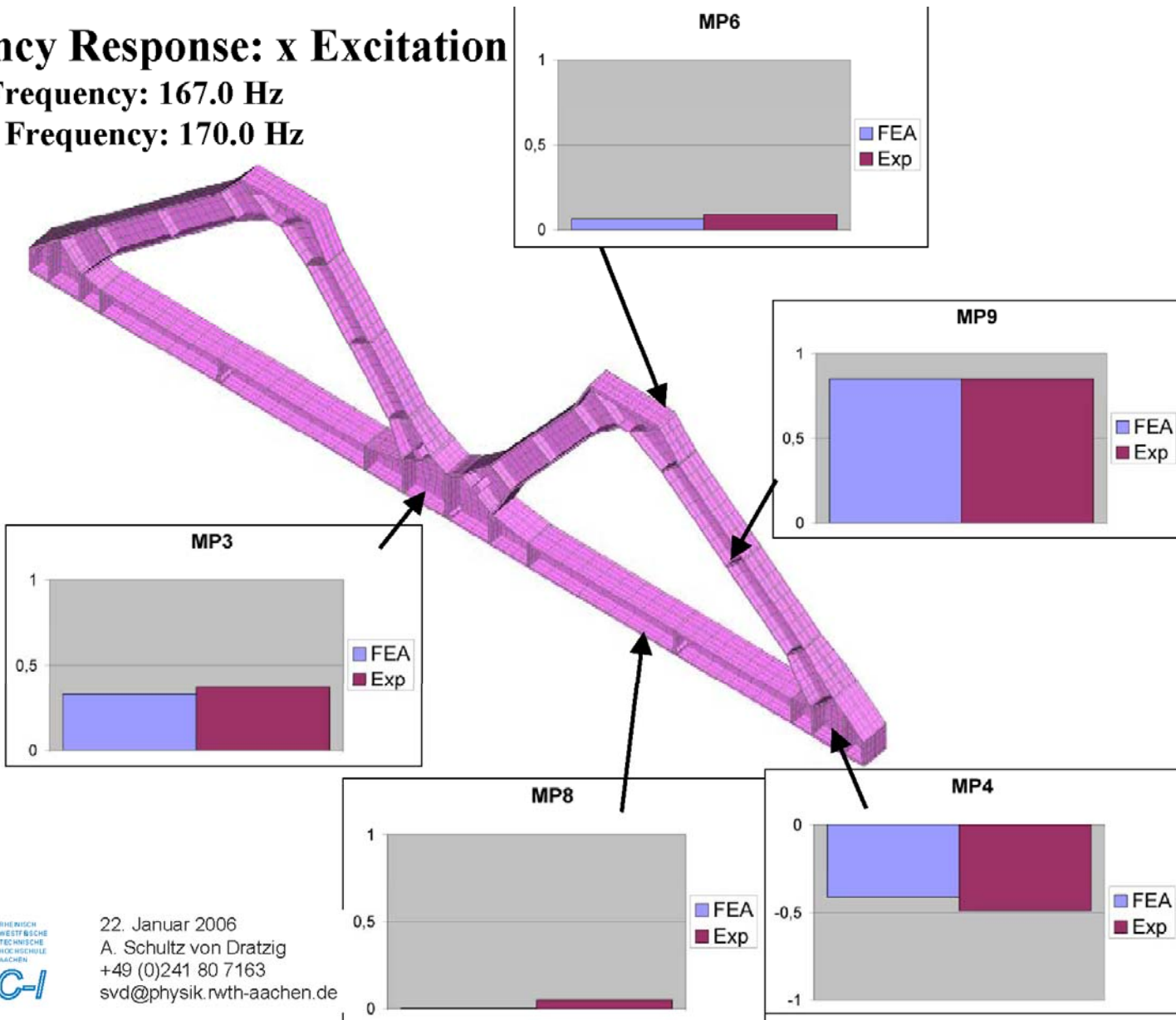
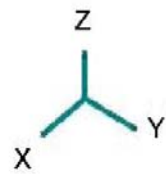
Measured Frequency: 136.6 Hz



Frequency Response: x Excitation

Nominal Frequency: 167.0 Hz

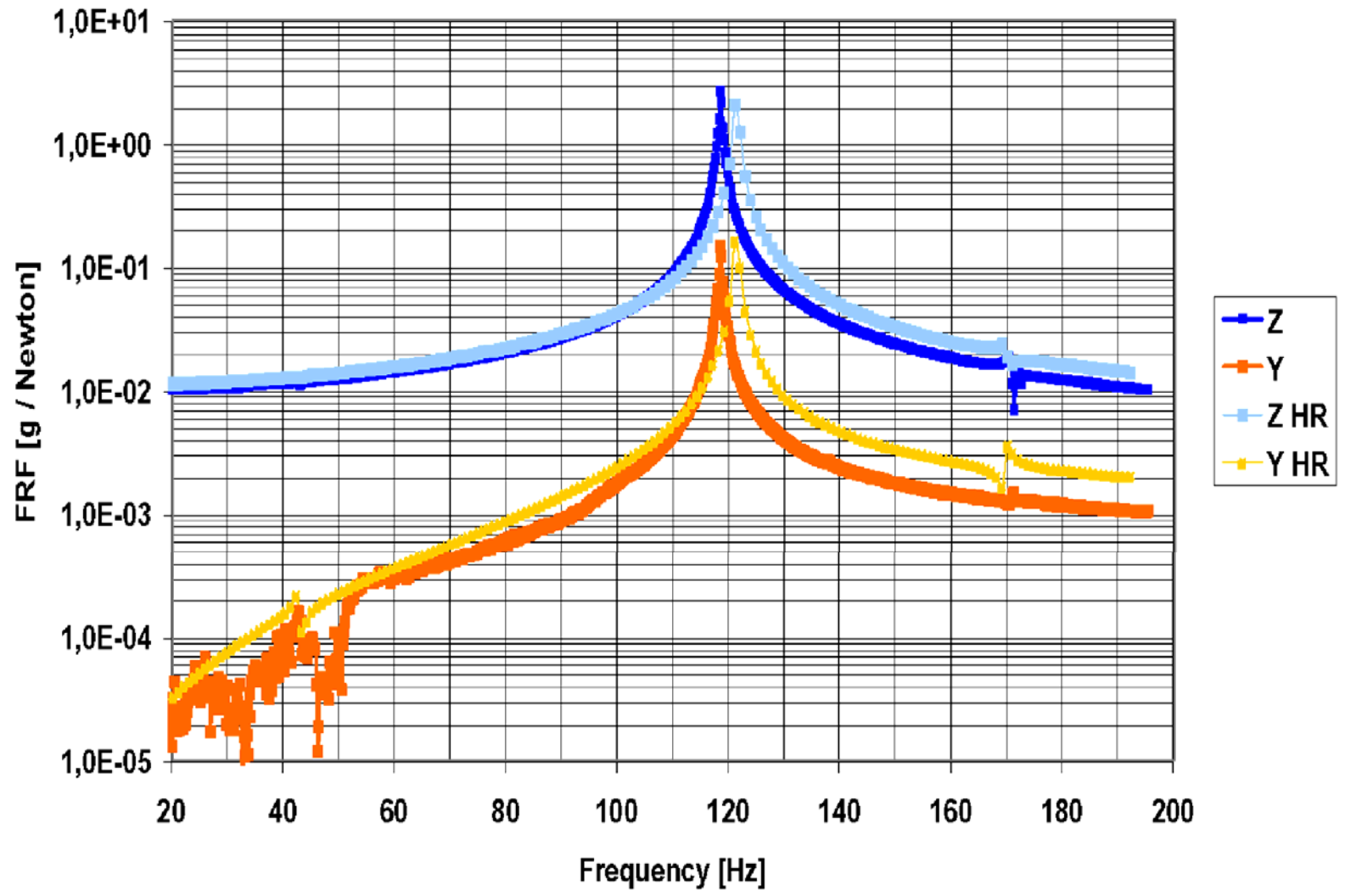
Measured Frequency: 170.0 Hz



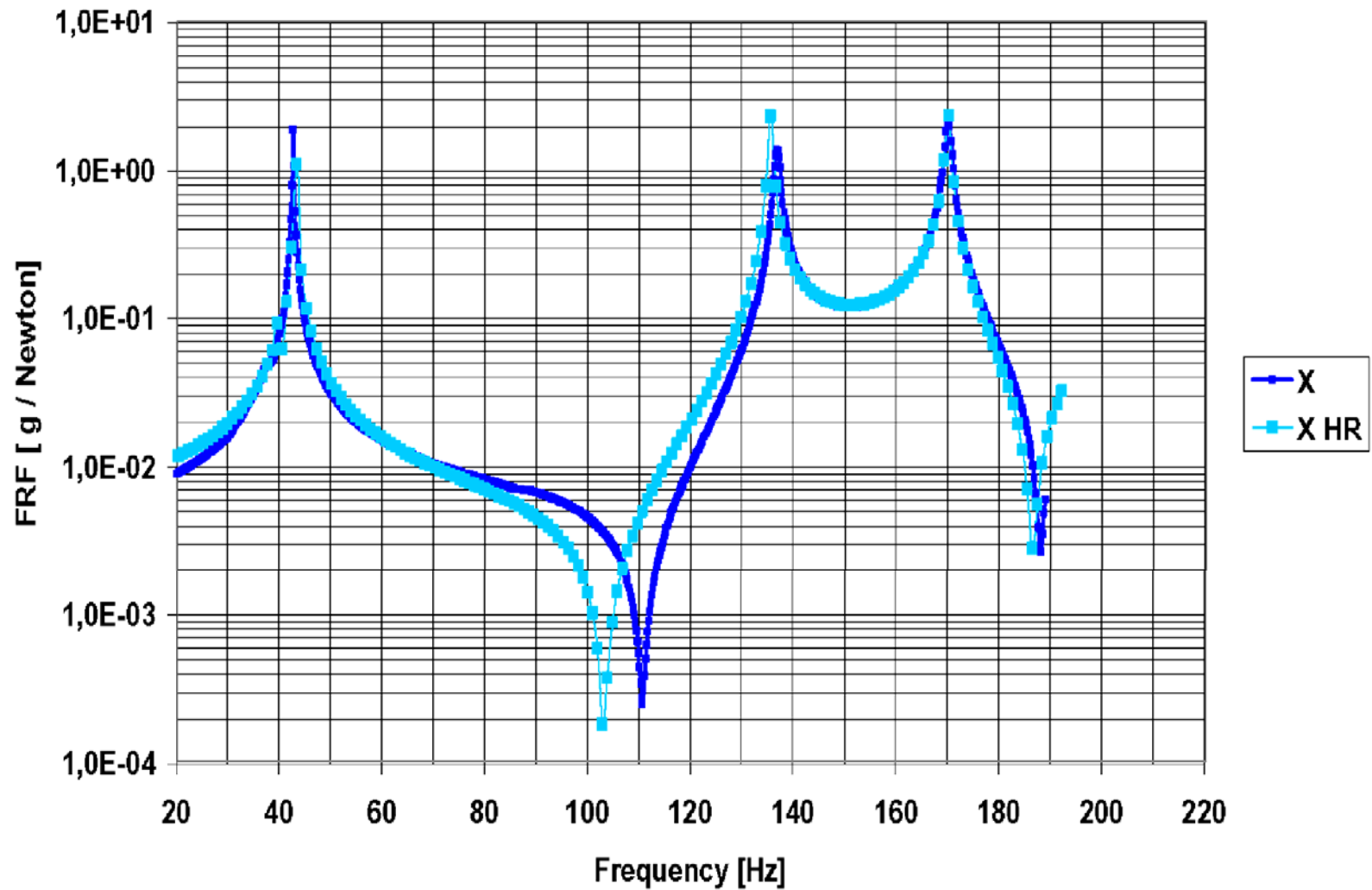
Harmonic Response Analysis

30. Nov. 2005
27

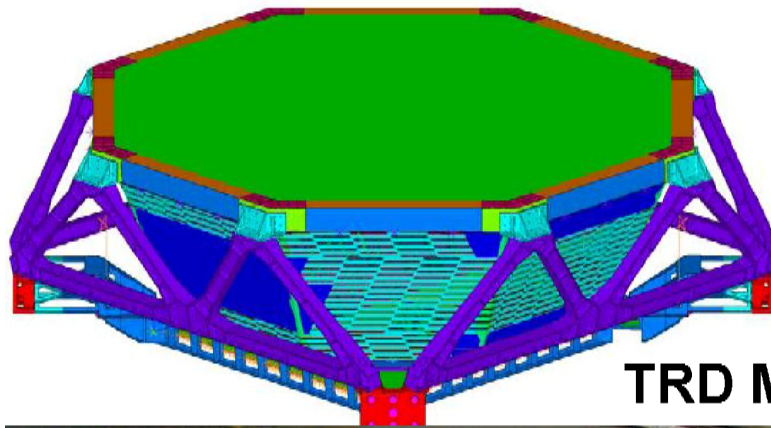
M-Structure FRF 05-25-03 MP4 (N 9428)



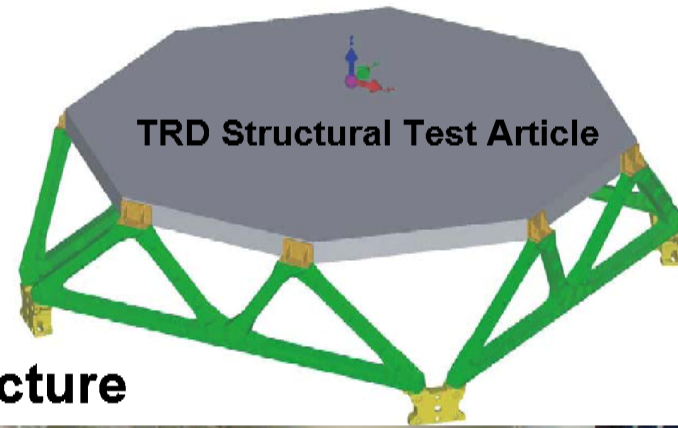
M-Structure FRF 06-01-02 MP9 (N12136)



TRD Octagon M-Structure Dimensional Tests of Flight Model

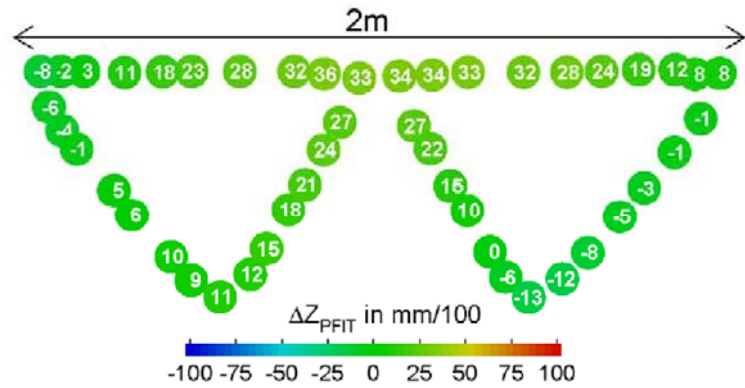


TRD M-Structure

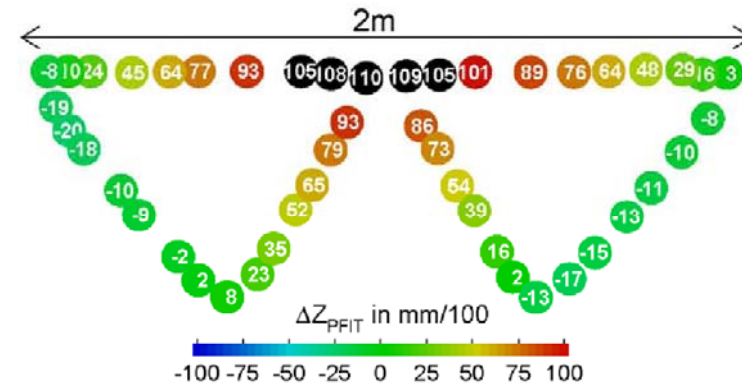


Planarity 3D Measurement

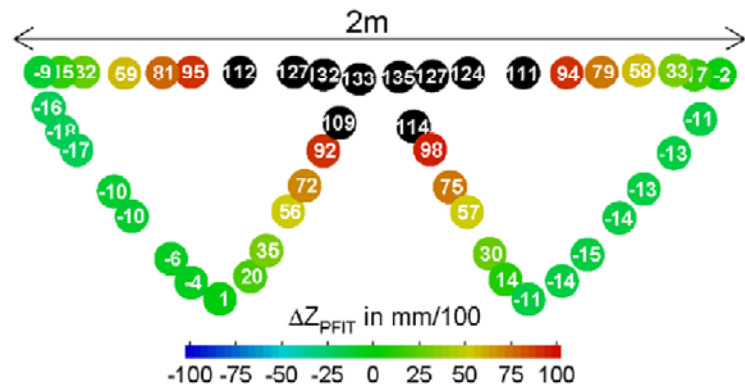
Deviation from Corner Plane-Fit FM M-Structure 1



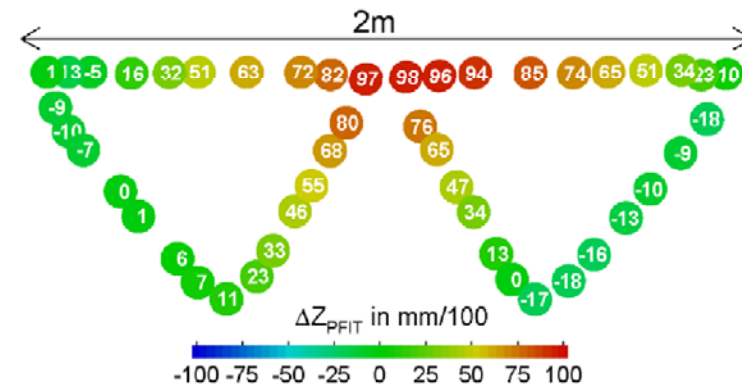
Deviation from Corner Plane-Fit FM M-Structure 2



Deviation from Corner Plane-Fit FM M-Structure 3



Deviation from Corner Plane-Fit FM M-Structure 4



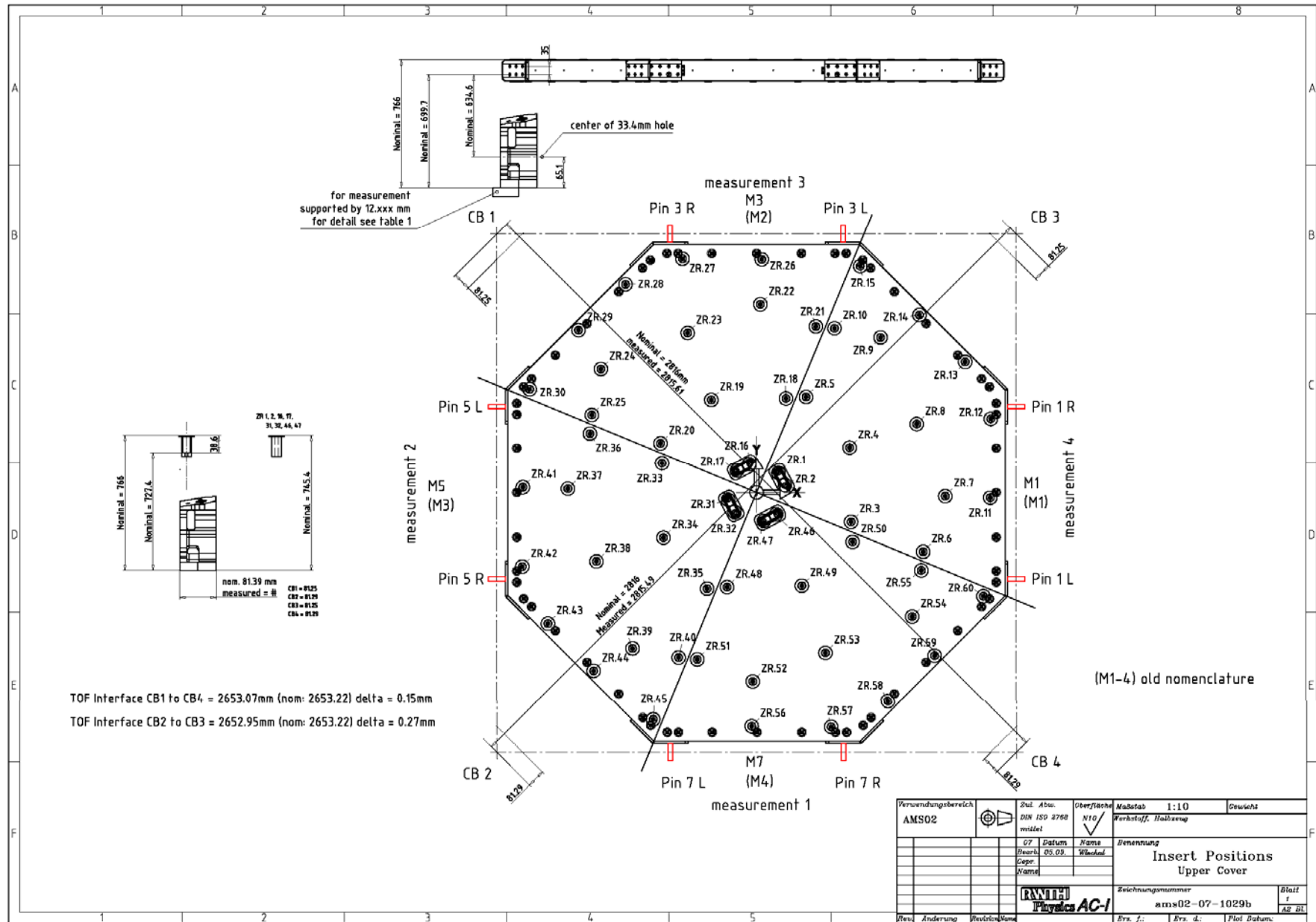
Overall Dimensions: Measured - Nominal (μm)

	Nominal	M-str #1	M-str #2	M-str #3	M-str #4
Total length top	1880,00	-50	280	130	240
Total length bottom	1880,00	-150	-150	-210	-80
Left upper side	470,62	20	130	-120	30
Right upper side	470,62	-50	-70	0	-30
Total height left	523,93	-120	140	180	280
Total height right	523,93	-80	120	180	130

Parallelity of Interface Planes (mrad)

	M-str #1	M-str #2	M-str #3	M-str #4
Lower left nX	Ref.Plane			
Lower left nZ	Ref.Plane			
Lower right nX	0	1	1	1
Lower right nZ	-2	-1	-2	-1
Upper left nX	0	0	0	0
Upper left nZ	-1	1	-3	0
Upper right nX	0	0	0	0
Upper right nZ	-2	-1	-2	-1

TRD Octagon M-Structure Dimensions of Assembled M- Structure Supports



Measurement #1

Pos.	X	Y	Z	Z of pin to granite	nominal = 699,7	delta
Pin 5_l	2282,61	-450,03	646,62	699,48	699,7	-0,22
Pin 5_r	2295,08	301,09	646,93	699,78	699,7	0,08
Pin 1_l	9,56	339,10	646,87	699,73	699,7	0,03
Pin 1_r	1,31	-412,28	646,50	699,36	699,7	-0,34
CB 2	2160,90	923,15	12,16			
CB 4	170,49	956,14	12,33			

Measurement #2

Pos.	X	Y	Z	Z of pin to granite	nominal = 699,7	delta
Pin 3_l	2274,02	-461,33	646,81	699,74	699,7	0,04
Pin 3_r	2271,02	289,43	646,97	699,90	699,7	0,20
Pin 7_l	-14,35	291,75	646,67	699,61	699,7	-0,10
Pin 7_r	-8,81	-459,12	646,93	699,86	699,7	0,16
CB 1	2127,26	909,32	12,16			
CB 2	136,393	911,71	12,18			

Measurement #3

Pos.	X	Y	Z	Z of pin to granite	nominal = 699,7	delta
Pin 1_l	2233,608	-475,88	646,87	699,89	699,7	0,19
Pin 1_r	2233,937	275,56	646,61	699,63	699,7	-0,07
Pin 5_l	-47,87	282,65	646,65	699,67	699,7	-0,03
Pin 5_r	-45,991	-468,52	646,87	699,89	699,7	0,19
CB 3	2088,671	895,72	12,06			
CB 1	97,834	902,13	12,10			

Measurement #4

Pos.	X	Y	Z	Z of pin to granite	nominal = 699,7	delta
Pin 7_l	2276,186	-486,25	646,67	699,60	699,7	-0,10
Pin 7_r	2272,243	264,64	647,02	699,96	699,7	0,26
Pin 3_l	-12,006	268,30	646,75	699,69	699,7	-0,01
Pin 3_r	-8,643	-482,43	646,81	699,74	699,7	0,04
CB 4	2130,773	884,68	12,30			
CB 3	139,734	888,34	12,04			

699,73 average

Tabelle1

Pos.	X-Nominal	Y-Nominal	Z-Nominal	Z-Measured
ZR.1	97,77	87,44	745,40	745,78
ZR.2	127,01	32,76	745,40	745,80
ZR.3	421,81	-131,43	766,00	767,16
ZR.4	415,39	201,91	766,00	766,69
ZR.5	220,83	428,62	766,00	767,14
ZR.6	743,51	-264,68	766,00	766,90
ZR.7	842,06	-16,82	766,00	766,84
ZR.8	714,55	307,46	766,00	766,94
ZR.9	553,43	694,58	766,00	767,08
ZR.10	347,85	735,25	766,00	767,17
ZR.11	1042,94	-23,4	766,00	767,31
ZR.12	1045,69	330,81	766,00	767,09
ZR.13	931,13	584,68	766,00	767,05
ZR.14	726,99	794,79	766,00	767,25
ZR.15	462,69	1012,51	766,00	767,24
ZR.16	-32,76	127,01	745,40	745,77
ZR.17	-87,44	97,77	745,40	745,76
ZR.18	131,43	421,81	766,00	767,18
ZR.19	-201,91	415,39	766,00	767,10
ZR.20	-428,62	220,83	766,00	767,20
ZR.21	264,68	743,51	766,00	766,96
ZR.22	16,82	842,06	766,00	767,15
ZR.23	-307,46	714,55	766,00	767,53
ZR.24	-694,58	553,43	766,00	767,02
ZR.25	-735,25	347,85	766,00	767,14
ZR.26	23,4	1042,94	766,00	767,38
ZR.27	-330,81	1045,69	766,00	767,31
ZR.28	-584,68	931,13	766,00	not reachable

ZR.29	-794,79	726,99	766,00	767,30
ZR.30	-1012,51	462,69	766,00	767,29
ZR.31	-127,01	-32,76	745,40	745,80
ZR.32	-97,77	-87,44	745,40	745,78
ZR.33	-421,81	131,43	766,00	767,14
ZR.34	-415,39	-201,91	766,00	767,21
ZR.35	-220,83	-428,62	766,00	767,30
ZR.36	-743,51	264,68	766,00	767,12
ZR.37	-842,06	16,82	766,00	767,35
ZR.38	-714,55	-307,46	766,00	767,31
ZR.39	-553,43	-694,58	766,00	766,99
ZR.40	-347,85	-735,25	766,00	767,09
ZR.41	-1042,94	23,4	766,00	767,60
ZR.42	-1045,69	-330,81	766,00	767,51
ZR.43	-931,13	-584,68	766,00	767,59
ZR.44	-726,99	-794,79	766,00	767,60
ZR.45	-462,69	-1012,51	766,00	767,47
ZR.46	87,44	-97,77	745,40	745,80
ZR.47	32,76	-127,01	745,40	745,80
ZR.48	-131,43	-421,81	766,00	767,24
ZR.49	201,91	-415,39	766,00	767,07
ZR.50	428,62	-220,83	766,00	767,18
ZR.51	-264,68	-743,51	766,00	767,31
ZR.52	-16,82	-842,06	766,00	767,17
ZR.53	307,46	-714,55	766,00	767,20
ZR.54	694,58	-553,43	766,00	767,20
ZR.55	735,25	-347,85	766,00	767,04
ZR.56	-23,4	-1042,94	766,00	767,34
ZR.57	330,81	-1045,69	766,00	767,21
ZR.58	584,68	-931,13	766,00	not reachable
ZR.59	794,79	-726,99	766,00	767,21
ZR.60	1012,51	-462,69	766,00	767,20