Minutes of RESULTS, PITZ Physics Seminar, 2017-12-14

Project: PITZ
Participants:
Zeuthen: M. Gross, M. Krasilnikov, O. Lishilin, H. Qian, F. Stephan, H. Huck,
R. Niemczyk, G. Loisch
TU Dramstadt (TEMF): Steffen Schmid

1) Agenda
1. Ye Chen: Emission of Space Charge Dominated e-beams in Pancake regime

2) Results:
1. Y. Chen: Emission studies are ongoing. In October 2017, measurements were done with a short Gaussian (2 ps) photocathode laser pulse. The laser transverse distribution is recorded. For short bunches in RF guns, a PPC model is extensively used to describe photoemission. This model does not fit completely with the measurements. One of the possible reasons for that is that the extracted beam is space-charge dominated (the effective emission radius is larger than the laser BSA). Introducing a correction factor to the effective emission radius allows to fit the PPC model with the measured data. ASTRA simulations were done implementing two transverse distributions: a uniform and a core-and-halo generated. The core-and-halo is closer to the measurements, but not perfectly. Convergence studies were done by varying numerical simulation parameters and it seems that the convergence is not an issue.

   Mark Dohlus provided a PIC photoemission code named KRACK (written in MATLAB) which provides results even closer to the measurement. The UMAF code yields values even higher that the measured ones.

   Tolerance studies were done: varying gun phase +- 1 deg and 0.75-0.95 rms ps laser pulse – the emission is not sensitive for these changes; the pulse shape also does not play a significant role as the emission process is very fast.

   Conclusion: these tool model more or less well the transverse dynamics, but not the longitudinal dynamics – further modelling is needed, including not only the vacuum side of the cathode, but the semiconductor side as well.

   There is some data taken with 300-fs Pharos pulses, but it is not considered, as the laser transmission was badly attenuated during the measurements.

   A constant photodiode monitoring of laser energy is wished.

Protocol prepared by
O. Lishilin