PS/OP/Info 92-09
11.2.1992

AAC TIMING

Copie des transparents
du cours donné aux techniciens d'opération AAC/LEAR
le 11.2.1992
par T. Eriksson

Distribution

Section OP/AAC/LEAR
AAS
LEAS

AAC timing

1) Introduction

2) Interface PS/AC/AA

3) Synchronization / RF-clocktrains

4) Operating modes - timing aspects

5) Controls

6) Diagnostic tools

1.) Pulsed elements in AAC

— The pulsed dipoles + quadrupoles in the dog-leg, the transfer line AA ⇄ AC, the injection line before target + the AC septa are continously pulsed (every 4.8 sec.) to keep the magnet windings + power supplies at a constant temperature and therefore guarantee a stable current. This is especially important in the dog-leg bending magnets (μs-steering).

— Some elements have both coarse + fine timing, for example, coarse to start charging of a power supply and fine to discharge at beam passage (or slightly before to allow the current to reach its peak).

— Coarse timing is clocked with the PS C-train which is derived from the magnet cycle and has a jitter vs. the beam of ~ ±1 μs (for AC ⇄ AA transfers ~ ±10 μs).
Fine timing is derived from any of the RF-systems — PS, AC h=1 or AA. The jitter vs. the beam is a few ns.

a)

Pulsed elements in AAC

Element	Type of timing	Pulsed how
Kickers (~4)	coarse (charge) + fine (discharge)	On request
Dog-Leg magnets (bending + Quads)	coarse	Continously
Inj. line up to target (bending + Quads)	coarse	Continously
Transfer Line AA ⟺ AC (bending + Quads)	coarse	Continously
AC injection + AC ejection septas	coarse	Continously
Li-Lenses	coarse (charge) + fine (discharge)	On request
Mag. Horn	coarse (charge) + fine (discharge)	On request
RFAC h=6	fine (discharge)	On request
RFAC h=1 (start GPA, ph. loop, sync.)	coarse	On request
RFAA h=1 (start GPA, ph. loop, sync.)	coarse	On request
~~Shutters~~	~~coarse~~	~~On request~~
Cooling AC + AA (sequence + pow. meas.)	coarse	On request
P/U + kicker movement	coarse	On request

1b)

AAC instrumentation that need triggers

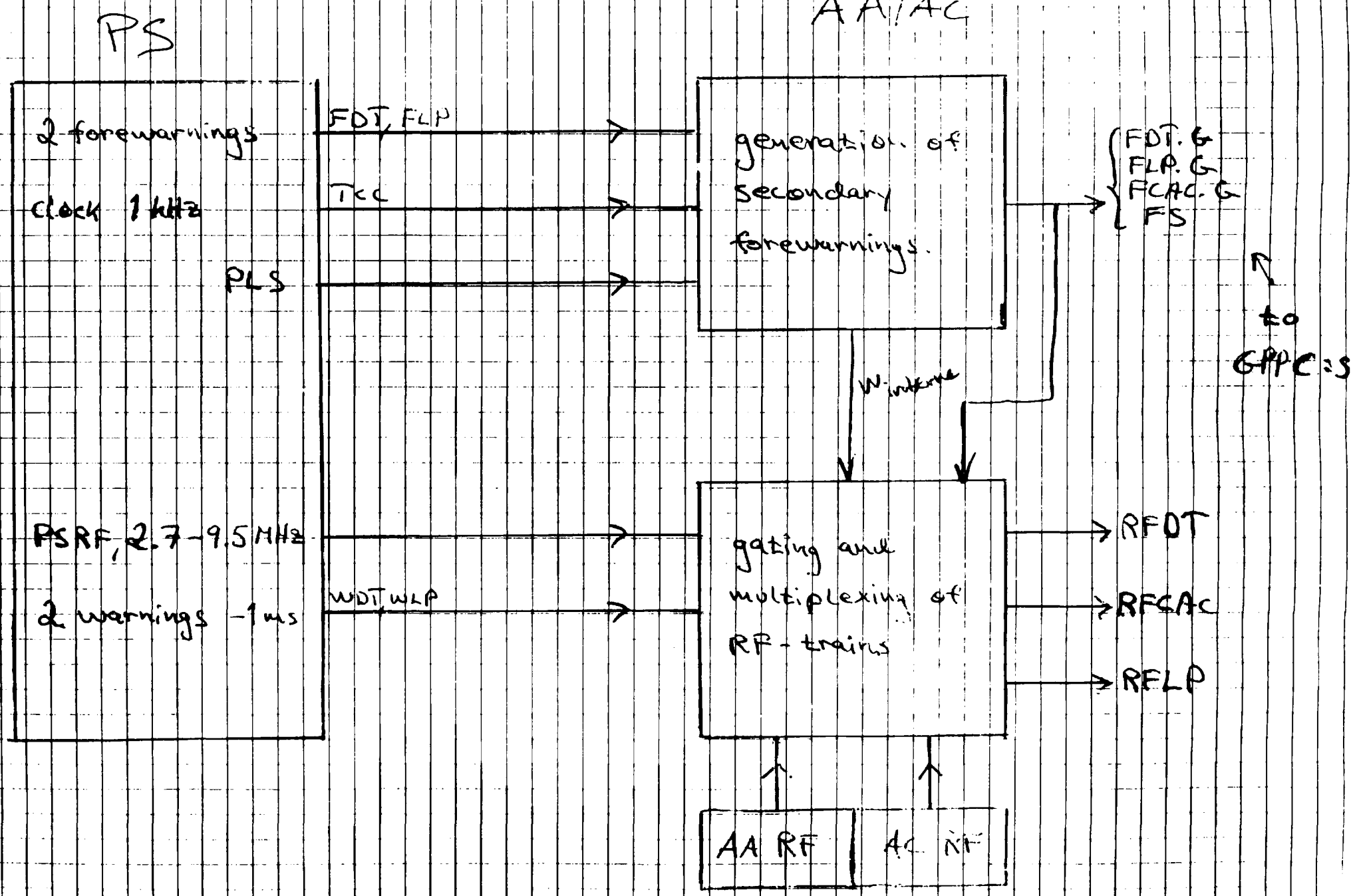
Element	Type of timing	Pulsed how
Beam transformers (×3)	fine	On request
Sem grids AA ⟷ AC line	fine	On request
DC transformers AA + AC	coarse	Continously
Position pick-ups AA+AC	coarse	On request — Asynchronously
Digitizer	fine	On request
Spectrum analyzer	fine	On request
FFT	coarse	On request
Electron (pion) yield	fine	On request
Radiation monitoring integration	coarse	Continously
ACR triggers (×6)	coarse/fine	On request/ continously
MCR SOS-signals		

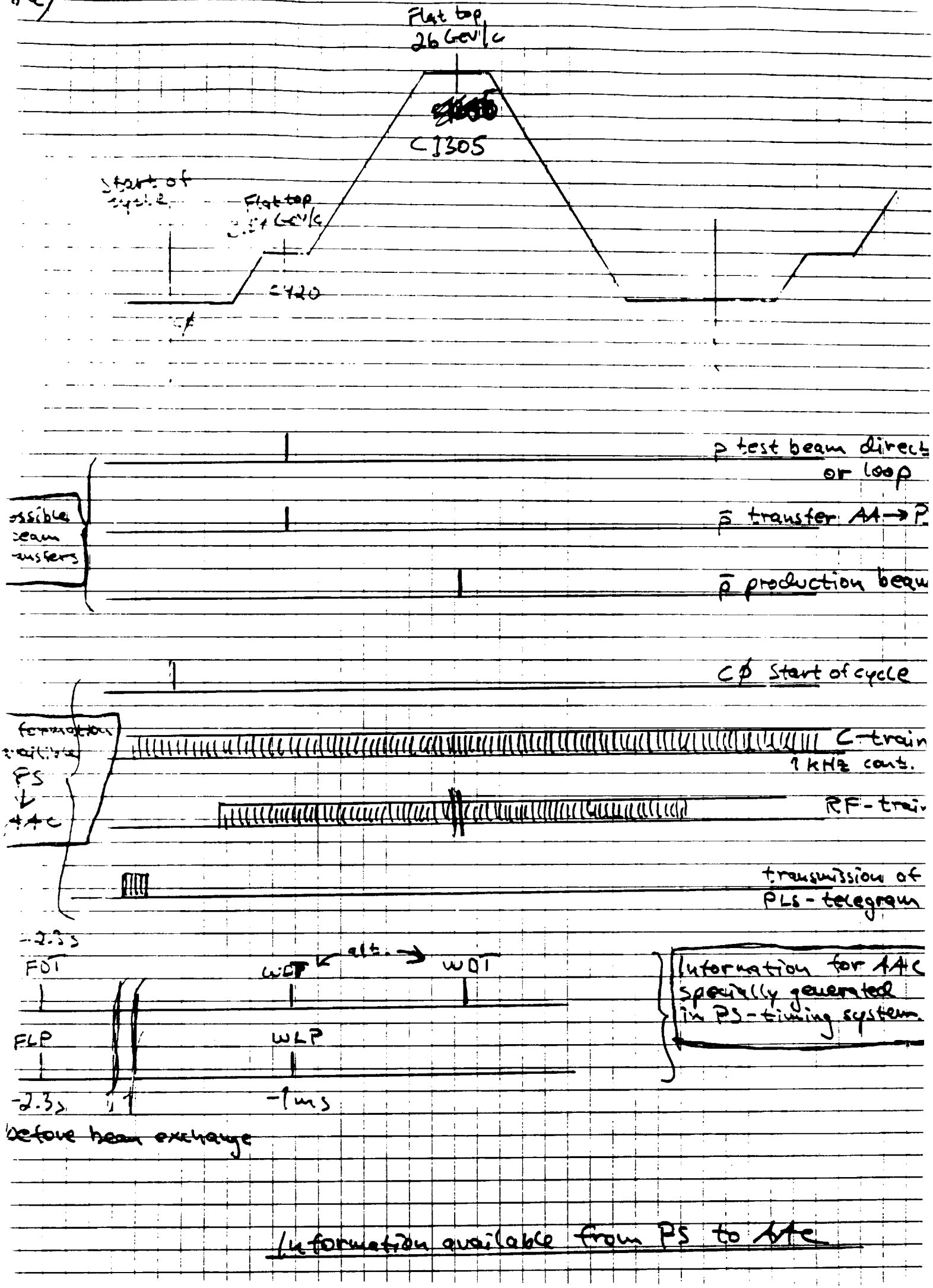
2] Interface between machines and rings

— PS is always timing master, it generates and transmits to AAC:

C-clock train	1 kHz continous	for coarse timing
RF-train	2,7 - 9,5 MHz	for synchronization bunch → bucket
PLS-train	At beginning of each cycle	used for handshake
Cϕ	pulse	start of PS-cycle
FDT, FLP	2.3 s before beam exchange	FDT = Forewarning DirecT FLP = Forewarning LooP
WDT, WLP	1 ms before beam exchange	synchronous with bunch

Timing exchanged between PS and ACOL





Information available from PS to AAC

Information available from AAC to PS

— Request for beam transfer via the "direct" line. } $\bar{p}$ production or p test beam direct.

— Request for beam transfer via the "Loop". } $\bar{p}$ ejection or p test beam via the loop.

— Train RFAA — Only for $\bar{p}$ ejection. Used to synchronize PSRF to AARF.

Information available for transfers between AA and AC

— FCAC.G, Forewarning for transfers in the AA — AC line. Used for transfers in both directions.

— RF-train, Selected from either AARF, ACRF or PSRF according to op. mode.

Other information available

— FS, Forewarning synchrone (or Sim), synchronous with either FOT or FLP depending on mode. Continuously pulsing.

Examples of handshake PS ⟷ AAC

MODE 1

- The request conditions DT (or LP) are cabled into the PLS-computer (in PS-timing). This computer reads the state at a certain time before the start of next cycle. This way, the PLS-computer can decide if the next cycle is the one before the beam exchange cycle or not.

- The FDT forewarning (-2.3s) is produced independently in the PS-timing. Transmission to AAC is done via the Camac loops.

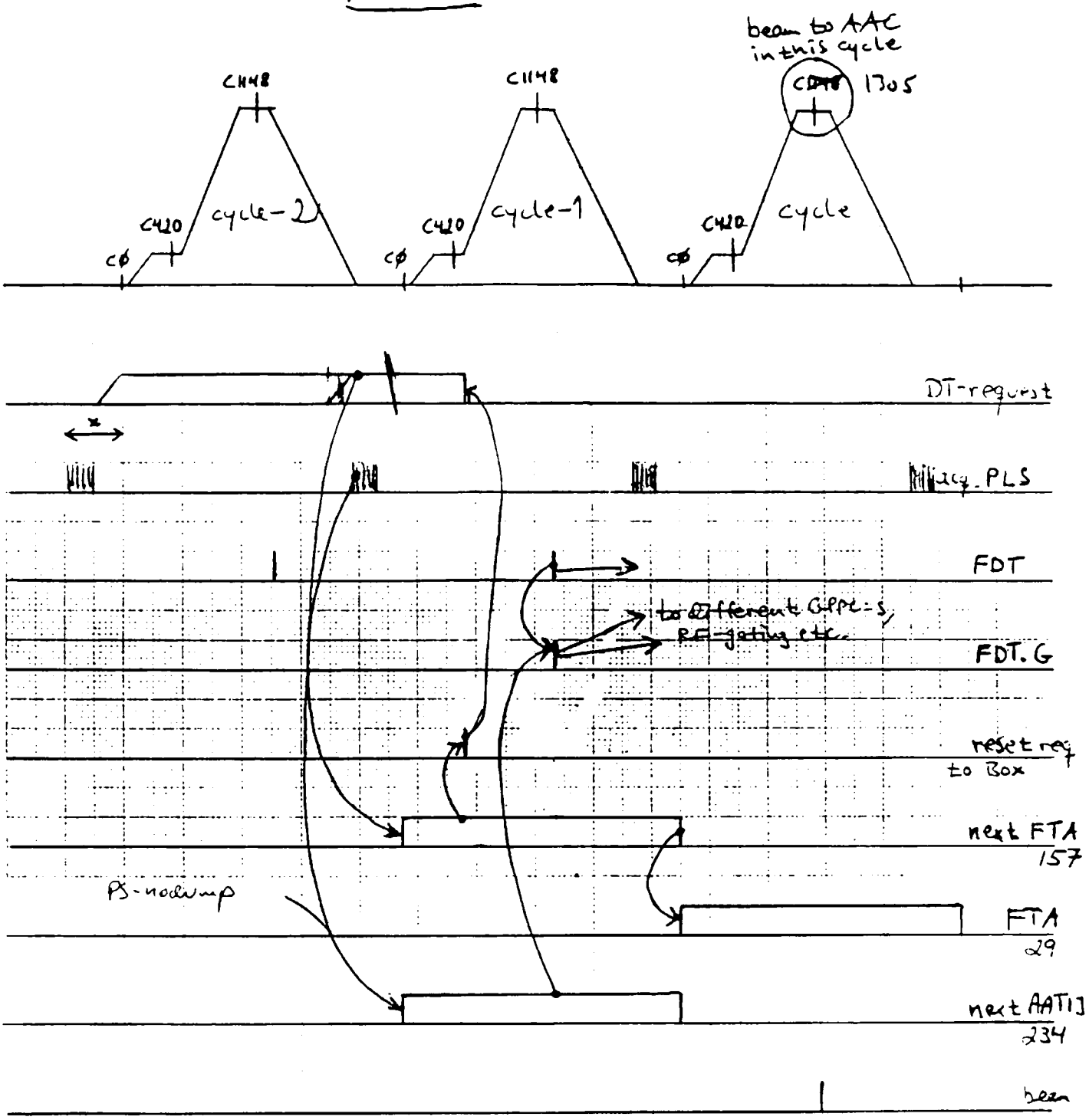
- In AAC central timing, the FDT is AND:ed with PLS-line 234 (next AATI) to produce FDT.G (also -2.3s).

- The "reset request" signal is produced in AAC central timing. Start pulse is C0 and clock train is C. The delay is enough to make sure that the request drops after the PLS-computers acquisition of the request conditions and well before the acquisition for the following cycle. "Reset request" is only produced when line 157 (next FTA) is present. This means that if, for some reason, the beam is sent to the dump in PS, the request will be reset, but FDT.G will not be produced.

- When the request is continous, it is forced high in the request hardware and "reset request" is ignored.

2/

MODE 1



DT-request, single shot

$\bar{p}$ accumulation

Only 26 GeV C-cycles

3/

Examples of handshake PS ↔ AAC

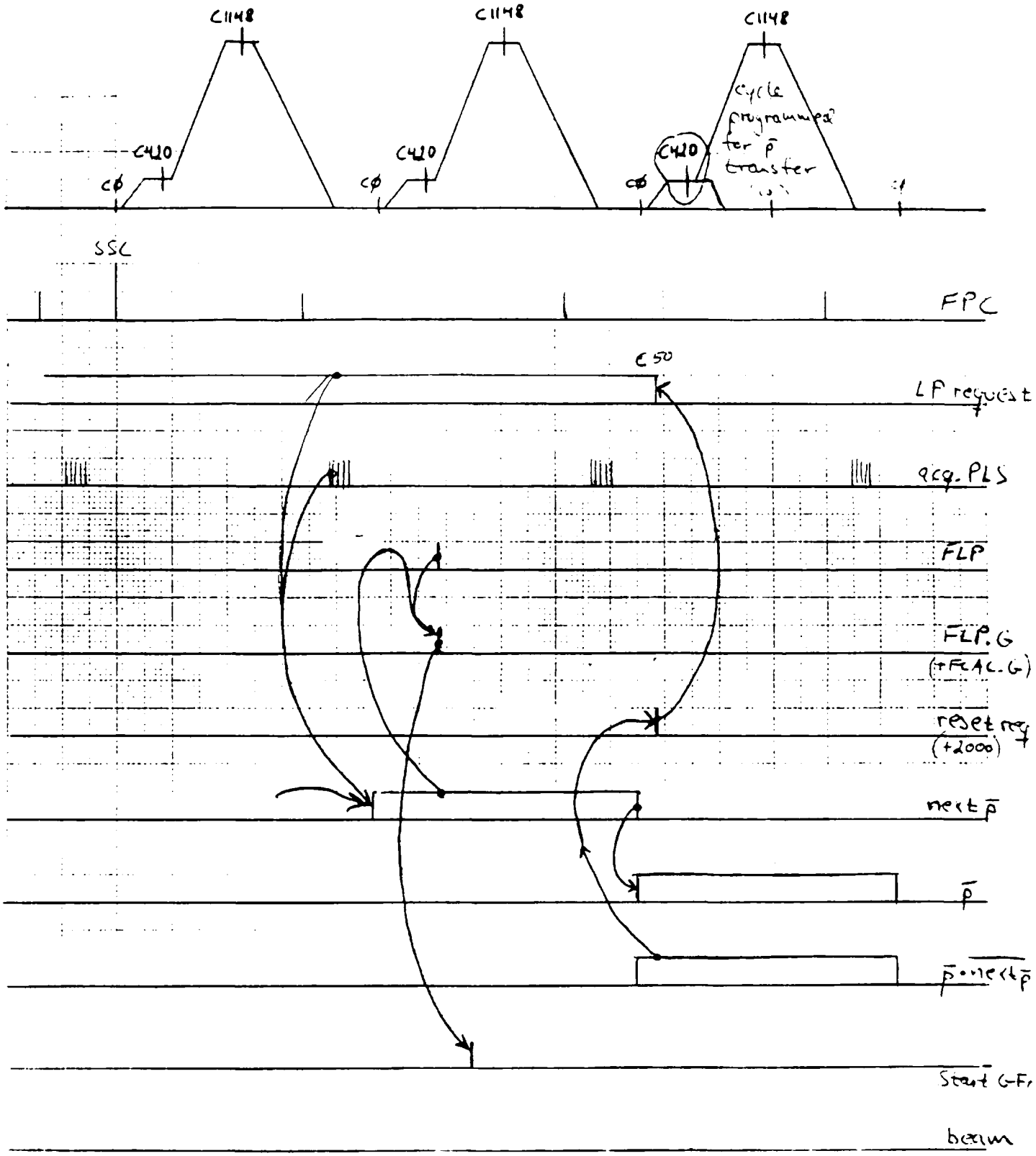
MODE 5

— The handshake for $\bar{p}$ transfers is similar to the one for accumulation except for the way the "reset request" is created. This is done to allow for transfers with a given number of shots. The PLS is also here controlling the sequence.

— The PLS-Condition that makes the reset is an AND of 2 PLS-lines, 17 (pbar), and the inverse of 145 (next=pbar). (Means $\bar{p}$ this cycle but not next cycle.) This AND is done in the AAC central timing by hardware. A GPPC is internally set to produce an output when line 17 is present. It also has the external gate enabled and connected to the output of a PLS-decoder which is programmed to give a high output when line 145 is not present.

— FLP.C- is used to start the counter that starts the GFA:s in the AMRF-system ~2 sec. before the beam transfer.

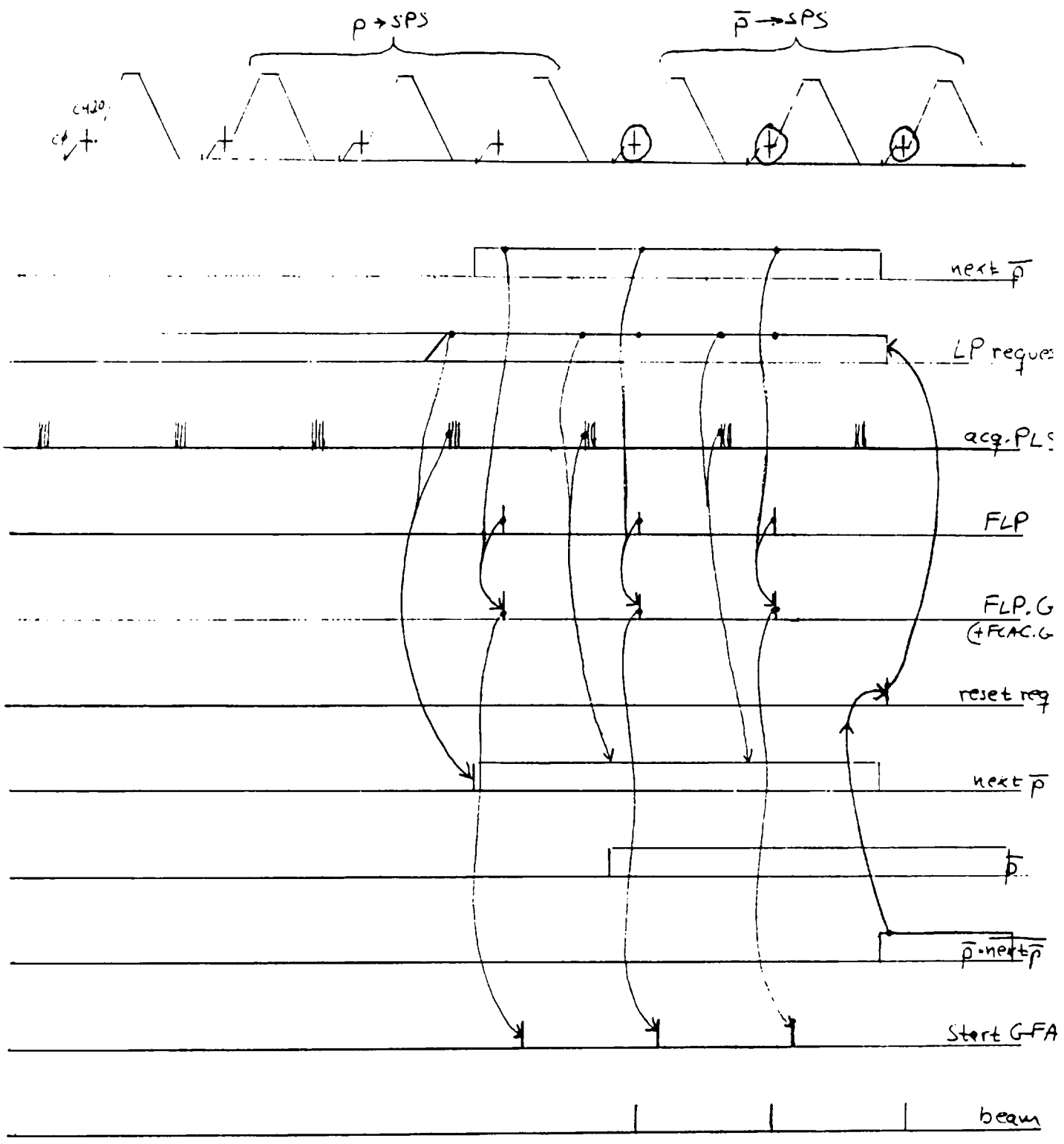
MODE 5



Loop request single shot

mode $\bar{p}$ ejection SPS/LEAR

only C-cycles



Loop request continous 3 shots

mode $\bar{p}$ ejection SPS

C-cycles

3/

Synchronization of RF-systems

The RF-systems in AA and AC(h=1) can each be switched to synchronize on AC, AA or PS RF. This is done by the RF hardware (low level control) and is controlled by the mode program. There are also timing inputs, START SYNC and STOP SYNC used to start the synchronization just before the beam exchange and stop it just after.

Fine timing with gated RF-trains

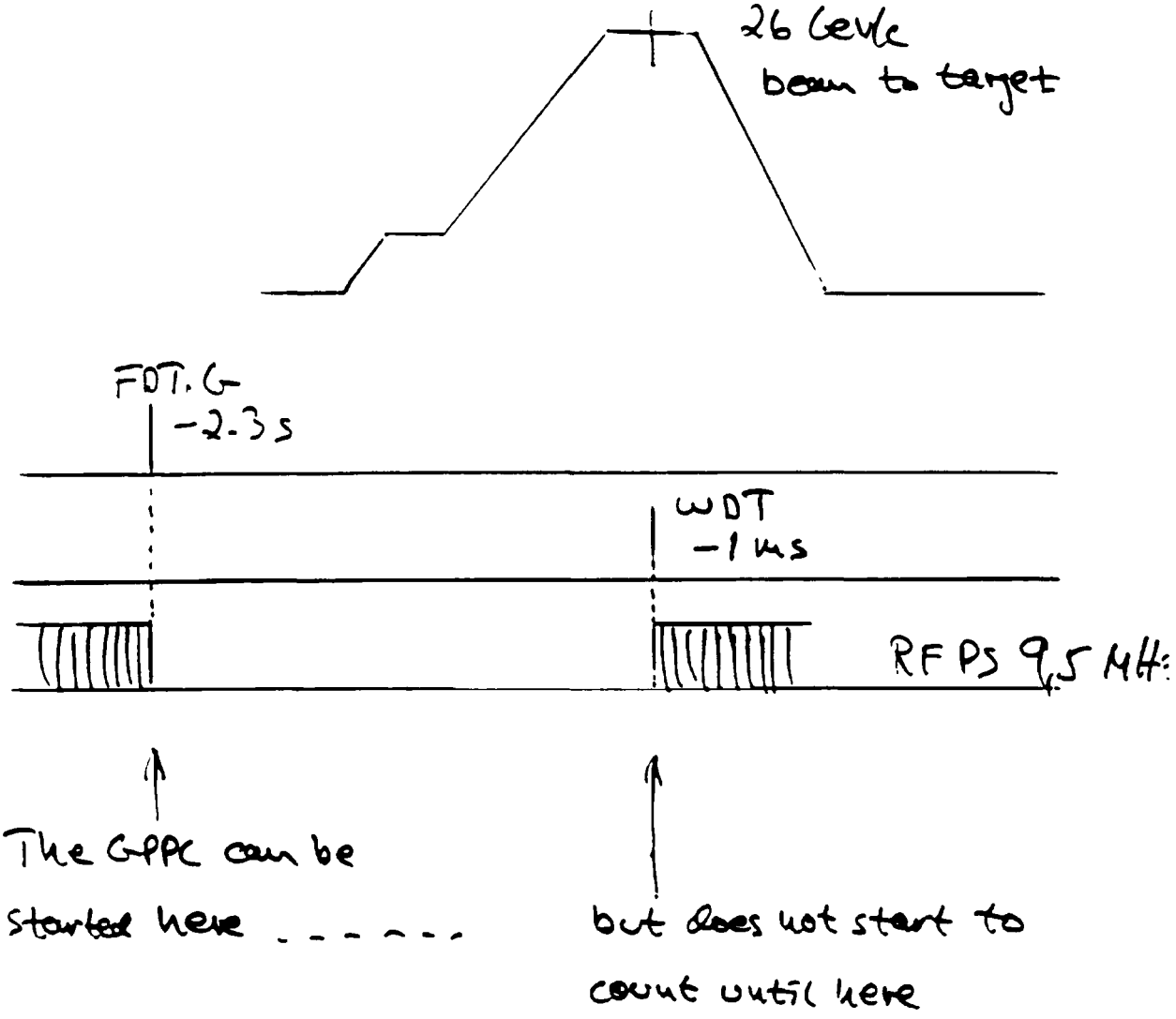
The RF-trains are used to clock GPPC:s that deal with precise timing. To reduce the number of timing pulses distributed around the machine, the RF-trains are stopped 2.3 s before beam transfer using the gated forewarnings. Then, a warning coming either from PS or from AC internal timing is used to re-start the RF-train. This way, the forewarnings can be used as start pulses for all GPPC:s — the GPPC receives the start pulse at -2.3 s and then waits for the first RF-pulse to start counting at -1 ms.
With 9,5 MHz clock frequency, the maximum count in the GPPC would not be enough to cover 2.3 s.

Multiplexing of RF-trains

It is necessary to select the right RF-train for each part of the machine for a given mode. Example; the inj. kicker timi in AC must be clocked with PSRF in mode 1, and with ACRF in mode 4 (reverse ejection).
Control + multiplexing is done by a special module (already existing PS

1b)

Example: fine timing for injection into AC



Since the maximum count in the GPPC is ~32000, the range in this case will be 3,2 ms — 1 ms before, and 2,2 ms after the beam exchange.

"gating"

Synchronization PS – Ac – AA

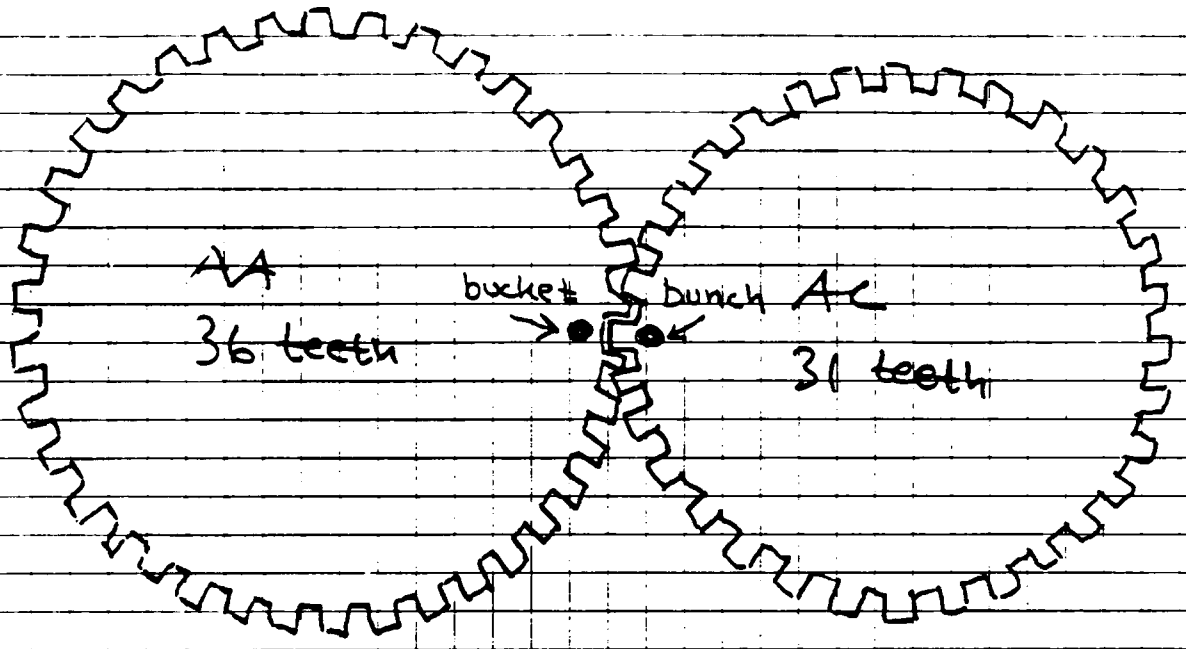
MODE:	Transfer:	Frequency master:	Fiducial freq.:
1.	PS → AC	PS	Frev PS
	Ac → AA	AC	Frev Ac/31
2.	PS → AA	PS	Frev PS
3.	AA → Ac	AA	Frev AA/36
4.	Ac → target	Ac	Frev Ac
5.	AA → PS	AA*	Frev AA/4*
6.	PS → Ac	Not used – beam is captured with phase loop.	
7.	PS → AA	PS	Frev PS
8.	Combined modes		
9.			
10.	PS → Ac	Not used – beam is captured with phase loop.	
	Ac → AA	AC	Frev Ac/31

9)

Relation AC-AA

$$\frac{\text{Frev AA}}{36} = \frac{\text{Frev AC}}{31}$$

This can be compared to two toothwheels of different size:



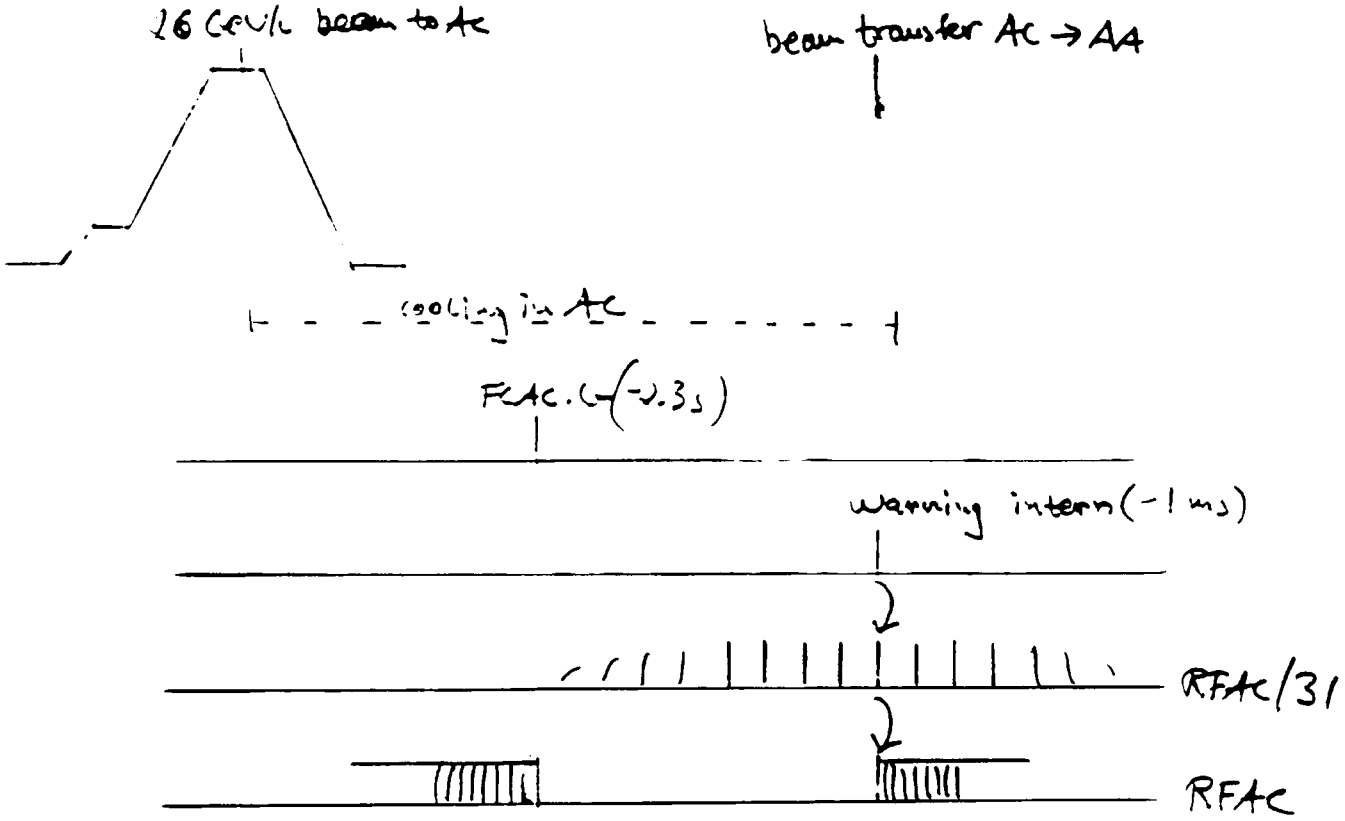
The bunch "hits" the bucket once per 36 revolutions in AA or once per 31 revolutions in AC.

The maximum wait-time from when the timing says "go" until the two RF-systems are synchronous is:

$$\frac{1846.4\,\text{Hz}}{36} = \frac{1590}{31} \approx 51.4\,\text{Hz} \Rightarrow 20\,\mu\text{s}$$

We will get a jitter of $\pm 10\,\mu$s for transfers AC $\rightleftarrows$ AA

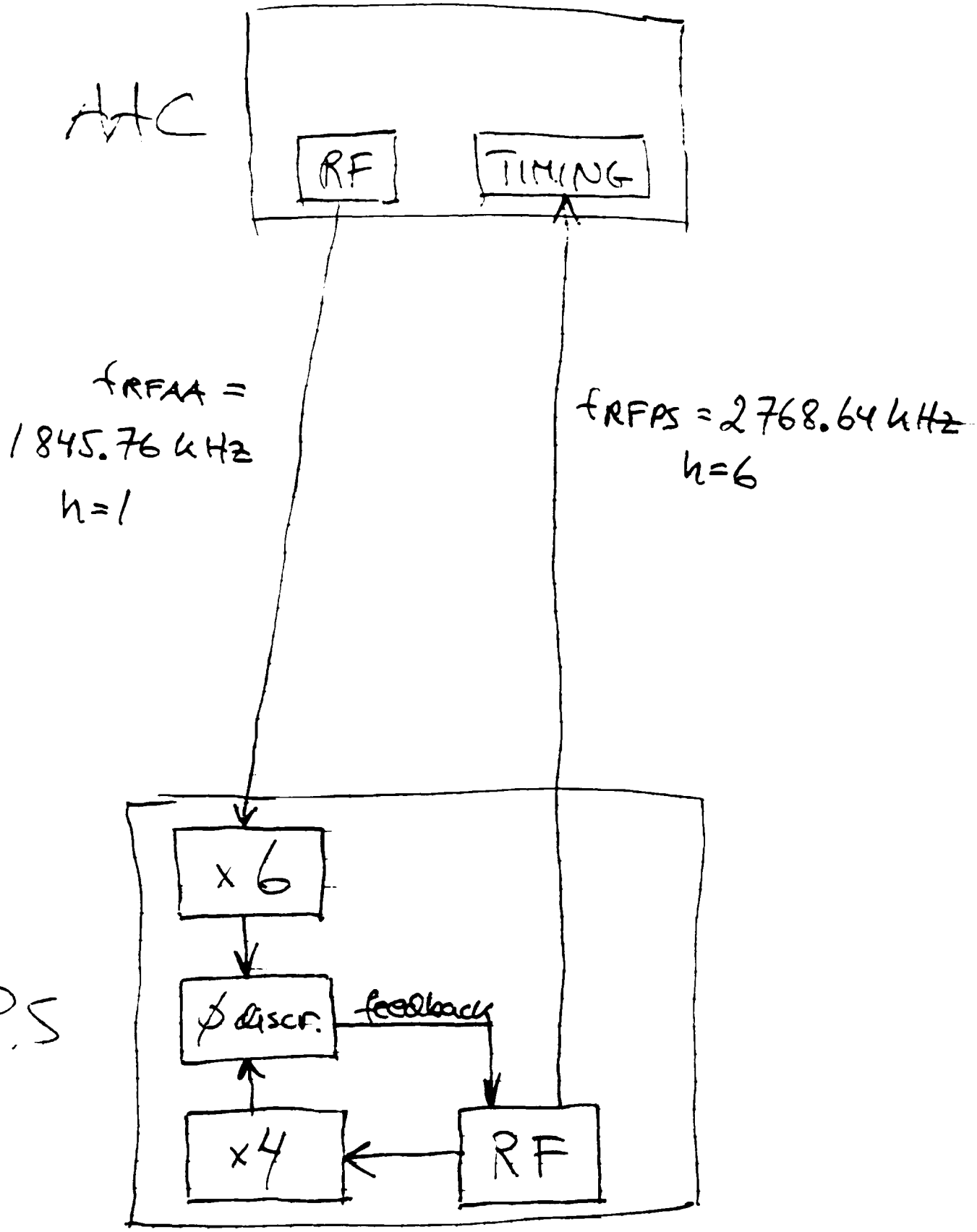
Example: fine timing for transfer AC → AA (bunch to bucket)



After the warning has been produced the first pulse RFAC/31 will start the RFAC which then is used to clock all GPPCs used for the transfer (kickers etc.)

RF synchronization PS-AAC p transfers

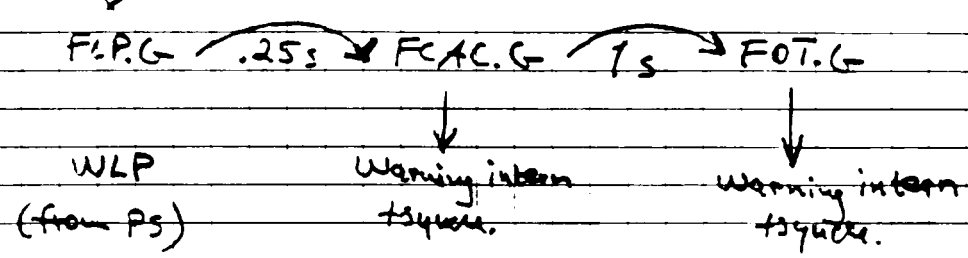
$f_{RFAA} \times 6 = f_{RFPS} \times 4$



4/ Operating Modes

For each mode, the mode program sets the central timing CPPCs to generate the right sequence of events (forewarnings, warnings).

Ex. Mode 4 FLP



*/ This mode is special — FOT.G is no longer created by gating of FOT. It is done by delaying FCAC.G 1s instead.

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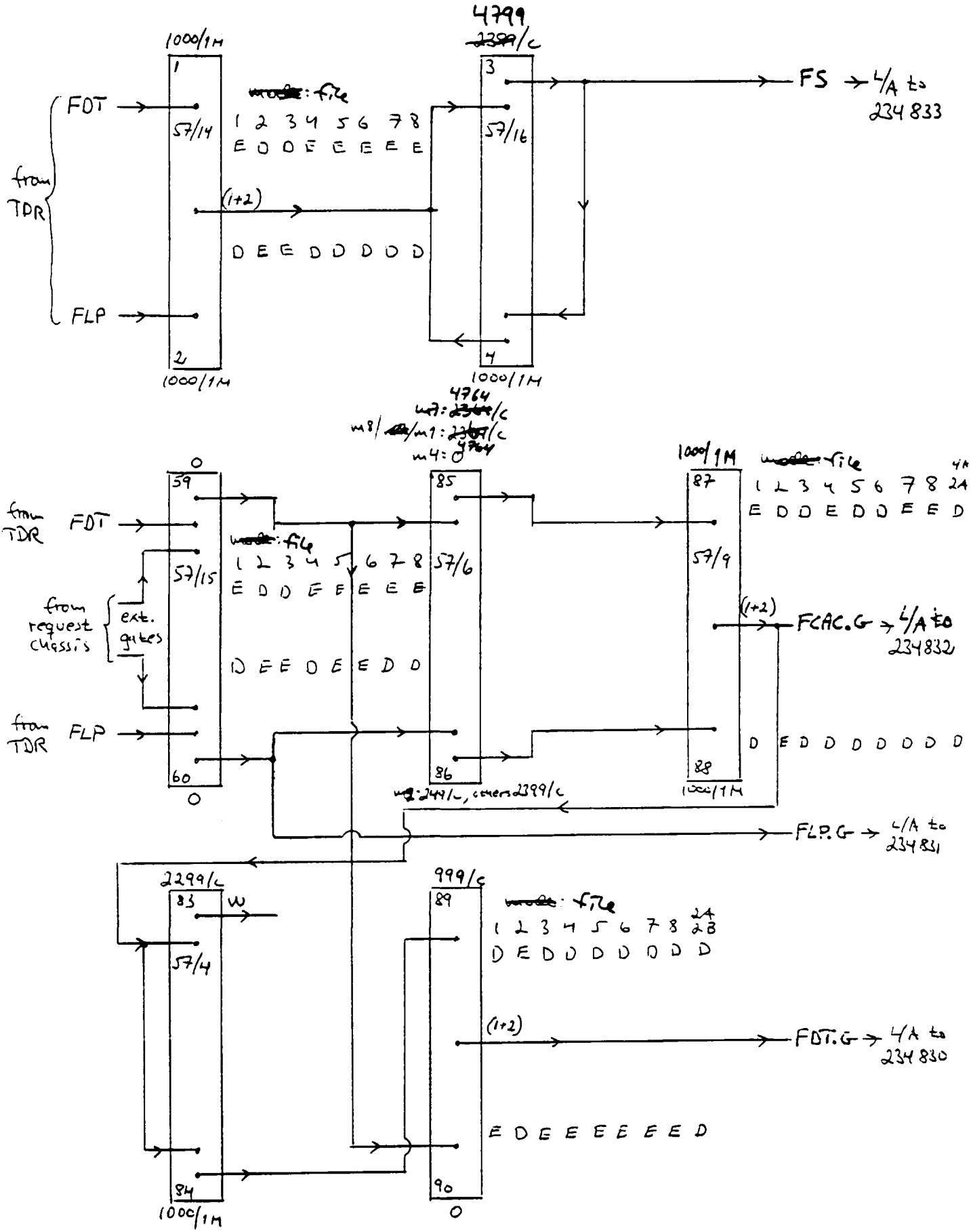
Central timing: Simulation + forewarning generation



Central timing : warming + synchronization, RF-gating

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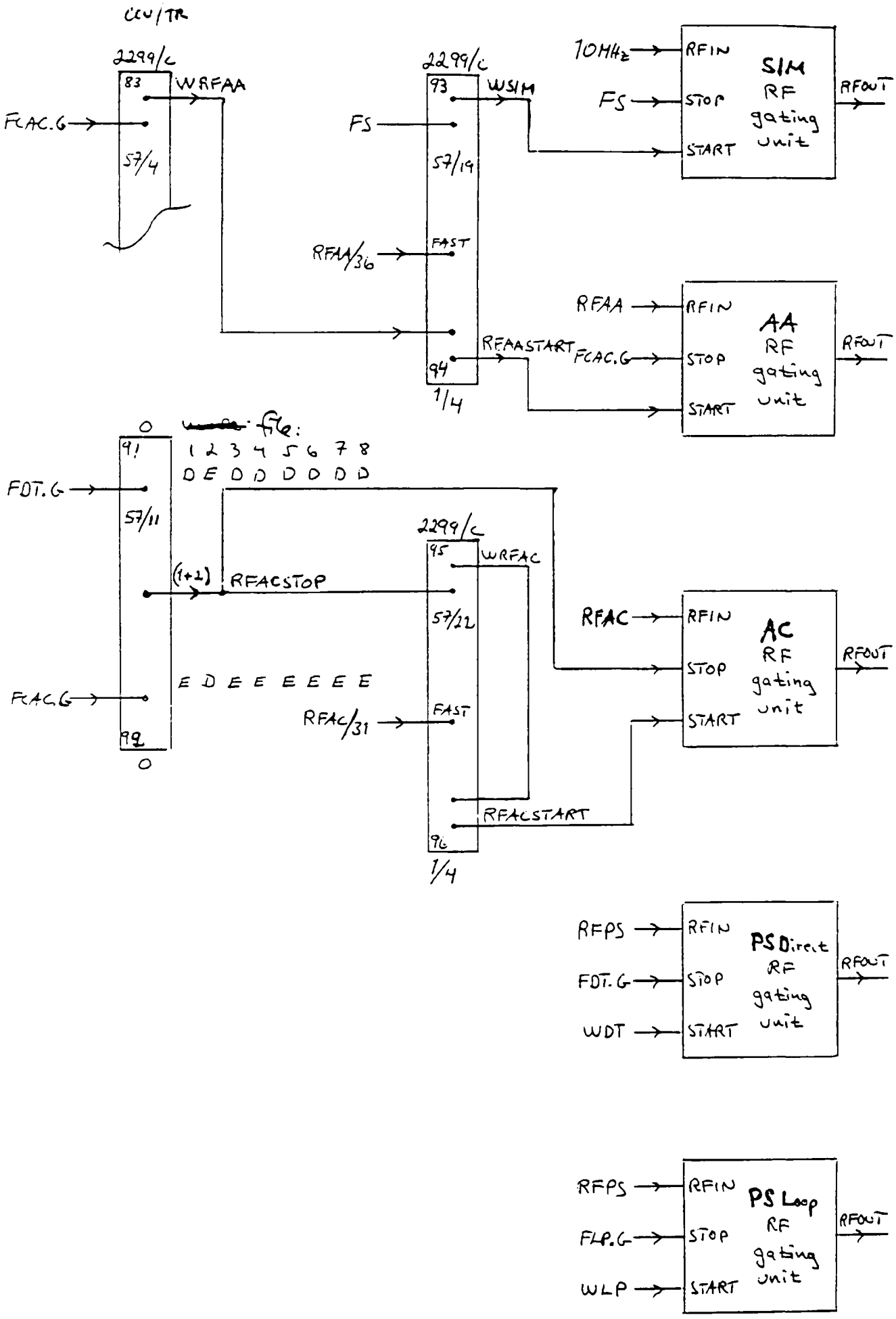


MULTIPLEXING OF RF-TRAINS

Which RF-train is needed for which timing?

MODE:	TIMING FOR: AC inj. line related equipment (DT)	AA ⟷ Ac line related equipment (CAc)	AA ej. line related eq: (LP)
1)	PS	AC	—
2)	—	—	PS
3)	—	AA	PS
4)	AC	AA	PS
5)	—	—	PS
6)	PS	—	—
7)	PS	PS	—
8)	PS	—	PS
9)	PS	—	PS
10)	PS	AC	—

Stopped by FDT.G
Started by WDT

Stopped by FLP.G
Started by WLP

The gating of PSRF must be separated

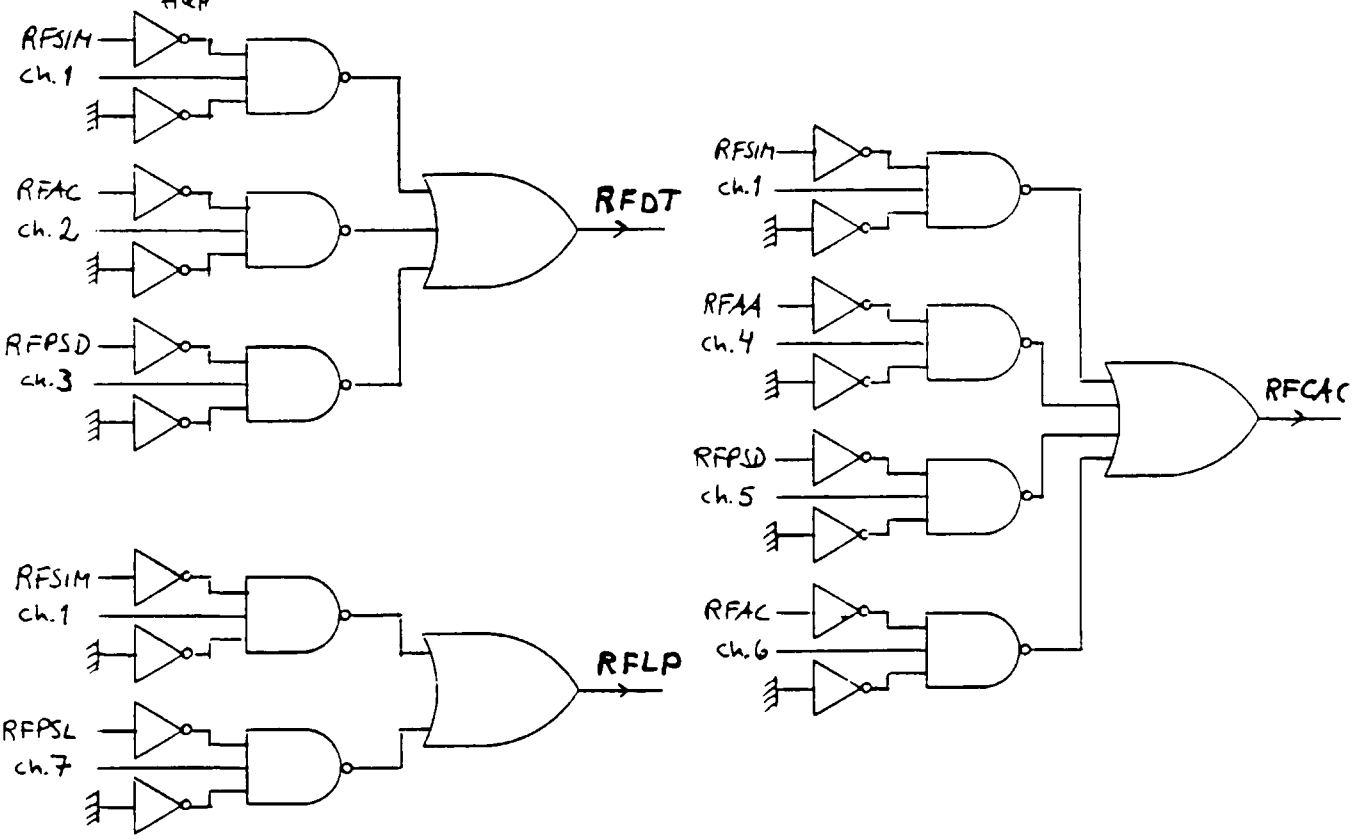
9/9/87

Central timing : RF multiplexing

PLS decoder #1

file		1	2,3,4 2	5 3	6,7 4	8 5	9 6	10 7	sim 8	RF in:	RF out:
channel:											
(9)	1	0	0		0	0	0	0	1	SIM	RFDT
(10)	2	0	1		0	0	0	0	0	AC	
(11)	3	1	0		1	1	1	1	0	PSD	
	1	0	0		0			0	1	SIM	RFAC
(12)	4	0	1		0			0	0	AA	
(13)	5	0	0		1			0	0	PSD	
(14)	6	1	0		0			1	0	AC	
	1		0	0		0	0		1	SIM	RFLP
15)	7		1	1		1	1		0	PSL	

file



4/ Operating Modes

1.) $\bar{p}$ accumulation

2.) p via loop to AA — like 4.) but FCAC.G + FDT.G OFF

3.) p via loop to AC — like 4.) but FDT.G OFF

4.) p via loop to AC, reverse ejection

5.) $\bar{p}$ ejection

6.) p direct to AC — like 7.) but FCAC.G OFF

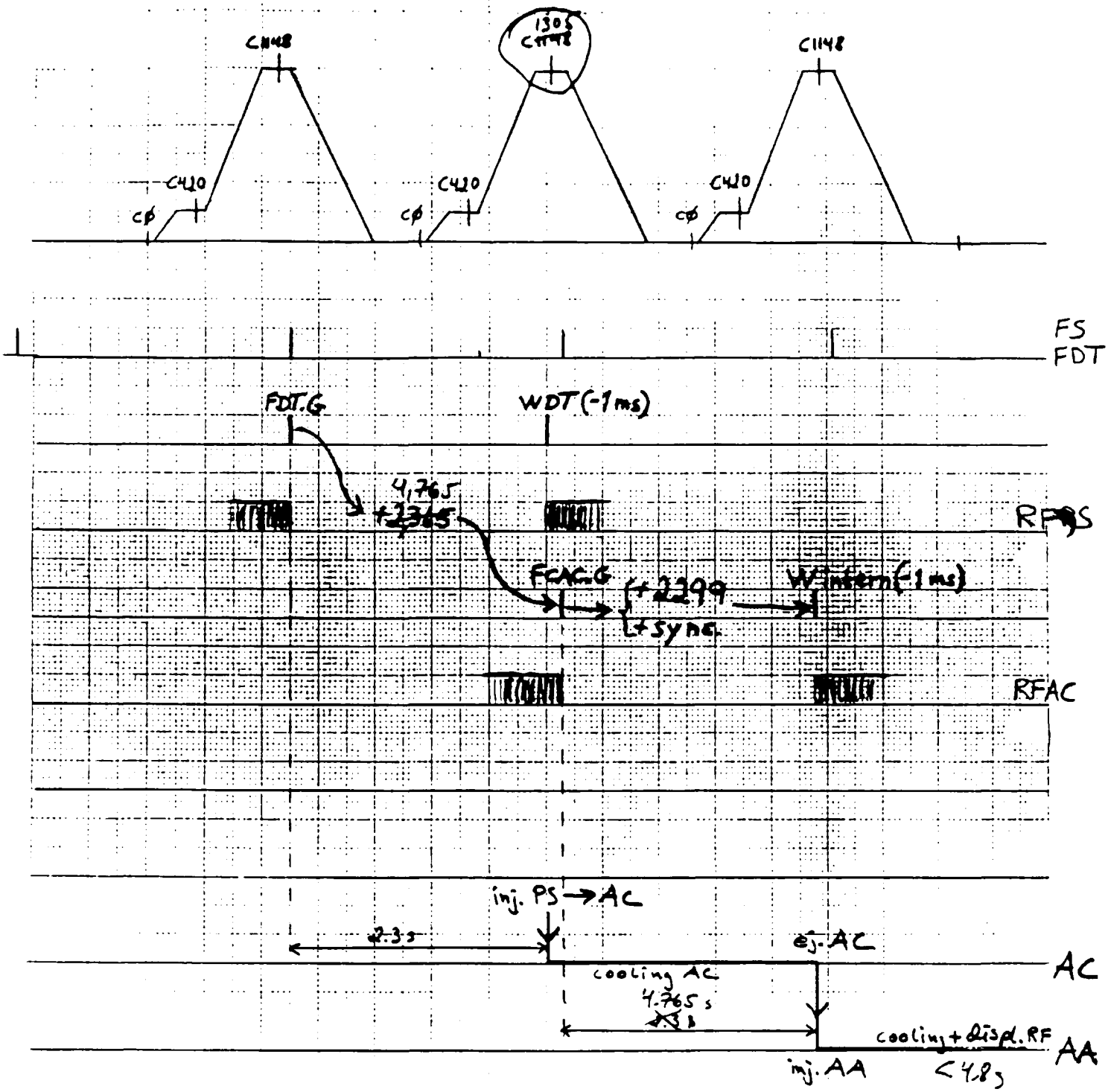
7.) p direct to AA, 1 turn in AC

8.) AC: p direct, AA: p via loop — AC like 6.) AA like 2.)

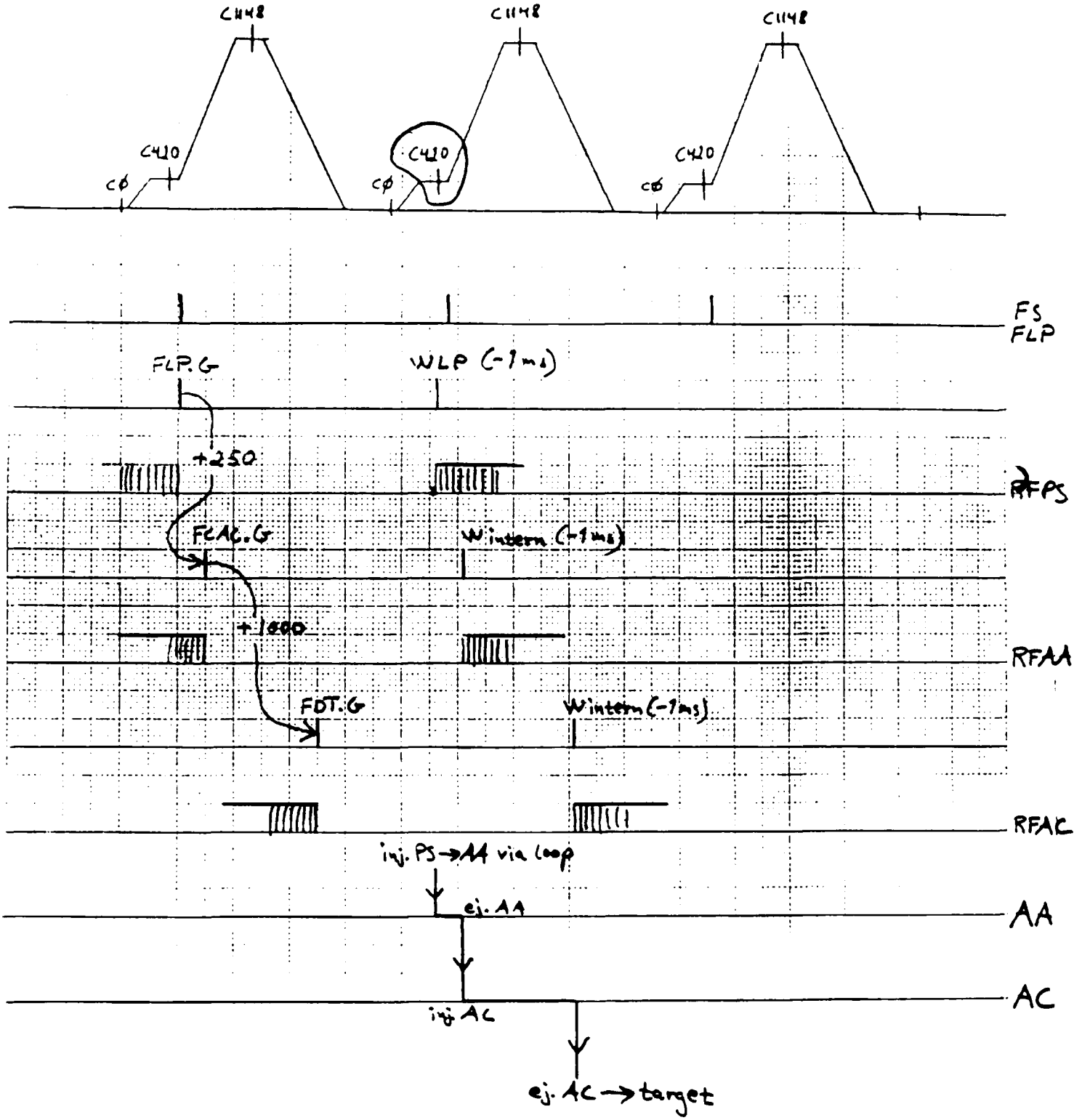
9.) AC: $\bar{p}$, AA: p via loop — AC like 1.) AA like 2.) FCAC.G OFF

10.) p direct to AA, delayed in AC

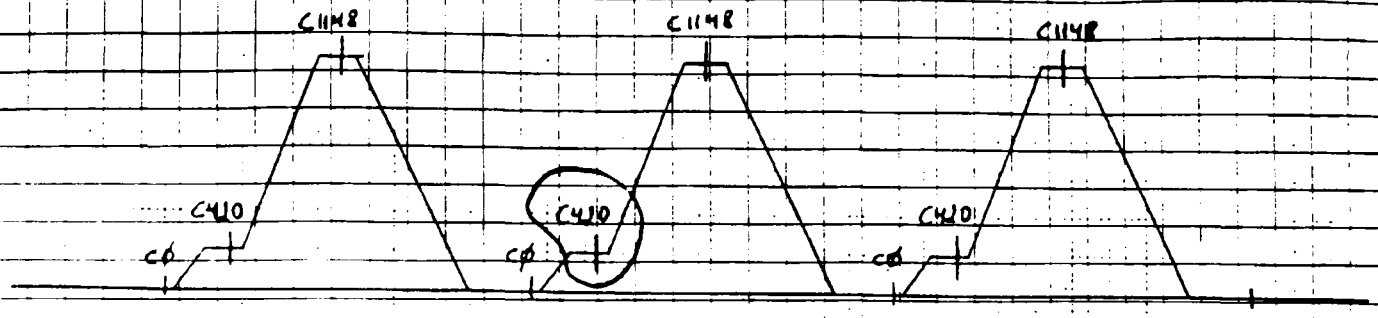
MODE 1, Single shot, 2,4 s cycle

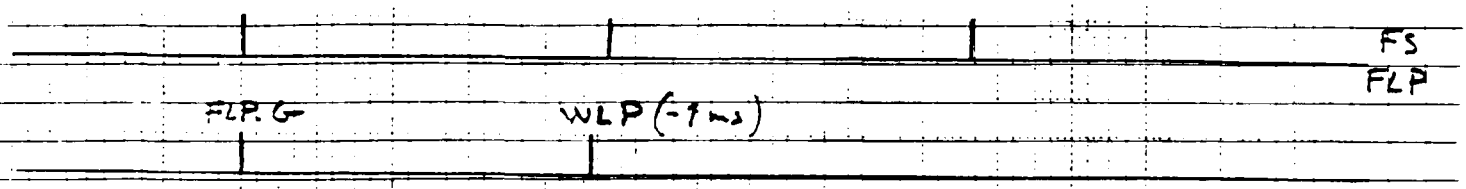


MODE 4 p via loop to AC, reverse ejection



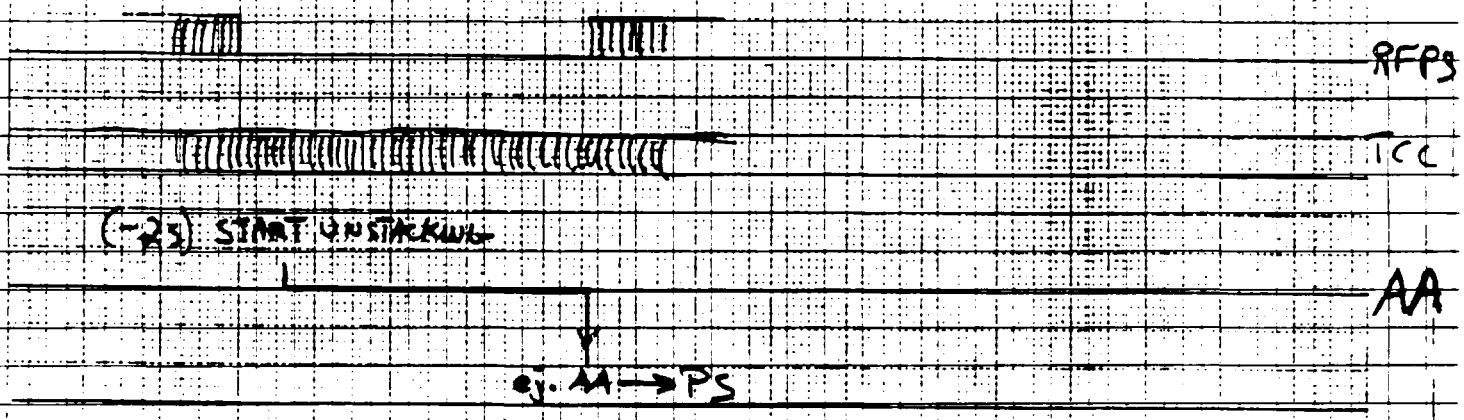
MODE 5 $\bar{p}$ transfer



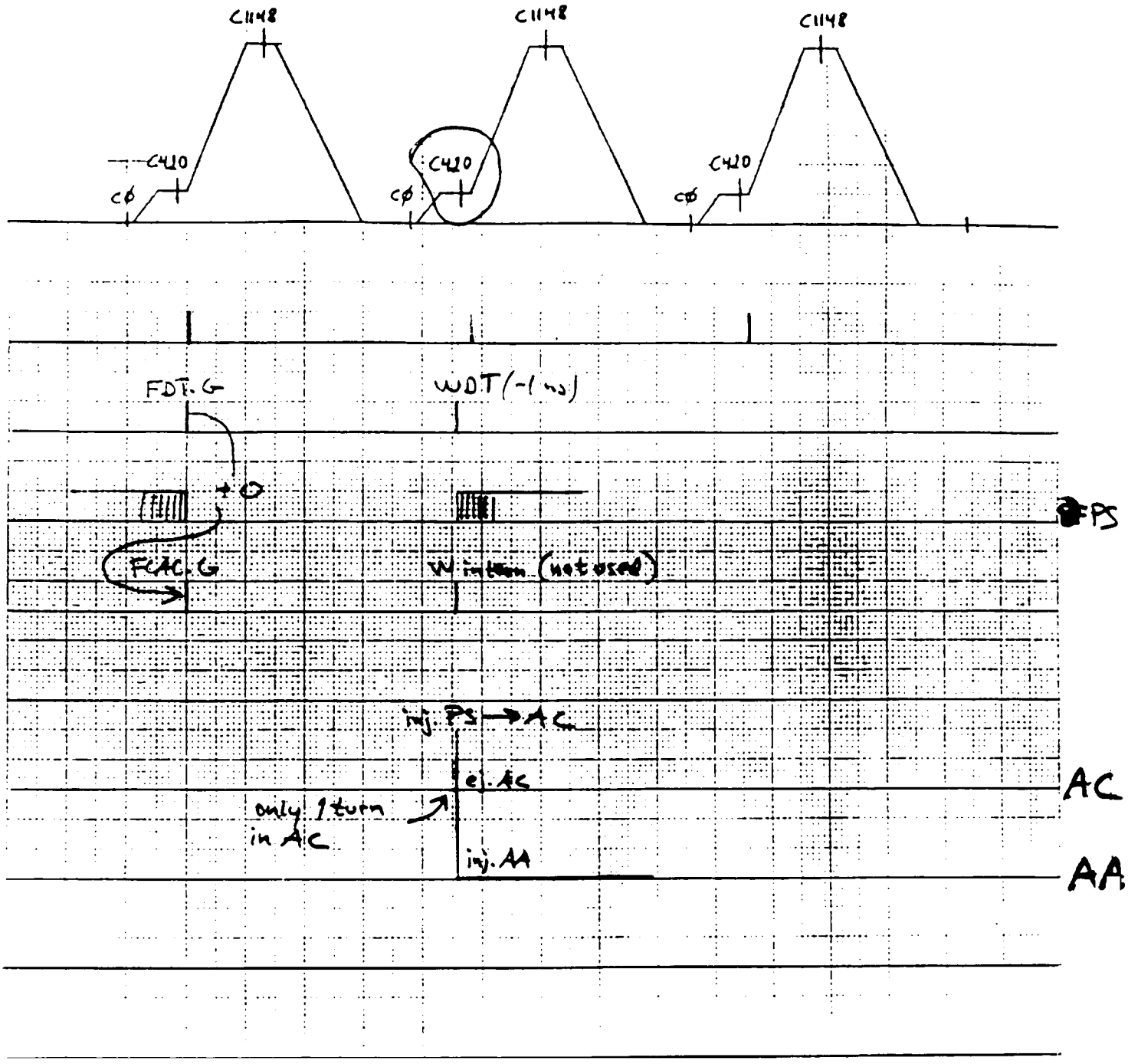


FLP. G

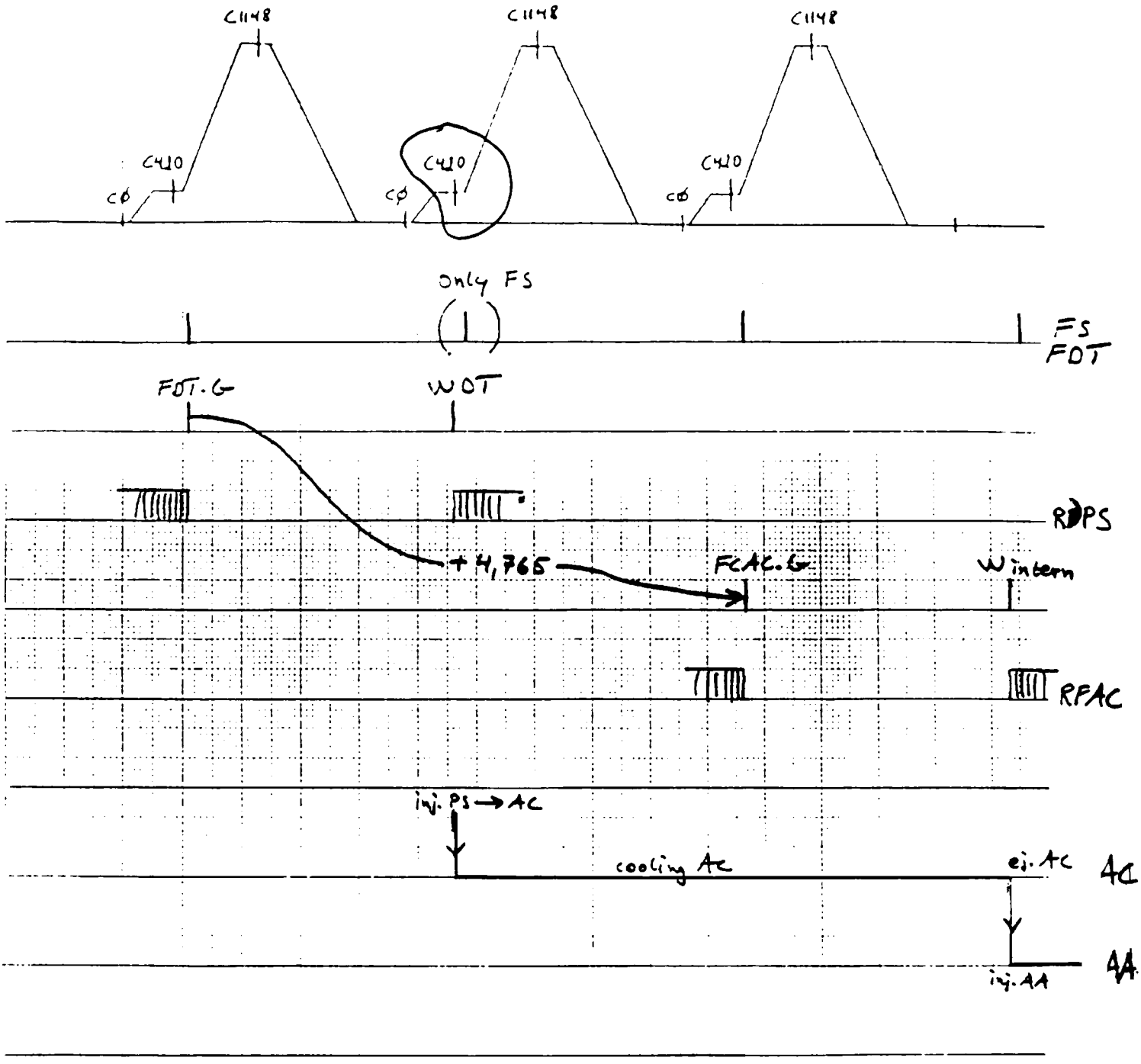
WLP (-1 ms)



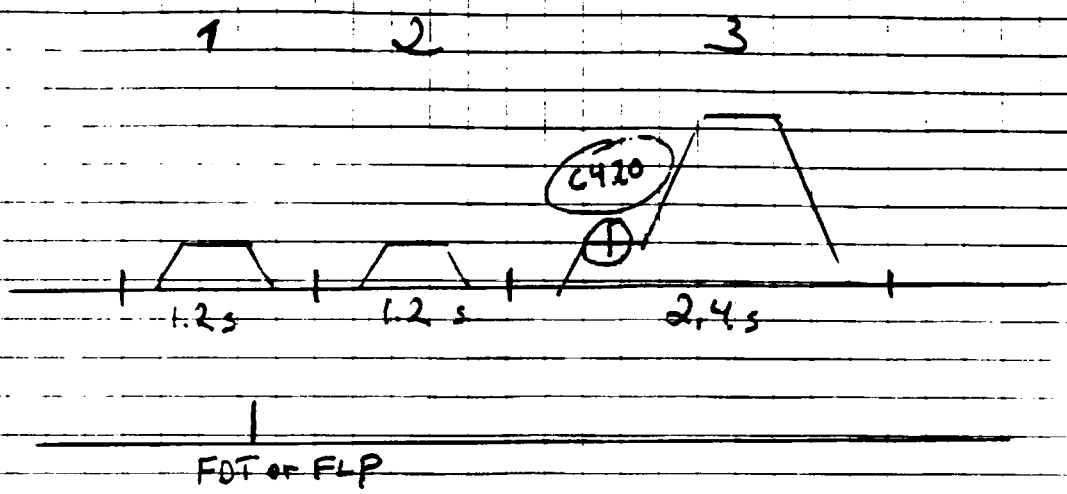
MODE 7, p direct to AA 1 turn in AC



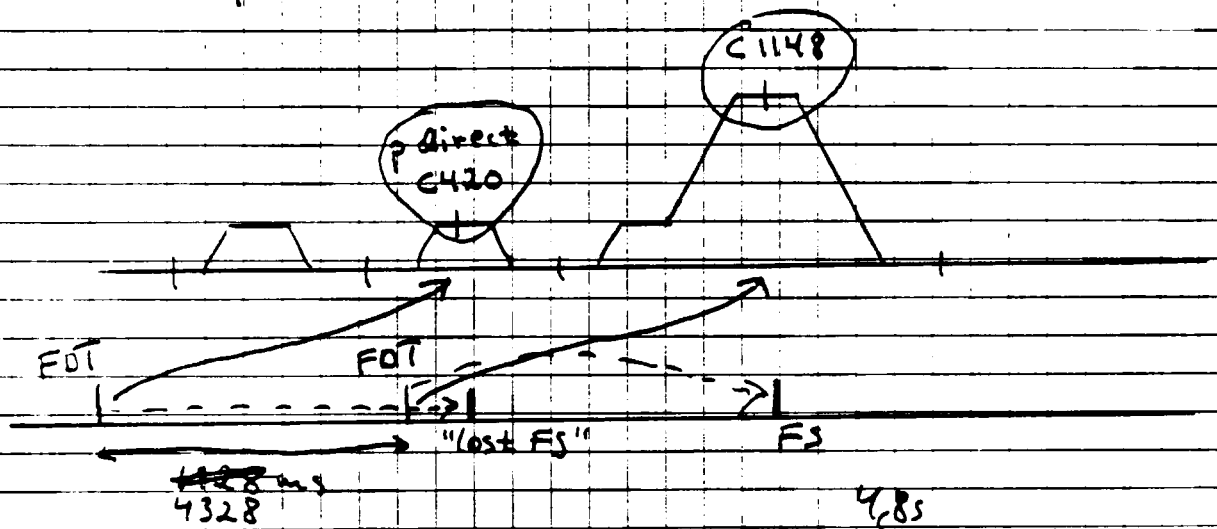
MODE 10, p direct to AA, delayed in AC. 4,8 s cycle



PS Supercycle restrictions

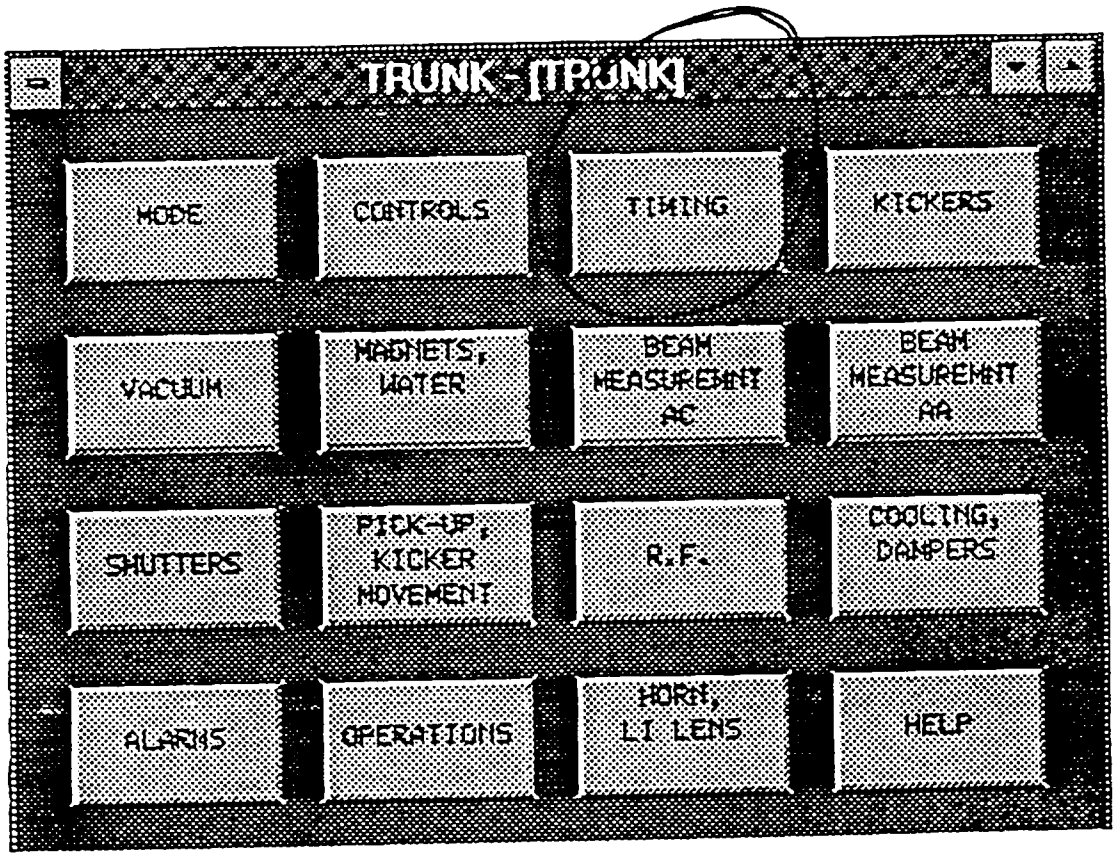


— Never a short cycle before a C420 transfer cycle. The PLS-information will be from cycle 1, i.e. 2 cycles before the transfer cycle and the handshake will not work.

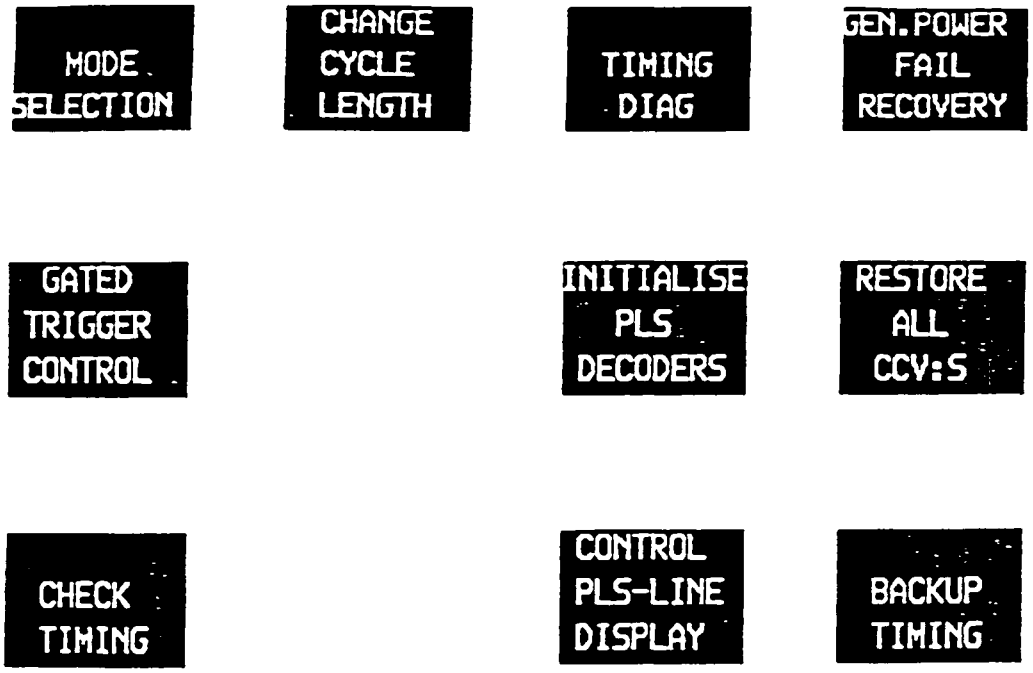


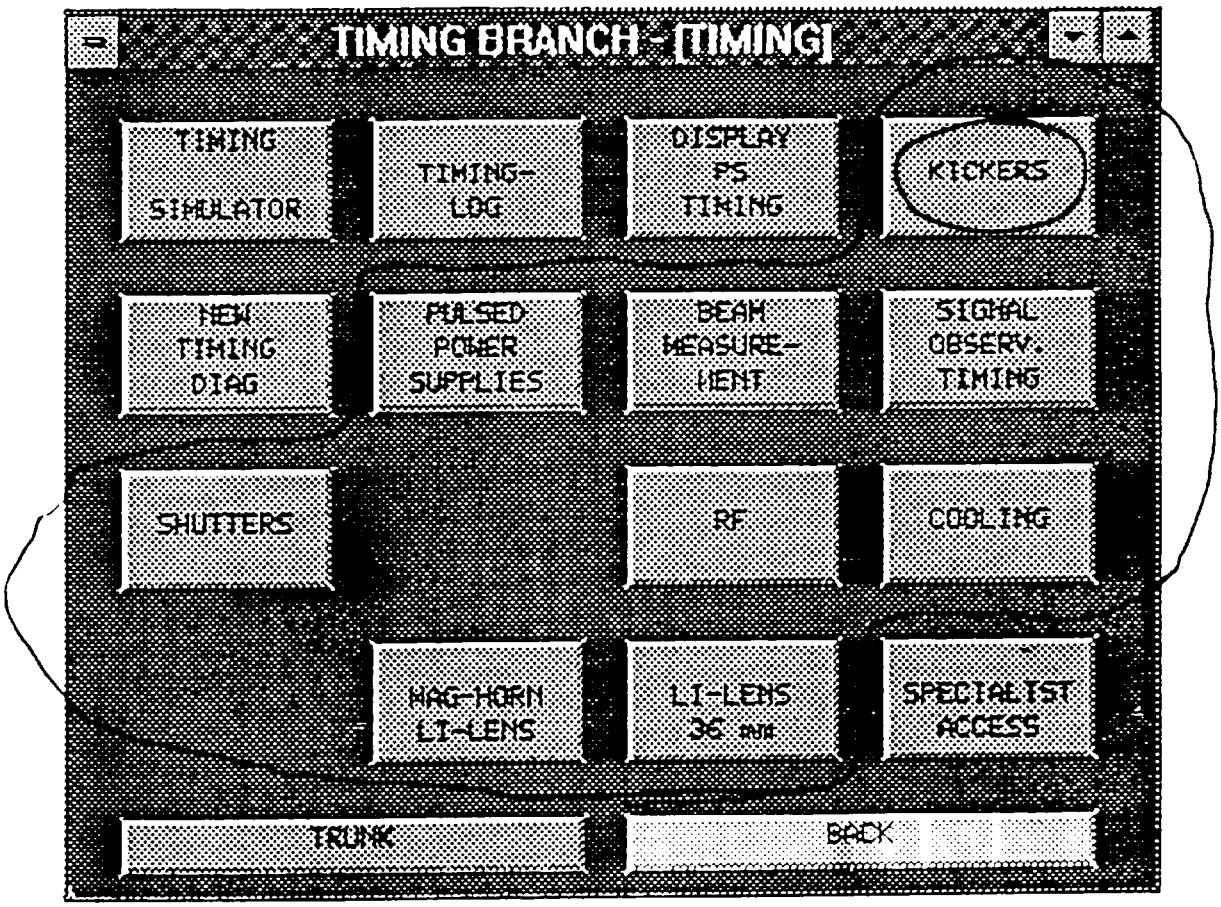
— Never FDT:s of other interval than ~~2,4~~ 4,8 s. FS is synchronized to FDT — if one FDT comes less than ~~2,4~~ 4,8 s after the preceding FDT, one FS will be lost. (The same for FLP)

5/ Controls


TRUNK-[TRUNK]
MODE
CONTROLS
TIMING
KICKERS
VACUUM
MAGNETS, WATER
BEAM MEASUREMENT AC
BEAM MEASUREMENT AA
SHUTTERS
PICK-UP, KICKER MOVEMENT
R.F.
COOLING, DAMPERS
ALARMS
OPERATIONS
HORN, LI LENS
HELP

TIMING SPECIALIST ACCESS - [(JPR)TIM-SPEC]




TIMING BRANCH - [TIMING]
TIMING SIMULATOR
TIMING-LOG
DISPLAY PS TIMING
KICKERS
NEW TIMING DIAG
PULSED POWER SUPPLIES
BEAM MEASURE-MENT
SIGNAL OBSERV. TIMING
SHUTTERS
RF
COOLING
MAG-HORN LI-LENS
LI-LENS 36 PMs
SPECIALIST ACCESS
TRUNK
BACK

TIMING BRANCH - KICKERS

1998-02-07-15:49:37

AC INJECTION KICKER TIMING

NAME	EQN	RACK	LCR	ST	SA	START	TRAIN	FROM	CCV	STAT
CX.IKIK-CYCLE	66	B11	101	21	1	FDT.G	1 ms	FDT.G	-1	??
CX.IKIK-SCR	67	B11	101	22	0	66	1 ms	66	-1	??
CX.IKIK-MSW	68	B11	101	22	1	67	.63 us	WDT	-1	??
CX.IKIK-FINE (IN KICKER CTRLS)						68	1 ms	68	-4	ON

FDT.G = 2300 ms , WDT = 1 ms BEFORE BEAM EXCHANGE
FDT.G/WDT ARE USED FOR REV. EJECTION

TIM(68,SA0D) 241 CAMAC ERROR FOR FUNCTION 1

6) Diagnostic tools

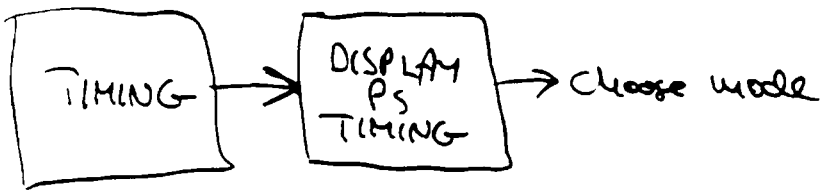
ANNEXE 1

1990-11-27-16:11:18
PS-AA TIMING SETTINGS (from <TT> Pls option : FE16A
Operation mode : Pbar Accumulation

EQN	OB.NAME	CCV	AQN	TRN	OUT	PLSG	LINE	EXTG
1	PX.S16C	1305	1305	C	ENA	DIS		ENA
13	PX.FPA16A	-1100	-1100	C	ENA	ENA	213	DIS
25	PX.FDT16A	0	0	C	DIS	DIS		DIS
37	PX.S16RF	9978	9978	RF	ENA	DIS		DIS
43	PX.WDT	-9531	-9531	RF	ENA	ENA	87	DIS
50	PX.SKFA16	0	0	RF	ENA	DIS		DIS
51	PX.EKFA16	10	10	RF	ENA	DIS		DIS
97	PX.BU1-16	9973	9973	C	DIS	DIS		DIS

SWITCHING POWER SUPPLIES (from <TT>)
BTI 247S CCV = 1525.98 AQN = 0
BTI 327 CCV = 375.00 AQN = 0

PS BENDING FIELD (from <CPS> Pls option : AA)
AQN = 12559.8 Gauss



1990-11-27-16:11:33
PS-AA TIMING SETTINGS (from <TT> Pls option : FI16A)
Operation mode : Test p:s via loop

EQN	OB.NAME	CCV	AQN	TRN	OUT	PLSG	LINE	EXTG
1	PX.S16C	420	420	C	ENA	DIS		ENA
27	PX.FAPI16A	100	100	C	ENA	ENA	232	DIS
28	PX.FLP	0	0	C	DIS	DIS		DIS
37	PX.S16RF	2777	2777	RF	ENA	DIS		DIS
42	PX.WLP	-2768	-2768	RF	ENA	ENA	104	DIS
50	PX.SKFA16	1	1	RF	ENA	DIS		DIS
51	PX.EKFA16	1	1	RF	ENA	DIS		DIS
97	PX.BU1-16	2776	2776	C	DIS	DIS		DIS

SWITCHING POWER SUPPLIES (from <TT>)
BTI 247S CCV = 190.01 AQN = 0
BTI 327 CCV = 472.70 AQN = 469.97

PS BENDING FIELD (from <CPS> Pls option : AA
AQN = [illegible] Gauss

ANNEXE 2

1990-11-27-16:11:46

PS-AA TIMING SETTINGS (from <TT> Pls option : FI16A)

Operation mode : Pbar ejection

EQN	OB.NAME	CCV	AQN	TRN	OUT	PLSG	LINE	EXTG
1	PX.S16C	420	420	C	ENA	DIS		ENA
27	PX.FAPI16A	100	100	C	ENA	ENA	232	DIS
28	PX.FLP	0	0	C	DIS	DIS		DIS
37	PX.S16RF	2777	2777	RF	ENA	DIS		DIS
42	PX.WLP	-2768	-2768	RF	ENA	ENA	104	DIS
50	PX.SKFA16	1	1	RF	ENA	DIS		DIS
51	PX.EKFA16	1	1	RF	ENA	DIS		DIS
97	PX.BU1-16	2776	2776	C	DIS	DIS		DIS

SWITCHING POWER SUPPLIES (from <TT>)

BTI 247S CCV = 190.01 AQN = 0

BTI 327 CCV = 472.70 AQN = 469.66

PS BENDING FIELD (from <CPS> Pls option : AA)

AQN = 1693.6 Gauss

1990-11-27-16:11:58

PS-AA TIMING SETTINGS (from <TT> Pls option : FI16A)

Operation mode : Test p:s via direct

EQN	OB.NAME	CCV	AQN	TRN	OUT	PLSG	LINE	EXTG
1	PX.S16C	420	420	C	ENA	DIS		ENA
14	PX.FPAI16A	100	100	C	ENA	ENA	211	DIS
26	PX.FDTI16A	0	0	C	DIS	DIS		DIS
37	PX.S16RF	2777	2777	RF	ENA	DIS		DIS
43	PX.WDT	-2768	-2768	RF	ENA	ENA	87	DIS
50	PX.SKFA16	1	1	RF	ENA	DIS		DIS
51	PX.EKFA16	1	1	RF	ENA	DIS		DIS
97	PX.BU1-16	2776	2776	C	DIS	DIS		DIS

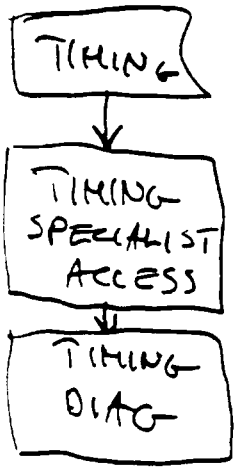
SWITCHING POWER SUPPLIES (from <TT>)

BTI 247S CCV = 190.01 AQN = 0

BTI 327 CCV = 472.70 AQN = 469.97

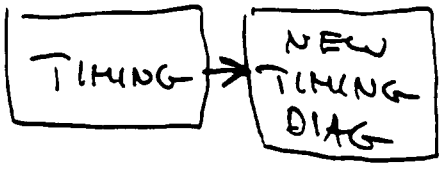
PS BENDING FIELD (from <CPS> Pls option : AA)

AQN = 1693.5 Gauss



SUPERCYCLE NUMBER (BACKWARDS) 1
EVENTS IN THE SUPERCYCLE: 45

EVENT:	NAME:	TIME FROM SSC:
1	SSC	
2	FCAC.G	1400,0042 ms
3	FDT	1435,0033 ms
4	FDT.G	1435,0037 ms
5	FS	1435,0056 ms
6	STRT GFA AA	3659,9844 ms
7	WCAC	3698,9954 ms
8	WDT	3734,0354 ms
9	FCAC.G	6199,9807 ms
10	FDT	6234,9798 ms
11	FDT.G	6234,9802 ms
12	FS	6234,9821 ms
13	STRT GFA AA	8459,9609 ms
14	WCAC	8498,9674 ms
15	WDT	8534,0110 ms
16	FCAC.G	10999,9572 ms
17	FDT	11034,9563 ms
18	FDT.G	11034,9568 ms
19	FS	11034,9586 ms
20	STRT GFA AA	13259,9374 ms
21	WCAC	13298,9388 ms
22	WDT	13333,9881 ms
23	FCAC.G	15799,9338 ms
24	FDT	15834,9328 ms
25	FDT.G	15834,9333 ms
26	FS	15834,9351 ms
27	STRT GFA AA	18059,9139 ms
28	WCAC	18098,9210 ms
29	WDT	18133,9649 ms
30	FCAC.G	20599,9102 ms
31	FDT	20634,9093 ms
32	FDT.G	20634,9098 ms
33	FS	20634,9116 ms
34	FLP	22149,9027 ms
35	STRT GFA AA	22859,8904 ms
36	WCAC	22898,8974 ms
37	WDT	22933,9409 ms
38	WLP	24448,9054 ms
39	FCAC.G	25399,8868 ms
40	FDT	25434,8858 ms
41	FDT.G	25434,8863 ms
42	FS	25434,8881 ms
43	STRT GFA AA	27659,8670 ms
44	WCAC	27698,8702 ms
45	WDT	27733,9180 ms
46	SSC	28799,8588 ms



1991-12-16-00:47:26

ch.	Pulse	Reference	Measured	Delta t	no.	ch. st.
	FDT	0,0000	0,0000	0,0000	1	INHIB.
	FDT.G	0,0005	0,0005	0,0000	2	INHIB.
	FS	0,0024	0,0023	- 0,0001	3	INHIB.
	WDT	2299,0319	2299,0322	0,0003	6	INHIB.
	FCAC.G	4764,9792	4764,9773	- 0,0019	8	INHIB.
	FS	4799,9806	4799,9787	- 0,0019	11	INHIB.
	STRT GFA AA	7024,9603	7024,9576	- 0,0027	12	INHIB.
	WCAC	7063,9619	7063,9714	0,0095	13	INHIB.

STRT GFA AA	2224,9812
FDT	4799,9764
FDT.G	4799,9768
WDT	7099,0082
FCAC.G	9564,9539

FILE NO. 9 , 6 SHOTS TO SPS 1990-10-02-21:37:37
EVENTS IN THE SUPERCYCLE: 45
TIMINGS USED IN PBAR TRANSFER:

EVENT:	NAME:	TIME FROM SSC:	DELTA T:
1	SSC		
9	FLP	17349,9336 ms	
14	FLP	19749,9228 ms	2399,9891 ms
20	FLP	22149,9122 ms	2399,9893 ms
25	FLP	24549,9014 ms	2400,0000 ms
29	FLP	26949,8906 ms	2399,9891 ms
35	FLP	29349,8800 ms	2399,9893 ms
40	FLP	36549,8477 ms	7200,0000 ms
1	SSC		
8	FLP.G	17349,9335 ms	
15	FLP.G	19749,9228 ms	2399,9892 ms
19	FLP.G	22149,9121 ms	2399,9892 ms
24	FLP.G	24549,9013 ms	2400,0000 ms
30	FLP.G	26949,8906 ms	2399,9892 ms
34	FLP.G	29349,8799 ms	2399,9892 ms
1	SSC		
12	WLP	19648,9218 ms	
17	WLP	22048,9124 ms	2399,9905 ms
22	WLP	24448,9011 ms	2399,9886 ms
27	WLP	26848,8915 ms	2399,9903 ms
32	WLP	29248,8792 ms	2400,0000 ms
37	WLP	31648,8693 ms	2399,9900 ms
42	WLP	38848,8367 ms	7199,9674 ms
1	SSC		
11	STRT GFA AA	18249,9208 ms	
16	STRT GFA AA	20649,9100 ms	2399,9891 ms
26	STRT GFA AA	25449,8886 ms	2399,9892 ms
31	STRT GFA AA	27849,8779 ms	2399,9892 ms
36	STRT GFA AA	30249,8671 ms	2399,9891 ms
1	SSC		
7	DIGITIZER	17349,9334 ms	
13	DIGITIZER	19749,9227 ms	2399,9892 ms
18	DIGITIZER	22149,9120 ms	2399,9892 ms
23	DIGITIZER	24549,9012 ms	2400,0000 ms
28	DIGITIZER	26949,8905 ms	2399,9892 ms
33	DIGITIZER	29349,8798 ms	2399,9892 ms

1991-12-12-11:57:58

ch.	Pulse	Reference	Measured	Delta t	no.	ch. st.
	FLP	0,0000	0,0000	0,0000	1	ACTIVE
	FLP.G	0,0000	0,0000	0,0000	2	ACTIVE
	FS	0,0016	0,0015	- 0,0001	3	ACTIVE
	FCAC.G	249,9988	249,9988	0,0000	4	ACTIVE
	FDT.G	1249,9940	1249,9939	- 0,0001	6	ACTIVE
	WLP	2298,9885	2298,9875	- 0,0010	8	ACTIVE
	WCAC	2548,9821	2548,9930	0,0109	9	ACTIVE
	RFAC START	3548,9882	3548,9794	- 0,0088	11	ACTIVE
	FS	4799,9787	4799,9784	- 0,0003	12	ACTIVE
	FS		9599,9553			
	FS		14399,9322			
	FS		19199,9090			
	FS		23999,8860			
	FLP		28799,8615			

AAC MODE: 4 ANALYZING FOR MODE: 4
TSM STATUS: RUNNING SEQUENCE NO. BACKWARDS: 1

Mode 4, p via loop to At, Ac, rev. ejection

SPS TRANSFERS

SELECTED BUCKET AREA	.6	eVs
NUMBER OF PBARS PER SHOT	120	E9
NUMBER OF CONSECUTIVE SHOTS	3	
RECORDED RF PARAMETER	PHASE	

EXPECTED INTENSITY UNITS: 1E7	RING BEFORE EJ.	RING AFTER EJ.	LOST FROM RING	TFA 8006	EFF. %
1139	6226	4737	1488	1534	103.1
2148	4737	2716	2021	2080	102.9
1421	2716	1537	1179	1220	103.4

TRANSFERRED 75.3% OF STACK 1991-12-20-00:10:45

1991-12-20-00:12:32

ch.	Pulse	Reference	Measured	Delta t	no.	ch.st.
	FLP	0,0000	0,0000	0,0000	1	INHIB.
	FLP.G	0,0001	0,0001	0,0000	2	INHIB.
	STRT GFA AA	899,9872	899,9865	- 0,0007	3	INHIB.
	WLP	2298,9878	2298,9887	0,0009	4	INHIB.

AAC MODE: 11 ANALYZING FOR MODE: 5
TSM STATUS: RUNNING SEQUENCE NO. BACKWARDS: 5

3:rd shot

1991-12-20-00:12:42

ch.	Pulse	Reference	Measured	Delta t	no.	ch. st.
	FLP	0,0000	0,0000	0,0000	1	INHIB.
	FLP.G	0,0001	0,0000	- 0,0001	2	INHIB.
	STRT GFA AA	899,9872	899,9864	- 0,0008	3	INHIB.
	WLP	2298,9878	2298,9877	- 0,0001	4	INHIB.

AAC MODE: 11 ANALYZING FOR MODE: 5
TSM STATUS: RUNNING SEQUENCE NO.BACKWARDS: 6

1991-12-20-00:12:52

ch.	Pulse	Reference	Measured	Delta t	no.	ch. st.
	FLP	0,0000	0,0000	0,0000	1	INHIB.
	FLP.G	0,0001	0,0000	- 0,0001	2	INHIB.
	STRT GFA AA	899,9872	899,9864	- 0,0008	3	INHIB.
	WLP	2298,9878	2298,9882	0,0004	4	INHIB.

FLP 2399,9873

AAC MODE: 11 ANALYZING FOR MODE: 5
TSM STATUS: RUNNING SEQUENCE NO.BACKWARDS: 7

SHOTS 1/2 [redacted] SPS

1991-12-20-00:16:11

ch.	Pulse	Reference	Measured	Delta t	no.	ch.st.
	FLP	0.0000	0.0000	0.0000	1	INHIB.
	FLP.G	0.0001	0.0000	- 0.0001	2	INHIB.
	STRT GPA AA	899.9872	9.9911	- 889.9961	4	INHIB.
	WLP	2298.9878	2298.9877	- 0.0001	6	INHIB.

AAC MODE: 11 ANALYZING FOR MODE: 5
TSM STATUS: RUNNING SEQUENCE NO.BACKWARDS: 58

LEAR XFER