ACCEPTANCE SUMMARY FOR LHC MAGNETS BUILT AT BNL
Magnets D2L104, D2L106, D2L107

Date of this summary: 2 April 2004

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 committee has approved the magnets for shipment to CERN.

The information needed for MEB review (ID cards, field quality data, survey data) has been sent to CERN.

MINUTES OF ACCEPTANCE MEETING
Date of acceptance meeting: 18 March 2004
Present at acceptance meeting: Anerella, Durnan, Escallier, Hocker, Jain, Muratore, Plate, Porretto, Schmalzle, Wanderer, Willen

Quench Data: Muratore showed the quench performance of the magnets. All three operated far in excess of their operating currents at the LHC. D2L104 went through two thermal cycles because of problems with the cryogenic system (lead flow blocked) and the calendar (testing before and after the Christmas-New Year's break) during the test period. With the agreement of CERN, the quench test goals were reduced following the test of D2L104, to minimize the time on the test stand. The quench testing of D2L106 and D2L107 went quickly.

After the test was complete, when technicians started to install the QQS assembly, it was noticed that the magnet had compressor oil in both end volumes. The source of this was found to be a rarely used line in the cryogenic system. As much oil as possible was removed from the end volumes. After consultations at BNL and CERN, it was concluded that the presence of the oil elsewhere in the magnet would not interfere with its performance. However, there was a concern that the oil might contaminate the LHC cryogenic system. To test this possibility, a quantity of dry nitrogen was blown through the magnet in both directions using a test procedure developed by both CERN and BNL. No sign of oil was found on a collecting surface just outside the exhaust point of the gas. This result was accepted as satisfactory by CERN. The quench plots and tabulations are available on the Web at
http://www.bnl.gov/magnets/LHC_Acceptance/D2_Test_Results.asp

Field Quality: Jain showed the warm data and cold data from these magnets. (His talk is at the Web address given above.) He compared warm data from these three magnets to the measurements from all nine D2's (18 apertures, except for the normal quadrupole, 9 apertures, because of the sign difference between the left and right apertures). The harmonic data of these three magnets were very similar to the others. The left and right

apertures in D2L106 and D2L107 were not as well aligned (integral field angle differences of 0.5 and 0.3 mrad, respectively) as those in most other magnets (differences < 0.2 mrad). The field angle differences did not change with cooldown. Nothing in the documentation indicated the cause of this.

Jain presented an analysis that will improved the determination of the integral transfer function (slide 15) for most of the D2 magnets. Warm and cold data are available for 6 magnets (12 apertures). The principal source of error in the ITF measurement is the axial position of the 1m mole in the end regions of the magnet. The eight measurements of the TF in the body of the magnet are well determined, warm and cold. Thus, the warm-cold differences in the body transfer function for all 12 apertures are well-determined. The differences were used as the value on the abscissa. When the warm-cold differences in ITF were used as the ordinates, 9 of the 12 apertures fell relatively close to a straight line, while three were far from it. The data suggest that, for the three apertures that were far from the line, a value determined by the warm-cold difference in BTF and the fitted line is more accurate than the measured value.

Dynamic measurements are available only from D2L104 because of a change in the test program after this magnet.

Jain compared the FQ data to Version 1 of the reference tables (made when only RHIC data were available) and to the unofficial Version 2 (made after data from two 3m prototypes were available). Version 2 takes into account the non-zero values for the normal quadrupole at room temperature, and differences in the sextupole due to differences between the RHIC tooling and the collared coils in the twin-aperture magnets.

The data were reviewed and approved by F. Pilat after the meeting [1].

Engineering: Escallier reported that changes in the voltage tap wiring at the IFS had been made and checked, in response to a request from CERN. The documentation of this is underway. Except for the incomplete documentation, he said that the magnet met specifications. [ECR documentation completed – see [2]]

Schmalzle said that the mechanical construction of the magnets met specifications, except for the position of one pipe in D2L107. CERN has previously approved this deviation.

QA: Hocker reported that the only major item that was incomplete was the ECR for the voltage tap wiring changes. Two minor omissions (a signature, a date) should be filled in today. One minor item, application of the "BNL" label to the cryostat, will be taken care of when the magnet is prepared for shipment. [ECR documentation and application of "BNL" label completed – see [2]]

Safety: Durnan stated that the magnets satisfied the safety requirements (specifically, pressure and electrical) established for them.

Survey: Plate said that he had reviewed the survey data and found them acceptable. The final survey data were sent by Plate to D. Missiaen on 17 March for review. Previously, CERN had accepted the deviation of the m/c pipe on D2L107 (0.6 mm in x, 2 mm in z).

These notes written by P. Wanderer

FOOTNOTES

[1] email from F. Pilat to P. Wanderer, 24 March 2004:

I had a short discussion with Animesh and that confirms that we do not see problems with the D2 data. Looking at the Version 2 reference harmonics, Dl2104 is OK, and the only noticeable number is a skew octupole at 6000A in Dl2106 and, to a lesser extent, a normal octupole in Dl2107 at 6000A. Again, no red flags here.

[2] email from H. Hocker to P. Wanderer, 1 April 2004:

The documentation for the IFS repair and the decal installation has been completed. There are no open documentation items affecting acceptance for these magnets.