

masked_data_RG_80nM, signature 3b8cc8b6

Recording

Rat heart, ventricular fibrillation. 128 × 80 px, 3,800 frames, 1 kHz, 112.5 µm/px, deposit checks: unit range, non integer, nan mask partial, temporal smoothing, spatial smoothing. Source 10.5281/zenodo.18319102; publication 10.1093/cvr/cvaa141; licence CC-BY-4.0; Verstraeten, Bjorn; Lootens, Sebastiaan. sha256 9e30977de373f78d1b5d236bd100e46bb79c72152d3a7516b9c03c4849391076.

Run

82fe7343-d416-4536-b39e-19b7eca30443, 2026-10-27 23:46 UTC to 2026-10-27 23:48 UTC, status done. Protocol Rat whole heart optical mapping (Zenodo 18319102), parameters v1 set by developer (not a domain scientist). Code 905d5bebbb29da7ad46cd5045db14330695037c3 (uncommitted changes), 9 workers.

Methods

Recording Rat heart, ventricular fibrillation (RG 80 nM) (doi:10.5281/zenodo.18319102; 128x80 px, 3800 frames, 1000 Hz) was analysed over frames 200-3600. Deposit shows signs of prior processing (provisional): unit range, non integer, nan mask partial, temporal smoothing, spatial smoothing. Each pixel was baseline-corrected by subtracting a 121-frame centered moving average; NaN pixels were set to zero. Dye polarity (upright) was taken from the sign of the median per-pixel skew of dV/dt. For phase only, each frame was spatially filtered with a Gaussian (sigma 1.0 px, truncated at 4.0 sigma); no temporal low-pass was applied. Phase was the angle of the Hilbert transform with 200 frames of padding on each side. Phase singularities were plaquettes with |winding| > 0.9 turns at least 3 px inside the tissue edge; they were tracked across frames (same charge, <= 4.0 px per frame, gaps <= 5 frames), and a persistent rotor was a track lasting >= 25 frames (1 cycle(s) of the fastest segment) within 3.0 px of an opposite-charge singularity in no more than 50% of its frames. Sensitivity: baseline 150, 75, 38, 121 frames x sigma 0.5, 1.0, 2.0 px, and tracker variants. All thresholds and criteria are provisional pending review by a domain scientist.

Verdict

Verdict: this signature has no physiology-range pass/fail verdict because the checked stable metrics have no cited ranges, and the provisional ranges, stability threshold and criteria are provisional. Reportable as descriptive outputs are singularity_frames_frac at 1.0 fraction of frames and dominant_freq_hz at 40.294 Hz; the persistent-rotor counts are unstable and not reportable as single values, with whole_recording.persistent_rotors and persistent_rotor_tracks spanning 204.0–464.0 and whole_recording.persistent_rotor_count_max spanning 9.0–21.0 across settings. Persistent-rotor interpretation needs methods review because a cited analysis of the same rat deposit warns that naive phase-singularity detections may include false positives at conduction blocks (DOI 10.1371/journal.pcbi.1013963); additionally, the strict/default/loose trackers found 250/303/450 counts, and the recording is preprocessed rather than raw camera data, with transformed measured polarity and preprocessing-dependent SNR noted by inspection.
physiology_ok: None; send back: False. Reviewer sign-off: pending.

Parameters (as run)

```
% Rat whole heart optical mapping (Zenodo 18319102), v1, read-only
% set by developer (not a domain scientist); provisional, REVIEW_NEEDED 16
baseline_frames = 121;      % >= 2 x slowest cycle (26, images): ok
pad_frames      = 200;      % each side, outside the window
spatial_sigma   = 1.0;      % px, Gaussian, phase only
spatial_truncate = 4.0;      % kernel radius, sigma
lowpass         = [];       % none
polarity        = 1;        % measured, skew of dV/dt
rotor_threshold = 0.9;      % turns, |winding| per plaquette
rotor_erode_px  = 3;        % px from tissue edge ignored
link_px         = 4.0;      % tracking, max step per frame
max_gap         = 5;        % frames a track may vanish
min_cycles      = 1.0;      % own rotations, min_frames = 25
pair_dist_px    = 3.0;      % opposite-charge pairing
paired_frac     = 0.5;      % max paired fraction of a track
render_step     = 4;        % movie only
```

Segments

Segment	Defined	Analysed	Cycle, frames	Expected rotors	Bounded by
Ventricular fibrillation (whole recording)	0-3,800	200-3,600	26 (86% of pixels)	not stated	recording start → recording end

Metrics

Metric	Unit	Ventricular fibrillation (whole recording)	Physiological range
Rhythm			
Dominant frequency	Hz	40.294	none cited
Rotors			
Persistent rotors	count	204-464 (unstable)	none cited
Max concurrent persistent rotors	count	9-21 (unstable)	none cited
Frames with a singularity	fraction	1.000	none cited
Beats, where a global rhythm exists			
Beats	count	0	none cited
Global amplitude ratio	ratio	0.28	gate ≥ 0.30 provisional
APD50	ms	no global beat	none cited
APD90	ms	no global beat	none cited
Conduction velocity	cm/s	no global beat	none cited

Criteria and reportable values

Item	Rule or segment	Result
Design expectations	none stated for this recording's segments	no criterion to test; counts are descriptive (provisional)
persistent rotor tracks	all	204-464 count, unstable, not reportable
dominant freq (Hz)	whole recording	40.29 Hz, no cited range
persistent rotors	whole recording	204-464 count, unstable, not reportable
singularity frames fraction	whole recording	1 fraction of frames, no cited range
persistent rotor count max	whole recording	9-21 count, unstable, not reportable

Provisional rules behind this signature

Rule	Description	Expert	Status
protocol_parameter_set worker/voltage/protocol_params.py (developer_defaults, set_params)	Each protocol's fixed, versioned analysis parameters (version 1 = developer defaults); no run or agent may deviate	optical mapping analyst	provisional
baseline_window_rule worker/voltage/baseline_rule.py (FACTOR, evaluate)	A run proceeds only if the protocol's baseline window is $\geq 2 \times$ the slowest segment's cycle, the cycle from the MAP channel when a DAQ log exists, else from per-pixel dominant frequency on linearly detrended pixels; otherwise the run is held by code	optical mapping analyst	provisional
filter_defaults worker/voltage/preprocess.py (Params)	Default baseline window (frames) and spatial Gaussian sigma/truncate for phase	optical mapping analyst (cardiac electrophysiology)	provisional
tissue_mask worker/voltage/io.py (tissue_mask)	Tissue = not NaN in frame 0 and nonzero temporal std	optical mapping analyst	provisional
polarity worker/voltage/preprocess.py (polarity)	Dye polarity from sign of median per-pixel skew of dV/dt	optical mapping analyst / voltage dye chemist	provisional
singularity_detection worker/voltage/preprocess.py (Params.rotor_threshold, rotor_erode_px)	Phase singularity = $ winding > \text{threshold turns}$, $\geq$ erode px from tissue edge	computational cardiac electrophysiologist (phase mapping)	provisional
rotor_persistence worker/voltage/rotors.py (TrackParams)	Track linking distance/gap and minimum lifetime for a persistent rotor	computational cardiac electrophysiologist (phase mapping)	provisional
chirality_pairing worker/voltage/rotors.py (TrackParams.pair_dist_px, paired_frac)	Opposite-charge singularities within pair distance are a pair; tracks paired most of their life are excluded from rotors	computational cardiac electrophysiologist (phase mapping)	provisional
sensitivity_grid worker/voltage/sensitivity.py (SIGMAS, BASELINE_MULTIPLES, baseline_levels)	Filter levels tested: spatial sigma and baseline window values	optical mapping analyst	provisional
analysis_window worker/voltage/runs.py (default_window)	Frames analysed: whole recording minus one filter pad at each end (unless the plan narrows it)	cardiac electrophysiologist familiar with the dataset	provisional
prior_processing_flags worker/voltage/inspect.py (prior_processing)	Thresholds for flagging depositor processing (normalization, masking, temporal/spatial smoothing)	imaging scientist (camera acquisition and noise)	provisional
physiology_reference_rates worker/voltage/physiology.py (RANGES, TOLERANCE_FRAC)	Cited physiological ranges (single-study values widened by a 25% tolerance), applied to segments by their expected rhythm; used by the critic and for frame-rate sanity checks	cardiac electrophysiologist per species	provisional

Provisional rules behind this signature

Rule	Description	Expert	Status
stability_rule worker/agents/critic.py (STABLE_FRAC, stability)	A metric is reportable only if its spread across all sensitivity settings is $\leq 25\%$ of its median (zero spread when all values are 0); otherwise 'unstable, not reportable'	biostatistician + optical mapping analyst	provisional
persistence_threshold_vari ants worker/agents/critic.py (persistence_variants)	The persistent-rotor rule is run at two lifetimes, one measured cycle of the fastest segment and the paper's cited rotation period; both verdicts stored, disagreement flagged	computational cardiac electrophysiologist (phase mapping)	provisional
persistent_rotor_criterion worker/voltage/sensitivity .py (MIN_ROTORS_PRESENT, setting MAX_ROTORS_ABSENT)	Persistent-rotor finding holds if every 'present' segment has ≥ 1 persistent rotor and every 'absent' segment has none, at every	cardiac electrophysiologist	provisional

Review items

Topic	Detail	Severity
unstable:whole_recording.persistently_rotors	The persistent-rotor count varies over 204.0–464.0 across the filter grid and tracker variants, exceeding the provisional stability threshold and making the single count not reportable.	warn
unstable:whole_recording.persistently_rotor_count_max	The maximum simultaneous persistent-rotor count varies over 9.0–21.0 across the filter grid and tracker variants, exceeding the provisional stability threshold and making the single count not reportable.	warn
unstable:persistent_rotor_tracks	The persistent-rotor track count varies over 204.0–464.0 across the filter grid and tracker variants, exceeding the provisional stability threshold and making the single track count not reportable.	warn
preprocessed deposit	The deposit is not raw camera data and is documented as background-subtracted, spatially binned, low-pass filtered, drift-removed, and normalized; analyses requiring raw fluorescence/counts or unfiltered noise statistics would be misleading.	warn
polarity transformed relative to dye	RH237 normally dims on depolarization, but measured polarity is non-inverted with 7/7 blocks agreeing; using measured polarity for orientation should avoid activation-analysis errors, but this transformation should be documented.	warn
SNR depends on preprocessing	Median SNR is high, but documented temporal filtering and detected temporal smoothing can inflate SNR by reducing apparent frame-to-frame noise.	info
reference thresholds provisional	No frame-rate inference was needed because the deposit states 1 kHz, but automated processing flags and provisional rhythm/reference-rate tools are not yet domain-scientist reviewed.	info
naive phase singularity false positives	A cited analysis of the same rat deposit reports that naive phase-singularity approaches can create spurious rotational-driver detections at functional conduction blocks, so rotor counts and tracks should be interpreted cautiously.	warn
tracker sensitivity	Strict, default, and loose trackers find 250, 303, and 450 persistent rotors respectively; the rule verdicts agree, but the count sensitivity reinforces that the rotor counts should not be reported as single values.	warn

Rat heart, ventricular fibrillation (RG 80 nM)

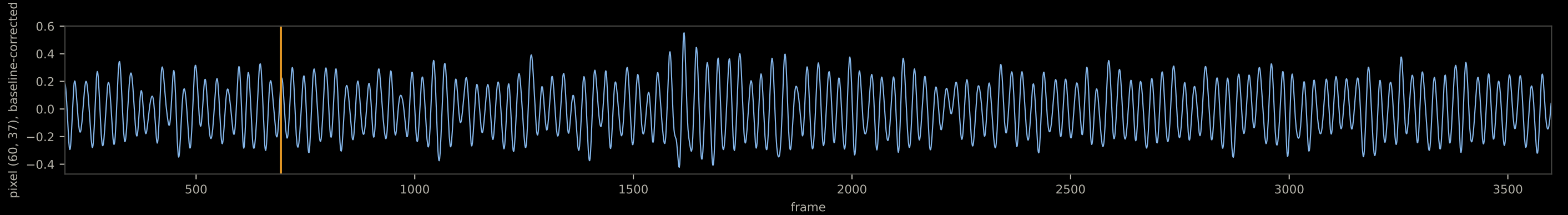
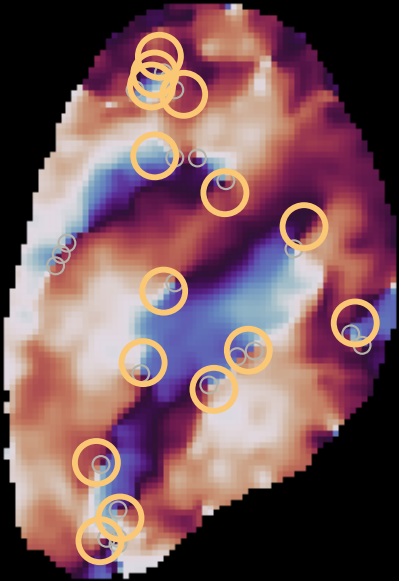
camera: frame as deposited



voltage: baseline-corrected only



phase: singularities (small), persistent rotors (ring)



Data: Public reference recording, ventricular fibrillation. doi:10.5281/zenodo.18319102. 128x80 px, 3800 frames; shown 200-3600 every 1. Frame rate: 1000 Hz.
Camera: values as deposited (may include the depositor's processing), linear gray 0 to 1, NaN black; nothing subtracted or filtered by us.
Voltage: baseline-corrected only (121-frame centered moving average subtracted), polarity x+1, no spatial filter, gray +/-0.326 (99th pct |V|).
Phase: Hilbert, on spatial Gaussian sigma=1.0 px (truncate 4.0) of the voltage signal, 200-frame pad. Singularity (small circle): |winding| > 0.9 turns, >= 3 px from tissue edge. Persistent rotor (large ring): tracked same-charge singularity lasting >= one cycle, not mostly in a close opposite-charge pair. Thresholds provisional.
Temporal low-pass: none. Display: native pixels, nearest-neighbour, no interpolation or boundary smoothing.
Opening frame 694: display choice: frame with the most concurrent persistent rotors (15) in ventricular fibrillation (whole recording), midpoint of the longest such stretch.

Provenance

```
{
  "recording": {
    "id": "73e4ebe2-6b09-4582-a1d6-ded901b7d124",
    "label": "Rat heart, ventricular fibrillation (RG 80 nM)",
    "source": "public",
    "source_ref": "10.5281/zenodo.18319102",
    "publication_ref": "10.1093/cvr/cvaa141",
    "storage_path": "public/masked_data_RG_80nM.mat",
    "format": "mat",
    "sha256": "9e30977de373f78d1b5d236bd100e46bb79c72152d3a7516b9c03c4849391076",
    "size_bytes": 293204250,
    "license": "CC-BY-4.0",
    "attribution": "Verstraeten, Bjorn; Lootens, Sebastiaan",
    "rights_source": {
      "ref": "10.5281/zenodo.18319102",
      "url": "https://zenodo.org/records/18319102",
      "kind": "deposit_metadata",
      "creators": [
        "Verstraeten, Bjorn",
        "Lootens, Sebastiaan"
      ],
      "license_as_stated": "cc-by-4.0"
    },
    "frame_rate_hz": 1000,
    "frame_rate_source": {
      "ref": "10.5281/zenodo.18319102",
      "kind": "deposit_metadata",
      "quote": "Emitted fluorescence was recorded with high-resolution CMOS cameras at a sampling rate of 1 kHz, with a spatial resolution of 128 \u00d7 80 pixels and a pixel size of approximately 100\u00b5m."
    },
    "pixel_size_um": 112.5,
    "pixel_size_source": {
      "ref": "10.5281/zenodo.18319102",
      "kind": "deposit_metadata",
      "note": "midpoint of the stated 100-125 um; conduction velocities carry a +/-11% range from this alone",
      "quote": "Emitted fluorescence was recorded with high-resolution CMOS cameras at a sampling rate of 1 kHz, with a spatial resolution of 128 \u00d7 80 pixels and a pixel size of approximately 100\u00b5m."
    },
    "frames": 3800,
    "height": 128,
    "width": 80,
    "inverted": false
  },
  "protocol": {
    "id": "a0059cf5-fbde-4942-a18f-399ebe70e9ff",
    "name": "Rat whole heart optical mapping (Zenodo 18319102)",
    "species": "rat",
    "tissue": "whole_heart",
    "params_version": 1,

```

```

    "params_set_by": "developer (not a domain scientist)",
    "params_note": "version 1: the library defaults as of commit 363372b; provisional, see
protocol_params.py"
},
"run": {
    "id": "82fe7343-d416-4536-b39e-19b7eca30443",
    "status": "done",
    "started_at": "2026-10-27T23:46:44.310458+00:00",
    "finished_at": "2026-10-27T23:48:45.548478+00:00",
    "code": {
        "dirty": true,
        "git_commit": "905d5bebbb29da7ad46cd5045db14330695037c3"
    },
    "workers": 9,
    "steps": [
        "load",
        "deposit_checks",
        "baseline_correct",
        "polarity",
        "spatial_filter(phase only)",
        "hilbert_phase",
        "phase_singularities",
        "track_and_pair",
        "beats_apd_cv",
        "sensitivity",
        "render"
    ],
    "protocol_params": {
        "params": {
            "link_px": 4.0,
            "max_gap": 5,
            "min_cycles": 1.0,
            "pad_frames": 200,
            "paired_frac": 0.5,
            "render_step": 4,
            "pair_dist_px": 3.0,
            "spatial_sigma": 1.0,
            "rotor_erode_px": 3,
            "baseline_frames": 121,
            "rotor_threshold": 0.9,
            "spatial_truncate": 4.0
        },
        "version": 1,
        "protocol_id": "a0059cf5-fbde-4942-a18f-399ebe70e9ff"
    },
    "baseline_rule": {
        "ok": true,
        "ratio": 4.654,
        "cycles": {
            "whole_recording": {
                "n_frames": 3800,
                "cycle_frames": 26,
                "pixels_agreeing_frac": 0.8585122699386503,
                "pixels_with_rhythm_frac": 1.0,

```

```

    "interval_quartiles_frames": [
      25.0,
      26.0,
      29.0
    ]
  },
  "factor": 2.0,
  "reason": null,
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  "status": "provisional",
  "baseline_frames": 121,
  "slowest_segment": "whole_recording",
  "required_min_frames": 52,
  "slowest_cycle_frames": 26
},
"deposit_checks": {
  "flags": [
    {
      "flag": "unit_range",
      "value": [
        0.0,
        1.0
      ],
      "suggests": "min-max normalized",
      "threshold": "[0, 1] spanned"
    },
    {
      "flag": "non_integer",
      "value": 0.0003442292944785276,
      "suggests": "not raw camera counts (camera output is integer); weak alone",
      "threshold": 0.5
    },
    {
      "flag": "nan_mask_partial",
      "value": [
        0
      ],
      "suggests": "mask encoded in a few frames only; other frames carry non-tissue values"
    },
    {
      "flag": "temporal_smoothing",
      "value": 0.959237783400513,
      "suggests": "temporally low-pass filtered (white shot noise gives dV lag-1 autocorr
near -0.5)",
      "threshold": 0.5
    },
    {
      "flag": "spatial_smoothing",
      "value": 0.9479694003115444,
      "suggests": "spatially filtered or binned (shot noise is independent between pixels)",
      "threshold": 0.8
    }
  ],

```

```

"status": "provisional",
"measures": {
  "max": 1.0,
  "min": 0.0,
  "frames_used": 2000,
  "integer_frac": 0.0003442292944785276,
  "negative_frac": 0.0,
  "frames_with_nan": 1,
  "dv_lag1_autocorr_median": 0.959237783400513,
  "neighbour_dv_corr_median": 0.9479694003115444
},
"processed_before_deposit": true
},
"pipeline_check": null
},
"signature": {
  "id": "3b8cc8b6-ef45-4633-9365-0217c5c54720",
  "created_at": "2026-10-27T23:48:45.169738+00:00",
  "movie_path": "runs/82fe7343-d416-4536-b39e-19b7eca30443/movie.mp4",
  "frames": {
    "f0": 200,
    "f1": 3600,
    "maps": "runs/82fe7343-d416-4536-b39e-19b7eca30443/frames/maps.npz",
    "dtype": "<f4",
    "phase": "runs/82fe7343-d416-4536-b39e-19b7eca30443/frames/phase.npy",
    "shape": [
      3400,
      128,
      80
    ],
  },
  "sha256": {
    "maps": "24aa2dfc2134c34fc0dcf070a96b7af4d65e64996b35708e5b5823496617ece8",
    "phase": "8299faa3c46a5bedbc0fad024fdf743b54614eac101f3f15181c0afe29cd1b13",
    "voltage": "79f7a050312d4d65996774bdd45837eeb483ad1547e057aecdee021b345d9f3e"
  },
  "voltage": "runs/82fe7343-d416-4536-b39e-19b7eca30443/frames/voltage.npy",
  "map_keys": [
    "dominant_frequency:whole_recording",
    "dominant_frequency>window"
  ],
  "map_units": {
    "dominant_frequency>window": "Hz",
    "dominant_frequency:whole_recording": "Hz"
  }
},
"filter_params": {
  "mask": "not NaN in frame 0 and nonzero temporal std",
  "render": {
    "step": 4,
    "palettes": {
      "phase": "twilight",
      "camera": "gray",
      "voltage": "gray"
    },
  },

```

```

    "interpolation": "nearest"
  },
  "window": {
    "f0": 200,
    "f1": 3600,
    "segments": [
      {
        "name": "whole_recording",
        "label": "ventricular fibrillation (whole recording)",
        "defined": [
          0,
          3800
        ],
        "analysed": [
          200,
          3600
        ],
        "citation": null,
        "defined_by": "developer (no comparison defined)",
        "segment_id": "1eb0a669-d021-4b1a-a0b7-d652eaabb546",
        "end_event_id": null,
        "start_event_id": null,
        "expected_persistent_rotors": null
      }
    ],
    "illumination": null,
    "frame_rate_hz": 1000.0,
    "frame_rate_source": {
      "ref": "10.5281/zenodo.18319102",
      "kind": "deposit_metadata",
      "quote": "Emitted fluorescence was recorded with high-resolution CMOS cameras at a
sampling rate of 1 kHz, with a spatial resolution of 128 \u00d7 80 pixels and a pixel size
of approximately 100\u00b5m."
    },
    "segment_cycles_frames": {
      "whole_recording": 25
    }
  },
  "lowpass": null,
  "polarity": 1,
  "tracking": {
    "link_px": 4.0,
    "max_gap": 5,
    "min_cycles": 1.0,
    "min_frames": 25,
    "paired_frac": 0.5,
    "pair_dist_px": 3.0
  },
  "pad_frames": 200,
  "phase_method": "angle of scipy.signal.hilbert along time, on spatially filtered signal",
  "spatial_sigma": 1.0,
  "rotor_erode_px": 3,
  "spatial_method": "scipy.ndimage.gaussian_filter per frame, mode=reflect; NaN set to 0
before filtering, non-tissue zeroed after",

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"baseline_frames": 121,
"baseline_method": "scipy.ndimage.uniform_filter1d, mode=reflect, subtracted per pixel",
"polarity_method": "sign of median per-pixel skew of dV/dt on baseline-corrected signal",
"rotor_threshold": 0.9,
"spatial_truncate": 4.0,
"spatial_applies_to": "phase/activation only; displayed voltage is baseline-corrected
only"
},
"criteria_status": {
"note": null,
"rules": [
{
"id": "protocol_parameter_set",
"expert": "optical mapping analyst",
"status": "provisional",
"values": {
"set_by": "developer (not a domain scientist)",
"protocol": "Rat whole heart optical mapping (Zenodo 18319102)",
"protocol_id": "a0059cf5-fbde-4942-a18f-399ebe70e9ff",
"params_version": 1
},
"decision": null,
"location": "worker/voltage/protocol_params.py (developer_defaults, set_params)",
"reviewed": false,
"reviewer": null,
"description": "Each protocol's fixed, versioned analysis parameters (version 1 =
developer defaults); no run or agent may deviate",
"reviewed_at": null
},
{
"id": "baseline_window_rule",
"expert": "optical mapping analyst",
"status": "provisional",
"values": {
"ok": true,
"factor": 2.0,
"source": "per-pixel dominant frequency (images)",
"required_min_frames": 52,
"slowest_cycle_frames": 26
},
"decision": null,
"location": "worker/voltage/baseline_rule.py (FACTOR, evaluate)",
"reviewed": false,
"reviewer": null,
"description": "A run proceeds only if the protocol's baseline window is >= 2x the
slowest segment's cycle, the cycle from the MAP channel when a DAQ log exists, else from
per-pixel dominant frequency on linearly detrended pixels; otherwise the run is held by
code",
"reviewed_at": null
},
{
"id": "filter_defaults",
"expert": "optical mapping analyst (cardiac electrophysiology)",
"status": "provisional",

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```

"values": {
  "lowpass": null,
  "spatial_sigma": 1.0,
  "baseline_frames": 121,
  "spatial_truncate": 4.0
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"decision": null,
"location": "worker/voltage/preprocess.py (Params)",
"reviewed": false,
"reviewer": null,
"description": "Default baseline window (frames) and spatial Gaussian sigma/truncate
for phase",
"reviewed_at": null
},
{
  "id": "tissue_mask",
  "expert": "optical mapping analyst",
  "status": "provisional",
  "values": {
    "rule": "not NaN in frame 0 and nonzero std",
    "tissue_pixels": 5216
  },
  "decision": null,
  "location": "worker/voltage/io.py (tissue_mask)",
  "reviewed": false,
  "reviewer": null,
  "description": "Tissue = not NaN in frame 0 and nonzero temporal std",
  "reviewed_at": null
},
{
  "id": "polarity",
  "expert": "optical mapping analyst / voltage dye chemist",
  "status": "provisional",
  "values": {
    "method": "median skew of dV/dt",
    "result": 1
  },
  "decision": null,
  "location": "worker/voltage/preprocess.py (polarity)",
  "reviewed": false,
  "reviewer": null,
  "description": "Dye polarity from sign of median per-pixel skew of dV/dt",
  "reviewed_at": null
},
{
  "id": "singularity_detection",
  "expert": "computational cardiac electrophysiologist (phase mapping)",
  "status": "provisional",
  "values": {
    "rotor_erode_px": 3,
    "rotor_threshold": 0.9
  },
  "decision": null,
  "location": "worker/voltage/preprocess.py (Params.rotor_threshold, rotor_erode_px)",

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```

    "reviewed": false,
    "reviewer": null,
    "description": "Phase singularity = |winding| > threshold turns, >= erode px from
tissue edge",
    "reviewed_at": null
  },
  {
    "id": "rotor_persistence",
    "expert": "computational cardiac electrophysiologist (phase mapping)",
    "status": "provisional",
    "values": {
      "link_px": 4.0,
      "max_gap": 5,
      "min_cycles": 1.0,
      "min_frames": 25
    },
    "decision": null,
    "location": "worker/voltage/rotors.py (TrackParams)",
    "reviewed": false,
    "reviewer": null,
    "description": "Track linking distance/gap and minimum lifetime for a persistent
rotor",
    "reviewed_at": null
  },
  {
    "id": "chirality_pairing",
    "expert": "computational cardiac electrophysiologist (phase mapping)",
    "status": "provisional",
    "values": {
      "paired_frac": 0.5,
      "pair_dist_px": 3.0
    },
    "decision": null,
    "location": "worker/voltage/rotors.py (TrackParams.pair_dist_px, paired_frac)",
    "reviewed": false,
    "reviewer": null,
    "description": "Opposite-charge singularities within pair distance are a pair; tracks
paired most of their life are excluded from rotors",
    "reviewed_at": null
  },
  {
    "id": "sensitivity_grid",
    "expert": "optical mapping analyst",
    "status": "provisional",
    "values": {
      "sigmas": {
        "light": 0.5,
        "default": 1.0,
        "heavier": 2.0
      },
      "trackers": {
        "loose": [
          6.0,
          10

```

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    ],
    "strict": [
        2.0,
        1
    ],
    "default": [
        4.0,
        5
    ]
},
"baselines": {
    "run": 121,
    "3x_cycle": 75,
    "6x_cycle": 150,
    "1.5x_cycle": 38
}
},
"decision": null,
"location": "worker/voltage/sensitivity.py (SIGMAS, BASELINE_MULTIPLES,
baseline_levels)",
"reviewed": false,
"reviewer": null,
"description": "Filter levels tested: spatial sigma and baseline window values",
"reviewed_at": null
},
{
    "id": "analysis_window",
    "expert": "cardiac electrophysiologist familiar with the dataset",
    "status": "provisional",
    "values": {
        "f0": 200,
        "f1": 3600
    },
    "decision": null,
    "location": "worker/voltage/runs.py (default_window)",
    "reviewed": false,
    "reviewer": null,
    "description": "Frames analysed: whole recording minus one filter pad at each end
(unless the plan narrows it)",
    "reviewed_at": null
},
{
    "id": "prior_processing_flags",
    "expert": "imaging scientist (camera acquisition and noise)",
    "status": "provisional",
    "values": {
        "flags": [
            "unit_range",
            "non_integer",
            "nan_mask_partial",
            "temporal_smoothing",
            "spatial_smoothing"
        ],
        "thresholds": {

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        "int_frac": 0.5,
        "neg_frac": 0.01,
        "dv_autocorr": 0.5,
        "neighbour_corr": 0.8
    }
},
"decision": null,
"location": "worker/voltage/inspect.py (prior_processing)",
"reviewed": false,
"reviewer": null,
"description": "Thresholds for flagging depositor processing (normalization, masking,
temporal/spatial smoothing)",
"reviewed_at": null
},
{
    "id": "physiology_reference_rates",
    "expert": "cardiac electrophysiologist per species",
    "status": "provisional",
    "values": {
        "ranges": [],
        "tolerance_frac": 0.25,
        "segment_rhythm_rule": "expected persistent rotors 'present' -> spiral arrhythmia"
    },
    "decision": null,
    "location": "worker/voltage/physiology.py (RANGES, TOLERANCE_FRAC)",
    "reviewed": false,
    "reviewer": null,
    "description": "Cited physiological ranges (single-study values widened by a 25%
tolerance), applied to segments by their expected rhythm; used by the critic and for frame-
rate sanity checks",
    "reviewed_at": null
},
{
    "id": "stability_rule",
    "expert": "biostatistician + optical mapping analyst",
    "status": "provisional",
    "values": {
        "unstable": [
            "whole_recording.persistent_rotors",
            "whole_recording.persistent_rotor_count_max",
            "persistent_rotor_tracks"
        ],
        "stable_frac": 0.25
    },
    "decision": null,
    "location": "worker/agents/critic.py (STABLE_FRAC, stability)",
    "reviewed": false,
    "reviewer": null,
    "description": "A metric is reportable only if its spread across all sensitivity
settings is <= 25% of its median (zero spread when all values are 0); otherwise 'unstable,
not reportable'",
    "reviewed_at": null
},
{

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    "id": "persistence_threshold_variants",
    "expert": "computational cardiac electrophysiologist (phase mapping)",
    "status": "provisional",
    "values": {
        "measured_cycle": 25,
        "paper_rotation": null
    },
    "decision": null,
    "location": "worker/agents/critic.py (persistence_variants)",
    "reviewed": false,
    "reviewer": null,
    "description": "The persistent-rotor rule is run at two lifetimes, one measured cycle
of the fastest segment and the paper's cited rotation period; both verdicts stored,
disagreement flagged",
    "reviewed_at": null
},
{
    "id": "persistent_rotor_criterion",
    "expert": "cardiac electrophysiologist",
    "status": "provisional",
    "values": {
        "max_absent": 0,
        "min_present": 1
    },
    "decision": null,
    "location": "worker/voltage/sensitivity.py (MIN_ROTORS_PRESENT, MAX_ROTORS_ABSENT)",
    "reviewed": false,
    "reviewer": null,
    "description": "Persistent-rotor finding holds if every 'present' segment has >= 1
persistent rotor and every 'absent' segment has none, at every setting",
    "reviewed_at": null
}
],
"status": "provisional",
"all_reviewed": false,
"superseded_by_run": null
}
},
"segments": [
{
    "id": "1eb0a669-d021-4b1a-a0b7-d652eaabb546",
    "position": 1,
    "name": "whole_recording",
    "label": "ventricular fibrillation (whole recording)",
    "start_frame": 0,
    "end_frame": 3800,
    "expected_persistent_rotors": null,
    "definition": "whole recording; no events detected or logged",
    "defined_by": "developer (no comparison defined)",
    "citation": null,
    "evidence": {},
    "provisional": true
}
],

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"events": []  
}
```