Minutes of RESULTS, PITZ Physics Seminar, 24.03.2022

Project: PITZ
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Agenda:

1. AOB
2. G. Georgiev, GENESIS simulations of THz FEL seeding (DPG rehearsal)
3. R. Niemczyk, PhD project – lessons learned – evaluating progress, strategy & schedule

Results:

1) AOB
   a. FS: Status of installation and operation over Easter? Working week before Easter could be used for shut down work (week 15- 16). People are on holidays.
   b. MK: Valve is cleaned and restarted. It was not damaged. Sensor was exchanged. Maybe that caused conditioning problem.
   c. FS: Radiation protection teaching -> next RC
   d. FS: Annual Appraisal Interviews -> agree dates with supervisor
   e. FS: IPAC 2022 -> condition to participate regarding covid. Raffael and Prach should look into it.
   f. MK: Summer student data on site.
   g. FS: Anne sent an email for quadrupole for beamline design for radiation biology.
   h. FS: Cherenkov screen tests from Artem?. Nobody heard from him
   i. FS: Required parameters for conditioning of gun 5?
   j. FS: Don't forget abstracts for LINAC -> 1st April. MK: Prach with ideal THz source and MK conditioning of gun
   k. FS: ICR, UK people gave no code for fast dose calculation code.

2) GENESIS simulations of THz FEL seeding
   a. FS: should be less slides(total 22). In line, THz based on short FEL. Remove short. MK: what is meant by short? GG: It is compact
   b. FS: slide 9 pre-bunched beam what does it mean? Show how flat top and gaussian pre-bunched beam look like.
   c. MG: what is bunching factor? MK: example of bunching factor in slide 9
   d. FS: beam energy? You mean light pulse energy is changing. Should be clearly mentioned. MK: I would say that radiation pulse
   e. MK: what is physical meaning of dip that you are producing in radiation. GG: electrons having longer wavelength produce this THz radiation. In flattop bunches reach min energy and then start to increase. For gaussian there is

continuous increase. MK: why is pulse energy changing? FS: Can you change it by kick?

f. MK: is slippage included? Is it possible that some bunches radiate after delay?
g. WH: This happens when tails take over. Core cannot dominate over tails
h. MK: to be checked if some slice lases because of slippage. WH: even in flattop all slices start to lase
i. FS: absolute scale. Gaussian goes higher than flattop and also sooner
j. GG: charge is 2nC
k. WH: slide 13. This difference is related to peak current. about a factor of 10. depends where you stop. It develops independently. HQ: 200A peak with 3.4 m undulator. Peak current is decisive factor. WH: Repeat this with same current flat top. HQ: In exp what is gaussian current ever reached? For 4nC ~ 150A. Xli: 150-200. Depends on initial laser pulse. If its shorter than it can be higher.What bunching factor is necessary for lasing. Common is 10^{-3}. What is bunching factor you used?
l. FS: How does the pulse that you wan to send like look. Slide 7: like green one 1st plot. How does it look like for flat top? show the modulations and bunching factor
m. MK: which simulation corresponds to what bunching factor? HQ: He only put bunching factor in simulation.
n. RN: backwards approach. What THz? What bunching factor? What e beam you need to have at entrance? And then what you need to have at photocathode with the beamline
o. WH: You DPG talk group is electron accelerator at FEL. It is also focused on accelerators. You are facing non-experts at FEL. Dimitri talks about laser heater stuff. Margarat will talk about osillators. Introduce audience density modulation -> bunching factor -> conditions for SASE. -> details for specific application.
p. MK: mention in 1 slide if tapering helps as we don't have it.
q. WH: I only see intensities. Main message is narrow spectrum and there is no figure on that. That is most important comparison for SASE and seeded FEL. For gaussian slide 12 is not convincing.
r. MK: where these defects come from? GG: They go away after tapering. MK: looking into SASE to seeded, you get narrow but with side peaks. Could we have a movie that shows development of peaks. This spectrum does not advertise seeding. HQ: Gaussian develops into saturation so we get side peaks. WH: In no seeded case, you get gaussian. And pre-bunched you get side peaks. Reduce and shape the message.
s. MK: change pic on slide 4(undulator). FS: Describe bunching when you use it so that people remember it. MK: replace energy by radiation everywhere RN: shady area for error bar in page 10.
t. MK: slide 12. How do you normalize your spectra? GG: Not sure. Spectrum calculations are made by X.Li scripts. It is arbitrary to some extent. Xli: Fourier transform of temporal profile. Will confirm later.
u. X-Li: Slide 12 shows pre-bunched beam is better from shady area. MK: take shot to shot case and plot avg by dotted line.

v. MK: We have to consider it for ideal machine. Effect of tapering on UV and Xray. It improves by a factor of 5. Shrink content on FEL lasing.

3) Discussion on Run:
   a. FS: Winnie reported at FHP, the group taking care of RF sources, the pulse length increased from 650us to 800us at XFEL. Is it forseen to extend it? 900us extend is possible. They start RF while high voltage is ramping at XFEL.
   b. FS: Not clear is if they want 1ms. Highest priority is stability. Flash operates at 4.5 MW. Run with 5MW for 1ms. check with night automatic runs. 650us with 7.5-8MW to prepare for 800us XFEL case. They need smallest emittance.
   c. MK: We have 4 milestones to demonstrate. 1 gun-trip per day. 6.5 MW @650us. 800-900us @ 6.5-6.7MW. 1ms@ 5-6MW. FS: 1 trip per day at XFEL. For gun5 conditioning, slowly increase power level. set priority list. Range them according to avg power. FS: like pareto front.

4) PhD project – lessons learned – evaluating progress, strategy & schedule
   a. NA: Should there be first experimental data and then simulation or the other way around. FS: iterate them to get best results. MK: preliminary simulation. Fast evaluation program to check results and to determine the trend. RN: Do a quick check during even someone's else shift.
   b. CR: good documentation even when you don't understand it at that time in case that beam is not available afterwards.
   c. FS: Start writing early. 2nd year is good already. You would have to iterate it later.
   d. FS: clarify with your supervisor key subjects that have to be done. Small things can be skipped. Agree with all supervisors (UHH & DESY) what you want to keep and skip. somethings can be adapted. Keep your supervisors updated. TW: I agree. RN: Keeping WH updated like every 3 months.
   e. FS: We had only 3 examples of laser shaping. We could have dependence on gun gradient that would have made thesis rich. Balance time with rich data.

Protocol prepared by
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