Minutes 27th AWAKE Run 2 Meeting,
November 19th, 2020

https://indico.cern.ch/event/976534/

Present: Livio Verra, Edda Gschwendtner, Martin Weidl, Steffen Doebert, John Patrick Farmer, Ans pardons, Eloïse Guran, Eugenio Senes, Joseph Wolfenden, Kook-Jin Moon, Linbo Liang, Michele Bergamaschi, Pablo Morales Guzman, Rebecca Ramjiawan, Valentine Fedosseev, Giovanni Zevi Della Porta, Peerawan Wiwattananon, Luca Garolfi, Can Davut, Harsha Panuganti, Linbo Liang, Konstantin Lotov, Mariana Moreira, Sébastien Perrault.

Matters Arising (Edda Gschwendtner)

Edda shows the last meeting's minutes and discusses the relative pending actions:

- Francesco will show in the next meetings the results of the discussions concerning the minimization of the pointing jitter of the proton beam;
- John: 3D simulations work for Run 1 are still ongoing. The effort will take several months before being completed
- Linbo is running further simulations with improved resolution to study the matching with non-Gaussian beams. He will show results as soon as ready.

Edda reminds that the CNGS dismantling meeting will take place at 3pm and that the Technical and Physics Board will take place in the week of November 29th.

The 2021 schedule for the SPS is about to be finalized and will be approved in the first week of December by the CERN council. AWAKE will receive a total of 7 weeks of proton beam. The detailed schedule will be available in December.

Radius matching tolerances for new parameter sets (John Farmer)

John shows further studies about the tolerances on the beam radius to achieve the matching condition. As the witness bunch itself drives the blowout, the electron bunch density affects the time necessary to generate the plasma bubble and therefore the amount of beam whose emittance is preserved.

He shows again the definition of beam goodness Q, defined by the two factors Q_E (the fraction of charge within the 1% energy range), and Q_t (the fraction of the beam within the 4D hypersphere of radius $2\sigma_{matched}$)

For emittance larger than the ideal case (2 mm mrad for 100pC beam), the overall beam quality is worse. This is explained by the fact that it takes a longer time for a larger beam to generate the blowout. This issue can be partially addressed by also increasing the charge (even though this has an effect on the beam loading and therefore on the energy distribution).

The results show that the injection phase is important to preserve the beam quality: each of these beams has a different "working point".

John run a first simple 1D scan limited to Q_t. He shows that for higher emittance witness, the beam quality is better preserved for $\sigma > \sigma_{matched}$. According to John, this is consistent with a slow blowout generation. Thus, larger beams drive smaller wakefields, that are matched by larger beams.
This seems to suggest that a large range of radii will give a comparable transverse quality of the acceleration (for now, limited to Q_t).

Comment from Steffen: it seems from this that we have a factor of 2 margin around the matched beam size. How does this affect the energy distribution?
John: according to these simulations, beam loading depends weakly on the beam radius, thus there is no big difference in energy.

Action→John: continue working on this.

Dynamics of offset beams (Martin Weidl)

Martin continued studying the effect of an injection offset on the electron beam quality. He uses a static driver proton beam and inject electrons with different offsets, investigating the emittance. He observed that the electron bunch slices undergo large-amplitude betatron oscillations with a frequency changing along the bunch. He run an injection offset scan excluding the self-fields (i.e. ignoring space charge forces) for two different injection timings (2.5 ps apart)

He observes that, for both the injection phases, an offset on the order of few μm prevents both Q_E and Q_t to be better than 0.5.

Integration - 2nd laser room (Peerawan Wiwattananon)

As the electron sources will be relocated in TCC4, also the UV laser room has to be moved in order to keep the beam path as short as possible.
Nat shows and discusses three different proposals to relocate the UV laser room.

1. TSG41 (replacing the current streak room)
2. TSG42
3. TSG4

The laser room must be at least 8-meter-long and 1.4-meter-high.
Because of the dimension requirements, the best option seems to be in TSG4 (even if the beam path is not the shortest possible). The laser room needs to be completely built, thus affecting both cost and schedule.

Valentin, Steffen: the path must be as short as possible to limit imperfections and jitters at the photocathode.

Action→Nat, Valentin: continue the discussion and define the suitable location.

Any other business

Sébastien asks all the experts involved in Run 2c to calculate how much time they will need to commission their equipment, compared to (and with the experience of) Run 1, so that he can start working on a preliminary schedule.

Next meeting, Wednesday December 9th, 14:00
Agenda: to be defined.

Livio Verra,
November 23rd 2020