Exp. 274: RF-KO Extraction with High Frequency Excitation

Machine experiments review, 1.12.2025

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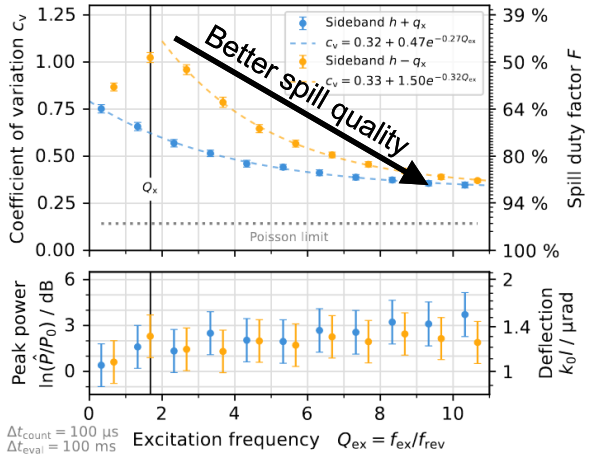
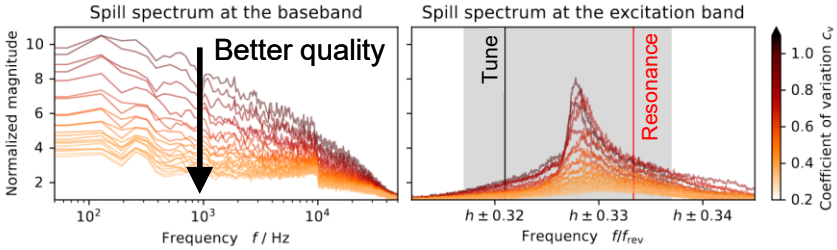
Rendering: GSI/FAIR, Zeitrausch

Using high frequency excitation

- Xsuite simulation study
  - HIT lattice with coasting beam
  - Resonant slow RF-KO extraction with feedback
  - Noise excitation with “large” width
    - Covers full detuning range of slow extraction
    - Ensures efficient excitation (low power)

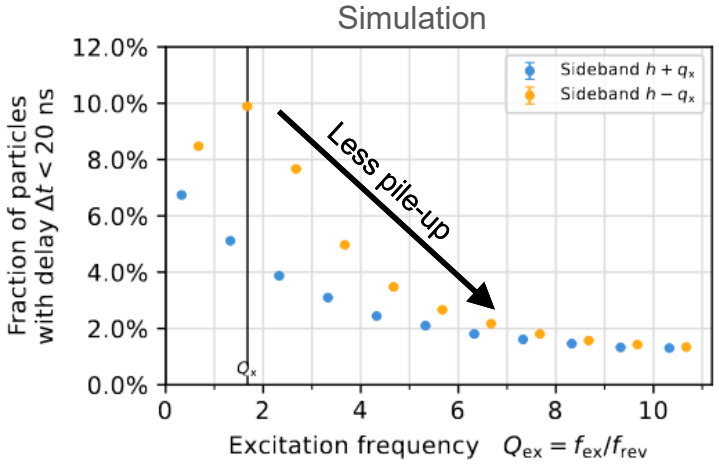
- Distinct behaviour at different sidebands
  - Spill quality can be improved
  - Excitation imprint likewise reduced

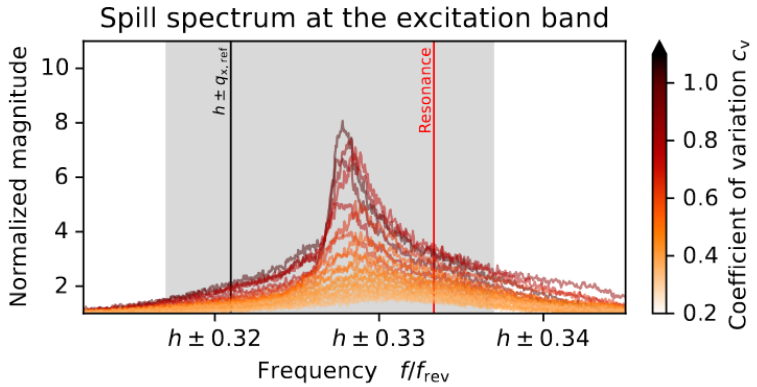




Using high frequency excitation

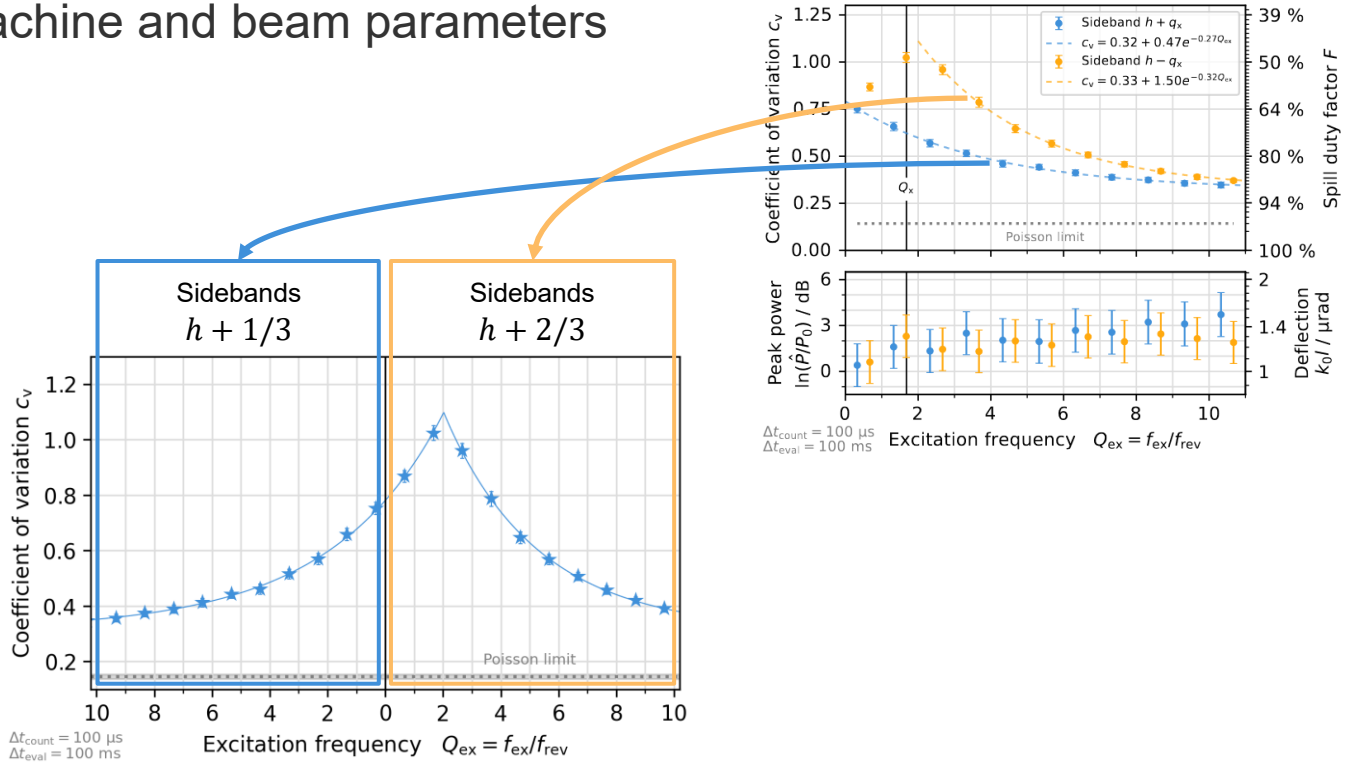
- Pile-up reduction with high harmonic excitation
  - → Reduction of excitation imprint avoids clustering





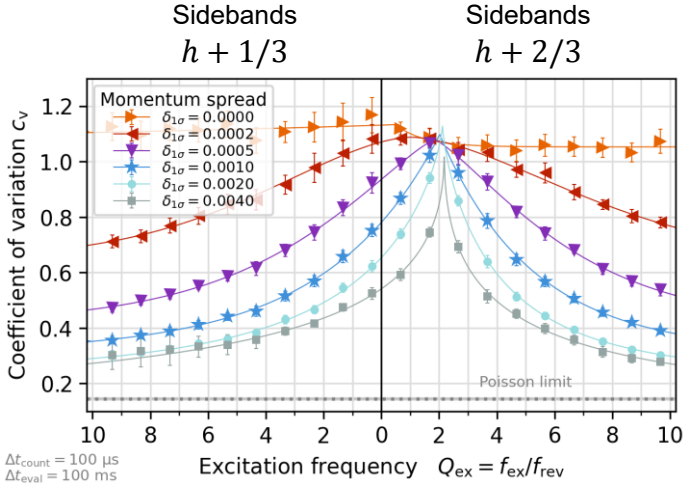
Using high frequency excitation

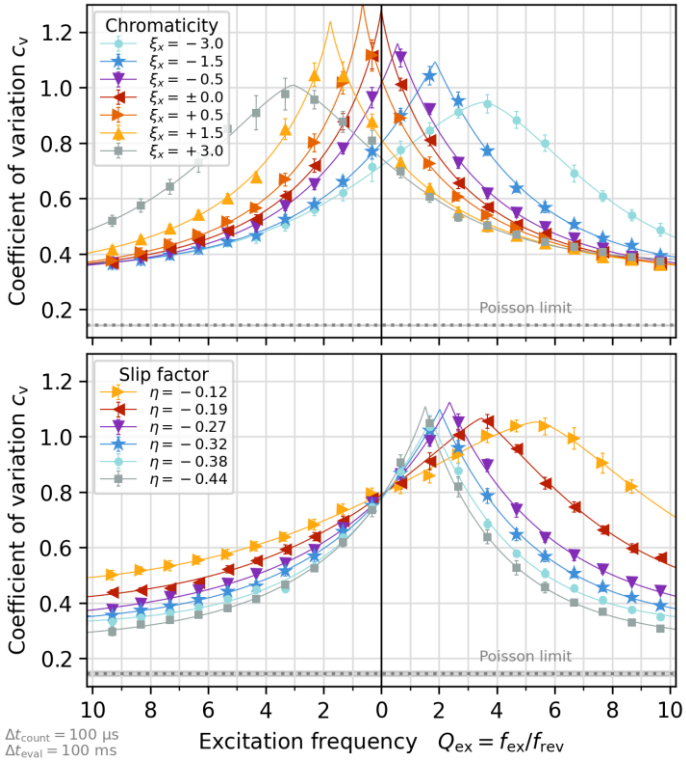
- Depends on machine and beam parameters



Using high frequency excitation

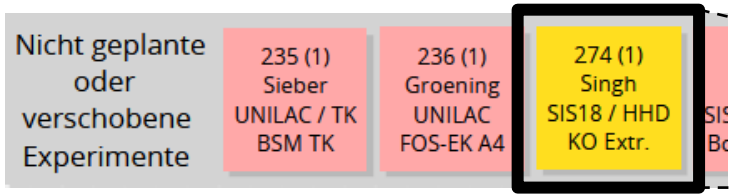
- Depends on machine and beam parameters
  - → Momentum spread, chromaticity, slip factor

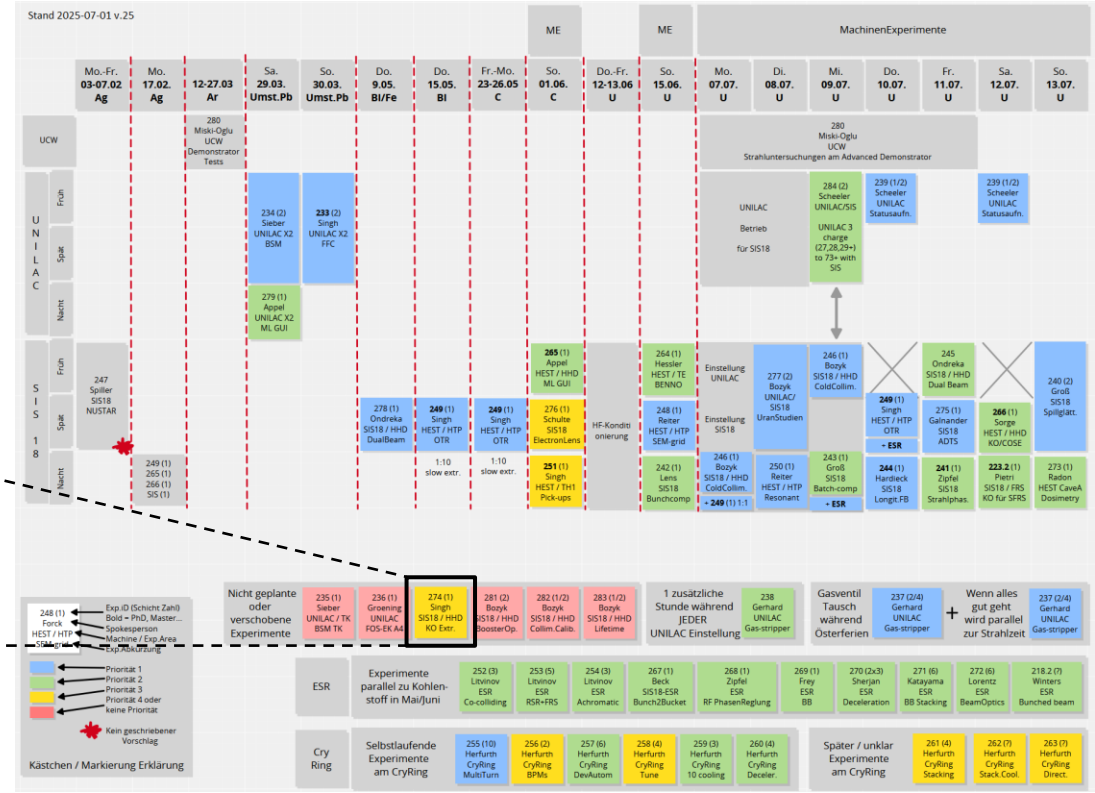




Using high frequency excitation

- Machine experiment 274
  - Applicability at SIS18/100 for high rigidity beams
  - Not yet scheduled
  - **Requested again** for next time



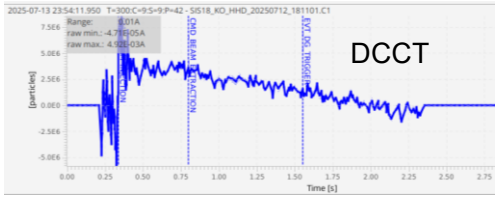


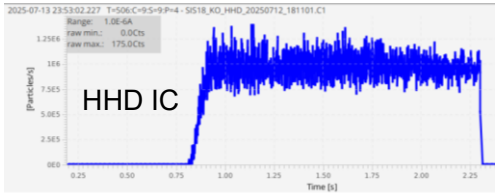
Parasitic tests for Spill Optimization System (SOS)

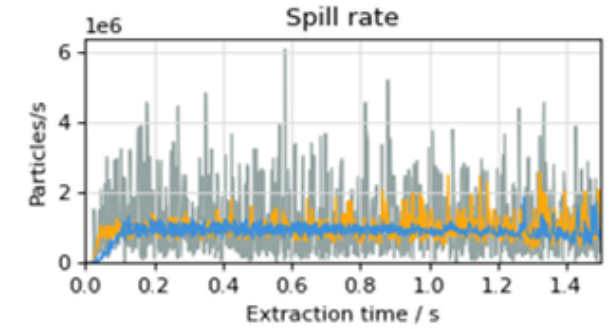
High Power RF Amplifier for KO Extraction

R. Singh, P. Niedermayer,
P. Kowina, B. Zipfel

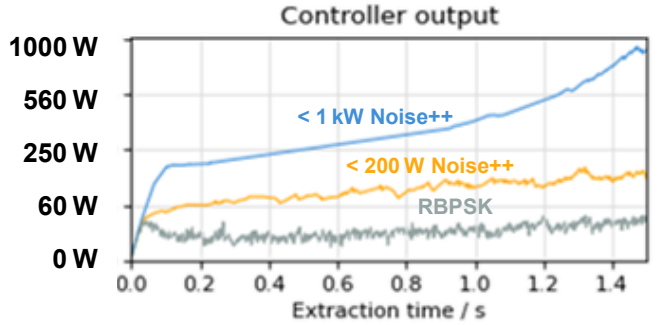
- 2 kW Barthels RF Amplifier (6MHz) from FZJ/IKP COSY inventory
  - 1.5 kW safety limit (lab tests with spare by P. Kowina)
  - Feed-throughs modified and RF parts exchanged
- **Parasitic test on 13.7.2025 with RRF**
  - 12 T m $^{238}U^{73+}$ beam, 1.5 s spill from SIS18 to HHD
  - 1 kW KO power used to fully empty the SIS18
  - Improvement: RBPSK · Noise++ · 1 kW Noise++
    - Spill quality factor: **32%** → **86%** → **94%**
    - Fluctuations (c_v): 1.45 → 0.4 → 0.25





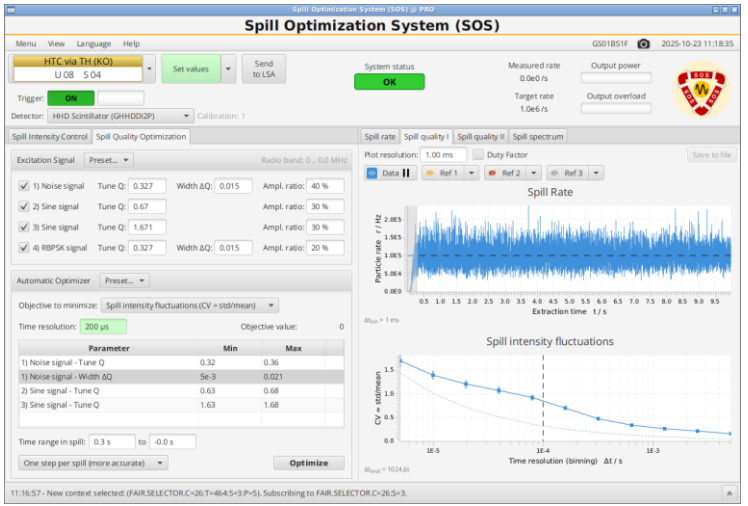


$\Delta t_{count} = 1$ ms



Spill Optimization System (SOS) Test

- SOS multiplexing and system integration — Status 11/25
  - Signal multiplexer for automatic switching between detectors (EEL) — 100% ✓
  - Dynamic spill rate control — 100% ✓
  - FESA class, Yocto FEC and dedicated JavaFX GUI — 80%
  - Integration with LSA and LASSIE — 50%
  - Documentation and operator training — 70%
- **Parasitic test on 8.7.2025**
  - Multiplexed settings & signals ✓
  - Data acquisition & evaluation ✓
- **Next:** Test in Wetrun Jan 2026
  - Multiplexed optimization, LSA



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