PSB BEAM AVAILABILITY TILL 2010

(Summary from HIP WG)

- STATUS REPORT ON JUNE 19 (AB-ATC)
- PROGRESS SINCE
- COMMENTS

STATUS OF INVESTIGATION

(as presented at the AB ATC on June 19)

Summary of physics requests

USER	CERN COMMITMENT*	USERS' WISHES
LHC	**Planned beams**	Luminosity upgrades *[long term]*
CNGS	**4.5×10^{19} p/year**	Upgrade ~ $\times2$ *[medium term]*
ISOLDE	**1.92 μA ****	Upgrade ~ $\times5$ *[medium term]*
EURISOL		1-2 GeV / 5 MW
Future ν beams		> 2 GeV / 4 MW

* Reference value for analysis

** 1350 pulses/h – 3.2×10^{13} ppp

Proton beam availability*

* Outcome of analysis by S. Baird

Basic Assumptions (2007-2010):

- Accelerators time schedule
  - PS operating time/year: 5400 h (without setting-up)
  - SPS/LHC operating time: 4700 h (without setting-up)
  - SPS in LHC filling mode: 15 % of the time
  - SPS in LHC pilot mode: 35 % of the time
- Availability
  - PS & PSB: 90 %
  - SPS for CNGS: 80 %
- Beam intensities
  - SPS intensity for CNGS: 4.4×10^{13} ppp 8.6×10^{13} ppp
  - PS intensity for CNGS: 3×10^{13} ppp 4.8×10^{13} ppp

Performance without improvements to the accelerators

USERS	2004 - 2006	2007 - 2010	Beyond 2010
PS East Hall, nTOF, AD	**OK**	**OK**	**OK**
SPS FT (except CNGS)	**OK**	**Less cycles**	**Less cycles**
LHC	**OK (injectors only)**	**OK (21.6 s supercycle)**	**OK (21.6 s supercycle)**
CNGS	**OK (only in 2006)**	▪ **Flux × 0.75** ▪ **PS irradiation**	**Nominal flux (no upgrade)**
ISOLDE	**OK**	**Flux × 1.08 (no upgrade)**	**Superseded by EURISOL facility**

Performance with basic improvements

- Solid state switch for magnets in the CNGS transfer line
- Flexible supercycle control in the SPS
- New multi-turn ejection from the PS

USERS	2006 - 2009	Beyond 2009
LHC	**OK (22.8 s supercycle)**	**OK (22.8 s supercycle)**
CNGS	**OK (22.8 s supercycle)**	**Nominal flux (no upgrade)**
ISOLDE	**Flux × 0.92 (no upgrade)**	**Superseded by EURISOL facility**

⇒ **The HIP WG strongly recommends a quick implementation of these improvements**

Benefits of other possible improvements

- 0.9 s basic period
- Double PSB batch for CNGS (**8.6×10^{13} ppp in SPS**)
- Linac 4 (**6.4×10^{13} ppp in the PSB for ISOLDE + single PSB batch for LHC & CNGS**)

	0.9 s basic period	**0.9 s basic period + Double PSB batch for CNGS**	**0.9 s basic period + Linac 4**
LHC	**OK (23.4 s supercycle)**	**OK (25.2 s supercycle)**	**OK (17.1 s supercycle)**
CNGS	**Flux × 0.95**	**Flux × 1.8**	**Flux × 1.8**
ISOLDE	**Flux × 1.6**	**Flux × 1.65**	**Flux × 3.9 (1.95×2)**
Comments	**- Shorter SPS porch**	**- Shorter SPS porch**	**- Shortest SPS & LHC porches, - Simple operation, margin - Potential for LHC upgrade**

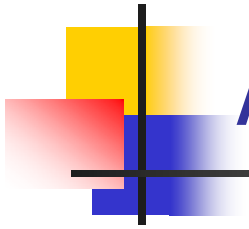
⇒ **Logical upgrade path to satisfy all requirements of accepted users**

PROGRESS SINCE JUNE 19

- AB management has endorsed the first set of recommendations
- Corresponding improvements are progressing well
- The analysis is being refined

COMMENTS

- The "approved" upgrades bring no benefit to ISOLDE
- First benefits come with the reduced cycle time (factor ~ 1.6 for 0.9 s)
- Linac 4 is needed to reach a factor ~ 4:
  - It unavoidably comes with an increase of the number of protons per pulse
  - It is not yet clear how much the other users will be interested in linac 4 …
  - What is the latest date at which linac 4 will still be an interesting upgrade for ISOLDE ?



ANNEX

MEMBERS

M. Benedikt	PSB	Secretary
K. Cornelis	SPS	
R. Garoby		Chairman
E. Metral	PS	
F. Ruggiero	LHC	
M. Vretenar	Linac(s)	

MOTIVATION

[*Quotes from the mandate of the HIP project leader*]

- "…there are convincing reasons to improve the beams delivered by the present proton accelerator complex. These may include increasing the flux of protons delivered to ISOLDE and CNGS, and preparing for an upgrade of the LHC performance beyond the original goals."
- In the longer term, "…High intensity proton beams with a power exceeding 1 MW are necessary for the next generation of physics experiments after the year 2010".

this is why

- "An early definition of the most interesting solutions to CERN requirements will help focus our limited resources and improve the benefits from the present joint efforts taking place in Europe. In a later stage, it will also give the opportunity to propose a solution satisfying all needs and making optimum use of CERN assets in terms of expertise, hardware and infrastructure."

Mandate of the HIP working group

- Define a list of specifications for beam performance based on perceived future physics needs.
- Investigate possible changes to the CERN complex of proton accelerators.
- Publish a summary of various alternatives and compare them in terms of performance, flexibility and approximate cost. The associated requirements in technical competence should be underlined. A preferred scheme should be indicated with the possible option of a staged realisation.
- Present the recommendations for approval by the A&B management by the end of 2003.

WORK PROGRESS

- Minutes and presentations available at:

  http://ab-div.web.cern.ch/ab-div/Projects/hip/

- Builds upon previous work:
  1. CERN/PS 2001-041 (AE), CERN/SL 2001-032
     Increasing the Proton Intensity of PS and SPS, R. Cappi (editor)
  2. LHC Project Report 626,
     LHC Luminosity and Energy Upgrade: a Feasibility Study, F. Ruggiero (ed.)

- 16 meetings since January 9, 2003

Subjects treated

SPEAKERS	USERS' NEEDS	ACCELERATORS' ISSUES
S. Baird		Proton beam availability
T. Nilsson	ISOLDE upgrade and future plans	
M. Benedikt, G. Metral		Potential of shorter basic period
K. Elsener	CNGS needs and potential	
M. Giovannozzi		PS new multi-turn ejection
M. Lamont		SPS ppm and fast supercycle changes
M. Vretenar		Possible upgrades of linacs
A. Mueller (CNRS)	EURISOL	
A. Blondel (Geneve)	Future neutrino beams	
H. Schonauer		RCS option
F. Ruggiero		Potential LHC upgrades
D. Manglunki		CT status and possible improvement
E. Shaposhnikova		High intensity in SPS: longitudinal issues
K. Cornelis		High intensity in SPS: transverse issues
J. Virdee	Future LHC upgrades	