CERN-DILLY-NOTE-2020-01-10

January 2020

Triplet b_6 errors from FiDeL and WISE

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Keywords: WISE, FiDeL, b6, Triplets, LHC, ID-Cards

Summary

Compares b_6 for the LHC-Triplets as measured given by the FiDeL report, the ID-Cards and from the WISE tables.

Contents

1 Motivation

As seen before beam-based corrections and the b_4 in WISE [1] agree well for IR1 but not for IR5 [2]. Ezio gathered for that reason the original data from the magnet reports [3] and there the values for IR5 are different from the WISE errors and closer to the beam-based measurements [4].

A check for the values of b_6 between these documents and WISE is done in this note. Additionally the values from the ID-cards is compared.

2 Comparison of available values

The layout shown in Figs. 1 and 2 and Table 1 as gathered from [3, 4] help to get an overview which coldmasses are currently (RunII) installed in which order in the LHC.

Figures 3 and 4 are also taken from [3] and summarize the MQXA, MQXB measurements respectively. **The individual field measurements for the MQXA were not in the report.**

Table 2 and Fig. 5 list and compare all available data for b_6, including the WISE error tables at collision from 2011[5] and 2015[6]. Notably only every second value from the MQXA ID-cards lies withing the range of the 2015 WISE values. The 2011 WISE values for most of the MQXB are quite different from all other sources. The MQXB data from the FiDeL report and the ID-cards list identical values in most cases, exception here is the Q2 left of IP1, **even though the powering of the magnets lists different values** (the ID-cards seem to be taken from the second-highest powering measurements but judging from the average and std-values they are very close, see Fig. 4a).

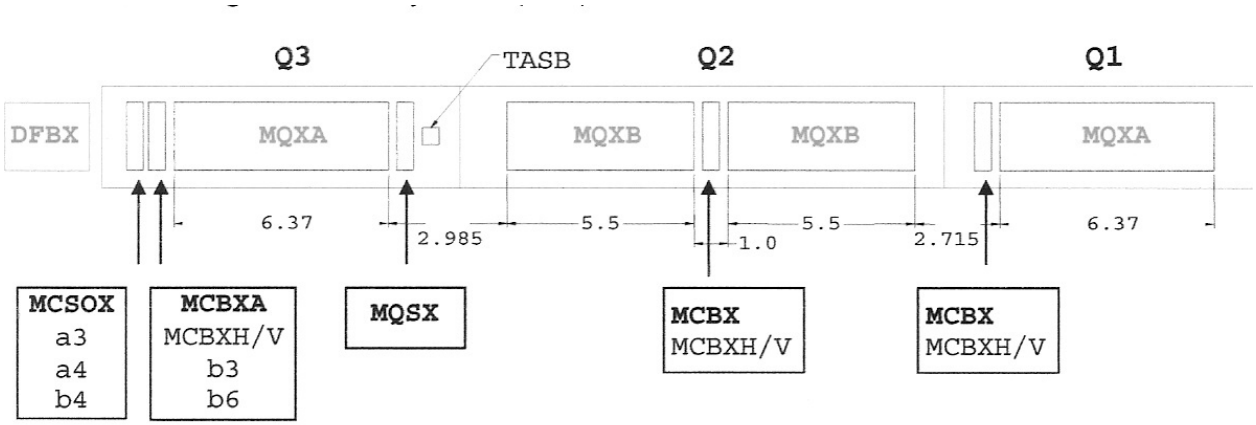


Figure 1: Schematic LHC triplet layout

	Q1	Q2a	Q2b	Q3
		Magnet number		
IR1L	2	7	9	15
IR1R	6	19	18	18
IR5L	3	11	8	14
IR5R	5	6	5	17

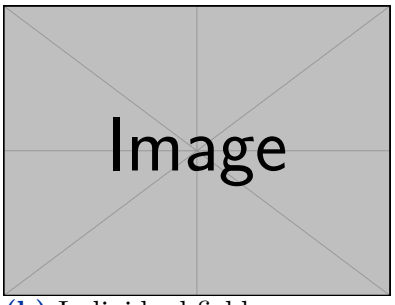
Figure 2: LHC Triplet Coldmasses

Table 1: ID-Card Names for installed Magnets

Element	Magnet	ID-Card
MQXA.1L1	MQXA02	LQXA02
MQXA.3L1	MQXA15	LQXC05
MQXA.1R1	MQXA06	LQXA06
MQXA.3R1	MQXA18	LQXC08
MQXA.1L5	MQXA03	LQXA03
MQXA.3L5	MQXA14	LQXC04
MQXA.1R5	MQXA05	LQXA05
MQXA.3R5	MQXA17	LQXC07
MQXB.A2L1	MQXB07	LQXB06
MQXB.B2L1	MQXB09	LQXB06
MQXB.A2R1	MQXB19	LQXB10
MQXB.B2R1	MQXB18	LQXB10
MQXB.A2L5	MQXB11	LQXB05
MQXB.B2L5	MQXB08	LQXB05
MQXB.A2R5	MQXB06	LQXB03
MQXB.B2R5	MQXB05	LQXB03

		b6	b10
392 A	Ave	-0.81	0.04
	Std	0.22	0.01
3207 A (3.3 TeV)	Ave	0.38	-0.01
	Std	0.08	0.00
6177 A (6.3 TeV)	Ave	0.33	-0.01
	Std	0.08	0.01
6677 A (6.8 TeV)	Ave	0.33	-0.01
	Std	0.09	0.01
6677 A - 392 A	Ave	1.13	-0.06
	Std	0.24	0.01

(a) Average and standard deviation over coldmasses at various fields



(b) Individual field measurements at 6677 A (*missing*)

Figure 3: MQXA allowed multipole components

		b6	b10
669 A	Ave	-1.52	0.05
	Stdev	0.61	0.02
5460 A	Ave	0.06	0.01
	Stdev	0.36	0.01
11347 A	Ave	0.07	0.02
	Stdev	0.36	0.01
11925 A	Ave	0.07	0.02
	Stdev	0.36	0.01
669 A - 11347 A	Ave	-1.67	0.04
	Stdev	0.19	0.01

(a) Average and standard deviation over coldmasses at various field strengths

Cold mass	b6	b10
1	-0.401	0.016
2	-0.309	0.019
3	-0.403	0.020
5	0.163	0.028
6	0.353	0.026
7	0.224	0.016
8	-0.012	0.044
9	0.218	0.020
10	0.372	0.029
11	0.398	0.031
12	0.181	0.023
13	0.309	0.019
15	0.427	0.018
16	0.220	-0.001
17	0.157	0.015
18	-0.231	-0.009
19	0.415	0.003
20	-0.859	0.030
Average	0.07	0.02
Stdev	0.36	0.01

(b) Individual field measurements at 11 925 A

Figure 4: MQXB allowed multipole components

Table 2: Comparison between b_6 in units from FiDeL, ID-Card and WISE values at 6677 A for MQXA and 11 925 A (FiDeL) / 11 347 A (ID-Cards) for MQXB.

Magnet	**FiDeL**	**ID-Card**	**WISE 2011**	**WISE 2015** Mean	Std	Min	Max
MQXA.1L1	-	0.500	0.322	0.314	0.076	0.115	0.478
MQXA.3L1	-	0.251	0.194	0.195	0.072	-0.013	0.340
MQXA.1R1	-	0.407	0.228	0.224	0.066	0.099	0.373
MQXA.3R1	-	0.270	0.213	0.205	0.080	0.018	0.365
MQXA.1L5	-	0.446	0.268	0.248	0.082	0.075	0.398
MQXA.3L5	-	0.301	0.245	0.248	0.076	0.067	0.462
MQXA.1R5	-	0.425	0.246	0.242	0.068	0.087	0.427
MQXA.3R5	-	0.263	0.206	0.201	0.085	0.052	0.373
MQXB.A2L1	0.224	0.218	0.157	0.167	0.015	0.131	0.201
MQXB.B2L1	0.218	0.210	0.157	0.160	0.016	0.126	0.192
MQXB.A2R1	0.415	0.415	0.036	0.359	0.016	0.327	0.399
MQXB.B2R1	-0.231	-0.231	0.036	-0.288	0.015	-0.320	-0.250
MQXB.A2L5	0.398	0.398	0.136	0.344	0.017	0.308	0.382
MQXB.B2L5	-0.012	-0.012	0.136	-0.069	0.018	-0.111	-0.035
MQXB.A2R5	0.353	0.353	0.202	0.293	0.019	0.256	0.332
MQXB.B2R5	0.163	0.163	0.202	0.104	0.017	0.062	0.139

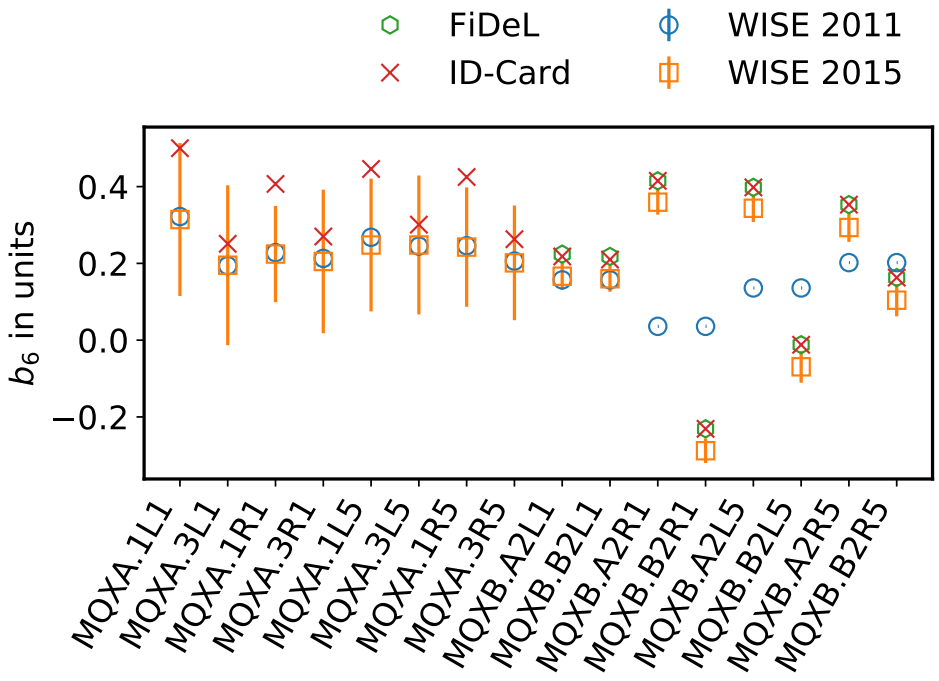


Figure 5: Comparison between b_6 in units from FiDeL, ID-Card and WISE values at 6677 A for MQXA and 11 925 A (FiDeL) / 11 347 A (ID-Cards) for MQXB.The errorbars indicate min and max value of the WISE 2015 data. The WISE 2011 data is constant over the seeds.

References

[1] A. T. Department, *Windows Interface to Simulation Errors*. URL: http://wise.web.cern.ch/.

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