Minutes of RESULTS, PITZ Physics Seminar, 2017-10-12

Project: PITZ
Participants:
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1) Agenda

1. Yauhen Kot: Emittance Measurements and Simulations for European XFEL
2. AOB

2) Results:

- Simulations with 50-53 MV/m, 6 ps RMS Gaussian laser profile, transverse radial homogeneous, booster accelerating module with same gradient in all cavities,
- Measured emittance numbers show only statistical errors, currently it is believed that the **screens are saturated which could lead to an overestimation** of the emittance numbers
- For 1nC and BSA diameter = 1.5 mm, 6ps rms Gaussian profile: third harmonic cavity should not affect emittance measurement (long phase space looks inverted due to 3rd harmonic cavity), emittance at the beginning extreme high, slice emittance has bump in the centre of the bunch and has high value at the front and rear end of the bunch, slice energy spread is 1.925 keV at the peak current (will be further increased by laser heater), maybe 10 % deviation between averaged slice emittance and slice emittance at max peak current slice
- For 500 pC: ASTRA simulated projected emittance is 1.28 mm mrad and 1.23 mm mrad
- Most of the emittance optimization took place in April to June 17, stayed then more or less the same, even with an increase of gun field from 53.0 to 54.4 MV/m – day to day changing accelerator setup, since the machine was running at the emittance measurement had not the top priority - since the gun field increased the solenoid current increased as well
- Last bigger emittance optimization had took place in 2016
- Change of the gun setting changes matching, but increase of mismatching parameter from i.e. 1.1 to 1.5 doesn't distort the emittance measurement much in Yauhen's experience
- Optimized solenoid current in ASTRA simulation differs from opt. sol. Current in measurement, probably caused by wrong calibration
- 2017 emittance measurement match the ASTRA simulations more than the emittance measurements carried out in 2016
- 0.75 mm mrad measured slice emittance at the max current slice (on 20.04.2017) – shape of the slice emittance along the pulse is higher in the centre than on the front and rear end of the bunch

- Emittance and mismatch changes only slightly when you change the gun phase in the range pm 4 deg around the optimum
- It wasn't really looked into flattop laser pulse emittance measurement (maybe only few days)
- Mikhail presents some of our emittance considerations
- PITZ: Lyot filter issue from the THz measurement: It's not clear if the modulation in the phase space is temporal or only in momentum – TDS measurements required to confirm it's a temporal modulation

Protocol prepared by
R. Niemczyk