BUNCH PATTERN VIA SINGLE PHOTON COUNTING AT SPEAR3

SLAC NATIONAL ACCELERATOR LABORATORY

Jeff Corbett (SLAC), Perry Leong (UC Davis) and Linnea Zavala (Whitworth University)

U.S. DEPARTMENT OF ENERGY Office of Science

Abstract

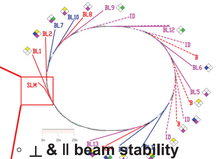
A PicoHarp300 has been commissioned at SPEAR3 for Time-Correlated Single-Photon Counting. Intitial results with a low dark-current PMT reveal a relatively large measurement error and charge spill on injection that need to be corrected for pump/probe operations. The PMT afterpulse can be removed by de-convolution. Measurements between adjacent topoff cycles clearly delineate charge injection into discrete buckets. A graphical interface in matlab extends the functionality of the PicoHarp300 for storage ring bunch pattern applications.

SLAC, SPEAR3 and Visible Beam Diagnostics

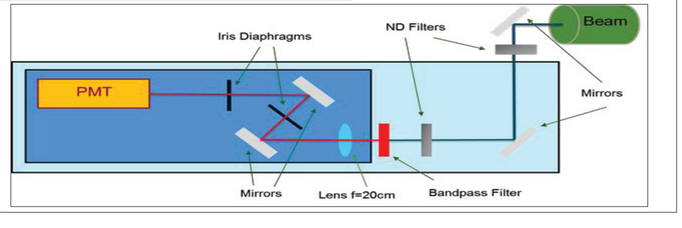
Aerial view of SLAC

SPEAR3 Light Source

Visible Diagnostic Beam Line

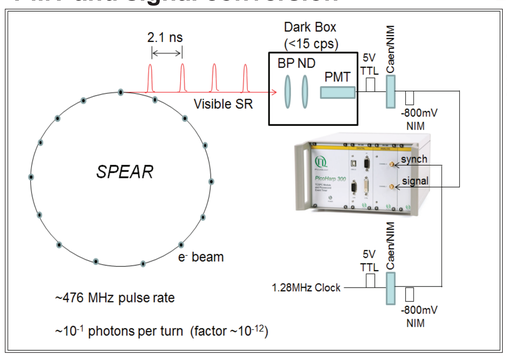


- ⊥ & ∥ beam stability
- Streak camera
- Cross-correlation
- Interferometer
- Rotating mirror
- Fast-gated camera
- Injection dynamics
- Beam halo
- Single photon
- …

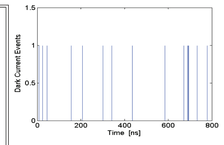


TCSPC DetectorConfiguration

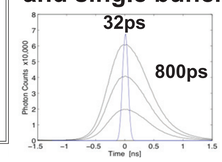
PMT and signal conversion



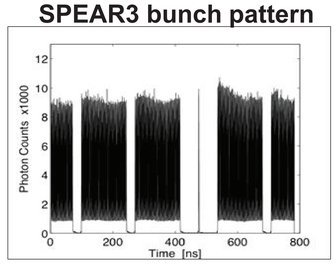
Dark count (15 cps)



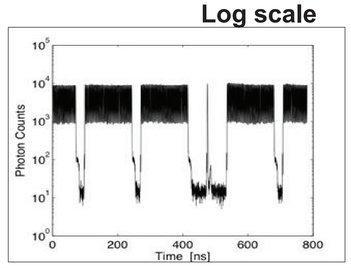
Impulse response and single bunch



SPEAR3 bunch pattern

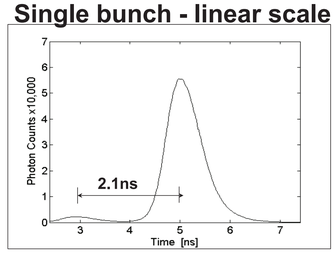


Log scale

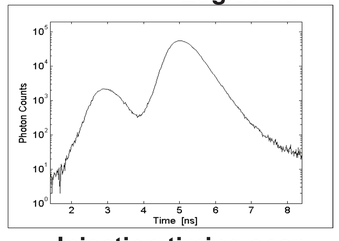


Charge Spill and Afterpulse

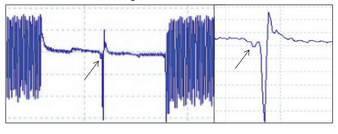
Single bunch - linear scale



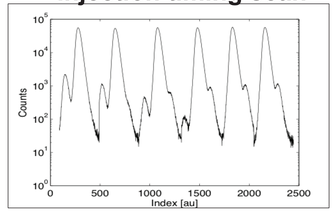
Log scale



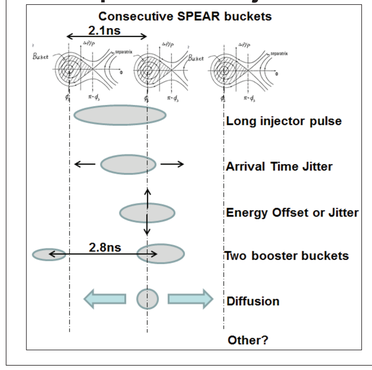
Oscilloscope trace /zoom



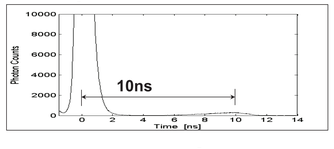
Injection timing scan



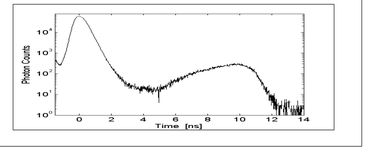
Multiple bucket injection



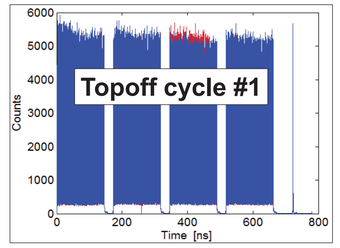
After pulse – linear scale

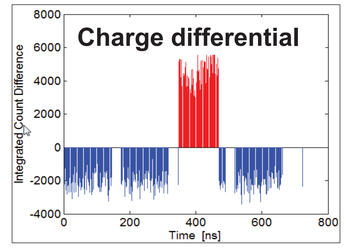


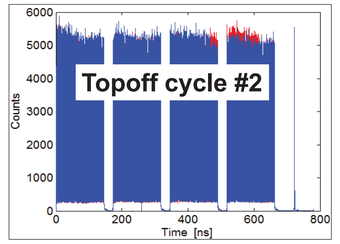
Log scale

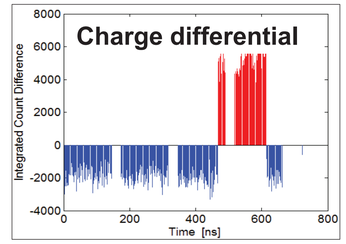


Topoff Diagnostic and GUI Development

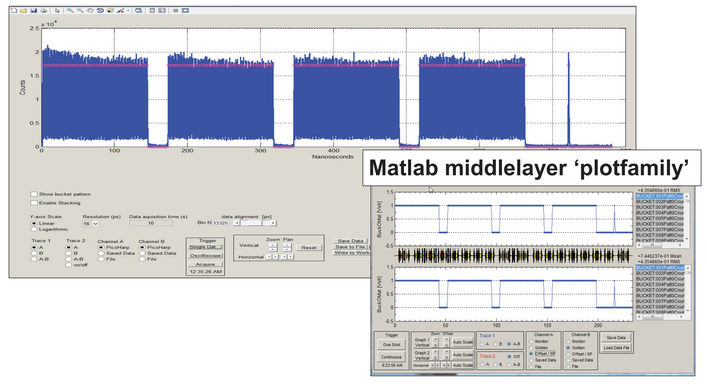








PicoHarp300 display interface



Summary

- PicoHarp300 TCSPC device at SPEAR3
- PMT with TTL conversion noisy
- Charge spill at injection identified
- afterpulse can be removed in software
- topoff measurements effective
- Matlab gui to extend capability