SESSION 5: A PRELIMINARY LOOK AHEAD

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Abstract

The fifth session of the Evian workshop was dedicated to discussions on the expected setup of the LHC during run 3, including the evolution of the injected beam parameters as the LIU is commissioned, the expectations from the experiments and the LHC configuration.

G. RUMOLO - WHAT TO EXPECT FROM THE INJECTORS DURING RUN 3

All pre-LS2 proton beams are planned to be recovered by the end of 2021, while intensity and brightness of the LHC beams will be gradually ramped up to the LIU values throughout 2022-2024. The commissioning of momentum slip stacking in the SPS for Pb ions is expected to take place in 2021 to allow delivery of LIU ion beams to the LHC for the 2021 Pb-Pb run.

Discussion

P. Baudrenghien asked whether the expectations for the first year of run 3 are realistic since the recovery of all beams in 2021 represents a large amount of work. **G. Rumolo** answered that this is the current plan, and probably the most challenging part is the commissioning of slip stacking in 2021, given the limited amount of time available for its operational deployment.

J. Jowett reminded that special beams will be needed for the proton-ion run, in particular with different bunch spacings. **G. Rumolo** answered that this will be part of the pre-LS2 performance recovery.

X. Buffat asked whether special actions were already taken to understand and control the horizontal instabilities limiting the intensity of the 25 ns trains in the SPS. **G. Rumolo** answered that a few operational knobs are known to mitigate these instabilities, at least up to a certain intensity, however further studies will be conducted during LS2 to better identify their source and assess the best mitigation strategy.

R. Steerenberg mentioned that the bunch population in the PS could not be achieved last year and the option of a Landau cavity had been considered. However, now it seems that the target has been reached in 2018, so he asked whether and why the Landau cavity is no longer needed. **G. Rumolo** answered that the improvement of the PS performance in 2018 is likely resulting from more operational optimisation as well as the new power supplies of the 40/80 MHz and broadband cavities - in particular the latter, thanks to which the saturation in the amplifier could be avoided. Following the 2018 achievements, the option of the Landau cavity has been set aside and will be only reconsidered during Run 3 (outside of LIU) if it turns out that lower longitudinal emittances or higher currents are required out of the PS.

E. Bravin asked about the main risks associated with the recovery of pre-LS2 performance. **G. Rumolo** answered that there are several new equipments and systems to be commissioned, notably the connection of LINAC4 to the PSB and the SPS upgraded main RF system. This is challenging and implies a learning curve. **E. Bravin** asked about the reliability. **G. Rumolo** answered that reliability runs have been performed with LINAC4 and additional ones are planned. For the operation of the other injectors, reliability is expected to be the same as before LS2.

B. PETERSEN - DESIDERATA AND CONSTRAINTS FROM THE EXPERIMENTS

For ATLAS and CMS the constraints are mostly unchanged, whereas for LHCb and ALICE the detector upgrade will allow for higher levelled luminosities. A fixed external crossing angle in the vertical plane would be favourable to the reduce the systematics at LHCb. Several special runs are considered including low pile-up, high β as well as collision of various ions species. They will be further detailed and prioritised during LS2.

Discussion

R. Bruce asked about the acceptable integrated luminosity loss to increase the beam energy in 2021. **B. Petersen** answered about 50%.

E. Jensen asked about the limitation due to pile up density. **B. Petersen** answered that this constraint is embedded in the pile-up and the luminous region limitations. For example, a pile-up of 200 leads to a density of 1 event/mm which is currently not manageable.

S. Fartoukh asked whether the variation of the luminous region due to β^* levelling would be an issue for the experiment. **B. Petersen** answered that this requires further studies.

N. KARASTATHIS - REPORT FROM THE RUN 3 CONFIGURATION WORKING GROUP

The bunch intensity in the LHC seem limited to $1.8 \cdot 10^{11}$ protons. To cope with this increase intensity and brightness, a large β^* range is requires for luminosity levelling representing a major change in the operational cycle. The initial β^* can be achieved within a combined ramp and squeeze, thus allowing for collision at the end of the ramp, without dedicated squeeze process. The crossing angle should be minimised to preserve the triplet lifetime.

Discussion

M. Lamont asked about the origin of the triplet integrated dose limitation of 30 MGy. **N. Karastathis** answered that it comes from measurements from the magnet group and EN-STI. It is considered a rough estimate with significant

uncertainty. **E. Todesco** added that this is the best estimate; the phenomena related to radiation could be possibly slower.
G. Iadarola asked about the impact of a higher dose in terms of shorts or failure rate for example. **E. Todesco** answered that this is uncharted territory.
P. Collier asked whether we have a strategy for the validation of multiple β^* and crossing steps within a reasonable amount of time. **J. Wenninger** answered that, qualification-wise, there is no time estimate. **S. Redaelli** mentioned that the present strategy with a thorough validation of extreme configurations with relaxed tests at intermediate configurations has been quite successful in the establishment of the combined ramp and squeeze.