

First-order detection for the Steady-State Microbunching experiment at the MLS

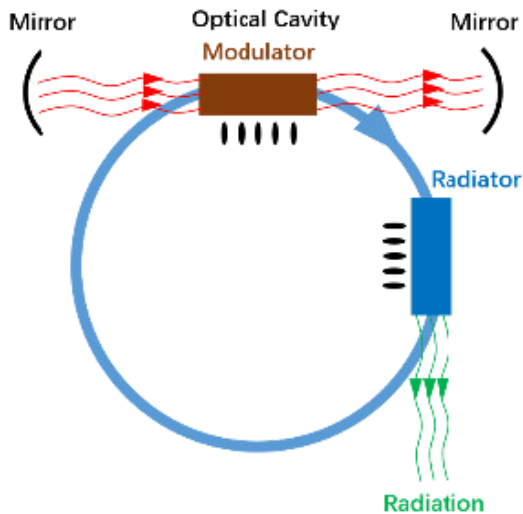
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Virtual MT ARD ST3 Meeting, 24 September 2020

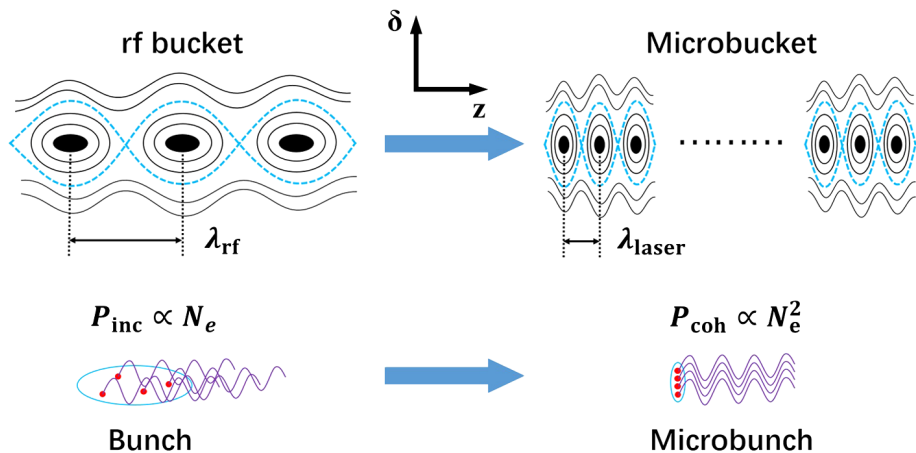
Motivation for SSMB

- Rising demand for high power radiation sources at short wavelengths
 - ▶ e.g. EUV lithography for the computer chip industry
- Steady-State Microbunching (SSMB) is proposed by D. Ratner and A. Chao to produce coherent synchrotron radiation at a storage ring over a wide range of wavelengths
 - ⇒ SSMB combines high peak power of coherent radiation from microbunches with high repetition rate of a storage ring to provide an ultra high average power radiation source

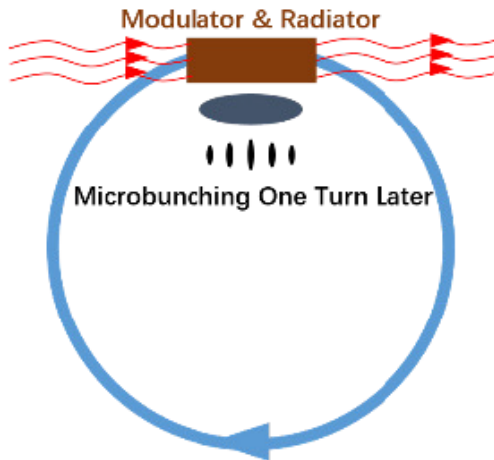
The concept of SSMB



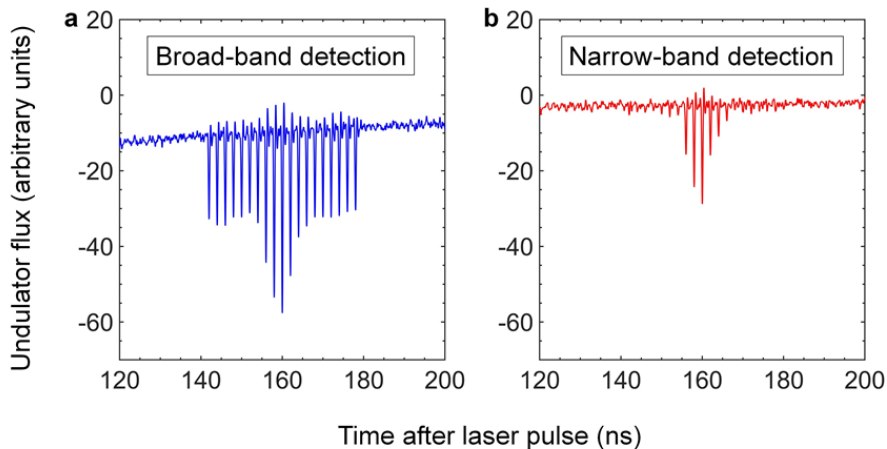
Microbuckets and microbunches



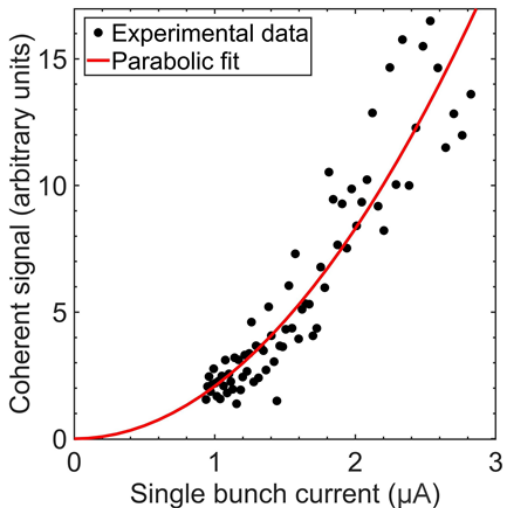
The SSMB Proof-of-Principle experiment at the MLS



Second harmonic coherent radiation signal



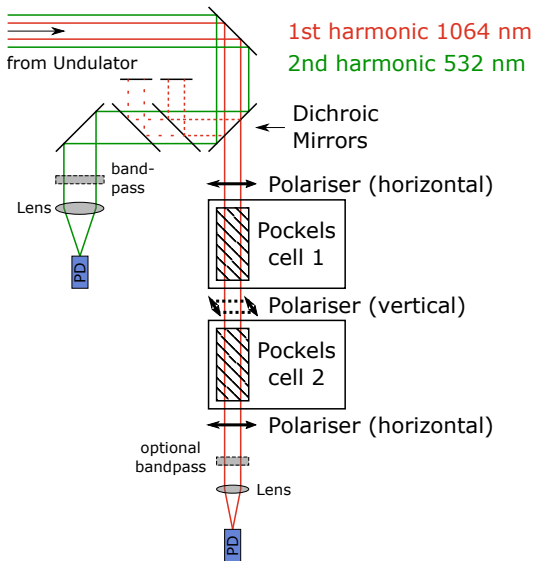
Current scaling of coherent signal



Concept for first harmonic detection

- So far: first order detection not possible because detectors are blinded by laser pulse
 - Idea: Separate laser pulse and SSMB signal in time
 - Use a fast optical switch to block the laser pulse but let through the SSMB signal 160 ns later
- ⇒ Pockels cells

Planned setup for the detection on the first harmonic



Conclusion

- The SSMB PoP experiment has already been successful in proving the basic SSMB mechanism
 - A first order detection setup serves as a conclusion to the first phase of PoP
 - ▶ direct, first order detection important conceptually
 - ▶ better measurement accuracy due to stronger signal
 - So far, the experiments have been single-pass with no steady-state reached.
- ⇒ In a second phase of the PoP experiment a MHz pulsed laser will be used to excite microbunching on a turn-by-turn basis as a next step towards a true SSMB scheme