

20th AWAKE Instrumentation Meeting

Tuesday 26 November 2024, 1400 GVA time

All presentations can be found on Indico at: <https://indico.cern.ch/event/1478756/>

Run 2c BPM development update (Laurence Stant – CERN)

Laurence gives presentation of the status of tests and developments of the pBPM and eBPM systems for Run 2c.

Michele asks about the additional testing required. Laurence says that testing the eBPMs with e-beam would be beneficial to gain more statistics and testing eBPMs with p-beams would be useful to check the proton power which would give more information on which technique to use for limiting the proton signal. Michele says that e-beam testing can be done outside of the proton run and for Laurence to contact Michele with any beamtime requests.

Edda asks whether the HL-LHC electronics can be used. Laurence answers that there are 3 options, which should be considered from first to last;

1. Keep the electronics the same as HL or
2. Change the material values but keep the circuit boards the same or
3. Change the circuit boards too

Edda asks in terms of budget whether these modifications were included or not. Stefano answers that these modifications were not considered when preparing the costs and should be reviewed.

Thibaut understands that the modifications are very limited. Laurence confirms this and says that he would need more beam tests and analysis to give more confidence.

Thibaut asks if there are any updates about the pick-ups themselves. Michal answers that the vacuum team requires the end and feedthrough flanges to be modified and that Michal and BPM team are evaluating the impact on the performance now.

Thibaut asks whether the striplines can be replaced with button BPMs. Laurence says that the same analysis he did for the striplines can be done for the buttons to see.

Stefano adds that he contacted Victor from TRIUMF to ask about the manufacturing of the striplines and has not had an answer yet. Stefano will check again with Victor.

Michal adds that he is awaiting feedback from the workshop on the production of the BPMs – shape and cost.

Effects observed in electron BPM readings (Collette Pakuza – CERN)

Collette gives presentation about peaks that were observed in the eBPM readings during the run this year.

Michele says that some beam movements were observed on BTV during operation at the same rate as SPS extraction. Nikita adds that they only look at the areas along the beam line that are more critical for operation. The BTVs that Nikita looked into were BTV106 just after the vertical bend and a BTV inside the plasma cell. Nikita says that beam movements were seen on BTV106 but not on the BTV inside the plasma cell (or within jitter). Therefore, the observed beam movements were not so crucial for operation. Collette adds that during previous discussions with Nikita, the e-beam movements seen on BTV106 were in the vertical direction and were not seen/within beam jitter in the horizontal which is contrary to what the BPM readings show.

Michele adds that the e-beam alignment is done with the screens on the extraction shot. Therefore, the drifts observed in the BPMs were not so crucial for operation so far.

Michal adds that slide 18 where the individual channels are plotted shows that it is more likely beam movements than EMI as channels a and b are anticorrelated and the same effect is seen in all BPMs even when they have different cable routing and their electronics are physically located in different rooms.

Federico suggests to plot the beam position along the line and not against time to see if something can be seen from the optics. Michal comments that from the plots, the magnitude of the peaks are increasing along the e line and similar in amplitude in the common line. The direction of the peaks is also reversed for e-line vs common line due to different convention of H+ and H- between the two lines.

Steffen says that from Run 2a, this effect was identified to come from some EMI on the cables of the correctors in the e-line during SPS cycle giving some physical movement to the beam. This was thought to be from the spectrometer magnets. (Michele commented after the meeting that the spectrometer magnets are not pulsed, confirmed by Fern too.) Steffen suggests to contact EPC with this problem and for them to measure the current in the correctors in the e-line during the proton run.

Steffen also comments that operations would profit more from aligning using the 10 Hz electron-beam data from BPMs rather than at the rate of SPS extraction like what is done now with the screens.

Edda asks Collette to add Eleonora to these meetings. (Done after the meeting)

Thibaut raises the last point of the open questions on slide 20 of whether we need the ChDR and HF BPMs or not for Run 2c. Stefano comments that we know they have good signal rejection with 1×10^{11} ppb. With the system at present, with 30 GHz detection, we know that 3×10^{11} ppb are still sometimes detected. We did not have enough resources to go into another R&D phase of changing the system to reject also the 3×10^{11} ppb. So, if the present system is still useful then we can keep it for Run 2c.

Thibaut says that the assumption on which the system is based on is that the signal detected at 30 GHz is dominated by electrons and there is little to no proton signal. However, as was measured by Beth, there is still some signal picked up by the protons at this detection frequency with a large shot-to-shot variability. Is this useful information for AWAKE? Or can we ask SPS to change the way in which they do the bunch rotation to reduce the higher frequency components in the p-bunch and to be able to control the reproducibility better. Michele says that non-invasive measurement of position is for sure better than using the screens and spectrum information of the p-bunch is also useful to have.

Thibaut comments that in any case the effects of the current of the magnets should be identified and removed first.

BTV design for Run 2c (Stefano Mazzoni – CERN)

Stefano presents some options for the BTV design for Run 2c.

Federico comments that not only does the beta function need to be considered but also the oscillations of the beam that need to be tracked.

Thibaut comments that a custom BTV for AWAKE might be a good option as it could also be more compact but the costs of each of the options should be understood. Ben says that he will look into a cost estimation of the CTF3 BTV, the standard solution and the customised chamber, and will provide some rough numbers.

AOB

Joshua asks for cost of chamber for the HF BPM. Michal will provide this to him. (Done after the meeting)

Collette Pakuza, 26 November 2024