Minutes 21st AWAKE Run 2 Meeting,
July 2nd, 2020

https://indico.cern.ch/event/934983/

Present: Livio Verra, Edda Gschwendtner, Steffen Doebert, Valentine Fedosseev, Giovanni Zevi Della Porta, Joshua Timothy Moody, Rebecca Ramjiawan, Claudia Ahdida, John Patrick Farmer, Patric Muggli, Stefano Mazzoni, Francesco Maria Velotti, Pablo Morales Guzman Allen Caldwell, Guoxin Xia, Luca Garolfi, Collette Pakuza, Kook-Jin Moon, Linbo Liang, Mariana Moreira, Harsha Panuganti, Eugenio Senes

Matters Arising (Edda Gschwendtner)

The European strategy update has been published. In the document, high priority is given to novel accelerators. This might have an impact on the next cost&schedule review.

The discussion for the 2021 proton beam time is ongoing; the final schedule will be issued in December.

Run2 general and Physics

Emittance for the 2 windows-2 beam dumps injection scheme (Livio Verra)

Livio summarizes the previous discussions on the injection scheme:

- Due to scattering in Rb vapor, we put aside the option with long Rb column and SiN window at an imaging waist in the transfer line.
- The option with the 3rd expansion volume might be not practical because of remaining scattering and implementation of the expansion volume in the transfer line.
- To limit the scattering in the "2windows-2dumps" scheme, we are considering ~200nm SiN for the vacuum window and ~100μm Al for the laser beam dump.

With the request that the waist of the beam is downstream of the laser beam dump, one can calculate the minimum emittance achievable after the scattering, given the incoming emittance, the required β function at the injection, the thickness of the foils.

Livio shows that if we use the SiN membrane and a 100μm Al beam dump and initial emittance of 2 mm mrad, the emittance can be maintained around 7 mm and 12 mm mrad, for density = 7 and 2 • 10^{14} cm^{-3} respectively.

Action→ Livio, WDL: check that the SiN membrane and the <100μm Al beam dump are feasible for the experiment.

Livio notes that it should be checked whether we can conduct the injection experiment and prove blowout, beam loading, matching in the low-density, high-emittance setup. In fact, the experiment will start at low density and then move to higher density for the final experiments and beam delivery to applications.
Action→ John, simulation team: check what are the necessary incoming parameters to meet the goals in the low-density, high-emittance beam.

Comment from Steffen: the electron beam source and the transfer line are optimized to provide 2 mm mrad, 100 pC beam. If the charge requirement changes, the emittance will change.

Matching simulations (John Patrick Farmer)

John shows simulation results, using his new code. He can perform a long-window simulation to obtain the proton-driven wakefields. Then, he runs short-window simulations for the injected electron bunch, superimposed to the proton wakefields.

In previous meetings he showed that he could run the long-window simulation with plasma electron density $7 \bullet 10^{14}$ cm^{-3} and then study the injection of the witness bunch by varying different parameters.

For this density, he shows that if the emittance of the incoming beam is 20 mm mrad, the blowout regime is reached only for a 1nC electron bunch. But, in this case, the wakefields driven by the electron bunch are comparable in amplitude with the proton driven one. Thus, neither acceleration nor beam loading takes place.

Comment from Livio: according to the above presentation, in the high-density case we will be able to inject ~7 mm mrad electron bunch.

Action→ John: run the same kind of simulation for low-density case, optimizing the parameters to reach blowout, beam loading and matching.

Comment from Patric: these simulations can be also useful to check the effect on a second proton driver bunch, in order to study the achievable repetition rate of the experiment.

Run2 integration

Among the three options for the integration, the "Liberty" version has been chosen for further investigation. In particular:

- Steffen is checking if the long wave guides connecting Klystrons to RF are suitable.
- Rebecca is studying the long shift of proton beam line.
- Nat is looking into the racks' installation for TSG4, ventilation issues, handling of large devices.

Next meeting, Thursday 16 July 2020, 14:00.
Agenda: to be defined.

Livio Verra,
July 6th 2020