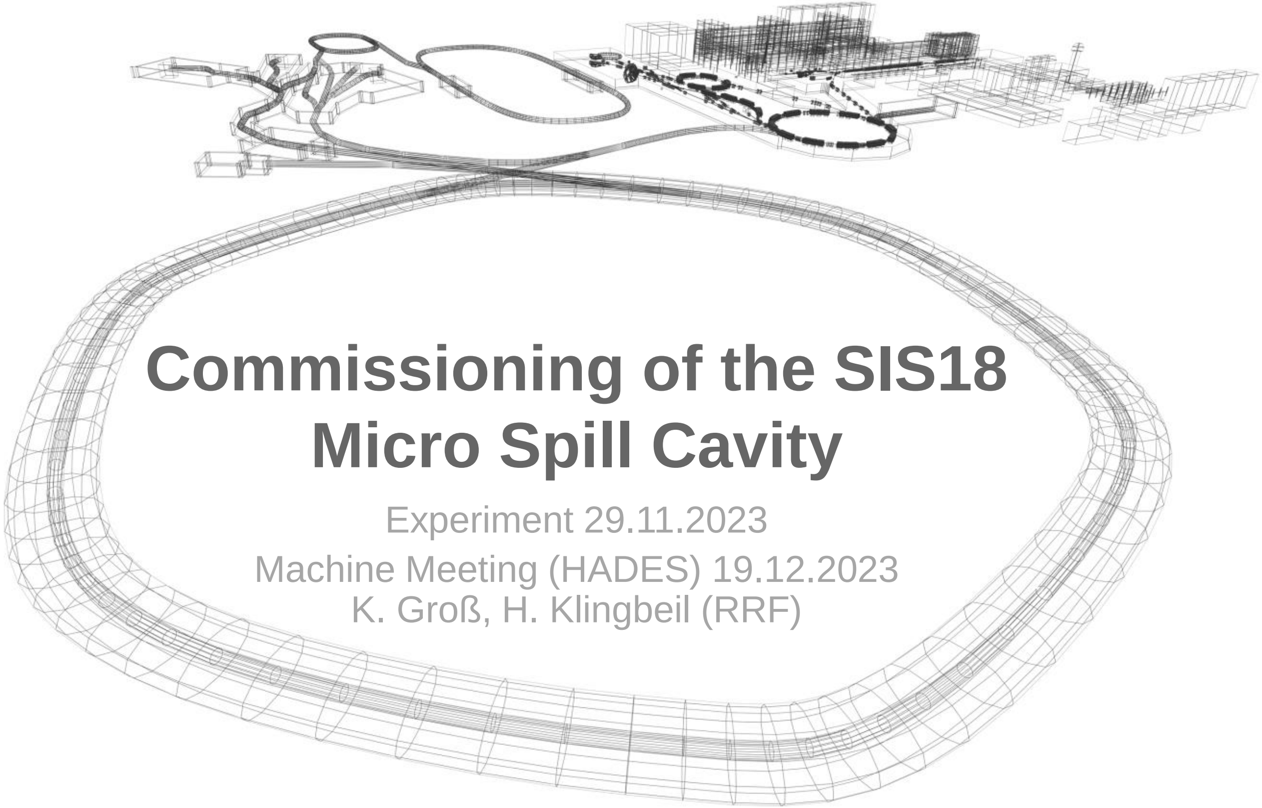


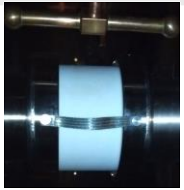
Commissioning of the SIS18 Micro Spill Cavity

Experiment 29.11.2023

Machine Meeting (HADES) 19.12.2023

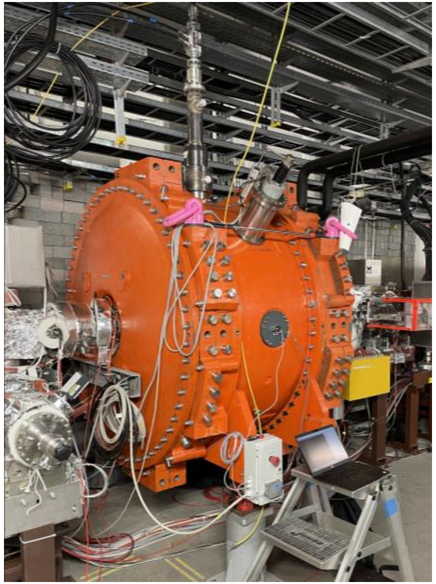
K. Groß, H. Klingbeil (RRF)

Parameters of the Micro Spill Cavity GS11BE6



Requirements and Limits

- Access SIS18 required before & after operation to remove short-circuit
- Conditioning required, warming-up & cooling-down time
- Locally operated (BG 1.016)
- Frequency range 81 to 81.8 MHz
  (down to 79 MHz with low voltages – sparks)
- Gap voltage amplitude up to 25 kV
- Impedance without shortcut about 500 kΩ, $Q_0 \approx 5000$

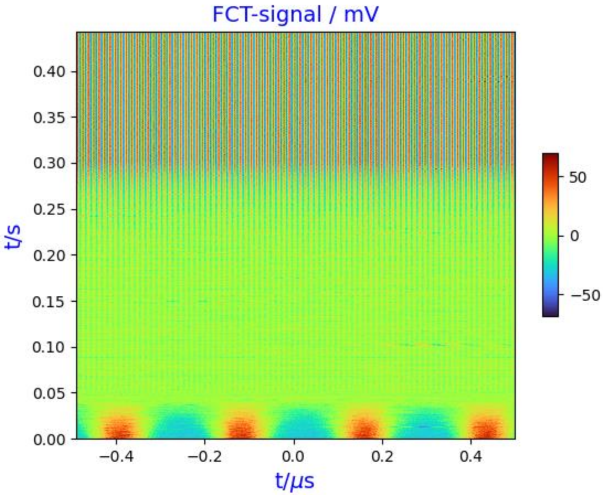


Settings on 29.11.2023

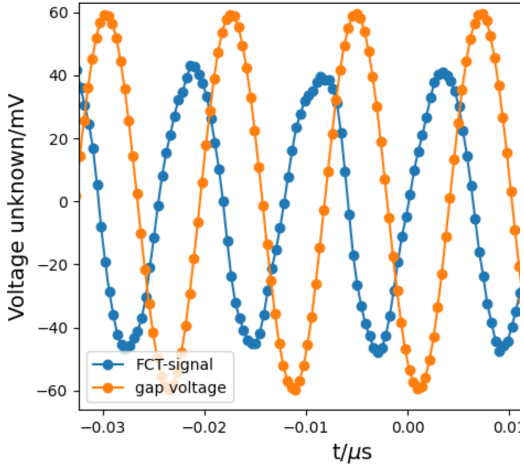
- Conditioning 1:40 h, $^{14}N^{7+}$, 300 MeV/u, 2 s flattop,
  8 s slow extraction, h=90 (81.4366 MHz / 904.9 kHz)

Measurements with Micro Spill Cavity on 29.11.2023

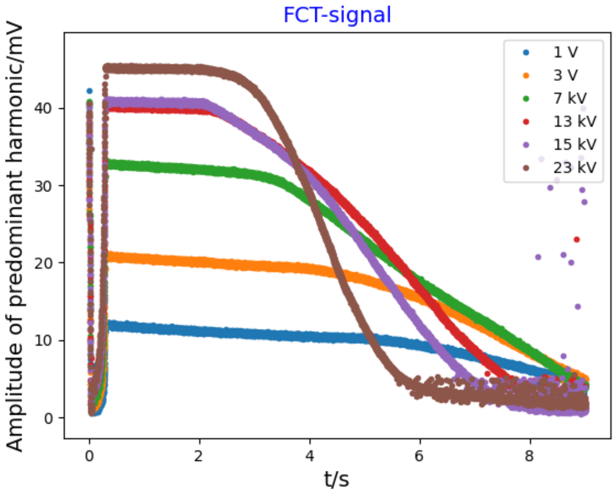
- Preliminary results, detailed analysis still has to take place
- Beam current measurements in SIS for 100 V to 23 kV, ≈ 10^9 particles / 1 mA
- Spill measurements in HHD (Ablass-Expert & TDC)



Figures: h = 4 → capture @ h = 90



rf signals at 81,345 MHz

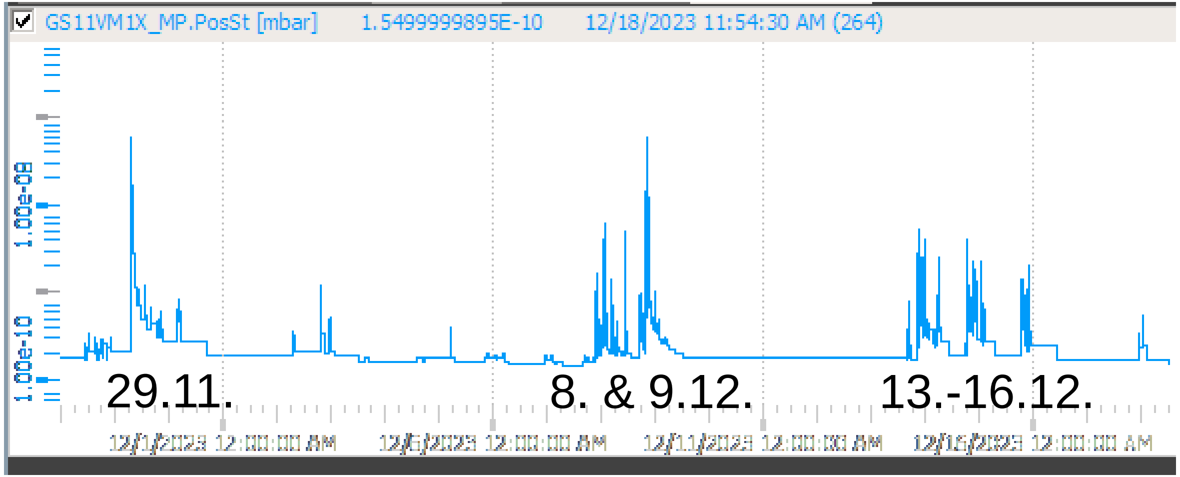


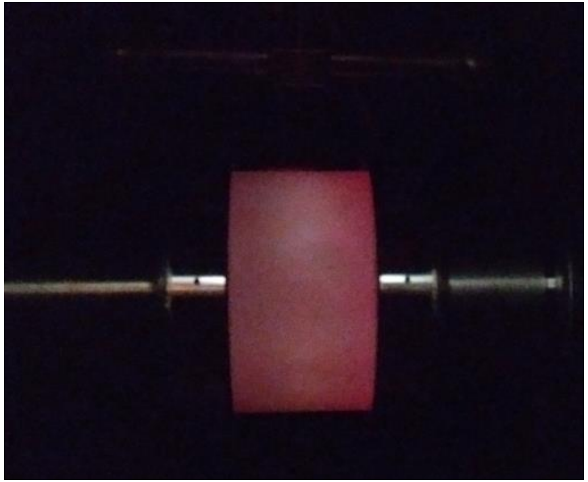
decreasing current during extraction

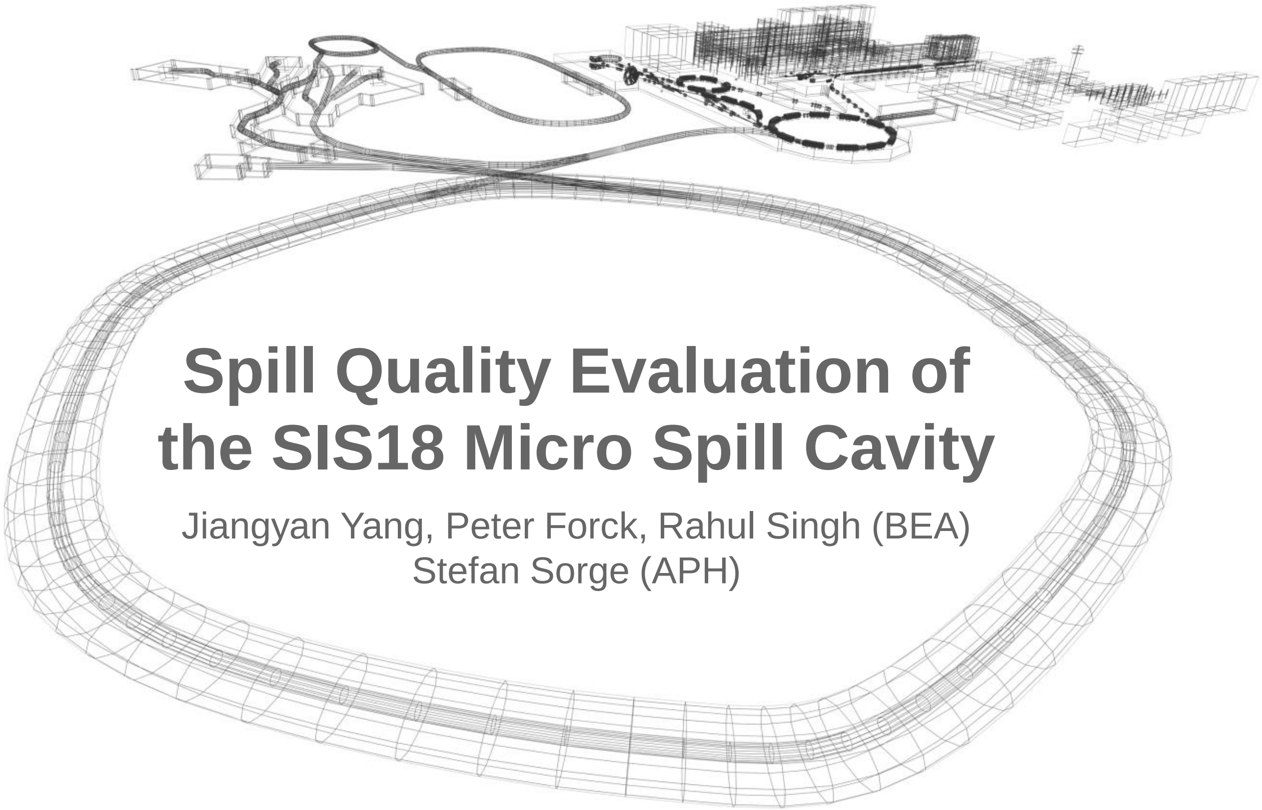
Remarks on Cavity Impedance and Vakuum

Additionally tested:

- Successful acceleration of $1.5 \cdot 10^{10}$ particles, 15 mA
- Induced voltage was < 100 V





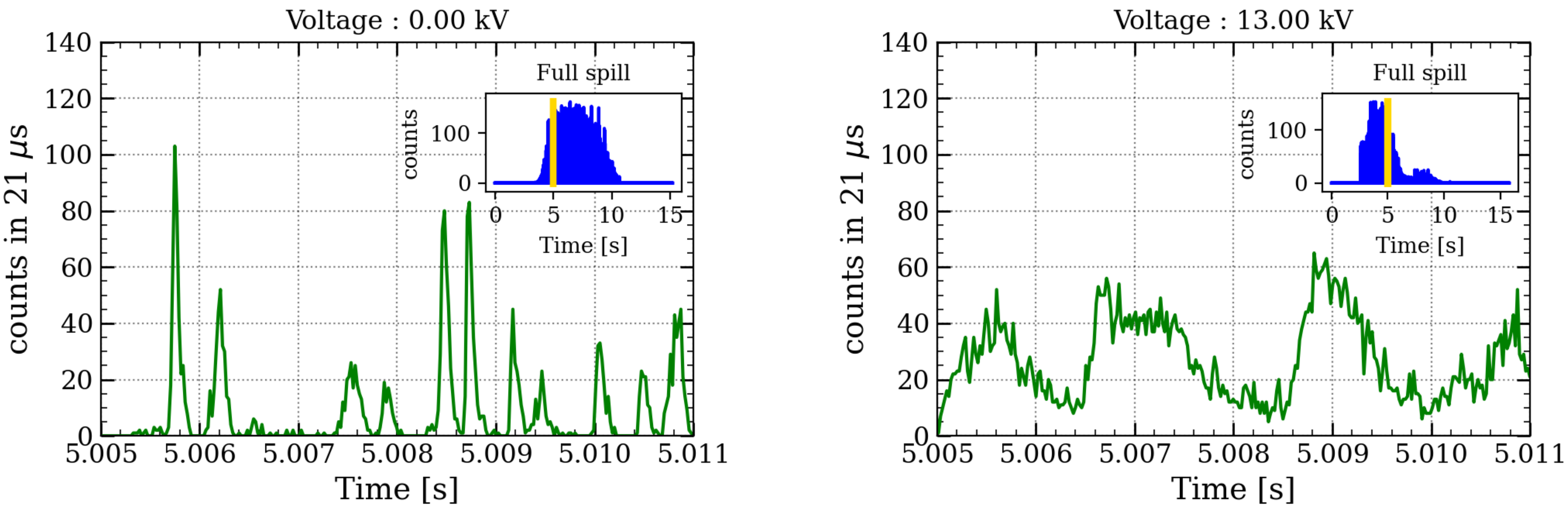


Spill Quality Evaluation of the SIS18 Micro Spill Cavity

Jiangyan Yang, Peter Forck, Rahul Singh (BEA)
Stefan Sorge (APH)

Extracted Spill and micro structures

Spill structure in 6 ms



Results: significant improvement for 80 MHz bunching.

Spill quality evaluation: time dependent duty factor

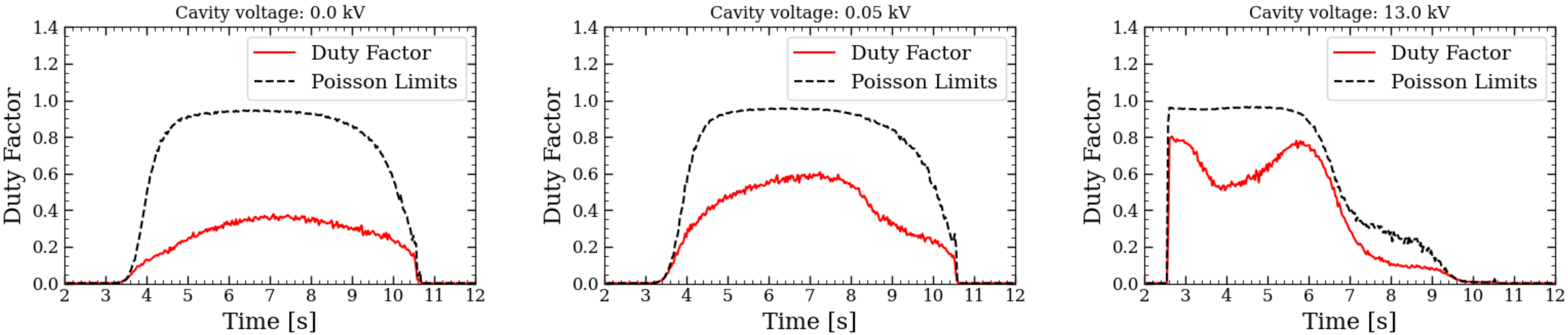
Duty factor:

$$F(t_i) = \frac{\mu^2(t_i)}{\mu^2(t_i)+\sigma^2(t_i)}$$

μ: mean value
σ: standard deviation

Within time window T_{eva}

T_{read} = 21 μs, T_{eva} = 31.5 ms



Results:

- The higher the duty factor, the better the spill quality
- The improvement of spill quality for bunching is obvious.

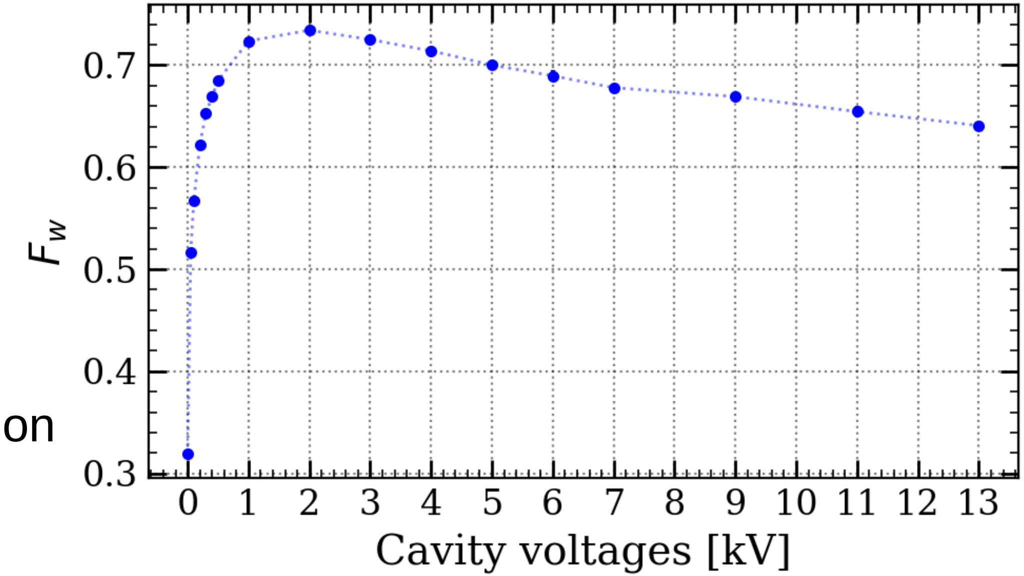
Spill quality characterization over entire spill

Weighted duty factor F_w

$$F_w = \frac{\sum \mu(t_i) \cdot F(t_i)}{\sum \mu(t_i)}$$

$\mu(t_i)$ & $\sigma^2(t_i)$:

mean & variance within evaluation window



To be investigated: why is the ‘best spill’ measured at 2 kV

Acknowledgments

- **TRI (Transport and Installation)**
  Dirk Acker, Klaus Lück, Markus Grenz-Gustafson, Michelle Diebel, Kosmas Kalaitzidis et al.
- **Bau**
  Bjoern Benz, Johannes Kalenda
- **LRF (Linac RF)**
  Jens Zappai, Bernhard Schlitt, Gerald Schreiber et al.
- **VAC (Vacuum Systems)**
  Maria Cristina Bellachioma, Edgar Renz, Graziano Savino
- **BEA (Beam Instrumentation)**
  Peter Forck, Plamen Boutachkov, Timo Milosic, Jiangyan Yang, Oleksandr Chorniy
- **ARP (Accelerator Radiation Protection)**
  Ekaterina Kozlova, Alexey Sokolov
- **ATP (Atomic, Quantum & Fundamental Physics)**
  Alexandre Gumberidze
- **OPE (Accelerator Operation)**
  Christoph Böhm, Achim Bloch-Späth et al.
- **RRF (Ring RF)**
  Peter Hülsmann (jetzt DESY), Bernhard Zipfel, Christof Thielmann, Martin Hardieck, Janet Schmidt, Oliver Disser, Sebastian Lux, Thomas Winnefeld, Robert Balß, Uli Laier, Harald Klingbeil, Dieter Lens, Stefan Schäfer et al.
- **SIS (SIS100/SIS18)**
  Peter Spiller