

1st PPS on Thursday, 2017-03-16

Attendants:

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1. R. Fiorito, "A new method for measuring rms emittance for beams with significant space charge"
2. R. Fiorito, HDR imaging

Results

1. PITZ could be a test facility for different emittance measurement techniques for space-charge dominated beams. Known methods: pepper pot, quadrupole scan, phase space tomography. New: an OTR technique which relies on r and r' measurements to calculate rr' correlations. With a single-foil OTR, your divergence should be $> 0.1/\gamma$ (~ 3 mrad in case of PITZ) to be measured. If one has two foils, one can do OTR interferometry and measure divergence down to $0.01/\gamma$ (0.3 mrad for PITZ). This method is limited by scattering on the foils. But it's possible to exchange the first foil with a mesh, than have a second foil and an OTR mirror (complicated). Another method: dielectric foil+OTR mirror. This allows to measure both r and r' – one camera should be focused on the second foil(mirror) (r) and another camera should be focused to the infinity (r'). Use quad scan to find rr' . No space charge case: the minimum spotsize gives you the correlation term. New approach: use envelope equation to compute cross-correlation from r and r' measured at different focusing points (quad or solenoid). The method shows agreement with the WARP simulation within 10-15%. The errors: the higher spacecharge, the higher effect from the experimental errors. Some additional limitations are here: focal lengths of quads/solenoids should be same of close, emittance should stay constant over the drift length. Proposed procedure for OTR emittance at PITZ:
 - a. measure r and r' using solenoid or quad scan
 - b. use proposed algorithm to calculate rr' and emittance
 - c. compare with emittance measured with standard techniques for different charges
 - d. use additional means of measuring divergence
2. Halo observation is compromised by a bright beam core. From the optics, high intensity core introduce some more scatterings and from the electronics, high charge flows over pixels around the core. A micromirror-based method for better dynamic range is realized in Cockroft institute for better halo observation: one can block the beam core (SLM-like technique).

To do

1. Check the possibilities to realize such a measurement at PITZ (estimate/recalculate parameters again, think about hardware needed etc.)
2. R. Fiorito can provide a micromirror device and a cooled CCD camera in order to study HDR possibilities at PITZ (interesting, to be prepared).

Protocol is prepared by O. Lishilin on 2017-03-16