

Location of Low Current Quenches
in DCA313 and DCA314

The first quench in each of DCA313 and DCA314 was at an "anomalously" low current, 4930 A and 5525 A respectively. The quenches occur at essentially the same location in both cases, and determination of this location relative to mechanical features of the coil is important (although there is little chance to change anything on the GD magnets at this late stage).

Figures 1 and 2 show the voltage traces for the earliest three voltage tap segments to go normal. In each case, the upper figure (a) shows the three signals directly on a common scale. In the lower figure (b) the two segments used for detailed location determination are shown on an expanded vertical scale and the "upper-lower" signal is shown for the straight section. The quench originals in the segment 18A-19D which includes the lead end one turn from the splice and the pole turn straight section on the non-splice side. Tap 18B, which divides the end from the straight section, is broken in DCA313. Although this tap is intact in DCA314, the parameter files were not properly updated between the two magnets, so only the one signal is recorded. Because the data logger was set up to optimize the location of high current quenches, data recording does not begin until some time after the quench begins. For these reasons the location within the quenching section can best be determined from the location at which it first appears in the adjacent turn: segments 17A-17B (lead end) and 17B-18D (straight section). These two segments go normal at almost the same times, indicating an origin near tap 17B. In both cases 17A-17B goes normal first, by 2 ± 0.5 msec in DCA313 and 3 ± 0.5 msec in DCA314.

The quench velocity can be determined from the known length [1] of 250 mm of the 17A-17B segment and the sum of the propagation times to the two ends. (The arrival time at tap 17A is determined from the break in the slope of the (17A-17B) signal near $t=0$.) Because the voltage traces are quite linear, a constant quench velocity is a good assumption. A $\pm 20\%$ uncertainty has been arbitrarily applied to the velocity estimates. The deduced velocities are 8.6 ± 1.7 mm/msec in DCA313 and 11.4 ± 2.3 mm/msec in DCA314. Figure 3 shows the locations of the voltage taps at the lead end. Tap 17B is 102 mm from the end of the straight section and 25 mm from the end of the G10 pole key, which is also the boundary between the end clamp and the collared portion. Table I gives the distance of the quench origins from several features. The error on the distance from tap 17B comes from the uncertainties in the time delays for the quench to reach the tap and the quench velocity added in quadrature. The errors on the distances from the end of the straight section and from the end clamp-collar boundary have been increased by 5 mm to account for mechanical tolerances. No contribution to the error has been included for uncertainties resulting from the use of information from the turn adjacent to the quenching turn. The quench locations, with the smaller error bars, are indicated in Figure 3. Both quenches are consistent with being at the end clamp boundary and are definitely away from the curved part of the end.

REFERENCE

- [1] J. Strait, Location of turn-to-turn short in DCA318, TS-SSC 91-234, 12/4/91.

Table I

	DCA313	DCA314
Distance from 17B towards end	17±5 mm	34±9 mm
Distance from end of straight section	85±10 mm	68±14 mm
Distance into the end clamp	-9±10 mm	8±14 mm

Distribution:

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M.J. Lamm
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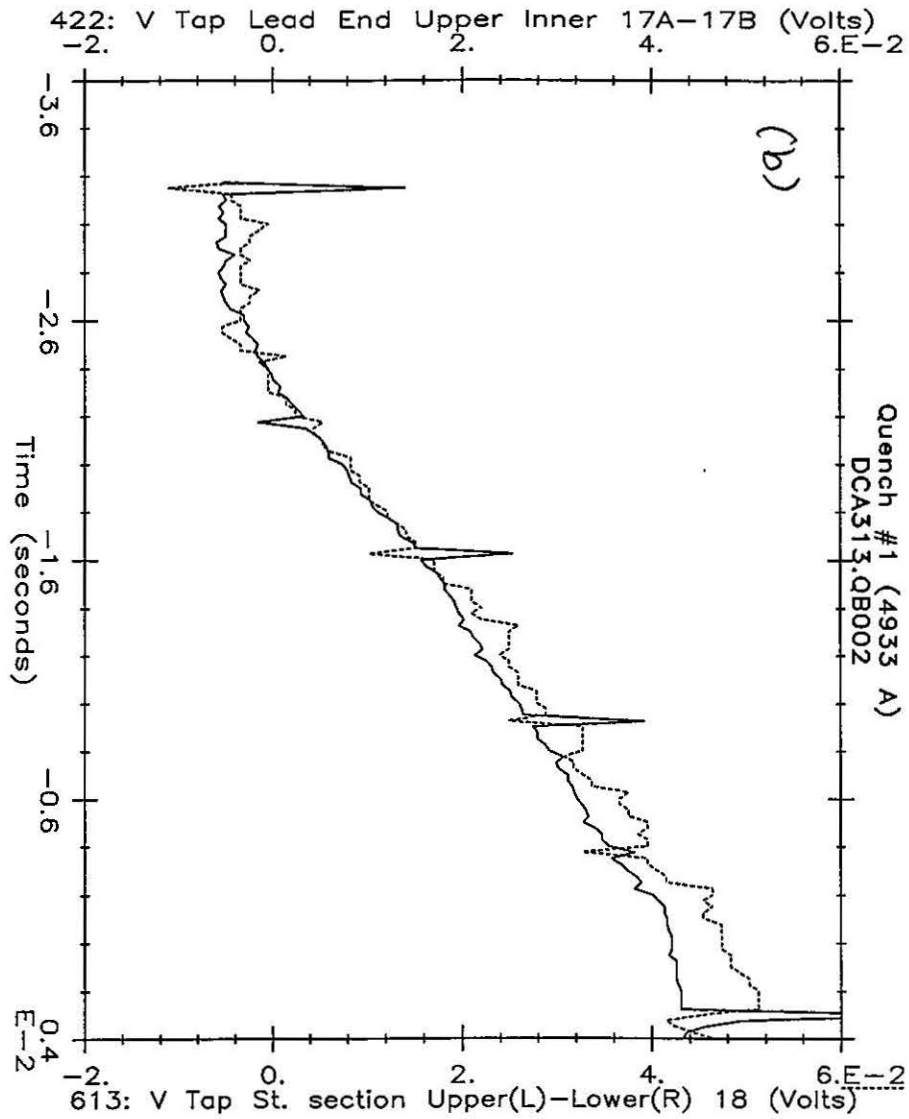
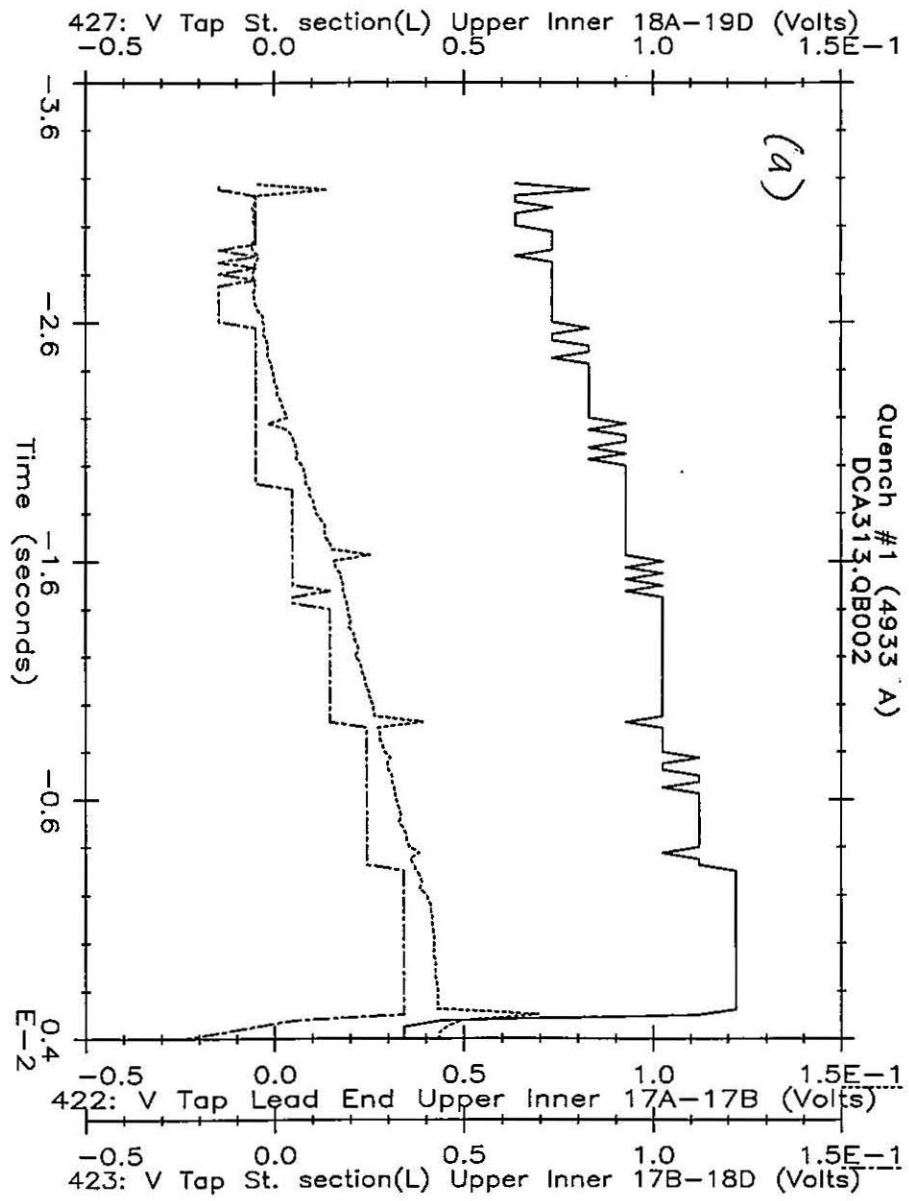


Figure 1

Handwritten mark resembling a stylized 'K' or 'R'.

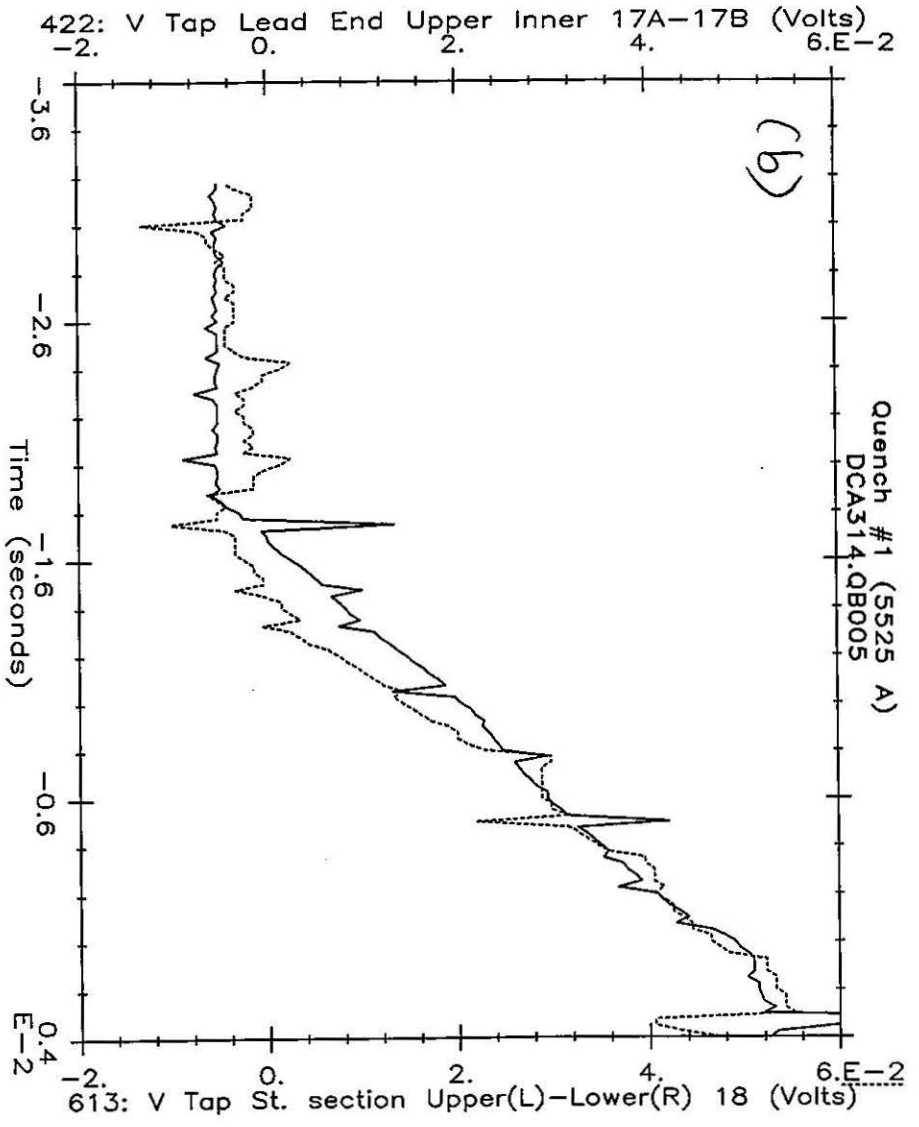
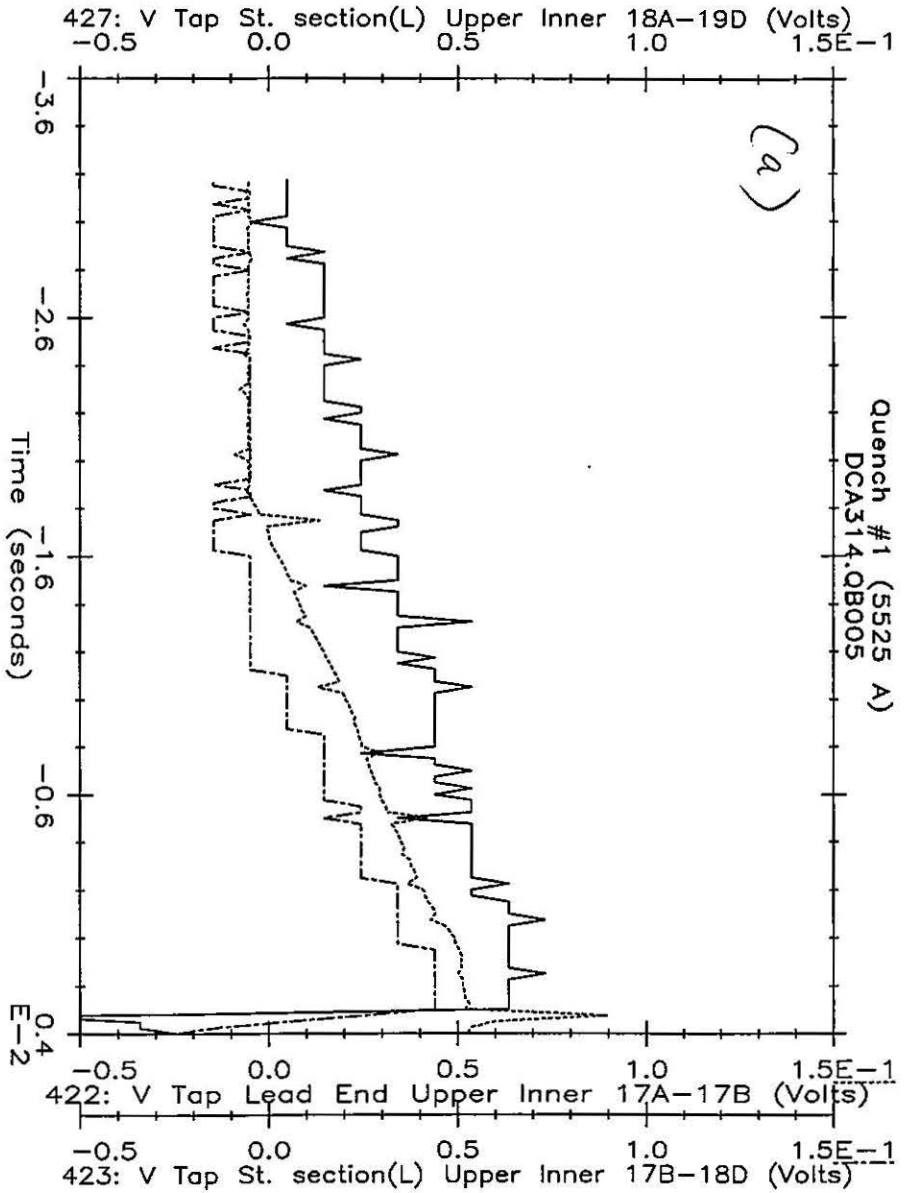


Figure 2