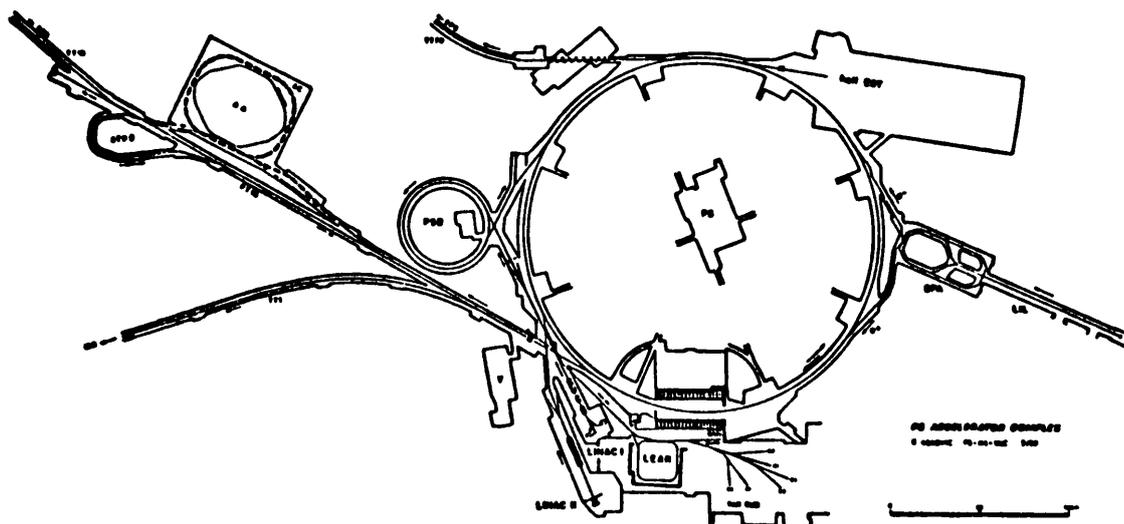


EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

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STATISTICS OF PS OPERATION



1985

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STATISTICS OF PS OPERATION

1 9 8 5

Explanatory note

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.

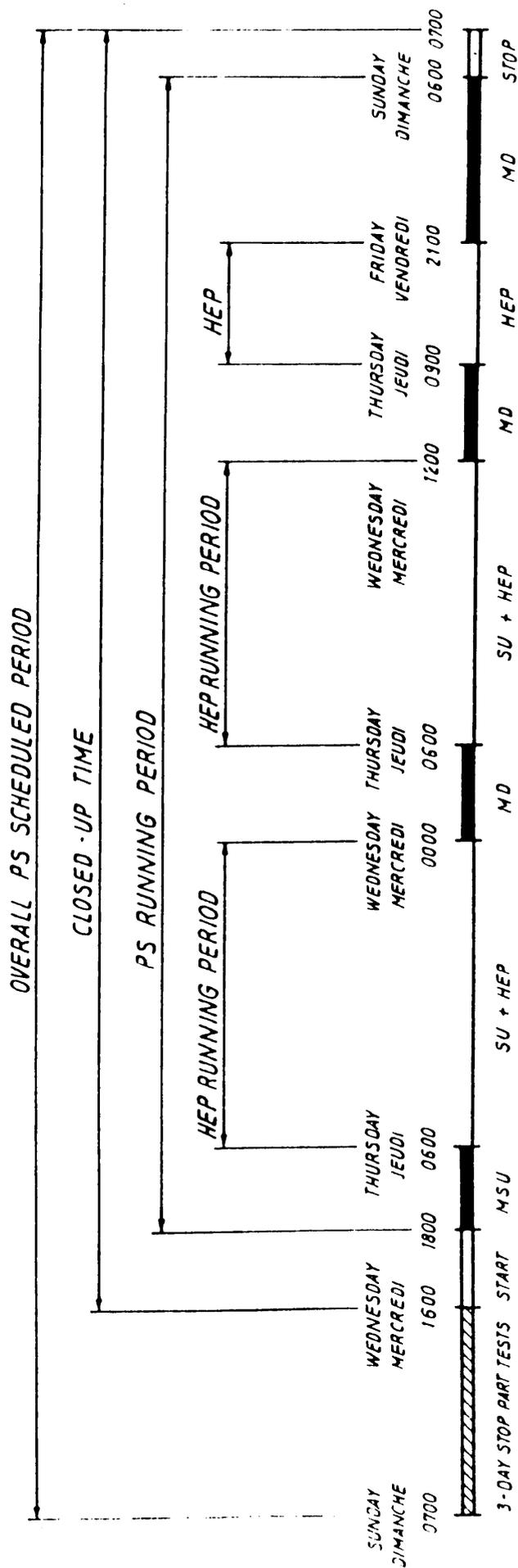
PS RUNNING PERIOD is defined as the time of continuous PS operation from the scheduled end of a PS start-up until the beginning of the next shutdown procedure and includes stops for breakdowns, etc.

HEP RUNNING PERIOD is a period of continuous PS operation for High Energy Physics. They are generally three such periods per PS running period, not necessarily of equal length and separated by a machine development period.

Change since last year

- New Table No. 20: FAULT DISTRIBUTION BY SYSTEM FOR AA
- New Table No. 26: TOTAL PSB INTENSITY PER RING AND NUMBER OF PULSES
- New Table No. 27: STATISTICS OF PS INTENSITY AND FAULTS SINCE 1981

DEFINITIONS FOR A NORMAL RUNNING PERIOD



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

(Days and hours are only mentioned as example.)

- TABLE 1 : A VIEW OF PS PERFORMANCE FOR 1985

- TABLE 2 : 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:

- HEP : time used for high energy 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, Linac and PSB testing, prior to PS start-up

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 3 : DISTRIBUTION OF HEP TIME

Under this heading, the time used for high energy physics is divided into four distinct categories (expressed as a percentage of total hours of HEP 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 HEP
OFF TIME	FAULTS%	: self-explanatory
	USER REQUEST%	: time during which PS is stopped at HEP users request

- TABLE 4 : HEP STATISTICS OF INTENSITY AND NUMBER OF PULSES

The total intensity, the total number of accelerated beam pulses and the average intensity ($1 \text{ Tpp}^{-1} = 10^{12}$ protons per pulse) are given. These are calculated for the entire HEP time in each "PS running period".

- TABLE 5 : TOTAL DISTRIBUTION OF BEAM INTENSITY (HEP)

The distribution of the beam between the various targets and ejection systems is given for the HEP time of each "PS running period". Totals and percentages are quoted for the year 1985.

(APTST : tests of AA injection and ejection at 3.5 GeV/c)

- TABLE 6 : HEP STATISTICS

This gives the total number of hours of HEP time, the total number of accelerated beam pulses, the total intensity and the average intensity computed over the total time for the year 1985. The same figures are given for the period 1960-1984 inclusive and under "Grand Total" are given the overall totals and overall average for 1985.

- TABLE 7 : 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 8 : MD 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 MD time in each "PS running period".

- TABLE 9 : 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 1985.

- TABLE 10 : DISTRIBUTION OF MSU TIME

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

ON TIME % : self-explanatory

OFF TIME % : self-explanatory

- TABLE 11 : MSU 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 MSU time in each "PS running period".

- TABLE 12 : 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 1985.

- TABLE 13 : STATISTICS

This gives the total number of hours of HEP + 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 1985. Under "Grand Total" are given the overall totals and overall average for 1960-1985 inclusive.

- TABLE 14 : FAULT DISTRIBUTION BY SYSTEM

This gives the breakdown time per "PS running period" according to the various PS system*. Totals and percentages for 1985 are given.

- TABLE 15 : VARIATIONS OF AVERAGE INTENSITY (HEP)

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

- TABLE 16 : PERCENTAGE OF FAULTS

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

* See annex 1 for the meaning of this heading.

• TABLE 17 : AVAILABILITY FOR THE SPS AND AA IN PERCENTAGE

This graph shows the availability for the SPS and AA in percentage. It is calculated for the HEP time of each "PS running period" according to the formulae:

$$\frac{\text{HEP time} - (\text{HEP faults} + \text{continuous transfer faults during HEP})}{\text{HEP time}} \quad \text{for SPS}$$

and

$$\frac{\text{AA running-in time} - \text{Total PS faults (as seen by AA)}}{\text{AA running-in time}} \quad \text{for AA}$$

• TABLE 18 : FAULT DISTRIBUTION BY SYSTEM (Number of faults/total time)

This table gives the breakdown time for the year 1985, 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 19 : FAULT DISTRIBUTION BY SYSTEM FOR THE BOOSTER (Number of faults/total time)

This table gives the breakdown time for the Booster only, for the year 1985.

• TABLE 20 : FAULT DISTRIBUTION BY SYSTEM (number of faults/total time) for AA. This table gives the breakdown time for the AA only, for 1985

• TABLE 21 : STATISTIQUES AA (Y. Renaud)
Récapitulatif pour l'année 1985.

• TABLE 22 : 1985 PS SCHEDULE

* See annex 1 for the meaning of this heading.

- TABLE 23 : STATISTIQUES LEAR (R. Ley)

Statistiques LEAR pour 1985.

- TABLE 24 : ANNUAL STATISTICS FOR THE PS COMPLEX (monthly)

- TABLE 25 : EVOLUTION OF FAULT DISTRIBUTION BY SYSTEM SINCE 1981

- TABLE 26 : TOTAL PSB INTENSITY PER RING AND NUMBER OF PULSES. The distribution of the beam between the different transformers is given for each "PS running period". Total intensity and number of pulses are quoted for 1985.

- TABLE 27 : STATISTICS OF PS INTENSITY AND FAULTS SINCE 1981.

Références

L. Henny, Opération du PS - Expériences de Physique, PS/OP/Notes 85-14, 85-21, 85-29, 86-1.

M. Bouthéon, Monthly Management Reports, Technical parameters, for 1985 (January 1986).

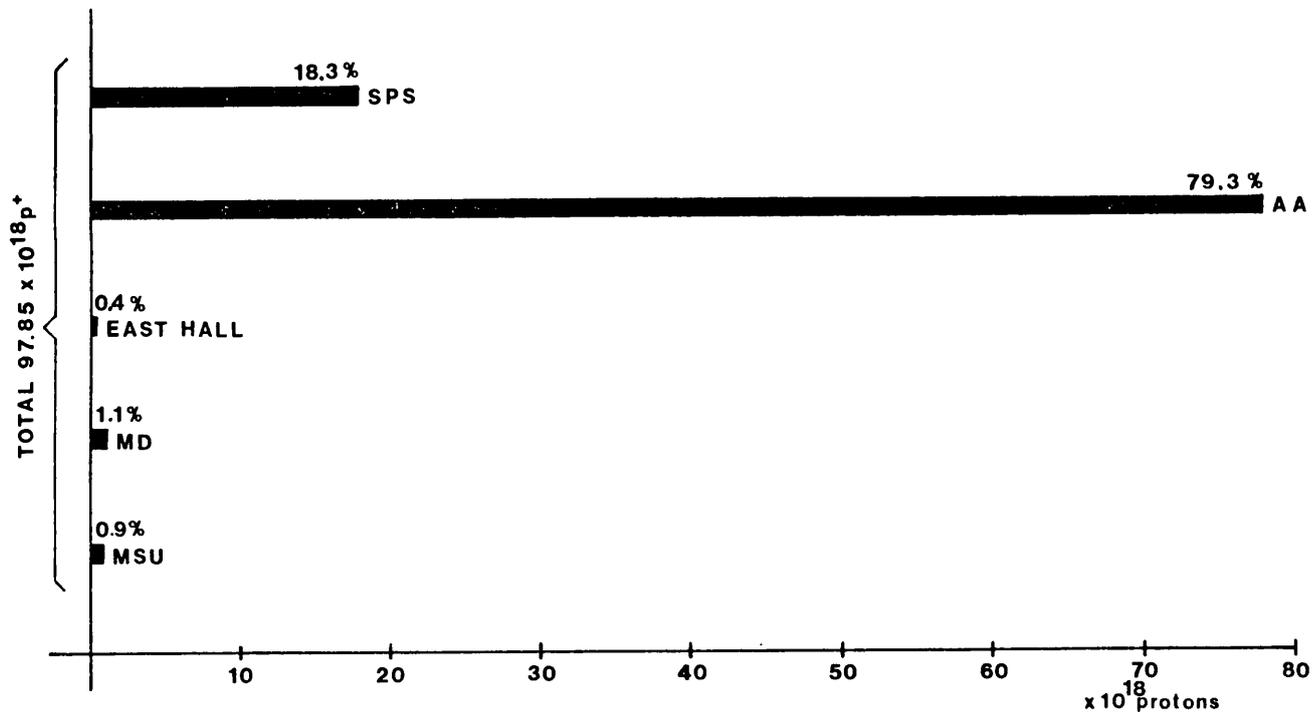


Fig.1 GENERAL DISTRIBUTION OF p ACCELERATED BY THE PS IN 1985

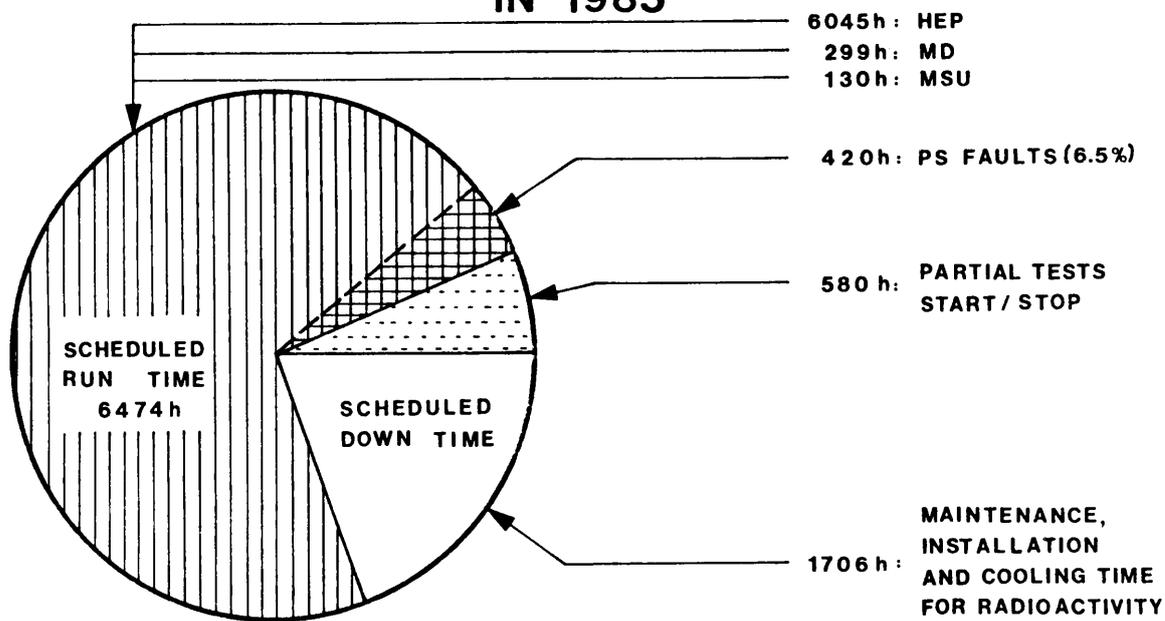


Fig.2 DIVISION OF PS CAKE FOR 1985

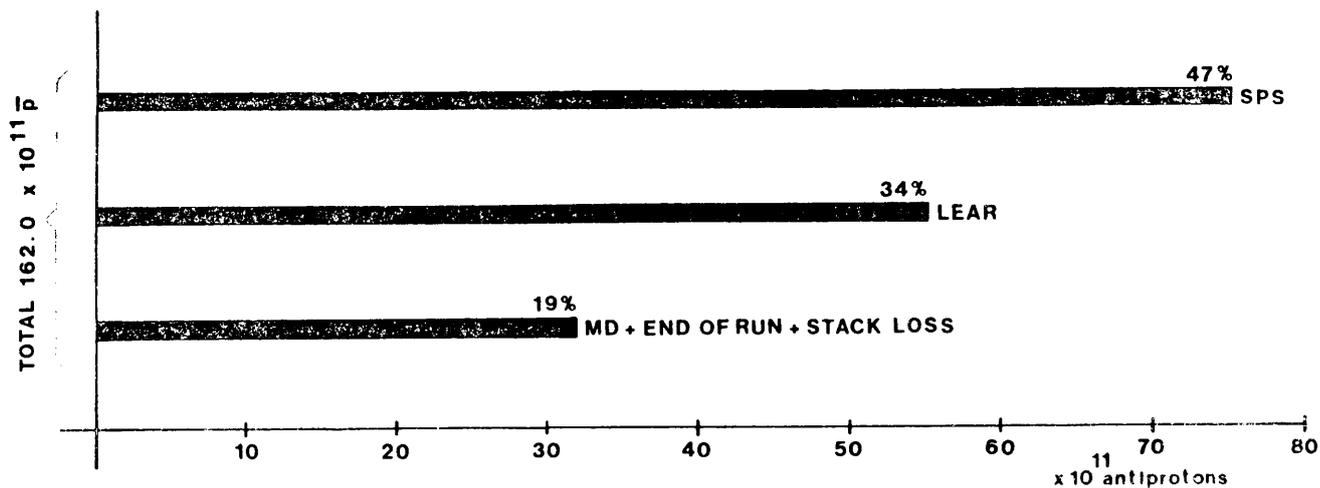


Fig.3 GENERAL DISTRIBUTION OF p-bar BY AA IN 1985

TABLE 2

STATISTICS OF PS OPERATION

WEEK NO	CLOCK TIME (HOURS)	CLOSED --UP TIME										TOTAL SCHED (HOURS)	TOTAL WORKED (HOURS)	P. T. (HOURS)	MAINT. AND INSTAL. (HOURS)	COOLING DOWN AND MISCELLANEOUS (HOURS)
		HEP		M.D.		M.S.U.		START/STOP (HOURS)								
		SCHEDULED (HOURS)	WORKED (HOURS)	SCHEDULED (HOURS)	WORKED (HOURS)	SCHEDULED (HOURS)	WORKED (HOURS)									
1 - 6	984												240	744		
7 - 14	1344	853	853	69	69	70	70		70		169	1161	60	24	99	
15	168													60	108	
16 - 25	1680	1368	1374	90	84	12	12		12		3	1473	34	48	125	
26 - 33	1344	1106	1106	114	114	12	12		12		3	1235	34	24	51	
34	168													60	108	
35 - 52	3072	2712	2712	32	32	36	36		36		3	2783	34	58	197	
TOTAL (HOURS)	8760	6039	6045	305	299	130	130		130		178	6652	402	1018	688	
PERCENT CLOCK TIME	<u>100.0</u>	68.9	<u>69.0</u>	3.5	<u>3.4</u>	1.5	1.5		1.5		<u>2.0</u>	<u>75.9</u>	4.6	11.6	7.9	
PERCENT CLOSED UP TIME		90.8	<u>90.9</u>	4.6	<u>4.5</u>	2.0	2.0		2.0		<u>2.6</u>	<u>100.0</u>	-	-	-	

DISTRIBUTION OF HEP TIME IN HOURS (IN %)

TABLE 3

WEEK NO	ON TIME		OFF TIME		TOTAL HOURS OF N.P. WORKED
	RUNNING	SETTING-UP	FAULTS	USER REQUEST	
1		<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>	
2		"	"	"	
3		"	"	"	
4		"	"	"	
5		"	"	"	
6		"	"	"	
7					
8					
9					
10	<i>743.27</i>		<i>98.54</i>	<i>10.39</i>	<i>853.00</i>
11	<i>(87.2)</i>		<i>(11.6)</i>	<i>(1.2)</i>	
12					
13					
14					
15		<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>	
16					
17					
18					
19	<i>1271.05</i>		<i>83.36</i>	<i>19.19</i>	<i>1374.00</i>
20	<i>(92.5)</i>		<i>(6.1)</i>	<i>(1.4)</i>	
21					
22					
23					
24					
25					
26					
27					
28	<i>1044.58</i>		<i>60.56</i>	<i>0.06</i>	<i>1106.00</i>
29	<i>(94.5)</i>		<i>(5.5)</i>	<i>(-)</i>	
30					
31					
32					
33					
34		<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>	
35					
36					
37					
38					
39					
40					
41					
42					
43	<i>2571.15</i>		<i>140.27</i>	<i>0.18</i>	<i>2712.00</i>
44	<i>(94.8)</i>		<i>(5.2)</i>	<i>(-)</i>	
45					
46					
47					
48					
49					
50					
51					
52					
TOTAL %	<i>93.1</i>		<i>6.4</i>	<i>0.5</i>	<i>100.00</i>
TOTAL HOURS	<i>5630.45</i>		<i>383.53</i>	<i>30.22</i>	<i>6045.00</i>

HEP STATISTICS OF INTENSITY AND N° OF PULSES

TABLE 4

WEEK N°	TOTAL INTENSITY [$10^{16} p^+$]	AVERAGE INTENSITY [Tpp^{-1}]	NUMBER OF PULSES
1	<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>
2	"	"	"
3	"	"	"
4	"	"	"
5	"	"	"
6	"	"	"
7	875.5	6.96	1 258 704
8			
9			
10			
11			
12			
13			
14			
15	<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>
16	2 338.6	9.96	2 348 660
17			
18			
19			
20			
21			
22			
23			
24			
25			
26	1 720.5	7.88	2 184 755
27			
28			
29			
30			
31			
32			
33			
34	<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>
35	4 656.3	11.51	4 044 247
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
51			
52			
TOTAL	9 590.9	9.75	9 836 366

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

TOTAL DISTRIBUTION OF BEAM INTENSITY (HEP)

ALL VALUES ARE IN 10¹⁶ PROTONS

TABLE 5

WEEK NO	PRODUCTION TARGETS	DUMP TARGETS 93-97-D2 47-48	CONTINUOUS TRANSFER		FAST EJECTIONS			SLOW EJECTION	TOTAL
			SPS + D2		APTST	16			
			SPS	D2		AA	D2		
7 - 14		1.2	9.0	2.0		863.0	0.3	875.5	
16 - 25		6.2	798.5	0.3		1524.3	9.3	2338.6	
26 - 33		3.5	952.8	0.4		743.9	19.9	1720.5	
35 - 52		3.6	23.0	0.7		4622.4	6.6	4656.3	
TOTAL		14.5	1783.3	3.4		7753.6	36.1	9590.9	
PERCENT		0.2	18.6	-		80.8	0.4	100.0	

HEP STATISTICS

TABLE 6

YEAR	TOTAL HOURS OF N.P. WORKED	TOTAL NUMBER OF PULSES ACCELERATED	TOTAL NUMBER OF PROTONS [10 ¹⁶]	AVERAGE [Tpp ⁻¹]
TOTAL FOR 1985	6 045.0	9 836 366	9 590.9	9.75
TOTAL FOR 1960...1984	125 027.8	183 842 494	72 060.5	3.92
GRAND TOTAL 1960...1985	131 072.8	193 678 860	81 651.4	4.22

DISTRIBUTION OF MD TIME IN HOURS (IN %)

TABLE 7

WEEK N ^o	ON TIME		OFF TIME		TOTAL HOURS OF MD WORKED
	RUNNING	SETTING-UP	FAULTS	USER REQUEST	
1		<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>	
2		"	"	"	
3		"	"	"	
4		"	"	"	
5		"	"	"	
6		"	"	"	
7					
8					
9					
10	<i>57.30</i>		<i>11.30</i>		<i>69.00</i>
11	<i>(83.3)</i>		<i>(16.7)</i>		
12					
13					
14					
15		<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>	
16					
17					
18					
19	<i>79.36</i>		<i>4.24</i>		<i>84.00</i>
20	<i>(94.8)</i>		<i>(5.2)</i>		
21					
22					
23					
24					
25					
26					
27					
28					
29	<i>107.05</i>		<i>6.55</i>		<i>114.00</i>
30	<i>(93.9)</i>		<i>(6.1)</i>		
31					
32					
33					
34		<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>	
35					
36					
37					
38					
39					
40					
41					
42					
43	<i>32.00</i>				<i>32.00</i>
44	<i>(100.0)</i>				
45					
46					
47					
48					
49					
50					
51					
52					
TOTAL %	<i>92.4</i>		<i>7.6</i>		<i>100.00</i>
TOTAL HOURS	<i>276.11</i>		<i>22.49</i>		<i>299.00</i>

M. D. STATISTICS OF INTENSITY AND NO OF PULSES

TABLE 8

WEEK NO	TOTAL INTENSITY [10 ¹⁶ p ⁺]	AVERAGE INTENSITY [Tpp ⁻¹]	NUMBER OF PULSES
1	<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>
2	"	"	"
3	"	"	"
4	"	"	"
5	"	"	"
6	"	"	"
7	24.7	1.11	223 361
8			
9			
10			
11			
12			
13			
14			
15	<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>
16	33.9	2.72	124 668
17			
18			
19			
20			
21			
22			
23			
24			
25			
26	10.2	3.62	28 174
27			
28			
29			
30			
31			
32			
33			
34	<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>
35	40.3	0.96	419 420
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
51			
52			
TOTAL	109.1	1.37	795 623

1Tpp⁻¹ = 10¹² pp⁻¹

TABLE 9

TOTAL DISTRIBUTION OF BEAM INTENSITY (MD)

ALL VALUES ARE IN 10¹⁶ PROTONS

WEEK NO	PRODUCTION TARGETS		DUMP TARGETS 93-97-D2 47-48	CONTINUOUS TRANSFER		FAST EJECTIONS			SLOW EJECTION	TOTAL
				SPS + D2		APTST	16			
				SPS	D2		AA	D2		
7-14			10.7	0.8	0.1	13.1		62	24.7	
16-25			14.2	4.2		15.4		0.1	33.9	
26-33			7.0	2.4		0.8			10.2	
35-52			16.4			23.9			40.3	
TOTAL			48.3	7.4	0.1	53.2		0.1	109.1	
PERCENT			44.3	6.8	0.1	48.7		0.1	100.0	

DISTRIBUTION OF MSU TIME IN HOURS (IN %)

TABLE 10

WEEK NO	ON TIME		OFF TIME		TOTAL HOURS OF MSU WORKED
	RUNNING	SETTING-UP	FAULTS	USER REQUEST	
1		<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>	
2		"	"	"	
3		"	"	"	
4		"	"	"	
5		"	"	"	
6		"	"	"	
7					
8					
9					
10	60.02		9.58		70.00
11	(85.1)		(14.3)		
12					
13					
14					
15		<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>	
16					
17					
18					
19	9.15		2.45		12.00
20	(77.5)		(22.5)		
21					
22					
23					
24					
25					
26					
27					
28					
29	12.00		-		12.00
30	(100.0)				
31					
32					
33					
34		<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>	
35					
36					
37					
38					
39					
40					
41					
42					
43	35.34		0.26		36.00
44	(98.9)		(1.1)		
45					
46					
47					
48					
49					
50					
51					
52					
TOTAL %	89.9		10.1		
TOTAL HOURS	116.51		13.09		130.00

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

TABLE 11

WEEK N°	TOTAL INTENSITY [10 ¹⁶ p ⁺]	AVERAGE INTENSITY [Tpp ⁻¹]	NUMBER OF PULSES
1	<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>
2	'	'	'
3	'	'	'
4	'	'	'
5	'	'	'
6	'	'	'
7			
8			
9			
10			
11	12.3	1.16	105 816
12			
13			
14			
15	<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>
16			
17			
18			
19			
20	10.0	5.27	18 971
21			
22			
23			
24			
25			
26			
27			
28			
29	35.7	3.93	90 756
30			
31			
32			
33			
34	<i>SCHEDULED</i>	<i>SHUT</i>	<i>DOWN</i>
35			
36			
37			
38			
39			
40			
41			
42			
43	27.2	3.84	70 806
44			
45			
46			
47			
48			
49			
50			
51			
52			
TOTAL	85.2	2.98	286 349

1Tpp⁻¹ = 10¹² pp⁻¹

TABLE 12

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

ALL VALUES ARE IN 10¹⁶ PROTONS

WEEK NO	PRODUCTION TARGETS	DUMP TARGETS 93-97-D2 47-48	CONTINUOUS TRANSFER		FAST EJECTIONS			SLOW EJECTION	TOTAL
			SPS + D2		APTST	AA + D2	16		
7-14		0.1	4.7			7.5		62	12.3
16-25		0.1	3.0			6.5		0.4	10.0
26-33			35.5					0.2	35.7
35-52			0.1	0.4		26.7			27.2
TOTAL		0.2	43.3	0.4		40.7		0.6	85.2
PERCENT		0.2	50.8	0.5		47.8		0.7	100.0

**PS STATISTICS
FOR HEP + MD + MSU**

TABLE 13

YEAR	TOTAL HOURS WORKED	TOTAL NUMBER OF PULSES ACCELERATED	TOTAL NUMBER OF PROTONS [10 ¹⁶]	AVERAGE [Tpp ⁻¹]
TOTAL FOR 1985	6 474.0	10 918 338	9 785.2	8.96
TOTAL FOR 1960...1984	128 790.3	188 695 503	73 743.8	3.91
GRAND TOTAL 1960...1985	135 264.3	199 613 841	83 529.0	4.18

TABLE 14

YEAR	1/1	11/2	8/4	15/4	24/6	19/8	26/8	TOTAL			
1985	10/2	7/4	14/4	23/6	18/8	25/8	31/12				
TIME WORKED HEP+MD +MSU (HOURS)	DOWN	992	DOWN	1470	1232	DOWN	2780	6474			
BREAK-DOWN TIME (HOURS)	SHUT	120.22	SHUT	90.45	67.51	SHUT	140.53	419.51			
BREAK-DOWN TIME %	SCHEDULED	12.1	SCHEDULED	6.2	5.5	SCHEDULED	5.1	6.5			
FAULT DISTRIBUTION BY SYSTEM (HOURS)									PERCENTAGE		
									OF TOTAL TIME WORKED =6474 h	OF TIME LOST =419h51	
MACHINE	MAIN MAGNET & AUXIL.	24.09	-	1.23		3.41	29.13	0.45	7.0		
	MAIN GENERATOR	2.29	1.35	-		3.11	7.15	0.11	1.7		
	LINAC	25.56	10.50	9.40		25.27	71.53	1.11	17.1		
	BOOSTER	16.15	15.35	8.56		27.20	68.06	1.05	16.2		
	INJECT.	DOWN	-	DOWN	4.11	3.43	DOWN	4.27	12.21	0.19	2.9
	ACCEL.	SHUT	4.12	SHUT	3.08	1.16	SHUT	5.57	14.33	0.23	3.5
	VACUUM	SCHEDULED	-	SCHEDULED	0.13	2.12	SCHEDULED	4.09	6.34	0.10	1.6
	EJECT. & TARGETS	SCHEDULED	5.14	SCHEDULED	2.21	0.49	SCHEDULED	4.57	13.21	0.21	3.2
	CONTROL		27.03		39.01	13.52		24.02	103.58	1.61	24.8
	BEAM TRANSPORT		0.12		0.22	1.28		2.55	4.57	0.08	1.2
	MISCELL.		-		0.13	0.37		6.51	7.41	0.12	1.8
	EXTER. FAULTS		14.52		13.16	23.55		27.56	79.59	1.24	19.0

VARIATION OF AVERAGE INTENSITY [T_{pp}^{-1}]

PER "HEP RUNNING PERIOD"
(PROGRAMMED INTENSITY)

1985

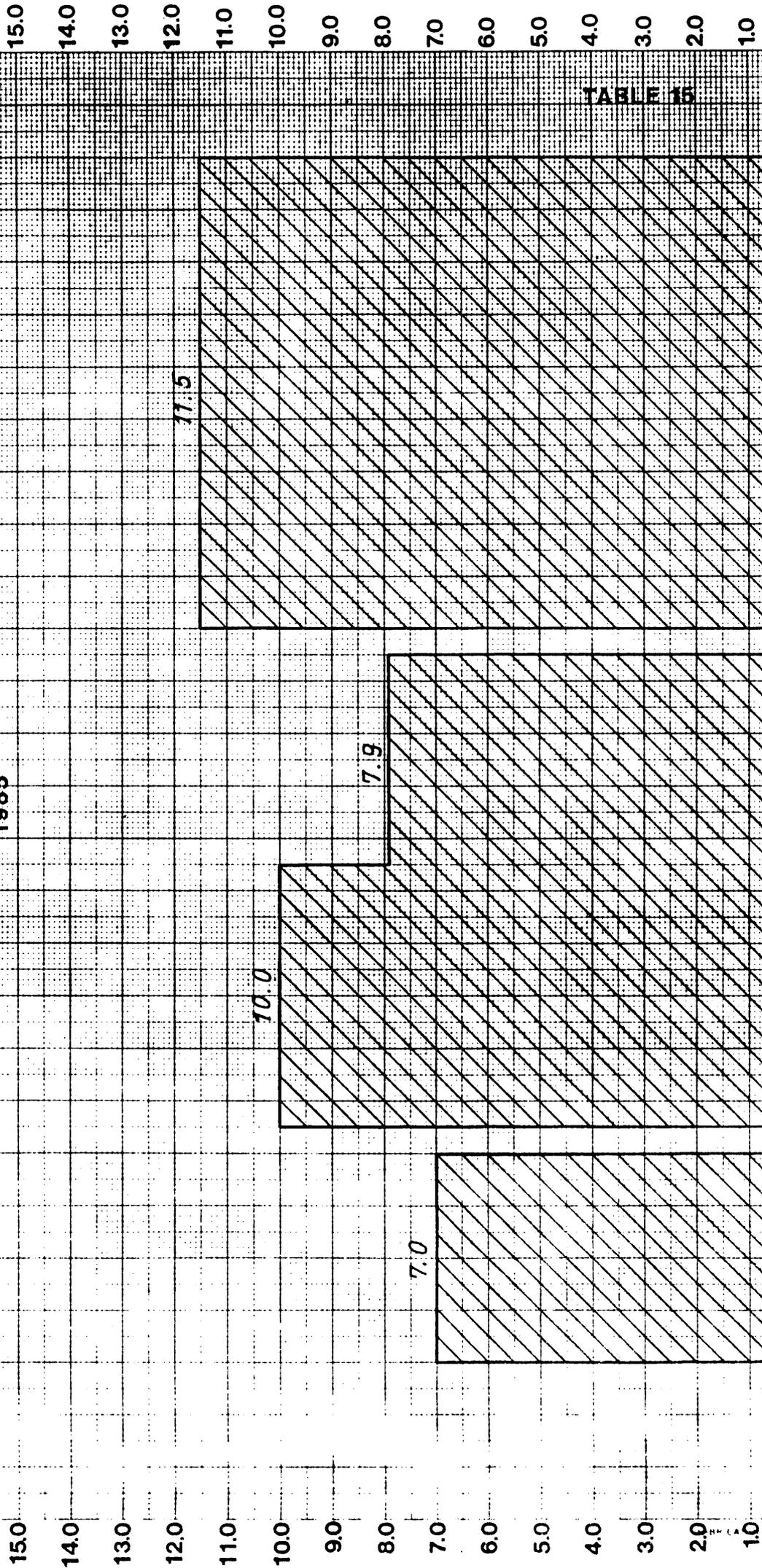


TABLE 15

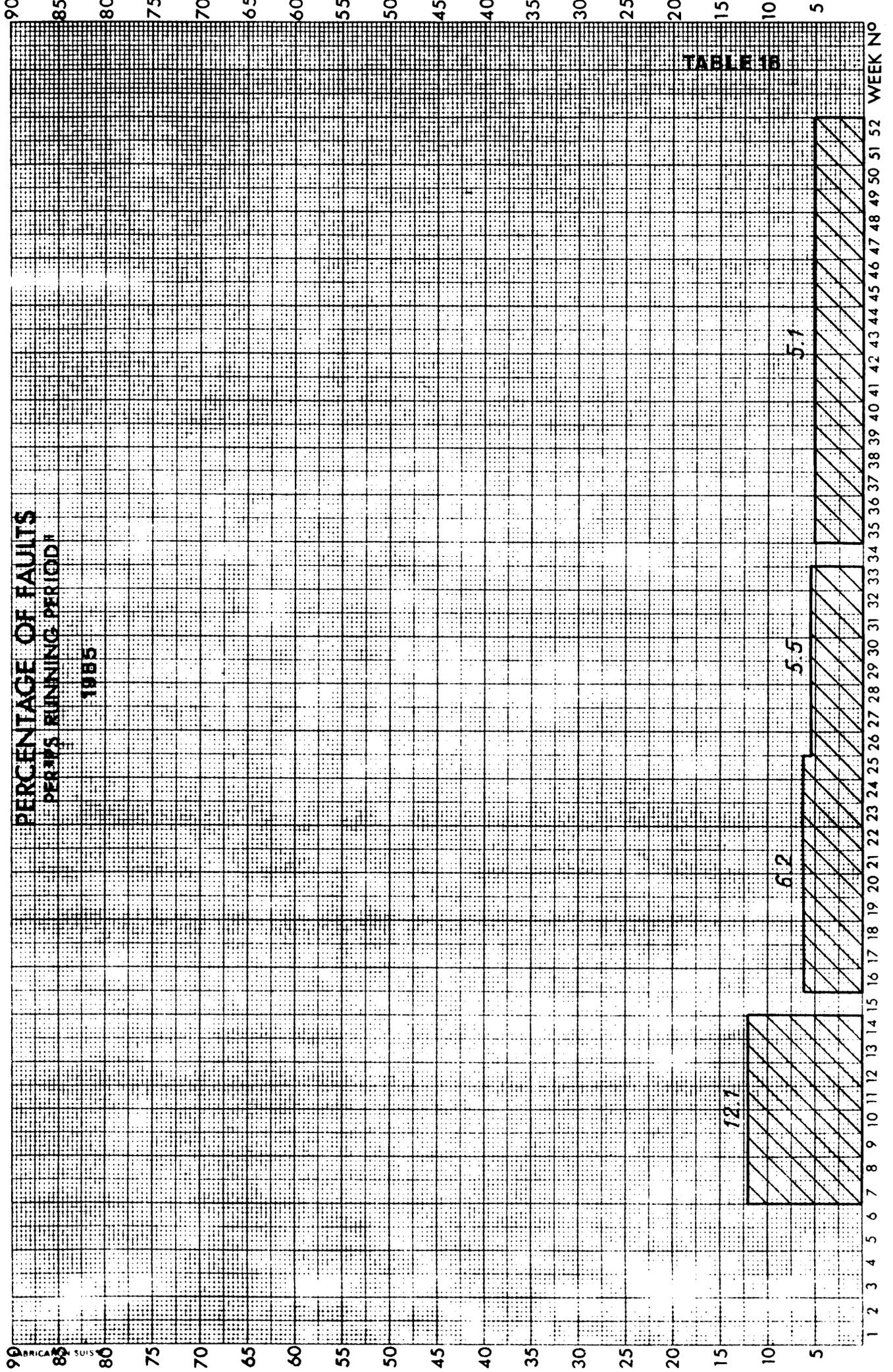


TABLE 18

AVAILABILITY FOR THE SPS AND AA IN PERCENTAGE

PER 11-MONTH RUNNING PERIOD¹¹

(AA)

1985

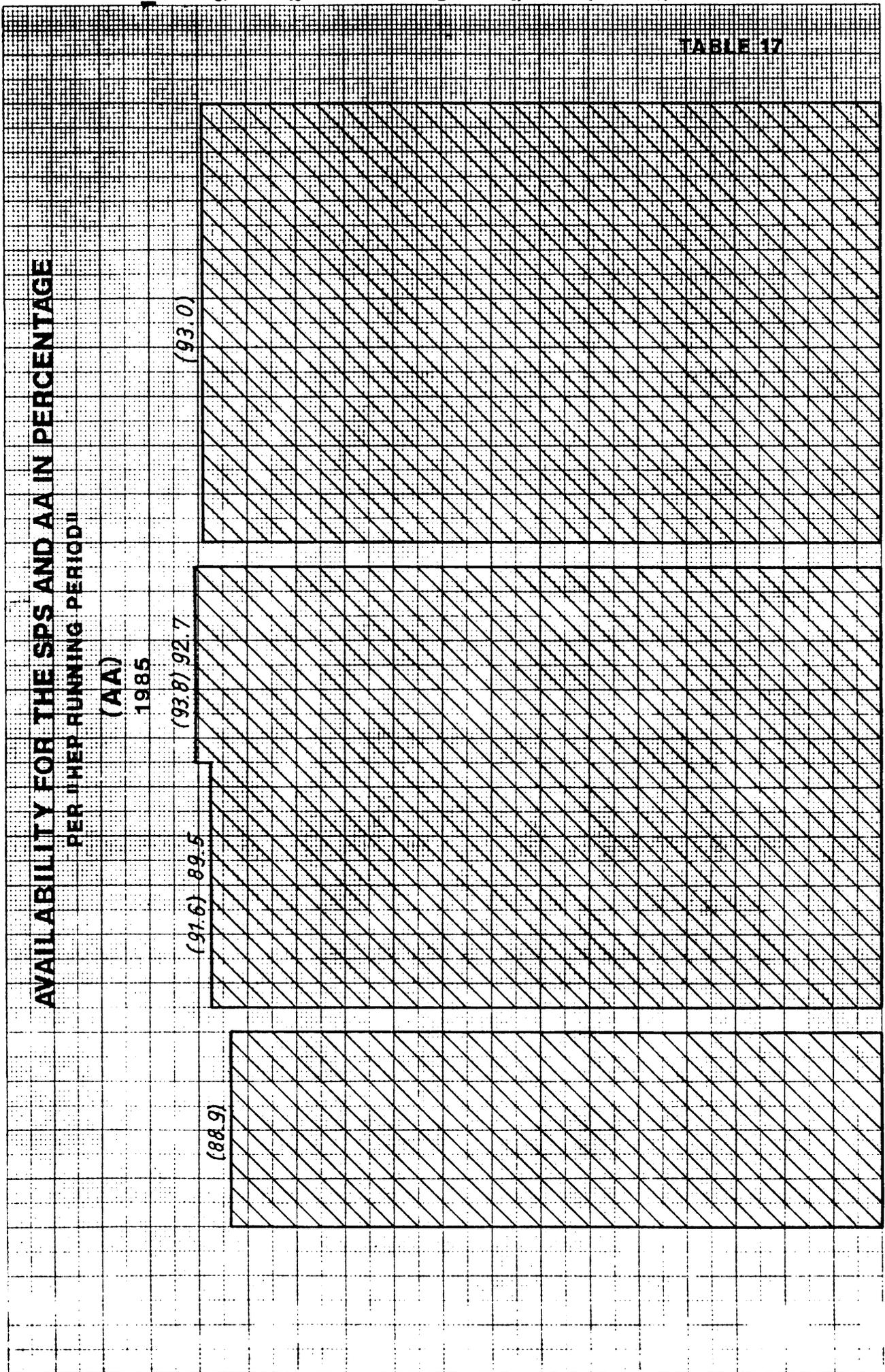
(91.6) 89.5

(93.8) 92.7

(93.0)

(88.9)

TABLE 17



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

YEAR	0'-10'	10'-20'	20'-1H	1H-3H	3H-6H	> 6H	TOTAL
1985	193/14 ^h .56	116/26 ^h .11	121/71 ^h .01	102/167 ^h .38	18/72 ^h .05	7/68 ^h .00	557/419 ^h .51
MAIN MAGNET & AUXILIARIES	5/0.21	2/0.28	5/2.46	4/8.30	2/6.35	1/10.33	19/29.13
MAIN GENERATOR	2/0.11	3/0.41	2/1.35	3/4.48	-	-	10/7.15
LINAC	73/4.56	24/5.13	20/12.48	18/28.16	2/10.17	1/10.23	138/71.53
BOOSTER	19/1.31	15/3.11	28/14.38	18/29.20	5/19.26	-	85/68.06
INJECTION	15/1.11	7/1.30	4/2.26	4/7.14	-	-	30/12.21
ACCELERAT.	11/1.07	17/4.02	6/3.27	1/2.44	1/3.13	-	36/14.33
VACUUM	1/0.1	1/0.13	-	4/6.20	-	-	6/6.34
EJECTION & TARGETS	5/0.13	4/1.08	11/6.26	3/5.34	-	-	23/13.21
CONTROL	49/4.14	26/5.43	31/18.48	39/62.41	1/5.30	1/7.02	147/103.58
BEAM TRANSPORT	2/0.10	5/1.05	6/3.42	-	-	-	13/4.57
MISCELL.	4/0.24	8/2.02	2/0.52	1/1.12	1/3.11	-	16/7.41
EXT. FAULTS	7/0.37	4/0.55	6/3.33	7/10.59	6/23.53	4/40.02	34/79.59
STOP ON REQUEST (RX)							

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

YEAR	0' - 10'	10' - 20'	20' - 1H	1H - 3H	3H - 6H	> 6H	TOTAL
1985	19/1 ^h .31	15/3 ^h .11	28/14 ^h .38	18/29 ^h .20	5/19 ^h .26	-	85/68 ^h .06
AIMANT	6/0.23	2/0.23	3/1.04	5/10.45	1/5.50		17/18.25
ALIMENTAT.	8/0.50	8/1.42	13/7.43	9/12.15	4/13.36		42/36.06
KICKERS		1/0.16	1/0.20				2/0.36
ACCELERAT.	4/0.15	2/0.29	3/1.11	2/4.11			11/6.06
VACUUM	1/0.03		1/0.20				2/0.23
CONTROL		2/0.21	5/3.05	1/1.06			8/4.32
MISCELL.			2/0.55	1/1.03			3/1.58
EXT. FAULTS							

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

1 9 8 5	0'-10'	10'-20'	20'-1h	1h-3h	3h-6h	>6h	TOTAL
INJ. ELEMENT	71/7h07	38/9h34	48/29h27	31/62h43	22/96h15	14/154h41	224/359h47
EJ. ELEMENT	6/0h40	8/2h10	13/7h48	7/13h53	5/21h28	11/130h43	50/176h42
RING ELEMENT	-	-	-	-	-	-	-
KICKERS	28/2h29	4/0h45	6/2h56	3/5h21	2/10h20	-	43/21h51
SHUTTERS	17/1h46	2/0h33	3/1h52	-	-	-	22/04h11
R.F.	2/0h13	-	3/2h10	2/5h30	1/5h40	3/23h58	11/37h31
COOLING	2/0h15	3/0h40	1/0h20	3/6h33	2/7h10	-	11/14h58
VACUUM	1/0h10	1/0h15	-	-	-	-	2/0h25
CONTROLS	9/0h58	10/2h35	11/8h23	7/15h22	5/19h53	-	42/47h11
TIMING	1/0h02	1/0h10	2/1h05	-	1/5h00	-	5/6h17
SECURITY	1/0h10	-	1/0h40	-	-	-	2/0h50
WATER	-	4/1h01	1/0h26	5/8h24	4/18h49	-	14/28h40
MISCELL.	4/0h24	3/0h55	7/3h47	3/4h50	-	-	17/09h56

PS/OP/YR/ed
17.1.1986

STATISTIQUES AA

Période : ANNEE 1985 du 27.02 au 23.12.1985

I FONCTIONNEMENT AA

Heures prévues par schedule : 5764h
Heures effectivement réalisées : 5781h55

Observations

Les pertes de stack incluent les pertes pour raisons extérieures
(orages en particulier)

II PANNES PS

Total des pannes PS (vues par le AA) : 407h34
Disponibilités du PS pour le AA : 93,0%

III PANNES AA

Total des pannes AA : 359h47
AA down time (sans perte de stack) : 6,2%
AA down time (avec " " ") : 16,9%

Répartition des différentes pannes

AA inj. line	: 176h42	Vacuum	: 0h25
AA ej. line	: 0	Comput controls	: 47h11
AA ring el	: 11h15	Timing	: 6h17
Kickers	: 21h51	Security	: 0h50
Shutters	: 4h11	Water	: 28h40
RF	: 37h31	Miscellaneous	: 9h56
Stoc. cooling	: 14h58		

IV FONCTIONNEMENT EFFECTIF DU AA

a) Sans tenir compte des pertes de stack : 5422h08 (soit 93,8%)
b) En tenant compte des pertes de stack : 4802h18 (soit 83,1%)

V PRODUCTION D'ANTI-PROTONS : 16196,96 10^9 (en ≈ 3700 h)
===== (soit $\approx 4,4 \cdot 10^9$ /h)

VI PERTES DE STACK : 2805,93 10^9
représentant un temps d'accumulation de : 619h50

VII STACK MAXIMUM DURANT LA PERIODE : 4,2376 10^{11} le 23.11 à 3h52

1985 ACCELERATOR SCHEDULE

MACHINE : PS Complex

TABLE 22

	JAN						FEB			MAR			
	1	2	3	4	5	6	7	8	9	10	11	12	13
MO		7	14	21	28	4	11	18	25	4	11	18	25
TU	1												
WE													
TH	PS SHUT DOWN						31		28	P1			
FR					1				1				
SA													
SU	6	13	20	27	3	10	17	24	3	10	17	24	31

AA STOP →

	APR						MAY					JUN			
	14	15	16	17	18	19	20	21	22	23	24	25	26		
MO	1	8	15	22	29	6	13	20	27	3	10	17	24		
TU					30										
WE					1		P2								
TH															
FR									31						
SA									1						
SU	7	14	21	28	5	12	19	26	2	9	16	23	30		

← AA STOP

	JUL					AUG					SEP		
	27	28	29	30	31	32	33	34	35	36	37	38	39
MO	1	8	15	22	29	5	12	19	26	2	9	16	23
TU		SU+MO											
WE		d+	P3			31				P4			
TH					1								
FR										Sp̄S+			
SA									31	LEAR			
SU	7	14	21	28	4	11	18	25	1	8	15	22	29

AA STOP →

	OCT					NOV				DEC			
	40	41	42	43	44	45	46	47	48	49	50	51	52
MO	30	7	14	21	28	4	11	18	25	2	9	16	23
TU	1												
WE						P4				Sp̄S+			
TH				31						LEAR			
FR				1									
SA									30				
SU	6	13	20	27	3	10	17	24	1	8	15	22	29

▣▣▣▣ PSB - PS MD

Statistiques LEAR pour l'année 1985

		p/\bar{p}
MD + MSU	Heures prévues	1573
	Heures réalisées	1276
PHYSIQUE	Heures prévues	2651
	Total des impulsions	1612
	Impulsions réalisées	1391*
	Impulsions perdues	221

* déversement d'environ 1 heure

R. Ley

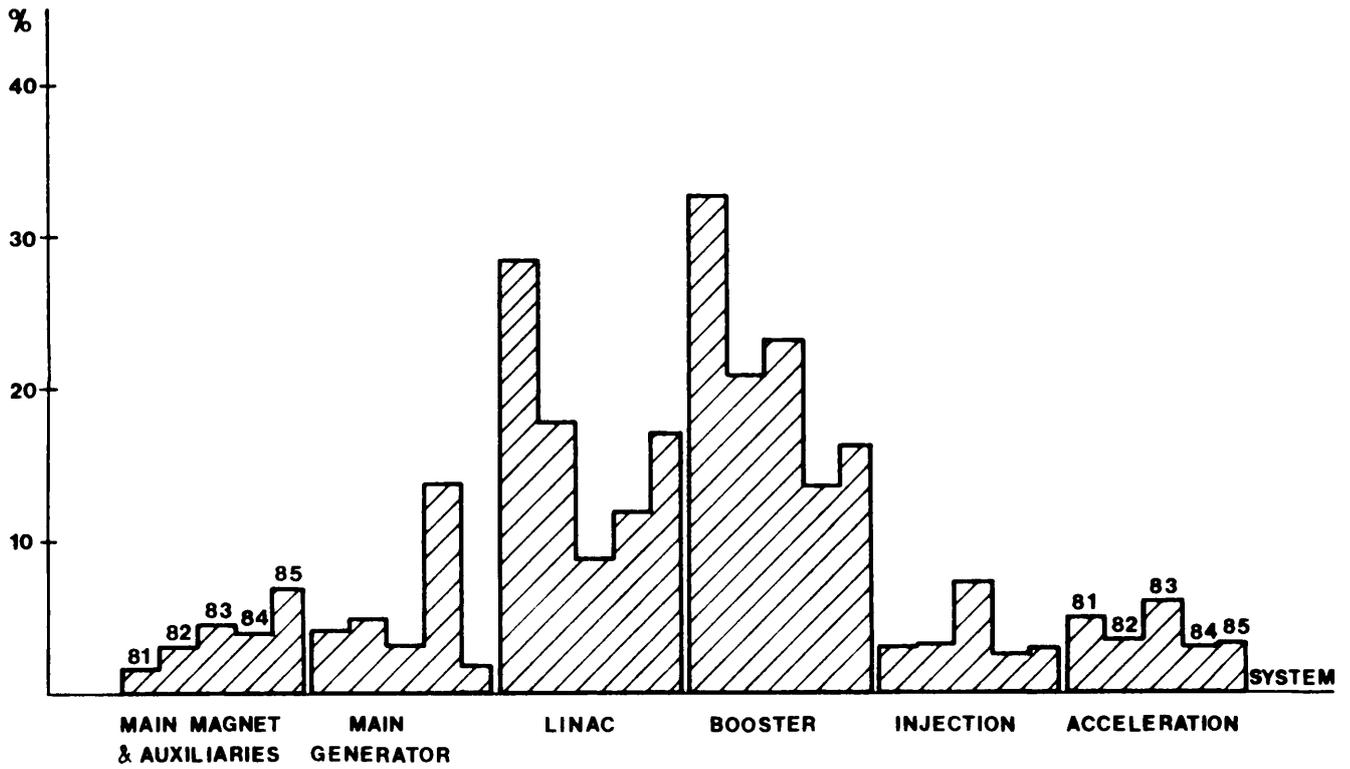
January 9, 1986

1 9 8 5 T E C H N I C A L P A R A M E T E R S

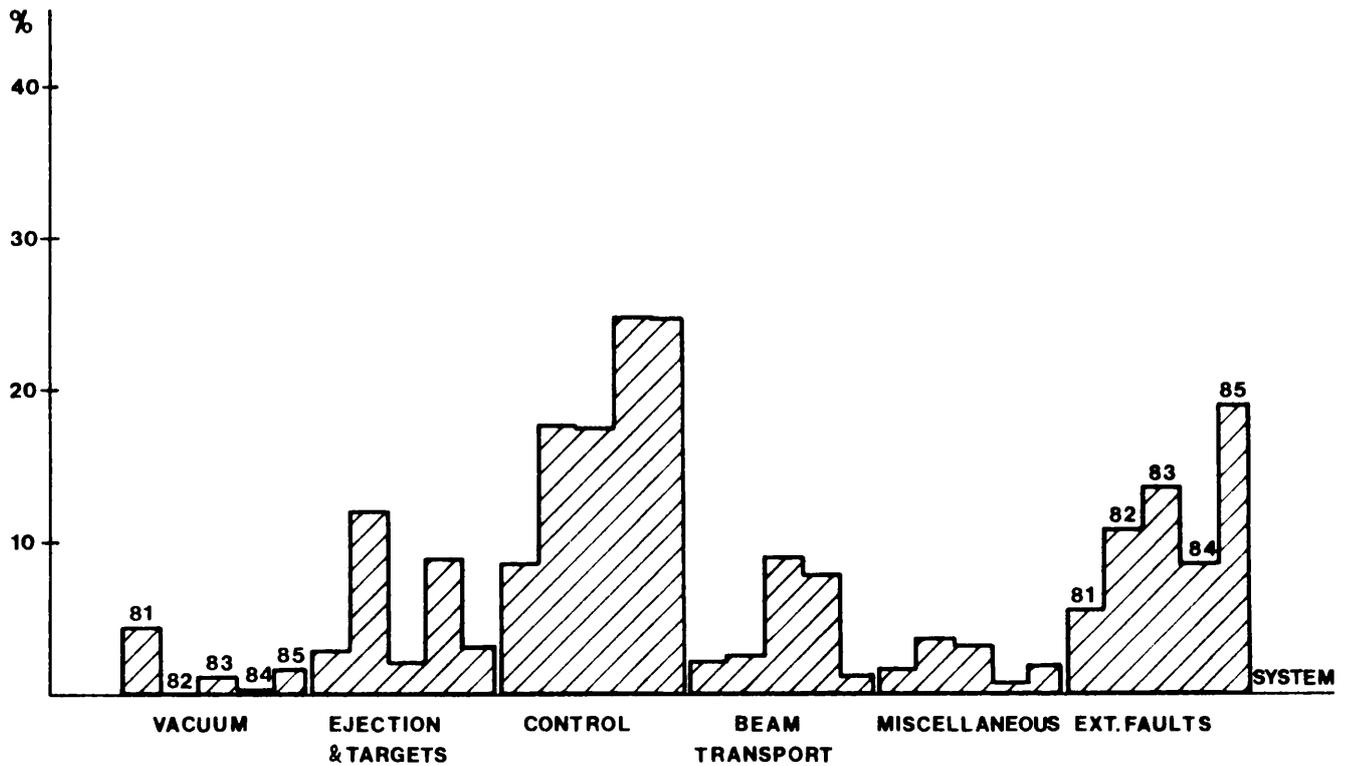
ACCELERATORS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
SC	256	652	144	344	672	652	320	SHUT DOWN	SHUT DOWN	360	672	452	4524
Hours scheduled for physics	34	469	142	187	676	645	316	SHUT DOWN	SHUT DOWN	352	667	444	3932
Hours given to physics	13.3%	71.9%	98.6%	54.4%	100.6%	98.9%	98.8%	SHUT DOWN	SHUT DOWN	97.8%	99.3%	98.2%	86.9%
Hours given/hours scheduled	8	12	34	4	12	12	-	SHUT DOWN	SHUT DOWN	8	12	-	102
Hours scheduled for MD+Setting-up	8	78	32	0	4	8	-	SHUT DOWN	SHUT DOWN	5	9	-	144
Hours given to machine development + SU	264	664	178	348	684	664	320	SHUT DOWN	SHUT DOWN	368	684	452	4686
Total hours scheduled	42	547	174	187	680	653	316	SHUT DOWN	SHUT DOWN	357	676	444	4136
Total hours realised													
PS		54	703	360	732	444	660	446	712	736	678	520	6045
Hours scheduled for physics		38	626	325	694	433	620	424	672	682	658	495	5667
Hours given to physics		70.4%	89%	90.3%	94.8%	97.5%	93.9%	95.1%	94.4%	92.7%	97.1%	95.2%	93.7%
Hours given/hours scheduled		266	41	57	12	45	84	69	8	8	8	9	607
Hours scheduled for MD+Setting-up		249	37	50	12	38	79	67	8	8	8	9	565
Hours given to machine development + SU		320	744	417	744	489	744	515	720	744	686	529	6652
Total hours scheduled		287	663	375	706	471	699	491	680	690	666	504	6232
Total hours realised													
- LINAC 2													
Hours scheduled	S	320	744	417	744	489	744	515	720	744	686	529	6652
Hours realised	H	320	721	411	737	488	738	511	716	725	684	529	6580
Hours realized/hours scheduled		100%	97%	98.6%	99.1%	99.8%	99.2%	99.2%	99.4%	97.4%	99.7%	100%	98.9%
- PSB													
Hours scheduled	U	320	744	417	744	489	744	515	720	744	686	529	6652
Hours realised	T	319	729	410	740	484	742	508	719	728	681	524	6584
Hours realized/hours scheduled		99.7%	98%	98.3%	99.5%	99.0%	99.7%	98.6%	99.9%	97.8%	99.3%	99.1%	99.0%
- AA													
Hours scheduled	D		720	356	738	408	394	409	720	744	720	529	5738
Hours realised	O		555	260	687	362	312	327	419	719	580	462	4683
Hours realized/hours scheduled			77%	73%	93.1%	88.7%	79.2%	80.0%	68.2%	96.6%	80.6%	87.3%	81.6%
- LINAC 1													
Hours scheduled	W		S	SHUT DOWN	SHUT DOWN	SHUT DOWN	480	108	576	100	40	-	1304
Hours realised	N		T	SHUT DOWN	SHUT DOWN	SHUT DOWN	360	108	546	100	38	-	1152
Hours realized/hours scheduled			P	SHUT DOWN	SHUT DOWN	SHUT DOWN	75.0%	100.0%	94.8%	100%	95.0%	-	88.3%
LEAR													
Hours scheduled for physics (p)													
Number of spills given to physics ²			144		517	214	180	313	248	452	320	320	2708
Number of spills lost			76		332	91	81	209	60*	228*	153+	161 o	1391
Efficiency			27		57	9	14	31	10	21	35	17	221
Hours scheduled for MD+SU (pp)			74%		85.3%	91.0%	85.3%	87.1%	85.7%	91.6%	81.4%	90.4%	86.3%
Hours given			112		184	31	448	86	368	104	64	64	1373
" " " "			98		153	31	160	86	435	94	65	42	1164

1) Included p stack losses
 2) 1 h. p spill time
 * 20' to 60' p spill time (105 MeV/c; 500-600 MeV/c)
 + 60' to 120' " " (600 MeV/c; 1,2 GeV/c)
 o 60' to 180' " " (1700 MeV/c)

TABLE 25



TOTAL: 1981 = 513^h47' 1982 = 492^h15' 1983 = 498^h56' 1984 = 494^h03'
 1985 = 419^h51'



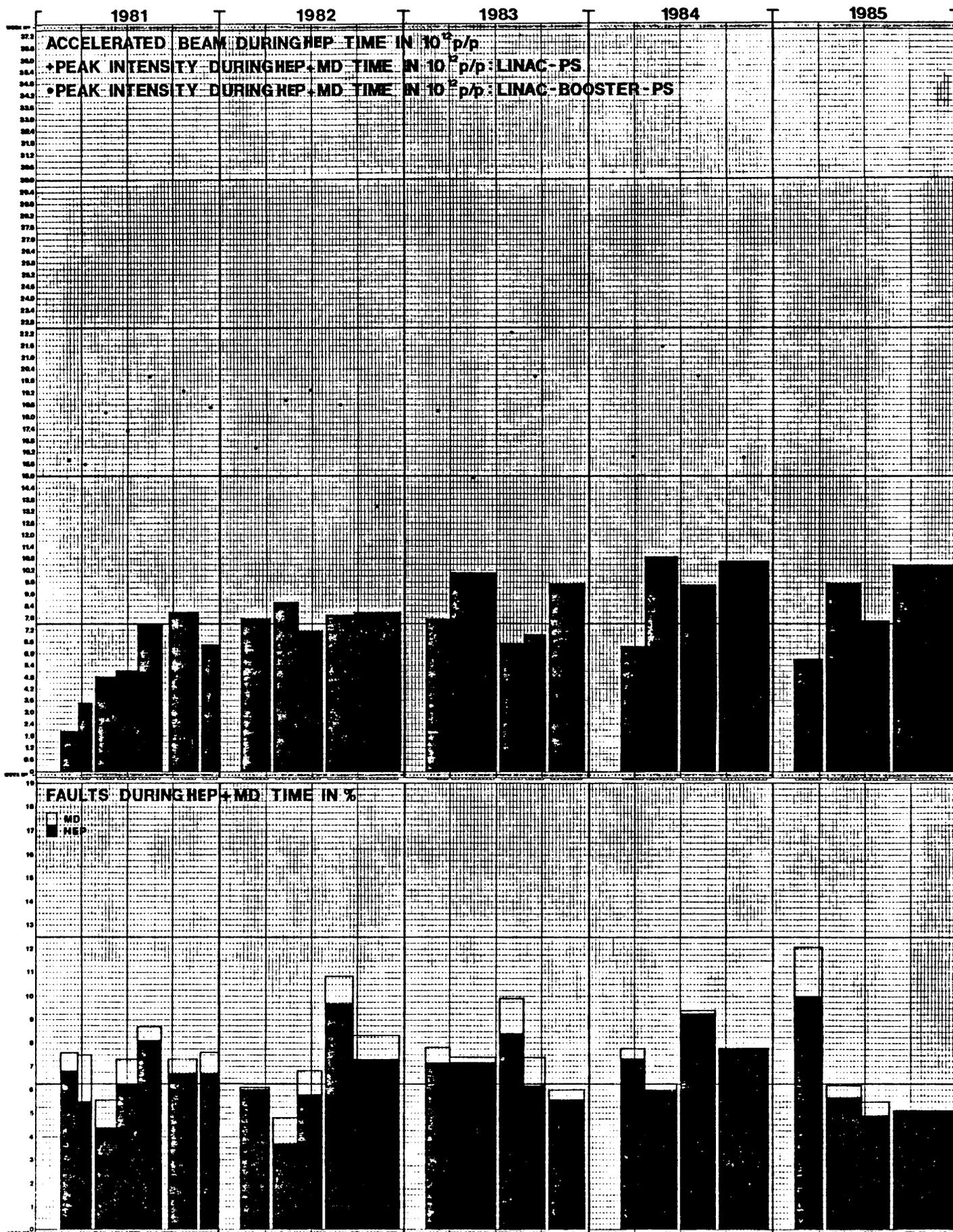
EVOLUTION OF FAULT DISTRIBUTION BY SYSTEM SINCE 1981

TOTAL PSB INTENSITY PER RING AND NO OF PULSES

ALL VALUES ARE IN 10^{16} PROTONS

WEEK NO		RING 4	RING 3	RING 2	RING 1	TOTAL
7-14	TRA 20	222	1252	1525	174	3173
	INJECTION	74	724	848	102	1748
	CAPTURE	48	605	698	72	1423
	ACCELERATION	38	547	601	54	1240
	OUT					1138
	PULSES (10^3)					2329
16-25	TRA 20	700	2329	2553	624	6206
	INJECTION	299	1323	1453	316	3391
	CAPTURE	245	1147	1248	241	2881
	ACCELERATION	223	1046	1110	219	2598
	OUT					2427
	PULSES (10^3)					2650
26-33	TRA 20	793	1686	1945	735	5159
	INJECTION	413	929	1092	477	2911
	CAPTURE	311	767	902	370	2350
	ACCELERATION	272	680	720	287	1959
	OUT					1798
	PULSES (10^3)					2652
35-52	TRA 20	324	5197	5452	81	11054
	INJECTION	89	3301	3421	43	6854
	CAPTURE	54	2828	2875	22	5779
	ACCELERATION	34	2543	2597	14	5188
	OUT					4783
	PULSES (10^3)					4491
TOTAL	TRA 20	2039	10464	11475	1614	25592
	INJECTION	875	6277	6814	938	14904
	CAPTURE	658	5347	5723	705	12433
	ACCELERATION	568	4816	5028	573	10985
	OUT					10146
	PULSES (10^3)					12122

TABLE 27



FAULT DISTRIBUTION BY SYSTEM

1. Main magnet and auxiliaries

Here are gathered all the faults of the PS magnets (PR.BHZ), the cooling system, the PFWs (PP.W), the "high energy" quadrupoles (PR.Q), the sextupoles (PR.X), the Tekelecs type power supplies (PP.T), the power supplies for type "D" (PP.D), the power supplies for type "M" (PP.M), the equipment for "B" and "BO.1" train generation (PX.TB), the shims, the octupoles (PR.O) and the dipoles (PR.D).

2. Main generator

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

3. Linacs I and II

All the Linac faults (including controls) for the old (Linac I) and the new (Linac II) are found here, except for vacuum faults (see the vacuum diagram annexed).

4. Booster

All the Booster faults (vacuum, RF, controls, etc.) are classed here, beginning from I-VS2 (BI.VVS10) up to T-VS5 (BTP.VVS20) for the vacuum; the ejection line to the PS up to T-Q05 (BTP.QNO10) inclusive (transfer line) for the magnet units; the transfer line up to and including TIS (PI.SMH42) 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 (PI.SMH26), injection quadrupoles (PI.QNO), BLW (PI.DHZ), vertical dipoles (PI.DVT), KM28 (PI.KFA28), BD44 (PTE.DVT10), kicker 22 (PI.KSW22) and 30 (PI.KSW30), skewed quadrupoles (PI.QSK), injection sextupoles (PI.XNO et SK), the Booster injection line to the PS (transfer line), i.e. the magnet after T-Q05 (BTP.QNO10), ((T-Q0610, BTP.QNO20 ...60), T-DH03 ...5 (BTP.DHZ20 ...40), T-DVO5 ...9 (BTP.DVT10 ...50), BLM (PR.MBL), T-TRI (PI.TFA), T-TR2 (BTP.TRA , Sem Grids (PR.MSG), TV30-34-46 (PR.MTV30-34-46), TU2...5 (BTP.UESOO...30), TIK (PI.KFA45), TIS (PI.SMH42), SB40...44 (PI.BSM40...44)), beam dumper (PR.STP), and the new equipment: the fast kicker (PI.KFA28), horizontal dipoles (PTE.DHZ10), Sem Grid 26 (PI.MSGH26L, MSGH26P, MSGV26L), TV 26 (PR.MTV26).

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 (PR.TRA72), the ACEM detectors (PR.MBL), the pick-up stations (PR.U). (See annex 2 for passive part).

7. Vacuum

All faults related to the PS, Linac I, Linac II, FA58, ligne FT16 and LEAR are found here, according to their position in the layout (see vacuum diagrams annexed).

8. Ejection - targets

Here are classed all the faults concerning the FAK (PR.KFA), fast bumpers (PE.BFA), the septa (PR.SMH), the internal targets (PR.TP, PR.TM), the dump targets (PR.TD), the ejected beam servo system, the minitoposcopes (PR.MTO), the "Cerenkovs", the TV's (PR.MTV), the septa and external targets lighting equipment, the measuring transformer for extracted beam, the SEC's and the BLM's (PR.MBL).

9. Control

All the faults of the various parts of the centralised PS computer system are found here, plus the security ((beam stoppers (BI.STP.BRi. STP-BTP.STP), fire detection equipment, barriers, etc.)), the timing (pulse distribution to linac, MCR, CB, etc.).

Note: 1) The faults due to security are put here.

2) As indicated in 3. and 4., the controls faults are included for the Linacs and the Booster as in the past.

10. Miscellaneous

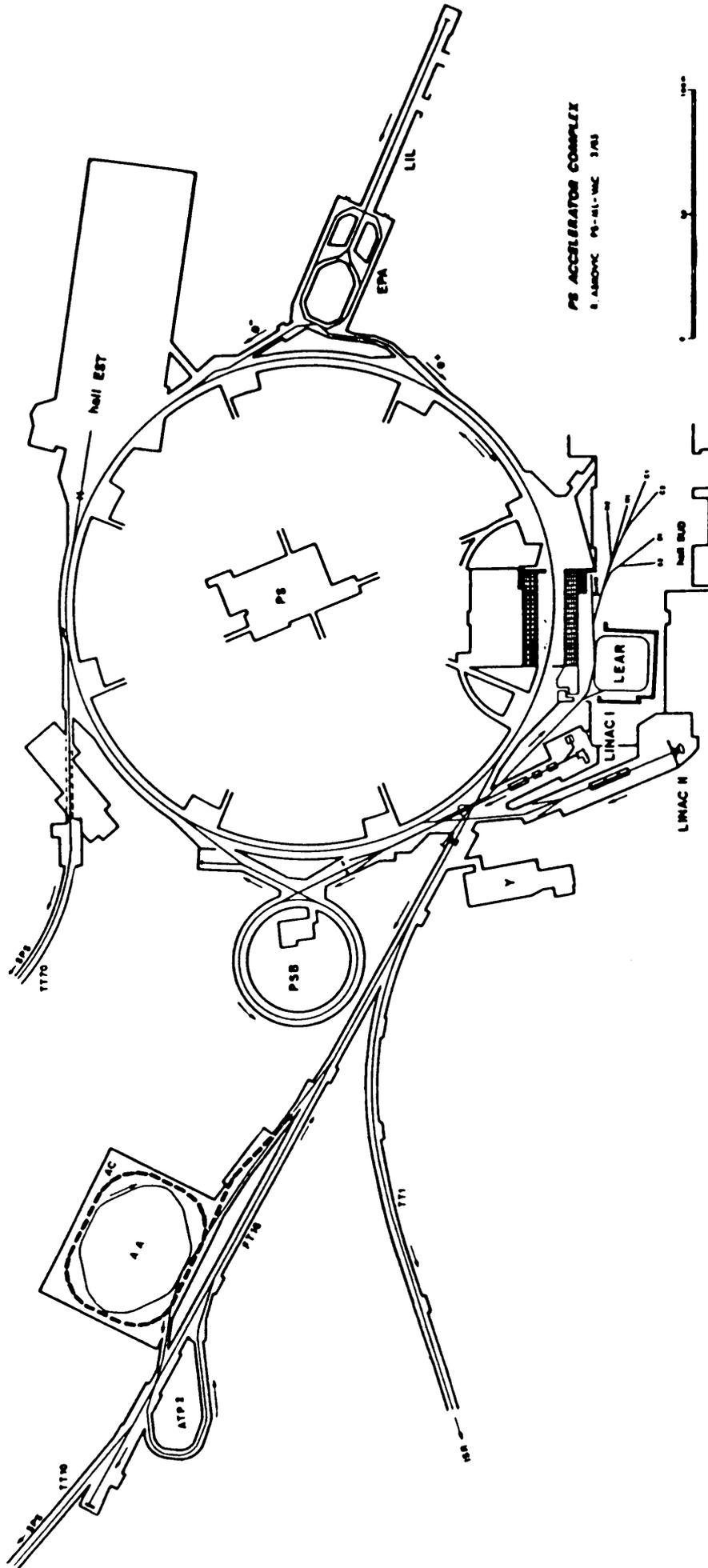
All the faults found here will be dealt with in detail in Annex 3.

11. Beam transport

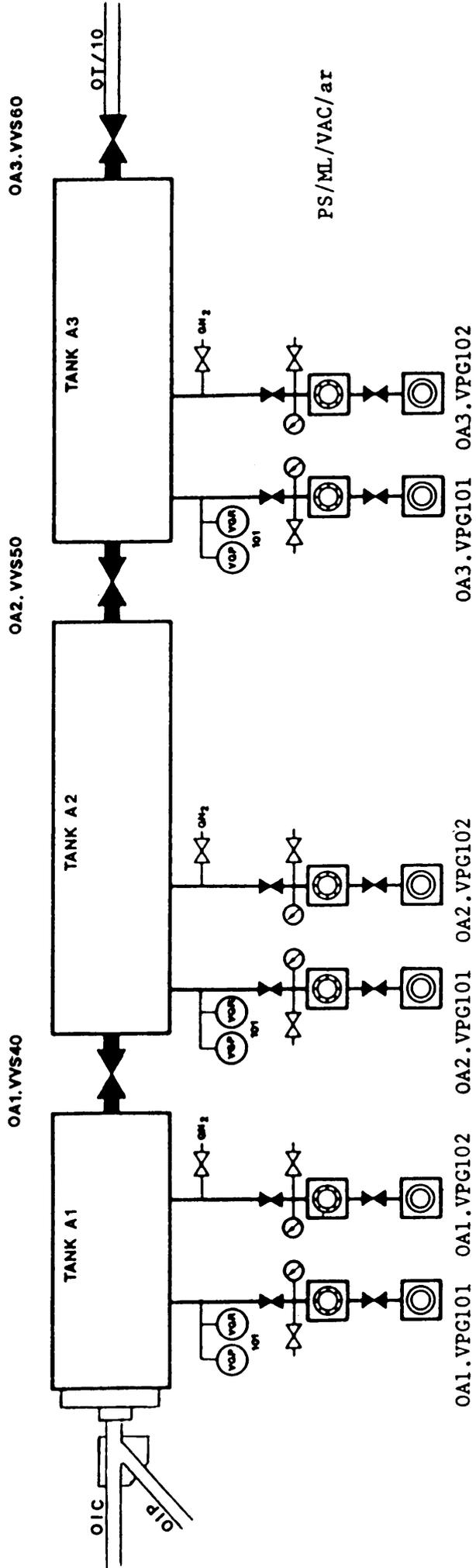
All the faults related to the separators, the magnets, the quadrupoles and their cooling system, the vacuum ejected beams, the septa (ex. MNP 35/1-2) and the hydrogen targets are to be found in this section; plus the ATP1, ATP2, FTD, TT2 and FA58 lines.

12. External faults

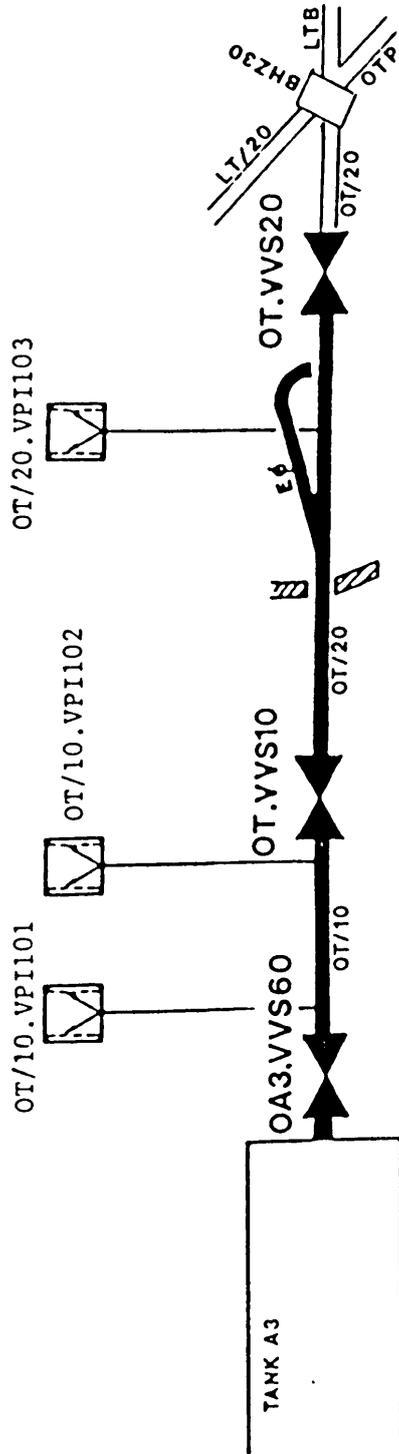
All the faults which are not attributed to an element found in or around the PS, i.e. thunderstorms, mains failures, stops due to SB causes (water supply, water pump below door 4, ventilation, etc.) are classed here. (Details in Annex 4).



TANKS A1 - A2 - A3



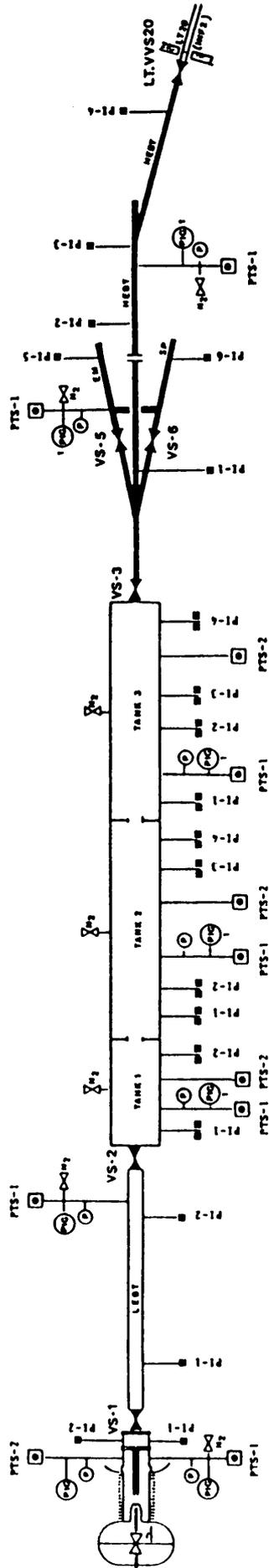
- LINE OT -

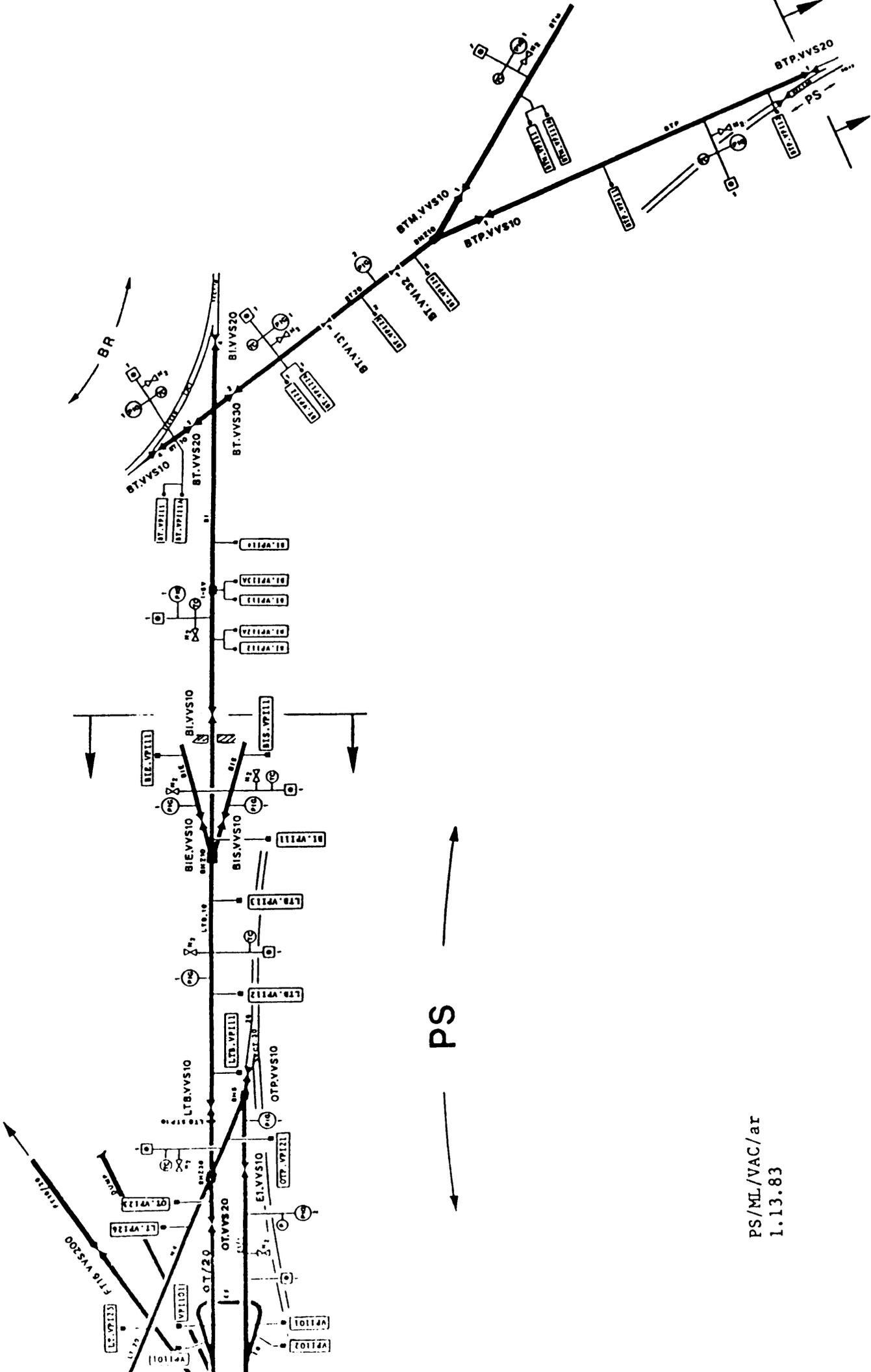


PS/ML/VAC/ar

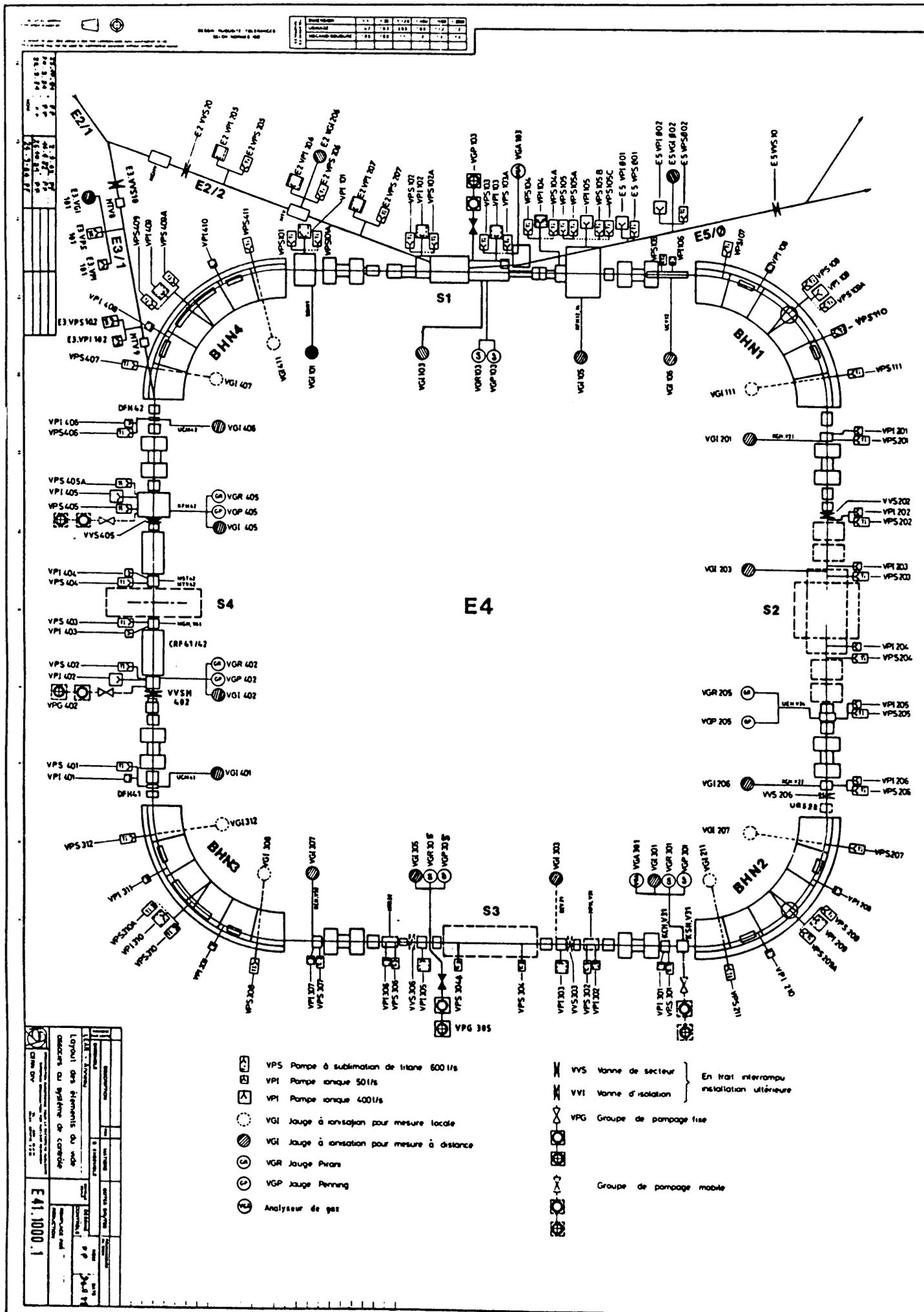
LINAC II

PS/ML/VAC/ar
13.1.83





PS/ML/VAC/ar
1.13.83

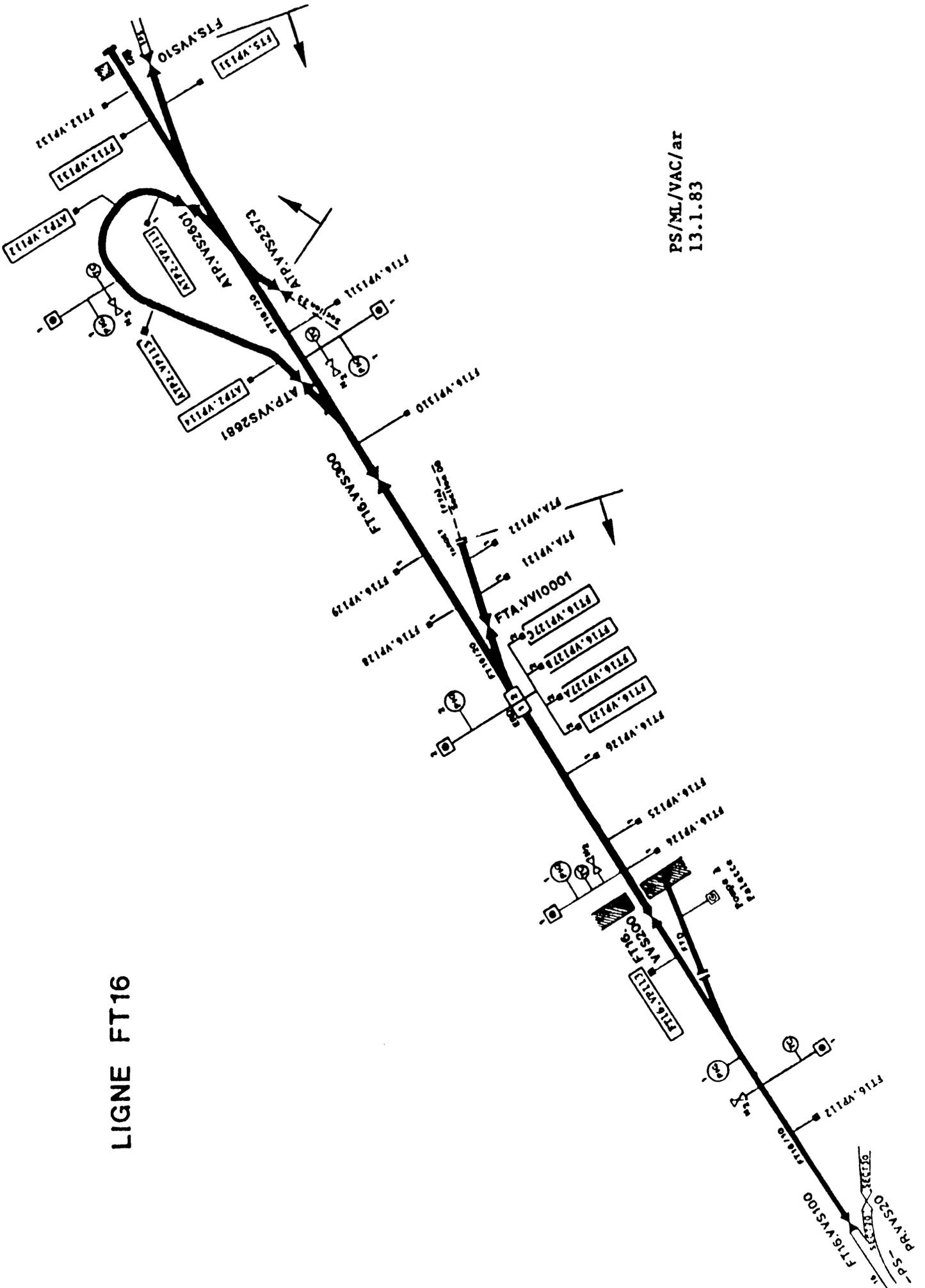


- VPS Pompe à sublimation de triane 600 l/s
- VPI Pompe à triane 50 l/s
- VPI Pompe à triane 400 l/s
- VGI Jauge à ionisation pour mesure locale
- VGI Jauge à ionisation pour mesure à distance
- VGR Jauge Piran
- VGP Jauge Penning
- Analyseur de gaz

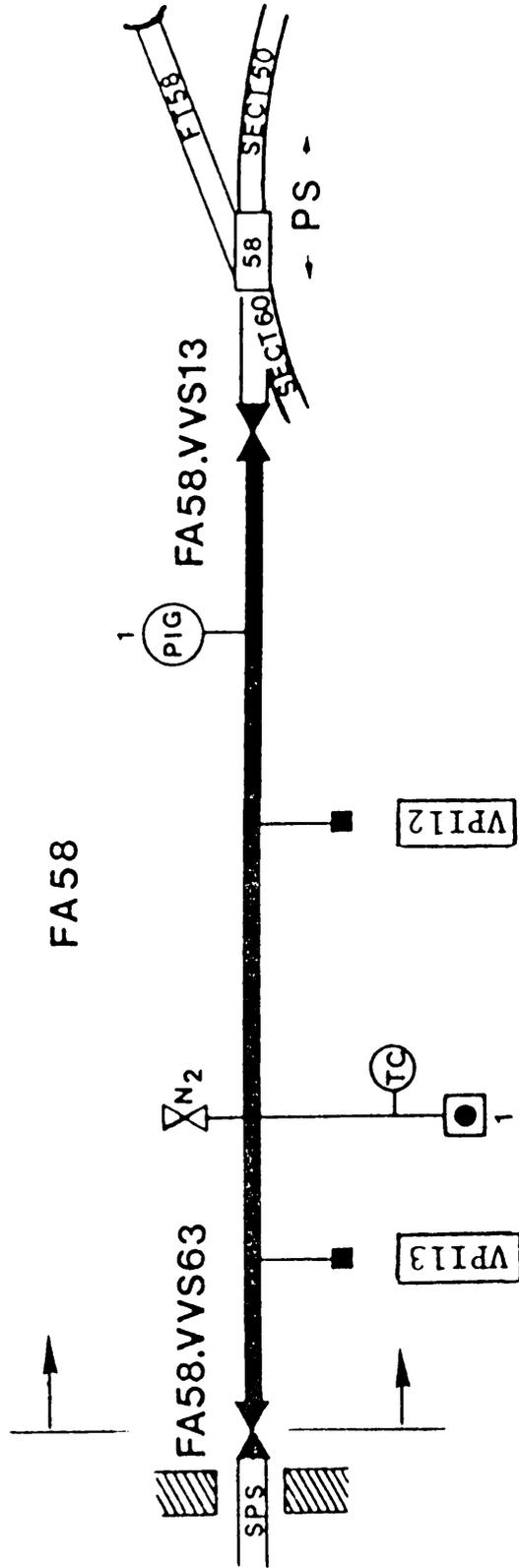
- VVS Vanne de secteur
 - VVI Vanne d'isolation
 - VPG Groupe de pompage fixe
 - Groupe de pompage mobile
- } En trait interrompu installation ultérieure

E41.000.1
 L'ensemble des éléments du vide
 connectés au système de contrôle
 CHIFFRE D'ORDRE : 200
 DATE : 1977

LIGNE FT16



PS/ML/VAC/ar
13.1.83



PS/ML/VAC/ar
13.1.83

PASSIVE PART ACCELERATION FAULTS (Number of hours) - 1985

NO FAULTS

MISCELLANEOUS FAULTS (Number of hours) - 1985

0h04	Injection in the PS ring	(Period 2)
0h09	Change of supercycle	"
0h18	No reason found	(Period 3)
0h19	Radiation alarm East Area	"
0h12	LEAR	(Period 4)
0h15	Inspection in TT2/TT70	"
0h14	Inspection in the PS ring	"
1h12	Operating fault	"
0h09	LEAR	"
0h19	Loss in TT2/TT70 (inspection)	"
0h30	No reason found	"
0h02	Operating fault	"
0h11	LEAR	"
0h14	LEAR	"
0h22	Operating fault	"
3h11	" "	"

TOTAL : 7h41

EXTERNAL FAULTS (Number of hours) - 1985

0h04	Ejection 16 security (SPS fault)	(Period 1)
0h08	Ejection 16 security (SPS fault)	"
0h14	LEAR	"
14h26	Mains failure	"

0h02	Ejection 16 security (SPS fault)	(Period 2)
0h36	Ejection 16 security (SPS fault)	"
0h07	" " "	"
0h22	Mains failure	"
1h38	" "	"
3h09	" "	"
7h09	" "	"
0h13	" "	"

1h49	Mains failure	(Period 3)
3h38	" "	"
12h07	" "	"
1h10	" "	"
1h00	" "	"
3h59	Water problem (SB - A20)	"
0h12	" "	"

1h09	Ejection 16 security (SPS fault)	(Period 4)
6h20	Mains failure	"
5h13	" "	"
3h55	" "	"
0h32	" "	"
0h03	Ejection 16 security (SPS fault)	"
0h06	" " " " "	"
0h07	" " " " "	"
0h16	" " " " "	"
0h48	" " " " "	"
0h45	Ejection 16 security (AA fault)	"
0h30	" " " " "	"
2h46	" " " " "	"
1h27	" " " " "	"
3h59	" " " " "	"

TOTAL : 79h59

FAULTS EXCEEDING 6 HOURS (Number of hours) - 1985

7h02	PLS + RF coarse tuning	(Period 1)
10h33	Magnet No. 85 (water)	"
14h26	Mains failure	"
7h09	Mains failure	(Period 2)
12h07	Mains failure	(Period 3)
6h20	Mains failure	(Period 4)
10h23	Linac-RF	"

TOTAL : 68h00

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