SUMMARY OF SESSION 6: SYSTEMS

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Abstract

Session number six focused on a set of accelerator sub-systems to address the limitations observed in 2016 and provide with possible solutions. The session also aimed at summarising the equipment performance and present new possible upgrades for 2017. This paper reports on the discussions held during the session.

FAILURE SCENARIOS AT BEAM TRANSFER
C. Bracco

During the presentation Chiara discussed possible failure scenarios when transferring the beams from SPS to LHC. In particular slide 18 discusses the possibility to hit the LHC aperture in case the TCDIs are at 5 sigmas. Beam impacts with large impact parameters are the worst-case scenario. G. Arduini asked if there is a significant difference in the response of the TCDI if they are moved by half a sigma. Chiara answered that there is no difference because the large impact parameters are the problem. If the beam impacts the collimator with a large impact parameter the beam will not be fully diluted and it could come out performing quite big oscillations of up to 12 sigma. If this beam impacts in a low beta element the energy density left in the beam could be beyond the damage threshold.

During the talk Chiara highlighted that local orbit bumps in LHC should not be neglected when addressing failure scenarios. G. Arduini commented that ULO-like bumps are meant to be consistent with the available aperture. Chiara answered that the problem is that local orbit bumps reduce nevertheless the aperture margins and bring the beams closer to the aperture limit making more likely to hit the aperture and produce damage. G. Arduini asked what is the safe aperture such if the beam is intercepted we are still below the damage limit. Chiara answered that if the attenuation provided by the TCDIs is not sufficient it is not possible to identify a safe aperture.

S. Redaelli asked if the aperture in the transfer line could be hit in case of a MKE failure. Chiara answered that in bad cases yes, however, measurements performed in 2016 revealed 15 sigmas aperture, thus there is quite some margin.

R. Bruce commented that large impact parameter could be a risk for the aperture, but then the beam goes through the whole aperture of the collimators and gets dilute, how can the emittance matters? Chiara answered that the problem is the beta function value at the level of the hit, which defines the beam size, and therefore, if enough energy is left in the beam, the energy density at the impact position can be an issue. V. Kain commented that the additional angular spread does not matter, and on top of this, the line is a single pass so the emittance is not blown up.

MKI
M. Barnes

M. Lamont asked if the “dynamic pressure rise” referred to is due to electron cloud and how this can be mitigated. Mike Barnes answered that yes the “dynamic pressure rise” is due to electron cloud - because the naked alumina has a secondary electron yield (SEY) of 10. With Cr2O3 coating, however, the maximum SEY goes down to 2.25 and therefore the expectations are that the electron cloud, and hence pressure rise, will be considerably reduced. In addition lab measurements show that the SEY of the Cr2O3 coating conditions down to ~1.3. A set of Cr2O3 coated liners will be installed in the SPS, during the SYETS, for tests with beam. The plan, if the tests in the SPS go according to plan, is to get a ceramic tube coated by June next year and install it in an MKI to see if this is a viable solution.

ADT, OBS BOX
D. Valuch

M. Lamont recalled that the loss in integrated luminosity as computed by F. Antoniou due to noise is a few %, he wonders if it is worth investing the effort in solving this issue. Daniel answered that in any case they will be working to fix other problems and the noise will be part of the package. Y. Papaphilippou reminded that there is still an unknown and considerable emittance blow up from injection to stable beams that could be coming from there. W. Hofle explained that he calculated the loss of luminosity and seems to be compatible with the 2 um shown in Daniel’s.

B. Goddard asked if now that the ADT can provide with the same functionality as the AC dipole, both systems need to be maintained or we could shut down the AC dipole. R. Tomas answered that from optics measurements point of view it is important to have both systems since they cover different regimes in strength and frequency.

R. Tomas made the remark that he has the impression that the ADT is noisier than the AC dipole. Daniel answered that this is not possible because it is a digital processing and therefore free of noise by itself.

BEAM INSTRUMENTATION

G. Trad

J. Jowett asked if it is possible to re-calibrate BSTR data from the pPb run at 6.5 TeV for the fills where the wrong calibration was used. Georges answered that unfortunately it is not possible because a proper calibration with beam was not done. 6.5 TeV Pbp is the only available data where a proper calibration with beam was carried out. However, relative differences can be used in any case.

M. Lamont asked if it is possible to reprocess the already existing data with new calibration values. Georges answered that yes, in fact the emittance plots shown by M. Hostettler where different measurements are compared over 2016 contained the re-processed data after fixing the calibration factors.

R. De Maria asked how it is possible to make compatible the changing crossing angle in case of luminosity levelling with this technique, with the DOROS feedback system. Georges answered that this needs to be assessed.

W. Kozanecki asked if the emittance plot shown by George contain the emittance reconstructed by the LHCb beam-gas vertex imaging or by the BGV. Georges answered that it is the LHCb beam-gas data. R. Alemany commented that these are the online data as we get in the control room via DIP, but the off-line data also exist and it should be more precise.

RF
H. Timko

E. Jensen pointed out that the RF team wishes to have the full detuning option operational in 2016 to demonstrate its feasibility in view of HL-LHC where this is absolutely needed due to klystron power limitations.

RADIATION TO ELECTRONICS
S. Danzeca

E. B. Holzer asked where the two events not caused by luminosity debris come from? Salvatore answered that may be they come from an orbit bump because the two events are much localised, but the source is not really known.

S. Redaelli commented that the TCL settings increases the losses but nevertheless they should remain in the shadow. We should understand, however, if something else has changed concerning failures in these regions. Salvatore answered that nothing has changed, the observed cross-sections match the expected ones in the RRs.

M. Lamont asked why the TCL are moving, S. Redaelli answered that TCLs go closer to the beam when the ROMAN POTs go in beam to protect them.

J. Jowett asked if it has been investigated why in the proton-lead run the losses in cell 8R1 and 8R5 where the reasons for the QPS failures. Salvatore answered that they have checked cell 9 not cell 8, but can be checked afterwards.

R. Schmidt asked why only the FGC-lites in the arcs would be installed during EYETS and not the ones giving problems in the RRs. D. Nisbet answered that the baseline is to exchange the RRs in LS2, but everything will be ready to do it in YETS 17/18 if needed. The exchanged of FGCs to FGC-lites in the RRs is more cumbersome that the ones in the arcs. Nevertheless, installing already the ones in the arcs will allow us to test the FGC-lite in operation. The reason why the FGC-lites are ready to be installed in the arcs and not in the RRs is that originally it was anticipated to have more problems in the arcs.

R. Alemany pointed out that the observation done during the talk concerning the possible improvement of the vacuum during 2016 is confirmed by the fact that in 2016 the beam-gas background is a factor two better than in 2015.