

**TEST RESULTS OF DSA326 AND
DSA101, 50 mm, APERTURE, 1.5 m
LONG MODEL DIPOLES**

TARIQ JAFFERY

FERMI NATIONAL ACCELERATOR LABORATORY

MSI MEETING AT FNAL, 29 OCTOBER 1991

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EXECUTIVE SUMMARY FOR TARIQ JAFFERY 10/28/91(MSIM AT FERMILAB)

**TITLE: TEST RESULTS OF DSA326 AND DSA101, 50 mm APERTURE,
1.5 m LONG MODEL DIPOLES**

-DSA326 IS THE FOURTH FERMILAB 50 mm APERTURE, 1.5 METER LONG MODEL DIPOLE THAT HAS BEEN COLD TESTED AT FERMILAB . THIS MAGNET HAS GONE THROUGH THREE THERMAL CYCLES. DURING THE FIRST TWO COOLDOENS THE QUENCHES WERE ERRATIC AND SHOWED SOME TRAINING . DURING THIRD COOLDOWN THE MAGNET PLATEAUED ABOVE THE PREDICTED CURRENT AT EACH TEMPERATURE (i.e. 4.2, 4.3 AND 3.8 K) . ALL PLATEAU QUENCHES WERE IN THE UPPER INNER COIL POLE TURN (TURN 19 STRAIGHT SECTION) EITHER ON RAMP SPLICE SIDE OR NON RAMP SPLICE SIDE OF THE COIL . WHEREAS ALL, BUT ONE QUENCH IN THIRD COOLDOWN, WERE ON THE RAMP SPLICE SIDE OF THE COIL (STILL UPPER INNER POLE TURN STRAIGHT SECTION).

PLATEAU CURRENTS :

# quenches	10 Qs	34 Qs	10 Q'S	
TEMP (K)	TC1	TC2	TC3	
4.2	7673 A	7586 A	7656A	DSA326
4.35	7386A	7412 A	7404 A	
3.8		8087 A	8105 A	
4.2	7783 A			DSA101
4.35	7568 A			
3.8				

quenches 12 Qs

- ON THE THIRD COOLDOWN THE END PRELOAD WAS INCREASED FROM 250 LBS (<30 in-lb torque) TO 4000 LBS (~37 ft-lb torque)PER BULLET. THE LEAD END SCREWS WERE ALSO TORQUED TO ~37 ft-lb/screw . THERE IS NO OBVIOUS CHANGE IN QUENCH PLATEAU CURRENT DUE TO INCREASE IN END PRELOAD .

- DSA101 SHOWED VERY LITTLE TRAINING AT 4.35 K AND 4.2 K AND PLATEAUED ABOVE THE PREDICTED QUENCH CURRENT. PLATEAU QUENCHES ARE IN LOWER INNER COIL POLE TURN (TURN 19 STRAIGHT SECTION) ON RAMP SPLICE SIDE OF THE COIL .

- THE END PRELOAD ON DSA101 WAS 500 LBS PER BULLET .

-DSA101 HAS BEEN WARMED UP AND A SECOND COOLDOWN WILL START ON 10/30/91

THE QUENCH PROPAGATION VELOCITY, FOR BOTH MAGNETS, DURING A PLATEAU QUENCH (AT 16 A/S) IS ~85 m/s IN THE STRAIGHT SECTION OF THE HIGHEST FIELD REGION (POLE TURNS) . WHEREAS IN THE RAMP SPLICE THE QUENCH VELOCITY CAN BECOME AS SMALL AS ~33 m/s . ALL THE STANDARD PLATEAU QUENCHES WERE IN THE POLE TURN AND THE MAGNET PLATEAUED WELL ABOVE THE SSC OPERATING MARGIN .

**TEST RESULTS OF DSA326 AND
DSA101, 50 mm APERTURE, 1.5 m
LONG MODEL DIPOLES**

I. INTRODUCTION

II. MECHANICAL BEHAVIOR

III. QUENCH BEHAVIOR

IV. HARMONICS

DSA326

DSA101

ALUMINUM END CLAMPS
WITH AZIMUTHAL G10CR

S.S. END CLAMPS
WITH AZIMUTHAL G10CR
(LIKE DSA321)

8 HEATERS

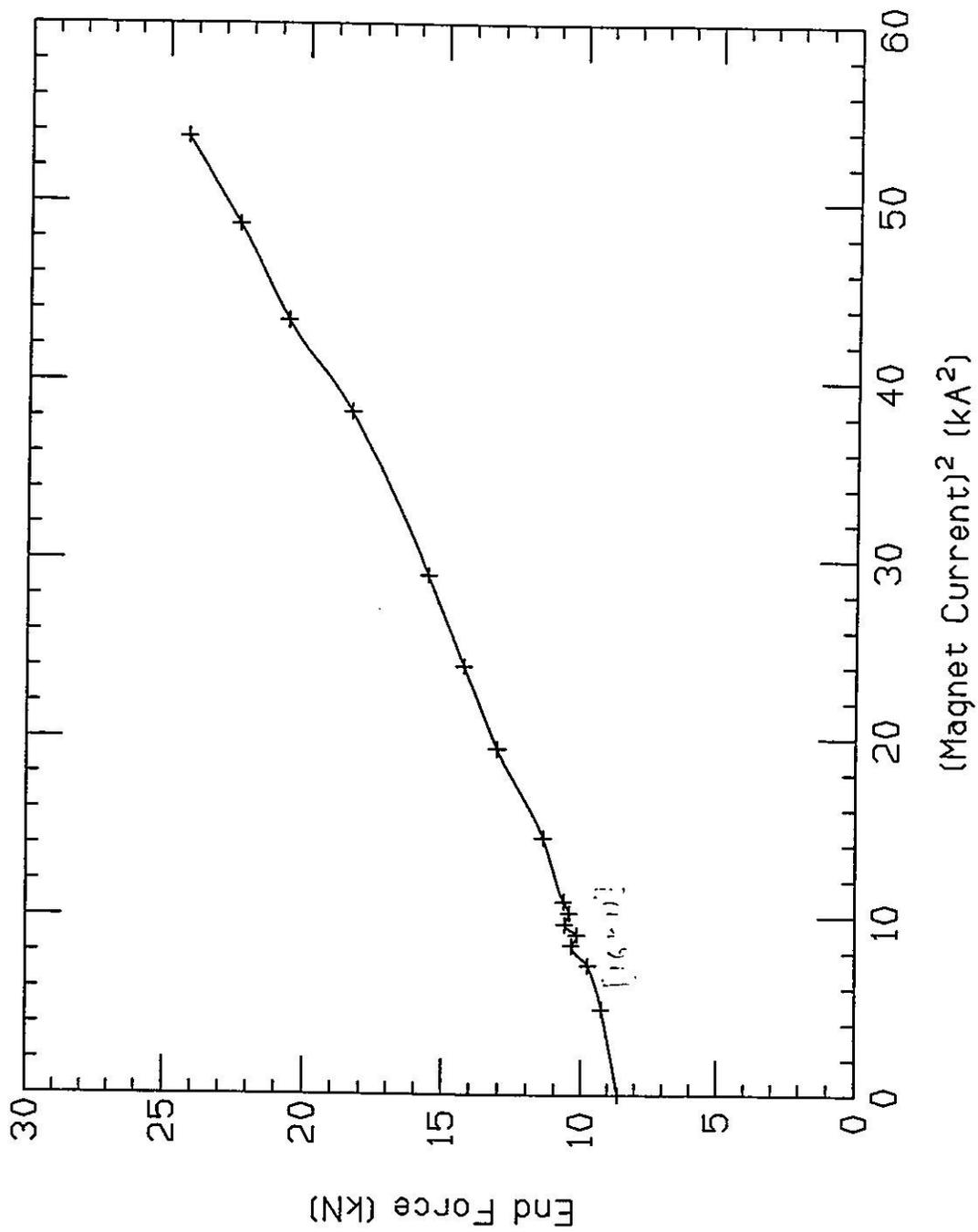
NO HEATERS

- DIFFERENT COIL PRESTRESS
- BOTH HAVE VERTICALLY SPLIT YOKE
- DSA101 IS FIRST SSC BUILT MODEL MAGNET
- DSA326 IS FOURTH FERMILAB, 1.5m MODEL, COLD TESTED
IN LAB2
- DSA326 HAS NO SHIMS (LIKE DSA323)
- HIGH MANGANESE STEEL "FILLER " LAMINATIONS IN END
REGIONS TO PREVENT THERMAL STRESSES IN SHELL

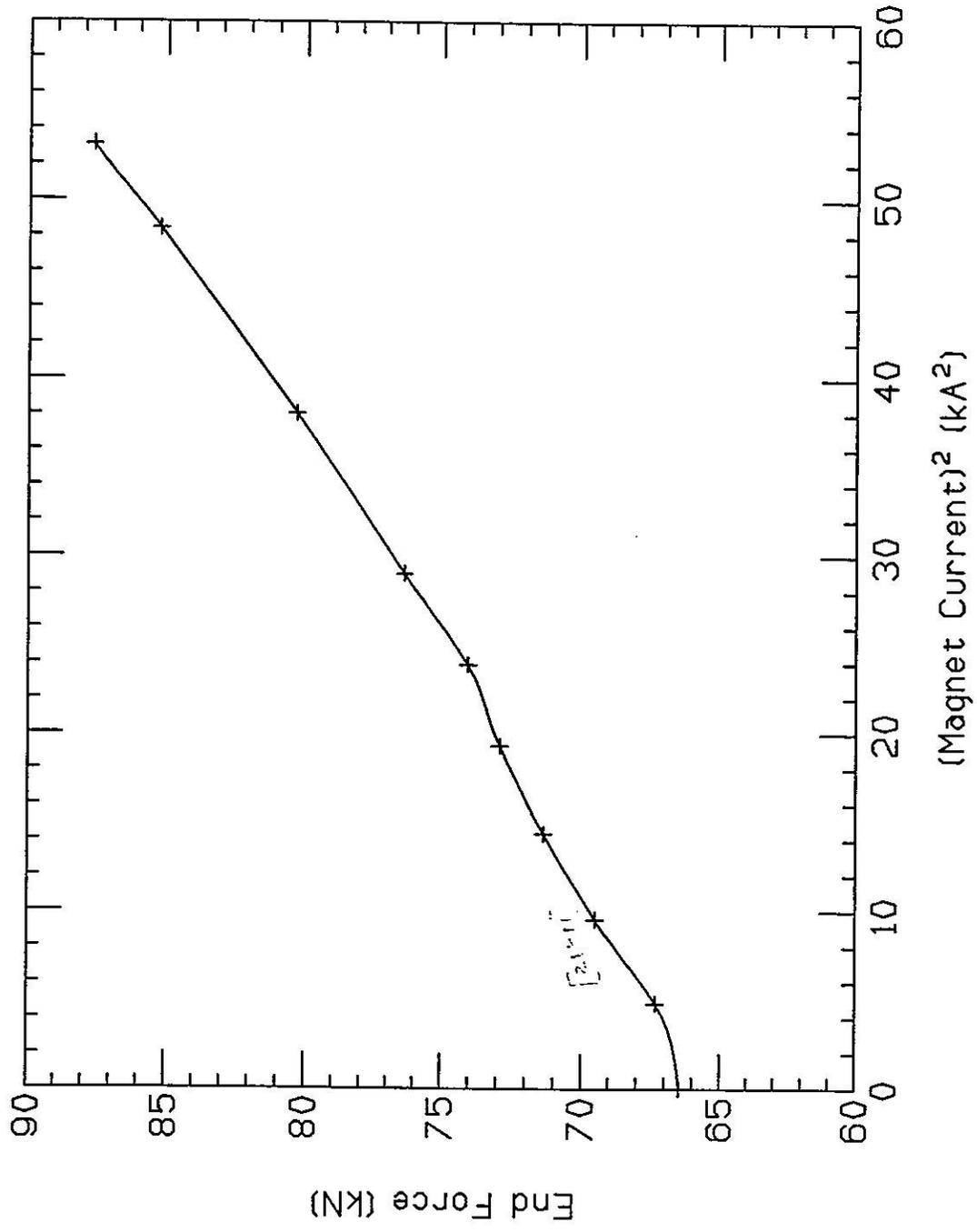
PRESTRESS CHANGE WITH COOLDOWN
1.5 m Long , 50 mm Aperture
SSC Model Dipoles at Fermilab

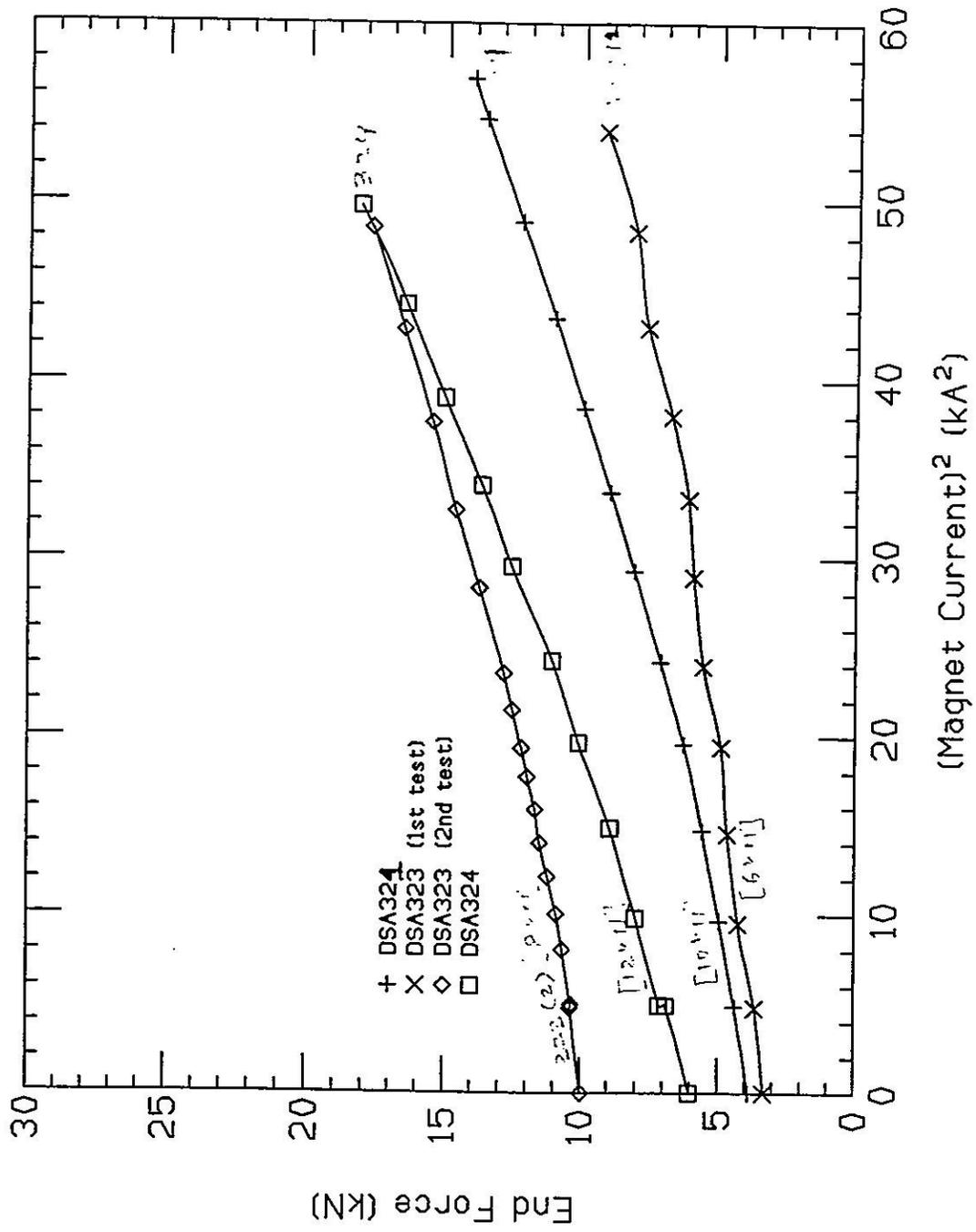
Magnet	Coil Stress Change (MPa)		End Force Change (kN)
	Inner Coil	Outer Coil	
DSA321	-19	-14	-1
DSA323	-30	-10	0
DSA324	-33	-8	1
DSA326 _(TC1)	-34	-25	4.8
DSA326 _(TC2)	-37	-23	5
DSA326 _(TC3)	-36	-22	-2.5
DSA101 _(TC1)	-35	-22	

DSA326 THERMAL CYCLE 2



DSA326 THERMAL CYCLE 3





THREE THERMAL CYCLES ON DSA326
COOLDOWNS 1 & 2- ERRATIC QUENCHES - SHOWED SOME TRAINING .
THIRD COOLDOWN - MAGNET PLATEAUED ABOVE THE PREDICTED
CURRENT AT 4.2, 4.3 AND 3.8 K . PLATEAU QUENCHES IN THE UI
COIL POLE TURN (TURN 19 STRAIGHT SECTION) .
ALL, BUT ONE QUENCH IN THIRD COOLDOWN, WERE ON THE RAMP
SPLICE SIDE OF THE COIL

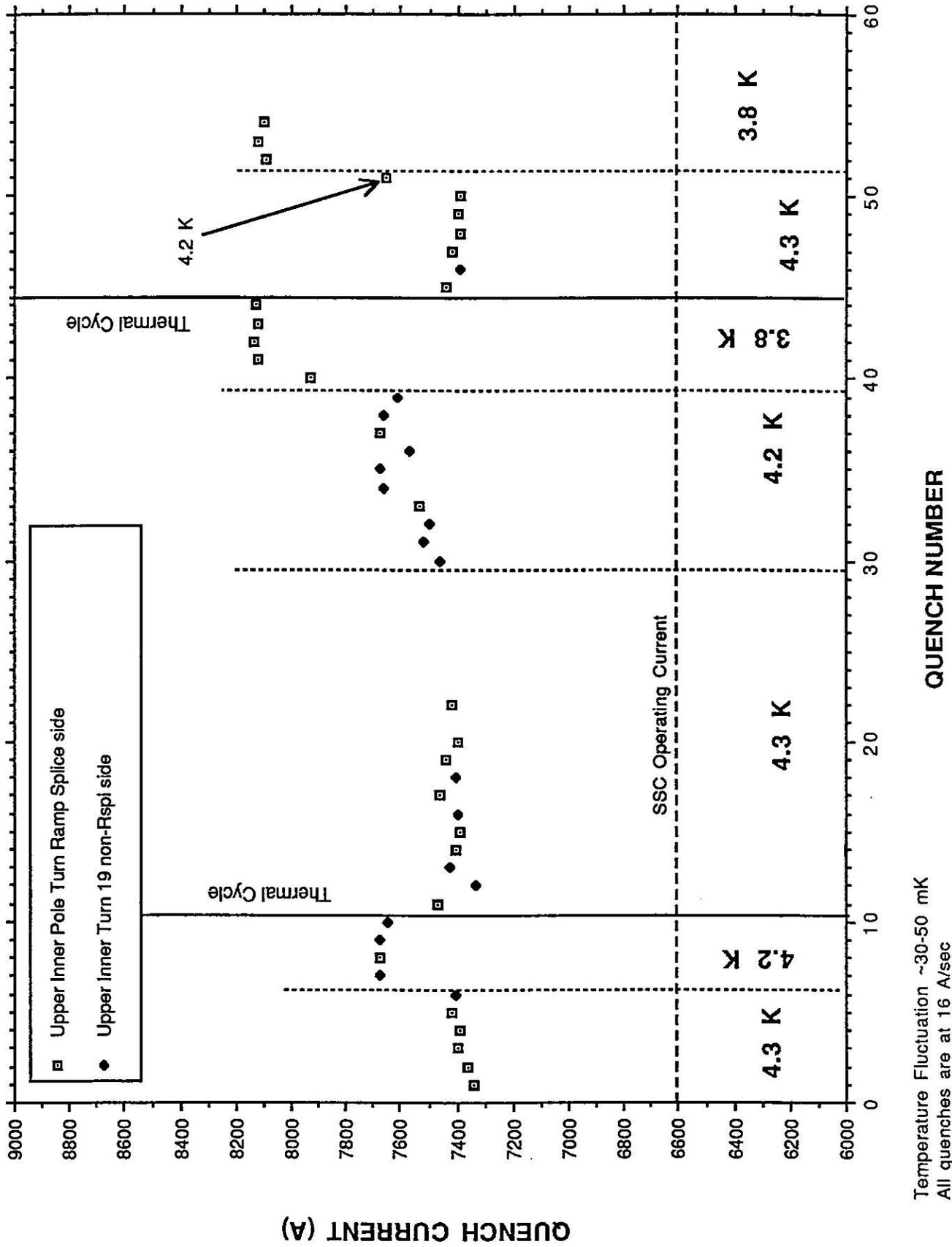
THIRD COOLDOWN -INCREASED END PRELOAD FROM 250 LBS TO
4000 LBS PER BULLET. THE LEAD END SCREWS WERE ALSO
TORQUED TO ~37 ft-lb/screw . THERE IS NO OBVIOUS CHANGE IN
QUENCH PLATEAU CURRENT DUE TO INCREASED END PRELOAD .

- DSA101 SHOWED VERY LITTLE TRAINING AT 4.35 K AND 4.2 K
AND PLATEAUED ABOVE THE PREDICTED QUENCH CURRENT.
PLATEAU QUENCHES ARE IN LOWER INNER COIL POLE TURN (TURN
19 STRAIGHT SECTION) ON RAMP SPLICE SIDE OF THE COIL .

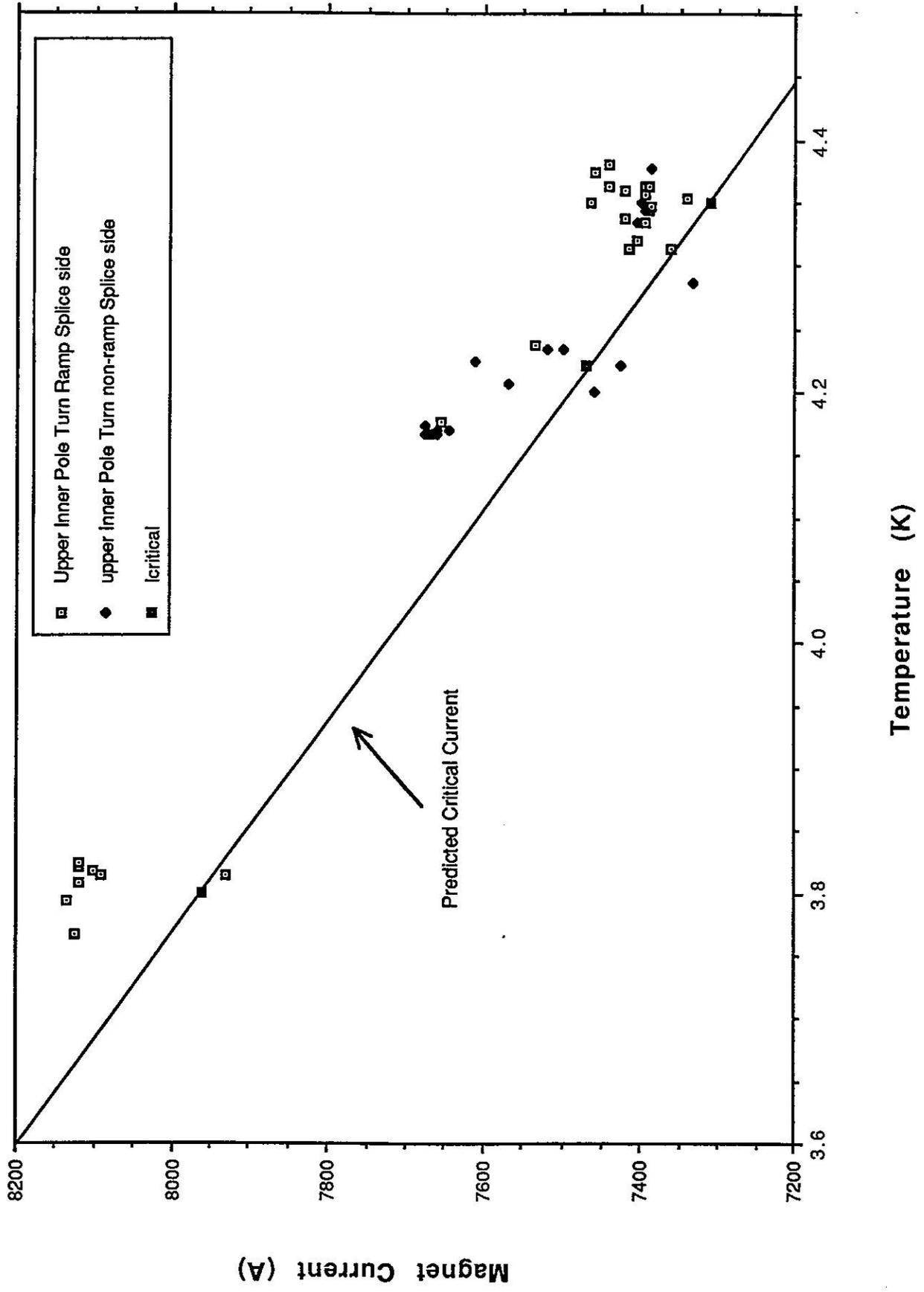
- THE END PRELOAD ON DSA101 WAS 500 LBS PER BULLET .
-DSA101 HAS BEEN WARMED UP AND A SECOND COOLDOWN WILL
START ON ~10/30/91

**BOTH MAGNETS-ALL THE STANDARD PLATEAU QUENCHES WERE IN
THE POLE TURN AND THE MAGNETS PLATEAUED WELL ABOVE THE
SSC OPERATING MARGIN .**

DSA326 QUENCH HISTORY (Fermilab built 50 mm aperture, 1.5 m long SSC dipole)

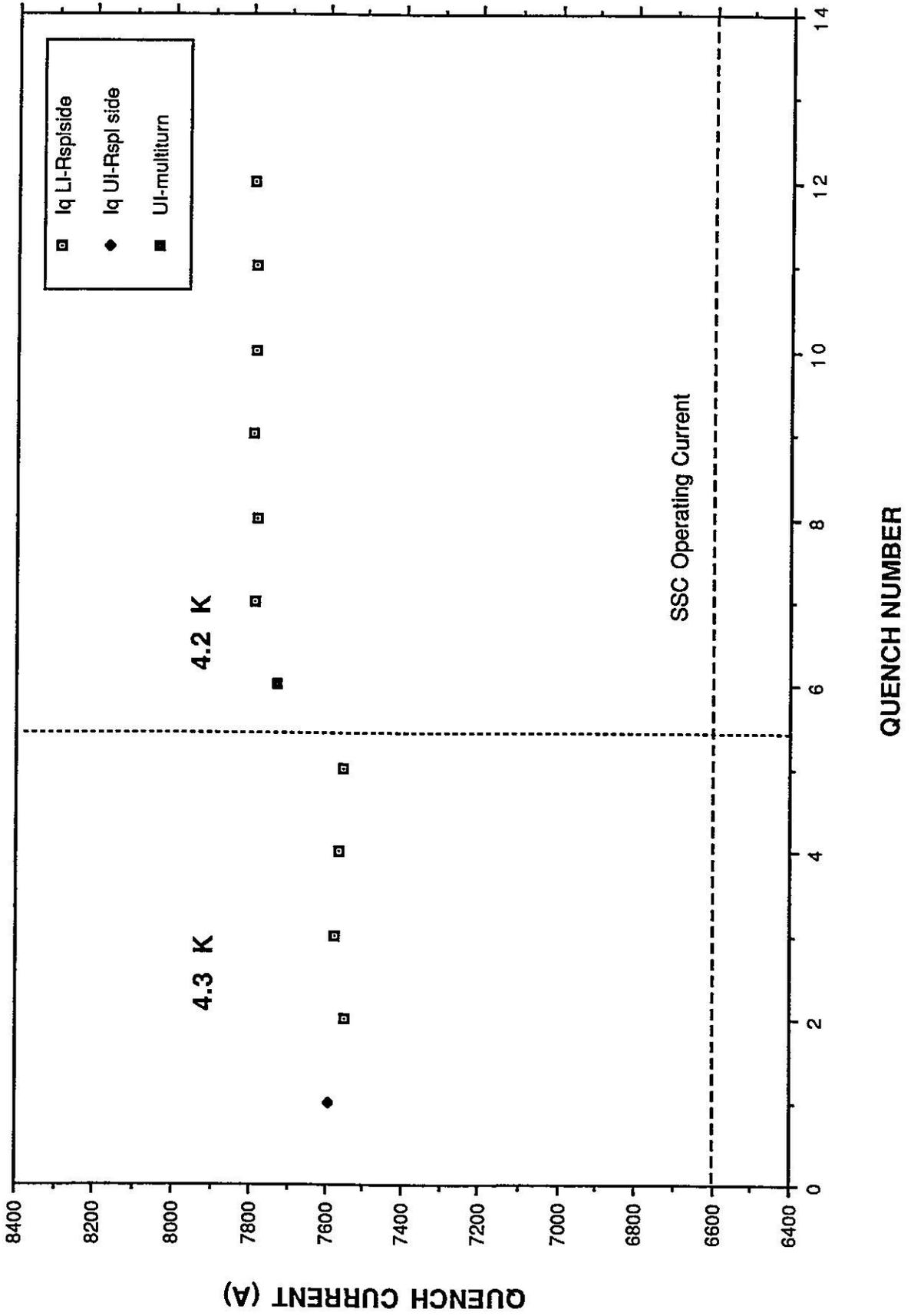


DSA326 Quench Current vs Temperature

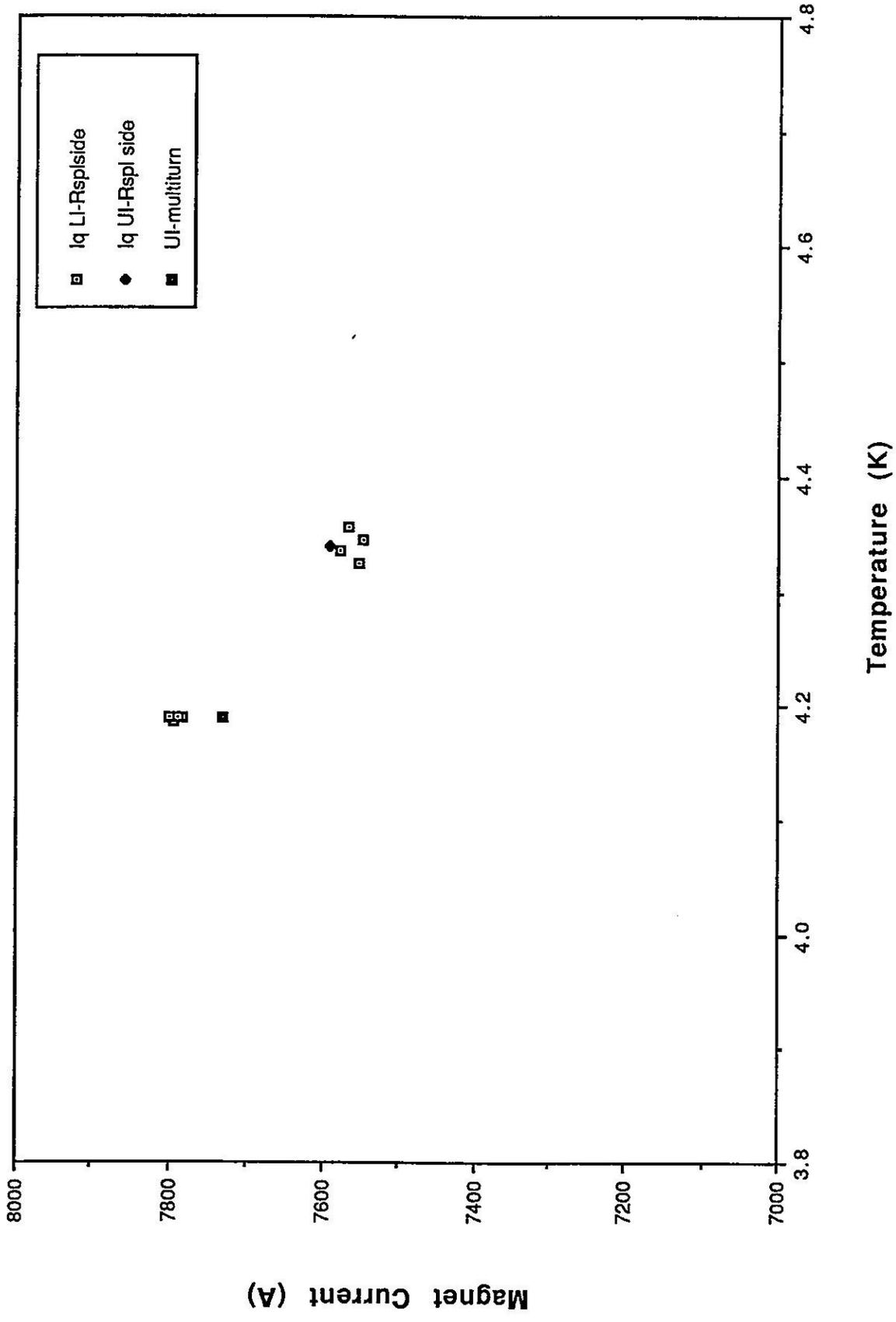


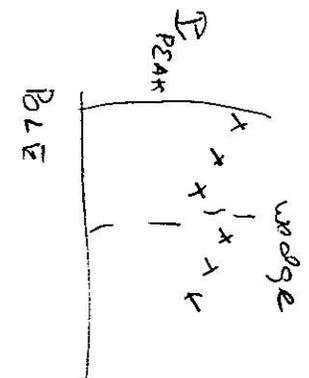
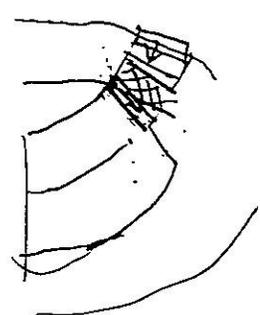
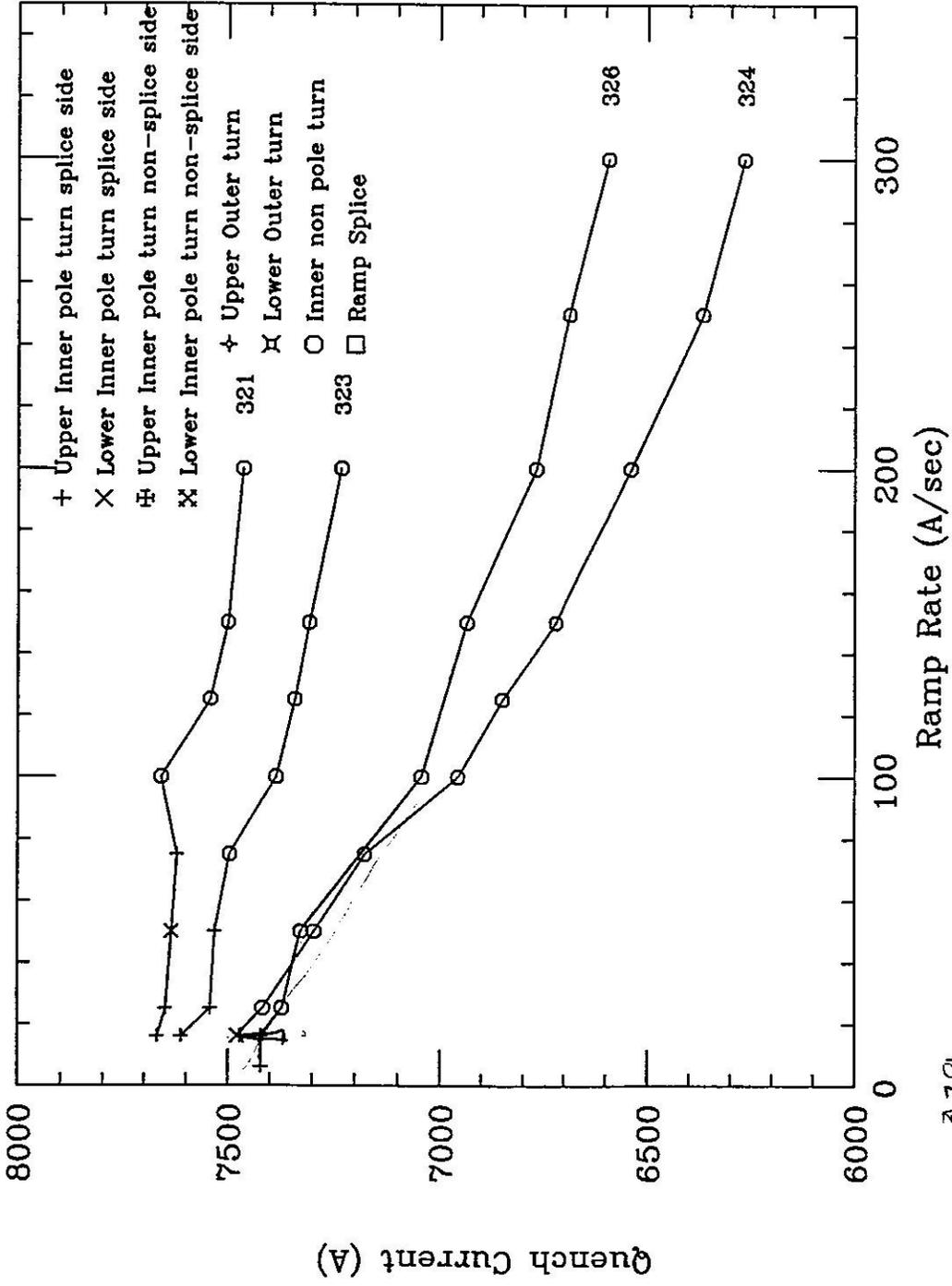
DSA101 QUENCH HISTORY

First SSC built 50 mm aperture, 1.5 m long dipole



DSA101 Quench Current vs Temperature





ALLOWED HARMONICS; LAB2

18 INCH ACTIVE LENGTH MORGAN COIL PROBE AVERAGE VALUE AWAY FROM THE GAGE PACK

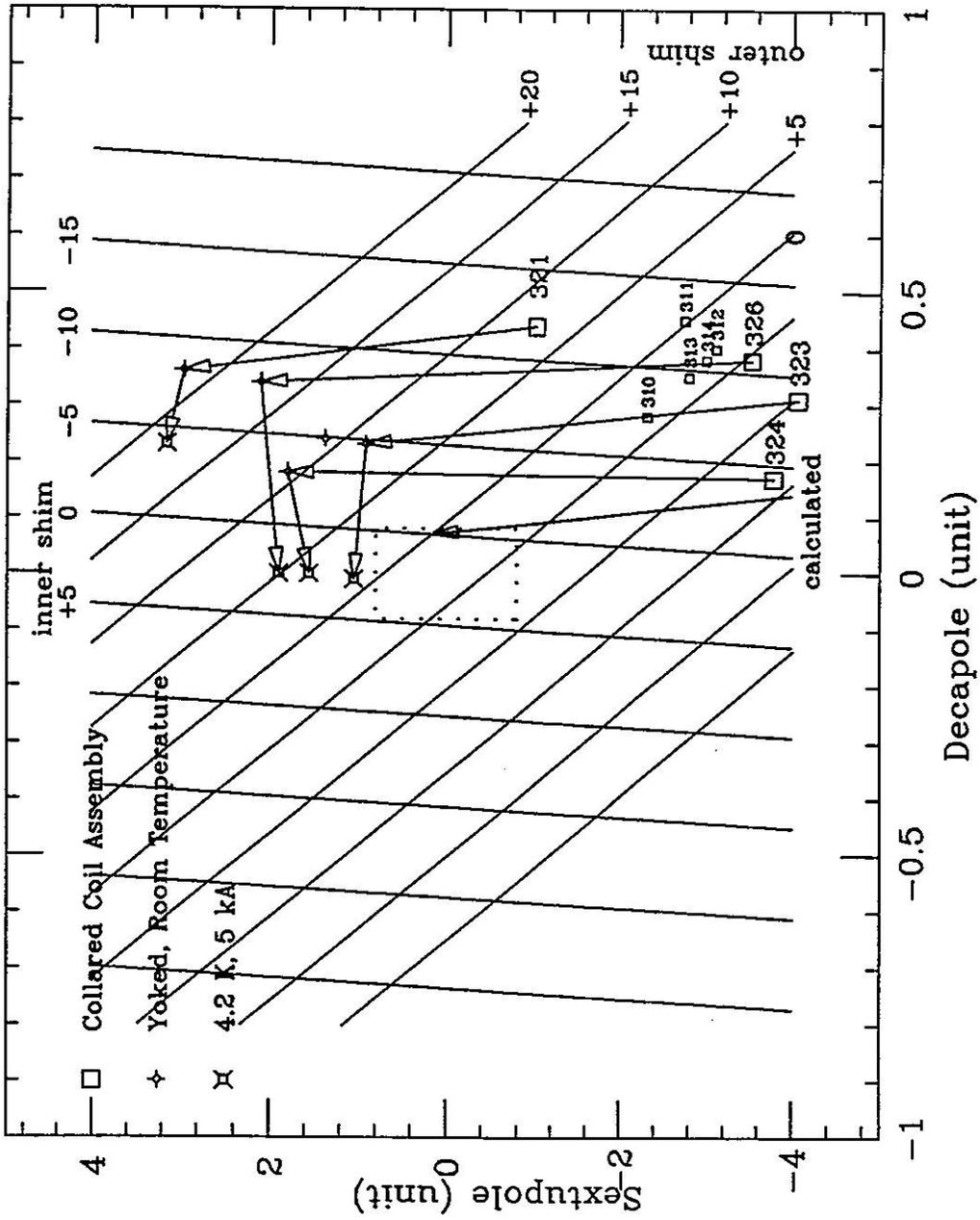
MAGNET	5 kA		Yoked \pm 10 A	
	b2	b4	b2	b4
DSA323	.91	.23	.91	0.23
DSA324	1.4	.002	1.8	0.18
DSA326	2.0 \pm .02		2.1	0.34
DSA101				

TRANSFER FUNCTION FOR 50 mm MAGNETS (T/kA)

	DSA321	DSA323	DSA324	PREDICTED
Collared Coils \pm 10 A	0.795	.794	.794	.795
Yoked \pm 10 A	1.043	1.043	1.044	1.045
Cold at 5 kA	1.036	1.033 \pm .002	1.037	1.044

	DSA326	DSA101		PREDICTED
Collared Coils \pm 10 A	.793			.795
Yoked \pm 10 A	1.042			1.045
Cold at 5 kA	1.04 \pm .002			1.044
Cold at 3 kA		*1.047 \pm .002		1.045

* measured with Rawson Lush fieldmeter (1/4 in rotating probe)



Distribution:

FNAL

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