EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

CERN / PS / OP 80- 1 (REV.)
January 1980

STATISTICS OF PS OPERATION 1979

G. AZZONI
B. CROS

STATISTICS
OF PS OPERATION
1979

Explanatory Note

N.B. :

a) As the PS has always run with the Booster as its injector, the 50 MeV/800 MeV subdivisions have been suppressed.

b) Graph No. 16 shows the availability of the PS complex for the SPS.

c) Annex 4 gives details of external faults.

d) Annex 5 gives a record of faults exceeding 6 hours.

e) New tables named "Fault Distribution by System, No. of fault/Total time" (No. 17 - 18 - 19) have been added. In this issue we publish the statistics pertaining to 1977, 1978 and the current year.

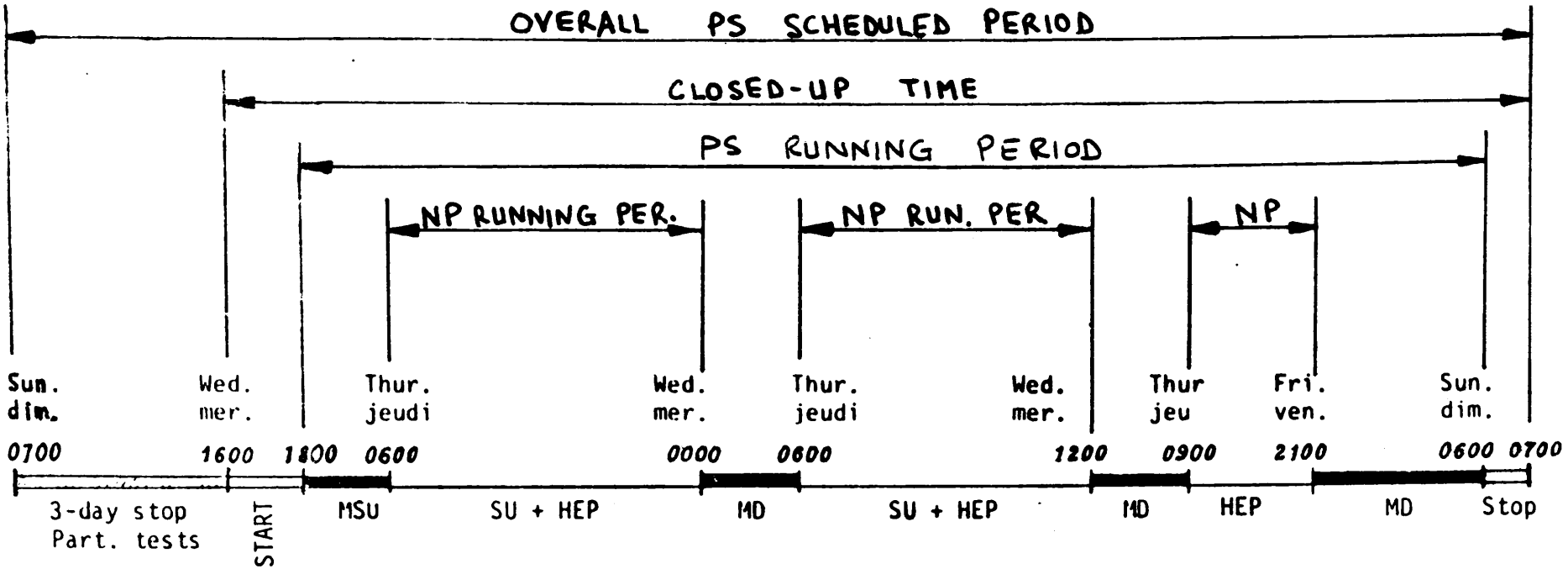
In order to clarify the figures quoted, it is necessary to give definitions of the headings for the various tables and to specify the time involved.

OVERALL PS SCHEDULED PERIOD is defined as the time which elapses between the end of one PS running period and the end of the next.

PS RUNNING PERIOD is defined as the time of continuous PS operation from the scheduled end of a PS start-up until the beginning of the next shut-down procedure and includes stops for breakdowns, etc.

NP RUNNING PERIOD is a period of continuous PS operation for nuclear physics. There are generally three such periods per PS running period, not necessarily of equal length and separated by a machine development period.

NORMAL RUNNING PERIOD



MSU : Machine setting-up
MD : PS and/or Booster Machine Development
SU : Setting-up
HEP : High Energy Physics (including ISR and SPS)

• TABLE 1 : STATISTICS OF PS OPERATION

For each "overall PS scheduled period", the following statistics are given:

Clock time : total number of hours in the "overall PS scheduled period".

Closed-up time is the total of the following:

- NP : time used for nuclear physics
- MD : time used for machine development.
- MSU : time used for machine setting-up.
- Start/Stop : time allocated to starting up and stopping the PS.

Part. Tests (P.T.): time taken for magnet and Linac testing, prior to PS start-up.

Maintenance and Installation: self-explanatory.

Cooling-down and Miscellaneous: time allowed for PS cooling-down plus all the other time not included under the various headings of this chapter.

• TABLE 2 : DISTRIBUTION OF NP TIME

Under this heading the time used for nuclear physics is divided into four distinct categories (expressed as a percentage of total hours of NP time), viz.:

ON TIME
- RUNNING % : time during which the beam is actually used for high energy physics.
- SETTING-UP % : high energy operation setting-up time attributed to NP

OFF TIME
- FAULTS % : self-explanatory.
- USER REQUEST %: time during which PS is stopped at NP users' request.

• TABLE 3 : NP STATISTICS OF INTENSITY AND NUMBER OF PULSES

The total intensity, the total number of accelerated beam pulses and the average intensity are given. These are calculated for the entire NP time in each "PS running period".

TABLE 4 : TOTAL DISTRIBUTION OF BEAM INTENSITY (NP)

The distribution of the beam between the various targets and ejection systems is given for the NP time of each "PS running period". Totals and percentages are quoted for the year 1979.

TABLE 5 : NP STATISTICS

This gives the total number of hours of NP time, the total number of accelerated beam pulses, the total intensity and the average intensity computed over the total time for the year 1979. The same figures are given for the period 1960-1978 inclusive and under "Grand Total" are given the overall totals and overall average for 1960-1979 inclusive.

TABLE 6 : DISTRIBUTION OF MD TIME

Under this heading the time used for machine development is divided into two distinct categories, viz.:

ON TIME RUNNING % : self-explanatory.

OFF TIME FAULTS % : self-explanatory.

TABLE 7 : MD STATISTICS OF INTENSITY AND No. OF PULSES

The total intensity, the total number of accelerated beam pulses and the average intensity are given. These are calculated for the entire MD time in each "PS running period".

TABLE 8 : TOTAL DISTRIBUTION OF BEAM INTENSITY (MD)

The distribution of the beam between the various targets and ejection systems is given for the MD time of each "PS running period". Totals and percentages are quoted for the year 1979.

TABLE 9 : DISTRIBUTION OF MSU TIME

Under this heading the time used for machine setting-up is divided into two distinct categories, viz.:

ON TIME RUNNING % : self-explanatory.

OFF TIME FAULTS % : self-explanatory.

• TABLE 10 : MSU STATISTICS OF INTENSITY AND No. OF PULSES

The total intensity, the total number of accelerated beam pulses and the average intensity are given. These are calculated for the entire MSU time in each "PS running period".

• TABLE 11 : TOTAL DISTRIBUTION OF BEAM INTENSITY (MSU)

The distribution of the beam between the various targets and ejection systems is given for the MSU time of each "PS running period". Totals and percentages are quoted for the year 1979.

• TABLE 12 : PS STATISTICS

This gives the total number of hours of NP + MD + MSU time, the total number of accelerated beam pulses, the total intensity and the average intensity computed over the total time for the year 1979. Under "Grand Total" are given the overall totals and overall average for 1960-1979 inclusive.

• TABLE 13 : FAULT DISTRIBUTION BY SYSTEM

This gives the breakdown time per "PS running period" according to the various PS systems*. Totals and percentages for 1979 are given.

• TABLE 14 : VARIATION OF AVERAGE INTENSITY (NP)

The evolution of average intensity during NP time of each "PS running period" is plotted on a graph.

• TABLE 15 : PERCENTAGE OF FAULTS

This graph shows the percentage of faults per "PS running period".

• TABLE 16 : AVAILABILITY FOR THE SPS IN PERCENTAGE

This graph shows the availability for the SPS in percentage. It is calculated for the NP time of each "PS running period" according to the formula:

$$\frac{\text{NP TIME} - (\text{NP FAULTS} + \text{CONTINUOUS TRANSFER FAULTS DURING NP})}{\text{NP TIME}}$$

* See annex 1 for the meaning of each heading.

TABLE 17 : FAULT DISTRIBUTION BY SYSTEM (No. of faults/Total time) for 1977

This table gives the breakdown time per year, according to the various PS systems*. The faults are further subdivided into particular time-slices as follows:

0 to 10 minutes
10 to 20 minutes
20 min. to 1 hour
1 to 3 hours
3 to 6 hours
more than 6 hours

TABLE 18, 19

The same as above for 1978 and 1979.

References

1. D. Dekkers, OPERATION - EXPERIENCES DE PHYSIQUE - TRAVAUX DANS LES GROUPES, PS/OP/Notes 79-16, 79-18, 79-22, 79-23, 79-24 et 80-1.

2. E. Brouzet, K. Schindl, Compte rendu des séances d'étude sur le PS (MD) et le Booster (ME), PS/OP/BR/Notes 79-2, 79-3, 79-5, 79-7, 79-9 et 80-1.

Distribution

Liste PS/1 (Personnel Scientifique de la Division PS)
PS Operation
L. Bernard
F. Bonaudi
H. Bonnin
H. Charmot
M. Ciriani
M. Coninckx
M.C. Crowley-Milling
C. Dutriat
J. Guillet
V. Hatton
M. Höfert
A. Lévrier
M. Nielsen
G. Rossat
H. Schönbacher
J.L. Vallet
PS Co-ordinator

---

* See annex 1 for the meaning of this heading.

Annex 1

FAULT DISTRIBUTION BY SYSTEM

1. Main magnet and auxiliaries

Here are gathered all the faults of the PS magnets, the cooling system, the Pole Face Windings and their power supplies, the "high energy" quadrupoles, the sextupoles, the bump coils, the "transition" power supply, the "Tekelec" type power supplies, the power supplies for type "D", the power supplies for type "M", the equipment for "B" and "BO.1" train generation and the shims.

2. Main generator

All the faults concerning the main magnet power supply are classed in this section.

3. LINAC (Old and New)

All the pre-injector and LINAC faults, the inflector parts I and II, the injection part I including the emittance and spectrometry lines are found here, except for vacuum faults in inflector parts I and II and the measurement lines (see the vacuum diagram annexed).

4. BOOSTER

All the Booster faults (vacuum, RF, etc.) are classed here, injection part II, the ejection line to the PS up to T-Q5 inclusive (transfer line) for the magnet units, and up to T-VS5 inclusive for the vacuum; the transfer line up to and including TIS for the magnet power supplies and for demineralized water supply.

5. Injection

This section comprises all the faults related to 50 MeV and 800 MeV injection, viz. :

Inflector 26, - injection quadrupoles, - BLW, - vertical dipoles, - KM30, - BD44, kickers 22 and 30, skewed quadrupoles, - injection sextupoles, - the Booster injection line to the PS (transfer line), i.e. the magnets after T-Q5[T-Q6... 10, T-DH3 .... 5, T-DV6 ..... 9, BLM (800 MeV), TR1, TR2, SEM Grids, TV30, TV34, TV46, TU2 .... 5, TIK, TIS, SB40 ... 44,] beam dumper.

6. Acceleration

All the faults related to the radio-frequency (beam control, cavities, etc.) which can be defined as active equipment are found here; plus all the faults concerning what can be called the passive part : I_p measuring system, - - the ACEM detectors, - the pick-up stations (see Annex 2 for passive part).

7. Vacuum

All faults related to the PS vacuum system go in this section, viz. : PS, - inflector lines I and II (INF1 and INF2), - injection line I (INJ.1) including the emittance and spectrometry lines (IE and IS), - the 800 MeV injection line from T-VS5 (see vacuum diagram annex). The TT1 transfer line from V408; the TT2 transfer line from V337; the TT10 transfer line from V501 (see vacuum diagram annexed); the D2 line; the e_{16} beam line from SV74-2 (see vacuum diagram annexed).

8. Ejection - Targets

Here are classed all the faults concerning the FAK, FAST BUMPERS, the septa, the internal targets, the dump targets, the ejected beam servo systems, the telescopes, the toposcopes, the "Cerenkovs", the TVs, the septa and external targets lighting equipment, the measuring transformers for extracted beam, the SECs and the BLMs.

Note : We have inserted in this section the target faults, because the fault percentage from this equipment is too low to justify a separate section.

9. Control

This section has been created because the faults due to the computers and associated equipment are not negligible (this probably also applies to the future). Therefore all the faults of the various systems associated with the computers are found here (STAR, - function generators), security (B.S., - fire detection equipment, barriers, etc.) the timing (pulse distribution to Linac, MCR, CB, etc.).

Note : For the same reason as above, the faults due to security have been put here.

10. Miscellaneous

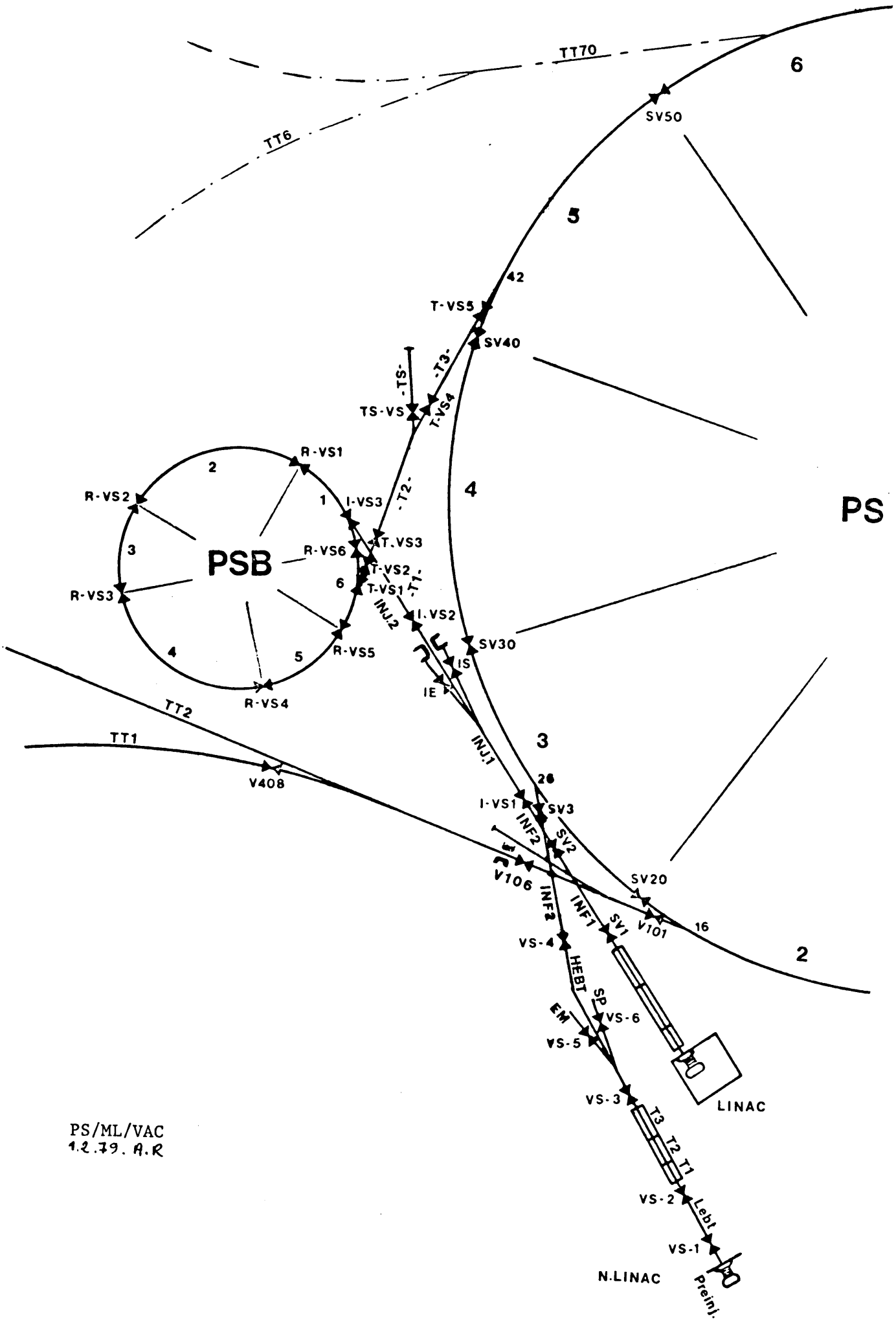
All the faults found here will be dealt with in detail in Annex 3.

11. Beam transport

All the faults related to the separators, the magnets, the quadrupoles and their cooling system, the vacuum ejected beams, the septa (ex. MNP 35/1-2), and the hydrogen targets are to be found in this section.

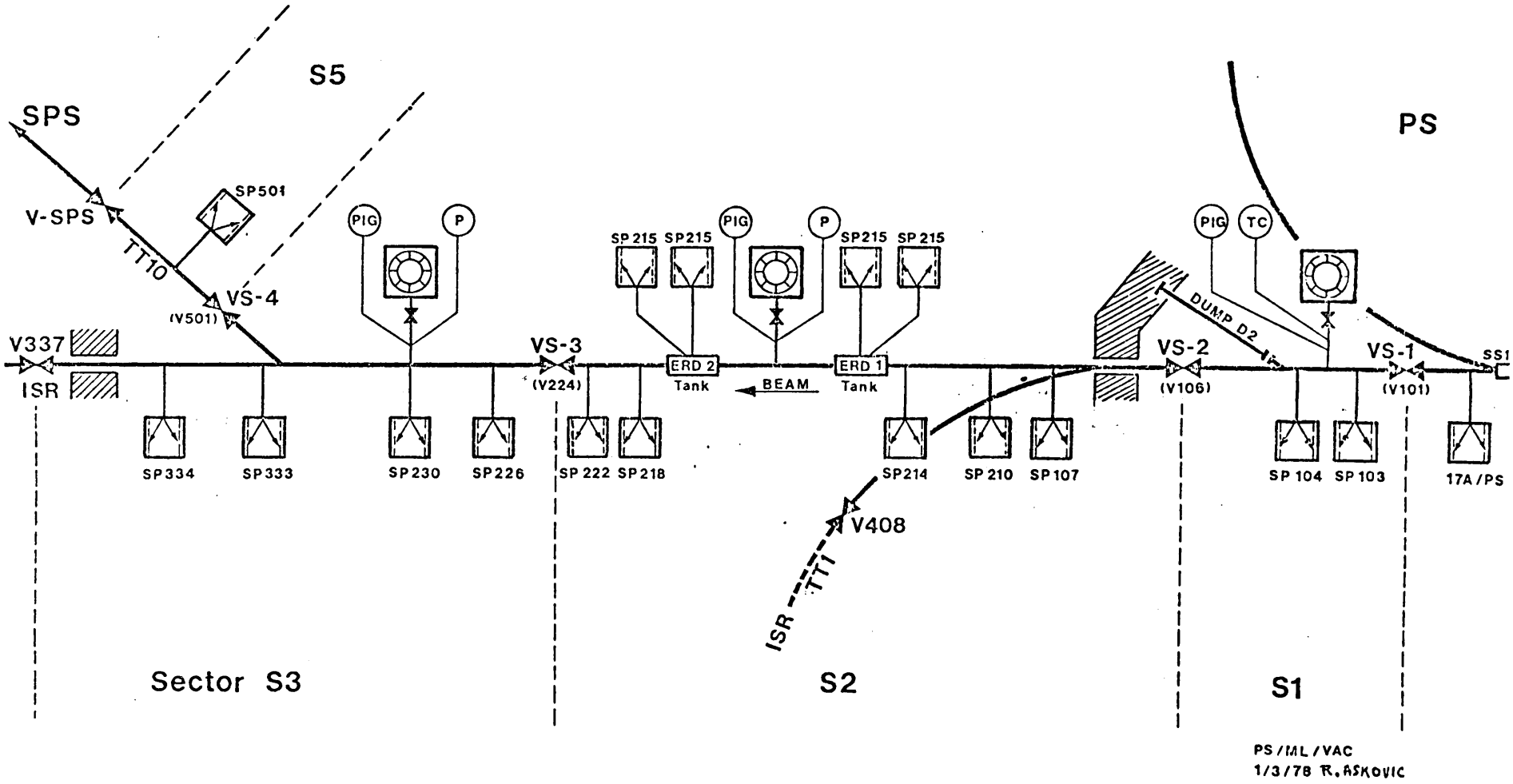
12. External faults

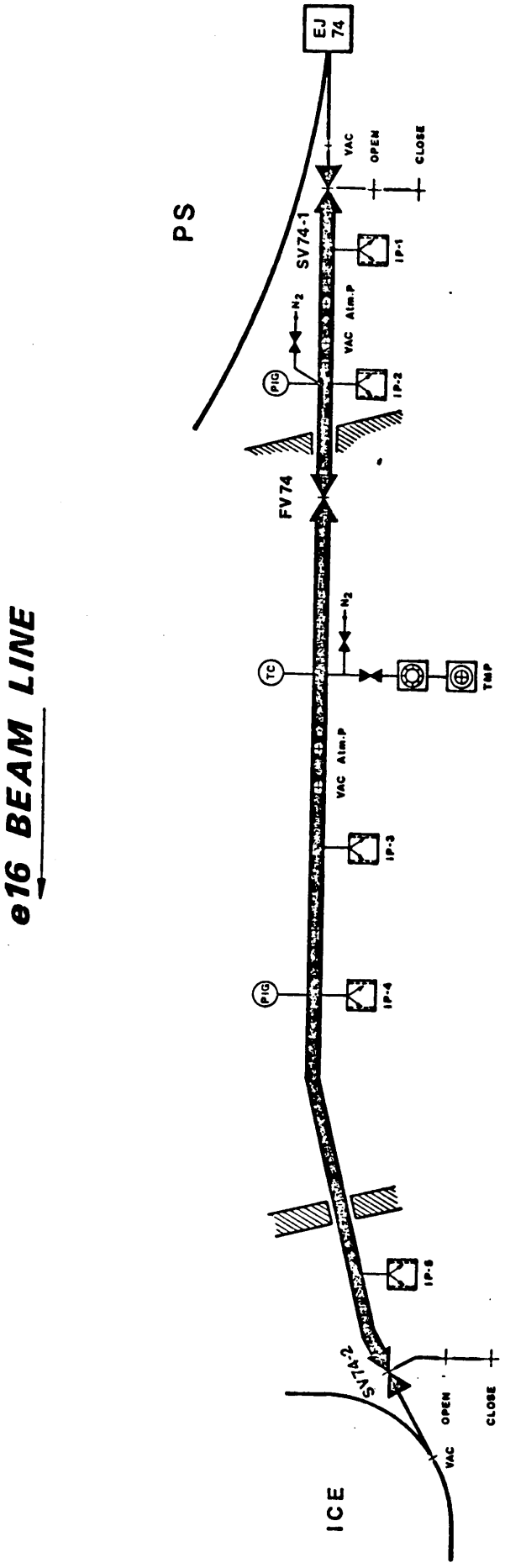
All the faults which are not attributed to an element found in or around the PS, i.e. thunderstorms, - mains failures, - stops due to SB causes (water supply, water pump below door 4, ventilation, etc.) are classed here. (Details in Annex 4).



PS/ML/VAC
1.2.79. A.R

TT2 LINE


S5
SPS
V-SPS
TT10
SP501
VS-4
(V501)
V337
ISR
PIG
P
SP334
SP333
SP230
SP226
VS-3
(V224)
SP215 SP215
SP215 SP215
ERD 2
Tank
ERD 1
Tank
BEAM
SP222 SP218
SP214
SP210
SP107
V408
ISR
TT1
PS
PIG
TC
DUMP D2
VS-2
(V106)
VS-1
(V101)
SS1
SP 104
SP 103
17A/PS
Sector S3
S2
S1
PS/ML/VAC
1/3/78 R.ASKOVIC



PS/ML/VAC
13-11-79 RA

Annex 2

PASSIVE PART ACCELERATION FAULTS

N O F A U L T S

MISCELLANEOUS FAULTS (HOURS)

0.3	Humidity verification in main ring	
0.1	Change of supercycle	(Period 1)
0.1	" " "	
0.1	" " "	
0.2	No reason found	(Period 2)
0.9	Short cycle tests in New Linac	
1.3	18 kV failure due to short-circuit in building 367	(Period 3)
0.1	Operating fault (security)	
0.2	Check of security conditions	(Period 4)
0.2	Operating fault (security)	
0.2	Operating fault	(Period 6)

Annex 4

EXTERNAL FAULTS (HOURS)

0.1	Mains failure	(Period 1)
0.3	Mains failure	(Period 2)
5.7	" "	
4.5	" "	
0.6	" "	
0.1	Mains failure	(Period 3)
0.1	" "	
0.1	" "	
0.1	Mains failure	
0.7	" "	
0.2	Failure of computer system supply	(Period 4)
1.2	Mains failure	(Period 5)
3.6	Mains failure	(Period 6)
0.2	" "	
0.4	Main power failure tests	
0.7	Door opened by security service (Linac)	

FAULTS EXCEEDING 6 HOURS (HOURS)

13.3	Dump target	(Period 5)
12.7	Main generator	(Period 6)

STATISTICS OF PS OPERATION

WEEK NO	CLOCK TIME	CLOSED—UP TIME							TOTAL	P.T.	MAINT. AND INSTAL.	COOLING DOWN AND MISCELLANEOUS
		N.P.		M.D.		M.S.U.		START/STOP				
	(HOURS)	SCHEDULED (HOURS)	WORKED (HOURS)	SCHEDULED (HOURS)	WORKED (HOURS)	SCHEDULED (HOURS)	WORKED (HOURS)	(HOURS)	(HOURS)	(HOURS)	(HOURS)	(HOURS)
1	168										60	108
2	168										60	108
3	168										60	108
4	168										60	108
5	168										60	108
6	168										60	108
7	168										60	108
8	168									60	60	48
9 - 15	1176	936	936	102	102	—	—	33	1071	34	24	47
16 - 22	1176	960	960	120	120	12	12	3	1095	34	24	23
23	168										60	108
24 - 30	1176	972	972	108	108	12	12	3	1095	34	24	23
31 - 37	1176	960	960	120	120	12	12	3	1095	34	24	23
38	168										60	108
39 - 44	1008	828	828	84	84	12	12	3	927	34	24	23
45 - 51	1176	939	939	105	105	12	12	3	1059	34	24	59
52	192										60	132
TOTAL (HOURS)	8760	5595	5595	639	639	60	60	48	6342	264	804	1350
PERCENT CLOCK TIME	100.0	63.9	63.9	7.3	7.3	0.7	0.7	0.5	72.4	3.0	9.2	15.4
PERCENT CLOSED UP TIME	—	88.2	88.2	10.1	10.1	0.9	0.9	0.8	100.0	—	—	—

DISTRIBUTION OF N.P. TIME

WEEK N°	ON TIME		OFF TIME		TOTAL HOURS OF N.P. WORKED
	RUNNING %	SETTING-UP %	FAULTS %	USER REQUEST %	
1		SCHEDULED	SHUT	DOWN	
2		"	"	"	
3		"	"	"	
4		"	"	"	
5		"	"	"	
6		"	"	"	
7		"	"	"	
8		"	"	"	
9 10 11 12 13 14 15	96.2 (900.8)		3.7 (34.5)	0.1 (0.7)	936.0
16 17 18 19 20 21 22	96.1 (922.5)		3.9 (37.3)	- (0.2)	960.0
23		SCHEDULED	SHUT	DOWN	
24 25 26 27 28 29 30	97.4 (946.8)		2.6 (25.0)	- (0.2)	972.0
31 32 33 34 35 36 37	96.0 (921.7)		4.0 (38.2)	- (0.1)	960.0
38		SCHEDULED	SHUT	DOWN	
39 40 41 42 43 44	95.2 (788.0)		4.8 (39.9)	- (0.1)	828.0
45 46 47 48 49 50 51	96.3 (903.9)		3.7 (34.8)	- (0.3)	939.0
52		SCHEDULED	SHUT	DOWN	
TOTAL %	96.2		3.8	-	100.0
TOTAL HOURS	5383.7		209.7	1.6	5595.0

N. P. STATISTICS OF INTENSITY AND Nº OF PULSES

WEEK Nº	TOTAL INTENSITY [10^{16}]	AVERAGE INTENSITY [Tpp^{-1}]	NUMBER OF PULSES
1	SCHEDULED	SHUT DOWN	
2	"	" "	
3	"	" "	
4	"	" "	
5	"	" "	
6	"	" "	
7	"	" "	
8	"	" "	
9 10 11 12 13 14 15	1 116.1	6.58	1 696 052
16 17 18 19 20 21 22	1 158.4	7.37	1 570 672
23	SCHEDULED	SHUT DOWN	
24 25 26 27 28 29 30	1 225.7	8.01	1 530 202
31 32 33 34 35 36 37	1 188.8	8.58	1 385 380
38	SCHEDULED	SHUT DOWN	
39 40 41 42 43 44	1 004.5	7.68	1 308 234
45 46 47 48 49 50 51	1 292.8	8.53	1 515 661
52	SCHEDULED	SHUT DOWN	
TOTAL	6 986.3	7.76	9 006 201

$1\ Tpp^{-1} = 10^{12} pp^{-1}$

TOTAL DISTRIBUTION OF BEAM INTENSITY (N.P.)

ALL VALUES ARE IN 10^{16} PROTONS

WEEK Nº	PRODUCTION TARGETS		DUMP TARGETS	CONTINUOUS TRANSFER		FAST EJECTIONS				SLOW EJECTION	TOTAL
	01		93-97			16		58	74	62	
				SPS	D2	ISR	D2				
9 - 15	57.1		25.7	665.2	89.1	13.5			0.9	264.6	1116.1
16 - 22	19.3			548.9	40.3	17.0			0.4	532.5	1158.4
24 - 30	17.3			633.4	54.4	12.2			0.1	508.3	1225.7
31 - 37	16.0			651.7	52.0	0.5			0.4	468.2	1188.8
39 - 44	15.5			456.3	56.7	13.3	10.8	13.2		438.7	1004.5
45 - 51	16.7			668.8	41.1	13.1		36.9		516.2	1292.8
TOTAL	141.9		25.7	3624.3	333.6	69.6	10.8	50.1	1.8	2728.5	6986.3
PERCENT	2.0		0.4	51.9	4.8	1.0	0.1	0.7	-	39.1	100.0

NP STATISTICS

YEAR	TOTAL HOURS OF N.P. WORKED	TOTAL NUMBER OF PULSES ACCELERATED	TOTAL NUMBER OF PROTONS [10^{16}]	AVERAGE [Tpp^{-1}]
TOTAL FOR 1979	5 595.0	9 006 201	6 986.3	7.76
TOTAL FOR 1960...1978	89 510.3	125 951893	25 841.2	2.05
GRAND TOTAL [1960...1979]	95 105.3	134 958 094	32 827.5	2.43

DISTRIBUTION OF MD TIME

WEEK N°	ON TIME		OFF TIME		TOTAL HOURS OF MD WORKED
	RUNNING %	SETTING-UP %	FAULTS %	USER REQUEST %	
1		SCHEDULED	SHUT DOWN		
2		"	" "		
3		"	" "		
4		"	" "		
5		"	" "		
6		"	" "		
7		"	" "		
8		"	" "		
9 10 11 12 13 14 15	96.5 (98.4)		3.5 (3.6)		102.0
16 17 18 19 20 21 22	94.0 (112.8)		6.0 (7.2)		120.0
23		SCHEDULED	SHUT DOWN		
24 25 26 27 28 29 30	97.1 (104.9)		2.9 (3.1)		108.0
31 32 33 34 35 36 37	97.5 (117.0)		2.5 (3.0)		120.0
38		SCHEDULED	SHUT DOWN		
39 40 41 42 43 44	94.9 (79.7)		5.1 (4.3)		84.0
45 46 47 48 49 50 51	91.2 (95.8)		8.8 (9.2)		105.0
52		SCHEDULED	SHUT DOWN		
TOTAL %	95.2		4.8		100.0
TOTAL HOURS	608.6		30.4		639.0

M.D. STATISTICS OF INTENSITY AND Nº OF PULSES

WEEK Nº	TOTAL INTENSITY $[10^{16}]$	AVERAGE INTENSITY $[Tpp^{-1}]$	NUMBER OF PULSES
1	SCHEDULED	SHUT DOWN	
2	〃	〃 〃	
3	〃	〃 〃	
4	〃	〃 〃	
5	〃	〃 〃	
6	〃	〃 〃	
7	〃	〃 〃	
8	〃	〃 〃	
9 10 11 12 13 14 15	49.3	6.56	75 095
16 17 18 19 20 21 22	40.5	3.35	120 740
23	SCHEDULED	SHUT DOWN	
24 25 26 27 28 29 30	23.8	0.76	309 660
31 32 33 34 35 36 37	57.0	2.12	268 873
38	SCHEDULED	SHUT DOWN	
39 40 41 42 43 44	41.0	3.46	118 483
45 46 47 48 49 50 51	31.8	2.28	139 416
52	SCHEDULED	SHUT DOWN	
TOTAL	243.4	2.36	1 032 267

$1\ Tpp^{-1} = 10^{12} pp^{-1}$

TOTAL DISTRIBUTION OF BEAM INTENSITY (M.D.)

ALL VALUES ARE IN 10^{16} PROTONS

WEEK NO	PRODUCTION TARGETS		DUMP TARGETS	CONTINUOUS TRANSFER		FAST EJECTIONS				SLOW EJECTION	TOTAL
	01		93-97	16				58	74	62	
				SPS	D2	ISR	D2				
9-15	0.2		13.0	14.3	17.7		2.0			2.1	49.3
16-22	0.2		6.3		17.6		6.8			9.6	40.5
24-30			18.0	0.2	2.2	0.8	0.1			2.5	23.8
31-37	0.1		38.0		6.6	0.5	5.5			6.3	57.0
39-44	0.6		22.8		3.2	0.5		0.2		13.7	41.0
45-51	0.1		17.6	1.7	6.6		2.6	0.5		2.7	31.8
TOTAL	1.2		115.7	16.2	53.9	1.8	17.0	0.7		36.9	243.4
PERCENT	0.5		47.5	6.6	22.1	0.8	7.0	0.3		15.2	100.0

DISTRIBUTION OF MSU TIME

WEEK Nº	ON TIME		OFF TIME		TOTAL HOURS OF MSU WORKED
	RUNNING %	SETTING-UP %	FAULTS %	USER REQUEST %	
1		SCHEDULED	SHUT DOWN		
2		"	" "		
3		"	" "		
4		"	" "		
5		"	" "		
6		"	" "		
7		"	" "		
8		"	" "		
9 10 11 12 13 14 15					–
16 17 18 19 20 21 22	97.5 (11.7)		2.5 (0.3)		12.0
23		SCHEDULED	SHUT DOWN		
24 25 26 27 28 29 30	90.0 (10.8)		10.0 (1.2)		12.0
31 32 33 34 35 36 37	96.7 (11.6)		3.3 (0.4)		12.0
38		SCHEDULED	SHUT DOWN		
39 40 41 42 43 44	41.7 (5.0)		58.3 (7.0)		12.0
45 46 47 48 49 50 51	91.7 (11.0)		8.3 (1.0)		12.0
52		SCHEDULED	SHUT DOWN		
TOTAL %	83.5		16.5		100.0
TOTAL HOURS	50.1		9.9		60.0

M.S.U. STATISTICS OF INTENSITY AND Nº OF PULSES

WEEK Nº	TOTAL INTENSITY [10^{16}]	AVERAGE INTENSITY [Tpp^{-1}]	NUMBER OF PULSES
1	SCHEDULED	SHUT DOWN	
2	"	" "	
3	"	" "	
4	"	" "	
5	"	" "	
6	"	" "	
7	"	" "	
8	"	" "	
9 10 11 12 13 14 15	–	–	–
16 17 18 19 20 21 22	12.1	4.12	29 327
23	SCHEDULED	SHUT DOWN	
24 25 26 27 28 29 30	3.4	8.42	4 037
31 32 33 34 35 36 37	6.4	5.86	10 912
38	SCHEDULED	SHUT DOWN	
39 40 41 42 43 44	3.0	5.44	5 512
45 46 47 48 49 50 51	3.1	2.18	14 179
52	SCHEDULED	SHUT DOWN	
TOTAL	28.0	4.38	63 967

$1\ Tpp^{-1} = 10^{12}\ pp^{-1}$

M.S.U. STATISTICS OF INTENSITY AND N° OF PULSES

WEEK N°	TOTAL INTENSITY [10^{16}]	AVERAGE INTENSITY [Tpp^{-1}]	NUMBER OF PULSES
1	SCHEDULED	SHUT DOWN	
2	"	" "	
3	"	" "	
4	"	" "	
5	"	" "	
6	"	" "	
7	"	" "	
8	"	" "	
9 10 11 12 13 14 15	–	–	–
16 17 18 19 20 21 22	12.1	4.12	29 327
23	SCHEDULED	SHUT DOWN	
24 25 26 27 28 29 30	3.4 .	8.42	4 037
31 32 33 34 35 36 37	6.4	5.86	10 912
38	SCHEDULED	SHUT DOWN	
39 40 41 42 43 44	3.0	5.44	5 512
45 46 47 48 49 50 51	3.1	2.18	14 179
52	SCHEDULED	SHUT DOWN	
TOTAL	28.0	4.38	63 967

$1\ Tpp^{-1} = 10^{12} pp^{-1}$

TOTAL DISTRIBUTION OF BEAM INTENSITY (M.S.U.)

ALL VALUES ARE IN 10^{16} PROTONS

WEEK NO	PRODUCTION TARGETS		DUMP TARGETS	CONTINUOUS TRANSFER		FAST EJECTIONS				SLOW EJECTION	TOTAL
	01		93-97			16		58	74	62	
				SPS	D2	ISR	D2				
9-15											-
16-22	0.1		4.8		6.1					1.1	12.1
24-30			1.8		1.5					0.1	3.4
31-37			4.2		1.8					0.4	6.4
39-44			2.4	0.3	0.2	0.1					3.0
45-51			0.4	0.7	1.4					0.6	3.1
TOTAL	0.1		13.6	1.0	11.0	0.1				2.2	28.0
PERCENT	0.3		48.6	3.6	39.3	0.3				7.9	100.0

PS STATISTICS
FOR NP + MD + MSU

YEAR	TOTAL HOURS WORKED	TOTAL NUMBER OF PULSES ACCELERATED	TOTAL NUMBER OF PROTONS [10^{16}]	AVERAGE [Tpp^{-1}]
TOTAL FOR 1979	6 294.0	10 102 435	7 257.7	7.18
TOTAL FOR 1960...1978	90 247.3	126 452 658	26 077.4	2.06
GRAND TOTAL [1960...1979]	96 541.3	136 555 093	33 335.1	2.44

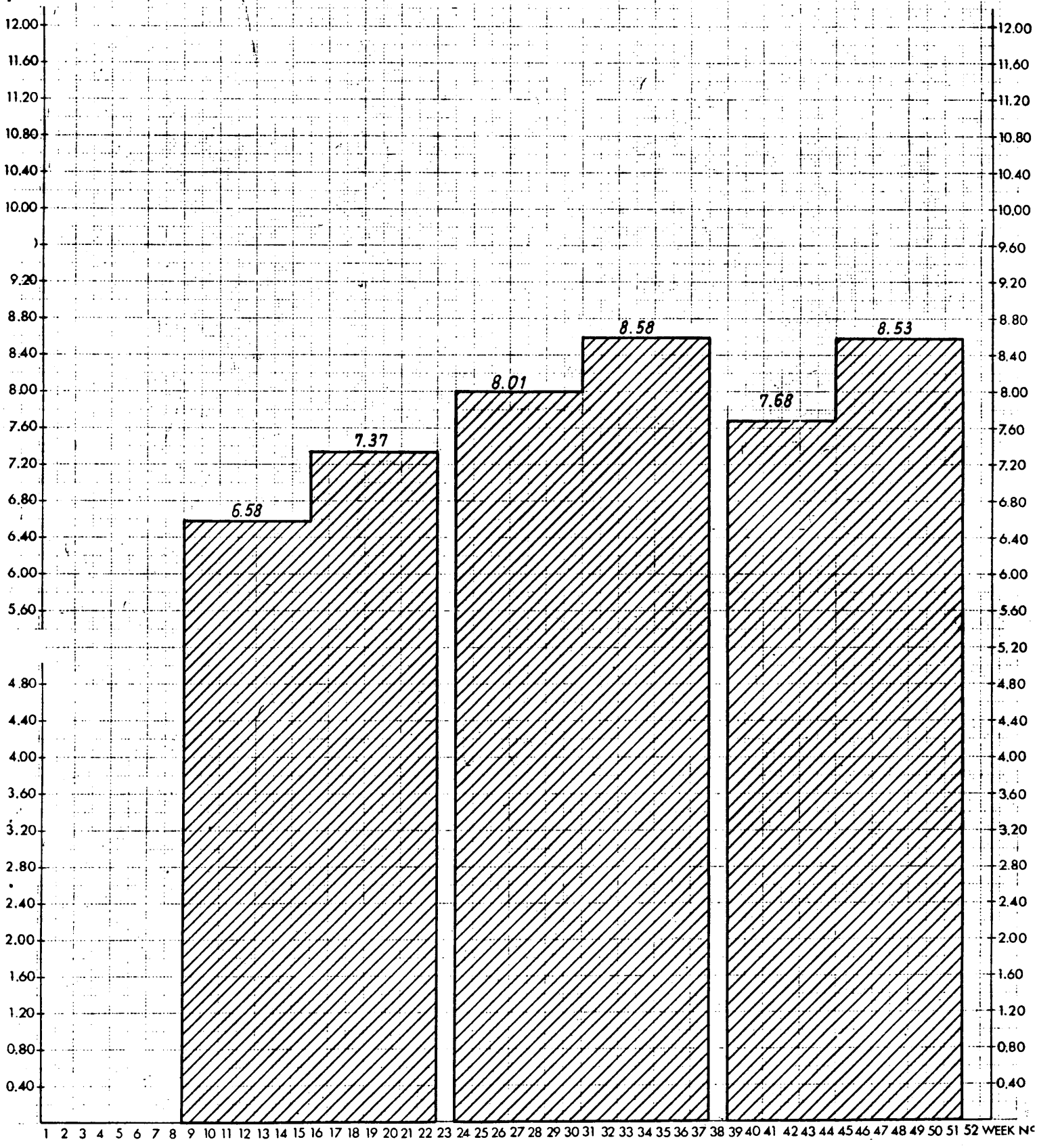
YEAR 1979	2/1 25/2	27/2 13/4	18/4 3/6	4/6 11/6	13/6 29/7	1/8 16/9	17/9 23/9	26/9 4/11	7/11 21/12	24/12 31/12	TOTAL
TIME WORKED NP+MD+MSU (HOURS)	DOWN	1038.0	1092.0	DOWN	1092.0	1092.0	DOWN	924.0	1056.0	DOWN	6294.0
BREAK-DOWN TIME (HOURS)	SHUT	38.1	44.8	SHUT	29.3	41.6	SHUT	51.2	45.0	SHUT	250.0
BREAK-DOWN TIME %	SCHEDULED	3.7	4.1	SCHEDULED	2.7	3.8	SCHEDULED	5.5	4.3	SCHEDULED	4.0

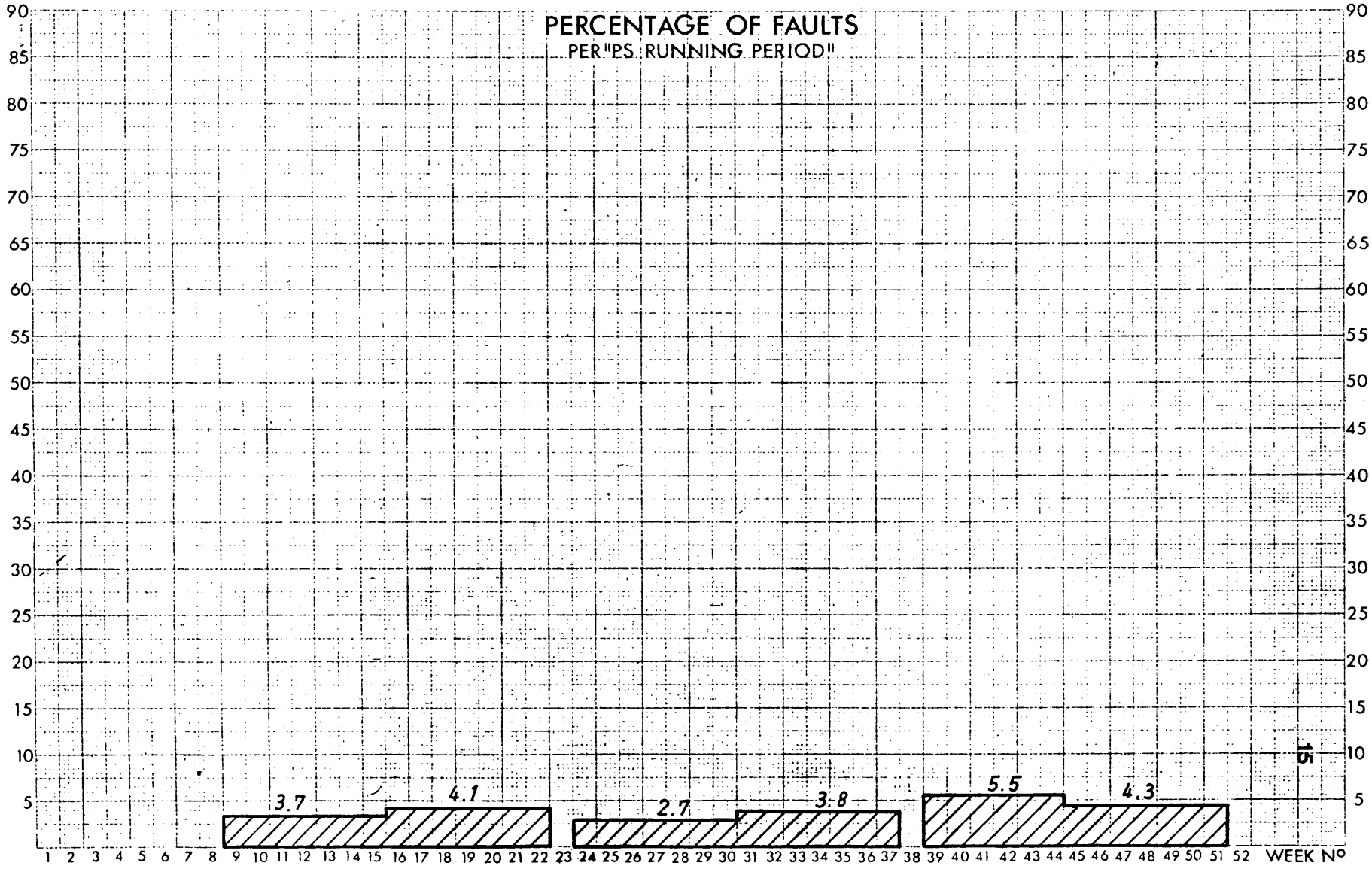
FAULT DISTRIBUTION BY SYSTEM (HOURS)												PERCENTAGE	
												OF TOTAL TIME WORKED = 6294.0	OF TIME LOST = 250.0
MACHINE	MAIN MAGNET & AUXIL.		9.4	5.8		1.3	1.2		1.6	0.6		19.9	0.32	8.0
	MAIN GENE-RATOR		5.8	3.4		-	5.6		0.7	14.3		29.8	0.48	11.9
	LINAC		11.2	10.0		9.5	13.2		15.8	3.9		63.6	1.01	25.5
	BOOSTER		1.9	2.6		2.7	8.1		10.9	9.9		36.1	0.58	14.4
	INJECT.		1.8	4.4		2.1	0.8		0.1	-		9.2	0.15	3.7
	ACCEL.	DOWN	2.7	3.9	DOWN	-	3.1	DOWN	5.0	0.8	DOWN	15.5	0.25	6.2
	VACUUM	SHUT	1.2	-	SHUT	0.3	-	SHUT	-	-	SHUT	1.5	0.02	0.6
	EJECT.& TARGETS	SCHEDULED	0.3	0.4	SCHEDULED	0.2	0.9	SCHEDULED	14.3	0.2	SCHEDULED	16.3	0.26	6.5
	CONTROL		2.6	1.9		11.3	6.9		1.1	7.9		31.7	0.51	12.7
	BEAM TRANS-PORT		0.5	0.2		0.3	0.3		0.5	2.3		4.1	0.06	1.6
	MISCELL.		0.6	1.1		1.3	0.5		-	0.2		3.7	0.06	1.5
	EXTER. FAULTS		0.1	11.1		0.3	1.0		1.2	4.9		18.6	0.30	7.4

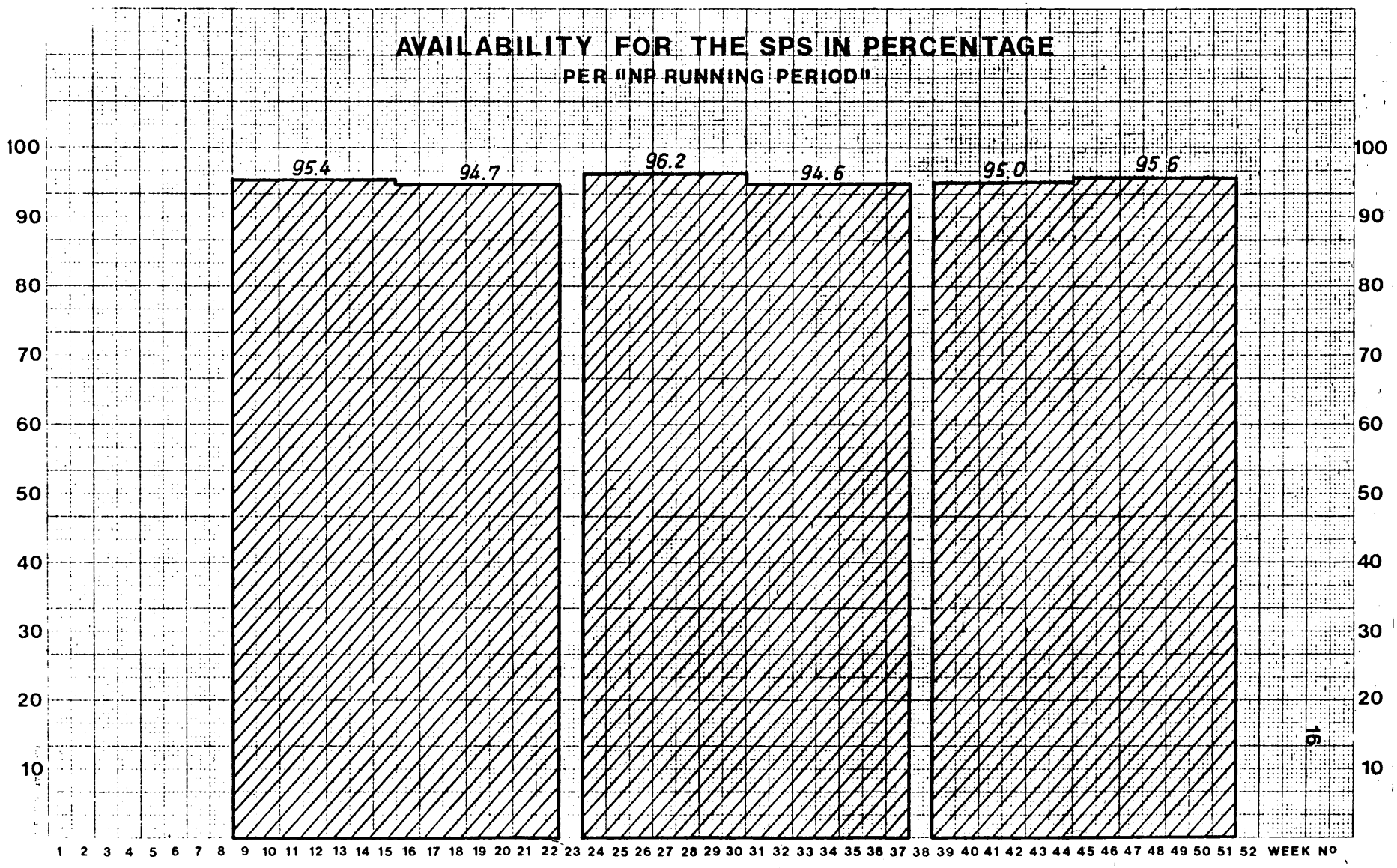
VARIATION OF AVERAGE INTENSITY $[Tpp^{-1}]$

PER "NP RUNNING PERIOD"

(PROGRAMMED INTENSITY)




PERCENTAGE OF FAULTS
PER "PS RUNNING PERIOD"
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
WEEK Nº
3.7
4.1
2.7
3.8
5.5
4.3
15


AVAILABILITY FOR THE SPS IN PERCENTAGE
PER "NP RUNNING PERIOD"
100
90
80
70
60
50
40
30
20
10
95.4
94.7
96.2
94.6
95.0
95.6
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 WEEK Nº
16

FAULT DISTRIBUTION BY SYSTEM (Number of faults / Total time)

YEAR 1977	0'- 10'	10'-20'	20'- 1H	1H - 3H	3H-6H	> 6H	TOTAL
	352 / 27^{h}08	107 / 26^{h}23	106 / 64^{h}45	78 / 135^{h}57	19 / 82^{h}23	12 / 93^{h}08	674 / 429^{h}44
MAIN MAGNET & AUXILIARIES	48 / 3^{h}27	9 / 2^{h}20	11 / 7^{h}23	13 / 18^{h}50	-	-	81 / 32^h
MAIN GENERATOR	18 / 1^{h}30	3 / 45'	9 / 5^{h}42	1 / 1^{h}03	-	-	31 / 9^h
LINAC	66 / 5^{h}05	16 / 4^{h}05	31 / 19^{h}59	15 / 25^{h}52	3 / 10^{h}53	-	131 / 65^{h}54
BOOSTER	27 / 2^{h}16	16 / 4^{h}11	14 / 8^{h}32	10 / 17^{h}52	1 / 4^{h}06	1 / 6^{h}15	69 / 43^{h}12
INJECTION	25 / 1^{h}27	4 / 1^{h}06	6 / 3^{h}20	7 / 11^{h}49	1 / 5^h	-	43 / 22^{h}42
ACCELERAT.	27 / 2^{h}36	19 / 4^{h}47	10 / 5^{h}44	3 / 4^{h}23	-	-	59 / 17^{h}30
VACUUM	-	1 / 13'	1 / 21'	2 / 3^{h}26	-	-	4 / 4^h
EJECTION & TARGETS	6 / 36'	4 / 50'	4 / 2^{h}26	2 / 3^{h}56	1 / 4^{h}20	1 / 13^{h}40	18 / 25^{h}48
CONTROL	76 / 4^{h}49	8 / 1^{h}55	4 / 2^{h}24	4 / 6^{h}08	1 / 3^{h}03	4 / 30^{h}41	97 / 49^h
BEAM TRANSPORT	6 / 45'	3 / 49'	1 / 30'	2 / 3^{h}14	-	-	12 / 5^{h}18
MISCELL.	9 / 44'	2 / 25'	-	2 / 2^{h}36	-	-	13 / 3^{h}45
EXT. FAULTS	10 / 55'	5 / 1^{h}17	7 / 3^{h}31	11 / 23^{h}06	3 / 13^{h}21	2 / 13^{h}20	38 / 55^{h}30
STOP ON REQUEST (Rx)	34 / 2^{h}58	17 / 3^{h}40	8 / 4^{h}53	6 / 13^{h}42	9 / 41^{h}40	4 / 29^{h}12	78 / 96^{h}05

FAULT DISTRIBUTION BY SYSTEM (Number of faults/Total time)

YEAR 1978	0'-10' 260/20h58	10'-20' 90/21h57	20'-1H 91/55h26	1H-3H 60/103h35	3H-6H 13/51h27	>6H 8/80h35	TOTAL 522/333h58
MAIN MAGNET & AUXILIARIES	22/ 1h32	5/ 1h09	9/7h40	7/ 7h39	1/ 3h37	-	44/ 21h37
MAIN GENERATOR	11/ 57'	3/ 47'	-	3/ 6h11	-	-	17/ 7h55
LINAC	50/ 4h10	12/ 3h06	12/ 7h07	13/ 23h20	1/3h47	-	88/ 41h30
BOOSTER	19/ 1h24	11/ 3h06	6/3h06	2/4 h06	1/ 3h53	-	39/ 15h35
INJECTION	19/ 1h24	3/ 29'	11/6 h16	2/ 2h02	-	-	35/ 10h11
ACCELERAT.	18/ 1 h57	10/ 2h14	8/ 4h53	3/ 5h33	1/ 3h35	-	40/ 18h12
VACUUM	-	1/ 18'	1/ 57'	2/ 4h04	-	-	4/ 5h19
EJECTION & TARGETS	1/ 04'	1/ 14'	2/ 51'	1/ 1h02	-	-	5/ 2h11
CONTROL	48/ 3h44	11/ 2h56	10/ 5h32	11/ 19h22	4/ 14h19	-	84/ 45h53
BEAM TRANSPORT	5/ 40'	6/ 1h20	-	-	-	-	11/ 2h
MISCELL.	5/ 21'	3/ 42'	2/ 1h02	3/ 4h37	-	-	13/ 6h42
EXT. FAULTS	17/ 1h09	3/ 46'	9/ 5h38	1/ 2h28	2/ 7h15	1/ 20h24	33/ 37h40
STOP ON REQUEST (Rx)	45/ 3h36	21/ 4h50	21/ 12h24	12/ 23h11	3/ 15h01	7/ 60h11	109/ 119h13

FAULT DISTRIBUTION BY SYSTEM(Number of faults/ Total time)

YEAR 1979	0'- 10' 324 / 23^h46	10'-20' 144/ 35^h41	20'- 1H 116/ 72^h16	1H - 3H 57/ 85^h43	3H-6H 15/ 65^h17	> 6H 11/ 130^h	TOTAL 667/ 412^h43
MAIN MAGNET & AUXILIARIES	59/ 3^h40	15/ 3^h30	12/ 5^h59	4/ 6^h46			90/ 19^h55
MAIN GENERATOR	26/ 1^h32	7/ 1^h52	3/ 1^h48	4/ 6^h19	1/ 5^h32	1/ 12^h42	42/ 29^h45
LINAC	77/ 5^h55	32/ 8^h14	24/ 16^h52	18/ 25^h59	2/ 6^h34		153/ 63^h34
BOOSTER	23/ 2^h16	6/ 1^h40	18/ 12^h04	8/ 12^h12	2/ 7^h56		57/ 36^h08
INJECTION	25/ 1^h25	10/ 2^h37	5/ 4^h05	1/ 1^h05			41/ 9^h12
ACCELERAT.	13/ 47'	21/ 4^h54	7/ 3^h17	5/ 6^h35			46/ 15^h33
VACUUM	1/ 3'	2/ 27'		1/ 1^h			4/ 1^h30
EJECTION & TARGETS	2/ 14'	4/ 58'	3/ 1^h49			1/ 13^h17	10/ 16^h18
CONTROL	31/ 2^h35	19/ 4^h41	15/ 9^h33	6/ 11^h44	1/ 3^h08		72/ 31^h41
BEAM TRANSPORT	7/ 45'	6/ 1^h27	5/ 1^h57				18/ 4^h09
MISCELL.	9/ 36'	4/ 55'	1/ 50'	1/ 1^h20			15/ 3^h41
EXT. FAULTS	8/ 36'	2/ 23'	5/ 2^h47	1/ 1^h11	3/ 13^h39		19/ 18^h36
STOP ON REQUEST (Rx)	43/ 3^h22	16/ 4^h03	18/ 11^h15	8/ 11^h32	6/ 28^h28	9/ 104^h01	100/ 162^h41