WHAT WILL WE DO WITH BEAM IN 2009/10? - DISCUSSION

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EXPERIMENTS DESIDERATA (M. FERRO-LUZZI)

M. Ferro-Luzzi´s presentation covered the requirements from all the LHC experiments (ATLAS, CMS, ALICE, LHCb, LHCf and TOTEM) in terms of luminosity and energy taking into account the cross-section of the relevant physics processes. The presentation was followed by a discussion which main points are summarized next:

- The experiments approve the multi-bunch operation with 50 ns separation as a viable option for initial commissioning; however, they strongly recommend operate with 25 ns as soon as possible.
- The experiments do not plan to do any technical stop during the next operation with beam of the machine.
- The 8 pb^{-1} scenario quoted in slide 29 (half nominal LHC intensity) raised some concern with regard to beam operation because it corresponds to a stored energy in the beam that is about 100 times the Tevatron stored energy (present world record). At the same time the LHC magnets have a lower quench limit than Tevatron magnets. This implies that the efficiency of beam loss control and beam cleaning must be 2-3 orders of magnitudes beyond Tevatron state of the art. The LHC collimation and other systems must work at their theoretical limits to achieve this. It is not realistic to assume that this can be achieved in the first year of LHC physics. Normal problems (e.m. noise from the beam, RF heating problems, spurious losses and quenches, etc) should be expected on the way to the very high LHC beam intensities.

(LEAD) IONS IN THE LHC (J. JOWETT)

J. Jowett's presentation focused on the strategy for Pb-Pb operation of the LHC, revising the parameter space (luminosity, energy, etc), the readiness of the LHC systems to be able to cope with lead beams, and finished with a proposal for a commissioning plan for the first Pb-Pb collisions. The presentation triggered some comments which are recalled in the following:

- The machine protection system for ions may need more discussions but quite some work has been already done which is documented. The analysis of the Monte-Carlo done up to now shows that the energy deposition of lead ions and protons differs significantly only at the beginning of the impact where ions develop an initial high (Bethe-Bloch) ionization from the nuclear charge (~ Z^2). Nevertheless, after the fragmentation of the nucleus the energy deposition pattern is the same as for protons, which implies that the BLM thresholds (to avoid quenches) can be identical for Pb and for protons.
- A remark was done during the discussion concerning the feasibility of using the D1 ondulator for ions. It was made clear that the ondulator is used for the synchrotron light monitor (designed to detect protons in the abort gap) which will not work for the spectrum of radiation from ions. In order to measure the transverse beam profile of the ions, the Rest Gas Ionization Monitor (BGI) has to be used. The problem is that those monitors work with injected gas which remains an issue for operation with beam. So far, no tests have been conducted to investigate the feasibility of using those monitors without pressure bumps.

READINESS OF AND PLANS FOR THE INJECTORS FOR 2009 (E. METRAL)

This talk was devoted to the injection chain into LHC. It covered all the achievements done for the proton and ion injection during 2007 and 2008, together with plans for 2009.

- During the discussion that followed the presentation it was stressed that between August and end of September the final commissioning of ions in the injectors will take place.
- One of the achievements presented was the viability of injecting into the SPS a high intensity bunch together with a pilot bunch. Nonetheless, it was pointed out that this may not be acceptable in LHC because the LHC BPM system is auto triggered with a threshold setting. For intensities above ~ 5 10^{10} per bunch the threshold must be increased to trigger only on bunches with $I \geq 4\ 10^{10}$. This is done to avoid fake triggers due to signal reflections on the cables. When running with low intensity bunches, the threshold is set very low to trigger above ~ 10^9 per bunch. If bunches with intensities above 5 10^{10} are mixed with pilots, the pilots will never be detected/measured by the BPMs because of the trigger threshold. Therefore we do not really know where they are

and what they do. They will surely have the same closed orbit, but they could be oscillating with large amplitudes.

ARE WE READY FOR THE 2009 BEAM OPERATION (S. REDAELLI)

The talk reviewed the status of the procedures and how the were used during beam commissioning in 2008. The improvements needed for beam operation in 2009 were presented together with the requirements for ion operation. The talk was followed by a discussion where a couple of concerns were addressed:

- Currently FiDEL does not include the hysteresis of the trim quadrupoles in the model which was addressed as a source of concern for the tune control. The reason that was given for this absence in the model was that the influence of the hysteresis on tune stability has not yet been studied. Nevertheless, if it has a real effect it could be implemented in the model. It was stressed, however, that including this phenomenon in FiDEL may not have sense if the feedback is switched on. Moreover, there are studies showing that hysteresis essentially affects the convergence speed and not the achievable tune accuracy (presented in Chamonix 2006, W. Venturini and R. Steinhagen). While the tune control and stabilization of the circulating beam tunes is not an issue, the initial injection tune of a freshly recycled machine, for example, may, in the worst case, be not reproducible enough and may require re-steering prior to establishing nominal circulating beam tune. The latter matter is fairly easy with the available LHC tune diagnostics. A proposal to minimize issues concerning tune reproducibility at injection consists on operating the trim quadrupoles with a slightly non-zero current which requires some minor lattice (optics) adjustments that will have to be addressed by ABP group.
- Since the 50 ns schema seems to be a preferable option for initial commissioning, all the LHC systems have to be sure they are ready to work with this type of beam.