

**EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE**

CERN - PS DIVISION

PS/ PA/ Note 94-15 (PPC)

**MINUTES OF THE PPC MEETING
HELD ON 15.3. 1994**

D. Manglunki

Geneva, Switzerland
31 March, 1994

Minutes of the PPC meeting held on March 15th, 1994

Present:

V. Agoritsas, J. Boillot, M. Bouthéon, R. Capi (Chairman), M. Chanel, V. Chohan, G. Cyvoct, D. Dekkers, D. Dumollard, R. Garoby, G. Gelato, H. Haseroth, E. Jensen, H. Koziol, P. Lefèvre, D. Manglunki (Secretary), C. Metzger, F. Pedersen, U. Raich, N. Rasmussen, J.P. Riunaud, K. Schindl, G. Schneider, H. Schönauer, C. Steinbach, E. Schulte, A. Terrier, H. Ullrich, M. Vretenar, E. Wildner, D.J. Williams.

Introduction (R.Cappi)

A contribution from H. Koziol : "state of preparation of beam diagnostics for Pb ions" is added to the agenda.

Status and present performance of Pb Linac (M. Vretenar)

- Most elements (source, LEBT, IH tanks 1-2-3, ITF) of the lead-ion linac are installed.
- The source routinely delivers 75A of Pb²⁷⁺.
- The RFQ is delayed by 10 more days and is not expected to arrive at CERN before Easter.
- The transverse emittances have been measured to be well inside the theoretical RFQ acceptance, despite some fragmentation. It will not be possible to measure them once the RFQ is installed. (See attached copies of transparencies.)

Status of PSB modifications and MD forecast (H. Schönauer)

- The vacuum has reached a value of 9×10^{-10} Torr for the non-hydrogen pressure.
- Most modifications/improvements are taking place at the expected time. (See attached copies of transparencies.)

Status of PS modifications and MD forecast (D. Manglunki)

- The SPS expects the proton test beam at 13 GeV/c in week 22.
- Most hardware modifications have been completed. Ten sublimators will be installed during the short June shutdown (week 25).
- A B-triggered ejection does not seem feasible, but PS/CO is still investigating.
- The beam control will not allow RF gymnastics (capture on h=40, debunch/recapture on h=20) at injection this year. (See attached copies of transparencies.)

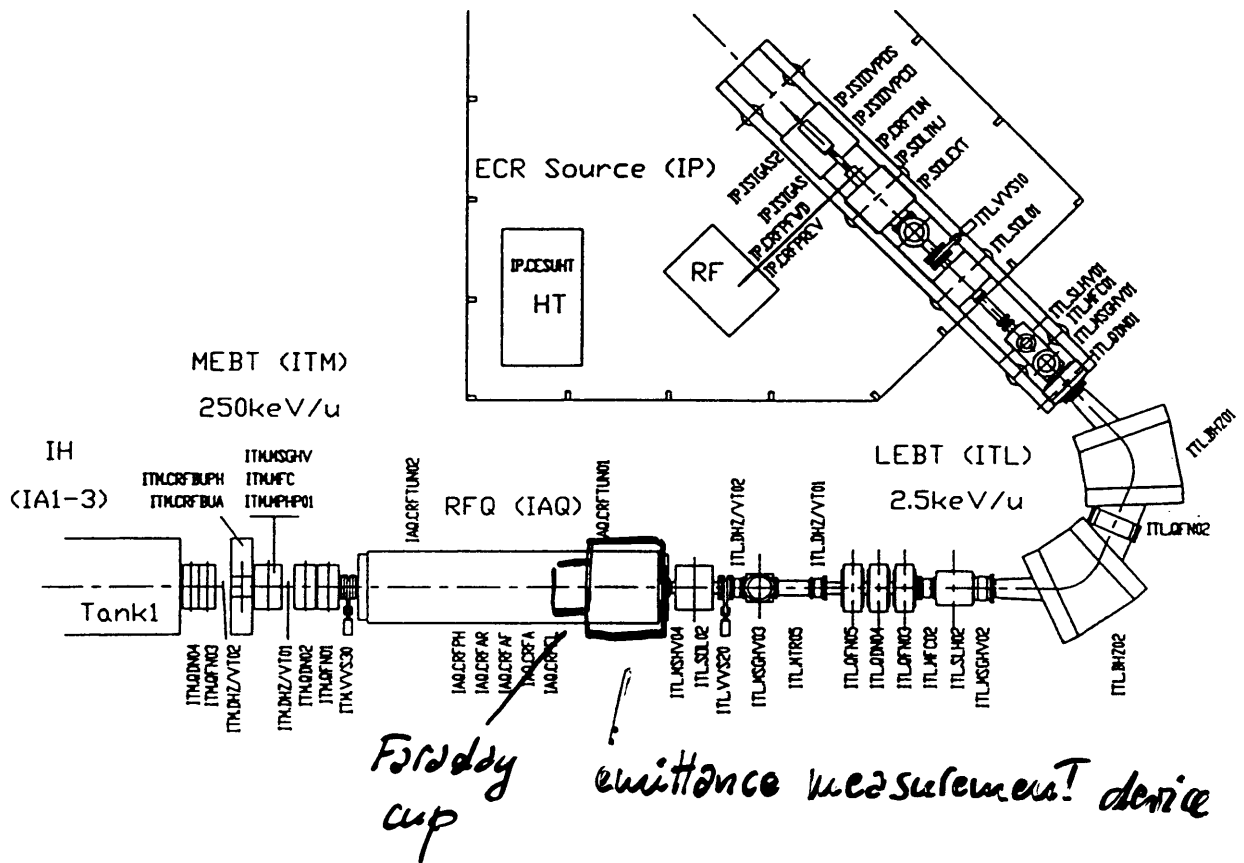
State of preparation of beam diagnostics for Pb ions (H. Koziol)

- Apart from the pick-ups in the transfer lines and the CODD, most of the instrumentation that works for the protons should work for the Pb ions.
- The beam radial position measurement system should be operational in June, most probably in stand-alone (i.e. not included in the PS control system).
- A video freeze system will be essential for the observation of the Pb beam on the scintillating screens. (See attached copies of transparency.)

MV 15.3.94

STATUS AND PRESENT PERFORMANCE OF PB-LINAC (LINAC 3)

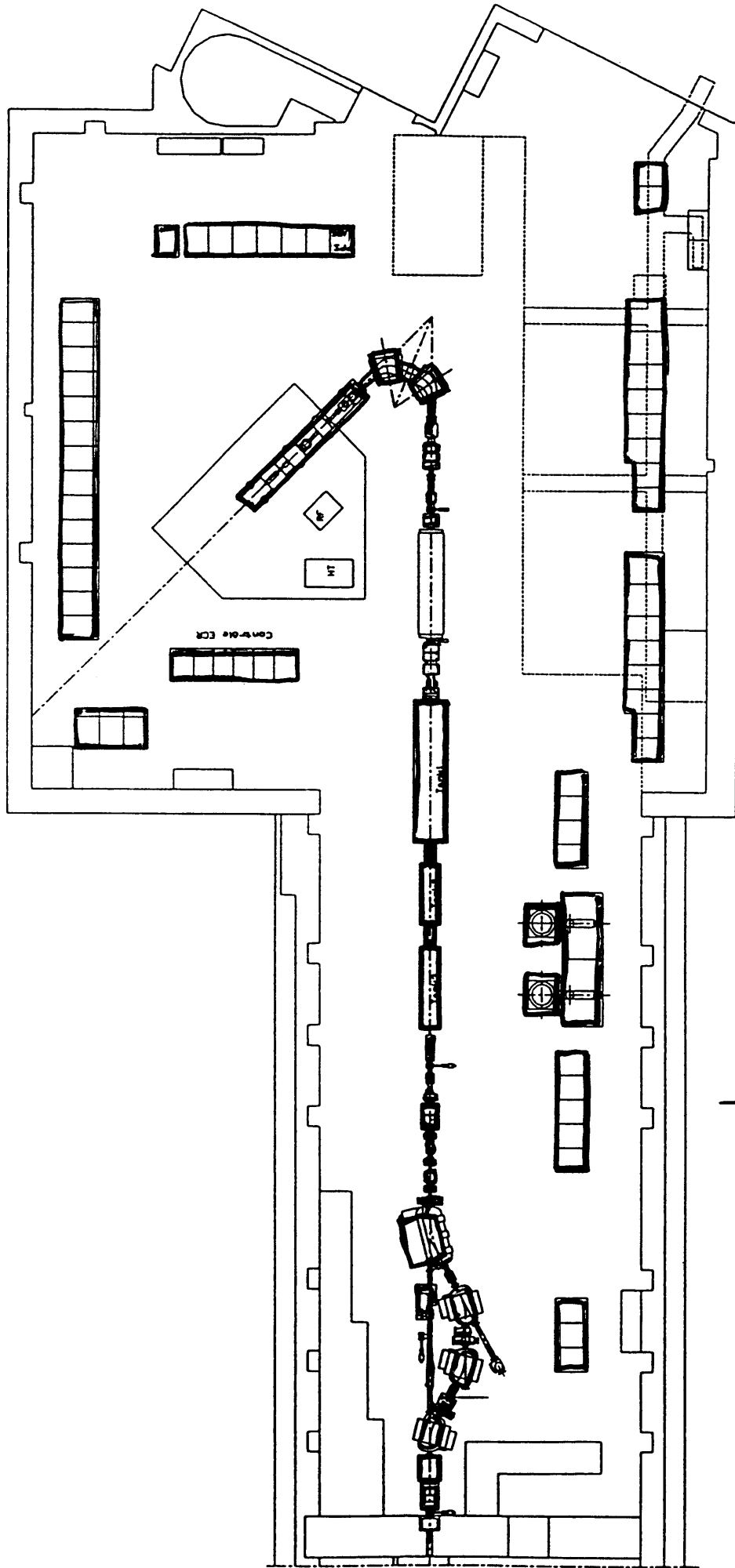
- SOURCE * running steadily $\sim 75 \mu\text{A Pb}^{27+}$
* final optimization for I and q still to be done
- LEBT * beam measurements in progress $2.5 \text{ eV/u Pb}^{27+}$
at low intensity ($\sim 50 \mu\text{A}$)
* emittances ok (some fragmentation for certain settings, but well inside RFA acceptance).
* offset in beam position (v) \Rightarrow installation of 1 additional steerer.
* transmission $\sim 85\%$, to be measured more precisely.
- RFA * vacuum Test at Legnaro ok
* remains : - assembling of the vanes in the tank
- low level RF measurements and tuning
* delivery at Cern : ? [after Easter].
- #1, 2, 3 installed; tanks 2 and 3 conditioned to nominal field level
- ITF [Filter, Stripper and Measurement line]
* elements installed
* testing in progress.



LEBT (LI.ITL) Measurements - March 1994

- Beam current $\approx 50 \mu\text{A}$ not yet optimised
- Emittances $< \approx 5 \pi \text{ mm mrad}$ (nominal yellow report - $150 \pi \text{ mm mrad}$).

CHOICE OF THE CHARGE STATE (Pb^{25+} or Pb^{27+} ?)
 TO BE DONE SOON AFTER THE MEASUREMENTS
 AT HIGH INTENSITY.





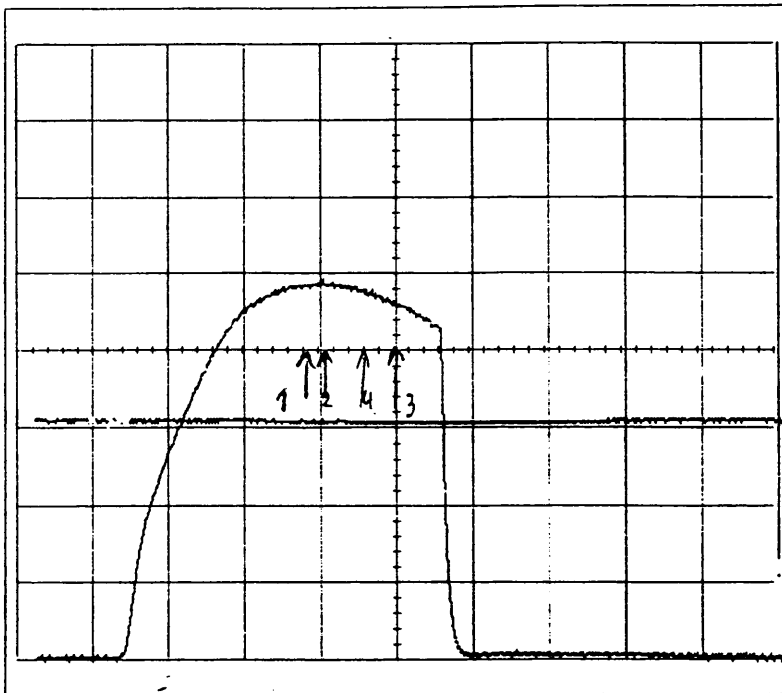
-  equipment installed in L3 area - 15.3.84
-  equipment ready to be installed

Fig. 3.1 Plan of Building 351 with Linac 3 Layout



DATE: Feb 15/94

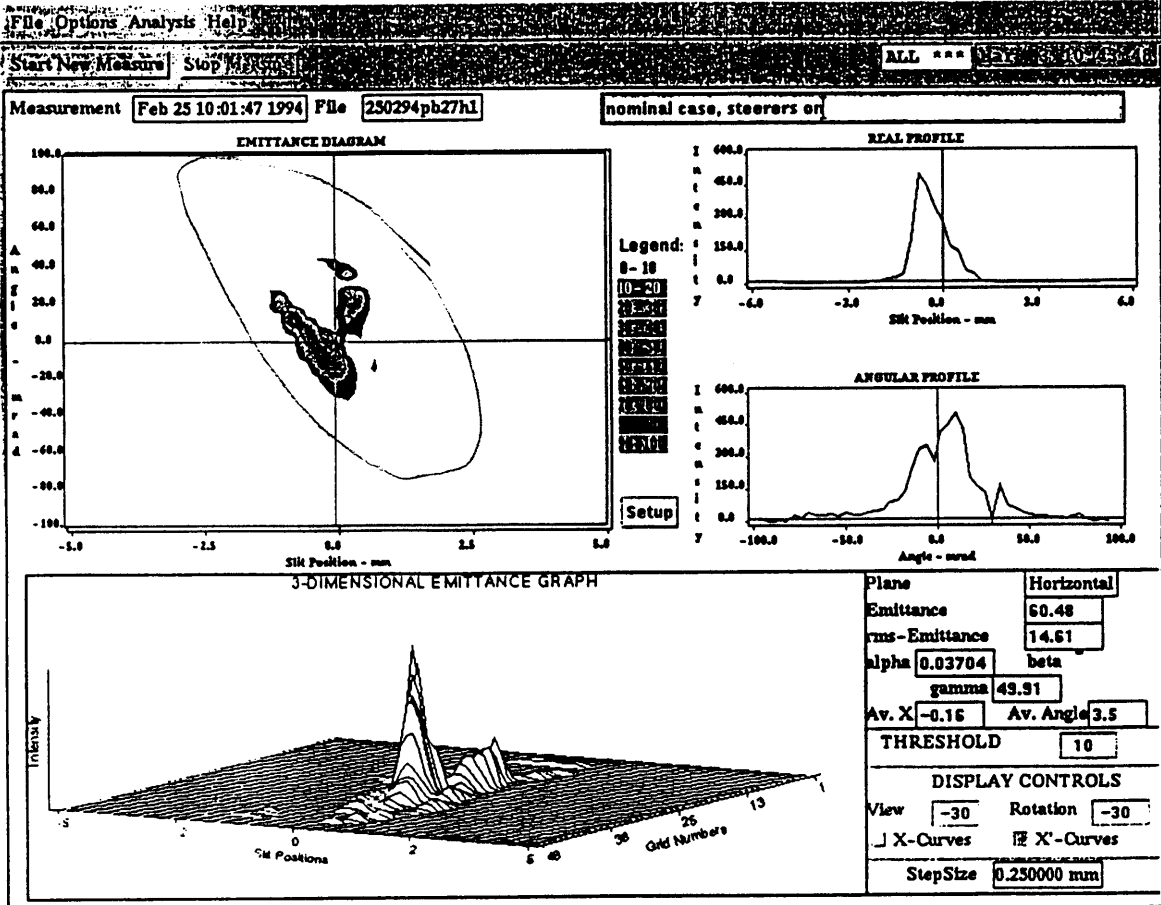
TIME: 16:01:52

TR1A: 0.20V :500:

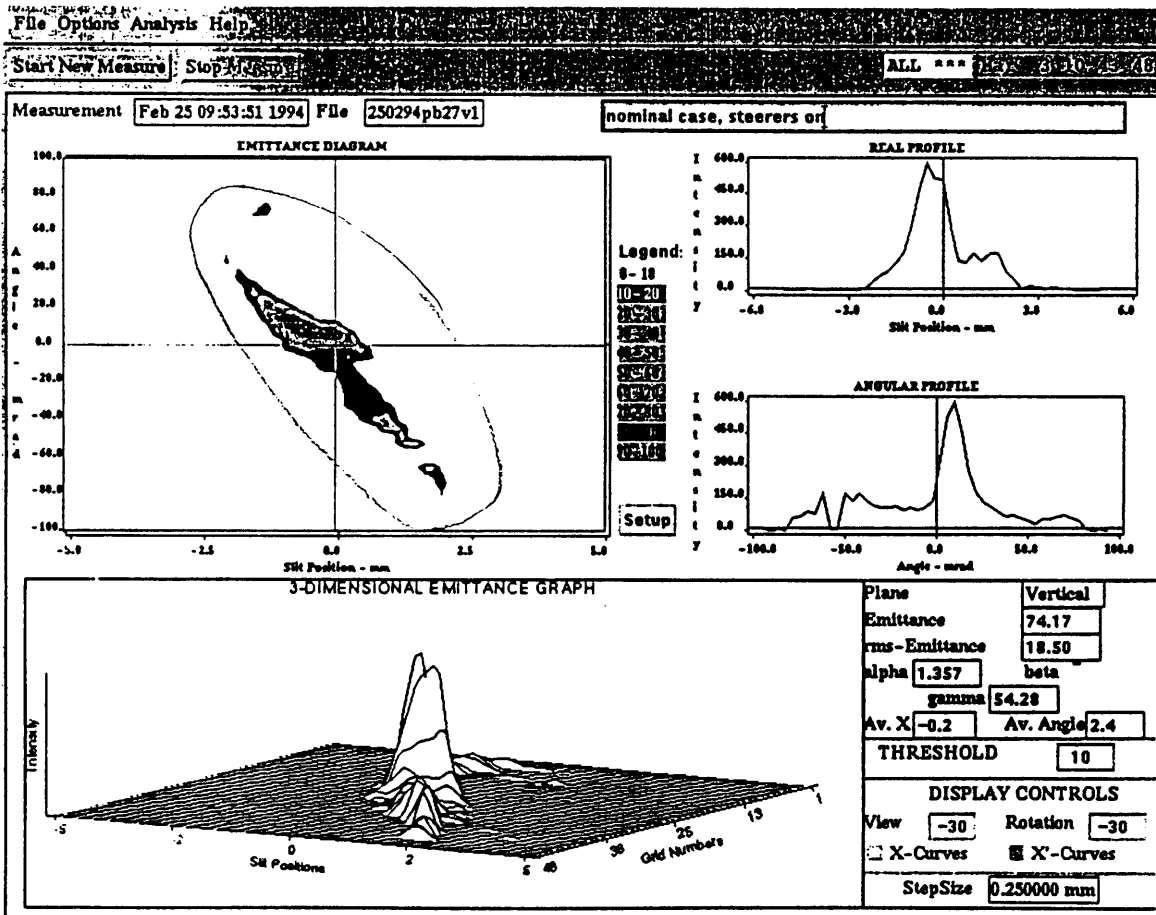
TR2A: 100mV :500:

triggered 1250,15

50,1A



Max & Min values on Horizontal & Vertical motors read...



Max & Min values on Horizontal & Vertical motors read...

ACCELERATION of Pb^{53+} in the PSB.

Improvements in the PSB :

1. Vacuum improvements \rightarrow AT/VA : Non-Hydrogen pressure $9 \cdot 10^{-10}$ Torr
2. Modifications and improvements of the Main Power Supply to operate at highest possible dI/dt to shorten acceleration time.
3. Try to inject and rf-capture the ion beam from the linac on a rising magnet field at highest possible dB/dt
4. A new staircase pulsed magnet ("Distributer") to distribute slices of the linac beam pulse over the vertical levels of the four Booster rings. Lengthening of the flattops of the existing one appears more expensive.
5. Lengthening the flat top of the pulsed septa in the injection line BI.SMV (vertical) and BI.SMH (horizontal, stack of four in the Booster ring), slope of slow injection kicker
6. Lengthening the flat top of the ejection kickers BE.KFA14L1 (stack of four in the ring) and of the vertical recombination kickers BT.KFA10,40 and BT.KFA20
7. A new digital beam control system, operating only on ion cycles $\omega = 2\omega_{p0}$
8. Five new beam current transformers in the injection line
9. A stack of four slow DC beam current transformers in the Booster ring with a dynamic range extending down to ion intensities. They will also allow extension of the range of emittance measurements (Beamscope) to ions.
10. As beam positions in the beam lines cannot be measured directly at low intensity, steering has to be monitored by TV observation of scintillator screens. Their movements will be synchronized with the ion cycles (pulse-to-pulse modulation) in order not to interfere with proton cycles. Video signals will be digitally processed to enhance readability.

PSB Modifications for Lead Ion Facility: Status as known 15/03/94

SYSTEM	STATUS
Main Power Converter: <i>highest possible dI/dt to shorten acceleration time</i>	
4 Rectifier-inverter groups (instead of 3)	ready; successfully tested (for LHC)
dV/dt 150 kV/s (fast initial rise) 470 kV/s (without DC filter)	tested measured; further tests in April
Kickers	
Cables, connection boxes	Installed
Transfer kickers	gas piping, cables connected , cable filling ready
Ejection kicker	all modules disassembled; ferrites baked, installed, ready
Slow injection kicker (one of four stacks - new ferrites)	modified, ready, installed
New Pb Distributor: <i>Staircase pulsed magnet to distribute Linac3 pulse (400 μs) vertically to four PSB levels</i>	
Ceramic chamber (2 + 2 spares)	# 1 delivered, vac & metrology tested, # 2 delivered, vac & metrology tested, # 3 , 4 Wk 12 ?
Flash coating with thin metallic layer (10 kohm/sq Ti) test on prototype ?	#1,2 : Wk12, in CERN: LEP 2 conflict
Metallic replacement chambers	ready; installed
Ceramic chambers, installation	5 April ?? or Wk 25...
Magnets : Ferrites	assembled
mechanical structures	ready
Installation of 4 magnets without chambers	ready
Pulsed power converters	Prototype delivered April; Series in June , commissioning July
Timing	Hardware ready, installed
Inject. line modification (steering dipoles DHZ/VT40)	ready
PSB injection pulsed septa upgrading <i>flat-top lengthened to cope with 400 μs ion beam</i>	P.S. modification done partially tested
RF: Digital Beam Control System <i>Required to accelerate low intensity, and to change harmonic number h=20 to h=10 during cycle</i>	
Hardware modules	ready
installation	Wk 14
Linac3 - PSB Line beam current transformers <i>5 new transformers for sensing beams of a few 10 μA (lead) and up to 200 mA (protons) on alternate cycles</i>	
Transformer construction, stands	finished
installation	finished
Electronics	under development...
PSB Ring DC transformers (4) <i>New slow current transformers to cover a few 10⁹ (Pb) to 10¹³ (protons) charges per cycle</i>	Interface electronics: production; Tests Wk 11,12
software (G. Hemelsoet)	ready for test Wk 11

Résultats des ME sur Calim. principale

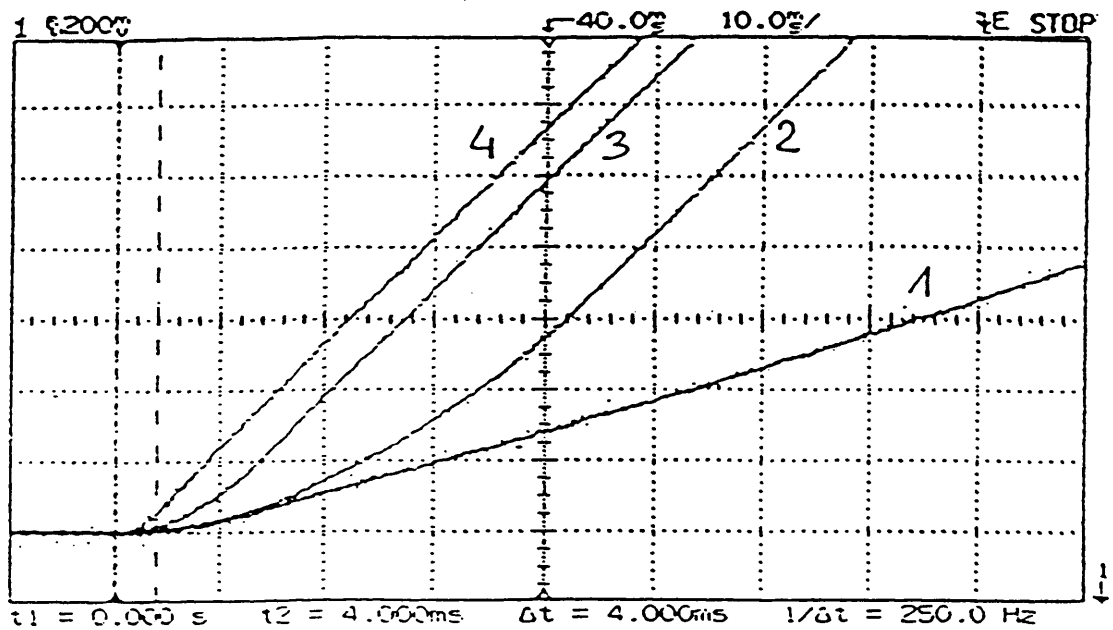


Fig. 4.2 Initial Current Rise in PSB Magnet Versus Power Converter Conditions
 Three groups of the Main Power Converter with different limits to the voltage rise:

- #1 Standard proton cycle for comparison
- #2 Fastest possible rise with present rate limit of 45 kV/s
- #3 Modified rate limiter at 125 kV/s (maximum envisagable with DC filter)
- #4 Rate limit pushed to 475kV/s without DC filter (effect of bypassing it, on proton acceleration still to be tested)

Lead-Ion Beam Tests in 1994: Running-in and Tests of PSB :

Test	Responsibles	Remarks	hrs	Planned for
Proton Tests (prior to Ion Tests)				March - June
Control System Running-in	CO + OP + BS		<∞	March - April
MPS: Test of fast ion cycle	H. Fiebiger	ME	>6	18/19 April
RF Digital Beam Control in R3 Test of PPM "User", p compatibility Debunching and Recapture on Intermediate flat top	G. Schneider + F. Blas F. Pedersen	ME ME + Parasite ME	8	18/19 April 27.4.:Reserve
idem for other rings	idem	ME	7	4 May 7hBlock
RF capture at high Bdot and/or with high Vdot	N. Rasmussen, F. Pedersen, H. Schönauer	Parasite ME ~10 sessions		April - May
Beam Diagnostics Tests:				
Injection line beam transformers	G. Gelato + F. Nanni + CO + OP	SU without or with "bricole"		April - May
Ring DC transformers	P. Odier + CO + OP	during SU		March
Transfer line transformer software	G. Gelato + C. Carter + CO + OP	during SU		March
PPM of scintillator screens with Video Freeze	H. Schönauer + E. Chevallay + OP	test in parasite		April - May
PB-ION Tests :		on parasite cycles (cf. ISOLDE !)		From 15 June...
Steering of level 3 Beam through Inj. line (screens)	BS + OP			Week 24, 25+)
Test of Beam trf. with Pb Ions	G. Gelato + F. Nanni + OP			Week 24,25+), 26
Set-up of Injection in Ring 3	BS + OP			Week 25+), 26
Test of DC Transf. in R3 with ions	P. Odier + CO + OP			Week 26
Ion lifetime test on 4.2 MeV/u flat cycle (Ring 3)	BS + OP	VacuumTest Parasite ME		Week 26
RF Capture setup with digital beam control system Debunching/Recapture / 2nd Acc #)	G. Schneider + F. Blas + N. Rasmussen + BS	Magnet #) Cycle to be determined		Week 26 - 29
Tests of Ion Magn. Cycles 4Groups	H. Fiebiger	Startup / ME	>6	23.6 / 4/5.7.
Fast RF Capture	N. Rasmussen + H. Schönauer + H. Fiebiger	#) Parasite ME		
Steering / Injection in Rings 1,2, 4	BS + OP	Old / New Pb Distributer ?		Week 26,27
RF capture in Rings 1,2,4	G. Schneider + F. Blas + BS + OP			Week 29 - 31 (?)
Acceleration to Intermediate flat top, debunching, recapture, Ring 3	idem	if not yet #) achieved		Week 29 - 31
Acceleration to Flat top (R 3)	idem	idem		Week 32
Test of synchronisation (Ring 3)	idem			Week 32
Setup Ejection and Transfer (R 3)	BS + OP			Week 33
Test transfer line transformer software	G. Gelato + C. Carter + CO + OP			Week 33
Repeat procedure for Rings 1,2,4	BS + OP			Week 34

+) 2 days shut-down + startup during this week

#) Depending on Vacuum Test

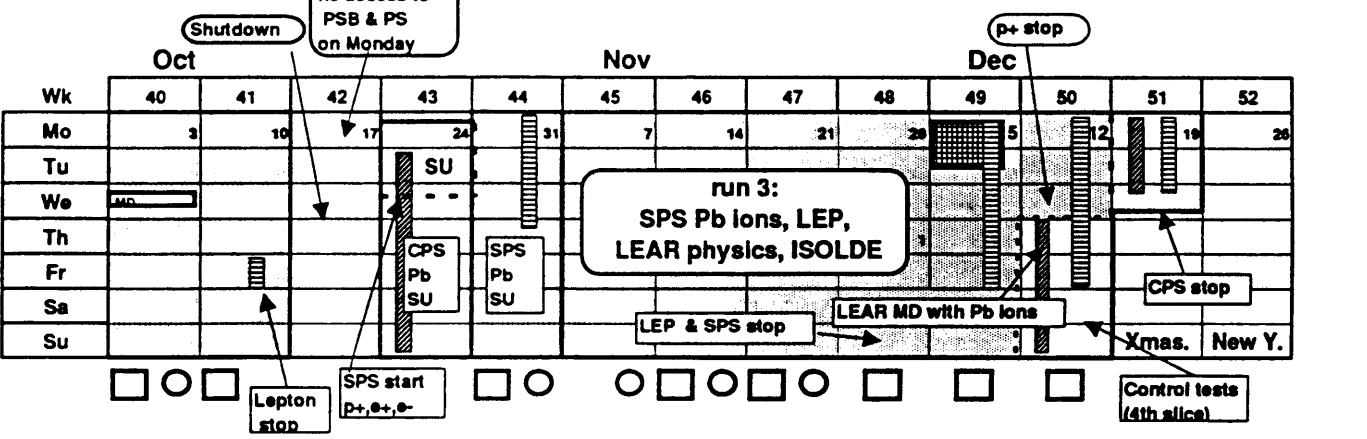
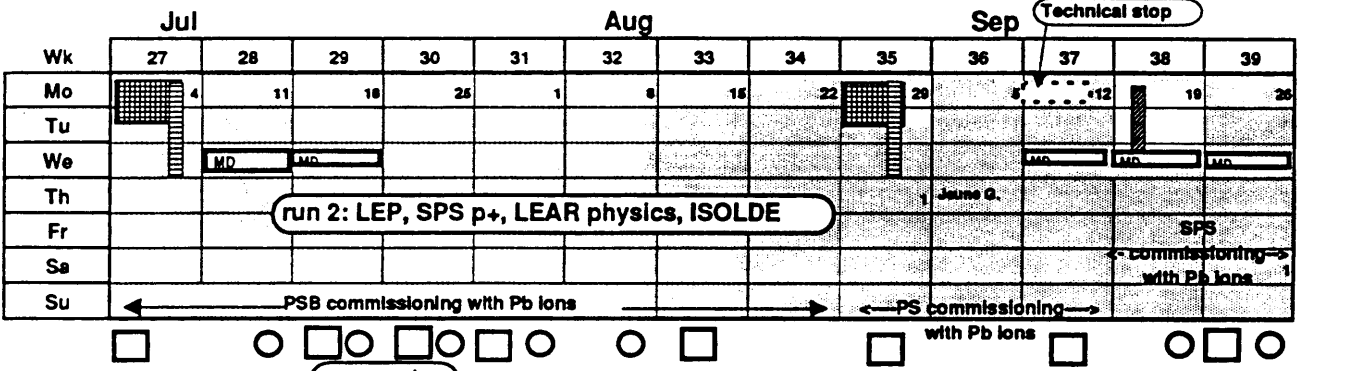
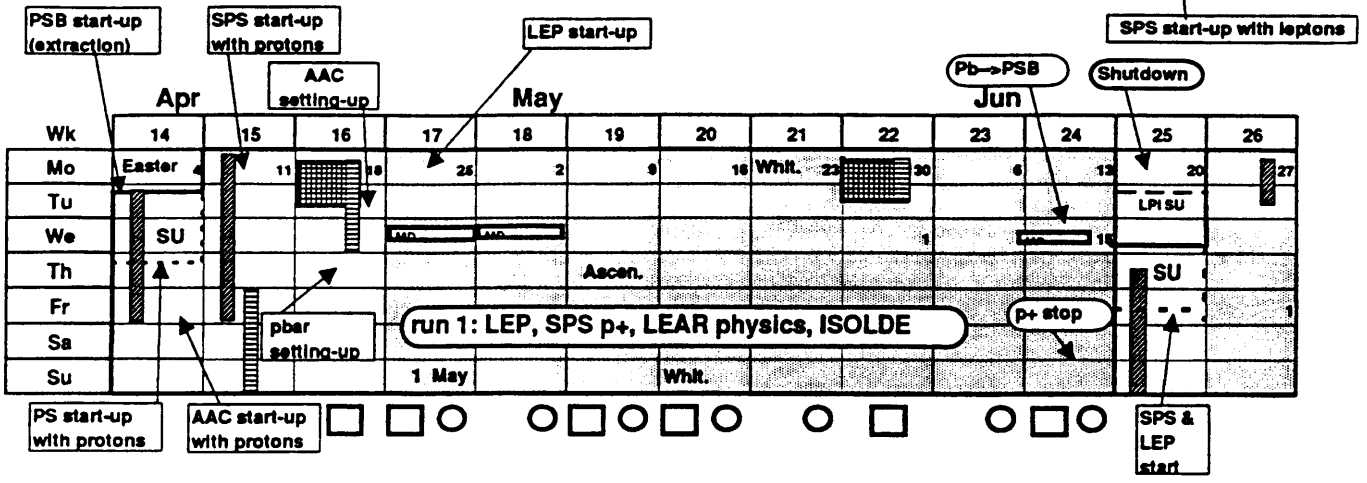
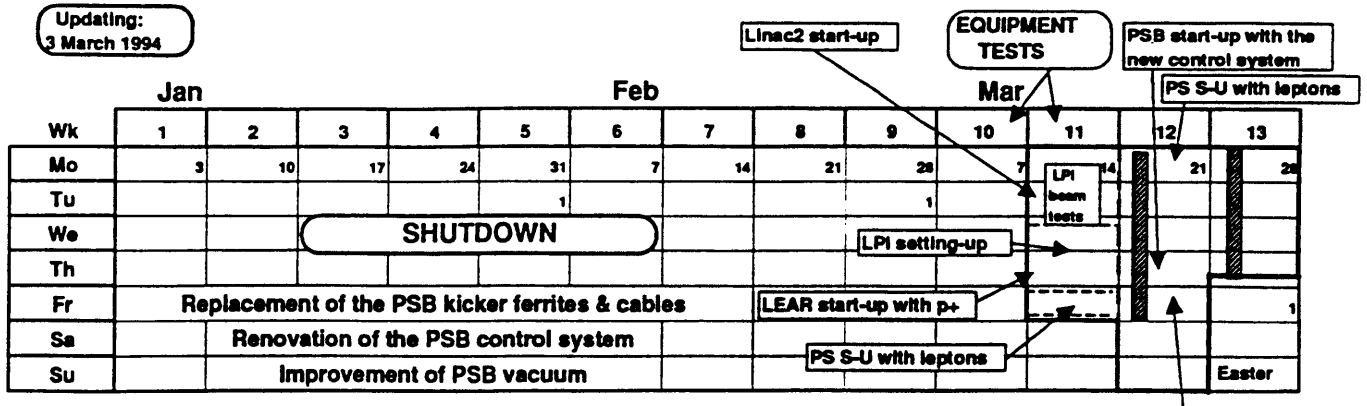
Preparation of the lead ion beam commissioning in the PS

PS modifications			
Septum 58 and 16			Striplines installed, vacuum OK, power tests OK
Kicker 45			Being done, some (expected) problems
Vacuum improvement			10 sublimators to be installed in June
TT2 Stripper	M.Thivent		Installed, cables in CCR
	K.Metzmacher		Vacuum OK in 1 hour
	M.Van Rooy/A.Burlet		Installed, to be tested
	G.Martini		Does not seem feasible
	A.Burlet		ppm switch installed
	G.Gelato		
	J.Philippe		
Beam transformers in TT2			
B-frigged ejection			
Wide band pick-up			
Instrumentation check			
Scintillating screens	U.Raich		
Beam current transformers	G.Gelato		
SEM grids	G.Martini		
Extraction transfo	G.Gelato		
"Chronometer"	E.Schulte		Application program OK in July (?)
Required MD			
Digital beam control	R.Garoby		
F cycles	N.Blazianu		
Injection	OP +		3x8h, parasitic, protons parasitic
Lifetime measurements	D.Manglunki		
RF gymnastics at injection	R.Garoby		
Acceleration	R.Garoby		
Fast extraction			
Stripper efficiency			







1994 - P S COMPLEX SCHEDULE

Approved by
Research Board
25 November 1993

Updating:
3 March 1994



MD : Linacs / PSB / PS MD session in parallel with LEP operation (7 hours on Wednesday from 6 am to 1 pm, 14 hrs on 13 July.)

-  LEAR Physics
-  Linacs 2 or 3, PSB, & PS MD
-  LPI MD
-  LEAR MD (p+ or pbar)
-  weeks with ISOLDE (see ISOLDE schedule)
-  weeks with East Hall (for details, see 4 week schedule)

STATE OF PREPARATION OF BEAM DIAGNOSTICS FOR Pb-IONS

LINAC

- measurement line, Raich OK
- BT, Gelato analogue OK, digital later
- Phase-PU, Williams expected to work
- Bunch-Length & Velocity Meas't (BLVM), Williams expected to work

BOOSTER INJECTION LINE

- PU, Williams will not be available
- BT, Gelato expected to work (electronics not yet ready)

BOOSTER RING

- closed orbit observ., Williams expected to work
- BT, Gelato OK (software still to be tested)

TRANSFER BOOSTER-PS

- PU, Williams will not be available
- BT, Gelato may work (kicker noise!), new software not yet tested

PS RING

- BT, Gelato OK
- closed orbit observ., Schulte will not be available
- mean radial position, Schulte exp.to work (stand-alone, at min.)
- WCM, Schulte OK
- high sensitivity PU, Schulte OK
- fast wire scanners, Raich expected to work at high energy

TT2

- PU, Schulte OK
- SEM-grids (old), Raich expected to work
- BTs at stripper foil analogue expected to work
- BLM, Agoritsas request ? specs ?

EVERYWHERE

- MTV have worked with O-ions