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LIU Project at CERN

PLANS FOR THE UPGRADE OF THE LHC INJECTOR COMPLEX
The LHC injector complex is composed of 6 accelerators (Linac2, PSB, PS and SPS for protons, plus Linac3 and LEIR for other ions) which were initially commissioned with beam many years ago (up to 53 years in the case of the PS). Thanks to successive waves of upgrade and consolidation, these accelerators operate today with a high reliability and progressed in performance up to being capable to supply beam to the LHC with characteristics exceeding the nominal design goal. Moreover, many other experimental facilities benefit from beam pulses not used by the LHC, over all the energy range covered by the different synchrotrons (ISOLDE and REX-ISOLDE for the PSB, AD and East Hall for the PS, North Hall and CNGS for the SPS).
Extensive consolidation is necessary to continue to supply reliably the present beams to all users, including the LHC. However, users expect beam characteristics to further progress (e.g for LHC and for neutrino physics), and hence, consolidation is not sufficient and upgrade is mandatory. In 2010, after detailed study, the CERN management took the decision to base the future of the LHC injector complex on the replacement of Linac2 by Linac4, and on an ambitious consolidation and upgrade programme of all the other accelerators. The LHC Injectors Upgrade (LIU) project has been created to coordinate this effort.
The goal of the LIU project is to provide the beam required for the High Luminosity operation of the LHC. The main components of the LIU work programme for protons are the completion of Linac4, the modification of the PSB for H- injection at 160 MeV and acceleration up to 2 GeV, the modification of the PSB to PS beam transfer equipment for 2 GeV, and, in the PS and SPS the modification and additions required for preserving beam stability in all planes with more than twice the intensity in the same emittances (e.g. installation of new feedbacks, impedance reduction campaign, RF power upgrade, cure of electron cloud generation). The actions required in the injector complex for the High Luminosity operation of the LHC with other ions are under investigation.
The other users will directly benefit from the LIU project, thanks to the increased reliability and the improved beam characteristics.
The implementation of consolidation and upgrades can only take place during shutdowns and it is therefore tightly linked to the LHC planning. The LIU project is presently planned to complete after the second long LHC shutdown (LS2, starting at end 2017), and most probably during awinter shutdown preceding LS3. The total material cost, in addition to the cost of Linac4 (91 MCHF) is estimated approximately at 180 MCHF (80 % consolidation, 20 % pure upgrade).

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