IEFC workshop 2011

Session 6 (Thursday 24 March, 2011)

Consolidation and Upgrade Plans for the Injector Complex

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Content of Session 6

Infrastructure	EL Consolidation and Upgrade of Infrastructure	F. Duval
	CV Consolidation and Upgrade of Infrastructure	M. Nonis
Accelerators	LIU Baseline Beam Parameters and Planning	R. Garoby
	Possibility to Connect Linac4 during LS1	M. Vretenar
	Plans for the PS Injector	K. Hanke
	Plans for the PS	H. Damerau (repl. S. Gilardoni)
	Plans for the SPS	B. Goddard

Consolidation § Upgrade of EL and CV Infrastructure

- Plans for coherent upgrades during the period 2011-2025: request for project leaders to communicate any change in the assumptions.
- Important EL goal: provide the capacity to power the full Meyrin site from EDF.
- CV planning is based on risk analysis. Meyrin site will be treated first, Prevessin (SPS) last.
- Remarks:
  - Time interval between long enough shutdowns is increasing => Intense work shutdowns
  - Long term activity which will require continuity and support at adequate level during 15 years. Some additional staff is urgently needed to fulfill the objectives of LS1.
  - Shutdown work on infrastructure will create interruption of services: need for careful advanced planning with users to minimize interference. **Crucial need to minimize thermal stress on linac2!**

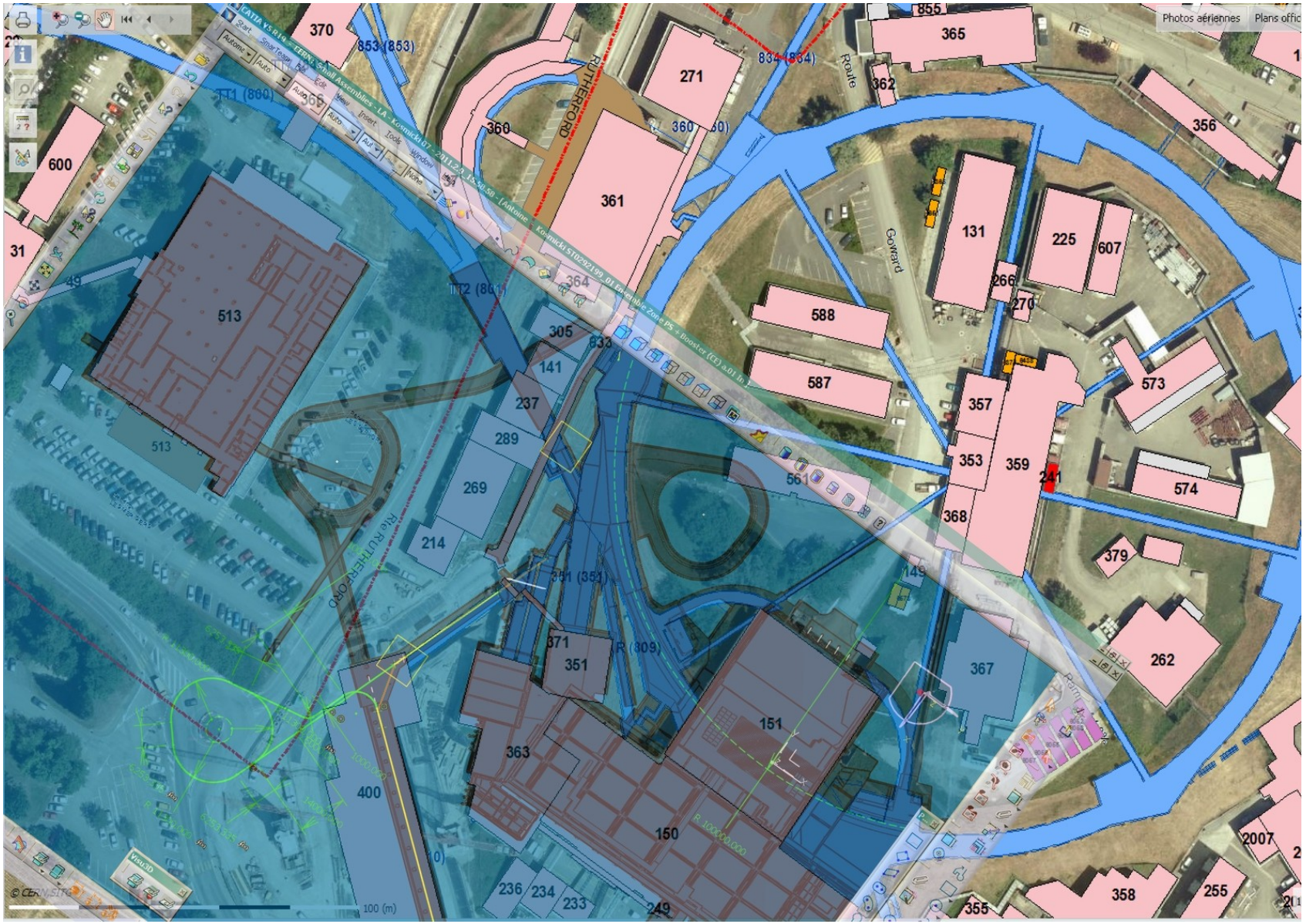
LIU beam parameters and planning

- Issues to address **in the proton injectors** are identified (the needs of heavy ions have not yet been analyzed). A number of actions deserve more study before being launched (e.g. against e-clouds).
- A significant amount of work related to upgrade and consolidation is planned during LS1 (details in the following talks).
- The RCS study will conclude in the summer 2011.
- Baseline and stretched estimates of beam characteristics after LIU (~2020):
  - With all the foreseen actions, the SPS injectors can saturate the SPS and allow for tests beyond baseline performance (« stretched »).
  - Baseline beam characteristics for 25 ns bunch trains cover part of the scenarios envisaged in HL-LHC.
  - Baseline as well as stretched beam characteristics for 50 ns bunch trains are insufficient for HL-LHC.
  - **Request for including present beam characteristics, as well as the difference between 1.4 and 2 GeV injection energy in the PS.**
  - **Need for iteration with HL-LHC…**
- No gain is expected for LHC before LS2 if Linac4 is connected to the PSB during LS1, but time would be gained adjusting PSB / PS, and work during LS2 would be eased.

Linac4 connection during LS1 and plans for the PS injector

- Linac4 connection during LS1 is feasible as a minor change to the present planning under the following conditions:
  - LHC shutdown duration is ~19 months for protons. **Possibility of recommissioning with Lead ions?**
  - Decision of (irreversible) modification of PSB has to be taken after Linac4 has successfully accelerated to 100 MeV.
  - H- source will probably not be nominal, but sufficient for getting the usual beam characteristics from the PSB for all users.
  - Resources: no obvious interference identified with the needs of the LHC during LS1…
- Baseline solution for the PS injector is the PSB at 2 GeV:
  - Main subjects: H- injection at 160 MeV and energy upgrade to 2 GeV
  - Report published with detailed hardware analysis, cost estimate (55 MCHF) and planning.
- RCS option under study (conclusion during the summer):
  - Locations: inside PS ring (difficult passage of transfer lines) or outside (longer lines and lack of space on the surface)
  - **The schedule of construction is an essential information.**

RCS: Comparison of all Locations



Plans for the PS

- PS is less advanced than PSB and SPS (late start)
- Baseline solution is with injection at 2 GeV:
  - Upgrade of the injection system (redesign of bumper, new septum and additional kicker in SS53). **In case of RCS, it should be capable to pulse at 10 Hz.**
  - Low energy corrector magnets may need replacement (under study).
- Main magnets systematically monitored. Bus bars replacement under study. Spare PFWs ordered.
- RF: need for improving RF feedbacks to reduce beam loading effects during gymnastics and displace instability thresholds. LLRF development and MD required to implement new gymnastics.
- Beam dynamics: transverse damper to be made operational and upgraded; longitudinal instability damper to design and build.
- On-going study of the e-clouds effects at 26 GeV and potential solutions.
- **Because of the cluttered cable trays, unused cables should be removed when equipments are replaced.**

SPS plans

- Baseline goal for beam characteristics at SPS ejection result from the SPS WG, in line with the presentation in Chamonix2011 (1.8E11 p/b within 2.5 mm.mrad at 25 ns spacing, 2.5E11 p/b within 3.5 mm.mrad at 50 ns spacing):
  - Based on preliminary results with low gamma-t lattice in 2010.
  - Assumes perfect cure of e-cloud effects, extensive upgrade of 200 MHz RF, improved damper, upgraded beam instrumentation, Kickers impedance reduction, etc.
- Need for MDs (204 h requested out of 336!) to precisely define :
  - Beam instrumentation
  - Cures/mitigation of e-cloud effects and outgassing of components,
  - Beam dump…
- Planning:
  - Some work in LS1 [aC coating of one sextant **(some conflict with LHC),** preparation for 200 MHz RF upgrade, improvement of beam instrumentation,…]
  - Most installation in LS2 (aC coating of full ring, finalization of 200 MHz RF upgrade,…)
- Resources: ~69 MCHF + 183 FTEs