mouse_2609_150ms_control_MiCAM, signature 804ddd67

Recording

Open-Source Low-Cost Cardiac Optical Mapping System: mouse_2609_150ms_control_MiCAM. 100 × 100 px, 2,047 frames, 0.977 kHz, pixel size not stated, deposit checks: negative values. Source 10.5281/zenodo.5557829; publication 10.1371/journal.pone.0259174; licence cc-by-4.0; Rybashlykov Dmitry. sha256 6f7fd1ea3f1f2610645c5d235dd4bc189bcdf58c1a038c8f8e68e2233948253e.

Run

6e21b7f8-7cd1-499c-8e8f-ab37b36c7113, 2026-10-28 18:15 UTC to 2026-10-28 18:18 UTC, status done. Protocol Mouse whole heart optical mapping (Luther lab), parameters v3 set by developer (not a domain scientist). Code 008c2dc076bcebf9e7fa01a05e8b7c4b5a713b37 (uncommitted changes), 9 workers.

Methods

Using provisional protocol f65d786f-f194-4be2-88b8-10d3dd25d674 with provisional parameter set version 3, the fixed analysis parameters were baseline_frames 901, spatial_sigma 1.0, spatial_truncate 4.0, pad_frames 500, rotor_threshold 0.9, rotor_erode_px 3, link_px 4.0, max_gap 5, min_cycles 1.0, pair_dist_px 3.0, paired_frac 0.5, and render_step 4. The recording has 2047 frames of 100 by 100 pixels in mat format; the frame rate used was 977.0 Hz from the recording-row admission entry citing 10.1371/journal.pone.0259174, and the pixel size was not available. The analysed window used for rhythm reporting was frames 500 to 1547, and the provisional segment definition was one whole_recording segment spanning frames 0 to 2047; the parameter set, segment definitions, and criteria are provisional.

Verdict

Verdict: no physiology pass/fail can be computed because no stable ranged checks are available; the provisional ranges, stability threshold, and criteria should be treated as provisional. What is reportable is the stable whole-recording singularity-frames fraction, range 1.0 to 1.0, only as an observed output without a cited physiological range. What is not reportable as single values is persistent rotors, range 1.0 to 5211.0; maximum concurrent persistent-rotor count, range 1.0 to 124.0; dominant frequency, range 55.989 to 107.311 Hz; and persistent rotor tracks, range 1.0 to 5211.0. A same-species mouse spiral-wave context passage is available, but dominant-frequency comparison should wait because this metric is unstable (DOI 10.1371/journal.pcbi.1011660). Review the tracker count sensitivity, with strict/default/loose counts of 327, 1118, and 94, and the inspector concerns about 977.0 Hz MiCAM frame-rate provenance, likely pre-deposit sign or conditioning, all-negative integer data values, rhythm-detector unsuitability for the expected paced period, and the non-biological mask.
physiology_ok: None; send back: False. Reviewer sign-off: pending.

Parameters (as run)

```
% Mouse whole heart optical mapping (Luther lab), v3, read-only
% set by developer (not a domain scientist); provisional, REVIEW_NEEDED 16
baseline_frames  = 901;     % >= 2 x slowest cycle (7, images): ok
pad_frames       = 500;     % 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 = 17
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
Whole recording	0–2,047	500–1,547	7 (86% of pixels)	not stated	recording start → recording end

Metrics

Metric	Unit	Whole recording	Physiological range
Rhythm			
Dominant frequency	Hz	55.989–107.311 (unstable)	none cited
Rotors			
Persistent rotors	count	1–5,211 (unstable)	none cited
Max concurrent persistent rotors	count	1–124 (unstable)	none cited
Frames with a singularity	fraction	1.000	none cited
Beats, where a global rhythm exists			
Beats	count	63	none cited
Global amplitude ratio	ratio	2.00	gate ≥ 0.30 provisional
APD50	ms	4	none cited
APD90	ms	5	none cited
Conduction velocity	cm/s	[not computed]	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	1–5.21e+03 count, unstable, not reportable
dominant freq (Hz)	whole recording	56–107 Hz, unstable, not reportable
persistent rotors	whole recording	1–5.21e+03 count, unstable, not reportable
singularity frames fraction	whole recording	1 fraction of frames, no cited range
persistent rotor count max	whole recording	1–124 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 >= 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	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| > threshold turns, >= 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
pipeline_check worker/agents/pipeline.py (INSTRUCTIONS, validator)	The pipeline agent's hold/proceed decision from protocol mismatches and inspector anomalies; it chooses no parameter	optical mapping analyst	provisional

Provisional rules behind this signature

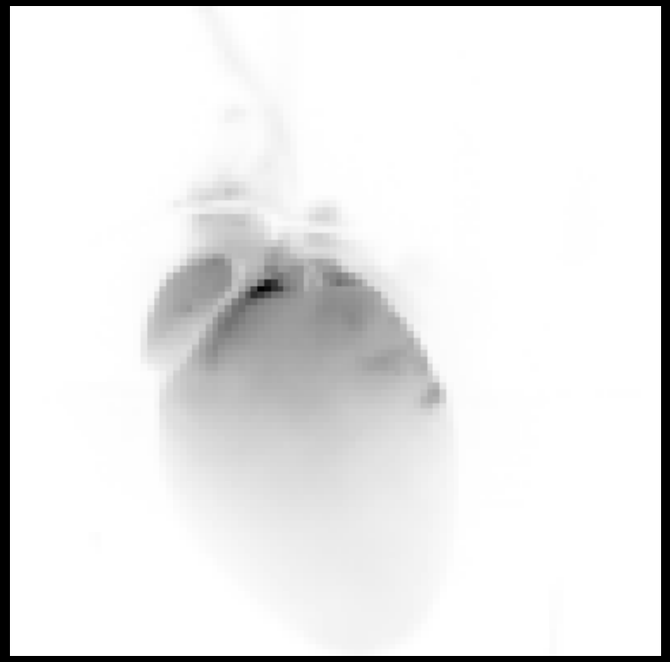
Rule	Description	Expert	Status
physiology_reference_rates worker/voltage/physiology.py (RANGES, TOLERANCE_FRAC)	Cited physiological ranges (single-study values widened by a 25% tolerance), applied to segments by their expected rhythm; used by the critic and for frame-rate sanity checks	cardiac electrophysiologist per species	provisional
stability_rule worker/agents/critic.py (STABLE_FRAC, stability)	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'	biostatistician + optical mapping analyst	provisional
persistence_threshold_variants 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, MAX_ROTORS_ABSENT)	Persistent-rotor finding holds if every 'present' segment has >= 1 persistent rotor and every 'absent' segment has none, at every setting	cardiac electrophysiologist	provisional

Review items

Topic	Detail	Severity
unstable:whole_recording.persistent_rotors	Persistent-rotor count varies across the range 1.0 to 5211.0 across filter and tracker settings, exceeding the provisional stability rule.	warn
unstable:whole_recording.persistent_rotor_count_max	Maximum concurrent persistent-rotor count varies across the range 1.0 to 124.0 across filter and tracker settings, exceeding the provisional stability rule.	warn
unstable:whole_recording.dominant_freq_hz	Dominant frequency varies across the range 55.989 to 107.311 Hz across baseline windows, exceeding the provisional stability rule.	warn
unstable:persistent_rotor_tracks	Persistent rotor tracks vary across the range 1.0 to 5211.0 across filter and tracker settings, exceeding the provisional stability rule.	warn
tracker_count_sensitivity	Tracker variants produced different counts: strict 327, default 1118, and loose 94, so count magnitude needs tracking-parameter review even though rule-level agreement is true.	warn
Frame-rate provenance for a MiCAM file	Use 977.0 Hz as the working frame rate, but the cited paper quote is for the custom system whereas this file is labelled MiCAM; Zenodo metadata does not state the MiCAM frame rate.	warn
Pre-deposit sign/conditioning	Measured polarity is consistently non-inverted despite Di-4-ANEPPS normally dimming on depolarization, suggesting a sign flip or conditioning before deposit or export.	warn
Unexplained all-negative data values	All values are negative integers and are flagged as processed_before_deposit; the linked paper documents possible workflows, but the deposit README does not explain this file-level transformation.	warn
Rhythm detector not suitable for the expected paced period here	The rhythm tool result should not be used for physiology or frame-rate inference here because the expected paced period lies beyond the rhythm tool's baseline-window suitability.	info
Mask is not a heart segmentation	The mask is based only on nonzero temporal standard deviation and covers almost the entire image; tissue-only spatial interpretation needs a biological mask.	warn

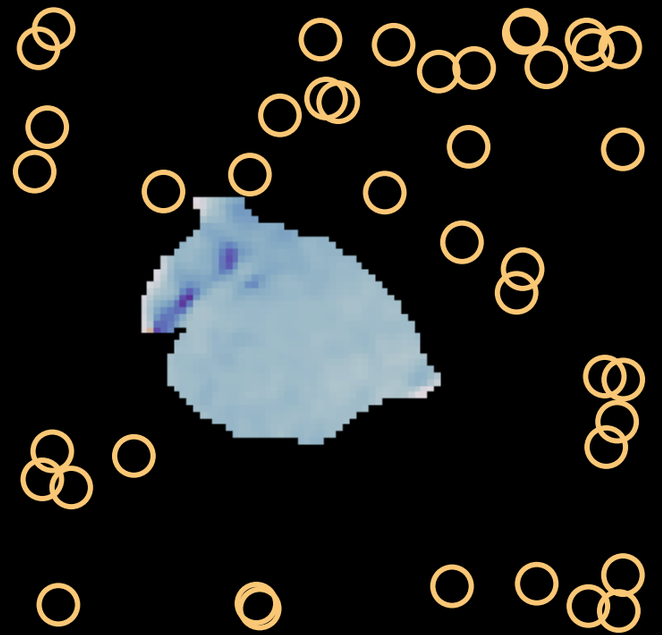
Open-Source Low-Cost Cardiac Optical Mapping System: mouse_2609_150ms_control_MiCAM

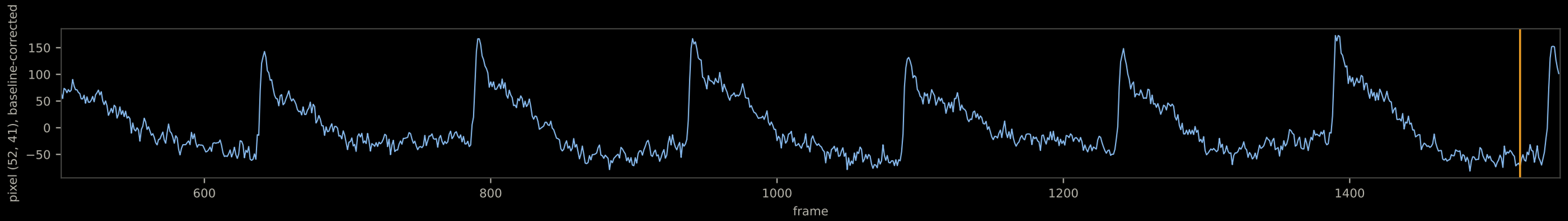
camera: frame as deposited



voltage: baseline-corrected only

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





Data: Public reference recording, Hussaini, Luther, Lädke (MPI Göttingen), CC-BY 4.0. doi:10.5281/zenodo.5557829. 100x100 px, 2047 frames; shown 500-1547 every 1. Frame rate: 977.0 Hz.
Camera: values as deposited (may include the depositor's processing), linear gray -1.34e+04 to -25, NaN black; nothing subtracted or filtered by us.
Voltage: baseline-corrected only (901-frame centered moving average subtracted), polarity x+1, no spatial filter, gray +/-148 (99th pct |V|).
Phase: Hilbert, on spatial Gaussian sigma=1.0 px (truncate 4.0) of the voltage signal, 500-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 1519: display choice: frame with the most concurrent persistent rotors (41) in whole recording, midpoint of the longest such stretch.

Provenance


```
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 "recording": {
  "id": "ae77081e-a125-471f-8805-27dad0688848",
  "label": "Open-Source Low-Cost Cardiac Optical Mapping System:
mouse_2609_150ms_control_MiCAM",
  "source": "admission",
  "source_ref": "10.5281/zenodo.5557829",
  "publication_ref": "10.1371/journal.pone.0259174",
  "storage_path": "uploads/public/7764050e/mouse_2609_150ms_control_MiCAM.mat",
  "format": "mat",
  "sha256": "6f7fd1ea3f1f2610645c5d235dd4bc189bcdf58c1a038c8f8e68e2233948253e",
  "size_bytes": 30452226,
  "license": "cc-by-4.0",
  "attribution": "Rybashlykov Dmitry",
  "rights_source": {
   "ref": "10.5281/zenodo.5557829",
   "kind": "deposit_metadata",
   "admitted_by": "project lead",
   "license_as_stated": "cc-by-4.0"
  },
  "frame_rate_hz": 977.0,
  "frame_rate_source": {
   "by": "project lead",
   "ref": "10.1371/journal.pone.0259174",
   "kind": "admission",
   "quote": "The custom software was designed to make recordings with a resolution of
200x200 pixels and a framerate of 977 frames per second (FPS).",
   "source": "paper_methods"
  },
  "pixel_size_um": null,
  "pixel_size_source": null,
  "frames": 2047,
  "height": 100,
  "width": 100,
  "inverted": false
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 "protocol": {
  "id": "f65d786f-f194-4be2-88b8-10d3dd25d674",
  "name": "Mouse whole heart optical mapping (Luther lab)",
  "species": "mouse",
  "tissue": "whole_heart",
  "params_version": 3,
  "params_set_by": "developer (not a domain scientist)",
  "params_note": "version 3: baseline 901 frames = 2.1 x the 433-frame (2.31 Hz) post-
termination cycle resolved under v2; v2's 641 frames was 1.48 cycles, on the 1.5-cycle line,
and the pipeline check held one run and passed another on the same inputs. pad 500 >= half
the window. Provisional (REVIEW_NEEDED item 16)."
 },
 "run": {
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"workers": 9,
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 "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": 500,
  "paired_frac": 0.5,
  "render_step": 4,
  "pair_dist_px": 3.0,
  "spatial_sigma": 1.0,
  "rotor_erode_px": 3,
  "baseline_frames": 901,
  "rotor_threshold": 0.9,
  "spatial_truncate": 4.0
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 "version": 3,
 "protocol_id": "f65d786f-f194-4be2-88b8-10d3dd25d674"
},
"baseline_rule": {
 "ok": true,
 "ratio": 128.714,
 "cycles": {
  "whole_recording": {
   "n_frames": 2047,
   "cycle_frames": 7,
   "pixels_agreeing_frac": 0.8584858485848584,
   "pixels_with_rhythm_frac": 1.0,
   "interval_quartiles_frames": [
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    7.0,
    7.0
   ]
  }
 },
 "factor": 2.0,
```

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   "reason": null,
   "source": "per-pixel dominant frequency (images)",
   "status": "provisional",
   "baseline_frames": 901,
   "slowest_segment": "whole_recording",
   "required_min_frames": 14,
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  "deposit_checks": {
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     "flag": "negative_values",
     "value": 1.0,
     "suggests": "baseline-subtracted or normalized; raw fluorescence counts are non-
negative",
     "threshold": 0.01
    }
   ],
   "status": "provisional",
   "measures": {
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    "min": -13413.0,
    "frames_used": 2000,
    "integer_frac": 1.0,
    "negative_frac": 1.0,
    "frames_with_nan": 0,
    "dv_lag1_autocorr_median": -0.49938253876247546,
    "neighbour_dv_corr_median": 0.06412793593881308
   },
   "processed_before_deposit": true
  },
  "pipeline_check": {
   "model": "openai:gpt-5.5",
   "proceed": true,
   "anomalies": [
    {
     "topic": "Frame-rate provenance for a MiCAM file",
     "severity": "warn",
     "effect_on_analysis": "The fixed pipeline can run with the admitted working frame rate
of 977.0 Hz, but the provenance is indirect for this MiCAM, 100x100 deposited file because
the cited paper statement is for the custom iDS system and 200x200 acquisition. Time-based
interpretation should therefore cite this caveat."
    },
    {
     "topic": "Pre-deposit sign/conditioning",
     "severity": "warn",
     "effect_on_analysis": "The deposited signal appears non-inverted despite the paper
naming Di-4-ANEPPS, which normally dims on depolarization. The downstream pipeline orients
recordings from the measurement, so this does not by itself invalidate analysis, but
polarity and any sign-dependent interpretation should be treated as pre-conditioned before
deposit."
    },
    {
     "topic": "Unexplained all-negative data values",
```

```
     "severity": "warn",
     "effect_on_analysis": "All sampled values are negative integers, suggesting baseline subtraction, normalization, or another file-level transformation before deposit. This means amplitude baselines and noise estimates may not reflect raw fluorescence counts, and the protocol's analysis is applied to a processed deposited array."
    },
    {
     "topic": "Mask is not a heart segmentation",
     "severity": "warn",
     "effect_on_analysis": "The analysis mask covers nearly the whole image and is based only on nonzero temporal standard deviation, not a biological heart segmentation. Spatial maps from the fixed pipeline may include non-tissue/background pixels unless a biological mask is generated for interpretation outside this run."
    },
    {
     "topic": "Rhythm detector not suitable for the expected paced period here",
     "severity": "info",
     "effect_on_analysis": "The short dominant cycles reported by rhythm tools should not be used as physiology or for frame-rate inference because the expected paced period from the file label and paper is outside the rhythm tool's baseline-correction window; this is a reporting caveat and not a hold condition."
    },
    {
     "topic": "baseline-window rule",
     "severity": "info",
     "effect_on_analysis": "The coded baseline-window rule passed: baseline_frames 901 is at least 2.0 times the slowest coded cycle, with ratio 128.714. Per policy this rule is reported only as informational and does not change proceed status here."
    }
   ],
   "rationale": "The recording may be analysed under the fixed provisional mouse whole-heart protocol as it stands. The protocol does not specify a conflicting fixed indicator, pixel size, frame rate, or image size, and the admitted 977.0 Hz frame rate is the working value on record for this file, although its MiCAM-specific provenance is only medium confidence. The main limitations are not parameter mismatches but provenance and preprocessing warnings: the deposited array appears sign/conditioning transformed, all-negative, and masked nearly as the full image, so the fixed parameters can be applied but results must be interpreted as applying to the processed deposited recording rather than raw fluorescence or a tissue-only mask.",
   "mismatches": [],
   "hold_reason": null,
   "protocol_id": "f65d786f-f194-4be2-88b8-10d3dd25d674",
   "methods_text": "Using provisional protocol f65d786f-f194-4be2-88b8-10d3dd25d674 with provisional parameter set version 3, the fixed analysis parameters were baseline_frames 901, spatial_sigma 1.0, spatial_truncate 4.0, pad_frames 500, rotor_threshold 0.9, rotor_erode_px 3, link_px 4.0, max_gap 5, min_cycles 1.0, pair_dist_px 3.0, paired_frac 0.5, and render_step 4. The recording has 2047 frames of 100 by 100 pixels in mat format; the frame rate used was 977.0 Hz from the recording-row admission entry citing 10.1371/journal.pone.0259174, and the pixel size was not available. The analysed window used for rhythm reporting was frames 500 to 1547, and the provisional segment definition was one whole_recording segment spanning frames 0 to 2047; the parameter set, segment definitions, and criteria are provisional.",
   "recording_id": "ae77081e-a125-471f-8805-27dad0688848",
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 }
},
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  "f1": 1547,
  "maps": "runs/6e21b7f8-7cd1-499c-8e8f-ab37b36c7113/frames/maps.npz",
  "dtype": "<f4",
  "phase": "runs/6e21b7f8-7cd1-499c-8e8f-ab37b36c7113/frames/phase.npy",
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   100,
   100
  ],
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   "phase": "a7f991a270140f9a40c42b847371848291c872a97ebdce5a5cbf5eae065f1307",
   "voltage": "35e7b15db730a09c2f8db8fff35d6aa572a4acf7b39fbf317758c5e400c7762d"
  },
  "voltage": "runs/6e21b7f8-7cd1-499c-8e8f-ab37b36c7113/frames/voltage.npy",
  "map_keys": [
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   "dominant_frequency:whole_recording",
   "dominant_frequency:window"
  ],
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   "activation:whole_recording": "ms",
   "dominant_frequency:whole_recording": "Hz"
  }
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 "filter_params": {
  "mask": "not NaN in frame 0 and nonzero temporal std",
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   "step": 4,
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    "camera": "gray",
    "voltage": "gray"
   },
   "interpolation": "nearest"
  },
  "window": {
   "f0": 500,
   "f1": 1547,
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     "label": "whole recording",
     "defined": [
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       0,
       2047
      ],
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       500,
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      ],
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      "defined_by": "admission (project lead); no comparison defined",
      "segment_id": "f43dd23d-fc9d-4a02-a299-3c478800b938",
      "end_event_id": null,
      "start_event_id": null,
      "expected_persistent_rotors": null
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    ],
    "illumination": null,
    "frame_rate_hz": 977.0,
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     "by": "project lead",
     "ref": "10.1371/journal.pone.0259174",
     "kind": "admission",
     "quote": "The custom software was designed to make recordings with a resolution of
200x200 pixels and a framerate of 977 frames per second (FPS).",
     "source": "paper_methods"
    },
    "segment_cycles_frames": {
     "whole_recording": 17
    }
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   "lowpass": null,
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    "max_gap": 5,
    "min_cycles": 1.0,
    "min_frames": 17,
    "paired_frac": 0.5,
    "pair_dist_px": 3.0
   },
   "pad_frames": 500,
   "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",
   "baseline_frames": 901,
   "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,
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only"
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  "note": null,
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    "id": "protocol_parameter_set",
    "expert": "optical mapping analyst",
    "status": "provisional",
    "values": {
     "set_by": "developer (not a domain scientist)",
     "protocol": "Mouse whole heart optical mapping (Luther lab)",
     "protocol_id": "f65d786f-f194-4be2-88b8-10d3dd25d674",
     "params_version": 3
    },
    "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": 14,
     "slowest_cycle_frames": 7
    },
    "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",
    "values": {
     "lowpass": null,
     "spatial_sigma": 1.0,
     "baseline_frames": 901,
     "spatial_truncate": 4.0
    },
    "decision": null,
    "location": "worker/voltage/preprocess.py (Params)",
    "reviewed": false,
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     "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": 9999
     },
     "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)",
     "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": 17
     },
     "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
       ],
       "strict": [
        2.0,
        1
       ],
       "default": [
        4.0,
        5
       ]
```

```
      },
      "baselines": {
       "run": 901,
       "3x_cycle": 51,
       "6x_cycle": 102,
       "1.5x_cycle": 26
      }
     },
     "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": 500,
      "f1": 1547
     },
     "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": [
       "negative_values"
      ],
      "thresholds": {
       "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": "pipeline_check",
     "expert": "optical mapping analyst",
     "status": "provisional",
     "values": {
      "model": "openai:gpt-5.5",
      "proceed": true,
      "anomalies": [
       "Frame-rate provenance for a MiCAM file",
       "Pre-deposit sign/conditioning",
       "Unexplained all-negative data values",
       "Mask is not a heart segmentation",
       "Rhythm detector not suitable for the expected paced period here",
       "baseline-window rule"
      ],
      "mismatches": []
     },
     "decision": null,
     "location": "worker/agents/pipeline.py (INSTRUCTIONS, validator)",
     "reviewed": false,
     "reviewer": null,
     "description": "The pipeline agent's hold/proceed decision from protocol mismatches and
inspector anomalies; it chooses no parameter",
     "reviewed_at": null
    },
    {
     "id": "physiology_reference_rates",
     "expert": "cardiac electrophysiologist per species",
     "status": "provisional",
     "values": {
      "ranges": [
       "mouse_spiral_rotation_hz"
      ],
      "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",
```

```
       "whole_recording.dominant_freq_hz",
       "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
    },
    {
     "id": "persistence_threshold_variants",
     "expert": "computational cardiac electrophysiologist (phase mapping)",
     "status": "provisional",
     "values": {
      "measured_cycle": 17,
      "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": [
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  {
   "id": "f43dd23d-fc9d-4a02-a299-3c478800b938",
   "position": 1,
   "name": "whole_recording",
   "label": "whole recording",
   "start_frame": 0,
   "end_frame": 2047,
   "expected_persistent_rotors": null,
   "definition": "whole recording; no events detected or logged at admission",
   "defined_by": "admission (project lead); no comparison defined",
   "citation": null,
   "evidence": {},
   "provisional": true
  }
 ],
 "events": []
}
```