Minutes of the HSC section

242nd meeting on Monday 26/10/2020 (10:30 in 6/R-012)

Present: See https://docs.google.com/spreadsheets/d/1fZiu3vtf546odhd2ONxtW0mx9p8cV-fURT9Kxi7QCys/edit#gid=1045220939

1) Newcomers / visitors / departures

- Welcome to Martino Biancacci (second child of NicoloB)!

2) Comments on the minutes of the previous 241st meeting + Actions

- Some additional summaries from BenoitS

- Collimator activity meeting on Monday 12/10/2020: the planning has not changed => Next measurements are planned on Nov 2nd to 4th (TCSPM#7 and 8) and then 16th to 18th (TCSPM#9 and 10).

- Collimator activity meeting on Monday 19/10/2020: There are still serious problems with vacuum of TCSPM#6, and additional bakeouts are taking place with additional compensatory measures. It seems linked to a change of material used for the MoGr material, since both TCSPM#7 and 8 are also suffering from vacuum issues at the manufacturer. The consequences are: (i) TCSPM#6 will not be installed today as planned; (ii) TCSPM#7 and 8 will not be shipped to CERN today as planned. For us, this means that the next measurements will be delayed. If the current bakeout and compensatory measures work, then there will be 3 days/1 week of delay. If not, it will take at least 2 weeks more.

- PS-MPC: there are issues with PS wire scanners, and for instance it is not clear that the wire will be monitored with resistance measurements (meaning that we cannot monitor heating or damage => I pointed this out since Jonathan was implying that this monitoring was optional). Federico said that this issue is due to a request by TE-VSC to change the insulation cable material in new wire scanners to reduce outgassing. Also, the problem is that right now the priority is on the PSB.

- Actions from last meetings

  - Action 1 (SergeyAnt et al.): HL-LHC tolerances to beam position offsets at the Crab Cavities => To be followed up by/with RamaC. RamaC et al. will get back to us in September. Waiting for new HOM tables as they are still in the process of iterating on the design of the couplers (info from SergeyAnt on 05/11/18).

- Action 2 (BenoitS, NicoloB et al.): Provide the (current) impedance model (and wake function model) of all the CERN machines.

=> Ongoing. 2 non-mbs Summer Students joined to help in this activity. On-going.

- Action 3 (XavierB, BenoitS et al.): Follow-up of LHC instabilities (with automatic tools) => See LHC_TIM meetings (https://indico.cern.ch/category/10168/) and web site (http://lhcinstability.web.cern.ch/lhcinstability/). Done.

- Action 4 (Gianni et al.): Follow-up of heat load differences in the LHC sectors => On-going with high priority (see e.g. the ABP forum https://indico.cern.ch/event/740046/).

- After the excellent talk given by GianniI at the LMC on 29/08/18, I think that now everybody is convinced that e-cloud is the key player. The next 2 steps are

- Convince everybody that 1) in 2012 the difference in heat loads between the sectors was not present; 2) the measured load was/is reliable and 3) the measured heat load was the same or below what we had during Run 2. Was already shown in the past but it seems that there are still some questions about it => To be done at the LMC on 12/09/18.

- In close collaboration with vacuum team, try and identify the source(s)…

- Action 5 (LeeC et al.): SPS horizontal instability studies => On-going (KevinL and MichaelS could also help in the future). CarloZ will follow this up. CarloZ obtained very interesting results (see https://indico.cern.ch/event/752791/contributions/3118952/attachments/1709067/2754700/SPS_CBI_theoretical.pdf).

- Action 6 (MauroM et al.): PS horizontal instability at 26 GeV with adiabatic bunch shortening => To be followed-up by e-cloud team. For the moment, it is fine as the new scheme is currently not planned after the very good results from the PS.

- Action 7 (TatianaR, MauroM, EiriniK): PSB impedance model and related instabilities => Talk by MauroM at the LIU-PSB beam dynamics on 23/04/2018. Talk today (25/06/18) by TatianaR. Following past studies from MauroM about some missing dipolar impedances, one should try and study the effect of a HOM (scanning the different parameters) with DELPHI to see how we can reproduce the observations and give more quantitative info about the possible missing impedance. EiriniK obtained very interesting results (see https://indico.cern.ch/event/754245/contributions/3124979/attachments/1716520/2770001/PSB_HorInstability_tunescan_160MeV_EKP_HSC.pdf). Planned MD on Monday 12/11/18.

- Action 8 (ClaudiaT et al.): LHC BTF studies and possible instabilities due to noise

1) Try and explain the factor 3-4 between 2016 and 2017 (whereas the impedance

model should be the same within ~ 10-20%).

2) What is the exact mechanism leading to instability? Is it the one from XavierB (with the white noise), drilling a hole in the stability diagram?

3) To be studied also in the presence of ADT and see if the modes observed are those from impedance as well as the rise-time.

=> Discussed at the LBOC on 27/03/18. To be continued to fully understand the mechanism behind. On-going.

- Action 9 (AdrianO): Continue and finalize the space charge studies on SPS TMCI => Discussed on 09/04/18, on-going and on-going discussions with A. Burov et al. On-going: See also simulation results included in ICAP18 paper + https://indico.cern.ch/event/763977/contributions/3171002/attachments/1738041/2828049/TIwithSC_SPS_AOandEM.pptx + MDs being done in the SPS before the end of the run.

- Action 10: GianniI raised the question about the bunch length to be used for HL-LHC instability studies. Until now we have been using the rms value from a Gaussian distribution => To be reviewed in the future in case there are good arguments to use another function (such as the q-Gaussian). Nothing for the moment.

- Action 11 (LottaM et al.): Detailed simulation studies to try and explain the 16L2 instabilities in 2017 => Some first simulation results were discussed on 23/04/2018 and others today (09/07/2018). To be continued. Some update discussed today (09/07/18). Talk at LBOC on 31/07/18 (https://indico.cern.ch/event/746500/contributions/3087758/attachments/1695578/2729100/LBOC_20180731_16L2update.pdf).

- Action 12 (MarioB et al. and MichaelS): SPS coherent tune shift bunch-by-bunch: can we reproduce this from theory/simulation using the SPS impedance model (staring first with the resistive-wall)? => To be done by MichaelS after his PHD (as COAS).

- Action 13 (OlavB): Detailed simulation of the quadrupolar impedance to be performed for the 4-pole structure => Done.

- Action 14 (DavidA et al.): Try and solve the numerical issue in https://indico.cern.ch/event/712792/contributions/2937067/attachments/1619147/2574980/LandauDampingForISRinstability_EM_19-03-18.pdf and compare the results with other codes. Should not be a high priority for DavidA => To be followed up by EliasM.

- Action 15 (DavidA et al.): Check the TMCI results with tune spread (same numerical issue as above still to be solved) and compare the results with other codes. Will be done with NicolasM.

- Action 16 (SergeyAnt): Check the effect on Im[Z/n] of the HL-LHC coated inner triplets. Presented at WP2 on 03/07 and no measureable effect

(https://indico.cern.ch/event/741104/contributions/3059804/attachments/1679470/2697601/Impedance_effects_of_the_HL-LHC_coated_inner_triplets_WP2.pptx).

- Action 17 (OlavB): Understand why a 4-pole structure has exactly the same dipolar impedance as the one with 2 parallel plates. Not high priority. Info from OlavB: "Probably the best way to do it is to use the Schwarz-Christoffel Mapping as suggested by Simon Hirlander. This will be a big project in itself, and will probably require that we have a technical or maybe even a PhD student to do it".

- Action 18 (OlavB): Finalize the work on multi-polar impedances and document it. High priority (before retirement). Info from OlavB: "The multipolar structures should be able to reduce the transverse impedance to zero. Many simulations still to be done to verify this. In order to strongly reduce the longitudinal impedances, the structures should probably be made of high impedance materials with low dielectric constant. Studies should still be done to understand the relationship between image charges and image currents." OlavB suggested also to investigate single ended measurements of the transverse impedance, i.e. without using hybrids.

- Action 19 (DavidA): Plot the increase in real and imaginary parts of the impedances (dipolar and quadrupolar) for 2016, 2017 and 2018 compared to 2015. Plot also the case 2017 compared to 2016 for ClaudiaT and her LBOC talk on 27/03/2018 => Done.

- Action 20 (DavidA): Finalize the impedance and related instability studies for the EOS and do the same for Injection and Flat-Top => Still to be finished.

- Action 21 (NicoloB, DavidA and XavierB): Summarize all the past comparisons between predictions and measurements of LHC transverse instabilities at high-energy vs Q' WITHOUT ADT => Still to be done (it is quite high priority for our LHC instability studies!).

- Action 22 (Everybody): Some volunteers (2-3 people) for the ABP BBQ on 28/06/18 => Done: we have 2.

- Action 23 (NicolasM): Try and answer to the request from RogelioT's team to estimate the amplitude-detuning contribution of collimators => Started and some presentation at impedance meeting on 15/06 and also HSC on 25/06 (see https://indico.cern.ch/event/738175/contributions/3046069/attachments/1673678/2686078/20180615_impedance_meeting_nonlinear_terms_slide8.pdf): CST and analytical formula works.

- Action 24 (XavierB for week starting on 21/05/18): Beam stability studies for HL-LHC => Try and make the scenarios more robust by ensuring enough spread for the small BCMS emittance also during the collapse of the separation. Subsequent simulation work is needed by RiccardoDM and YannisP's team => Done but new version still to be read/commented (see Action 29 below) => Done. BUT DA seems not so good so we need to find other parameters: an optimization is therefore still needed. News from XavierB on 05/08/19 (and discussion together), who updated the note on the octupole strategy with DA plots from Nikos: https://cernbox.cern.ch/index.php/s/JPM3ER2w4ktdCJI. It seems difficult to

reach configurations with a tune separation larger than 5E-3, with either polarities. RogelioT said that a correction below 1E-4 is challenging, and PACMAN linear coupling (non-correctable) also gives a contribution in that order of magnitude. This does not seem compatible with the recommendation of C- / (delta Q_min) < 0.1 (see page 3 of http://cds.cern.ch/record/2301292/files/CERN-ACC-NOTE-2018-0002.pdf). Check what can be done and if we relax our request to ~ 0.2 (instead of ~ 0.1), what would be the required octupole current to compensate.

- Action 25 (FrancescoG): In the framework of the beam-induced RF heating, collect somewhere all the "maximum temperatures" for all the different equipment, e.g. due to interlock or past observations, etc. Done: warning and damage limits are now indicated (when possible) => See reports at https://rfheating.web.cern.ch.

- Action 26 (Instability team): Organise and perform the tests at injection (to try and reduce the coherent activity and associate emittance blow-up) and high energy (to continue and check the margins) => Still on-going => See for instance results of these studies during coming week 33 (coupled to some studies to reduce the RF voltage at injection). News from XavierB on 05/08/19: done and results reported at Evian2019.

- Action 27 (BenoitS et al.): Finalize the HL-LHC impedance report and send it to GA asap => Done by BenoitS et al. Next: I have to re-read it before sending it to GA => Done (a 2nd time) and comments will be given tomorrow (07/08/18) to the impedance team before sending the new version to GA (proposed deadline for the impedance team to send it to GA: Friday 17/08 => Was sent to GA on SU 19/08).

- Action 28 (SergeyA et al.): Scaling of impedance and related stability for collimators vs. gap and resistivity (assuming only 1 collimator; all collimators; all the machine)? => On-going. To be reported at next WP2 meeting on 21/08 (https://indico.cern.ch/event/750135/).

- Action 29 (EliasM): Final reading of HL-LHC paper from XavierB => Done.

- Action 30 (BenoitS et al.): Possible use of a solenoid in the SPS ZS? => It seems that there is still the suspicion of electromagnetic fields inducing the sparking. Do we have an EM model of the ZS? It would be great if we could understand the origin of this limitation. Remark:

> - Sparking in the ZS mainly occurs mainly when the bunch length of the LHC beams becomes very short, i.e. during the last part of the ramp and at flat top. This conditions slowly with time.
>
> - Had also lots of sparking with the 8b4e beam (which was also slightly improved with time, but still it was relatively strong). This points more towards electromagnetic fields induced by the beam rather than electron cloud.
>
> MarioB could help in this activity. CarloZ will follow this up. CarloZ is following this up: he started to contact some relevant people and to identify some impedance modes which could play some role. To be followed up.

- Action 31 (BenoitS et al.): EDMS document "Continuous Transfer Decommissioning in the PS Ring" Under Approval => There is a couple of points related to impedance (potential reduction) that would be good to answer.

- Action 32 (BenoitS et al.): Participation and follow-up of PaoloF's meetings for impedance aspects. BenoitS mentioned that the integration with the wrong layout was checked by BenoitS and RiccardoDM and noticed at the ECR level. This was clarified and now there should not be anything.

- Action 33 (SergeyAnt): Check DQW Crab Cavity impedance and related effects after new simulations (with new CST software), if the latter are confirmed/understood. Linked to Action 1.

- Action 34 (YannisP and EliasM): Review the situation of machine settings for starting after TS1 (tunes, chromaticity, octupoles) in view of continuing the studies on the beam 1 / beam 2 lifetime difference => Done by GianniI.

- Action 35 (SergeyAnt and EliasM): TMCI measurements and implications for HL-LHC => What would be the impact of the various impedance scenarios (with present collimation system, with upgraded collimation system after LS2 and with full collimator upgrade) on TMCI threshold and implications in terms of stability? Done and DavidA gave a talk at WP2 on 24/07 (https://indico.cern.ch/event/743627/contributions/3071936/attachments/1692446/2723312/2018-07-24_Amorim_WP2_v2.pptx). Still some follow-up to be done by DavidA to answers to the questions raised during the meeting => Done https://indico.cern.ch/event/752407/contributions/3116866/attachments/1717559/2771554/2018-09-18_Amorim_WP2_HL_TMCI_update_v2.pptx.

- Action 36 (AdrianO): Re-simulate the SPS Q26 optics as this is where we have the largest disagreement with AlexeyB. On-going. AdrianO (and RiccardoDM) could restart the GPU server with the aid of HerveM on Monday 27/08/18.

- Action 37 (EliasM): Follow-up of the issue with the mouse of the 6/R-012 room. Done by AlessiaV.

- Action 38 (EiriniK): Compare the pictures of the nTOF gammat-jump before and after optimization => Done in the last slide of the MSWG talk on 13/07/18 https://indico.cern.ch/event/735644/contributions/3034031/attachments/1686408/2712004/nToFoptimization_MSWGmeeting_13072018.pdf

=> No dramatic changes, a small change at the extremities according to MAD-X.

- Action 39 (DavidA et al.): TMCI for HL-LHC at WP2 ~ mid July (exact date tbd) => Done on 24/07 + Follow-up of questions raised during the WP2 meeting. See Action 35.

- Action 40 (SergeyAnt et al.): Detailed explanation of the effect of coating collimators at WP2 ~ mid August (exact date tbd) => Linked to Action 28.

- Action 41 (NicolasM and SergeyArs): Check that the CFC conductivity of the collimators is the smallest one in the direction of the beam (it should be a factor 5 larger in the transverse plane, according for instance to NicolasM's PHD thesis on p.183) => NicolasM mentioned that this was discussed at the WP2 meeting on 24/07: it seems clear that all the LHC collimators were not cut in the wrong direction (where the resistivity is much higher than in the other 2 directions, by a factor ~ 5). However, it seems that a doubt still exists in the other 2 directions where the resistivity could different up to ~ 30%. Next: see Action 46 below.

- Action 42 (XavierB and instability team): continue to try and decrease the Landau octupole current at flat-top to see where the limit is. We are at 450 A at the moment… Linked to Action 26. News from XavierB on 05/08/19: done and results reported at Evian2019.

- Action 43 (XavierB and instability team): feedback from ABP about the use of the ADTObsBox => I will answer to DanielV on 07/08/18. Done and sent by XavierB (fine for DanielV).

- Action 44 (Everybody) for Monday 13/08: Pros/cons of moving to Prévessin.

    - People relying on public transportation to come to work from the Swiss side, will be heavily penalized.

    - We will get away from experts in materials properties from the TE dpt (unless they move as well); close collaboration with them is often useful for e.g. resistivity characterization / knowledge of coating properties / etc.

    - One should think of a better shuttle service (i.e. much more often than every hour or so, and running also early in the morning / late in the evening), or, better, trying to get a public bus or tram up to Prevessin.

    - If going to a new building, try and improve the temperature control.

    - Other pros to go to Prévessin:

        - Closer to CCC,

        - Closer to BE-RF and TE-ABT colleagues,

        - Chance to be in a building that is in a better state and healthier (in our building: asbestos, woodworms, lab dust, radiation from PS complex, humidity, temperature).

    - Other pros to stay in Meyrin:

        - Much easier to reach by public transport for students and visitors. CERN shuttle service would not compensate the loss,

- Much more central: most things happen in Meyrin,

- Closer to all general services (bank, Uniqa, post office, doctor, football pitch),

- Closer to most technical groups and experiments,

- Very nice and useful PS cafeteria,

- That must depend on home location, but for BenoitS for instance, traffic in the morning would get significantly more difficult => It would be more convenient for people living in Prévessin and Eastward in Pays de Gex, but much worse for all the others,

- Restaurant 3 is really far from the standards of R2 and R1, and many would commute every day at lunch time.

- Action 45 (EliasM et al. => XavierB and NicolasM) by the end of 08/18: Detailed analysis of beam stability for Run III for a reference scenario provided by StéphaneF, highlighting in particular the "delta" from the new LS2 collimators. Done: talk done on Sept. 21st at the Run III meeting (https://indico.cern.ch/event/746728/contributions/3130409/attachments/1720381/2777223/20180921_RunIII_impedance_considerations.pdf).

- Action 46 (NicoloB et al.): Linked to action 41 above, we should try and measure on a bench a collimator and see which resistivity we have in the 3 directions. Some meas. done on CFC and measurements revealed large difference between directions.

- Action 47 (EliasM): Will check all the ECRs and comment them as of now (checking that it is fine from impedance and e-cloud in particular).

- Action 48 (EliasM): Check past predictions about the effect of the serigraphy on SPS beam stability in transverse (following some nice analysis from CarloZ, which seems to be the possible explanation of some recently observed horizontal instability) => Seems indeed to be confirmed by pyHEADTAIL simulations (but still work in progress), as could be seen in the talk by CarloZ at the ABP Injectors Day 30/04/19 (see https://indico.cern.ch/event/799216/contributions/3388235/attachments/1836192/3008570/Impedance_ABPday_v3.pdf).

- Action 49 (EliasM et al.): Continue the discussions with DanielV to check what the ADT is sending to the beam (compared to what we think is sent). Also important after the results of the recent tests with reduced ADT bandwidth (and instability observed while increasing the gain by 30%) and possible future MDs to use the ADT on excitation mode for Landau damping studies. XavierB checked the actual gain and it seems to be more than 200 turns instead of 50 (05/11).

- Action 50 (XavierB et al.): Provide the lists of recommended parameters to assure beam

stability in the LHC (during the full cycle) for the (main) different beams which can be used in operation or MDs, and present them at some future LBOC meeting => 1 bunch (or few bunches) not colliding; 1 beam; 2 beams. Others? One should try and provide in particular some information about the requirements on octupole strength as a function of brightness to provide guidelines for the definition of the settings for future calibration fill or special runs.

=> Done at LBOC on 27/06/2017 (https://indico.cern.ch/event/648641/): it is the same for 2018.

Maybe in the future we could try and do more to separate according to the different kind of beams (at least 1 bunch and full beam) and LHC phases (injection; FT; etc.).

- Action 51 (XavierB and NicolasM): There are always a lot of discussions about the emittance growth from injection oscillations (as the steering of the lines seem difficult these days) => Would be great to show on some slides what the emittance growth is predicted with the chroma we have (~ 15 units), the octupoles we have (~ 60 A) and the ADT damping time we have (~ 10-20 turns? tbc). As the ADT damping time is very fast, it should be fine but would be good to have some simulation results (partly done already in the past by XavierB). Done: see https://indico.cern.ch/event/658828/contributions/2687995/attachments/1507882/2350735/coherentEffectsatInjection_LRC_14-08-17.pdf.

- Action 52 (DavidA): for TMCI in HL-LHC, try also and compare to a case for HL-LHC with the same settings (gaps) of the collimators. Done.

- Action 53 (EliasM to answer to W. Hofle): What is our requirement wrt the ADT (at injection and high energy) for the report being compiled by O. Brüning on the full energy exploitation of LHC (7.5 TeV)? => After discussion with W. Hofle and X. Buffat, it was decided to have:

1) Injection damping time: 10 turns.

2) High-energy damping time: 50-100 turns.

3) Noise: reduction by a factor of 4 at full bandwidth, i.e. bunch-by-bunch (there would then be also the reduction of bandwidth as an additional means to reduce noise).

- Action 54 (EliasM et al.): Report at the LMC about the instability studies status => Will be done once finalized (both at injection, after the RF voltage reduction, and high energy).

- Action 55 (GianniI et al.): Perform simulations of e-cloud instabilities at LHC (and HL-LHC) injection, scanning the RF voltage at injection (currently reduced in the LHC from 6 MV down to 4.5 MV, with a last step to be done at 4 MV) to try and study the impact on the required chromaticity and octupole settings to stabilise the beam. Planned with GianniI (as discussed few days before HSC meeting of 06/05/2019). Status on 28/05/19

(GianniI): Simulations presently running in Bologna (including an intensive convergence scan). It will take a few weeks to accumulate 20000 turns. Should be able to present some first results towards the beginning of July (LHC intensity) and aim at having a more complete picture in fall.

- Action 56 (DavidA et al.): Check beam stability from impedance for high-beta run at injection (collimator settings sent by RoderikB) => Done by D. Amorim and N. Mounet (see slides today – 03/09/18 – to be also discussed at the CollWG in the afternoon).

- Action 57 (BenoitS and LottaM): finalize the contributions to Evian2017. Done by BenoitS.

- Action 58 (LMC action for LHC coordination and BE-OP): continue to explore beam parameters (voltage and octupoles) in a controlled way. Done.

- Action 59 (SergeyAnt et al.): Action for us for the HiLumi meeting to review the strategy and further optimization of the impedance reduction, in particular for after LS2 => Should we work more on geometric part? Or RW? Or some other collimators? For this we need to have a plot per collimator of the octupole needed with RW only and with RW + geometric part (with all the usual assumptions of the OP scenario: Q' = 15, assumed collimator settings, etc.). It would be also interesting to have the same plot produced to see the improvement in the required octupole current vs. the possible upgrade made by adding the case where the collimators geometric impedance would have been reduced to the (reasonably) bare minimum (which does not mean that this will be done...). Done.

- Action 60 (SergeyAnt and NicolasM): Check that the split in Landau octupole current between the different collimators is fine (as NicolasM raised the point of the non-additive contribution of the different elements (leading to different modes, etc.). Done and there is no perfect solution as the octupole currents are anyway not additive. The least bad approach is maybe to consider a machine without collimators first, compute the octupole threshold, and then gradually add up each collimator impedance and compute the resulting octupole threshold. But the order in which one chooses the collimators, will matter...

- Action 61 (KevinL): What is the (detailed) explanation of the transfer line (between SPS and LHC) instabilities? => Discussing with KevinL, it seems that this was due to e-cloud and once the SPS was scrubbed the instability did not appear anymore => Is it really the cause and is it really fully understood? See also IEFC 15/06/18: https://indico.cern.ch/event/736870/contributions/3039866/attachments/1668465/2675680/01b_Instabilities.pptx.

- Action 62 (DavidA): Continue the past studies on instability rise-time above TMCI intensity threshold (using the SPS Q26 case) by looking in particular at the intra-bunch motion in the different regimes => On-going.

- Action 63 (BenoitS et al.): Send to StefanoR our quantitative estimate for the collimator impedance in parking position => Done:

https://indico.cern.ch/event/763977/contributions/3171005/attachments/1746563/2828067/20181105_HSC_impact_oldTCSG_in_parking_RunIII.pdf. NicolasM did it, from the resistive-wall + taper impedance point of view: there is no impact from the secondary collimators in parking (<0.06% on the impedance itself, not visible impact on the octupole threshold). As BenoitS mentioned, there might still be the issue of the non-touching RF-fingers => BenoitS is following this up.

- Action 64 (XavierB et al.): Send input to DanielV before the end of the year if we need some modifications on the ADT system (the "baseline" is: no concrete input from ABP before December, the damper after LS2 will be exactly the same as today). => Evian19 as deadline? Done.

- Action 65 (machine coordinators => NicoloB): Send the week summary to GA, RS and all the SLs. Done by NicoloB.

- Action 66 (NicoloB): to finalise the identification of the source of the LEIR instability, come back to the initial configuration (termination) on the KQFHV31 (old BTF kicker) to see if the damper is then still needed to stabilise the beam. Done: in the end, the culprit for the LEIR instability at injection without damper is UHV41 (old BTF pickup) => It is now disconnected.

- Action 67 (CarloZ): In the framework of the PSB instability studies, check Sacherer's formula for instability rise-times from the HOM at 1.7 MHz with Q = 100. On-going and the issue could come from the considered bunch spectrum (Gaussian vs. Sinusoidal modes…). At least the difference is not coming from the relativistic beta factor.

- Action 68 (AdrianO): Check what the reason is for difference in stabilizing octupole current for HL-LHC with pyHEADTAIL simulations compared to past predictions (~ 300 A) => Seems to be a factor ~ 2 lower (as mentioned by NicoloB and SergeyAnt, it might be due to the different transverse distribution used in the past (quasi-parabolic) instead of Gaussian here). Solved by AdrianO (different parameters used).

- Action 69 (EliasM and MassimoG): Check the maximum speed between 0 at ~ 1.5 sigmas for HL-LHC => Revision of separation bump collapse time for HL-LHC with MassimoG, DavideG, XavierB and NicolasM and it is OK.

- Action 70 (XavierB): Analysis of the 150 Hz oscillations on the beam observed during the last part of the run => High priority and quite urgent as if we knew where to look, we could maybe have a look with ions. Would be good also to know when this started to appear => See also with HSI section.

- Action 71 (XavierB and EliasM for March 2019): Document in a note why we think that for HL-LHC it will be OK with LOF < 0, whereas we had some issues in 2012 (explaining therefore what we think happened in 2012). Note written by XavierB and commented by EliasM on 04/05/19 (should be released soon).

- Action 72 (AdrianO): Re-do the same simulations to study the effect of space charge on the SPS TMCI with Q26 but using the space charge parameter of Q20 (i.e. ~ 5 instead

of ~ 27). Then re-do also the same simulations but for the Q20 optics.

- Action 73 (XavierB): Check WP2 actions => Results and plans for the future. Done.

- Action 74 (EliasM): Following some checks/comparisons from SergeyArs, check GALACTIC (both theory and simulation results) => Done by EliasM for the comparsion between GALACTIC (and GALACLIC) and Laclare's approach: see https://indico.cern.ch/event/788200/contributions/3275041/attachments/1780791/2896974/SummaryOfMy3IPAC19papers_EM_17-01-19.pdf. Some past comparisons between GALACTIC and DELPHI were shown in https://cds.cern.ch/record/2652200/files/CERN-ACC-SLIDES-2018-0003.pdf.

- Action 75 (SergeyAnt et al.): Perform pyHEADTAIL simulations with space charge to try and reproduce the measured stability diagrams (with the damper used as a controlled impedance) and compare with some past analytical estimates. See also some past studies in https://journals.aps.org/prab/pdf/10.1103/PhysRevSTAB.11.014201. On-going (06/05/19).

- Action 76 (XavierB, by 14/01/2019 to be ready also with the DA simulations by HSI by the end of January in preparation of the collimation review that is going to take place on 11-12/02/2019): Check the stability limits (i.e. telescopic factor/octupole current required to stabilize the beam during the collapse of the separation bumps) for the ultimate scenario and BCMS emittance for the 3 cases already considered (No collimator upgrade, LS2 upgrade, baseline upgrade) but for POSITIVE octupole polarity => Done by XavierB (see HSC meeting of 21/01/2019).

- Action 77 (WP2 team, < 25/02/2019: exact date still to come…): Contributions will certainly have to be sent to GianluigiA for 1st draft of the new version of HL-LHC TDR + HiLumi book (proposed to be done in parallel and the info should be sent to LucioR and OliverB by 25/02/2019) => Work on TDR is ongoing with some updates from EliasM for the part on beam stability (as of 20/02/19). Done (as of 06/05/19).

- Action 78 (ClaudiaT and impedance team): Check the factor ~ 1.5 stronger impedance than model from BTF measurements in the LHC (see HSC meeting on 17/12/2018) => Done and seems to be in agreement with other observations from impedance team (see Action 81). Reminder: BTF was done on B1H at top energy.

- Action 79 (DavidA et al., during LS2): (i) taking all the impedance measurements performed so far, try and conclude on the impedance of the LHC for B1H, B2H, B1V and B2V at the different phases of the LHC cycle (done, see Action 81 below); (ii) perform beam dynamics simulations with the measured impedance model and compare with the results with the ideal one.

- Action 80 (SergeyAnt with NHTVS and NicolasM with DELPHI): quantify the required tune spread to stabilise a single bunch assuming that we are running at a factor ~ 2 (~ 3) below TMCI (for Q' = 0) with ADT, and that the impedance is ~ 2 times higher. => Done on 18/02/2019 : non-linear effect confirmed by NHTVS and DELPHI (with LHC impedance model) but smaller than GALACTIC (with broad-band impedance model) => Is the difference due to the different impedances ? To be looked at in the

future (see Action 83).

- Action 81 (Impedance team for Wednesday 04/02/2019): quantify the factor between the measured impedance-induced tune shift and the predicted one for B1H, B1V, B2H and B2V in the LHC at flat-top => Done, see slides from today's meeting (18/02/2019): https://indico.cern.ch/event/795854/contributions/3306471/attachments/1791211/2923590/2019-02-11_tune-shifts_measurements_16-17-18_v2.pdf.

- Action 82 (SergeyAnt with NHTVS and NicolasM with DELPHI): check which impedance would be needed to reproduce the past measurements with Q' < 0 (see summarising plot from LeeC et al.) => Done on 18/02/2019 => No simple impedance factor can reproduce the past measurements. Furthermore, some differences appear between NHT and DELPHI for Q' < 0 => To be followed up.

- Action 83 (SergeyAnt with NHTVS and NicolasM with DELPHI): as a follow-up of Action 80, compare results with GALACTIC (see https://indico.cern.ch/event/794757/contributions/3306443/attachments/1789562/2915350/DestabilisingEffectOfADTwithLargerImpedance_EM_04-02-19.pdf) if the same impedance as GALACTIC is used (see http://accelconf.web.cern.ch/AccelConf/ipac2018/papers/thpaf048.pdf) => Concluded on 06/05/19 (see slides by NicolasM: https://indico.cern.ch/event/818165/contributions/3417043/attachments/1838893/3014013/20190506_NMounet_HSC_action83_DELPHI.pdf).

- Action 84 (SergeyAnt with NHTVS and NicolasM with DELPHI): Try and understand (at some point… low priority) why a significant difference seems to be observed for Q' < 0 as a region with 0 current in octupoles is observed in DELPHI contrary to NHTVS.

- Action 85 (DavidA): all the predictions of LHC transverse tune shifts from impedance are made with Sacherer's formula (using dipolar and quadrupolar impedances) and it should be compared to pyHEADTAIL simulations in the future to see what is the error made (should be within few tens of % depending on the longitudinal distribution, but we are now at this level of precision between measurements and predictions…).

- Action 86 (SergeyArs): Check the longitudinal impedance of the HL-LHC pumping holes and evaluate to possible beam-induced RF heating. Try and estimate the impact of a certain randomization of the pumping holes. These results should be then presented at the WP2. BenoitS looked at it and concluded that it is small.

- Action 87 (?): Detailed analysis of the different stages of a realistic model of the LHC transverse damper implemented in pyHEADTAIL. In other words, how does it compare quantitatively to a perfect bunch-by-bunch damper as concerns the single-bunch and coupled-bunch stability vs. chromaticity and Landau octupole?

- Action 88 (AdrianO): Using the same parameters as in IPAC18 paper (and the broad-band resonator), try and identify from pyHEADTAIL simulations when and how the 2-mode approach starts to become important. => Done on 25/03/2019.

- Action 89 (AdrianO): Following the same approach as for Action 88, find the curve of

stability for Landau damping WITHOUT transverse damper, to be able to compare to the case WITH transverse damper (and compare to predictions https://indico.cern.ch/event/807899/contributions/3362767/attachments/1816203/2971974/LDforTMCI_EM_25-03-2019_2.pdf).

- Action 90 (KevinL, AdrianO and LottaM): Try and understand why the results of the new pyHT simulations from MauroM for the PS instability at injection are not the same as with the HT code and published in the PAC07 paper (see https://accelconf.web.cern.ch/accelconf/p07/PAPERS/FRPMN074.PDF) => This is important and urgent to do this as other people such as FrankZ also obtained some strange results: is there an issue or is it a matter of "correctly using pyHT"?

- Action 91 (DavidA with DELPHI, SergeyAnt with NHT, AdrianO et al. with PyHT): The effect of the longitudinal distribution on the instability rise-time seems quite important for Q' = 0 => This should be confirmed, first, if it is the same thing with the threshold octupole current. Could this be that the effect of the controlled longitudinal blow-up on the longitudinal distribution has such an important impact for Q' close to zero?

- Action 92 (DavidA, SergeyAnt, SergeyArs, BenoitS): Question from GianluigiA triggered by the IPAC19 paper from FrankZ et al. "Updated high-energy LHC design" => What is the expected tune variation vs. bunch position expected for the LHC at injection and flat-top due to impedance? Might be good to compare the past LucVos' predictions (see Ref. [28] of the IPAC19 paper) with NHT (for which the "Arbitrary filling pattern" will be discussed by SergeyAnt on Monday 29/04/19) and pyHT. Similar studies should be done for the SPS (CarloZ and GiovanniR) => Already started by MichaelS. BenoitS and DavidA started to look at that (29/04/19).

- Action 93 (NicoloB et al.?, with a timeline which remains to be defined as this should require some code development): study the SPS transverse stability with ions and slip-stacking. Profit also from the visit in FNAL in June to learn from their experience, as I saw some nice simulations from them in the past (at least in longitudinal…).

- Action 94 (EliasM et al.): decide on the place and date for the HSC hiking day (many thanks SergeyAnt for the excellent proposals!) => Not possible before the summer vacation. Will see at the end of the summer.

- Action 95 (EliasM et al. for HSC section): Follow up list of actions from ABP Injectors Day held on 30/04/12 (https://indico.cern.ch/event/799216/)

> - ABP-ID-1: "LEIR – The possibility to use Tune kicker or the transverse damper for optics measurement is under investigation (NicoloB). Clarify the status and possibilities".
>
> - ABP-ID-2: "SPS horizontal instability is the major challenge. What to do after identification, already seen at 1.8e11 protons/bunch. => Review the findings by September 2019. Extrapolation after impedance reduction campaign".
>
> - ABP-ID-3: "Produce comparison impedance models before and after LS2 for

each machine and evaluate observables to compare with".

- ABP-ID-4: "Define measurement programme for validating the models and include it in the re-commissioning planning".

- ABP-ID-5: "LottaM is looking at PS electron cloud. Margin for longitudinal and transverse emittance? Is the transverse feedback sufficient to counteract electron cloud instabilities? End of 2019".

- ABP-ID-6: "Strategy for correction of the coherent vertical tune shift along the batch. End of 2019".

- ABP-ID-7: "Trade off SPS 200MHz HOM damping and transverse stability. Proposal by September 2019".

- ABP-ID-8: "Transverse stability for ions in slip stacking. End of 2019".

- ABP-ID-9: "Optics study at LEIR: define (with MassimoG and RichardS) the plans for optics measurements and requirements and include in the recommissioning planning."

=> See 1st status report on 04/07/19 (https://indico.cern.ch/event/829903/contributions/3474994/attachments/1874561/3086173/ABPinjectorsMeeting_EM_04-07-2019.pdf).

- Action 96 (EliasM et al. for HSC section) from WP2 meeting of 02/07/2019 (https://indico.cern.ch/event/826475/): Estimate the effect of electron cloud, impedance, and beam-beam force on the observed crabbing. Done for beam-beam during HSC meeting on 23/03/20.

- Action 97 (XavierB et al. for HSC section) from WP2 meeting on 09/07/2019 (https://indico.cern.ch/event/831847/): As a follow-up of the talk from XavierB (on "Summary of instability observations: implications for HL-LHC"), GianluigiA mentioned that it would be important to identify which measurements we would like to do during Run 3: what do we want to measure and how do we plan to do? Would be great to have a written procedure. SergeyAnt stressed the importance to have a reliable measurement of Landau damping (estimated for the moment either with BTF or anti-damper) and GianniI suggested also to try and profit from the Van der Meer cycles to try and perform some of our measurements => Deadline: end 2019 – beginning 2020.

- Action 98 (EliasM et al. for HSC section): Following discussion with GianluigiA (on 09/07/19) and previous discussion with RogelioT, StefanoR, MassimoG and YannisP:

- If we want for HL-LHC to use a tele-index of 1.7 and LOF < 0 (keeping the same assumptions as in the 2019 collimation review), what would be the maximum bunch intensity with the LS2 upgrade?

- Similarly to the previous study, what would be the minimum beta* which

could be reached for the nominal HL-LHC intensity, LOF < 0 and tele-index of 1.7?

- Contact RoderikB to have his latest collimators' settings (after optimization of the optics to reduce the impedance and improve the collimation efficiency) and check what would be the gain in octupole current when the LS2 upgrade is assumed?

- As a follow-up of Action 98 (and after discussion with GianluigiA, YannisP, XavierB and NikosK):

  - XavierB: update the stability plot from collimation review, without coupling => Needs r ~ 1.9 (instead of 1.7) for LS3 upgrade and ~ 2.2 (instead of 2.0) for LS2 upgrade.

  - NikosK: check the required r for DA such that there is enough space, i.e. to have a tune separation of 5E-3 with tune accuracy of 1E-3, i.e. 6E-3 tune separation.

  - Then, see with this r what is the required coupling correction to achieve this => With RogelioT and see if this is feasible.

  - And then finally see what would be the intensity limit with the assumed feasible parameters, both with LS2 and LS3 upgrade and with LS2 upgrade only.

  - Finally, it was recently mentioned that cryo will need ~ 15 min before going in collision at 5E34, starting at ~ 1.5E34 => What are the implications for us, as it would mean collide at ~ 2 m?

- Action 99 (EliasM): EliasM (and YannisP) to send some feedback to GianluigiA et al. on the Fermilab Experiment by end of August. Done.

- Action 100 (XavierB): Detailed analysis of the effect of the radial modes (with the Circulant Matrix formalism) for the case of the SPS TMCI with a BBR impedance. => Done by XavierB (see HSC meeting of 09/09/2019). To be documented in 2020 (paper alone – which it would deserve - and as a part of a paper with EliasM and GiovanniR).

- Action 101 (CarloZ): Show the final exact formula obtained for the indirect space charge wake function, not discussed during the presentation of last HSC meeting. Done, see new slides for the HSC meeting held on 02/09/19.

- Action 102 (BenoitS): Following WP2 on 03/09/19 and discussion about possible issue with badly terminated BPM (equipment), we should try and see what are the predictions from simulations (similar study as for the Crab Cavities…).

- Action 103 (BenoitS et al.): Following TCC on 12/09, follow up the issue of much higher impedance measured in COLDEX with laser treatment.

- Action 104 (XavierB and NicolasM et al.): As a follow-up of past discussions on LHC instabilities at high energy (also at Zermatt), (i) try and identify a possible HOM which could explain the measurements of Landau octupoles threshold vs. chromaticity and (ii) try and plan some (coherent instability) studies in the future with a ADT gain closer to the expected instability rise-time (less gain should mean also lower noise from the ADT…but then there are the other sources of noise etc.). SergeyAnt started to look at that (discussion on 21/10/19). To be finalised and documented by end February 2020 (by SergeyAnt) and then followed up (by XavierB) looking also at the effect of a distorted longitudinal distribution and nonlinear synchrotron motion (as started by AdrianO).

- Action 105 (WP2 members involved): Follow-up of WP2 actions => See https://indico.cern.ch/event/850078/ where I presented the status and next steps for HSC.

- News from GianniI on 30/01/20 for these actions https://indico.cern.ch/event/850078/contributions/3572946/attachments/1912009/3160187/electron_cloud_coh_inch_effects_23082019_uptodate_GI-EM.pdf :

- "Done for single bunch stability…" => Update on Q1-2020: presented by LucaS at WP2 meeting on 10/12/19, to be finalised and documented by Summer 2020.

- "Study of coupled bunch stability…" => Update on second half of November. Presented by LottaM at WP2 meeting on 10/12/19. Origin of the dependence of the pattern along the train to be investigated by LottaM in 2020.

- "The electron cloud instability threshold…" => Deadline to be defined once simulation of the arcs is completed. Present focus is understanding the mechanisms and simplifying models.

- "Study of incoherent effects…" => Update end of 2019. Status presented by KostasP at WP2 meeting on 10/12/19. First tracking studies for LHC should come in 2020.

- News from GianniI on 30/01/20 for these actions https://indico.cern.ch/event/850078/contributions/3572946/attachments/1912009/3160185/electron_cloud_buildup_GI-EM.pdf:

- "In the crab cavities…" => End of 2020: LorenzoG presented the status and plans at the e-cloud meeting on 24/01/20.

- "Y-chambers…" => Action on hold pending clarification with WP12. VincentB confirmed that there is NEG coating.

- "Understanding of the origin of…" => Long-term action. Ongoing. Status of the studies presented in 2 notes CERN-ACC-NOTE-2019-0057 and CERN-ACC-NOTE-2019-0041.

- "Electron cloud build-up in the triplet BPMs…" => GianniI to clarify with WP13 whether these electrons or heat load are an issue. Had a couple

of iteractions with M. Krupa from BI. It was agreed that the coating of the body and the stripline will be performed. Presently, GalinaS is evaluating the effect of residual electrons. Results could be presented in Spring 2020".

- "Study the impact of the ionization…" => End of 2019. Presented by LottaM at WP2 meeting on 10/12/20.

- Action 106 (ABP injectors members involved): Follow-up of ABP Injectors actions => See https://indico.cern.ch/event/847707/ where I presented the status and next steps for HSC.

- Action 107 (A. Oeftiger et al.): Simulate the SPS Q26 instability with the real (most advanced) impedance model instead of the broad-band impedance model (once the comparison with YuriA's model is finalised with the broad-band impedance model first).

- Action 108 (N. Mounet et al.): Analyse carefully the possible HL-LHC modes with positive real part, looking at their rise-time and required Landau octupoles current to reach beam stability.

- Action 109 (Everybody): Try and finalise/complete etc. the table I presented at the SC workshop on the beneficial/detrimental effects on TMCI.

- Action 110 (B. Salvant et al.): A factor ~ 1.5 more impedance is measured in LHC at high energy from coherent tune shift and BTF => What can be the reasons and consequences on the required Landau octupole current to stabilize the beam?

- Action 111 (E. Metral et al.): Following WP2 meeting on 29/10/19, start to think about possible LHC MDs for LHC during Run 3 => LHC MD day on 28/01/2020

- MD1: Investigate orbit offset on collimator impedance (see for instance talk from SergeyAnt https://indico.cern.ch/event/858460/contributions/3614738/attachments/1934485/3205298/TCSPM_Measurement_Summary_WP2_29.10.2019.pdf).

- Other MDs discussed during HSC meeting on 18/11/19.

- Action 112 (B. Salvant et al.): Finalise the study of the impedance of the HL-LHC e-lens and crystal collimators and include them in the HL-LHC impedance model. Reminder: both equipment have been approved at the LIU/HL-LHC Cost and Schedule review of November 2019.

- Action 113 (N. Mounet): Check whether the change of the weld position has any impact looking at the round and flat optics taking into account that for the triplet and D1 both beams are going through the beam screen.

- Action 114 (N. Mounet): For LHC Run3, check beam stability over the full cycle (including low-mu fills) and decide on the octupole polarity (=> with GA an WP2).

- Action 115 (B. Salvant et al. within the IWG): Try and help developing a better longitudinal impedance model for HL-LHC.

- Action 116 (to be assigned …following comment from GA at WP2 on 19/11/19) on e-lens: Study what happens in terms of losses and blow-up when the beam oscillates and start to touch the areas with large diffusion rates similarly to what we do to study what happens when the crab cavities should fail with the difference that for crab cavities we can detect the malfunctioning of the hardware and the issue is to make sure that the phenomena occurring before the malfunctioning is detected and the beam dump are not such to generate phenomena. For the case of instabilities we do not have other detection mechanism triggering the beam dump other than beam losses (at least at the moment).

- Action 117 (B. Salvant et al.): Try and measure the tune shift of the LHC collimator TCSP.A4L6.B2 for which a second taper has a huge (100%) contribution (see talk form S. Antipov at Impedance meeting on 22/11/19).

- Action 118 (G. Iadarola et al.): Try and measure the predicted mechanism of loss of Landau damping due to e-cloud at LHC injection (see talk from GianniI at e-cloud meeting on 22/11/19).

- Action 119 (G. Iadarola et al.): Study in detail with simulations all the effects separately to better understand the contribution from each effect such as head-tail phase shift, detuning with Jx,y, etc.(see talk from GianniI at e-cloud meeting on 22/11/19).

- Action 120 (BenoitS): Check with ManfredW a possible issue with a LHC BPM in Q5L8, which would be badly terminated.

- Action 121 (XavierB and SondreF): Inform CC people asap if CC noise has to be reduced for beam stability considerations (and by how much).

    - From WP2 163 (26/11/19) => Determine noise limits from stability considerations (Xavier); Study the dependence of latency and diffusion rates on impedance (SondreF); Study with simulations or theory whether the interplay between impedance and noise can lead to an enhancement of the noise amplitude (Elias => See Action 122).

- Action 122 (XavierB and NicolasM): Is there a way to simulate the combined effect of noise excitation and impedance? Yes, might have some results in few months…

- Action 123 (LottaM): Cross-ionization increases the electron and ion densities up to at least 1E17 m-3. Based on previous instability simulation studies (with a different initial state without cross-ionization, but similar average electron and ion densities), this could be compatible with the observed instabilities => To be shown and then we close this subject (after presentations at WP2, LMC and documenting it).

- Action 124 (Gianni et al.): After the detailed convergence check of LucaS, check some past results where the convergence was not reached to be sure that we did not have (too) wrong conclusions, e.g. with the study of the required bandwidth of an intra-bunch damper to damp e-cloud instability (with KevinL et al.).

- Action 125 (XavierB and NicolasM): Following the issue mentioned during past LMCs on some RODs, we need to pass the message that it is very important for us. How? We should really push to have the maximum Landau octupole current available in the future, motivating the people to repair all the defected octupoles but we need to find the correct criterion (as it is true that 1 or 2 missing shouldn't be a problem… but when does this start to be a problem? and we should not wait to be close to a problem…).

- Action 126 (EliasM or several members from HSC, still tbd): Present the LHC MDs on collective effects during the LHC MD day on 28/01/2019.

- Action 127 (BenoitS and IWG): Try and identify which LEIR equipment could be (mainly) responsible for the horizontal instability observed at ~ 17 MHz with a Q of ~ 3-4 (see talk from NicoloB at HSC on 09/12/19).

- Action 128 (EliasM): Define a set of reference measurements and tools for beam stability monitoring year-to-year on a consistent basis : injectors and LHC.

- Action 129 (NicolasM): What are the beam stability predictions from DELPHI with the plausible resonator impedance identified by SergeyAnt (HSC, 16/12/19)?

- Action 130 (BenoitS): Is there anything that could give rise to the resonator impedance identified by SergeyAnt (HSC, 16/12/19)?

- Action 131 (WP2 people involved for WP2 meeting on 25/02/2020):

    - Update on impedance police actions (VELO measurements and simulations, MKI, need for beam screen rotation, HL tertiary cllimator, New RF deformable RF fingers) (B. Salvant, N. Mounet, et al),

    - Laslett tune shift for the HL-LHC scenarios (S. Antipov),

    - Impedance model of the LHC: summary of the present understanding of the measurements (detuning with intensity, growth rates, BTF) (X. Buffat, E. Metral).

- Action 132 (LottaM and pyHT team, from HSC 13/01/20): try and understand the bumps in the simulations made by NicolasM, which disappear with the number of MacroParticles (to be taken into account in the required number of MPs). Done (HSC 27/01/20).

- Action 133 (BenoitS, SergeyAnt, XavierB): WP2 meeting on 10/03/2020 devoted to be impedance and related instabilities (https://indico.cern.ch/event/881273/).

- Action 134 (All supervisors of students): Follow the new procedure put in place for DOCT (see HSC meeting on 27/01/2020).

- Action 135 (Everybody involved): finalise all the MD notes from LHC run 2, before April 2020 (reminder from RogelioT at the LHC MD day on 28/01/20) => Current status:

1) MD note on 16L2 by BenoitS.

2) MD1787 (Rise time versus chroma and damper settings at injection energy) => This MD was initially planned to measure growth rate versus chromaticity at LHC injection energy, but due to technical issues it never happened. It was replaced instead by a quick test on the TDI impedance. Done: Sent by NicoloB to RogelioT on 05/02/20.

3) MD2490 (Measurement of the TMCI Threshold at Flat-Top) => To be finalised by DavidA et al.

4) MD3308 (Instability growth rate versus chromaticity at injection) => Sent by DavidA to NicoloB. To be reviewed before publication.

5) MD3310 (Complex tune shift as a function of the intensity for single bunches at top energy) => To be finalised by DavidA et al.

6) MD3318 (Impedance contribution of Secondary and Tertiary collimators) => To be finalised by DavidA et al. I read it and gave comments on 19/02/20.

7) The notes from MD1446 (done, 20/04/20), MD1447 (done, 20/04/20), MD1875 (done, 20/04/20), and MD2191 are complete from our side and they are within the collimation team => StefanoR and AlessioM are aware and they are following this up.

=> To be finalised by April (as agreed with RogelioT).

- Action 136 (CarloZ): Serigraphy design of the MKP from CATIA ST1235174 (email from Wim Weterings on 27/01/20) => Feedback needed by week 9 (which for them is end of week 8, i.e. 21/02/20).

- Action 137 (BenoitS and impedance team): Following proposal from SergeyAnt to minimize the Horizontal impedance first as it is higher than the Vertical one, decide on the strategy to adopt => Done (20/02/20). Check done by NicolasM with B1 whereas SergeyAnt studied B2 and with a different method => Proposed list:

B1 (TCPs are already in)

TCSG.D4L7.B1

TCSG.B4L7.B1

TCSG.E5R7.B1

TCSG.6R7.B1

B2 (with TCPs)

TCP.D6R7.B2 [already available for installation]

TCSG.D4R7.B2

TCSG.B4R7.B2

TCP.C6R7.B2

TCSG.E5L7.B2

TCSG.6L7.B2

- Action 138 (BenoitS and impedance team): Comment about the EDMS documents on TCDS and TCDQ; Crystal primary collimators.

- Action 139 (XavierB and NicolasM): Send to DanielV our requests in terms of ADT settings for Run 3 (and HL-LHC, knowing that for that we will still have time in the future to further refine our requests if needed).

- Action 140 (XavierB): Following the new analysis of transverse beam stability at the end of squeeze and during the collapse (see HSC meeting of 24/02/20), we need also to review what happened in 2012 to be sure that we fully understood the situation there (as correctly pointed by GianluigiA) => Already done (as of 25/02/20): the plane perpendicular to the separation plane during the async. collapse was treated properly at the time (see Fig. 4.10(a) of XavierB's PHD thesis http://cds.cern.ch/record/1987672/files/CERN-THESIS-2014-246.pdf). The issue arises with the presence of the large Piwinski angle in HL without crab cavity.

- Action 141 (NicolasM): Following the check of the prioritised list of collimators (see Action 137), once we know exactly the final list of collimators we need to update our intensity limit for LHC.

- Action 142 (NicolasM&XavierB for 1st action and GianniI for 2nd): following the special LHC Run 3 meeting of FR 28/02/20,

> 1) we should present clearly our results and predictions (and assumptions etc. with, in particular, the point I mentioned below), and in particular GianluigiA would like to see what happens (as concerns our transverse instabilities) when we increase the intensity from ~ 1.1E11 p/b (as we had in 2018) to ~ 1.8E11 p/b, vs. transverse emittance, to see what needs to be done and when (i.e. vs bunch intensity) to stabilise our beams.
>
> 2) we should present what we think we need as stabilising knobs (in particular chroma and octupoles) to stabilise our instabilities at injection between ~ 1.1E11 p/b (as we had in 2018) and ~ 1.8E11 p/b and what would be the corresponding transverse emittance.

- Action 143 (CarloZ): Following the WP2 meeting on 10/03/2020, compute (Qy-Qx)

for each bunch as this is what is important for linear coupling => Done by CarloZ and presented at WP2 meeting on 21/04/20.

- Action 144 (NicolasM and XavierB): Following the discussions at the Special LHC Run3 meeting of Friday 03/04/20 on the "factor 2" in octupoles current, review and document the HL-LHC case where no margin exists for learning curve, operational flexibility and possible HW non-conformities.

- Action 145 (NicolasM and BenoitS): Check that the cooling capacity is sufficient to cool even a fully grazed TCDQ.

- Action 146 (BenoitS and GianniI): How many ECRs and Functional Specifications did the impedance and e-cloud team comment over the last years? Anything that we should change in the procedures?

> => Answer by GianniI (07/04/20): in a year, he got in the order of 5 documents, which are collected here: http://ecloud.web.cern.ch/documents_and_slides/#engineering-change-requests-ecrs. No comment on procedure. Usual reminder: this kind of requests should come enough time in advance (when it is still possible to make modifications on the design in case issues are found).

- Action 147 (GianniI): Following the new analytical work on Ecloud in DELPHI (HSC 20/04/20), it might be useful at some point to compare with what Perevedentsev did in the past (https://cds.cern.ch/record/585578/files/p171.pdf) => GianniI looked at it and recovered Perevedentsev when some approximations are made but his formalism is more general (being documented in the CERN note, 23/04/20).

- Action 148 (GianniI, XavierB et al.): The new formalism from GianniI (Ecloud in DELPHI, HSC 20/04/20), including the detuning impedance, could be used to continue our studies on the effect of detuning impedance to try and explain the destabilising effect in the PS (from MauroM's PyHEADTAIL simulations) and we could also compare to XavierB's BimBim code => GianniI showed during the HSC meeting on 27/04/20 that his code reproduces well results from PyHEADTAIL when impedances are considered (driving and detuning): it can be used for extensive scans.

- Action 149 (NicoloB and NicolasM): Taking into account radiation (while waiting for measurements), it would be great to have the best estimate from your side of the conductivity of all our CFC collimators: 5 micromOhm? 10? 15? => It seems to be a huge work according to NicolasM, so let see what can be reasonably done and which assumption seems the most realistic.

- Action 150 (XavierB): As a follow-up of the talk given at the WP2 meeting on 21/04/20, study the possible mitigation of Shakiri effect (scanning beta* and crab angle to obtain the available parameter space with the separation in the crossing plane).

- Action 151 (XavierB and SondreF): In the framework of the studies of the noise-excited instabilities, benchmark/check studies with ValeriV (see some of his results mentioned in HSC meeting of 04/05/20).

- Action 152 (AdnanK et al.): Follow-up of the chipped MoGr block for the TCSPM#3, which has a small chip at the final edge of the active surface.

- Action 153 (SebastienJ and EliasM): Study the effect of an inductive impedance on top of the usual BBR for the SPS TMCI, using DELPHI. See also Action 159.

1) Simulate the usual SPS case with a (BBR) Broad-Band Resonator impedance (fr * taub = 2.8, Q = 1, Rs = 10 MOhm/m, Q' = 0, etc.) => Already done!

2) Simulate the same case as 1) adding a pure inductive impedance such that it is 5-10-15-20-25-30-50-100 times bigger than the low-frequency inductive part of the BBR.

3) Simulate the same cases as 2) but adding a (very) strong reactive damper (say with a damping time of 1 turn or even less, to be checked) such that the main mode 0 is not shifted (to mimic the effect of space charge).

For each case:

a) Plotting the real part of the modes vs. intensity

b) Plotting the imaginary part of modes vs. intensity

c) Looking at the intra-bunch motion vs. intensity

- Action 154 (GianniI and e-cloud team): Now that we have a better understanding of our e-cloud simulations and theory (with the recent Vlasov solver of GianniI), it would be interesting to see at some point (when you will have time and finished your detailed analysis) a comparison between your exact results and the simplified formula I used in the past for the SPS (see https://cds.cern.ch/record/550194/files/ps-2002-009.pdf), based on the TMCI from a broad-band impedance (describing the e-cloud) using some scalings with intensity and beam-size from F. Zimmermann et al. The simplified intensity threshold is given by Eq. (38) and some plots in Figs. 8-9-10-11. Of course, this was only a very first simple model... Let see what the comparison will reveal!

- Action 155 (XavierB for instability team, BenoitS for impedance team and GianniI for e-cloud team): Check/comment the 2 EDMS documents (LHC-BGC-ES-0001 v.0.9 and LHC-BPW-ES-0001 v.0.9) as concerns impedance and e-cloud considerations as well as specifications in particular for beam instability measurements.

- Action 156 (BenoitS et al.): Plan for future impedance measurements (as of 03/06/2020)

- **June 17/18 (TCSPM#1)**
- **June 18/19 (TCSPM#2)**
- **June 24/25 (TCSPM#3)**
- **June 25/26 (TCPPM#3)**
- July 8/9 (TCLD#4)
- July 9/10 (TCLD#5)
- July 27/28 (TCPPM#5)

- July 28/29 (TCPPM#4)
- August 31/Sept 1 (TCSPM#5)
- Sept 1/2 (TCSPM#6)
- Sept 30/Oct 1 (TCSPM#7)
- Oct 1/Oct 2 (TCSPM#8)
- Oct 29/30 (TCSPM#9)
- Oct 30/Nov 2 (TCSPM#10)

=> The most difficult part and highest priority are the first 4 collimators, and the first one of these may be more difficult as it is a new type (even if it is close to the TCPPM we already measured).

- Action 157 (XavierB): Start to collect all the information linked to the LHC beam instrumentation related to beam instability analyses (all the available instruments, their bandwidths, etc.) and put this information on our instability monitoring webpage.

- Action 158 (EliasM): Reserve some parasitic MD slots in CERN PS in Spring 2021 to perform some studies with VadimG (from GSI, with OliverBF and VladimirK) on "Stability diagram reconstruction with anti-damper, octupoles and space charge".

- Action 159 (SebastienJ): Can an inductive impedance suppress the TMCI? Interesting first results from Sebastien (discussed with him on 03/06/2020) => To be continued with some issues observed with DELPHI (to be clarified with NicolasM). Would be good also if someone could help him to do similar simulations with PyHEADTAIL (without necessarily looking at the modes for the moment but looking at the instability growth-rate to check how the TMCI is modified with increasing inductive impedance). First status report presented on 15/06/2020.

- Action 160 (EiriniK): With the past results of the CERN PSB horizontal instability and the recent similar results of the ISIS vertical instability, try and fully understand why the instability is sometimes observed only in a portion (core) of the bunch. Did we observe this also with the PyHT simulations?

- Action 161 (CarloZ): With the past results of the CERN PSB horizontal instability and the recent similar results of the ISIS vertical instability, try and fully understand why/how the instability radial mode number depends on the tune. => Done on 22/06/20.

Answer on 22/06/20: attached to HSC section meeting of 22/06/20 is a plot (https://indico.cern.ch/event/930254/contributions/3910212/attachments/2061341/3457927/GR_vstune_modedependence.png) from a theoretical estimation of the horizontal growth rates at natural chromaticity as function of the betatron tune for the PSB case. Changing the tune from 4.22 to 4.3 the mode number is also expected to change. For the explored tunes the theory predicts that mode 2, 3 and 4 should be observed. A similar dependence of the mode number on the tune has been observed also in measurements when sweeping the tune around 4.26. See for instance (slides 27-29 of the following talk of EiriniK: https://indico.cern.ch/event/827063/contributions/3489226/attachments/1890085/3116854/KOUKOVINI_PSBsim160MeV_HSC_5Aug2019.pdf).

- Action 162 (NicolasM and XavierB): they received some info sent by RoderikB et al.

to study the HL-LHC beam stability with updated parameters => Deadline by end of June (or beginning/mid of July) and then send info to YannisP. WP2 end of July.

- Action 163 (NicolasM): Following a discussion on specs for LS3 collimator material with StefanoR et al. on 16/06/20, it would be good to see what would be the octupole threshold change if we would install collimators in graphite with Mo coating at 55 and 100 nOhm m for the slots foreseen for the phase 2. => Done on 22/06/20: neglecting the impact of graphite vs. MoGr, the impact is expected to be at worse 1% (22/06/20).

- Action 164 (NicolasM and GianniI et al.): Check, with DELPHI, the results from GALACTIC as concerns the coherent space charge modes, trying to reproduce (or not…) the figures of Slide 6 of https://indico.cern.ch/event/932629/contributions/3919088/attachments/2062309/3466054/SCmodesFromGALACTIC-ComparisonWithBimBim_EM_29-06-20.pdf without and with radial modes (and others if possible with more modes and larger space charge parameters) => See also slide 21 of https://indico.gsi.de/event/10458/contributions/45035/attachments/31926/40534/MitigationOfTMCIthroughSC_EM_30-06-2020.pptx.

- Action 165 (EliasM and/or any person interested ;-)): Re-derive/extend the past simplified theory of emittance exchange (see https://cds.cern.ch/record/529690/files/ps-2001-066.pdf or https://journals.aps.org/prab/pdf/10.1103/PhysRevSTAB.10.064003), using the same formalism but without making the adiabatic assumption and compare to the recent result from https://journals.aps.org/prab/pdf/10.1103/PhysRevAccelBeams.23.044003.

- Action 166 (XavierB): To try and compare only the space charge part without the incoherent force between GALACTIC and BimBim, what is the resulting plot from BimBim? (the result from GALACTIC can be found here: https://indico.cern.ch/event/930254/contributions/3913895/attachments/2060477/3458415/SCmodesFromGALACTIC_EM_22-06-20.pdf). Reminder: space charge here is modelled as a “negative inductance”.

- Action 167 (SebastienJ): To try and compare only the space charge part without the incoherent force between GALACTIC and DELPHI, what is the resulting plot from DELPHI? (the result from GALACTIC can be found here: https://indico.cern.ch/event/930254/contributions/3913895/attachments/2060477/3458415/SCmodesFromGALACTIC_EM_22-06-20.pdf). Reminder: space charge here is modelled as a “negative inductance”.

- Action 168 (EliasM and/or any person interested ;-)): Solve GALACTIC and/or another Vlasov solver (DELPHI) with space charge self-consistently to 1) see the differences between the non-self-consistent and the self-consistent approaches and 2) try and reproduce the BimBim results.

- Action 169 (all WP2 people involved, to be discussed with GianluigiA et al. on 08/10/20): follow-up of all the WP2 actions (see HSC meeting from 31/08/20).

- Action 170 (team working on LHC): As proposed by GianluigiA, can we apply impedance localization measurements to find whether there is a localized HOM source

(Extra HOM-like impedance to explain the high octupole threshold at Q0 ~ 0 in the LHC)?

- Action 171 (AdnanK): Redo the detailed analysis of the LHC and HL-LHC TMCI studies with EDELPHI, instead of DELPHI (or PyHT) + Sacherer to compute the effect of the detuning impedance.

- Action 172 (GianniI et al.): Fully understand the new slow instability (before the main mode coupling) revealed by e-cloud in the LHC dipoles (see e-cloud meeting from 09/10/2020).

- New actions from this meeting:

- Action 173 (BenoitS et al.): organize a zoom meeting with Erion Gjonaj from GSI to see how to collaborate and help him/them even more on all the impedance aspects.

3) General infos and follow-up (EliasM)

- SLM

- COVID-19
  - Access list is replaced by an "exclusion list" as of 19th October at noon. Only people falling in the exclusion list (vulnerable, older than 70, and those excluded by HSE) will not be able to access CERN. All other MoP are given automatic access.
  - The call for volunteers for flu vaccine campaign was successful as now there are enough volunteers for the Prevessin site.
  - Extraordinary meeting of Swiss health government took place recently: Swiss government is now requesting to favour TW, inviting International Organisations to follow this advice. On 20th October, there was a discussion at the ED and we will then know if there will be implications on the teleworking policy. We got more news since then.
- ATS management board confirmed non-installation of 11T dipoles during LS2.
- **SPS Ion run in 2021**: SPSC discussed ion run and are not strongly requesting an ion run in 2021. They're waiting to know the length of the SPS YETS during 2021 – 2022. The MKP installation in SPS will entail a longer 2021-2022 shutdown and it would mean injectors should stop earlier in 2021, with consequent implications for the ion run. Will know more after the meeting on 23rd with the LHC experiments. At the moment, the length of stop 2021 -22 is rather short: 4 weeks (including the Christmas break).
- R. Billen mentioned that soon we will receive request proposals for VIA projects.

- MKPL measurements by CarloZ et al. on WE 14/10/2020 => See talk today.

- Zoom meeting with AdrianO for possible collaboration between GSI and CERN => Indirect SC + resistive wall effects for SPS. GiovanniR and CarloZ (and HannesB) informed.

- Discussion also with Erion Gjonaj for possible collaboration (to be approved by the German ministry of science) => See Action 173.

- LHC summary (GianluigiA)

    - AOB: NXCALS data accessibility (C. Roderick)

        - Recent issue with the NXCALS DB: inability to extract data <36 h old. Indeed two events one with no impact and the other one creating temporary "holes" in the data accessible. Resolved now with no loss of data. Both solved by IT-DB

        - Due to corrupted metadata in HBASE. First time this problem has been seen. Origin not understood yet

        - Possible implications for the future operation of the post-mortem need to be fully assessed

        - IT-DB is investigating the original cause and a post-mortem analysis is ongoing

        - Additional technical solutions are being discussed including alarms

    - Optics repository of the CERN accelerator complex (R. De Maria)

        - Not only for the LHC but also for the injectors

        - FIDEL and field quality should be added to the model

    - ECR approvals and ECR workflow (A.-L. Perrot)

        - New project to streamline the process of updating Layout DB, MADX and GEODE. Involves ABP, EN/ACE and BE/CO. Started in October

        - Upgrade of the BRAN Luminosity Monitors in IR1 and 5 approved (the new detector should be more sensitive than the present one)

        - Minor intervention in UJ18 in view of SND (LHC Scattering and Neutrino Detector) proposal => Approved

    - Simulating the effect of beam-beam on beam lifetime with GPUs (K. Paraschou)

        - Quite a number of questions: effect of noise to be included, effect of the transient due to the adjust process. It is clear that we have now an interesting tool to exploit to understand the behaviour of the beam in collision.

    - AOB: Effect of the synchrotron tune on e-cloud instabilities (G. Iadarola)

        - Question from Elena on the difference with respect to the SPS: in the SPS the effect of voltage is stronger because of the longer bunches that we have at injection in the SPS.

- AOB: An update of the S45 cool-down (K. Brodzinski)

    - Cool down has started with LN2. Slowing down during the week-end due to the reduced delivery pace of LN2. Reached 174 K. We should be at 80 K in 10 days.

    - AOB: LHC hydrants: status and maintenance plans (O. Crespo-Lopez)

    - Refurbishment and tests during LS2

- TCC meeting on 15/10/2020 (GianluigiA)

    - Recap of e-beam tests with gun prototypes (S. Sadovich)

        - Description of the development of the electron gun so far and the performance of the first CERN electron gun prototype for the Hollow Electron Lens

        - Some issues observed with the prototype:

            o Oscillation of the filament current due to contact between the filament wires

            o Current leak through ceramic insulator

            o Too high outgassing

            o The last two points resulting in HV breakdown

        ⇨ Therefore a new design of the electron gun has been proposed

    - Status of HEL gun design (A. Kolehmainen)

        - New designs try to provide a better thermal contact and improve cooling for the cathode (operated at 950 C)

        - Detailed description of the design changes

    - Update on DEMO2 test results + test program for phase 2 (A. Ballarino)

        - Demonstrator for the cold powering of the inner triplets

        - Full size MgB2 cable assembly for Inner triplets: 19 cables for a total of more than 100 kA (117 kA)!

        - Last validation step of the R&D program

        - Two tests in June 2020 and in September 2020: in the second 2 x 18 kA+12x2kA cables powered

        - Next steps: installation of MgB2 prototypes cables for Matching section and test

- TCC meeting on 22/10/2020 (RogelioT)

    - Announcements:

        - Agreed with management to focus on the 11T installation for LS3.

        - New rules for remote teleworking in place, TCC meeting kept in remote.

    - AOB Nicolas Kos, Confirmation of D2 beam screen cross section:

        - D2 cold bore had to change manufacturing process.

        - It has been measured that the maximum BS outer diameter can be increased from Ø92.45 to Ø93.4 mm.

        - Final tolerances presented and OKed by Riccardo (who also recommended showing tolerances added in quadrature).

        - Serge comments that an exact drawing with all cooling tubes should be shown.

        - Also the tolerances should be updated in the drawing.

    - H. Prin, D2 cold mass interfaces

        - 1st proposal for the interface between cold mass and the ancillary line was discarded as it displaced elements.

        - New solution OK.

        - After some delta in cost concerns Serge mentions that, more importantly than cost, this solution works for all WPs, not as before.

        - Riccardo notices that Lmag is given as 7.88m instead of the drawing value: 7.778 m.

        - He inquired via email that it was just a typo.

    - Arnaud Vande Craen, D2 connection to WP6A

        - Nothing relevant for WP2

    - Chiara Bracco, WP14 short technical update

        - Some important non-conformities of TDIS and MKI-Cool are being addressed.

        - Good progress with the tests to allow small movements of the TCDQ in opposite direction than during energy ramp to follow β* squeeze and levelling. Tests will soon be finalized and discussed with concerned WPs, like WP2.

- HPC workshop (GiovanniR) => Went well and was as successful as the first part in Spring with this time no talk from ABP but more info from our IT colleagues. A report should be written which should serve as input for the requests to be made for the next 5 years.

- Rencontres accélérateurs 2020 - 17 novembre (BenoitS) => Website and program available here (as well as in our EventsAndDates webpage): https://indico.cern.ch/event/904251/.

- The antidamper paper from SergeyAnt et al., which has been submitted to PRL, could go through but this will require some major modifications and work from some HSC colleagues.

- Summary of the heat load task force (GianniI) => The meeting was focused on issues related to vacuum procedures during cooldown (presentation by Paolo):

- To prevent events like the one that occurred in 16L2 in Run 2, the mechanical pumping is now stopped before the beginning of the cooldown. As a consequence, there is an interval of time in which the vacuum chambers are still rather warm, but no active pumping is present. As a consequence, a significant amount of hydrogen accumulates due to outgassing (mainly from stainless steel).
- The beam screen regeneration usually performed when the cold masses are at 1.9 K is meant to move the hydrogen on the cold bores. Nevertheless, hydrogen can accumulate on portion of the beam screens that remain cold (so-called "cold bridges").
- The hydrogen accumulated in these areas would be released during operation due to electron or photon bombardment and could create significant beam losses.
- To avoid this situation, it is proposed to perform another regeneration when the cold masses are at 20 K.
- According to TE-CRG this is technically feasible, but stopping the cooldown for the regeneration would entail significant delays. On the other hand, it is planned to keep the magnets at 20K after training, to minimise energy consumption. It is proposed therefore to perform the regeneration during this phase.

- EDMS documents => Request for comments: Functional Specification - CRYOGENIC DIRECTIONAL COUPLER BPMs FOR THE HL-LHC INNER TRIPLETS IN THE IR 1 AND 5 (2020-10-20 18h46)

    - Was, as usual, followed up closely by BenoitS et al. for impedance team (as well as GianniI for e-cloud aspects) => Document seems fine to me, but this will be confirmed by BenoitS et al., who will write the usual comment for the impedance team.

- ABP info meetings: please remember to send me any proposals you would have. Some people from the team gave already 5 talks but some only gave 1, so let's try and correct this.

- This week there is the LER2020 workshop => Talks from NicoloB, GiovanniR and myself tomorrow. See my slides in AOB and don't hesitate for any comment.

- BenoitS

    - Collimation activity meeting this morning: no good news for TCSPM6, which is not vacuum compliant yet.

- Crisis management team: BenoitS mentioned that there seems to be no management check for the request to have an attestation to come to CERN during the curfew and he was wondering whether this is normal: checking with GA in the afternoon, he mentioned that it is normal. They rely on the fact that the person should discuss with his/her supervisor before and that the reason should be purely professional. If not, this would be considered as a serious professional misconduct.

- AdnanK measured the irradiated samples (RF measurements) => To be presented next week.

4) MKPL beam coupling impedance measurements with and without serigraphy (CarloZ): https://indico.cern.ch/event/965333/contributions/4076665/attachments/2129427/3585794/MKPLmeasurements_HSC2020_vw.pdf

- Summary

  - The MKPL was predicted to suffer of beam induced heating with LIU beam already in 2013: 2018 temperature data confirm the criticality of the kicker.

  - The MKPL is expected to limit operation and scrubbing during run III.

  - Impedance mitigation solution is available and validated with impedance measurements (indeed: very nice agreement between simulation predictions and measurements for both cases without and with serigraphy: congratulations!) => Ongoing: simulation of the measurement setup (C. Antuono).

- Question from MikeB: any consequence of the frequency shift with serigraphy? => CarloZ answered that it is the goal of the work by ChiaraA to check everything but should have a negligible effect on beam stability (the resonance was already evaluated to be negligible in the past). CarloZ mentioned that the shift could be due to the measurement set-up and therefore not be real. To be checked.

- Next => Summarise this very nice success story during the coming ABP info meeting this Thursday.

5) Follow-up of actions (Everybody)

- None.

6) Miscellaneous

- The 243rd HSC meeting will take place on Monday 02/11/2020 at 10:30, with the current agenda:

1) General info and follow-up (EliasM)

2) Validation of simulated power distribution in MKP-L (Oskar Bjorkqvist)

3) RF measurement of irradiated samples (AdnanK)

4) Follow-up of actions (Everybody)

5) Progress/status in the different activities/projects, reports from meetings and in particular issues/successes in the different machines (Everybody)

- Important events and dates for HSC: https://espace.cern.ch/be-dep/ABP/HSC/SitePages/EventsAndDates.aspx.

- Web site: https://espace.cern.ch/be-dep/ABP/HSC/default.aspx.

Minutes by E. Metral, 27/10/2020.