



De: C. CARNEIRO
R. GOUDARD
C. HUMBERTCLAUDE

EST/SU
EP/CMI
EP/HC

A: G. BENCZE
F. GASPARINI
H. GERWIG
A. HERVE
C. LASSEUR
J. MOCHOLI
T. RODRIGO

EP/CMO
EP/HC
EP/CMI
EP/CMI
EST/SU
EP/CMO
EP/HC

CMS-MA-UR-0001

CMS - MAB PROTOTYPE

I - Deformation test under the load and the humidity II - Planarity of the MAB

Measurements from 29th July until 31st October 2002 at CERN (ISR / I4)



MAB Prototype in ISR during the deformation test

PART I

Deformation test under the load and the humidity

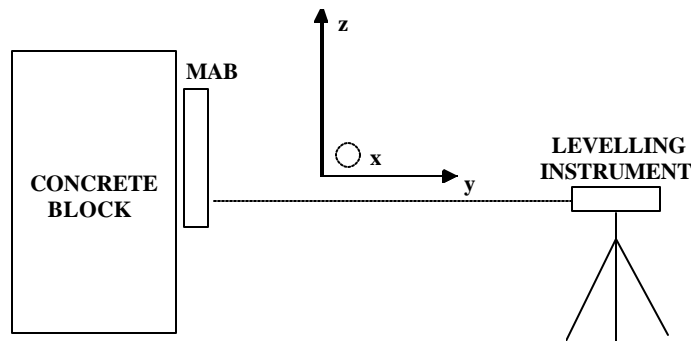
1.1 – PROCEDURE AND MEASUREMENTS

Following H. Gerwig's request, the measurement of the MAB deformation under load, time and humidity has been performed from 29th July until end of October 2002 in the ISR/I4 lab.

H. Gerwig has indicated the measured points on the MAB.

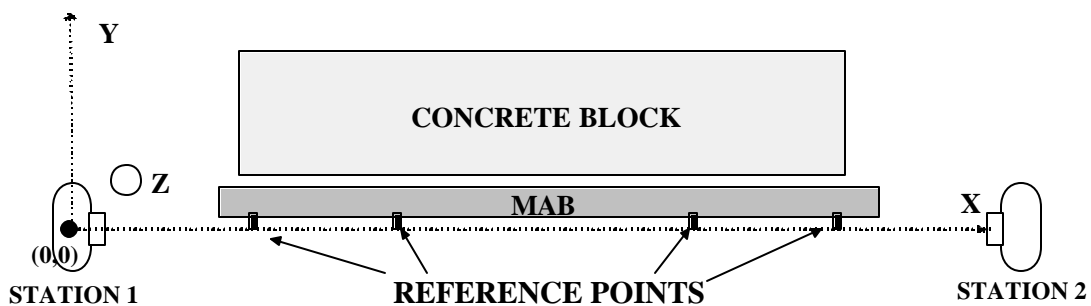
↪ 1.1.1. Method

The vertical movements have been measured by level on 7 points numbered N1 to N7:



The horizontal movements have been measured with a theodolite on 11 points numbered E12 to E112.

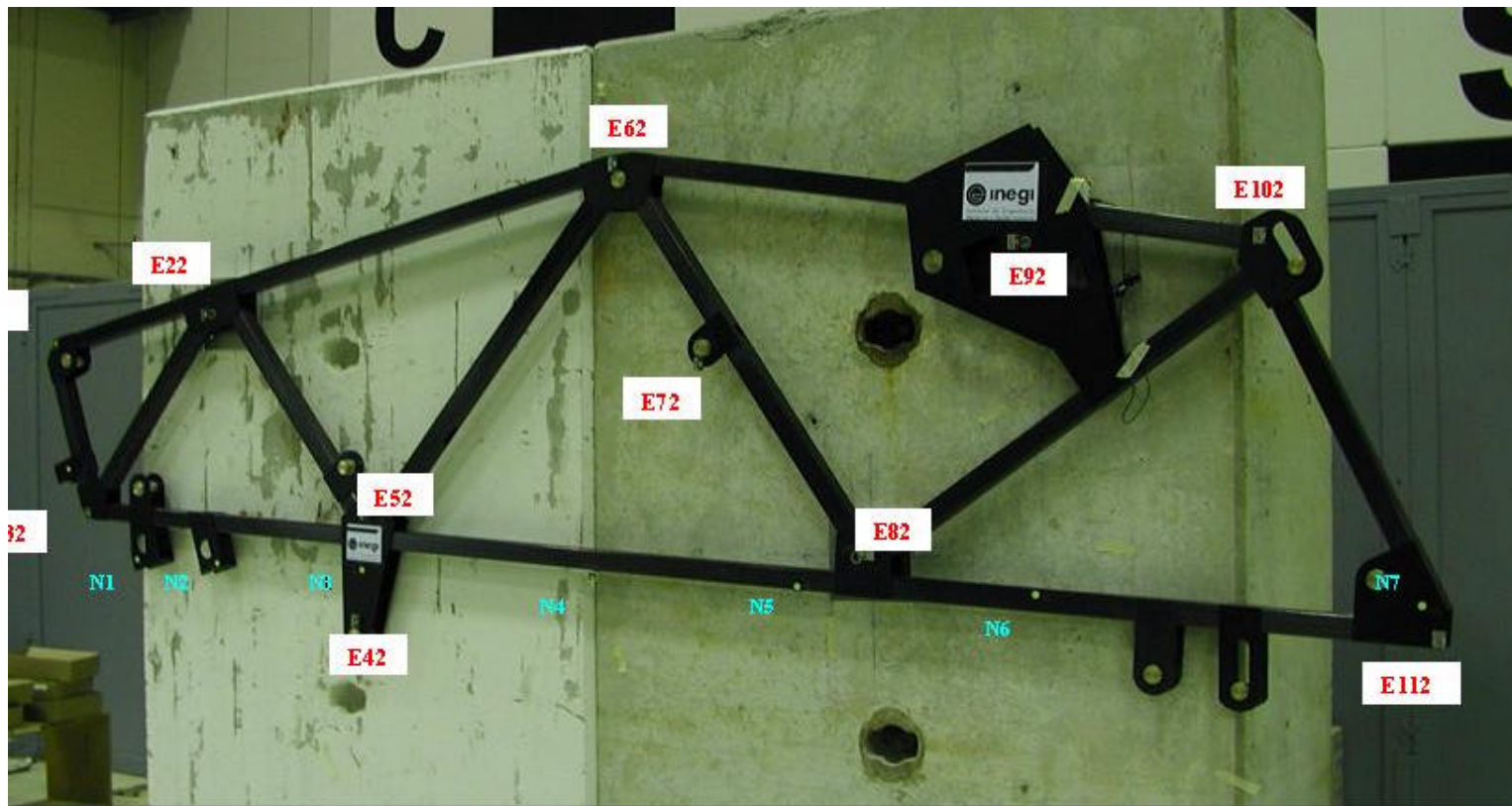
The difference of small angles (very precisely measured) times the distance gives the displacement vectors in the Y direction.



1.1.2. Measured point positions on the prototype

N1 to N7: levelling – vertical movements

E12 to E112: theodolite – Horizontal movements



Muons calibration bench

November 11th, 2002
CMS-MA-UR-0001

↪ 1.1.3. Measurements – Type and Dates

			Theodolite	Level		nb of days diff/mes0	nb of days diff/mes6	nb of days diff/previou s mes
MES0	Without load	Monday	29.07.02	29.07.02		0	/	0
MES1	With load	Tuesday	30.07.02	30.07.02		1	/	1
MES2	"	Thursday	01.08.02	01.08.02		3	/	2
MES3	"	Monday	05.08.02	07.08.02		9	/	6
MES4	"	Thursday	08.08.02	08.08.02		10	/	1
MES5	"	Friday	16.08.02	16.08.02		18	/	8
<i>MAB slightly touched by somebody on tuesday 20.08.02</i>								
MES6	"	Monday	26.08.02	26.08.02		28	0	10
MES7	"	Friday		30.08.02		32	4	4
MES8	"	Tuesday	03.09.02	03.09.02		36	8	4
MES9	"	Monday		09.09.02		42	14	6
MES10	"	Wednesday	11.09.02	11.09.02		44	16	2
MES11	"	Friday		13.09.02		46	18	2
MES12	"	Monday	16.09.02	16.09.02		49	21	3
MES13	"	Thursday		19.09.02		52	24	3
MES14	Without load	Thursday		19.09.02		52	24	0
MES15	"	Friday		20.09.02		53	25	1
MES16	"	Tuesday		24.09.02		57	29	4
MES17	"	Friday		11.10.02		74	46	17
MES18	"	Friday		18.10.02		81	53	7
MES19	"	Monday		28.10.02		91	63	10
MES20	"	Thursday		31.10.02		94	66	3
MES21	With load	Thursday		31.10.02		94	66	0

*** Information's mail send by Gyorgy Bencze on August 28th:**

“ Last week (Tue, 20 Aug) the MAB was very slightly touched by a person belonging to transport. He was passing by with an object. I was there and warned them but still it happened. The area that was touched is the most sticking out part on the entrance side (E11 target). “

This event happened between measure 5 and measure 6.

Despite this information and the visible movements of this event on the survey results, H. Gerwig has asked us to continue the measurements as before.

↪ 1.1.4. Recorded temperature and humidity

The temperature and the humidity have been recorded during the three months of measurement.

Mean Temperature during those 3 months: 19.5 °C

The humidity has varied between 32 % and 82 %.

✓ See the sketches in Appendix showing the recorded temperature and humidity during the MAB test (related with the measurement dates)

1.2 – RESULTS.

Accuracy of the measurement: 0.05mm for the levelling
From 0.02 to 0.05 mm with the theodolite

1.2.1 - Horizontal vectors

DIFFERENCES WITH RESPECT TO MESURE 0

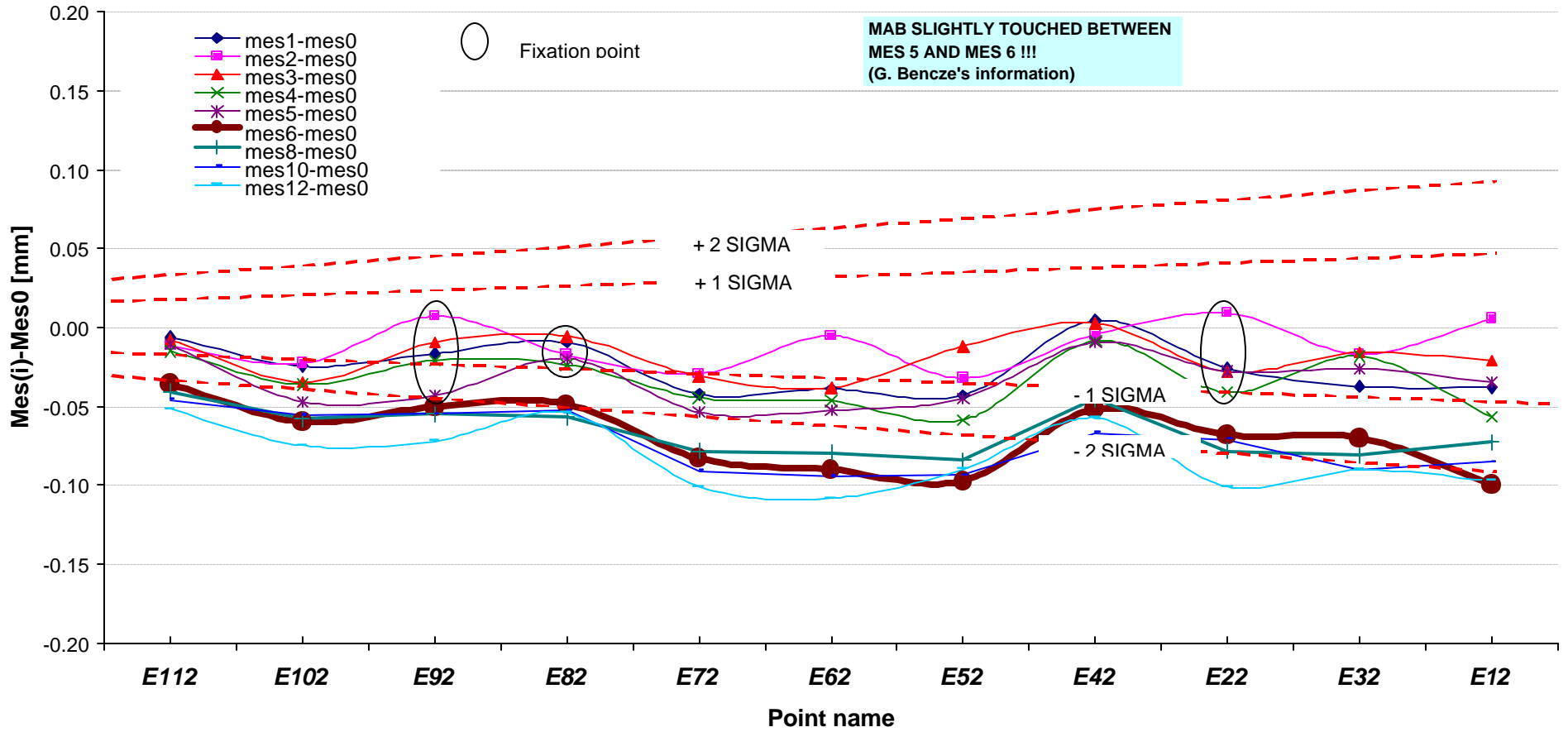
Horizontal Vector (mm)

Theodolite

POINTS ST2	DIST TO POINT (m)	ACCURACY emq 1 sig (mm)	MES1-MES0 1 day		MES2-MES0 3 days		MES3-MES0 7 days		MES4-MES0 10 days		MES5-MES0 18 days		MES6-MES0 28 days	
			Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq
E112	2.01	0.016	-0.006	0.4	-0.011	0.7	-0.008	0.5	-0.015	1.0	-0.011	0.7	-0.036	2.3
E102	2.35	0.018	-0.025	1.3	-0.023	1.2	-0.035	1.9	-0.036	2.0	-0.047	2.6	-0.060	3.2
REF 5	2.52	0.020	0.024	1.2	0.015	0.8	0.011	0.6	-0.001	0.1	-0.002	0.1	-0.019	0.9
E92	2.88	0.023	-0.016	0.7	0.007	0.3	-0.010	0.4	-0.021	0.9	-0.043	1.9	-0.050	2.2
E82	3.25	0.026	-0.010	0.4	-0.017	0.7	-0.006	0.2	-0.024	0.9	-0.020	0.8	-0.048	1.9
REF 4	3.41	0.027	0.001	0.0	-0.002	0.1	0.014	0.5	-0.009	0.4	-0.009	0.3	-0.012	0.4
E72	3.65	0.029	-0.042	1.5	-0.029	1.0	-0.031	1.1	-0.044	1.6	-0.054	1.9	-0.083	2.9
E62	3.88	0.030	-0.039	1.3	-0.005	0.2	-0.038	1.3	-0.046	1.5	-0.053	1.7	-0.090	3.0
REF 3	4.62	0.036	-0.041	1.1	-0.041	1.1	-0.024	0.7	-0.035	1.0	-0.043	1.2	-0.039	1.1
E52	4.67	0.037	-0.043	1.2	-0.032	0.9	-0.012	0.3	-0.059	1.6	-0.045	1.2	-0.097	2.7
E42	4.71	0.037	0.005	0.1	-0.005	0.1	0.003	0.1	-0.008	0.2	-0.009	0.3	-0.052	1.4
E22	5.24	0.041	-0.026	0.6	0.009	0.2	-0.028	0.7	-0.041	1.0	-0.028	0.7	-0.068	1.7
E32	5.74	0.045	-0.037	0.8	-0.017	0.4	-0.016	0.4	-0.018	0.4	-0.026	0.6	-0.070	1.5
E12	5.88	0.046	-0.038	0.8	0.006	0.1	-0.021	0.5	-0.057	1.2	-0.035	0.8	-0.099	2.2
REF TRIP1	9.16	0.072												

POINTS ST2	DIST TO POINT (m)	ACCURACY emq 1 sig (mm)	MES8-MES0 36 days		MES10-MES0 44 days		MES12-MES0 49 days	
			Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq
E112	2.01	0.016	-0.040	2.6	-0.046	2.9	-0.052	3.3
E102	2.35	0.018	-0.058	3.1	-0.055	3.0	-0.075	4.1
REF 5	2.52	0.020	-0.025	1.2	-0.028	1.4	-0.042	2.1
E92	2.88	0.023	-0.055	2.4	-0.055	2.4	-0.072	3.2
E82	3.25	0.026	-0.057	2.2	-0.053	2.1	-0.054	2.1
REF 4	3.41	0.027	-0.005	0.2	-0.055	2.1	-0.092	3.5
E72	3.65	0.029	-0.078	2.7	-0.091	3.2	-0.101	3.5
E62	3.88	0.030	-0.079	2.6	-0.094	3.1	-0.108	3.6
REF 3	4.62	0.036	-0.055	1.5	-0.020	0.6	-0.010	0.3
E52	4.67	0.037	-0.084	2.3	-0.093	2.6	-0.090	2.5
E42	4.71	0.037	-0.045	1.2	-0.067	1.8	-0.057	1.6
E22	5.24	0.041	-0.078	1.9	-0.071	1.7	-0.101	2.5
E32	5.74	0.045	-0.081	1.8	-0.090	2.0	-0.090	2.0
E12	5.88	0.046	-0.073	1.6	-0.085	1.9	-0.097	2.1
REF TRIP1	9.16	0.072						

Horizontal vectors - differences w.r.t. mes0



↶ 1.2.2. Vertical vectors

DIFFERENCES WITH RESPECT TO MESURE 0

Vertical Vector (mm)

Level

POINTS	ACCURACY emq 1 sig (mm)	MES1-MES0 1 day		MES2-MES0 3 days		MES3-MES0 9 days		MES4-MES0 10 days		MES5-MES0 18 days		MES6-MES0 28 days	
		Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq
N1	0.050	-0.010	0.2	-0.015	0.3	-0.026	0.5	-0.036	0.7	-0.116	2.3	-0.156	3.1
N2	0.050	-0.030	0.6	-0.001	0.0	-0.056	1.1	-0.006	0.1	-0.096	1.9	-0.128	2.6
N3	0.050	-0.050	1.0	-0.009	0.2	-0.060	1.2	-0.013	0.3	-0.100	2.0	-0.110	2.2
N4	0.050	-0.040	0.8	-0.044	0.9	-0.058	1.2	-0.068	1.4	-0.137	2.7	-0.074	1.5
N5	0.050	-0.045	0.9	-0.029	0.6	-0.054	1.1	-0.044	0.9	-0.114	2.3	-0.048	1.0
N6	0.050	-0.063	1.3	-0.021	0.4	-0.075	1.5	-0.085	1.7	-0.113	2.3	-0.060	1.2
N7	0.050	-0.057	1.1	-0.047	0.9	-0.093	1.9	-0.070	1.4	-0.124	2.5	0.011	0.2

POINTS	ACCURACY emq 1 sig (mm)	MES7-MES0 32 days		MES8-MES0 36 days		MES9-MES0 42 days		MES10-MES0 44 days		MES11-MES0 46 days		MES12-MES0 49 days	
		Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq
N1	0.050	-0.146	2.9	-0.135	2.7	-0.171	3.4	-0.164	3.3	-0.152	3.3	-0.194	3.3
N2	0.050	-0.113	2.3	-0.094	1.9	-0.142	2.8	-0.131	2.6	-0.116	2.6	-0.159	2.6
N3	0.050	-0.100	2.0	-0.095	1.9	-0.119	2.4	-0.115	2.3	-0.111	2.3	-0.169	2.3
N4	0.050	-0.083	1.7	-0.069	1.4	-0.102	2.0	-0.082	1.6	-0.090	1.6	-0.139	1.6
N5	0.050	-0.029	0.6	-0.018	0.4	-0.051	1.0	-0.039	0.8	-0.046	0.8	-0.080	0.8
N6	0.050	-0.018	0.4	0.008	0.2	-0.036	0.7	-0.049	1.0	-0.031	1.0	-0.066	1.0
N7	0.050	0.027	0.5	0.027	0.5	-0.004	0.1	-0.015	0.3	-0.008	0.3	-0.052	0.3

POINTS	ACCURACY emq 1 sig (mm)	MES13-MES0 52 days		MES14-MES0 52 days		MES15-MES0 53 days		MES16-MES0 57 days		MES17-MES0 74 days		MES18-MES0 81 days	
		Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq
N1	0.050	-0.179	3.6	-0.121	2.4	-0.142	2.8	-0.152	3.0	-0.177	3.5	-0.197	3.9
N2	0.050	-0.168	3.4	-0.103	2.1	-0.129	2.6	-0.130	2.6	-0.155	3.1	-0.179	3.6
N3	0.050	-0.157	3.1	-0.095	1.9	-0.136	2.7	-0.127	2.5	-0.168	3.4	-0.172	3.4
N4	0.050	-0.135	2.7	-0.092	1.8	-0.119	2.4	-0.127	2.5	-0.154	3.1	-0.158	3.2
N5	0.050	-0.093	1.9	-0.046	0.9	-0.084	1.7	-0.095	1.9	-0.109	2.2	-0.122	2.4
N6	0.050	-0.081	1.6	-0.033	0.7	-0.053	1.1	-0.054	1.1	-0.078	1.6	-0.084	1.7
N7	0.050	-0.038	0.8	0.012	0.2	-0.012	0.2	0.001	0.0	-0.034	0.7	-0.038	0.8

POINTS	ACCURACY emq 1 sig (mm)	MES19-MES0 91 days		MES20-MES0 94 days		MES21-MES0 94 days	
		Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq
N1	0.050	-0.166	3.3	-0.177	3.5	-0.213	4.3
N2	0.050	-0.156	3.1	-0.178	3.6	-0.203	4.1
N3	0.050	-0.131	2.6	-0.172	3.4	-0.198	4.0
N4	0.050	-0.144	2.9	-0.167	3.3	-0.183	3.7
N5	0.050	-0.074	1.5	-0.118	2.4	-0.140	2.8
N6	0.050	-0.066	1.3	-0.105	2.1	-0.115	2.3
N7	0.050	-0.021	0.4	-0.067	1.3	-0.088	1.8

DIFFERENCES WITH RESPECT TO THE MESURE 6

Vertical Vector (mm)

Level

POINTS ST2	ACCURACY (mm)	MES7-MES6 4 days		MES8-MES6 8 days		MES9-MES6 14 days		MES10-MES6 16 days		MES11-MES6 18 days		MES12-MES6 21 days	
		Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq
N1	0.050	0.010	0.2	0.020	0.4	-0.016	0.3	-0.008	0.2	0.004	0.1	-0.038	0.8
N2	0.050	0.015	0.3	0.034	0.7	-0.014	0.3	-0.002	0.0	0.012	0.2	-0.031	0.6
N3	0.050	0.010	0.2	0.015	0.3	-0.009	0.2	-0.004	0.1	-0.001	0.0	-0.059	1.2
N4	0.050	-0.009	0.2	0.005	0.1	-0.028	0.6	-0.007	0.1	-0.016	0.3	-0.065	1.3
N5	0.050	0.019	0.4	0.030	0.6	-0.003	0.1	0.009	0.2	0.002	0.0	-0.032	0.6
N6	0.050	0.042	0.8	0.068	1.4	0.024	0.5	0.012	0.2	0.029	0.6	-0.006	0.1
N7	0.050	0.016	0.3	0.016	0.3	-0.015	0.3	-0.026	0.5	-0.019	0.4	-0.063	1.3

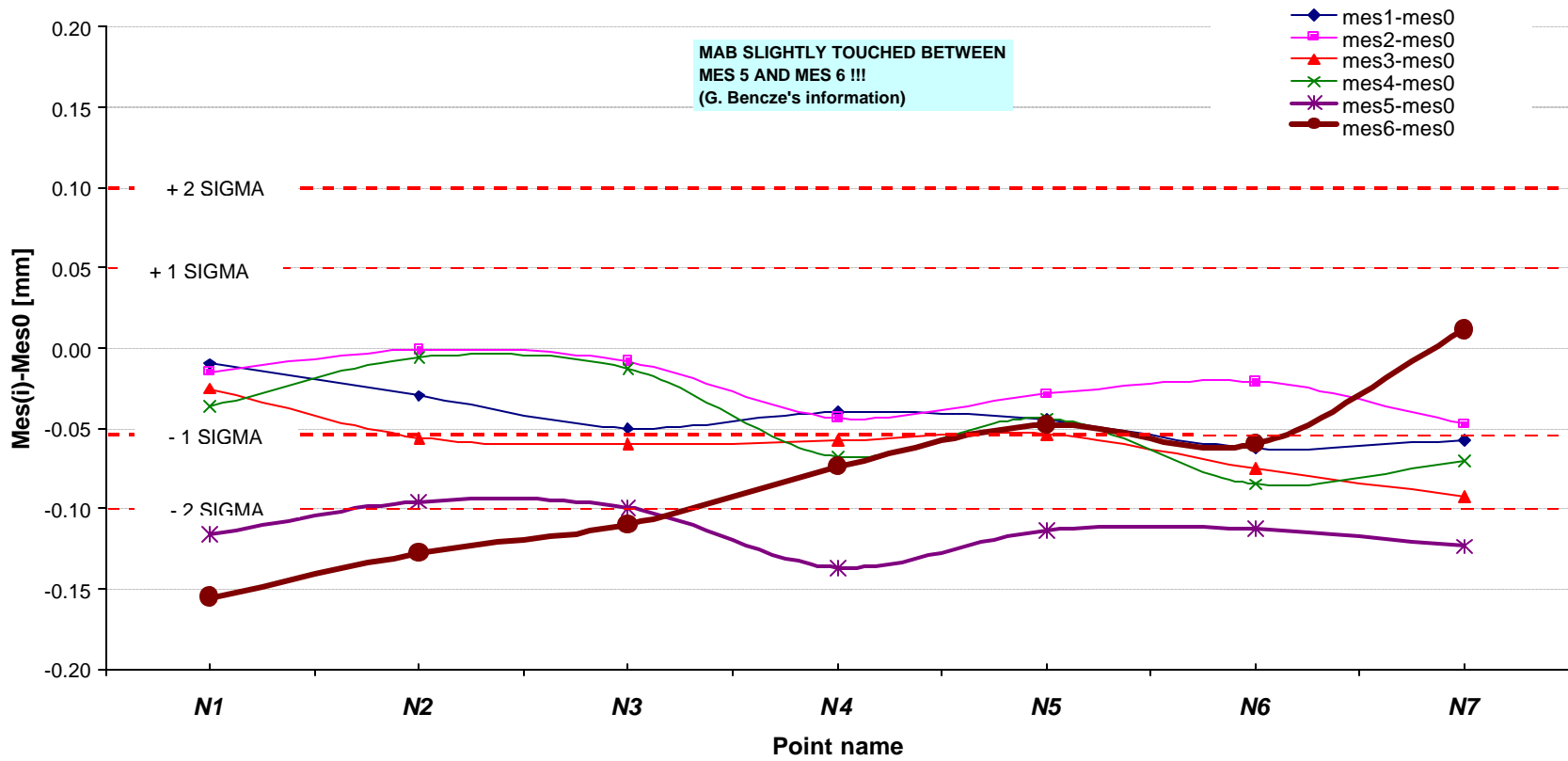
**Without
load**

POINTS ST2	ACCURACY (mm)	MES13-MES6 24 days		MES14-MES6 24 days		MES15-MES6 25 days		MES15-MES6 29 days		MES17-MES6 46 days		MES18-MES6 53 days	
		Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq
N1	0.050	-0.023	0.5	0.035	0.7	0.014	0.3	0.004	0.1	-0.021	0.4	-0.042	0.8
N2	0.050	-0.039	0.8	0.026	0.5	-0.001	0.0	-0.001	0.0	-0.026	0.5	-0.051	1.0
N3	0.050	-0.047	0.9	0.015	0.3	-0.026	0.5	-0.017	0.3	-0.058	1.2	-0.062	1.2
N4	0.050	-0.061	1.2	-0.018	0.4	-0.045	0.9	-0.053	1.1	-0.080	1.6	-0.084	1.7
N5	0.050	-0.045	0.9	0.002	0.0	-0.036	0.7	-0.047	0.9	-0.061	1.2	-0.074	1.5
N6	0.050	-0.020	0.4	0.028	0.6	0.008	0.2	0.007	0.1	-0.018	0.4	-0.023	0.5
N7	0.050	-0.049	1.0	0.001	0.0	-0.023	0.5	-0.009	0.2	-0.045	0.9	-0.049	1.0

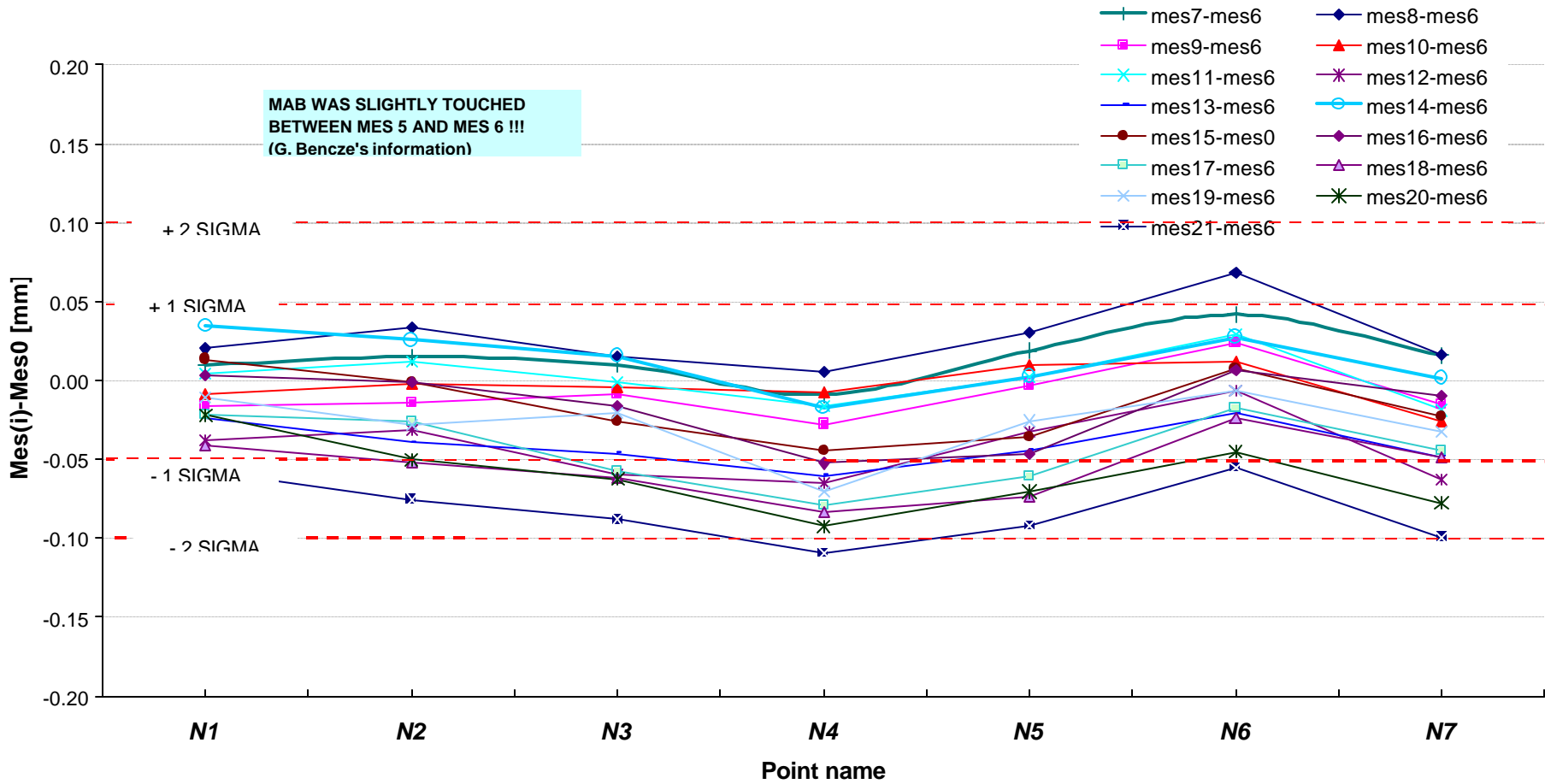
With load

POINTS	ACCURACY emq 1 sig (mm)	MES19-MES6 63 days		MES20-MES6 66 days		MES21-MES6 66 days	
		Vector (mm)	Vect / emq	Vector (mm)	Vect / emq	Vector (mm)	Vect / emq
N1	0.050	-0.010	0.2	-0.022	0.4	-0.057	1.1
N2	0.050	-0.028	0.6	-0.050	1.0	-0.075	1.5
N3	0.050	-0.020	0.4	-0.062	1.2	-0.088	1.8
N4	0.050	-0.070	1.4	-0.093	1.9	-0.109	2.2
N5	0.050	-0.026	0.5	-0.070	1.4	-0.092	1.8
N6	0.050	-0.006	0.1	-0.045	0.9	-0.055	1.1
N7	0.050	-0.032	0.6	-0.078	1.6	-0.099	2.0

Levelling - differences w.r.t. mes0



Levelling - differences w.r.t. mes6 - over 66 days



Muons calibration bench

November 11th, 2002
CMS-MA-UR-0001

PART II

Planarity of the MAB

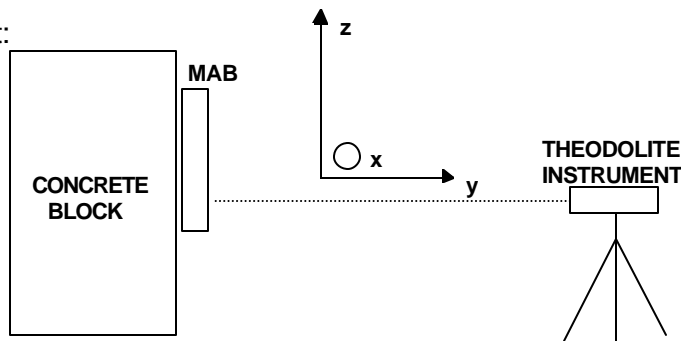
2.1 – PROCEDURE AND MEASUREMENTS

Following H. Gerwig’s request, the measurement of the planarity of the MAB has been performed on November 1st 2002 in the ISR/I4 lab.

↳ **2.1.1. Method**

The point positions (3D coordinates) have been measured by theodolite.
 Accuracy: 0.6mm

First measurement:

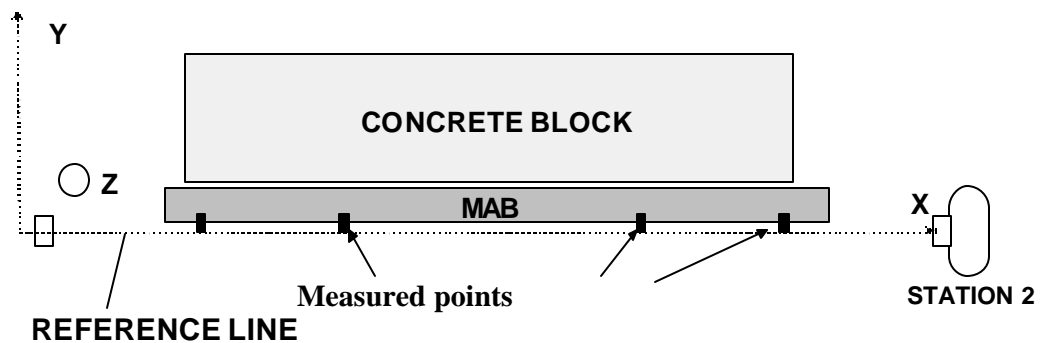


In order to get a more precise accuracy for the MAB plane (in Y direction), an additional measurement has been performed with an other theodolite.

A reference line has been set-up parallel to two extreme points (#01 and #09) and the precise distances between this reference line and the measured points have been measured.

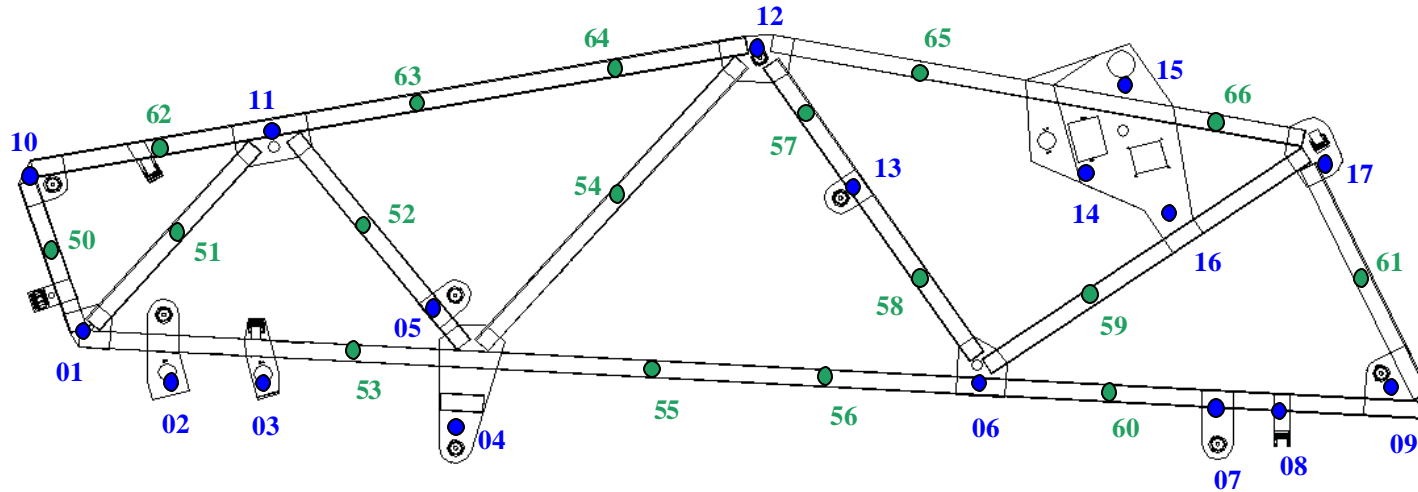
Accuracy in Y: 0.3mm

Second measurement:



↪ 2.1.2. Measured point positions on the prototype

PLANARITY OF THE MAB Point numbering



- Point number for points on tubes: from 50 to 66
- Point number for points on plates: from 01 to 17

Muons calibration bench

November 11th, 2002
CMS-MA-UR-0001

2.2 – RESULTS.

Accuracy of the measurement:

0.6 mm for X and Z coordinates

0.3 mm for Y coordinates (perpendicular to the MAB plane)

After the 3D coordinate calculation of all points, two best-fit planes have been calculated. The first one for the points belonging to the plates of the MAB, the second one for the points belonging to the tubes of the MAB.

↳ 2.2.1. Summary: Plane on the plates

Equation of the plane $-0.000920 * x + 0.999855 * y + -0.017017 * z + 0.04066 \text{ (m)} = 0$

Largest Distance from Plane on + side (mm) **2.0 At Point 9**

Largest Distance from Plane on - side (mm) **-3.5 At Point 5**

Dist = 'Signed' Dist. to Plane (- => Origin & Pt on same side / Plane, + => Origin & Pt on opp. side / Plane)

↳ 2.2.2. Summary: Plane on the tubes

Equation of the plane $-0.001036 * x + 0.999872 * y + -0.015945 * z + 0.04364 \text{ (m)} = 0$

Largest Distance from Plane on + side (mm) **1.7 At Point 61**

Largest Distance from Plane on - side (mm) **-1.1 At Point 55**

Dist = 'Signed' Dist. to Plane (- => Origin & Pt on same side / Plane, + => Origin & Pt on opp. side / Plane)

2.2.1. Planes results

HOLDING PLATES

Results of Plane Fitting - Centroid Method

Date of Calculation: 1/11/2002

Plane of the points on the plates

Time of Calculation: 11:53:56

Equation and Direction Cosines of the Plane :

Eqn of a Plane: $Y + B*Z + C*X + D = 0$

B	-0.017019	sig_B	0.954 mm/m
C	-0.000920	sig_C	0.270 mm/m
D (m)	0.04067	sig_D	0.623 mm

Hence for Eqn of the form: $a*x + b*y + c*z + d = 0$ with a, b, c : Dir. Cosines of perp. Line to the Plane

a	-0.000920
b	0.999855
c	-0.017017
d (m)	0.04066

Bearing and Vertical Angle of the Vector from the origin to the plane

Bearing (Grades)	399.9414
Vertical Angle (Grades)	101.0834
Dist from the origin to the plane (m)	0.04066

Observed Coords (m)

Name	Weight	Dist (mm)
1	1.0	0.9
2	1.0	1.5
3	1.0	0.1
4	1.0	-0.5
5	1.0	-3.5
6	1.0	-1.1
7	1.0	-0.5
8	1.0	0.4
9	1.0	2.0
10	1.0	1.2
11	1.0	0.6
12	1.0	-0.2
13	1.0	-2.2
14	1.0	0.5
15	1.0	0.1
16	1.0	0.6
17	1.0	0.3

Dist = 'Signed' Dist. to Plane : (Sign - : Origin & Pt on same side / Plane)
(Sign + : Origin & Pt on opp. side / Plane)

dX, dY, dZ = Diff. co-ordinates (Diff. co-ordinates = Pt. proj. - Pt. obs.)

Summary of the data in the Calculated Co-ordinate Axis

Equation of the plane $-0.000920* x + 0.999855* y + -0.017017* z + 0.04066 (m) = 0$

Largest Distance from Plane on + side (mm) **2.0 At Point 9**

Largest Distance from Plane on - side (mm) **-3.5 At Point 5**

Dist = 'Signed' Dist. to Plane (- => Origin & Pt on same side / Plane, + => Origin & Pt on opp. side / Plane)

MAB TUBES**Results of Plane Fitting - Centroid Method****Date of Calculation:** 1/11/2002**Plane of the points on the tubes****Time of Calculation:** 11:45:29**Equation and Direction Cosines of the Plane :****Eqn of a Plane: $Y + B*Z + C*X + D = 0$**

B	-0.015947	sig_B	0.677 mm/m
C	-0.001036	sig_C	0.189 mm/m
D (m)	0.04365	sig_D	0.368 mm

Hence for Eqn of the form: $a*x + b*y + c*z + d = 0$ with a, b, c : Dir. Cosines of perp. Line to the Plane

a	-0.001036
b	0.999872
c	-0.015945
d (m)	0.04364

Bearing and Vertical Angle of the Vector from the origin to the plane

Bearing (Grades)	399.9340
Vertical Angle (Grades)	101.0151
Dist from the origin to the plane (m)	0.04364

Observed Coords (m)

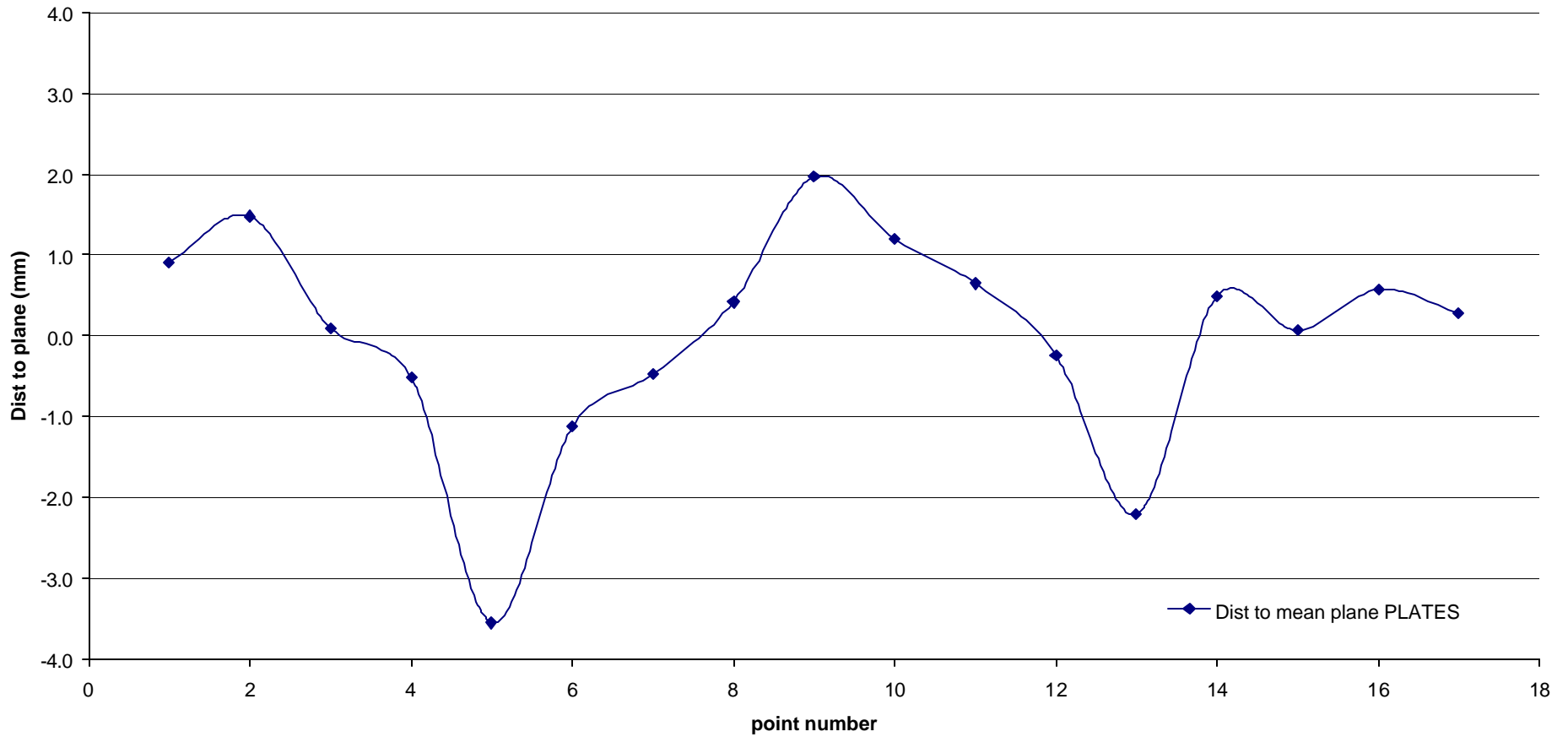
		Dist
Name	Weight	(mm)
50	1.0	1.5
51	1.0	0.6
52	1.0	-0.7
53	1.0	-0.7
54	1.0	-0.3
55	1.0	-1.1
56	1.0	-0.6
57	1.0	-0.6
58	1.0	0.1
59	1.0	0.3
60	1.0	0.2
61	1.0	1.7
62	1.0	0.5
63	1.0	0.3
64	1.0	-0.4
65	1.0	-0.7
66	1.0	0.0

Dist = 'Signed' Dist. to Plane : (Sign - : Origin & Pt on same side / Plane)**(Sign + : Origin & Pt on opp. side / Plane)****dX, dY, dZ = Diff. co-ordinates (Diff. co-ordinates = Pt. proj. - Pt. obs.)****Summary of the data in the Calculated Co-ordinate Axis**Equation of the plane **$-0.001036* x + 0.999872* y + -0.015945* z + 0.04364 (m) = 0$** Largest Distance from Plane on + side (mm) **1.7 At Point 61**Largest Distance from Plane on - side (mm) **-1.1 At Point 55**

Dist = 'Signed' Dist. to Plane (- => Origin & Pt on same side / Plane, + => Origin & Pt on opp. side / Plane)

↳ 2.2.2. Plane graphics

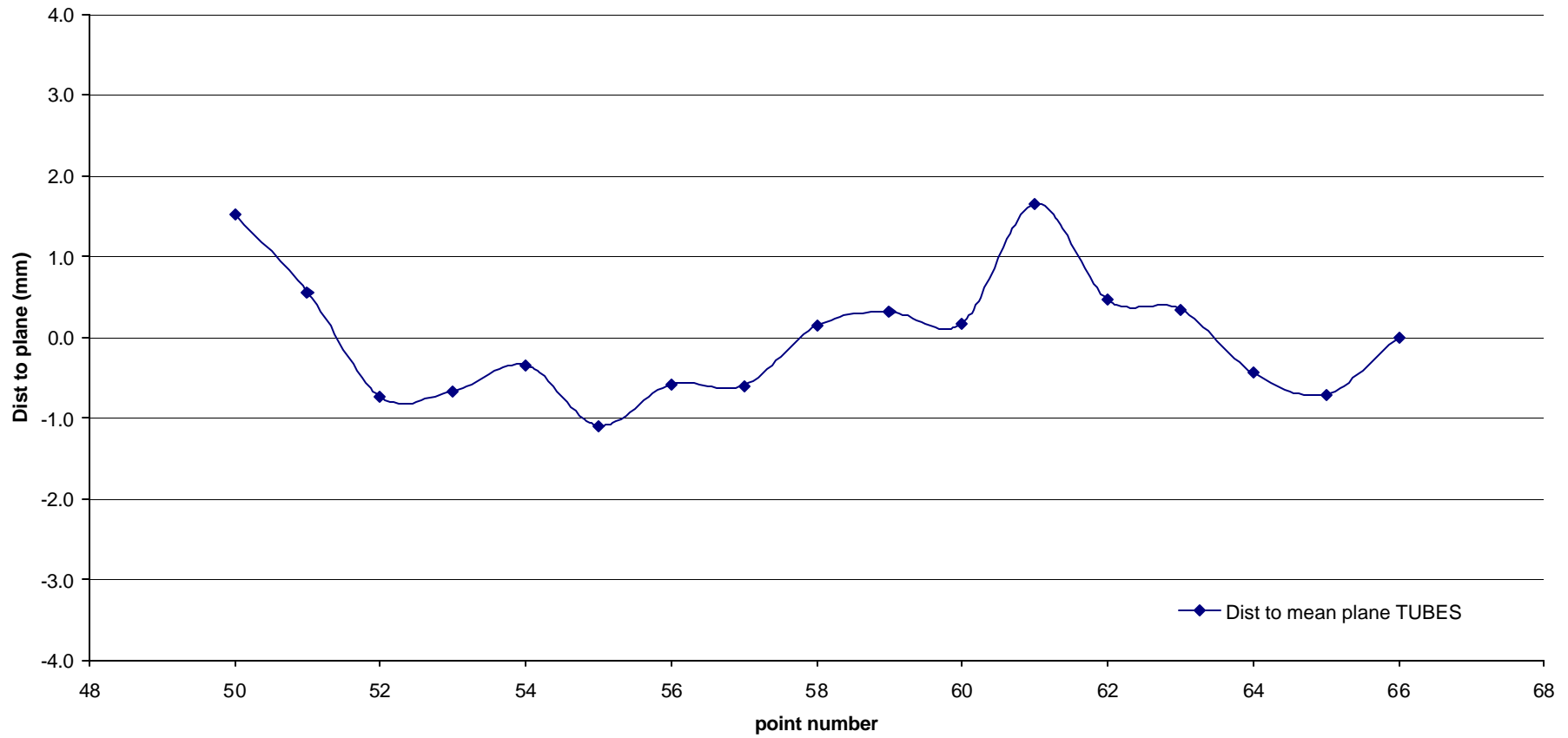
MAB - Distances to mean plane
(points on the Plates)



Muons calibration bench

November 11th, 2002
CMS-MA-UR-0001

MAB - Distances to mean plane (points on the Tubes)



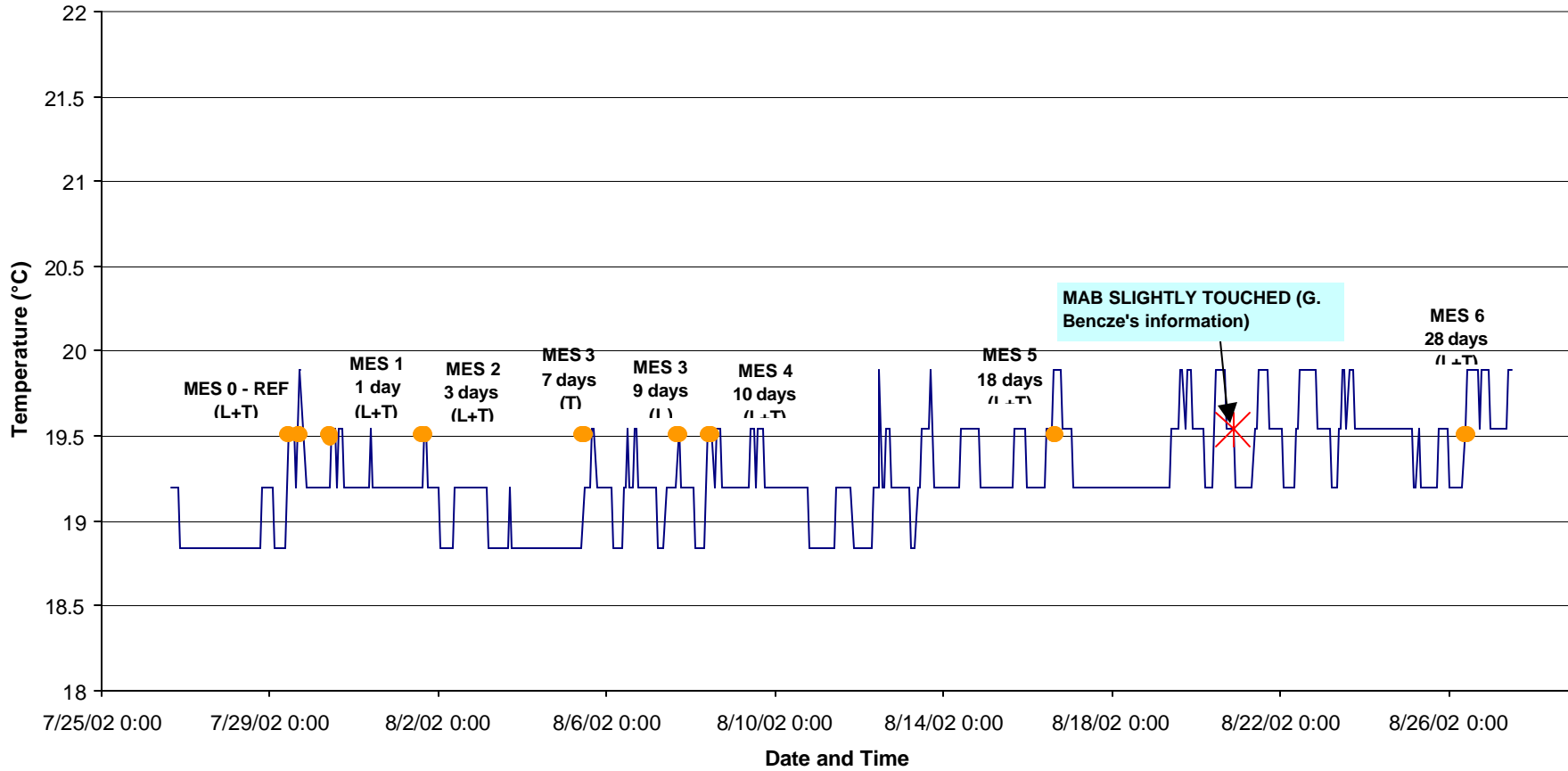
Muons calibration bench

November 11th, 2002
CMS-MA-UR-0001

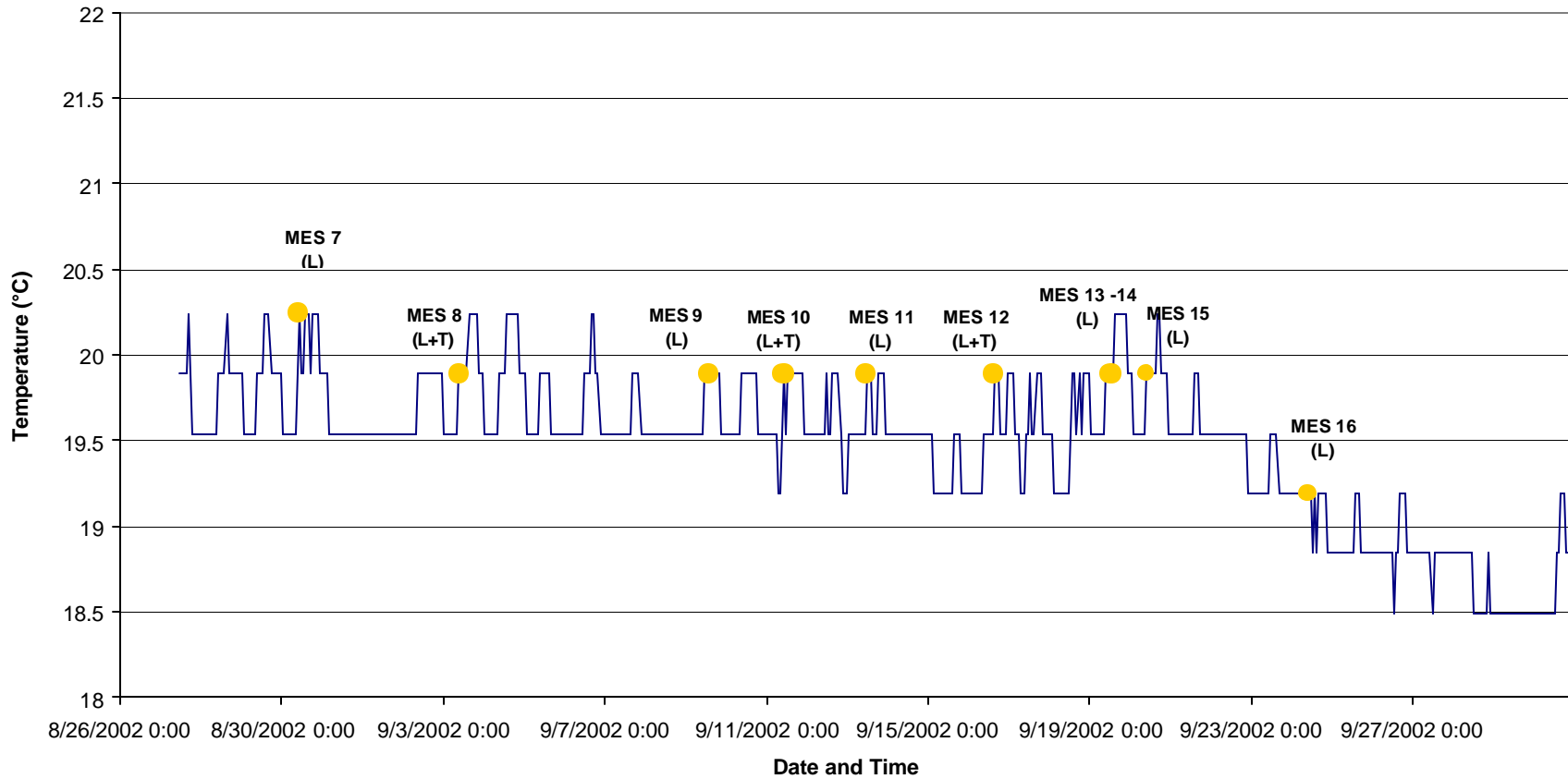
APPENDIX

Temperature and humidity charts

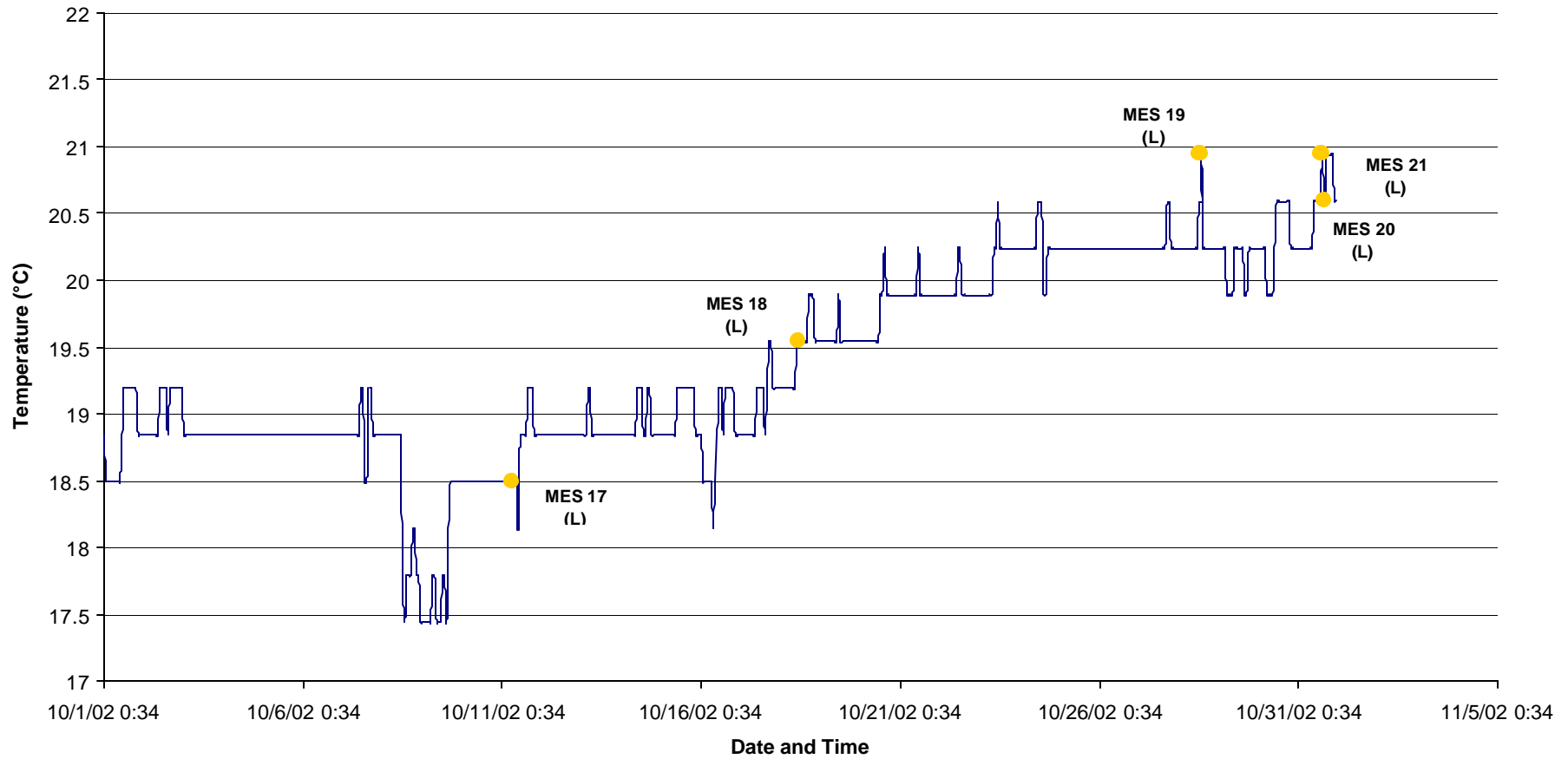
TEMPERATURE OF THE MAB DURING THE TEST 1 / 3 (28th July - 27th August 02)



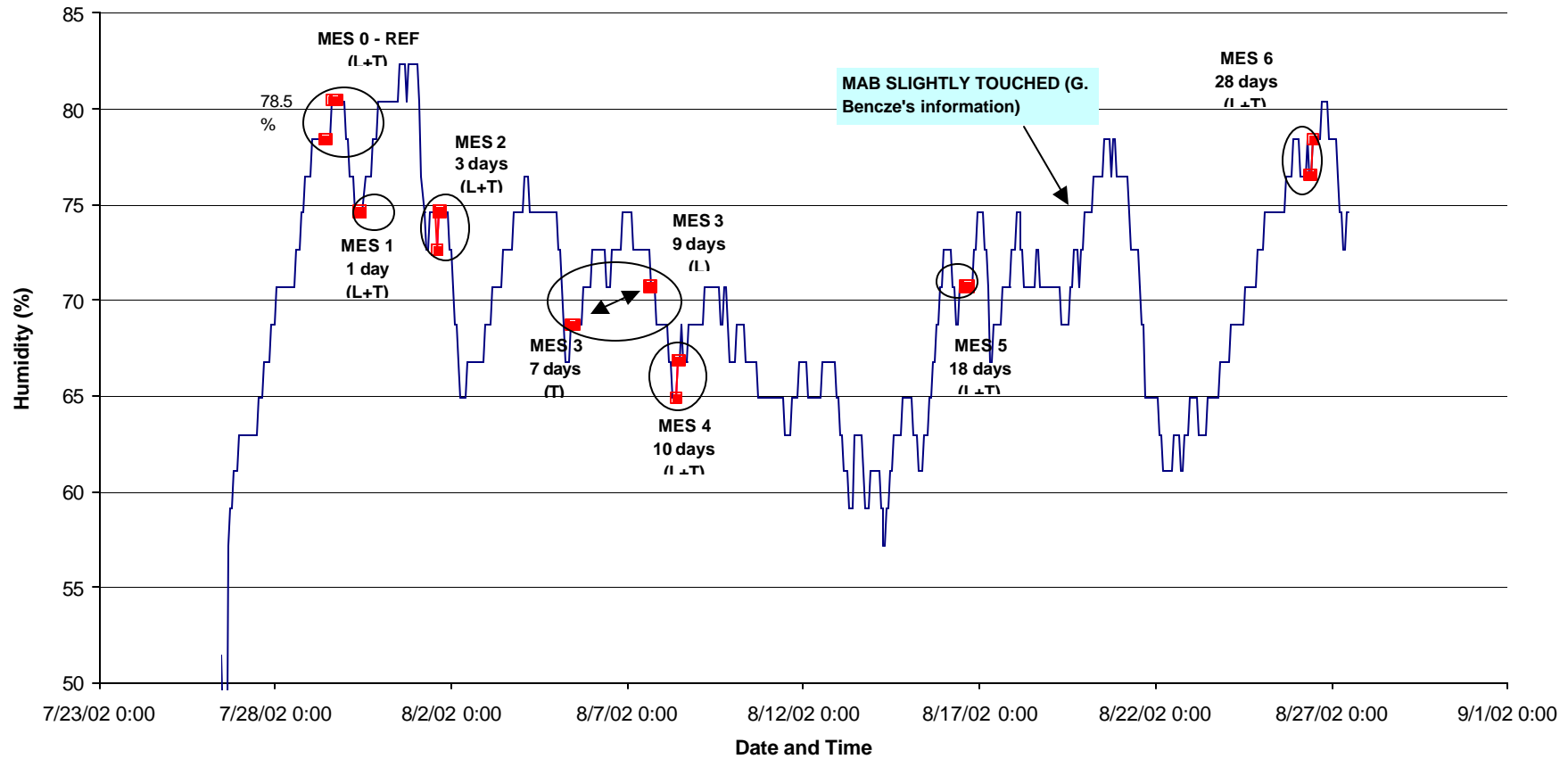
TEMPERATURE OF THE MAB DURING THE TEST
2 / 3 (28th August - 30th September 02)



TEMPERATURE OF THE MAB DURING THE TEST
3 / 3 (1st October - 31st October 02)

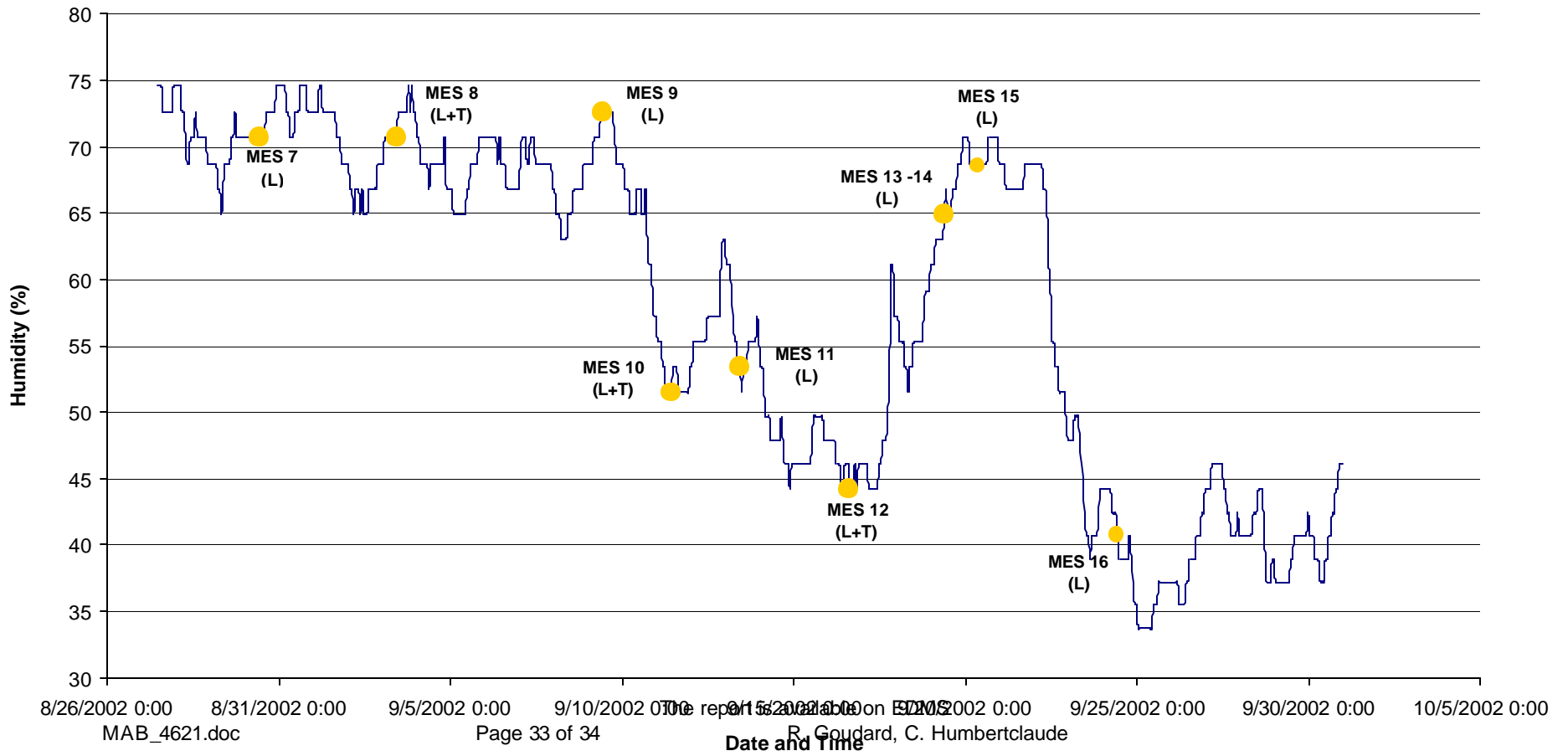


HUMIDITY OF THE ISR/I4 DURING THE MAB TEST 1 / 3 (28th July - 27th August 02)



The report is available on EDMS

REL. HUMIDITY OF THE ISR/I4 HALL DURING THE MAB TEST 2 / 3 (28th August - 30th September 02)



REL. HUMIDITY OF THE ISR/I4 HALL DURING THE MAB TEST 3 / 3 (1st October - 31st October 02)

