

# 21<sup>st</sup> AWAKE Instrumentation Meeting

Tuesday 21 January 2025, 1530 GVA time

All presentations can be found on Indico at: <https://indico.cern.ch/event/1491891/>

EO bunch length monitor for Run 2c: plans and preparations (Collette Pakuza – CERN)

## **BL monitor resolution:**

Marlene asks about the resolution of the EOSD technique. Collette responds that the current quoted resolution in the BI specifications document is (correction) 10% of the nominal BL to be measured (200 fs sigma) but this **needs to be further defined in collaboration with the AWAKE team.**

## **BL monitor location:**

Michele asks if there are any updates on the selected location of the EOSD BL monitor. A discussion follows with several suggested locations and configurations:

- Close to injection point is ideal from experimental perspective, but there are spatial constraints, as the gap between the plasma cells should ideally be kept to a minimum.
- In a straight line, at the end of the linac – easy to access and would allow for tuning but this would place the BL measurement far from the injection point.
- Use of multiple monitors to also confirm BL close to injection.
- If the injection region is too space-limited, a monitor downstream of the plasma cell (since laser delivery is via fibre), though this needs to be checked from a beam optics perspective.
- Alternatively, in a straight line at the end of the 150 MeV line, after the dipole at the merge point.

Edda notes that further **discussion with the planning team is required.**

Status of beam instruments for Run 2c (Stefano Mazzoni – CERN)

## **ChDR and HF BPMs:**

Thibaut suggests that this should be brought to the AWAKE Physics Board to decide whether the HF pick-ups (PUs) are necessary for AWAKE Run 2c and if this technology is required for an AWAKE-like facility.

Stefano explains that while the technology works, the chosen operating frequency means that, at  $3e11$  ppb, signal is still detected from the protons, with a large shot-to-shot variability. This implies that the proton spectrum extends beyond what was initially assumed when designing the PU.

Thibaut mentions that IPP has presented that the SPS bunch lengths will be even shorter in the future. Marlene clarifies that this is not the AWAKE baseline and emphasizes the need to check whether the shorter bunch lengths would improve the experiment or not.

Edda asks for more details on the amount of R&D required. Stefano explains that we would need to identify a frequency regime where there is no proton signal but this is currently unclear as there is no way to precisely measure the proton frequency spectrum. Thibaut adds that previous tests by Beth have shown that the proton signal extends to much higher frequencies, reaching several tens of GHz. Thibaut emphasises that someone would need to look at the proton bunch spectrum under the new beam conditions and to spend more time characterising the proton bunch. If the proton bunch is not reproducible and the spectrum is pushing to too high frequencies, then this could be a showstopper.

Edda says a summary of this should be **presented at the PEB**.

Marlene points out that if a proton bunch characterisation is required at AWAKE, then it must be done before the end of the proton run this year. Stefano suggests some checks could be performed in the SPS, such as using the EO pick-up.

## Update of ChDR bunch length monitor studies (Jack Mcgunigal – University of Manchester)

### **CST simulations:**

Michele asks why the dielectrics are protruding. Can explains that this design increases the ChDR intensity. Michele inquires whether the DR from the radiator edges play a role. Can responds that the time of arrival and low intensity of this DR means it has little impact.

Stefano comments that **intensities at different frequencies could be checked** to investigate the shadowing effect, as 37% and 25% of the first radiator intensity at 85 GHz seems very low (slide 7).

Thibaut suggests performing a **simulation with the radiators flush** to eliminate the effects of the protruding dielectrics.

Stefano adds that, experimentally, there are three dielectrics on one side of the chamber and one on the opposite side, opposite the last of the three dielectrics. The shadowing effect can be directly checked with measurements by comparing the single dielectric with its opposite pair.

### **Actions:**

1. Discuss the BL monitor resolution with AWAKE team to better define this – Collette
2. Discuss the location and number of BL monitors with the AWAKE and planning team – Collette to organise
3. Present the ChDR and HF BPM summary at the PEB – Collette
4. Conduct additional simulations at different frequencies and with the radiators flush to the beampipe – Jack

Collette Pakuza, 28 January 2025