Minutes of the 33rd Impedance Working Group meeting

Date: 27/06/2019
Location: 864-01-B04

Review and approval of minutes from 32nd meeting.

BS made a point about the IWG recommendation on the triplet shielded bellows. A discussion with TE-VSC is necessary in order to determine the worst case configuration of the deformable fingers for operation.

ACTION: Josef Sestak will pass the information to Jaime Perez Espinos.

BS reviewed the open points. No further comments were addressed and the minutes were approved.

Agenda of the 33rd IWG meeting:

- Measurements of the kicker KFA45 outcome (Branko Popovic, Mike Barnes)
- HOM-damping in 200MHz SPS RF cavities requirements for transverse impedance (Carlo Zannini)
- TCLD simulations sign convention (Inigo Lamas Garcias, Lorenzo Teofili)
- LHCb vacuum sectorization (Joseph Sestak)
- Feedback from IPAC (Benoit Salvant)
- AoB:
  - SPS case extraction line discussions
  - TCPCH measurement news
  - LSS1 and LSS5 discussions

The meeting commenced at 15:30 with the following attendees:
See attendance list.

Presentations

Measurements of the kicker KFA45 outcome

Branko Popovic (BP) gave a presentation of the results of his wire measurements on the KFA45 magnet. He showed a 3D model of the device and pointed out that the high voltage connections had been left in two configurations: opened and shorted. He showed comparisons between measurement and simulation results with shorted HV ports and pointed out that there are three modes not yet understood: Two that are not seen in the simulations and one that appears in simulations but is not seen in the
measurements at 73 MHz. To check what might be the cause of this, he checked if the CST model handles correctly the permeability values of the ferrites. Then he checked if the solver itself could be the problem and finally if the wire measurement method itself may be the cause of these strange modes. He however found that none of these were the cause to the problem. When all was ruled out, the solution turned out to be due to a geometry issue in the 3D model, where a small piece of metal was missing and when reintroduced in the model, it removed the 73 MHz mode.

Branko showed how he could simulate different configurations of the HV ports (open/shorted) in CST schematic. It suggested that leaving the HV ports open might lead to strong resonances.

He concluded by explaining that the simulation has been verified via measurements and that the transition piece in the model completely removed the 73 MHz mode. He also suggested to possibly incorporate HV cables in CST schematic for future simulations.

Comments and discussion

Benoit Salvant (BS) asked when this KFA45 was extracted from the PS but Mike Barnes (MB) answered that he did not know. The ECR should clarify this aspect.

BS thanked BP for the thorough study and noted that the story of this 73 MHz mode shows that it is important to benchmark simulations and measurements before concluding on the impedance contribution of a device.

BP asked if it would be possible to do the measurement with actual cables connected to the HV ports and MB answered that it should be possible if there are cables available in the lab. Aaron Farricker (AF) pointed out that one would still have to consider the terminations of the cables themselves but MB said that they will be left open as this should somewhat correspond to the connection to a non-firing thyatron.

ACTION (for BP and TE-ABT): If cables are available, measure KFA45 with HV cables connected.

LHCb vacuum sectorization

Josef Sestak (JS) presented the new vacuum layout of LHCb IP8.X (model and diameter transitions). He showed multiple 3D images and mechanical schematics showing the specifics of the upgrade. He mentioned that the wake field suppressor to be installed needed a thicker design in order to withstand a new order of movements. He recalled that the small cavity shape that the wake field suppressor creates was checked and approved by the IWG.
He showed pictures of the real equipment and the welded ring with a machined CF knife and special transition chamber 80/54 that was found and was not defined in the original model.

He stressed that there would not be an aperture blow-up and asked if anyone knew if there is a schematic for the transition chamber in A1L8.X, otherwise they’d have to redraw it. He concluded:

- Sector valve ID63 mm upstream of VELO
- That the new design will be equipped with and RF contact 80R/63
- Short transition chamber 63/54 VELO
- No aperture blow-up

Comments and discussion

Christine Vollinger (CV) asked about the status of the ECR for the VELO/SMOG2 and JS answered that it was accepted with warning but formally rejected at the LMC and that a new version is being drafted. After the meeting, the new version of the ECR was circulated.

CV expressed her concern about the next steps.

BS asked if the mismatch found will be presented at the TREX meeting. JS answered affirmatively. IG commented that production needs to be launched soon since the installation is foreseen for December.

BS stressed that nothing is to be followed up by the IWG but the Wakefield suppressor. Concerning SMOG2 and ECR, this should be followed by the LMC.

CV asked if it is planned to coat the Wakefield suppressors and JS answered that it is possible. CV expressed concerns about flaking of the coating when the thin wake field suppressor foil is moved.

HOM-damping in 200MHz SPS RF cavities

Carlo Zannini (CZ) presented on the multi-bunch horizontal instability that was observed in the SPS during run II. He said that he has been developing a dedicated model for multi-bunch simulations and put emphasis on the importance of using analytic models to avoid numerical artefacts. He showed how different beam parameters would produce stable/unstable beams in the simulation, and presented some bunch parameter limits they have been able to make based on this model and explained that some studies are still ongoing. He explained that simulations can take a lot of time due to the discretization of the threshold range.

He said that they have specifically been looking at, and comparing, the multi-bunch instabilities when the HOMs at 939.45 MHz are and are not present, respectively. To study this, he looked at the growth rate of the instabilities when the mode is present.
The results he presented are similar to those obtained with Nested Head-Tail Vlasov solver used by S. Antipov. The undumped case is above the threshold, so it should not be accepted. He explained that the plot shown is meant to give a guideline for the dumping scheme.

He explained finally that two independent studies have concluded that the 938 MHz HOM in the 200 MHz dampers in the SPS could affect the horizontal stability. They have been able to produce a threshold plot to use as a template for the choice of damping scheme. Although Carlo warned that estimations are conservative.

Comments and discussion
CV asked from which cavity configuration the Q and R numbers on slide 7 are coming from and explicitly which damping scheme has been used for the simulation. Nasrin Nasresfahani (NN) explained that the numbers do not seem to represent the situation that we will have in the machine ‘after LS2’. There was some disagreement over whether simulations should be run on 4-5 section cavities or 3-4 section cavities.

ACTION: Nasrin to cross-check the numbers submitted to Carlo and to provide the cavity configuration on which these numbers are based.

ACTION (for BE-RF): decide which cavity configurations need to be assessed in order to be representative of the ‘after LS2’ configuration, and perform the simulations when needed.

ACTION: Carlo to check the sensitivity on the resonance frequency

TCLD simulations sign convention
Inigo Lamas Garcia (IG) presented in the place of Lorenzo Teofili (LT) on the sign convention for the simulations of the TCLD. The problem they had faced was that a negative transverse impedance would appear when post-processing the simulated transverse wire scan impedance measurements. To understand if there was a problem in the post processing, they ran wakefield simulations of the structure. He showed graphs of the transverse impedance they obtained in previous measurements (that were presented at IWG 31). Then he went on to show the results of the new simulations where they simulated a 0mm and 5mm translation. He explained that the problem had been due to a change in the mesh between the two models where there is a frequency shift of the mode that does not allow computing the dipolar impedance properly. He explained there might be more simulations required where it is made sure that the same mesh is being used for both models in order to obtain a more accurate result.
AOBs

1) New RF measurements to characterize the longitudinal impedance of the LHC UA9 goniometer

Danilo Quartullo presented the progress on these new and updated measurements. He explained they are being made because there are large discrepancies between the previous measurements and simulations. This was suspected to be largely due to inaccurate CAD models used in CST.

He showed some measurements from 2017 where some anomalies in the results suggested that some of the low frequency modes were fictitious.

He gave a rundown on how they performed the new measurements. He then showed the overall results and said that the results overall look good and agree better with simulations than the previous measurements.

For conclusions, he explained that the significant low frequency mode (~300 MHz) detected in the 2017 measurements probably was due to poor flange contacts. Some of the discrepancies between the 2017 measurements and the simulations require more analysis.

Comments and discussion

BS thanked the team for having found a way to get measurements with all the access constraints. He added that the story of this 300 MHz mode shows how important it is to benchmark simulations and measurements before concluding on the impedance of a device.

ACTION: D. Quartullo et al to continue with the data post processing and come back to the IWG later on.

**ACTIONS RECAP:**

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