National Synchrotron Light Source II

Brookhaven National Laboratory

U.S. DEPARTMENT OF ENERGY

The Evolution of Fill Pattern Measurement at NSLS-II

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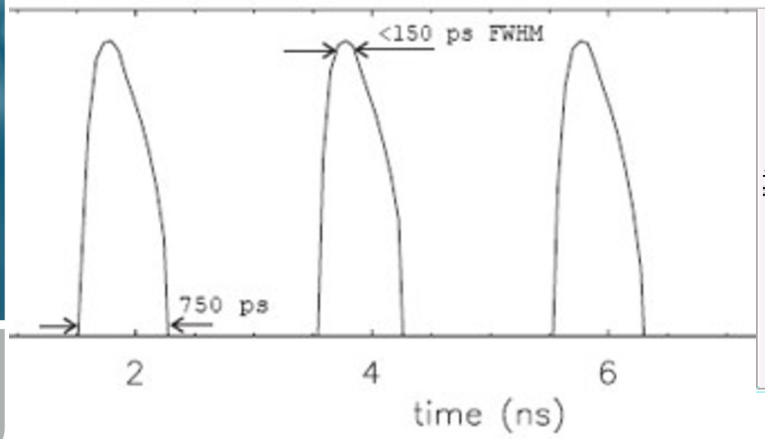
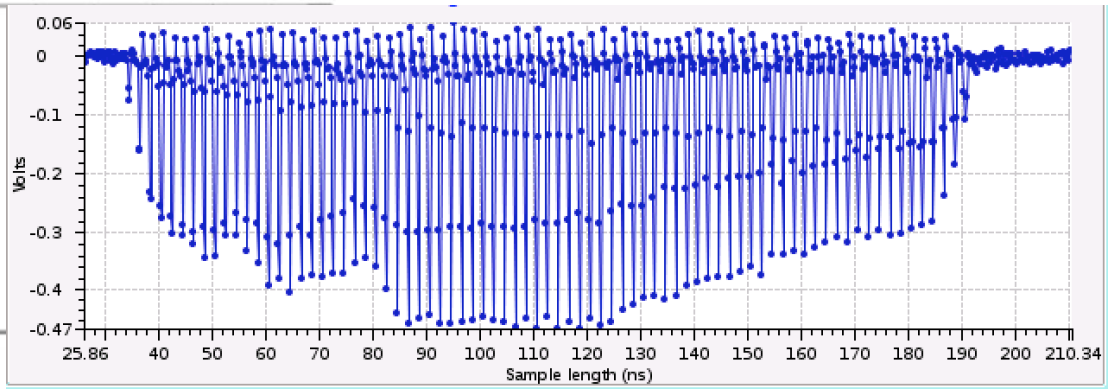
Fill Pattern Measurement (FPM): What is it? Why?

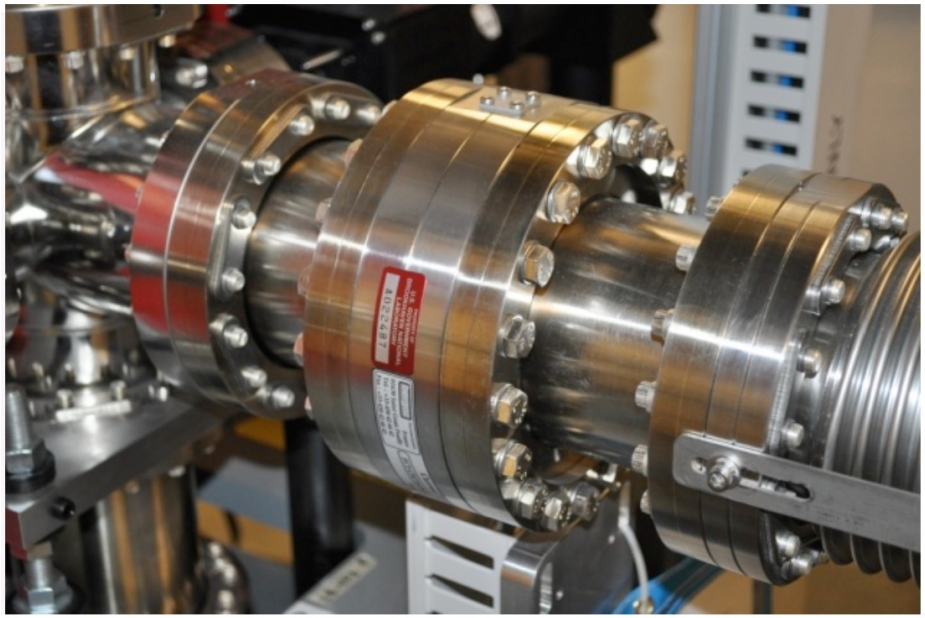
- Fill pattern: a.k.a filling pattern, bunch pattern, bunch structure, …
  - multiple-bunch (bunch-train) injection is common in a modern light source
  - Fill Pattern: the shape of individual bunch
  - The more uniform/even distribution, the better
  - FPM provides relative bunch-to-bunch charge information



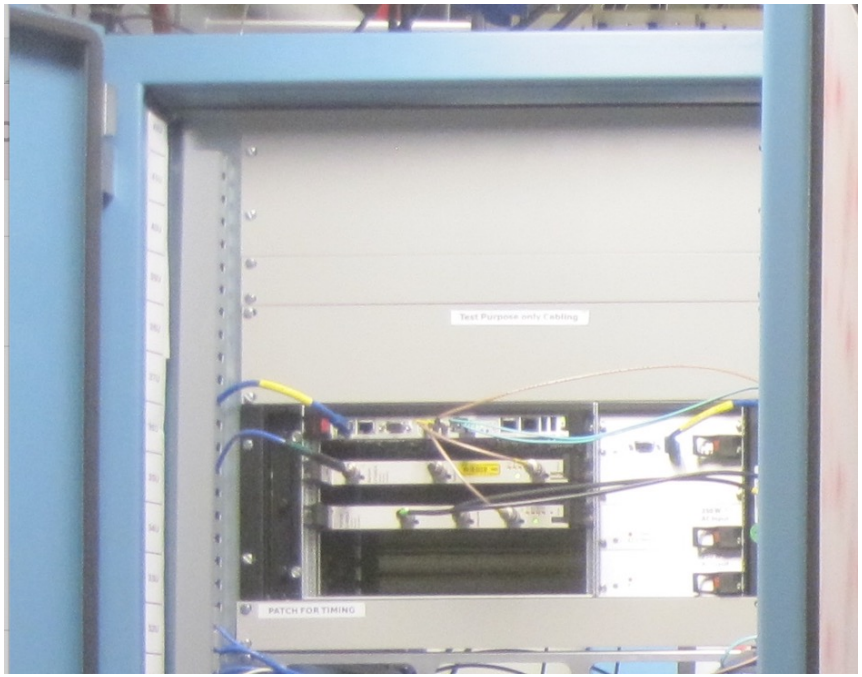


FPM: How?

- FPM = Sensor / detector + Fast digitizer + IOC + Timing



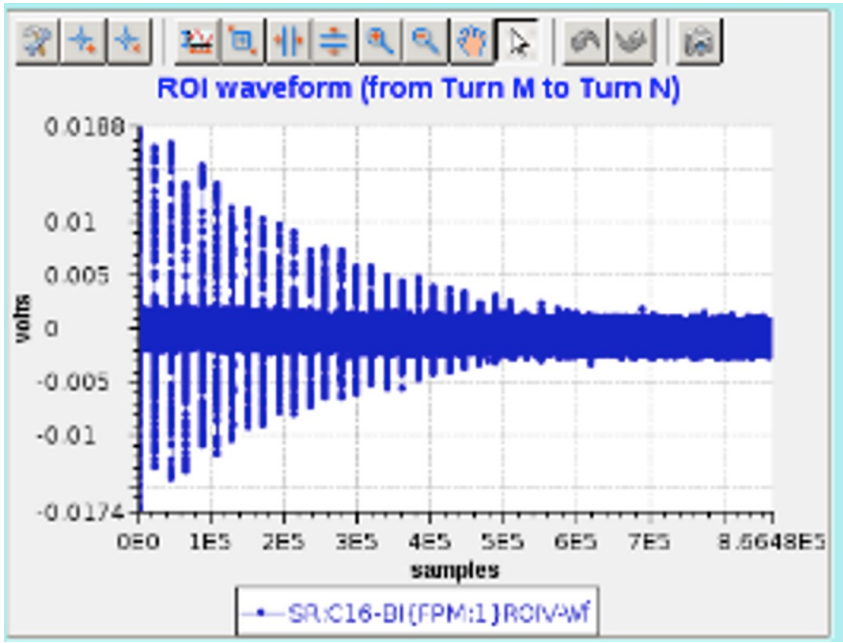
Detector: Bergoz FCT (Fast Current Transformer)



DAQ (data acquisition) = Digitizer + CPU (IOC)

FPM: the past

- compactPCI-based DAQ: Agilent Acqiris (8GS/s, 10-bit, ENOB: 6-bit)



Agilent Acqiris: discontinued

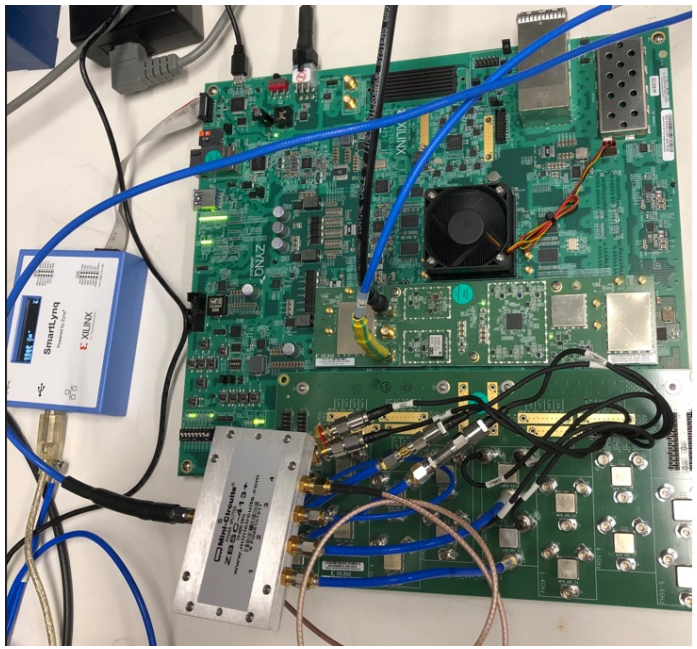
FPM: the present

- ADQ7: the world's fastest modular digitizer(?): 10GS/s, 14-bit

Analog performance up to 1 GHz		
SNR	[dB]	56
SNDR	[dB]	56
SFDR [dBc]		60
ENOB	[bits]	9

FPM: the future

- For the Injector: Xilinx FPGA (RFSoC, ZCU208); 5GS/s, 14-bit, 8-ch
- For Storage Ring: Time-Correlated Single Photon Counting (TCSPC)



TCSPC: PicoHarp-300