IBS and Instrumentation in IOTA

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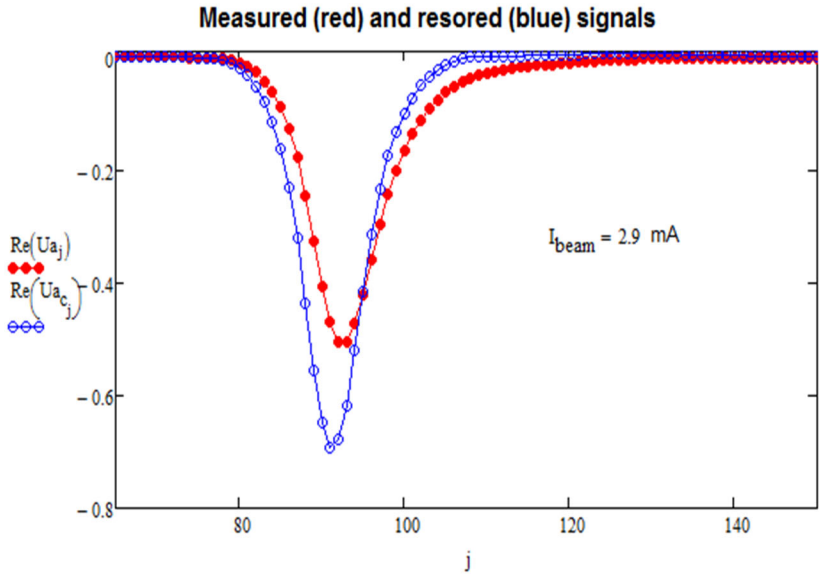
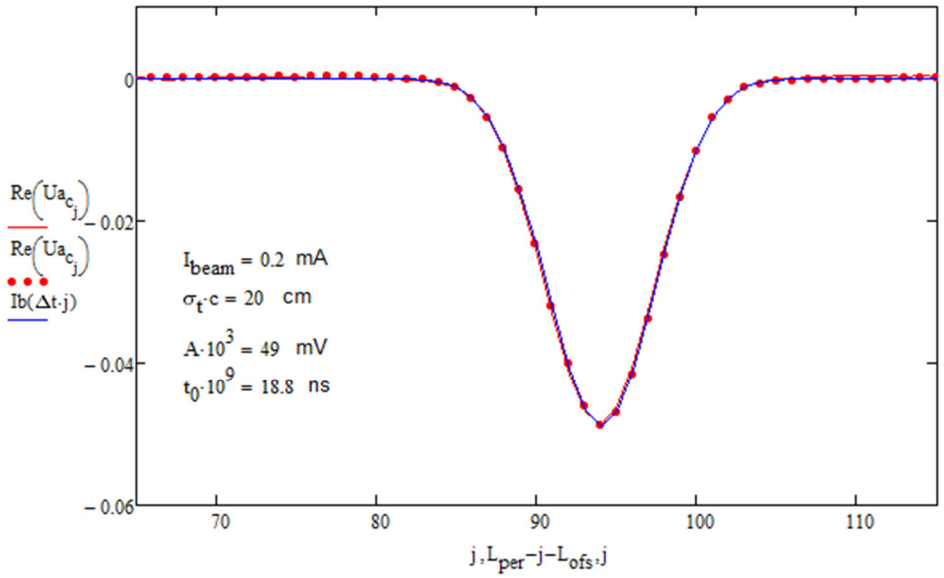
Goals and Objectives

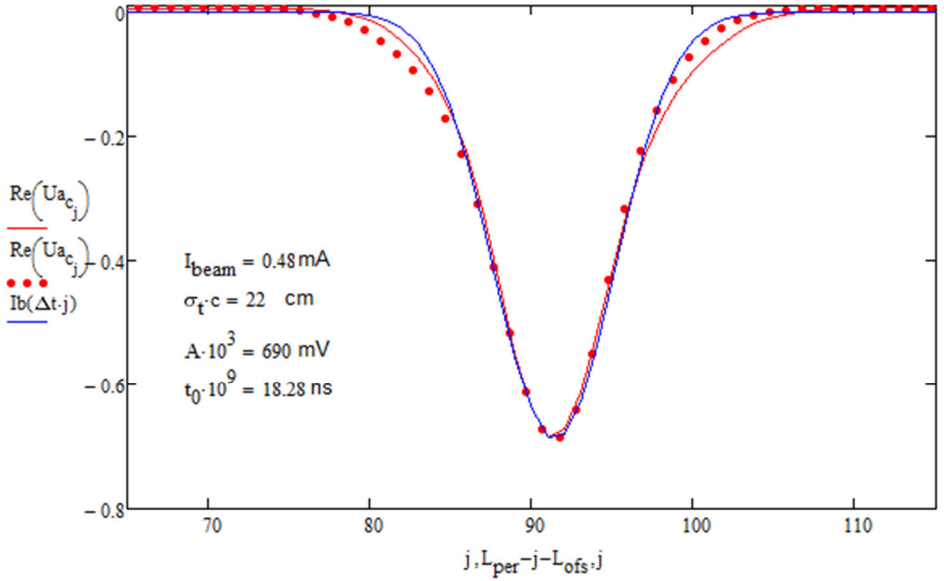
- Goals
  - Verify accuracy of our instrumentation
    - Bunch length
    - Beam emittances
    - Momentum spread
    - Bunch and beam current measurements
  - Optics verification as a byproduct of beam size measurements
    - Coupling
  - Measurements/calibration of RF voltage
    - Beam deceleration due to interaction with vacuum chamber and RF
  - Characterization of longitudinal impedance
  - Characterization of vacuum: measured by gages versus actual
- The above measurements/parameters are related through: IBS, Touschek scattering, scattering at the residual gas, longitudinal impedance, RF voltage calibration

Previous Measurements: Bunch Length

- Dispersion in the cable affects the beam profile
- Bunch self-compression with the current increase
  - Non-gaussian tail
  - An absence of bunch lengthening with beam current which should be driven by IBS

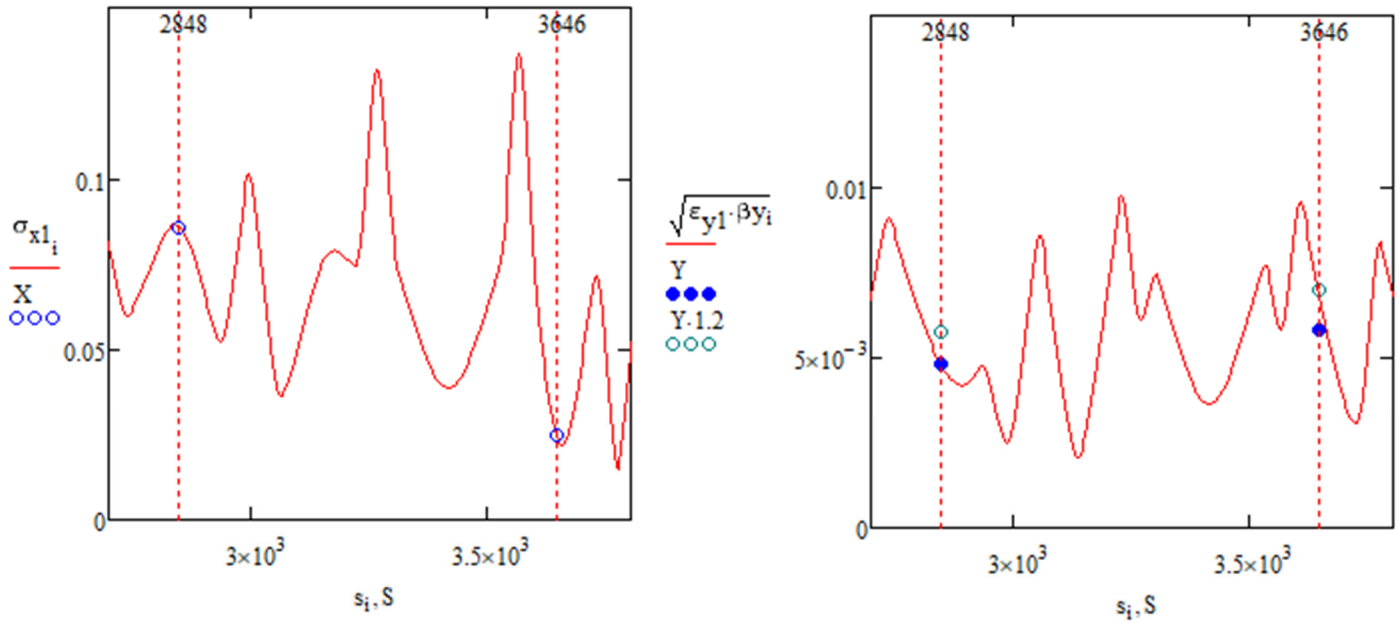






Previous Measurements: Bunch Size / Emittance

- Vertical beam size measurements are inconsistent at 20% (M3L and M1L)



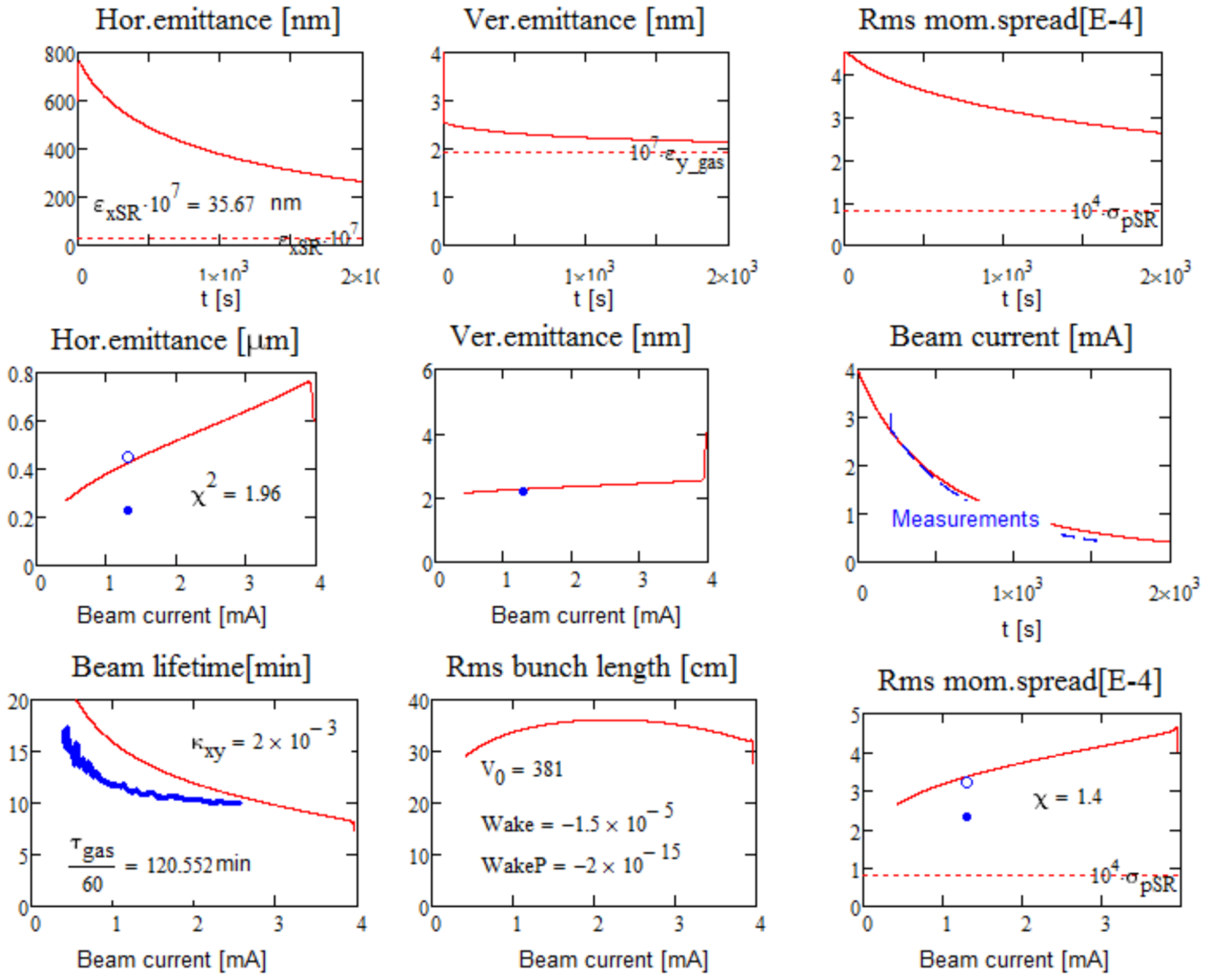
- Most possible reason: incorrect location of sync light monitors in optics file

Simulations of beam parameters evolution

- What is accounted
  - SR damping and heating
  - Single and multiple scattering at the residual gas
  - Single (Touschek) and multiple IBS
- Other things to be accounted
  - RF voltage
  - Machine acceptance
  - Beam optics -> slip factor

Previous Measurements: Beam Heating Simulations

- Measured and computed beam parameters do not quite coincide



- Problem: insufficient amount of information to point out the problem

New Measurements

- Prerequisites
  - Datalogging for synclights
  - Optics measurements are performed and optics is verified
  - RGA measurements would be good supplement but not required
- Measurements need to be performed with well decoupled optics and at coupling resonance with 100% coupling
- Measure in a wide range of beam current (4 mA -> 0.4 μA)
  - Bunch waveform from RWM simultaneously with RF waveform with the prob (mark the measurements time)
    - ⇒ Bunch profile, actual RF voltage, higher RF harmonics
  - Datalogging
    - Beam current from DCCT
    - Synclights (beam sizes and intensity)
    - Vacuum at few locations
- Required time
  - 1 shift
  - Another shift may require after data analysis is complete