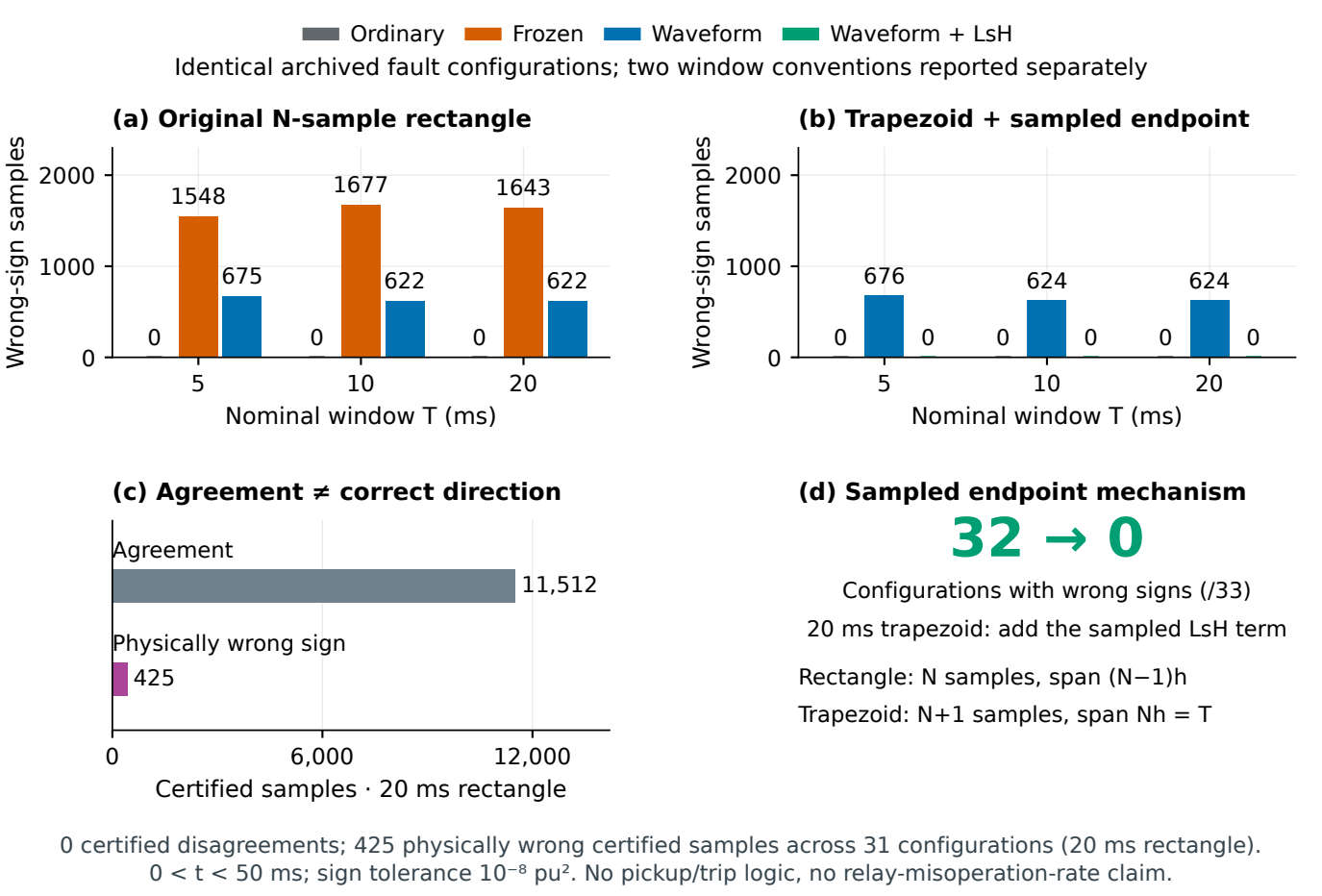

Ordinary
Frozen
Waveform
Waveform + LsH
Identical archived fault configurations; two window conventions reported separately
(a) Original N-sample rectangle
Wrong-sign samples
2000
1000
0
1548
675
1677
622
1643
622
0
0
0
5
10
20
Nominal window T (ms)
(b) Trapezoid + sampled endpoint
Wrong-sign samples
2000
1000
0
676
624
624
0
0
0
0
0
0
5
10
20
Nominal window T (ms)
(c) Agreement ≠ correct direction
Agreement
11,512
Physically wrong sign
425
0
6,000
12,000
Certified samples · 20 ms rectangle
(d) Sampled endpoint mechanism
32 → 0
Configurations with wrong signs (/33)
20 ms trapezoid: add the sampled LsH term
Rectangle: N samples, span (N−1)h
Trapezoid: N+1 samples, span Nh = T
0 certified disagreements; 425 physically wrong certified samples across 31 configurations (20 ms rectangle).
0 < t < 50 ms; sign tolerance 10⁻⁸ pu². No pickup/trip logic, no relay-misoperation-rate claim.