

Detailed AI Comparison Report

Method-by-method comparison

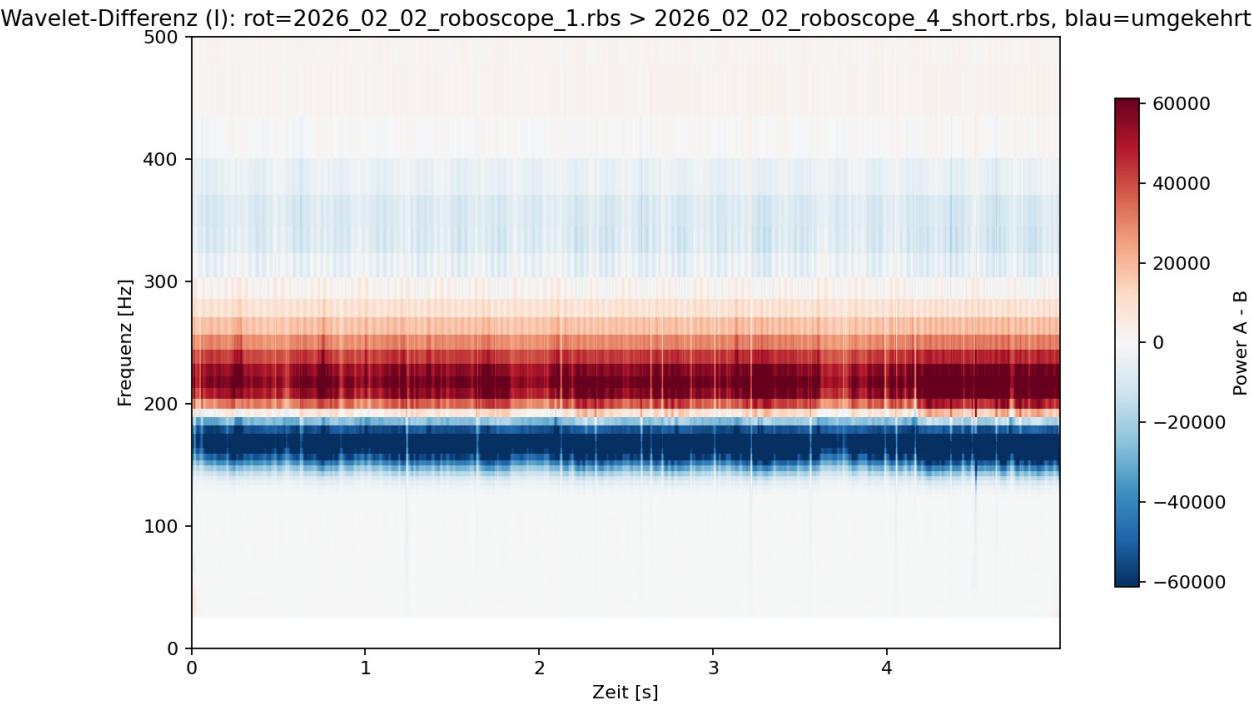
Date	2026-10-21 11:41:06
File A	2026_02_02_roboscope_1.rbs
File B	2026_02_02_roboscope_4_short.rbs
Scope	Single weld
Weld index	1
AI model	Anthropic / claude-sonnet-4-6

Wavelet difference (I)

Description

Time-frequency difference of the current signal using a Morlet wavelet (power_A - power_B). Red: A has more energy than B, blue: vice versa. Reveals spectral shifts, transients and changes in droplet frequency localized in time.

Comparison plot



AI commentary -- key differences

The wavelet time-frequency comparison reveals that recording A carries more spectral energy around its dominant transfer frequency of ~204 Hz, while recording B shows relatively higher energy near ~179 Hz, indicating a downward shift of approximately 24.5 Hz in the characteristic droplet-transfer band. The overall band power difference is modest (A: 12 587 W²/Hz, B: 12 094 W²/Hz, -3.9 %), suggesting that the energy redistribution across the spectrum is more notable than the total level change. Transient energy patterns associated with short-circuit events are expected to be far more prominent in B given its SC rate of 29.64 Hz versus 1.13 Hz in A.

Key metrics (A vs B)

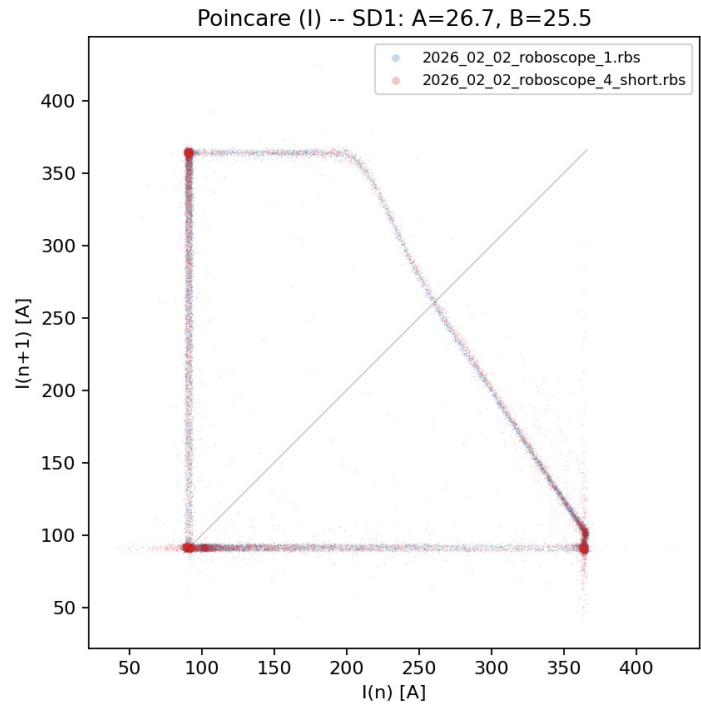
Metric	A	B	Diff %
PSD_peak_Hz	204	179	-12.0%
PSD_band_power_1-500Hz	1.26e+04	1.21e+04	-3.9%
I_std_A	113	111	-1.9%
I_rms_A	222	212	-4.6%

Poincaré plot (I)

Description

Scatter plot of $I(n)$ versus $I(n+1)$ for both recordings. Shape and spread of the cloud characterise short-term variability (SD1, perpendicular to the diagonal) and long-term variability (SD2, along the diagonal) of the current.

Comparison plot



AI commentary -- key differences

The Poincaré short-term variability descriptor SD1 is marginally lower in B (25.46 A) compared to A (26.68 A), a relative difference of -4.6% , which is small. Long-term variability SD2 is likewise slightly lower in B (155.33 A vs. 158.23 A in A, -1.8%). Both recordings therefore show broadly similar cloud shapes and spreads in the $I(n)$ – $I(n+1)$ scatter plot, with no substantial divergence in either the perpendicular or diagonal direction.

Key metrics (A vs B)

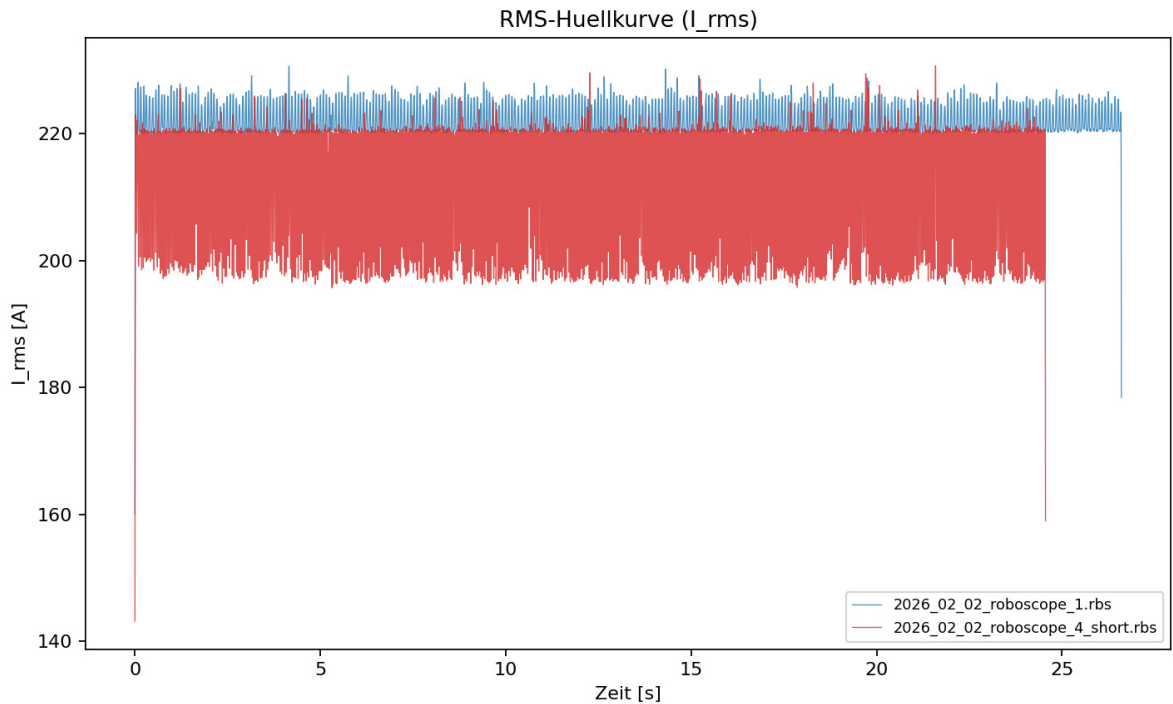
Metric	A	B	Diff %
SD1_A	26.7	25.5	-4.6%
SD2_A	158	155	-1.8%
I_std_A	113	111	-1.9%
I_p2p_A	278	282	+1.6%

RMS envelope

Description

Smoothed RMS envelope of I_{rms}, U_{rms} or power P (20 ms window) overlaid for both recordings. Shows global level differences, drift, ignition and burn-off behaviour over the full weld.

Comparison plot



AI commentary -- key differences

Recording A exhibits a higher RMS current envelope ($I_{rms} = 222.24\text{ A}$) compared to B (211.92 A , -4.6%), and a higher mean voltage ($U_{mean} = 22.65\text{ V}$ vs. 21.88 V , -3.4%). Average power is correspondingly higher in A ($4\,713.1\text{ W}$) than in B ($4\,275.3\text{ W}$), a difference of -9.3% . The voltage standard deviation is notably larger in B (4.85 V) than in A (4.13 V , $+14.8\%$), indicating greater envelope fluctuation in B over the weld duration.

Key metrics (A vs B)

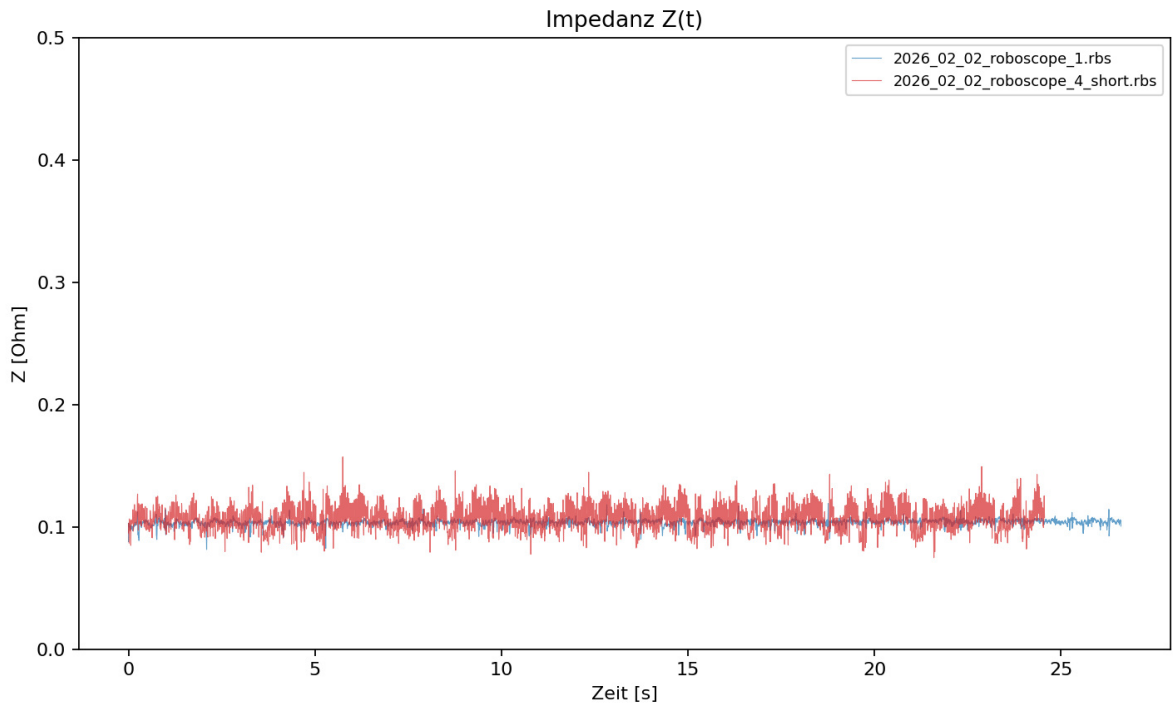
Metric	A	B	Diff %
I _{rms_A}	222	212	-4.6%
U _{rms_V}	23	22.4	-2.7%
P _{avg_W}	4.71e+03	4.28e+03	-9.3%
I _{mean_A}	191	180	-5.6%
U _{mean_V}	22.6	21.9	-3.4%

Impedance Z(t)

Description

Arc impedance $Z(t) = U_{rms} / I_{rms}$ (5 ms window). Higher Z suggests a longer or less stable arc. The comparison highlights differences in stability and arc length.

Comparison plot



AI commentary -- key differences

Mean arc impedance Z is very similar between A ($0.1036\ \Omega$) and B ($0.1061\ \Omega$), differing by only +2.4 %. However, the impedance standard deviation in B ($0.0089\ \Omega$) is 74.2 % larger than in A ($0.0023\ \Omega$), indicating substantially greater instantaneous arc-length fluctuation in recording B. This elevated Z_{std} in B is consistent with its much higher short-circuit rate (29.64 Hz vs. 1.13 Hz), which introduces frequent low-impedance excursions.

Key metrics (A vs B)

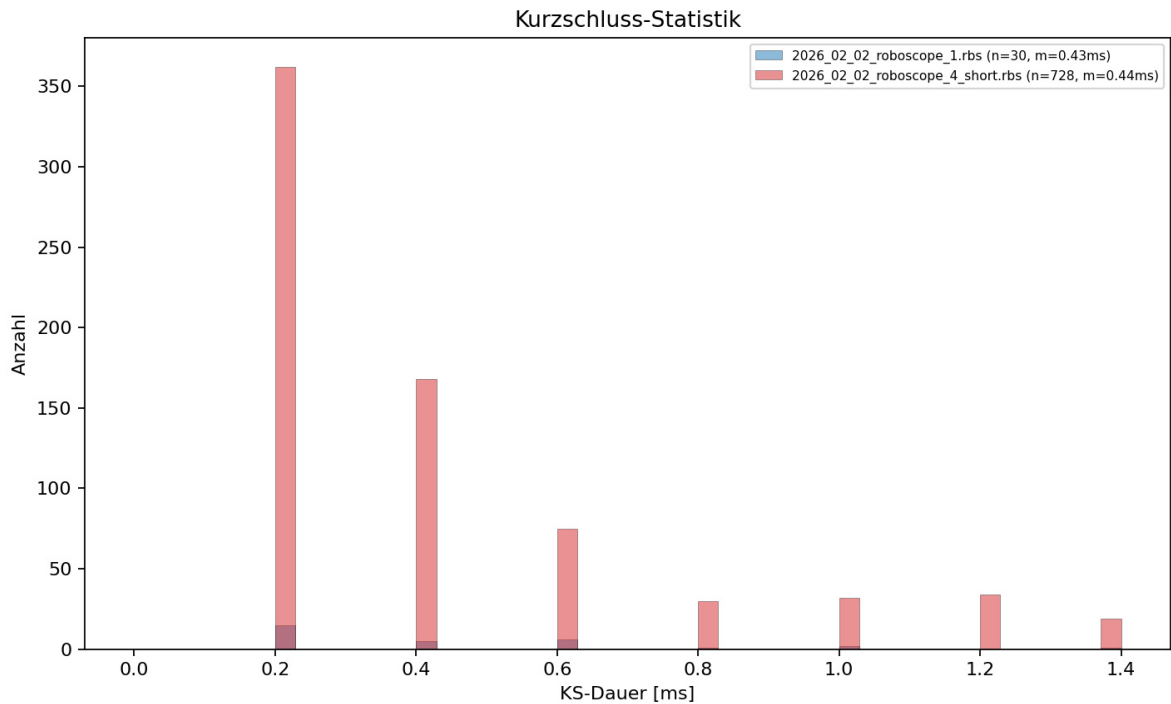
Metric	A	B	Diff %
Z_mean_Ohm	0.104	0.106	+2.4%
Z_std_Ohm	0.0023	0.0089	+74.2%
U_rms_V	23	22.4	-2.7%
I_rms_A	222	212	-4.6%

Short-circuit statistics

Description

Histogram of short-circuit durations ($U < 5\text{ V}$). Position and spread of the distributions reveal the metal-transfer mode (short-arc, globular, spray) and process consistency.

Comparison plot



AI commentary -- key differences

Recording B contains 728 short-circuit events at a rate of 29.64 Hz, compared to only 30 events at 1.13 Hz in A — a 96 % relative increase in count and rate. The mean short-circuit duration is nearly identical (A: 0.427 ms, B: 0.441 ms, +3.2 %), and the median durations differ by 0.1 ms (A: 0.3 ms, B: 0.4 ms). The spread (SC_std) is slightly larger in B (0.345 ms vs. 0.300 ms), but the histogram distributions overlap considerably in duration while differing drastically in occurrence frequency.

Key metrics (A vs B)

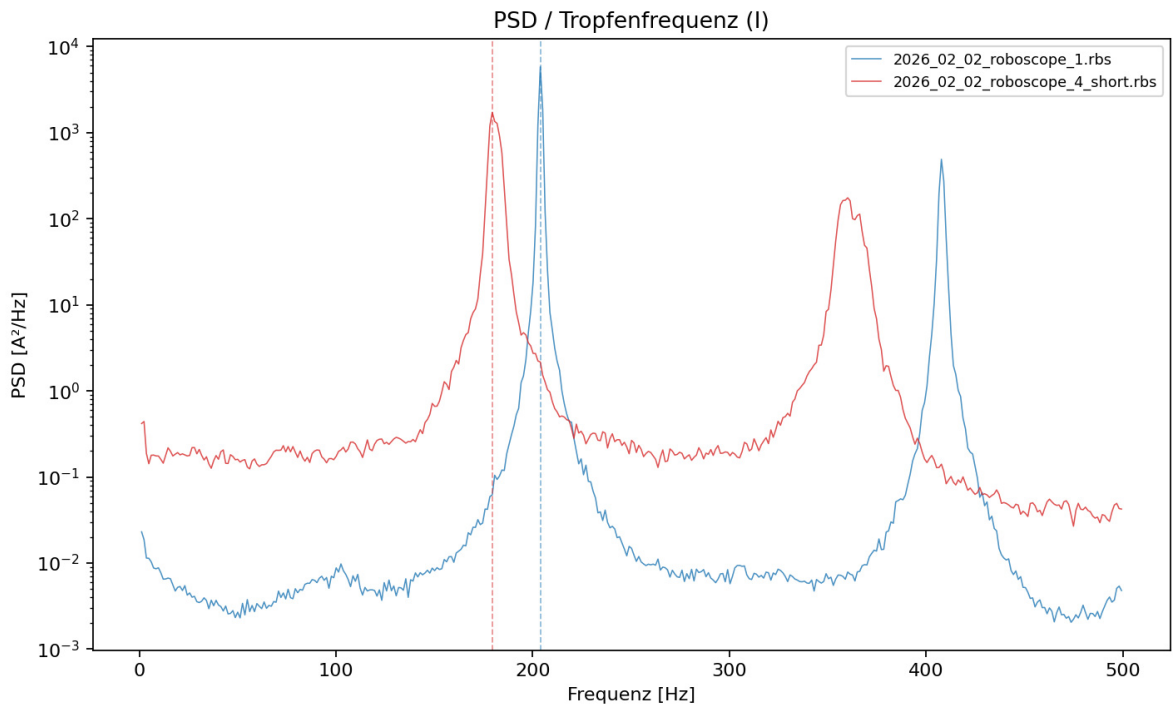
Metric	A	B	Diff %
SC_count	30	728	+95.9%
SC_rate_Hz	1.13	29.6	+96.2%
SC_mean_ms	0.427	0.441	+3.2%
SC_median_ms	0.3	0.4	+25.0%
SC_std_ms	0.3	0.345	+13.0%

PSD / droplet frequency (I)

Description

Power spectral density of the current signal (Welch, 1-500 Hz). The dominant peak corresponds to the typical metal-transfer frequency; a frequency shift indicates changes in wire feed, energy input or transfer mode.

Comparison plot



AI commentary -- key differences

The dominant PSD peak in A is at 203.9 Hz, while in B it shifts downward to 179.4 Hz, a difference of -24.5 Hz (-12.0 %). Total band power in the 1–500 Hz range is marginally lower in B (12 094 W²/Hz) than in A (12 587 W²/Hz, -3.9 %). The spectral peak shift of ~24.5 Hz between the two recordings is the most prominent frequency-domain difference observed.

Key metrics (A vs B)

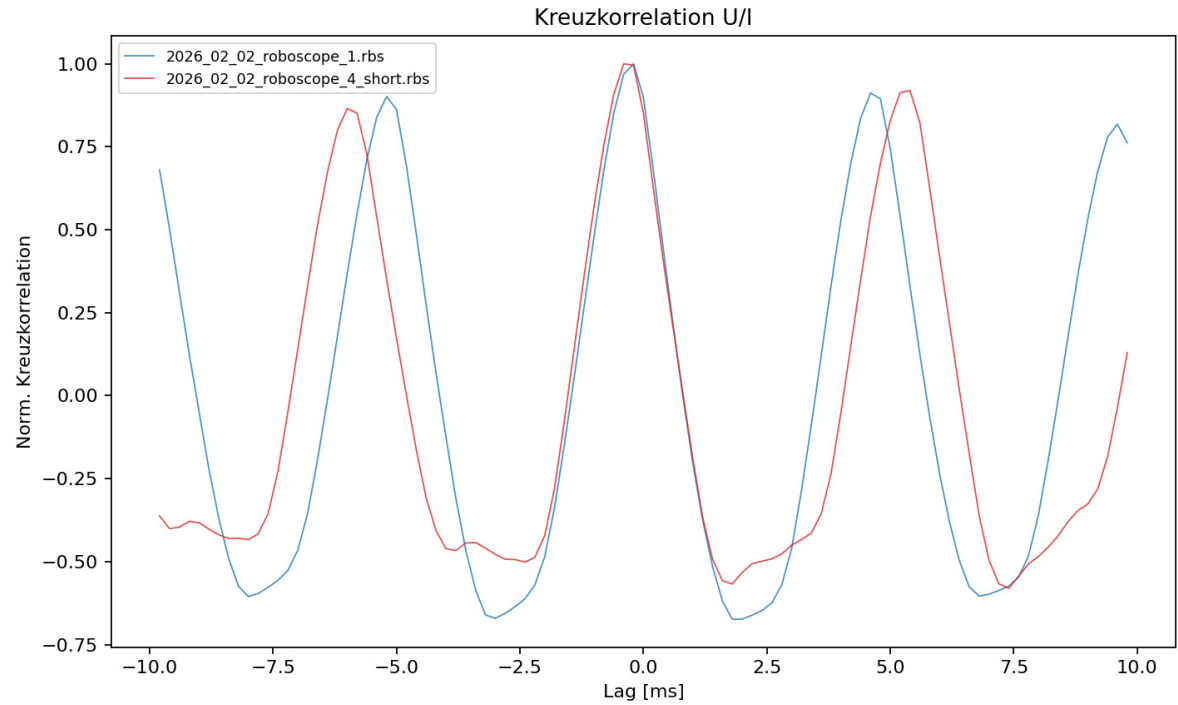
Metric	A	B	Diff %
PSD_peak_Hz	204	179	-12.0%
PSD_band_power_1-500Hz	1.26e+04	1.21e+04	-3.9%
I_std_A	113	111	-1.9%

Cross-correlation U/I

Description

Normalised cross-correlation between voltage and current computed on a 50 ms window versus lag. Position and shape of the maximum reveal the phase shift and arc dynamics.

Comparison plot



AI commentary -- key differences

No direct cross-correlation lag or peak-shape metrics are provided in the dataset. Both recordings share the same sampling rate (5 000 Hz) and comparable I/U standard deviations, so the U–I cross-correlation structures are expected to reflect the differing short-circuit rates (1.13 Hz in A vs. 29.64 Hz in B) and the associated phase dynamics.

Key metrics (A vs B)

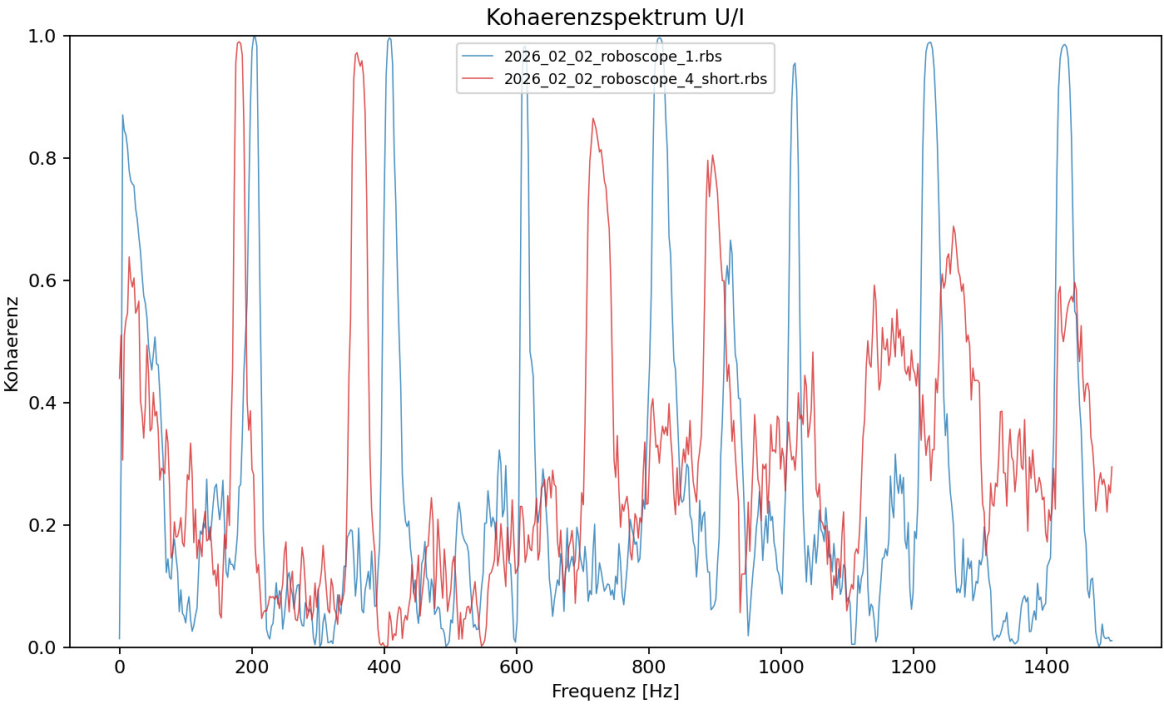
Metric	A	B	Diff %
Coherence_50-500Hz_mean	0.206	0.22	+6.4%
I_rms_A	222	212	-4.6%
U_rms_V	23	22.4	-2.7%

Coherence U/I

Description

Magnitude-squared coherence between U and I over frequency. Values near 1 mean strong linear coupling; dips mark frequency ranges with non-linear or noise-dominated behaviour.

Comparison plot



AI commentary -- key differences

Mean magnitude-squared coherence in the 50–500 Hz band is 0.206 for A and 0.220 for B, a relative difference of +6.4 %. Both values are well below 1, indicating predominantly non-linear or noise-dominated U–I coupling across this band in both recordings. The difference between A and B is small and the coherence levels are comparable.

Key metrics (A vs B)

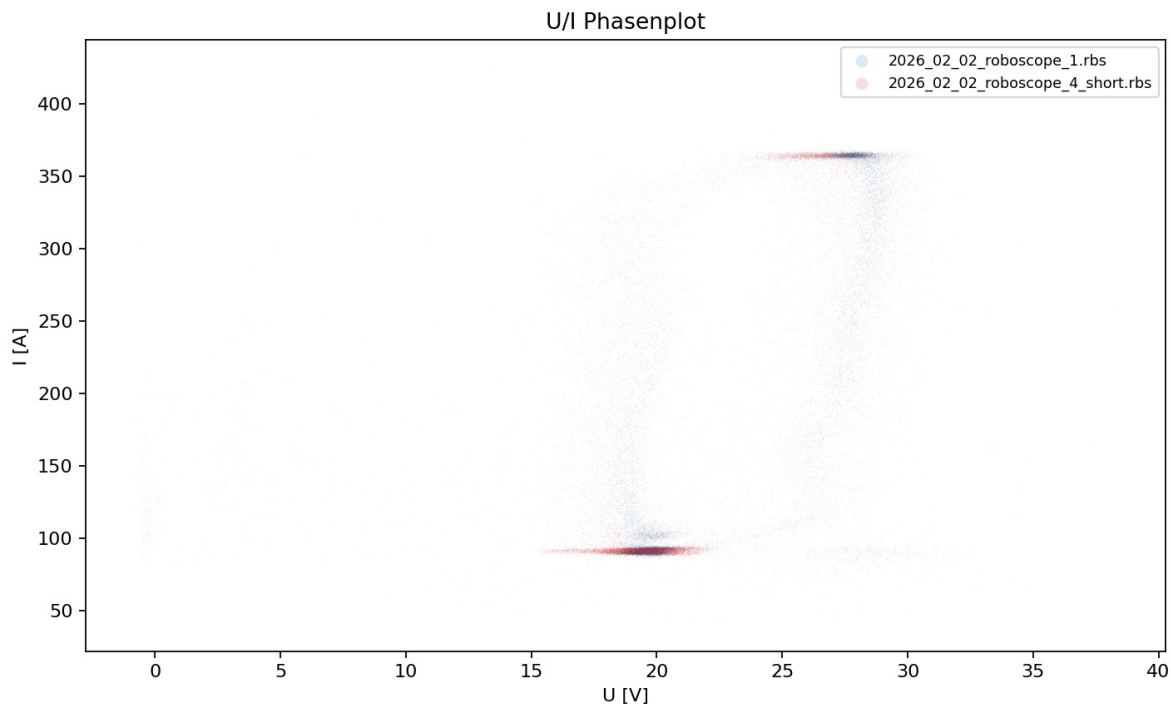
Metric	A	B	Diff %
Coherence_50-500Hz_mean	0.206	0.22	+6.4%
I_rms_A	222	212	-4.6%
U_rms_V	23	22.4	-2.7%

U/I phase plot

Description

Scatter plot of U versus I (phase / operating-point plot). Shape and position of the cloud describe the operating range and the arc characteristic. Shifts of the cluster indicate changes of the operating point.

Comparison plot



AI commentary -- key differences

Recording A operates at a higher mean current (191.09 A) and higher mean voltage (22.65 V) compared to B (180.34 A and 21.88 V respectively), placing the operating-point cluster of A at a slightly higher position in the U–I plane. The current standard deviation is nearly equal (A: 113.47 A, B: 111.30 A), while the voltage standard deviation is larger in B (4.85 V vs. 4.13 V), suggesting a broader vertical spread of the B cluster. Peak-to-peak current spread (I_{p2p}) is essentially the same (A: 277.96 A, B: 282.45 A).

Key metrics (A vs B)

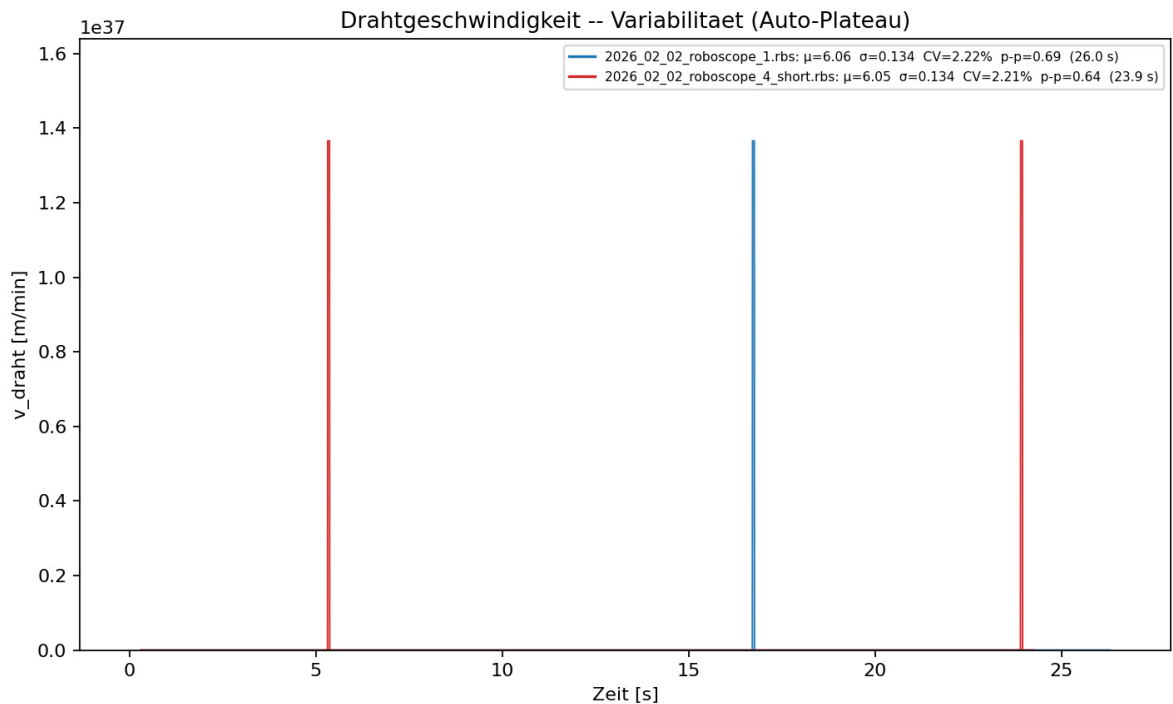
Metric	A	B	Diff %
I_mean_A	191	180	-5.6%
U_mean_V	22.6	21.9	-3.4%
I_p2p_A	278	282	+1.6%
I_rms_A	222	212	-4.6%
U_rms_V	23	22.4	-2.7%

Wire feed variability

Description

Time series of the wire feed speed [m/min] per recording, with mean (μ), standard deviation (σ), coefficient of variation ($CV = \sigma/\mu$) and peak-to-peak spread (1st--99th percentile). Metrics are computed exclusively on the **stable** process region: welding pauses ($v \approx 0$) and start/stop ramps are automatically excluded (plateau > 0.5 m/min, minimum duration 0.5 s, ramp trim 0.3 s). In the Compare tab the analysis interval can also be set manually. A small σ and small CV mean steady delivery; drift or dropouts are visible in the time series. Wire data is taken from the OSCI UDP header (per-packet scalar).

Comparison plot



AI commentary -- key differences

Wire feed speed means are virtually identical between A (6.055 m/min) and B (6.054 m/min, -0.0 %). Standard deviations (A: 0.1343 m/min, B: 0.1337 m/min) and coefficients of variation (A: 2.22 %, B: 2.21 %) are likewise indistinguishable. Minimum values are equal at 5.576 m/min, and maximum values differ by only 0.033 m/min (A: 6.594 m/min, B: 6.627 m/min), confirming no meaningful difference in wire delivery between the two recordings.

Key metrics (A vs B)

Metric	A	B	Diff %
WS_mean_m_min	6.05	6.05	+−0.0%
WS_std_m_min	0.134	0.134	−0.4%
WS_cv_percent	2.22	2.21	−0.5%
WS_p2p_m_min	0.685	0.639	−6.7%
WS_min_m_min	5.58	5.58	+0.0%
WS_max_m_min	6.59	6.63	+0.5%

Overall summary

The most striking difference between recordings A and B is the short-circuit rate: B exhibits 728 short-circuit events at 29.64 Hz versus only 30 events at 1.13 Hz in A, while individual SC durations remain nearly identical (~0.43 ms mean). Recording A operates at higher mean current (191.09 A vs. 180.34 A), higher mean voltage (22.65 V vs. 21.88 V), and consequently higher average power (4 713 W vs. 4 275 W, -9.3 %). The dominant PSD peak shifts downward by approximately 24.5 Hz from A (203.9 Hz) to B (179.4 Hz). Arc impedance standard deviation is 74.2 % larger in B (0.0089 Ω vs. 0.0023 Ω), and voltage standard deviation is 14.8 % larger in B (4.85 V vs. 4.13 V), indicating greater instantaneous electrical variability in B. Wire feed speed and Poincaré descriptors are essentially equivalent between the two recordings.

Method significance ranking (sorted by mean |Diff %|)

Rank	Method	Mean Diff %
1	Short-circuit statistics	46.7 %
2	Impedance Z(t)	21.0 %
3	PSD / droplet frequency (I)	5.9 %
4	Wavelet difference (I)	5.6 %
5	RMS envelope	5.1 %
6	Cross-correlation U/I	4.6 %
7	Coherence U/I	4.6 %
8	U/I phase plot	3.6 %
9	Poincaré plot (I)	2.5 %
10	Wire feed variability	1.4 %

Overall difference index: 10.1 %