

Poster TUP04

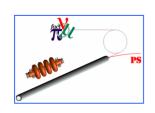


The SPL Front End: A 3 MeV H- Test Stand at CERN

C.Rossi, L.Bruno, F.Caspers, R.Garoby, J.Genest, K.Hanke, M.Hori, D.Kuchler, A.Lombardi, M.Magistris, A.Millich, M.Paoluzzi, E.Sargsyan, M.Silari, T.Steiner, M.Vretenar, CERN, Geneva, Switzerland P.-Y.Beauvais, CEA, Saclay, France, P. Ausset, CNRS, Orsay, France

presented by R. Garoby





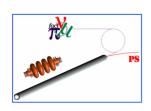
The 3 MeV H- Test Stand at CERN



OUTLINE

- The long term SPL project: motivation for a 3 MeV Test Stand.
- The intermediate Linac4 phase: a valuable improvement of the CERN proton accelerator complex.
- The 3 MeV Test Stand: a short term study tool and the future SPL Front End.
- Status and Planning.





Linac4 parameters



Phase 2

(SPL)

Phase 1 (PSB)

Linac4 could be later used as front-end of the SPL: its RF structures are designed to operate at the full SPL

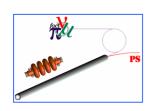
PARAMETERS

duty cycle.

 Relaxed parameters
· Space and
infrastructure available
in the PS South Hall
•RF from LEP
(klystrons, waveguides,
etc already in stock)

Maximum repetition rate	4	50	HZ
Source current *	50	30	mA
RFQ current *	40	21	mA
Chopper beam-on factor	75	62	%
Current after chopper *	30	13	mA
Pulse length (max.)	0.5	2.8	ms
Average current	15	1820	μΑ
Max. beam duty cycle	0.1	14	%
Max. number of particles per pulse	0.9	2.3	· 10 ¹⁴
Transverse norm. emittance (rms)	0.25	0.25	π mm mrad
Longitudinal emittance (rms)	0.3	0.3	π deg MeV
Maximum design current	30		μΑ

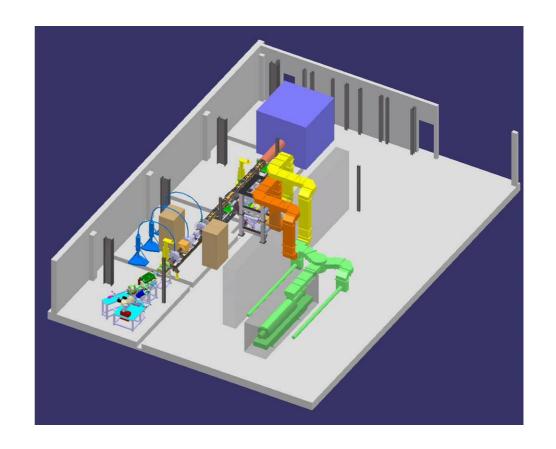




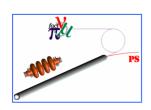
Goals of the 3 MeV Test Stand



- Validation of the design of the 3 MeV pre-injector
- Comparison of simulation codes
- Characterization of the "real" beam after the chopper line to optimize the design of the downstream accelerator



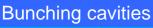




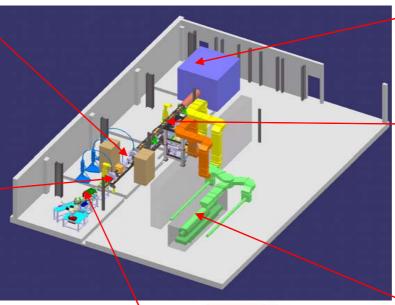
The 3 MeV Test Stand



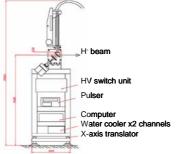




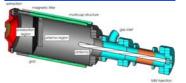




Beam Shape and Halo Monitor



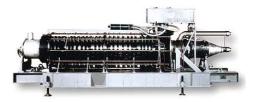




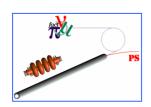
IPHI RFQ



HV pulsed power supplies for the LEP klystrons





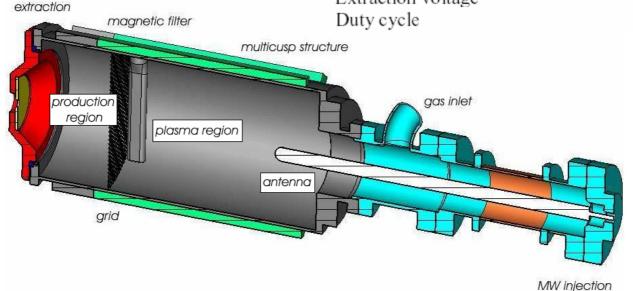


The H- ECR Source



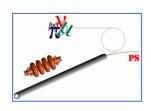
Instantaneous current
Pulse length
Repetition rate
Extraction voltage
Duty cycle

DINAC 4 SPL 50 mA > 40 mA
0.5 ms 2.8 ms
2 Hz 50 Hz
95 kV 95 kV
1 % 14.0 %



- Tests on the prototype source are under way. Design work will continue during the rest of 2004 and 2005.
- The final source is not expected before 2007.



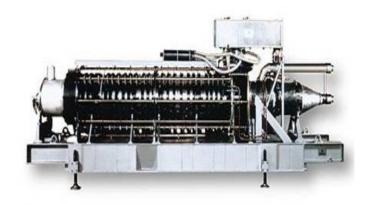


The RFQ



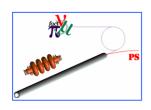
The 3 MeV test place is based on the IPHI ("Injecteur de Protons de Haute Intensité") RFQ which is being developed within the IPHI collaboration between CEA and CNRS, recently joined by CERN.





RF power is generated by a LEP klystron (352.21 MHz, 1 MW CW) operated in pulsed mode, by means of dedicated power supplies developed in collaboration between GSI and CERN.



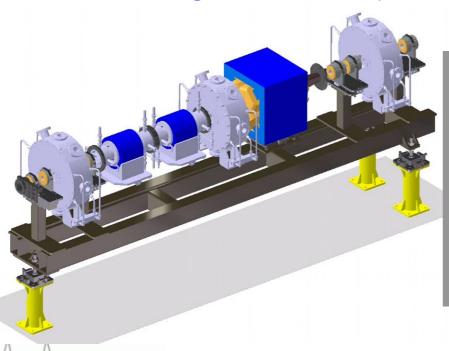


The Chopper line



Motivation:

- · generation of the required time structure of the beam
- · cleaning of the beam halo
- · matching to the subsequent RF structures.



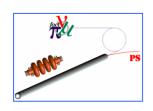
General guidelines

Compact design 3.7 m length Dynamic range 20 - 60 mA Small ϵ growth +4% longitudinal +8% transverse

Tolerant to alignment errors

Good vacuum ~10-8 Torr





The Beam Shape & Halo Monitor



Longitudinal measurement

Measure residual H^- in (not completely) chopped buckets with a sensitivity of ~ 1000 ions, in the vicinity of full bunches (10^8 ions). Detector must be turned ON/OFF within 1 ns, gating ratio $1:10^6$

Transverse measurement

Halo diagnostics:

H- beom

Hy switch

unit

Pulsar

Computer

Water cooler x 2 channels

X-axis translator

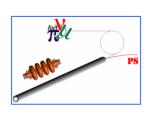
Beam core: d=1 cm, 10⁸ H⁻/bunch/cm² Beam halo: d=4 cm, 10³ H⁻/bunch/cm²

Active area of detector 4 × 4 cm

Dynamic range: 1:106 by integrating over

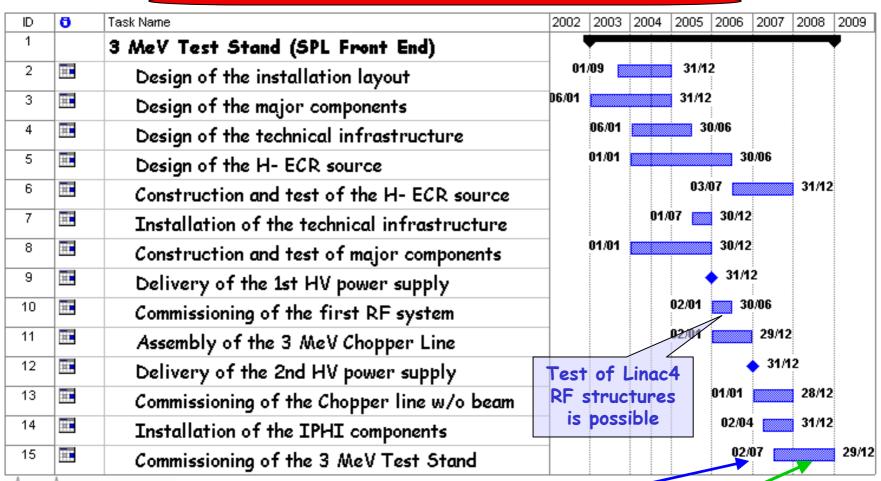
several buckets

All components have been delivered. The vacuum chamber is being designed. The detector will be commissioned during the first months of 2005.



Planning of the Project

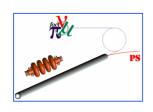






Linac4 approval

Decision on SPL



Status of the Project



- The European Union is supporting beam dynamics studies and RF system developments in the frame of the HIPPI "Joint Research Activity".
- The design of the 3 MeV Test Stand and its components is almost completed. Still missing:
 - study of the beam current monitor
 - design of short sections of the vacuum chamber
- The decision about Linac4 construction in 2006 has been announced by the CERN DG among the strategic priorities of the laboratory

⇒ The 3 MeV Test Stand is due to become the source of all protons at CERN!