

CERN LIBRARIES, GENEVA

ISR PERFORMANCE REPORT

CM-P00072848

The implementation of the real-time  
system for data acquisition, monitoring,  
logging and data retrieval for the  
Superconducting Low-Beta Insertion

The real-time monitoring and data-acquisition system for the Superconducting Low-Beta Insertion including all required functions and services <sup>was</sup> ~~has been~~ completed in October 1980. However, major services <sup>were</sup> ~~have been~~ available already <sup>at</sup> ~~since~~ the beginning of 1980 throughout the test and running-in period of the insertion.

It provides important information about the eight superconducting magnets, their cryostats and the associated cryogenic system. This information consists of 138 digital quantities and 341 analog quantities the latter being composed of 251 elementary measurable quantities and 90 dependent quantities, i.e. data that are calculated as functions of elementary data.

The system together with the Alarm system is running on a dedicated NORD-10S computer on a round-the-clock basis (available also during ISR shutdowns) (see Fig. 1).

Data acquisition may be instantaneous by direct operator call or regular for ephemeral memorization and automatic monitoring. Memorization of data for further analysis (recording) is provided by means of a 2.5 Megabyte disk storage. Although in principle the memorized information is fleeting, data gained during a certain interval of operation may be kept forever on a disk copy. The interval of continuously recorded data may vary from one to several days according to the logging frequency chosen.

Software for retrospective analysis exists that can graphically or textually display information as function of time or render groups of data from a historical moment. Automatic monitoring includes alarm messages to SRC and A8, a computer-driven siren in A8 and alarm transmission to the SB division. The monitoring criteria are defined by the users in a data base. There may be different thresholds and settings for each quantity for four operation modes (magnet operation, liquefaction, refrigeration and stand-by mode).

The software is engineered in modules to such an extent that the dependence of programs upon user-defined facts is minimized. In this way, names of quantities, identification texts, physical dimensions of quantities, the lay-out of data and even calculation algorithms can be defined and changed by the user in a large data base.

The programs may be driven from one of two computer consoles (one in SRC and one in A8) comprising a visual-display unit (VDU) with keyboard and hard-copy printer (A8 only), a touch-panel and graphic-display screen. Hard-copies from either display may be output in SRC. A local alarm printer is provided in A8.

The system is flexible, user-friendly and easy to use. Any Cryogenic operator, be he familiar with computers or not, can easily extract curves or figures that are relevant for him (see Fig. 2, 3 etc).

#### Conclusions

The system is indispensable to ensure the reliable working of the superconducting magnets and their associated cryogenics. Moreover, it is useful for the running-in or tests of the Low- $\beta$  insertion as it helps to check the proper functioning of components and can elucidate the course of physical processes determining the operation of the plant.

L.A. Tausch

Encl. Figures

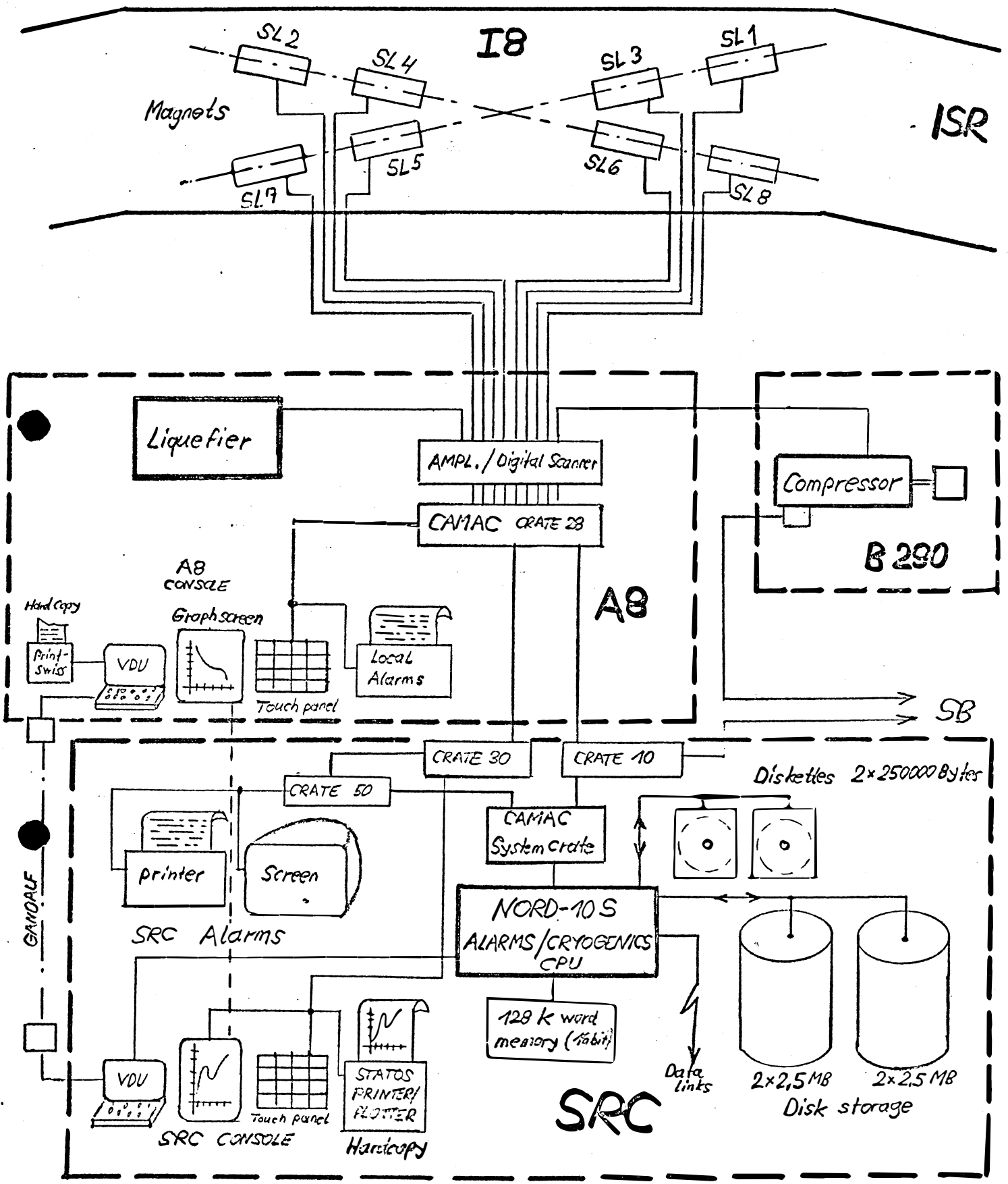
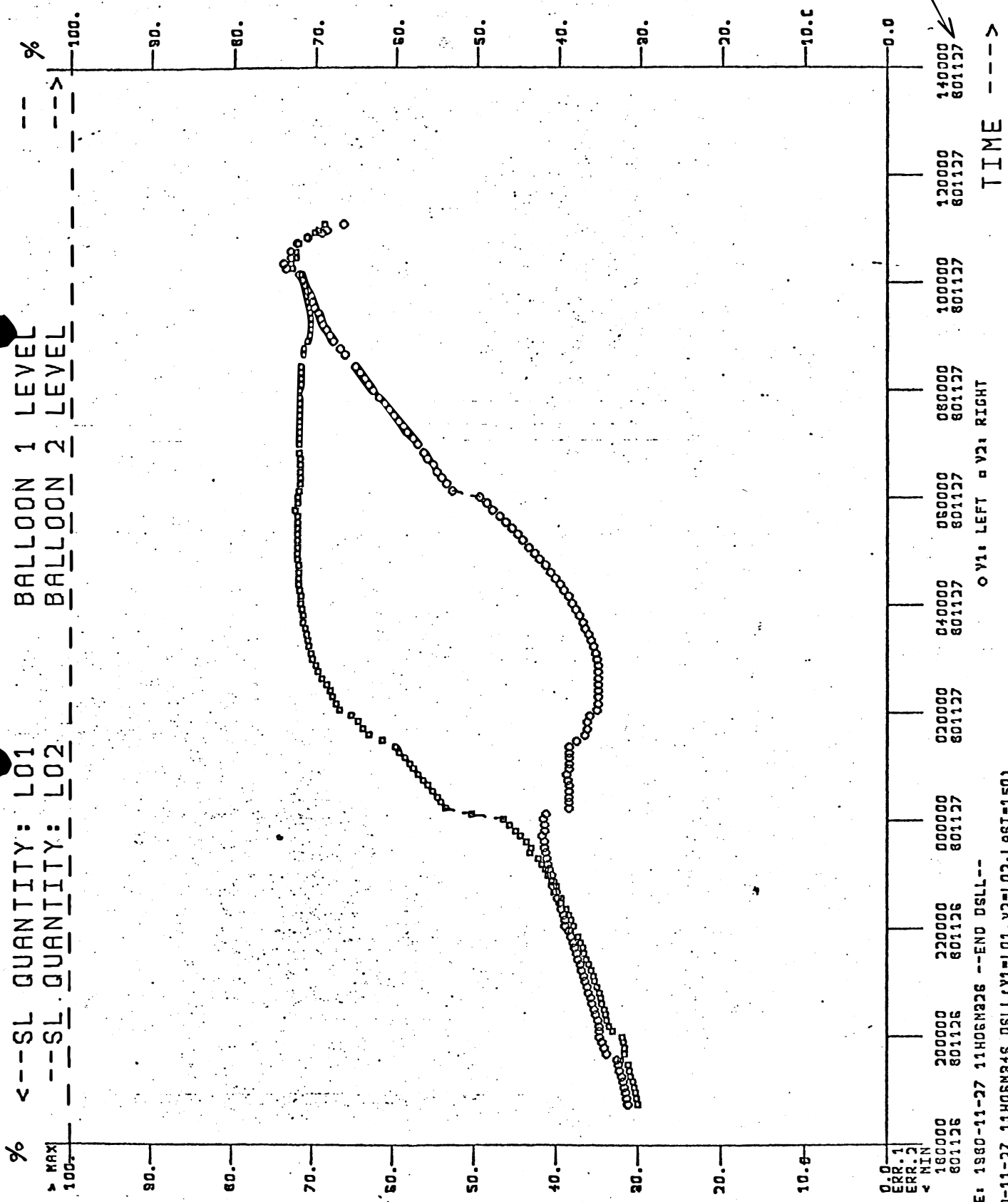


Fig 1 Data Acquisition and Monitoring for the Supraconducting Low- $\beta$  Insertion with NORD-10S computer



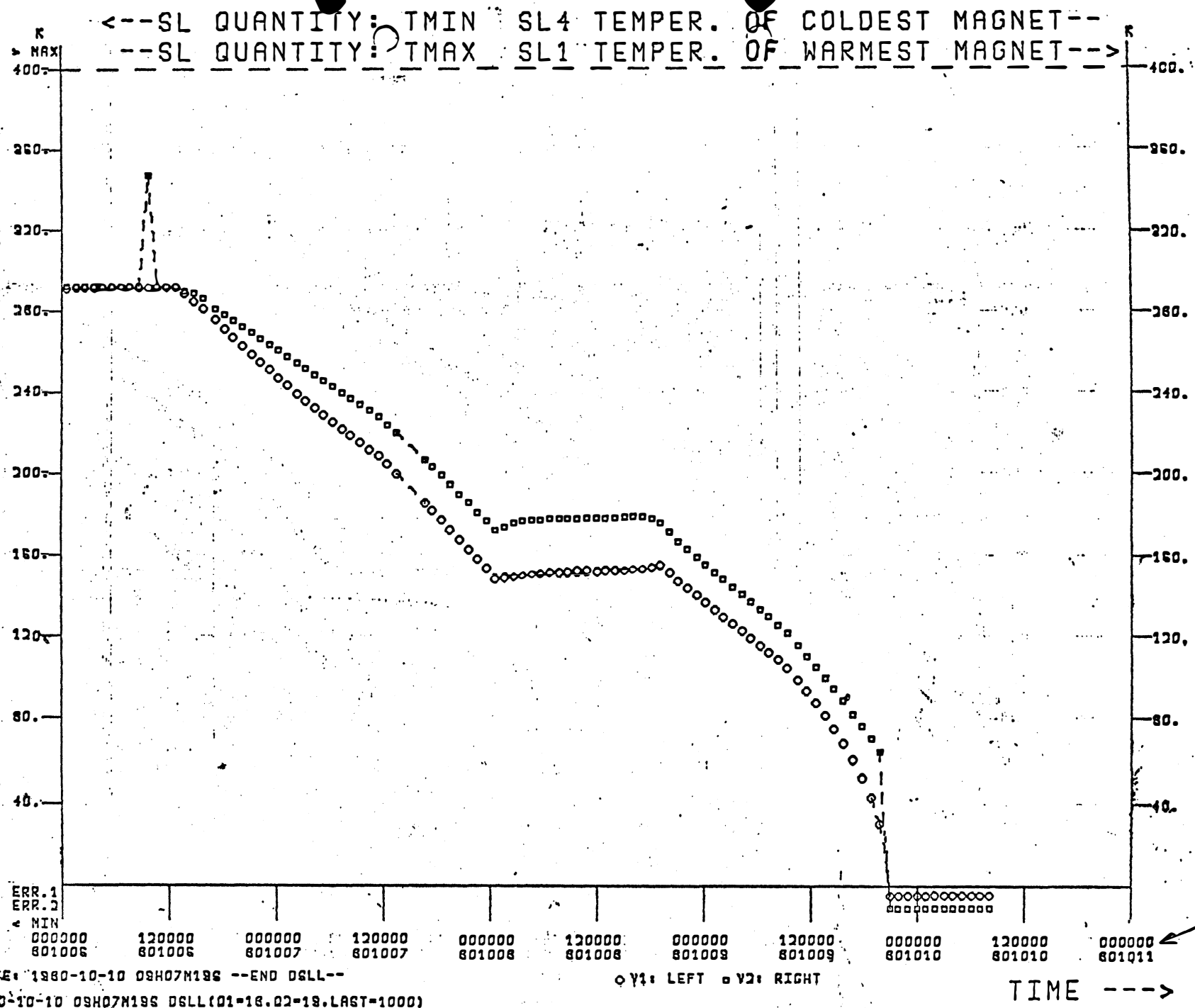
read. MHOOSOM  
80-11-27  
etc.

← SL QUANTITY: L01 BALLOON 1 LEVEL  
 --- SL QUANTITY: L02 BALLOON 2 LEVEL

DATE: 1980-11-27 11H06M326 --END DSLL--  
 1980-11-27 11H06M34S DSLL(Y1=L01.Y2=L02.LAST=150)

Fig. 2

Fig. 3

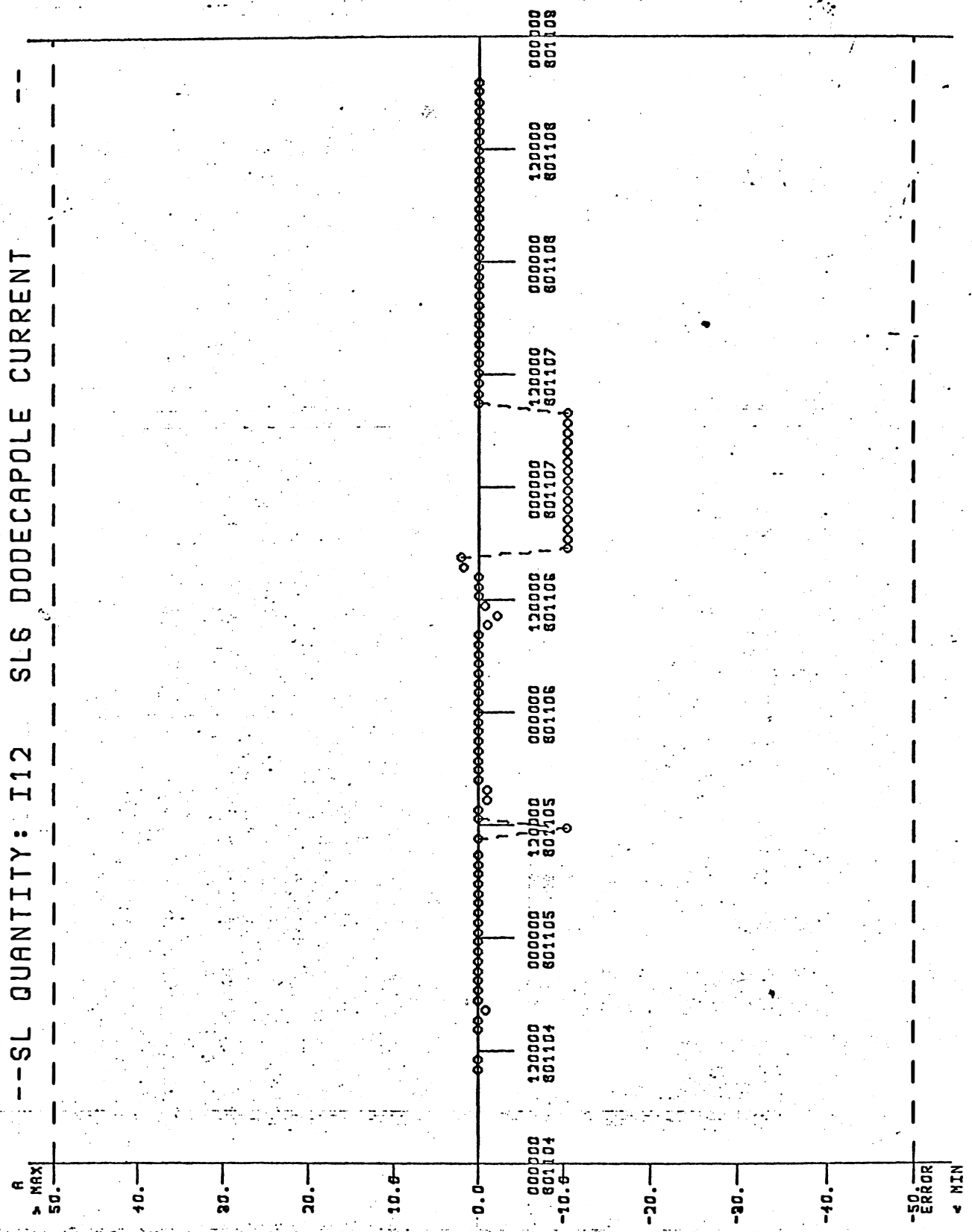


read  
OH OMOS  
-80-10-11  
etc.





--SL QUANTITY: I12 SLS DODECAPOLE CURRENT



TIME ---->

O Y1: LEFT

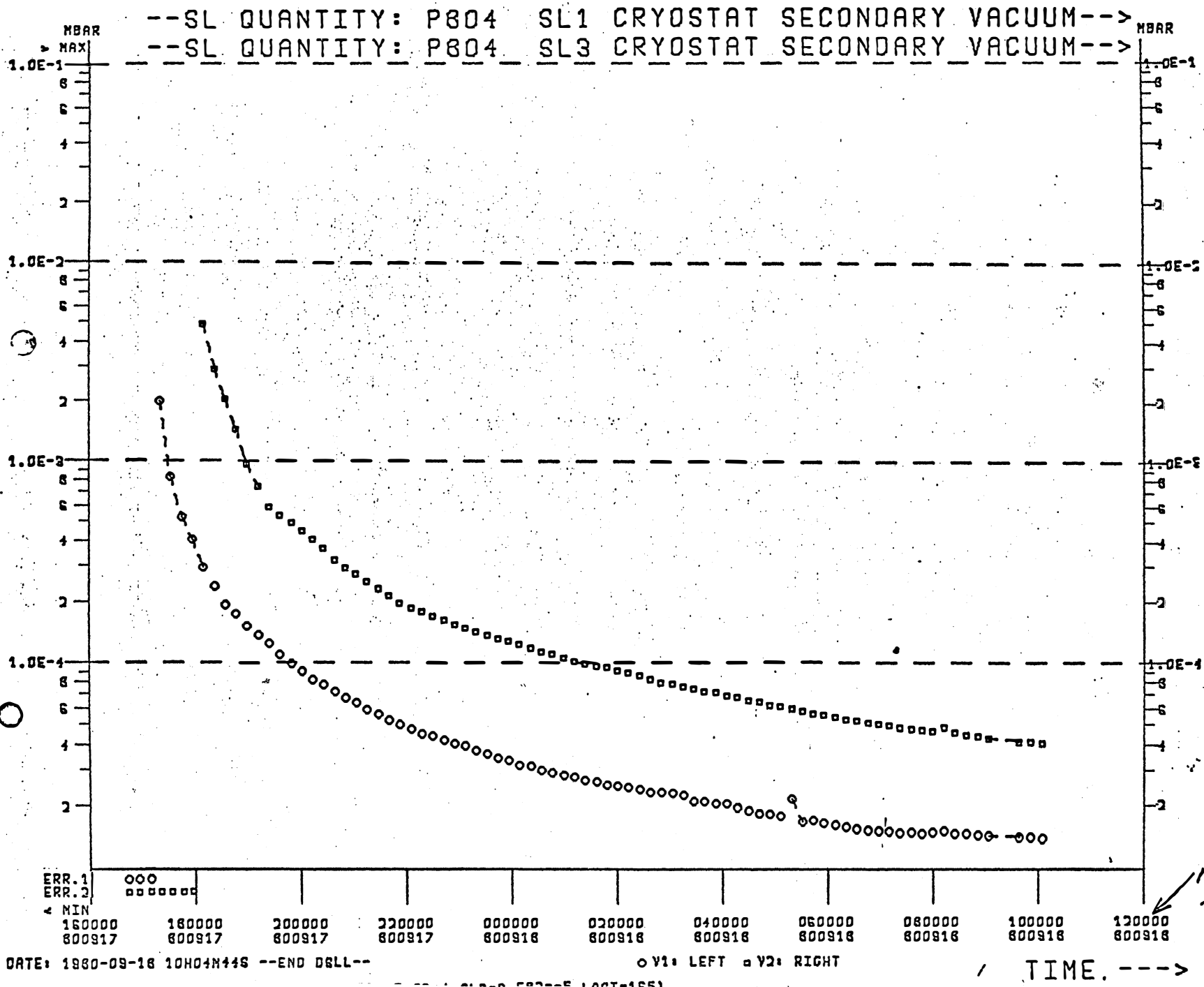
DATE: 1980-11-08 12H02M35S --END. 06LL--

1980-11-08 12H02M35S 06LL(Y=6112.T=100000.D=4.FIRST=1000)

Fig. 6



Fig. 17



— SUPERCONDUCTING LOW-BETA QUANTITIES — /STAND-BY/

Q	NAME	IDENTIFICATION TEXT	SL	VALUE	REMARKS
1	PC	CRYOSTAT PRESSURE P15	7	1.073	BAR
2	LC	CRYOSTAT LHE LEVEL L14	7	0.0000	%
3	P003	CRYOSTAT PRIMARY VACUUM	7	7.800E -3	MBAR
4	P004	CRYOSTAT SEC. VACUUM	7	0.0000	MBAR *OUT OF RANGE*
5	F16	CRYOSTAT & TR. LINE FLOW	7	0.2442	L/MIN
6	T20	CRYOSTAT GAS-IN TEMP.	7	195.1	K
7	T21	MAGNET GAS OUTPUT TEMP.	7	195.8	K
8	T22	MAGN.SCREEN GAS-IN TEMP.	7	0.0000	K *OUT OF RANGE*
9	T23	MAGN.SCREEN GAS-OUT TEMP.	7	207.7	K
10	T24	TRANSFER LINE OUTP. TEMP.	7	287.1	K
11	T17	MAGNET BACK TEMPERATURE	7	194.8	K
12	T18	MAGNET INTERM. TEMP.	7	194.6	K
13	T19	MAGNET FRONT TEMPERATURE	7	195.2	K
14	GT	MAGNET TEMP. GRADIENT	7	0.8485	K/M
15	DT	TEMP. DIFF. GAS-IN/MAG. BACK	7	0.2673	K
16	TI	SINGLE-MAGNET MEAN TEMP.	7	194.9	K
17	TAV	MAGNET MEAN TEMPERATURE	7	203.9	K
18	TMIN	TEMPER. OF COLDEST MAGNET	5	171.9	K
19	TMAX	TEMPER. OF WARMEST MAGNET	3	262.2	K
20	DTM	MAGNET MAXIMUM TEMP. DIFF.	3	58.34	K
23	TA	LEAD A TEMPERATURE T4	7	289.0	K
24	TB	LEAD B TEMPERATURE T5	7	288.3	K
25	TC	LEAD C TEMPERATURE T6	7	289.7	K
26	TS	LEAD S TEMPERATURE T7	7	289.4	K
27	TD	LEAD D TEMPERATURE T8	7	289.8	K
28	EA	LEAD A VOLTAGE E9	7	0.1954	MV
29	EB	LEAD B VOLTAGE E10	7	1.270	MV
30	EC	LEAD C VOLTAGE E11	7	0.0000	MV
31	ES	LEAD S VOLTAGE E12	7	0.1954	MV
32	ED	LEAD D VOLTAGE E13	7	0.0000	MV
33	RA	LEAD A RESISTANCE	7	0.0000	MUOHM *OUT OF RANGE*
34	RB	LEAD B RESISTANCE	7	0.0000	MUOHM *OUT OF RANGE*
35	RC	LEAD C RESISTANCE	7	0.0000	MUOHM *OUT OF RANGE*
36	RS	LEAD S RESISTANCE	7	0.0000	MUOHM *OUT OF RANGE*
37	RD	LEAD D RESISTANCE	7	0.0000	MUOHM *OUT OF RANGE*
38	I4	QUADRUPOLE CURRENT	7	0.0000	A
39	I6	SEXTUPOLE CURRENT	7	0.0000	A
40	I12	DODECAPOLE CURRENT	7	6.838E -2	A
41	I25	SEXTUPOLE DIODE CURRENT	7	8.547E -3	A
42	I26	DODECAPOLE DIODE CURRENT	7	1.099E -2	A
46	TAVA	LEAD A MEAN TEMPERATURE	7	289.7	K
47	TAVB	LEAD B MEAN TEMPERATURE	7	289.0	K
48	TAVC	LEAD C MEAN TEMPERATURE	7	289.9	K
49	TAVS	LEAD S MEAN TEMPERATURE	7	289.8	K
50	TAVD	LEAD D MEAN TEMPERATURE	7	290.5	K
51	TMINA	LEAD A MIN. TEMPERATURE	5	288.9	K
52	TMINB	LEAD B MIN. TEMPERATURE	2	288.2	K
53	TMINC	LEAD C MIN. TEMPERATURE	2	289.0	K
54	TMINS	LEAD S MIN. TEMPERATURE	2	288.4	K
55	TMIND	LEAD D MIN. TEMPERATURE	2	289.0	K
56	TMAXA	LEAD A MAX. TEMPERATURE	3	291.2	K
57	TMAXB	LEAD B MAX. TEMPERATURE	4	290.6	K
58	TMAXC	LEAD C MAX. TEMPERATURE	4	291.5	K
59	TMAXS	LEAD S MAX. TEMPERATURE	3	291.2	K
60	TMAXD	LEAD D MAX. TEMPERATURE	4	292.1	K
61	DTMA	LEAD A MAX. TEMP. DIFF.	3	1.523	K
62	DTMB	LEAD B MAX. TEMP. DIFF.	4	1.545	K
63	DTMC	LEAD C MAX. TEMP. DIFF.	4	1.612	K
64	DTMS	LEAD S MAX. TEMP. DIFF.	2	1.412	K
65	DTMD	LEAD D MAX. TEMP. DIFF.	4	1.579	K
71	J1	COMPRESSOR POWER	7	1.954	KW
72	P025	COMPRESSOR SUCTION PRESS.	7	1.778	BAR
73	P024	COMPRESSOR DISCH. PRESS.	7	1.709	BAR
74	T046	COMPR. DEL. BEF. ORIF. TEMP.	7	6.624	C
75	P047	COMPR. DEL. BEF. ORIF. PRESS.	7	1.722	BAR
76	P048	COMPR. DELIV. ORIF. PRESS.	7	0.0000	MBAR *BELOW RANGE*
77	FC01	COMPRESSOR DELIV. FLOW	7	0.0000	G/S *P048 ERROR*
78	S161	TURBINE 1 SPEED	7	0.0000	1/S *BELOW RANGE*
79	S162	TURBINE 2 SPEED	7	0.0000	1/S *BELOW RANGE*
80	P130	TURBINE INLET FRESSURE	7	1.087	BAR
81	T134	COLDBOX LP/HP132 INL. TEMP	7	40.00	K
82	T135	COLDBOX COOLDOWN OUT. TEMP	7	285.7	K
83	P011	COLDBOX VACUUM(PRIMARY)	7	995.2	MBAR
84	PS12	COLDBOX VACUUM(SEC.)	7	0.0000	MBAR
85	PS13	PRIMARY PUMP VACUUM	7	980.7	MBAR
86	L163	COLDBOX GKW LHE LEVEL	7	0.0000	MM *BELOW RANGE*
89	LDEW	DEWAR LEVEL	7	0.0000	MM
90	P123	DEWAR PRESSURE	7	1.055	BAR
91	L01	BALLOON 1 LEVEL	7	33.29	%
92	L02	BALLOON 2 LEVEL	7	35.87	%
93	P023	BUFFER PRESSURE	7	16.64	BAR
94	P129	CRYOSTAT RETURN PRESSURE	7	1.058	BAR
95	T154	SCREEN VALVE BOX TEMP.	7	286.4	K
96	PL003	TR. LINE PRIMARY VACUUM	7	0.8076	MBAR
97	PL004	TR. LINE SECONDARY VACUUM	7	0.0000	MBAR *OUT OF RANGE*

\*\*\*\*\* PROGRAM DYSL/ALARM-CYROG \*\*\*\*\*

1981-01-07 14H44M25S DYSL(O=5,G=CRYO)

-- SUPERCONDUCTING LOW-BETA QUANTITIES -- ..CRYOSTAT.. /STAND-BY/

Q	NAME	IDENTIFICATION TEXT	SL	VALUE	REMARKS
1	PC	CRYOSTAT PRESSURE P15	1	1.071	BAR
1	PC	CRYOSTAT PRESSURE P15	2	1.065	BAR
1	PC	CRYOSTAT PRESSURE P15	3	1.063	BAR
1	PC	CRYOSTAT PRESSURE P15	4	1.067	BAR
1	PC	CRYOSTAT PRESSURE P15	5	1.072	BAR
1	PC	CRYOSTAT PRESSURE P15	6	1.065	BAR
1	PC	CRYOSTAT PRESSURE P15	7	1.069	BAR
1	PC	CRYOSTAT PRESSURE P15	8	1.076	BAR
2	LC	CRYOSTAT LHE LEVEL L14	1	0.0000	%
2	LC	CRYOSTAT LHE LEVEL L14	2	0.0000	%
2	LC	CRYOSTAT LHE LEVEL L14	3	0.0000	%
2	LC	CRYOSTAT LHE LEVEL L14	4	0.0000	%
2	LC	CRYOSTAT LHE LEVEL L14	5	0.0000	%
2	LC	CRYOSTAT LHE LEVEL L14	6	0.0000	%
2	LC	CRYOSTAT LHE LEVEL L14	7	0.0000	%
2	LC	CRYOSTAT LHE LEVEL L14	8	0.0000	%
5	F16	CRYOSTAT & TR. LINE FLOW	1	0.0000	L/MIN
5	F16	CRYOSTAT & TR. LINE FLOW	2	0.2442	L/MIN
5	F16	CRYOSTAT & TR. LINE FLOW	3	0.0000	L/MIN
5	F16	CRYOSTAT & TR. LINE FLOW	4	0.0000	L/MIN
5	F16	CRYOSTAT & TR. LINE FLOW	5	0.0000	L/MIN
5	F16	CRYOSTAT & TR. LINE FLOW	6	0.0000	L/MIN
5	F16	CRYOSTAT & TR. LINE FLOW	7	0.2442	L/MIN
5	F16	CRYOSTAT & TR. LINE FLOW	8	0.0000	L/MIN
6	T20	CRYOSTAT GAS-IN TEMP.	1	198.3	K
6	T20	CRYOSTAT GAS-IN TEMP.	2	188.6	K
6	T20	CRYOSTAT GAS-IN TEMP.	3	263.6	K
6	T20	CRYOSTAT GAS-IN TEMP.	4	254.8	K
6	T20	CRYOSTAT GAS-IN TEMP.	5	173.0	K
6	T20	CRYOSTAT GAS-IN TEMP.	6	174.3	K
6	T20	CRYOSTAT GAS-IN TEMP.	7	195.4	K
6	T20	CRYOSTAT GAS-IN TEMP.	8	189.6	K
9	T23	MAGN.SCREEN GAS-OUT TEMP.	1	213.7	K
9	T23	MAGN.SCREEN GAS-OUT TEMP.	2	203.3	K
9	T23	MAGN.SCREEN GAS-OUT TEMP.	3	270.3	K
9	T23	MAGN.SCREEN GAS-OUT TEMP.	4	266.0	K
9	T23	MAGN.SCREEN GAS-OUT TEMP.	5	190.4	K
9	T23	MAGN.SCREEN GAS-OUT TEMP.	6	190.8	K
9	T23	MAGN.SCREEN GAS-OUT TEMP.	7	208.1	K
9	T23	MAGN.SCREEN GAS-OUT TEMP.	8	204.7	K
10	T24	TRANSFER LINE OUTP. TEMP.	1	286.9	K
10	T24	TRANSFER LINE OUTP. TEMP.	2	286.6	K
10	T24	TRANSFER LINE OUTP. TEMP.	3	287.1	K
10	T24	TRANSFER LINE OUTP. TEMP.	4	286.7	K
10	T24	TRANSFER LINE OUTP. TEMP.	5	287.4	K
10	T24	TRANSFER LINE OUTP. TEMP.	6	286.6	K
10	T24	TRANSFER LINE OUTP. TEMP.	7	287.2	K
10	T24	TRANSFER LINE OUTP. TEMP.	8	286.2	K

## -- SUPERCONDUCTING LOW-BETA QUANTITIES -- /STAND-BY/

Q	NAME	IDENTIFICATION TEXT	LOGICAL CONDITION	
1	SLU1	HKS1	OPERATION MODE	OFF
2	SLU1	HKS2	LIQUEFACTION MODE	OFF
3	SLU1	HKS3	REFRIGERATION MODE	OFF
4	SLU1	HKS4	STANDBY MODE	ON
5	SLU1	PCV113	BALLOON RETURN VALVE	LOCKED CLOSED
6	SLU1	FS226	COLDBOX COOLING WATER FLOW	< 1M**3/H
7	SLU1	EZ212	PRIMARY VACUUM PUMP	OPERATIONAL
8	SLU1	PA110	EJECTOR SUCTION PRESSURE	> 1 BAR
9	SLU1	HCV122	GHE WITHDRAWAL VALVE	LOCKED CLOSED
10	SLU1	HCV123	LHE WITHDRAWAL VALVE	LOCKED CLOSED
11	SLU1	HCV131	GHE RETURN VALVE	LOCKED CLOSED
12	SLU1	HCV132	GHE RETURN VALVE	LOCKED CLOSED
13	SLU1	LA163	LHE SEPARATOR LEVEL	< 20 %
14	SLU1	PCV119	COLD EJECTOR SUCTION VALVE	LOCKED CLOSED
15	SLU1	HE127	LHE SEPARATOR HEATER	LOCKED CLOSED
16	SLU1	TCV124	WARM GHE MIXING VALVE	LOCKED CLOSED
17	SLU1	FS625	DIFFUSION PUMP WATER FLOW	< 1.0 M**3/H
18	SLU1	TS133	ADSORBER TEMPERATURE	NORMAL
19	SLU1	TS139	ADSORBER TEMPERATURE	NORMAL
20	SLU1	PCV112	WARM EJECTOR FEED VALVE	LOCKED CLOSED
21	SLU1	PS312.1	COLDBOX VACUUM	> 5.0E-6 MBAR
22	SLU1	PS312.2	COLDBOX VACUUM	> 7.0E-5 MBAR
23	SLU1	PS313	COLDBOX PRIMARY-PUMP VACUUM	> 1.0E-2 MBAR
24	SLU1	PS713	COLDBOX COMPRESSED AIR PRESSURE	< 5 BAR
25	SLU1	EV214	COLDBOX HIGH-VACUUM VALVE	CLOSED
26	SLU1	FS612	COMPRESSOR COOLING WATER FLOW	> 10 M**3/H
27	SLU1	EZ001	OIL PUMP	OPERATIONAL
28	SLU1	HV033	COMPRESSOR PURGE VALVE	NOT CLOSED
29	SLU1	PDS022	COMPRESSOR OIL PRESSURE	> 3 BAR
30	SLU1	PS019	COMPRESSOR SUCTION PRESSURE	> 0.95 BAR
31	SLU1	PS020	COMPRESSOR DELIVERY PRESSURE	< 19 BAR
32	SLU1	PS021	COMPRESSOR BYPASS	OPEN - O.K.
33	SLU1	PS710	COMPRESSOR COMP. AIR PRESSURE	> 5 BAR
34	SLU1	PCV014	GHE DISCHARGING VALVE	LOCKED CLOSED
35	SLU1	PCV015	GHE CHARGING VALVE	LOCKED CLOSED
36	SLU1	TA038	1ST STAGE DELIVERY TEMPERATURE	< 190 C
37	SLU1	TA039	2ND STAGE DELIVERY TEMPERATURE	< 175 C
38	SLU1	TA040	3RD STAGE DELIVERY TEMPERATURE	< 145 C
39	SLU1	TA041	COMPRESSOR DELIVERY TEMPERATURE	< 40 C
40	SLU1	TS042	1ST STAGE DELIVERY TEMPERATURE	< 195 C
41	SLU1	TS043	2ND STAGE DELIVERY TEMPERATURE	< 180 C
42	SLU1	TS044	3RD STAGE DELIVERY TEMPERATURE	< 150 C
43	SLU1	TS045	COMPRESSOR DELIVERY TEMPERATURE	< 45 C
44	SLU1	TA511	MOTOR WINDING TEMPERATURE	< 70 C
45	SLU1	TS511	MOTOR WINDING TEMPERATURE	< 80 C
46	SLU5	ES001	18-KVOLT AC-NETWORK	UP
47	SLU5	ES002	18-KVOLT AC-BREAKER	OPERATIONAL
48	SLU5	ES003	MOTOR	3 KV NORMAL
49	SLU5	ES005	COMPRESSOR	OFF
50	SLU1	EZV170	DEWAR AUXILIARY PRESSURE CONTROL	OPERATIONAL
51	SLU1	HCV118	DEWAR DIRECT RETURN VALVE	LOCKED CLOSED
52	SLU1	LCV117	LHE DEWAR FEED VALVE	LOCKED CLOSED
53	SLU1	LS165	LHE DEWAR LEVEL	< 200 MM
54	SLU1	PS131	DEWAR PRESSURE	< 1.4 BAR
55	SLU1	SA161	TURBINE 1 SPEED	< 2500 1/S
56	SLU1	SS161	TURBINE 1 SPEED	< 2600 1/S
57	SLU1	SS162	TURBINE 2 SPEED	< 2600 1/S
58	SLU1	SA162	TURBINE 2 SPEED	< 2500 1/S
59	SLU1	TA134	TURBINE OUTLET TEMPERATURE	> 14 K
60	SLU1	TCV114	TURBINE INPUT VALVE	LOCKED CLOSED
61	SLU1	TS190	TURBINE 1 BEARING COOLING-WATER	< 30 C
62	SLU1	TS191	TURBINE 2 BEARING COOLING-WATER	< 30 C
63	SLU1	TS192	TURBINE 1 BREAK COOLING-WATER	< 30 C
64	SLU1	TS193	TURBINE 2 BREAK COOLING-WATER	< 30 C
65	SLU1	IS110	ASSURED 220 VOLT AC POWER	OFF
66	SLU1	IS111	48 VOLT DC POWER	ON
67	SLU1	IS112	NO-BREAK 220 VOLT AC POWER	ON
68	SLU6	PA006	B290/SL COOLING WATER PRESSURE	> 3.2 BAR
69	SLU6	PDA025	AS/SL WATER FILTER DP	< 0.6 BAR
70	SLU6	PA026	AS/SL COOLING WATER PRESSURE	> 3.2 BAR
71	SLU6	PDA005	B290/SL WATER FILTER	DP < 0.8 BAR
72	SLU3	VVL306	TR. LINE VACUUM VALVE	CLOSED
73	SLU3	PUS00.1	TR. LINE VACUUM PUMPING UNIT	STOPPED
74	SLU3	PUS00.2	TR. LINE VACUUM PUMPING UNIT	OPERATIONAL
75	SLU3	VVL307	TR. LINE AUX. VACUUM VALVE	CLOSED
76	SLU3	VVS16	PRINCIPAL-VACUUM VALVE	**AMBIGUOUS**
77	SLU3	PUS8101	SPARE VACUUM PUMPING UNIT	STOPPED
78	SLU3	PUS8102	SPARE VACUUM PUMPING UNIT	OPERATIONAL
79	SLU3	VVS17	SPARE AUXILIARY VACUUM VALVE	**AMBIGUOUS**
80	SL8	VV206	CRYOSTAT VACUUM VALVE	CLOSED
81	SL8	PUS00.1	VACUUM PUMPING UNIT	STOPPED
82	SL8	PUS00.2	VACUUM PUMPING UNIT	OPERATIONAL
83	SL8	VV307	TRANSFER LINE VACUUM-VALVE	CLOSED
84	SL8	LS14	CRYOSTAT LHE LEVEL	< 90 %
85	SL8	PS	CRYOSTAT PRESSURE	< 1.25 BAR
86	SL8	LCU1	TRANSFER VALVE	LOCKED CLOSED
87	SLU9	QREC	QUENCH RECORDER	OPERATIONAL
88	SLU9	SIR1	INTERLOCK RING 1	OPERATIONAL
89	SLU9	SIR2	INTERLOCK RING 2	OPERATIONAL