

Minutes of RESULTS, PITZ Physics Seminar, 17.03.2022

Project: PITZ

Participants. C. Richard, M. Krasilnikov, A. oppelt, H. Qian, F. Stephan, Zohrab, A. Hoffmann, A. Lueangaramwong, F. Riemer, G. Georgiev, G. Adhikari, M. Gross, N. Aftab, P. Boonpornprasert, R. Niemczyk, X. Li, Z. Aboulbanine

Agenda:

- 1) AOB
- 2) H. Qian “Slice energy spread spatial correlation and slit filtering effects”
- 3) N. Aftab, “Longitudinal Phase Space Reconstruction via Tomography”

Results:

- 1) AOB
 - a) FS: We need to further investigate all the trips we are having. HQ: Proposal to look through data to develop a method to predict trips and turn off before the gun trips
 - b) FS: Summer student proposal for beam based alignment of the booster at PITZ. MK: He has a preliminary code for investigating this. FS: We need to chose which student we want.
 - c) FS: Reminder to do annual appraisal interviews
 - d) GG: Update on cathode experiments with Humbolt students. Need a replacement sensor head, but otherwise ready for tests.
 - e) RN: It would be best to have more people come to the office once corona regulations are relaxed. MG: DESY still recommends working from home and digital events even with relaxed national regulations.
 - f) FS: Need to submit abstracts for LINAC by 01.04.22. Currently, only Prach is presenting there. Gun 5.1 LLRF performance should be presented. MK volunteered.
- 2) Talk by N. Aftab
 - a) PB: How did you improve the LPS study from previous work. NA: The initial matrix has been updated, narrowed required phase advance range which reduces redundancy and improves accuracy, and offset beam effects will be added.
 - b) PB: How do you determine if the new method is better than the previous method: NA: The results can be compared to simulate results. Comparisons are done using pixel-by-pixel rms error
 - c) MK: You set negative pixels to zero. Do you check the integrated charge after this: NA: No, I check the projections not the integrated signals.
 - d) AL: Are you assuming the system is linear? Is this valid or just the method you chose? NA: We are using the transport matrix from the booster to the measurement station so it is linear. We change the initial estimate and keep the transport matrix constant which is measured and/or simulated.

- e) FS: How do you feel about where you are in the time scale of your thesis? NA: I am several months behind schedule due to the issues with artifacts. MK: She got behind because it was unknown what the challenges would be. Now the problems are clear. She still needs experimental results. FS: It's good to keep adding better ideas, but you also need to finish.

3) Talk by H. Qian

- a) FS: Why do the simulation results show a discrepancy by a factor of three but the experimental results do not? HQ: The results are sensitive to the beam halo and you have to really trust the simulation results to believe the factor of three.
- b) FS: Is it definite that the results with cutting at EMSY3 is always an upper limit of the energy spread? HQ: That is unclear, we have to trust the simulations.
- c) XL: We should look at making cuts at different locations. QH: The hope was the beam would be emittance dominated not space charge and the energy spread would be diluted spatially so the location of the cut shouldn't have too much of an effect. But this should be investigated.
- d) MK: Can we change the beam, e.g. bunch length, in experiment to try to replicate the curves found in simulations? HQ: From previous results, we don't see too much change in the results.
- e) FS: What we care about for the FEL is the central portion of the beam. How well do we measure that portion? MK: That is too simplified of a view of the FEL and beam dynamics we need to also consider the beam tails.
- f) FS: We have under and over estimates of the energy spread. We should publish both and say the true energy spread is somewhere between.
- g) HQ: Before we resubmit the paper, we should discuss the details of the simulations with the experts at Hamburg.
- h) RN: What we have is one point of view. We need to put it in light of what is good for FEL operation. MK: Yes, but we need to be clear what we are presenting.
- i) FS: There are a lot of simulation results, maybe don't show all of these because the paper would be too long. HQ: The referee is asking for simulation results, maybe they can fit in an appendix.
- j) RN: We should back off on the strength of our results because of how dependent they are on simulations. HQ: Yes, but we should still be consistent with our simulations. Also, because we cut the beam we need to know the beam correlations. We need to use the simulations to do this.
- k) FS: How well does the experiment beam size match the simulations? HQ: I tried to make them match, but with the cut it is very hard to match the simulations with experiment
- l) XL: Can we scan the slit and try to combine the measurements? HQ: Yes in theory, but it's not straightforward.
- m) General take-away: Adding the slit cut to the energy spread measurement adds complexity that needs to be further investigated

- n) FS: Can we use EMSY2 to make the cut and use the quads to prepare the beam for the cut. HQ: I tried this in simulations and I can change the results from over estimating to under estimating by changing the quad strength (with EMSY3). So somewhere there is a quad setting that would correctly measure the energy spread. This is the ideal situation but it isn't clear how to do this.

Protocol prepared by
Chris Richard, 17.03.22
(Name, Date)