DISCUSSION SUMMARY OF SESSION "RUNNING IN 2011 – LUMINOSITY"

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Abstract

The discussion during the session "Running in 2011 - Luminosity" is summarised.

EXPERIMENTS' EXPECTATIONS – M. FERRO-LUZZI

Massimiliano Ferro-Luzzi discussed the requirements of the experiments for the 2011 run. He assumed 144 days of luminosity production referring to M. Meddahi's presentation later in this session. The goals (1 fb^{-1}) and special desiderata were mentioned. Special desiderata comprised luminosity levelling for LHCb; a special energy run for ALICE; TOTEM and ALFA 90 m β* runs; luminosity calibration.

Massimiliano proposed two options for the luminosity calibration. It can be done in parasitically as end of fill studies or in dedicated fills. W. Kozanecki replied that in case of 4 TeV top energy it will have to be dedicated fills due to instrumental issues on the detector side. R. Assmann commented on the rich physics program presented by Massimiliano. He said the number of changes to the machine should be minimised to reduce the overhead. Also, a plan should be established now and not be changed again in the middle of the year.

Concerning the 90 m β* optics it was mentioned in Massimiliano's presentation to prepare the optics in several MDs. B. Goddard replied that it would be probably better for overall efficiency to have one change to the machine and finish off the 90 m β* optics preparation in one block. S. Myers mentioned that the 10 days of special physics for the experiments allocated in Massimiliano's talk will mean 10 days less at the end of the proton physics period where normally the machine reaches its peak performance.

G. E. Tonelli presented his preference for collecting 1 fb^{-1} first before switching to any special physics program to make sure that this goal is definitely met. J. Schukraft replied concerning ALICE's intermediate energy run. It was approved by the Research Board and will therefore have to be fitted in. The machine crew will have to decide when it is best. There is however an important deadline for the ALICE collaboration is a conference in May. A third of the data is impacted by the intermediate energy data.

R. Jacobsson mentioned that there was no mention of using β* to level luminosity, only separation. Using β* might be much more reproducible.

F. Gianotti was in favour of M. Lamont's proposal to put the intermediate energy run around Easter before the possible scrubbing run. Flexibility in the planning will be required. R. Schmidt and G. E. Tonelli both stressed that it would be important to show the feasibility of running at 10^{33} first before switching to any special physics. UFOs and electron cloud might be more difficult to tackle than assumed. S. Bertolucci remarked that we should concentrate on short term planning and that we do not have a choice but do the intermediate energy run. It was approved by the Research Board.

PUSHING THE LIMITS – BEAM – E. METRAL

Elias Metral summarised the situation in terms of collective effects in 2010 with impedance, beam-beam and electron cloud and the measures which were taken to stabilise the beams. He also gave an outlook for the maximum expected performance from the injectors. Landau octupoles are required to stabilise nominal bunches due to very good field quality in the LHC. Extra non-linearities have to be introduced.

L. Evans asked why we did not use the nominal parameters for longitudinal emittance. It is supposed to be 2.5 eVs. This should reduce the need of Landau octupoles. K. Cornelis added that longer bunches would naturally see more non-linearities. E. Chapochnikova replied that we were running in this configuration due to the extra margin at 3.5 TeV. Beam life times are better like this.

R. Assmann asked why bunch intensities above nominal are not the target for 2011 as it would be beneficial for luminosity. In this regard 50 ns (bunch intensities up to 1.5×10^{11}) is better than 75 ns (bunch intensities up to 1.2×10^{11}).

L. Evans said that smaller initial emittances at the moment of collisions also result in shorter emittance growth times.

F. Zimmermann commented on the statement in Elias's slides that 1.7 SEY was assumed for the electron cloud simulations where in reality it is rather between 2 and 2.5. He said that they had got the information from the vacuum team. M. Jimenez replied that in the simulations a situation after scrubbing is assumed. In addition there are long sections in the LHC with stainless steel surfaces, like beam position monitors and dampers which are not NEG coated. However, he anticipated a rapid drop in SEY with scrubbing.

PUSHING THE LIMITS: CROSSING ANGLES, APERTURE AND BETA* - WERNER HERR

Werner Herr presented the possibilities in terms of crossing angles and beta star to maximise the luminosity and providing sufficient aperture.

R. Assmann commented that there is even more margin as W. Herr had assumed nominal emittances for his estimates. B. Goddard asked whether we should not use the emittances at the end of the fill which are much larger than the initial ones to do the calculations. R. Assmann replied that the hierarchy should always be OK.

W. Herr mentioned that we should try to maximise the integrated luminosity and not the peak luminosity.

P. Collier asked whether the once proposed tilted crossing scheme could give more margin for LHCb. W. Herr replied that the beam screen orientation is fixed now. It could however give some margin at 7 TeV and 10 m β*.

LUMINOSITY ANALYSIS – G. PAPOTTI

Giulia Papotti presented an analysis of the 150 ns run luminosity data.

B. Holzer commented on the fact that the lifetimes of the two beams were consistently different. Efforts should be made to equalise them in 2011.

G. Arduini wanted to know whether for the 50 ns fill any e-cloud typical bunch-by-bunch variations could be seen. Giulia Papotti said that there is not enough statistics as it was only a single fill, but the typical electron cloud bunch differences were not apparent.

S. Myers asked whether smaller emittances from the injectors were kept small throughout the fill. V. Kain replied that indeed if smaller emittances were injected, the emittances were also smaller at the beginning of physics. However, the emittance growth times became shorter and shorter with smaller emittances and larger bunch intensities. Towards the end of the 150 ns run period the growth times at the beginning of stable beams were partly below 10 h.

Giulia had also shown the detrimental effect of the hump on the emittance during a physics fill. She claimed about 20 % integrated luminosity loss for this particular fill. The hump is most certainly a dipolar field acting in the vertical plane mostly coupling into beam 2.

V. Shiltsev mentioned that a more realistic physics model should be used for analysing the luminosity. Exponential and double exponential functions as were used in the analysis do not describe any underlying physics process.

LUMINOSITY CALIBRATION – S. WHITE

S. White reported on the results of the 2010 van der Meer scan campaign and the requests scans in 2011.

S. Bertolucci commented on the 3 % expected accuracy for the proton total cross-section measurement by TOTEM and 4 % for luminosity. He said this was unrealistic. Time should rather be spent on getting the van der Meer method and beam-gas below 5 %. S. White replied that TOTEM would bring a valuable and complimentary cross-check. H. Burkhardt also added that the 90 m β* optics should be declared a milestone for the machine. R. Schmidt mentioned that using the main quadrupoles for tune compensation as proposed for the high β* optics might hit QPS limits. This would have to be checked before.

W. Kozanecki mentioned that it would be of interest for the experiments to have several bunches in the bunch trains with fewer collisions or none to understand the systematics between low and high pile-up.

S. Redaelli said that a Roman pot takes 3 times as long as setting up 1 collimator. In 2011 more pots will be in the machine and it will have to be decided how to proceed. Either not all pots are set up or more time will have to be foreseen for the Roman pot setting up.

P. Collier asked how important it is to know the luminosity below 5 % accuracy. F. Gianotti replied that in the first half of 2011 experiments can live with an accuracy of 5 % on luminosity, but in the second half of 2011 the accuracy should be below 5 %. M. Ferro-Luzzi remarked that prioritisation will be required for 2011.

HEAVY IONS IN 2011 AND BEYOND – J. JOWETT

John Jowett presented the machine results of the first LHC ion run and set the scene for the ion run in 2011.

John had projected running at higher luminosities in 2011. S. Myers asked whether this would be OK with the predicted rate of Single Event Upsets (SEU). M. Brugger replied that the main problem is coming from EPC and QPS equipment and losses far into the arc. These losses could be avoided with re-matching the dispersion at least for beam 2.

J. Schukraft wanted to know why nominal ion luminosities were not planned for 2011. John replied that there is still a lot to be learned about emittance preservation. The hump and IBS are not under control yet.

John had proposed additional cryogenic collimators for point 2 and point 3. O. Bruning asked why cryogenic collimators are not also required for point 1 and point 5, as they also want to take ions. In any case cryogenic collimators will probably not be ready to be installed before 2016 according to L. Rossi. J.P. Tock added that the situation for cryogenic collimators should however be easier for point 2 than for point 3 due to the empty cryostat.

John had also mentioned that fewer bunches would fit into the LHC than previously foreseen due to the abort gap keeper window length. B. Goddard added that this could possibly be adjusted. It would however need an access to the machine and cannot be done on the fly.

OPERATIONAL SCHEDULE 2011 & POTENTIAL PERFORMANCE – M. MEDDAHI

Malika Meddahi presented an overview of the performance reach for 2011 with the different options, a proposal for the operational schedule and the ramp-up of the intensity.

Malika proposed to directly start with 75 ns and skip 150 ns. G. Arduini disagreed. He argued with establishing first of all a known situation. With 150 ns, very small emittances are possible and different effects can be studied separately, like the effect of head-on beam-beam. P. Baudrenghien also mentioned that they still have a not understood an issue with one cavity with 75 ns bunch spacing. Having a period with 150 ns and then switching to 75 ns to watch the behaviour of that cavity would be beneficial. R. Schmidt said that the step up in intensity with 75 ns would possibly be slower than with 150 ns. The different bunch spacing might have different EMC effects on electronics and equipment nearby.

B. Goddard remarked that we should not decide yet whether to run with 75 or 50 ns for the rest of the year. The outcome of the scrubbing run should show the direction. R. Assmann agreed as 50 ns could bring more bunch intensity.

The maximum beam energy was also mentioned. S. Myers said that if we run at 3.5 TeV we would not have to redo the luminosity calibration right away.