Minutes of the PPC Meeting

held on 15.09.1992

Present: J. Boillot, E. Brouzet, R. Cappi (Chairman), V. Chohan, G. Daems, D. Dumollard, R. Garoby, S. Hancock, Ch. Hill, K. Hübner, D. Manglunki (Secretary), M. Martini, K. Metzmacher, A. Pace, M. Paoluzzi, J.P. Potier, N. Rasmussen, J.P. Riunaud, Cl. Saulnier, K. Schindl, H. Schönauer, E. Schulte, C. Steinbach, P. Têtu, M. Vretenar, E. Wildner-Malandain.

MD forecasts for 1993 (R.Cappi):

Three types of Machine Developement periods are requested for 1993 (see attached copy of transparency):

- Four "standard" 30 hour periods running from Monday at 6 h 00 to Tuesday at 12 h 00.
- Two weeks at the end of the year for LHC-type beam tests at 1.4 GeV. The details are exposed by K.Schindl in the second part of the meeting.
- Six 10-hour periods, replacing two 30-hour periods, taking place on Tuesdays. They will be made in parallel with leptons for LEP (no other proton or antiproton user available).

LHC test at 1.4 GeV. Where are we? (K.Schindl)

K.Schindl presents the reasons, the resources required and the schedule for the 1.4 GeV test foreseen at the end of 1993 (see attached copy of transparencies).

Discussion points:

- The hardware changes (rf cavity on h=2, kickers) will first be made on the Booster, probably allowing LEAR to be filled during the first days, but this has to be confirmed.
- The double-batch filling of the PS is considered a worthwhile part of the experiment.
- The last part of the MD will, if time allows it, be devoted to tests at 1 GeV, to prove the usefulness of the 1.4 GeV. K.Hübner suggests a similar MD at 800 MeV as the one recently made (cf PS/PA Note 92-08) to confirm expectations at lower energy, before the 1.4 GeV test. After a long discussion, this idea is finally rejected, because :
  a. the two weeks are needed not only for the 1.4 GeV, but also for other studies (stability, transition, h=1,...).
  b. going to 800 MeV and back is hardly possible in a 30-h MD.

c. rather than decreasing the energy, the regime with an increased Q-spread due to space charge can be simulated by shortening the bunches on the PS 1 GeV flat top by rf-voltage increase.

d. the present 5-bunches beam is only marginally comparable with the LHC h=1, RFQ2 beam.

- Review of the hardware status:

a. No PO Group member is present at the meeting and the point about the power supplies modifications will be made in a next meeting.

b. M. Vretenar gives news about the RFQ II. It should be delivered next week to the PS Division. Tests will take place during the last three months of 1992, and the installation during the winter shutdown should not be a problem.

c. Ch. Steinbach says the new wire should be ready before Easter but software problems are expected. R.Cappi points out that good functionning the good functionning of the flying wire is essential for the MD.

d. M. Paoluzzi says the h=1 rf cavity for the PSB is working in the lab and will be installed in the PSB next year.

e. K. Metzmacher announces the thyratron sets are being modified to allow the PSB ejection kickers to work at 1.4 GeV.

- J.P. Riunaud: the rise time of the PS injection kickers can be checked by injecting the second bunch next to the first one, and not diametrically opposed.

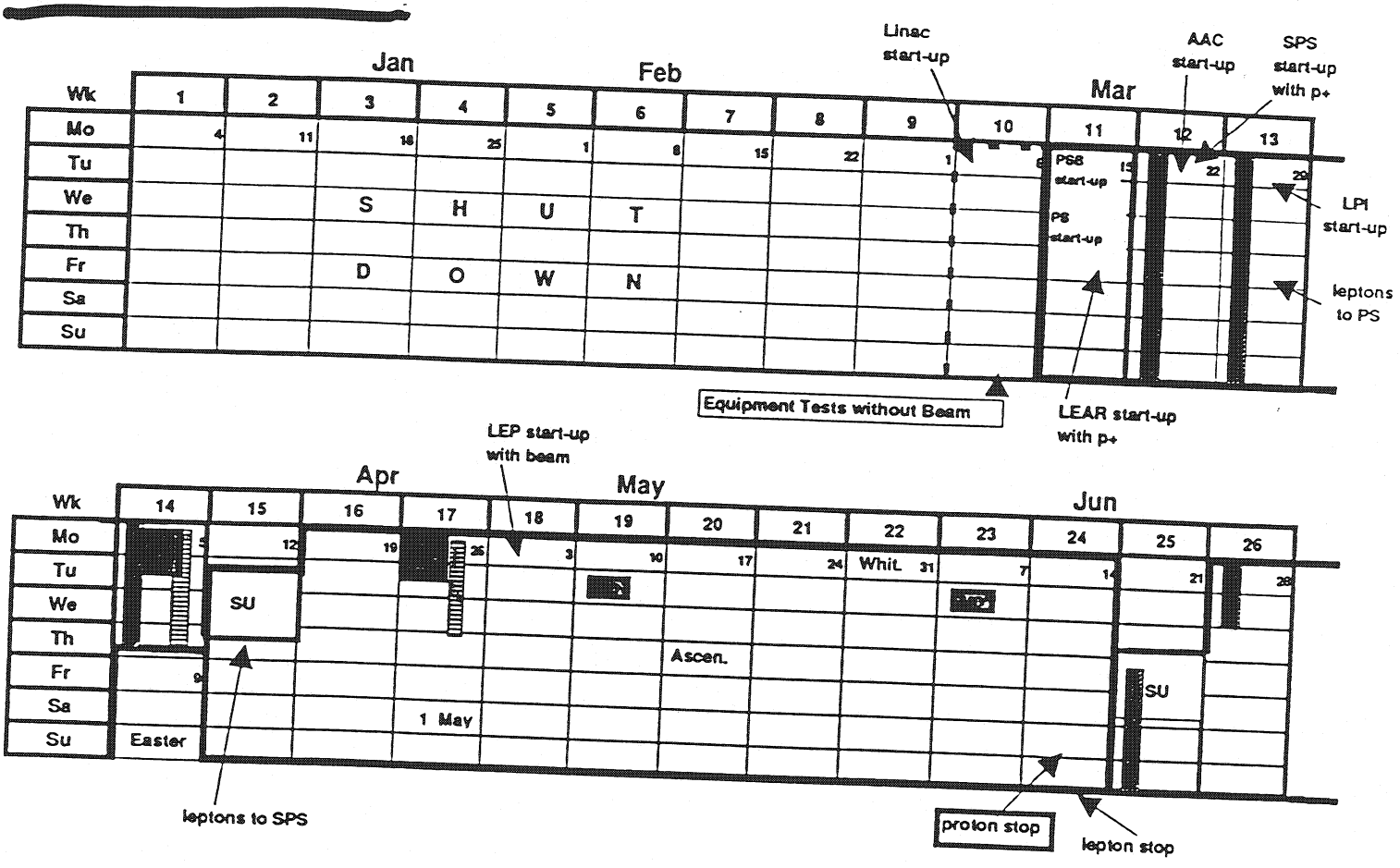
- P. Têtu: There is a well-known blow-up in LINAC tank I. This should be studied carefully with RFQ II after its installation and running-in.

New MD reports:

- N. Rasmussen, H. Schönauer, "PSB ME-NEWS: Injection and RF capture at large Bdot (II)", PS/HI/ME 92-02, 9 July 1992.

- R. Cappi, M. Martini, J.P. Riunaud, K. Schindl, H. Schönauer "LHC-type beam in the PS complex. Production and emittance measurements", PS/PA/Note 92-08, 3 August 1992.

PRELIMINARY 1993 PS SCHEDULE



K.Schindl 9/92

Test of LHC Proton Beam End 1993

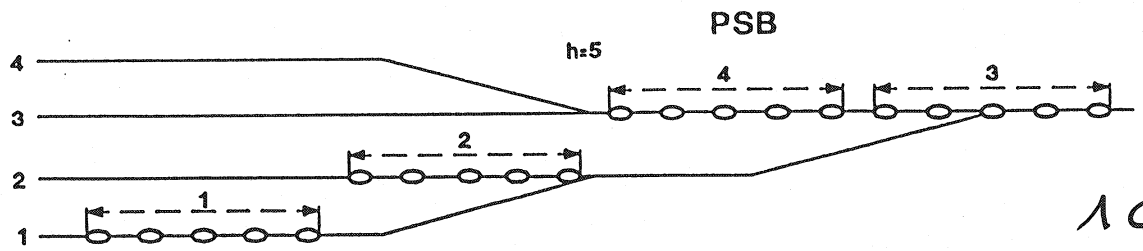
Full Scheme	Test
RFQ2 installed	RFQ2 installed (1993 shut-down)
Linac2 200 mA in 20 μs in PPM	Linac2 200 mA in 20 μs, dedicated
PSB h=1, all rings	PSB h=1 prototype in ring 3
PSB h=2, all rings	PSB h=2 prototype in ring 3
PSB accelerating to 1.4 GeV on all cycles (except ISOLDE)	PSB accelerating one ring to 1.4 GeV on two cycles during 14.4 sec (Bρ +26%)
PSB to PS line: all elements at 1.4 GeV and pulsed (ejection, recombination, transfer, injection PS, all +26%)	PSB to PS line: only elements dealing with level 3 to be increased by 26%, on 2 cycles in 14.4 sec
Two PSB cycles to fill PS (2*4 bunches)	Two PSB cycles to fill PS? (2*1 bunches)
In PS, acceleration of 8 bunches on h=8 to 26 GeV/c	In PS, acceleration of 1 (2?) bunches on h=8 to 26 GeV/c
De-bunching and re-bunching on h=140 (h=84) in PS at 26 GeV/c for LHC bunch spacing: 15 ns (25 ns)	Ejection of 1 (2) bunches and transverse profile measurement on new SEMfil in TT2

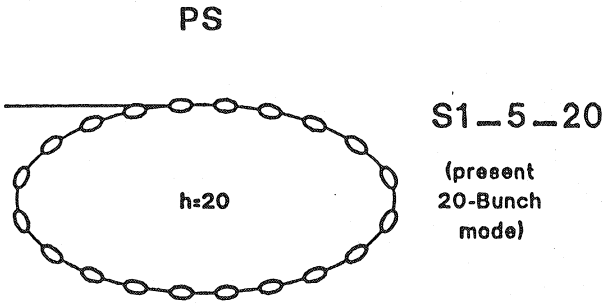
Resources for Beam Test

(PS/LHC Minutes 92-02)

	Total Cost (kFr)		Cost "a fonds perdu"	
	kFr	man-months	kFr	man-months
PSB Main Supply upgrading to 1.4 GeV	70	5	35	2.5
RF h=1, h=2 cavities in PSB ring 3	100-150	18	50	9
PSB-PS transfer (level 3) supplies upgrading +26%	15	4	15	4
Kickers (BE3KFA10)	10	2	10	2
Total Test	**195-235**	**29**	**110**	**17.5**

PSB-PS Recombination Schemes for LHC



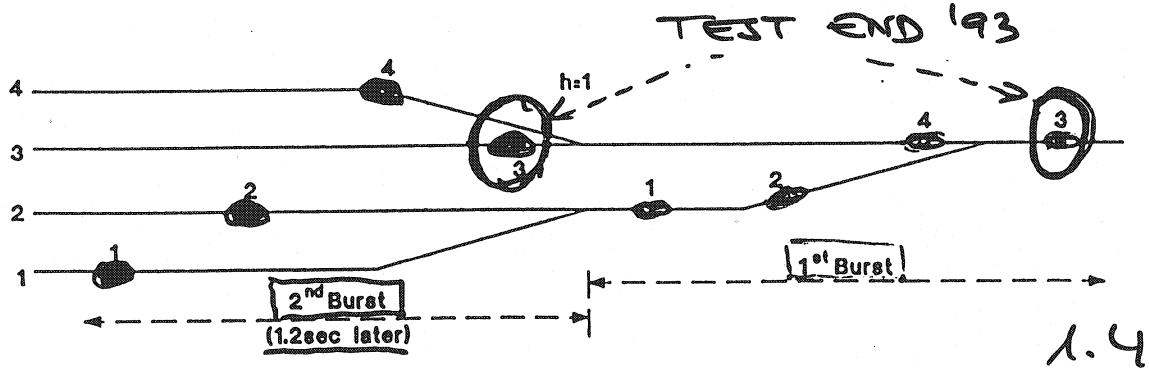


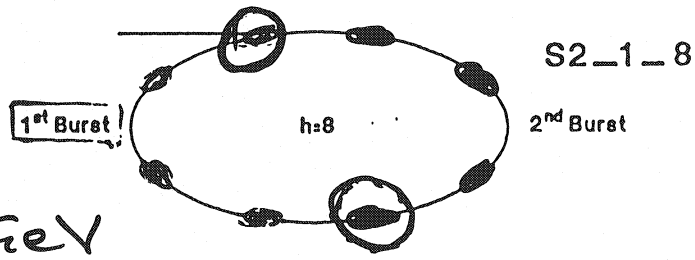
1 GeV

ONE PSB CYCLE PER PS CYCLE

DOUBLE BATCH
1.0 → 1.4 GeV
} TO EASE SPACE CHARGE IN { PSB / PS

TEST END '93





1.4 GeV

TWO PSB CYCLES PER PS CYCLE

POSSIBLE MD SCHEDULE

- HARDWARE CHANGES TO 1.4 GeV IN PSB, LATER IN PS ---> (& TRANSFER PS?)
- ONE BUNCH (= 1 RING) PSB TO 1.4 GeV, THEN TO PS, ACC. $h=8$, $\Rightarrow$ TT2
- TWO PSB PULSES @ 1 BUNCH TO PS $\Rightarrow$ TT2
- REDUCE PSB ENERGY TO 1 GeV AND REPEAT EXPERIMENT TO PROVE THAT 1.4 GeV IS INDEED REQUIRED

SCALING ΔQ 1 GeV ⇒ 1.4 GeV
(AT PS INJECTION)

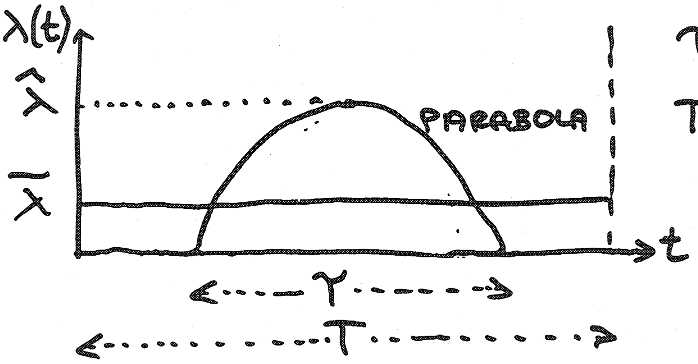
FOR $Q_x \approx Q_y$ (PS) , $\varepsilon_x \approx \varepsilon_y$ (LHC BEAM)

$$\Delta Q \approx - \frac{N r_p}{8\pi B_f \beta\gamma^2 \varepsilon^*} \times \text{FORM FACTORS}$$

r_p $1.53 \, 10^{-18}$ m $\qquad \varepsilon^*_{x,y} = \frac{\sigma^2_{x,y}}{\beta_{x,y}} (\beta\gamma)$

N... #p in <u>FILLED</u> PS RING

BUNCHING FACTOR B_f (STATIONARY BUCKET)



τ ... BUNCH LENGTH

T ... BUCKET LENGTH

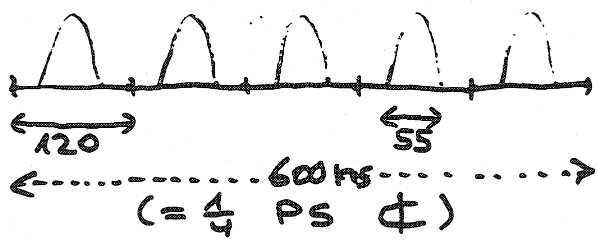
$$B_f = \frac{\bar{\lambda}}{\hat{\lambda}} = \frac{2}{3} \frac{\tau}{T}$$

VERSION COMPLETEE ET CORRIGEE APRES LA REUNION

BUNCH DISTRIBUTION

AT 1 GeV
(RECENT TESTS)

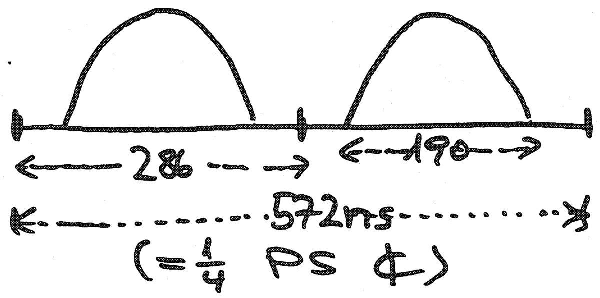
PSB h = 5
PS h = 20



N/4 =
5 * 0,36 . 10^{12}
= 1,8 . 10^{12}

AT 1.4 GeV
(FUTURE TESTS)

PSB h = 1
PS h = 8



N/4 =
2 * 1,8 . 10^{12}
= 3,6 . 10^{12}

TRANSVERSE UNIFORM DISTR.

	$\beta\gamma^2$	N	ε^*	T	τ	B_f	F (IMAGES)	ΔQ
1 GeV	3.73	7,2 . 10^{12}	2.5 μm	120 ns	55 ns	0.306	1.08	**0.166**
1.4 GeV	5.69	1,44 . 10^{13}	2.5	286	190	0.443	1.10	**0.152**

K.S. 16.9.92

V. Agoritsas	PS
B.W. Allardyce	PS
B. Autin	PS
Y. Baconnier	PS
S. Baird	PS
S. Battisti	PS
J. Boillot	PS
J. Bosser	PS
M. Bouthéon	PS
E. Brouzet	SL
R. Cappi	PS
F. Caspers	PS
M. Chanel	PS
V. Chohan	PS
L. Coull	PS
G. Cyvoct	PS
G. Daems	PS
D. Dekkers	PS
J.P. Delahaye	PS
L. Durieu	PS
J. Evans	PS
B. Frammery	PS
R. Garoby	PS
G. Gelato	PS
R. Giannini	PS
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J. Gruber	PS
S. Hancock	PS
H. Haseroth	PS
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Ch. Hill	PS
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D. Warner	PS
M. Weiss	PS
E. Wildner-Malandain	PS
D.J. Williams	PS