Minutes of the meeting 18/03 2005:
Certification of the data for the QUAD axis measurements for upload to the MAS geometry data base.

Present:
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Excused : **M.Coccoli**

Pen: **Elena wildner**

Aim of meeting:

The urgent need for data for the main quadrupoles (MEB) makes it indispensable to finish the series of corrections of measurement data, so that the certification of the information can be completed and the database be used for generation of MEB id-cards and for analysis of the quadrupole geometry. This meeting was held to give the present status of the measurement data and a plan for the modifications in the data base according to the available calibration factors (also related to the manpower available to recalculate data according to new calibration in TS/SU) and according to the needs of the MEB (installation in tunnel).

Short version of the minutes, summary:

According to AT/MTM and TS/SU, AC-mole data and data from the classical mole used for mechanical axis measurements vy SU show close enough results (a max difference of 0.1mm locally between the two moles) and we should be able to use AC-mole data for the mechanical axis measurements. However a large amount of existing AC-mole data has to be retreated, which also implies recalculation of SSW data using AC-mole data for reference. TS/SU will continue to to use the classical mole for mechanical measurements for still some time, for checks.
For the magnetic axis measurements by the AC-mole two weeks for calibrations and checks are still needed.
SSW data cannot be re-treated by calibrations of similar and have to be retracted from the data base if not considered good (outliers and all corrector axis and angle measurements).
Re-treatment of data and uploads are not free of cost and a priority list must be given to TS/SU to manage this. These priorities are given by the list for the installation sequence.
The SSW measurements presently in the data base have been checked against theoretical shrinkage data and are considered validated.
Next step will be to introduce in the data base the tolerances specified in the work shop of alignment, 2002. This specification is according to T.Tortchanoff what should be used. The information flow has been discussed and in a month a baseline system with uploads of mole measurements made by TS/SU in synchronism with MTF(EDMS) uploads will be in operation.

The certification

The certification is made in the following way

1. Comparison between measurements from the SU-mole and the AC-mole for the mechanical axis. The SU-mole is considered a reference.
2. Comparison of the shrinkage of the distance between the two cold bore tubes between theoretical values and measurements with AC mole and SSW.
3. The data base will be equipped (when manpower available) with the available tolerances on the data points, this may give an indication on the measurement validity.

Information about the situation

After very recent (a few days) discovery of a problem of the definition of the local coordinate system
After the very recent (a few days) discovery of a problem with the definition of the local coordinate system for the mechanical axis measured with the AC-mole, it was agreed that the mechanical axis measured with the SU-mole and the AC-mole respectively seem to coincide sufficiently well now. This means that from now on we can consider that the AC mole measurements of the mechanical axis can be used as the reference for the calculation of the mean geometrical plane. TS/SU still continue to measure using the SU-mole for some time, to cross check AC-mole and SU-mole data. However a large amount of the already uploaded data has to be reloaded due to the calibration errors.
All measurements with problems (agreed on by Marco) have been taken out from the data-base. Some of those magnets will re-measured.
Only AC-mole data, not SSW data for the magnetic axis measurements of the correctors should be used.

Whenever a SU mole measurement of the warm mechanical axis exists, it was decided that this measurement should be used for calculation of. all the SSW measurement (cold and warm) to be represented in the same reference coordinate system to limit recalculation efforts.

When SSW data are loaded in the database (MAS/MA), data has to be transformed (using a transformation routine furnished by TS/SU), to be represented in the reference coordinate system. This implies that if only AC mole data exist, these data have been used for calculating the reference system. If now AC mole data is wrong (has to be reloaded in the database) the transformation of the SSW data has to be recalculated when the new AC mole data is loaded in the database.

Magnetic axis measurements using the AC mole still need checking by MTM (calibration factors etc.). This will be done during the following weeks, and data have to be correct for upload in two weeks (action Juan).

The checking of the SSW data (magnetic axis) in the horizontal plane has been done by comparing with theoretical horizontal and vertical shrinkage. The following table

shows the results for the theoretical inter-axis distance, the measured inter-axis distance, the inter-axis distance with outliers more than 3 sigma from the mean taken out, and the corresponding shrinkage.

Theoretical values for the inter-axis distance are 194.38 mm at ambient temperature (warm), 194.00 mm at cryogenic temperature (cold).

Inter-axis distance	Measured (W)	Measured (C)	Shrinkage
Mean	194.35 mm	194.00 mm	-0.37 mm
Mean without outliers	194.49 mm	194.03 mm	-0.46 mm
Stdev	0.37 mm	0.17 mm	0.44 mm
Stdev without outliers	0.08 mm	0.05 mm	0.09 mm

If we take out outliers we see a small systematic difference in the shrinkage of 0.1 mm with respect to theoretical. However the theoretical inter-axis distance at cold shows very good agreement with theoretical data. When we get the AC mole data for the warm measurements we will make the comparison between warm AC-mole and warm SSW data.

In the vertical plane the situation is the following, theoretical value at ambient temperature is 0.0 mm (reference values are the cold bore mechanical centre) and -1.3 mm at cryogenic temperature.

Inter-axis distance	Measured (W)	Measured (C)	Shrinkage
Mean	0.06 mm	-1.33 mm	-1.42 mm
Mean without outliers	0.03 mm	-1.32 mm	-1.37 mm
Stdev	0.19 mm	0.12 mm	0.24 mm
Stdev without outliers	0.14 mm	0.11 mm	0.13 mm

I copy a statement in a mail from Marco: the SSW measurement precision is within 0.06 mm and dominated by the Leica, the instrument itself being better than 0.01 mm (from 1 error propagation study at Fermilab and repeatability studies at CERN).

With these results we conclude that the measurements seem good enough for upload to the database.

Information flow (baseline):

As for uploads of the main dipole data, the uploads of the quadrupole data for the mole measurements will in a close future be done by TS/SU using an upload program from Jerome. This program will be ready for use mid April (estimation by Jerome). This concerns only warm axis measurements by TS/SU. From this date on, the MTF will be filled synchronously with the data base in a similar way as for the dipole. Marco sends SSW data to Jerome for fit on the fiducials and upload.

Information flow for reloads of existing data and for measurements made before the upload program is available:

It has been decided that Marco collects all measurements and sends the data to Jerome, who uploads data to the database. During the time before the availability of the upload program, Marco checks the validity, in particular, of the magnetic axis measurements since we consider that these measurements still need work (Juan).

Summary of the status of the data in the database of today:

The list (furnished by Jerome) of existing measurements is shown below (Annexe 1). Existing data is marked by X. During the meeting data to be reloaded or checked was identified and this has been indicated by red in the table. A column is added where comments made during the meeting concerning the measurements for the magnet is marked. "Re-treatment of AC mole data" means applying new calibration factors, recalculation of geometrical mean plane and fiducials. This work takes from half an hourwork up to half a day in case of problems (work done by Patrick). After this, data has to be re uploaded to the database (Jerome). "Refitting of SSW data" means applying a best fit on the fiducials to express SSW data, if it exists for this magnet, in the new reference of the AC mole data. After this, a new upload to the database is needed (work done by Jerome).

There are existing measurement data files that will be sent to Jerome as soon as possible.

62, 69 and 107 are considered ok (id cards produced).
For magnets 80 and 109 data are ready to be sent for upload.

Special SSS:

Marco informs that some special SSS magnets have been measured. The program for data treatment is different for each type of SSS and has to be finished (work done by Patrick). The following SSSS have been measured: 601, 602, 614, 612. Since Patrick is doing both the re-treatment of the AC-mole data and the programming work for the special SSS we need to give a list of priorities to him. Below (Annexe 2) is the list of magnets in order of installation priority (sent after the meeting by Michele Modena). Green means data ok and id card produced. Blue is magnets waiting for id-card. The recalculation of data should be done in the order of the installation priorities as far as this is possible according to measurement availability etc.

Next id cards:

For the MEB on Monday Michele would like to have, in addition the id cards for magnets 67 and 68, magnets 35 and 50 (magnets marked blue in the list for installation priorities). Data for magnet 68 will be sent to Jerome for upload on Monday 21/3. Id cards should be possible to create Monday afternoon. We did not discuss magnets 35 and 50 in the meeting but, according to the list, we would need re-treatment of magnet 35 and existing files sent for magnet 50. Mails will be sent with this request.

Annexe 1: Existing data in the database, status

Magnet	SU	AC_MAG	AC_MECH	WSSW	WSSW_B	CSSW	CSSW_B	Comments during meeting
1	X	X	X	X	X	X	X	Data ok
2	X			X		X		WSSW to be checked
4	X	X	X	X	X	X		Data ok
7	X							Data ok
8	X			X	X			Data ok
11	X	X	X	X		X		Re-treatment of AC-mole data, external points of CSSW to be taken out
12		X	X			X		Re-treatment of AC-mole data, re-fitting of SSW data
13	X	X	X	X				Re-treatment of AC-mole data
14		X	X			X		Re-treatment of AC-mole data, re-fitting of SSW data
15	X			X		X		Data ok
16	X	X	X			X		Re-treatment of AC-mole data
17	X			X		X		Data ok
18		X	X	X		X		Re-treatment of AC-mole data, refitting of SSW data
20	X	X	X			X		Re-treatment of AC-mole data
21		X	X	X		X		Re-treatment of AC-mole data, refitting of SSW data
23	X	X	X	X		X		Re-treatment of AC-mole data
24	X	X	X	X		X		Re-treatment of AC-mole data
30		X	X					Re-treatment of AC-mole data
31	X	X	X			X	X	Re-treatment of AC-mole data
35	X	X	X			X		Re-treatment of AC-mole data
36						X		CSSW to be checked
37	X	X	X	X		X		Re-treatment of AC-mole data
38				X				CSSW to be checked
39		X	X					Re-treatment of AC-mole data
40		X	X					Re-treatment of AC-mole data
41	X			X		X		Data ok,
43		X	X	X		X		Re-treatment of AC-mole data
44	X			X		X		Data ok
45				X		X		Existing file to be transferred to Jerome, fitting of SSW data
46		X	X	X		X		Re-treatment of AC-mole data, refitting of SSW data
50						X		Data ok,
51		X	X	X		X		Re-treatment of AC-mole data, refitting of SSW data
52				X		X		Existing file to be transferred to Jerome, fitting of SSW data
53		X	X	X		X		Re-treatment of AC-mole data, refitting of SSW data
54		X	X	X		X		Re-treatment of AC-mole data, refitting of SSW data
61		X	X	X		X		Re-treatment of AC-mole data, refitting of SSW data
62	X	X	X	X		X		Data ok, SU measurement to be taken out
64						X		To be re-measured (NC opened), files to be tranfered, fitting of SSW data
65		X	X	X		X		Re-treatment of AC-mole data, refitting of SSW data
66		X	X	X		X		Re-treatment of AC-mole data, refitting of SSW data
67	X	X	X			X		Data ok
68	X	X	X			X		Existing file to be transferred to Jerome, fitting of SSW data
69	X	X	X			X		Data ok
71		X	X					Re-treatment of AC-mole data
101		X	X					Re-treatment of AC-mole data
107	X	X	X					Data ok

Annexe 2: Priority for installation, to help selection of data to be treated first

Install priority	Slot	SSS n.
1	18L1	62
2	20L1	73
3	24L1	107
4	22L1	67
5	28L1	35
6	26L1	69
7	22R8	51
8	24R8	50
9	32L1	66
10	30L1	68
11	18R8	101
12	20R8	71
13	16L1	61
14	14L1	102
15	12L1	54
16	34R8	32
17	12R8	74
18	14R8	75
19	16R8	63
20	28R8	53
21	30R8	110
22	32R8	65
23	26R8	106
24	31R8	89
25	33R8	173
26	33L1	128
27	31L1	91
28	29L1	34
29	21R8	58
30	23R8	87
31	25R8	95
32	27R8	88
33	29R8	92
34	27L1	93
35	25L1	56
36	23L1	94
37	21L1	79
38	19L1	97
39	17L1	98
40	15L1	99
41	13L1	100
42	13R8	96
43	15R8	85
44	17R8	80
45	19R8	86