PRELIMINARY SET OF RULES FOR THE TTSM (CASE OF e+/e- OPERATIONS)

R. Garoby

Definitions

Data	Data gathered by the TTSM
Deduction	What can be logically deduced from data
Conclusion & Action	Clear expression of deduction and next action recommended for improving the diagnostics
Problem	Beam characteristics are probably not correct
Possible Problem	Suspicion that beam characteristics may be incorrect, but not certain
PS-RF	Equipment under the responsibility of the PS-RF team
SPS	Equipment under the responsibility of SPS teams
Timing	Equipment under the responsibility of the PS-CO team
KFA	Equipment under the responsibility of the PS-PA team
continuously	confirmed over more than 10 consecutive acquisitions with beam
other means	other acquisition systems (computer generated displays and/or analog signals observation)
beam present	URE95 gives a measurement

Conclusions are of different kinds:

- "OK" conclusions state that a system or sub-system is working correctly. There is an implicit hierarchy between these statements: for example, if everything is declared OK, it is not necessary to investigate deeper. An "OK" statement requires that the required conditions are met continuously.
- "Not OK" conclusions are obtained whenever the required conditions are met. Some require that beam is present, others do not.
- Whenever possible the specific pieces of equipment which can be suspected are given.

Other remarks:

- the threshold for decision are indicative, and are likely to be modified with experience.
- the present rules are probably imperfect and will need to be corrected "on line". It is very important that the analyzing system clearly declares which rules he uses to arrive at a given recommendation (if any...).
- Part of the installation may not be operational. The analysis should still proceed with the remaining part, and tolerate the recurrent messages of warning.

8/11/95
R. Garoby

Interpretation of data from TTSM-Ejection

Rule nb.	Data	Deduction	Conclusion & Action
1	URE95 is continuously within 2 ns from reference	Beam is properly synchronized w.r.t. the trains used by the ejection timings.	**Everything is OK**
2	URE95 is within 2ns from reference +- k*261.4 ns (k is not 0)	Beam is probably properly synchronized but some bunches are missing	**Beam Problem: missing bunches**
3	URE95 is more than 3 ns from reference	Beam is not properly synchronized w.r.t. the trains used by the ejection timings, or some bunches are missing	**Problem:** - investigate using the other data
4	No measurement for URE95	No beam at ejection, or beam intensity too small for a good measurement, or PU signal disconnected	**Possible Beam Problem:** - assume that "beam is not present" in the rules - investigate by other means
5	No refreshment of TTSM-Ejection data	Start ejection timing is not generated (PX.WDT), or control system in trouble	**Possible Timing or Control Problem:** - investigate by other means
6	The difference between ITRVSPS and URE95 is continuously within 2 ns from the difference between references	Beam is properly synchronized w.r.t. the reference trains	**PS-RF is working OK:** - if there is a problem it is likely to come from other equipment
7	The difference between ITRVSPS and URE95 is within 2 ns from the difference between references +- k*261.4 ns (k is not 0)	Beam is probably properly synchronized but some bunches are missing	**Beam Problem: missing bunches**
8	The difference between KFA 71-79 and URE95 is continuously within 30 ns (modulo 2091 ns) from the difference between references	Kicker position is OK for a proper ejection	**Kicker timing is OK w.r.t. the beam**
9	KFA71-79 is not within 30 ns of reference	Kicker position is different from reference	**Possible Problem: Kicker timing is not OK:** - check control values in ejection timings - check transmission of PX.WDT to TTSM

10	The difference between I1TRVEJE and URE95 is continuously within 2 ns from the difference between references +- k*261.4 ns	TRV train tracks properly the beam position until ejection	**TRV train is OK**
11	The difference between I1TRVEJE and URE95 differs by more than 6 ns from the difference between references +- k*261.4 ns and beam is present	TRV train is probably not OK	**Possible PS-RF problem:** - analyze TRV train with TTSM-Injection
12	ITRFEJE is continuously within 2 ns from reference	Start of ejection timing is OK w.r.t. the TRF train	**Ejection timing is using the TRF train OK**
13	I1TRVEJE is continuously within 5 ns from reference	Start of ejection timing is OK w.r.t. the TRV train	**Ejection timing is using the TRV train OK**
14	The difference between I1TRVEJE and I2TRVEJE is continuously within 1 ns from the difference between references	Beam frequency is OK (10^{-5} from reference)	**Beam frequency is OK:** - check B field to be certain of beam energy
15	The difference between I1TRVEJE and I2TRVEJE is more than 2 ns from the difference between references and beam is present	Beam Synchronisation does not work, or the SPS trains are not correct	**Beam frequency is not OK:** - apply the following rules - check control parameters of PS-RF system
16	The difference between I1TRFSPS and I2TRFSPS is continuously within 2 ns from the difference between references	Synchronisation frequency is OK (2. 10^{-6} from reference)	**SPS RF train is OK:** - can be confirmed more accurately with other RF measurements
17	The difference between I1TRFSPS and I2TRFSPS is more than 3 ns from the difference between references	Synchronisation frequency is not correct (> 3. 10^{-6} from reference)	**SPS problem: RF train is not OK** - no action in the PS before correction is done
18	Rules 15 and 16 apply, and PS-RF control parameters are OK	Beam control is not synchronizing the beam	**PS-RF problem:** - call specialist
19	No measurement of KFA71-79	KFA hardware is not pulsing, or signal is disconnected from TTSM	**Possible KFA problem:** - check KFA operation with other devices
20	No measurement of I1TRFSPS or I2TRFSPS or ITRVSPS	No signal available for synchronisation, or it is disconnected from TTSM	**Possible SPS or PS-RF problem:** - check signals with other devices
21	No measurement of ITRFEJE or I1TRVEJE or I2TRVEJE	TRF or TRV train not available, or disconnected from TTSM	**Possible PS-RF problem:** - check signals with other devices

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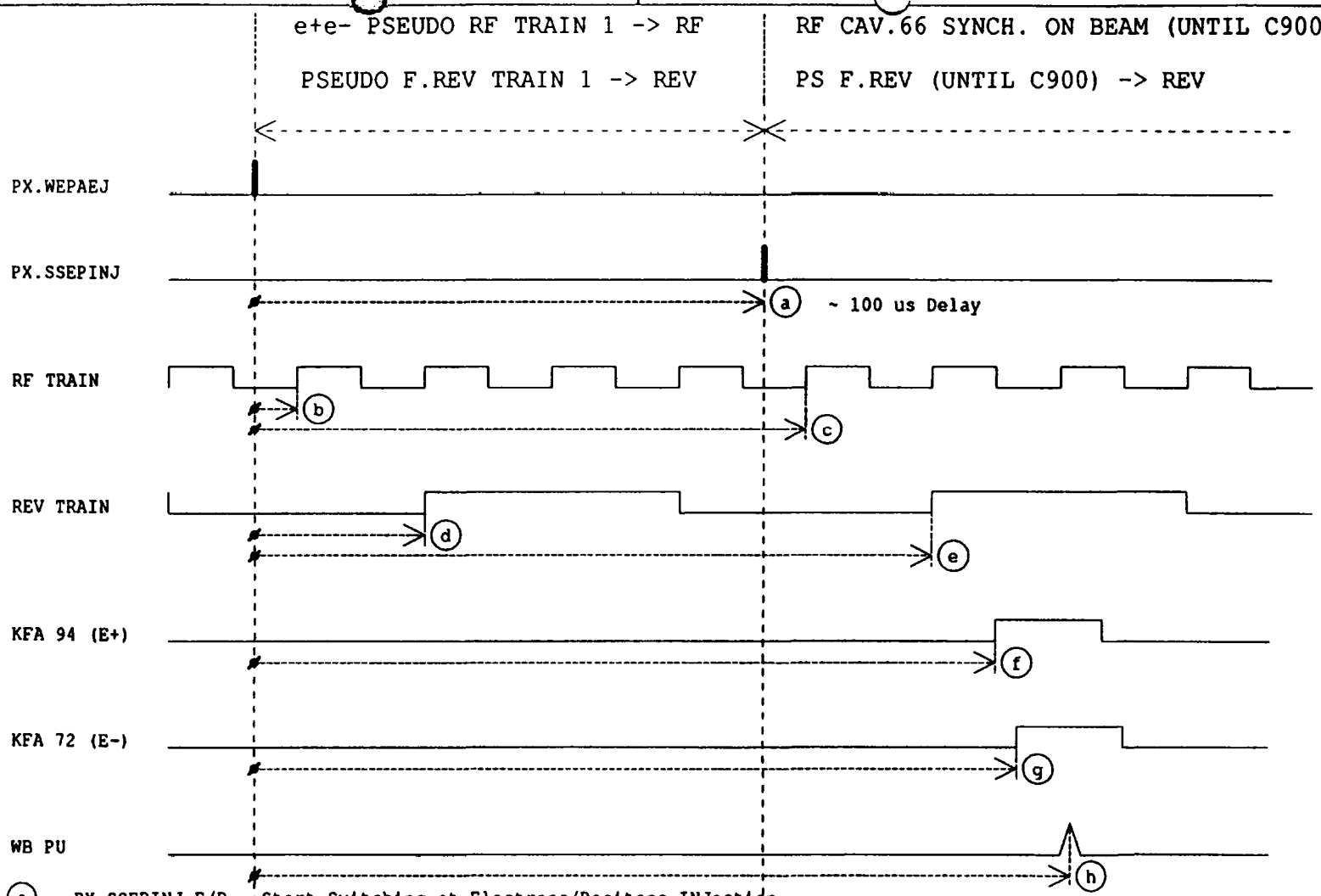
Interpretation of data from TTSM-Injection

Rule nb.	Data	Deduction	Conclusion & Action
1	URE95 is continuously within 2 ns from reference	Timing of beam transfer works correctly	**Transfer timings are OK**
2	URE95 is more than 3 ns from reference	Timing of beam transfer may not be OK	**Possible Problem:** - investigate using other data - check control parameters for beam transfer
3	No measurement for URE95	No beam at injection, or beam intensity too small for a good measurement, or PU signal disconnected	**Possible Beam Problem:** - assume that "beam is not present" in the rules - investigate by other means
4	No refreshment of TTSM-Injection data	Start injection timing is not generated (PX.WEPAEJ), or control system in trouble	**Possible Timing or Control Problem:** - investigate by other means
5	No measurement of KFA94 (e+) or KFA72(e-)	KFA hardware is not pulsing, or signal is disconnected from TTSM	**Possible KFA problem:** - check KFA operation with other devices
6	KFA94(e+) or KFA72(e-) is not within 30 ns of reference	Kicker position is different from reference	**Possible Problem: Kicker timing is not OK:** - check control values in injection timings - check transmission of PX.WEPAEJ to TTSM
7	KFA94(e+) or KFA72(e-) is continuously within 30 ns of reference	Kicker position is OK for a proper injection	**Kicker timing is OK**
8	SSEPINJ is continuously within 150 ns of reference	SSEPINJ is correct w.r.t. WEPAEJ	**SSEPINJ is OK**
9	SSEPINJ is more than 150 ns from reference	SSEPINJ is not correct w.r.t. WEPAEJ	**Possible Problem: SSEPINJ may not be OK:** - check control value of SSEPINJ - check transmission of PX.WEPAEJ and PX.SSEPINJ to TTSM
10	No measurement of SSEPINJ	SSEPINJ is not pulsing, or is disconnected from TTSM	**Possible Problem: SSEPINJ may not be OK:** - check control value of SSEPINJ - check transmission of PX.SSEPINJ to TTSM

11	I1TRFINJ is continuously within 2 ns from reference	Start of injection timing is OK w.r.t. the TRF train	**Injection timing is OK w.r.t TRF train**
12	I1TRVINJ is continuously within 5 ns from reference	Start of injection timing is OK w.r.t. the TRV train	**TRV train is OK w.r.t. Injection timing**
13	The difference between I2TRVINJ and URE95 is continuously within 3 ns from the difference between references	Bunch tracking by the TRV train works correctly	**TRV train is OK after injection**
14	The difference between I2TRVINJ and URE95 is continuously within 3 ns from the difference between references +- k*261.4 ns (k is not 0)	Bunch tracking by the TRV train works correctly but bunches are missing	**Beam problem: missing bunches**
15	The difference between I2TRVINJ and URE95 is more than 4 ns from the difference between references +- k*261.4 ns	Bunch tracking by the TRV train may not be correct	**Possible Problem: TRV train may not be OK:** - check with TTSM-Ejection
16	The difference between I2TRVINJ and URE95 is more than 7 ns from the difference between references +- k*261.4 ns	Bunch tracking by the TRV train is not correct	**Problem: TRV train is not OK:** - check B field at injection - adjust RF phase at injection - call PS-RF specialist
17	No measurement of I1TRFINJ or I2TRFINJ or I1TRVINJ or I2TRVINJ	TRF or TRV train not available, or disconnected from TTSM	**Possible PS-RF problem:** - check signals with other devices
18	If rules 15 or 16 apply and beam losses are observed at low energy	Probably bad injection parameters	**Problem: probably bad injection parameters** - check B field at injection - adjust RF phase at injection - call PS-RF specialist



(a) = PX.SSEPINJ_E/P = Start Switching at Electrons/Positons INJection

(b) = PX.I1TRFINJ_E/P = Interval 1 Train RF INJection Electrons/Positons

(c) = PX.I2TRFINJ_E/P = Interval 2 Train RF INJection

(d) = PX.I1TRVINJ_E/P = Interval 1 Train ReV INJection

(e) = PX.I2TRVINJ_E/P = Interval 2 Train ReV INJection

(f) = PI.KFA94 = Kicker Injection Positons

(g) = PI.KFA72 = Kicker Injection Electrons

(h) = PR.URE95 = pick-Up REsistive 95

FILE : INJLEP

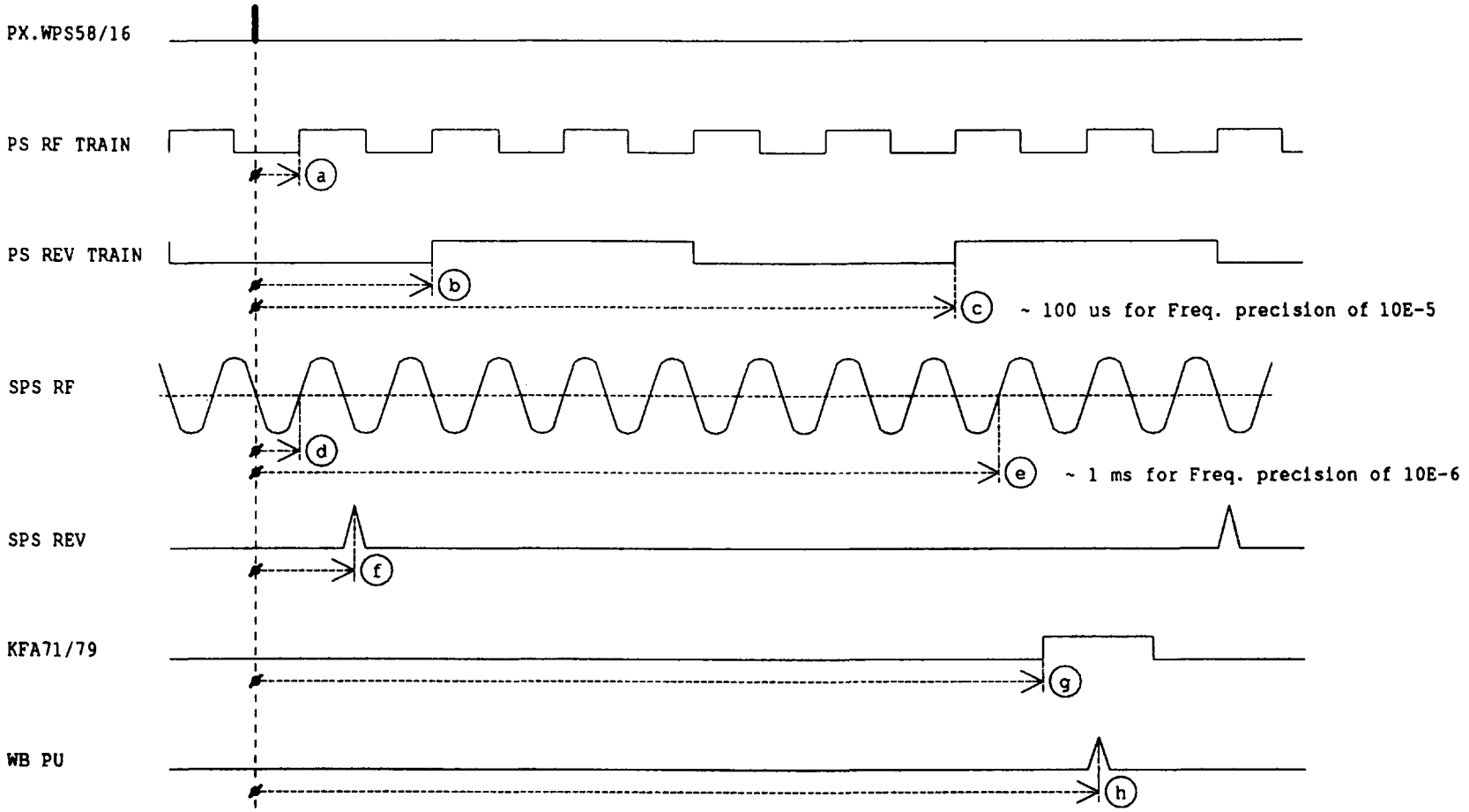
SURVEILLANCE TIMING (TTSM)
INJECTION ELECTRONS/POSITONS
SPN H240 + SPP H240

RESP: -		00-00	00-00-00
DESI: J.BOUCHERON		00-00	14-10-91
DRAW: J.BOUCHERON			14-10-91
MODA J.BOUCHERON			20-10-93
MODB J.BOUCHERON			05-05-94
MODC J.BOUCHERON			16-01-95

CERN-PS | PS/RF-LL _ | 3 | -

From C900 Onwards ----------> e+e- PSEUDO RF TRAIN 2 -> RF ----------> Until ELFT

From C900 Onwards ----------> PSEUDO F.REV TRAIN 2 -> REV ----------> Until EPC



(a) = PX.ITRFEJE_E/P = Interval Train RF EJEction Elect./Posit.

(b) = PX.I1TRVEJE_E/P = Interval 1 Train ReV EJEction Elect./Posit.

(c) = PX.I2TRVEJE_E/P = Interval 2 Train ReV EJEction Elect./Posit.

(d) = PX.I1TRFSPS_E/P = Interval 1 Train RF SPS Elect./Posit.

(e) = PX.I2TRFSPS_E/P = Interval 2 Train RF SPS Elect./Posit.

(f) = PX.ITRVSPS_E/P = Interval Train ReV SPS Elect./Posit.

(g) = PR.KFA71-79 (h) = PR.URE95 = pick-Up REsistive 95

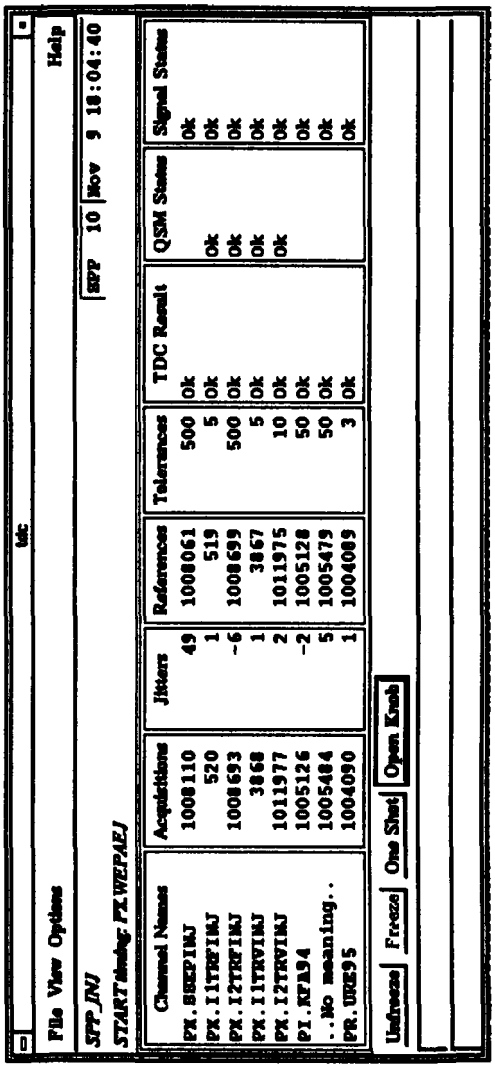
FILE : SPSLEP

SURVEILLANCE TIMING (TTSM)
EJECTION ELECT./POSIT.
SPN H240 + SPP H240

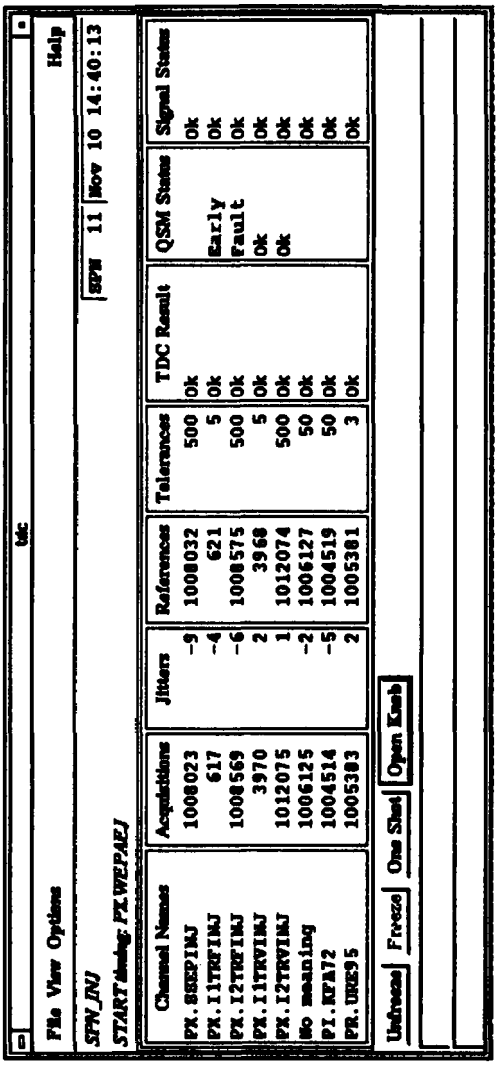
RESP: -	00-00	00-00-00
DESI: J.BOUCHERON	00-00	15-10-91
DRAW: J.BOUCHERON		15-10-91
MODA J.BOUCHERON		20-10-93
MODB J.BOUCHERON		05-05-94
MODC J.BOUCHERON		20-07-94

CERN-PS | PS/RF-LL _ | 3 | -

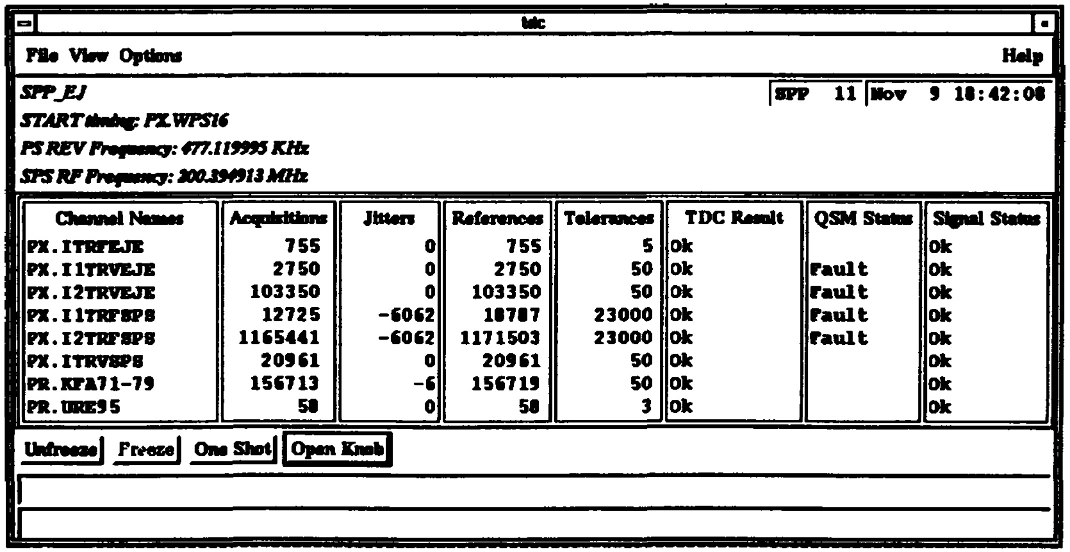
TYPICAL TTSA - INJECTION ACQUISITION FOR e+



TYPICAL TTSP - INJECTION
ACQUISITION FOR e⁻



TYPICAL TTSA - EJECTION ACQUISITION FOR e+



tdc

File View Options Help

SPP_EJ

START timing: PX.WPS16

PS REV Frequency: 477.119995 KHz

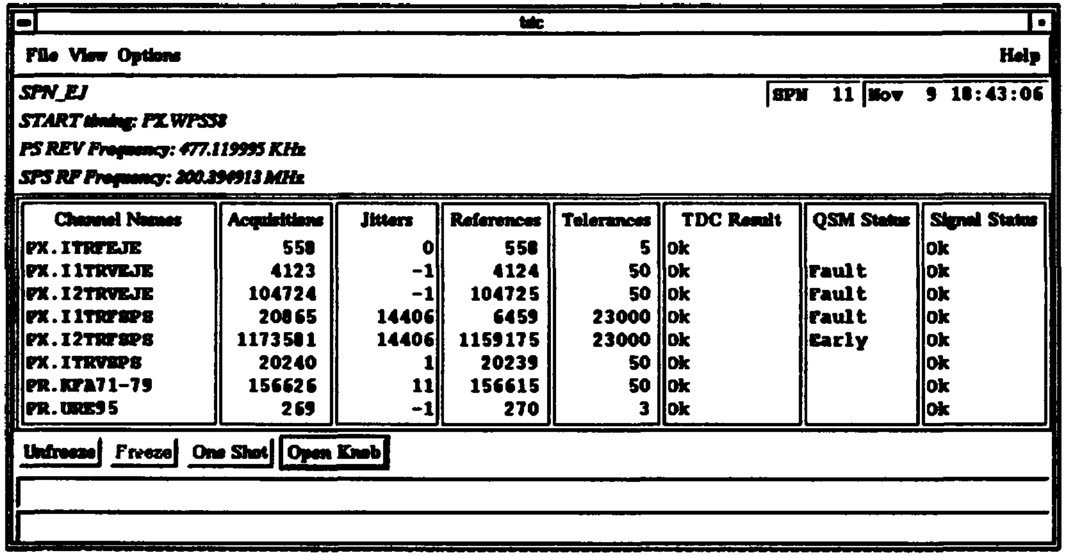
SPS RF Frequency: 200.394913 MHz

SPP 11 Nov 9 18:42:08

Channel Names	Acquisitions	Jitters	References	Tolerances	TDC Result	QSM Status	Signal Status
PX.ITRFEJE	755	0	755	5	Ok		Ok
PX.I1TRVEJE	2750	0	2750	50	Ok	Fault	Ok
PX.I2TRVEJE	103350	0	103350	50	Ok	Fault	Ok
PX.I1TRFSPS	12725	-6062	18787	23000	Ok	Fault	Ok
PX.I2TRFSPS	1165441	-6062	1171503	23000	Ok	Fault	Ok
PX.ITRVSPS	20961	0	20961	50	Ok		Ok
PR.KFA71-79	156713	-6	156719	50	Ok		Ok
PR.URE95	58	0	58	3	Ok		Ok

Unfreeze Freeze One Shot Open Knob

TYPICAL TTSM – EJECTION ACQUISITION FOR e^-



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File View Options Help

SPN_EJ | SPN 11 | Nov 9 18:43:06

START timing: PX.WPSS8

PS REV Frequency: 477.119995 KHz

SPS RF Frequency: 200.394913 MHz

Channel Names	Acquisitions	Jitters	References	Tolerances	TDC Result	QSM Status	Signal Status
PX.ITRFEJE	558	0	558	5	Ok		Ok
PX.I1TRVEJE	4123	-1	4124	50	Ok	Fault	Ok
PX.I2TRVEJE	104724	-1	104725	50	Ok	Fault	Ok
PX.I1TRFSPS	20865	14406	6459	23000	Ok	Fault	Ok
PX.I2TRFSPS	1173581	14406	1159175	23000	Ok	Early	Ok
PX.ITRVSPS	20240	1	20239	50	Ok		Ok
PR.KFA71-79	156626	11	156615	50	Ok		Ok
PR.URE95	269	-1	270	3	Ok		Ok

Unfreeze | Freeze | One Shot | Open Knob