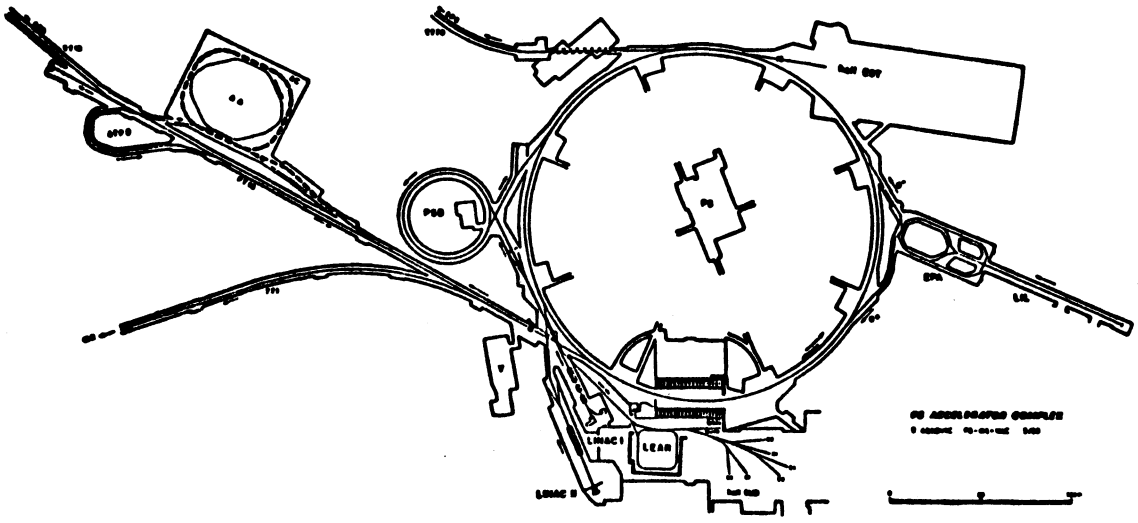
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

CERN/PS 86-3(OP)
January 1986

STATISTICS OF PS OPERATION



1985

G. AZZONI AND K. PRIESTNALL

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.

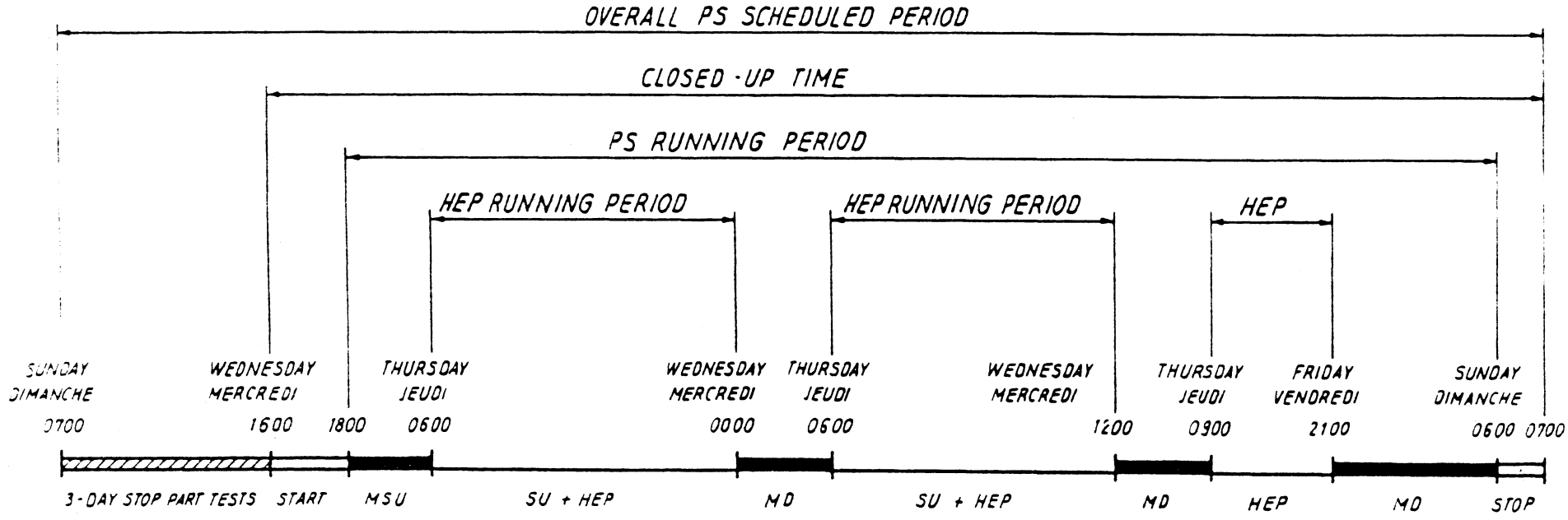
PS RUNNING PERIOD is defined as the time of continuous PS operation from the scheduled end of a PS start-up until the beginning of the next shutdown procedure and includes stops for breakdowns, etc.

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 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".

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* 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:

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

  and

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

- 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

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* 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).

TABLE 1

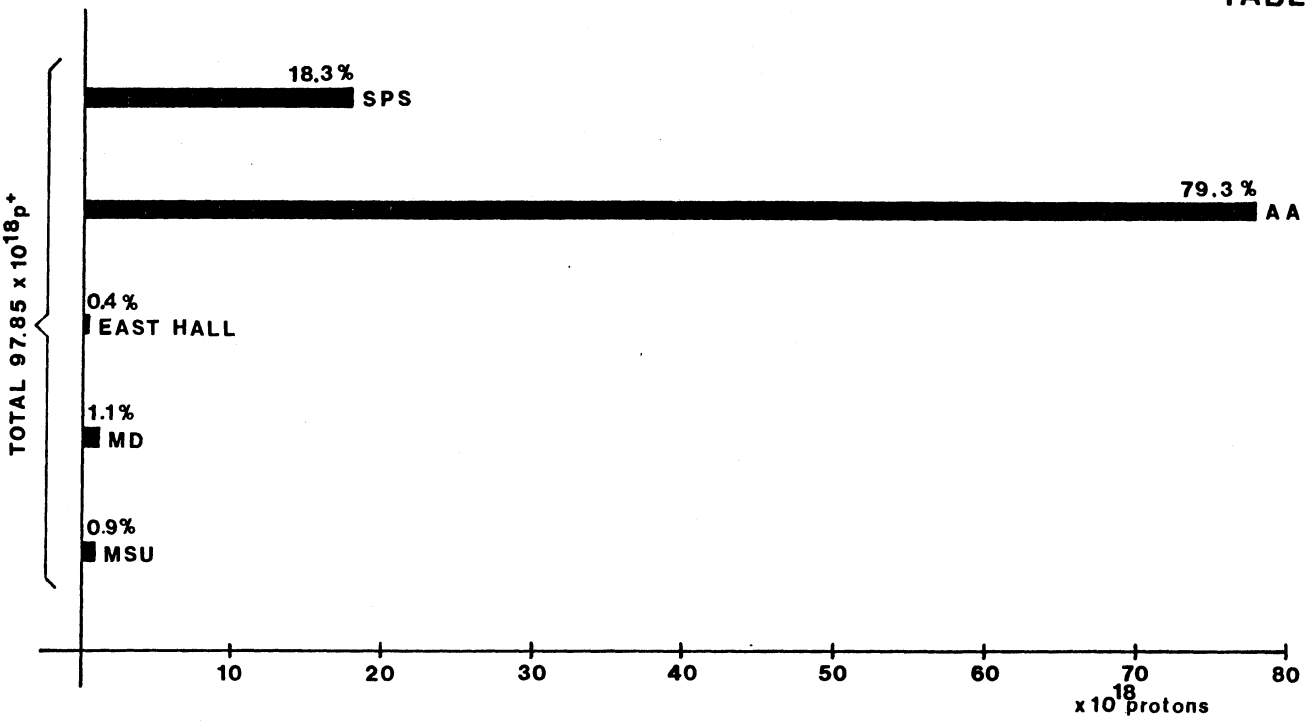


Fig.1 GENERAL DISTRIBUTION OF p ACCELERATED BY THE PS IN 1985

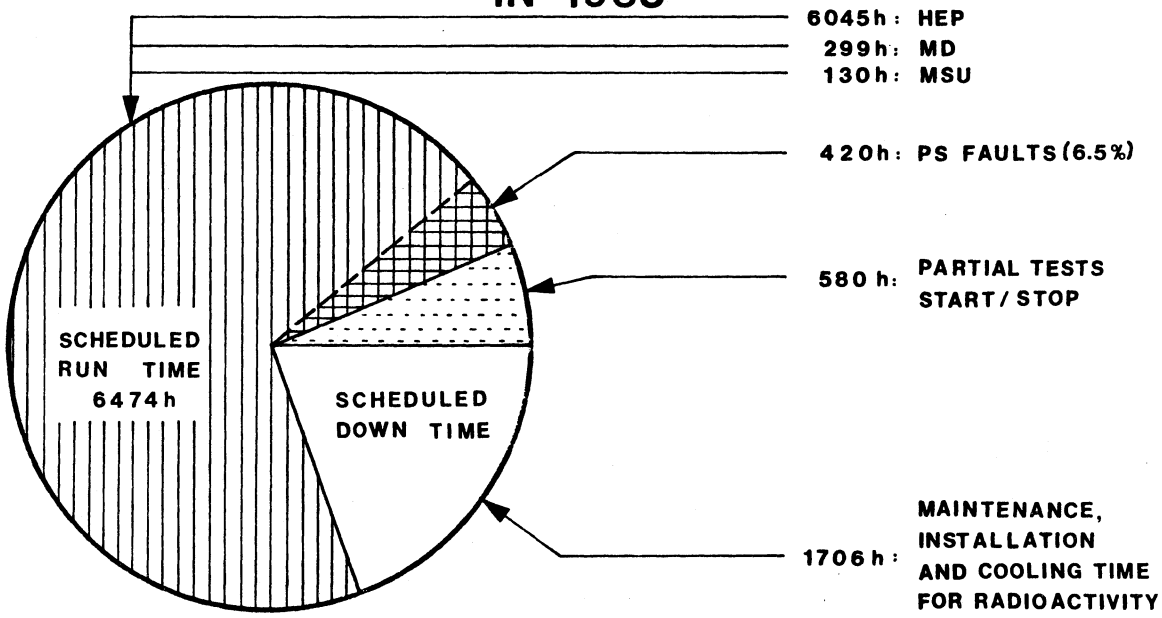


Fig.2 DIVISION OF PS CAKE FOR 1985

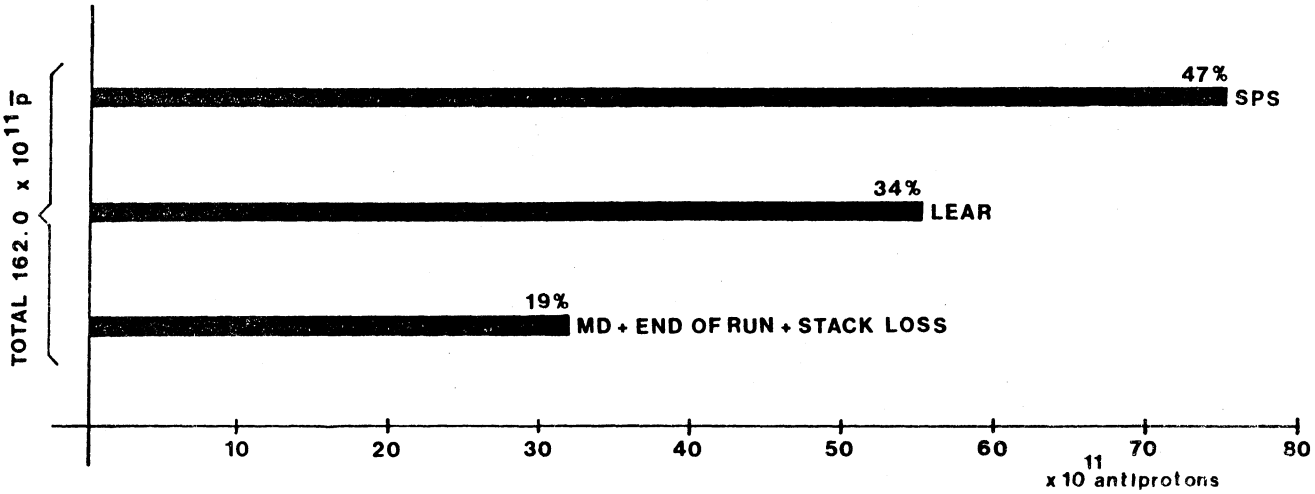


Fig.3 GENERAL DISTRIBUTION OF $\bar{p}$ BY AA IN 1985

STATISTICS OF PS OPERATION

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

TABLE 2

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		SCHEDULED	SHUT	DOWN	
2		"	"	"	
3		"	"	"	
4		"	"	"	
5		"	"	"	
6		"	"	"	
7 8 9 10 11 12 13 14	743.27 (87.2)		98.54 (11.6)	10.39 (1.2)	853.00
15		SCHEDULED	SHUT	DOWN	
16 17 18 19 20 21 22 23 24 25	1271.05 (92.5)		83.36 (6.1)	19.19 (1.4)	1374.00
26 27 28 29 30 31 32 33	1044.58 (94.5)		60.56 (5.5)	0.06 (-)	1106.00
34		SCHEDULED	SHUT	DOWN	
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52	2571.15 (94.8)		140.27 (5.2)	0.18 (-)	2712.00
TOTAL %	93.1		6.4	0.5	100.00
TOTAL HOURS	5630.45		383.53	30.22	6045.00

HEP STATISTICS OF INTENSITY AND Nº OF PULSES

TABLE 4

WEEK Nº	TOTAL INTENSITY [$10^{16}p^{+}$]	AVERAGE INTENSITY [Tpp^{-1}]	NUMBER OF PULSES
1	SCHEDULED	SHUT	DOWN
2	"	"	"
3	"	"	"
4	"	"	"
5	"	"	"
6	"	"	"
7 8 9 10 11 12 13 14	875.5	6.96	1 258 704
15	SCHEDULED	SHUT	DOWN
16 17 18 19 20 21 22 23 24 25	2 338.6	9.96	2 348 660
26 27 28 29 30 31 32 33	1 720.5	7.88	2 184 755
34	SCHEDULED	SHUT	DOWN
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52	4 656.3	11.51	4 044 247
TOTAL	9 590.9	9.75	9 836 366

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

TOTAL DISTRIBUTION OF BEAM INTENSITY (HE P)

ALL VALUES ARE IN 10^{16} PROTONS

WEEK NO	PRODUCTION TARGETS		DUMP TARGETS	CONTINUOUS TRANSFER	FAST EJECTIONS			SLOW EJECTION	TOTAL
			93-97-D2 47-48		16			62	
				SPS + D2	APTST	AA + D2			
7 - 14			1.2	9.0	2.0	863.0		0.3	875.5
16 - 25			6.2	798.5	0.3	1 524.3		9.3	2 338.6
26 - 33			3.5	952.8	0.4	743.9		19.9	1 720.5
35 - 52			3.6	23.0	0.7	4 622.4		6.6	4656.3
TOTAL			14.5	1 783.3	3.4	7 753.6		36.1	9590.9
PERCENT			0.2	18.6	-	80.8		0.4	100.0

TABLE 5

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 Nº	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	57.30 (83.3)		11.30 (16.7)		69.00
15		SCHEDULED	SHUT	DOWN	
16 17 18 19 20 21 22 23 24 25	79.36 (94.8)		4.24 (5.2)		84.00
26 27 28 29 30 31 32 33	107.05 (93.9)		6.55 (6.1)		114.00
34		SCHEDULED	SHUT	DOWN	
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52	32.00 (100.0)		-		32.00
TOTAL %	92.4		7.6		100.00
TOTAL HOURS	276.11		22.49		299.00

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	SCHEDULED	SHUT	DOWN
2	"	"	"
3	"	"	"
4	"	"	"
5	"	"	"
6	"	"	"
7 8 9 10 11 12 13 14	24.7	1.11	223 361
15	SCHEDULED	SHUT	DOWN
16 17 18 19 20 21 22 23 24 25	33.9	2.72	124 668
26 27 28 29 30 31 32 33	10.2	3.62	28 174
34	SCHEDULED	SHUT	DOWN
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52	40.3	0.96	419 420
TOTAL	109.1	1.37	795 623

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

TOTAL DISTRIBUTION OF BEAM INTENSITY (MD)

ALL VALUES ARE IN 10^{16} PROTONS

WEEK NO	PRODUCTION TARGETS		DUMP TARGETS	CONTINUOUS TRANSFER	FAST EJECTIONS			SLOW EJECTION	TOTAL
			93-97-D2 47-48	SPS + D2	16 APTST	AA + D2		62	
7-14			10.7	0.8	0.1	13.1			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

TABLE 9

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		SCHEDULED	SHUT	DOWN	
2		"	"	"	
3		"	"	"	
4		"	"	"	
5		"	"	"	
6		"	"	"	
7 8 9 10 11 12 13 14	60.02 (85.1)		9.58 (14.3)		70.00
15		SCHEDULED	SHUT	DOWN	
16 17 18 19 20 21 22 23 24 25	9.15 (77.5)		2.45 (22.5)		12.00
26 27 28 29 30 31 32 33	12.00 (100.0)		-		12.00
34		SCHEDULED	SHUT	DOWN	
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52	35.34 (98.9)		0.26 (1.1)		36.00
TOTAL %	89.9		10.1		100.00
TOTAL HOURS	116.51		13.09		130.00

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

TABLE 11

WEEK Nº	TOTAL INTENSITY [$10^{16}p^{+}$]	AVERAGE INTENSITY [Tpp^{-1}]	NUMBER OF PULSES
1	SCHEDULED	SHUT	DOWN
2	"	"	"
3	"	"	"
4	"	"	"
5	"	"	"
6	"	"	"
7 8 9 10 11 12 13 14	12.3	1.16	105 816
15	SCHEDULED	SHUT	DOWN
16 17 18 19 20 21 22 23 24 25	10.0	5.27	18 971
26 27 28 29 30 31 32 33	35.7	3.93	90 756
34	SCHEDULED	SHUT	DOWN
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52	27.2	3.84	70 806
TOTAL	85.2	2.98	286 349

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

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
			93-97-D2 47-48	SPS + D2	16 APTST	AA + D2		62	
7-14			0.1	4.7		7.5			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

TABLE 12

PS STATISTICS

TABLE 13

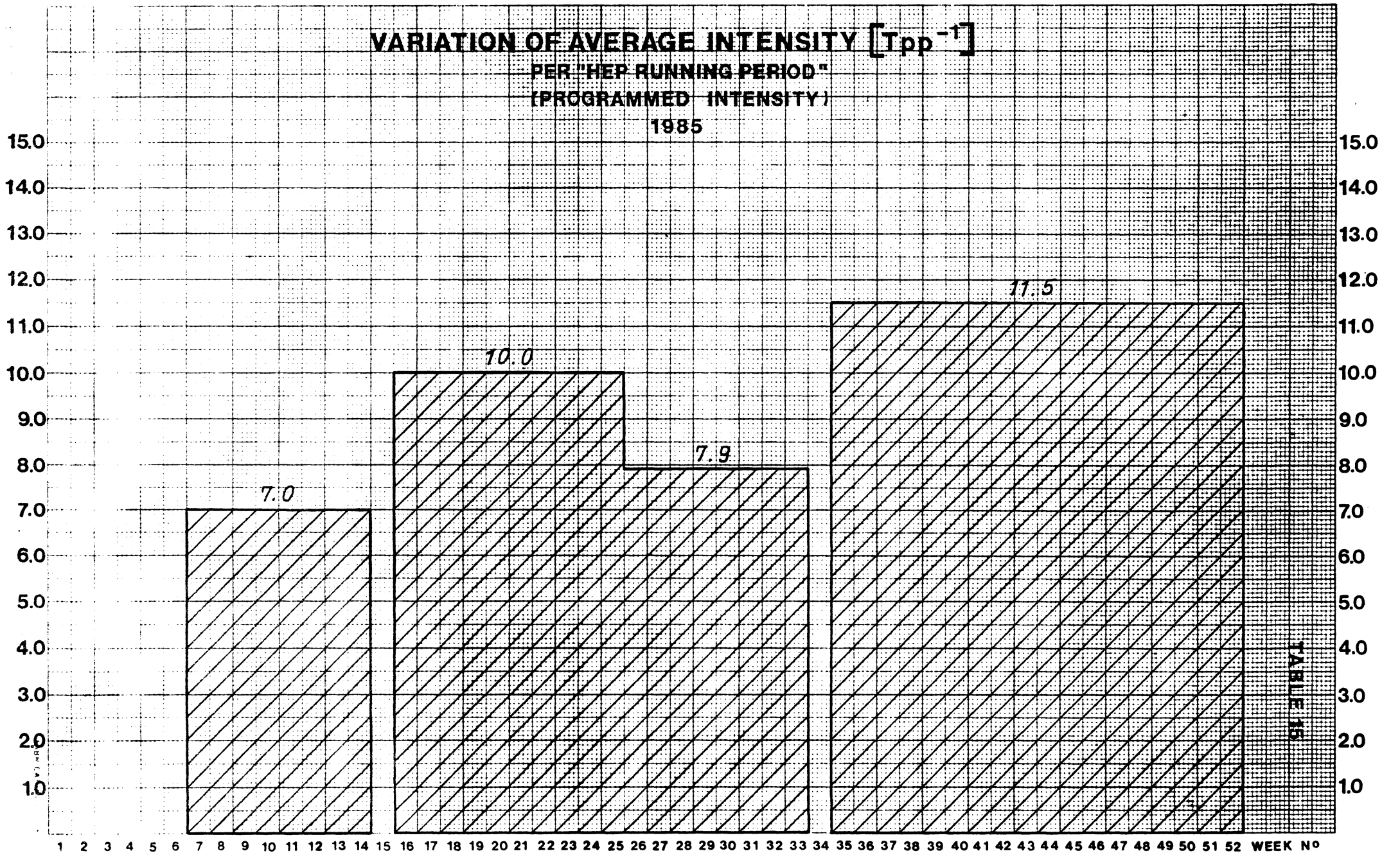
FOR HEP + MD + MSU

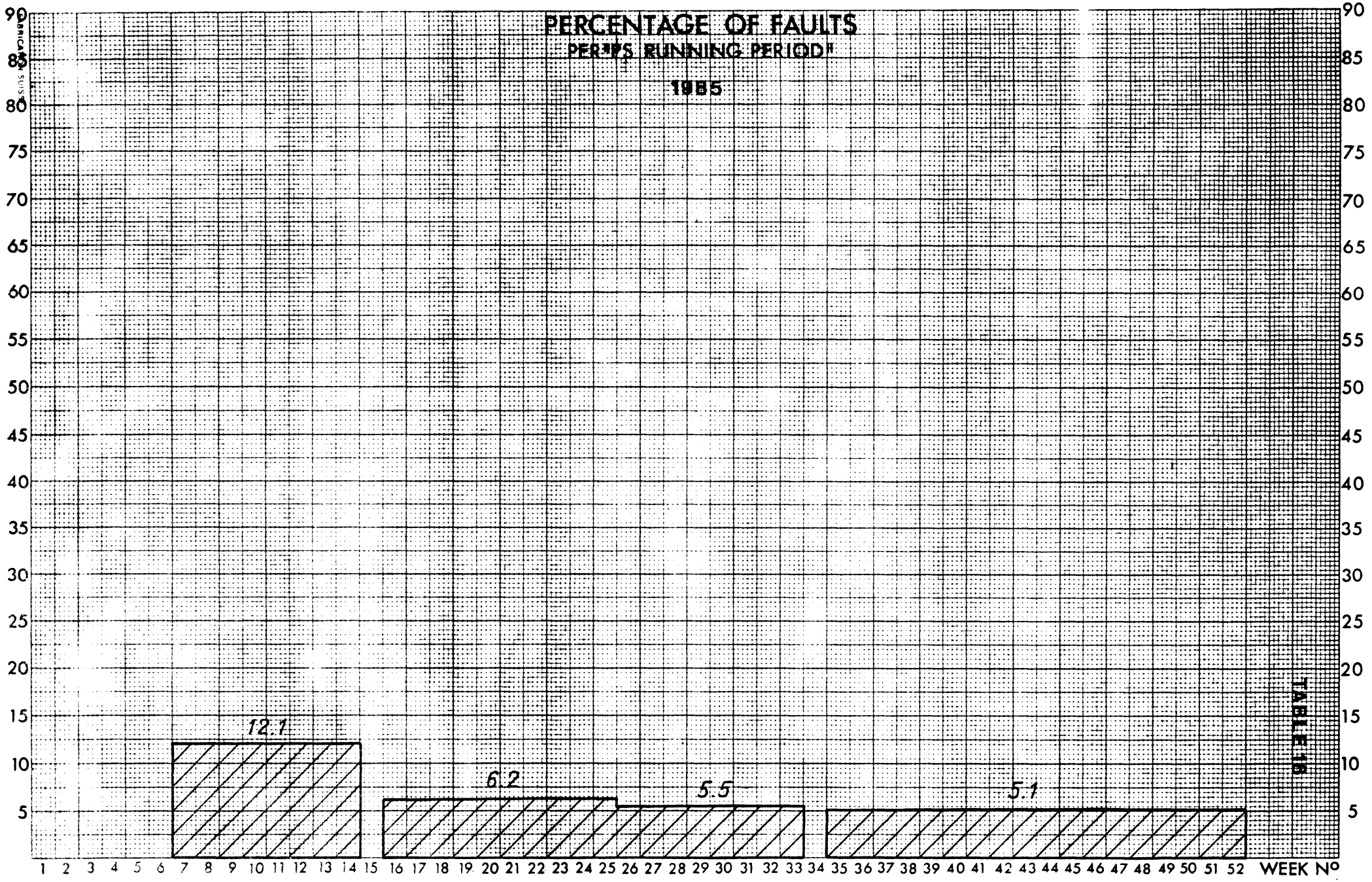
YEAR	TOTAL HOURS WORKED	TOTAL NUMBER OF PULSES ACCELERATED	TOTAL NUMBER OF PROTONS [10^{16}]	AVERAGE [Tpp^{-1}]
TOTAL FOR 1985	6 474.0	10 918 338	9 785.2	8.96
TOTAL FOR 1960...1984	128 790.3	188 695 503	73 743.8	3.91
GRAND TOTAL 1960...1985	135 264.3	199 613 841	83 529.0	4.18

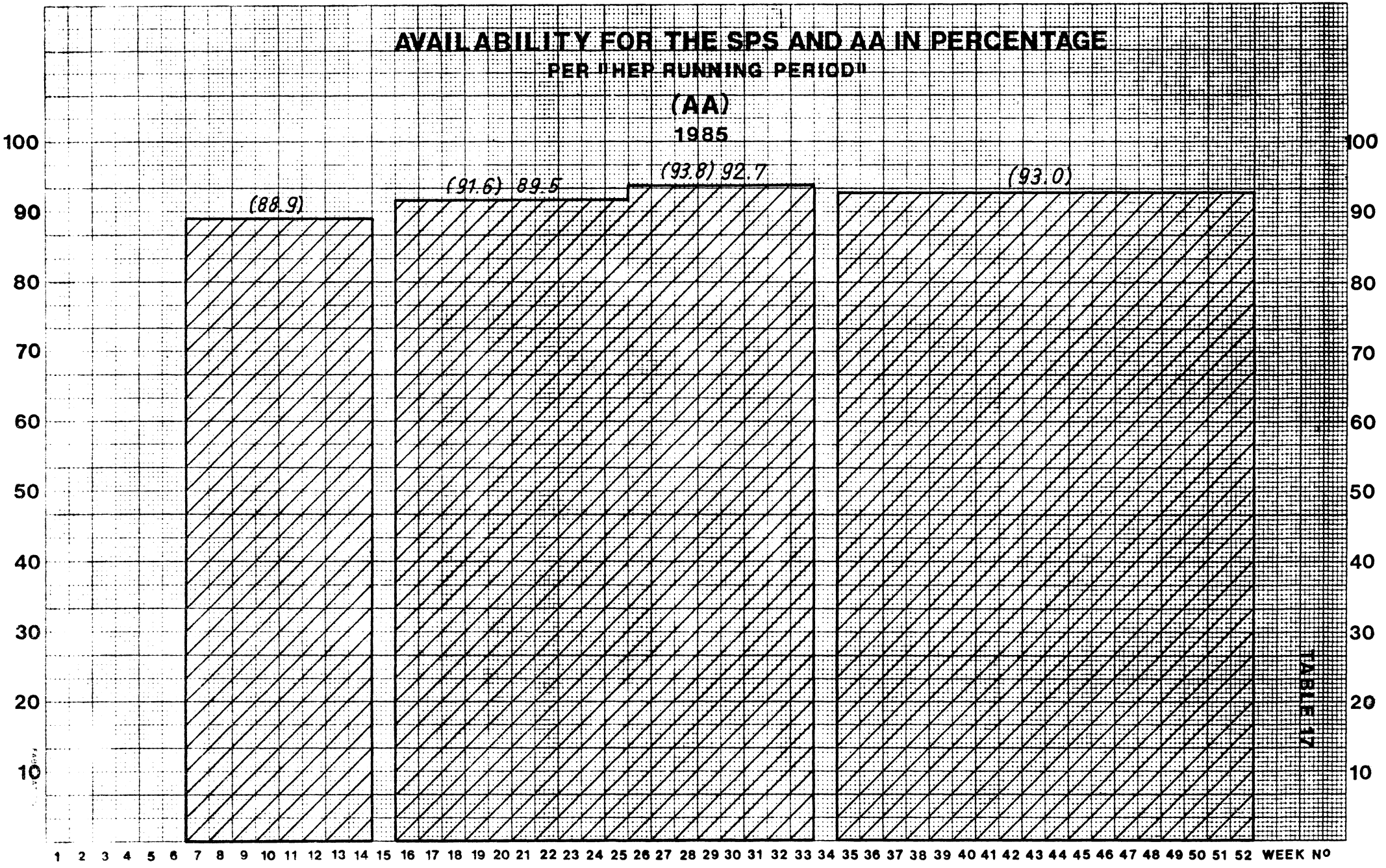
TABLE 14

YEAR 1985	1/1 10/2	11/2 7/4	8/4 14/4	15/4 23/6	24/6 18/8	19/8 25/8	26/8 31/12	TOTAL
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	PERCENTAGE OF TIME LOST =419h51
MACHINE	MAIN MAGNET & AUXIL.		24.09		-	1.23		3.41	29.13	0.45	7.0
	MAIN GENE-RATOR		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		5.14		2.21	0.49		4.57	13.21	0.21	3.2
	CONTROL		27.03		39.01	13.52		24.02	103.58	1.61	24.8
	BEAM TRANS-PORT		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 [Tpp⁻¹]
PER "HEP RUNNING PERIOD"
(PROGRAMMED INTENSITY)
1985
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
7.0
10.0
7.9
11.5
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
TABLE 15


PERCENTAGE OF FAULTS
PER 175 RUNNING PERIOD"
1985
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
12.1
6.2
5.5
5.1
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
TABLE 15


AVAILABILITY FOR THE SPS AND AA IN PERCENTAGE
PER "HEP RUNNING PERIOD"
(AA)
1985
(88.9)
(91.6) 89.5
(93.8) 92.7
(93.0)
100
90
80
70
60
50
40
30
20
10
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
PAGE 27

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

YEAR 1985	0'- 10' 193/14^{h}.56	10'-20' 116/26^{h}.11	20'- 1H 121/71^{h}.01	1H - 3H 102/167^{h}.38	3H-6H 18/72^{h}.05	> 6H 7/68^{h}.00	TOTAL 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)							

TABLE 18

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

YEAR 1985	0'-10' 19/1^{h}.31	10'-20' 15/3^{h}.11	20'-1H 28/14^{h}.38	1H-3H 18/29^{h}.20	3H-6H 5/19^{h}.26	> 6H -	TOTAL 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							

TABLE 19

PS/OP/YR/ed
10.01.1986

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

1 9 8 5	0'-10' 71/7h07	10'-20' 38/9h34	20'-1h 48/29h27	1h-3h 31/62h43	3h-6h 22/96h15	>6h 14/154h41	TOTAL 224/359h47
INJ. ELEMENT	6/0h40	8/2h10	13/7h48	7/13h53	5/21h28	11/130h43	50/176h42
EJ. ELEMENT	-	-	-	-	-	-	-
RING ELEMENT	-	2/0h30	-	1/2h50	2/7h55	-	5/11h15
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

TABLE 20

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'ANTIPROTONS

: 16196,96 10^9 (en ≈ 3700 h)
======= (soit ≈ 4,4 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				
FR					1				1				
SA													
SU	6	13	20	27	3	10	17	24	3	10	17	24	31

P1

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								
TH													
FR									31				
SA									1				
SU	7	14	21	28	5	12	19	26	2	9	16	23	30

P2

← 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+MD											
WE		d+			31								
TH					1								
FR										SpS̄	+		
SA									31	LEAR			
SU	7	14	21	28	4	11	18	25	1	8	15	22	29

P3 P4

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										SpS̄	+		
TH					31					LEAR			
FR					1								
SA									30				
SU	6	13	20	27	3	10	17	24	1	8	15	22	29

P4

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

1985 TECHNICAL PARAMETERS

ACCELERATORS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
SC													
Hours scheduled for physics	256	652	144	344	672	652	320	SHUT	SHUT	360	672	452	4524
Hours given to physics	34	469	142	187	676	645	316	DOWN	DOWN	352	667	444	3932
Hours given/hours scheduled	13.3%	71.9%	98.6%	54.4%	100.6%	98.9%	98.8%	|	|	97.8%	99.3%	98.2%	86.9%
Hours scheduled for MD+Setting-up	8	12	34	4	12	12	-	|	|	8	12	-	102
Hours given to machine development + SU	8	78	32	0	4	8	-	|	STARTUP	5	9	-	144
Total hours scheduled	264	664	178	348	684	664	320	|	60	368	684	452	4686
Total hours realised	42	547	174	187	680	653	316	|	60	357	676	444	4136
PS													
Hours scheduled for physics	|	54	703	360	732	444	660	446	712	736	678	520	6045
Hours given to physics	|	38	626	325	694	433	620	424	672	682	658	495	5667
Hours given/hours scheduled	|	70.4%	89%	90.3%	94.8%	97.5%	93.9%	95.1%	94.4%	92.7%	97.1%	95.2%	93.7%
Hours scheduled for MD+Setting-up	|	266	41	57	12	45	84	69	8	8	8	9	607
Hours given to machine development + SU	|	249	37	50	12	38	79	67	8	8	8	9	565
Total hours scheduled	|	320	744	417	744	489	744	515	720	744	686	529	6652
Total hours realized	|	287	663	375	706	471	699	491	680	690	666	504	6232
- LINAC 2													
Hours scheduled	S	320	744	417	744	489	744	515	720	744	686	529	6652
Hours realized		320	721	411	737	488	738	511	716	725	684	529	6580
Hours realized/hours scheduled	H	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 realized		319	729	410	740	484	742	508	719	728	681	524	6584
Hours realized/hours scheduled	T	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 realized[1]		|	555	260	687	362	312	327	419	719	580	462	4683
Hours realized/hours scheduled	O	|	77%	73 %	93.1%	88.7%	79.2%	80.0%	68.2%	96.6%	80.6%	87.3%	81.6%
- LINAC 1		S	S	|	|	|							
Hours scheduled	W	H	T	SHUT	SHUT	SHUT	480	108	576	100	40	-	1304
Hours realized		U	O	DOWN	DOWN	DOWN	360	108	546	100	38	-	1152
Hours realized/hours scheduled	N	T	P	|	|	|	75.0%	100.0%	94.8%	100%	95.0%	-	88.3%
LEAR		D											
Hours scheduled for physics ($\bar{p}$)	|	O	144	|	517	214	180	313	248	452	320	320	2708
Number of spills given to physics[2]	|	W	76	|	332	91	81	209	60*	228*	153+	161 ○	1391
Number of spills lost	|	N	27	|	57	9	14	31	10	21	35	17	221
Efficiency	|	|	74%	|	85.3%	91.0%	85.3%	87.1%	85.7%	91.6%	81.4%	90.4%	86.3%
Hours scheduled for MD+SU ($p\bar{p}$)	|	|	112	112	184	31	448	86	368	104	64	64	1573
Hours given " " " "	|	|		98	153	31	160	86	435	94	65	42	1164

1) Included $\bar{p}$ stack losses

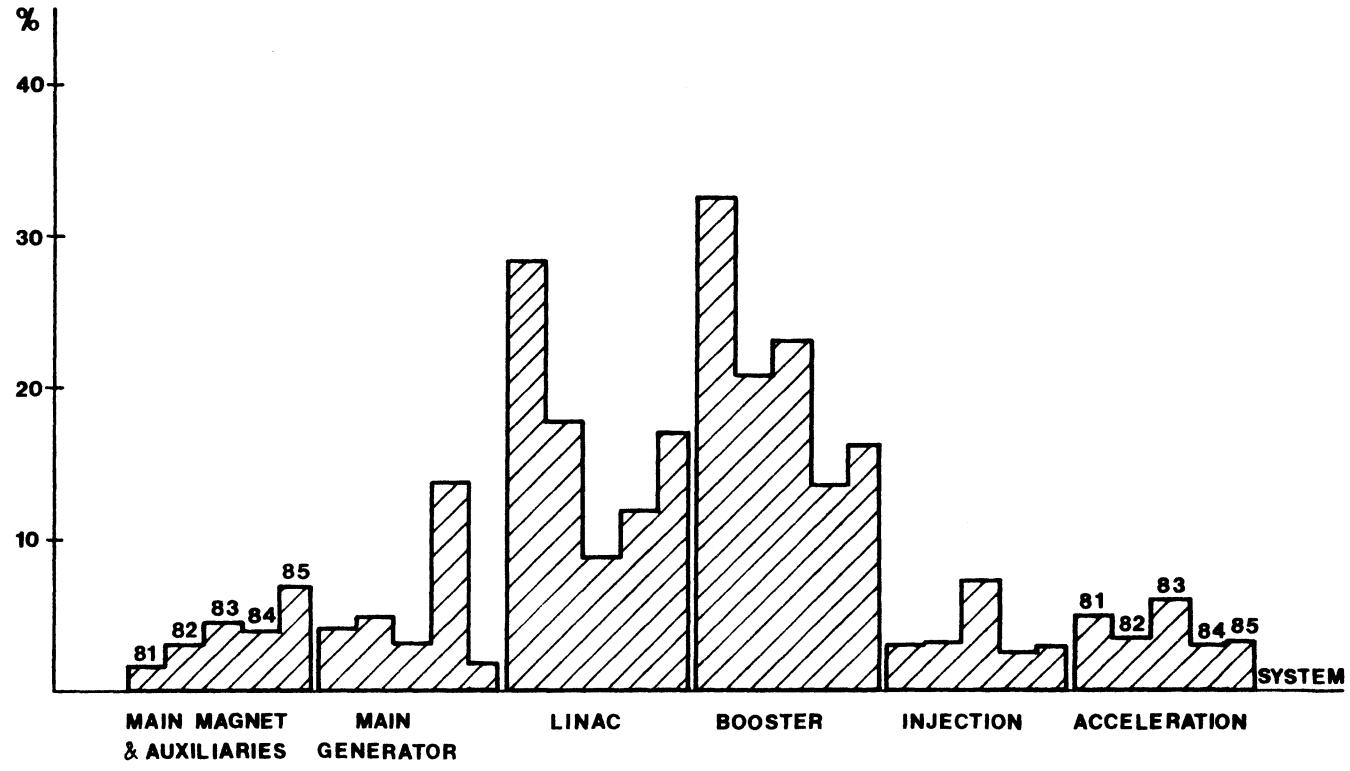
2) 1 h. $\bar{p}$ spill time

* 20' to 60' $\bar{p}$ spill time (105 MeV/c; 500-600 MeV/c)

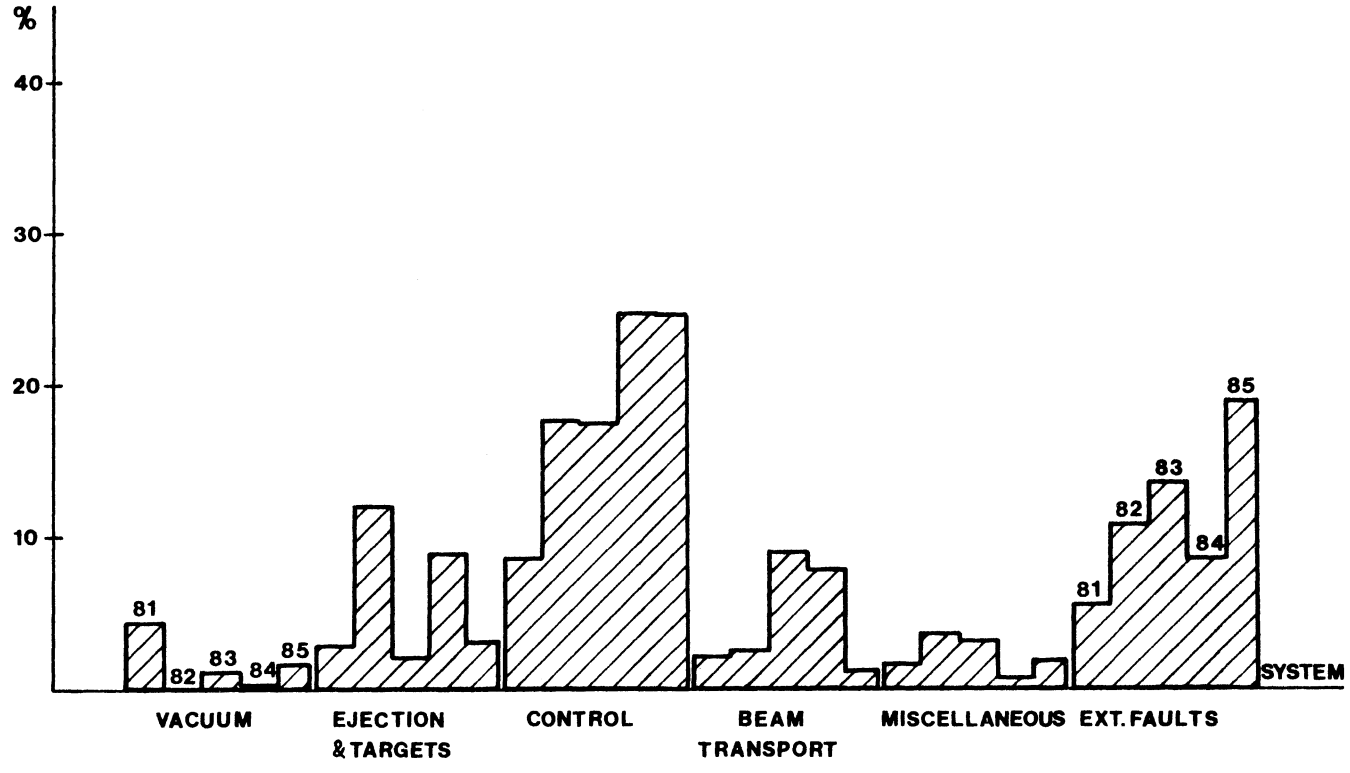
\+ 60' to 120' " " (600 MeV/c; 1,2 GeV/c)

○ 60' to 180' " " (1700 MeV/c)

TABLE 24



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



EVOLUTION OF FAULT DISTRIBUTION BY SYSTEM SINCE 1981

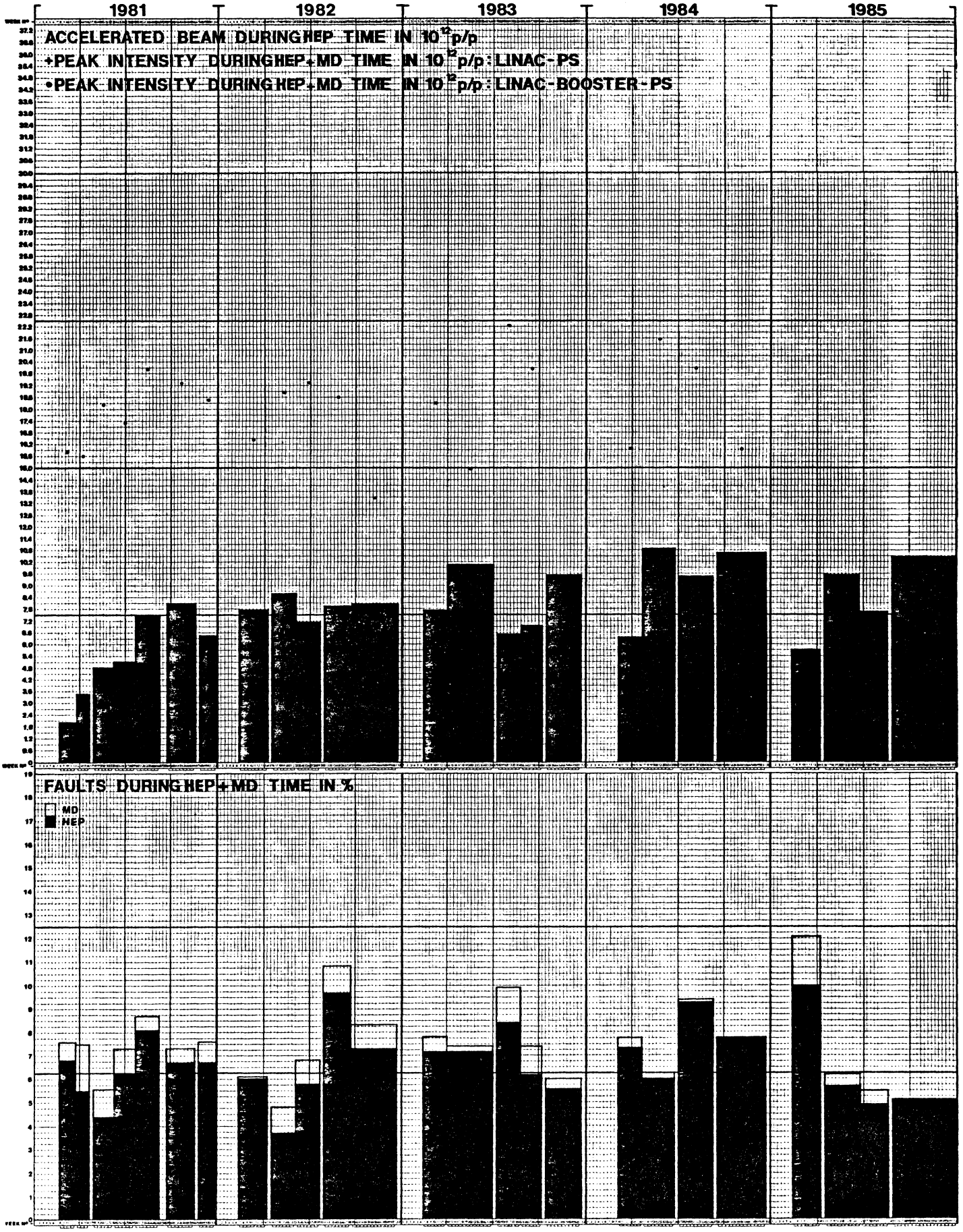
TOTAL PSB INTENSITY PER RING AND Nº OF PULSES

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 26

TABLE 27


1981
1982
1983
1984
1985
ACCELERATED BEAM DURING HEP TIME IN 10^{12} p/p
+PEAK INTENSITY DURING HEP + MD TIME IN 10^{12} p/p : LINAC - PS
•PEAK INTENSITY DURING HEP + MD TIME IN 10^{12} p/p : LINAC - BOOSTER - PS
FAULTS DURING HEP + MD TIME IN %
MD
HEP

Annex 1

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-QO5 (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-QO5 (BTP.QNO10), ((T-QO6 .....10, BTP.QNO20 ...60), T-DHO3 ...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.

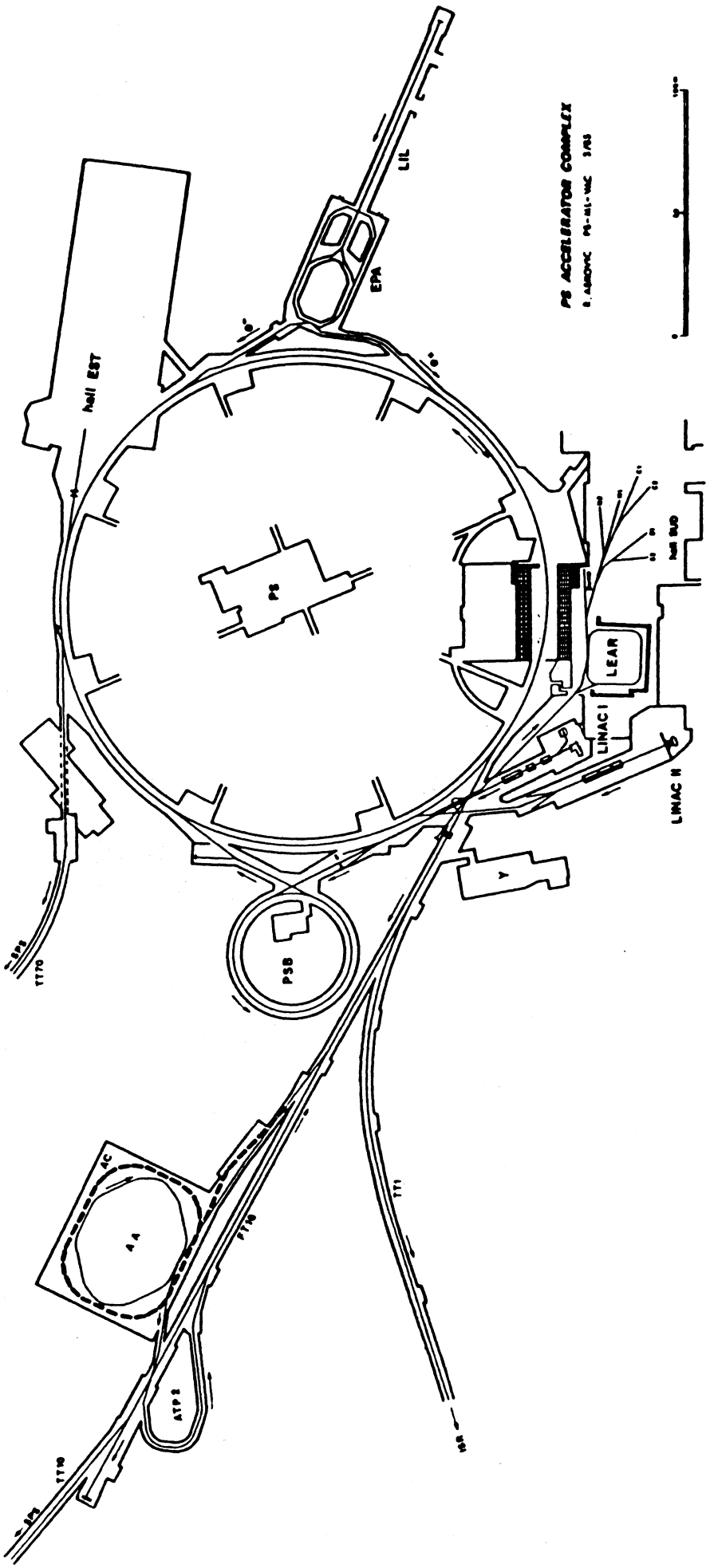
11. Beam transport

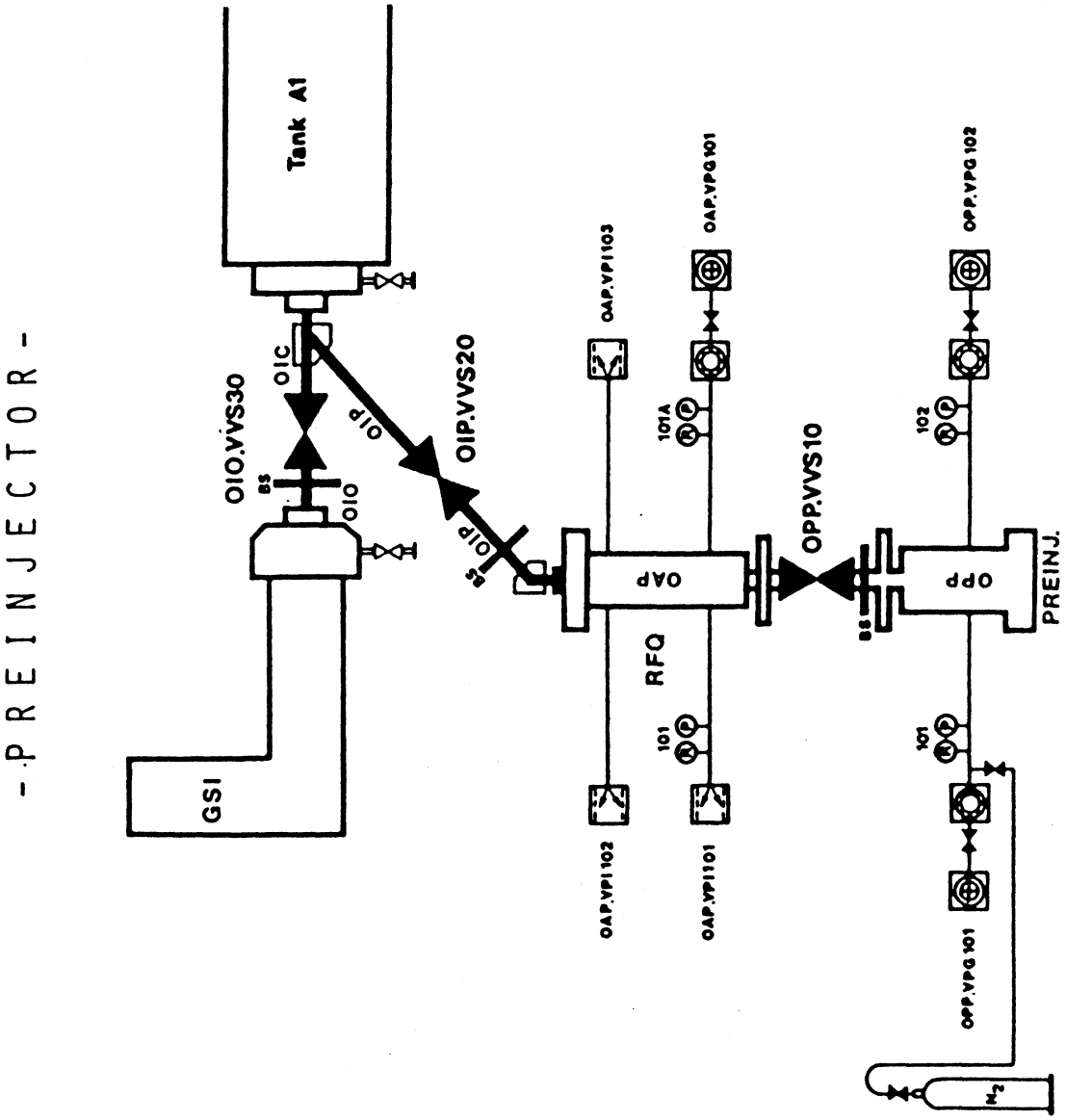
All the faults related to the separators, the magnets, the quadrupoles and their cooling system, the vacuum ejected beams, the septa (ex. MNP 35/1-2) and the hydrogen targets are to be found in this section; plus the ATP1, ATP2, FTD, TT2 and FA58 lines.

12. External faults

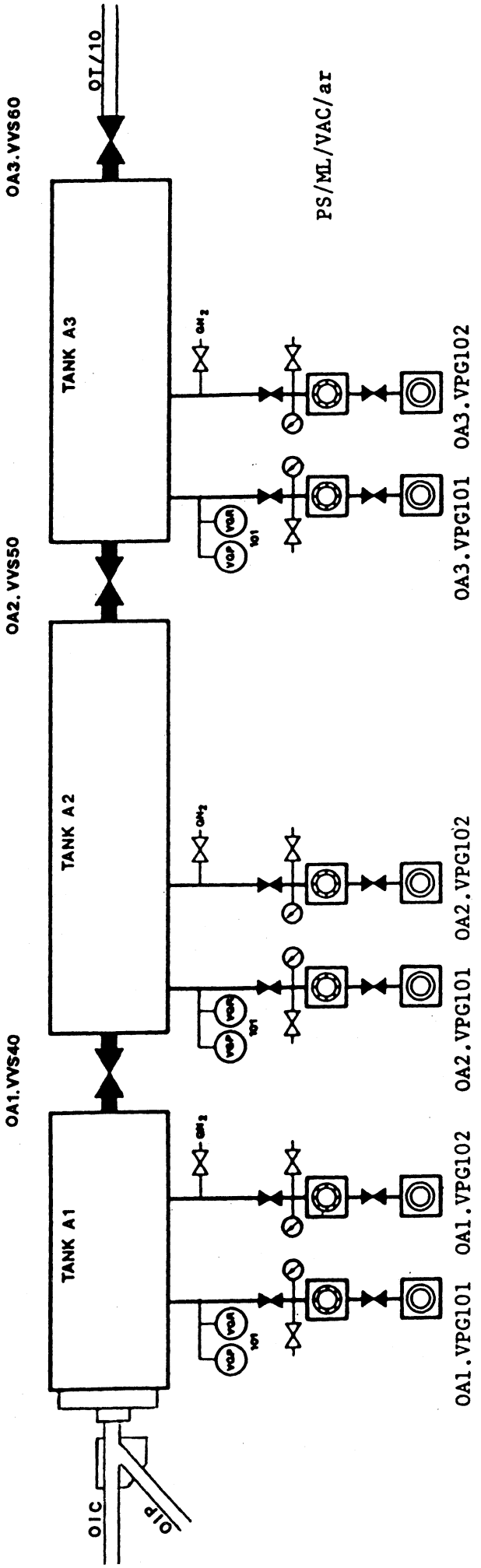
All the faults which are not attributed to an element found in or around the PS, i.e. thunderstorms, mains failures, stops due to SB causes (water supply, water pump below door 4, ventilation, etc.) are classed here. (Details in Annex 4).

Annex 1


PS ACCELERATION COMPLEX
LIL
EPA
hall EST
PS
LEAR
LINAC I
LINAC II
PSB
TT70
TT10
TT2
TT1
4A
4C
ATP2


-PREINJECTOR-
Tank A1
GSI
OIC
OIO.VVS30
BS
OIO
OIP
OIP.VVS20
OAP.VPI103
OAP.VPG101
101A
OAP
RFQ
101
OAP.VPI102
OAP.VPI101
OPP.VVS10
OPP.VPG102
102
OPP
PREINJ.
101
OPP.VPG101
H2

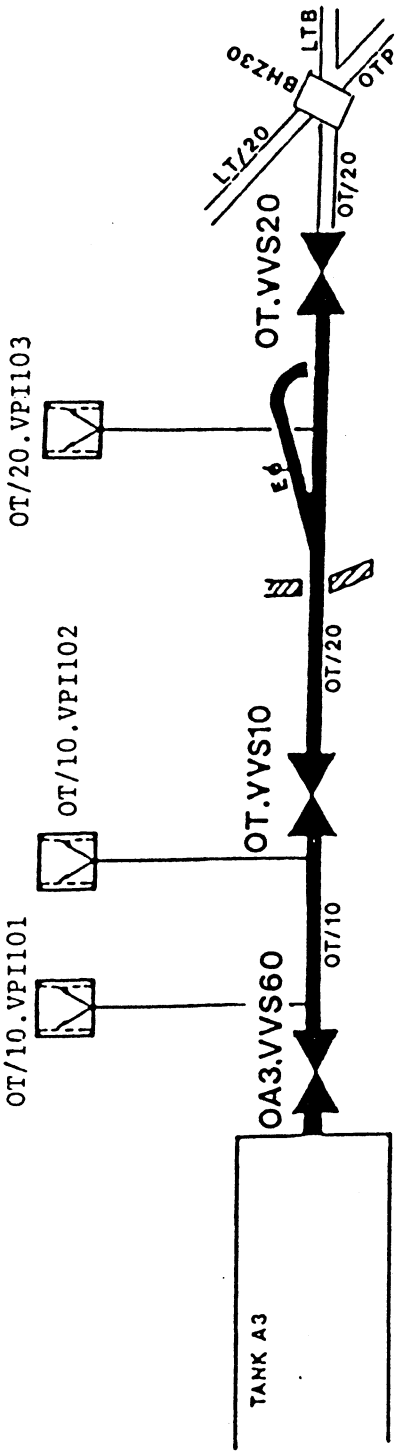
T A N K S A1 - A2 - A3



Annex 1

LC 12

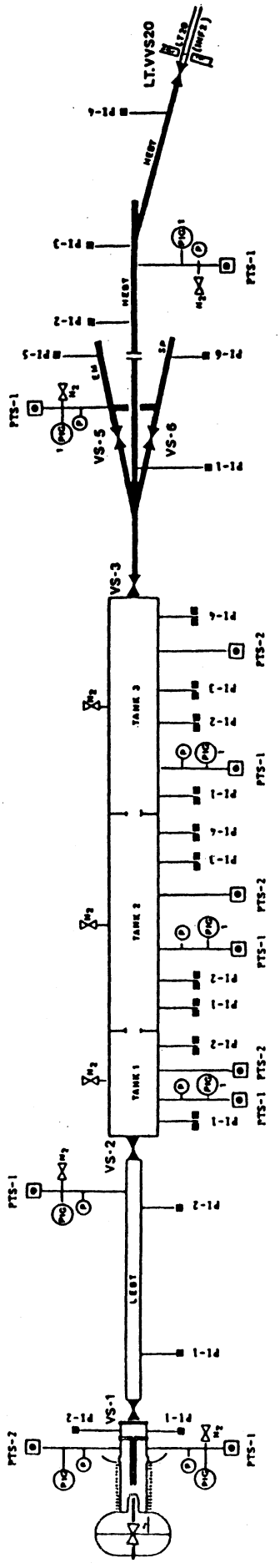
- L I N E O T -



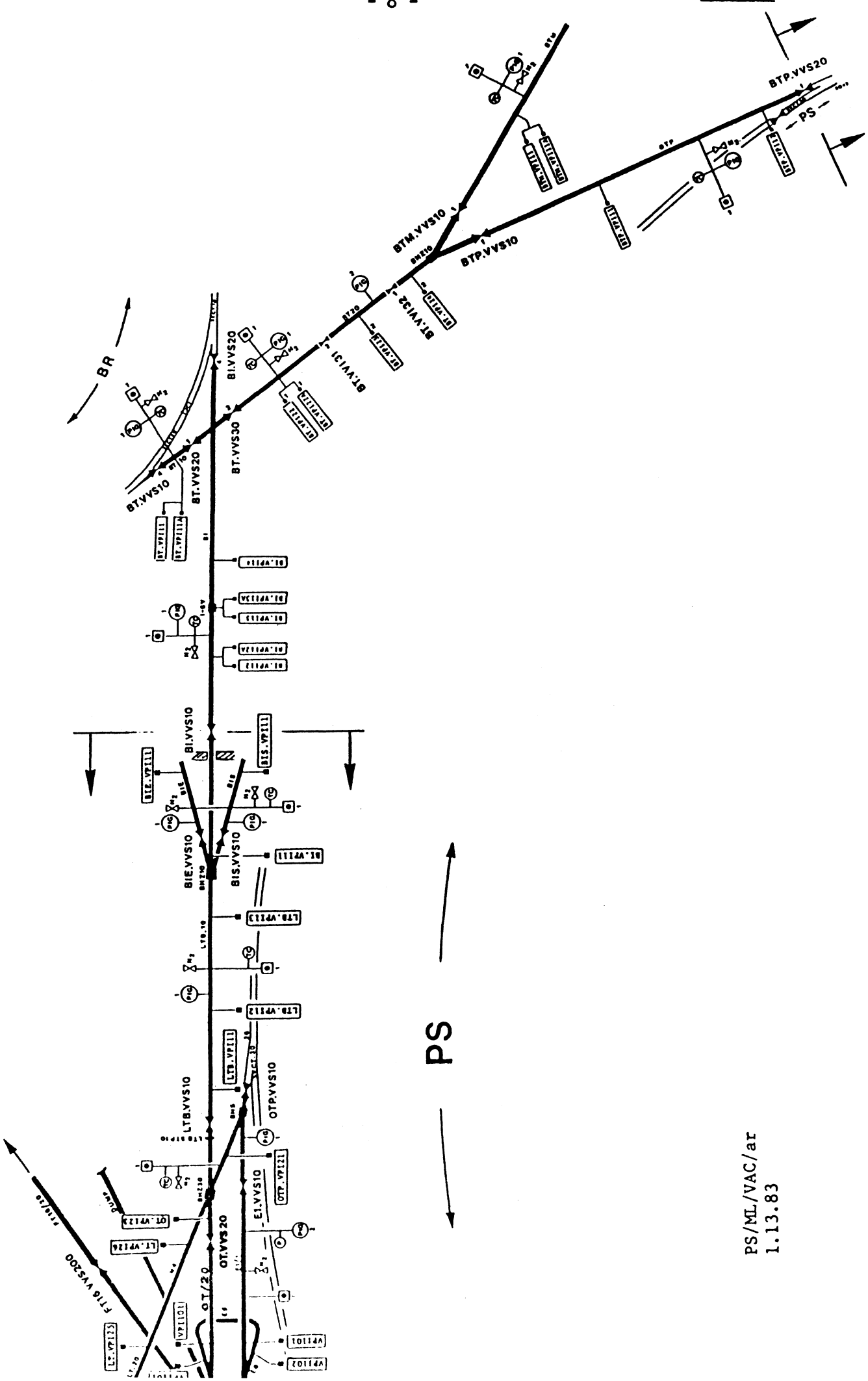
PS/ML/VAC/ar

PS/ML/VAC/ar
13.1.83

LINAC II

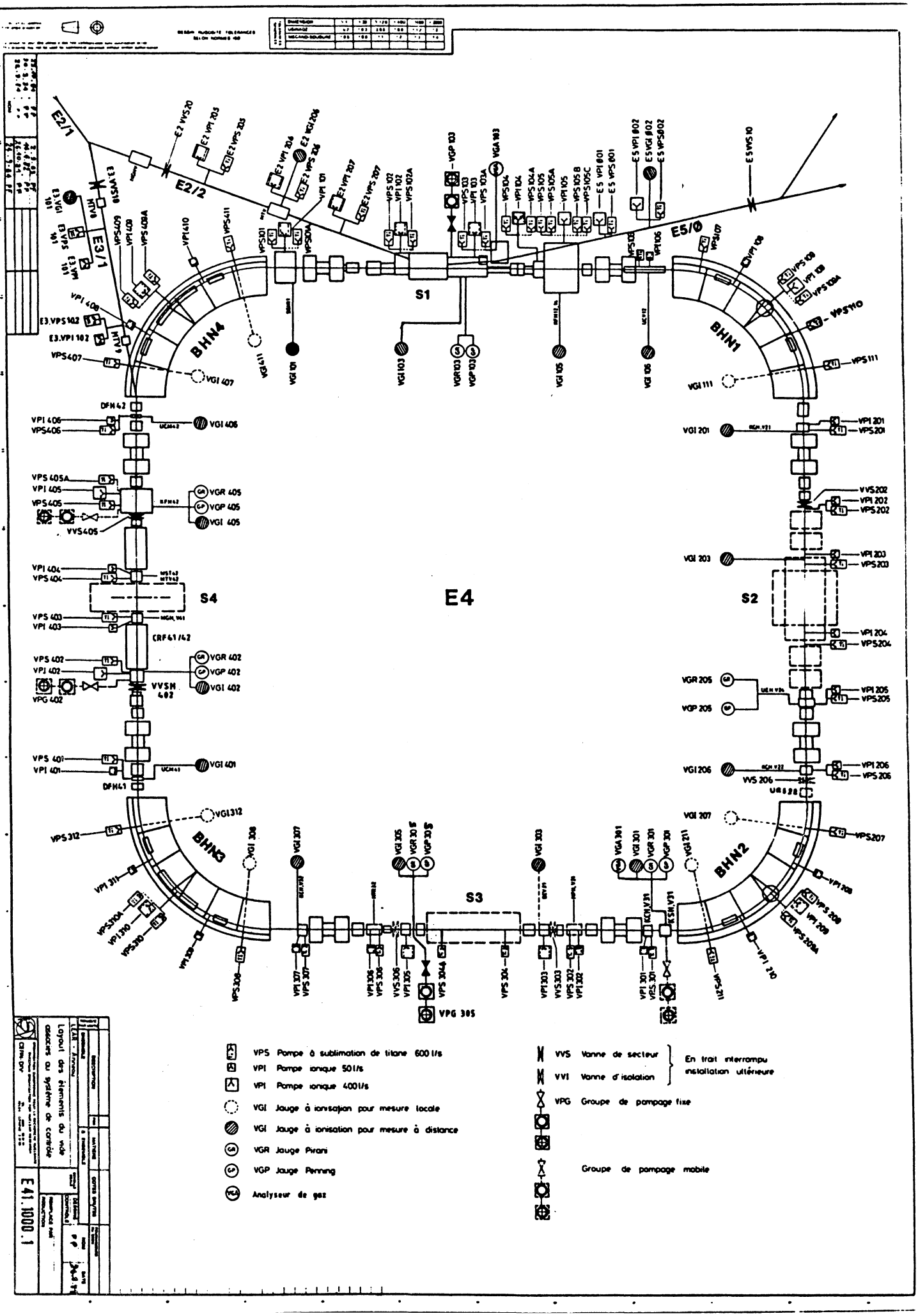


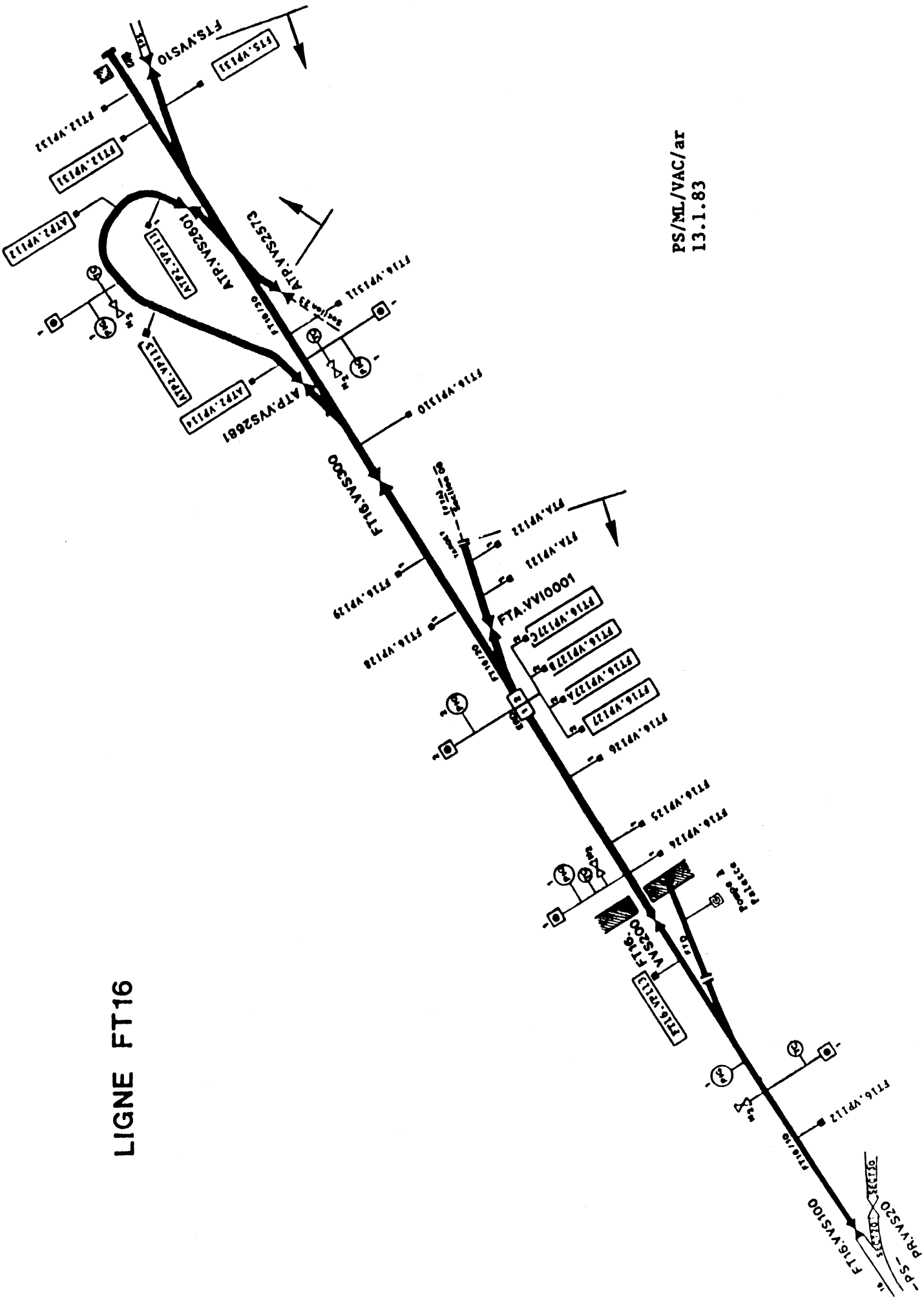
Annex I

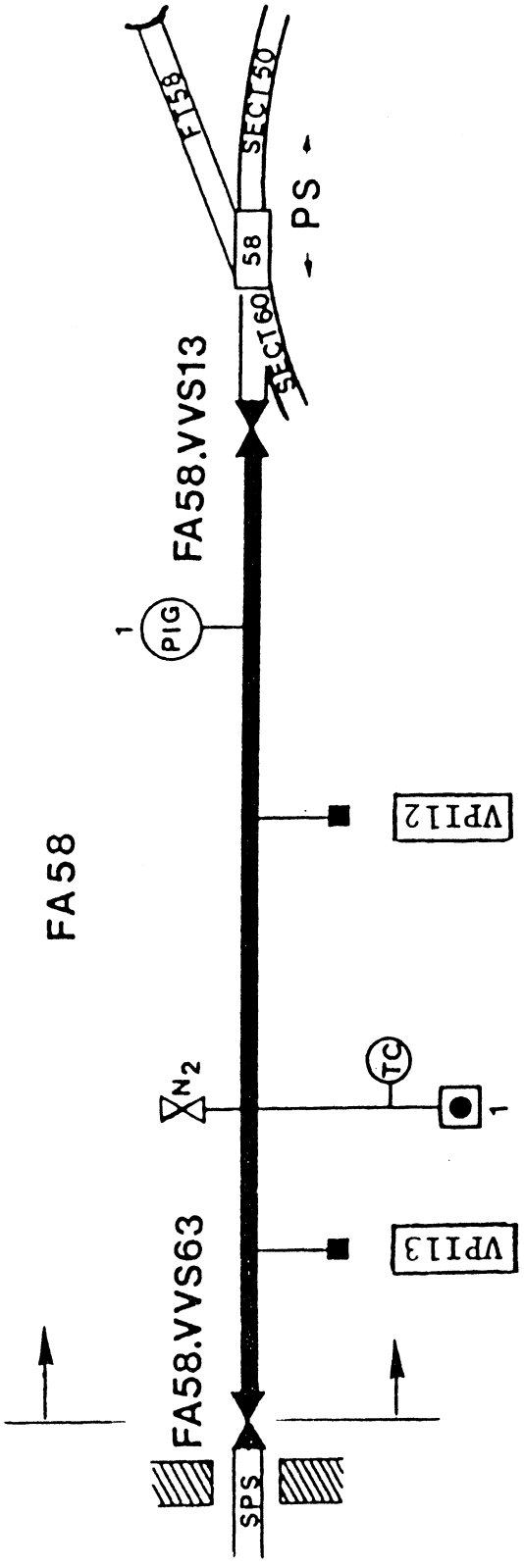


PS/ML/VAC/ar
1.13.83

Annex 1


E2/1
E2/2
E3/1
E5/1
E4
S1
S2
S3
S4
BHN1
BHN2
BHN3
BHN4
VPS Pompe à sublimation de titane 600 l/s
VPI Pompe ionique 50 l/s
VPI Pompe ionique 400 l/s
VGI Jauge à ionisation pour mesure locale
VGI Jauge à ionisation pour mesure à distance
VGR Jauge Pirani
VGP Jauge Penning
Analyseur de gaz
VVS Vanne de secteur
VVI Vanne d'isolation
En trait interrompu installation ultérieure
VPG Groupe de pompage fixe
Groupe de pompage mobile
E41.1000.1


LIGNE FT16
PS/ML/VAC/ar
13.1.83
FTS.VVS10
FTS.VP131
FT12.VP132
FT12.VP131
ATP2.VP112
ATP.VVS2601
ATP2.VP111
ATP.VVS2573
FT16.VP1311
ATP2.VP113
ATP2.VP114
ATP.VVS2681
FT16.VP1310
FT16.VVS300
FTA.VP122
FTA.VP121
FT16.VP129
FT16.VP128
FTA.VVI0001
FT16.VP127C
FT16.VP127B
FT16.VP127A
FT16.VP127
FT16.VP126
FT16.VP125
FT16.VP124
FT16.VVS200
FT16.VP113
FT16.VP112
FT16.VVS100
PR.VVS20
-PS-



PS/ML/VAC/ar
13.1.83

ANNEX 2

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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Distribution du résumé :
Personnel scientifique de la Division PS (PS/1)

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