Summary of Session 1: Operation in 2015

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Abstract

The first session of Evian focused on the operational configuration of LHC for 2015. This paper reports on the discussions held during the session.

PRELIMINARY ASSUMPTIONS, *GIULIA PAPOTTI*

B. Goddard stated that BCMS cannot be the baseline yet, as all protection devices in the injection region and dump region need to be validated for BCMS first. J. Uythoven added that the TDI would break during an impact of 6 BCMS batches from the SPS. V. Kain mentioned that the current transfer line collimators would not attenuate BCMS beam enough to protect the downstream equipment. S. Redaelli said that experimental robustness checks with BCMS beams will also have to be carried out with collimators. R. Schmidt asked how one can be sure about the simulations. Simulation of changing material properties due to shock waves and high temperature gradients is not straight forward. S. Redaelli replied that beam tests with CfC and graphite material blocks are planned in HiRadMat. He has planned tests where full jaws are tested against injection failure (that for the moment is considered the same for injection protection and for IR7 collimators, i.e. the hit of a full injection train). S. Redaelli plans to test three full jaws: 2 with advanced materials for future upgrades and one with the present CFC. There is the hope that BCMS beams can be *faked* at HRM by using smaller beta functions to achieve the same beam size. S. Fartoukh commented on the assumed bunch length, which was agreed to be 1.25 ns. W. Hofle remarked with the current length of the MKI waveform, part of the 25 ns batch was already on the rising and falling edges. The assumption so far was that the 8.2 μs for 6 BCMS batches should still be feasible with the MKIs. J. Uythoven said the MKI waveform will be measured during the sector test.

With ATS optics the phase advance between the dump kickers and the triplet at flattop collision optics will be 90 degrees. S. Redaelli mentioned that this fact will have an impact on assumed margins for the collimator setting choice and β^* reach. J. Wenninger replied that so far for all machine protection considerations the worst case (90 degrees) was assumed, as the phase advance can change due to failures. He does not see why now the strategy for collimator settings choice should be changed in view of ATS. S. Redaelli replied that the knowledge that the phase to the triplet was close to zero provided an additional margin: "Can we use the same assumptions if we know for sure that the triplet will be hit?"

S. Fartoukh remarked that this phase advance between dump kickers and triplet changes between injection and collision and that, actually, in 2012 the situation was more critical at injection. S. Redaelli replied that anyway at injection there are other margins and this phase advance is not so relevant.

V. Kain asked B. Gorini whether a pile-up of 56 events in the beginning of the fill would require leveling. B. Gorini replied that this could be tolerated as the luminosity will quickly decay.

EXPERIMENTS' EXPECTATIONS, *BENEDETTO GORINI*

P. Collier remarked during B. Gorini's talk that the energy in 2015 will not be larger than 6.5 TeV and that only in December 2014 we will know if energy needs to be lower. The experiments are aware of the risk of having to re-run their Montecarlo simulations at a lower energy.

J. Wenninger requested a clarification of the minimum meaningful energy change. B. Gorini answered that this minimum step is about 250 GeV per beam.

B. Goddard asked for a clarification on the B. Gorini's statement: "It is accepted that running at 25 ns could result in lower delivered luminosity in 2015 compared to a 50 ns scenario". In particular, B. Goddard asked whether a factor 10 lower luminosity would be OK and B. Gorini replied positively.

P. Collier commented that the physics program for 2015 will need prioritization. Many additional physics requests with different β^* and partly different energies have been approved for 2015.

ALICE will take data during p-p separated at 6 sigma. The dump threshold of their BCM is a luminosity of 6×10^{31} cm^{-2}s^{-1}. G. Arduini asked whether bunch-by-bunch luminosity variations due to blown up bunches from instabilities will not be harmful for ALICE. With the emittance variations we saw from run 1, a factor 10 difference in bunch-by-bunch luminosity can be expected. B. Gorini replied this should be OK.

Constant luminous region is important for the experiments according to B. Gorini and R. Jacobsson. S. Fartoukh said that during β^* leveling the crossing angle should also be changed to keep the luminous region as constant as possible. J. Jowett remarked that ALICE would profit from combined β^* and separation leveling.

COLLIMATION AND β^* REACH, *RODERIK BRUCE*

B. Goddard asked how Roderik's scenarios would change if we had to assume 10 asynchronous beam dumps per year for 6.5 TeV. Roderik said that this will have a big impact. The number of asynchronous beam dumps per year should be re-evaluated. R. Schmidt wanted to know how one can know that TCTs are damaged in case. S. Redaelli answered that TCT alignment checks would be used and loss maps would be compared to reference loss maps. It was mentioned that moving the TCTs with the fifth axis in case of a scratch to a new collimating surface is not available due to integration issues.

O. Brüning asked how reliable it would be to extrapolate the measured aperture from injection to collision optics knowing that in the past there were discrepancies. R. Bruce replied that discrepancies observed in the past disappeared after a careful analysis and that, anyway, this procedure would only be applicable as a worst case extrapolation.

THE LHC NOMINAL CYCLE, PRECYCLE AND VARIATIONS IN 2015, *JÖRG WENNINGER*

J. Wenninger mentioned in his talk that with the current software tools and restrictions coming from the MCS interlock functions of the collimator re-optimizing collide & squeeze might be hampered e.g. if the orbit would have to be re-adjusted to establish collision again. M. Lamont replied that one will have to count on reproducibility. J. Wenninger added that DOROS BPMs with increased resolution will be help a lot to control the orbit at the IP with the implied liability if a single DOROS BPM would fail. M. Lamont commented that maximizing the luminosity should be the ultimate tool to keep beams in collision.

P. Collier commented that IP8 β^* leveling looked dangerous. After this remark he asked about the *structures* that were building-up over time in the IR orbit correctors, probably based on cancellations between the involved correctors. J. Wenninger replied that this was not understood but that did not pose any significant problem.

S. Redaelli said that one should not give up on combined ramp & squeeze. It could bring significant reduction in turnaround time and probably represents an easier manipulation than the other that are considered feasible. J. Wenninger mentioned that the tools are not sufficiently ready to implement ramp & squeeze.

R. Tomás asked whether the $\beta^* = 19$ m optics would be considered a step in the de-squeeze towards the $\beta^* = 90$ m. J. Wenninger replied that this would depend on the final decision for the $\beta^* = 90$ m operation, as H. Burkhardt is proposing to inject directly at $\beta^* = 90$ m.

LEVELING OPTIONS AND STRATEGY, *ARKADIUSZ GORZAWSKI*

R. Jacobsson asked in case β^* leveling does not work how long it would take to commission another squeeze. J. Wenninger replied at least 3 or 4 days. He also remarked that it will be faster to revert from collide & squeeze than from IP8 β^*. Collide & squeeze would simply need to re-separate the beams and re-adjust the TCTs. R. Jacobsson also said that even though they offer to try out β^* leveling at point 8 they want efficiency and collect as much data as possible. They offer to try β^* leveling because they believe that the machine will be able to do it and see it as an investment for the future. B. Goddard asked if in case one goes for β^* leveling in point 8 one would have to repeat loss maps at every level β^* point. S. Redaelli agreed. G. Arduini remarked that this would not have to be done for collide & squeeze and also collide & squeeze would not take place during stable beams, hence not exposing the experiments.

ACKNOWLDEGEMENTS

Thanks to S. Redaelli for proofreading the manuscript.