ACCEPTANCE SUMMARY FOR LHC MAGNETS BUILT AT BNL
Magnet D3L101

Date of this summary: April 5, 2006

This document contains a short summary of the acceptance status (in italics, just below), the minutes of the acceptance meeting, and actions taken after the acceptance meeting [in square brackets within the text of the minutes, or as footnotes].

Acceptance status:
The BNL Acceptance Committee met on May 5, 2005. The approvals needed for acceptance were completed on May 10. Prior to the meeting, R. Ostojic requested that the magnet be sent to CERN before the meeting of the Acceptance Committee so that the QQS could be installed in a timely way. Pilat reviewed the field quality after the meeting and found only one item of concern, the skew quadrupole in one cold mass. Her email discussing this was forwarded to R. Ostojic on May 5. The ID card was sent to R. Ostojic on June 10.

In January, CERN reported that D3L102 failed hipot during incoming inspection. This failure was traced to abrasion of the kapton insulation of the leads, abraded by the inside wall of the end dome during transit. A plan was developed to cover the region of abrasion with additional insulation in all three D3's (waiver M0345). CERN requested that BNL verify that the repaired magnet would satisfy CERN requirements for magnet lifetime. Documentation of this work is appended to the D3L103 minutes, notes [2], [3]. D3L102 and D3L101 were repaired by T. Dilgen at CERN on April 27.

MINUTES OF ACCEPTANCE MEETING
Date of acceptance meeting: May 5, 2005
Present at acceptance meeting: Cozzolino, Escallier, Hocker, Jain, Muratore, Porretto, Wanderer, Willen.

Quench Data: Muratore showed the quench performance of the magnet, which was quite good. The magnet only quenched twice before reaching 6.5 kA. (Note that the horizontal bars represent the maximum current reached on a magnet ramp, without quenching.) After the magnet was ramped to 6.3 kA it was realized that the maximum current for this series of magnets should be 6.5 kA. The magnet reached 6.5 kA in both liquid and forced flow. Muratore also noted that the operation of the level probes was checked by observing their responses while the magnet was filled with liquid. As noted below, one redundant level probe was found to be inoperative. (The magnet was not quenched when cooled with liquid in order to shorten the test period.) Muratore's slides are available at www.bnl.gov/magnets/LHC_Acceptance

Field Quality: Jain showed the warm and cold data from the magnet. (His talk is available at the address given above.) The largest departure from expected harmonics in D3L101 is the geometric skew quadrupole in the right-hand cold mass. The warm measurement is shown in slide #11. The large value of a_2 in the eight central positions is caused by the use of two coils which differ in size by 0.03 mm (0.0013 inches), an unusually large amount. One of the two coils planned for this magnet developed electrical problems during assembly, and the spare was substituted, resulting in a relatively large value for a_2, ~ -6 units. The source of the large value at the nonlead end is not known.

The integral transfer functions (ITF) of the six cold masses in the three D3 magnets are ~ 0.09% larger than those of the five D1's (slide #5). The body transfer functions of the D3's are the same as those of the D1's (slide #6). As noted in the slide, differences in the warm measurement currents (necessary because the D3's have twice the resistance of the D1's) do not account for this difference. If the difference between the D3 and D1 ITFs were due to a difference in the effective length, the difference would be ~ 8 mm. However, the difference in the mean overall length of the coils, measuring after curing, is only 0.9 mm, with an uncertainty of 2.1 mm. No difference can be found in the yoke data. (The yoke length is set by stacking to a length determined by marks on the stacking fixture. The average D1 yoke weight was the same as the average D3 yoke weight within 1 part in 6080.) The D3's were measured before cold testing, and the D1's after cold testing, but it is not known how this would account for the difference in the ITF's.

Jain noted that the time-dependent measurements (e.g., snapback) were measured in D3L102 rather than in D3L101.

Jain noted that, for D3 magnets at high central fields, the yokes will saturate and the multipoles will show the effects due to the adjacent cold mass. This can be seen by comparing the change in field angle with current (slides #13-15). It is also seen in the multipoles which are produced by left-right asymmetries, such as b_2 (slide #18), a_3 (slide #19), b_4 (slide #20), etc. These effects were not taken into account in the tables of Expected Harmonics.

Pilat reported by email that the magnet field quality was ok, except for the skew quadrupole in the right-hand cold mass [2].

The Field Quality data were loaded into the CERN database on June 1.

Engineering: Escallier reported that one of the two warmup heaters was inoperative (deviation waiver M0331). This deviation has been accepted by CERN (email from R. Ostojic, 26 April 2005). It was also reported that level probe LI822, one of two in yoke assembly DML301, failed (deviation waiver M0339, accepted by R. Ostojic via email 10 June 2005). Cozzolino reported that the mechanical construction of the magnet was acceptable.

QA: Hocker reported that only one waiver (M0339) was not closed out.

Safety: Durnan reported by email that the documentation for the magnet met the safety specifications [1].

Survey: Cozzolino said that he had reviewed the survey data and found them acceptable. [The data were sent to D. Missiaen on June 2.]

These notes written by P. Wanderer

[1] Email from Durnan to Wanderer, 10 May 2005:
Re: D3L101 magnet acceptance
Reviewing my files I did not find any safety concerns for this magnet.
Jim Durnan

[2] Email from Pilat to Wanderer, 5 May 2005:
Re: D3L101
Following data review and discussion with Animesh, the only question mark in my mind are the -6 units of skew quadrupole in D3L101(R) at high current. I think that should be 'flagged' to CERN to verify that the coupling correction system can deal with that. It should but I can't verify that today.
With this caveat - it's a go for me.
Regards - Fulvia