

PAUL SCHERRER INSTITUT



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SLS2 Filling Pattern Feedback (3 Slides Only)

DLS2-SLS2 Exchange Meeting on BPMs & Feedbacks, Nov. 30, 2020, PSI

History & Motivation

- First years of SLS1 operation:
 - 400 mA top-up operation with sequential filling of bunches
 - Charge per bunch had larger variation over time
 - "Sawtooth shape", where falling edge was travelling slowly (~1 hour+)
 - Problems:
 - Operators observed period variation of orbit corrector current. Same period as edge in filling pattern. Reason: **Filling pattern dependence of BPM electronics (~1 μ m) -> slow periodic beam motion ~1 μ m**
 - Varying filling pattern: Impact on RF system (HOMs, 3HC, ...)
 - Some users want defined charge in a single bunch in the "bunch gap" (3-5x nominal charge: Camshaft mode ...)
- Solution: "Filling pattern Feedback" (B. Kalantari et al., EPAC 2004)

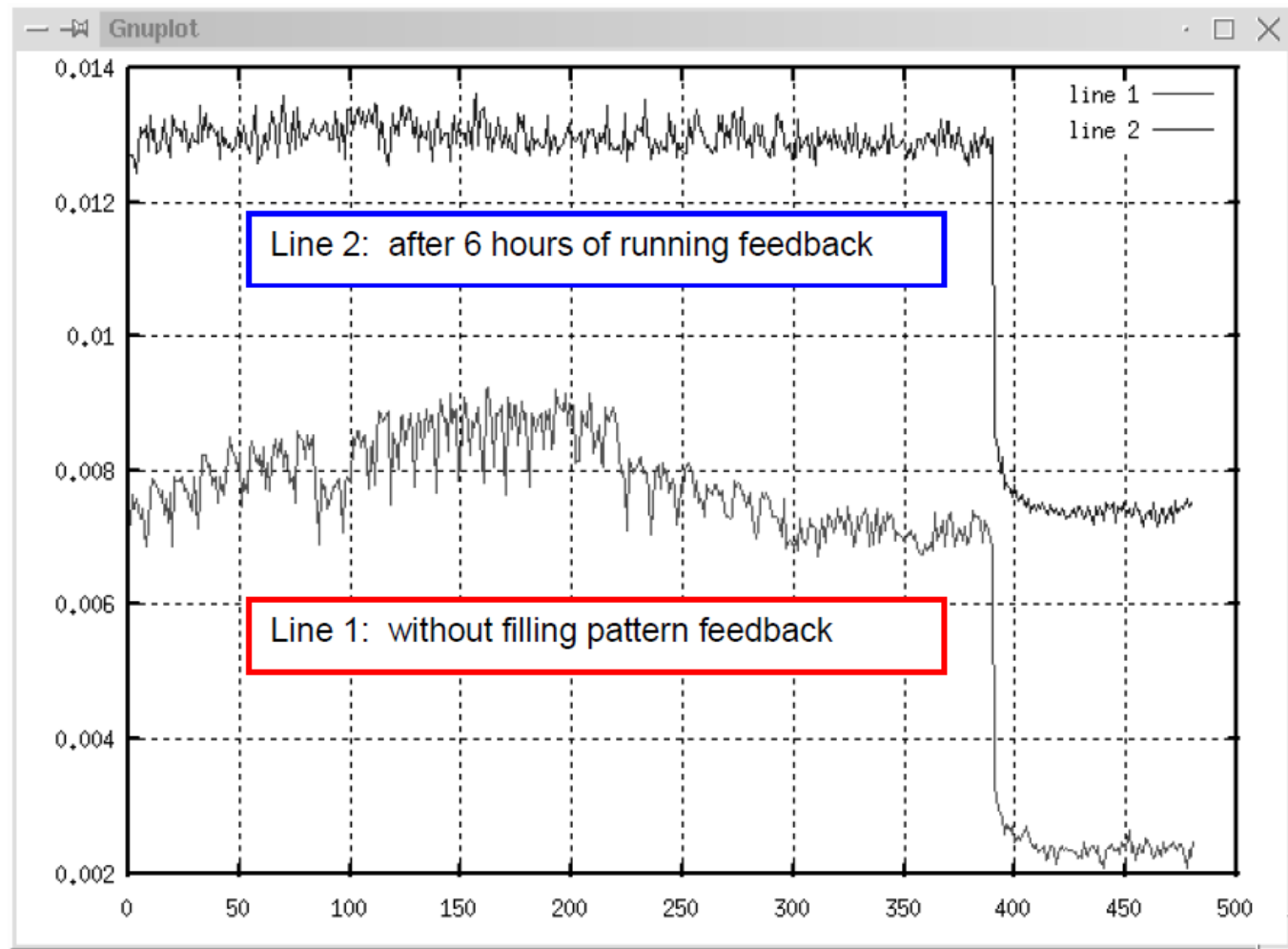


Figure 4: filling pattern comparison

SLS Filling Pattern Feedback (FPFB)

Filling patten / bunch purity measurement:
 Could be RF-based (by MBFB), or photon-
 based (responsibility: diagnostics group)

SLS1

- Charge in each RF bucket is programmable (as function of bucket number): “Filling pattern”
- Filling pattern feedback “FPFB” (runs on VMEbus CPU):
 - Measures charge in each bucket with fast ADC & photo diode
 - Controls injection timing & gun charge, trying to minimize difference between desired and actual “filling pattern” (~1% sufficient)
- Motivation:
 - User-defined filling patterns (“camshaft mode”, ...)
 - More stable orbit (filling pattern dependence of DBPM1 readings)
 - More stable/reproducible beam (HOM excitation, ...)

SLS2

- No new requirements (so far: No interest in high bunch purity ...)
 - > planning to keep SLS1 FPFB concept, only modernize hardware
- Presently evaluating RF-based vs. photon-based filling pattern measurement
 - Photon-based measurement may have higher resolution & dynamic range
 - RF-based system may be for free (MBFB with RFSoc can measure charge in each bunch), but limited by cable reflections etc.

Thank you for your attention!

