

TS-SSC 91-199  
J. Strait  
10/25/91

### DSA326 Quench Summary

Attached are a quench summary table and plots from DSA326. I lifted the quench summary for the first two cooldowns from Tariq Jaffery's area on the Vax and added the summary of the 3rd thermal cycle. I have not attempted to fill in quench locations and Tariq has done only some. (I hope he will finish tabulating the locations and publish a follow up note.) Figure 1 is a quench history plot. The quench plateaus at each temperature are somewhat erratic for reasons not wholly understood. There are also some indications of modest training at some points, but the "training" is only a little bigger than the spread in the plateau.

Figure 2 is a plot of quench current versus temperature for the first two thermal cycles and  $dI/dt \leq 16$  A/s. It is clear that the spread in quench currents cannot be explained by temperature fluctuations. Figure 3 is a plot of quench current versus ramp rate for second thermal cycle quenches at 4.35 K nominal temperature. The wide range of quench currents at 16 A/s is quite evident. There is no evident low ramp rate plateau. This is similar to the BNL short magnet DSA209. That magnet also showed an erratic quench plateau until the ramp rate was reduced to 2 A/s. This was not tried on DSA326.

On the third cooldown the end preload was increased from 500 lbs to 4000 lbs per bullet. There is no evident difference in quench performance due to the end preload change.

#### Distribution:

R. Bossert  
J. Carson  
S. Delchamps  
A. Devred  
W. Koska  
T. Jaffery  
M. Lamm  
G. Pewitt  
J. Tompkins (for SSCL)  
M. Wake  
B. Williams (for G.D. and Westinghouse)

Quench summary for first two cooldowns is taken from Tariq Jaffery, except that I have modified his quench numbers for files 100-108 by subtracting 3 from each. Tariq's comments on the first two cooldowns are attached below.

This includes all the quenches that we have, so far, from both cooldowns. During second cooldown quench current has been between 7330 - 7485 A. This is definitely not due to temperature fluctuations. Zero current prestress for bullet gages in quadrant 2 (ch#40) and 3 (during strain gage run to 7400 A , file dsa326.ca014) changed after the the run.

|  | Q2 bullet | Q3 bullet |
|--|-----------|-----------|
| Zero current prestress<br>before strain run to 7400 A= | 570 lb    | 570 lb    |
| Prestress after strain run to 7400 A=                  | 400 lb    | 520 lb    |

Bullets in Q4 (ch#45) show a sudden change in slope (could this be due to coil movement or may be bushing screw/bullet are slipping over each other) at ~3100 A during upramp and downramp. Could this be reason for unstable quenches during second cooldown which have been at different currents?

Tariq....

On the first two cooldowns the end load was set to 500 lbs/bullet. On the third cooldown the load was increased to 4000 lbs/bullet.

Quench File Summary  
DSA326

First Cooldown

| Q# | File   | I-m   | I-dot | I-t | QDC  | MIITS | t-Q    | V-max  | coil | t(H)  | V(H)  | T(b)  | T(m)  | T(b) | P         | LL     | Location             |                           |
|----|--------|-------|-------|-----|------|-------|--------|--------|------|-------|-------|-------|-------|------|-----------|--------|----------------------|---------------------------|
| 1  | -75.   | 0.    | 0.0   | 0.0 | V-di | 0.0   | 0.000  | 0.     | U0   | 0.000 | 0.    | 0.000 | 0.000 | 0.   | 0.        | 0.     | s.c.                 |                           |
| 2  | -85.   | 0.    | 0.0   | 0.0 | Vtot | 0.0   | -0.002 | 7.     | U0   | 0.000 | 0.    | 0.23  | 4.18  | 744. | 73.       | manua  | trip to check        |                           |
| 3  | -3674. | 0.    | 0.0   | 0.0 | Cu L | 0.0   | 0.000  | 0.     | U0   | 0.000 | 0.    | 0.23  | 4.18  | 743. | 73.       | manua  | trip to check        |                           |
| 4  | -3865. | 0.    | 0.0   | 0.0 | Cu L | 0.0   | 0.000  | 0.     | U1   | 0.000 | 0.    | 0.23  | 4.18  | 743. | 73.       | manua  | trip to check        |                           |
| 5  | -4114. | 0.    | 0.0   | 0.0 | Cu L | 0.0   | 0.000  | 0.     | U1   | 0.000 | 0.    | 0.23  | 4.18  | 743. | 73.       | manua  | trip to check        |                           |
| 6  | 1002.  | 0.    | 0.0   | 0.0 | V-di | 0.0   | 0.000  | -8.    | U1   | 0.000 | 0.    | 0.23  | 4.18  | 743. | 72.       | manua  | trip to check        |                           |
| 7  | 1991.  | 0.    | 0.0   | 0.0 | U-L  | 0.0   | 0.000  | -11.   | U1   | 0.000 | 0.    | 0.35  | 4.30  | 834. | 75.       | manua  | trip to check        |                           |
| 8  | 1002.  | 0.    | 0.0   | 0.0 | V-di | 0.0   | 0.000  | -6.    | U1   | 0.000 | 0.    | 0.36  | 4.32  | 845. | 72.       | manua  | trip to check        |                           |
| 9  | 997.   | 0.    | 0.0   | 0.0 | Vtot | 0.0   | -0.003 | -6.    | U1   | 0.000 | 0.    | 0.40  | 4.35  | 874. | 85.       | manua  | trip to check        |                           |
| 1  | 9      | 7343. | 16.   | 0.0 | 0.0  | U-L   | 0.0    | -0.017 | -26. | U1    | 0.000 | 0.    | 0.39  | 4.34 | 867.      | 74.    | TU19SR               | 3.5 ms from Ramp Sp   ice |
| 2  | 10     | 7362. | 16.   | 0.0 | 0.0  | U-L   | 0.0    | -0.014 | -23. | U1    | 0.000 | 0.    | 0.35  | 4.30 | 853.      | 65.    | TU19SR               | 3.5 ms from Ramp Sp   ice |
| 3  | 11     | 7397. | 16.   | 0.0 | 0.0  | U-L   | 0.0    | -0.011 | -26. | U1    | 0.000 | 0.    | 0.40  | 4.35 | 871.      | 69.    | TU19SR               | 3.5 ms from Ramp Sp   ice |
| 4  | 12     | 7392. | 16.   | 0.0 | 0.0  | U-L   | 0.0    | -0.015 | -26. | U1    | 0.000 | 0.    | 0.38  | 4.33 | 867.      | 66.    | TU19SR               | 3.5 ms from Ramp Sp   ice |
| 5  | 13     | 7416. | 16.   | 0.0 | 0.0  | U-L   | 0.0    | -0.019 | -26. | U1    | 0.000 | 0.    | 0.35  | 4.30 | 866.      | 66.    | TU19SR               | 2.6 ms from Ramp Sp   ice |
| 6  | 14     | 7406. | 16.   | 0.0 | 0.0  | U-L   | 0.0    | -0.009 | -24. | U1    | 0.000 | 0.    | 0.37  | 4.32 | 878.      | 67.    | TU19SL               | 4 ms from LE              |
| 7  | 15     | 1007. | 0.    | 0.0 | Vtot | 0.0   | 0.000  | 0.     | U1   | 0.000 | 0.    | 0.20  | 4.15  | 724. | 76.       | Manual | Trip to check system |                           |
| 8  | 17     | 7671. | 16.   | 0.0 | 0.0  | U-L   | 0.0    | -0.008 | -24. | U1    | 0.000 | 0.    | 0.20  | 4.15 | 724.      | 76.    | TU19SL               | 4 ms from LE              |
| 9  | 18     | 7676. | 16.   | 0.0 | 0.0  | U-L   | 0.0    | -0.008 | -24. | U1    | 0.000 | 0.    | 0.20  | 4.15 | 724.      | 59.    | TU19SL               | 7 ms from Ramp Sp   ice   |
| 19 | 20     | -6.   | -2.   | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U0    | 0.000 | 0.    | 0.20  | 4.15 | 724.      | 84.    | 4.20                 | 4.15 4.15 724.            |
| 21 | 22     | -2.   | -2.   | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U0    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 75.    | 4.20                 | 4.15 4.15 723.            |
| 23 | 24     | 1991. | 2025. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U0    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 74.    | 4.20                 | 4.15 4.15 723.            |
| 25 | 26     | 1986. | 1986. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 73.    | 4.20                 | 4.15 4.15 723.            |
| 27 | 28     | 1986. | 1986. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 74.    | 4.20                 | 4.15 4.15 723.            |
| 29 | 30     | 1991. | 1991. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 74.    | 4.20                 | 4.15 4.15 723.            |
| 31 | 32     | 1991. | 1991. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 74.    | 4.20                 | 4.15 4.15 723.            |
| 33 | 34     | 4978. | 4978. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 74.    | 4.20                 | 4.15 4.15 723.            |
| 35 | 36     | 4978. | 4978. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 74.    | 4.20                 | 4.15 4.15 723.            |
| 37 | 38     | 1986. | 1986. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 74.    | 4.20                 | 4.15 4.15 723.            |
| 39 | 40     | 1986. | 1986. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.20  | 4.15 | 723.      | 74.    | 4.20                 | 4.15 4.15 723.            |
| 41 | 42     | 1986. | 4973. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.20  | 4.16 | 724.      | 74.    | 4.20                 | 4.16 4.15 724.            |
| 43 | 44     | 4978. | 4968. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.21  | 4.17 | 716.      | 75.    | 4.21                 | 4.17 4.16 730.            |
| 45 | 46     | 4978. | 4978. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.21  | 4.17 | 4.16 730. | 75.    | 4.21                 | 4.17 4.16 730.            |
| 47 | 47     | 4978. | 4978. | 0.  | 0.0  | 0.0   | 0.0    | 0.000  | 0.   | U1    | 0.000 | 0.    | 0.21  | 4.17 | 4.16 730. | 75.    | 4.21                 | 4.17 4.16 730.            |

| Q# | F1*   | I-m | I-dot | I-t | I-dot | QDC | MIIIs | t-Q | V-max | Coi1 | t(H)  | V(H) | T(b) | T(m) | T(b) | P    | LL  | Location              |
|----|-------|-----|-------|-----|-------|-----|-------|-----|-------|------|-------|------|------|------|------|------|-----|-----------------------|
| 48 | -2.   | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | 1.    | UI   | 0.000 | 0.   | 0.00 | 0.00 | 0.00 | 0.   | 0.  | 0.                    |
| 49 | 1986. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -12.  | UI   | 0.000 | 0.   | 4.21 | 4.17 | 4.16 | 730. | 75. |                       |
| 50 | 1986. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -454  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 76. |                       |
| 51 | 1986. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -12.  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 76. |                       |
| 52 | 1986. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -12.  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 76. |                       |
| 53 | 4973. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -30.  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 76. |                       |
| 54 | 4978. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -30.  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 76. |                       |
| 55 | 4973. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -30.  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 76. |                       |
| 56 | 4973. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -31.  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 76. |                       |
| 57 | 4978. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -31.  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 76. |                       |
| 58 | 4978. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -30.  | UI   | 0.000 | 0.   | 4.23 | 4.19 | 4.19 | 750. | 73. |                       |
| 59 | 1991. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -520  | UI   | 0.000 | 0.   | 4.23 | 4.19 | 4.19 | 750. | 73. |                       |
| 60 | 1991. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -519  | UI   | 0.000 | 0.   | 4.23 | 4.19 | 4.19 | 750. | 73. |                       |
| 61 | 1986. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -521  | UI   | 0.000 | 0.   | 4.23 | 4.19 | 4.19 | 750. | 73. |                       |
| 62 | 4973. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -39.  | UI   | 0.000 | 0.   | 4.23 | 4.19 | 4.19 | 750. | 73. |                       |
| 63 | 4973. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -30.  | UI   | 0.000 | 0.   | 4.22 | 4.18 | 4.18 | 741. | 76. |                       |
| 64 | 4978. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -30.  | UI   | 0.000 | 0.   | 4.22 | 4.18 | 4.18 | 741. | 76. |                       |
| 65 | 1986. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -245  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 77. |                       |
| 66 | 1986. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -950  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 77. |                       |
| 67 | 1986. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -923  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 77. |                       |
| 68 | 1991. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -923  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 77. |                       |
| 69 | 1986. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -919  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 77. |                       |
| 70 | 4978. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -967  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 77. |                       |
| 71 | 4973. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -969  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 77. |                       |
| 72 | 4983. | 0.  | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -965  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 725. | 77. |                       |
| 73 | 7648. | 16. | 0.0   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 | -24.  | UI   | 0.000 | 0.   | 4.20 | 4.16 | 4.15 | 724. | 74. | IU19SL 4.5 ms from LE |

Quench File Summary

DSA326

Second Cooldown

| Q# | File  | I-m   | I-dot | I-t | QDC | Watts | t-Q    | V-max  | Coil | t(H) | V(H) | LL  | Location | trip to check safet | ckt           |     |
|----|-------|-------|-------|-----|-----|-------|--------|--------|------|------|------|-----|----------|---------------------|---------------|-----|
| 74 | 997.  | 0.    | 0.    | 0.  | 0.  | 0.    | 0.     | 0.     | 0.   | 0.   | 0.   | 73. | IU19SR   | -3.5 ms from Ramp   | Splic         |     |
| 75 | 7465. | 16.   | 0.    | 0.  | 0.  | 0.    | -0.11  | -8.    | 0.   | 0.   | 0.   | 83. | IU19SL   | -3 ms from LE       | tap           |     |
| 76 | 7333. | 16.   | 0.    | 0.  | 0.  | 0.    | -0.008 | -27.   | 0.   | 0.   | 0.   | 87. | IU19SL   | -3 ms from LE       | tap           |     |
| 11 | 7426. | 16.   | 0.    | 0.  | 0.  | 0.    | -0.008 | -21.   | 0.   | 0.   | 0.   | 77. | IU19SL   | -3 ms from LE       | tap           |     |
| 12 | 7408. | 16.   | 0.    | 0.  | 0.  | 0.    | -0.012 | -28.   | 0.   | 0.   | 0.   | 58. | IU19SR   | -3.5 ms from Ramp   | Sp            |     |
| 13 | 7441. | 16.   | 0.    | 0.  | 0.  | 0.    | -0.010 | -24.   | 0.   | 0.   | 0.   | 70. | IU19SR   | -4.5 ms from Ramp   | Sp            |     |
| 14 | 79.   | 7392. | 16.   | 0.  | 0.  | 0.    | -0.010 | -25.   | 0.   | 0.   | 0.   | 76. | IU19SL   | -3.5 ms from LE     | tap           |     |
| 15 | 80.   | 7397. | 16.   | 0.  | 0.  | 0.    | -0.010 | -26.   | 0.   | 0.   | 0.   | 77. | IU19SR   | -3 ms from Ramp     | Sp            |     |
| 16 | 81.   | 7460. | 16.   | 0.  | 0.  | 0.    | -0.011 | -26.   | 0.   | 0.   | 0.   | 68. | IU19SL   | -2.5 ms from LE     | tap           |     |
| 17 | 82.   | 7402. | 16.   | 0.  | 0.  | 0.    | -0.010 | -25.   | 0.   | 0.   | 0.   | 56. | IU19SR   | -3 ms from Ramp     | Sp            |     |
| 18 | 83.   | 7441. | 16.   | 0.  | 0.  | 0.    | -0.011 | -26.   | 0.   | 0.   | 0.   | 74. | IU19SR   | -3 ms from Ramp     | Sp            |     |
| 19 | 84.   | 7397. | 16.   | 0.  | 0.  | 0.    | -0.011 | -26.   | 0.   | 0.   | 0.   | 70. | IU19SL   | -3.5 ms from LE     | tap           |     |
| 20 | 85.   | 7421. | 6.    | 0.  | 0.  | 0.    | -0.011 | -27.   | 0.   | 0.   | 0.   | 73. | IU19SL   | -3 ms from LE       | tap           |     |
| 21 | 86.   | 7421. | 16.   | 0.  | 0.  | 0.    | -0.011 | -27.   | 0.   | 0.   | 0.   | 70. | IU19SL   | -3 ms from LE       | tap           |     |
| 22 | 87.   | 7372. | 25.   | 0.  | 0.  | 0.    | -0.007 | -19.   | 0.   | 0.   | 0.   | 78. | IU19SL   | -3 ms from LE       | tap           |     |
| 23 | 88.   | 7328. | 50.   | 0.  | 0.  | 0.    | -0.006 | -21.   | 0.   | 0.   | 0.   | 72. | IU19SL   | -3 ms from LE       | tap           |     |
| 24 | 89.   | 7044. | 100.  | 0.  | 0.  | 0.    | -0.007 | -21.   | 0.   | 0.   | 0.   | 80. | IU19SL   | -3 ms from LE       | tap           |     |
| 25 | 90.   | 6936. | 150.  | 0.  | 0.  | 0.    | -0.007 | -22.   | 0.   | 0.   | 0.   | 70. | IU19SL   | -3 ms from LE       | tap           |     |
| 26 | 91.   | 6770. | 200.  | 0.  | 0.  | 0.    | -0.007 | -23.   | 0.   | 0.   | 0.   | 80. | IU19SL   | -3 ms from LE       | tap           |     |
| 27 | 92.   | 6594. | 300.  | 0.  | 0.  | 0.    | -0.013 | -25.   | 0.   | 0.   | 0.   | 71. | IU19SL   | -3 ms from LE       | tap           |     |
| 28 | 93.   | 6687. | 250.  | 0.  | 0.  | 0.    | -0.007 | -24.   | 0.   | 0.   | 0.   | 72. | IU19SL   | -3 ms from LE       | tap           |     |
| 29 |       |       |       |     |     |       |        |        |      |      |      |     |          |                     |               |     |
| 30 |       |       |       |     |     |       |        |        |      |      |      |     |          |                     |               |     |
| 31 | 94.   | 7460. | 16.   | 0.  | 0.  | 0.    | 0.     | -0.008 | -22. | 0.   | 0.   | 0.  | 75.      | K QUENCHES          |               |     |
| 32 | 95.   | 7519. | 16.   | 0.  | 0.  | 0.    | 0.     | -0.011 | -23. | 0.   | 0.   | 0.  | 66.      | IU19SL              | -3 ms from LE | tap |
| 33 | 96.   | 7500. | 16.   | 0.  | 0.  | 0.    | -0.009 | -23.   | 0.   | 0.   | 0.   | 73. | IU19SL   | -3 ms from LE       | tap           |     |
| 34 | 97.   | 7534. | 16.   | 0.  | 0.  | 0.    | -0.011 | -24.   | 0.   | 0.   | 0.   | 73. | IU19SL   | -3 ms from LE       | tap           |     |
| 35 | 98.   | 7661. | 16.   | 0.  | 0.  | 0.    | -0.007 | -23.   | 0.   | 0.   | 0.   | 69. | IU19SL   | -3 ms from LE       | tap           |     |
| 36 | 99.   | 7676. | 16.   | 0.  | 0.  | 0.    | -0.007 | -23.   | 0.   | 0.   | 0.   | 73. | IU19SL   | -3 ms from LE       | tap           |     |
| 37 | 100.  | 7568. | 16.   | 0.  | 0.  | 0.    | -0.010 | -23.   | 0.   | 0.   | 0.   | 80. | IU19SL   | -3 ms from LE       | tap           |     |
| 38 | 101.  | 7671. | 16.   | 0.  | 0.  | 0.    | -0.011 | -24.   | 0.   | 0.   | 0.   | 84. | IU19SL   | -3 ms from LE       | tap           |     |
| 39 | 102.  | 7661. | 16.   | 0.  | 0.  | 0.    | -0.008 | -23.   | 0.   | 0.   | 0.   | 77. | IU19SL   | -3 ms from LE       | tap           |     |
| 40 | 103.  | 7612. | 16.   | 0.  | 0.  | 0.    | -0.006 | -24.   | 0.   | 0.   | 0.   | 73. | IU19SL   | -3 ms from LE       | tap           |     |
| 41 | 104.  | 7930. | 16.   | 0.  | 0.  | 0.    | 0.     | -0.013 | -23. | 0.   | 0.   | 0.  | 92.      | K QUENCHES          |               |     |
| 42 | 105.  | 8121. | 16.   | 0.  | 0.  | 0.    | -0.005 | -22.   | 0.   | 0.   | 0.   | 82. | IU19SL   | -3 ms from LE       | tap           |     |
| 43 | 106.  | 8136. | 16.   | 0.  | 0.  | 0.    | -0.005 | -22.   | 0.   | 0.   | 0.   | 70. | IU19SL   | -3 ms from LE       | tap           |     |
| 44 | 107.  | 8121. | 16.   | 0.  | 0.  | 0.    | -0.007 | -22.   | 0.   | 0.   | 0.   | 70. | IU19SL   | -3 ms from LE       | tap           |     |
| 45 | 108.  | 8126. | 16.   | 0.  | 0.  | 0.    | -0.005 | -23.   | 0.   | 0.   | 0.   | 79. | IU19SL   | -3 ms from LE       | tap           |     |

Quench File Summary  
DSA326

| Third Cooldown |      |           |      |     |       |     |       |     |        |      |      |      |      |      |      |      |          |  |
|----------------|------|-----------|------|-----|-------|-----|-------|-----|--------|------|------|------|------|------|------|------|----------|--|
| Q#             | File | I-m       | Idot | I-t | I-dot | QDC | MIIIs | b-Q | V-max  | Coil | t(H) | V(H) | T(b) | T(m) | P    | LL   | Location |  |
| 45             | 109  | 1002.     | 0.   | 0.  | 0.    | 0.  | 0.    | 0.  | 0.     | 0.   | 0.   | 0.   | 4.39 | 4.34 | 858. | 76.  |          |  |
| 46             | 110  | 1002.     | 0.   | 0.  | 0.    | 0.  | 0.    | 0.  | 0.     | 0.   | 0.   | 0.   | 4.37 | 4.32 | 844. | 74.  |          |  |
| 47             | 111  | 7441.     | 0.   | 0.  | 0.    | 0.  | 0.    | 0.  | 0.     | 0.   | 0.   | 0.   | 4.42 | 4.36 | 878. | 74.  |          |  |
| 48             | 112  | 7387.     | 16.  | 0.  | 0.    | 0.  | 0.    | 0.  | 0.     | 0.   | 0.   | 0.   | 4.41 | 4.36 | 877. | 58.  |          |  |
| 49             | 113  | 7421.     | 16.  | 0.  | 0.    | 0.  | 0.    | 0.  | 0.     | 0.   | 0.   | 0.   | 4.40 | 4.34 | 861. | 76.  |          |  |
| 50             | 114  | 7392.     | 16.  | 0.  | 0.    | 0.  | 0.    | 0.  | 0.     | 0.   | 0.   | 0.   | 4.40 | 4.35 | 871. | 79.  |          |  |
| 51             | 115  | 7397.     | 16.  | 0.  | 0.    | 0.  | 0.    | 0.  | 0.     | 0.   | 0.   | 0.   | 4.37 | 4.32 | 847. | 67.  |          |  |
| 52             | 116  | 7387.     | 16.  | 0.  | 0.    | 0.  | 0.    | 0.  | 0.     | 0.   | 0.   | 0.   | 4.39 | 4.33 | 855. | 70.  |          |  |
|                |      | DATA_LOST |      |     |       |     |       |     |        |      |      |      |      |      |      |      |          |  |
| 53             | 117  | 7656.     | 16.  | 0.  | 0.    | 0.  | 0.    | 0.  | -0.010 | -24. | 0.   | 0.   | 0.   | 4.21 | 4.16 | 726. | 73.      |  |
| 54             | 118  | 8092.     | 16.  | 0.  | 0.    | 0.  | 0.    | 0.  | -0.005 | -22. | 0.   | 0.   | 0.   | 3.84 | 3.80 | 499. | 87.      |  |
| 55             | 119  | 8121.     | 16.  | 0.  | 0.    | 0.  | 0.    | 0.  | -0.006 | -22. | 0.   | 0.   | 0.   | 3.85 | 3.81 | 505. | 88.      |  |
| 56             | 120  | 8102.     | 16.  | 0.  | 0.    | 0.  | 0.    | 0.  | -0.005 | -22. | 0.   | 0.   | 0.   | 3.84 | 3.81 | 503. | 81.      |  |
| 57             | 121  | 5355.     | 0.   | 0.  | 0.    | 0.  | 0.    | 0.  | -0.001 | 0.   | 0.   | 0.   | 0.   | 3.84 | 3.80 | 503. | 94.      |  |

## FORMAT:

NOTATION KEY

|   |   |
|---|---|
| Quench number or Spot heater number (e.g. s4 is spot heater 4)                                  |   |
| Quench file number  |   |
| Main coil current at quench   |   |
| Main coil dI/dt at quench   |   |
| Trim coil current at quench   |   |
| Trim coil dI/dt at quench   |   |
| Name of quench detection circuit which tripped:   |   |
| 1) U-L Upper - Lower Coil   |   |
| 2) V-dI Magnet - Idot   |   |
| 3) SC L SC Pwr Leads - Idot   |   |
| 4) Vtot Magnet  |   |
| 5) Trim Trim Coil   |   |
| 6) Cu L Cu Pwr Leads - IR   |   |
| 7) Gnd Ground Fault Monitor   |   |
| 8) Thru Through Bus - Idot  |   |
| LIMITS  | Integral of $(I^{**2})dt$ from t-Q to "infinity"                                      |
| T-t-Q   | Time first voltage appears in V(Upper) - V(Lower) (relative to quench detection time) |
| V-vmax  | Maximum voltage across any quarter coil   |
| Coil  | Coil corresponding to V-max   |
| Protection heater firing time (relative to quench detection time); -.999 if heater did not fire | Protection heater firing voltage; -999. if heater did not fire                        |
| Temperature at top of magnet  | Temperature at middle of magnet   |
| Temperature at bottom of magnet   | Temperature at bottom of magnet   |
| Dewar pressure (Torr)   |   |
| Liquid level (%)  |   |
| Quench or spot heater location  |   |

# DSA326 Quench History

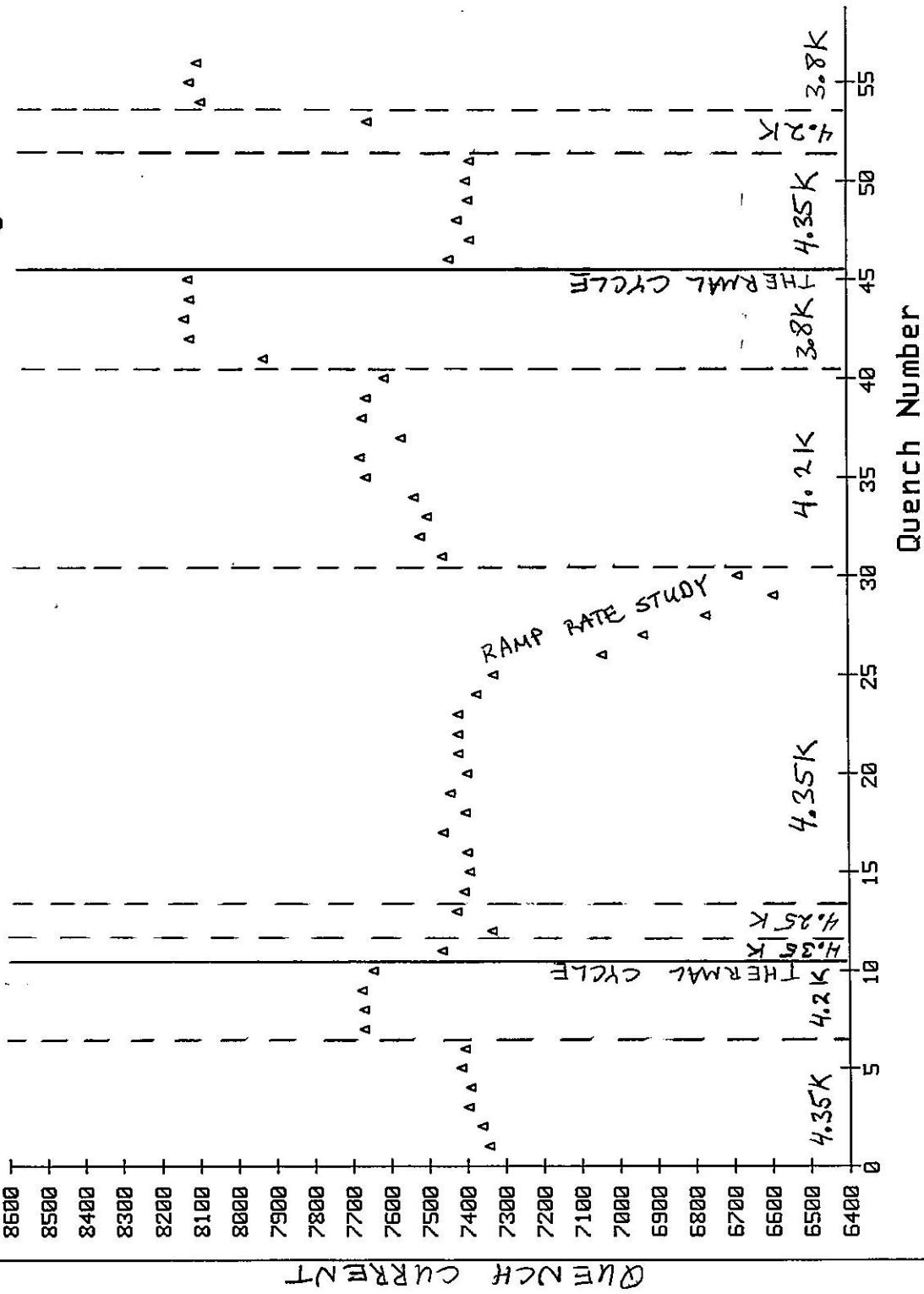


Figure 1

# DSA326 Quench History: $I_q$ vs T

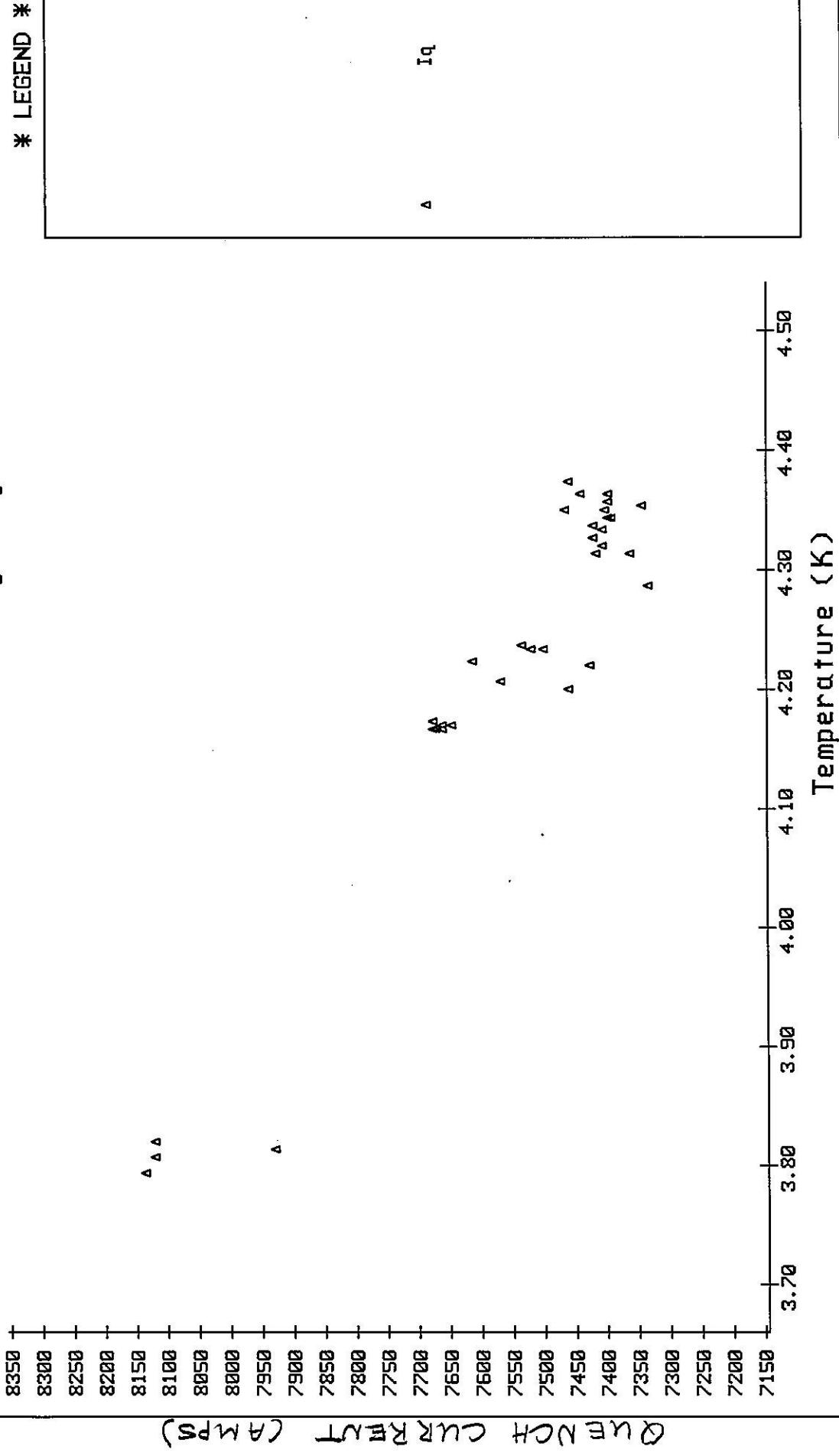


Figure 2

Figure 3

