THE SPS RUNNING IN 1999-2000 AND LATER

André FAUGIER, SL/OP, CERN, Geneva, Switzerland

Abstract

The SPS machine has been used since years as a multipulsing accelerator delivering in the same "frozen" supercycle hadron beams to the high energy experiments in the West and North zones, leptons to fill the LEP collider and hadron on a low energy cycle for parasitic MD purposes. Only very few time consuming cycle/supercycle changes were yearly performed for long MD's or for switching the machine from proton to lead. The future program will request very flexible beam conditions to face the high energy fixed target and LEP program until 2000, while preparing the machine for LHC tests and running with an eventual new neutrino program. The proposed 1999-2000 schedules will be presented, taking into account constraints like energy consumption, budget, planning restrictions and maximum LEP running time, as well as an overview of possible operational scenarios for the years to come to accomodate the future program as it is known today.

1 YEARS 1999 AND 2000

1.1 Shutdown work

Concerning the 1998-1999 winter shutdown, the main activities in the SPS will be concentrated around LSS4 where the tunnel has to be reinforced in view of the LHC related civil engineering work of the year after, and in LSS2 where the extraction region will be recabled. In LEP, the major activities will be the upgrade of the cryogenic plants, the replacement of some HOM couplers and of the RF antenna cables. During the 1999-2000 winter shutdown, the SPS activities will mainly concern the modifications of the pumping ports in two sextants of the SPS, the displacement of the west target T1 to allow the installation of the LHC TI2 transfer line and the civil engineering work in LSS4.

1.2 Budget constraints

A review has been done in mid 98[1] which recommended to adopt the accelerator schedules in 1999 and 2000 based on time between shutdowns with modest cuts , with option for LEP to recover some running time in case of low efficiency; these recommendations have been endorsed by the Management, and the 1999 schedules have been approved by the November 1998 Research Board.

1.3 Other requirements

The fixed target operation (NA48, later COMPASS and the test beams will be at 450 GeV/c, with a moderate intensity due to the absence of the neutrino program which ended in 1998 ($1.5 \pm .5\ 10^{13}$ pot per cycle); a request has also been made to get 25 nsec bunch spacing slowly extracted in North and West areas during short dedicated periods in 2000.

The 1999 lead operation will be at 40 GeV/c/n and the 2000 lead operation will be at 158 GeV/c/n with a possible short running period at 80 GeV/c/n.

Machine developments have been reorganised in SPS to minimise the perturbation of the last two years of LEP operation; the big MD blocks have been shortened down to 24 hours during which calibration runs will be performed at LEP; from June onwards, lepton will be made available during these blocks to fill LEP if beam is lost. To maximise the lepton availability and lepton intensity, a more stringent surveillance of the SPS lepton machine will be performed and some improvements will be done in the transfer lines like automatic steering to "golden" trajectories, emittance measurements.

2 YEARS AFTER 2000

2.1 Shutdown work

During the long 2000-2001 winter shutdown, major activities will take place in SPS: LHC civil engineering work in LSS4 within the radiation limit, installation of the LSS4 extraction, upgrade of travelling wave cavities in LSS3, modifications of the pumping ports in four sextants, removal of the equipment which was used for lepton operation.

The dismounting of the LEP collider will start immediately after the end of LEP running, in October 2000, in order to prepare the installation of the future LHC ring.

[1] Cern energy budget and accelerator schedule, K. Hubner et al AC Note (98-01)

2.2 Physics program

Presently, only COMPASS and West / North slow test beams are foreseen, but it exists some other possibilities like the continuation of NA48, neutrino beams to Gran Sasso (Figure 1). For economy reasons, from 2001 onwards, the slow extraction energy could be at 400GeV/c, with high intensity in the North area if NA48 continues; in this context, the neutrino program, if accepted would then impose a long supercycle with interleaved cycles providing beams to neutrino and to the West / North areas.

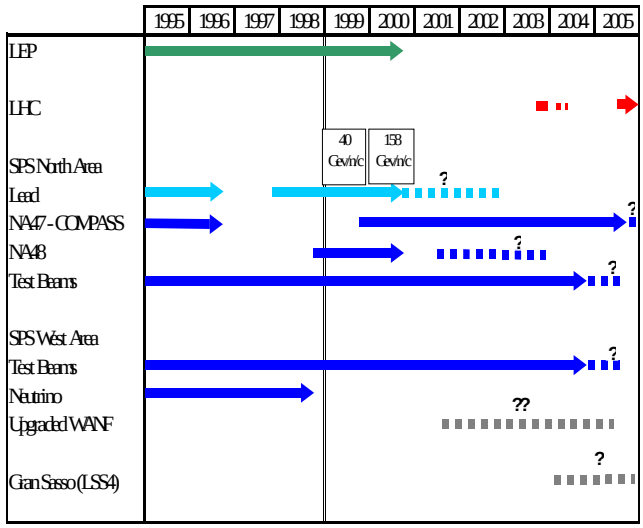

Figure 1: Possible long term physics program

3 CONSEQUENCES

The intensive campaign of requested MD's to prepare the LHC beams together with the new operation schemes will impose a large diversity of beams on different cycles and supercycles; the SPS machine operation must therefore be made more flexible to fulfil all these requirements (Figure 2). The SPS has been until now "supercycle" oriented; only functions of the current supercycle are resident in the hardware, which implies that the supercycle changes are generally slow; a "poor man" multicycling scheme, which uses the existing features of the timing to switch to alternative tables stored in the Mugef coast and recovery tables is possible but under restrictive conditions. In view of LHC, a SL/CO project is under development, which will make the SPS "cycle" oriented, under the control of a Central Beam and Cycle Management system (see Control presentations in this workshop).

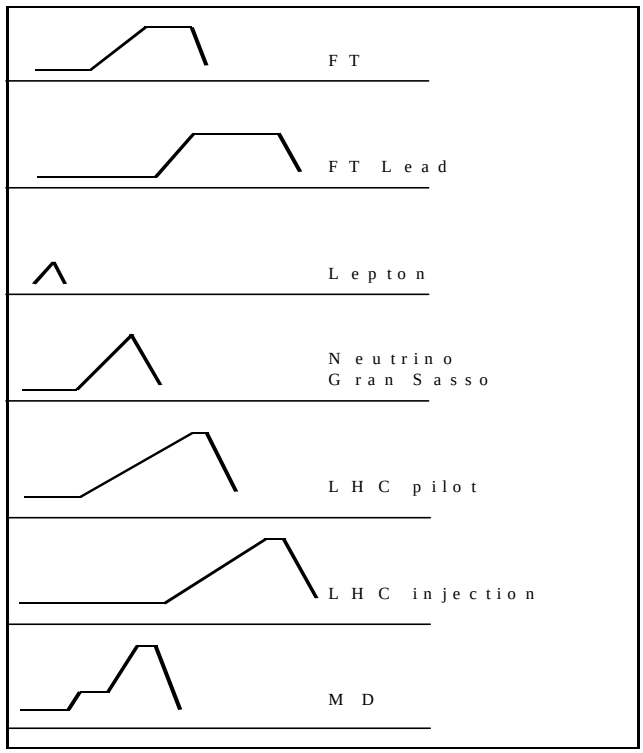

Figure 2: Examples of present and future SPS cycles

4 CONCLUSION

The coming running periods till 2002 will be slightly reduced due to budgetary constraints. All efforts will be made to optimise the LEP production while raising the beam energy at its limit; the SPS/CPS MD big blocks have been reduced to 24 hours to minimise the perturbations on LEP production and work is being done in SPS to maximise the intensity and the disponibility of lepton to fill LEP. Moreover, the always increasing demand of new operations and the intensive campaign of MD's essentially to prepare the SPS as an LHC injector will request a very high flexibility and reliability of the SPS machine in the years to come. This flexibility will necessitate important modifications in the way of sequencing the machine and a Controls project is under development to achieve these objectives before the first LHC octant injection tests in 2003.